Configuration Manual 12/2005 Edition

simodrive

Three-Phase Motors for
Main Spindle Drives
Synchronous Built-in Motors 1FE1

SIEMENS

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SIMODRIVE
Three–Phase Motors for Main Spindle Drives

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Configuration Manual

12.2005 Edition

Designation of the documentation

Printing history

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

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

Status code in the ”Remarks” column:

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

Edition	Order No.	Remarks
10.00	6SN1 197–0AC00–0BP0	**A**
09.01	6SN1 197–0AC00–0BP1	**C**
01.02	6SN1 197–0AC00–0BP2	**C**
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02.03	6SN1 197–0AC00–0BP4	**C**
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12.05	6SN1 197–0AC00–0BP6	**C**

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The controller may support functions that are not described in this documentation. However, no claim can be made regarding the availability of these functions when the equipment is first supplied or in the event of servicing.

We have checked that the contents of this document correspond to the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee complete conformance. The information given in this publication is reviewed at regular intervals and any corrections that might be necessary are made in the subsequent printings. Suggestions for improvement are also welcome.

Subject to change without prior notice.

Order No. 6SN1197–0AC00–0BP6
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Siemens Aktiengesellschaft

Foreword

Information on SIMODRIVE documentation

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

This document 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.

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

Target group of the Configuration Manual

The Configuration Manual addresses planners and design engineers. It supports you when selecting motors, calculating the drive components, selecting the required accessories as well as when selecting line and motor–side power options.

Technical Support

Should you have any questions about our products, then please contact the following hotline:

European and African time zones

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Correct use

Please carefully note the following:
The equipment may only be used for applications described in the catalog or in the Configuration Manual, and only in combination with devices or components from other manufacturers which have been approved or recommended by Siemens.

The successful and safe operation of this equipment and motors is dependent on professional transport, storage, installation and mounting as well as careful operator control, service and maintenance.

Definition of qualified personnel

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

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

Explanation of symbols

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

Danger

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

Warning

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

Caution

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

Caution

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

Notice

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

Note

In this document, it can be advantageous to observe the information provided in a Note.

Danger and warning information

Danger

- Start–up/commissioning is absolutely prohibited until it has been completely ensured that the machine, in which the components described here are to be installed, is in full compliance with the specifications of Directive 98/37/EC.
- Only appropriately qualified personnel may commission SIMODRIVE units and AC motors.
- This personnel must carefully observe the technical customer documentation belonging to this product and be knowledgeable about and observe the danger and warning information.
- Operational electrical equipment and motors have parts and components which are at hazardous voltage levels.
- When the machine or system is operated, hazardous axis movements can occur.
- All of the work carried–out on the electrical machine or system must be carried–out with it in a no–voltage condition.
- SIMODRIVE drive units are designed for operation on low–ohmic, grounded line supplies (TN line supplies).
- SIMODRIVE drive units with three–phase motors may only be connected to the line supply through residual–current operated circuit–breakers, if corresponding to EN 50178, Chapter 5.2.11.2, it has been clearly proven that the SIMODRIVE unit is compatible with the residual–current operated circuit–breaker.

Warning

- For 1FE1 motors, voltages are present at the motor terminals when the rotor is rotating (as a result of the permanent magnets). The voltage can be up to 2 kV depending on the particular motor type.
- For special versions of the drive units and motors, information and data in the catalogs and quotations additionally apply.
- In addition to the danger and warning information/instructions in the technical customer documentation supplied, the applicable domestic, local and plant–specific regulations and requirements must be carefully taken into account.

Caution

- The motors can have surface temperatures of over +100° C.
- This is the reason that temperature–sensitive components, e.g. cables or electronic components may neither be in contact nor be attached to the motor.
- When handling cables, please observe the following:
  - They may not be damaged,
  - they may not be stressed,
  - they cannot come into contact with rotating parts.

Caution

- SIMODRIVE drive units with three–phase motors are subject to a voltage test, in compliance with EN 50178 as part of a routine test. While the electrical equipment of industrial machines is being subject to a voltage test in accordance with EN60204–1, Section 19.4, all SIMODRIVE drive unit connections must be disconnected/withdrawn in order to avoid damaging the SIMODRIVE drive units.
- Motors should be connected–up according to the circuit diagram provided. They must not be connected directly to the three–phase supply because this will damage them.

Notes

- SIMODRIVE units with three–phase motors fulfill, when operational and in dry operating rooms, the Low–Voltage Directive 73/23/EEC.
- SIMODRIVE units with three–phase motors fulfill, in the configuration specified in the associated EC Declaration of Conformity, the EMC Directive 89/336/EEC.

ESDS information and instructions

Caution

Electro**S**tatic **D**ischarge **S**ensitive Devices (ESDS) are individual components, integrated circuits, or modules that can be damaged by electrostatic fields or discharges.

Handling ESDS boards:

- When handling components, make sure that personnel, workplaces, and packaging are well earthed.
- Personnel in ESDS areas with conductive flooring may only handle electronic components if:
  - They are grounded with an ESDS bracelet, and
  - They are wearing ESDS shoes or ESDS shoe grounding straps
- Electronic boards should only be touched if absolutely necessary.
- Electronic boards must not come into contact with plastics or items of clothing containing synthetic fibers.
- Boards must only be placed on conductive surfaces (work surfaces with ESDS surface, conductive ESDS foam, ESDS packing bag, ESDS transport container).
- Electronic boards may not be brought close to data terminals, monitors or television sets. (Minimum clearance >10 cm).
- Measurements must only be taken on boards when:
  - the measuring unit is grounded (e.g. via a protective conductor) or
  - when floating measuring equipment is used, the probe is briefly discharged before making measurements (e.g. a bare–metal control housing is touched).

Disposal

Motors must be disposed of carefully taking into account domestic and local regulations in the normal recycling process or by returning to the manufacturer.

The following must be taken into account when disposing of the motor:

- Oil should be disposed of according to the appropriate regulations for disposing of used oil (no mixing with solvents, cold cleaning agents or remains of paint)
- Components that are to be recycled should be separated according to:
  - Electronics to be disposed of (encoder electronics)
  - Iron to be recycled
  - Aluminum
  - Processed metal parts (gearwheels, motor windings)

Space for your notes

Table of Contents

1 Description of the Synchronous Motor

1.1 Features, system prerequisites

Applications

The 1FE1 series has been developed for directly driven motor spindles. The built–in motor is a compact drive solution where the mechanical motor power is transferred directly to the spindle without any mechanical transmission elements.

The motor is mounted between the spindle bearings so that the motor–spindle assembly has a high degree of stiffness. This means, for example, that C–axis operation for lathes can be implemented using just one drive.

Standard 1FE1 built–in motors are liquid–cooled, permanent–magnet synchronous motors that are supplied as components (refer to Fig. 1-1).

After the motor components have been assembled on the spindle, a complete motor spindle unit is formed.

Fig. 1-1 Components of 1FE1 synchronous built–in motors

Comparison, synchronous/induction motor technology

The most important advantages of synchronous motor technology with respect to induction motor technology are (assuming the same power rating and the same frame size):

- Higher torque (up to 60%) for the same active part volumes (compare, 1PH2 motors). This results in a more compact machine design.
- Shorter accelerating times for the same moment of inertia
- Lower cooling power required for the same torque

Temperature characteristics, synchronous/induction motor technology

- Typically, synchronous motor rotors have a different temperature characteristic than induction motor rotors. Under no load conditions and at high speeds induction motor rotors are cooler (lower temperature increase) – while under full load conditions, rotors can reach temperatures of up to 250° C.
- In the speed range up to 200% rated speed $n \leq 2 \bullet nN$, a synchronous motor generates significantly less power loss in the rotor as a comparable induction motor rotor. This applies both for no–load operation as well as for operation with a load. This means that the bearing and rotor temperatures are lower, the spindle and material do not expand as much and a higher degree of precision is achieved.
- In the speed range $\geq 2 \bullet n_N$ up to the maximum motor speed, under no–load conditions, the synchronous motor can have a higher temperature rise than an induction motor. The reason for this is the field weakening current required, that for a synchronous motor must be additionally impressed in the winding in order to weaken the rotor field. For this speed range, typical temperature values for synchronous motors are 110° C in the stator. However, the temperature increase when a load is connected (approx.10...15° C) is significantly lower when compared to an induction motor. The rotor of an induction motor can reach approx. 250° C when a load is connected.
- The temperature characteristic/behavior must be taken into consideration when designing the spindle.

A comparison of torque/power for synchronous/induction motors

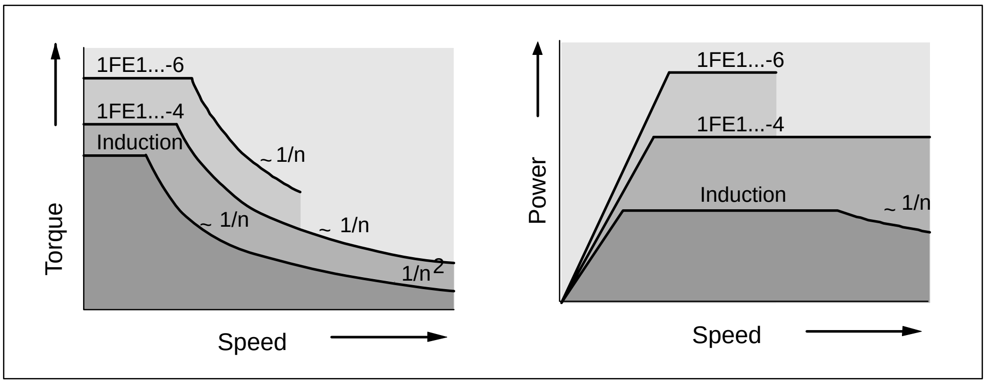

Fig. 1-2 Comparison of the torque/power characteristics between 1FE1 built–in motors and induction motors

Permanent–magnet synchronous motors

Depending on the motor type, the rotor has **inner** (IPM) or **outer** (APM) permanent magnets, refer to Chapter 2.5.2.

Motor spindle

A motor spindle generally comprises the following assemblies (refer to Fig. 1-3):

- Spindle housing
- Spindle shaft with bearings
- Built–in motor
- Cooling system
- Encoder system

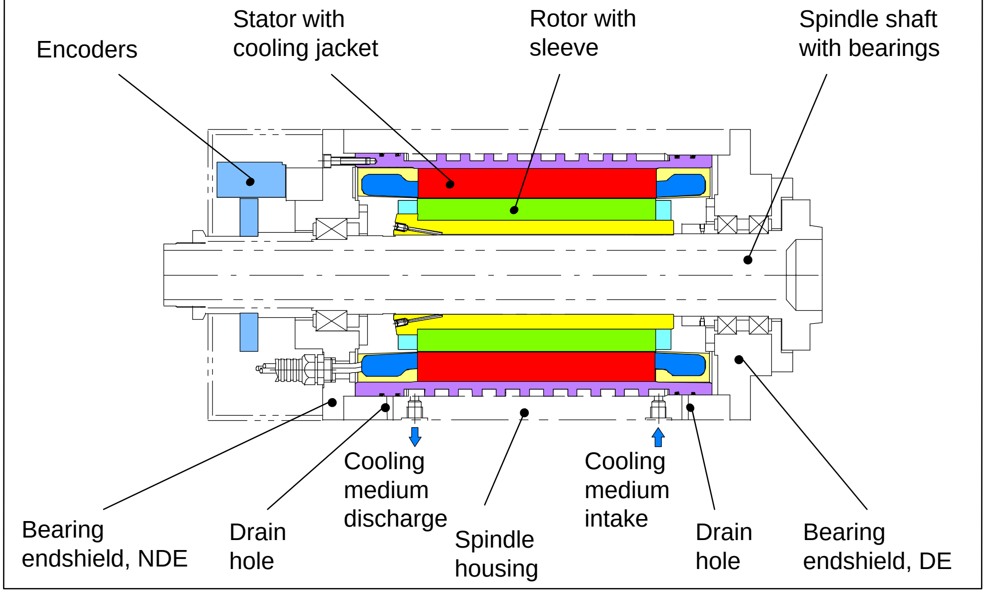

Fig. 1-3 Design of a motor spindle

Note

The spindle manufacturer is responsible for designing the bearings, lubrication and cooling.

A ferrite spindle shaft is required in order to achieve the appropriate electrical characteristics.

Features and applications of built–in motors

1FE1 built–in motors can be adapted to a wide range of applications thanks to the different frame sizes. The most important features are:

- As a result of its features, the 4–pole series is especially suitable for high speeds (e.g. milling applications).
- As a result of their features, the 6 and 8–pole series are especially suitable for machining with high torque levels (e.g. turning and grinding applications) and C–axis operation.
- Depending on the maximum EMF (pole wheel voltage > 800 V), a VP module is required (refer to Chapter 3.3).
- Maximum speed: up to 40.000 RPM (dependent on the frame size)
- Maximum rated torque: up to 820 Nm (dependent on the frame size)
- Torque is transmitted to the spindle without any play through a press fit.
- The rotor has been completely machined. The rotor does not have to be machined after mounting/installation.
- Rotors **with** sleeve are, depending on the version from the manufacturer, pre–balanced or not balanced and can be disassembled.
- Rotors **without** sleeves are not balanced. They cannot be disassembled without damage.

System requirements

The following requirements must be fulfilled:

- Open–loop and closed–loop control modules
  - SINUMERIK 840D (from SW 5.3) with SIMODRIVE 611 digital
  - SINUMERIK 840Di with SIMODRIVE 611 universal HR
  - SINUMERIK 840Di with SIMODRIVE 611 universal E HR
  - SINUMERIK 840C (from SW 6.4) with SIMODRIVE 611 digital

    Criteria to select the control module:

    —> High–speed milling applications —> High Standard

    —> Machining with C–axis quality: —> High Performance
  - SIMODRIVE 611 universal (from SW 3.3)
- For an EMF [1] > 830 V, a VP module is required (refer to the motor Order No., Description, refer to Chapter 3.3)

  1FE1□□□–□□□□□–□□□□

  0 = no VPM required (EMF < 830 V)

  1 = VPM required (EMF > 830 V)
- Hollow–shaft measuring system (refer to Chapter 1.8)

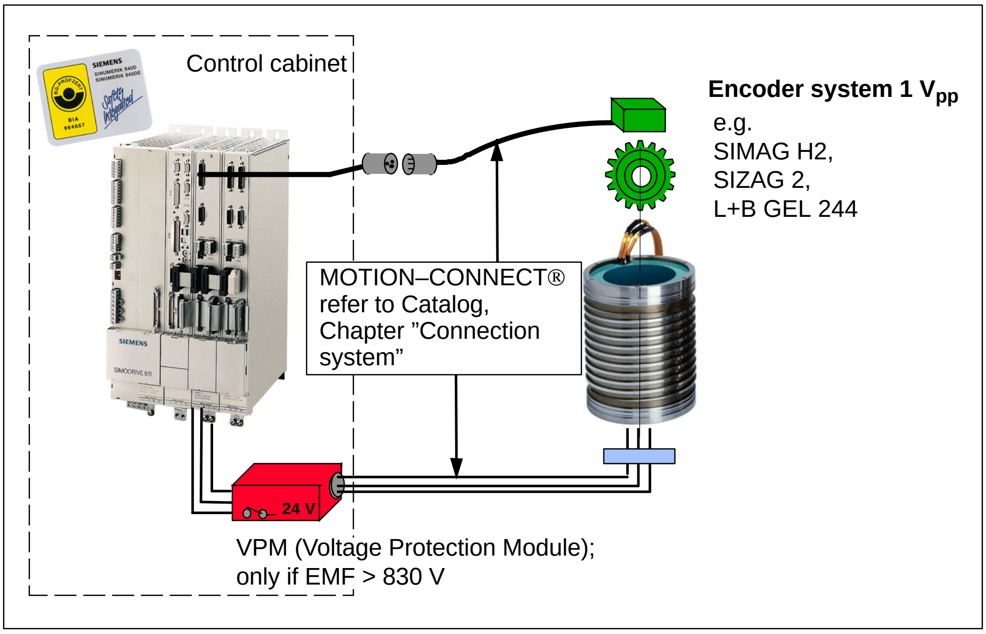

Fig. 1-4 System integration

1) EMF = induced rms phase–to–phase motor voltage

Accuracy

The precision of a motor spindle is defined on one hand by the mechanical design and on the other hand by the control technology and the encoder resolution.

Mechanical system

The machining precision of the spindle that can be achieved is influenced, in addition to the system stiffness (housing, bearings, spindle), also by its smooth running properties. The spindle manufacturer is responsible for the implementation and proving the corresponding performance.

Warning

Static charging of the rotor:

At higher speeds, depending on the spindle design as well as the properties of the spindle bearings (e.g. grease and minimum oil lubrication), the rotor can be statically charged–up! The spindle manufacturer must apply the appropriate counter–measures.

If ceramic bearings are used, the motor shaft must be grounded as otherwise arcing could occur between the shaft and the sensor housing!

Closed–loop control

The decisive closed–loop control factors include:

- The number of encoder signals per spindle revolution
- The precision when mounting and adjusting the encoder system
- The multiplication of the encoder signals
- The sampling time of the current and speed controller

In conjunction with the Performance control (closed–loop) of SIMODRIVE 611 digital, the motor spindle is suitable for C–axis operation.

Degree of protection

The motor components have degree of protection IP00.

The final degree of protection is determined by the mechanical design of the spindle housing of the particular manufacturer. Protection against coming into contact, foreign bodies and water for electrical equipment is specified in accordance with DIN IEC 60034, Part 5.

Recommendation: IP54 (minimum degree of protection)

Magnetic excitation

Forces occur between the rotor and stator of electrical motors due to the inherent magnetic principle of operation.

These forces must be able to be absorbed by the surrounding mechanical assembly. In order to avoid exciting vibration, the motor spindle (spindle shaft, bearings, spindle housing) should be designed to be as stiff as possible.

1.2 Technical features

Table 1-1 Technical features, 1FE1 motors

Technical features	Version
Motor type	Synchronous spindles with permanent–magnet rotor (4, 6 or 8 pole)
Type of construction	Individual components (IM 5110 acc. to DIN IEC 60034–7): Stator, rotor
Degree of protection	IP00 (acc. to DIN IEC 60034, Part 5): Stator, rotor
Cooling (refer to Chapter 1.6)	Water cooling with T_{H2O} = 25 °C acc. to EN 60034–1 and Q = 8 l/min
Standard protection temperature monitoring	2 KTY PTC thermistors in the stator winding (of which 1 is a reserve)
Full protection (optional)	In addition to the standard protection 1 x PTC thermistor triplet (3 sensors in series) Can be evaluated, e.g. using a thermal motor protection unit: Order number 3RN1013–1GW10
Universal protection (optional)	– Full protection + – NTC PT3–51–F + – NTC K227
Winding insulation	Temperature Class F acc. to DIN IEC 60034 permits an average winding temperature rise of ΔT = 105 K for a cooling–medium temperature of +5 °C to + 25 °C (recommendation +25 °C)
Balance quality of the rotor (acc. to ISO 1940–1) Rotor with sleeve: Rotor without sleeve:	 Depending on the particular version, pre–balanced, balance quality G 2.5, reference speed 3600 RPM or non–balanced for complete balancing after mounting and installation Not pre–balanced
Motor voltage (terminal voltage)	Regulated: Maximum 3–ph. 430 V_{rms} Non–regulated: Maximum 3–ph. 420 V_{rms}
Supply voltage of the SIMODRIVE 611 converter system	3–ph 400 V AC ± 10% (i.e. $V_{DC\ link}$ ≦ 600 V) → All 1FE1 motors can be operated 3–ph 480 V AC +6%, –10% (i.e. $V_{DC\ link}$ ≦ 680 V) → 1FE1□□□–4W can be used → If you wish to use 1FE1□□□–6W, please inquire → If you wish to use 1FE1□□□–8W, please inquire
Connection type	Free single cables U1, V1, W1 (cable conductors); Length 0.5 m (preferred version) or 1.5 m
Torque ripple 1FE1 ... –6W 1FE1 ... –8W 1FE1 ... –4W	 ≦ 1 % at 20 RPM and M_N/2 referred to the rated torque ≦ 1 % at 20 RPM and M_N/2 referred to the rated torque ≦ 2 % at 20 RPM and M_N/2 referred to the rated torque

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Note

Technical data are system data and are only applicable in conjunction with the specified system components (1FE1 built–in motor, SIMODRIVE 611 digital, SIMODRIVE 611 universal, VP module, etc.).

Scope of supply of the 1FE1 built–in motor

1. a) APM rotor package

   or

   b) IPM rotor package
2. Stator package with cooling jacket (optional, without cooling jacket)
3. Round sealing rings (4x) (for versions with a standard cooling jacket)
4. Motor rating plate
5. Installation Instructions
6. Circuit diagram

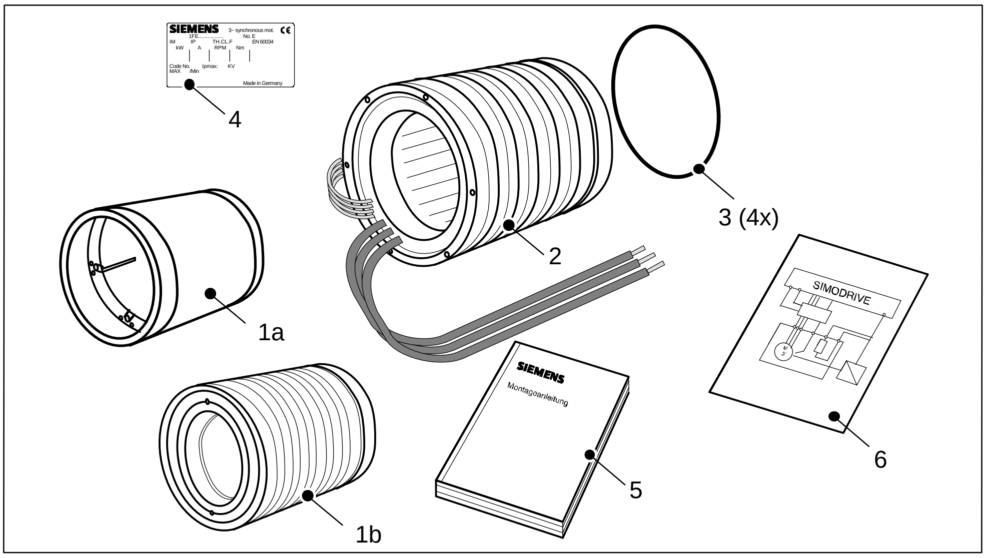


Fig. 1-5 Scope of supply of the 1FE1 built–in motor

Motor rating plate

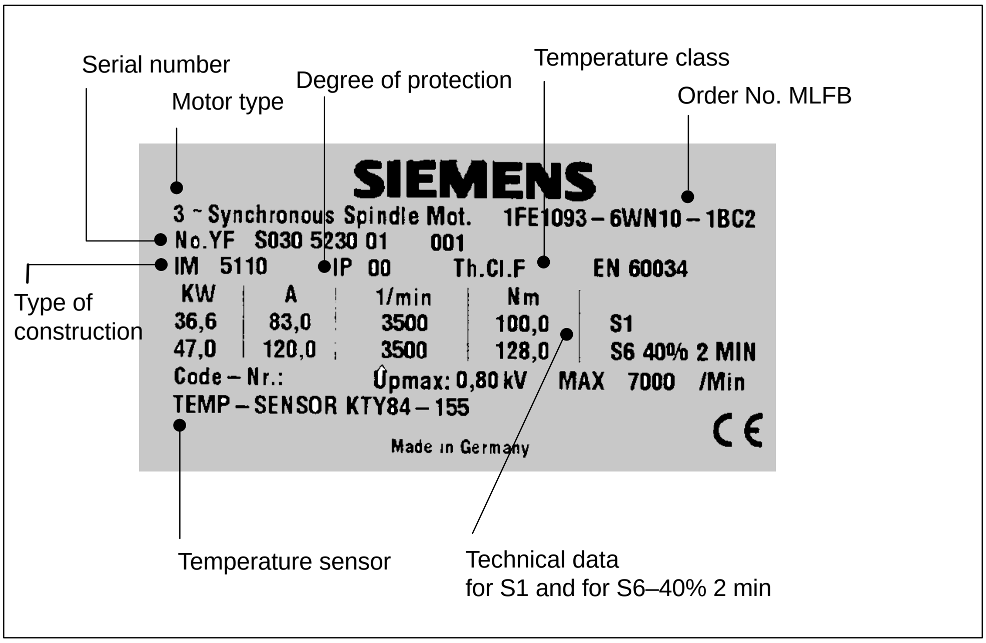


Fig. 1-6 Motor rating plate for 1FE1093–6WN10

1.3 Technical data

Table 1-2 Technical data

Order No. [MLFB] 1FE1....	**Rated torque M_N [Nm]** [1]			**Rated current I_N [A]**			Maximum current	Rated speed	Maximum speed	**Power** [1] S1/ S6–40%/ S6–25%	Power unit fulfills motor duty type S1 to S6–...	
	S1	S6–40%	S6–25%	S1	S6–40%	S6–25%	I_{max} [2] [A]	n_N [RPM]	n_{max} [RPM]	P_N [kW]	S6–40% [3] [A]	S6–25% [3] [A]
6–pole built–in motors												
041-6WM□0	4.5	6	7	13	17.5	21.5	26	15800	20000	7.4/9.9/11.6	24/32/32	24/32/32
042–6WN□0	11	14	16	24	32	40	48	12500	18000	14.4/18.3/20.9	45/60/76	45/60/76
042–6WR□0	11	14	16	19	26	32	38	10000	15000	11.5/14.7/16.8	24/32/32	30/40/51
051–6WN□0	10	12.5	14.4	15	22	27	30	6000	12000	6.3/7.9/9	24/32/32	24/32/32
051–6WK□0	10	12.4	14.0	20	29	36	40	8000	15000	8.3/10.2/11.8	24/32/32	30/40/51
052–6WN□0	20	25.4	29.0	30	44	55	60	5500	12000	11.5/14/16.5	30/40/51	45/60/76
052–6WK□0	18	23.0	26.5	37	54	68	74	7500	15000	14/18/21	45/60/76	45/60/76
054–6WN□0	37	46.0	52.0	60	89	110	120	6000	12000	23/28/33	60/80/102	85/110/127
061–6WH□0	13	17	21	21	30	37	42	8500	12000	11.6/15/18.5	24/32/32	30/40/51
061–6WY□0	13	17	21	8	11.5	14	16	3000	5000	4/5.3/6.8	8/10/16	8/10/16
064–6WN□1	56	80.5	97.0	56	80	100	112	4300	12000	25/36/44	60/80/102	85/110/127
064-6WQ□1	56	81	97.5	43	61	77	86	3400	10000	20/29/34	45/60/76	45/60/76
082–6WP□0	65	81	95	65	91	112	130	5000	8500	34/41.5/50	85/110/127	85/110/127
082–6WS□0	65	81	95	45	62	76	90	3600	6000	24.5/31/34	45/60/76	45/60/76
082-6WQ□1	65	81	95	60	84	103	120	4300	9000	29.3/36.5/42	60/80/102	60/80/102
082-6WW□1	65	81	95	30	42	51	60	2200	9000	15/18.5/20	30/40/51	30/40/51
084–6WR□1	130	175	200	60	84	103	120	2300	9000	31/40/42	60/80/102	60/80/102
084–6WU□1	130	175	200	45	64	79	90	1700	7000	23/31/32	45/60/76	45/60/76
084–6WX□1	130	175	200	30	42	52	60	1100	4500	15/19/19	30/40/51	30/40/51
091–6WN□0	28	36	41	24	35	43	48	3500	7000	10/13/15	24/32/32	30/40/51
091–6WS□0	30	36	41	15	19	23	30	2000	4000	6.3/7.5/8.6	24/32/32	24/32/32
092–6WN□0	66	85	98	58	84	103	116	3500	7000	24/31/36	60/80/102	60/80/102
092–6WR□1	66	85	98	41	58	72	82	3200	7000	22/28.5/29	45/60/76	45/60/76
093–6WN□0	100	128	147	83	120	150	166	3500	7000	36/47/54	85/110/127	120/150/193
093–6WS□0	100	127	148	53	76	94	106	2000	4000	21/27/31	60/80/102	60/80/102
093–6WV□1	100	129	149	43	60	75	86	1600	7000	17/22/25	45/60/76	45/60/76
113–6WU□1	150	190	220	60	91	114	124	2100	6500	33/35/35	60/80/102	85/110/127
113–6WX□1	150	190	220	43	62	78	86	1400	5700	22/24/24	45/60/76	45/60/76

Table 1-2 Technical data, continued

Order No. [MLFB] 1FE1....	Rated torque M_N [Nm] 1)			Rated current I_N [A]			Maximum current	Rated speed	Maximum speed	Power 1) S1/ S6–40%/ S6–25%	Power unit fulfills motor duty type S1 to S6–...	
	S1	S6–40%	S6–25%	S1	S6–40%	S6–25%	I_{max} 2) [A]	n_N [RPM]	n_{max} [RPM]	P_N [kW]	S6–40% 3) [A]	S6–25% 3) [A]
114–6WR□1	200	258	285	108	160	198	216	2000	6500	42/47/53	120/150/193	120/150/193
114–6WT□1	200	258	285	84	123	154	168	1400	6500	29/37/43	85/110/127	120/150/193
114-6WW□1	200	257	291	58	85	106	116	1000	6000	21/27/30	60/80/102	60/80/102
115–6WT□1	265	340	385	85	123	154	170	1500	6500	41.6/45/45	85/110/127	120/150/193
116–6WR□1	300	387	440	109	160	200	218	1200	6500	38/48/56	120/150/193	200/250/257
116–6WT□1	300	387	440	84	123	154	168	900	5500	28/36/42	85/110/127	120/150/193
116-6WW□1	300	385	435	60	87	108	120	700	4000	22/28/31	60/80/102	85/110/127
8–pole built–in motors												
144–8WL□1	430	620	700	133	193	241	266	1400	6500	63/80/80	200/250/257	200/250/257
145–8WN□1	585	795	890	200	290	360	400	1700	8000	104/125/125	200/250/257 6)	–
145–8WS□1	585	795	890	130	188	235	260	1100	5000	67.4/80/80	200/250/257	200/250/257
145-8WQ□1	585	795	890	158	230	285	316	1300	6000	79.6/97/97	200/250/257	–
147–8WN□1	820	1110	1240	200	290	360	400	1200	5500	103/125/125	200/250/257 6)	–
147–8WS□1	820	1110	1240	130	190	235	260	750	3500	64.4/78/80	200/250/257	200/250/257
147-8WQ□1	820	1110	1240	158	230	285	316	950	4200	81.6/97/97	200/250/257 6)	–
4–pole built–in motors												
051–4HC□0	5	7	9	25	34.5	42	50	24000	40000	12.6/17.6/22.6	45/60/76	45/60/76
051–4WN□1	6.5	9	11	12	17	21	24	9500	30000	6.5/8/8	24/32/32	24/32/32
052–4HD□0	12	15	19	57	75	95	114	25000	40000 5)	31.4/35/35	120/150/193	120/150/193
052–4HG□1	12	15	19	44	59	73	88	19000	40000 5)	24/30/34	85/110/127	85/110/127
052–4WK□1	13	17	21	30	39	49	60	12500	30000	17.5/19/19	40/60/76	40/60/76
052–4WN□1	13	18	22	20	26	33	40	8000	30000	11/12/12	30/40/51	30/40/51
053–4HH□1	18	23	28	46	63	77	92	13500	40000 5)	25.5/33/35	85/110/127	85/110/127
053–4WN□1	20	27	32	29	38	47	58	7900	30000	16.5/18/18	45/60/76	45/60/76
053–4WJ□1	20	27	32	36	49	60	72	11000	30000	23/25/25	60/80/102	60/80/102
072–4WH□1	28	40	48	64	96	119	128	9700	24000	28.5/28.5/28.5	85/110/127	85/110/127
072–4WL□1	28	40	48	45	68	84	90	6800	24000	20/20/20	60/80/102	60/80/102
072–4WN□1	28	40	48	36	54	67	72	5500	24000	16/16/16	45/60/76	45/60/76
073–4WN□1	42	59	71	65	97	120	130	6800	24000	30/30/30	85/110/127	85/110/127
073–4WT□1	45	64	75	30	44	55	60	3200	14000	15/15/15	30/40/51	45/60/76
074-4WM□1	60	87	99	97	144	176	194	7700	20000	48/51/51	120/150/193	120/150/193

Table 1-2 Technical data, continued

Order No. [MLFB] 1FE1....	**Rated torque M_N [Nm]** [1)]			**Rated current I_N [A]**			Maximum current	Rated speed	Maximum speed	**Power** [1)] S1/ S6–40%/ S6–25%	Power unit fulfills motor duty type S1 to S6–...	
	S1	S6–40%	S6–25%	S1	S6–40%	S6–25%	I_{max}[2)] [A]	n_N [RPM]	n_{max} [RPM]	P_N [kW]	S6–40% [3)] [A]	S6–25% [3)] [A]
074–4WN□1	56	78	95	91	136	168	182	7000	20000	41/41/41	120/150/193	120/150/193
074–4WT□1	60	85	95	53	77	95	106	4100	18000	25.8/28/28	60/80/102	60/80/102
082–4WN□1	42	55	63	42	60	76	84	3500	20000	15.5/15.5/15.5	45/60/76	45/60/76
082–4WR□1	42	55	63	24	34	43	48	2000	11000	8.8/8.8/8.8	24/32/32	30/40/51
083–4WN□1	63	83	95	77	110	137	154	4200	20000	28/28/28	85/110/127	120/150/193
084–4WN□1	84	115	127	105	150	187	210	4300	20000	38/38/38	120/150/193	120/150/193
084–4WP□1	78	110	127	79	120	150	160	4300	20000	35/35/35	85/110/127	120/150/193
084-4WQ□1	84	110	126	83	119	147	166	3400	18000	30/30/30	85/110/127 [4)]	120/150/193
084–4WT□1	84	110	127	60	85	105	120	3000	15000	26.4/26.4/26.4	60/80/102	85/110/127
085–4WN□1	105	139	159	105	150	187	210	3500	18000	38/38/38	120/150/193	120/150/193
085–4WT□1	105	140	160	60	85	105	120	2200	12000	24/24/24	60/80/102	85/110/127
085-4WQ□1	105	140	160	85	120	150	170	3000	16000	33/33/33	85/110/127	120/150/193
092–4WP□1	45	60	73	41	58	72	82	3400	18000	16/16/16	45/60/76	45/60/76
092–4WV□1	50	64	73	24	35	43	48	2000	10000	10.5/10.5/10.5	30/40/51	30/40/51
093–4WH□1	75	105	112	83	120	148	166	4500	18000	35/35/35	85/110/127	120/150/193
093-4WM□1	75	103	113	64	92	114	128	3500	18000	27.5/27.5/27.5	85/110/127	85/110/127
093–4WN□1	75	103	112	60	86	107	120	3300	16000	26/26/26	60/80/102	85/110/127
094–4WK□1	100	138	150	108	156	192	216	4400	18000	46/46/46	120/150/193	120/150/193
094–4WL□1	100	138	150	90	130	160	180	3800	18000	40/40/40	120/150/193	120/150/193
094–4WS□1	100	125	140	60	85	105	120	2500	13000	26/26/26	60/80/102	85/110/127
094–4WU□1	95	119	133	45	64	79	90	1800	10000	18/18/18	45/60/76	60/80/102
095–4WN□1	125	172	188	108	156	192	216	3500	18000	46/46/46	120/150/193	120/150/193
096–4WN□1	150	208	225	120	173	214	240	3300	16000	52/52/52	120/150/193	200/250/257
103–4WN□1	102	140	155	84	127	158	168	3600	16000	38.5/45/45	85/110/127	120/150/193
104–4WN□1	136	190	206	120	181	226	240	3800	16000	54/65/65	120/150/193	200/250/257
105–4WN□1	170	236	260	120	180	221	240	3000	16000	53/65/65	120/150/193	200/250/257
106–4WN□1	204	280	312	159	240	300	318	3400	16000	72/85/85	200/250/257	–
106–4WR□1	204	270	300	128	184	227	260	2900	14000	62/66/66	200/250/257	200/250/257
106–4WS□1	200	270	300	120	170	210	240	2700	12500	56.5/60/60	120/150/193	200/250/257
106–4WY□1	200	270	300	60	85	105	120	1200	6000	25/30/30	60/80/102	85/110/127
124–4WN□1	200	275	312	135	198	247	270	3000	14000	63/75/75	200/250/257	200/250/257

Table 1-2 Technical data, continued

Order No. [MLFB] 1FE1....	Rated torque M_N [Nm] 1)			Rated current I_N [A]			Maximum current I_{max} 2) [A]	Rated speed n_N [RPM]	Maximum speed n_{max} [RPM]	Power 1) S1/ S6–40%/ S6–25% P_N [kW]	Power unit fulfills motor duty type S1 to S6–...	
	S1	S6–40%	S6–25%	S1	S6–40%	S6–25%					S6–40% 3) [A]	S6–25% 3) [A]
125–4WN□1	250	345	390	162	240	295	324	3000	14000	78/90/90	200/250/257	–
125–4WP□1	250	345	390	147	215	270	294	2500	12500	65/82/82	200/250/257	–
126–4WN□1	300	410	470	200	295	365	400	3000	14000	94/115/115	200/250/257	–
126–4WP□1	300	410	470	180	265	330	360	2500	12500	78/100/100	200/250/257	–
126-4WQ□1	300	410	470	147	215	270	294	2000	10000	63/82/82	200/250/257	–

↑

Winding version: 1, 3, 5 refer to the Order No., Chapter 4

Note: Data specified in this table apply for a cooling jacket with cast winding in conjunction with water cooling

1) Data for ΔT=105K
2) The maximum current may not be exceeded due to the danger of de–magnetization.
3) Assignment, motor – drive converter: The current data (S1/S6–40%/Imax [A_{rms}] according to the main spindle load duty cycle with f_T = 3.2 kHz) refer to the drive converter system SIMODRIVE 611 digital/611 universal (refer to Table 1-3).
4) Possible with power unit 85/110/127 up to n_{max} = 16000 RPM
Possible with power unit 120/150/193 up to n_{max} = 18000 RPM
5) A series reactor L_{series} is required in order to safety and reliably operate the following motors
1FE1052–4HD.0 and 1FE1052–4HG.1 L_{series} = 0.23 mH, Order No.: 6SE7028–2HS87–1FE0
1FE1053–4HH.1 L_{series} = 0.32 mH, Order No.: 6SE7026–0HS87–1FE0
Note when using the series reactor:
The drive converter setting–data is only applicable in conjunction with the specified reactor. If a third–party reactor is used, the specified data is not guaranteed. If a series reactor is used, this represents a source of heat, surface temperatures can reach up to approx. 100° C. Technical data, refer to Catalog DA 65.10.
6) The motor performance is limited by the SIMODRIVE power units that are presently available, (S6–60% duty), compare power unit and motor currents.

Selecting the power units

The required power units are selected according to the peak currents and continuous currents that occur in the load duty cycle. If several motors are operated in parallel with one drive converter, then the summed values of the peak and continuous currents must be taken into account.

Notice

For system configurations, where built–in motors are used together with regulated (closed–loop control) infeed units, electrical oscillations can occur with respect to ground potential.

These oscillations result in increased voltage stressing.

Factors that influence these system oscillations include, among others

- Cable lengths
- Size of the infeed and regenerative feedback module
- Number of axes
- Motor size
- Winding design

If increased voltage stressing occurs or if the main insulation is damaged, an HFD reactor with damping resistor should be used to dampen the system oscillations.

Table 1-3 Order No. of power units

Current [A]	Order No. [MLFB] of the power units
8/10/16	6SN1123–1AA00–0**B**A1
24/32/32	6SN1123–1AA00–0**C**A1
30/40/51	6SN1123–1AA00–0**D**A1
45/60/76	6SN1123–1AA00–0**L**A1
60/80/102	6SN1123–1AA00–0**E**A1
85/110/127	6SN1123–1AA00–0**F**A1
120/150/193	6SN1123–1AA00–0**J**A1
200/250/257	6SN1123–1AA00–0**K**A1

Using smaller power units

Note

When smaller power units are used, for several motor types, the complete speed range cannot be used (even when the motor utilization is somewhat lower). Please contact your local Siemens office.

1.3.1 Determining the maximum speed of the 1FE1 built–in motor when operated without VP module

Only applicable for built–in motors with Order No. [MLFB] 1FE1□□□–□□□□**1**–1□□□

This means that a VP module is required.

If a VP module is not used, then using the subsequent formula, the maximum speed ($n_{max\_without\_VPM}$) can be determined; motors can be operated up to this speed without having to use a VP module.

$$n_{max\_without\_VPM}\ [RPM] = \frac{830\ [V] \bullet 1000}{k_E\ [V/1000\ RPM] \bullet \sqrt{2}}$$

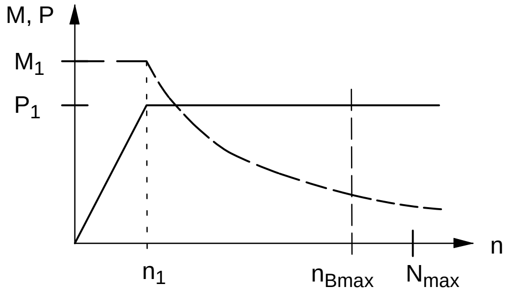
k_E = voltage constant (refer to Chapter 5)

Caution

Operation above the $n_{max\_without\_VPM}$ is not permissible without a VP module.

Siemens accepts no liability for any damage that is caused because these danger notes have not been carefully observed.

1.3.2 Calculating the accelerating (ramp–up time) using the torque/ power characteristic



$$t_h = \frac{\pi}{60} \cdot \frac{J_{tot}}{M_1} \left[n_1 + \frac{n_{Bmax}^2}{n_1} \right]$$

or

$$t_h = \frac{\pi^2}{1800} \cdot \frac{J_{tot}}{P_1} \left[n_1^2 + n_{Bmax}^2 \right]$$

Designations:

- t_h Accelerating time up to the maximum operating speed n_{Bmax} in [s]
- J_{tot} Total moment of inertia, (rotor and spindle) in [kgm^2]
- n_1 Transition speed in [RPM] (e.g. S6–25%)
- n_{Bmax} Max. operating speed ($\leq n_{max}$) in [RPM]
- N_{max} Max. speed in [RPM]
- M_1 Accelerating torque in [Nm] (e.g. S6–25%)
- P_1 Accelerating power in [W] (e.g. S6–25%)

Fig. 1-7 Calculating the accelerating time

Calculation of the ramp-up time for 4-pole built-in motors and for the operating mode S6-25% *)
Formula: th = (pi / 60) * (J total / M1 S6-25%) * (n1+ (nBmax customer spec.² / n1))

input data	**1) select a motor:**	**1FE1074-4WT11**	calculation
	2) type the customer specific moment of inertia [kgm²]:	1.00000	
	3) type the customer specific maximal speed [rpm]:	5000	

result of calculation		motor specific data	
ramp-up time th [s]:	**0,0000**	J rot [kgm²]:	
		J total [kgm²]:	0,00000
motor current S6-25% [A]:		n1 at S6-25% [rpm]:	
required power module without derating: with derating refer to table 1-2		nBmax customer specific [rpm]:	5000
		Nmax [rpm]:	

*) With the 200/250/257 A power unit, the following motors reach, as a maximum, duty type S6–40% (refer to Chapter 1.3, Technical data):
1FE1106–4WN11, 1FE1125–4WN11, 1FE1125–4WP11,
1FE1126–4WN11, 1FE1126–4WP11, 1FE1126–4WQ11;
The acceleration time only changes insignificantly.

1.3.3 Rotor weights and moments of inertia

Table 1-4 Rotor weight and moment of inertia

Order No. [MLFB]	Rotor code	Sleeve yes = x	Balancing yes = x	Rotor weight [kg]	Moment of inertia [kg*m^2]
6–pole built–in motors					
1FE1041-6W□□□-1□A□				0.33	0.00019
1FE1042-6W□□□-1□A□				0.57	0.00033
1FE1051-6W□□□-1□A□				1.20	0.00106
1FE1051-6W□□□-1□C□		x	x	1.90	0.00152
1FE1052-6W□□□-1□A□				2.20	0.00195
1FE1052-6W□□□-1□C□		x	x	3.10	0.00248
1FE1054–6W□□□-1□A□				4.30	0.00380
1FE1061–6W□□□-1□A□				1.10	0.00141
1FE1061–6W□□□-1□B□		x	x	2.10	0.00242
1FE1064–6W□□□-1□A□				4.30	0.00553
1FE1082–6W□□□-1□A□				3.60	0.01048
1FE1082–6W□□□-1□B□		x	x	7.70	0.01841
1FE1082–6W□□□-1□C□		x	x	6.80	0.01710
1FE1082–6W□□□-1□D□		x	x	6.10	0.01604
1FE1084–6W□□□-1□A□				7.10	0.02067
1FE1084–6W□□□-1□C□		x	x	12.20	0.03068
1FE1091–6W□□□-1□A□				2.60	0.00814
1FE1091–6W□□□-1□B□		x	x	5.40	0.01423
1FE1091–6W□□□-1□C□		x	x	4.50	0.01293
1FE1092–6W□□□-1□A□				5.00	0.01566
1FE1092–6W□□□-1□B□		x	x	9.10	0.02398
1FE1092–6W□□□-1□C□		x	x	7.50	0.02155
1FE1092–6W□□□-1□Z□	T37	x		8.30	0.02289
1FE1093–6W□□□-1□A□				7.40	0.02317
1FE1093–6W□□□-1□B□		x	x	12.70	0.03346
1FE1093–6W□□□-1□C□		x	x	10.50	0.03017
1FE1093–6W□□□-1□Z□	T06	x		10.50	0.03017
1FE1113–6W□□□-1□D□		x	x	19.80	0.07747
1FE1113–6W□□□-1□E□		x	x	14.50	0.06512
1FE1114–6W□□□-1□A□				12.70	0.06239
1FE1114–6W□□□-1□B□		x	x	24.90	0.09843
1FE1114–6W□□□-1□C□		x	x	19.60	0.08650
1FE1114–6W□□□-1□Z□	T46	x		22.40	0.09342
1FE1114–6W□□□-1□Z□	T49	x		20.80	0.08971

Table 1-4 Rotor weight and moment of inertia, continued

Order No. [MLFB]	Rotor code	Sleeve yes = x	Balancing yes = x	Rotor weight [kg]	Moment of inertia [kg*m^2]
1FE1114–6W□□□-1□Z□	T52	x		18.60	0.08353
1FE1115–6W□□□-1□C□		x	x	23.80	0.10503
1FE1116–6W□□□-1□A□				18.90	0.09285
1FE1116–6W□□□-1□B□		x	x	35.80	0.14152
1FE1116–6W□□□-1□C□		x	x	28.20	0.12445
8–pole built–in motors					
1FE1144–8W□□□-1□A□				14.50	0.11447
1FE1145–8W□□□-1□C□		x	x	28.30	0.21636
1FE1147–8W□□□-1□C□		x	x	37.70	0.28823
4–pole built–in motors					
1FE1051–4W□□□-1□A□				0.70	0.00057
1FE1051–4H□□□-1□A□				0.60	0.00045
1FE1052–4W□□□-1□A□				1.35	0.00110
1FE1052–4H□□□-1□A□				1.15	0.00087
1FE1053–4W□□□-1□A□				2.00	0.00163
1FE1053–4H□□□-1□A□				1.70	0.00128
1FE1072–4W□□□-1□A□				2.20	0.00287
1FE1073–4W□□□-1□A□				3.30	0.00430
1FE1074–4W□□□-1□A□				4.40	0.00573
1FE1082–4W□□□-1□A□				3.10	0.00559
1FE1083–4W□□□-1□A□				4.70	0.00847
1FE1084–4W□□□-1□A□				6.20	0.01118
1FE1085–4W□□□-1□A□				7.70	0.01388
1FE1092–4W□□□-1□R□				3.80	0.00916
1FE1093–4W□□□-1□A□				7.50	0.01694
1FE1093–4W□□□-1□R□				5.60	0.01350
1FE1094–4W□□□-1□A□				9.60	0.02168
1FE1094–4W□□□-1□R□				7.50	0.01808
1FE1095–4W□□□-1□A□				11.70	0.02642
1FE1095–4W□□□-1□R□				9.30	0.02242
1FE1096–4W□□□-1□A□				13.90	0.03139
1FE1096–4W□□□-1□R□				11.20	0.02700
1FE1103–4W□□□-1□A□				5.30	0.01589
1FE1104–4W□□□-1□A□				7.00	0.02098
1FE1105–4W□□□-1□A□				8.70	0.02608
1FE1106–4W□□□-1□A□				10.50	0.03147
1FE1124–4W□□□-1□A□				12.10	0.05112

Table 1-4 Rotor weight and moment of inertia, continued

Order No. [MLFB]	Rotor code	Sleeve yes = x	Balancing yes = x	Rotor weight [kg]	Moment of inertia [kg*m^2]
1FE1125–4W□□□-1□A□				15.00	0.06337
1FE1126–4W□□□-1□A□				18.00	0.07604

1.3.4 Dimensions

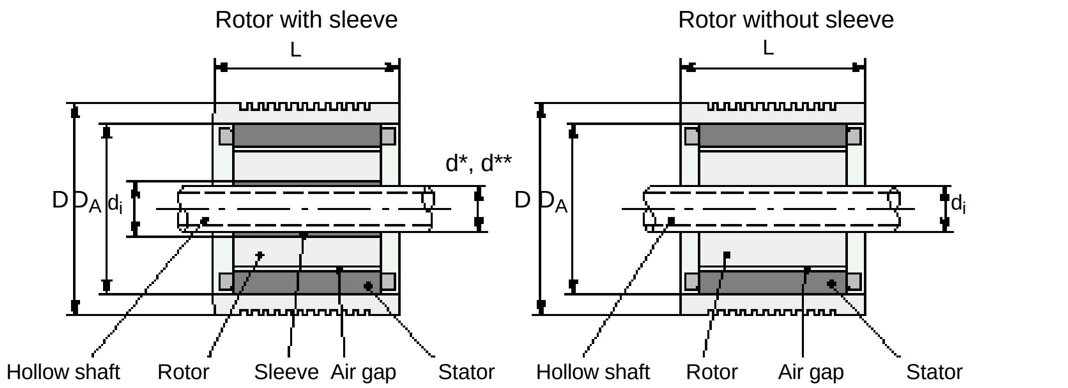


Fig. 1-8 Dimensions of 1FE1 motors (refer to Table 1-5 and Table1-6); Dimension drawings, refer to Chapter 6

Table 1-5 Dimensions of 1FE1 built–in motors, 6–/8–pole

Order No. [MLFB] of the built–in motors. 1FE1...	**L** [mm]	**D** [mm]	**D_A** [mm]	**d_i** –.**A**□. [mm]	**d*** –.**B**□. [mm]	**d**** –.**C**□. [mm]	**d**** –.**D**□. [mm]	**d**** –.**E**□. [mm]	**d**** [mm]			
6–pole built–in motors					**Rotor standard sleeves, inner diameter balanced**				Rotor special sleeves, inner diameter **unbalanced** 1)			
041–6W ... –1BA□	107	95	85	44	–	–	–	–	–	–	–	–
042–6W ... –1BA□	157	95	85	44	–	–	–	–	–	–	–	–
051–6W ... –1B□□	170	115	103.5	42	–	33	–	–	–	–	–	–
052–6W ... –1B□□	220	115	103.5	42	–	33	–	–	–	–	–	–
054–6W ... –1BA□	320	115	103.5	42	–	–	–	–	–	–	–	–
061–6W ... –1B□□	130	130	118	58	48	–	–	–	–	–	–	–
064–6W ... –1BA□	280	130	118	58	–	–	–	–	–	–	–	–
082–6W ... –1B□□	195	190	170	93	67	74	80		–	–		
084–6W ... –1B□□	295	190	170	93	–	74	–	–	–	–	–	–
091–6W ... –1B□□	150	205	180	92	67	80	–	–	–	–	–	–
092–6W ... –1B□□	200	205	180	92	67	80	–	–	74 (T37)	–	–	–
093–6W ... –1B□□	250	205	180	92	67	80	–	–	–	80.1 (T06)	–	–
113–6W ... –1B□□	260	250	220	120	–	–	80	105.2	–	–	–	–
114–6W ... –1B□□	310	250	220	120	82	102	–	–	92 (T46)	98 (T49)	105 (T52)	110 (T55)
115–6W ... –1B□□	360	250	220	120	–	102	–	–	–	–	–	–
116–6W ... –1B□□	410	250	220	120	82	102	–	–	–	–	–	–
8–pole built–in motors												
144–8W ... –1BA□	340	310	280	166.7	–	–	–	–	–	–	–	–
145–8W ... –1BC□	390	310	280	–	–	150.3	–	–	125 (T62)	140.3 (T70)	–	–
147–8W ... –1BC□	490	310	280	–	–	150.3	–	–	–	–	–	–

Refer to Chapter 4, Order No.

A = without rotor sleeve
B = with rotor sleeve, dimensions, refer to column d*
C = with rotor sleeve, optional, dimensions, refer to column d** –.**C**□
D= with rotor sleeve, optional, dimensions, refer to column d** –.**D**□
E = with rotor sleeve, optional, dimensions, refer to column d** –.**E**□

1) On request

Table 1-6 Dimensions of 1FE1 built–in motors, 4–pole

Order No. [MLFB] of the built–in motors.	**L** [mm]	**D** [mm]	D_A [mm]	d_i –.□**A**. [mm]	d_i –.□**R**. [mm]
4–pole built–in motors					
1FE1051–4H ... –1BA□	130	120	106	46	–
1FE1051–4W ... –1BA□	130	120	106	46	–
1FE1052–4H ... –1BA□	180	120	106	46	–
1FE1052–4W ... –1BA□	180	120	106	46	–
1FE1053–4H ... –1BA□	230	120	106	46	–
1FE1053–4W ... –1BA□	230	120	106	46	–
1FE1072–4W ... –1BA□	185	155	135	58	–
1FE1073–4W ... –1BA□	235	155	135	58	–
1FE1074–4W ... –1BA□	285	155	135	58	–
1FE1082–4W ... –1BA□	190	180	160	68	–
1FE1083–4W ... –1BA□	240	180	160	68	–
1FE1084–4W ... –1BA□	290	180	160	68	–
1FE1085–4W ... –1BA□	340	180	160	68	–
1FE1092–4W ... –1BR□	200	205	180	–	80
1FE1093–4W ... –1B□□	250	205	180	72	80
1FE1094–4W ... –1B□□	300	205	180	72	80
1FE1095–4W ... –1B□□	350	205	180	72	80
1FE1096–4W ... –1B□□	400	205	180	72	80
1FE1103–4W ... –1BA□	265	230	200	96	–
1FE1104–4W ... –1BA□	315	230	200	96	–
1FE1105–4W ... –1BA□	365	230	200	96	–
1FE1106–4W ... –1BA□	415	230	200	96	–
1FE1124–4W ... –1BA□	315	270	240	110	–
1FE1125–4W ... –1BA□	365	270	240	110	–
1FE1126–4W ... –1BA□	415	270	240	110	–

Refer to Chapter 4, Order No.

A = without rotor sleeve, dimensions refer to column d_i –.□**A**.
R = without rotor sleeve, d_i = 80 mm, dimens. refer to column d_i –.□**R**.

1.4 Rotor position identification (RLI)

For incremental measuring systems, the controller automatically carries–out a rotor position identification (RLI) each time before the system is powered–up. This is necessary in order to determine the electrical field angle to start the synchronous motor.

For 1FE1 motors, two RLI techniques can be used:

- Saturation–based rotor position identification
  (this is the technique selected as default in the SIMODRIVE system)
- Motion–based rotor position identification routine

Note

For a detailed description, refer to the Description of Functions, SIMODRIVE 611 digital and SIMODRIVE 611 universal, Drive Functions.

1.4.1 Saturation–based rotor position identification

- This functions both for rotors that can freely rotate as well as for rotors that are mechanically locked.
- The accuracy when determining the rotor position depends on the magnetic characteristics of the motor.
- A minimum current is required for the rotor position identification, i.e. when selecting the power unit and motor, the following must apply:

  Rated current (S1 current), power unit $\geq$ 50 % rated motor current.
- When using series reactors or for motors with a low degree of saturation, the accuracy when determining the rotor position is low or the RLI does not provide any result at all.

1.4.2 Motion–based rotor position identification routine

- The rotor **must be able to freely rotate**.
- The rotor position is determined with a high accuracy.
- Independent of the magnetic motor characteristics.
- The quality of the result is not influenced when using series reactors.

1.4.3 Special issues regarding rotor position identification (RLI) for specific motors

For various high–speed main spindle synchronous motors, (low–inductance motors and for motors with series reactor belonging to the high–speed 2–series), e.g.:

– 1FE104☐–6WN10–...
– 1FE1052–4H☐☐☐ (high–speed 2–series)
– 1FE1053–4H☐☐☐ (high–speed 2–series)

the electrical rotor position angle cannot be determined with sufficient quality using the saturation–based rotor position identification routine. Although the saturation–based RLI is, for these motors, sufficient to start the motor, it isn't accurate enough to achieve the optimum efficiency.

There are two alternative strategies when operating the specified motors:

Note

Software prerequisites for both of these strategies:

The drive software must support both of these RLI versions – i.e. saturation–based and motion–based techniques; from software release 6.x

---

1. Changing–over the RLI technique from saturation–based to motion–based.

   Prerequisites:
   The rotor **must be free to rotate when powering–up**. If this cannot be reliably done in operation, because e.g. in the case of a fault, the spindle is blocked by the tool, then the motion–based RLI cannot be used.

2. Determining the angular commutation offset using motion–based RLI and operationally starting the motor using saturation–based RLI.

   Prerequisites:
   Encoder with zero mark (the zero mark is used for fine commutation).

   Description:
   When commissioning the motor for the first time or when re–commissioning it, the precise commutation angle is determined using motion–based RLI. In this case, the motor must be able to freely rotate. After the commutation angle has been precisely determined and saved in the machine data, then the saturation–based RLI is selected. The saturation–based RLI technique is normally used. After it has been powered–up, the motor initially operates using the less accurate commutation angle; at the latest after one revolution after it crosses the zero mark for the first time, the saved (precise) commutation angle is read–in.

Procedure:

1. Changing–over the RLI technique from saturation–based to motion–based; set MD1075 to ”3”.
2. Activating the zero mark for the fine commutation; MD1011, set bit 12 to ”1” and bit 13 to ”0”.
3. Before enabling the motor, activate the ”commissioning support”; set MD1017 to ”1”.
4. The angular commutation offset is automatically entered into the machine data.

Then: Change–over the RLI technique from motion–based to saturation–based; set MD1075 to ”1”.

Notice

When disassembling the encoder (spindle service/maintenance), the commutation angle must be re–determined (qualified personnel must carry–out this work).

1.5 Drive converter pulse frequencies, controller data and de–rating

The SIMODRIVE power units are used according to the main spindle load duty cycle (drive converter pulse frequency f_T = 3.2 kHz).

The power units listed in Table 1-7 must be de–rated (reduced current) for a drive converter basic fundamental frequency f_U < 0.5 Hz. This is for thermal reasons.

Table 1-7 Selection help for the de–rating for the drive converter basic fundamental frequency f_U < 0.5 Hz

1FE1□□□–4□□□□ n [RPM]	**< 15**	**< 15**	**< 15**	**< 15**	**< 15**
1FE1□□□–6□□□□ n [RPM]	**< 10**	**< 10**	**< 10**	**< 10**	**< 10**
1FE1□□□–8□□□□ n [RPM]	**< 7.5**	**< 7.5**	**< 7.5**	**<7.5**	**< 7.5**
Drive converter pulse frequency f_T [kHz]	**3.20**	**4.00**	**5.33**	**6.40**	**8.00**
6SN112□–1AA00–0JA1	110/130/150	101/119/138	86/101/117	73/87/100	55/65/75
6SN112□–1AA00–0KA1	155/180/220	142/165/202	121/140/171	103/120/147	78/90/110

Power units with currents $I_{S1}/I_{S6-40}/I_{max}$ [A_{rms}]

Note:

f_V [kHz] Drive converter basic fundamental frequency

f_V = 0. Hz —> n = 15 RPM for 4–pole built–in motors (1FE1□□□–4□□□□)

fU = 0.5 Hz —> n = 10 RPM for 6–pole built–in motors (1FE1□□□–6□□□□)

fU = 0.5 Hz —> n = 7.5 RPM for 8–pole built–in motors (1FE1□□□–8□□□□)

Drive converter pulse frequencies and de–rating

The rated motor current is the basis when selecting the power unit.

The power unit de–rating should be taken into account for the following speeds:

n > 16000 RPM for 4–pole built–in motors

n > 10600 RPM for 6–pole built–in motors

n > 8000 RPM for 8–pole built–in motors

At higher speeds, the power unit can no longer supply the specified current. Depending on the selected maximum speeds, the de–rating according to Table 1-8 should be taken into account. If required, the next larger power unit should be used.

Note

Depending on the maximum motor speed, in order to achieve optimum control behavior, a drive converter pulse frequency f_T according to Table 1-8 must be selected.

Table 1-8 Selection help for de–rating at high speeds

1FE1□□□–4□□□□[1)] n_{max} **[RPM]**	**≤ 16000**	**≤ 20000**	**≤ 26500**	**≤ 32000**	**≤ 40000**
1FE1□□□–6□□□□ [1)] n_{max} **[RPM]**	**≤ 10600**	**≤ 13300**	**≤ 17700**	**≤ 21300**	**≤ 26600**
1FE1□□□–8□□□□ n_{max} **[RPM]**	**≤ 8000**	**≤ 10000**	**≤ 13300**	**≤ 16000**	**≤ 20000**
Drive converter pulse frequency f_T [kHz] [1)]	**3.20**	**4.00**	**5.33**	**6.40**	**8.00**
6SN1 12□–1AA00–0CA1	24/32/32	22/29/29	18/23/23	14/19/19	10/13/13
6SN1 12□–1AA00–0DA1	30/40/51	28/37/47	24/32/41	21/28/36	17/22/28
6SN1 12□–1AA00–0LA1	45/60/76	42/56/70	36/48/61	32/42/53	25/33/42
6SN1 12□–1AA00–0EA1	60/80/102	55/73/94	47/62/79	40/53/68	30/40/51
6SN1 12□–1AA00–0FA1	85/110/127	79/102/117	68/88/102	60/77/89	47/61/70
6SN1 12□–1AA00–0JA1	120/150/193	110/138/177	93/117/150	80/100/129	60/75/97
6SN1 12□–1AA00–0KA1	200/250/257	183/229/236	156/195/200	133/167/171	100/125/129

Power units with currents $I_{S1}/I_{S6-40}/I_{max}$ $[A_{rms}]$

1) Exception
To ensure optimum operation, for the following motors, the following setting data must be taken into account.

Motor type	**Drive converter pulse frequency f_T [kHz]**	**Current controller clock frequency [kHz]**
1FE1042–6WN10	8	Standard
1FE1052–4HD10	8	16; MD 1000 = 2
1FE1053–4HH10	8	16; MD 1000 = 2

1.6 Cooling

An extremely high power density is achieved for liquid–cooled motors.

The stators of built–in motors are liquid cooled. The user connects the duct, used for cooling, to the cooling circuit. The cooling duct geometry is designed so that the stator power losses are dissipated.

Cooling media

Water or low viscosity oils can be used as cooling media (carefully observe any de–rating required).

If water is used as cooling medium, then the appropriate quantity of additives must be used for anti–corrosion protection and to slow down the growth of algae. The type and quantity of additive should be taken from the manufacturer's specifications for these additives (refer to table 1-9) and the particular ambient conditions.

Table 1-9 Manufacturers of chemical additives

Company	Address	Telephone/URL
Tyforop Chemie GmbH	Hellbrookstr. 5a, D–22305 Hamburg	URL: http://www.tyfo.de
Joh.A. Beckiser Wassertechnik GmbH	Bergstr. 17 D–40699 Erkrath	Tel.: +49 (0)2104 / 40075
CINCINNATI CIMCOOL Cincinnati Milacron b. v./ Cimcool Division	Postfach 98 NL–3031 AB Vlaardingen	Tel.: 003110 / 4600660
Fuchs Petrolub AG	Friesenheimer Strasse 17 D–68169 Mannheim	Tel.: +49 (0)621 / 3802–0 URL: http://www.fuchs–oil.com
Hebro Chemie GmbH	Rostocker Straße D–41199 Mönchengladbach	Tel.: +49 (0)2166 / 6009–0 URL: http://www.hebro–chemie.de
Fa. Hoechst	Refer to the Internet address	URL: http://www.hoechst.com
Houghton Lubricor GmbH	Werkstrasse 26 D–52076 Aachen	Tel.: +49 (0)2408 / 14060
Schilling–Chemie GmbH u. Produktions KG	Steinbeißstr. 20 D–71691 Freiberg	Tel.: +49 (0)7141 / 7030

Note

The cooling mediums and cooling medium supplements are third–party products; we neither know that they basically suitable for the application nor do we provide any guarantee It is the responsibility of the user to select and use suitable cooling mediums and chemical additives. The cooling medium and additives must be compatible to the materials used to feed the cooling medium on the motor and machine sides. In conjunction with the following materials, the mediums to be used must first be discussed with the cooling medium manufacturer.

Table 1-10 List of materials of the motor–side 1FE1 cooling water circuit

Cooling jacket circuit	Material
Cooling jacket	Steel or aluminum, depending on the type
O rings	FPM (Viton)

If, for example, Tyfocor (Tyforop Chemie GmbH) is used, then 75% water and 25% anti–corrosion agent should be used.

When using other cooling media (e.g. oil), the following data should be determined and the motor de–rating (reduced output) should be clarified with your local Siemens office:

- Specific gravity — ρ [kg/m^3]
- Specific thermal capacity — c_P [kJ/(kg·K)]
- Dynamic viscosity at the cooling medium intake temperature — η [Pa·s]
- Cooling–medium intake temperature — [°C]
- Thermal conductivity coefficient — λ [W/(m·K)]
- Flow rate — $\dot{V}$ [l/min]
- For third–party cooling jacket — Cooling jacket geometry required

Note

The motor power still does not have to be reduced for oil – water mixtures with less than 10 %. The cooling medium must be pre–cleaned or filtered in order to prevent the cooling circuit from becoming blocked.

The maximum permissible particle size after filtering should be 100 µm.

Flow rate

An adequate thermal transition is achieved with a flow rate of 8 l/min.

Cooling medium pressure

Maximum steady–state cooling–medium pressure: 0.7 MPa (7.0 bar)
Pressure drop (this is automatically obtained): approx. 0.03 MPa (0.3 bar)

Cooling–medium intake temperature

In order to prevent moisture condensation, the cooling–medium intake temperature must be greater than the ambient temperature.

$T_{cool} > T_{environ} \leqq 40\ °C$

The motors are designed in accordance with EN 60034–1 for operation up to 25 °C cooling medium temperature, maintaining all of the motor data. Operation up to 40 °C cooling medium temperature is possible with de–rating (reduced power).

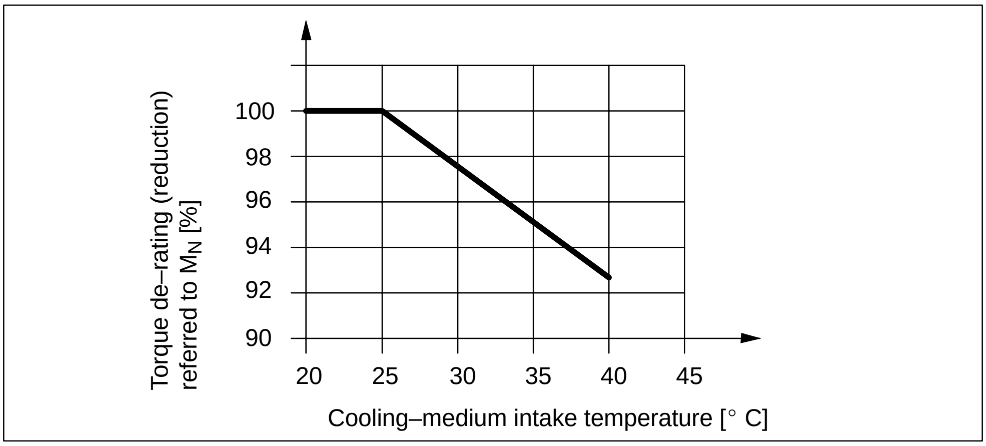


Fig. 1-9 Influence of the cooling–medium intake temperature on M_N as a percentage

Cooling system

A cooling system (i.e. heat exchanger) must be used in order to guarantee a cooling medium intake temperature of 25 °C. It is possible to operate several motors from a single cooling system.

The cooling systems are not included in the scope of supply of 1FE1 built–in motors. A list of addresses of cooling system manufacturers is provided in Catalog NC 60.

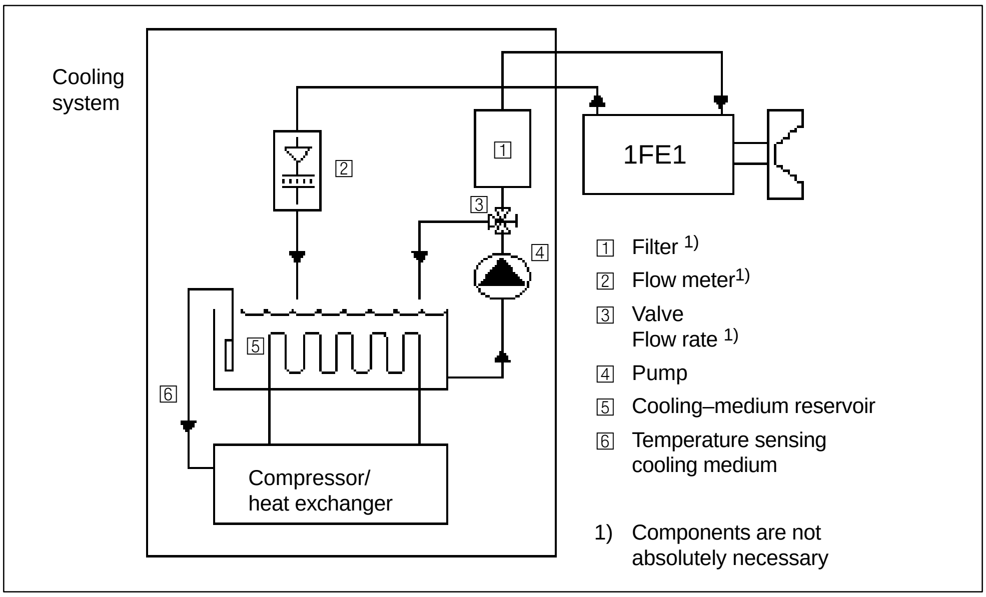


Fig. 1-10 Cooling circuit

1.6.1 Cooling power to be dissipated

The values specified in Table 1-11 refer to a cooling–medium temperature of 25 °C and S1 duty.

The cooling powers to be dissipated at maximum speed and rated speed are specified in the following table. Intermediate values can be linearly estimated proportional to the speed.

Table 1-11 Cooling power to be dissipated

Motor type	Cooling power to be dissipated [W] at the maximum speed	Cooling power to be dissipated [W] at the rated speed
6–pole built–in motors		
1FE1041–6WM10	1100	900
1FE1042–6WN10	1400	1400
1FE1042–6WR10	1400	1400
1FE1051–6WK10	1500	1400
1FE1051–6WN10	1500	1300
1FE1052–6WK10	2800	2500
1FE1052–6WN10	2400	2200
1FE1054–6WN10	4200	4200
1FE1061–6WH10	1600	1300
1FE1061–6WY10	1200	1000
1FE1064–6WN11	4300	2800
1FE1064–6WQ11	3200	3000
1FE1082–6WP10	3300	2600
1FE1082–6WQ11	3300	2500
1FE1082–6WS10	2500	2300
1FE1082–6WW11	3300	2200
1FE1084–6WR11	5500	3800
1FE1084–6WU11	5000	3800
1FE1084–6WX11	4000	3300
1FE1091–6WN10	2000	1500
1FE1091–6WS10	1800	1300
1FE1092–6WN10	3000	3000
1FE1092–6WR11	3000	2300
1FE1093–6WN10	3600	3400
1FE1093–6WS10	3600	3400
1FE1093–6WV11	4000	3000
1FE1113–6WU11	4000	2800

Table 1-11 Cooling power to be dissipated, continued

Motor type	Cooling power to be dissipated [W] at the maximum speed	Cooling power to be dissipated [W] at the rated speed
1FE1113–6WX11	3800	2700
1FE1114–6WR11	4600	4100
1FE1114–6WT11	4600	4100
1FE1114–6WW11	4600	4100
1FE1115–6WT11	5800	4500
1FE1116–6WR11	6700	5500
1FE1116–6WT11	6000	5500
1FE1116–6WW11	5000	5000
8–pole built–in motors		
1FE1144–8WL11	8500	6000
1FE1145–8WN11	10000	7500
1FE1145–8WQ11	9500	7200
1FE1145–8WS11	7500	7000
1FE1147–8WN11	10000	8500
1FE1147–8WQ11	10000	8500
1FE1147–8WS11	8500	8500
4–pole built–in motors		
1FE1051–4HC10	2000	1500
1FE1051–4WN11	1400	900
1FE1052–4HD10	3200	3000
1FE1052–4HG11	3200	2300
1FE1052–4WK11	2800	1600
1FE1052–4WN11	2800	1600
1FE1053–4HH11	3800	3600
1FE1053–4WN11	3800	2200
1FE1053–4WJ11	3800	2200
1FE1072–4WH11	3200	2000
1FE1072–4WL11	3200	2200
1FE1072–4WN11	3200	2200
1FE1073–4WN11	4500	2700
1FE1073–4WT11	2800	2400
1FE1074–4WM11	5000	3500
1FE1074–4WN11	5000	3500
1FE1074–4WT11	3800	2500
1FE1082–4WN11	2600	2000

Table 1-11 Cooling power to be dissipated, continued

Motor type	Cooling power to be dissipated [W] at the maximum speed	Cooling power to be dissipated [W] at the rated speed
1FE1082–4WR11	2000	2000
1FE1083–4WN11	3600	2800
1FE1084–4WN11	4600	3600
1FE1084–4WP11	5000	3600
1FE1084–4WQ11	4600	3600
1FE1084–4WT11	4200	3600
1FE1085–4WN11	5000	4100
1FE1085–4WQ11	5000	4100
1FE1085–4WT11	4000	4000
1FE1092–4WP11	3300	1900
1FE1092–4WV11	2000	1700
1FE1093–4WH11	4500	3100
1FE1093–4WM11	4500	3500
1FE1093–4WN11	4000	3100
1FE1094–4WK11	5300	3700
1FE1094–4WL11	5300	3700
1FE1094–4WS11	3500	3500
1FE1094–4WU11	3000	3000
1FE1095–4WN11	6500	4500
1FE1096–4WN11	6500	5000
1FE1103–4WN11	4500	3300
1FE1104–4WN11	5000	4000
1FE1105–4WN11	6000	4700
1FE1106–4WN11	8000	5500
1FE1106–4WR11	7500	5000
1FE1106–4WS11	7000	4800
1FE1106–4WY11	5000	5000
1FE1124–4WN11	6000	4500
1FE1125–4WN11	7500	5000
1FE1125–4WP11	7000	4800
1FE1126–4WN11	9000	6000
1FE1126–4WP11	8000	5800
1FE1126–4WQ11	7000	5500

1.7 Thermal motor protection

The stator winding can be supplied with the following motor protection to sense (measure) and monitor the motor temperature:

- Standard protection: 2 x KTY 84
- Full protection (option): 2 x KTY 84 + 1 x PTC thermistor triplet (3 sensors in series)
- Universal protection (option): 2 x KTY 84
+ 1 x PTC thermistor triplet
+ NTC PT3–51F
+ NTC K227/33k/A1

Order No., refer to Chapter 4.

Caution

At extremely low speeds or when a load is applied when the motor is stationary, all 3 motor phases must be monitored. This monitoring function must be realized using the PTC thermistor triplet.

Notice

The PTC and NTC thermistors are ESDS components. Please carefully note the ESDS information and instructions in the Foreword.

Note

At rated load, the winding temperature can reach up to 150 °C.

Temperature evaluation using a KTY 84 (Standard protection)

Notice

Full motor protection is not guaranteed when only a KTY 84 is used.

Under rated load conditions, the winding temperature can reach approx. 150°C. The winding (temperature Class F) is designed for this operating state.

Using a KTY 84 thermistor, the motor is protected against overload while **operational**.

The drive converter senses and evaluates the motor temperature using the KTY 84 sensor signal. An external tripping/evaluation unit is not required. The PTC thermistor function is monitored.

1. Pre–alarm temperature

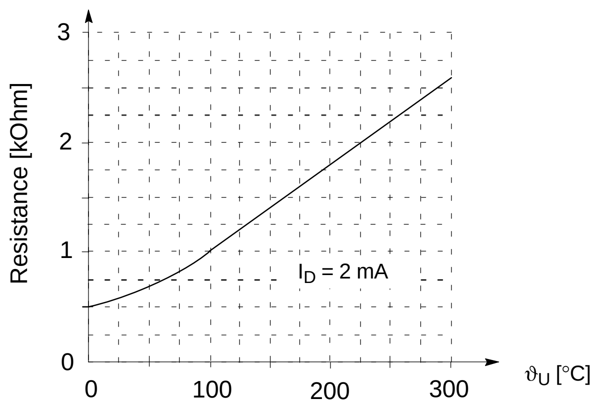
   When the pre–alarm temperature is exceeded, the drive converter signals this using an appropriate fault signal. This fault signal must be externally evaluated. The signal is withdrawn if the motor temperature < pre–alarm temperature.

   If the pre–alarm temperature is exceeded for longer than 240 s (standard setting) or longer than the parameterized time, then a fault signal is issued and the drive is tripped (powered–down). A detailed description is provided in the following documentation ”Description of Functions, SIMODRIVE l611, Motor Temperature Monitoring”.

2. Motor limit temperature

   When the motor limit temperature exceeds 160°C, the drive converter shuts down and signals this using an appropriate fault signal.

Table 1-12 Technical data of the KTY 84 NTC thermistor

Designation	Description
Type	KTY 84
Resistance when cold (20 °C)	approx. 580 Ω
Resistance when warm (100 °C)	approx. 1000 Ω
Connection (refer to Fig. 1-11)	Using the encoder cable
Cable cross–section Outer diameter	0.22 mm^2 1.2 mm
Temperature characteristic	

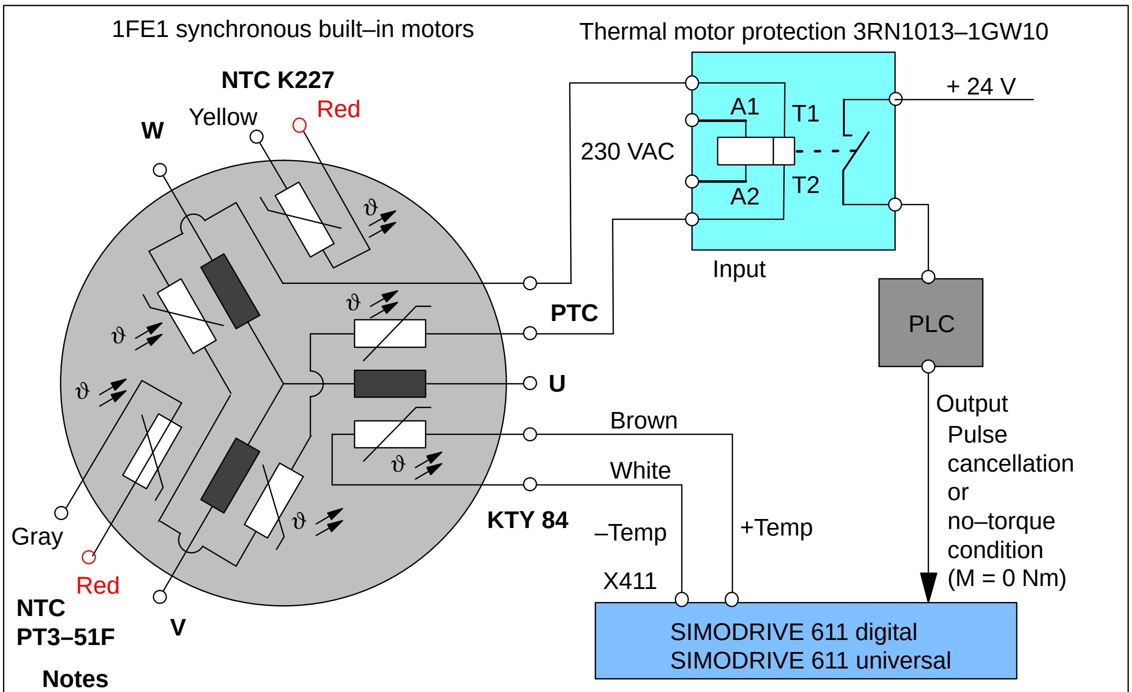
Temperature evaluation using the PTC thermistor triplet (full motor protection, option)

For special applications (e.g. when a load is applied with the motor stationary or for extremely low speeds), the temperature of all of the three motor phases must be additionally monitored using a PTC thermistor triplet.

The PTC thermistor triplet must be evaluated using an external tripping/evaluation unit (this is not included in the scope of supply). This means that the sensor cable is monitored for wire breakage and short–circuit by this unit. When the response temperature is exceeded, the motor motor must be switched into a no–current condition within 1 s.

Table 1-13 Technical data of the PTC thermistor triplet

Designation	Technical data
Type (acc. to DIN 44082–M180)	PTC thermistor triplet
PTC resistance (20 °C)	≤ 750 Ω
Resistance when warm (180 °C)	≥ 1710 Ω
Connection (refer to Fig. 1-11)	Using an external tripping/evaluation unit
Cable cross–section/outer diameter	0.14 mm²/0.9 mm
Response temperature	180 °C
Note: The PTC thermistors do not have a linear characteristic and are therefore not suitable to determine the instantaneous temperature. Characteristic acc. to DIN VDE 0660 Part 303, DIN 44081, DIN 44082	



Notes

- KTY 84: Observe the polarity! + Temp = brown, – Temp = white
- PTC: Independent of the polarity; red, white
- NTC K227: Independent of the polarity; red, yellow
- NTC PT3–51F: Independent of the polarity; red, gray
- PLC: The shutdown circuit via the PLC (programmable logic controller) must be carefully checked to ensure that it correctly shuts down before the motor is actually commissioned!

Fig. 1-11 Temperature monitoring

Temperature evaluation using NTC thermistors (universal protection, option)

Notice

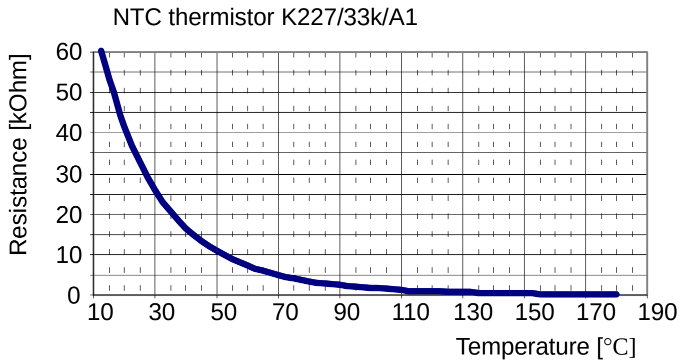
Temperature evaluation using the NTC K227 and NTC PT3–51F thermistors does not guarantee full motor protection.

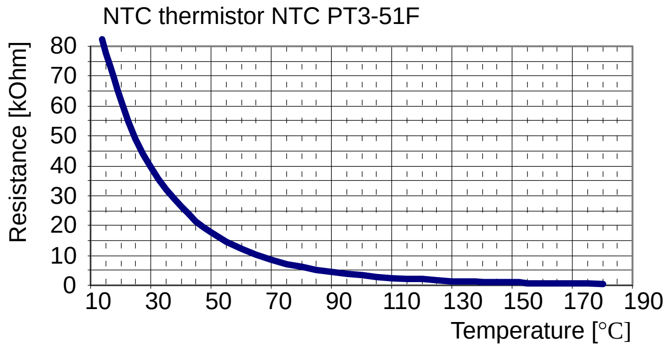
The NTC K227 and NTC PT3–51F thermistors are used if the drive converter cannot evaluate the KTY PTC thermistor.

The drive converter senses and evaluates the motor temperature using the sensor signal (refer to the drive converter documentation).

Table 1-14 Technical data, NTC K227 and NTC PT3–51

Designation	Technical data	
	NTC K227	**NTC PT3–51F**
PTC resistance (25 °C)	approx. 32.8 kΩ	approx. 49.1 kΩ
Resistance when warm (100 °C)	approx. 1800 Ω	approx. 3300 Ω
Connection (refer to Fig. 1-11)	Using the encoder cable	
Cable cross–section Outer diameter	0.14 mm^2 0.8 mm	0.14 mm^2 0.8 mm
Temperature characteristic		





1.8 Encoder system

Function

The encoder system has the following functions:

- Speed actual value encoder for the closed–loop speed control
- Position encoder for the closed–loop position control

The rotor position is determined by the software function ”pole position identification” at power–up, refer to Chapter 1.4.

Encoder systems that can be used

Typically, toothed–wheel encoders (e.g. SIMAG H2) or a comparable hollow–shaft encoder system is used with sinusoidal voltage signals 1Vpp.

The encoder system is not included in the scope of supply (option).

Components

The encoder system comprises the following components:

- Sensor head
- Toothed wheel or a comparable hollow–shaft element

The sensor head is mounted to the spindle housing; the toothed measuring wheel is mounted to the spindle. The generated signals are evaluated in the SIMODRIVE drive converter.

Note

The appropriate manufacturer’s documentation must be carefully observed when engineering, mounting/installing and adjusting the encoder system!

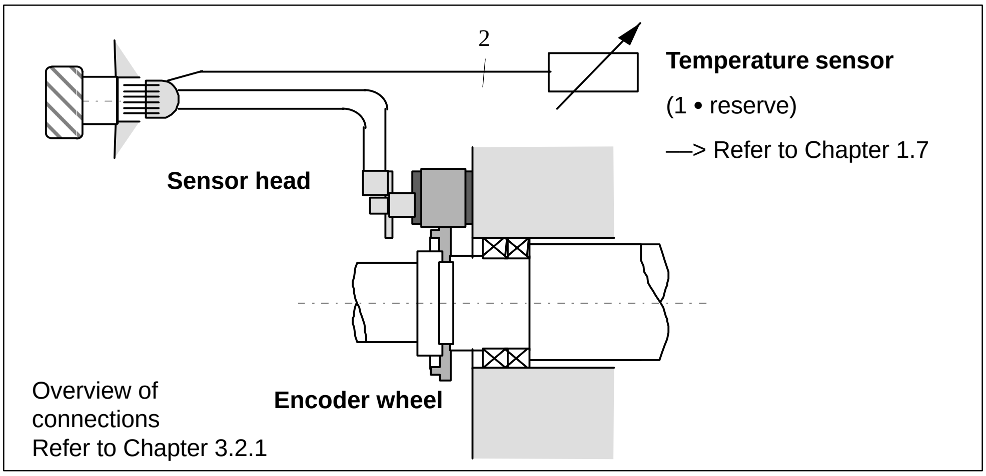


Fig. 1-12 Encoder mounting schematic

Note

A detailed technical description of the encoder system can be taken from the following references:

Reference: Configuration Manual/Installation Instructions, SIMAG H2 toothed–wheel encoder

Catalog NC 60

GEL 244 encoder system from Lenord and Bauer (L & B)

For applications where it is not possible to use an encoder due to the high speed, then we recommend that the GEL 244 toothed encoder from L & B is used.

With these types of encoders, the signal amplitude depends heavily on the clearance between the toothed wheel and sensor head. This is the reason that these encoder systems must be precisely mounted and installed carefully taking into account the mechanical dimensions and tolerances.

Note

The appropriate manufacturer's documentation must be carefully observed when engineering, mounting/installing and adjusting the encoder system!

Please note the following limitations:

1. The encoder can be operated with Standard 2 or Performance modules.
2. Changes to the clearance between the toothed wheel and the sensor head may not exceed ± 20 µm.

   This applies for operation over the complete operating temperature and speed range.
3. The signal tolerances, specified in the Operating Instructions of the GEL 244 encoder, must be carefully observed and the correct assignment of the zero mark should be checked after the encoder has been mounted and installed. This check can be made, for example, using the diagnostics box.

   Order No. (MLFB) of the diagnostics box: 6FX2007–1AA00
4. As a result of offset and amplitude drift, an increased speed ripple and lower positioning accuracy when compared to SIMAG H2, can be expected.
5. Implementation of the GEL 244 encoder

   The encoder is available with the same pin layout (pin–compatible) to Siemens measuring systems.

   A 17–pin flange–mounted socket with plug contacts and outer thread is also used.

   The technical data and a detailed order number can be taken from the L & B documentation.

6. Order administration

   The encoders are ordered directly from L & B:

   Lenord & Bauer GmbH, Dohlenstraße 32
   D–46145 Oberhausen
   Tel.: +49 (208) 9963 – 0
   Fax: +49 (208) 676292
   Internet: http://www.lenordundbauer.com

7. If technical problems are encountered, please contact L & B directly.

■

Brief Mounting Overview 2

2.1 Safety information and instructions when mounting

Danger

Safety in magnetic and electromagnetic fields:

- The safety codes according to VBG 125 must always be carefully observed. As part of the current accident prevention regulations, the access and presence of personnel close to synchronous built–in motors should be carefully managed and regulated.
- Personnel with active implants e.g. heart pacemakers or ferro–magnetic parts implanted in their body (containing iron) may not work with these motors in this working environment.
- Personnel with heart pacemakers must always maintain a safety distance of at least 0.5 m from these motors.
- For persons with implants, the limit value in exposed situations (i.e. where hazardous substances are available in the air as a result of electrical, magnetic or electromagnetic fields) in compliance with the rules for health and safety at work is 0.5 mT (millitesla).
- The specific effects of permanent–magnet rotors (magnetic force/field) on electro–magnetic devices, computers, watches, data mediums, e.g. credit and telephone cards and company ID tags must be carefully observed.

