SINAMICS S

1PH7 Induction Motors for Machine Tools

Configuration Manual 04/2009

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1PH7 induction motors (Machine tools)

Configuration Manual

(APH7W), 04/2009
6SN1197-0AD72-0BP0

Legal information

Warning notice system

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

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

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

⚠CAUTION
with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

CAUTION
without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

NOTICE
indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

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

Qualified Personnel

The device/system may only be set up and used in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by **qualified personnel**. Within the context of the safety notes in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

Proper use of Siemens products

Note the following:

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

Trademarks

All names identified by ® are registered trademarks of the Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

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

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℗ 04/2009

Preface

Information on the documentation

At http://www.siemens.com/motioncontrol/docu information is available on the following topics:

- Ordering documentation
  Here you can find an up-to-date overview of publications
- Downloading documentation
  Links to more information for downloading files from Service & Support.
- Researching documentation online
  Information on DOConCD and direct access to the publications in DOConWeb.
- Compiling documentation individually on the basis of Siemens content with the My Documentation Manager (MDM), see http://www.siemens.com/mdm
  The My Documentation Manager offers you a range of features for creating your own machine documentation.
- Training and FAQs
  Information on the range of training courses and FAQs (frequently asked questions) are available via the page navigation.

Target group

Planners and project engineers

Benefits

The Configuration Manual supports you when selecting motors, calculating the drive components, selecting the required accessories as well as when selecting line and motor-side power options.

Standard scope

The scope of the functionality described in this document can differ from the scope of the functionality of the drive system that is actually supplied. Other functions not described in this documentation might be able to be executed in the drive system. This does not, however, represent an obligation to supply such functions with a new control or when servicing. Extensions or changes made by the machine manufacturer are documented by the machine manufacturer.

For the sake of simplicity, this documentation does not contain all detailed information about all types of the product and cannot cover every conceivable case of installation, operation, or maintenance.

Technical Support

If you have any technical questions, please contact our hotline:

	Europe/Africa
Phone	+49 180 5050 222
Fax	+49 180 5050 223
	0.14 €/min. from German landlines (mobile call charges may differ)
Internet	http://www.siemens.com/automation/support-request

	Americas
Telephone	+1 423 262 2522
Fax	+1 423 262 2200
E-mail	mailto:techsupport.sea@siemens.com

	Asia/Pacific
Telephone	+86 1064 757 575
Fax	+86 1064 747 474
E-Mail	mailto:support.asia.automation@siemens.com

Note

For technical support telephone numbers for different countries, go to:
http://www.automation.siemens.com/partner

Questions about this documentation

Please send any questions about the technical documentation (e.g. suggestions, corrections) to the following fax number or e-mail address:

Fax	+49 (0) 9131 / 98-2176
E-mail	mailto:docu.motioncontrol@siemens.com

A fax form is available in the appendix of this document.

Information on the product

http://www.siemens.com/sinamics

EC Declarations of Conformity

The EC Declaration of Conformity for the EMC Directive can be found/obtained

- in the Internet:

  http://support.automation.siemens.com under entry ID 22383669 or
- with the responsible local Siemens office

Danger and warning information

⚠ DANGER

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 provisions of the EC Machinery Directive.

Only appropriately qualified personnel may commission the SINAMICS units and the motors.

These personnel must carefully observe the technical customer documentation associated with this product and be have knowledge of and carefully observe the danger and warning notices.

Operational electrical equipment and motors have parts and components which are at hazardous voltage levels. All of the work carried out on the electrical machine or system must be carried out with it in a no-voltage condition.

When the machine or system is operated, hazardous axis movements can occur.

SINAMICS devices with synchronous motors may only be connected to the power supply via residual current protective devices if it has been verified (in accordance with EN 50178, Section 5.2.11.2) that the device is compatible with the residual current protective device.

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

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

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

⚠ WARNING

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.

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 +80 °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 connecting up cables, please observe that they
– are not damaged
– are not subject to tensile stress
– cannot be touched by rotating components.

CAUTION

Motors should be connected in accordance with the operating instructions. They must not be connected directly to the three-phase supply because this will damage them.

SINAMICS units and motors are subjected to a voltage test during routine testing. It is not permitted to perform an additional high-voltage test on the motor; such a test can destroy electronic components such as the temperature sensor or encoder.

CAUTION

The DRIVE-CLiQ interface contains motor and encoder-specific data as well as an electronic rating plate. This is the reason that this Sensor Module may only be operated on the original motor - and may not be mounted onto other motors or replaced by a Sensor Module from other motors.

The DRIVE-CLiQ interface has direct contact to components that can be damaged/destroyed by electrostatic discharge (ESDS). Neither hands nor tools that could be electrostatically charged should come into contact with the connections.

Note

When operational and in dry operating rooms, SINAMICS units with motors fulfill the Low-Voltage Directive.

In the configurations specified in the associated EC Declaration of Conformity, SINAMICS units with motors fulfill the EMC Directive.

ESDS instructions and electromagnetic fields

⚠ CAUTION

An **e**lectrostatic-**s**ensitive **d**evice (ESDS) is an individual component, integrated circuit, or module that can be damaged by electrostatic fields or discharges.

ESDS regulations for handling boards and equipment:

When handling components that can be destroyed by electrostatic discharge, it must be ensured that personnel, the workstation and packaging are well grounded!

Personnel in ESD zones with conductive floors may only touch electronic components if they are
– grounded through an ESDS bracelet and
– wearing ESDS shoes or ESDS shoe grounding strips.

Electronic boards may only be touched when absolutely necessary.

Electronic boards may not be brought into contact with plastics and articles of clothing manufactured from man-made fibers.

Electronic boards may only be placed on conductive surfaces (table with ESDS surface, conductive ESDS foam rubber, ESDS packing bag, ESDS transport containers).

Electronic boards may not be brought close to data terminals, monitors or television sets. Minimum clearance to screens > 10 cm).

Measurements may only be carried-out on electronic boards and modules if
– the measuring instrument is grounded (e.g. via a protective conductor) or
– before making measurements with a potential-free measuring device, the measuring head is briefly discharged (e.g. by touching an unpainted blank piece of metal on the control cabinet).

⚠ DANGER

It may be dangerous for people to remain in the immediate proximity of the product – especially for those with pacemakers, implants or similar – due to electric, magnetic and electromagnetic fields (EMF) occurring as a consequence of operation.

The machine/system operator and the people present near the product must observe the relevant guidelines and standards! These are, for example, in the European Economic Area (EEA) the Electromagnetic Fields Directive 2004/40/EC and the standards EN 12198-1 to 12198-3 and in the Federal Republic of Germany the Employer's Liability Insurance Association Regulations for the Prevention of Industrial Accidents BGV 11, with the relevant rule BGR 11 "Electromagnetic Fields".

Then a risk assessment must be carried out for every workplace, activities for reducing dangers and exposure for people decided upon and implemented, as well as determining and observing exposure and danger areas.

Information regarding third-party products

NOTICE
This document contains recommendations relating to third-party products. This involves third-party products whose fundamental suitability is familiar to us. It goes without saying that equivalent products from other manufacturers may be used. Our recommendations are to be seen as helpful information, not as requirements or regulations. We cannot accept any liability for the quality and properties/features of third-party products.

Environmental compatibility

- Environmental aspects during development

  When selecting supplier parts, environmental compatibility was an essential criteria.

  Special emphasis was placed on reducing the envelope dimensions, mass and type variety of metal and plastic parts.

  Effects of paint-wetting impairment substances can be excluded (PWIS test)

- Environmental aspects during production

  Supplier parts and the products are predominantly transported in re-usable packing. Transport for hazardous materials is not required.

  The packing materials themselves essentially comprises paperboard containers that are in compliance with the Packaging Directive 94/62/EC.

  Energy consumption during production was optimized.

  Production has low emission levels.

- Environmental aspects for 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 according to the regulations for disposing of old oil (e.g. gear oil when a gearbox is mounted)

  Not mixed with solvents, cold cleaning agents of remains of paint

  Components that are to be recycled should be separated according to:

  – Electronics scrap (e.g. encoder electronics, sensor modules)
  – Iron to be recycled
  – Aluminum
  – Non-ferrous metal (gearwheels, motor windings)

Residual risks of power drive systems

When carrying out a risk assessment of the machine in accordance with the EU Machinery Directive, the machine manufacturer must consider the following residual risks associated with the control and drive components of a power drive system (PDS).

1. Unintentional movements of driven machine components during commissioning, operation, maintenance, and repairs caused by, for example:
   - Hardware defects and/or software errors in the sensors, controllers, actuators, and connection technology
   - Response times of the controller and drive
   - Operating and/or ambient conditions not within the scope of the specification
   - Parameterization, programming, cabling, and installation errors
   - Use of radio devices/cellular phones in the immediate vicinity of the controller
   - External influences/damage
2. Exceptional temperatures as well as emissions of light, noise, particles, or gas caused by, for example:
   - Component malfunctions
   - Software errors
   - Operating and/or ambient conditions not within the scope of the specification
   - External influences/damage
3. Hazardous shock voltages caused by, for example:
   - Component malfunctions
   - Influence of electrostatic charging
   - Induction of voltages in moving motors
   - Operating and/or ambient conditions not within the scope of the specification
   - Condensation/conductive contamination
   - External influences/damage
4. Electrical, magnetic and electromagnetic fields generated in operation that can pose a risk to people with a pacemaker, implants or metal replacement joints, etc. if they are too close.
5. Release of environmental pollutants or emissions as a result of improper operation of the system and/or failure to dispose of components safely and correctly.

More extensive information concerning the residual risks associated with the PDS is provided in the relevant chapters of the technical user documentation.

Table of contents

Motor description

1

1.1 Properties

Overview

Air-cooled 1PH7 motors are rugged and low-maintenance 4-pole induction motors with squirrel-cage rotors. A fan for providing forced ventilation is mounted axially on the rear side of the motor. The air flow direction is as standard from the motor shaft (DE) to the rear of the motor (NDE) in order to keep the motor heat loss away from the machine. The reverse direction of air flow can be ordered as an option.

The motors are equipped with an integrated encoder system for sensing the motor speed and indirect position. For machine tools, the encoder system is capable of C-axis operation as standard - i.e. an additional encoder is not required for C-axis operation.

	
Shaft heights 100 to 160	Shaft heights 180 and 225

Benefits

- Short overall length of motor
- Minimized disturbing contour thanks to the integrated terminal box (shaft heights 100 to 160)
- Maximum speeds up to 9000 rpm (option: 12000 rpm)
- Full rated torque is continuously available, even at standstill
- Optimally adapted to the SINAMICS S120 power graduations

Area of application

- Compact machine tools
- Complex machining centers and lathes
- Customized machines
- Printing industry:
  - Single drives for printing units
- Rubber, plastics, wire and glass manufacturing:
  - Drives for extruders, calenders, rubber injection machines, foil machines, fleece machines
  - Wire-drawing machines, wire-stranding machines, etc.
- General applications such as e.g. coilers and winder drives.

1.1.1 Torque overview

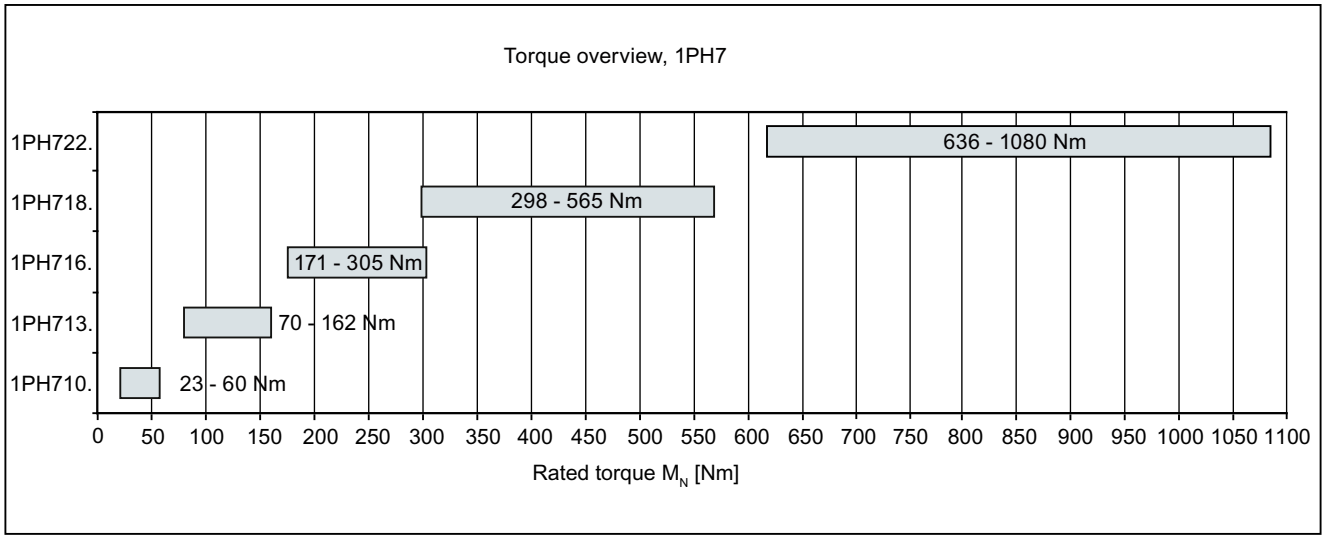


Figure 1-1 Torque overview

1.2 Technical features

Table 1- 1 Technical features

Technical feature	Version		
Motor type	Induction motor		
Type of construction according to EN 60034–7 (IEC 60034–7)	IM B3, IM B5, IM B35 (see selection and ordering data)		
Degree of protection acc. to EN 60034–5 (IEC 60034–5)	IP55 (fan IP54)		
Cooling according to EN 60034–6 (IEC 60034–6)	Forced ventilation; fan mounted axially at NDE		
Fan supply voltage for separately driven fan	3-ph. 400 V AC, 50 Hz 3-ph. 400 V AC, 60 Hz 3-ph. 480 V AC, 60 Hz		
Winding insulation acc. to EN 60034–1 (IEC 60034–1)	Temperature Class 155 (F) for a coolant temperature of +40 °C		
Temperature monitoring acc. to EN 60034–11 (IEC 60034–11)	KTY 84 temperature sensor in stator winding		
Motor voltage	3-ph. 400 V AC 3-ph. 480 V AC		
Sound pressure level at 50 Hz (acc. to ISO1680–1; EN 21680) Tolerance + 3 dB(A)	Shaft height	Airflow direction	Sound pressure level dB(A)
	100	NDE → DE	70
		DE → NDE	70
	132	NDE → DE	70
		DE → NDE	70
	160	NDE → DE	72
		DE → NDE	75
	180	NDE → DE	73
		DE → NDE	73
	225	NDE → DE	74
		DE → NDE	76
Connection type	Terminal box for power; top-mounted terminal box Connector or DRIVE-CLiQ interface for signals (mating connector is not included in the scope of supply)		
Speed encoder, integrated for motors without DRIVE-CLiQ interface	• without encoder • Absolute encoder 2048 S/R singleturn, 4096 revolutions multiturn, with EnDat interface (AM2048S/R encoder) • Incremental encoder, sin/cos 1 Vpp, 2048 S/R with C and D tracks (encoder IC2048S/R) • Incremental encoder sin/cos 1 Vpp 2048 S/R with C and D tracks (encoder IN2048S/R)		
Speed encoder, integrated for motors with DRIVE-CLiQ interface	• Incremental encoder 22 bit (resolution 4194304, internal 2048 S/R) + commutating position 11 bit (encoder IC22DQ) • Absolute encoder 22 bit singleturn (resolution 4194304, internal 2048 S/R) + 12 bit multiturn (traversing range 4096 revolutions) (encoder AM22DQ) • Incremental encoder 22 bit (resolution 4194304, internal 2048 S/R), without commutating position (encoder IN19DQ)		
Balancing acc. to IEC 60034–14	Standard: Balancing with half feather key, marked with H at the shaft face; option: Full-key balancing (see Selection and ordering data)		

Technical feature	Version	
Shaft end to DIN 748–3 (IEC 60072–1)	With keyway and feather key, plain shaft (see Selection and ordering data)	
Bearing version DE (standard)	SH 100 to 160 for belt coupling and coupling output:	Deep-groove ball bearings
	SH 180 to 225 for coupling output: for belt coupling or increased radial forces:	Deep-groove ball bearings Cylindrical-roller bearings
Radial eccentricity, concentricity, and axial eccentricity acc. to DIN 42955, IEC 60072–1)	SH 100 to 160: SH 180 to 225:	Tolerance level R (reduced) Tolerance level N (normal)
Vibration severity acc. to IEC 60034–14	Level A is maintained up to the nominal limit	
Paint finish	SH 100 to 160:	Without paint finish, Standard paint finish, anthracite RAL 7016
	SH 180 to 225:	Primed, Standard paint finish, anthracite RAL 7016
	See "Options" table	
Documentation supplied with the motors	Operating instructions (German, English)	
Options	See "Options" table	

S/R = Signals/Revolution

Options

Table 1- 2 Codes and option description

Order code	Option description	For use with 1PH7 induction motors with shaft height	
		SH 100 SH 160	SH 180 SH 225
	Standard paint finish in another color, RAL ...	○ 1)	■ 2)
	Special paint finish in another color, RAL ...	○	■ 3)
G14	Fan unit with air filter	–	■ 4)
K31	2nd rating plate supplied separately in terminal box	Standard	■
K40	Regreasing system, DE and NDE	–	■
K55	Cable entry plate, terminal box, customer-specific (plain text is required)	–	■
L27	NDE bearing, insulated version		■
M03	Version for hazardous areas Zone 2, Category 3G (gas)	■	–
M39	Version for hazardous areas Zone 22, Category 3D (dust)	■	■
Y55	Non-standard shaft end DE	○	○
Y80	Different rating plate data (plain text is required)	○	○
Y82	Additional rating plate with orderer's data	○	○

■ Option is possible.

○ On request

\- Not available

1) Order using an order code (without plain text) e.g.
X01: RAL 9005 (matt black)
X02: RAL 9001 (cream)
X03: RAL 6011 (reseda green)
X04: RAL 7032 (pebble grey)
X05: RAL 5015 (sky blue)
X06: RAL 1015 (light ivory)

2) Order with order code R1Y (it is necessary to specify the RAL color in plain text)

3) Order with order code R2Y (it is necessary to specify the RAL color in plain text)

4) Only possible for cooling NDE → DE

1.3 Selection and ordering data

Shaft height	Rated speed	Continuous speed, max.		Speed, max.[1]		Rated power for duty type in accordance with IEC 60034-1				**1PH7 asynchronous motor with solid shaft** **Forced ventilation**
SH	n_{rated}	$n_{S1\ cont.}$[2]	$n_{S1\ cont.}$[3]	n_{max}	n_{max}[4]	P_{rated}				Order No. **Core type**
						S1	S6-60%	S6-40%	S2-30 min	
	rpm	rpm	rpm	rpm	rpm	kW (HP)	kW (HP)	kW (HP)	kW (HP)	
100	2000	5500	–	9000	–	7 (9.39)	8.5 (11.4)	10 (13.4)	9.25(12.4)	**1PH7103 - ■ ■ G02 - 0C■ 0**
	1500	5500	–	9000	–	9 (12.1)	11 (14.8)	13 (17.4)	12 (16.1)	**1PH7107 - ■ ■ F02 - 0C■ 0**
132	1000	4500	–	8000	–	12 (16.1)	15 (20.1)	18.5 (24.8)	16 (21.5)	**1PH7133 - ■ ■ D02 - 0C■ 0**
	2000					20 (26.8)	25 (33.5)	30 (40.2)	27.5 (36.9)	**1PH7133 - ■ ■ G02 - 0C■ 0**
	1000	4500	–	8000	–	17 (22.8)	20.5 (27.5)	25 (33.5)	22.5 (30.2)	**1PH7137 - ■ ■ D02 - 0C■ 0**
	2000					28 (37.6)	35 (46.9)	43 (57.7)	39 (52.3)	**1PH7137 - ■ ■ G02 - 0C■ 0**
160	1000	3700	–	6500	–	22 (29.5)	27 (36.2)	33 (44.3)	30 (40.2)	**1PH7163 - ■ ■ D03 - 0C■ 0**
	1500					30 (40.2)	37 (49.6)	45 (60.4)	41 (55.0)	**1PH7163 - ■ ■ F03 - 0C■ 0**
	1500	3700	–	6500	–	37 (49.6)	46 (61.7)	56 (75.1)	51 (68.4)	**1PH7167 - ■ ■ F03 - 0C■ 0**

Fans:	External fan unit, heavy-gauge threaded cable entry in terminal box					**2**	
	External fan unit, metric cable entry in terminal box					**7**	
Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp} without C and D track						**N**
Encoder systems for motors with DRIVE-CLiQ interface:	Incremental encoder 22 bit						**Q**
Type:[5]	IM B5 (IM V1, IM V3)					**2**	
	IM B35 (IM V15, IM V35)[6]					**3**	
Shaft extension (DE):[5]	**Balancing:**	**Direction of air flow (fan):**	**Blow-out direction:**				
Fitted key	Half-key	DE → NDE	Axial				**A**
Plain shaft	–	DE → NDE	Axial				**J**

Motor type (continued)	Rated torque	Moment of inertia	Weight, approx.	Rated current for duty type in accordance with IEC 60034-1				SINAMICS S120 Motor Module	
								Rated output current	**Booksize format**
	M_{rated}	J	m	I_{rated}				I_{rated}	Order No.
				S1	S6-60%	S6-40%	S2- 30 min	S1	
	Nm (lb_f-ft)	kgm^2 (lb_f-in-s^2)	kg (lb)	A	A	A	A	A	
1PH7103-2NG02-...	33.4 (24.6)	0.017 (0.15)	40 (88.2)	17.5	20.5	23.5	21.5	18	**6SL312■ - ■TE21-8AA3**
1PH7107-2NF02-...	57.3 (43.3)	0.029 (0.26)	63 (138.9)	23.5	27.5	31	29	30	**6SL312■ - 1TE23-0AA3**
1PH7133-2ND02-...	114.6 (84.5)	0.076 (0.67)	90 (198.5)	30	36	43	37.5	30	**6SL312■ - 1TE23-0AA3**
1PH7133-2NG02-...	95.5 (70.4)	0.076 (0.67)	90 (198.5)	45	54	63	59	45	**6SL312■ - 1TE24-5AA3**
1PH7137-2ND02-...	162.3 (119.7)	0.109 (0.96)	130 (287)	43	50	60	54	45	**6SL312■ - 1TE24-5AA3**
1PH7137-2NG02-...	133.7 (98.6)	0.109 (0.96)	130 (287)	60	73	87	80	60	**6SL312■ - 1TE26-0AA3**
1PH7163-2ND03-...	210.1 (155)	0.19 (1.68)	180 (397)	55	65	77	71	60	**6SL312■ - 1TE26-0AA3**
1PH7163-2NF03-...	191.0 (141)	0.19 (1.68)	180 (397)	72	86	102	94	85	**6SL312■ - 1TE28-5AA3**
1PH7167-2NF03-...	235.5 (174)	0.23 (2.04)	228 (503)	82	97	115	104	85	**6SL312■ - 1TE28-5AA3**

Cooling:	
Internal air cooling	**0**
External air cooling	**1**
Motor Module:	
Single Motor Module	**1**
Double Motor Module	**2**

1) For continuous duty (with 30% n_{max}, 60% $^2/_3$ n_{max}, 10% standstill) for a duty cycle time of 10 min.
2) Bearing version for coupling/belt output.
3) Bearing version for increased maximum speed.
4) Version for increased maximum speed only possible with vibration magnitude grade SR. The following options are not possible:
   • Shaft seal.
5) The following motor versions are required for ZF gearbox mounting prepared (see Gearboxes for gear selection):
   • Shaft with fitted key and full-key balancing
6) Motors of shaft height 160 and higher require foot support.

Shaft height	Rated speed	Continuous speed, max.		Speed, max.[1]		Rated power for duty type in accordance with IEC 60034-1				**1PH7 asynchronous motor with solid shaft** **Forced ventilation**
SH	n_{rated}	$n_{S1\ cont.}$[2]	$n_{S1\ cont.}$[3]	n_{max}	n_{max}[4]	P_{rated}				Order No. **Standard type**
						S1	S6-60%	S6-40%	S2-30 min	
	rpm	rpm	rpm	rpm	rpm	kW (HP)	kW (HP)	kW (HP)	kW (HP)	
100	1500	5500	10000	9000	12000	3.7 (4.96)	4.5 (6.03)	5.25 (7.04)	4.9 (6.57)	**1PH7101 - ■ ■ F ■ ■ - 0 ■ ■ ■**
	1000	5500	10000	9000	12000	3.7 (4.96)	4.5 (6.03)	5.25 (7.04)	4.7 (6.30)	**1PH7103 - ■ ■ D ■ ■ - 0 ■ ■ ■**
	1500					5.5 (7.38)	6.7 (8.98)	7.7 (10.3)	7 (9.39)	**1PH7103 - ■ ■ F ■ ■ - 0 ■ ■ ■**
	2000					7 (9.39)	8.5 (11.4)	10 (13.4)	9.25 (12.4)	**1PH7103 - ■ ■ G ■ ■ - 0 ■ ■ ■**
	1500	5500	10000	9000	12000	7 (9.39)	8.5 (11.4)	10 (13.4)	9.25 (12.4)	**1PH7105 - ■ ■ F ■ ■ - 0 ■ ■ ■**
	1000	5500	10000	9000	12000	6.25 (8.38)	7.5 (10.1)	8.8 (11.8)	7.75 (10.4)	**1PH7107 - ■ ■ D ■ ■ - 0 ■ ■ ■**
	1500					9 (12.1)	11 (14.8)	13 (17.4)	12 (16.1)	**1PH7107 - ■ ■ F ■ ■ - 0 ■ ■ ■**
	2000					10.5 (14.1)	12.5 (16.8)	14.5 (19.4)	13.5 (18.1)	**1PH7107 - ■ ■ G ■ ■ - 0 ■ ■ ■**

Fans:	External fan unit, heavy-gauge threaded cable entry in terminal box	**2**
	External fan unit, metric cable entry in terminal box	**7**
Encoder systems for motors without DRIVE-CLiQ interface:	Absolute encoder EnDat 2048 S/R	**E**
	Incremental encoder sin/cos 1 V_{pp} with C and D track	**M**
	Incremental encoder sin/cos 1 V_{pp} without C and D track	**N**
Encoder systems for motors with DRIVE-CLiQ interface:	Absolute encoder, 22 bit single-turn + 12 bit multi-turn	**F**
	Incremental encoder, 22 bit with 11 bit commutation position	**D**
	Incremental encoder, 22 bit	**Q**
Terminal box/ Cable entry:	Top/right	**0**
	Top/NDE	**2**
	Top/left	**3**
Type:[5]	IM B3 (IM V5, IM V6)	**0**
	IM B5 (IM V1, IM V3)	**2**
	IM B35 (IM V15, IM V35)[7]	**3**

Bearing version for:	**Vibration magnitude:**	**Shaft and flange accuracy:**	
Coupling/belt output	Grade R	Tolerance R	**B**
Coupling/belt output	Grade S	Tolerance R	**C**
Coupling/belt output	Grade SR	Tolerance R	**D**
Increased speed (coupling/belt output) [6]	Grade SR	Tolerance R	**L**

Shaft extension (DE):[5]	**Balancing:**	**Direction of air flow (fan):**	**Blow-out direction:**	
Fitted key	Half-key	DE → NDE	Axial	**A**
Fitted key	Half-key	NDE → DE	Axial	**B**
Fitted key	Full-key	DE → NDE	Axial	**C**
Fitted key	Full-key	NDE → DE	Axial	**D**
Plain shaft	–	DE → NDE	Axial	**J**
Plain shaft	–	NDE → DE	Axial	**K**

Degree of protection:	**Seal:**	**Paint finish:**	
IP55, fan IP54	–	Unpainted	**0**
IP55, fan IP54	DE flange with shaft sealing ring[6]	Unpainted	**2**
IP55, fan IP54	–	Anthracite	**3**
IP55, fan IP54	DE flange with shaft sealing ring[6]	Anthracite	**5**
IP55, fan IP54	–	Anthracite, two coats	**6**
IP55, fan IP54	DE flange with shaft sealing ring[6]	Anthracite, two coats	**8**

Motor type (continued)	Rated torque	Moment of inertia	Weight, approx.	Rated current for duty type in accordance with IEC 60034-1				SINAMICS S120 Motor Module	
								Rated output current	**Booksize format**
	M_{rated}	J	m	I_{rated}				I_{rated}	Order No.
				S1	S6-60%	S6-40%	S2- 30 min	S1	
	Nm (lb_f-ft)	kgm^2 (lb_f-in-s^2)	kg (lb)	A	A	A	A	A	
1PH7101 - ..F...	23.6 (17.4)	0.017 (0.15)	40 (88.2)	10	11.5	12.5	12	18	**6SL312■ - ■TE21-8AA3**
1PH7103 - ..D...	35.3 (26.0)	0.017 (0.15)	40 (88.2)	10	11.5	13	12	18	**6SL312■ - ■TE21-8AA3**
1PH7103 - ..F...	35.0 (25.8)	0.017 (0.15)	40 (88.2)	13	16	18	16.5	18	**6SL312■ - ■TE21-8AA3**
1PH7103 - ..G...	33.4 (24.6)	0.017 (0.15)	40 (88.2)	17.5	20.5	23.5	21.5	18	**6SL312■ - ■TE21-8AA3**
1PH7105 - ..F...	44.6 (32.9)	0.029 (0.26)	63 (139)	17.5	21	23.5	22	18	**6SL312■ - ■TE21-8AA3**
1PH7107 - ..D...	59.7 (44.0)	0.029 (0.26)	63 (139)	17.5	20.5	23	21	18	**6SL312■ - ■TE21-8AA3**
1PH7107 - ..F...	57.3 (43.3)	0.029 (0.26)	63 (139)	23.5	27.5	31	29	30	**6SL312■ - 1TE23-0AA3**
1PH7107 - ..G...	50.1 (37.0)	0.029 (0.26)	63 (139)	26	28.5	33	31	30	**6SL312■ - 1TE23-0AA3**

Cooling:	
Internal air cooling	**0**
External air cooling	**1**
Motor Module:	
Single Motor Module	**1**
Double Motor Module	**2**

1) For continuous duty (with 30% n_{max}, 60% $^2/_3$ n_{max}, 10% standstill) for a duty cycle time of 10 min.
2) Bearing version for coupling/belt output.
3) Bearing version for increased maximum speed.
4) Version for increased maximum speed only possible with vibration magnitude grade SR. The following options are not possible:
   • Shaft sealing ring.
5) The following motor versions are required for ZF gearbox mounting prepared (see Gearboxes for gear selection):
   • Types IM B5 or IM B35
   • Shaft with fitted key and full-key balancing
6) Only appropriate if the sealing ring is occasionally lubricated with oil spray/mist. A sealing ring is not possible with increased maximum speed.
7) Motors of shaft height 160 and higher require foot support.

Shaft height	Rated speed	Continuous speed, max.		Speed, max.[1]		Rated power for duty type in accordance with IEC 60034-1				**1PH7 asynchronous motor with solid shaft Forced ventilation**
SH	n_{rated}	$n_{S1\ cont.}$[2]	$n_{S1\ cont.}$[3]	n_{max}	n_{max}[4]	P_{rated}				Order No. **Standard type**
						S1	S6-60%	S6-40%	S2-30 min	
	rpm	rpm	rpm	rpm	rpm	kW (HP)	kW (HP)	kW (HP)	kW (HP)	
132	1500	4500	8500	8000	10000	11 (14.8)	13.5 (18.1)	16.5 (22.1)	15 (20.1)	**1PH7131 - ■ ■ F ■ ■ - 0 ■ ■ ■**
	1000	4500	8500	8000	10000	12 (16.1)	15 (20.1)	18.5 (24.8)	16 (21.5)	**1PH7133 - ■ ■ D ■ ■ - 0 ■ ■ ■**
	1500					15 (20.1)	18.5 (24.8)	23 (30.8)	20.5 (27.5)	**1PH7133 - ■ ■ F ■ ■ - 0 ■ ■ ■**
	2000					20 (26.8)	25 (33.5)	30 (40.2)	27.5 (36.9)	**1PH7133 - ■ ■ G ■ ■ - 0 ■ ■ ■**
	1500	4500	8500	8000	10000	18.5 (24.8)	23 (30.8)	28 (37.6)	25.5 (34.2)	**1PH7135 - ■ ■ F ■ ■ - 0 ■ ■ ■**
	1000	4500	8500	8000	10000	17 (22.8)	20.5 (27.5)	25 (33.5)	22.5 (30.2)	**1PH7137 - ■ ■ D ■ ■ - 0 ■ ■ ■**
	1500					22 (29.5)	27.5 (36.9)	33 (44.3)	30 (40.2)	**1PH7137 - ■ ■ F ■ ■ - 0 ■ ■ ■**
	2000					28 (37.6)	35 (46.9)	43 (57.7)	39 (52.3)	**1PH7137 - ■ ■ G ■ ■ - 0 ■ ■ ■**

Fans:	External fan unit, heavy-gauge threaded cable entry in terminal box	**2**
	External fan unit, metric cable entry in terminal box	**7**
Encoder systems for motors without DRIVE-CLiQ interface:	Absolute encoder EnDat 2048 S/R	**E**
	Incremental encoder sin/cos 1 V_{pp} with C and D track	**M**
	Incremental encoder sin/cos 1 V_{pp} without C and D track	**N**
Encoder systems for motors with DRIVE-CLiQ interface:	Absolute encoder, 22 bit single-turn + 12 bit multi-turn	**F**
	Incremental encoder, 22 bit with 11 bit commutation position	**D**
	Incremental encoder, 22 bit	**Q**
Terminal box/ Cable entry:	Top/right	**0**
	Top/NDE	**2**
	Top/left	**3**
Type:[5]	IM B3 (IM V5, IM V6)	**0**
	IM B5 (IM V1, IM V3)	**2**
	IM B35 (IM V15, IM V35)[7]	**3**

Bearing version for:	**Vibration magnitude:**	**Shaft and flange accuracy:**	
Coupling/belt output	Grade R	Tolerance R	**B**
Coupling/belt output	Grade S	Tolerance R	**C**
Coupling/belt output	Grade SR	Tolerance R	**D**
Increased speed (coupling/belt output) [6]	Grade SR	Tolerance R	**L**

Shaft extension (DE):[5]	**Balancing:**	**Direction of air flow (fan):**	**Blow-out direction:**	
Fitted key	Half-key	DE → NDE	Axial	**A**
Fitted key	Half-key	NDE → DE	Axial	**B**
Fitted key	Full-key	DE → NDE	Axial	**C**
Fitted key	Full-key	NDE → DE	Axial	**D**
Plain shaft	–	DE → NDE	Axial	**J**
Plain shaft	–	NDE → DE	Axial	**K**

Degree of protection:	**Seal:**	**Paint finish:**	
IP55, fan IP54	–	Unpainted	**0**
IP55, fan IP54	DE flange with shaft sealing ring[6]	Unpainted	**2**
IP55, fan IP54	–	Anthracite	**3**
IP55, fan IP54	DE flange with shaft sealing ring[6]	Anthracite	**5**
IP55, fan IP54	–	Anthracite, two coats	**6**
IP55, fan IP54	DE flange with shaft sealing ring[6]	Anthracite, two coats	**8**

Motor type (continued)	Rated torque	Moment of inertia	Weight, approx.	Rated current for duty type in accordance with IEC 60034-1				SINAMICS S120 Motor Module	
								Rated output current	**Booksize format**
	M_{rated}	J	m	I_{rated}				I_{rated}	Order No.
				S1	S6-60%	S6-40%	S2-30 min	S1	
	Nm (lb_f-ft)	kgm^2 (lb_f-in-s^2)	kg (lb)	A	A	A	A	A	
1PH7131 - ..F...	70.0 (51.6)	0.076 (0.67)	90 (198)	24	29	34	31.5	30	**6SL312■ - 1TE23-0AA3**
1PH7133 - ..D...	114.6 (84.5)	0.076 (0.67)	90 (198)	30	36	43	37.5	30	**6SL312■ - 1TE23-0AA3**
1PH7133 - ..F...	95.5 (70.4)	0.076 (0.67)	90 (198)	34	41	49	43.5	45	**6SL312■ - 1TE24-5AA3**
1PH7133 - ..G...	95.5 (70.4)	0.076 (0.67)	90 (198)	45	54	63	59	45	**6SL312■ - 1TE24-5AA3**
1PH7135 - ..F...	117.8 (86.9)	0.109 (0.96)	130 (287)	42	50	58	54	45	**6SL312■ - 1TE24-5AA3**
1PH7137 - ..D...	162.3 (119.7)	0.109 (0.96)	130 (287)	43	50	60	54	45	**6SL312■ - 1TE24-5AA3**
1PH7137 - ..F...	140.1 (103.3)	0.109 (0.96)	130 (287)	57	68	79	73	60	**6SL312■ - 1TE26-0AA3**
1PH7137 - ..G...	133.7 (98.6)	0.109 (0.96)	130 (287)	60	73	87	80	60	**6SL312■ - 1TE26-0AA3**

Cooling:	
Internal air cooling	**0**
External air cooling	**1**
Motor Module:	
Single Motor Module	**1**

1) For continuous duty (with 30% n_{max}, 60% $^2/_3$ n_{max}, 10% standstill) for a duty cycle time of 10 min.
2) Bearing version for coupling/belt output.
3) Bearing version for increased maximum speed.
4) Version for increased maximum speed only possible with vibration magnitude grade SR. The following options are not possible:
   • Shaft sealing ring.
5) The following motor versions are required for ZF gearbox mounting prepared (see Gearboxes for gear selection):
   • Types IM B5 or IM B35
   • Shaft with fitted key and full-key balancing
6) Only appropriate if the sealing ring is occasionally lubricated with oil spray/mist. A sealing ring is not possible with increased maximum speed.
7) Motors of shaft height 160 and higher require foot support.

