

SIEMENS

SIMODRIVE

Planning Guide

11.2000 Edition

AC Motors for Feed and Main Spindle Drives

SIMODRIVE AC Motors for Feed and Main Spindle Drives

Planning Guide

Foreword

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Valid for

6SN11 equipment series

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 |
| 11.93 | 6SN1197-0AA20-0BP0 | C |
| 08.95 | 6SN1197-0AA20-0BP1 | C |
| 10.96 | 6SN1197-0AA20-0BP2 | C |
| 01.98 | 6SN1197-0AA20-0BP3 | C |
| 11.00 | 6SN1197-0AA20-0BP4 | C |

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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Functions may be executable in the control but are not described in this documentation. No claims can be made on these functions if included with a new shipment or when involved with service.

We have checked the contents of this document to ensure that they coincide with the described hardware and software. The information in this document is regularly checked and necessary corrections are included in reprints.

We are thankful for any recommendations for improvement.

Subject to change without prior notice.

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-static discharge sensitive 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 (ElectroStatic Discharge Sensitive 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□

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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.

[illegible]

Electrical Data

1.1 Definitions

Example of the characteristics

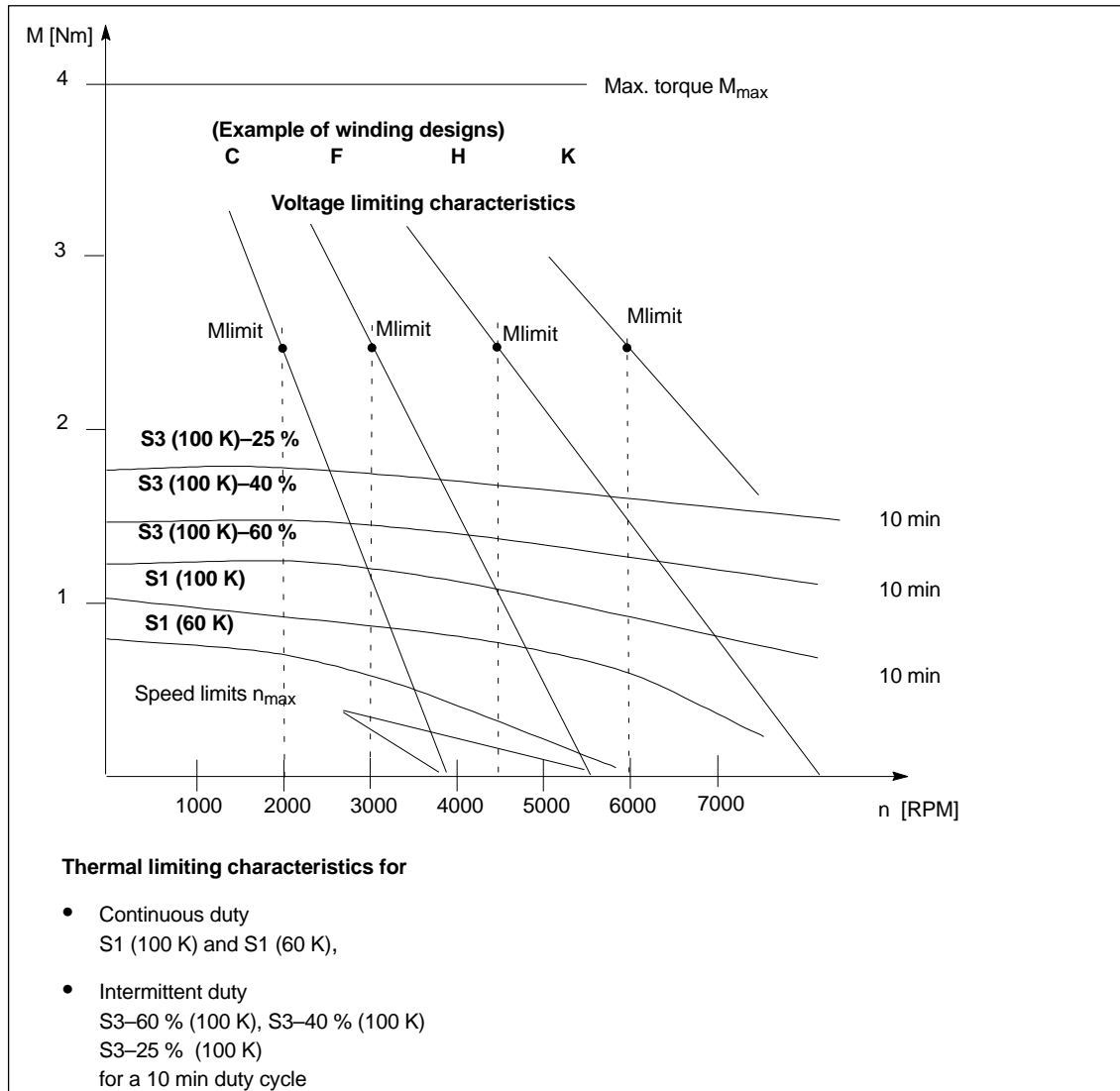


Fig. 1-1 Speed–torque diagram

1.1 Definitions

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.

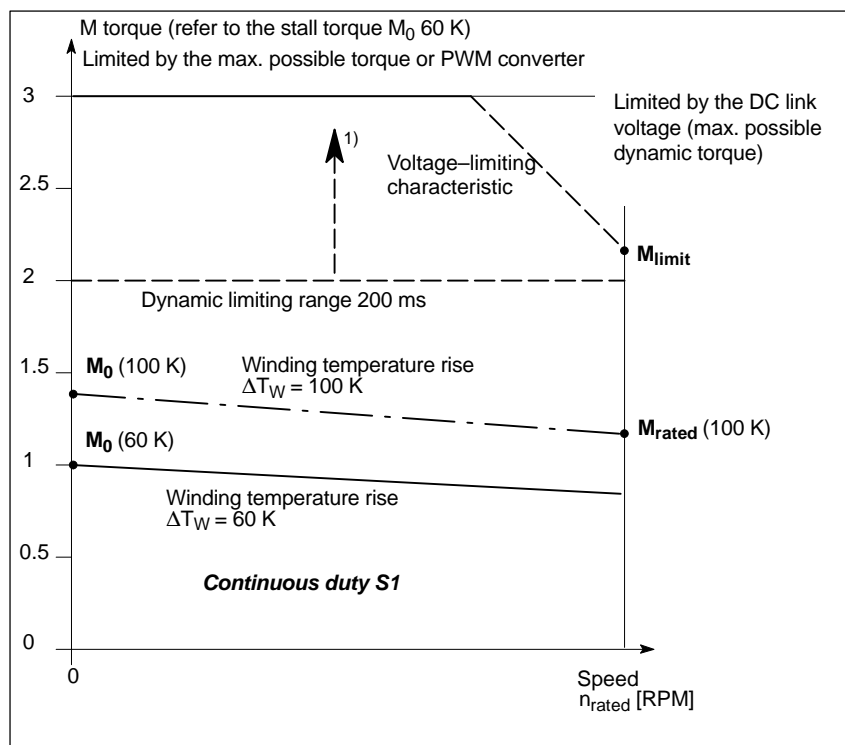


Fig. 1-2 Torque characteristics of AC servomotors

- 1) Dynamic limiting range $2 \cdot M_0 (60 \text{ K})$ 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 $4 \cdot M_0 (100 \text{ K})$.

**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.

ALS**Thermal limiting characteristic**

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

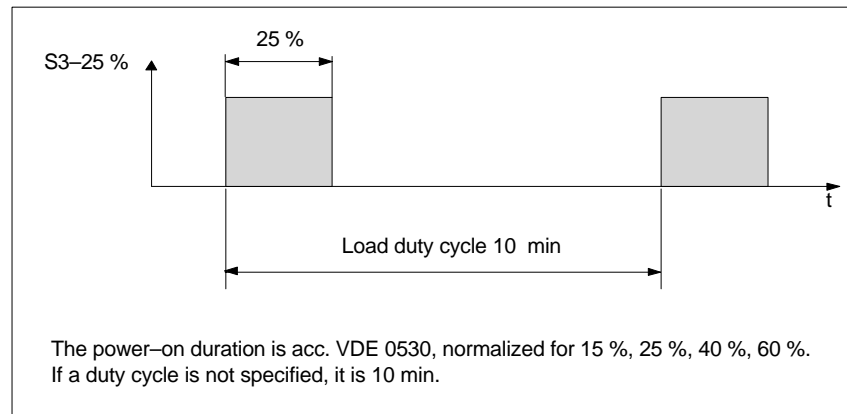


Fig. 1-3 Power-on duration in intermittent duty

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.

1.1 Definitions

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

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 $V_{DC \text{ link}(\text{new})}$, is given by: **$U_{DC \text{ link}(\text{new})}/600 \text{ V for 1FT5/6/ 1FK6}$**

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):

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

$$3000 \text{ RPM} * 0.82 = 2460 \text{ RPM.}$$

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

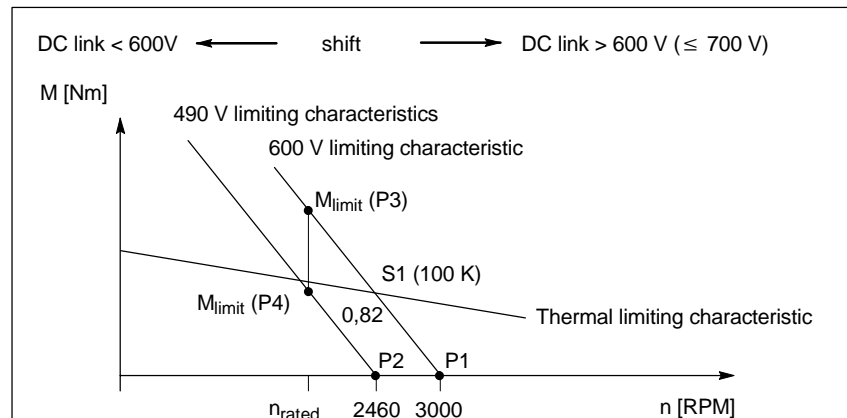


Fig. 1-4 Voltage limiting characteristic shift

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

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

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

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

Check: P4 must lie on the new limiting characteristic

1.1 Definitions

| | |
|--|--|
| 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. |

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 demagnetized if the current is further increased.

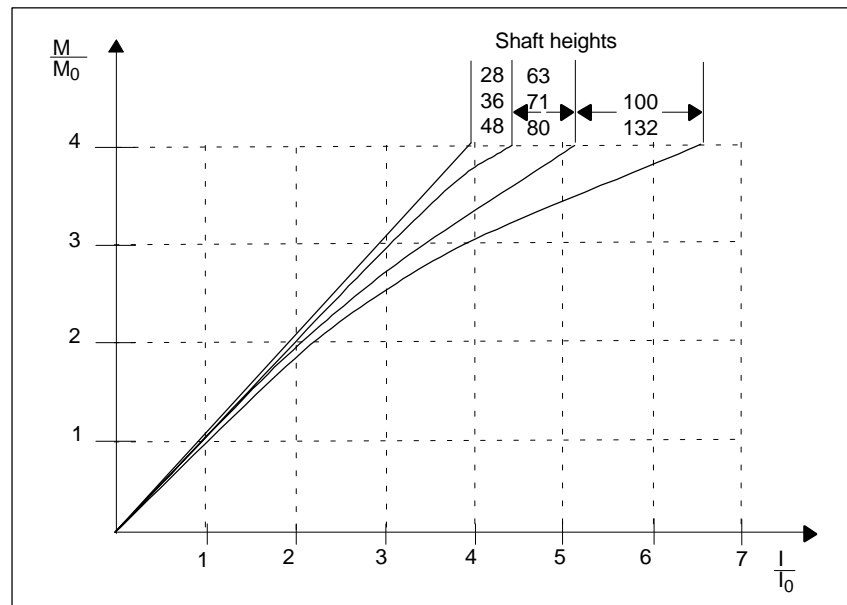
Typical
M/I characteristic


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. $2 \cdot M_0$.


Important

These constants are not valid (motor losses) when calculating 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.

1.1 Definitions

| | |
|---|--|
| 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 $L_D = 1.5 \cdot L_{ph}$ 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} | <p>The mechanical time constant is obtained from the tangent along a theoretical ramp-function starting at the origin.</p> <p>1FT5: $T_{mech} = 2 \cdot R_{ph} \cdot J_{mot}/k_T^2$ [s] 1FT6/1FK6: $T_{mech} = 3 \cdot R_{ph} \cdot J_{mot}/k_T^2$ [s]</p> <p>J_{mot} = Moment of inertia of the servomotors [kgm²] R_{ph} = Resistance of a stator winding phase [Ohm] k_T = Torque constant[Nm/A]</p> |
| 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 operating 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.

1.2 Rating plate data

ALS

Example from the 1FK6 series:

| | | | |
|----------------------------|-------------------------|------------------|--------------------------------|
| SIEMENS | | CE | |
| 3 ~ Permanent-Magnet-Motor | | | |
| 1FK6060 - 6AF71 - 1TG0 | | | |
| Nr.E | Fabrik-Nr. (13 Zeichen) | (3Z.) | EN 60034 |
| $M_{O/N}$ | 6.0 / 4.0 Nm | I_O | 4.3 A |
| U_{IN} | 270 V | $n_{N/max}$ | 3000 / 3900 /min ⁻¹ |
| IM B5 | IP 64 | Th.CL.F / KTY 84 | |
| Made in Germany | | | |

Country of manufacture

Type of construction, degree of construction, insulating material class / thermal protection

Induced, phase-to-phase, RMS motor voltage; rated speed / max. permissible speed

Standstill (stall) torque, rated torque
standstill (stall) current

Serial number;
data acc. to the Standards

16-digit motor Order No.

Motor type

Manufacturer;
Standards (CE, UL, CSA)

[illegible]

Mechanical Data

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.

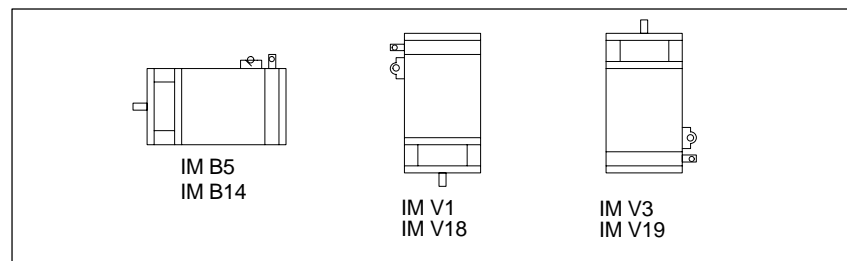


Fig. 2-1 Type of construction

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.

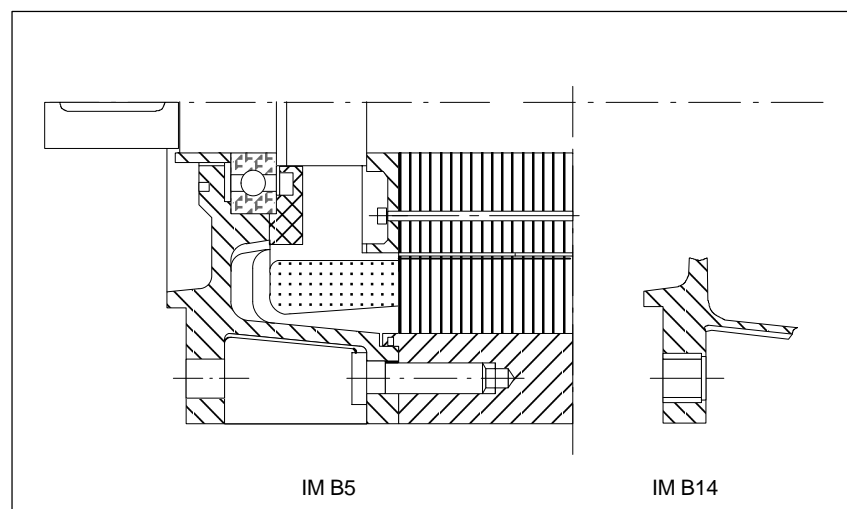


Fig. 2-2 Type of construction IM B5/IM B14 (with threaded gland)

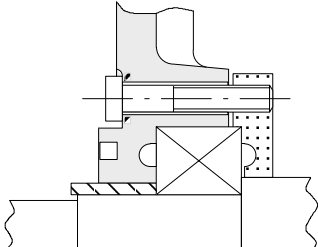
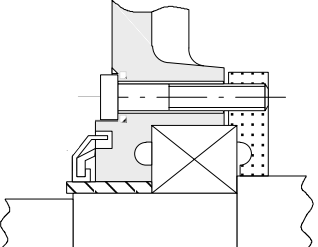
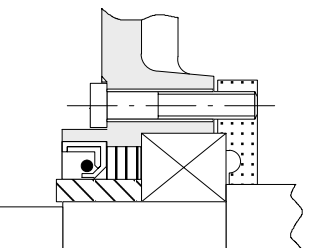
2.1 Definitions

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 aggressive 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 ₂ O; 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

2.1 Definitions

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!

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 |

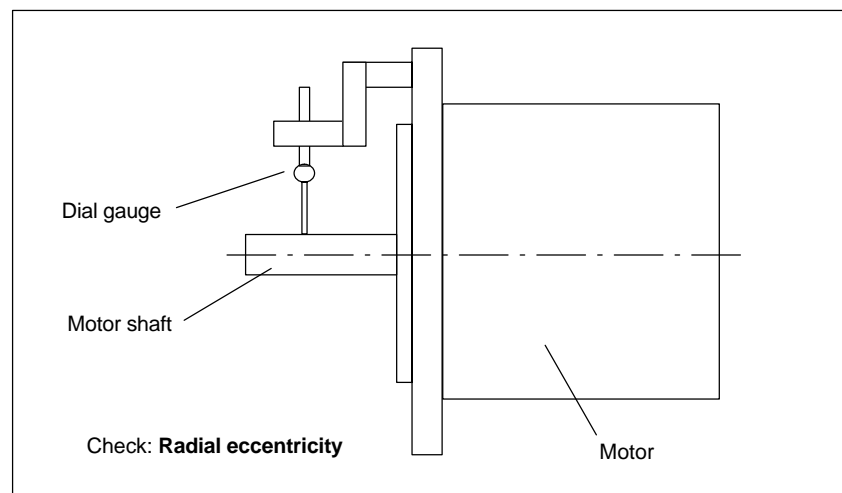


Fig. 2-3 Radial eccentricity check

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 |

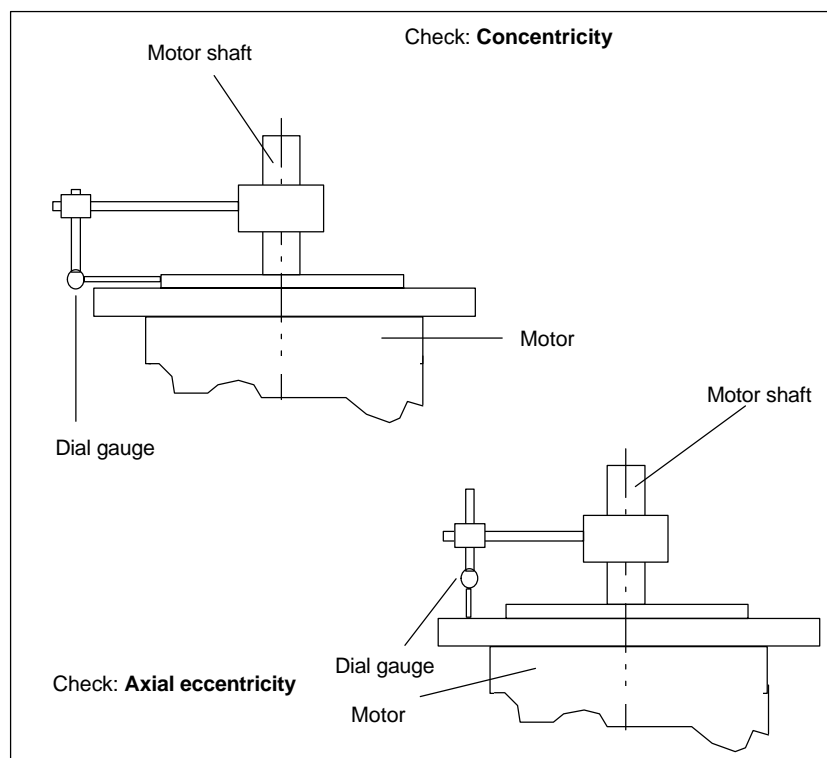


Fig. 2-4 Concentricity and axial eccentricity check

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.

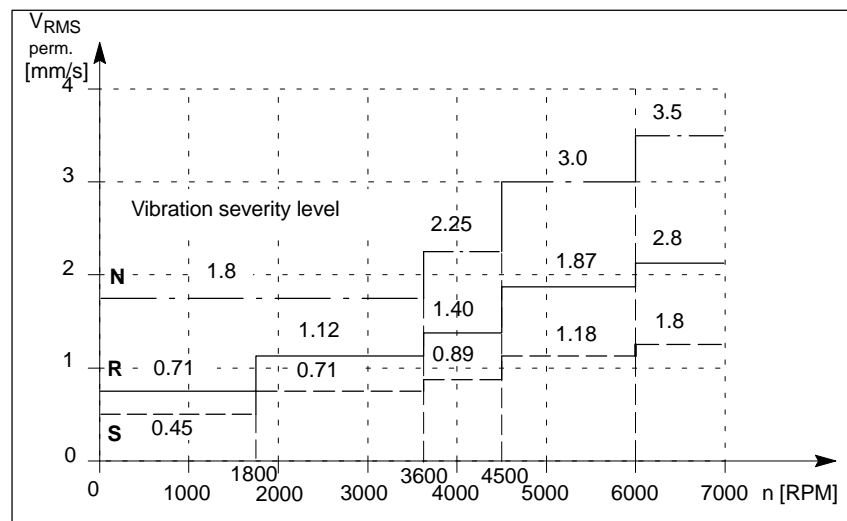


Fig. 2-5 Characteristics of vibration severity level limits for shaft heights 28 to 132

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 | Acceleration |
|--------------|-----------------------|
| 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/s² axial (20 Hz to 2 kHz)
30 m/s² radial (20 Hz to 2 kHz)

Balancing (acc. to DIN ISO 8821)

For motors **with** key:

1FT5 motors: Full-key balancing
FT6/1FK6 motors: Half-key balancing

2.1 Definitions

Cantilever force stressing

The permissible cantilever forces are shown in the diagrams for the corresponding motors

Application point of the cantilever forces at the shaft end

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

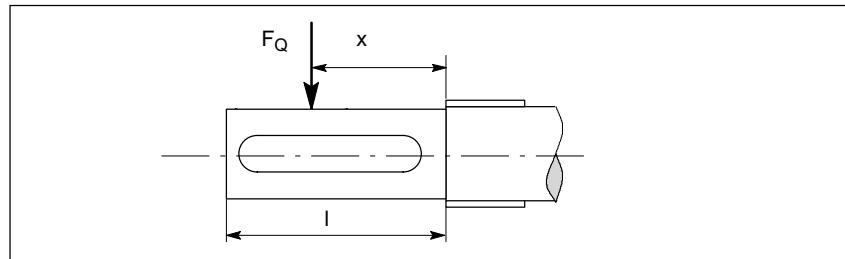


Fig. 2-6 Point of application of cantilever forces at the shaft ends of motors

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 without additional mounting components**

The motor torque must be reduced by between 5 % and 10 %. We recommend that the system is configured using the $M_0(60k)$ values.

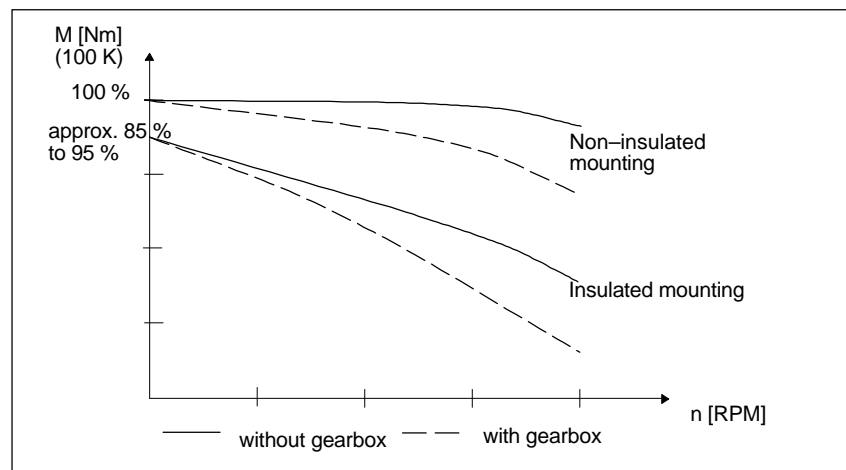


Fig. 2-7 S1 characteristics

- **Thermally insulated mounting with 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 provided in the following section.

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:

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

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

| | | |
|----------|-----------------|--|
| S1 duty: | $f = 2$ | Factor due to gearbox temperature rise |
| S3 duty: | $f = f_1 * f_2$ | |
| | $f_1 = 2$ | For the motor accelerating torque |
| | $f_2 = 1$ | for ≤ 1000 switching cycles of the gearbox |
| | $f_2 > 1$ | 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 (f_2) 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.

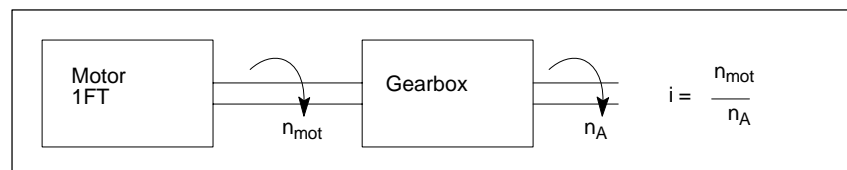


Fig. 2-8 Dimensioning the gearbox

2.2 Mounted/integrated components

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:

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

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

| | |
|-----------|--|
| M_V | calculated "torque loss" |
| a | $\pi/2$ for 1FT5 motors fed with squarewave currents $\pi/3$ 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 | $\eta \approx 0.94$ | single-stage |
| Spur gearing | $\eta \approx 0.95$ | |
| Cyclo gearbox | $\eta \approx 0.92$ | single-stage |
| Harmonic drive | $\eta \approx 0.7$ | |
| Worm gear | $\eta \approx 0.45 \dots 0.9$ | |

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

The torque does not have to be reduced.

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

Planetary gear-boxes 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 gear-boxes

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)

($W = 1/2 \cdot J_{\text{tot}} \cdot \omega^2$; J_{tot} in [kgm²], 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 \pm 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:

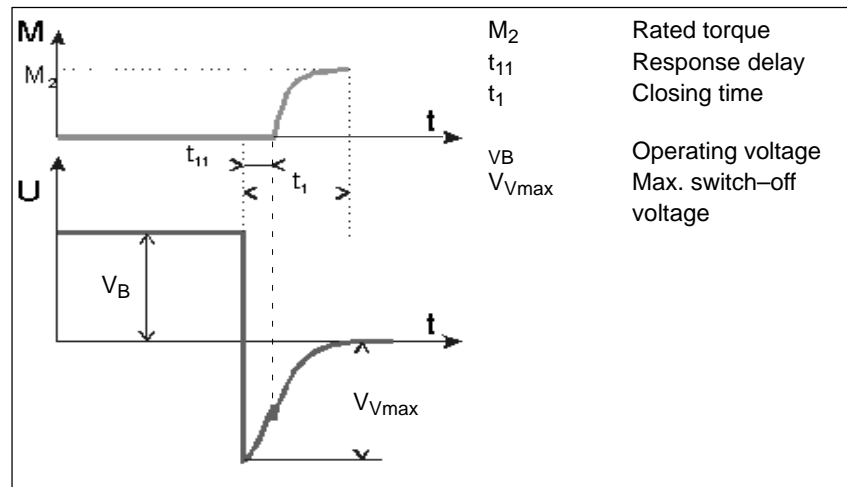


Fig. 2-9 Voltage characteristic when braking

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:

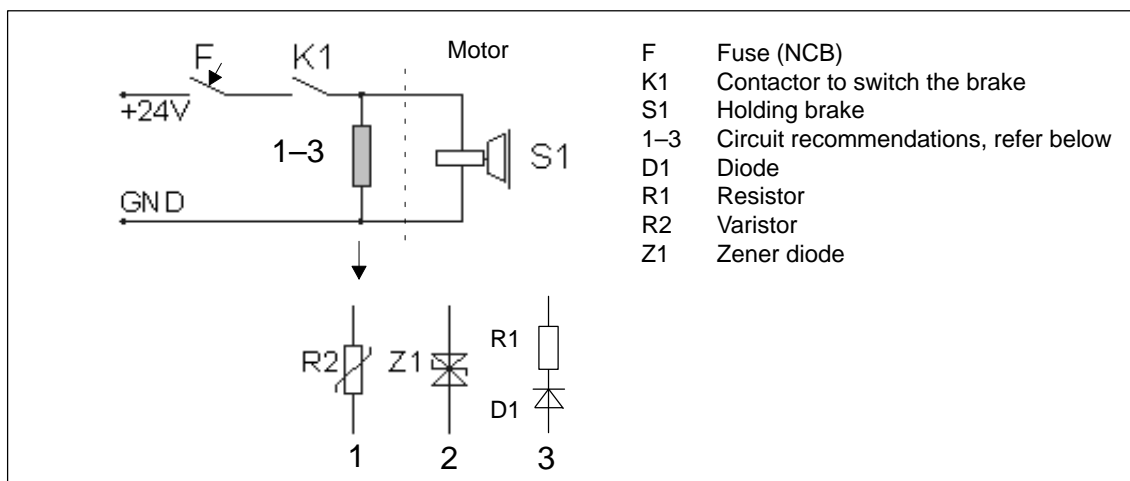


Fig. 2-10 Recommended external power supply for the holding brake

**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 drop along copper cables can be approximated as follows:

$$dU = 0.042 \cdot (l/q) \cdot I_{\text{Brake}}$$

l = Cable length in m
 q = Brake conductor cross-section in mm²
 I_{Brake} = Brake DC current in A
 dU = Voltage drop along the brake cable in V

Example: 1FK6101 with EBD brake 3.8B $I_{\text{Brake}}=0.9\text{A}$, $l=50\text{m}$, $q=1\text{mm}^2$

$$dV = 0.042 \cdot 50 / 1 \cdot 0.9 = 1.89$$

this means, that the voltage on the supply side must be a minimum of $24\text{V} \cdot 0.9 + 1.89\text{V} = 23.5\text{ V}$.

Defining torques

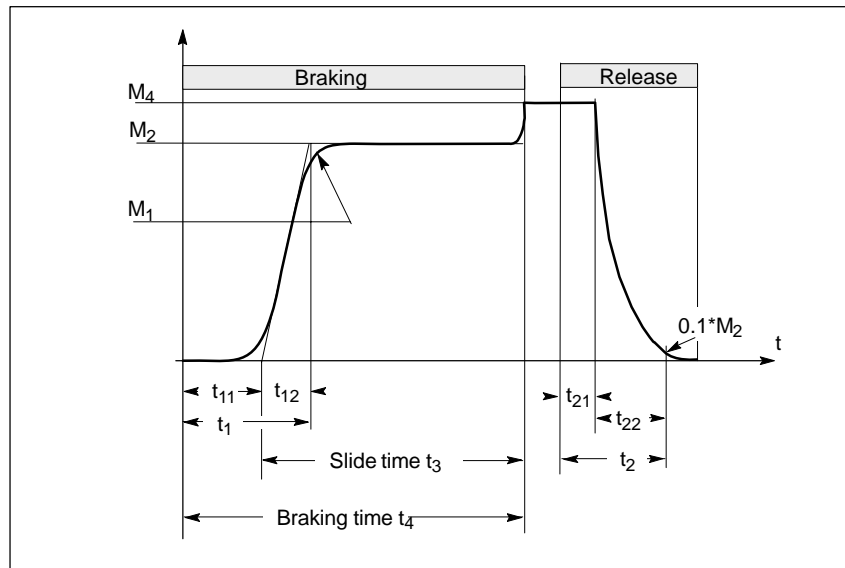


Fig. 2-11 Defining torques and switching times according to VDE 0580

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:

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

$t_{11} \doteq$ Response delay

$t_{12} \doteq$ Rise time

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

$t_4 \doteq$ Braking time

Brake release:

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

$t_2 \doteq$ Separating time

$t_{21} \doteq$ Response delay, when separating

$t_{22} \doteq$ Drop-out time

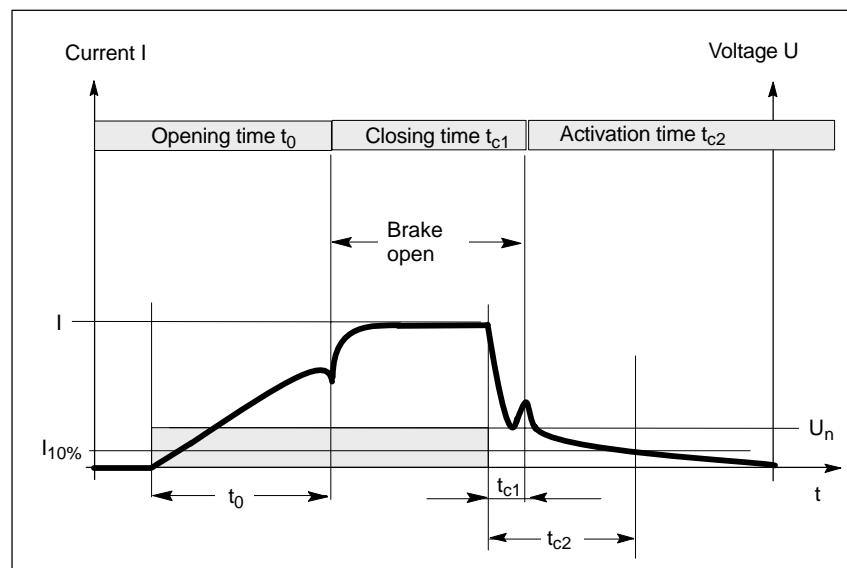


Fig. 2-12 Definitions of times for holding operation (this deviates from DIN VDE 0580)

Measured with damping circuit connected in parallel with the contactor: (damping circuit 3)

Series circuit comprising free-wheeling diode and resistor $R = 5 \cdot R_{\text{Brake}}$



[illegible]

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 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

3 Functions – Options

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 [kgm²]
 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.

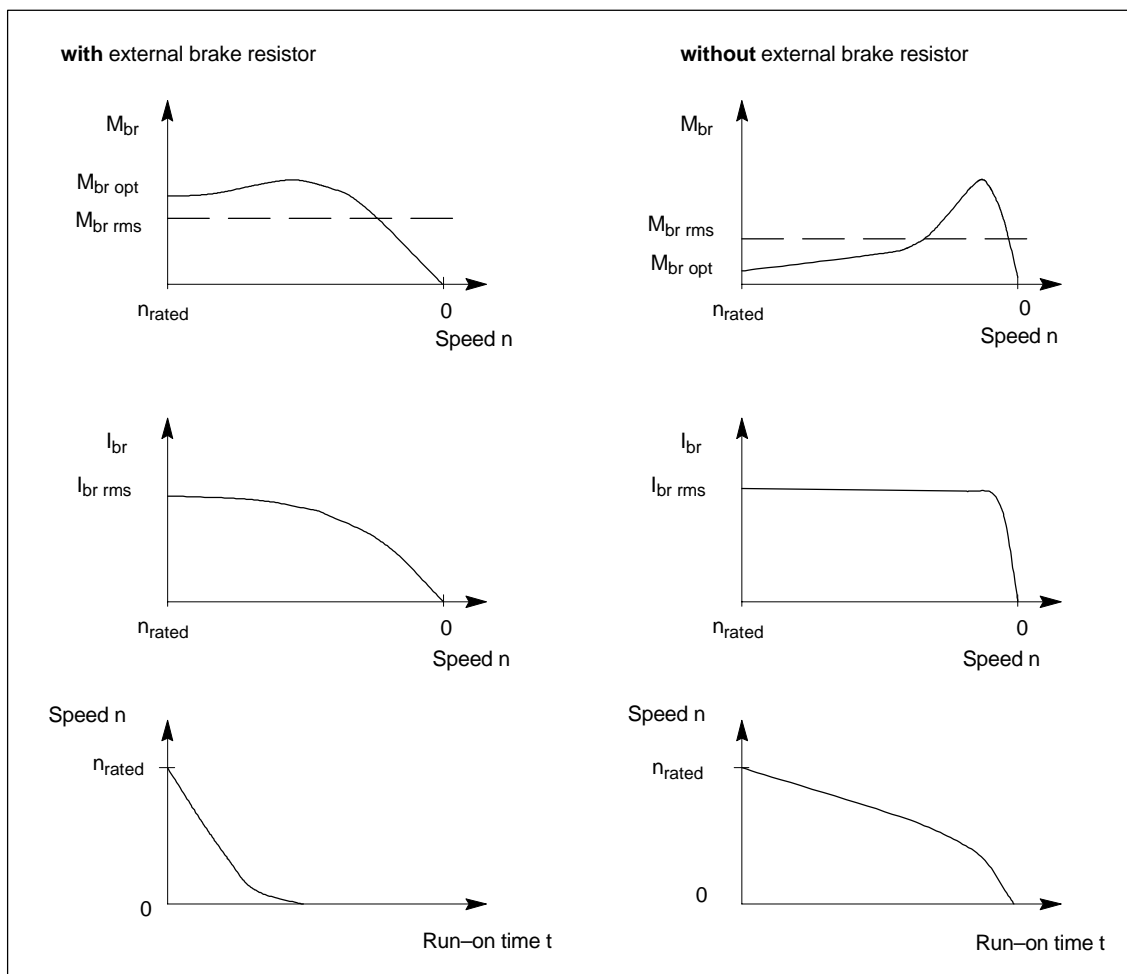
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Fig. 3-1 Armature short-circuit braking

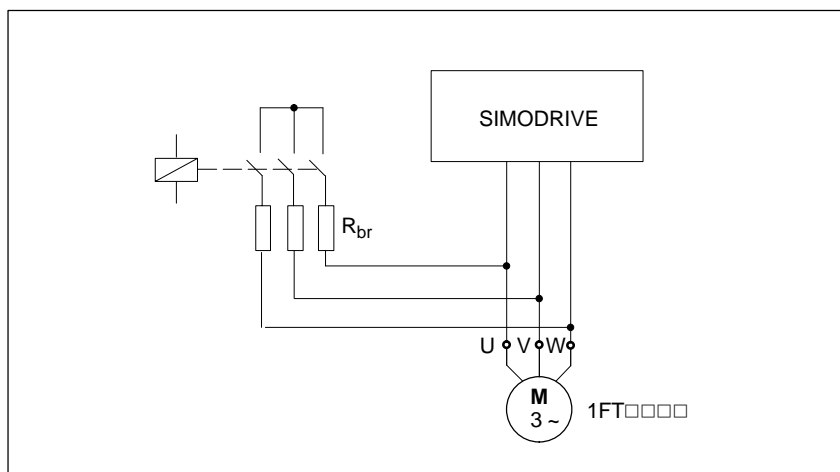


Fig. 3-2 Circuit (principle) for armature short-circuit braking

[illegible]

4

Termination Technology

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 [mm²] | 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:

$$\begin{aligned}
 &1\text{FT5:} \quad I_{\text{rms}} = I_0 \cdot \sqrt{\frac{2}{3}} \quad (\text{at standstill: } I_{\text{rms}} = I_0!) \\
 &1\text{FT6/1FK6:} \quad I_{\text{rms}} = I_0
 \end{aligned}$$

4.1 Power cables

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

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.

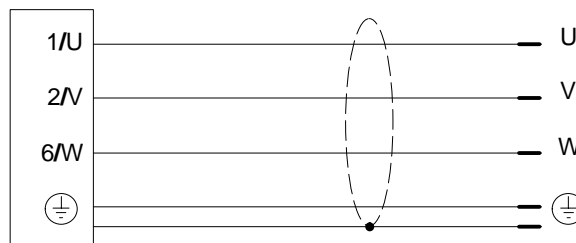
Pre-assembled power cables

- without brake cables

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

Servomotor
connectors size 1; 1.5; 2; 3

SIMODRIVE
conductor end sleeves
acc. to DIN 46228

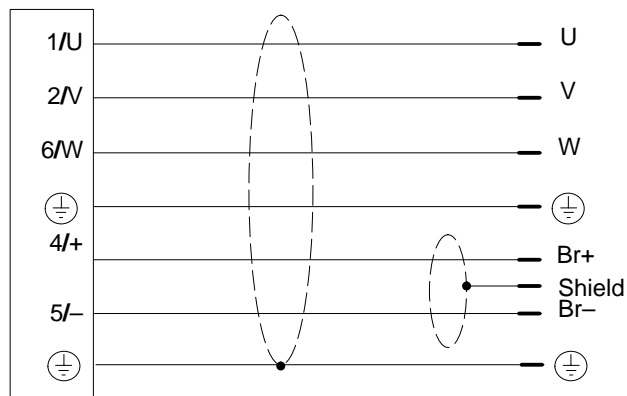


- with brake cables

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

Servomotor
connectors size 1; 1.5; 2; 3

SIMODRIVE
conductor end sleeves
acc. to DIN 46228



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

AL S**Length code****Ordering data****Order No.**

Cable, pre-assembled

6FX□ 002-□□□□-□□□0

Length code:

1 m to 99 m

100 m to 199 m

200 m to 299 m

0 m

10 m

20 m

30 m

40 m

50 m

60 m

70 m

80 m

90 m

0 m

1 m

2 m

3 m

4 m

5 m

6 m

7 m

8 m

9 m

1

2

3

A

B

C

D

E

F

G

H

J

K

A

B

C

D

E

F

G

H

J

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!

4.3 Cable versions

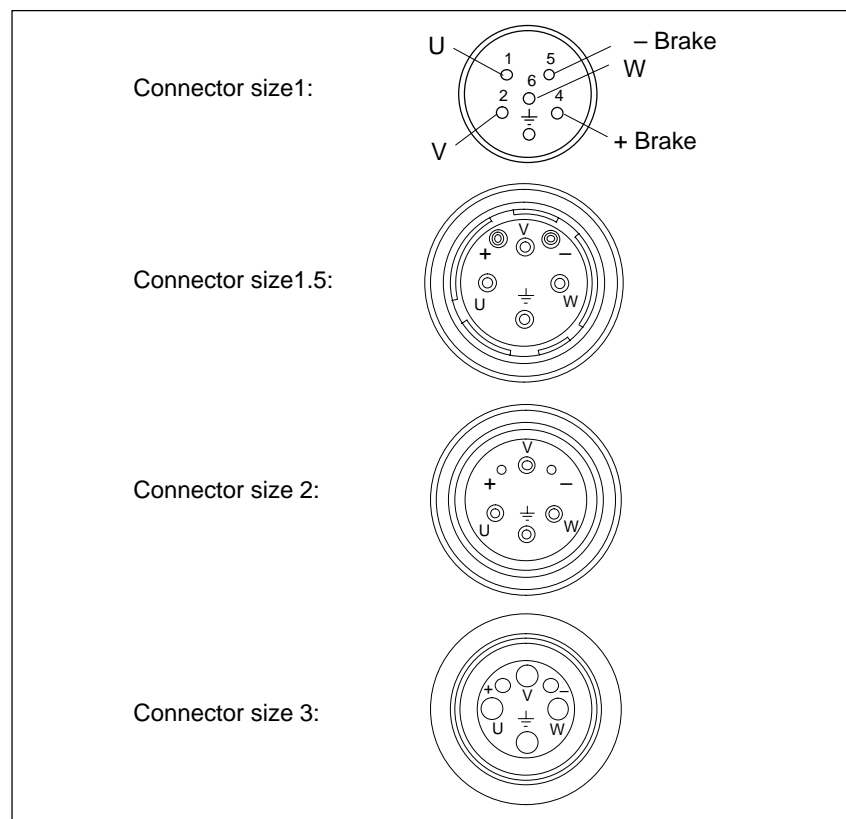
Connector assignments

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



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General Information on AC Induction Motors

ALA

| | | |
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Notes

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1

ALA

Electrical Data

1.1 Definitions

| | | | | | | | |
|--|---|------------|------------|------|--------------------|------|------------|
| Mechanical limiting speed n_{\max} | <p>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!</p> <p>The following load duty cycle applies:</p> <table> <tr> <td>30 %</td><td>n_{\max}</td></tr> <tr> <td>60 %</td><td>$2/3 n_{\max}$</td></tr> <tr> <td>10 %</td><td>Standstill</td></tr> </table> | 30 % | n_{\max} | 60 % | $2/3 n_{\max}$ | 10 % | Standstill |
| 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. | | | | | | |
| Electrical limiting speed n_1 | The maximum permissible electrical speed n_1 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) | <p>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.</p> <table> <tr> <td>S6 – 40 %:</td><td>4 min load</td></tr> <tr> <td></td><td>6 min no-load time</td></tr> </table> | S6 – 40 %: | 4 min load | | 6 min no-load time | | |
| S6 – 40 %: | 4 min load | | | | | | |
| | 6 min no-load time | | | | | | |

1.1 Definitions

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:

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

AC motors have a high overload capability in the constant-power range. For several AC motors, the overload capability in the highest 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.

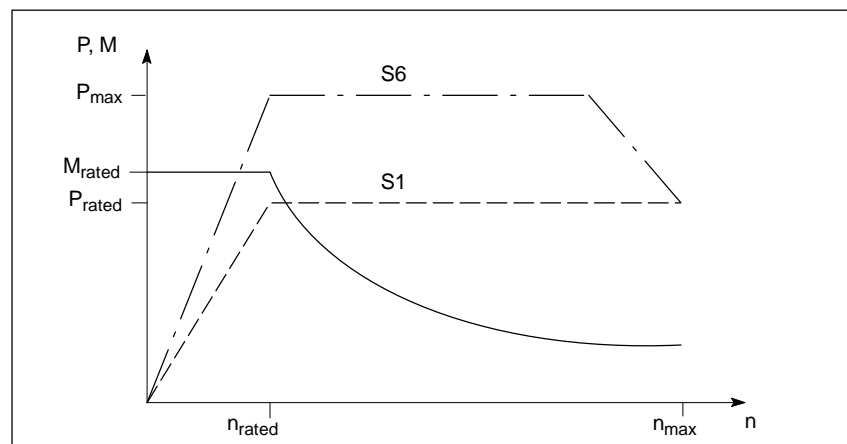


Fig. 1-1 Basic characteristics of power P and torque M as a function of the speed n (duty types according to VDE 0530 Part 1)

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.

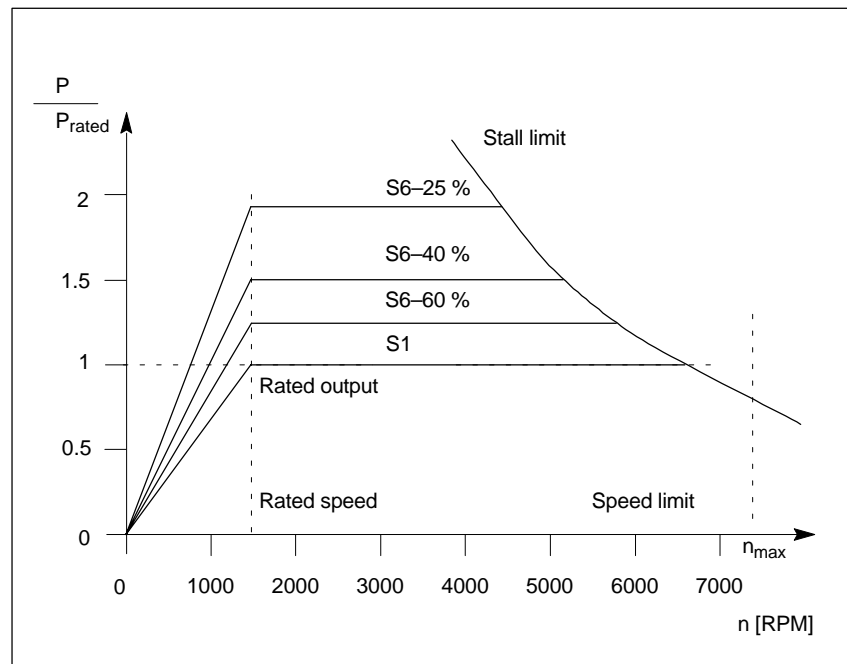


Fig. 1-2 Power characteristics, limiting and characteristics

Motor limits

For induction motors, the speed and power data are limited due to thermal and mechanical¹⁾ 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).

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

1) Shaft end stressing; bearing stressing

1.1 Definitions

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.

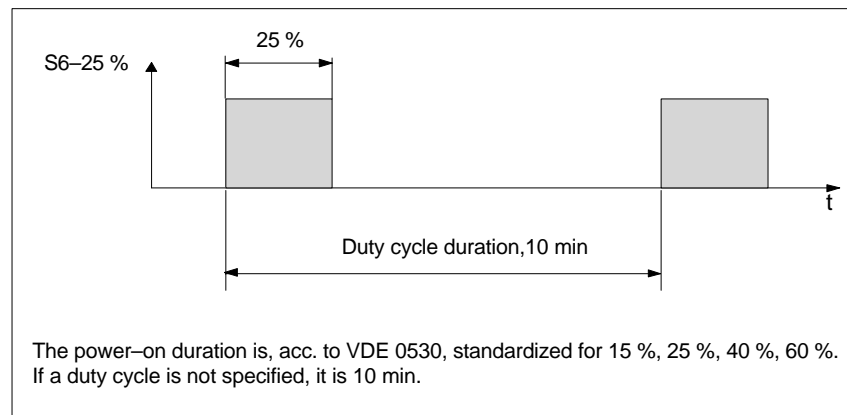


Fig. 1-3 Power-on duration in intermittent operation

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.

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 $V < 1.5 \cdot V$ then, as continuous output, only

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

$V_{\text{DC link}}$ 490 V for UE modules

$V_{\text{DC link}}$ 600 V for I/R modules

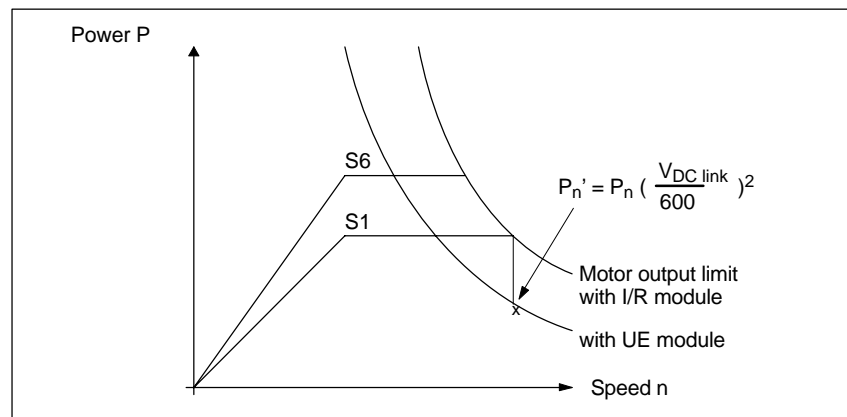


Fig. 1-4 Power-speed diagram, general

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.

1.1 Definitions

- 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

Example:
Shaft height 132

ALA

| SIEMENS | | R c R | | CE | |
|---|-------|----------|----------------------|-----------|---------|
| 3 ~ Mot. 1PH7137 – 2NG00 – 0BA00 No. L994 0025 01 001 | | | | | |
| IM B3 | | IP 55/54 | | Th.Cl.FYF | |
| V | A | kW | cosφ | Hz | RPM |
| 350 Y | 60.00 | 28.00 | 0.88 | 68.0 | 2000 S1 |
| 398 Y | 56.00 | 29.00 | 0.87 | 77.8 | 2300 S1 |
| 450 Y | 52.00 | 30.00 | 0.84 | 89.4 | 2650 S1 |
| EN 60034 | | | max. 8000 RPM | | |
| TEMP – SENSOR KTY 84 – 130 | | | ENCODER D01 2048 S/R | | |
| | | | CODE No.: 412 | | |
| Made in Germany | | | | | |

Temperature sensor, encoder, Code No. _____

Operation _____

Type of contr., degr.of prot., temp. rise class _____

Motor Order No., Serial No. _____

Notes

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2

ALA

Mechanical Data for 1PH4 and 1PH7

2.1 Definitions

Types of construction

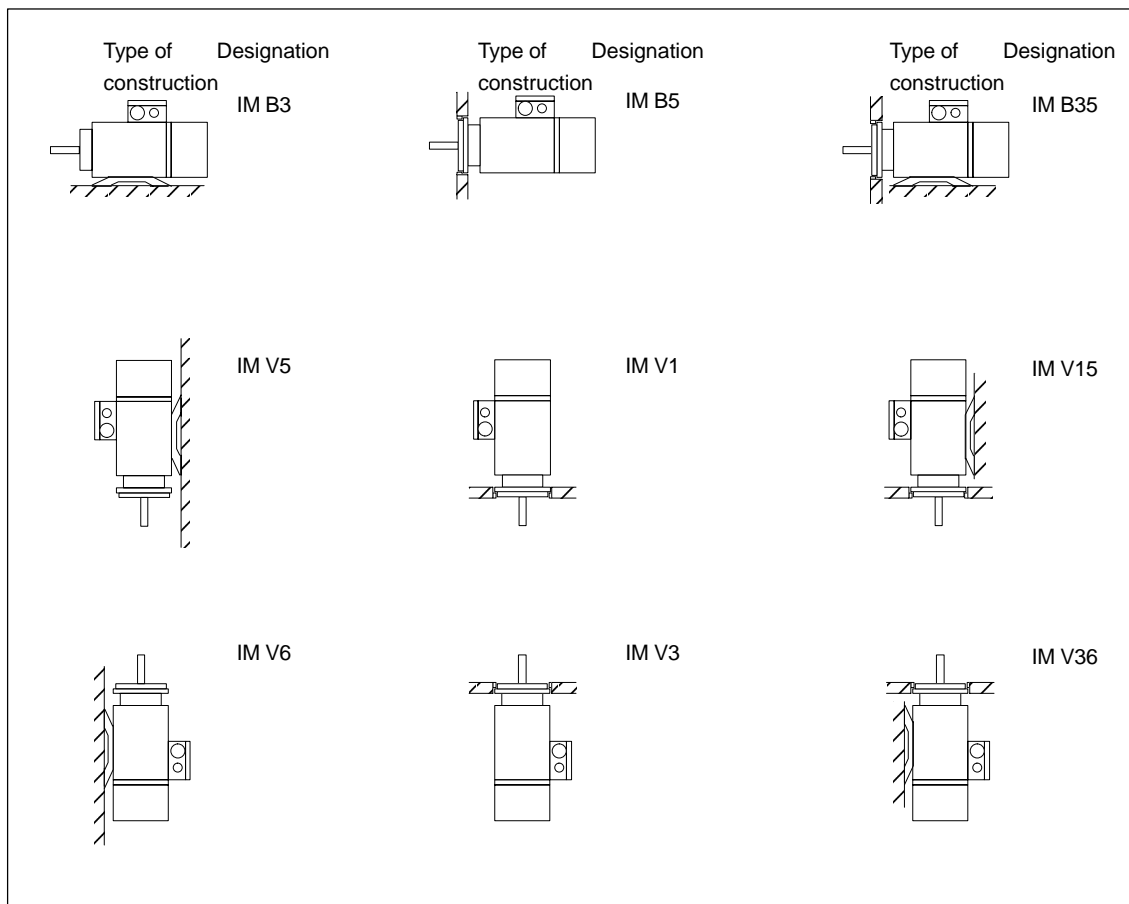


Fig. 2-1 Types of construction

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.

2.1 Definitions

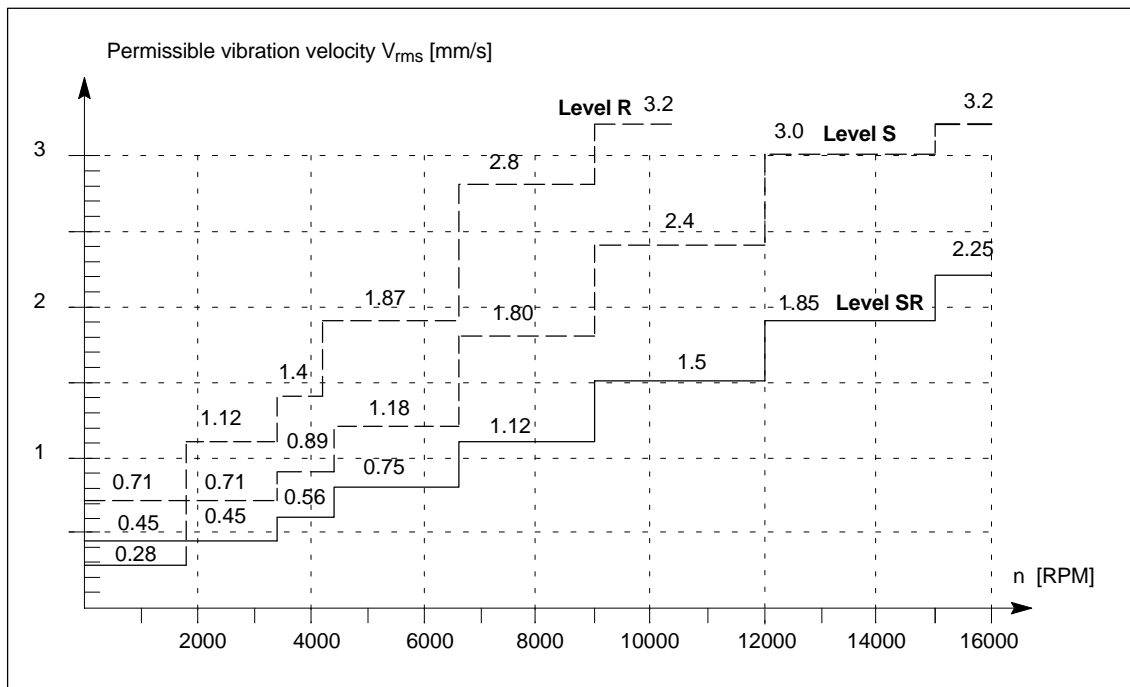


Fig. 2-2 Vibration severity – limit values, AC motors, shaft heights 100 mm to 132 mm

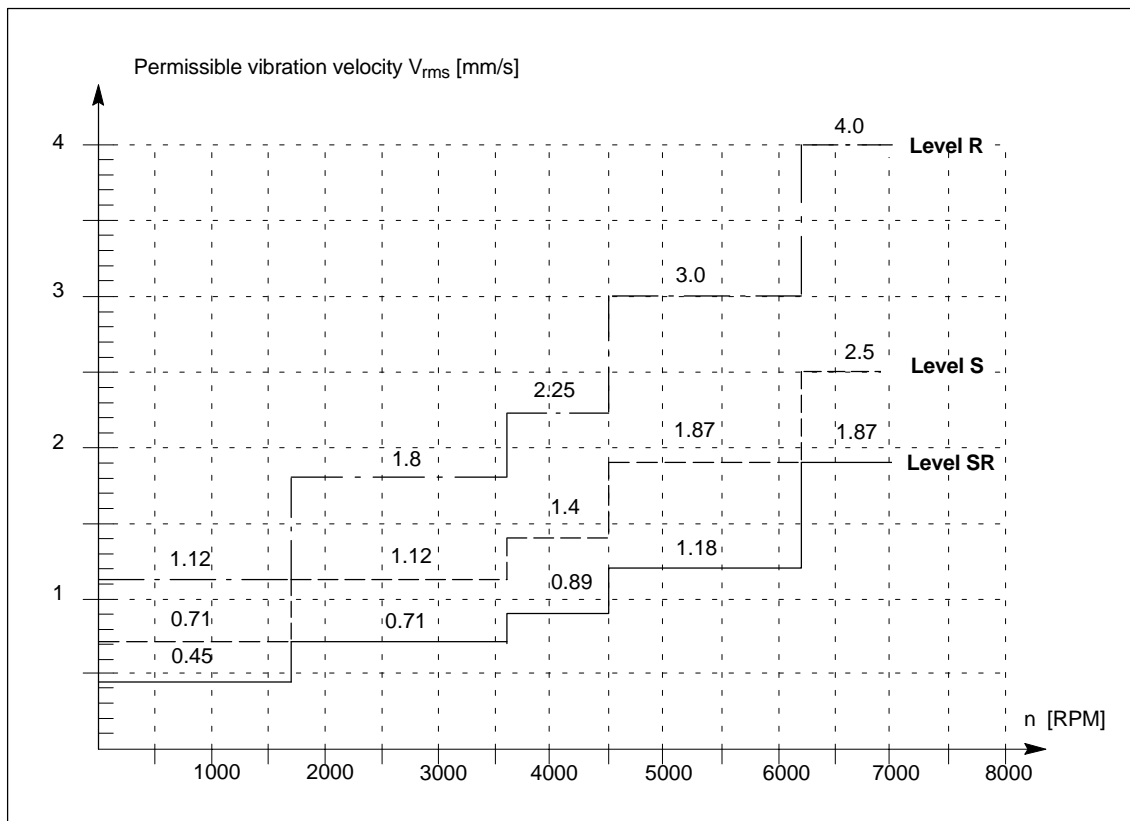


Fig. 2-3 Vibration severity, AC motors, shaft heights 160 mm to 225 mm

Requirements when balancing mounted components, especially belt pulleys

The vibration quality of motors with mounted belt pulleys, 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 to be achieved. For full key-balanced motors, we recommend belt pulleys with two keyways on opposite sides of the shaft, however, only one key in the shaft end.

ALA

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 | <ul style="list-style-type: none">–auxiliary shaft with keyway–keyway with the same dimensions as the motor shaft end–auxiliary shaft, half-key balanced <p>–Balance quality of the auxiliary shaft $\leq 10\%$ of the required balancing quality of the mounted components</p> | <ul style="list-style-type: none">–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 | <ul style="list-style-type: none">–auxiliary shaft without keyway–auxiliary shaft, if required with taper |
| Attach the component to the auxiliary shaft for balancing | <ul style="list-style-type: none">–attach with key–key design, dimensions and material the same as the motor shaft end | <ul style="list-style-type: none">–attach with key–keyway design, dimensions and materials the same as for full-key balancing of the auxiliary shaft | <ul style="list-style-type: none">–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 | <ul style="list-style-type: none">–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 | <ul style="list-style-type: none">–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.

2.1 Definitions

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.

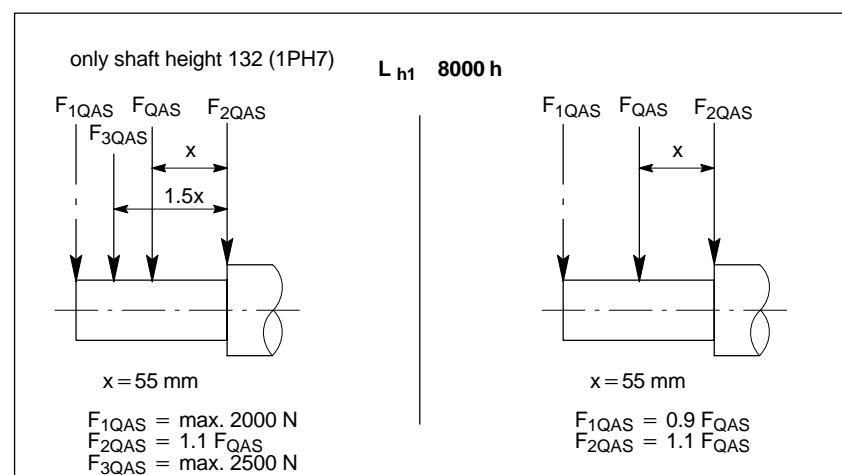


Fig. 2-4 Point of application of cantilever forces at the motor shaft end

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:

$$F_U = 2 * 10^7 * P / (n * D) \text{ in [N]}$$

| | | |
|-------|-------|-----------------------|
| 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)

$$L_{h \text{ tot}} = \frac{100}{\frac{q_1}{L_{h1}} + \frac{q_2}{L_{h2}} + \frac{q_3}{L_{h3}}} \quad \begin{array}{l} L_h = \text{from the diagram} \\ q = \text{time for which it is effective} \\ \text{with constant conditions [\%]} \end{array}$$

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.

ALA

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

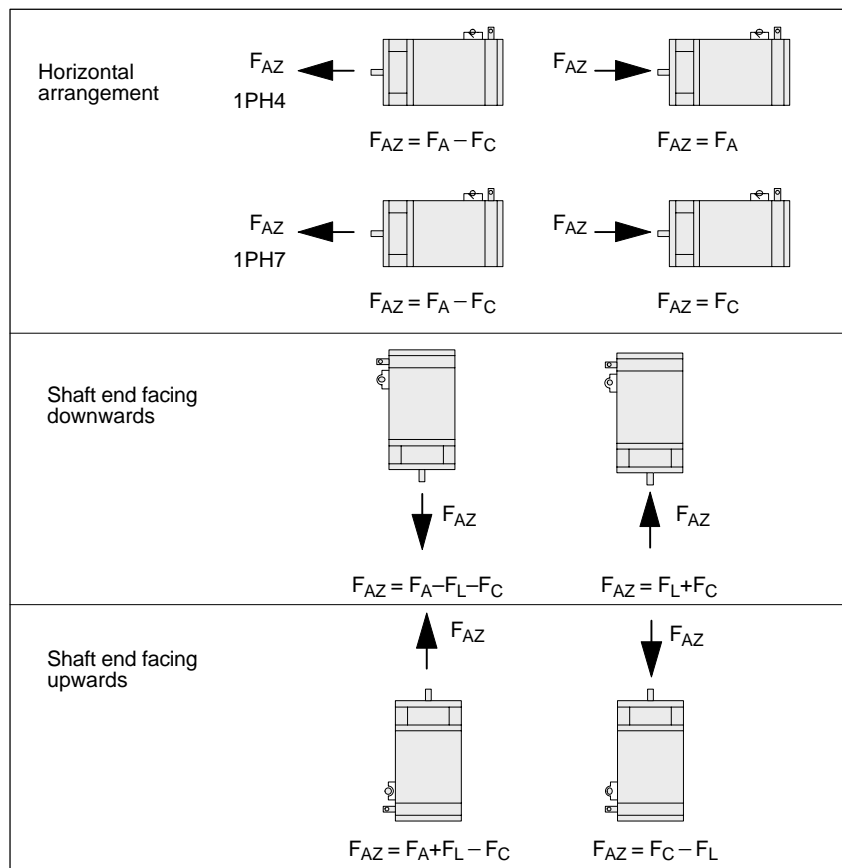


Fig. 2-5 Permissible axial force for 1PH7 motors

- 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 height 100 | 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 height 160 | 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⁾ |

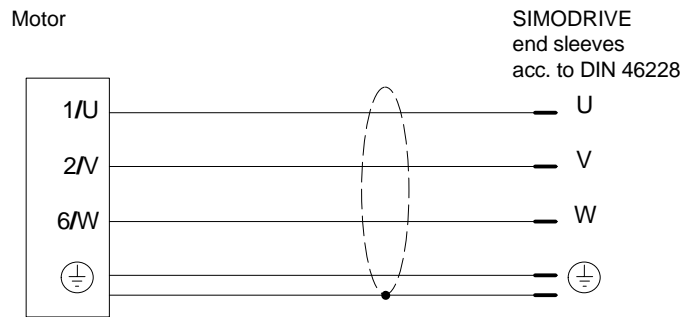


Caution

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.

- 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: | with overall shield | B A | |
| | (2 x 1.5) | | | |
| | 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 connection overview, must be observed.

Note

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

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Notes

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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:

$$M = P \cdot 9550/n, \quad M \text{ in Nm, } P \text{ in kW, } n \text{ in RPM}$$

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 :

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

3 Planning

The accelerating torque M_B is calculated as follows:

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

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

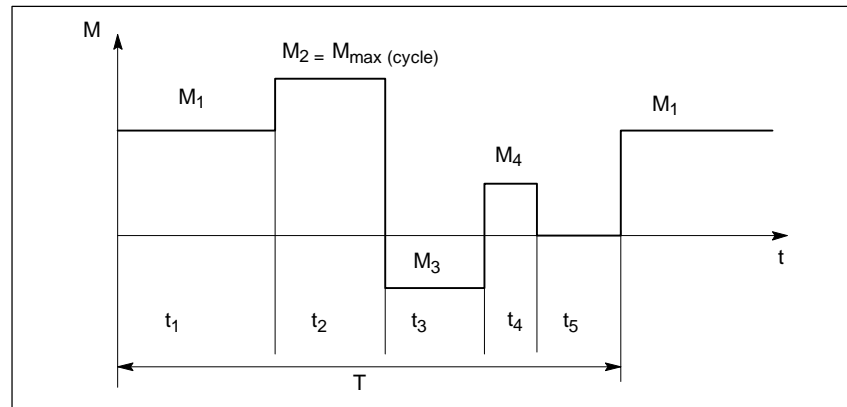


Fig. 3-1 Load duty cycle with 1PH6- motor

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

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

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:

- $T/T_{\text{th}} \leq 0.1$ (for a period of between 2 and 4 min)
A motor, with rated torque M_n should be selected:
 $M_n > M_{\text{rms}}$ and $M_{\text{max (cycle)}} < 2M_n$
- $0.1 \leq T/T_{\text{th}} \leq 0.5$ (for a period of between approx. 3 min and approx 20 min)

A motor with a rated torque M_n should be selected:

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

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

If, for load duty cycles, torques above M_n occur for longer than $0.5 T_{\text{th}}$, then a motor with a rated torque $M_n > M_{\text{max (cycle)}}$ 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: $J = 0.2 \text{ kgm}^2$, the friction can be neglected.

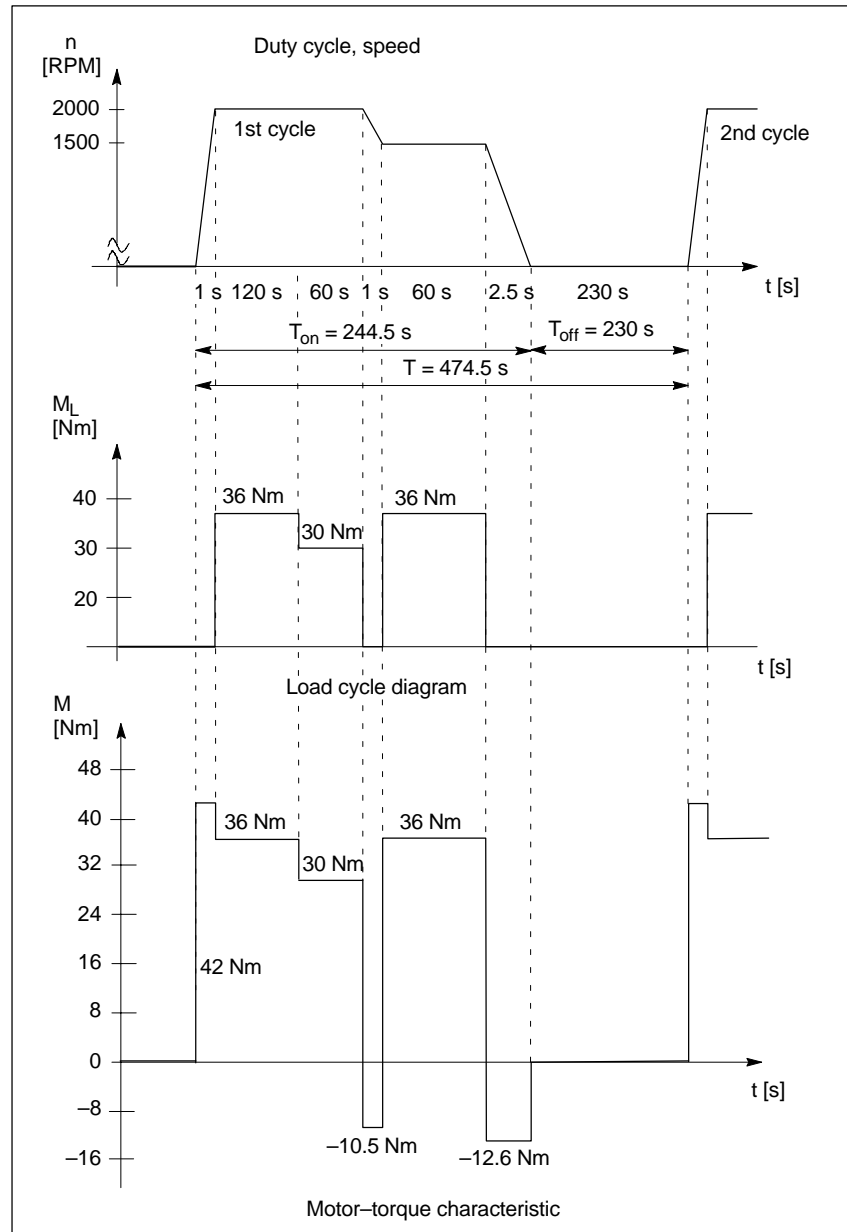
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Fig. 3-2 Load duty cycle as example

3 Planning

Calculating the accelerating torques

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

Accelerating for 1 s from 0 to 2000 RPM:

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

Braking for 1 s from 2000 to 1500 RPM:

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

Braking for 2.5 s from 1500 to 0 RPM:

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

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

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

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

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

$$M_{rms} = 24.7 Nm \approx 25 Nm$$

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.

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 $P_{\max} = 8 \text{ kW}$ at $n_{\max} = 5250 \text{ RPM}$ is required.
The field-weakening range should be 1 : 3.5.

The transition speed, demanded for this particular application, would then be $5250/3.5 \text{ RPM} = 1500 \text{ RPM}$.

The power-speed diagram shows, as solution, a motor with e.g.
 $P_n = 9 \text{ kW}$, $n_n = 1500 \text{ RPM}$, $M_n = 57 \text{ Nm}$.

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1FT5 AC Servomotors

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1FT5

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1

Motor Description

1.1 Characteristics and technical data

1FT5

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 $\Delta T=60$ 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 |

1.1 Characteristics and technical data

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 $\Delta T = 100$ K for an ambient temperature of 40 °C. |
| Installation altitude (acc. to IEC and EN 60034–1) | ≤ 1000 m 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, concentricity and axial eccentricity (DIN 42955; IEC 60072–1) | Tolerance R |
| Vibration severity (acc. to EN 60034–14; IEC 60034–14) | Degree R |
| Integrated/mounted components | <ul style="list-style-type: none"> • Fail-safe holding brake; 24 V \pm 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 |

1.1 Characteristics and technical data

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 con- verter current [A] | P _{calc} [kW] | Conne- ctor size | Cross- section ¹⁾ [mm ²] | 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 |

1FT5

1.1 Characteristics and technical data

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⁾ [mm ²] | 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 |

1 Core type
0 Not a core type

w/out brake cable: without overall shield
with overall shield
with brake cable: without overall shield
with overall shield

A
C
B
D

Lengths²⁾
(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 $I_{0rms} = I_{0[100K]} \times \sqrt{2/3}$; 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

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] | P _{calc} [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 |

1FT5

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

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

Calculating the output

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

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) 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 | – 4.7 | 1.5 1.5 | 1.9 | 4.1 3.9 |
| 1FT5036-□AK71 | – 4.7 | 2.3 2.4 | 3.0 | 6.6 6.2 |
| 1FT5042-□AF71 | – | 1.8 | 2.3 | 2.7 |
| 1FT5042-□AK71 | – 7.8 | 1.7 1.8 | 2.3 | 4.8 4.5 |
| 1FT5044-□AF71 | – 2.8 | 3.6 3.7 | 4.5 | 6.0 5.8 |
| 1FT5044-0AK71 | – 5.9 | 2.9 3.6 | 4.5 | 10.0 9.2 |
| 1FT5046-□AF71 | – 2.7 | 6.9 7.6 | 9.4 | 12.8 11.9 |
| 1FT5046-□AK71 | – 3.4 | 4.9 7.2 | 9.1 | 20.6 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 |
| 1FT5062-0AK71 | 10.0 | 2.8 | 3.5 | 5.4 |
| | — | 1.6 | | 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 |
| 1FT5064-0AK71 | 4.7 | 6.1 | | 11.9 |
| | — | 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 |

1FT5

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 |

1.2 Functions and options

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 |
| 1FT5074-0SK71 | 3.9 | 17.0 | | 32.5 |
| | – | 7.0 | 22.2 | 59.0 |
| | 2.2 | 18.0 | | 52.5 |
| 1FT5076-0SG71 | – | 11.5 | 31.6 | 54.5 |
| 1FT5076-0SK71 | 1.2 | 25.5 | | 48.5 |
| | – | 8.9 | 31.6 | 80.0 |
| | 1.1 | 25.5 | | 71.5 |
| 1FT5102-0SF71 | – | 20.5 | 56.6 | 75.5 |
| 1FT5102-0SG71 | 0.82 | 45.5 | | 67.5 |
| | – | 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 |

1FT5

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 |
| 1FT5132-0SC71 | 1.0 | 98.5 | | 58.0 |
| | – | 51.0 | 128.0 | 114.0 |
| 1FT5132-0SF71 | 0.56 | 101.0 | | 103.0 |
| | – | 35.5 | 124.0 | 140.0 |
| | 0.56 | 100.0 | | 125.0 |
| 1FT5134-0SA71 | – | 77.0 | 160.0 | 86.5 |
| 1FT5134-0SC71 | 0.68 | 131.0 | | 77.5 |
| | – | 54.5 | 156.0 | 137.0 |
| | 0.47 | 124.0 | | 123.0 |
| 1FT5136-0SA71 | – | 94.0 | 206.0 | 109.0 |
| 1FT5136-0SC71 | 0.56 | 166.0 | | 98.5 |
| | – | 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-magnetization
When utilized acc. to M_0 (60 K), the additional brake resistor is not required.

1.2 Functions and options

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 |
| 1FT5073-0AF71 | 4.7 – 3.9 | 9.1 5.9 9.1 | 11.3 | 8.8 14.7 13.3 |
| 1FT5100-0AC71 | – | 10.0 | 18.1 | 15.8 |
| 1FT5100-0AF71 | 3.3 – 2.7 | 14.5 8.0 14.5 | 18.0 | 14.3 23.8 21.4 |
| 1FT5101-0AC71 | – | 15.0 | 29.0 | 26.0 |
| 1FT5101-0AF71 | 2.2 – 1.5 | 24.0 11.9 23.5 | 28.7 | 23.5 39.0 34.5 |
| 1FT5103-0AC71 | – | 21.0 | 42.4 | 38.0 |
| 1FT5103-0AF71 | 1.5 – 1.2 | 34.0 16.0 34.5 | 42.7 | 34.0 56.5 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 Technical data of the holding brakes used with 1FT5 motors

| Motor type | Brake type | Holding torques M_4 ¹⁾ | | Dyn. torque M_{1m} [Nm] 120 °C | 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 | | | | | | | |
| 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 $n=3000/\text{min}$

3) Each emergency stop with $n=2000/\text{min}$

4) $W=1/2 \cdot J_{\text{total}} \cdot \omega^2$; J_{total} in [kgm²], ω in [1/s], W in [J]

1.2 Functions and options

**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 | | Max. speed | Highest switching power | Rated power | Brake closing time | Moment of inertia | Lifetime, oper- ations (nom. val.) |
|------------|------------|--------------------------------|-------|---------------|-------------------------------|----------------|--------------------------|----------------------|---|
| | | [Nm] | [RPM] | | | | | | |
| 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.

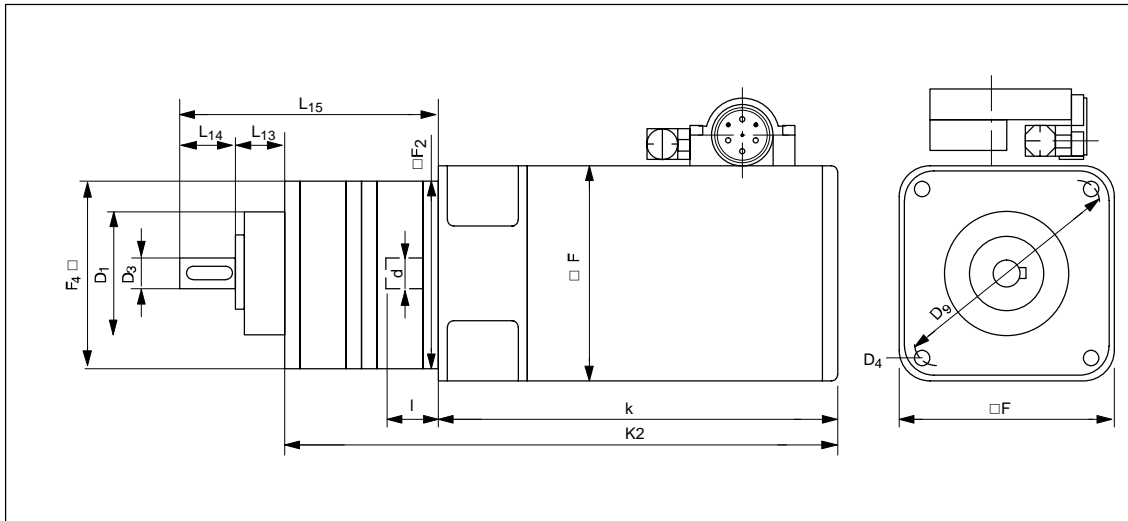


Fig. 1-1 1FT5 motor with planetary gearbox (alpha Company) SPG 1 stage dimensions in [mm]

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 | | |

1.2 Functions and options

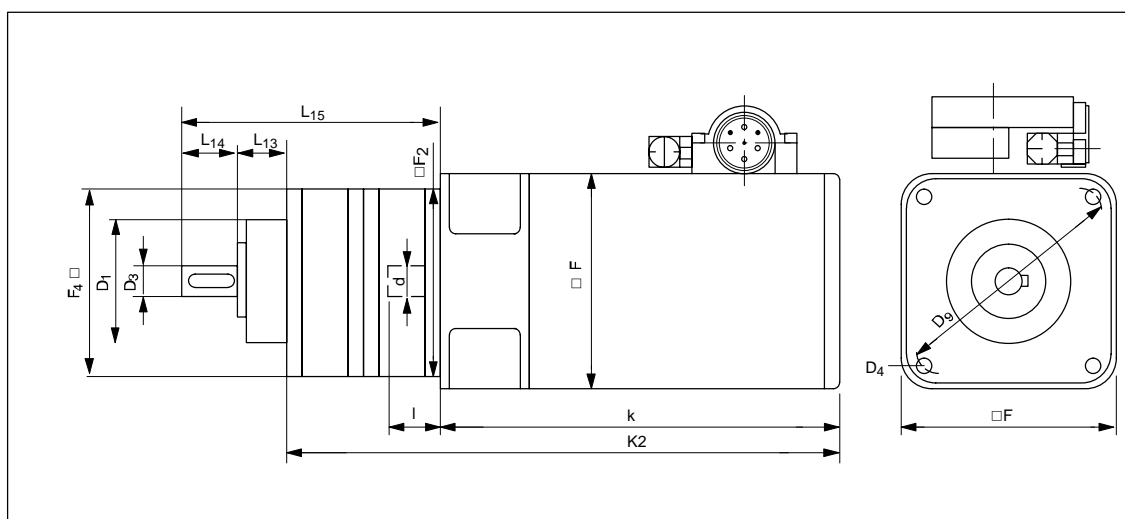


Fig. 1-2 1FT5 motor with planetary gearbox (alpha Company) SPG 2 stage – dimensions in [mm]

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

| Standart 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 | | | | SPG 140–M02 | 30 | 82 | 297 | 130 | 40 | 11 | 165 | 141 | | 428 | 140 |
| 1FT5064 | 281 | 40 | 19 | 115 | | | | | | | | | | | 466 | |
| 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 | SPG 240–M02 | 40 | 130 | 413 | 200 | 85 | 17 | 290 | 240 | | 568 | 190 |
| 1FT5076 | 373 | 50 | 24 | 142 | | | | | | | | | | | 616 | |
| 1FT5102 | 352 | 58 | 32 | 190 | | | | | | | | | | | 595 | |
| 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 | | 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 1FT5036 | SPG 060-M01 | 1.5 | X | X | X | X | 6000 | 40 (32) ³⁾ | 2600 | 0.14 | 0.12 |
| 1FT5042 1FT5044 1FT5046 | SPG 075-M01 | 2.8 | X | X | X | X | 6000 | 100 (80) ³⁾ | 3800 | 0.57 | 0.4 |
| 1FT5062 1FT5064 1FT5066 | SPG 100-M01 | 6.2 | X | X | X | X | 4500 | 250 (200) ³⁾ | 6000 | 2.0 | 1.3 |
| 1FT5072 1FT5074 1FT5076 | SPG 140-M01 | 11.5 | X | X | X | X | 4000 | 500 (400) ³⁾ | 9000 | 5.7 | 3.5 |
| 1FT5102 1FT5104 1FT5106 1FT5108 | SPG 180-M01 | 27 | X | X | X | X | 3500 | 1100 (880) ³⁾ | 14000 | 30.6 | 17.4 |
| 1FT5132 1FT5134 1FT5136 1FT5138 | SPG 210-M01 | 45 | X | X | X | X | 2000 | 1600 (1280) ³⁾ | 15000 | 70.0 | 31.0 |
| 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 $F_a=0.5 \cdot F_r$ 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 $i=10$

1.2 Functions and options

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-ventila- ted | Planetary gearbox 2 stage | | Available gearbox ratios $i =$ | | | | | Max. per- missible in- put speed | Max. per- missible output tor- que | Max. per- missible drive out shaft load 1) | Moment of inertia, ge- arbox |
|---|------------------------------|-------------------------|-----------------------------------|-----|-----|-----|-----|--|---|--|---|
| 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 kgm ² |
| 1FT5034 1FT5036 | SPG 075-M02 | 3.1 | X | X | X | X | X | 6000 | 100 | 3800 | 0.47 |
| 1FT5042 1FT5044 | | | X | X | X | X | | | | | 0.52 |
| | | | X | X | | | | | | | |
| 1FT5042 1FT5044 1FT5046 | SPG 100-M02 | 7.1 | | | X | X | X | 4500 | 250 | 6000 | 1.7 |
| 1FT5062 1FT5064 | | | X | X | X | X | X | | | | 1.8 |
| | | | X | X | | | | | | | |
| 1FT5064 1FT5066 | SPG 140-M02 | 14.5 | | | X | X | X | 4000 | 500 | 9000 | 4.4 |
| 1FT5072 | | | X | X | | | | | | | 5.1 |
| 1FT5072 1FT5074 1FT5076 | SPG 180-M02 | 29 | | | X | X | | 4000 | 1100 | 14000 | 5.5 |
| 1FT5072 1FT5074 1FT5076 | SPG 210-M02 | 51 | | | | X | X | 3000 | 1600 | 15000 | 6.25 |
| 1FT5102 | | | X | X | | | | | | | |
| 1FT5076 1FT5102 1FT5104 1FT5106 1FT5108 | SPG 240-M02 | 61 | | | X | X | X | 3000 | 3000 | 22000 | 19.0 |
| | | | X | X | 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 $F_a=0.5 \cdot F_r$ 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 |

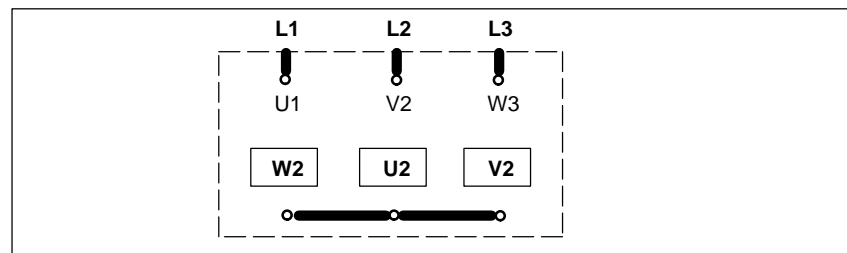


Fig. 1-3 Fan connection, shaft heights 100/132

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

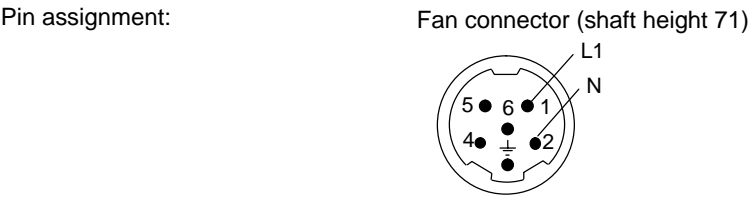
The available torque is reduced by approx. 20 % when reversing the air flow direction.

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



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 | 20 |
| 100 | 30 |
| 132 | 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!

1.3 Interfaces

Circuit diagrams

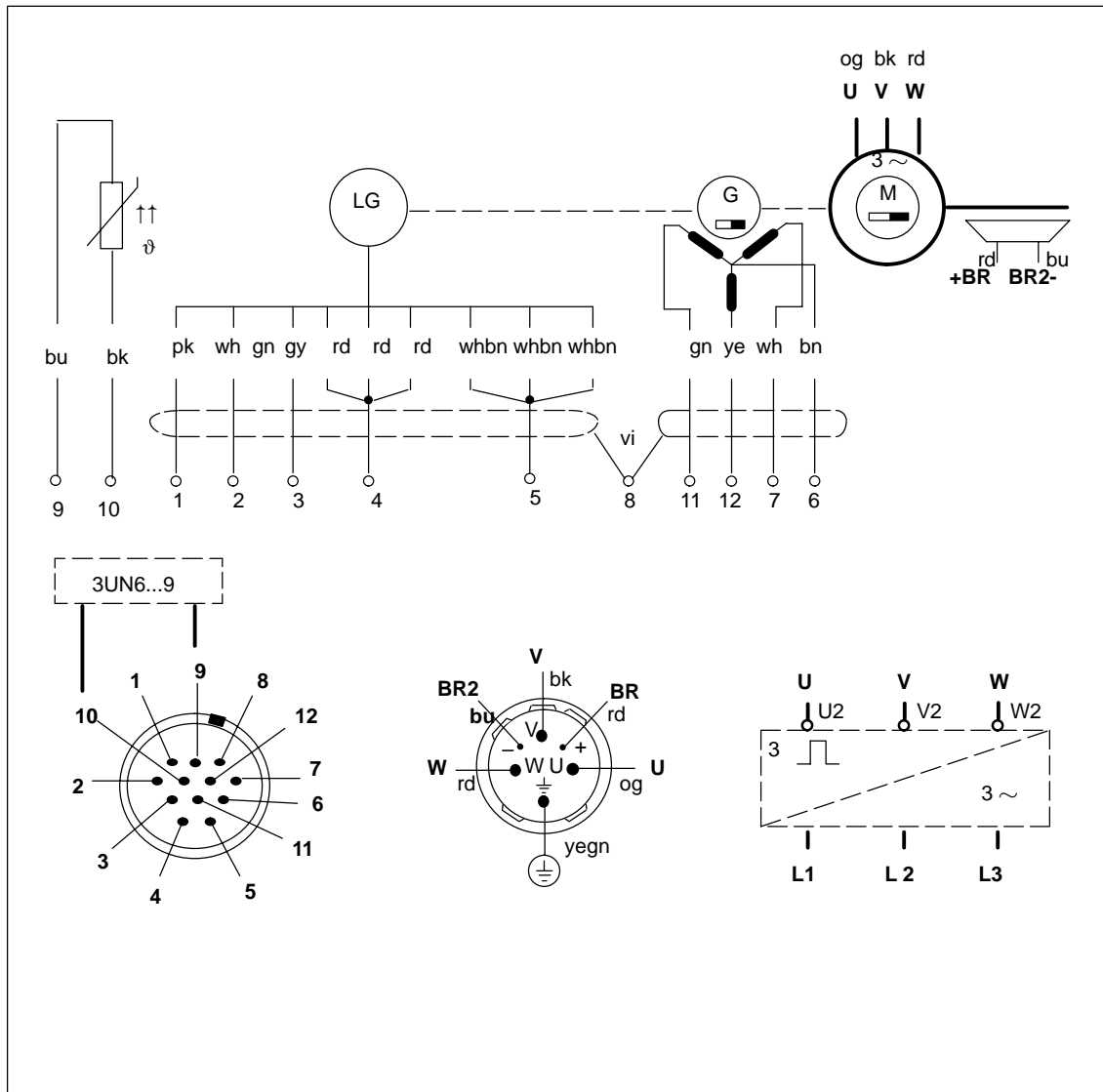


Fig. 1-4 Connection assignment: Power, brake, tachometer, position encoder and PTC thermistor

1.4 Thermal motor protection

Refer to GE Chapter 1

1.5 Encoders

Refer to GE Chapter 1



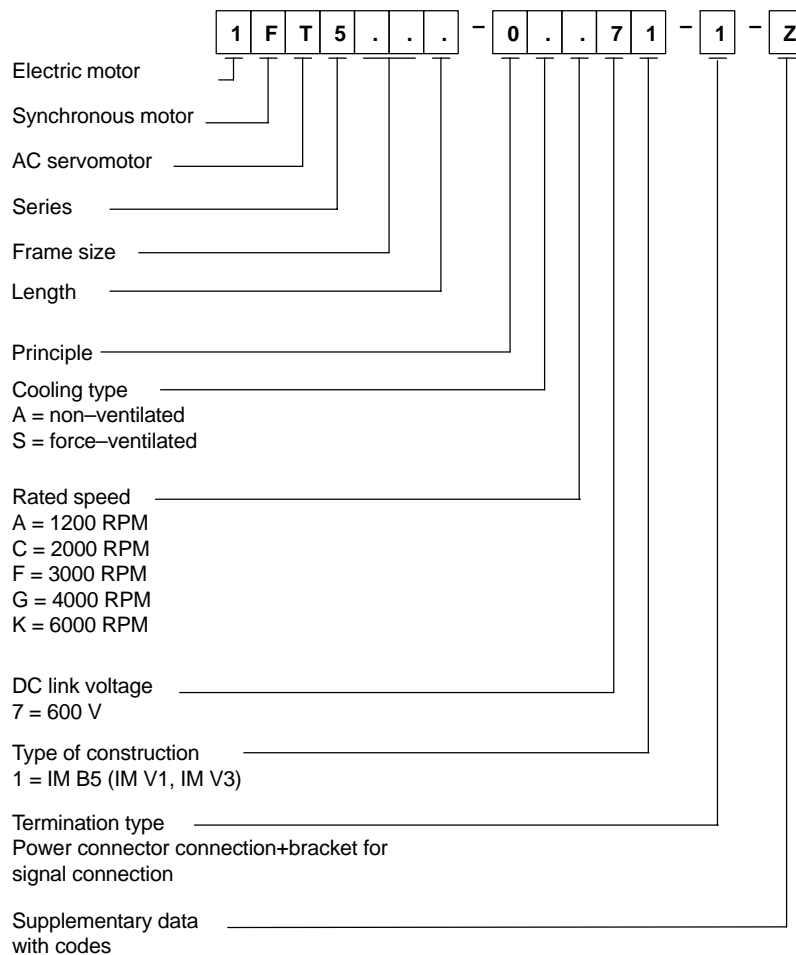
Order Designations

2

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.

1FT5


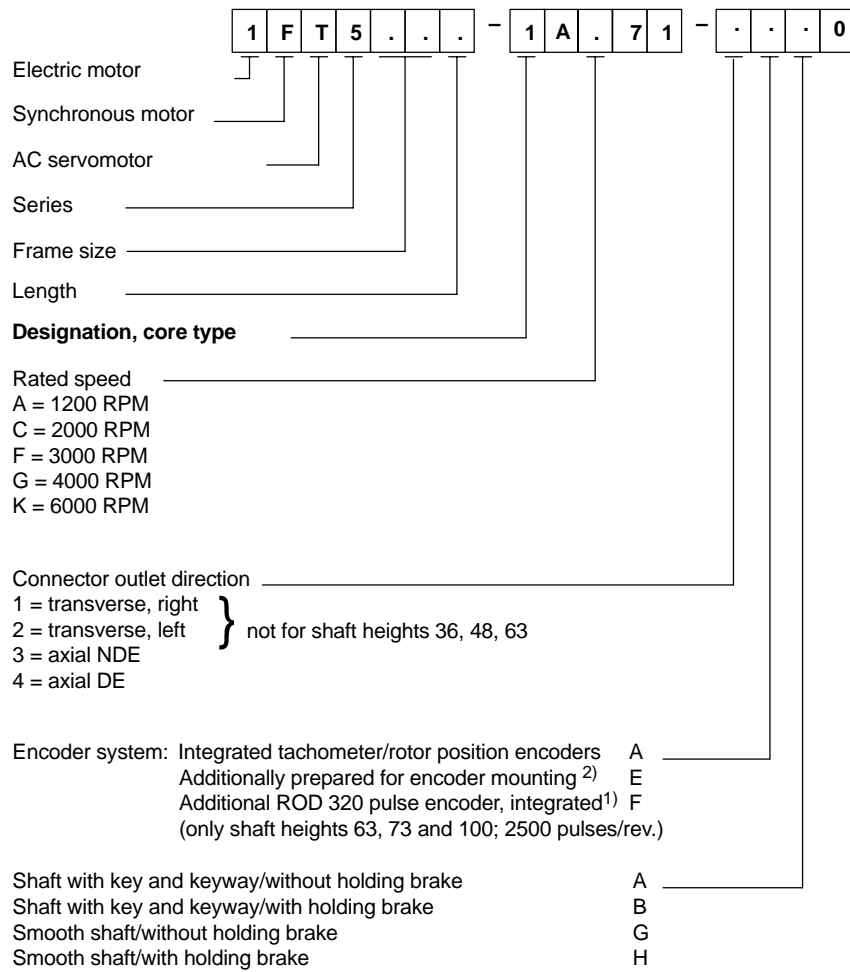
2 Order Designations

**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 ≤ 0.71 mm/s >1800 to 3600 RPM ≤ 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 instructions ⁵⁾ | 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 $\Delta T=60$ 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.

Order designation, core types



1FT5

1) Limiting frequency: 300 kHz; motors may only be dimensioned for a winding temperature $\Delta T=60$ 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 $\Delta T = 100\text{ K}$
- 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

1FT5102–0AF71–1–Z

$n_{\text{rated}} = 3000\text{ RPM}$,

$M_0 = 33\text{ Nm at } \Delta T = 100\text{ K}$

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)



3

Technical Data and Characteristics

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 $\Delta T = 60$ K. Shaft heights 100 and 132 may still be utilized according to $\Delta T = 100$ K.
 - The shift of the voltage limiting characteristics is described in Chapter AL S/1.1.
 - The specified thermal limiting characteristics are referred to $\Delta T = 100$ K.
-

3.1.1 Standard motors

Note

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

3.1 Speed–torque diagrams

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 | $R_{\text{ph.}}$ | 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 | |

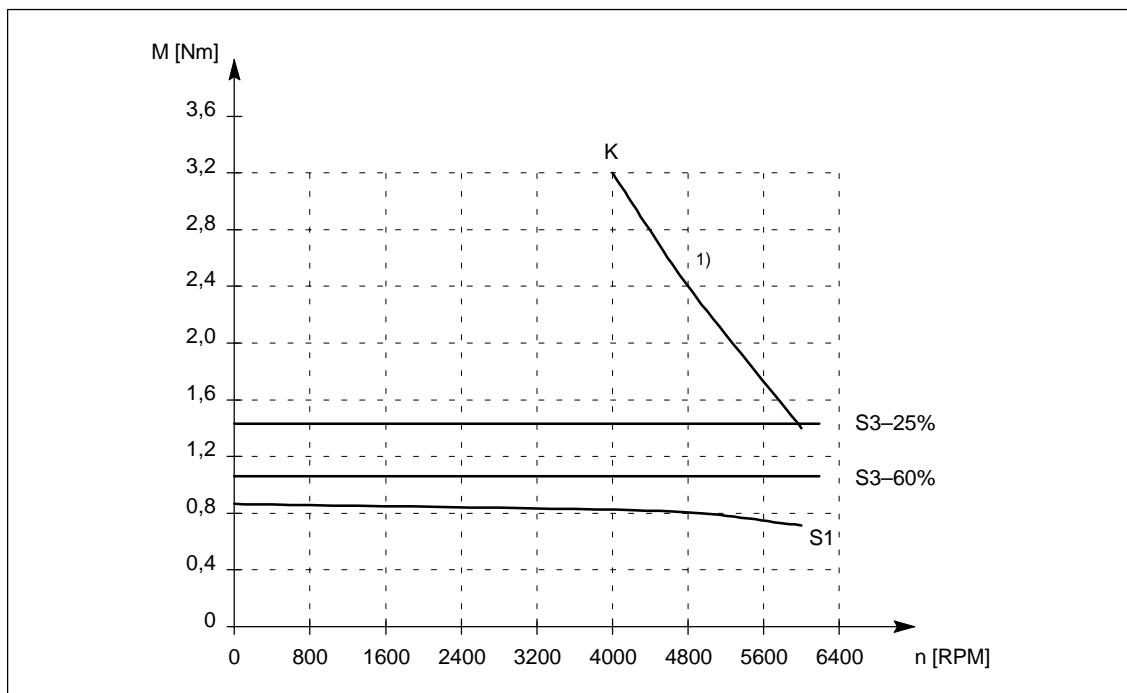


Fig. 3-1 Speed–torque diagram 1FT5034

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 | $R_{\text{ph.}}$ | 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 | |

1FT5

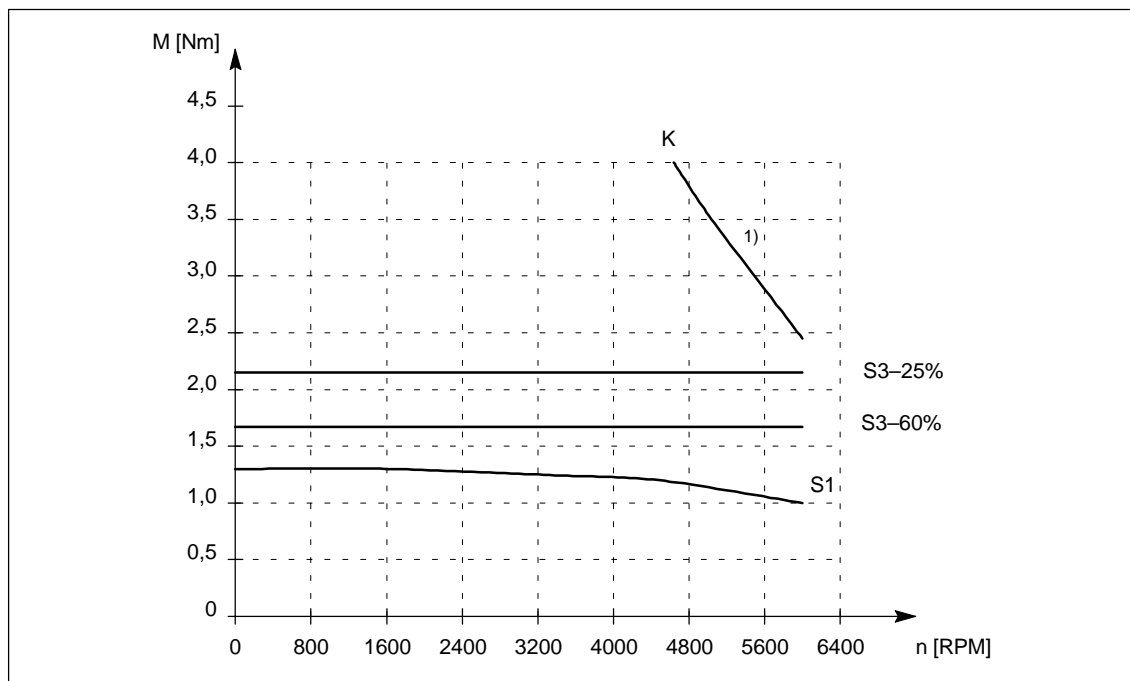


Fig. 3-2 Speed–torque diagram 1FT5036

1) valid for a 600 V DC link voltage

3.1 Speed-torque diagrams

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 | $R_{\text{ph.}}$ | 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 | |

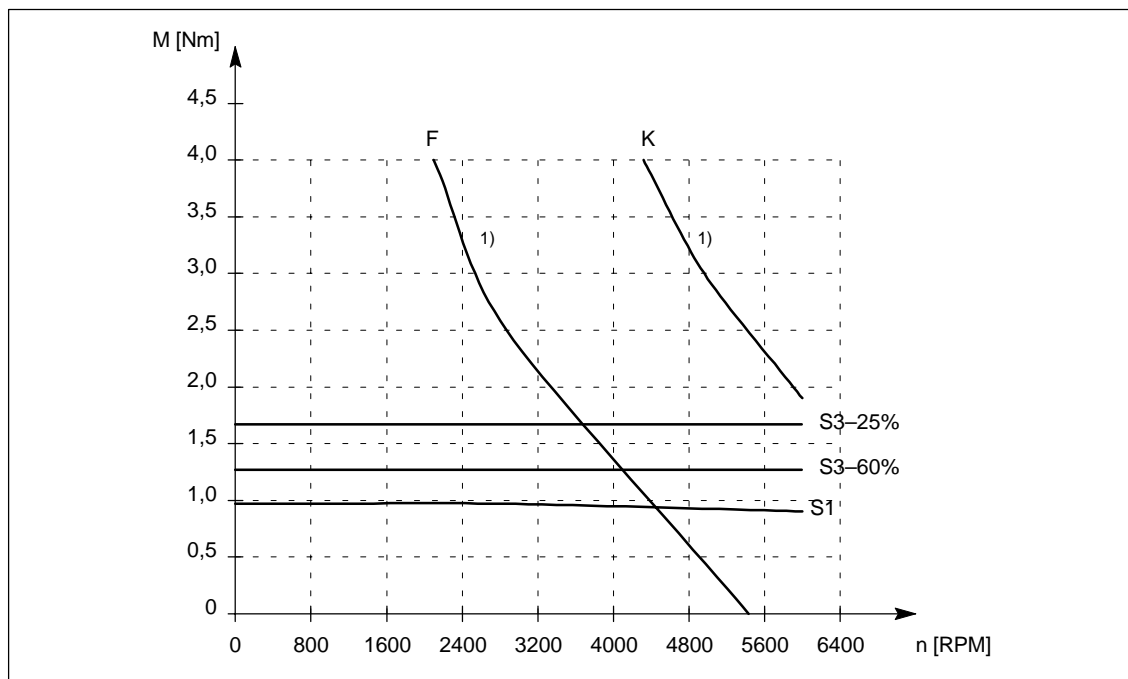


Fig. 3-3 Speed-torque diagram 1FT5042

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 | $R_{\text{ph.}}$ | 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 | |

1FT5

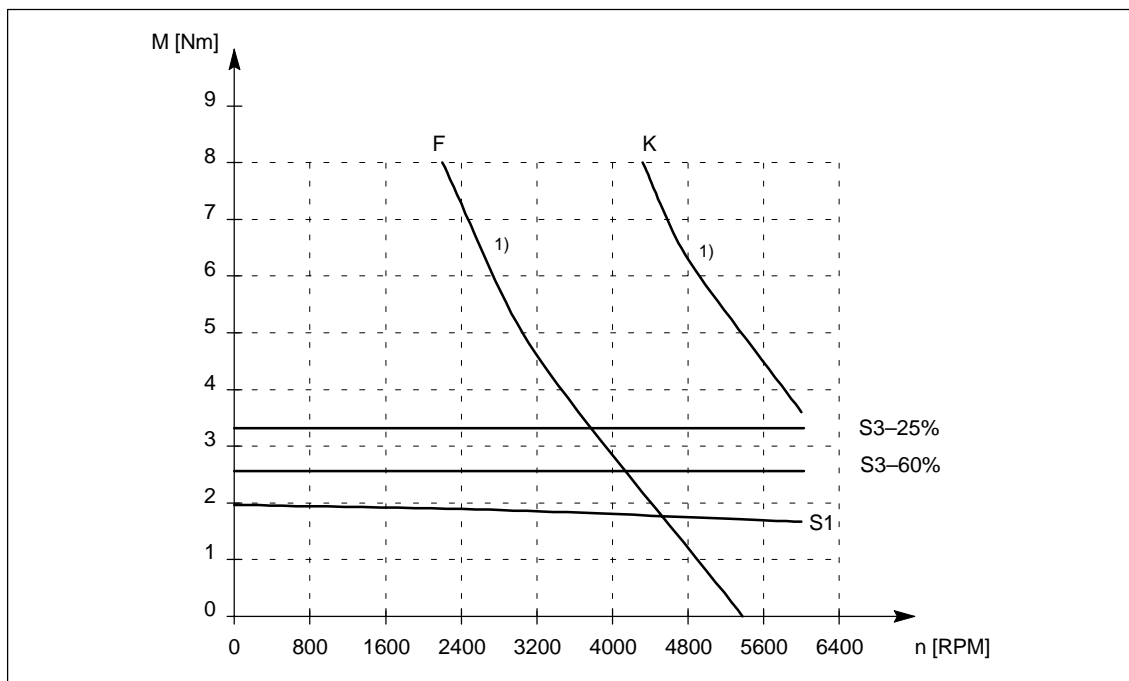


Fig. 3-4 Speed–torque diagram 1FT5044

1) valid for a 600 V DC link voltage

3.1 Speed–torque diagrams

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 | $R_{\text{ph.}}$ | 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 | |

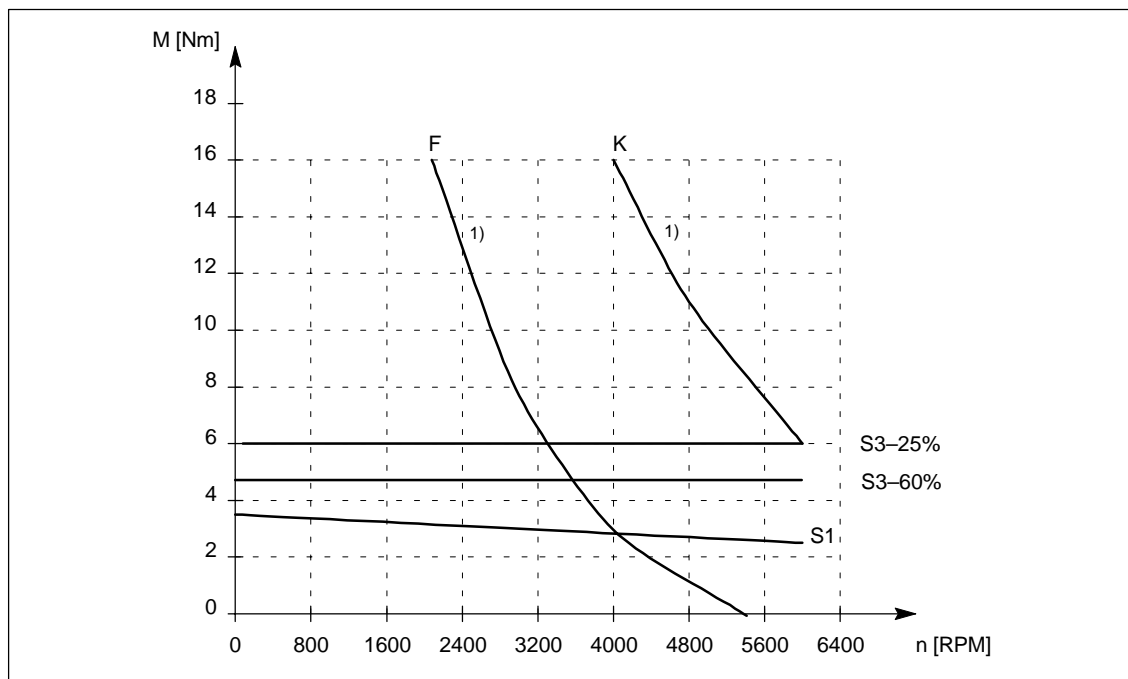


Fig. 3-5 Speed–torque diagram 1FT5046

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 | $R_{\text{ph.}}$ | 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

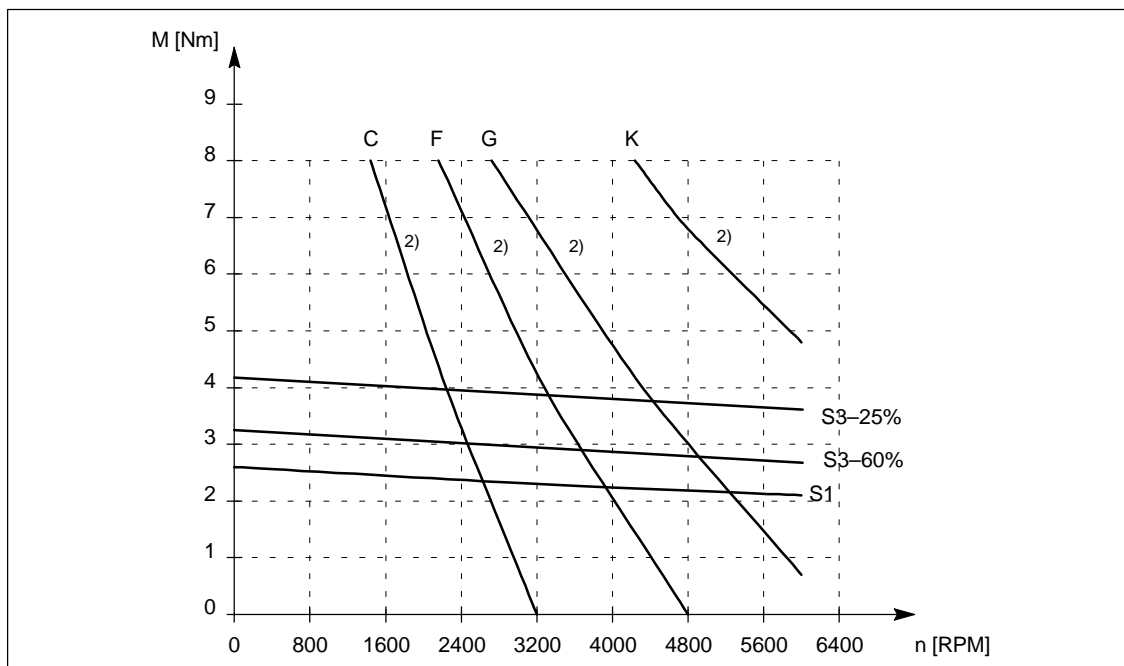


Fig. 3-6 Speed–torque diagram 1FT5062

2) valid for a 600 V DC link voltage

3.1 Speed–torque diagrams

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 | $R_{\text{ph.}}$ | 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 |

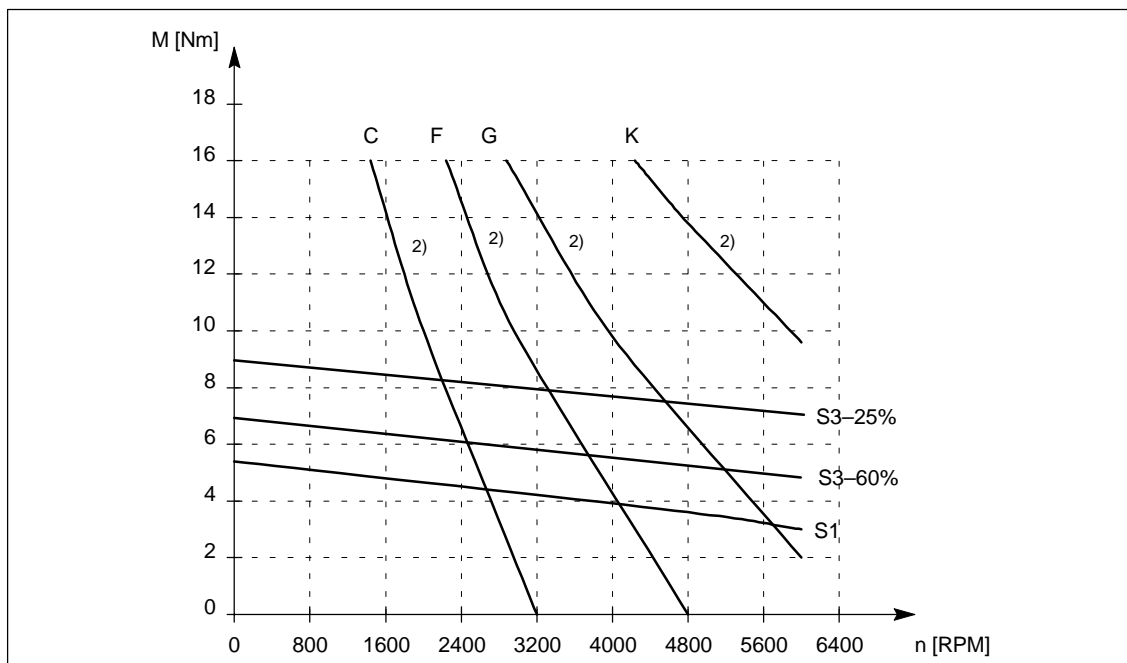


Fig. 3-7 Speed–torque diagram 1FT5064

2) valid for a 600 V DC link voltage

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 | $R_{\text{ph.}}$ | 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 |

1FT5

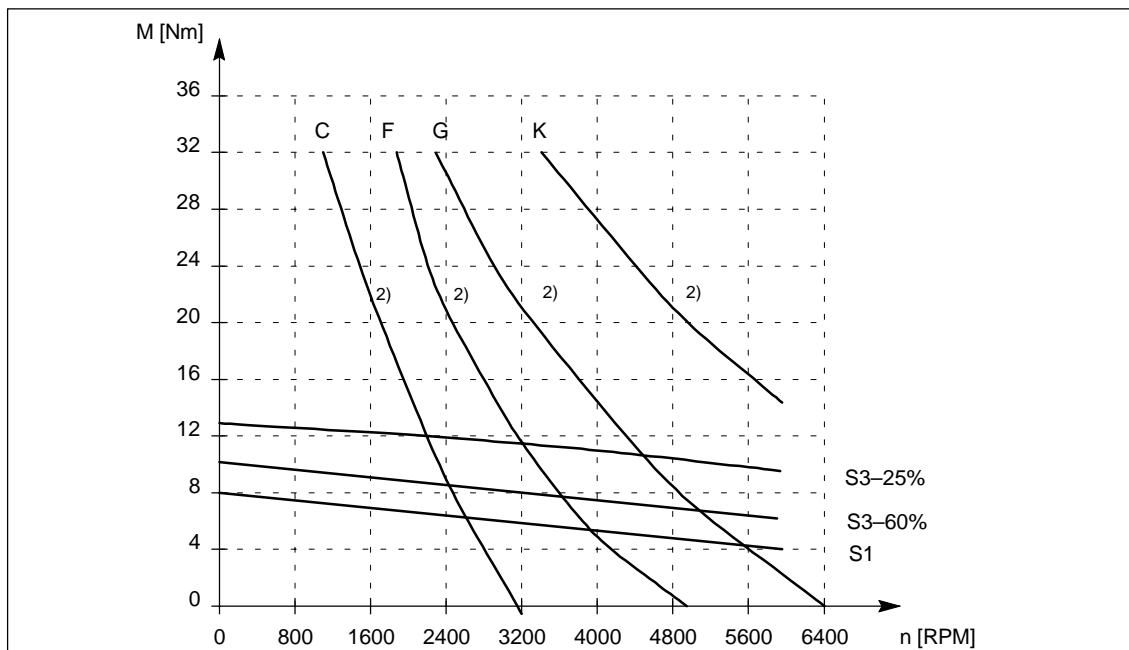


Fig. 3-8 Speed–torque diagram 1FT5066

2) valid for a 600 V DC link voltage

3.1 Speed–torque diagrams

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 | $M_{\text{rated}} (100 \text{ K})$ | Nm | 9.5 | 8.5 | 7.5 | 5.0 |
| Rated current | I_{rated} | A | 6.3 | 8.4 | 9.8 | 9.9 |
| Stall torque | $M_0 (60 \text{ K})$ | Nm | 10.0 | 10.0 | 10.0 | 10.0 |
| Stall torque | $M_0 (100 \text{ K})$ | Nm | 12.0 | 12.0 | 12.0 | 12.0 |
| Stall current | $I_0 (60 \text{ K})$ | A | 6.1 | 9.1 | 12.0 | 17.5 |
| Stall current | $I_0 (100 \text{ K})$ | 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 | $R_{\text{ph.}}$ | 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 |

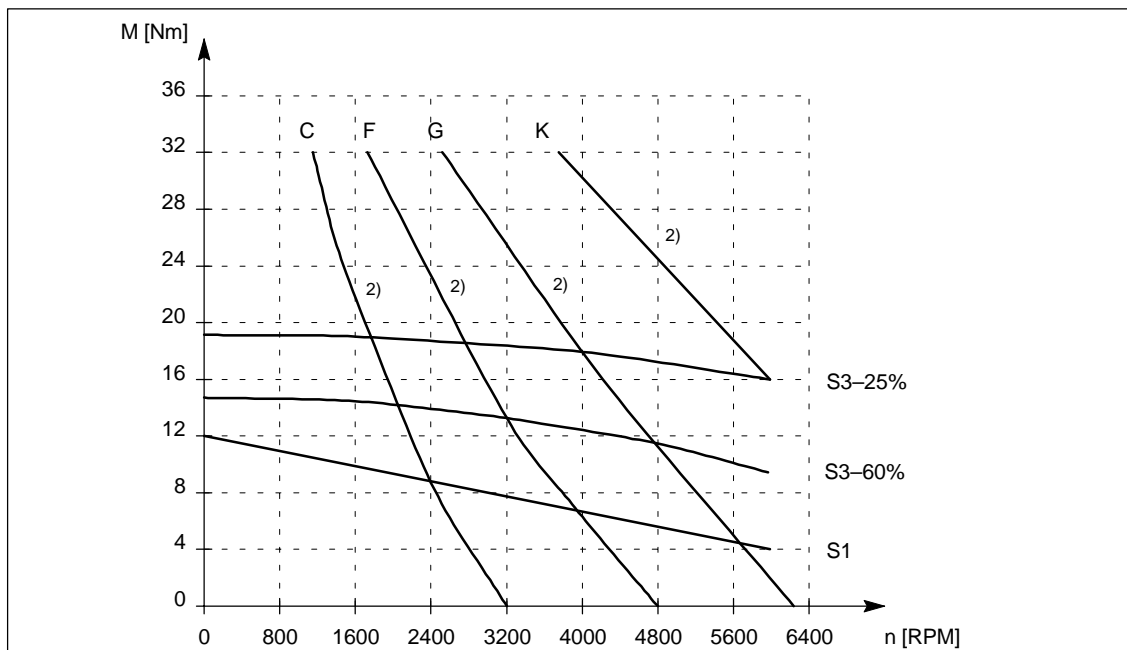


Fig. 3-9 Speed–torque diagram 1FT5072

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 | $R_{\text{ph.}}$ | 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 |

1FT5

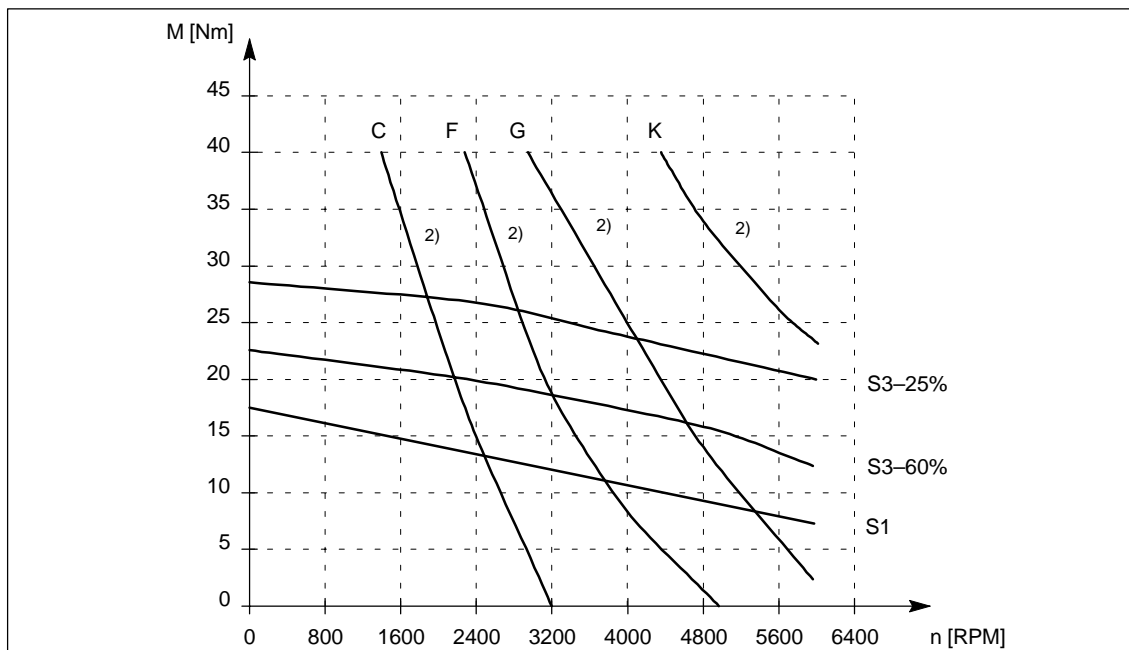


Fig. 3-10 Speed–torque diagram 1FT5074

2) valid for a 600 V DC link voltage

3.1 Speed–torque diagrams

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 | $M_{\text{rated}} (100 \text{ K})$ | Nm | 18.5 | 16.5 | 13.0 | 4.0 |
| Rated current | I_{rated} | A | 12.0 | 16.0 | 17.0 | 9.0 |
| Stall torque | $M_0 (60 \text{ K})$ | Nm | 18.0 | 18.0 | 18.0 | 18.0 |
| Stall torque | $M_0 (100 \text{ K})$ | Nm | 22.0 | 22.0 | 22.0 | 22.0 |
| Stall current | $I_0 (60 \text{ K})$ | A | 11.5 | 16.5 | 21.5 | 32.0 |
| Stall current | $I_0 (100 \text{ K})$ | 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 | $R_{\text{ph.}}$ | 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 |

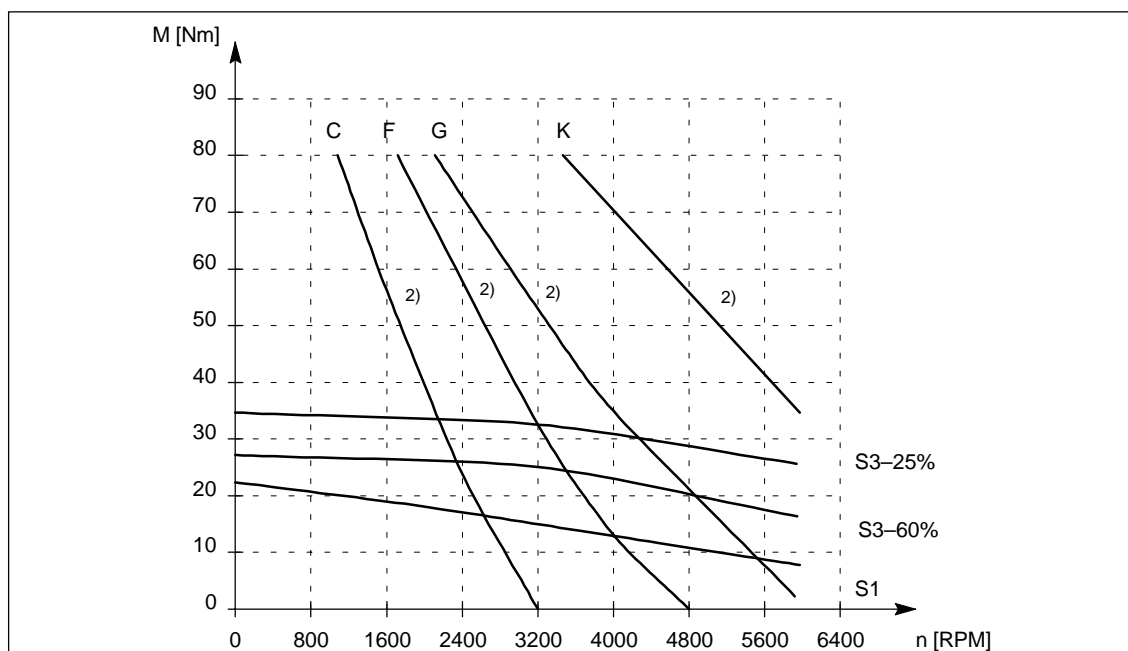


Fig. 3-11 Speed–torque diagram 1FT5076

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 | $M_{\text{rated}} (100 \text{ K})$ | Nm | 31.0 | 29.0 | 25.0 | 10.0 |
| Rated current | I_{rated} | A | 12.0 | 19.0 | 25.0 | 13.0 |
| Stall torque | $M_0 (60 \text{ K})$ | Nm | 27.0 | 27.0 | 27.0 | 27.0 |
| Stall torque | $M_0 (100 \text{ K})$ | Nm | 33.0 | 33.0 | 33.0 | 33.0 |
| Stall current | $I_0 (60 \text{ K})$ | A | 9.9 | 16.5 | 25.0 | 31.5 |
| Stall current | $I_0 (100 \text{ K})$ | 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 | $R_{\text{ph.}}$ | 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 |

1FT5

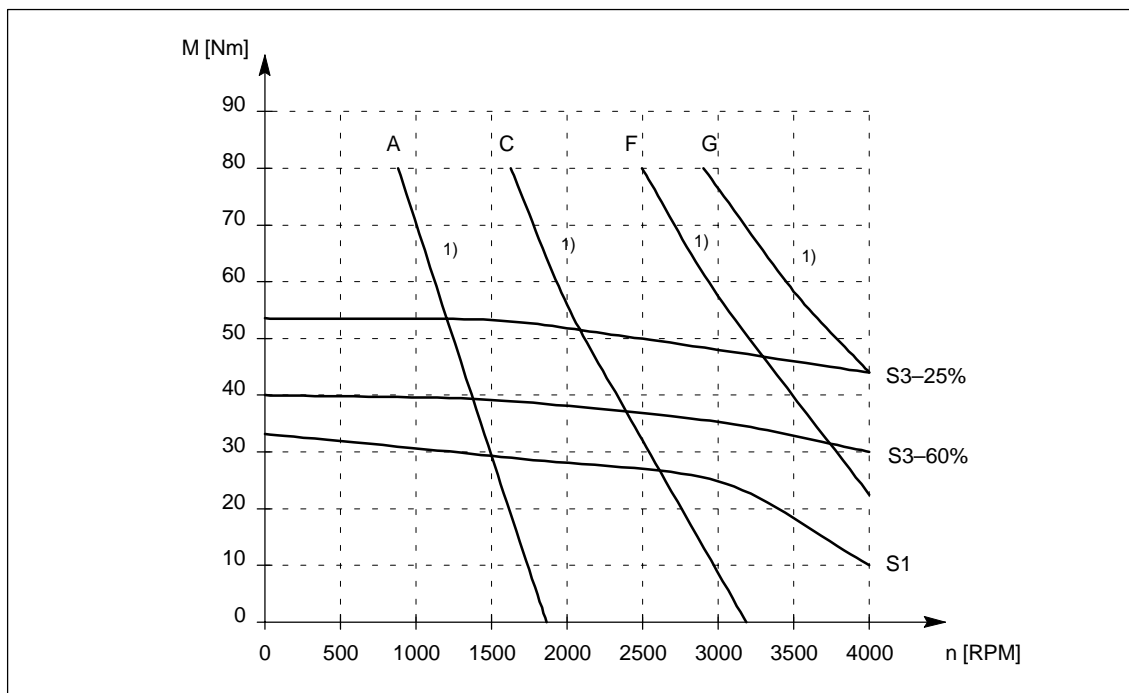


Fig. 3-12 Speed–torque diagram 1FT5102

1) valid for a 600 V DC link voltage

3.1 Speed–torque diagrams

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 | $M_{\text{rated}} (100 \text{ K})$ | Nm | 40.0 | 35.0 | 29.0 | |
| Rated current | I_{rated} | A | 16.0 | 23.0 | 29.0 | |
| Stall torque | $M_0 (60 \text{ K})$ | Nm | 37.0 | 37.0 | 37.0 | |
| Stall torque | $M_0 (100 \text{ K})$ | Nm | 45.0 | 45.0 | 45.0 | |
| Stall current | $I_0 (60 \text{ K})$ | A | 14.0 | 22.5 | 34.0 | |
| Stall current | $I_0 (100 \text{ K})$ | 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 | $R_{\text{ph.}}$ | 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 | |

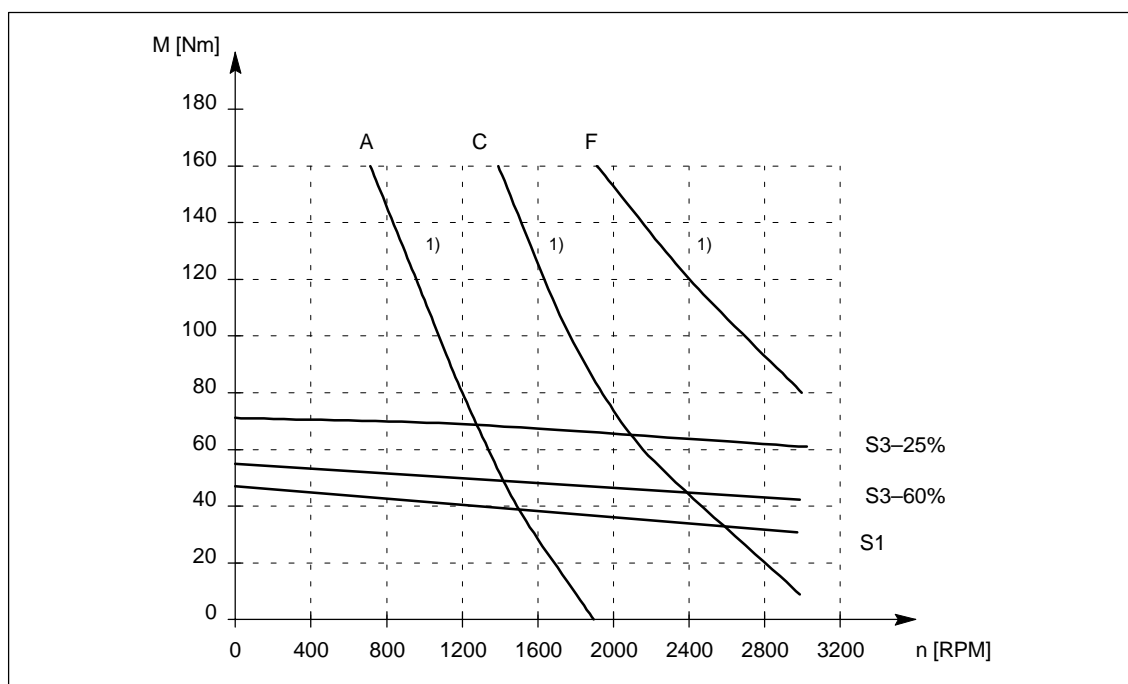


Fig. 3-13 Speed–torque diagram 1FT5104

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 | |

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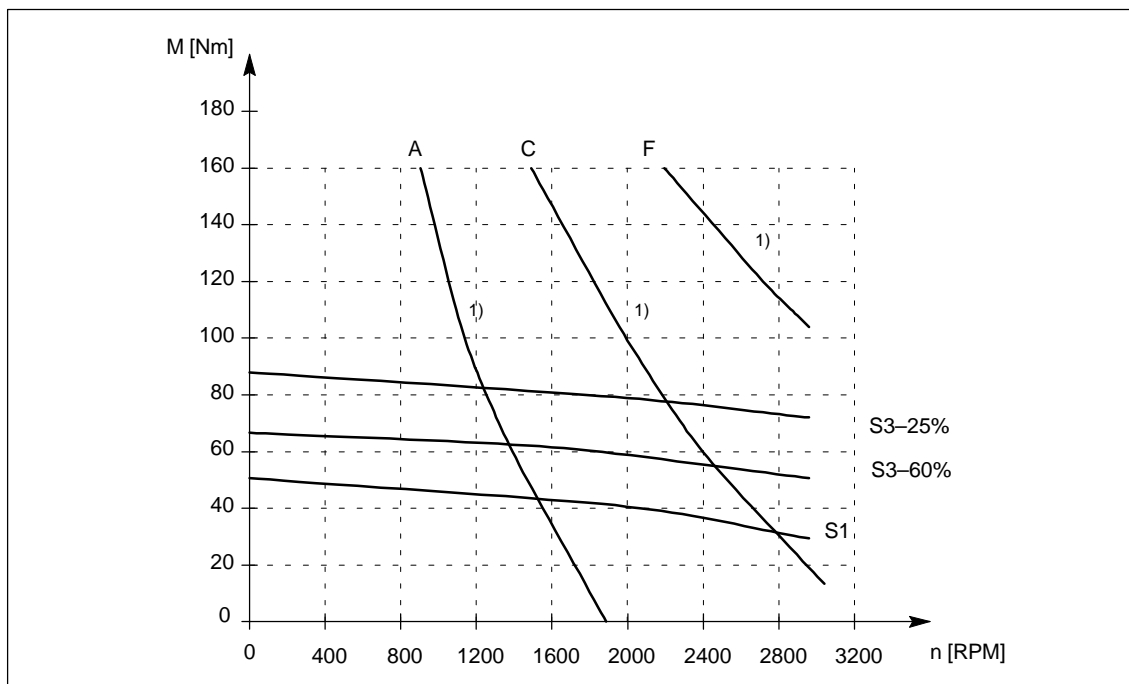


Fig. 3-14 Speed–torque diagram 1FT5106

1) valid for a 600 V DC link voltage

3.1 Speed–torque diagrams

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 | $R_{\text{ph.}}$ | 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 | |

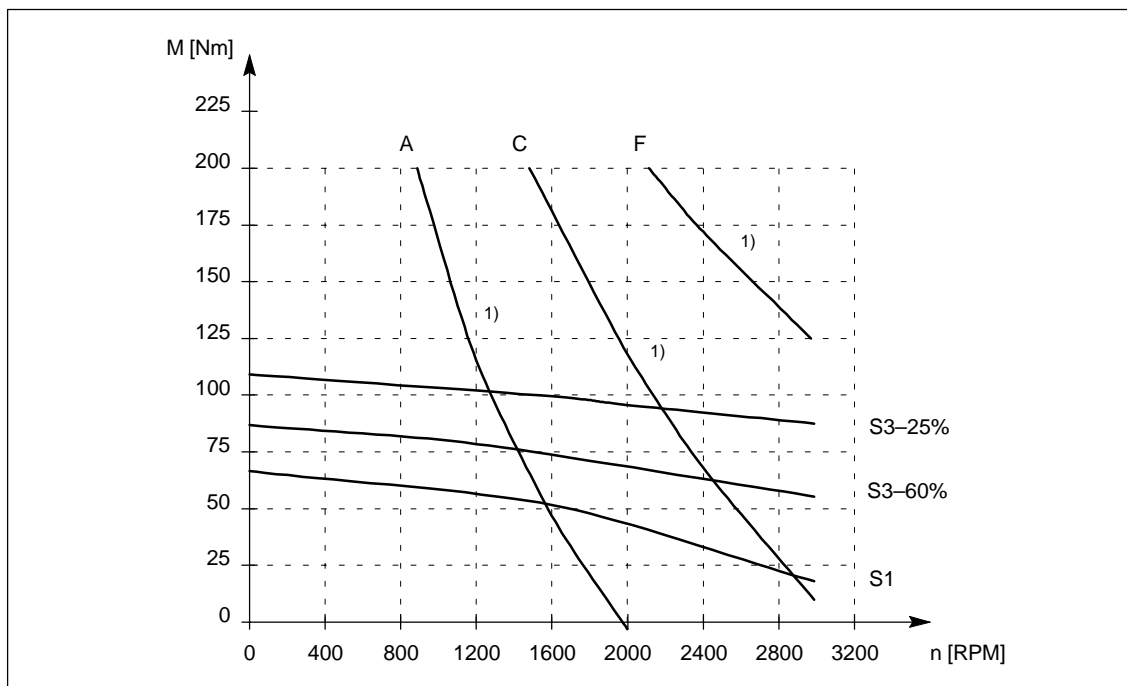


Fig. 3-15 Speed–torque diagram 1FT5108

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 | |

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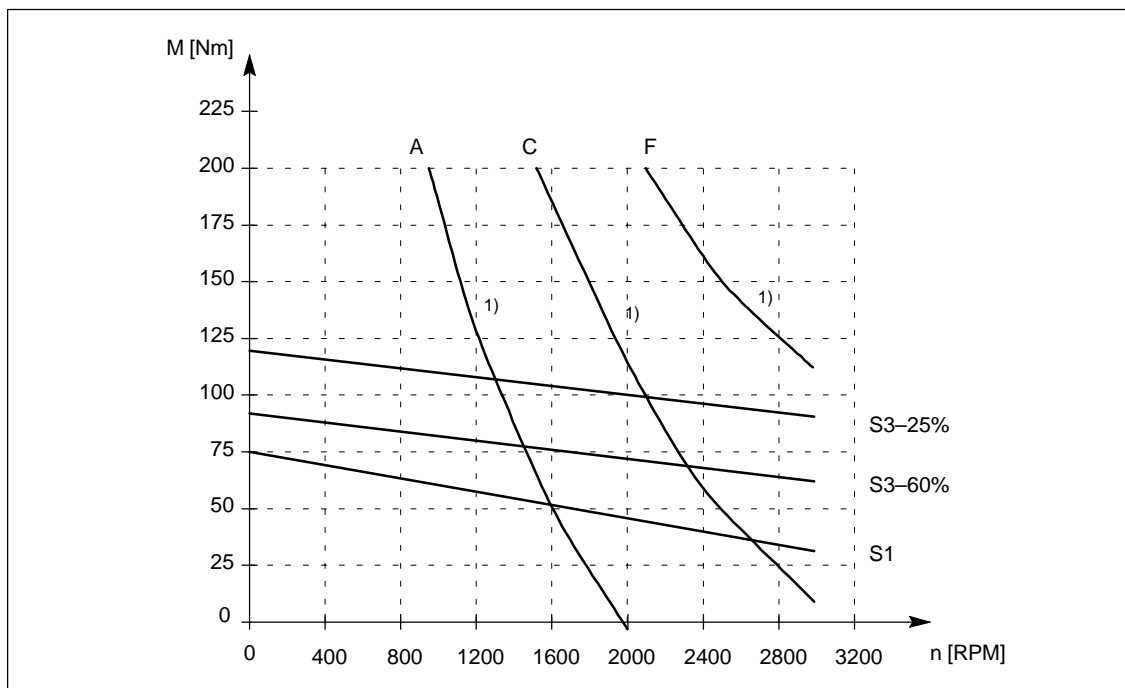


Fig. 3-16 Speed–torque diagram 1FT5132

1) valid for a 600 V DC link voltage

3.1 Speed–torque diagrams

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 | $R_{\text{ph.}}$ | 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 | |

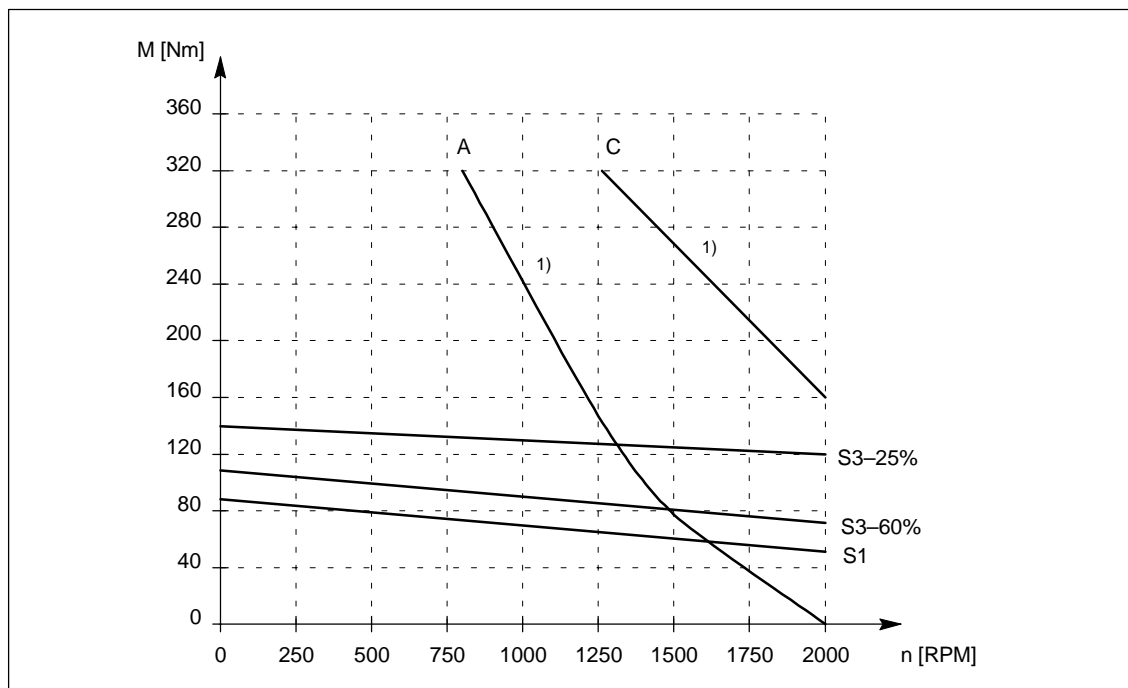


Fig. 3-17 Speed–torque diagram 1FT5134

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 | $R_{\text{ph.}}$ | 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 | |

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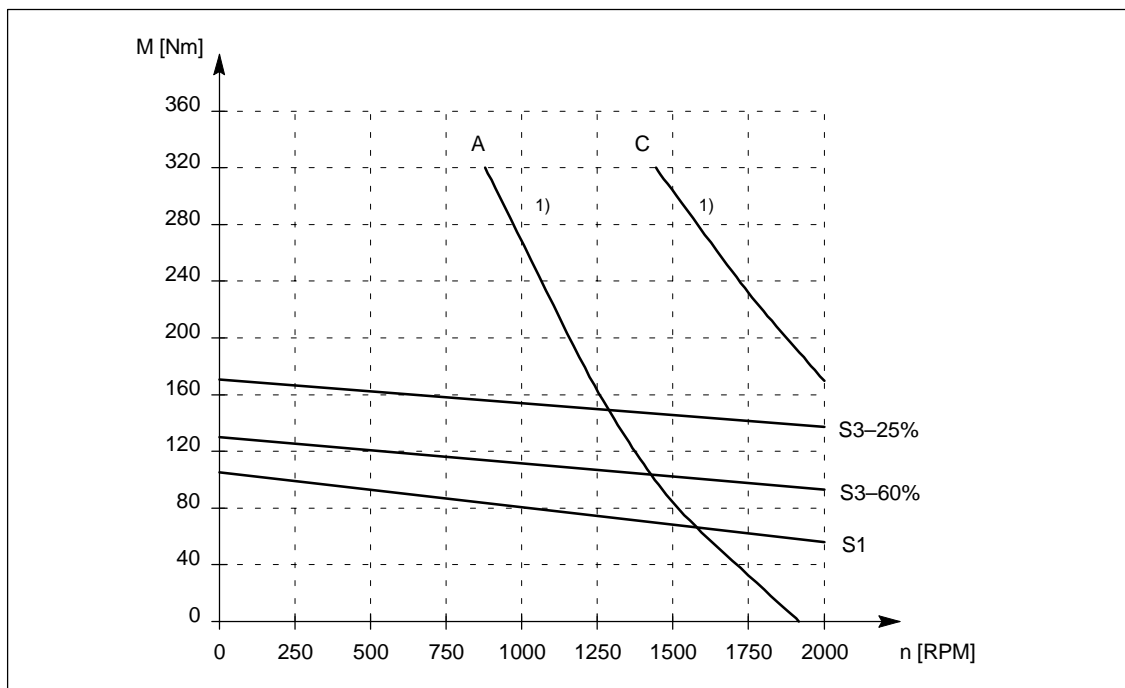


Fig. 3-18 Speed–torque diagram 1FT5136

1) valid for a 600 V DC link voltage

3.1 Speed–torque diagrams

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 | $R_{\text{ph.}}$ | 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 | |

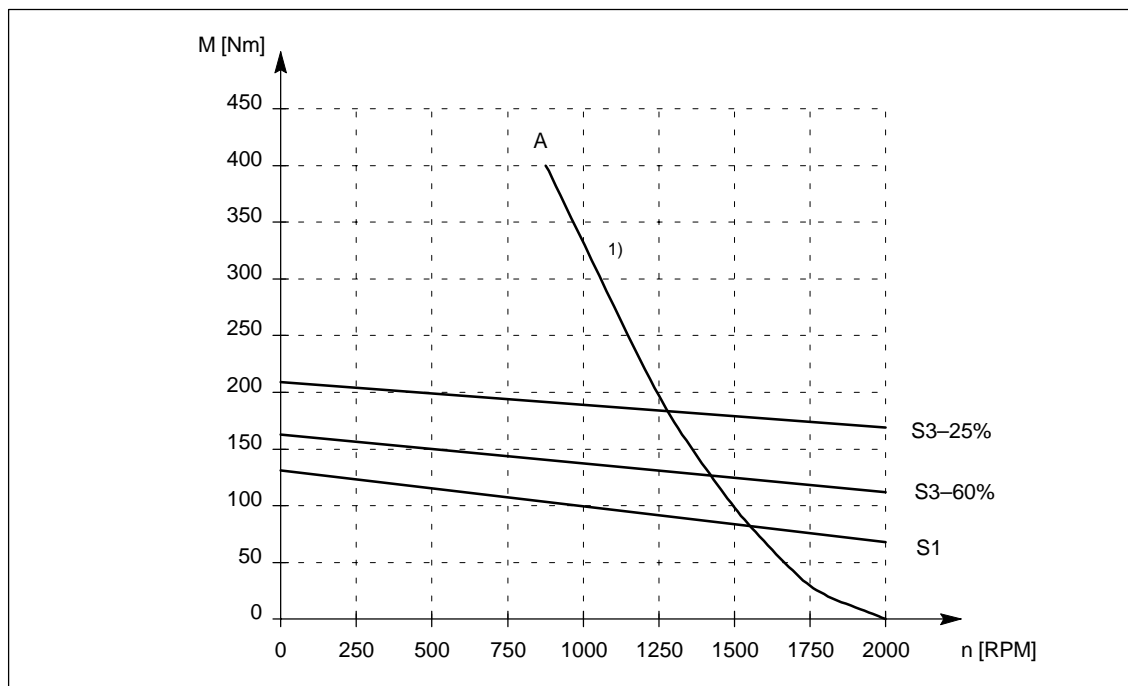


Fig. 3-19 Speed–torque diagram 1FT5138

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 | $R_{\text{ph.}}$ | 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 | |

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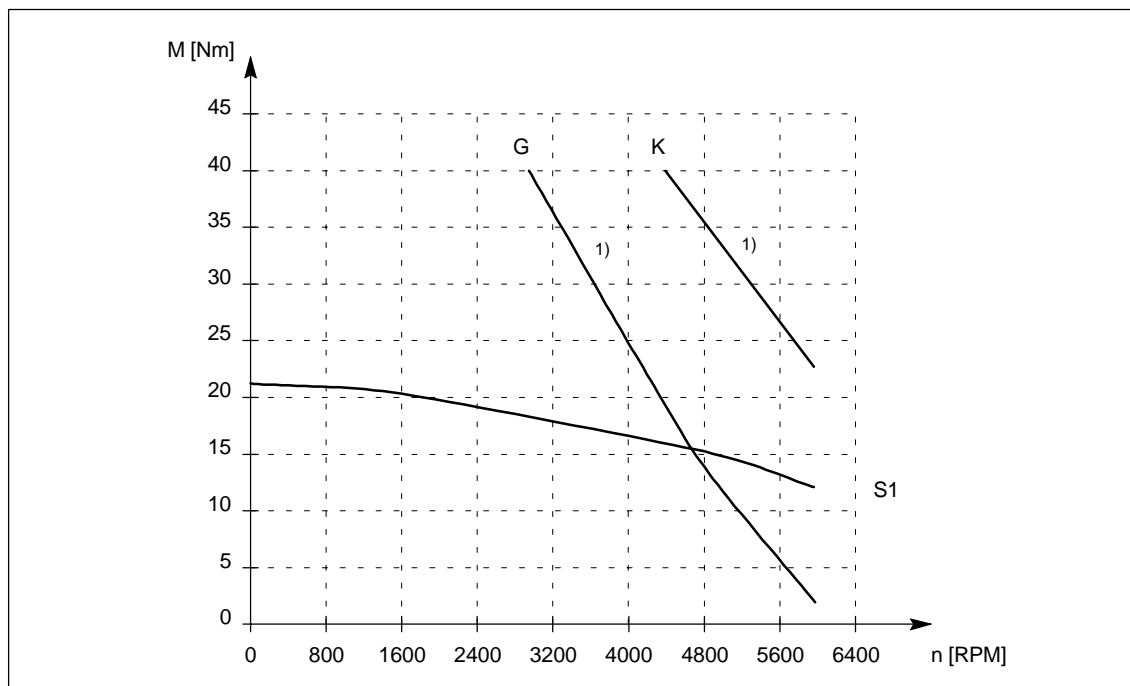


Fig. 3-20 Speed–torque diagram 1FT5074. force-ventilated

1) valid for a 600 V DC link voltage

3.1 Speed–torque diagrams

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 | $R_{\text{ph.}}$ | 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 | |

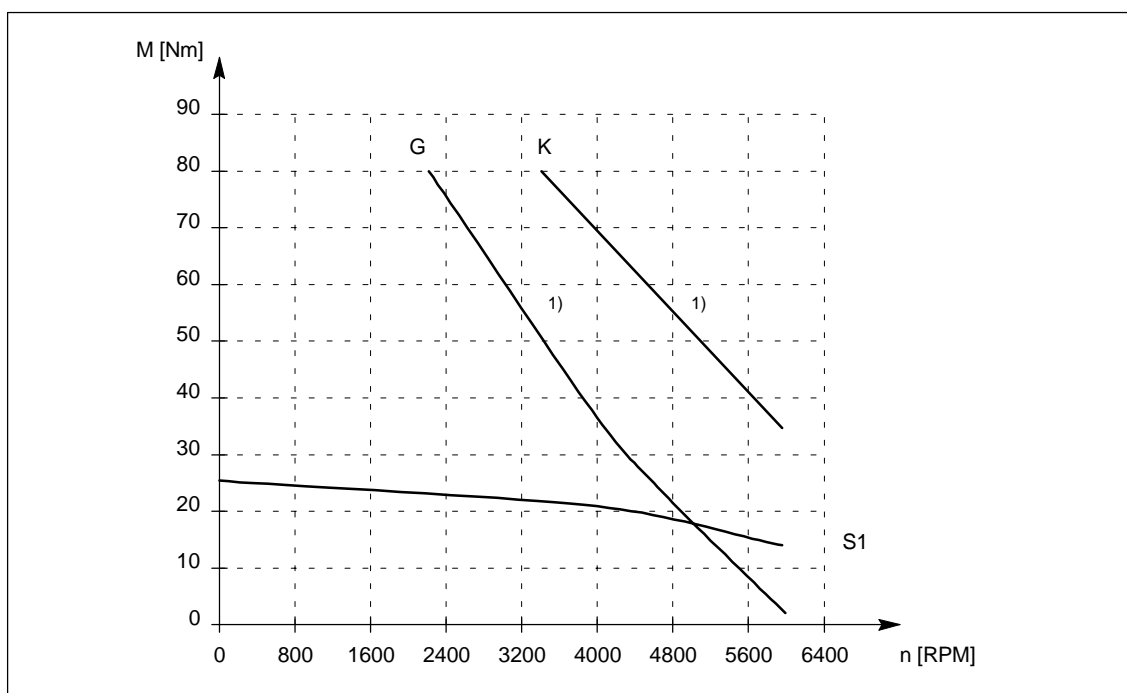


Fig. 3-21 Speed–torque diagram 1FT5076. force–ventilated

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 | $R_{\text{ph.}}$ | 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 | |

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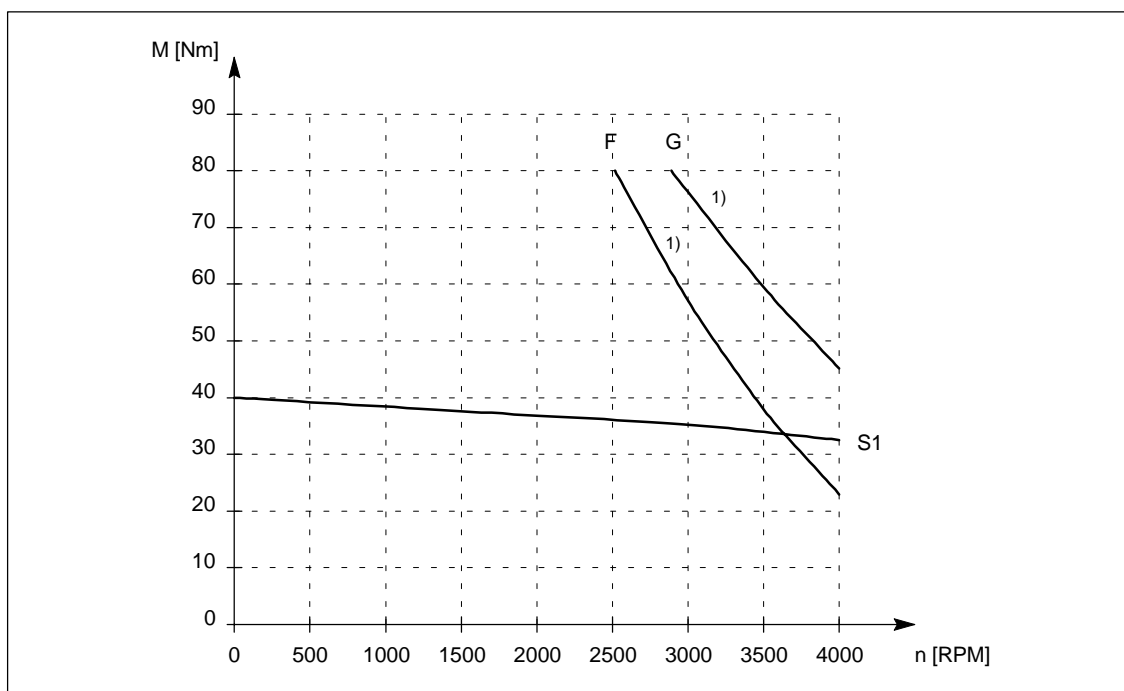


Fig. 3-22 Speed–torque diagram 1FT5102. force–ventilated

1) valid for a 600 V DC link voltage

3.1 Speed–torque diagrams

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 | $R_{\text{ph.}}$ | 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 | |

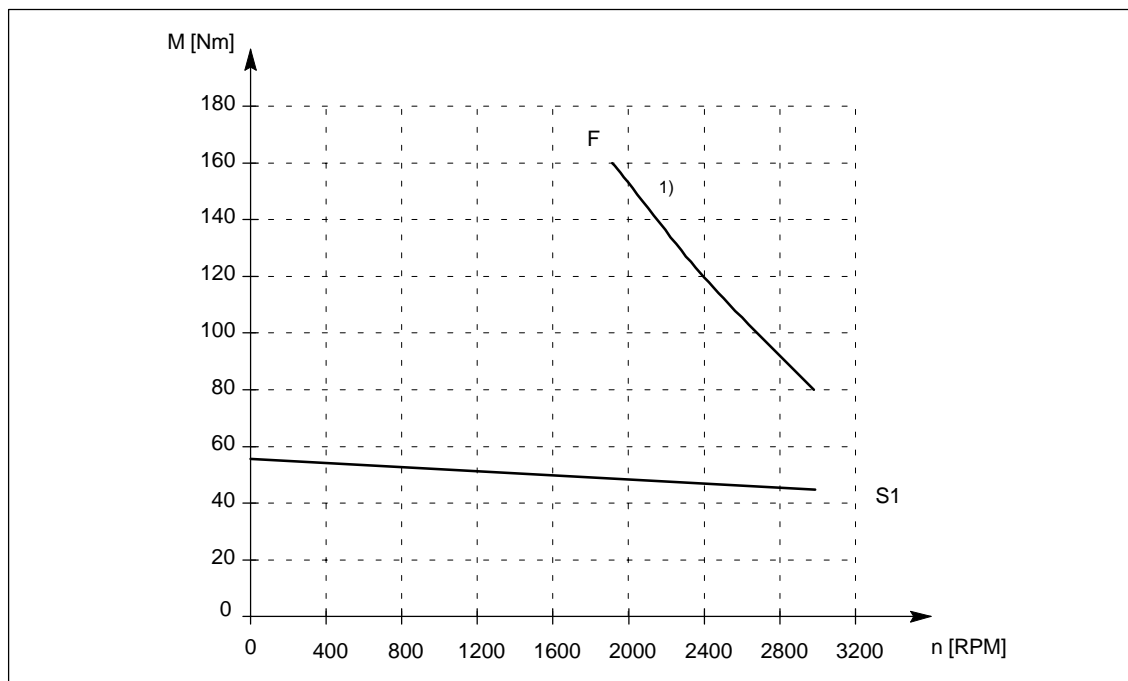


Fig. 3-23 Speed–torque diagram 1FT5104. force–ventilated

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 | $R_{\text{ph.}}$ | 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