Warning

It is important that the Installation Instructions are carefully observed when engineering/configuring the system and before assembly/disassembly. These Mounting Instructions also include the appropriate safety and danger information/instructions regarding mounting and installation.

Order No. of the Installation Instructions:
610.43000.02 German/English
610.43000.62 Italian/Spanish/French

The Installation Instructions are available as follows:
– They are supplied with every built–in motor
– They are available through the Siemens–Intranet and on DOCONCD
– Can be ordered from your local Siemens office.

It is **not** possible to assembly/disassemble the motors with this particular document (Synchronous Built–in motors 1FE1, Configuration Manual)

Warning

There are potential hazards present when handling, storing and mounting the 1FE1 rotor assemblies equipped with permanent magnets. Only qualified, trained personnel who are knowledgeable about the specific dangers may work with these components.

Note

- The locations where 1FE1 rotor assemblies are mounted and stored must be clearly identified in accordance with VBG 125.
- There is a danger of injury as a result of the high magnetic forces. This means that the rotor may only be handled using suitable production and mounting resources and equipment.
- 1FE1 rotor assemblies must always be provided with non–magnetic protective covers ($\geq$ 20 mm) to separate them from ferromagnetic parts and components. It is not permissible that the rotors are placed directly down on magnetic surfaces, e.g. steel floors or surfaces (danger of crushing).
- Magnetic rotors must be stored in their original packaging. It should be ensured that the environment is dust–free and subject to low vibration levels.

W09 – Warning regarding a hazardous location
W27 – Warning relating to injuries to hands
W13 – Warning regarding magnetic fields
P11 – Prohibited for personnel with heart pacemakers

Fig. 2-1 Warning label provided

2.2 Mounting the rotor (brief description)

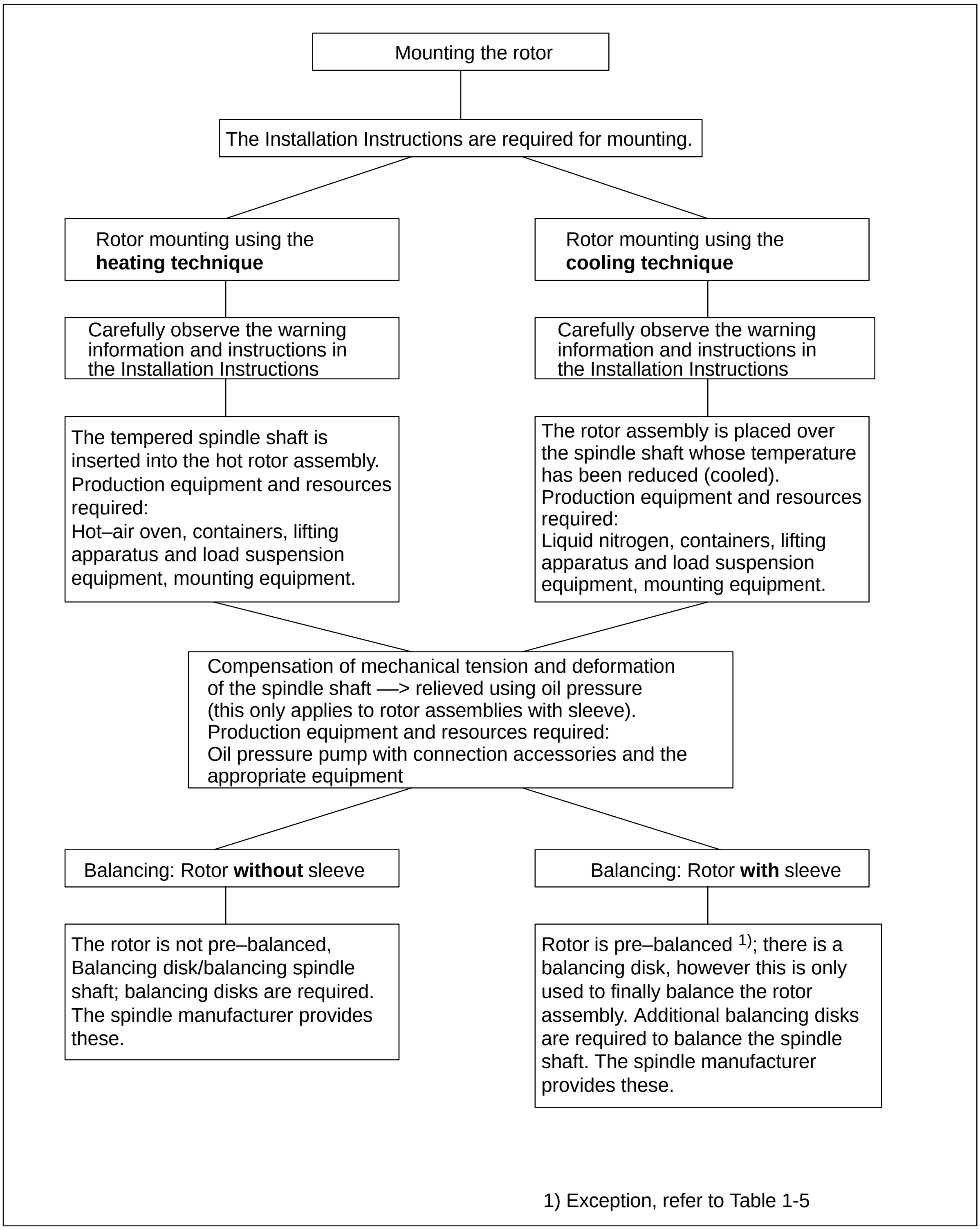


Fig. 2-2 Procedure when mounting the rotor onto the spindle

2.3 Removing the rotor (brief description)

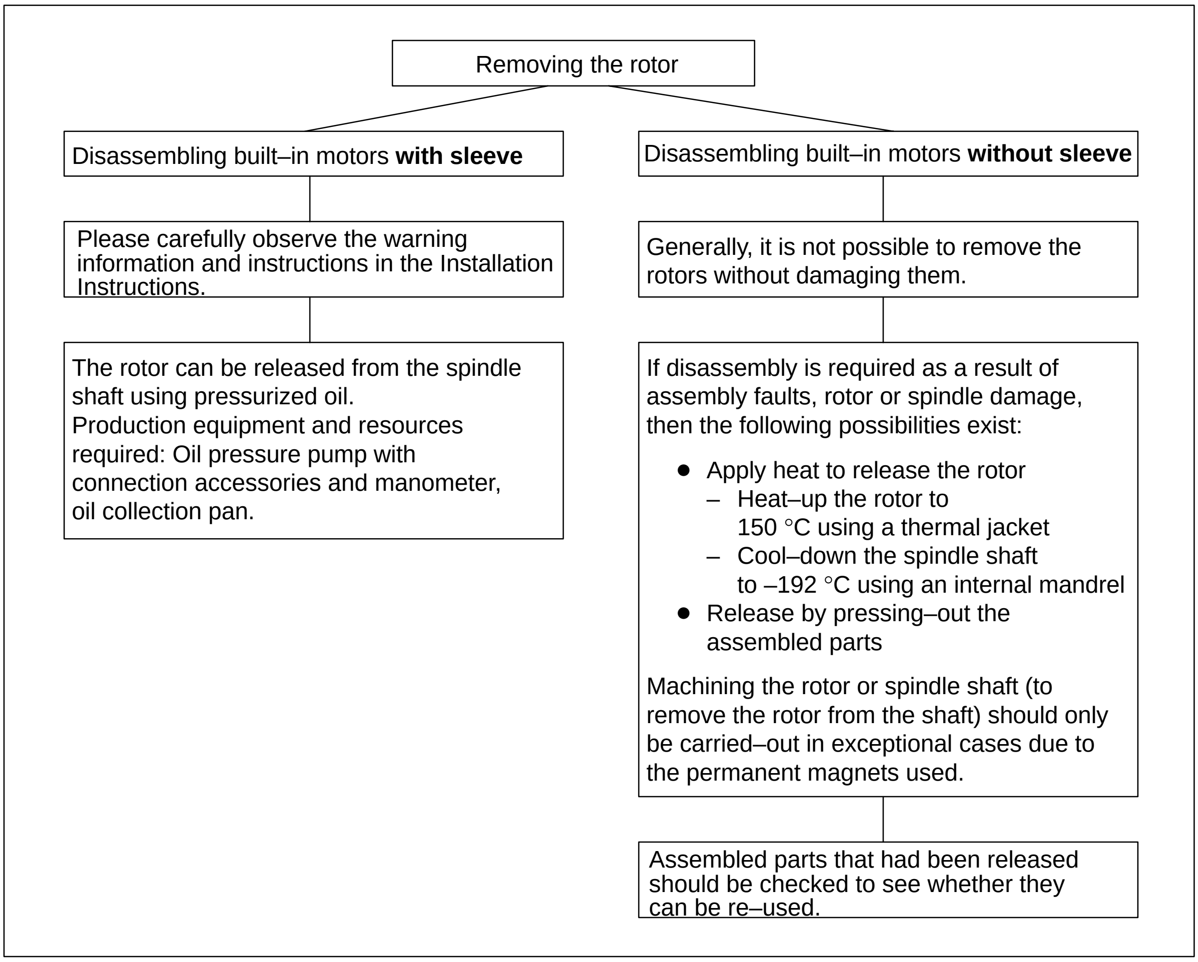


Fig. 2-3 Procedure when removing the rotor from the spindle

2.4 Mounting the stator (brief description)

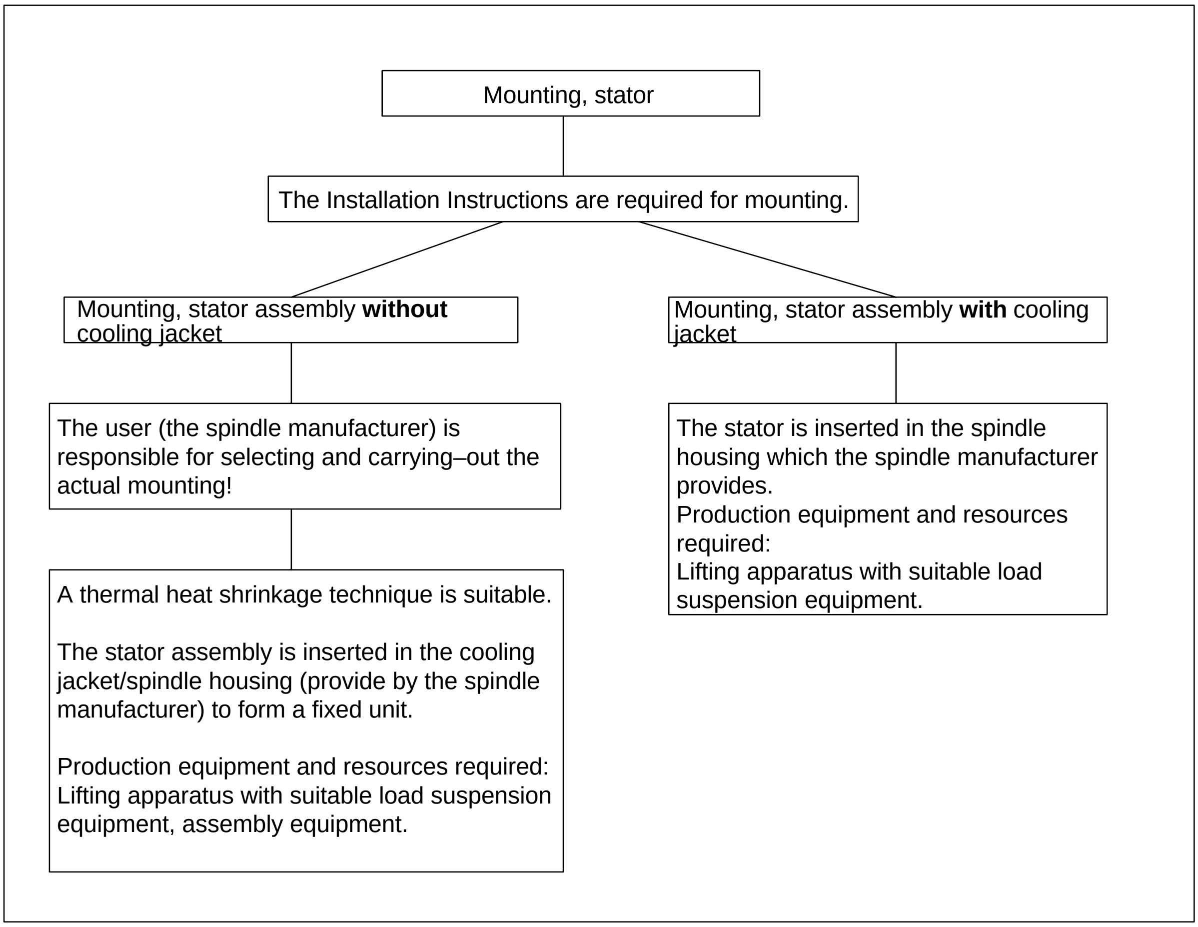


Fig. 2-4 Procedure to mount the stator

2.5 Mounting the motor spindle (brief description)

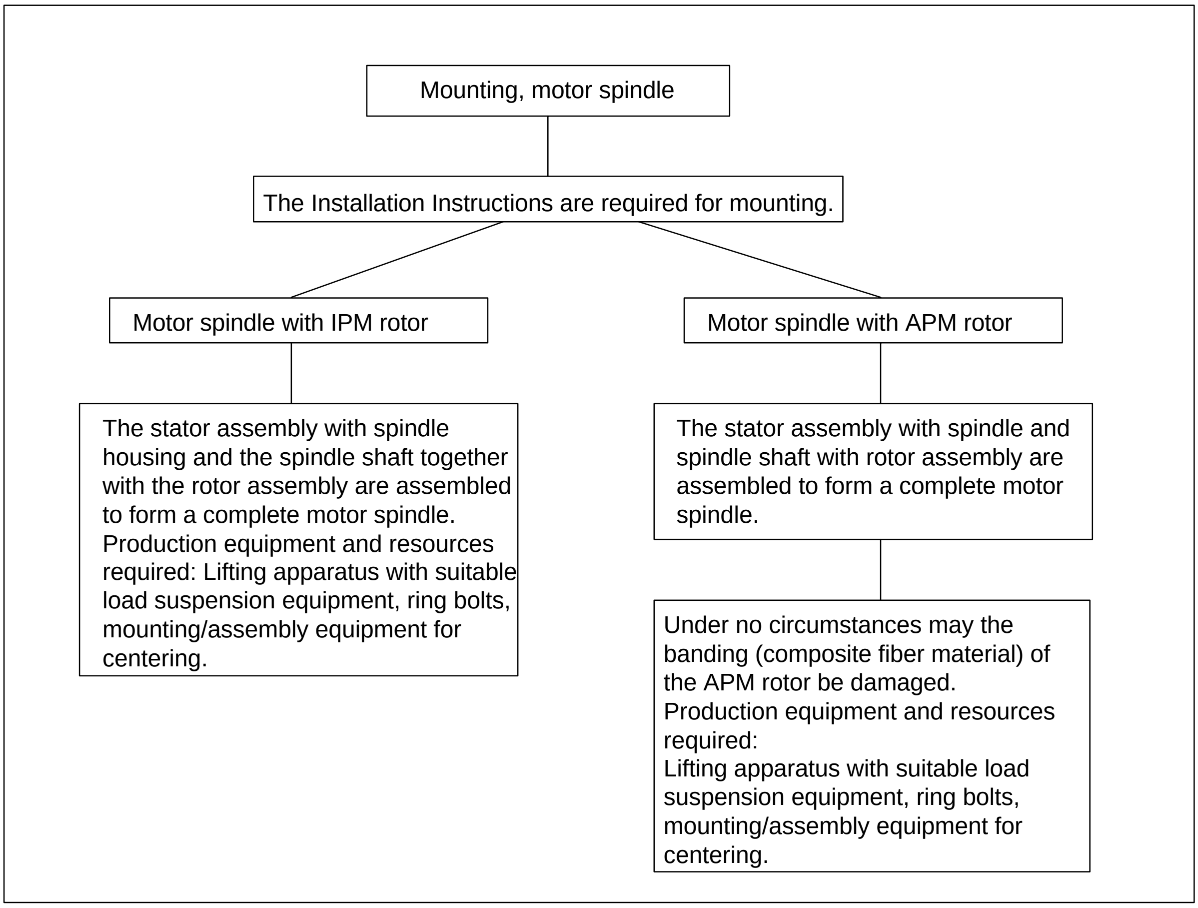


Fig. 2-5 Procedure when mounting the motor spindle

2.5.1 Magnetic forces

Warning

High magnetic forces are present as a result of the permanent magnets in the rotor. These magnetic forces can draw the spindle into the stator bore (danger of crushing)!

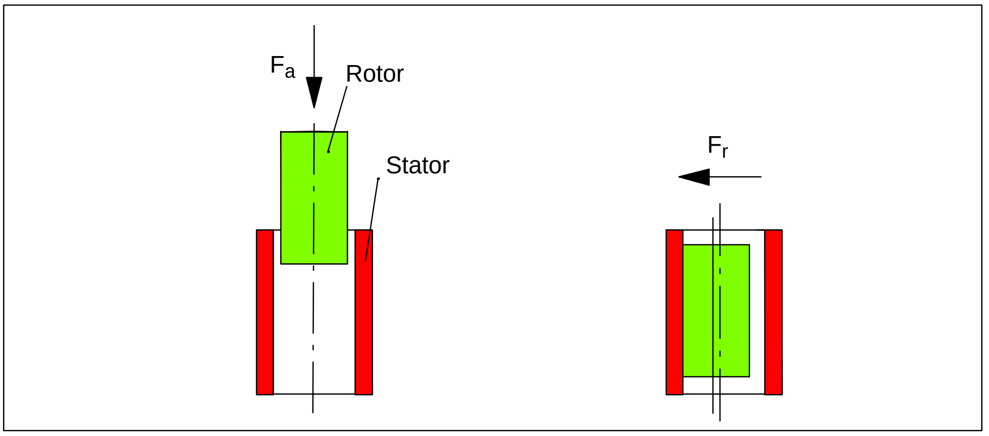


Fig. 2-6 Magnetic forces

Note

The radial forces specified in Table 2-1 are maximum values that occur if the rotor comes into contact with the stator at one side. For a perfectly centered (ideal case) rotor (no eccentricity), the resulting radial force is zero.

Between a centered rotor and a rotor in contact with the stator, the radial force can be linearly converted as a function of the eccentricity (calculated air gap, 0.5 mm).

Table 2-1 Magnetic forces (radial forces)

Motor type	F_a [N]	F_r [N]
6–pole built–in motors		
1FE1041–6 ...	180	200
1FE1042–6 ...	180	400
1FE1051–6 ...	180	200
1FE1052–6 ...	180	400
1FE1054–6 ...	180	800
1FE1061–6 ...	250	250
1FE1064–6 ...	250	1000
1FE1082–6 ...	350	700
1FE1084–6 ...	350	1400
1FE1091–6 ...	360	350

Table 2-1 Magnetic forces (radial forces), continued

Motor type	F_a [N]	F_r [N]
1FE1092–6 ...	360	700
1FE1093–6 ...	360	1050
1FE1113–6 ...	450	1300
1FE1114–6 ...	450	1700
1FE1115–6 ...	450	2200
1FE1116–6 ...	450	2600
8–pole built–in motors		
1FE1144–8 ...	700	2400
1FE1145–8 ...	700	3000
1FE1147–8 ...	700	4200
4–pole built–in motors		
1FE1051–4 ...	200	150
1FE1052–4 ...	200	300
1FE1053–4WJ..	180	870
1FE1053–4HH..	200	450
1FE1072–4 ...	260	700
1FE1073–4 ...	260	1050
1FE1074–4 ...	260	1400
1FE1082–4 ...	300	850
1FE1083–4 ...	300	1275
1FE1084–4 ...	300	1700
1FE1085–4 ...	300	2125
1FE1092–4 ...	340	1000
1FE1093–4 ...	340	1500
1FE1094–4 ...	340	2000
1FE1095–4 ...	340	2500
1FE1096–4 ...	340	3000
1FE1103–4 ...	250	750
1FE1104–4 ...	250	1000
1FE1105–4 ...	250	1250
1FE1106–4 ...	250	1500
1FE1124–4 ...	350	1800
1FE1125–4 ...	350	2300
1FE1126–4 ...	350	2800

2.5.2 Types of construction (IPM, APM)

IPM rotors are rotors with permanent magnets on the **inside**.
APM rotors are rotors with permanent magnets on the **outside**.

Assigning the type of construction to the motor types

Table 2-2 Assigning the type of construction to the motor types

Motor type	IPM rotor		APM rotor	
	without sleeve	with sleeve	without sleeve	with sleeve
6–pole built–in motors				
1FE104☐–6	–	–	X	–
1FE105☐–6	X	X	–	–
1FE106☐–6	X	X	–	–
1FE108☐–6	X	X	–	–
1FE109☐–6	X	X	–	–
1FE111☐–6	X	X	–	–
8–pole built–in motors				
1FE1144–8	–	–	X	–
1FE1145–8	–	–	–	X
1FE1147–8	–	–	–	X
4–pole built–in motors				
1FE105☐–4W☐	X	–	–	–
1FE105☐–4H☐	–	–	X	–
1FE107☐–4	X	–	–	–
1FE108☐–4	X	–	–	–
1FE109☐–4	X	–	–	–
1FE110☐–4	–	–	X	–
1FE112☐–4	–	–	X	–

Design

1FE1 motor rotors are completely machined and are mounted directly onto the motor spindle shaft without having to be post–worked.

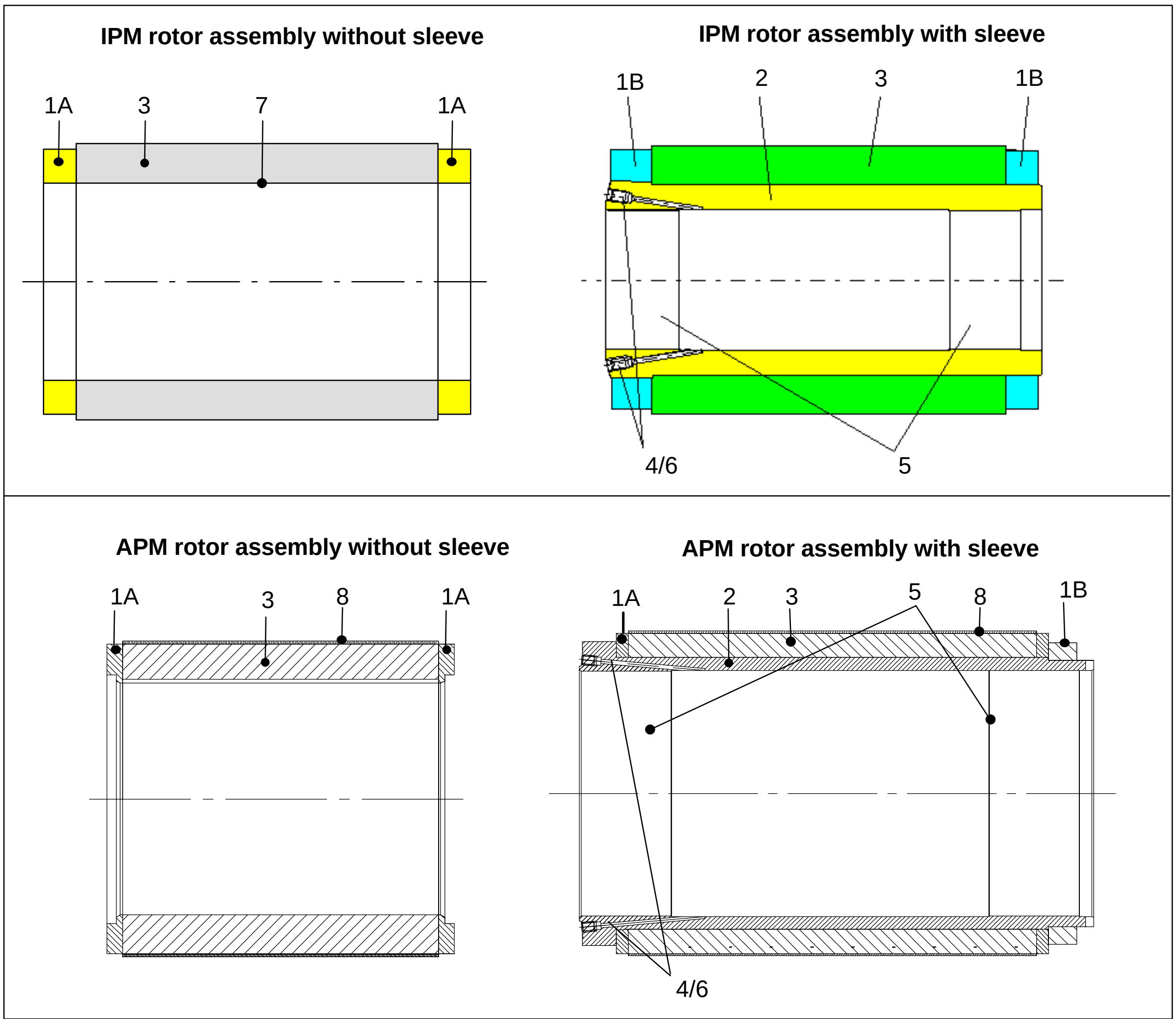


Fig. 2-7 Typical design of IPM and APM rotor assemblies without and without sleeve (for a description of the code numbers, refer to Table 2-3

Table 2-3 Description of the code number in Fig. 2-7

Code	Description	Code	Description
1A	End disk	5	Stage press fit
1B	Balancing disk	6	Threaded stud
2	Sleeve	7	Cylindrical press fit
3	Rotor assembly	8	Composite fiber
4	Pressurized oil connection		

Rotor sleeves

Note

- **Built–in motors without rotor sleeve:**
  Without a sleeve, the force is transferred without any play. Larger outer spindle diameters are achieved because there is no rotor sleeve. Generally, for rotors without sleeves, it is not possible to release the spindle–rotor assembly.
- **Built–in motors with rotor sleeve:**
  The rotor is located on an inner sleeve with stage press fit. The press fit can be released using pressurized–oil without damaging the joint surfaces.

The spindle manufacturer mounts the rotor onto the spindle using a thermal procedure. The spindle in the area around the press fit must be machined with specific dimensions and tolerances to ensure that the torque is transferred through a force fit without any play.

2.5.3 Recommendations for balancing the rotor without sleeve

- Rotors with sleeve in B, C, D and E versions are supplied with balance quality G 2.5 (reference speed 3600 RPM (acc. to DIN ISO 1940,
  Exception: Frame size 1FE114□–8W□□□.
- Rotors without sleeve are not balanced.

After the rotor has been mounted on the spindle, it may be necessary to finely balancing the complete rotor spindle system. The balancing planes required must be provided on the spindle system. It is not permissible to remove material from the rotor assembly.

After the rotor without sleeve has been mounted onto the spindle, the complete system must be balanced. The balancing disks required are not included in the scope of supply.

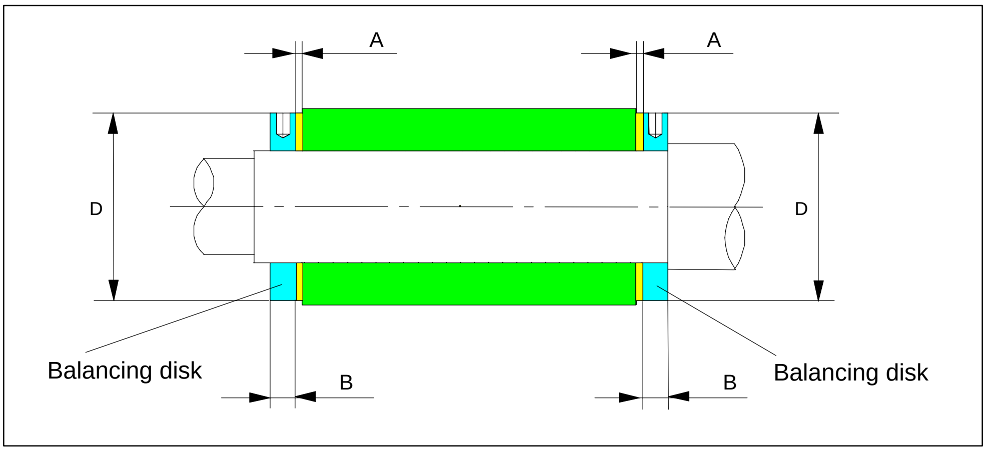


Fig. 2-8 Recommended balancing disks for rotors without sleeve; dimensions A, B and D, refer to Table 2-4

Table 2-4 Dimensions A, B and D for the recommended balancing disks (refer to Fig. 2-8)

Motor type	A [mm] 1)	B [mm]	D [mm]
1FE104□–6□□□	The balancing disk endstop is the rotor sleeve	10	52
1FE105□–6□□□	5 3)	10	70
1FE106□–6□□□	4	10	80
1FE108□–6□□□	4	12	117
1FE109□–6□□□	5 3)	12	125
1FE111□–6□□□	5 3)	12	155
1FE114□–8□□□ 2)	The balancing disk endstop is the rotor sleeve	12	190
1FE1144–8□□□ 2)	22	15	186
1FE105□–4□□□	4	10	63
1FE105□–4H□□	7.5	10	63
1FE107□–4□□□	4	10	80
1FE108□–4□□□	4	10	95
1FE109□–4□□□ Rotor di = 72 mm Rotor di = 80 mm	 5 3) 4	 12 12	 113 113
1FE110□–4□□□	4 3)	12	120
1FE112□–4□□□	4 3)	12	145

1) Minimum clearance A between the rotor and external balancing disk for magnetic materials. For non–magnetic materials, clearance A is not required (refer to the recommendations in the dimension drawings).

2) Version only with rotor sleeve – not pre–balanced

3) Clearance as a result of the rotor end disks (=aluminum or non–magnetic steel). The balancing disk may be in contact with the rotor end disk.

Mounting dimensions

The mounting dimensions can be taken from the dimension drawings, Chapter 6.

A minimum spindle wall thickness is required in the area around the press fit. These thicknesses are specified in the dimension drawings.

Information regarding the balance quality, refer to the dimension drawings.

2.6 Packaging and transport

Note

- When the 1FE1 rotor assemblies are packaged as standard, they can be transported by truck, rail, ship in accordance with the DB Guidelines (without certification).
- 1FE1 rotor packaging is not suitable for transport by air.
  Special IATA regulations apply in this case.

■

Space for your notes

Electrical Connection 3

3.1 Safety information/instructions

Danger

Electrical plants and systems should be designed and constructed so that they do not represent any potential hazards. Information on this subject is provided in VDE 0113 (EN 60204–1).

Danger

In order to prevent accidents caused by touching active components, protective measures must be provided to protect against direct as well as indirect contact. Information is provided in DIN VDE 0100, Part 410 and DIN VDE 0106, Part 100.

All work should be undertaken with the system in a no–voltage condition.

Voltage is present at the motor terminals when the rotor is spinning (up to 2 kV) due to the permanent magnets.

Warning

The stator assembly is electrically connected to the cooling jacket. The cooling jacket must be electrically connected through a good connection in order to ensure the appropriate electrical connection to the spindle box. The cross–section is the effective connection surface.

The spindle manufacturer is responsible in ensuring that the complete motor is grounded in–line with the relevant regulations.

3.1.1 High–voltage test

Before being shipped, the stators of the built–in motors are subject to a high–voltage test in compliance with DIN IEC 60034.

However, the Standards Commission recommends that when electrical components are mounted/installed (such as built–in motors), that a new high–voltage test according to DIN IEC 60034 is carried–out after the final mounting and assembly.

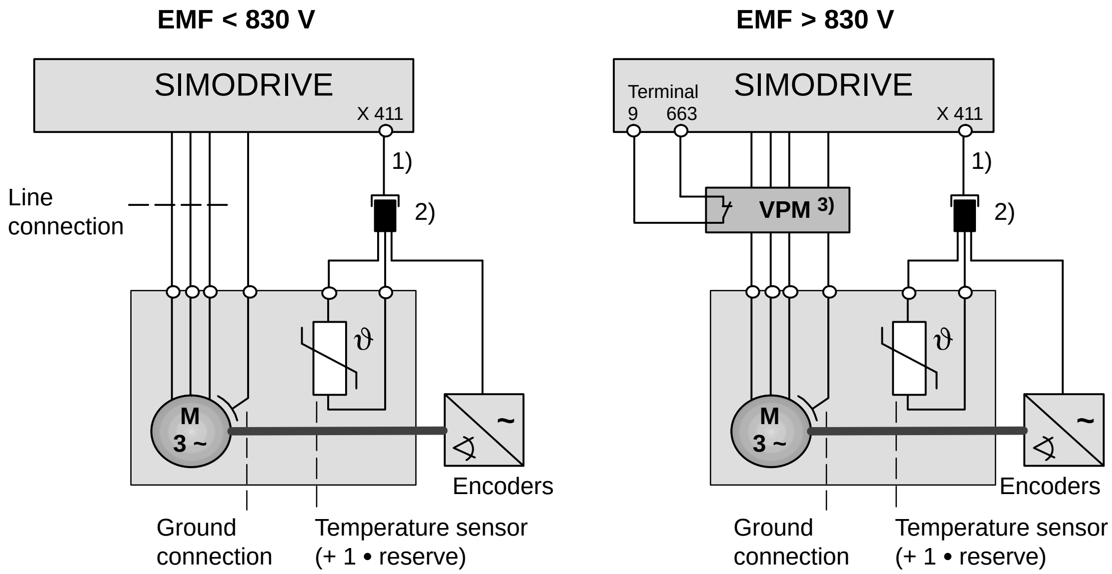
Warning

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

If the test voltage is connected to a temperature sensor, then it will be destroyed.

3.2 Connection system

3.2.1 Overview of connections



1) Signal cable
Draggable – but with some degree of restriction –
Order No. [MLFB] 6FX5 002–2CA31–1□□0
Suitable for drag chains, Order No. [MLFB] 6FX8 002–2CA31–1□□0

2) 17–pin plug connector for signals, outer thread, Order No. [MLFB] 6FX2003–1CF17
Mounting flange optionally available for retrofit [MLFB] 6FX2003–7DX00

3) **A voltage protection module (VPM) is required for an EMF > 830 V, refer to Chapter 3.3**

Fig. 3-1 Overview of connections

3.2.2 Connecting cables

The power connection is fed out from a winding overhang of the stator. The free cable ends are fed to a terminal box that has to be provided by the spindle/machinery construction company.

We recommend that the free cable ends are fed out at the spindle box in a suitable protective tubing with cable gland. Effective strain relief must be provided. The required minimum bending radii must be carefully maintained (3 to 4 x the outer cable diameter).

Standard cables from the range of accessories for the SIMODRIVE 611 drive converter system are used from the spindle bus interface onwards.

Because of the high voltages involved, cables that are suitable for higher mechanical requirements should be used in conjunction with a connection socket and VP module.

The maximum length of the connecting cable is 50 m with and without VP module.

The temperature sensor is connected in the flanged connection socket of the encoder.

3.2.3 Cable cross–sections and outer cable diameter

The values specified in Table 3-1 refer to the cable outlet of the motor.

All of the connecting cables should be engineered and dimensioned corresponding to the rated current according to IEC 60204–1 as a function of the routing type C (cables and conductors routed along walls/panels and in cable trays) and the ambient temperature.

Table 3-1 Cable cross–sections (Cu) and outer diameter of the connecting cables

Motor type	L = 0.5 m1)		L = 1.5 m2)	
	Cable cross–section per phase [mm²]	Outer cable diameter [mm]	Cable cross–section per phase [mm²]	Outer cable diameter [mm]
6–pole built–in motors				
1FE1 041–6WM10	2.5	3.1	2.5	3.1
1FE1 042–6WN10	2.5	4.4	2.5	4.4
1FE1 042–6WR10	2.5	4.4	2.5	4.4
1FE1 051–6WN10	2.5	4.4	2.5	4.4
1FE1 051–6WK10	2.5	4.4	2.5	4.4
1FE1 052–6WN10	2.5	4.4	2.5	4.4
1FE1 052–6WK10	4.0	5.5	4.0	5.5
1FE1 054–6WN10	6.0	6.3	6.0 3)	4.5 3)
1FE1 061–6WH10	2.5	4.4	2.5	4.4

Table 3-1 Cable cross–sections (Cu) and outer diameter of the connecting cables, continued

Motor type	L = 0.5 m1)		L = 1.5 m2)	
	Cable cross–section per phase [mm²]	Outer cable diameter [mm]	Cable cross–section per phase [mm²]	Outer cable diameter [mm]
1FE1 061–6WY10	2.5	4.4	2.5	4.4
1FE1 064–6WN11	6.0	6.3	10.0	7.9
1FE1 064–6WQ11	4.0	5.5	6.0	6.3
1FE1 082–6WP10	10	7.9	10	7.9
1FE1 082–6WS10	4	5.5	6	6.3
1FE1 082–6WQ11	6	6.3	10	7.9
1FE1 082–6WW11	2.5	4.4	2.5	4.4
1FE1 084–6WR11	6.0	6.3	10.0	7.9
1FE1 084–6WU11	4.0	5.5	6.0	6.3
1FE1 084–6WX11	2.5	4.4	2.5	4.4
1FE1 091–6WN10	2.5	4.4	2.5	4.4
1FE1 091–6WS10	2.5	4.4	2.5	4.4
1FE1 092–6WN10	6.0	6.3	10.0	7.9
1FE1 092–6WR11	4.0	5.5	6.0	6.3
1FE1 093–6WN10	10.0	7.9	16.0	9.0
1FE1 093–6WS10	6.0	6.3	10.0	7.9
1FE1 093–6WV11	4.0	5.5	6.0	6.3
1FE1 113–6WU11	4.0	5.5	6.0	6.3
1FE1 113–6WX11	4.0	5.5	6.0	6.3
1FE1 114–6WR11	16.0	9.0	25.0	11.0
1FE1 114–6WT11	10.0	7.9	16.0	9.0
1FE1 114–6WW11	6.0	6.3	10.0	7.9
1FE1 115–6WT11	10.0	6.6	16.0	8.9
1FE1 116–6WR11	16.0	9.0	25.0	11.0
1FE1 116–6WT11	10.0	7.9	16.0	9.0
1FE1 116–6WW11	6.0	6.3	10.0	7.9
8–pole built–in motors				
1FE1 144–8WL11	25.0	11.0	2 • 16.0	9.0
1FE1 145–8WN11	2 • 16.0	9.0	2 • 16.0	9.0
1FE1 145–8WQ11	2 • 10.0	7.9	2 • 16.0	9.0
1FE1 145–8WS11	25.0	11.0	25.0 4)	11.0 4)
1FE1 147–8WN11	2 • 16.0	9.0	2 • 16.0	9.0
1FE1 147–8WQ11	2 • 10.0	7.9	2 • 16.0	9.0
1FE1 147–8WS11	25.0	11.0	25.0	11.0

Table 3-1 Cable cross–sections (Cu) and outer diameter of the connecting cables, continued

Motor type	L = 0.5 m1)		L = 1.5 m2)	
	Cable cross–section per phase [mm²]	Outer cable diameter [mm]	Cable cross–section per phase [mm²]	Outer cable diameter [mm]
4–pole built–in motors				
1FE1 051–4HC10	2.5	3.7	2.5	3.7
1FE1 051–4WN11	2.5	4.4	2.5	4.4
1FE1 052–4HD10	6.0	4.8	6.0	4.8
1FE1 052–4HG11	4.0	4.2	6.0	4.79
1FE1 052–4WN11	2.5	4.4	2.5	4.4
1FE1 052–4WK11	2.5	4.4	4.0	5.5
1FE1 053–4HH11	4.0	4.3	6.0	4.8
1FE1 053–4WN11	2.5	4.4	2.5	4.4
1FE1 053–4WJ11	4.0	4.2	4.0	4.2
1FE1 072–4WH11	6.0	6.3	10.0	7.9
1FE1 072–4WL11	4.0	5.5	6.0	6.3
1FE1 072–4WN11	2.5	4.4	4.0	5.5
1FE1 073–4WN11	6.0	6.3	10.0	7.9
1FE1 073–4WT11	2.5	4.4	2.5	4.4
1FE1 074–4WM11	16.0	9.0	25.0	11.0
1FE1 074–4WN11	10.0	7.9	16.0	9.0
1FE1 074–4WT11	6.0	4.8	6.0	4.8
1FE1 082–4WN11	4.0	5.5	6.0	6.3
1FE1 082–4WR11	2.5	4.4	2.5	4.4
1FE1 083–4WN11	10.0	7.9	16.0	9.0
1FE1 084–4WN11	16.0	9.0	25.0	11.0
1FE1 084–4WP11	10.0	7.9	16.0	9.0
1FE1 084–4WQ11	10.0	7.9	16.0	9.0
1FE1 084–4WT11	6.0	6.3	10.0	7.9
1FE1 085–4WN11	16.0	9.0	25.0	11.0
1FE1 085–4WT11	6.0	6.3	10.0	7.9
1FE1 085–4WQ11	10.0	7.9	16.0	9.0
1FE1 092–4WP11	4.0	5.5	6.0	6.3
1FE1 092–4WV11	4.0	5.5	6.0	6.3
1FE1 093–4WH11	10.0	7.9	16.0	9.0
1FE1 093–4WM11	6.0	6.3	10.0	7.9
1FE1 093–4WN11	6.0	6.3	10.0	7.9
1FE1 094–4WK11	16.0	9.0	25.0	11.0
1FE1 094–4WL11	10.0	7.9	16.0	9.0

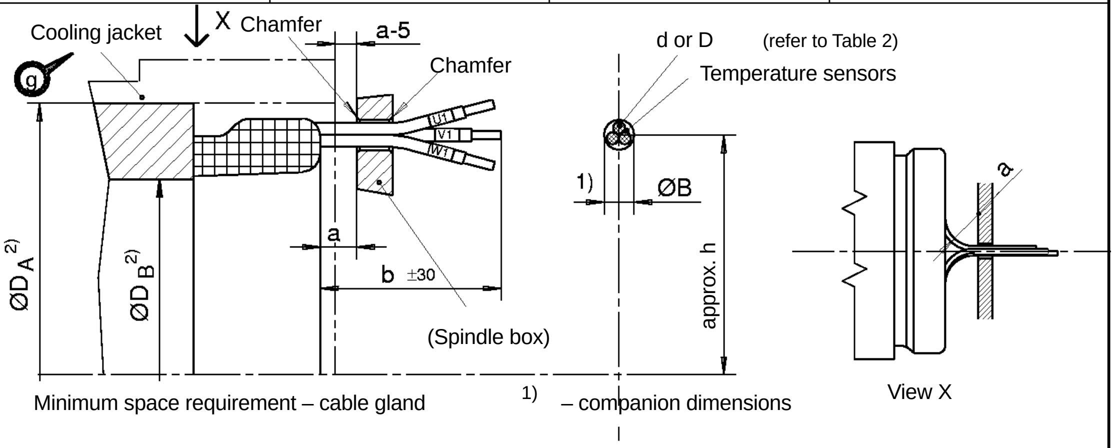
Table 3-1 Cable cross–sections (Cu) and outer diameter of the connecting cables, continued

Motor type	L = 0.5 m1)		L = 1.5 m2)	
	Cable cross–section per phase [mm²]	Outer cable diameter [mm]	Cable cross–section per phase [mm²]	Outer cable diameter [mm]
1FE1 094–4WS11	6.0	6.3	10.0	7.9
1FE1 094–4WU11	4.0	5.5	6.0	6.3
1FE1 095–4WN11	16.0	9.0	25.0	11.0
1FE1 096–4WN11	16.0	9.0	25.0	11.0
1FE1 103–4WN11	10.0	7.9	16.0	9.0
1FE1 104–4WN11	16.0	9.0	25.0	11.0
1FE1 105–4WN11	16.0	9.0	25.0	11.0
1FE1 106–4WN11	2 • 10.0	7.9	2 • 16.0	9.0
1FE1 106–4WR11	25.0	11.0	2 • 16.0	9.0
1FE1 106–4WS11	25.0	11.0	25.0	11.0
1FE1 106–4WY11	6.0	6.3	10.0	7.9
1FE1 124–4WN11	25.0	11.0	2 • 16.0	9.0
1FE1 125–4WN11	2 • 16.0	9.0	2 • 16.0	9.0
1FE1 125–4WP11	25.0	11.0	2 • 16.0	9.0
1FE1 126–4WN11	2 • 16.0	9.0	2 • 16.0	9.0
1FE1 126–4WQ11	25.0	11.0	2 • 16.0	9.0
1FE1 126–4WP11	2 • 16.0	9.0	2 • 16.0	9.0

1) According to DIN 46200, it can only be used inside the motor spindle
2) VDE 0298, Parts 3, 4 provide information information and instructions on using cables
3) Teflon cable
4) Connecting cable, also for 1.5 m is in one section

Cable type

1	2	3	4

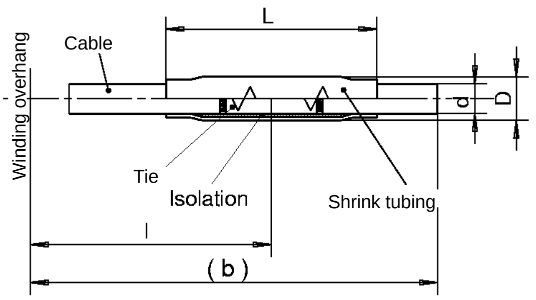


Cable length	Version
b = 500	Two–section
b ≥ 1500	Single–section *)

Table 1 – Cable version

$B = n \cdot d \text{ or } D$	3)
$h = \frac{D_A + D_B}{4}$	
$a = 5 \cdot d$	

*) Two–section cable version (dimensions D, L, l only for two–section versions)



Cable cross–section 1)	Typical values D	Typical values L	Max. cable Ø d	Dim. l
2.5	7	70	4.4	120
4	9	75	5.5	
6	10	75	6.3	
10	11	80	7.9	
16	12	85	9.0	
25	16	90	11.0	

Table 2 – Dimensions, individual cables

1) Cable cross–section and number of individual cables, refer to Configuration Manual and electrical data sheet
Note: If required, provide an elongated hole as cable entry point for large cable cross–sections.

2) Dimensions, refer to the motor dimension sheet

3) n = 2.3 for 3 individual cables; n = 3.3 for 6 individual cables.
Dimension d or D acc. to Table 2

Dimension drawing 1FE1
510.40171.01 g

Fig. 3-2 Cable type

3.2.4 Recommended grounding

Note

A protective conductor must be connected to the spindle housing through a good electrical connection. Further, it must be ensured that there is a good electrical connection between the spindle housing and the cooling jacket.

VDE 0113 (EN 60204–1) provides data and information on the minimum required cross–section of the protective conductor.

When grounding the system, it must be ensured that there is a good electrical connection between the protective conductor and the spindle box. This connection must be protected against corrosion (e.g. the connection surfaces must be bare and a coat of Vaseline applied).

Protection against hazardous currents flowing through the body (example for the protective conductor connection)

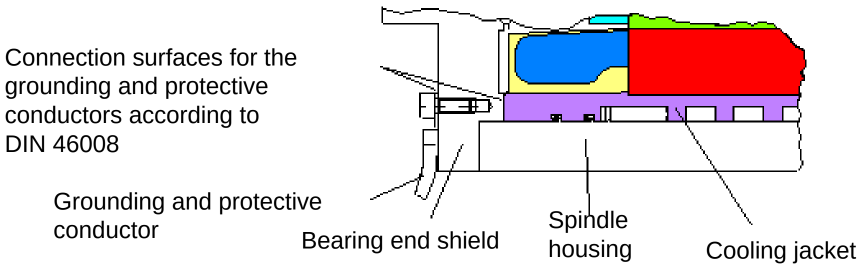


Fig. 3-3 Recommended grounding

3.2.5 Terminal box

The terminal box must have, as a minimum, degree of protection IP 54 according to DIN IEC 60034–5. Seals must be appropriately provided between the spindle housing (spindle box) and the terminal box and at the terminal box cover.

The terminal box is not included in the scope of supply.

3.3 VP module (VPM, Voltage Protection Module)

Use and application

Notice

A VP module is required for motors with an EMF > 830 V.

When a fault condition develops, the VPM limits the DC link voltage at the drive converter.

If the line supply voltage fails or if the drive converter pulses are canceled as a result of the power failure, at maximum motor speed, the synchronous motor regenerates a high voltage back into the DC link.

The VPM detects when the motor voltage is too high and short–circuits the 3 motor feeder cables. The energy remaining in the motor is converted into heat (thermal energy) as a result of the short–circuited. Response voltage, 830 V DC +/–1%.

The VPM must be located close to the drive converter (maximum distance to the converter = 1.5 m). MOTION–CONNECT cables should also be used in conjunction with the VP module.

The VP module can only be used in conjunction with SIMODRIVE 611 digital, SIMODRIVE 611 universal and 1FE1 built–in motors.

The VP module is not included with the 1FE1 built–in motors and must be separately ordered.

Note

The following references are available on the VP module:

Reference:	/VPM/	Operating Instructions VPM 120, VPM 200
	/BU/	Catalog NC 60

3.3.1 Technical data of the VP modules

Table 3-2 Technical data of the VP modules

Designation	VPM 120	VPM 200 / VPM 200 DYNAMIK *)
Order No. for metric gland	6SN1113–1AA00–1JA1	6SN1113–1AA00–1KA1/ 6SN1113–1AA00–1KC1
Dimensions H • W • D [mm]	300 • 150 • 180	300 • 250 • 190/ 300 • 250 • 260
Connection on the converter side (conductor cross–section)	U3, V3, W3; M50 (max. 50 mm^2)	U3, V3, W3; 2 • M50 (max. 2 • 50 mm^2)
Connection on the motor side (conductor cross–section)	U4, V4, W4; M50 (max. 50 mm^2)	U4, V4, W4; 2 • M50 (max. 2 • 50 mm^2)
Signaling contact 1 • M16 Max. conductor cross–section	1 • NC contact (floating) 24 V DC ≦ 1.5 mm^2	1 • NC contact (floating) 24 V DC ≦ 1.5 mm^2
Rated current	≦ 3 AC 120 A_{rms}	≦ 3 AC 200 A_{rms}
Short time load	2 • I_N for approx. 500 ms	3 • I_N for approx. 500 ms
Connection length on the drive converter side	≦ 1.5 m	≦ 1.5 m
Connection length on the motor side	≦ 50 m	≦ 50 m
Power loss – normal operation – short–circuit operation with I_N	 approx. 0 W approx. 360 W (max. 2 min)	 approx. 0 W approx. 1.1 W (max. 2 min)
Response voltage	830 V DC +/– 1%	830 V DC +/– 1%
Degree of protection	IP20	IP20
Ambient temperature	0 ... 50 °C	0 ... 50 °C
Installation altitude	1000 m above sea level (otherwise de–rating)	1000 m above sea level (otherwise de–rating)
Vibratory load (acc. to DIN EN 60721)	up to 1 g	up to 1 g
Shock stressing (acc. to DIN EN 60721)	up to 10 g	up to 10 g
Max. permissible braking time	≦ 2 min	≦ 2 min
Weight	approx. 6 kg	approx. 11 kg/approx. 13 kg

***) Note: VPM 200 DYNAMIK**

The VPM 200 DYNAMIK should be used in the following cases:

- When third–party/unlisted synchronous motors are used (they generally have higher inductances than 1FE1 motors) and when a third–party/unlisted motor is combined with a series reactor
- Combination of 1FE1 motor with series reactor

Capacitance of the drive converter group with VP module

In order that a defined DC link voltage is not exceeded when a fault condition develops, and to limit the voltage rate–of–rise, the SIMODRIVE DC link must have a minimum capacitance. This minimum capacitance is calculated according to the following approximate formula:

$C_{DC\ link\ min}$ [µF] = I_{Nmotor} [A] • 33.33

This required DC link capacitance must be taken into account when engineering the system.

Warning

It is not permissible that switching elements are inserted in the connecting cables U, V, W between the drive converter, VPM and motor!

Maximum permissible braking time with VP module

The braking time for a terminal short–circuit (with VPM) can be approximately calculated as follows:

$t_{Br} = K \cdot 10^{-6} \cdot J_{tot} \cdot n^2$

t_{Br} = braking time in [s]
K = brake constant [(s • min^2)/(kg • m^2)], (refer to Table 3-3)
J_{tot} = total moment of inertia ($J_{rot} + J_{external}$) in [kgm^2]
(J_{rot} refer to Chapter 5 Technical Data)
n = maximum speed in [RPM^2]

Note

It must be ensured that the braking time t_{Br} is $\leqq$ 120 s.

3.3.2 Selecting the VP module and determining the brake constant K

Table 3-3 Selecting the VPM; brake constant K

Motor type	VPM	Brake constant (K)
6–pole built–in motors		
1FE1041–6WM10	–	–
1FE1042–6WN10	–	–
1FE1042–6WR10	–	–
1FE1051–6WN10	–	–
1FE1051–6WK10	–	–
1FE1052–6WN10	–	–
1FE1052–6WK10	–	–
1FE1054–6WN10	–	–
1FE1061–6WH10	–	–
1FE1061–6WY10	–	–
1FE1064–6WN11	120	1.0
1FE1064–6WQ11	120	1.1
1FE1082–6WP10	–	–
1FE1082–6WS10	–	–
1FE1082–6WQ11	120	1.8
1FE1082–6WW11	120	2.0
1FE1084–6WR11	120	1.2
1FE1084–6WU11	120	1.3
1FE1084–6WX11	120	1.5
1FE1091–6WN10	–	–
1FE1091–6WS10	–	–
1FE1092–6WN10	–	–
1FE1092–6WR11	120	2.3
1FE1093–6WN10	–	–
1FE1093–6WS10	–	–
1FE1093–6WV11	120	1.0
1FE1113–6WU11	120	2
1FE1113–6WX11	120	2.2
1FE1114–6WR11	120	1.1
1FE1114–6WT11	120	1.1
1FE1114–6WW11	120	1.1
1FE1115–6WT11	120	1.4
1FE1116–6WR11	120	0.9
1FE1116–6WT11	120	0.9
1FE1116–6WW11	120	1.9

Table 3-3 Selecting the VPM; brake constant K, continued

Motor type	VPM	Brake constant (K)
8–pole built–in motors		
1FE1144–8WL11	200	0.8
1FE1145–8WN11	200	0.6
1FE1145–8WQ11	200	0.8
1FE1145–8WS11	200	0.9
1FE1147–8WN11	200	0.6
1FE1147–8WQ11	200	0.7
1FE1147–8WS11	200	0.8
4–pole built–in motors		
1FE1051–4HC10	–	–
1FE1051–4WN11	120	5.5
1FE1052–4HD10	–	–
1FE1052–4HG11	120	1.3
1FE1052–4WN11	120	3.4
1FE1052–4WK11	120	3.2
1FE1053–4HH11	120	1.0
1FE1053–4WN11	120	2.5
1FE1053–4WJ11	120	2.1
1FE1072–4WH11	120	3.3
1FE1072–4WL11	120	2.7
1FE1072–4WN11	120	3.6
1FE1073–4WN11	120	2.6
1FE1073–4WT11	120	2.8
1FE1074–4WM11	120	2.3
1FE1074–4WN11	120	2.3
1FE1074–4WT11	120	2.0
1FE1082–4WN11	120	3.6
1FE1082–4WR11	120	5.3
1FE1083–4WN11	120	2.7
1FE1084–4WN11	120	2.2
1FE1084–4WP11	120	1.8
1FE1084–4WQ11	120	2.6
1FE1084–4WT11	120	2.3
1FE1085–4WN11	120	1.8
1FE1085–4WT11	120	2.5
1FE1085–4WQ11	120	2.1
1FE1092–4WP11	120	3.7
1FE1092–4WV11	120	5.7

Table 3-3 Selecting the VPM; brake constant K, continued

Motor type	VPM	Brake constant (K)
1FE1093–4WH11	120	2.7
1FE1093–4WM11	120	2.7
1FE1093–4WN11	120	3.0
1FE1094–4WK11	120	2.3
1FE1094–4WL11	120	2.3
1FE1094–4WS11	120	3.0
1FE1094–4WU11	120	3.5
1FE1095–4WN11	120	1.9
1FE1096–4WN11	120	1.9
1FE1103–4WN11	120	1.3
1FE1104–4WN11	200	1.1
1FE1105–4WN11	200	0.9
1FE1106–4WN11	200	0.9
1FE1106–4WR11	200	1.11
1FE1106–4WS11	200	1.3
1FE1106–4WY11	120	1.7
1FE1124–4WN11	200	1.1
1FE1125–4WN11	200	0.9
1FE1125–4WP11	200	1.0
1FE1126–4WN11	200	0.8
1FE1126–4WQ11	200	1.1
1FE1126–4WP11	200	0.9

3.3.3 Connecting the VPM 120, VPM 200 and VPM 200 DYNAMIK

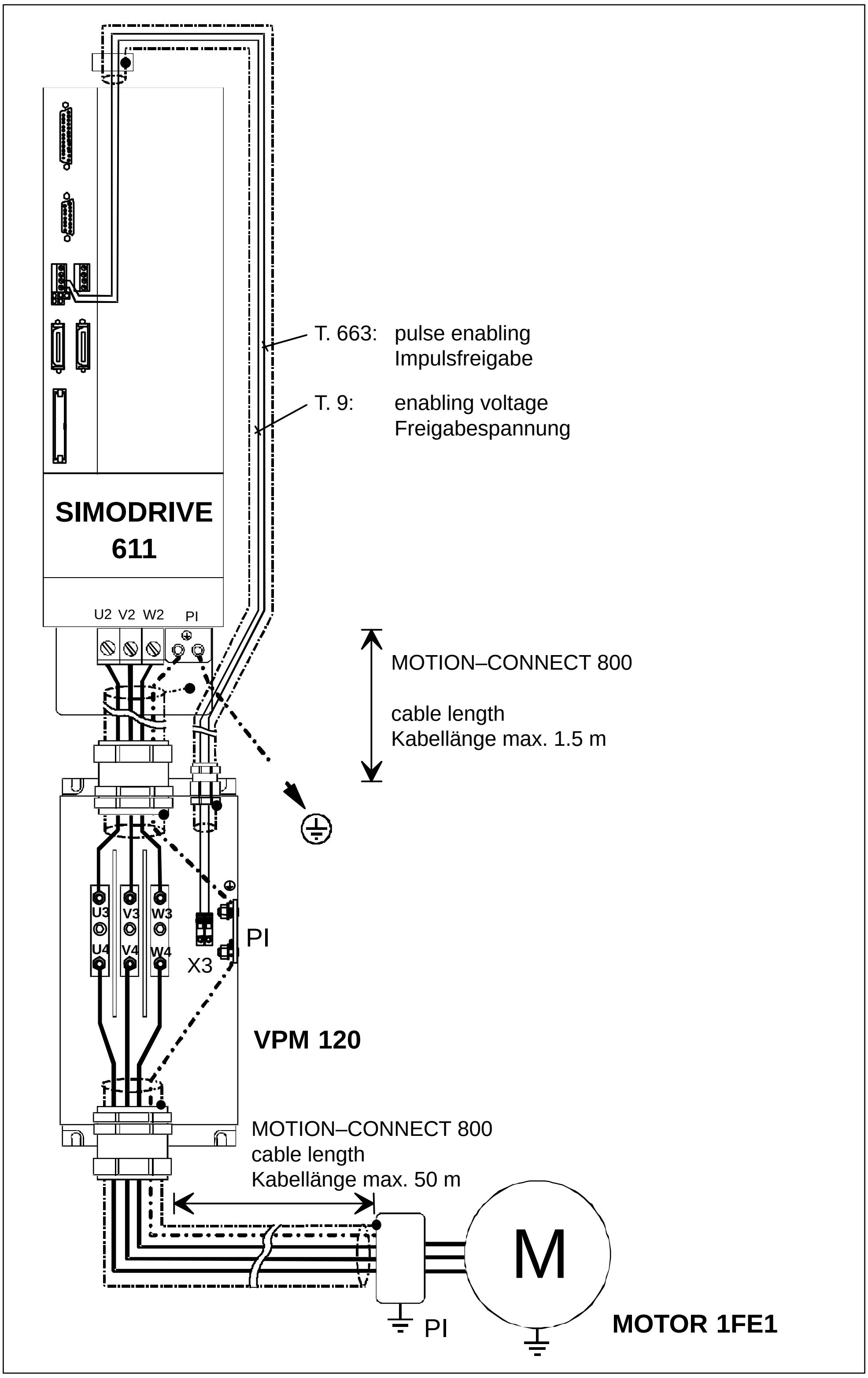


Fig. 3-4 Connecting VPM 120

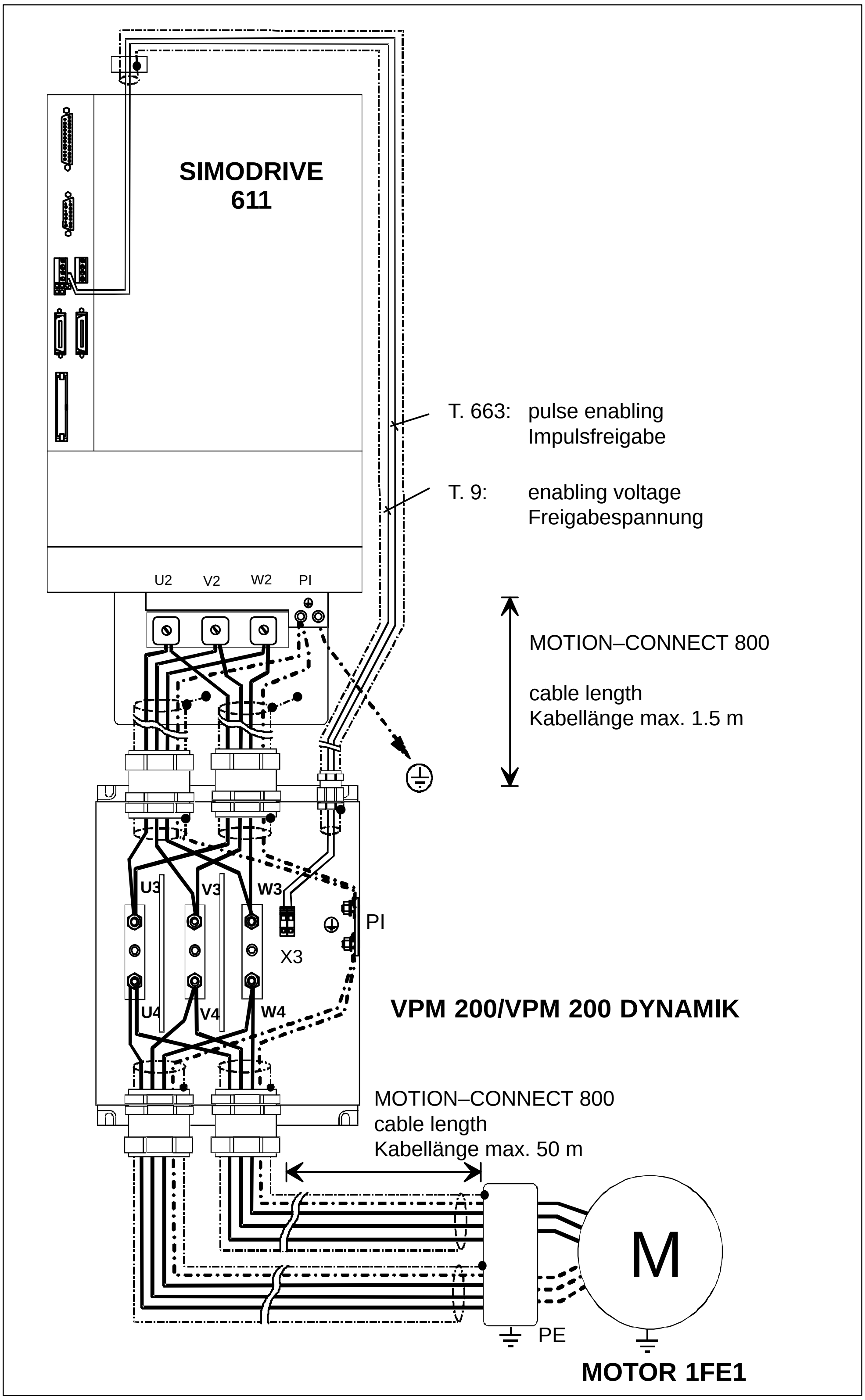


Fig. 3-5 Connecting VPM 200 and VPM 200 DYNAMIK

■

Order Designation

4

Structure of the order designation

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

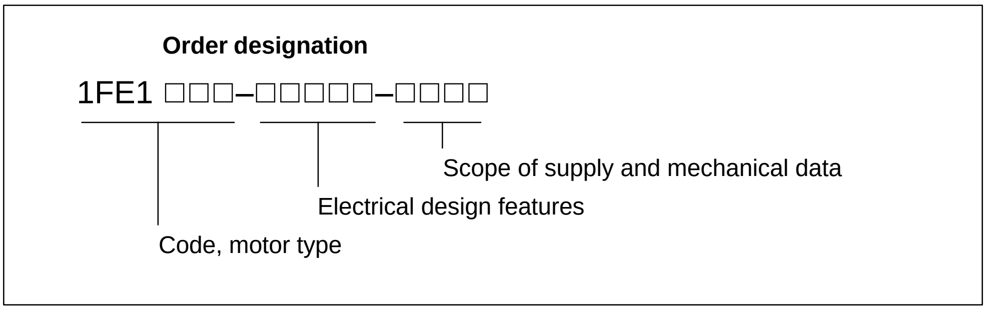


Fig. 4-1 Order designation

For possible combinations, refer to Chapter 1.3, Technical data or Catalog NC 60.

Please note that not every theoretical combination is possible.

Order designation 1FE1 □□□–□□□□□–□□□□

Liquid–cooled three–phase synchronous motors
Machine tool – main spindle drive

Size

Length

Lamination cross–section
4 = 4–pole, 6 = 6–pole, 8 = 8–pole

Cooling type (liquid–cooled = W, H)

Winding versions: H, K, L, N, Q, R, S, T, U, V, W, Y

Winding version
- 0 = impregnated winding with standard protection (2 x KTY)
- 1 = cast winding with standard protection (2 x KTY)
- 3 = cast winding with full protection (2 x KTY + PTC–PTC thermistor triplet)
- 5 = cast winding with universal protection: 2 x KTY + PTC thermistor triplet + NTC PT3–51F + NTC K227 can only be supplied with 0.5 m cable 1)

Voltage limiting module (VPM)
- 0 = without VPM
- 1 = with VPM

Scope of supply
- 1 = stator and rotor
- 2 = spare part, only stator (W in the rotor version)
- 3 = spare part, only rotor (W in the stator version)

Stator version
- A = version without cooling jacket 1)
- B = standard version with cooling jacket
- W = spare part, rotor, stator has not significance

Rotor version
- A, R = without rotor sleeve
- B = with standard rotor sleeve (mounting–compatible to 1PH2 motors)
- C, D, E = with rotor sleeve (large bore diameter)
- Txx = special rotor sleeve, on request
- W = spare part, stator, rotor is of no significance

Connection type
- 0 = free cable ends 1500 mm (cable outlet at the larger housing outer diameter, rigid connecting location, refer to Chapter 3.2)
- 1 = free cable ends, 1500 mm (cable outlet at the smaller housing outer diameter, rigid connecting location, refer to Chapter 3.2) 1)
- 2 = free flexible cable ends, 500 mm, **preferred version** Cable outlet at the larger outer housing diameter
- 3 = free flexible cable ends, 500 mm, (cable outlet at the smaller housing outer diameter) 1)

1) Only available on request; please contact your local Siemens office

Fig. 4-2 Details of the order designation

■

Technical Data and Characteristics 5

5.1 P/n and M/n diagrams

Built–in motors must be continually cooled independent of the operating mode.

Note

The friction losses depend on the motor spindle mechanical design (e.g. bearing losses, turbulence losses, losses at shaft glands).

As the built–in motor manufacturer is not aware of the magnitude of these losses, the motor power ratings and torques, specified in this documentation, refer to the values which the built–in motor transfers to the spindle. The total function losses must be subtracted from the specified values in order to determine the net shaft output.

The dotted lines in the diagrams indicate the motor utilization for duty type S6. The power module is specified in Chapter 1.3.

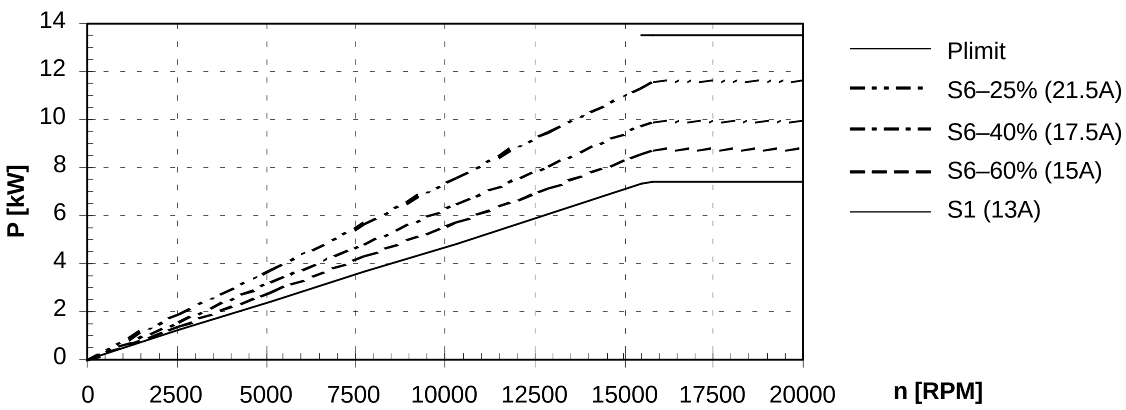
Note

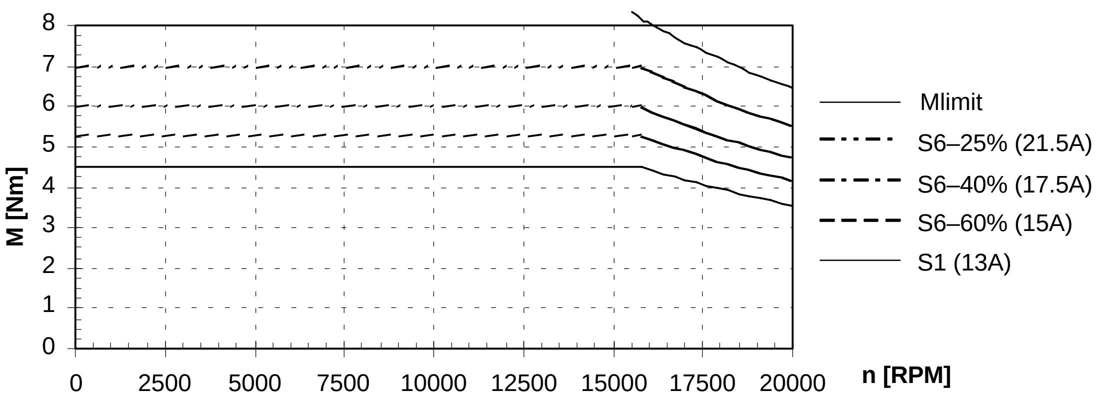
The values in the characteristics and those specified apply for water–cooled versions and a cast winding design.

5.2 P/n and M/n diagrams for 6–pole 1FE1 motors

Table 5-1 Motor type 1FE1041–6WM10

Three–phase synchronous built–in motor 1FE1041–6WM10			
Rated power	P_N	kW	7.4
Rated speed	n_N	RPM	15800
Rated torque	M_N	Nm	4.5
Rated current	I_N	A	13
Maximum current	I_{max}	A	26
Maximum rotational speed	n_{max}	RPM	20000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	29
Thermal time constant	T_{therm}	min	1
Stator weight with cooling jacket	m_{St}	kg	2.5
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

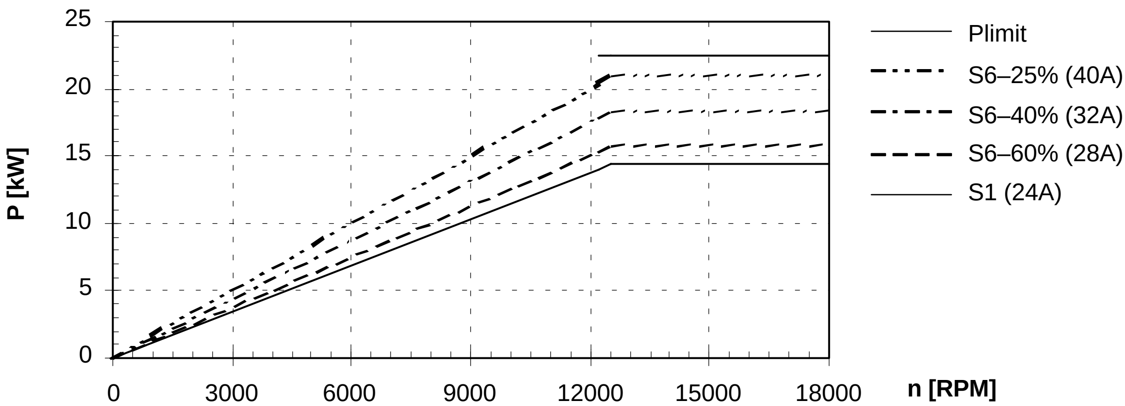


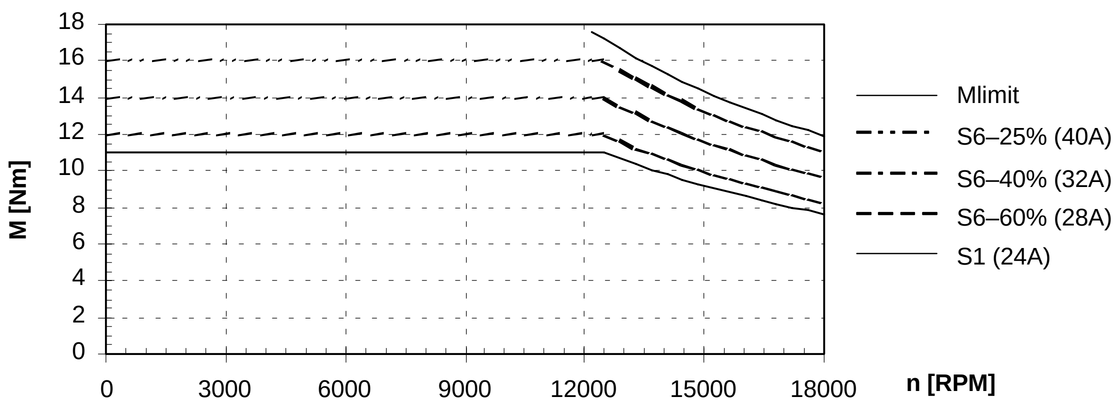


The data for duty type S6 are valid for a 1 min. duty cycle.

Table 5-2 Motor type 1FE1042–6WN10

Three–phase synchronous built–in motor 1FE1042–6WN10			
Rated power	P_N	kW	14.4
Rated speed	n_N	RPM	12500
Rated torque	M_N	Nm	11
Rated current	I_N	A	24
Maximum current	I_{max}	A	48
Maximum rotational speed	n_{max}	RPM	18000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	33
Thermal time constant	T_{therm}	min	1
Stator weight with cooling jacket	m_{St}	kg	6
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

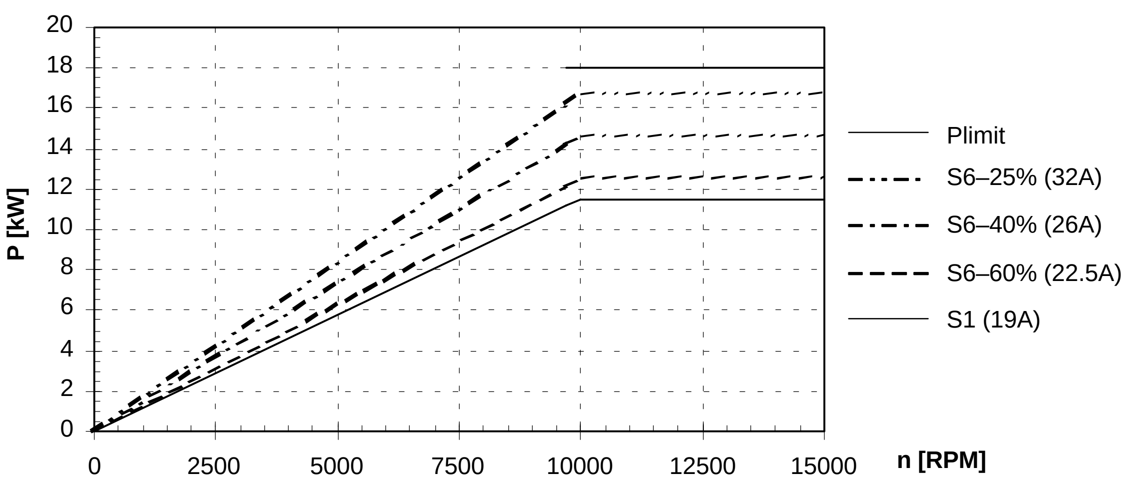


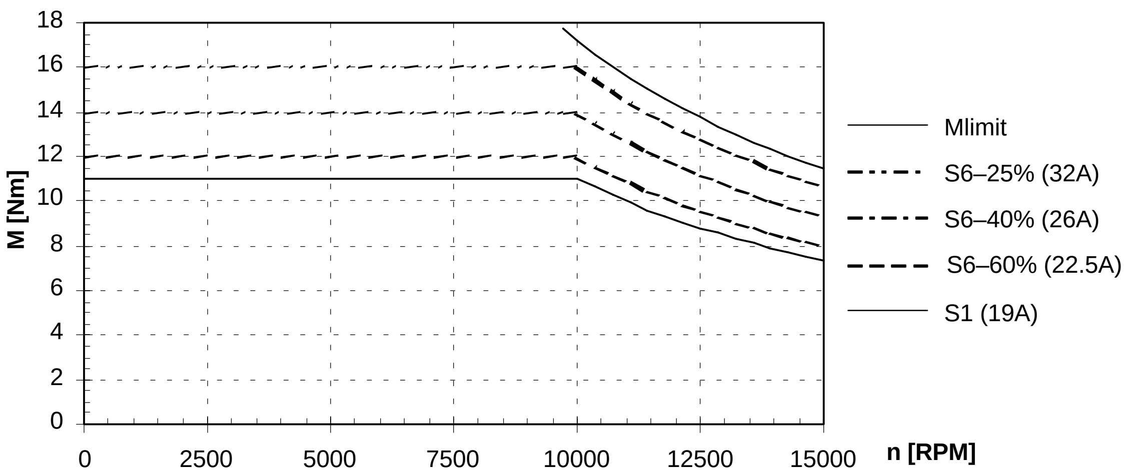


The data for duty type S6 are valid for a 1 min. duty cycle.
For optimum operation, a drive converter pulse frequency of 8 kHz is required

Table 5-3 Motor type 1FE1042–6WR10

Three–phase synchronous built–in motor 1FE1042–6WR10			
Rated power	P_N	kW	11.5
Rated speed	n_N	RPM	10000
Rated torque	M_N	Nm	11
Rated current	I_N	A	19
Maximum current	I_{max}	A	38
Maximum rotational speed	n_{max}	RPM	15000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	41
Thermal time constant	T_{therm}	min	1
Stator weight with cooling jacket	m_{St}	kg	6
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

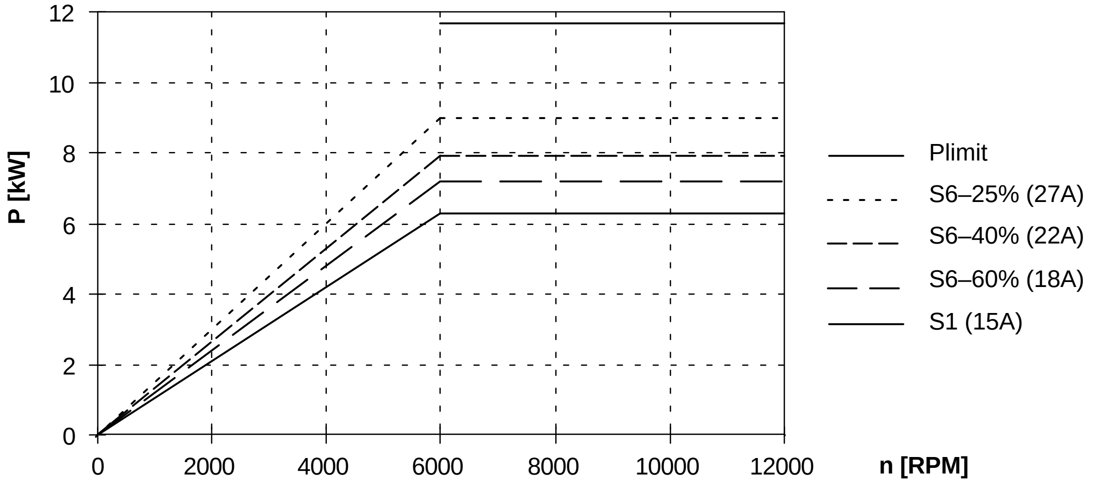


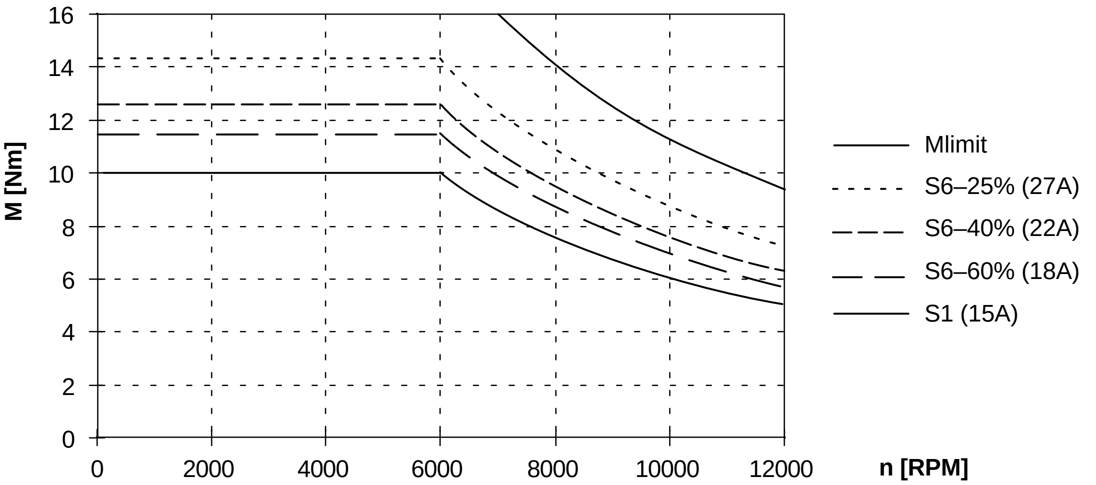


The data for duty type S6 are valid for a 1 min. duty cycle.

Table 5-4 Motor type 1FE1051–6WN10

Three–phase synchronous built–in motor 1FE1051–6WN10			
Rated power	P_N	kW	6.3
Rated speed	n_N	RPM	6000
Rated torque	M_N	Nm	10
Rated current	I_N	A	15
Maximum current	I_{max}	A	30
Maximum rotational speed	n_{max}	RPM	12000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	47
Thermal time constant	T_{therm}	min	2
Stator weight with cooling jacket	m_{St}	kg	4
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

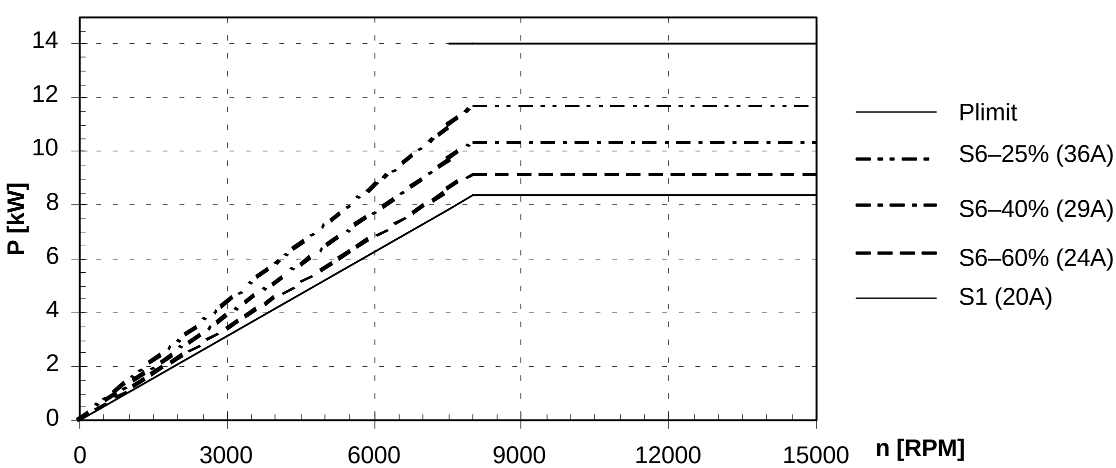


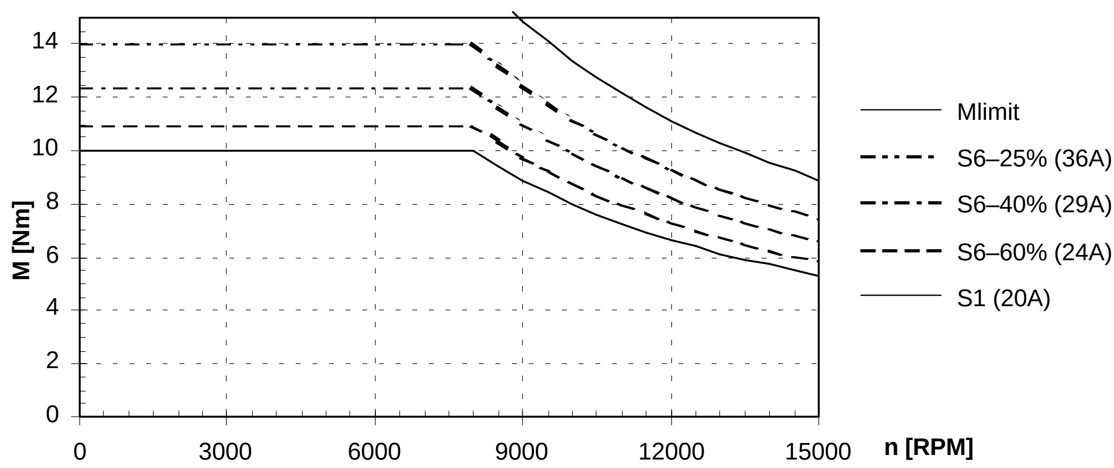


The data for duty type S6 are valid for a 1 min. duty cycle.

Table 5-5 Motor type 1FE1051–6WK10

Three–phase synchronous built–in motor 1FE1051–6WK10			
Rated power	P_N	kW	8.3
Rated speed	n_N	RPM	8000
Rated torque	M_N	Nm	10
Rated current	I_N	A	20
Maximum current	I_{max}	A	40
Maximum rotational speed	n_{max}	RPM	15000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	36
Thermal time constant	T_{therm}	min	2
Stator weight with cooling jacket	m_{St}	kg	4
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

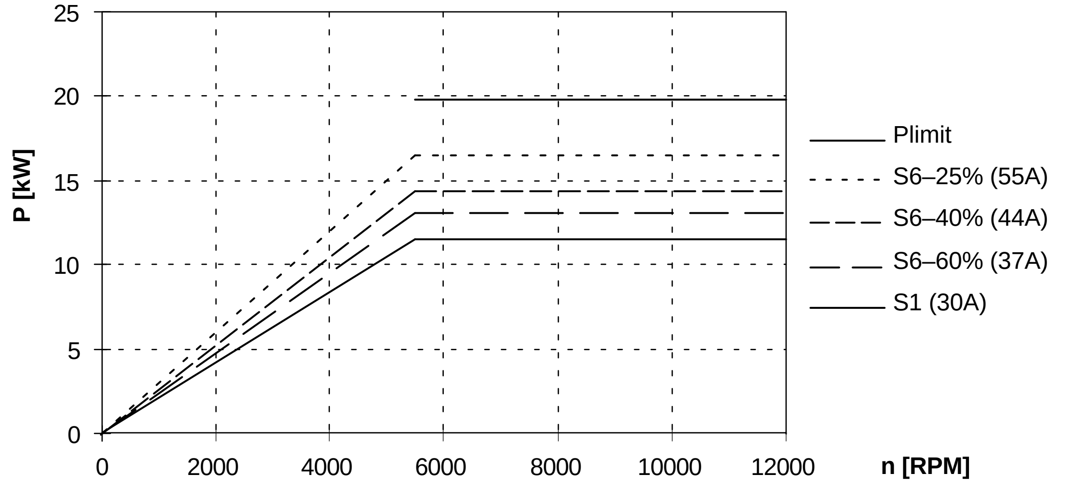


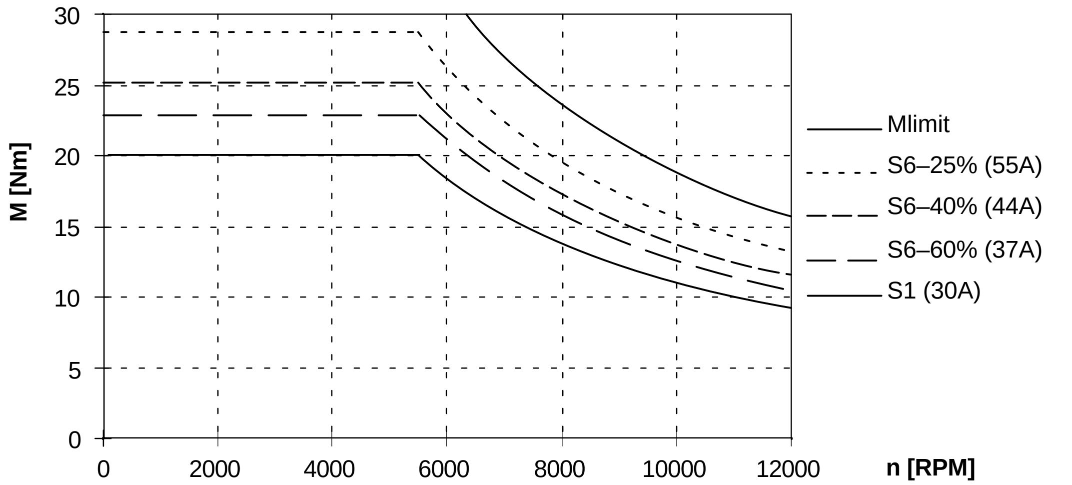


The data for duty type S6 are valid for a 1 min. duty cycle.