Shaft height	Rated speed	Continuous speed, max.		Speed, max.[1]		Rated power for duty type in accordance with IEC 60034-1				**1PH7 asynchronous motor with solid shaft** **Forced ventilation**
SH	n_{rated}	$n_{S1\ cont.}$[2]	$n_{S1\ cont.}$[3]	n_{max}	n_{max}[4]	P_{rated}				Order No. **Standard type**
						S1	S6-60%	S6-40%	S2-30 min	
	rpm	rpm	rpm	rpm	rpm	kW (HP)	kW (HP)	kW (HP)	kW (HP)	
160	500	3700	7000	6500	8000	12 (16.1)	15 (20.1)	18 (24.1)	16.5 (22.1)	**1PH7163 -■■B■■-0■■■**
	1000					22 (29.5)	27 (36.2)	33 (44.3)	30 (40.2)	**1PH7163 -■■D■■-0■■■**
	1500					30 (40.2)	37 (49.6)	45 (60.4)	41 (55.0)	**1PH7163 -■■F■■-0■■■**
	2000					36 (48.3)	44 (59.0)	52 (69.7)	48 (64.4)	**1PH7163 -■■G■■-0■■■**
	500	3700	7000	6500	8000	16 (21.5)	19.5 (26.1)	24 (32.2)	21.5 (28.8)	**1PH7167 -■■B■■-0■■■**
	1000					28 (37.5)	34.5 (46.3)	42 (56.3)	38 (51.0)	**1PH7167 -■■D■■-0■■■**
	1500					37 (49.6)	46 (61.7)	56 (75.1)	51 (68.4)	**1PH7167 -■■F■■-0■■■**
	2000					41 (55.0)	51 (68.4)	61 (81.8)	56 (75.1)	**1PH7167 -■■G■■-0■■■**

Fans:	External fan unit, heavy-gauge threaded cable entry in terminal box	**2**
	External fan unit, metric cable entry in terminal box	**7**
Encoder systems for motors without DRIVE-CLiQ interface:	Absolute encoder EnDat 2048 S/R	**E**
	Incremental encoder sin/cos 1 V_{pp} with C and D track	**M**
	Incremental encoder sin/cos 1 V_{pp} without C and D track	**N**
Encoder systems for motors with DRIVE-CLiQ interface:	Absolute encoder, 22 bit single-turn + 12 bit multi-turn	**F**
	Incremental encoder, 22 bit with 11 bit commutation position	**D**
	Incremental encoder, 22 bit	**Q**
Terminal box/ Cable entry:	Top/right	**0**
	Top/NDE	**2**
	Top/left	**3**
Type:[5]	IM B3 (IM V5, IM V6)	**0**
	IM B35 (IM V15, IM V35)[7]	**3**

Bearing version for:	**Vibration magnitude:**	**Shaft and flange accuracy:**	
Coupling/belt output	Grade R	Tolerance R	**B**
Coupling/belt output	Grade S	Tolerance R	**C**
Coupling/belt output	Grade SR	Tolerance R	**D**
Increased speed (coupling/belt output)[6]	Grade SR	Tolerance R	**L**

Shaft extension (DE):[5]	**Balancing:**	**Direction of air flow (fan):**	**Blow-out direction:**	
Fitted key	Half-key	DE → NDE	Axial	**A**
Fitted key	Half-key	NDE → DE	Axial	**B**
Fitted key	Full-key	DE → NDE	Axial	**C**
Fitted key	Full-key	NDE → DE	Axial	**D**
Plain shaft	–	DE → NDE	Axial	**J**
Plain shaft	–	NDE → DE	Axial	**K**

Degree of protection:	**Seal:**	**Paint finish:**	
IP55, fan IP54	–	Unpainted	**0**
IP55, fan IP54	DE flange with shaft sealing ring[6]	Unpainted	**2**
IP55, fan IP54	–	Anthracite	**3**
IP55, fan IP54	DE flange with shaft sealing ring[6]	Anthracite	**5**
IP55, fan IP54	–	Anthracite, two coats	**6**
IP55, fan IP54	DE flange with shaft sealing ring[6]	Anthracite, two coats	**8**

Motor type (continued)	Rated torque	Moment of inertia	Weight, approx.	Rated current for duty type in accordance with IEC 60034-1				SINAMICS S120 Motor Module	
								Rated output current	**Booksize format**
	M_{rated}	J	m	I_{rated}				I_{rated}	Order No.
				S1	S6-60%	S6-40%	S2- 30 min	S1	
	Nm (lb_f-ft)	kgm^2 (lb_f-in-s^2)	kg (lb)	A	A	A	A	A	
1PH7163 - ..B...	229.2 (169)	0.19 (1.68)	180 (397)	30	36	42	39	30	**6SL312■ - 1TE23-0AA3**
1PH7163 - ..D...	210.1 (155)	0.19 (1.68)	180 (397)	55	65	77	71	60	**6SL312■ - 1TE26-0AA3**
1PH7163 - ..F...	191.0 (141)	0.19 (1.68)	180 (397)	72	86	102	94	85	**6SL312■ - 1TE28-5AA3**
1PH7163 - ..G...	171.9 (127)	0.19 (1.68)	180 (397)	85	100	114	107	85	**6SL312■ - 1TE28-5AA3**
1PH7167 - ..B...	305.5 (225)	0.23 (2.04)	228 (503)	37	44	53	48	45	**6SL312■ - 1TE24-5AA3**
1PH7167 - ..D...	267.4 (197)	0.23 (2.04)	228 (503)	71	85	100	92	85	**6SL312■ - 1TE28-5AA3**
1PH7167 - ..F...	235.5 (174)	0.23 (2.04)	228 (503)	82	97	115	104	85	**6SL312■ - 1TE28-5AA3**
1PH7167 - ..G...	195.8 (144)	0.23 (2.04)	228 (503)	89	106	124	115	132	**6SL312■ - 1TE31-3AA3**

Cooling:	
Internal air cooling	**0**
External air cooling	**1**
Motor Module:	
Single Motor Module	**1**

1) For continuous duty (with 30% n_{max}, 60% $^2/_3$ n_{max}, 10% standstill) for a duty cycle time of 10 min.

2) Bearing version for coupling/belt output.

3) Bearing version for increased maximum speed.

4) Version for increased maximum speed only possible with vibration magnitude grade SR. The following options are not possible:
- Shaft sealing ring.

5) The following motor versions are required for ZF gearbox mounting prepared (see Gearboxes for gear selection):
- Types IM B5 or IM B35
- Shaft with fitted key and full-key balancing

6) Only appropriate if the sealing ring is occasionally lubricated with oil spray/mist. A sealing ring is not possible with increased maximum speed.

7) Motors of shaft height 160 and higher require foot support.

Shaft height	Rated speed	Continuous speed, max.			Speed, max.[1]		Rated power for duty type in accordance with IEC 60034-1				**1PH7 asynchronous motor with solid shaft** **Forced ventilation**
SH	n_{rated}	$n_{S1\ cont.}$[2]	$n_{S1\ cont.}$[3]	$n_{S1\ cont.}$[4]	n_{max}	n_{max}[5]	P_{rated}				Order No. **Standard type**
							S1	S6-60%	S6-40%	S2-30 min	
	rpm	rpm	rpm	rpm	rpm	rpm	kW (HP)	kW (HP)	kW (HP)	kW (HP)	
180	500	3500	3000	4500	5000	7000	21.5 (28.8)	26.5 (35.5)	30.5 (40.9)	30 (40.2)	**1PH7184 - ■ ■ T ■ ■ - 0 ■ ■**
	1000						39 (52.3)	48 (64.4)	58 (77.8)	58 (77.8)	**1PH7184 - ■ ■ D ■ ■ - 0 ■ ■**
	1250						40 (53.6)	50 (67.1)	56 (75.1)	66 (88.5)	**1PH7184 - ■ ■ E ■ ■ - 0 ■ ■**
	1500						51 (68.4)	68 (91.2)	81 (109)	81 (109)	**1PH7184 - ■ ■ F ■ ■ - 0 ■ ■**
	2500						78 (105)	97 (130)	115 (154)	115 (154)	**1PH7184 - ■ ■ L ■ ■ - 0 ■ ■**
	500	3500	3000	4500	5000	7000	29.6 (39.7)	36.5 (48.9)	43 (57.7)	38 (51.0)	**1PH7186 - ■ ■ T ■ ■ - 0 ■ ■**
	1000						51 (68.4)	65 (87.2)	77 (103)	77 (103)	**1PH7186 - ■ ■ D ■ ■ - 0 ■ ■**
	1250						60 (80.5)	71 (95.2)	80 (107)	84 (113)	**1PH7186 - ■ ■ E ■ ■ - 0 ■ ■**
	1500						74 (99.2)	94 (126.1)	113 (151.5)	113 (151.5)	**1PH7186 - ■ ■ F ■ ■ - 0 ■ ■**
	2500						106 (142.1)	131 (175.7)	157 (210.5)	165 (221.3)	**1PH7186 - ■ ■ L ■ ■ - 0 ■ ■**

Fans:	External fan unit, heavy-gauge threaded cable entry in terminal box	**2**
	External fan unit, metric cable entry in terminal box	**7**
Encoder systems for motors without DRIVE-CLiQ interface:	Absolute encoder EnDat 2048 S/R	**E**
	Incremental encoder sin/cos 1 V_{pp} 2048 S/R with C and D track	**M**
	Incremental encoder sin/cos 1 V_{pp} 2048 S/R without C and D track	**N**
Encoder systems for motors with DRIVE-CLiQ interface:	Absolute encoder, 22 bit single-turn + 12 bit multi-turn	**F**
	Incremental encoder, 22 bit with 11 bit commutation position	**D**
	Incremental encoder, 22 bit	**Q**
Terminal box/ Cable entry:	Top/right	**0**
	Top/DE	**1**
	Top/NDE	**2**
	Top/left	**3**
Type:	IM B3	**0**
	IM B3 (IM V5, IM V6) (hoisting system for vertical types)	**2**
	IM B35[9]	**3**
	IM B35 (for 1PH7184 with 450 mm (17.7 in) flange only)[9]	**4**
	IM B35 (IM V15, IM V35) (hoisting system for vertical types)[9]	**5**
	IM B35 (IM V15, IM V35) (for 1PH7184 with 450 mm (17.7 in) flange only)[9]	**6**

Bearing version for:	**Vibration magnitude:**	**Shaft and flange accuracy:**	
Coupling output	Grade R	Tolerance N	**A**
Coupling output	Grade R	Tolerance R	**B**
Coupling output	Grade S	Tolerance R	**C**
Coupling output	Grade SR	Tolerance R	**D**
Belt output	Grade R	Tolerance N	**E**
Belt output	Grade R	Tolerance R	**F**
Increased cantilever force (belt output)[6]	Grade R	Tolerance N	**G**
Increased cantilever force (belt output)[6]	Grade R	Tolerance R	**H**
Increased speed (coupling output)[6]	Grade S	Tolerance R	**J**

Shaft extension (DE):[7]	**Balancing:**	**Direction of air flow (fan):**	**Blow-out direction:**	
Fitted key	Half-key	DE → NDE	Right	**A**
Fitted key	Half-key	NDE → DE	Axial	**B**
Fitted key	Full-key	DE → NDE	Right	**C**
Fitted key	Full-key	NDE → DE	Axial	**D**
Plain shaft	–	DE → NDE	Right	**J**
Plain shaft	–	NDE → DE	Axial	**K**

Degree of protection:	**Seal:**	**Paint finish:**	
IP55, fan IP54	–	Primed	**0**
IP55, fan IP54	DE flange with shaft sealing ring[6]	Primed	**2**
IP55, fan IP54	–	Anthracite	**3**
IP55, fan IP54	DE flange with shaft sealing ring[6]	Anthracite	**5**
IP55, fan IP54	–	Anthracite, two coats	**6**
IP55, fan IP54	DE flange with shaft sealing ring[6]	Anthracite, two coats	**8**

Motor type (continued)	Rated torque	Moment of inertia	Weight, approx.[8]	Rated current for duty type in accordance with IEC 60034-1				SINAMICS S120 Motor Module	
								Rated output current	**Booksize format**
	M_{rated}	J	m	I_{rated}				I_{rated}	Order No.
				S1	S6-60%	S6-40%	S2-30 min	S1	
	Nm (lb_f-ft)	kgm^2 (lb_f-in-s^2)	kg (lb)	A	A	A	A	A	
1PH7184 - ..T...	410 (302)	0.5 (4.43)	390 (860)	76	90	103	102	85	**6SL312■ - 1TE28-5AA3**
1PH7184 - ..D...	372 (274)	0.5 (4.43)		90	106	126	126	132	**6SL312■ - 1TE31-3AA3**
1PH7184 - ..E...	305 (225)	0.5 (4.43)		85	100	110	128	85	**6SL312■ - 1TE28-5AA3**
1PH7184 - ..F...	325 (240)	0.5 (4.43)		120	149	174	174	132	**6SL312■ - 1TE31-3AA3**
1PH7184 - ..L...	298 (220)	0.5 (4.43)		172	204	237	237	200	**6SL312■ - 1TE32-0AA3**
1PH7186 - ..T...	565 (417)	0.67 (5.93)	460 (1014)	105	126	147	130	132	**6SL312■ - 1TE31-3AA3**
1PH7186 - ..D...	487 (359)	0.67 (5.93)		118	141	164	164	132	**6SL312■ - 1TE31-3AA3**
1PH7186 - ..E...	458 (338)	0.67 (5.93)		120	135	150	156	132	**6SL312■ - 1TE31-3AA3**
1PH7186 - ..F...	471 (347)	0.67 (5.93)		170	210	250	250	200	**6SL312■ - 1TE32-0AA3**
1PH7186 - ..L...	405 (299)	0.67 (5.93)		235	290	345	407	260	**6SL332■ - 1TE32-1AA0**
Cooling: Internal air cooling External air cooling									**0** **1**
Motor Module: Single Motor Module									**1**

1) For continuous duty (with 30% n_{max}, 60% $^2/_3$ n_{max}, 10% standstill) for a duty cycle time of 10 min.

2) Bearing version for coupling/belt output.

3) Bearing version for increased cantilever force.

4) Bearing version for increased maximum speed.

5) Version for increased maximum speed, only possible in combination with vibration magnitude grade S. The following options are not possible:
- ZF gearbox mounting prepared
- Shaft sealing ring

6) Only appropriate if the sealing ring is occasionally lubricated with oil spray/mist. A sealing ring is not possible for type IM B3 (IM V5, IM V6), version with increased cantilever force or increased maximum speed.

7) The following motor versions are required for ZF gearbox mounting prepared (see Gearboxes for gear selection):
- Type IM B35, IM V15 (not IM V35)
- Shaft with fitted key and full-key balancing
- Bearing version for coupling output
- Shaft and flange accuracy tolerance R
- DE flange with shaft sealing ring

8) Applies to type IM B35, as type IM B3, the motor is 20 kg (44 lb) lighter.

9) Motors of shaft height 160 and higher require foot support.

Shaft height	Rated speed	Continuous speed, max.			Speed, max.[1]		Rated power for duty type in accordance with IEC 60034-1				**1PH7 asynchronous motor with solid shaft** **Forced ventilation**
SH	n_{rated}	$n_{S1\ cont.}$[2]	$n_{S1\ cont.}$[3]	$n_{S1\ cont.}$[4]	n_{max}	n_{max}[5]	P_{rated}				Order No. **Standard type**
							S1	S6-60%	S6-40%	S2-30 min	
	rpm	rpm	rpm	rpm	rpm	rpm	kW (HP)	kW (HP)	kW (HP)	kW (HP)	
225	700	3100	2700	3600	4500	5500	55 (73.8)	66 (88.5)	75 (101)	78 (105)	**1PH7224 - ■ ■ C■ ■ -0 ■ ■ ■**
	1000						71 (95.2)	88 (118)	105 (141)	114 (153)	**1PH7224 - ■ ■ D■ ■ -0 ■ ■ ■**
	1500						100 (134)	126 (169)	136 (182)	140 (188)	**1PH7224 - ■ ■ F■ ■ -0 ■ ■ ■**
	2500						142 (190)	176 (236)	210 (281)	220 (295)	**1PH7224 - ■ ■ L■ ■ -0 ■ ■ ■**

Fans:	External fan unit, heavy-gauge threaded cable entry in terminal box	**2**
	External fan unit, metric cable entry in terminal box	**7**
Encoder systems for motors without DRIVE-CLiQ interface:	Absolute encoder EnDat 2048 S/R	**E**
	Incremental encoder sin/cos 1 V_{pp} with C and D track	**M**
	Incremental encoder sin/cos 1 V_{pp} without C and D track	**N**
Encoder systems for motors with DRIVE-CLiQ interface:	Absolute encoder, 22 bit single-turn + 12 bit multi-turn	**F**
	Incremental encoder, 22 bit with 11 bit commutation position	**D**
	Incremental encoder, 22 bit	**Q**
Terminal box/ Cable entry:	Top/right	**0**
	Top/DE	**1**
	Top/NDE	**2**
	Top/left	**3**
Type:	IM B3	**0**
	IM B3 (IM V5, IM V6) (hoisting system for vertical types)	**1**
	IM B35[9]	**3**
	IM B35 (IM V15, IM V35) (hoisting system for vertical types)[9]	**5**

Bearing version for:	**Vibration magnitude:**	**Shaft and flange accuracy:**	
Coupling output	Grade R	Tolerance N	**A**
Coupling output	Grade R	Tolerance R	**B**
Coupling output	Grade S	Tolerance R	**C**
Coupling output	Grade SR	Tolerance R	**D**
Belt output	Grade R	Tolerance N	**E**
Belt output	Grade R	Tolerance R	**F**
Increased cantilever force[6] (belt output)	Grade R	Tolerance N	**G**
Increased cantilever force[6] (belt output)	Grade R	Tolerance R	**H**
Increased speed (coupling output)[6]	Grade S	Tolerance R	**J**

Shaft extension (DE):[7]	**Balancing:**	**Direction of air flow (fan):**	**Blow-out direction:**	
Fitted key	Half-key	DE -> NDE	Right	**A**
Fitted key	Half-key	NDE -> DE	Axial	**B**
Fitted key	Full-key	DE -> NDE	Right	**C**
Fitted key	Full-key	NDE -> DE	Axial	**D**
Plain shaft	–	DE -> NDE	Right	**J**
Plain shaft	–	NDE -> DE	Axial	**K**

Degree of protection:	**Seal:**	**Paint finish:**	
IP55, fan IP54	–	Primed	**0**
IP55, fan IP54	DE flange with shaft sealing ring[6]	Primed	**2**
IP55, fan IP54	–	Anthracite	**3**
IP55, fan IP54	DE flange with shaft sealing ring[6]	Anthracite	**5**
IP55, fan IP54	–	Anthracite, two coats	**6**
IP55, fan IP54	DE flange with shaft sealing ring[6]	Anthracite, two coats	**8**

Motor type (continued)	Rated torque	Moment of inertia	Weight, approx.[8]	Rated current for duty type in accordance with IEC 60034-1				SINAMICS S120 Motor Module	
								Rated output current	**Booksize format**
	M_{rated}	J	m	I_{rated}				I_{rated}	Order No.
				S1	S6-60%	S6-40%	S2-30 min	S1	
	Nm (lb_f-ft)	kgm^2 (lb_f-in-s^2)	kg (lb)	A	A	A	A	A	
1PH7224 - ..C...	750 (553)	1.48 (13.1)	650 (1433)	117	135	149	155	132	**6SL312■ - 1TE31-3AA3**
1PH7224 - ..D...	678 (500)	1.48 (13.1)	650 (1433)	164	190	222	240	200	**6SL312■ - 1TE32-0AA3**
1PH7224 - .. F...	636 (469)	1.48 (13.1)	650 (1433)	188	230	248	256	200	**6SL312■ - 1TE32-0AA3**
1PH7224 - .. L...	542 (xxx)	1.48 (13.1)	650 (1433)	298	355	419	438	310	**6SL332■ - 1TE33-1AA0**

Cooling:	
Internal air cooling	**0**
External air cooling	**1**
Motor Module:	
Single Motor Module	**1**

1) For continuous duty (with 30% n_{max}, 60% $^2/_3$ n_{max}, 10% standstill) for a duty cycle time of 10 min.

2) Bearing version for coupling/belt output.

3) Bearing version for increased cantilever force.

4) Bearing version for increased maximum speed.

5) Version for increased maximum speed, only possible in combination with vibration magnitude grade S. The following options are not possible:
- ZF gearbox mounting prepared
- Shaft sealing ring

6) Only appropriate if the sealing ring is occasionally lubricated with oil spray/mist. A sealing ring is not possible for type IM B3 (IM V5, IM V6), version with increased cantilever force or increased maximum speed.

7) The following motor versions are required for ZF gearbox mounting prepared (see Gearboxes for gear selection):
- Type IM B35, IM V15 (not IM V35)
- Shaft with fitted key and full-key balancing
- Bearing version for coupling output
- Shaft and flange accuracy tolerance R
- DE flange with shaft sealing ring

8) Applies to type IM B35, as type IM B3, the motor is 20 kg (44 lb) lighter.

9) Motors of shaft height 160 and higher require foot support.

Shaft height	Rated speed	Continuous speed, max.			Speed, max.[1]		Rated power for duty type in accordance with IEC 60034-1				**1PH7 asynchronous motor with solid shaft Forced ventilation**
SH	n_{rated}	$n_{S1\ cont.}$[2]	$n_{S1\ cont.}$[3]	$n_{S1\ cont.}$[4]	n_{max}	n_{max}[5]	P_{rated} S1	S6-60%	S6-40%	S2-30 min	Order No. **Standard type**
	rpm	rpm	rpm	rpm	rpm	rpm	kW (HP)	kW (HP)	kW (HP)	kW (HP)	
225	1000	3100	2700	-	4500	-	92 (123)	114 (153)	136 (182)	136 (182)	**1PH7224 -■■C■■-0■■■**
	1500						130 (174)	161 (216)	192 (257)	200 (268)	**1PH7224 -■■D■■-0■■■**
	2500						168 (225)	208 (279)	248 (332)	265 (355)	**1PH7224 -■■F■■-0■■■**
	1000						113 (151)	140 (187)	167 (224)	167 (224)	**1PH7224 -■■L■■-0■■■**
	1500						160 (214)	198 (265)	237 (318)	237 (318)	**1PH7224 -■■F■■-0■■■**
	2500						205 (275)	254 (340)	303 (406)	310 (416)	**1PH7224 -■■L■■-0■■■**

Fans:	External fan unit, heavy-gauge threaded cable entry in terminal box	**2**
	External fan unit, metric cable entry in terminal box	**7**
Encoder systems for motors without DRIVE-CLiQ interface:	Absolute encoder EnDat 2048 S/R	**E**
	Incremental encoder sin/cos 1 V_{pp} with C and D track	**M**
	Incremental encoder sin/cos 1 V_{pp} without C and D track	**N**
Encoder systems for motors with DRIVE-CLiQ interface:	Absolute encoder, 22 bit single-turn + 12 bit multi-turn	**F**
	Incremental encoder, 22 bit with 11 bit commutation position	**D**
	Incremental encoder, 22 bit	**Q**
Terminal box/ Cable entry:	Top/right	**0**
	Top/DE	**1**
	Top/NDE	**2**
	Top/left	**3**
Type:	IM B3	**0**
	IM B3 (IM V5, IM V6) (hoisting system for vertical types)	**1**
	IM B35[9]	**3**
	IM B35 (IM V15, IM V35) (hoisting system for vertical types)[9]	**5**

Bearing version for:	**Vibration magnitude:**	**Shaft and flange accuracy:**	
Coupling output	Grade R	Tolerance N	**A**
Coupling output	Grade R	Tolerance R	**B**
Coupling output	Grade S	Tolerance R	**C**
Coupling output	Grade SR	Tolerance R	**D**
Belt output	Grade R	Tolerance N	**E**
Belt output	Grade R	Tolerance R	**F**
Increased cantilever force[6] (belt output)	Grade R	Tolerance N	**G**
Increased cantilever force[6] (belt output)	Grade R	Tolerance R	**H**

Shaft extension (DE):[7]	**Balancing:**	**Direction of air flow (fan):**	**Blow-out direction:**	
Fitted key	Half-key	DE -> NDE	Right	**A**
Fitted key	Half-key	NDE -> DE	Axial	**B**
Fitted key	Full-key	DE -> NDE	Right	**C**
Fitted key	Full-key	NDE -> DE	Axial	**D**
Plain shaft	–	DE -> NDE	Right	**J**
Plain shaft	–	NDE -> DE	Axial	**K**

Degree of protection:	**Seal:**	**Paint finish:**	
IP55, fan IP54	–	Primed	**0**
IP55, fan IP54	DE flange with shaft sealing ring[6]	Primed	**2**
IP55, fan IP54	–	Anthracite	**3**
IP55, fan IP54	DE flange with shaft sealing ring[6]	Anthracite	**5**
IP55, fan IP54	–	Anthracite, two coats	**6**
IP55, fan IP54	DE flange with shaft sealing ring[6]	Anthracite, two coats	**8**

Motor type (continued)	Rated torque	Moment of inertia	Weight, approx.[8]	Rated current for duty type in accordance with IEC 60034-1				SINAMICS S120 Motor Module	
								Rated output current	**Booksize format**
	M_{rated}	J	m	I_{rated}				I_{rated}	Order No.
				S1	S6-60%	S6-40%	S2-30 min	S1	
	Nm (lb_f-ft)	kgm^2 (lb_f-in-s^2)	kg (lb)	A	A	A	A	A	
1PH7226 - ..D...	880 (xxx)	1.93 (xxx)	750 (1653)	198	237	280	280	200	**6SL312■ - 1TE32-0AA3**
1PH7226 - ..F...	828 (xxx)	1.93 (xxx)	750 (1653)	278	330	387	403	310	**6SL332■ - 1TE33-1AA0**
1PH7226 - ..L...	642 (xxx)	1.93 (xxx)	750 (1653)	262	428	501	413	380	**6SL332■ - 1TE33-8AA0**
1PH7228 - ..D...	1080 (xxx)	2.326 (xxx)	860 (1896)	240	289	342	342	260	**6SL332■ - 1TE32-6AA0**
1PH7228 - ..F...	1019 (xxx)	2.326 (xxx)	860 (1896)	350	413	483	483	380	**6SL332■ - 1TE33-8AA0**
1PH7228 - ..L...	783 (xxx)	2.326 (xxx)	860 (1896)	433	534	630	644	490	**6SL332■ - 1TE35-0AA0**

Cooling:	
Internal air cooling	**0**
External air cooling	**1**
Motor Module:	
Single Motor Module	**1**

1) For continuous duty (with 30% n_{max}, 60% $^2/_3$ n_{max}, 10% standstill) for a duty cycle time of 10 min.

2) Bearing version for coupling/belt output.

3) Bearing version for increased cantilever force.

4) Bearing version for increased maximum speed.

5) Version for increased maximum speed, only possible in combination with vibration magnitude grade S. The following options are not possible:
- ZF gearbox mounting prepared
- Shaft sealing ring

6) Only appropriate if the sealing ring is occasionally lubricated with oil spray/mist. A sealing ring is not possible for type IM B3 (IM V5, IM V6), version with increased cantilever force or increased maximum speed.

7) The following motor versions are required for ZF gearbox mounting prepared (see Gearboxes for gear selection):
- Type IM B35, IM V15 (not IM V35)
- Shaft with fitted key and full-key balancing
- Bearing version for coupling output
- Shaft and flange accuracy tolerance R
- DE flange with shaft sealing ring

8) Applies to type IM B35, as type IM B3, the motor is 20 kg (44 lb) lighter.

9) Motors of shaft height 160 and higher require foot support.

1.4 Rating plate data

The rating plate contains the technical specifications relevant to the motor.

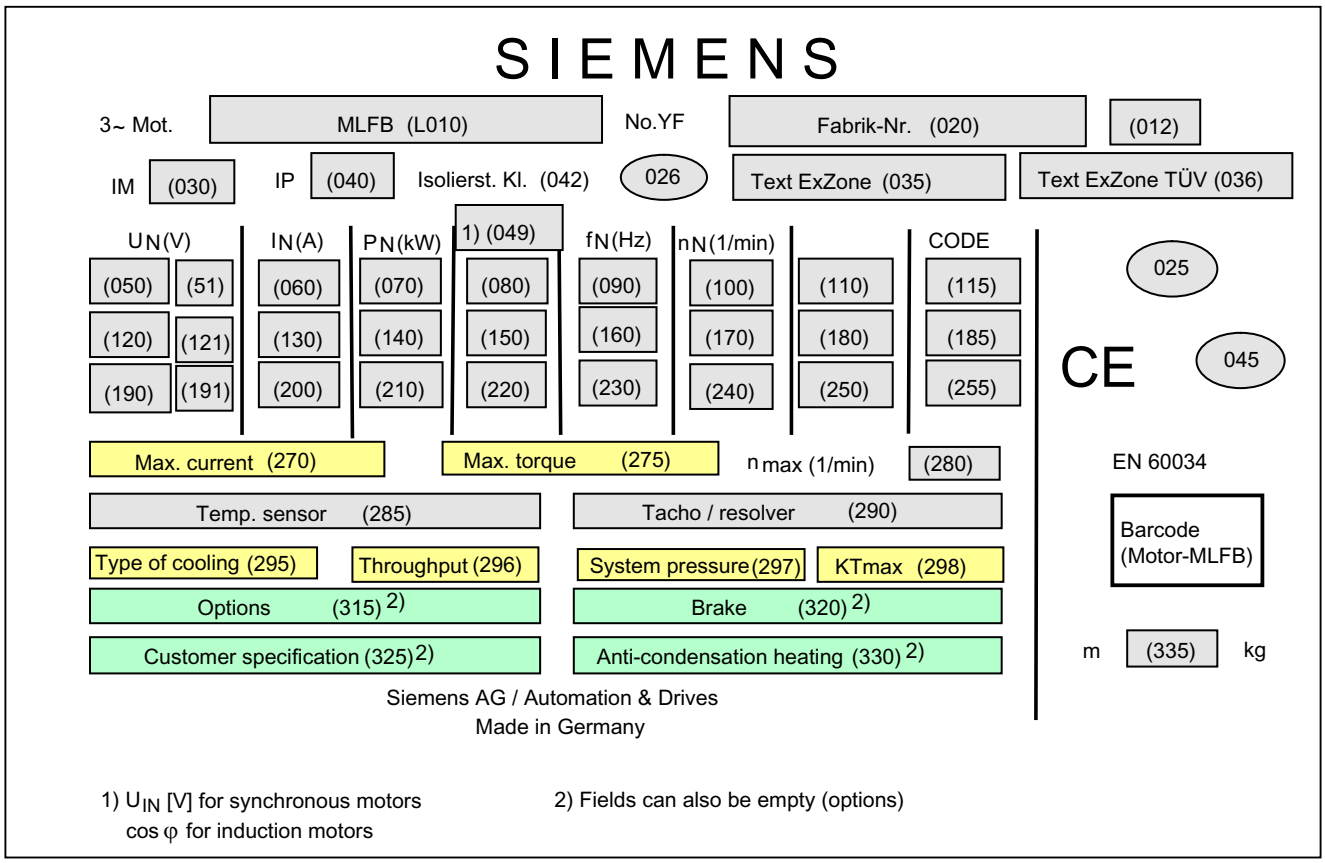


Figure 1-2 Schematic layout of rating plate

Table 1- 3 Elements on the rating plate

No.	Description	No.	Description
010	Order number	170	Rated speed n_N (2)
012	Consecutive number, part of serial number	180	Operating mode (2)
020	Serial number	185	Code for operating point 2
025	UL approval	190	Rated voltage V_N (3)
026	Graphical symbol zone 2	191	Switching mode 3
030	Type of construction	200	Rated current I_N (3)
035	Identification code zone 2	210	Rated power P_N (3)
036	Protection against explosion	220	cos φ (3)
040	Degree of protection	230	Rated frequency f_N (3)
045	Type of balancing	240	Rated speed n_N (3)
049	For induction cos φ; for synchronous V_{IN}	250	Operating mode (3)
050	Rated voltage V_N (1)	255	Code for operating point 3
051	Switching mode 1	270	Max. current I_{max}
060	Rated current I_N (1)	275	Max. torque M_{max}
070	Rated power P_N (1)	280	Max. speed n_{max}
080	cos φ (1)	285	Temperature sensor
090	Rated frequency f_N (1)	290	Tachometer/resolver
100	Rated speed n_N (1)	295	Cooling method
110	Operating mode (1)	296	Throughput l/min (m^3/s)
115	Code for operating point 1	297	System pressure
120	Rated voltage V_N (2)	298	Maximum coolant temperature
121	Switching mode 2	315	Options (I)
130	Rated current I_N (2)	320	Options (II)
140	Rated power P_N (2)	325	Optional customer information
150	cos φ (2)	330	Anti-condensation heating/place holder
160	Rated frequency f_N (2)	335	Weight

Configuration

2

2.1 Configuring software

2.1.1 SIZER engineering tool

Overview

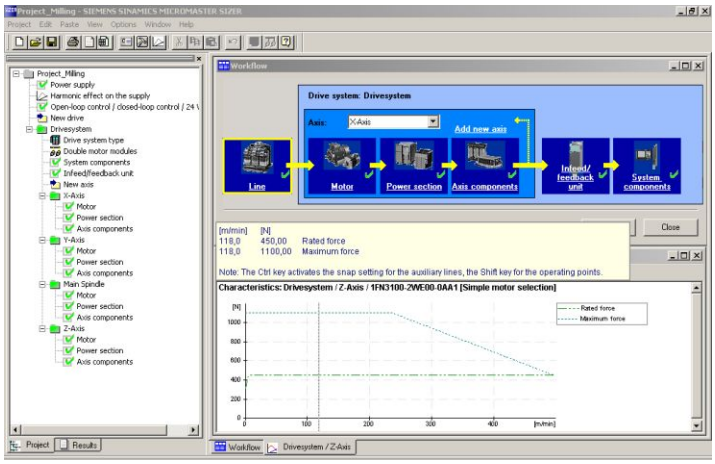


Figure 2-1 SIZER

The SIZER configuration tool provides an easy-to-use means of configuring the SINAMICS and MICROMASTER 4 drive families, as well as the SINUMERIK solution line CNC control and SIMOTION Motion Control system. It provides support for the technical planning of the hardware and firmware components required for a drive task. SIZER supports the complete configuration of the drive system, from simple individual drives to complex multi-axis applications.