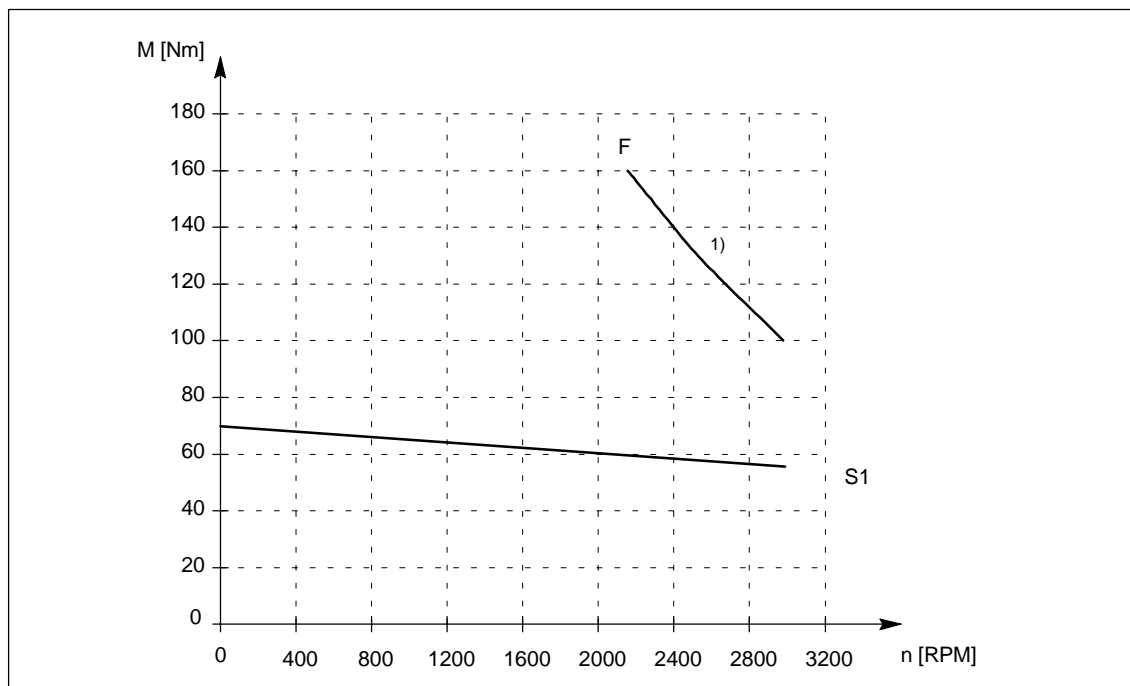


Fig. 3-24 Speed–torque diagram 1FT5106. force–ventilated

1) valid for a 600 V DC link voltage

3.1 Speed–torque diagrams

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 | $R_{\text{ph.}}$ | 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 | |

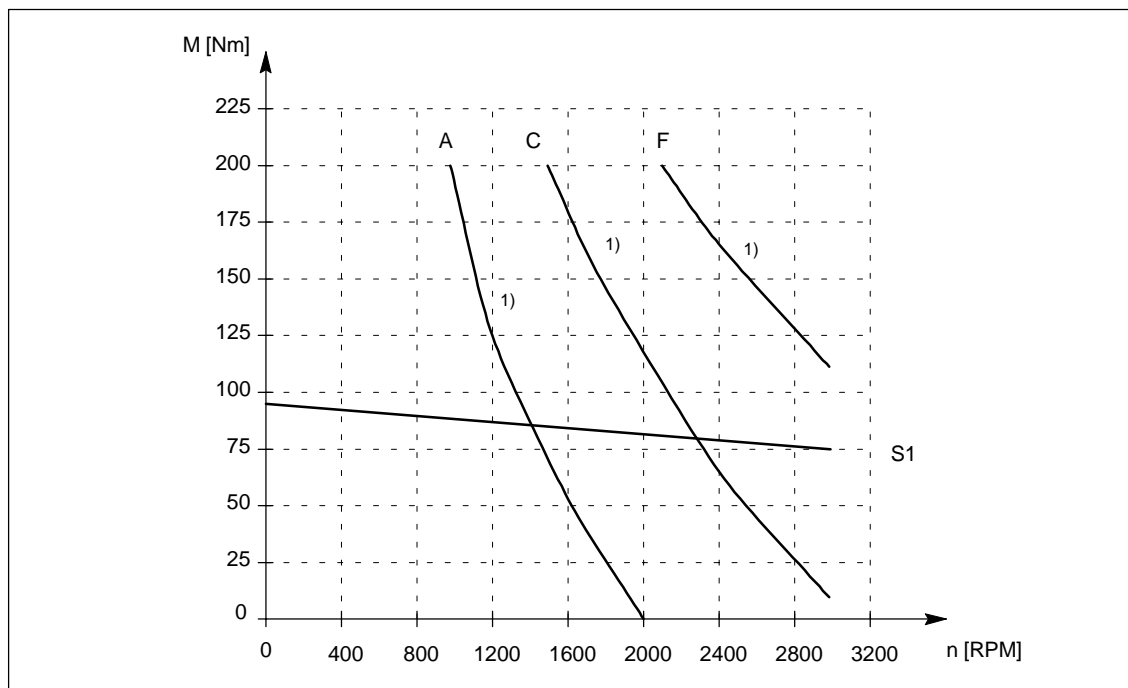


Fig. 3-25 Speed–torque diagram 1FT5132. force–ventilated

1) valid for a 600 V DC link voltage

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 | $R_{\text{ph.}}$ | 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 | |

1FT5

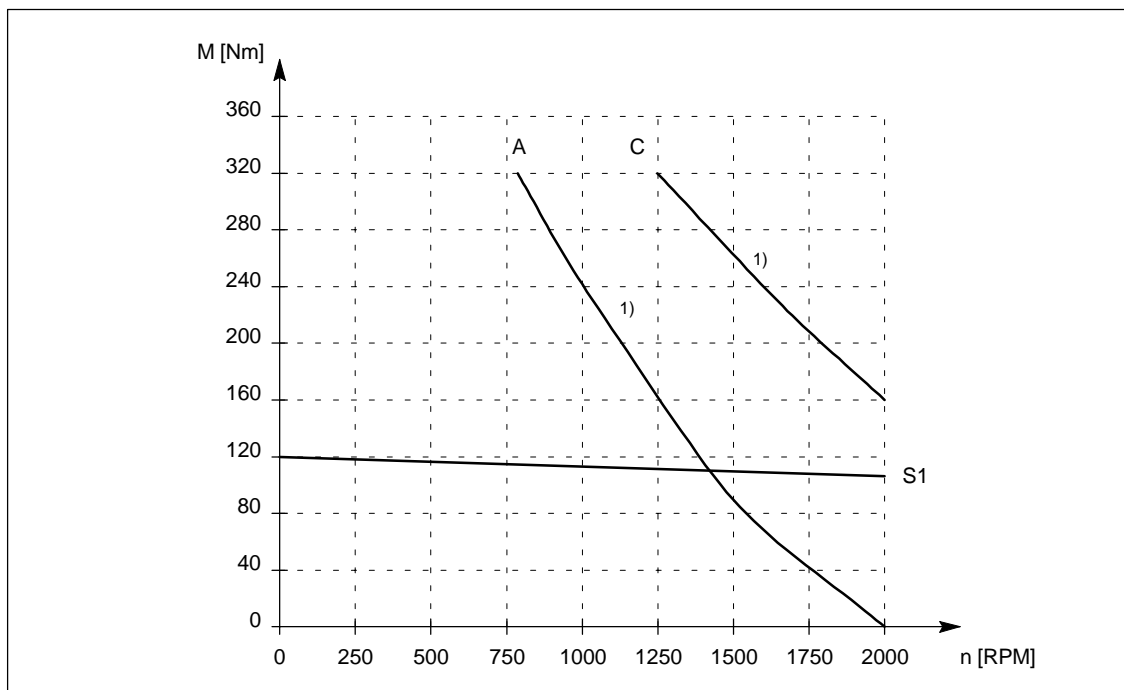


Fig. 3-26 Speed–torque diagram 1FT5134. force-ventilated

1) valid for a 600 V DC link voltage

3.1 Speed–torque diagrams

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 | $R_{\text{ph.}}$ | 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 | |

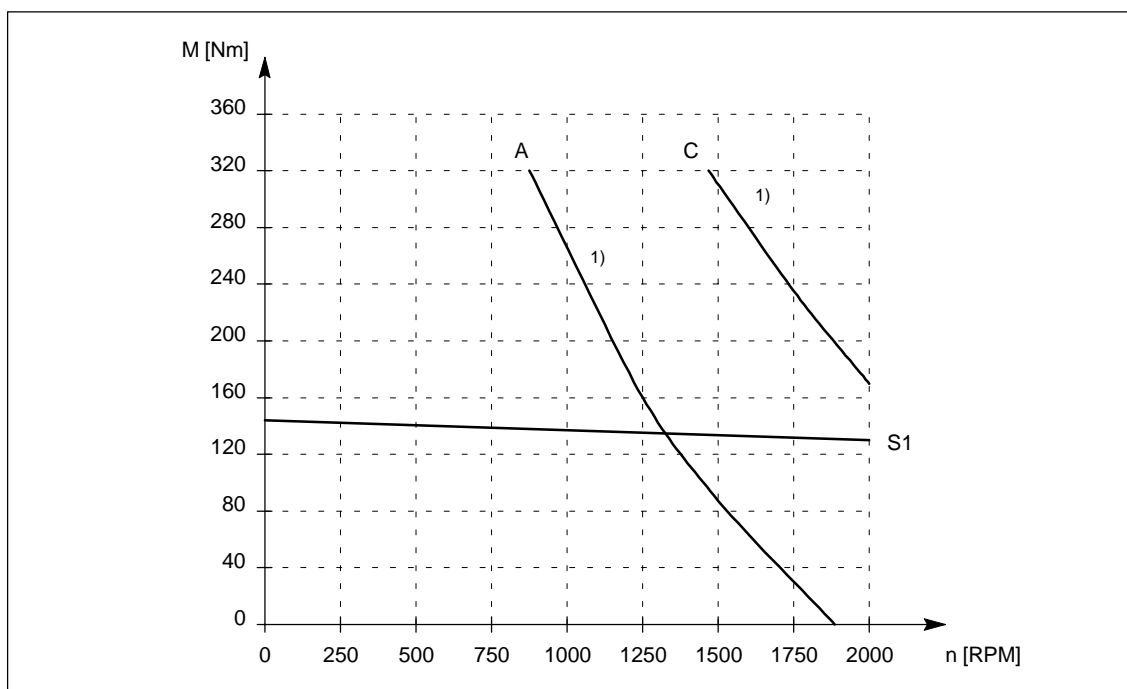


Fig. 3-27 Speed–torque diagram 1FT5136. force–ventilated

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 | $R_{\text{ph.}}$ | 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 | |

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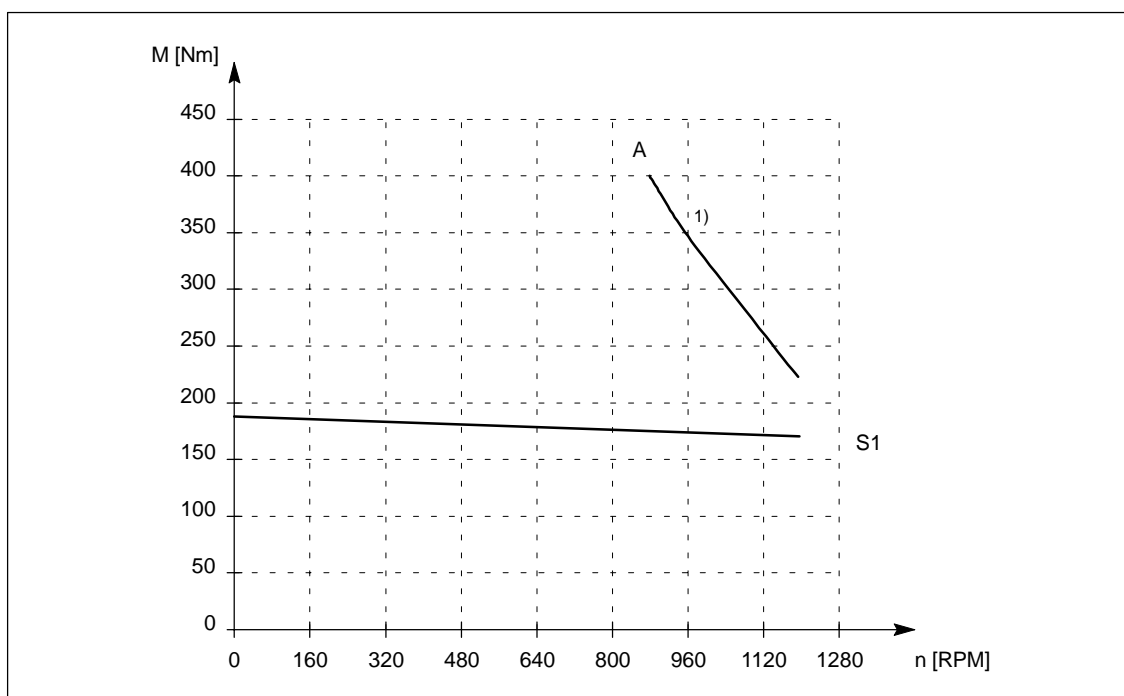


Fig. 3-28 Speed–torque diagram 1FT5138. force-ventilated

1) valid for a 600 V DC link voltage

3.1 Speed–torque diagrams

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 | $R_{\text{ph.}}$ | 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 | |

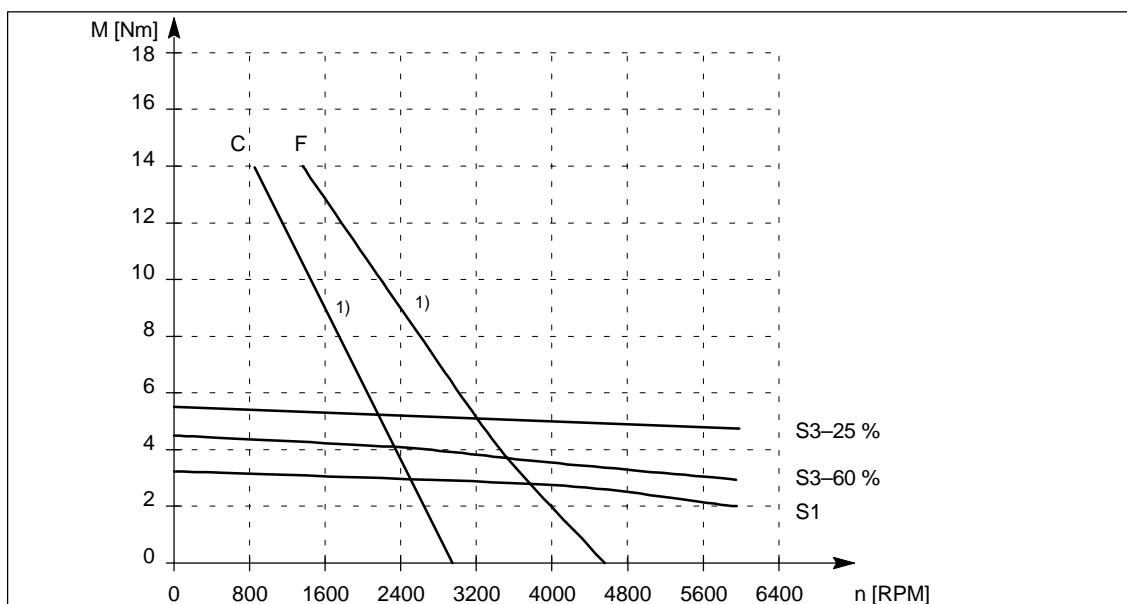


Fig. 3-29 Speed–torque diagram 1FT5070

1) valid for 600 V DC link voltage

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 | $R_{\text{ph.}}$ | 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 | |

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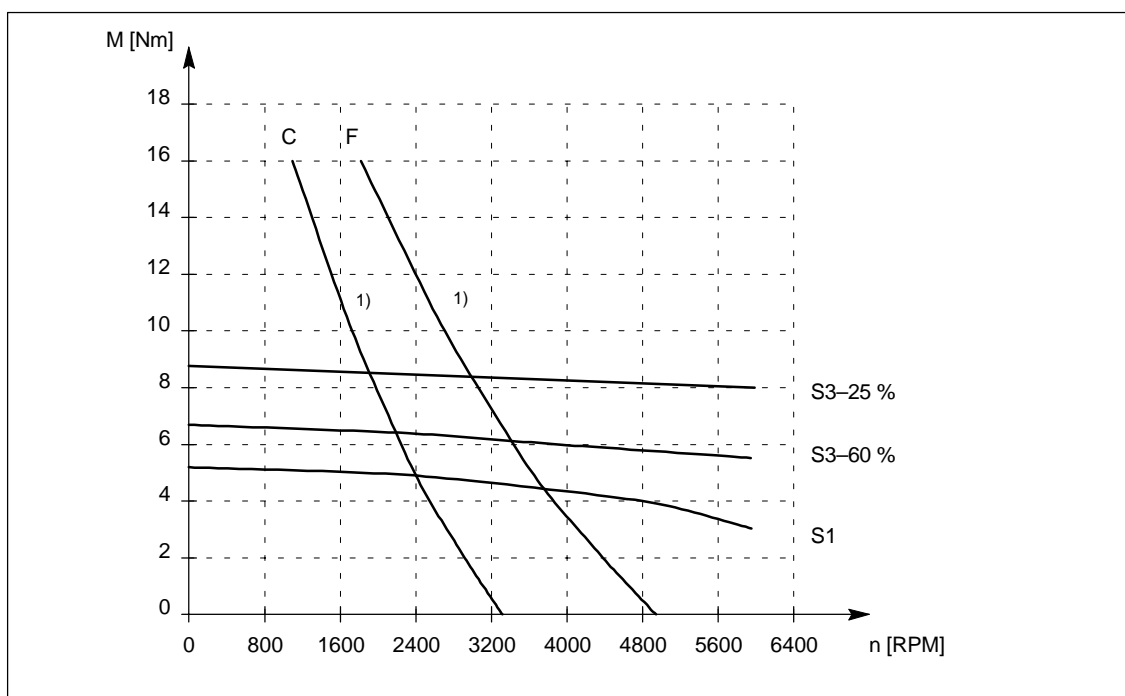


Fig. 3-30 Speed–torque diagram 1FT5071

1) valid for 600 V DC link voltage

3.1 Speed–torque diagrams

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 | $R_{\text{ph.}}$ | 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 | |

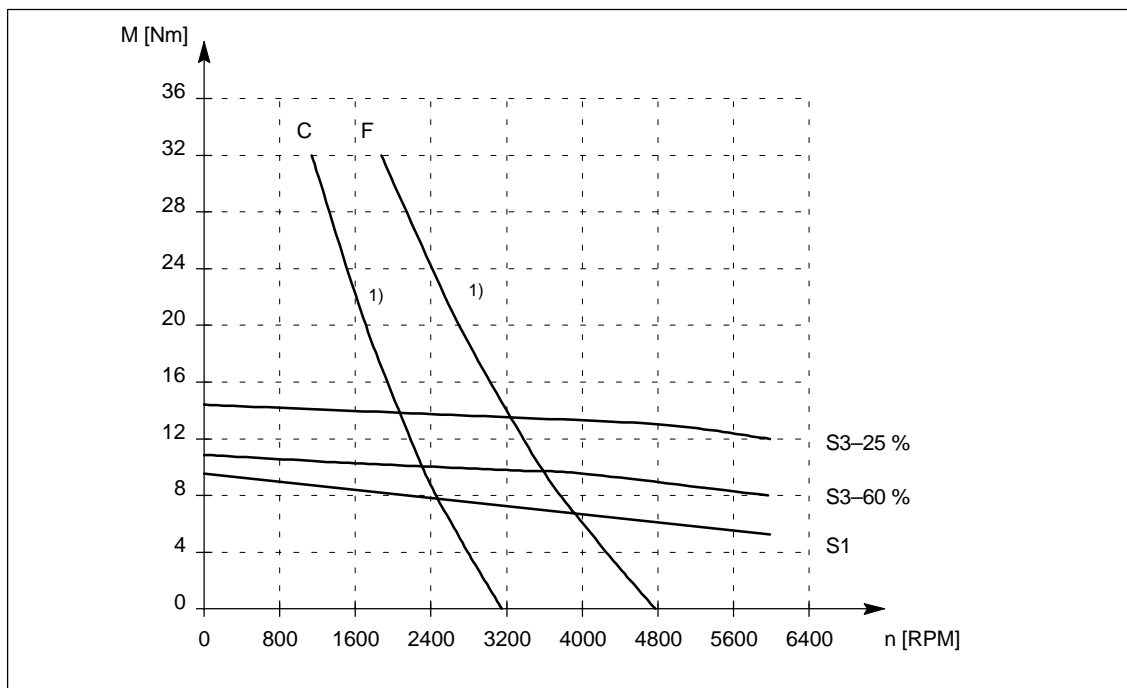


Fig. 3-31 Speed–torque diagram 1FT5073

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 | $R_{\text{ph.}}$ | 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 | |

1FT5

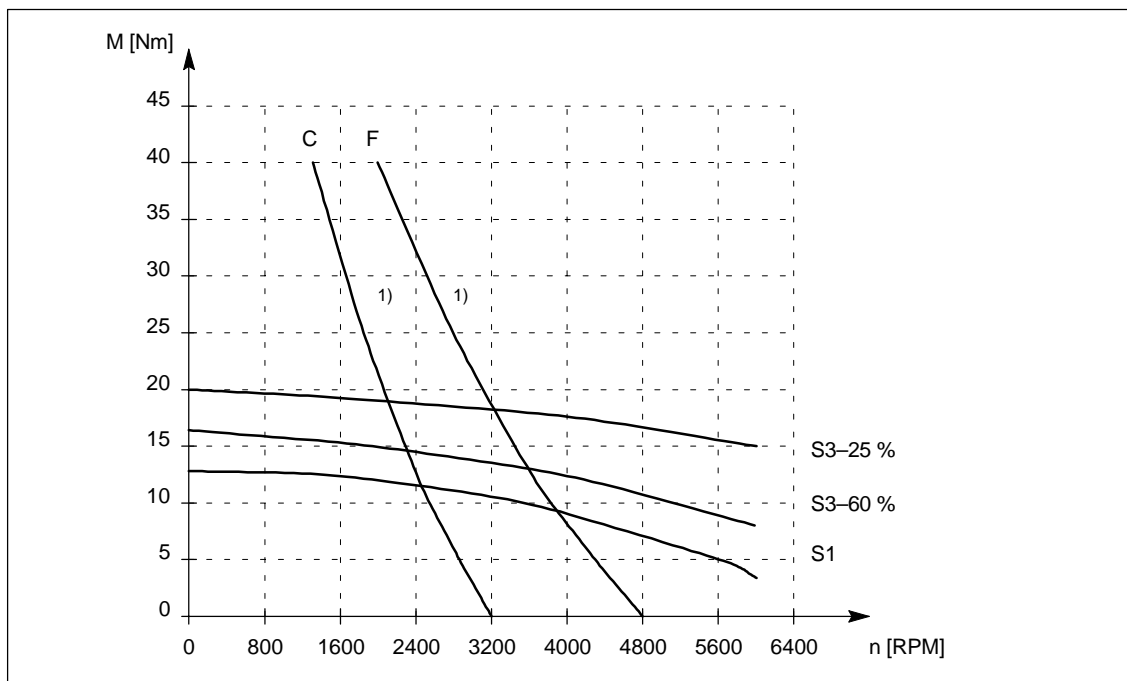


Fig. 3-32 Speed–torque diagram 1FT5100

1) valid for 600 V DC link voltage

3.1 Speed–torque diagrams

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 | $R_{\text{ph.}}$ | 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 | |

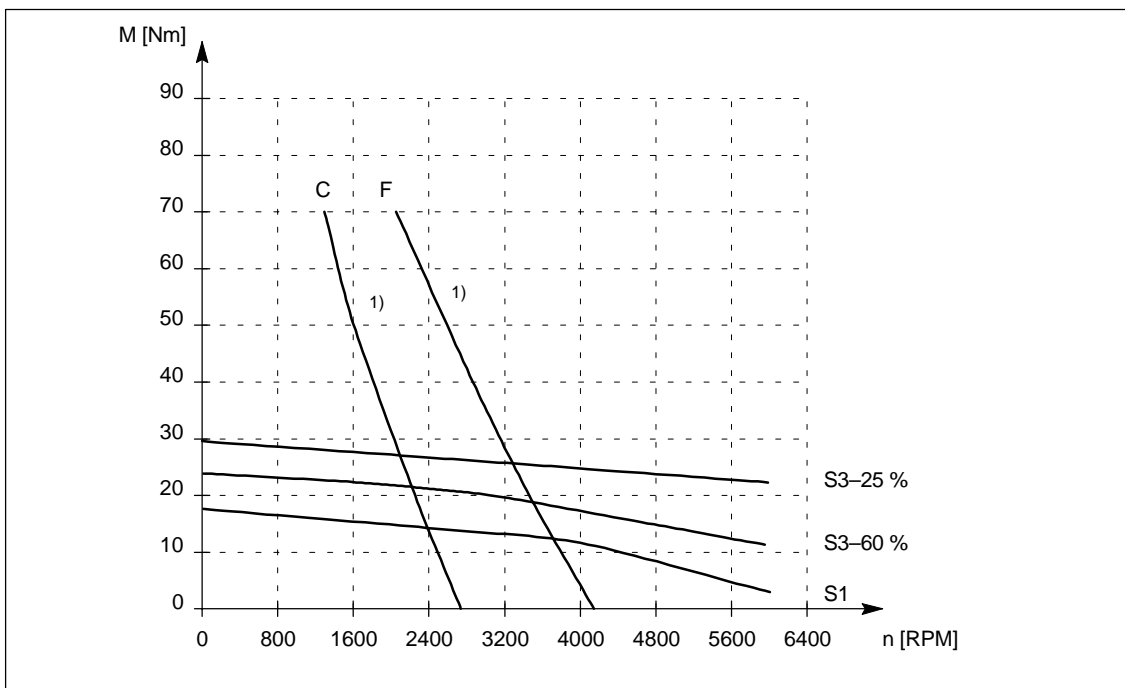


Fig. 3-33 Speed–torque diagram 1FT5101

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 | $R_{\text{ph.}}$ | 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 | |

1FT5

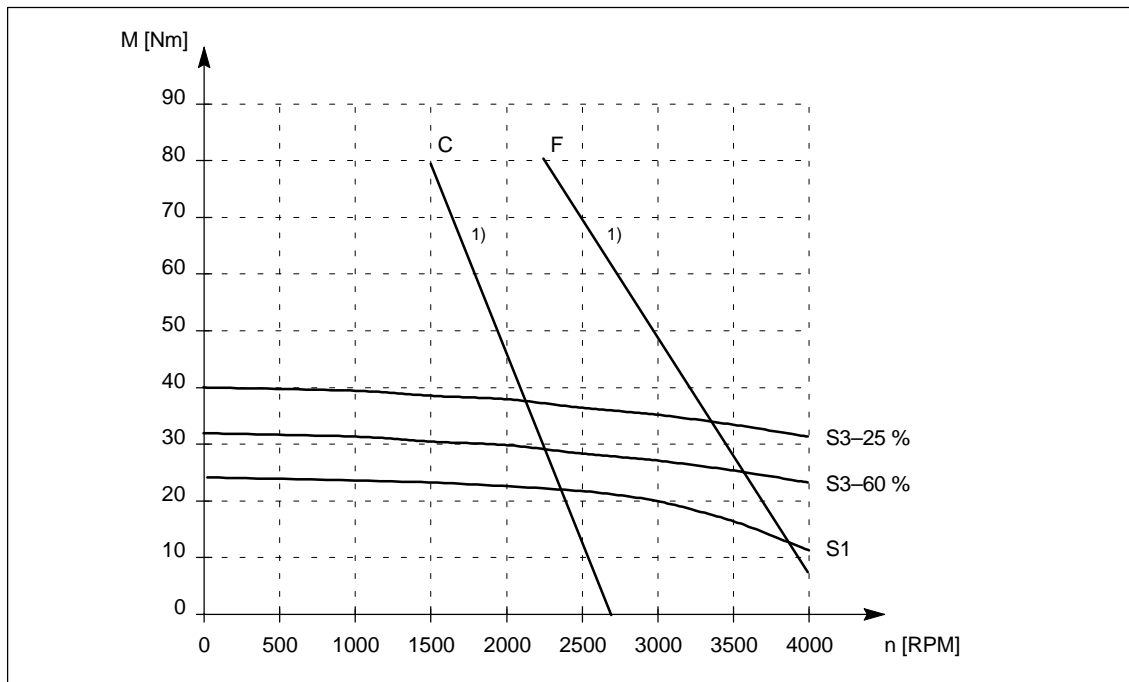


Fig. 3-34 Speed–torque diagram 1FT5103

1) valid for 600 V DC link voltage

3.2 Cantilever/axial force diagrams

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

Axial force F_{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

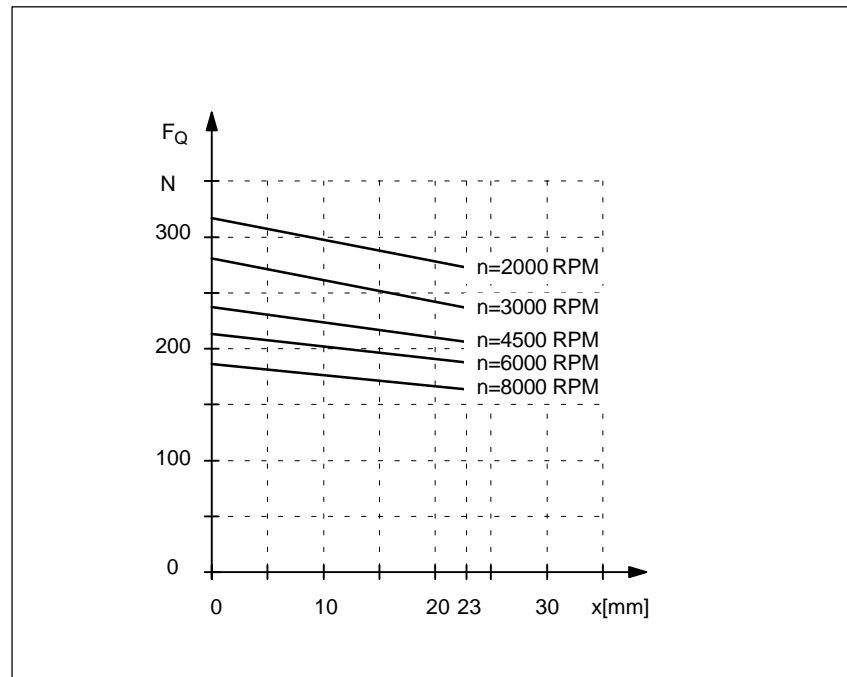
Axial forces are not permissible for motors with integrated holding brake!

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

3.2.1 Standard motors

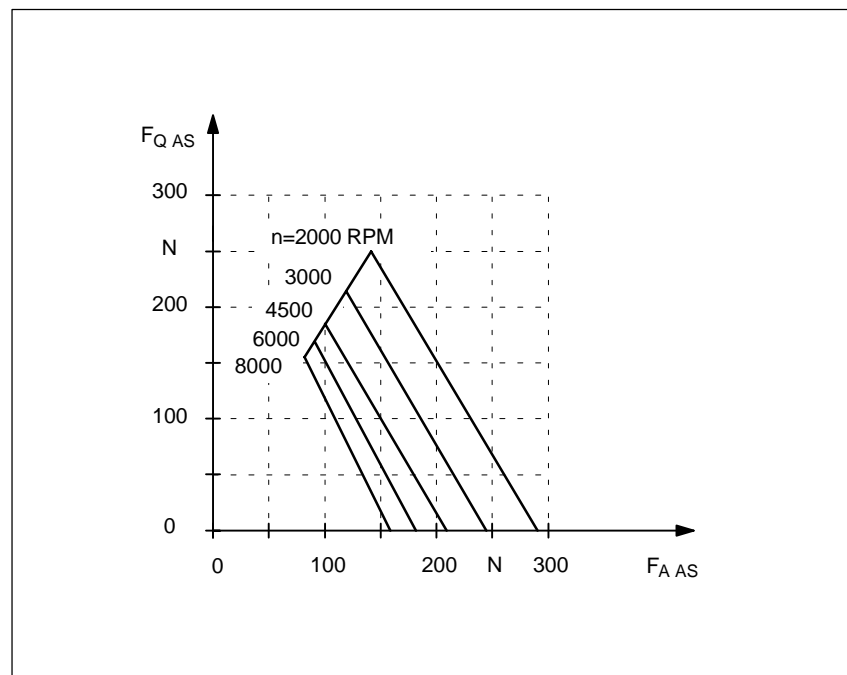
Cantilever force 1FT5034 to 1FT5036

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


1FT5

Axial force 1FT5034 to 1FT5036

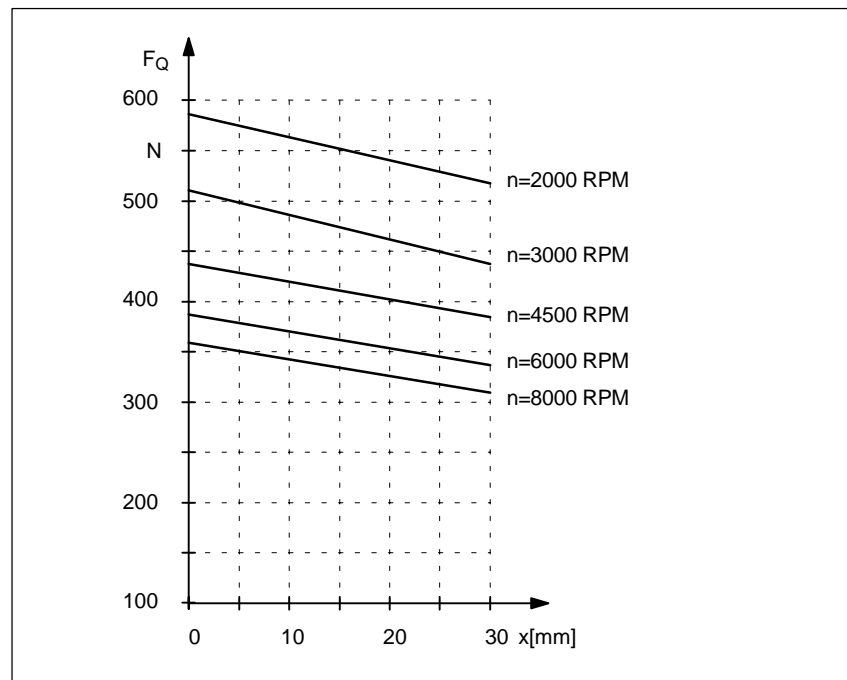
Permissible axial force as a function of the cantilever force.



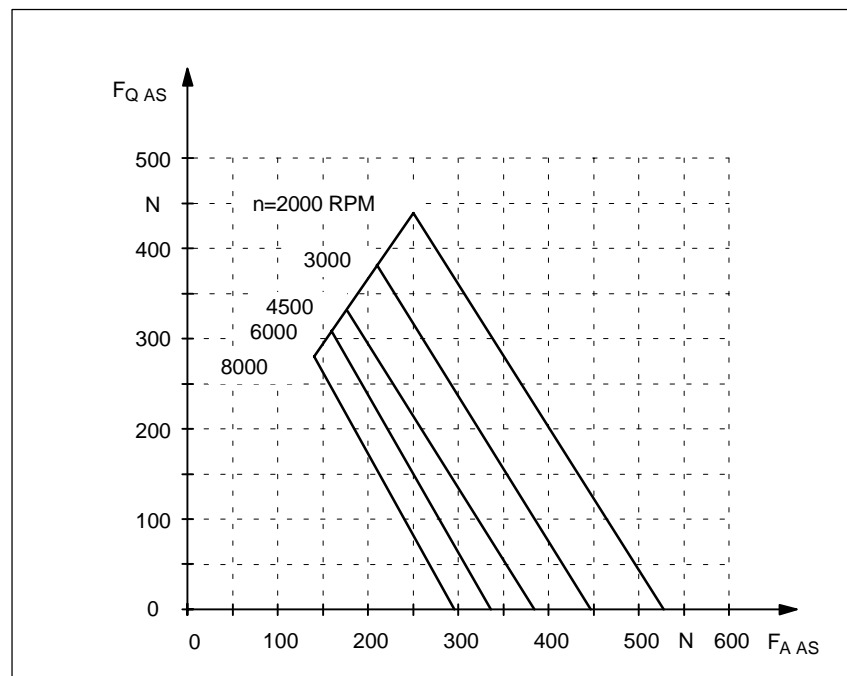
3.2 Cantilever/axial force diagrams

**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.

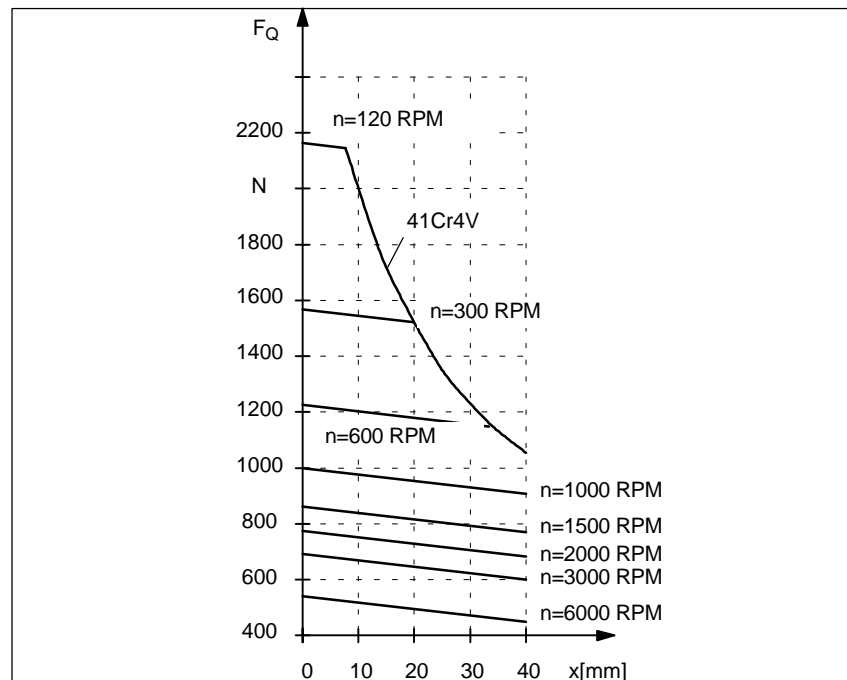
**Axial force
1FT5042 to
1FT5046**

Permissible axial force as a function of the cantilever force.



Cantilever force
1FT5062 to
1FT5066

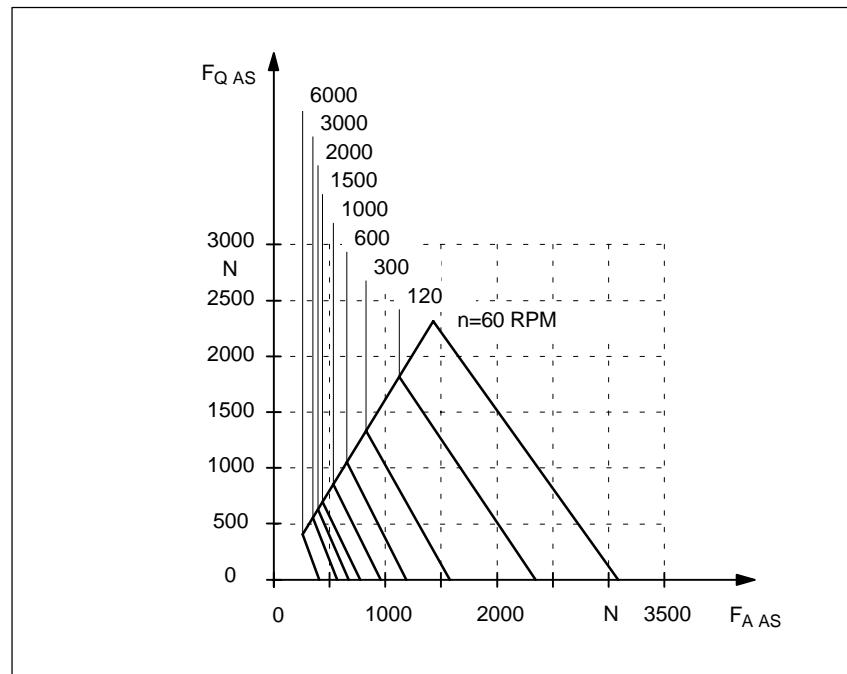
Cantilever force F_Q at distance x from the shaft shoulder for a nominal bearing lifetime of 20 000 h.



1FT5

Axial force
1FT5062 to
1FT5066

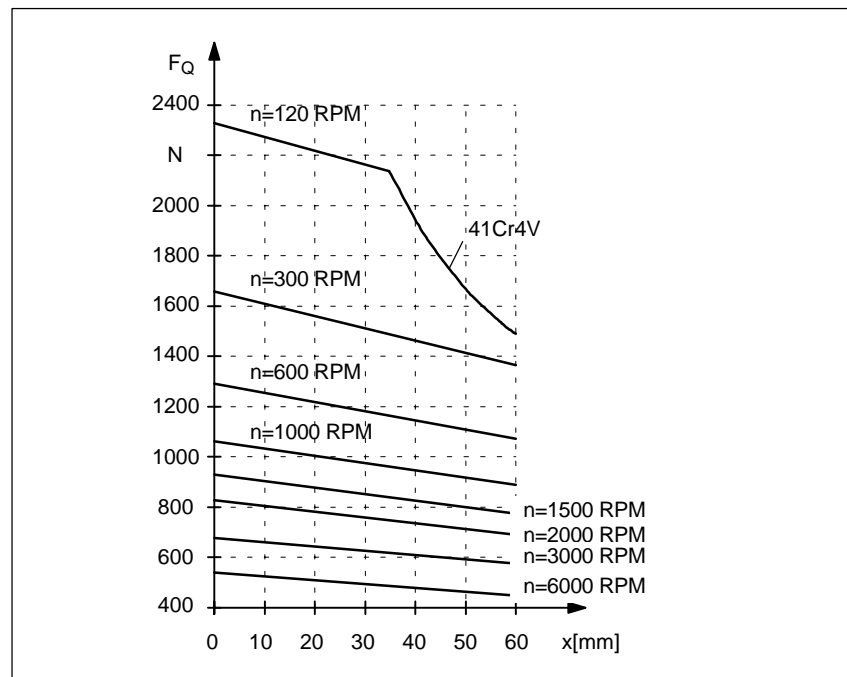
Permissible axial force as a function of the cantilever force.



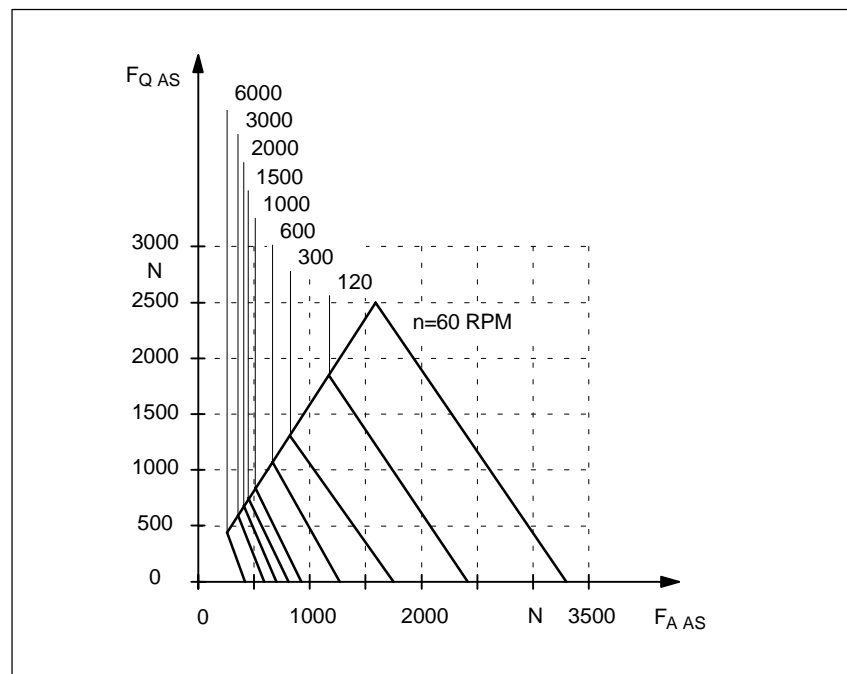
3.2 Cantilever/axial force diagrams

**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.

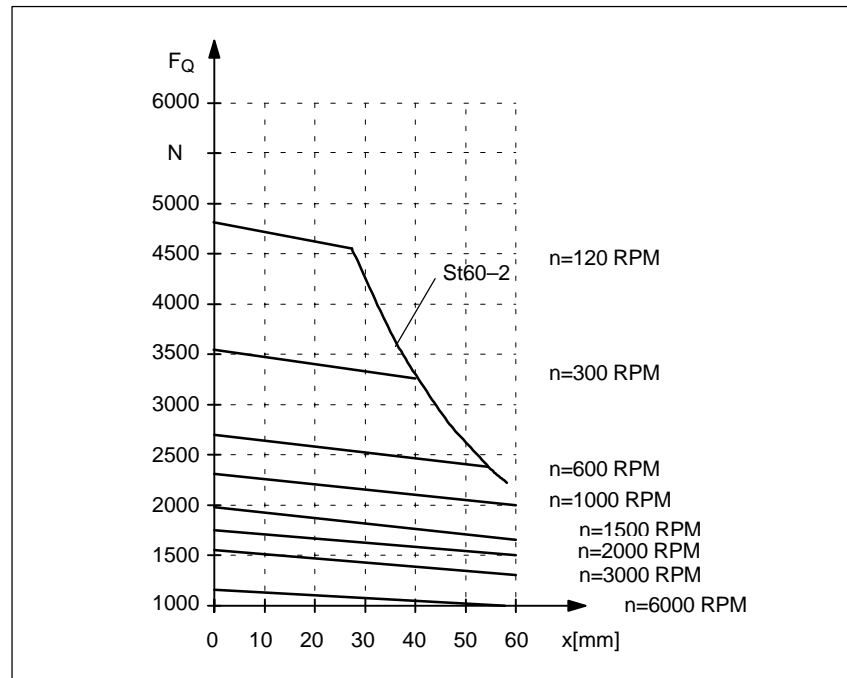
**Axial force
1FT5072 to
1FT5076**

Permissible axial force as a function of the cantilever force.

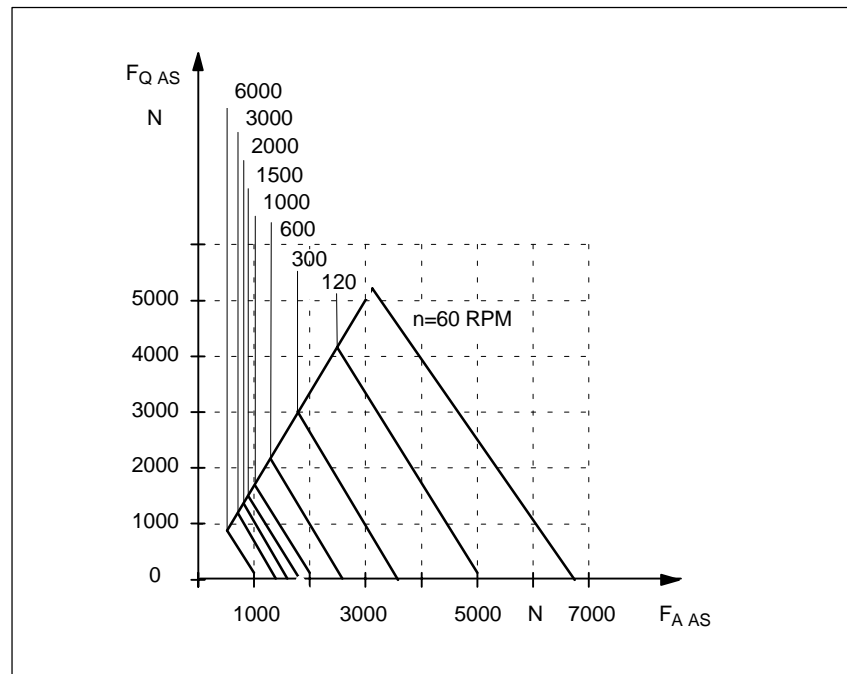


**Cantilever force
1FT5102 to
1FT5104**

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


1FT5
**Axial force
1FT5102 to
1FT5104**

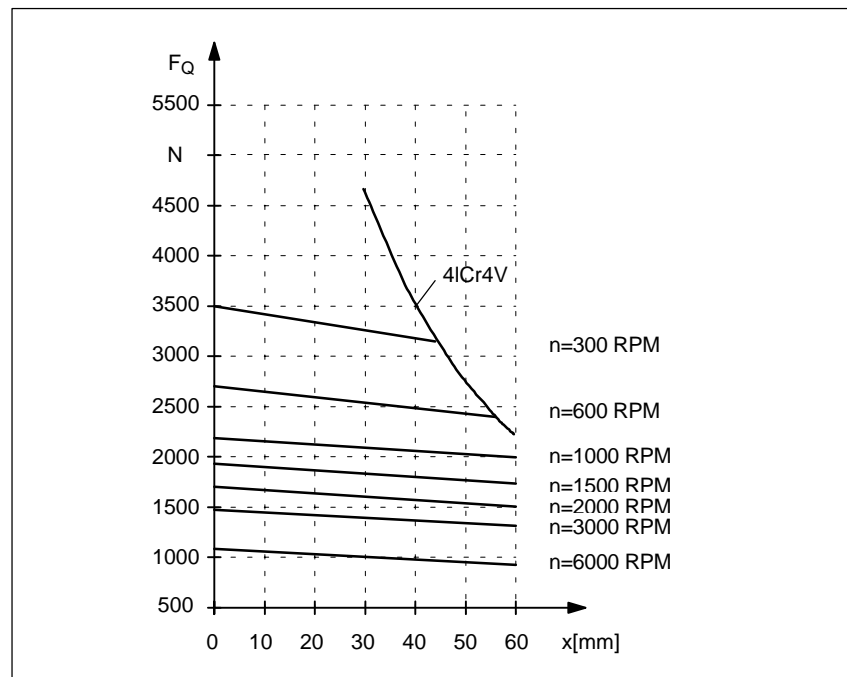
Permissible axial force as a function of the cantilever force.



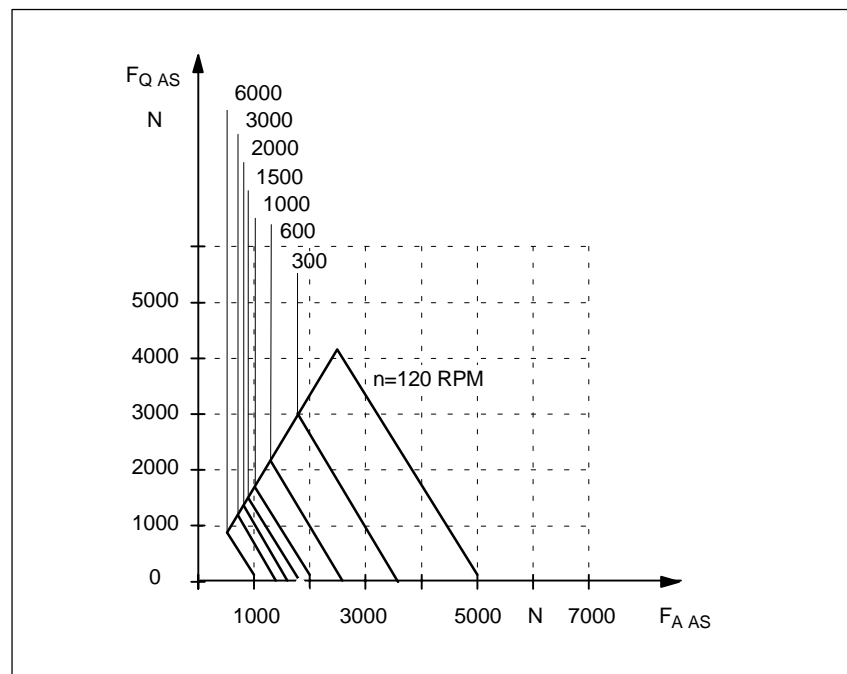
3.2 Cantilever/axial force diagrams

**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.

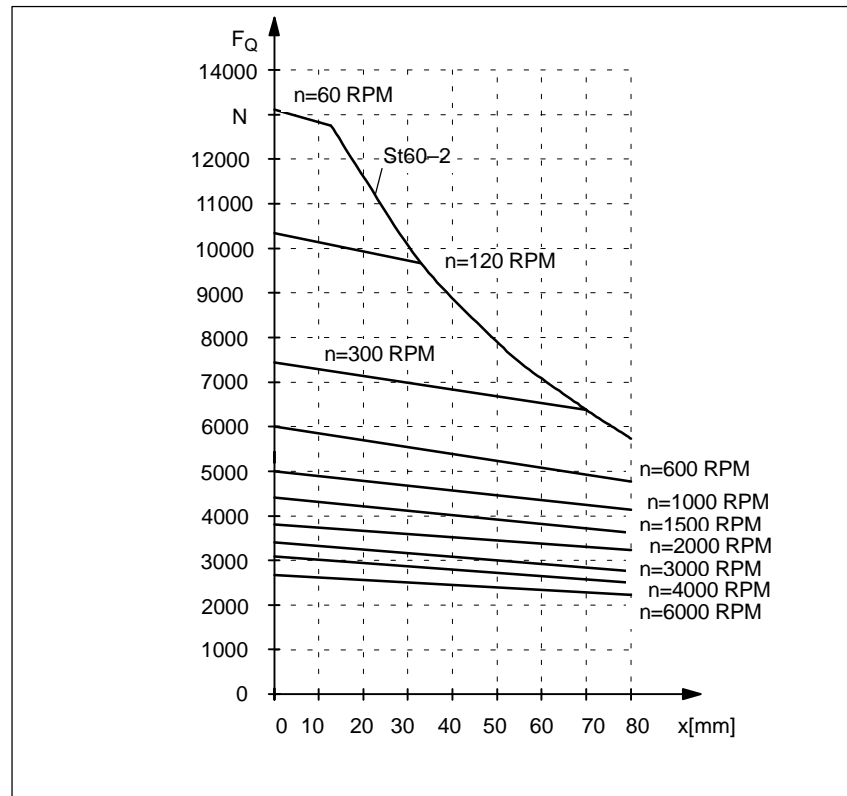
**Axial force
1FT5106 to
1FT5108**

Permissible axial force as a function of the cantilever force.



Cantilever force
1FT5132 to
1FT5136

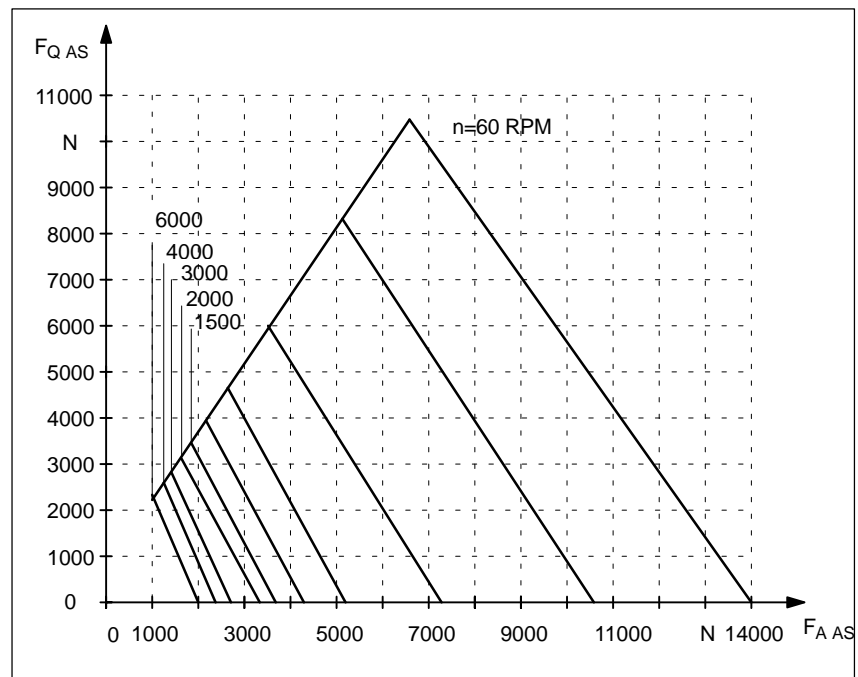
Cantilever force F_Q at distance x from the shaft shoulder for a nominal bearing lifetime of 20 000 h.



1FT5

Axial force
1FT5132 to
1FT5136

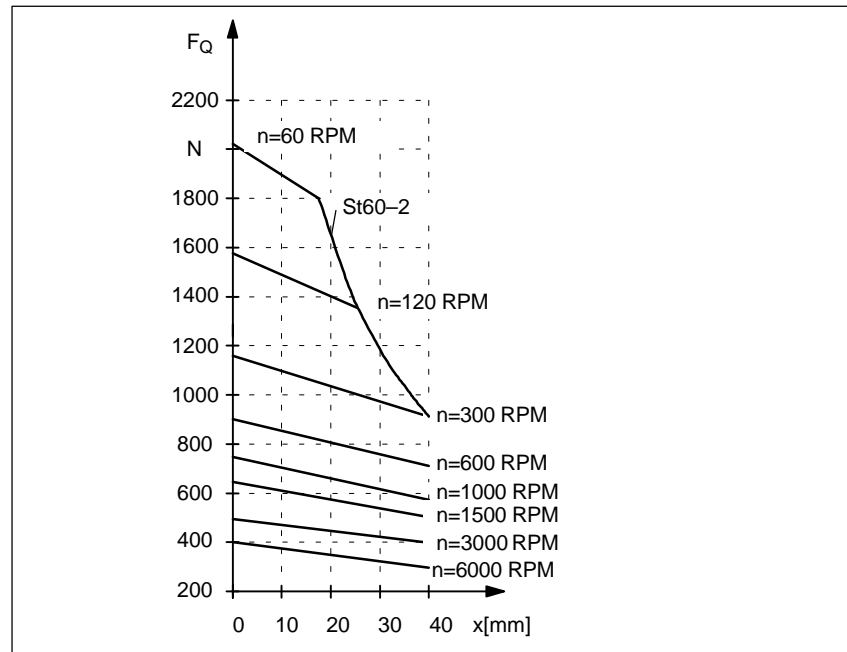
Permissible axial force as a function of the cantilever force.



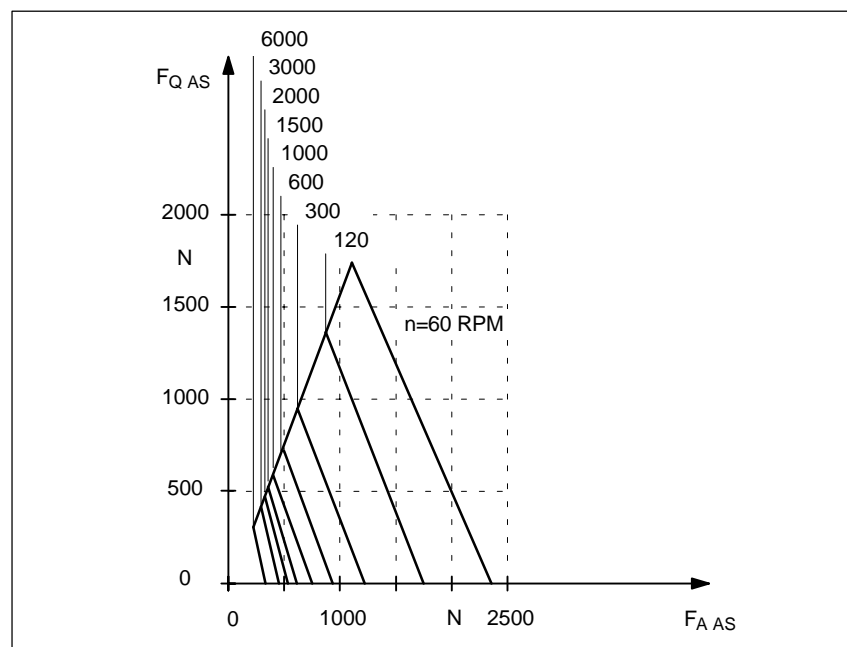
3.2.2 Short motors

**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.

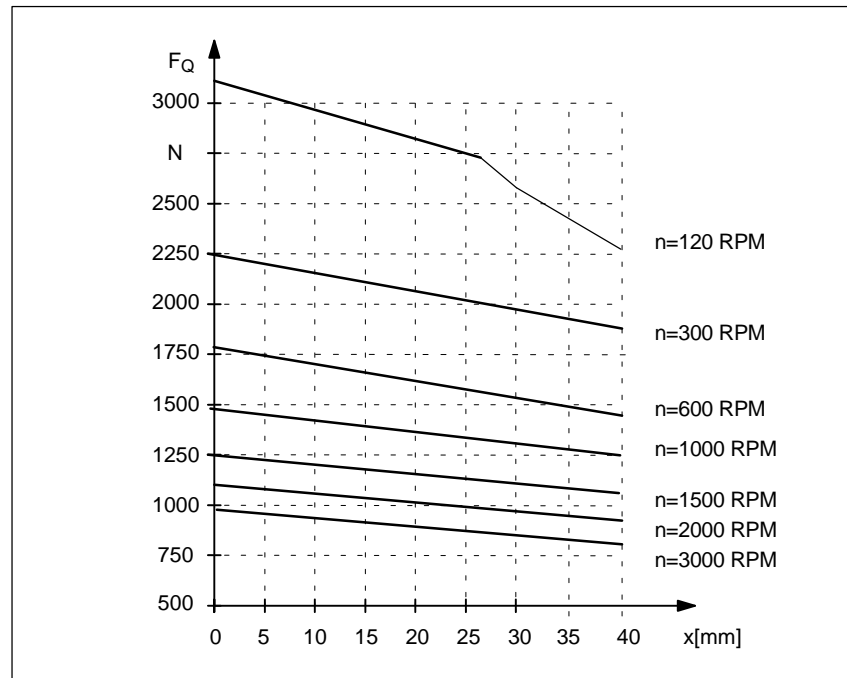
**Axial force
1FT5070 and
1FT5071**

Permissible axial force as a function of the cantilever force.



Cantilever force
1FT5100
1FT5101
1FT5103

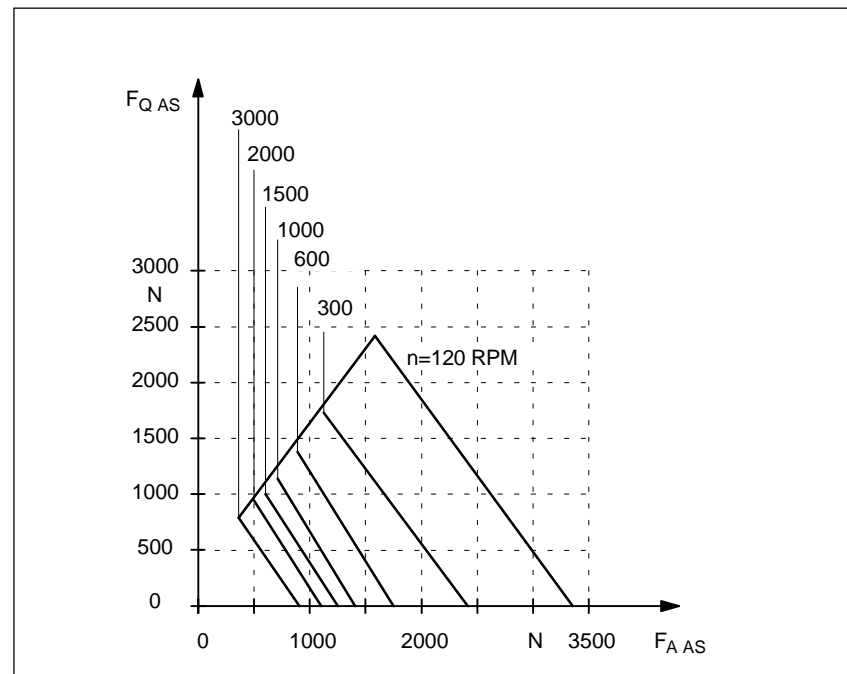
Cantilever force F_Q at distance x from the shaft shoulder for a nominal bearing lifetime of 20 000 h.



1FT5

Axial force
1FT5100
1FT5101
1FT5103

Permissible axial force as a function of the cantilever force.



Notes

[illegible]

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.

1FT5

Standard type of construction, basic version

| | |
|--|-----------|
| 1FT503□ non-ventilated with connector size 1 | 1FT5/4-75 |
| 1FT504□ non-ventilated with connector size 1 | 1FT5/4-76 |
| 1FT506□ non-ventilated with connector size 1 | 1FT5/4-77 |
| 1FT507□ non-ventilated with connector size 1 | 1FT5/4-78 |
| 1FT507□ non-ventilated with connector size 2 | 1FT5/4-79 |
| 1FT510□ non-ventilated with connector size 2/3 | 1FT5/4-80 |
| 1FT513□ non-ventilated with connector size 2/3 | 1FT5/4-81 |
| 1FT507□ force ventilated with connector size 2/3 | 1FT5/4-82 |
| 1FT510□ force ventilated with connector size 2/3 | 1FT5/4-83 |
| 1FT513□ force ventilated with connector size 3 | 1FT5/4-84 |

Standard type of construction, optional pulse encoder mounting

| | |
|--|-----------|
| 1FT503□ non-ventilated with connector size 1 | 1FT5/4-85 |
| 1FT504□ non-ventilated with connector size 1 | 1FT5/4-86 |
| 1FT506□ non-ventilated with connector size 1 | 1FT5/4-87 |
| 1FT507□ non-ventilated with connector size 1 | 1FT5/4-88 |
| 1FT507□ non-ventilated with connector size 2 | 1FT5/4-89 |
| 1FT510□ non-ventilated with connector | 1FT5/4-90 |
| 1FT513□ non-ventilated with connector size 2/3 | 1FT5/4-91 |

Short type of construction, basic version

| | |
|--|-----------|
| 1FT507□ non-ventilated with connector size 1 | 1FT5/4-92 |
| 1FT510□ non-ventilated with connector size 2 | 1FT5/4-93 |

Short type of construction, optional pulse encoder mounting

| | |
|--|-----------|
| 1FT507□ non-ventilated with connector size 1 | 1FT5/4-94 |
| 1FT510□ non-ventilated with connector size 2 | 1FT5/4-95 |

Standard type of construction, optional working brake

| | |
|--|-----------|
| 1FT507□ non-ventilated with connector size 2 | 1FT5/4-96 |
| 1FT510□ non-ventilated with connector size 2/3 | 1FT5/4-97 |
| 1FT513□ non-ventilated with connector size 2/3 | 1FT5/4-98 |

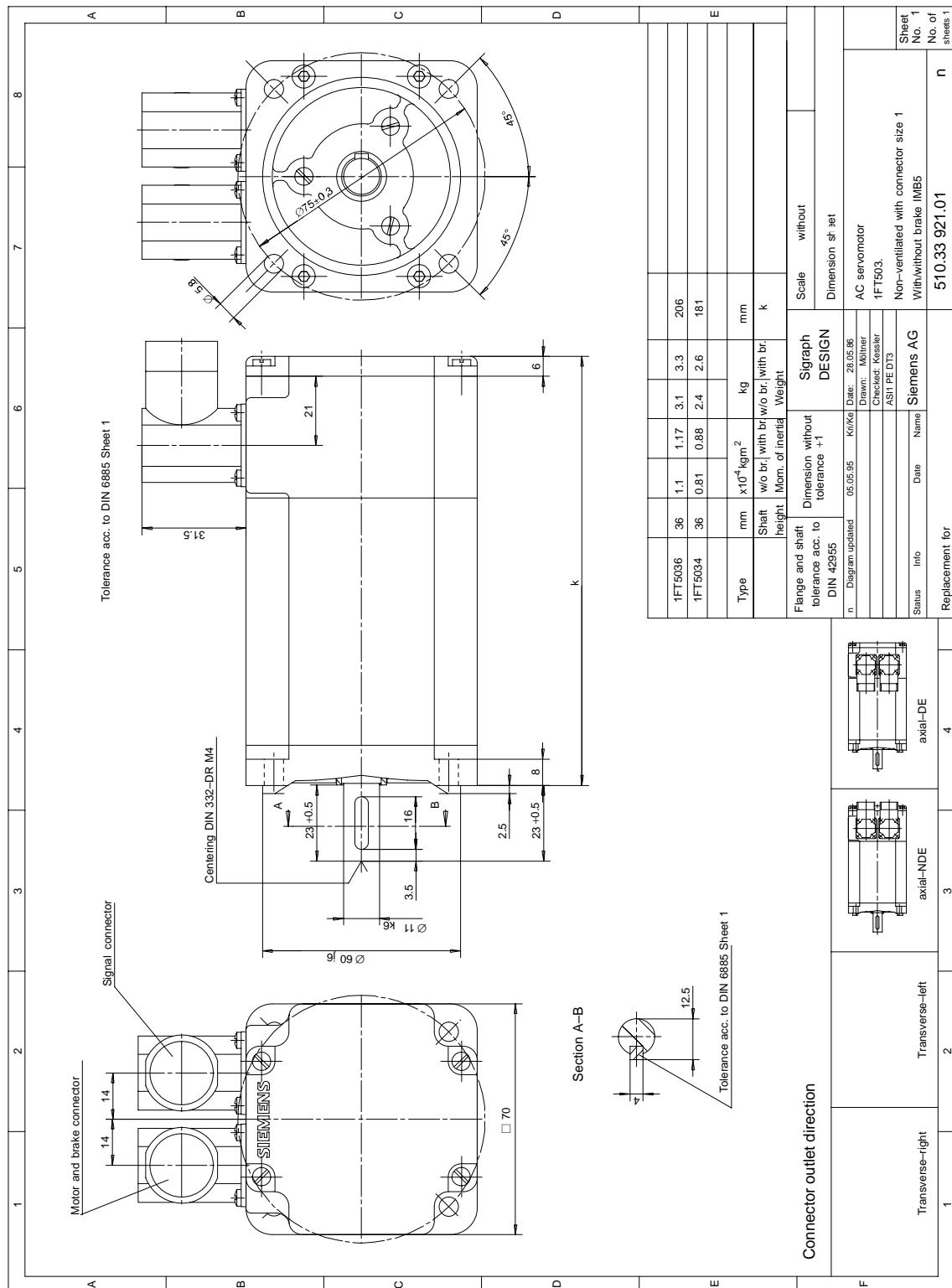


Fig. 4-1 1FT503□ non-ventilated with connector size 1

1FT5

4 Dimension Drawings

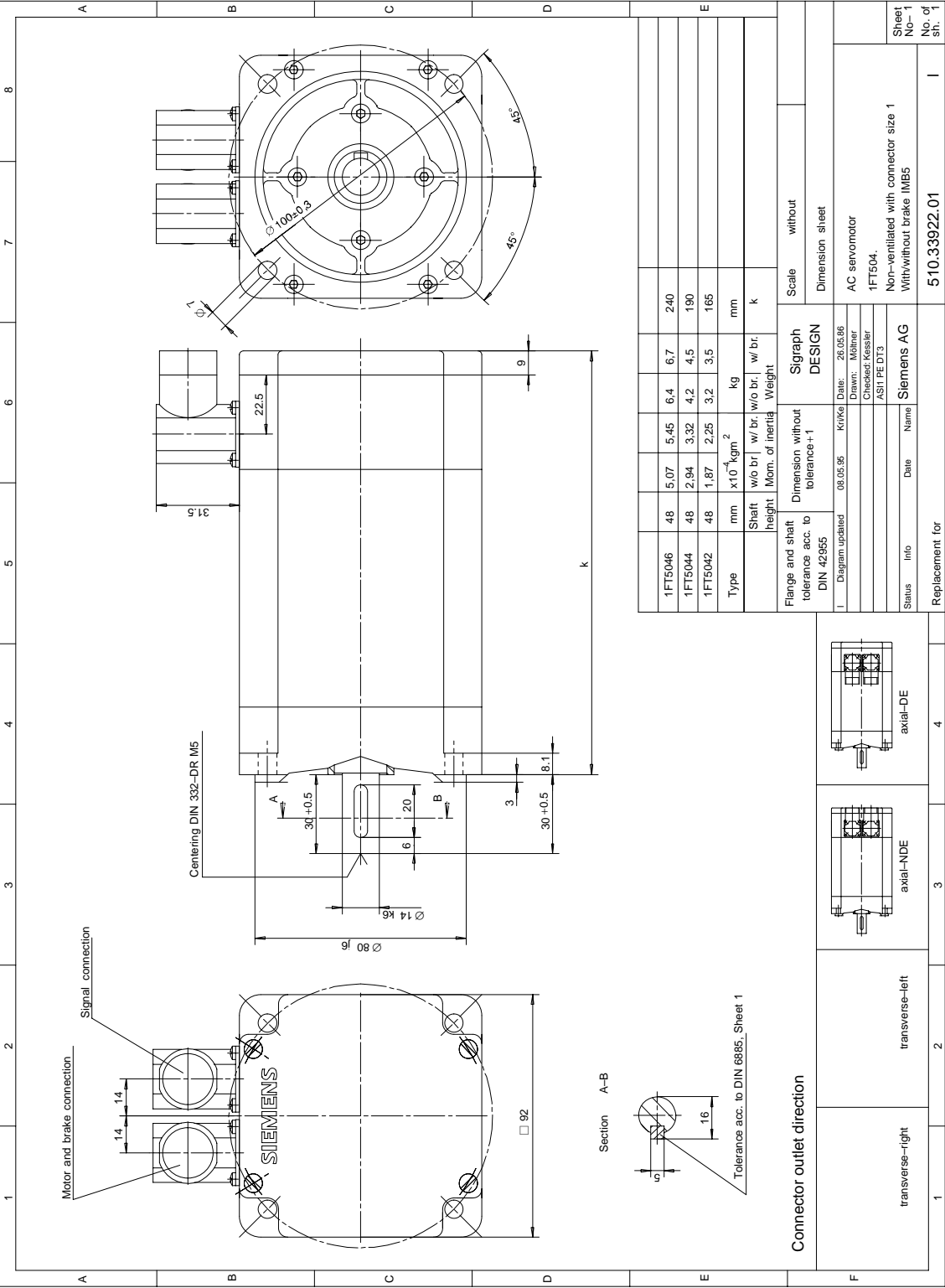
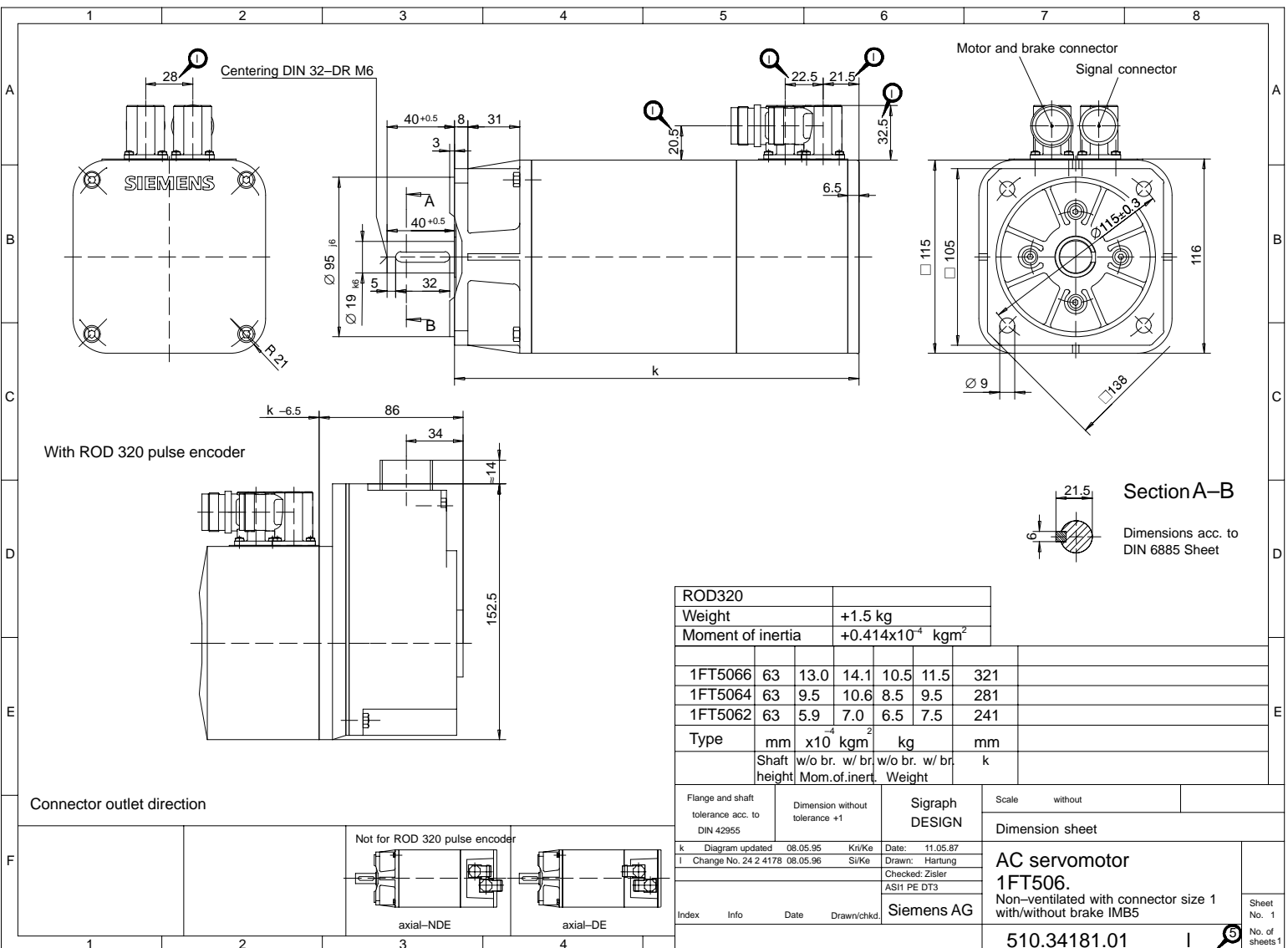


Fig. 4-2 1FT504□ non-ventilated with connector size 1



1FT5

4 Dimension Drawings

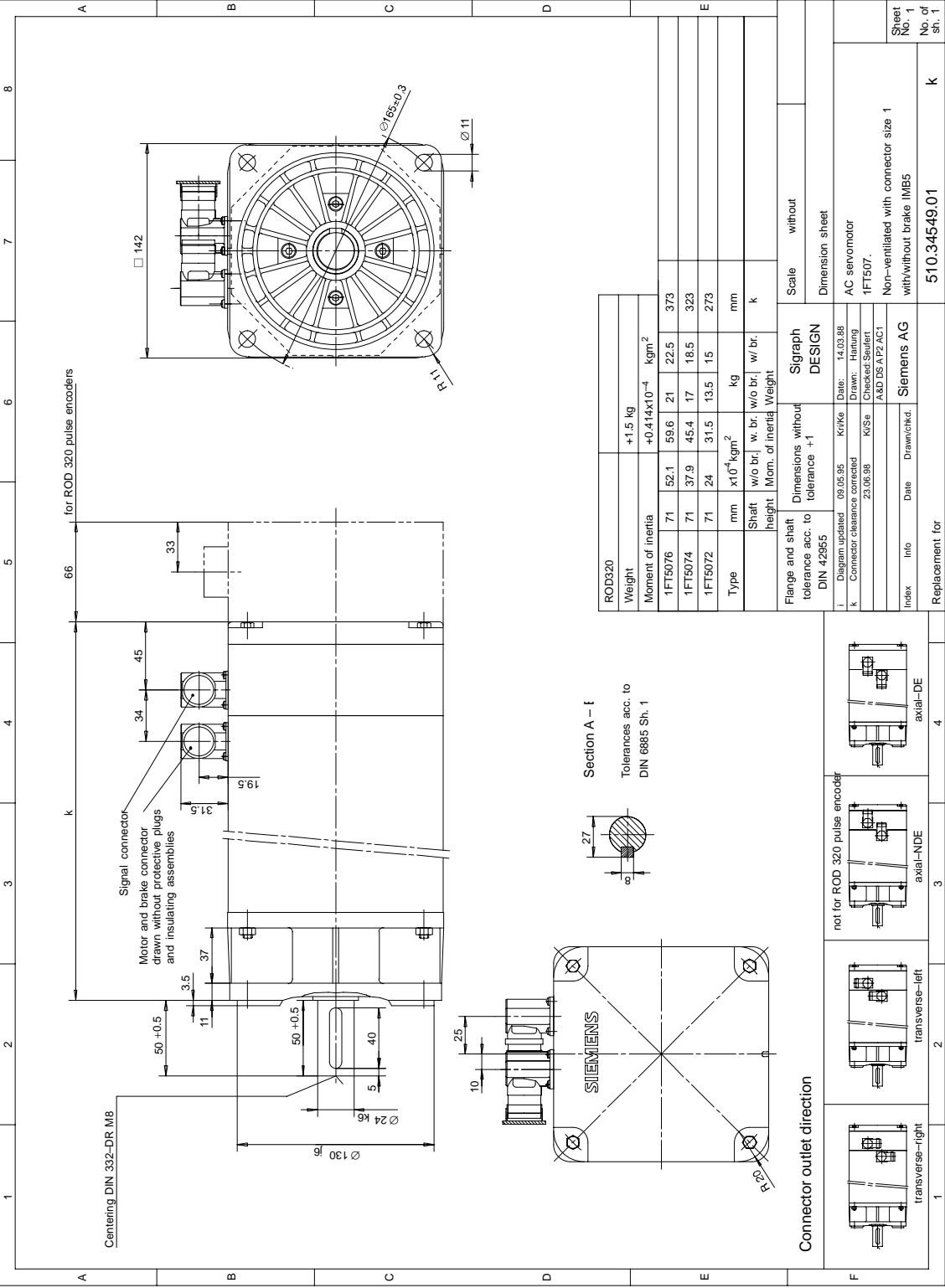


Fig. 4-4 1FT507□ non-ventilated with connector size 1

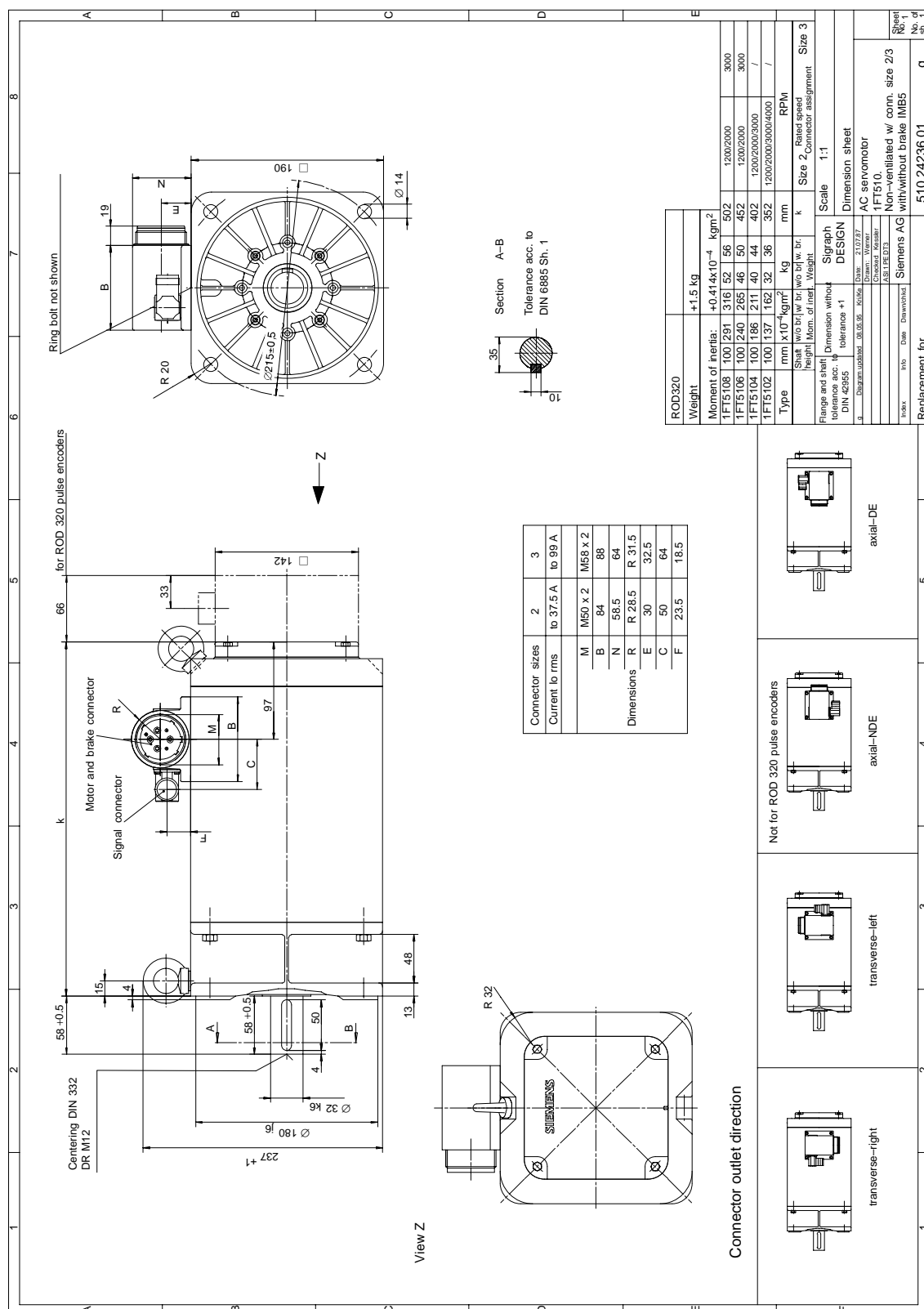


Fig. 4-6 1FT510□ non-ventilated with connector size 2/3

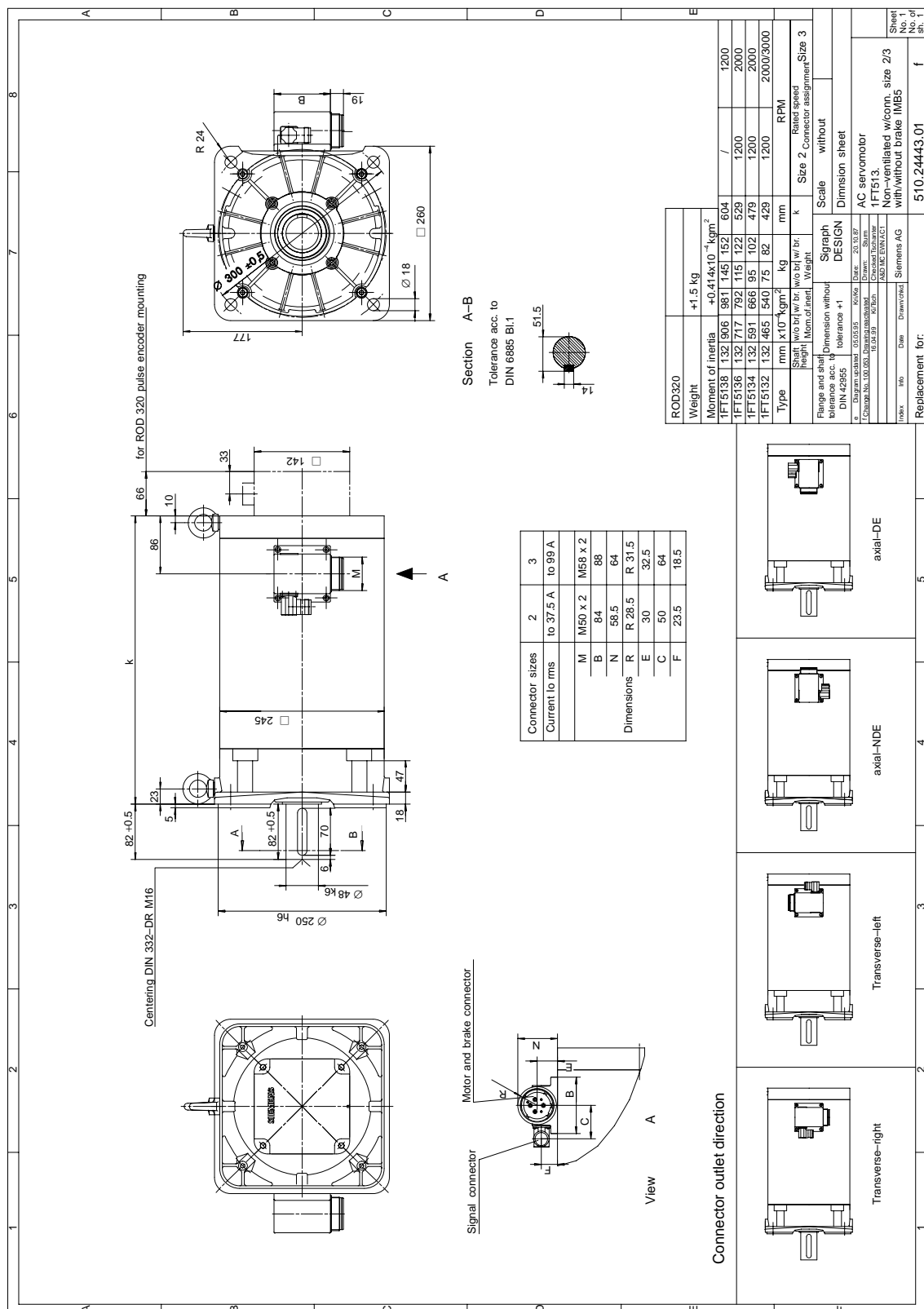


Fig. 4-7 1FT513□ non-ventilated with connector size 2/3

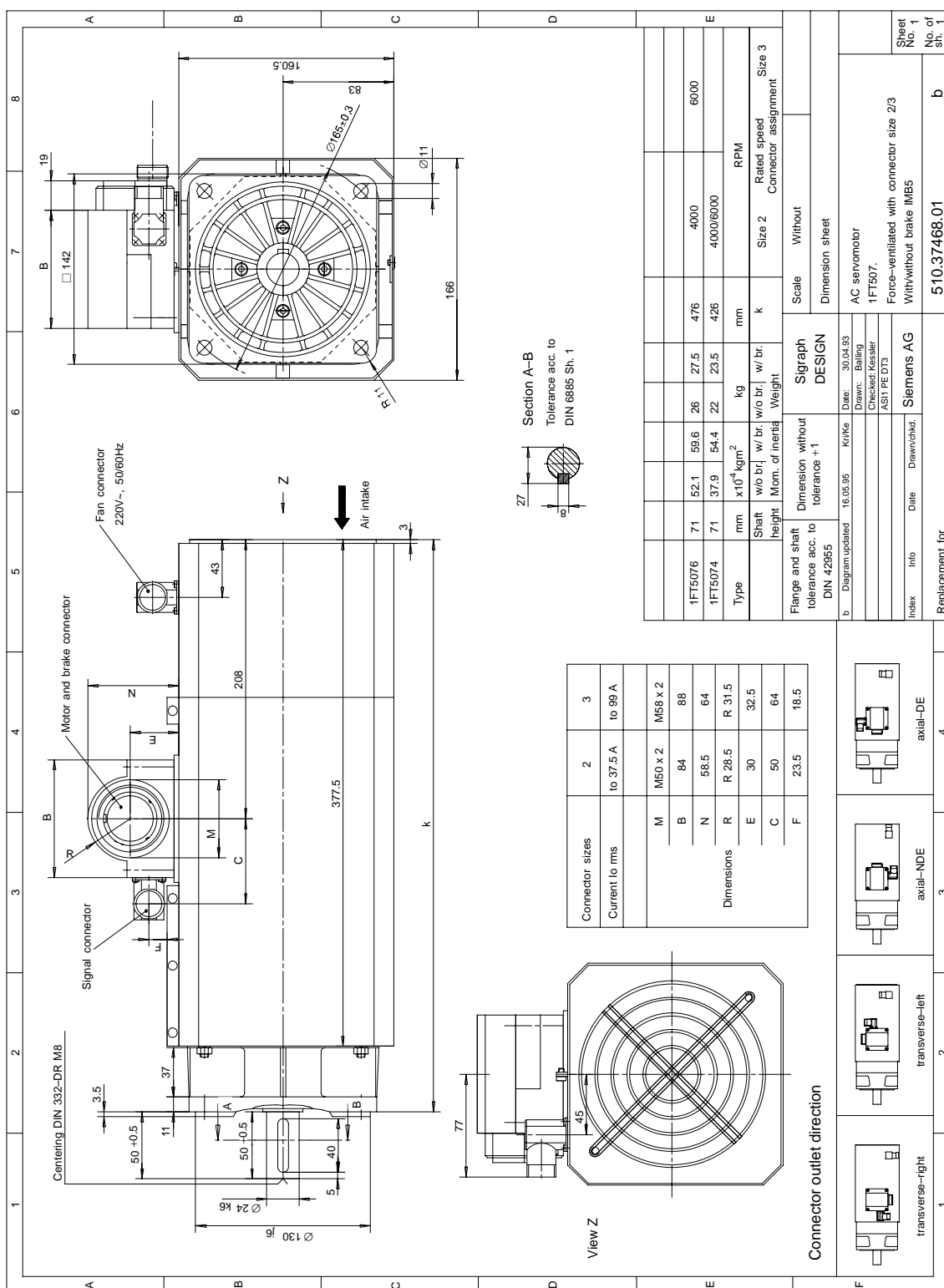
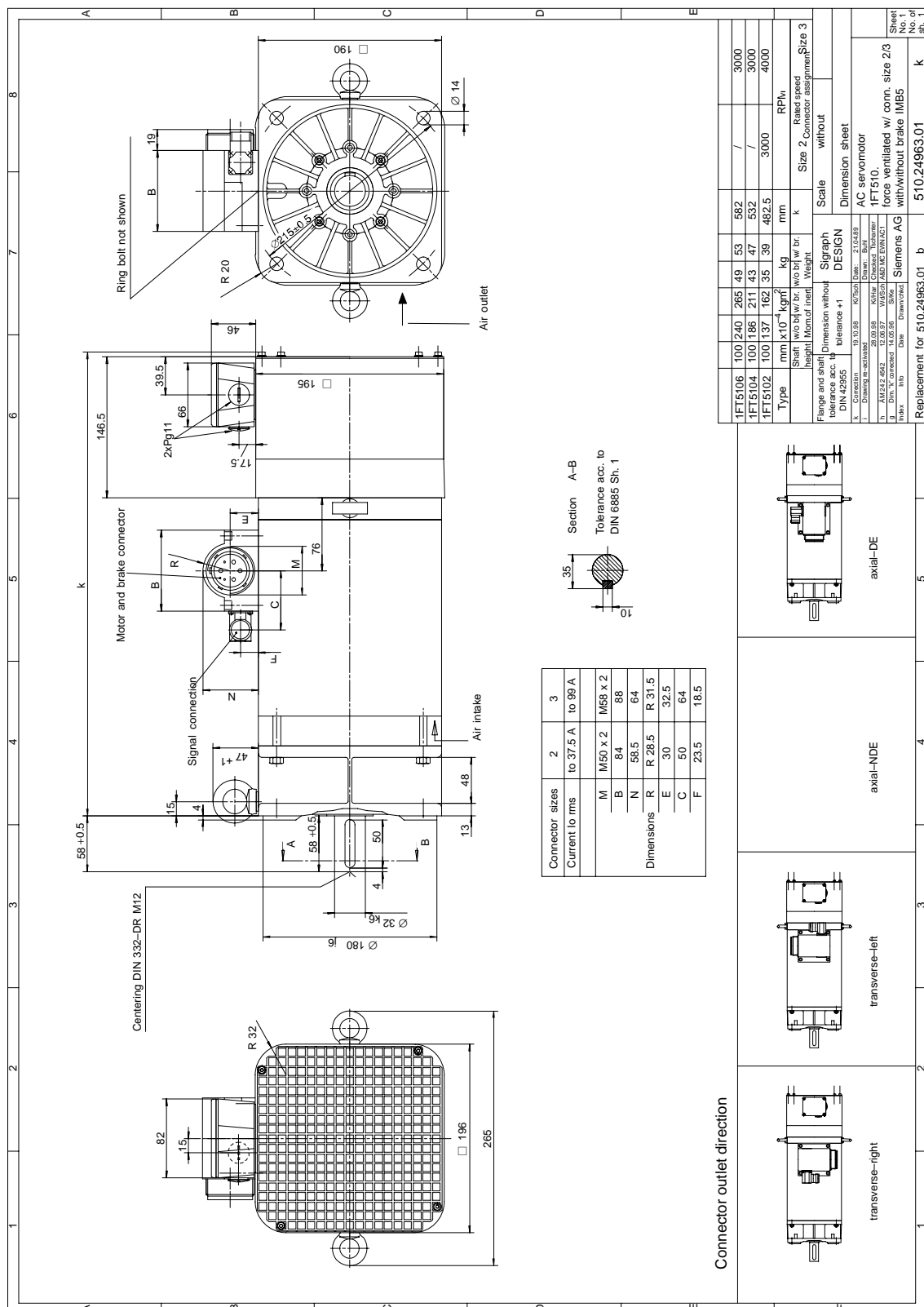


Fig. 4-8 1FT507□ force ventilated with connector size 2/3



1FT5

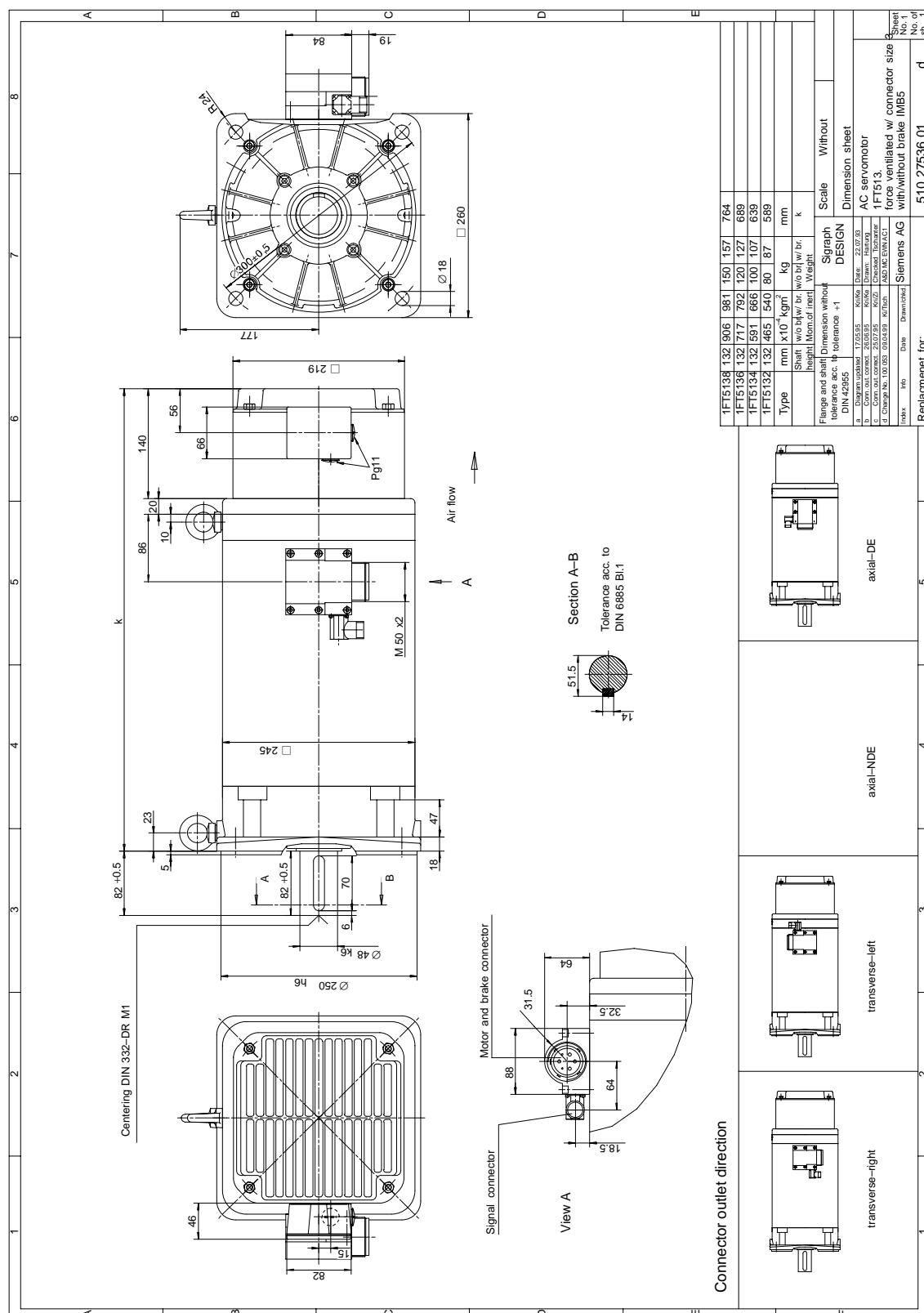


Fig. 4-10 1FT513 force ventilated with connector size 3

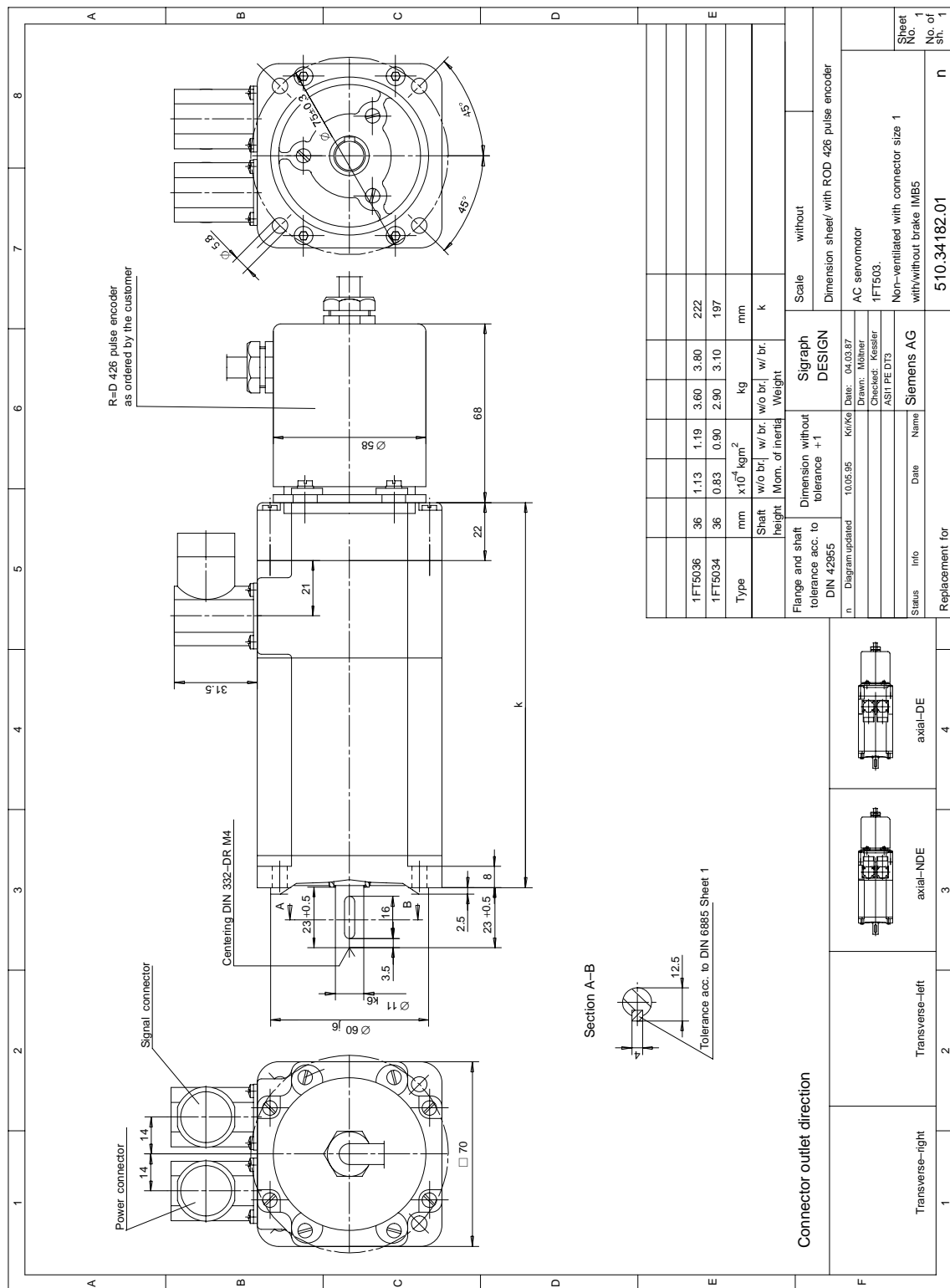


Fig. 4-11 1FT503□ non-ventilated with connector size 1

1FT5

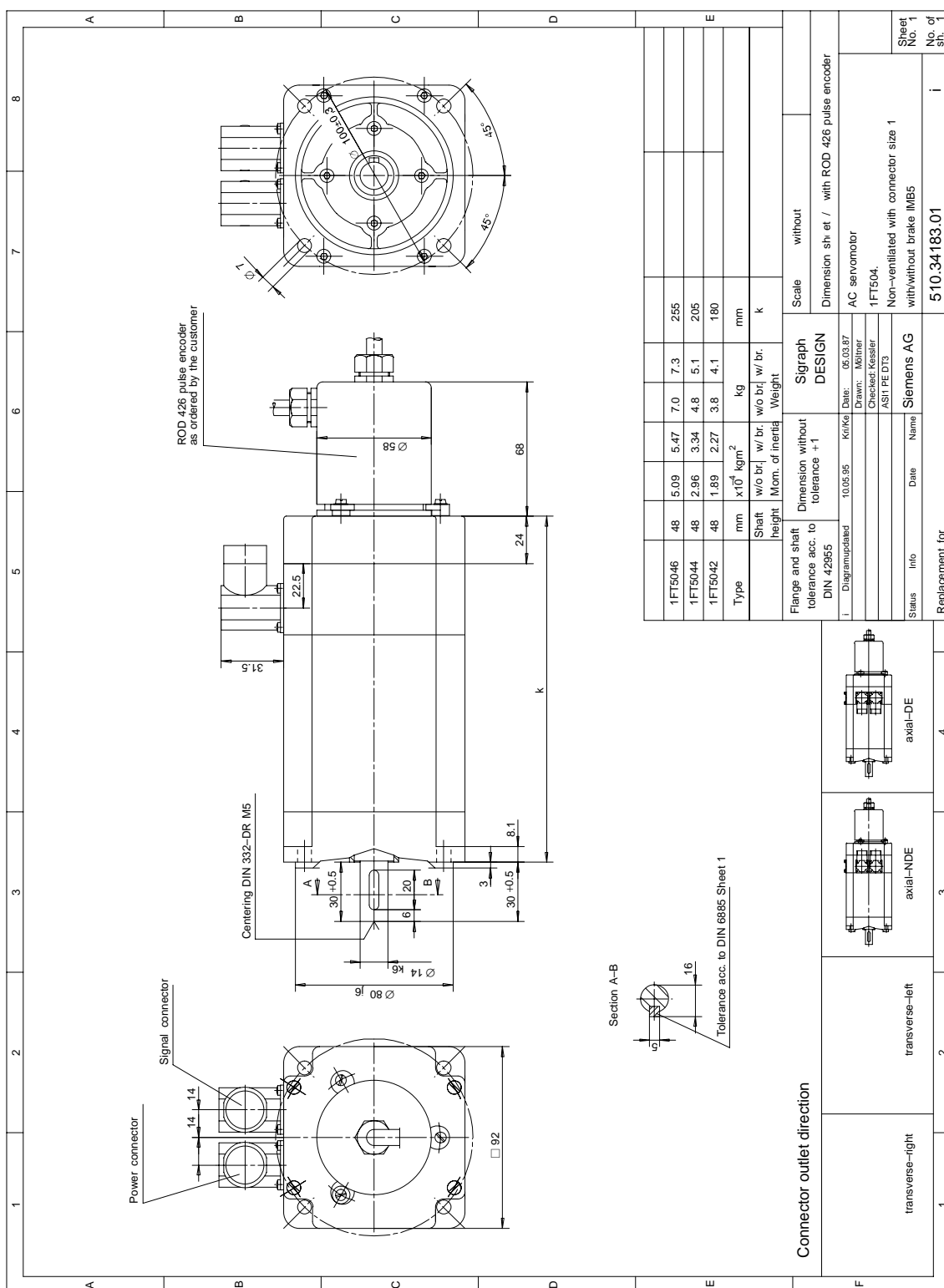


Fig. 4-12 1FT504□ non-ventilated with connector size 1

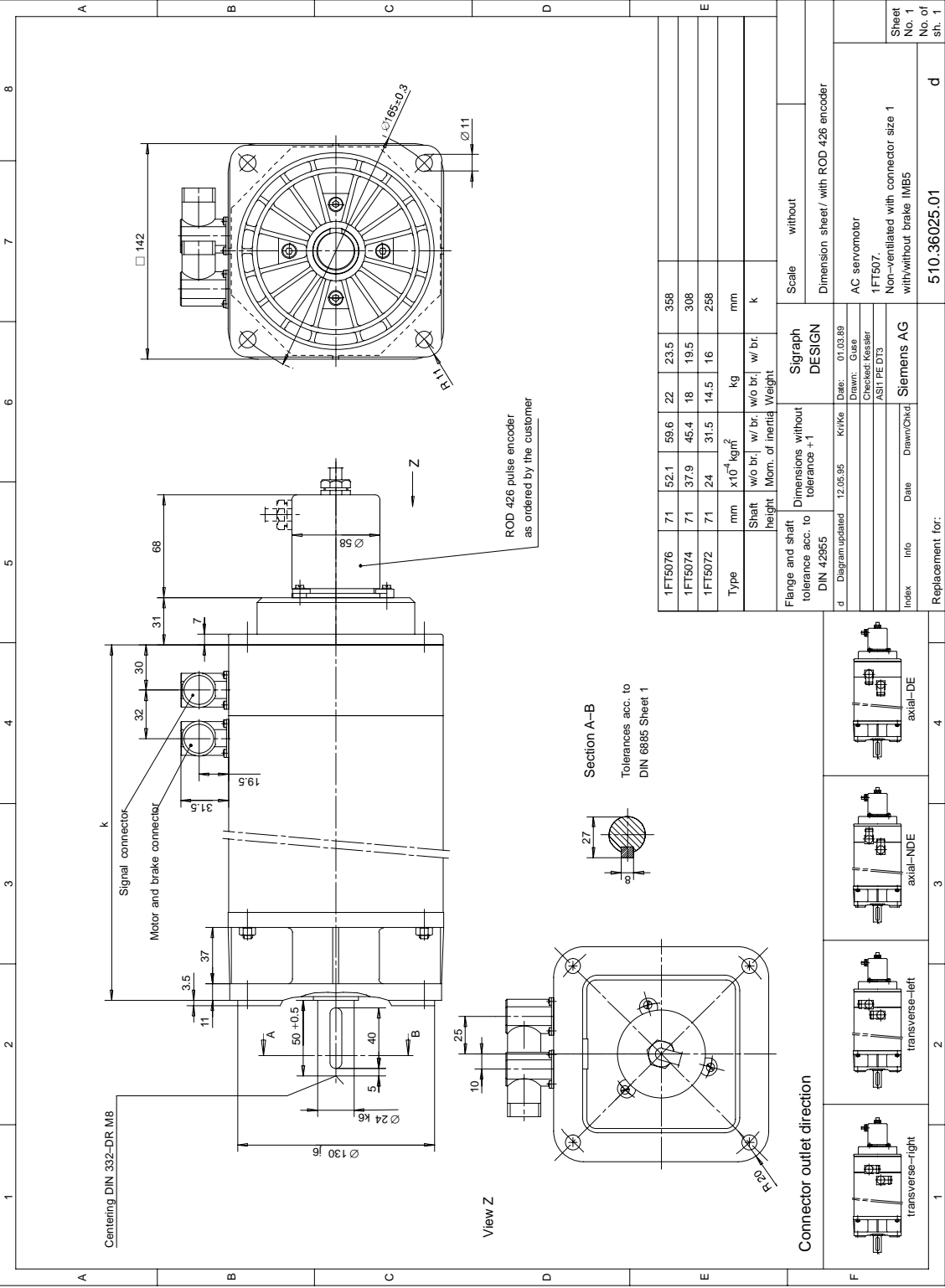
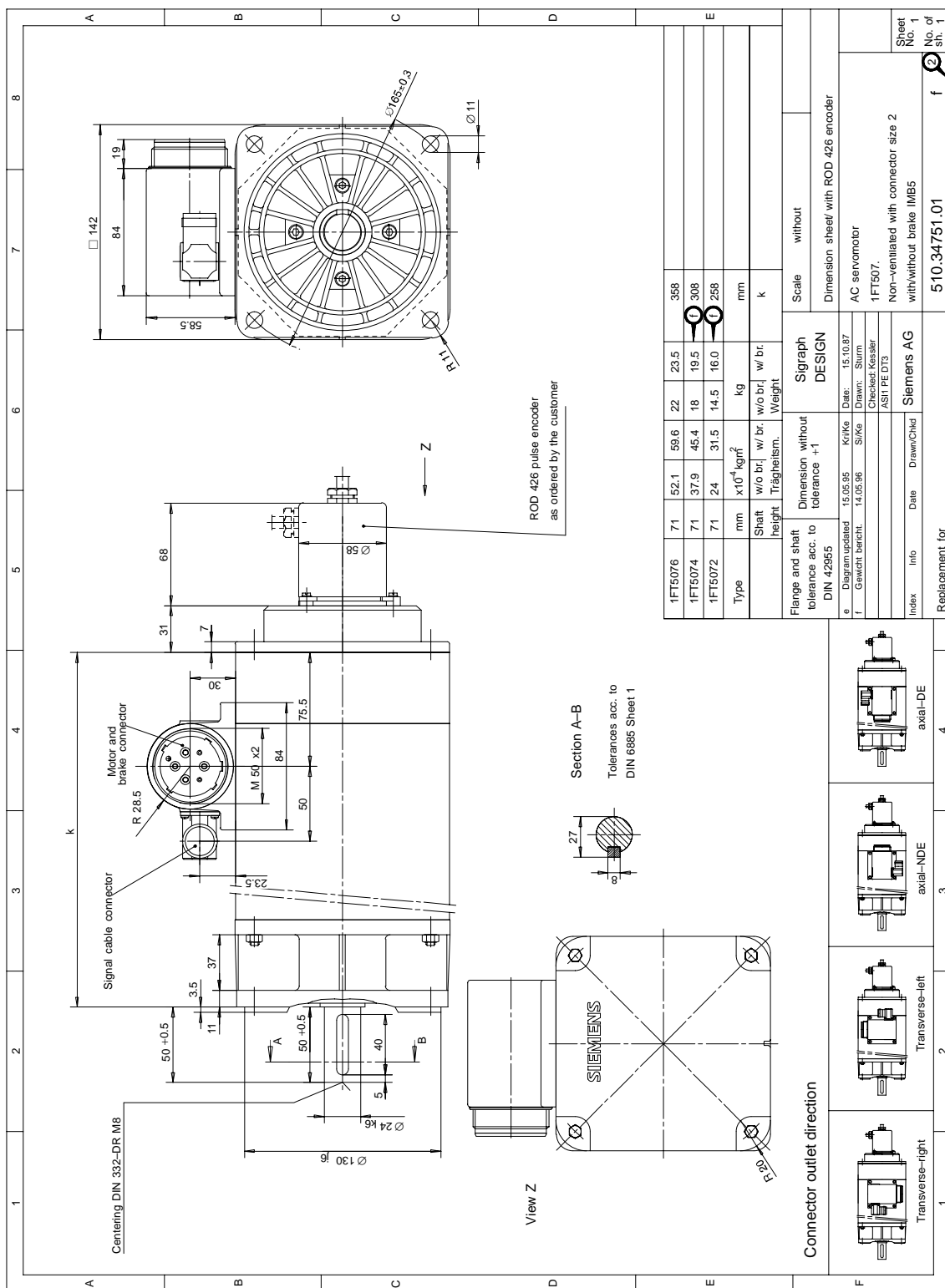


Fig. 4-14 1FT507□ non-ventilated with connector size 1



1FT5

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

4 Dimension Drawings

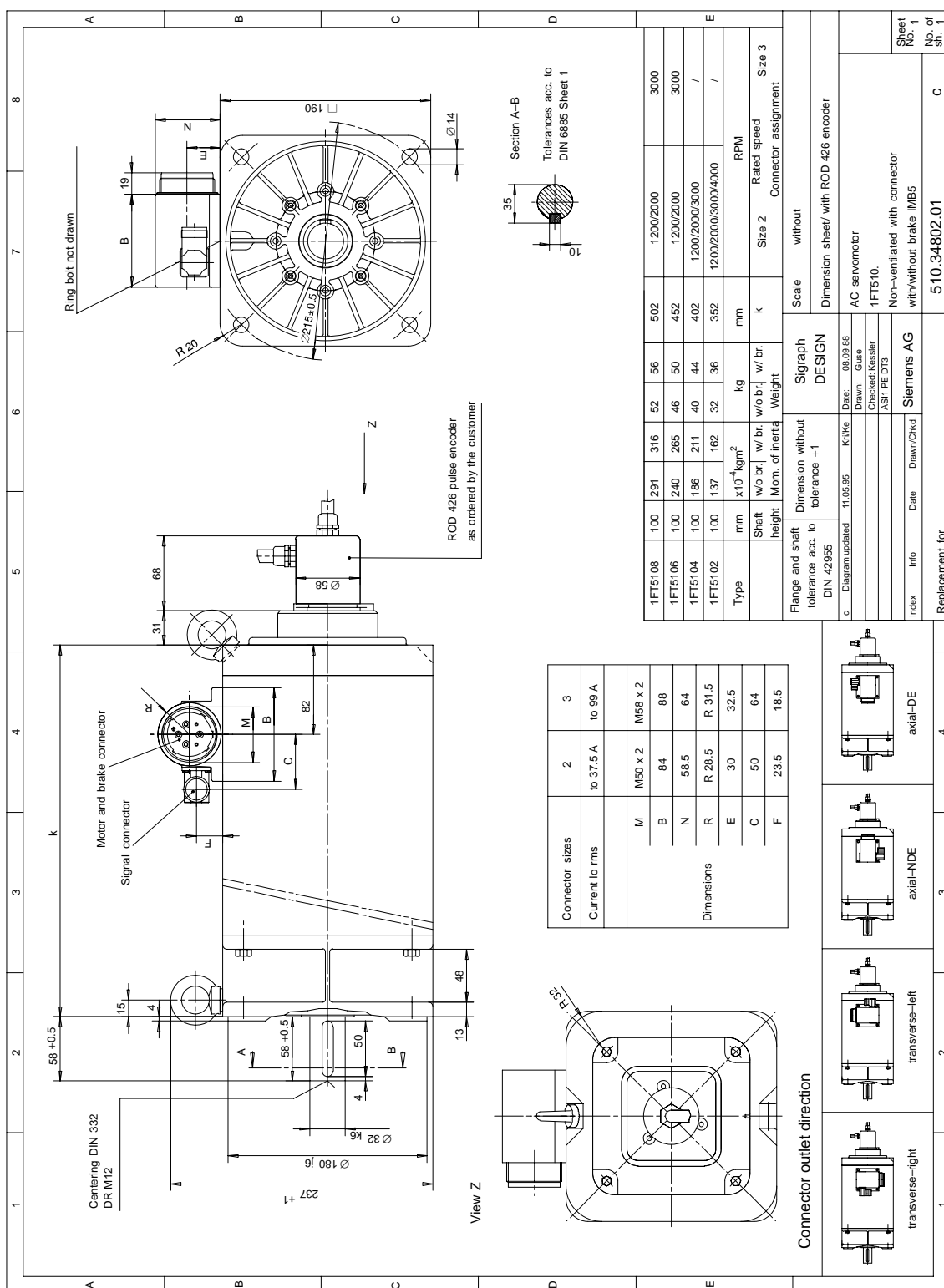
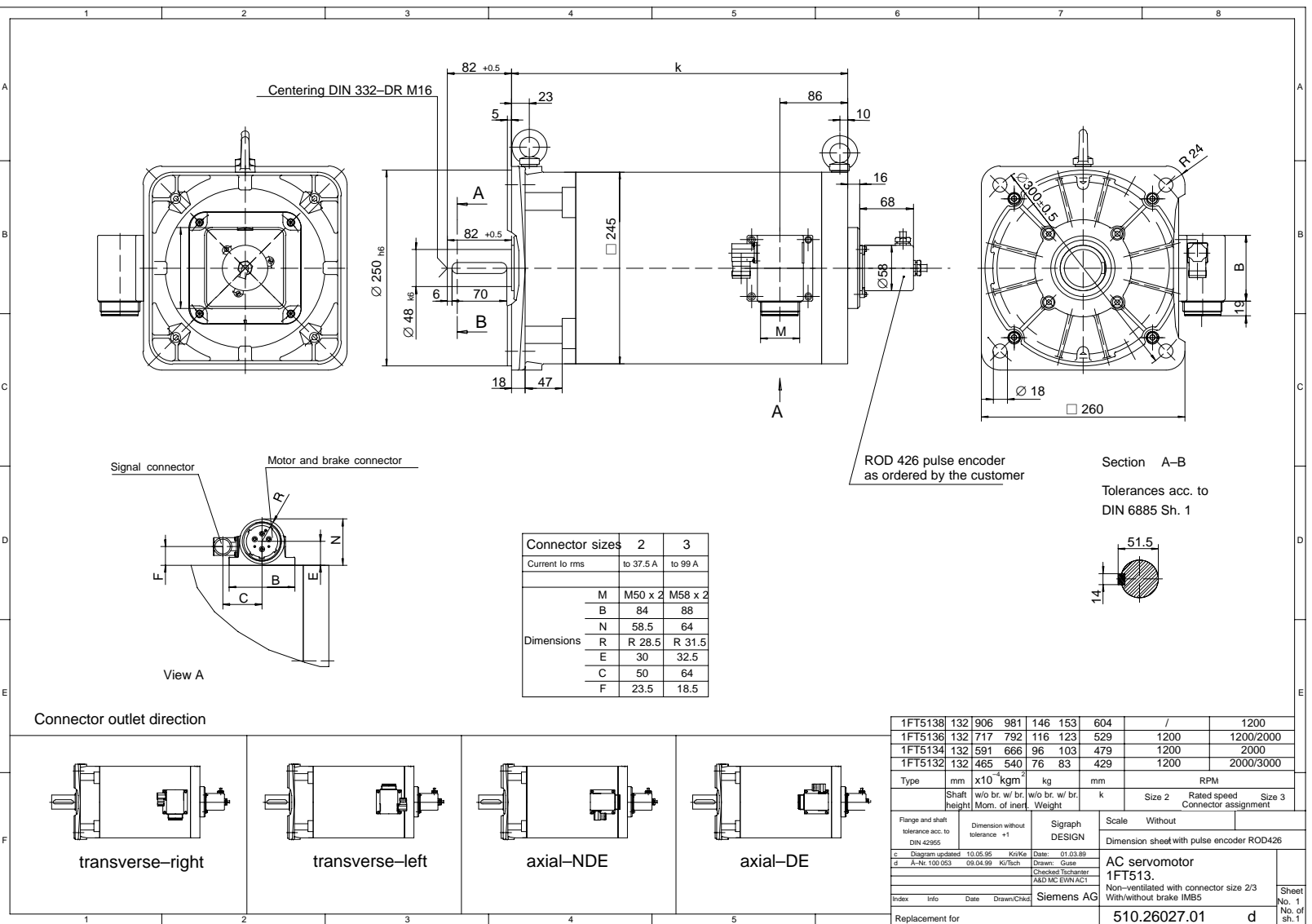


Fig. 4-16 1FT510□ non-ventilated with connector



4 Dimension Drawings

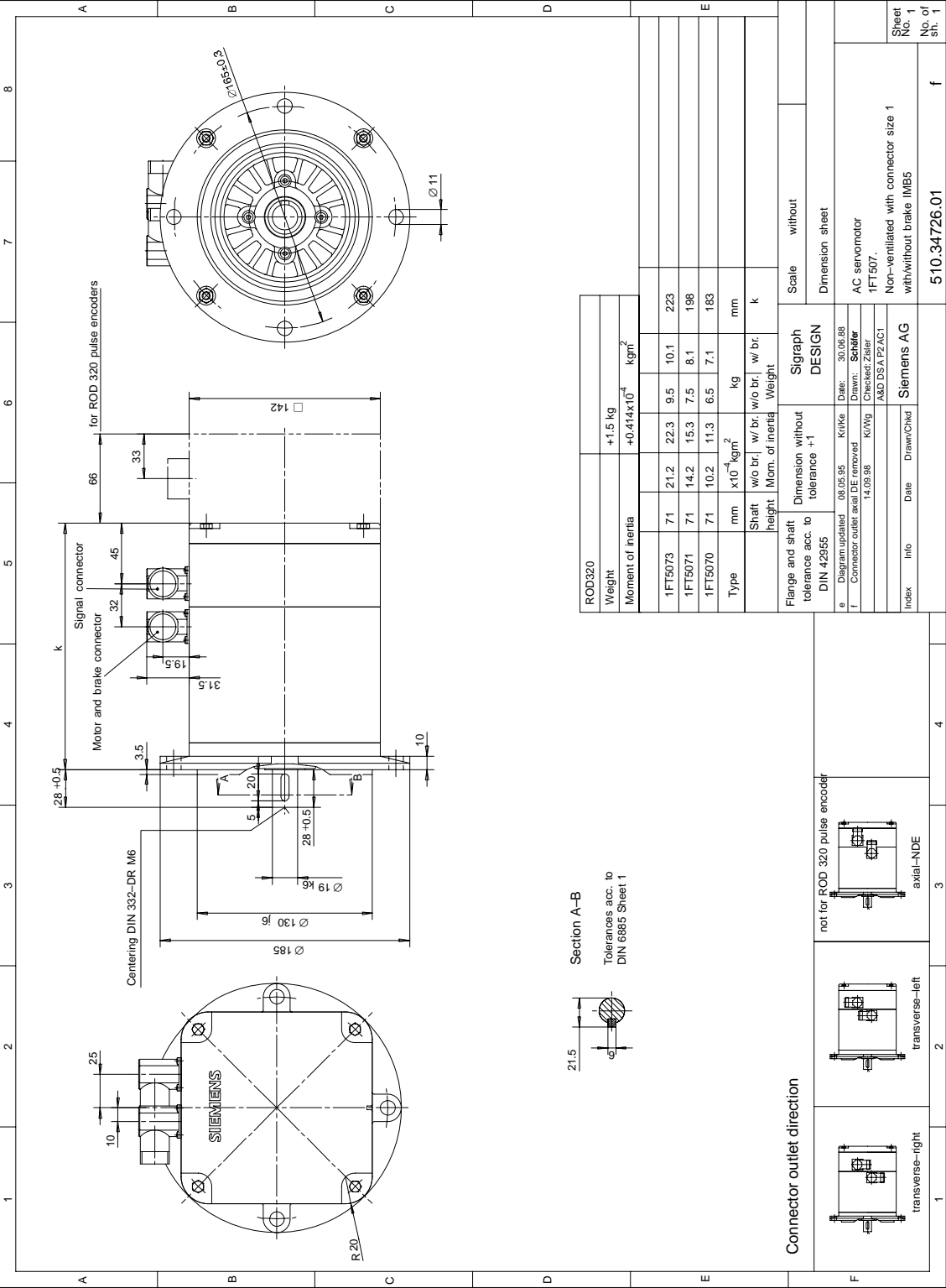
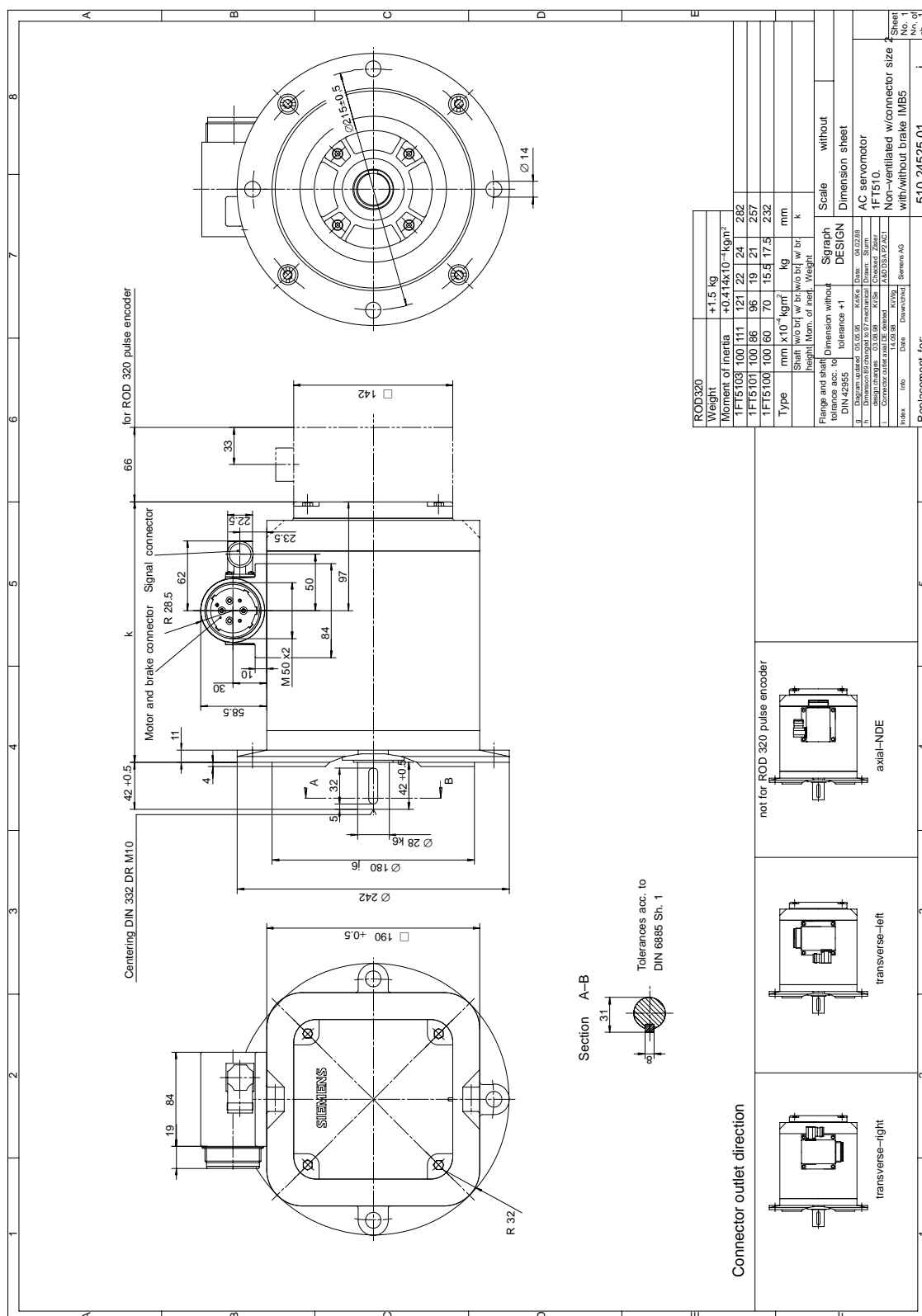


Fig. 4-18 1FT507□ non-ventilated with connector size 1



1FT5

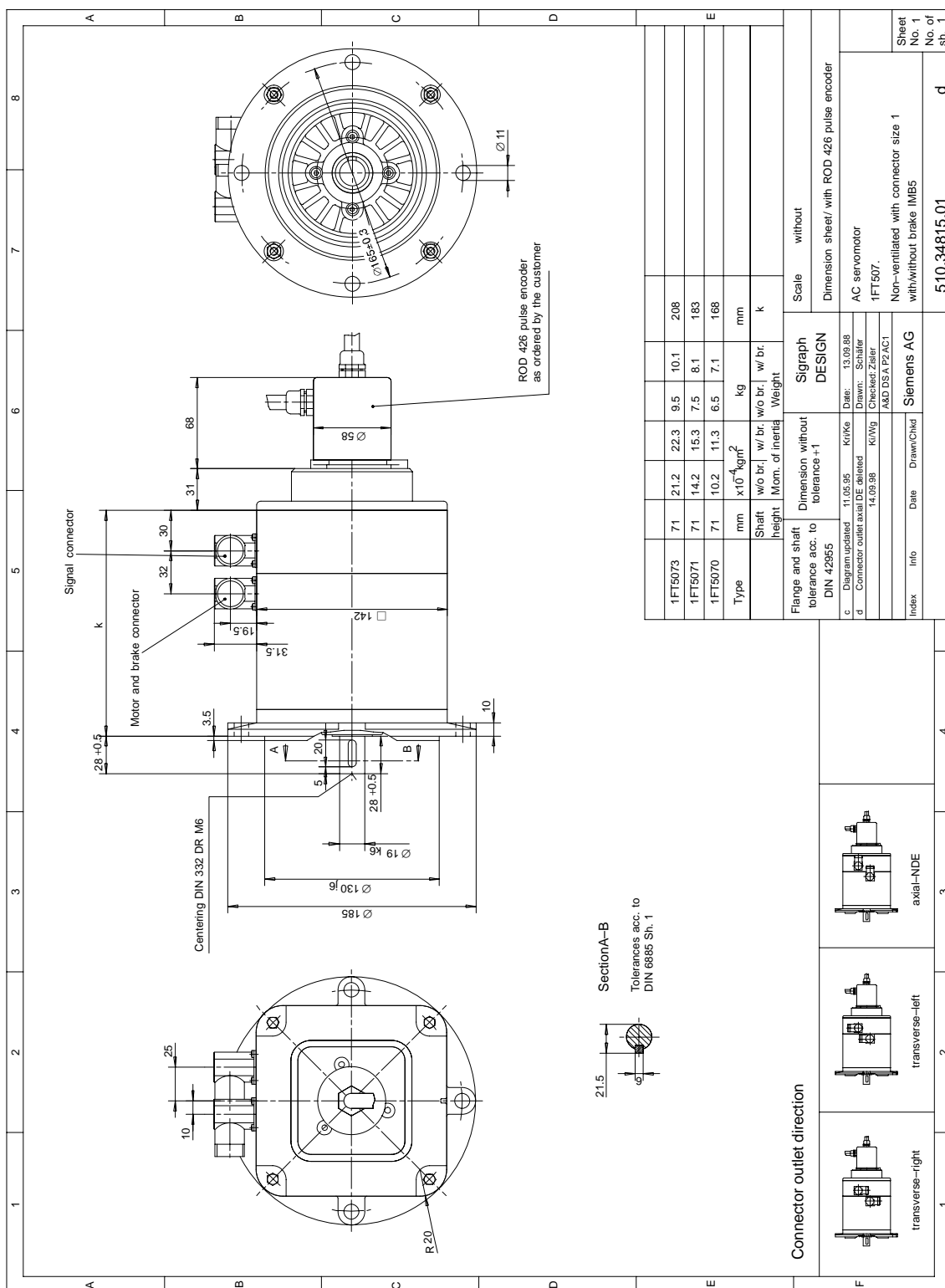


Fig. 4-20 1FT507□ non-ventilated with connector size 1

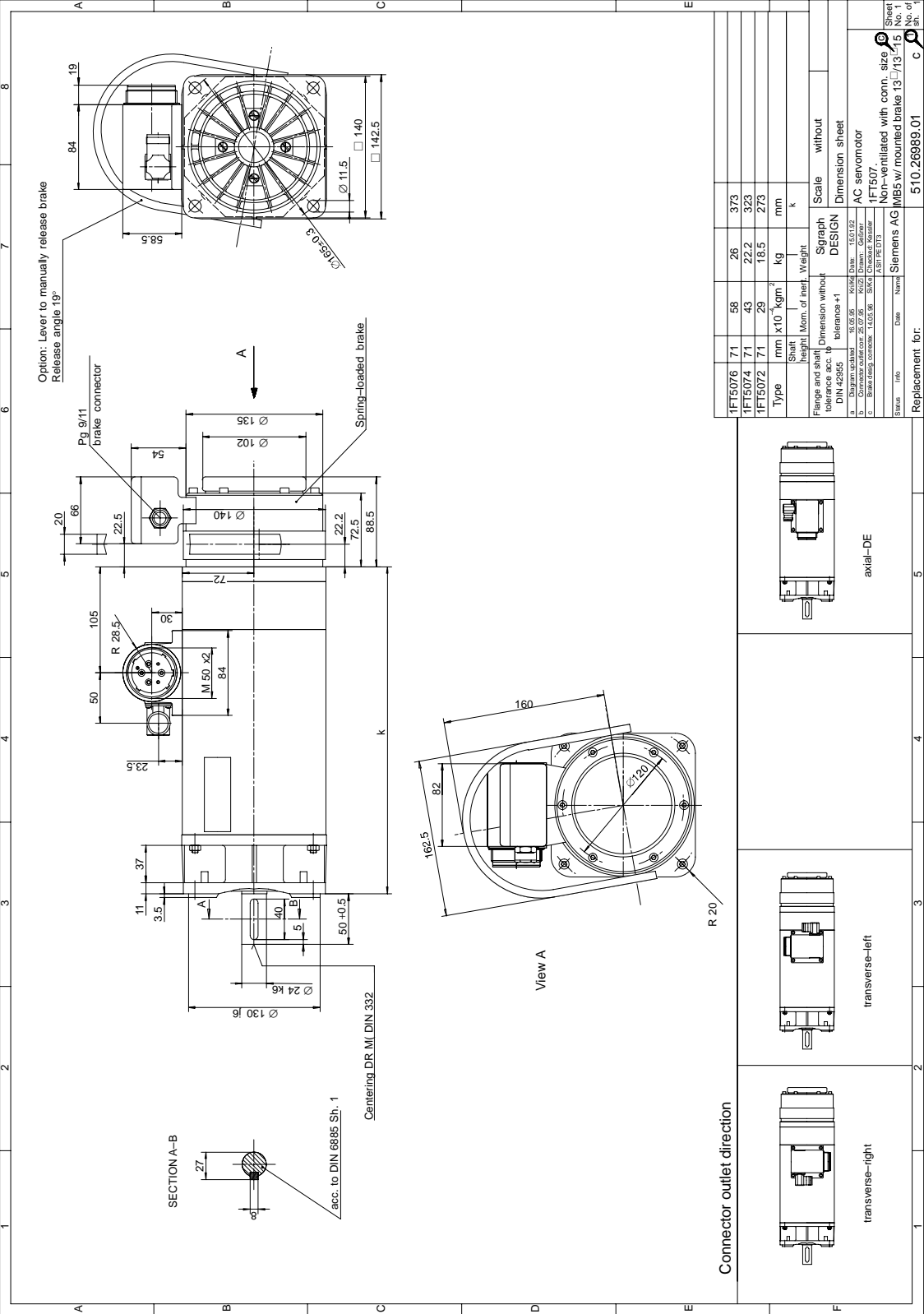


Fig. 4-22 1FT507□ non-ventilated with connector size 2

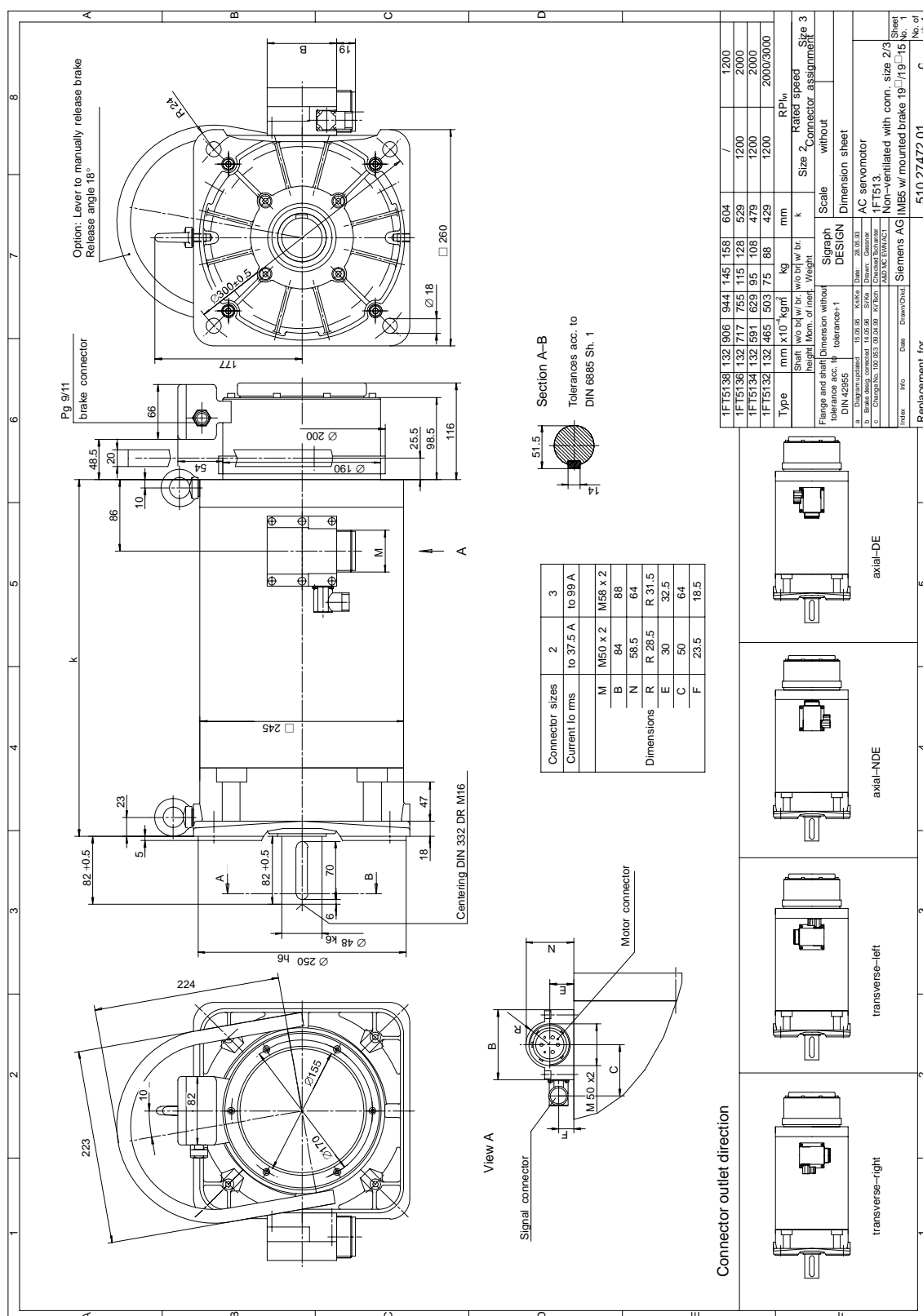


Fig. 4-24 1FT513□ non-ventilated with connector size 2/3

5

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1FT5

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1FT6 AC Servomotors

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1FT6

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1

Motor Description

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 characteristic 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 $\Delta T=60$ 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 |

1FT6

1.1 Characteristics and technical data

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 $\Delta T = 100 \text{ K}$ for an ambient temperature of $40 \text{ }^{\circ}\text{C}$. Lifetime > 40 000 h |
| Installation altitude (acc. to EN and IEC 60034-1) | $\leq 1000 \text{ m}$ 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 <ul style="list-style-type: none"> • speed sensing • rotor position sensing • indirect position sensing (incremental) |

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 | <ul style="list-style-type: none"> • fail-safe holding brake; 24V \pm 10% supply voltage (acc. to DIN 0580 7/79) • mounted planetary gearbox • multi-turn absolute value encoder¹⁾ • resolver |

1FT6

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

1.1 Characteristics and 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] | Con- nec- tor size | Cross- section [mm ²] | 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 |

1.1 Characteristics and technical data

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

1 Core type
4, 6, 8 Pole No.

without brake cable: without overall shield
with overall shield
with brake cable: without overall shield
with overall shield

A
C
B
D

Lengths⁴⁾
(examples)

5 m AF
10 m BA
15 m BF
18 m BJ
25 m CF

Power calculation

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

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 widening 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 servomotors 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 | — 9.1 | 2.9 3.3 | 4.1 | 3.8 3.5 |
| 1FT6061-□AF71 | — 9.4 | 2.5 3.3 | 4.1 | 5.4 4.9 |
| 1FT6061-□AH71 | — 7.3 | 2.0 3.3 | 4.1 | 8.2 7.4 |
| 1FT6061-□AK71 | — 7.1 | 1.7 3.3 | 4.1 | 10.0 8.9 |
| 1FT6062-□AC71 | — 7.7 | 4.3 5.2 | 6.4 | 5.6 5.2 |
| 1FT6062-□AF71 | — 6.4 | 3.7 5.2 | 6.5 | 8.6 7.8 |
| 1FT6062-□AH71 | — 5.5 | 2.9 5.2 | 6.4 | 12.1 10.8 |
| 1FT6062-□AK71 | — 4.4 | 2.4 5.1 | 6.4 | 16.0 14.3 |
| 1FT6064-□AC71 | — 5.8 | 6.4 8.6 | 10.6 | 9.1 8.2 |
| 1FT6064-□AF71 | — 4.9 | 5.2 8.5 | 10.6 | 13.1 11.8 |
| 1FT6064-□AH71 | — 3.6 | 4.1 8.6 | 10.7 | 19.9 17.8 |
| 1FT6064-□AK71 | — 2.9 | 3.4 8.6 | 10.7 | 26.0 23.7 |

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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 | — 6.5 | 4.4 6.0 | 7.5 | 7.3 6.6 |
| 1FT6081-□AF71 | — 5.1 | 3.7 6.1 | 7.6 | 11.0 9.9 |
| 1FT6081-□AH71 | — 3.7 | 2.8 6.0 | 7.5 | 16.4 14.7 |
| 1FT6081-□AK71 | — 3.4 | 2.4 6.2 | 7.7 | 20.6 18.5 |
| 1FT6082-□AC71 | — 4.2 | 6.2 9.4 | 11.7 | 11.9 10.7 |
| 1FT6082-□AF71 | — 3.2 | 5.0 9.5 | 11.8 | 17.7 15.9 |
| 1FT6082-□AH71 | — 2.4 | 3.7 9.2 | 11.5 | 26.0 23.0 |
| 1FT6082-□AK71 | — 2.2 | 3.3 9.8 | 12.1 | 33.0 29.0 |

1.2 Functions and options

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 | — 3.5 | 8.9 15.4 | 19.1 | 17.4 15.6 |
| 1FT6084-□AF71 | — 2.6 | 7.0 16.5 | 19.2 | 26.0 23.1 |
| 1FT6084-□AH71 | — 1.7 | 5.4 15.4 | 19.2 | 40.0 36.0 |
| 1FT6084-□AK71 | — 1.8 | 4.4 15.3 | 19.0 | 46.0 41.0 |
| 1FT6086-□AC71 | — 2.7 | 12.6 22.8 | 28.0 | 24.2 21.7 |
| 1FT6086-□AF71 | — 2.1 | 9.8 24.7 | 28.0 | 35.0 32.0 |
| 1FT6086-□AH71 | — 1.6 | 7.5 22.9 | 28.0 | 51.0 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 | — 3.9 | 12.0 22.6 | 28.0 | 17.5 15.8 |
| 1FT6102-□AC71 | — 2.8 | 10.0 22.7 | 28.0 | 24.7 22.1 |
| 1FT6102-□AF71 | — 2.3 | 7.7 22.5 | 28.0 | 34.0 31.0 |
| 1FT6102-□AH71 | — 1.7 | 6.1 23.0 | 29.0 | 50.0 45.0 |
| 1FT6105-□AB71 | — 2.2 | 19.1 40.0 | 50.0 | 31.0 28.0 |
| 1FT6105-□AC71 | — 1.7 | 16.0 40.0 | 50.0 | 42.0 38.0 |
| 1FT6105-□AF71 | — 1.2 | 12.0 39.0 | 49.0 | 62.0 56.0 |
| 1FT6108-□AB71 | — 1.4 | 32.0 70.0 | 87.0 | 53.0 47.0 |
| 1FT6108-□AC71 | — 1.2 | 26.0 69.0 | 86.0 | 68.0 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⁾ 1.7 | 27.0 64.0 | 80.0 | 46.0 41.0 |
| 1FT6132-□AC71 | — ¹⁾ 1.3 | 22.2 65.0 | 81.0 | 62.0 55.0 |
| 1FT6132-□AF71 | — ¹⁾ 0.9 | 16.7 64.0 | 80.0 | 92.0 80.0 |
| 1FT6134-□AB71 | — ¹⁾ 1.2 | 40.0 97.0 | 120.0 | 68.0 61.0 |
| 1FT6134-□AC71 | — ¹⁾ 0.9 | 34.0 99.0 | 122.0 | 94.0 84.0 |
| 1FT6136-□AB71 | — ¹⁾ 1.0 | 41.0 106.0 | 132.0 | 77.0 69.0 |
| 1FT6136-□AC71 | — ¹⁾ 0.9 | 34.0 107.0 | 134.0 | 98.0 88.0 |

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Table 1-10 Resistor braking for 1FT6 motors, shaft height 80, shaft heights 100 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 | — 2.3 | 6.9 15.4 | 19.2 | 27.0 24.4 |
| 1FT6084-□SH71 | — 1.7 | 5.4 15.4 | 19.2 | 40.0 36.0 |
| 1FT6084-□SK71 | — 1.4 | 4.3 15.5 | 19.2 | 52.0 46.0 |
| 1FT6086-□SF71 | — 1.6 | 10.1 23.0 | 29.0 | 41.0 37.0 |
| 1FT6086-□SH71 | — 1.1 | 7.1 22.1 | 28.0 | 59.0 53.0 |
| 1FT6086-□SK71 | — 1.1 | 6.0 22.2 | 28.0 | 70.0 62.0 |
| 1FT6105-□SC71 | — 1.5 | 15.8 40.0 | 49.0 | 45.0 40.0 |
| 1FT6105-□SF71 | — 1.2 | 12.0 39.0 | 49.0 | 62.0 56.0 |
| 1FT6108-□SC71 | — 0.9 | 27.0 70.0 | 87.0 | 76.0 68.0 |
| 1FT6132-□SC71 | — ¹⁾ 1.1 | 23.3 65.0 | 81.0 | 70.0 62.0 |
| 1FT6134-□SC71 | — ¹⁾ 0.8 | 33.0 97.0 | 120.0 | 99.0 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.

1.2 Functions and options

Table 1-11 Resistor braking for 1FT6 motors, shaft height 80 and 100 (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 | — 2.3 | 6.9 15.4 | 19.2 | 27.0 24.4 |
| 1FT6084-□WH71 | — 1.7 | 5.4 15.4 | 19.2 | 40.0 36.0 |
| 1FT6084-□WK71 | — 1.4 | 4.3 15.5 | 19.2 | 52.0 46.0 |
| 1FT6086-□WF71 | — 1.6 | 10.1 23.4 | 29.0 | 41.0 37.0 |
| 1FT6086-□WH71 | — 1.1 | 7.1 22.1 | 28.0 | 59.0 53.0 |
| 1FT6086-□WK71 | — 1.1 | 6.0 22.2 | 28.0 | 70.0 62.0 |
| 1FT6105-□WC71 | — 0.8 | 15.8 39.0 | 49.0 | 62.0 56.0 |
| 1FT6105-□WF71 | — 0.6 | 12.8 41.0 | 51.0 | 92.0 83.0 |
| 1FT6108-□WB71 | — 1.2 | 32.0 70.0 | 87.0 | 57.0 51.0 |
| 1FT6108-□WC71 | — 0.9 | 27.0 70.0 | 87.0 | 76.0 68.0 |
| 1FT6108-□WF71 | — 0.6 | 21.0 71.0 | 88.0 | 115.0 103.0 |

Holding brake

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

The holding brake cannot be retrofitted! Motors with holding brake are longer by the space required to integrate 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⁾ | | Dyn. torque | DC current | Power drain | Opening time | Closing time ¹⁾ | Mom. of inertia [10 ⁻⁴ kgm ²] | Highest switching work ^{2) 4)} [J] |
|--------------------|------------|--|--------|-------------|------------|-------------|--------------|----------------------------|---|---|
| | | [Nm] | | [Nm] | [A] | [W] | [ms] | [ms] | | |
| | | 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 |

1FT6

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 fluctuations and spread between the units (production tolerances)

1) standardized according to VDE 0580 with varistor circuit

2) for each emergency stop with $n=3000/\text{min}$

3) for each emergency stop with $n=2000/\text{min}$

4) $W = 1/2 \cdot J_{\text{tot}} \cdot \omega^2$; J_{tot} [kgm²] ; ω [1/s] ; W [J]

1.2 Functions and options

Gearboxes

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

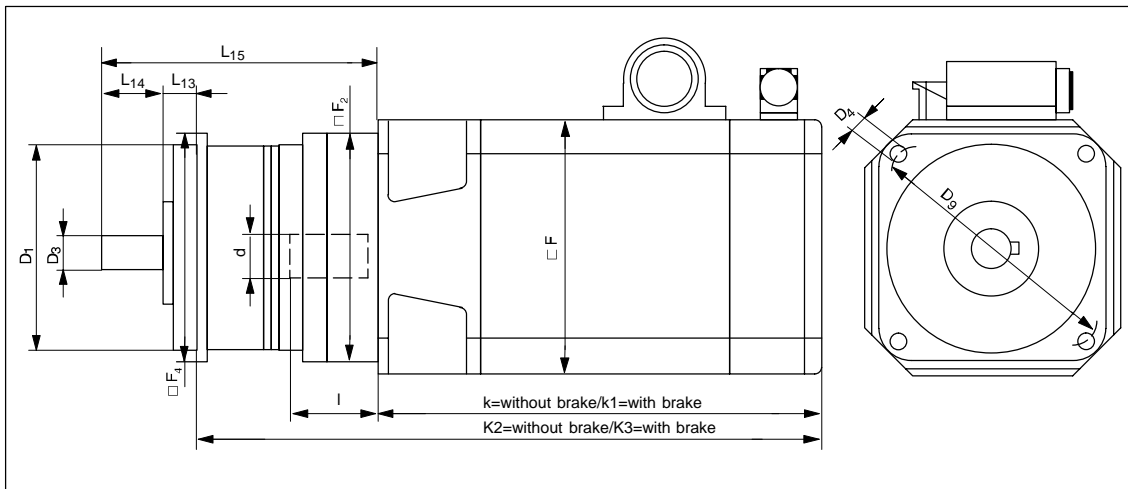


Fig. 1-1 1FT6 motor with planetary gearbox (alpha company) SPG 1-stage, dimensions in [mm]

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

| Motor, standard version | | | | | | Planetary gearbox, 1 stage | | | | | | | | | | | | Dimen- sions | |
|-------------------------|------------|-----|----|----|-----|----------------------------|------------|-----|-----|-----|----|-----|-----|------|------|-----|-----|-----------------|--|
| Type | Dimensions | | | | | Type | Dimensions | | | | | | | | | | | | |
| | k | k1 | l | d | □ F | | L13 | L14 | L15 | D1 | D3 | D4 | D9 | □ F4 | □ F2 | K2 | K3 | | |
| 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 | | |

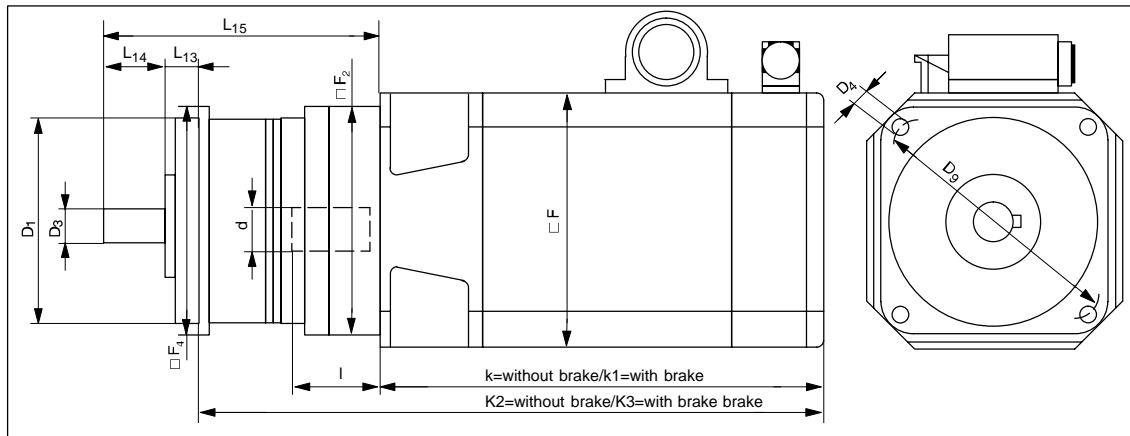


Fig. 1-2 1FT6 motor with planetary gearbox (alpha Company) SPG 2-stage, dimensions in [mm]

1FT6

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

| Motor, standard version | | | | | | Planetary gearbox, 2 stage | | | | | | | | | | | | Dimension | |
|-------------------------|------------|-----|-----|-----|-----|----------------------------|-----------------|-----------------|-----------------|----------------|----------------|----------------|----------------|------|------|----------------|----------------|-----------|--|
| Type | Dimensions | | | | | Type | Dimensions | | | | | | | | | | | | |
| | k | k1 | I | 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 | | | | | | | | | | | 375 | 410 | | |
| 1FT6044 | 278 | 313 | | | | | | | | | | | | | | 425 | 460 | | |
| 1FT6061 | 228 | 258 | 50 | 24 | 116 | | | | | | | | | | | 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 | | | | | | | | | | | 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 | | | | | | | | | | | 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 | | | | | | | | | | | 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 | | | | | | | | | | | 538 | 584 | | |
| 1FT6105 | 370 | 416 | | | | | | | | | | | | | | 613 | 659 | | |
| 1FT6108 | 470 | 516 | | | | | | | | | | | | | | 713 | 759 | | |

1.2 Functions and options

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 ra- tios <i>i</i> = | | | | Max. per- missible in- put speed | Max. per- missible output tor- que | Max. per- missible 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>i</i> =4 10 ⁻⁴ kgm ² | J _G at <i>i</i> =10 10 ⁻⁴ kgm ² |
| 1FT6031 1FT6034 | SPG 060-M01 | 1.5 | X X | X X | X X | X | 6000 | 40 (32) ³⁾ | 2600 | 0.17 | 0.15 |
| 1FT6034 | SPG 075-M01 | 2.8 | X | X | X | X | 6000 | 100 (80) ³⁾ | 3800 | 0.57 | 0.4 |
| 1FT6041 | | | X | X | X | X | | | | 0.63 | 0.46 |
| 1FT6044 | | | X | X | X | X | | | | | |
| 1FT6044 | SPG 100-M01 | 6.2 | | | | X | 4500 | 250 (200) ³⁾ | 6000 | 2.0 | 1.3 |
| 1FT6061 | | | X | X | X | X | | | | 2.7 | 2.0 |
| 1FT6062 | | | X | X | X | X | | | | | |
| 1FT6064 | | | X | X | X | X | | | | | |
| 1FT6081 1FT6082 1FT6084 1FT6086 | SPG 140-M01 | 11.5 | X X X X | X X X X | X X X X | 4000 | 500 (400) ³⁾ | 9000 | 8.4 | 6.2 | |
| 1FT6086 | | | X | X | X | | | | | | X |
| 1FT6086 | | | X | X | X | | | | | | X |
| 1FT6102 | | | X | X | X | | | | | | X |
| 1FT6105 1FT6108 | SPG 180-M01 | 27 | X X X | X X X | X X X | 3500 | 1100 (880) ³⁾ | 14000 | 30.6 | 17.4 | |
| 1FT6102 | | | X | X | X | | | | 31.7 | 18.5 | |
| 1FT6105 | | | X | X | X | | | | | | |
| 1FT6105 1FT6108 | SPG 210-M01 | 45 | | | | X X | 2000 | 1600 (1280) ³⁾ | 15000 | 62.1 | 28.1 |
| 1FT6132 | | | X | X | X | 70.0 | | | | 36.0 | |
| 1FT6134 | | | X | X | X | | | | | | |
| 1FT6136 | | | X | X | X | | | | | | |
| 1FT6132 1FT6134 1FT6136 | SPG 240-M01 | 61 | | | | X X X | 2000 | 3000 (2400) ³⁾ | 22000 | 131 | 73.0 |
| 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 $F_a=0.5 \cdot F_r$ 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- ventilated | Planetary gearbox 2-stage | | Available gearbox ratio $i =$ | | | | | Max. per- missible in- put speed | Max. per- missible output tor- quet | Max. per- missible drive-out shaft load 1) | Moment of inertia of the gear- box | |
|--|------------------------------|-------------------------|----------------------------------|-------------|-------------|--------|--------|--|--|--|--|-----|
| 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 1FT6034 | SPG 075-M02 | 3.1 | X X | X X | X | X | X | 6000 | 100 | 3800 | 0.52 | |
| 1FT6034 | SPG 100-M02 | 7.1 | | | X | X | X | 4500 | 250 | 6000 | 1.7 | |
| 1FT6041 1FT6044 | | | X X | X X | X | X | 1.8 | | | | | |
| 1FT6061 1FT6062 | | | X X | X X | X | | 2.5 | | | | | |
| 1FT6041 1FT6044 | | | | | X X | X X | X | | | | 4.4 | |
| 1FT6061 1FT6062 1FT6064 | | X X | | X X | X | 5.1 | | | | | | |
| 1FT6062 1FT6064 | SPG 180-M02 | 29 | | | X | X | X | 4000 | 1100 | 14000 | | 5.5 |
| 1FT6081 1FT6082 1FT6084 1FT6086 | | | X X X X | X X X | X X X | X | | | | 8.2 | | |
| 1FT6082 1FT6084 1FT6086 | SPG 210-M02 | 51 | | | X X | X | X | 3000 | 1600 | 15000 | 11.6 | |
| 1FT6102 1FT6105 | | | X X | X | X | | | | | | 16.4 | |
| 1FT6084 1FT6086 | SPG 240-M02 | 61 | | | | X X | X X | 3000 | 3000 | 22000 | 24.2 | |
| 1FT6102 1FT6105 1FT6108 | | | | X X | X | X X | X | | | | 29.7 | |
| Code | | | | | | | | | | | | |
| Gearbox with keyway | | | V12 | V13 | V15 | V16 | V17 | | | | | |
| Gearbox shaft without keyway | | | V32 | V33 | V35 | V36 | V37 | | | | | |

1FT6

- Nominal values for the maximum permissible drive shaft load at the shaft center at a speed $n_{G2}=300$ RPM
Axial load $F_a=0.5 \cdot F_r$ for SPG 075 to SPG 180; $F_a=F_r$ for SPG 210 and SPG 240.
- For SPG 060 and SPG 075: ≤ 8 arcmin

1.2 Functions and options

Supplementary cooling

The various cooling types have already been defined in Chapter 2.1, General information 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

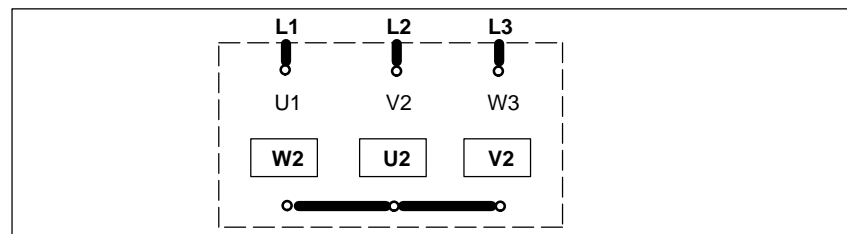
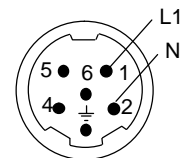


Fig. 1-3 Connecting the fan, shaft height 132

- **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: Connector¹⁾ (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 available with vibration severity grade N.