Table 5-6 Motor type 1FE1052–6WN10

Three–phase synchronous built–in motor 1FE1052–6WN10			
Rated power	P_N	kW	11.5
Rated speed	n_N	RPM	5500
Rated torque	M_N	Nm	20
Rated current	I_N	A	30
Maximum current	I_{max}	A	60
Maximum rotational speed	n_{max}	RPM	12000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	47
Thermal time constant	T_{therm}	min	2
Stator weight with cooling jacket	m_{St}	kg	6
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

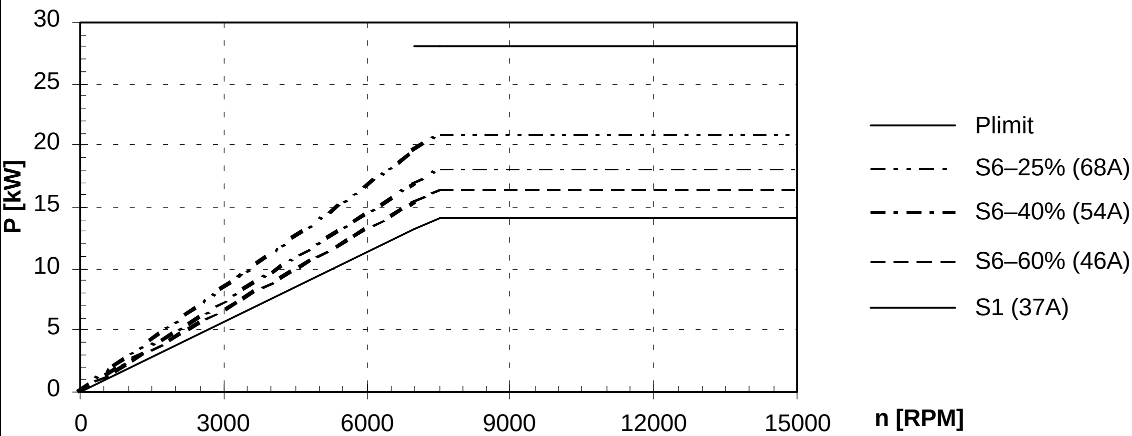


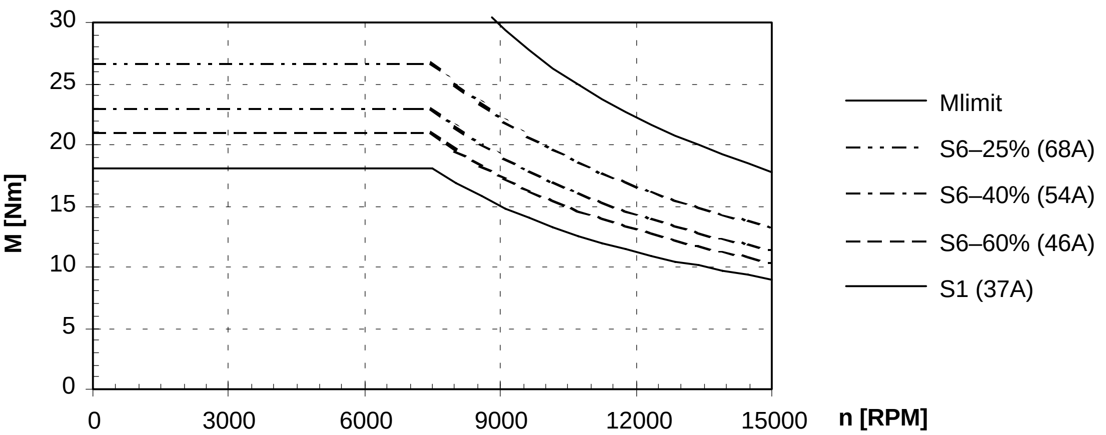


The data for duty type S6 are valid for a 1 min. duty cycle.

Table 5-7 Motor type 1FE1052–6WK10

Three–phase synchronous built–in motor 1FE1052–6WK10			
Rated power	P_N	kW	14
Rated speed	n_N	RPM	7500
Rated torque	M_N	Nm	18
Rated current	I_N	A	37
Maximum current	I_{max}	A	74
Maximum rotational speed	n_{max}	RPM	15000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	36
Thermal time constant	T_{therm}	min	2
Stator weight with cooling jacket	m_{St}	kg	6
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

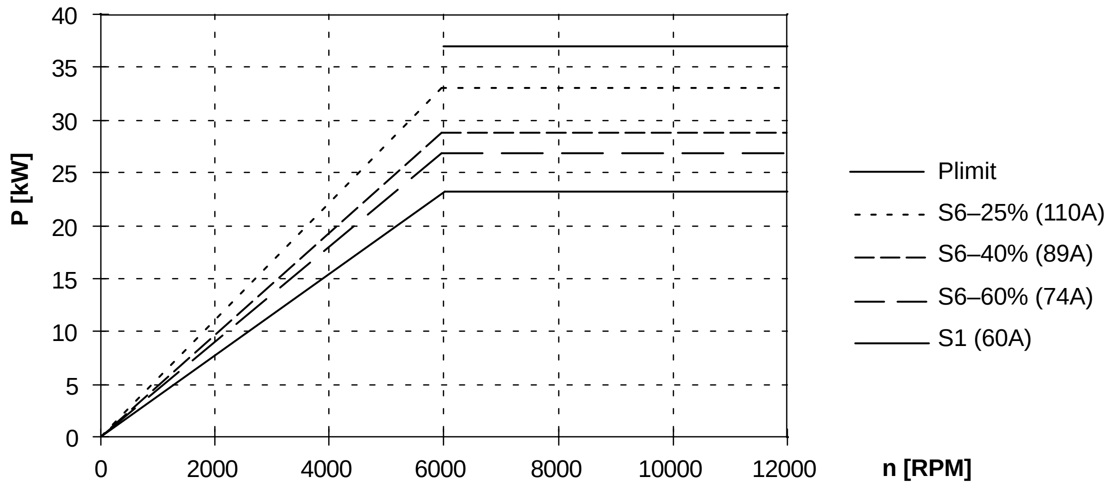


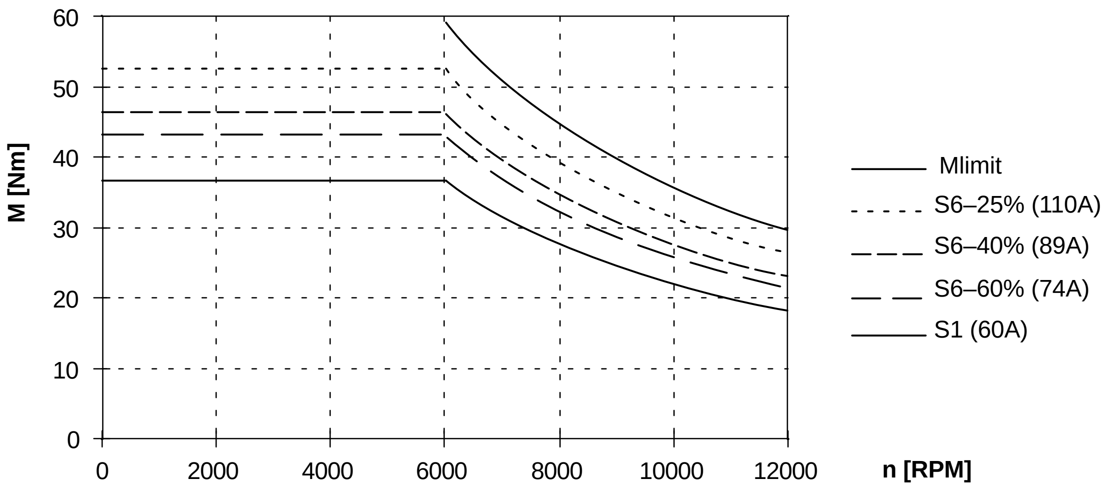


The data for duty type S6 are valid for a 1 min. duty cycle.

Table 5-8 Motor type 1FE1054–6WN10

Three–phase synchronous built–in motor 1FE1054–6WN10			
Rated power	P_N	kW	23
Rated speed	n_N	RPM	6000
Rated torque	M_N	Nm	37
Rated current	I_N	A	60
Maximum current	I_{max}	A	120
Maximum rotational speed	n_{max}	RPM	12000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	43
Thermal time constant	T_{therm}	min	2
Stator weight with cooling jacket	m_{St}	kg	10
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

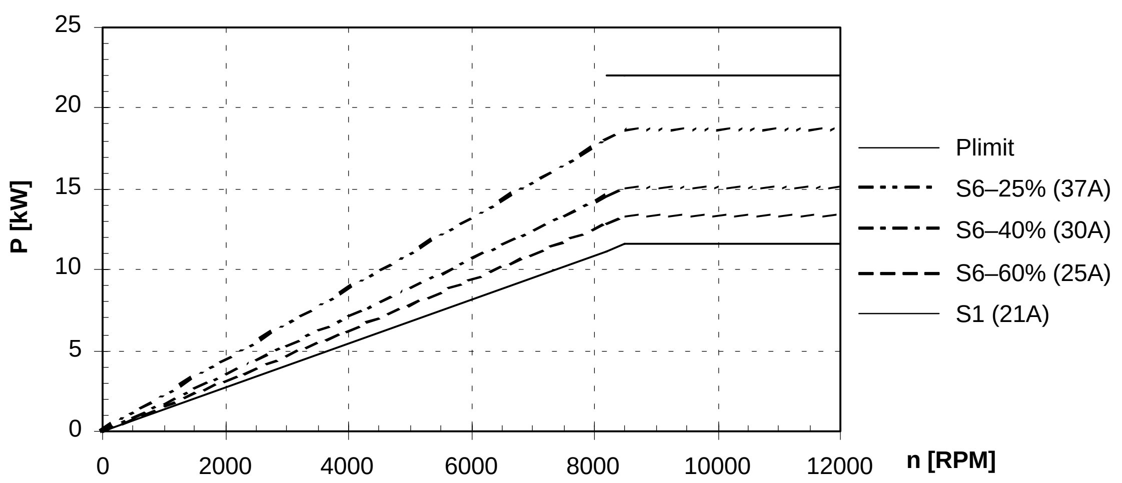


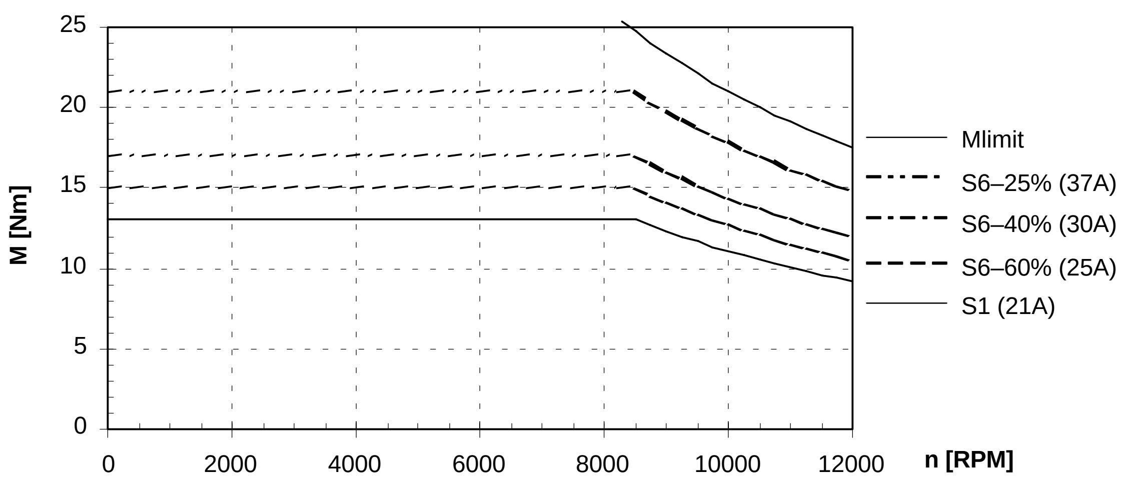


The data for duty type S6 are valid for a 1 min. duty cycle.

Table 5-9 Motor type 1FE1061–6WH10

Three–phase synchronous built–in motor 1FE1061–6WH1			
Rated power	P_N	kW	11.6
Rated speed	n_N	RPM	8500
Rated torque	M_N	Nm	13
Rated current	I_N	A	21
Maximum current	I_{max}	A	42
Maximum rotational speed	n_{max}	RPM	12000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	42
Thermal time constant	T_{therm}	min	1.5
Stator weight with cooling jacket	m_{St}	kg	4
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

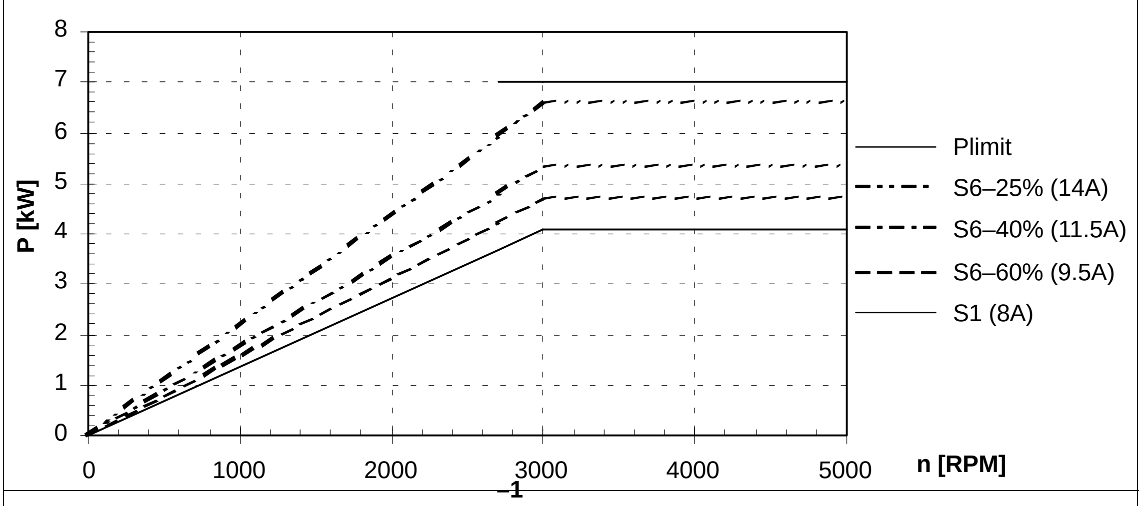


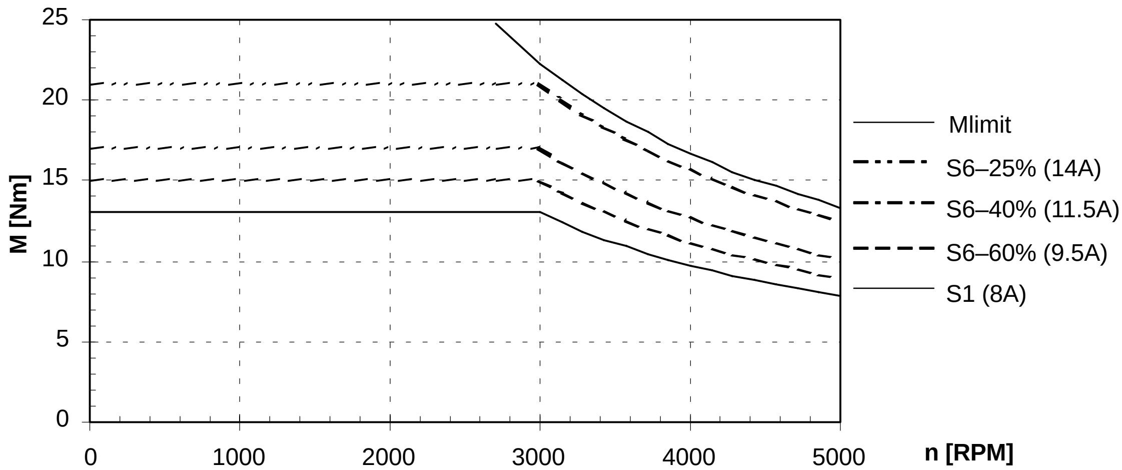


The data for duty type S6 are valid for a 1 min. duty cycle.

Table 5-10 Motor type 1FE1061–6WY10

Three–phase synchronous built–in motor 1FE1061–6WY10			
Rated power	P_N	kW	4
Rated speed	n_N	RPM	3000
Rated torque	M_N	Nm	13
Rated current	I_N	A	8
Maximum current	I_{max}	A	16
Maximum rotational speed	n_{max}	RPM	5000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	108
Thermal time constant	T_{therm}	min	1.5
Stator weight with cooling jacket	m_{St}	kg	4
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

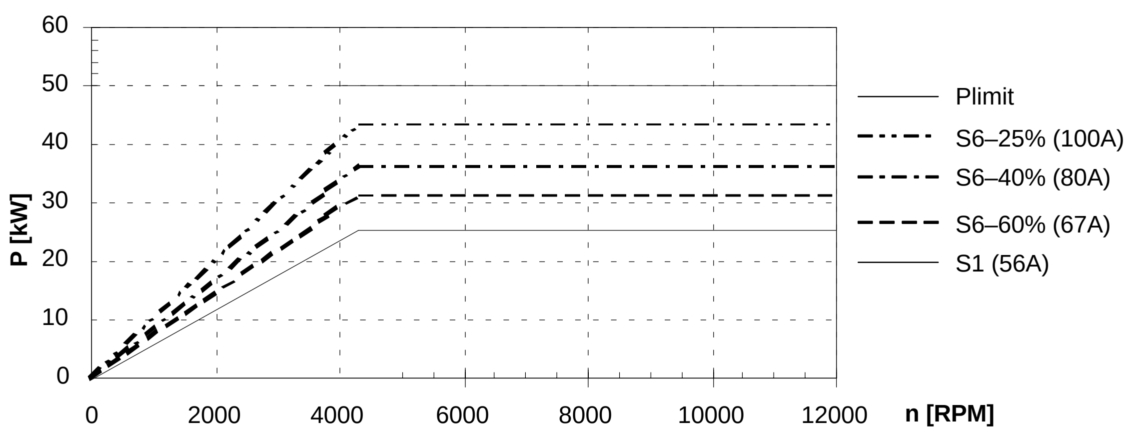


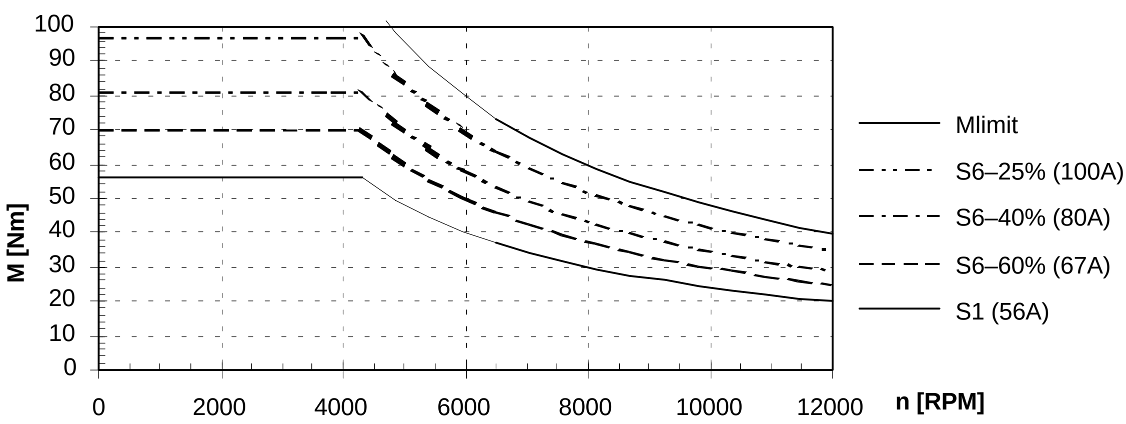


The data for duty type S6 are valid for a 1 min. duty cycle.

Table 5-11 Motor type 1FE1064–6WN11

Three–phase synchronous built–in motor 1FE1064–6WN11			
Rated power	P_N	kW	25
Rated speed	n_N	RPM	4300
Rated torque	M_N	Nm	56
Rated current	I_N	A	56
Maximum current	I_{max}	A	112
Maximum rotational speed	n_{max}	RPM	12000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	72
Thermal time constant	T_{therm}	min	1.5
Stator weight with cooling jacket	m_{St}	kg	10
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

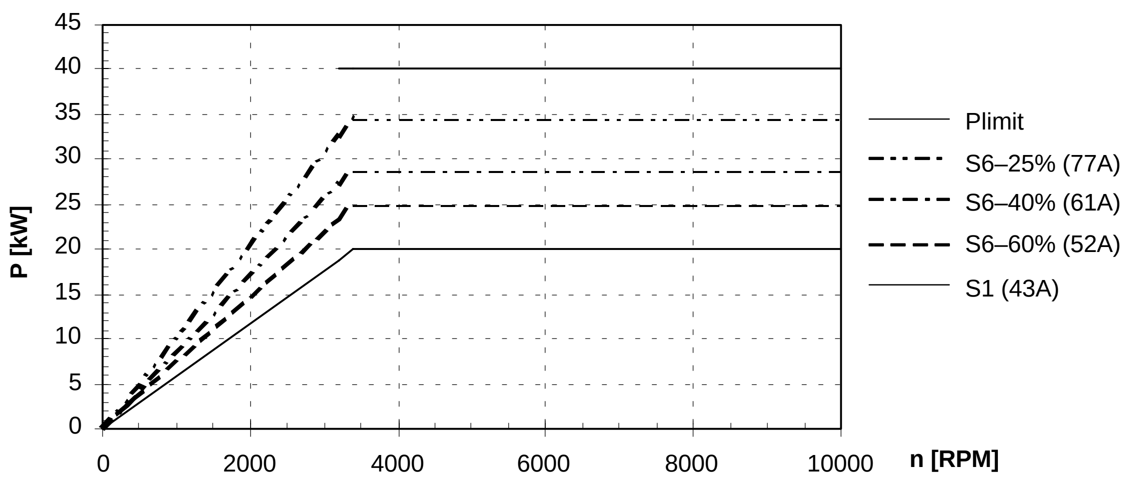


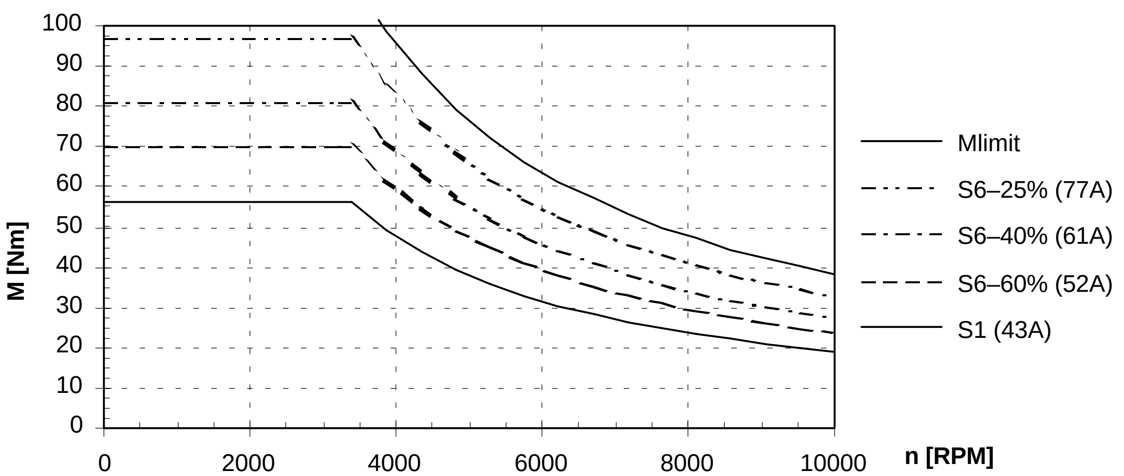


The data for duty type S6 are valid for a 1 min. duty cycle.

Table 5-12 Motor type 1FE1064–6WQ11

Three–phase synchronous built–in motor 1FE1064–6WQ11			
Rated power	P_N	kW	20
Rated speed	n_N	RPM	3400
Rated torque	M_N	Nm	56
Rated current	I_N	A	43
Maximum current	I_{max}	A	86
Maximum rotational speed	n_{max}	RPM	10000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	92
Thermal time constant	T_{therm}	min	2
Stator weight with cooling jacket	m_{St}	kg	10
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

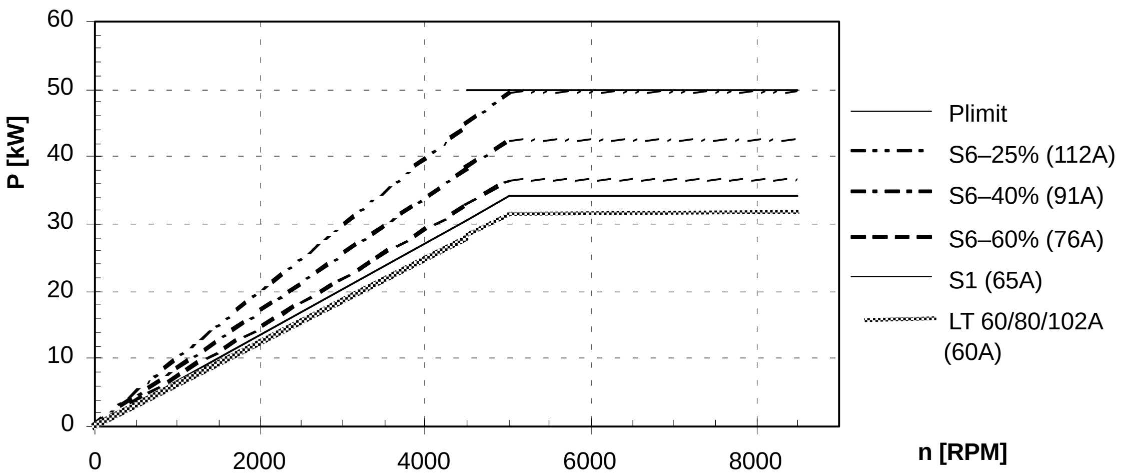


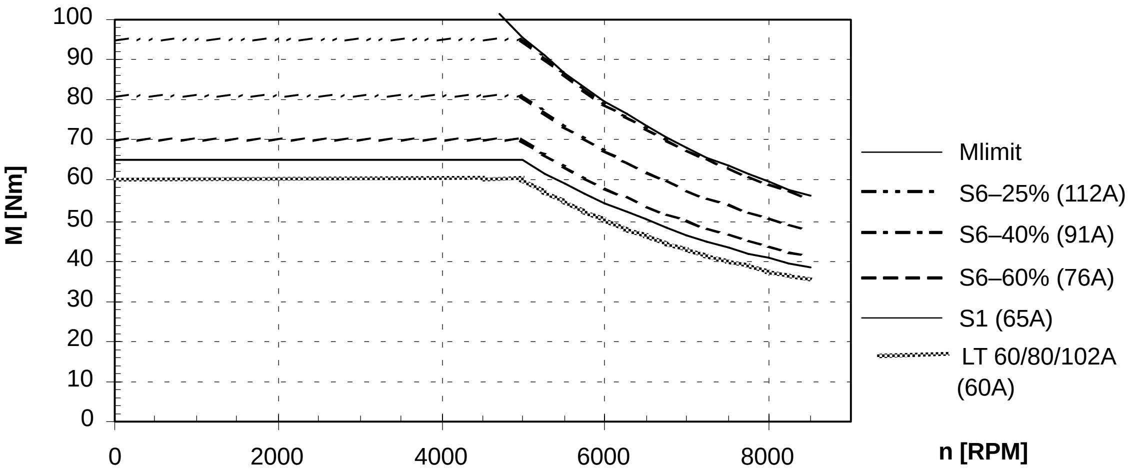


The data for duty type S6 are valid for a 1 min. duty cycle.

Table 5-13 Motor type 1FE1082–6WP10

Three–phase synchronous built–in motor 1FE1082–6WP10			
Rated power	P_N	kW	34
Rated speed	n_N	RPM	5000
Rated torque	M_N	Nm	65
Rated current	I_N	A	65
Maximum current	I_{max}	A	130
Maximum rotational speed	n_{max}	RPM	8500
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	68
Thermal time constant	T_{therm}	min	2
Stator weight with cooling jacket	m_{St}	kg	10
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

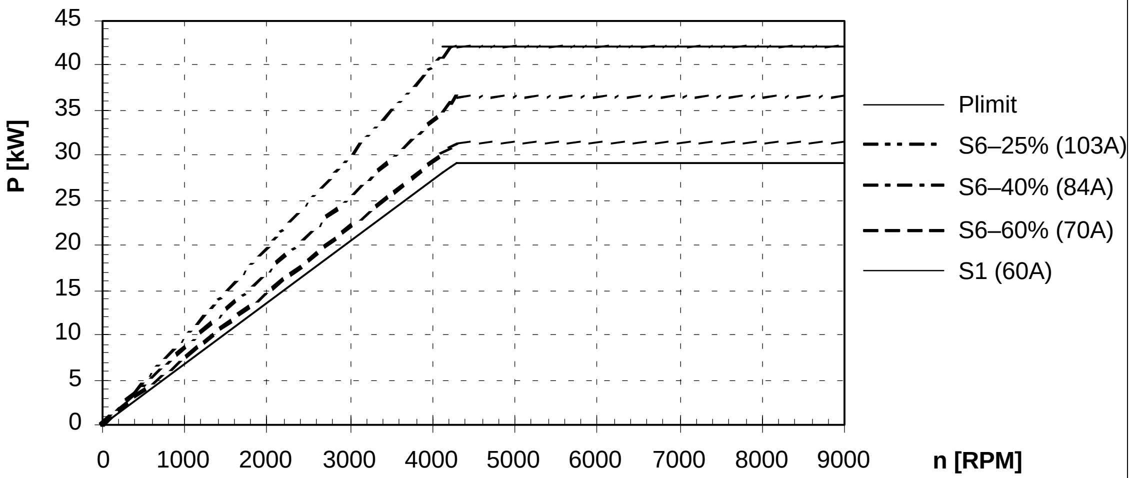


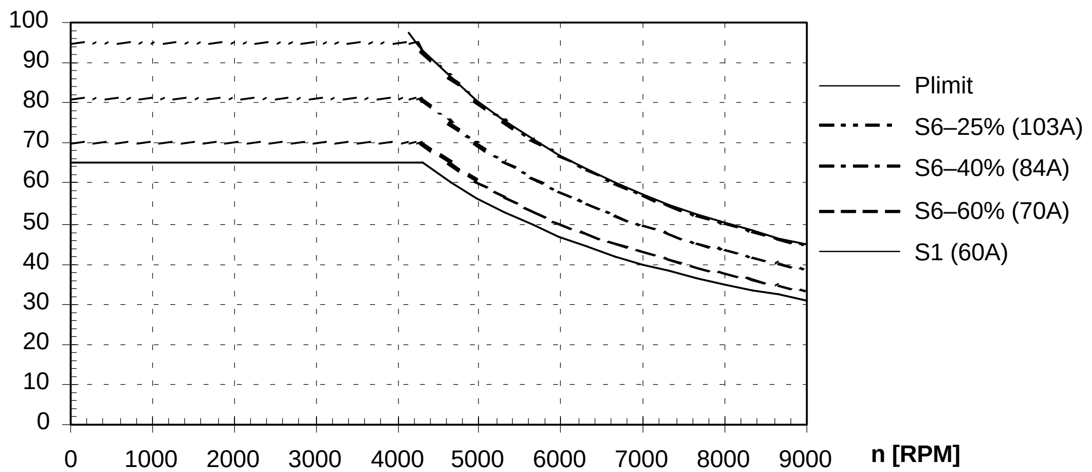


The data for duty type S6 are valid for a 1 min. duty cycle.

Table 5-14 Motor type 1FE1082–6WQ11

Three–phase synchronous built–in motor 1FE1082–6WQ11			
Rated power	P_N	kW	29.3
Rated speed	n_N	RPM	4300
Rated torque	M_N	Nm	65
Rated current	I_N	A	60
Maximum current	I_{max}	A	120
Maximum rotational speed	n_{max}	RPM	9000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	75
Thermal time constant	T_{therm}	min	2
Stator weight with cooling jacket	m_{St}	kg	10
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

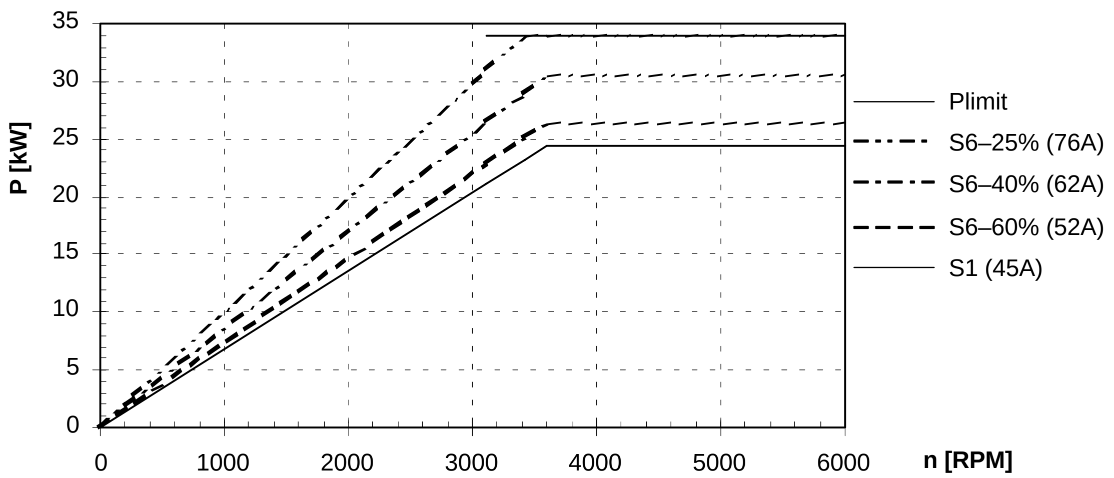


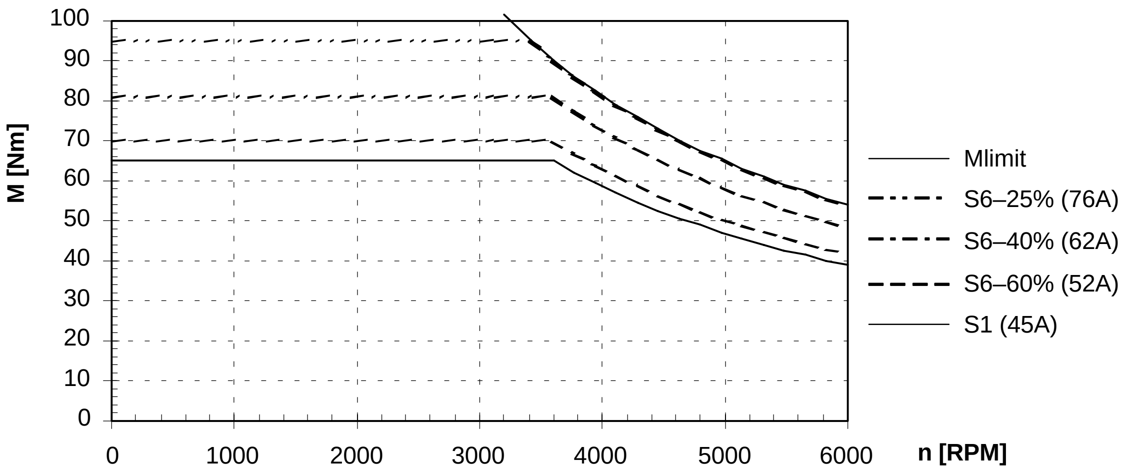


The data for duty type S6 are valid for a 1 min. duty cycle.

Table 5-15 Motor type 1FE1082–6WS10

Three–phase synchronous built–in motor 1FE1082–6WS10			
Rated power	P_N	kW	24.5
Rated speed	n_N	RPM	3600
Rated torque	M_N	Nm	65
Rated current	I_N	A	45
Maximum current	I_{max}	A	90
Maximum rotational speed	n_{max}	RPM	6000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	98
Thermal time constant	T_{therm}	min	2
Stator weight with cooling jacket	m_{St}	kg	10
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

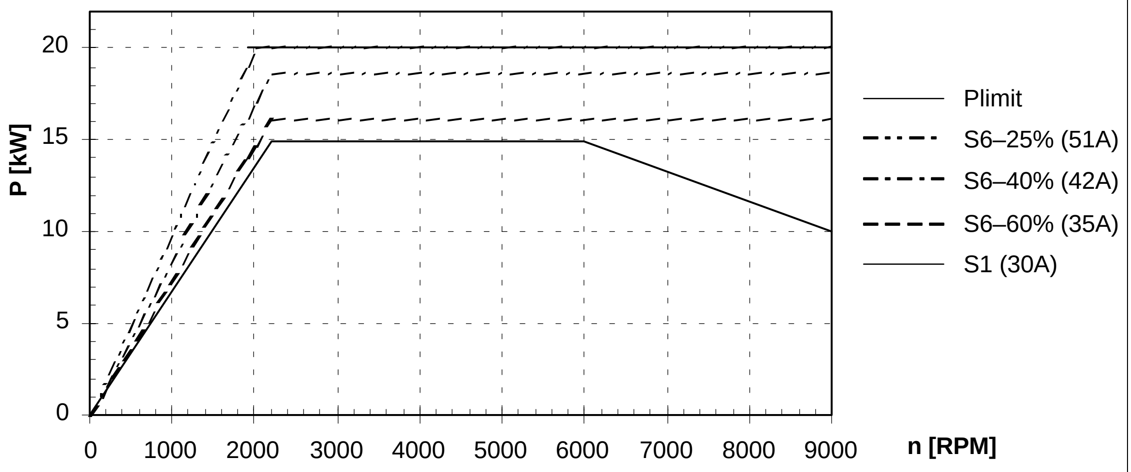


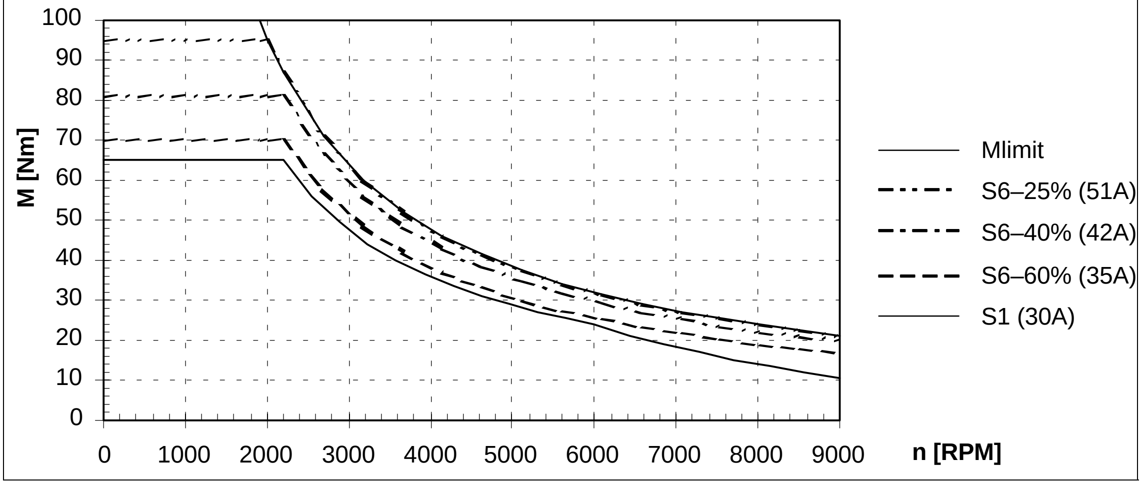


The data for duty type S6 are valid for a 1 min. duty cycle.

Table 5-16 Motor type 1FE1082–6WW11

Three–phase synchronous built–in motor 1FE1082–6WW11			
Rated power	P_N	kW	15
Rated speed	n_N	RPM	2200
Rated torque	M_N	Nm	65
Rated current	I_N	A	30
Maximum current	I_{max}	A	60
Maximum rotational speed	n_{max}	RPM	9000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	151
Thermal time constant	T_{therm}	min	2
Stator weight with cooling jacket	m_{St}	kg	10
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

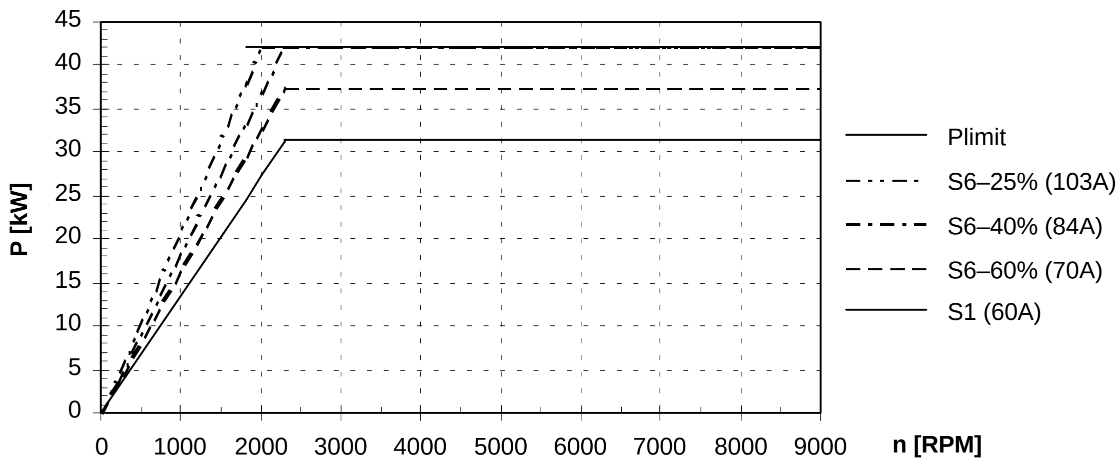


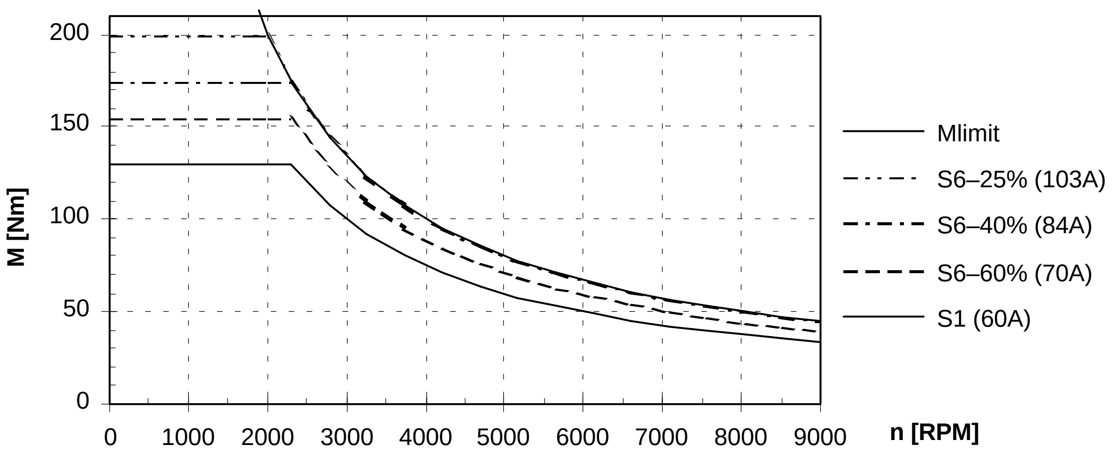


The data for duty type S6 are valid for a 1 min. duty cycle.

Table 5-17 Motor type 1FE1084–6WR11

Three–phase synchronous built–in motor 1FE1084–6WR11			
Rated power	P_N	kW	31
Rated speed	n_N	RPM	2300
Rated torque	M_N	Nm	130
Rated current	I_N	A	60
Maximum current	I_{max}	A	120
Maximum rotational speed	n_{max}	RPM	9000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	150
Thermal time constant	T_{therm}	min	2.5
Stator weight with cooling jacket	m_{St}	kg	22
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

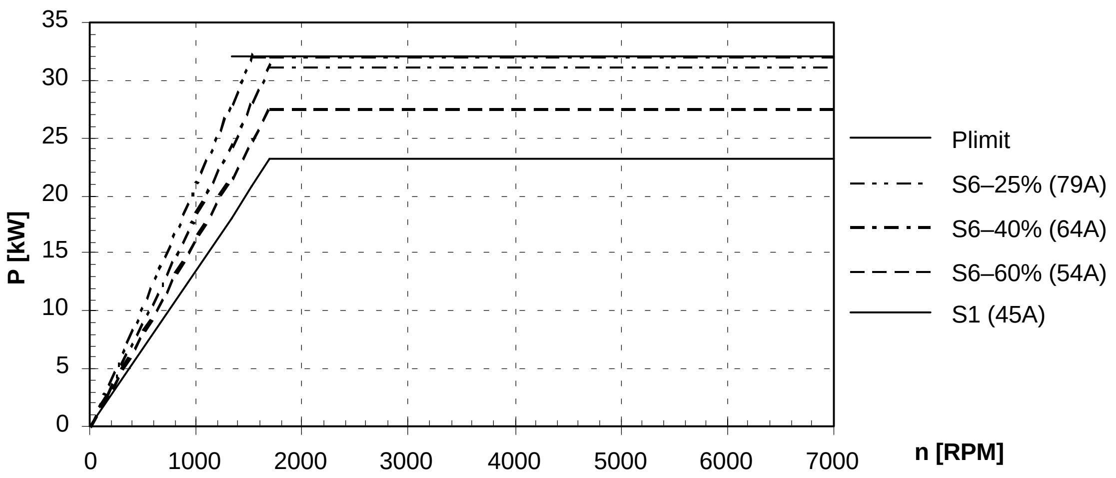


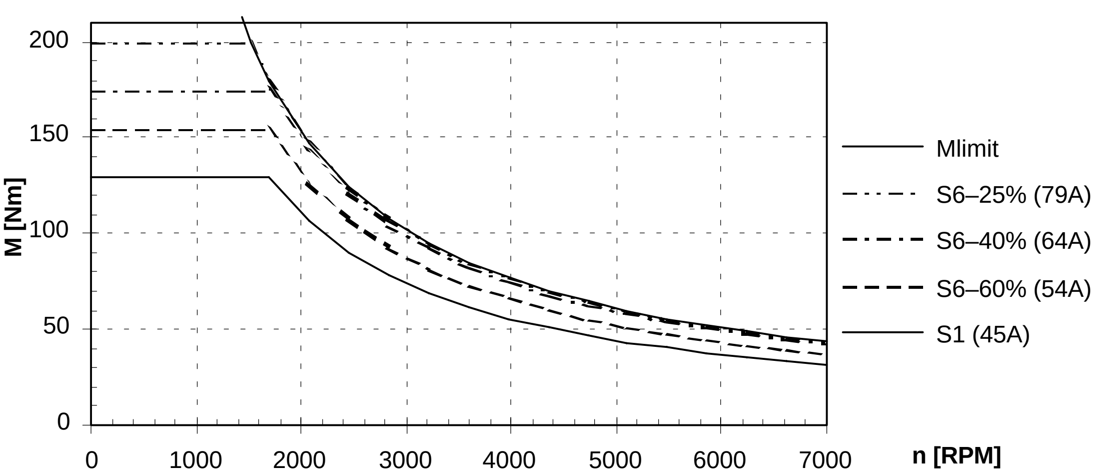


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-18 Motor type 1FE1084–6WU11

Three–phase synchronous built–in motor 1FE1084–6WU11			
Rated power	P_N	kW	23
Rated speed	n_N	RPM	1700
Rated torque	M_N	Nm	130
Rated current	I_N	A	45
Maximum current	I_{max}	A	90
Maximum rotational speed	n_{max}	RPM	7000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	195
Thermal time constant	T_{therm}	min	2.5
Stator weight with cooling jacket	m_{St}	kg	22
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

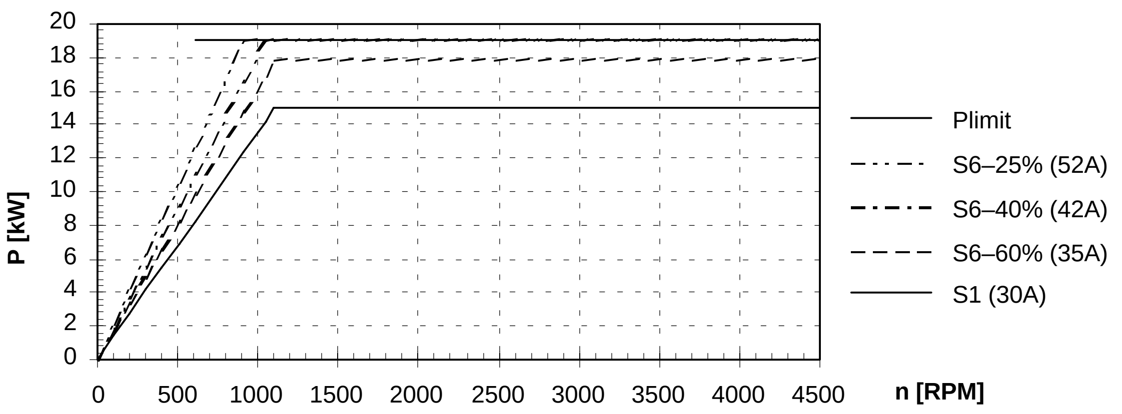


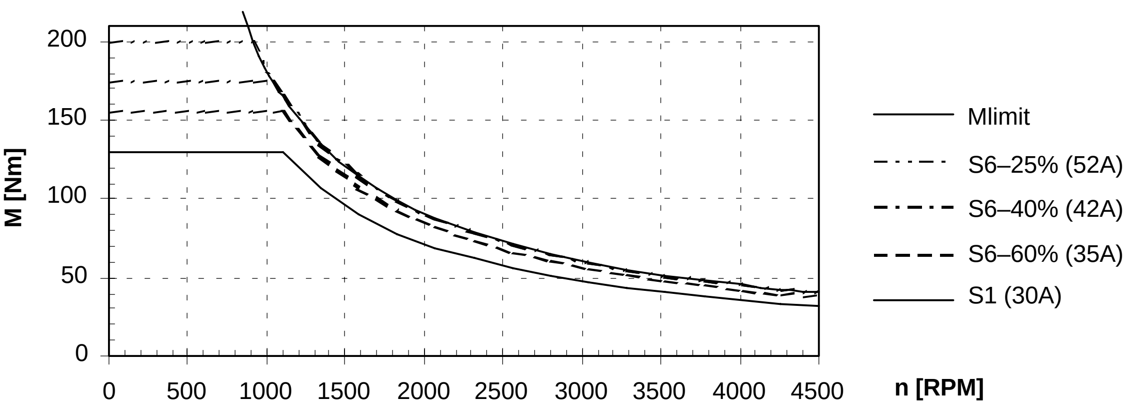


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-19 Motor type 1FE1084–6WX11

Three–phase synchronous built–in motor 1FE1084–6WX11			
Rated power	P_N	kW	15
Rated speed	n_N	RPM	1100
Rated torque	M_N	Nm	130
Rated current	I_N	A	30
Maximum current	I_{max}	A	60
Maximum rotational speed	n_{max}	RPM	4500
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	302
Thermal time constant	T_{therm}	min	2.5
Stator weight with cooling jacket	m_{St}	kg	22
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

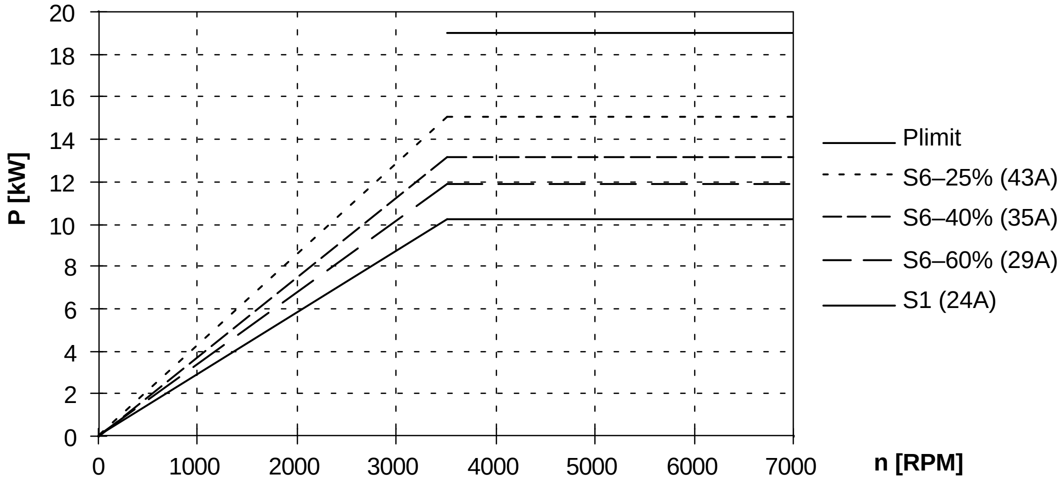


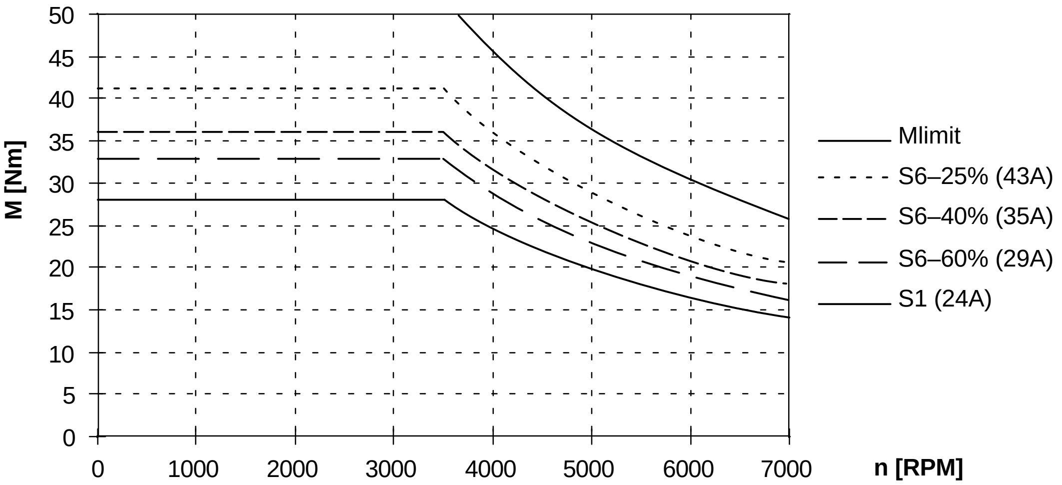


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-20 Motor type 1FE1091–6WN10

Three–phase synchronous built–in motor 1FE1091–6WN10			
Rated power	P_N	kW	10
Rated speed	n_N	RPM	3500
Rated torque	M_N	Nm	28
Rated current	I_N	A	24
Maximum current	I_{max}	A	48
Maximum rotational speed	n_{max}	RPM	7000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	80
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	14
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

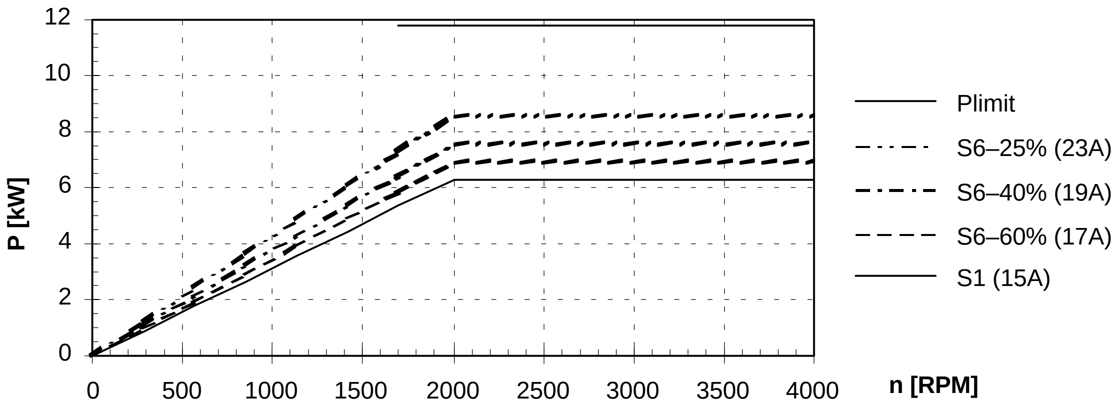


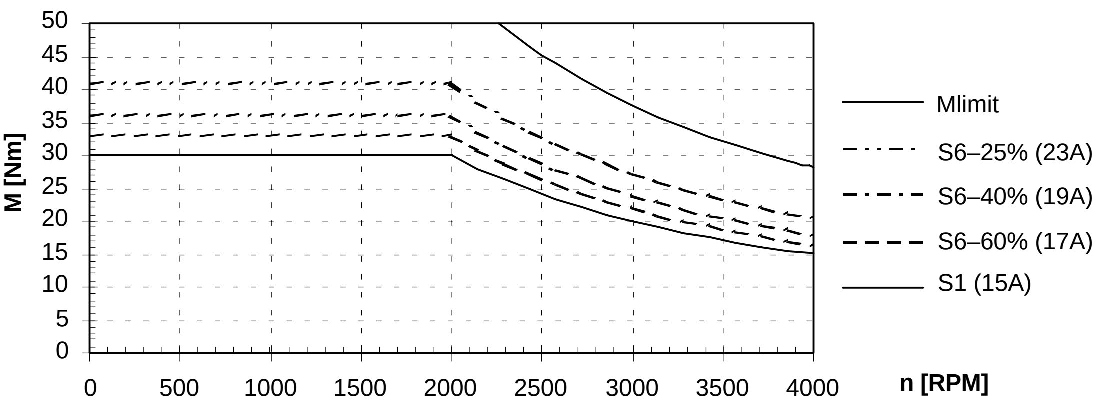


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-21 Motor type 1FE1091–6WS10

Three–phase synchronous built–in motor 1FE1091–6WS10			
Rated power	P_N	kW	6.3
Rated speed	n_N	RPM	2000
Rated torque	M_N	Nm	30
Rated current	I_N	A	15
Maximum current	I_{max}	A	30
Maximum rotational speed	n_{max}	RPM	4000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	140
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	14
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

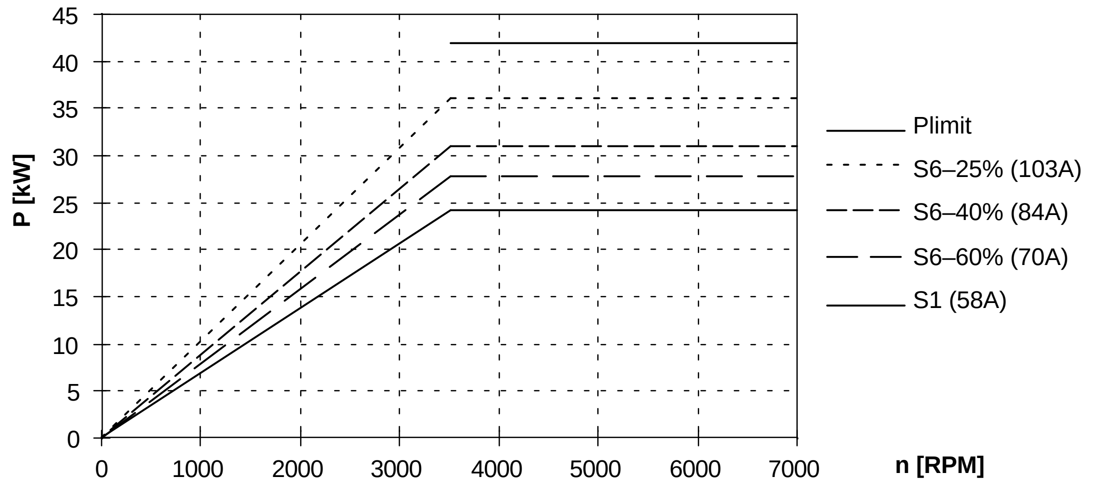


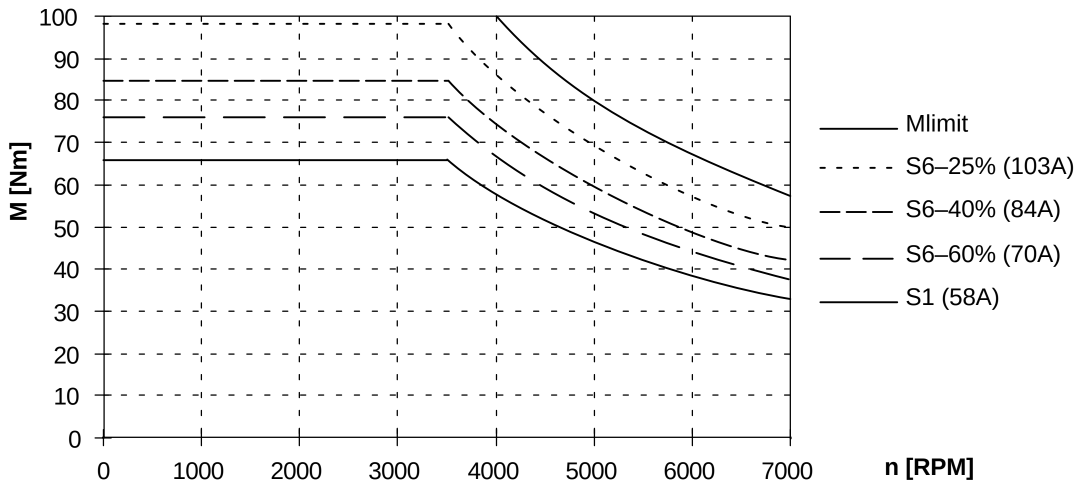


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-22 Motor type 1FE1092–6WN10

Three–phase synchronous built–in motor 1FE1092–6WN10			
Rated power	P_N	kW	24.2
Rated speed	n_N	RPM	3500
Rated torque	M_N	Nm	66
Rated current	I_N	A	58
Maximum current	I_{max}	A	116
Maximum rotational speed	n_{max}	RPM	7000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	80
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	21
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

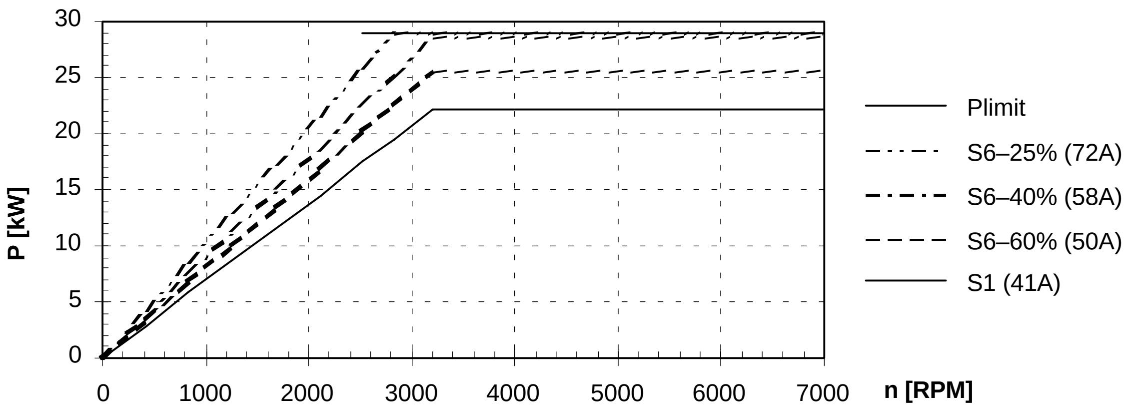


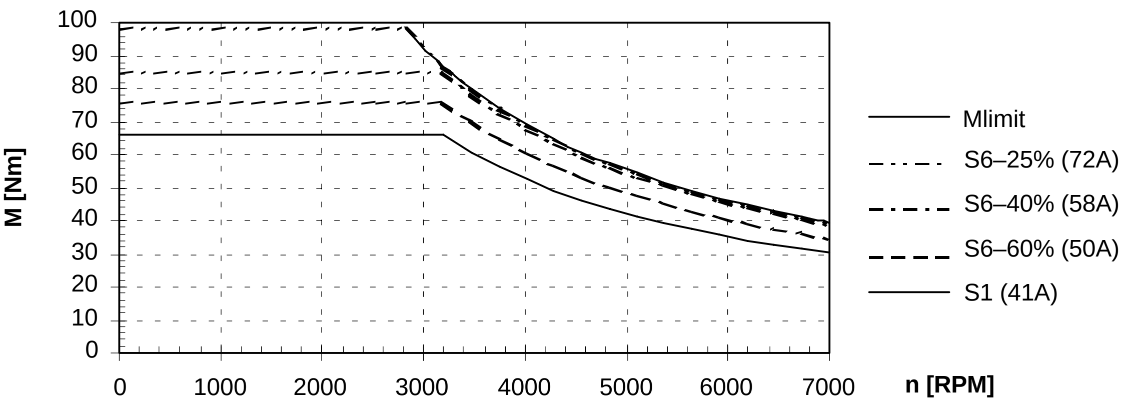


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-23 Motor type 1FE1092–6WR11

Three–phase synchronous built–in motor 1FE1092–6WR11			
Rated power	P_N	kW	22
Rated speed	n_N	RPM	3200
Rated torque	M_N	Nm	66
Rated current	I_N	A	41
Maximum current	I_{max}	A	82
Maximum rotational speed	n_{max}	RPM	7000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	113
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	21
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

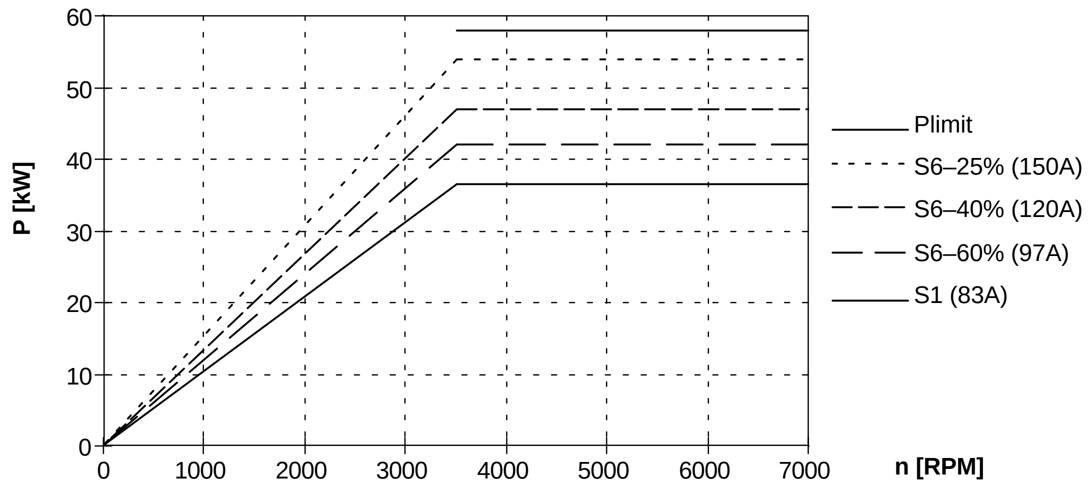


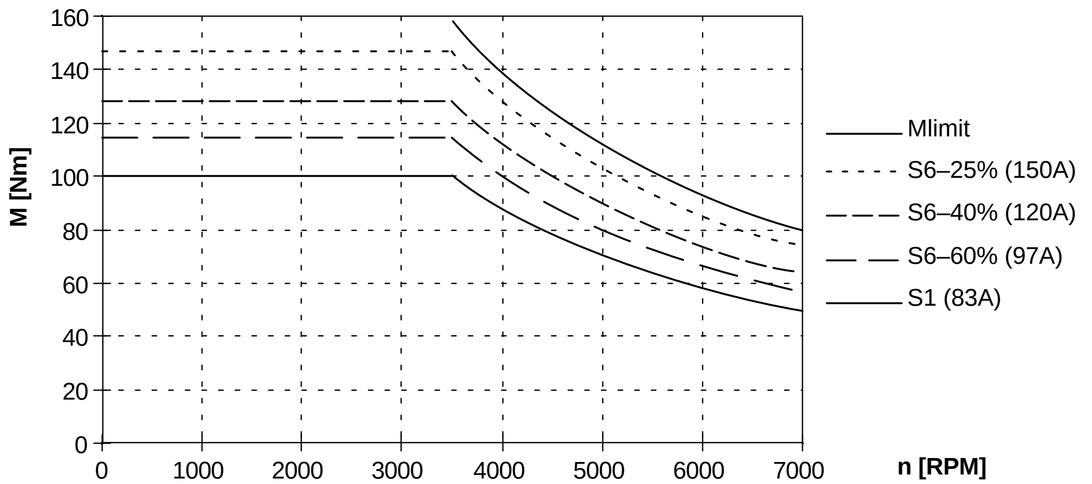


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-24 Motor type 1FE1093–6WN10

Three–phase synchronous built–in motor 1FE1093–6WN10			
Rated power	P_N	kW	36.6
Rated speed	n_N	RPM	3500
Rated torque	M_N	Nm	100
Rated current	I_N	A	83
Maximum current	I_{max}	A	166
Maximum rotational speed	n_{max}	RPM	7000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	84
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	28
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

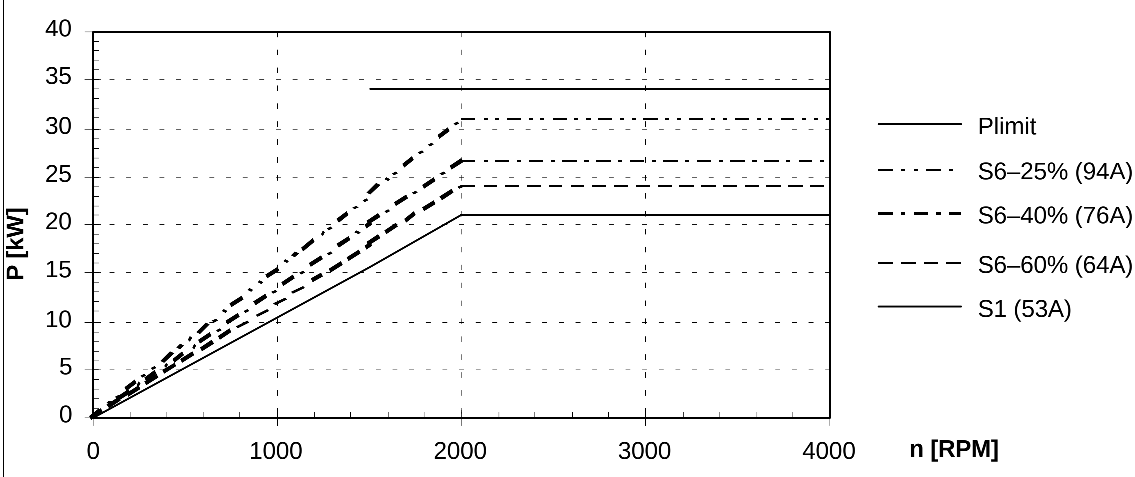


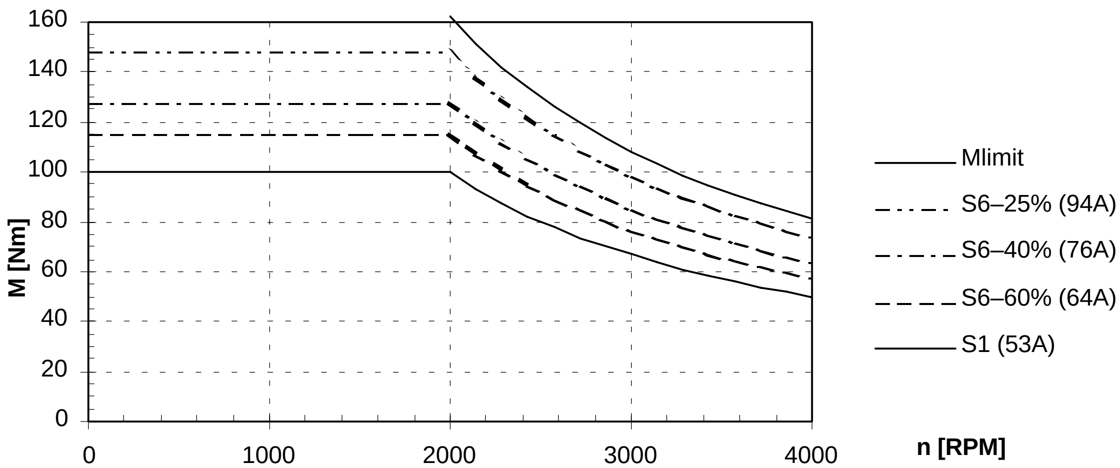


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-25 Motor type 1FE1093–6WS10

Three–phase synchronous built–in motor 1FE1093–6WS10			
Rated power	P_N	kW	21
Rated speed	n_N	RPM	2000
Rated torque	M_N	Nm	100
Rated current	I_N	A	53
Maximum current	I_{max}	A	106
Maximum rotational speed	n_{max}	RPM	4000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	133
Thermal time constant	T_{therm}	min	3.0
Stator weight with cooling jacket	m_{St}	kg	28
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

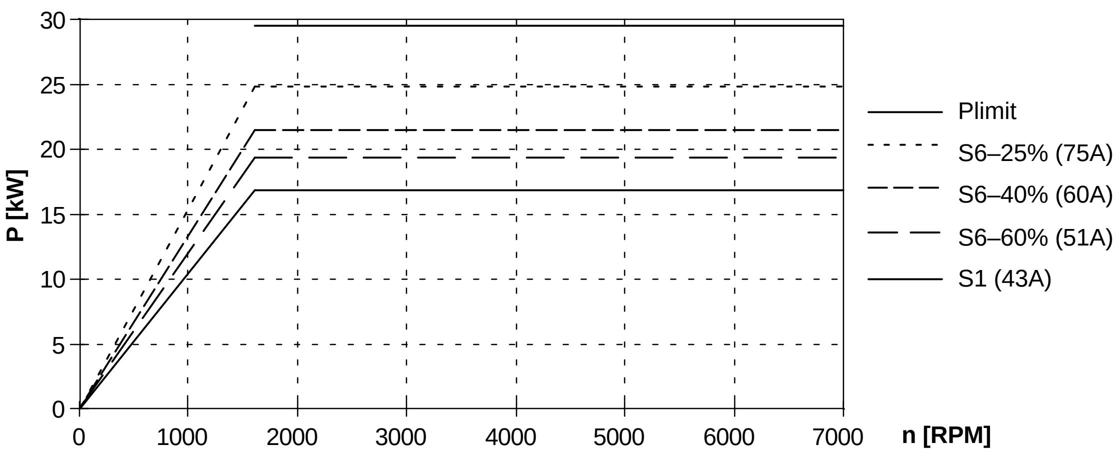


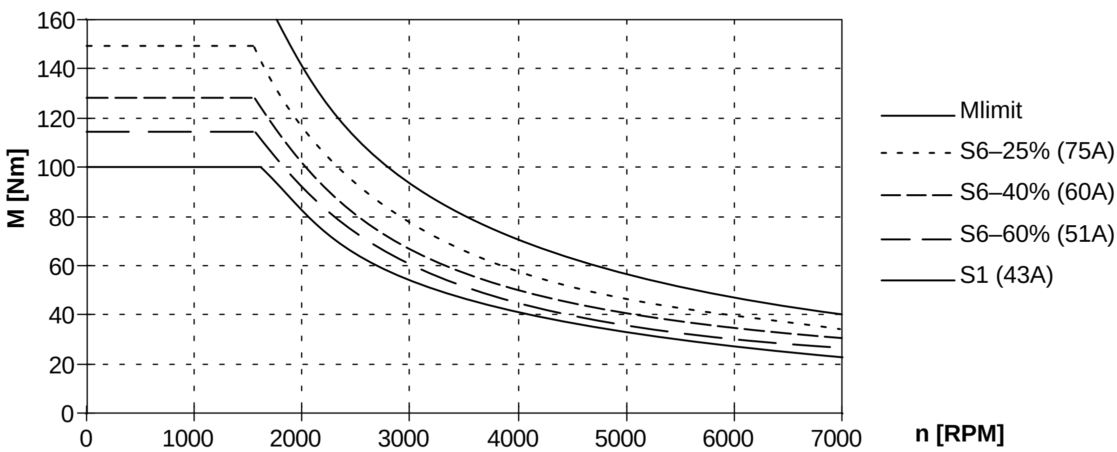


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-26 Motor type 1FE1093–6WV11

Three–phase synchronous built–in motor 1FE1093–6WV11			
Rated power	P_N	kW	16.8
Rated speed	n_N	RPM	1600
Rated torque	M_N	Nm	100
Rated current	I_N	A	43
Maximum current	I_{max}	A	86
Maximum rotational speed	n_{max}	RPM	7000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	168
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	28
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

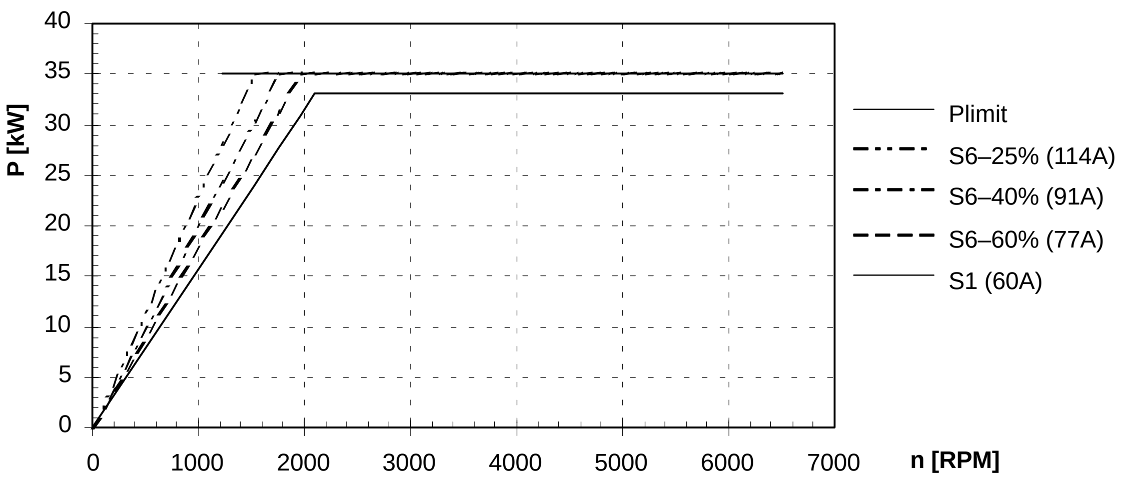


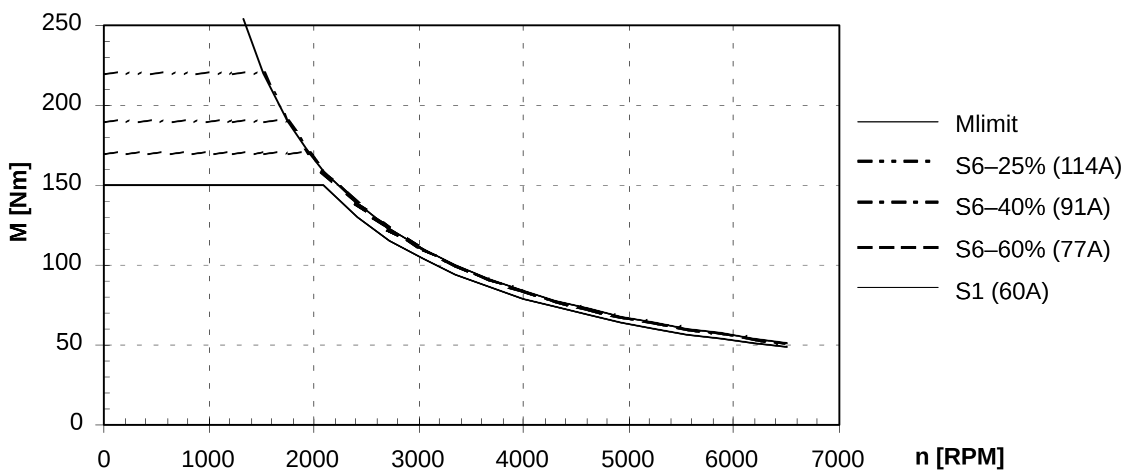


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-27 Motor type 1FE1113–6WU11

Three–phase synchronous built–in motor 1FE1113–6WU11			
Rated power	P_N	kW	33
Rated speed	n_N	RPM	2100
Rated torque	M_N	Nm	150
Rated current	I_N	A	60
Maximum current	I_{max}	A	124
Maximum rotational speed	n_{max}	RPM	6500
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	175
Thermal time constant	T_{therm}	min	4
Stator weight with cooling jacket	m_{St}	kg	43
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

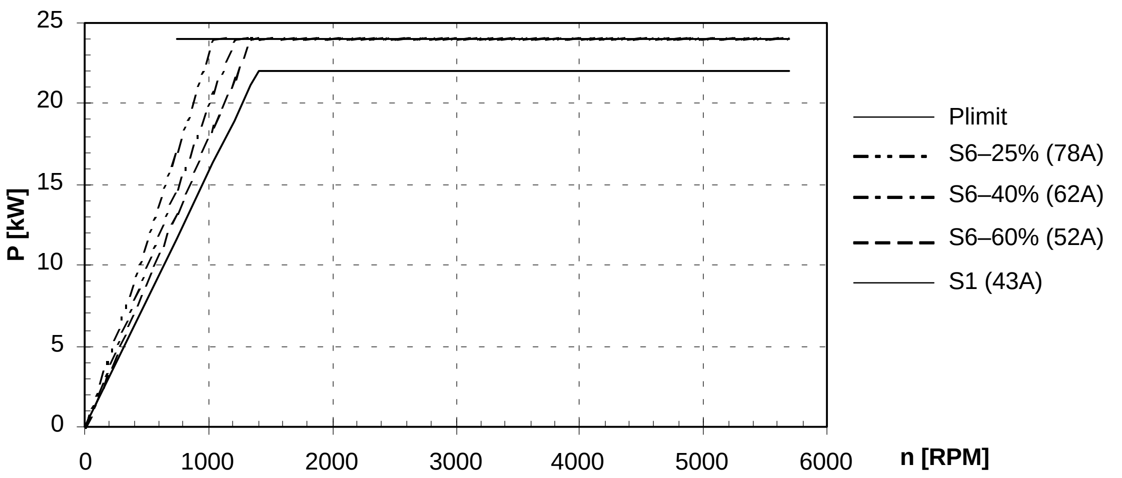


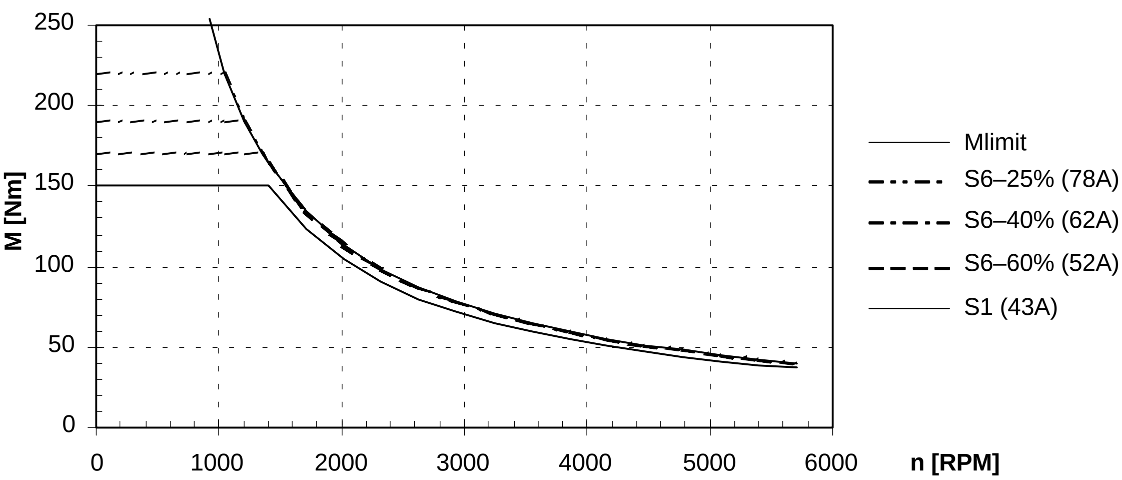


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-28 Motor type 1FE1113–6WX11

Three–phase synchronous built–in motor1FE1113–6WX11			
Rated power	P_N	kW	22
Rated speed	n_N	RPM	1400
Rated torque	M_N	Nm	150
Rated current	I_N	A	43
Maximum current	I_{max}	A	86
Maximum rotational speed	n_{max}	RPM	5700
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	251
Thermal time constant	T_{therm}	min	4
Stator weight with cooling jacket	m_{St}	kg	43
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

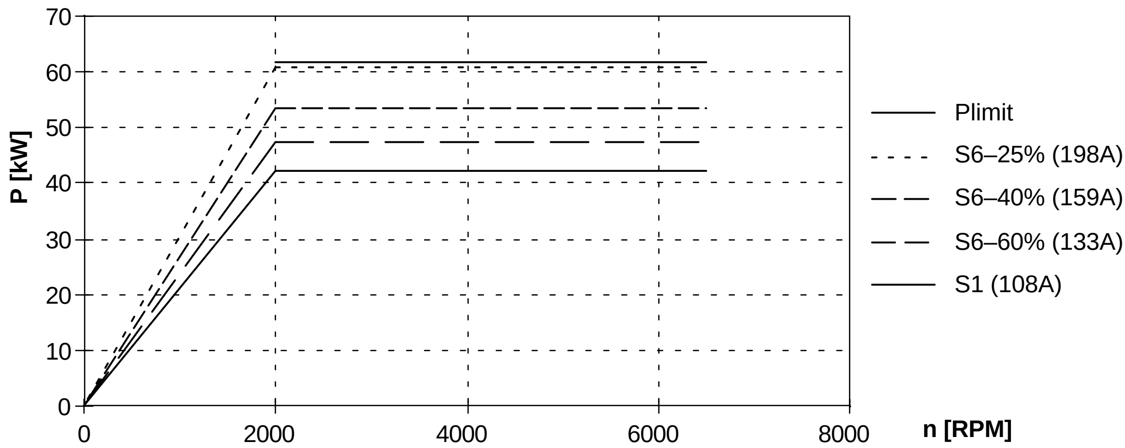


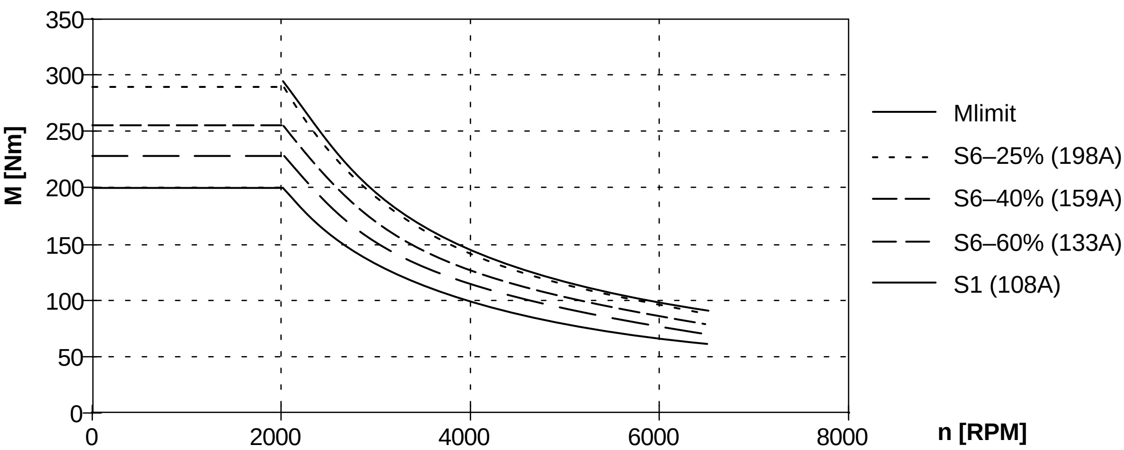


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-29 Motor type 1FE1114–6WR11