SIZER supports all of the engineering steps in a workflow:

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

When SIZER was being designed, particular importance was placed on a high degree of usability and a universal, function-based approach to the drive application. The extensive user navigation makes it easy to use the tool. Status information keeps you continually informed about how engineering is progressing.

The SIZER user interface is available in German and English. The drive configuration is saved in a project. In the project, the components and functions used are displayed in a hierarchical tree structure. The project view permits the configuration of drive systems and the copying/inserting/modifying of drives already configured.

The configuration process produces the following results:

- Parts list of components required (Export to Excel)
- Technical specifications of the system
- Characteristics
- Comments on system reactions
- Location diagram of drive and control components and dimension drawings

These results are displayed in a results tree and can be reused for documentation purposes. User support is provided by technological online help, which provides the following information:

- Detailed technical data
- Information about the drive systems and their components
- Decision-making criteria for the selection of components.

Minimum system requirements

- PG or PC with Pentium™ II 400 MHz (Windows™ 2000), Pentium™ III 500 MHz (Windows™ XP)
- 256 MB RAM (512 MB recommended)
- At least 1.7 GB of free hard disk space
- An additional 100 MB of free hard disk space on Windows system drive
- Monitor resolution, 1024×768 pixels
- Windows™ 2000 SP2, XP Professional SP1, XP Home Edition SP1
- Microsoft Internet Explorer 5.5 SP2

Order number for SIZER

Table 2- 1 Order number for SIZER

Engineering tool	Order number (MLFB)
SINAMICS MICROMASTER SIZER German/English	6SL3070-0AA00-0AG0

2.1.2 STARTER drive/commissioning software

The easy-to-use STARTER drive/commissioning tool can be used for:

- Commissioning,
- Optimization, and
- Diagnostics

You will find a description in the Intranet under the following address:

http://mall.automation.siemens.com

Select the country and then in the menu bar "Products".

In the navigator, set "Drive Technology" → "Engineering software" → "STARTER drive/commissioning software"

Download, refer under http://support.automation.siemens.com

2.1.3 SinuCom commissioning tool

The simple-to-use commissioning software for PC/PG serves to ensure optimum commissioning of drives with SINAMICS S120/SIMODRIVE 611 digital. You will find a description in the Intranet under the following address:

https://mall.automation.siemens.com

Select your country and then in the menu bar "Products".

In the navigator, select "Automation Systems" → "SINUMERIK CNC automation systems" → HMI software for CNC controls" → "Tools" → "SinuCom".

2.2 SINAMICS procedure when engineering

Motion control

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

As a result of these considerations, servo drives must meet the following requirements:

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

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

General configuring procedure

The function description of the machine provides the basis when configuring the drive application. The definition of the components is based on physical interdependencies and is usually carried out as follows:

Table 2- 2 Configuring procedure

Step	Description of the configuring activity	
1.	Clarification of the type of drive	Refer to the next chapter
2.	Definition of supplementary conditions and integration into an automation system	
3.	Definition of the load, calculation of the maximum load torque and selection of the motor	
4.	Selection of the SINAMICS Motor Module	Refer to catalog
5.	Steps 3 and 4 are repeated for additional axes	
6.	Calculation of the required DC link power and selection of the SINAMICS Line Module	
7.	Selection of the line-side options (main switch, fuses, line filters, etc.)	
8.	Specification of the required control performance and selection of the Control Unit, definition of component cabling	
9.	Definition of other system components (e.g. braking resistors)	
10.	Calculation of the current demand of the 24 V DC supply for the components and specification of the power supplies (SITOP devices, Control Supply Modules)	
11.	Selection of the components for the connection system	
12.	Configuration of the drive line-up components	
13.	Calculation of the required cable cross sections for power supply and motor connections	
14.	Inclusion of mandatory installation clearances	

2.3 Selecting and dimensioning induction motors

2.3.1 Clarification of the type of drive

The motor is selected on the basis of the required torque, which is defined by the application, e.g. traveling drives, hoisting drives, test stands, centrifuges, paper and rolling mill drives, feed drives or main spindle drives. Gearboxes to convert motion or to adapt the motor speed and motor torque to the load conditions must also be considered.

As well as the load torque, which is determined by the application, the following mechanical data is among those required to calculate the torque to be provided by the motor:

- Masses to be moved
- Diameter of the drive wheel
- Leadscrew pitch, gear ratios
- Frictional resistance
- Mechanical efficiency
- Traversing paths
- Maximum velocity
- Maximum acceleration and maximum deceleration
- Cycle time

2.3.2 Defining the supplementary conditions and integration into an automation system

You must decide whether synchronous or induction motors are to be used.

Synchronous motors are the best choice if it is important to have low envelope dimensions, low rotor moment of inertia and therefore maximum dynamic response ("Servo" control type).

Induction motors can be used to increase maximum speeds in the field weakening range. Induction motors for higher power ratings are also available.

The following factors are especially important when engineering a drive application:

- The line system configuration, when using specific types of motor and/or line filters on IT systems (non-grounded systems)
- The utilization of the motor in accordance with rated values for winding temperature rise 60 K or 100 K (for synchronous motors).
- The ambient temperatures and the installation altitude of the motors and drive components.
- Heat dissipation from the motors through natural ventilation, forced ventilation or water cooling

Other constraints apply when integrating the drives into an automation environment such as SINUMERIK or SIMOTION.

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

2.3.3 Selecting induction motors

A differentiation must be made between 3 applications when selecting a suitable induction motor:

Case 1: The motor essentially operates in continuous duty.

Case 2: A periodic duty cycle determines how the drive is dimensioned.

Case 3: A high field weakening range is required.

The objective is to identify characteristic torque and speed operating points, on the basis of which the motor can be selected depending on the particular application.

Once the application has been defined and specified, the maximum motor torque is calculated. Generally, the maximum motor torque is required when accelerating. The load torque and the torque required to accelerate the motor are added.

The maximum motor torque is then verified with the limiting characteristic curves of the motors.

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

- The dynamic limits must be adhered to, i.e. all speed-torque points of the relevant load event must lie below the relevant limiting characteristic curve.
- The thermal limits must be adhered to, i.e. the rms motor torque at the average motor speed resulting from the duty cycle must lie below the S1 characteristic curve (continuous duty). The rms value of the motor current within a duty cycle must be less than the rated motor current.
- In the field-weakening range, the permissible motor torque is restricted by the voltage limit characteristic (stability limit). A margin of 30 % should be observed.

2.3.4 Motor operates continuously

The following motor must be selected: $P_{N,\ Motor} \geq P_{required}$

An overload is dimensioned for transient overloads (e.g. when accelerating). The peak torque must lie below the stability limit.

It must then be verified that the selected motor can supply the necessary output over the desired speed range. If this is not the case, a larger motor or a different winding variant must be selected.

2.3.5 Motor operates with a periodic duty cycle

The duty cycle determines how the drive is dimensioned. It is assumed that the speeds during the duty cycle lie below the rated speed.

If the power is known, but the torques during the duty cycle are unknown, then the power must be converted to a torque:

$M = P \bullet 9550 / n$ M in [Nm], P in [kW], n in [rpm]

The torque to be generated by the motor comprises the frictional torque $M_{friction}$, the load torque of the driven machine M_{load} and the accelerating torque M_B:

$M = M_{friction} + M_{load} + M_B$

The accelerating torque M_B is calculated as follows:

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

M_B	Acceleration torque in Nm referred to the motor shaft (on the motor side)
$J_{motor+load}$	Total moment of inertia in kgm² (on the motor side)
Δn	Speed variation in rpm
t_B	Acceleration time, in s

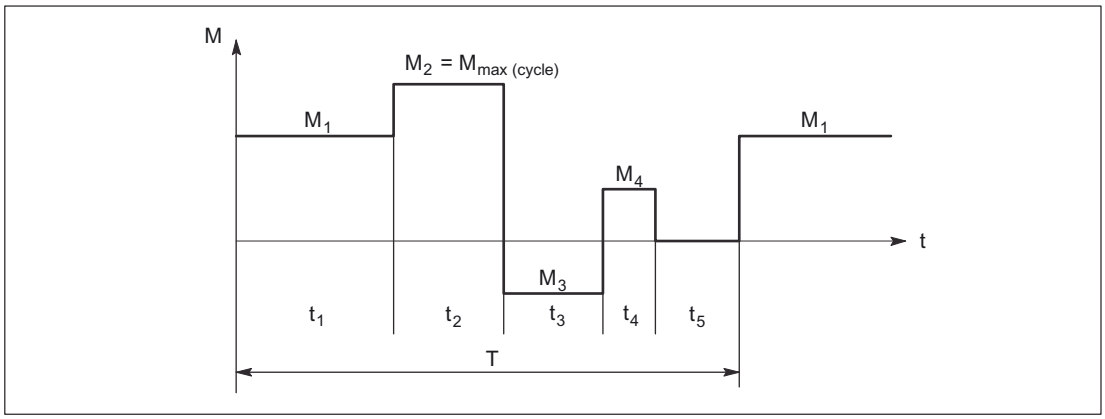


Figure 2-2 Periodic duty cycle (example)

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

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

A differentiation should be made depending on the period T and the thermal time constant T_{th} of the motor that is dependent on the shaft height:

- $T/T_{th} \leq 0.1$ (for a cycle duration of 2 to 4 min)
- $0.1 \leq T/T_{th} \leq 0.1$ (for a cycle duration of 3 to 20 min)
- $T/T_{th} > 0.5$ (for a cycle duration of approx. 15 min)

Motor selection

Table 2- 3 The motor is selected depending on the cycle duration and the thermal time constant

Cycle duration	Motor selection
$T/T_{th} \leq 0.1$ (cycle duration of 2 to 4 min)	A motor with the following rated torque M_N should be selected: $M_N > M_{rms}$ and $M_{max\ (cycle)} < 2\ M_N$
$0.1 \leq T/T_{th} \leq 0.5$ (cycle duration of approx. 3 to approx. 20 min)	A motor with the following rated torque M_N should be selected: $M_N > \frac{M_{rms}}{1.025 - 0.25 \cdot \frac{T}{T_{th}}}$ and $M_{max\ (cycle)} < M_N$
$T/T_{th} > 0.5$ (for a cycle duration of approx. 15 min)	If, for duty cycles, torques occur above M_N for longer than $0.5\ T_{th}$, then a motor with the following rated torque should be selected: $M_N > M_{max\ (cycle)}$.

Selection of Motor Modules

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

2.3.6 A high field weakening range is required

Proceed as follows for applications with a field-weakening range greater than for standard induction motors:

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

Finally, a check should be made as to whether the motor can generate the torque or the power at the transition speed required by the application (n_N, P_N).

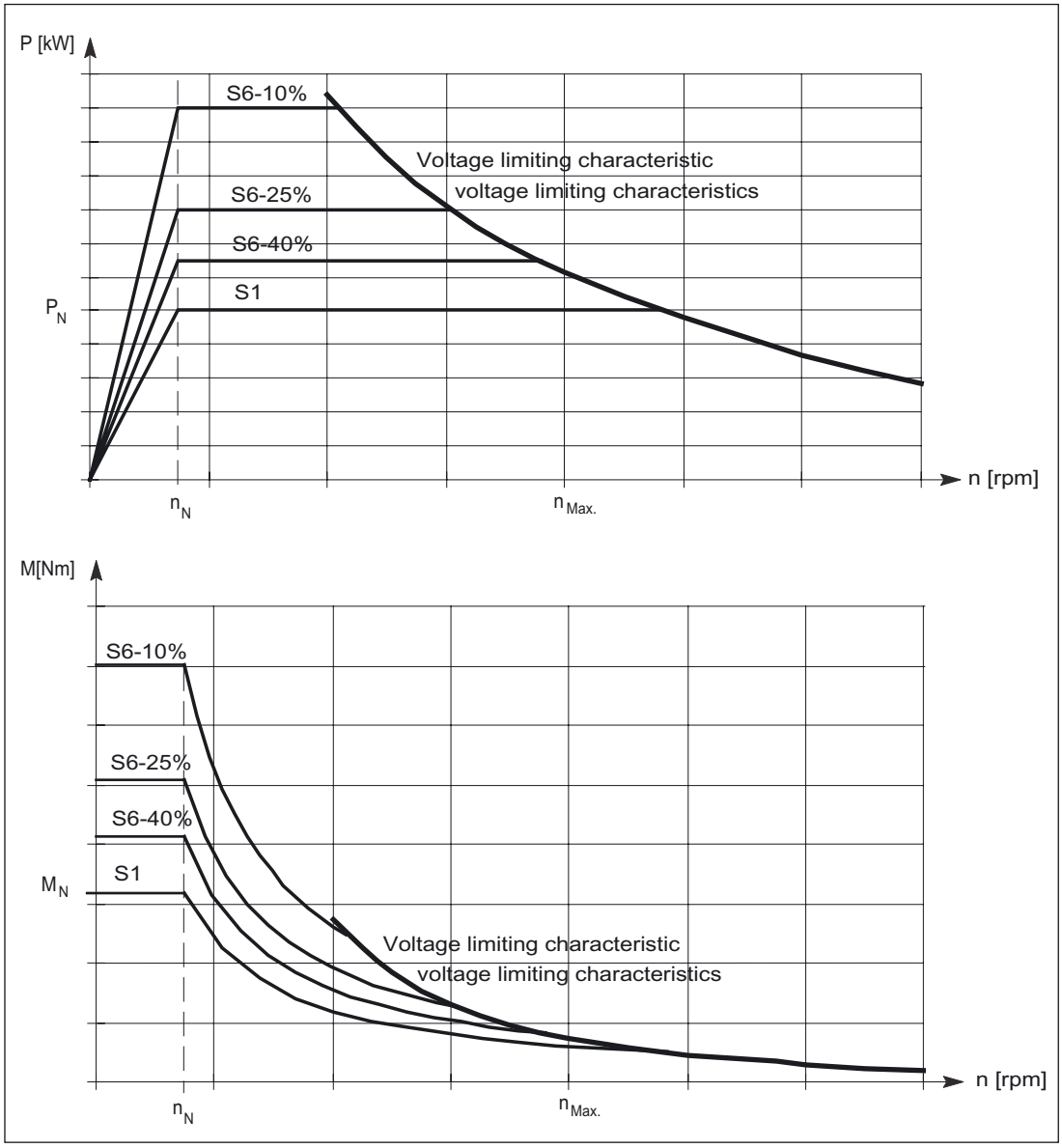


Figure 2-3 Motor selection based on power-speed and torque-speed diagrams

Example of the calculation of n_N

A specific power of P_{max} = 8 kW is required at n_{max} = 5250 rpm.
The field weakening range should be 1 : 3.5.

Calculation of the required rated speed n_N: 5250 / 3.5 rpm = 1500 rpm.

Mechanical properties of the motors

3

3.1 Cooling

1PH7 motors are force-ventilated. When mounting the motor, it must be ensured that the motor can be well ventilated. This is especially true when mounting the motors in enclosures. It is not permissible that hot discharged air is drawn-in again; cooling air must be able to freely enter and exit. Accumulated dirt in the cooling ducts should be avoided as this can reduce the cooling airflow.

All catalog data refer to an ambient temperature of 40°C and an installation altitude up to 1000 m above sea level.

⚠ CAUTION
Temperatures of over 100°C can occur at the surface of the motor.

Ambient/cooling medium temperature

Operation: T = -15 °C to +40 °C (without any restrictions)
Storage: T = -20 °C to +70 °C

Under conditions other than those specified above (ambient temperature > 40°C or installation altitude > 1000 m above sea level), the permissible torque/power must be determined from the following table. Ambient temperatures and installation altitudes are rounded-off to 5° C or 500 m respectively.

Table 3- 1 Factors for reducing the torque/power acc. to EN 60034-6

Installation altitude above sea level	Ambient temperature in °C		
	40	45	50
1000	1.00	0.96	0.92
1500	0.97	0.93	0.89
2000	0.94	0.90	0.86
2500	0.90	0.86	0.83
3000	0.86	0.82	0.79
3500	0.82	0.79	0.75
4000	0.77	0.74	0.71

NOTICE
For ambient temperatures > 50 °C, please contact your local Siemens office.

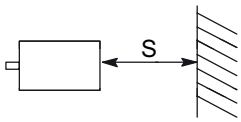
Mounting a fan and minimum clearance to the customers mounted parts and components

Table 3- 2 Fan mounting

Shaft height [mm]	Fan mounting
100 to 225	NDE axial, can be rotated through 4 x 90°

The minimum clearance to the customer's mounted parts and components and the air discharge opening as well as the minimum clearance S between the air intake and air discharge openings and adjacent components must be maintained.

Table 3- 3 Minimum clearances

Shaft height [mm]	Minimum clearance to the customer's mounted parts and components [mm]	Minimum clearance S [mm]	
100	30	30	
132	60	60	
160	80	80	
180	100	80	
225	100	80	

Air flow rate, air flow direction and air discharge

Table 3- 4 Air flow rate, air flow direction and air discharge

Shaft height [mm]	Air flow direction	Required air flow rate [m^3/s]	Air discharge	Pressure drop (Δp) [Pa]
100	NDE → DE	0.04	Axial	on request
	DE → NDE	0.04	Axial	
132	NDE → DE	0.1	Axial	on request
	DE → NDE	0.1	Axial	
160	NDE → DE	0.15	Axial	on request
	DE → NDE	0.15	Axial	
180	NDE → DE	0.19	Axial	650
	DE → NDE	0.19	Radial	650
225	NDE → DE	0.36	Axial	900
	DE → NDE	0.36	Radial	

Note

If the ambient air is polluted by particles of dust or similar substances, then the preferable air flow direction is NDE → DE.

Cleaning the cooling air passages

For air-cooled motors, the cooling ducts, through which the ambient air flows, must be regularly cleaned depending on the degree of pollution at the mounting location. These air ducts can be cleaned, e.g. using dry, oil-free compressed air.

Please refer to the Operating Instructions for details.

Motors with pipe connection

1PH7 motors that are configured to allow pipes to be connected and/or for operation with a separately driven fan must have pipes and a fan of suitable type and dimensioning mounted and connected to them.

Note

For motors with pipe/duct connection, the potential pressure drop within the motor is specified in the table.

3.2 Degree of protection acc. to EN 60034-5

Degree of protection designation

The degree of protection designation in accordance with EN 60034-5 (IEC 60034-5) is described using the letters "IP" and two digits (e.g. IP64).

IP = International Protection
1st digit = protection against ingress of foreign bodies
2nd digit = protection against harmful ingress of water

Since most cooling lubricants used in machine tools and transfer machines are oily, creep-capable, and/or corrosive, protection against water alone is insufficient. The motors must be protected by suitable covers.

Attention must be paid to providing suitable sealing of the motor shaft for the selected degree of protection for the motor.

NOTICE
Depending on these ambient conditions- such as the chemical properties of dusts or the cooling media used at the installation site - it is only conditionally possible to evaluate the suitability of the motor for the particular environment using the degree of protection (e.g. electrically conductive dusts or aggressive cooling medium vapors or liquids). In these cases, the motor must be additionally protected using the appropriate measures.

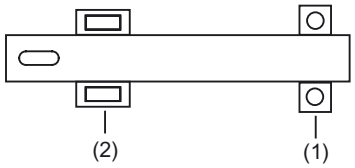
NOTICE
Liquid must be prevented from collecting on the motor shaft as well as jets of oil (or are not permissible at all) - even for versions with radial shaft sealing ring.

3.3 Bearing version

3.3.1 Drive output types and bearing versions

1PH7 induction motors are suitable for coupling output and belt coupling. The bearing versions and their applications are summarized in the following table.

Table 3- 5 Drive output type with the appropriate bearing design

<table>
<tr><th>Application</th><th colspan="2">Bearing version</th></tr>
<tr><td>• Coupling output
• Planetary gearboxes, low radial forces</td><td rowspan="2">Shaft heights 100 to 160
 
</td><td>SH 180 to 225
 
</td></tr>
<tr><td>• Belt coupling with normal radial force
• Pinion output with straight teeth
• Belt coupling with increased radial force</td><td>SH 180 to 225
 
</td></tr>
</table>

1) Deep-groove ball bearings (floating bearing)

2) Cylindrical-roller bearing

Output type, bearing version and maximum speed

Table 3- 6 Output type, bearing version and maximum speed

Shaft height	Bearing type/ drive output type	Bearings on the motor side	Bearing designation	Max. continuous speed for S1 duty [rpm]		Max. speed limit [1] [rpm]	
				n_{s1}	n_{s1} [1]	n_{max}	n_{max} [2]
100	Deep-groove ball bearings for coupling output or belt coupling configurations	DE NDE	6308 C4 6208 C4	5500	10000	9000	12000
132	Deep-groove ball bearings for coupling output or belt coupling configurations	DE NDE	6310 C4 6210 C4	4500	8500	8000	10000
160	Deep-groove ball bearings for coupling output or belt coupling configurations	DE NDE	6312 C4 6212 C4	3700	7000	6500	8000
180	Deep-groove ball bearings for coupling output	DE NDE	6214 C3 6214 C3	3500	4500	5000	7000
180	Cylindrical roller bearings for belt coupling	DE NDE	NU2214E 6214 C3	3500	-	5000	-
180	Cylindrical roller bearings for increased radial forces	DE NDE	NU2214E 6214 C3	3000	-	5000	-
225	Deep-groove ball bearings for coupling output	DE NDE	6216 C3 6216 C3	3100	3600 (for 1PH7224)	4500	5500 (for 1PH7224)
225	Cylindrical roller bearings for belt coupling	DE NDE	NU2216E 6216 C3	3100	-	4500	-
224 226	Cylindrical roller bearings for increased radial forces	DE NDE	NU2216E 6216 C3	2700	-	4500	-
228	Cylindrical roller bearings for increased radial forces	DE NDE	NU2216E 6216 C3	2500	-	4000	-

1) For continuous operation (with 30% n_{max}, 60% 2/3 n_{max}, 10% standstill) for a cycle duration of 10 min.

2) Version for increased maximum speed

Maximum continuous speed n_{S1}

The max. permissible continuous operating speed n_{S1} depends on the bearing version and the shaft height.

⚠ CAUTION

If the motor is operated at speeds between n_{s1} and n_{max}, then a speed duty cycle is assumed that has time components with low speed and standstill in order that the lubricant being used can re-generate.

3.3.2 Bearing lifetime

The bearing lifetime is limited by material fatigue (fatigue lifetime) or lubrication failure (grease lifetime). The fatigue lifetime (statistical bearing lifetime L_{10h}) is mainly dependent on the mechanical load. The inter-dependency is shown in the radial force/axial force diagrams. The values are determined according to DIN/ISO 281.

The grease lifetime is mainly dependent on the bearing size, speed, temperature as well as the vibrational load.

The grease lifetime can be extended by especially favorable operating conditions (low or average speed, low bearing temperatures, low radial force or vibration load).

A reduction of the grease lifetime can be expected for difficult operating conditions and when motors are mounted vertically.

Lifetime lubrication (without re-lubricating)

For lifetime lubrication, the grease lifetime is harmonized with the bearing lifetime L_{10h}.

Bearing change interval (t_{LW})

The recommended bearing change intervals are obtained from the inter-dependencies mentioned above for a specific operating point such as:

- Coupling output or belt coupling
- Horizontal mounting position
- Cooling-medium temperature up to max. +40 °C
- Complying with the permissible radial and axial forces (refer to Chapter "Radial and axial forces")
- Complying with the maximum permissible speeds (refer to Chapter "Technical data and characteristics")
- The bearing change intervals are reduced for unfavorable operating conditions, for example
  - Average speed > as specified in the following table
  - Vibration and shock load
  - Frequent reversing operation

Note

When replacing the motor bearings, we also recommend that encoders with their own bearings are also replaced.

Table 3- 7 Recommended bearing change intervals (standard bearing design)

Shaft height	Drive output type	Average operating speed n_m [rpm]	Stat. bearing lifetime L_{10h} [h]	Recommended bearing change interval t_{LW} [h]	
				Permanent lubrication	Regreasing
100	Coupling output or belt coupling	≤ 3000 ≤ 2500	20000	20000	-
132	Coupling output or belt coupling	≤ 2500 ≤ 2000			
160	Coupling output or belt coupling	≤ 2000 ≤ 1500			
180	Coupling output	≤ 2000	40000	20000	40000
	Belt coupling	≤ 1500	24000	12000	24000
	Increase radial forces		20000		20000
225	Coupling output	≤ 1750	40000 1)	20000	40000 1)
	Belt coupling	≤ 1400	24000	12000	24000
	Increase radial forces		20000		20000

1) When vertically mounted 25000 [h]

Table 3- 8 Recommended bearing change intervals for increased speeds (standard bearing design)

Shaft height	Average operating speed1) n_m [rpm]	Recommended bearing change interval t_{LW} [h]	Max. continuous speed in S1 operation n_{s1} [rpm]
100	2500 < n_m < 6000	8000	5500
132	2000 < n_m < 5500		4500
160	1500 < n_m < 4500		3700
180	1500 < n_m < 4000		3500 2)
225	1400 < n_m < 3500		3100 3)

1) This assumes a speed duty cycle, also with low speeds and zero speeds

2) For increased radial force ≤ 3000 [rpm]

3) For increased radial force ≤ 2700 [rpm]

Table 3- 9 Recommended bearing change intervals for bearing versions with increased maximum speed

Shaft height	Average operating speed 1) n_m [rpm]	Recommended bearing change interval t_{LW} [h]	Max. continuous speed in S1 operation n_{s1} [rpm]
100	8000 ≤ n_m < 12000	8000	10000
132	6000 ≤ n_m < 10000		8500
160	5000 ≤ n_m < 8000		7000
180	1500 ≤ n_m < 7000		4500 2)
225	1500 ≤ n_m < 5500		3600 2)

1) This assumes some speed fluctuation, also with low speeds and zero speeds

2) Only possible for coupling output

Regreasing

For motors which can be re-lubricated at defined re-lubricating intervals, the bearing lifetime can be extended and/or unfavorable factors such as mounting conditions, speed, bearing size and mechanical load can be compensated (refer to the table "Recommended bearing change intervals (standard bearing design)").

Depending on the frame size, restrictions have to be taken into account - e.g. vertical mounting/shaft position.

It is possible to regrease motors, shaft heights 180 and 225. A lubricating nipple is optionally provided, Code K40.

Regreasing intervals

Regreasing intervals are specified:

- on the lubrication plate of the induction motor
- in the table "Re-lubrication intervals"

NOTICE
For longer periods of time (e.g. longer than 1 re-lubrication interval) between shipping and commissioning the motor, the bearings must be lubricated. When re-lubricating, the shaft must be rotated in order to distribute the grease around the bearings (for additional information, see the Operating Instructions).

The values specified in the following table are valid for the following conditions:

- Cooling medium temperature up to max. +40 °C
- Horizontal mounting position
- Average operating speed, refer to the table "Recommended bearing change intervals (standard bearing design)"
- Complying with the permissible radial and axial forces (refer to Chapter "Radial and axial forces")
- Complying with the maximum permissible speeds (refer to Chapter "Technical data and characteristics")

Table 3- 10 Regreasing intervals

Shaft height	Bearing type/ drive output type	Bearing-type motor side	Bearing designation	Re-lubricating intervals in operating hours [h]	Quantity of grease for each re-lubrication operation [1] [g]	Grease chamber [2] [g]	Possible number of re-lubricating intervals [3]
180	Deep-groove ball bearings coupling output	DE NDE	6214 C3 6214 C3	8000	15	80	5
180	Cylindrical roller bearings belt coupling, increased radial forces	DE NDE	NU2214E 6214 C3	6000	20	80	4
225	Deep-groove ball bearings coupling output	DE NDE	6216 C3 6216 C3	8000	25	160	6
225	Cylindrical roller bearings belt coupling, increased radial forces	DE NDE	NU2216E 6216 C3	6000	40	160	4

1) Grease quantity for re-lubrication, normal conditions.

2) Quantity of grease that can be injected into the grease chamber when precisely maintaining the quantity of grease for each re-lubrication interval.

3) Calculated number of re-lubricating intervals; the bearing lifetime is specified according to statistical perspectives in accordance with the L_{10h}definition.

NOTICE

Unfavorable factors such as the effects of mounting/installation, speed or mechanical loads require that the re-lubricating intervals are appropriately adapted. Situations such as these require special consideration or must be be calculated - and must be engineered according to the limitations and constraints together with the responsible motor plant.

3.4 Radial and axial forces

3.4.1 Radial force (cantilever force)

Specific radial forces may not be exceeded in order to guarantee perfect operation.

For various shaft heights, a minimum force may not be fallen below. This is indicated in the radial force diagrams. The diagrams show the radial force F_R.

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

The force diagrams and tables only apply to the standard shaft ends at the DE. For smaller shaft diameters, only reduced radial forces may be transmitted or none at all.

For force levels going beyond these, please contact your local Siemens office.

⚠ CAUTION

For coupling output and belt coupling

If mechanical transmission elements are used which subject the shaft end to a radial force, it must be ensured that the maximum limit values specified in the radial force diagrams are not exceeded.

Bearings for belt coupling (shaft heights 180 to 225):
For applications with an extremely low radial force load, it should be ensured that the motor shaft is subject to a minimum radial force load as specified in the diagrams. Low radial forces can cause the bearings to roll in an undefined fashion which results in increased bearing wear.

For applications with radial force loads, which are less than the specified minimum radial forces (e.g. coupling output), then the bearings may not be used for belt couplings. For applications such as these, the induction motor must be ordered with bearings for coupling output.

CAUTION

Rotating forces

The motor bearings are designed for operation with radial force. Rotating forces from the process or imbalance > Q 2.5 can destroy the bearing seats and must therefore be avoided.

⚠ CAUTION

When using elements which increase the force/torque (e.g. gearboxes, brakes) then it must be ensured that the higher forces are not absorbed through the motor.

Note

The radial forces at the shaft end must be precisely dimensioned according to the guidelines specified by the belt manufacturer. The belt tension must be adjusted using the appropriate measuring equipment.