Cooling water inlet temperature: $\leq 25\text{ °C}$.

Cooling water connection: G3/8 “

Cooling water flow: 5 l/min ($\pm 0.75\text{ l}$)

Max. permissible pressure: 2.5 bar

Pressure drop, inlet–outlet (return line): $< 0.1\text{ bar}$

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/m³]

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

1.2 Functions and options

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 |

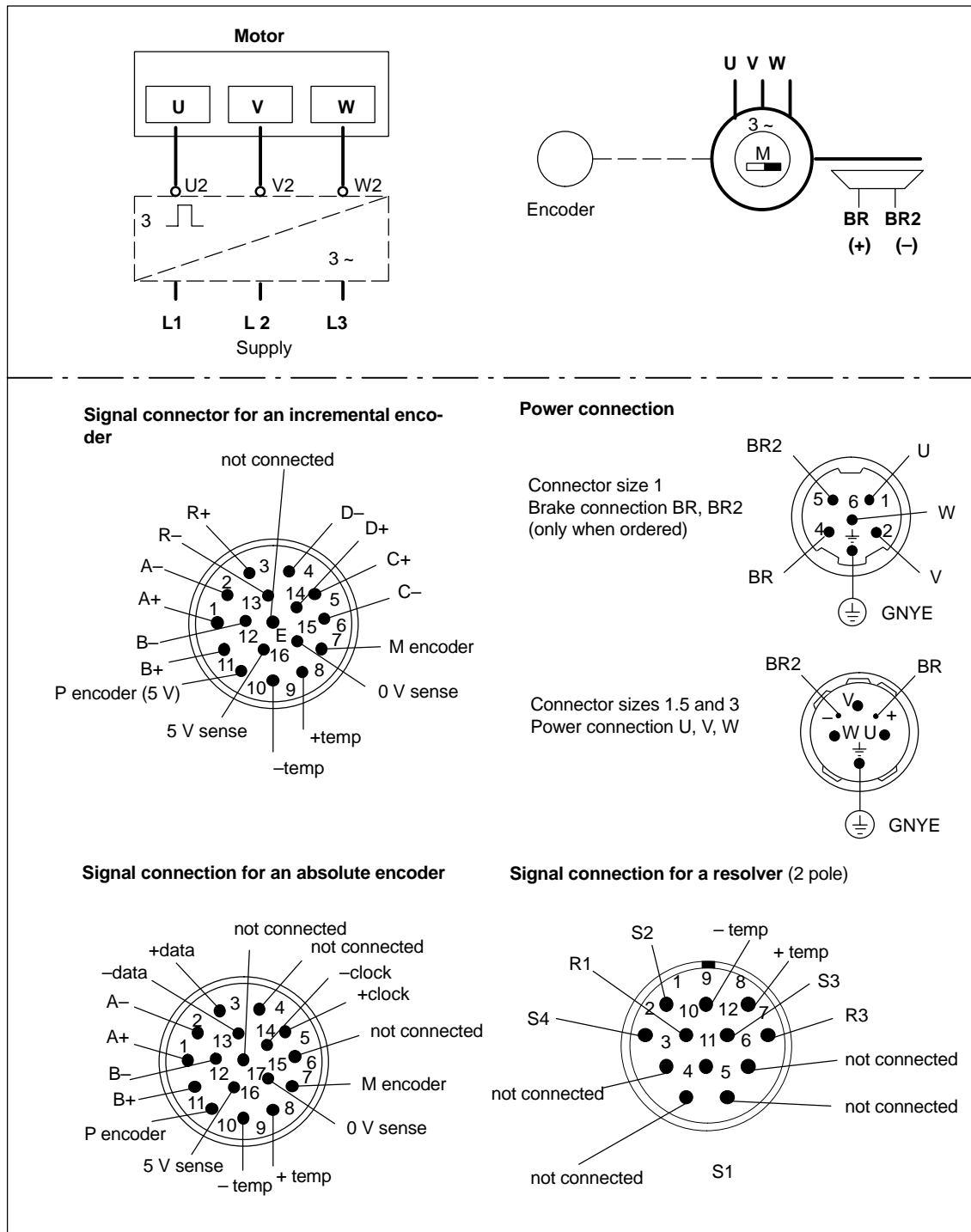
It may be necessary to use other pinions (e.g. Shore hardness 80 Sh–A). They must be optimally harmonized with the mounted mechanical system.

**Warning**

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

1.3 Interfaces

Circuit diagrams



1FT6

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

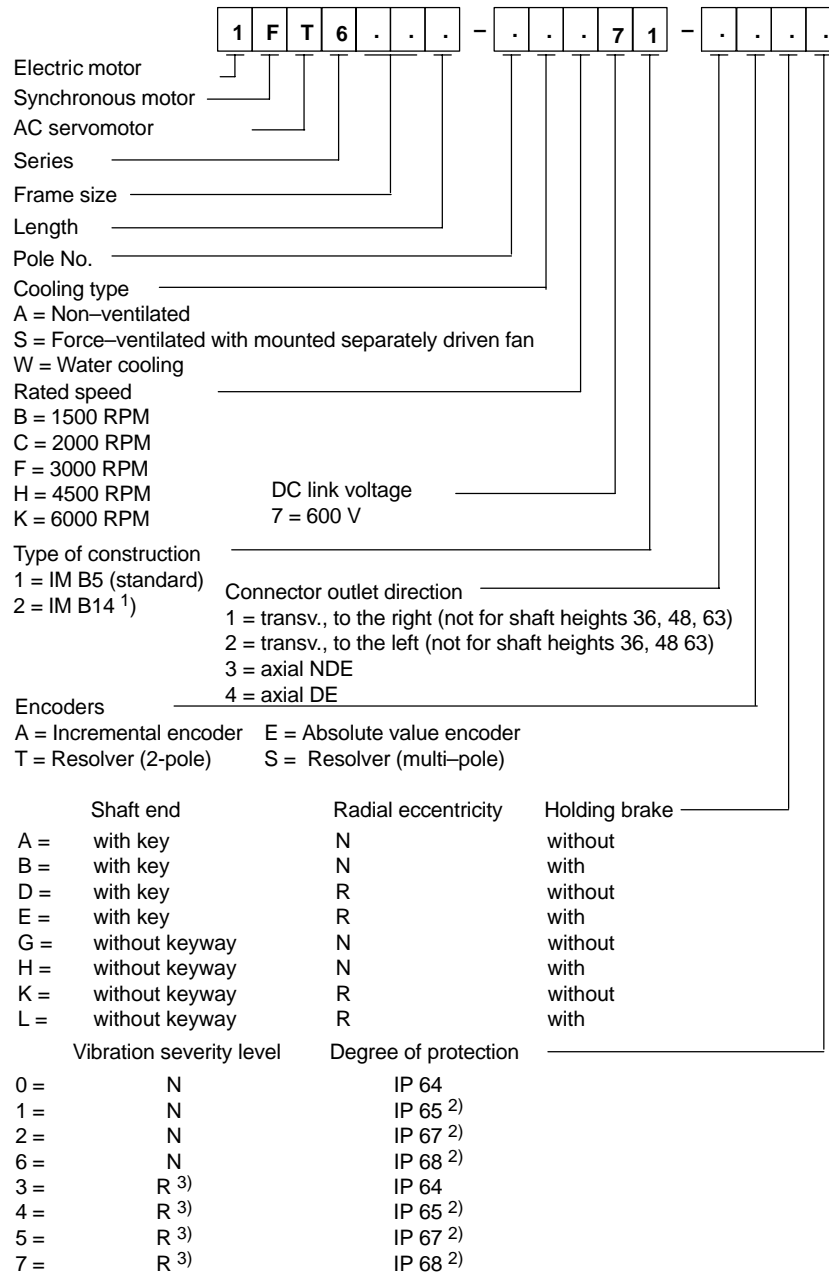
Description, refer to Chapter 1.2.2, Integrated encoders (GE), Page GE/1–17 .



Order Designations

2

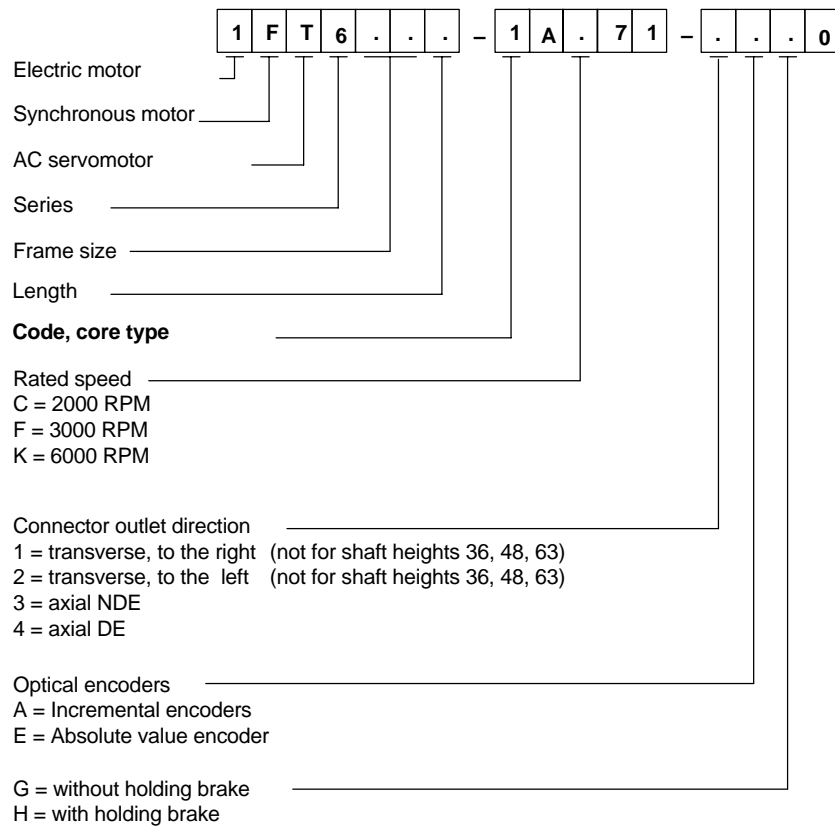
Order designation (standard type)


1FT6

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

2 Order Designations

Order designations, core types



3

Technical Data and Characteristics

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 $\Delta T = 60$ K. Shaft heights 100 and 132 can still be utilized according to $\Delta T = 100$ K.
 - The shift of the voltage limiting characteristics is described in Chapter ALS/1.1.
 - The specified thermal S3 limit characteristics are referred to $\Delta T = 100$ 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
-

1FT6

3.1 Speed-torque diagrams

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 | $R_{\text{ph.}}$ | 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 | |

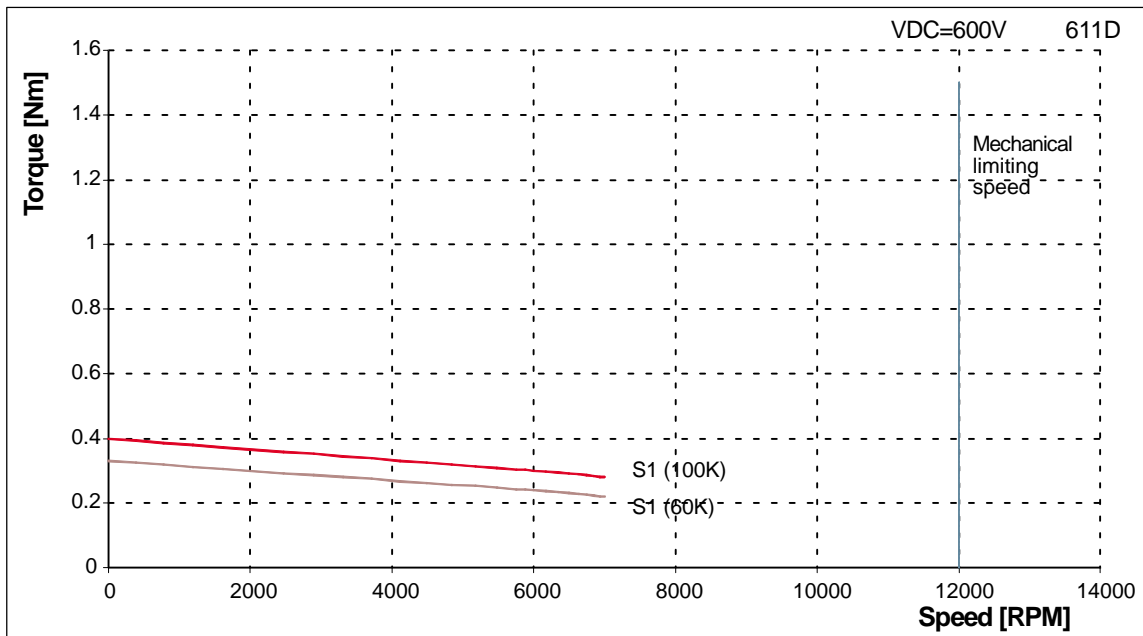


Fig. 3-1 Speed-torque diagram 1FT6021

Table 3-2 Standard motor 1FT6024

| 1FT6024 | | | | |
|-----------------------------------|------------------------------------|-------------------------|-------|--|
| Technical data | Code | Units | | |
| Engineering data | | | | |
| Rated speed | n_{rated} | RPM | 6000 | |
| Rated torque | $M_{\text{rated}} (100 \text{ K})$ | Nm | 0.5 | |
| Rated current | $I_{\text{rated}} (100 \text{ K})$ | A | 0.9 | |
| Stall torque | $M_0 (60 \text{ K})$ | Nm | 0.66 | |
| Stall torque | $M_0 (100 \text{ K})$ | Nm | 0.8 | |
| Stall current | $I_0 (60 \text{ K})$ | A | 1.05 | |
| Stall current | $I_0 (100 \text{ K})$ | 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 | $R_{\text{ph.}}$ | 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 | |

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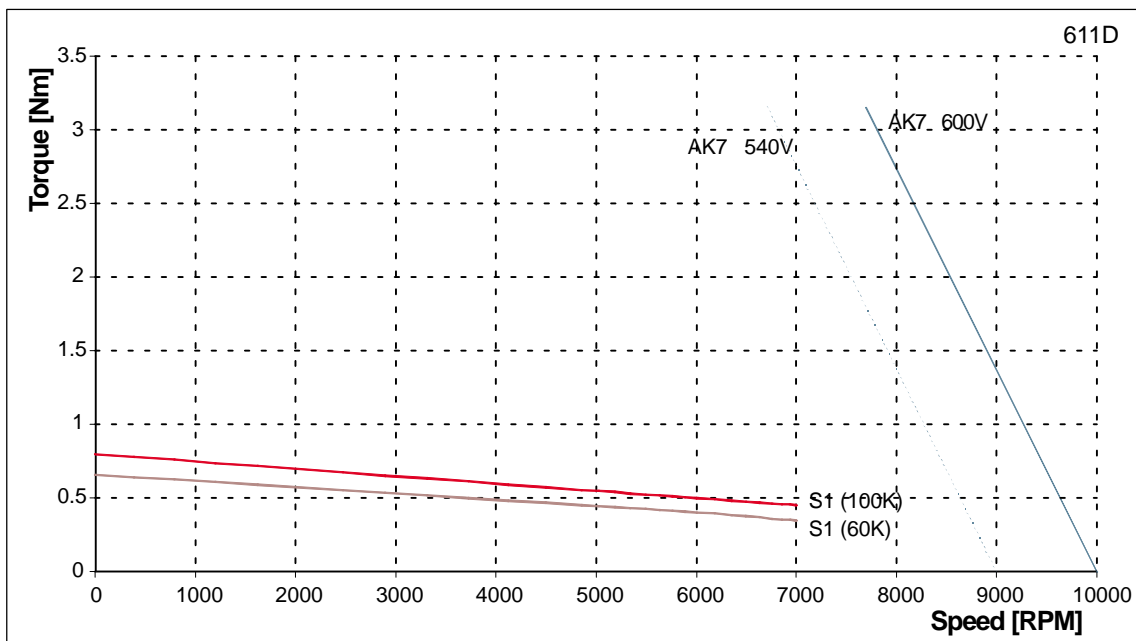


Fig. 3-2 Speed–torque diagram 1FT6024

3.1 Speed-torque diagrams

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 | $R_{\text{ph.}}$ | 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 | |

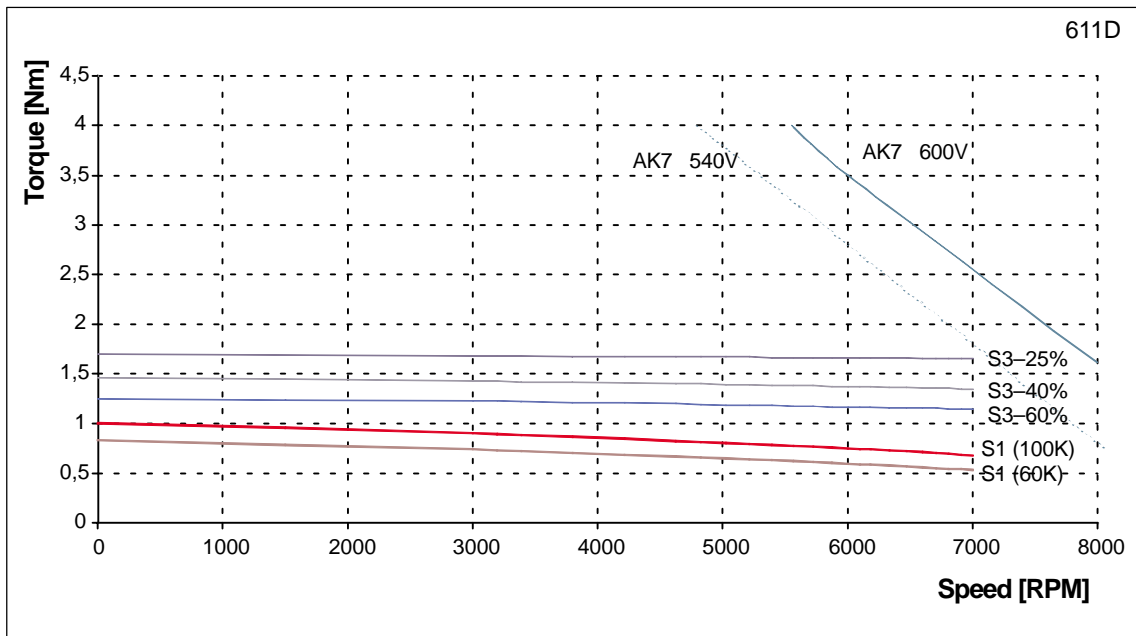


Fig. 3-3 Speed-torque diagram 1FT6031

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 | $R_{\text{ph.}}$ | 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 | |

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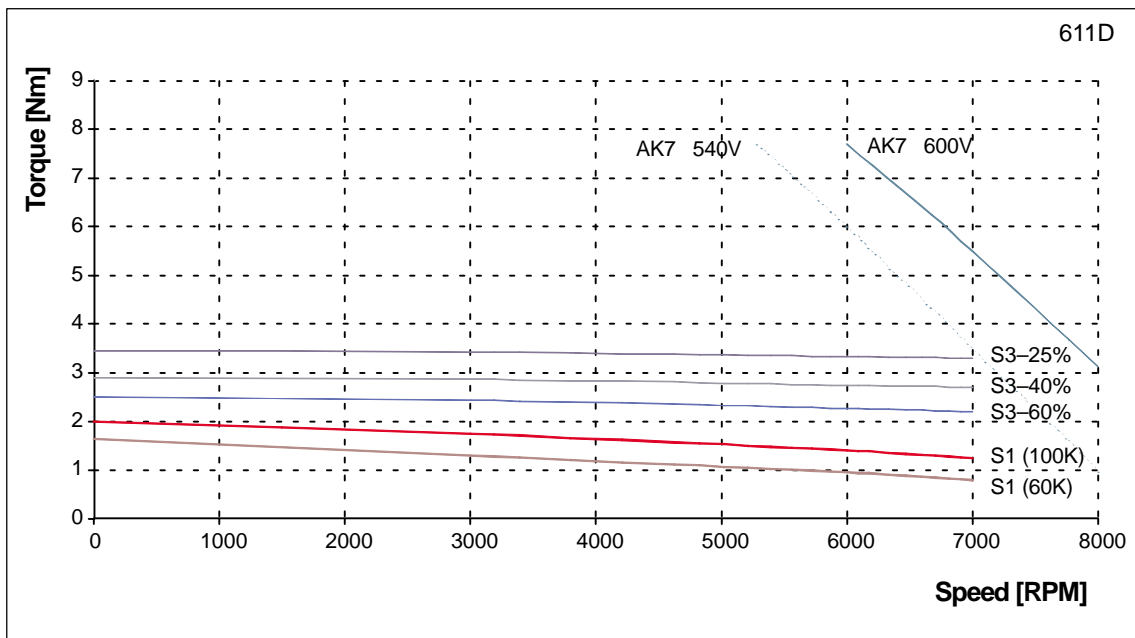


Fig. 3-4 Speed–torque diagram 1FT6034

3.1 Speed-torque diagrams

| 1FT6041 | | | | | |
|-----------------------------------|----------------------------|------------------------|-------|-------|--|
| Technical data | Code | Units | -□AF7 | -□AK7 | |
| Engineering data | | | | | |
| Rated speed | n_{rated} | RPM | 3000 | 6000 | |
| Rated torque | $M_{rated} (100\text{ K})$ | Nm | 2.15 | 1.70 | |
| Rated current | $I_{rated} (100\text{ K})$ | A | 1.7 | 2.4 | |
| Stall torque | $M_0 (60\text{ K})$ | Nm | 2.15 | 2.15 | |
| Stall torque | $M_0 (100\text{ K})$ | Nm | 2.60 | 2.60 | |
| Stall current | $I_0 (60\text{ K})$ | A | 1.55 | 2.60 | |
| Stall current | $I_0 (100\text{ K})$ | 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 | |

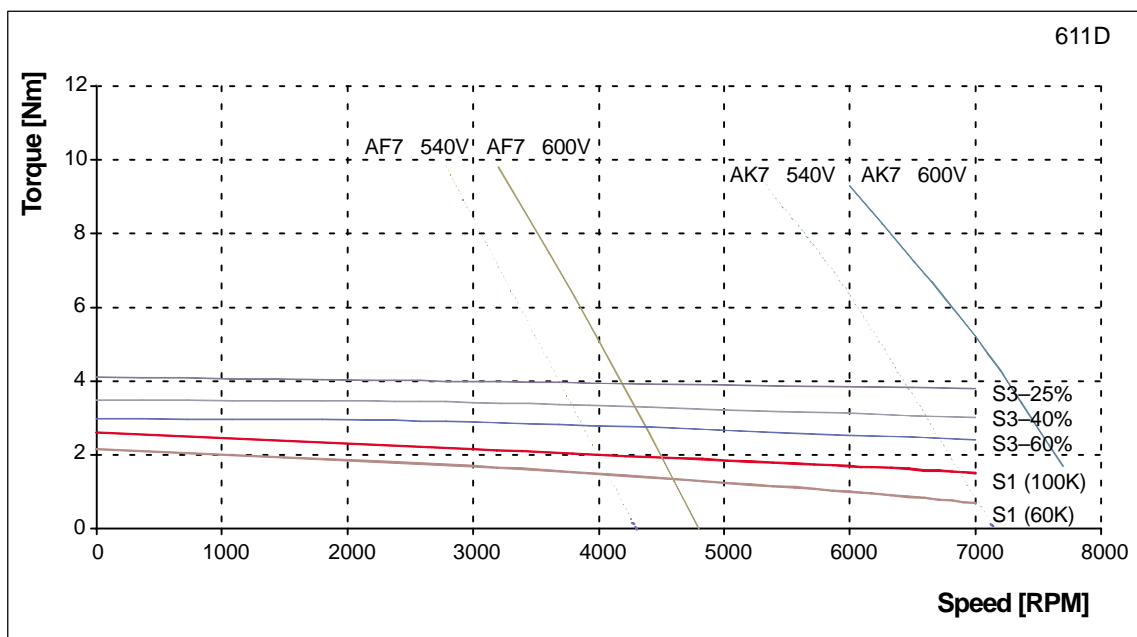


Fig. 3-5 Speed-torque diagram 1FT6041

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 | $R_{\text{ph.}}$ | 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 | |

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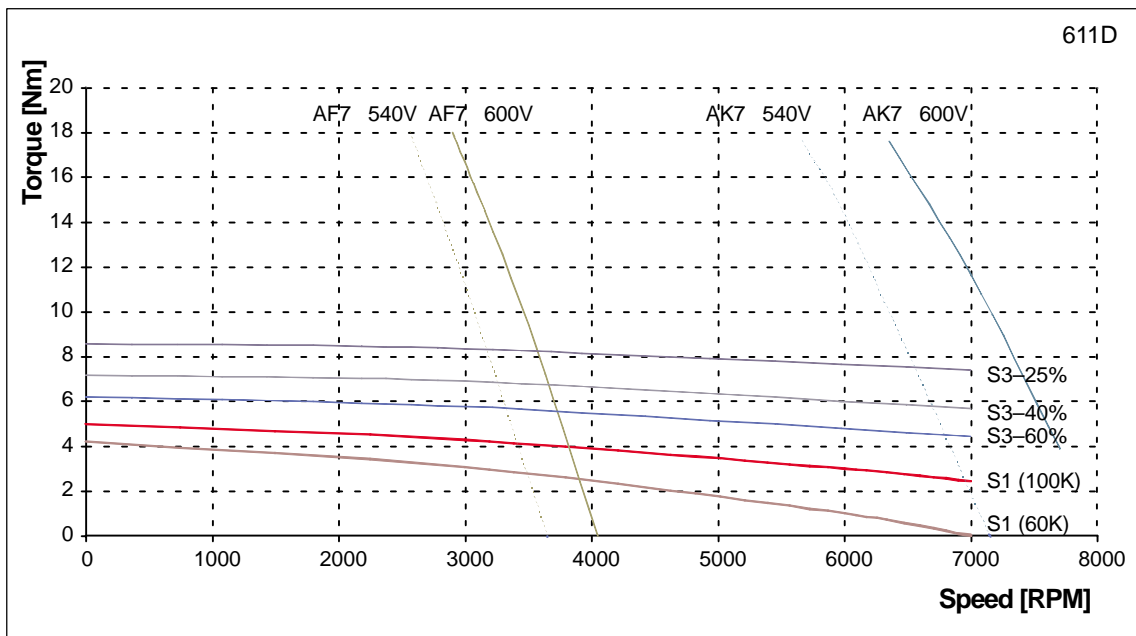


Fig. 3-6 Speed–torque diagram 1FT6044

3.1 Speed-torque diagrams

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 | $M_{\text{rated}} (100 \text{ K})$ | Nm | 3.70 | 3.50 | 2.90 | 2.10 |
| Rated current | $I_{\text{rated}} (100 \text{ K})$ | A | 1.9 | 2.6 | 3.4 | 3.1 |
| Stall torque | $M_0 (60 \text{ K})$ | Nm | 3.3 | 3.3 | 3.3 | 3.3 |
| Stall torque | $M_0 (100 \text{ K})$ | Nm | 4.0 | 4.0 | 4.0 | 4.0 |
| Stall current | $I_0 (60 \text{ K})$ | A | 1.60 | 2.25 | 3.4 | 4.10 |
| Stall current | $I_0 (100 \text{ K})$ | 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 | $R_{\text{ph.}}$ | 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 |

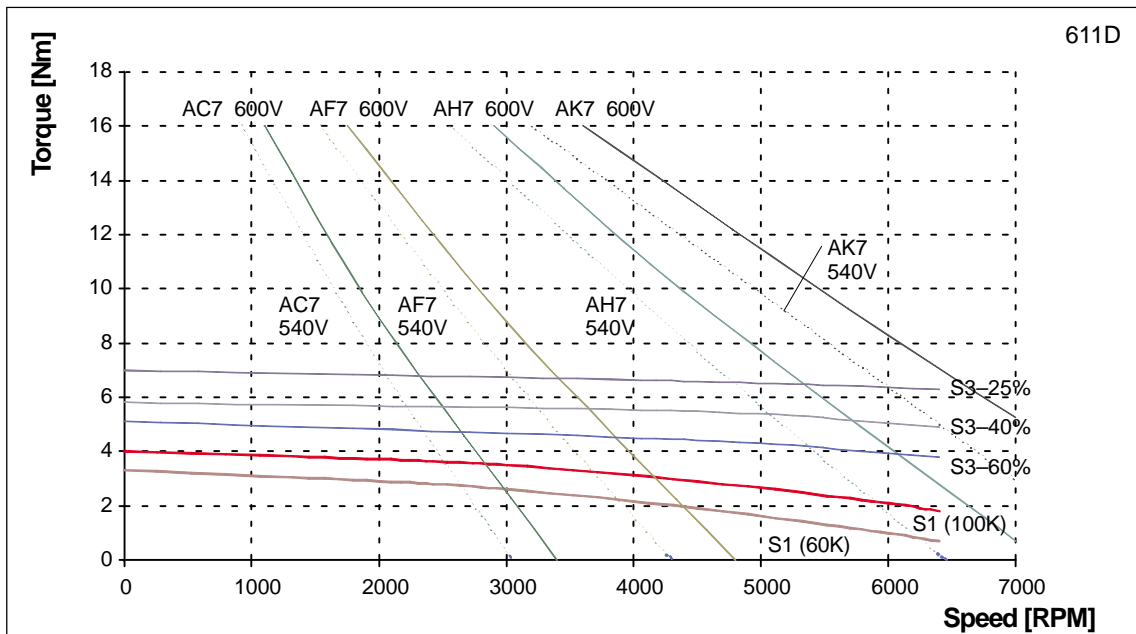


Fig. 3-7 Speed-torque diagram 1FT6061

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 | $M_{\text{rated}} (100 \text{ K})$ | Nm | 5.20 | 4.70 | 3.60 | 2.10 |
| Rated current | $I_{\text{rated}} (100 \text{ K})$ | A | 2.6 | 3.4 | 3.9 | 3.2 |
| Stall torque | $M_0 (60 \text{ K})$ | Nm | 5.00 | 5.00 | 5.00 | 5.00 |
| Stall torque | $M_0 (100 \text{ K})$ | Nm | 6.00 | 6.00 | 6.00 | 6.00 |
| Stall current | $I_0 (60 \text{ K})$ | A | 2.30 | 3.40 | 4.80 | 6.30 |
| Stall current | $I_0 (100 \text{ K})$ | 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 | $R_{\text{ph.}}$ | 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 |

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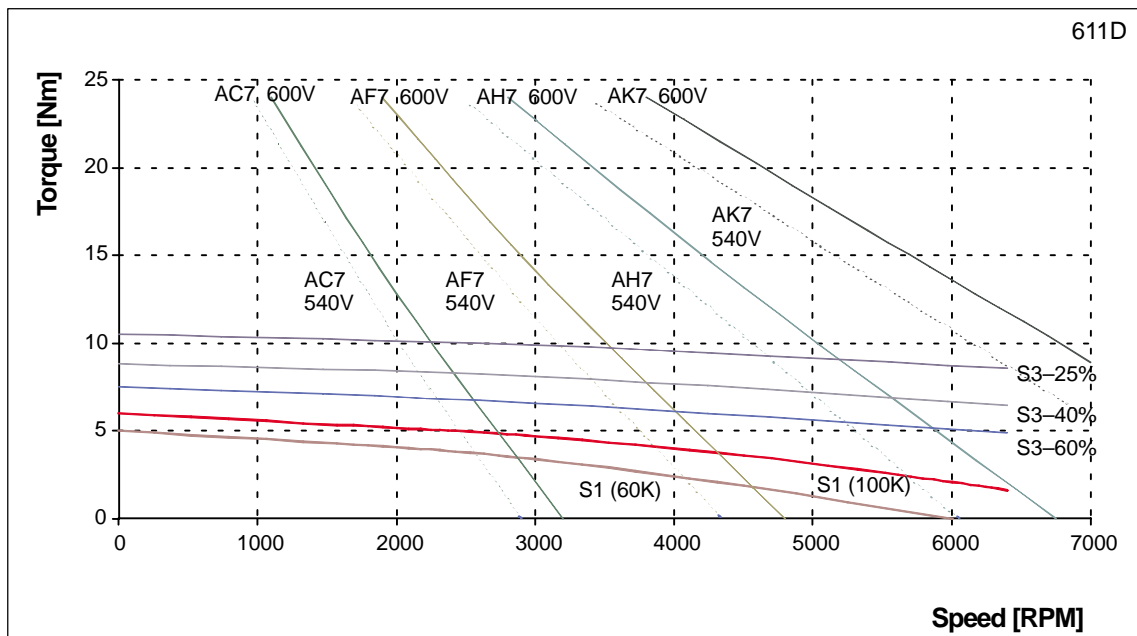


Fig. 3-8 Speed–torque diagram 1FT6062

3.1 Speed-torque diagrams

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 | $M_{\text{rated}} (100 \text{ K})$ | Nm | 8.00 | 7.00 | 4.80 | 2.10 |
| Rated current | $I_{\text{rated}} (100 \text{ K})$ | A | 3.8 | 4.9 | 5.5 | 3.5 |
| Stall torque | $M_0 (60 \text{ K})$ | Nm | 7.90 | 7.90 | 7.90 | 7.90 |
| Stall torque | $M_0 (100 \text{ K})$ | Nm | 9.50 | 9.50 | 9.50 | 9.50 |
| Stall current | $I_0 (60 \text{ K})$ | A | 3.50 | 5.00 | 7.50 | 10.0 |
| Stall current | $I_0 (100 \text{ K})$ | 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 | $R_{\text{ph.}}$ | 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 |

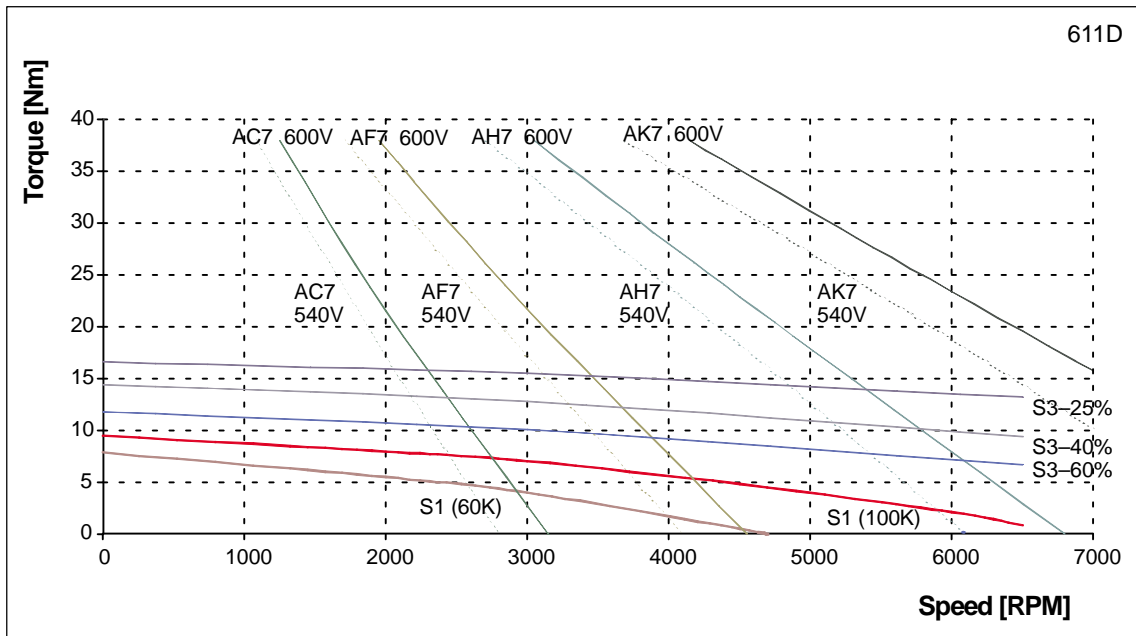


Fig. 3-9 Speed-torque diagram 1FT6064

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 | $M_{\text{rated}} (100\text{ K})$ | Nm | 7.50 | 6.90 | 5.80 | 4.60 |
| Rated current | $I_{\text{rated}} (100\text{ K})$ | A | 4.1 | 5.6 | 7.3 | 7.7 |
| Stall torque | $M_0 (60\text{ K})$ | Nm | 6.60 | 6.60 | 6.60 | 6.60 |
| Stall torque | $M_0 (100\text{ K})$ | Nm | 8.00 | 8.00 | 8.00 | 8.00 |
| Stall current | $I_0 (60\text{ K})$ | A | 3.30 | 4.90 | 7.40 | 9.1 |
| Stall current | $I_0 (100\text{ K})$ | 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 | $R_{\text{ph.}}$ | 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

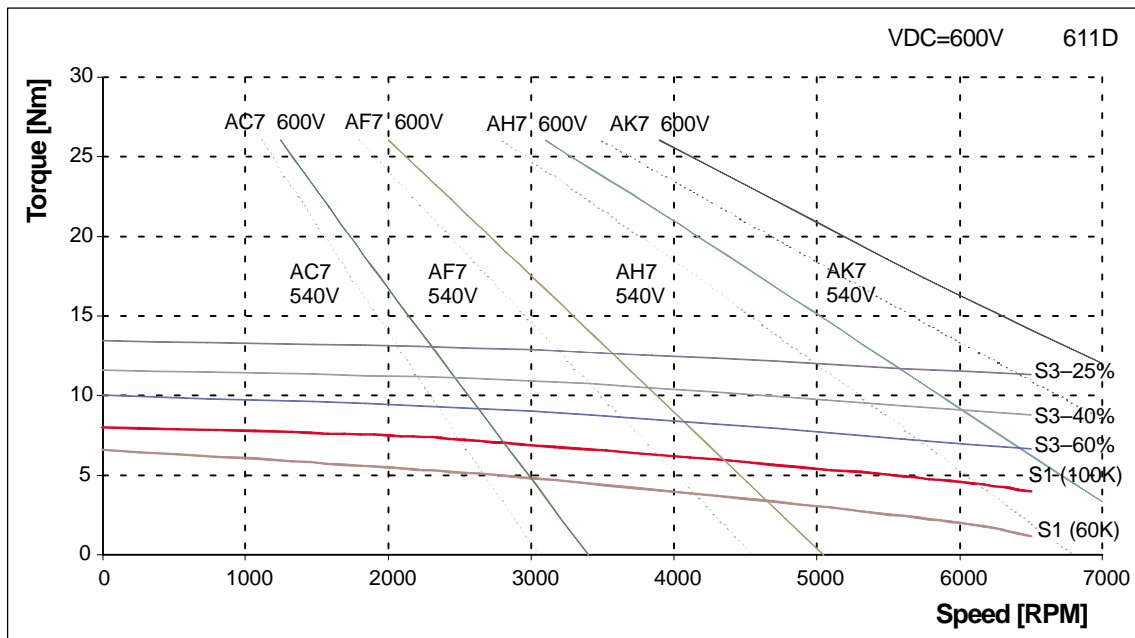


Fig. 3-10 Speed–torque diagram 1FT6081

3.1 Speed-torque diagrams

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 | $R_{\text{ph.}}$ | 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 |

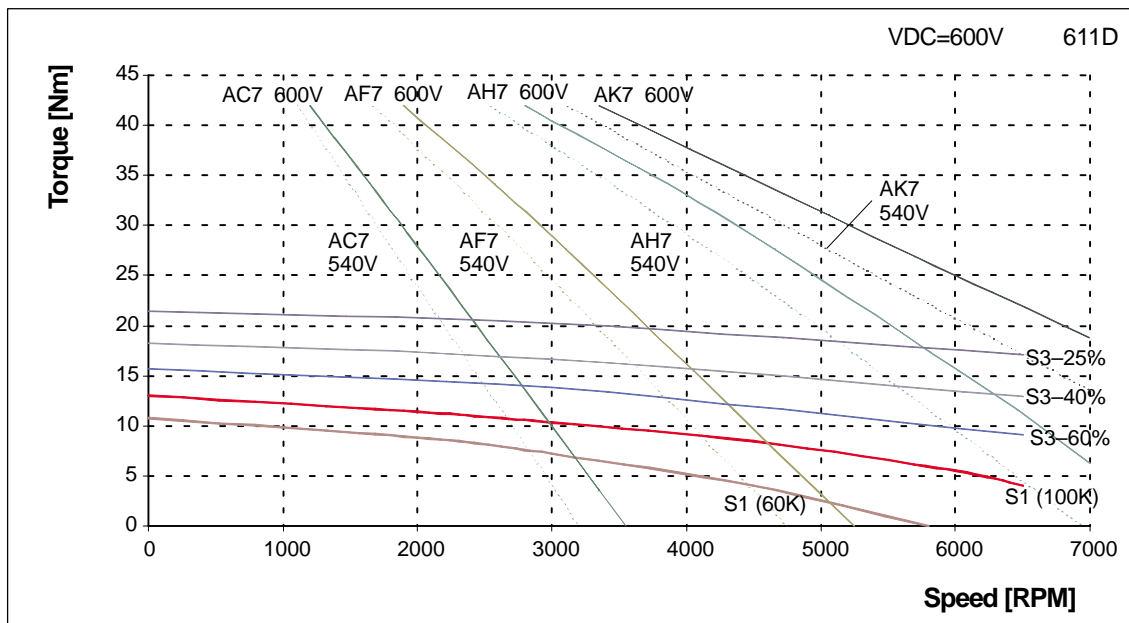


Fig. 3-11 Speed-torque diagram 1FT6082

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 | $M_{\text{rated}} (100\text{ K})$ | Nm | 16.90 | 14.70 | 10.5 | 6.5 |
| Rated current | $I_{\text{rated}} (100\text{ K})$ | A | 8.3 | 11.0 | 12.5 | 9.2 |
| Stall torque | $M_0 (60\text{ K})$ | Nm | 16.60 | 16.60 | 16.60 | 16.60 |
| Stall torque | $M_0 (100\text{ K})$ | Nm | 20.00 | 20.00 | 20.00 | 20.00 |
| Stall current | $I_0 (60\text{ K})$ | A | 7.70 | 11.30 | 17.50 | 20.20 |
| Stall current | $I_0 (100\text{ K})$ | 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 | $R_{\text{ph.}}$ | 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 |

1FT6

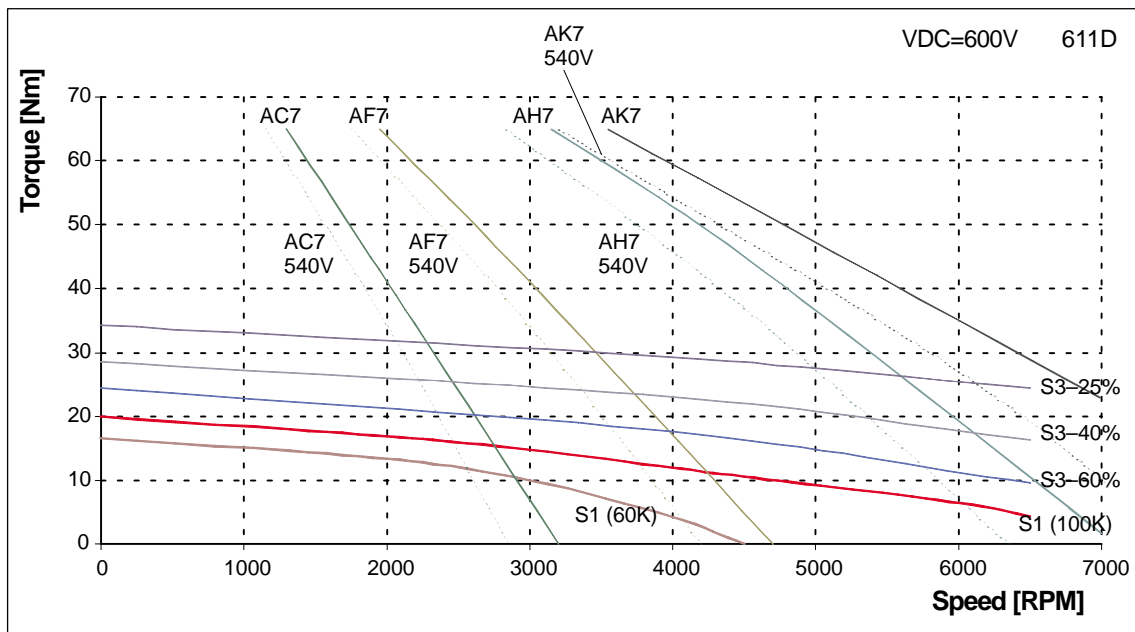


Fig. 3-12 Speed–torque diagram 1FT6084

3.1 Speed–torque diagrams

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 | $R_{\text{ph.}}$ | 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 | |

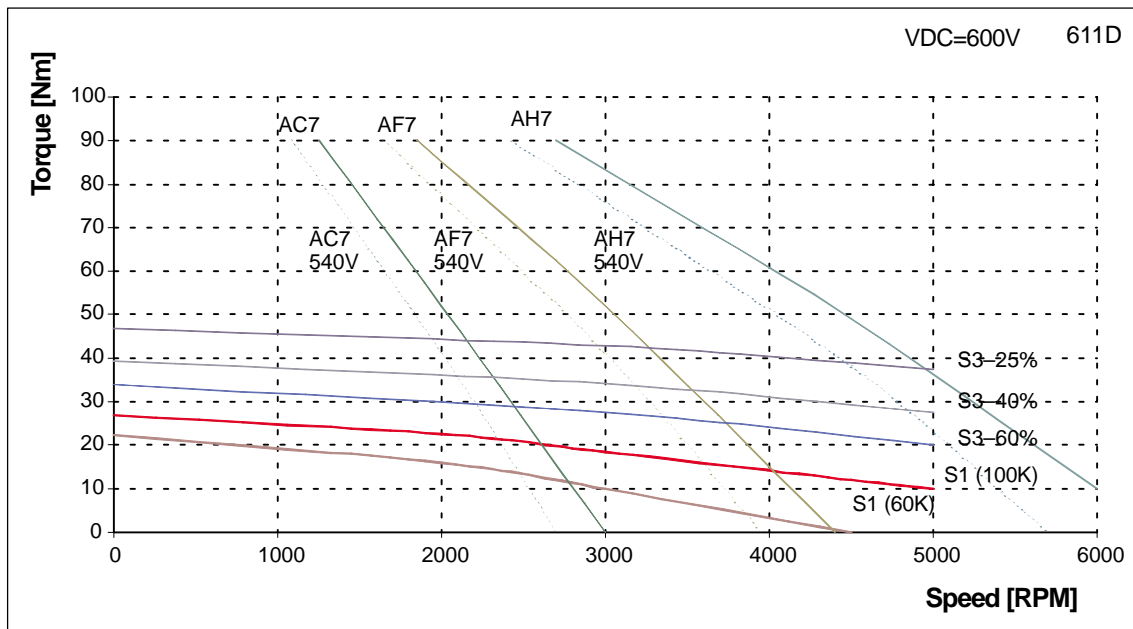


Fig. 3-13 Speed–torque diagram 1FT6086

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 | $M_{\text{rated}} (100 \text{ K})$ | Nm | 24.50 | 23.00 | 19.50 | 12.00 |
| Rated current | $I_{\text{rated}} (100 \text{ K})$ | A | 8.4 | 11.0 | 13.2 | 12.0 |
| Stall torque | $M_0 (60 \text{ K})$ | Nm | 22.40 | 22.40 | 22.40 | 22.40 |
| Stall torque | $M_0 (100 \text{ K})$ | Nm | 27.00 | 27.00 | 27.00 | 27.00 |
| Stall current | $I_0 (60 \text{ K})$ | A | 7.30 | 10.20 | 14.20 | 20.50 |
| Stall current | $I_0 (100 \text{ K})$ | 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 | $R_{\text{ph.}}$ | 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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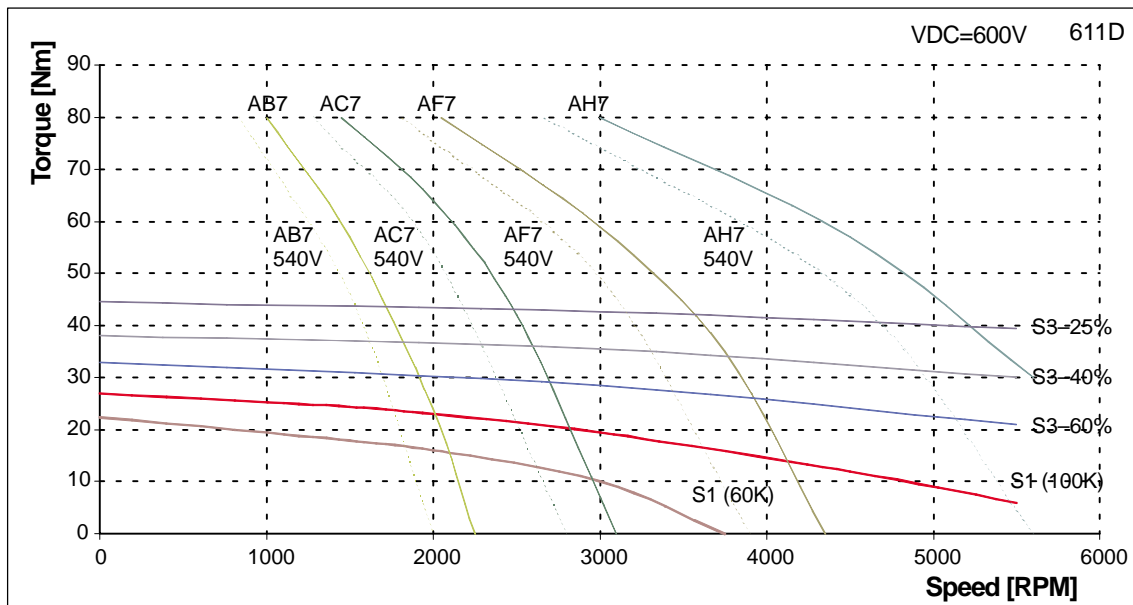


Fig. 3-14 Speed–torque diagram 1FT6102

3.1 Speed-torque diagrams

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 | $M_{\text{rated}} (100 \text{ K})$ | Nm | 41.00 | 38.00 | 31.00 | |
| Rated current | $I_{\text{rated}} (100 \text{ K})$ | A | 14.5 | 17.6 | 22.5 | |
| Stall torque | $M_0 (60 \text{ K})$ | Nm | 42.00 | 42.00 | 42.00 | |
| Stall torque | $M_0 (100 \text{ K})$ | Nm | 50.00 | 50.00 | 50.00 | |
| Stall current | $I_0 (60 \text{ K})$ | A | 13.80 | 18.40 | 28.00 | |
| Stall current | $I_0 (100 \text{ K})$ | 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 | $R_{\text{ph.}}$ | 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 | |

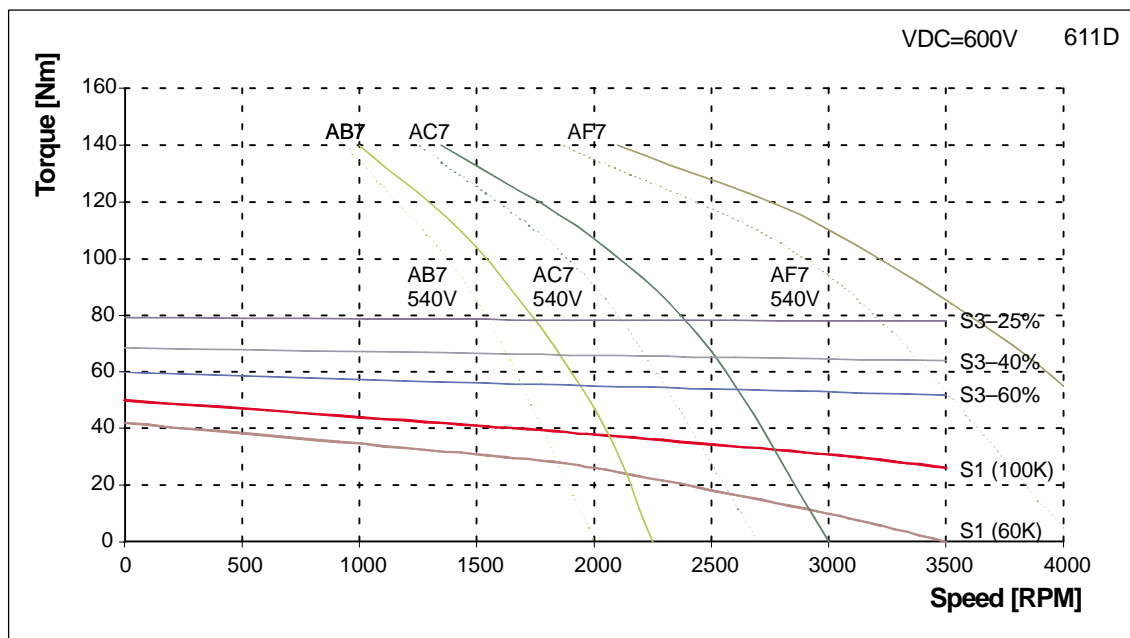


Fig. 3-15 Speed-torque diagram 1FT6105

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 | $R_{\text{ph.}}$ | 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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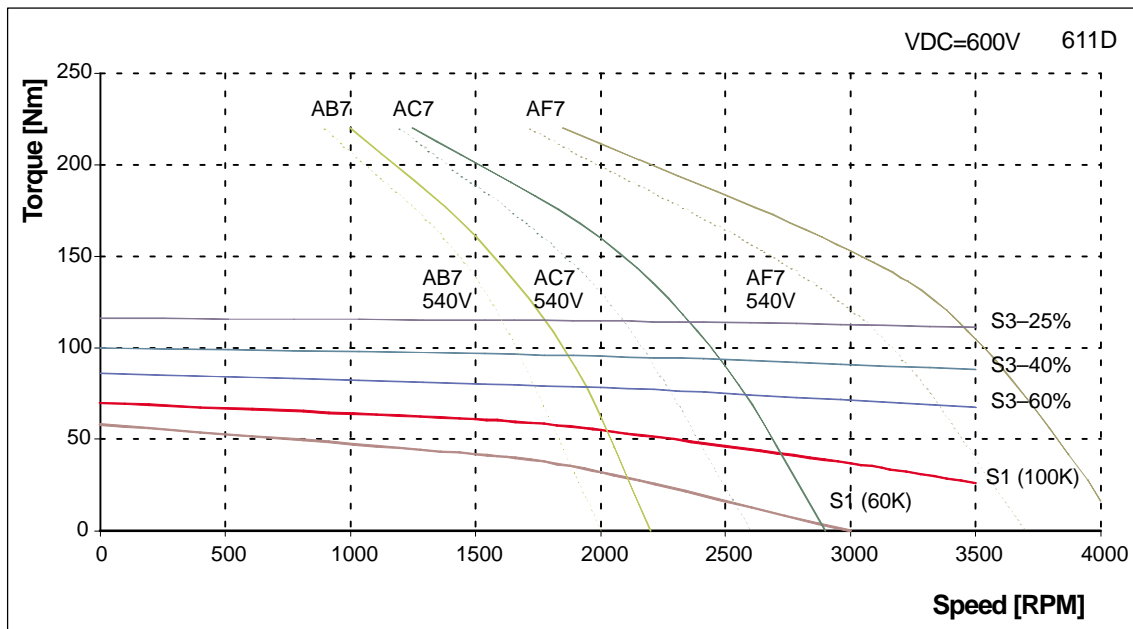


Fig. 3-16 Speed–torque diagram 1FT6108

3.1 Speed-torque diagrams

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 | $R_{\text{ph.}}$ | 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 | |

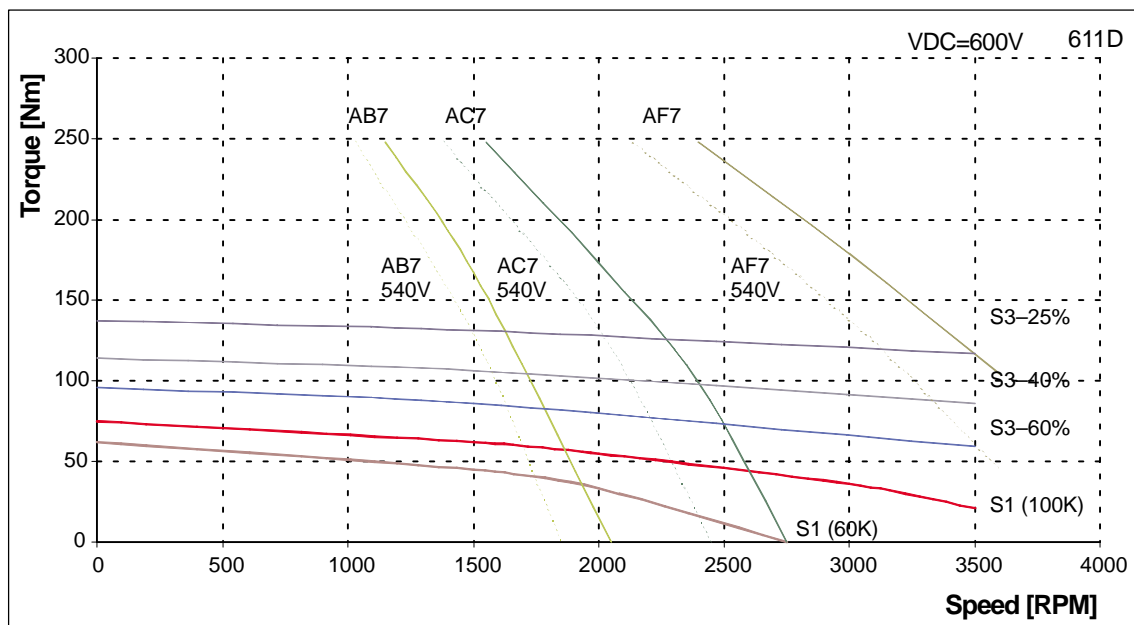


Fig. 3-17 Speed-torque diagram 1FT6132

Table 3-17 Standard motor 1FT6134

| 1FT6134 | | | | | |
|-----------------------------------|------------------------------------|-------------------------|-------|-------|--|
| Technical data | Code | Units | -□AB7 | -□AC7 | |
| Engineering data | | | | | |
| Rated speed | n_{rated} | RPM | 1500 | 2000 | |
| Rated torque | $M_{\text{rated}} (100 \text{ K})$ | Nm | 75.00 | 65.00 | |
| Rated current | $I_{\text{rated}} (100 \text{ K})$ | A | 24.0 | 27.0 | |
| Stall torque | $M_0 (60 \text{ K})$ | Nm | 79.00 | 79.00 | |
| Stall torque | $M_0 (100 \text{ K})$ | Nm | 95.00 | 95.00 | |
| Stall current | $I_0 (60 \text{ K})$ | A | 24.00 | 33.00 | |
| Stall current | $I_0 (100 \text{ K})$ | 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 | $R_{\text{ph.}}$ | 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 | |

1FT6

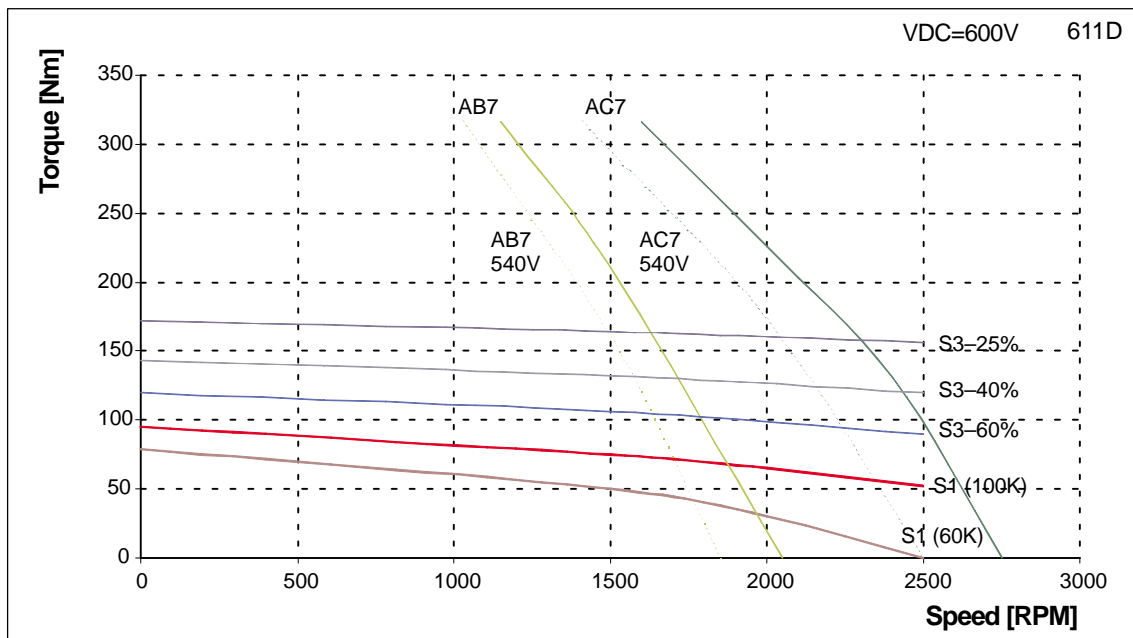


Fig. 3-18 Speed–torque diagram 1FT6134

3.1 Speed-torque diagrams

Table 3-18 Standard motor 1FT6136

| 1FT6136 | | | | | |
|-----------------------------------|------------------------------------|-------------------------|--------|--------|--|
| Technical data | Code | Units | -□AB7 | -□AC7 | |
| Engineering data | | | | | |
| Rated speed | n_{rated} | RPM | 1500 | 2000 | |
| Rated torque | $M_{\text{rated}} (100 \text{ K})$ | Nm | 88.00 | 74.00 | |
| Rated current | $I_{\text{rated}} (100 \text{ K})$ | A | 27.0 | 30.0 | |
| Stall torque | $M_0 (60 \text{ K})$ | Nm | 95.00 | 95.00 | |
| Stall torque | $M_0 (100 \text{ K})$ | Nm | 115.00 | 115.00 | |
| Stall current | $I_0 (60 \text{ K})$ | A | 28.00 | 35.00 | |
| Stall current | $I_0 (100 \text{ K})$ | 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 | $R_{\text{ph.}}$ | 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 | |

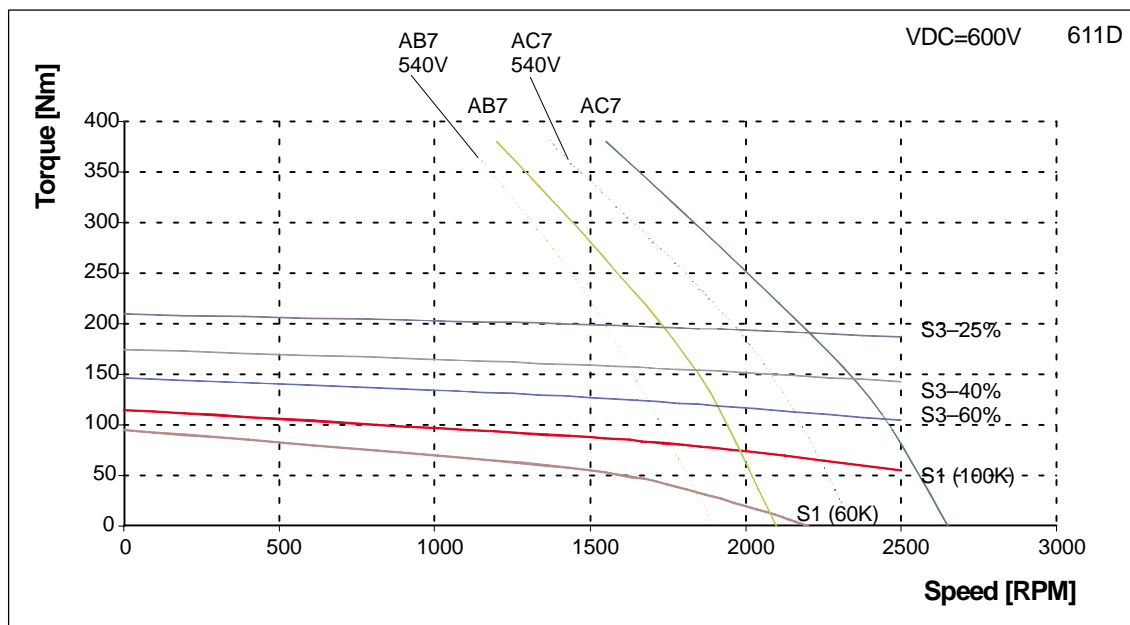


Fig. 3-19 Speed-torque diagram 1FT6136

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 | $R_{\text{ph.}}$ | 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 | |

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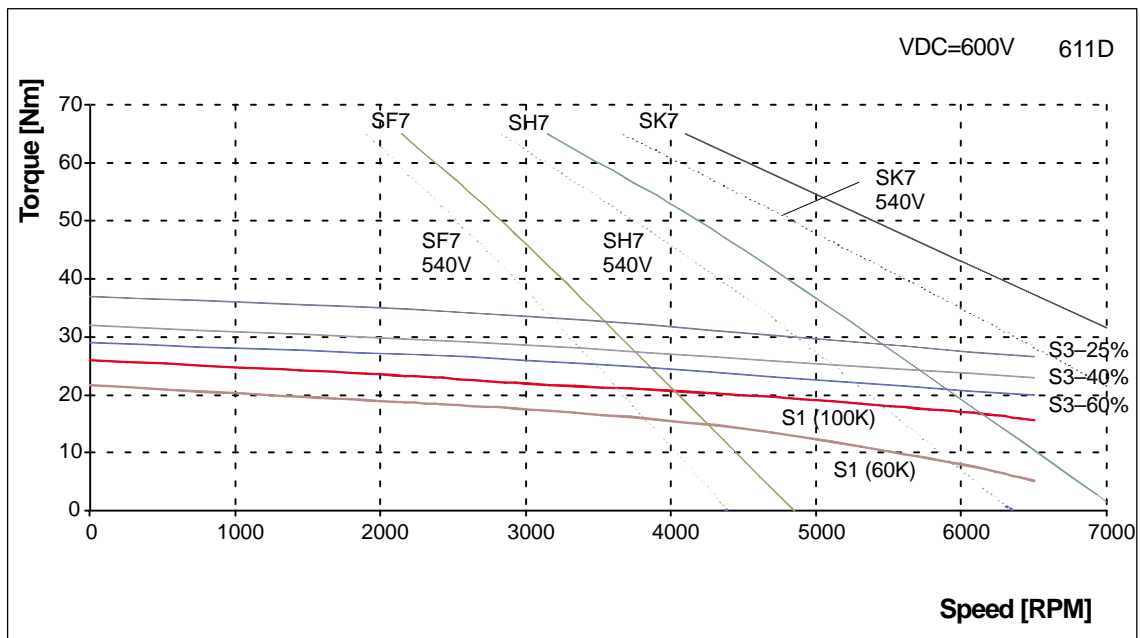


Fig. 3-20 Speed–torque diagram 1FT6084, force ventilated

3.1 Speed–torque diagrams

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 | $R_{\text{ph.}}$ | 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 | |

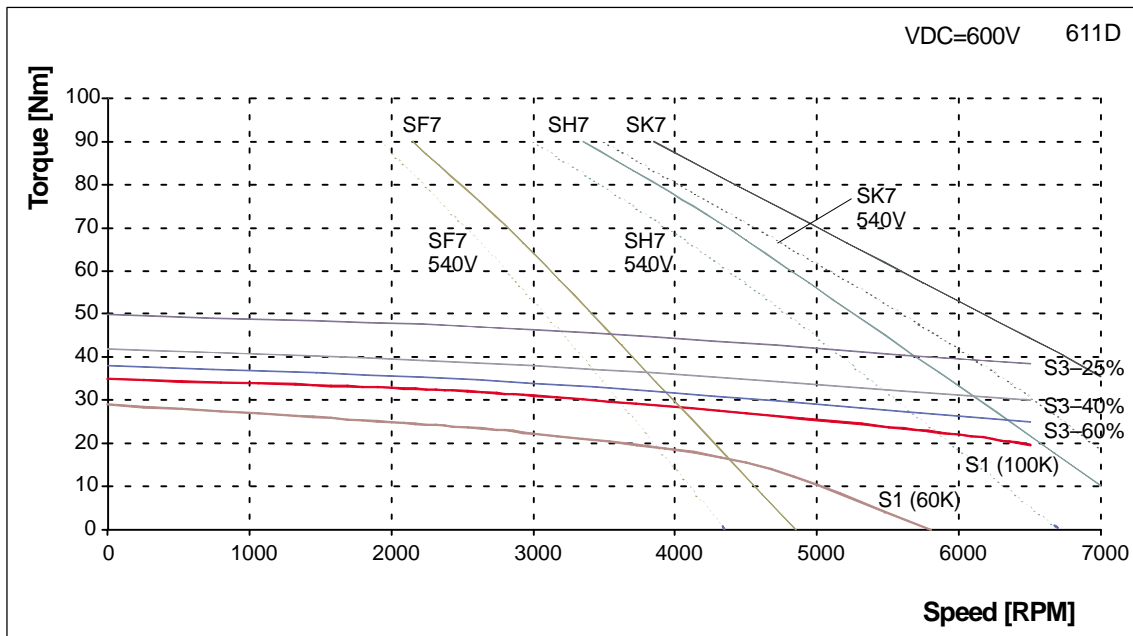


Fig. 3-21 Speed–torque diagram 1FT6086, force ventilated

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 | $R_{\text{ph.}}$ | 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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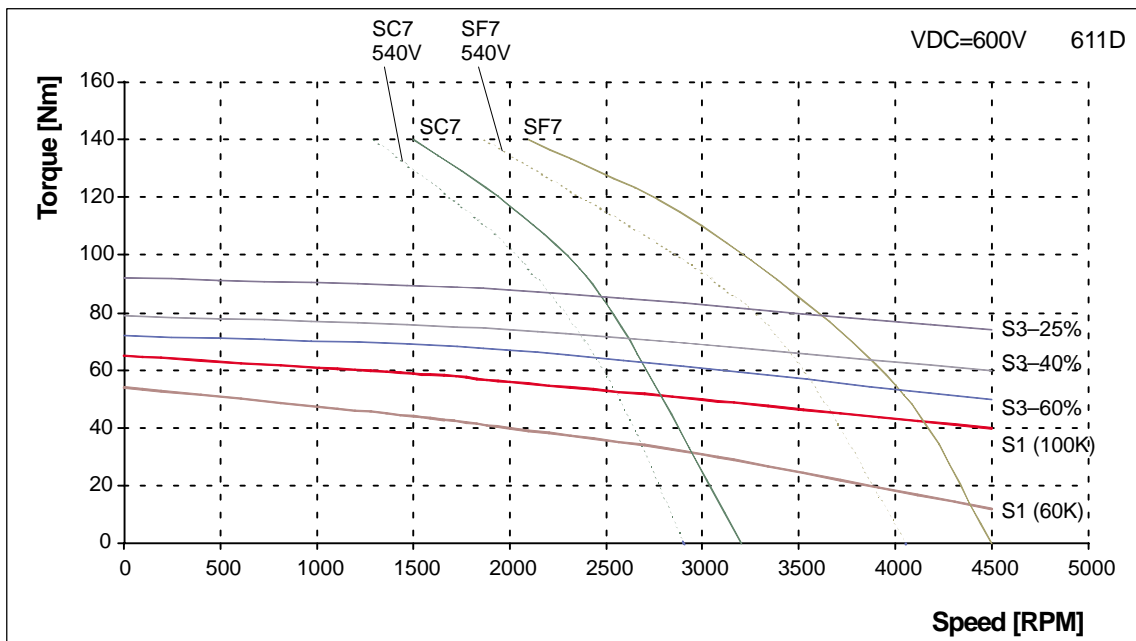


Fig. 3-22 Speed–torque diagram 1FT6105, force ventilated

3.1 Speed–torque diagrams

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 | |

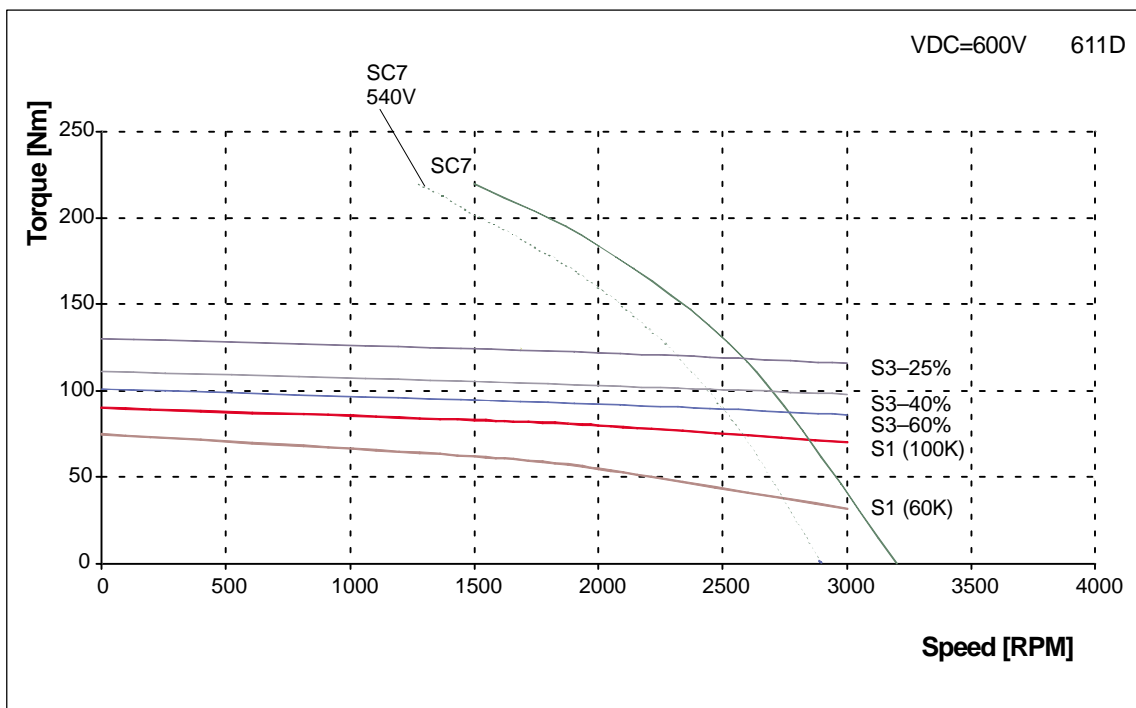


Fig. 3-23 Speed–torque diagram 1FT6108, force ventilated

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 | $R_{\text{ph.}}$ | 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 | | | |

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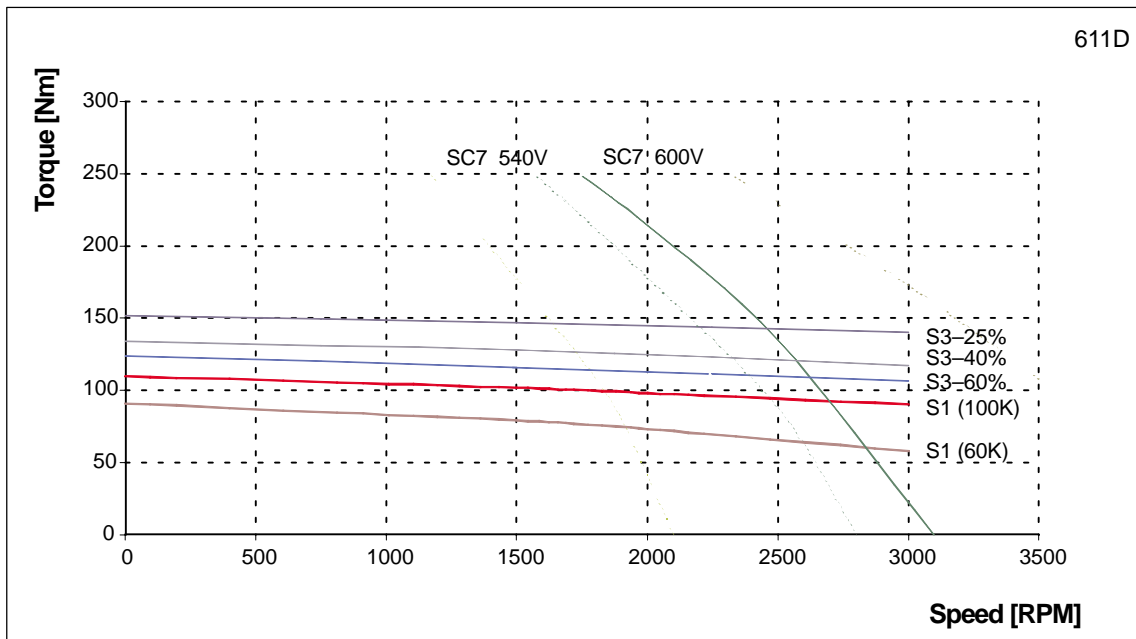


Fig. 3-24 Speed–torque diagram 1FT6132, force ventilated

3.1 Speed–torque diagrams

Table 3-24 Standard motor 1FT6134, force ventilated

| 1FT6134 | | | | |
|-----------------------------------|----------------------------|----------------------------|-------|--|
| Technical data | Code | Units | -□SC7 | |
| Engineering data | | | | |
| Rated speed | n_{rated} | RPM | 2000 | |
| Rated torque | M_{rated} (100 K) | Nm | 125 | |
| Rated current | I_{rated} (100 K) | A | 57 | |
| Stall torque | M_0 (60 K) | Nm | 116 | |
| Stall torque | M_0 (100 K) | Nm | 140 | |
| Stall current | I_0 (60 K) | A | 52 | |
| Stall current | I_0 (100 K) | A | 62 | |
| Moment of inertia (with brake) | J_{mot} | 10^{-4} kgm ² | 623 | |
| Moment of inertia (without brake) | J_{mot} | 10^{-4} kgm ² | 547 | |
| Limit data | | | | |
| Max. speed | n_{max} | RPM | 2950 | |
| Max. torque | M_{max} | Nm | 316 | |
| Peak current | I_{max} | A | 182 | |
| Limiting torque (600 V) | M_{limit} | Nm | 259 | |
| Limiting current (600 V) | I_{limit} | A | 121 | |
| Physical constants | | | | |
| Torque constant | k_T | Nm/A | 2.26 | |
| Voltage constant (phase-to-phase) | k_E | V/1000 RPM | 146 | |
| Winding resistance | $R_{\text{ph.}}$ | Ohm | 0.08 | |
| Three-phase inductance | L_D | mH | 2.7 | |
| Electrical time constant | T_{el} | ms | 36 | |
| Mechanical time constant | T_{mech} | ms | 2.5 | |
| Thermal time constant | T_{th} | min | 85 | |
| Thermal resistance | R_{th} | W/K | 0.02 | |
| Weight with brake | m | kg | 116 | |
| Weight without brake | m | kg | 106 | |

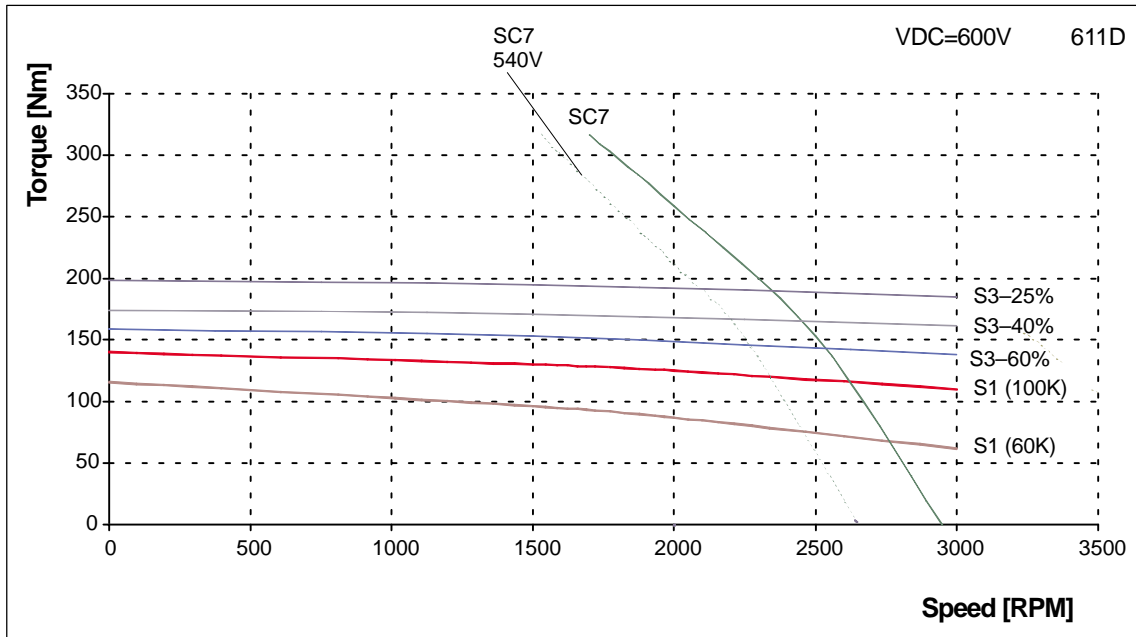


Fig. 3-25 Speed–torque diagram 1FT6134, force ventilated

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 | |

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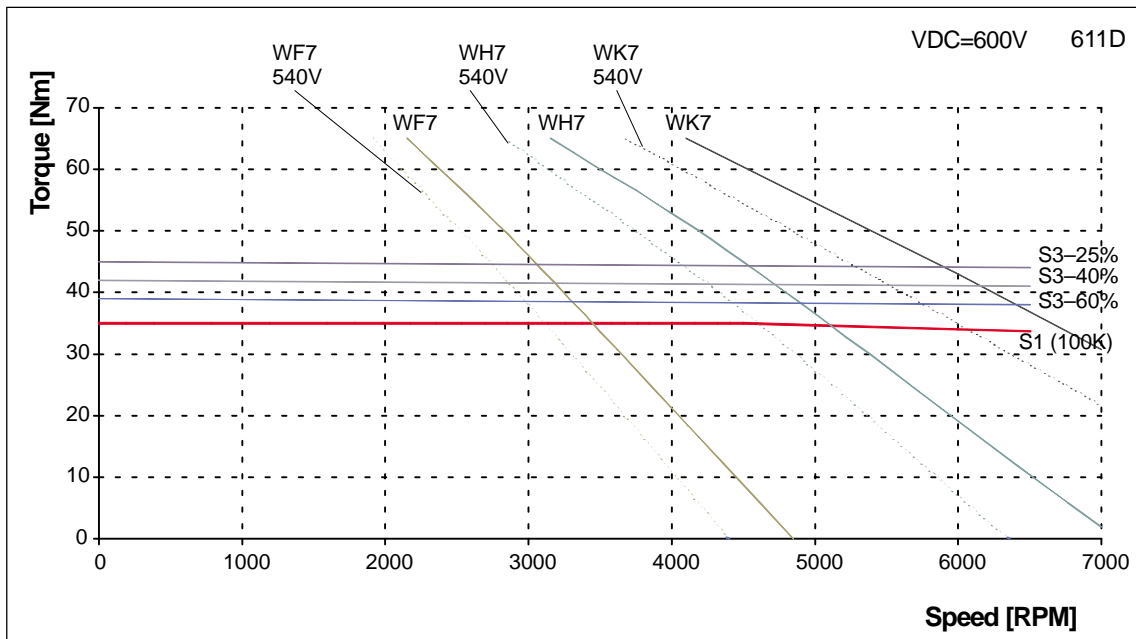


Fig. 3-26 Speed–torque diagram 1FT6084, water cooled

3.1 Speed–torque diagrams

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 | $M_{\text{rated}} (100 \text{ K})$ | Nm | 46 | 45 | 44 | |
| Rated current | $I_{\text{rated}} (100 \text{ K})$ | A | 37 | 53 | 58 | |
| Stall torque | $M_0 (60 \text{ K})$ | Nm | 39 | 39 | 39 | |
| Stall torque | $M_0 (100 \text{ K})$ | Nm | 47 | 47 | 47 | |
| Stall current | $I_0 (60 \text{ K})$ | A | 28 | 43 | 49 | |
| Stall current | $I_0 (100 \text{ K})$ | 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 | $R_{\text{ph.}}$ | 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 | |

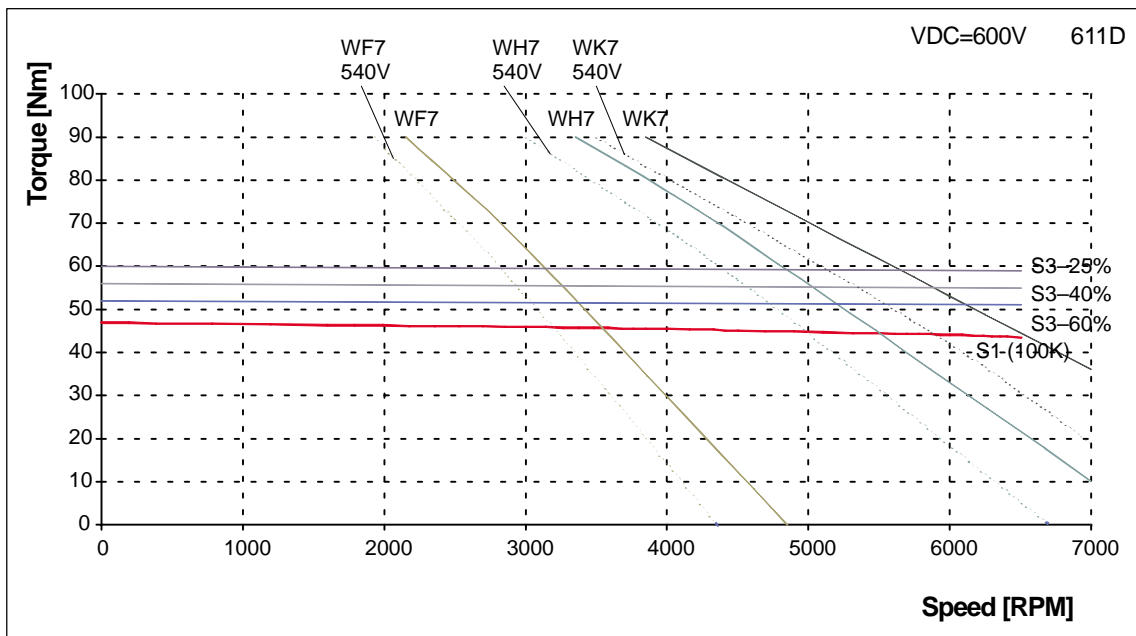


Fig. 3-27 Speed–torque diagram 1FT6086, water cooled

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 | $M_{\text{rated}} (100\text{ K})$ | Nm | 82 | 78 | |
| Rated current | $I_{\text{rated}} (100\text{ K})$ | A | 60 | 82 | |
| Stall torque | $M_0 (60\text{ K})$ | Nm | 70 | 70 | |
| Stall torque | $M_0 (100\text{ K})$ | Nm | 85 | 85 | |
| Stall current | $I_0 (60\text{ K})$ | A | 47 | 67 | |
| Stall current | $I_0 (100\text{ K})$ | 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 | $R_{\text{ph.}}$ | 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 | |

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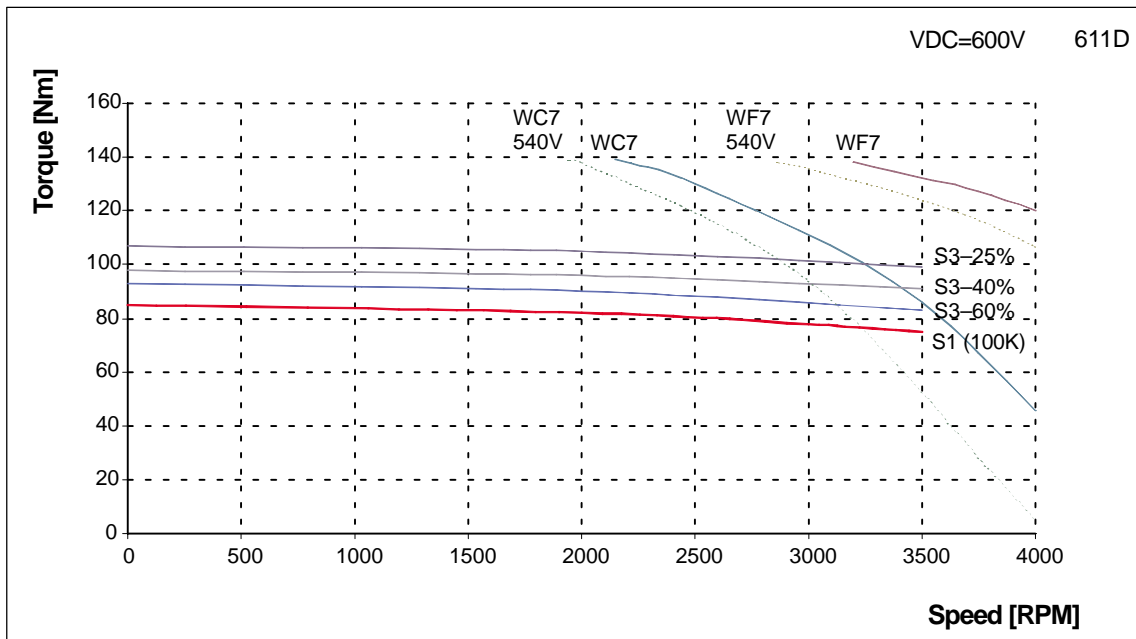


Fig. 3-28 Speed–torque diagram 1FT6105, water cooled

3.1 Speed–torque diagrams

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 | $M_{\text{rated}} (100 \text{ K})$ | Nm | 116 | 115 | 109 | |
| Rated current | $I_{\text{rated}} (100 \text{ K})$ | A | 43 | 57 | 81 | |
| Stall torque | $M_0 (60 \text{ K})$ | Nm | 98 | 98 | 98 | |
| Stall torque | $M_0 (100 \text{ K})$ | Nm | 119 | 119 | 119 | |
| Stall current | $I_0 (60 \text{ K})$ | A | 34 | 45 | 67 | |
| Stall current | $I_0 (100 \text{ K})$ | 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 | $R_{\text{ph.}}$ | 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 | |

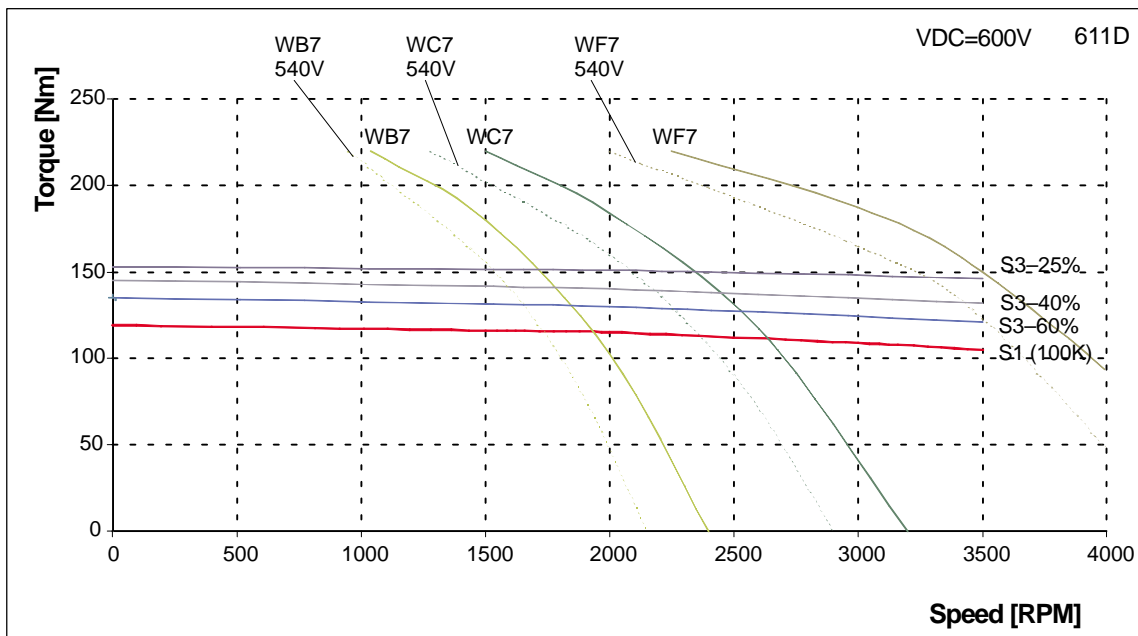


Fig. 3-29 Speed–torque diagram 1FT6108, water cooled

3.2 Cantilever/axial force diagrams

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

Axial force F_{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!

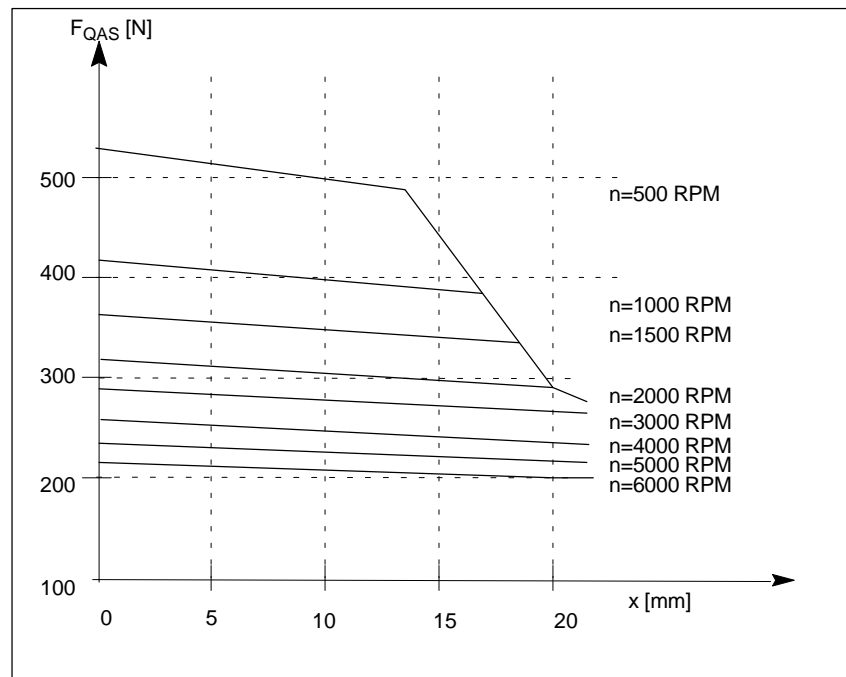
Definition, refer to Section 2.1, General information AC servomotors AL_S.

1FT6

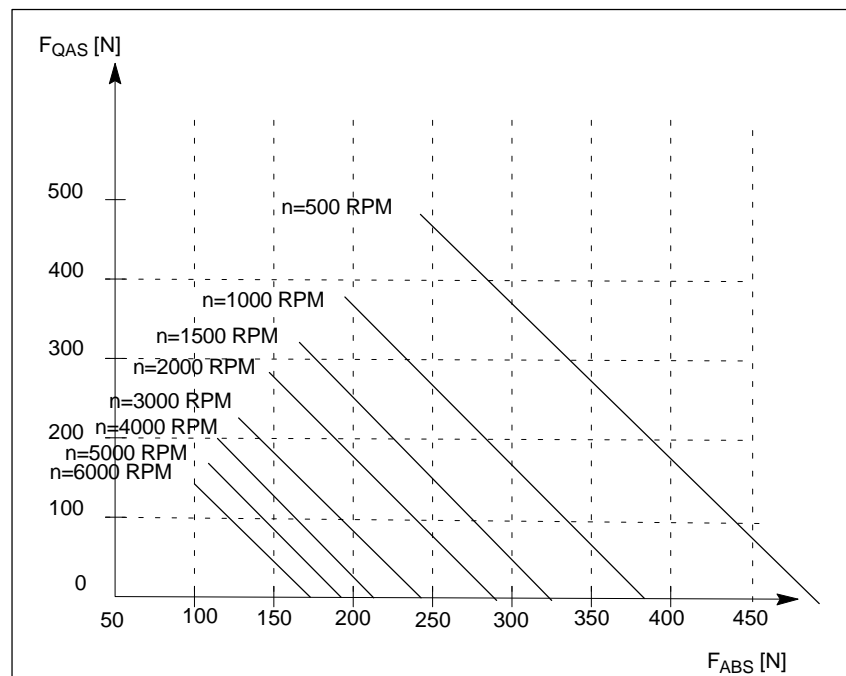
3.2 Cantilever/axial force diagrams

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.

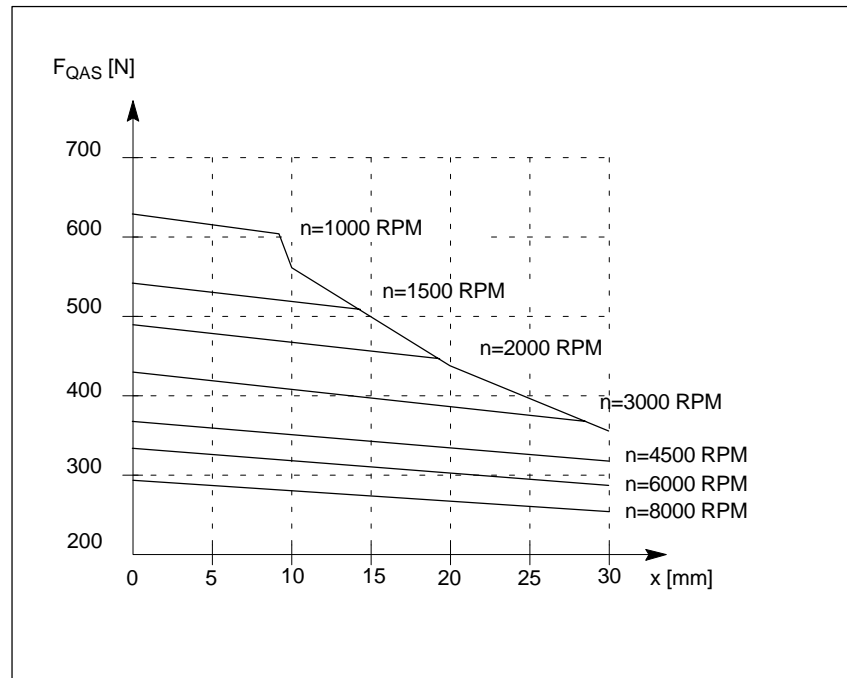
**Axial force**
1FT6024
1FT6028

Permissible axial force as a function of the cantilever force.



Cantilever force
1FT6031
1FT6034

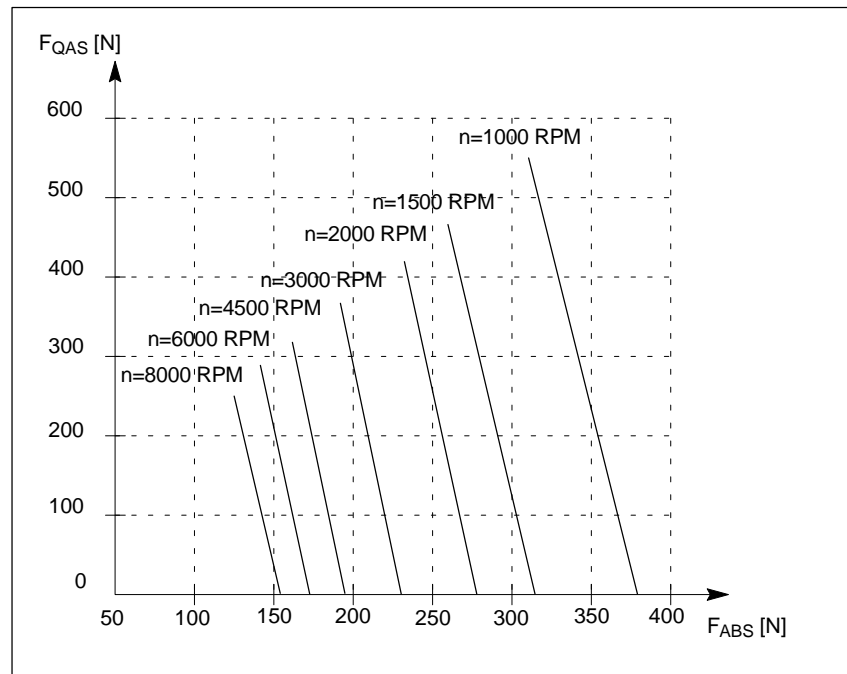
Cantilever force F_Q at a distance x from the shaft shoulder for a nominal bearing lifetime of 20,000 h.



1FT6

Axial force
1FT6031
1FT6034

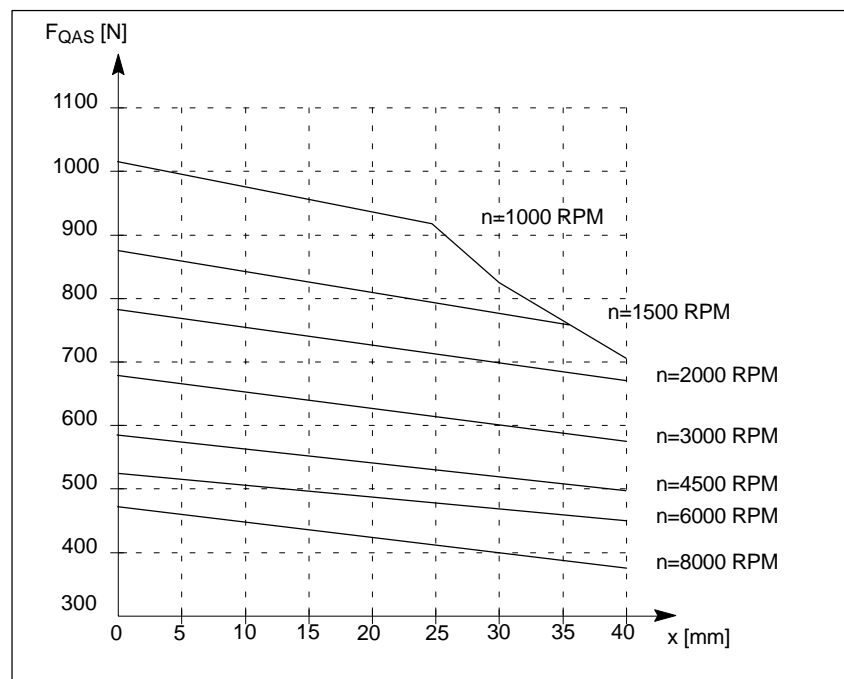
Permissible axial force as a function of the cantilever force.



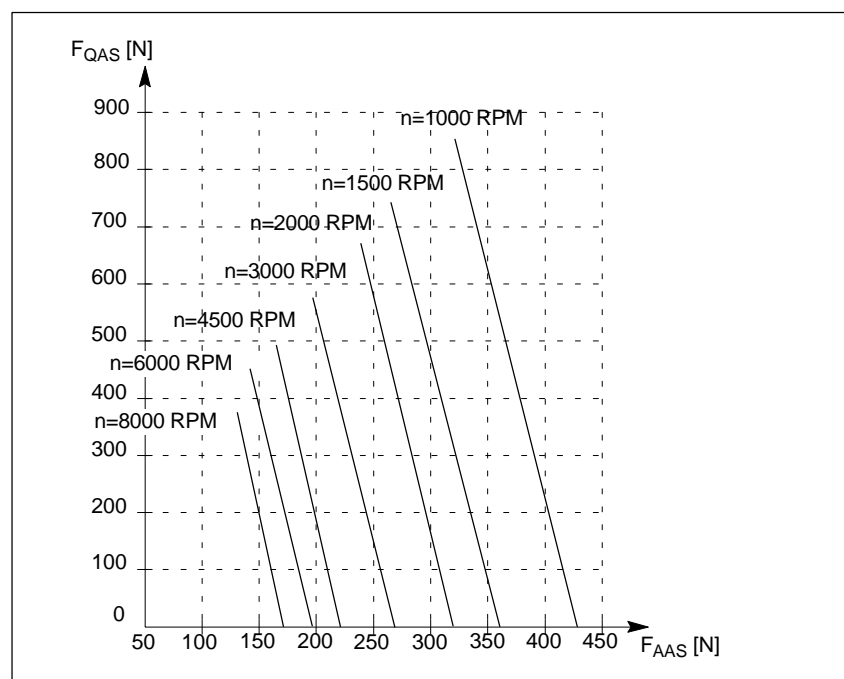
3.2 Cantilever/axial force diagrams

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.

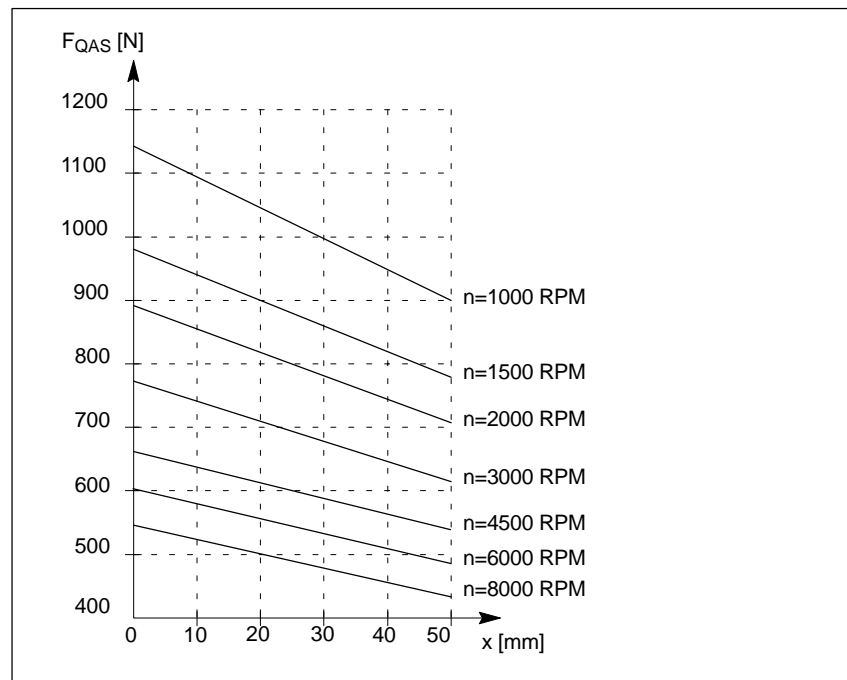
**Axial force**
1FT6041
1FT6044

Permissible axial force as a function of the cantilever force.



Cantilever force
1FT6061
1FT6062
1FT6064

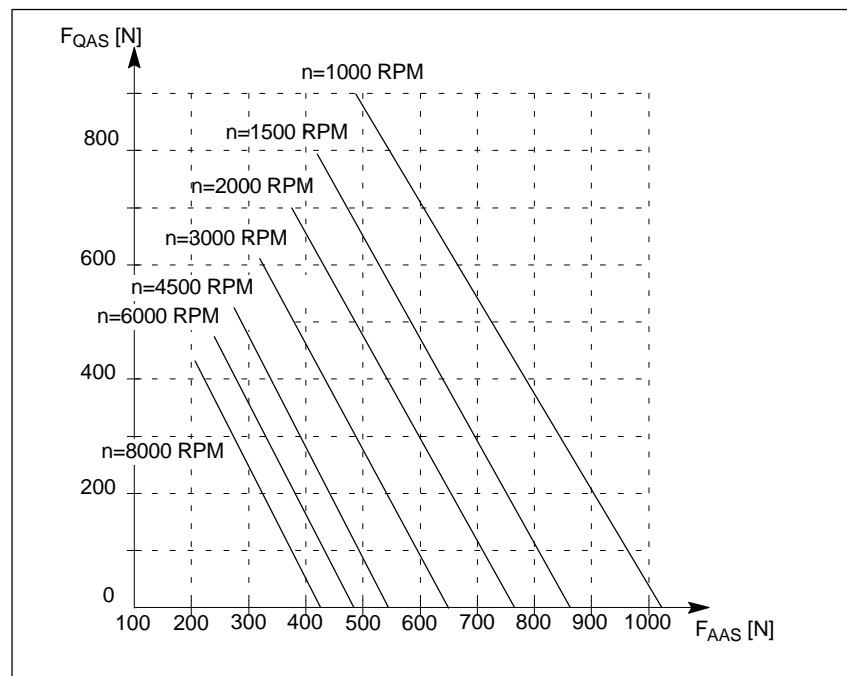
Cantilever force F_Q at a distance x from the shaft shoulder for a nominal bearing lifetime of 20,000 h.



1FT6

Axial force
1FT6061
1FT6062
1FT6064

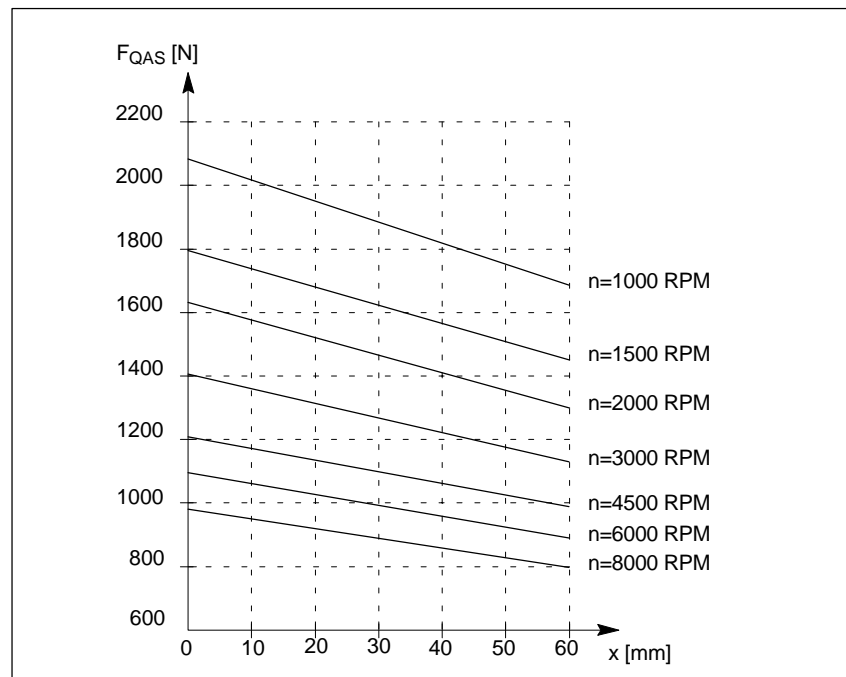
Permissible axial force as a function of the cantilever force.



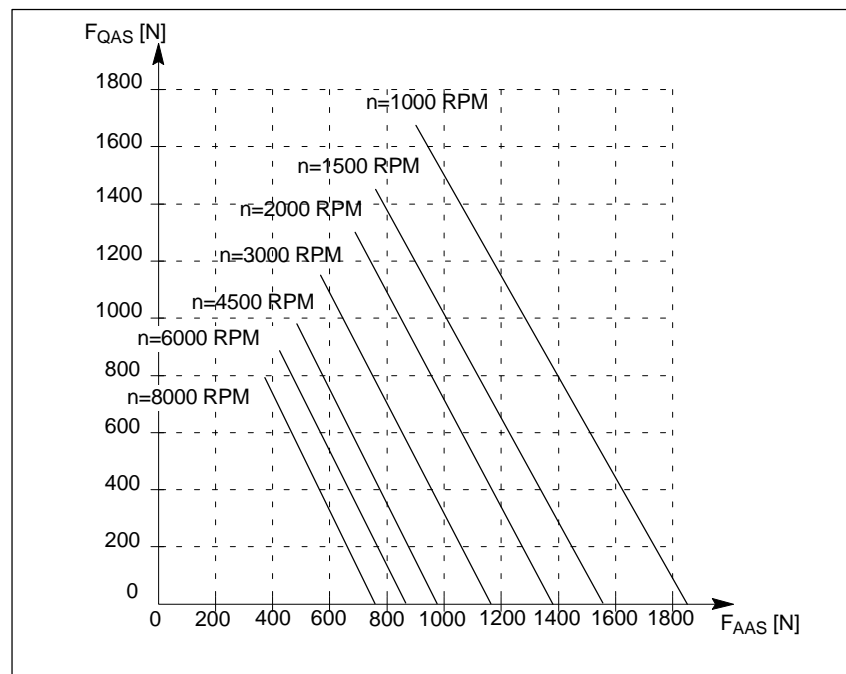
3.2 Cantilever/axial force diagrams

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.

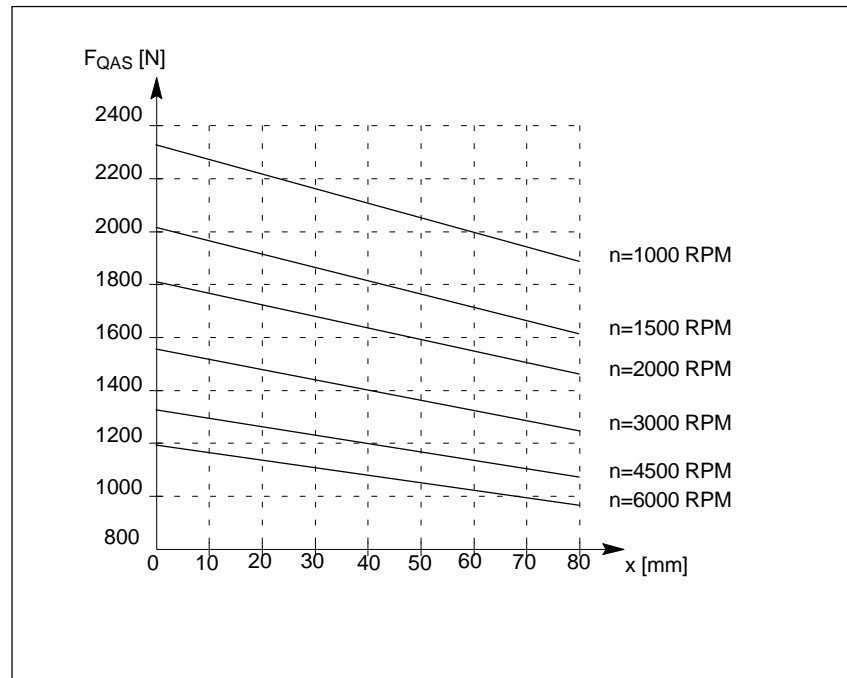
**Axial force****1FT6081****1FT6082****1FT6084****1FT6086**

Permissible axial force as a function of the cantilever force.



Cantilever force
1FT6102
1FT6105
1FT6108

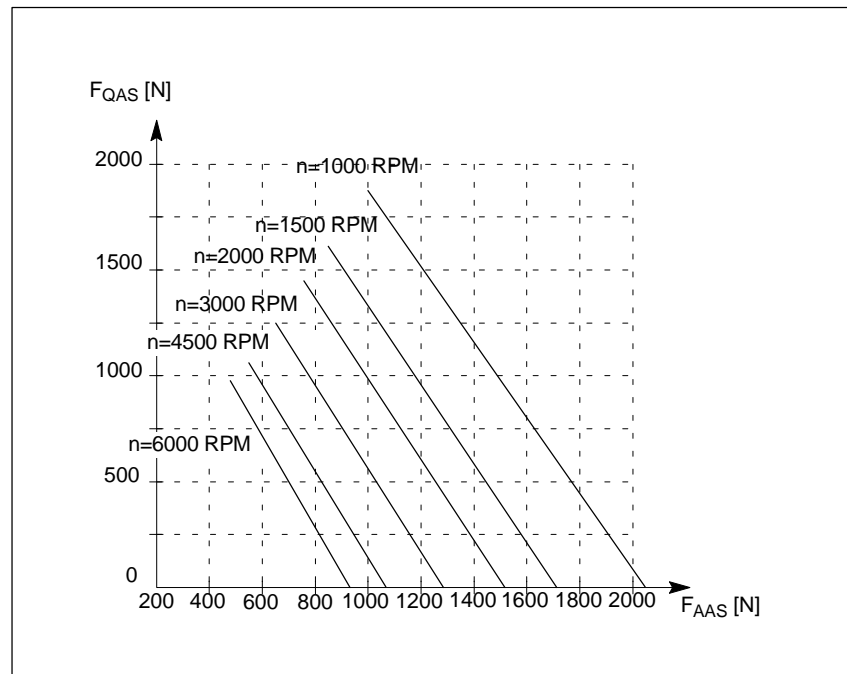
Cantilever force F_Q at a distance x from the shaft shoulder for a nominal bearing lifetime of 20,000 h.



1FT6

Axial force
1FT6102
1FT6105
1FT6108

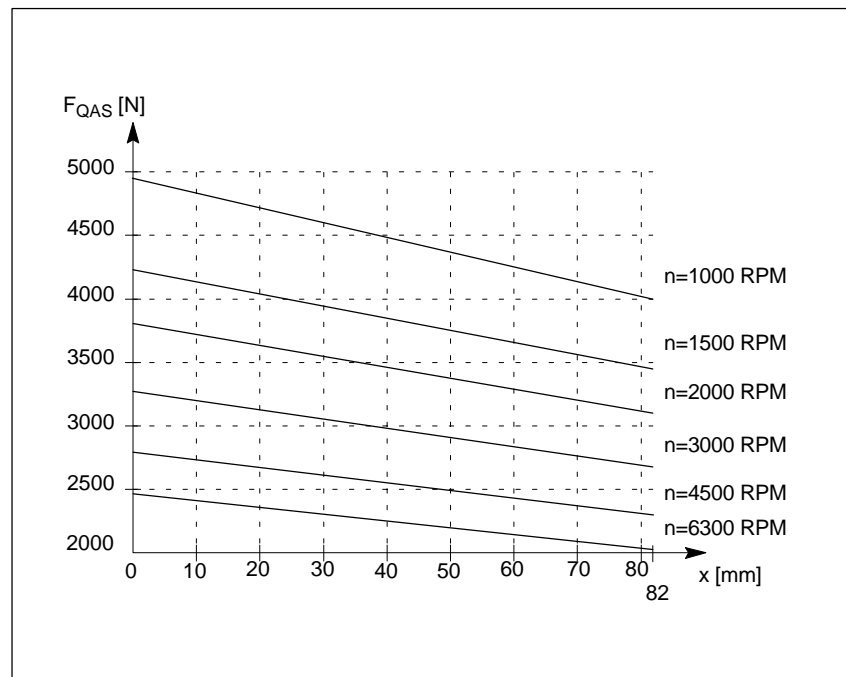
Permissible axial force as a function of the cantilever force.



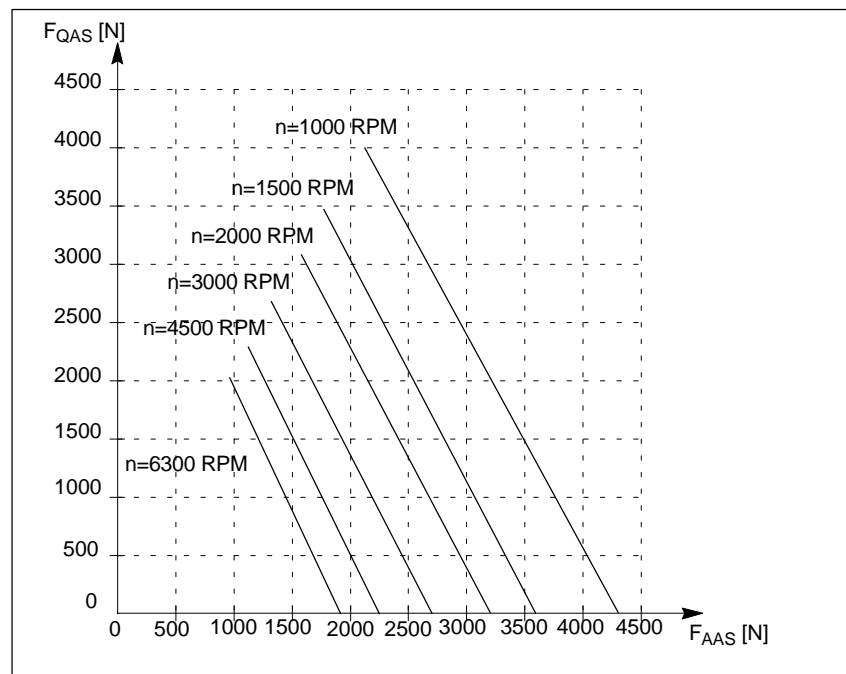
3.2 Cantilever/axial force diagrams

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.



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.

1FT6

Standard type of construction, non-ventilated

Motor type

| | |
|--|-----------|
| 1FT602□ non-ventilated | 1FT6/4-64 |
| 1FT603□ non-ventilated with connector size 1 | 1FT6/4-65 |
| 1FT604□ non-ventilated with connector size 1 | 1FT6/4-66 |
| 1FT606□ non-ventilated with connector size 1 | 1FT6/4-67 |
| 1FT608□ non-ventilated with connector size 1.5 | 1FT6/4-68 |
| 1FT610□ non-ventilated with connector size 1.5 | 1FT6/4-69 |
| 1FT613□ non-ventilated with connector size 1.5/3 | 1FT6/4-70 |

Standard type of construction, force-ventilated

Motor type

| | |
|--|-----------|
| 1FT608□ force-ventilated with connector size 1.5/3 | 1FT6/4-71 |
| 1FT610□ force-ventilated with connector size 1.5/3 | 1FT6/4-72 |
| 1FT613□ force-ventilated with connector size 3 | 1FT6/4-73 |

Standard type of construction, water-cooled

Motor type

| | |
|--|-----------|
| 1FT608□ water-cooled with connector size 1.5/3 | 1FT6/4-74 |
| 1FT610□ water-cooled with connector size 1.5/3 | 1FT6/4-75 |

4 Dimension Drawings

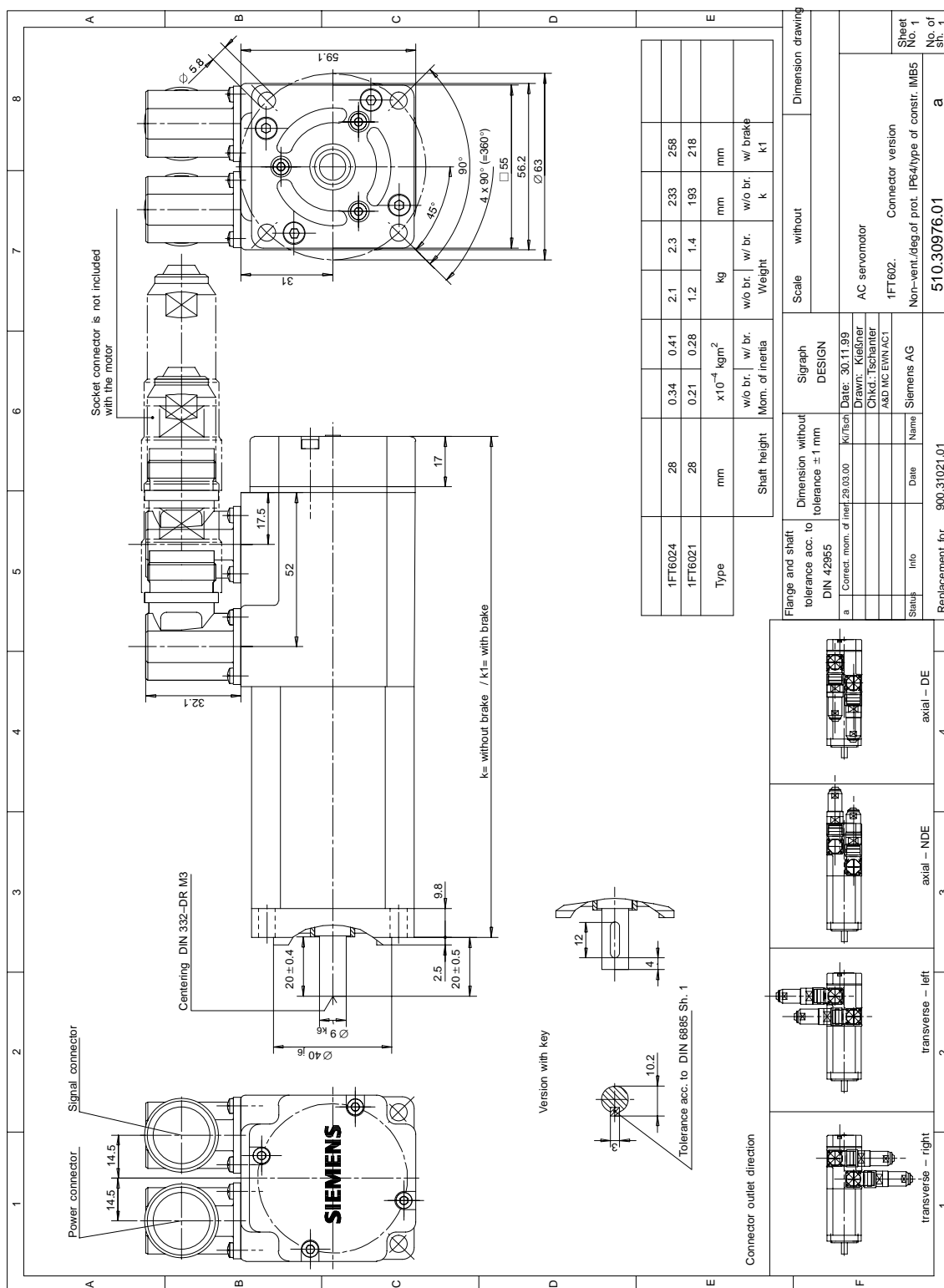


Fig. 4-1 1FT602□ non-ventilated

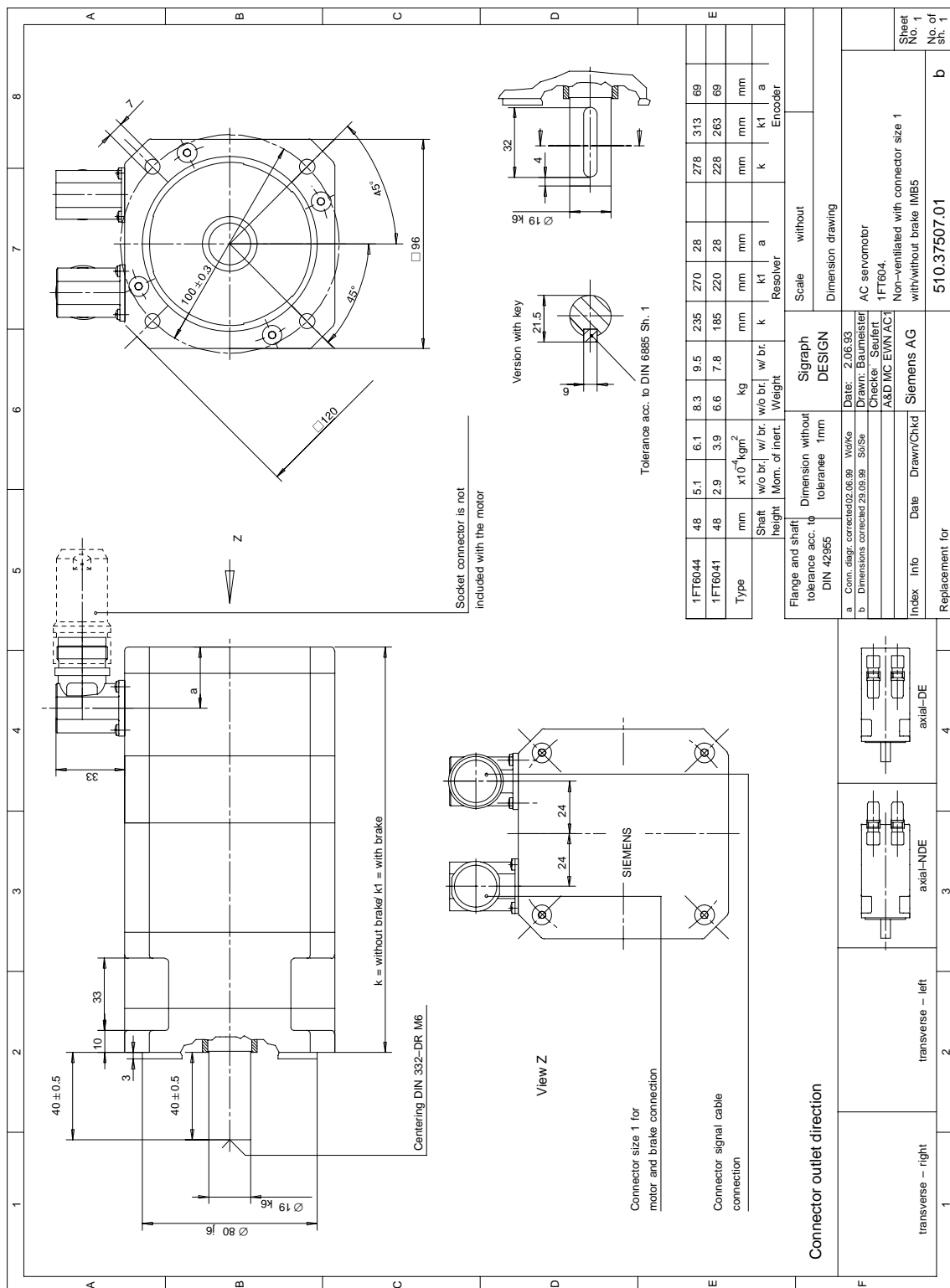
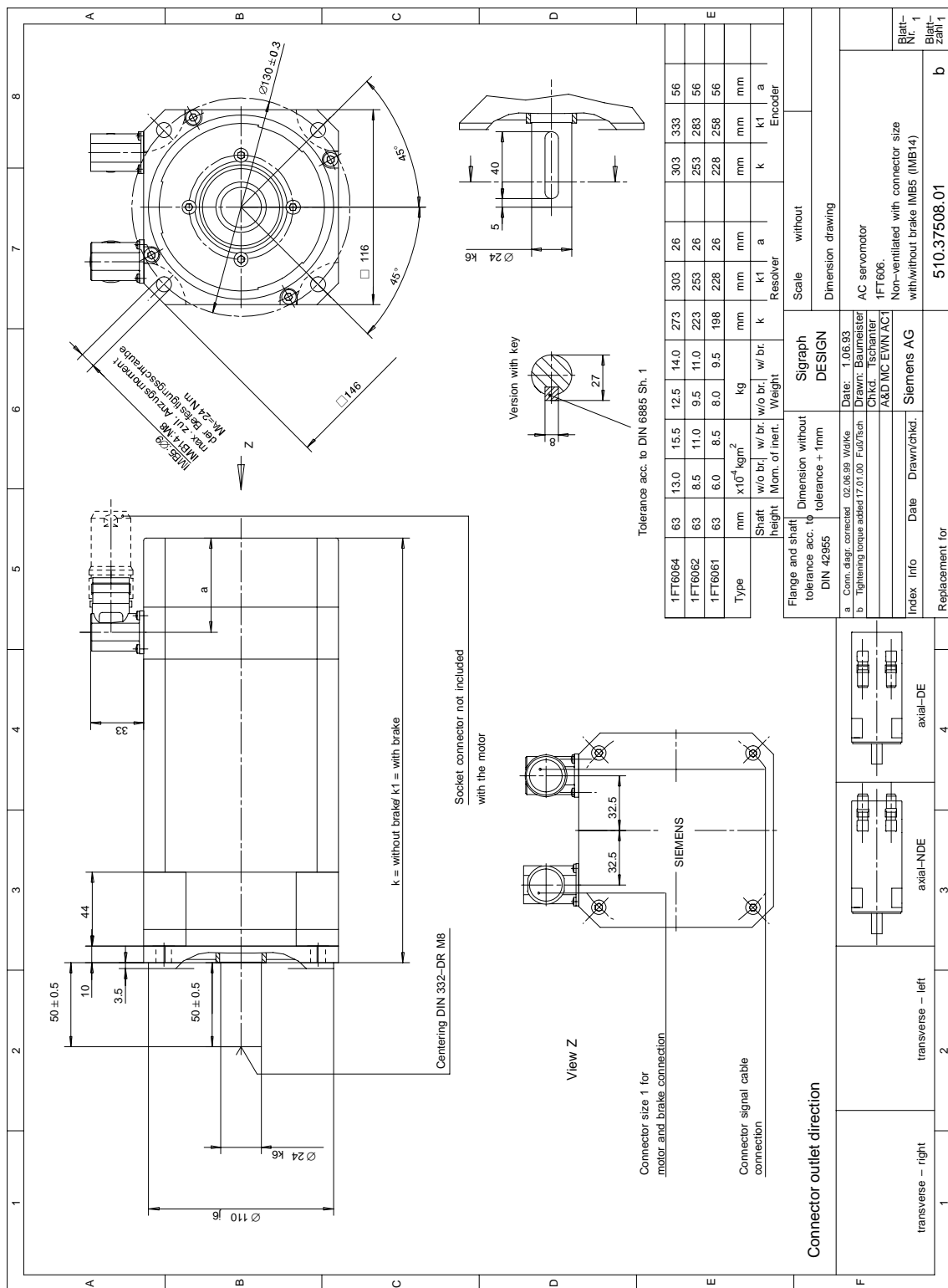


Fig. 4-3 1FT604□ non-ventilated with connector size 1



1FT6

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

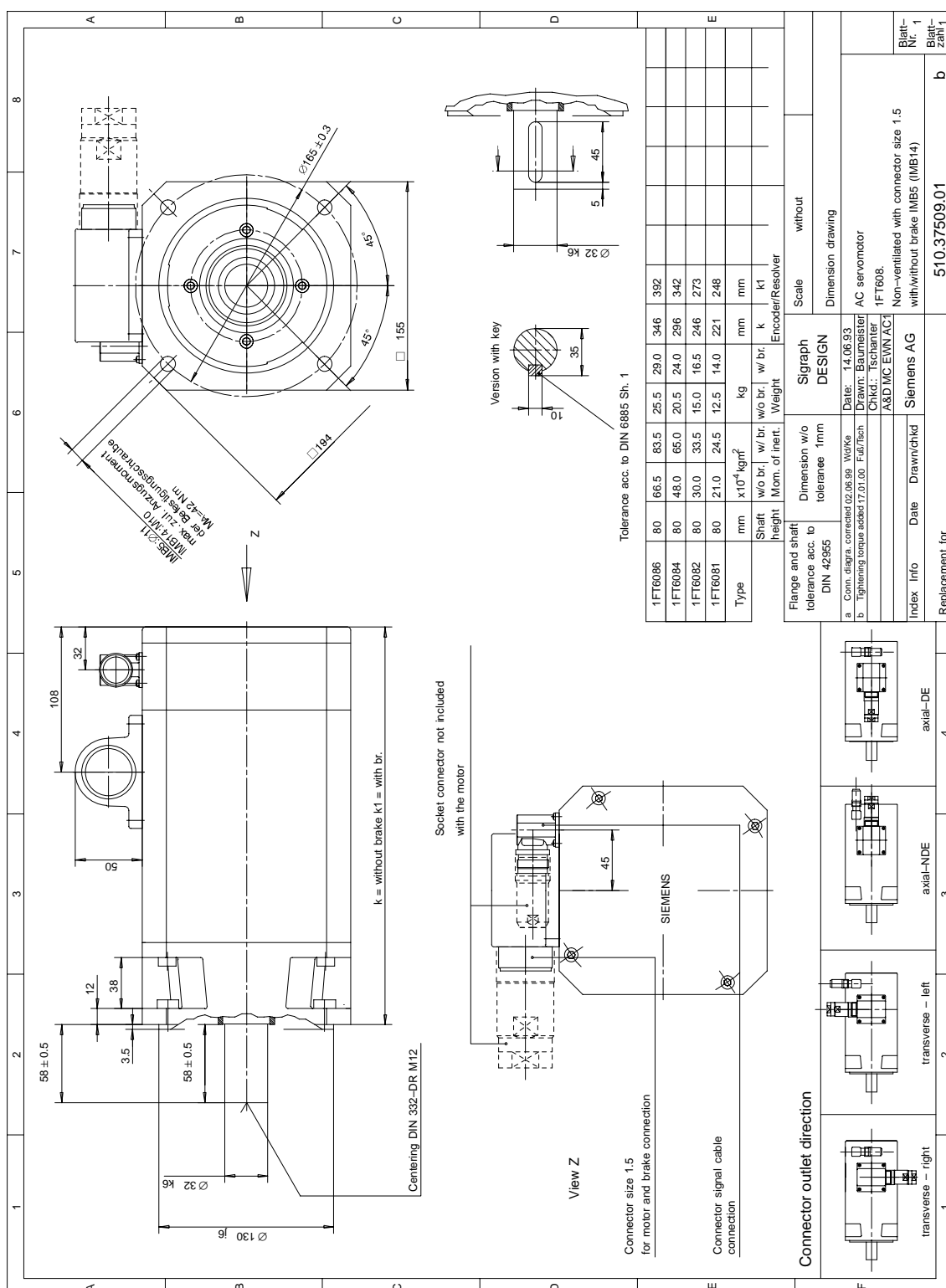


Fig. 4-5 1FT608□ non-ventilated with connector size 1.5

4 Dimension Drawings

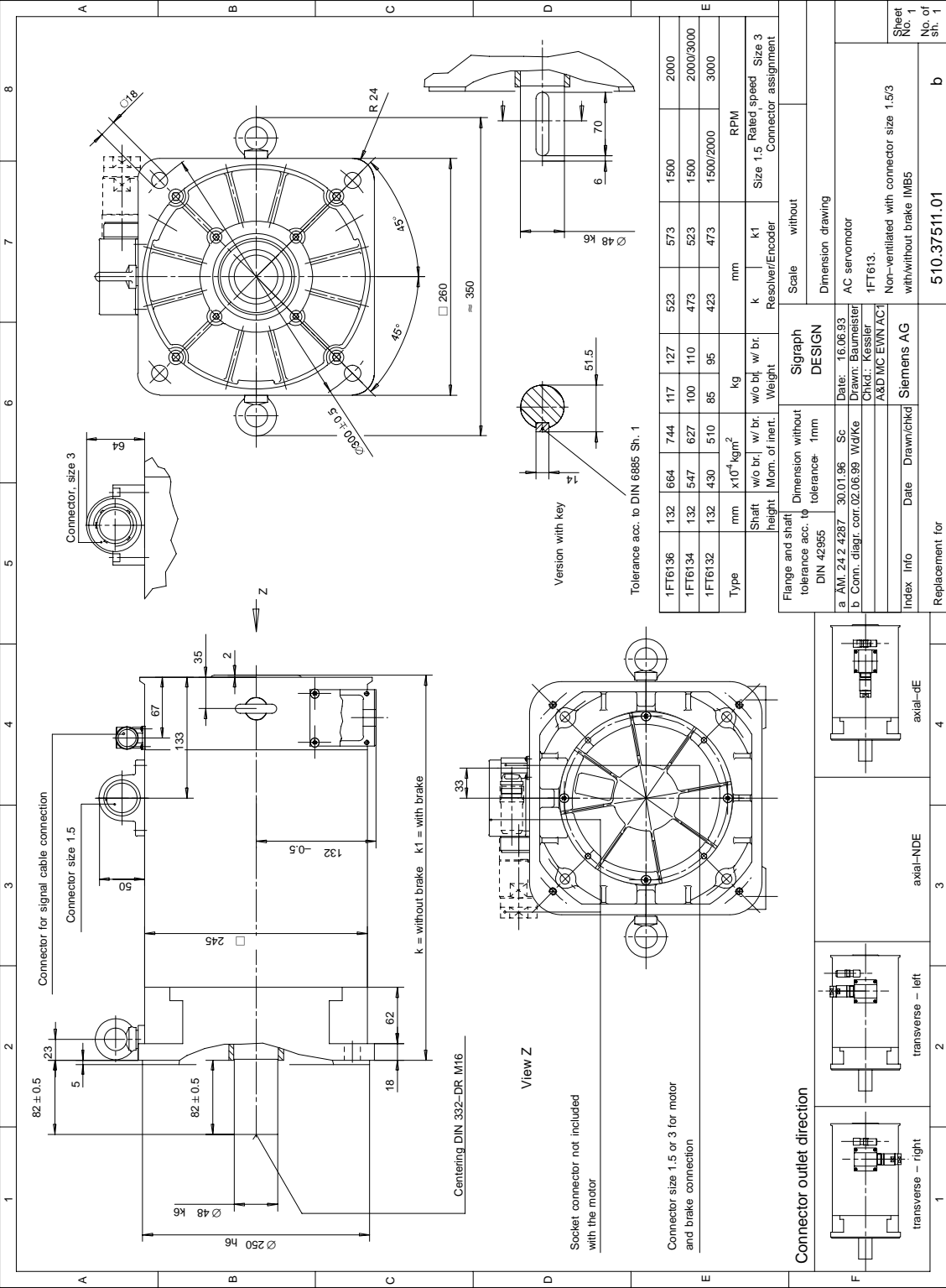


Fig. 4-7 1FT613□ non-ventilated with connector size 1.5/3

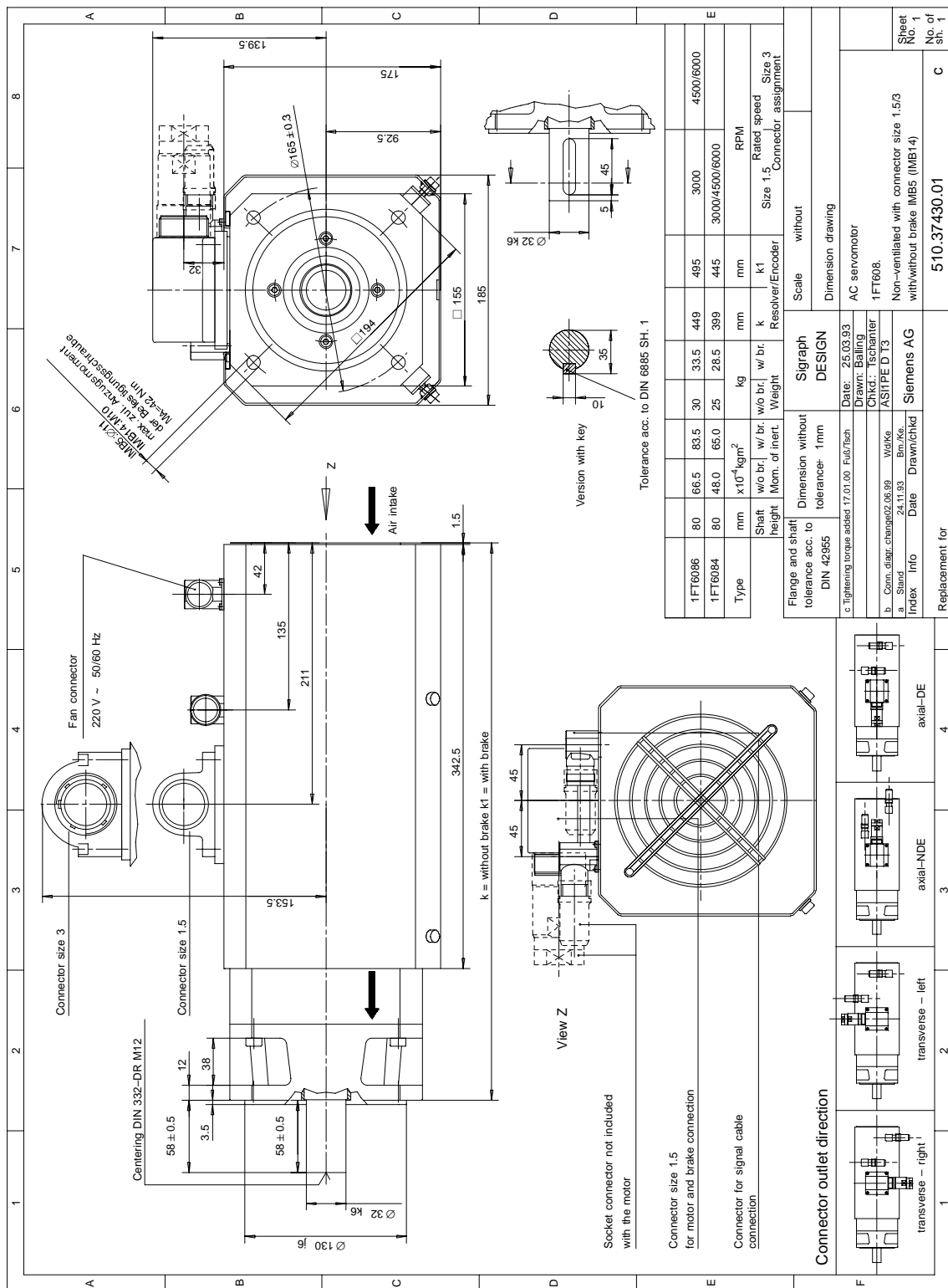


Fig. 4-8 1FT608 force-ventilated with connector size 1.5/3

1FT6

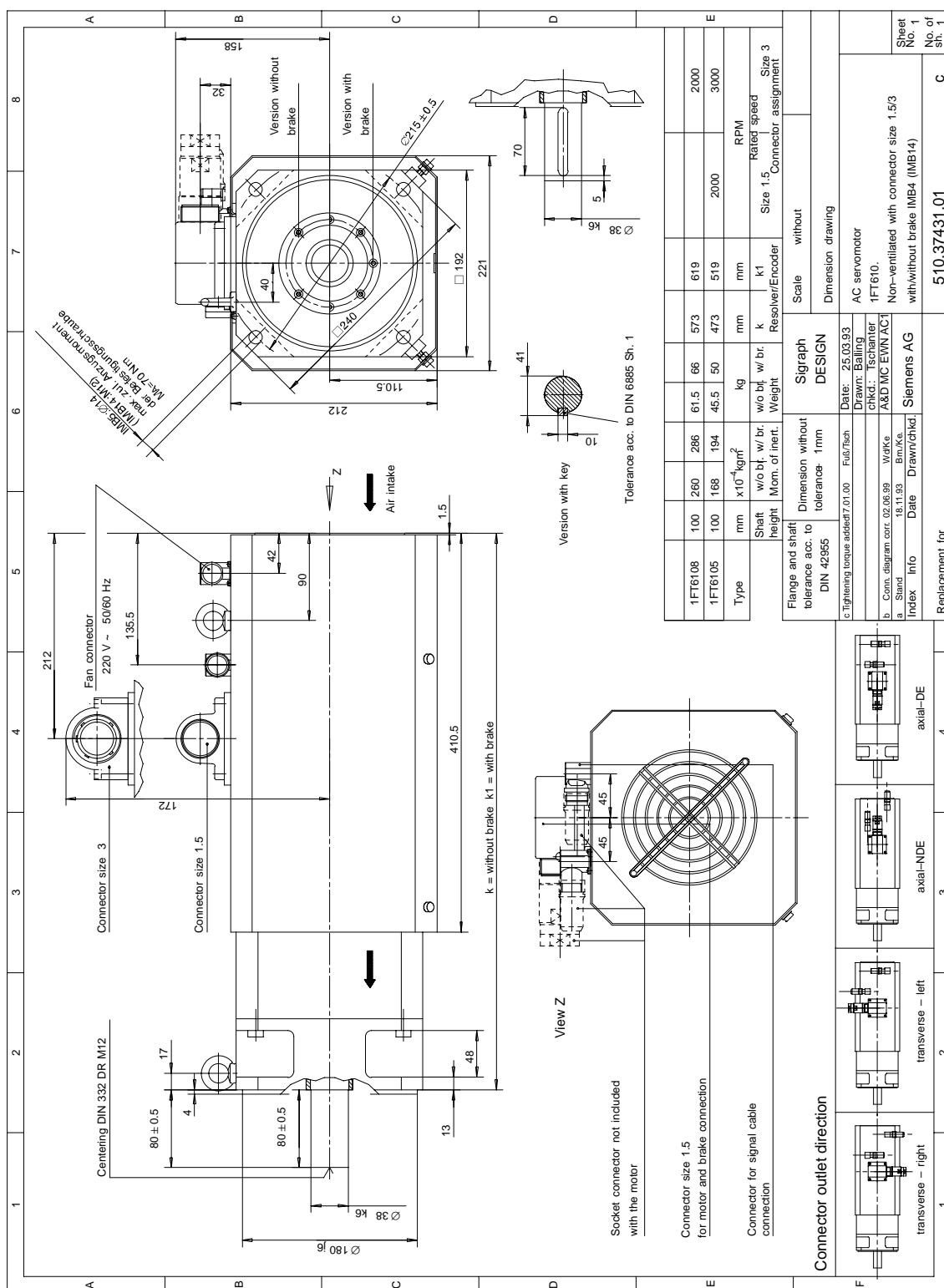


Fig. 4-9 1FT610□ force-ventilated with connector size 1.5/3

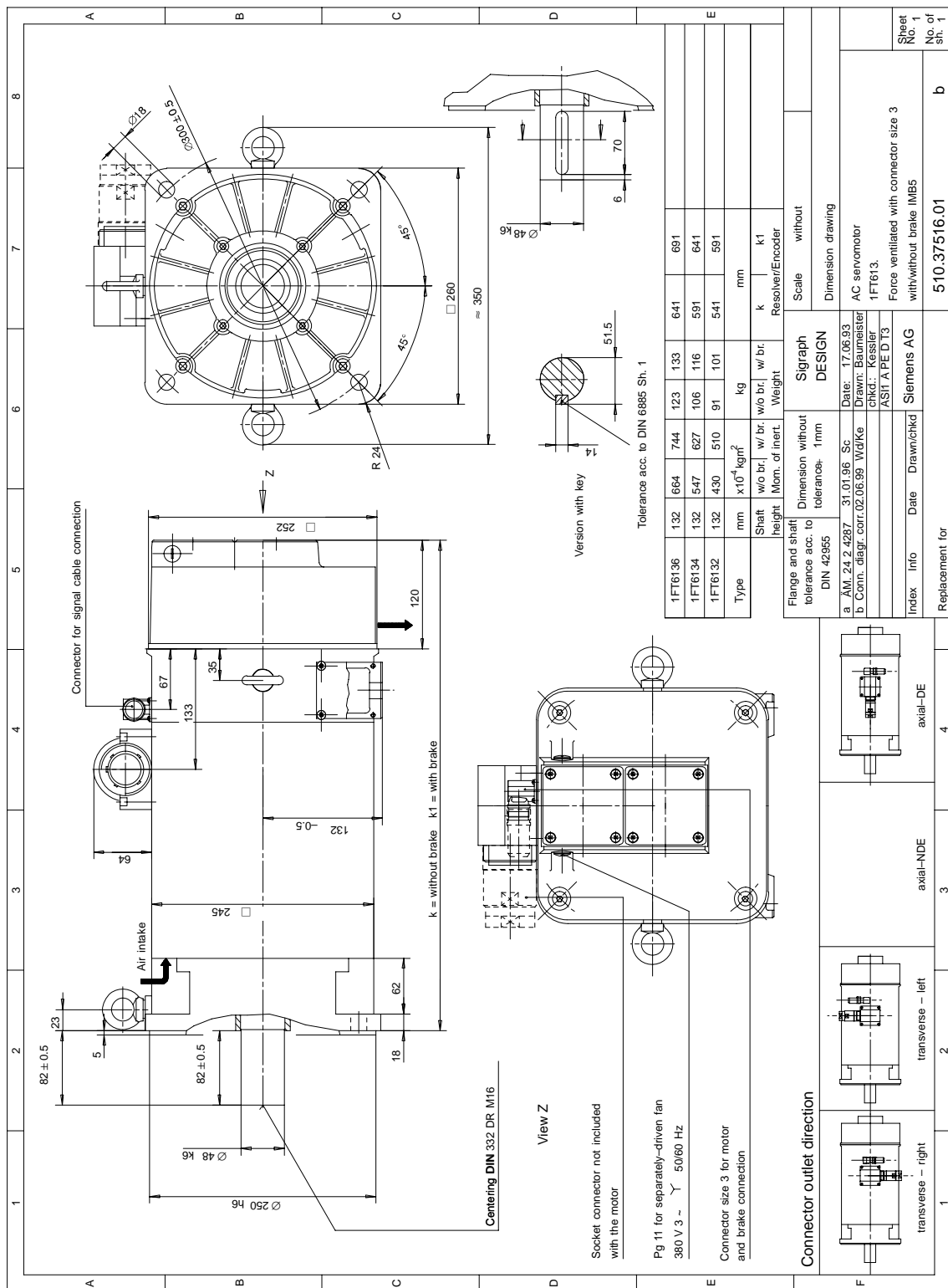


Fig. 4-10 1FT613 force-ventilated with connector size 3

1FT6

4 Dimension Drawings

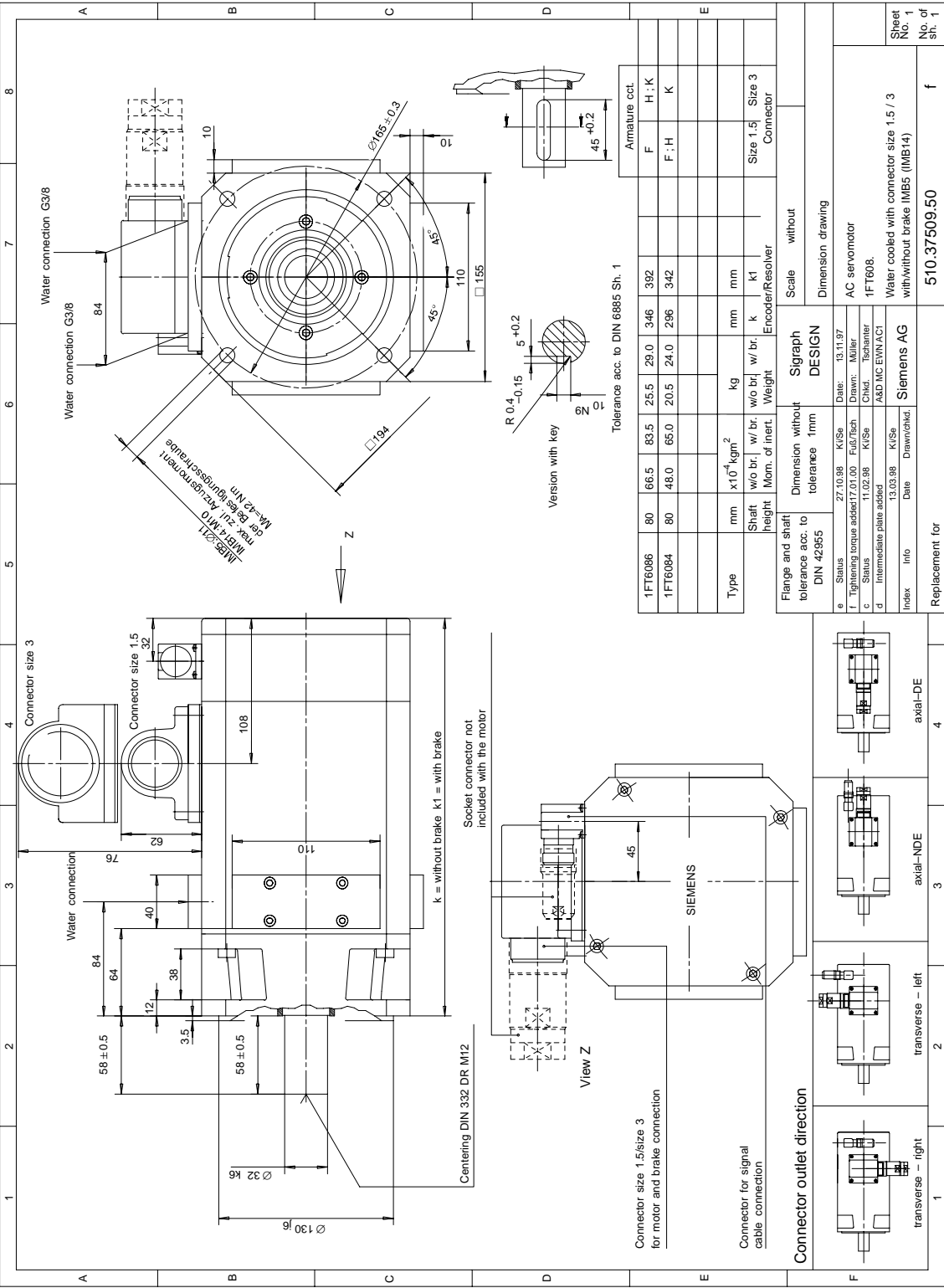


Fig. 4-11 1FT608 water-cooled with connector size 1.5/3

5

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1FT6

[illegible]

1FK6 AC Servomotors

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1FK6

[illegible]

1

Motor Description

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).

1FK6

Characteristics

Depending on the shaft height, the 1FK6 series has stall torques from 1.1 to 36 mm at rated speeds of 3000 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 $\Delta T=60$ K limit values.

1.1 Characteristics and technical data

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 $\Delta T = 100 \text{ K}$ for an ambient temperature of $40 \text{ }^{\circ}\text{C}$ lifetime > 40.000 h. |
| Installation altitude (acc. to IEC and EN 60034-1) | $\leq 1000 \text{ m}$ 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 <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • Fail-safe holding brake; supply voltage, 24V \pm 10% (acc. to DIN 0580 7/79) • Planetary gearbox (prerequisite: shaft without key- way) |
| Encoder system | <ul style="list-style-type: none"> • 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) |

1FK6

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

1.1 Characteristics and 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⁾ [mm ²] | 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
with overall shield
with brake cable: w/out overall shield
with overall shield

A
C
B
D

Lengths²⁾
(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) 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 absolute 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] | Connector size | Cross-section ¹⁾ [mm ²] | 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

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

Power calculation

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

Cables are not included in the scope of supply of the motors, they must be separately ordered, actual value cables, refer to Chapter, 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 absolute 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 current | Power drain | Opening time | Closing time | Moment of inertia, brake | Highest switching 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 |

1FK6

1) per emergency stop with $n = 3000/\text{min}$.

2) $\omega = 1/2 \cdot J_{\text{tot}} \cdot \omega^2$; J_{tot} [kgm²]; 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)

1.2 Functions and options

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-venti- lated Type | Planetary gearbox 1 stage play ≤12 arcmin Type | Gearbox weight approx. [kg] | Available gearbox ratios | | Max. permis- sible in- put speed 1) | Max. permissible output torque 1) | | Max. permis- sible drive— out shaft load 2) | Moment of inertia, gearbox |
|--|---|--|--------------------------------|--------|--|---|--------------------------------------|--|----------------------------------|
| | | | i = 5 | i = 10 | | n _{G1} [RPM] | M _{G2} for i = 5 [Nm] | | |
| 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 | | | X | | | | | | |
| 1FK6103 | | | X | | | | | | |
| Code Gearbox shaft with 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 Type | Rated speed n _{N1} [RPM] | Max. permissible output torque 1) 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).