Three–phase synchronous built–in motor 1FE1114–6WR11			
Rated power	P_N	kW	41.9
Rated speed	n_N	RPM	2000
Rated torque	M_N	Nm	200
Rated current	I_N	A	108
Maximum current	I_{max}	A	216
Maximum rotational speed	n_{max}	RPM	6500
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	132
Thermal time constant	T_{therm}	min	4
Stator weight with cooling jacket	m_{St}	kg	54
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

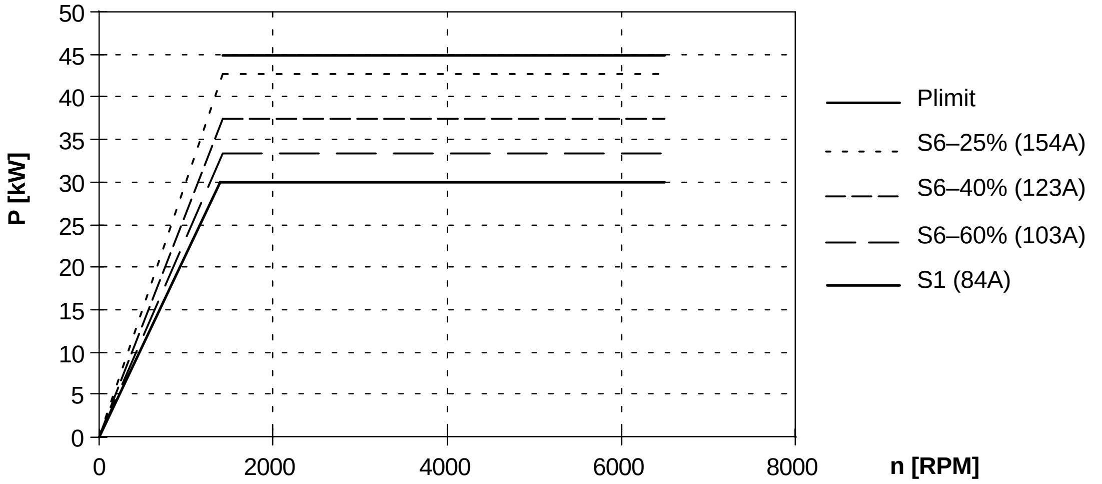


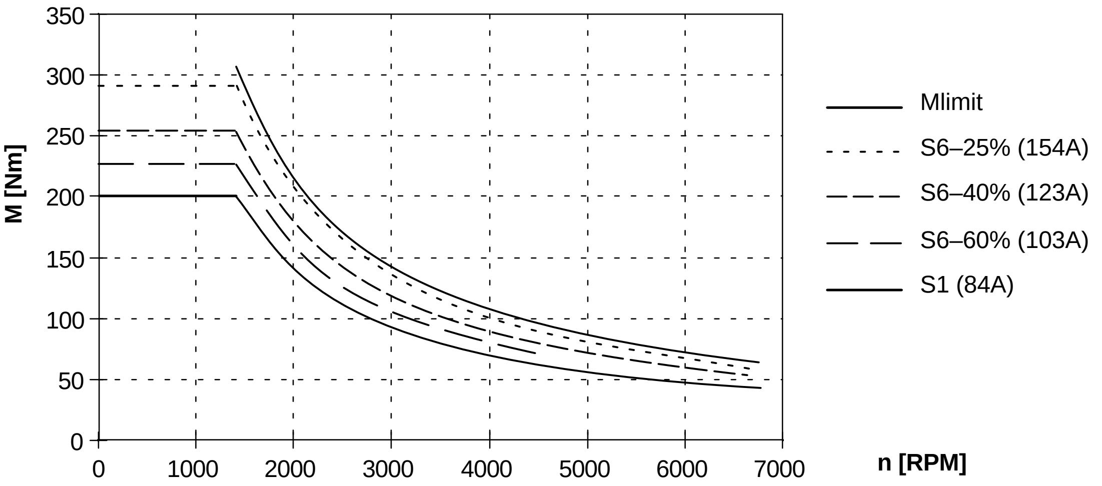


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-30 Motor type 1FE1114–6WT11

Three–phase synchronous built–in motor 1FE1114–6WT11			
Rated power	P_N	kW	29.3
Rated speed	n_N	RPM	1400
Rated torque	M_N	Nm	200
Rated current	I_N	A	84
Maximum current	I_{max}	A	168
Maximum rotational speed	n_{max}	RPM	6500
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	170
Thermal time constant	T_{therm}	min	4
Stator weight with cooling jacket	m_{St}	kg	54
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

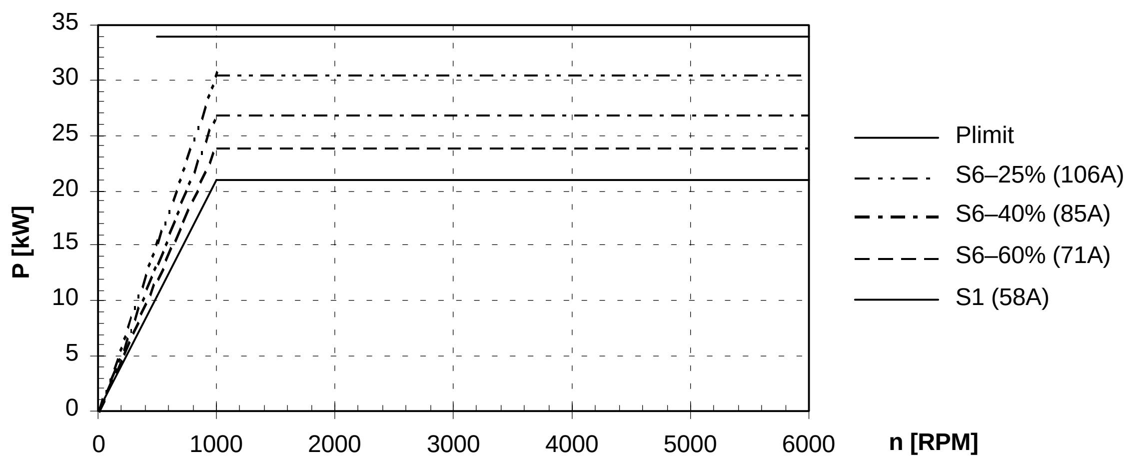


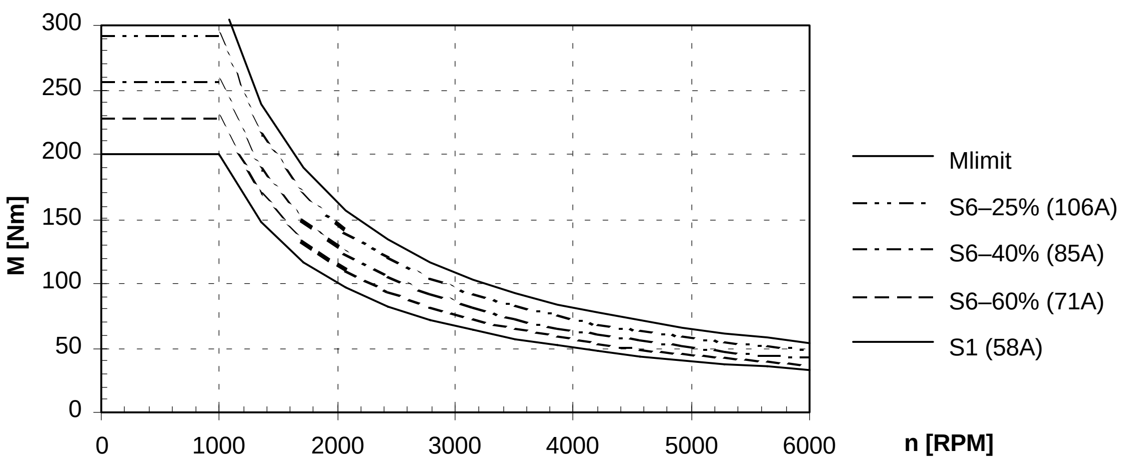


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-31 Motor type 1FE1114–6WW11

Three–phase synchronous built–in motor 1FE1114–6WW11			
Rated power	P_N	kW	20.9
Rated speed	n_N	RPM	1000
Rated torque	M_N	Nm	200
Rated current	I_N	A	58
Maximum current	I_{max}	A	116
Maximum rotational speed	n_{max}	RPM	6000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	245
Thermal time constant	T_{therm}	min	4
Stator weight with cooling jacket	m_{St}	kg	54
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

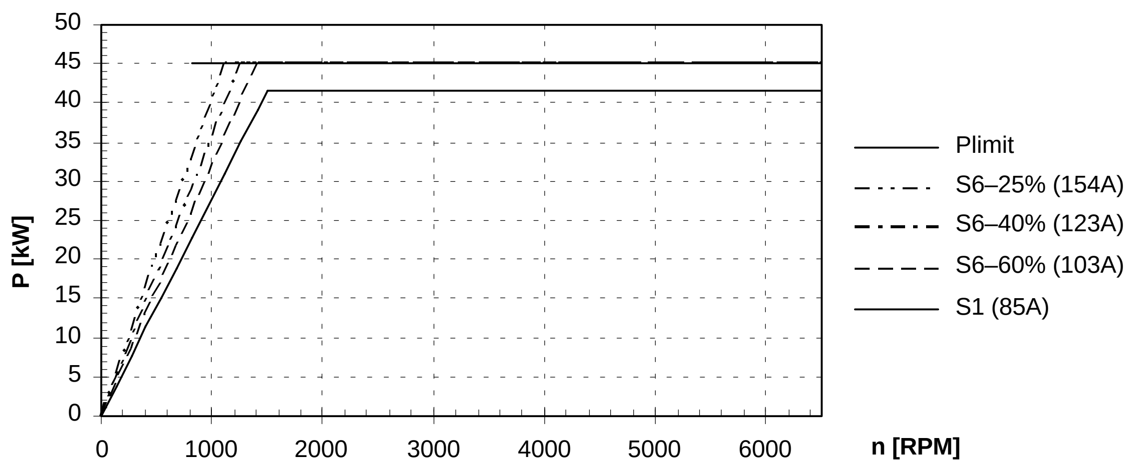


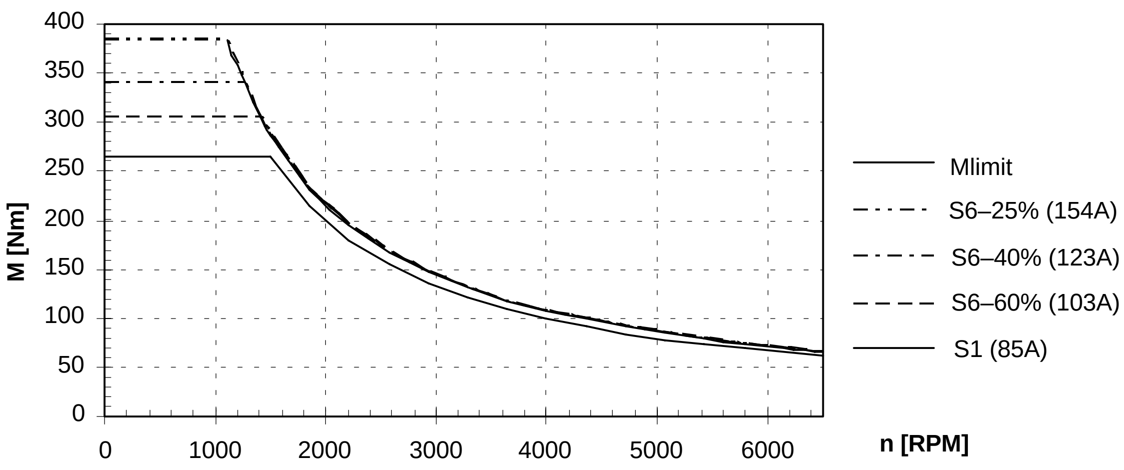


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-32 Motor type 1FE1115–6WT11

Three–phase synchronous built–in motor 1FE1115–6WT11			
Rated power	P_N	kW	41.6
Rated speed	n_N	RPM	1500
Rated torque	M_N	Nm	265
Rated current	I_N	A	85
Maximum current	I_{max}	A	170
Maximum rotational speed	n_{max}	RPM	6500
Moment of inertia 1)	J_{rot}	kg m^2	0.078
Voltage constant	k_E	V/1000 RPM	222
Thermal time constant	T_{therm}	min	4
Stator weight with cooling jacket	m_{St}	kg	65
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

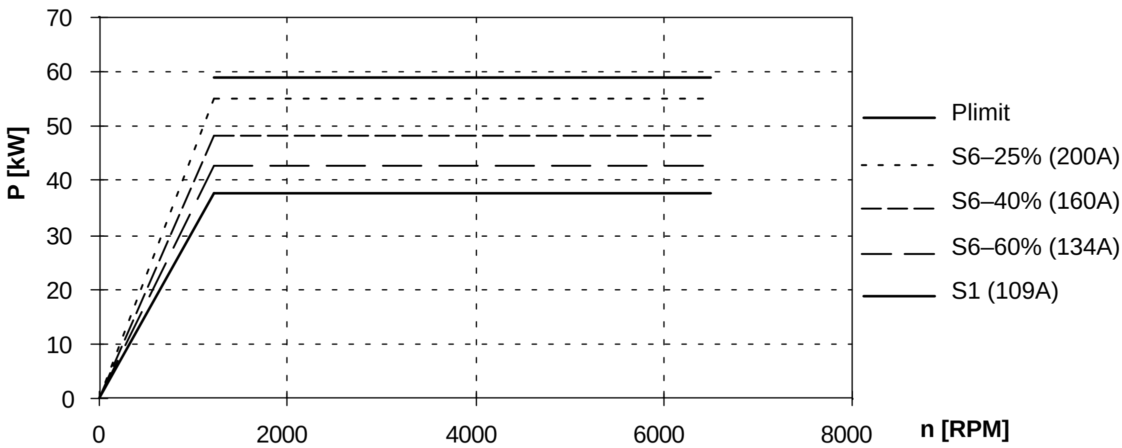


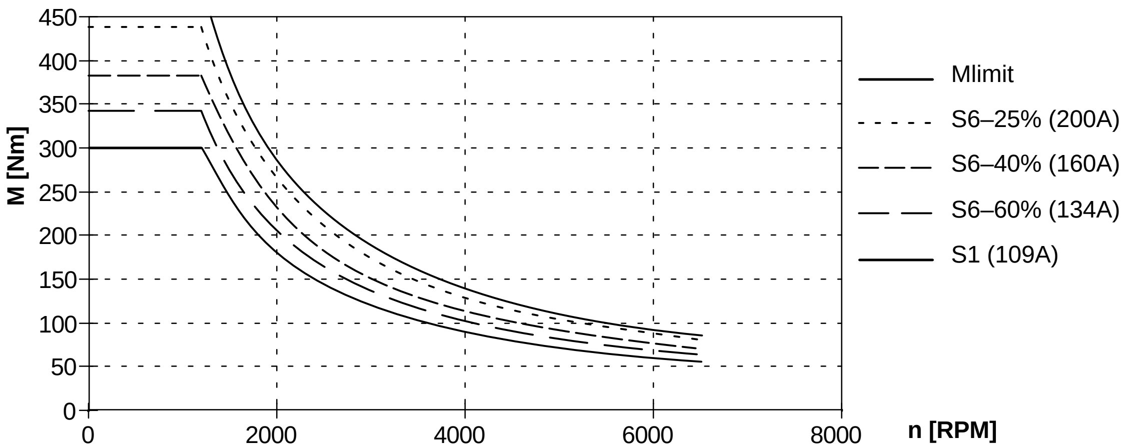


The data for duty type S6 are valid for a 2 min. duty cycle.
1) only rotor core without rotor sleeve

Table 5-33 Motor type 1FE1116–6WR11

Three–phase synchronous built–in motor 1FE1116–6WR11			
Rated power	P_N	kW	37.7
Rated speed	n_N	RPM	1200
Rated torque	M_N	Nm	300
Rated current	I_N	A	109
Maximum current	I_{max}	A	218
Maximum rotational speed	n_{max}	RPM	6500
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	200
Thermal time constant	T_{therm}	min	4
Stator weight with cooling jacket	m_{St}	kg	73
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

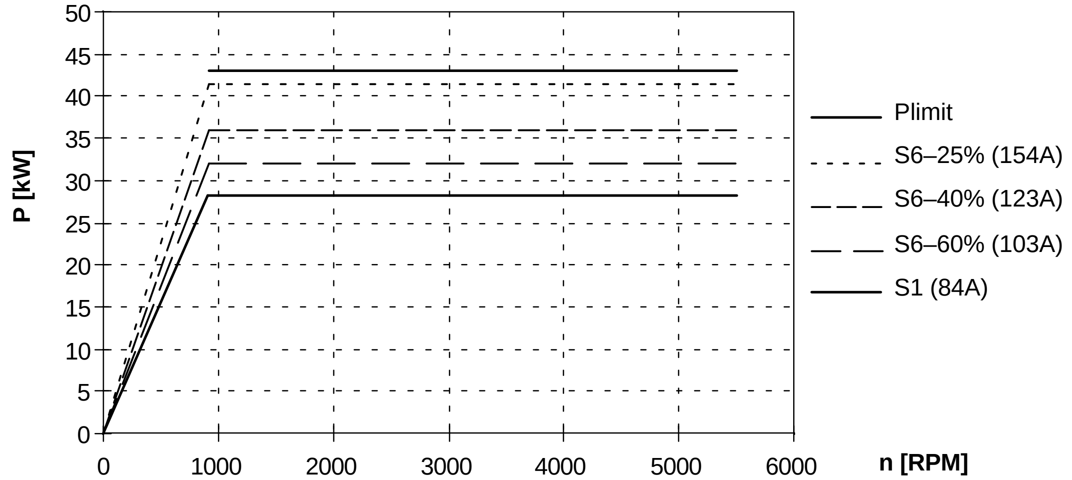


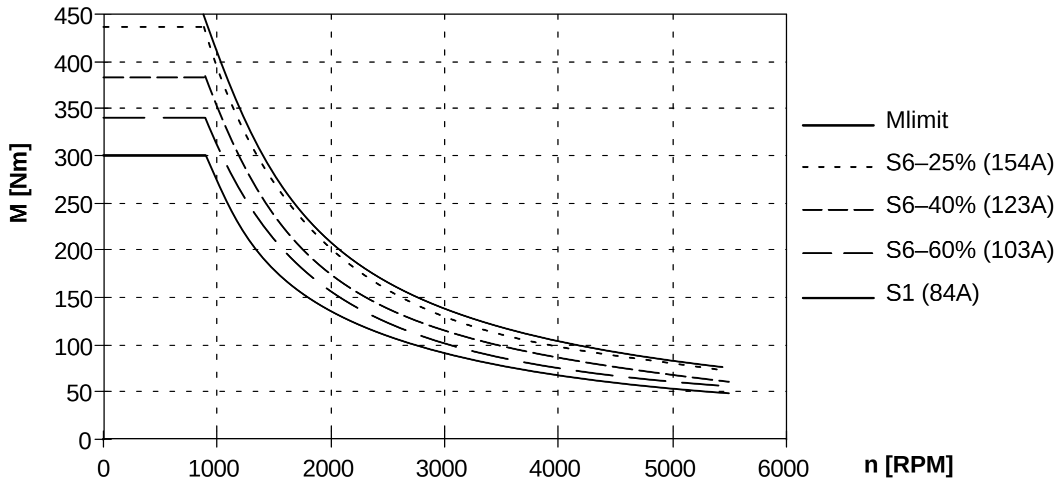


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-34 Motor type 1FE1116–6WT11

Three–phase synchronous built–in motor 1FE1116–6WT11			
Rated power	P_N	kW	28.3
Rated speed	n_N	RPM	900
Rated torque	M_N	Nm	300
Rated current	I_N	A	84
Maximum current	I_{max}	A	168
Maximum rotational speed	n_{max}	RPM	5500
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	256
Thermal time constant	T_{therm}	min	4
Stator weight with cooling jacket	m_{St}	kg	73
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

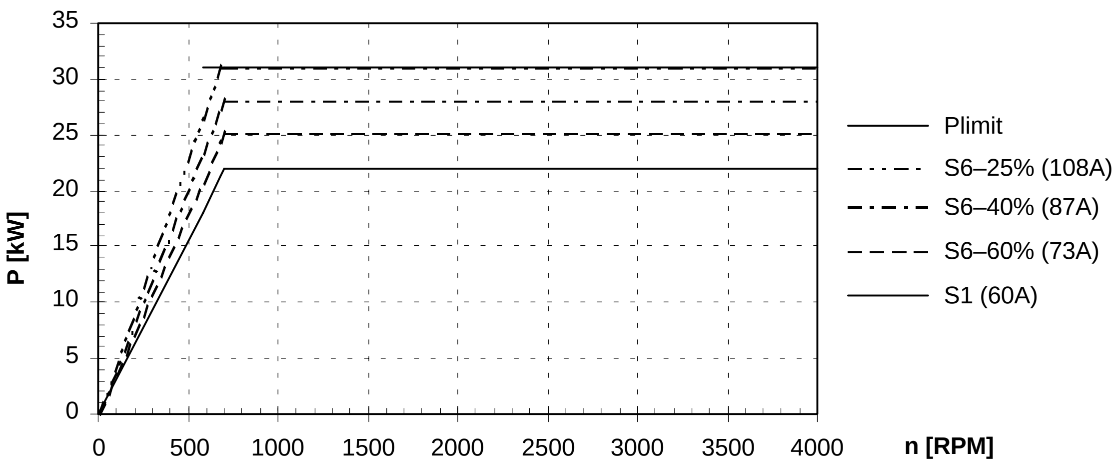


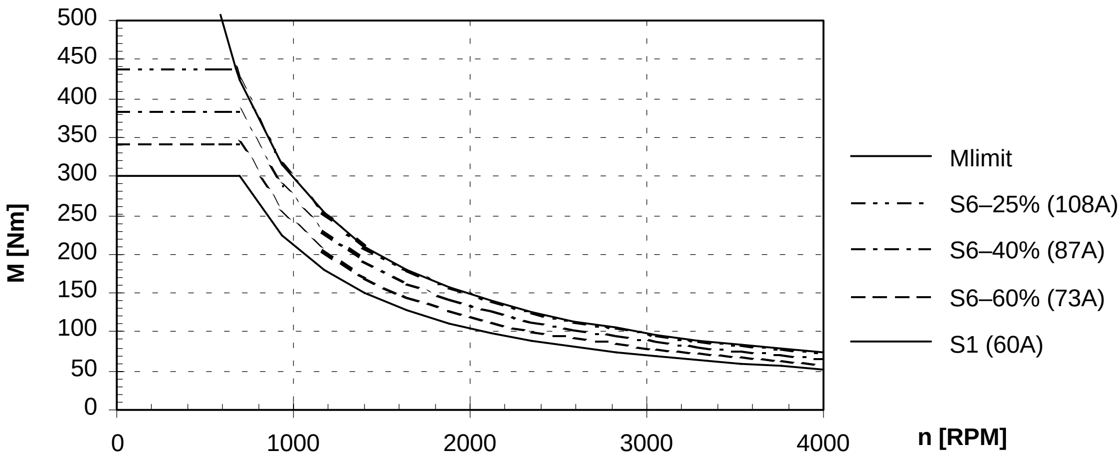


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-35 Motor type 1FE1116–6WW11

Three–phase synchronous built–in motor 1FE1116–6WW11			
Rated power	P_N	kW	22
Rated speed	n_N	RPM	700
Rated torque	M_N	Nm	300
Rated current	I_N	A	60
Maximum current	I_{max}	A	120
Maximum rotational speed	n_{max}	RPM	4000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	368
Thermal time constant	T_{therm}	min	4
Stator weight with cooling jacket	m_{St}	kg	73
Rotor weight	m_{Rot}	kg	Refer to Table 1-4



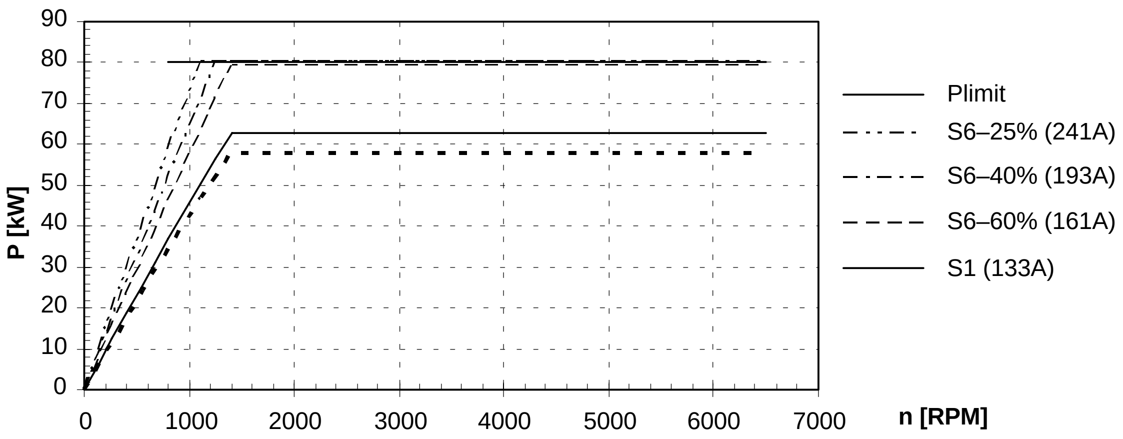


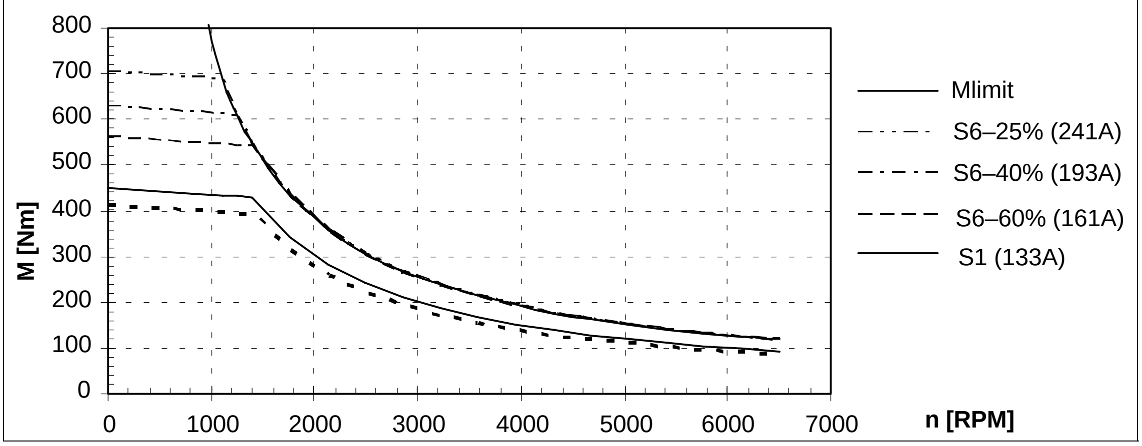
The data for duty type S6 are valid for a 2 min. duty cycle.

5.3 P/n and M/n diagrams for 8–pole 1FE1 motors

Table 5-36 Motor type 1FE1144–8WL11

Three–phase synchronous built–in motor 1FE1144–8WL11			
Rated power	P_N	kW	63
Rated speed	n_N	RPM	1400
Rated torque	M_N	Nm	430
Rated current	I_N	A	133
Maximum current	I_{max}	A	266
Maximum rotational speed	n_{max}	RPM	6500
Moment of inertia 1)	J_{rot}	kg m^2	0.11
Voltage constant	k_E	V/1000 RPM	218
Thermal time constant	T_{therm}	min	4
Stator weight with cooling jacket	m_{St}	kg	70
Rotor weight	m_{Rot}	kg	14.5

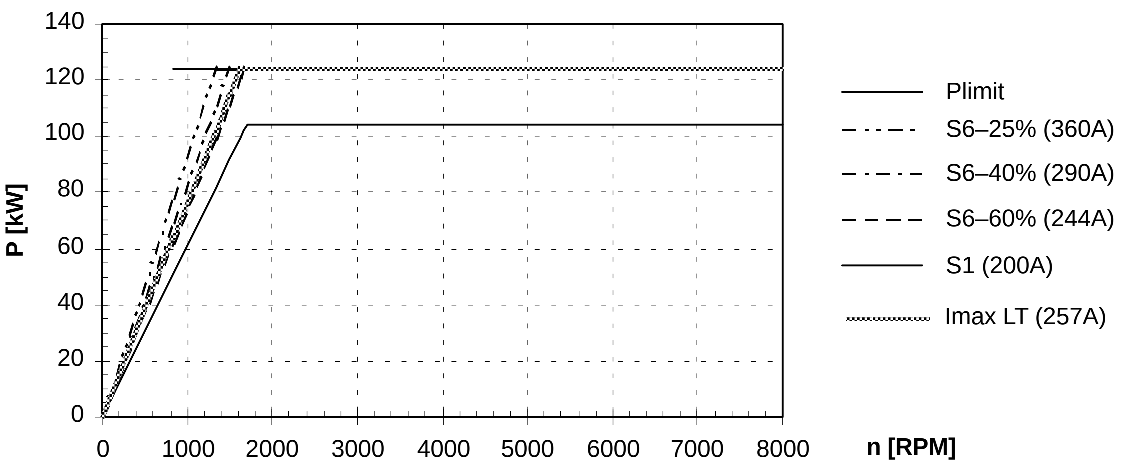


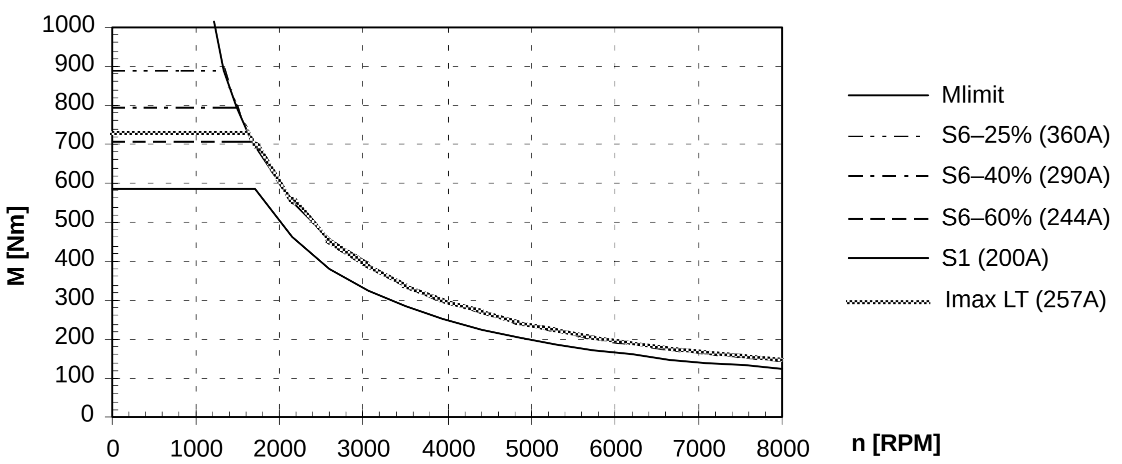


The data for duty type S6 are valid for a 2 min. duty cycle.
1) only rotor core without rotor sleeve

Table 5-37 Motor type 1FE1145–8WN11

Three–phase synchronous built–in motor 1FE1145–8WN11			
Rated power	P_N	kW	104
Rated speed	n_N	RPM	1700
Rated torque	M_N	Nm	585
Rated current	I_N	A	200
Maximum current	I_{max}	A	400
Maximum rotational speed	n_{max}	RPM	8000
Moment of inertia	J_{rot}	kg m^2	0.21636
Voltage constant	k_E	V/1000 RPM	187
Thermal time constant	T_{therm}	min	4
Stator weight with cooling jacket	m_{St}	kg	88.5
Rotor weight	m_{Rot}	kg	28.30

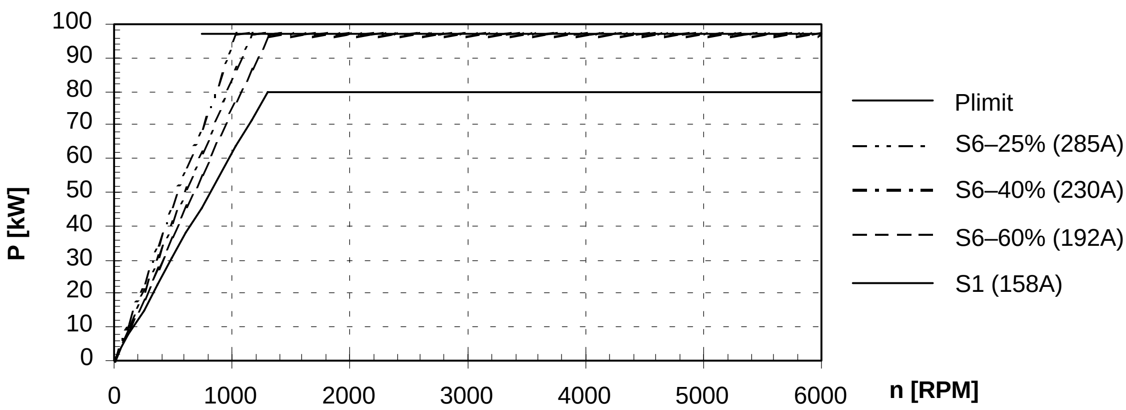


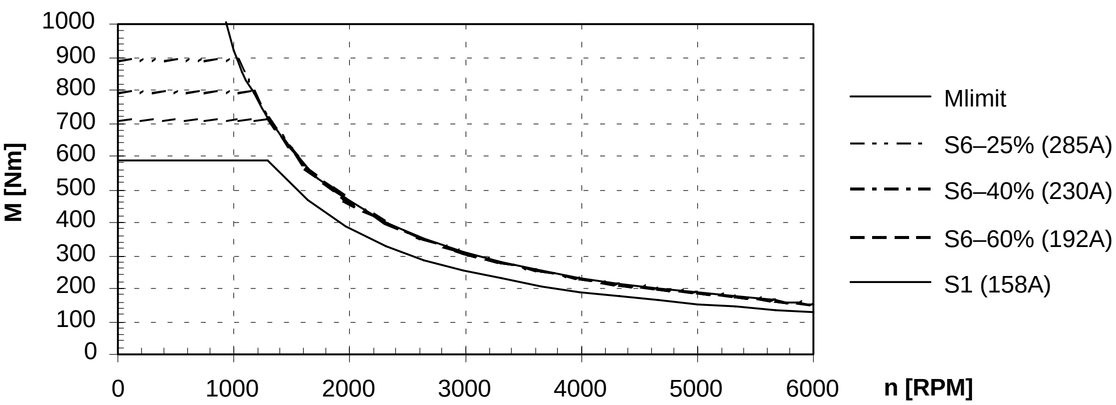


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-38 Motor type 1FE1145–8WQ11

Three–phase synchronous built–in motor 1FE1145–8WQ11			
Rated power	P_N	kW	79.6
Rated speed	n_N	RPM	1300
Rated torque	M_N	Nm	585
Rated current	I_N	A	158
Maximum current	I_{max}	A	316
Maximum rotational speed	n_{max}	RPM	6000
Moment of inertia	J_{rot}	kg m^2	0.21636
Voltage constant	k_E	V/1000 RPM	238
Thermal time constant	T_{therm}	min	4
Stator weight with cooling jacket	m_{St}	kg	88.5
Rotor weight	m_{Rot}	kg	28.30

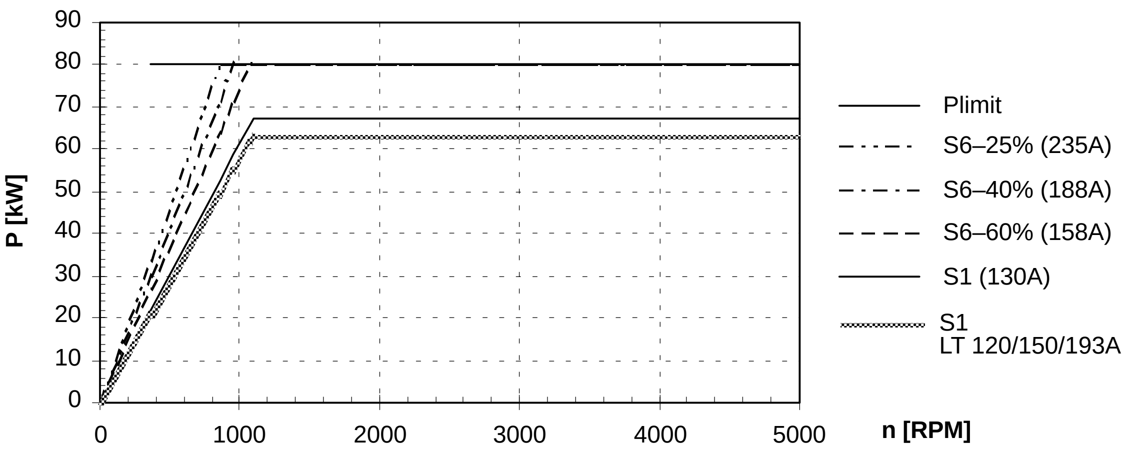


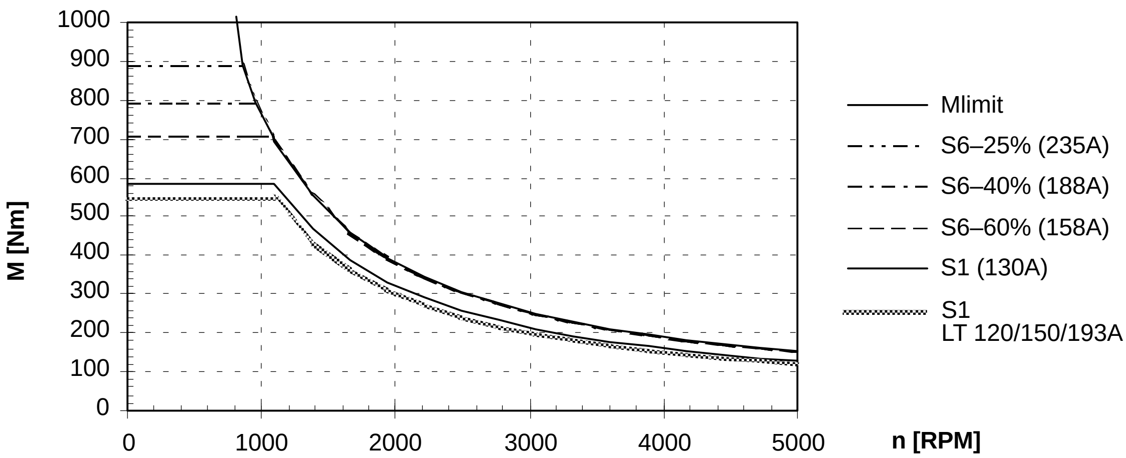


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-39 Motor type 1FE1145–8WS11

Three–phase synchronous built–in motor 1FE1145–8WS11			
Rated power	P_N	kW	67.4
Rated speed	n_N	RPM	1100
Rated torque	M_N	Nm	585
Rated current	I_N	A	130
Maximum current	I_{max}	A	260
Maximum rotational speed	n_{max}	RPM	5000
Moment of inertia	J_{rot}	kg m^2	0.21636
Voltage constant	k_E	V/1000 RPM	290
Thermal time constant	T_{therm}	min	4
Stator weight with cooling jacket	m_{St}	kg	88.5
Rotor weight	m_{Rot}	kg	28.30

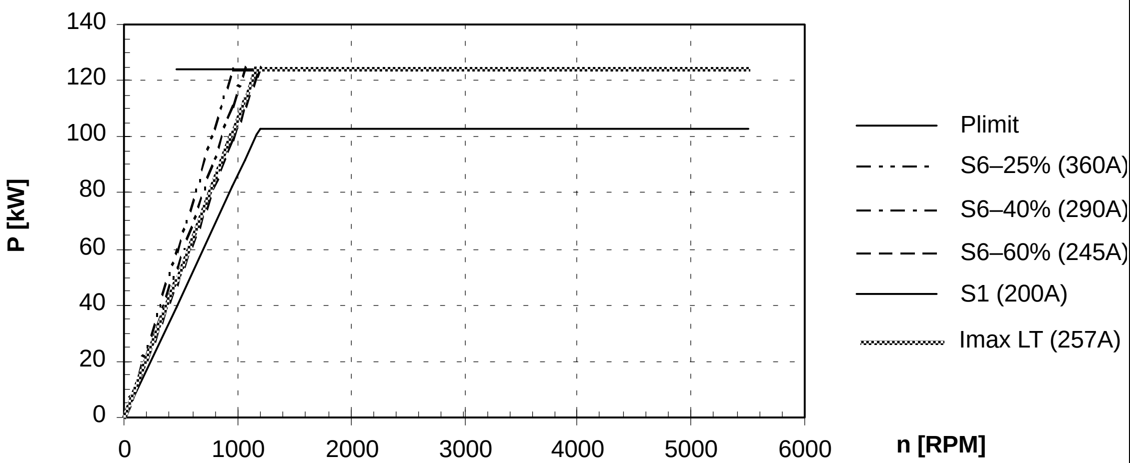


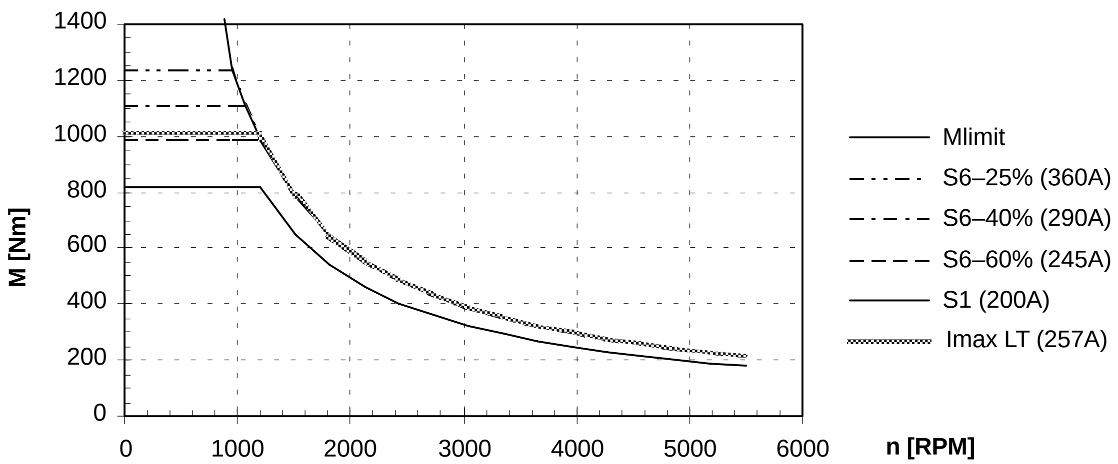


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-40 Motor type 1FE1147–8WN11

Three–phase synchronous built–in motor 1FE1147–8WN11			
Rated power	P_N	kW	103
Rated speed	n_N	RPM	1200
Rated torque	M_N	Nm	820
Rated current	I_N	A	200
Maximum current	I_{max}	A	400
Maximum rotational speed	n_{max}	RPM	5500
Moment of inertia	J_{rot}	kg m^2	0.28823
Voltage constant	k_E	V/1000 RPM	262
Thermal time constant	T_{therm}	min	4
Stator weight with cooling jacket	m_{St}	kg	116
Rotor weight	m_{Rot}	kg	37.70

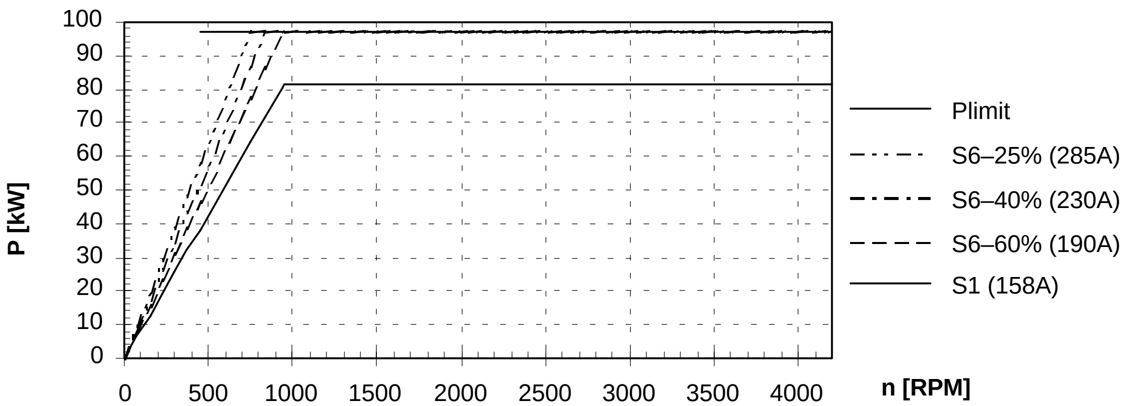


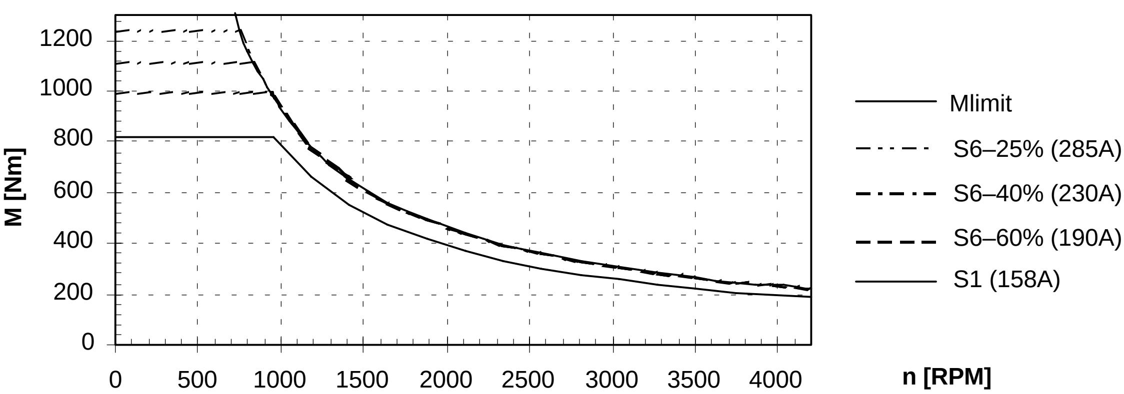


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-41 Motor type 1FE1147–8WQ11

Three–phase synchronous built–in motor 1FE1147–8WQ11			
Rated power	P_N	kW	81.6
Rated speed	n_N	RPM	950
Rated torque	M_N	Nm	820
Rated current	I_N	A	158
Maximum current	I_{max}	A	316
Maximum rotational speed	n_{max}	RPM	4200
Moment of inertia	J_{rot}	kg m^2	0.28823
Voltage constant	k_E	V/1000 RPM	355
Thermal time constant	T_{therm}	min	4
Stator weight with cooling jacket	m_{St}	kg	116
Rotor weight	m_{Rot}	kg	37.70

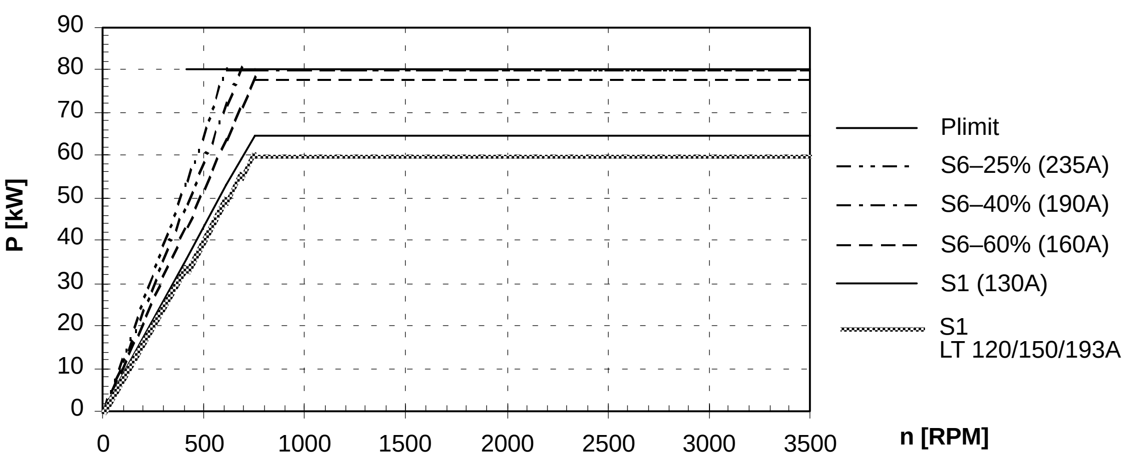


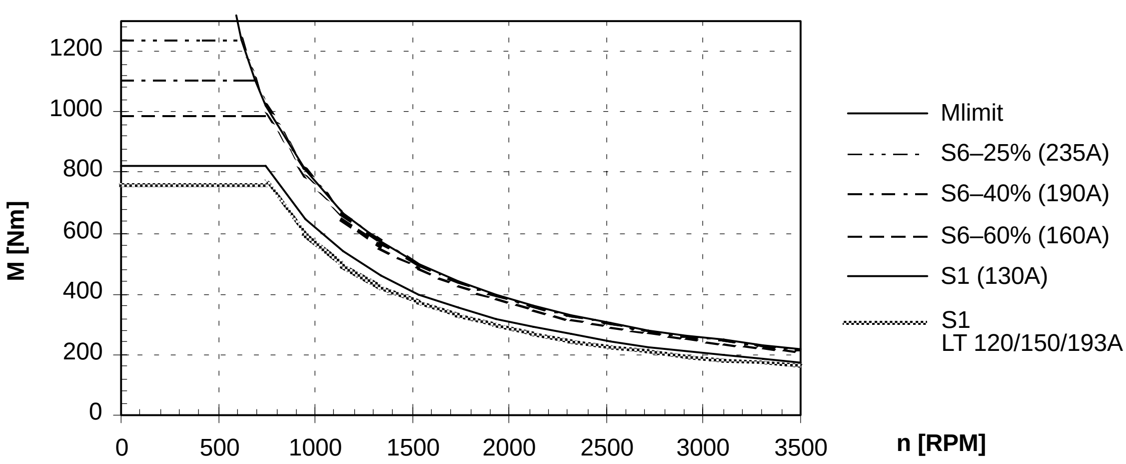


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-42 Motor type 1FE1147–8WS11

Three–phase synchronous built–in motor 1FE1147–8WS11			
Rated power	P_N	kW	64.4
Rated speed	n_N	RPM	750
Rated torque	M_N	Nm	820
Rated current	I_N	A	130
Maximum current	I_{max}	A	260
Maximum rotational speed	n_{max}	RPM	3500
Moment of inertia	J_{rot}	kg m^2	0.28823
Voltage constant	k_E	V/1000 RPM	405
Thermal time constant	T_{therm}	min	4
Stator weight with cooling jacket	m_{St}	kg	116
Rotor weight	m_{Rot}	kg	37.70



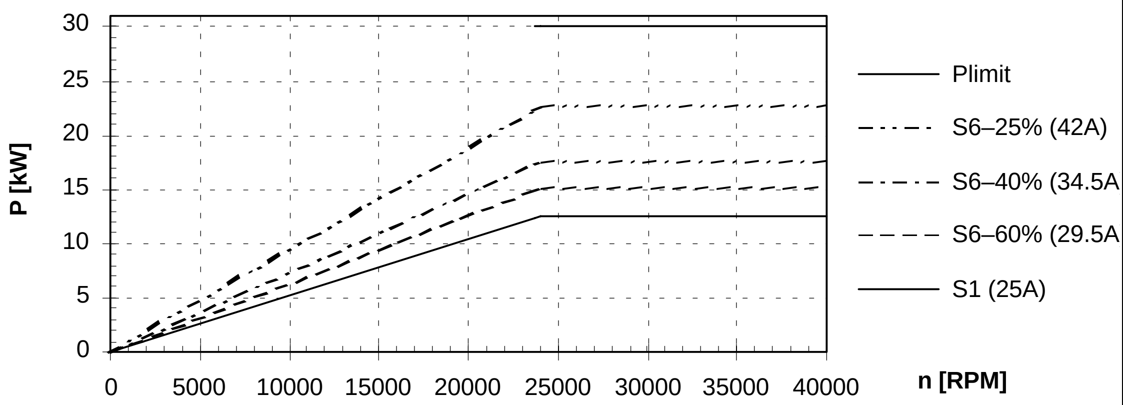


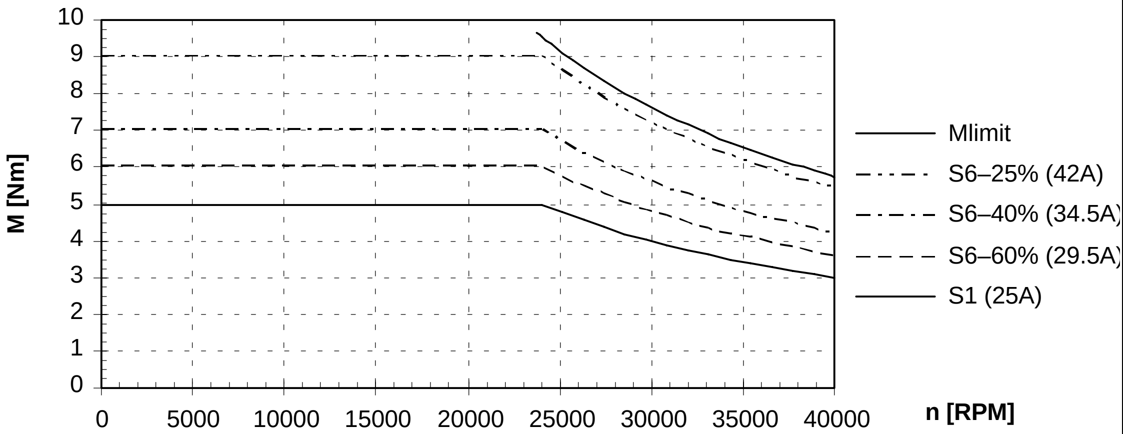
The data for duty type S6 are valid for a 2 min. duty cycle.

5.4 P/n and M/n diagrams for 4–pole 1FE1 motors

Table 5-43 Motor type 1FE1051–4HC10

Three–phase synchronous built–in motor 1FE1051–4HC10			
Rated power	P_N	kW	12.6
Rated speed	n_N	RPM	24000
Rated torque	M_N	Nm	5
Rated current	I_N	A	25
Maximum current	I_{max}	A	50
Maximum rotational speed	n_{max}	RPM	40000
Moment of inertia 1)	J_{rot}	kg m^2	0.00045
Voltage constant	k_E	V/1000 RPM	15
Thermal time constant	T_{therm}	min	1
Stator weight with cooling jacket	m_{St}	kg	3.5
Rotor weight	m_{Rot}	kg	0.60



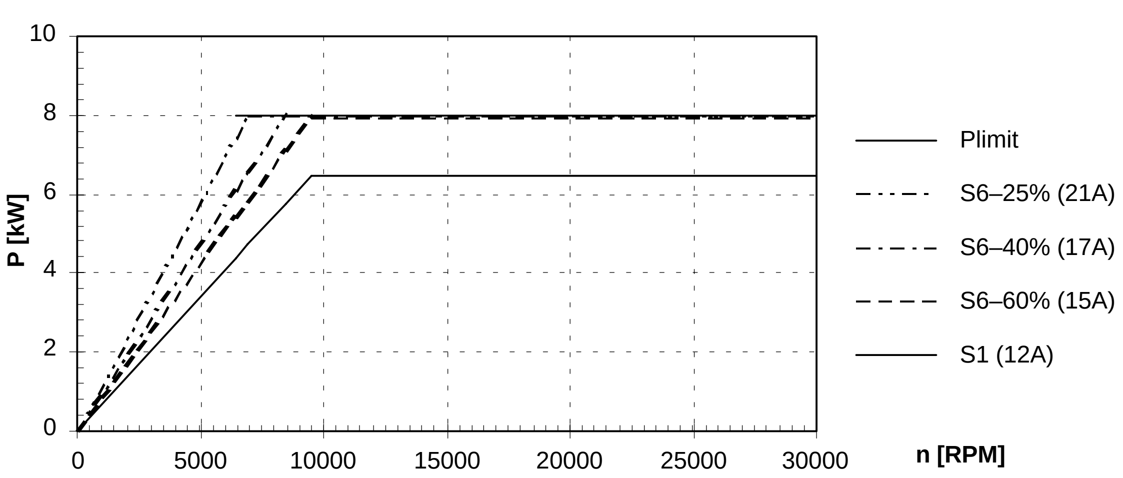


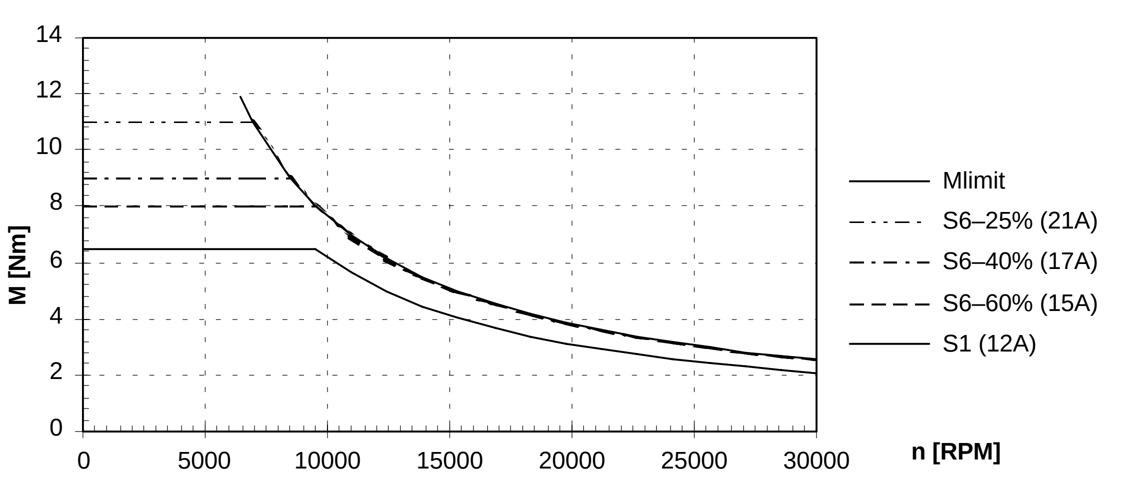
The data for duty type S6 are valid for a 1 min. duty cycle.

1) only rotor core without rotor sleeve

Table 5-44 Motor type 1FE1051–4WN11

Three–phase synchronous built–in motor 1FE1051–4WN11			
Rated power	P_N	kW	6.5
Rated speed	n_N	RPM	9500
Rated torque	M_N	Nm	6.5
Rated current	I_N	A	12
Maximum current	I_{max}	A	24
Maximum rotational speed	n_{max}	RPM	30000
Moment of inertia	J_{rot}	kg m^2	0.00057
Voltage constant	k_E	V/1000 RPM	34
Thermal time constant	T_{therm}	min	1
Stator weight with cooling jacket	m_{St}	kg	3.5
Rotor weight	m_{Rot}	kg	0.70

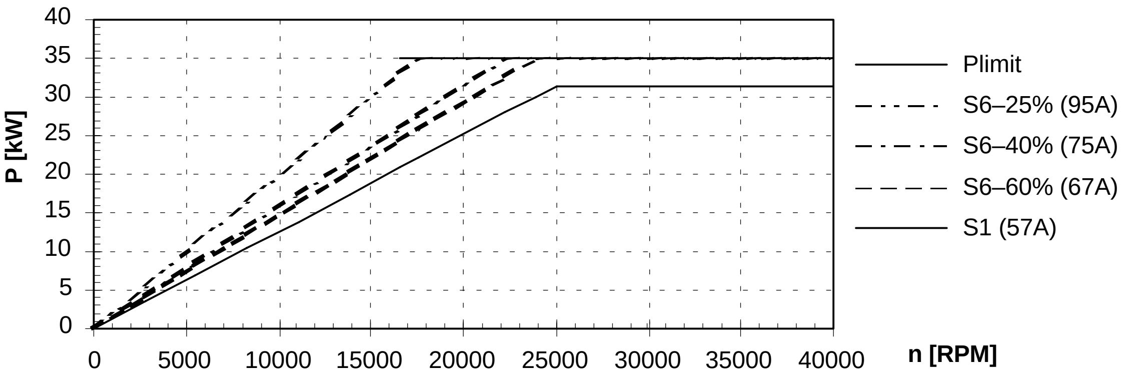


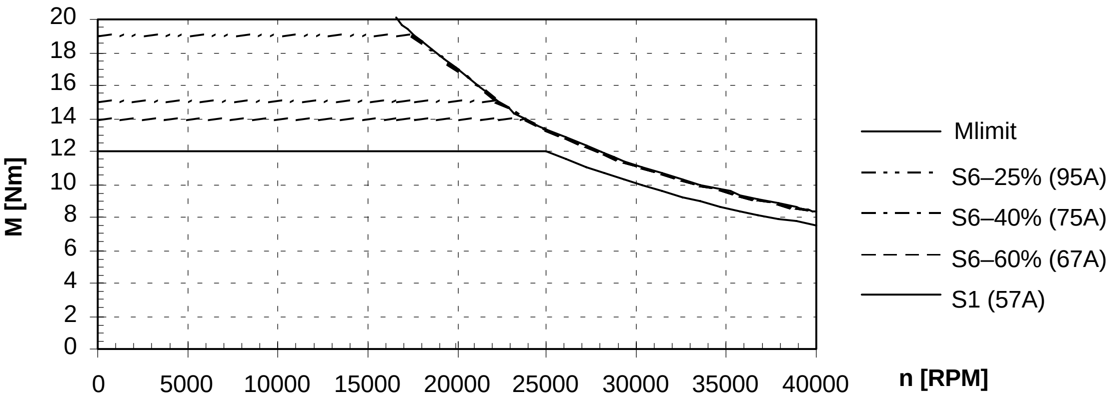


The data for duty type S6 are valid for a 1 min. duty cycle.

Table 5-45 Motor type 1FE1052–4HD10

Three–phase synchronous built–in motor 1FE1052–4HD10			
Rated power	P_N	kW	31.4
Rated speed	n_N	RPM	25000
Rated torque	M_N	Nm	12
Rated current	I_N	A	57
Maximum current	I_{max}	A	114
Maximum rotational speed	n_{max}	RPM	40000
Moment of inertia 1)	J_{rot}	kg m^2	0.00087
Voltage constant	k_E	V/1000 RPM	14
Thermal time constant	T_{therm}	min	1
Stator weight with cooling jacket	m_{St}	kg	6
Rotor weight	m_{Rot}	kg	1.15

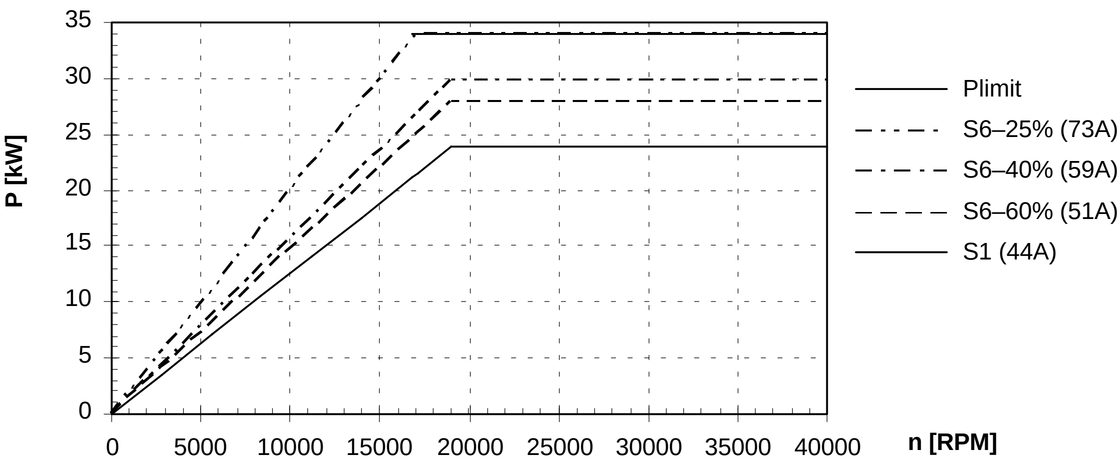


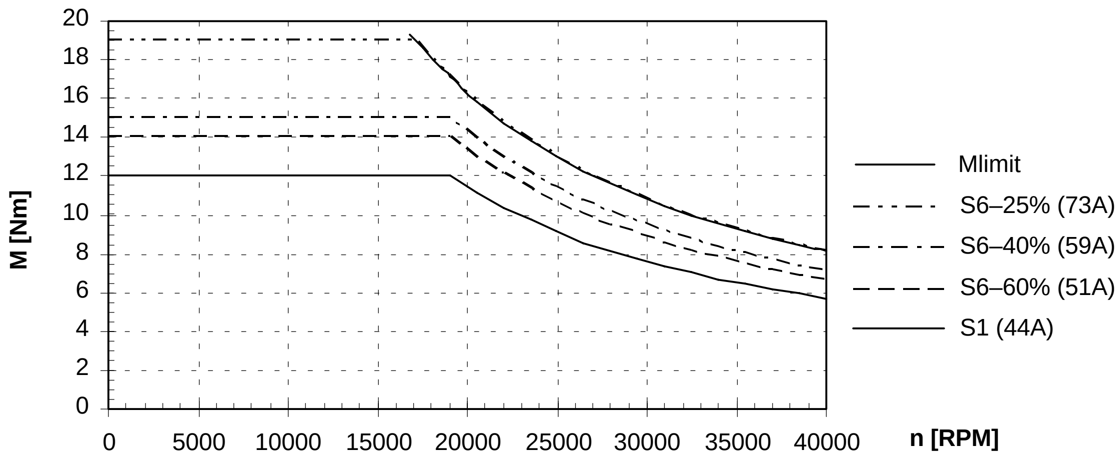


The data for duty type S6 are valid for a 1 min. duty cycle.
For optimum operation, a drive converter pulse frequency of 8 kHz is required.
A series reactor is required for safe and reliable operation: L_{series} = 0.23 mH;
Order No. and information on how to use the series reactor, refer to Chapter 1.3
1) only rotor core without rotor sleeve

Table 5-46 Motor type 1FE1052–4HG11

Three–phase synchronous built–in motor 1FE1052–4HG11			
Rated power	P_N	kW	23.9
Rated speed	n_N	RPM	19000
Rated torque	M_N	Nm	12
Rated current	I_N	A	44
Maximum current	I_{max}	A	88
Maximum rotational speed	n_{max}	RPM	40000
Moment of inertia 1)	J_{rot}	kg m^2	0.00087
Voltage constant	k_E	V/1000 RPM	18
Thermal time constant	T_{therm}	min	1
Stator weight with cooling jacket	m_{St}	kg	6
Rotor weight	m_{Rot}	kg	1.15

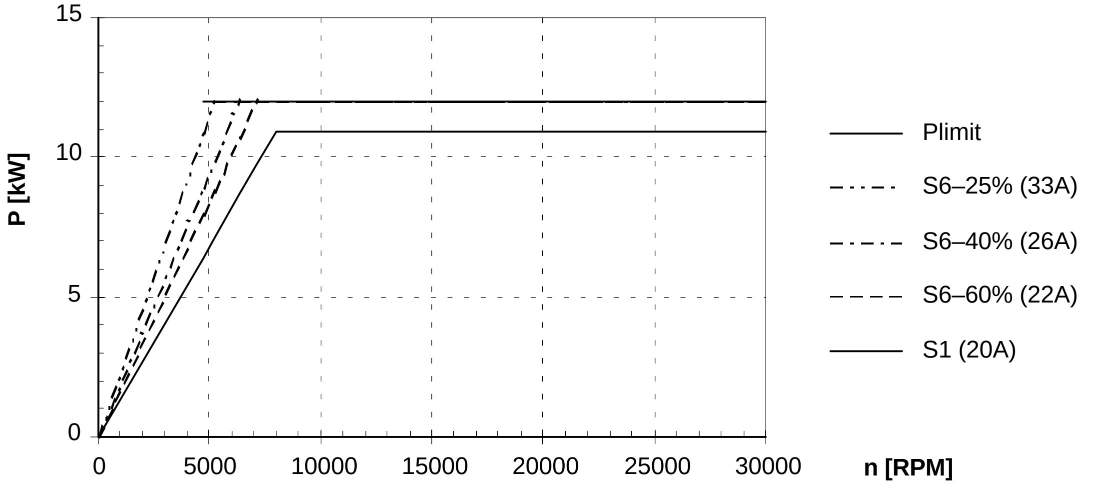


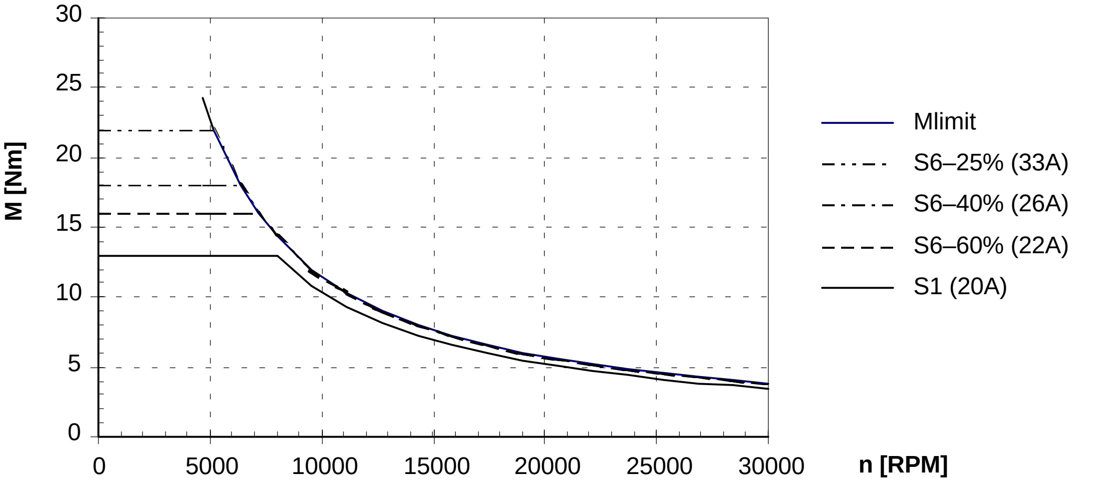


The data for duty type S6 are valid for a 1 min. duty cycle.
For optimum operation, a drive converter pulse frequency of 8 kHz is required.
A series reactor is required for safe and reliable operation: L_{series} = 0.23 mH;
Order No. and information on how to use the series reactor, refer to Chapter 1.3
1) only rotor core without rotor sleeve

Table 5-47 Motor type 1FE1052–4WN11

Three–phase synchronous built–in motor 1FE1052–4WN11			
Rated power	P_N	kW	11
Rated speed	n_N	RPM	8000
Rated torque	M_N	Nm	13
Rated current	I_N	A	20
Maximum current	I_{max}	A	40
Maximum rotational speed	n_{max}	RPM	30000
Moment of inertia	J_{rot}	kg m^2	0.00114
Voltage constant	k_E	V/1000 RPM	44
Thermal time constant	T_{therm}	min	1
Stator weight with cooling jacket	m_{St}	kg	6
Rotor weight	m_{Rot}	kg	1.40

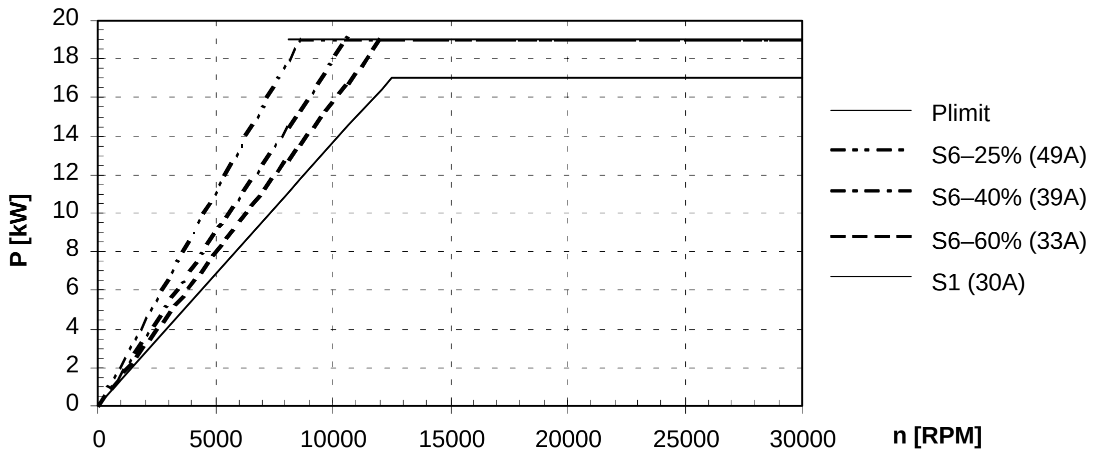


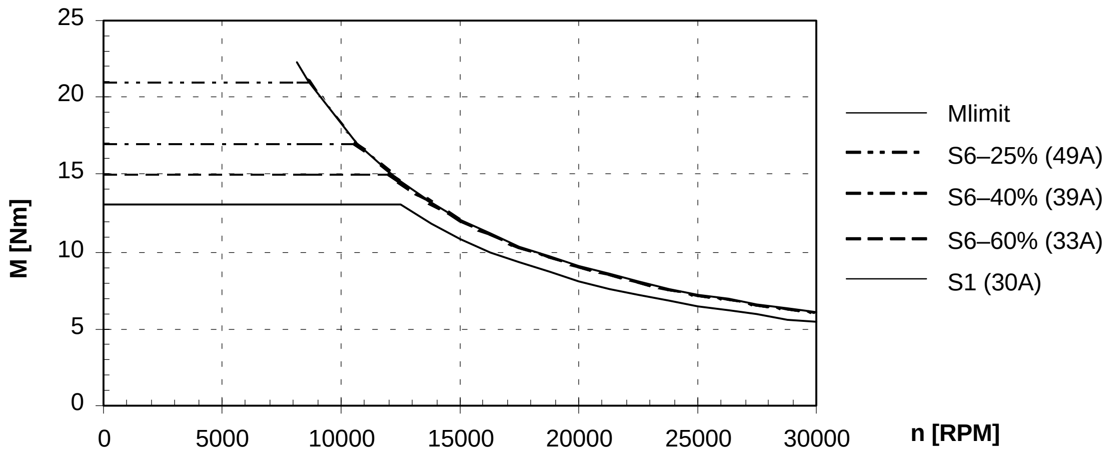


The data for duty type S6 are valid for a 1 min. duty cycle.

Table 5-48 Motor type 1FE1052–4WK11

Three–phase synchronous built–in motor 1FE1052–4WK11			
Rated power	P_N	kW	17.5
Rated speed	n_N	RPM	12500
Rated torque	M_N	Nm	13
Rated current	I_N	A	30
Maximum current	I_{max}	A	60
Maximum rotational speed	n_{max}	RPM	30000
Moment of inertia	J_{rot}	kg m^2	0.00114
Voltage constant	k_E	V/1000 RPM	28.4
Thermal time constant	T_{therm}	min	1
Stator weight with cooling jacket	m_{St}	kg	6
Rotor weight	m_{Rot}	kg	1.40

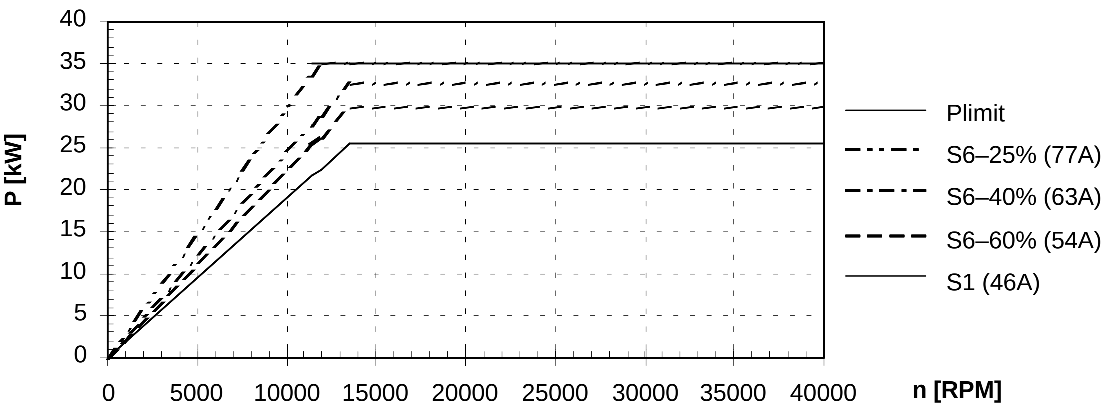


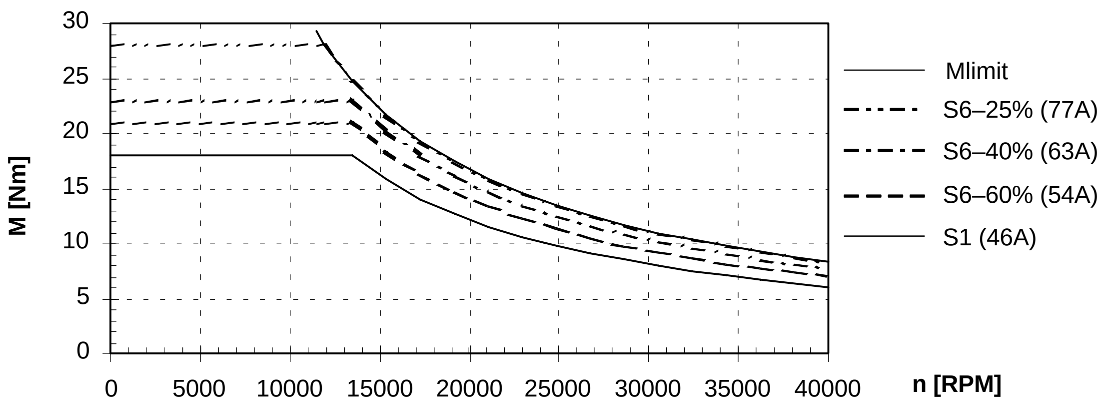


The data for duty type S6 are valid for a 1 min. duty cycle.

Table 5-49 Motor type 1FE1053–4HH11

Three–phase synchronous built–in motor 1FE1053–4HH11			
Rated power	P_N	kW	25.5
Rated speed	n_N	RPM	13500
Rated torque	M_N	Nm	18
Rated current	I_N	A	46
Maximum current	I_{max}	A	92
Maximum rotational speed	n_{max}	RPM	40000
Moment of inertia 1)	J_{rot}	kg m^2	0.00128
Voltage constant	k_E	V/1000 RPM	25
Thermal time constant	T_{therm}	min	1
Stator weight with cooling jacket	m_{St}	kg	8.5
Rotor weight	m_{Rot}	kg	1.70

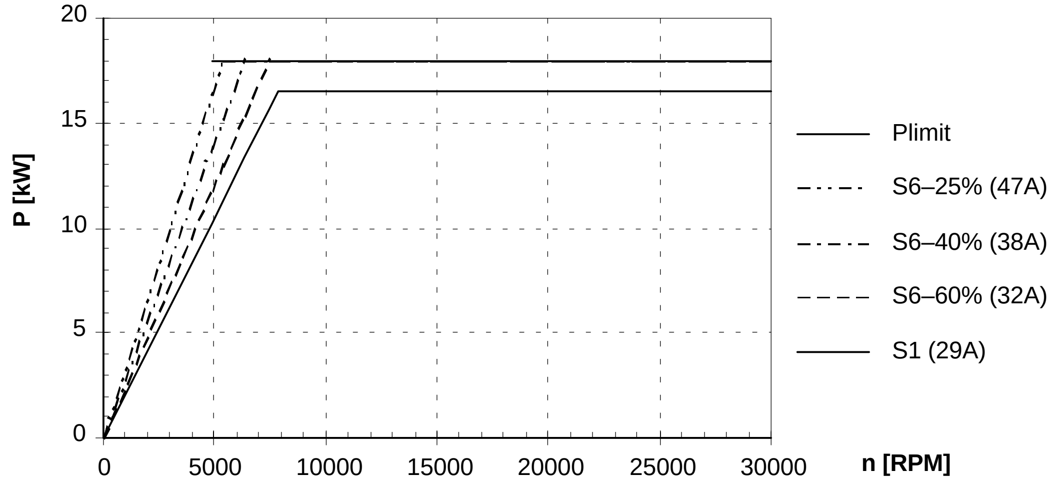


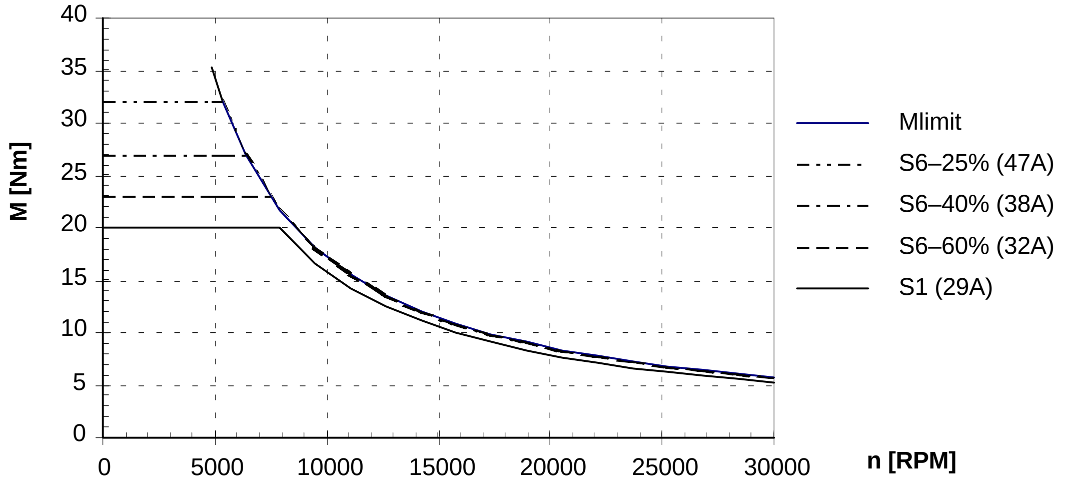


The data for duty type S6 are valid for a 1 min. duty cycle.
For optimum operation, a drive converter pulse frequency of 8 kHz is required.
A series reactor is required for safe and reliable operation: L_{series} = 0.32 mH;
Order No. and information on how to use the series reactor, refer to Chapter 1.3
1) only rotor core without rotor sleeve

Table 5-50 Motor type 1FE1053–4WN11

Three–phase synchronous built–in motor 1FE1053–4WN11			
Rated power	P_N	kW	16.5
Rated speed	n_N	RPM	7900
Rated torque	M_N	Nm	20
Rated current	I_N	A	29
Maximum current	I_{max}	A	58
Maximum rotational speed	n_{max}	RPM	30000
Moment of inertia	J_{rot}	kg m^2	0.00163
Voltage constant	k_E	V/1000 RPM	45
Thermal time constant	T_{therm}	min	1
Stator weight with cooling jacket	m_{St}	kg	8.5
Rotor weight	m_{Rot}	kg	2.00

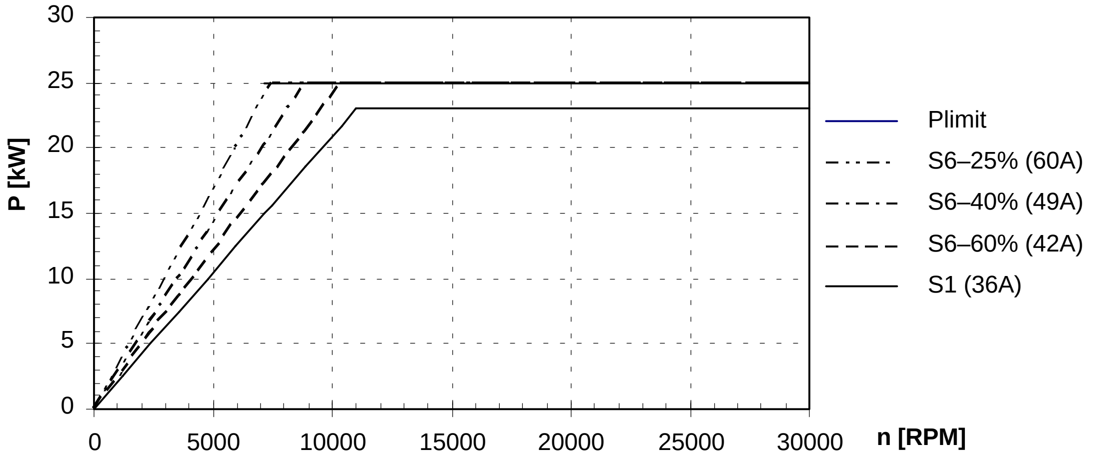


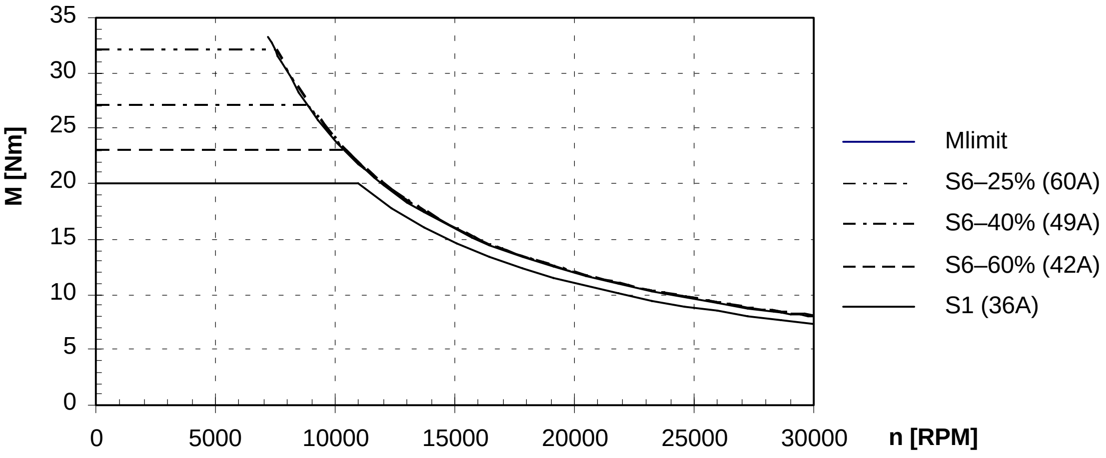


The data for duty type S6 are valid for a 1 min. duty cycle.

Table 5-51 Motor type 1FE1053–4WJ11

Three–phase synchronous built–in motor 1FE1053–4WJ11			
Rated power	P_N	kW	23
Rated speed	n_N	RPM	11000
Rated torque	M_N	Nm	20
Rated current	I_N	A	36
Maximum current	I_{max}	A	72
Maximum rotational speed	n_{max}	RPM	30000
Moment of inertia 1)	J_{rot}	kg m^2	0.0019
Voltage constant	k_E	V/1000 RPM	39
Thermal time constant	T_{therm}	min	1
Stator weight with cooling jacket	m_{St}	kg	8.5
Rotor weight	m_{Rot}	kg	2.00



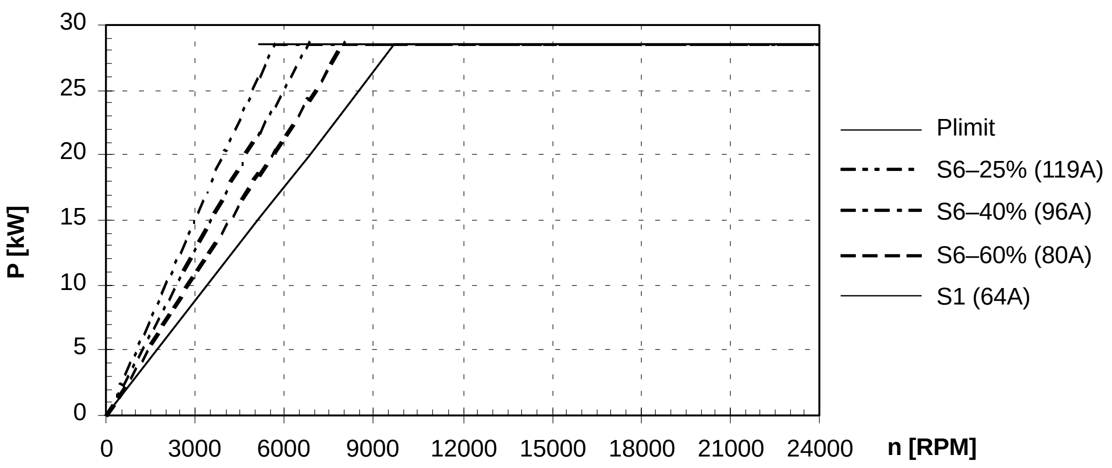


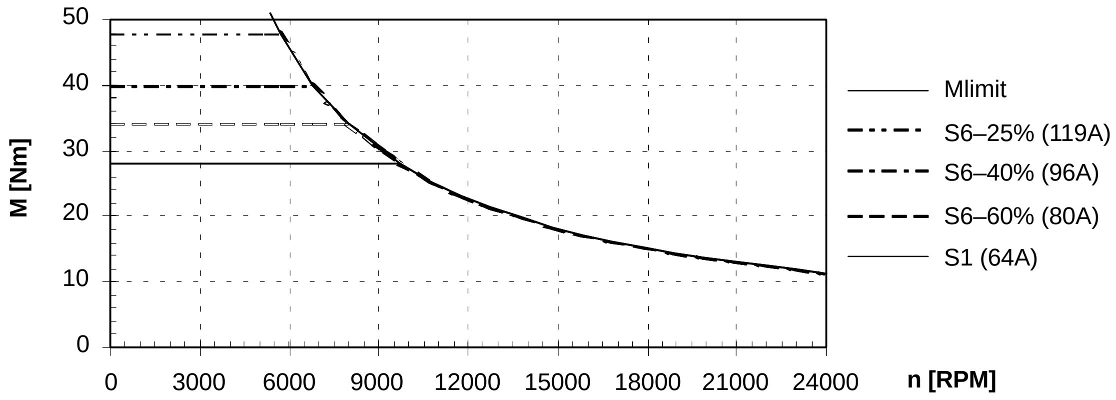
The data for duty type S6 are valid for a 1 min. duty cycle.