Calculating the total radial force F_R for belt couplings

If the belt manufacturer has not provided accurate radial force data, then this can be appropriately determined using the following formula:

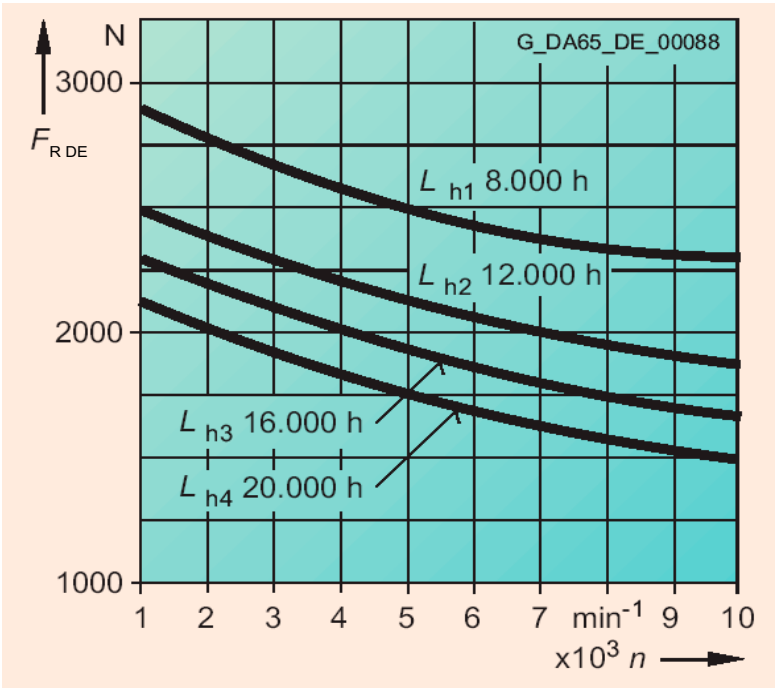
F_R [N] = c • F_U $\qquad$ F_U [N] = 2 • 10^7 • P / (n • D)

Table 3- 11 Explanation of the formula abbreviations

Formula abbreviations	Units	Description
c	--	Pre-tensioning factor: The pre-tensioning factor is an experience value provided by the belt manufacturer. It can be assumed as follows: For V belts: c = 1.5 to 2.5 for special plastic belts (flat belts), depending on the load type and belt type c = 2.0 to 2.5
F_U	N	Circumferential force
P	kW	Motor output
n	rpm	Motor speed
D	mm	Diameter of belt pulley

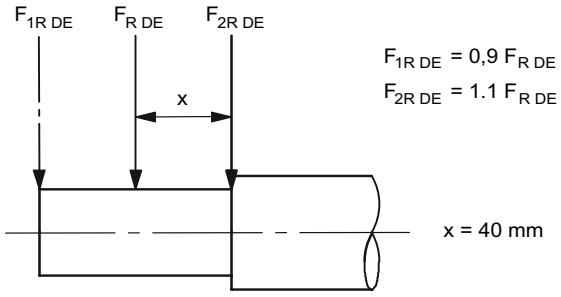
3.4.2 Radial force diagrams

SH 100, permissible radial forces for a standard bearing design



DE bearing: 6308 C4

NDE bearing: 6208 C4



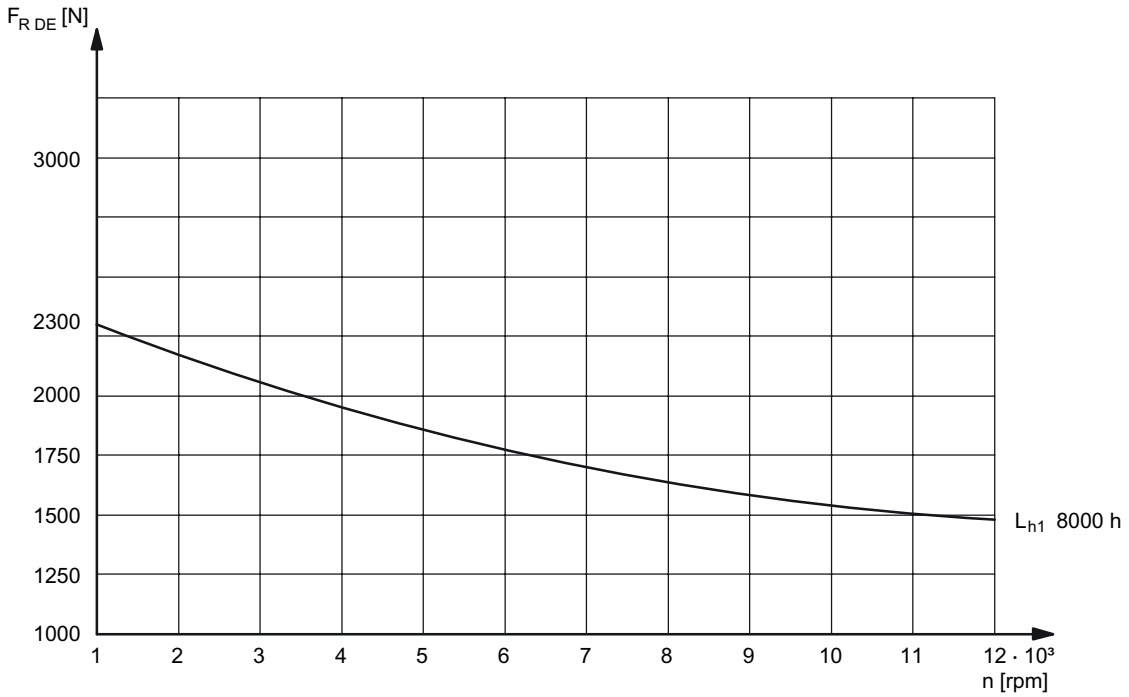
Estimated bearing lifetime for varying operating conditions ($F_{R\,DE}$; n)

$$L_{htot} = \frac{100}{\frac{q_1}{L_{h1}} + \frac{q_2}{L_{h2}} + \frac{q_3}{L_{h3}} + \frac{q_4}{L_{h4}}}$$

q = duration [%] with
Constant conditions

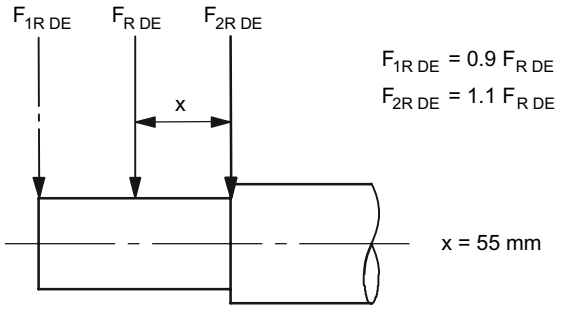
Figure 3-1 Radial force diagram, SH 100 for standard bearing designs

SH 100, permissible radial forces for increased max. speed



DE bearing: 6208 C4

NDE bearing: 6208 C4



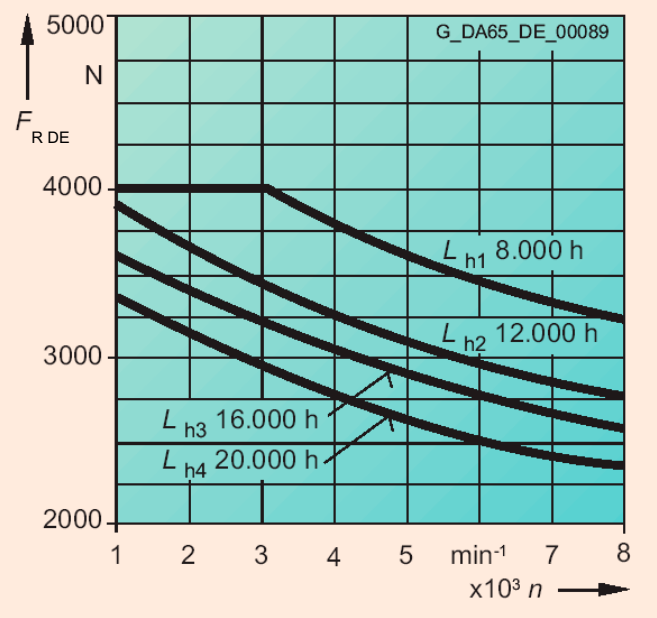
Estimated bearing lifetime for varying operating conditions ($F_{R\,DE}$; n)

$$L_{htot} = \frac{100}{\frac{q_1}{L_{h1}} + \frac{q_2}{L_{h2}} + \frac{q_3}{L_{h3}} + \frac{q_4}{L_{h4}}}$$

q = duration [%] with
Constant conditions

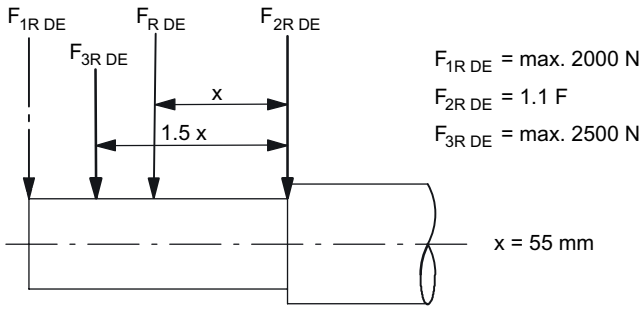
Figure 3-2 Radial force diagram, SH 100 for increased max. speed

SH 132, permissible radial forces for a standard bearing design



DE bearing: 6310 C4

NDE bearing: 6210 C4



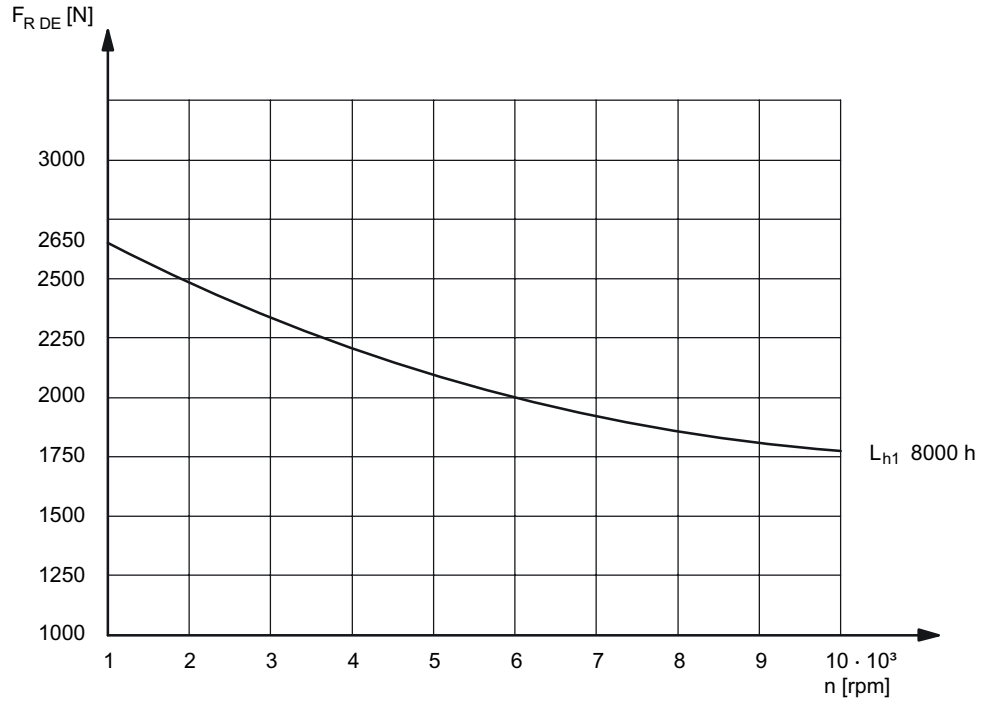
Estimated bearing lifetime for varying operating conditions ($F_{R\,DE}$; n)

$$L_{htot} = \frac{100}{\frac{q_1}{L_{h1}} + \frac{q_2}{L_{h2}} + \frac{q_3}{L_{h3}} + \frac{q_4}{L_{h4}}}$$

q = duration [%] with
Constant conditions

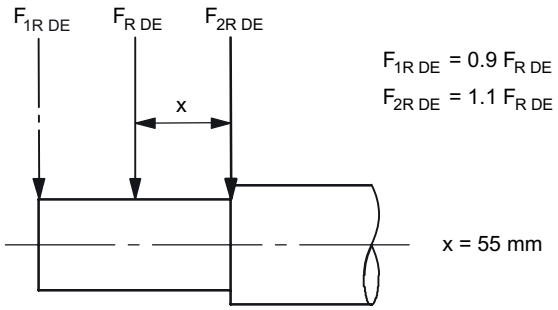
Figure 3-3 Radial force diagram, SH 132 for standard bearing designs

SH 132, permissible radial forces for increased max. speed



DE bearing: 6210 C4

NDE bearing: 6210 C4



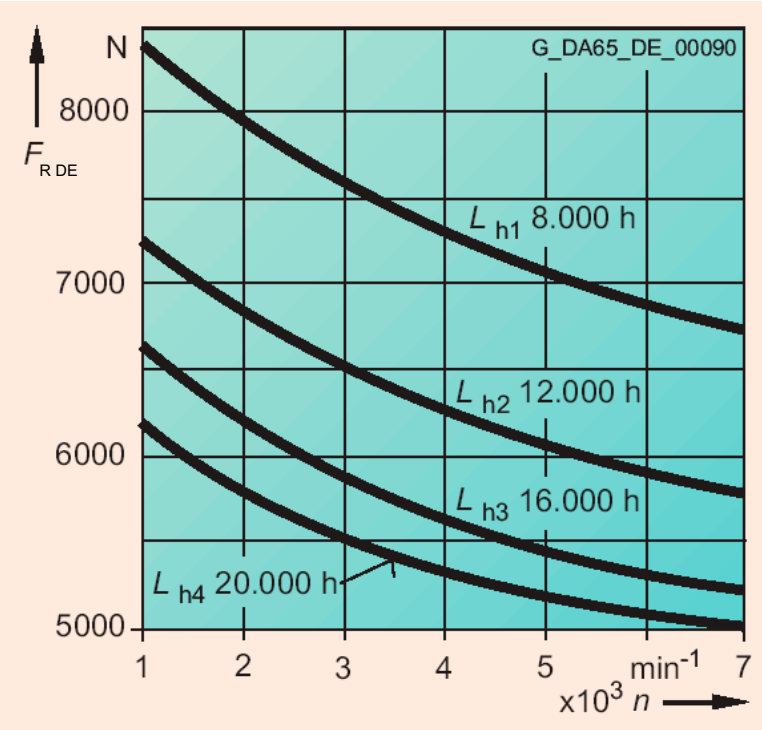
Estimated bearing lifetime for varying operating conditions ($F_{R\ DE}$; n)

$$L_{htot} = \frac{100}{\frac{q_1}{L_{h1}} + \frac{q_2}{L_{h2}} + \frac{q_3}{L_{h3}} + \frac{q_4}{L_{h4}}}$$

q = duration [%] with
Constant conditions

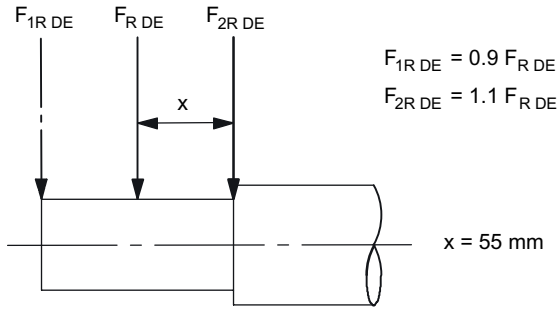
Figure 3-4 Radial force diagram, SH 132 for increased max. speed

SH 160, permissible radial forces for a standard bearing design



DE bearing: 6312 C4

NDE bearing: 6212 C4



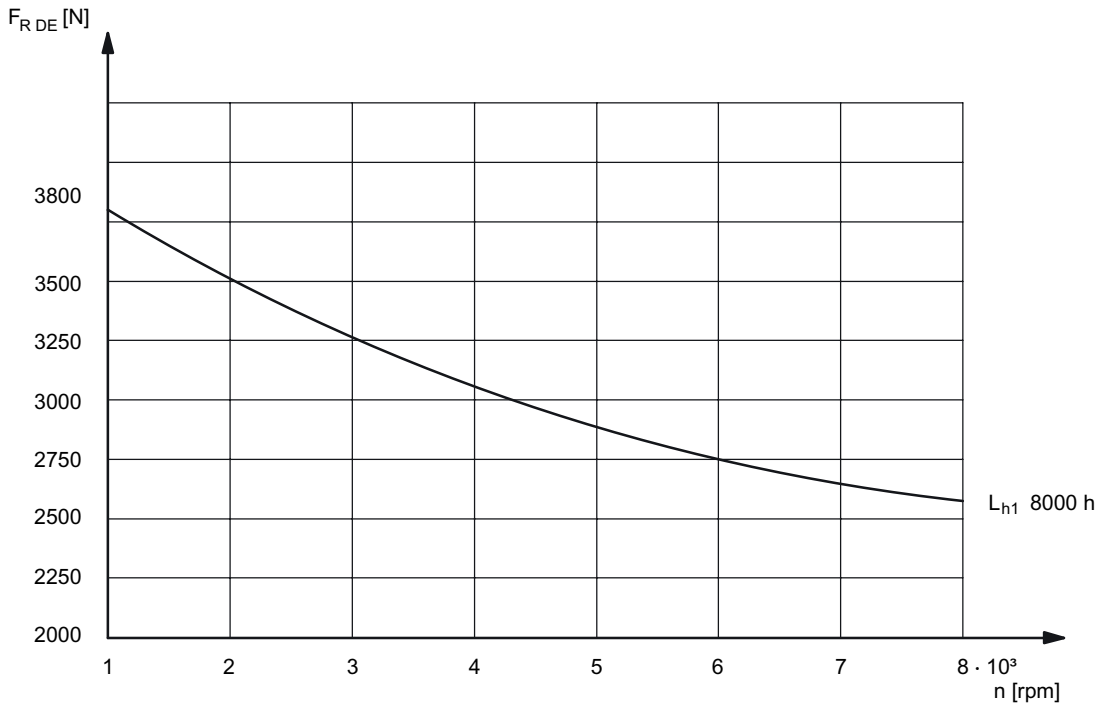
Estimated bearing lifetime for varying operating conditions ($F_{R\,DE}$; n)

$$L_{htot} = \frac{100}{\frac{q_1}{L_{h1}} + \frac{q_2}{L_{h2}} + \frac{q_3}{L_{h3}} + \frac{q_4}{L_{h4}}}$$

q = duration [%] with
Constant conditions

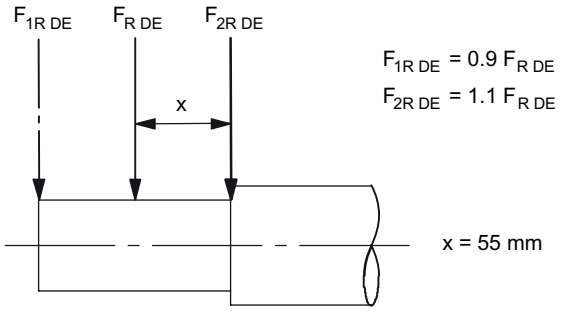
Figure 3-5 Radial force diagram, SH 160 for standard bearing designs

SH 160, permissible radial forces for increased max. speed



DE bearing: 6312 C4

NDE bearing: 6212 C4



Estimated bearing lifetime for varying operating conditions ($F_{R\,DE}$; n)

$$L_{htot} = \frac{100}{\frac{q_1}{L_{h1}} + \frac{q_2}{L_{h2}} + \frac{q_3}{L_{h3}} + \frac{q_4}{L_{h4}}}$$

q = duration [%] with
Constant conditions

Figure 3-6 Radial force diagram, SH 160 for increased max. speed

SH 180, permissible radial forces for a coupling output

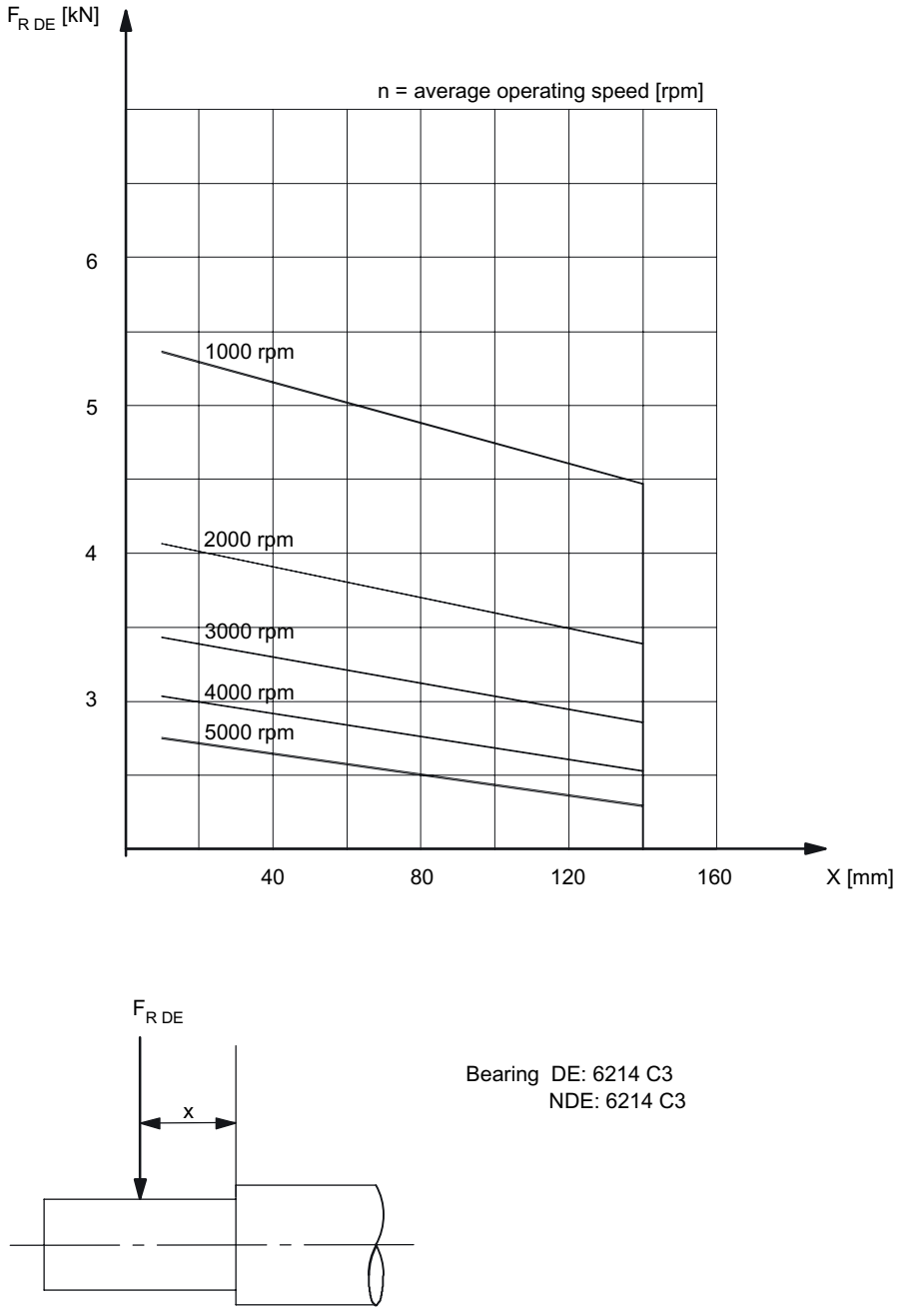


Figure 3-7 Radial force diagram, SH 180 for coupling output

SH 180, permissible radial forces for belt couplings

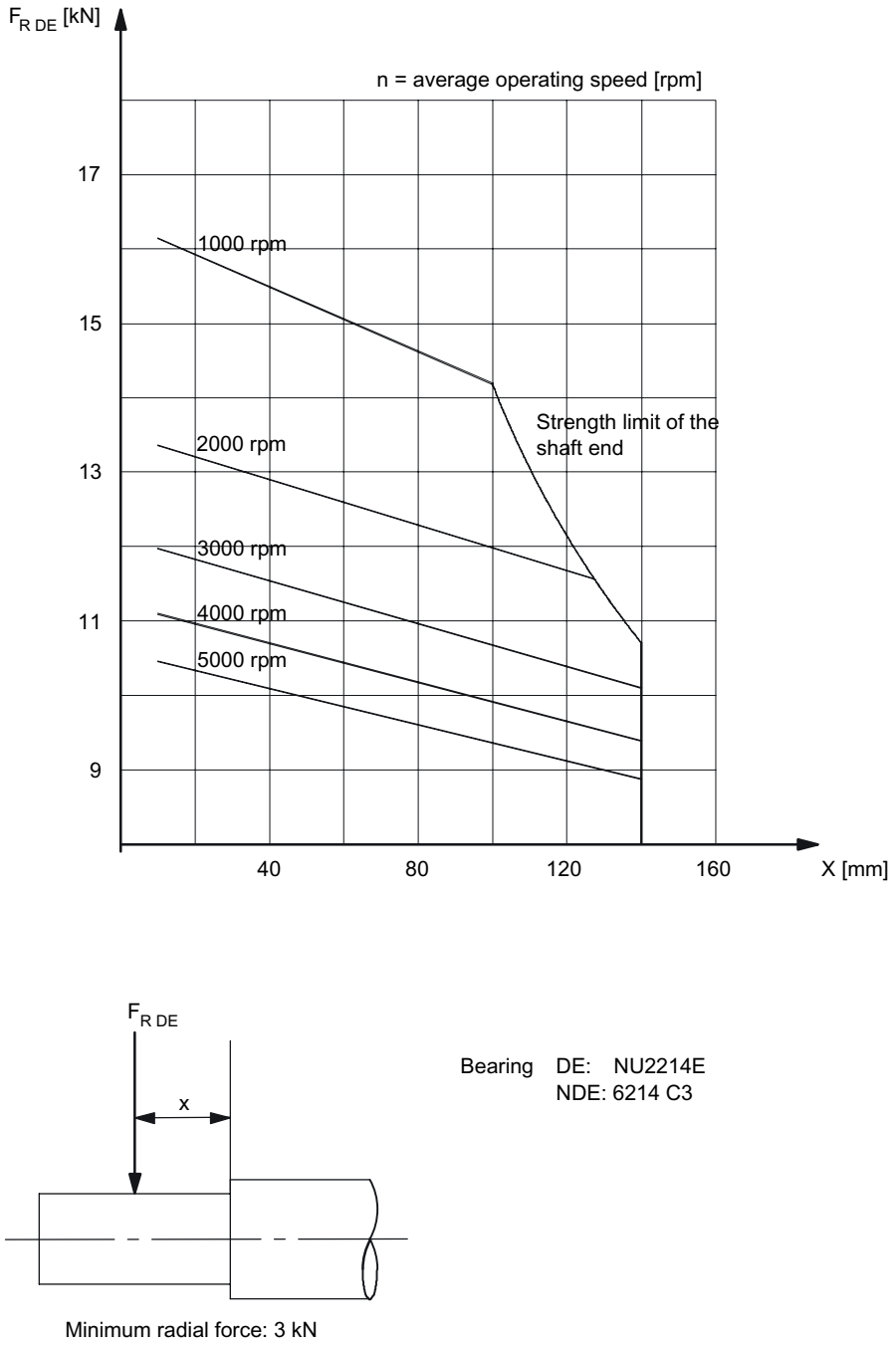


Figure 3-8 Radial force diagram, SH 180 for belt couplings

SH 180, permissible increased radial forces for belt couplings

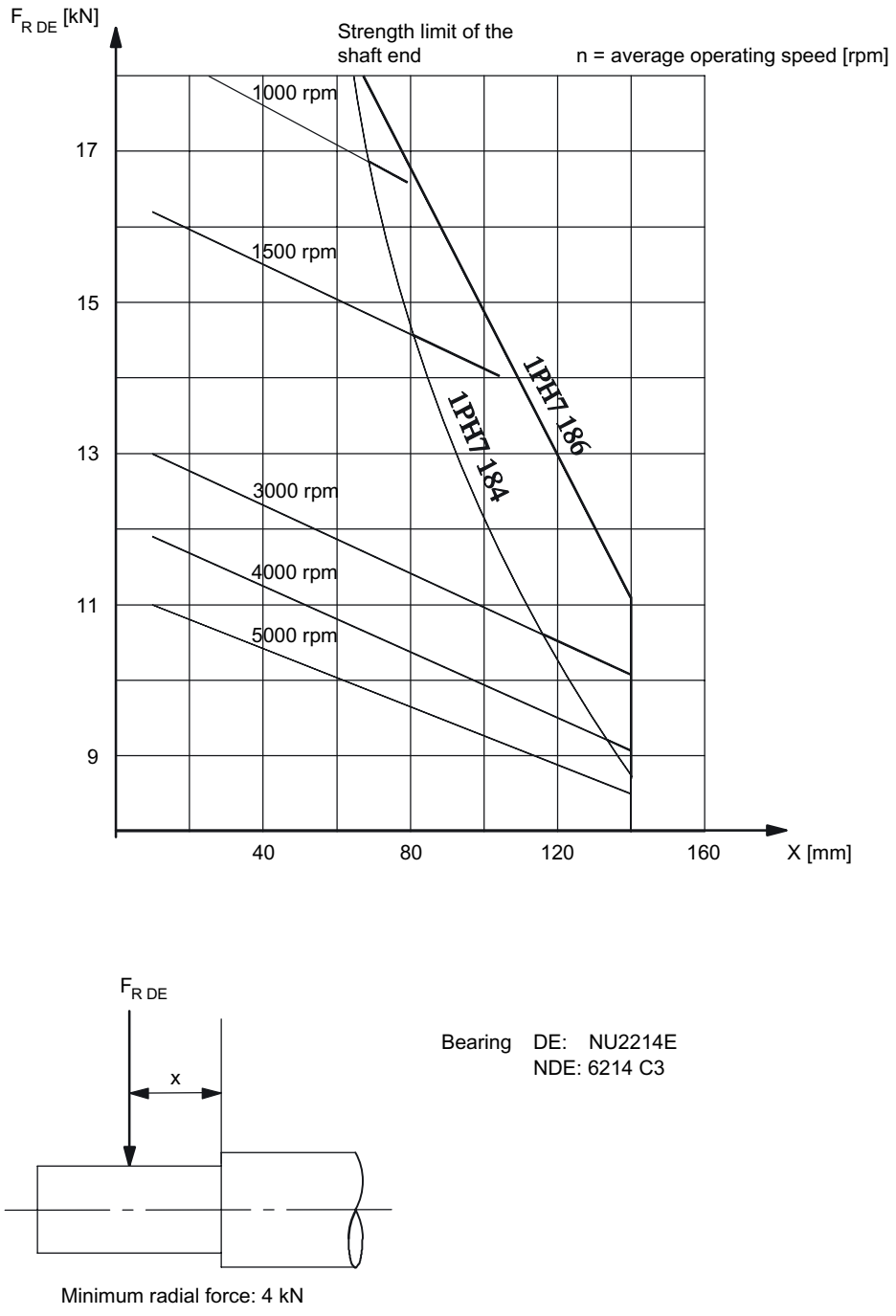
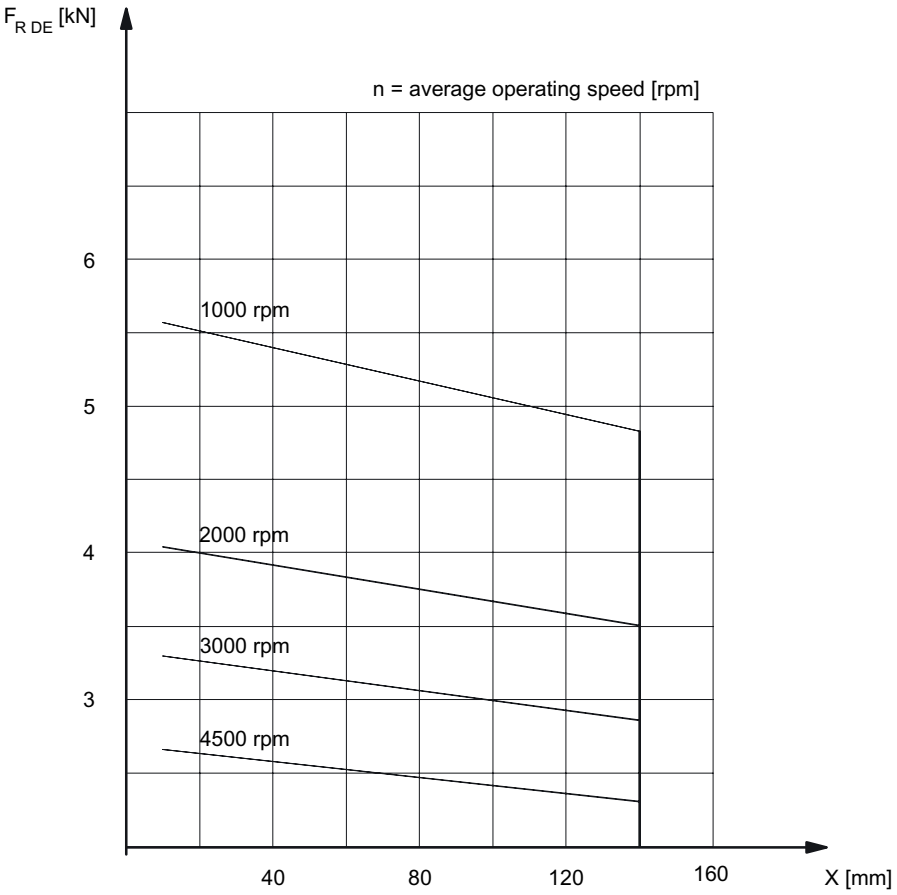
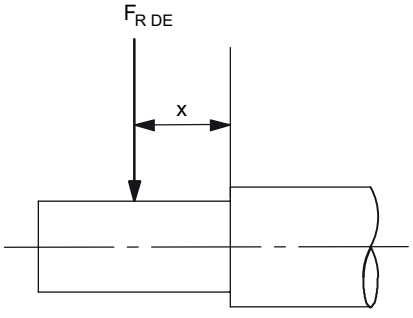


Figure 3-9 Radial force diagram, SH 180 for belt couplings (increased radial forces)

SH 225, permissible radial forces for a coupling output

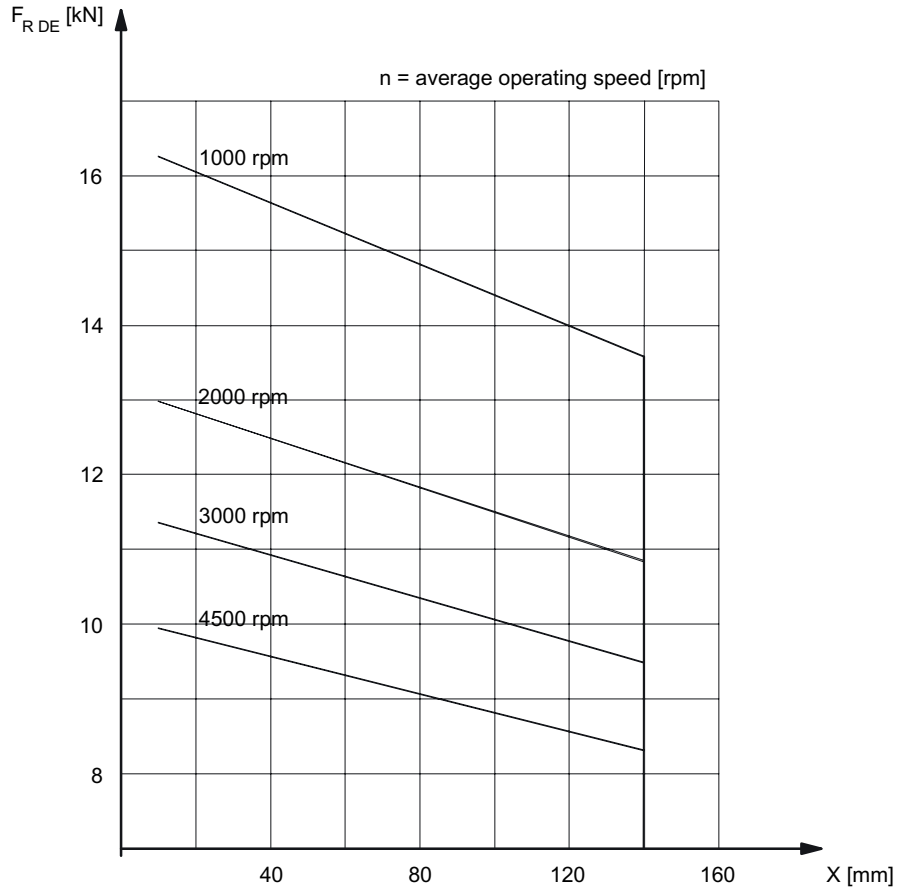


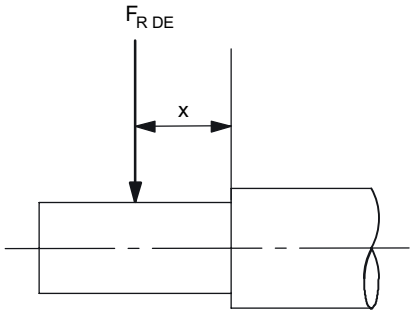


Bearing DE: 6216 C3
NDE: 6216 C3

Figure 3-10 Radial force diagram, SH 225 for coupling output

SH 225, permissible radial forces for belt couplings





Bearing DE: NU2214E
NDE: 6214 C3

Minimum radial force: 4 kN

Figure 3-11 Radial force diagram, SH 225 for belt couplings

SH 225, permissible increased radial forces for belt couplings

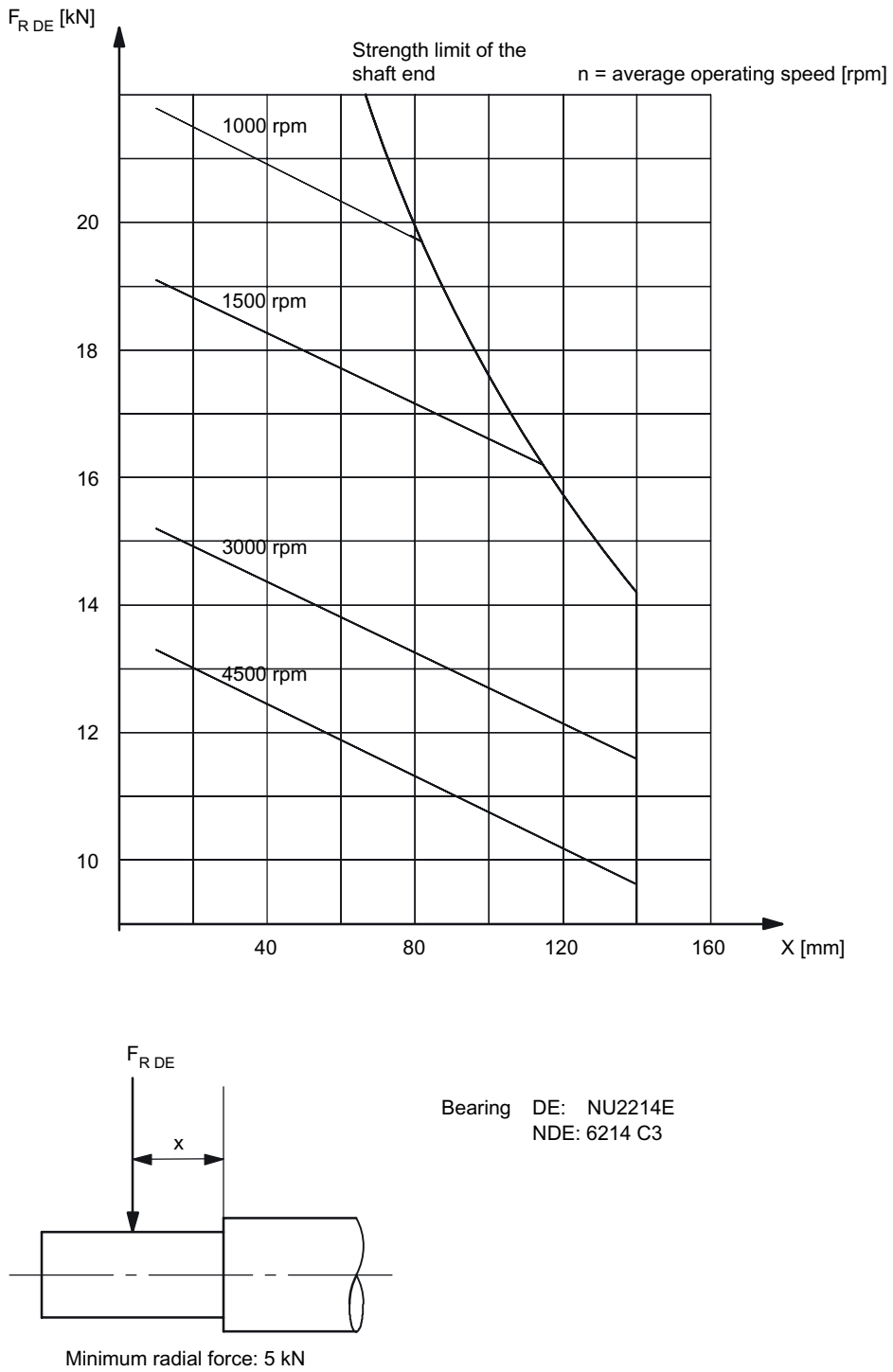


Figure 3-12 Radial force diagram, SH 225 for belt couplings (increased radial forces)

3.4.3 Axial force

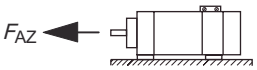
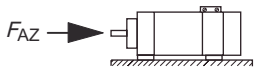
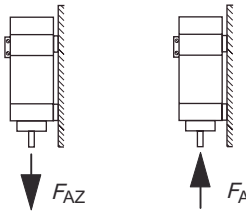
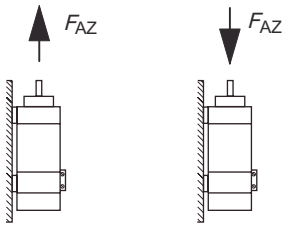
The axial force acting on the bearings comprises an external axial force (e.g. gearbox with helical gearing, machining forces through the tool), a bearing pre-load force and possibly the force due to the weight of the rotor when the motor is vertically mounted. This results in a maximum axial force that is a function of the direction.