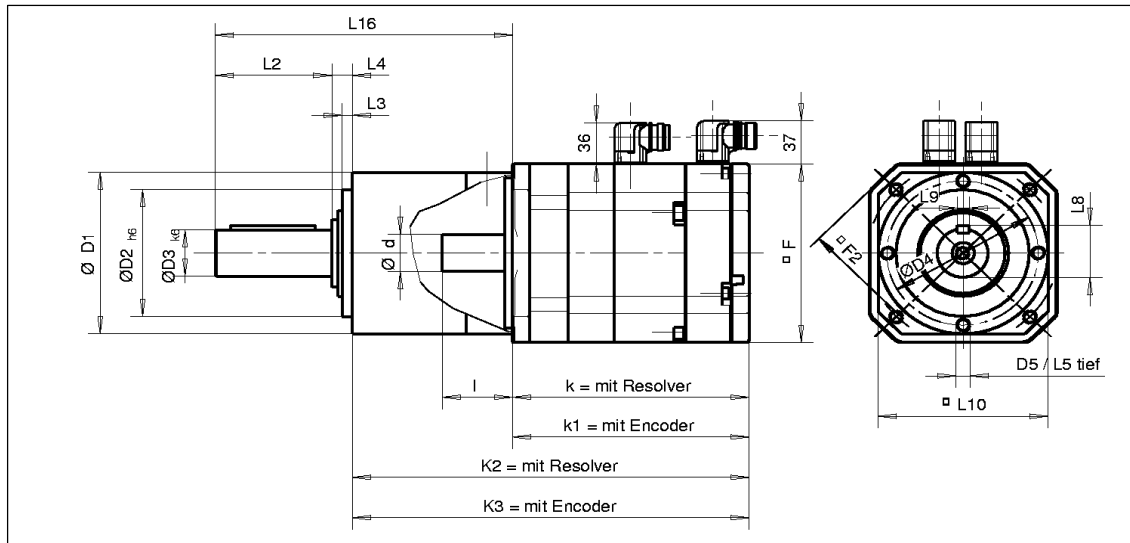


Fig. 1-1 Dimensions, 1FK6 motors (shaft heights 36–80) with planetary gearboxes (alpha Company, LP series)

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 | I | ∅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 | 160 | 204 | 40 | 19 | 96 | LP090–M01 | 90 | 68 | 22 | 80 | M6 | 158 | 36 | 5 | 10 | 12 | 24.5 | 6 | 90 | 272 | 316 |
| 1FK6042 | 192 | 238 | | | | | | | | | | | | | | | | | | 304 | 348 |
| 1FK6060 | 200 | 238 | 50 | 24 | 126 | LP120–M01 | 120 | 90 | 32 | 108 | M8 | 210 | 58 | 6 | 12 | 16 | 35 | 10 | 120 | 340 | 378 |
| 1FK6063 | 250 | 288 | | | | | | | | | | | | | | | | | | 390 | 428 |
| 1FK6080 | 195 | 242 | 58 | 32 | 155 | LP155–M01 | 155 | 120 | 40 | 140 | M10 | 265 | 82 | 8 | 15 | 20 | 43 | 12 | 150 | 363 | 410 |
| 1FK6083 | 233 | 280 | | | | | | | | | | | | | | | | | | 401 | 448 |

1.2 Functions and options

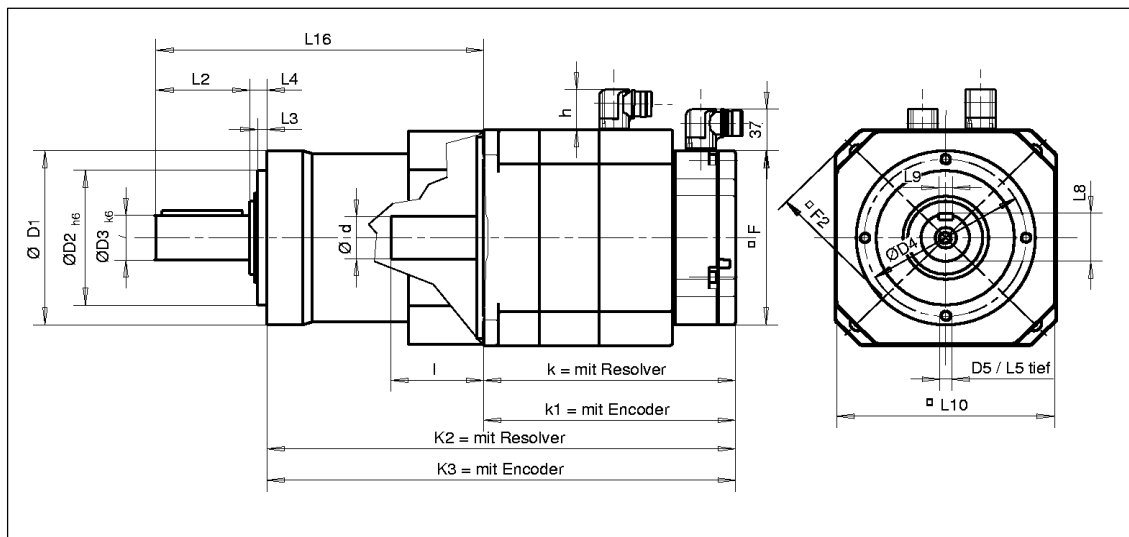


Fig. 1-2 Dimensions, 1FK6 motor (shaft height 100) with planetary gearbox (alpha Company, LP series)

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 | 244 | 291 | 80 | 38 | 54 | | | | | | | | | | | | | | | | 412 | 459 |
| 1FK6103 | 270 | 317 | 80 | 38 | 54 | | | | | | | | | | | | | | | | 438 | 485 |

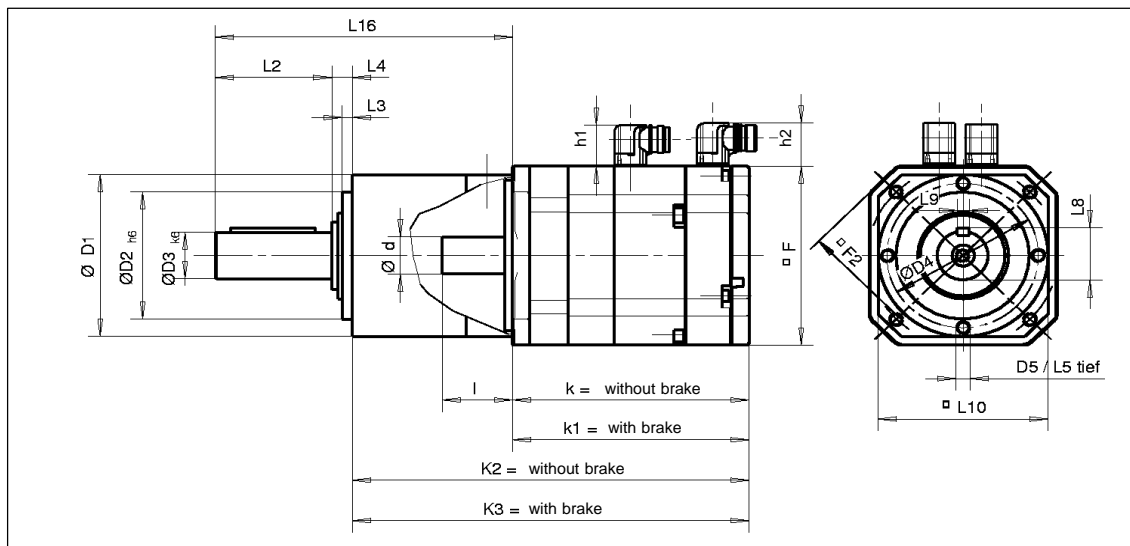


Fig. 1-3 Dimensions, 1FK6 motor, High Dynamic with planetary gearbox, (alpha Company, LP series)

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 | Ød | □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 | | | | | | | | | | | | | | | | | |
| | ØD1 | ØD2 | ØD3 | ØD4 | 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

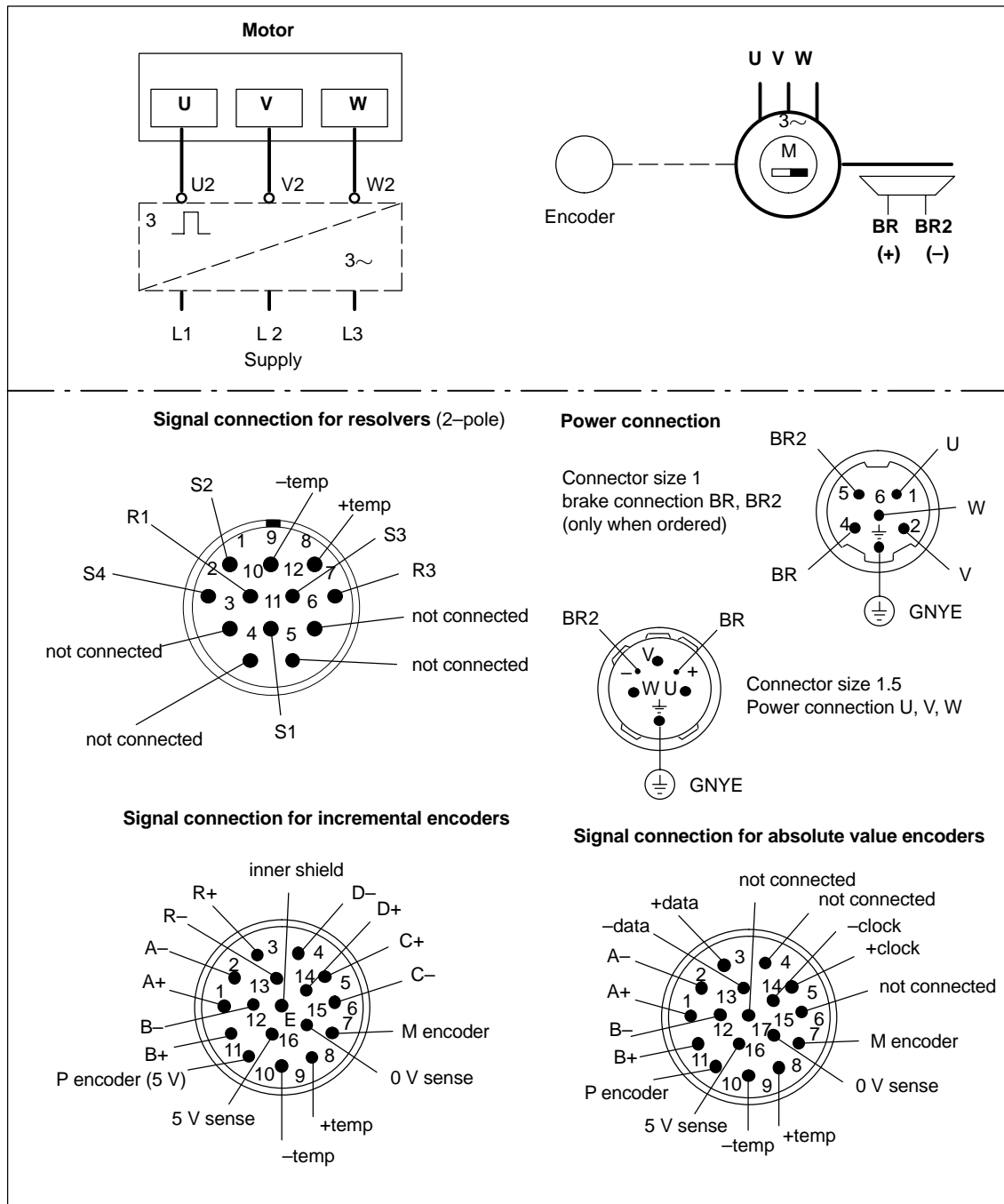


Fig. 1-4 Connector assignment: Power, brake, encoder

Connector can be rotated

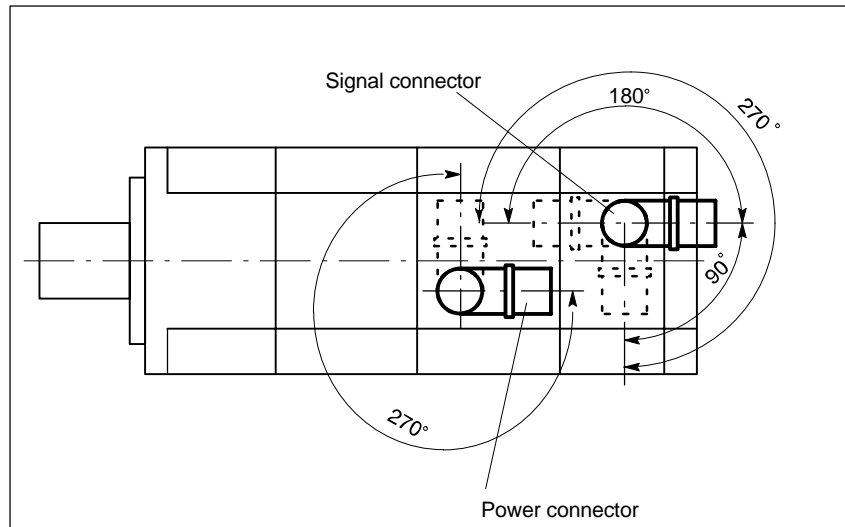


Fig. 1-5 Connector can be rotated

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: $M_{\max} = 8 \text{ Nm}$
Size 1.5: $M_{\max} = 15 \text{ Nm}$
- Signal connector: $M_{\max} = 8 \text{ Nm}$

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

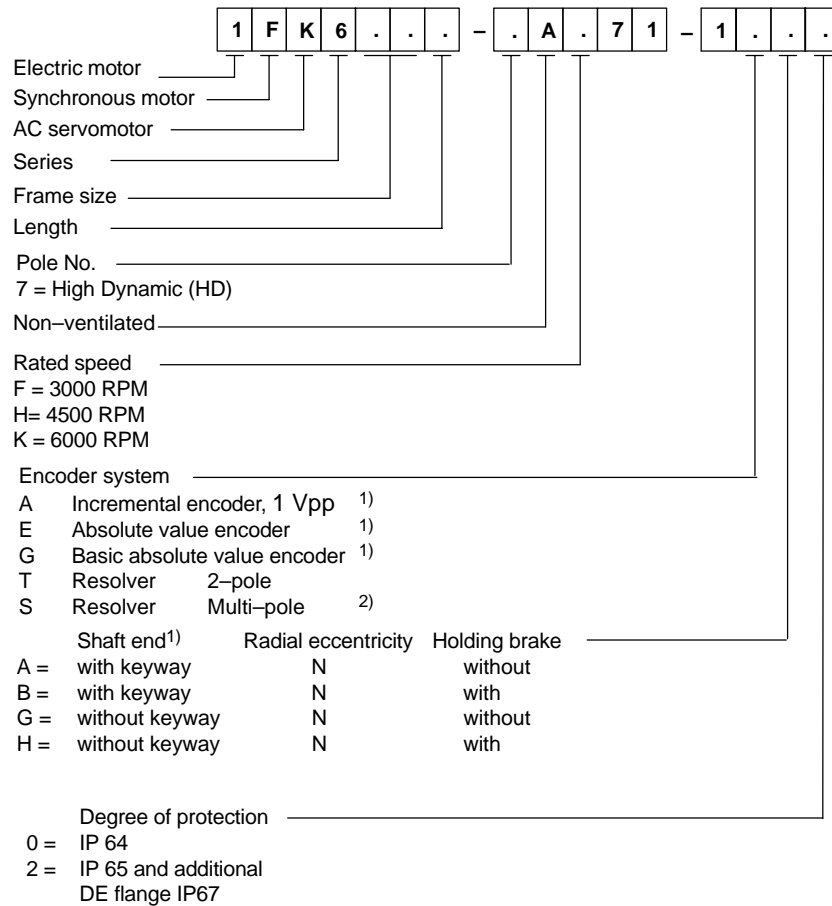
| | |
|--|--|
| Optical incremental encoder | Incremental encoder 1 Vpp Description, refer to Section GE, Chapter 1 |
| Optical multi-turn absolute value encoder | Absolute value encoder Description, refer to Section GE, Chapter 1 |
| Inductive basic absolute encoder | Inductive encoder system Description, 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


1FK6

1) not for shaft height 36

2) encoder pole number corresponds to that of the motor

[illegible]

3

Technical Data and Characteristics

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 $\Delta T = 60$ K. Shaft heights 100 and 132 can still be utilized according to $\Delta T = 100$ 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 $\Delta T = 100$ K.
 - 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 systems:
SIMODRIVE 611 digital from drive firmware 4.4.01
SIMODRIVE 611 universal from drive firmware 3.3.2
-

1FK6

3.1 Speed–torque diagrams

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 | |

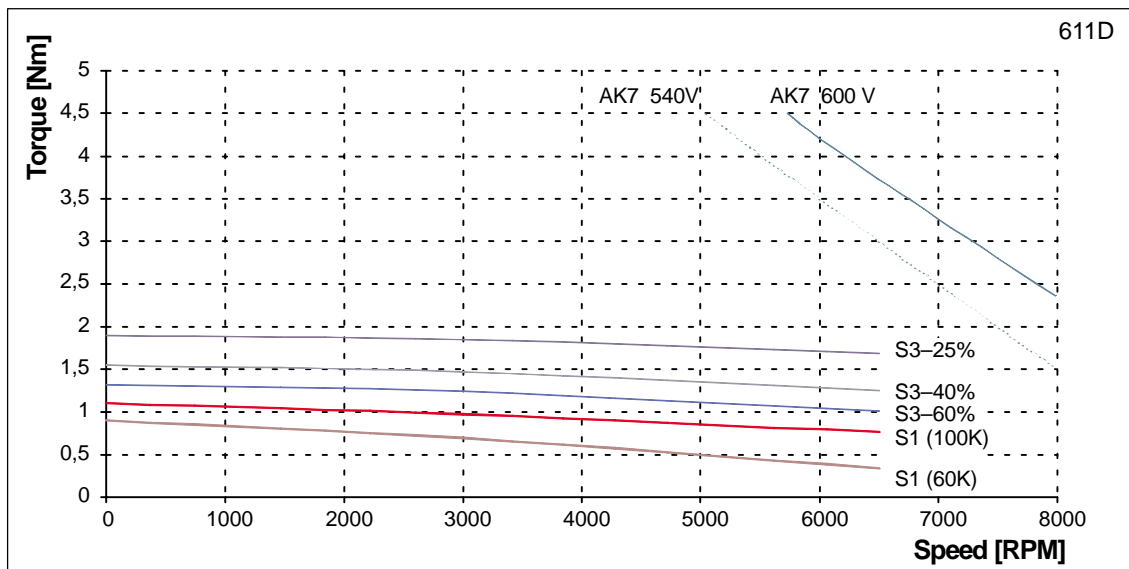


Fig. 3-1 Speed–torque diagram 1FK6032

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 | |

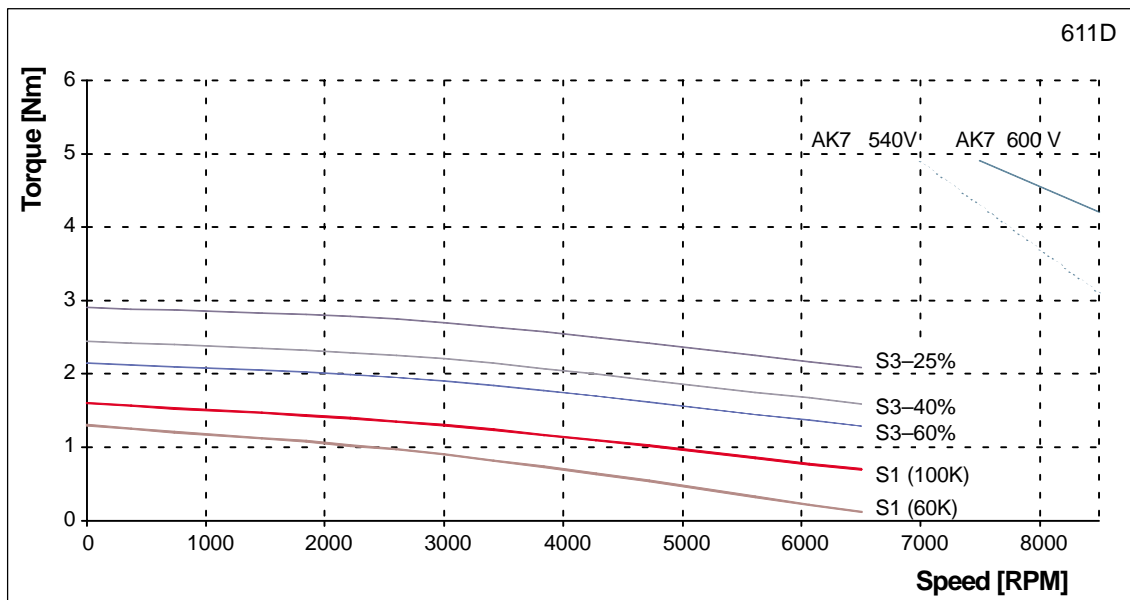
1FK6

Fig. 3-2 Speed–torque diagram 1FK6040

3.1 Speed-torque diagrams

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 | |

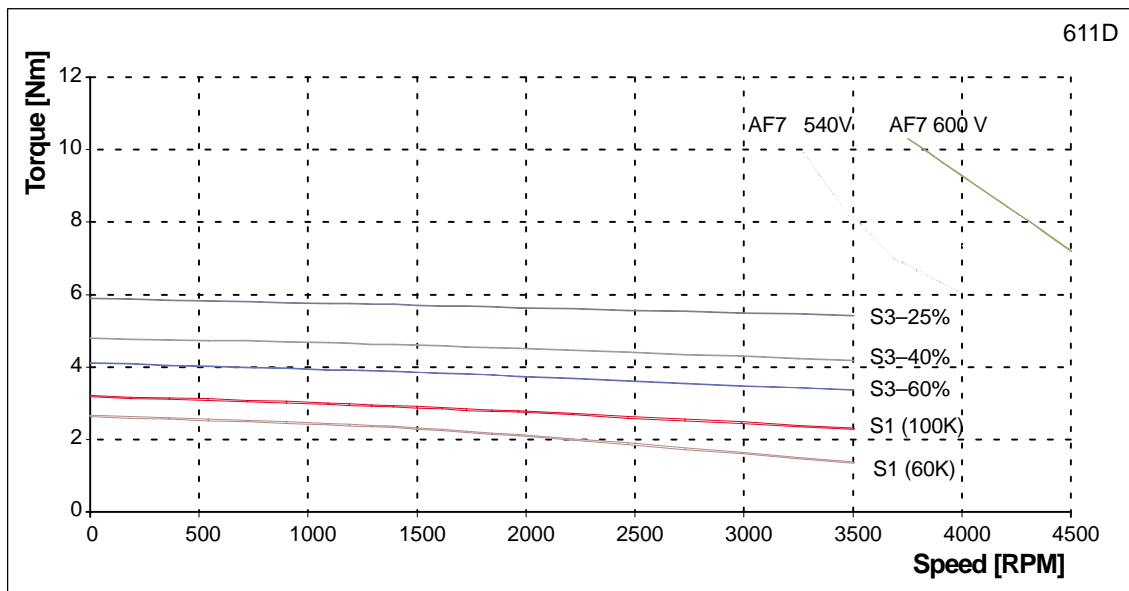


Fig. 3-3 Speed-torque diagram 1FK6042

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 | |

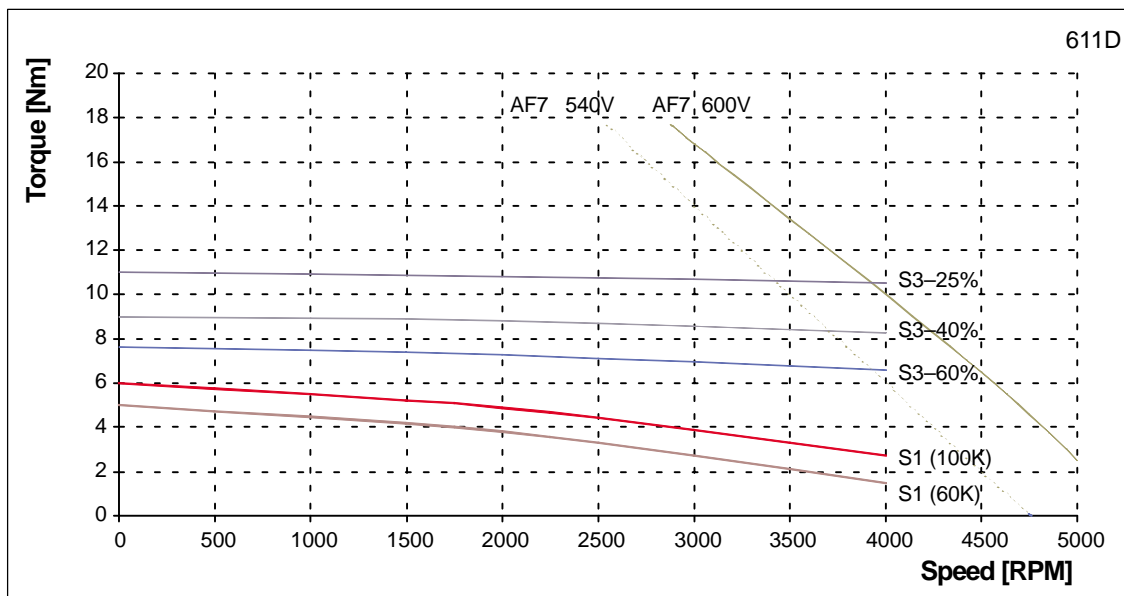
1FK6

Fig. 3-4 Speed–torque diagram 1FK6060

3.1 Speed–torque diagrams

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 | |

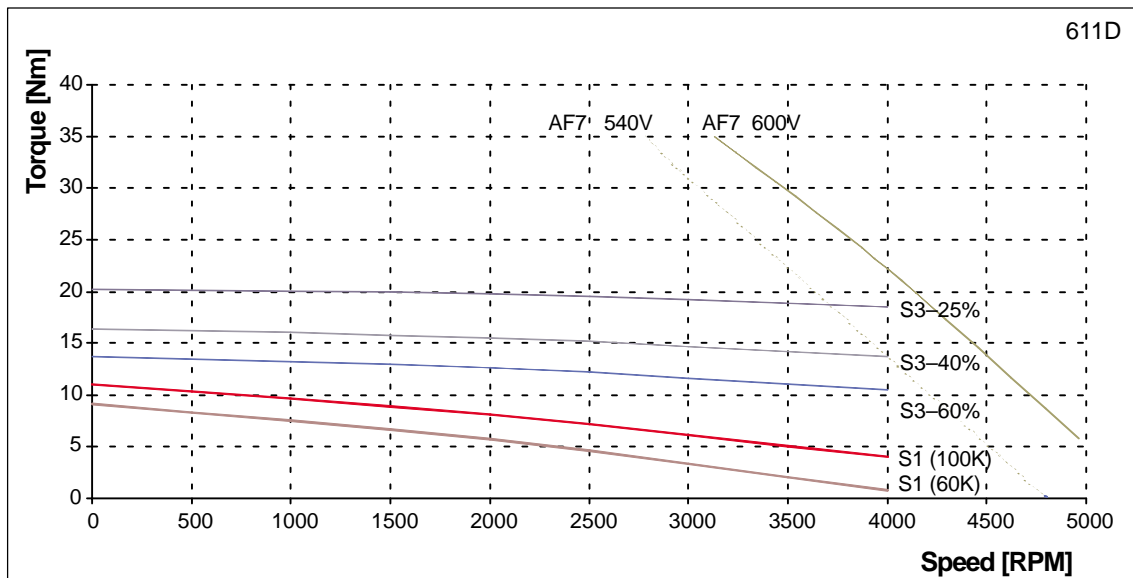


Fig. 3-5 Speed–torque diagram 1FK6063

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 | |

1FK6

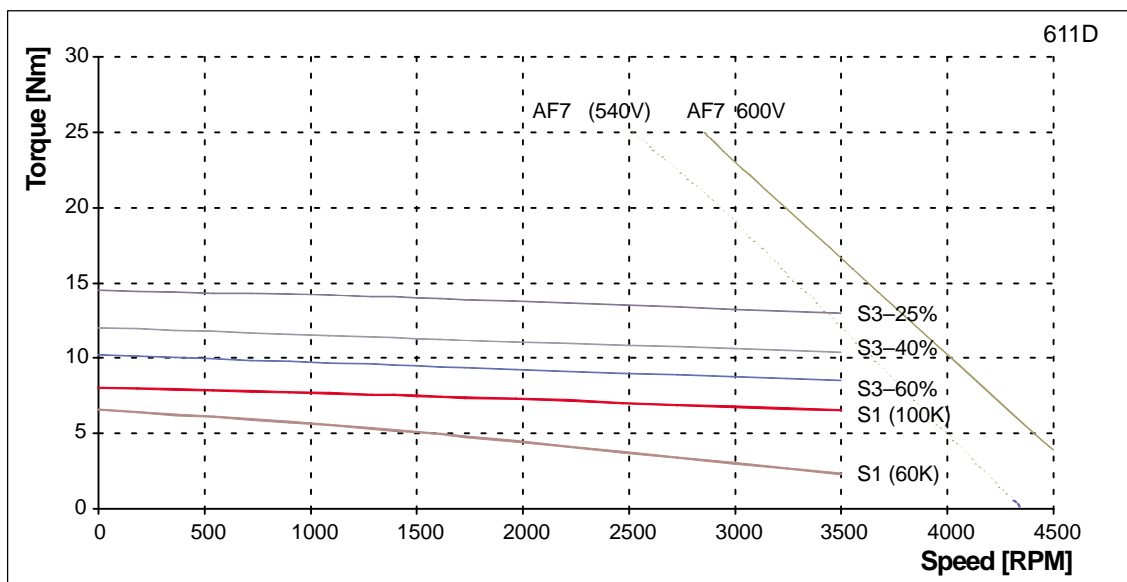


Fig. 3-6 Speed–torque diagram 1FK6080

3.1 Speed–torque diagrams

Table 3-7 Standard motor 1FK6083

| 1FK6083 | | | | |
|-----------------------------------|----------------------------|----------------------------|-------|--|
| Technical data | Code | Units | –6AF7 | |
| Engineering data | | | | |
| Rated speed | n_{rated} | RPM | 3000 | |
| Rated torque | M_{rated} (100 K) | Nm | 10.5 | |
| Rated current | I_{rated} | A | 7.7 | |
| Stall torque | M_0 (60 K) | Nm | 13.3 | |
| Stall torque | M_0 (100 K) | Nm | 16 | |
| Stall current | I_0 (60 K) | A | 8.3 | |
| Stall current | I_0 (100 K) | A | 10.4 | |
| Moment of inertia (with brake) | J_{mot} | 10^{-4} kgm ² | 29.7 | |
| Moment of inertia (without brake) | J_{mot} | 10^{-4} kgm ² | 27.1 | |
| Limit data | | | | |
| Max. speed | n_{max} | RPM | 4400 | |
| Max. torque | M_{max} | Nm | 50 | |
| Peak current | I_{max} | A | 36 | |
| Limiting torque | M_{limit} | Nm | 42 | |
| Limiting current | I_{limit} | A | 29 | |
| Physical constants | | | | |
| Torque constant | k_T | Nm/A | 1.54 | |
| Voltage constant | k_E | V/1000 RPM | 102 | |
| Winding resistance | R_{ph} | Ohm | 0.54 | |
| Three-phase inductance | L_D | mH | 6.0 | |
| Electrical time constant | T_{el} | ms | 11.1 | |
| Mechanical time constant | T_{mech} | ms | 1.8 | |
| Thermal time constant | T_{th} | min | 35 | |
| Thermal resistance | R_{th} | W/K | 0.15 | |
| Weight with brake | m | kg | 18.2 | |
| Weight without brake | m | kg | 17 | |

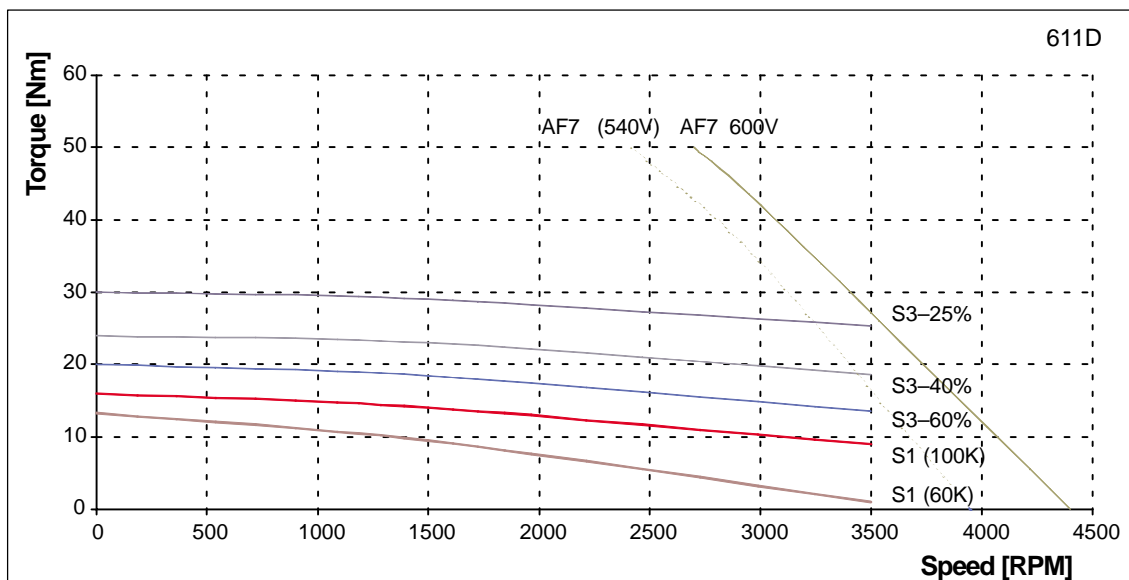


Fig. 3-7 Speed–torque diagram 1FK6083

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

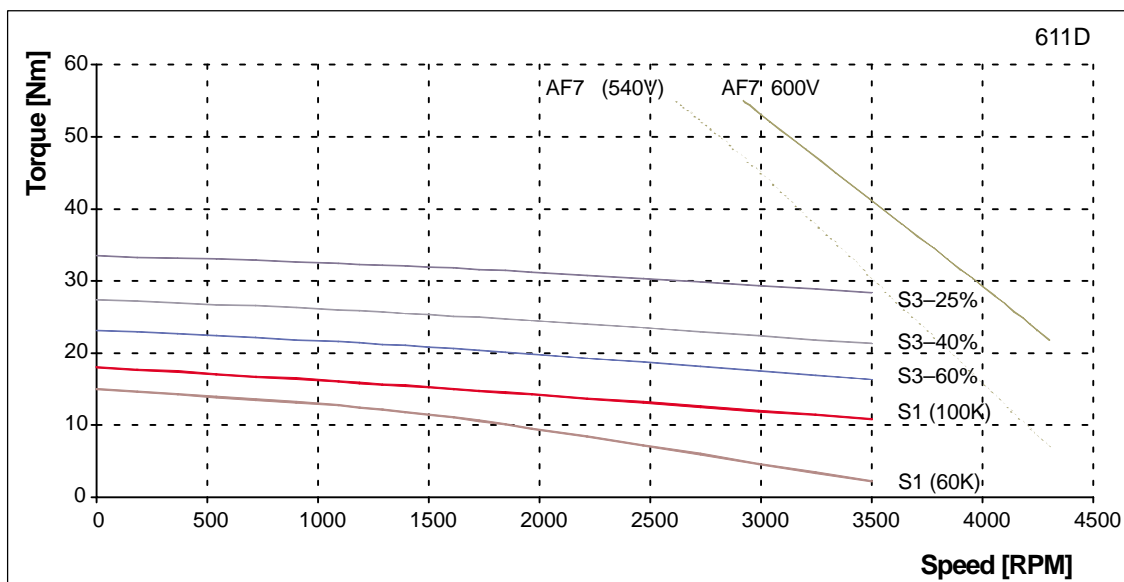


Fig. 3-8 Speed–torque diagram 1FK6100

3.1 Speed-torque diagrams

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 | |

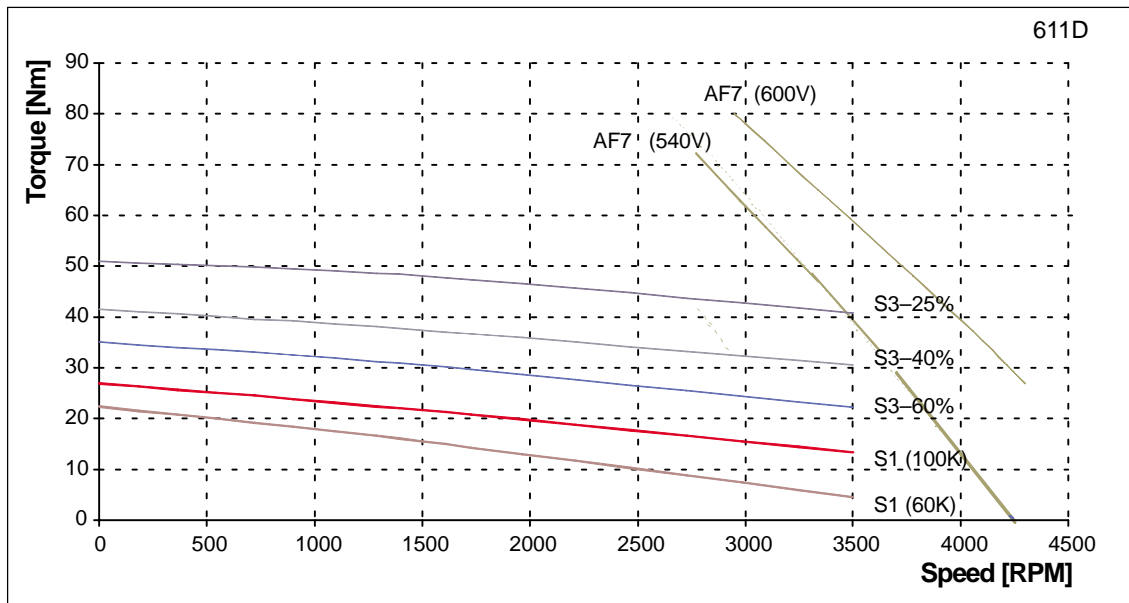


Fig. 3-9 Speed-torque diagram 1FK6101

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 | |

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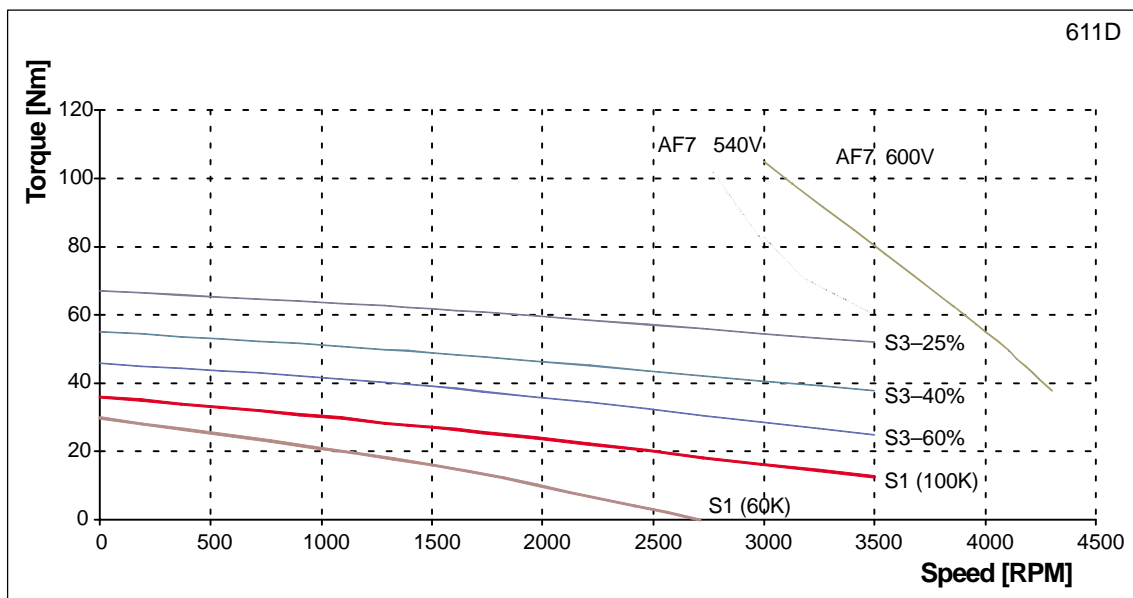


Fig. 3-10 Speed–torque diagram 1FK6103

3.1 Speed–torque diagrams

Table 3-11 Standard motor 1FK6043 HD

| 1FK6043 HD | | | | |
|-----------------------------------|------------------------------------|-------------------------|-------|--|
| Technical data | Code | Units | –7AH7 | |
| Engineering data | | | | |
| Rated speed | n_{rated} | RPM | 4500 | |
| Rated torque | $M_{\text{rated}} (100 \text{ K})$ | Nm | 2.6 | |
| Rated current | I_{rated} | A | 4.0 | |
| Stall torque | $M_0 (60 \text{ K})$ | Nm | 2.5 | |
| Stall torque | $M_0 (100 \text{ K})$ | Nm | 3.1 | |
| Stall current | $I_0 (60 \text{ K})$ | A | 3.6 | |
| Stall current | $I_0 (100 \text{ K})$ | 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 | |

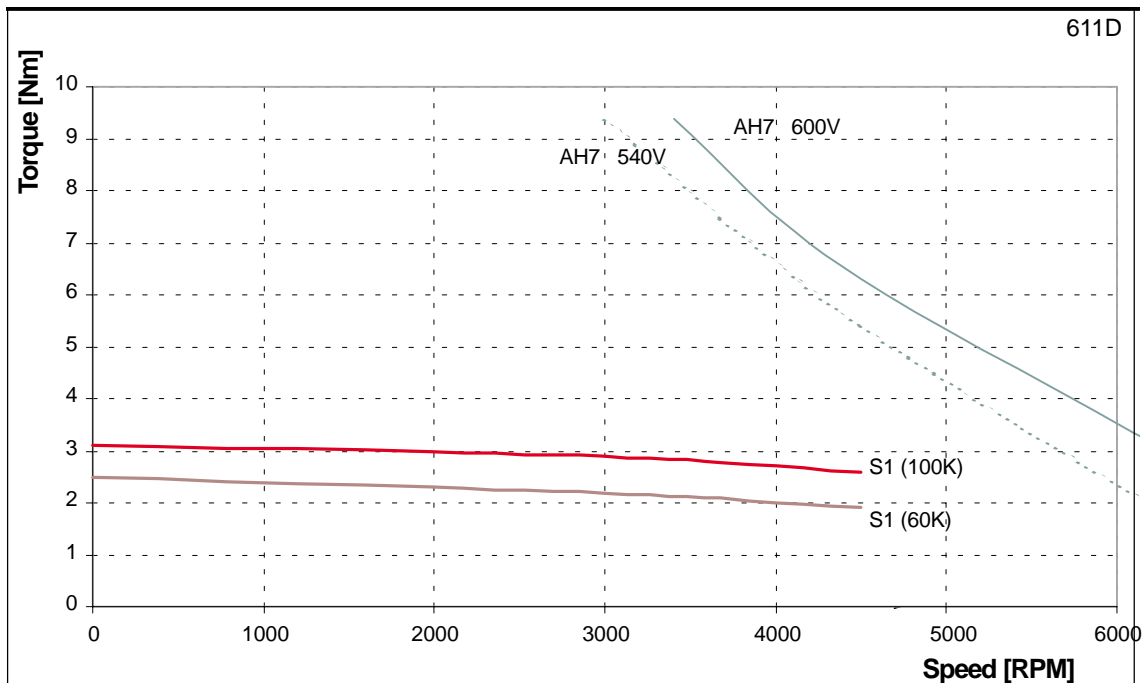


Fig. 3-11 Speed–torque diagram 1FK6043 HD

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

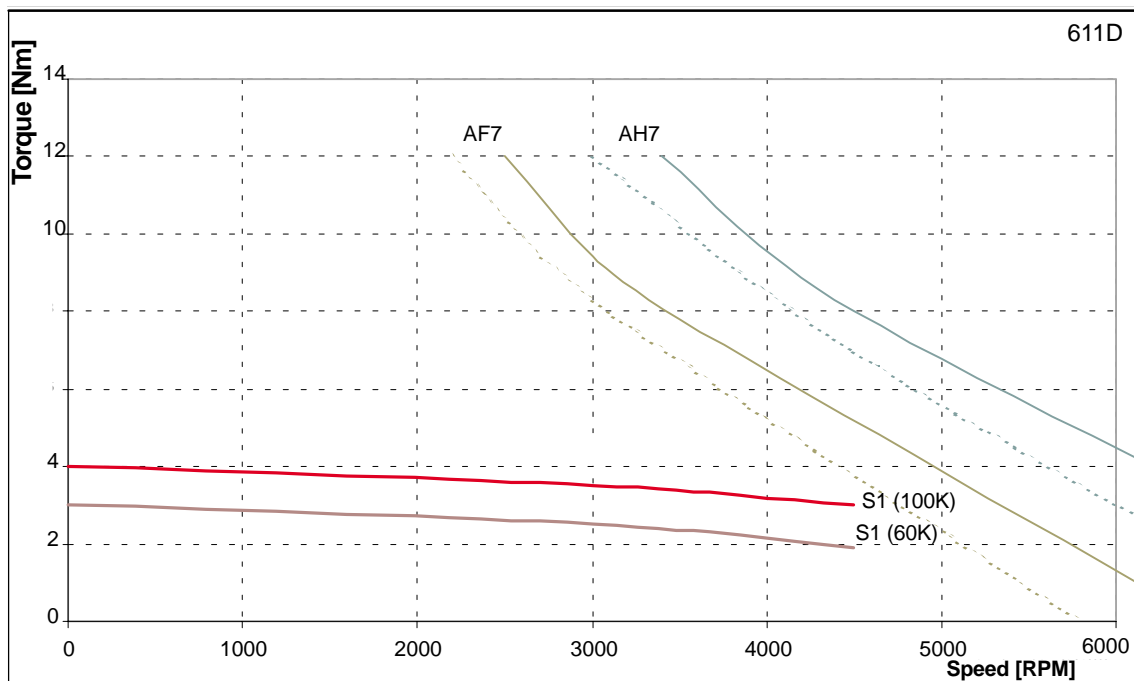


Fig. 3-12 Speed–torque diagram 1FK6044 HD

3.1 Speed–torque diagrams

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 | $M_{\text{rated}} (100 \text{ K})$ | Nm | 5.4 | 4.3 | |
| Rated current | I_{rated} | A | 5.3 | 5.9 | |
| Stall torque | $M_0 (60 \text{ K})$ | Nm | 4.9 | 4.9 | |
| Stall torque | $M_0 (100 \text{ K})$ | Nm | 6.4 | 6.4 | |
| Stall current | $I_0 (60 \text{ K})$ | A | 4.8 | 7.0 | |
| Stall current | $I_0 (100 \text{ K})$ | 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 | |

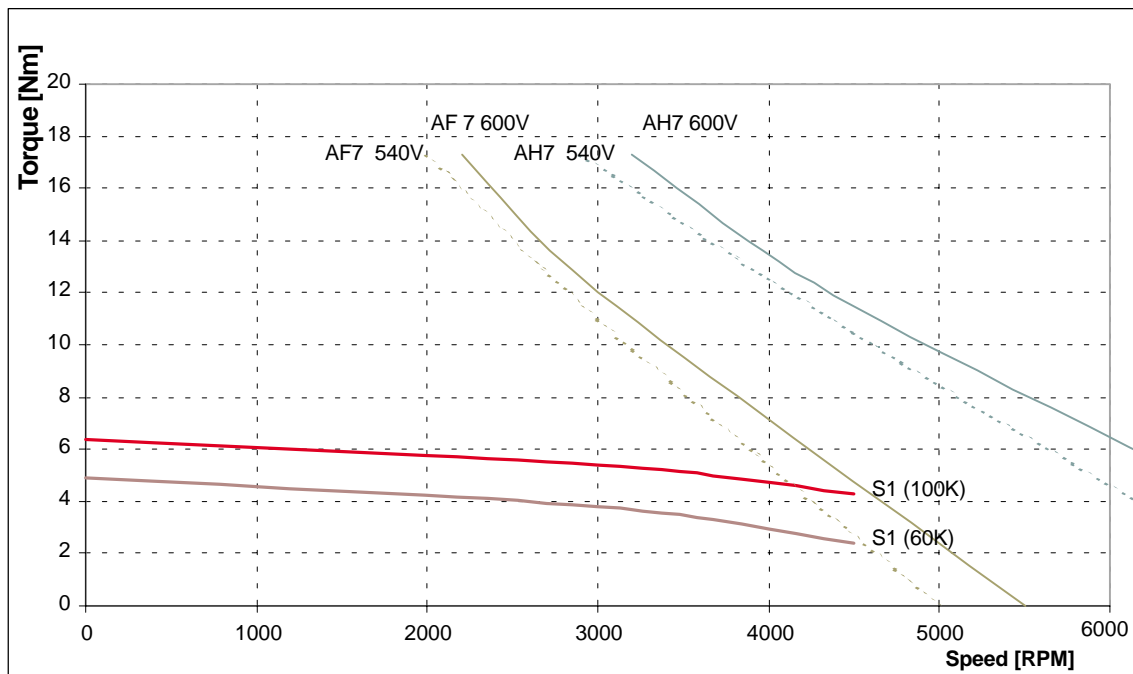


Fig. 3-13 Speed–torque diagram 1FK6061 HD

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 | |

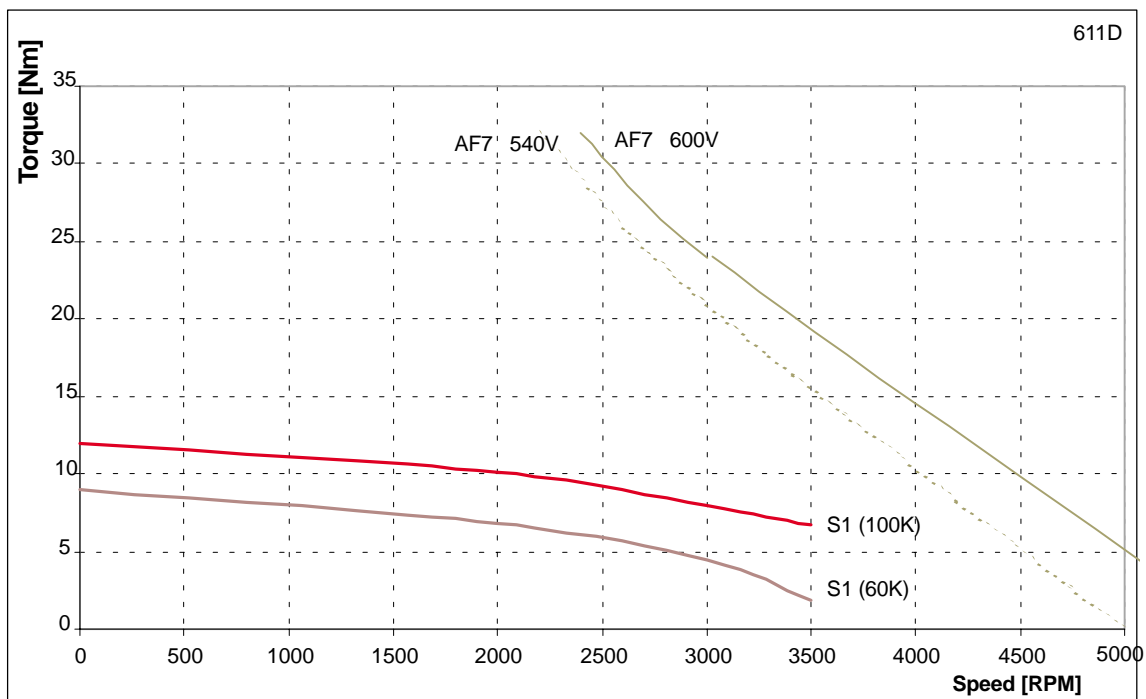
1FK6

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.



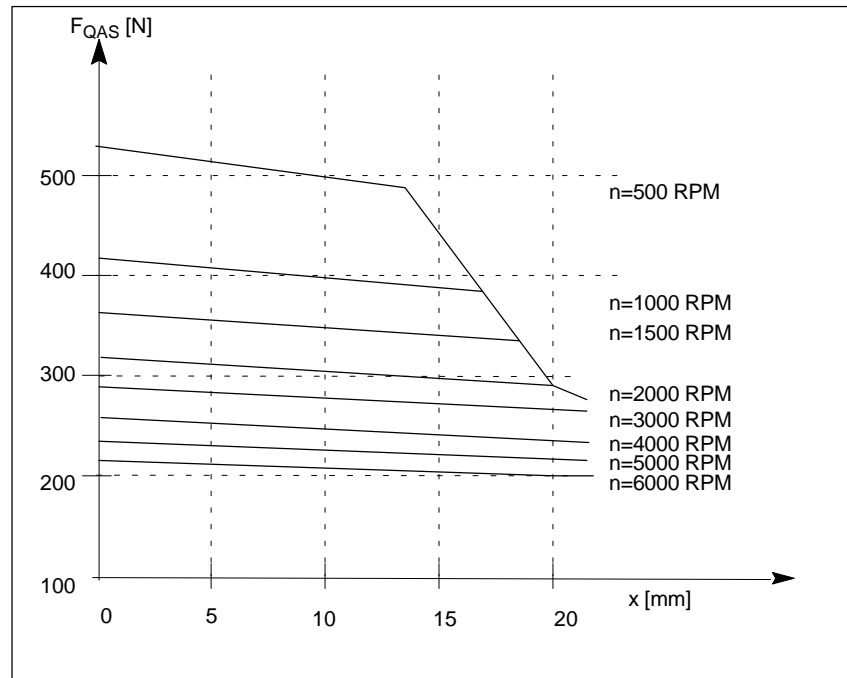
Caution

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.

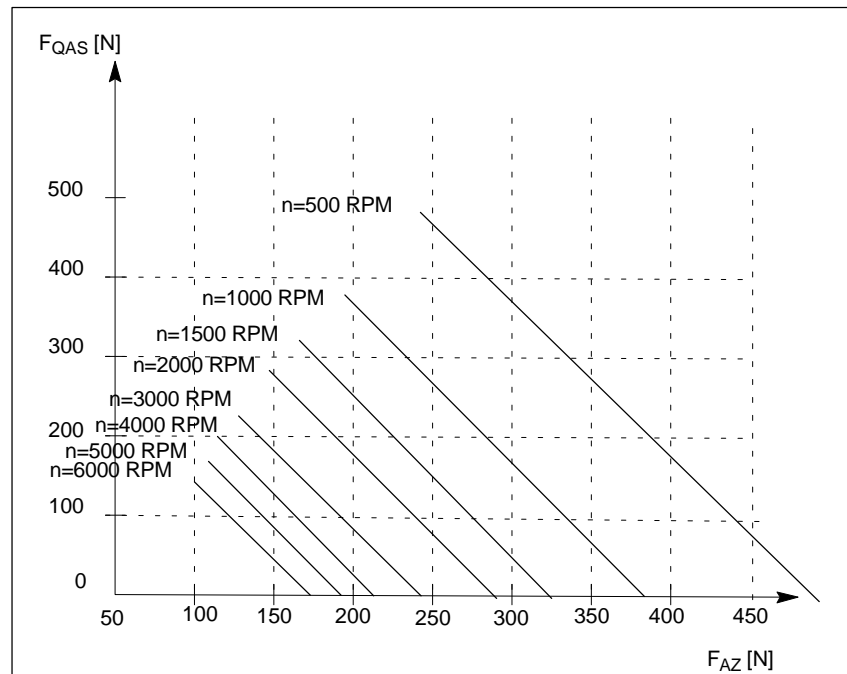
Cantilever force 1FK602

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

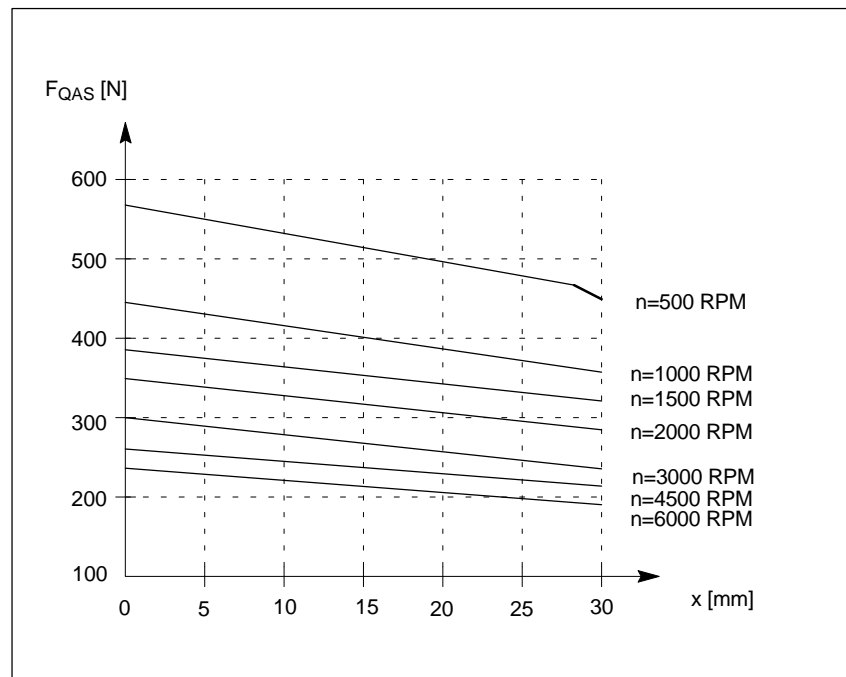
Permissible axial force as a function of the cantilever force.



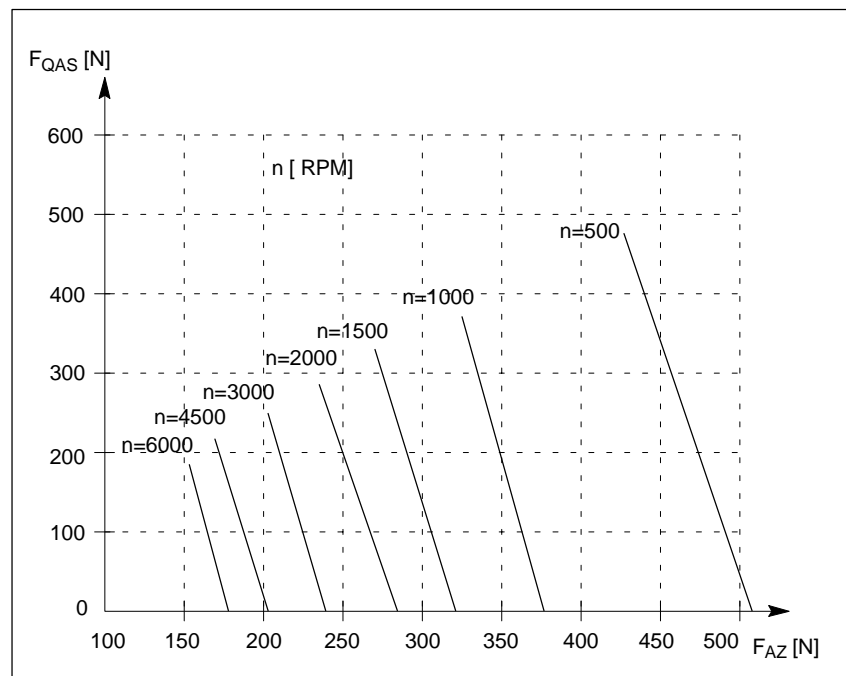
3.2 Cantilever/axial force diagrams

**Cantilever force
1FK603**

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

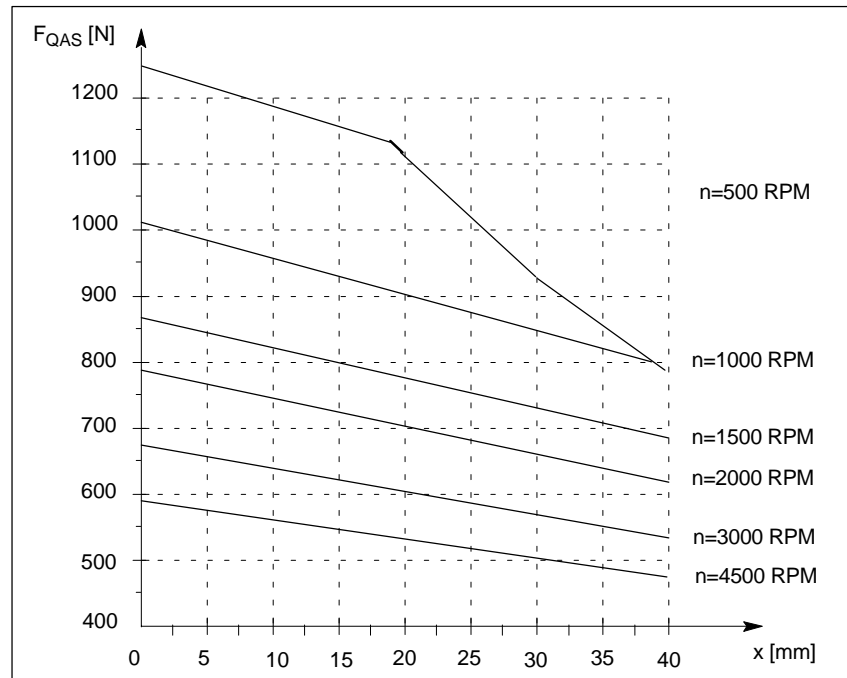
**Axial force
1FK603**

Permissible axial force as a function of the cantilever force



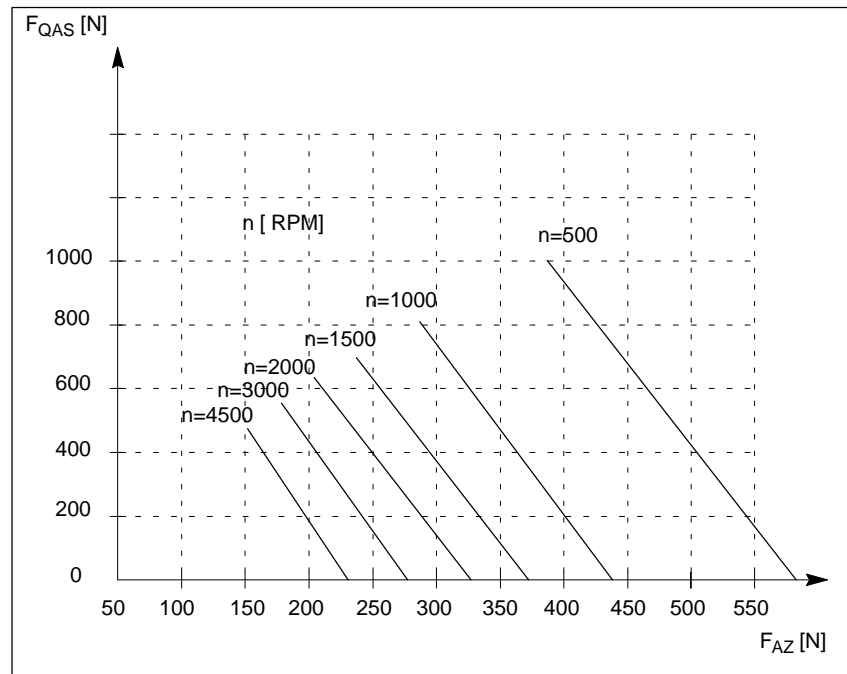
Cantilever force 1FK604

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


1FK6

Axial force 1FK604

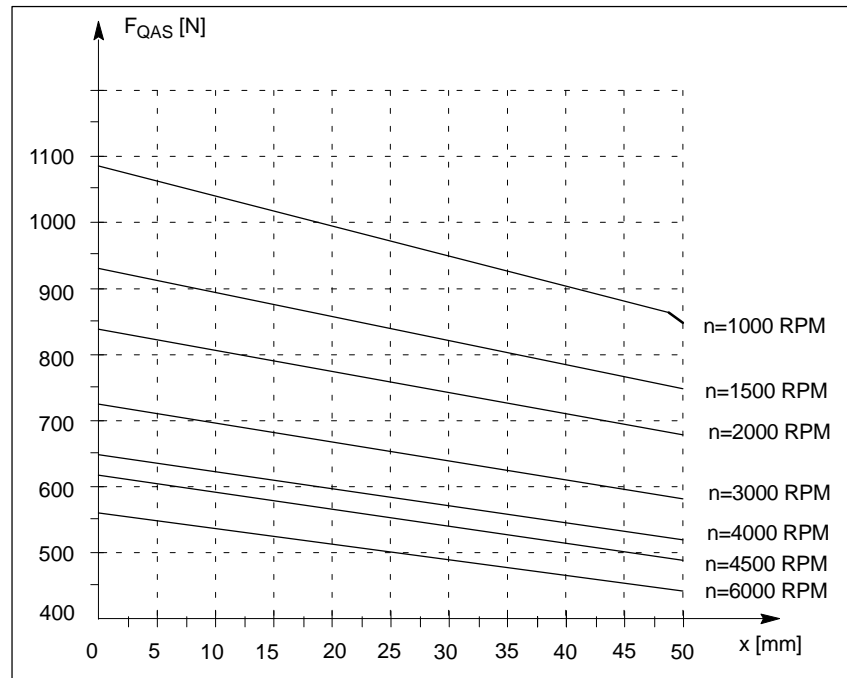
Permissible axial force as a function of the cantilever force



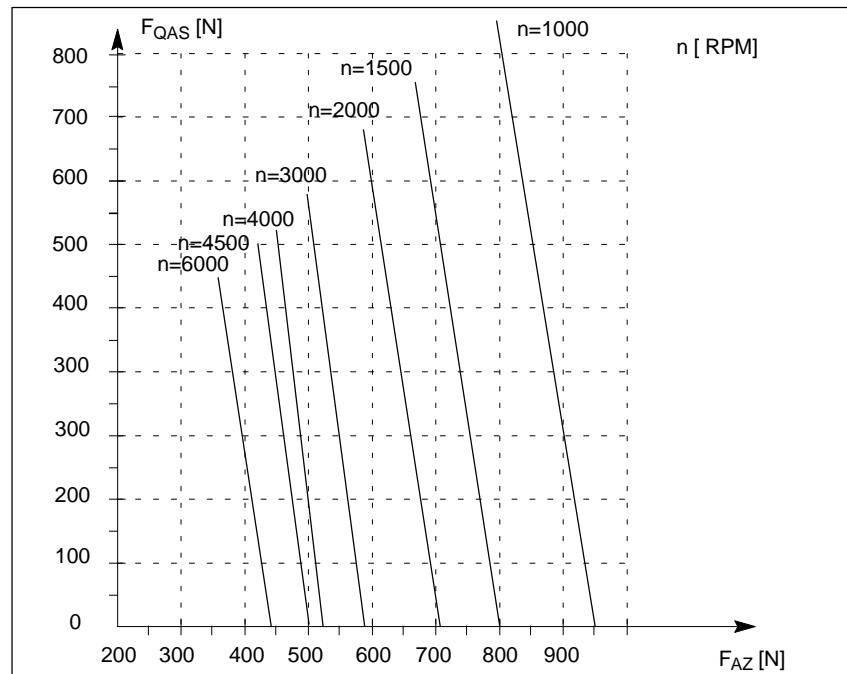
3.2 Cantilever/axial force diagrams

**Cantilever force
1FK6060**

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

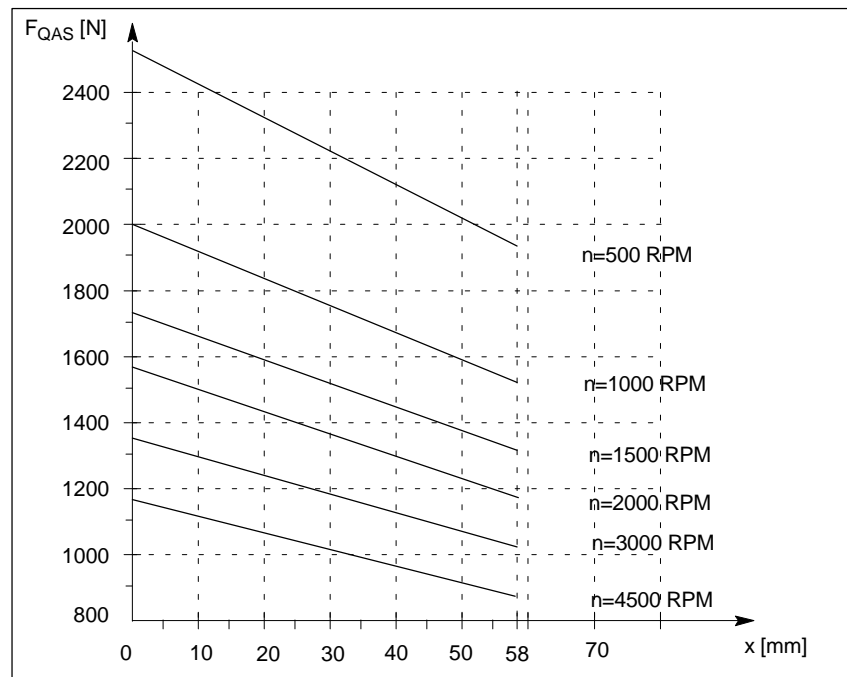
**Axial force
1FK6060**

Permissible axial force as a function of the cantilever force



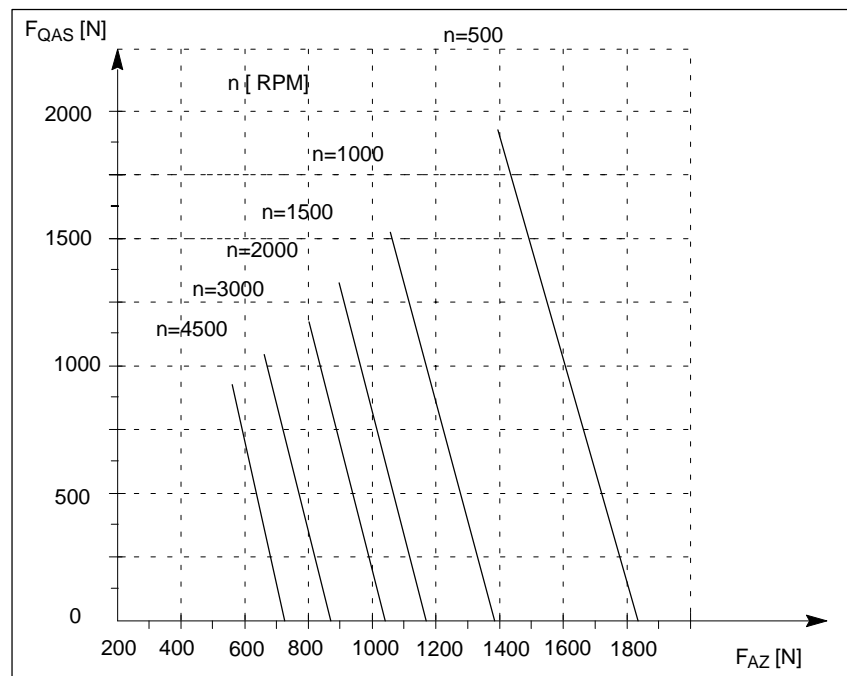
Cantilever force 1FK6080

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


1FK6

Axial force 1FK6080

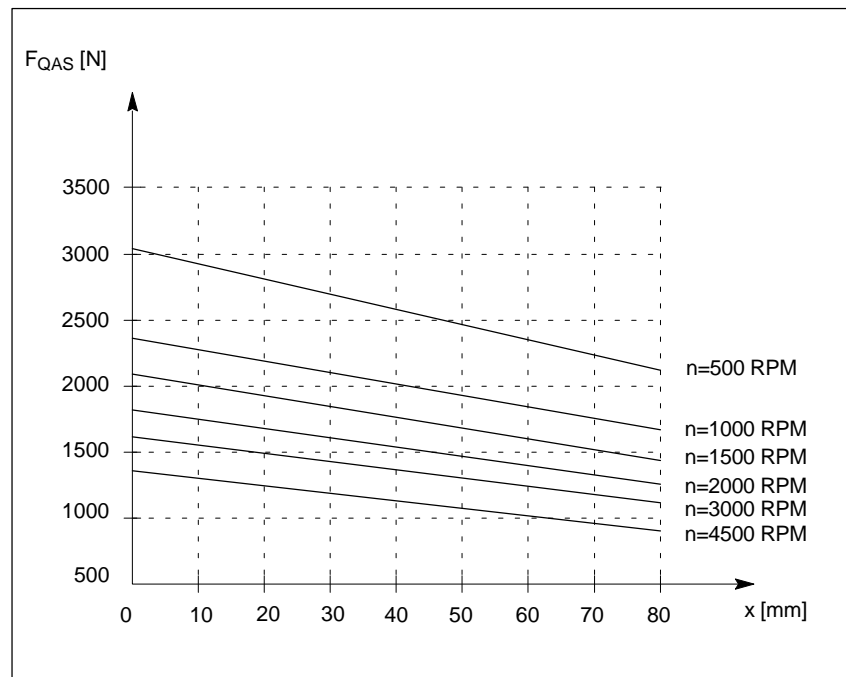
Permissible axial force as a function of the cantilever force



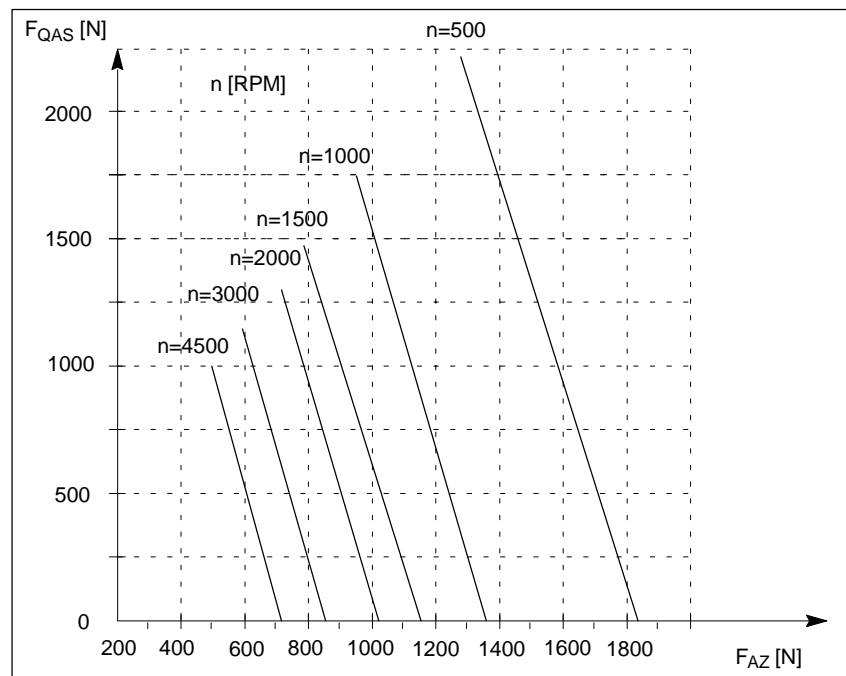
3.2 Cantilever/axial force diagrams

**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

| | |
|--|-----------|
| 1FK6032 non-ventilated with angled connector, size 1 | 1FK6/4-42 |
| 1FK604□ non-ventilated with angled connector, size 1 | 1FK6/4-43 |
| 1FK604□-7 non-ventilated with angled connector, size 1 | 1FK6/4-44 |
| 1FK606□ non-ventilated with angled connector, size 1 | 1FK6/4-45 |
| 1FK606□-7 non-ventilated with angled connector, size 1 | 1FK6/4-46 |
| 1FK608□ non-ventilated with connector, size 1 | 1FK6/4-47 |
| 1FK6100 non-ventilated with connector, size 1 | 1FK6/4-48 |
| 1FK610□ non-ventilated with connector, size 1.5 | 1FK6/4-49 |

1FK6

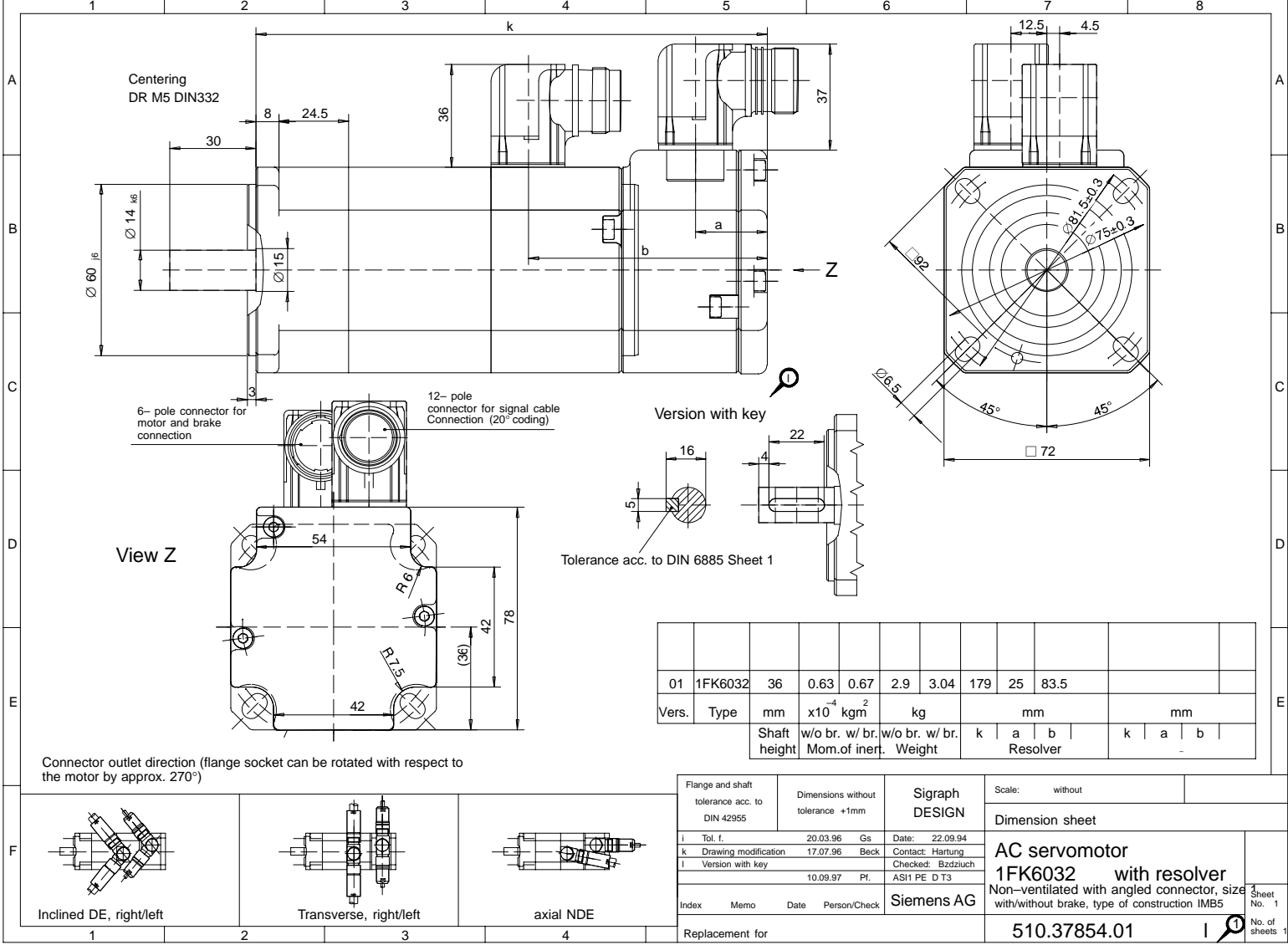


Fig. 4-1 1FK6032 non-ventilated with angled connector, size 1



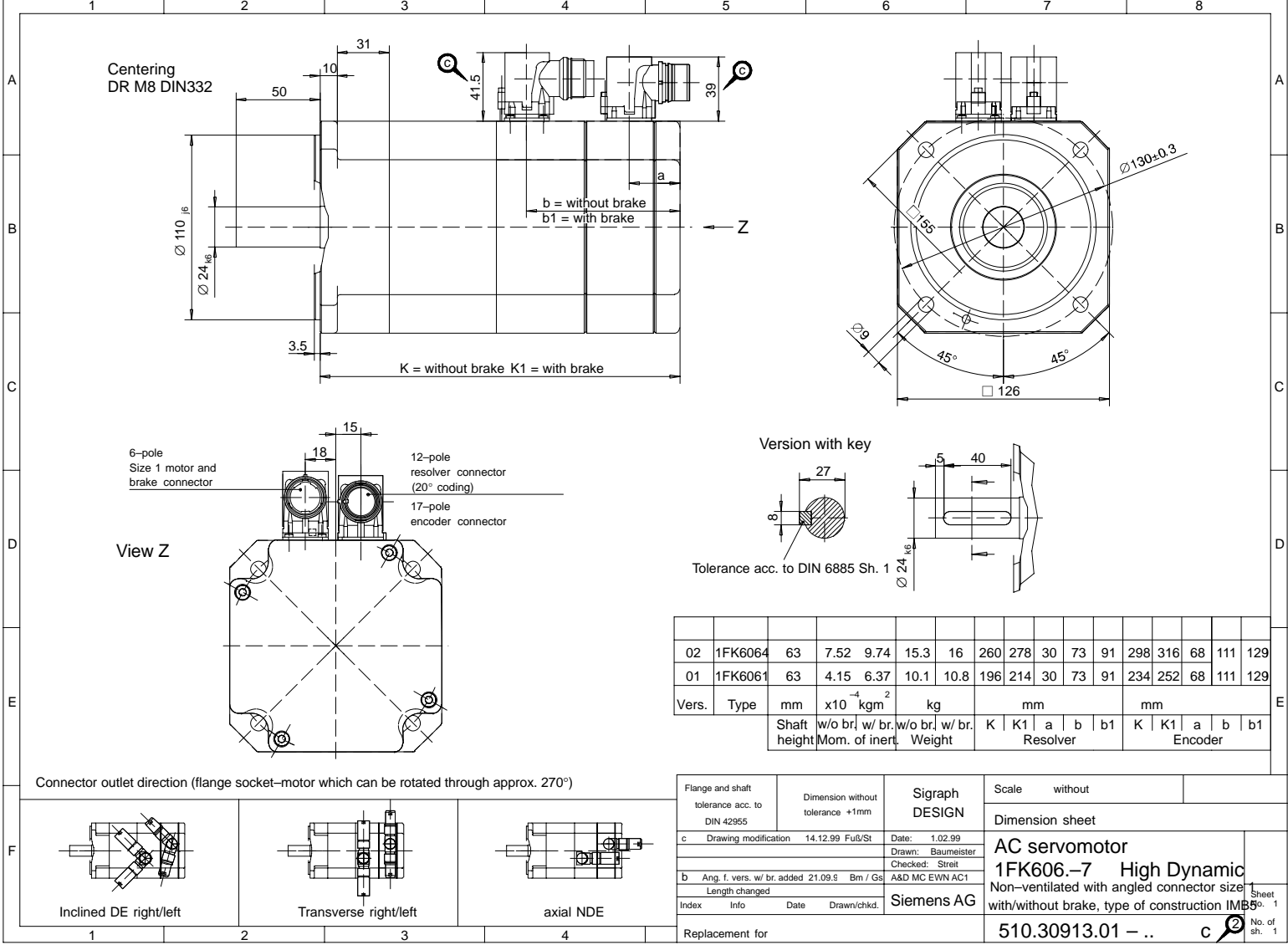


Fig. 4-5 1FK606-7 non-ventilated with angled connector, size 1

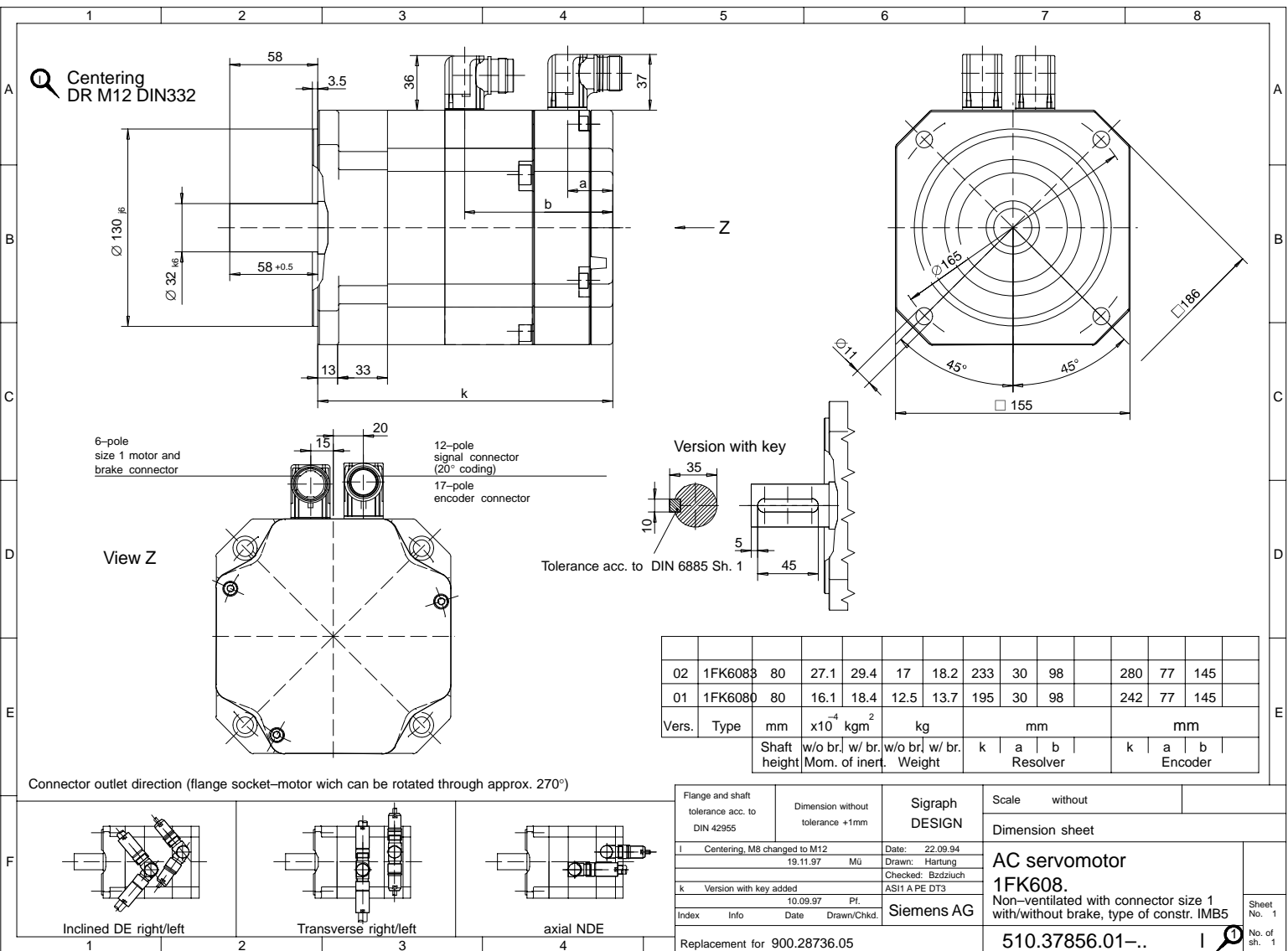


Fig. 4-6 1FK608 □ non-ventilated with connector, size 1

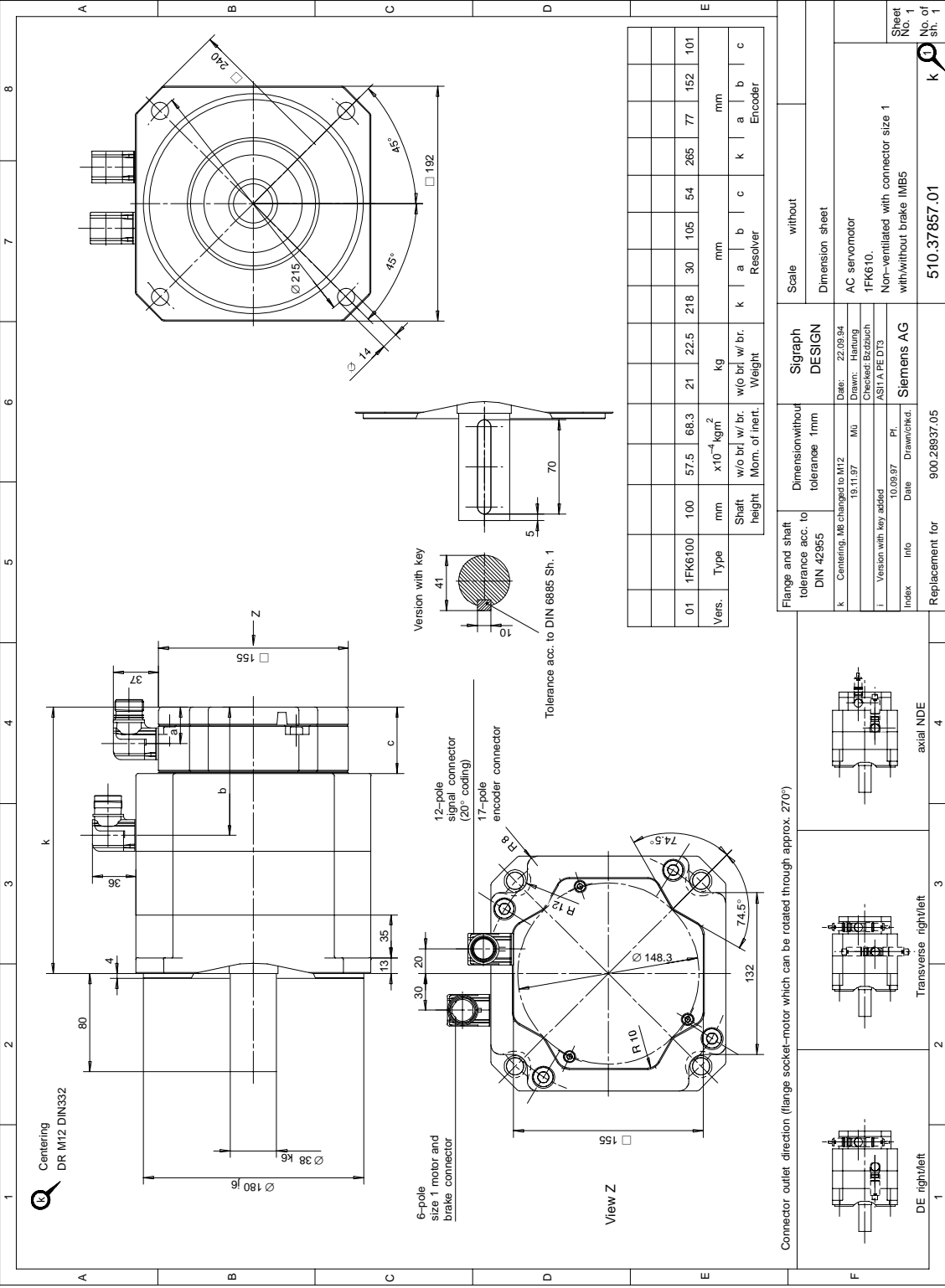
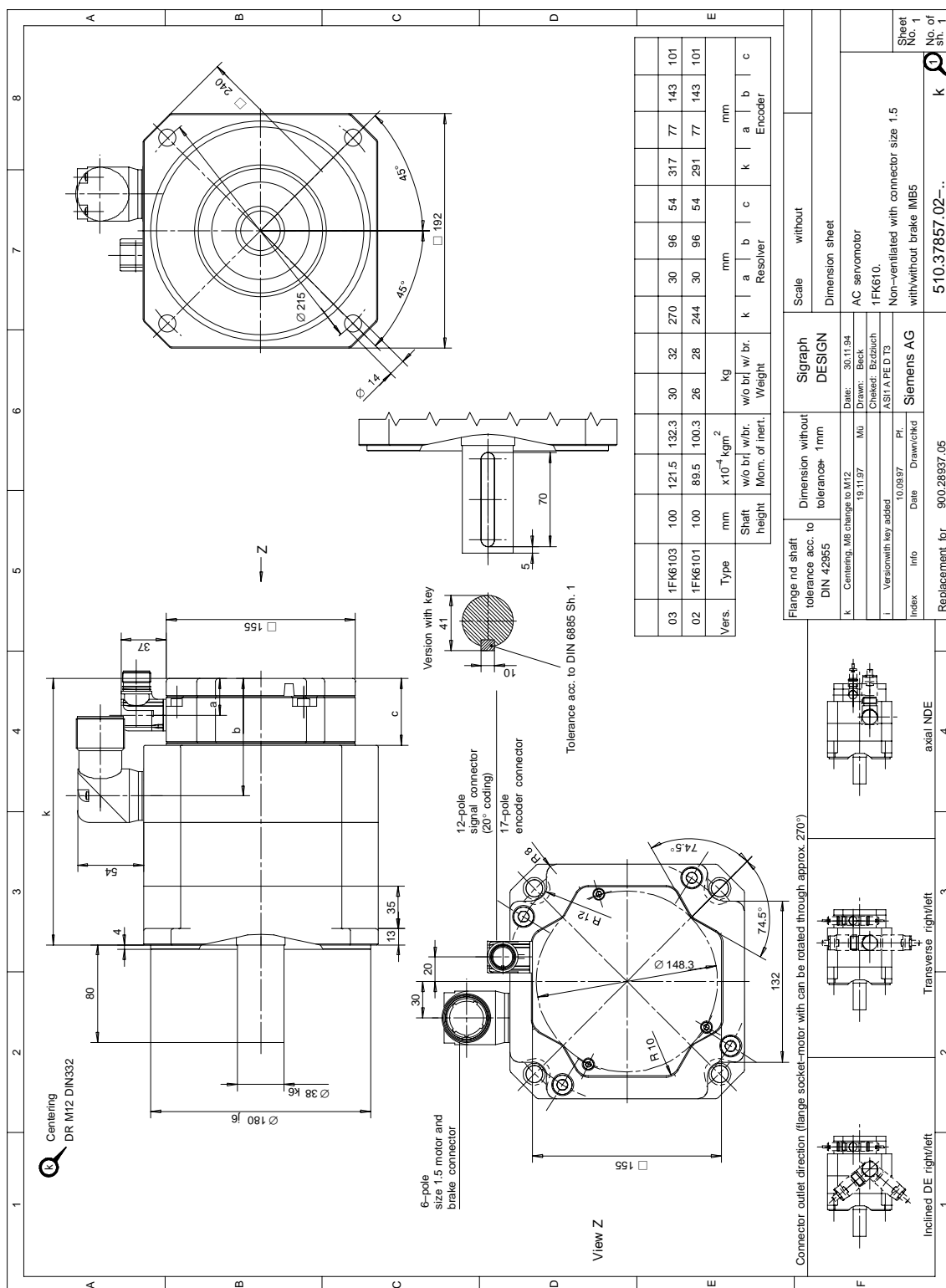


Fig. 4-7 1FK6100 non-ventilated with connector, size 1



1FK6

Fig. 4-8 1FK6101 non-ventilated with connector, size 1.5

Notes

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5

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1FK6

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1PH2 AC Built-in Motors

| | | |
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1PH2

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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.

1PH2

1.1 Characteristics and technical data

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 $T_{H_2O} = 25\text{ °C}$ and $Q = 8\text{ l/min}$ |
| 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 $+25\text{ °C}$ |
| Motor voltage | Max.: 3-ph. 430 V AC |
| Speed control range | $> 1: 500\,000$ |
| Connection type | Motor: free cable ends, $l = 1.5\text{ m}$, preferably $l = 0.5\text{ m}$ 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 encoder ¹⁾ 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 conditionally capable of C axis operation. Refer to the Chapter, Toothed-wheel encoders SIZAG 2, Page GE/2-1 (GE).

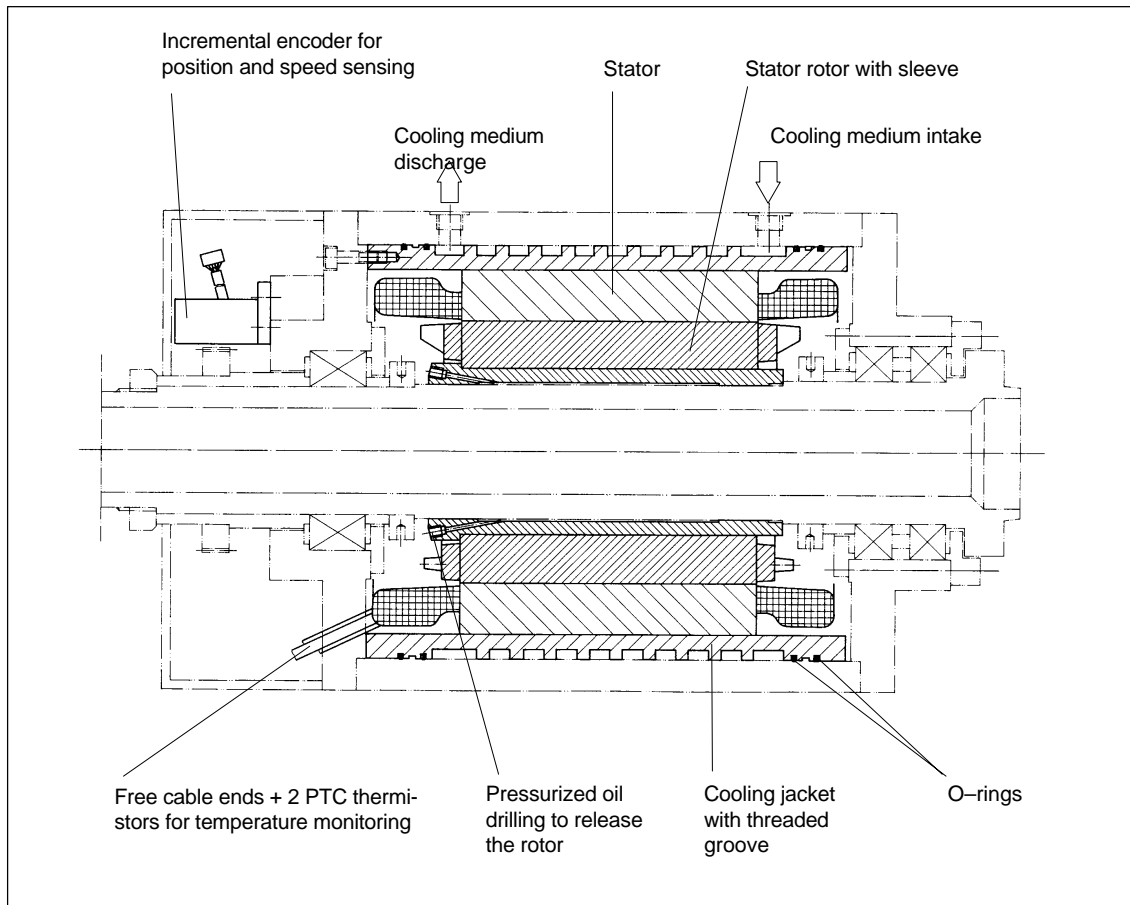
Design**Typical mounting****1PH2**

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

1.1 Characteristics and technical data

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 voltage | 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 _O [A] | U _N [V] | P _{rated} [kW] | | | | I _{rated} [A] | | |
| | | | | | | | S1 ΔT = 70 K | S1 ΔT = 105 K | S6–60 % | S6–40 % | S1 | S6–60 % | S6–40 % |
| | | | | | | | | | | | | | |
| Order No. | | | ΔT = 70 K | ΔT = 105 K | | | | | | | | | |
| Built-in motors with sleeve, rated speed 1500 RPM | | | | | | | | | | | | | |
| 1PH2 093–6WF4□ 1PH2 095–6WF4□ | 1500 | 10000 | 48 64 | 60 83 | 11 14 | 308 333 | 7,5 10,1 | 9,4 13 | 8,2 11 | 9,0 12 | 24 30 | 26 32 | 28 34 |
| 1PH2 113–6WF4□ 1PH2 115–6WF4□ 1PH2 117–6WF4□ 1PH2 118–6WF4□ | 1500 | 10000 | 95 105 115 146 | 118 137 151 197 | 22 22 25 33 | 253 281 274 260 | 15,1 16,5 18,1 23,6 | 18,5 21,5 23,7 30,9 | 17 18,5 20,5 26,0 | 19 21 23 29,5 | 56 55 60 82 | 61 60 67 90 | 67 66 74 100 |
| 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 1PH2 096–4WG42 | 2000 | 18000 | 22 48 | 34 76 | 11 22 | 208 215 | 4,7 10,1 | 7,1 15,9 | 5,2 11 | 5,8 12,3 | 22 43 | 23 46 | 25 50 |
| 1PH2 123–4WF42 1PH2 127–4WF42 1PH2 128–4WF42 | 1500 | 16000 | 73 134 159 | 108 203 235 | 21 33 37 | 173 211 204 | 11,5 21 25 | 17 31,9 36,9 | 13,5 25 29,5 | 16 29 35 | 57 85 101 | 64 97 116 | 74 108 132 |
| 1PH2 143–4WF42 1PH2 147–4WF42 | 1500 | 12000 | 191 242 | 286 350 | 42 44 | 246 263 | 30 38 | 44,9 55 | 36 46 | 42 53 | 101 116 | 116 136 | 132 153 |

1) Data for $\Delta T = 70$ K and rated speed, if not otherwise specified

Winding temperature rise $\Delta T = 105$ K:

1PH2 built-in motors can be utilized, instead of a winding temperature rise $\Delta T = 70$ K, with $\Delta T = 105$ 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 $\Delta T = 70$ 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 | | | | | |
| 1PH2093-6WF42 1PH2095-6WF42 | 67 | 85 | 180 | 205 | 250 300 |
| 1PH2113-6WF42 1PH2115-6WF42 1PH2117-6WF42 1PH2118-6WF42 | 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 |

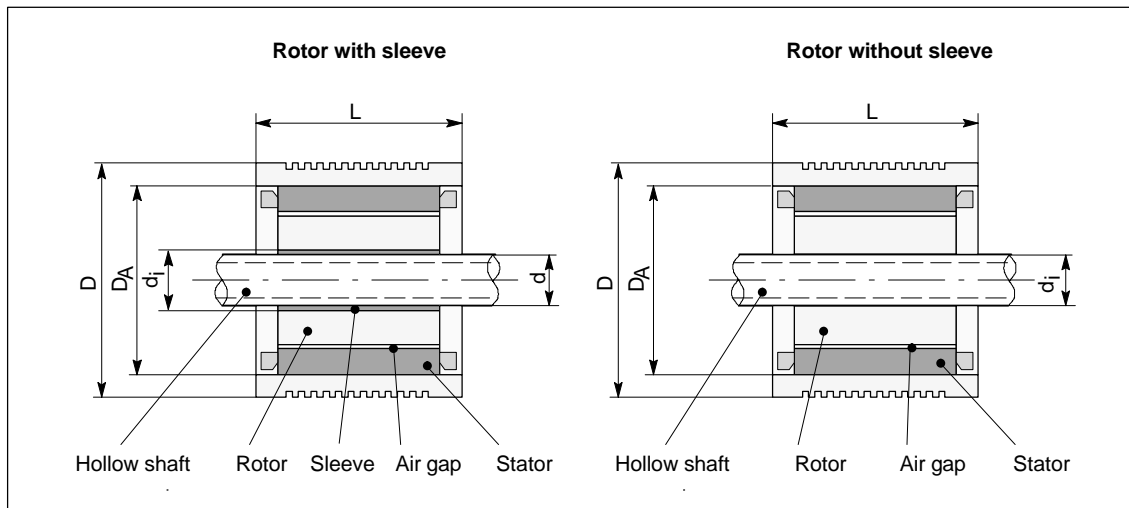
1PH2


Fig. 1-3 Dimensions

1.1 Characteristics and technical data

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 partial 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: ≥ 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.

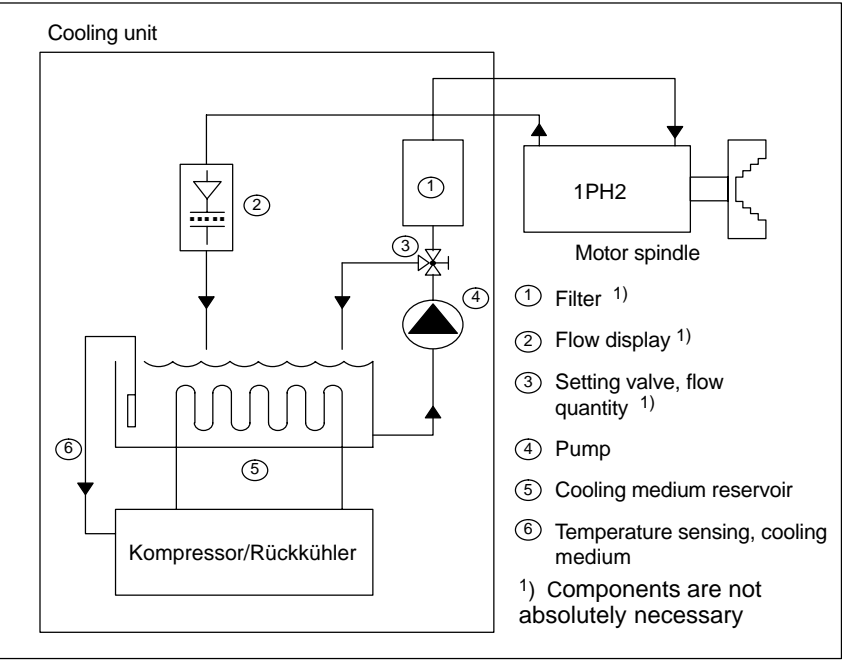


Fig. 1-4 Example of a cooling circuit

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.

1PH2

Note

When grounding, it should be ensured 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 jacket 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

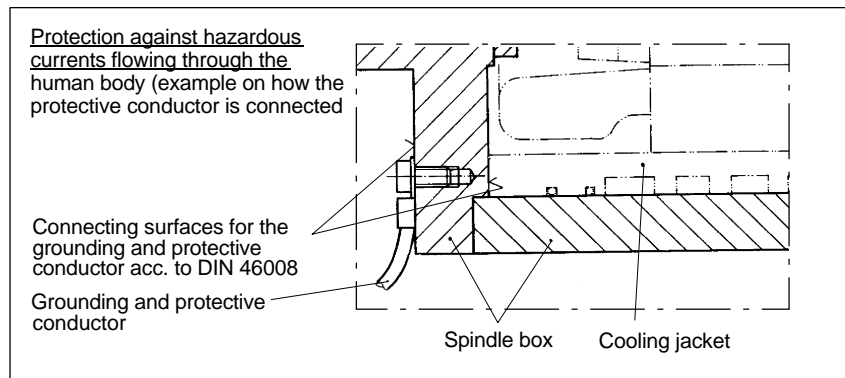


Fig. 1-5 Recommended grounding, motor spindle

High-voltage test

The stators of the built-in motors must be subject 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 appropriate 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 rotor¹⁾.
- The anti-corrosion agent on the mounting surfaces of the rotor sleeve must be removed.
- Clean the oil connection bores¹⁾. 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

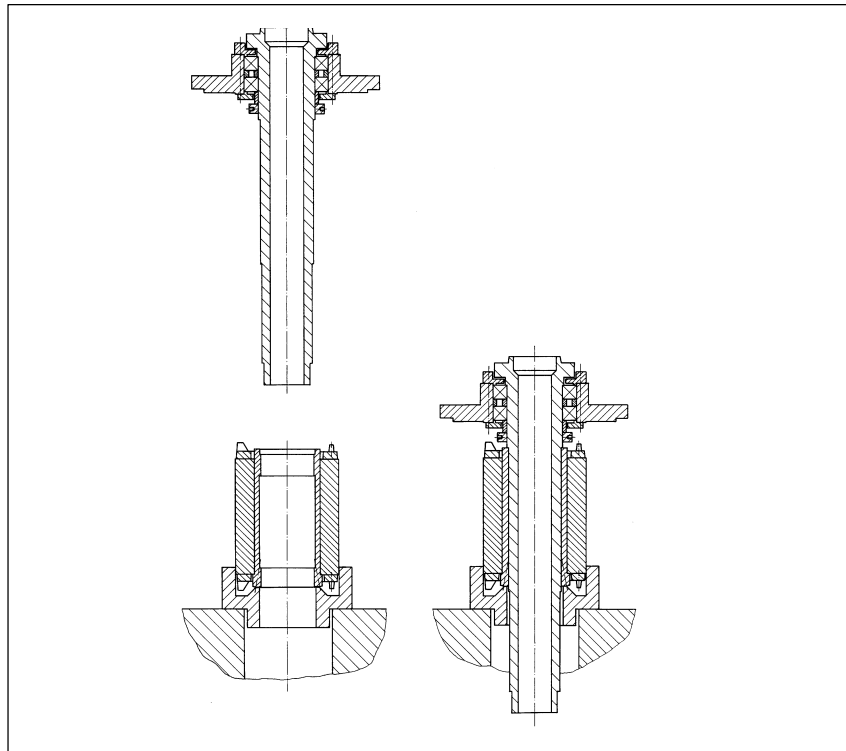


Fig. 1-6 Mounting the rotor onto the spindle

1PH2**Introducing the rotor into the spindle**

- Heat-up the rotor in an oven to $T = 180\text{ °C}$ 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 243¹⁾.
- 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 side¹⁾. 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)

1.4 Assembly

- If the parts do not line-up as required after room temperature has been reached, then this can be achieved by applying oil pressure¹⁾. It is important that the information and instructions in the disassembly section are observed.

Recommended viscosity of the disassembly fluid: 300 mm²/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 mm²/s at 20 °C is recommended (e.g. LH DF 900 from SKF).

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

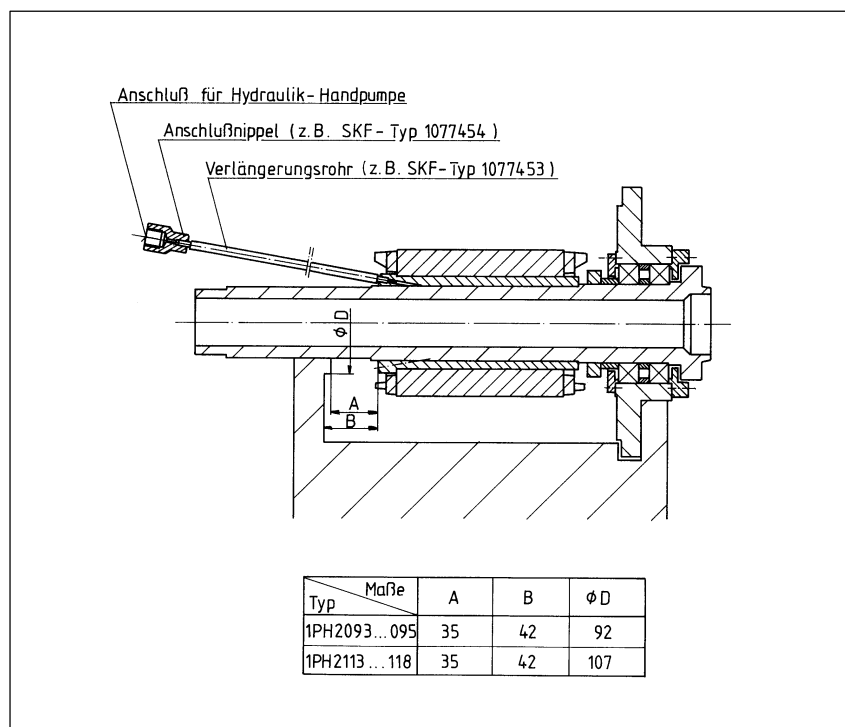
- Slowly increase the pressure in the rotor–spindle assembly to approx. $\frac{2}{3} p_{\max}$, and allow this to take effect for approx. 15 min. This will then allow the oil to be distributed and to penetrate into the joint surfaces. During this time, ensure that the oil pressure does not sink.
- Then, 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.



1PH2

Fig. 1-7 Disassembly, built-in motors with sleeve

1.4 Assembly

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 | G 2.5 |
| 1PH2113 – 118 | G 2.5 |
| 1PH2182 – 188 | G 2.5 |
| 1PH2254 – 256 | G 2.5 |

- The rotors without sleeve are not balanced

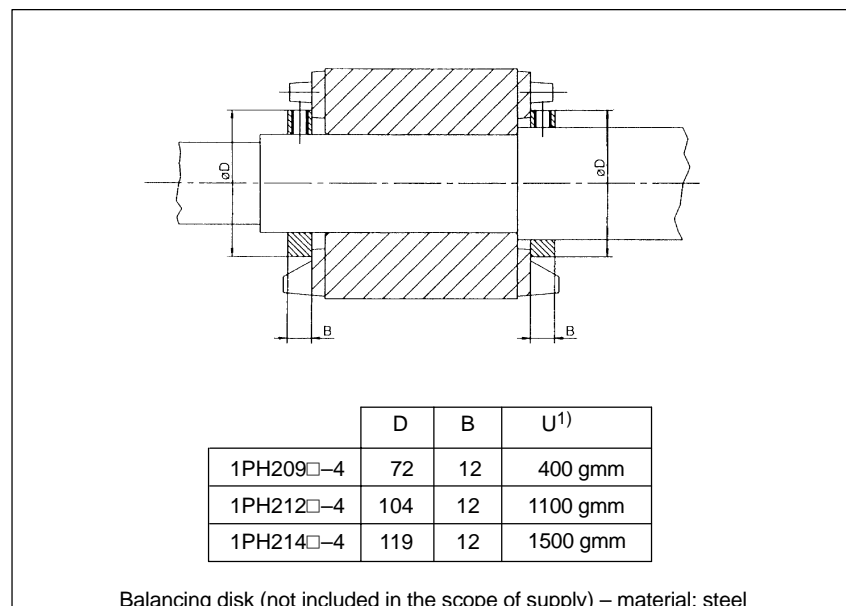


Fig. 1-8 Recommended, balancing disk balancing for built-in motors without sleeve

- 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 Minimum insulating clearances

| Supply voltage in [V] | ≤ 500 | > 500 to 660 |
|----------------------------|-------|--------------|
| Min. air clearance in [mm] | 4.5 | 6 |

1PH2

1.4 Assembly

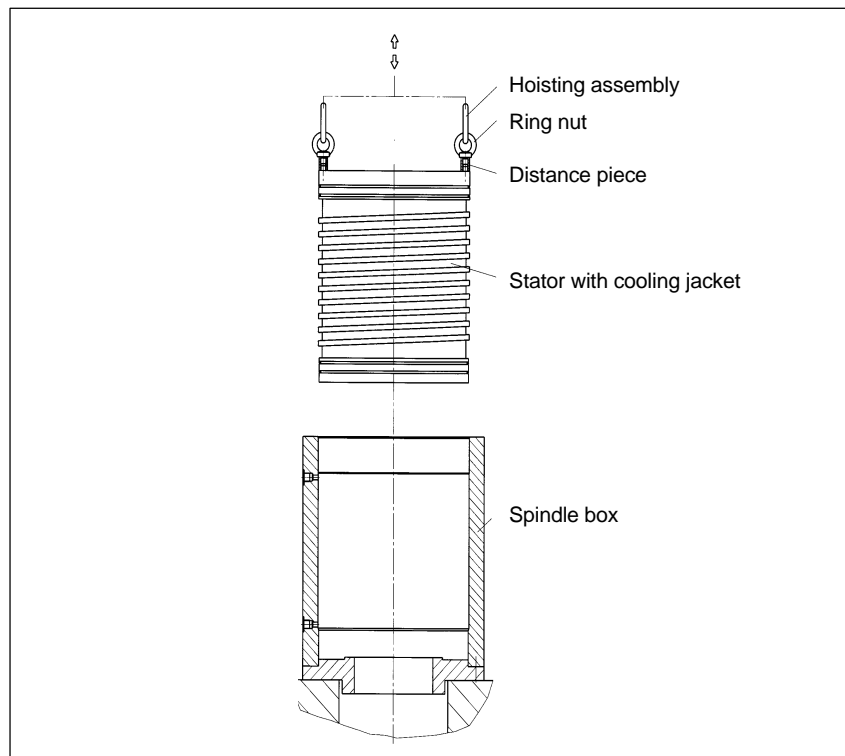


Fig. 1-9 Transporting and installing the built-in motor stator

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 |

1PH2

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.



[illegible]

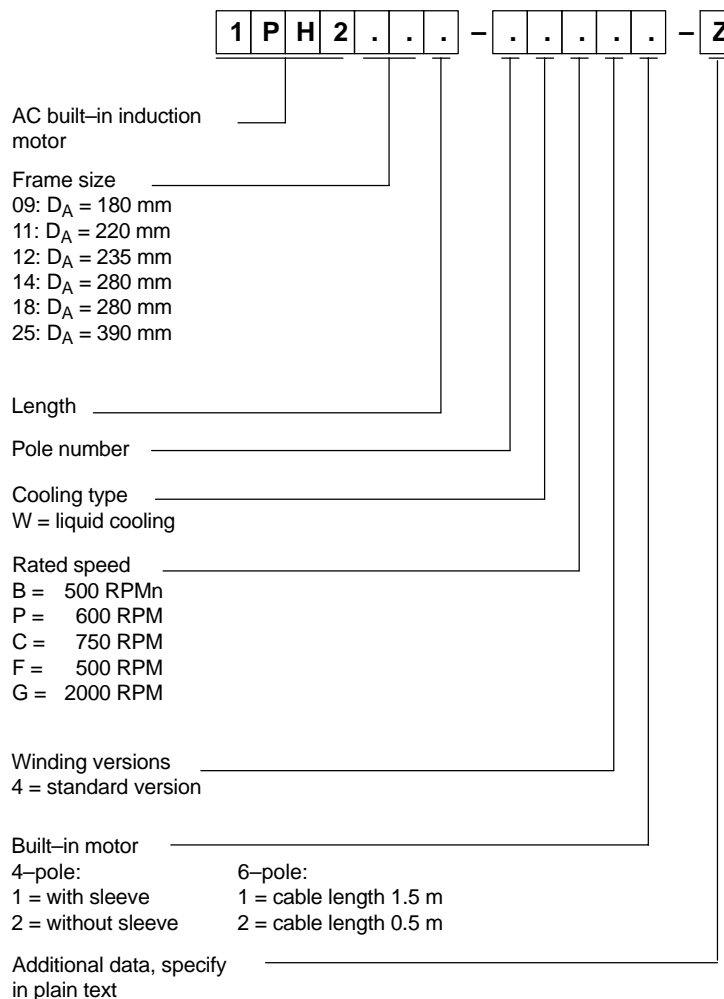
Order Designations

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.



1PH2

2 Order Designations

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 available. 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] |

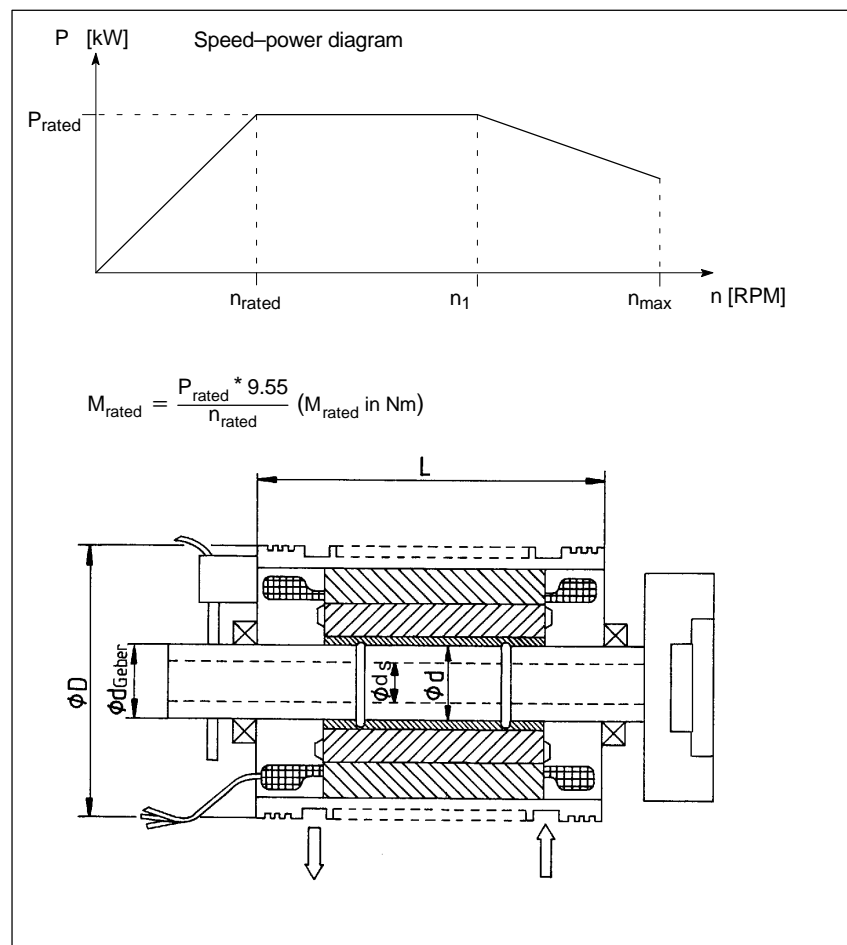
**1PH2**

Fig. 2-1 Checklist terminology



[illegible]

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.

1PH2

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 |

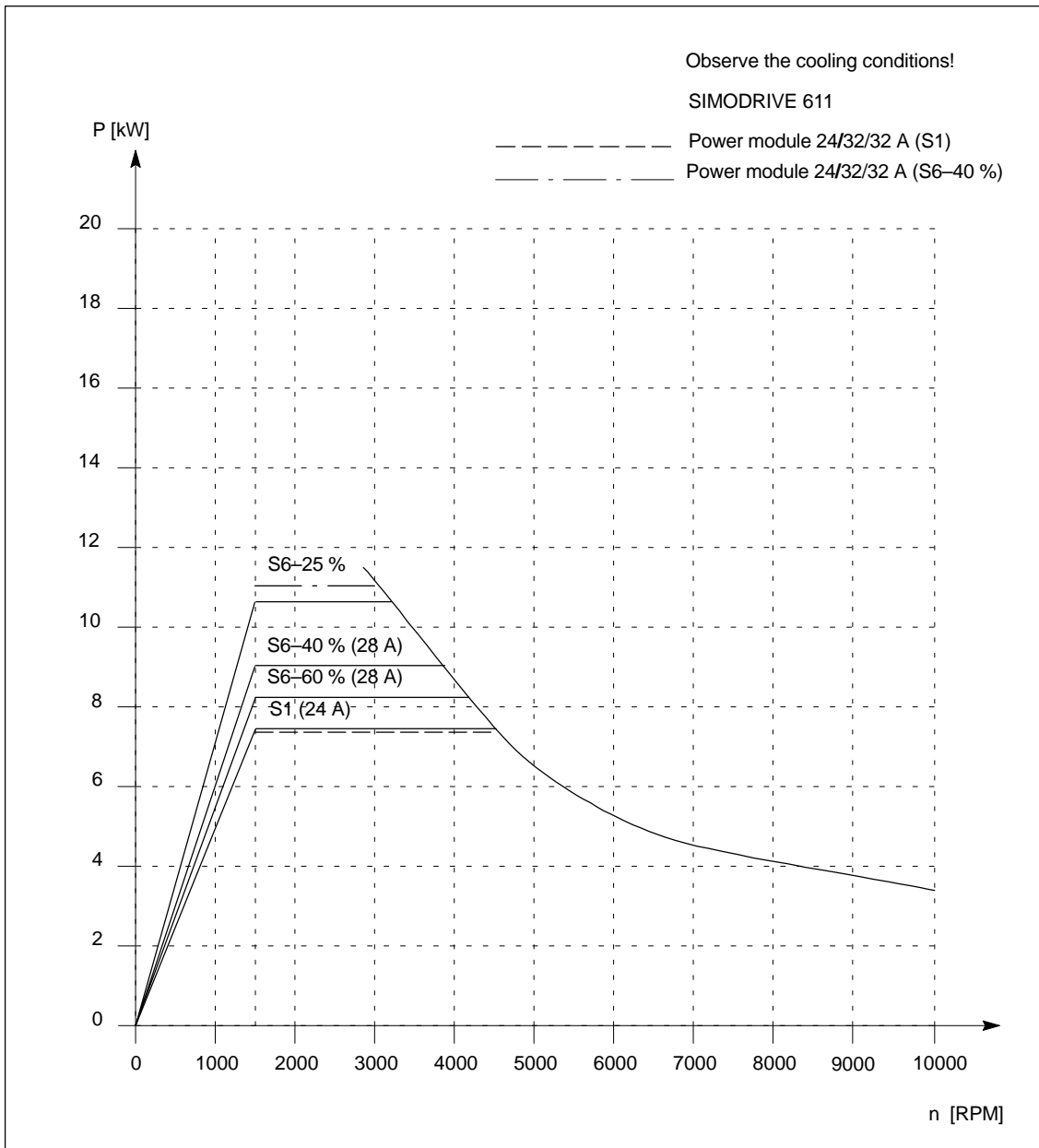


Fig. 3-1 Speed-power diagram 1PH2093-6WF4

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 |

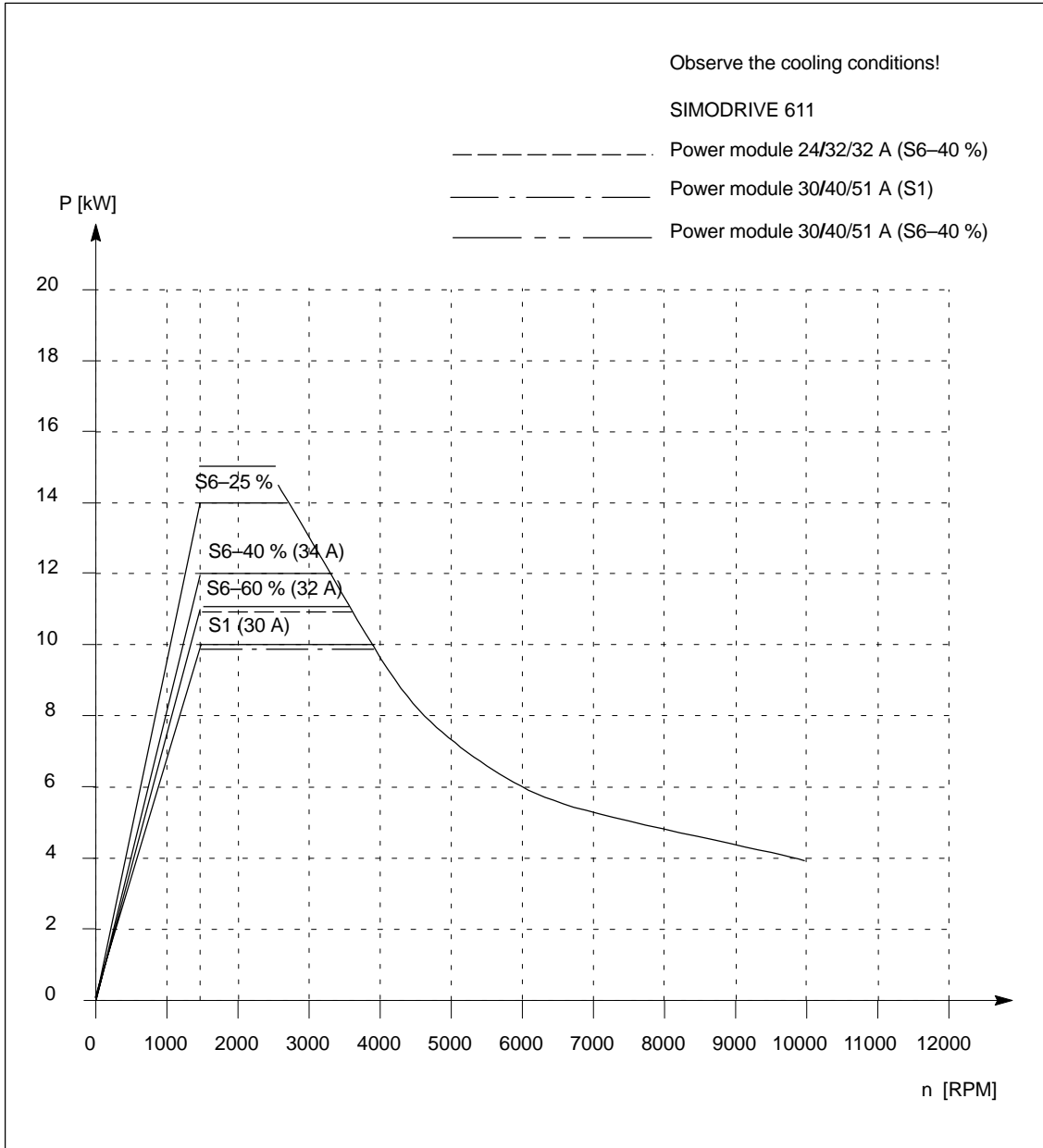


Fig. 3-2 Speed-power diagram 1PH2095-6WF4

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 [kgm ²] | Weight m [kg] |
|--|--|--|--|---|---|---|-----------------------|
| 15 | 1500 | 95 | 56 | 6 | 10000 | 0.066 | 59 |

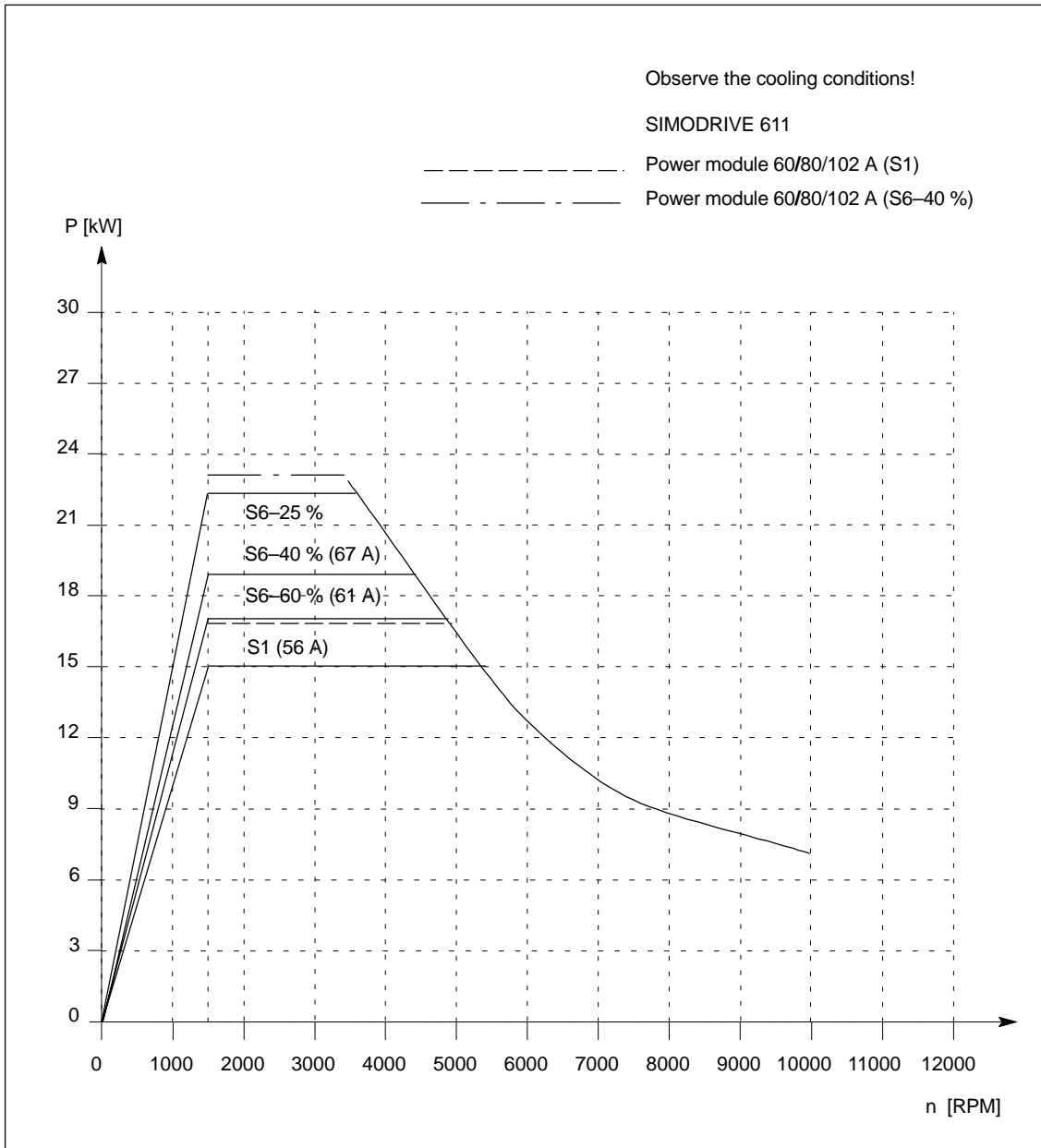


Fig. 3-3 Speed-power diagram 1PH2113-6WF4

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 [kgm ²] | Weight m [kg] |
|--|--|--|--|---|---|---|-----------------------|
| 16.5 | 1500 | 105 | 55 | 6 | 10000 | 0.073 | 65 |

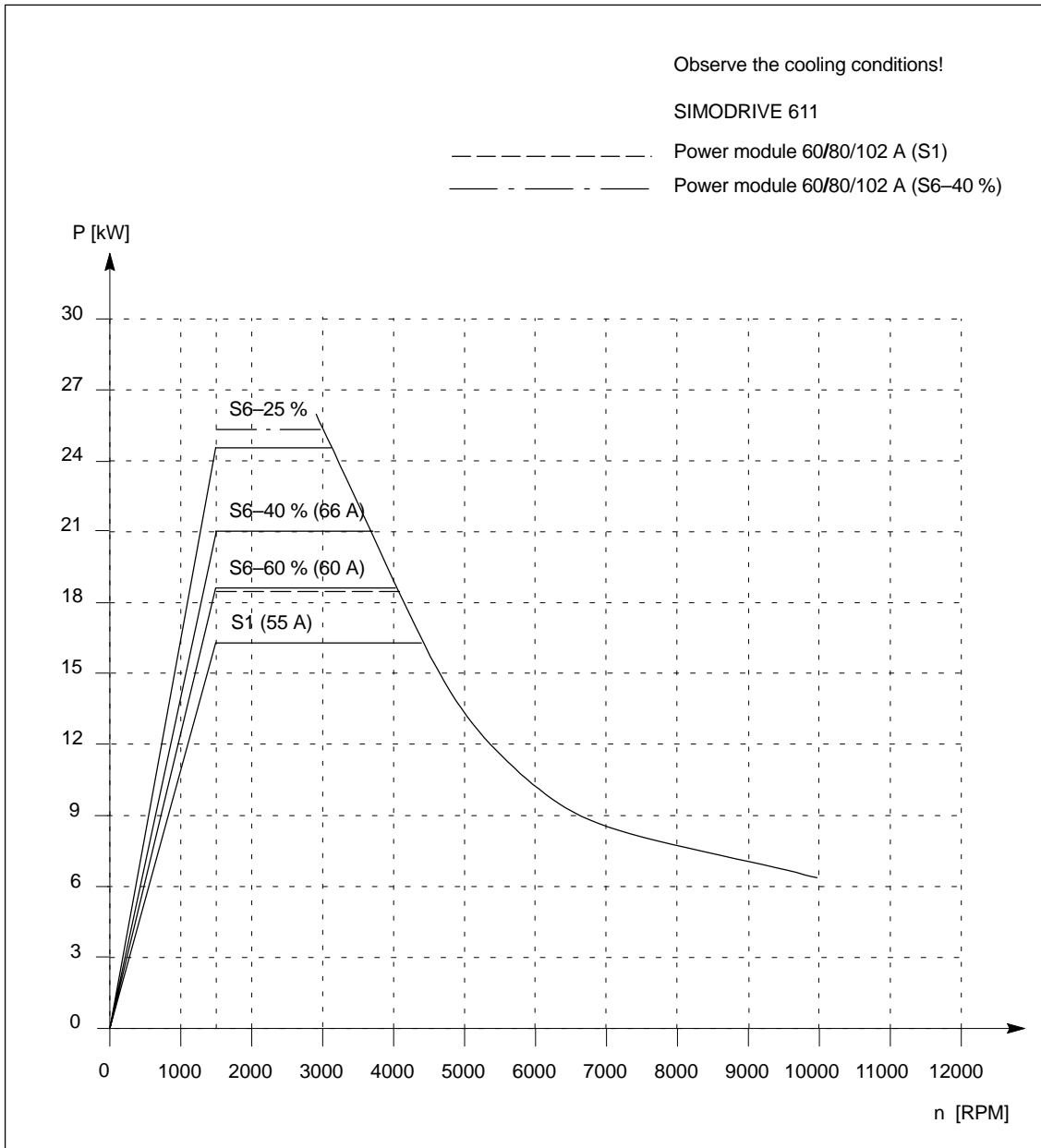
**1PH2**

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 |

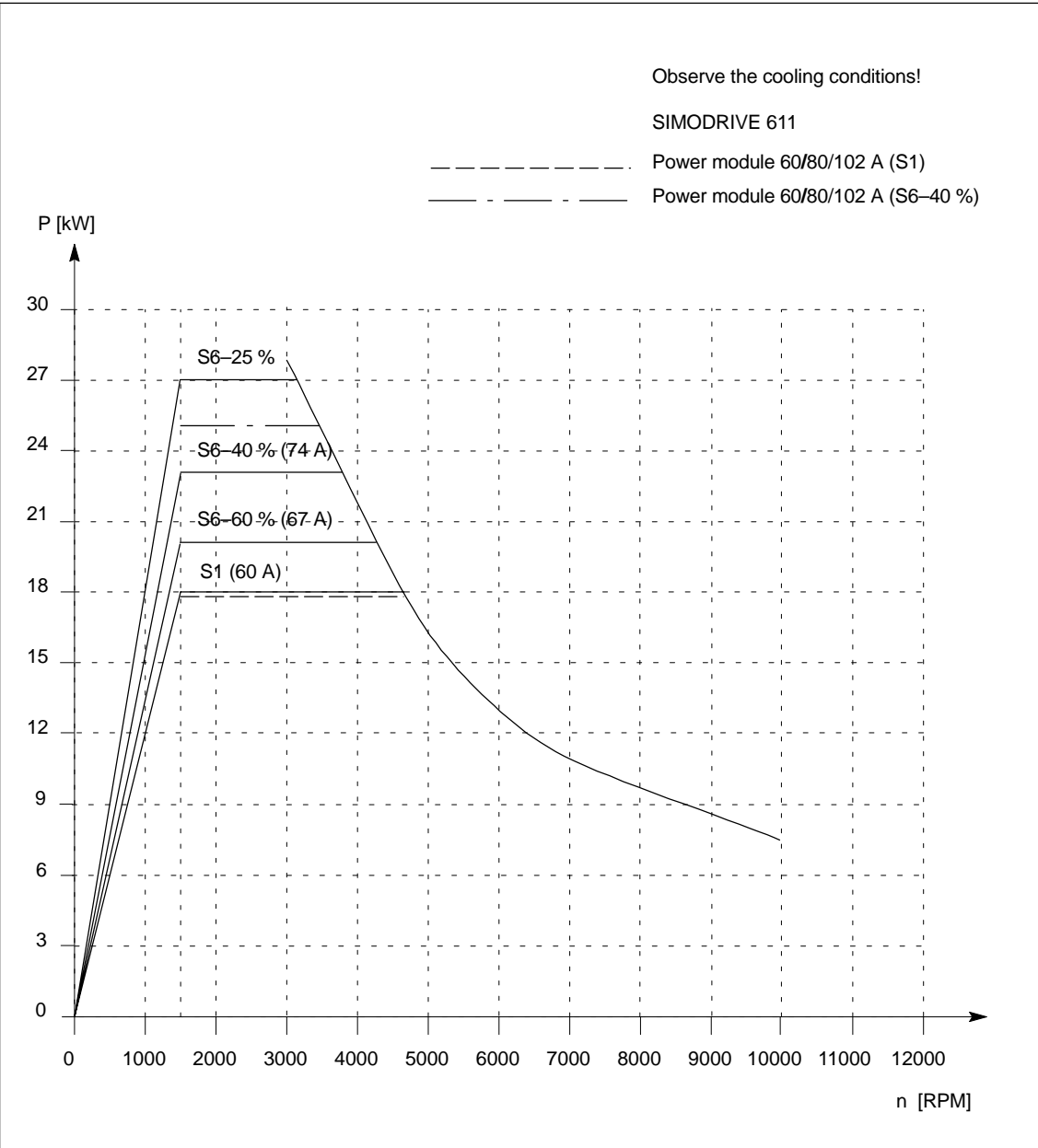
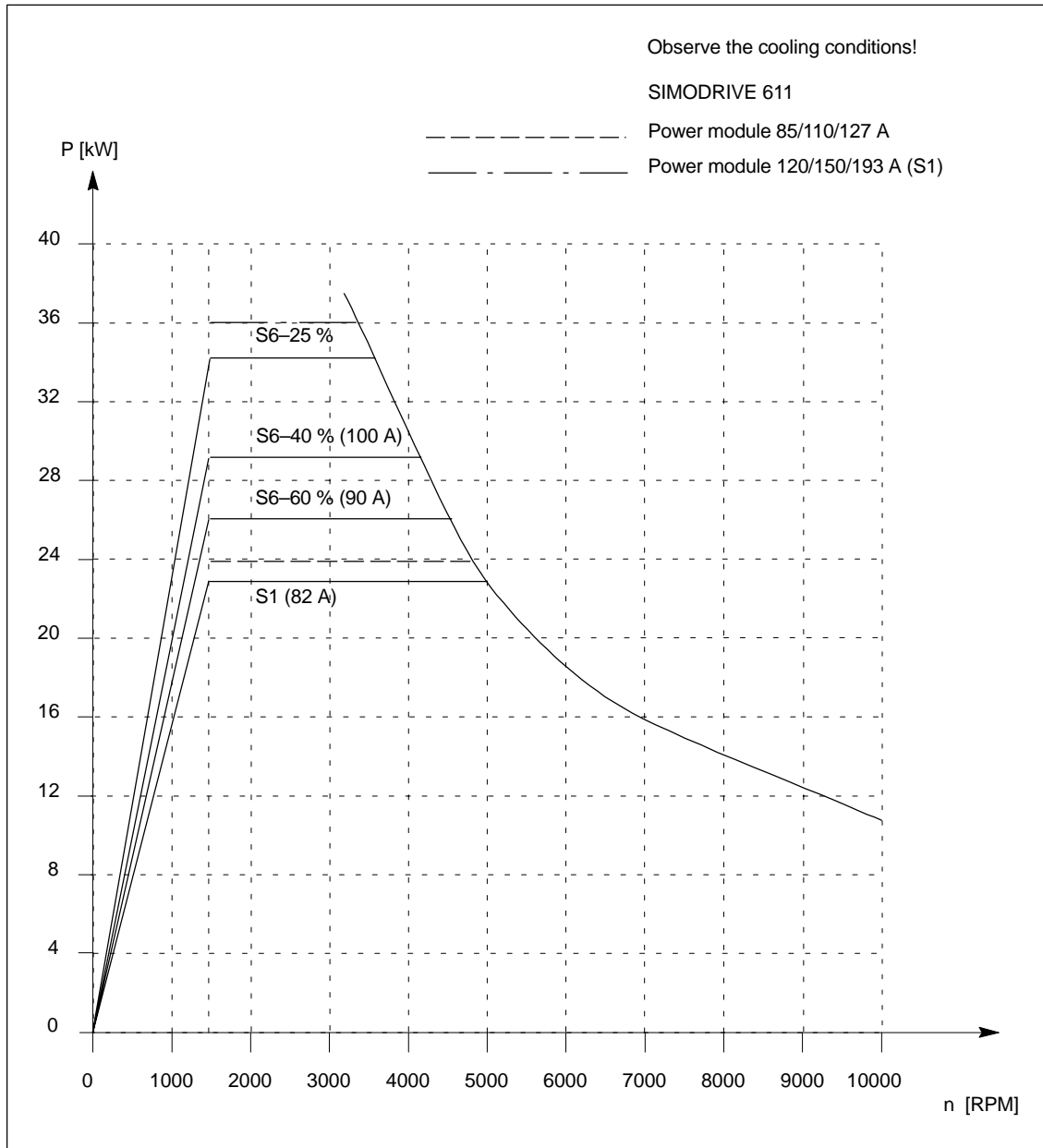


Fig. 3-5 Speed-power diagram 1PH2117-6WF4

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 |



1PH2

Fig. 3-6 Speed-power diagram 1PH2118-6WF41

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 |

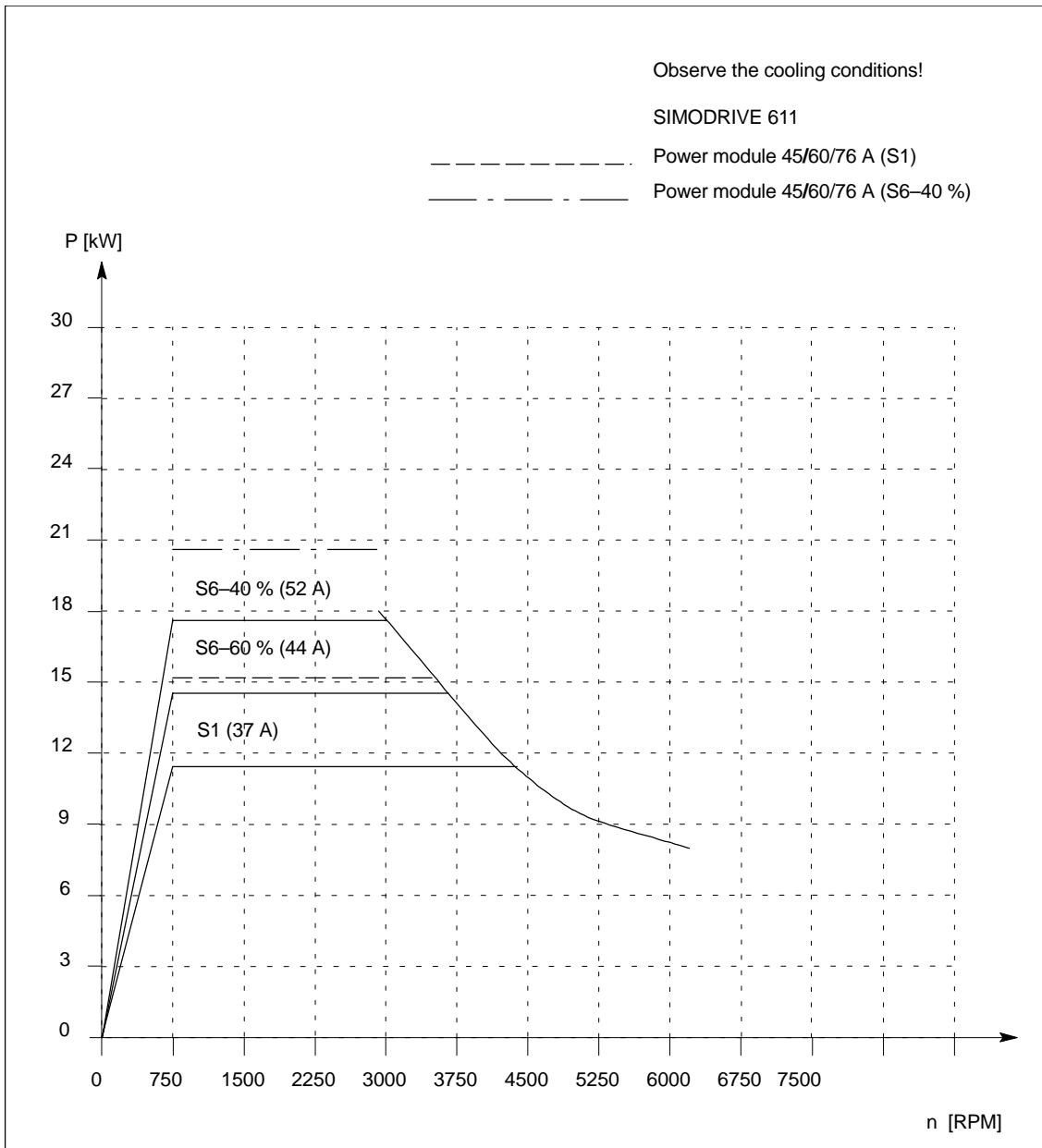


Fig. 3-7 Speed-power diagram 1PH2182-6WC4

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 |

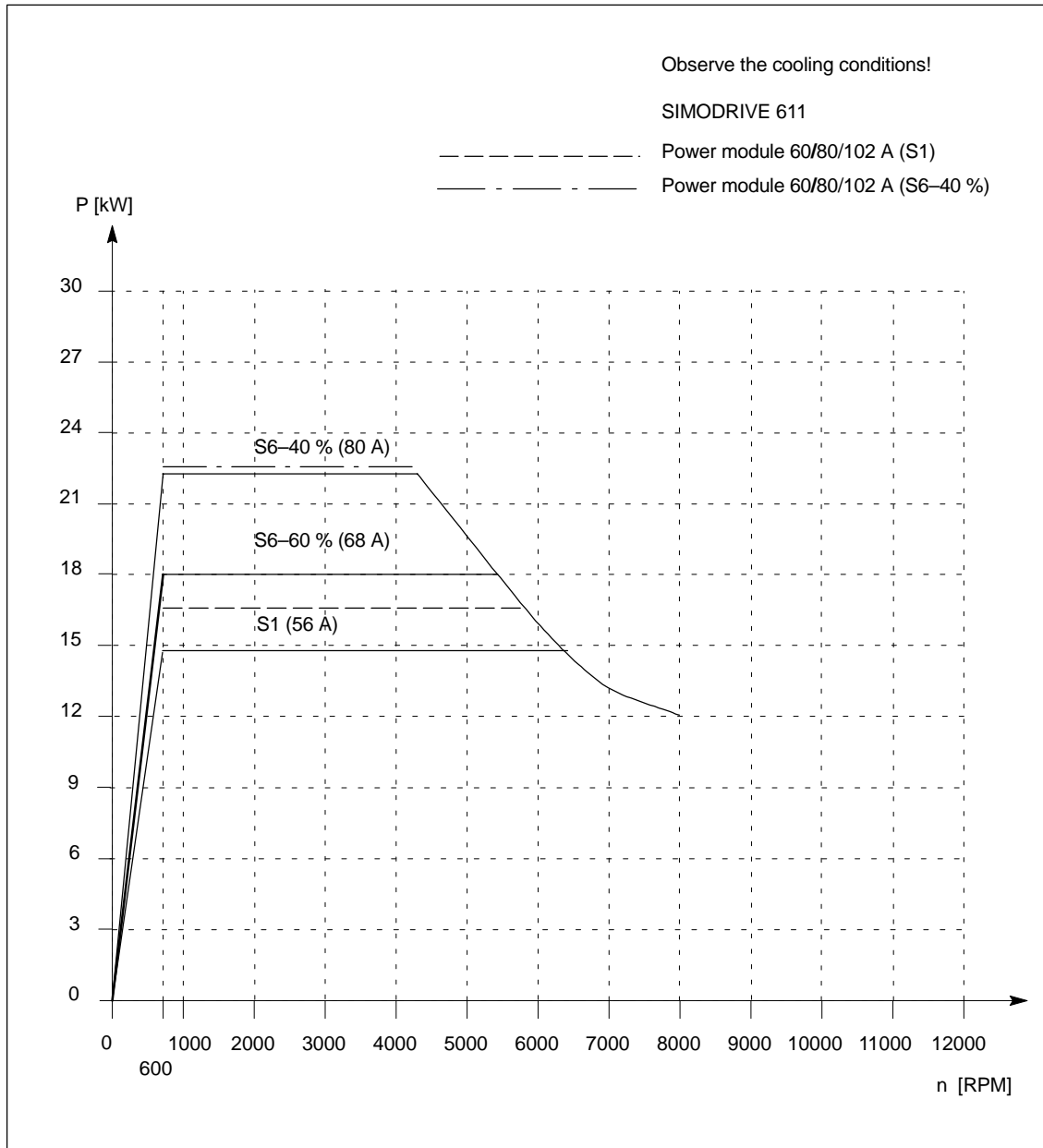
**1PH2**

Fig. 3-8 Speed-power diagram 1PH2184-6WP41

3.1 Speed-power diagrams

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 |

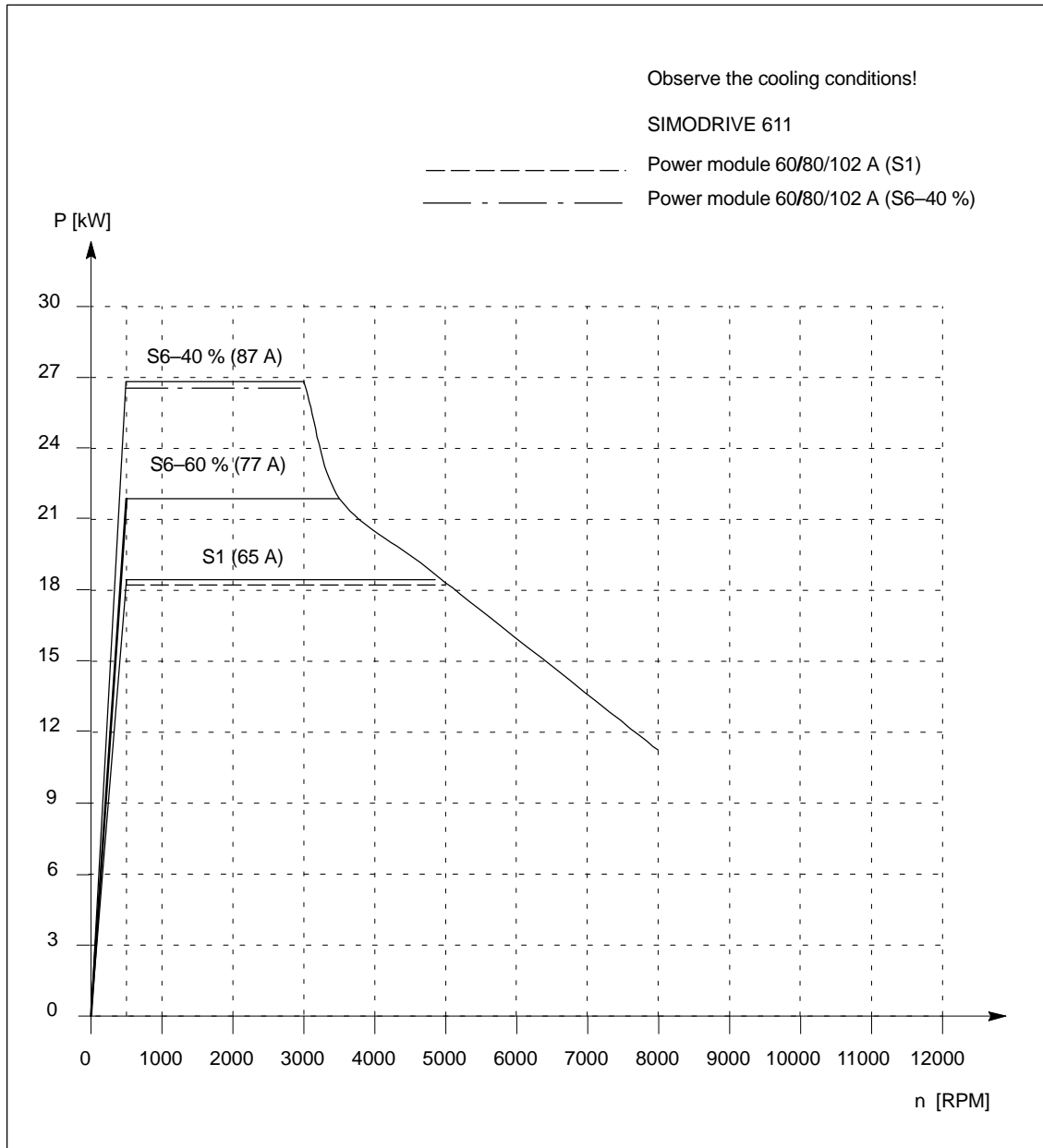


Fig. 3-9 Speed-power diagram 1PH2186-6WB41

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 |

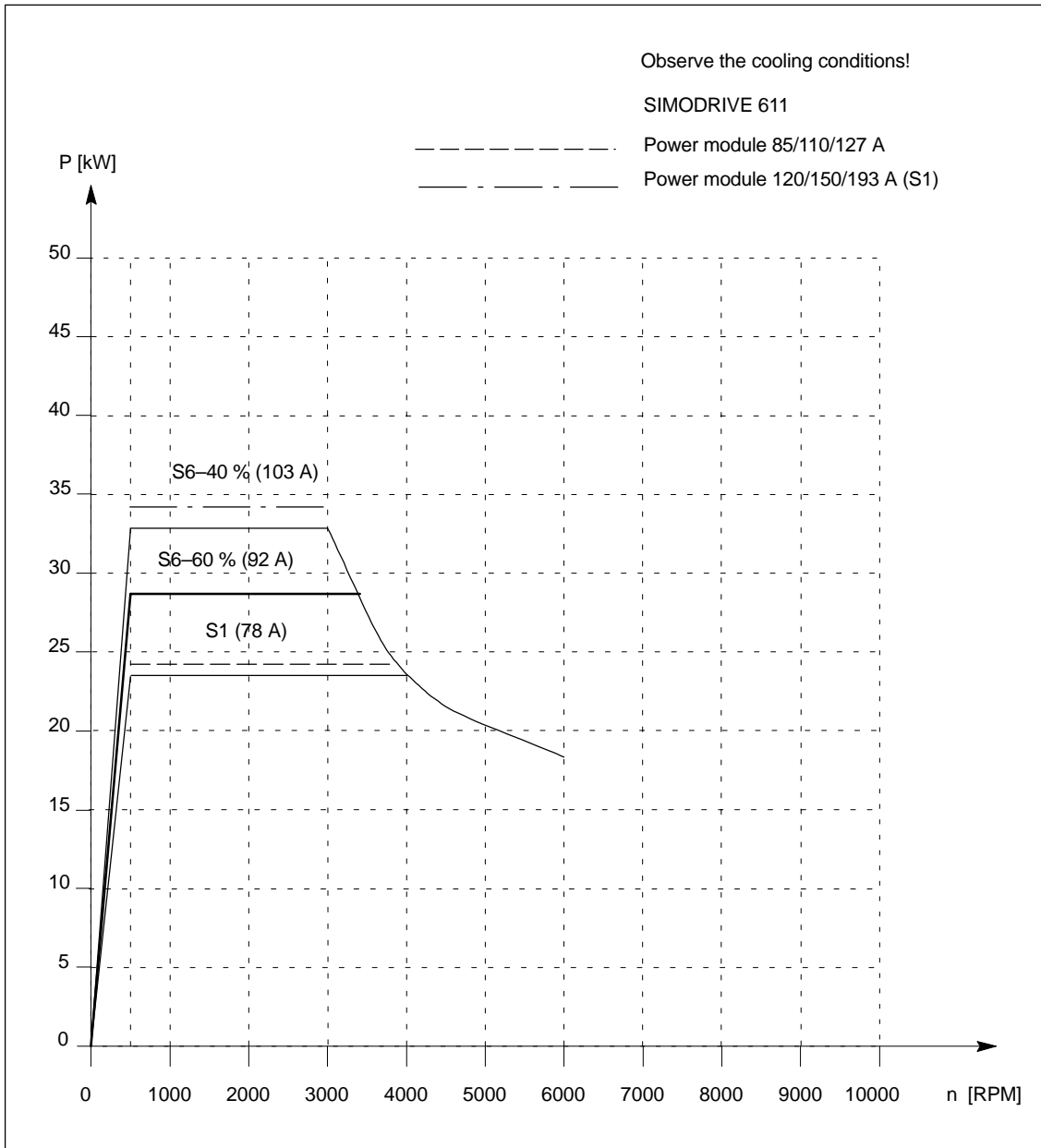
**1PH2**

Fig. 3-10 Speed-power diagram 1PH2188-6WB41

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 |

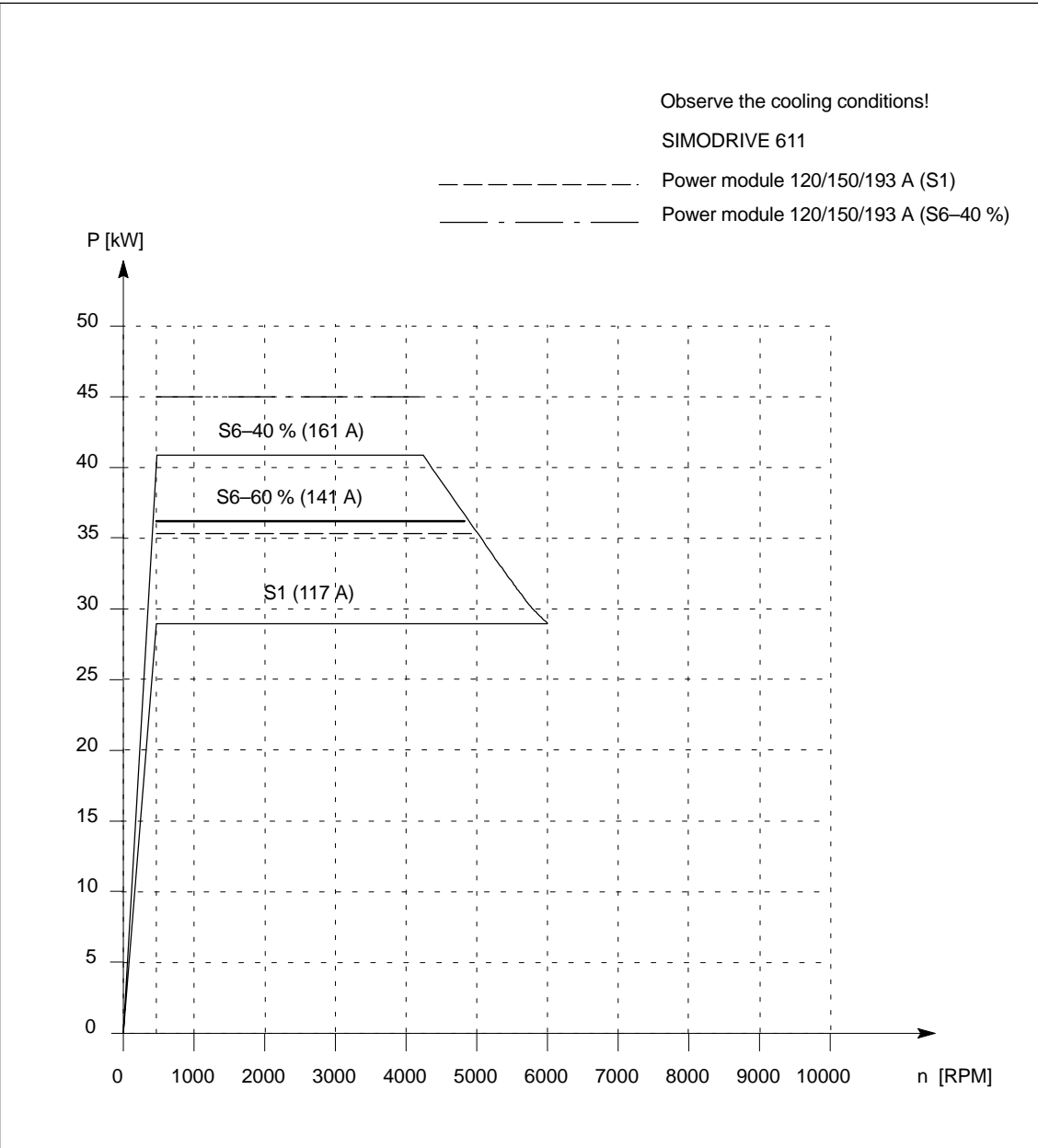
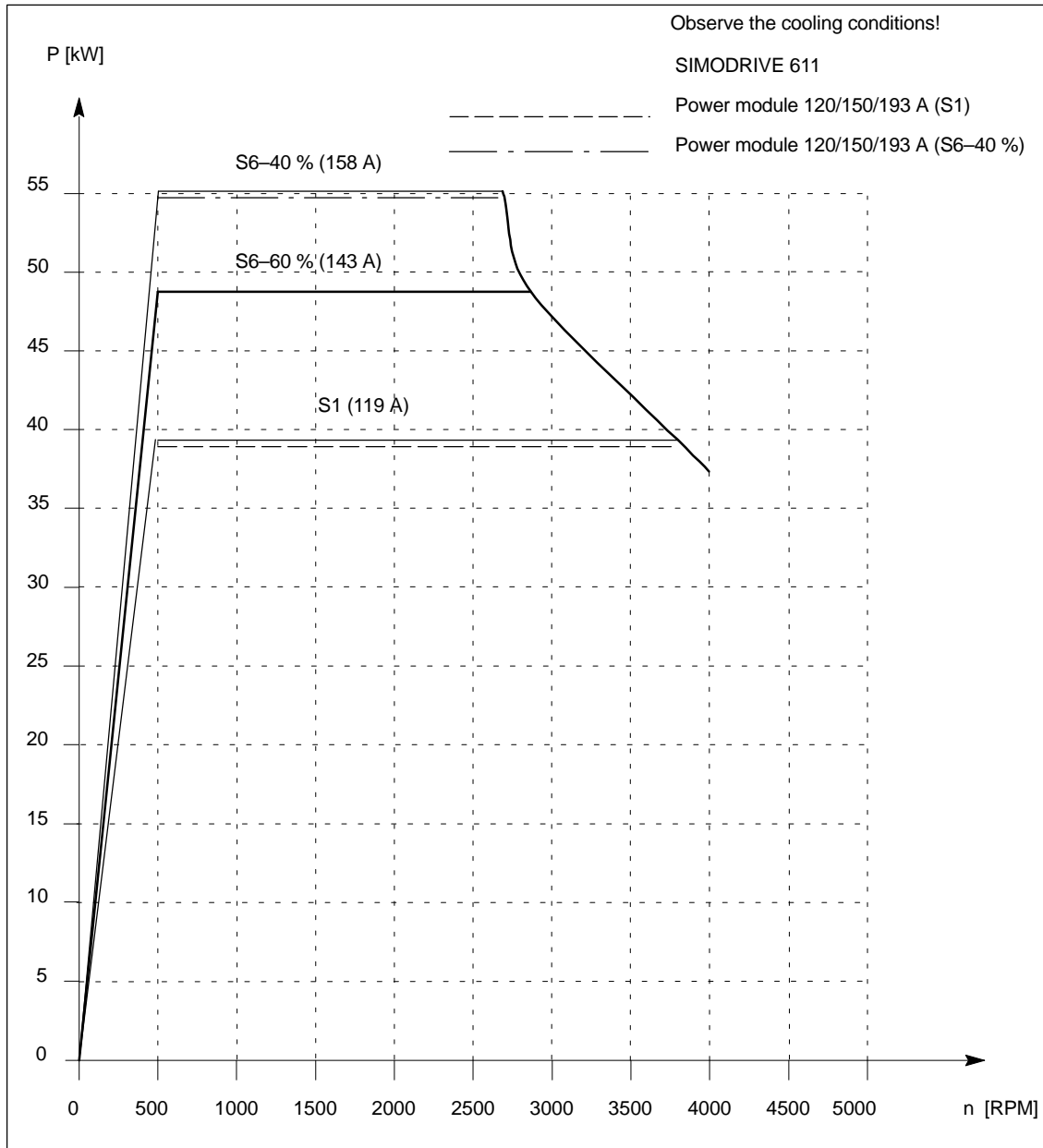