1) only rotor core without rotor sleeve

Table 5-52 Motor type 1FE1072–4WH11

Three–phase synchronous built–in motor 1FE1072–4WH11			
Rated power	P_N	kW	28.5
Rated speed	n_N	RPM	9700
Rated torque	M_N	Nm	28
Rated current	I_N	A	64
Maximum current	I_{max}	A	128
Maximum rotational speed	n_{max}	RPM	24000
Moment of inertia	J_{rot}	kg m^2	0.00287
Voltage constant	k_E	V/1000 RPM	33
Thermal time constant	T_{therm}	min	2.5
Stator weight with cooling jacket	m_{St}	kg	9
Rotor weight	m_{Rot}	kg	2.20

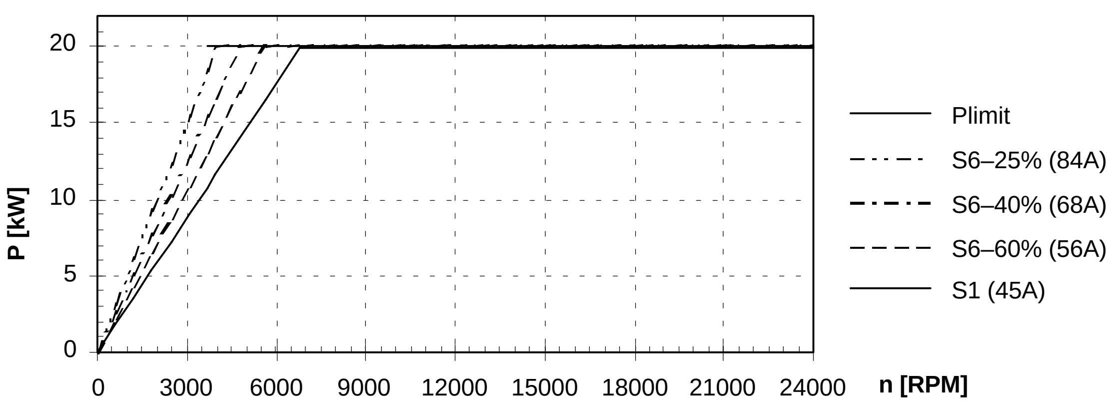


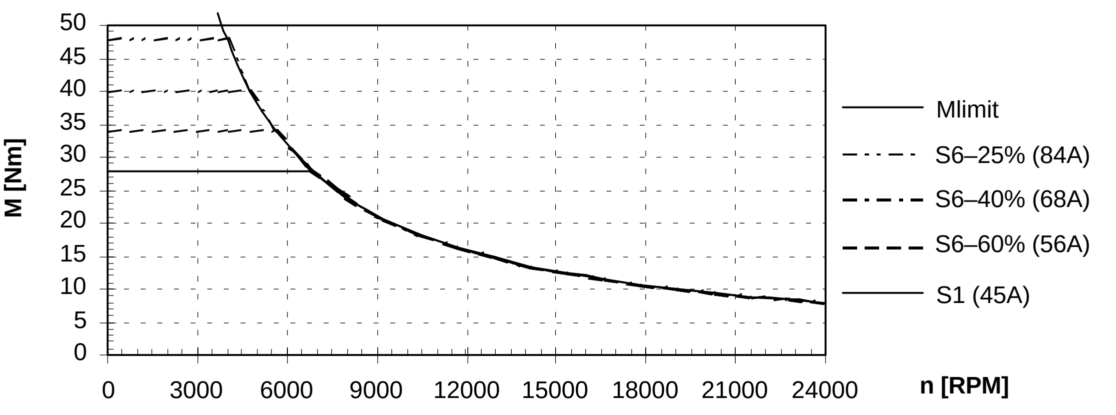


The data for duty type S6 are valid for a 1 min. duty cycle.

Table 5-53 Motor type 1FE1072–4WL11

Three–phase synchronous built–in motor 1FE1072–4WL11			
Rated power	P_N	kW	20
Rated speed	n_N	RPM	6800
Rated torque	M_N	Nm	28
Rated current	I_N	A	45
Maximum current	I_{max}	A	90
Maximum rotational speed	n_{max}	RPM	24000
Moment of inertia	J_{rot}	kg m^2	0.00287
Voltage constant	k_E	V/1000 RPM	46
Thermal time constant	T_{therm}	min	2.5
Stator weight with cooling jacket	m_{St}	kg	9
Rotor weight	m_{Rot}	kg	2.20

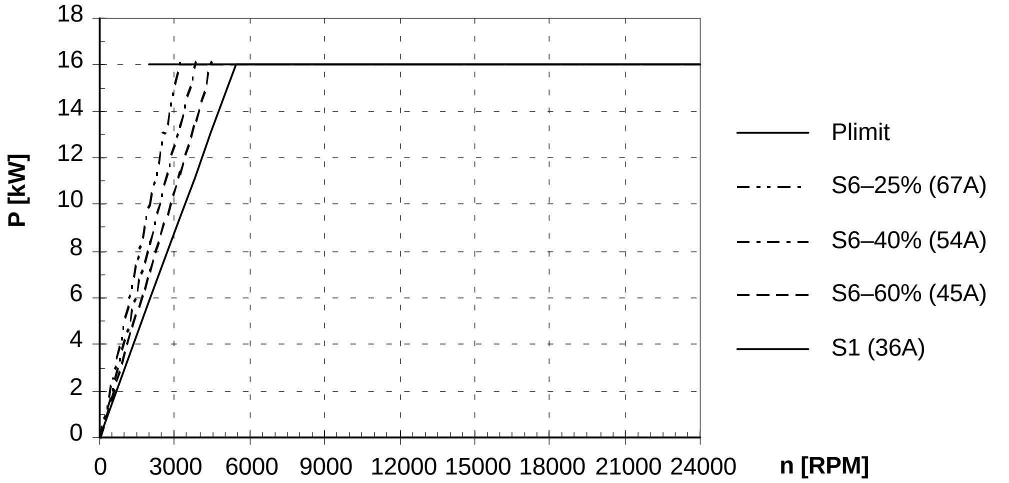


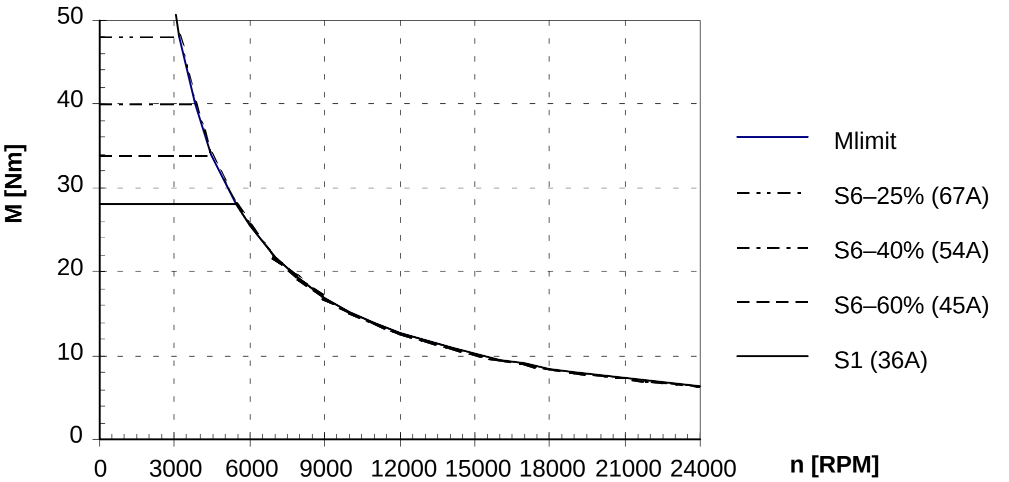


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-54 Motor type 1FE1072–4WN11

Three–phase synchronous built–in motor 1FE1072–4WN11			
Rated power	P_N	kW	16
Rated speed	n_N	RPM	5500
Rated torque	M_N	Nm	28
Rated current	I_N	A	36
Maximum current	I_{max}	A	72
Maximum rotational speed	n_{max}	RPM	24000
Moment of inertia	J_{rot}	kg m^2	0.00287
Voltage constant	k_E	V/1000 RPM	58
Thermal time constant	T_{therm}	min	2.5
Stator weight with cooling jacket	m_{St}	kg	9
Rotor weight	m_{Rot}	kg	2.20

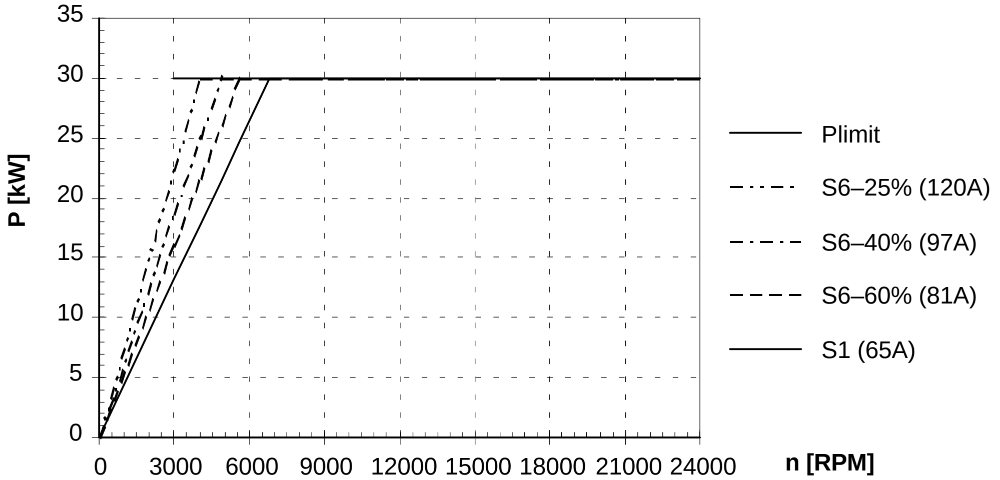


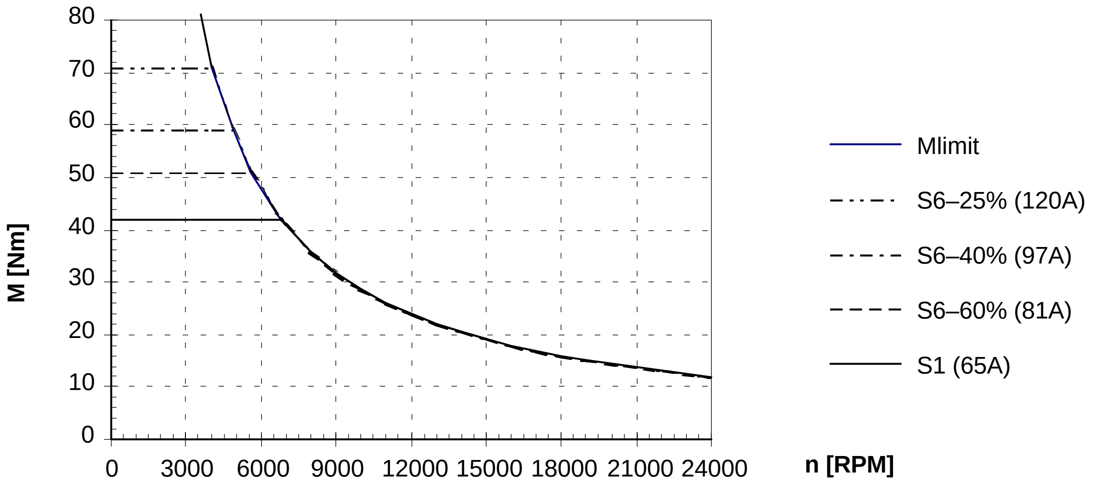


The data for duty type S6 are valid for a 1 min. duty cycle.

Table 5-55 Motor type 1FE1073–4WN11

Three–phase synchronous built–in motor 1FE1073–4WN11			
Rated power	P_N	kW	30
Rated speed	n_N	RPM	6800
Rated torque	M_N	Nm	42
Rated current	I_N	A	65
Maximum current	I_{max}	A	130
Maximum rotational speed	n_{max}	RPM	24000
Moment of inertia	J_{rot}	kg m^2	0.00430
Voltage constant	k_E	V/1000 RPM	49
Thermal time constant	T_{therm}	min	2.5
Stator weight with cooling jacket	m_{St}	kg	12.5
Rotor weight	m_{Rot}	kg	3.30

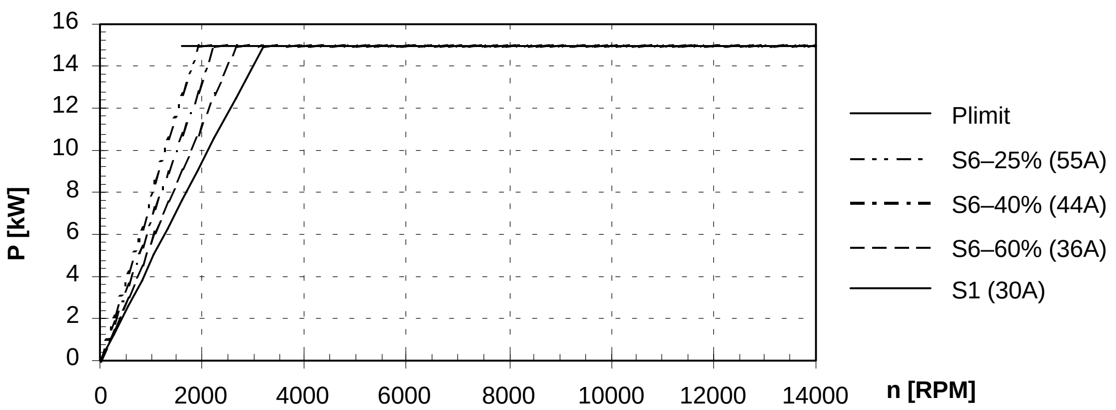


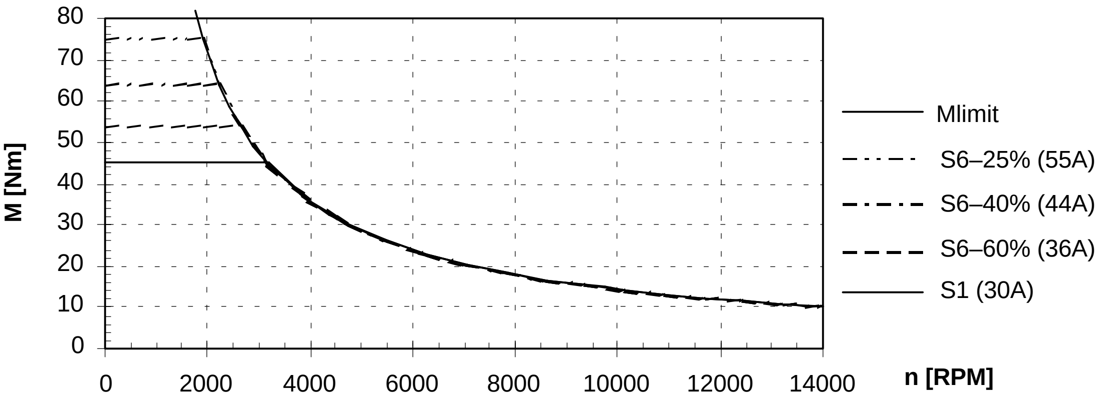


The data for duty type S6 are valid for a 1 min. duty cycle.

Table 5-56 Motor type 1FE1073–4WT11

Three–phase synchronous built–in motor 1FE1073–4WT11			
Rated power	P_N	kW	15
Rated speed	n_N	RPM	3200
Rated torque	M_N	Nm	45
Rated current	I_N	A	30
Maximum current	I_{max}	A	60
Maximum rotational speed	n_{max}	RPM	14000
Moment of inertia	J_{rot}	kg m^2	0.00430
Voltage constant	k_E	V/1000 RPM	104
Thermal time constant	T_{therm}	min	2.5
Stator weight with cooling jacket	m_{St}	kg	12.5
Rotor weight	m_{Rot}	kg	3.30

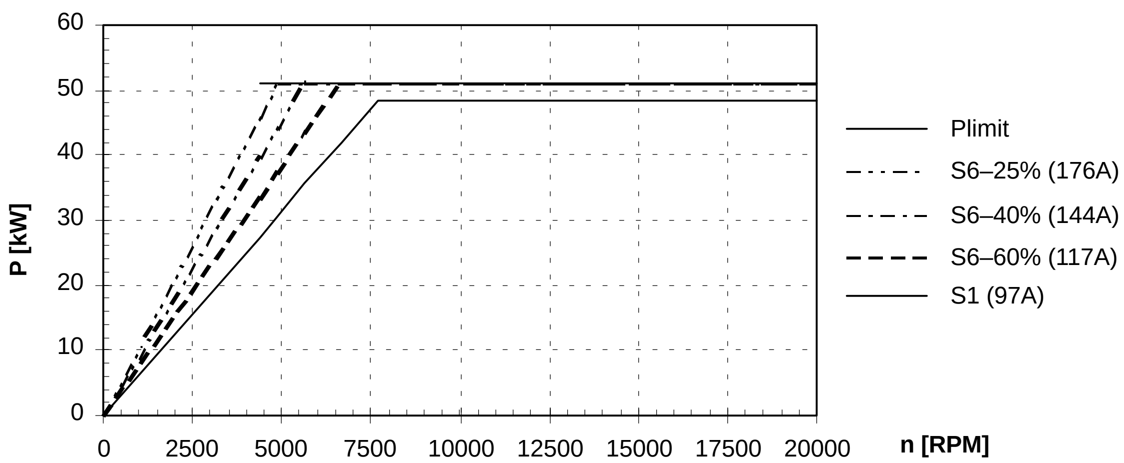


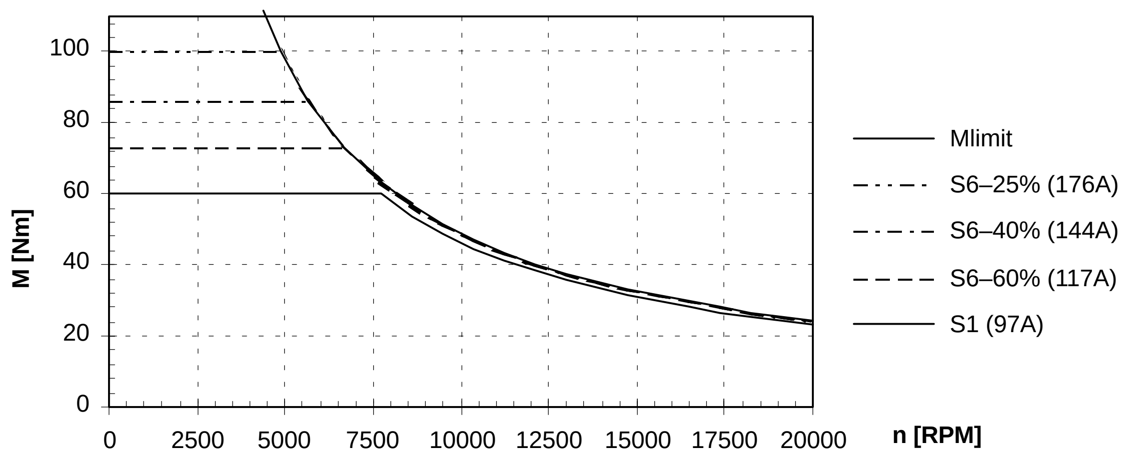


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-57 Motor type 1FE1074–4WM11

Three–phase synchronous built–in motor 1FE1074–4WM11			
Rated power	P_N	kW	48
Rated speed	n_N	RPM	7700
Rated torque	M_N	Nm	60
Rated current	I_N	A	97
Maximum current	I_{max}	A	194
Maximum rotational speed	n_{max}	RPM	20000
Moment of inertia	J_{rot}	kg m^2	0.00573
Voltage constant	k_E	V/1000 RPM	43
Thermal time constant	T_{therm}	min	2.5
Stator weight with cooling jacket	m_{St}	kg	16.5
Rotor weight	m_{Rot}	kg	4.40

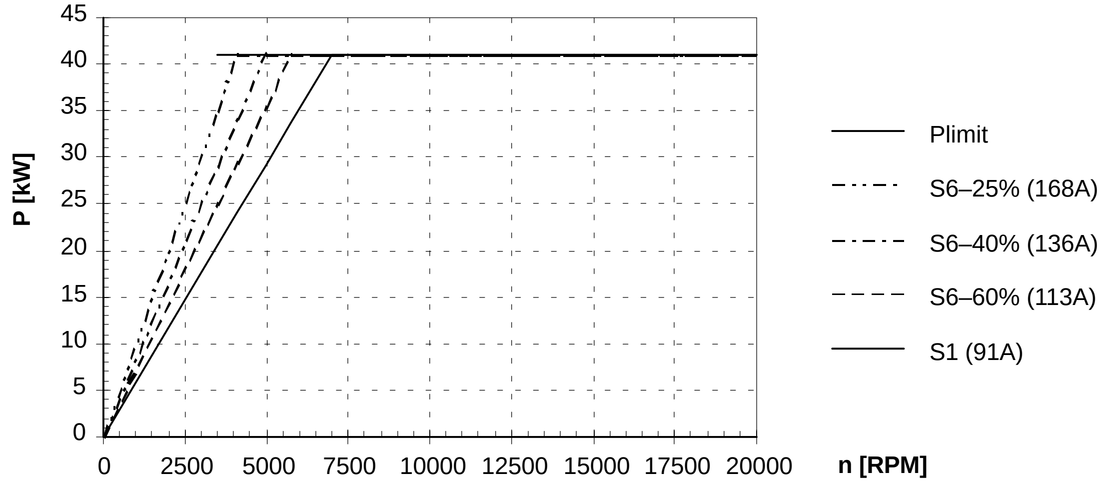


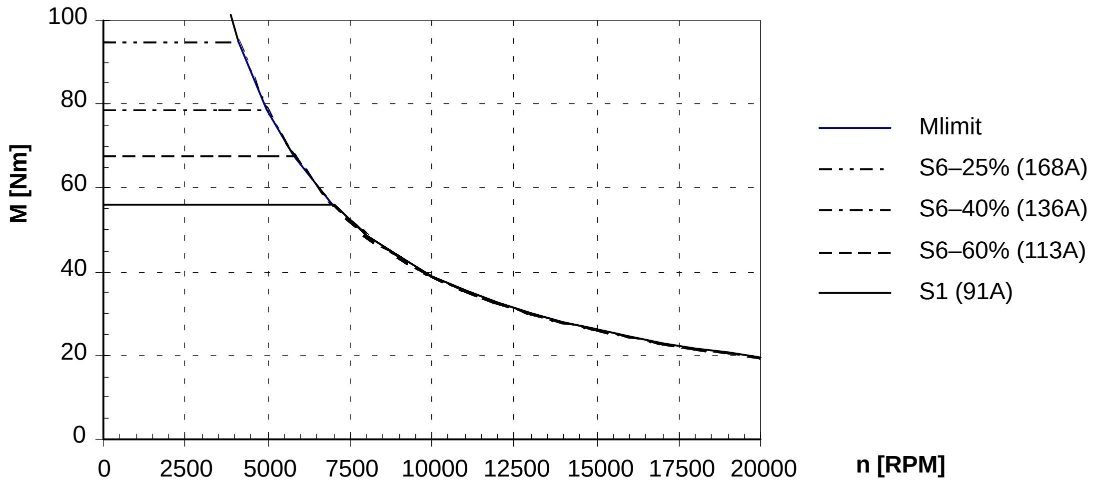


The data for duty type S6 are valid for a 1 min. duty cycle.

Table 5-58 Motor type 1FE1074–4WN11

Three–phase synchronous built–in motor 1FE1074–4WN11			
Rated power	P_N	kW	41
Rated speed	n_N	RPM	7000
Rated torque	M_N	Nm	56
Rated current	I_N	A	91
Maximum current	I_{max}	A	182
Maximum rotational speed	n_{max}	RPM	20000
Moment of inertia	J_{rot}	kg m^2	0.00573
Voltage constant	k_E	V/1000 RPM	47
Thermal time constant	T_{therm}	min	2.5
Stator weight with cooling jacket	m_{St}	kg	16.5
Rotor weight	m_{Rot}	kg	4.40

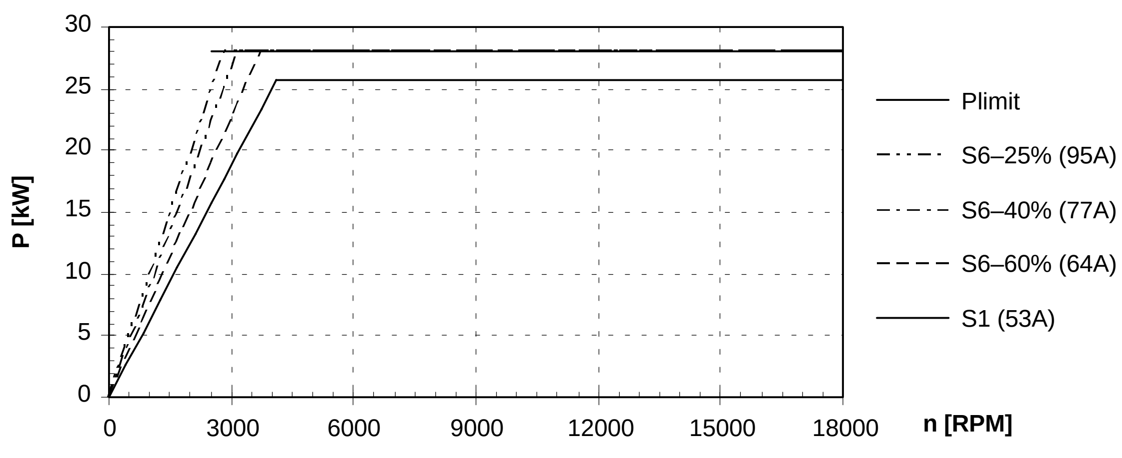


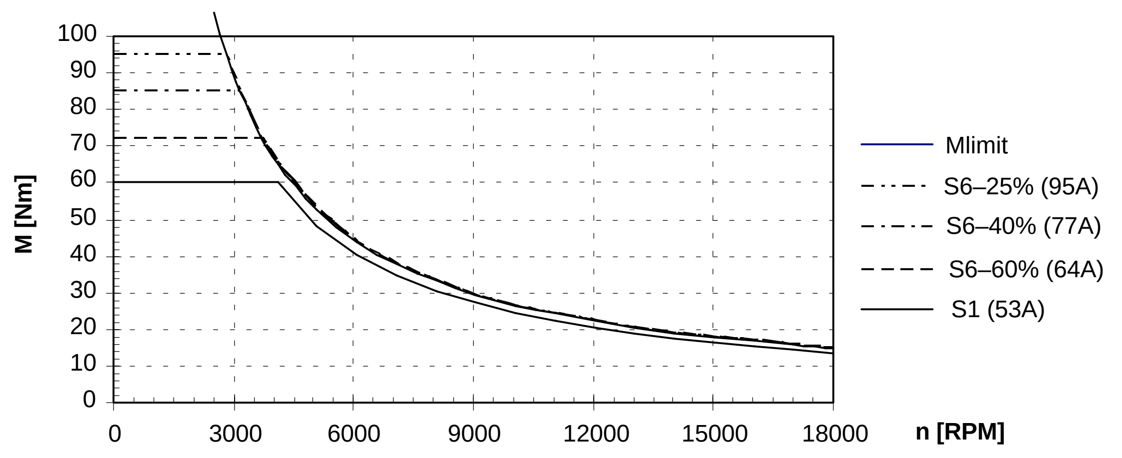


The data for duty type S6 are valid for a 1 min. duty cycle.

Table 5-59 Motor type 1FE1074–4WT11

Three–phase synchronous built–in motor 1FE1074–4WT11			
Rated power	P_N	kW	25.8
Rated speed	n_N	RPM	4100
Rated torque	M_N	Nm	60
Rated current	I_N	A	53
Maximum current	I_{max}	A	106
Maximum rotational speed	n_{max}	RPM	18000
Moment of inertia 1)	J_{rot}	kg m^2	0.00573
Voltage constant	k_E	V/1000 RPM	80
Thermal time constant	T_{therm}	min	2.5
Stator weight with cooling jacket	m_{St}	kg	16.5
Rotor weight	m_{Rot}	kg	4.40

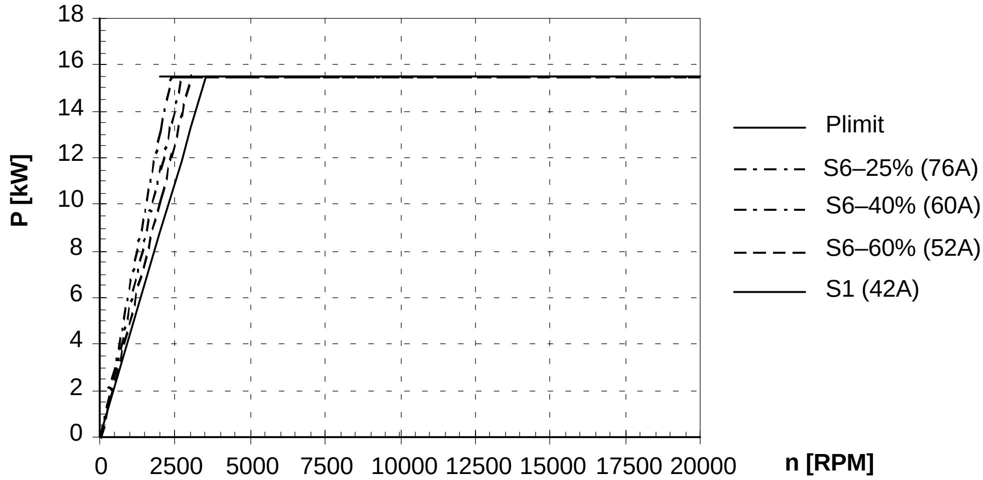


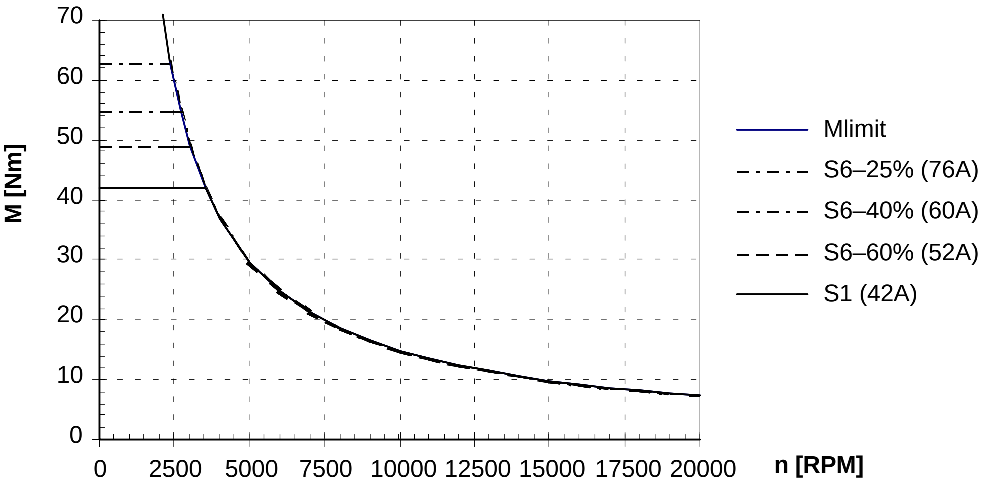


The data for duty type S6 are valid for a 1 min. duty cycle.
1) only rotor core without rotor sleeve

Table 5-60 Motor type 1FE1082–4WN11

Three–phase synchronous built–in motor 1FE1082–4WN11			
Rated power	P_N	kW	15.5
Rated speed	n_N	RPM	3500
Rated torque	M_N	Nm	42
Rated current	I_N	A	42
Maximum current	I_{max}	A	84
Maximum rotational speed	n_{max}	RPM	20000
Moment of inertia	J_{rot}	kg m^2	0.00559
Voltage constant	k_E	V/1000 RPM	74
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	12
Rotor weight	m_{Rot}	kg	3.10

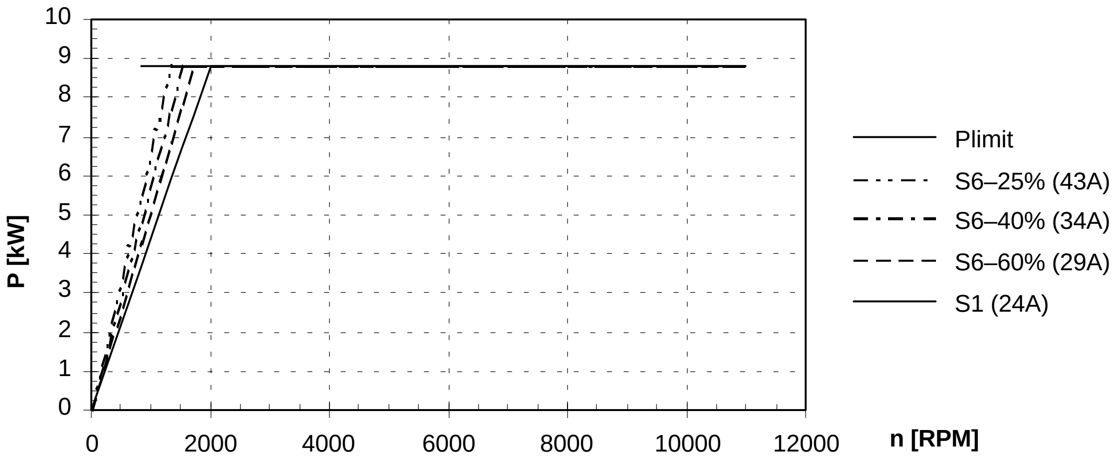


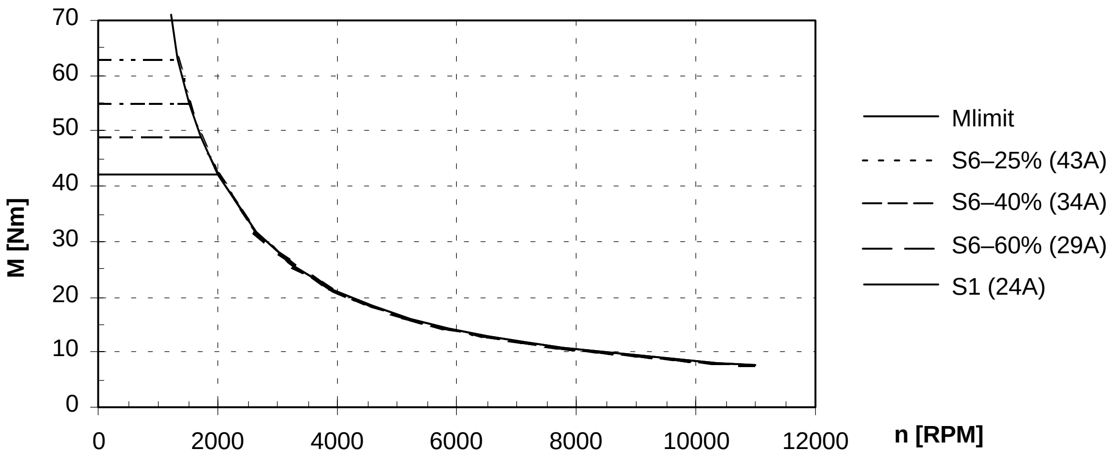


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-61 Motor type 1FE1082–4WR11

Three–phase synchronous built–in motor 1FE1082–4WR11			
Rated power	P_N	kW	8.8
Rated speed	n_N	RPM	2000
Rated torque	M_N	Nm	42
Rated current	I_N	A	24
Maximum current	I_{max}	A	48
Maximum rotational speed	n_{max}	RPM	11000
Moment of inertia	J_{rot}	kg m^2	0.00559
Voltage constant	k_E	V/1000 RPM	128
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	12
Rotor weight	m_{Rot}	kg	3.10

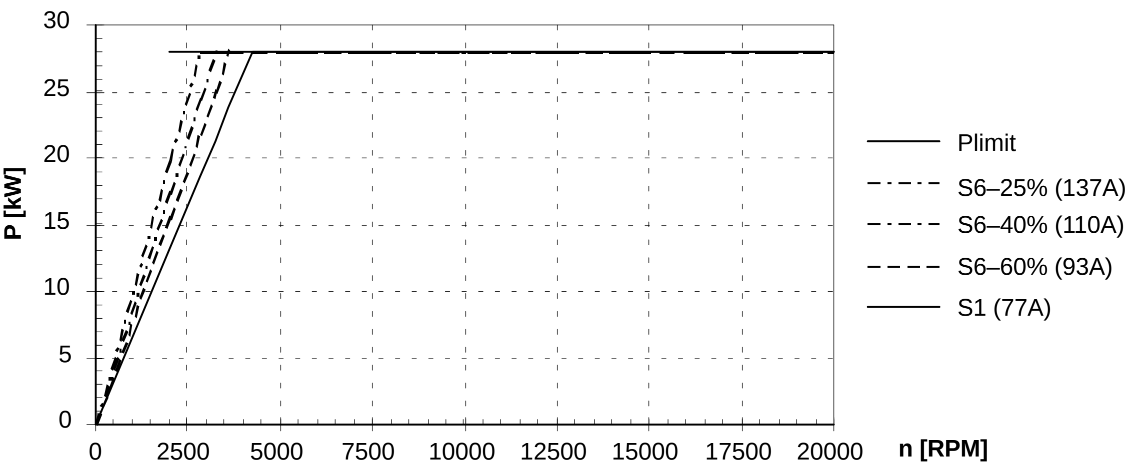


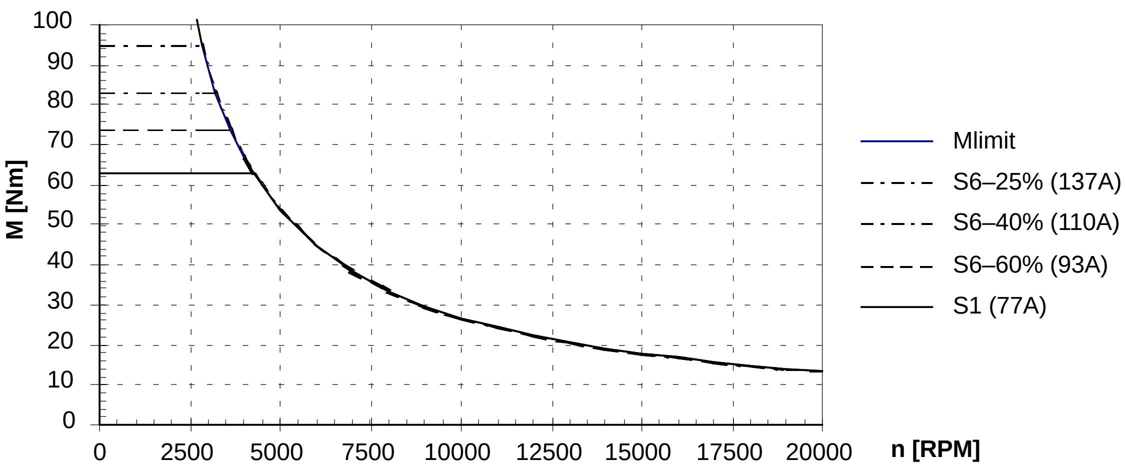


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-62 Motor type 1FE1083–4WN11

Three–phase synchronous built–in motor 1FE1083–4WN11			
Rated power	P_N	kW	28
Rated speed	n_N	RPM	4200
Rated torque	M_N	Nm	63
Rated current	I_N	A	77
Maximum current	I_{max}	A	154
Maximum rotational speed	n_{max}	RPM	20000
Moment of inertia	J_{rot}	kg m^2	0.00847
Voltage constant	k_E	V/1000 RPM	60
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	17
Rotor weight	m_{Rot}	kg	4.70

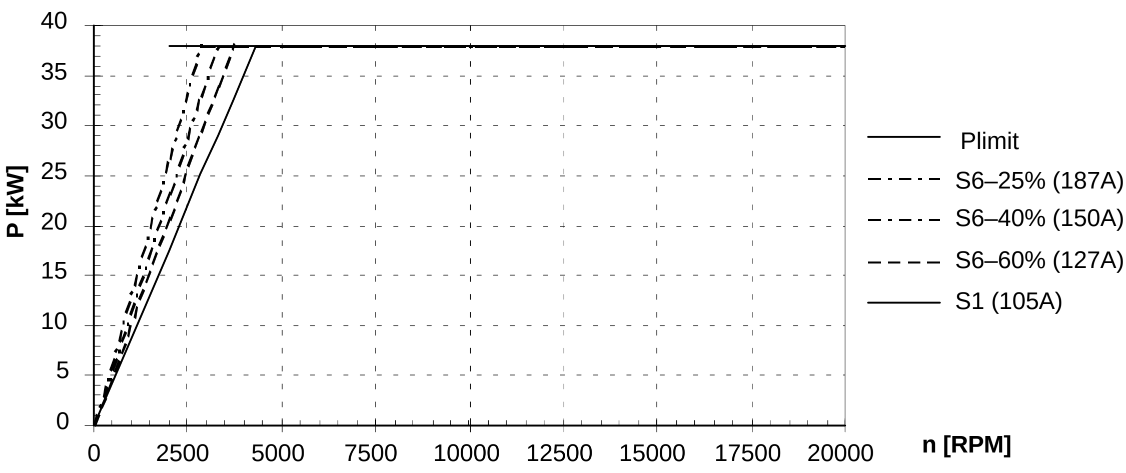


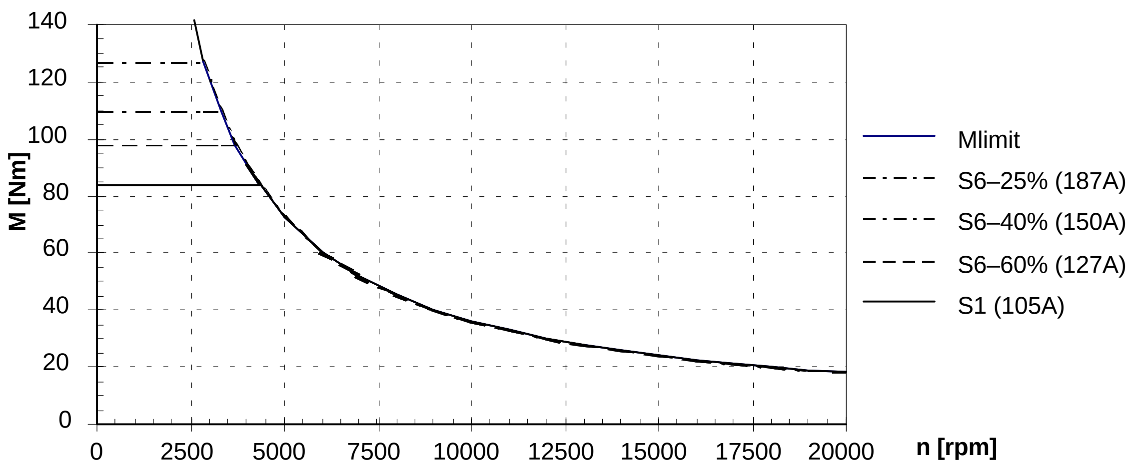


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-63 Motor type 1FE1084–4WN11

Three–phase synchronous built–in motor 1FE1084–4WN11			
Rated power	P_N	kW	38
Rated speed	n_N	RPM	4300
Rated torque	M_N	Nm	84
Rated current	I_N	A	105
Maximum current	I_{max}	A	210
Maximum rotational speed	n_{max}	RPM	20000
Moment of inertia	J_{rot}	kg m^2	0.01118
Voltage constant	k_E	V/1000 RPM	59
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	22
Rotor weight	m_{Rot}	kg	6.20

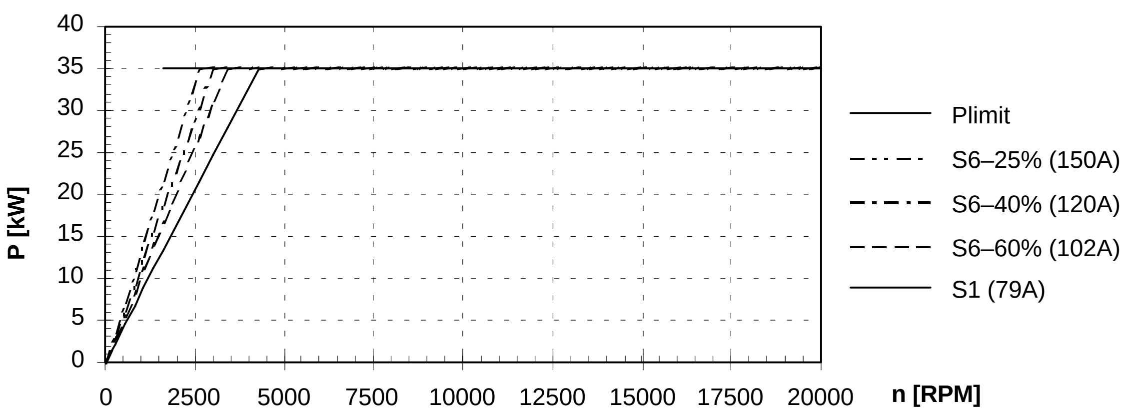


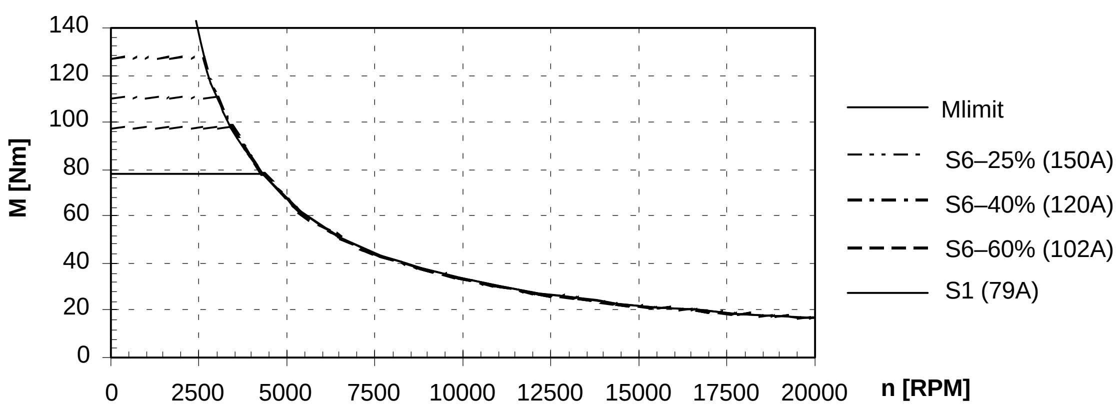


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-64 Motor type 1FE1084–4WP11

Three–phase synchronous built–in motor 1FE1084–4WP11			
Rated power	P_N	kW	35
Rated speed	n_N	RPM	4300
Rated torque	M_N	Nm	78
Rated current	I_N	A	79
Maximum current	I_{max}	A	160
Maximum rotational speed	n_{max}	RPM	20000
Moment of inertia	J_{rot}	kg m^2	0.01118
Voltage constant	k_E	V/1000 RPM	70
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	22
Rotor weight	m_{Rot}	kg	6.20

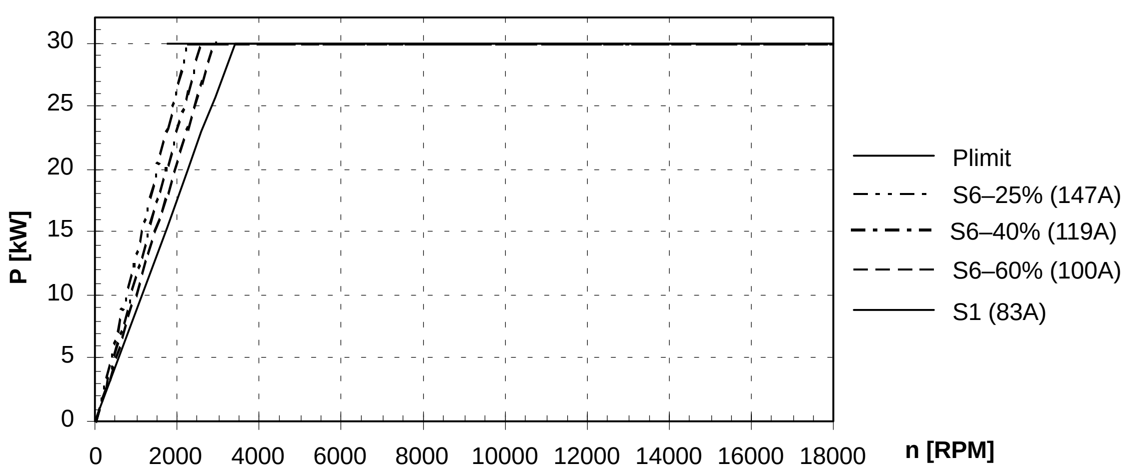


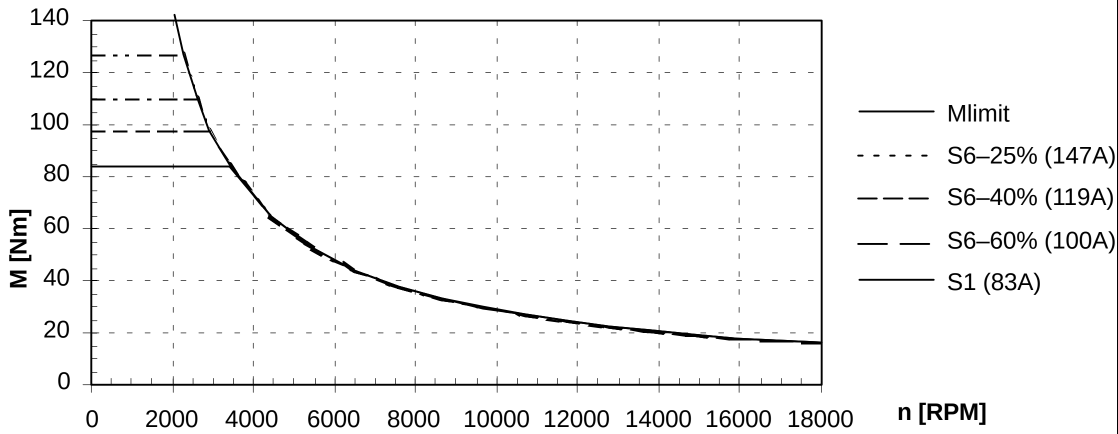


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-65 Motor type 1FE1084–4WQ11

Three–phase synchronous built–in motor 1FE1084–4WQ11			
Rated power	P_N	kW	30
Rated speed	n_N	RPM	3400
Rated torque	M_N	Nm	84
Rated current	I_N	A	83
Maximum current	I_{max}	A	166
Maximum rotational speed	n_{max}	RPM	18000
Moment of inertia	J_{rot}	kg m^2	0.01118
Voltage constant	k_E	V/1000 RPM	76
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	22
Rotor weight	m_{Rot}	kg	6.20

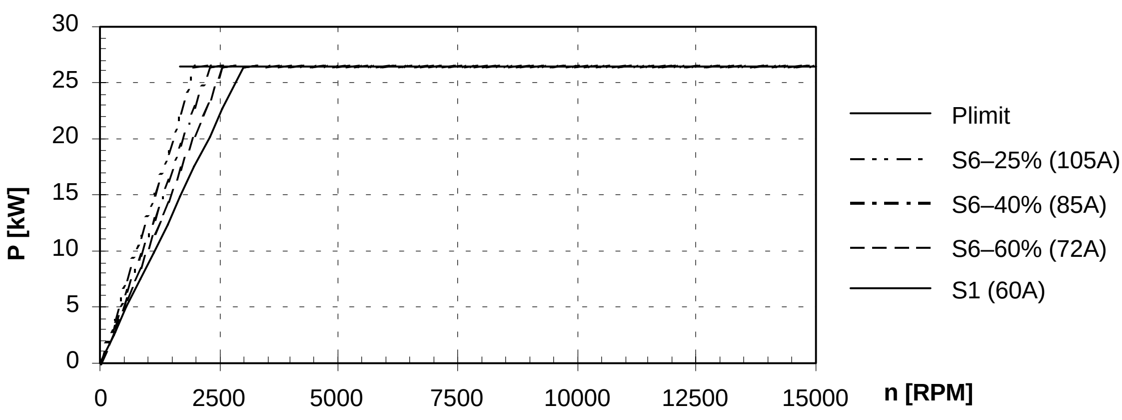


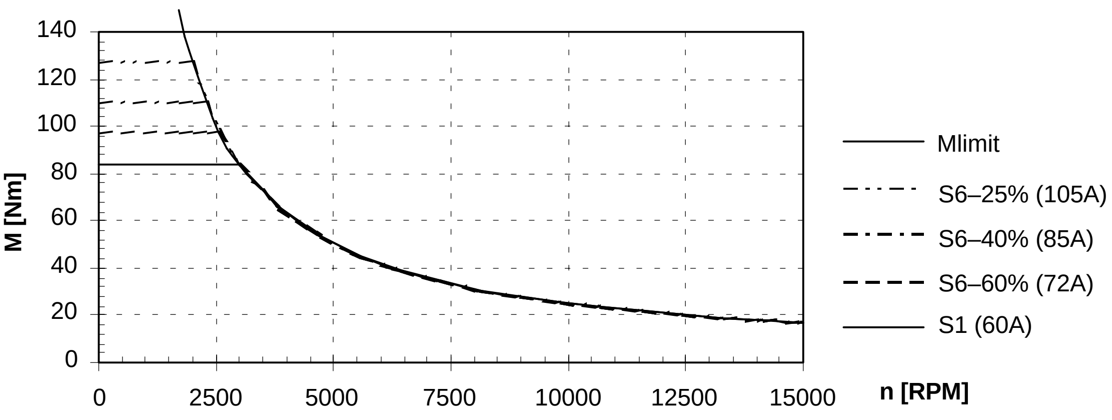


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-66 Motor type 1FE1084–4WT11

Three–phase synchronous built–in motor 1FE1084–4WT11			
Rated power	P_N	kW	26.4
Rated speed	n_N	RPM	3000
Rated torque	M_N	Nm	84
Rated current	I_N	A	60
Maximum current	I_{max}	A	120
Maximum rotational speed	n_{max}	RPM	15000
Moment of inertia	J_{rot}	kg m^2	0.01118
Voltage constant	k_E	V/1000 RPM	97
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	22
Rotor weight	m_{Rot}	kg	6.20

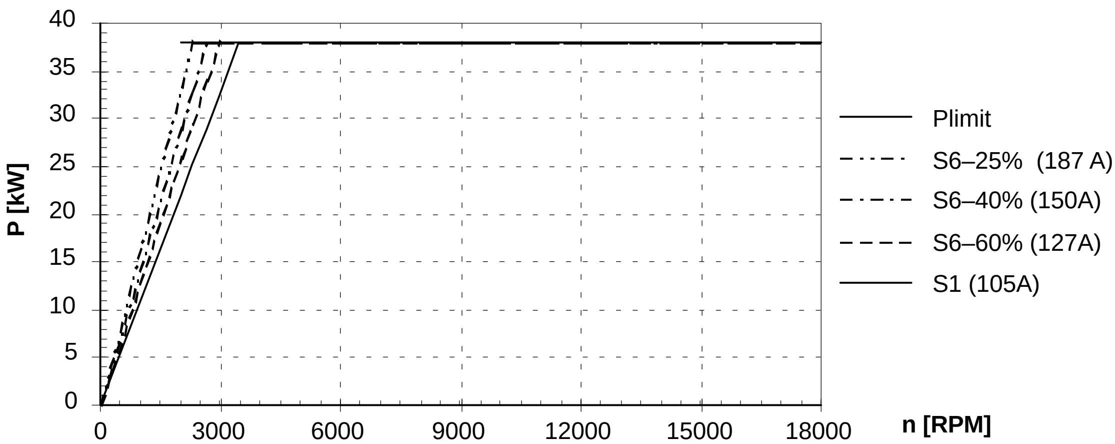


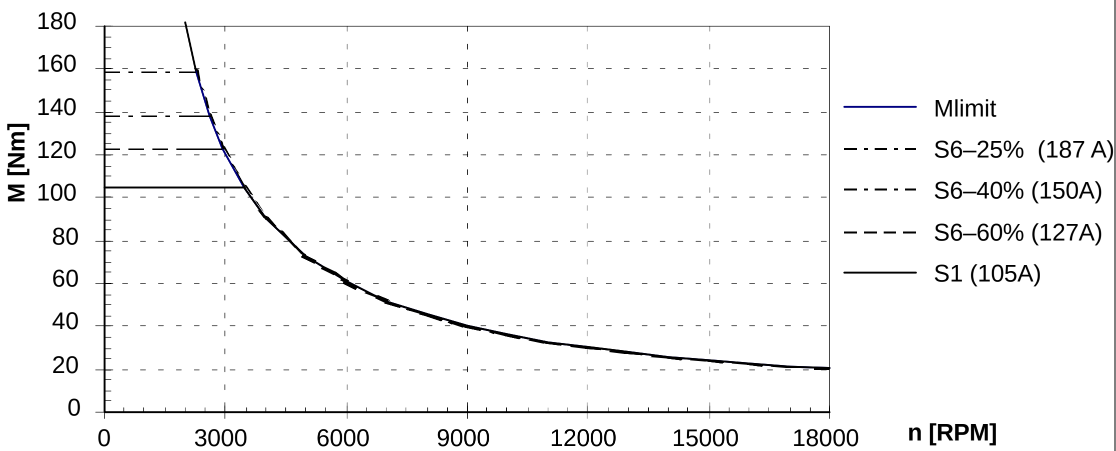


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-67 Motor type 1FE1085–4WN11

Three–phase synchronous built–in motor 1FE1085–4WN11			
Rated power	P_N	kW	38
Rated speed	n_N	RPM	3500
Rated torque	M_N	Nm	105
Rated current	I_N	A	105
Maximum current	I_{max}	A	210
Maximum rotational speed	n_{max}	RPM	18000
Moment of inertia	J_{rot}	kg m^2	0.01388
Voltage constant	k_E	V/1000 RPM	75
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	27
Rotor weight	m_{Rot}	kg	7.70

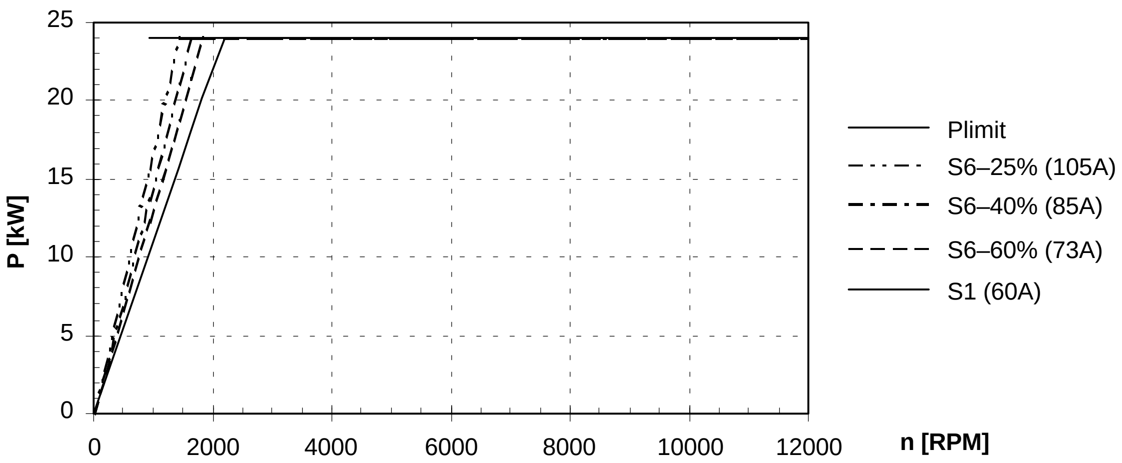


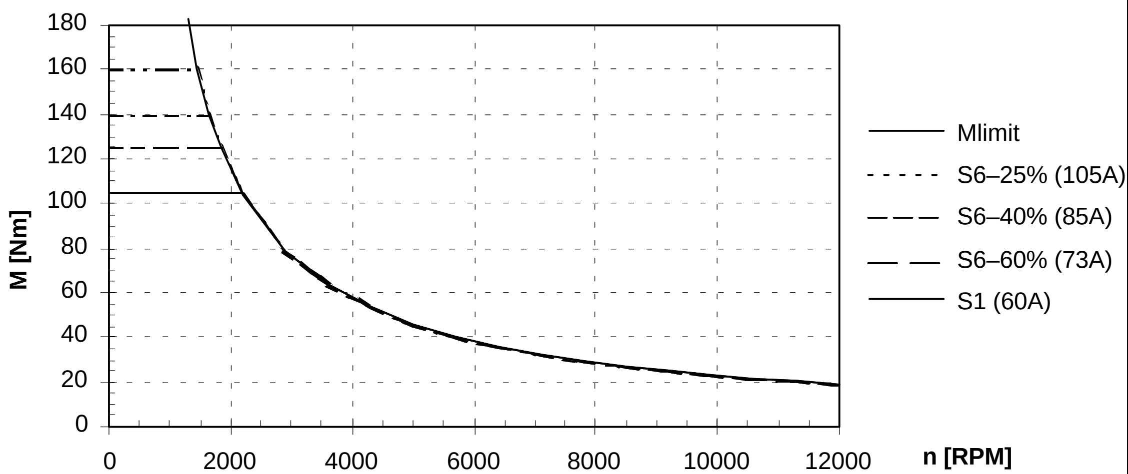


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-68 Motor type 1FE1085–4WT11

Three–phase synchronous built–in motor 1FE1085–4WT11			
Rated power	P_N	kW	24
Rated speed	n_N	RPM	2200
Rated torque	M_N	Nm	105
Rated current	I_N	A	60
Maximum current	I_{max}	A	120
Maximum rotational speed	n_{max}	RPM	12000
Moment of inertia	J_{rot}	kg m^2	0.01388
Voltage constant	k_E	V/1000 RPM	122
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	27
Rotor weight	m_{Rot}	kg	7.70

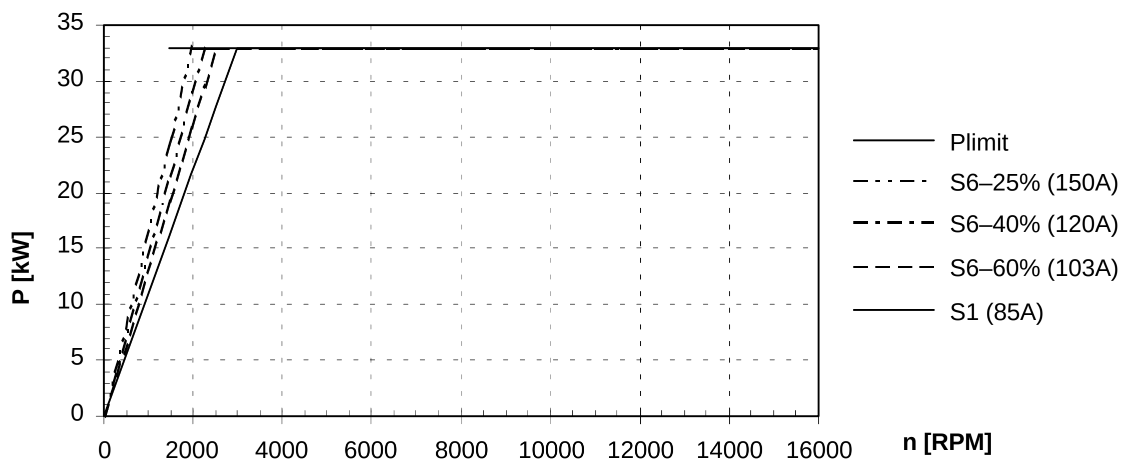


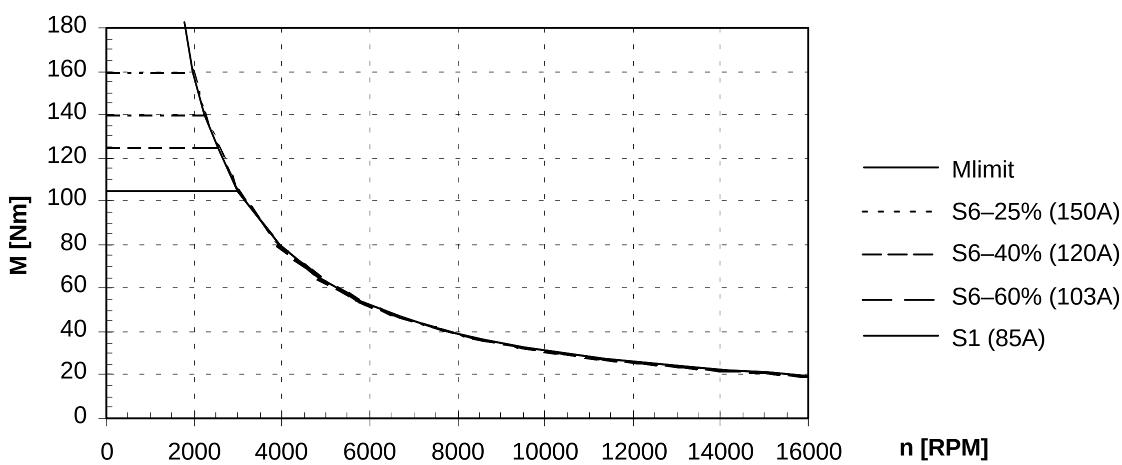


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-69 Motor type 1FE1085–4WQ11

Three–phase synchronous built–in motor 1FE1085–4WQ11			
Rated power	P_N	kW	33
Rated speed	n_N	RPM	3000
Rated torque	M_N	Nm	105
Rated current	I_N	A	85
Maximum current	I_{max}	A	170
Maximum rotational speed	n_{max}	RPM	16000
Moment of inertia	J_{rot}	kg m^2	0.01388
Voltage constant	k_E	V/1000 RPM	88
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	27
Rotor weight	m_{Rot}	kg	7.70

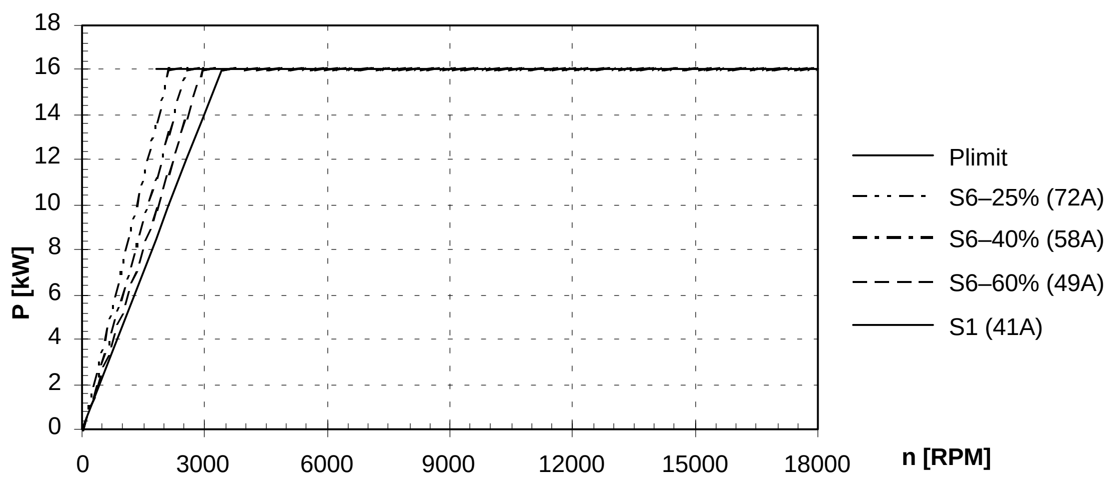


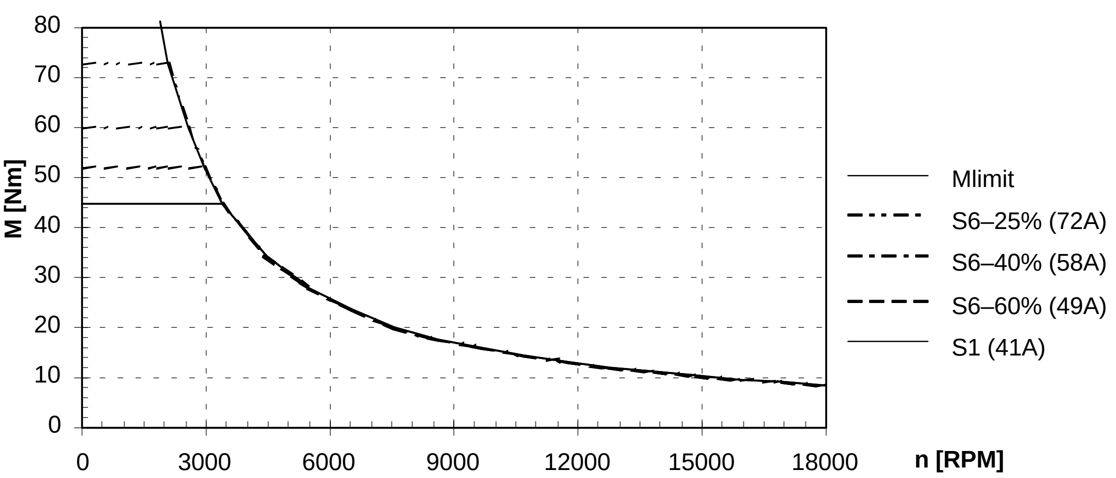


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-70 Motor type 1FE1092–4WP11

Three–phase synchronous built–in motor 1FE1092–4WP11			
Rated power	P_N	kW	16
Rated speed	n_N	RPM	3400
Rated torque	M_N	Nm	45
Rated current	I_N	A	41
Maximum current	I_{max}	A	82
Maximum rotational speed	n_{max}	RPM	18000
Moment of inertia	J_{rot}	kg m^2	0.00961
Voltage constant	k_E	V/1000 RPM	79
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	26
Rotor weight	m_{Rot}	kg	3.80

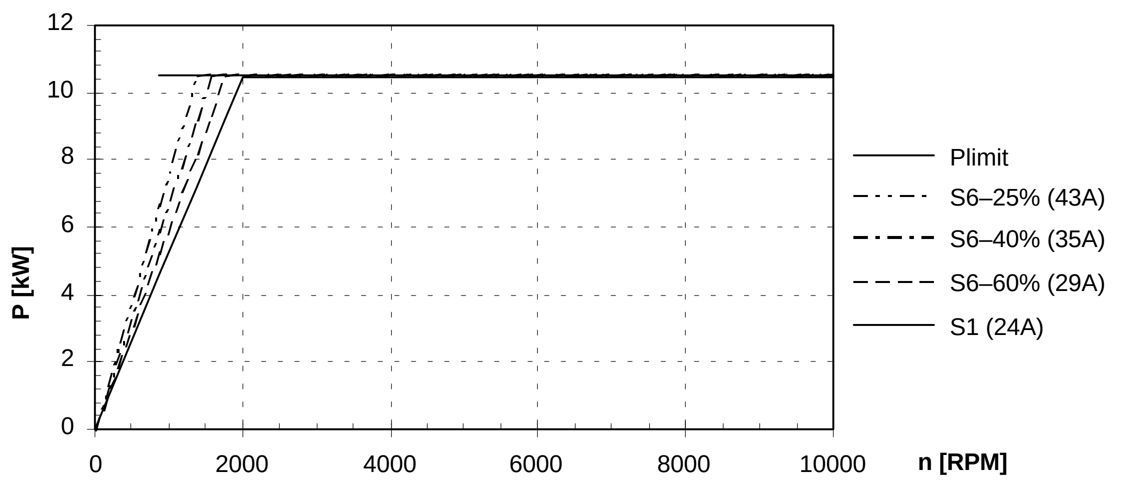


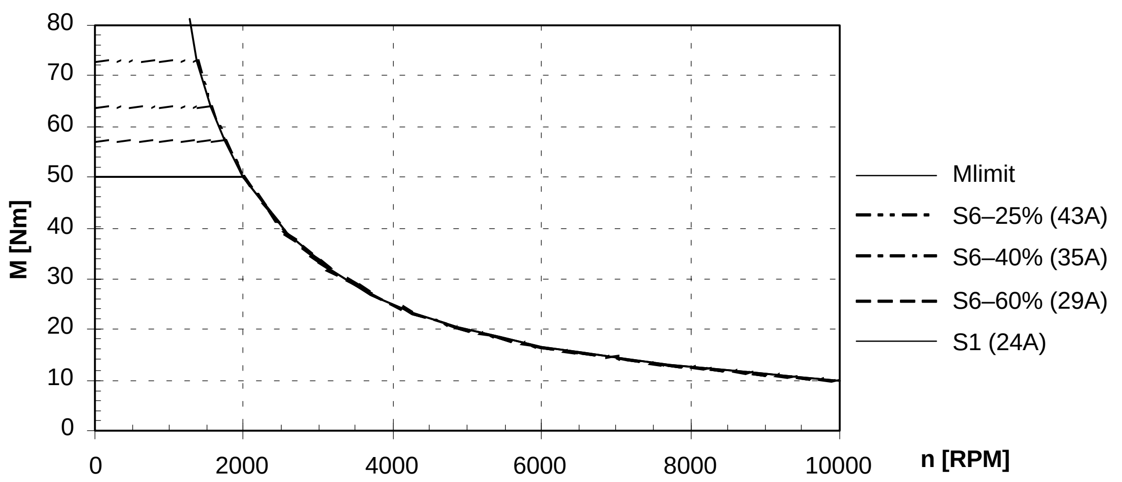


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-71 Motor type 1FE1092–4WV11

Three–phase synchronous built–in motor 1FE1092–4WV11			
Rated power	P_N	kW	10.5
Rated speed	n_N	RPM	2000
Rated torque	M_N	Nm	50
Rated current	I_N	A	24
Maximum current	I_{max}	A	48
Maximum rotational speed	n_{max}	RPM	10000
Moment of inertia	J_{rot}	kg m^2	0.00961
Voltage constant	k_E	V/1000 RPM	140
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	26
Rotor weight	m_{Rot}	kg	3.80

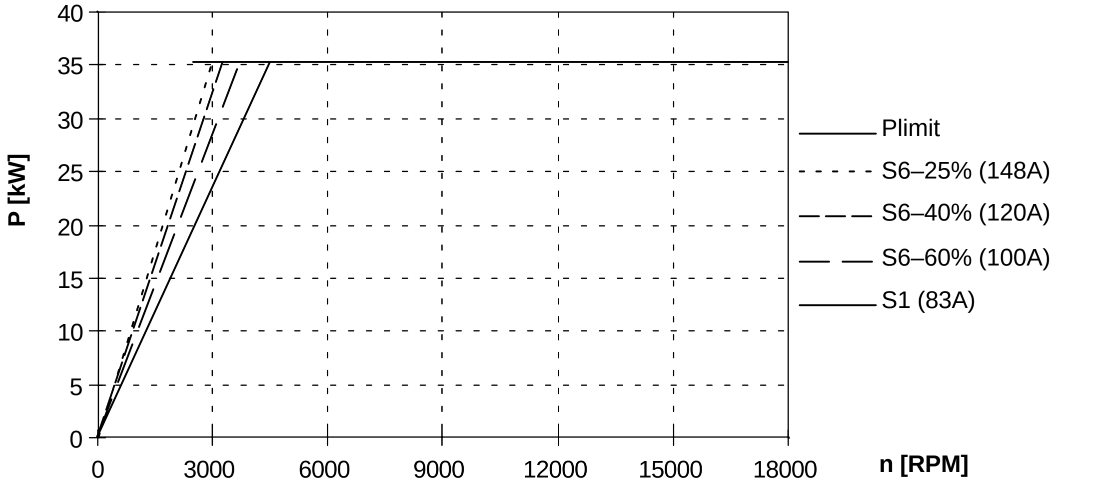


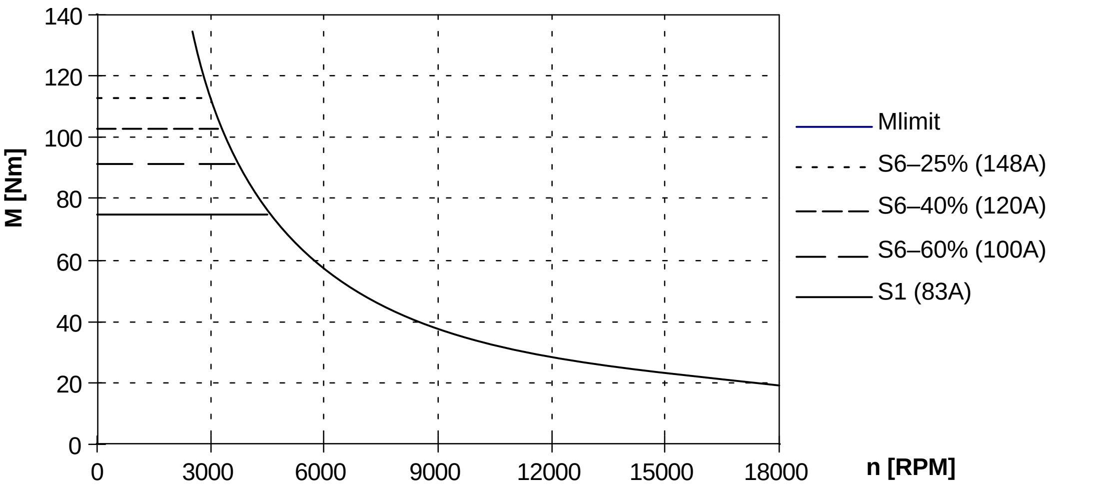


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-72 Motor type 1FE1093–4WH11

Three–phase synchronous built–in motor 1FE1093–4WH11			
Rated power	P_N	kW	35.3
Rated speed	n_N	RPM	4500
Rated torque	M_N	Nm	75
Rated current	I_N	A	83
Maximum current	I_{max}	A	166
Maximum rotational speed	n_{max}	RPM	18000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	61
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	36
Rotor weight	m_{Rot}	kg	Refer to Table 1-4



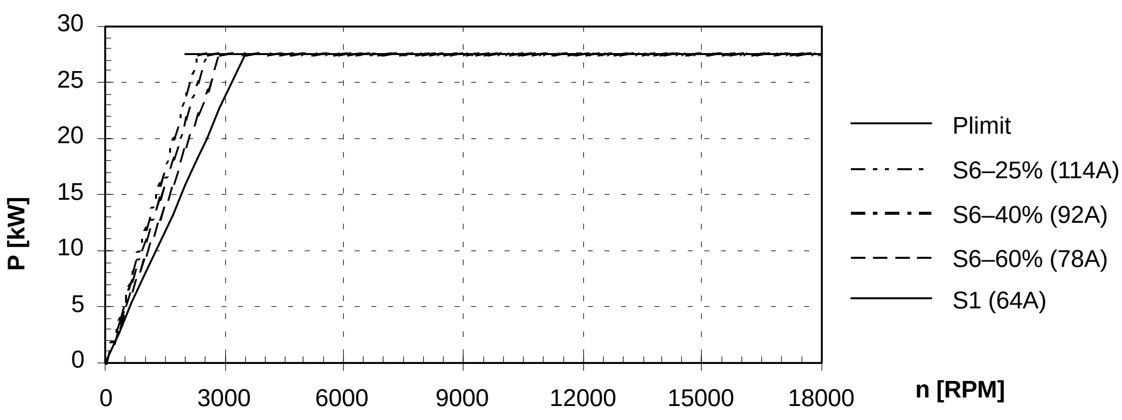


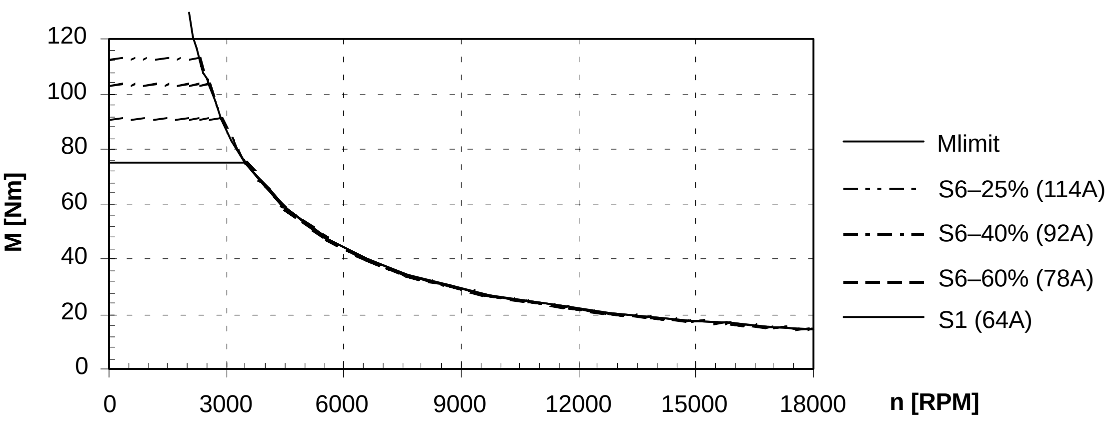
The data for duty type S6 are valid for a 2 min. duty cycle.