When using, for example, helical toothed wheels as drive element, in addition to the radial force, there is also an axial force on the motor bearings. For axial forces in the direction of the motor, the spring-loading of the bearings can be overcome, which under circumstances, can result in an axial shift of the rotor. This must be prevented as otherwise it could reduce the bearing and encoder lifetime.

Calculating the permissible axial force F_{AZ}

The permissible axial force F_{AZ} in operation depends on the motor mounting position.

Table 3- 12 Calculating the permissible axial force

Horizontal arrangement	Shaft end facing downwards	Shaft end facing upwards
 $F_{AZ} = F_A - F_C$  $F_{AZ} = F_C$	 $F_{AZ} = F_A - F_L - F_C$ $F_{AZ} = F_L + F_C$	 $F_{AZ} = F_A + F_L - F_C$ $F_{AZ} = F_C - F_L$

F_{AZ}	Permissible axial force in operation
F_A	Permissible axial force as a function of the average speed
F_C	Pre-loading force
F_L	Force due to weight of rotor

Forces due to weight of the rotor and pre-loading forces of the rotor

Table 3- 13 Forces due to the weight of the rotor F_L and pre-loading forces F_C of the rotor

Motor type	F_L [N]	F_C [N]
1PH7101	125	400
1PH7103	125	400
1PH7105	200	400
1PH7107	200	400
1PH7131	290	600
1PH7133	290	600
1PH7135	410	600
1PH7137	410	600
1PH7163	520	800
1PH7167	630	800
1PH7184	980	500 1)
1PH7186	1220	500 1)
1PH7224	1720	550 1)
1PH7226	2100	550 1)
1PH7228	2500	550 1)

1) only for coupling output

3.4.4 Axial force diagrams

The maximum axial forces F_A as a function of the radial force (cantilever force) are shown in the following force diagrams. The permissible bearing forces are specified without taking into account the force due to spring-loaded bearings, the rotor weight for vertical mounting as well as the direction of the force.

SH 100, permissible axial force

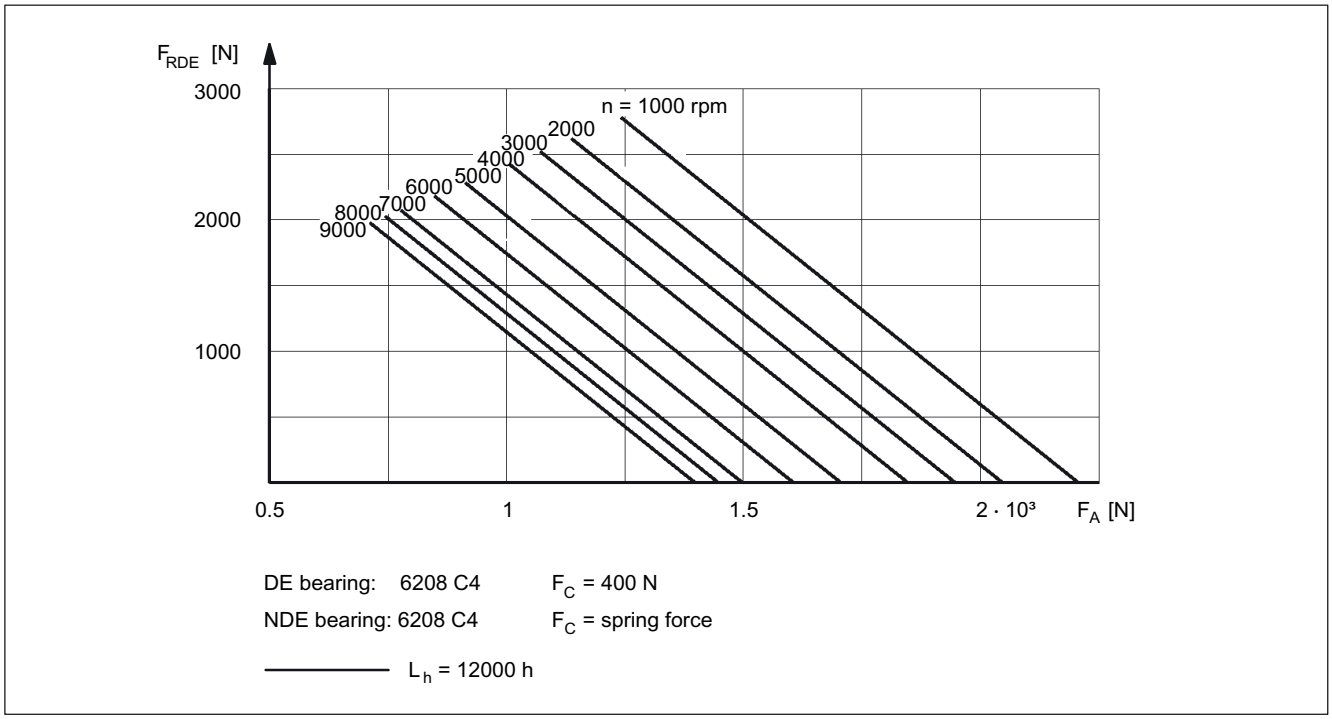


Figure 3-13 Axial force diagram, SH 100

SH 132, permissible axial force

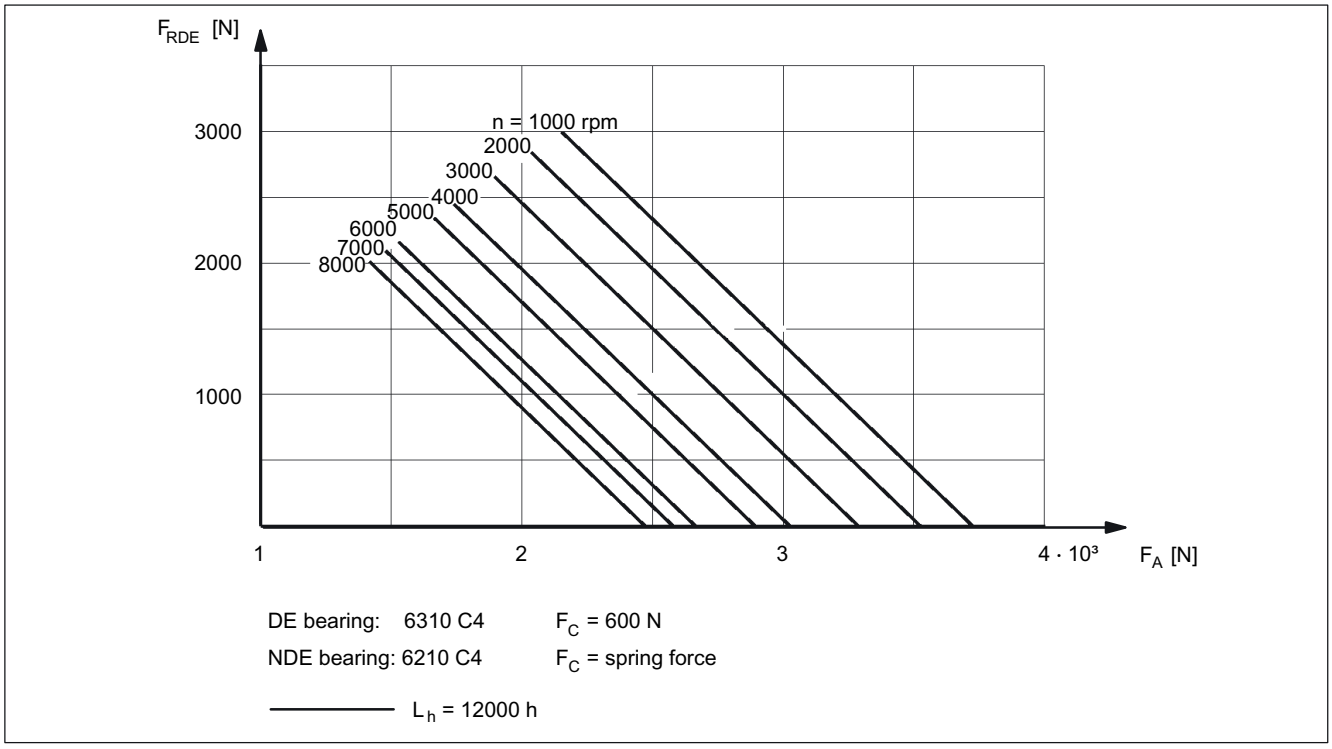


Figure 3-14 Axial force diagram, SH 132

SH 160, permissible axial force

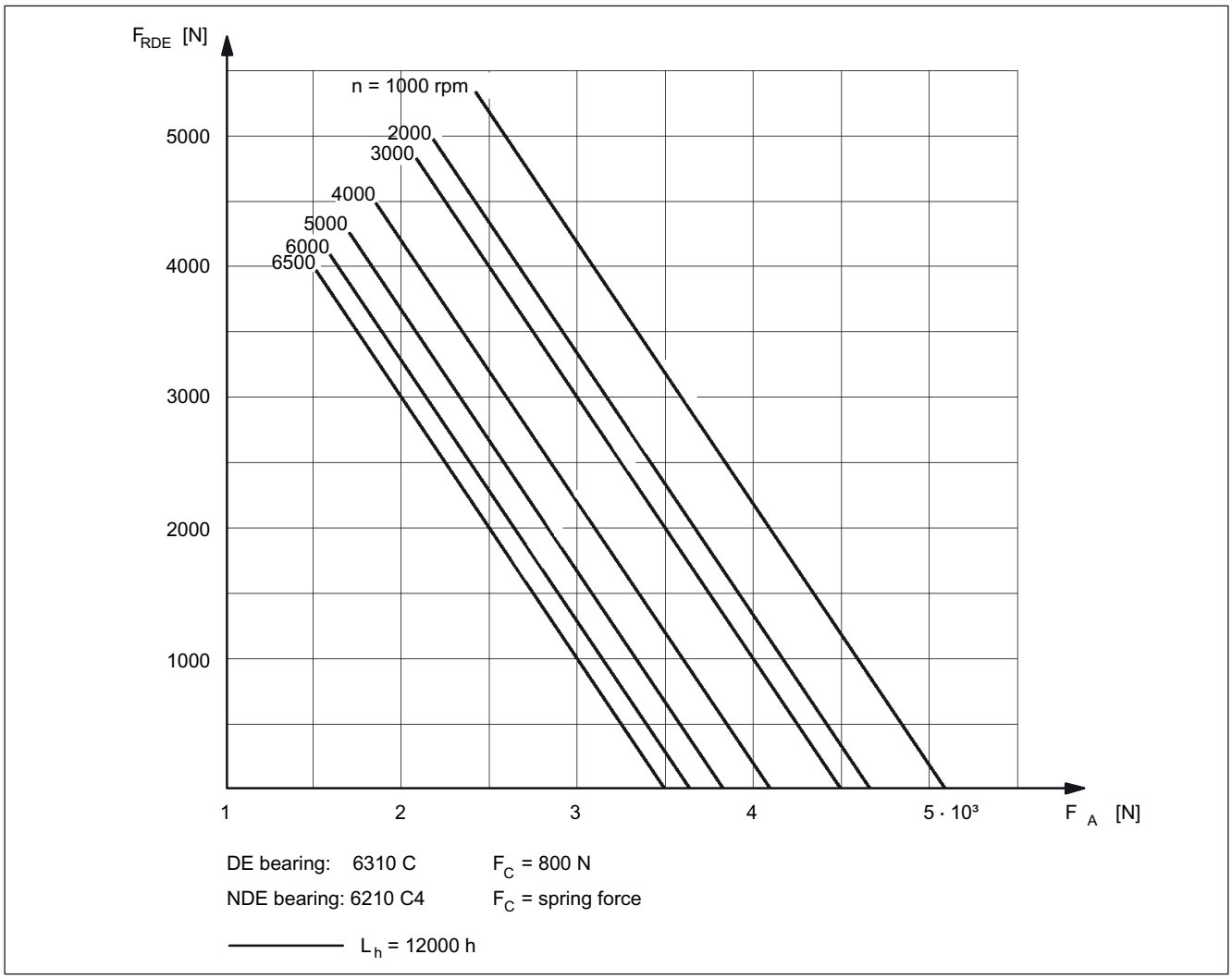


Figure 3-15 Axial force diagram, SH 160

SH 100, permissible axial force for the option, increased max. speed

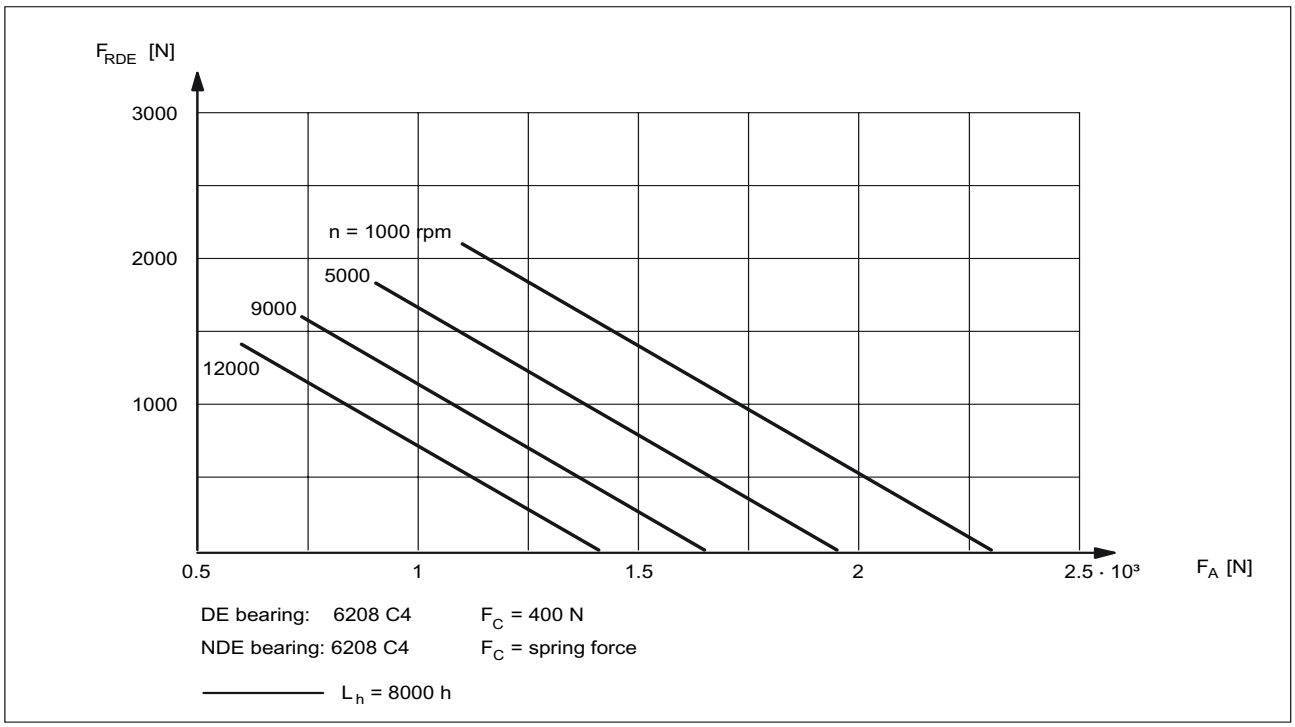


Figure 3-16 Cantilever force diagram, SH 100 (increased max. speed)

SH 132, permissible axial force for the option, increased max. speed

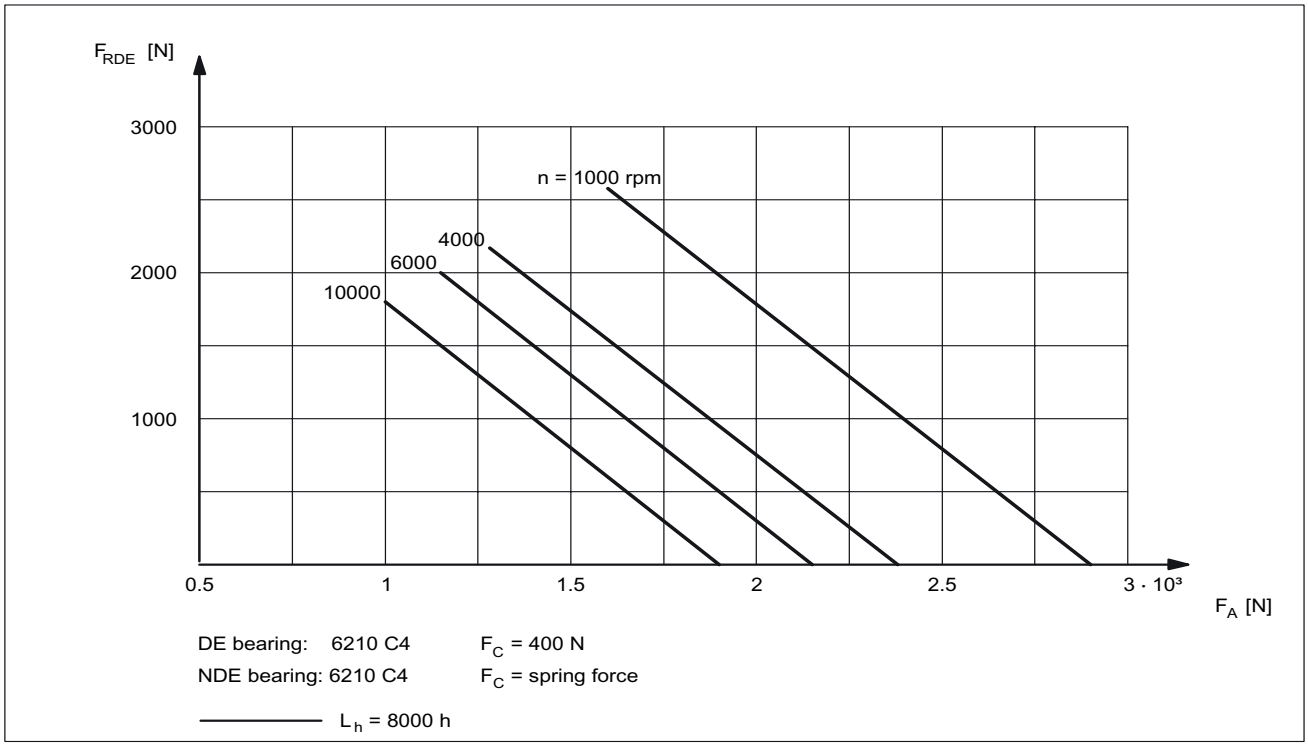


Figure 3-17 Cantilever force diagram, SH 132 (increased max. speed)

SH 160, permissible axial force for the option, increased max. speed

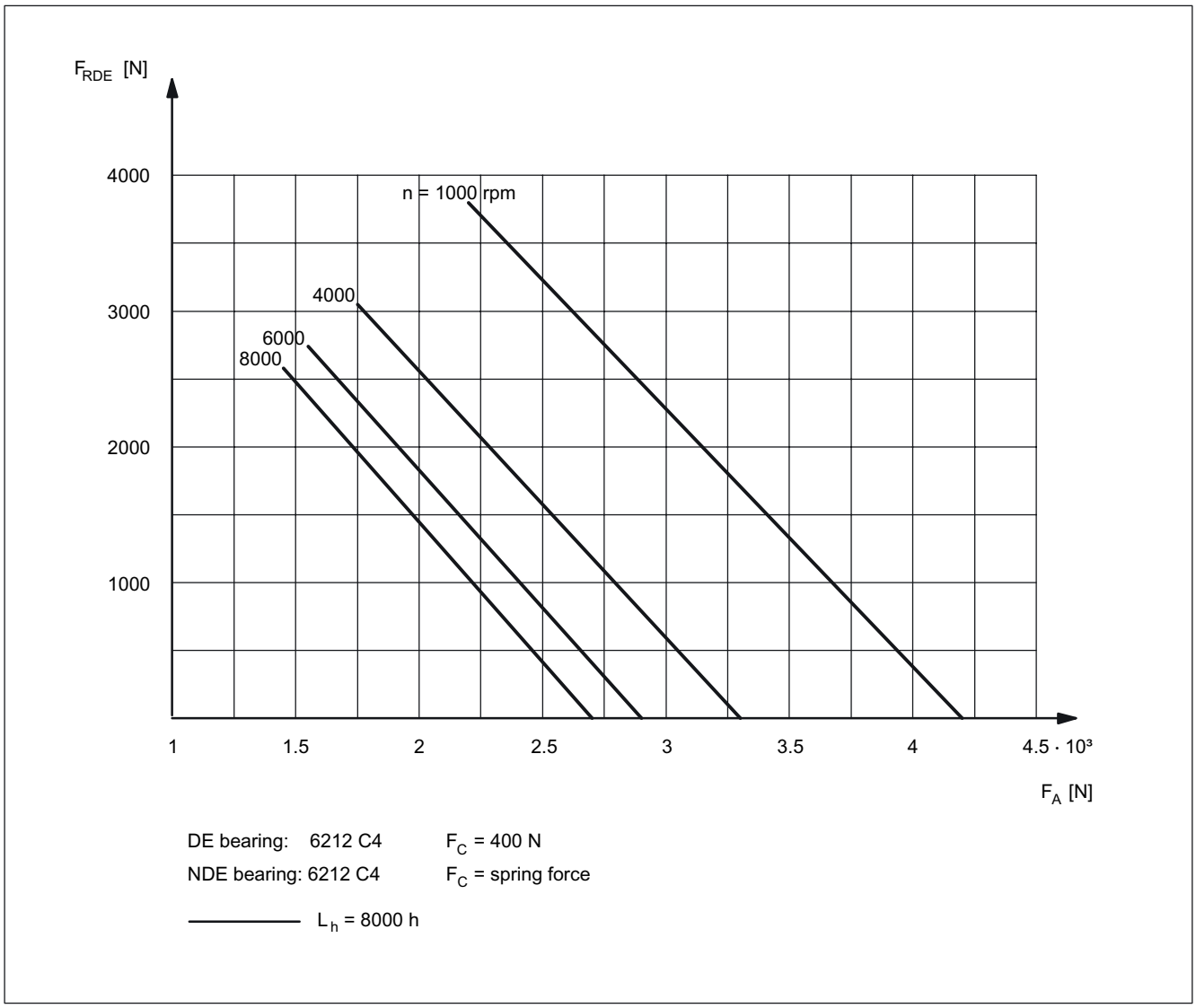


Figure 3-18 Cantilever force diagram, SH 160 (increased max. speed)

SH 180 to SH 225

For coupling outputs, belt couplings or pinion outputs with straight teeth, generally, only low axial forces occur. The locating bearing is adequately dimensioned so that these forces can be accepted in all mounting positions.

The following forces due to the weight of the output component are permissible at the shaft end in order to ensure perfect vibration characteristics (i.e. low vibration):

- SH 180: max. 500 N
- SH 225: max. 600 N

For pinion outputs with helical gearing, please contact your local Siemens office.

3.5 Shaft end and balancing

The drive shaft end is cylindrical in accordance with DIN 748 Part 3 (IEC 60072-1).

Standard: Keyway with feather key (half-key balancing)

The motor balance quality is certified in accordance with DIN ISO 8821.

3.6 Radial eccentricity, concentricity and axial eccentricity

The shaft and flange accuracies are checked according to DIN 42955, IEC 60072.
Data deviating from these values are indicated in the dimension drawings.

Table 3- 14 Radial eccentricity tolerance of the shaft to the frame axis (referred to cylindrical shaft ends)

Shaft height	Tolerance level N	Tolerance level R
100	0.05	0.025
132	0.05	0.025
160	0.06	0.03
180	0.06	0.03
225	0.06	0.03

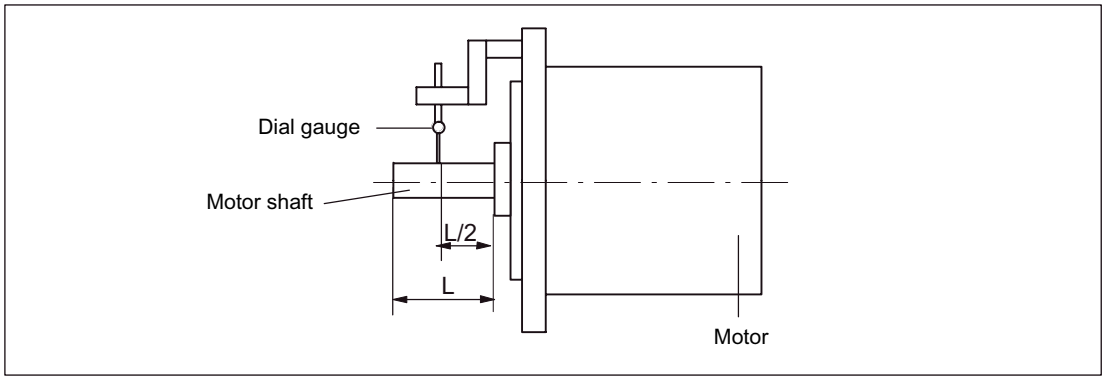


Figure 3-19 Checking the radial eccentricity

Table 3- 15 Concentricity and axial eccentricity tolerance of the flange surface to the shaft axis (referred to the centering diameter of the mounting flange)

Shaft height	Tolerance level N	Tolerance level R
100	0.1	0.05
132	0.125	0.063
160	0.125	0.063
180	0.125	0.063
225	0.125	0.063

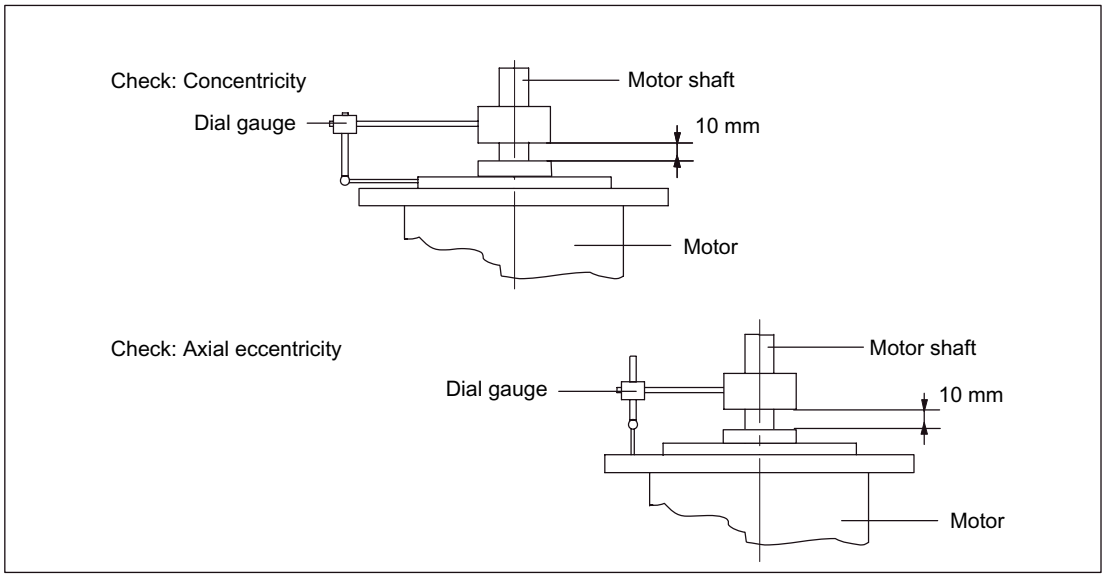


Figure 3-20 Checking the concentricity and axial eccentricity

3.7 Balancing process

Requirements placed on the process when balancing mounted components - especially belt pulleys

In addition to the balance quality of the motor, the vibration quality of motors with mounted belt pulleys and coupling is essentially determined by the balance quality of the mounted component.

If the motor and mounted component are separately balanced before they are assembled, then the process used to balance the belt pulley or coupling must be adapted to the motor balancing type.

For induction motors, a differentiation should be made between the following balancing types:

- Half key balancing (an "H" is stamped on the shaft face)
- Full key balancing (an "F" is stamped on the shaft face)
- Smooth shaft end (no keyway)

The balancing type is coded in the order designation.

For the highest demands placed on the system balance quality, we recommend that motors with smooth shaft (without keyway) are used. For motors balanced with full key, we recommend belt pulleys with two keyways on opposite sides, however, with only one key in the shaft end.

Table 3- 16 Requirements placed on the balancing process as a function of the motor balancing type

Balancing equipment/ Process step	Motor Half key balanced	Motor balanced with full key	Motor with plain shaft end
Auxiliary shaft to balance the mounted component	• Auxiliary shaft with keyway • Keyway with the same dimensions as in the motor shaft end • Auxiliary shaft half key balanced	• Auxiliary shaft with keyway • Slot design with the exception of the slot width (as the motor) can be freely selected • Auxiliary shaft full key balanced	• Auxiliary shaft without keyway • If required, use a tapered auxiliary shaft
	• Balance quality of the auxiliary shaft ≤ 10 % of the required balance quality of the component to be mounted to the motor		
Attaching the mounted component to the auxiliary shaft for balancing	• Attached using a key • Key design, dimensions and materials the same as at the motor shaft end	• Attached using a key • Key design, dimensions and material the same as used for the full key balancing of the auxiliary shaft	• Attach the component as far as possible without any play, e.g. using a light press fit on the tapered shaft
Position the mounted component on the auxiliary shaft	• Select a position between the mounted component and the key of the auxiliary shaft so that it is the same when mounted on the actual motor	• No special requirements	
Balance the mounted component	• Two-plane balancing is recommended - i.e. balancing in two planes at both sides of the mounted components at right angles to the axis of rotation		

Special requirements

If special requirements are placed on the smooth running operation of the machine, we recommend that the motor together with the output components is completely balanced. In this case, balancing should be carried-out in two planes of the output component.

3.8 Vibration severity level

The 1PH7 motors conform to vibration severity level A in accordance with EN 60034-14 (IEC 60034-14). The values indicated refer only to the motor. These values can be increased at the motor due to the overall vibration characteristics of the complete system after the drive has been mounted.

The motors comply with the vibration severity level A up to rated speed n_N.

Standard: Vibration severity level A/R

Option: Vibration severity level A/S or A/SR

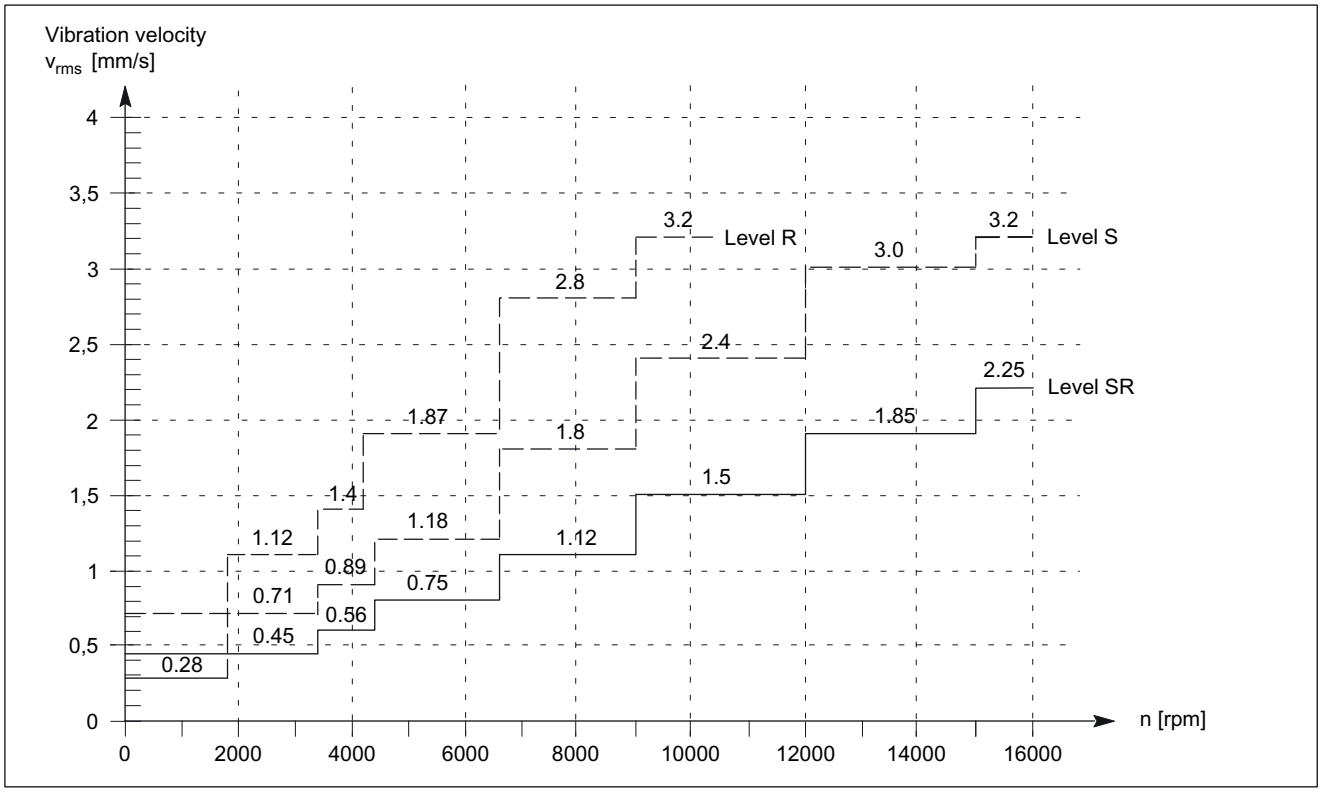


Figure 3-21 Vibration severity limit values for induction motors SH 100 to 132.