Fig. 3-11 Speed-power diagram 1PH2254-6WB41

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 |



1PH2

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 [kgm ²] | Weight m [kg] |
|--|--|--|--|---|---|---|-----------------------|
| 4.7 | 2000 | 22 | 22 | 4 | 18000 | 0.01 | 26 |

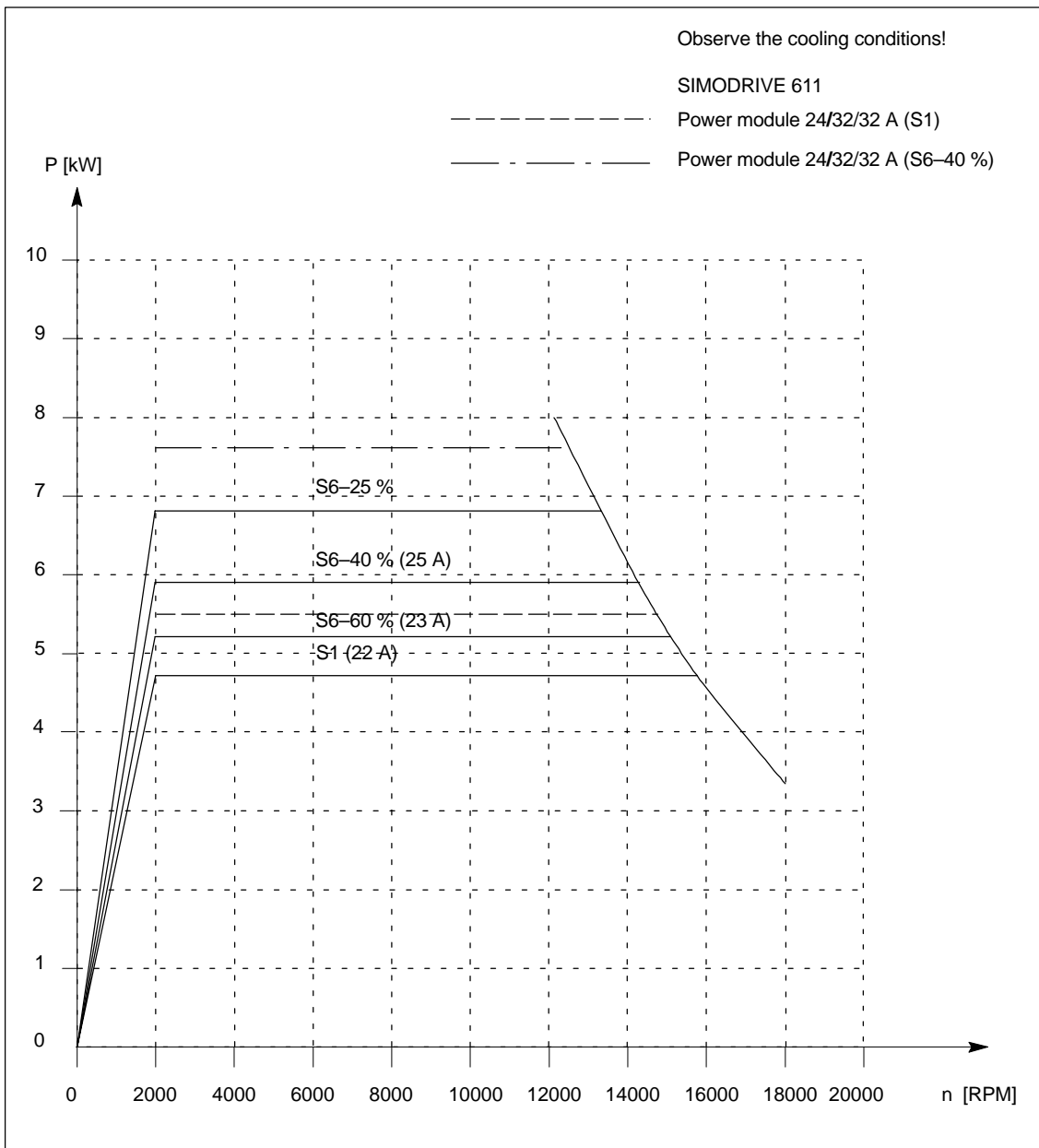


Fig. 3-13 Speed-power diagram 1PH2092-4WG42

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 |

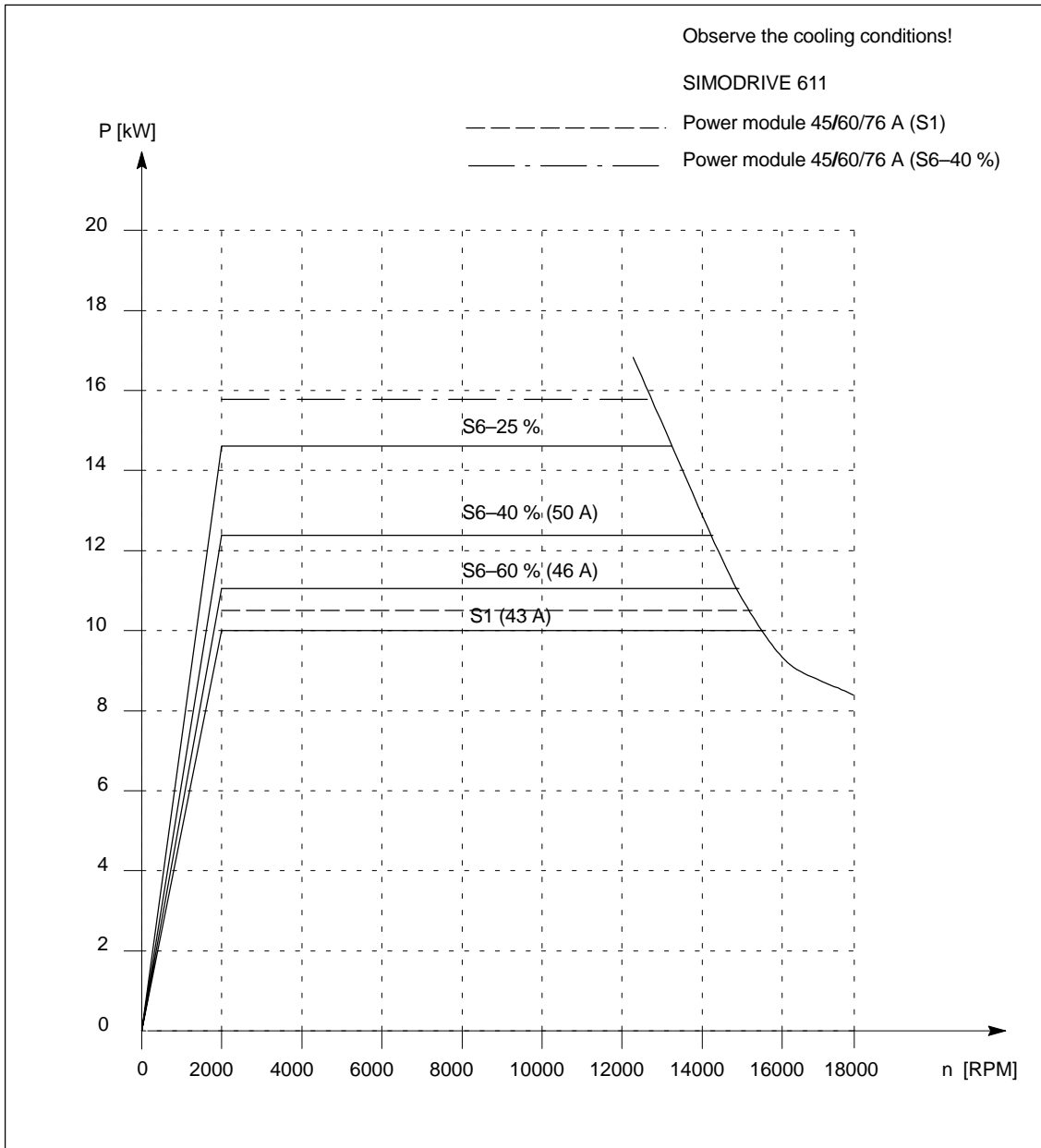
**1PH2**

Fig. 3-14 Speed-power diagram 1PH2096-4WG42

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 |

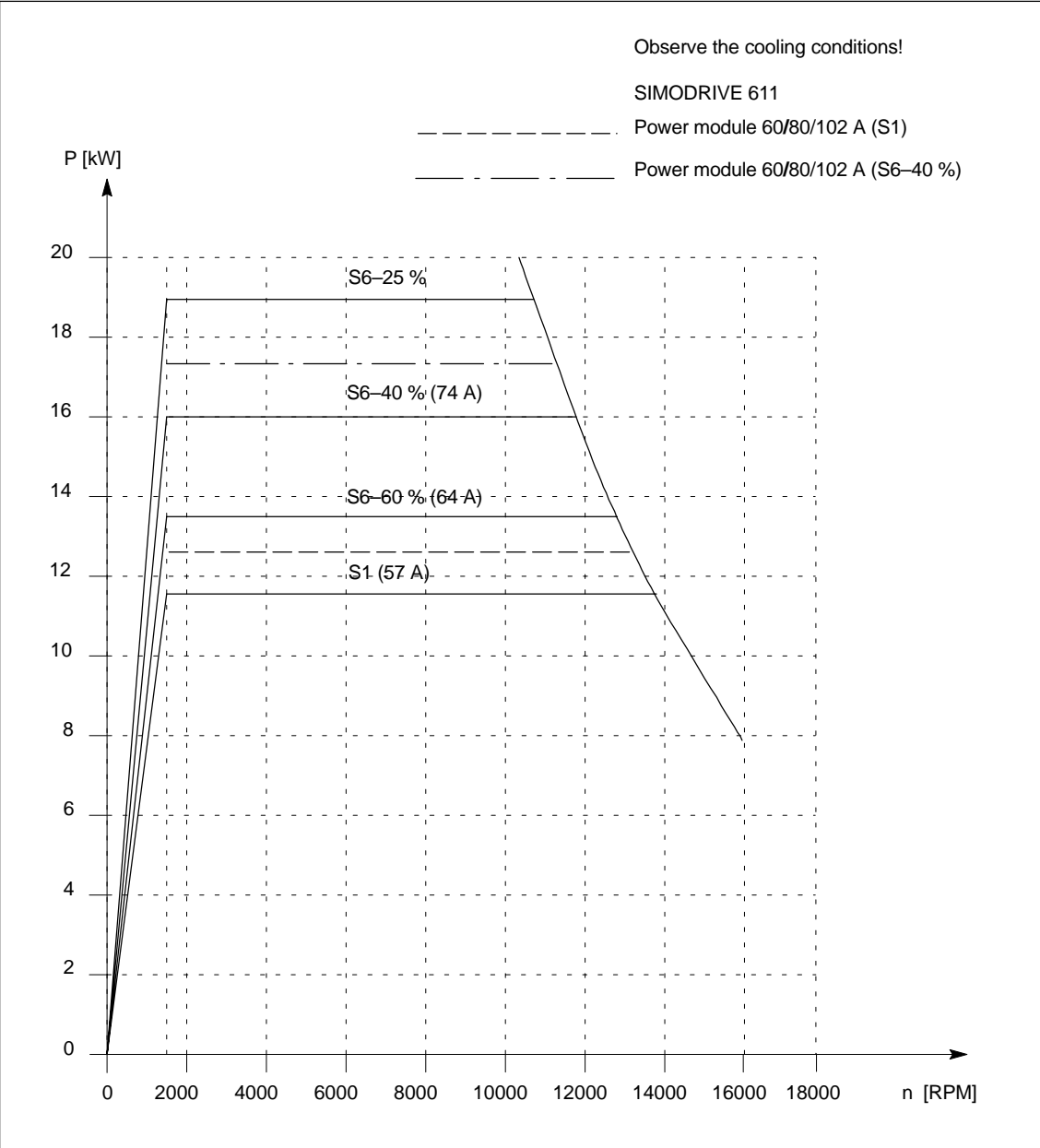


Fig. 3-15 Speed-power diagram 1PH2123-4WF42

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 |

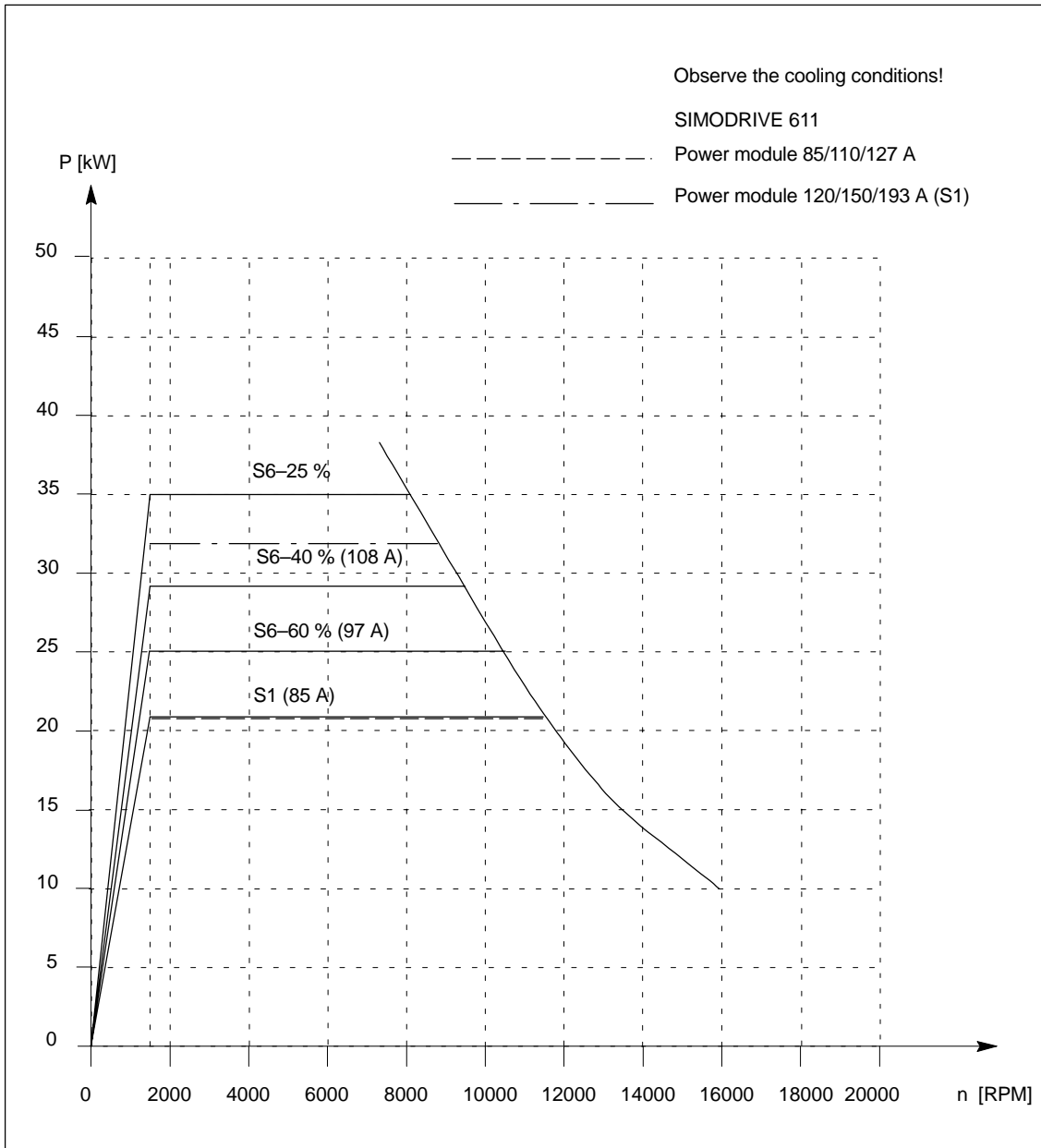
**1PH2**

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 [kgm ²] | Weight m [kg] |
|--|--|--|--|---|---|---|-----------------------|
| 25 | 1500 | 159 | 101 | 8 | 16000 | 0.103 | 127 |

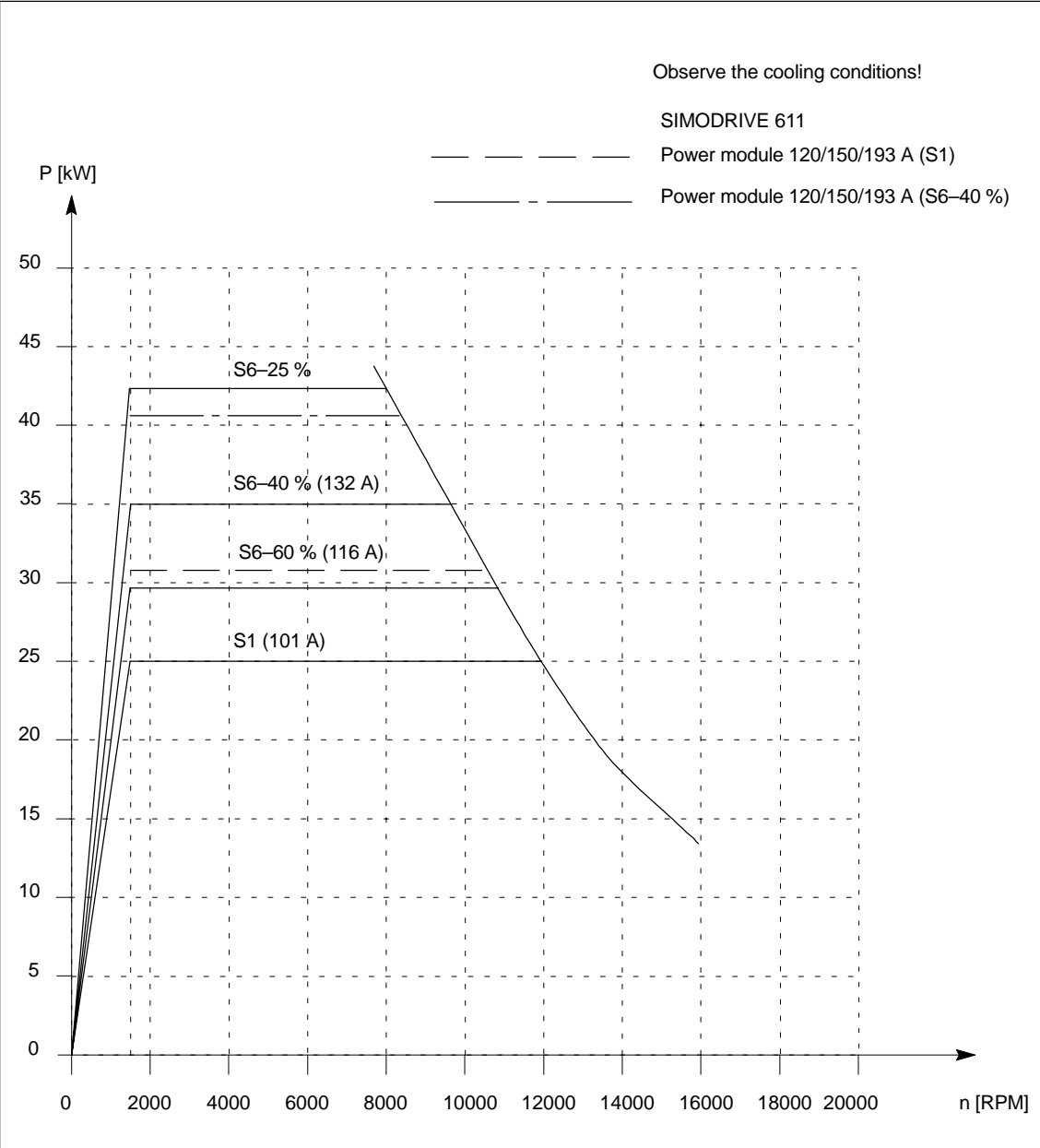


Fig. 3-17 Speed-power diagram 1PH2128-4WF42

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 |

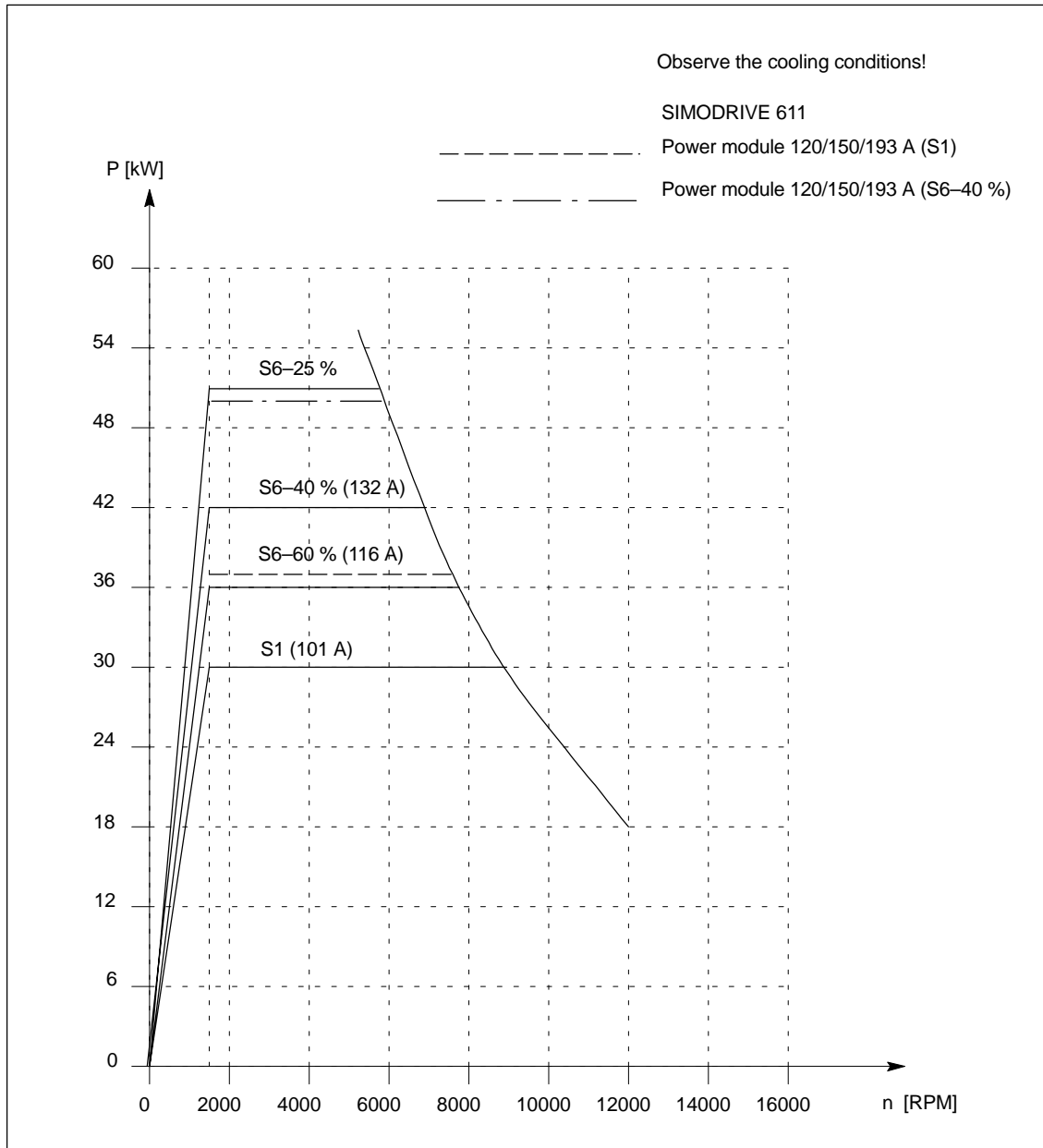
**1PH2**

Fig. 3-18 Speed-power diagram 1PH2143-4WF42

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 |

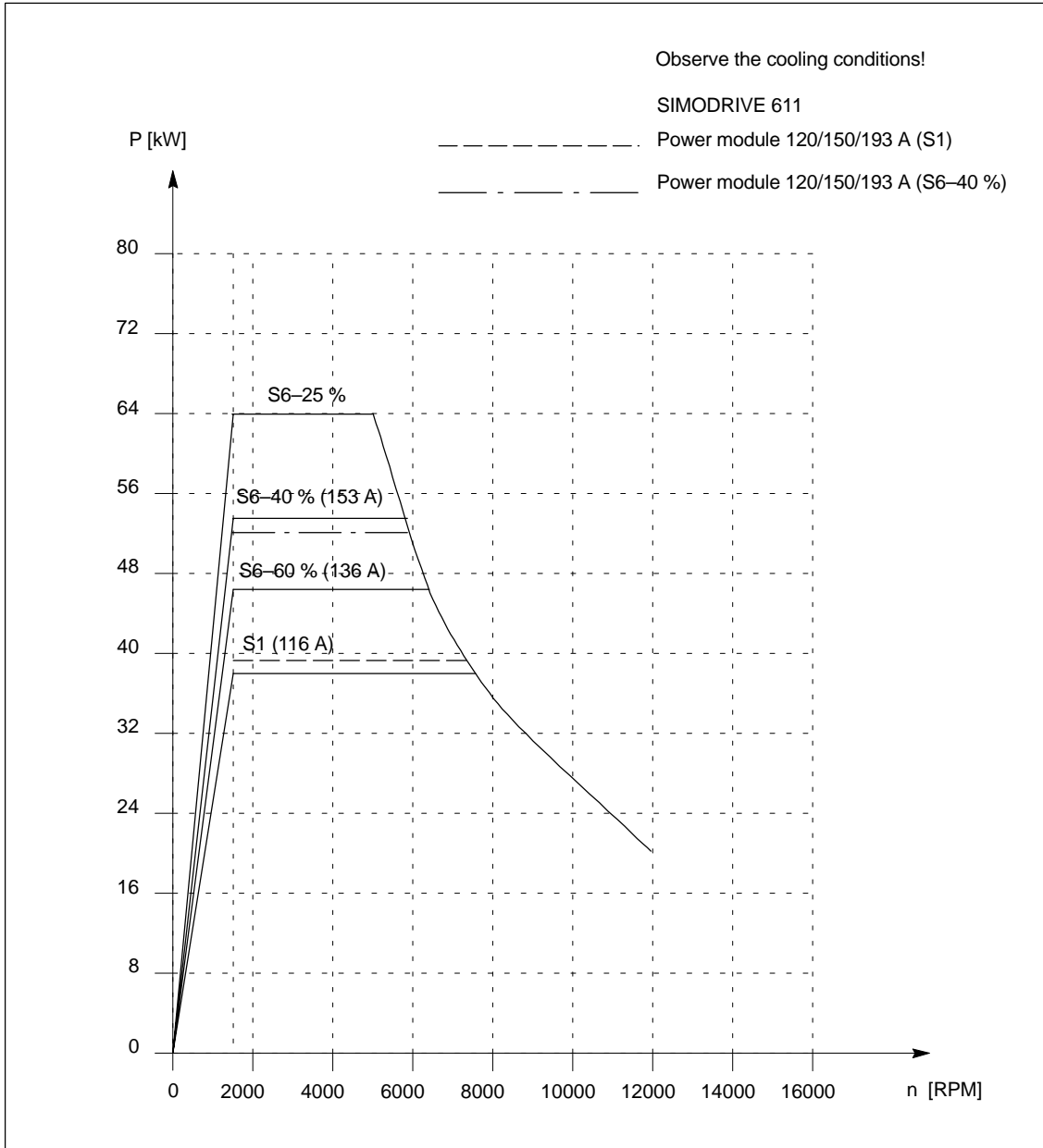


Fig. 3-19 Speed-power diagram 1PH2147-4WF42



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

| | |
|--|-----------|
| 1PH209□–6W motor dimensions | 1PH2/4-48 |
| 1PH209□–6W rotor companion dimensions | 1PH2/4-49 |
| 1PH209□–6W stator companion dimensions | 1PH2/4-50 |
| 1PH211□–6W motor dimensions | 1PH2/4-51 |
| 1PH211□–6W rotor companion dimensions | 1PH2/4-52 |
| 1PH211□–6W stator companion dimensions | 1PH2/4-53 |
| 1PH218□–6W motor dimensions (dimension drawing) | 1PH2/4-54 |
| 1PH218□–6W rotor companion dimensions (spindle) | 1PH2/4-55 |
| 1PH218□–6W stator companion dimensions (housing) | 1PH2/4-56 |
| 1PH225□–6W motor dimensions (dimension drawing) | 1PH2/4-57 |
| 1PH225□–6W rotor companion dimensions (spindle) | 1PH2/4-58 |
| 1PH225□–6W stator companion dimensions (housing) | 1PH2/4-59 |

1PH2

Version without sleeve

| | |
|---|-----------|
| 1PH209□V–4W motor dimensions | 1PH2/4-60 |
| 1PH209□V–4W rotor companion dimensions | 1PH2/4-61 |
| 1PH209□V–4W stator companion dimensions | 1PH2/4-62 |
| 1PH212□V–4W motor dimensions | 1PH2/4-63 |
| 1PH212□V–4W rotor companion dimensions | 1PH2/4-64 |
| 1PH212□V–4W stator companion dimensions | 1PH2/4-65 |
| 1PH214□V–4W motor dimensions | 1PH2/4-66 |
| 1PH214□V–4W rotor companion dimensions | 1PH2/4-67 |
| 1PH214□V–4W stator companion dimensions | 1PH2/4-68 |

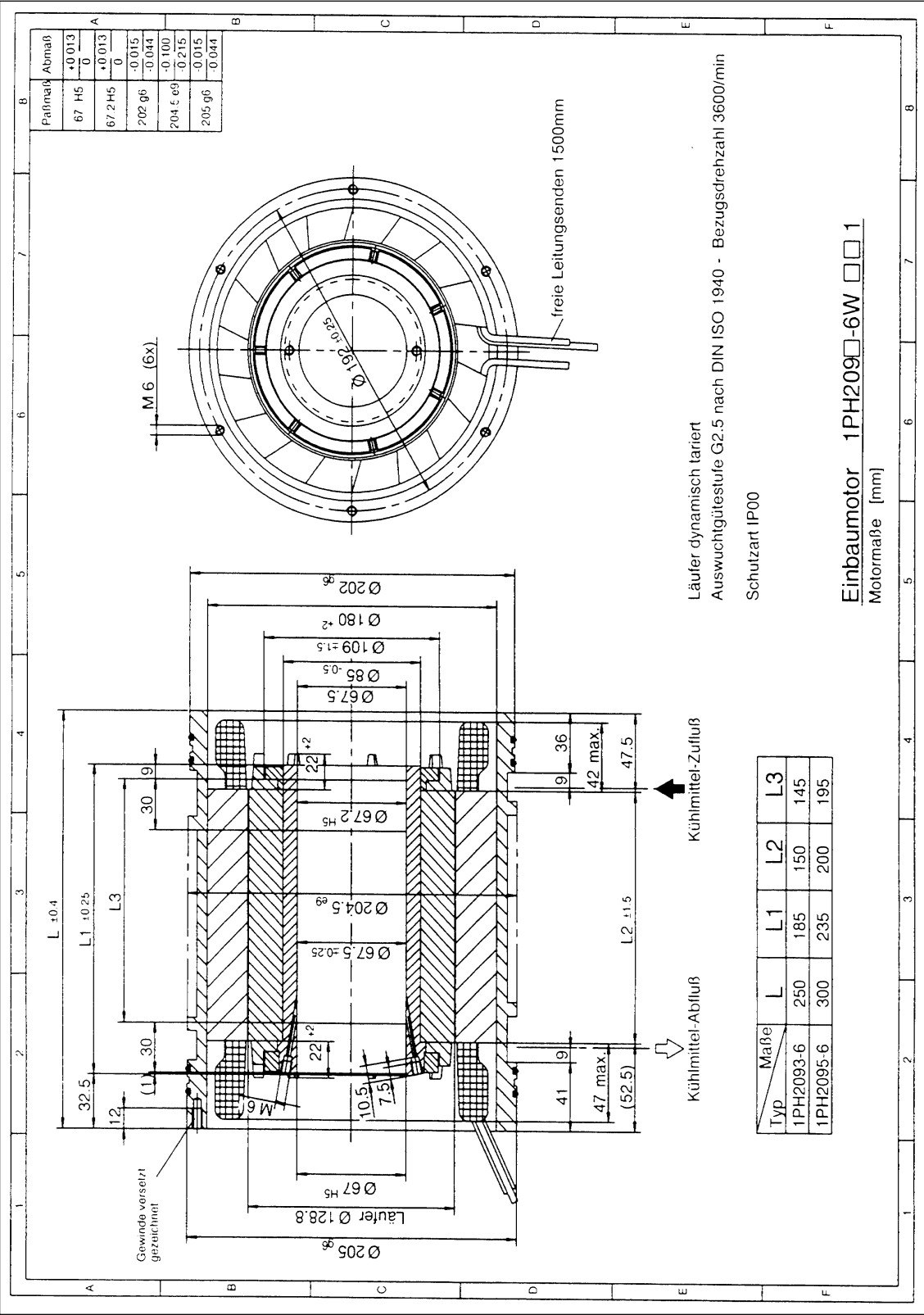


Fig. 4-1 1PH209-6W motor dimensions

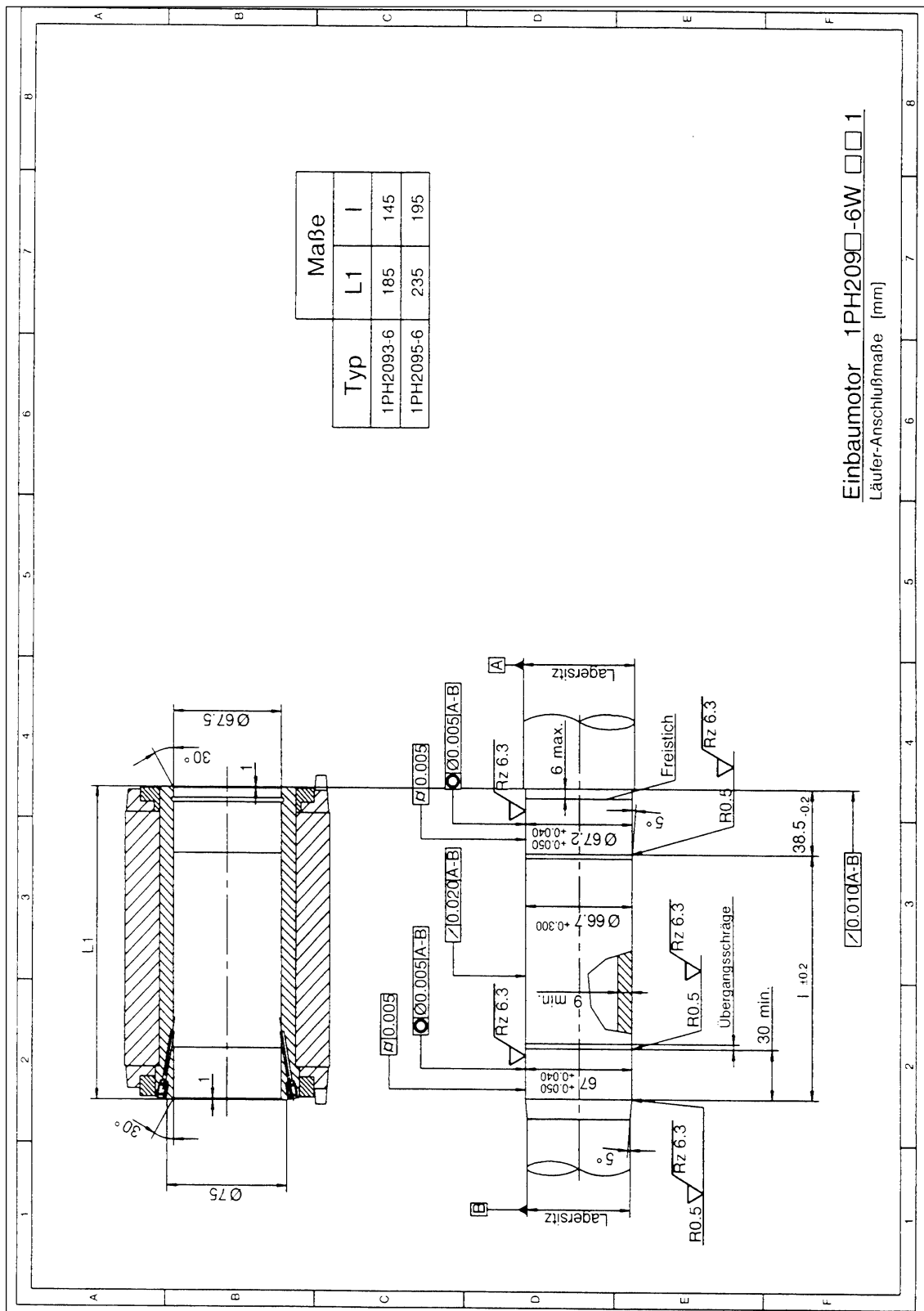


Fig. 4-2 1PH209-6W rotor companion dimensions

1PH2

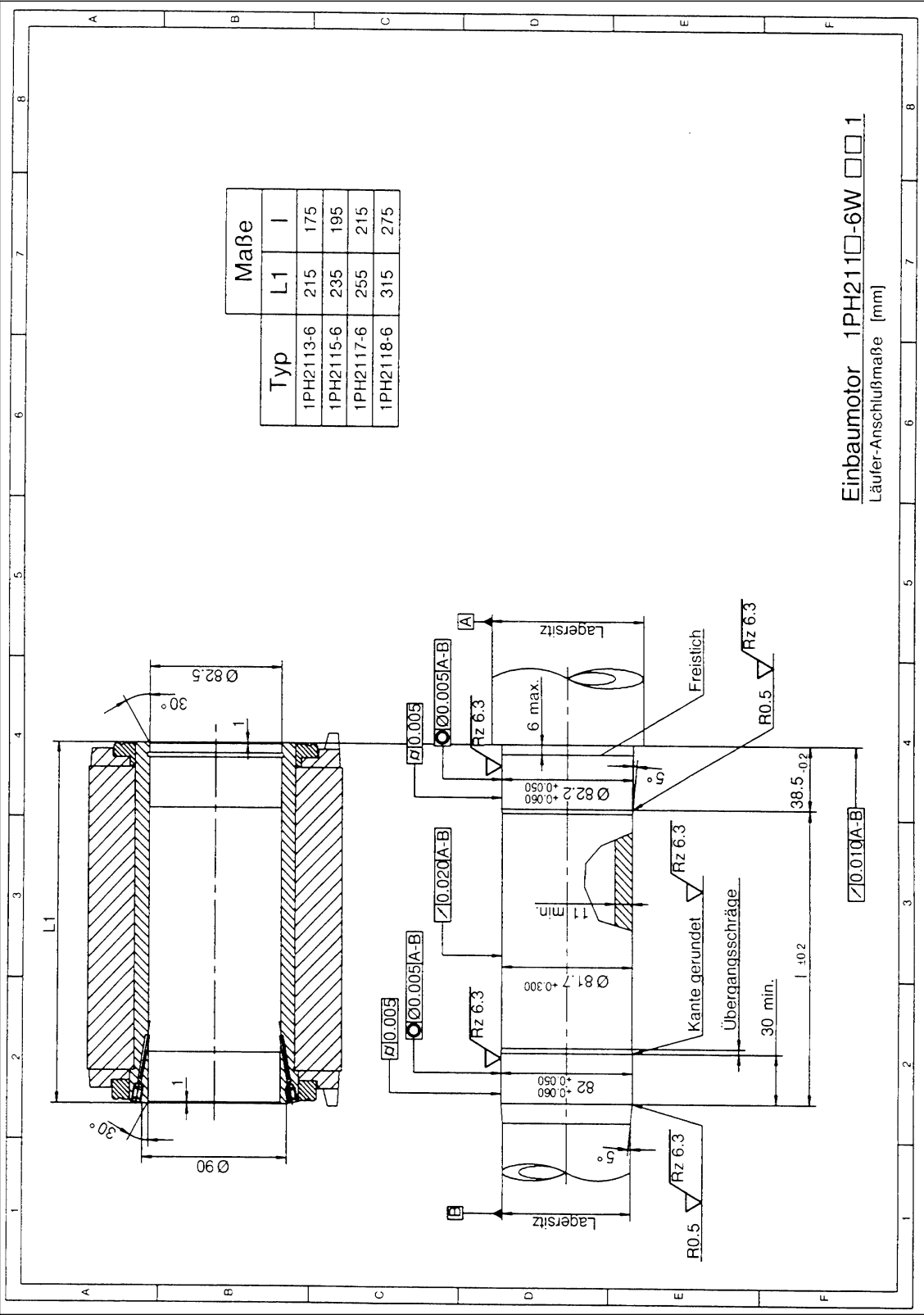


Fig. 4-5 1PH211-6W rotor companion dimensions

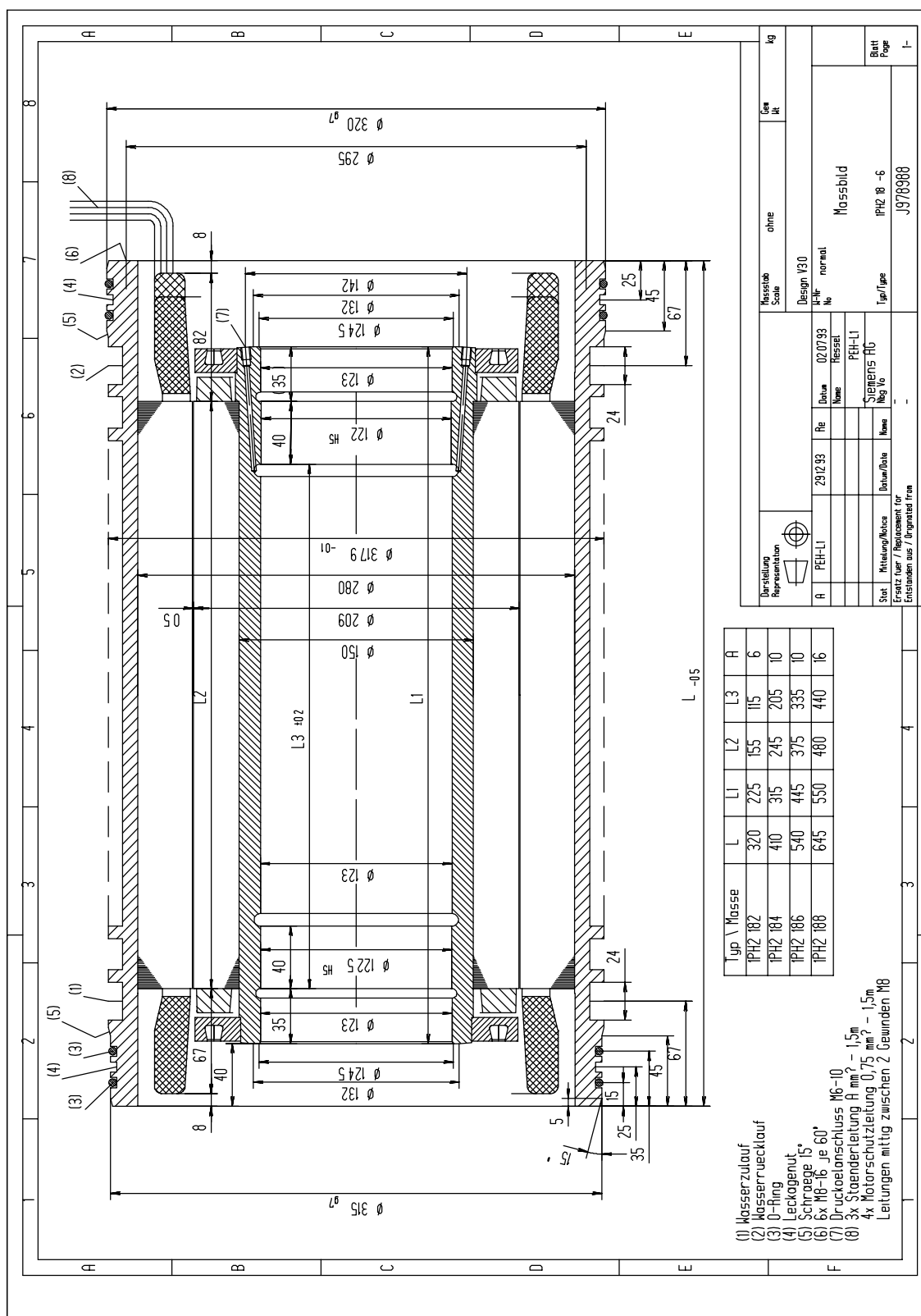
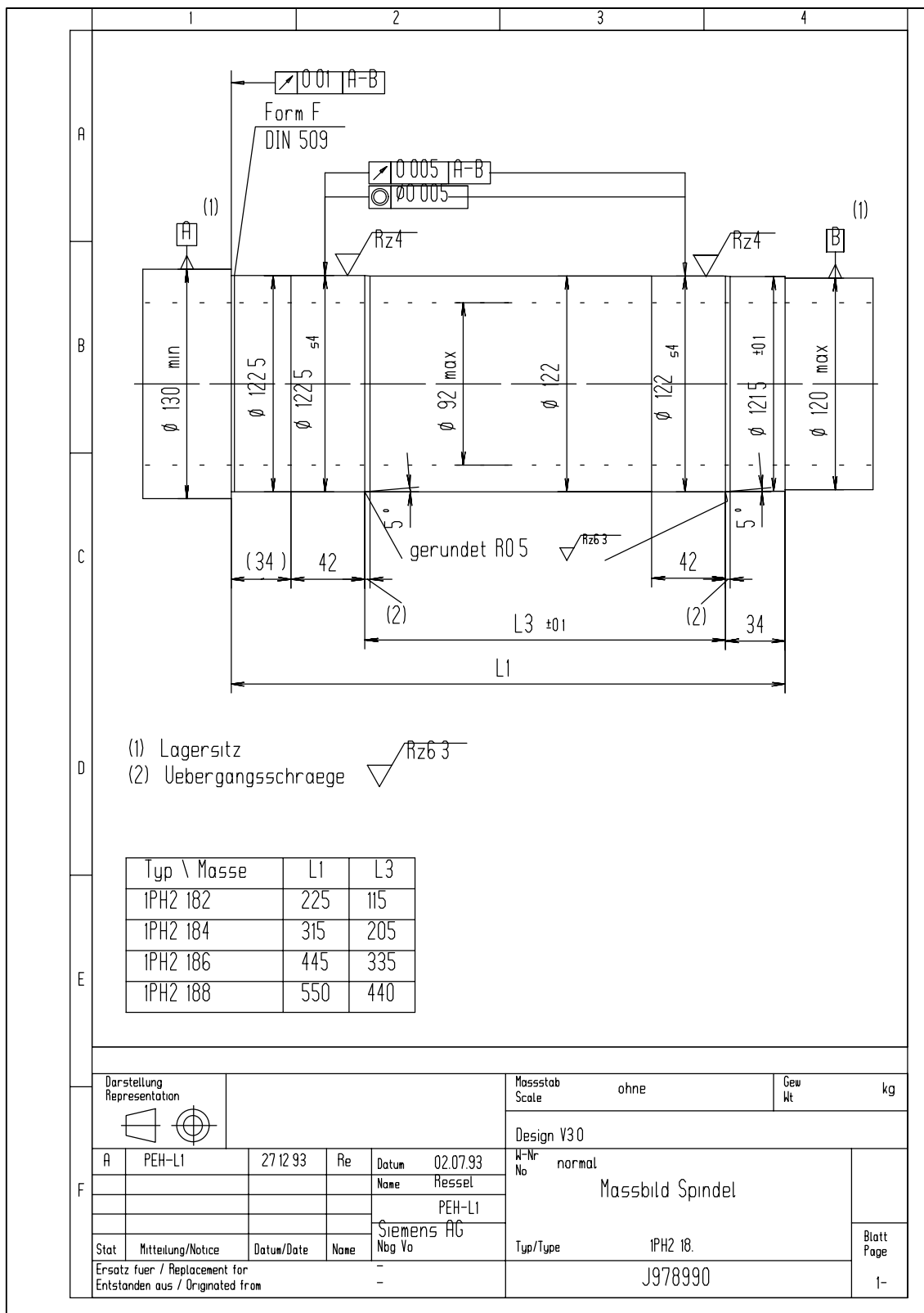


Fig. 4-7 1PH218□-6W motor dimensions (dimension drawing)



1PH2

Fig. 4-8 1PH218□-6W rotor companion dimensions (spindle)

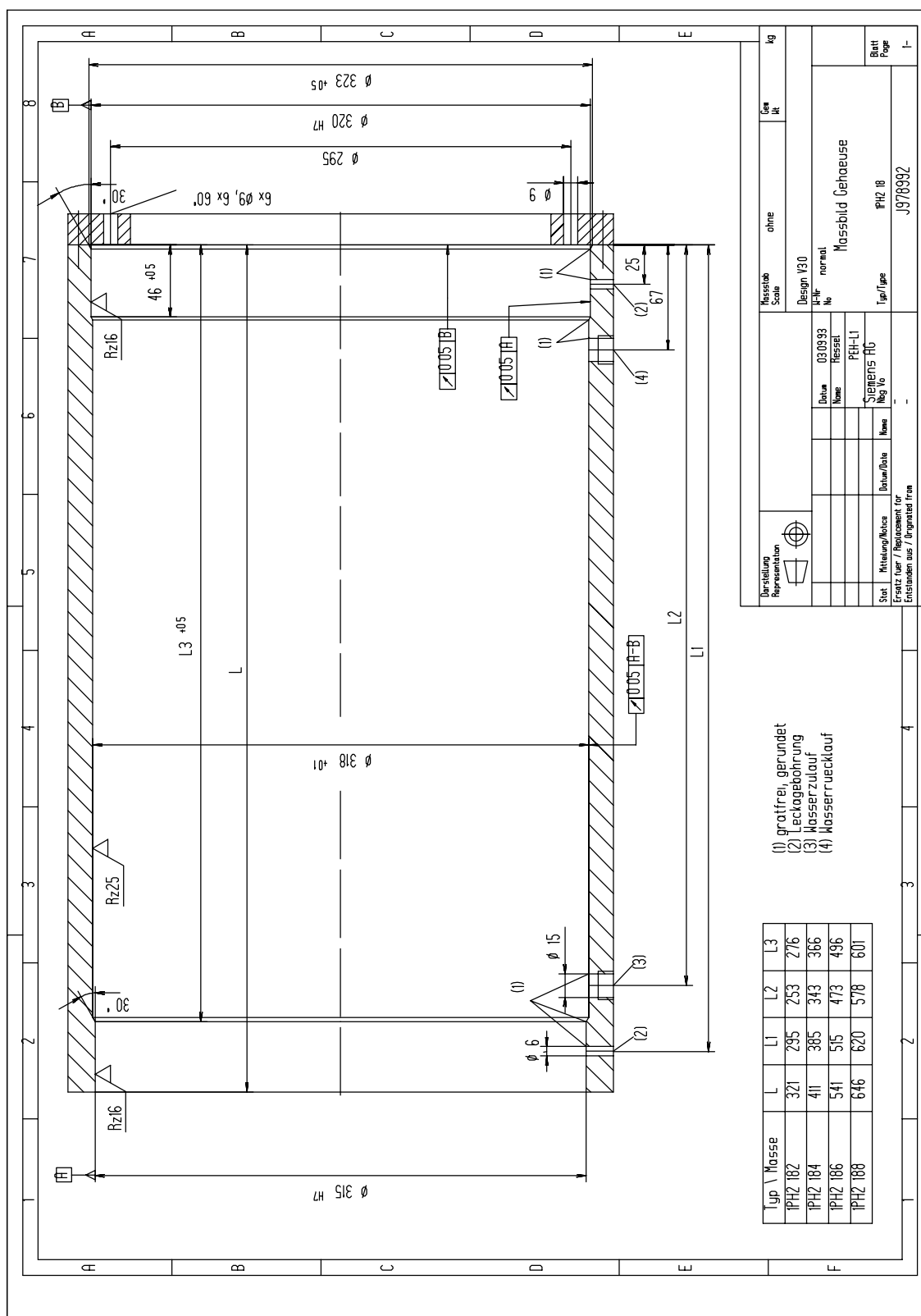


Fig. 4-9 1PH218□-6W stator companion dimensions (housing)

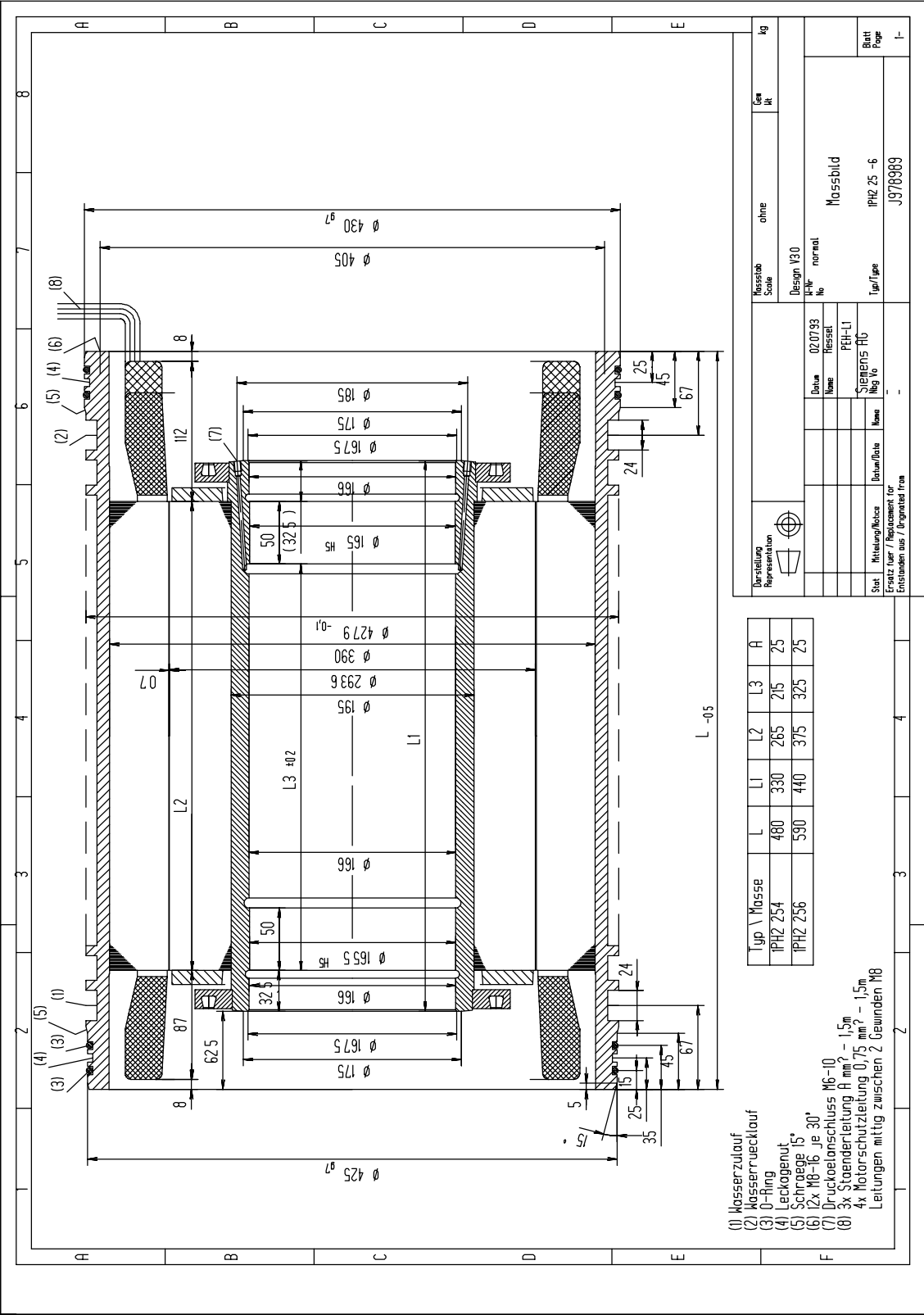


Fig. 4-10 1PH225-6W motor dimensions (dimension drawing)

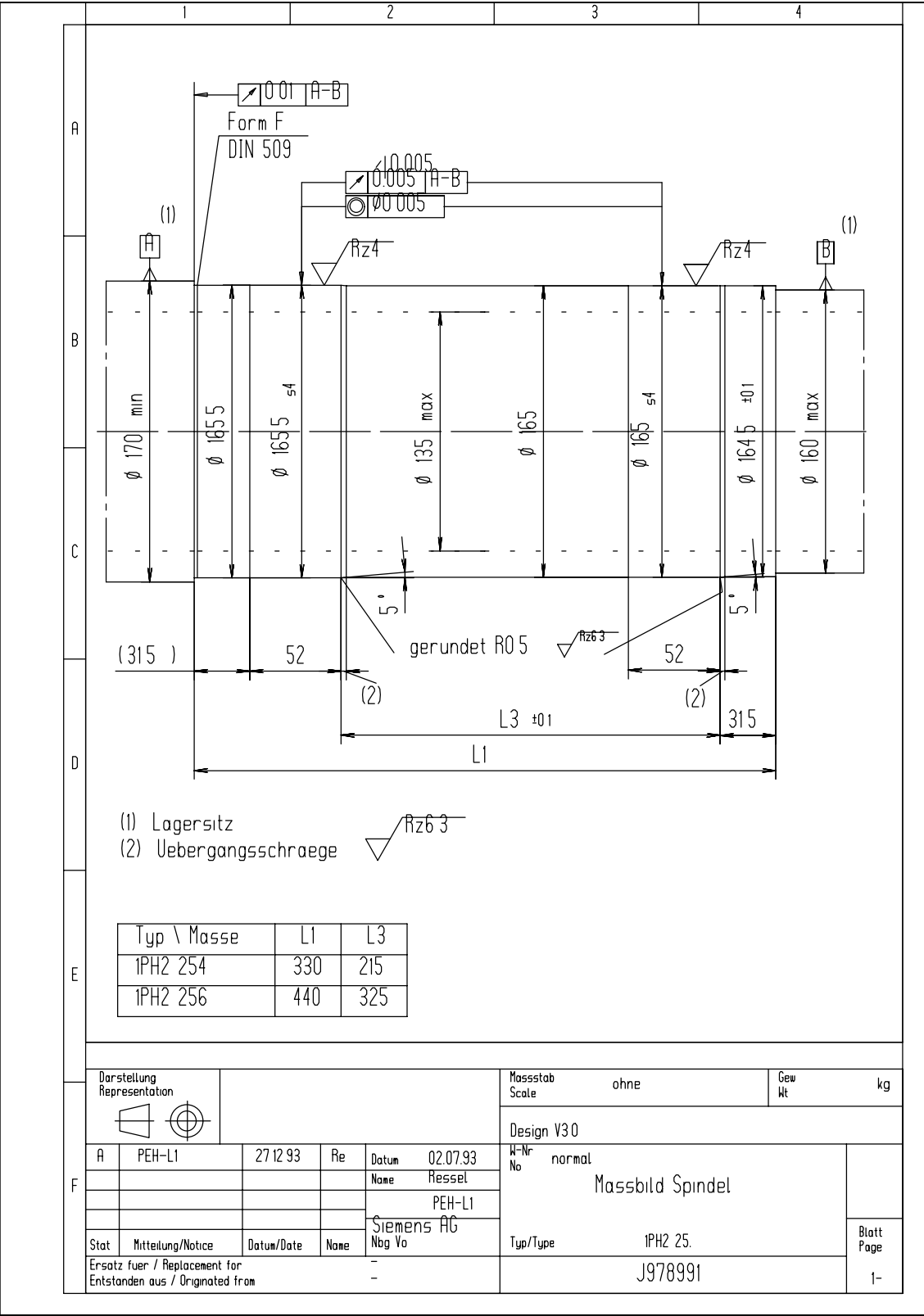


Fig. 4-11 1PH225-6W rotor companion dimensions (spindle)

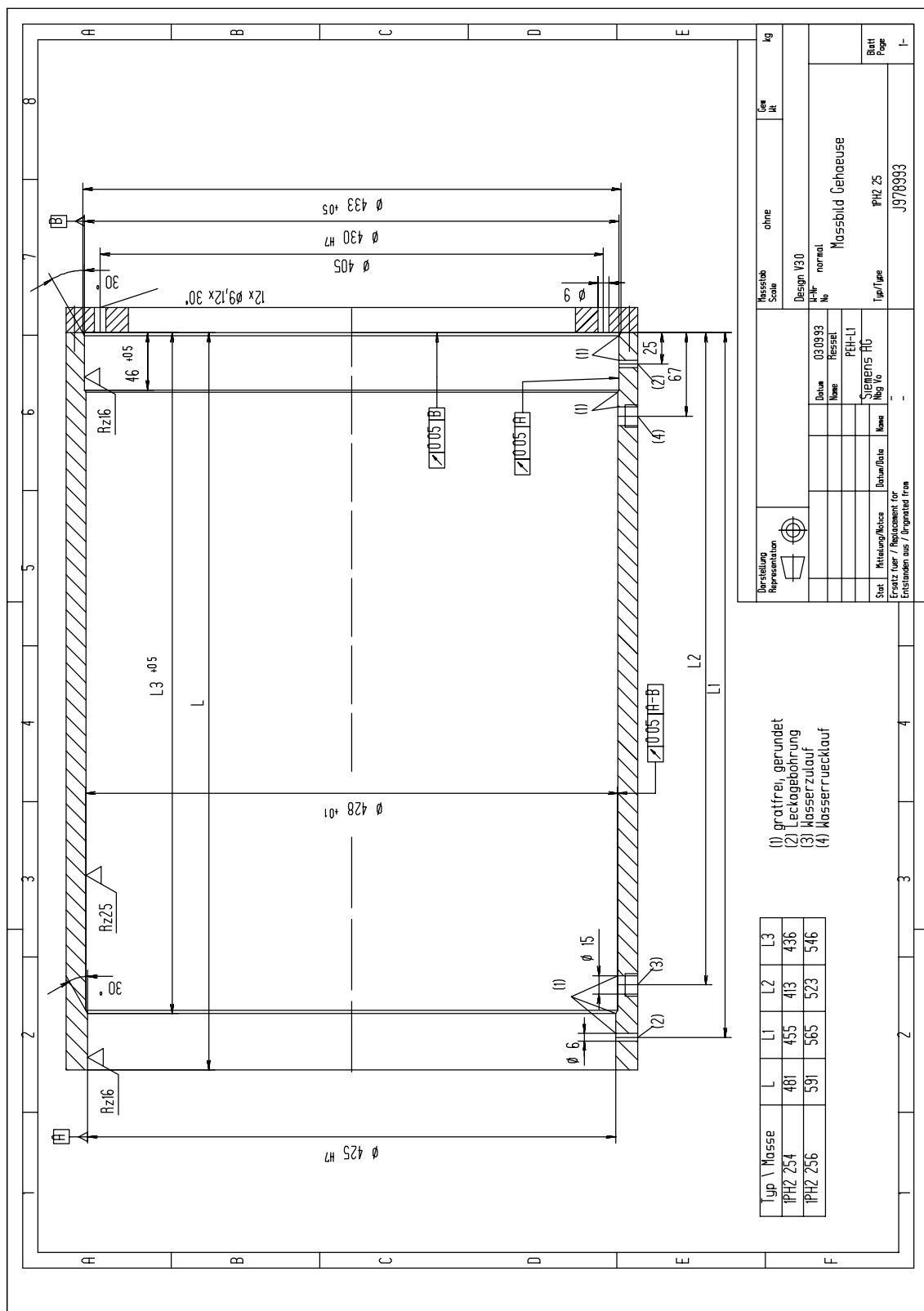


Fig. 4-12 1PH225□-6W stator companion dimensions (housing)

1PH2

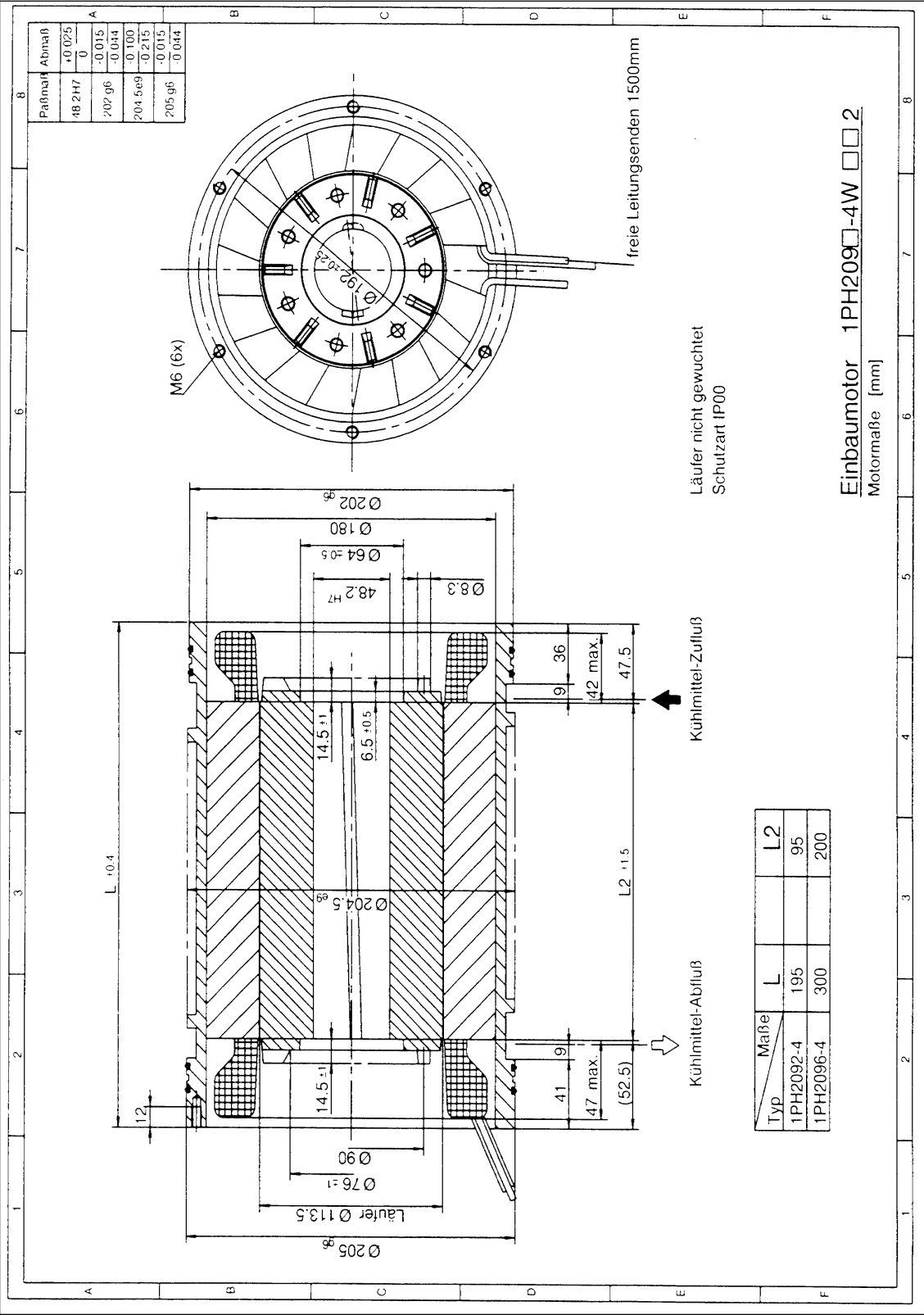
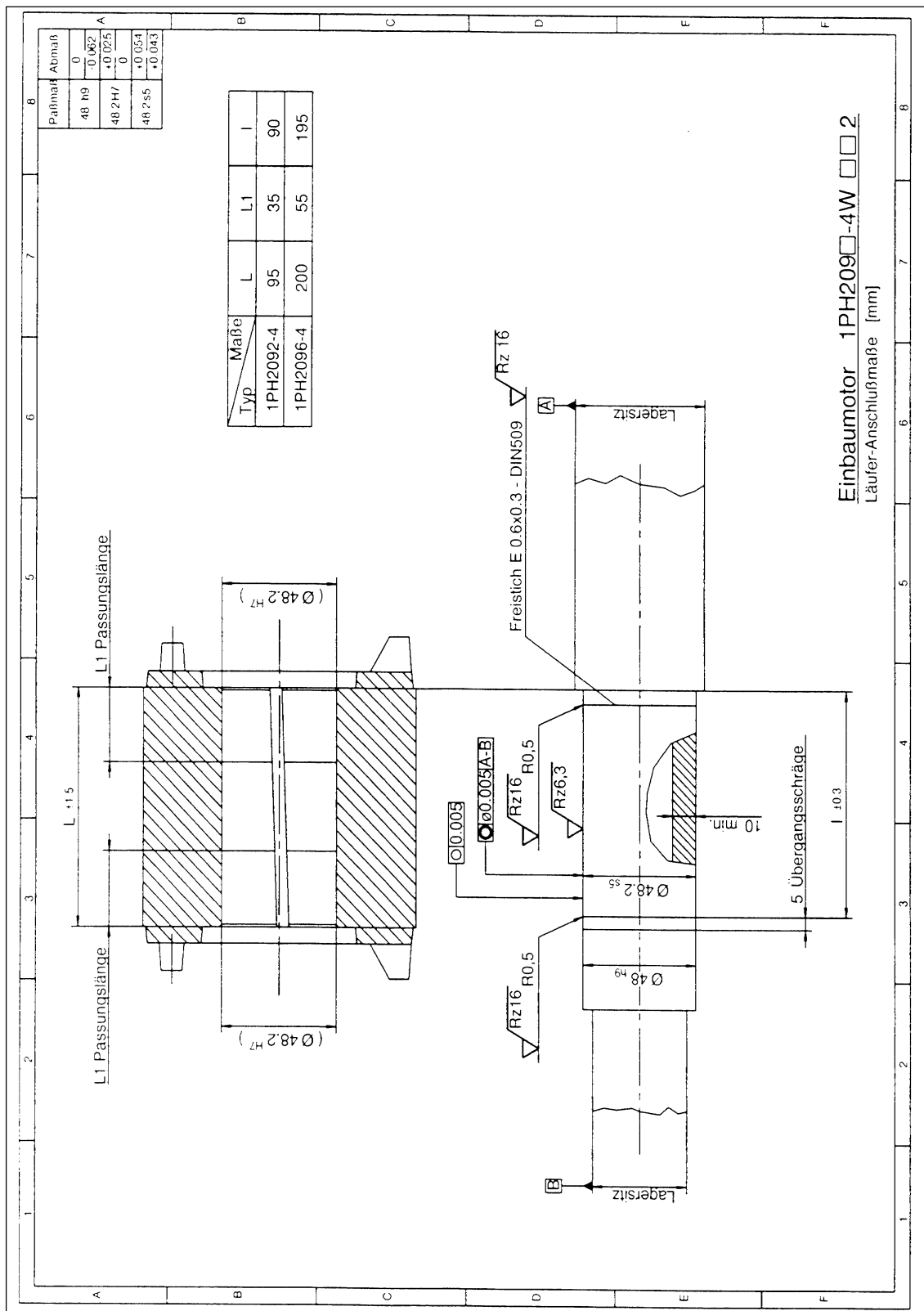
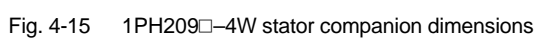


Fig. 4-13 1PH209-4W motor dimensions



1PH2

Fig. 4-14 1PH209-4W rotor companion dimensions



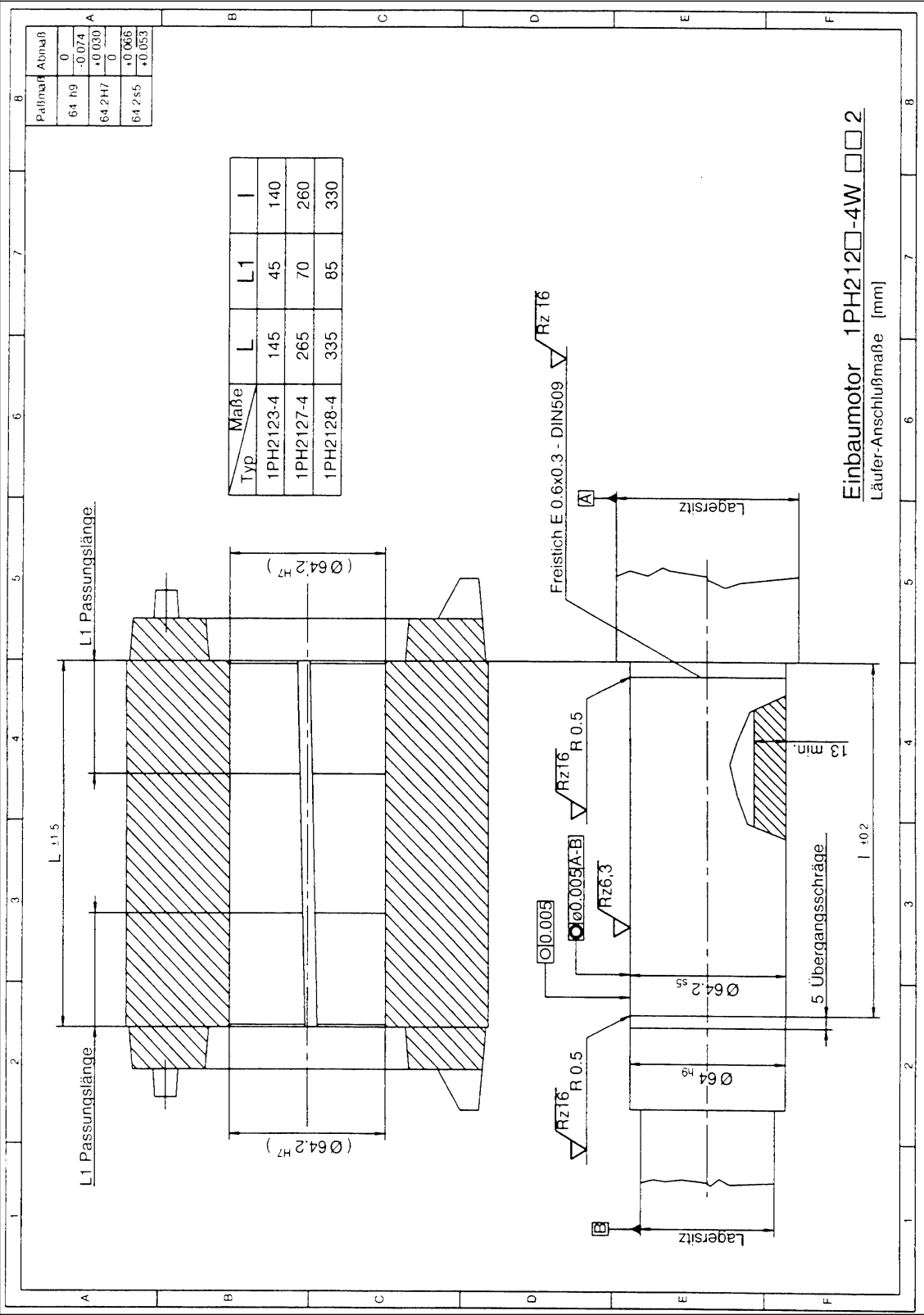


Fig. 4-17 1PH212-4W rotor companion dimensions

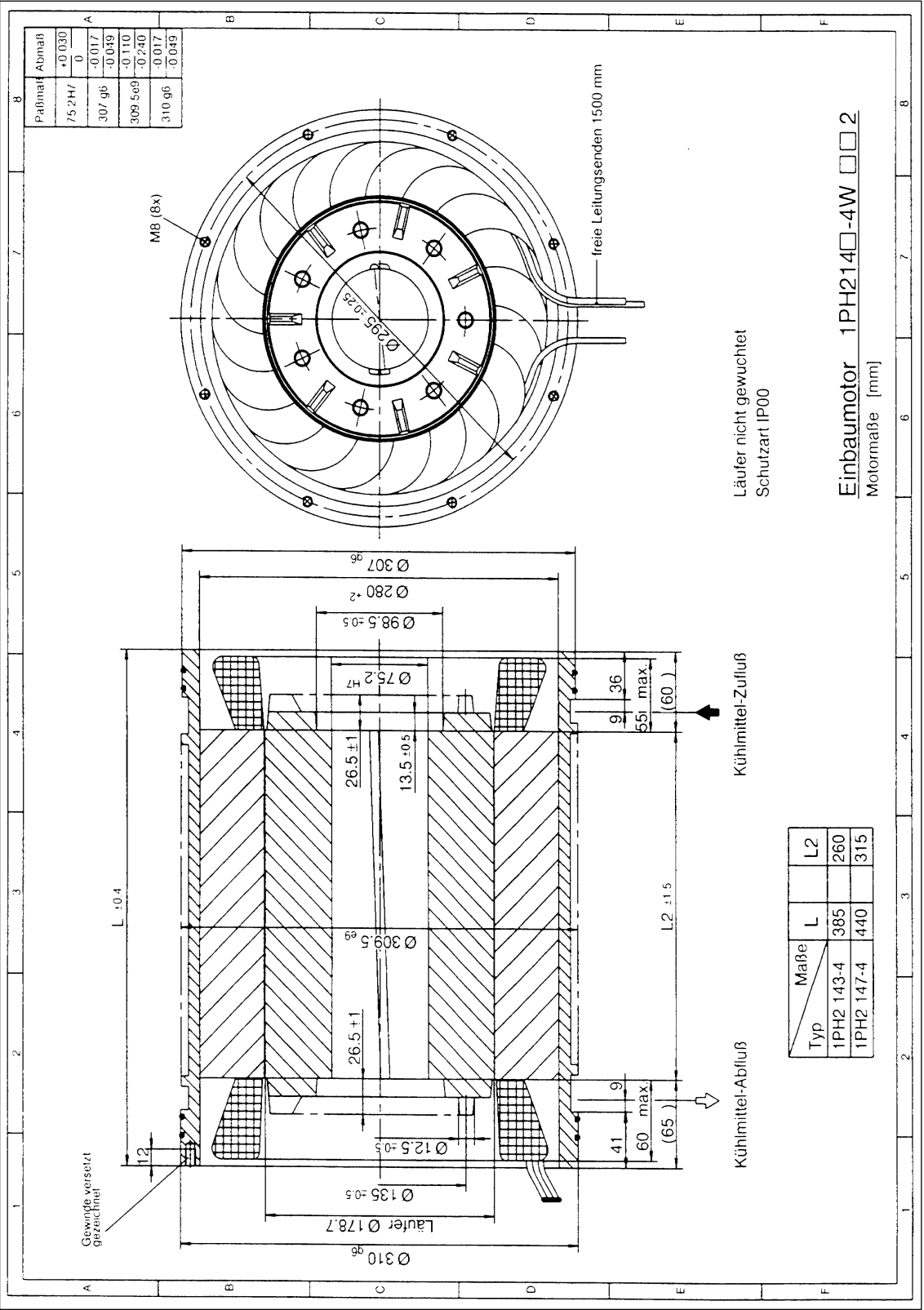
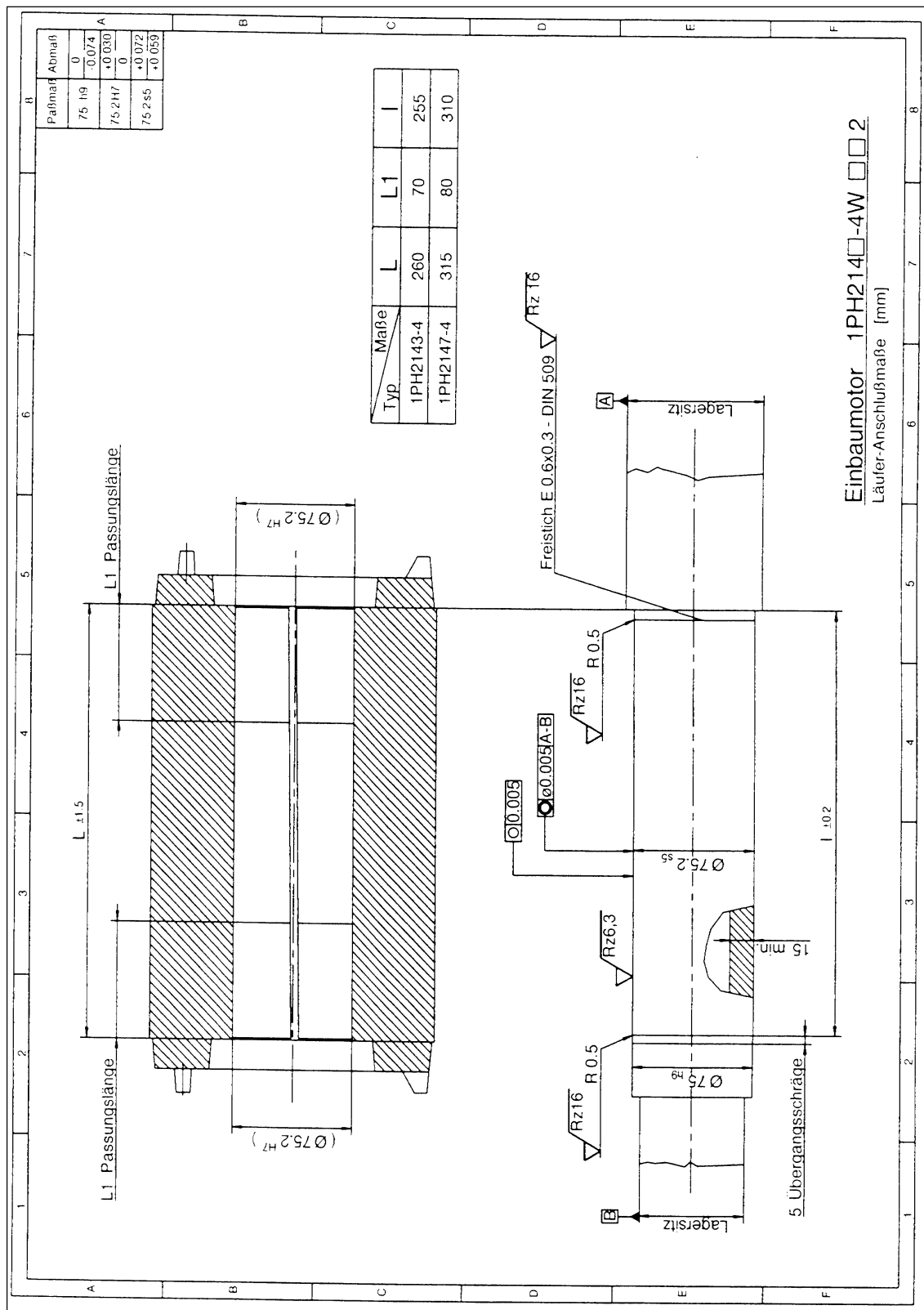


Fig. 4-19 1PH214-4W motor dimensions



1PH2

Fig. 4-20 1PH214-4W rotor companion dimensions

4 Dimension Drawings

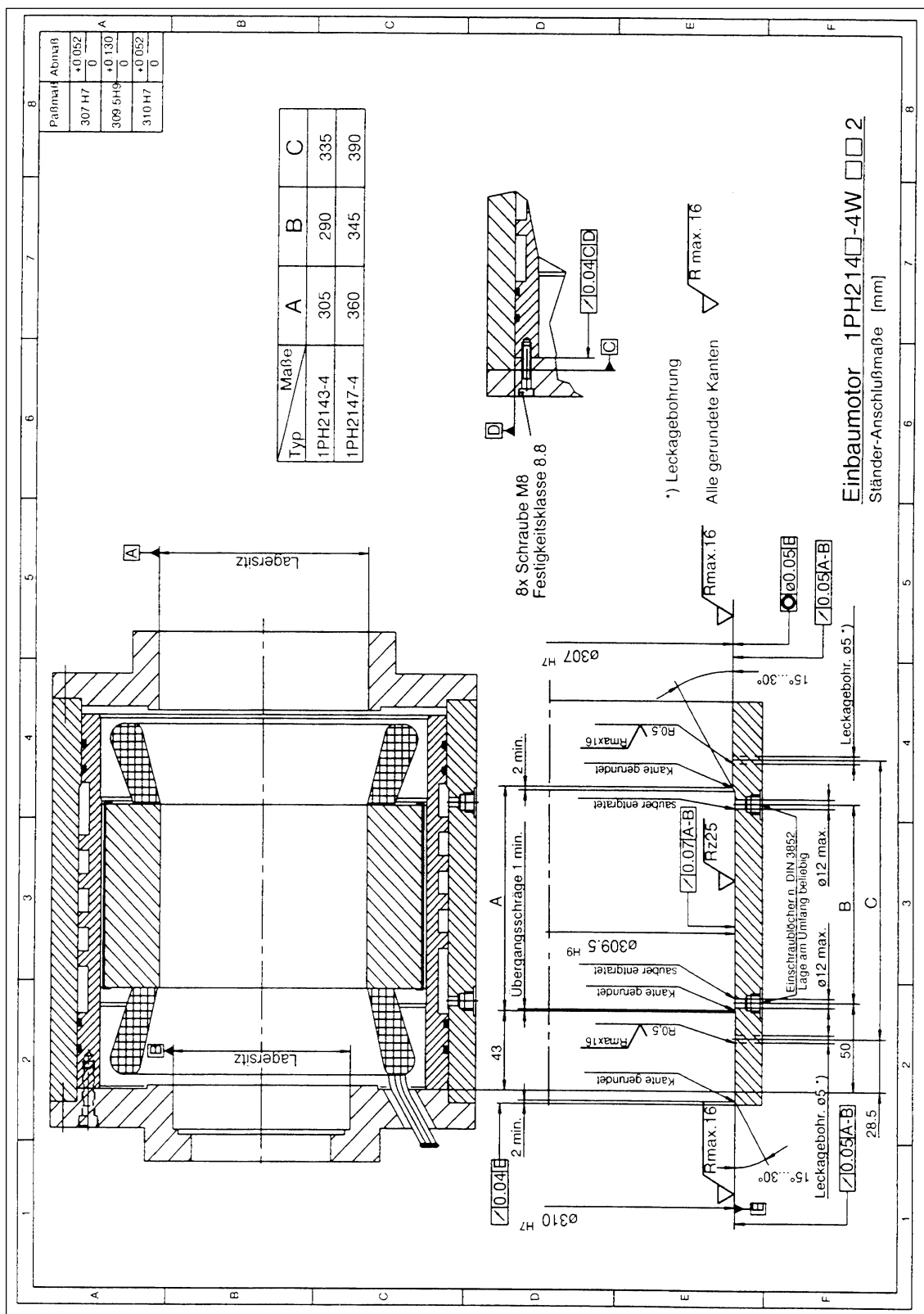


Fig. 4-21 1PH214-4W stator companion dimensions

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[illegible]

1PH4 AC Main Spindle Motors

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1PH4

Notes

[illegible]

1

Motor Description

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.

1PH4

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 ($\leq 25\text{ }^{\circ}\text{C}$, 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 $+25\text{ }^{\circ}\text{C}$ |
| 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 |

1.1 Characteristics and technical data

Table 1-1 Motors, standard version

| Technical features | Version |
|---|---|
| Encoder system | Integrated optical encoder <ul style="list-style-type: none"> • 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 design ¹⁾ (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 | <ul style="list-style-type: none"> • Changeover gearbox • Holding brake |
| Rating plate | 2. Rating plate supplied loose |

1) not suitable for coupling operation; minimum cantilever force required.

Technical data

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 μ m

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 | 6 | 1900 | G 1/4 | 7 |
| 1PH4105 | 6 | 2600 | | |
| 1PH4107 | 6 | 3000 | | |
| 1PH4133 | 8 | 2750 | G 3/8 | |
| 1PH4135 | 8 | 3500 | | |
| 1PH4137 | 8 | 4100 | | |
| 1PH4138 | 8 | 4500 | | |
| 1PH4163 | 10 | 4600 | G 1/2 | |
| 1PH4167 | 10 | 5400 | | |
| 1PH4168 | 10 | 6200 | | |

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.

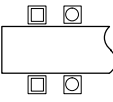
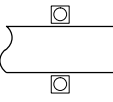
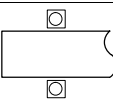
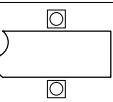
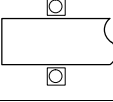
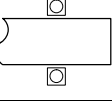
An external tripping unit is not required. The function of the PTC thermistor is monitored. An appropriate signal is output to the drive converter when a fault condition develops. When the motor temperature increases, a “pre-alarm motor overtemperature” relay signal is output, which must be externally 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-groove 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 <ul style="list-style-type: none"> Minimum cantilever force required For high cantilever forces | Standard double-bearing design |  |  |
| Coupling-out drive or planetary gearbox <ul style="list-style-type: none"> Reduced cantilever force is permissible | K00, (K02, K03) Single bearing design |  |  |
| Increased maximum speed <ul style="list-style-type: none"> Cantilever-free out-drive required, e.g. coupling | L37 Single-bearing design "spindle bearing design" |  |  |

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.

1PH4

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 [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] | 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 $0.8 \cdot t_{LW}$ (t_{LW} = bearing change interval)

1.4 Bearing concept

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 | <p>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).</p> <p>The brakes have no slip rings and are maintenance-free. Both of the friction surfaces are metal.</p> <p>Retrofit: Not possible</p> |
| Degree of protection | IP 00 |
| Supply voltage | 24 V DC $\pm 10\%$ |
| Mode of operation | <p>The brake operates according to the working principle, i.e. the brake is released when it is in a no-current condition.</p> <p>The brake may only be applied when the motor is at a standstill.</p> <p>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.</p> <p>After mounting to the motor, the brake should be checked to ensure that it is functioning correctly.</p> |

1PH4

1.6 Options

**Caution**

The holding brake is only designed for a limited number 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 1PH4 | Holding brake | | | | |
|-------------------------|---------------|------------|---------------------|--|-------------------|
| | ZF type | Order No. | Holding torque [Nm] | Power consumption, approx. 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

1.6 Options

Table 1-11 Dimensions for mounting single-surface holding brake [mm]

| Motor 1PH4 | DE shaft end | | | | | | d ₁ H8 | d ₂ Ø | d ₃ 3x displaced through max. +/-0.1 | d ₄ 120° |
|---|--------------|-----|-----|-----|----|--|----------------------|---------------------|--|------------------------|
| | d | D | I | h | y | | | | | |
| 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 gear-box

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.

**1PH4**

Order Designations

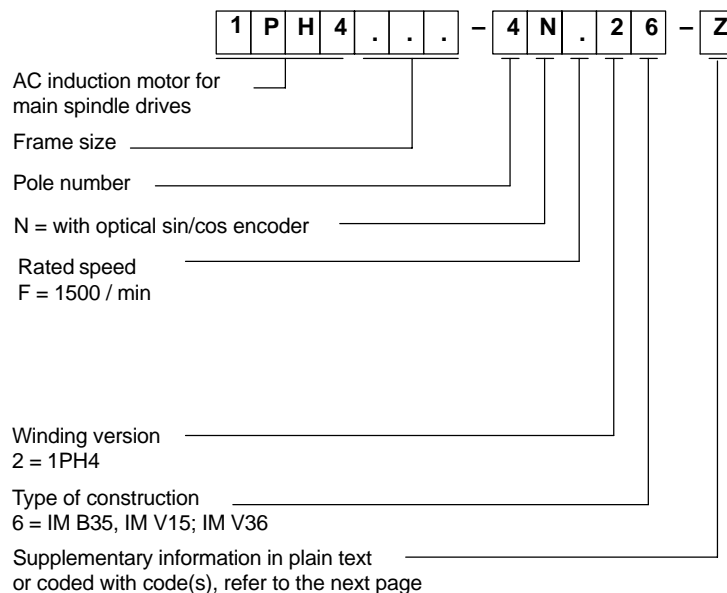
2

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.


1PH4

When ordering special AC motor versions, in addition, a code must be specified for each required version.

2 Order Designations

Supplementary
data for options

| Option | Code |
|--|--|
| Terminal box arrangement (when viewing the drive end) <ul style="list-style-type: none"> on the side, right on the side, left the small terminal box and signal connector rotated through 90° (cable entry from the drive end) the small terminal box and signal connector rotated through 90° (cable entry from the non-drive end) the terminal box and signal connector rotated through 180° | K09 K10 K83 K84 K85 |
| Bearing version on the drive end <ul style="list-style-type: none"> single-bearing design for coupling, planetary gearbox or for low up to medium cantilever forces single-bearing design for increased speeds radial shaft sealing ring; oil-tight | K00 L37 K18 |
| Vibration severity (acc. to IEC 34-14, DIN VDE 0530, Part 14) <ul style="list-style-type: none"> grade S for double-bearing design grade S for single-bearing design grade SR single-bearing designs | K05 1) 4) K02 1) 4) K03 1) 4) |
| Shaft and flange accuracy (acc. to DIN 42955) <ul style="list-style-type: none"> tolerance R | K04 2) |
| Drive shaft end AS <ul style="list-style-type: none"> shaft end "B" (without keyway) | K42 |
| Balancing <ul style="list-style-type: none"> half-key balancing | L69 |
| Gearboxes ⁵⁾ <ul style="list-style-type: none"> the motor is prepared for mounting a 2LG43 ZF changeover gearbox | K00 3) |
| Holding brake <ul style="list-style-type: none"> motor with mounted holding brake (drive end) | G46 4) |
| Others <ul style="list-style-type: none"> 2nd rating plate, supplied loose without encoder system | K31 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 %.

1PH4

Table 3-1 AC main spindle motor 1PH4103–4NF2

| Rated out-put P_{rated} [kW] | Rated speed n_{rated} [RPM] | Rated tor-que M_{rated} [Nm] | Rated cur-rent 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 |

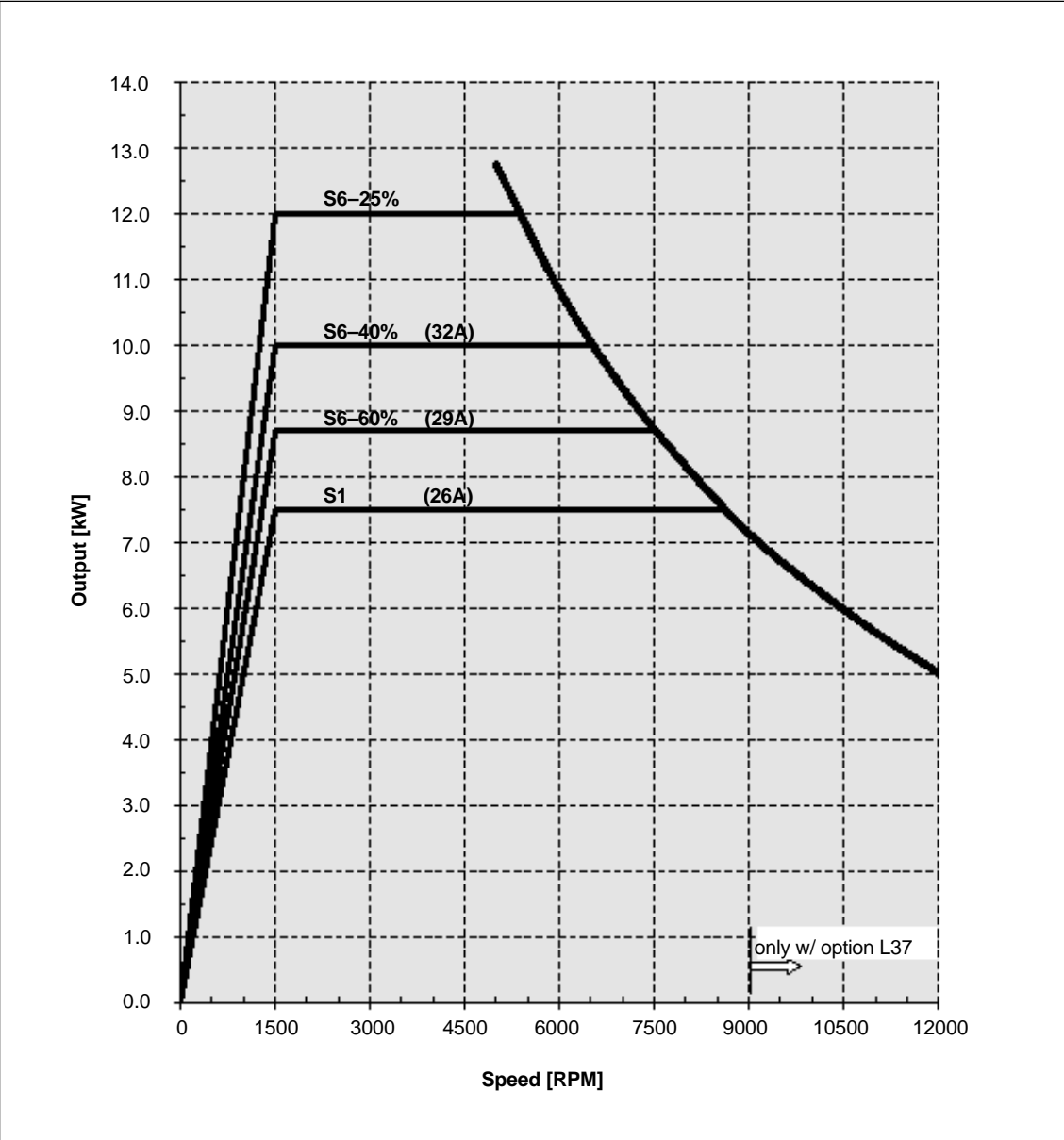
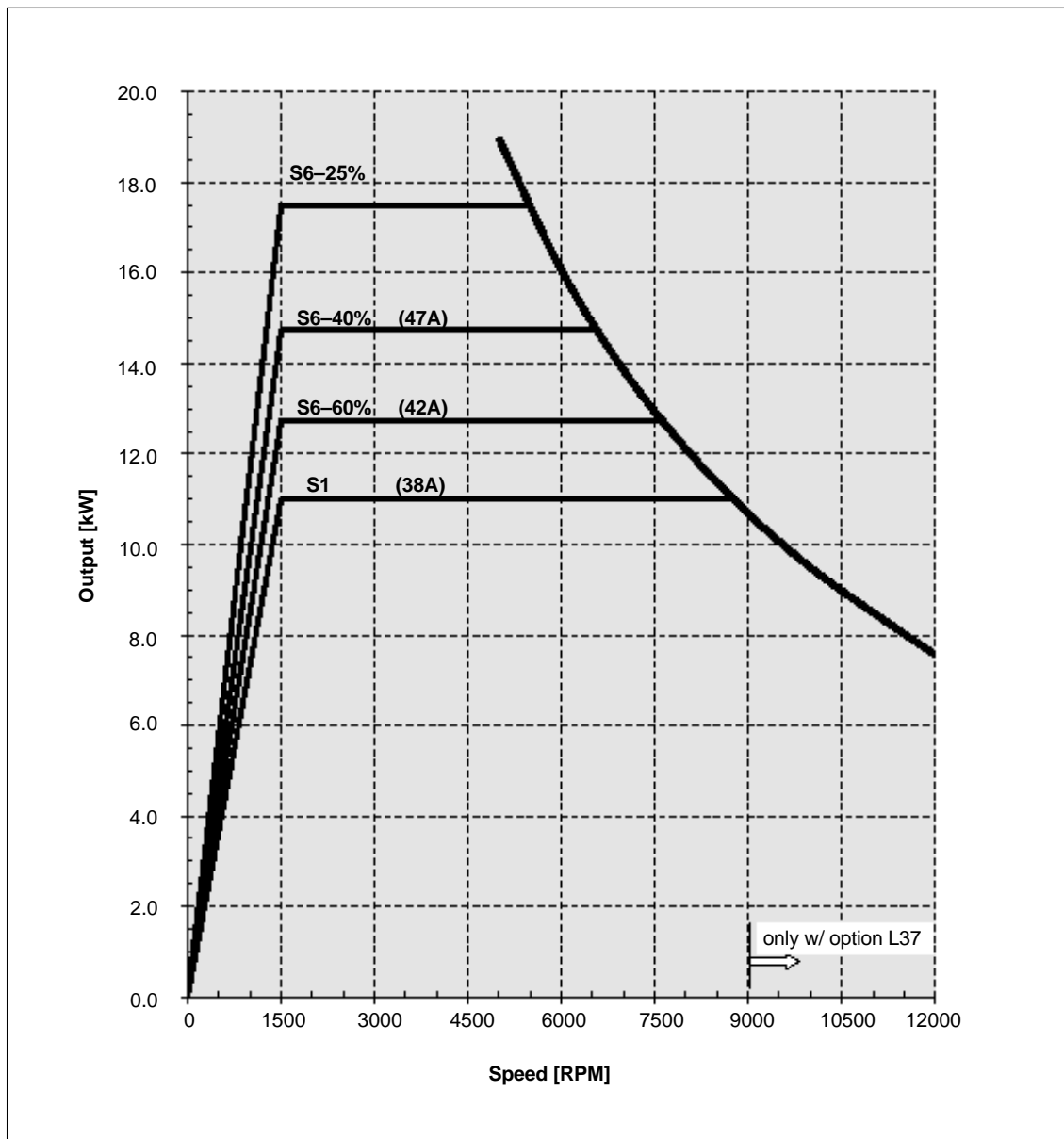


Fig. 3-1 Speed–power diagram 1PH4103–4NF2

Table 3-2 AC main spindle motor 1PH4105-4NF2

| Rated out-put P_{rated} [kW] | Rated speed n_{rated} [RPM] | Rated tor-que M_{rated} [Nm] | Rated cur-rent 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 |



1PH4

Fig. 3-2 Speed-power diagram 1PH4105-4NF2

Table 3-3 AC main spindle motor 1PH4107–4NF2

| Rated out-put P_{rated} [kW] | Rated speed n_{rated} [RPM] | Rated tor-que M_{rated} [Nm] | Rated cur-rent 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 |

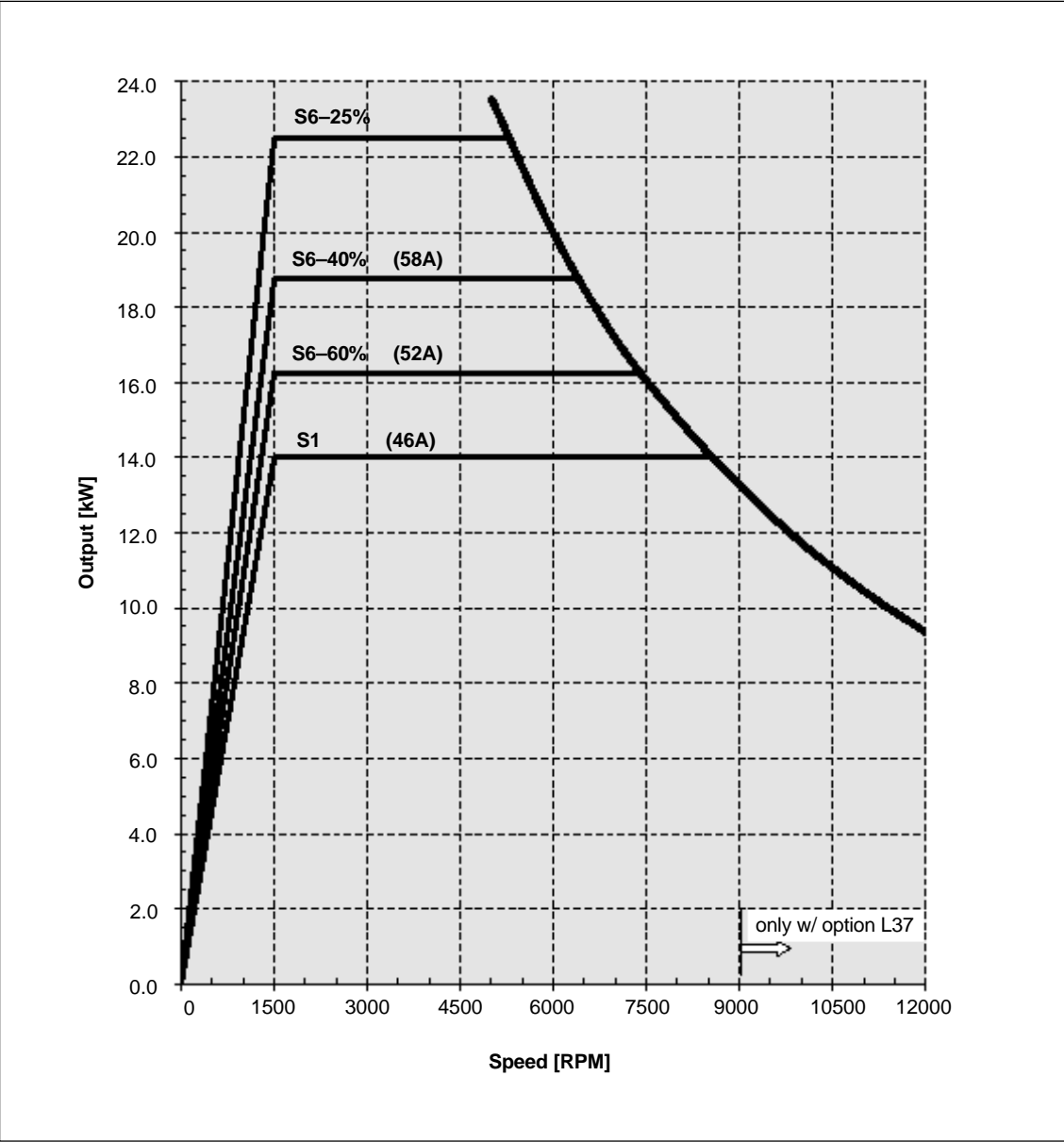


Fig. 3-3 Speed–power diagram 1PH4107–4NF2

Table 3-4 AC main spindle motor 1PH4133-4NF2

| Rated out-put P_{rated} [kW] | Rated speed n_{rated} [RPM] | Rated tor-que M_{rated} [Nm] | Rated cur-rent 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 |

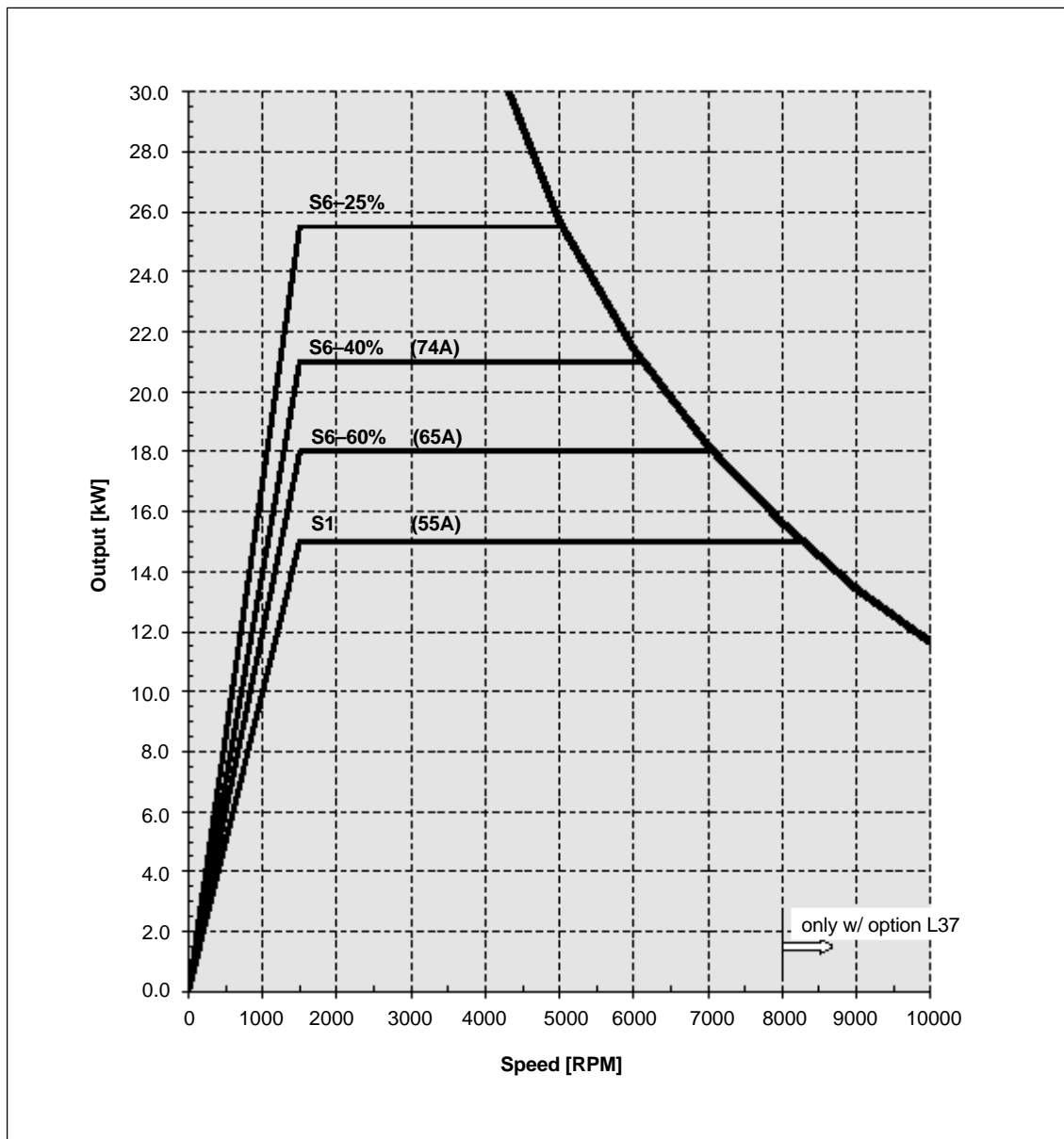
**1PH4**

Fig. 3-4 Speed-power diagram 1PH4133-4NF2

3.1 Speed–power diagrams

Table 3-5 AC main spindle motor 1PH4135–4NF2

| Rated out-put P_{rated} [kW] | Rated speed n_{rated} [RPM] | Rated tor-que M_{rated} [Nm] | Rated cur-rent 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 |

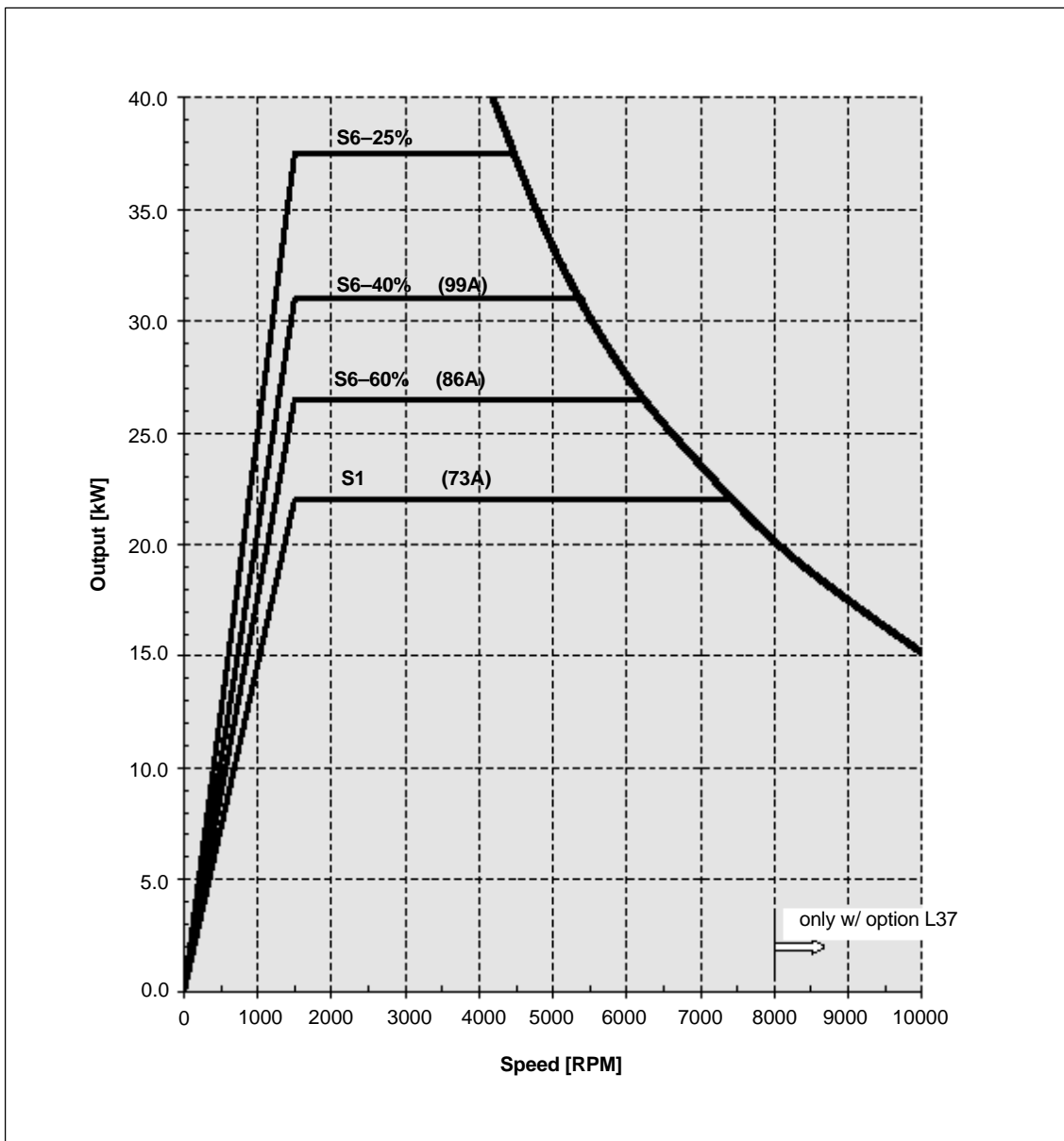


Fig. 3-5 Speed–power diagram 1PH4135–4NF2

Table 3-6 AC main spindle motor 1PH4137-4NF2

| Rated out-put P_{rated} [kW] | Rated speed n_{rated} [RPM] | Rated tor-que M_{rated} [Nm] | Rated cur-rent I_{rated} [A] | Time constant (therm.) T_{th} [min] | Max. speed n_{max} [RPM] | Moment of inertia J [kgm ²] | Weight m [kg] |
|---|--|---|---|---|---|---|-----------------------|
| 27 | 1500 | 170 | 85 | 11 | 8000 | 0.085 | 130 |

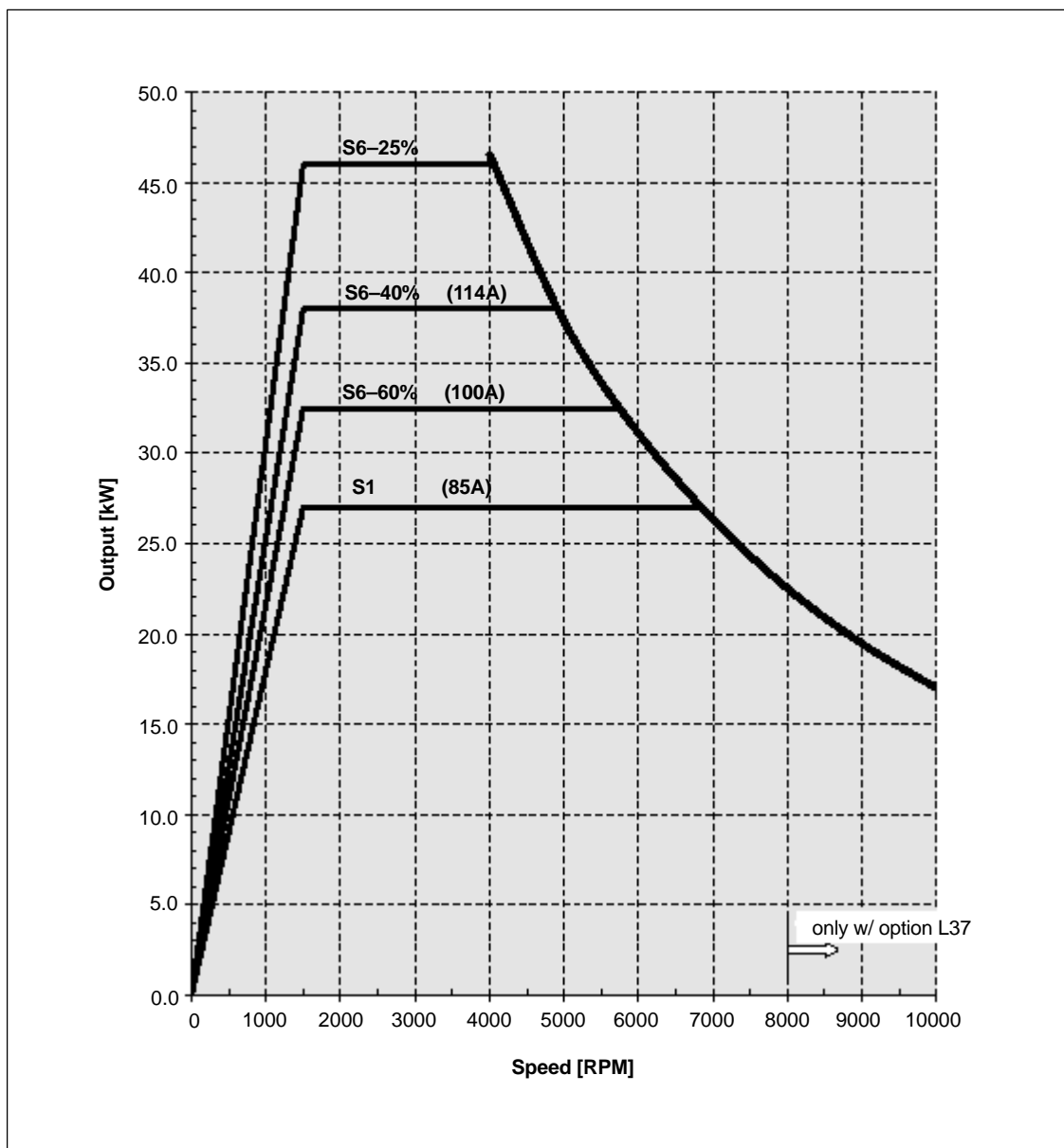
**1PH4**

Fig. 3-6 Speed-power diagram 1PH4137-4NF2

3.1 Speed–power diagrams

Table 3-7 AC main spindle motor 1PH4138–4NF2

| Rated out-put P_{rated} [kW] | Rated speed n_{rated} [RPM] | Rated tor-que M_{rated} [Nm] | Rated cur-rent 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 |

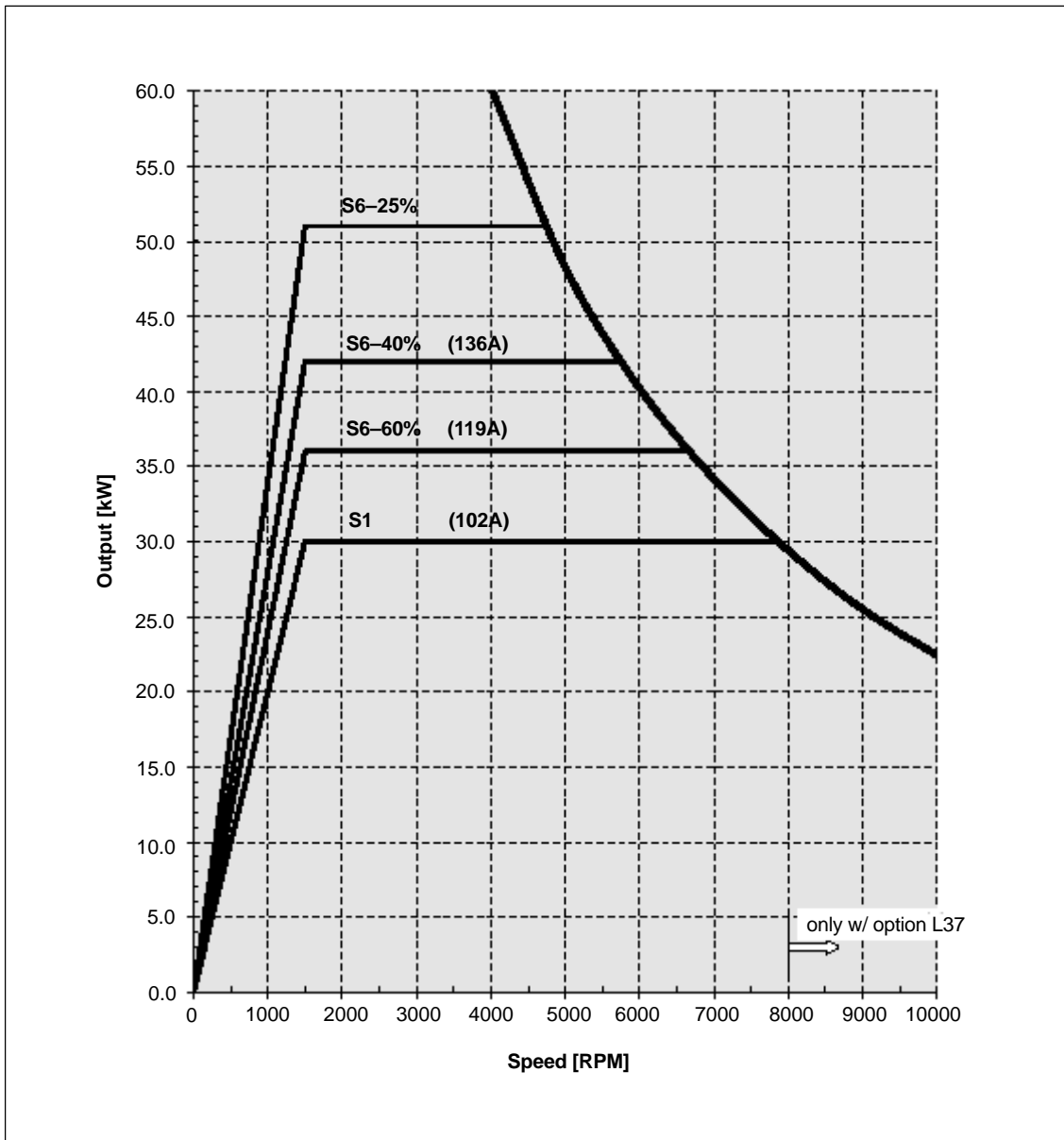


Fig. 3-7 Speed–power diagram 1PH4138–4NF2

Table 3-8 AC main spindle motor 1PH4163-4NF2

| Rated out- put P_{rated} [kW] | Rated speed n_{rated} [RPM] | Rated tor- que M_{rated} [Nm] | Rated cur- rent 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 |

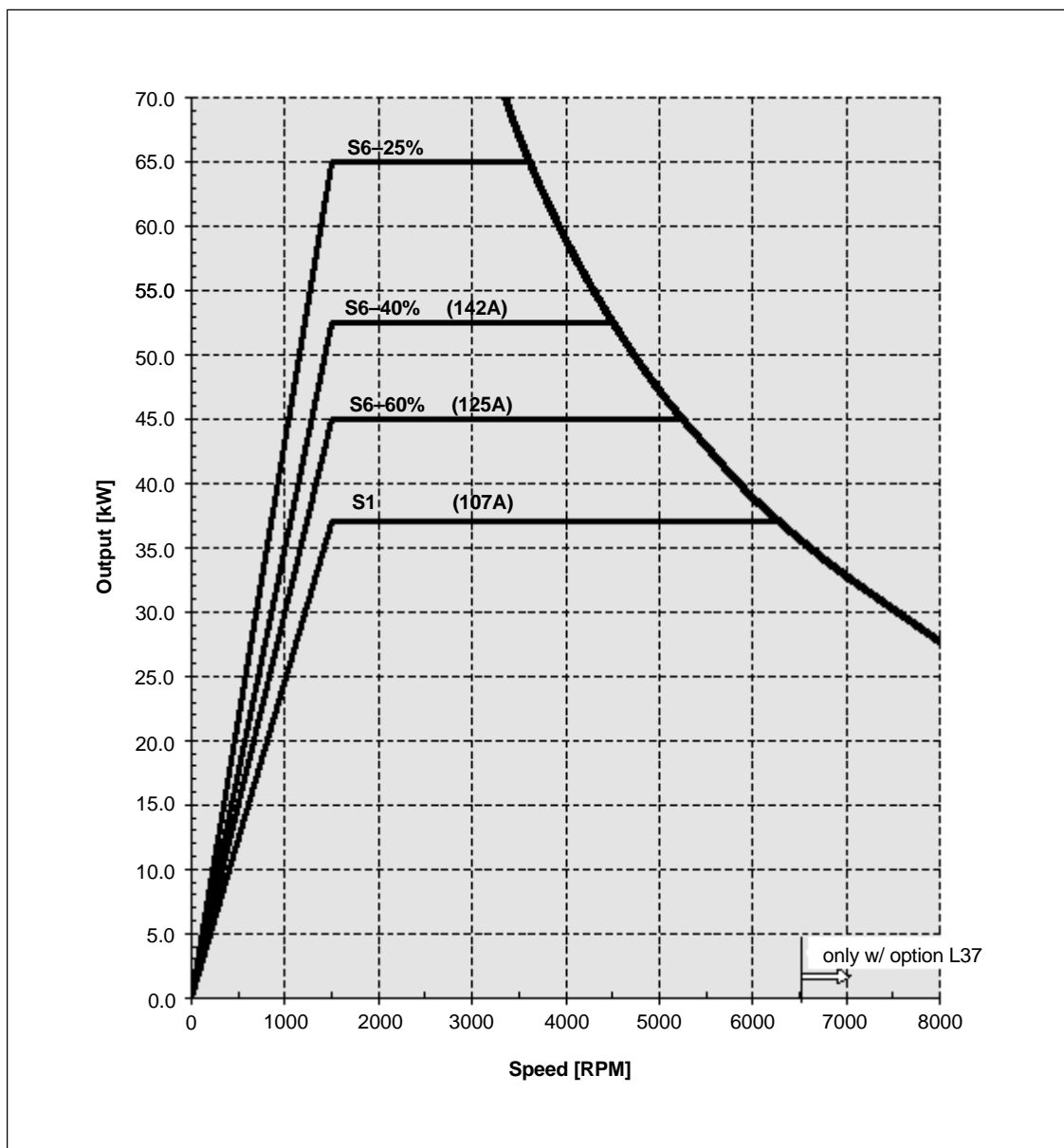
**1PH4**

Fig. 3-8 Speed-power diagram 1PH4163-4NF2

3.1 Speed–power diagrams

Table 3-9 AC main spindle motor 1PH4167–4NF2

| Rated out-put P_{rated} [kW] | Rated speed n_{rated} [RPM] | Rated tor-que M_{rated} [Nm] | Rated cur-rent 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 |

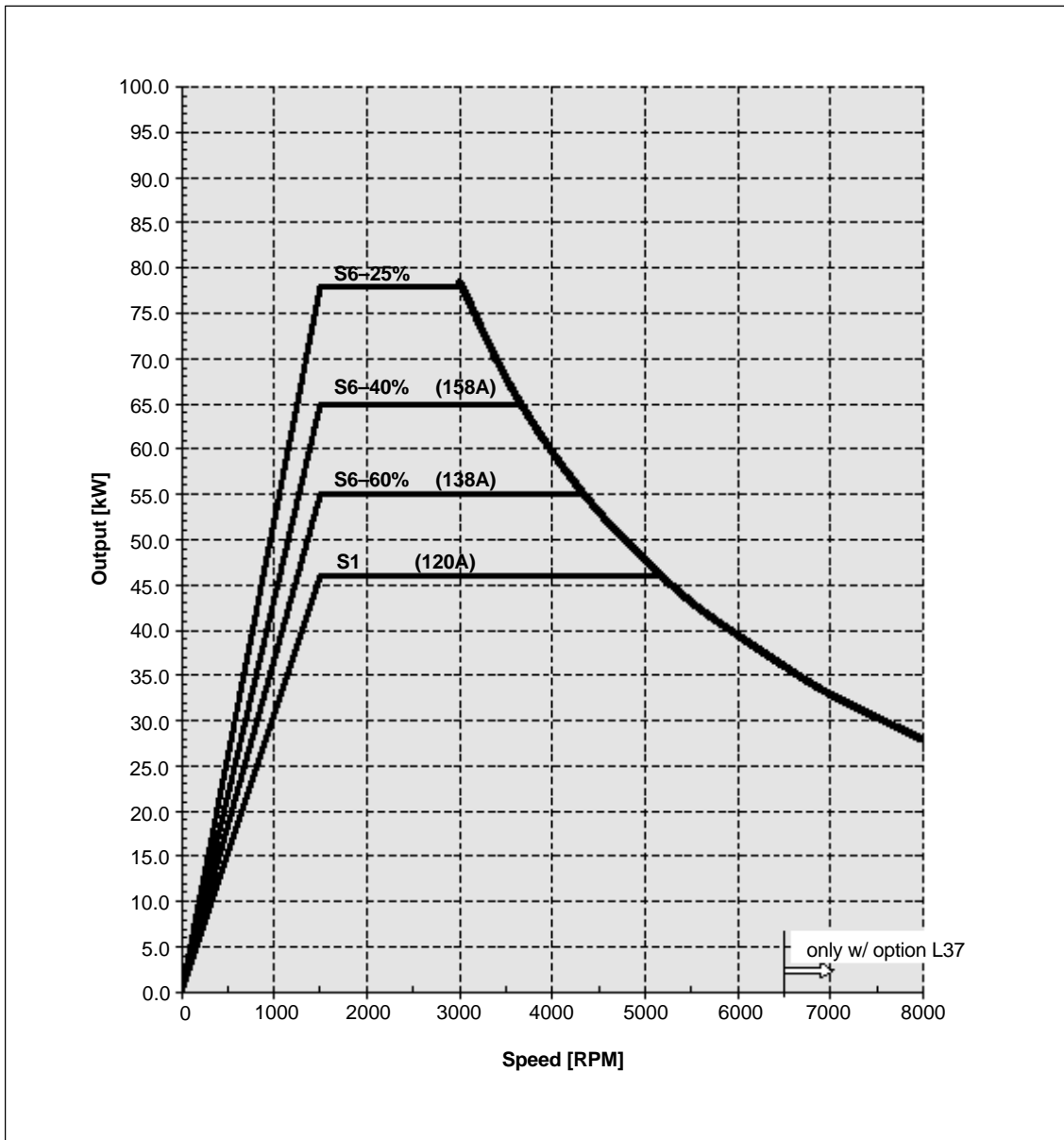
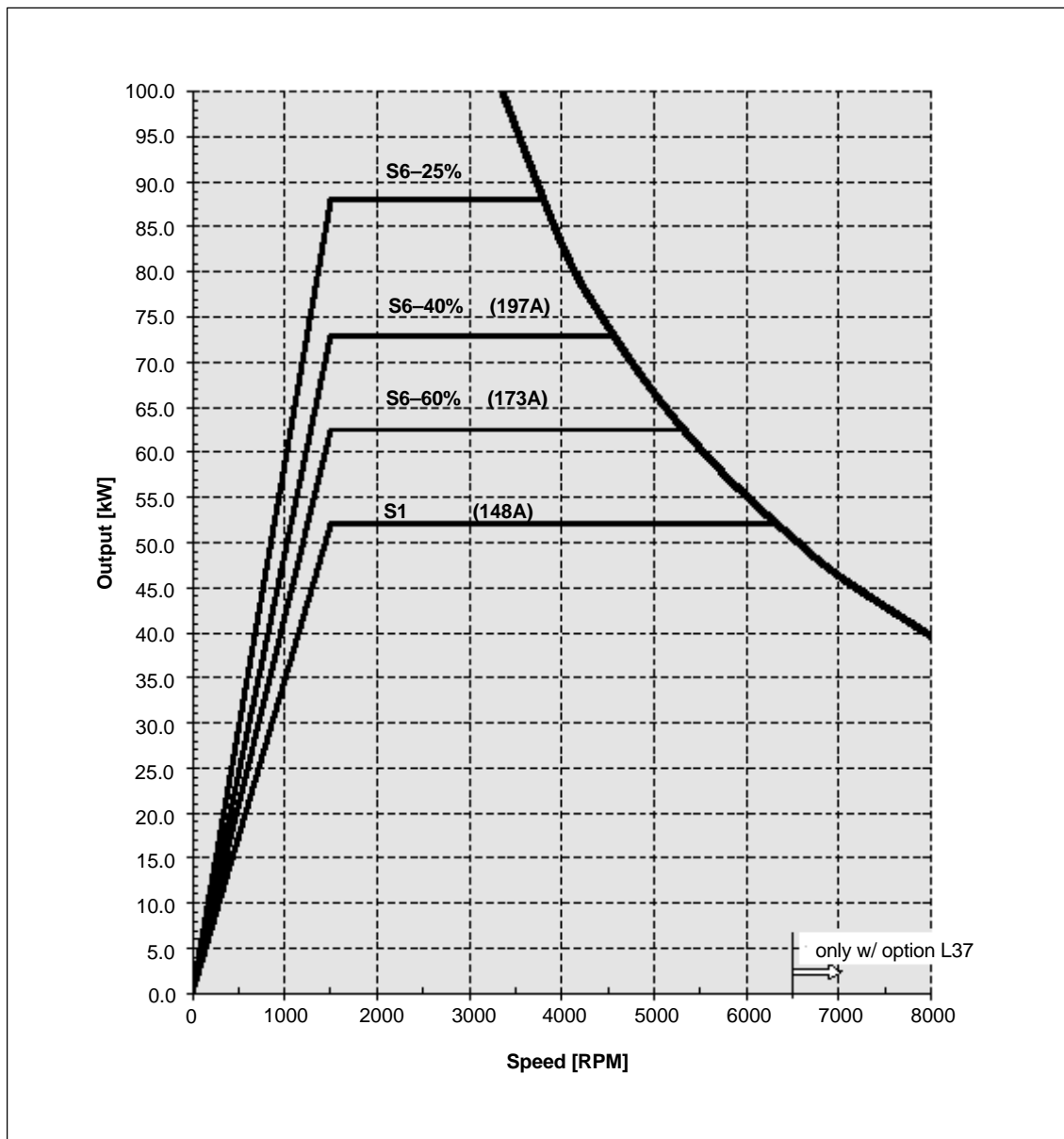


Fig. 3-9 Speed–power diagram 1PH4167–4NF2

Table 3-10 AC main spindle motor 1PH4168-4NF2

| Rated out-put P_{rated} [kW] | Rated speed n_{rated} [RPM] | Rated tor-que M_{rated} [Nm] | Rated cur-rent 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 |



1PH4

Fig. 3-10 Speed-power diagram 1PH4168-4NF2

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 that 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 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, 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 Chapter I 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 | 125 | 320 |
| 1PH4105 | 155 | 320 |
| 1PH4107 | 205 | 320 |
| 1PH4133 | 215 | 360 |
| 1PH4135 | 305 | 360 |
| 1PH4137 | 365 | 360 |
| 1PH4138 | 445 | 360 |
| 1PH4163 | 500 | 520 |
| 1PH4167 | 590 | 520 |
| 1PH4168 | 665 | 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 F_A in [N] | 1440 | 1270 | 1050 | 920 | 830 | 760 | 690 |
| 1PH413□–4 | Speed n in [RPM] | 1500 | 2000 | 3000 | 4000 | 5000 | 6700 | |
| | Axial force F_A in [N] | 1520 | 1330 | 1090 | 950 | 850 | 730 | |
| 1PH416□–4 | Speed n in [RPM] | 1500 | 2000 | 3000 | 4000 | 5300 | | |
| | Axial force F_A in [N] | 2080 | 1830 | 1520 | 1340 | 1180 | | |

**Cantilever force
1PH410□****Permissible cantilever forces for double-bearing designs (standard).**

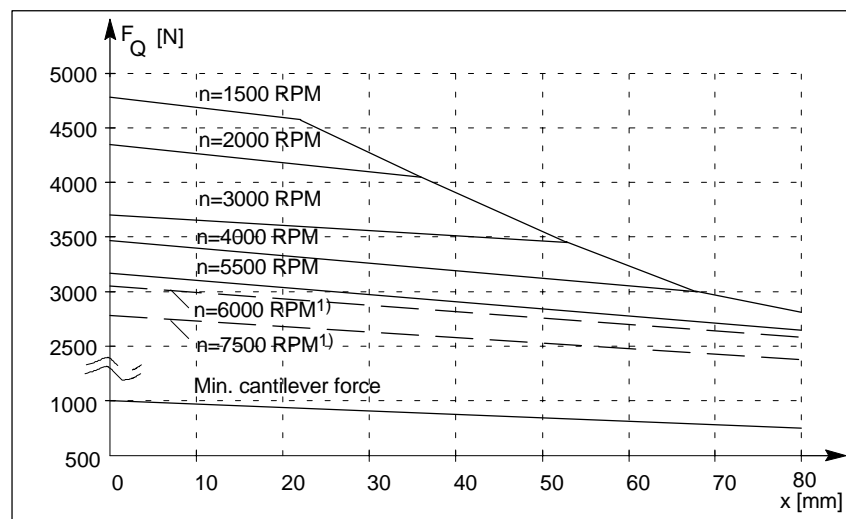
Permissible cantilever force F_Q at a distance x from the shaft shoulder for a nominal bearing lifetime of 20 000 h.

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

3.2 Cantilever/axial force diagrams

**Cantilever force
1PH413****Permissible cantilever forces for double-bearing design (standard).**

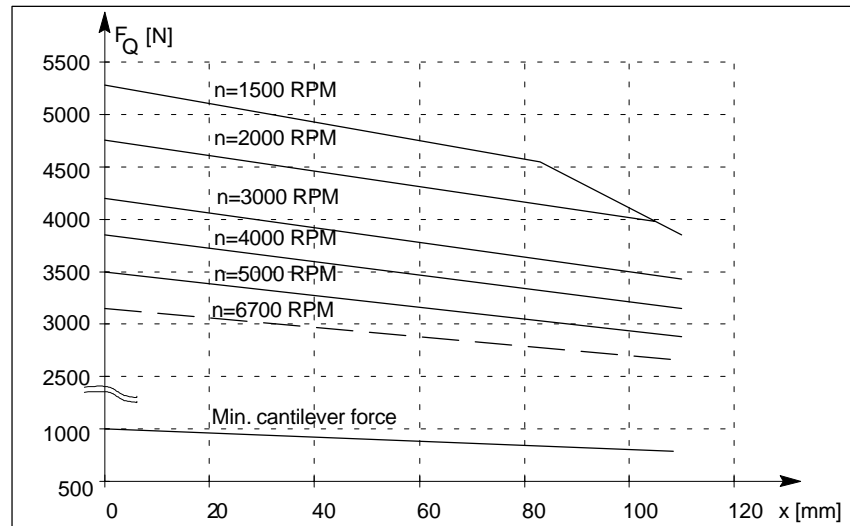
Permissible cantilever force F_Q at a distance x from the shaft shoulder for a nominal bearing lifetime of 20 000 h.

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).**

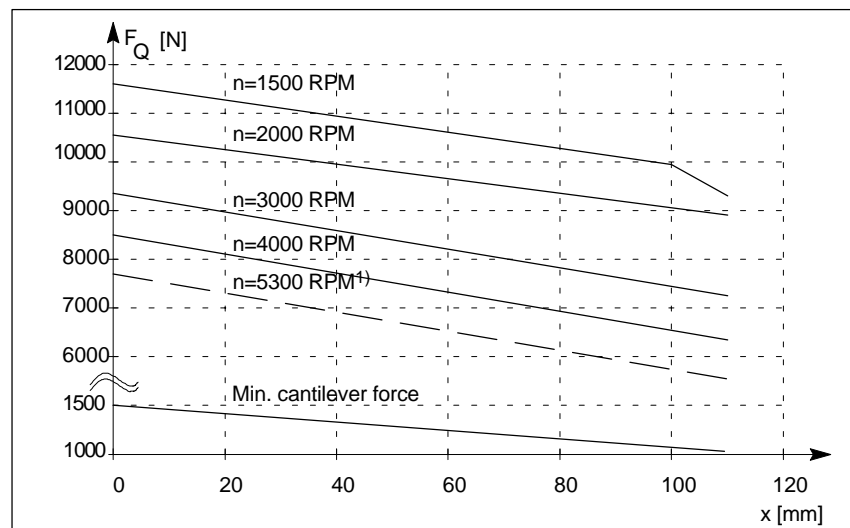
Permissible cantilever force F_Q at a distance x from the shaft shoulder for a nominal bearing lifetime of 20 000 h.

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)**

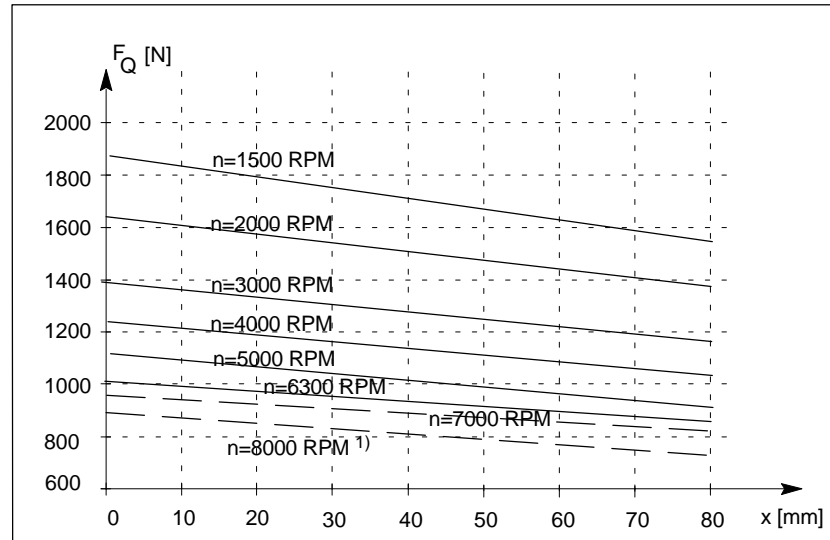
Permissible cantilever force F_Q at a distance x from the shaft shoulder for a nominal bearing lifetime of 20 000 h. ¹⁾

Max. continuous operating speed

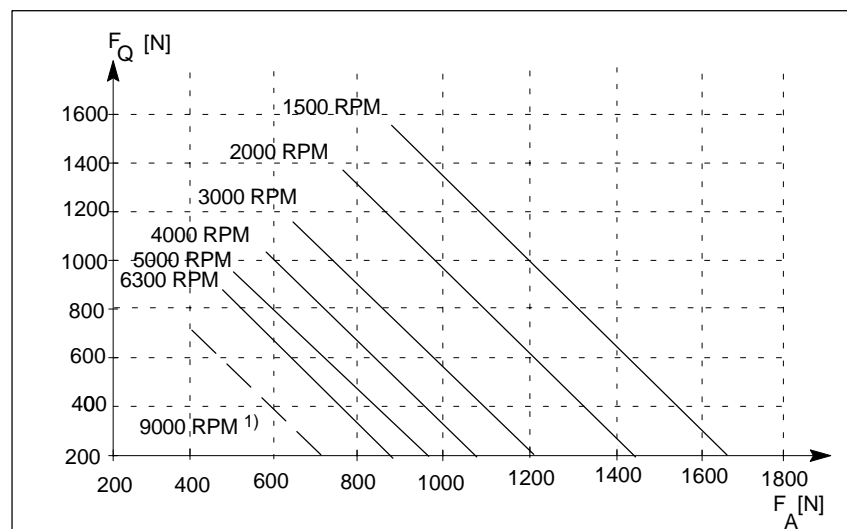
$n_{s1max} = 6500 \text{ RPM}$

Mechanical limiting speed

$n_{max} = 9000 \text{ RPM}$

**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.

1PH4

1) Permissible for continuous operation, however, reduced bearing lifetime

3.2 Cantilever/axial force diagrams

**Cantilever force
1PH413□****Permissible cantilever forces for 1PH413 single-bearing designs (option K00).**

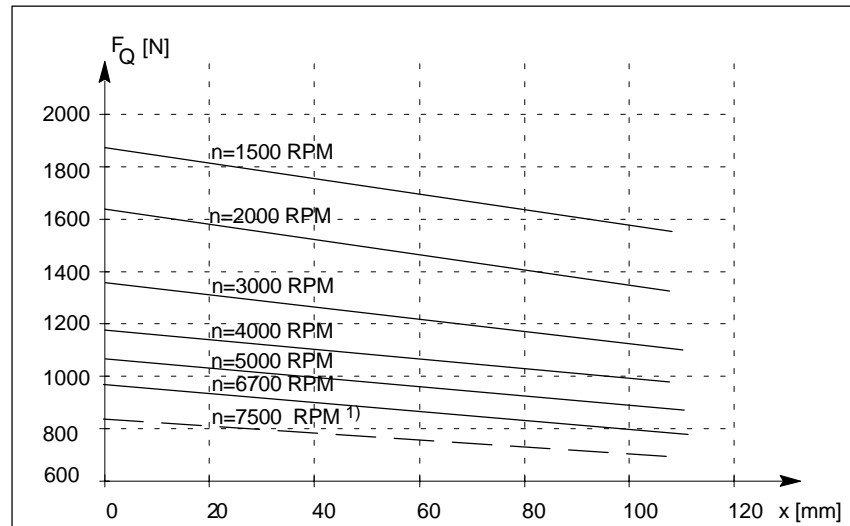
Permissible cantilever force F_Q at a distance x from the shaft shoulder for a nominal bearing lifetime of 20 000 h. ¹⁾

Max. continuous operating speed

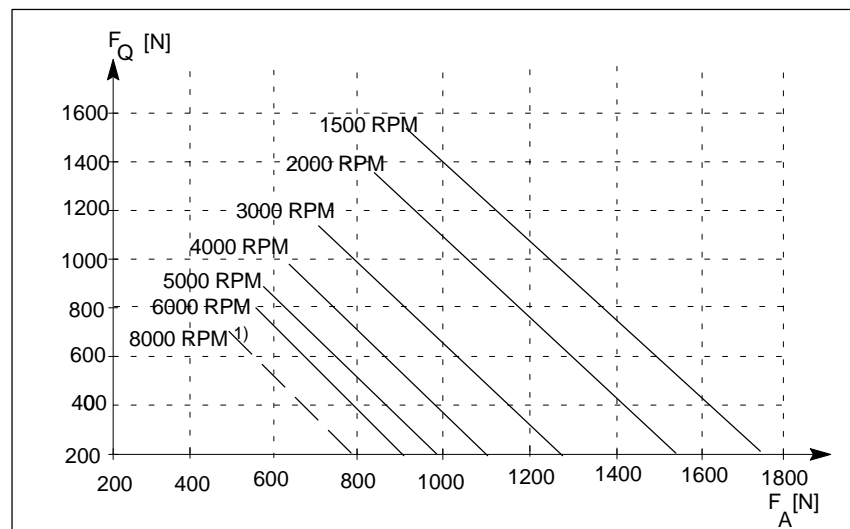
$n_{s1max} = 6000 \text{ RPM}$

Mechanical limiting speed

$n_{max} = 8000 \text{ RPM}$

**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).**

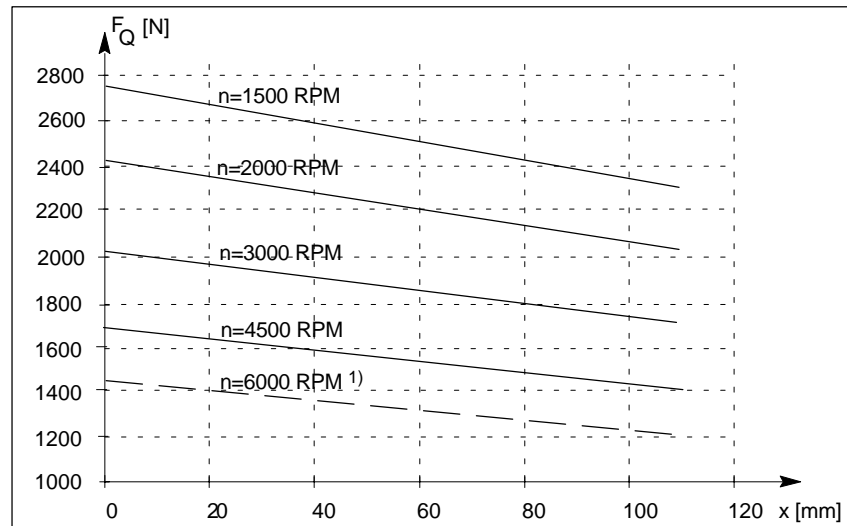
Permissible cantilever force F_Q at a distance x from the shaft shoulder for a nominal bearing lifetime of 20 000 h. ¹⁾

Max. continuous operating speed

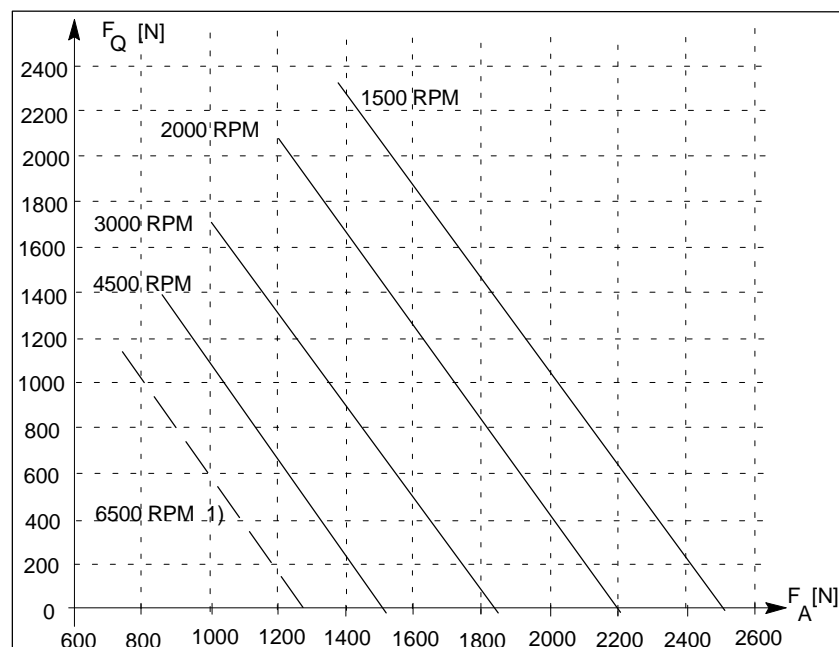
$n_{s1max} = 4500 \text{ RPM}$

Mechanical limiting speed

$n_{max} = 6500 \text{ RPM}$

**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

3.2 Cantilever/axial force diagrams

**Cantilever force
1PH410□****Permissible cantilever forces for 1PH410 single-bearing designs
(option K00 with L37)**

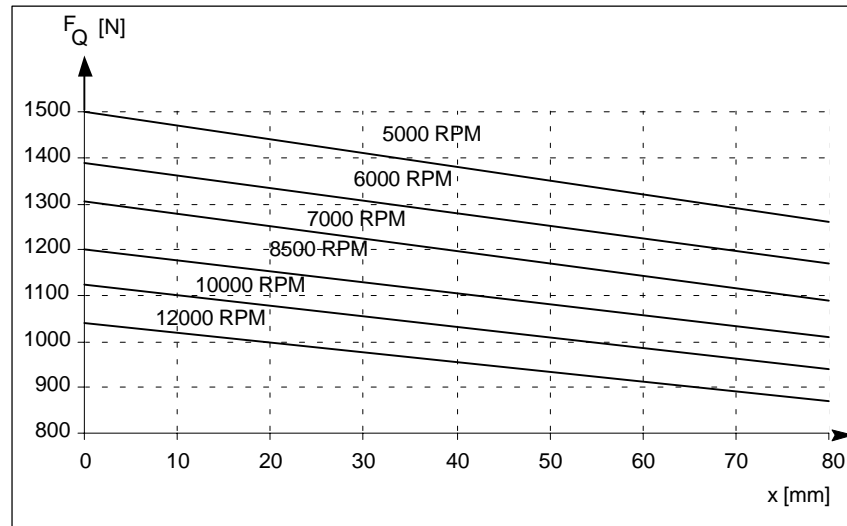
Permissible cantilever force F_Q at a distance x from the shaft shoulder for a nominal bearing lifetime of 10 000 h. ¹⁾

Max. continuous operating speed

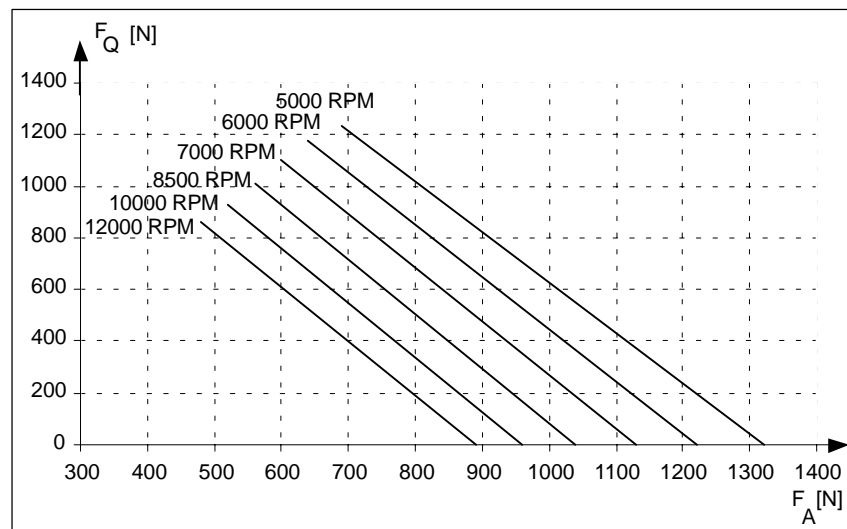
$n_{s1max} = 10000 \text{ RPM}$

Mechanical limiting speed

$n_{max} = 12000 \text{ RPM}$

**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).**

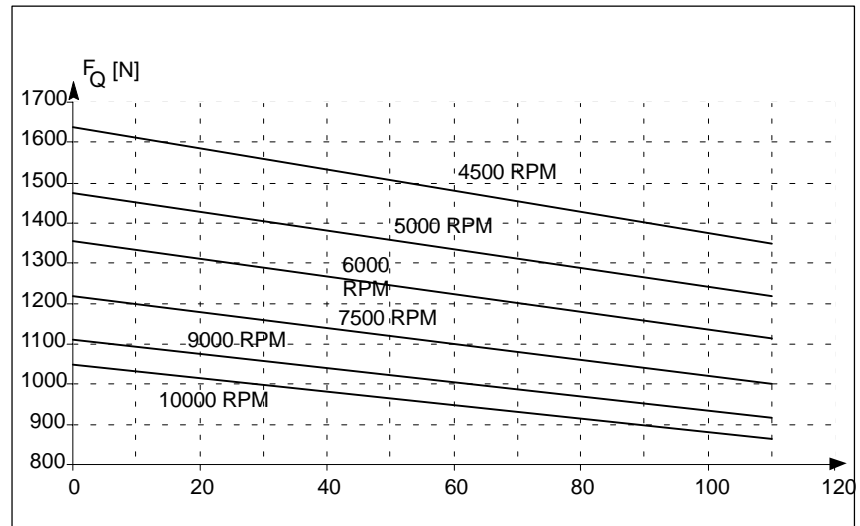
Permissible cantilever force F_Q at a distance x from the shaft shoulder for a nominal bearing lifetime of 10 000 h. ¹⁾

Max. continuous operating speed

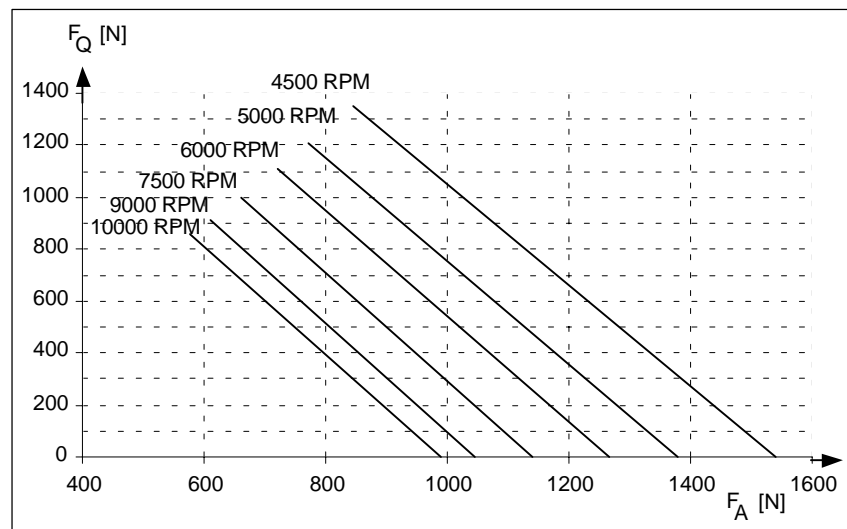
$n_{s1max} = 9250 \text{ RPM}$

Mechanical limiting speed

$n_{max} = 10000 \text{ RPM}$

**Cantilever force
1PH413□****Permissible cantilever forces for 1PH413 single-bearing designs (option
K00 with L37) as a function of the axial forces [mm]**

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

3.2 Cantilever/axial force diagrams

**Cantilever force
1PH416□****Permissible cantilever forces for 1PH416 single-bearing designs
(option K00 with L37).**

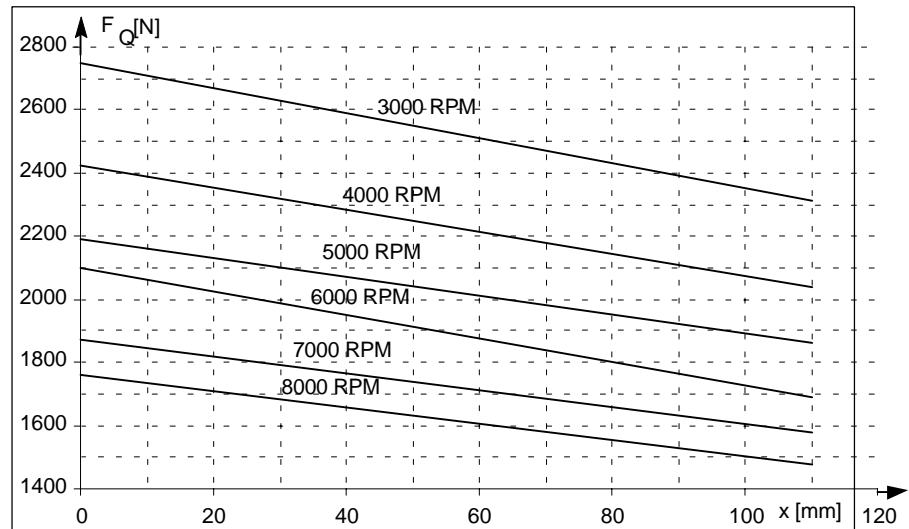
Permissible cantilever force F_Q at a distance x from the shaft shoulder for a nominal bearing lifetime of 10 000 h. ¹⁾

Ma. continuous operating speed

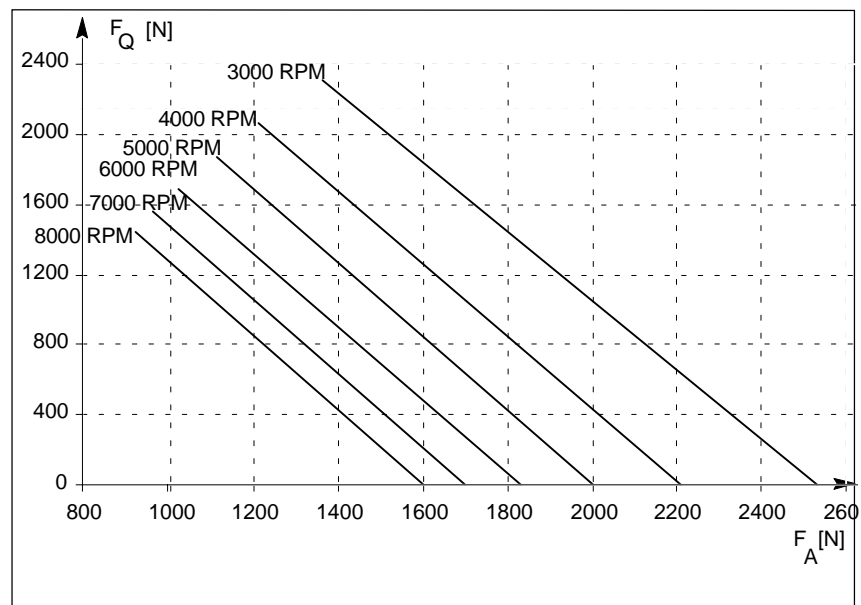
$n_{s1max} = 7000 \text{ RPM}$

Mechanical limiting speed

$n_{max} = 8000 \text{ RPM}$

**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

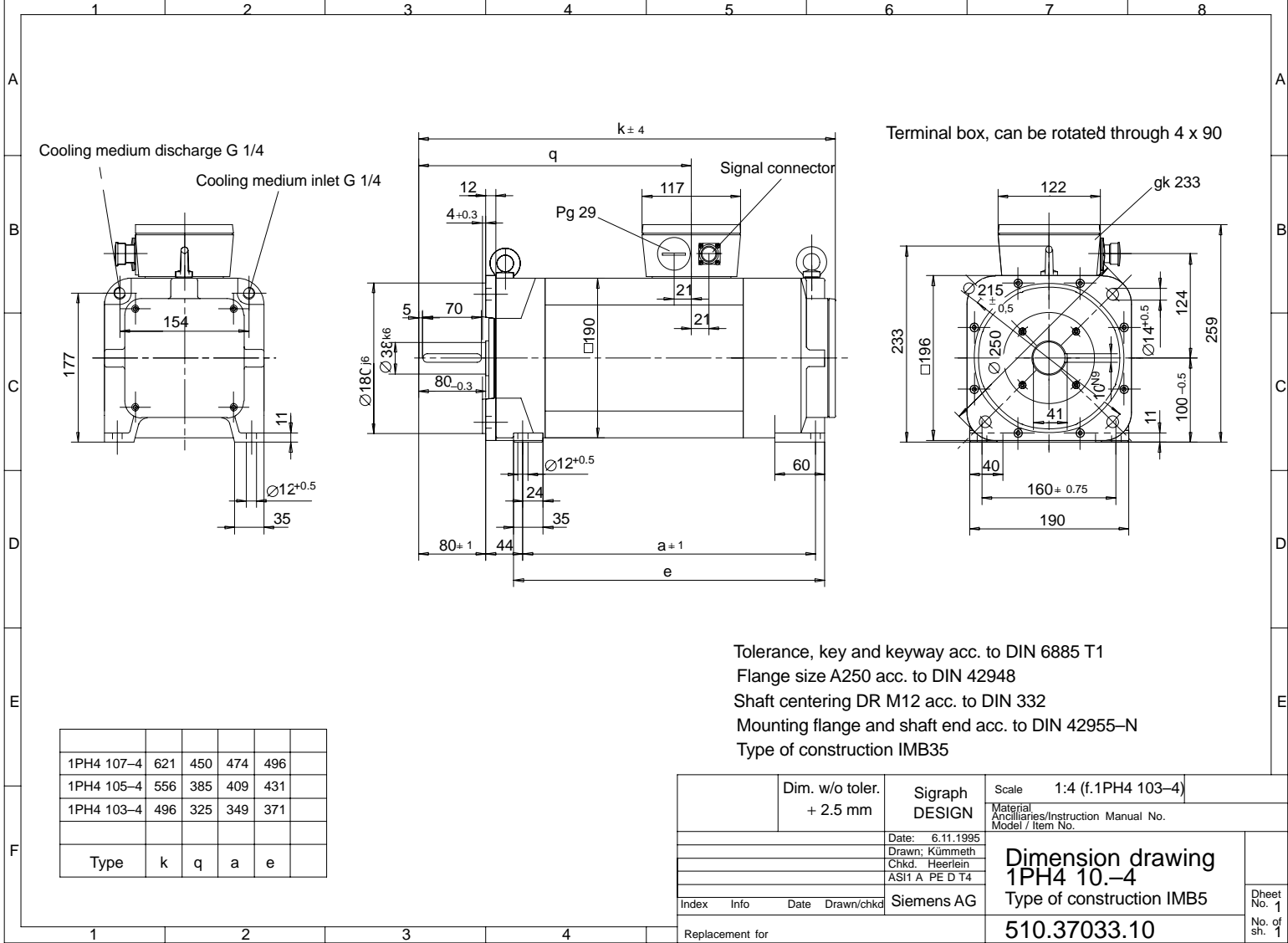
4

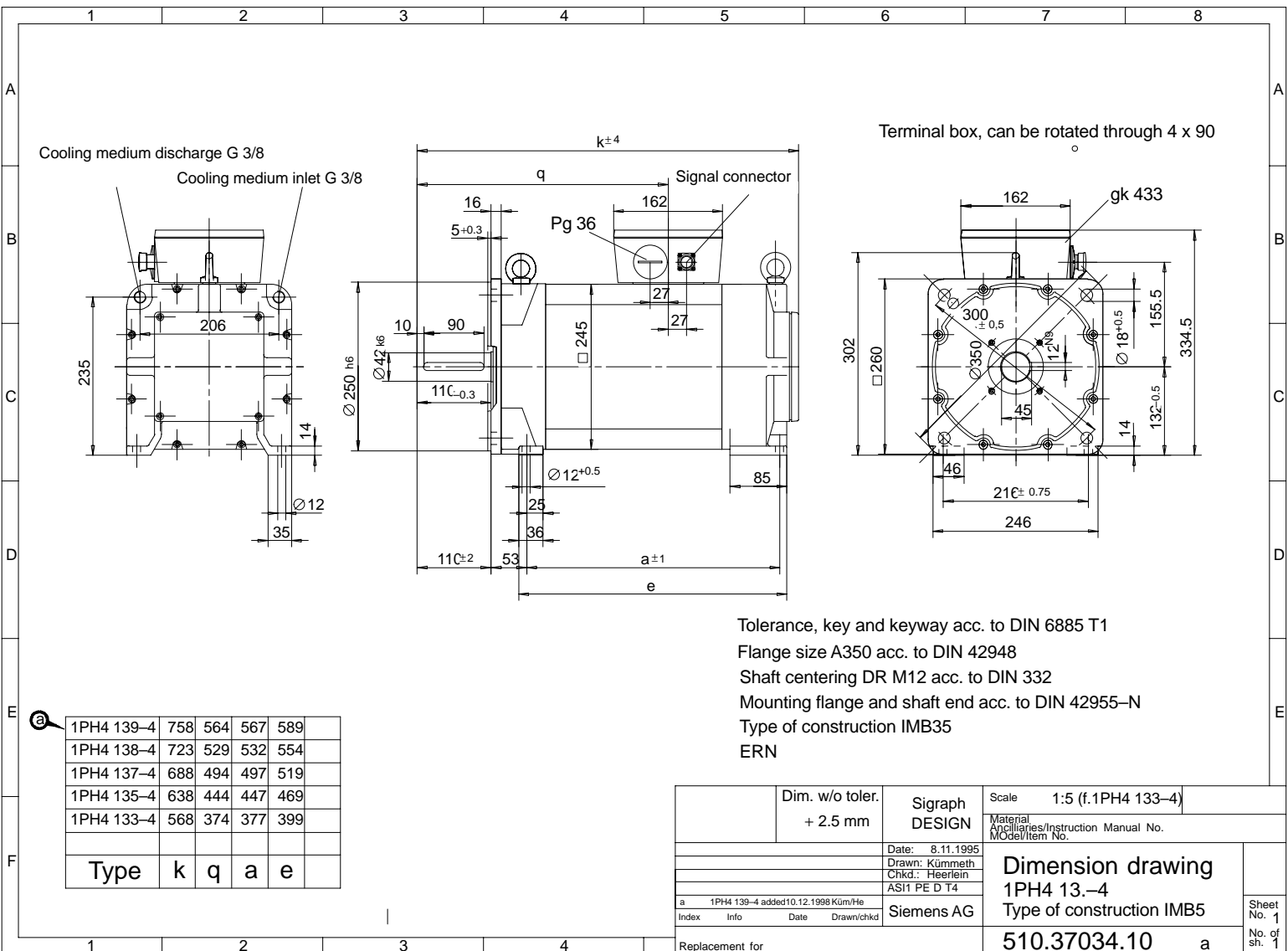
Note

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.

| | |
|--|-----------|
| 1PH4 10.-4 type of construction IMB 35 | 1PH4/4-40 |
| 1PH4 13.-4 type of construction IMB 35 | 1PH4/4-41 |
| 1PH4 16.-4 type of construction IMB 35 | 1PH4/4-42 |

1PH4





1PH4

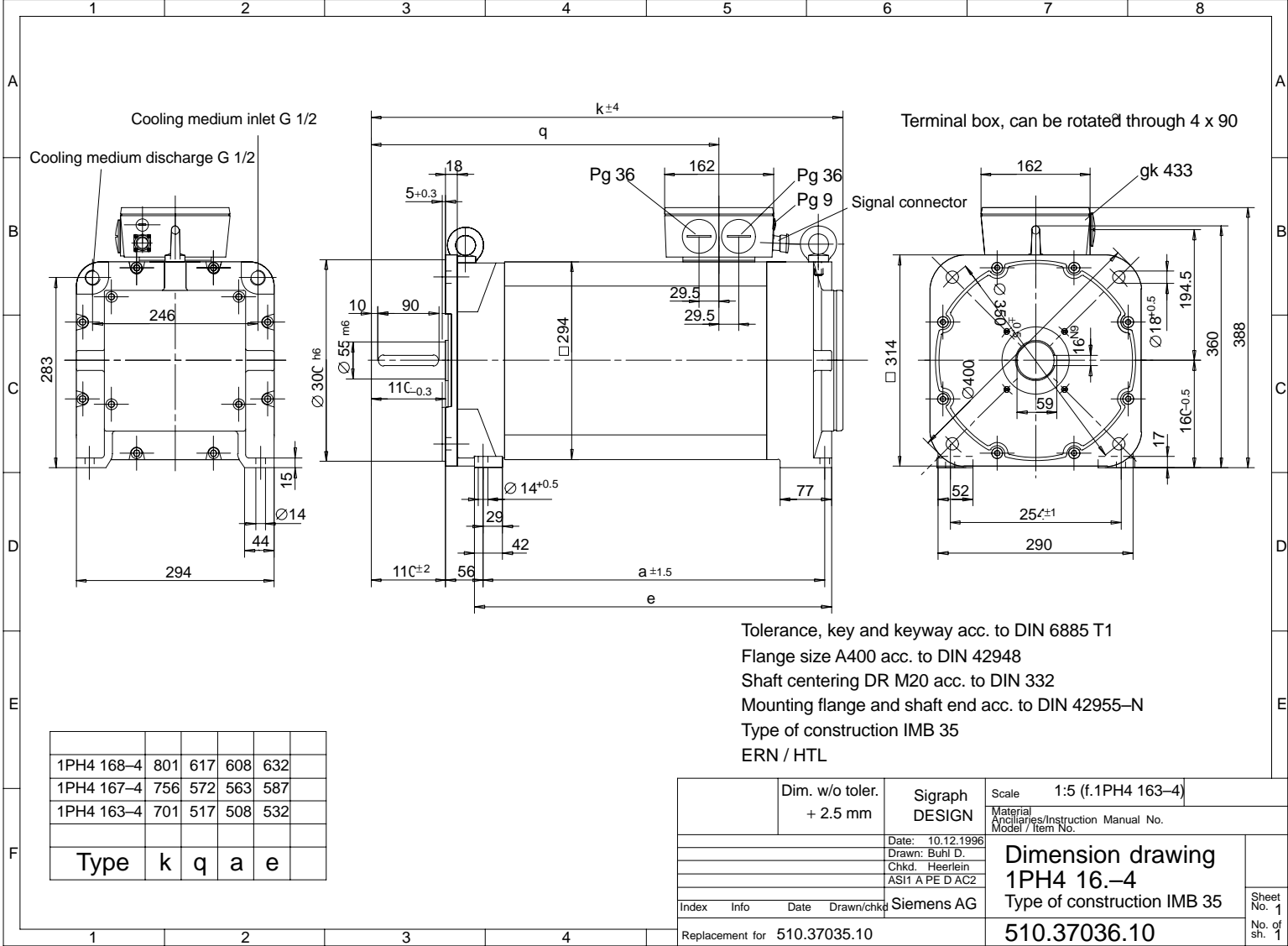


Fig. 4-3 1PH4 16.-4 type of construction IMB 35

5

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[illegible]

1PH7 AC Main Spindle Motors

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1PH7

Notes

[illegible]

1

Motor Description

1.1 Characteristics and technical data

Applications

The 1PH7 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 to 100 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 aggressive, or are electrically conducting

1.1 Characteristics and technical data

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) <ul style="list-style-type: none">Speed sensingIndirect 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 | | | | |
|---|---|-----|--------------------|-----|--|
| | 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: | left NDE or left DE | | | | left DE NDE or right NDE DE |
| Signal cable: | | | | | |
| 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 | | | | <ul style="list-style-type: none"> 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) | | | | |

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- 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

1.1 Characteristics and technical data

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 $n_{\text{max}}=4500$ 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 Prated [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%

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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:

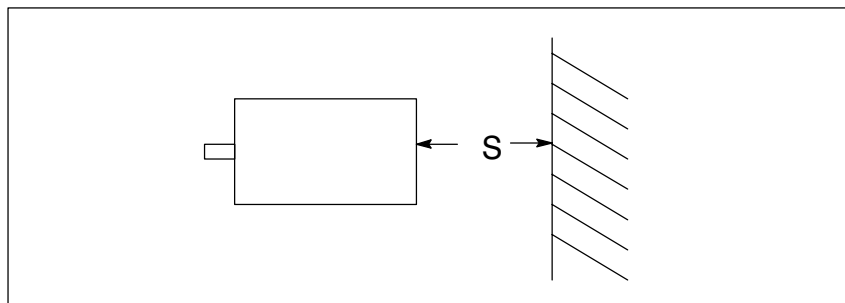


Fig. 1-1 Minimum clearance to air intake and air discharge openings

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: $T = -15\text{ °C to }+40\text{ °C}$ (without any restrictions)
 Bearing design: $T = -20\text{ °C to }+70\text{ °C}$

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 |

1PH7

1.2 Cooling

Supply for separately-driven fans

Table 1-9 Voltage

| Shaft height [mm] | Voltage [V] |
|-------------------|----------------------------------|
| 100 to 225 | 3-ph. 400 V AC, 50 Hz,(10 %) or |
| 100 to 160 | 3-ph. 400 V AC, 60 Hz (10 %) |
| 180 to 225 | 3-ph. 400 V AC 60 Hz (+10%) |
| 100 to 225 | 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.