5.4 P/n and M/n diagrams for 4–pole 1FE1 motors

Table 5-73 Motor type 1FE1093–4WM11

Three–phase synchronous built–in motor 1FE1093–4WM11			
Rated power	P_N	kW	27.5
Rated speed	n_N	RPM	3500
Rated torque	M_N	Nm	75
Rated current	I_N	A	64
Maximum current	I_{max}	A	128
Maximum rotational speed	n_{max}	RPM	18000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	80
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	36
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

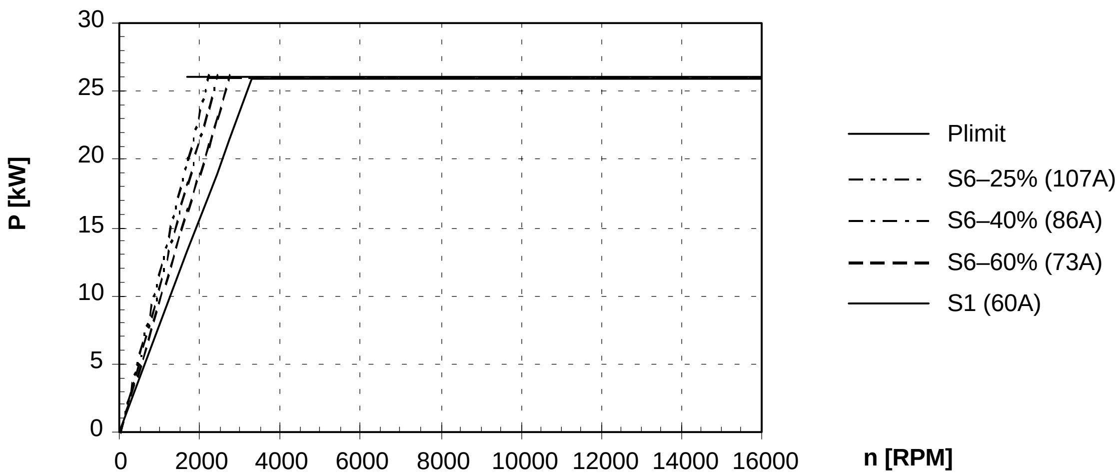


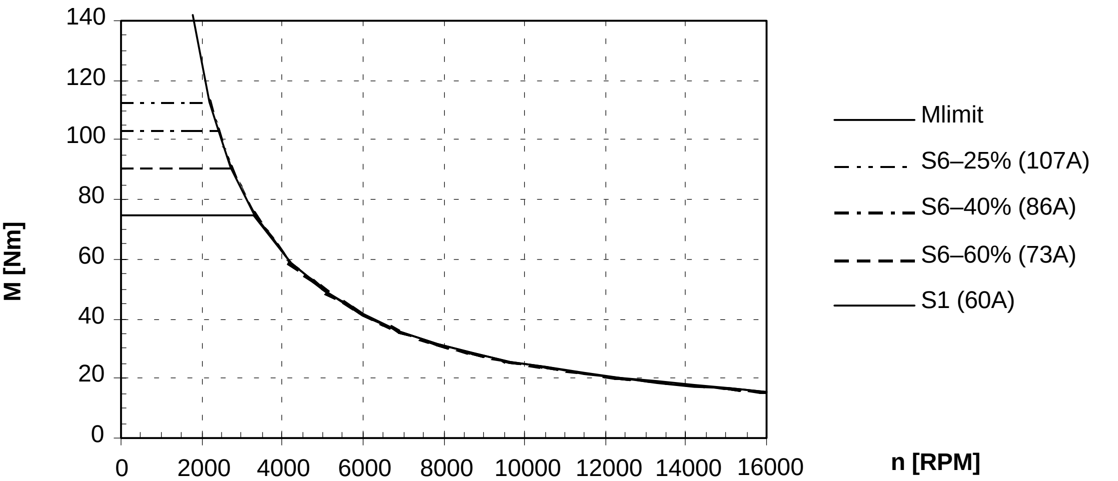


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-74 Motor type 1FE1093–4WN11

Three–phase synchronous built–in motor 1FE1093–4WN11			
Rated power	P_N	kW	26
Rated speed	n_N	RPM	3300
Rated torque	M_N	Nm	75
Rated current	I_N	A	60
Maximum current	I_{max}	A	120
Maximum rotational speed	n_{max}	RPM	16000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	85
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	36
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

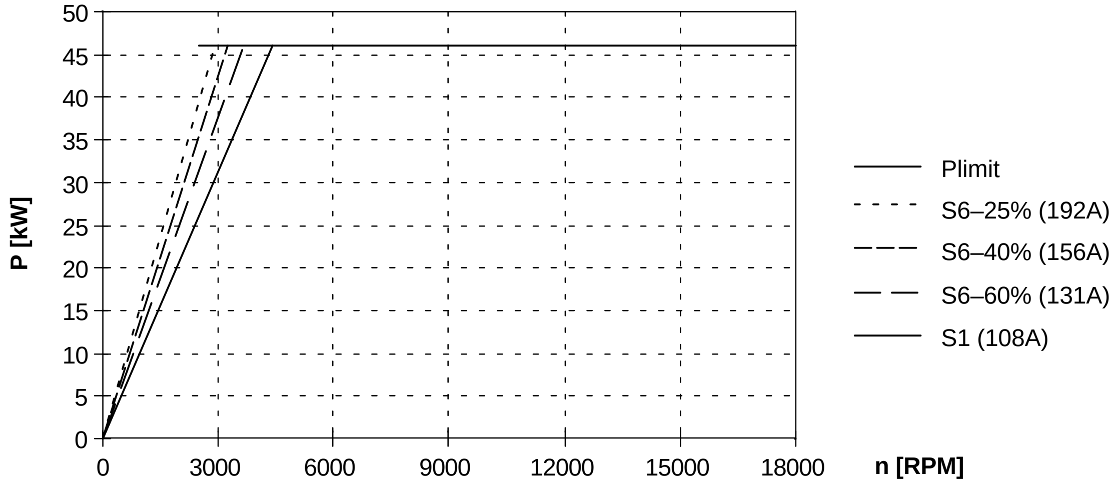


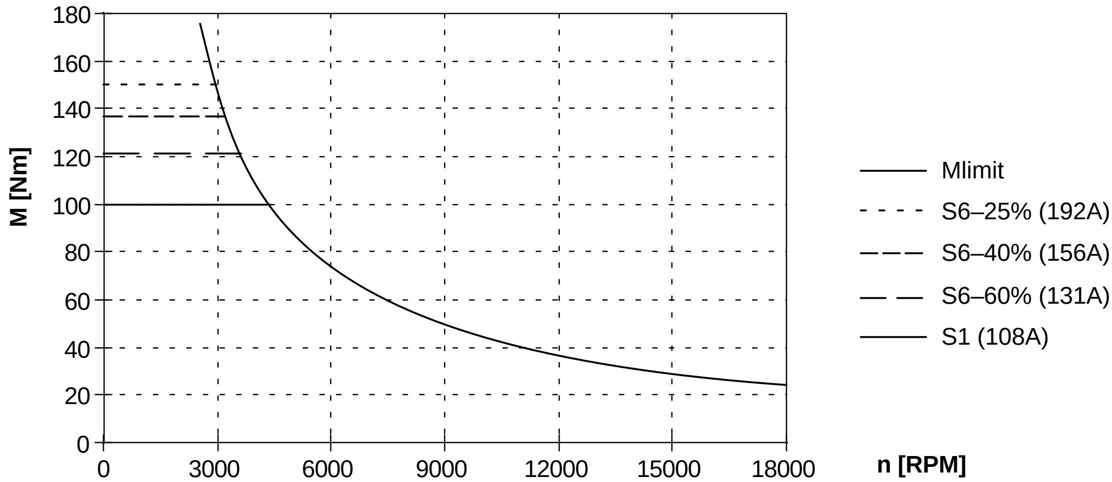


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-75 Motor type 1FE1094–4WK11

Three–phase synchronous built–in motor 1FE1094–4WK11			
Rated power	P_N	kW	46
Rated speed	n_N	RPM	4400
Rated torque	M_N	Nm	100
Rated current	I_N	A	108
Maximum current	I_{max}	A	216
Maximum rotational speed	n_{max}	RPM	18000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	63
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	41
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

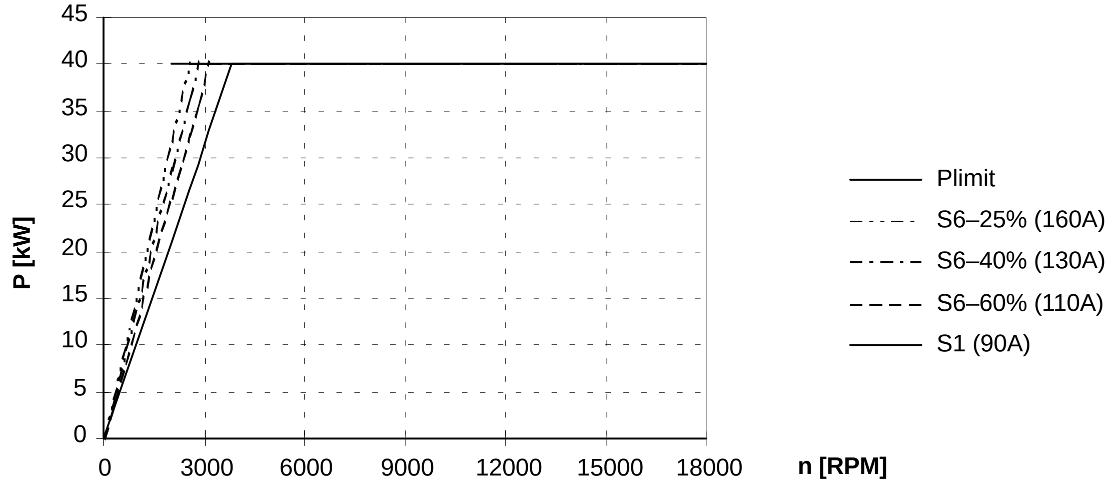


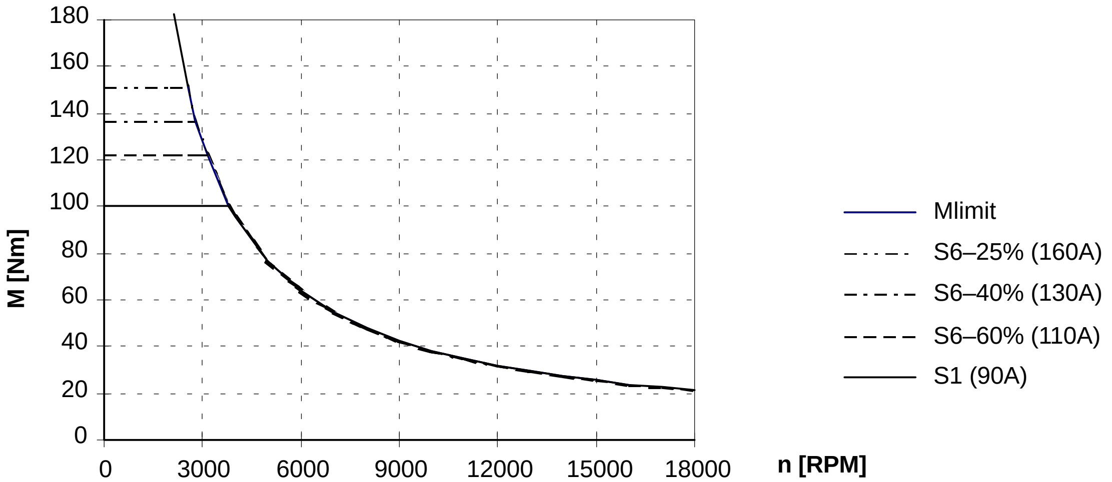


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-76 Motor type 1FE1094–4WL11

Three–phase synchronous built–in motor 1FE1094–4WL11			
Rated power	P_N	kW	40
Rated speed	n_N	RPM	3800
Rated torque	M_N	Nm	100
Rated current	I_N	A	90
Maximum current	I_{max}	A	180
Maximum rotational speed	n_{max}	RPM	18000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	76
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	41
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

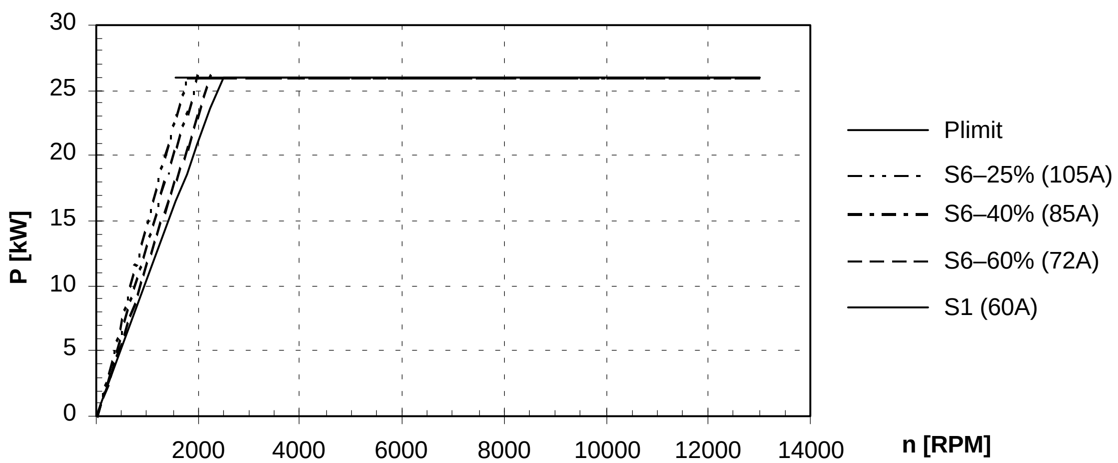


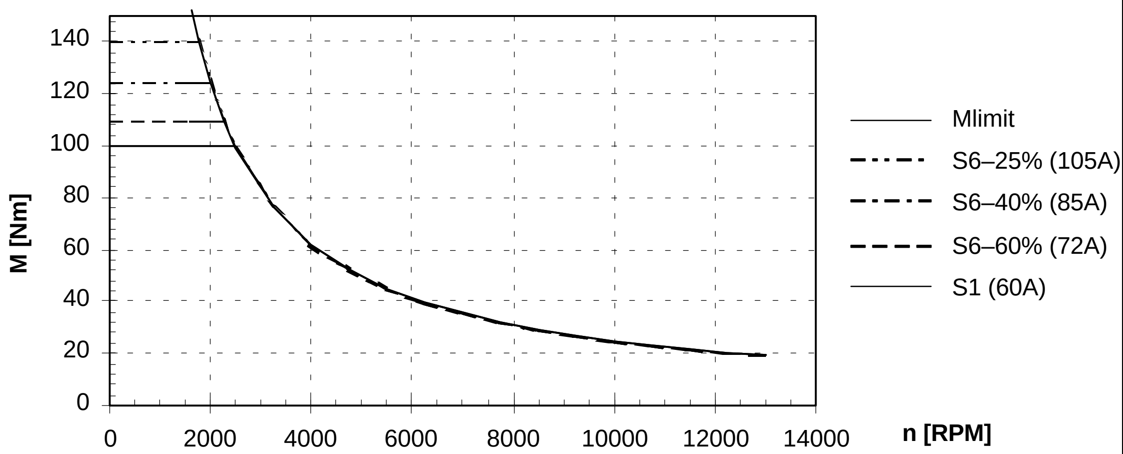


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-77 Motor type 1FE1094–4WS11

Three–phase synchronous built–in motor 1FE1094–4WS11			
Rated power	P_N	kW	26
Rated speed	n_N	RPM	2500
Rated torque	M_N	Nm	100
Rated current	I_N	A	60
Maximum current	I_{max}	A	120
Maximum rotational speed	n_{max}	RPM	13000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	113
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	41
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

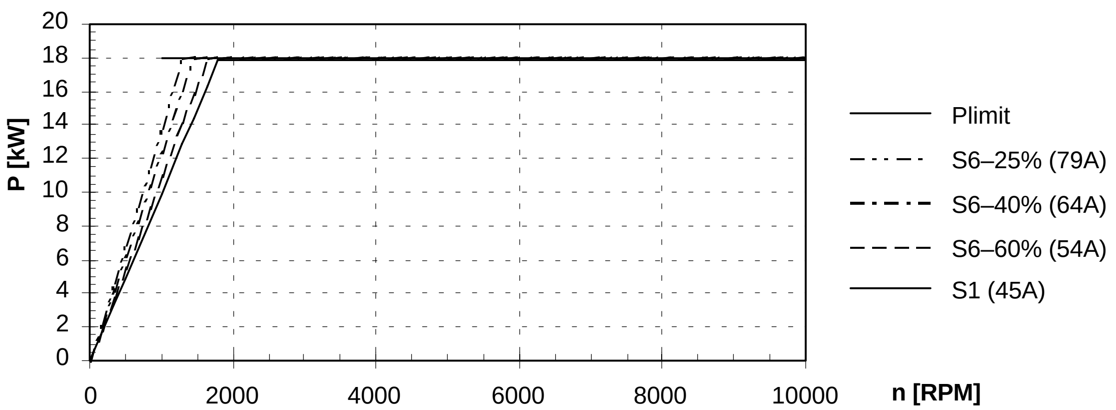


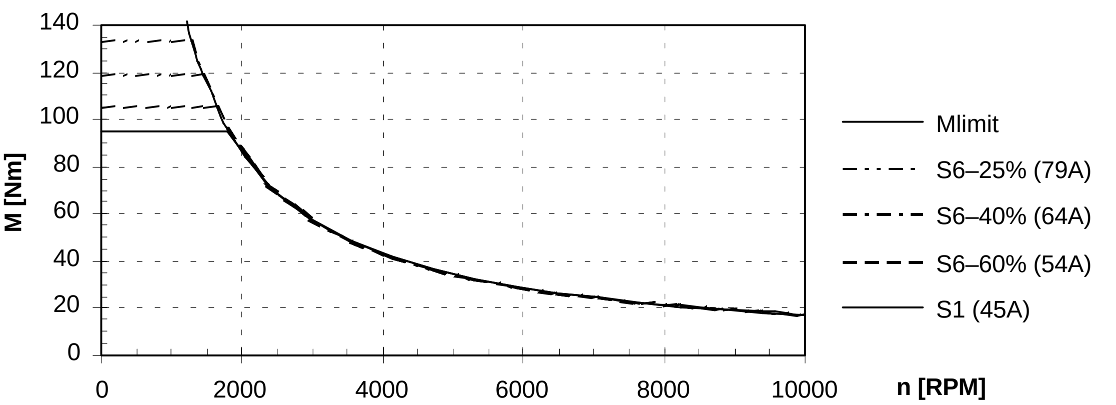


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-78 Motor type 1FE1094–4WU11

Three–phase synchronous built–in motor 1FE1094–4WU11			
Rated power	P_N	kW	18
Rated speed	n_N	RPM	1800
Rated torque	M_N	Nm	95
Rated current	I_N	A	45
Maximum current	I_{max}	A	90
Maximum rotational speed	n_{max}	RPM	10000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	145
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	41
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

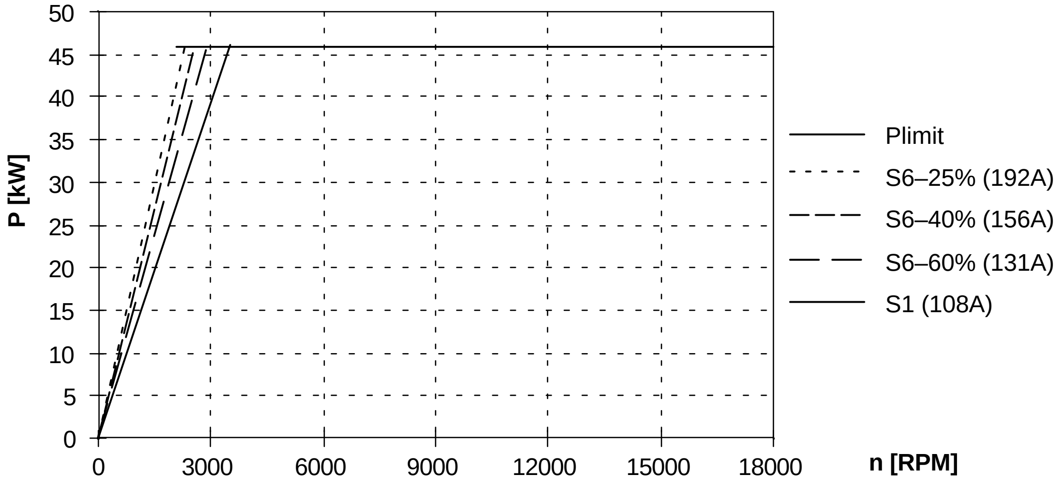


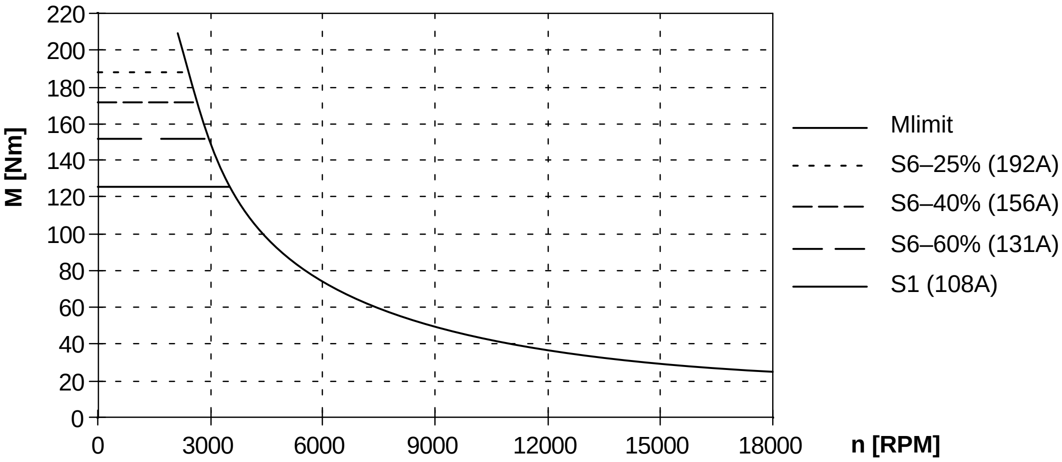


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-79 Motor type 1FE1095–4WN11

Three–phase synchronous built–in motor 1FE1095–4WN11			
Rated power	P_N	kW	46
Rated speed	n_N	RPM	3500
Rated torque	M_N	Nm	125
Rated current	I_N	A	108
Maximum current	I_{max}	A	216
Maximum rotational speed	n_{max}	RPM	18000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	79.0
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	47.5
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

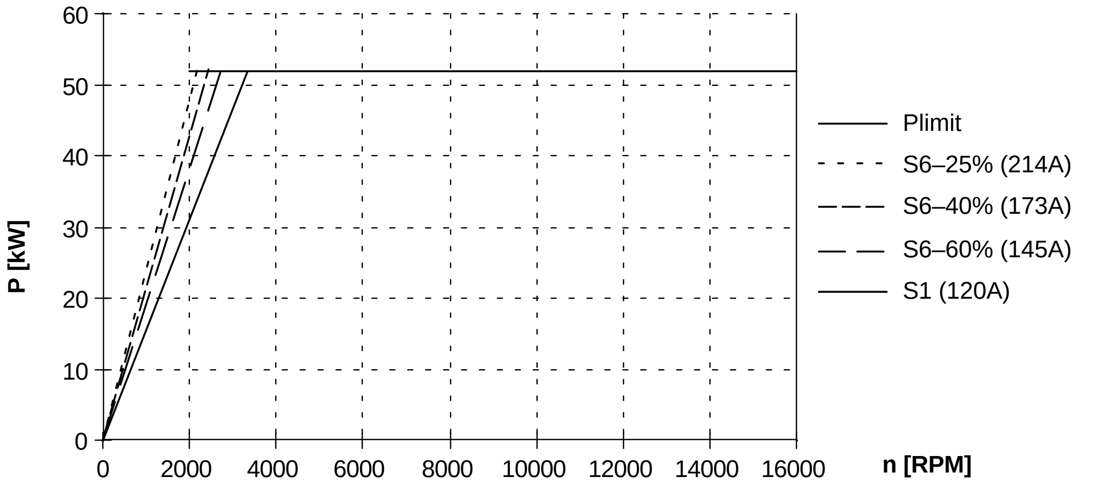


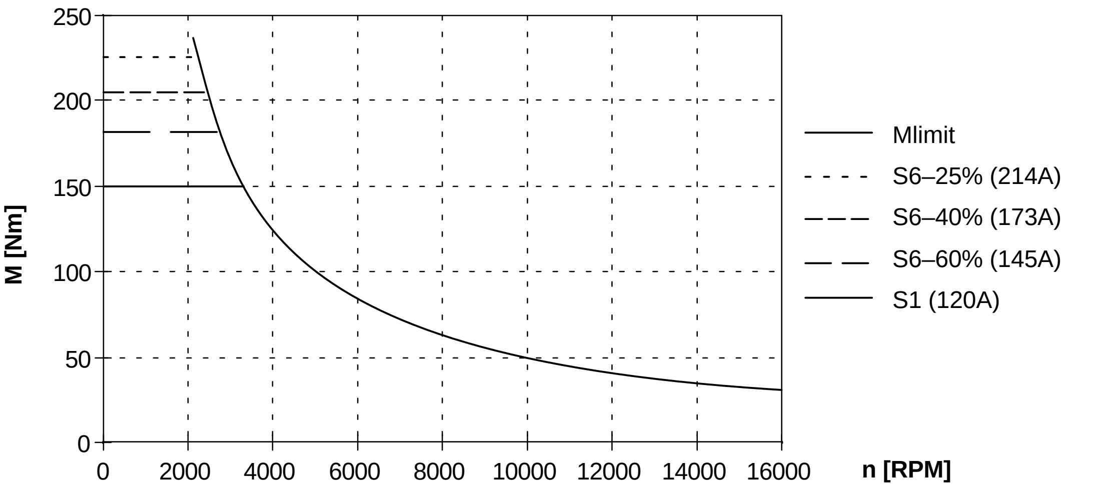


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-80 Motor type 1FE1096–4WN11

Three–phase synchronous built–in motor 1FE1096–4WN11			
Rated power	P_N	kW	52
Rated speed	n_N	RPM	3300
Rated torque	M_N	Nm	150
Rated current	I_N	A	120
Maximum current	I_{max}	A	240
Maximum rotational speed	n_{max}	RPM	16000
Moment of inertia	J_{rot}	kg m^2	Refer to Table 1-4
Voltage constant	k_E	V/1000 RPM	85
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	53
Rotor weight	m_{Rot}	kg	Refer to Table 1-4

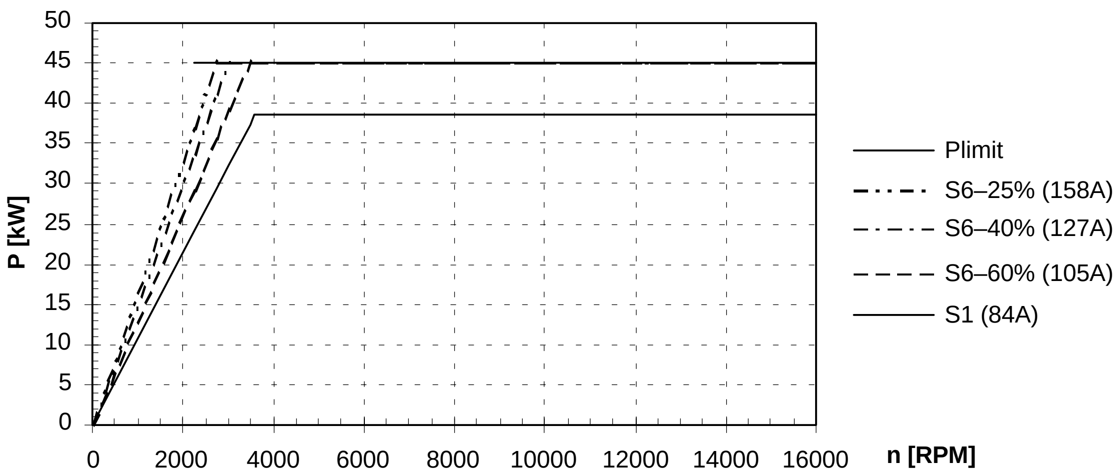


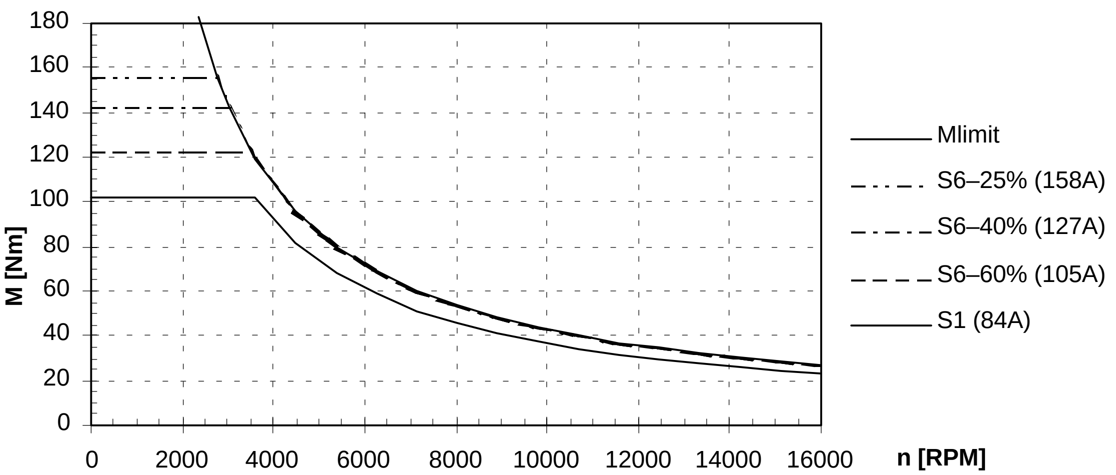


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-81 Motor type 1FE1103–4WN11

Three–phase synchronous built–in motor 1FE1103–4WN11			
Rated power	P_N	kW	38.5
Rated speed	n_N	RPM	3600
Rated torque	M_N	Nm	102
Rated current	I_N	A	84
Maximum current	I_{max}	A	168
Maximum rotational speed	n_{max}	RPM	16000
Moment of inertia	J_{rot}	kg m^2	0.01589
Voltage constant	k_E	V/1000 RPM	80
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	28.5
Rotor weight	m_{Rot}	kg	5.30

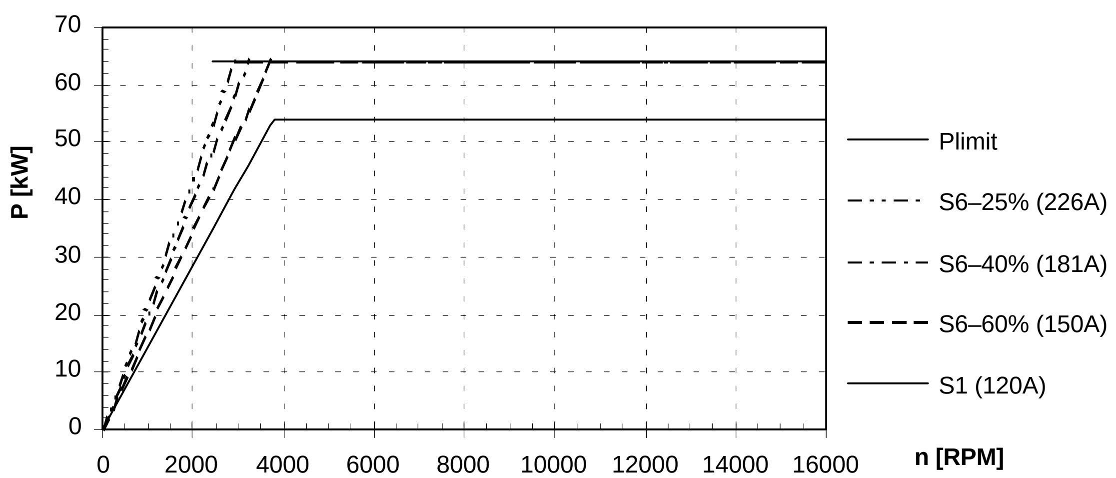


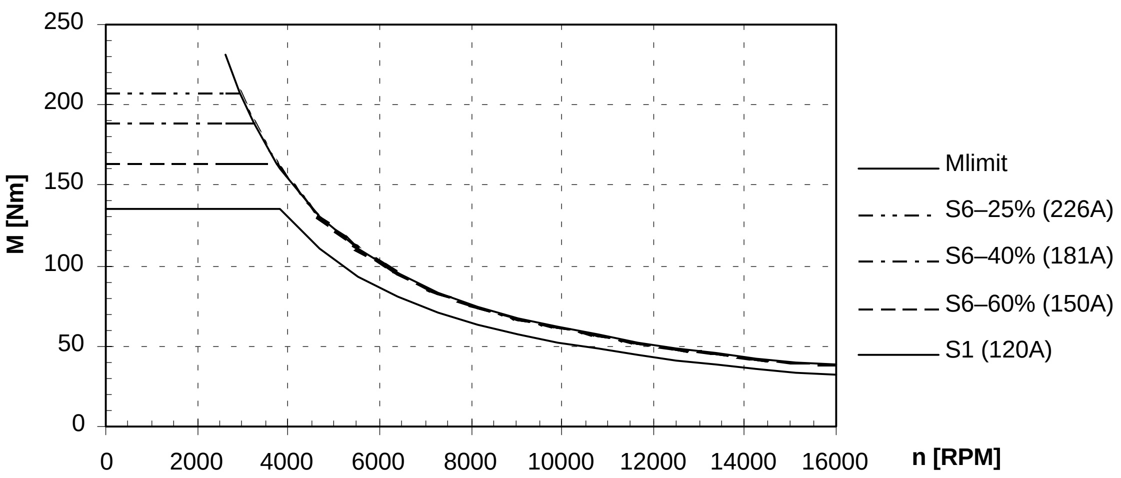


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-82 Motor type 1FE1104–4WN11

Three–phase synchronous built–in motor 1FE1104–4WN11			
Rated power	P_N	kW	54
Rated speed	n_N	RPM	3800
Rated torque	M_N	Nm	136
Rated current	I_N	A	120
Maximum current	I_{max}	A	240
Maximum rotational speed	n_{max}	RPM	16000
Moment of inertia	J_{rot}	kg m^2	0.02098
Voltage constant	k_E	V/1000 RPM	75
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	35.5
Rotor weight	m_{Rot}	kg	7.00

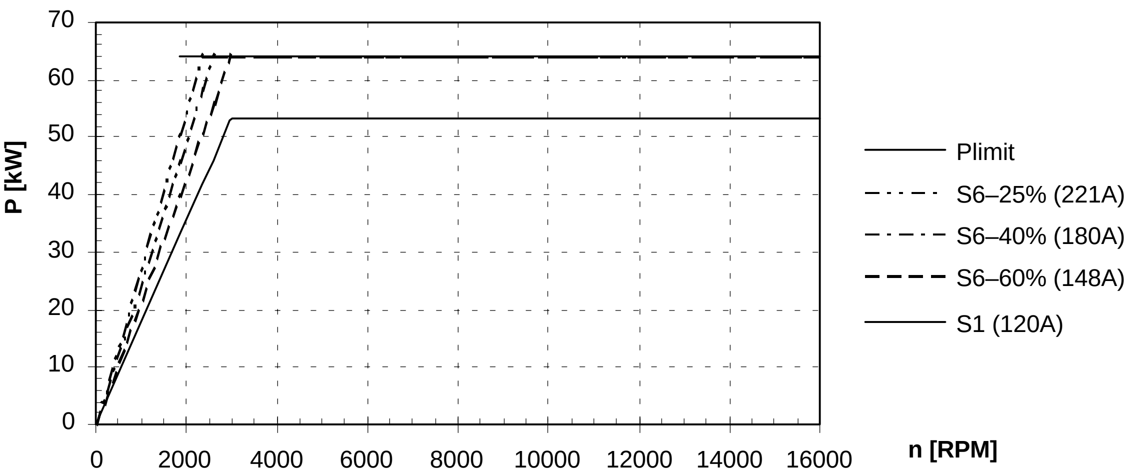


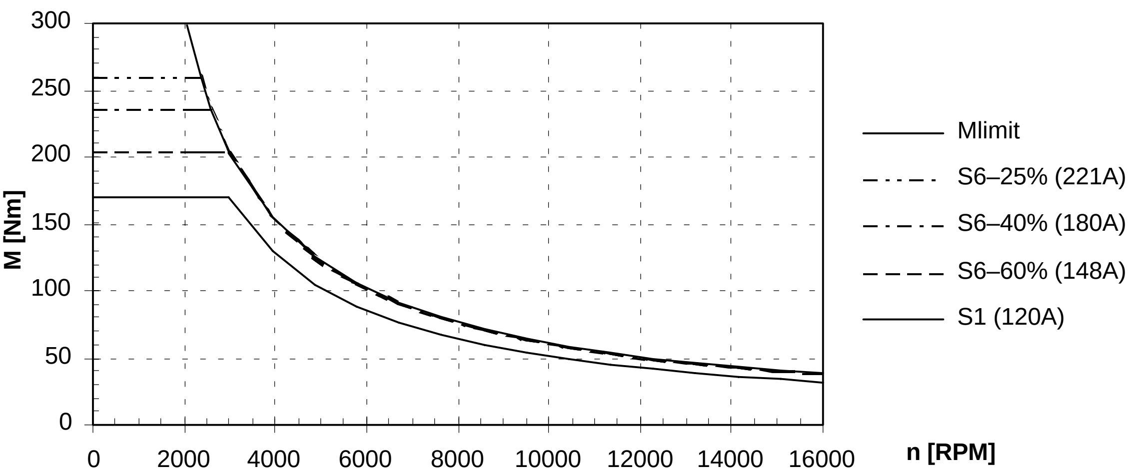


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-83 Motor type 1FE1105–4WN11

Three–phase synchronous built–in motor 1FE1105–4WN11			
Rated power	P_N	kW	53.4
Rated speed	n_N	RPM	3000
Rated torque	M_N	Nm	170
Rated current	I_N	A	120
Maximum current	I_{max}	A	240
Maximum rotational speed	n_{max}	RPM	16000
Moment of inertia	J_{rot}	kg m^2	0.02608
Voltage constant	k_E	V/1000 RPM	94
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	43
Rotor weight	m_{Rot}	kg	8.70

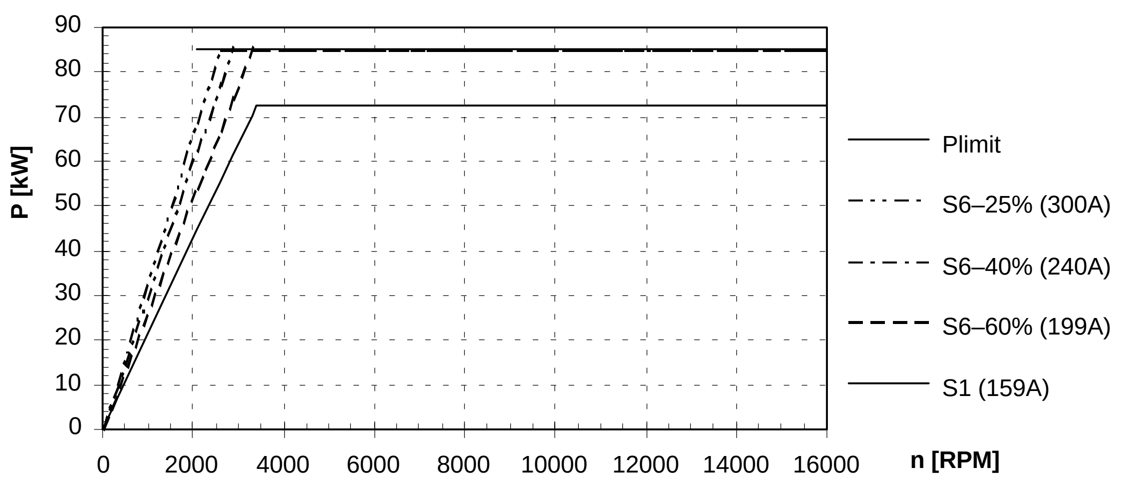


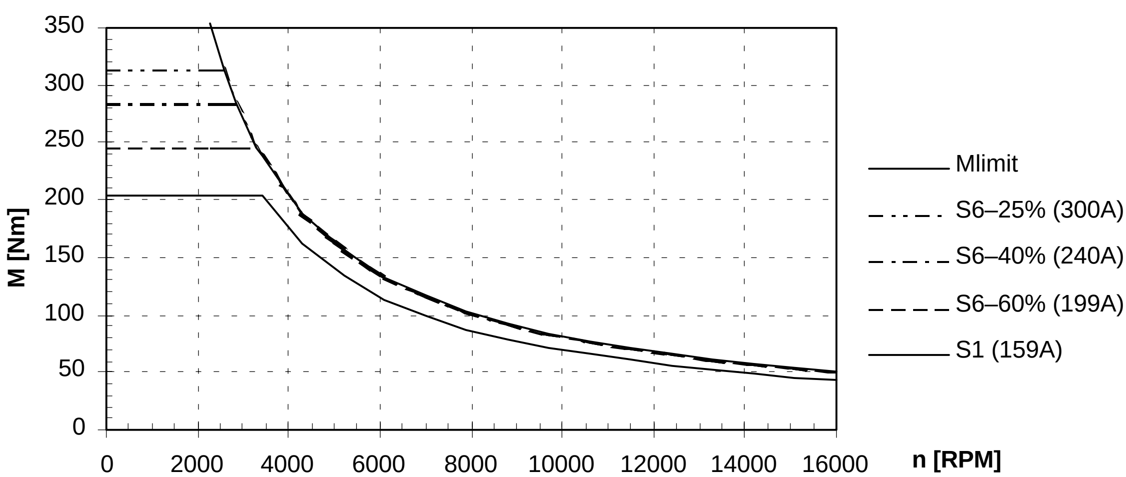


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-84 Motor type 1FE1106–4WN11

Three–phase synchronous built–in motor 1FE1106–4WN11			
Rated power	P_N	kW	72.6
Rated speed	n_N	RPM	3400
Rated torque	M_N	Nm	204
Rated current	I_N	A	159
Maximum current	I_{max}	A	318
Maximum rotational speed	n_{max}	RPM	16000
Moment of inertia	J_{rot}	kg m^2	0.03147
Voltage constant	k_E	V/1000 RPM	84
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	51
Rotor weight	m_{Rot}	kg	10.50

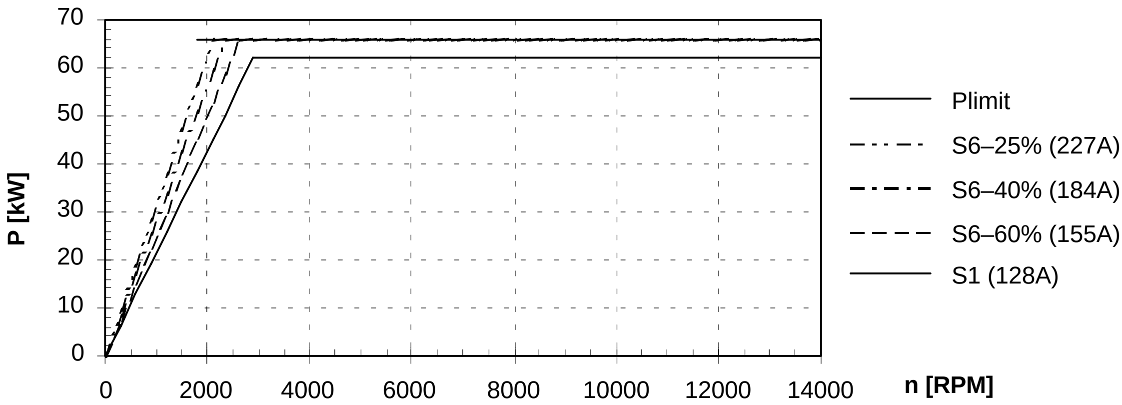


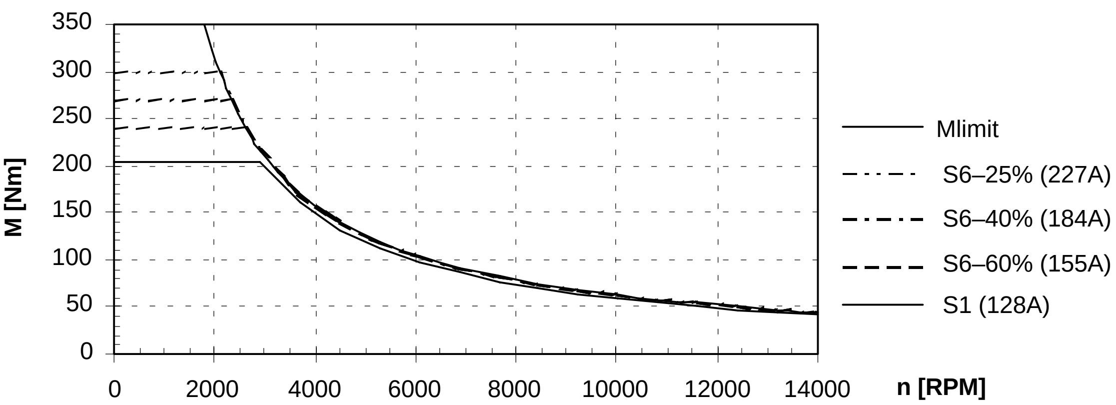


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-85 Motor type 1FE1106–4WR11

Three–phase synchronous built–in motor 1FE1106–4WR11			
Rated power	P_N	kW	62
Rated speed	n_N	RPM	2900
Rated torque	M_N	Nm	204
Rated current	I_N	A	128
Maximum current	I_{max}	A	260
Maximum rotational speed	n_{max}	RPM	14000
Moment of inertia	J_{rot}	kg m^2	0.03147
Voltage constant	k_E	V/1000 RPM	106
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	51
Rotor weight	m_{Rot}	kg	10.50

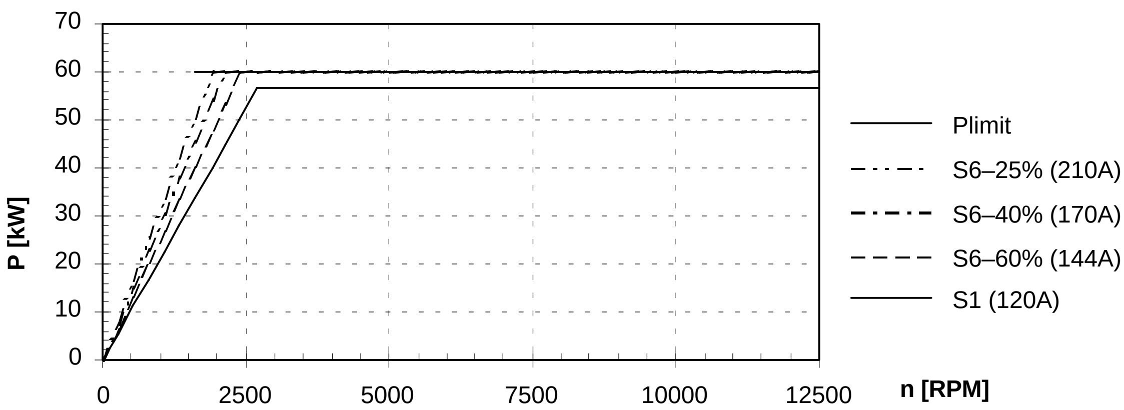


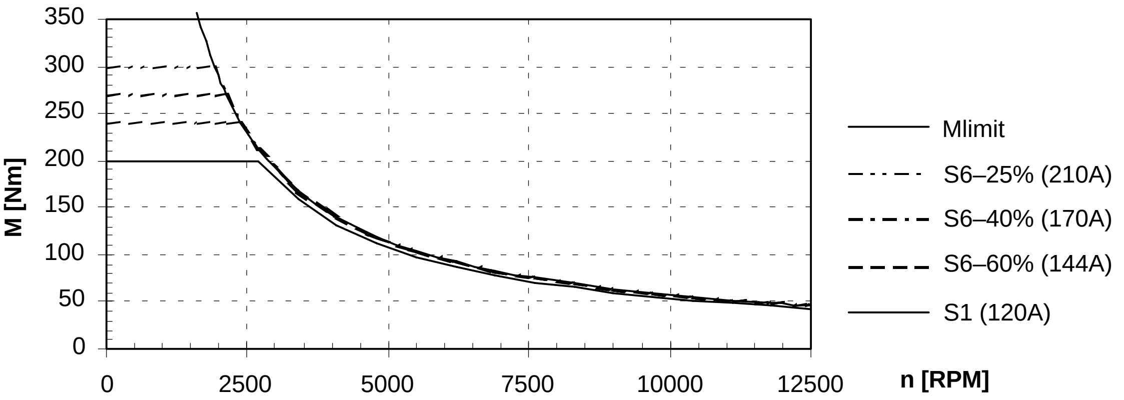


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-86 Motor type 1FE1106–4WS11

Three–phase synchronous built–in motor 1FE1106–4WS11			
Rated power	P_N	kW	56.5
Rated speed	n_N	RPM	2700
Rated torque	M_N	Nm	200
Rated current	I_N	A	120
Maximum current	I_{max}	A	240
Maximum rotational speed	n_{max}	RPM	12500
Moment of inertia	J_{rot}	kg m^2	0.03147
Voltage constant	k_E	V/1000 RPM	112
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	51
Rotor weight	m_{Rot}	kg	10.50

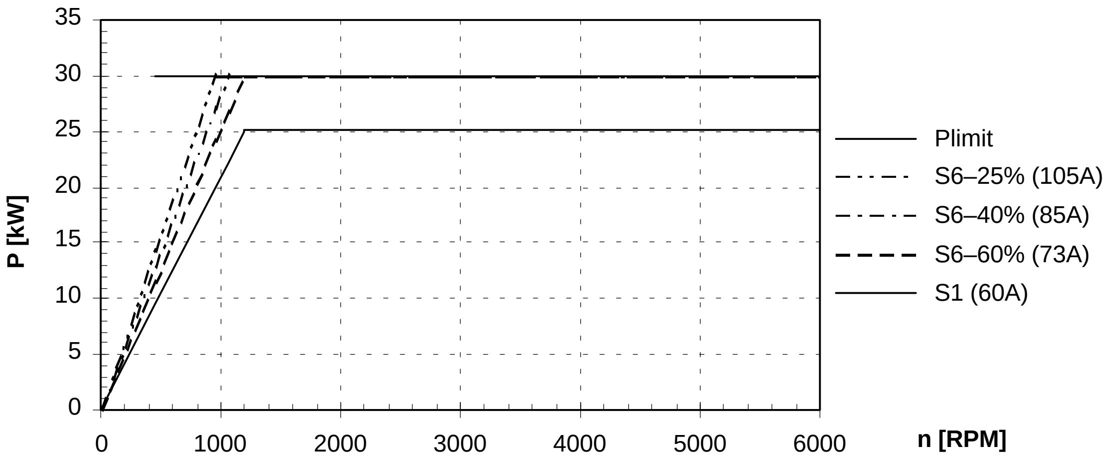


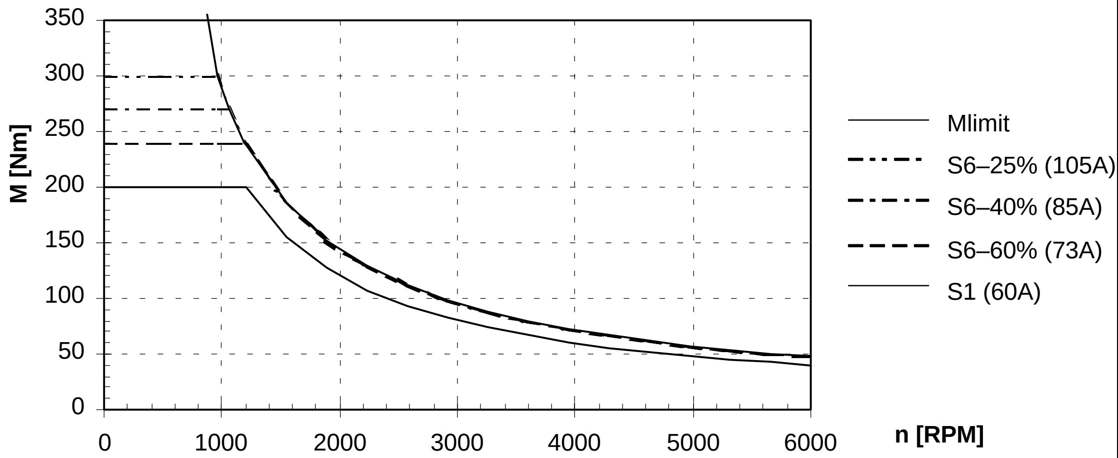


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-87 Motor type 1FE1106–4WY11

Three–phase synchronous built–in motor 1FE1106–4WY11			
Rated power	P_N	kW	25
Rated speed	n_N	RPM	1200
Rated torque	M_N	Nm	200
Rated current	I_N	A	60
Maximum current	I_{max}	A	120
Maximum rotational speed	n_{max}	RPM	6000
Moment of inertia	J_{rot}	kg m^2	0.03147
Voltage constant	k_E	V/1000 RPM	225
Thermal time constant	T_{therm}	min	3
Stator weight with cooling jacket	m_{St}	kg	51
Rotor weight	m_{Rot}	kg	10.50

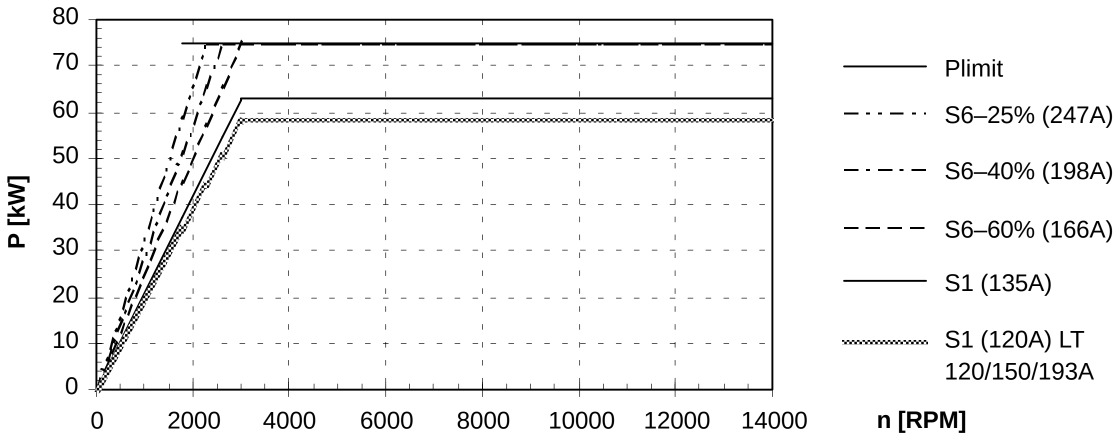


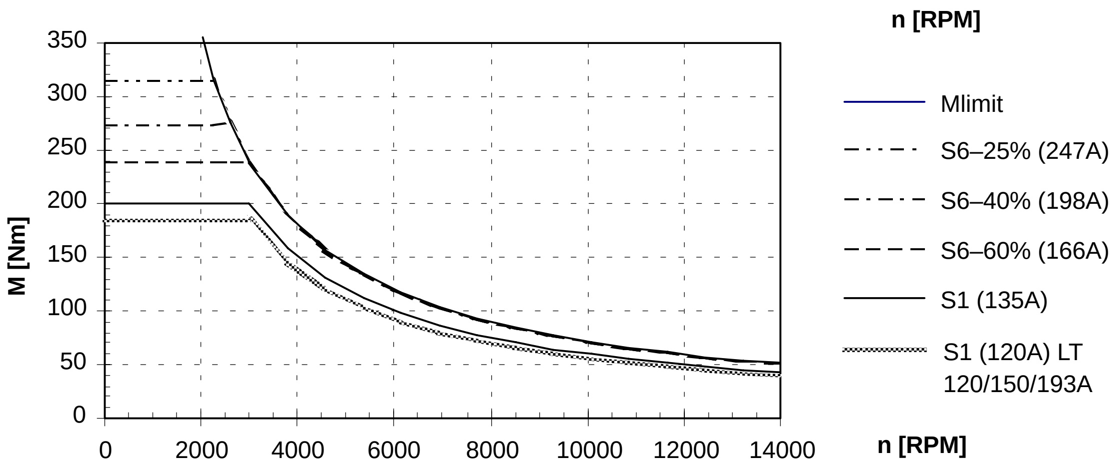


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-88 Motor type 1FE1124–4WN11

Three–phase synchronous built–in motor 1FE1124–4WN11			
Rated power	P_N	kW	63
Rated speed	n_N	RPM	3000
Rated torque	M_N	Nm	200
Rated current	I_N	A	135
Maximum current	I_{max}	A	270
Maximum rotational speed	n_{max}	RPM	14000
Moment of inertia	J_{rot}	kg m^2	0.05112
Voltage constant	k_E	V/1000 RPM	95
Thermal time constant	T_{therm}	min	4
Stator weight with cooling jacket	m_{St}	kg	50.5
Rotor weight	m_{Rot}	kg	12.10

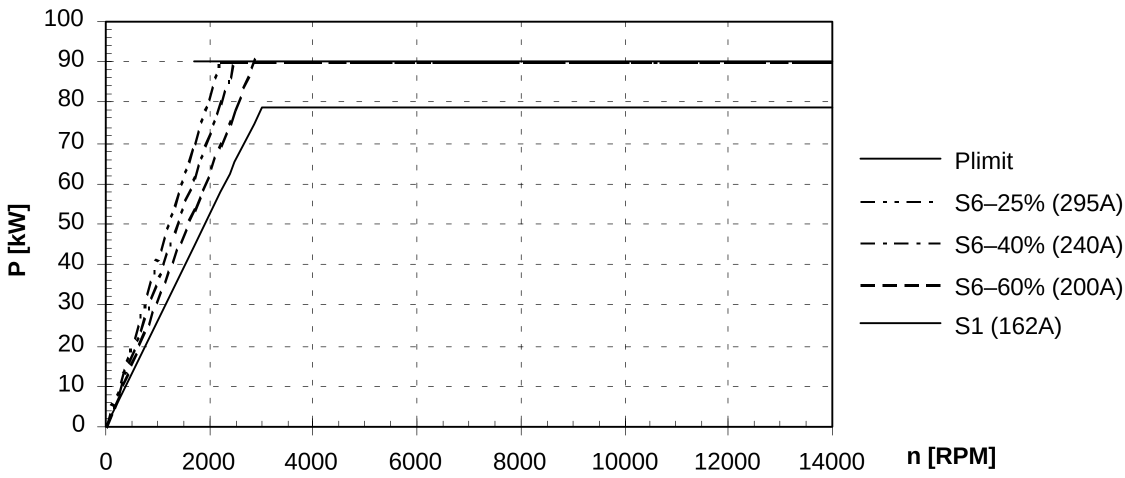


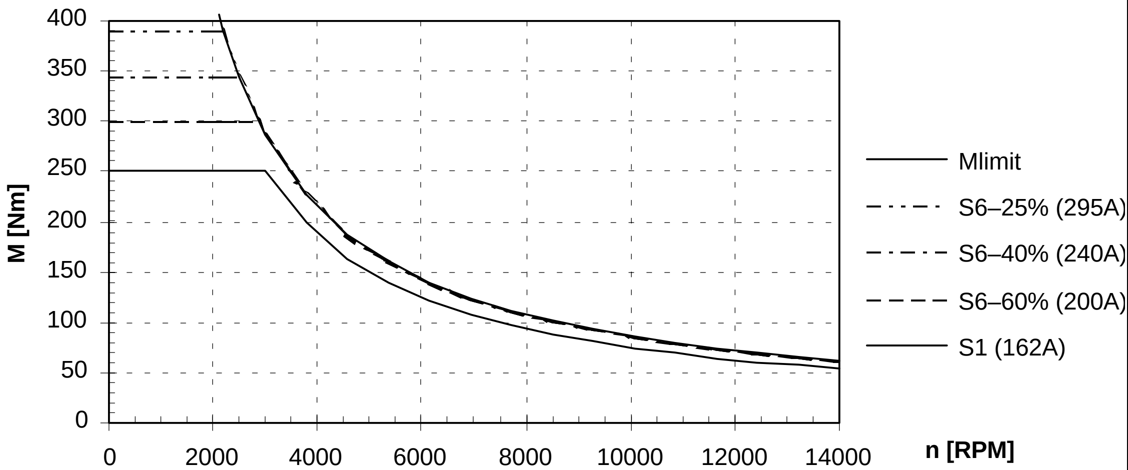


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-89 Motor type 1FE1125–4WN11

Three–phase synchronous built–in motor 1FE1125–4WN11			
Rated power	P_N	kW	78.5
Rated speed	n_N	RPM	3000
Rated torque	M_N	Nm	250
Rated current	I_N	A	162
Maximum current	I_{max}	A	324
Maximum rotational speed	n_{max}	RPM	14000
Moment of inertia	J_{rot}	kg m^2	0.06337
Voltage constant	k_E	V/1000 RPM	99
Thermal time constant	T_{therm}	min	4
Stator weight with cooling jacket	m_{St}	kg	61
Rotor weight	m_{Rot}	kg	15.00

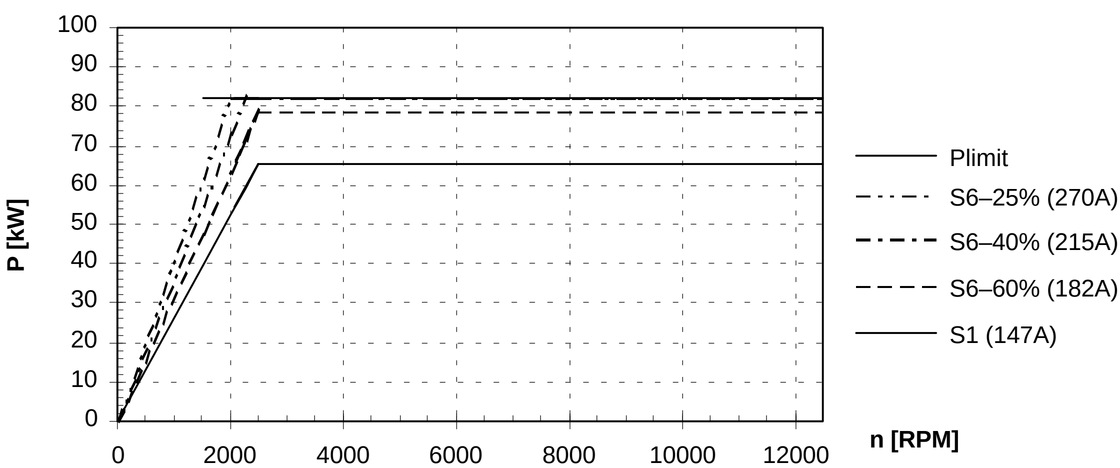


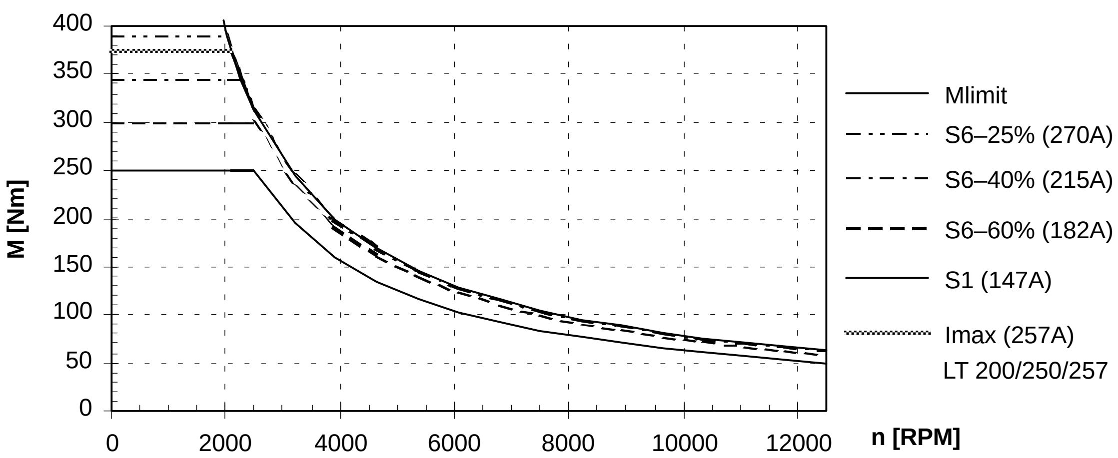


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-90 Motor type 1FE1125–4WP11

Three–phase synchronous built–in motor 1FE1125–4WP11			
Rated power	P_N	kW	65.5
Rated speed	n_N	RPM	2500
Rated torque	M_N	Nm	250
Rated current	I_N	A	147
Maximum current	I_{max}	A	294
Maximum rotational speed	n_{max}	RPM	12500
Moment of inertia	J_{rot}	kg m^2	0.06337
Voltage constant	k_E	V/1000 RPM	109
Thermal time constant	T_{therm}	min	4
Stator weight with cooling jacket	m_{St}	kg	61
Rotor weight	m_{Rot}	kg	15.00

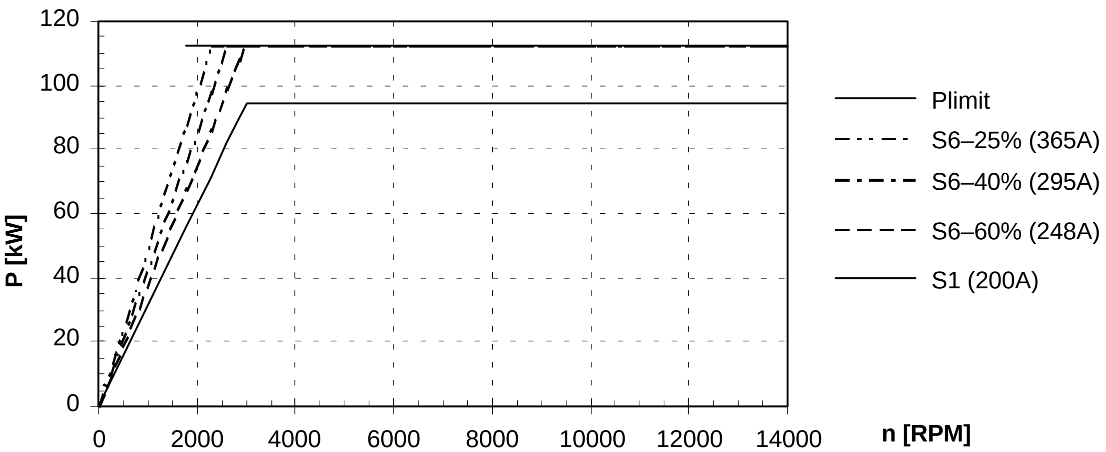


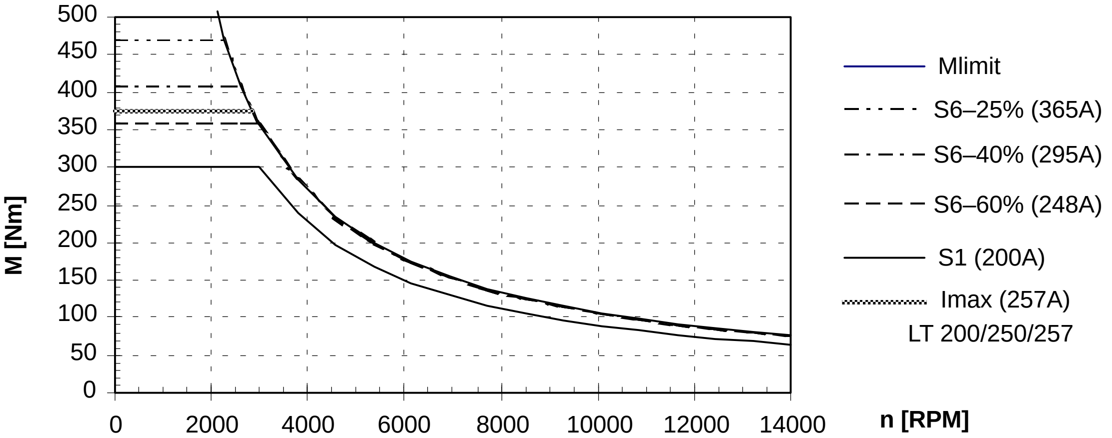


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-91 Motor type 1FE1126–4WN11

Three–phase synchronous built–in motor 1FE1126–4WN11			
Rated power	P_N	kW	94
Rated speed	n_N	RPM	3000
Rated torque	M_N	Nm	300
Rated current	I_N	A	200
Maximum current	I_{max}	A	400
Maximum rotational speed	n_{max}	RPM	14000
Moment of inertia	J_{rot}	kg m^2	0.07604
Voltage constant	k_E	V/1000 RPM	95
Thermal time constant	T_{therm}	min	4
Stator weight with cooling jacket	m_{St}	kg	72
Rotor weight	m_{Rot}	kg	18

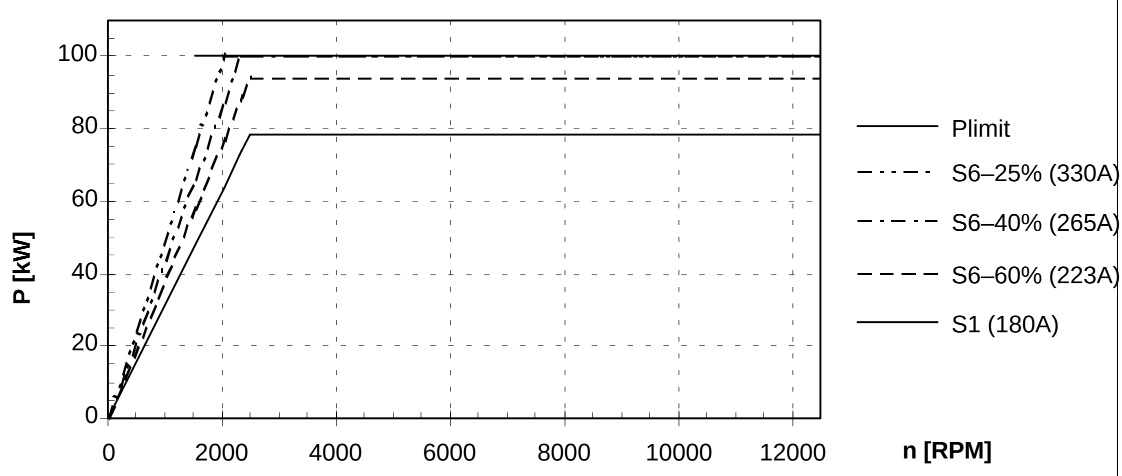


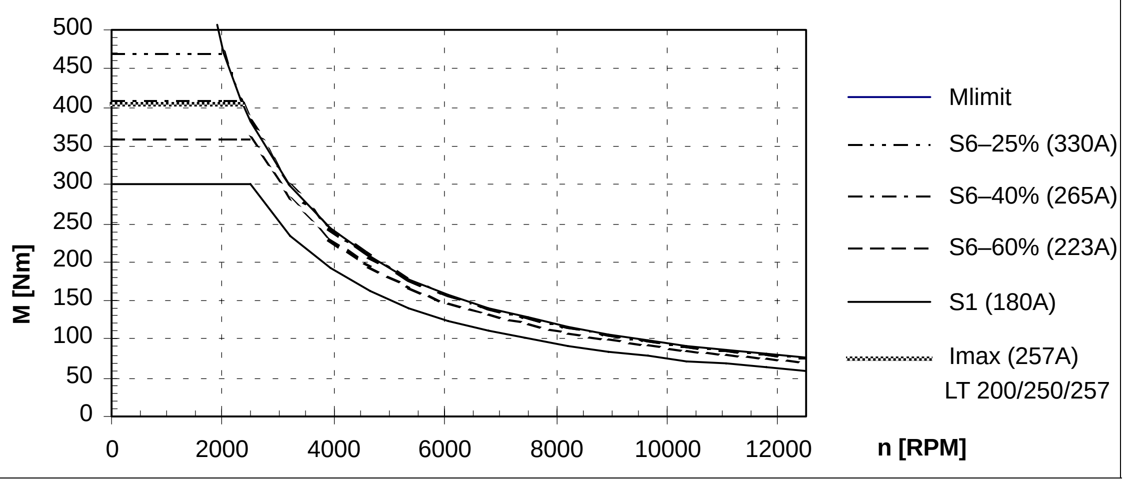


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-92 Motor type 1FE1126–4WP11

Three–phase synchronous built–in motor 1FE1126–4WP11			
Rated power	P_N	kW	78.5
Rated speed	n_N	RPM	2500
Rated torque	M_N	Nm	300
Rated current	I_N	A	180
Maximum current	I_{max}	A	360
Maximum rotational speed	n_{max}	RPM	12500
Moment of inertia	J_{rot}	kg m^2	0.07604
Voltage constant	k_E	V/1000 RPM	107
Thermal time constant	T_{therm}	min	4
Stator weight with cooling jacket	m_{St}	kg	72
Rotor weight	m_{Rot}	kg	18

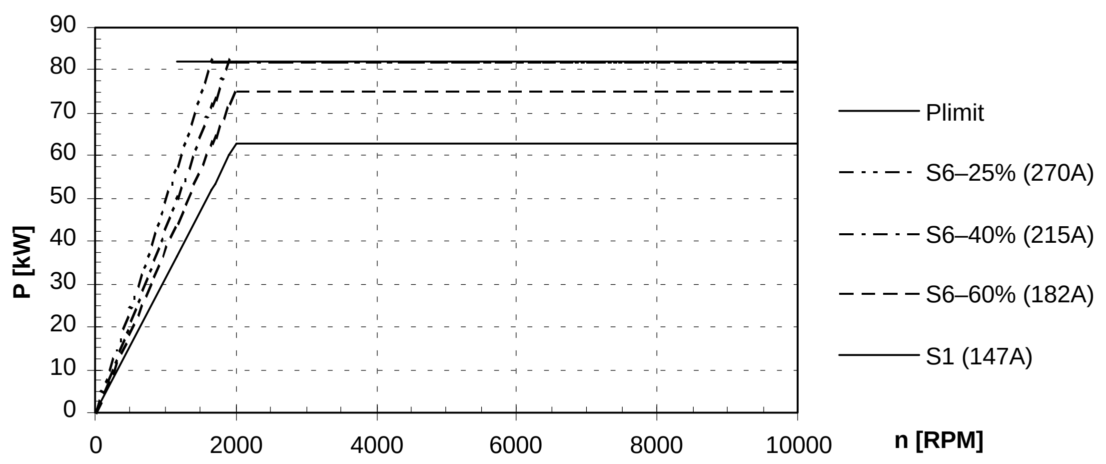


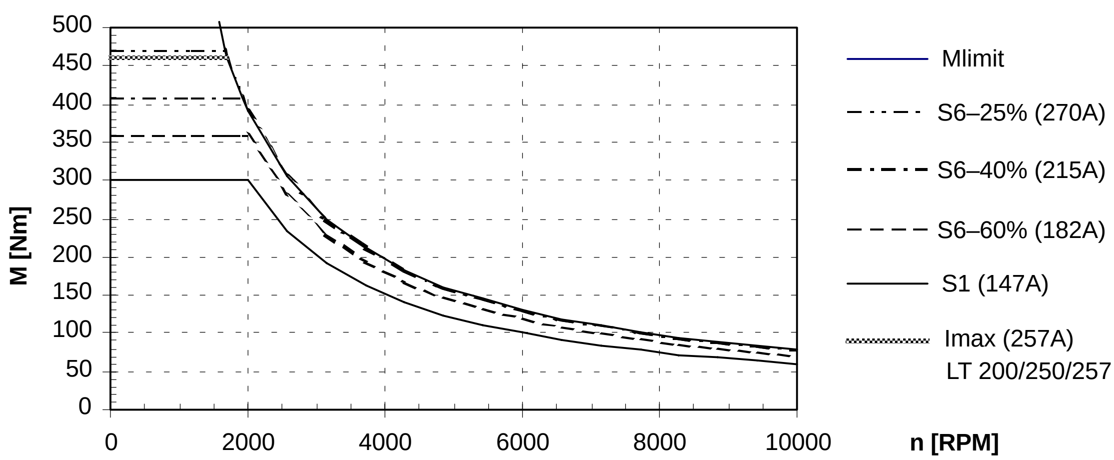


The data for duty type S6 are valid for a 2 min. duty cycle.

Table 5-93 Motor type 1FE1126–4WQ11

Three–phase synchronous built–in motor 1FE1126–4WQ11			
Rated power	P_N	kW	63
Rated speed	n_N	RPM	2000
Rated torque	M_N	Nm	300
Rated current	I_N	A	147
Maximum current	I_{max}	A	294
Maximum rotational speed	n_{max}	RPM	10000
Moment of inertia	J_{rot}	kg m^2	0.07604
Voltage constant	k_E	V/1000 RPM	130
Thermal time constant	T_{therm}	min	4
Stator weight with cooling jacket	m_{St}	kg	72
Rotor weight	m_{Rot}	kg	18





The data for duty type S6 are valid for a 2 min. duty cycle.

■

Dimension Drawings 6

Note

Siemens AG reserves the right to change the motor dimensions, as part of design improvements, without prior notification. The dimension drawings, provided in this documentation, can go out–of–date.

Current dimension drawings, refer to the Intranet under: Products & Solutions, Drive Technology, Synchronous Built–in Motors 1FE1, Dimension Drawings

The individual dimension drawings for the required motors can be found as follows in the Chapter ”Index”:

—> refer under the index entry ”Dimension drawings”

Dimension drawings with cooling jacket 1FE1□□□–□□□□□–□**B**□□

As standard, the stators are supplied with cooling jacket and cast winding overhang. In this case, the technical data in Chapter 1.3 are valid and the characteristics in Chapter 5.1.

Dimension drawings without cooling jacket 1FE1□□□–□□□□□–□**A**□□

Stators are supplied without cooling jacket without cast winding overhang, however with impregnated winding. The technical data in Chapter 1.3 are reached up to approx. 80 to 85%. Precise characteristics can be provided on request.

The following built–in motors can be supplied without cooling jacket **on request**

1FE105□–6W□□□, 1FE1061–6W□□□, 1FE1084–6W□□□, 1FE109□–6W□□□, 1FE111□–6W□□□, 1FE107□–4W□□□, 1FE108□–4W□□□, 1FE109□–4W□□□, 1FE110□–4W□□□.

Notice

For the mounting information ”rotor–companion dimensions”, a magnetic, conductive shaft material (steel) with a coefficient of expansion (longitudinal) of $11 \cdot 10^{-6}$/K for the recommended fit is used as basis.

6.1 1FE104.–6

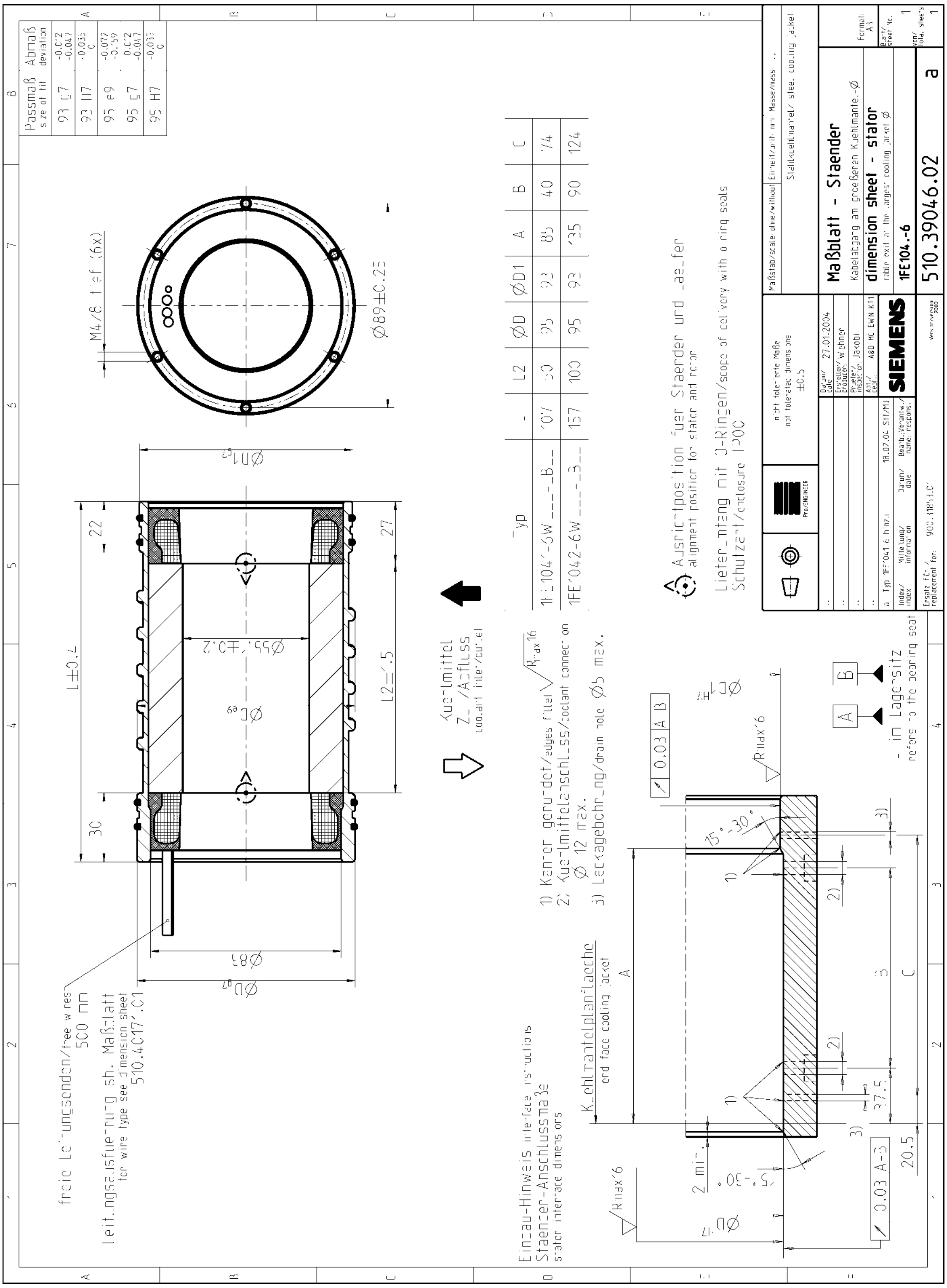


Fig. 6-1 1FE104□–6, stator with cooling jacket, cable outlet at the higher cooling jacket diameter

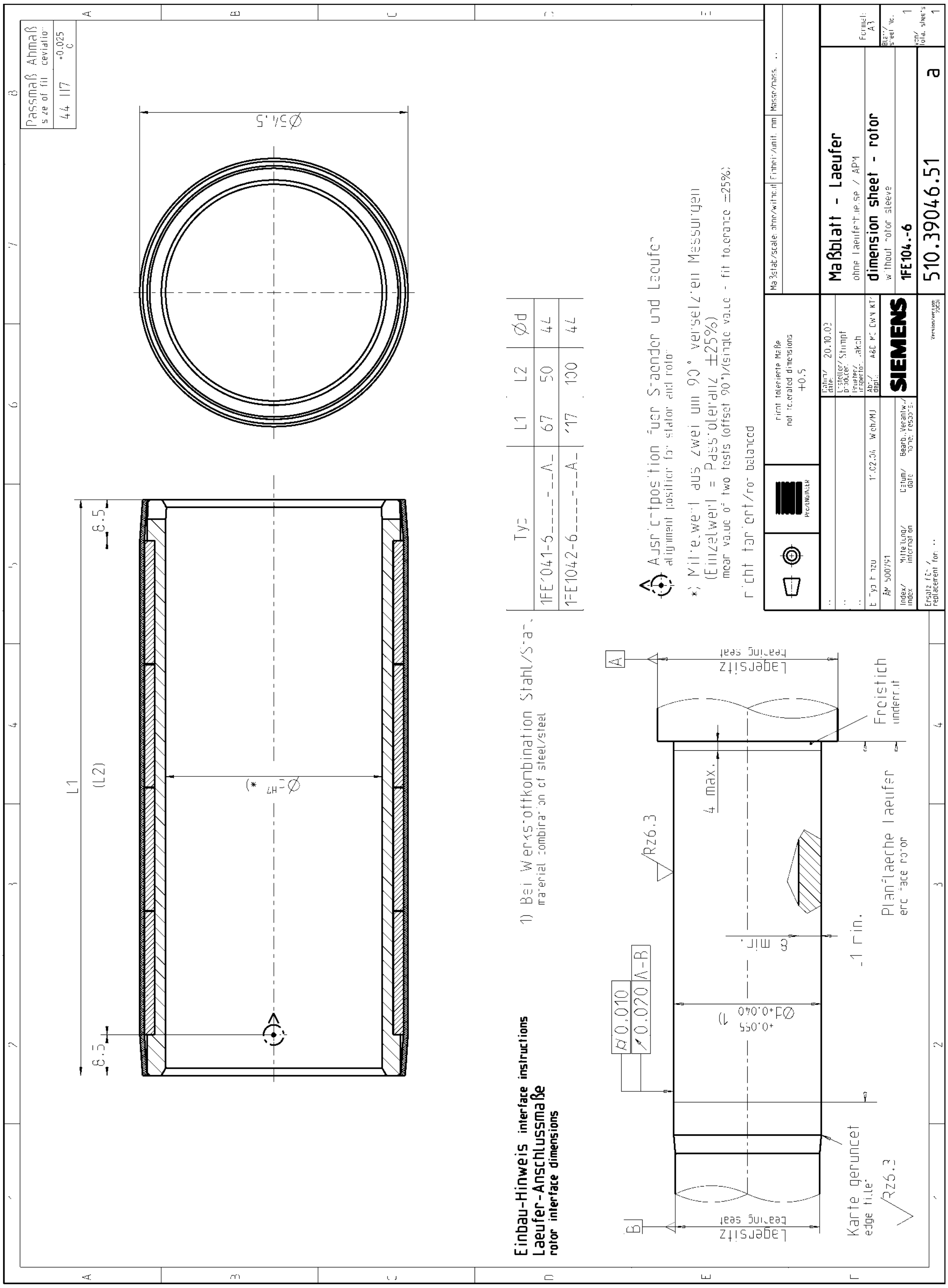


Fig. 6-2 1FE104□–6, built–in motor without rotor sleeve

6.2 1FE105.–6

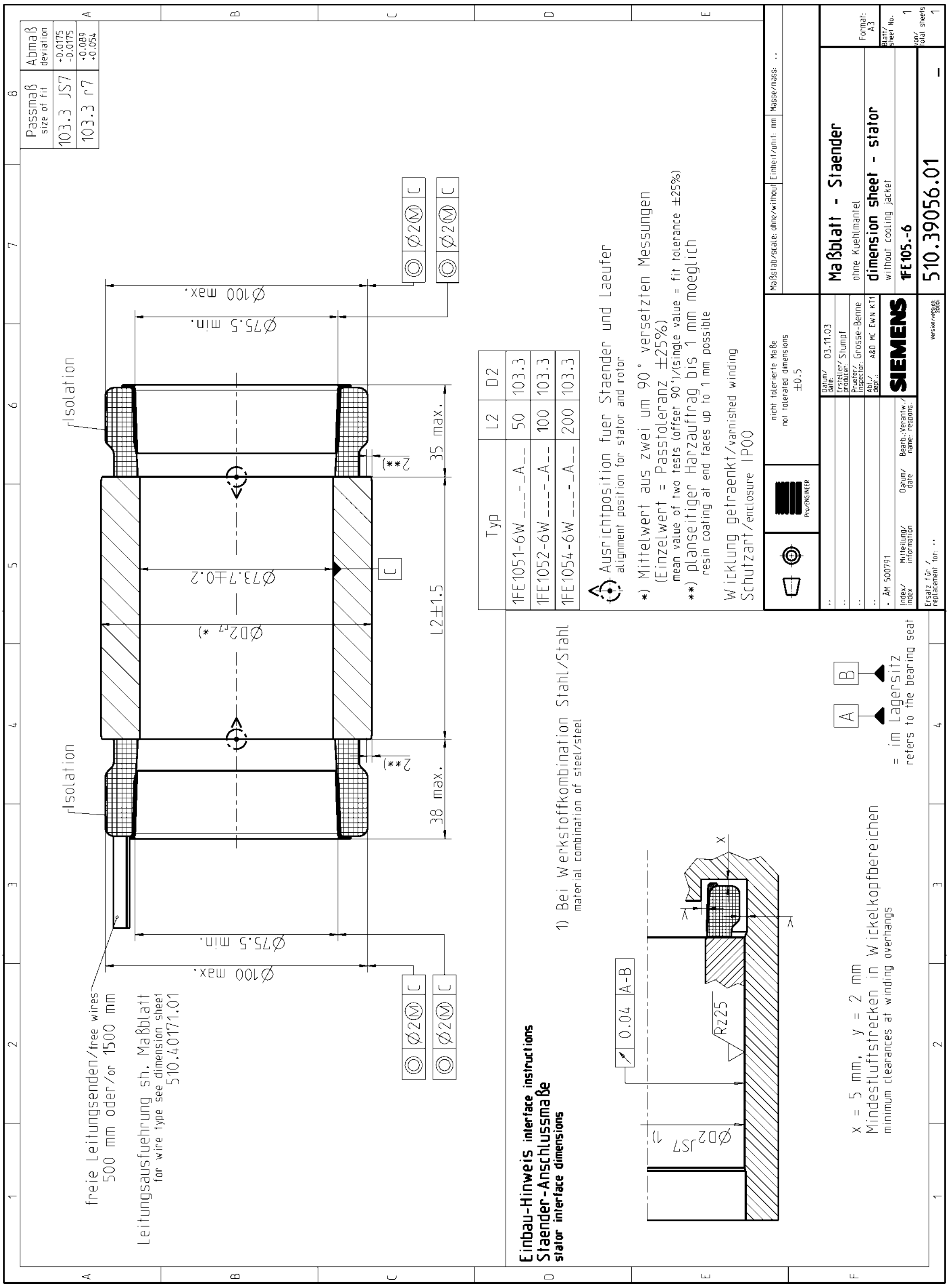


Fig. 6-3 1FE105□–6, stator without cooling jacket

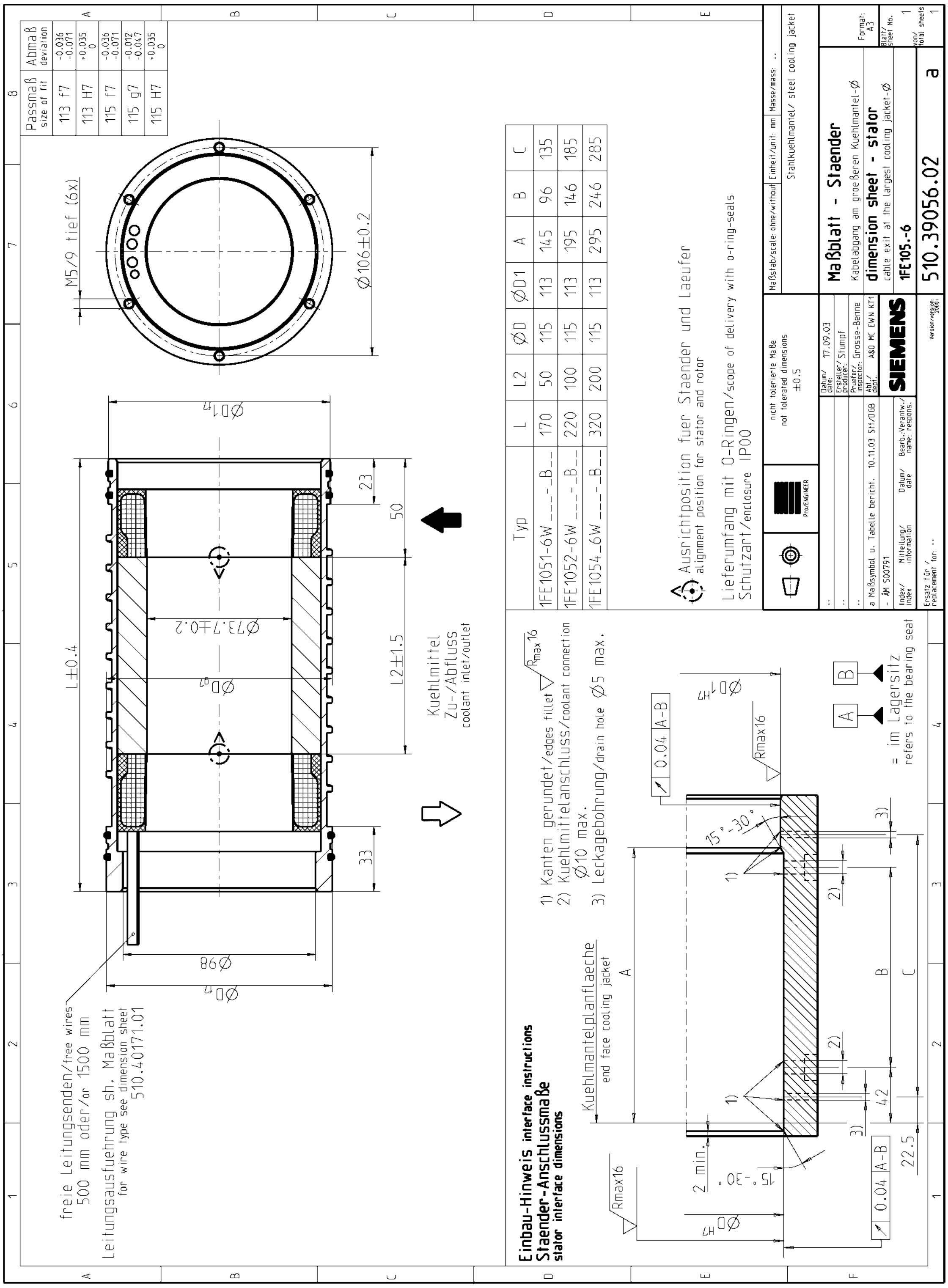


Fig. 6-4 1FE105□–6, stator with cooling jacket, cable outlet at the higher cooling jacket diameter

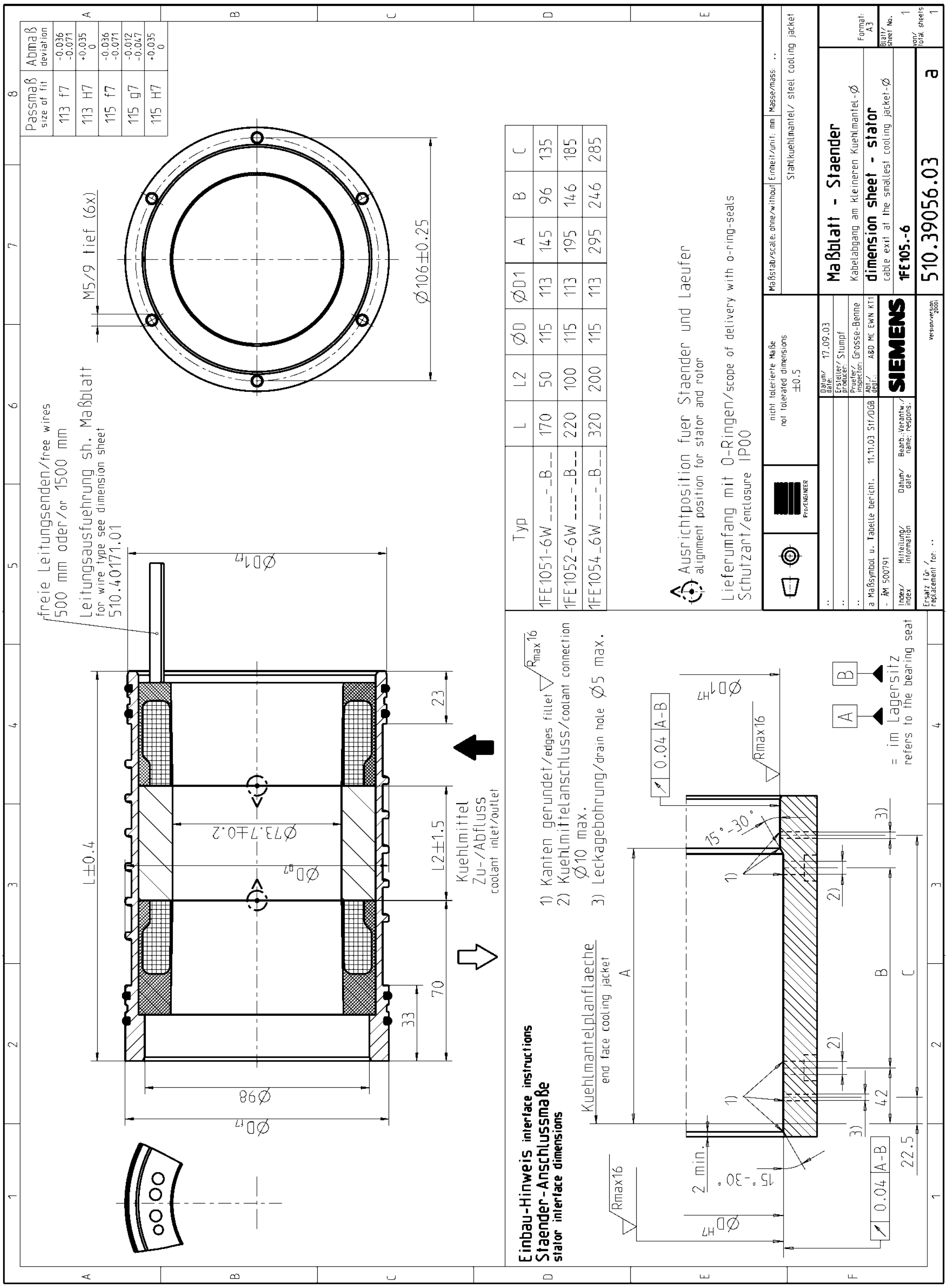


Fig. 6-5 1FE105□–6, stator with cooling jacket, cable outlet at the lower cooling jacket diameter