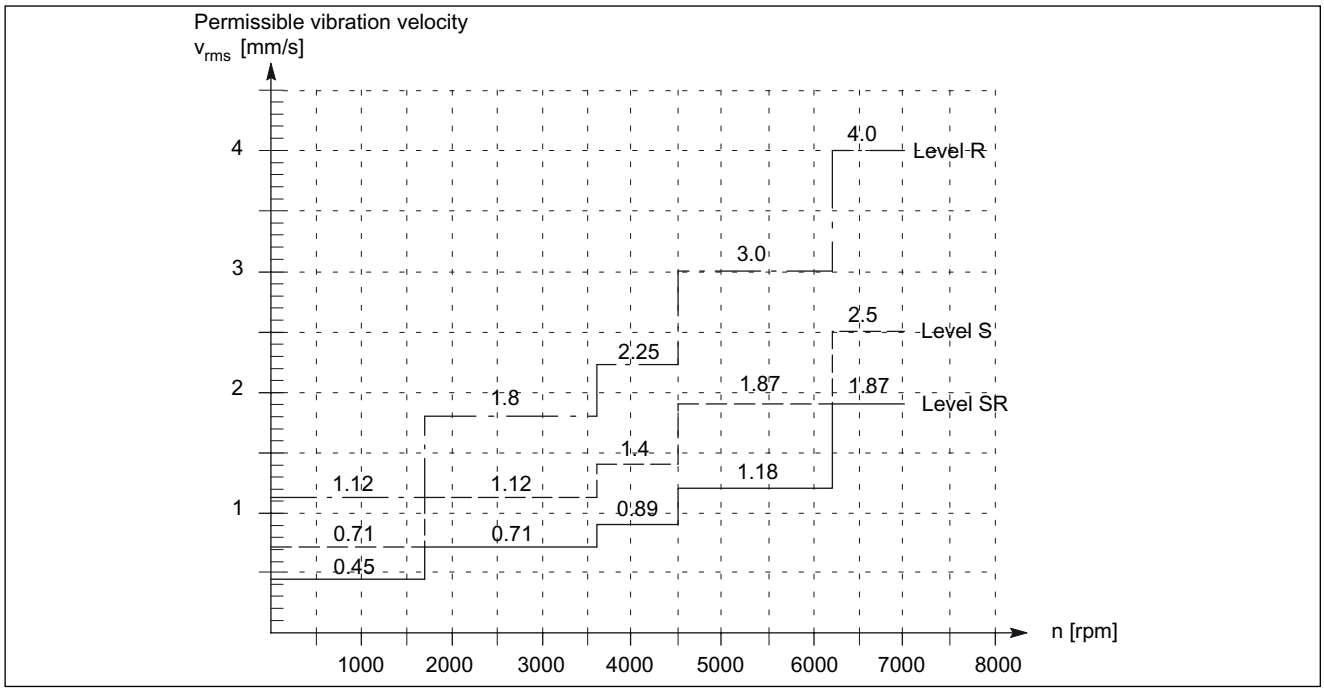


Figure 3-22 Vibration severity limit values for induction motors SH 160 to 225

3.9 Paint finish

1PH7 motors are supplied with the following paint finish:

- SH 100 to 160: Without paint finish or standard paint finish, anthracite RAL 7016
- SH 180 to 225: Primed or standard paint finish, anthracite RAL 7016

Other colors: Refer to the table "Technical features, options".

Note

Use in sub-tropical regions

The motors should be ordered with a "worldwide" paint finish if they are to be used in sub-tropical regions or if they are to be transported by sea to prevent corrosion.

Technical data and characteristics

4

4.1 Mode of operation and characteristics

A constant torque M_N is available from standstill up to the rated operating point. The constant-power range begins from the rated operating point (see P/n characteristic). Induction motors have a high overload capacity in the constant power range. For some induction motors, the overload capacity is reduced in the highest speed range.

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

$$M_{max}\ [Nm] < \frac{P_{max}\,[kW] \bullet 9550}{n\ [rpm]} \qquad P_{max}\,[kW] = 2 \bullet P_N$$

For main spindle applications, the constant power range used to machine a workpiece with constant cutting power is extremely important. The required drive converter power can be reduced by optimally utilizing the constant power range.

The following limits and characteristics apply as basis for all induction motors fed from drive converters.

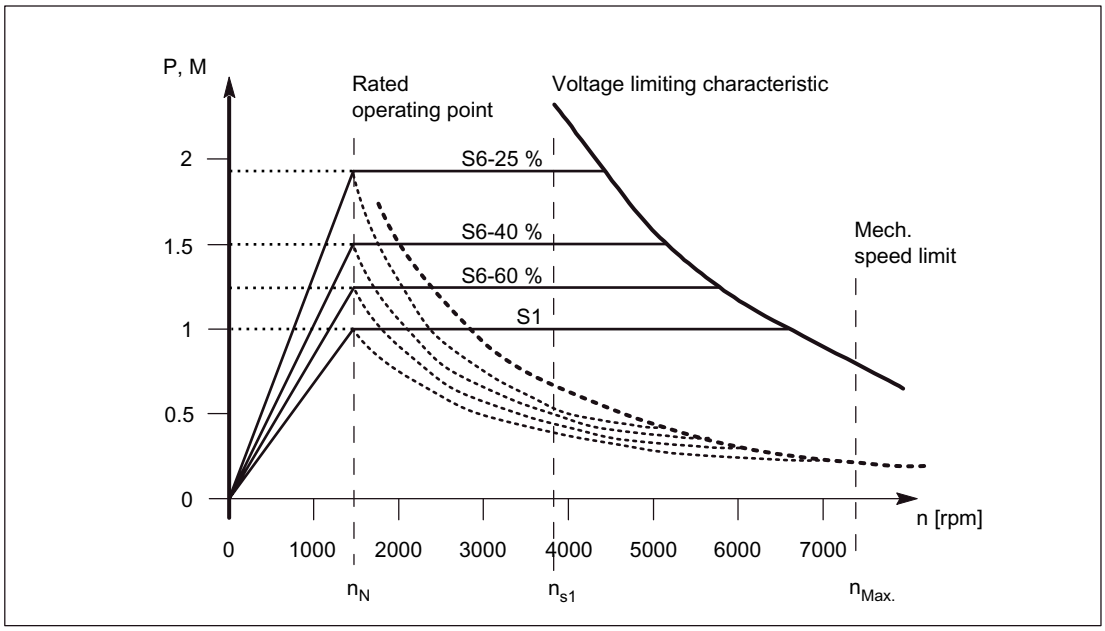


Figure 4-1 Power characteristics, limits and curves; torque-speed diagram

Power rating data for duty types S1 and S6

All power rating data of induction motors refer to continuous operation and the appropriate duty type S1.

However, for many applications, duty type S1 does not apply, if e.g. the load varies as a function of time. For this particular case, an equivalent sequence can be specified which represents, as a minimum, the same load for the motor.

For shorter accelerating times, torque surges or drives which have to handle overload conditions, short-time or peak currents are available in a 60 second cycle. The magnitude and precise engineering of these currents are described in the documentation for the relevant converter power units or Motor Modules.

The characteristics for continuous duty S1 and intermittent operation S6-60 %, S6-40 % and S6-25 % describe the permissible power values for an ambient temperature of up to 40 °C. A winding temperature rise of approx. 105 K can occur.

Speed limit

The maximum permissible speed n_{max} is determined by mechanical factors. The maximum speed n_{max} may not be exceeded and may not be continually used.

⚠ CAUTION

If the speed n_{max} is exceeded, this can damage the bearings, short-circuiting rings, press fits, etc. To ensure that the motor does not run at excessive speeds, the control must be configured accordingly or speed monitoring must be activated in the drive system.

4.2 Output voltages

Drive system

Table 4- 1 Voltages for the SINAMICS S120 drive system, 3-ph. 380 - 400 V AC

Infeed module	Mains voltage	DC link voltage	Output voltage
	U_{supply}	U_{ZK}	U_{mot}
Active Line Module	400 V	600 V	425 V

4.3 Offset of the voltage limit characteristic

The characteristics in chapter "P/n and M/n characteristics" refer to the Active Line Module, U_{supply} = 400 V. The output voltage U_{mot} is 425 V.

In order to identify the motor limits with an output voltage other than 425 V, the plotted voltage limiting characteristic must be shifted accordingly for the new output voltage.

Calculating the new voltage limiting characteristic

$$\text{Calculation } P_{new} = P_{\text{Characteristic curve}} \cdot \left(\frac{U_{mot,\,new}}{U_{Mot}}\right)^2$$

$$\text{Calculation } n_{new} = n_{\text{Characteristic curve}} \cdot \left(\frac{U_{mot,\,new}}{U_{Mot}}\right)^2$$

U_{Mot} = output voltage

$U_{mot,\,new}$ = new output voltage

Example: Calculating the new voltage limiting characteristic for operation on an SLM, U_{supply} = 400 V, output voltage U_{mot} = 380 V

Voltage limiting characteristic at 425 V	New voltage limiting characteristic at 380 V
$P_{\text{Characteristic curve}}$ at n = 6000 rpm = 22.6 kW	$P_{new} = 22.6\text{ kW} \cdot \left(\frac{380\text{ V}}{425\text{ V}}\right)^2 = 18.0\text{ kW}$
$P_{\text{Characteristic curve}}$ at n = 9000 rpm = 14.0 kW	$P_{new} = 14.0\text{ kW} \cdot \left(\frac{380\text{ V}}{425\text{ V}}\right)^2 = 11.3\text{ kW}$
$P_{\text{Characteristic curve}}$ at n = 15000 rpm = 4.7 kW	$P_{new} = 4.7\text{ kW} \cdot \left(\frac{380\text{ V}}{425\text{ V}}\right)^2 = 3.7\text{ kW}$

The result are the points of intersection in the new voltage limiting characteristic for 380 V.

The new speed up to which power remains constant is: $n_{new} = 8000\text{ rpm} \cdot \left(\frac{380\text{ V}}{425\text{ V}}\right)^2 = 6400\text{ rpm}$

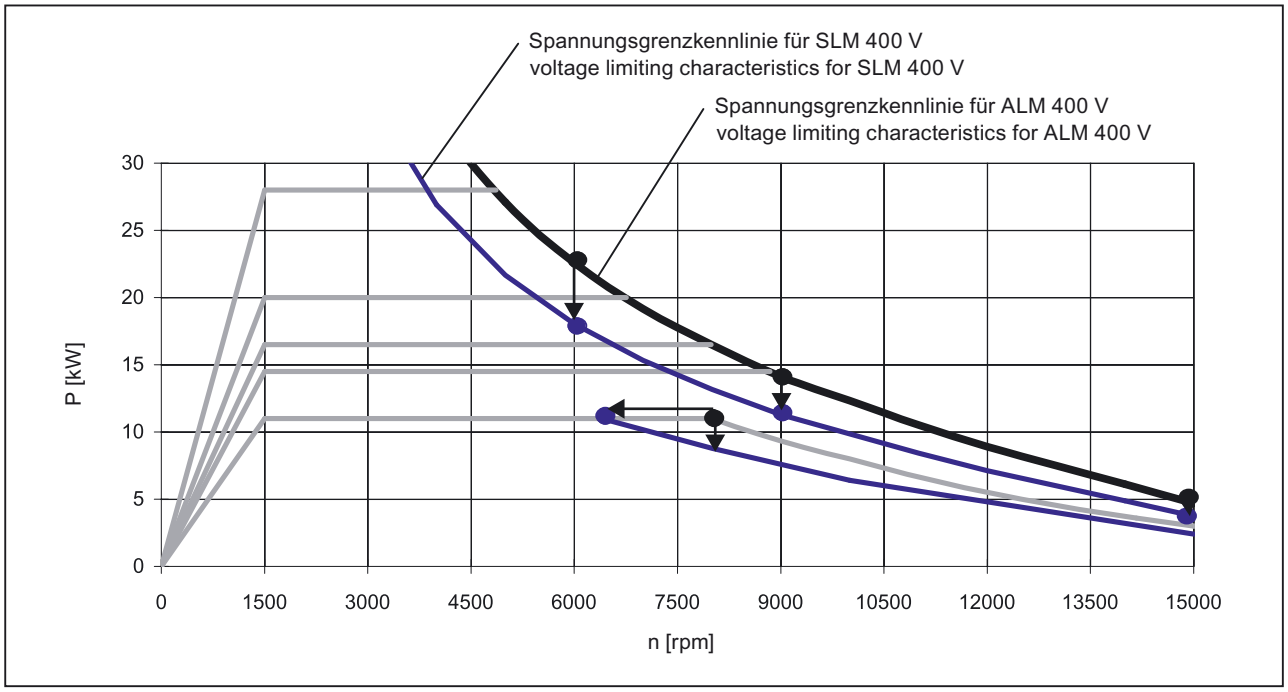


Figure 4-2 An example of the offset in the voltage limiting characteristic

4.4 P/n and M/n characteristics

4.4.1 Explanation of the abbreviations used

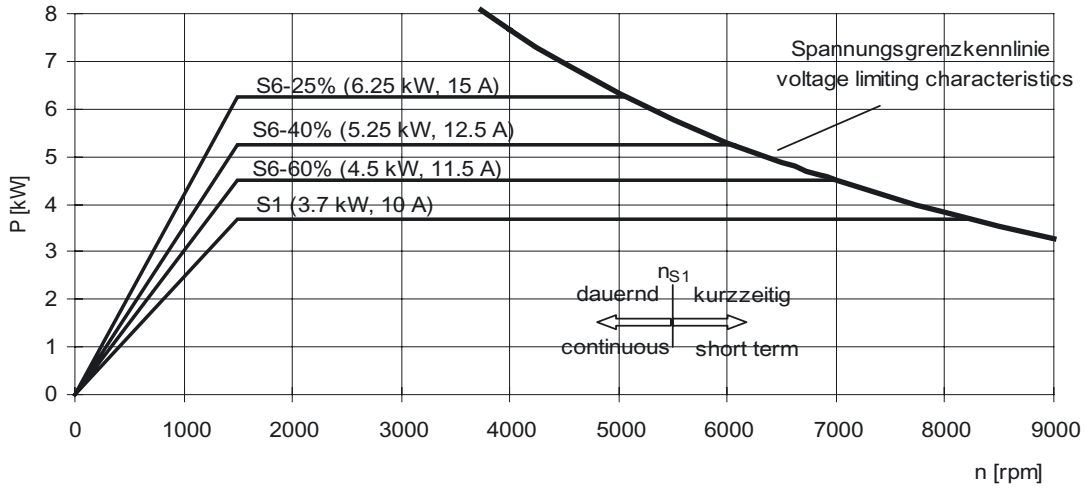
Irrespective of the operating mode, running motors must be cooled continuously.

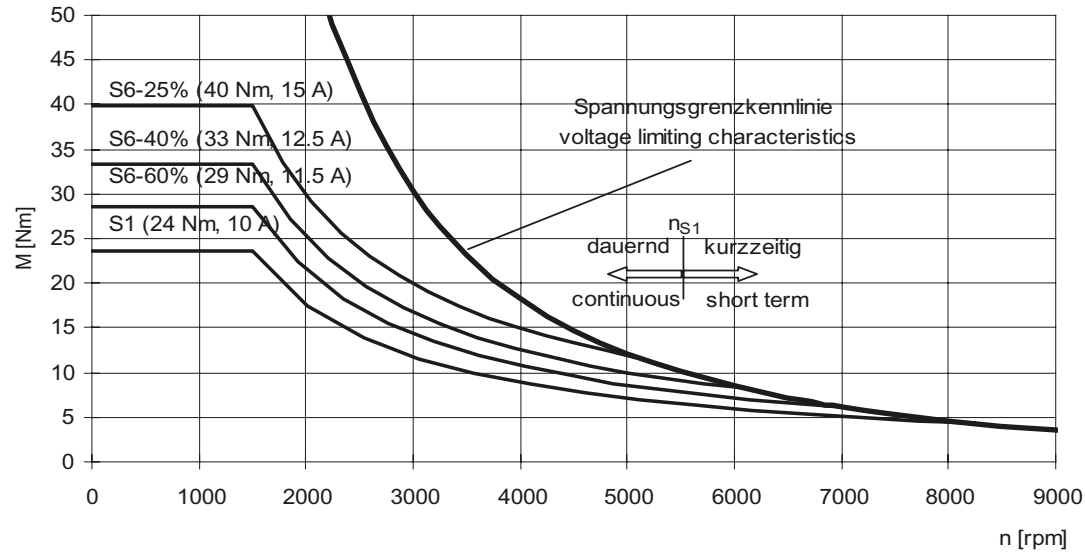
Table 4- 2 Explanation of abbreviations in the following tables

Abbreviation	Unit	Description
n_N	rpm	Rated speed
P_N	kW	Rated power
M_N	Nm (lb-in)	Rated torque
I_N	A	Rated current
U_N	V	Rated voltage
f_N	Hz	Rated frequency
n_2	rpm	Speed for field weakening with constant power
n_{max}	rpm	Maximum speed
T_{th}	min	Thermal time constant
I_μ	A	No-load current
I_{max}	A	Maximum current

Table 4- 3 SINAMICS, 3-ph. 400 V AC, Servo Control, (ALM), 1PH7101-□□F□□

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1500	3.7	23.6	10.0	350	51.6	8234	9000	20	5.9	20.0

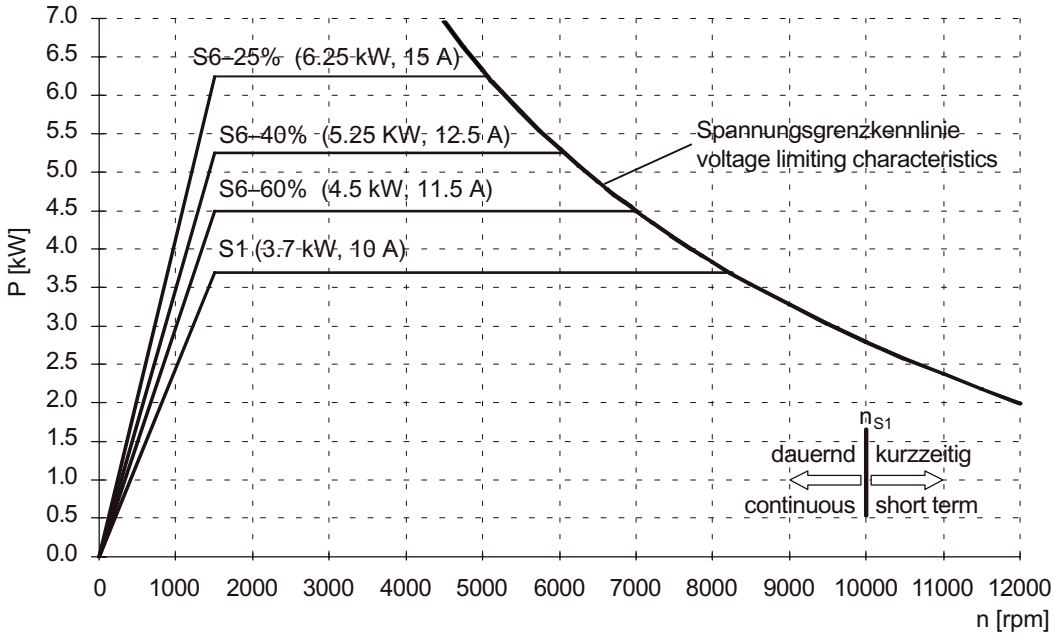


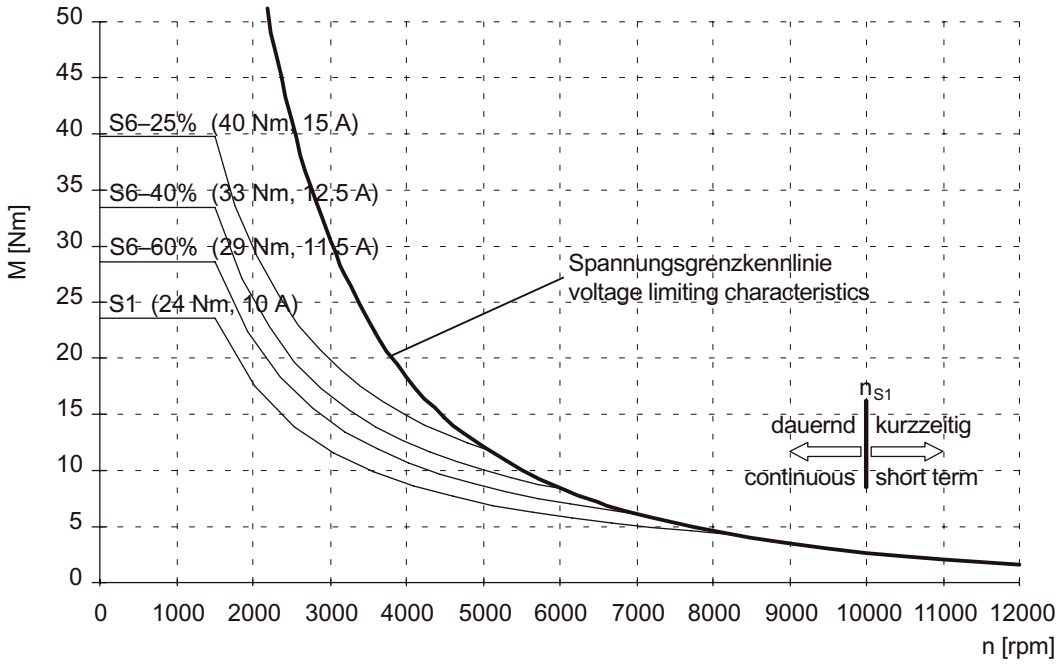


Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 4 SINAMICS, 3-ph. 400 V AC, Servo Control, (ALM), 1PH7101-□□F□□-0L

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1500	3.7	24	10	350	51.6	8234	12000	20	5.9	20.0

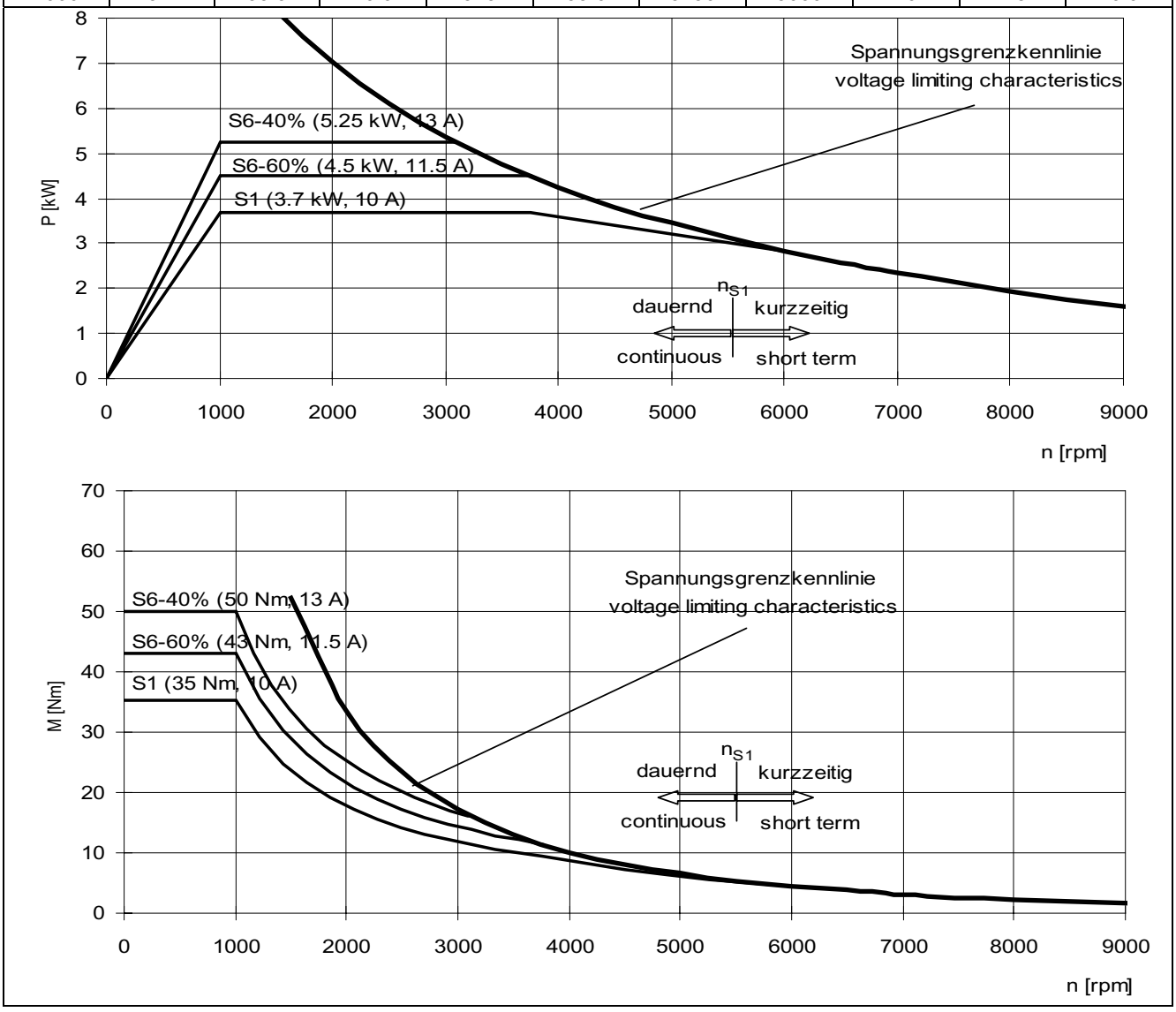




Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 5 SINAMICS, 3-ph. 400 V AC, Servo Control, (ALM), 1PH7103-□□D□□

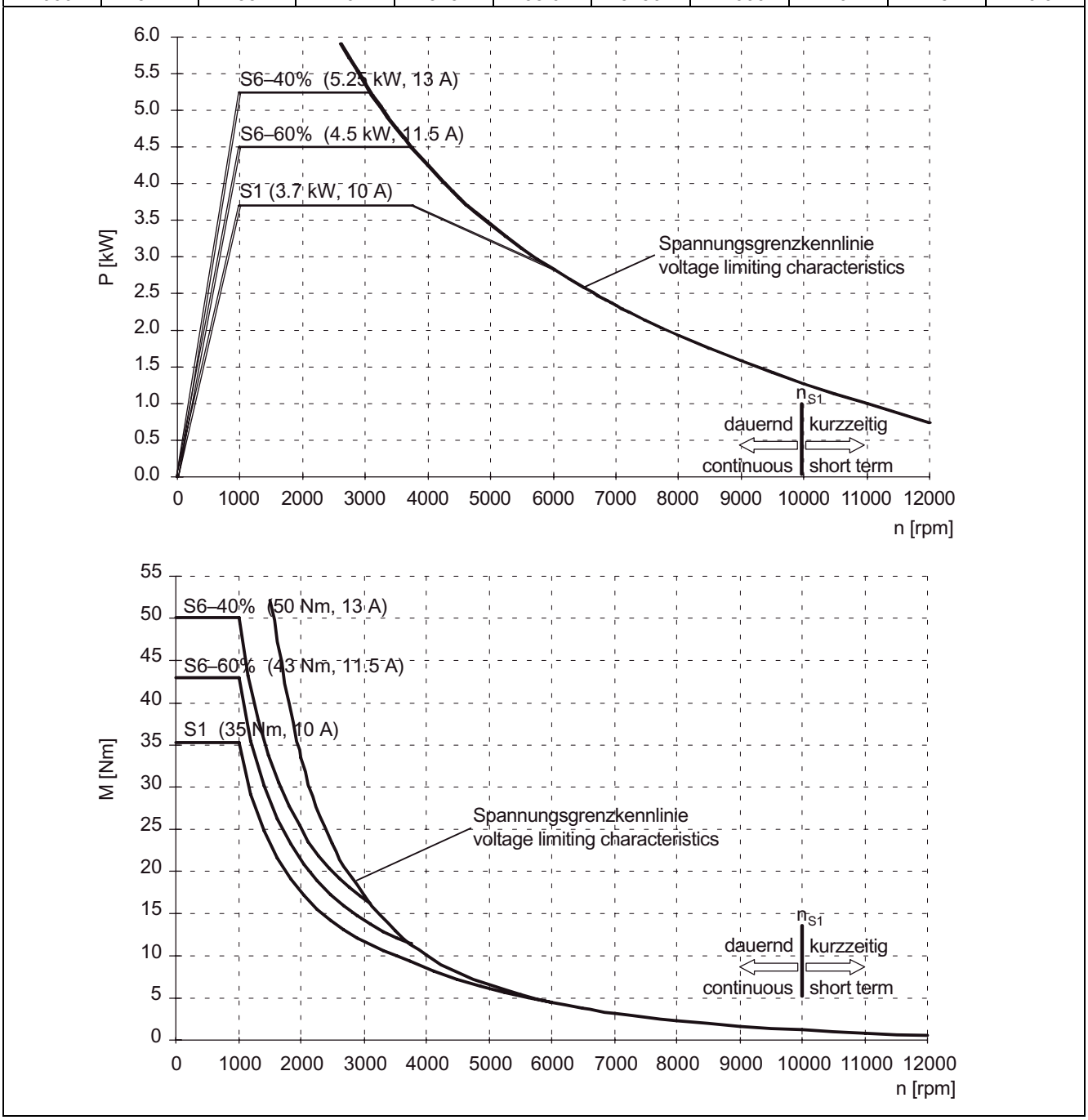
n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1000	3.7	35.3	10.0	343	35.6	3750	9000	20	4.8	20.0



Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 6 SINAMICS, 3-ph. 400 V AC, Servo Control, (ALM), 1PH7103-□□D□□-0L

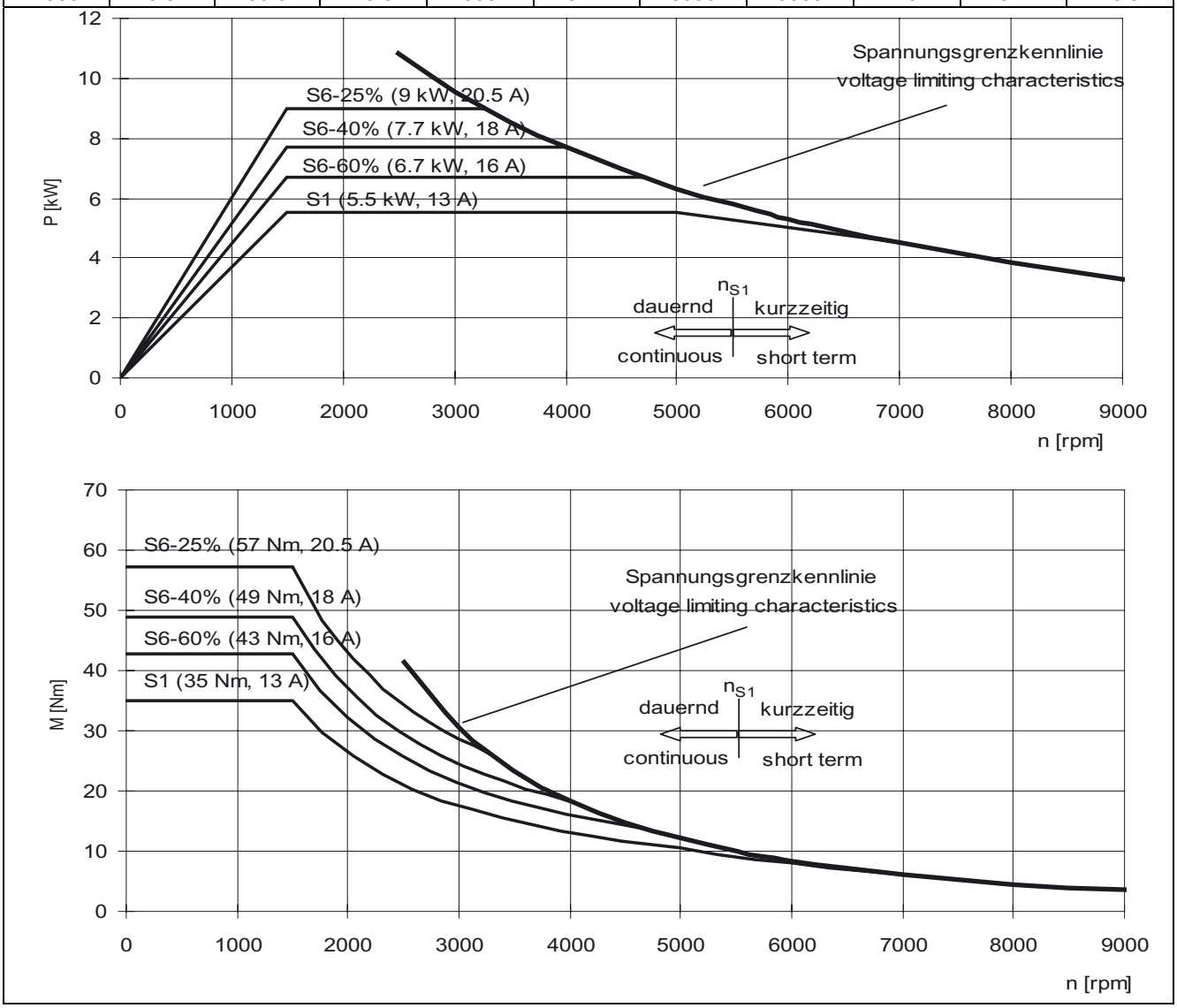
n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1000	3.7	35	10	343	35.6	3750	12000	20	4.8	20.0



Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 7 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7103-□□F□□