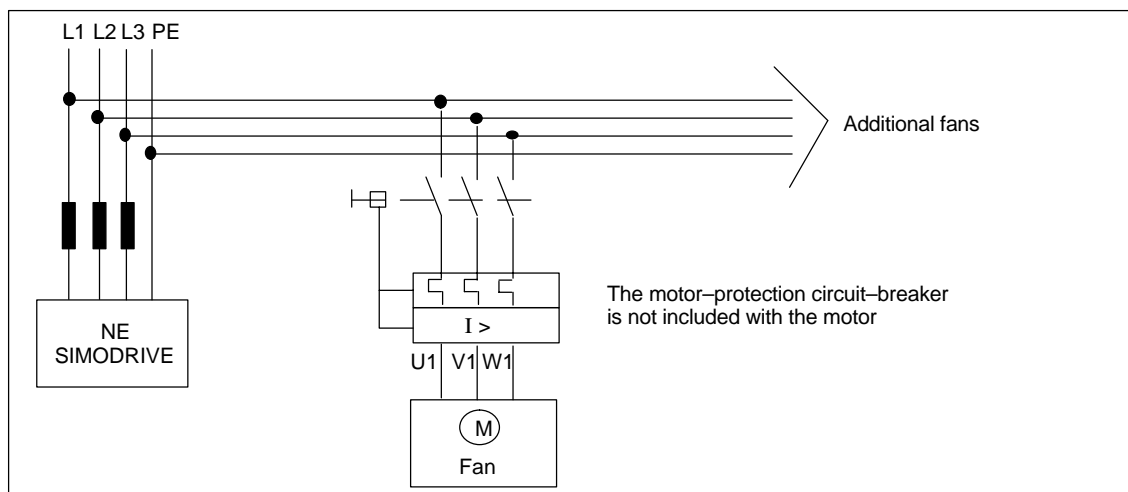


Fig. 1-2 Recommended connection

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.

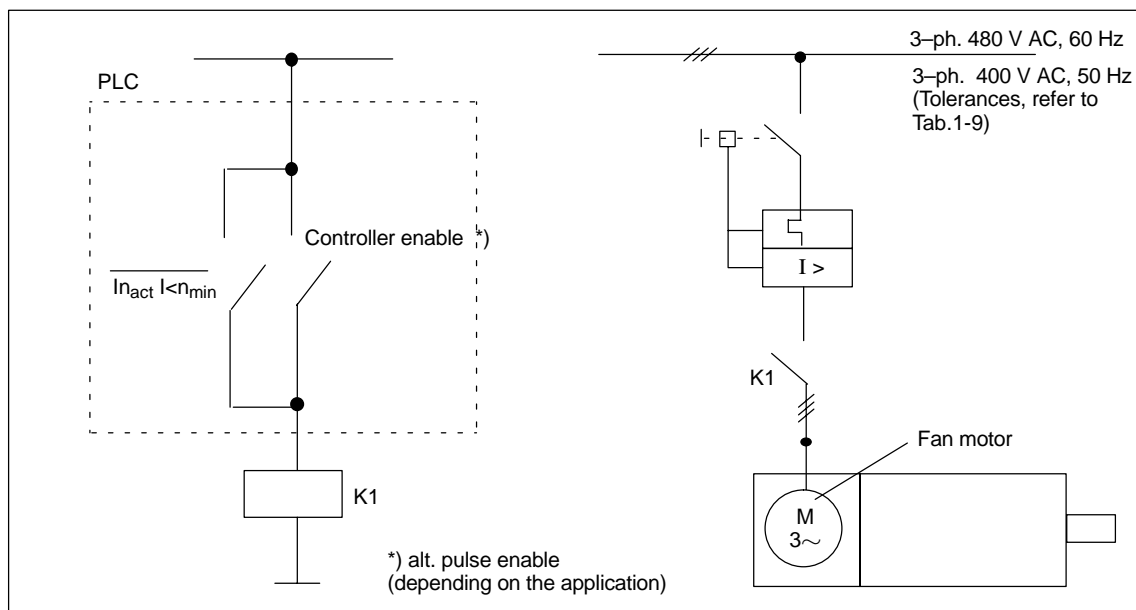


Fig. 1-3 Example: Fan control

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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

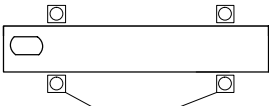
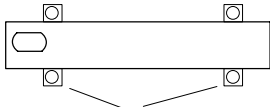
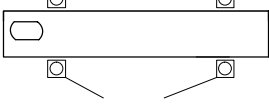
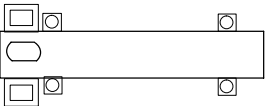

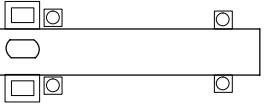
Shaft heights 180 and 225: Cylindrical roller bearings and deep-groove ball bearings on the drive side and deep-groove ball bearings on the non-drive side

—> 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 |
| <ul style="list-style-type: none"> • Coupling drive • Planetary gearbox <p>low cantilever forces</p> |  <p>Deep-groove ball bearings</p> |  <p>Deep-groove ball bearings</p> |
| <ul style="list-style-type: none"> • Belt drive with normal cantilever force • Pinion drive with straight teeth |  <p>Deep-groove ball bearings</p> |  <p>Cylindrical-roller bearings Deep-groove ball bearings</p> <p>Min. cantilever force required !</p> |
| <ul style="list-style-type: none"> • Belt drive with increased cantilever force |  |  <p>Cylindrical-roller bearings Deep-groove ball bearings</p> <p>Min. cantilever force required !</p> |

1PH7

1.4 Bearing design

Bearing change intervals, shaft heights 100 to 225 (t_{LW})

For coupling and belt drives, for a cooling medium temperature +30°C, 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 ≤ 2500 | 2500 < n _m < 6000 | n _{s1} ≤ 5500 |
| 1PH713□ | n _m ≤ 2000 | 2000 < n _m < 5500 | n _{s1} ≤ 4500 |
| 1PH716□ | n _m ≤ 1500 | 1500 < n _m < 4500 | n _{s1} ≤ 3700 |
| 1PH718□ | n _m ≤ 1500 | 1500 < n _m < 4000 | n _{s1} ≤ 3500 ²⁾ |
| 1PH7224 | n _m ≤ 1500 | 1500 < n _m < 3500 | n _{s1} ≤ 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 ≤ n _m ≤ 12000 | n _{s1} ≤ 10000 |
| 1PH713□ | 6000 ≤ n _m ≤ 10000 | n _{s1} ≤ 8500 |
| 1PH716□ | 5000 ≤ n _m ≤ 8000 | n _{s1} ≤ 7000 |
| 1PH718□ | 1500 ≤ n _m ≤ 7000 | n _{s1} ≤ 4500 |
| 1PH7224 | 1500 ≤ n _m ≤ 5500 | n _{s1} ≤ 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: n_{s1} 3000 RPM
 Shaft height 225: n_{s1} 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_{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 |

1PH7

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

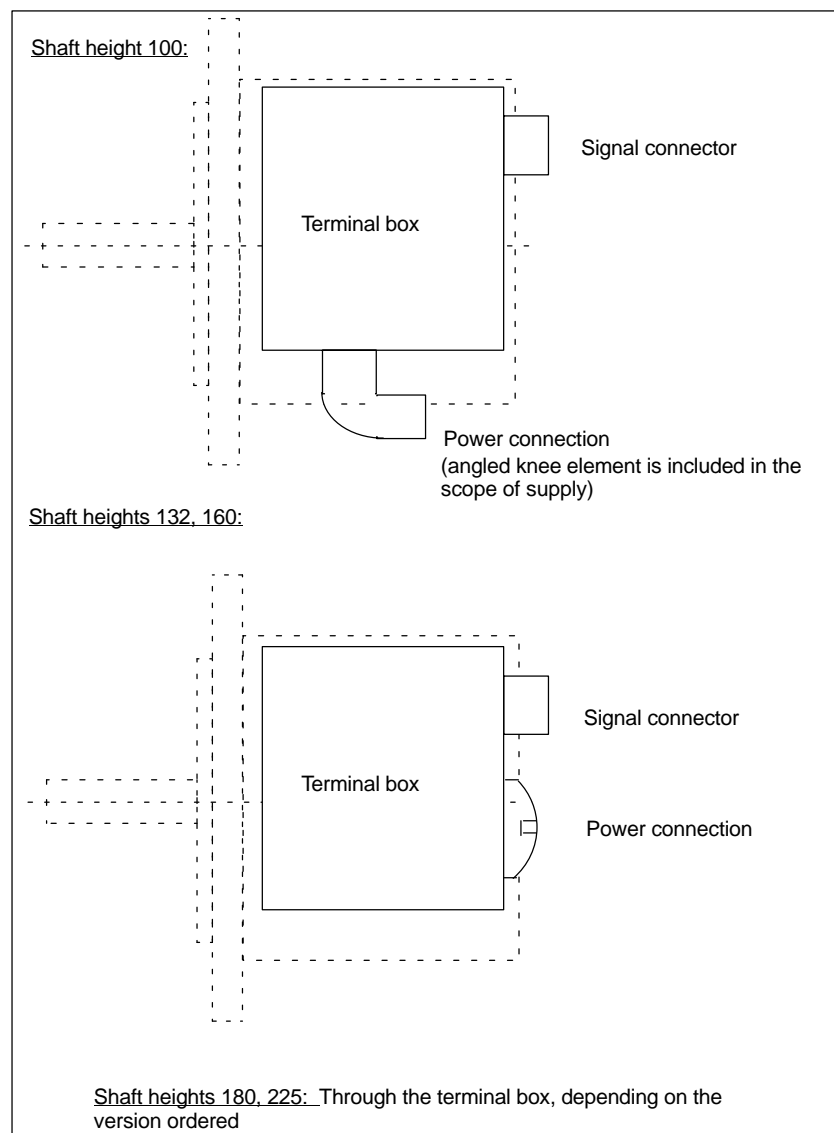
**1PH7**

Fig. 1-4 Cable outlet

1.7 Mounting 1PH4/7 motors

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.

1PH7

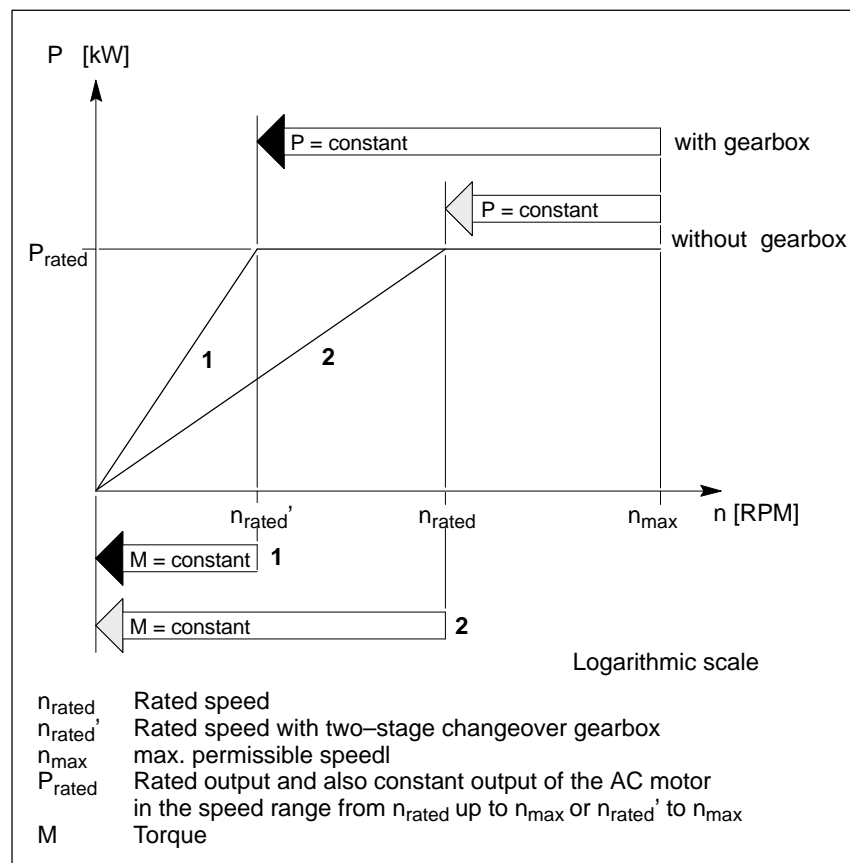


Fig. 1-5 Speed-power diagram when using a two-stage changeover gearbox to extend the speed range with constant power of the AC motors for main spindle drives

Example:

AC motor without changeover gearbox:

For $P = \text{constant}$ 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

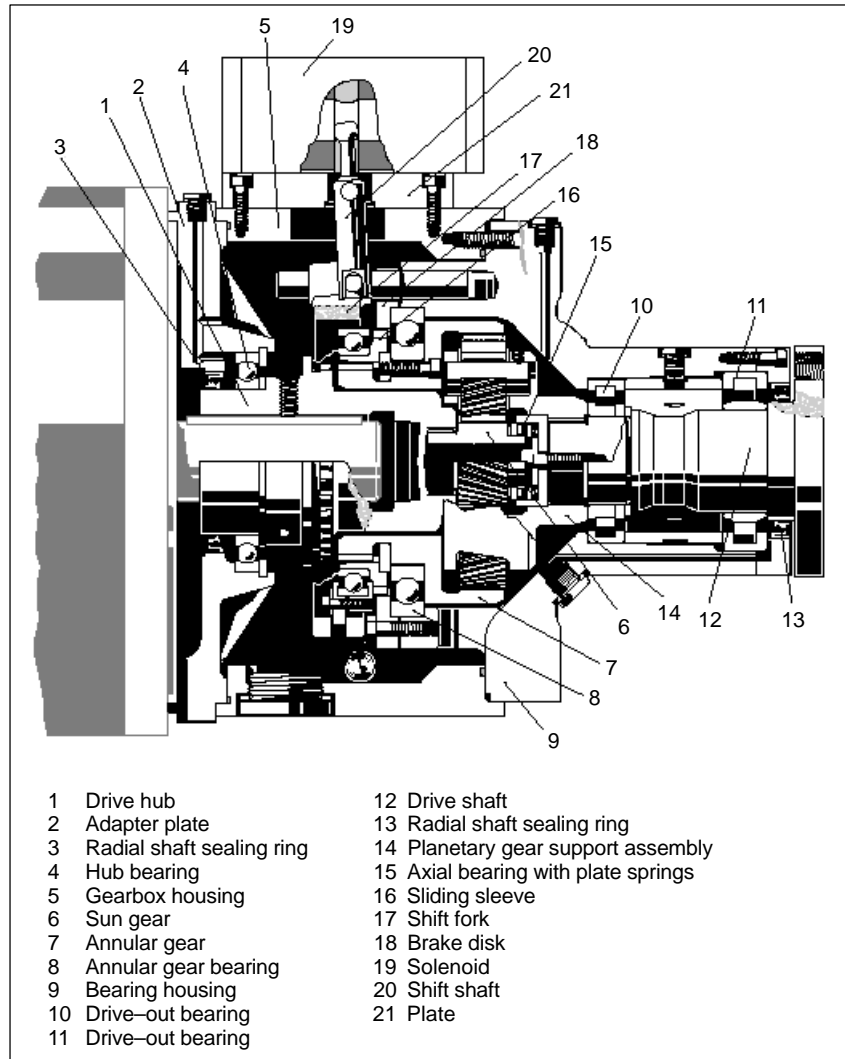


Fig. 1-6 Gearbox design (1PH7: shaft heights 100-160 / 1PH4: shaft heights 100-160)

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

1.8 Options

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 | | | |
| | | | | | i=1 | i=4 | | i=1 | i=4 | | |
| ZF desig. | | | RPM | Nm | Nm | Nm | Nm | Nm | 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⁾ | 186 | 2LG4260 ~... | 4000 | 800 | 800 | 3200 | 900 | 900 | 3600 | 110 | 160 |
| 2K 802 | 225 | 2LG4270 ~... | | | | | | | | | |

**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

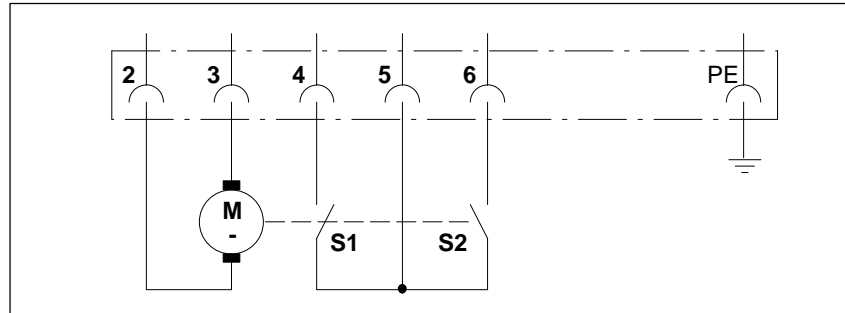


Fig. 1-7 Circuit diagram

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 | Output | Voltage | Current |
|-----------------------|------------------------|-------|--------|---|---|
| 2 and 3 | 1 changeover unit | 0 | – | 24 V DC | $I_{\max} = 5 \text{ A}$ (pull-in current) |
| 4 and 6 | 2 limit switches | 0 | 0 | 24 V DC $V_{\max} = 42 \text{ V DC}$ | $I_{\max} = 5 \text{ A}$ |

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) | +24 V DC | 0 V | 0 | L |
| b Changeover operation | | | 0 | 0 |
| c Mechanical changeover to the end stop ¹⁾ | | | L | 0 |
| When changing from stage i_1 to i_2 | | | | |
| d Initial position (c) | 0 V | +24 V DC | L | 0 |
| e Changeover operation | | | 0 | 0 |
| f Mechanical changeover to the end stop ¹⁾ | | | 0 | L |

L Contact closed

0 Contact open

1) After the changeover operation, a limit switch (S1 or S2) outputs a signal to the control to no longer energize the changeover unit.

1.8 Options**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.

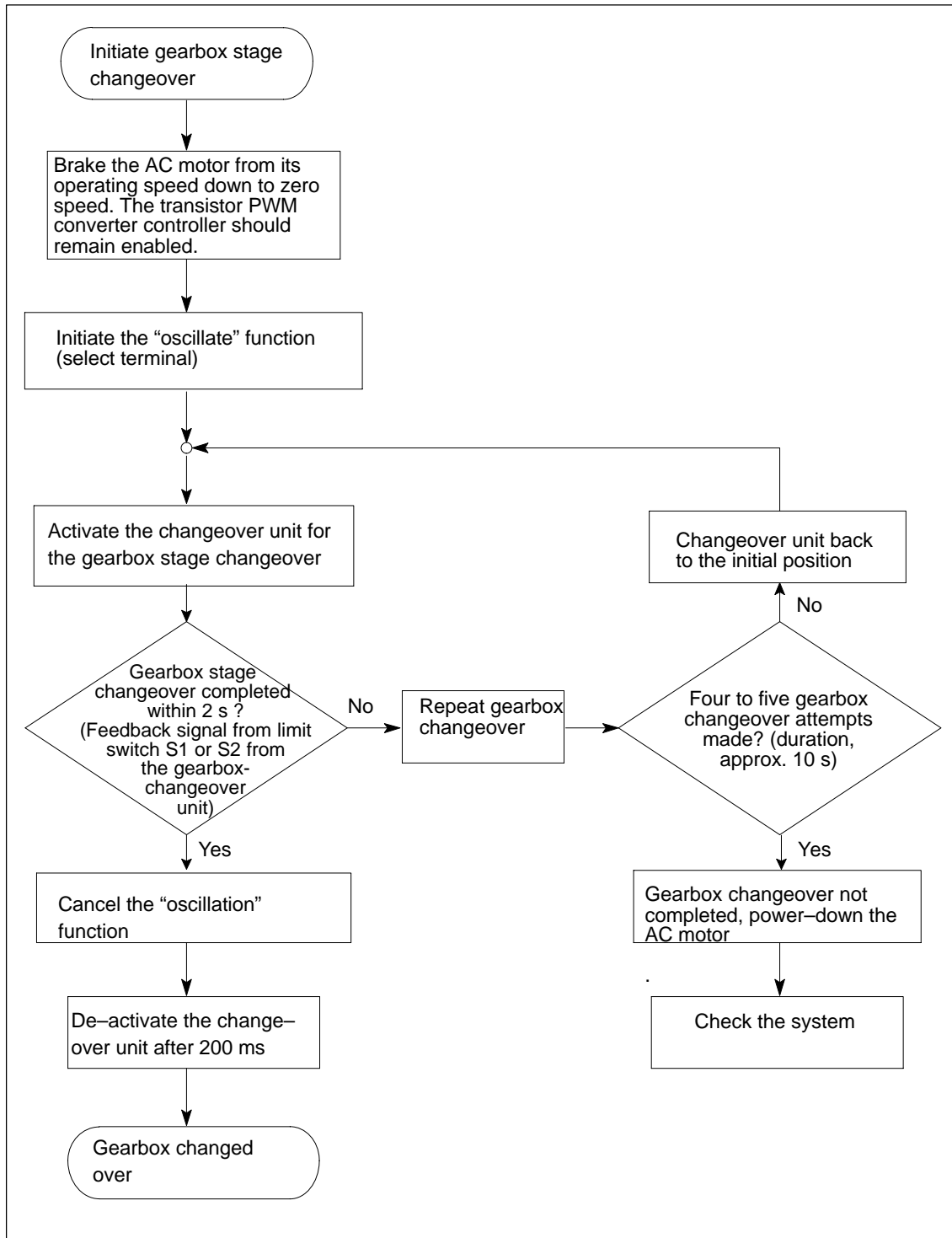

1PH7

Fig. 1-8 Sequence of a gearbox stage changeover

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 glass¹⁾

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.

Gearboxes 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.

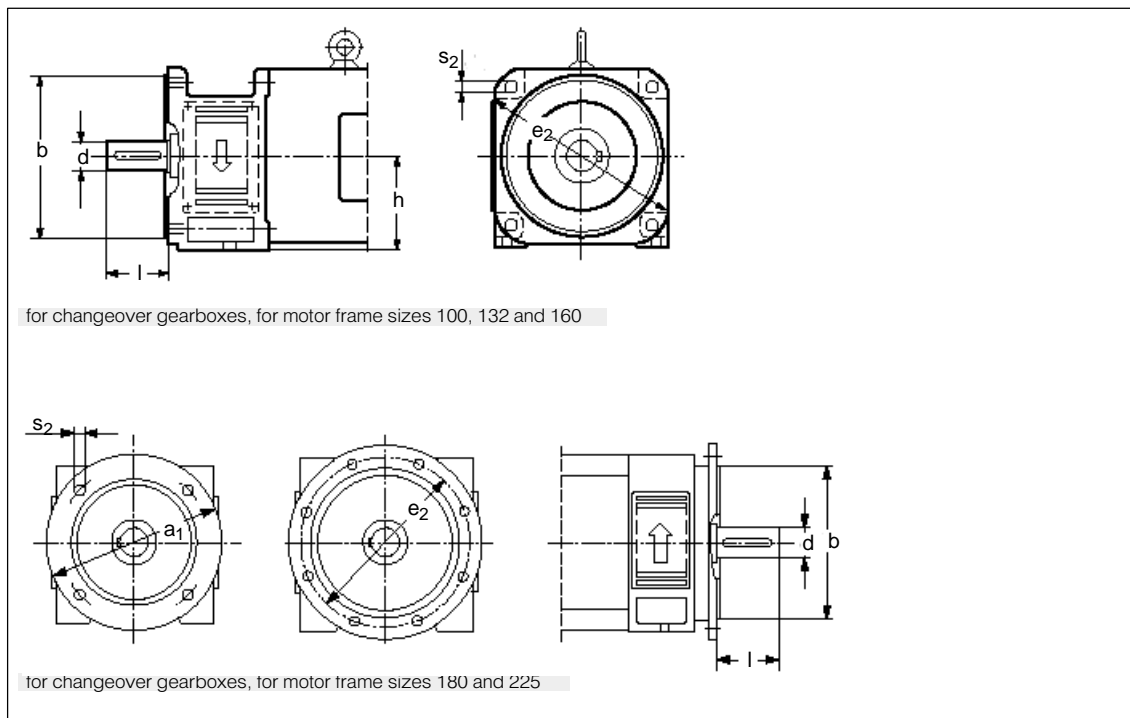


Fig. 1-9 Flange dimensions for AC motors
(dimensions, refer to Table 1-18)

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 |

1PH7

1.8 Options

- Changeover gearbox for frame size 100

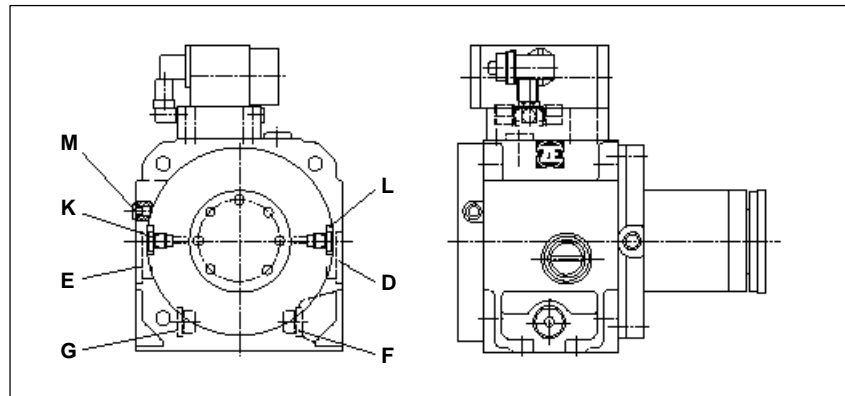


Fig. 1-10 Changeover gearbox with changeover unit for frame size 100

Table 1-19 Connections for the oil circulating lubrication

| Max. pressure | Oil return connection | Oil inlet connection | Mounting position |
|--|---|--|------------------------|
| 0.2 bar 1.5 bar | D Main direction of rotation, clockwise ¹⁾ | M (0.5 dm ³ /min) K/L (1.0 dm ³ /min) | V1 (closed version) |
| 1.5 bar | | G (1.5 dm ³ /min) main direction of rotation, clockwise F (1.5 dm ³ /min) main direction of rotation, counter clockwise | B5 V1 |
| 1.5 bar | E Main direction of rotation, counter-clockwise ¹⁾ | | |
| Oil circulating lubrication required for V1/V3 | | | |

1) View of the gearbox drive from the motor

- Changeover gearbox for frame sizes 132 and 160

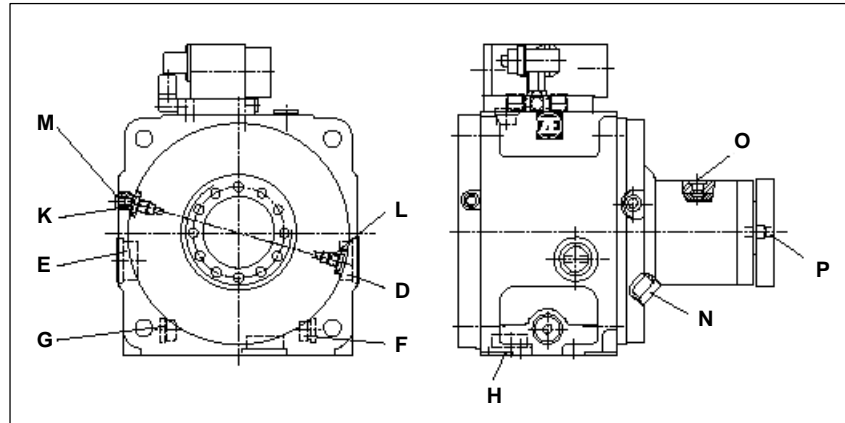


Fig. 1-11 Changeover gearbox with changeover unit for frame sizes 132 and 160

Table 1-20 Connections for oil circulating lubrication

| Max. pressure | Oil return connection | Oil inlet connection | Mounting position |
|--|--|--|------------------------|
| 2 bar | H | P (1.5 dm ³ /min) | V3 |
| 0.5 bar 1.5 bar | D Main direction of rotation, clockwise ¹⁾ | M (0.5 dm ³ /min) N (1.5 dm ³ /min) | V1 (closed version) |
| 1.5 bar | | G (1.5 dm ³ /min) main direction of rotation, clockwise F (1.5 dm ³ /min) main direction of rotation, counter-clockwise ¹⁾ | B5 V1 |
| 1.5 bar | | | |
| Oil circulating lubrication required for V1/V3 Connection = is additionally possible (0.5 dm ³ /min) | | | |

1PH7

1) View of the gearbox drive from the motor

1.8 Options

Dimension drawings with changeover gearboxes

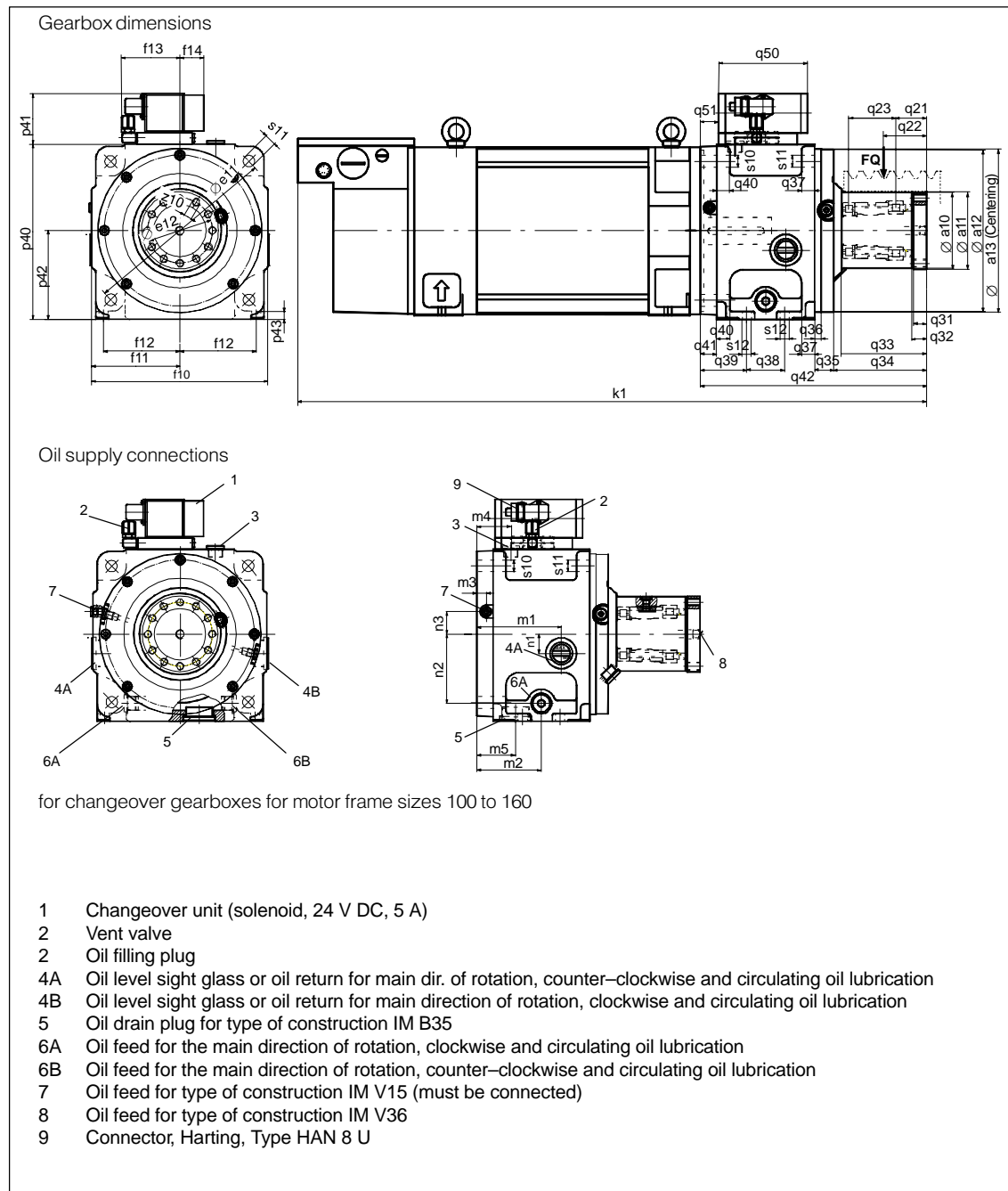


Fig. 1-12 AC motor and gearbox dimensions

Table 1-21 Two-stage changeover gearbox for AC motors 1PH7 and 1PH4 (dimensions, overview 1)

| Motor | | Dimensions in mm | | | | | | | | | | | | | | | | |
|------------|----------|--------------------------|-----------|-----|-----------|------------|-----|-----|-----|-----|------|------|---------------|-----|------|----|----|----|
| Frame size | Type | a10 Out drive housing | a11 k6 | a12 | a13 g6 | e11 0.2 | e12 | f10 | f11 | f12 | f13 | f14 | h Sh. hgt. | m1 | m2 | m3 | m4 | m5 |
| 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 | | | | | | | | | | | | | | | | | |
| 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 | | | | | | | | | | | | | | | | | |

1PH7

1.8 Options

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 | | | | | | | | | | | | | | | | |
| 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 holes | 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 |
| 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 |


1PH7

[illegible]

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

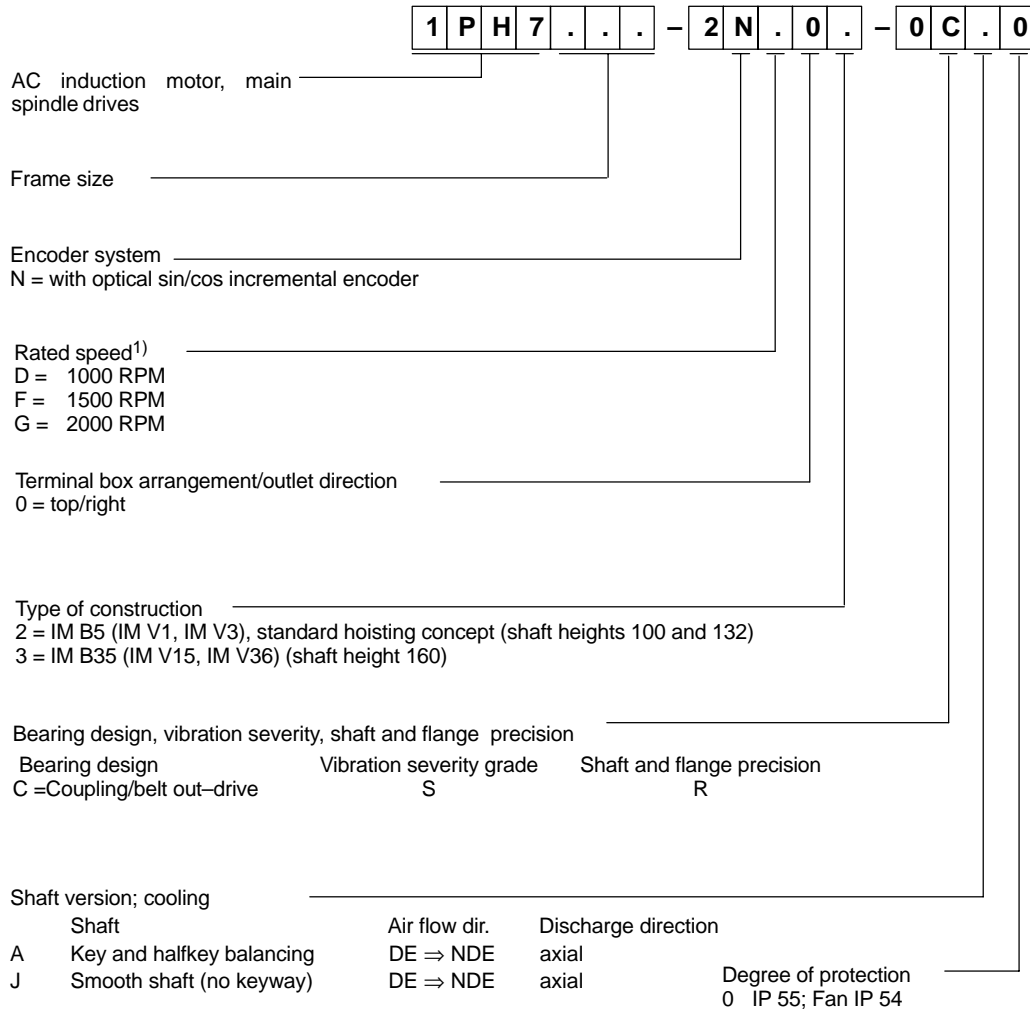
| 1 P H 7 . . . | | | | | | | - 2 N . . . | | | | - 0 . . . | | | |
|--|--|--|--------------------------|--|--|----------------------------|-------------|--|--|--|-----------|--|--|--|
| AC induction motor, main spindle drives | | | | | | | | | | | | | | |
| Frame size | | | | | | | | | | | | | | |
| 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 | | | | | | | | | | | | | | |

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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

2 Order designations

**Order designation
(core type)****Shaft heights 100
to 160**

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 | | | |

1PH7

- 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. $V_{DC \text{ link}}=680$ V), it is possible to operate the system on a 680 V DC link voltage.

[illegible]

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.

1PH7

3.1 Speed–power diagrams

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 [kgm ²] | Weight m [kg] |
|--|--|--|--|---|---|---|-----------------------|
| 3.7 | 1500 | 24 | 10 | 20 | 9000 | 0.017 | 40 |

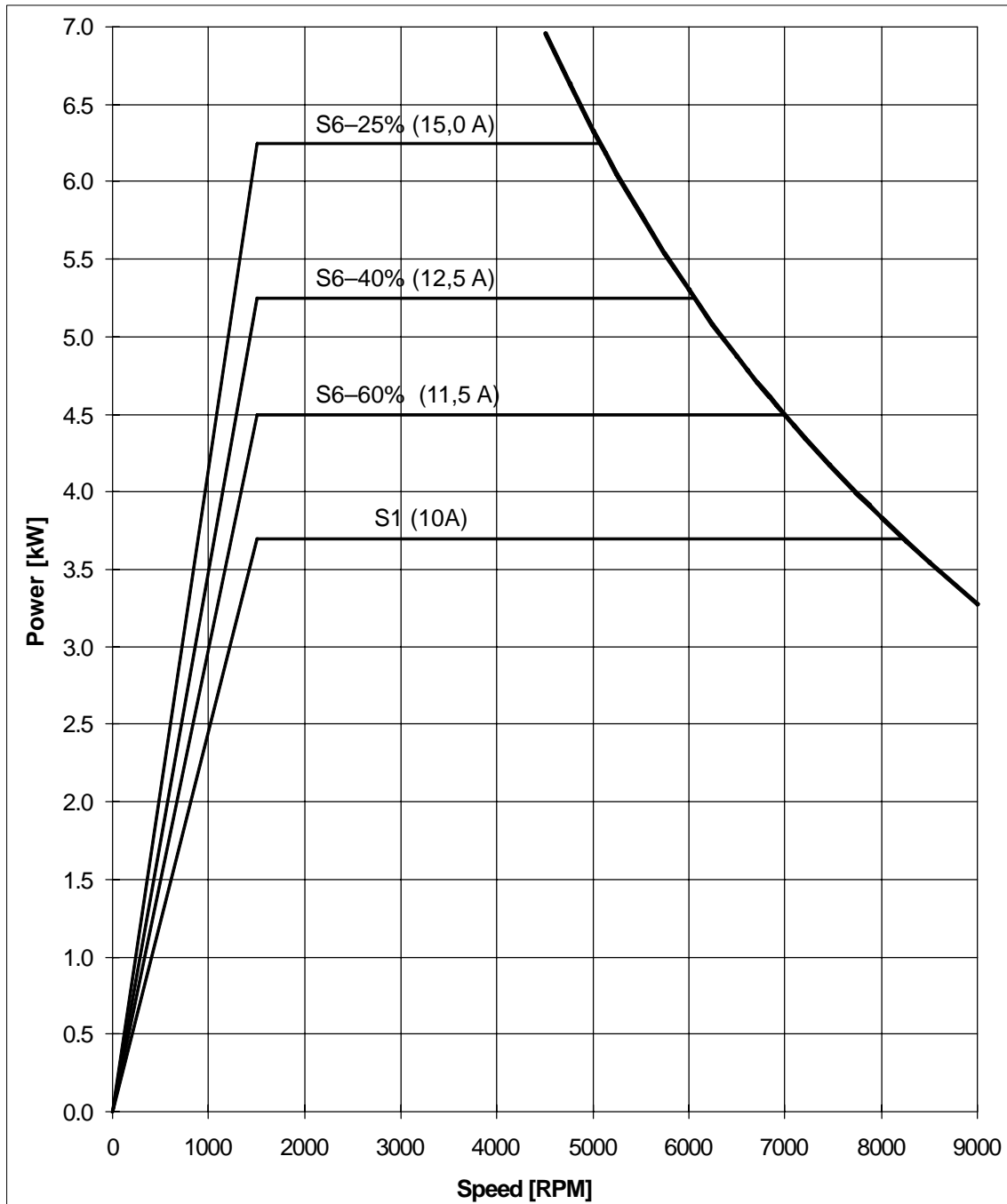


Fig. 3-1 Speed–power diagram 1PH7101–2NF□□

Table 3-2 AC main spindle motor 1PH7101-2NF□□-0L

| 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 | 1500 | 24 | 10 | 20 | 12000 | 0.017 | 40 |

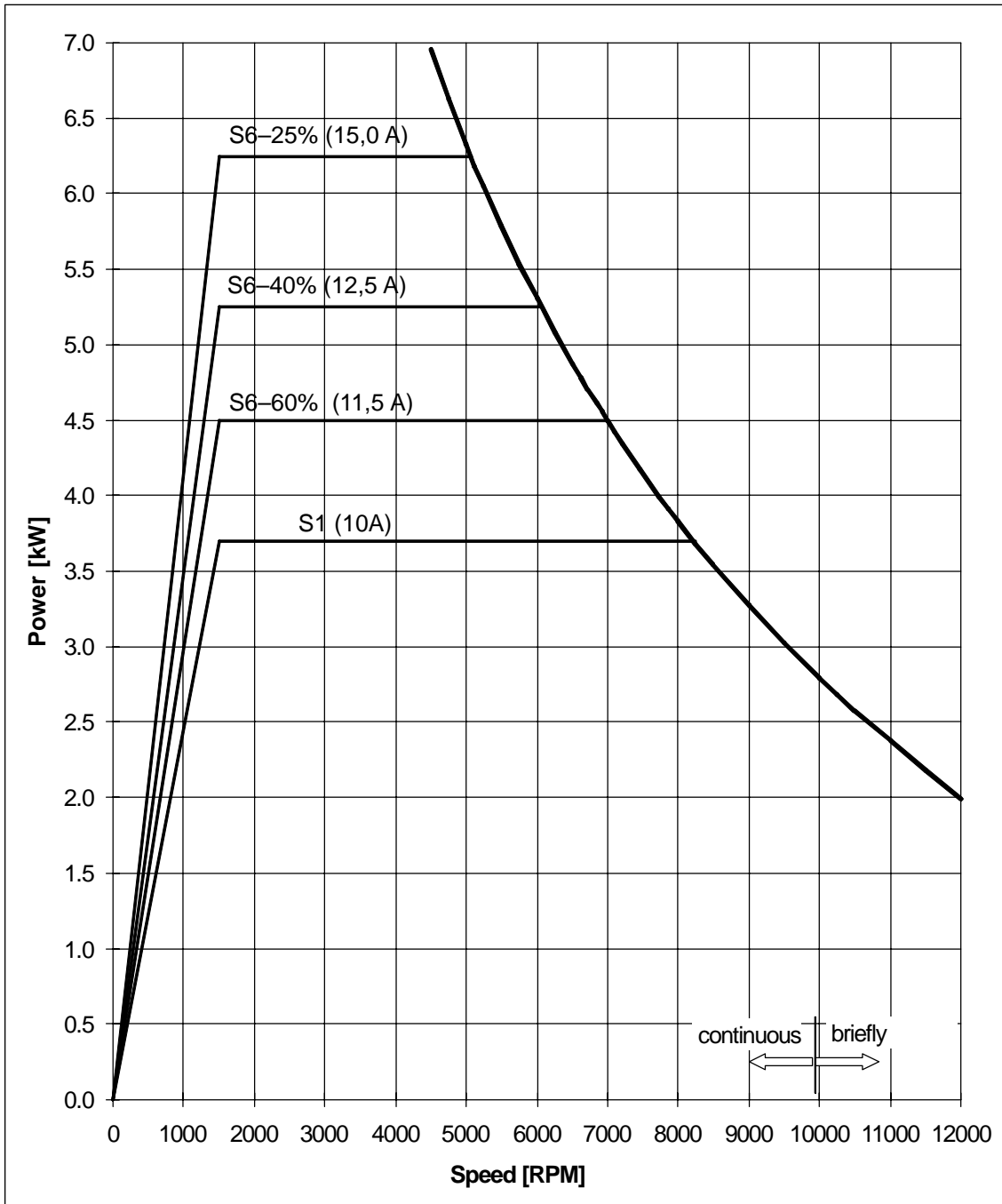
**1PH7**

Fig. 3-2 Speed-power diagram 1PH7101-2NF□□-0L

3.1 Speed-power diagrams

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 |

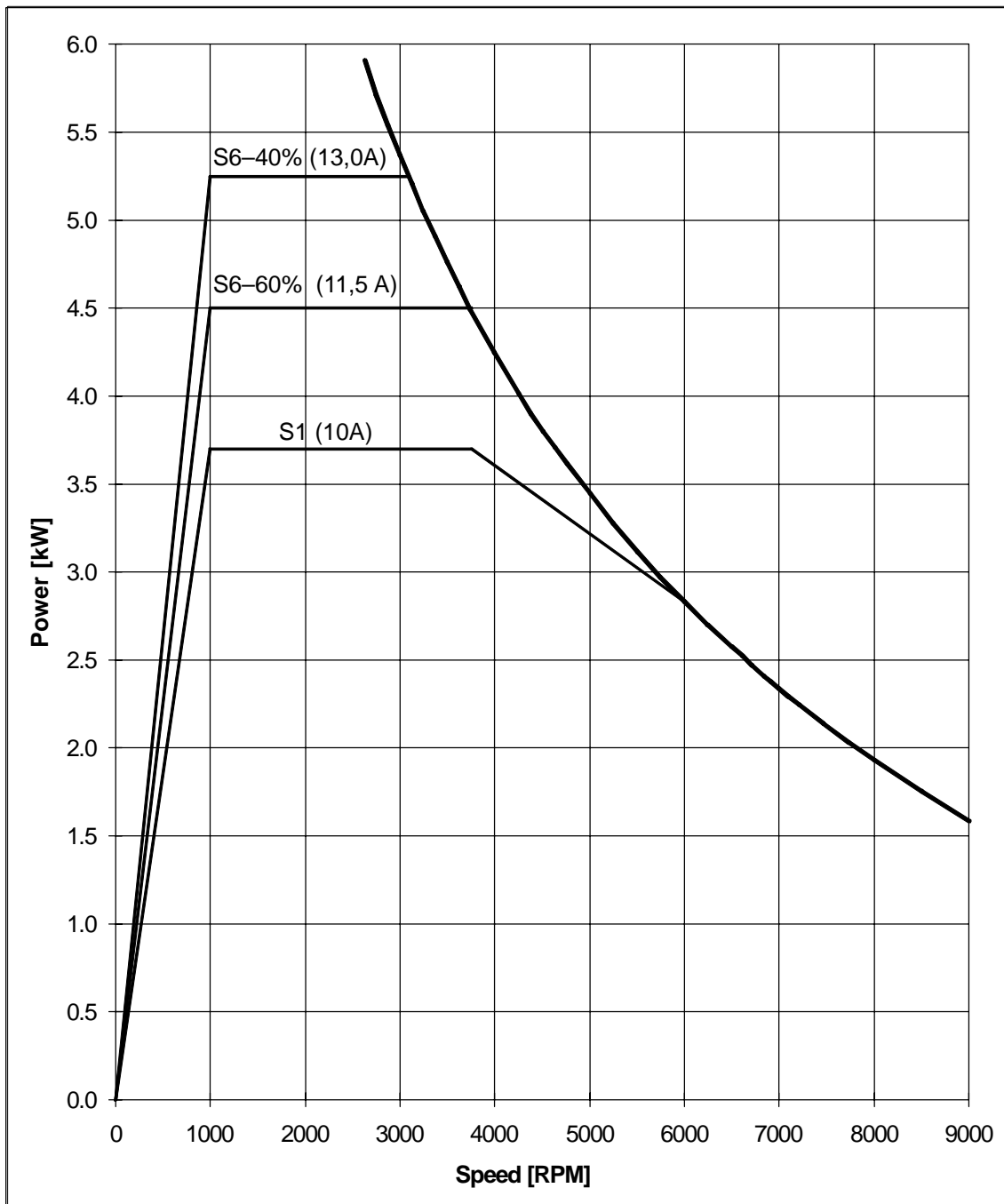


Fig. 3-3 Speed-power diagram 1PH7103-2ND

Table 3-4 AC main spindle motor 1PH7103-2ND□□-0L

| 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 |

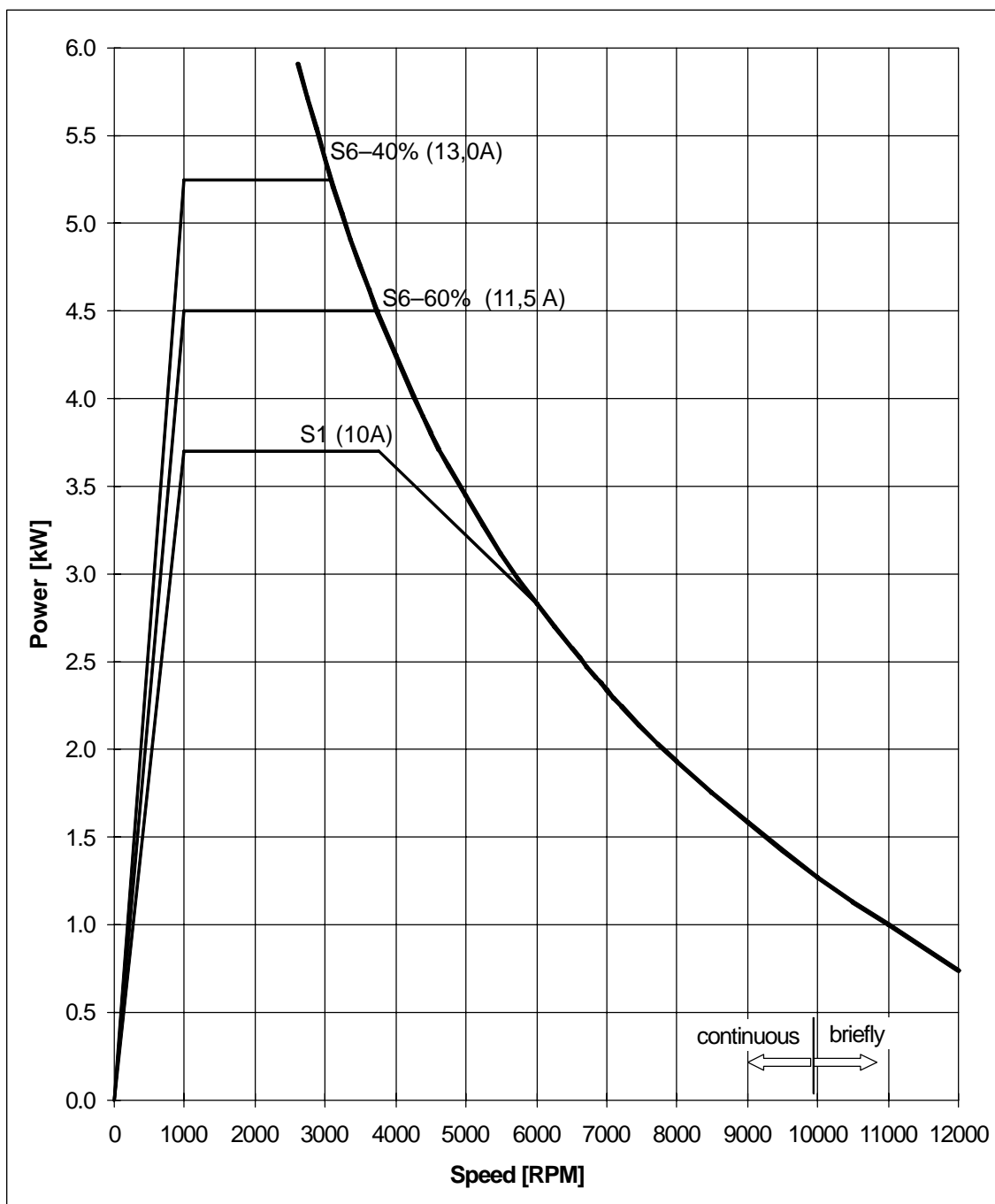
**1PH7**

Fig. 3-4 Speed-power diagram 1PH7103-2ND□□-0L

3.1 Speed–power diagrams

Table 3-5 AC main spindle motor 1PH7103-2NF

| Rated out-put P_{rated} [kW] | Rated speed n_{rated} [RPM] | Rated tor-que M_{rated} [Nm] | Rated cur-rent 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 |

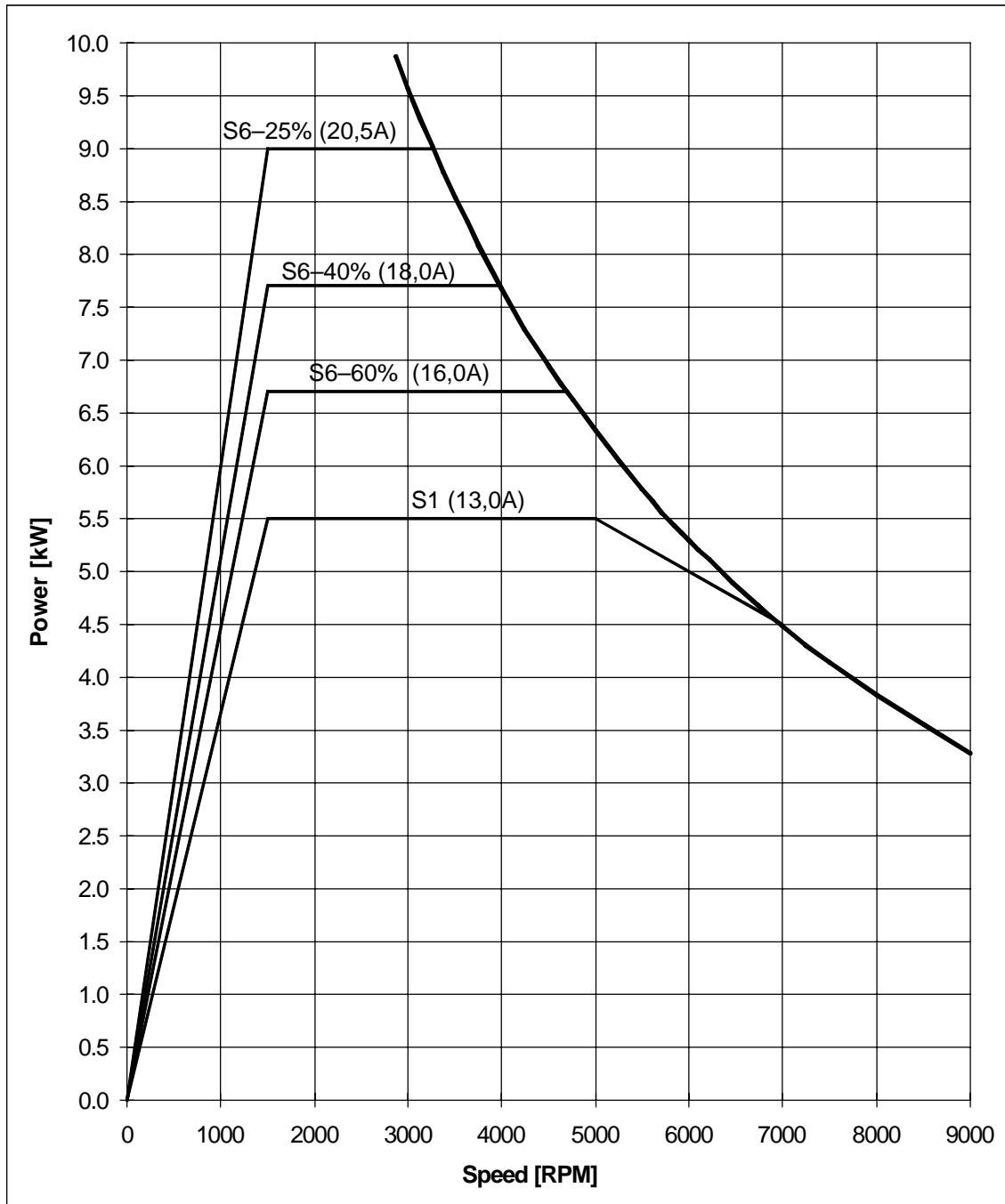


Fig. 3-5 Speed–power diagram 1PH7103-2NF

Table 3-6 AC main spindle motor 1PH7103-2NF□□-0L

| 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 |

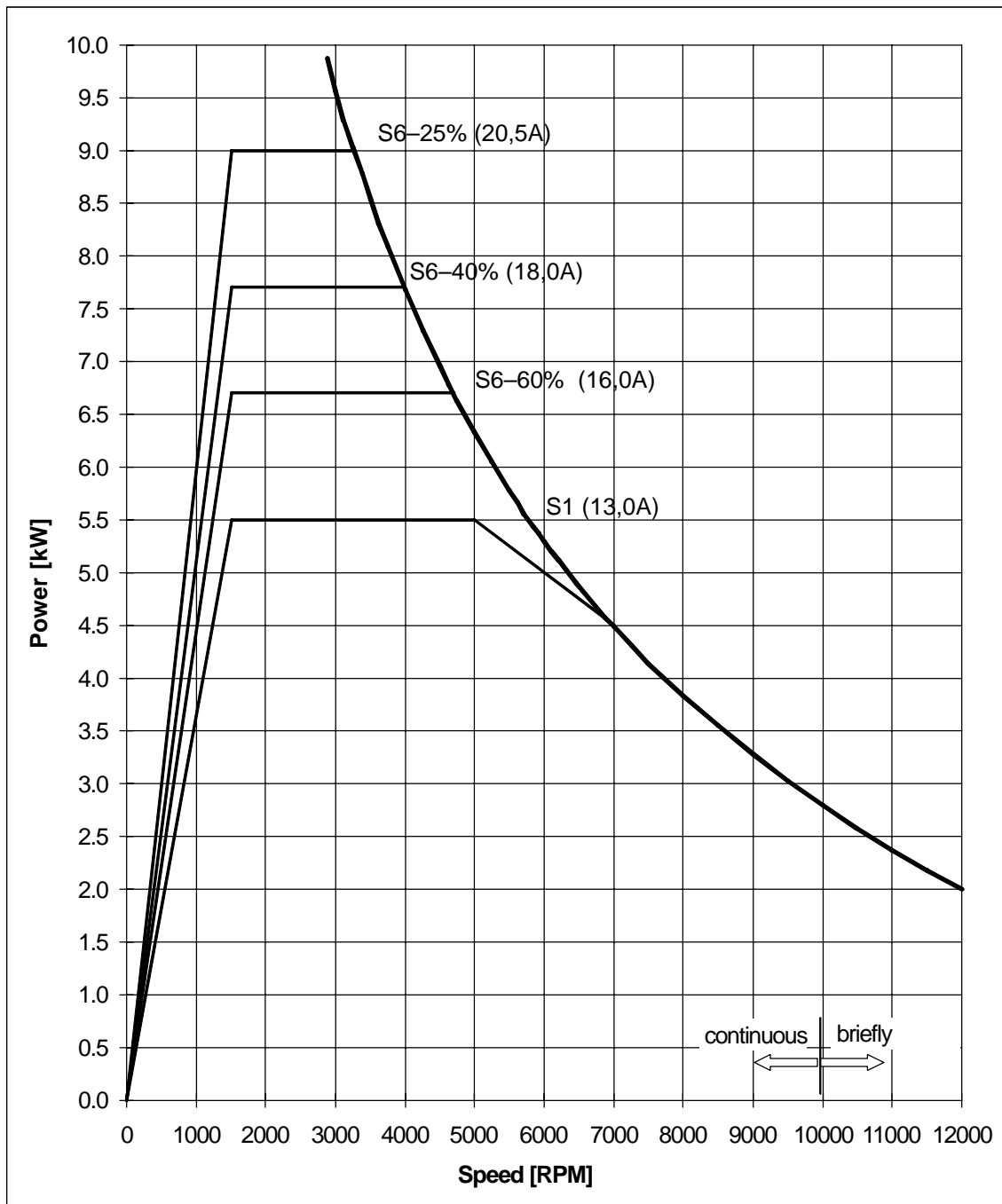
**1PH7**

Fig. 3-6 Speed-power diagram 1PH7103-2NF□□-0L

3.1 Speed–power diagrams

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 |

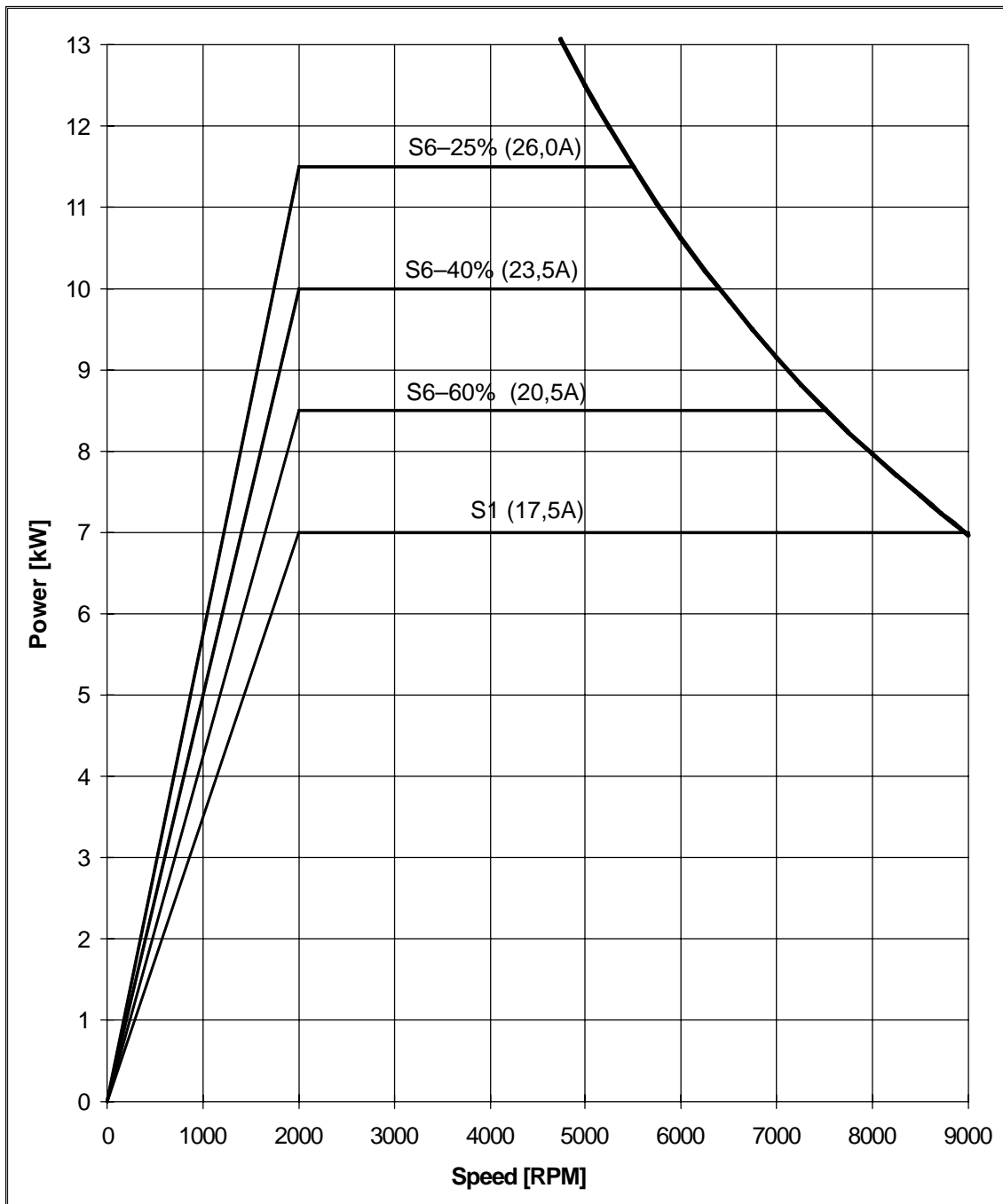


Fig. 3-7 Speed–power diagram 1PH7103–2NG□□

Table 3-8 AC main spindle motor 1PH7103-2NG□□-0L

| 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 |

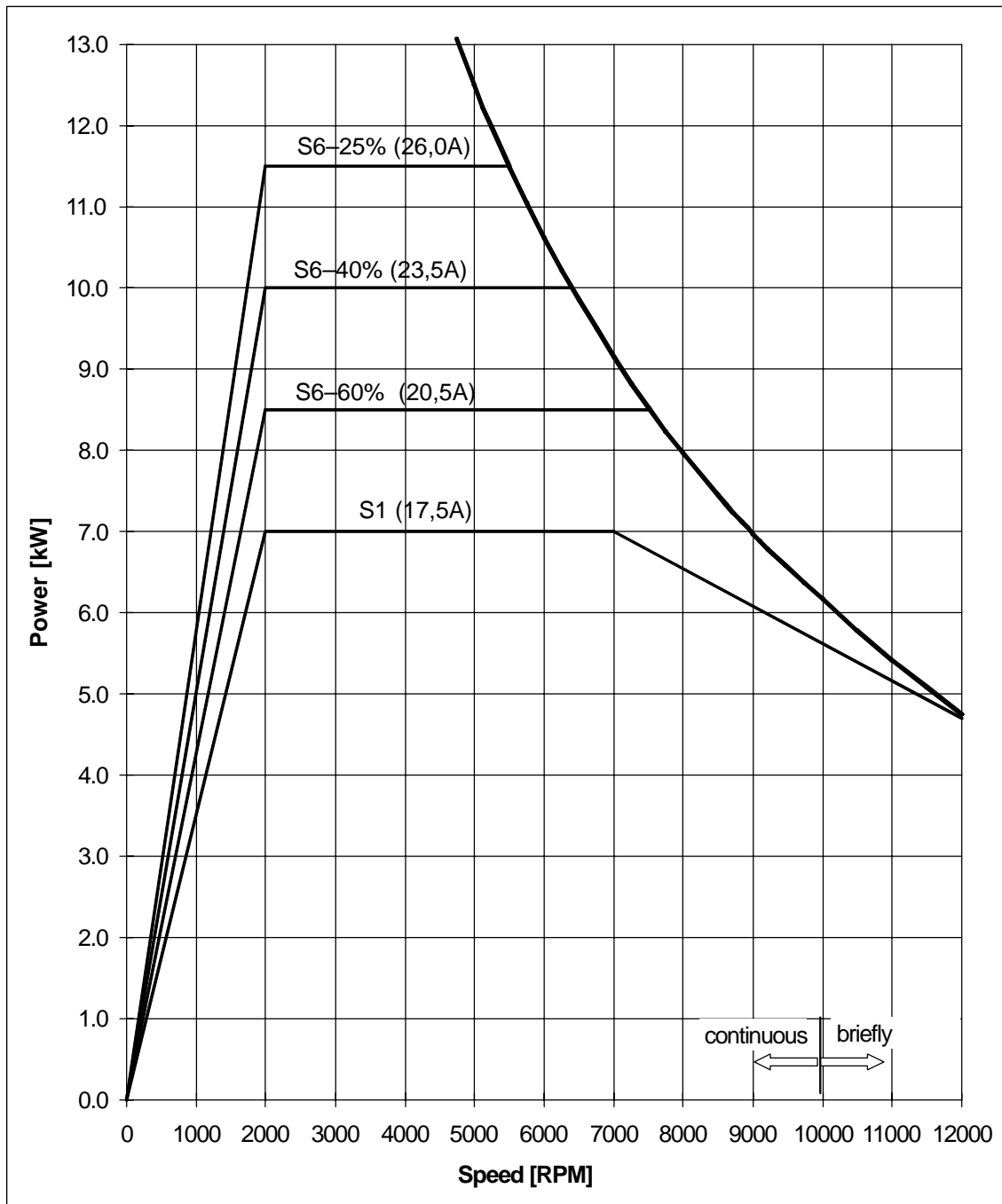
**1PH7**

Fig. 3-8 Speed-power diagram 1PH7103-2NG□□-0L

3.1 Speed–power diagrams

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 |

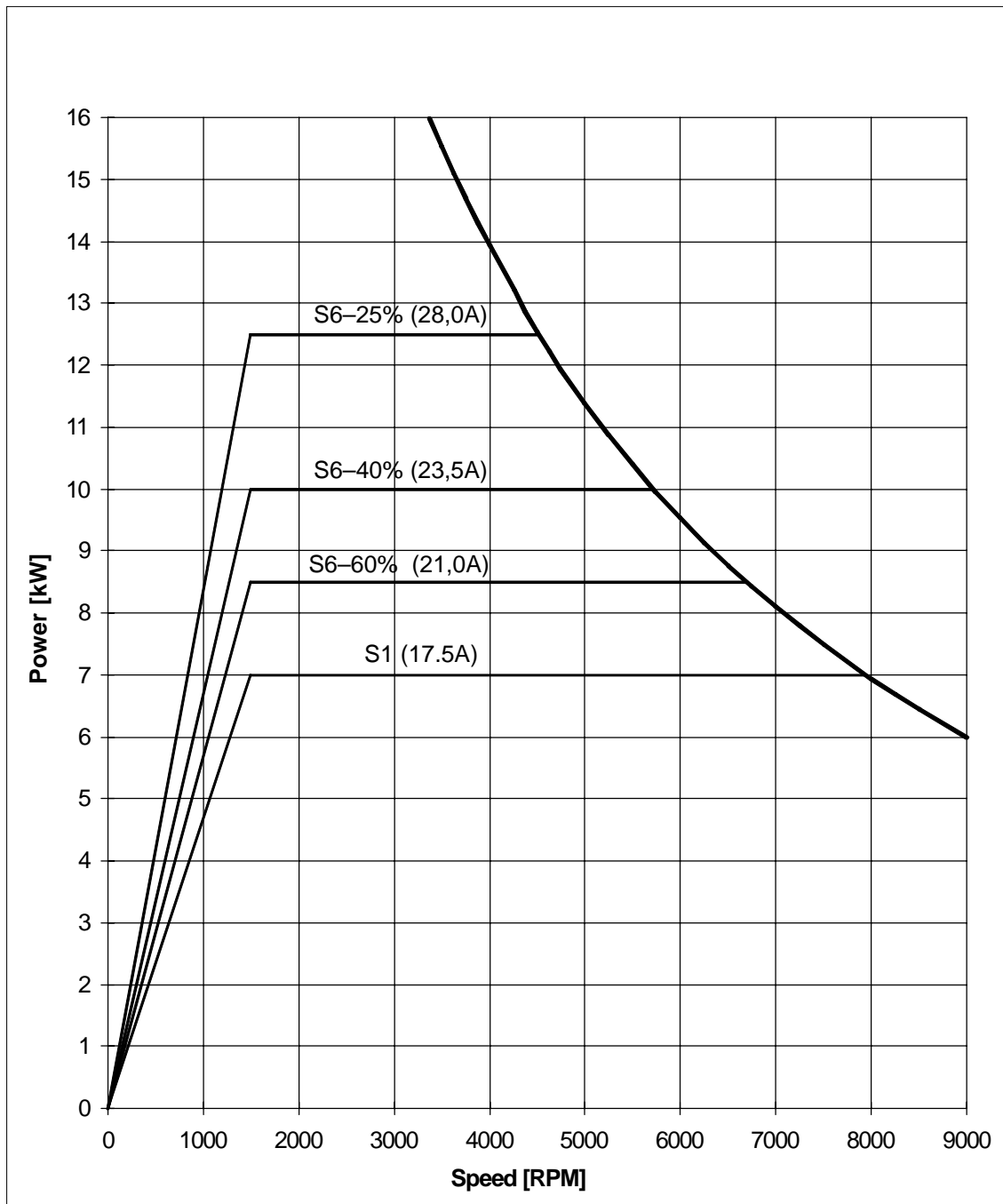


Fig. 3-9 Speed–power diagram 1PH7105–2NF□□

Table 3-10 AC main spindle motor 1PH7105-2NF□□-0L

| 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 | 12000 | 0.029 | 63 |

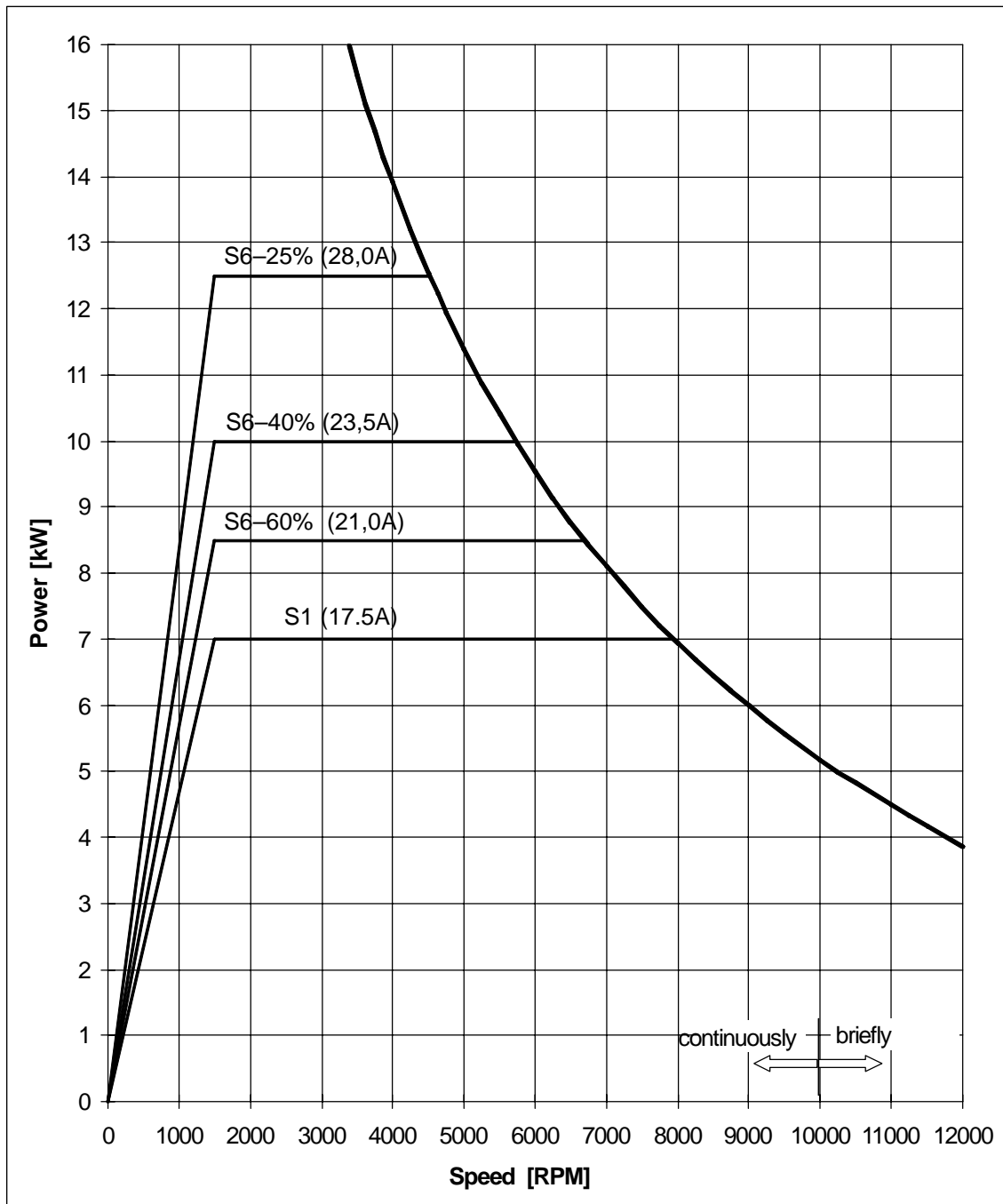
**1PH7**

Fig. 3-10 Speed-power diagram 1PH7105-2NF□□-0L

3.1 Speed–power diagrams

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 |

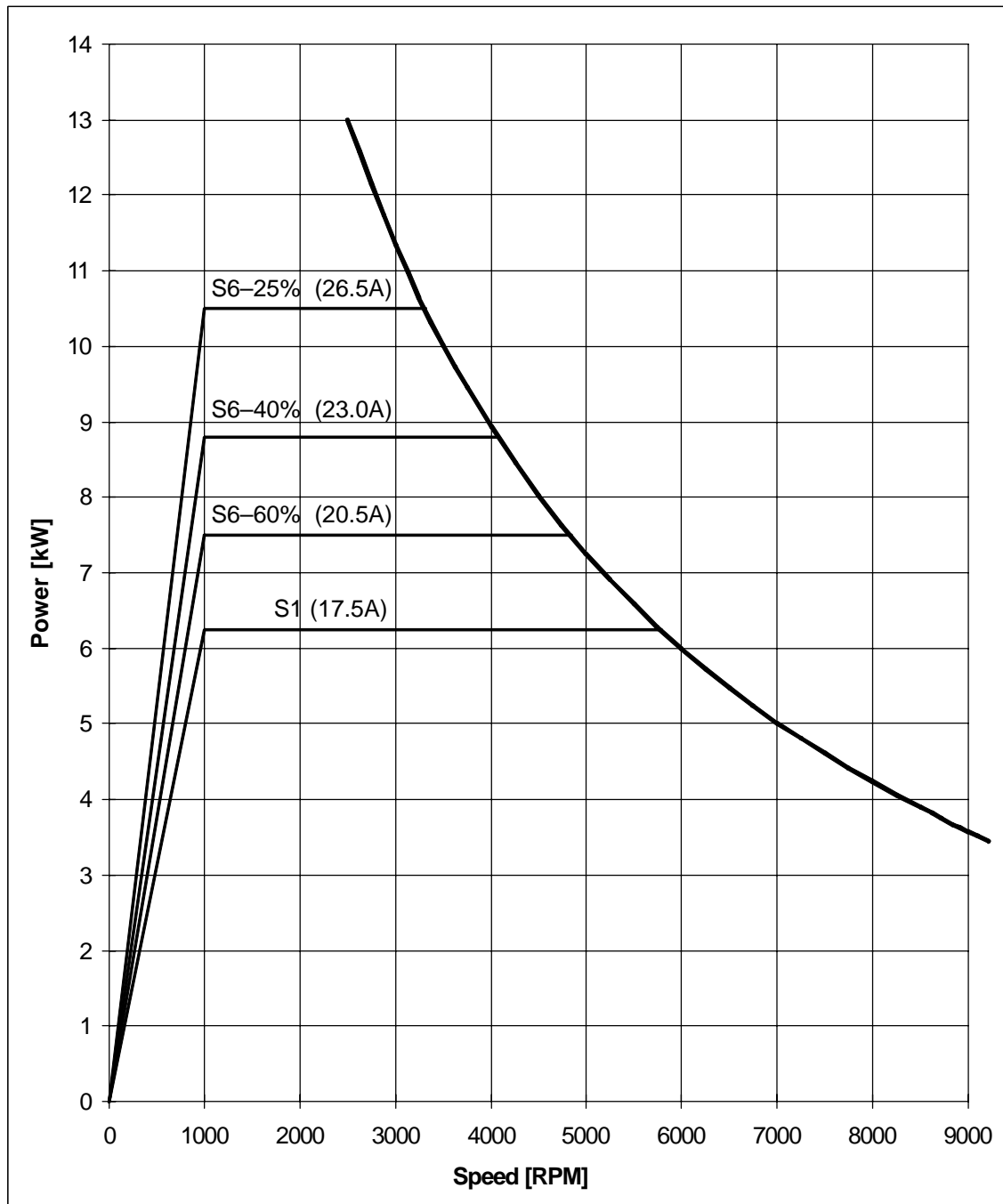
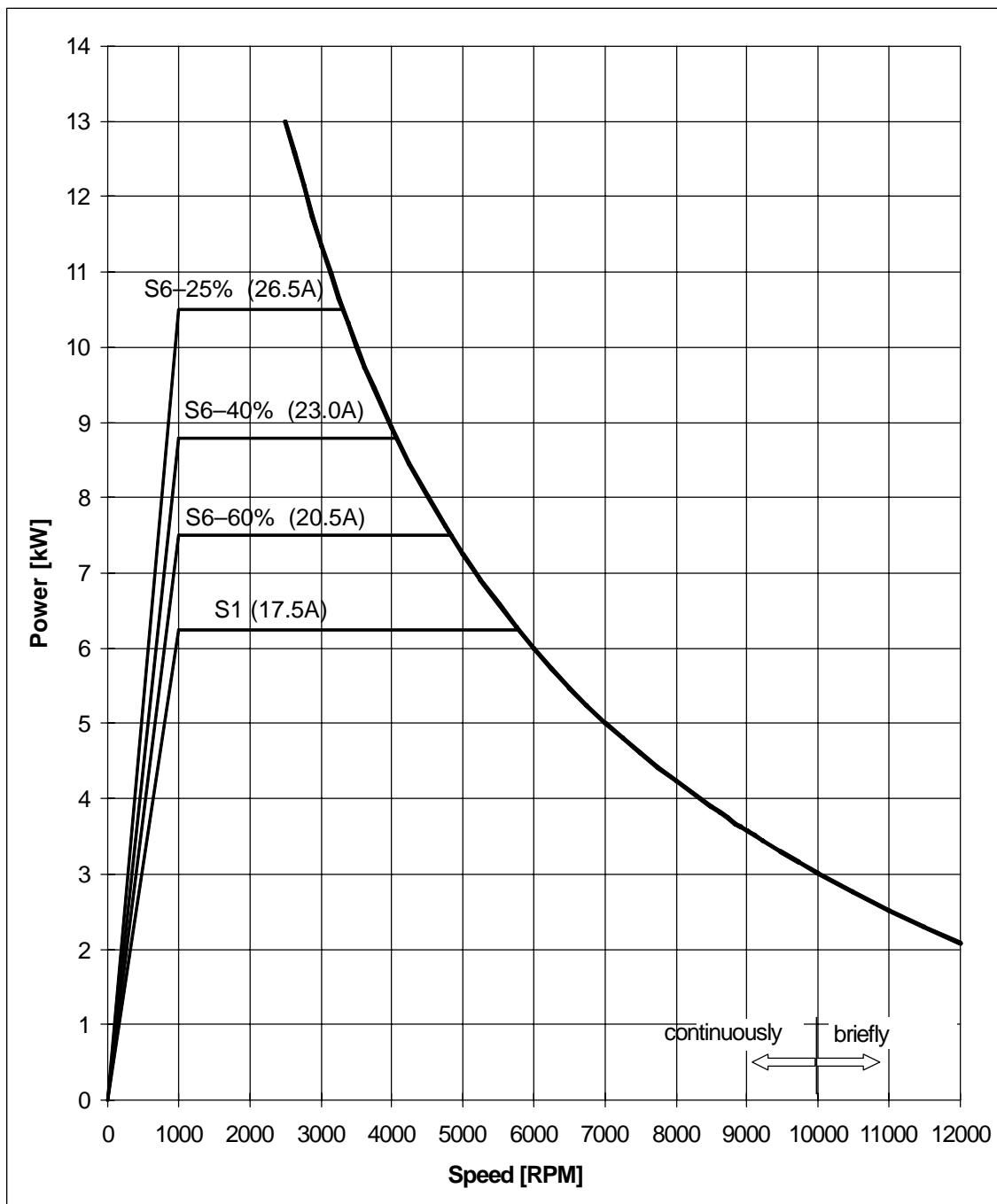


Fig. 3-11 Speed–power diagram 1PH7107-2ND

Table 3-12 AC main spindle motor 1PH7107-2ND□□-0L

| 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 | 12000 | 0.029 | 63 |



1PH7

Fig. 3-12 Speed-power diagram 1PH7107-2ND□□-0L

3.1 Speed–power diagrams

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 [kgm ²] | Weight m [kg] |
|--|--|--|--|---|---|---|-----------------------|
| 9.0 | 1500 | 57 | 23.5 | 20 | 9000 | 0.029 | 63 |

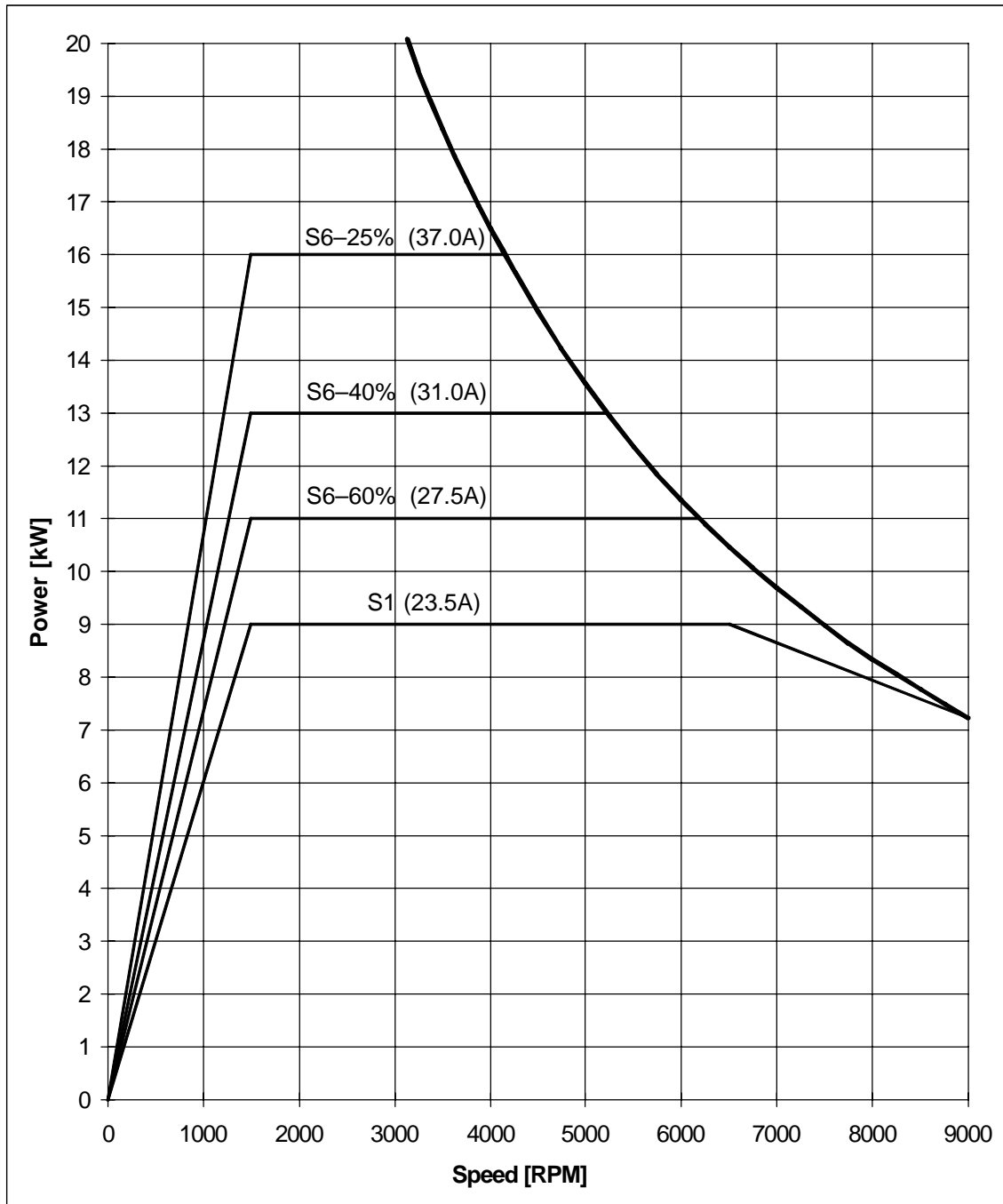


Fig. 3-13 Speed–power diagram 1PH7107–2NF□□

Table 3-14 AC main spindle motor 1PH7107-2NF□□-0L

| 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] |
|--|--|--|--|---|---|---|-----------------------|
| 9.0 | 1500 | 57 | 23.5 | 20 | 12000 | 0.029 | 63 |

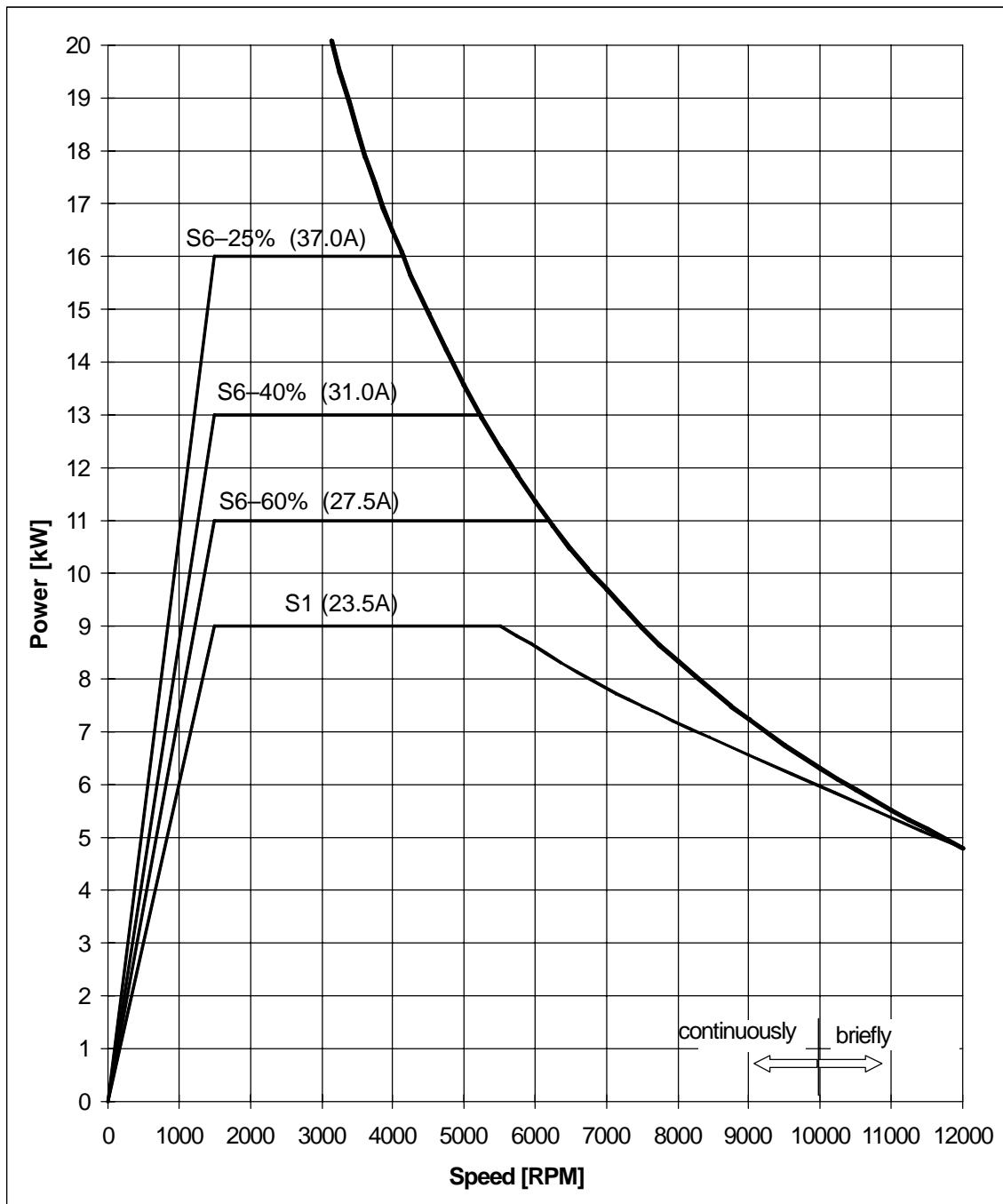
**1PH7**

Fig. 3-14 Speed-power diagram 1PH7107-2NF□□-0L

3.1 Speed–power diagrams

Table 3-15 AC main spindle motor 1PH7107-2NG

| Rated out-put P_{rated} [kW] | Rated speed n_{rated} [RPM] | Rated tor-que M_{rated} [Nm] | Rated cur-rent 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 |

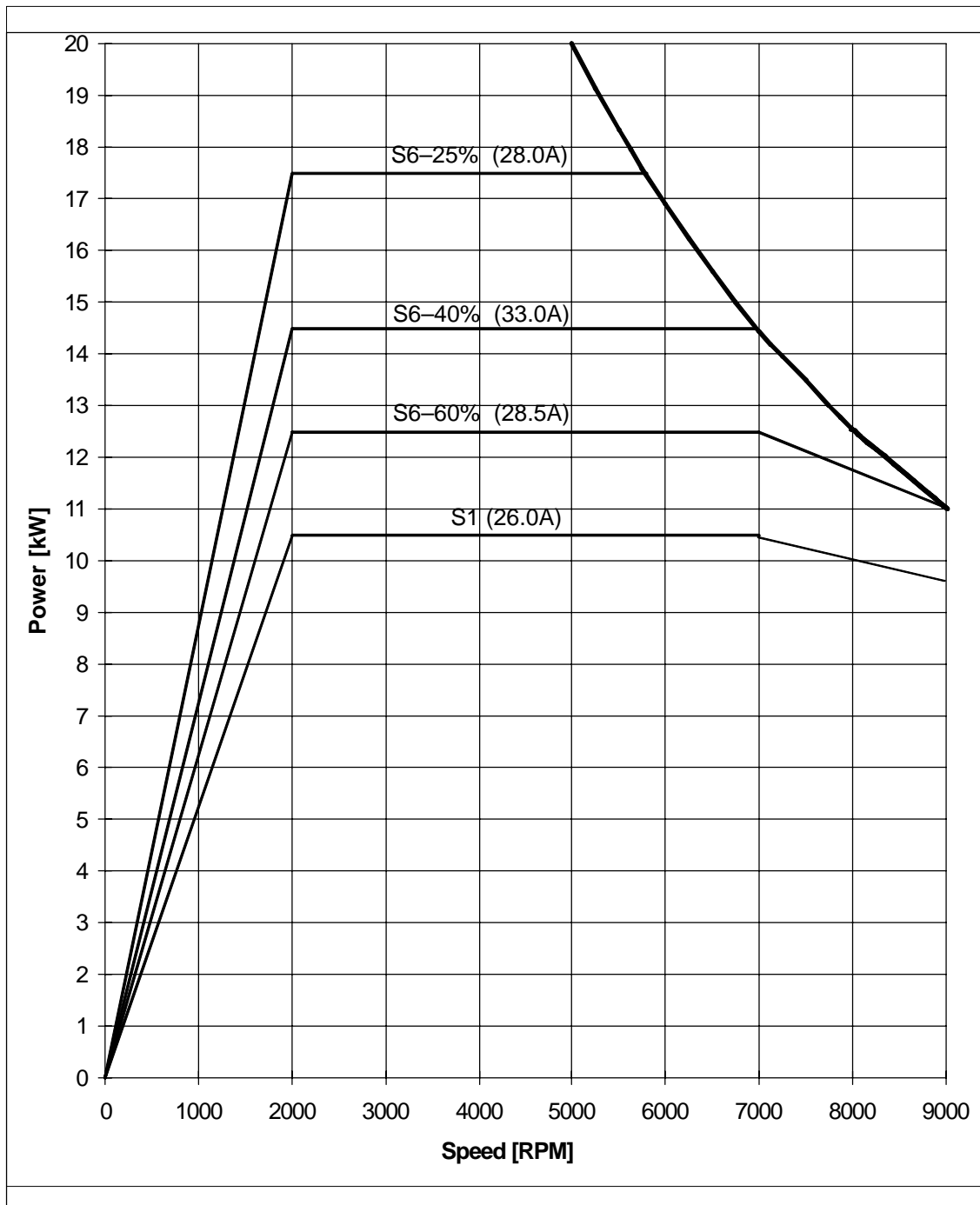


Fig. 3-15 Speed–power diagram 1PH7107-2NG

Table 3-16 AC main spindle motor 1PH7107-2NG□□-0L

| 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 | 12000 | 0.029 | 63 |

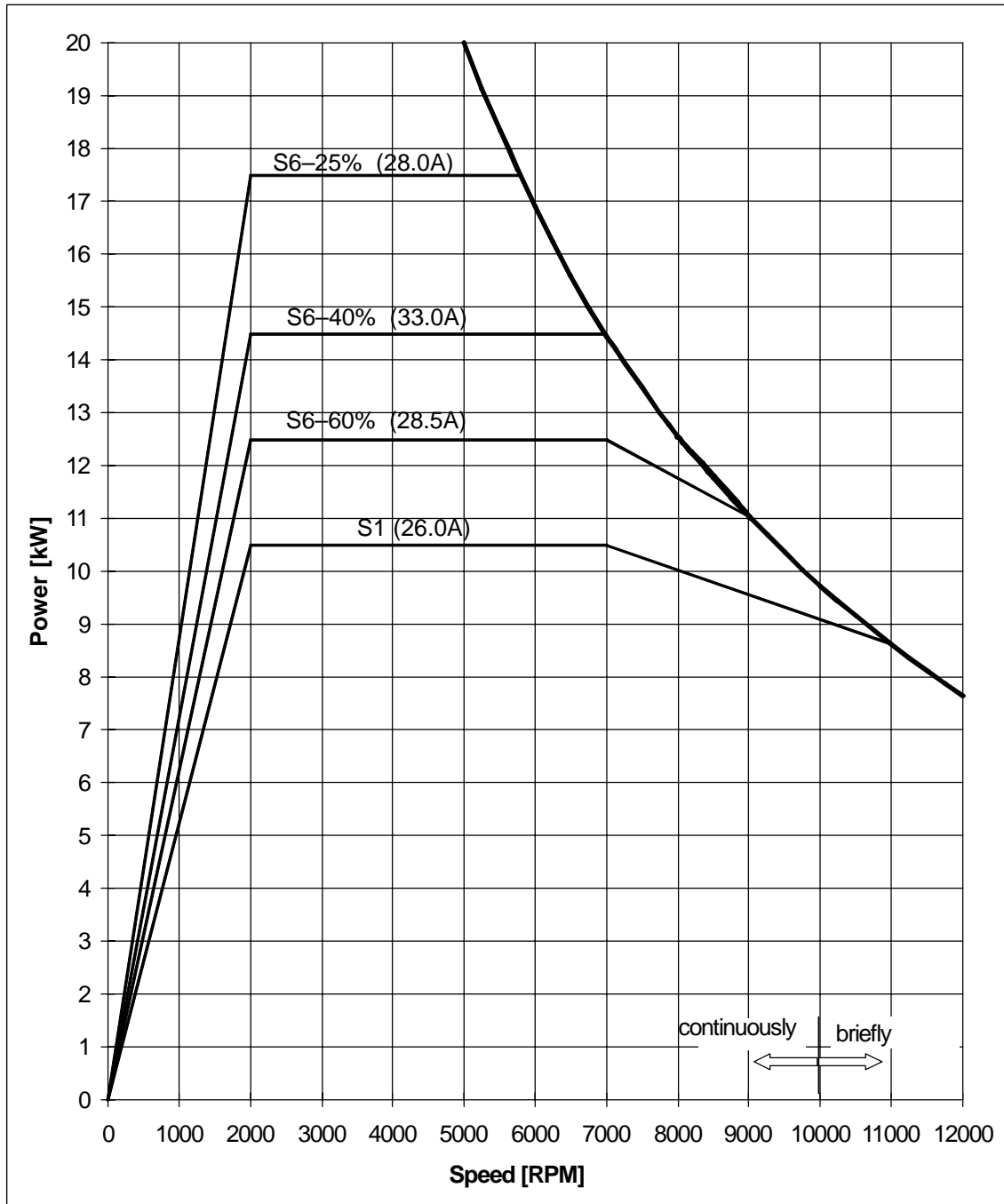
**1PH7**

Fig. 3-16 Speed-power diagram 1PH7107-2NG□□-0L

3.1 Speed-power diagrams

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 |

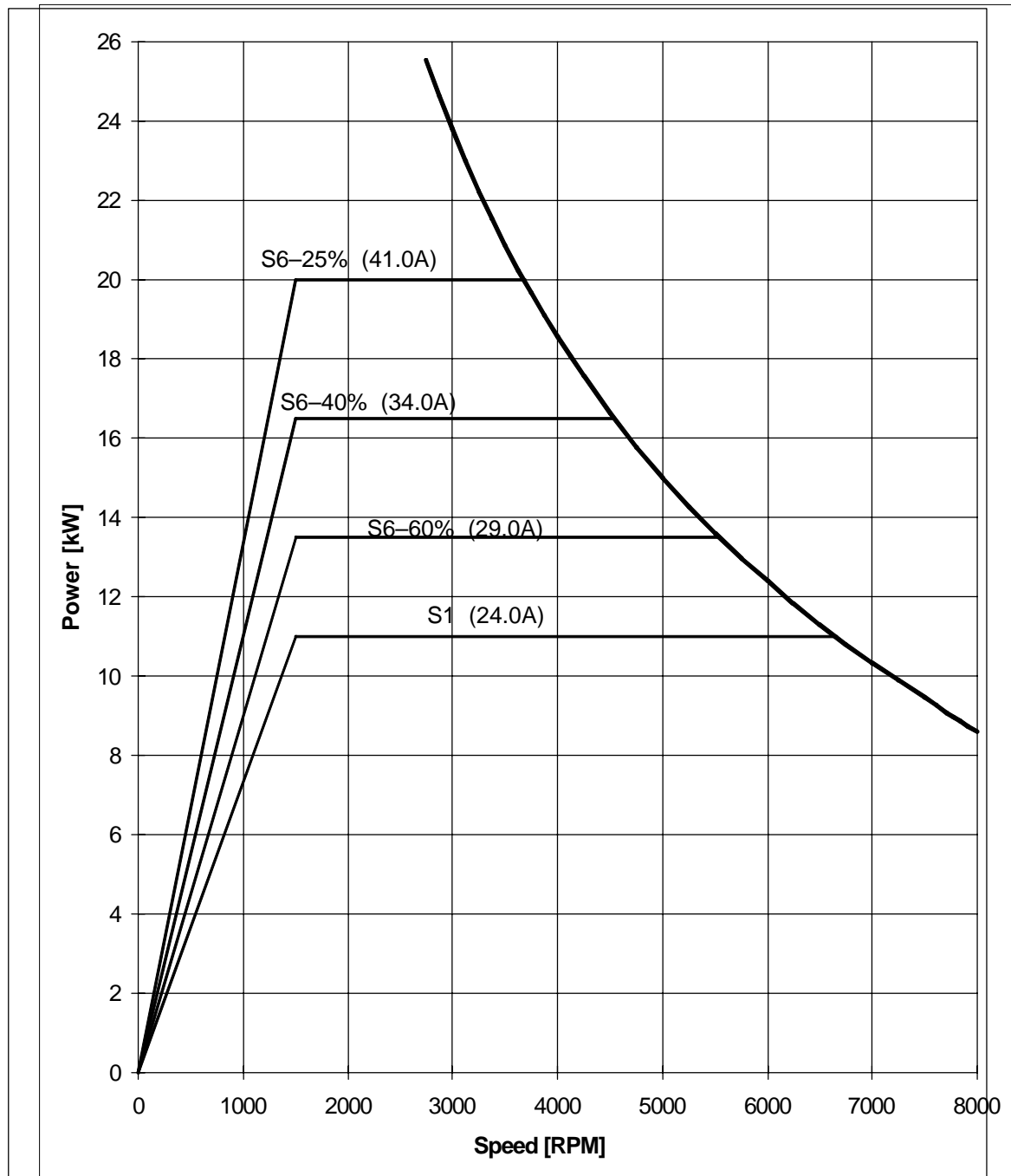


Fig. 3-17 Speed-power diagram 1PH7131-2NF□□

Table 3-18 AC main spindle motor 1PH7131-2NF□□-0L

| 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 |

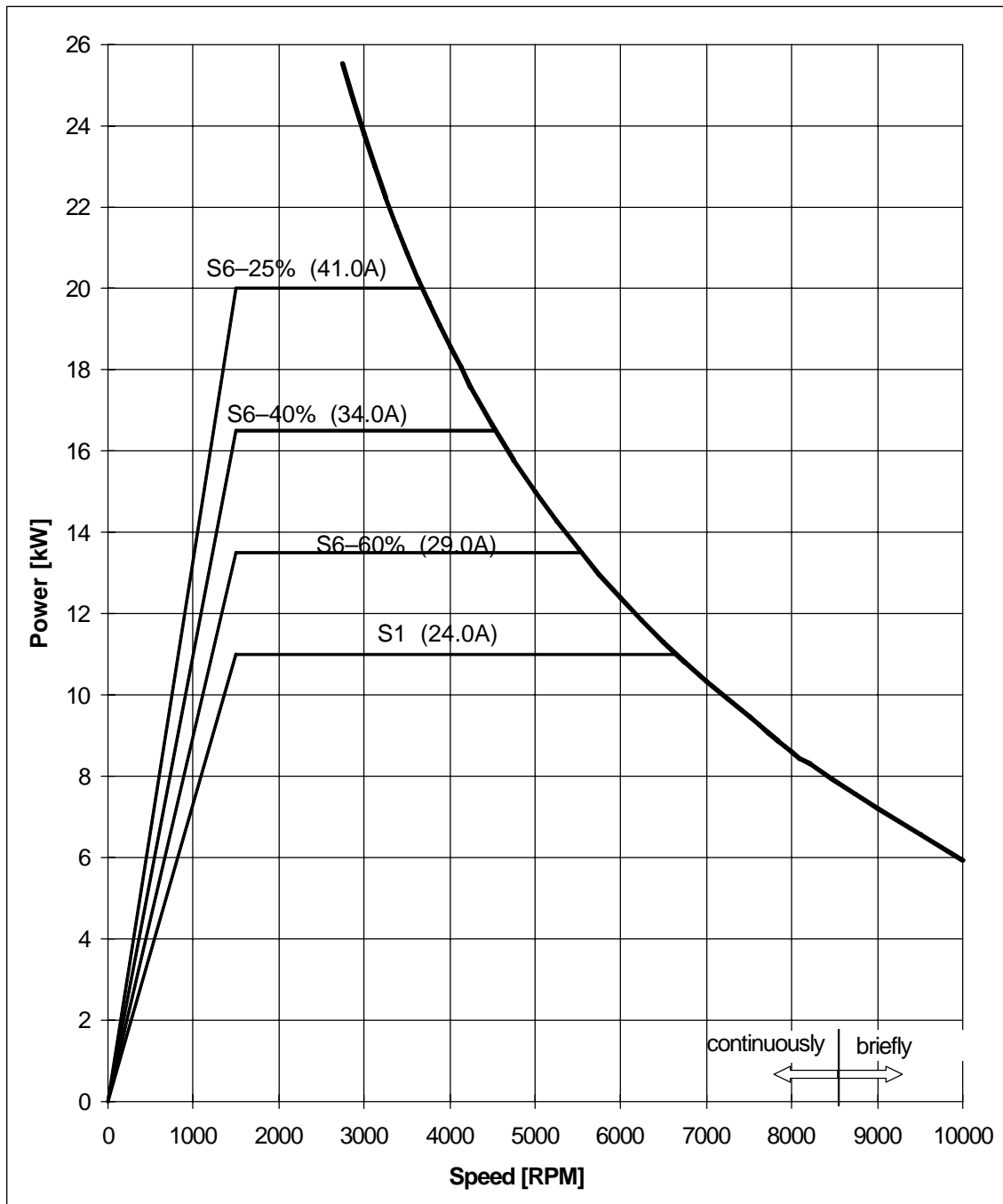
**1PH7**

Fig. 3-18 Speed-power diagram 1PH7131-2NF□□-0L

3.1 Speed–power diagrams

Table 3-19 AC main spindle motor 1PH7133–2ND□□

| Rated out-put P_{rated} [kW] | Rated speed n_{rated} [RPM] | Rated tor-que M_{rated} [Nm] | Rated cur-rent 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 |

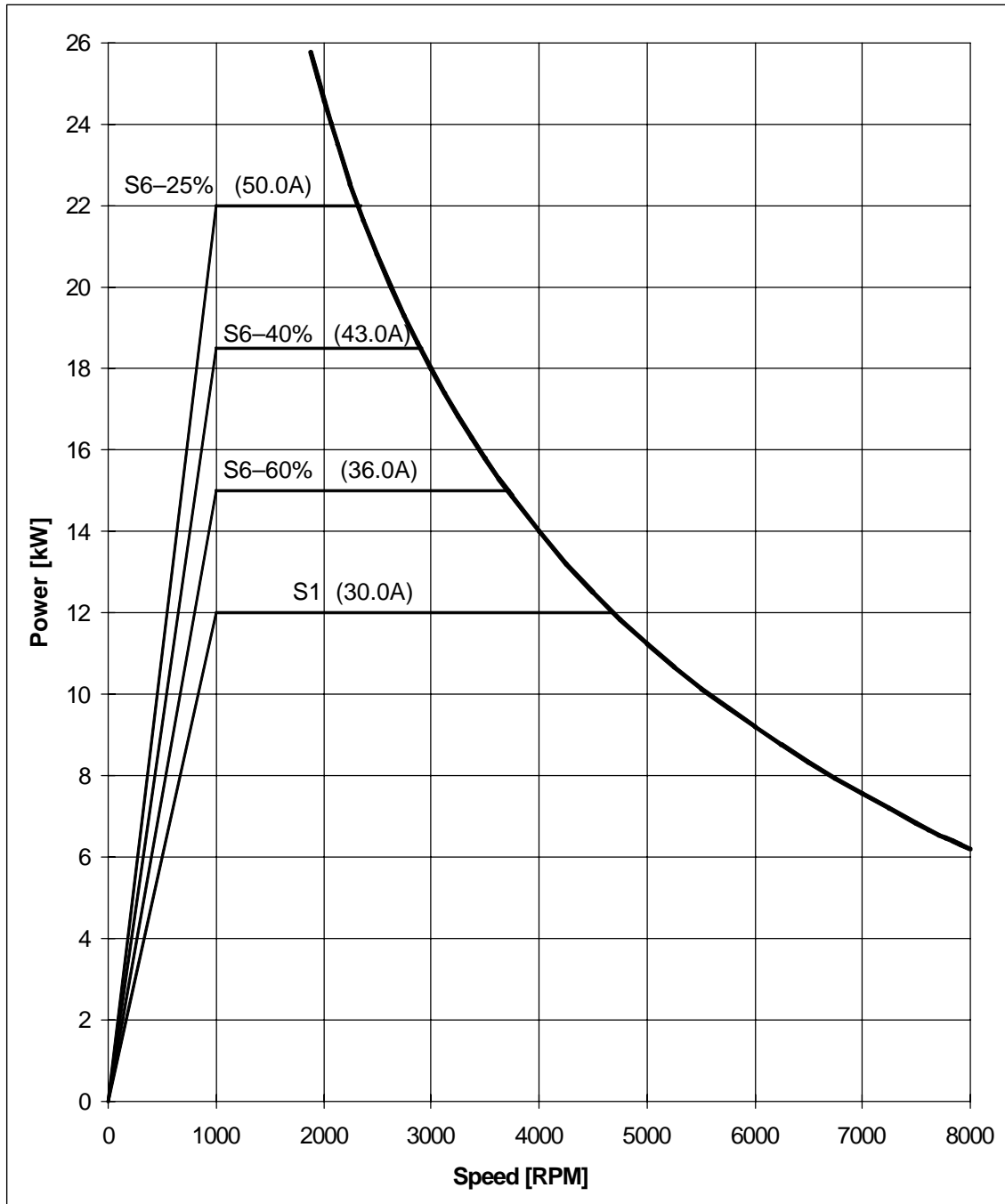


Fig. 3-19 Speed–power diagram 1PH7133–2ND□□

Table 3-20 AC main spindle motor 1PH7133-2ND□□-0L

| 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 | 10000 | 0.076 | 90 |

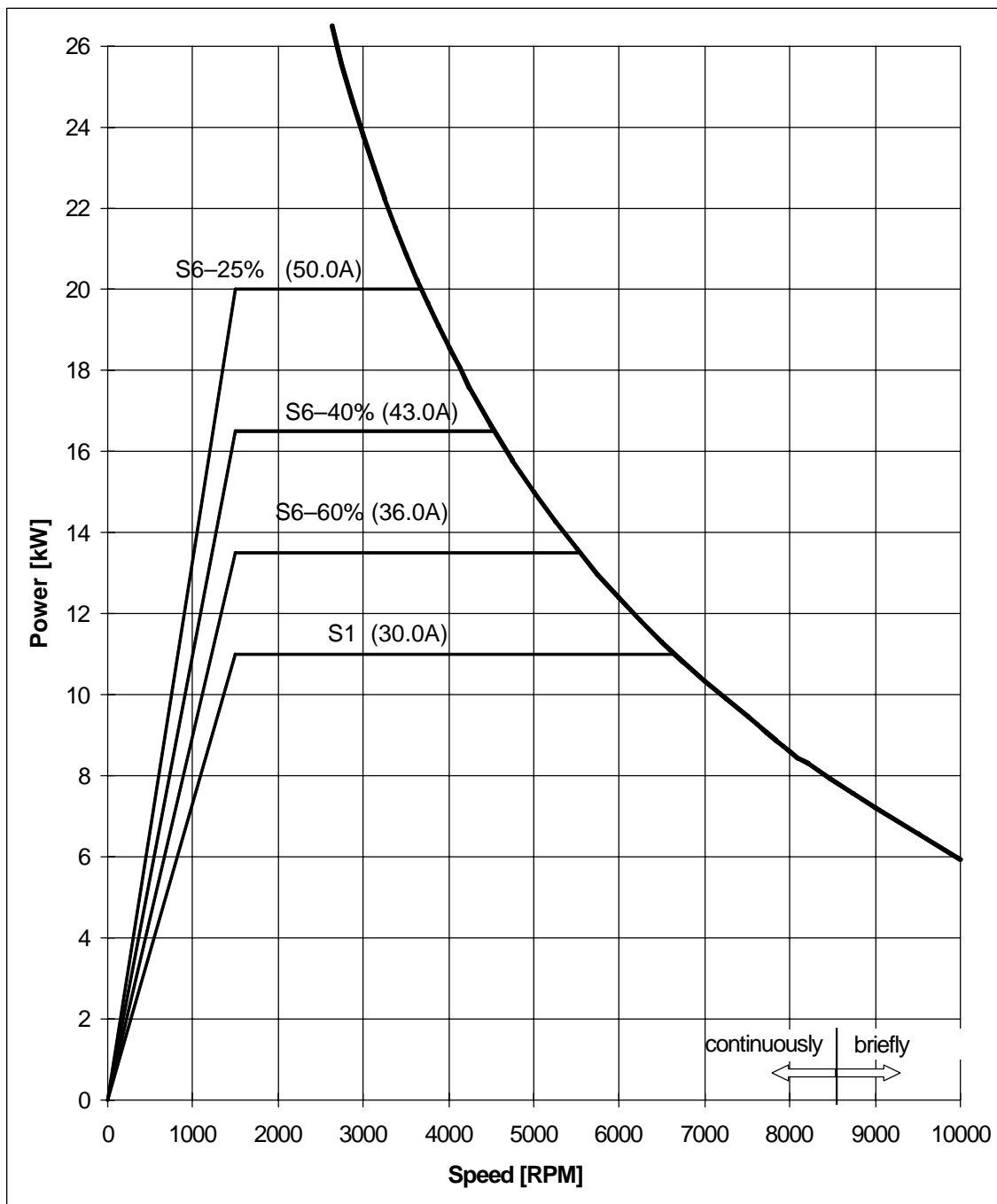
**1PH7**

Fig. 3-20 Speed-power diagram 1PH7133-2ND□□-0L

3.1 Speed–power diagrams

Table 3-21 AC main spindle motor 1PH7133-2NF

| Rated out- put P_{rated} [kW] | Rated speed n_{rated} [RPM] | Rated tor- que M_{rated} [Nm] | Rated cur- rent 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 |

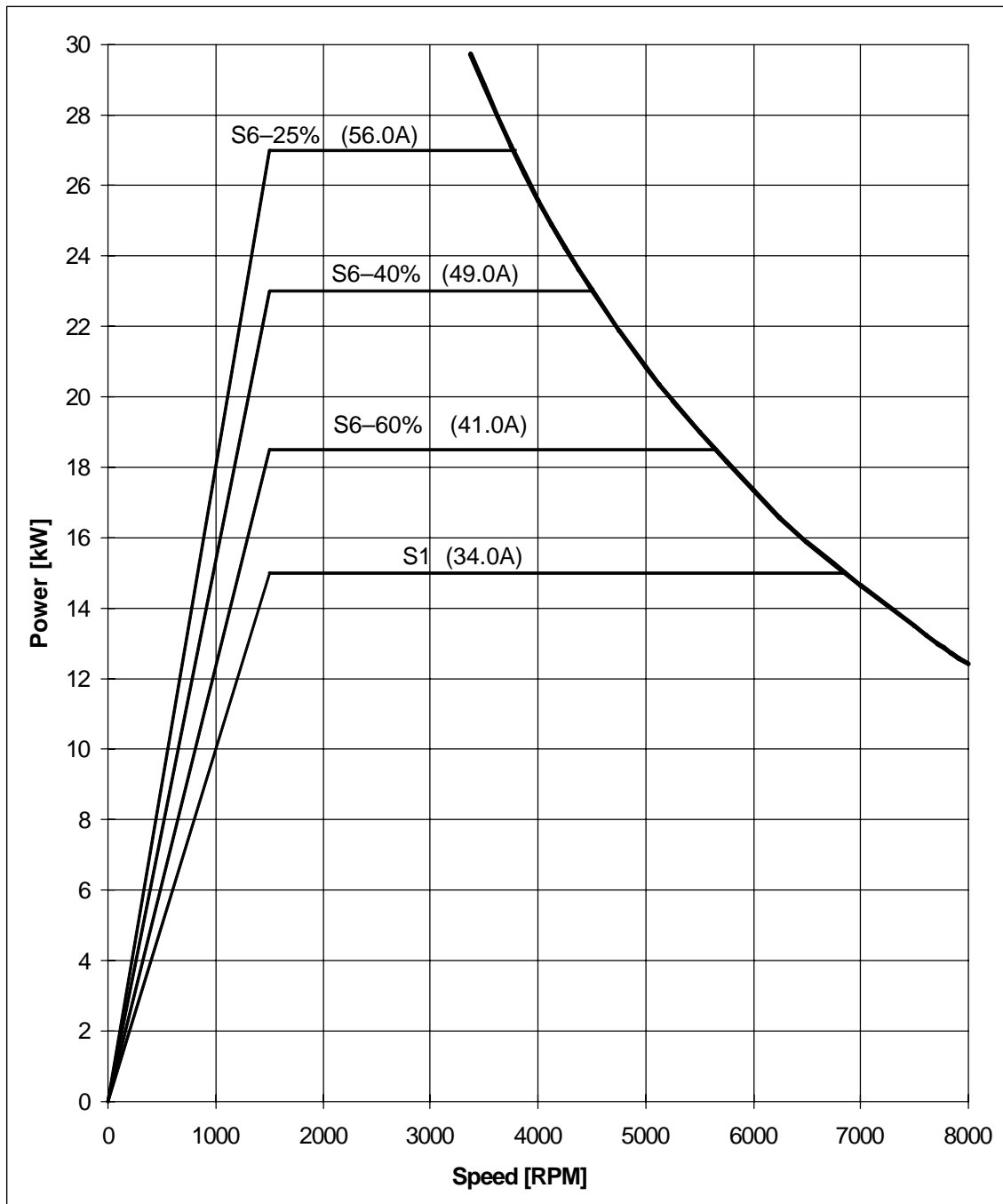


Fig. 3-21 Speed–power diagram 1PH7133-2NF

Table 3-22 AC main spindle motor 1PH7133-2NF□□-0L

| 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 |

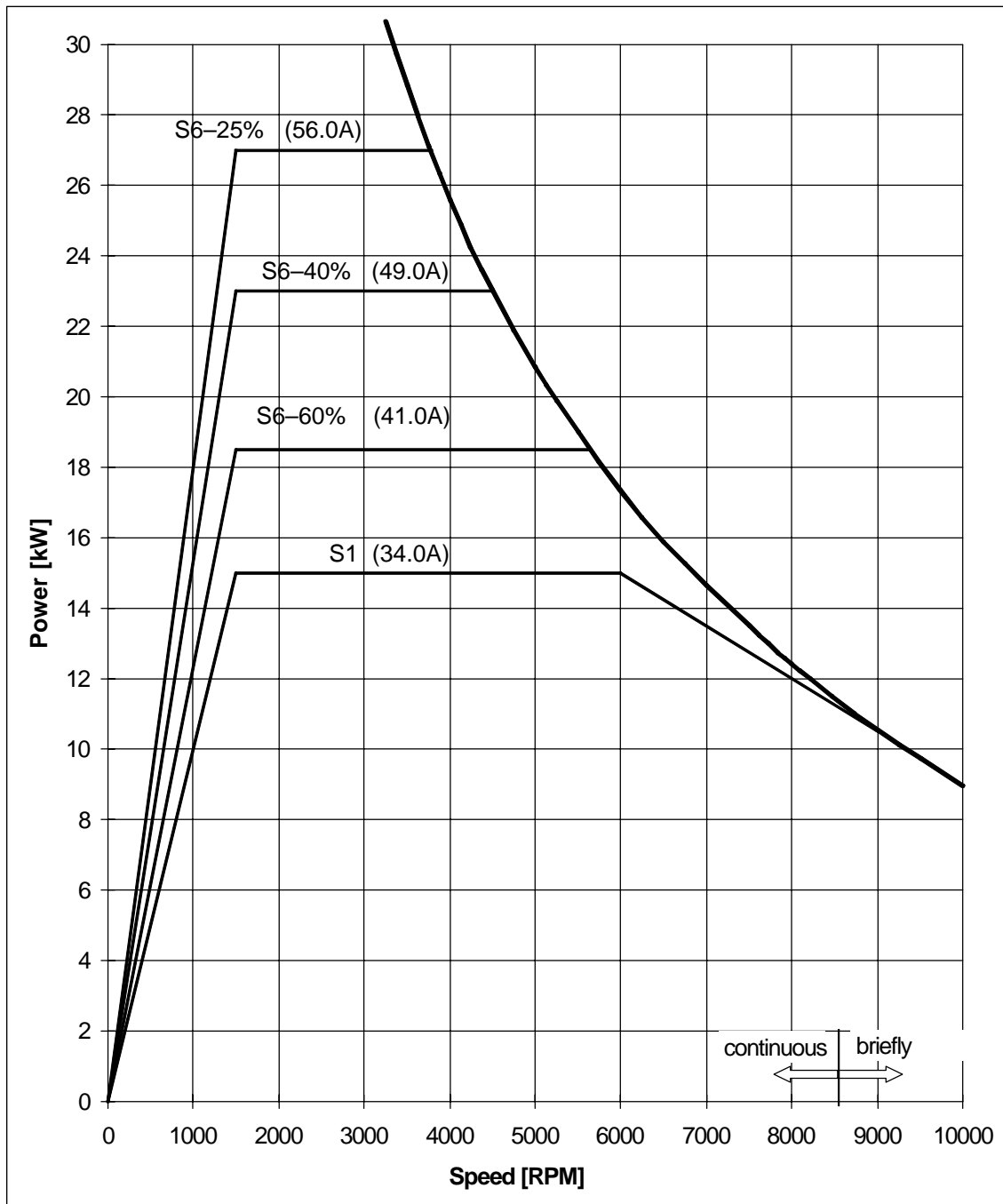
**1PH7**

Fig. 3-22 Speed-power diagram 1PH7133-2NF□□-0L

3.1 Speed-power diagrams

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 [kgm ²] | Weight m [kg] |
|--|--|--|--|---|---|---|-----------------------|
| 20 | 2000 | 95 | 45 | 30 | 8000 | 0.076 | 90 |

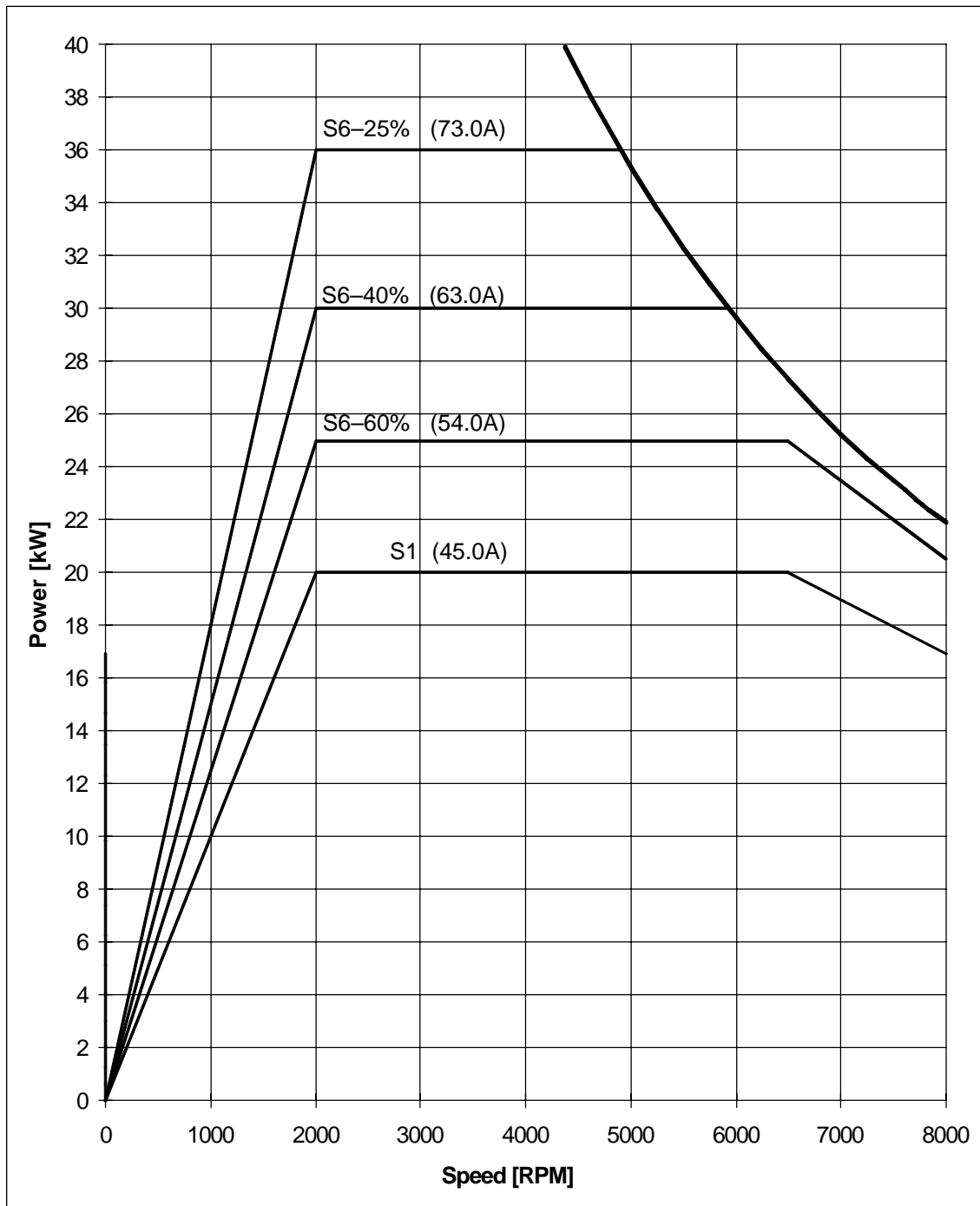


Fig. 3-23 Speed-power diagram 1PH7133-2NG□□

Table 3-24 AC main spindle motor 1PH7133-2NG□□-0L

| 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] |
|--|--|--|--|---|---|---|-----------------------|
| 20 | 2000 | 95 | 45 | 30 | 10000 | 0.076 | 90 |

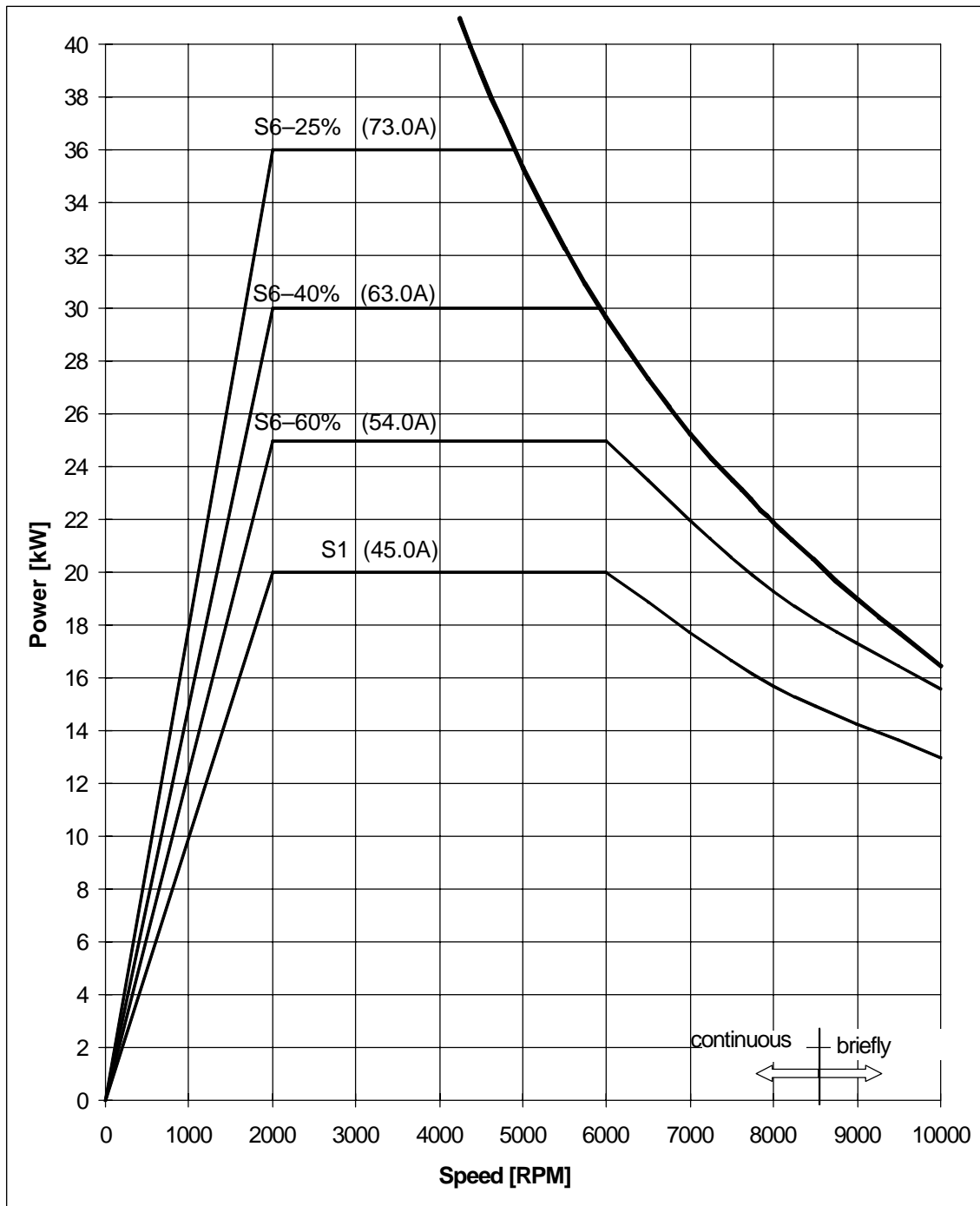
**1PH7**

Fig. 3-24 Speed-power diagram 1PH7133-2NG□□-0L

3.1 Speed–power diagrams

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 |

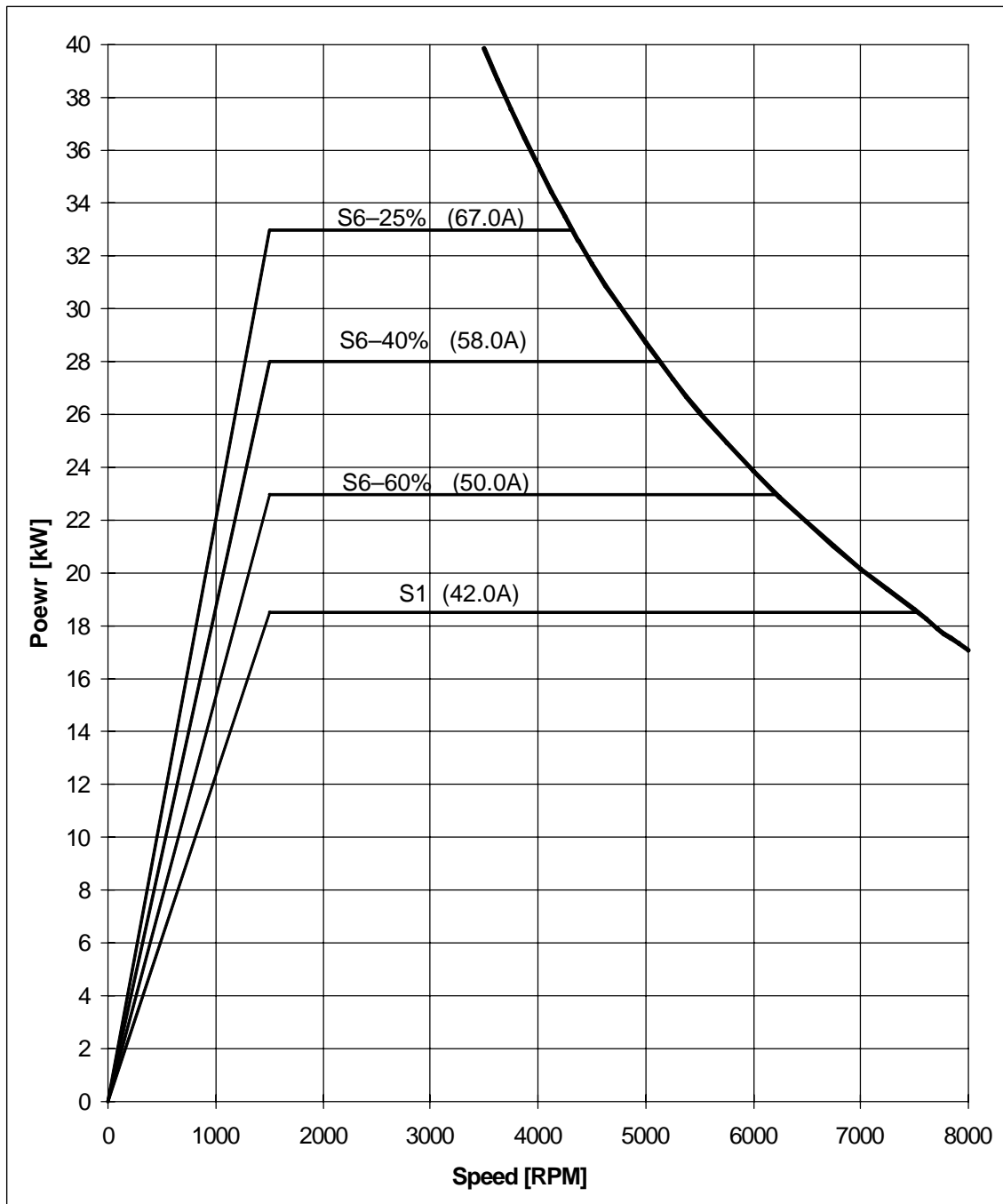


Fig. 3-25 Speed–power diagram 1PH7135-2NF

Table 3-26 AC main spindle motor 1PH7135-2NF□□-0L

| 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 |

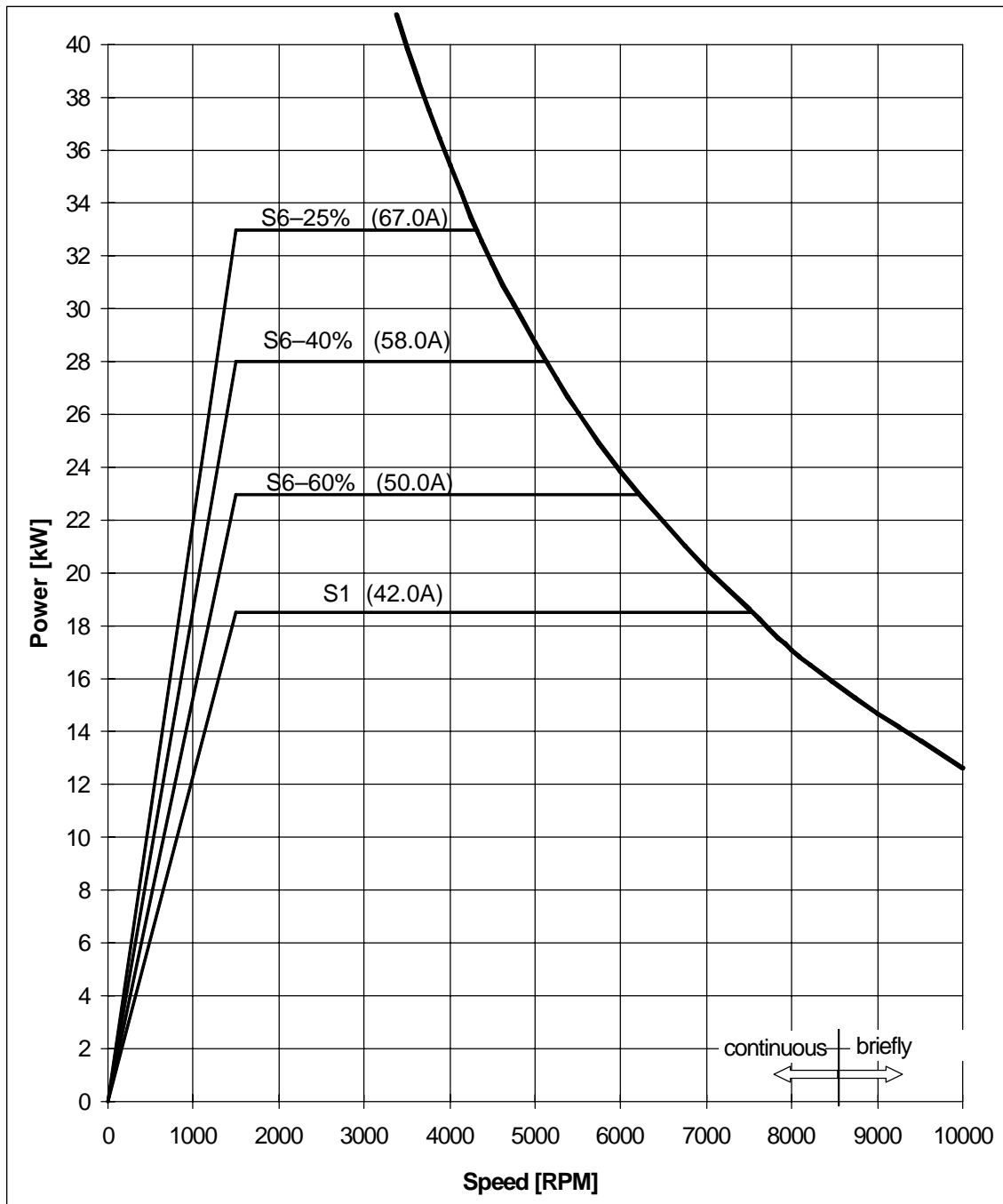
**1PH7**

Fig. 3-26 Speed-power diagram 1PH7135-2NF□□-0L

3.1 Speed-power diagrams

Table 3-27 AC main spindle motor 1PH7137-2ND□□

| Rated out-put P_{rated} [kW] | Rated speed n_{rated} [RPM] | Rated tor-que M_{rated} [Nm] | Rated cur-rent 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 |

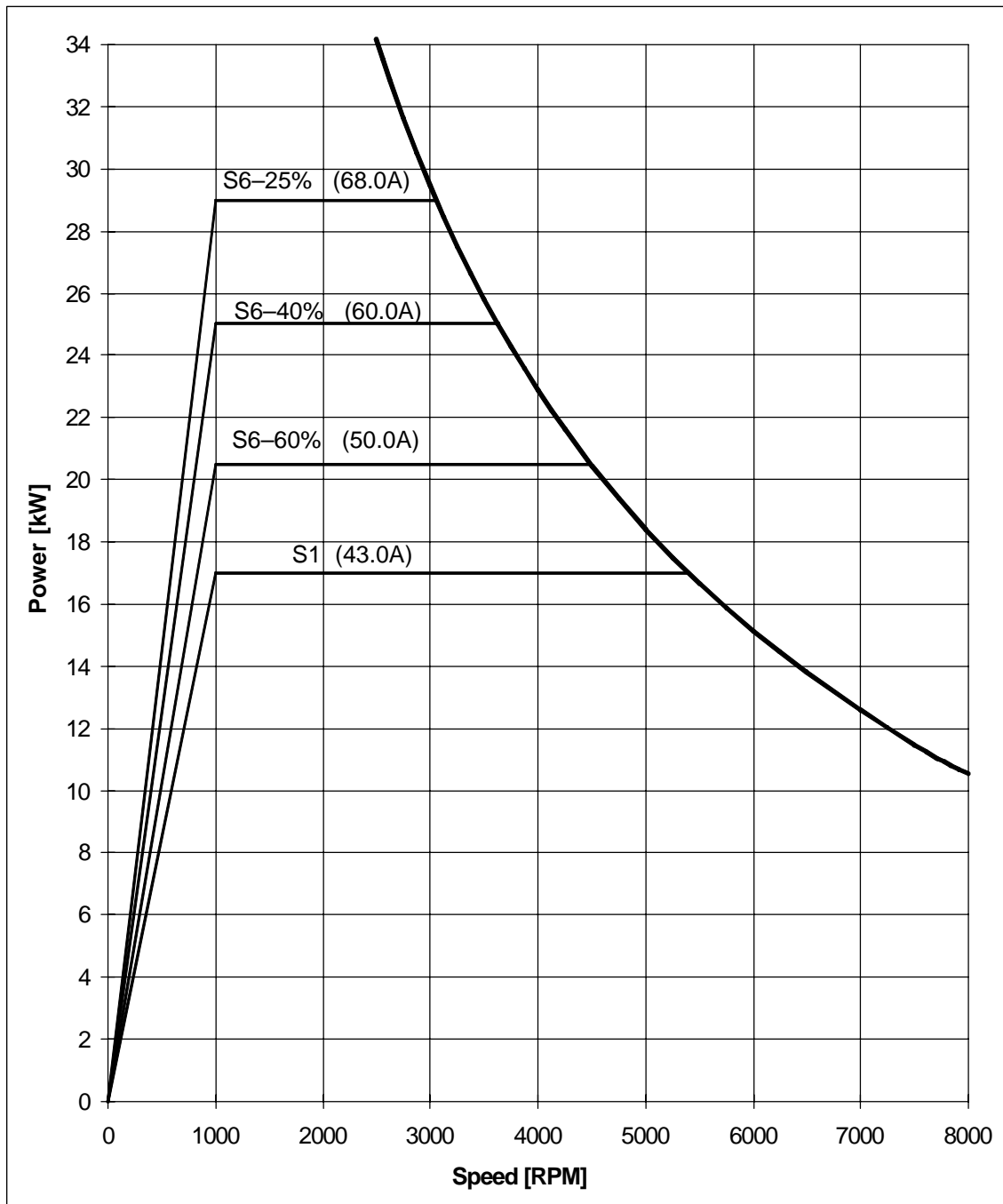


Fig. 3-27 Speed-power diagram 1PH7137-2ND□□

Table 3-28 AC main spindle motor 1PH7137-2ND□□-0L

| Rated out-put P_{rated} [kW] | Rated speed n_{rated} [RPM] | Rated tor-que M_{rated} [Nm] | Rated cur-rent 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 |

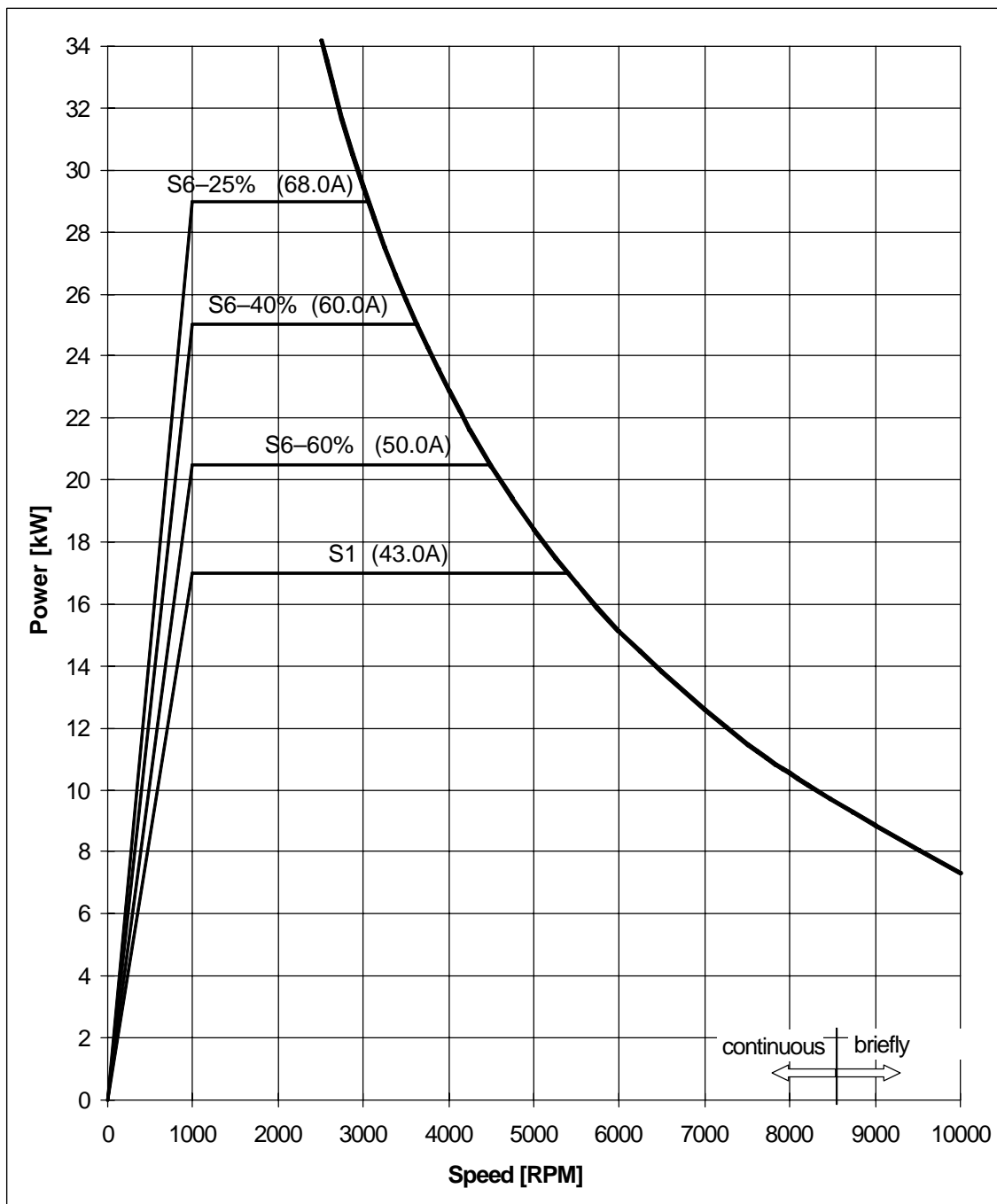
**1PH7**

Fig. 3-28 Speed-power diagram 1PH7137-2ND□□-0L

3.1 Speed–power diagrams

Table 3-29 AC main spindle motor 1PH7137–2NF□□

| Rated out- put P_{rated} [kW] | Rated speed n_{rated} [RPM] | Rated tor- que M_{rated} [Nm] | Rated cur- rent 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 | 8000 | 0.109 | 130 |