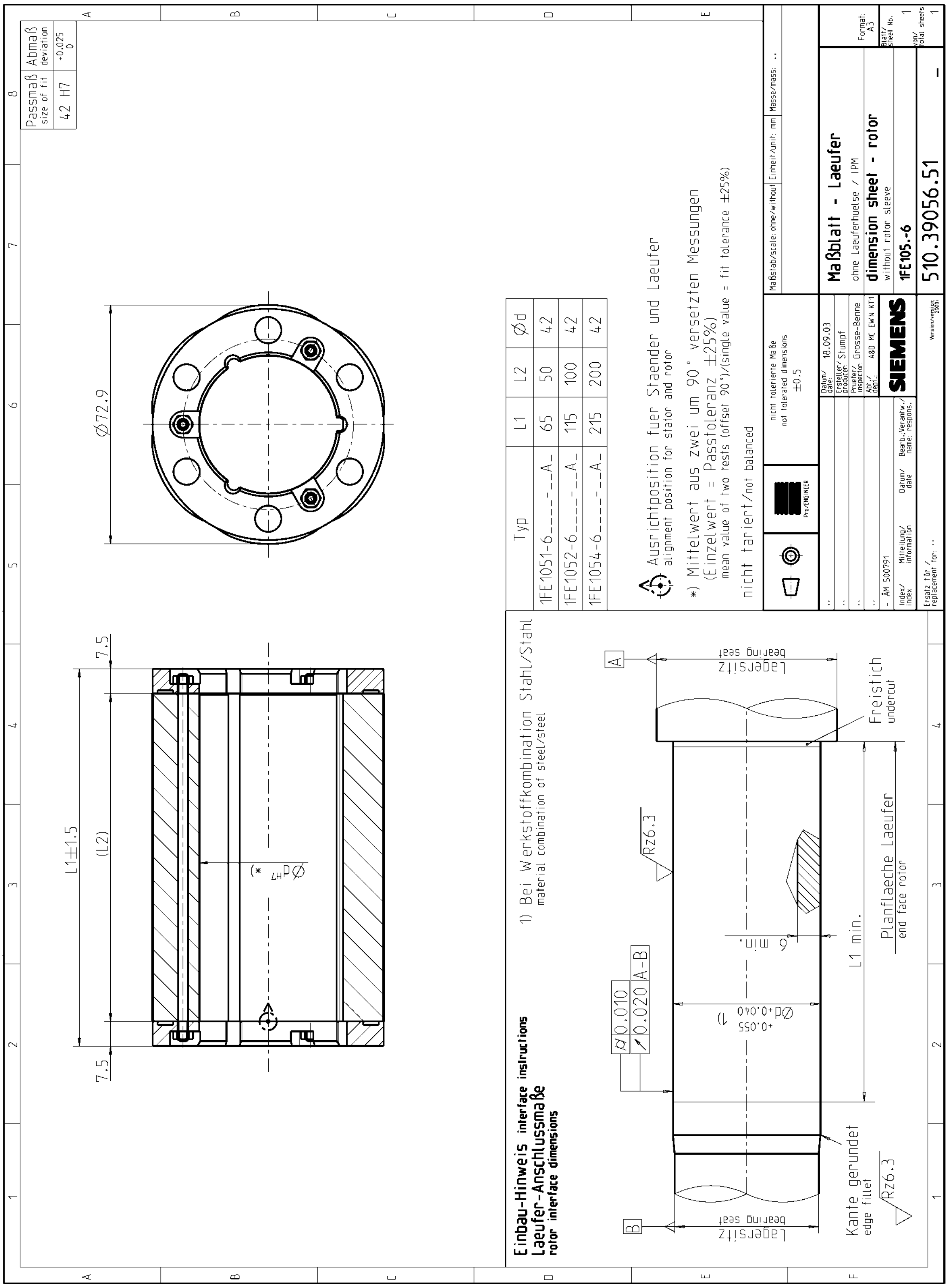


Fig. 6-6 1FE105□–6, rotor without sleeve

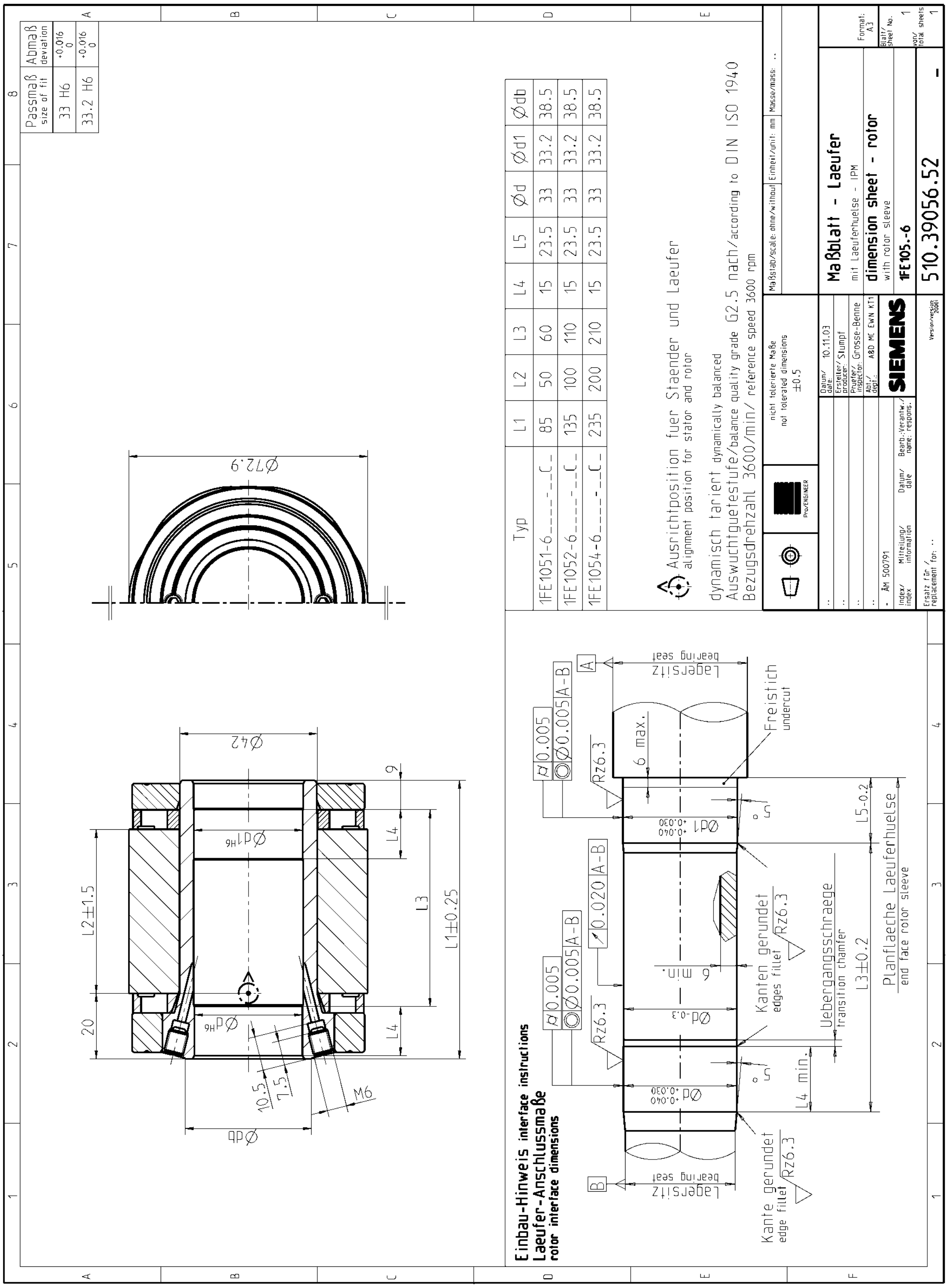


Fig. 6-7 1FE105□–6, rotor with sleeve

6.3 1FE106.–6

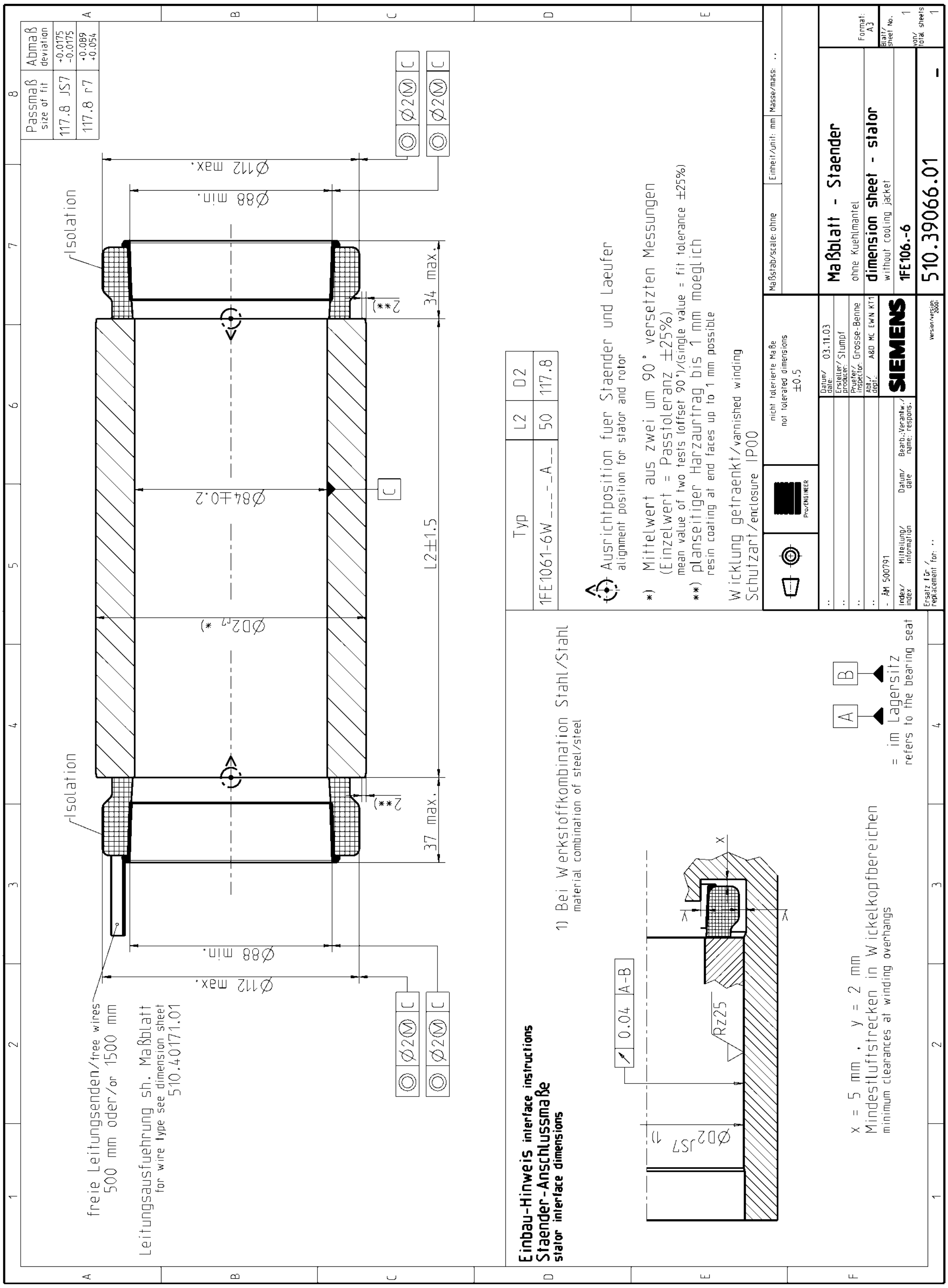


Fig. 6-8 1FE106□–6, stator without cooling jacket

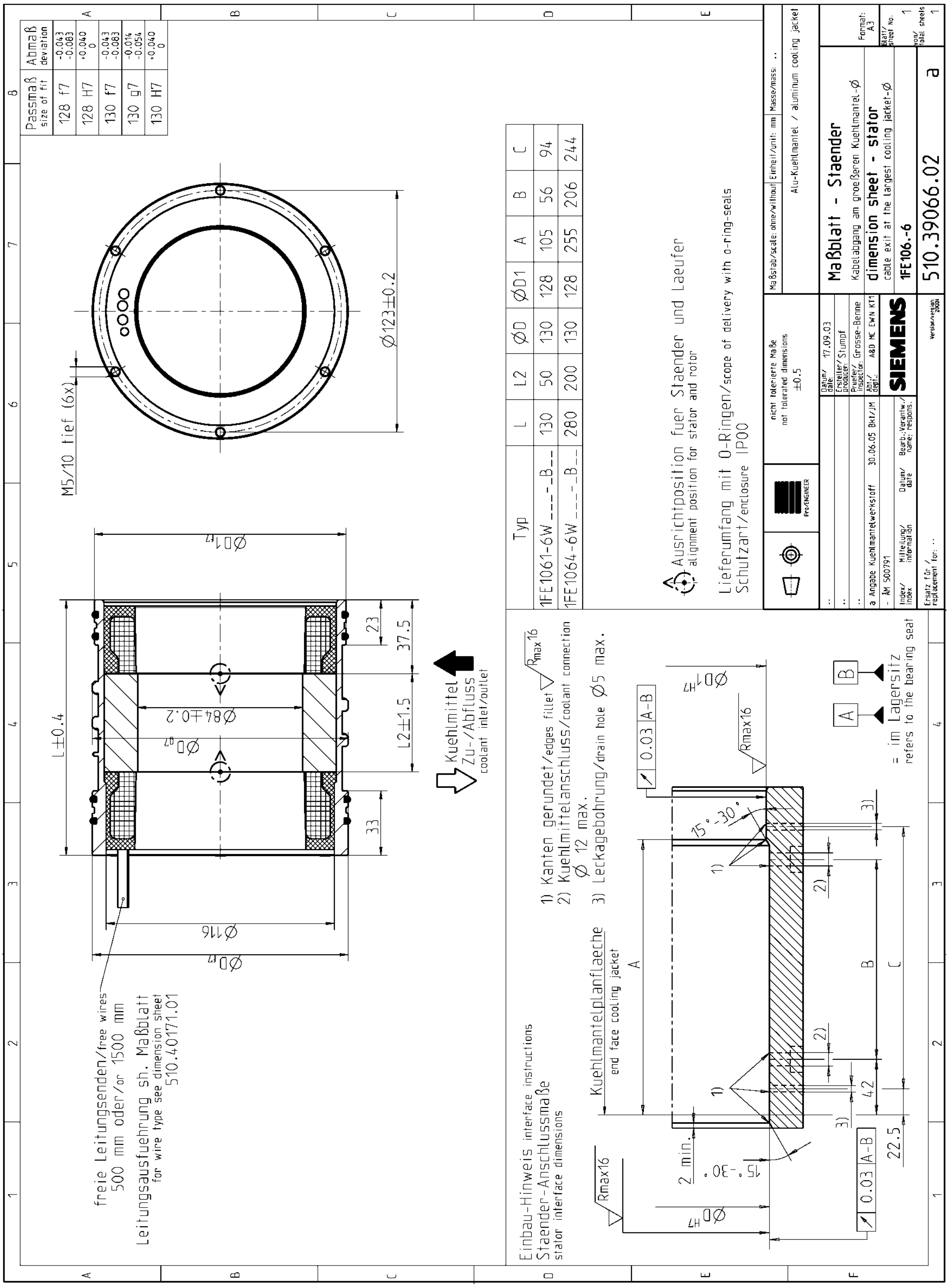


Fig. 6-9 1FE106□–6, stator with cooling jacket, cable outlet at the higher cooling jacket diameter

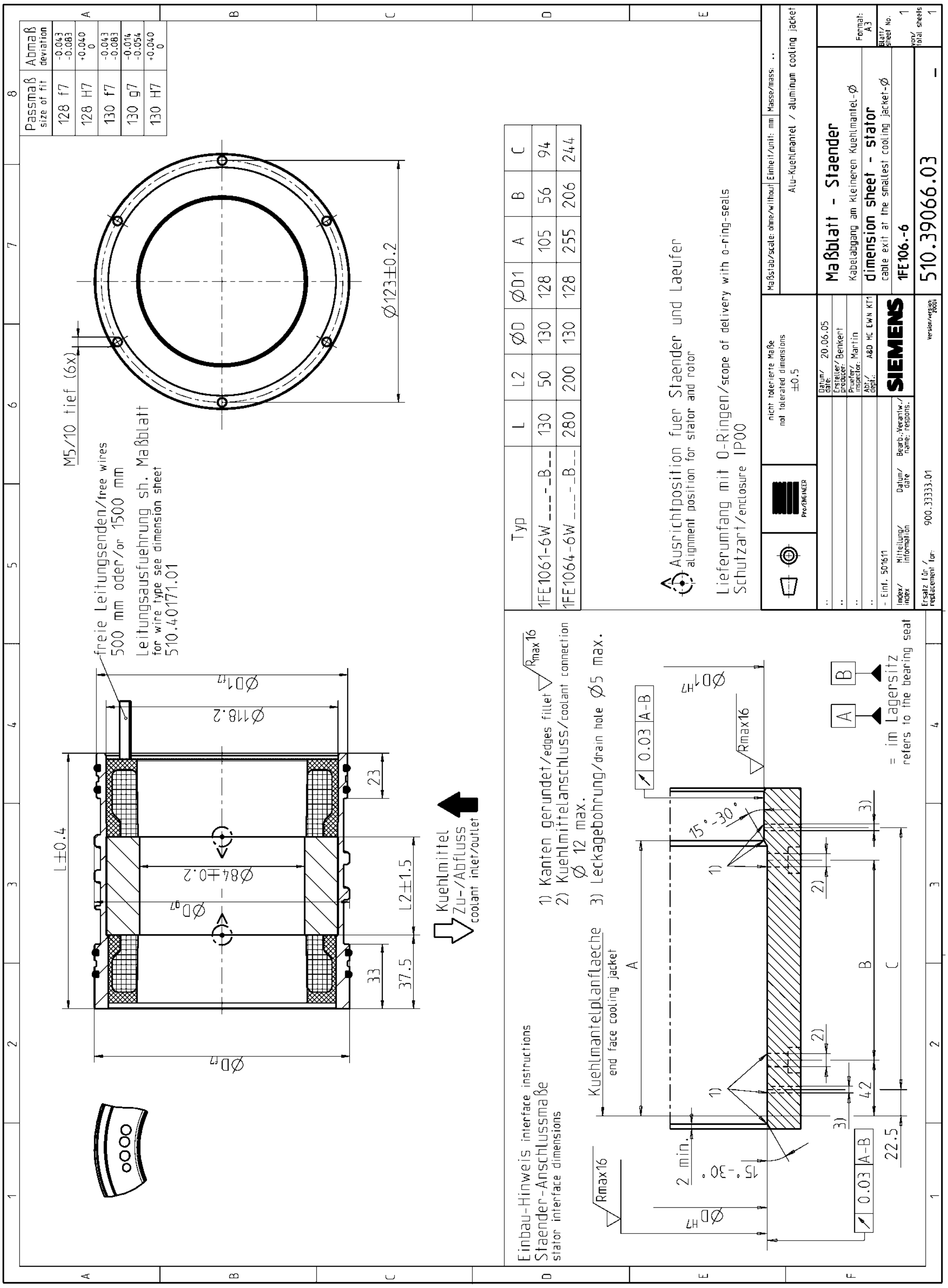


Fig. 6-10 1FE106□–6, stator with cooling jacket, cable outlet at the lower cooling jacket diameter

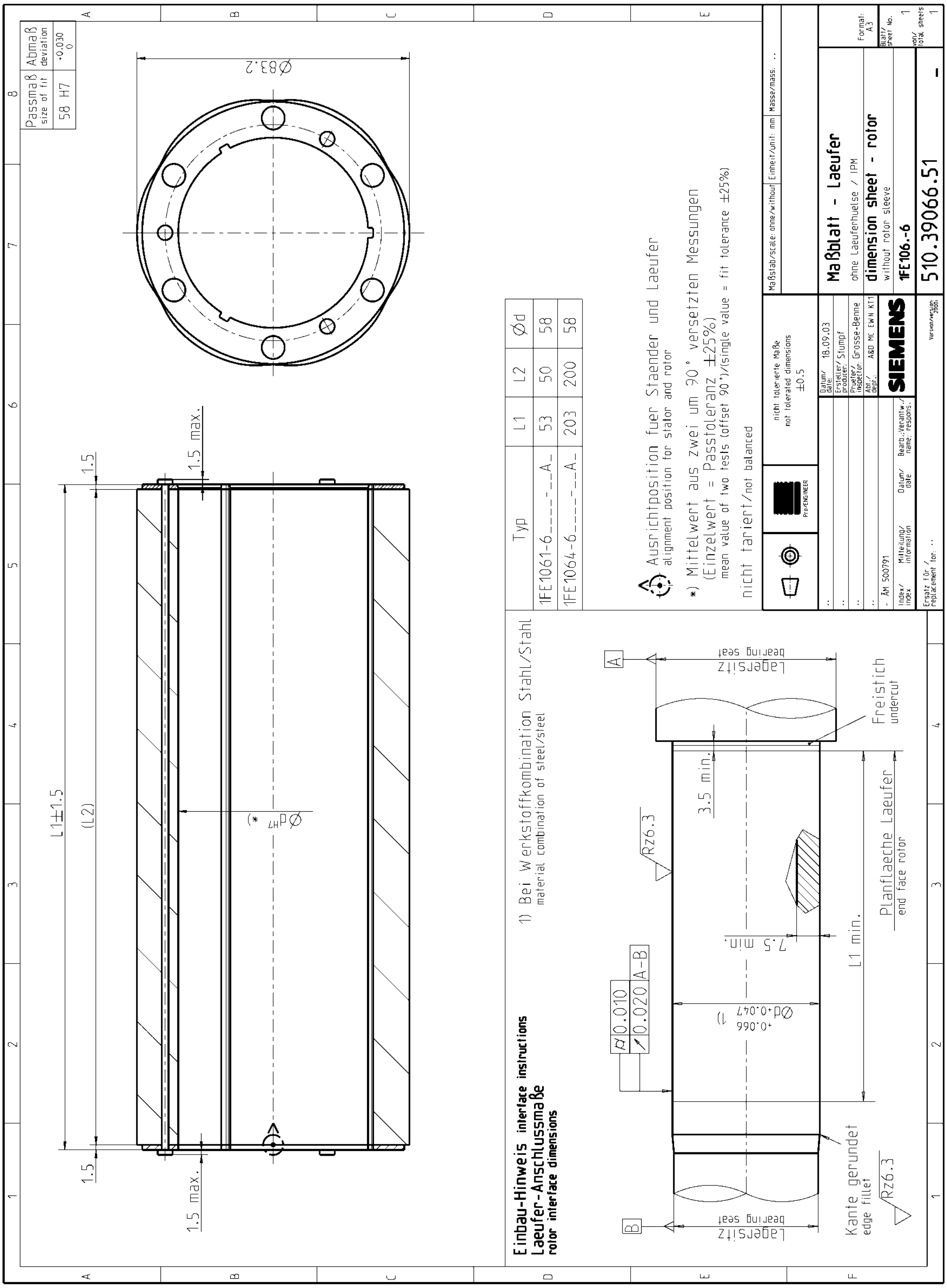


Fig. 6-11 1FE106□–6, rotor without sleeve

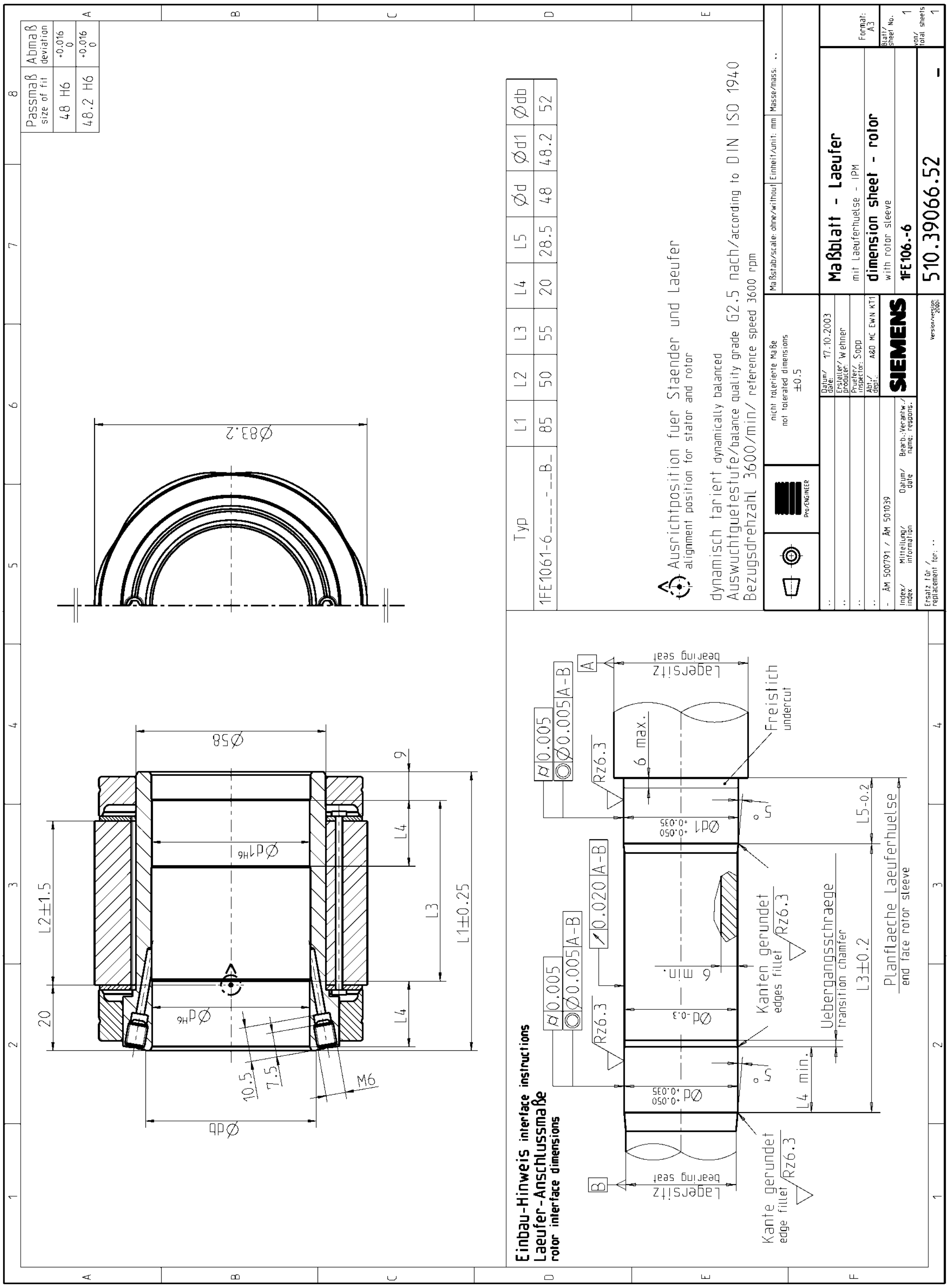


Fig. 6-12 1FE106□–6, rotor with sleeve

6.4 1FE108.–6

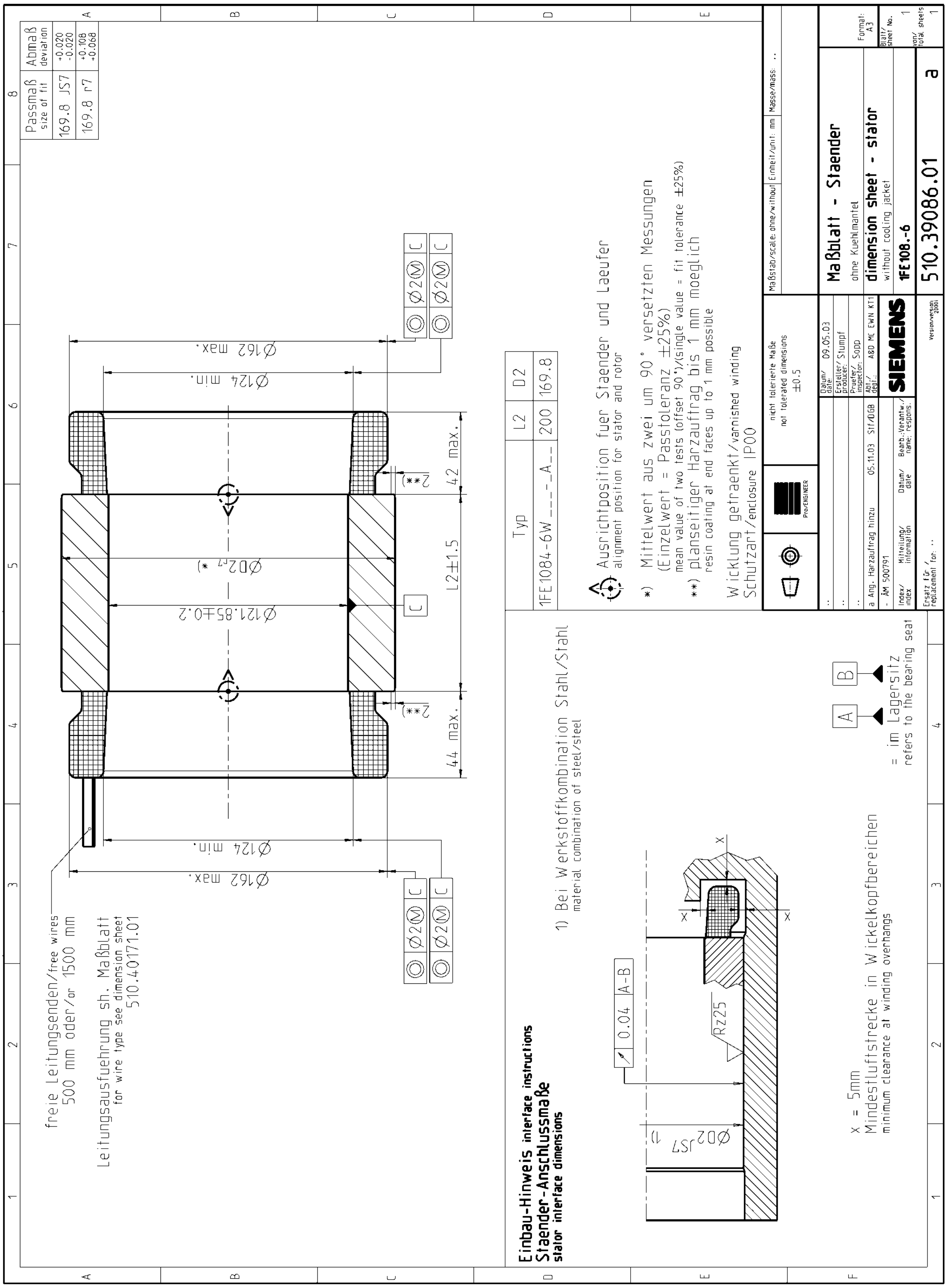


Fig. 6-13 1FE108□–6, stator without cooling jacket

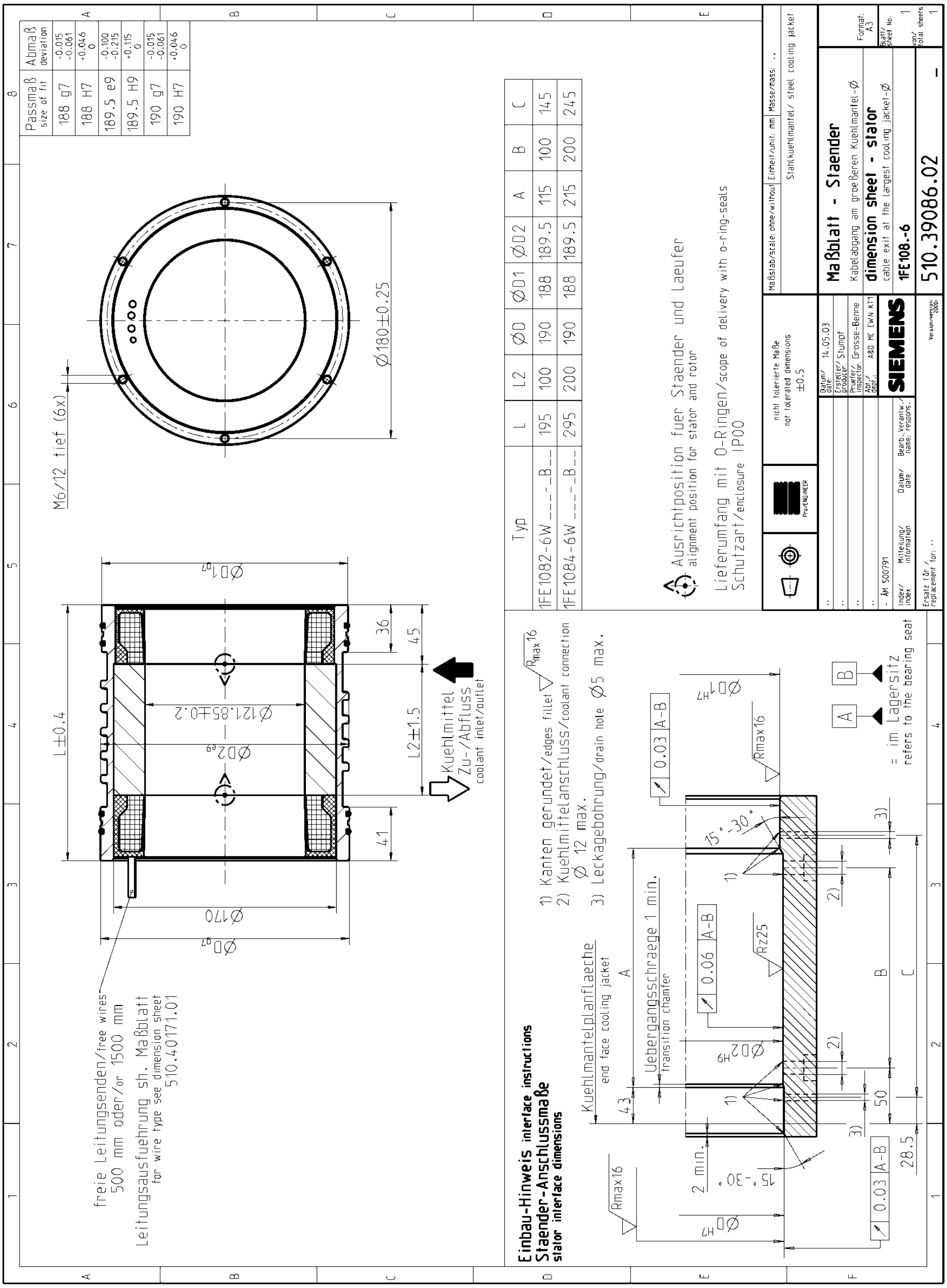


Fig. 6-14 1FE108□–6, stator with cooling jacket, cable outlet at the higher cooling jacket diameter

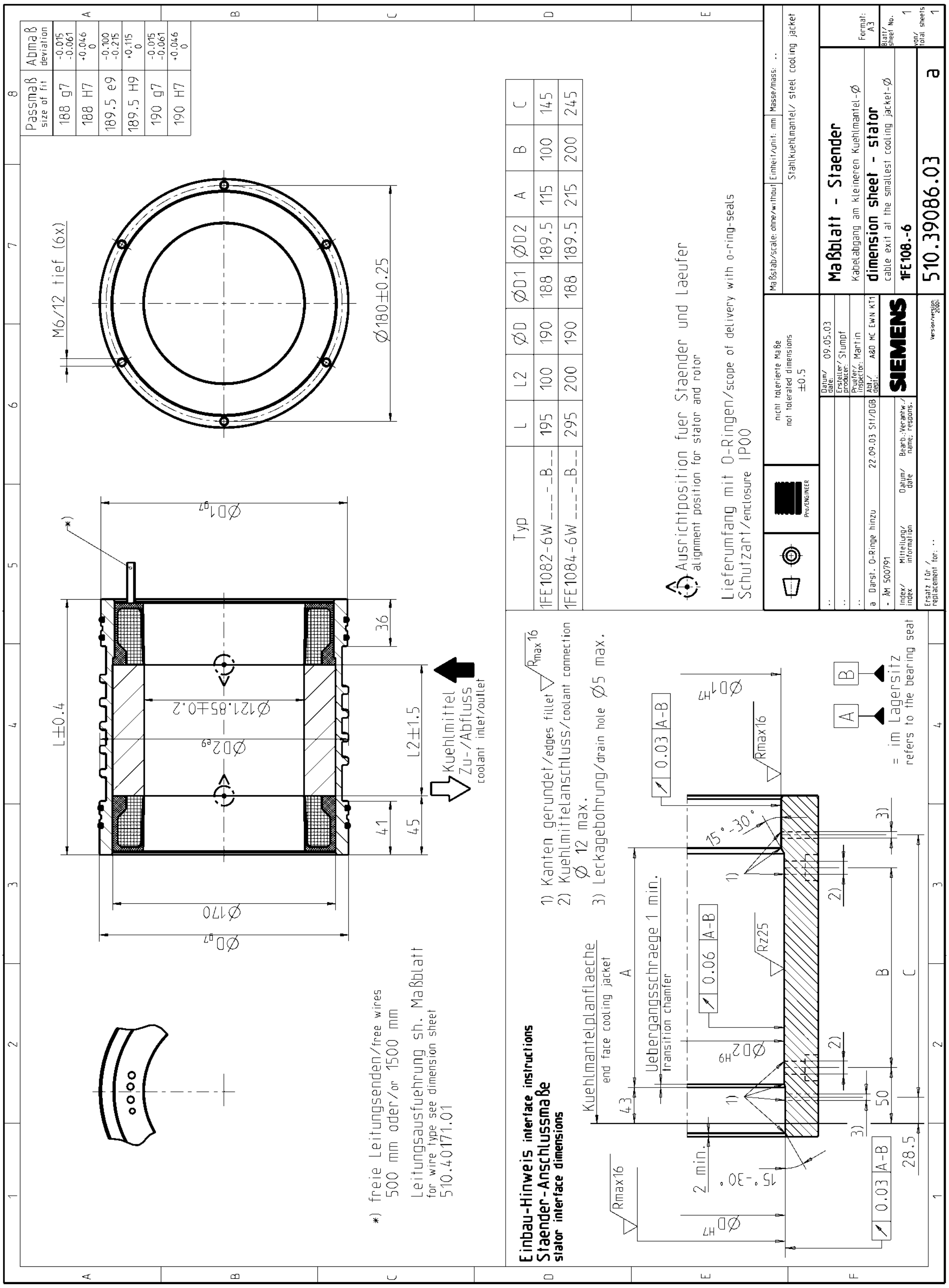


Fig. 6-15 1FE108□–6, stator with cooling jacket, cable outlet at the lower cooling jacket diameter

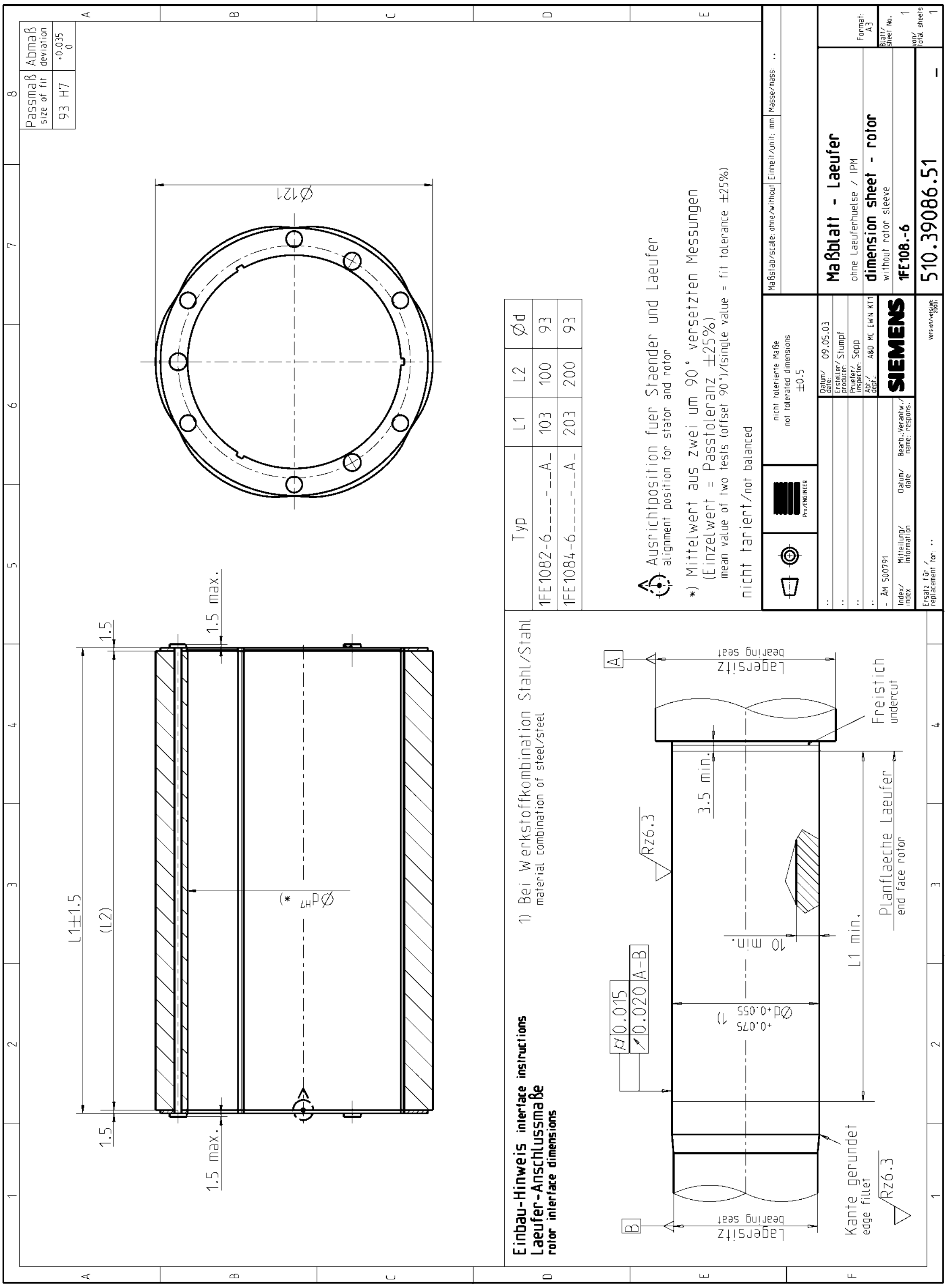


Fig. 6-16 1FE108□–6, rotor without sleeve

6.4 1FE108.–6

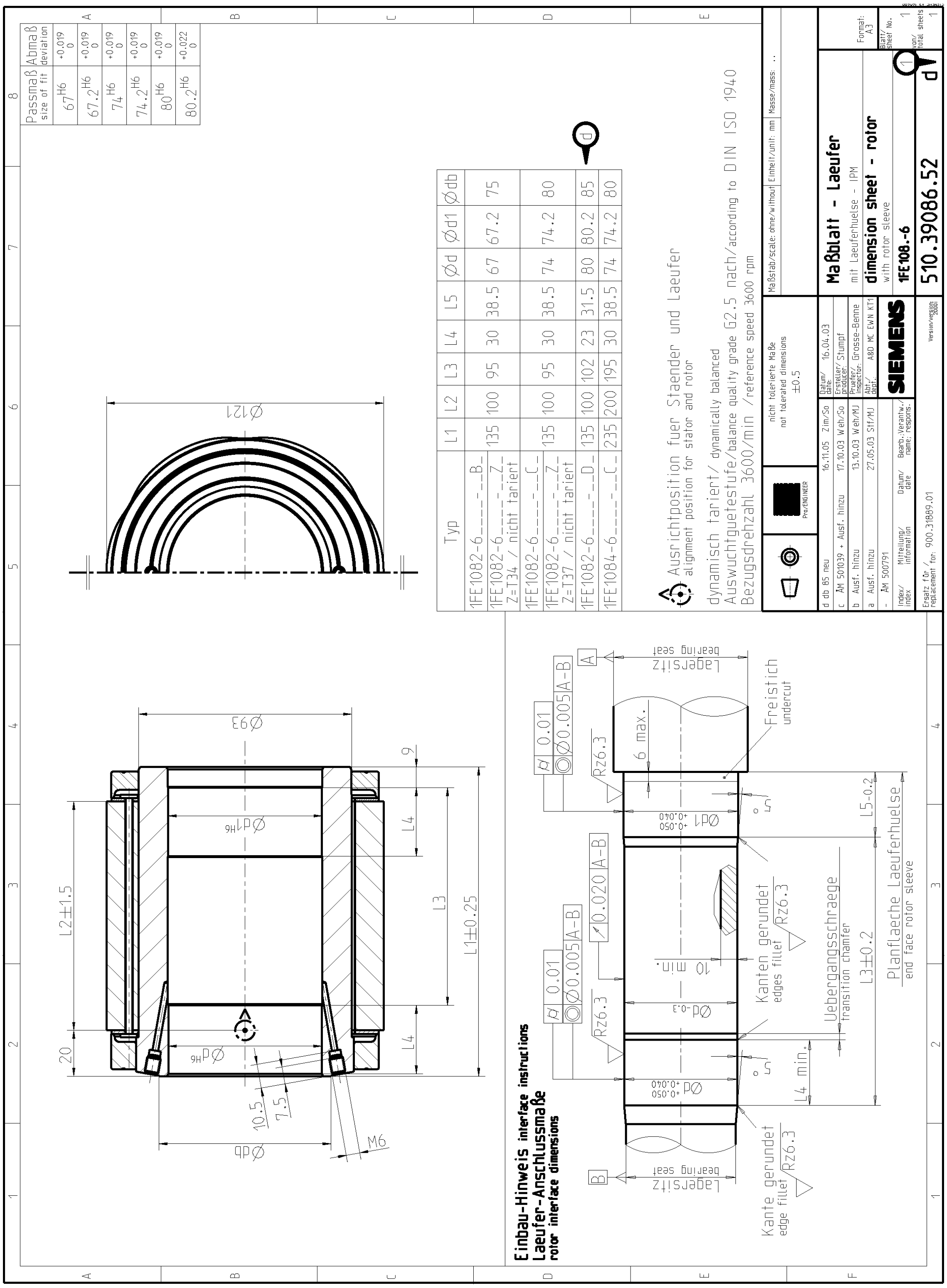


Fig. 6-17 1FE108□–6, rotor with sleeve

6.5 1FE109.–6

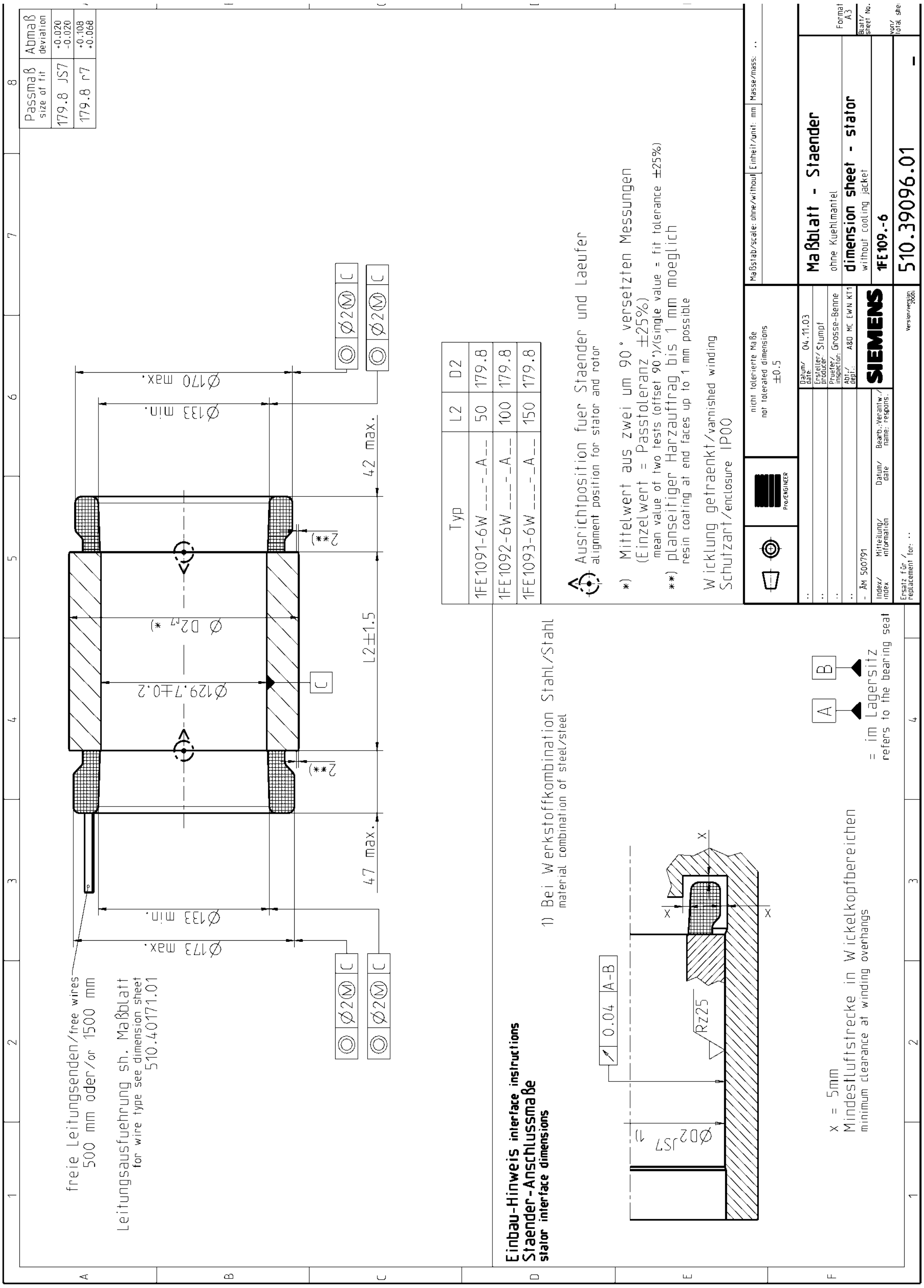


Fig. 6-18 1FE109□–6, stator without cooling jacket

6.5 1FE109.–6

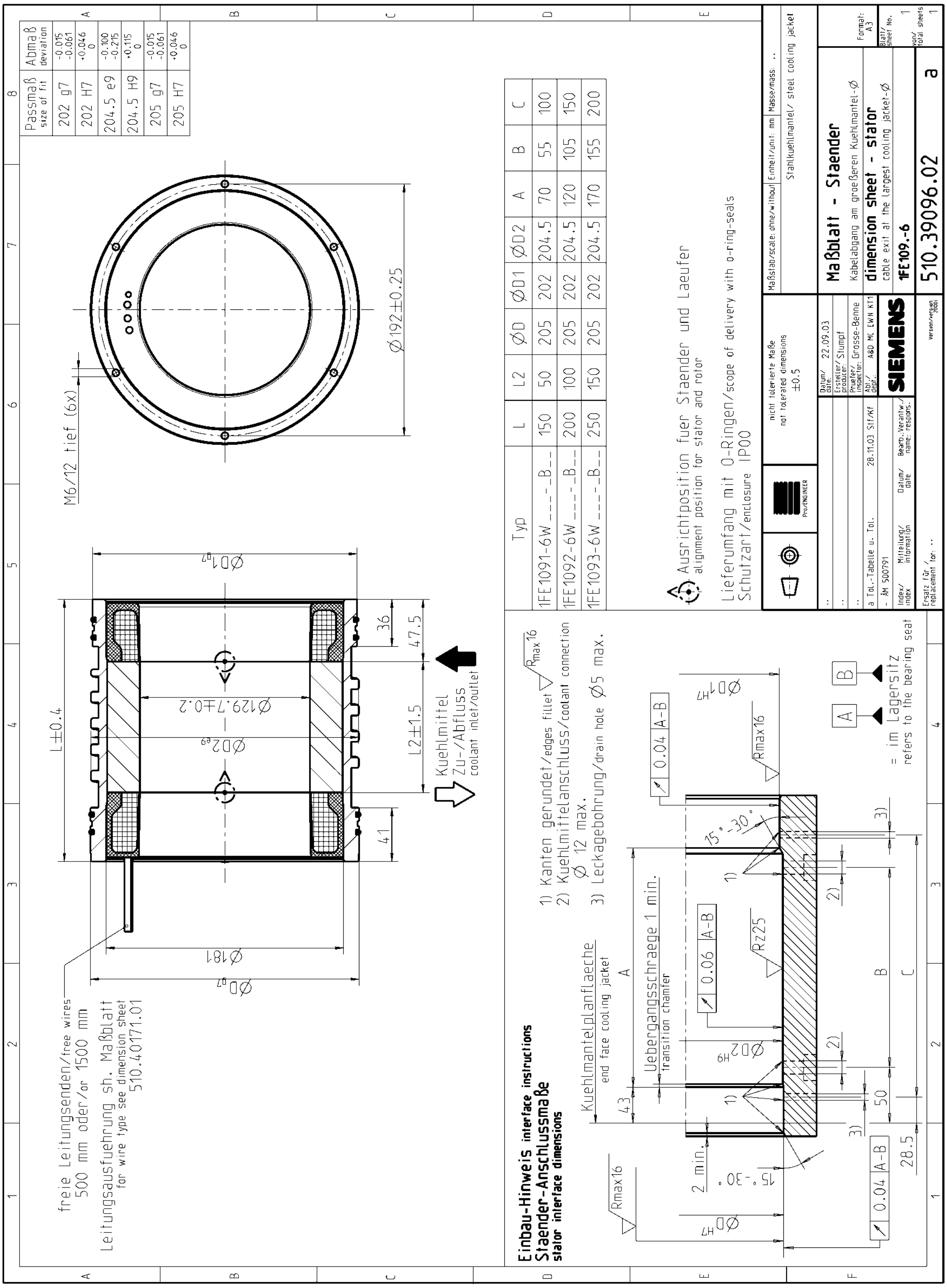


Fig. 6-19 1FE109□–6, stator with cooling jacket, cable outlet at the higher cooling jacket diameter

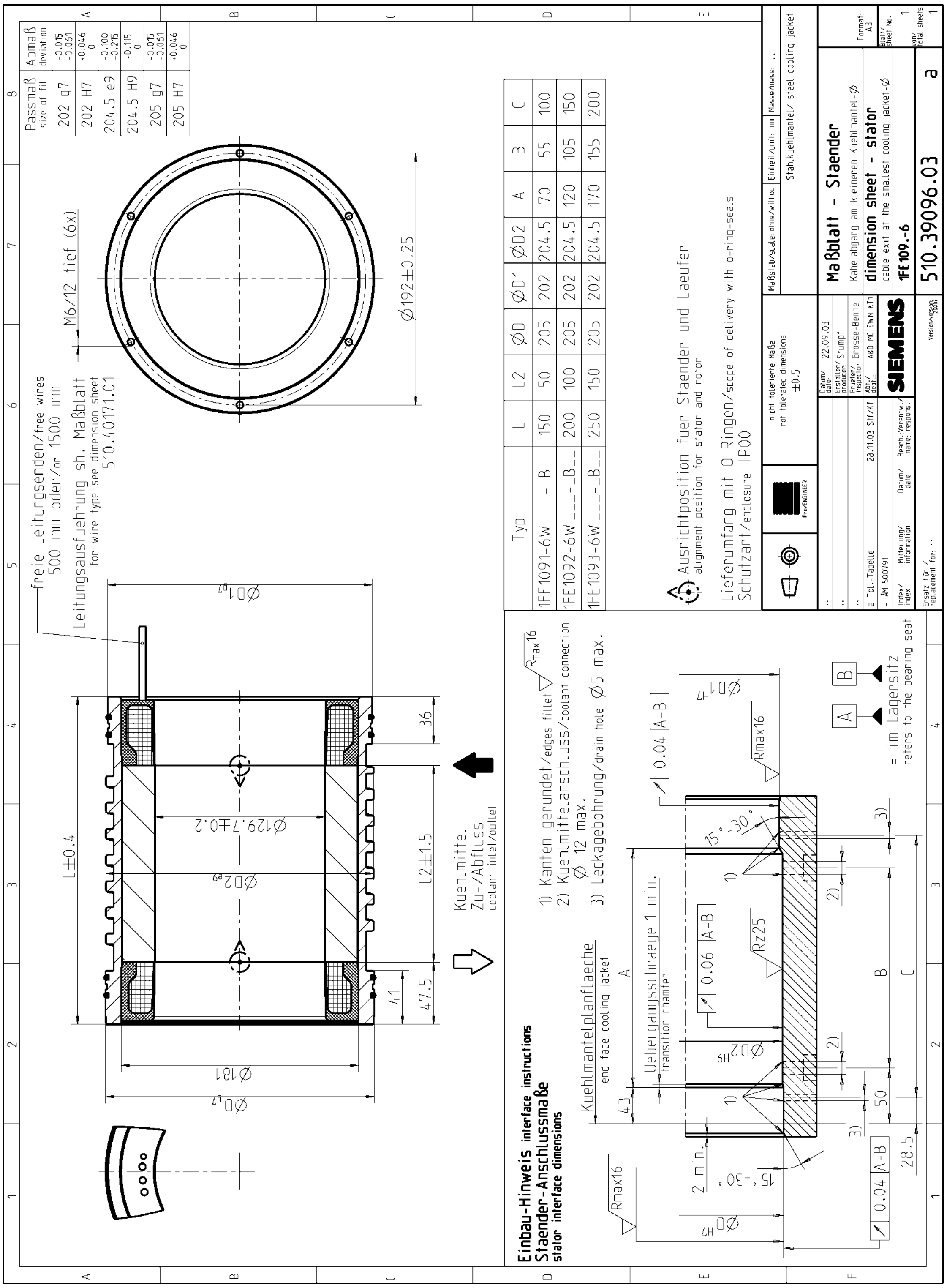


Fig. 6-20 1FE109□–6, stator with cooling jacket, cable outlet at the lower cooling jacket diameter

6.5 1FE109.–6

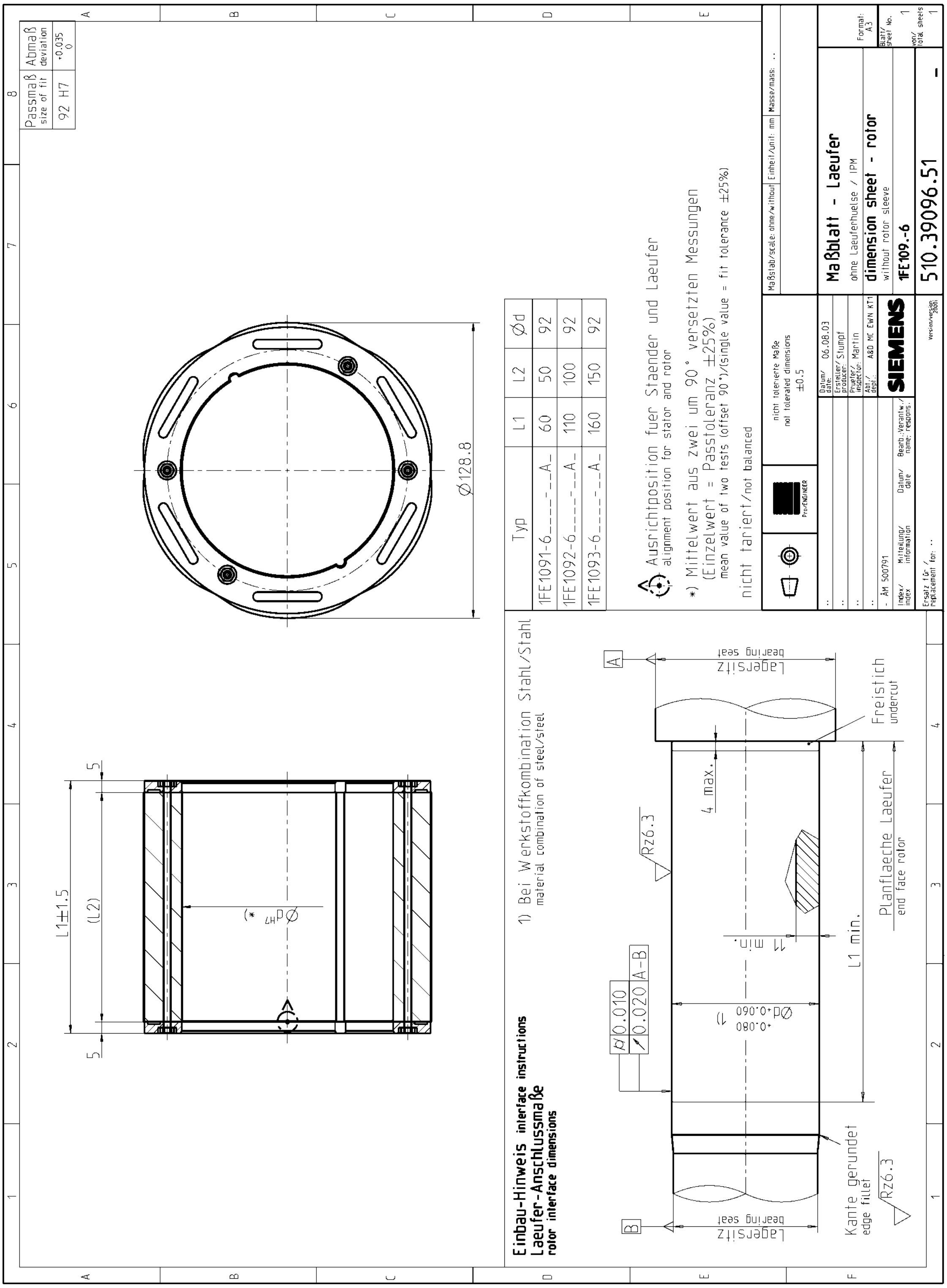


Fig. 6-21 1FE109□–6, rotor without sleeve

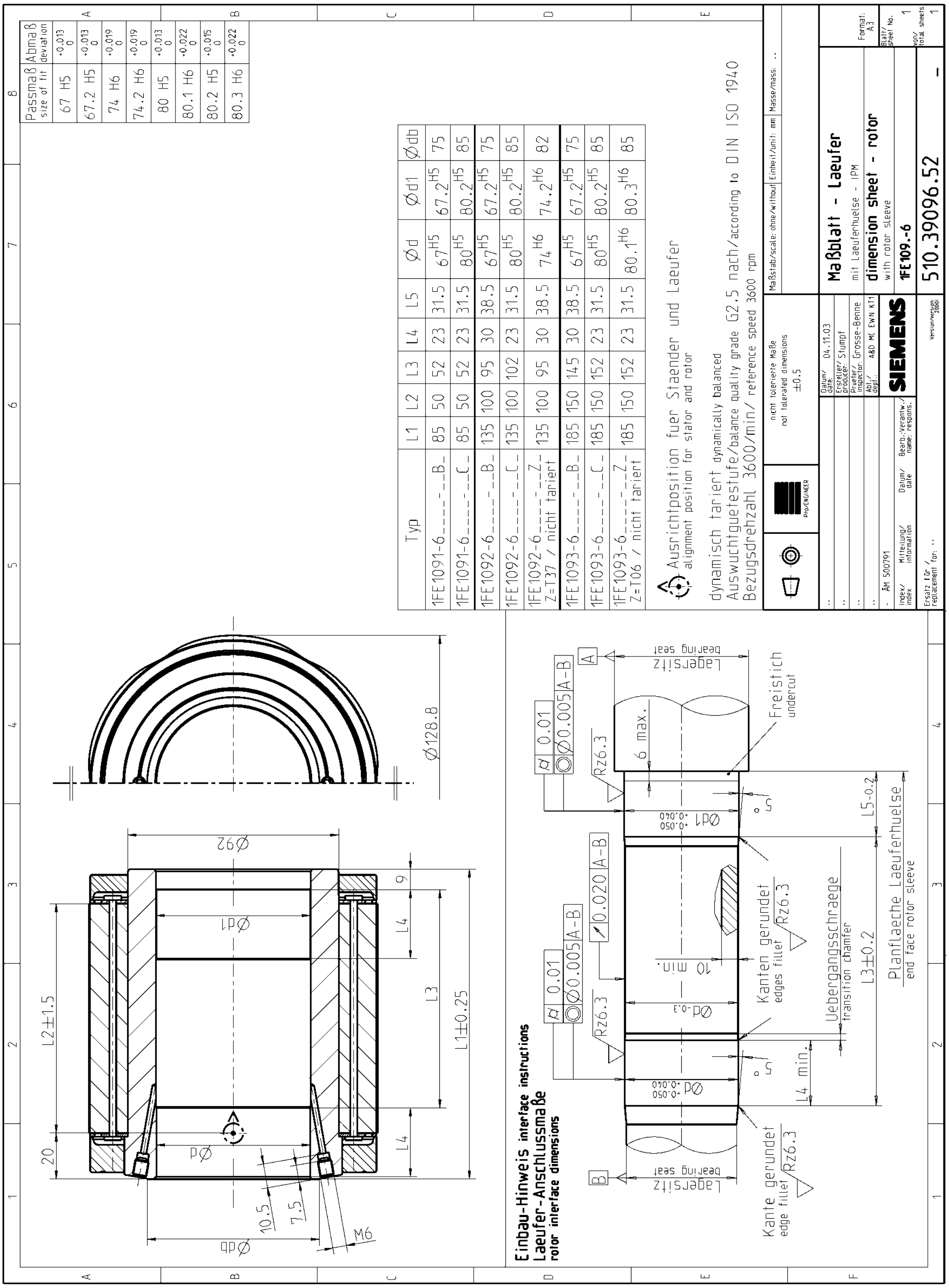


Fig. 6-22 1FE109□–6, rotor with sleeve

6.6 1FE111.–6

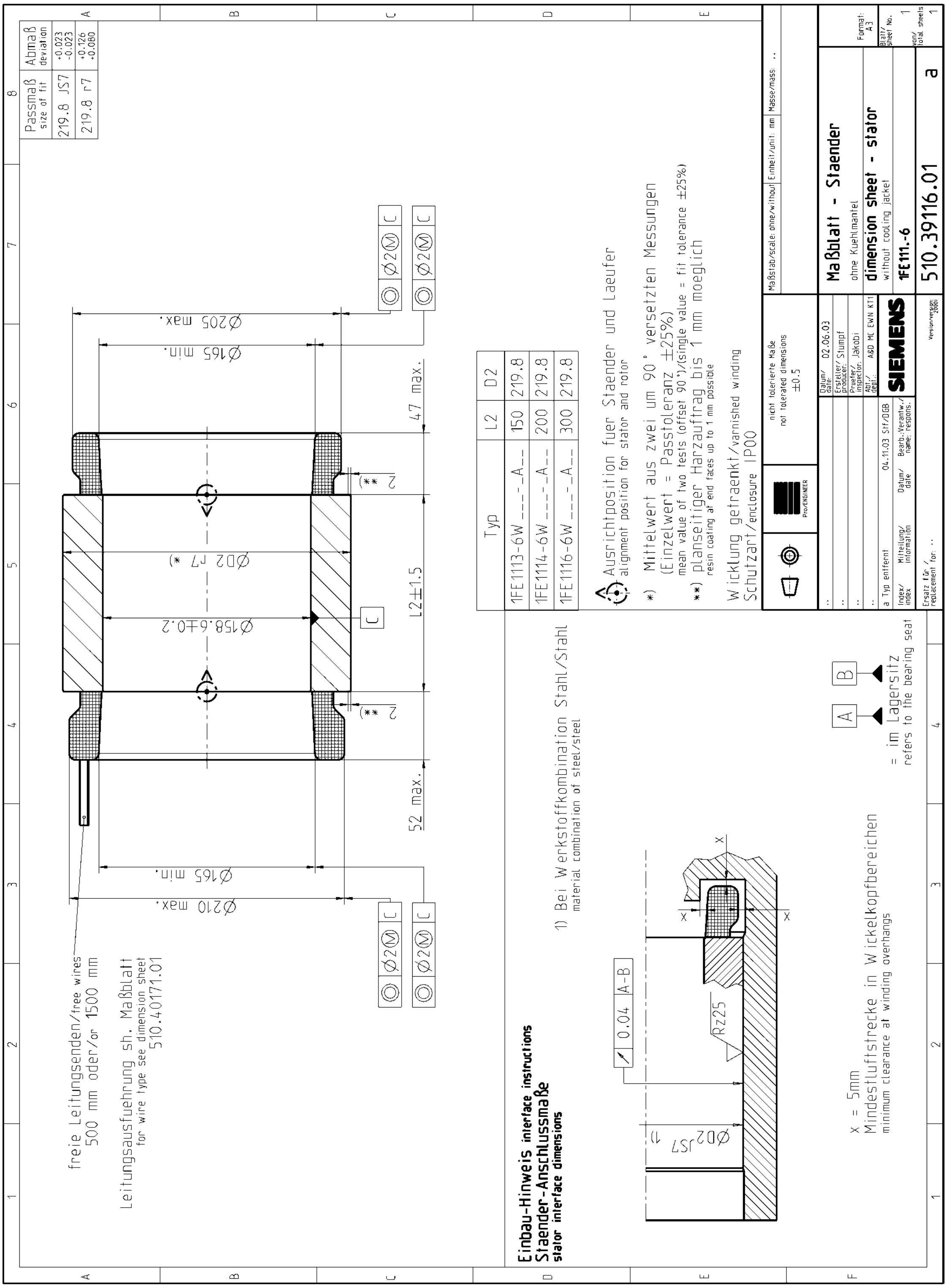


Fig. 6-23 1FE111□–6, stator without cooling jacket

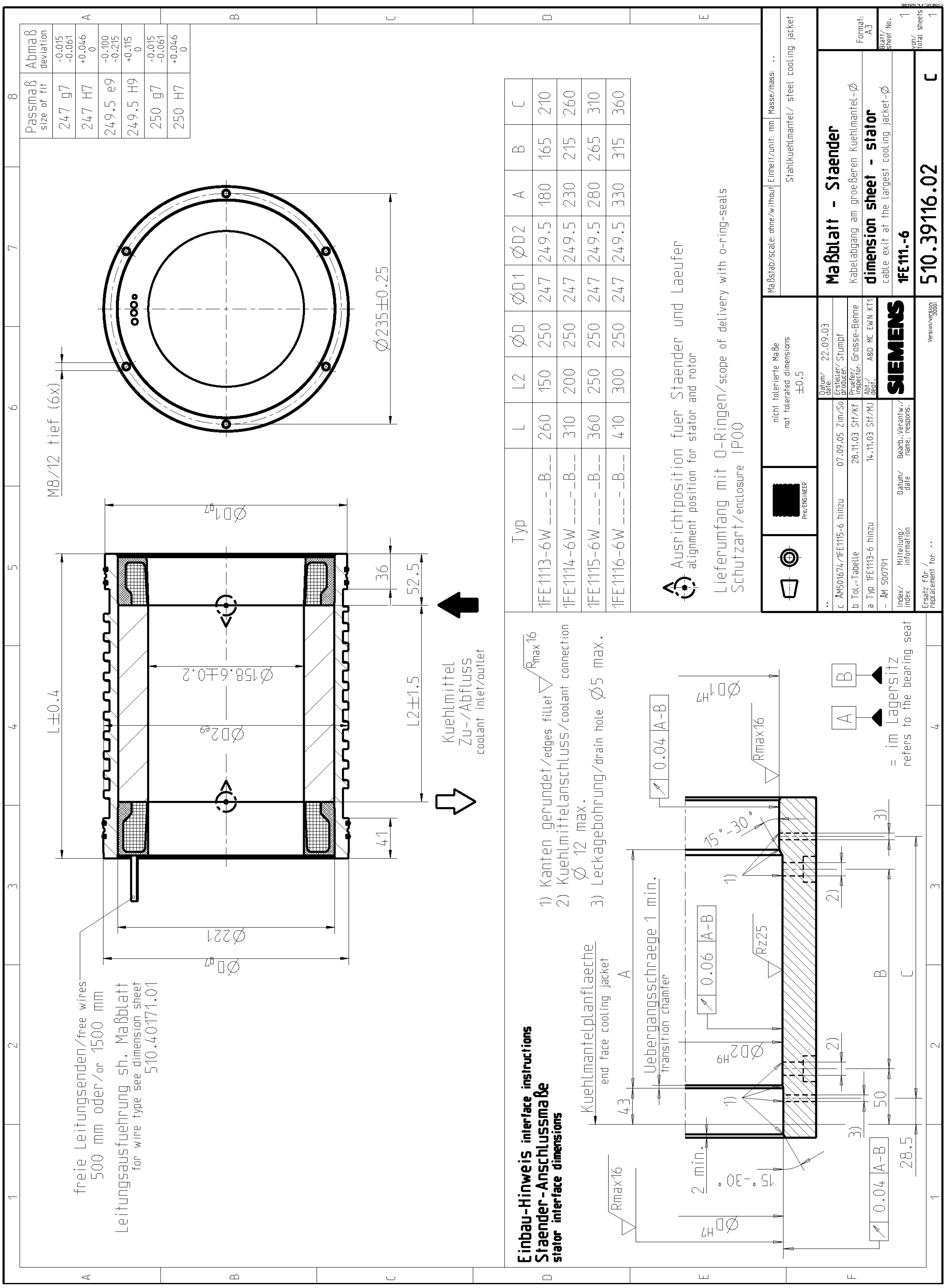


Fig. 6-24 1FE111□–6, stator with cooling jacket, cable outlet at the higher cooling jacket diameter

6.6 1FE111.–6

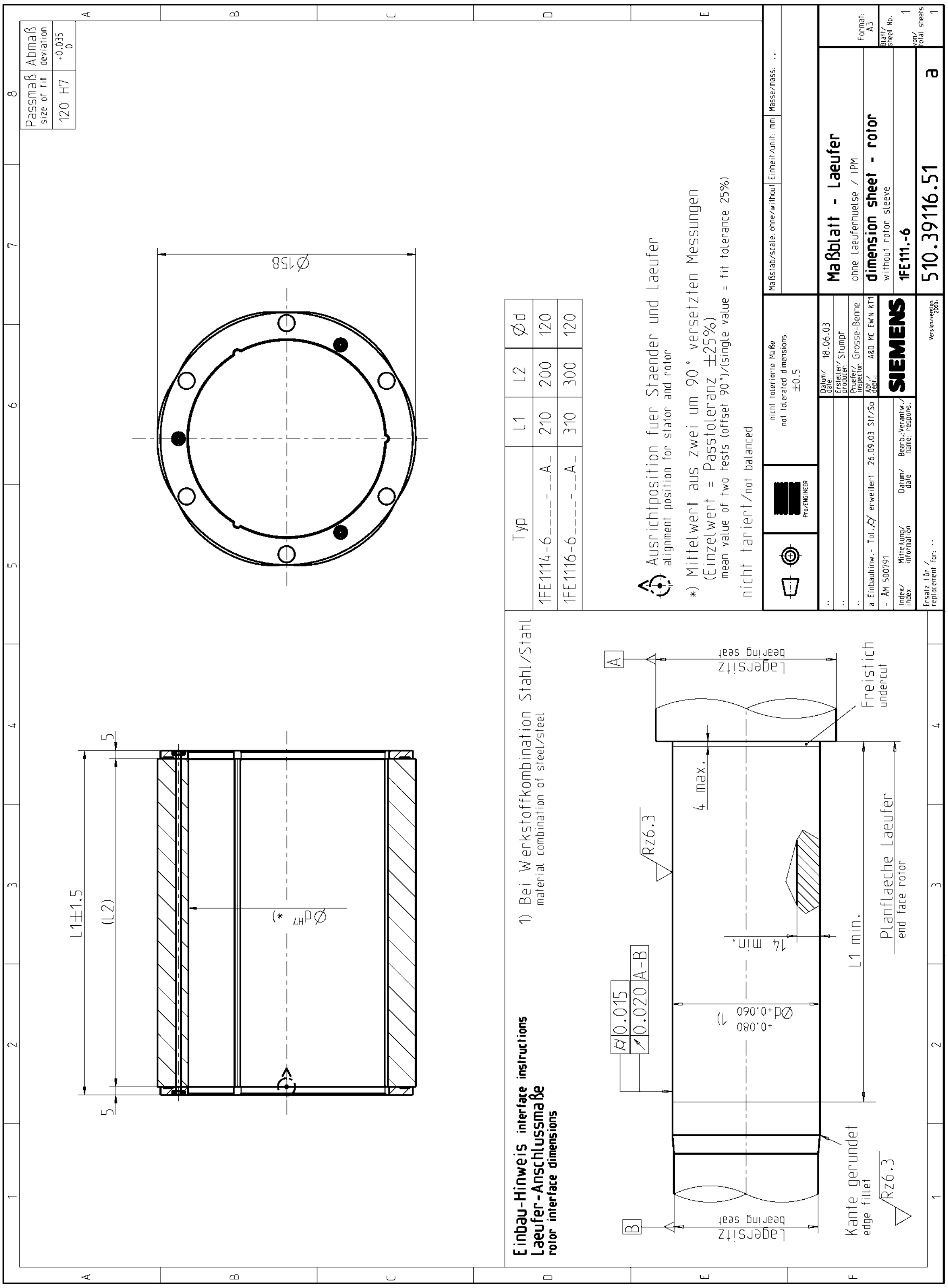


Fig. 6-25 1FE111□–6, rotor without sleeve

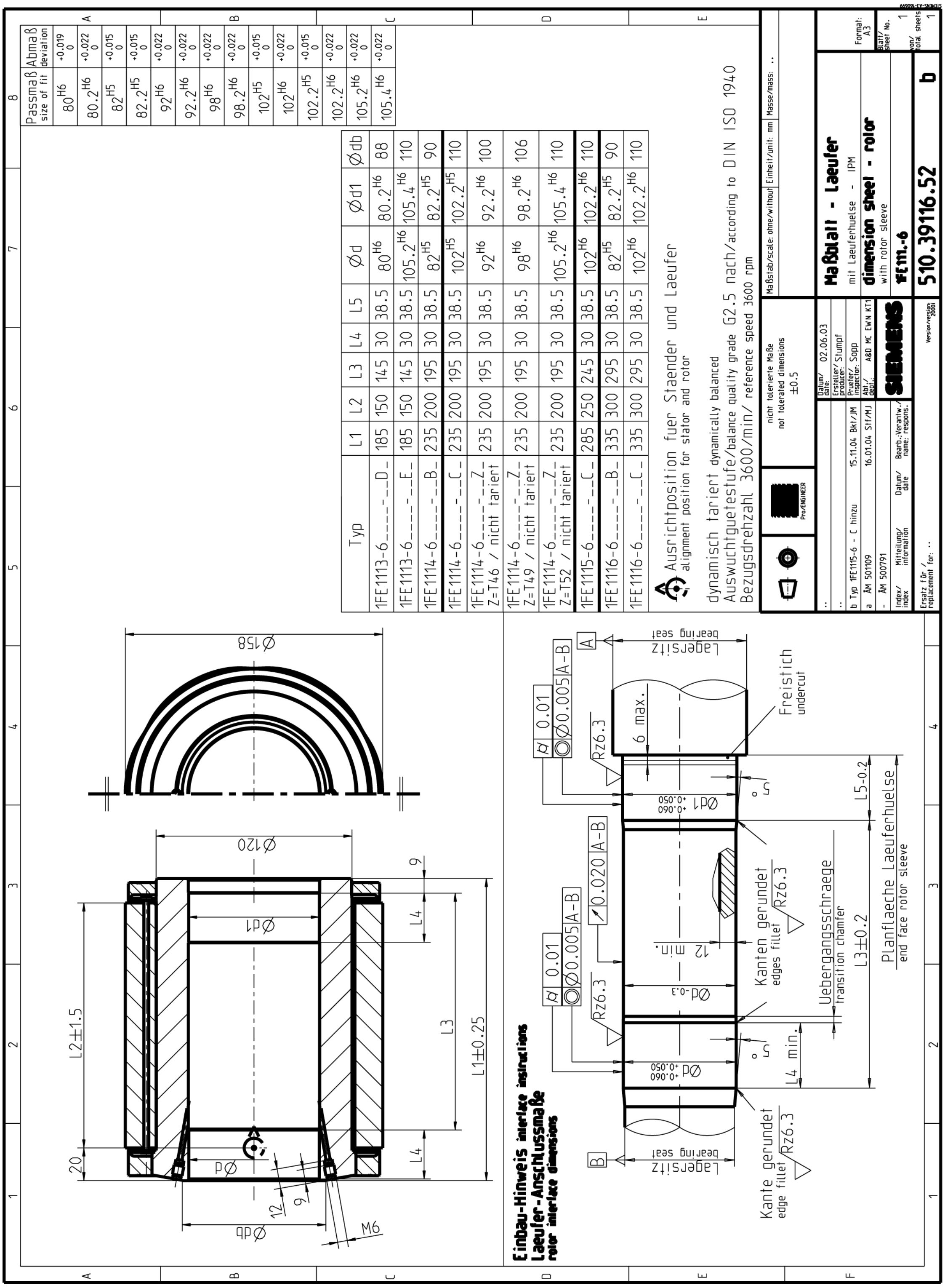


Fig. 6-26 1FE111□–6, rotor with sleeve

6.7 1FE114.–8

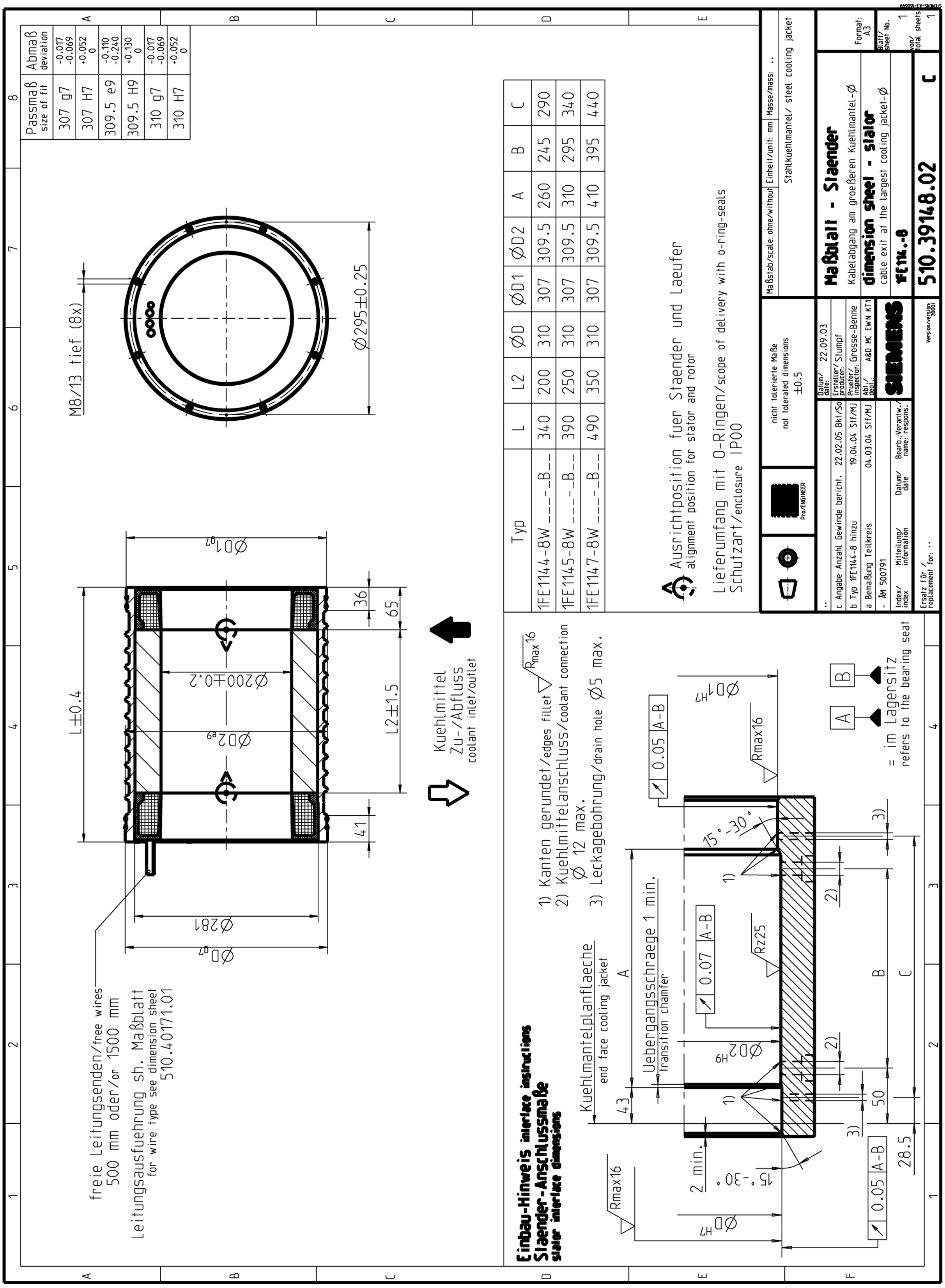


Fig. 6-27 1FE114□–8, stator with cooling jacket, cable outlet at the higher cooling jacket diameter