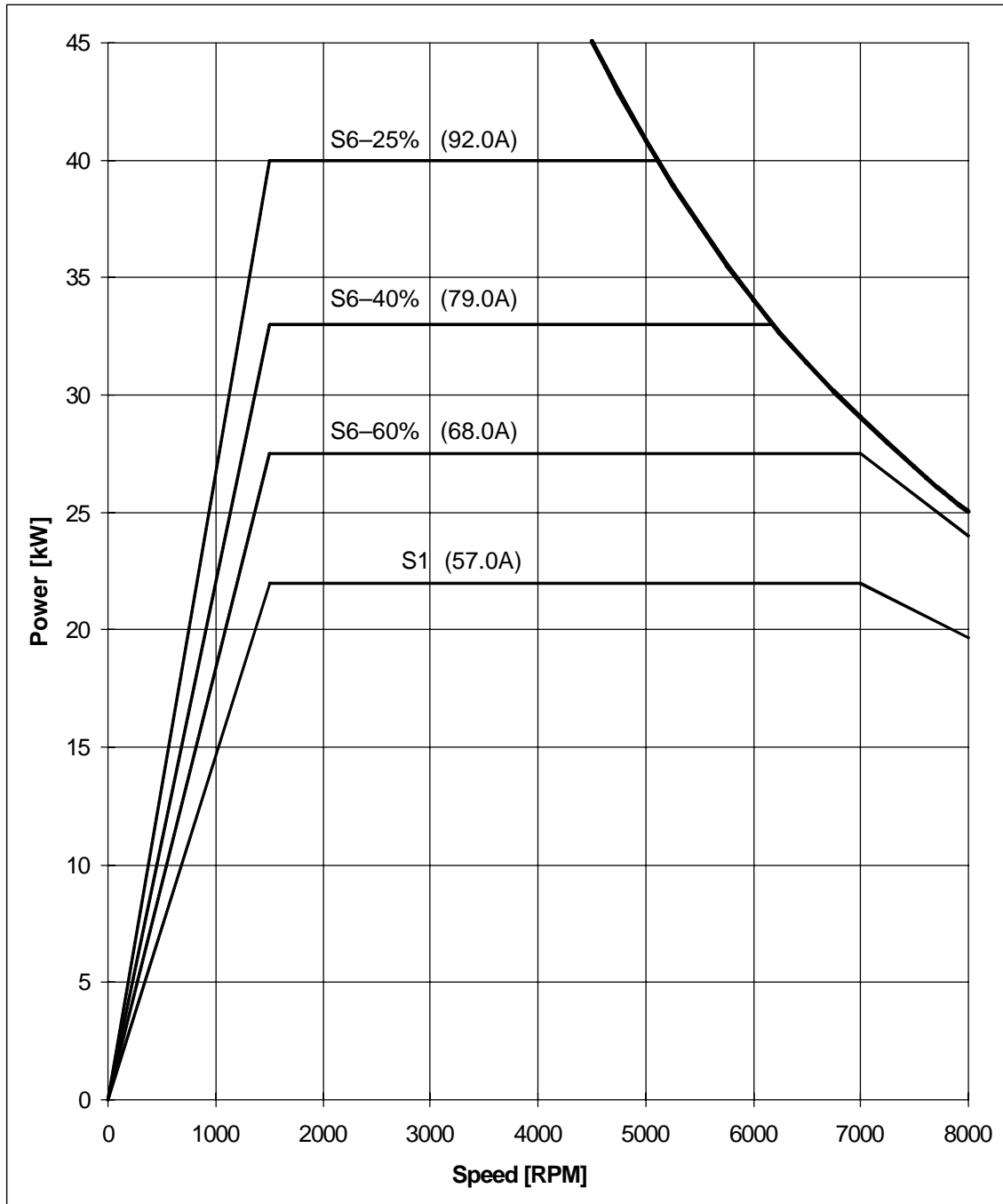


Fig. 3-29 Speed–power diagram 1PH7137–2NF□□

Table 3-30 AC main spindle motor 1PH7137-2NF□□-0L

| 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 |

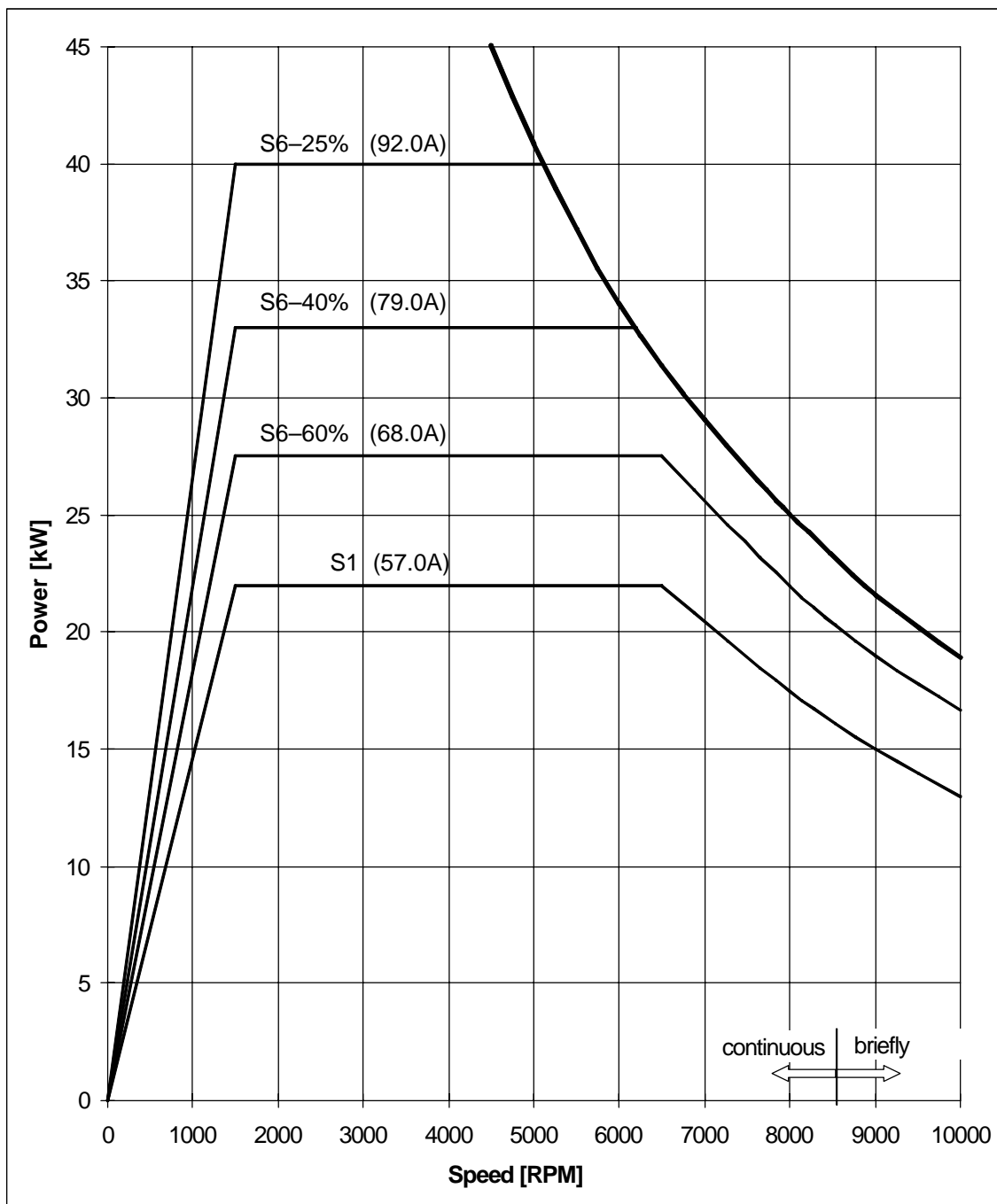
**1PH7**

Fig. 3-30 Speed-power diagram 1PH7137-2NF□□-0L

3.1 Speed–power diagrams

Table 3-31 AC main spindle motor 1PH7137–2NG□□

| Rated out-put P_{rated} [kW] | Rated speed n_{rated} [RPM] | Rated tor-que M_{rated} [Nm] | Rated cur-rent 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 |

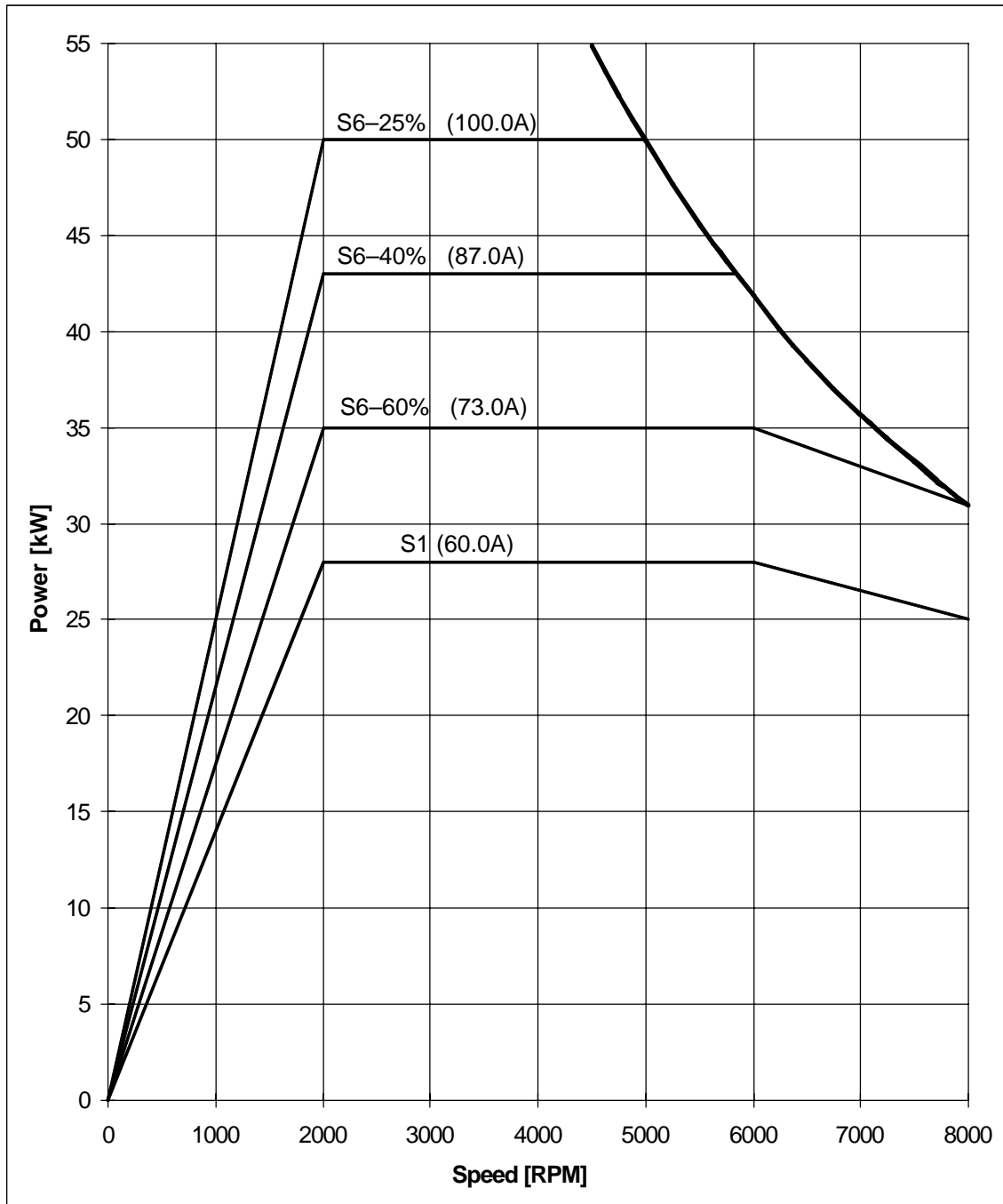


Fig. 3-31 Speed–power diagram 1PH7137–2NG□□

Table 3-32 AC main spindle motor 1PH7137-2NG□□-0L

| 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 |

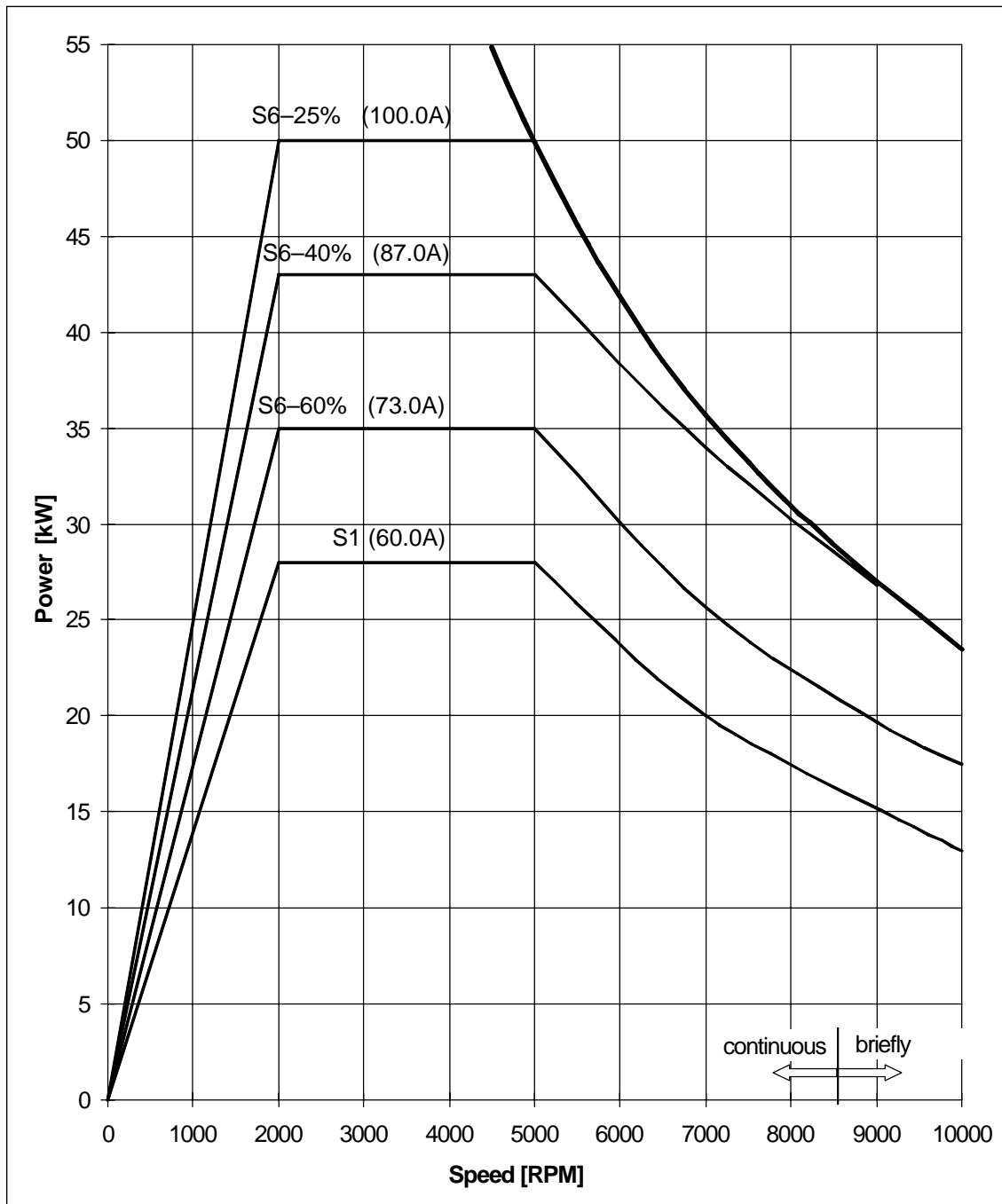
**1PH7**

Fig. 3-32 Speed-power diagram 1PH7137-2NG□□-0L

3.1 Speed-power diagrams

Table 3-33 AC main spindle motor 1PH7163-2NB

| Rated out-put P_{rated} [kW] | Rated speed n_{rated} [RPM] | Rated tor-que M_{rated} [Nm] | Rated cur-rent 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 |

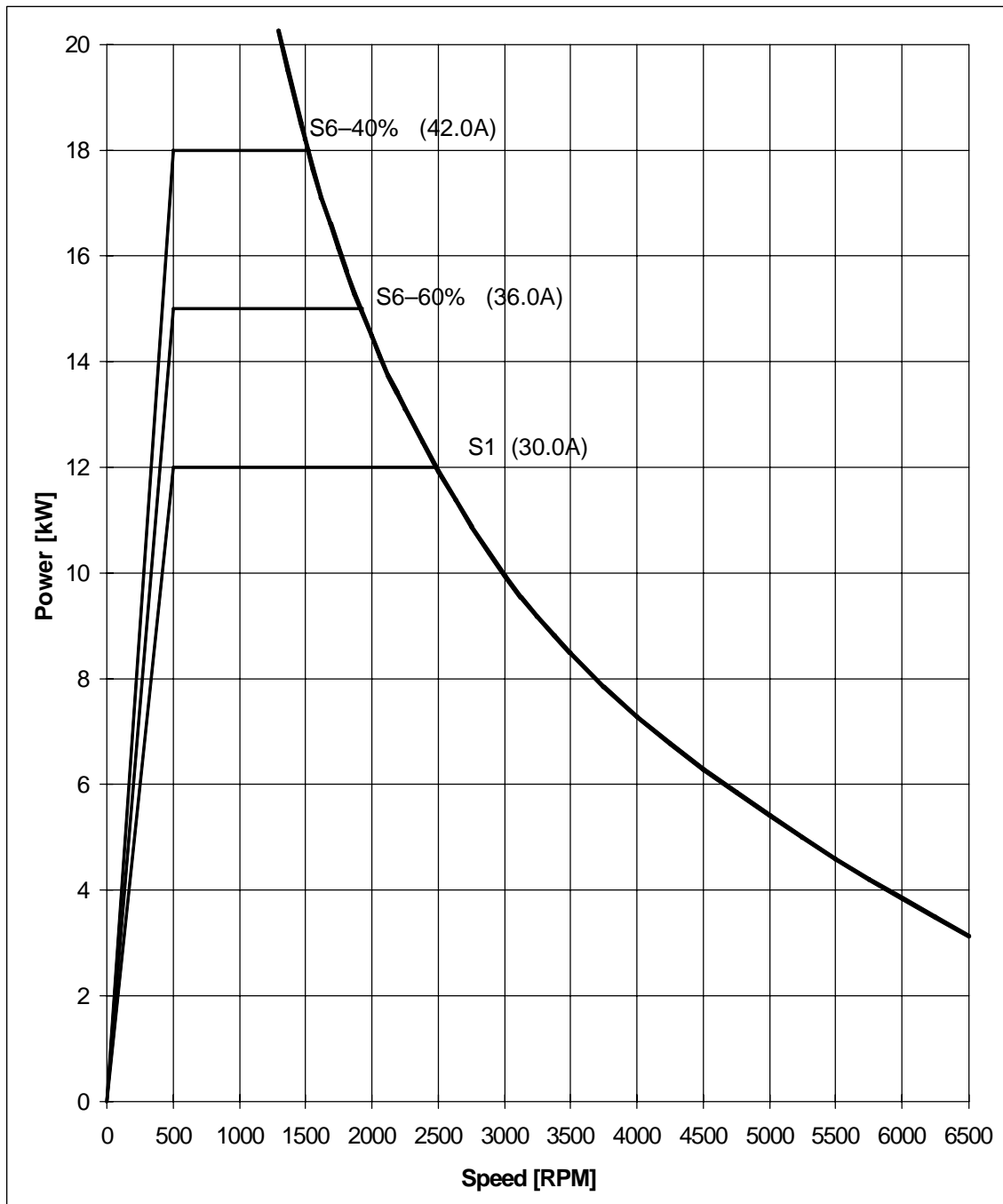


Fig. 3-33 Speed-power diagram 1PH7163-2NB

Table 3-34 AC main spindle motor 1PH7163-2NB□□-0L

| Rated out-put P_{rated} [kW] | Rated speed n_{rated} [RPM] | Rated tor-que M_{rated} [Nm] | Rated cur-rent 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 | 8000 | 0.19 | 180 |

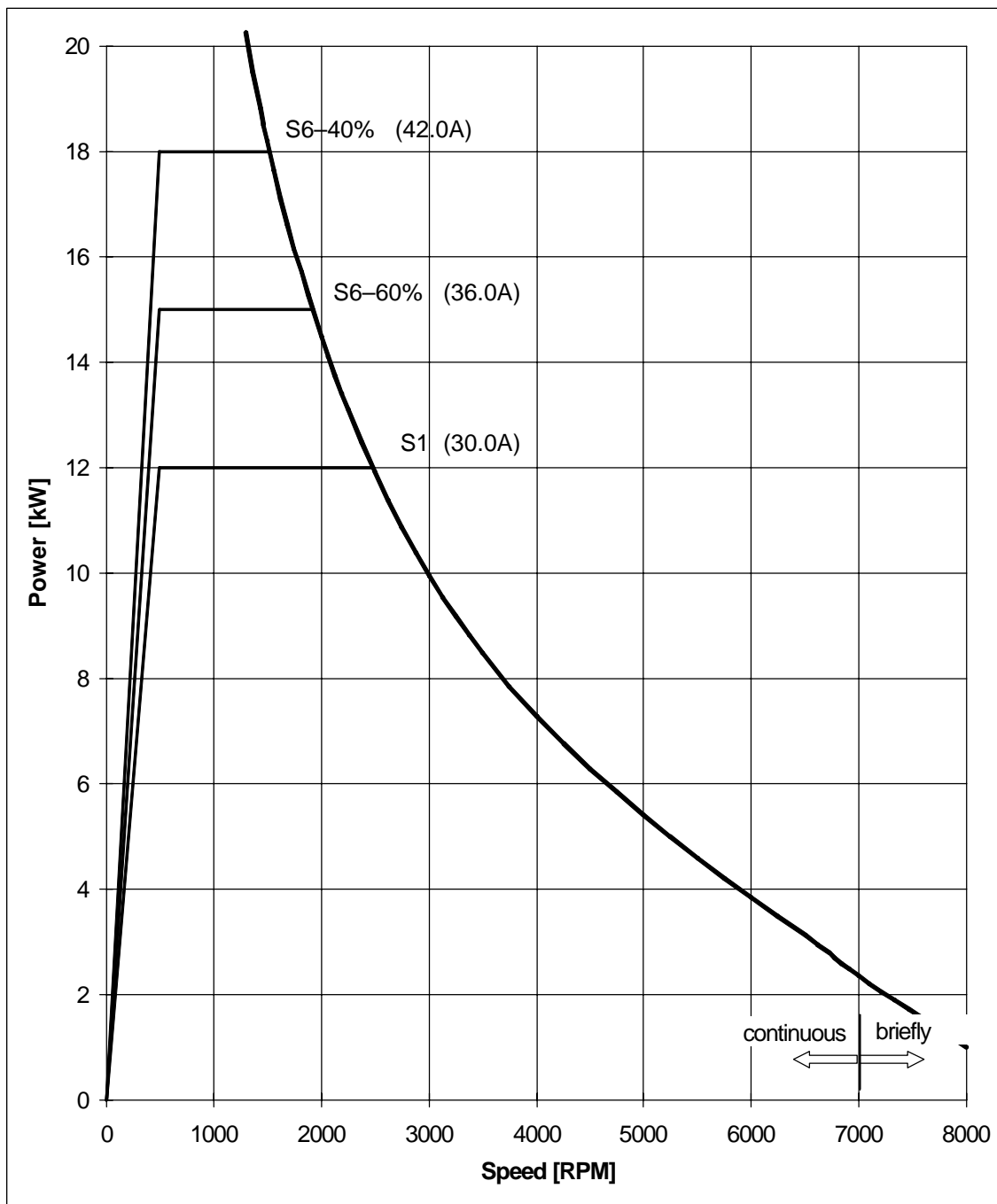
**1PH7**

Fig. 3-34 Speed-power diagram 1PH7163-2NB□□-0L

3.1 Speed–power diagrams

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 |

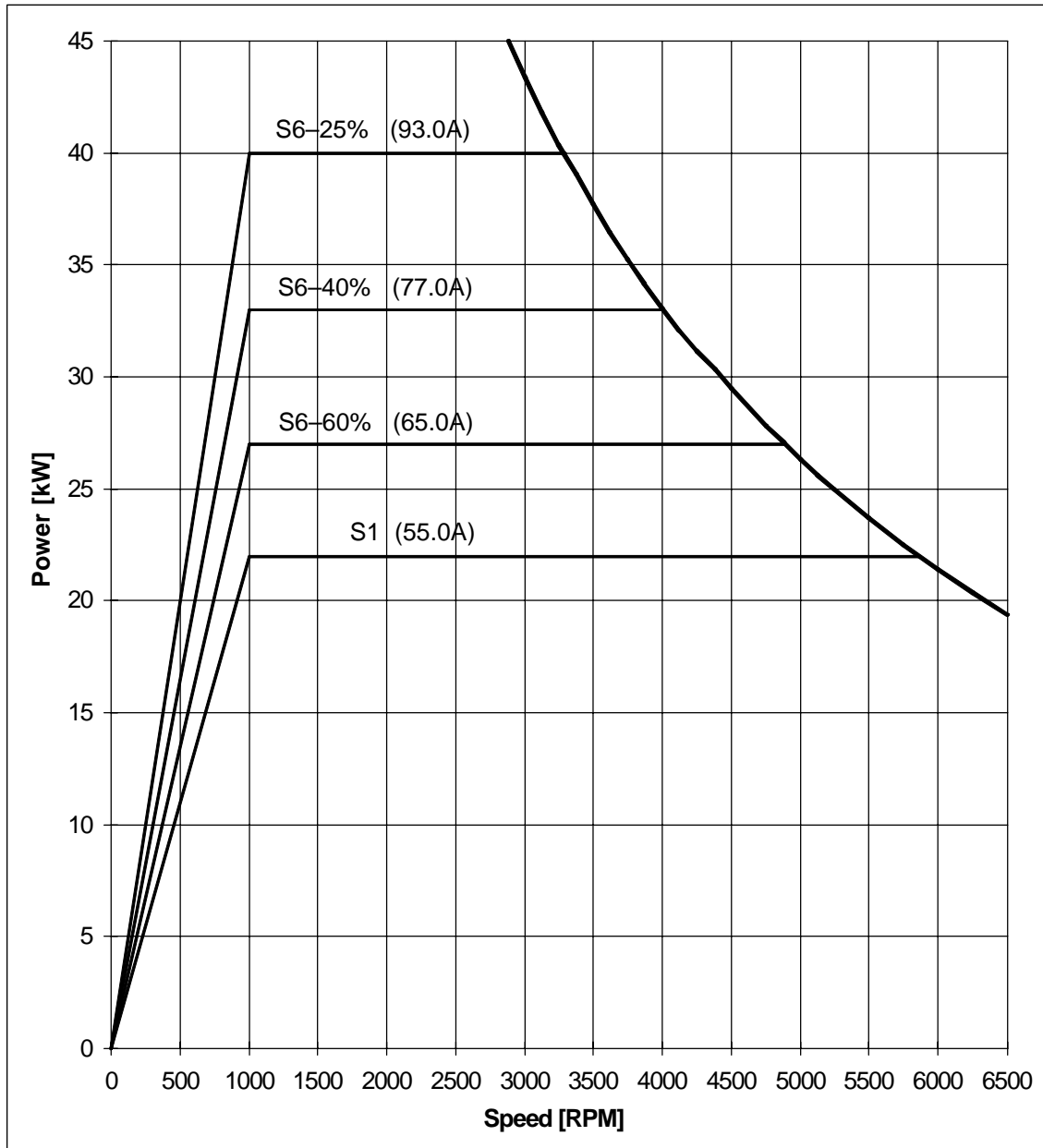
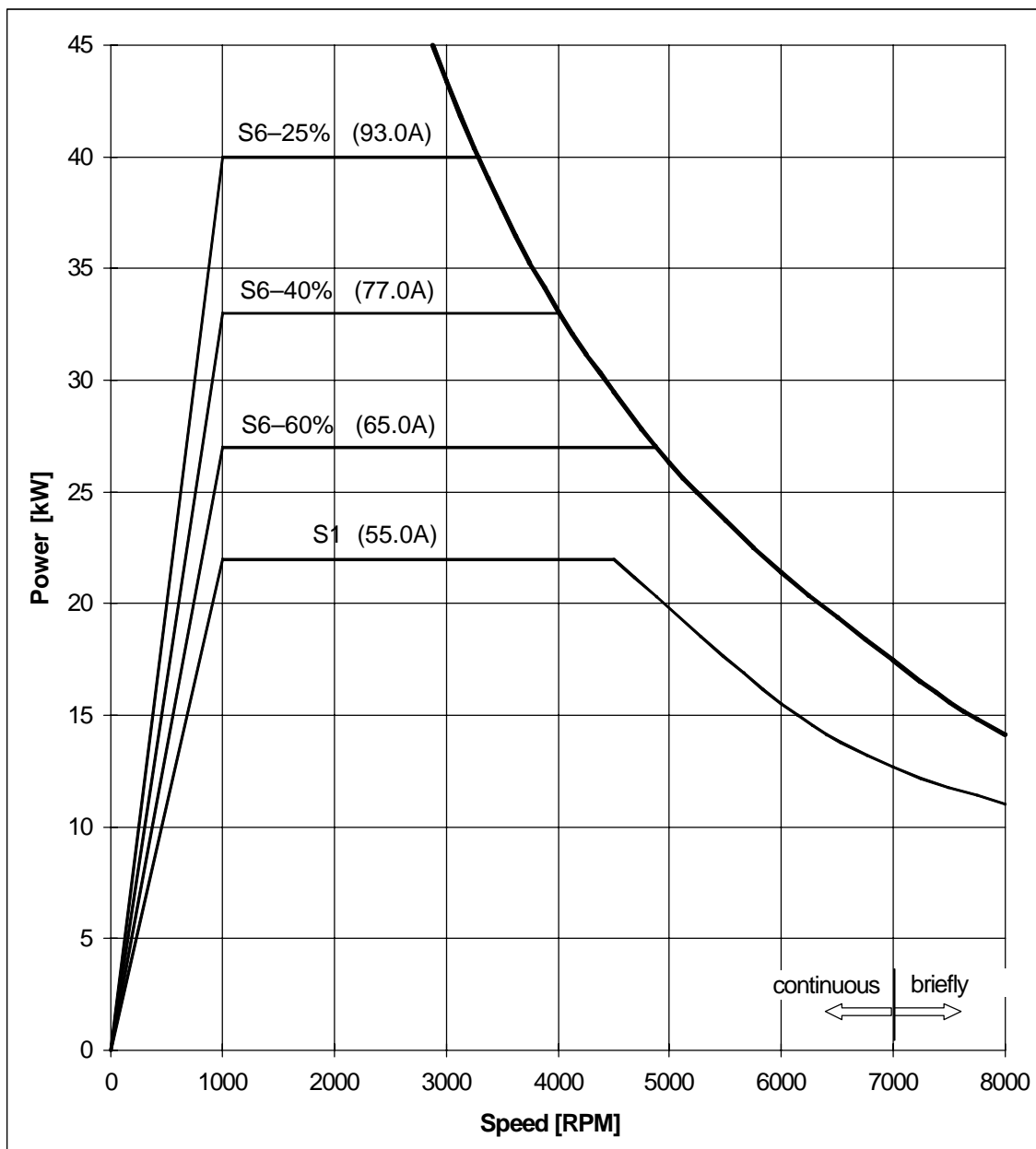


Fig. 3-35 Speed–power diagram 1PH7163–2ND□□

Table 3-36 AC main spindle motor 1PH7163-2ND□□-0L

| 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 | 8000 | 0.19 | 180 |



1PH7

Fig. 3-36 Speed-power diagram 1PH7163-2ND□□-0L

3.1 Speed–power diagrams

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 |

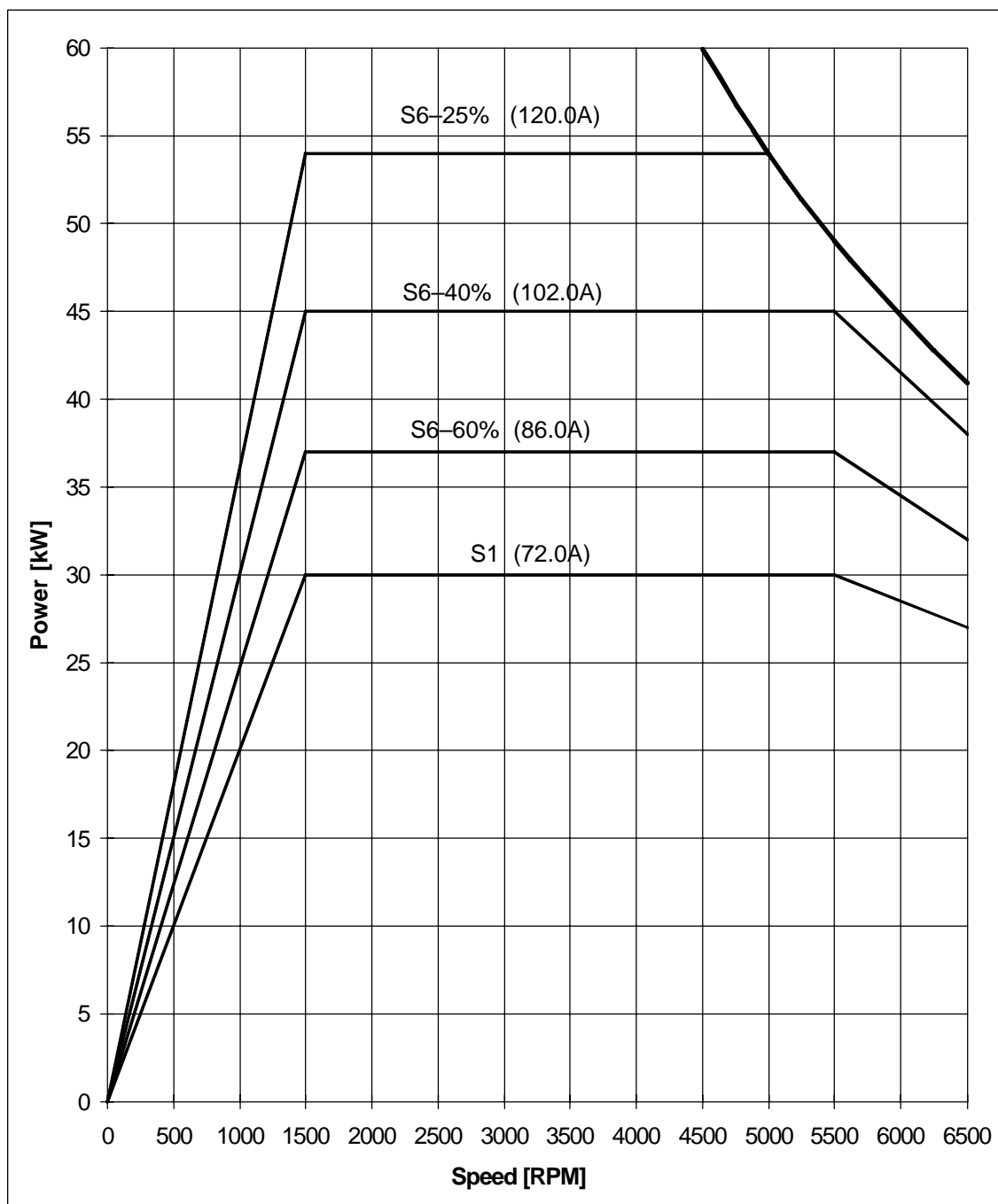


Fig. 3-37 Speed–power diagram 1PH7163–2NF□□

Table 3-38 AC main spindle motor 1PH7163-2NF□□-0L

| 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 | 8000 | 0.19 | 180 |

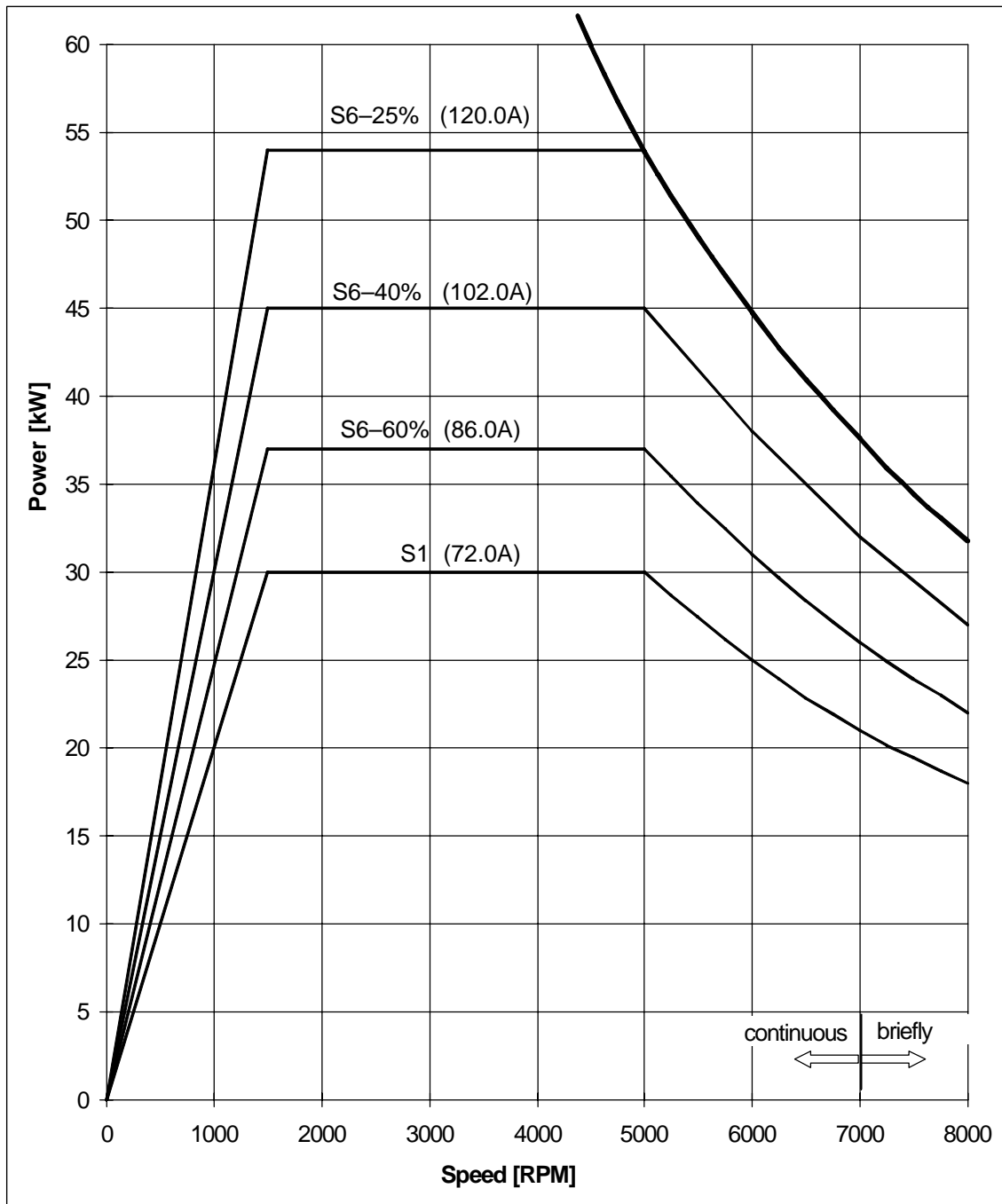
**1PH7**

Fig. 3-38 Speed-power diagram 1PH7163-2NF□□-0L

3.1 Speed-power diagrams

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 |

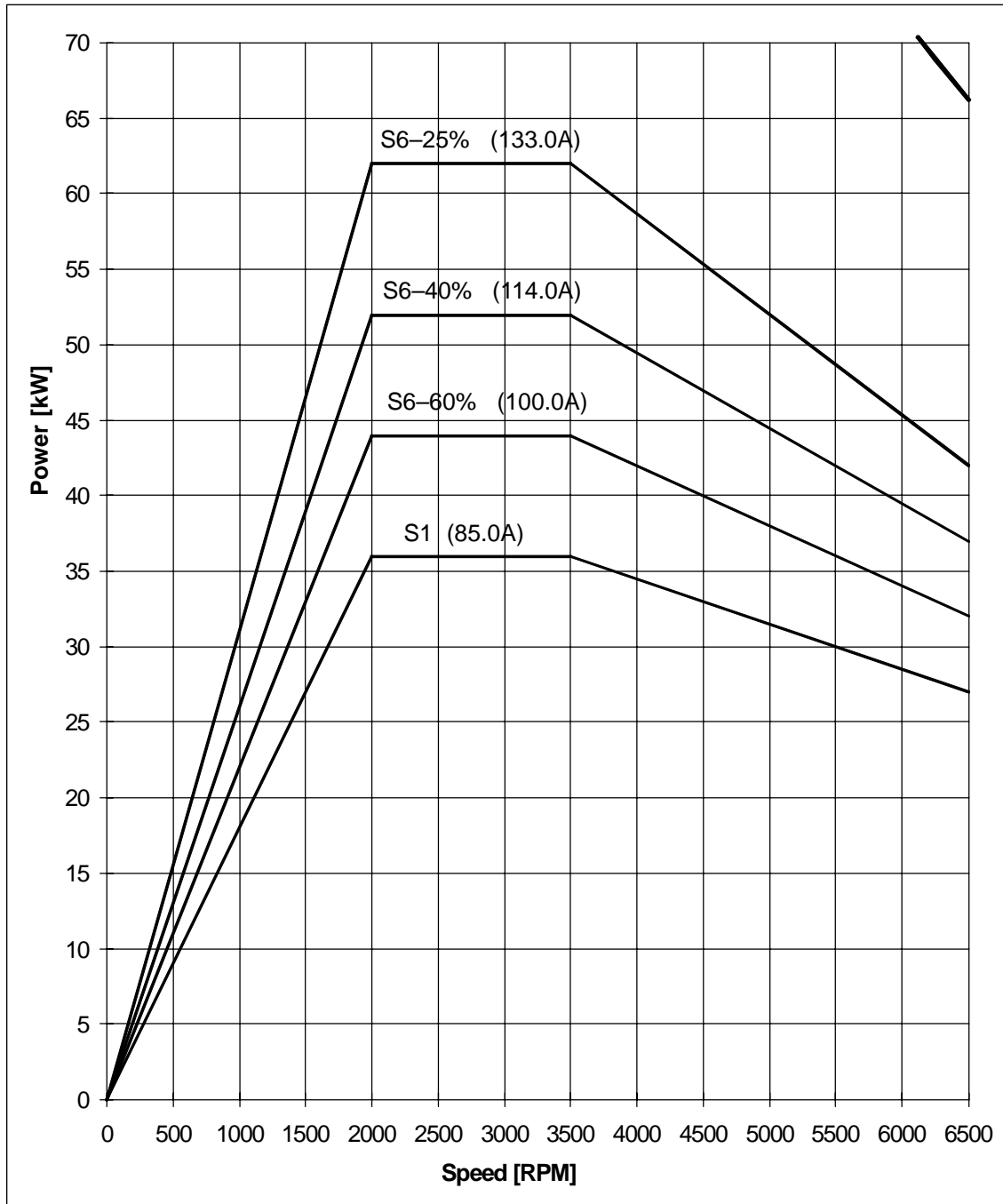


Fig. 3-39 Speed-power diagram 1PH7163-2NG4

Table 3-40 AC main spindle motor 1PH7163-2NG4□□-0L

| 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 |

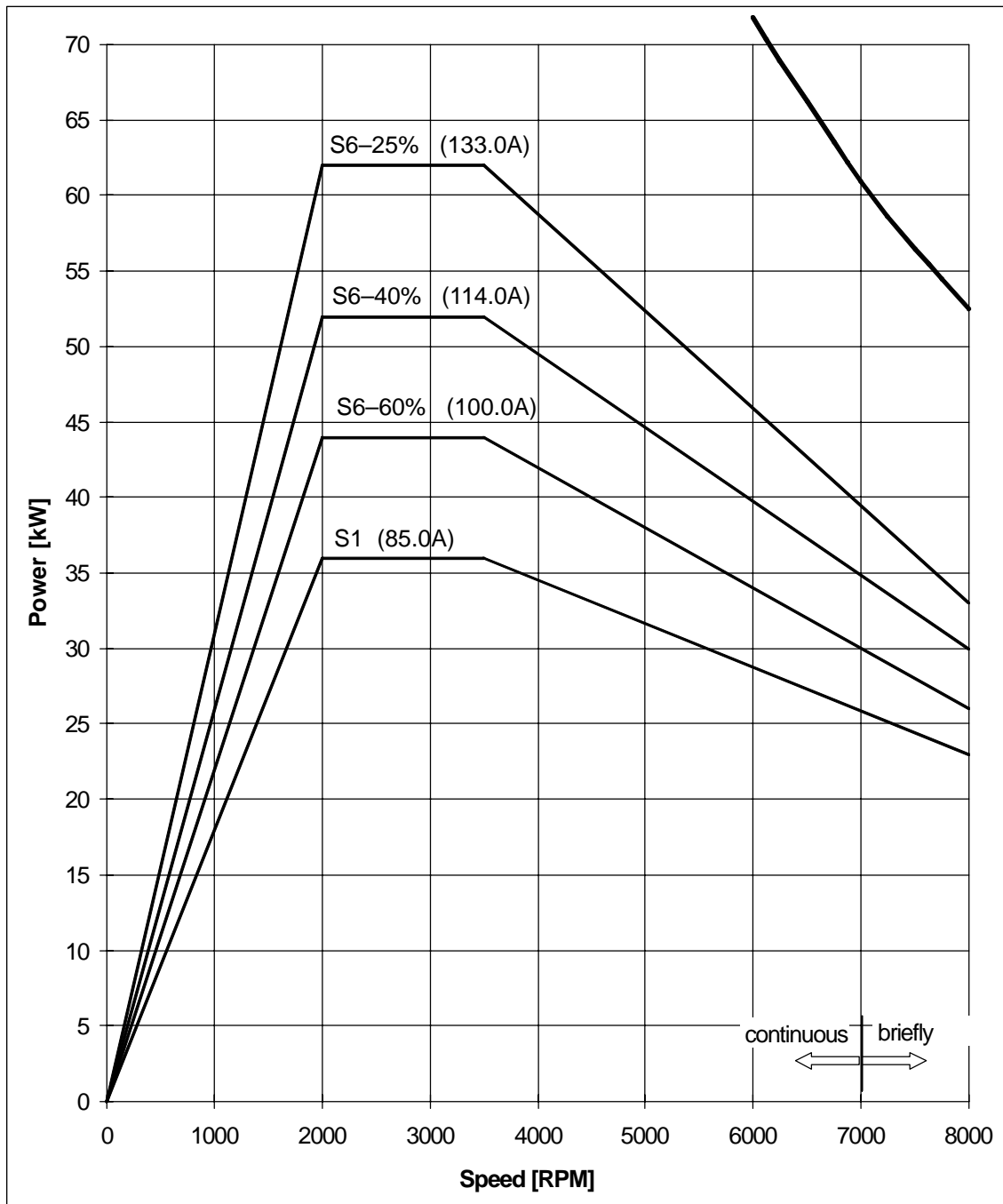
**1PH7**

Fig. 3-40 Speed-power diagram 1PH7163-2NG4□□-0L

3.1 Speed–power diagrams

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 |

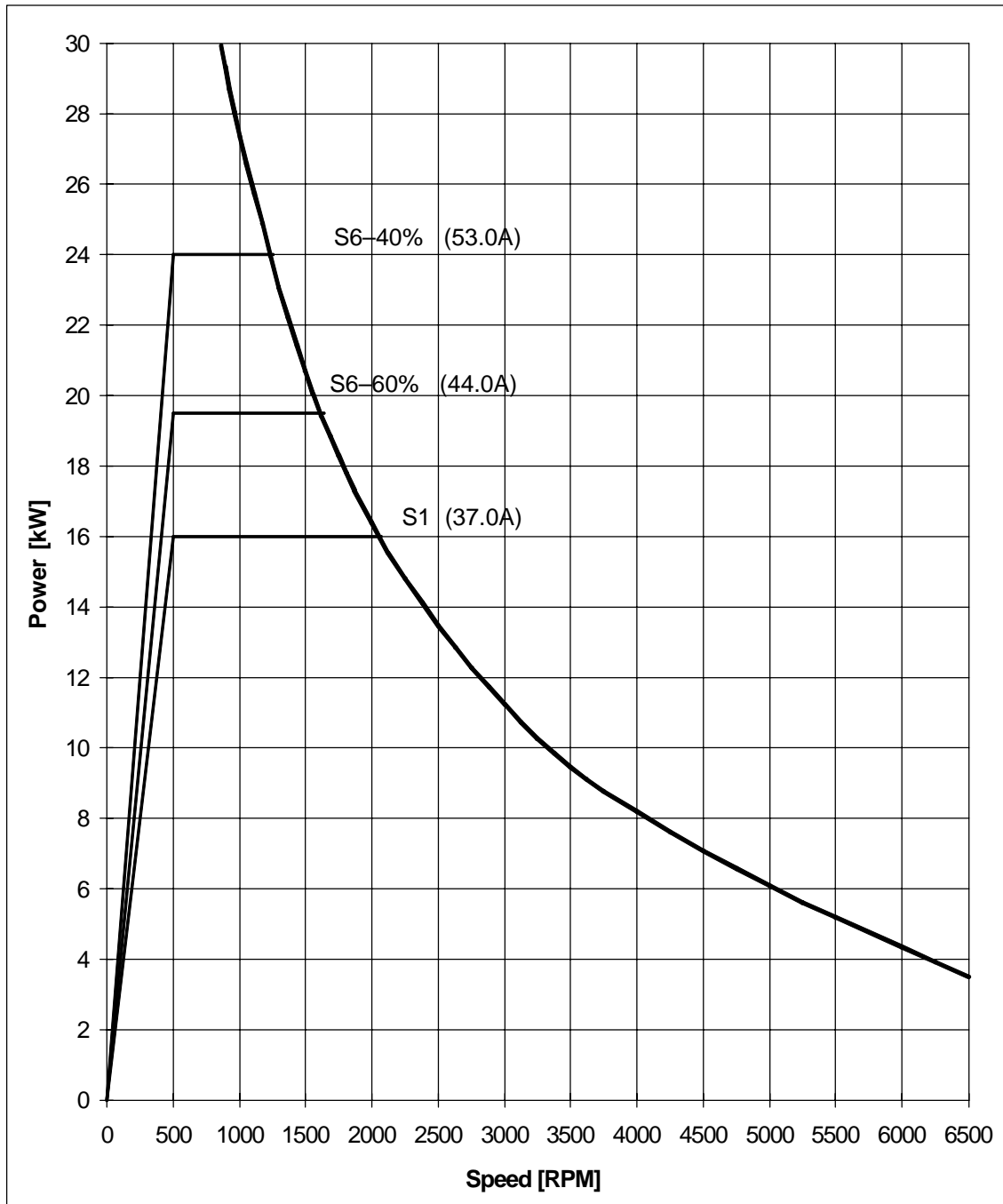


Fig. 3-41 Speed–power diagram 1PH7167-2NB4

Table 3-42 AC main spindle motor 1PH7167-2NB4□□-0L

| 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 |

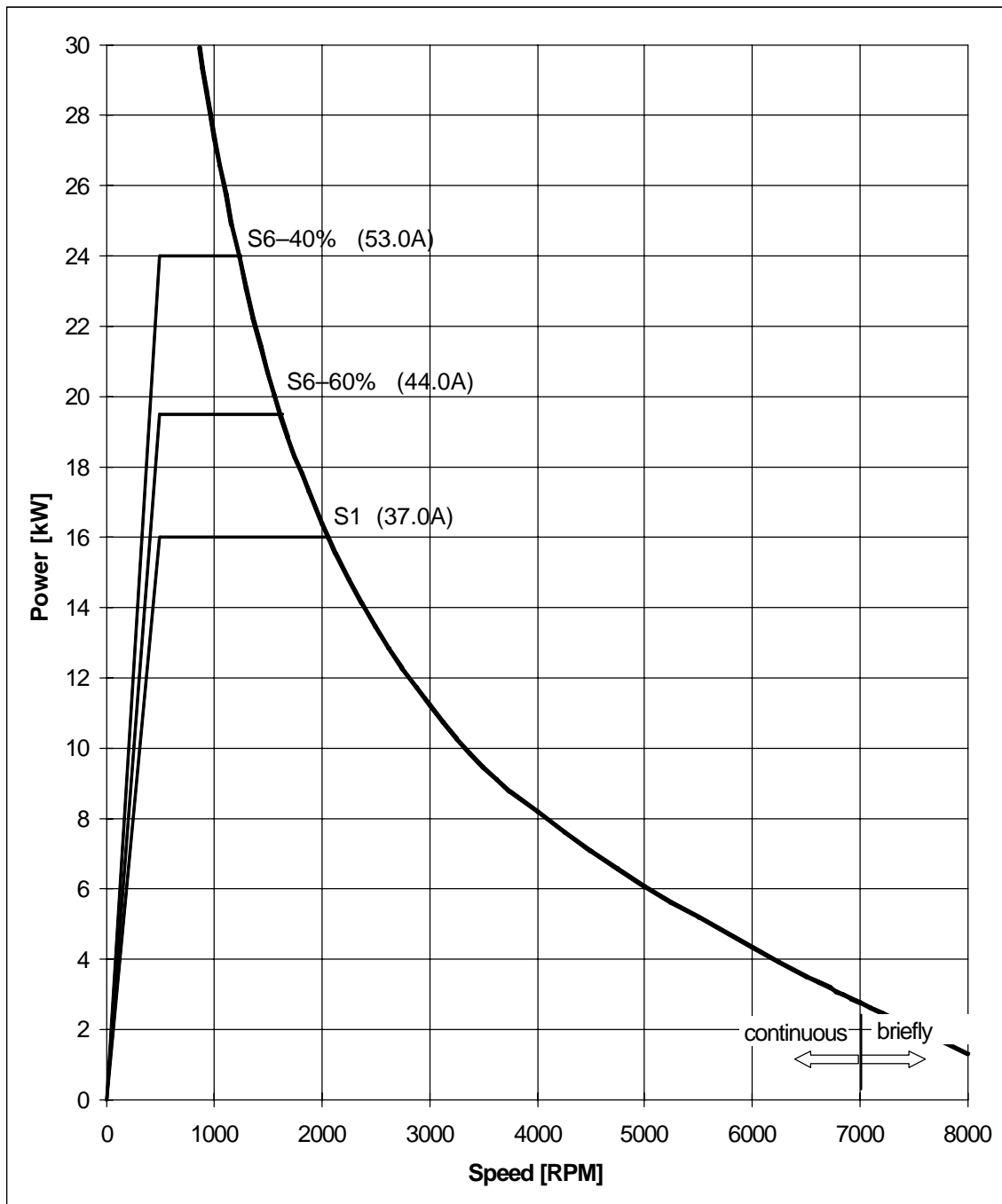
**1PH7**

Fig. 3-42 Speed-power diagram 1PH7167-2NB4□□-0L

3.1 Speed–power diagrams

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 [kgm ²] | Weight m [kg] |
|--|--|--|--|---|---|---|-----------------------|
| 28 | 1000 | 267 | 71 | 35 | 6500 | 0.23 | 228 |

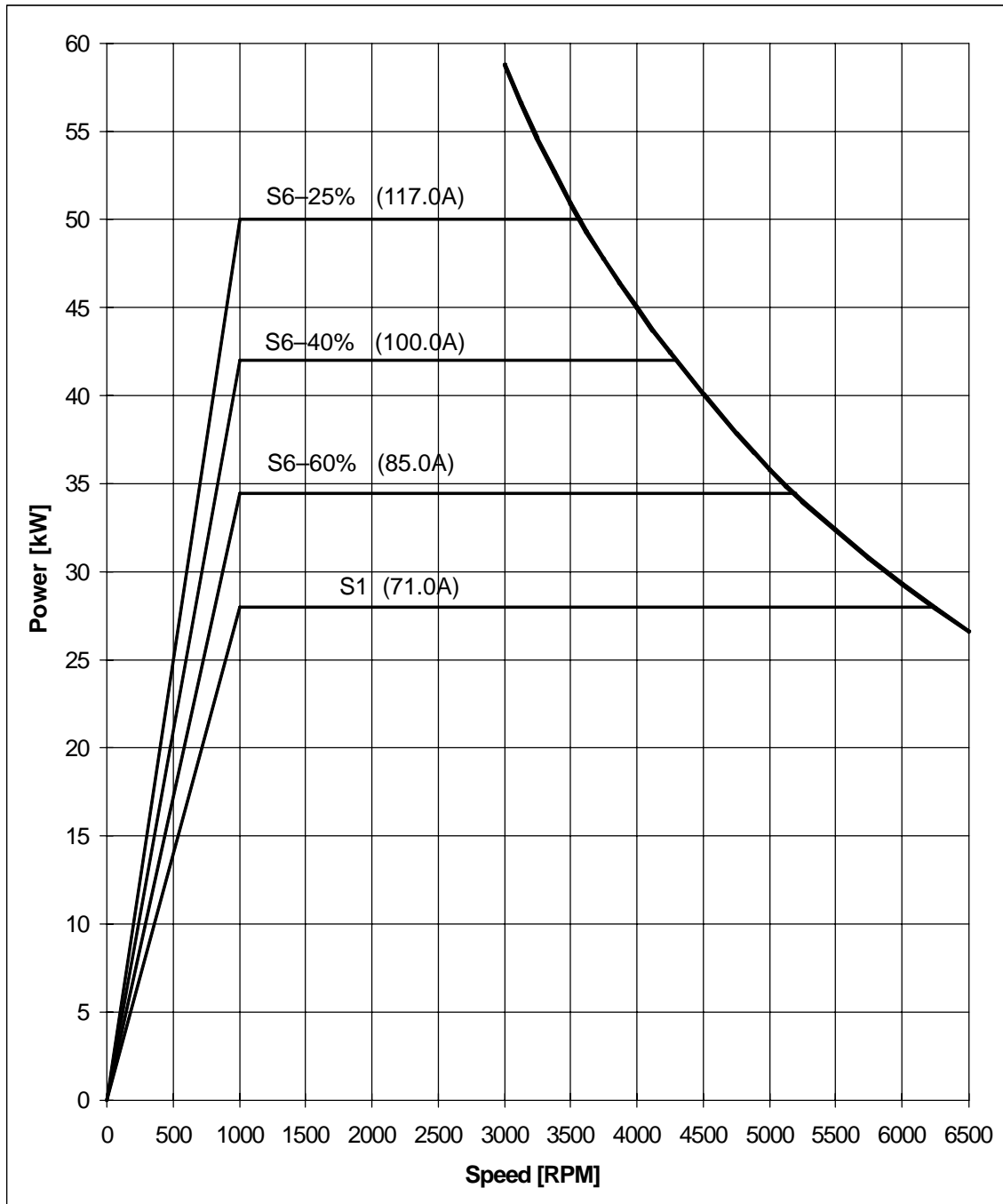


Fig. 3-43 Speed–power diagram 1PH7167-2ND4

Table 3-44 AC main spindle motor 1PH7167-2ND4□□-0L

| 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 | 1000 | 267 | 71 | 35 | 8000 | 0.23 | 228 |

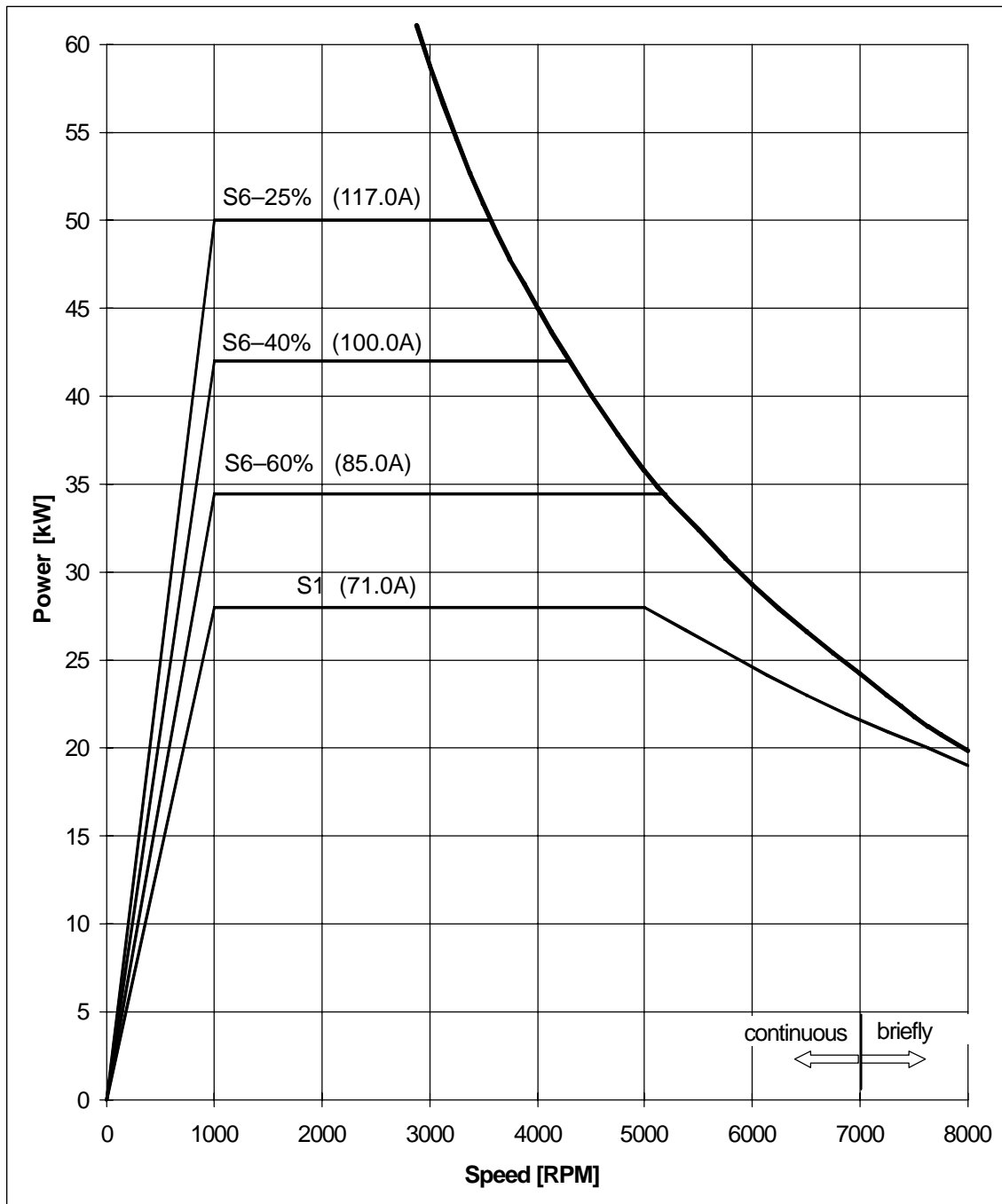
**1PH7**

Fig. 3-44 Speed-power diagram 1PH7167-2ND4□□-0L

3.1 Speed–power diagrams

Table 3-45 AC main spindle motor 1PH7167–2NF□□

| Rated out-put P_{rated} [kW] | Rated speed n_{rated} [RPM] | Rated tor-que M_{rated} [Nm] | Rated cur-rent 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 |

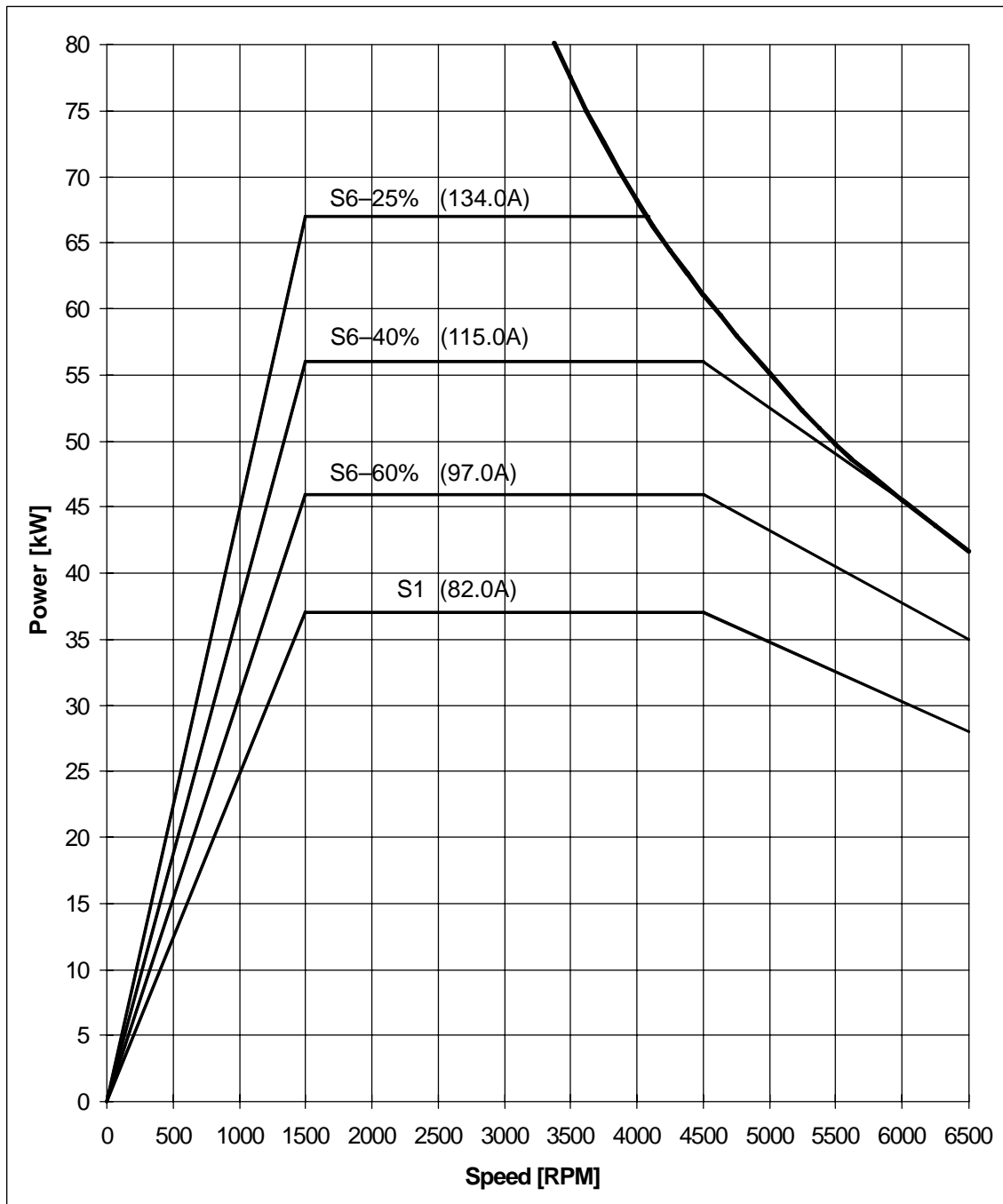


Fig. 3-45 Speed–power diagram 1PH7167–2NF□□

Table 3-46 AC main spindle motor 1PH7167-2NF□□-0L

| 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 |

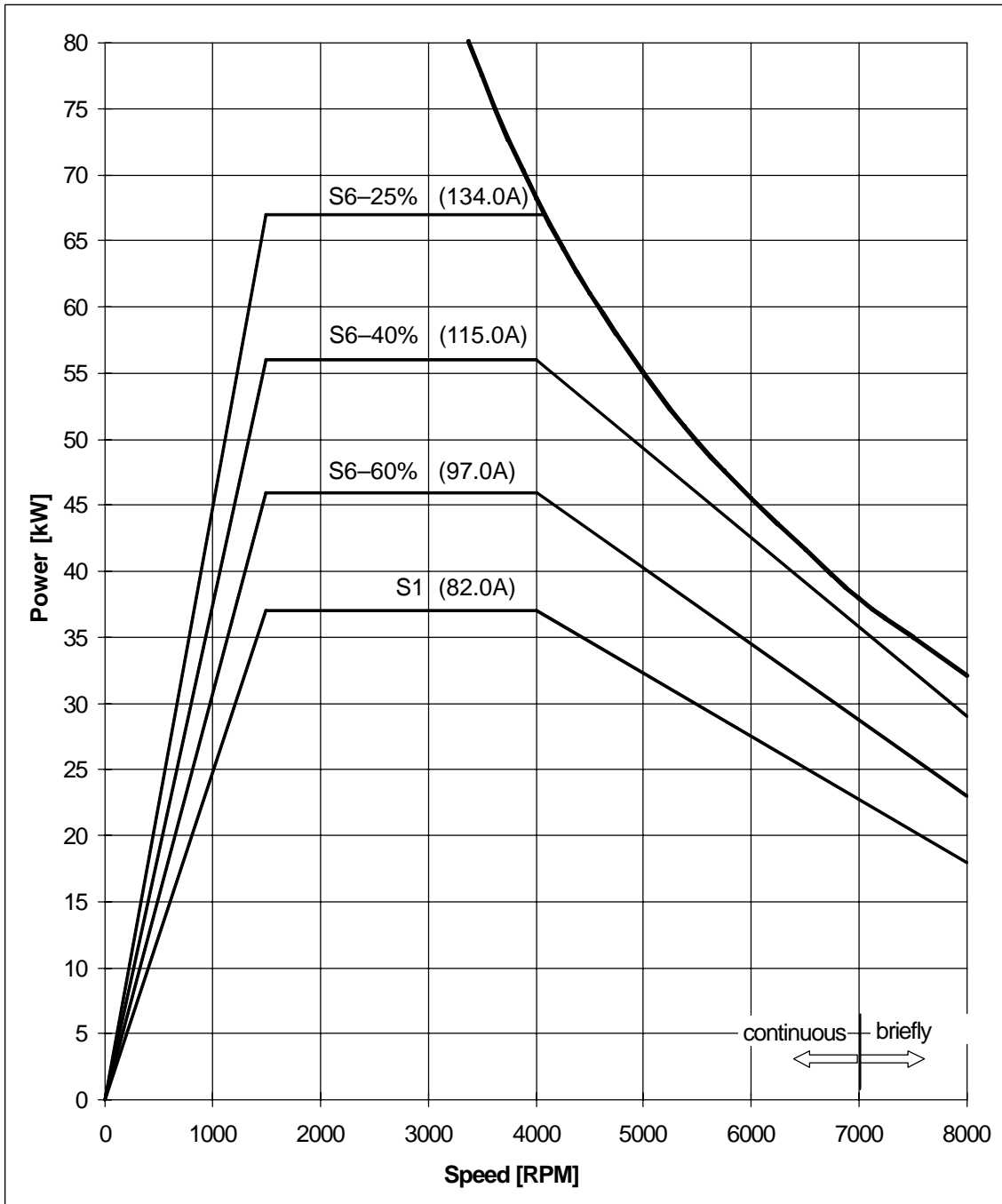
**1PH7**

Fig. 3-46 Speed-power diagram 1PH7167-2NF□□-0L

3.1 Speed-power diagrams

Table 3-47 AC main spindle motor 1PH7167-2NG

| Rated out- put P_{rated} [kW] | Rated speed n_{rated} [RPM] | Rated tor- que M_{rated} [Nm] | Rated cur- rent 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 |

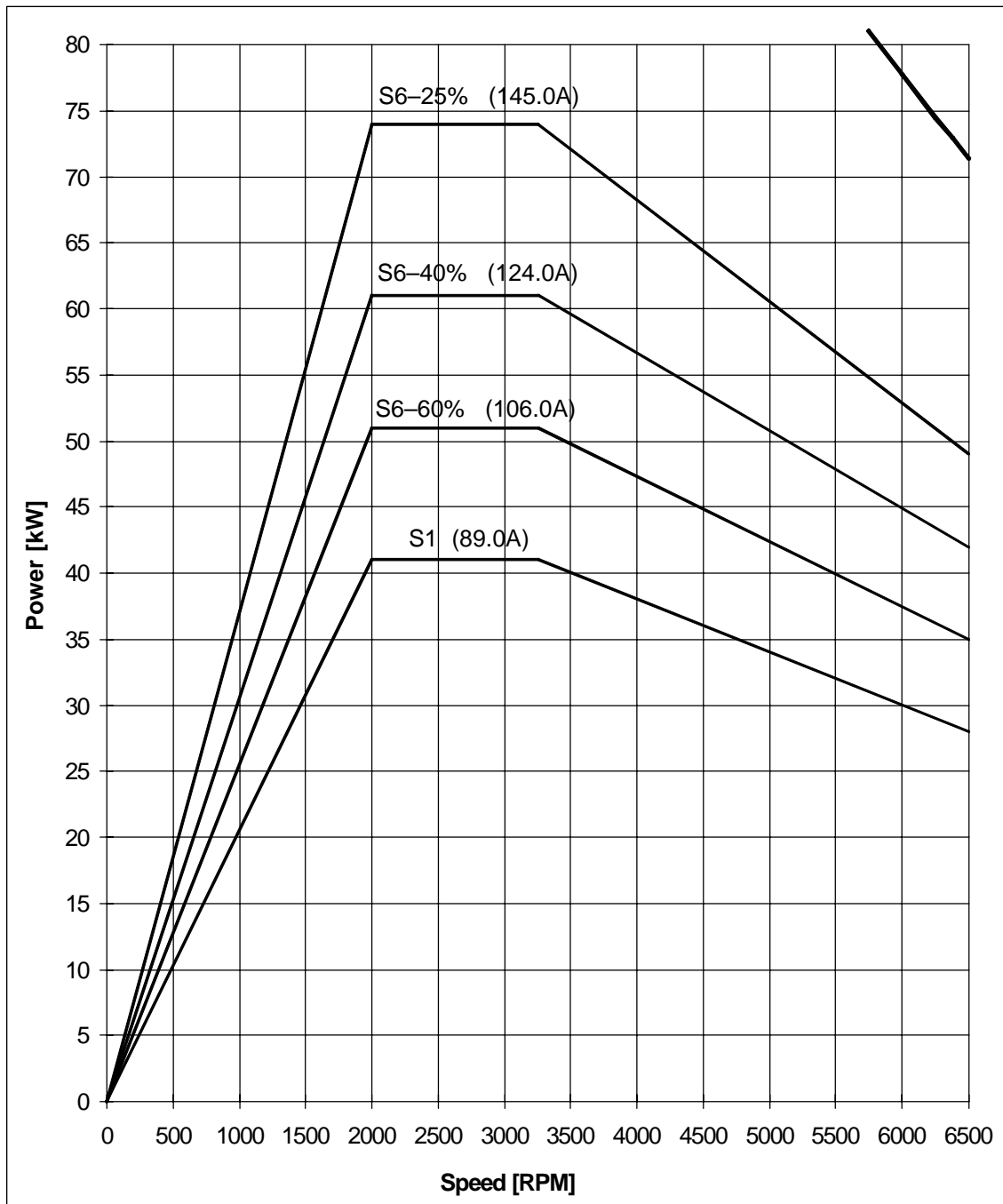


Fig. 3-47 Speed-power diagram 1PH7167-2NG

Table 3-48 AC main spindle motor 1PH7167-2NG□□-0L

| 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 | 8000 | 0.23 | 228 |

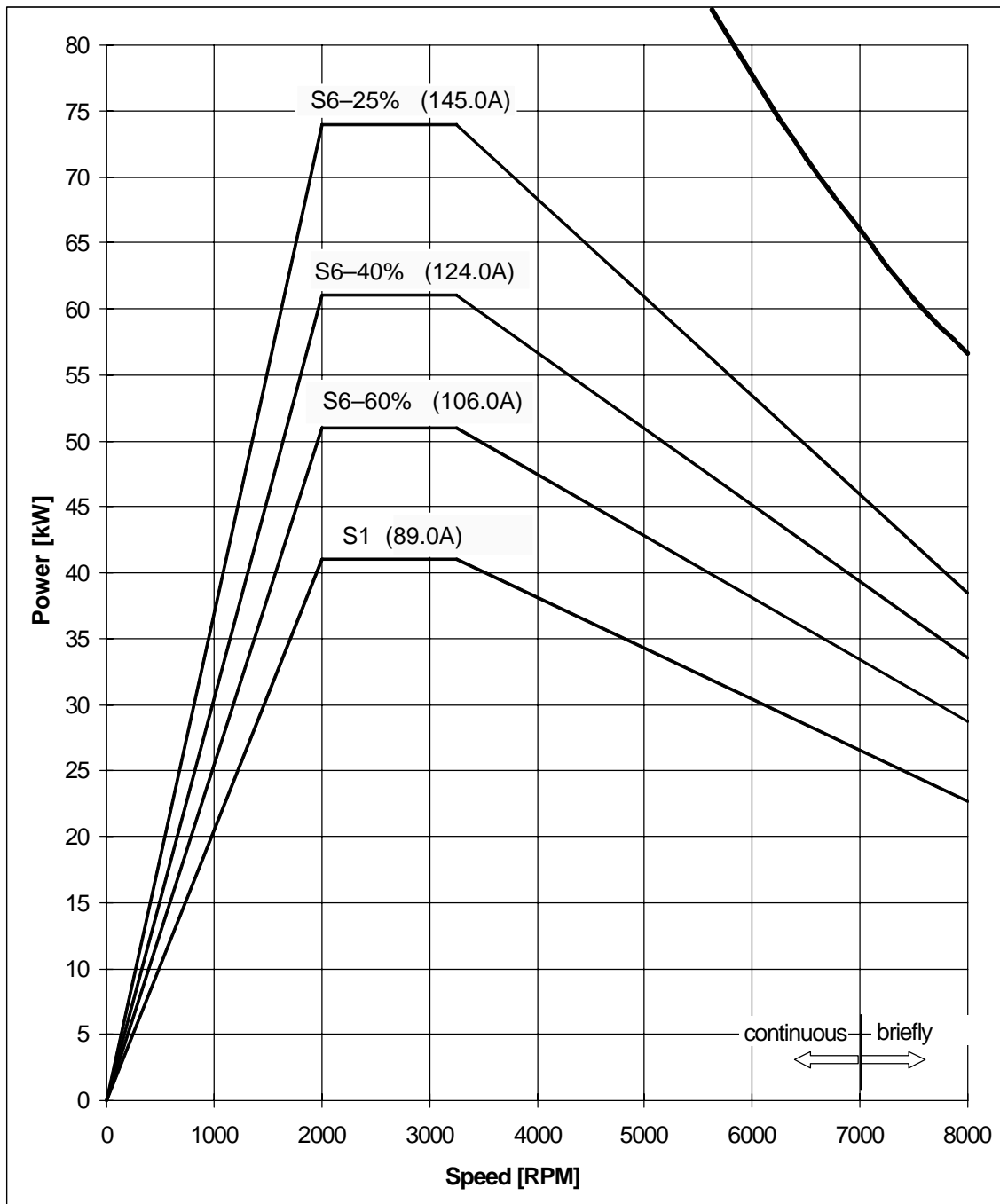
**1PH7**

Fig. 3-48 Speed-power diagram 1PH7167-2NG□□-0L

3.1 Speed–power diagrams

Table 3-49 AC main spindle motor 1PH7184–□NT□□

| Rated out-put P_{rated} [kW] | Rated speed n_{rated} [RPM] | Rated tor-que M_{rated} [Nm] | Rated cur-rent I_{rated} [A] | Time constant (therm.) T_{th} [min] | Max. speed n_{max} [RPM] | Moment of inertia J [kgm ²] | Weight m [kg] |
|---|--|---|---|---|---|---|-----------------------|
| 21.5 | 500 | 411 | 76 | 40 | 5000 7000 ¹⁾ | 0.5 | 390 |

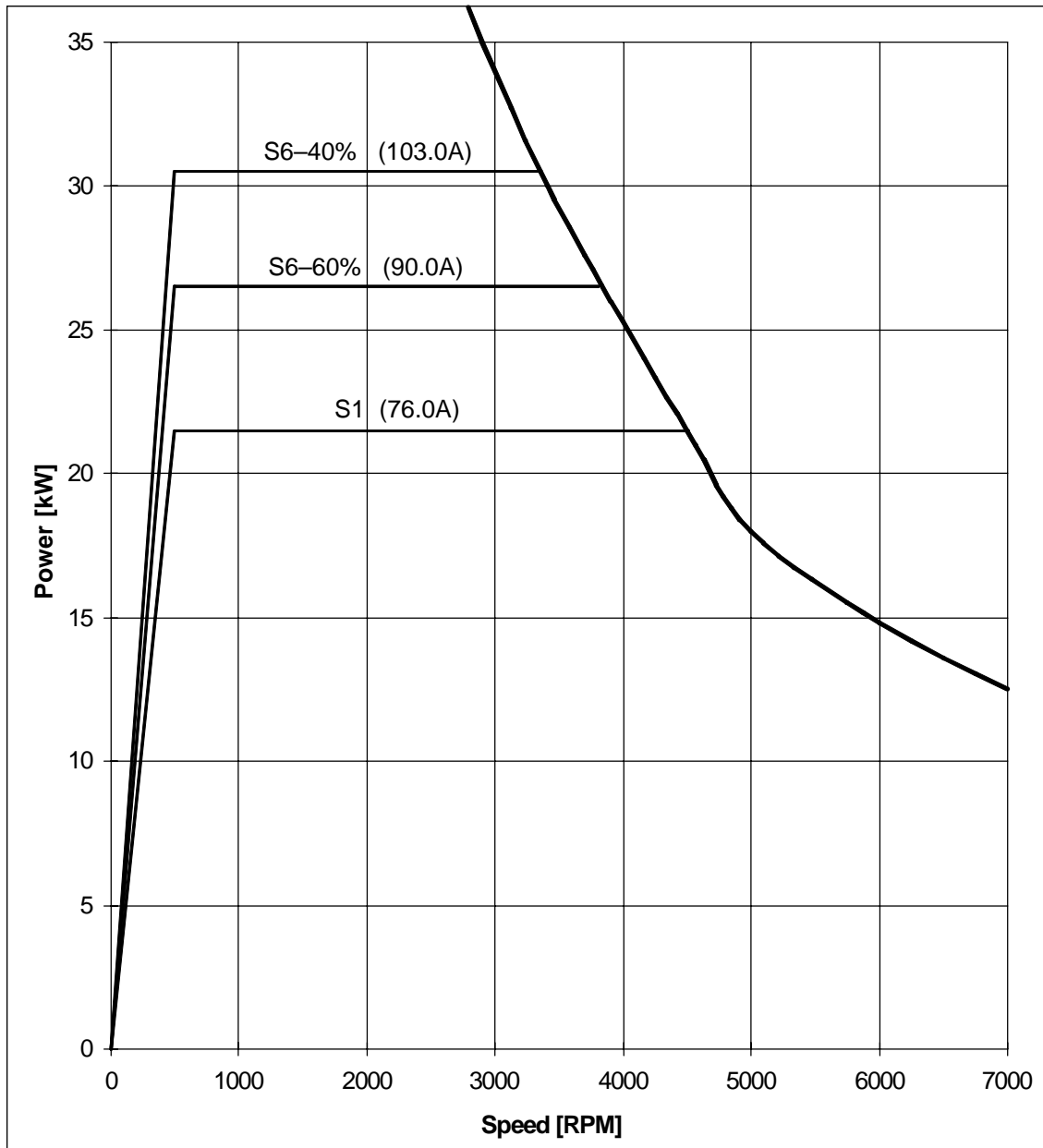


Fig. 3-49 Speed–power diagram 1PH7184–□NT□□

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⁾ | | |

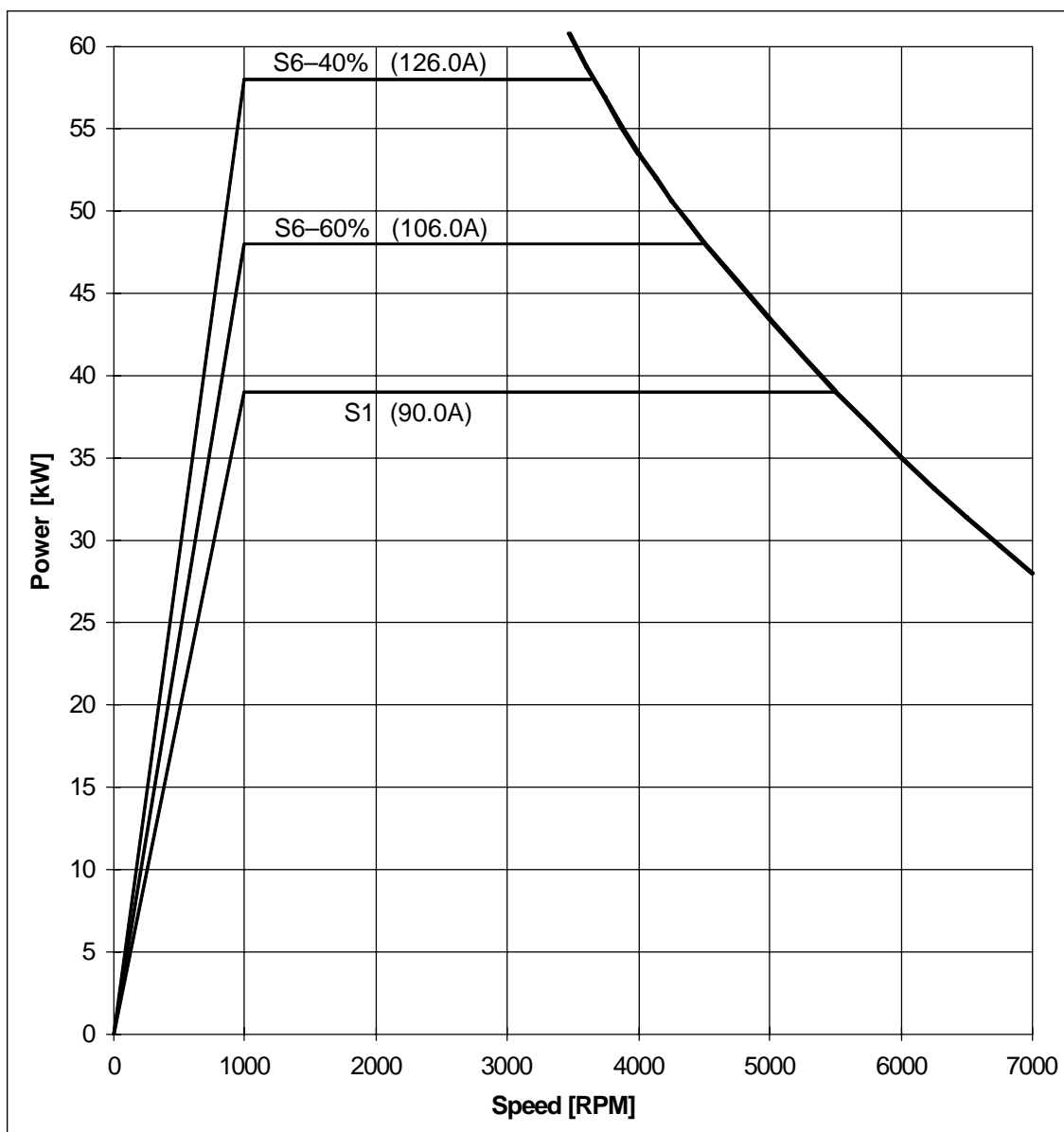
**1PH7**

Fig. 3-50 Speed-power diagram 1PH7184-□ND□□

1) optional

3.1 Speed-power diagrams

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 |

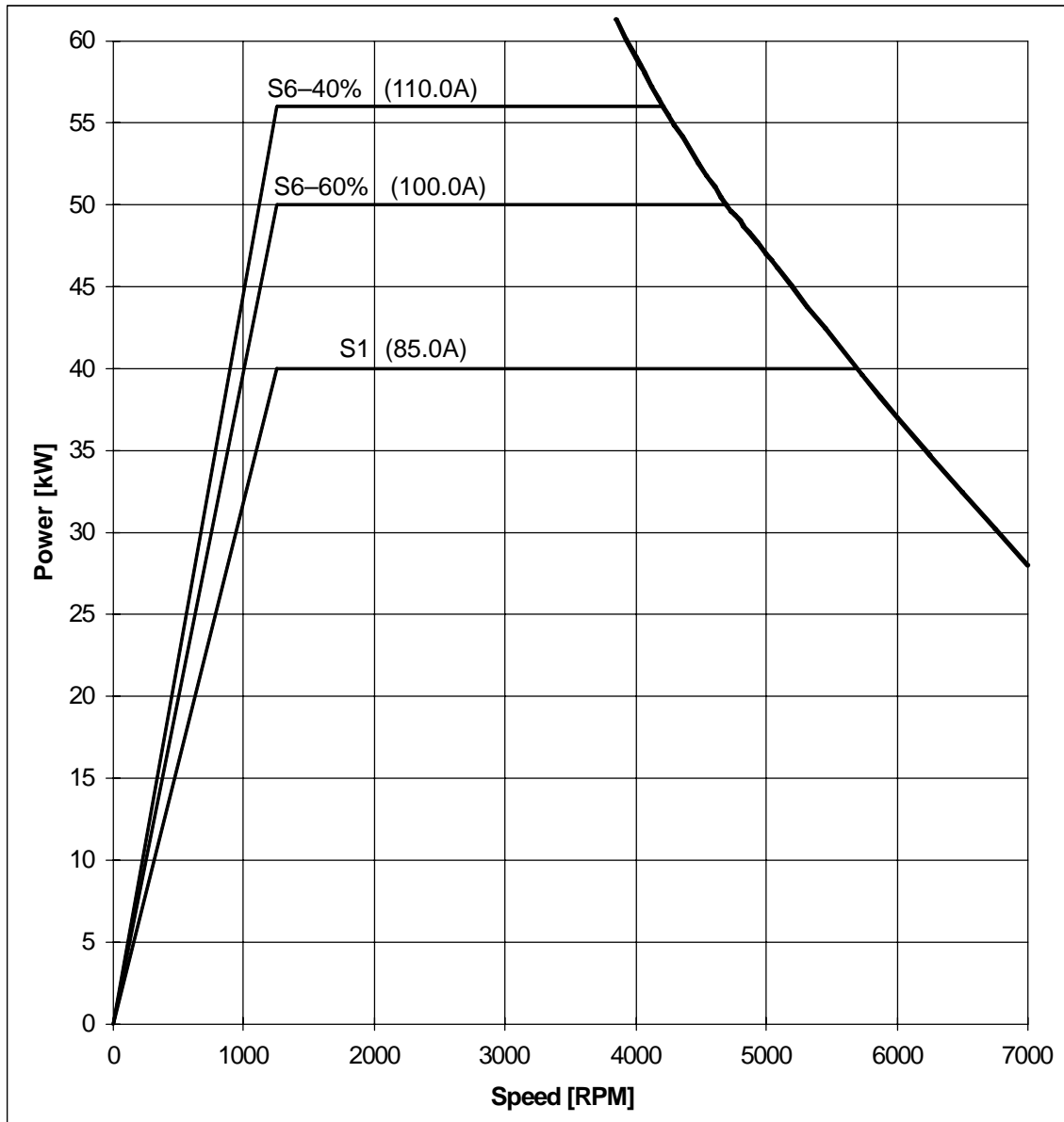


Fig. 3-51 Speed-power diagram 1PH7184-□NE□□

1) optional

Table 3-52 AC main spindle motor 1PH7184-□NF□□

| Rated out-put P_{rated} [kW] | Rated speed n_{rated} [RPM] | Rated tor-que M_{rated} [Nm] | Rated cur-rent 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 |

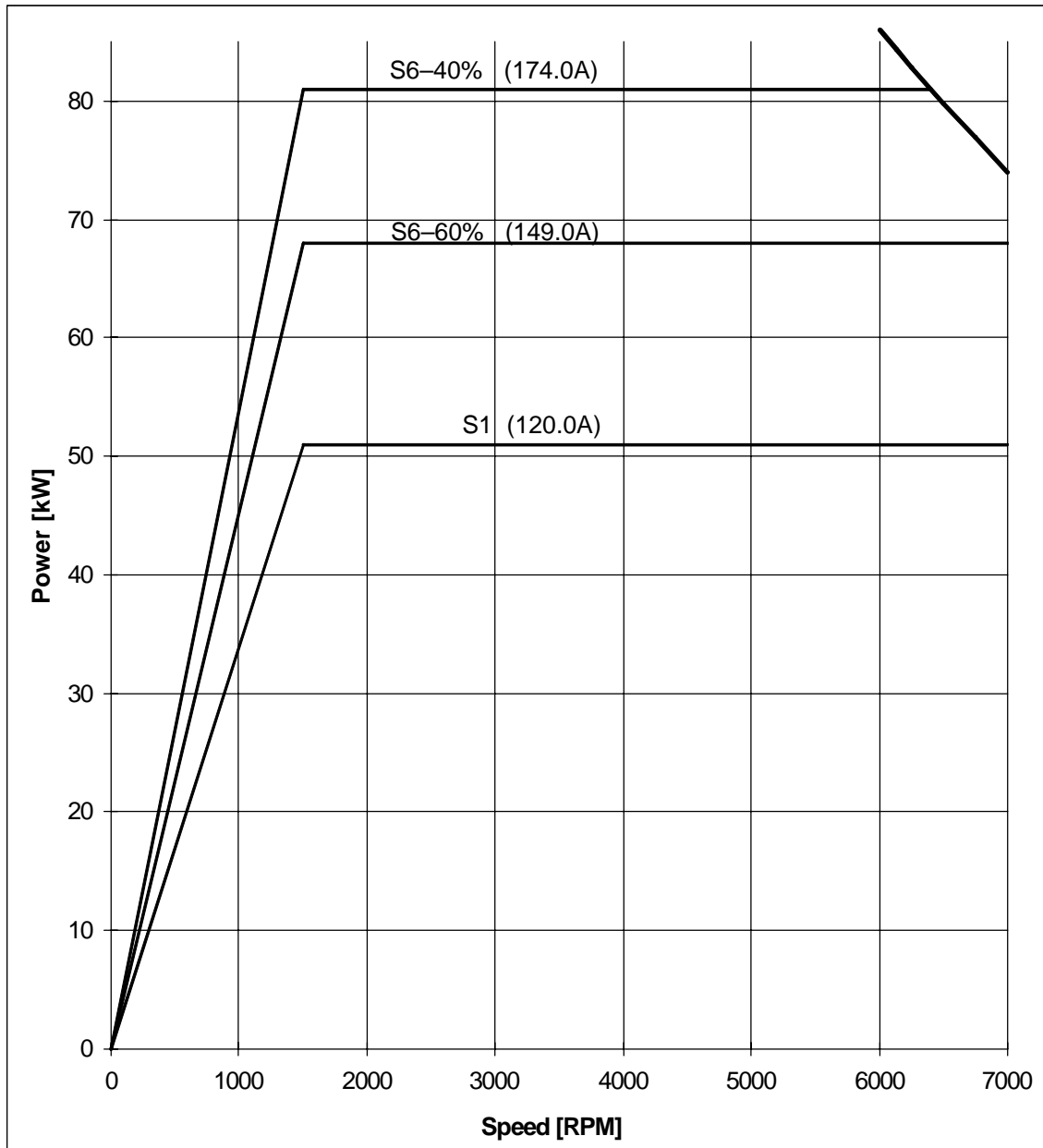
**1PH7**

Fig. 3-52 Speed-power diagram 1PH7184-□NF□□

1) optional

3.1 Speed–power diagrams

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 [kgm ²] | Weight m [kg] |
|--|--|--|--|---|---|---|-----------------------|
| 78 | 2500 | 298 | 172 | 40 | 5000 7000 ¹⁾ | 0.5 | 390 |

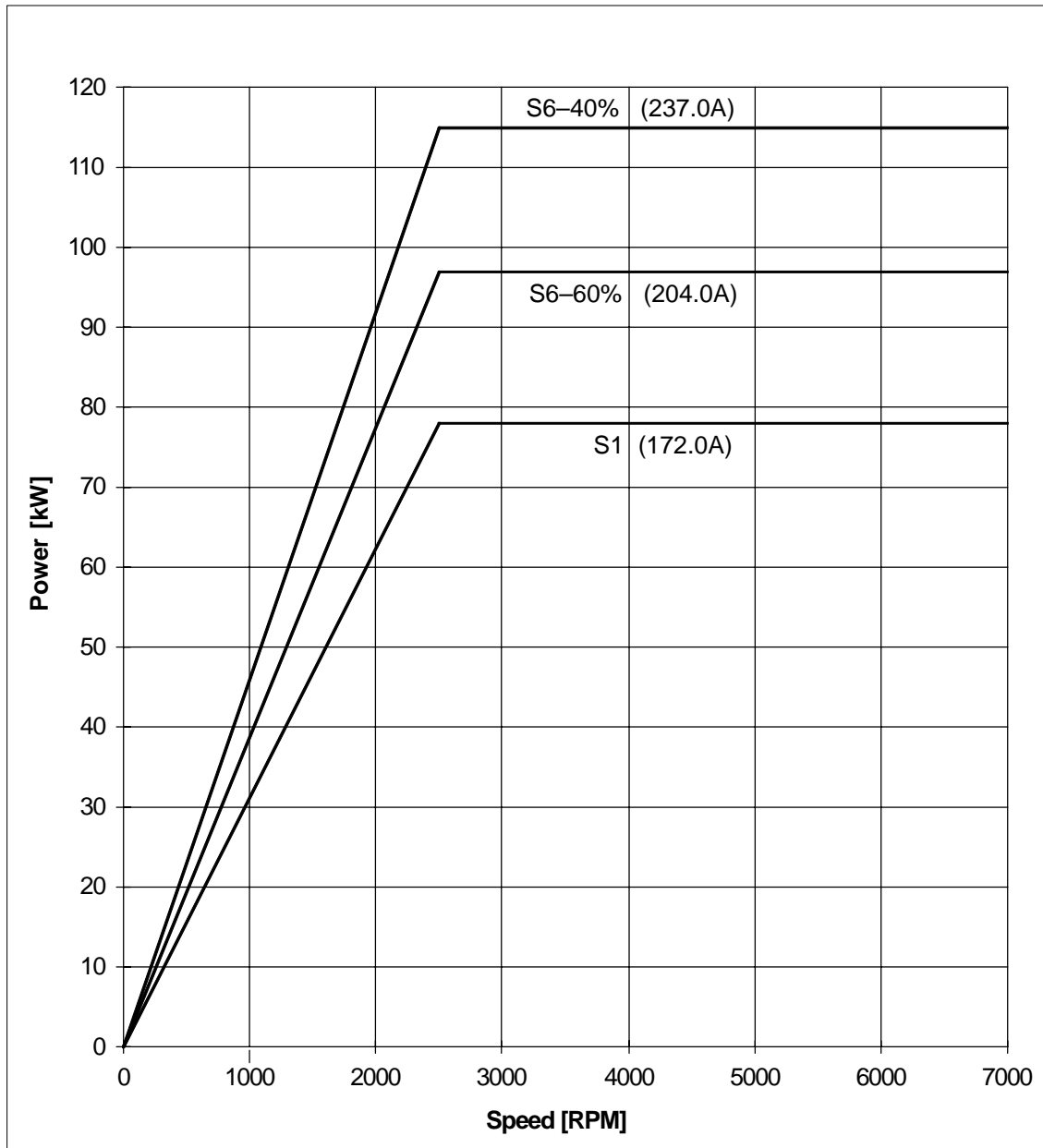


Fig. 3-53 Speed–power diagram 1PH7184–□NL□□

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 [kgm ²] | Weight m [kg] |
|--|--|--|--|---|---|---|-----------------------|
| 29.6 | 500 | 565 | 106 | 40 | 5000 7000 ¹⁾ | 0.67 | 460 |

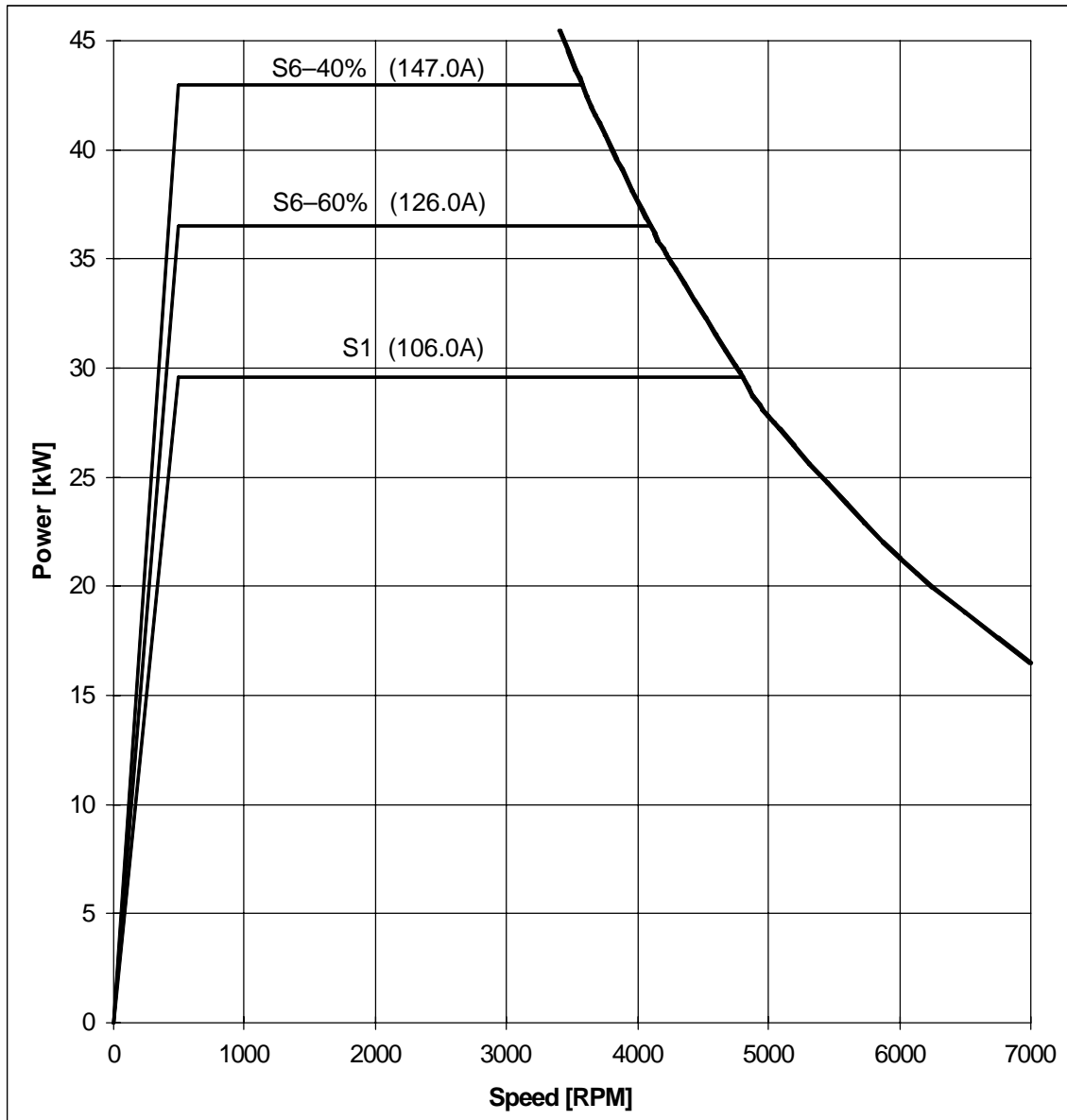
**1PH7**

Fig. 3-54 Speed-power diagram 1PH7186-□NT□□

1) optional

3.1 Speed–power diagrams

Table 3-55 AC main spindle motor 1PH7186–□ND□□

| Rated out-put P_{rated} [kW] | Rated speed n_{rated} [RPM] | Rated tor-que M_{rated} [Nm] | Rated cur-rent I_{rated} [A] | Time constant (therm.) T_{th} [min] | Max. speed n_{max} [RPM] | Moment of inertia J [kgm ²] | Weight m [kg] |
|---|--|---|---|---|---|---|-----------------------|
| 51 | 1000 | 487 | 118 | 40 | 5000 7000 ¹⁾ | 0.67 | 460 |

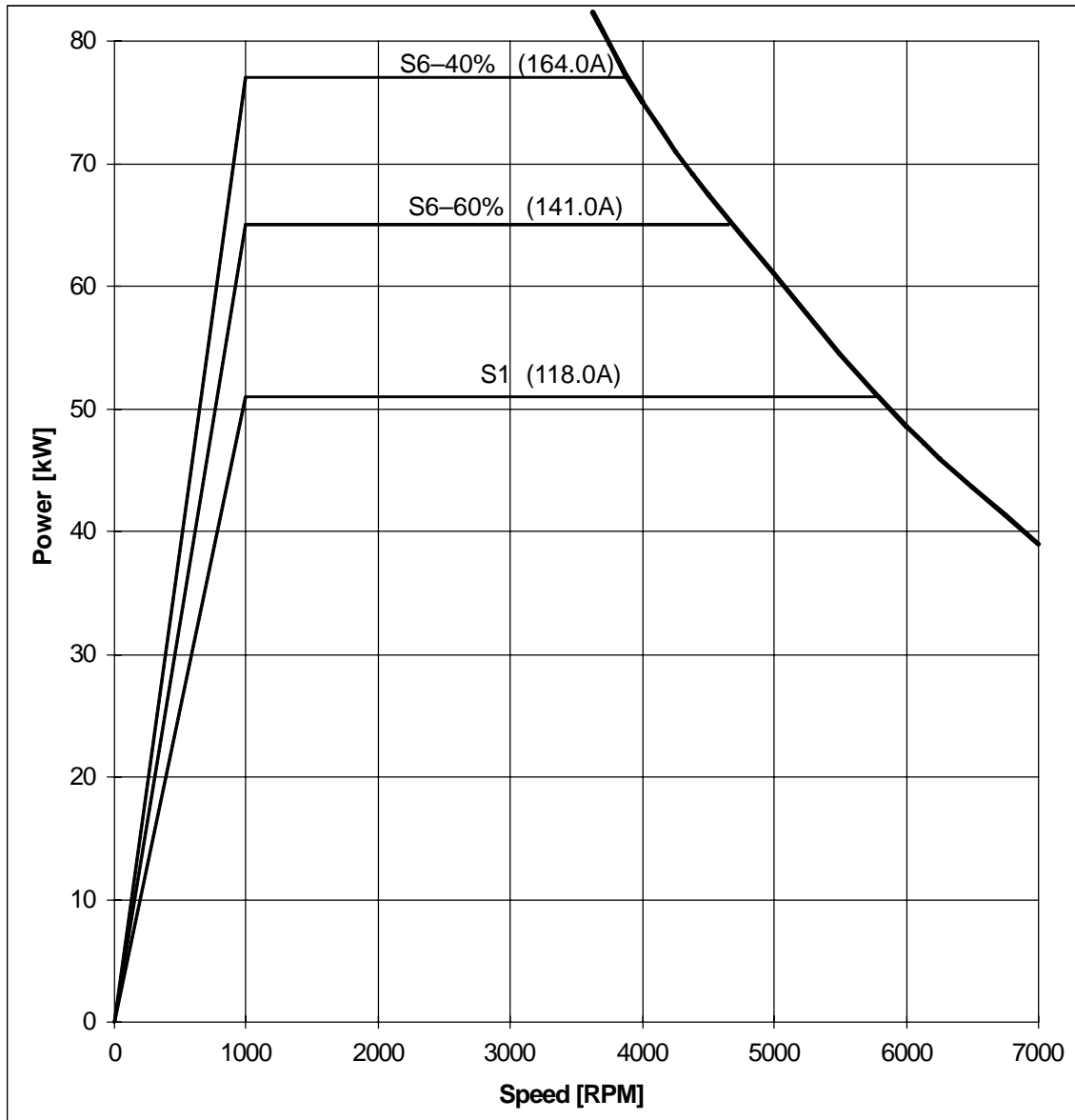


Fig. 3-55 Speed–power diagram 1PH7186–□ND□□

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 [kgm ²] | Weight m [kg] |
|--|--|--|--|---|---|---|-----------------------|
| 60 | 1250 | 458 | 120 | 40 | 5000 7000 ¹⁾ | 0.67 | 460 |

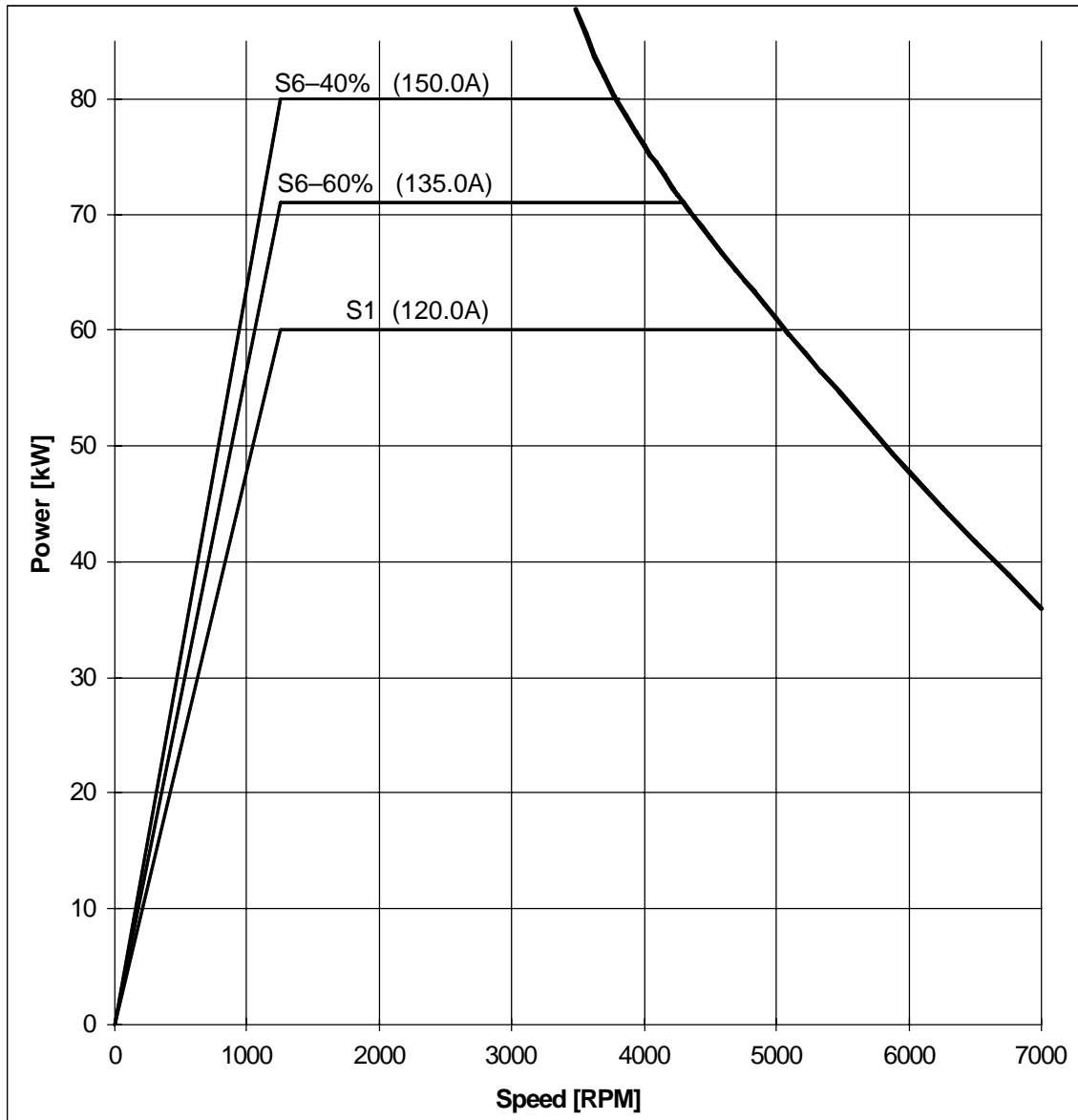
**1PH7**

Fig. 3-56 Speed-power diagram 1PH7186-□NE□□

1) optional

3.1 Speed–power diagrams

Table 3-57 AC main spindle motor 1PH7224–□NC□□

| Rated out-put P_{rated} [kW] | Rated speed n_{rated} [RPM] | Rated tor-que M_{rated} [Nm] | Rated cur-rent I_{rated} [A] | Time constant (therm.) T_{th} [min] | Max. speed n_{max} [RPM] | Moment of inertia J [kgm ²] | Weight m [kg] |
|---|--|---|---|---|---|---|-----------------------|
| 55 | 700 | 750 | 117 | 40 | 4500 5500 ¹⁾ | 1.48 | 650 |

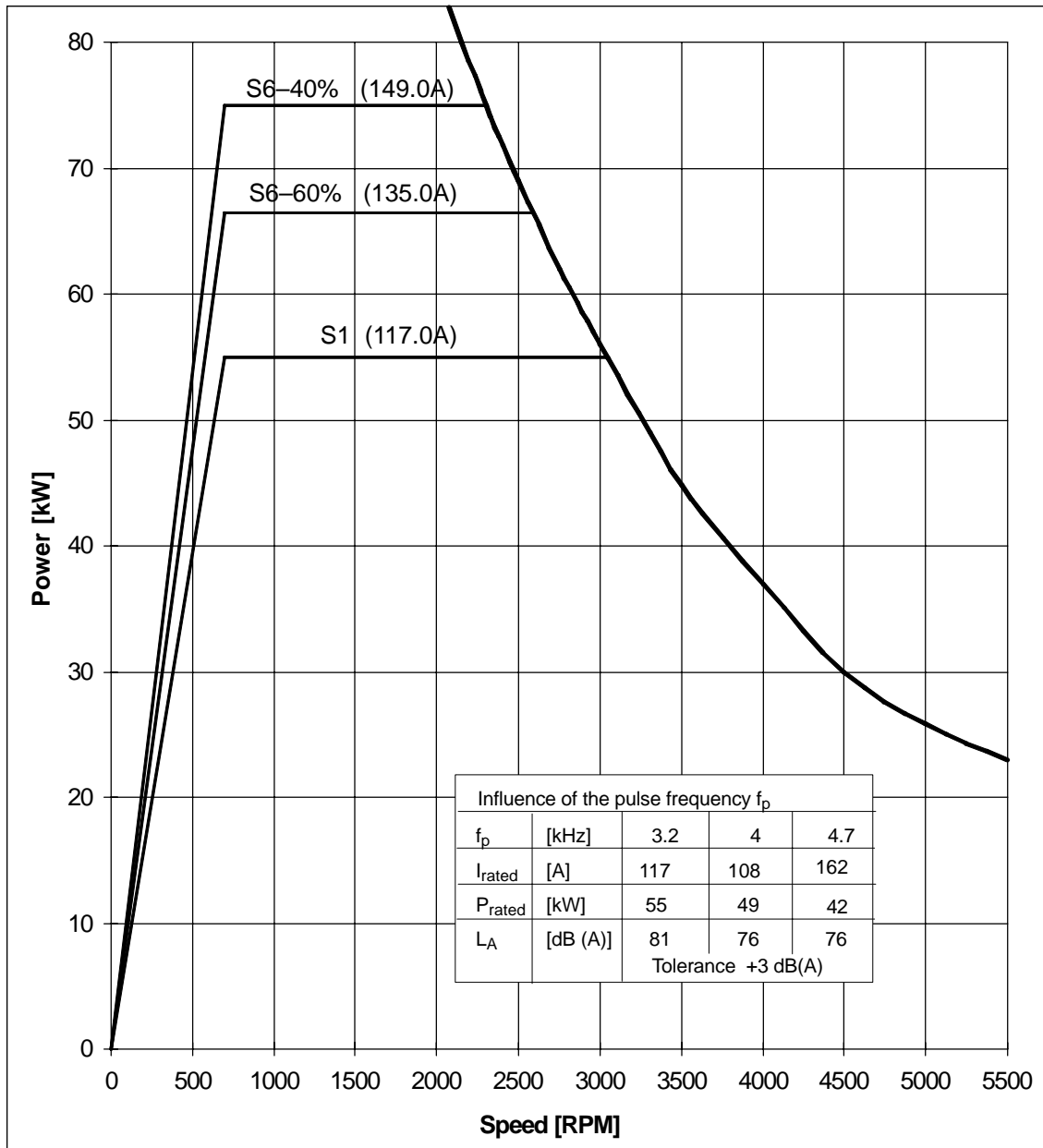


Fig. 3-57 Speed–power diagram 1PH7224–□NC□□

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 |

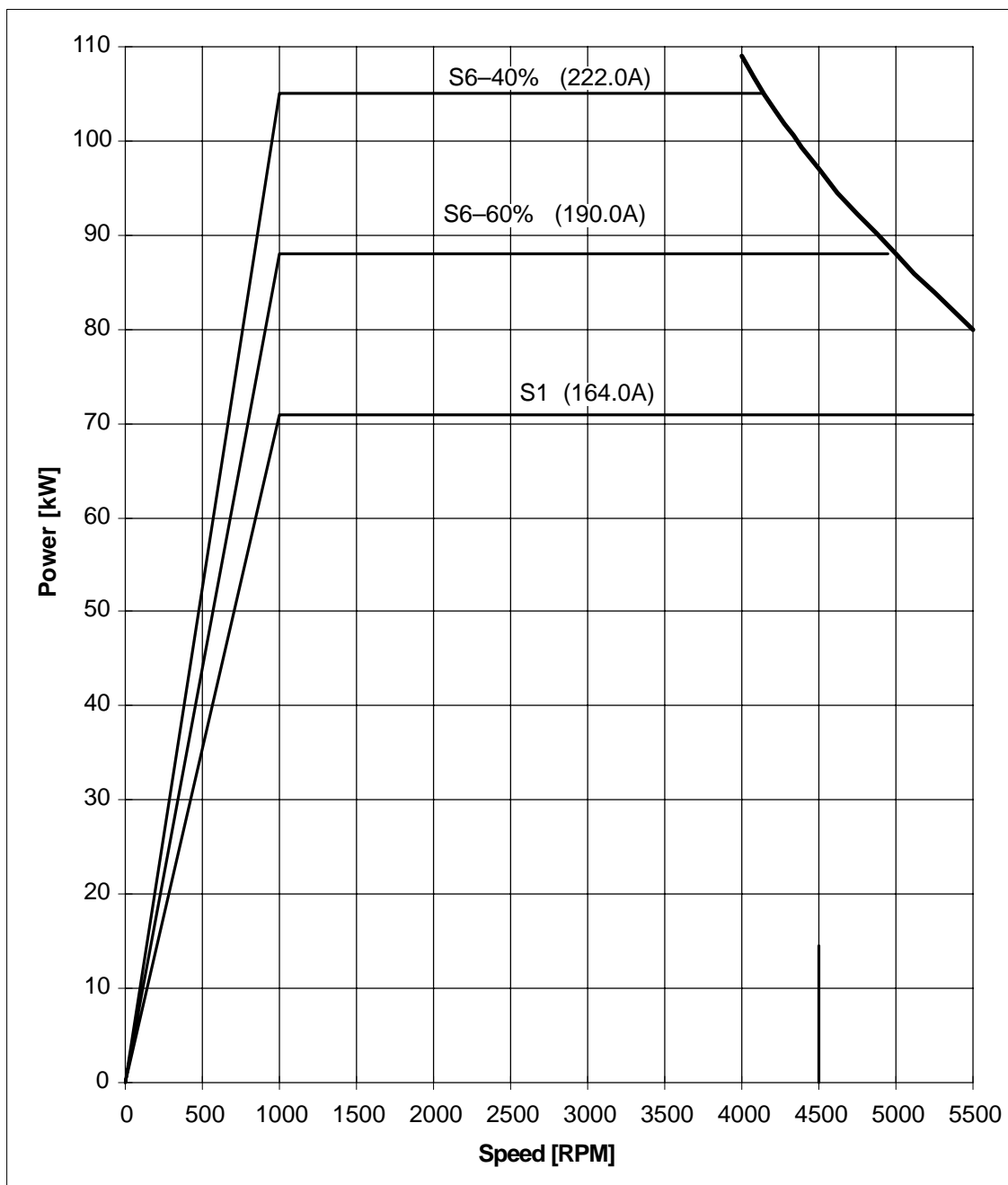
**1PH7**

Fig. 3-58 Speed-power diagram 1PH7224-□ND□□

1) optional

3.1 Speed–power diagrams

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 |

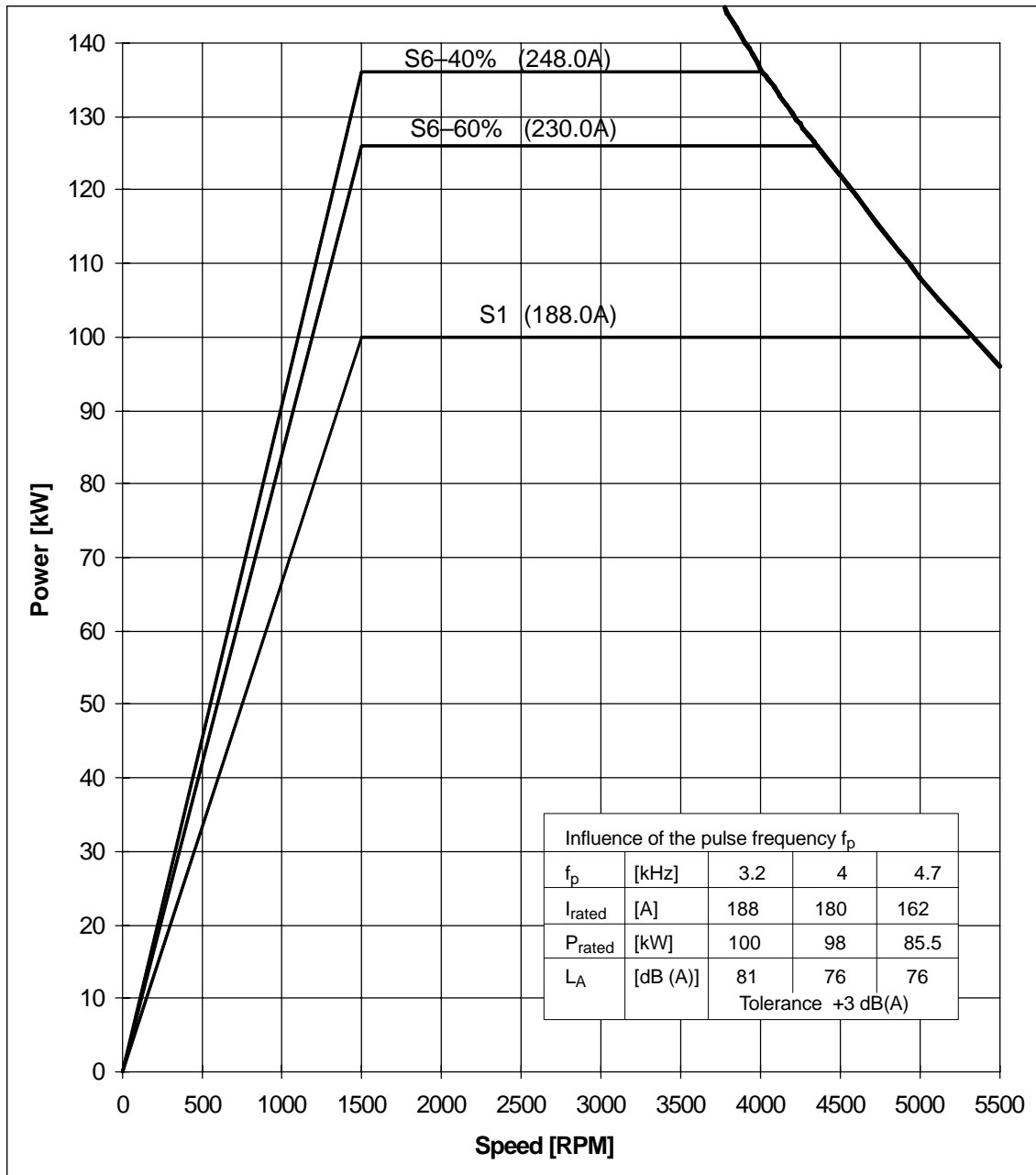


Fig. 3-59 Speed–power diagram 1PH7224–□NF□□

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.

1PH7

3.2 Cantilever/axial force diagrams

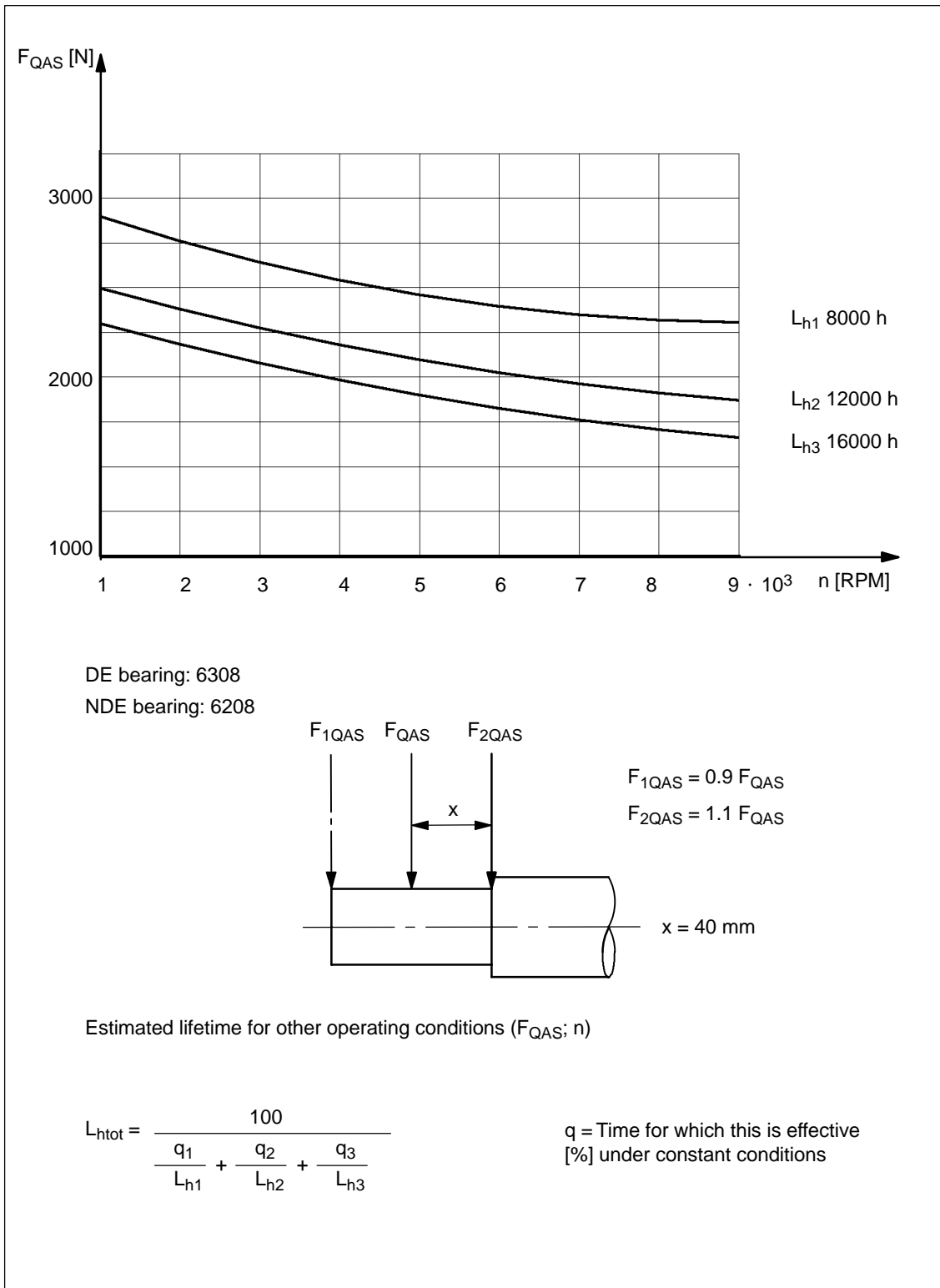
**Cantilever force
shaft height 100****Permissible cantilever force for a standard bearing design**

Fig. 3-60 Cantilever force diagram shaft height 100 for standard bearings

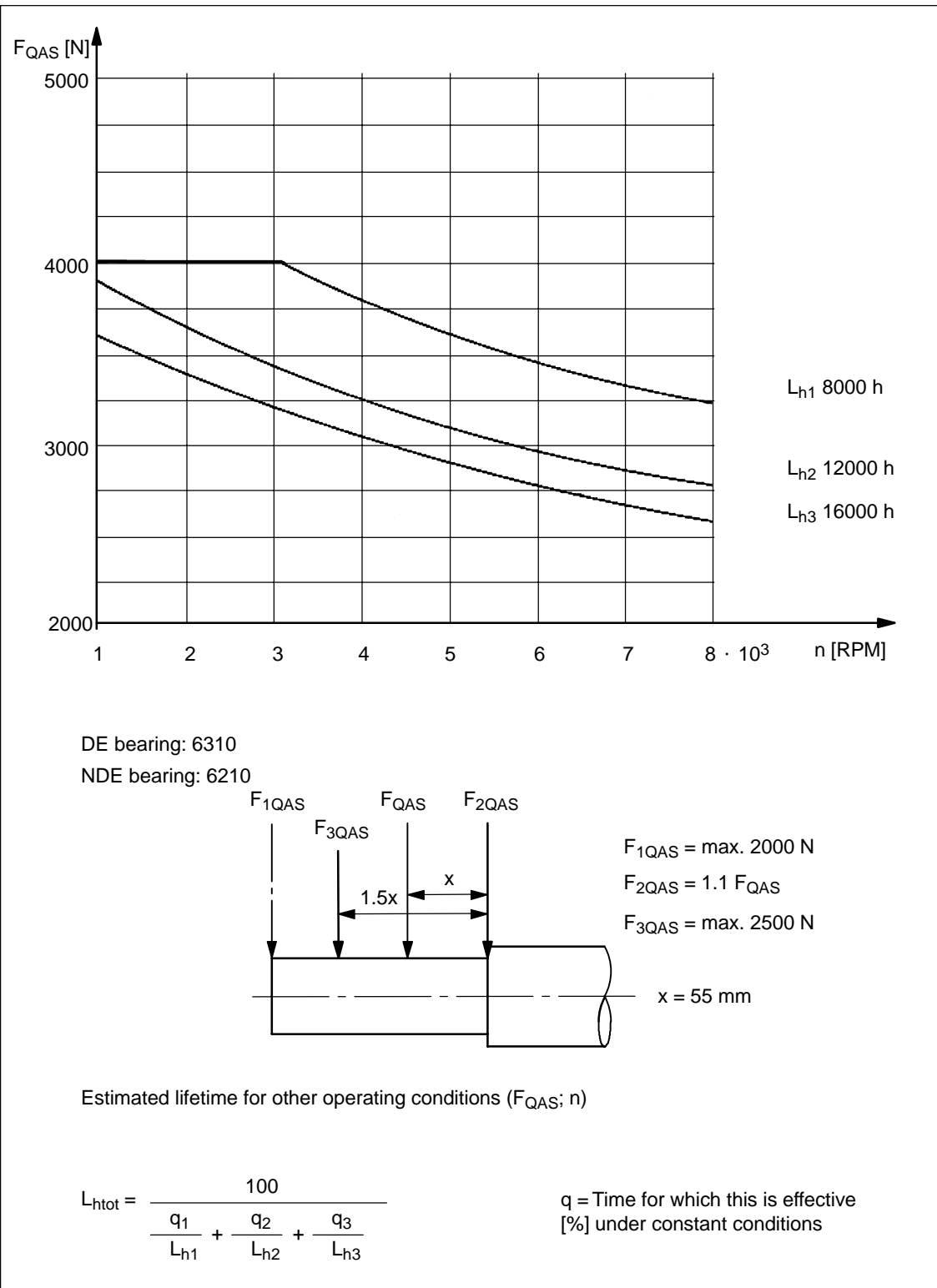
**Cantilever force
shaft height 132****Permissible cantilever force for a standard design.**

Fig. 3-61 Cantilever force diagram shaft height 132 for standard bearings

3.2 Cantilever/axial force diagrams

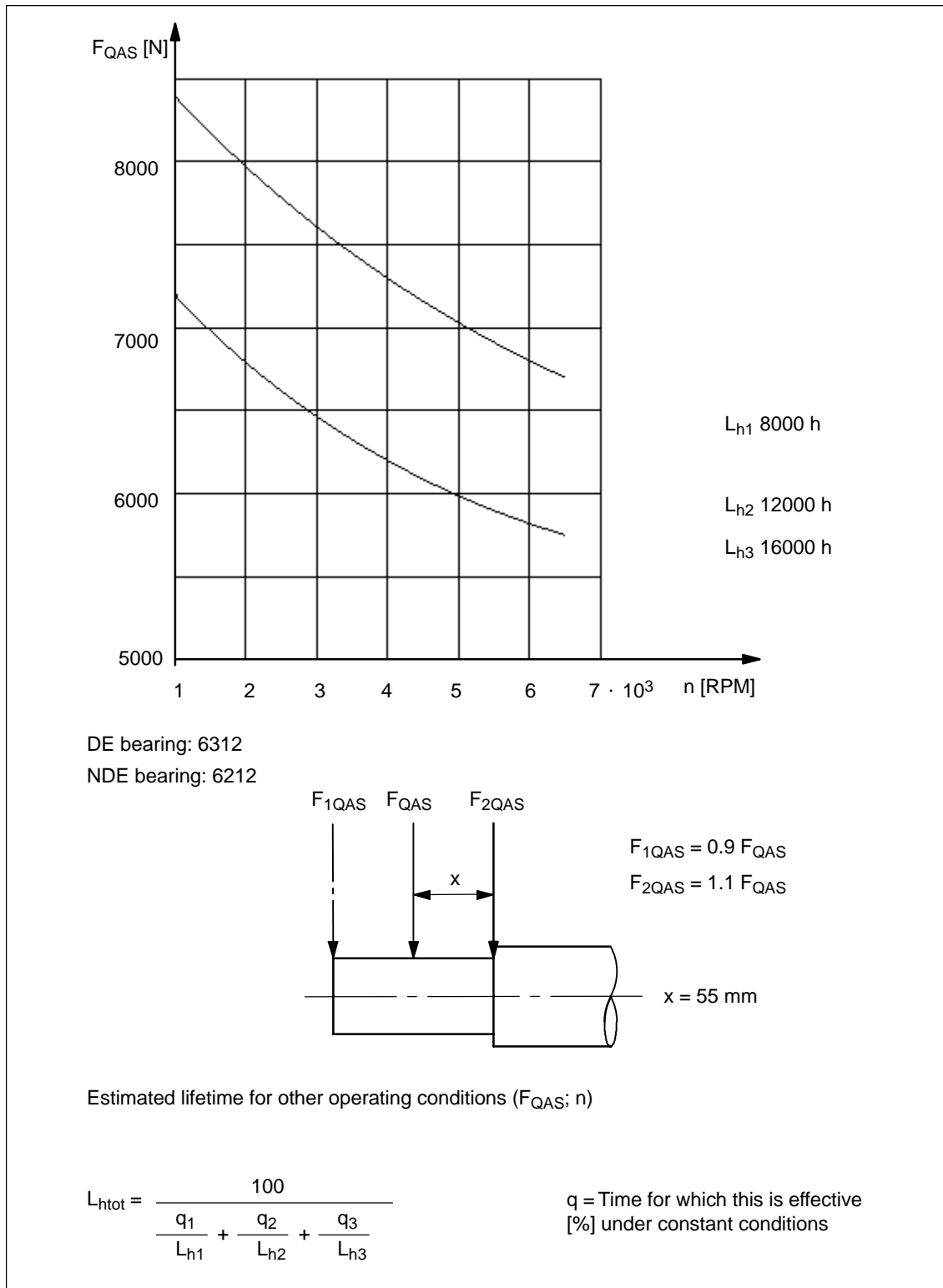
**Cantilever force
shaft height 160****Permissible cantilever force for a standard design.**

Fig. 3-62 Cantilever force diagram shaft height 160 for standard bearings

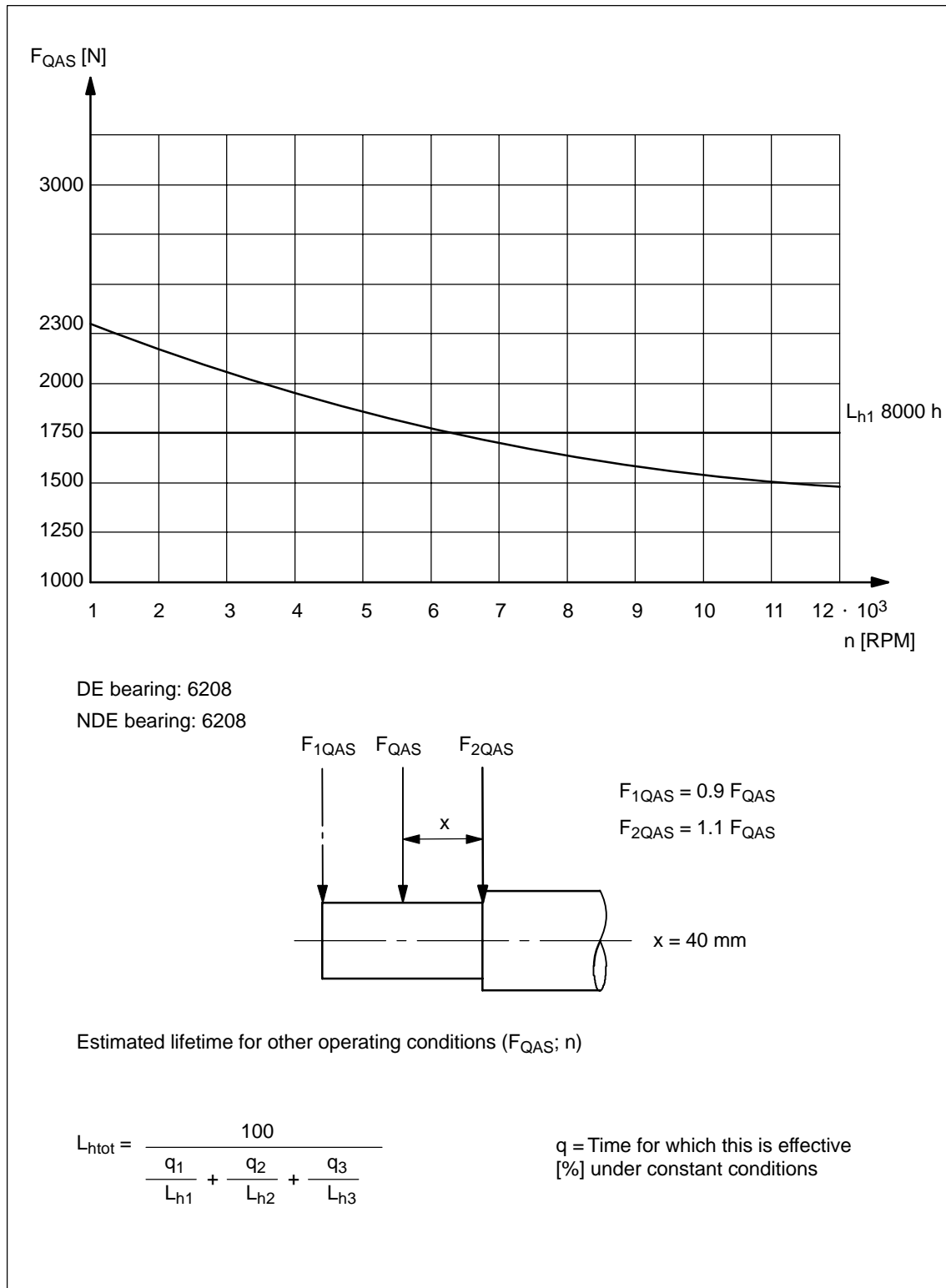
**Cantilever force
shaft height 100****Permissible cantilever forces for increased max. speed.****1PH7**

Fig. 3-63 Cantilever force diagram shaft height 100 at increased max. speed

3.2 Cantilever/axial force diagrams

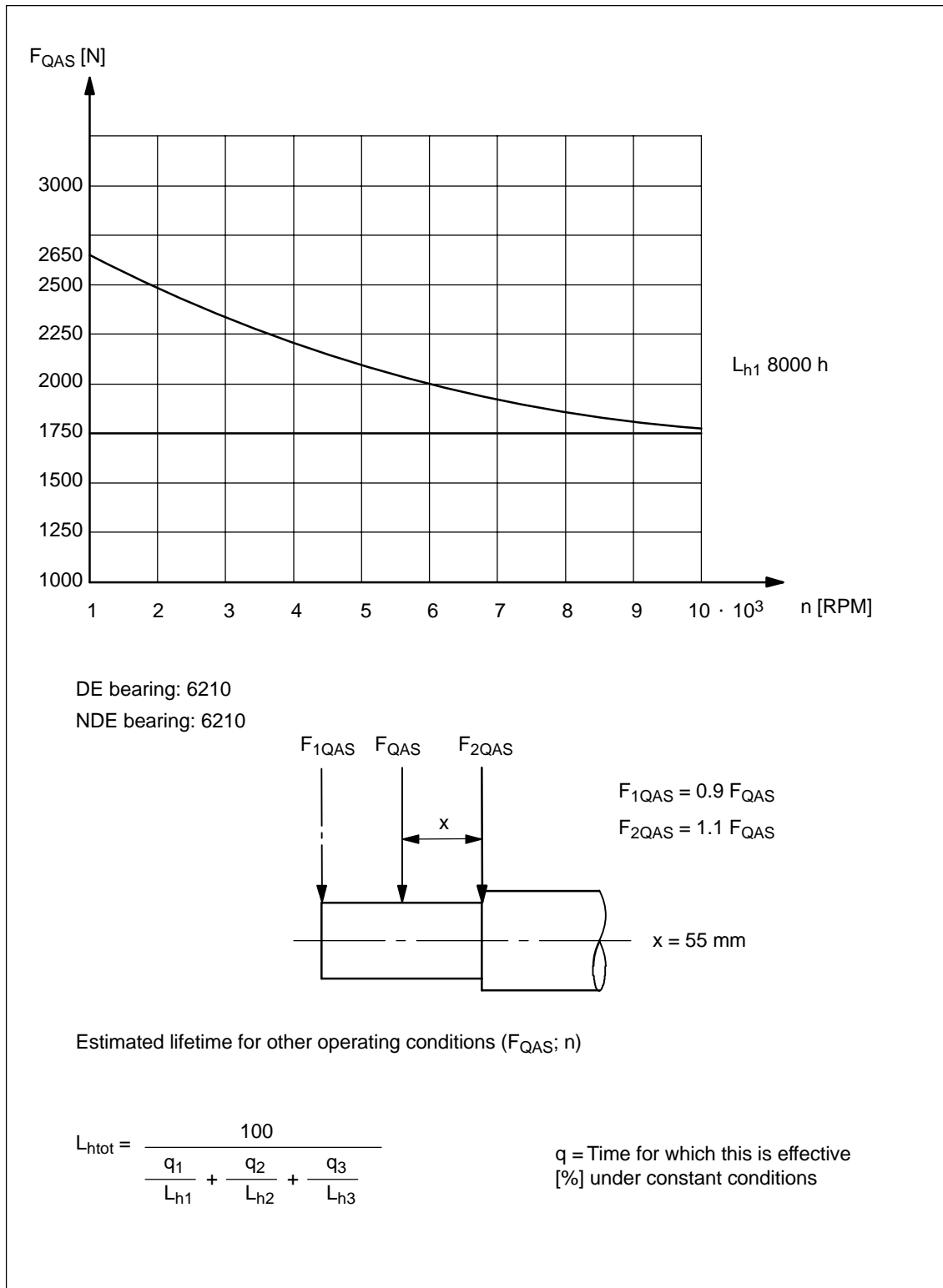
**Cantilever force
shaft height 132****Permissible cantilever forces for increased max. speed.**

Fig. 3-64 Cantilever force diagram shaft height 132 at increased max. speed

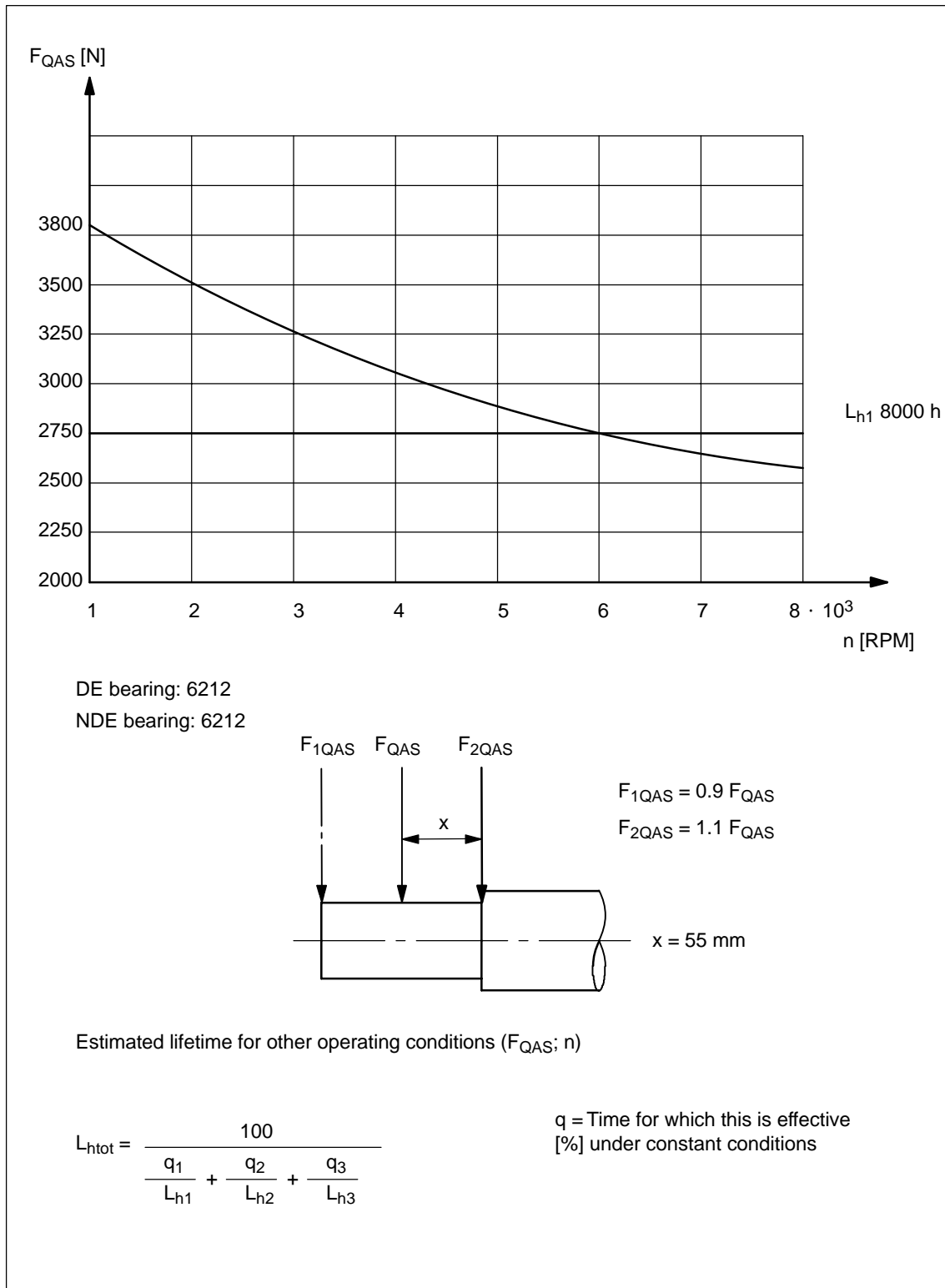
**Cantilever force
shaft height 160****Permissible cantilever forces for increased max. speed.****1PH7**

Fig. 3-65 Cantilever force diagram shaft height 160 at increased max. speed

Cantilever force shaft height 180

Permissible cantilever forces for coupling drives.

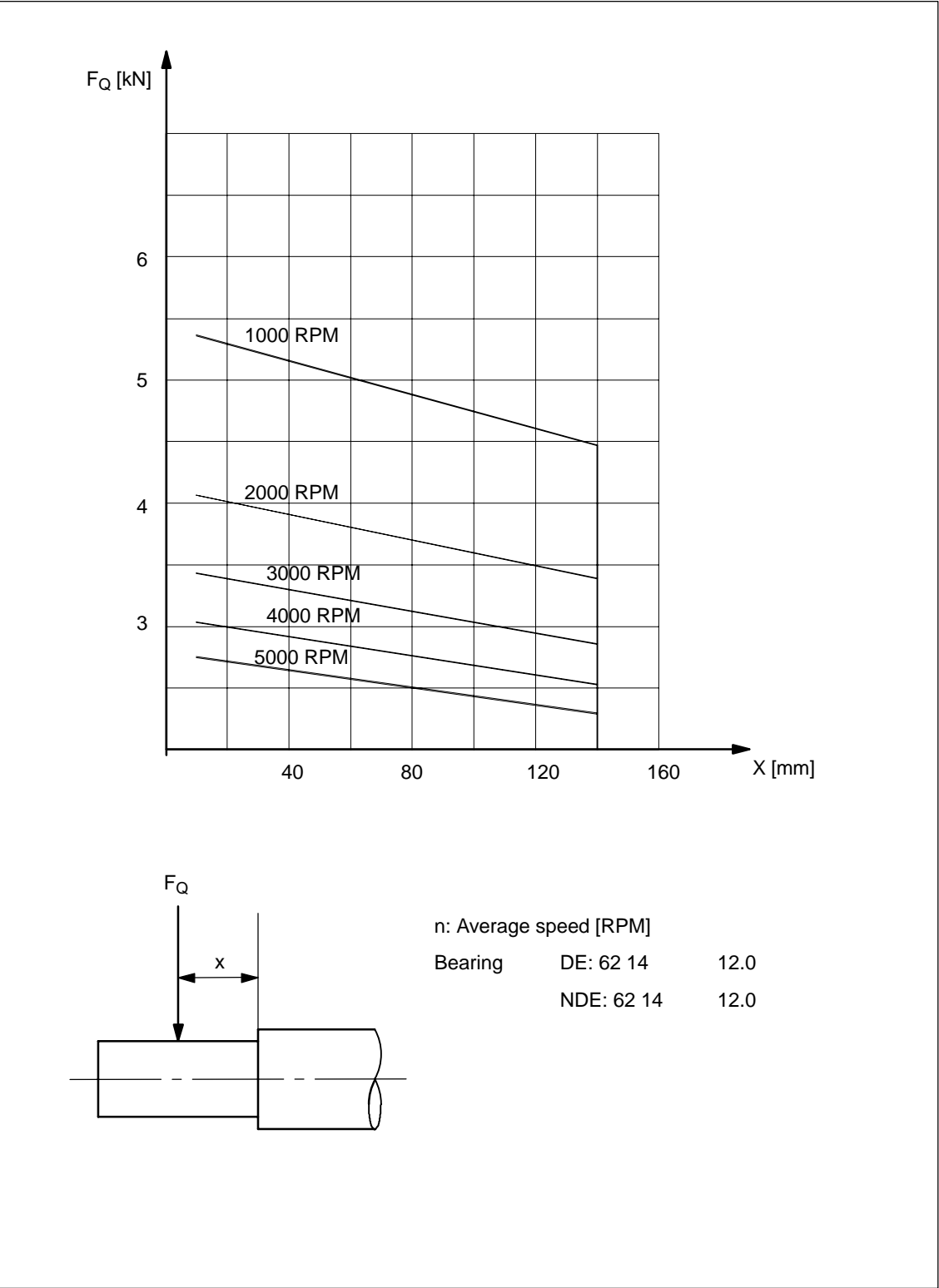


Fig. 3-66 Cantilever force diagram shaft height 180 with coupling drive out

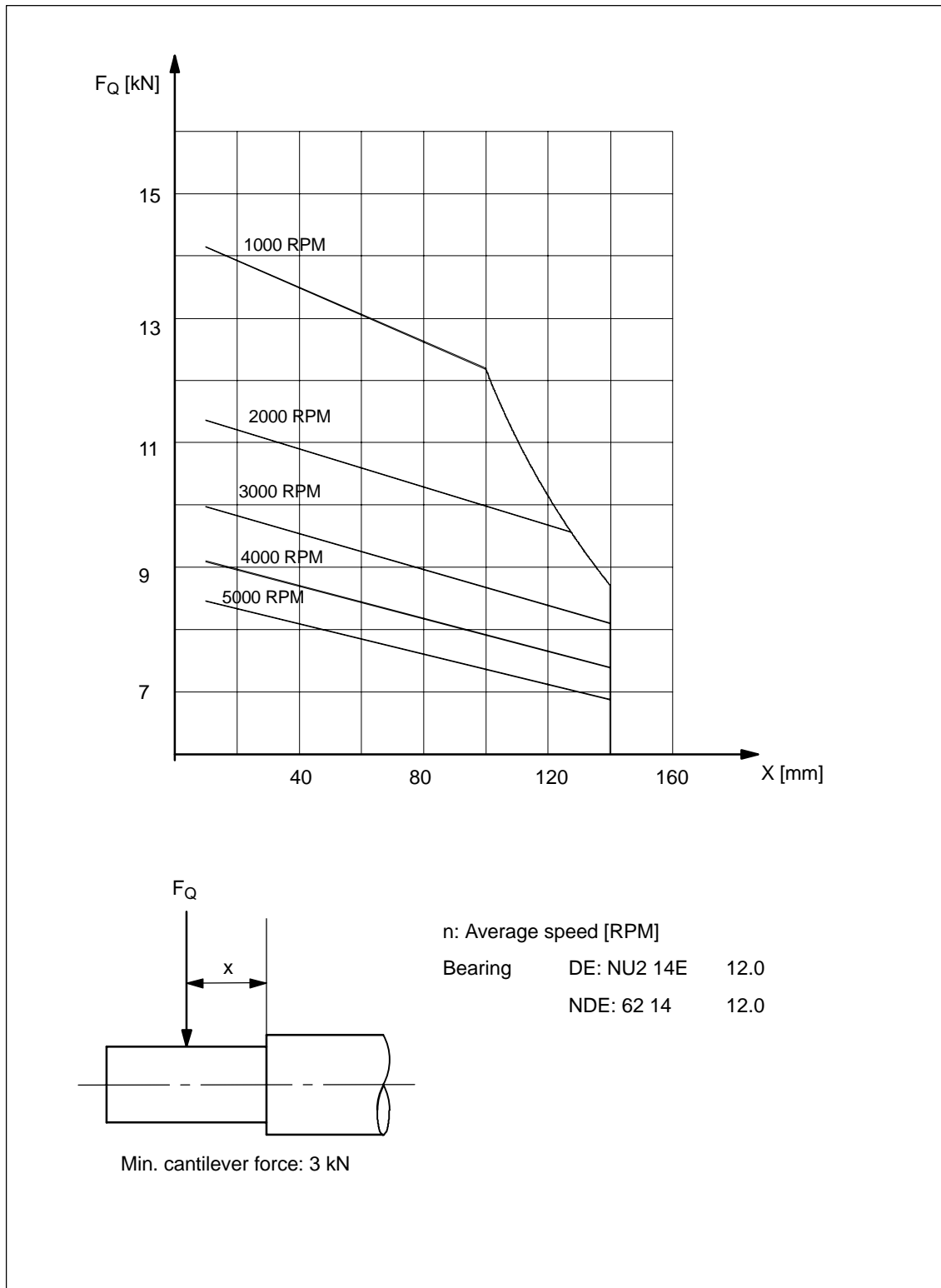
**Cantilever force
shaft height 180****Permissible cantilever forces for belt drives.****1PH7**

Fig. 3-67 Cantilever force diagram shaft height 180 for belt drives

3.2 Cantilever/axial force diagrams

**Cantilever force
shaft height 180**

Permissible increased cantilever forces for belt drives.