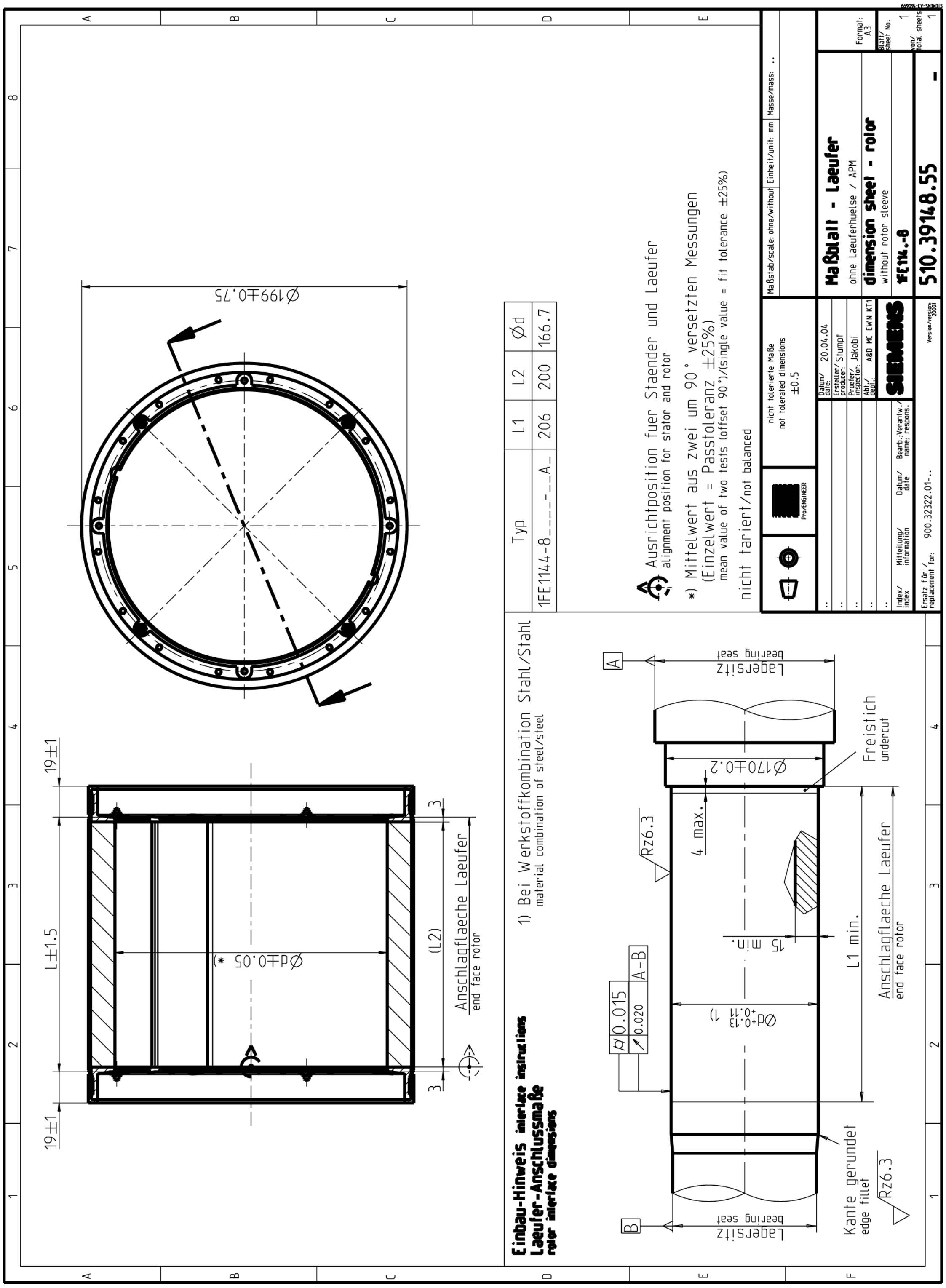


Fig. 6-28 1FE114□–8, rotor without sleeve

6.7 1FE114.–8

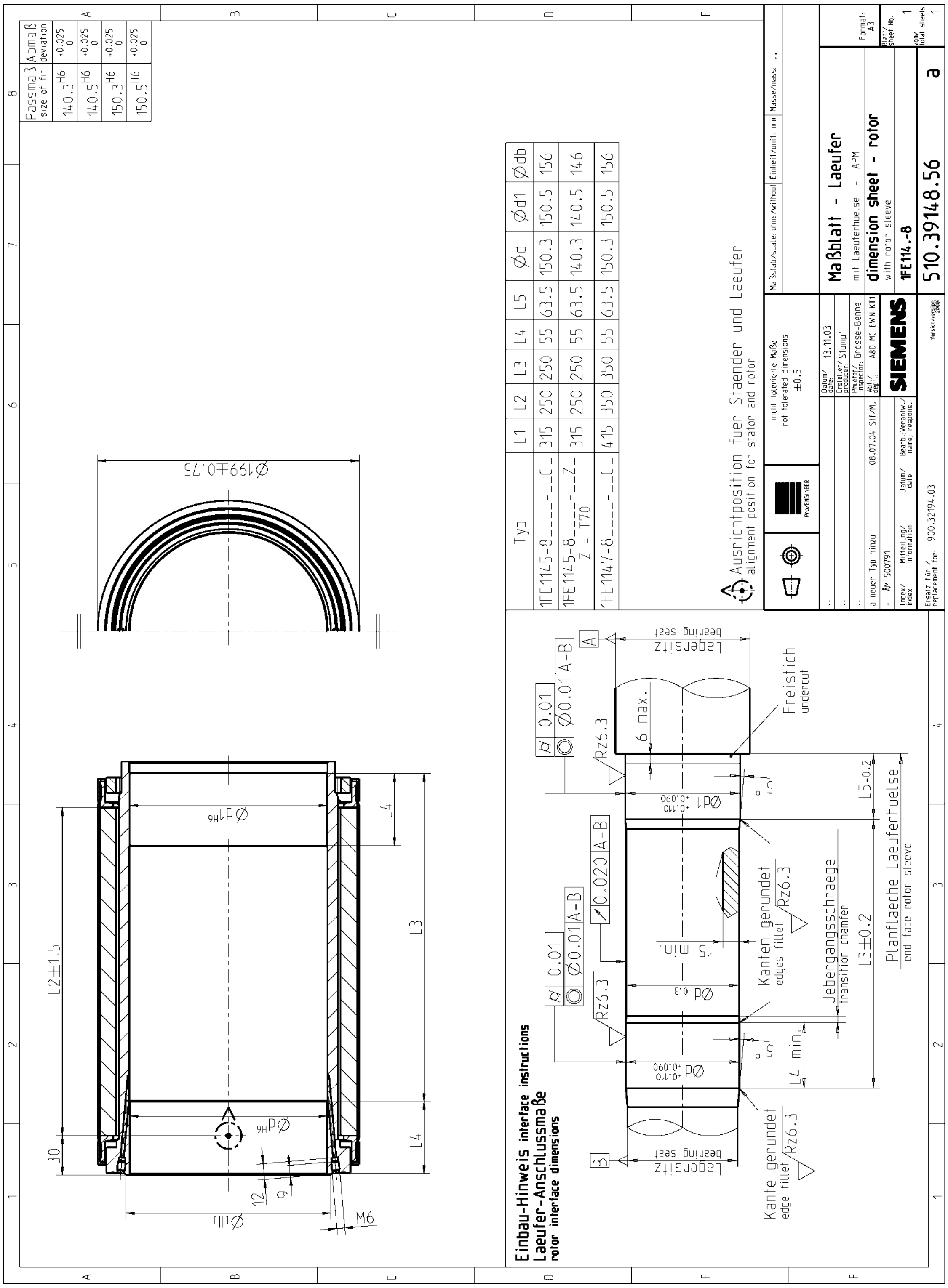


Fig. 6-29 1FE114□–8, rotor with sleeve

6.8 1FE105.–4

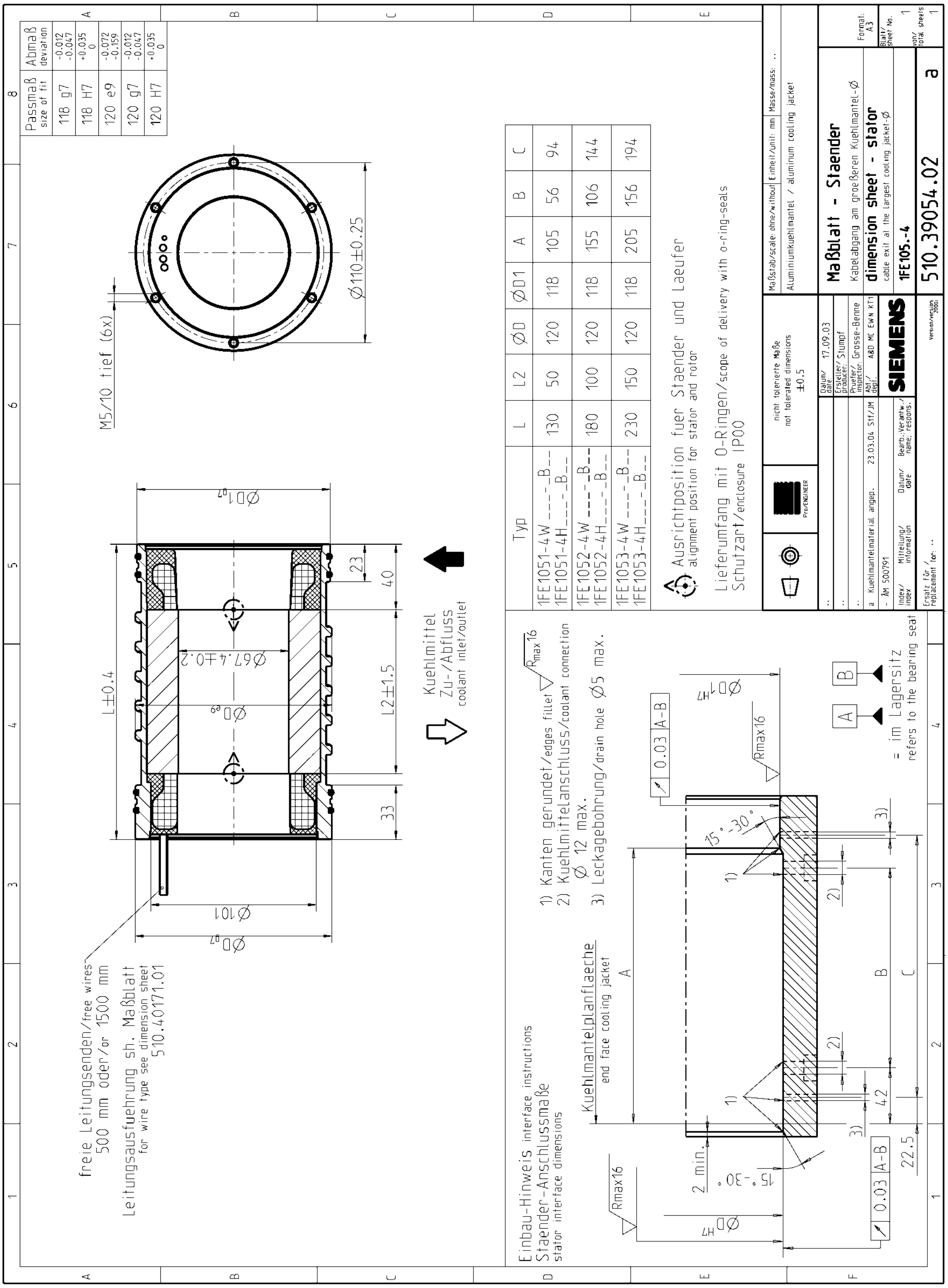


Fig. 6-30 1FE105□–4, stator with cooling jacket, cable outlet at the higher cooling jacket diameter

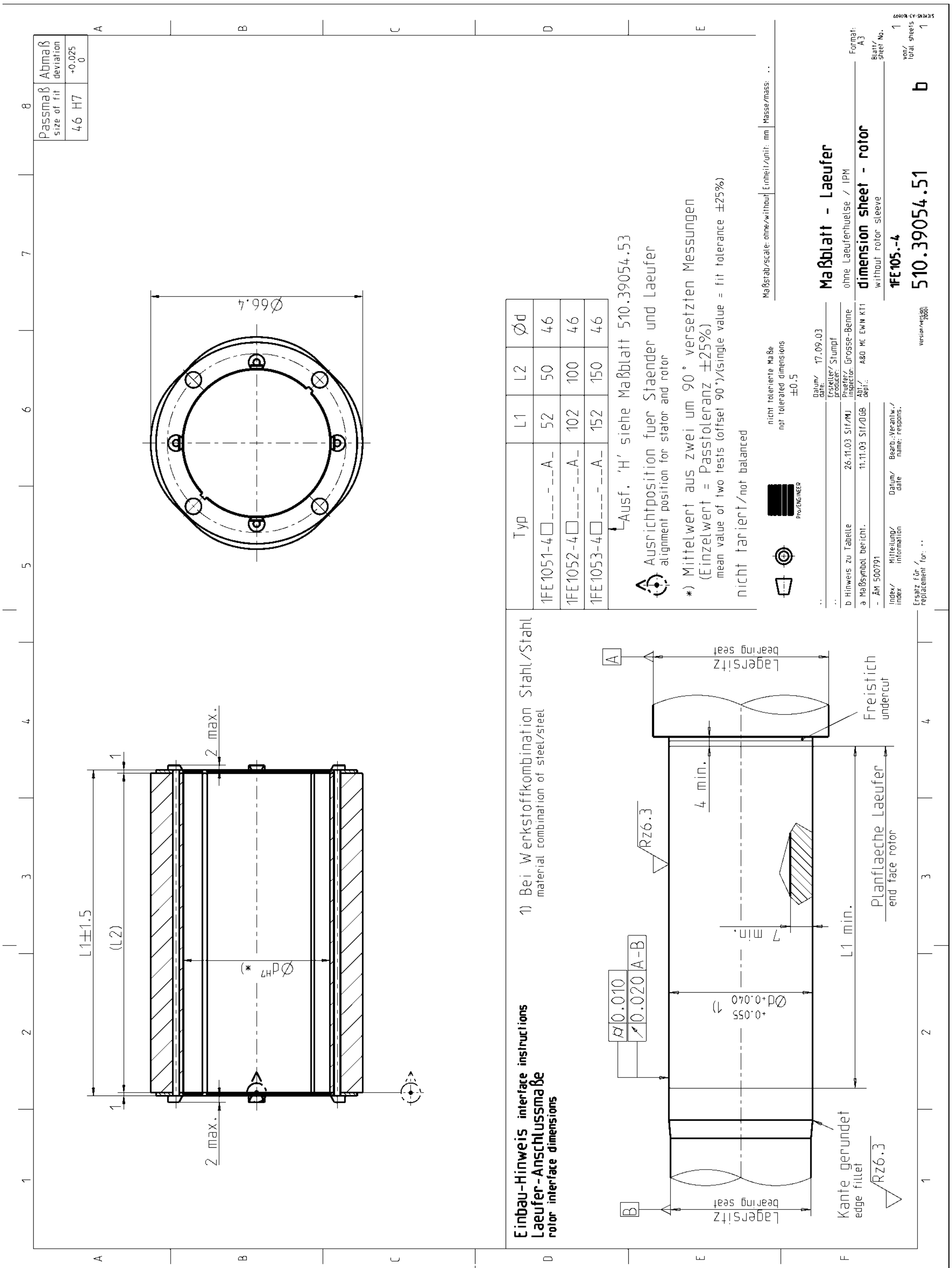


Fig. 6-31 1FE105□–4, rotor without sleeve

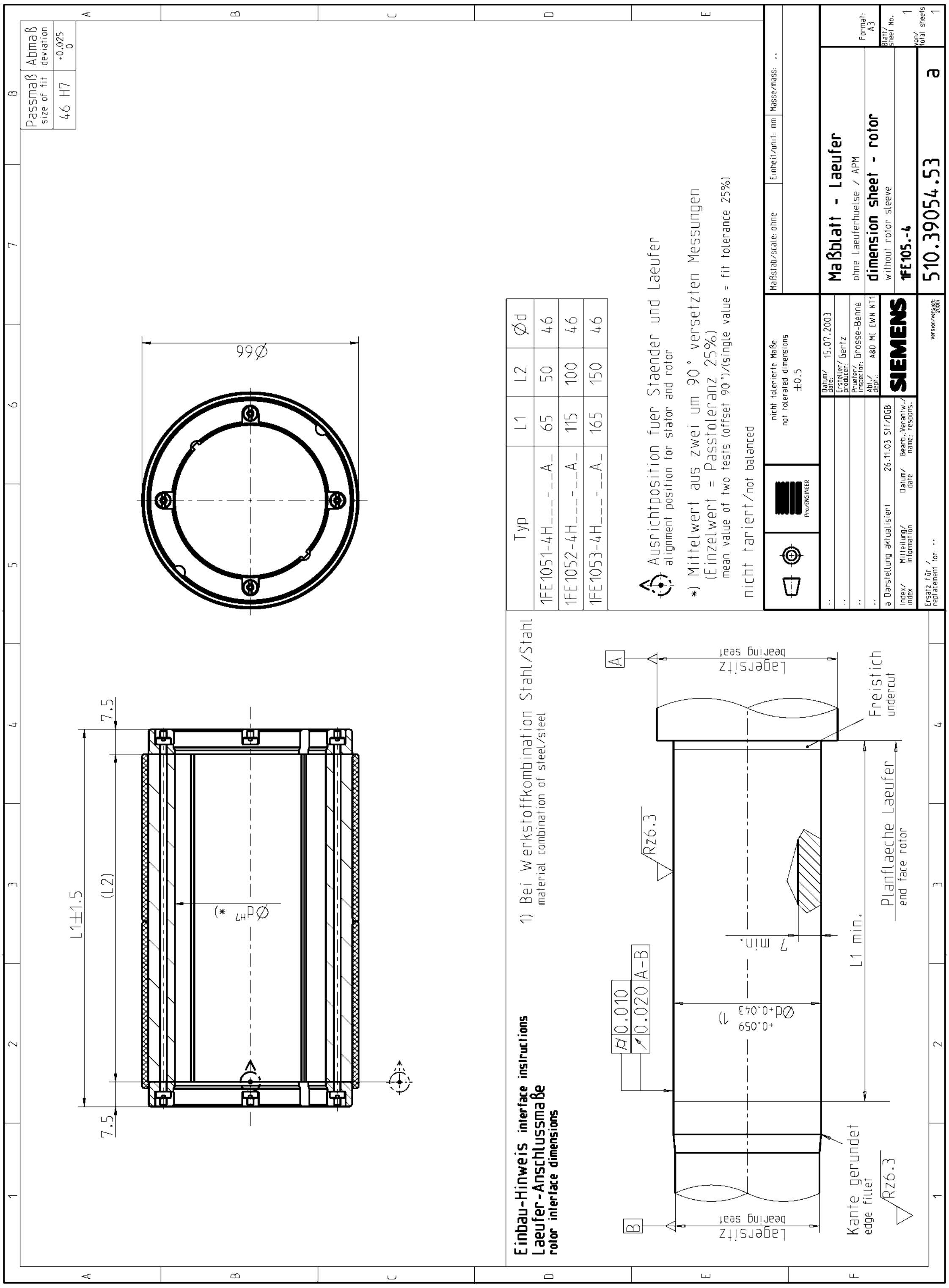


Fig. 6-32 1FE105□–4, rotor without sleeve High Speed 2

6.9 1FE107.–4

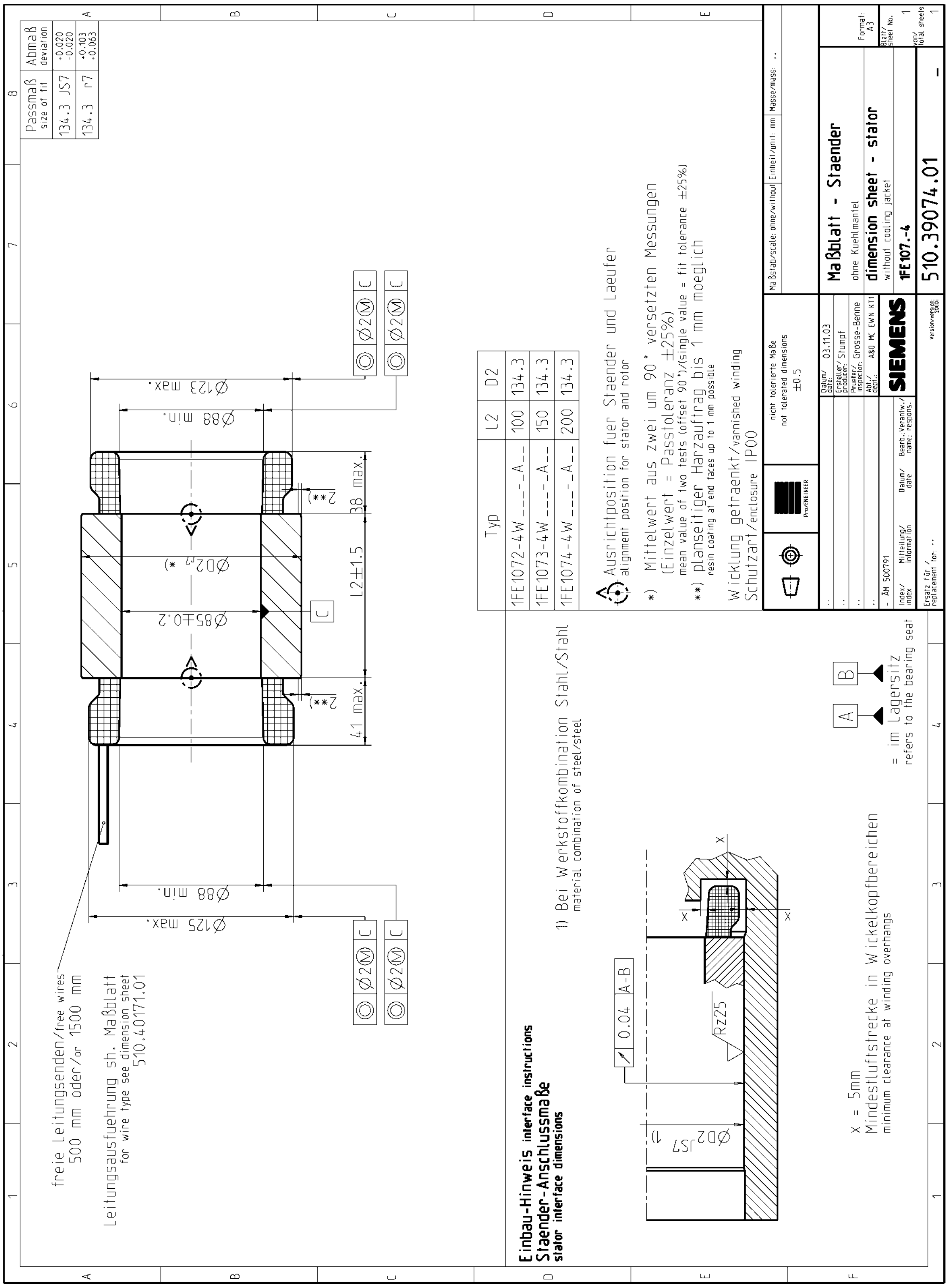


Fig. 6-33 1FE107□–4, stator without cooling jacket

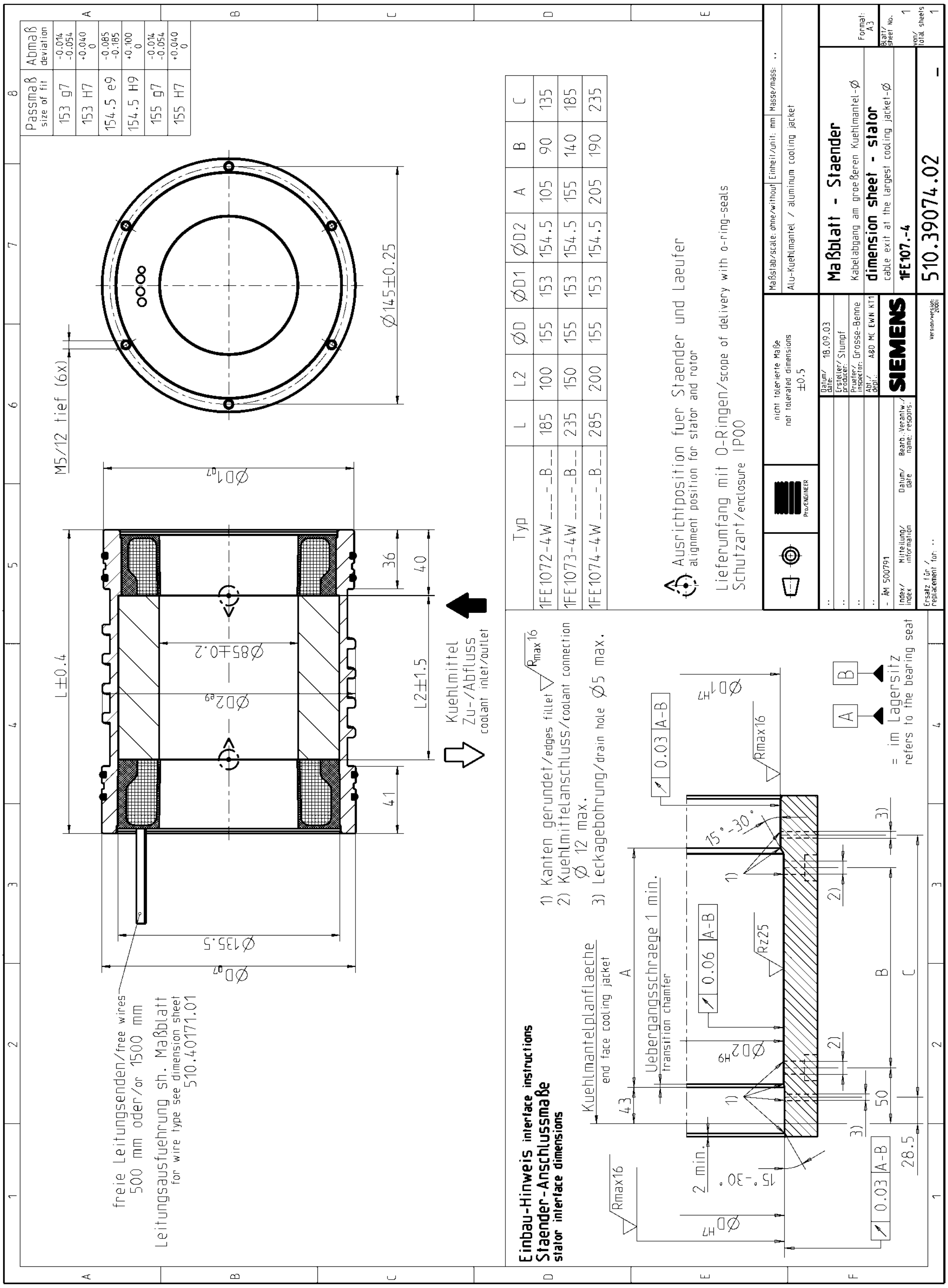


Fig. 6-34 1FE107□–4, stator with cooling jacket, cable outlet at the higher cooling jacket diameter

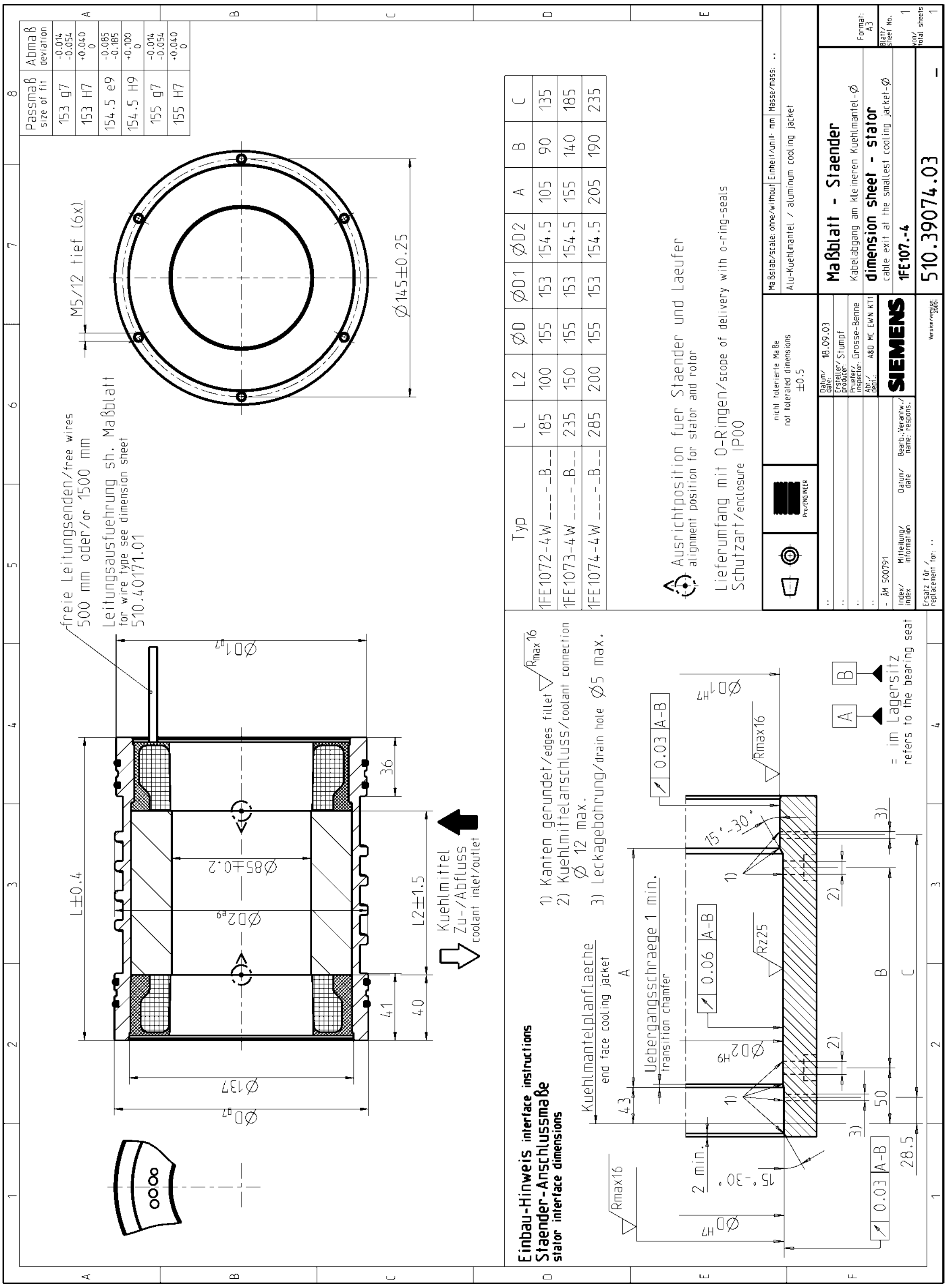


Fig. 6-35 1FE107□–4, stator with cooling jacket, cable outlet at the lower cooling jacket diameter

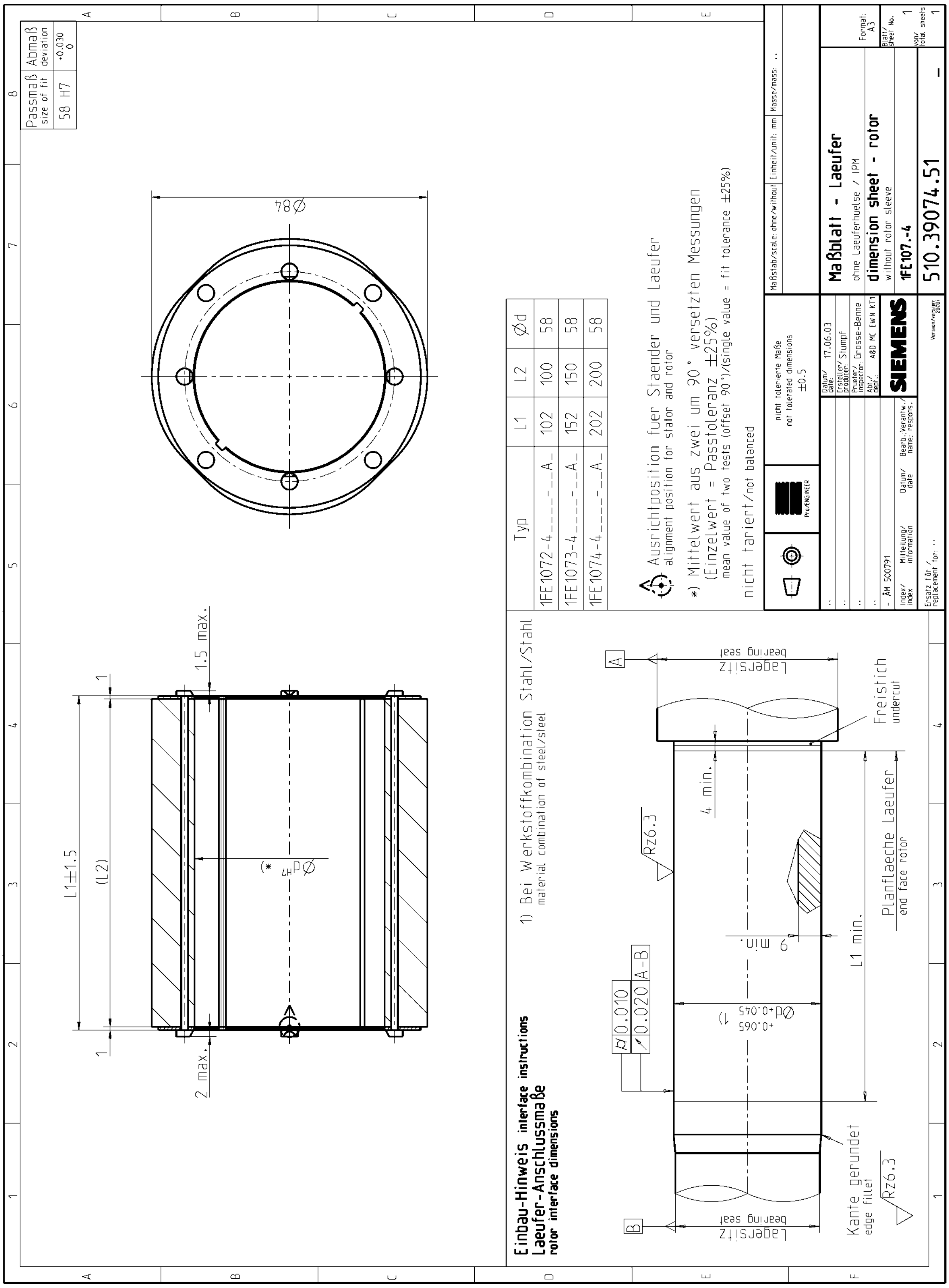


Fig. 6-36 1FE107□–4, rotor without sleeve

6.10 1FE108.–4

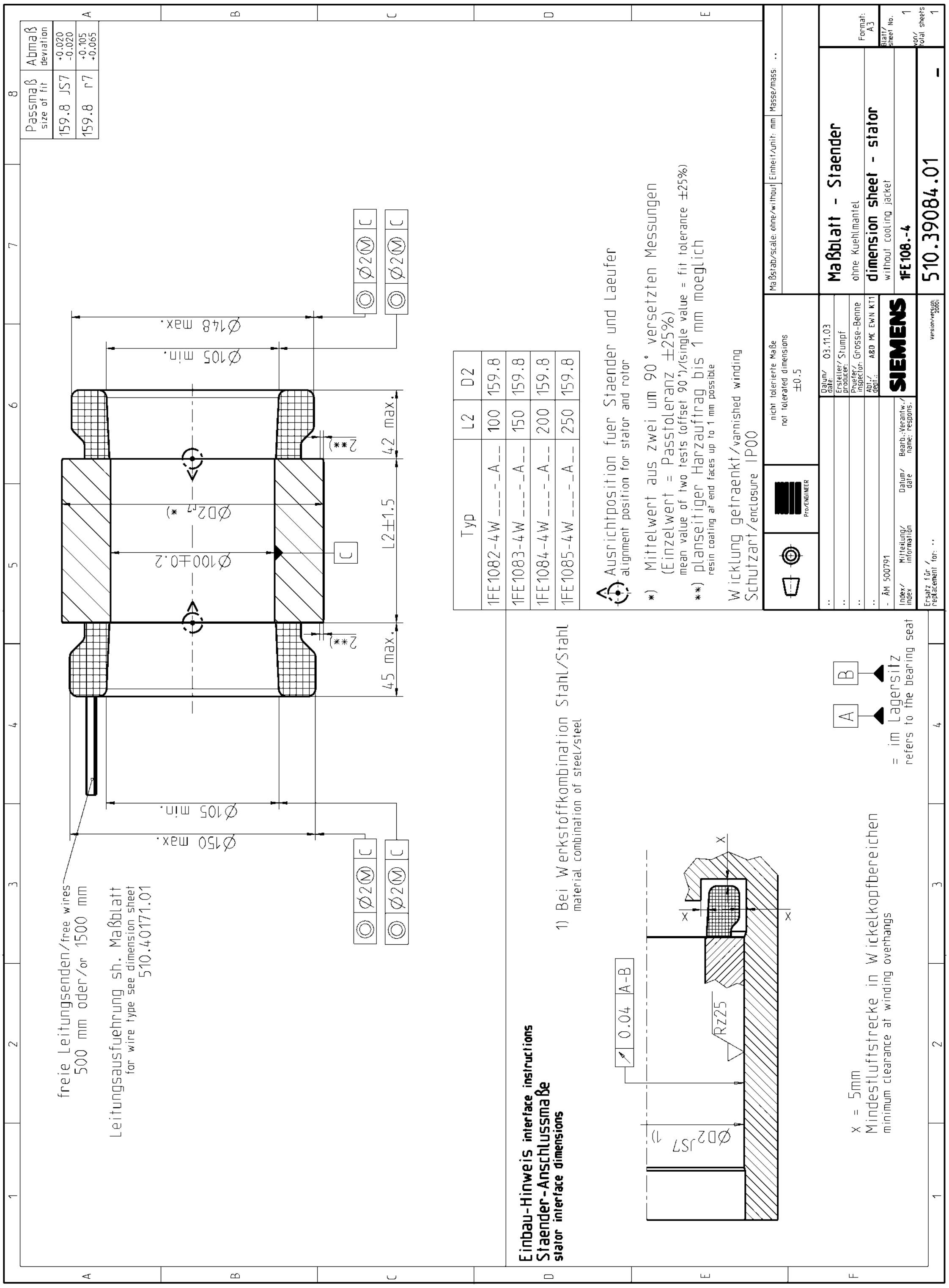


Fig. 6-37 1FE108□–4, stator without cooling jacket

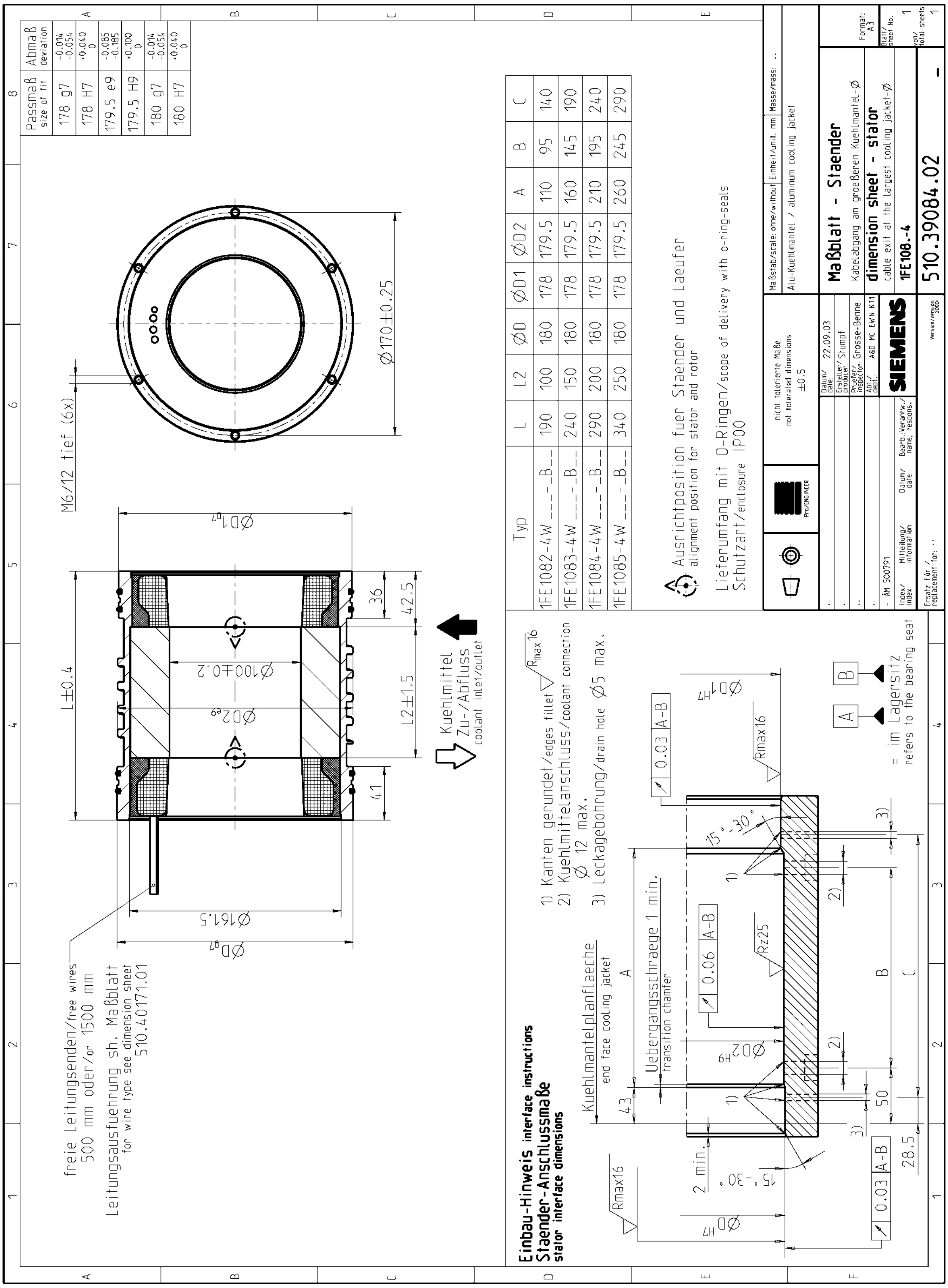


Fig. 6-38 1FE108□–4, stator with cooling jacket, cable outlet at the higher cooling jacket diameter

6.10 1FE108.–4

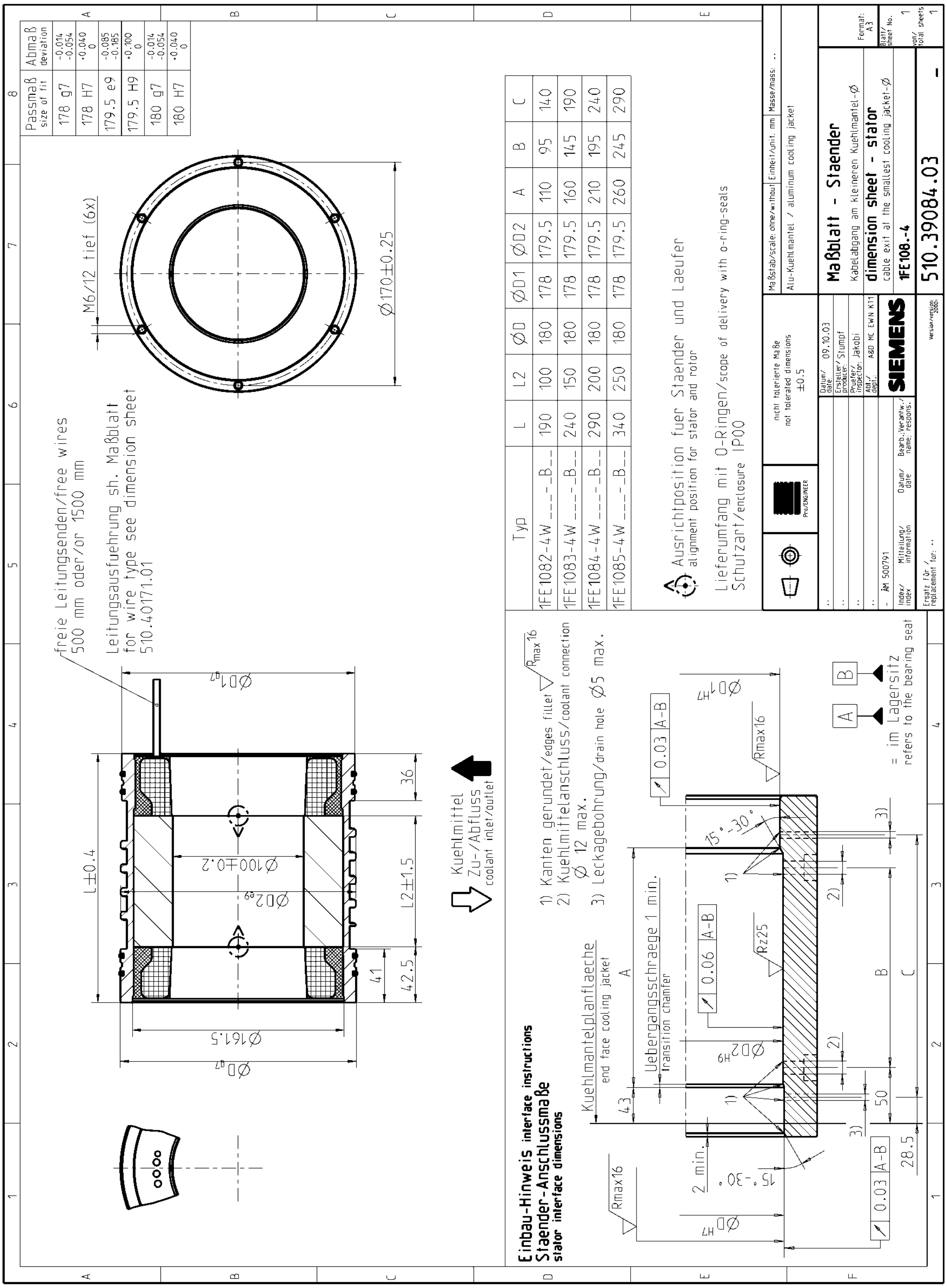


Fig. 6-39 1FE108□–4, stator with cooling jacket, cable outlet at the lower cooling jacket diameter

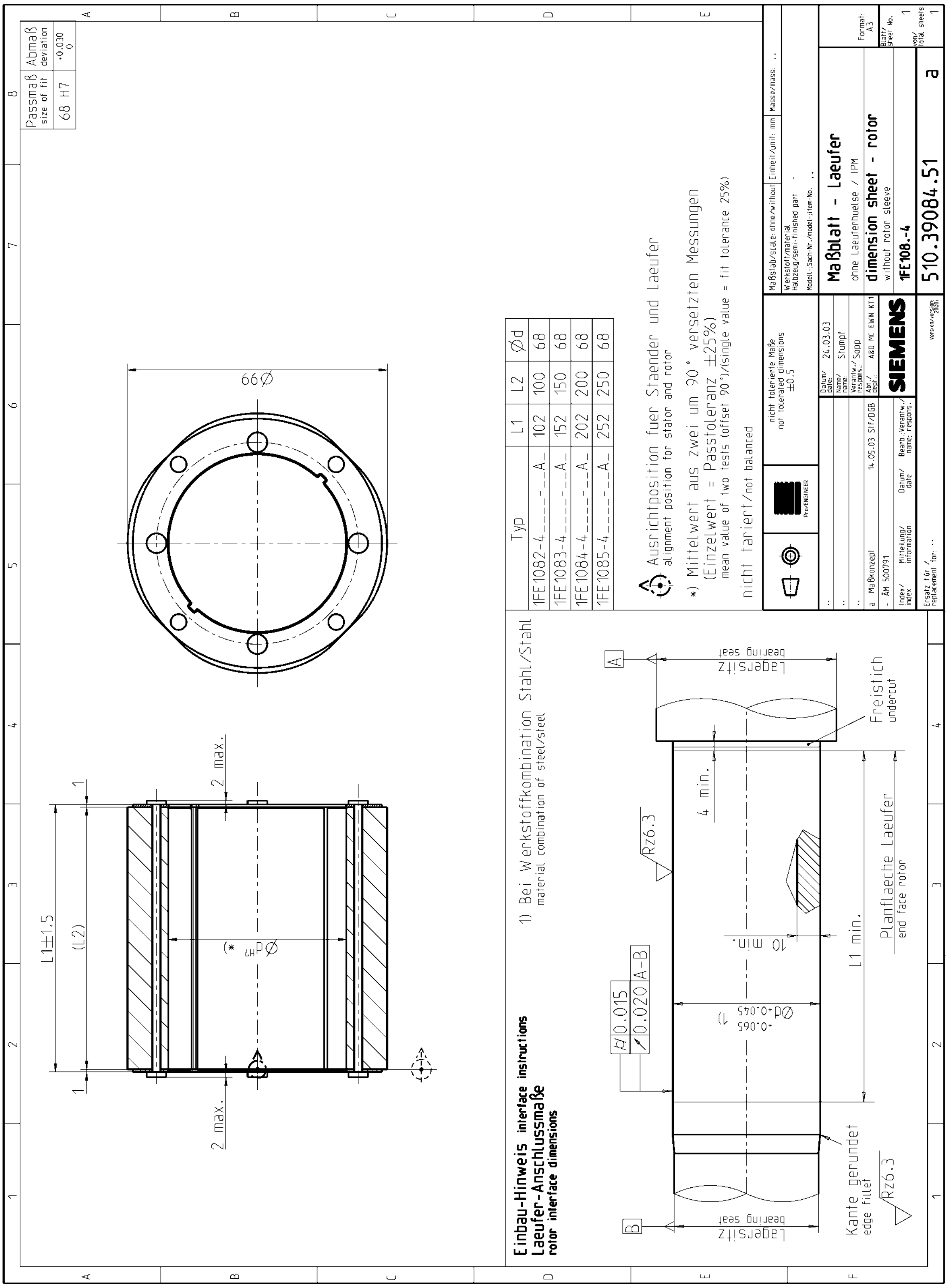


Fig. 6-40 1FE108□–4, rotor without sleeve

6.11 1FE109.–4

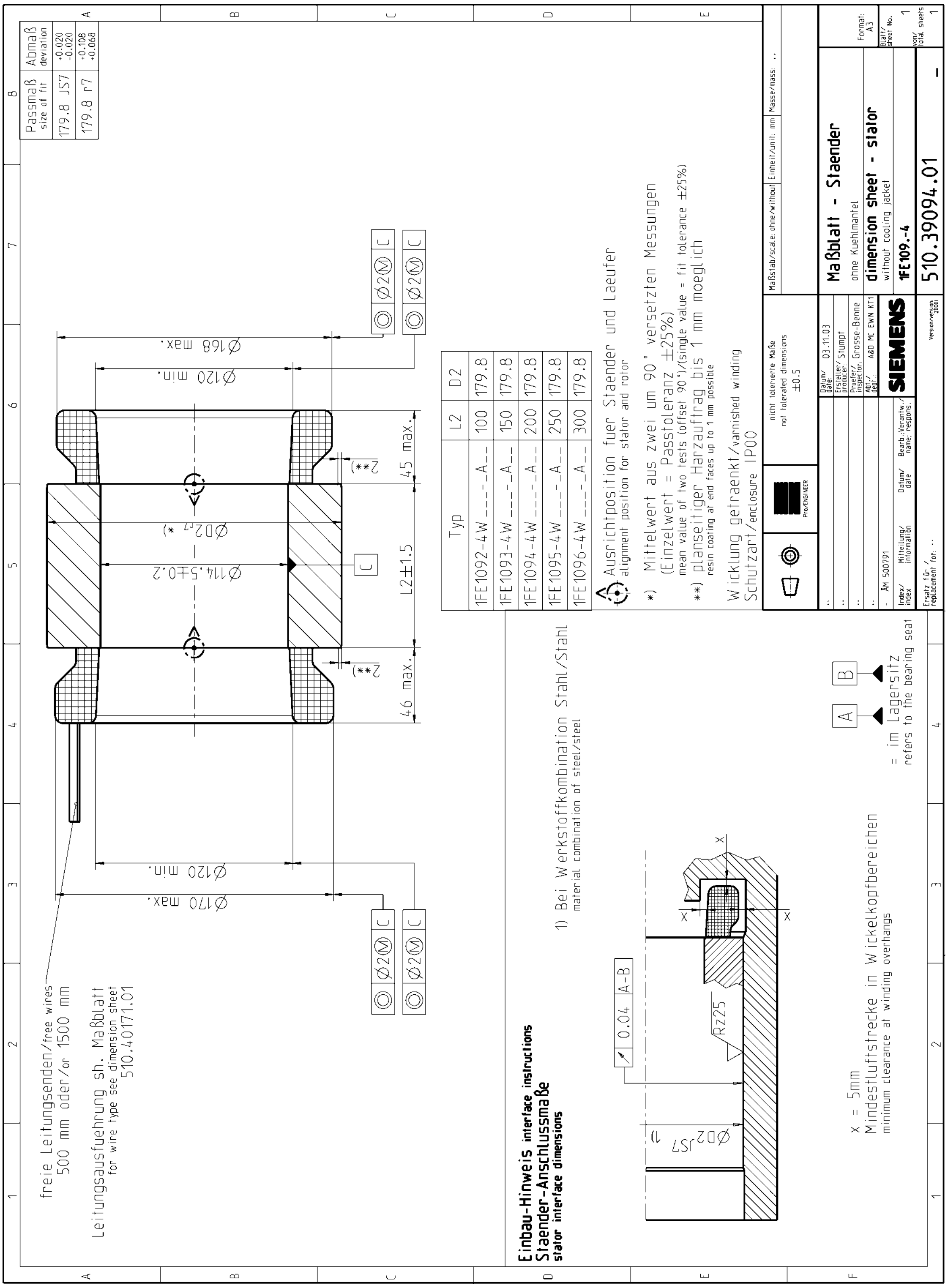


Fig. 6-41 1FE109□–4, stator without cooling jacket

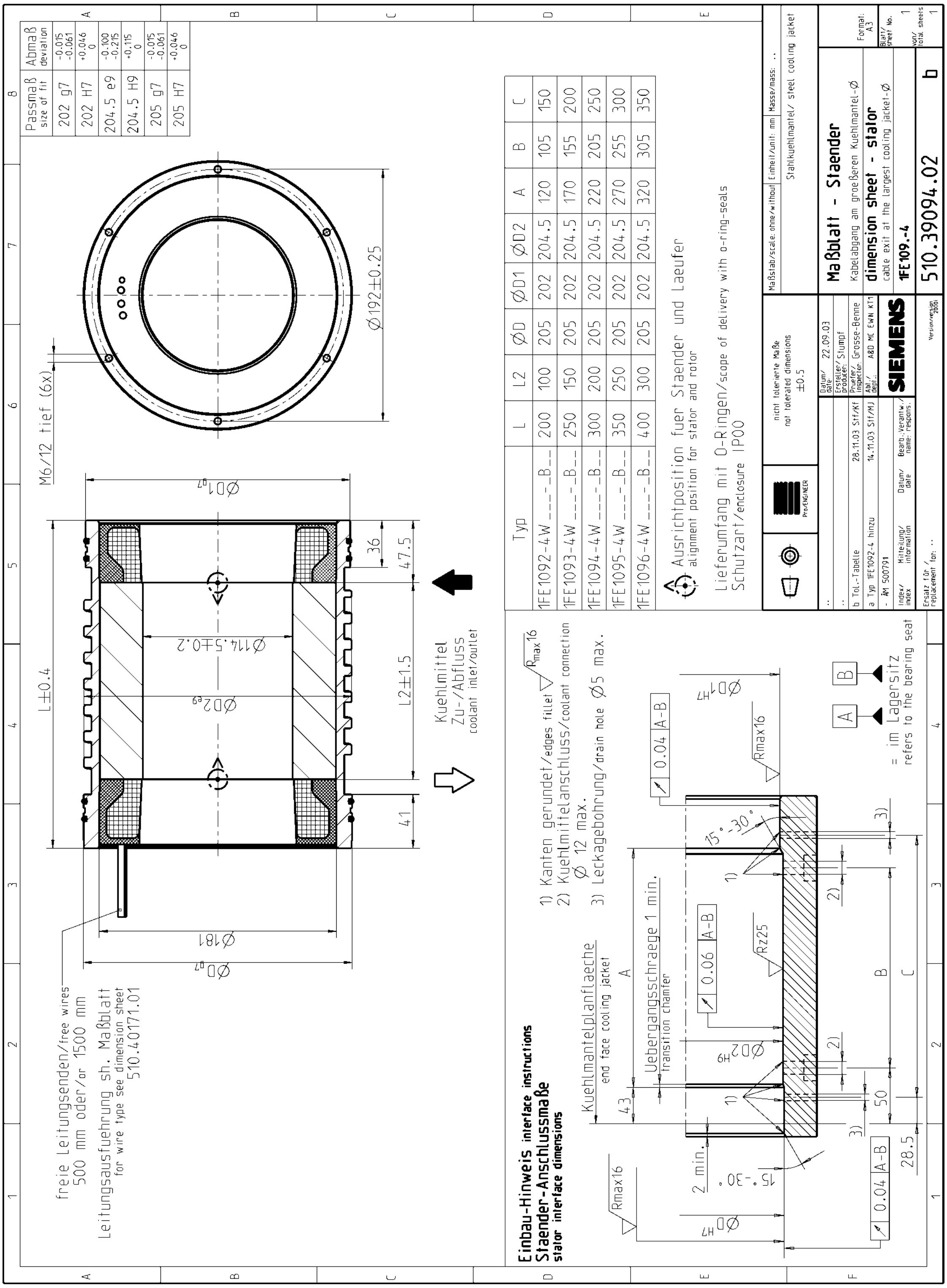


Fig. 6-42 1FE109□–4, stator with cooling jacket, cable outlet at the higher cooling jacket diameter

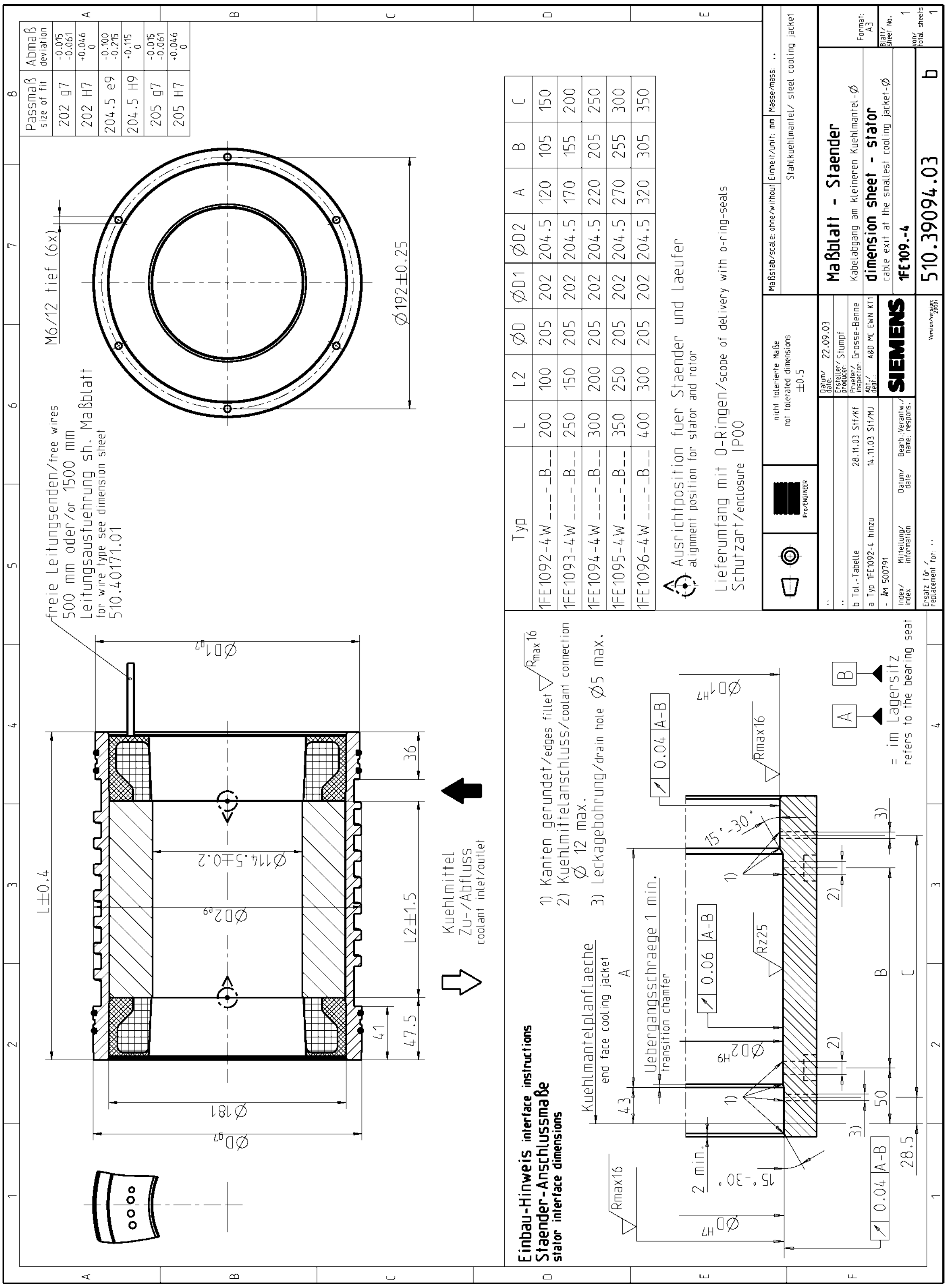


Fig. 6-43 1FE109□–4, stator with cooling jacket, cable outlet at the lower cooling jacket diameter

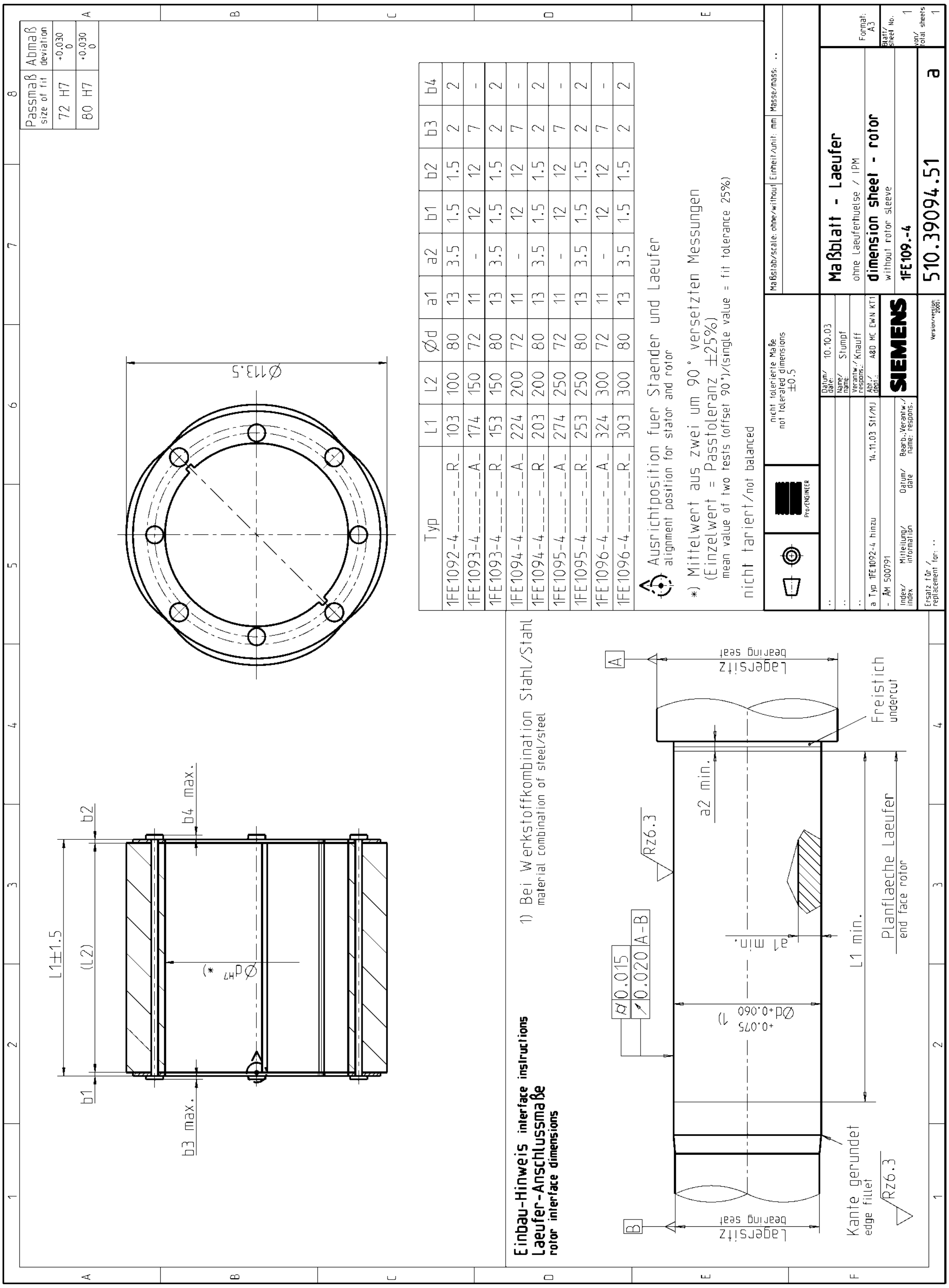


Fig. 6-44 1FE109□–4, rotor without sleeve

6.11 1FE109.–4

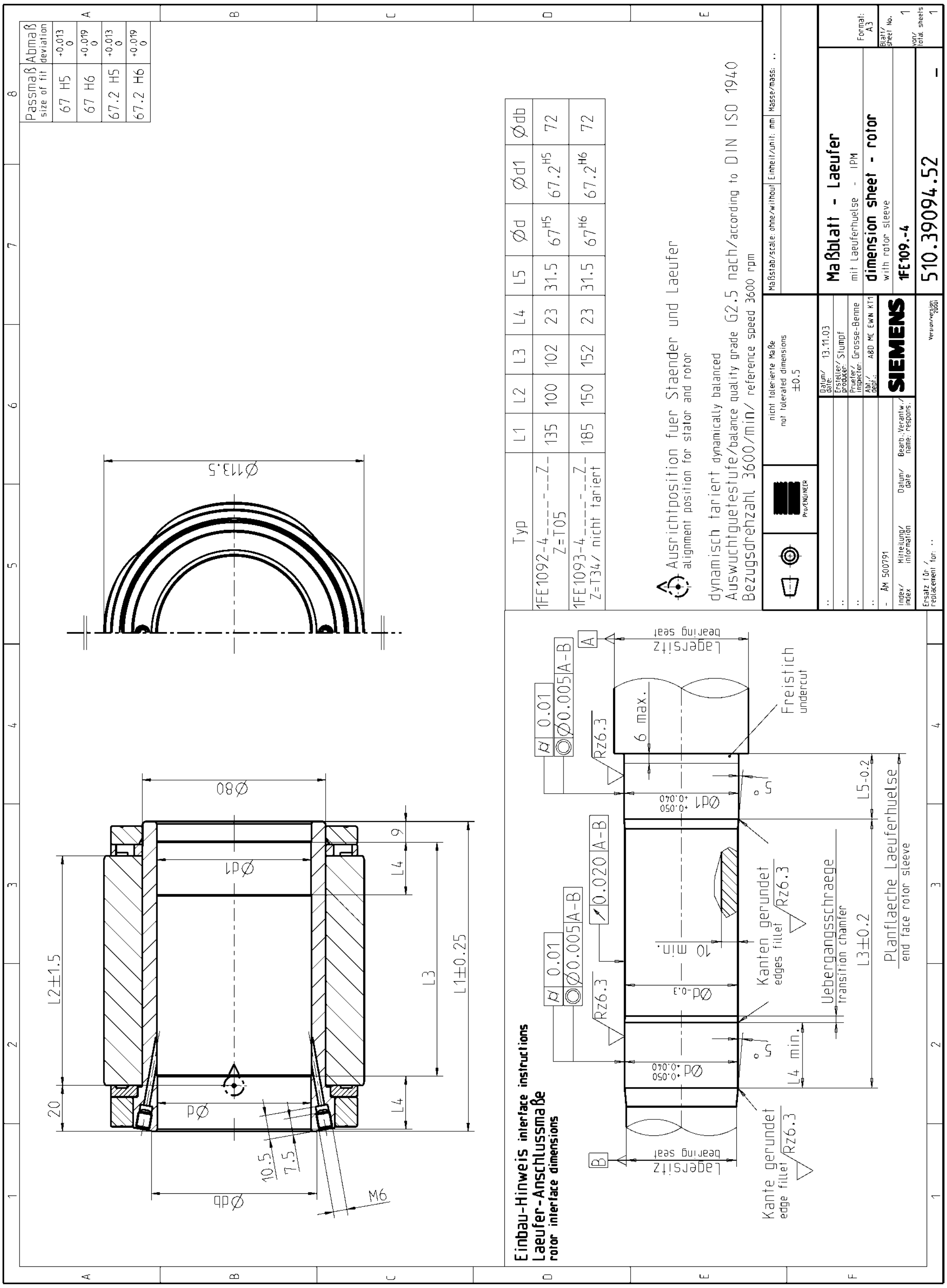


Fig. 6-45 1FE109□–4, rotor with sleeve

6.12 1FE110.–4

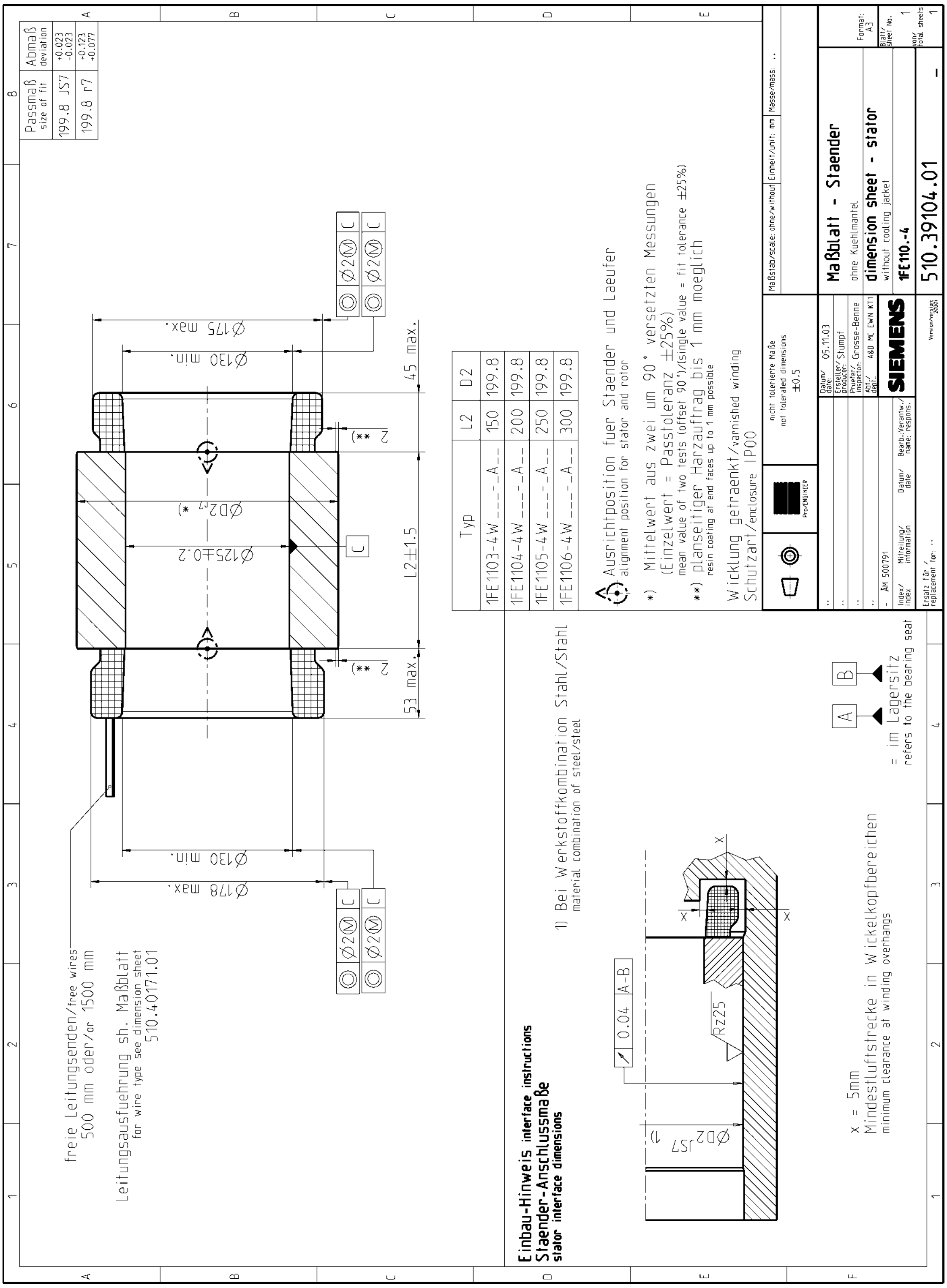


Fig. 6-46 1FE110□–4, stator without cooling jacket

6.12 1FE110.–4

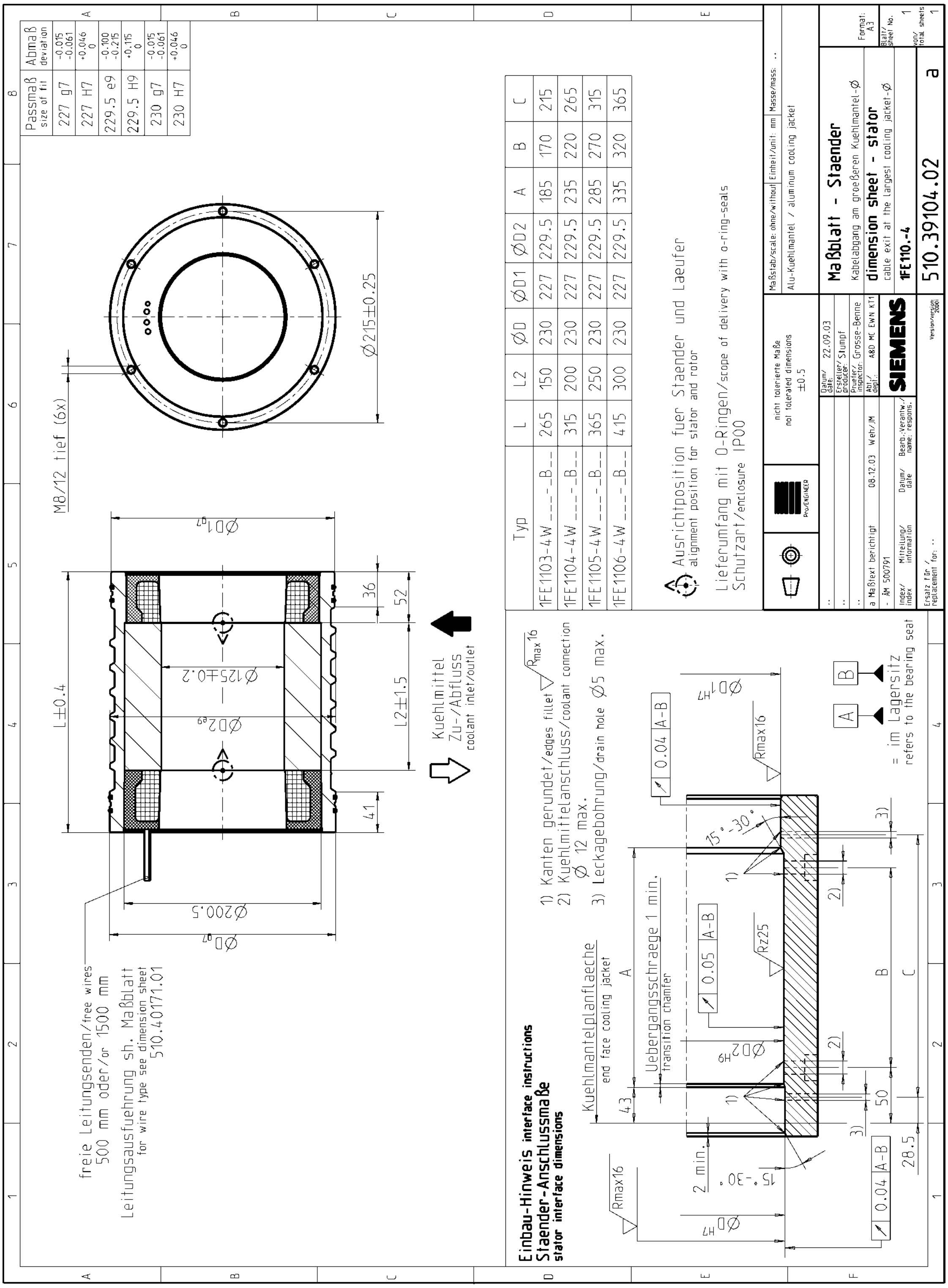


Fig. 6-47 1FE110☐–4, stator with cooling jacket, cable outlet at the higher cooling jacket diameter

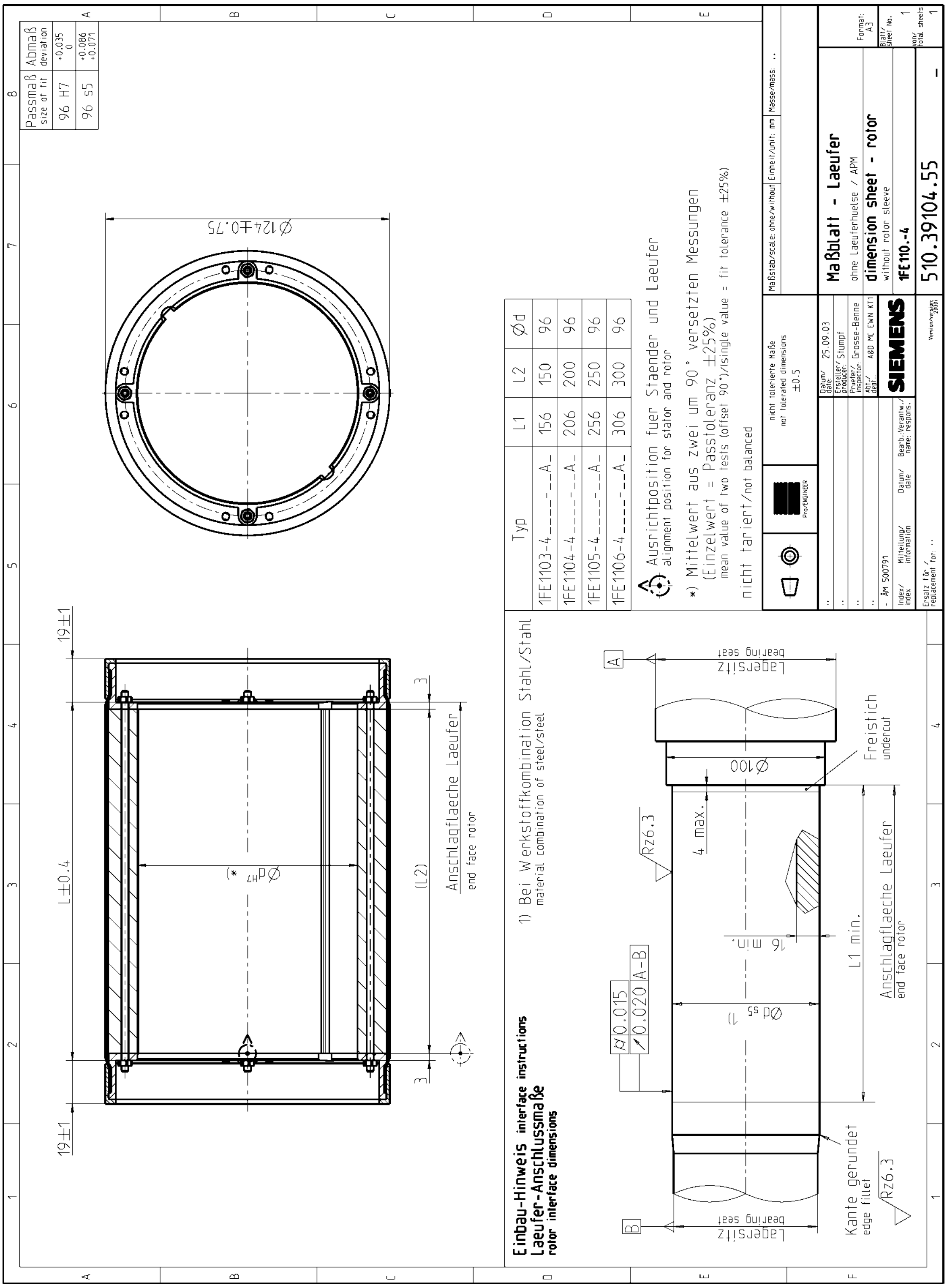


Fig. 6-48 1FE110□–4, rotor without sleeve

6.13 1FE112.–4

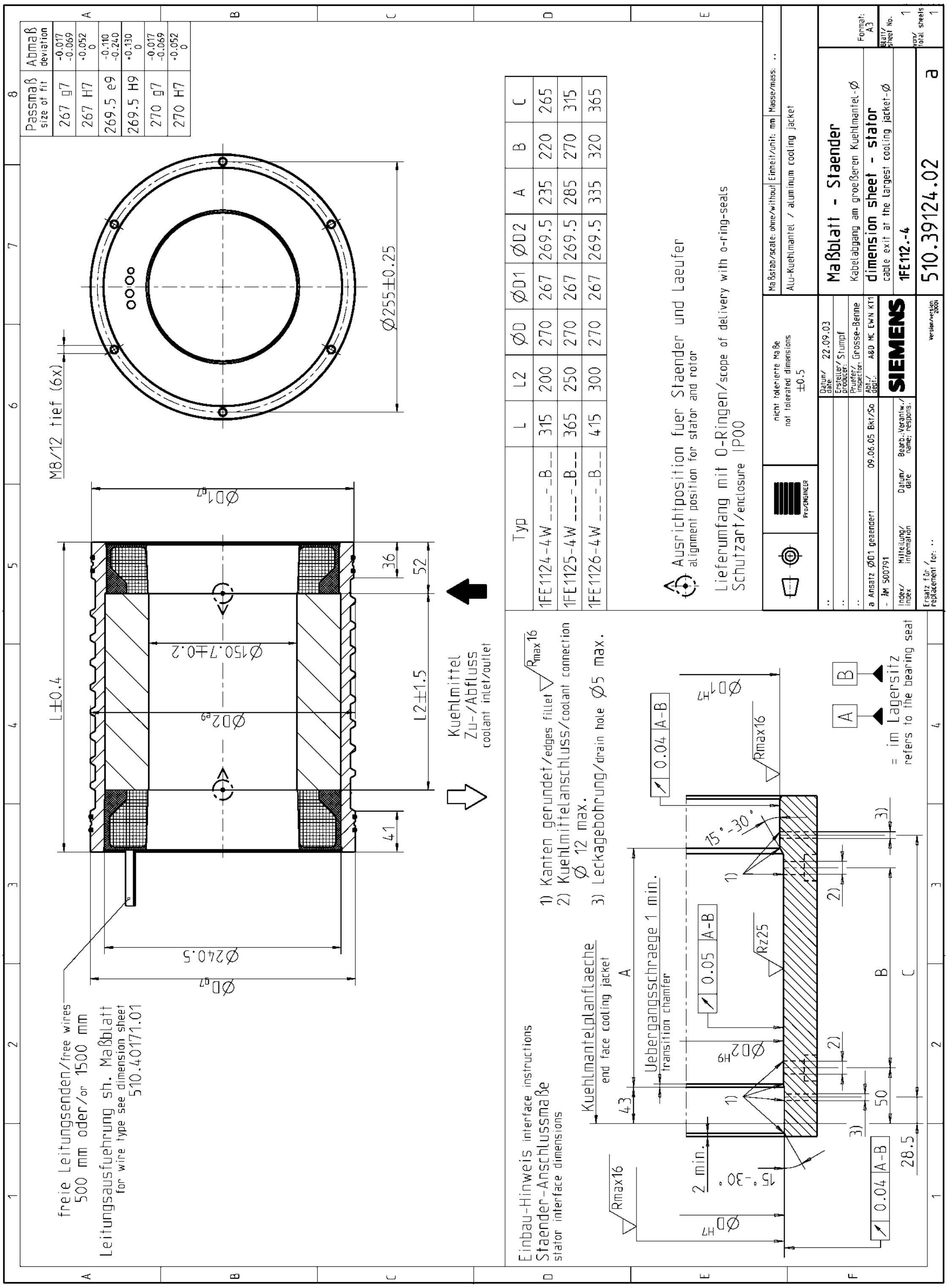


Fig. 6-49 1FE112□–4, stator with cooling jacket, cable outlet at the higher cooling jacket diameter

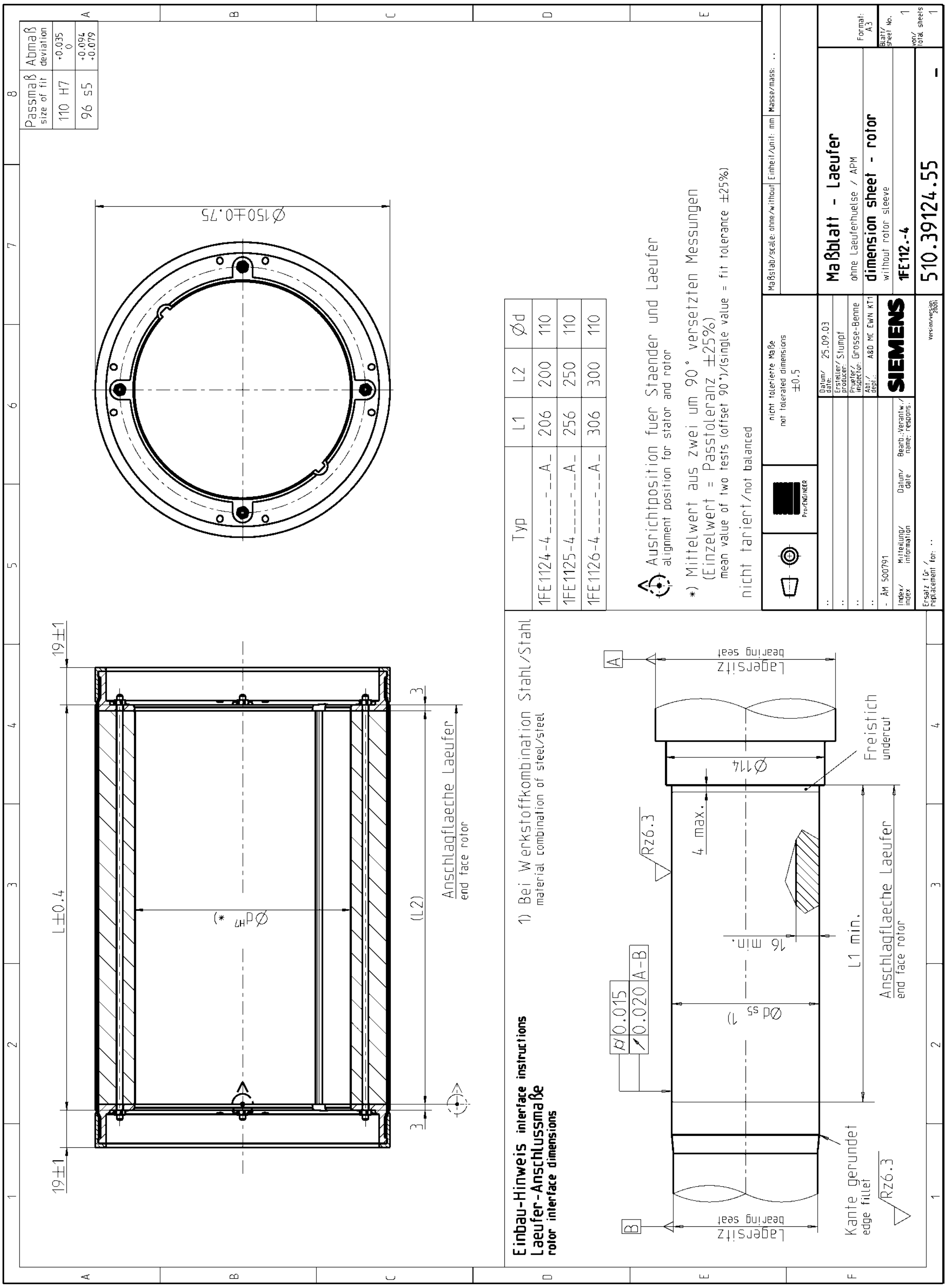


Fig. 6-50 1FE112□–4, rotor without sleeve

6.14 Dimension drawing for VPM 120, VPM 200, VPM 200 DYNAMIK

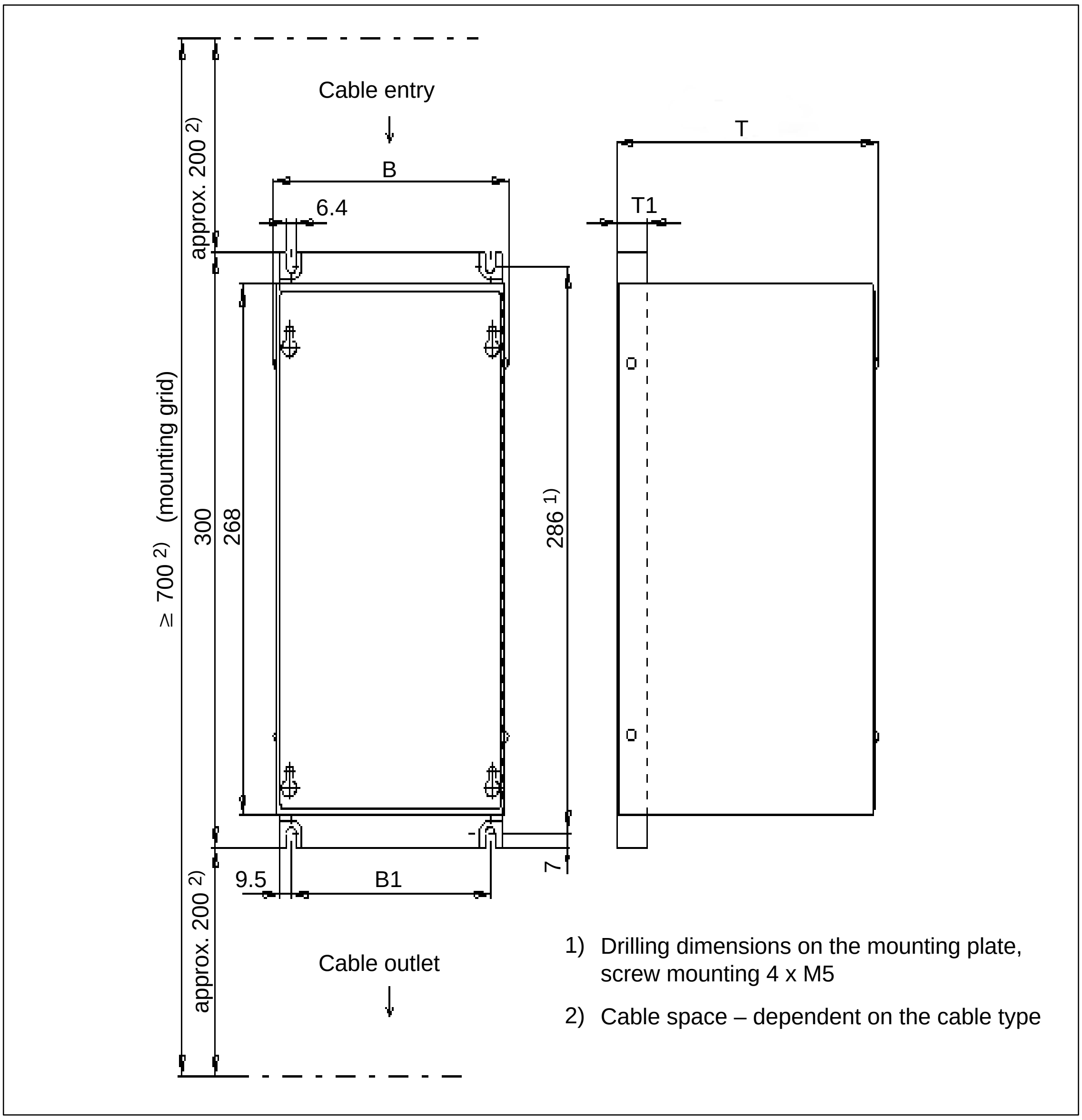


Fig. 6-51 Dimension drawing for VP modules

Table 6-1 Dimensions, weight

Module	Weight [kg]	B [mm]	B1 [mm]	T [mm]	T1 [mm]
VPM 120	approx. 6	150	125	180	20
VPM 200	approx. 11	250	225	190	30
VPM 200 DYNAMIK	approx. 13	250	225	260	30

■

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/BU/ **Catalog NC 60**

Automation Systems for Machine Tools
Order No.: E86060–K4460–A101–A9
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/PJAL/ **Configuration Manual, Synchronous Motors**

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Order No.: 6SN1197–0AD07–0BP1

/PFK7/ **Configuration Manual, Synchronous Motors**

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/APH7S/ **Configuration Manual, AC Induction Motors**
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Synchronous Built–in Motors 1FE1
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Suggestions

Corrections

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Three–Phase Motors for Main Spindle Drives
Synchronous Built–in Motors 1FE1

Manufacturer/Service Documentation

Configuration Manual

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