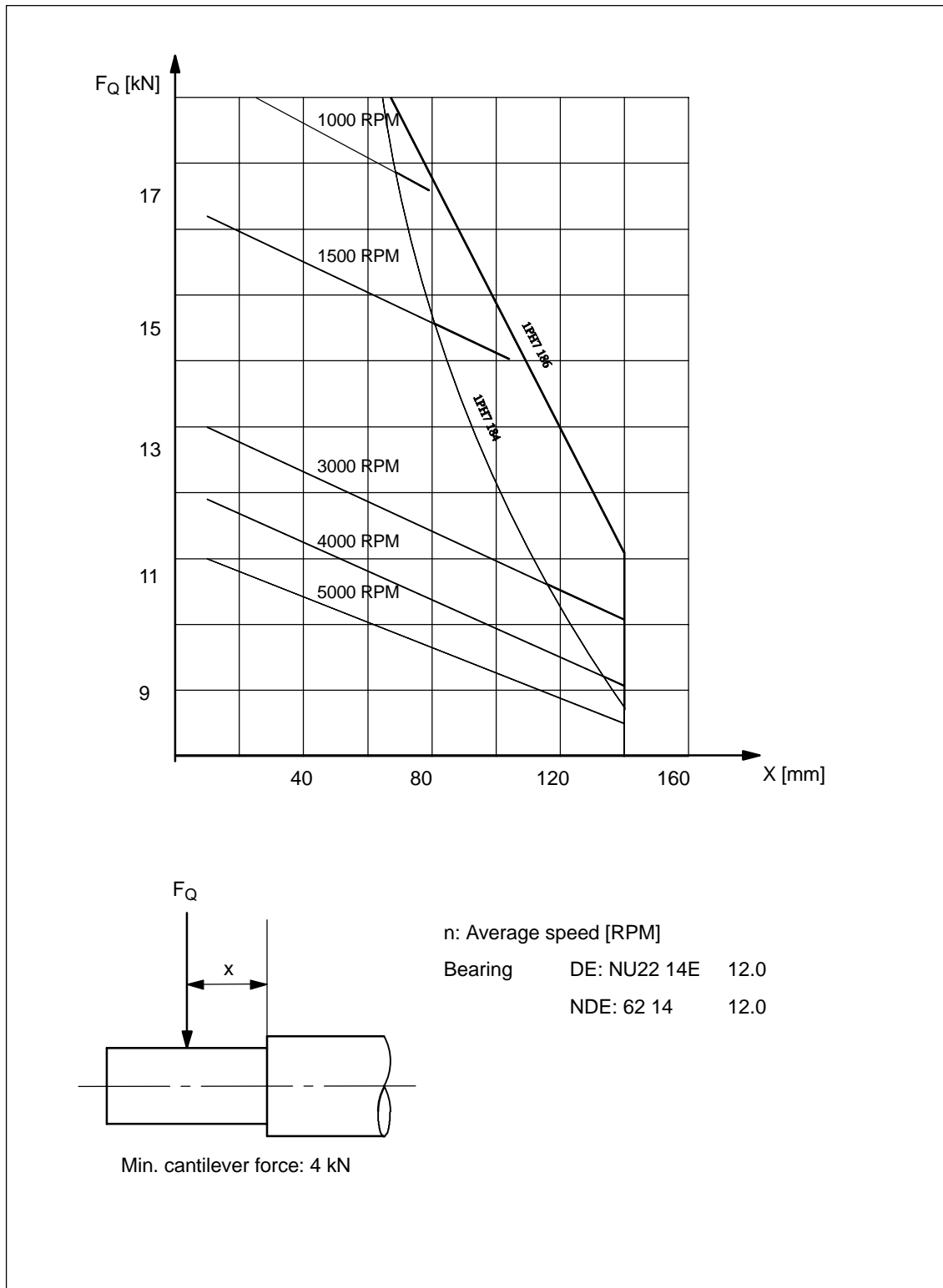


Fig. 3-68 Cantilever force diagram shaft height 180 for belt drives (increased cantilever force)

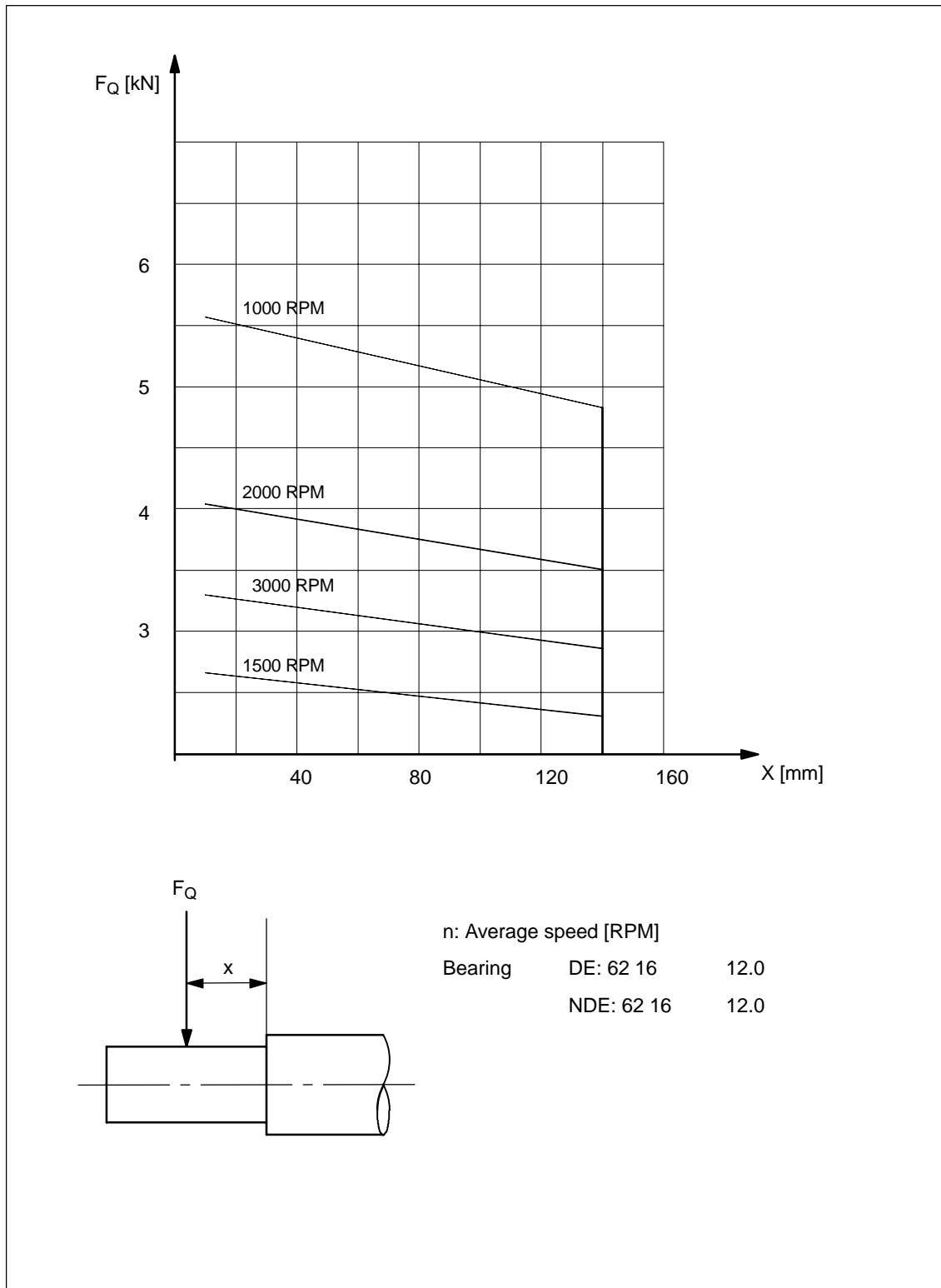
**Cantilever force
shaft height 225****Permissible cantilever forces for coupling drives.**

Fig. 3-69 Cantilever force diagram shaft height 225 with coupling drive out

Cantilever force shaft height 225

Permissible cantilever forces for belt drives

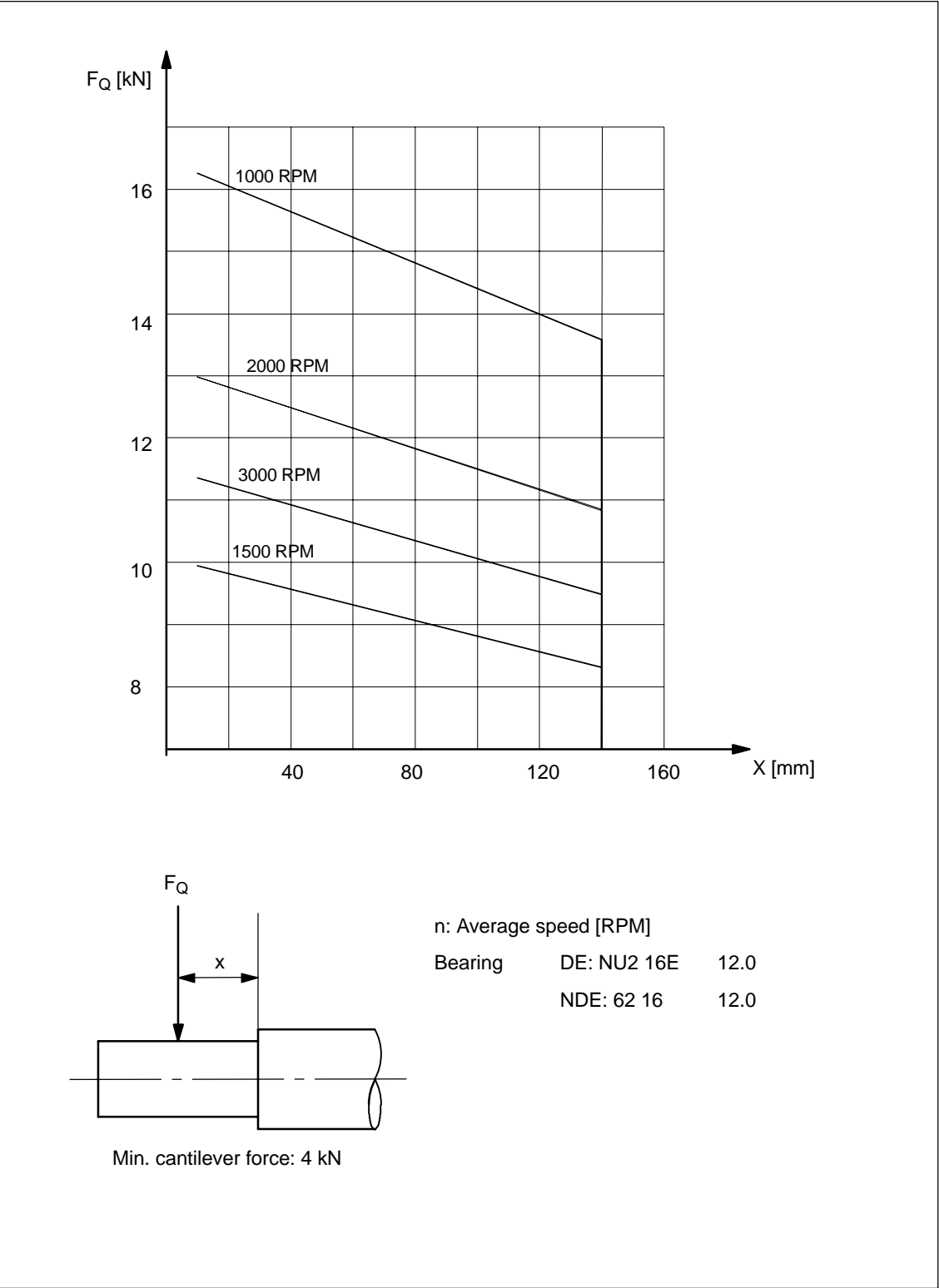


Fig. 3-70 Cantilever force diagram shaft height 225 for belt drives

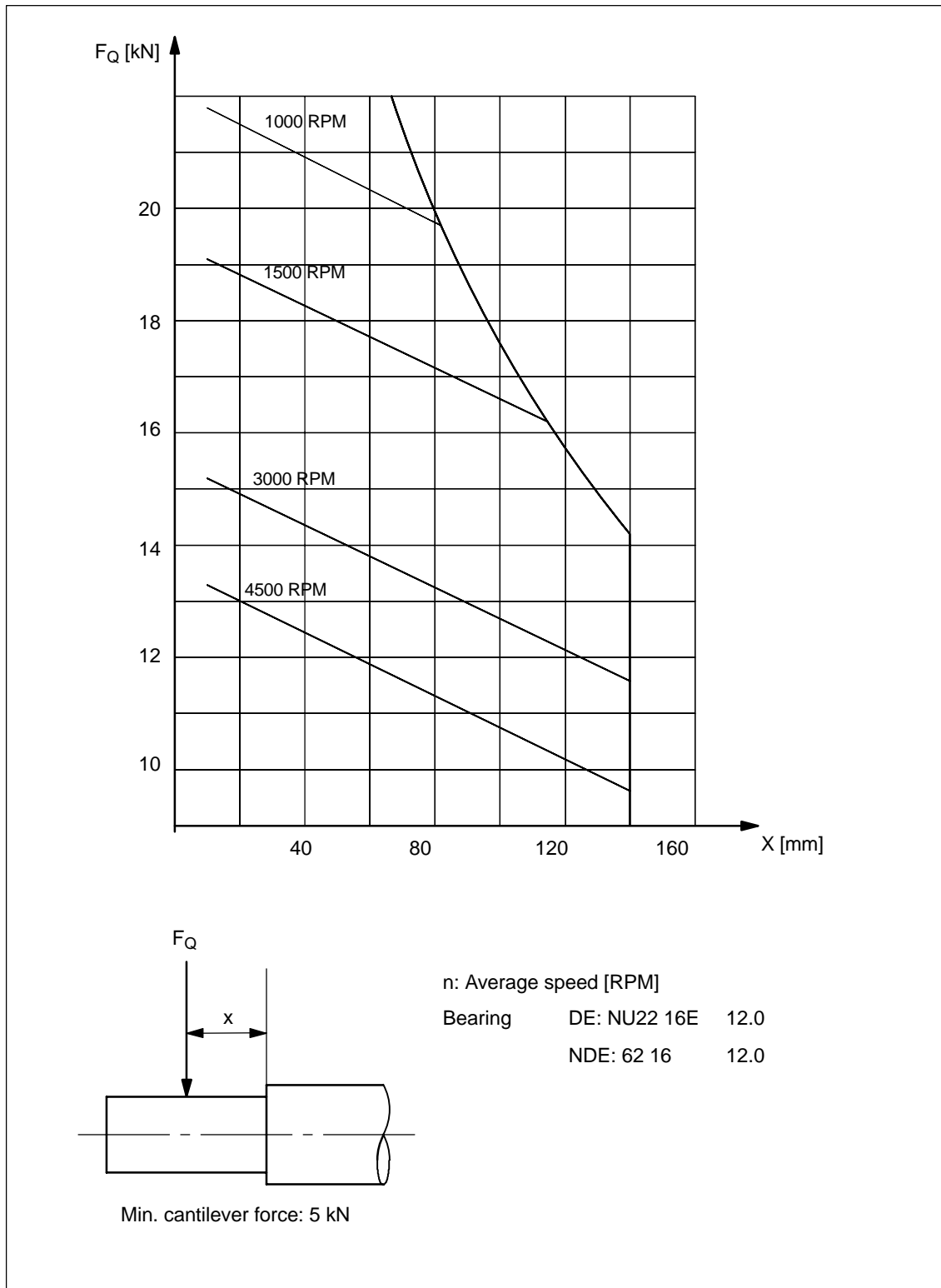
**Cantilever force
shaft height 225****Permissible increased cantilever forces for belt drives.**

Fig. 3-71 Cantilever force diagram shaft height 225 for belt drives (increased cantilever force)

3.2 Cantilever/axial force diagrams

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 forcesTable 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.

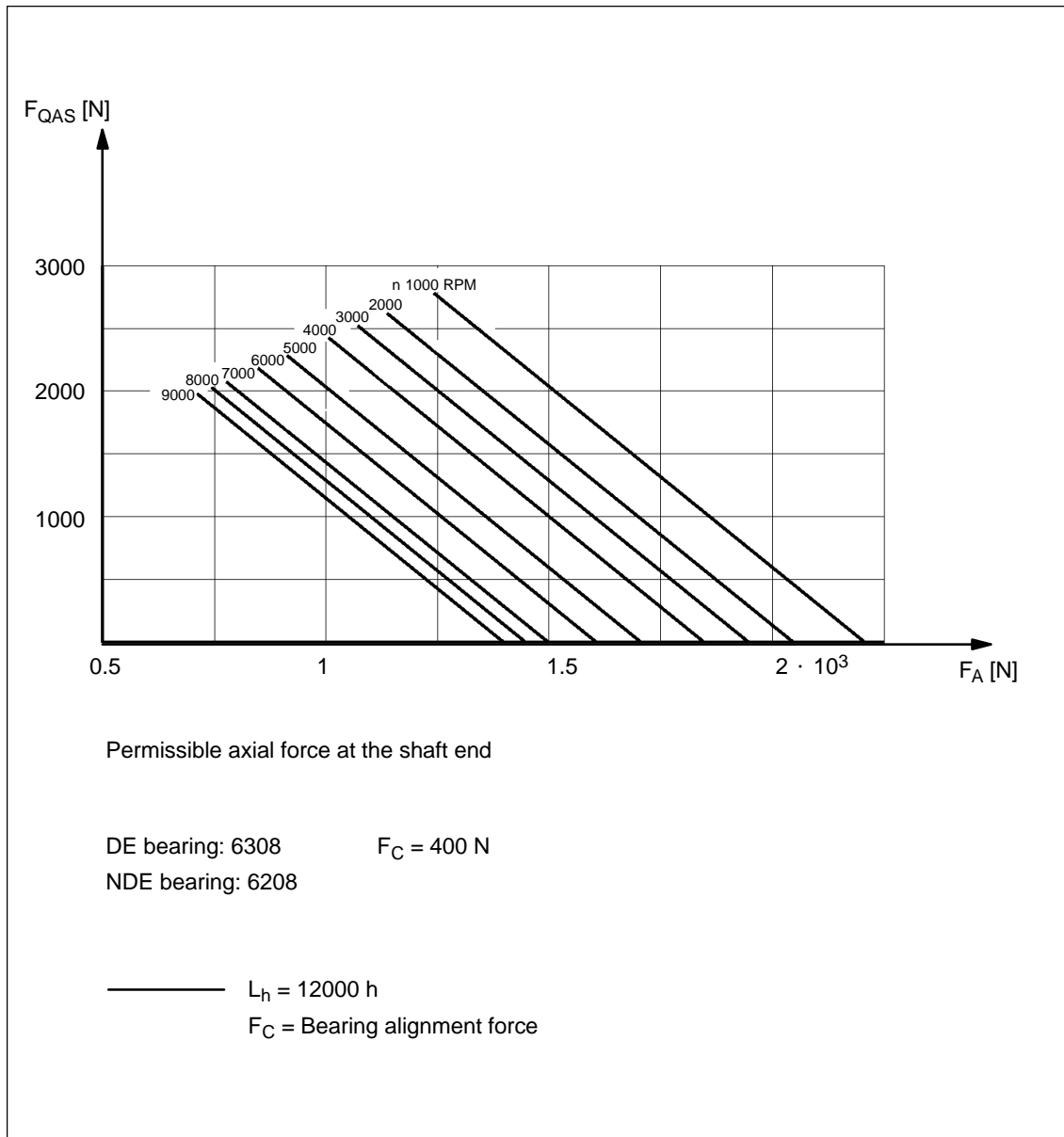
**1PH7**

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

3.2 Cantilever/axial force diagrams

**Axial force
shaft height 132**

Axial force at the shaft end.

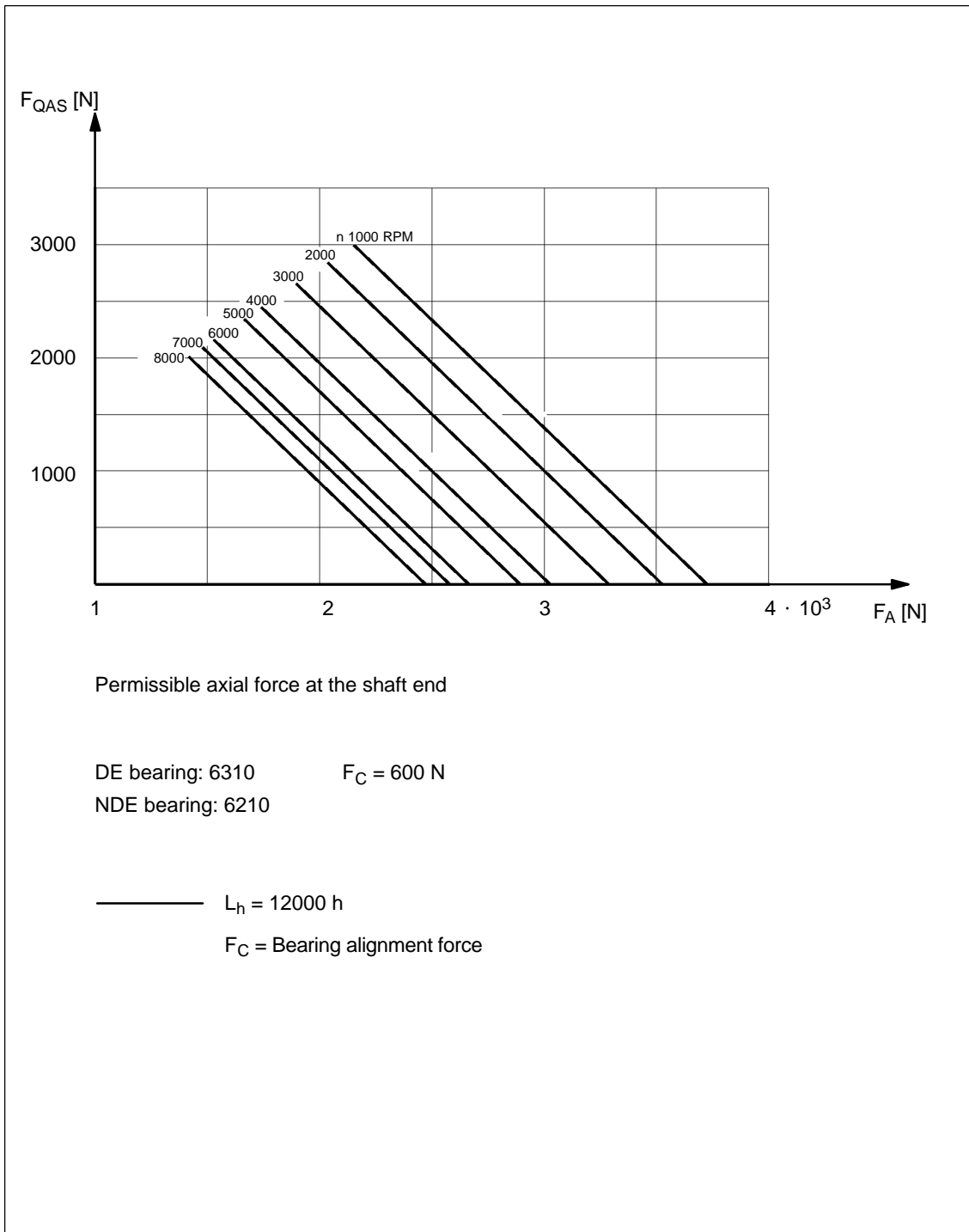


Fig. 3-73 Axial force diagram and the shaft end, shaft height 132

**Axial force
shaft height 160**

Permissible axial force at the shaft end.

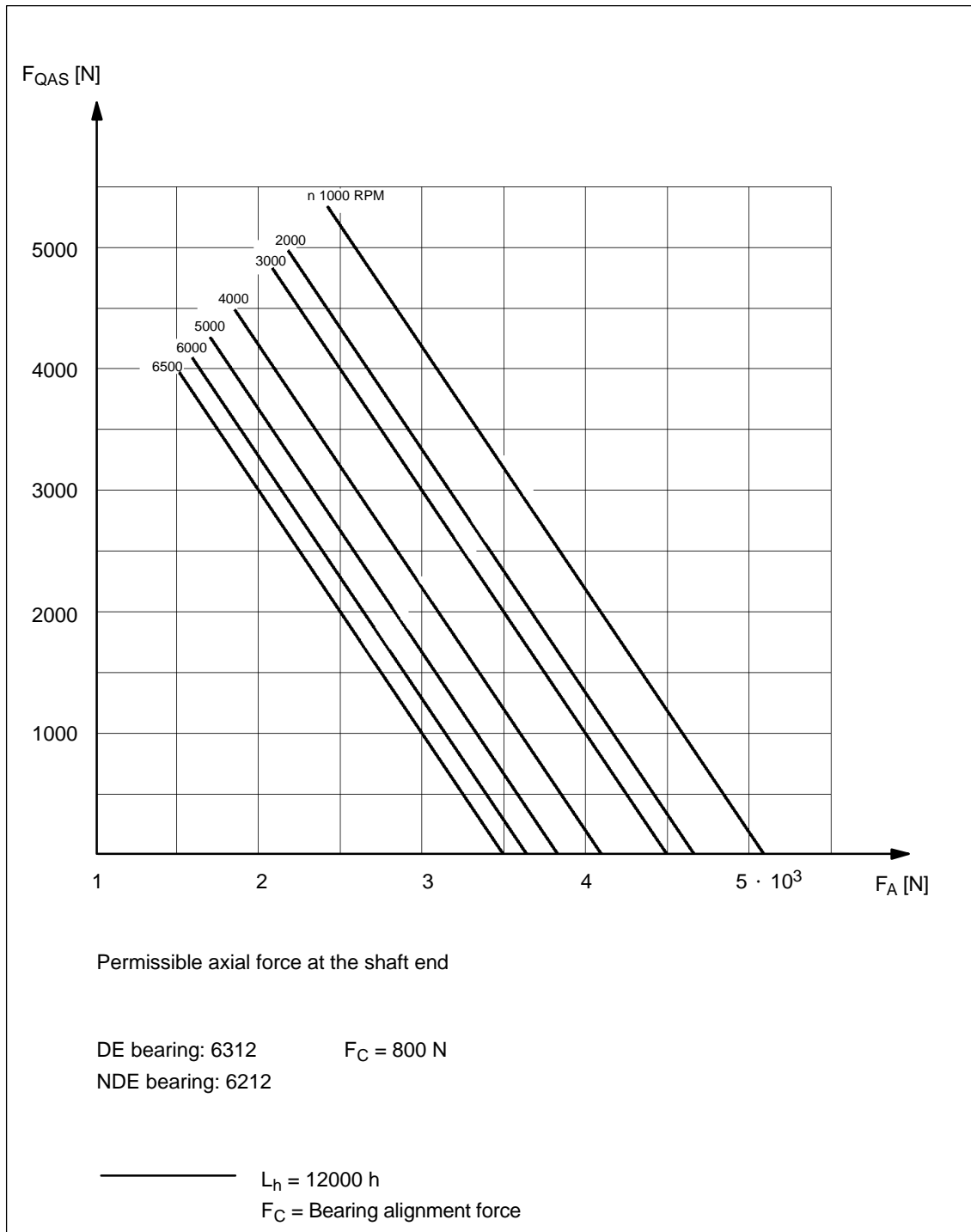
**1PH7**

Fig. 3-74 Axial force diagram and the shaft end, shaft height 160

3.2 Cantilever/axial force diagrams

**Axial force
shaft height 100**

Axial force at the shaft end at increased max. speed.

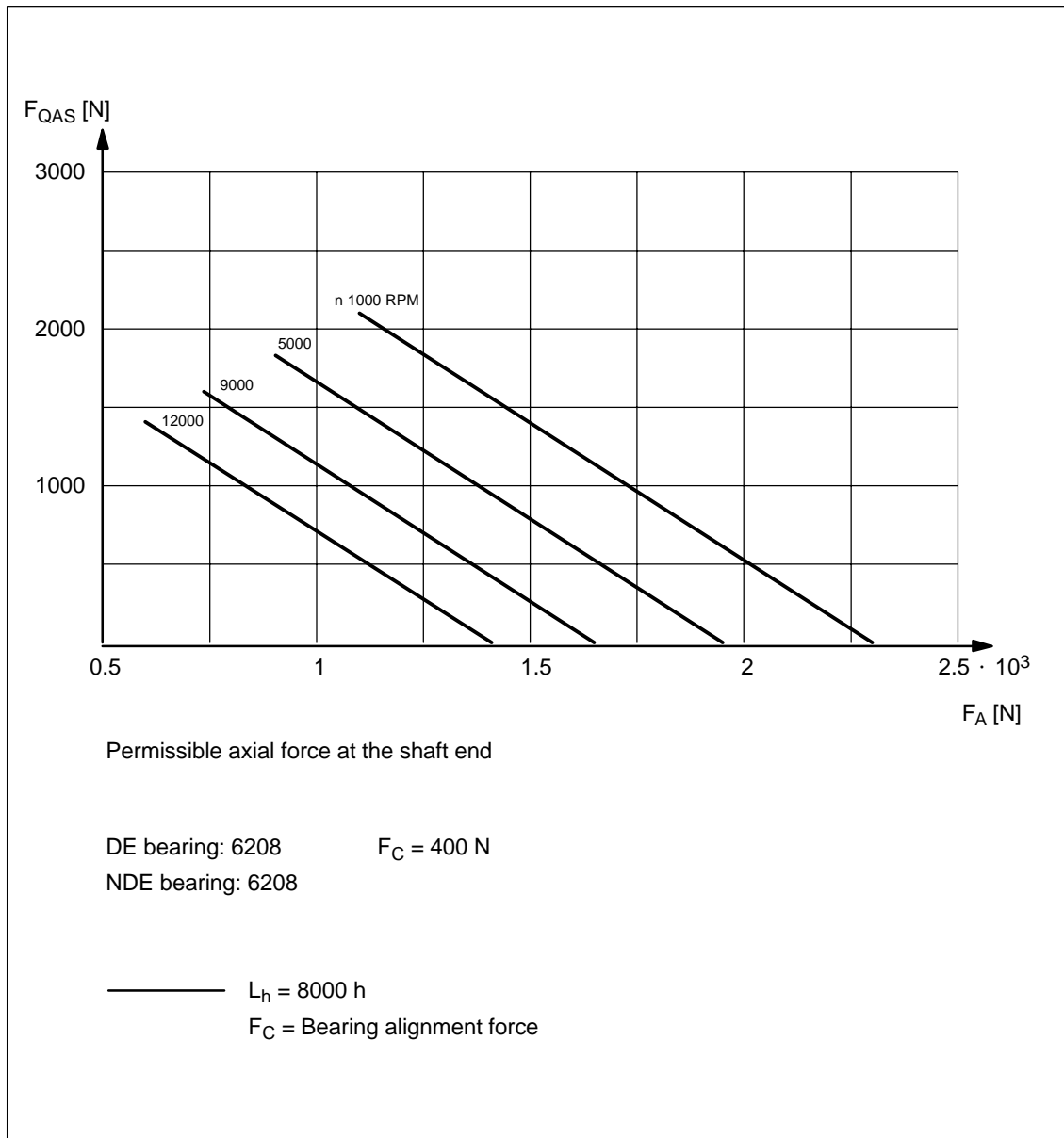


Fig. 3-75 Axial force diagram at the shaft end, shaft height 100 (increased max. speed)

**Axial force
shaft height 132**

Axial force at the shaft end at increased max. speed.

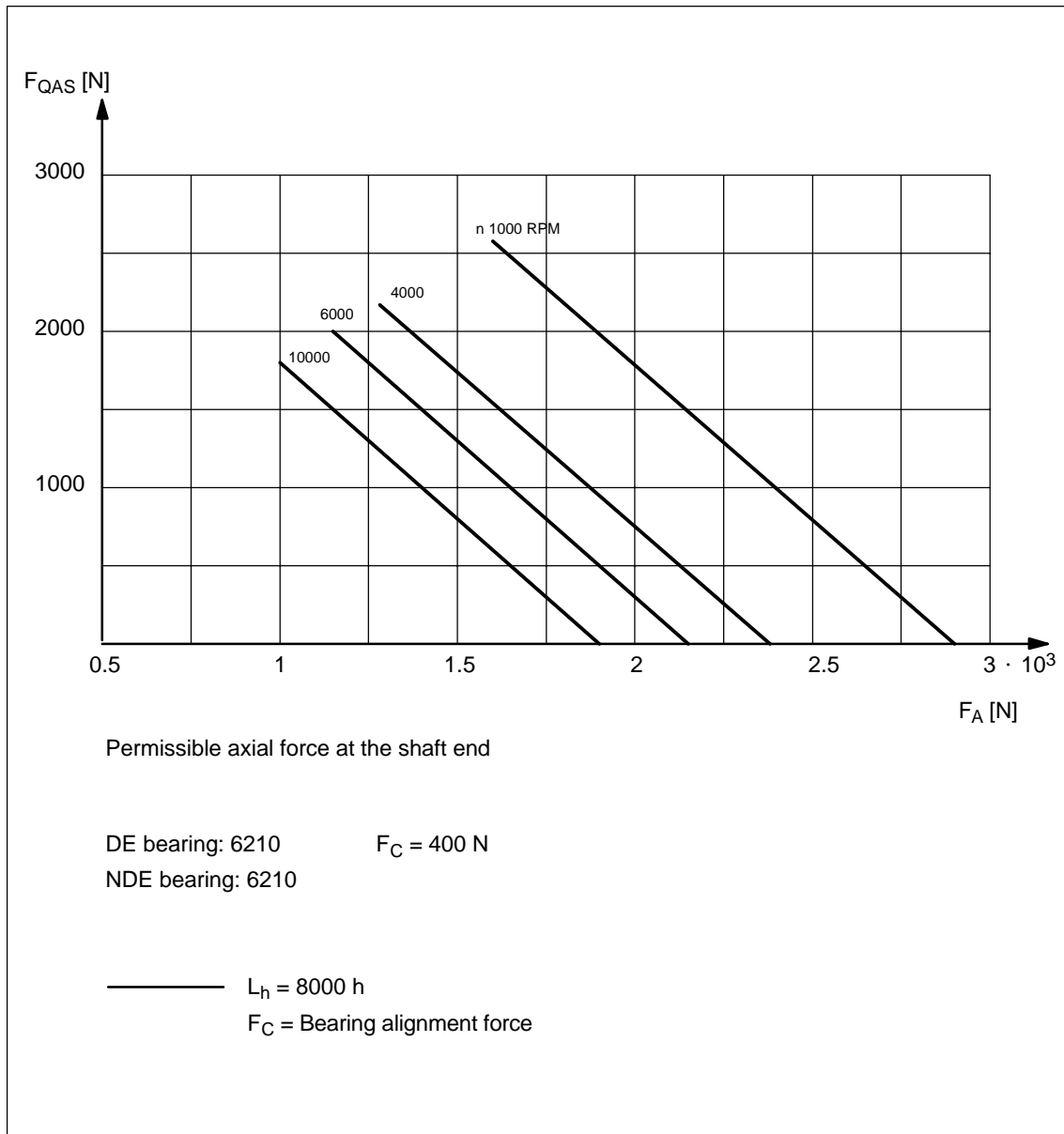
**1PH7**

Fig. 3-76 Axial force diagram at the shaft end, shaft height 132 (increased max. speed)

3.2 Cantilever/axial force diagrams

**Axial force
shaft height 160**

Axial force at the shaft end at increased max. speed.

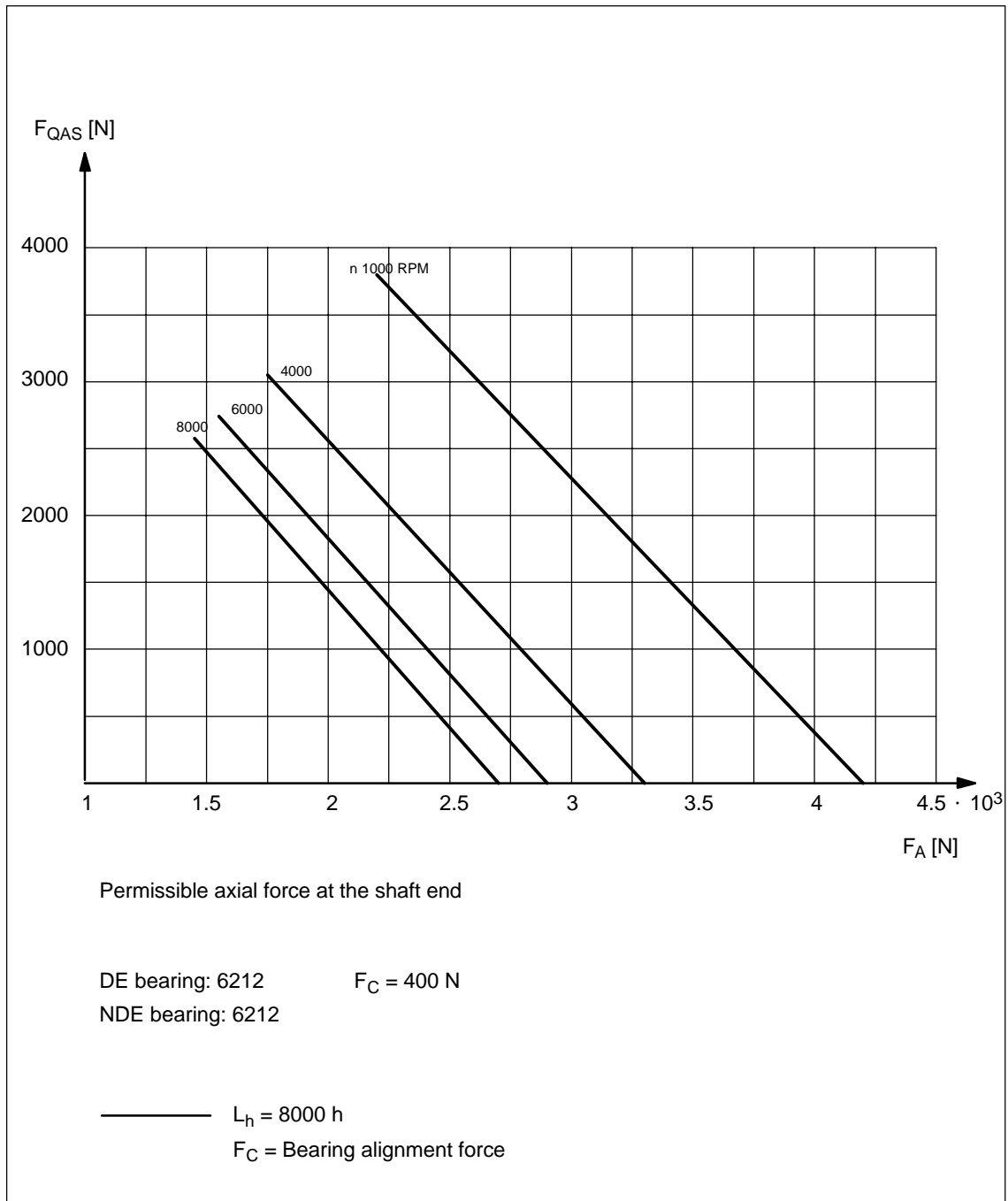


Fig. 3-77 Axial force diagram at the shaft end, shaft height 160 (increased max. speed)



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.

1PH7

4 Dimension Drawings

| | |
|--|------------|
| 1PH7 101/103, type of construction IM B3 | 1PH7/4-125 |
| 1PH7 101/103, type of construction IM B35 | 1PH7/4-126 |
| 1PH7 101/103, type of construction IM B5 | 1PH7/4-127 |
| 1PH7 105/107, type of construction IM B3 | 1PH7/4-128 |
| 1PH7 105/107, type of construction IM B35 | 1PH7/4-129 |
| 1PH7 105/107, type of construction IM B5 | 1PH7/4-130 |
| 1PH7 131/133, type of construction IM B3 | 1PH7/4-131 |
| 1PH7 131/133, type of construction IM B35 | 1PH7/4-132 |
| 1PH7 131/133, type of construction IM B5 | 1PH7/4-133 |
| 1PH7 135/137, type of construction IM B3 | 1PH7/4-134 |
| 1PH7 135/137, type of construction IM B35 | 1PH7/4-135 |
| 1PH7 135/137, type of construction IM B5 | 1PH7/4-136 |
| 1PH7 163, type of construction IM B3 | 1PH7/4-137 |
| 1PH7 163, type of construction IM B35 | 1PH7/4-138 |
| 1PH7 167, type of construction IM B3 | 1PH7/4-139 |
| 1PH7 167, type of construction IM B35 | 1PH7/4-140 |
| 1PH7 184, type of construction IM B3, air flow direction (NDE → DE) ... | 1PH7/4-141 |
| 1PH7 184, type of construction IM B35, air flow direction (NDE → DE) ... | 1PH7/4-142 |
| 1PH7 186, type of construction IM B3, air flow direction (NDE → DE) ... | 1PH7/4-143 |
| 1PH7 186, type of construction IM B35, air flow direction (NDE → DE) ... | 1PH7/4-144 |
| 1PH7 224, type of construction IM B3, air flow direction (NDE → DE) ... | 1PH7/4-145 |
| 1PH7 224, type of construction IM B35, air flow direction (NDE → DE) ... | 1PH7/4-146 |
| 1PH7 184, type of construction IM B3, air flow direction (DE → NDE) ... | 1PH7/4-147 |
| 1PH7 184, type of construction IM B35, air flow direction (DE → NDE) ... | 1PH7/4-148 |
| 1PH7 186, type of construction IM B3, air flow direction (DE → NDE) ... | 1PH7/4-149 |
| 1PH7 186, type of construction IM B35, air flow direction (DE → NDE) ... | 1PH7/4-150 |
| 1PH7 224, type of construction IM B3, air flow direction (DE → NDE) ... | 1PH7/4-151 |
| 1PH7 224, type of construction IM B35, air flow direction (DE → NDE) ... | 1PH7/4-152 |

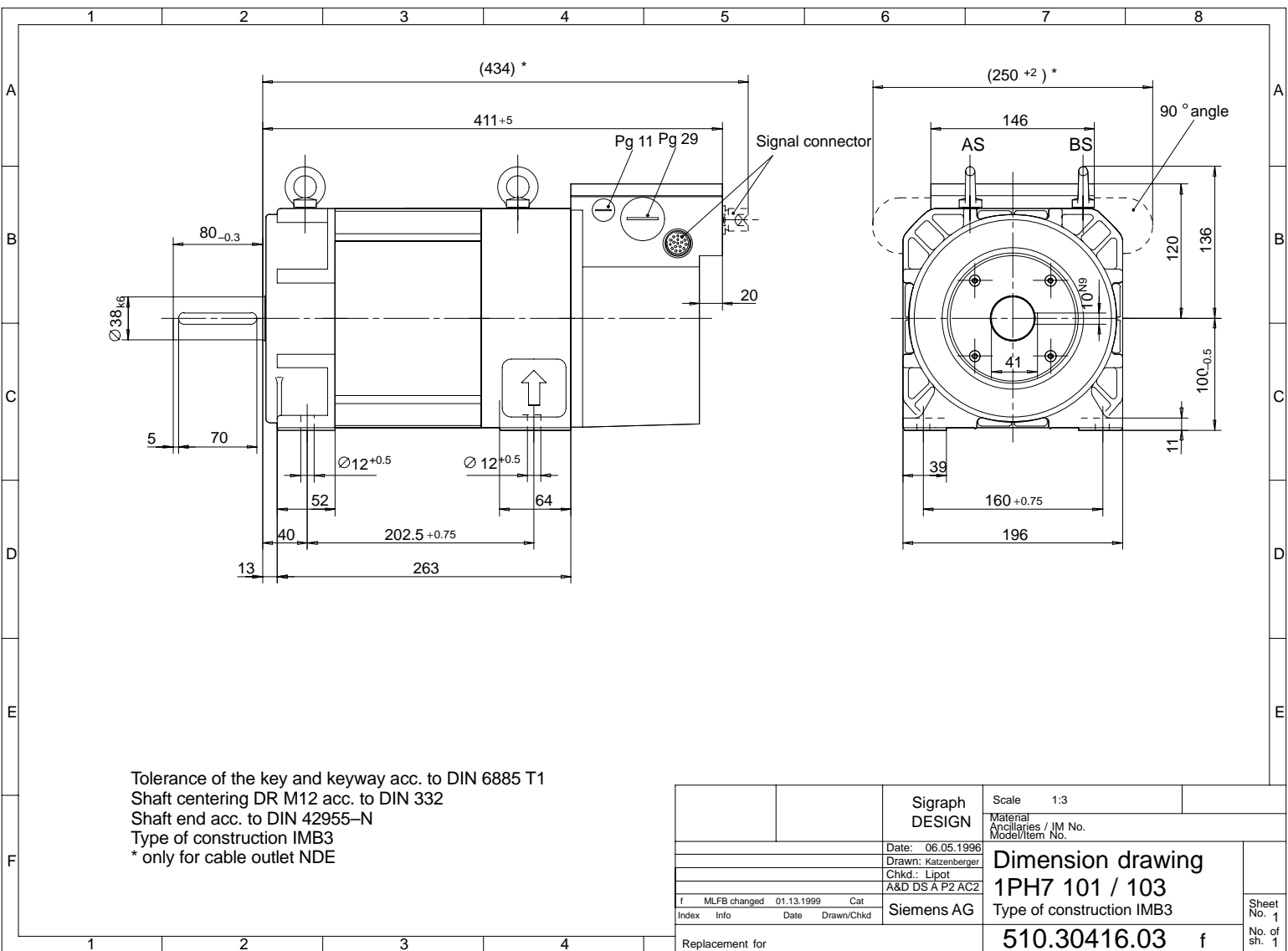
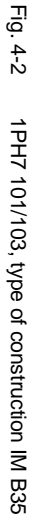


Fig. 4-1 1PH7 101/103, type of construction IM B3

1PH7

09.00



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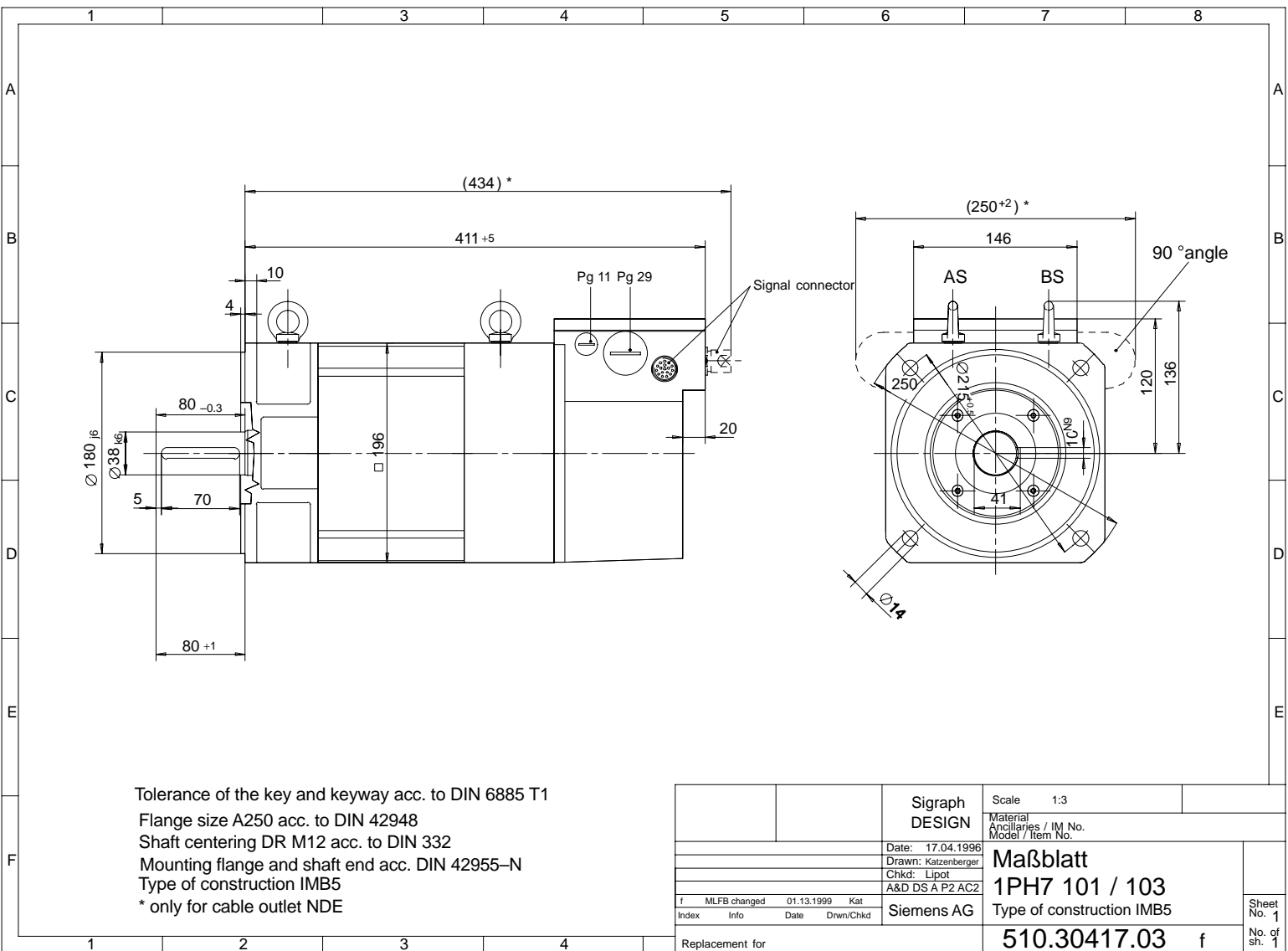


Fig. 4-3 1PH7 101/103, type of construction IM B5

1PH7

4 Dimension Drawings

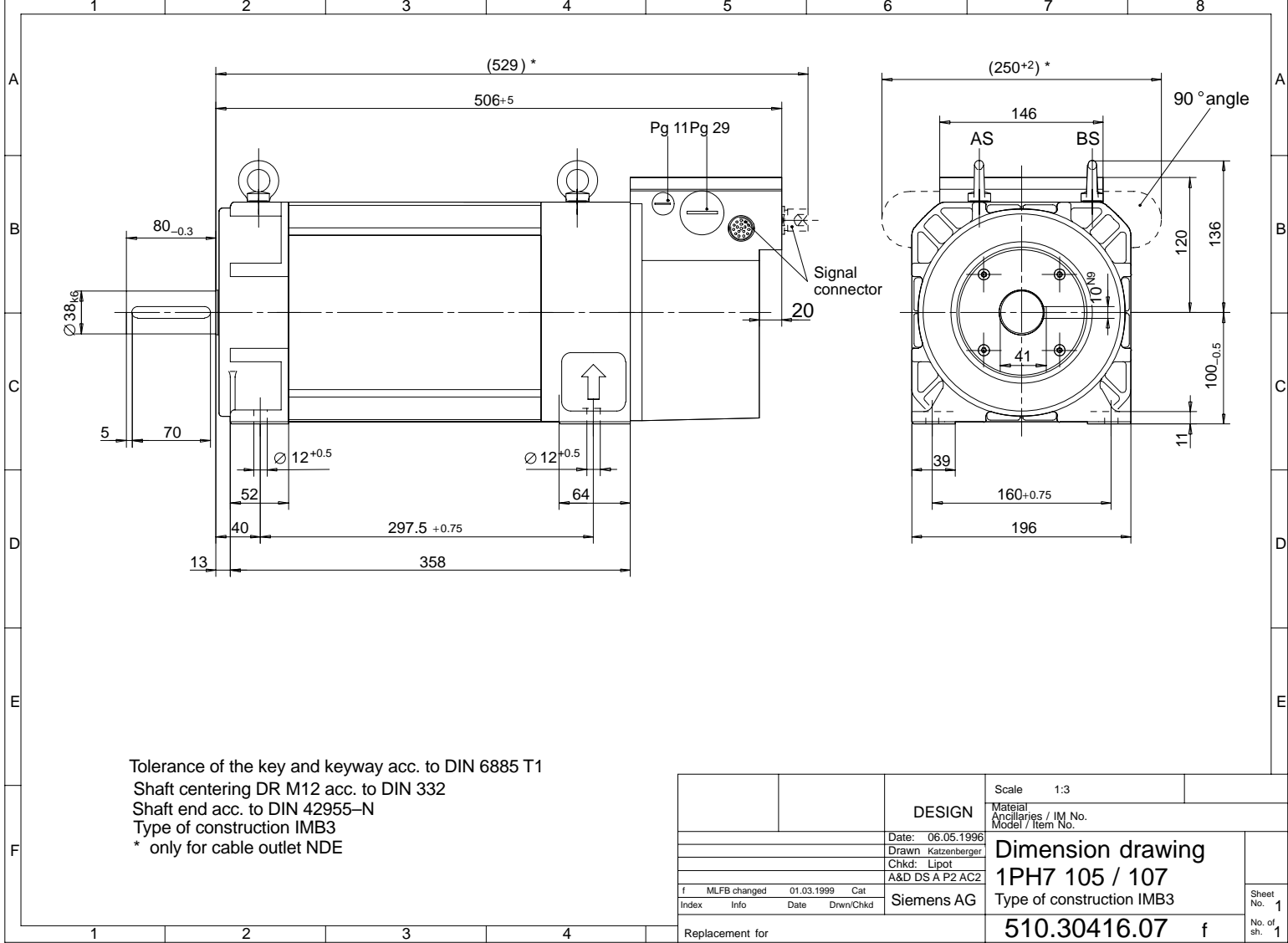


Fig. 4-4 1PH7 105/107, type of construction IM B3



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4 Dimension Drawings

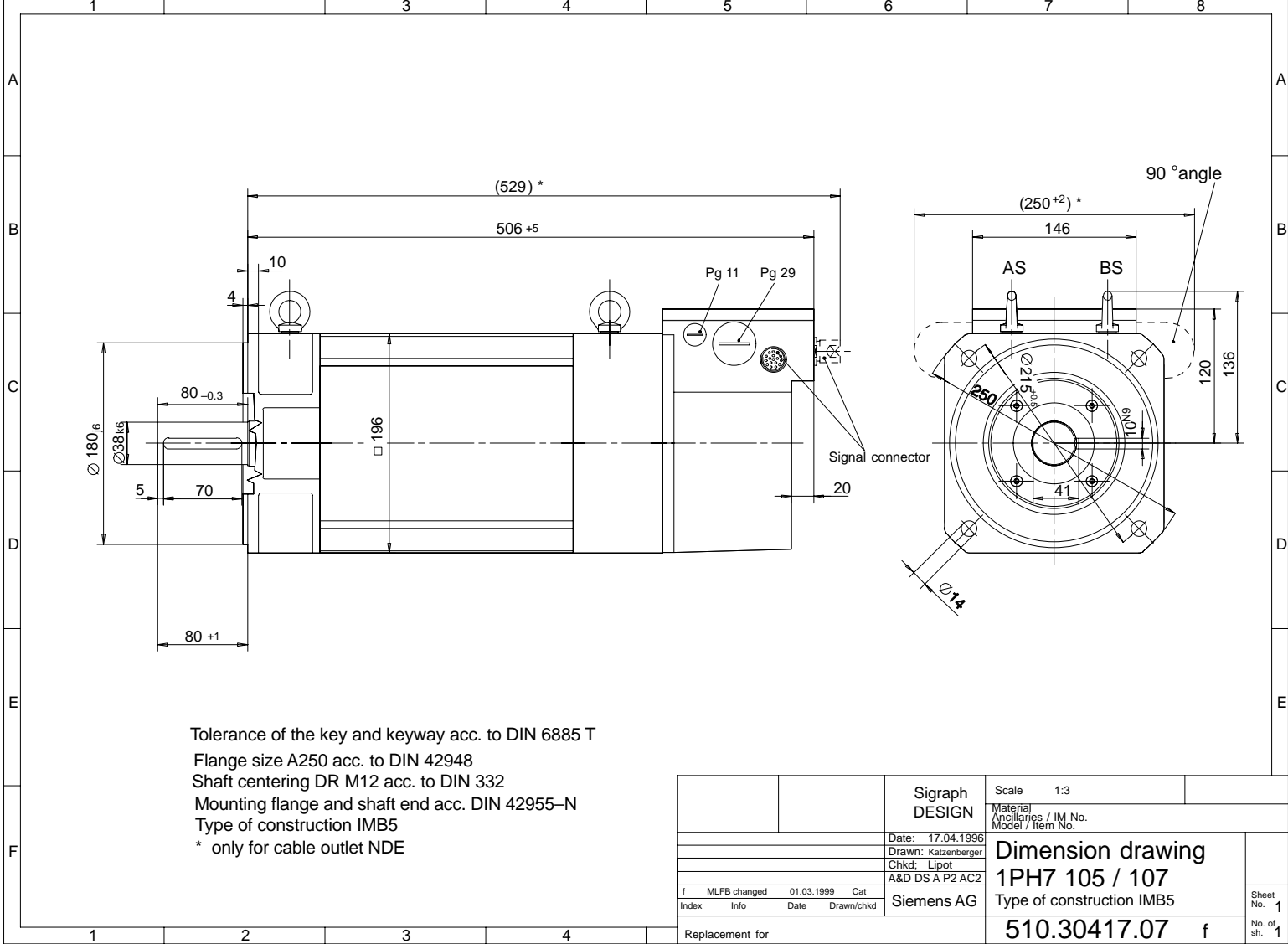


Fig. 4-6 1PH7 105/107, type of construction IMB5

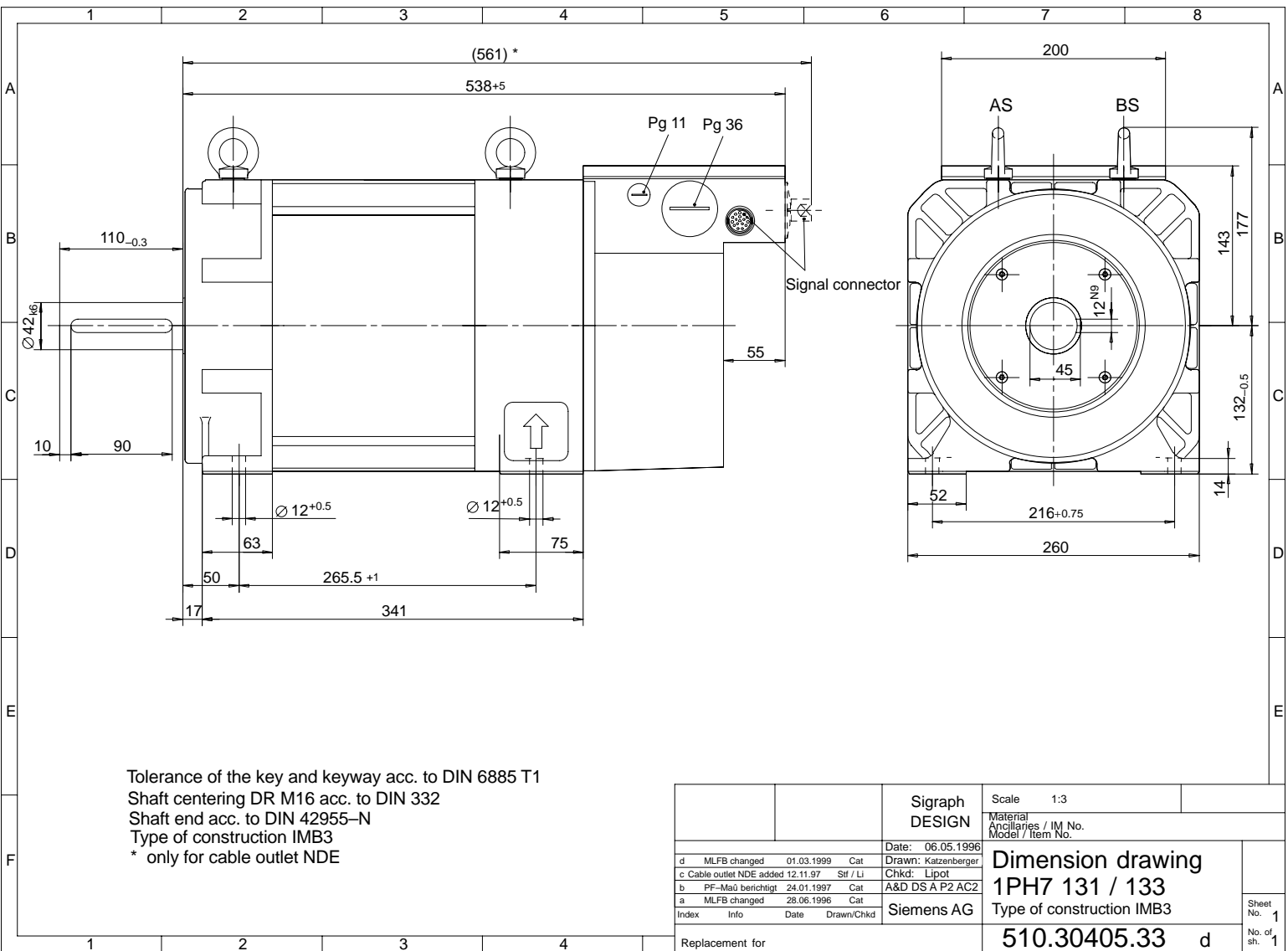


Fig. 4-7 1PH7 131/133, type of construction IMB3

1PH7

09.00

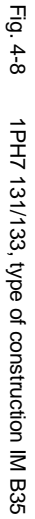


Fig. 4-8 1PH7 131/133, type of construction IM B35

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 | | | |
| | | | | Date 14.11.1997 | | Material Ancillaries / IM No. | | | |
| | | | | Drawn Stumpf | | Dimension drawing 1PH7 131 / 133 | | | |
| | | | | Chkd Lipot | | | | | |
| | | | | A&D DS A P2 AC2 | | | | | |
| a MLFB changed | | 01.03.1999 | | Cat | | Type of construction IMB35 | | Sheet No. 1 | |
| Index Info | | Date | | Drawn/chkd | | Siemens AG | | No. of sh. 1 | |
| Replacement for | | | | | | 510.30407.33 a | | | |

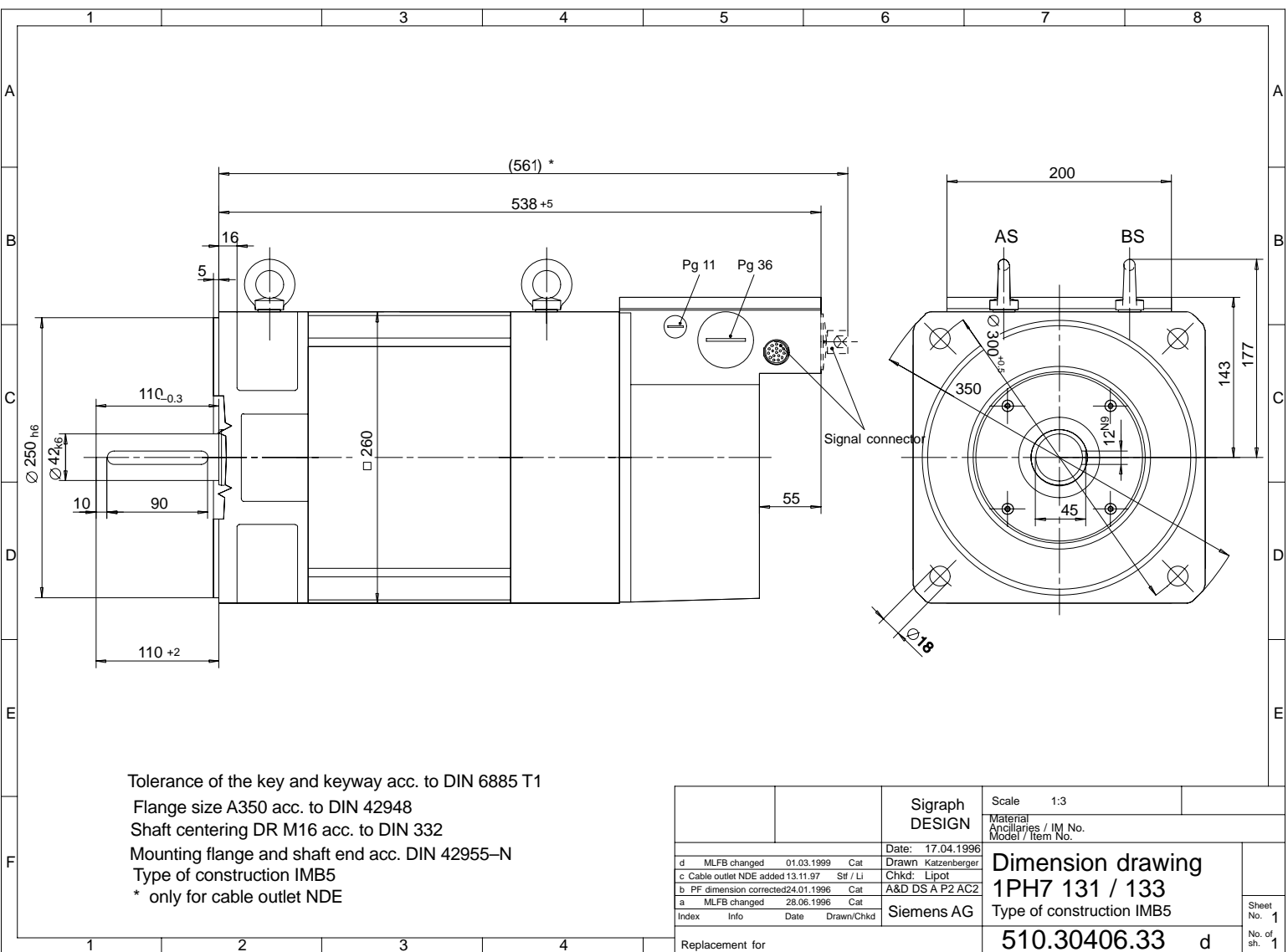


Fig. 4-9 1PH7 131/133, type of construction IM B5

1PH7

4 Dimension Drawings

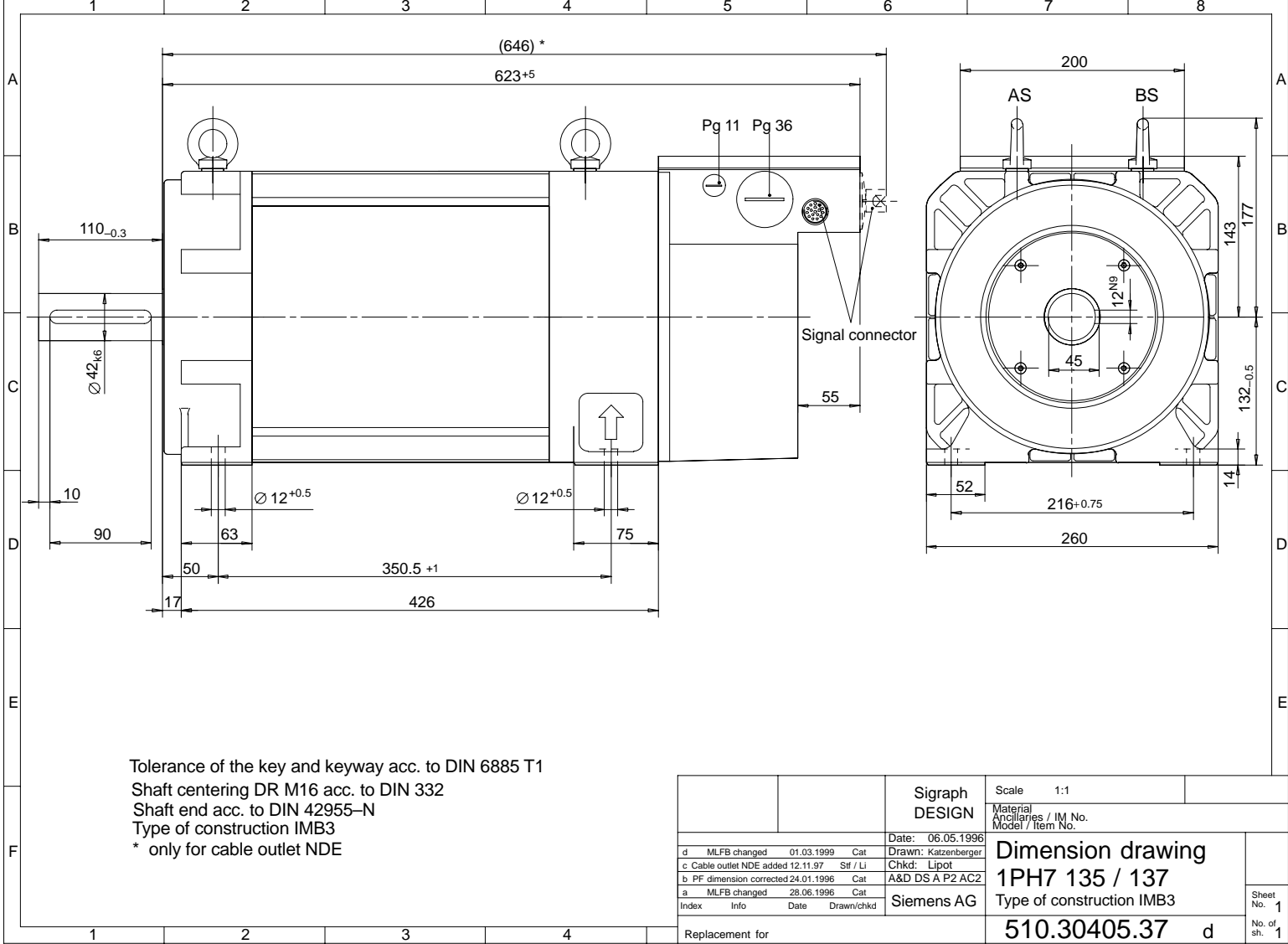


Fig. 4-10 1PH7 135/137, type of construction IM B3

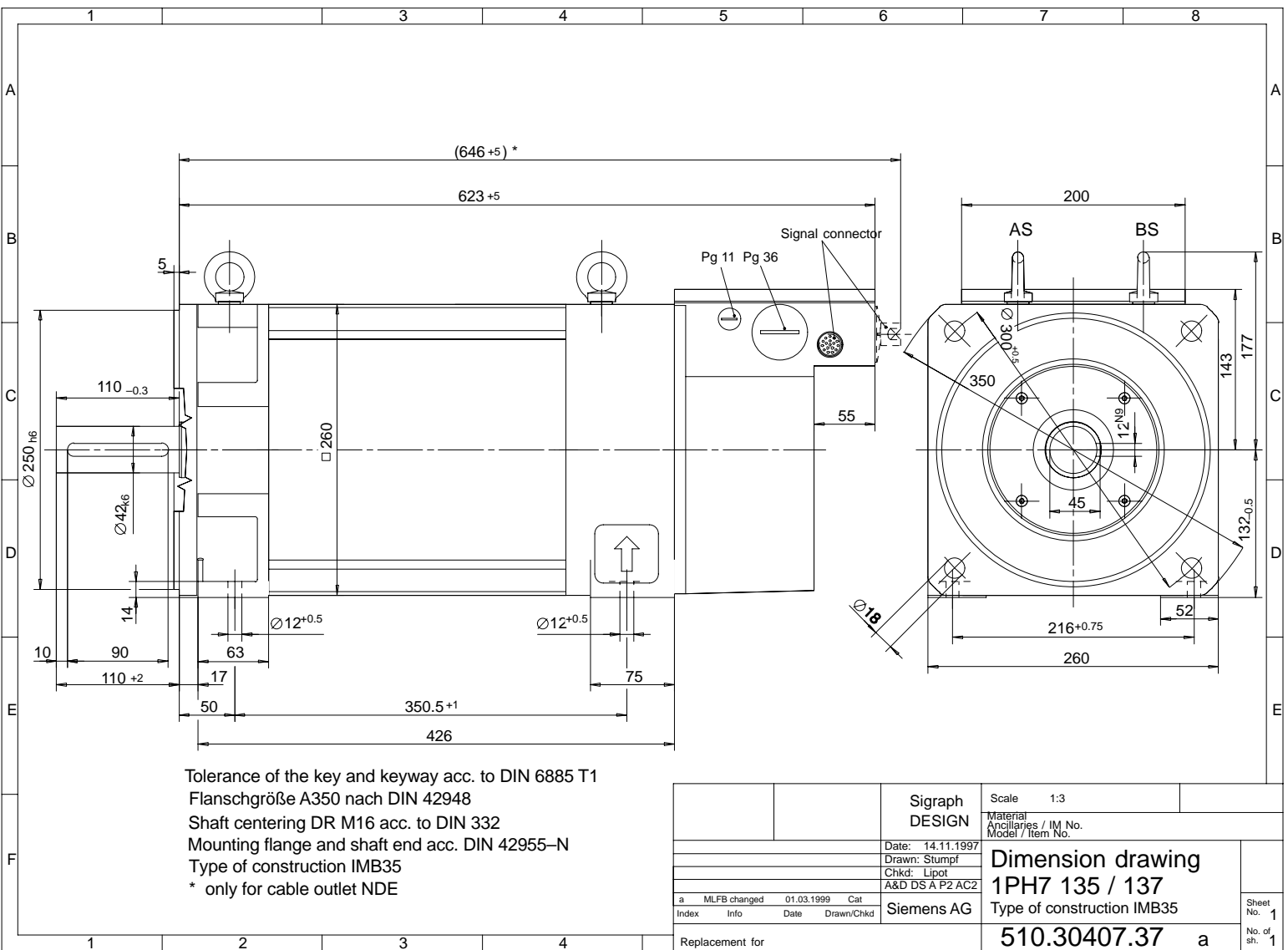


Fig. 4-11 1PH7 135/137, type of construction IM B35

1PH7

09.00

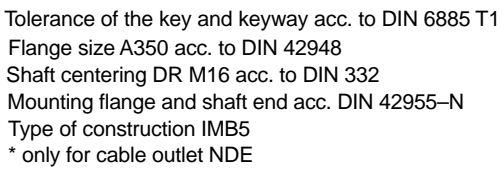


Fig. 4-12 1PH7 135/137, type of construction IM B5

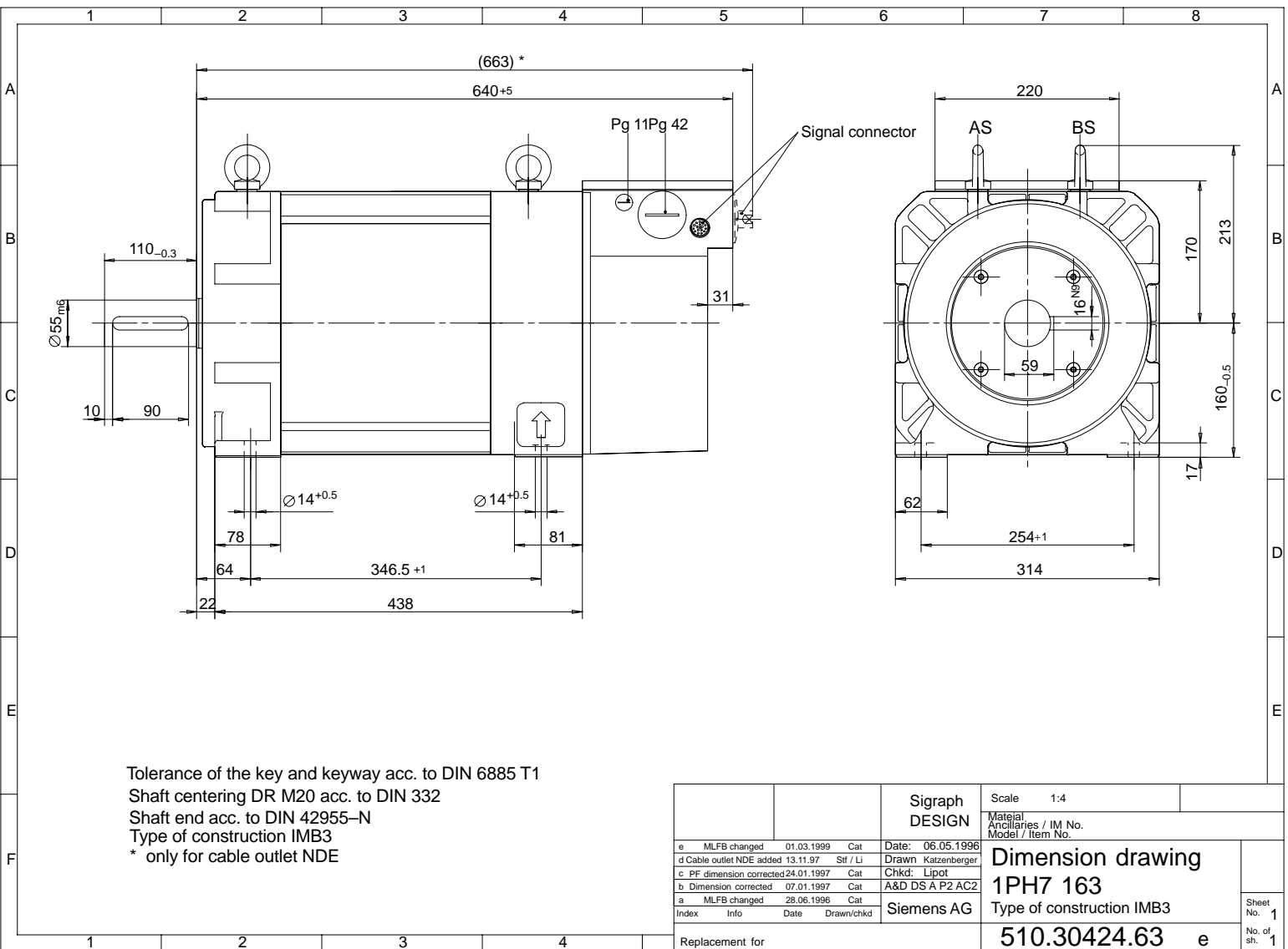


Fig. 4-13 1PH7 163, type of construction IM B3

1PH7

09.00

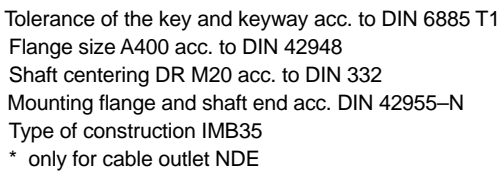


Fig. 4-14 1PH7 163, type of construction IM B35

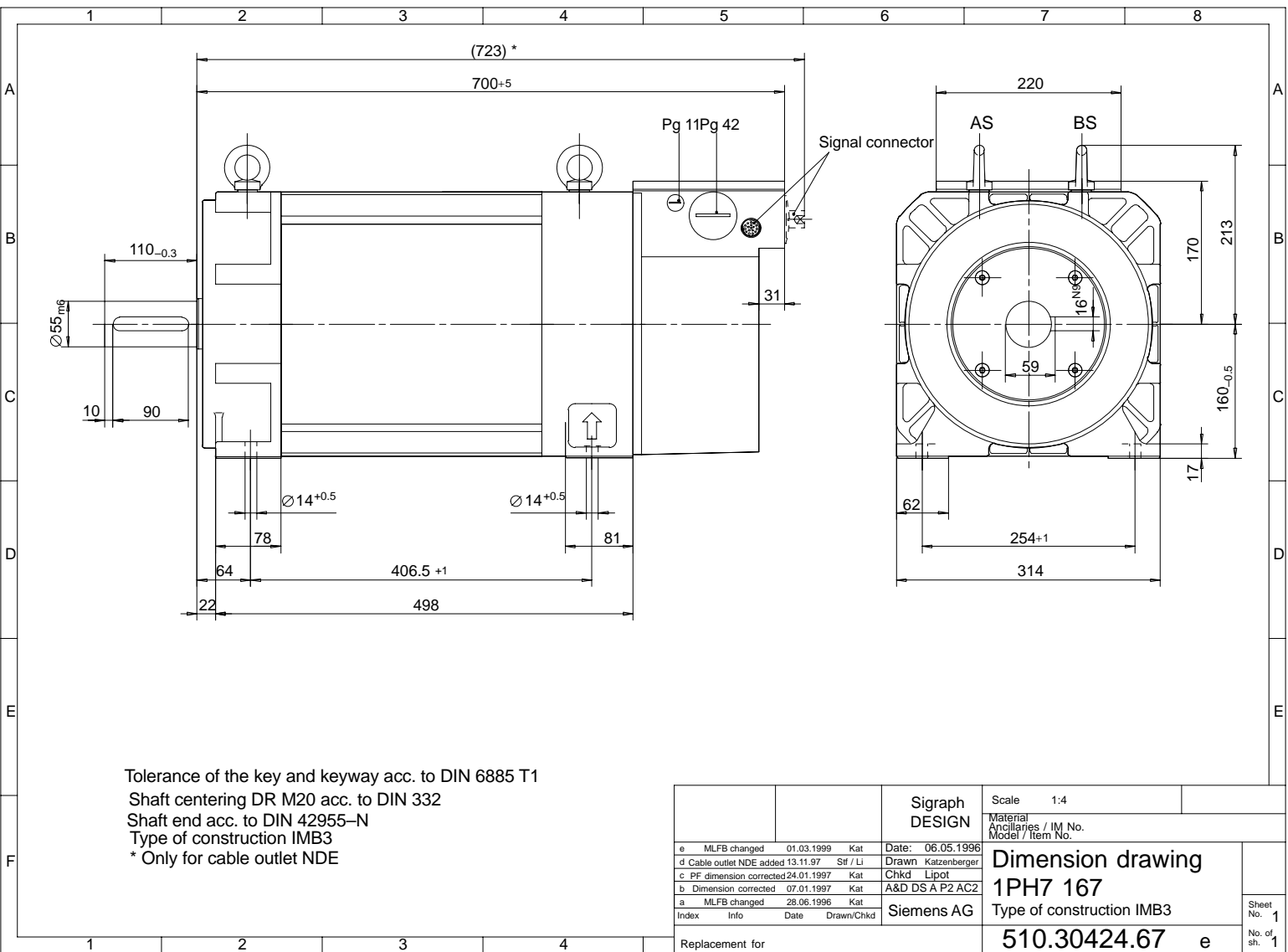


Fig. 4-15 1PH7 167, type of construction IM B3

1PH7

4 Dimension Drawings

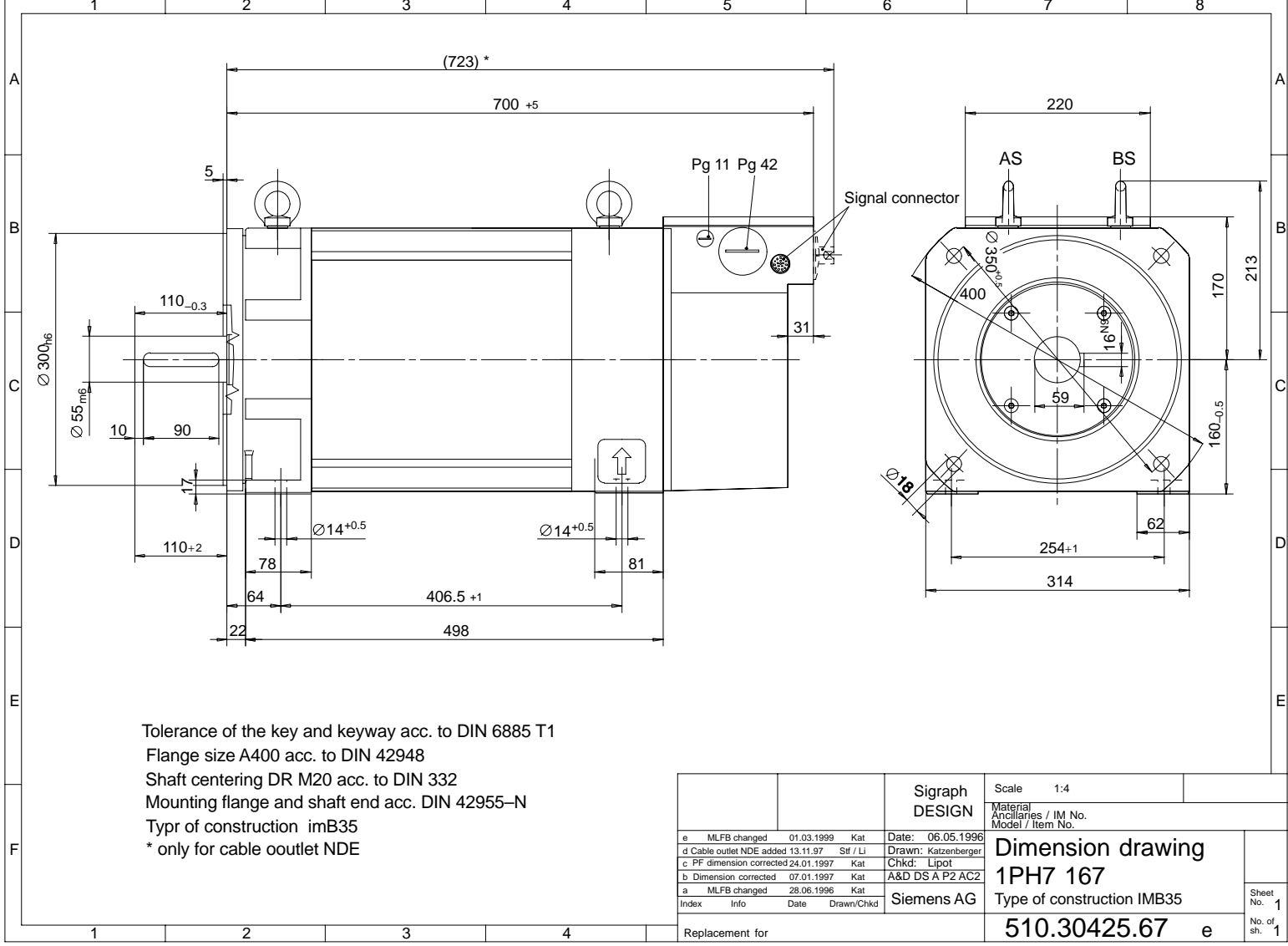
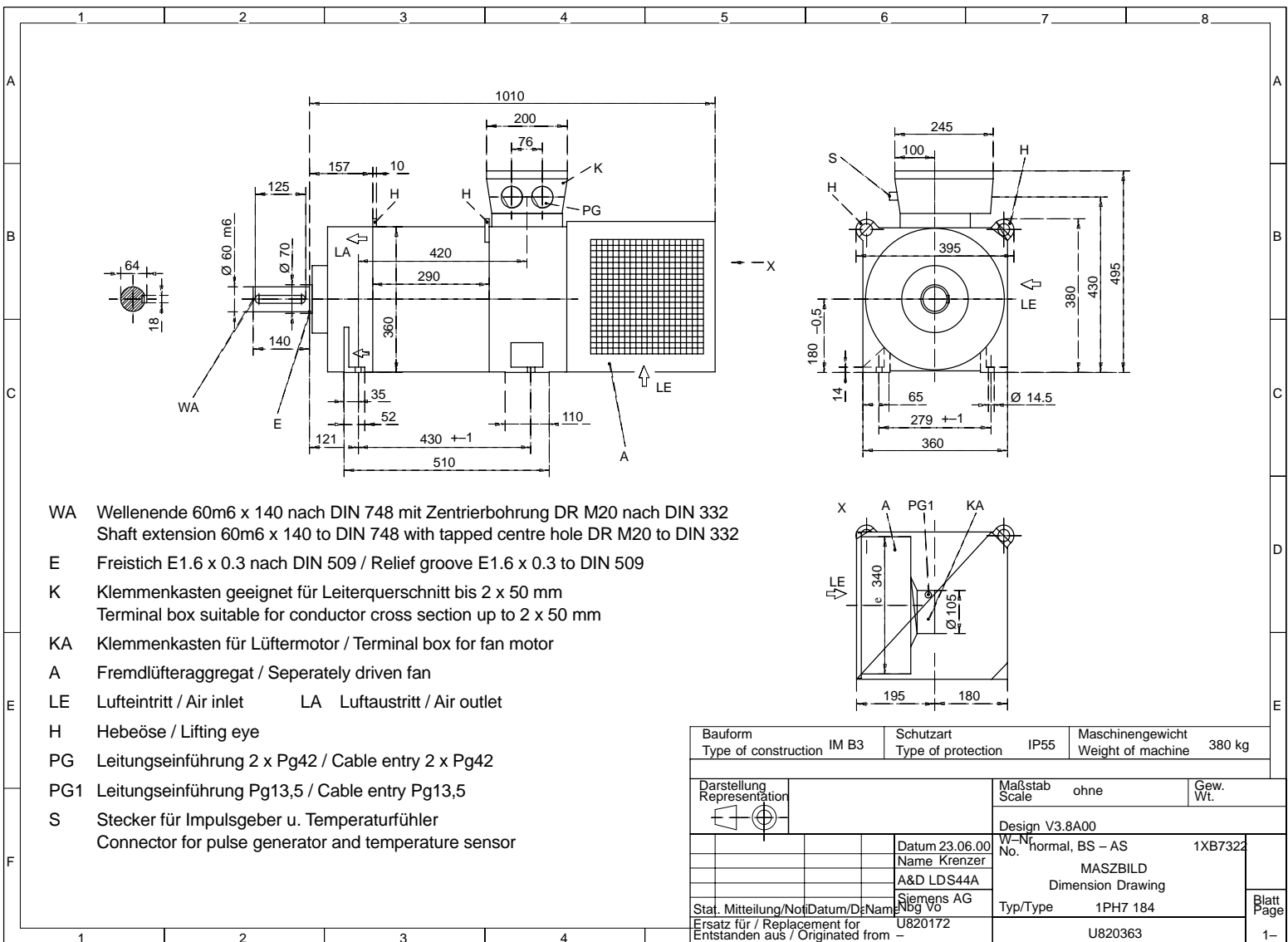


Fig. 4-16 1PH7 167, type of construction IM B35



1PH7

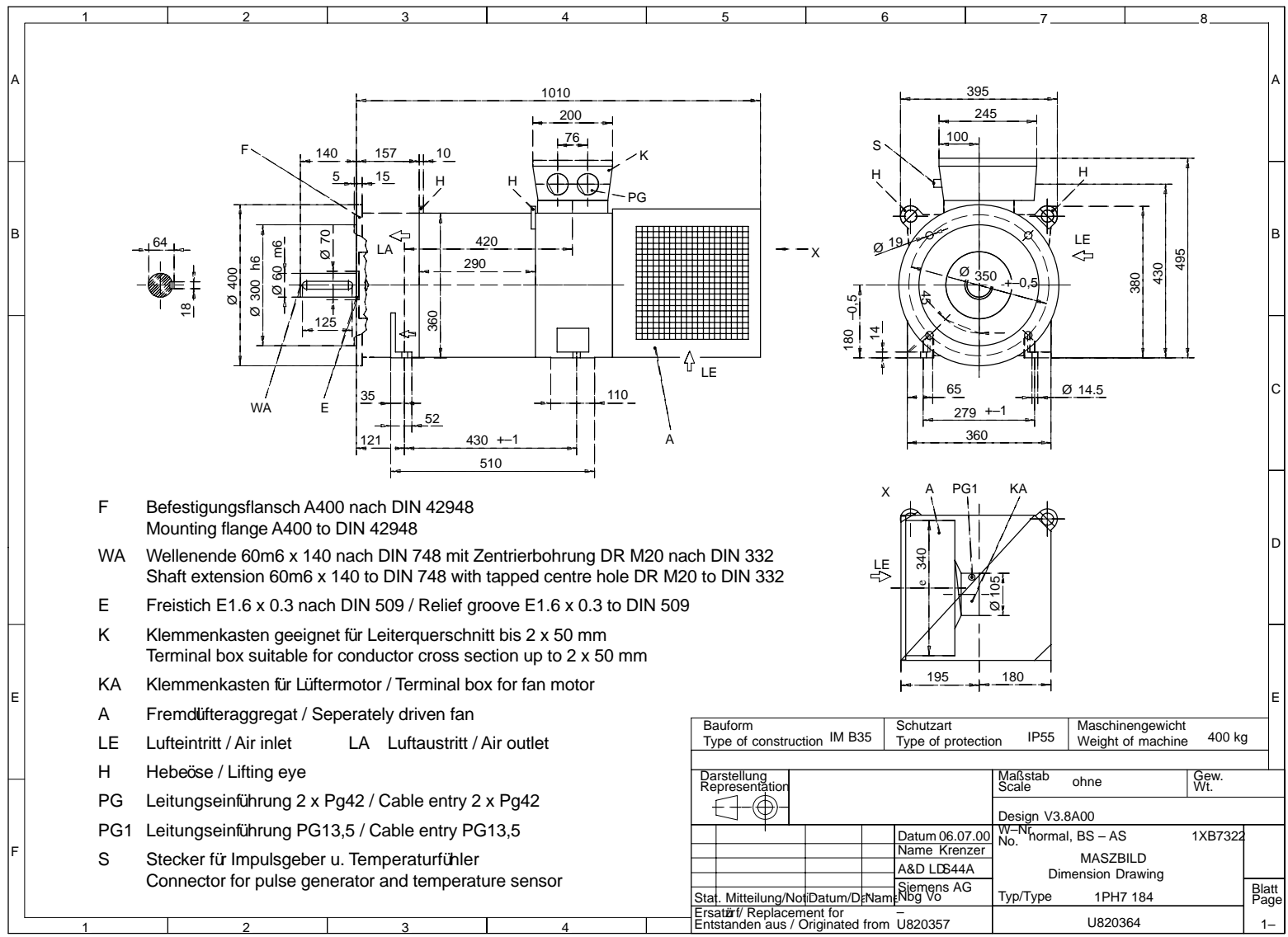
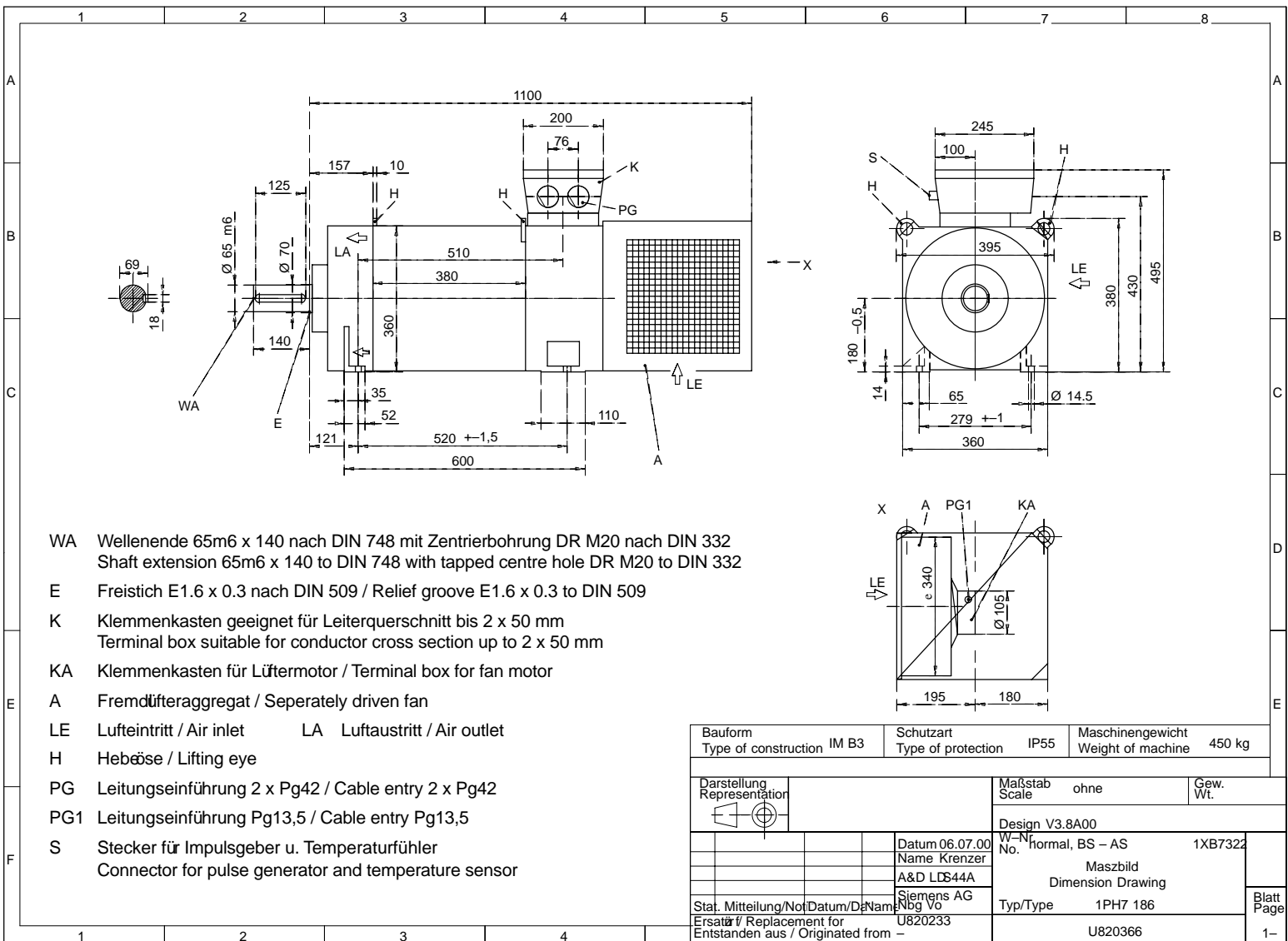


Fig. 4-18 1PH7 184, type of construction IM B35, air flow direction (NDE → DE)



1PH7

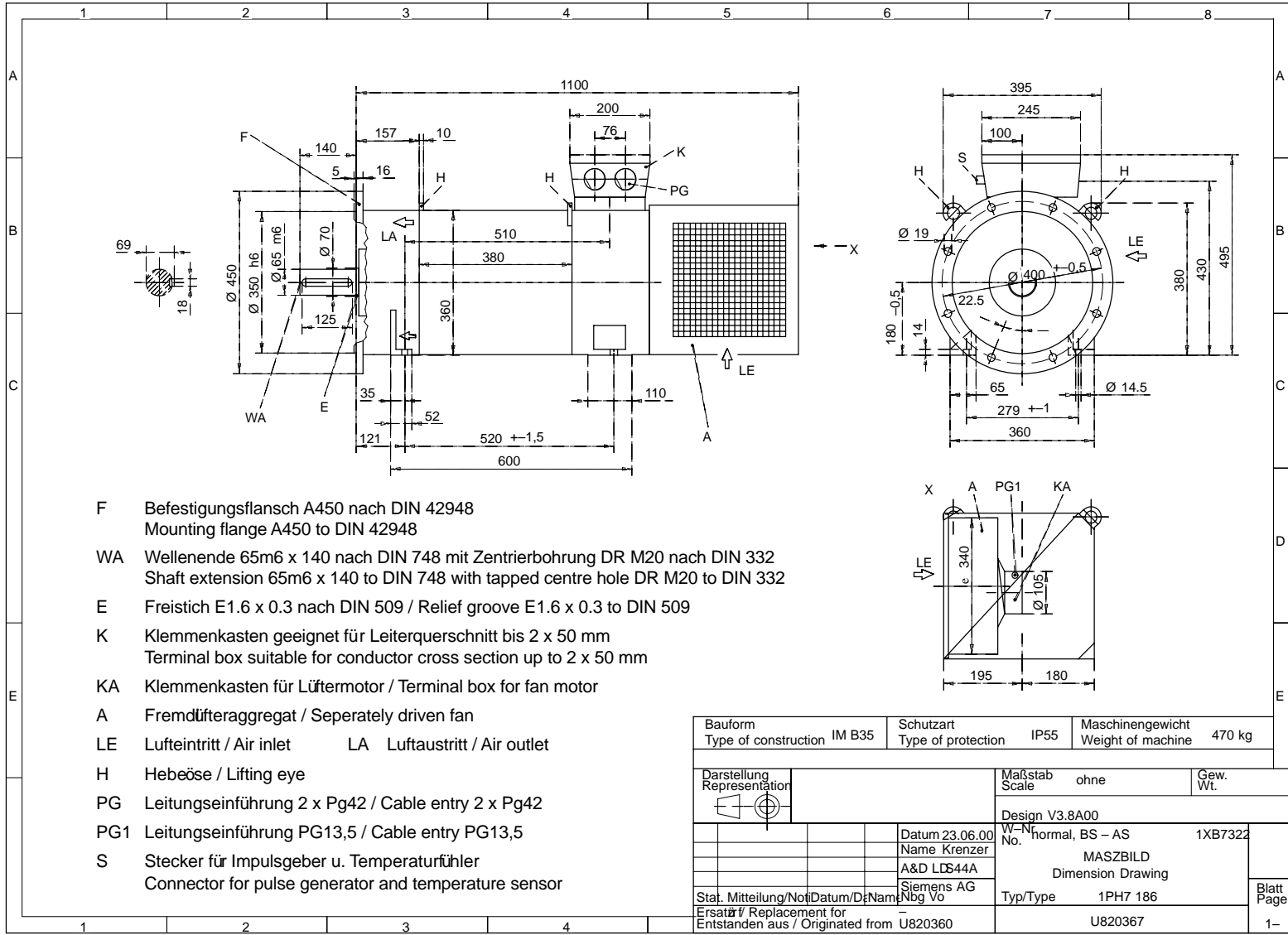
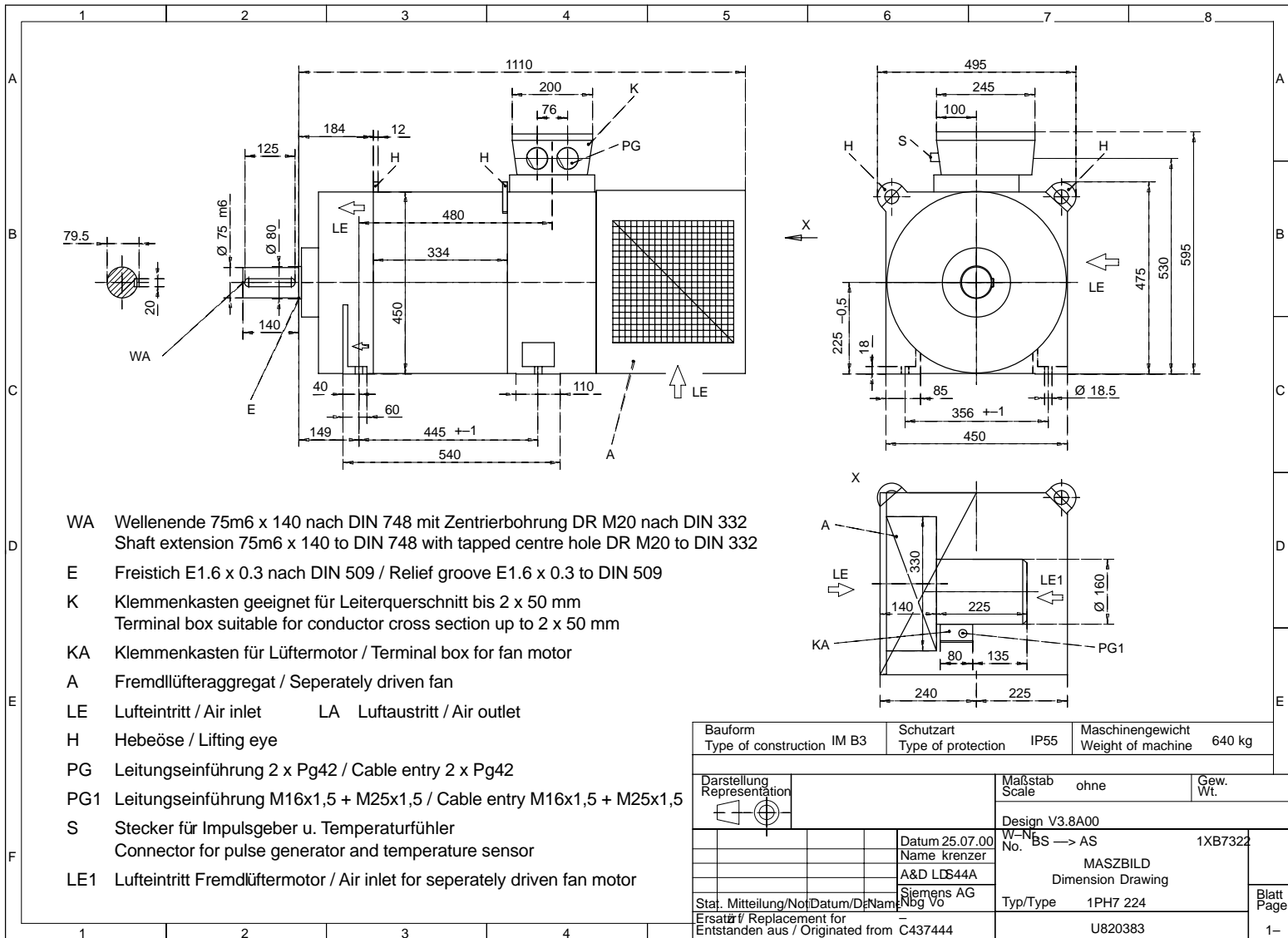


Fig. 4-20 1PH7 186, type of construction IM B35, air flow direction (NDE → DE)



1PH7

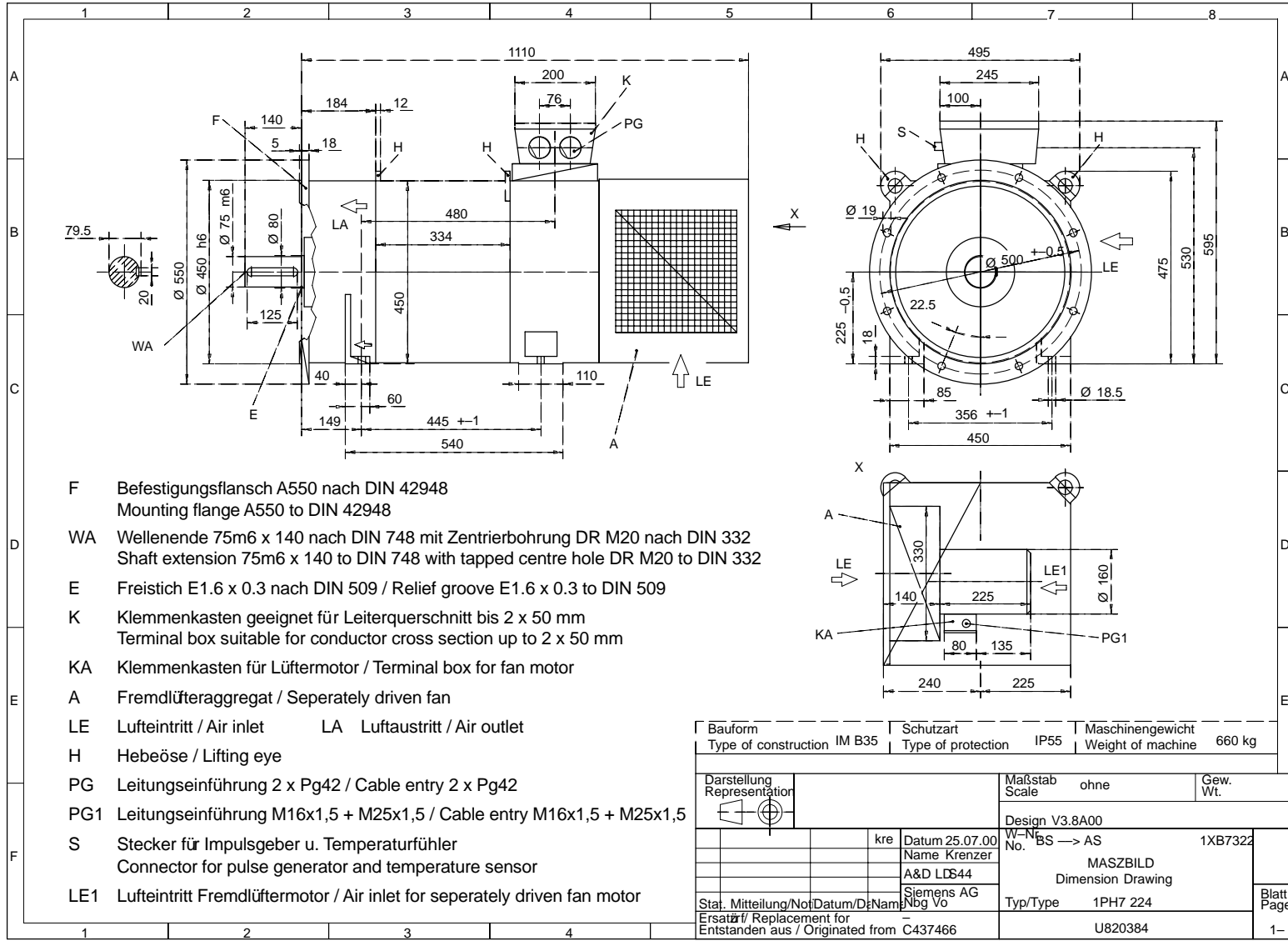


Fig. 4-22 1PH7 224, type of construction IM B35, air flow direction (NDE -> DE)



4 Dimension Drawings

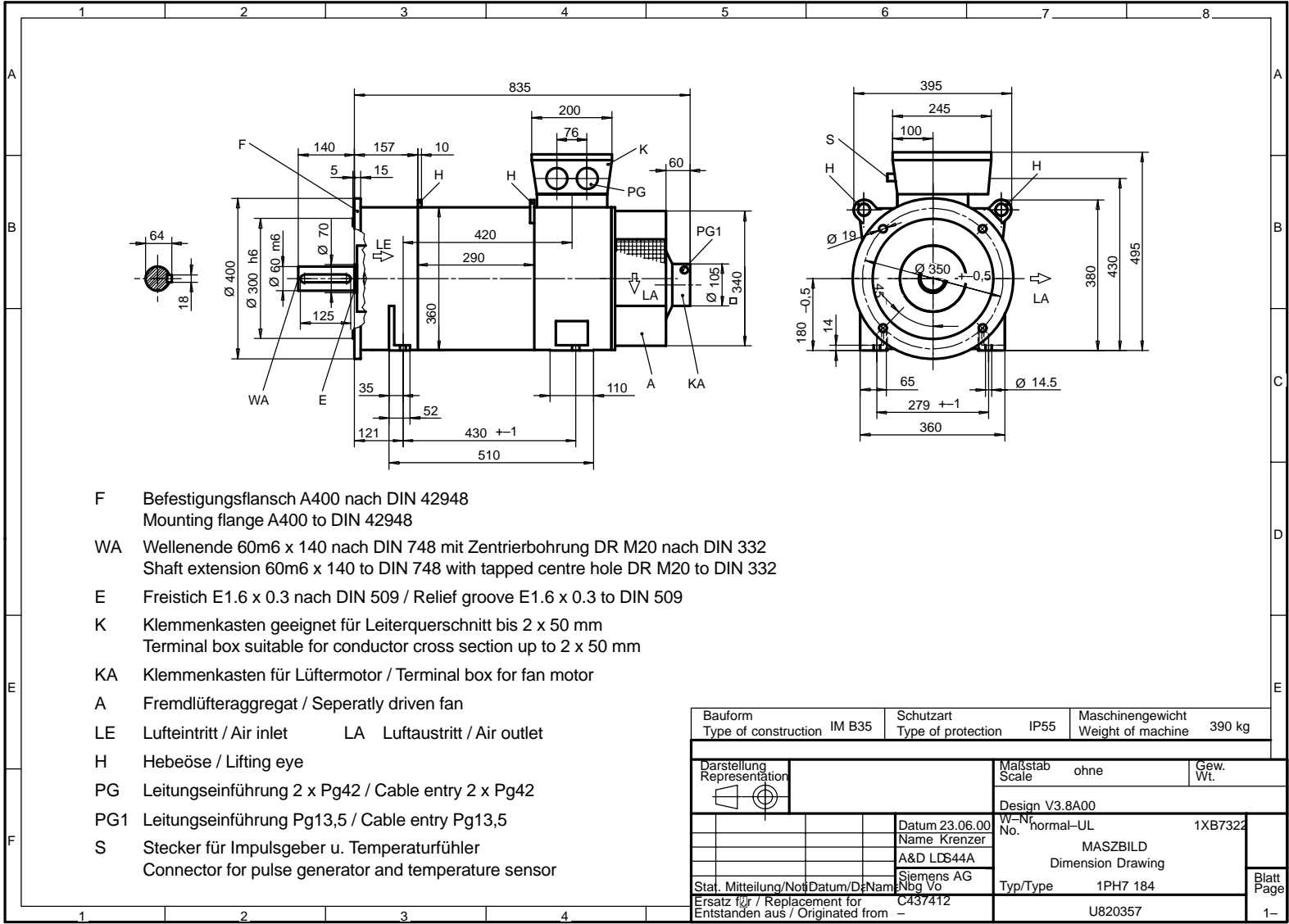
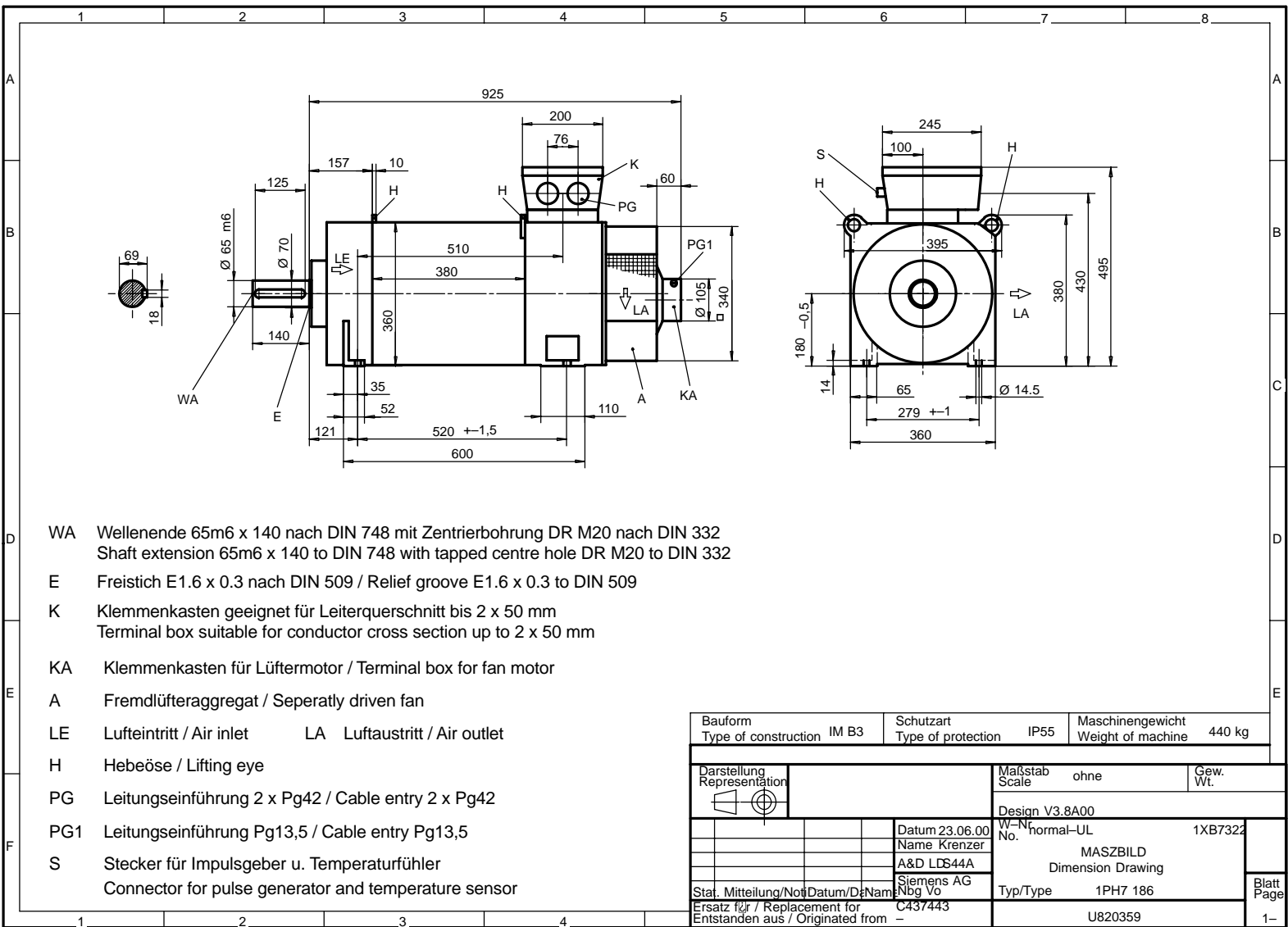


Fig. 4-24 1PH7 184, type of construction IM B35, air flow direction (DE → NDE)

Fig. 4-25 1PH7 186, type of construction IM B3, air flow direction (DE \rightarrow NDE)

1PH7

4 Dimension Drawings

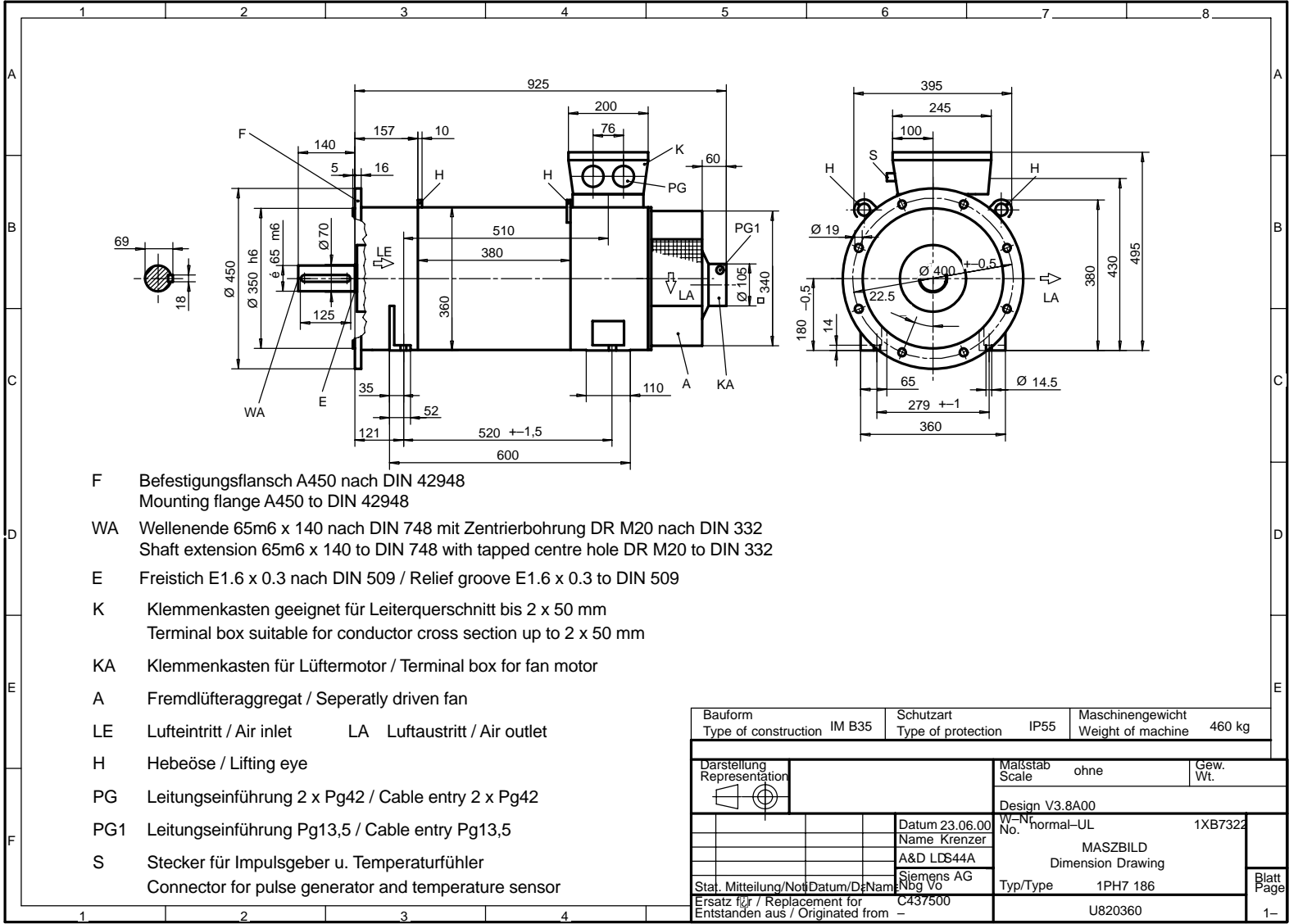


Fig. 4-26 1PH7 186, type of construction IM B35, air flow direction (DE → NDE)



11.00

■



5

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Encoder Systems (GE)

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GE

[illegible]

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 $4 \cdot I_{0\ 60\ K}$.

For servomotors (shaft heights 36 and 48), the temperature sensor only protects up to $2 \cdot I_{0\ 60\ K}$.

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.

GE

1.1 Motor 1FT5

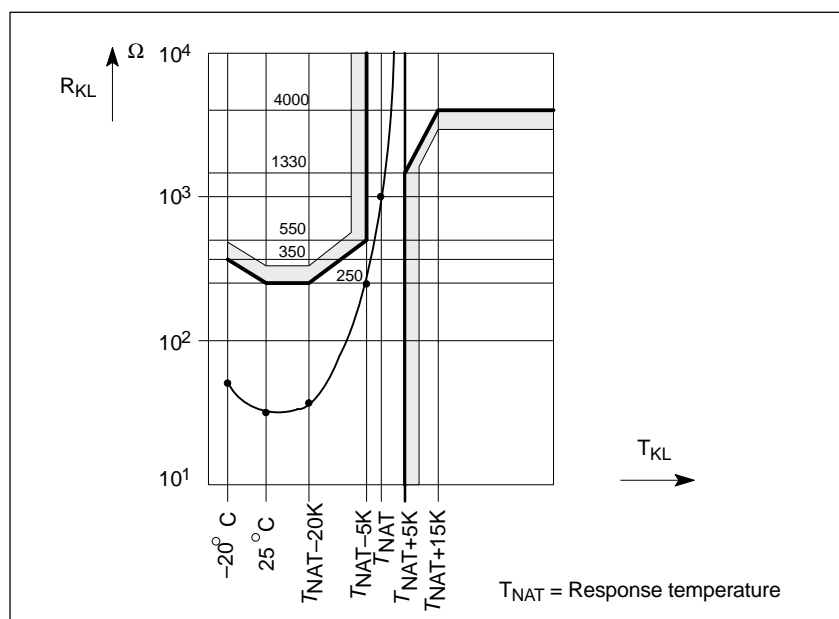


Fig. 1-1 Temperature characteristic

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) |

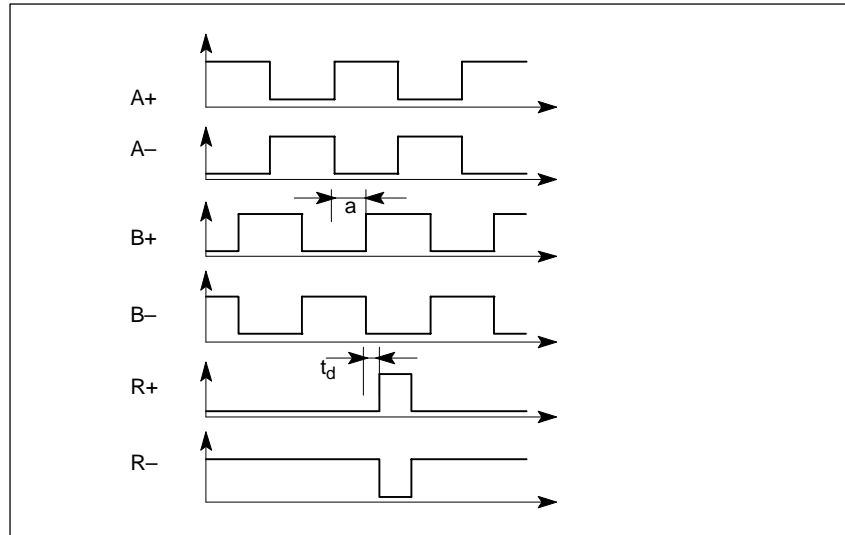


Fig. 1-2 Signal characteristics for a clockwise direction or rotation

The servomotors may only be utilized for a temperature rise of $\Delta T = 60 \text{ K}$.

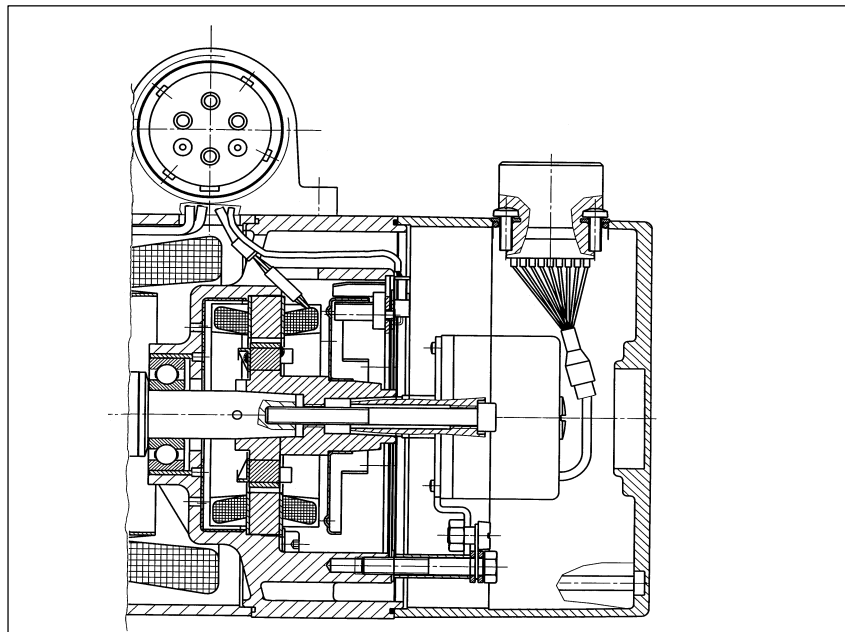


Fig. 1-3 1FT5 servomotors with integrated ROD 320.005 pulse encoder

GE

Table 1-2 Technical data, ROD 320.005 pulse encoder

| | |
|--|--|
| Mechanical speed | Max. 8500 RPM |
| Electrical speed | Dependent on the pulse No. (refer below) |
| Operating voltage | 5 V DC ±5 % |
| Current drain | ≤ 150 mA (without load) |
| Frequency range | 0 to 300 kHz |
| Edge clearance | a ≥ 420 ns |
| Delay | t _d ≤ 50 ns |
| U _{a0} zu U _{a1} and U _{a2} | I _{high} ≤ DC 20 mA |
| Output load capability | I _{low} ≤ DC 20 mA; C _{Load} ≤ 1000 pF |
| Short-circuit strength | Briefly, all outputs to 0 V; 1 output continuously at ≤ 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 |

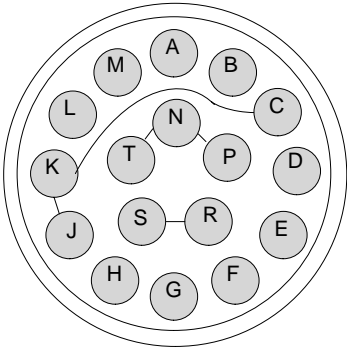
Maximum electrical speed:

$$n_{\max} = \frac{f_g * 10^3 * 60}{\text{Pulse No.}} \text{ [RPM]}$$

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 | 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° electrical 1 zero pulse per revolution |

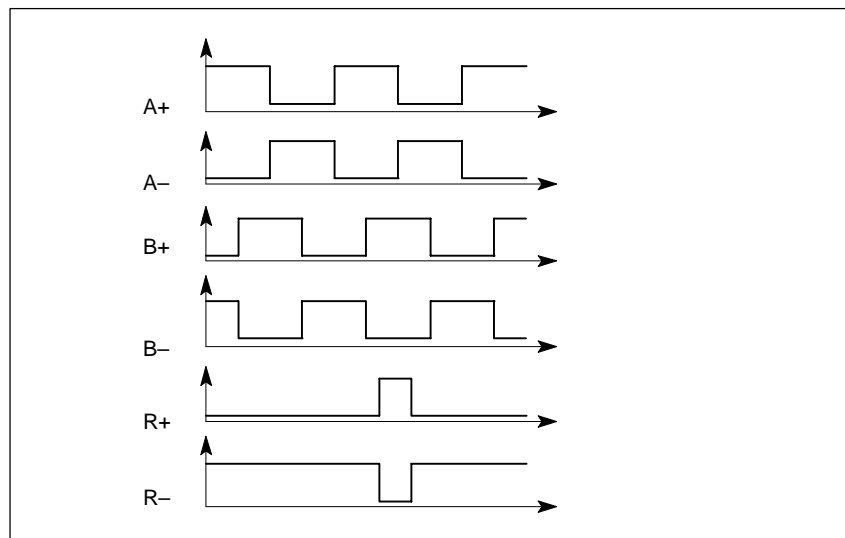


Fig. 1-4 Signal characteristics for a clockwise direction of rotation

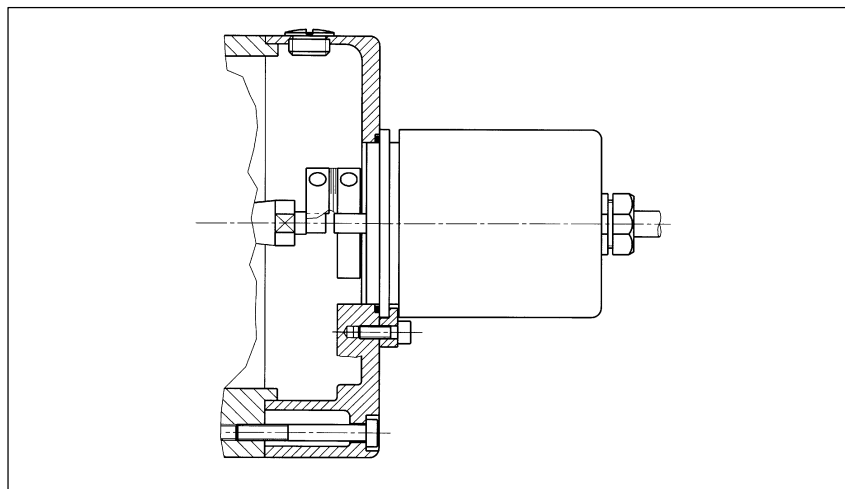


Fig. 1-5 1FT5 servomotor with mounted rotary encoder

GE

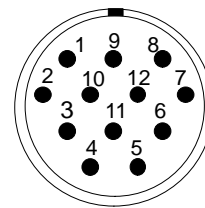
1.1 Motor 1FT5

Table 1-3 Technical data, ROD426 pulse encoder

| | |
|---|---|
| Speed Operating voltage Current drain Frequency range | Max. 12 000 RPM 5 V DC $\pm 5\%$ ≤ 150 mA (without load) 0 kHz to 300 kHz |
| Signal level Minimum edge clearance V_{a1} to V_{a2} Electrical resolution | RS 422 (TTL) $\geq 0.45\mu\text{s}$ at 300kHz 500 to 5000 pulses/revolution (corresponds to the resolution of a pulse disk); with external multiplication, up to 20 000 pulses/revolution |
| Degree of protection (acc. to DIN 40050) | <ul style="list-style-type: none"> without shaft input: IP 67 with shaft input: IP 64 |
| Operating temperature Storage temperature | $-30\text{ }^{\circ}\text{C}$ to $+100\text{ }^{\circ}\text{C}$ $-30\text{ }^{\circ}\text{C}$ to $+80\text{ }^{\circ}\text{C}$ |
| 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 | $0.0175 \cdot 10^{-4}\text{ kgm}^2$ |
| Moment of inertia of the encoder | $1.45 \cdot 10^{-6}\text{ kgm}^2$ |
| 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 | $U_{as}^{1)}$ |
| 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.

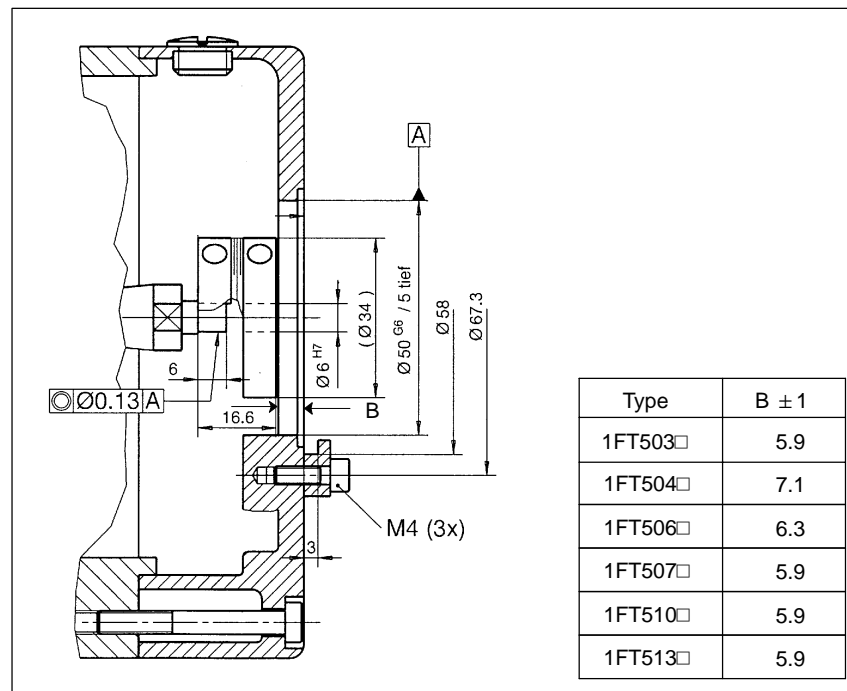


Fig. 1-6 Mounting absolute angle encoders with standard pulse encoder flange onto motors 1FT503□ to 1FT513□

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 $4 \cdot I_{0\ 60K}$ (\geq shaft height 63) and speed ≤ 0 .

For servomotors (shaft heights 28, 36 and 48) the temperature sensor only protects up to $2 \cdot I_{0\ 60K}$ 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.

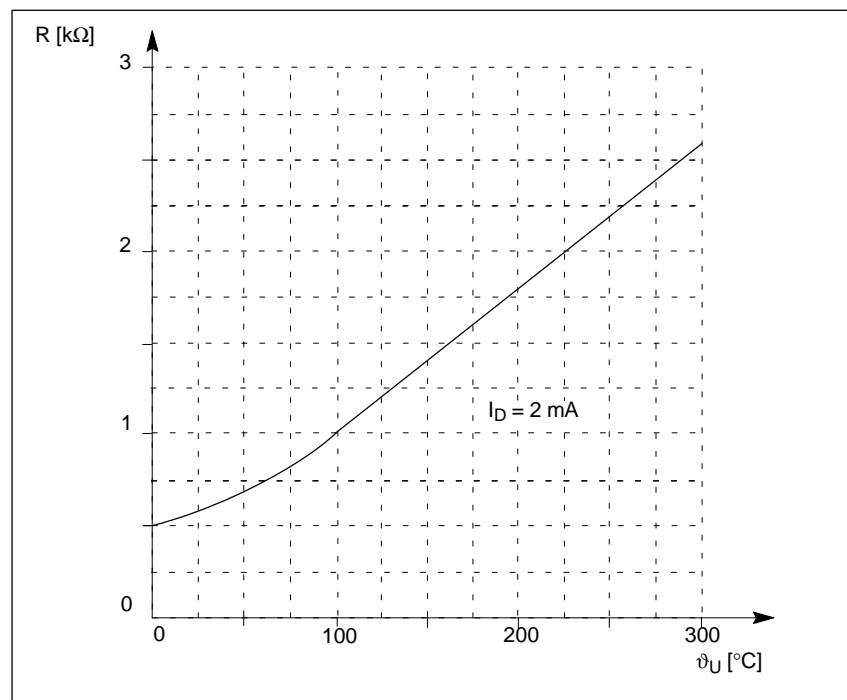


Fig. 1-7 Temperature characteristic

1.2.2 Integrated encoders

Incremental encoders 1 V_{pp}

| | |
|-----------------|--|
| Version: | Optical encoder system |
| Coupling: | On the NDE (integrated in the motor) |
| Application: | <ul style="list-style-type: none"> • 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):

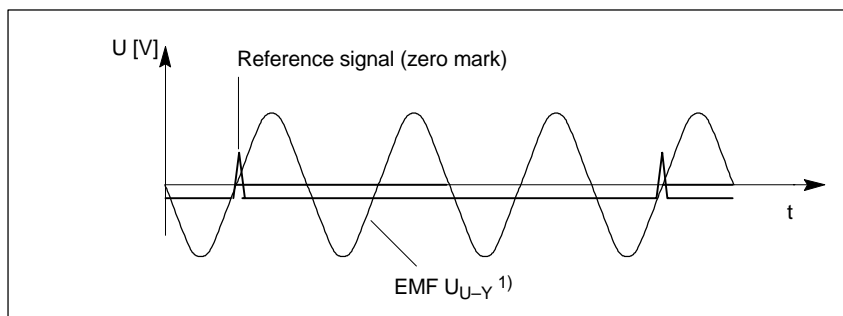


Fig. 1-8 Signal characteristics of the motor EMF and reference signal

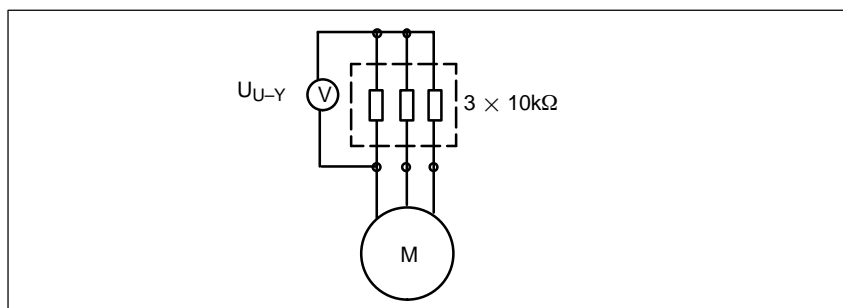


Fig. 1-9 A recommendation as to how an artificial neutral point can be created

1) V_{U-Y} : Phase voltage of phase U with respect to the artificial neutral point (refer to Fig. 1-9)

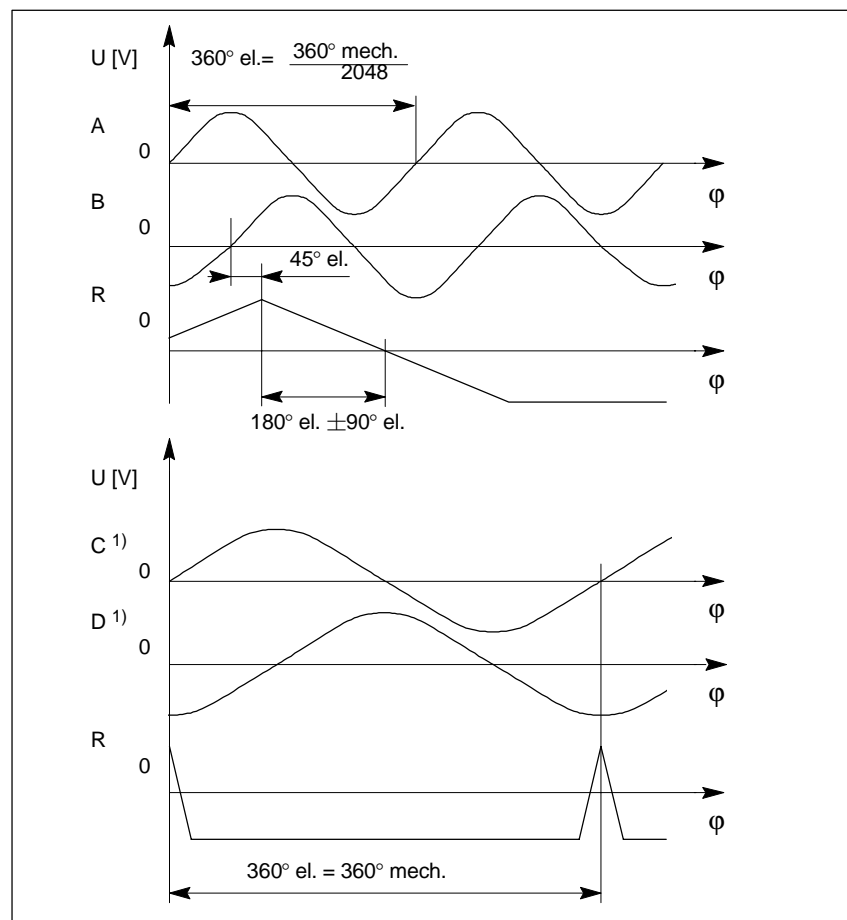


Fig. 1-10 Signal characteristics and assignment for a positive direction of rotation (clockwise direction of rotation when viewing the drive end); C–D signals only in combination with 1FT/1FK

Table 1-4 Technical data, ERN1381/1387 incremental encoder

| | |
|------------------------|---|
| Mech. limiting speed | 12 000 RPM |
| Operating voltage | 5V ± 5% |
| Current drain | max. 300 mA |
| Pulse number | 2048 |
| Incremental signals | 1 V _{pp} |
| Accuracy | ±40" |
| Vibration immunity | |
| Vibration (55–2000 Hz) | 100 m/s ² acc. to DIN IEC 68–2–6 |
| Shock (10 ms) | 1000 m/s ² acc. to DIN IEC 68–2–27 |
| Operating temperature | –15 °C to +120 °C |
| Storage temperature | –20 °C to +80 °C |

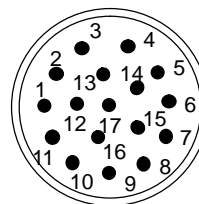
GE

1) not for ERN 1381

1.2 1FT6, 1FK6, 1PH motors

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: | <ul style="list-style-type: none"> • 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.

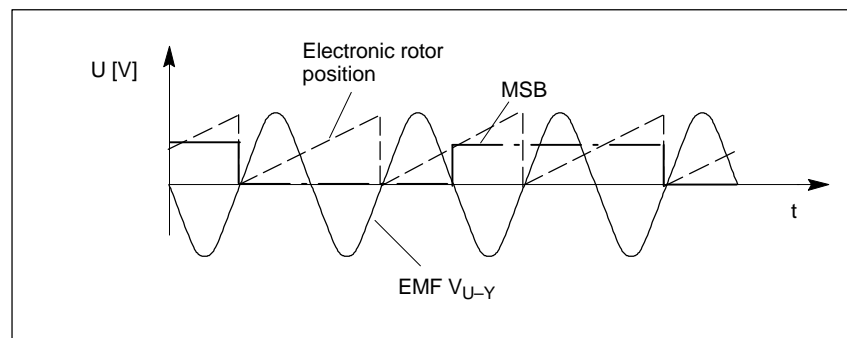


Fig. 1-11 Signal characteristics and assignment for a positive direction of rotation (clockwise of rotation when viewing the DE)

1.2 1FT6, 1FK6, 1PH motors

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

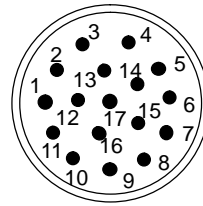
| | |
|--------------------------|--|
| Mech. limiting speed | 12 000 RPM |
| Operating voltage | 5 V \pm 5% |
| Current drain | max. 300 mA |
| Resolution, incremental | 2048 periods per revolution (EQI: 32) |
| Resolution, absolute | 4096 revolutions; coded |
| Incremental signals | 1 Vpp |
| Serial absolute position | RS 486 |
| Accuracy | $\pm 40''$ (basic absolute value encoder $\pm 400''$) |
| Vibration immunity | |
| Vibration (55–2000 Hz) | 100 m/s ² acc. to DIN IEC 68–2–6 |
| Shock (6 ms) | 1000 m/s ² acc. to DIN IEC 68–2–27 |
| Operating temperature | –15 °C to +115 °C |
| Storage temperature | –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 |

Resolvers

| | |
|--------------|---|
| Version: | Inductive encoder system (2 and multi-pole) ²⁾ |
| Coupling: | On the NDE (integrated in the motor) |
| Application: | <ul style="list-style-type: none"> • 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)

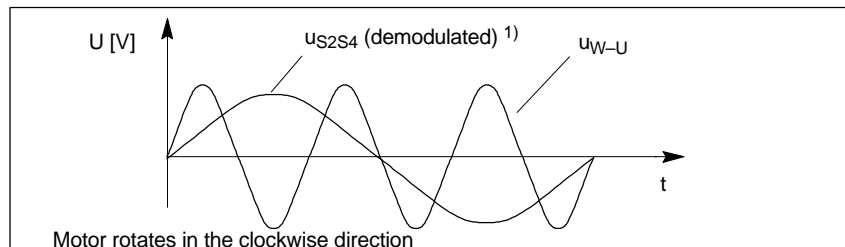


Fig. 1-12 Signal characteristics and assignment for a positive direction of rotation (clockwise direction of rotation when viewing the drive end)

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

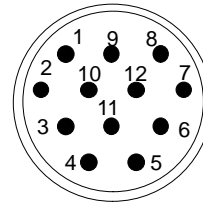
| | |
|------------------------------|-------------------------|
| Mech. limiting speed | 15 000 RPM |
| Excitation voltage | 5 V (rms) to 13 V (rms) |
| Excitation frequency | 4 kHz to 10 kHz |
| Current drain | < 80 mA (rms) |
| Angular accuracy (bandwidth) | < 14' |
| Pole No. | 2, 4 or 6 ²⁾ |
| Ratio | 0.5 |
| Vibration immunity | |
| Vibration (50–2000 Hz) | 200 m/s ² |
| Shock (11 ms) | 1000 m/s ² |
| Operating temperature | –55 °C to +155 °C |
| Storage temperature | 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



Notes

[illegible]

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 (indirect 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.

2 Toothed–Wheel Encoders SIZAG 2

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

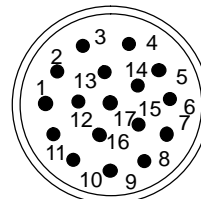
Table 2-2 Technical data

| | |
|---|---|
| Mechanical limiting speed | for $Z=512$ $n_{max.}=12000$ RPM for $Z=256$ $n_{max.}=24000$ RPM |
| Operating voltage Current drain Incremental signals Number of teeth Absolute accuracy for ideal mounting | $5V \pm 5\%$ 250 mA (typ.) 1 V _{pp} 256 or 512 $\pm 36''$ mech. for $Z=512$ teeth $\pm 72''$ 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 | $-20\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ |
| 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] | Groun d [g] | J [kgm ² · 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 |

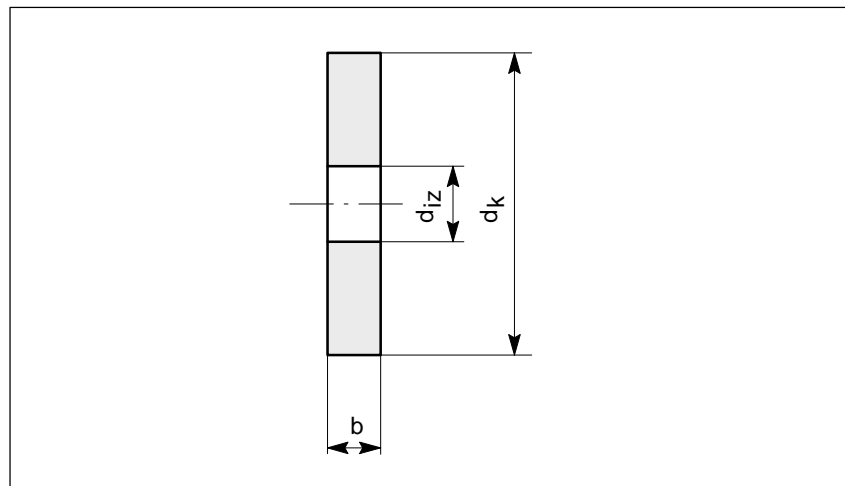


Fig. 2-1 Dimension drawing

2.2 Scanning head versions and order designations

Table 2-4 Overview, scanning head versions

| Order designation | Module m | Connecting cable |
|-------------------|----------|------------------|
| 6FX2001-8AA03 | 0.3 | 0.5 m |
| 6FX2001-8AA05 | 0.5 | 0.5 m |
| 6FX2001-8AJ03 | 0.3 | 2.0 m |
| 6FX2001-8AJ05 | 0.5 | 2.0 m |
| 6FX2001-8AK03 | 0.3 | 0.2 m |
| 6FX2001-8AK05 | 0.5 | 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).

2.4 Recommended mounting

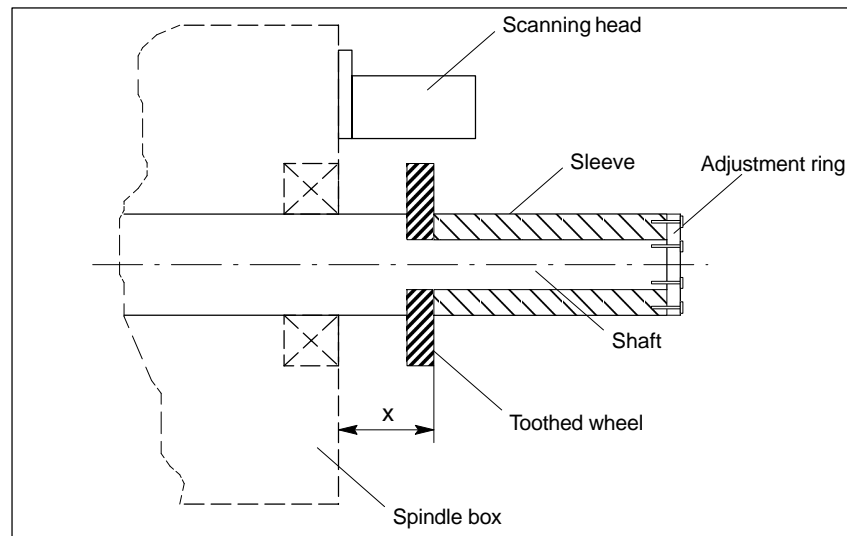


Fig. 2-2 Recommended mounting, toothed-wheel encoder

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

2.4 Recommended mounting

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 charge.

| | |
|---|---------|
| Encoder wheel with zero pulse, Sheet 1 | GE/2-30 |
| Encoder wheel with zero pulse, Sheet 2 | GE/2-31 |
| Mounting drawing, toothed-wheel encoder SIZAG 2 | GE/2-32 |
| Flange-mounted socket SIZAG 2 | GE/2-33 |

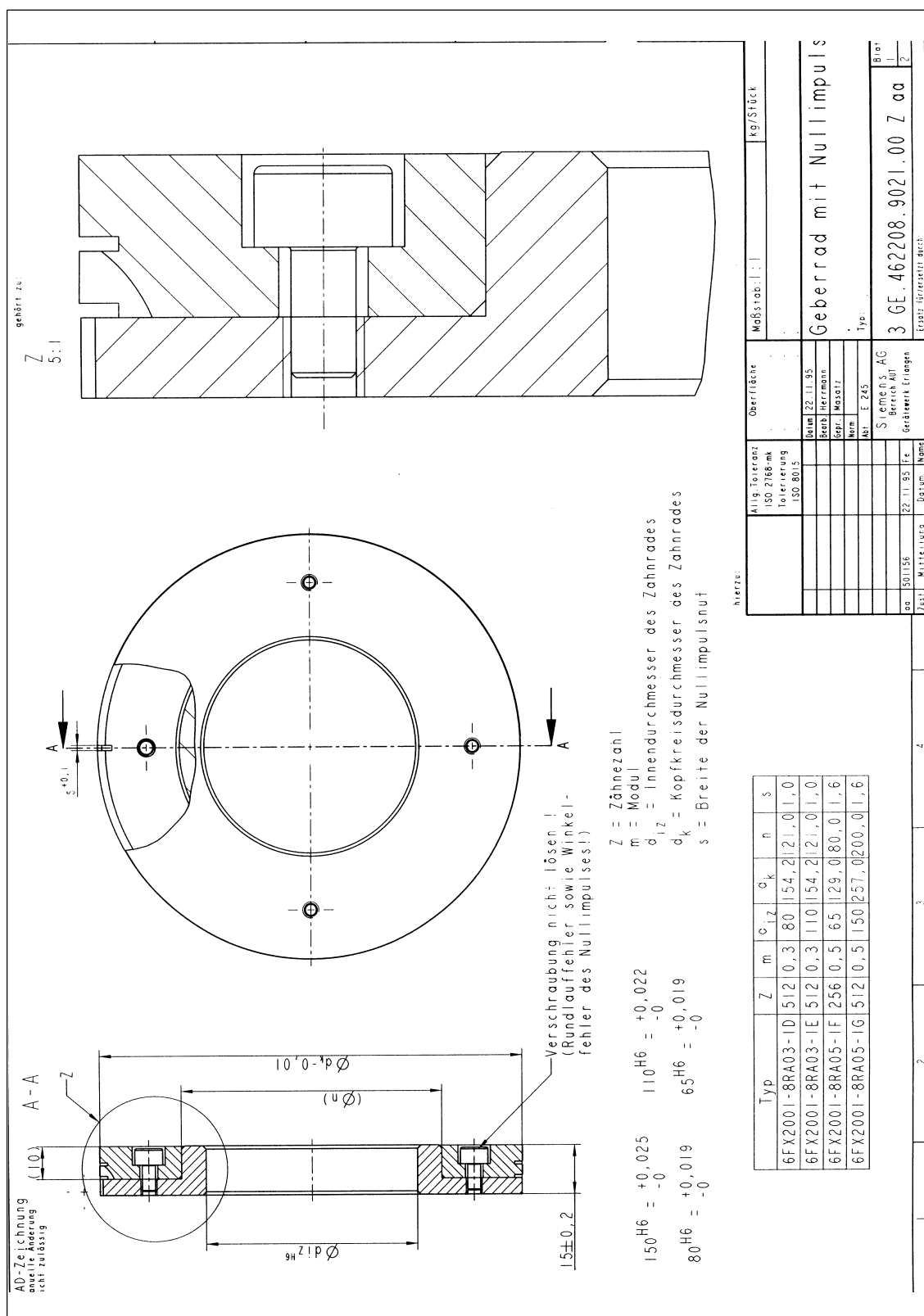


Fig. 2-3 Encoder wheel with zero pulse

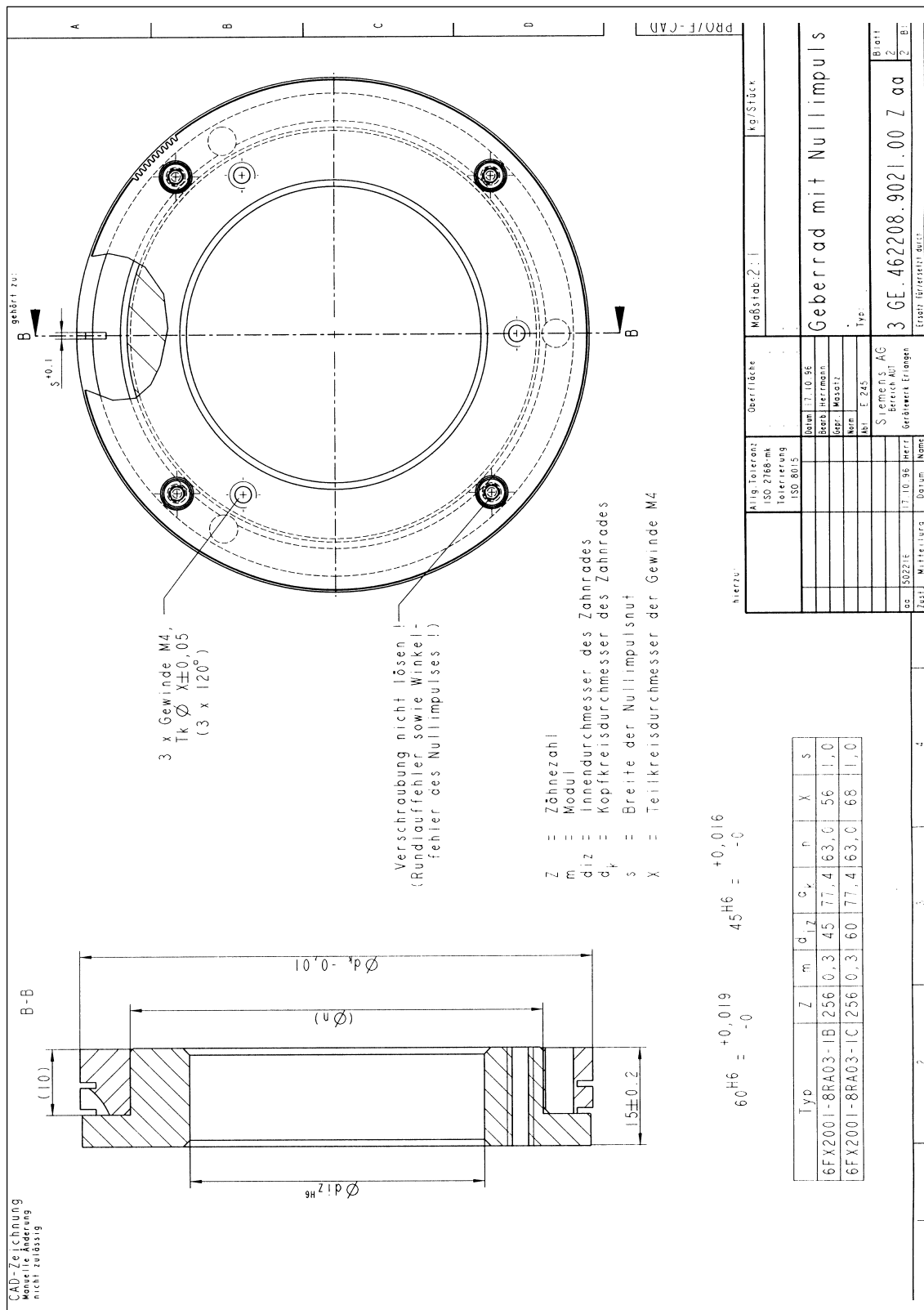


Fig. 2-4 Encoder wheel with zero pulse

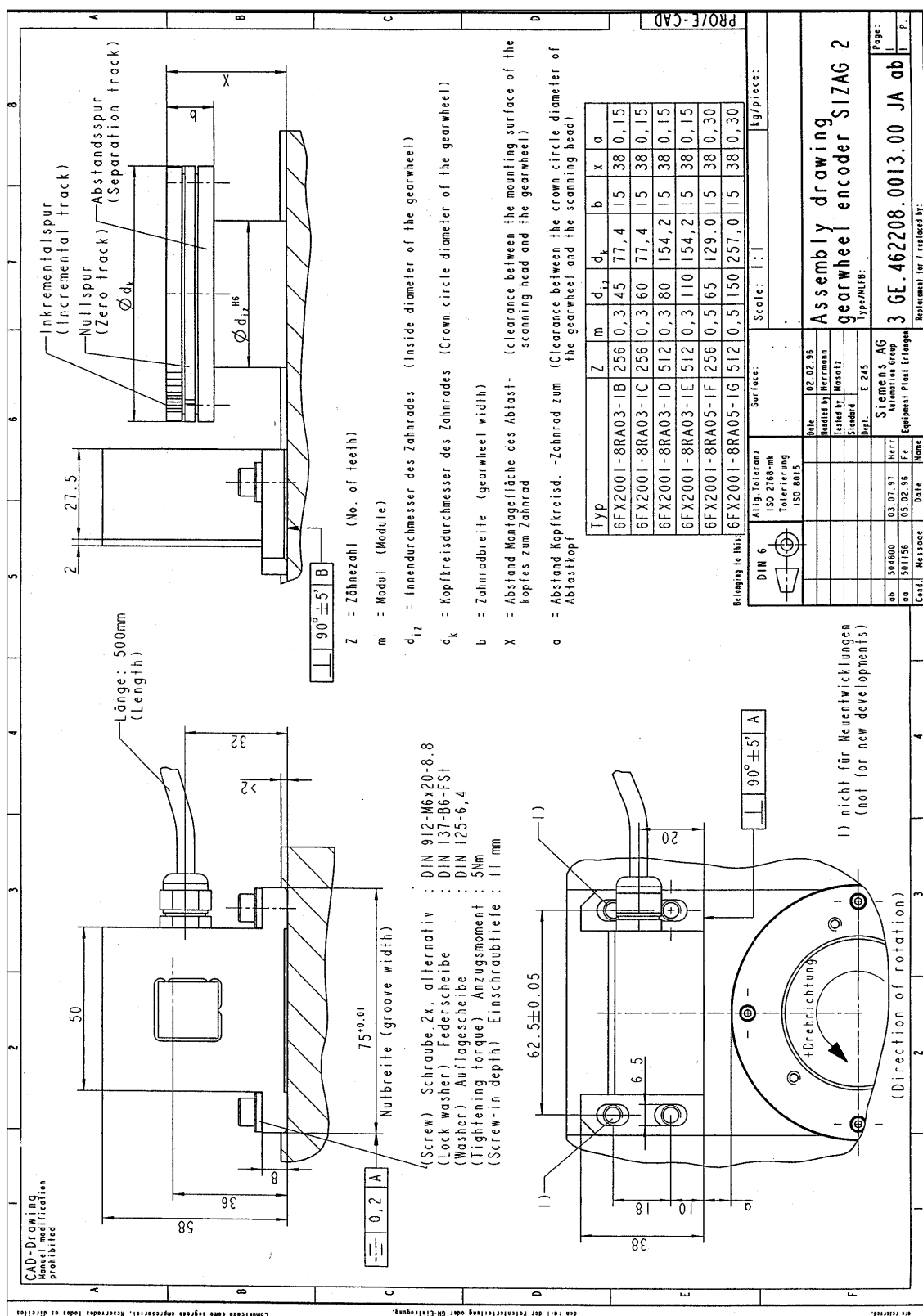


Fig. 2-5 Mounting drawing, toothed-wheel encoder SIZAG 2

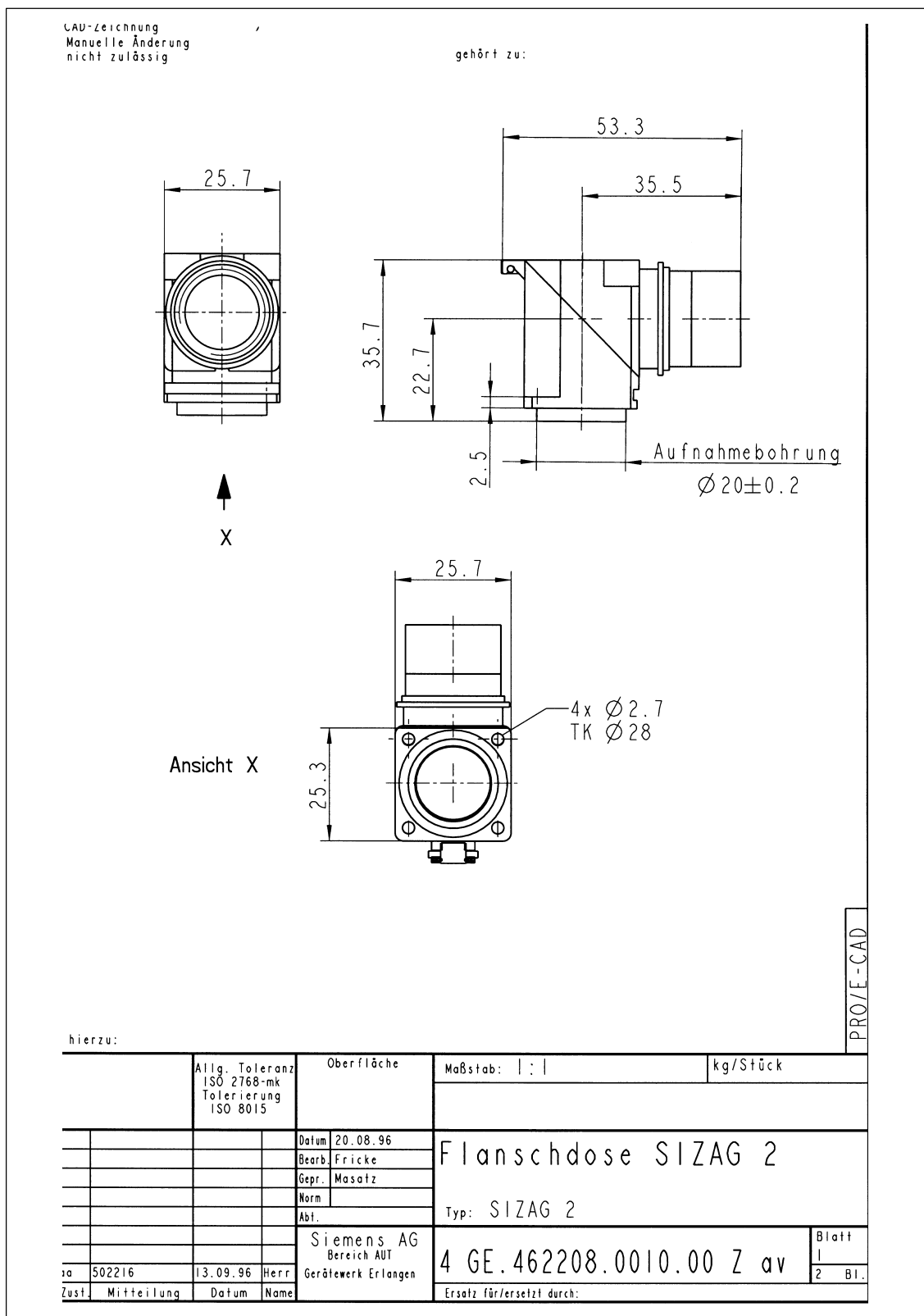


Fig. 2-6 Montagezeichnung Flange-mounted socket SIZAG 2

GE

[illegible]

3

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GE

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EEC Declaration of Conformity

A

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".

A

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.

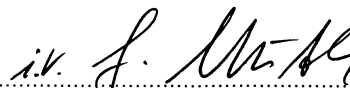
Erstmalige Anbringung der CE-Kennzeichnung: 96

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Bad Neustadt, den 13/8/96



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Achshöhe 36 bis 132

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Produktbezeichnung: **Drehstrom-Synchronmotor, Servoantrieb**
Typ 1FK6...
Achshöhe 36 bis 100

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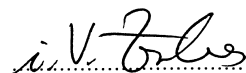
EN 60 204-1
EN 60 034-1
EN 60 034-5
EN 60 034-6
EN 60 034-9

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97615 Bad Neustadt a. d. Saale
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Produktbezeichnung: **Drehstrom-Asynchronmotor**
Typ 1PH2...
mit Käfigläufer, Hauptspindelantrieb
(Einbaumotor)

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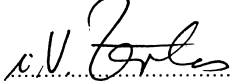
73/23/EWG Richtlinie des Rates zur Rechtsangleichung der Rechtsvorschriften der Mitgliedstaaten betreffend elektrischer Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen geändert durch RL 93/68/EWG des Rates

Die Sicherheitshinweise und Betriebsanleitungen sind zu beachten.

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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 08/96



Dr. Hans Peter Zerbes, Leiter der
Produktionseinheit Drehzahlveränderbare Antriebe
Standort Bad Neustadt



Dr. Gerhard Huhn, 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:

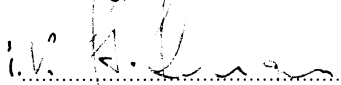
Harmonisierte Europäische Normen: EN 60 034-1
EN 60 034-5
EN 60 034-6
EN 60 034-9
EN 60 204-1

Sicherheitshinweise und Betriebsanleitungen sind zusätzlich zu beachten.

Erstmalige Anbringung der CE-Kennzeichnung: 1996

Siemens Aktiengesellschaft

Nürnberg, den 19.04.96


Stephan Karger, Leiter des
Geschäftszweigs Antriebssysteme
Standort Erlangen


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.

**A**

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Notes

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To
SIEMENS AG
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Fax 09131 / 98 –1145
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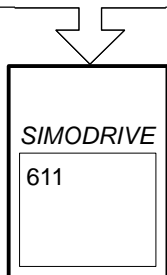


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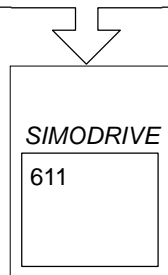


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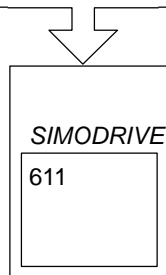
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Planning Guide
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Drives



Planning Guide
Transistor PWM Inverters for
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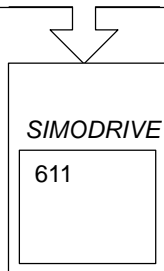


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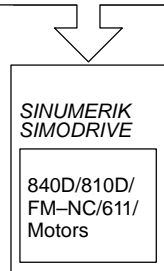
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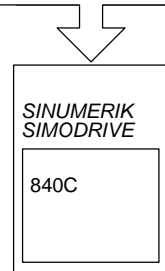


Start-up Instructions
Transistor PWM Inverters for
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Electronic Documentation



DOC ON CD
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