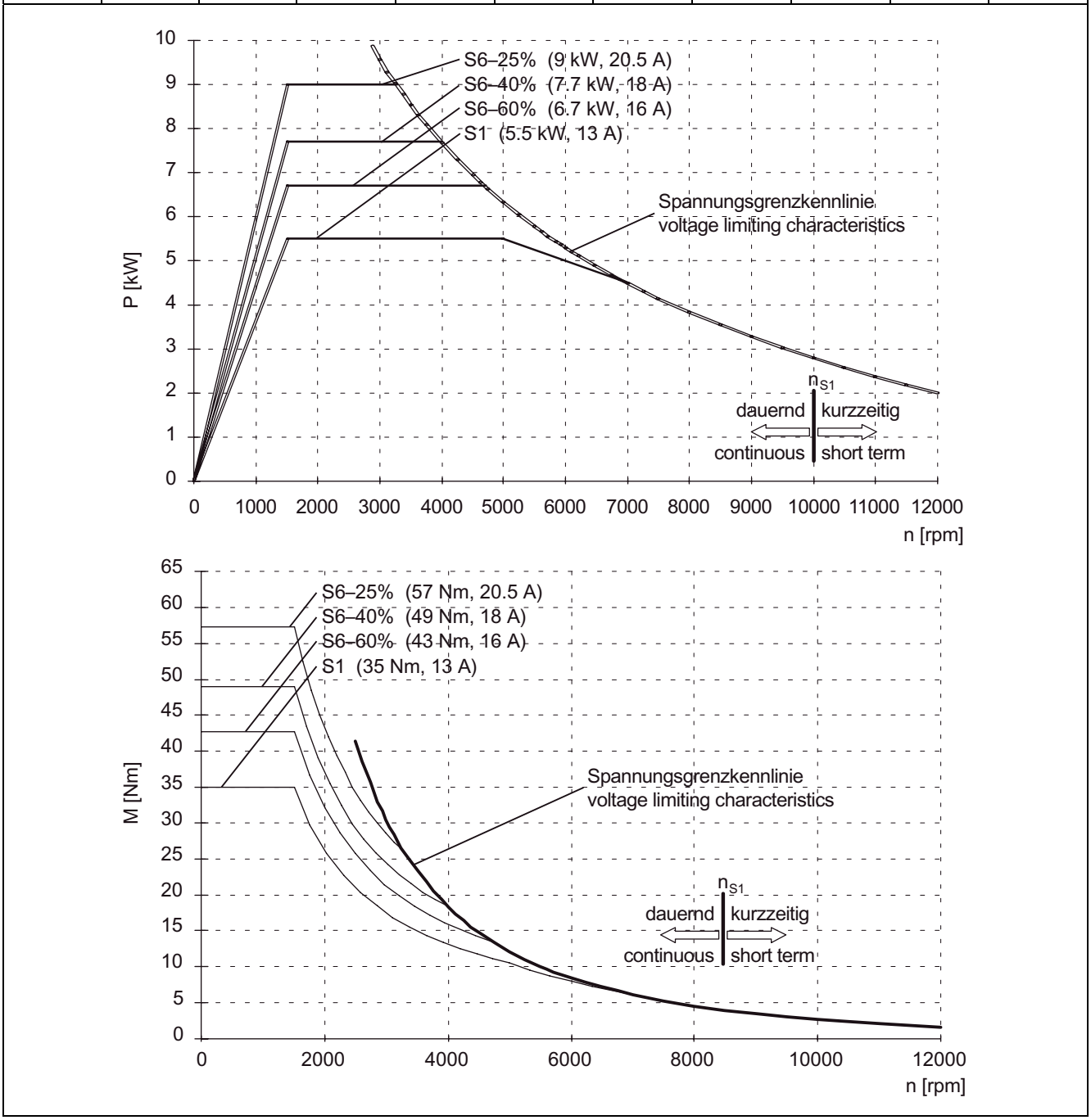
n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1500	5.5	35.0	13.0	350	52.7	5000	9000	20	5.4	26.0



Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 8 SINAMICS, 3-ph. 400 V AC, Servo Control, (ALM), 1PH7103-□□F□□-0L

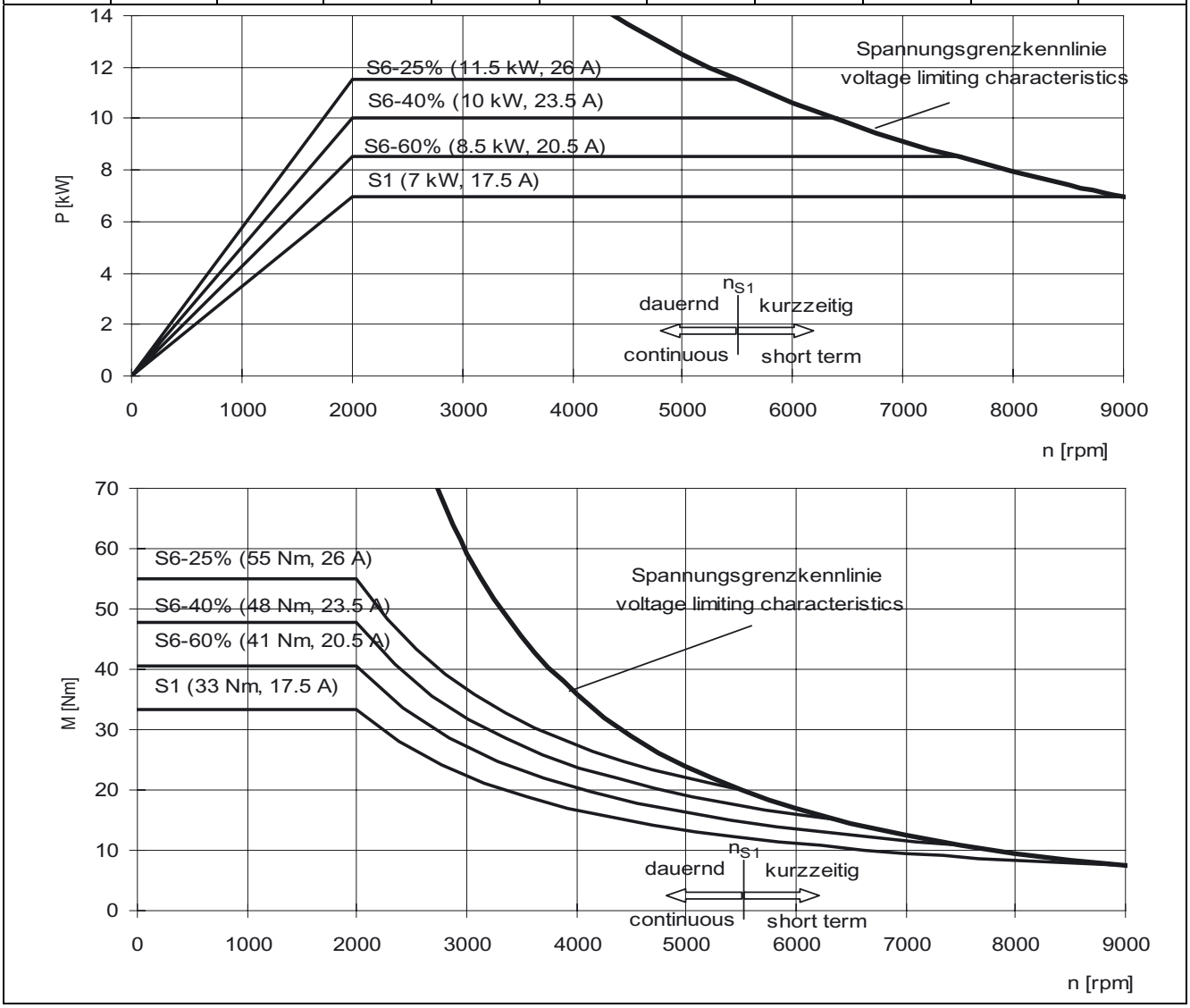
n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1500	5.5	35	13	350	52.7	5000	12000	20	5.4	26.0



Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 9 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7103-□□G□□

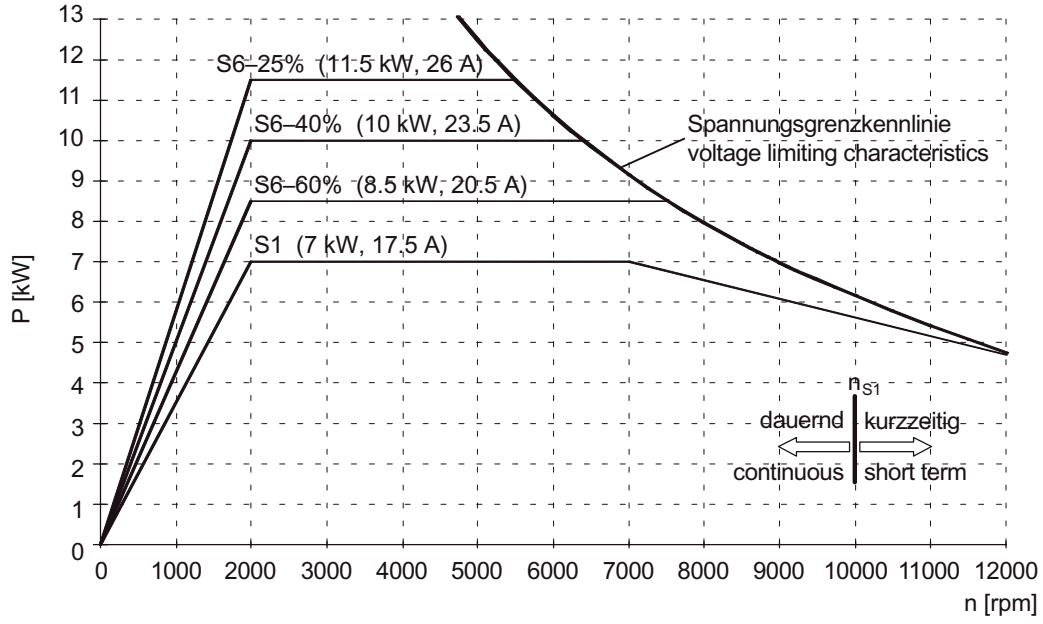
n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
2000	7.0	33.4	17.5	343	68.9	9000	9000	20	8.3	35.0

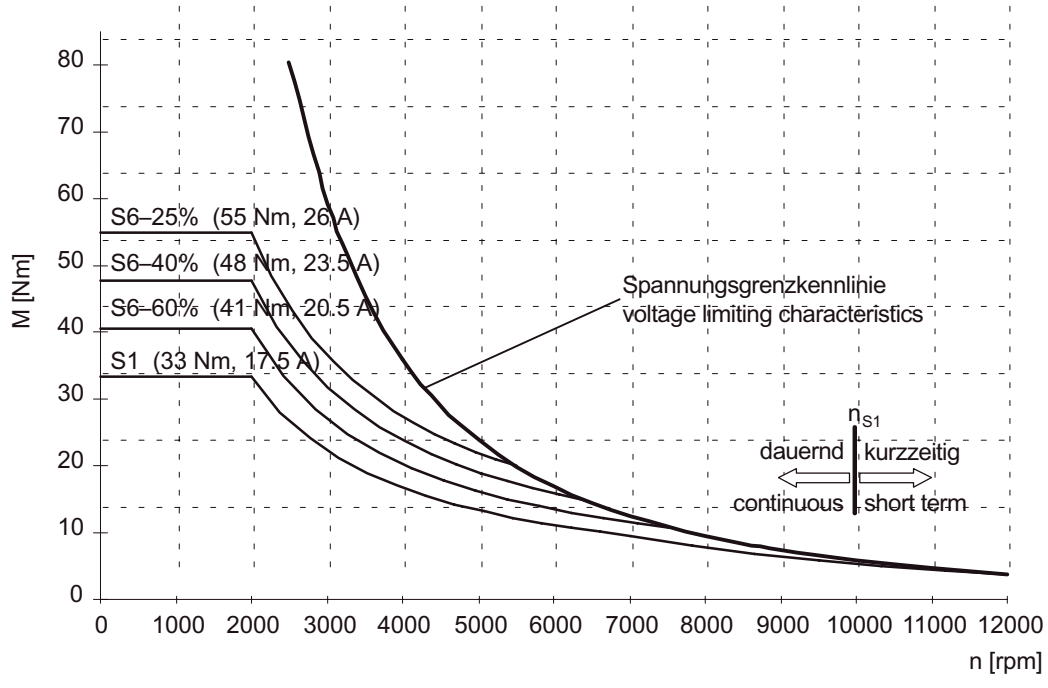


Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 10 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7103-□□G□□-0L

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
2000	7	33	17.5	343	68.9	7000	12000	20	8.3	35.0

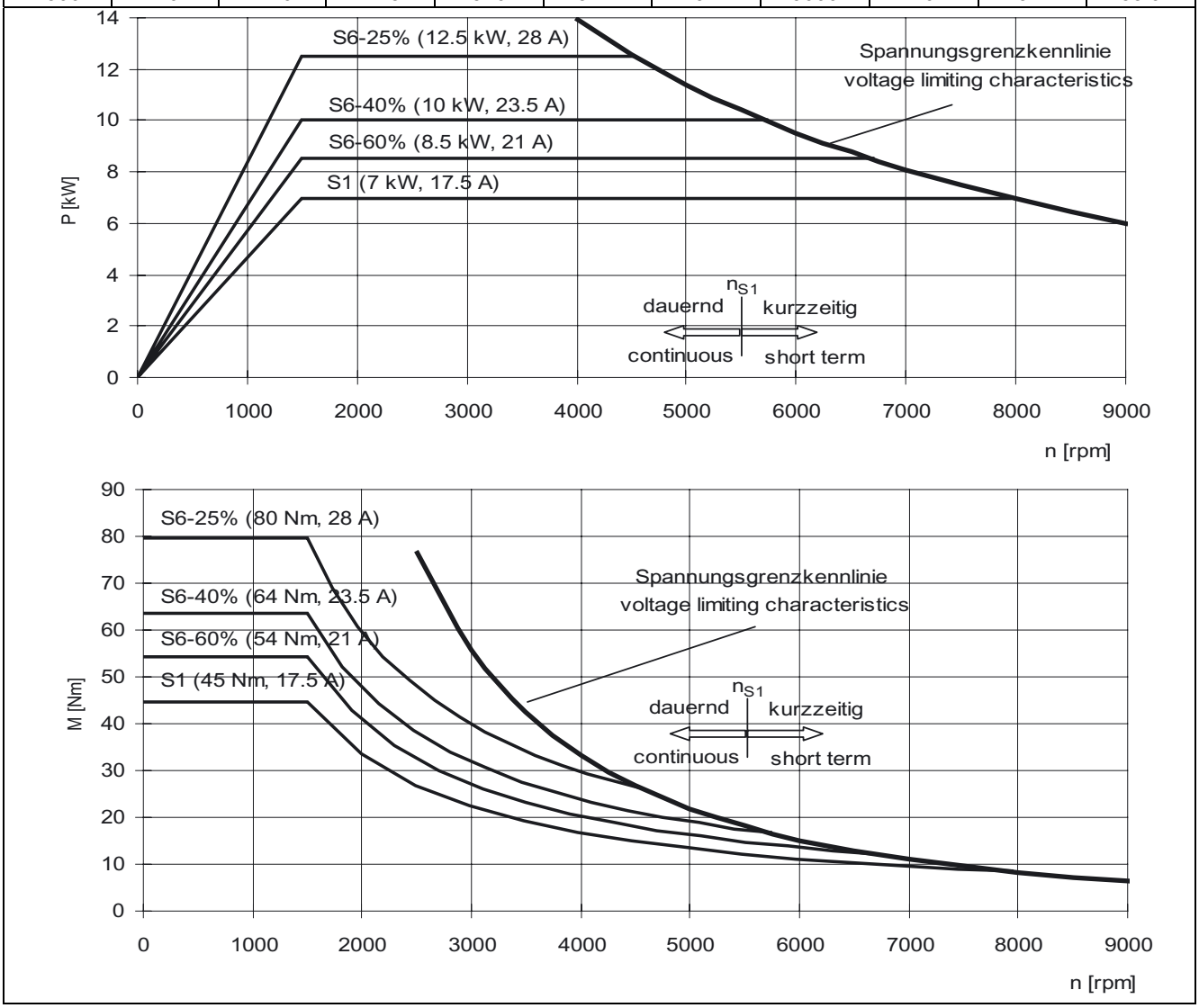




Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 11 SINAMICS, 3-ph. 400 V AC, Servo Control, (ALM), 1PH7105-□□F□□

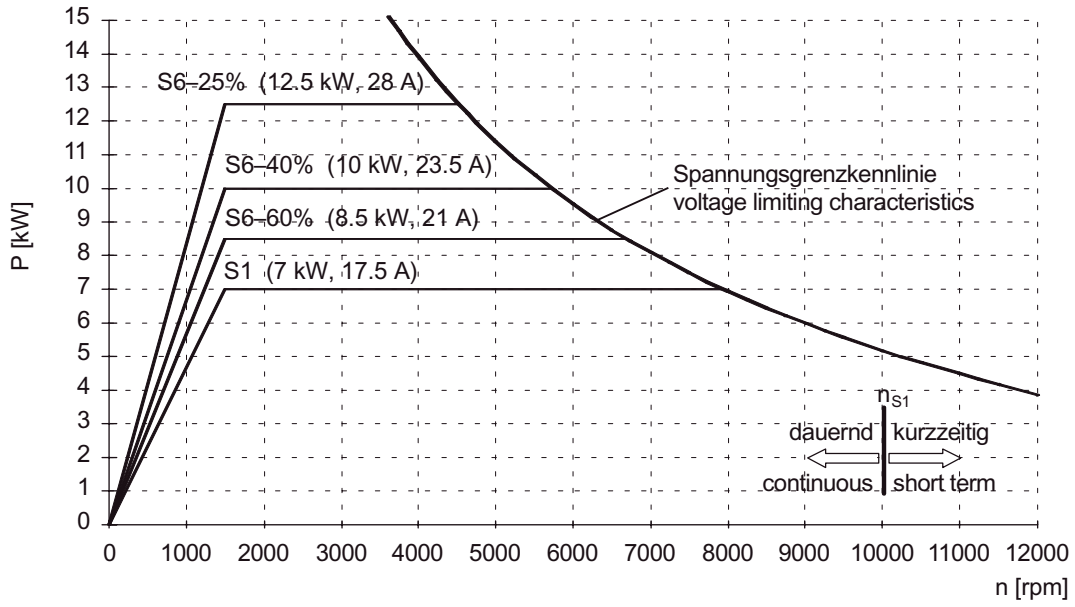
n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1500	7.0	44.6	17.5	346	51.7	7941	9000	20	9.4	35.0

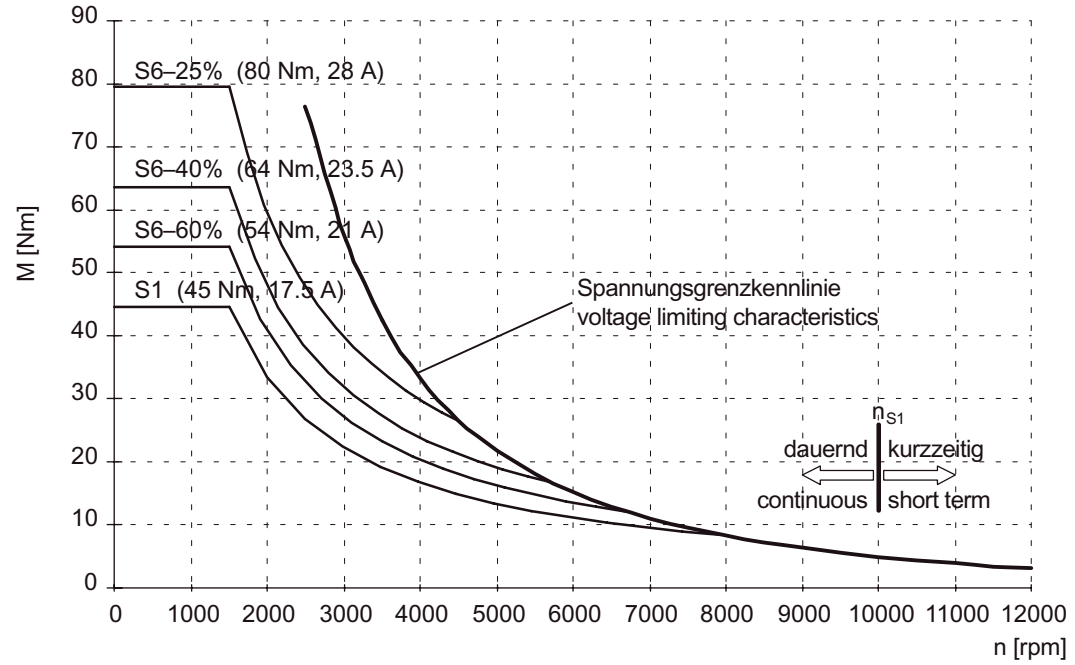


Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 12 SINAMICS, 3-ph. 400 V AC, Servo Control, (ALM), 1PH7105-□□F□□-0L

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1500	7.0	45	17.5	346	51.7	7941	12000	20	9.4	35.0

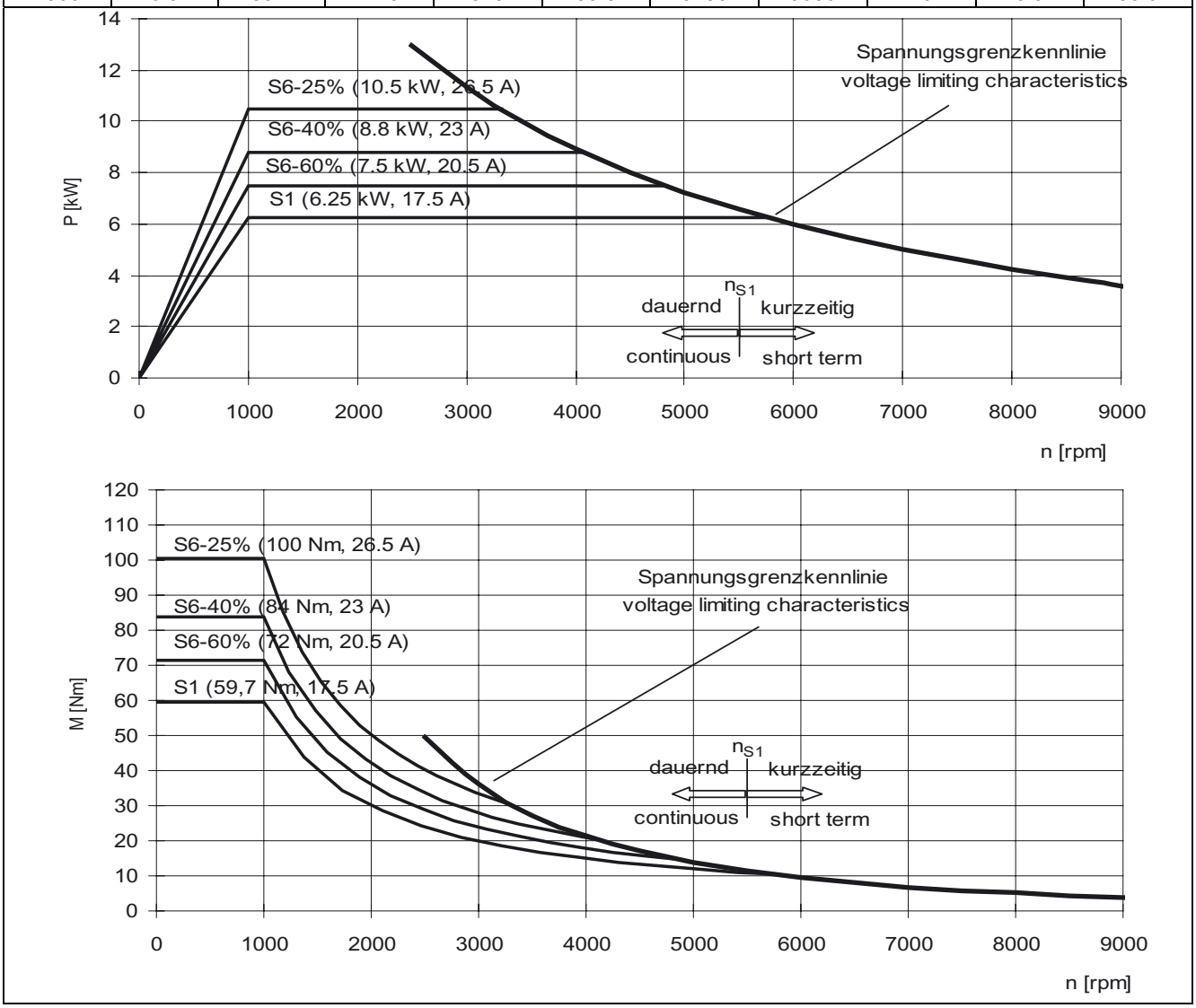




Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 13 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7107-□□D□□

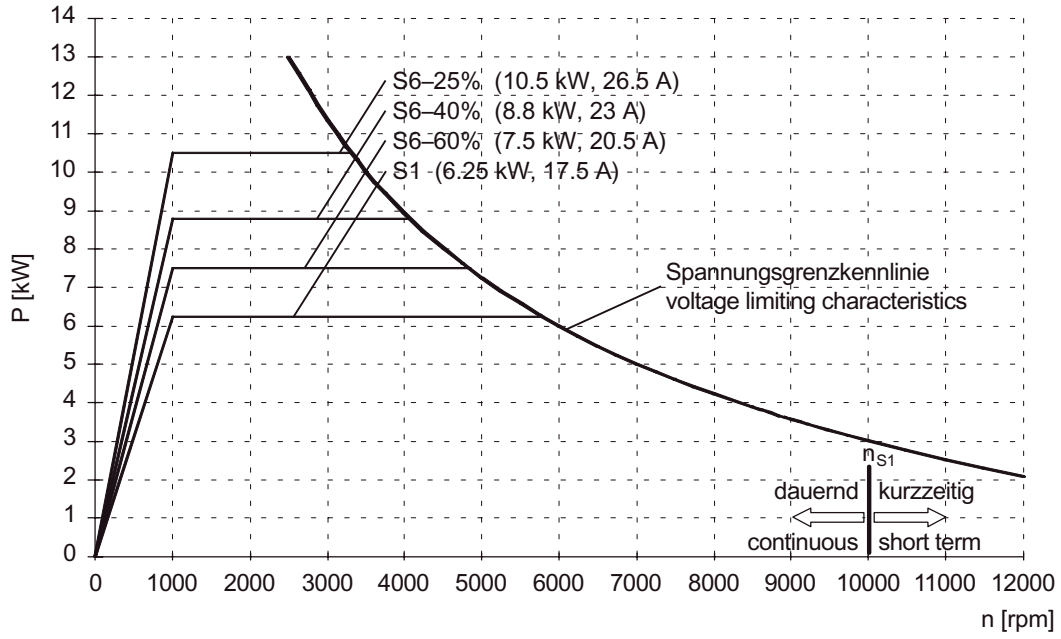
n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1000	6.3	59.7	17.5	319	35.3	5783	9000	20	8.9	35.0

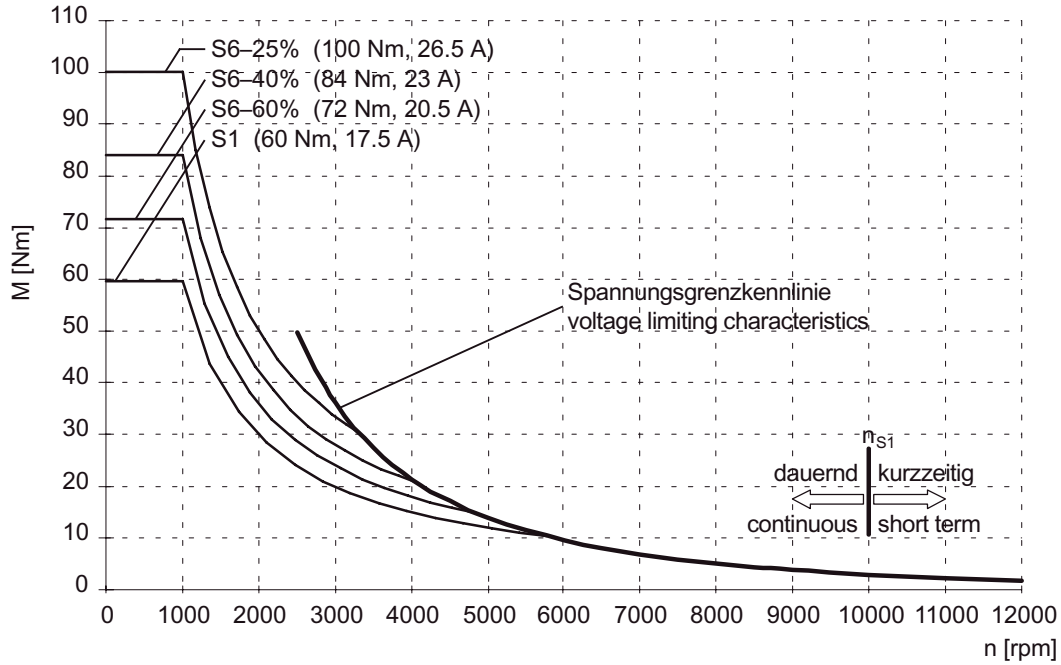


Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 14 SINAMICS, 3-ph. 400 V AC, Servo Control, (ALM), 1PH7107-□□D□□-0L

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1000	6.25	60	17.5	319	35.3	5783	12000	20	8.9	35.0

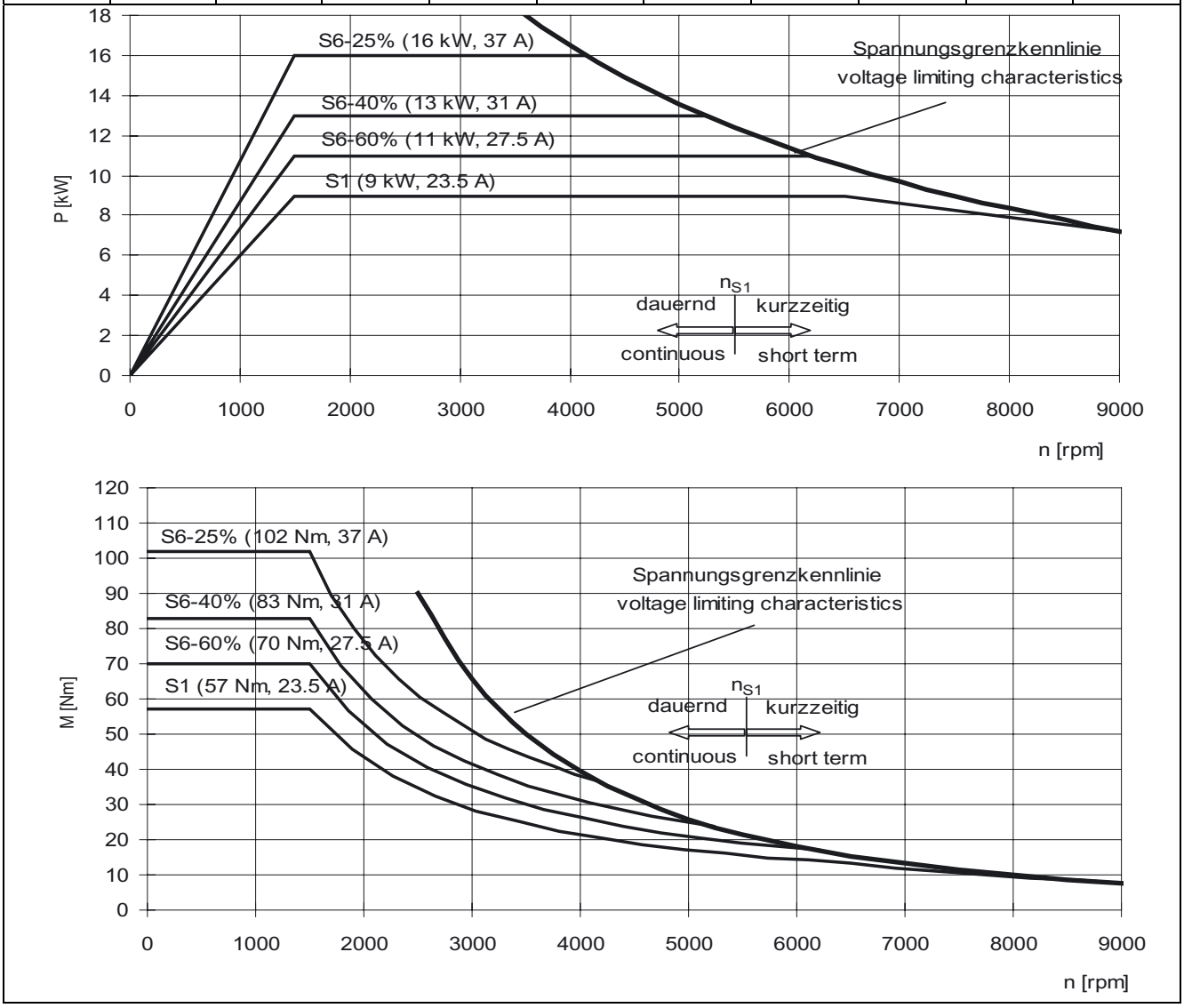




Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 15 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7107-□□F□□

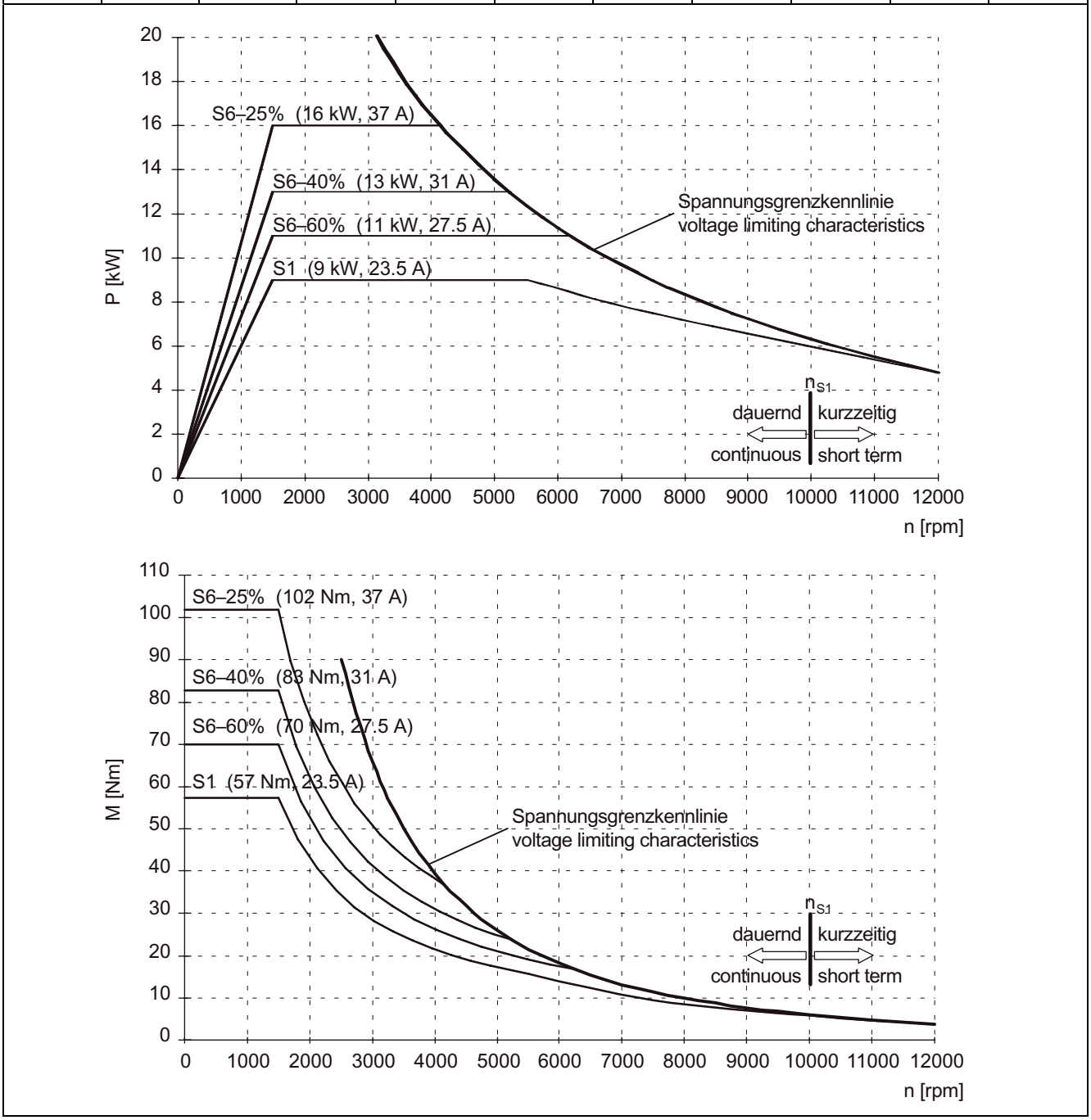
n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1500	9.0	57.3	23.5	336	52.0	6500	9000	20	11.0	47.0



Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 16 SINAMICS, 3-ph. 400 V AC, Servo Control, (ALM), 1PH7107-□□F□□-0L

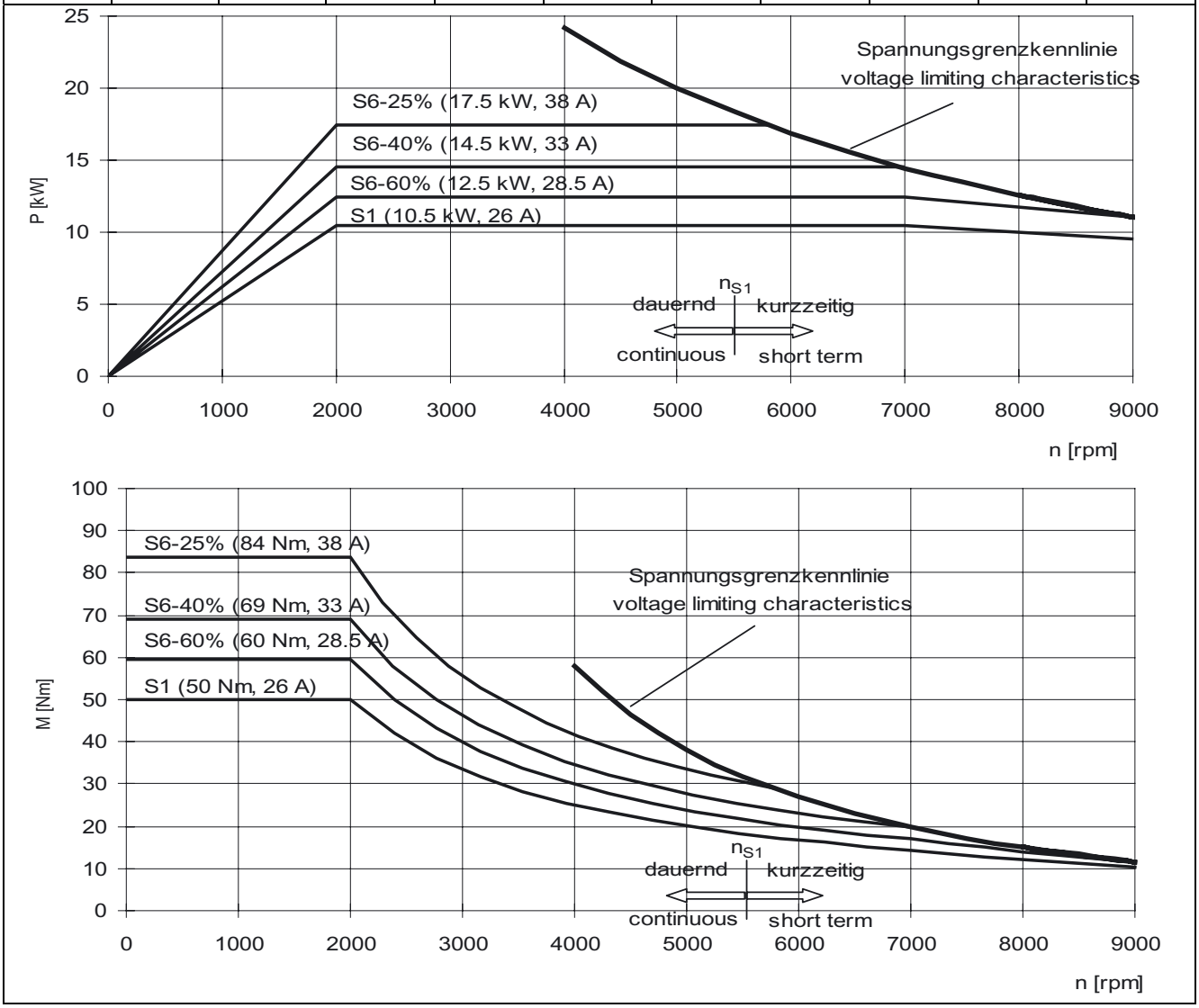
n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1500	9.0	57	23.5	336	52.0	5500	12000	20	11.0	47.0



Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 17 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7107-□□G□□

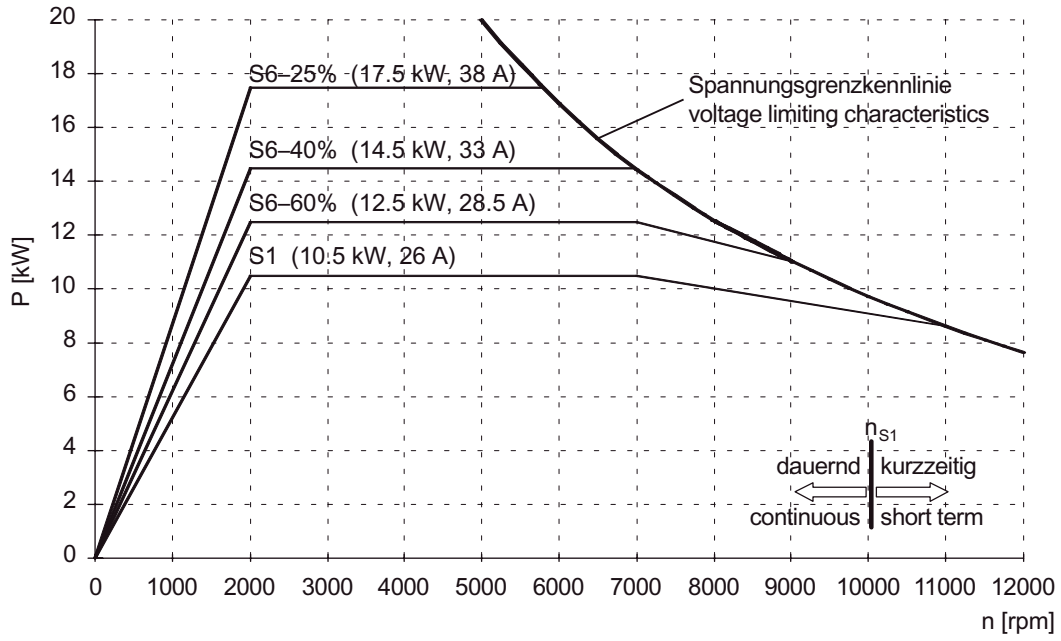
n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
2000	10.5	50.1	26.0	350	68.6	7000	9000	20	12.0	52.0

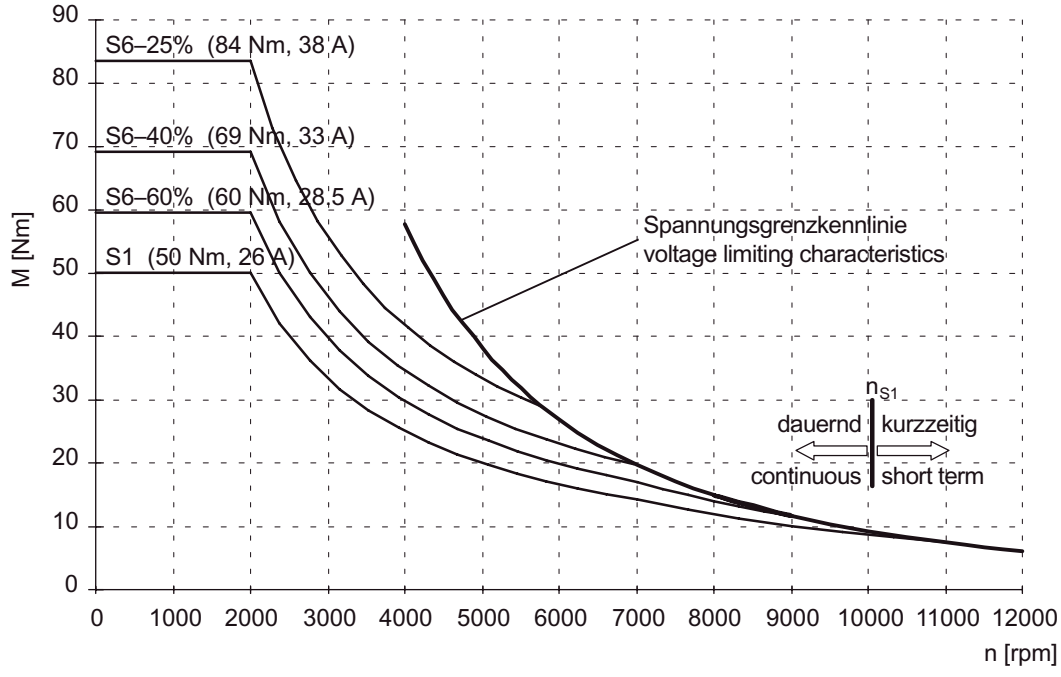


Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 18 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7107-□□G□□-0L

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
2000	10.5	50	26	350	68.6	7000	12000	20	12.0	52.0

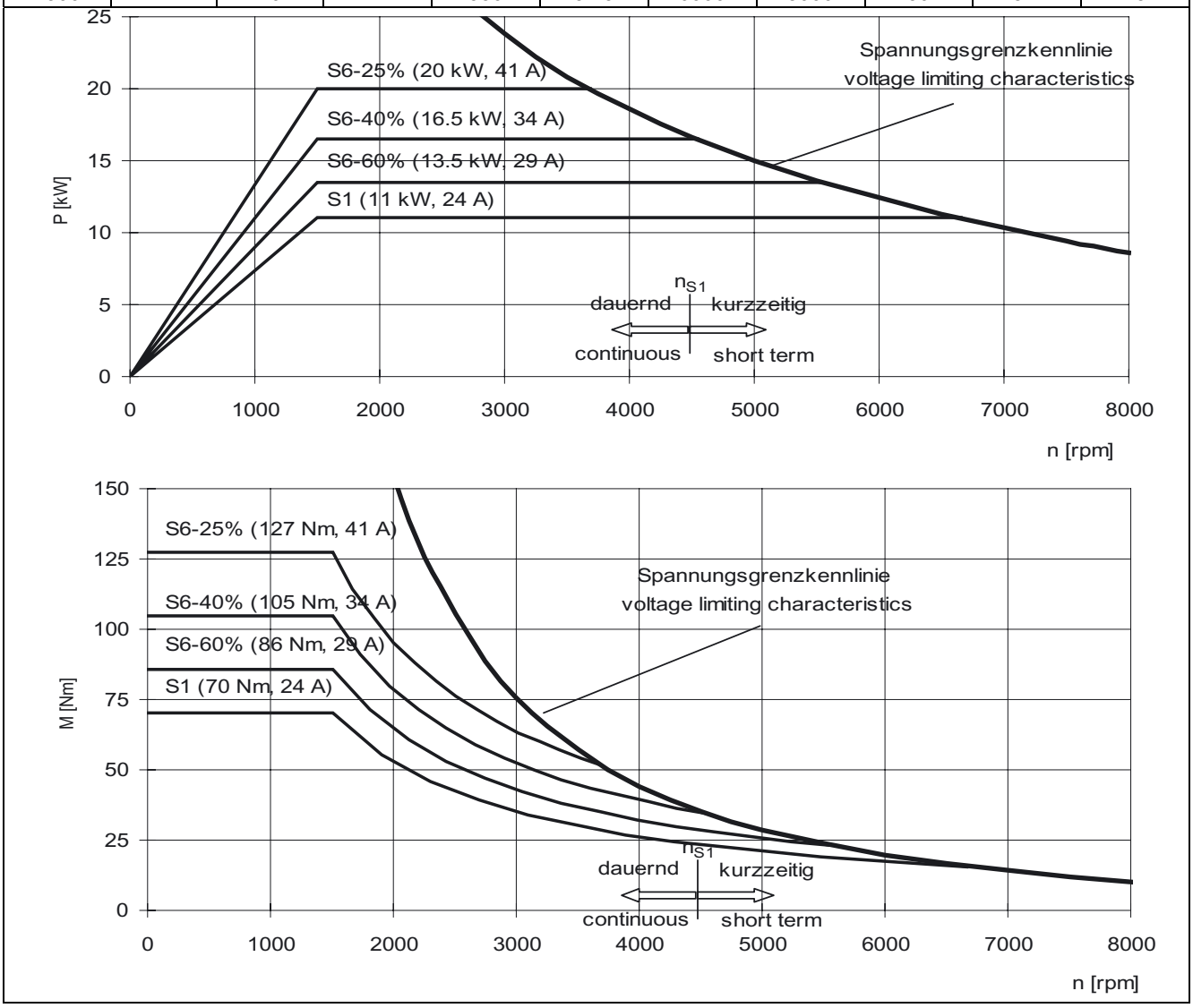




Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 19 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7131-□□F□□

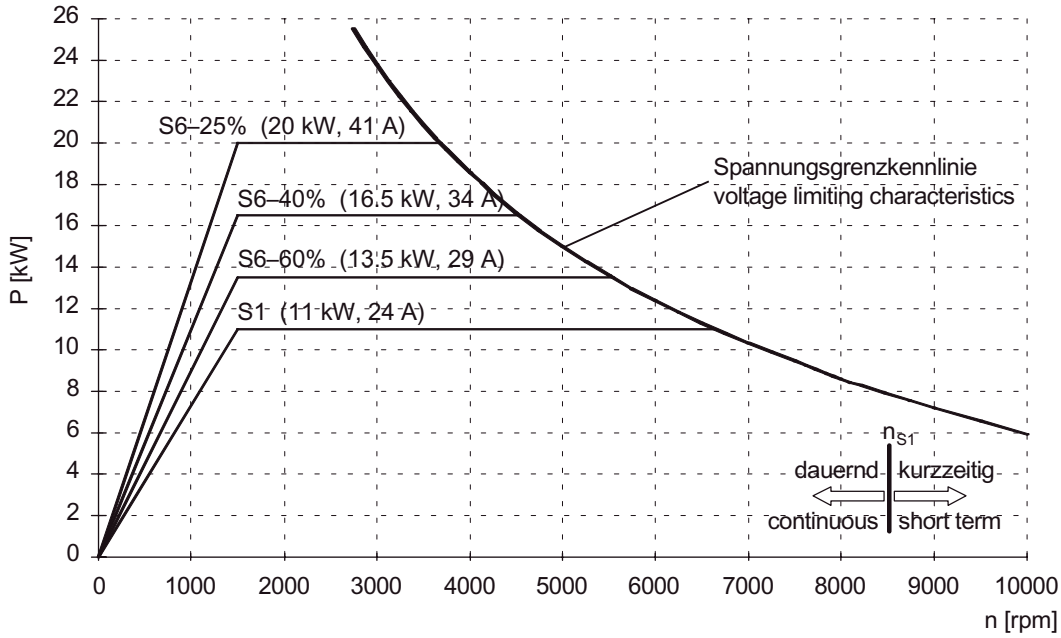
n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1500	11	70	24	350	51.3	6660	8000	30	8.4	48

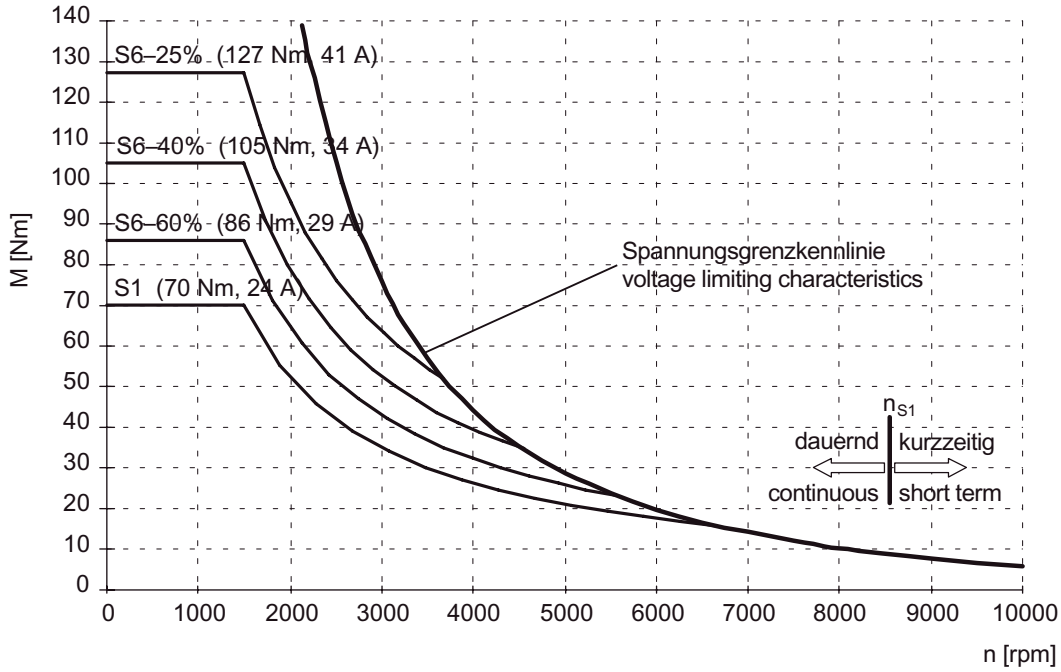


Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 20 SINAMICS, 3-ph. 400 V AC, Servo Control, (ALM), 1PH7131-□□F□□-0L

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1500	11	70	24	350	51.3	6660	10000	30	8.4	48

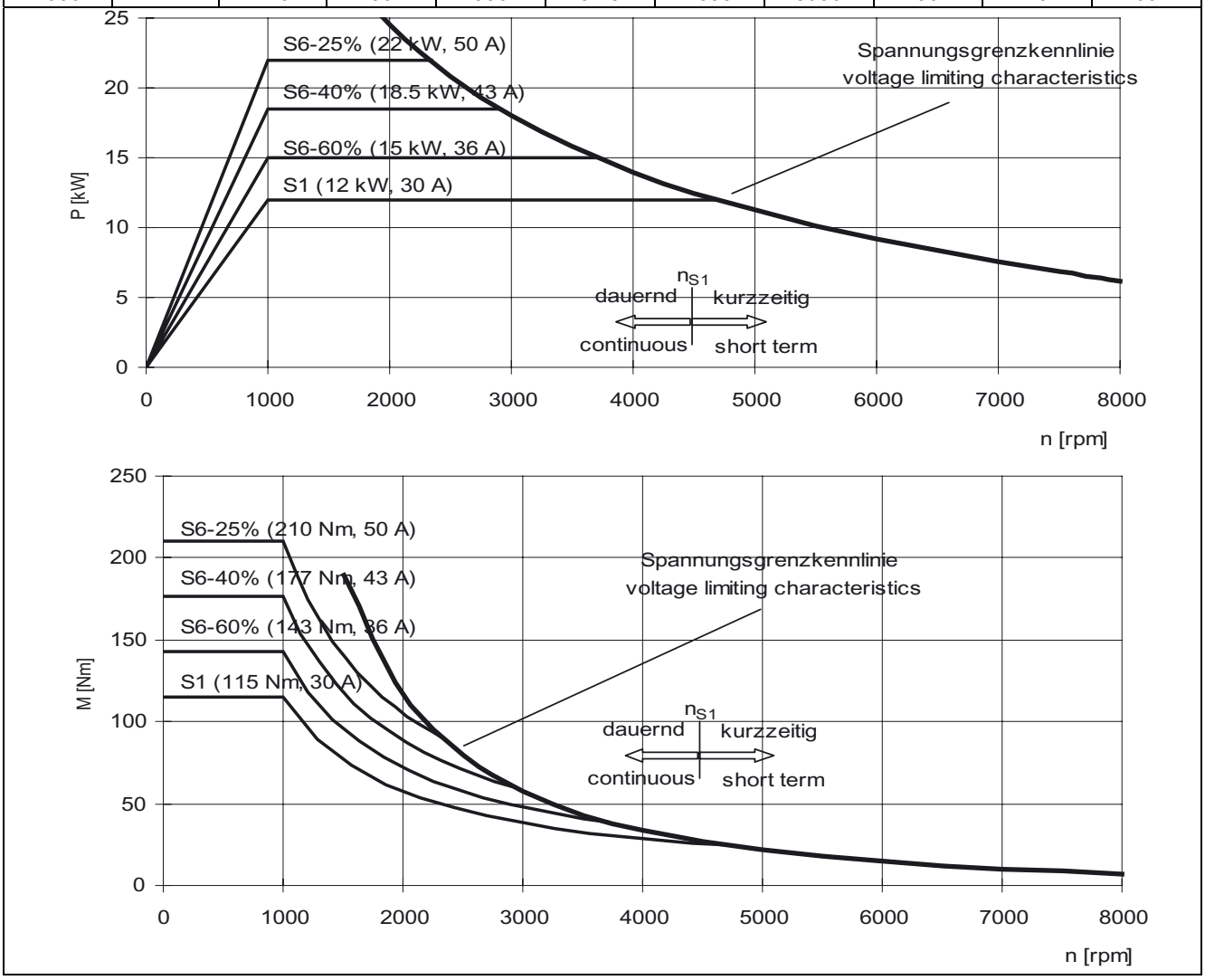




Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 21 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7133-□□D□□

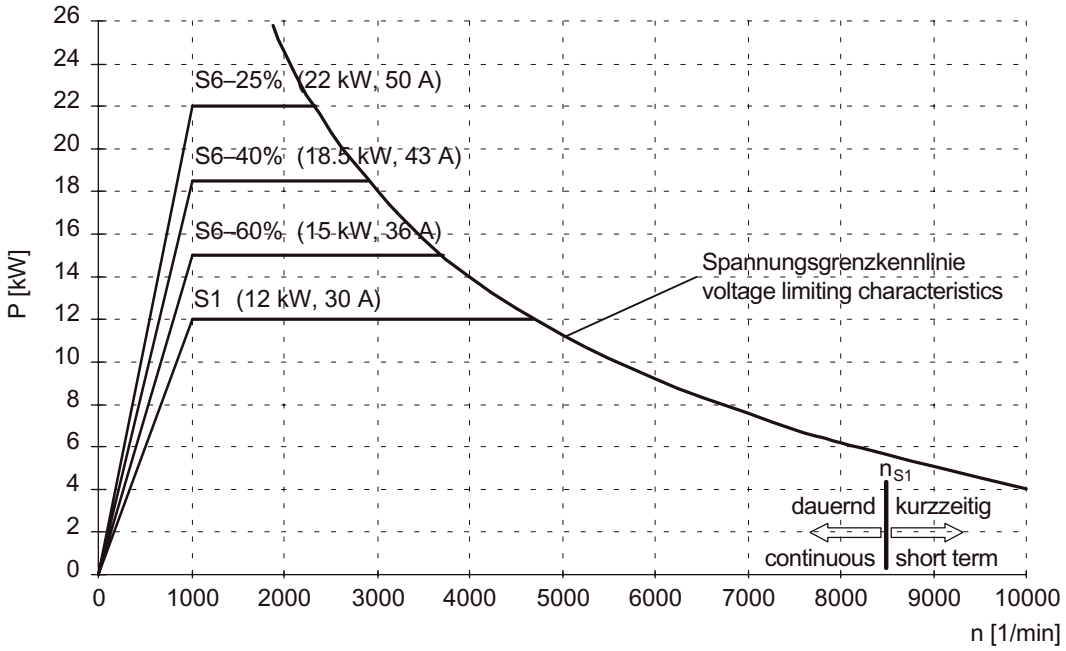
n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1000	12	115	30	336	34.8	4695	8000	30	13	60

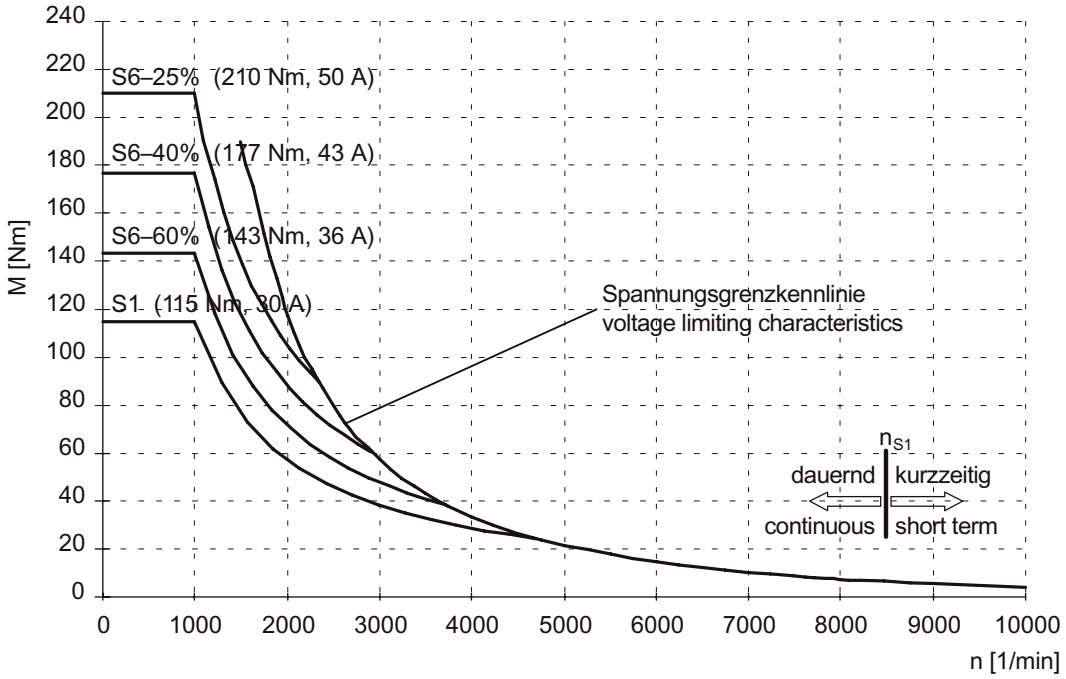


Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 22 SINAMICS, 3-ph. 400 V AC, Servo Control, (ALM), 1PH7133-□□D□□-0L

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1000	12	115	30	336	34.8	4695	10000	30	13	60

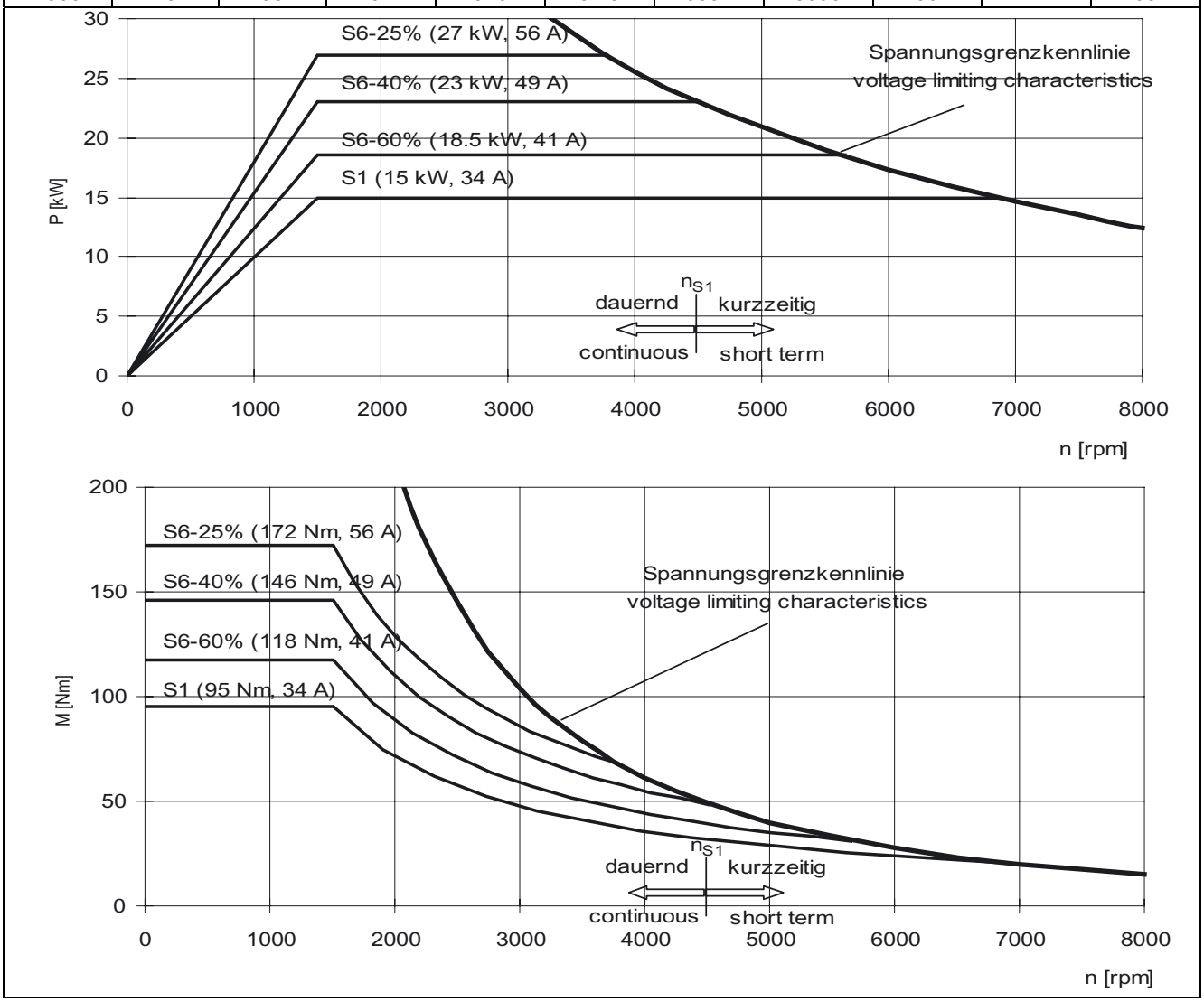




Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 23 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7133-□□F□□

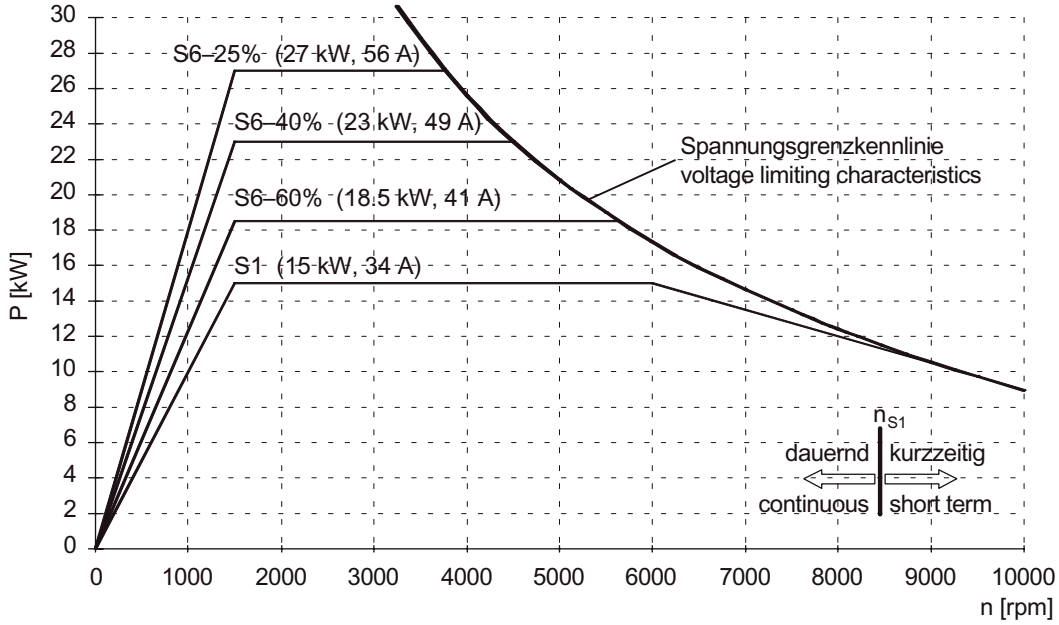
n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1500	15	95	34	346	51.3	6854	8000	30	14	68

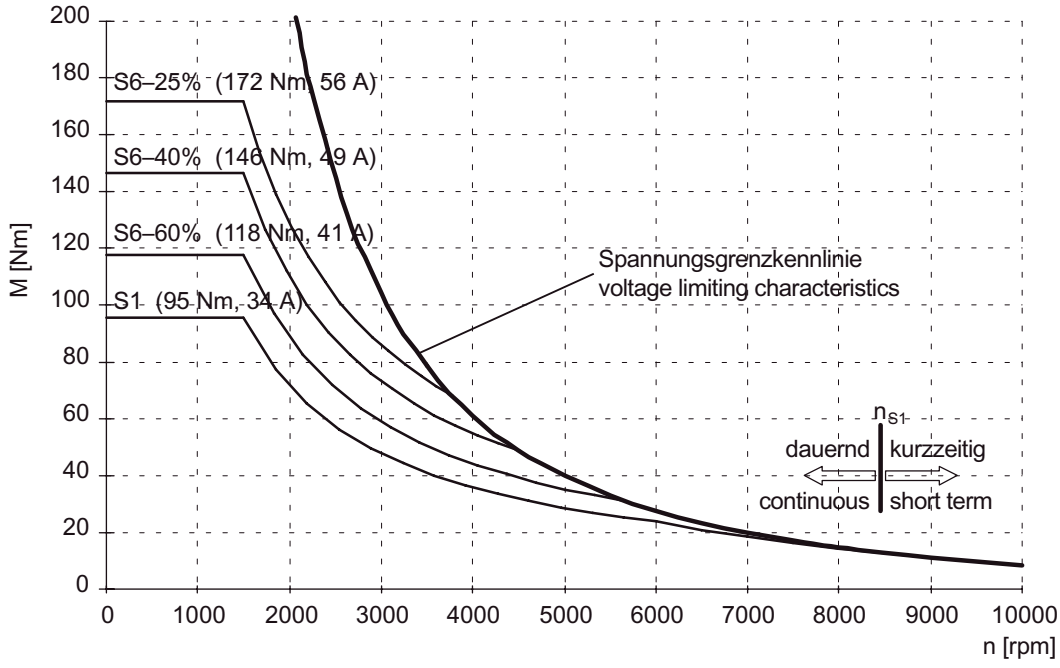


Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 24 SINAMICS, 3-ph. 400 V AC, Servo Control, (ALM), 1PH7133-□□F□□-0L

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1000	15	95	34	346	51.3	6000	10000	30	14	68

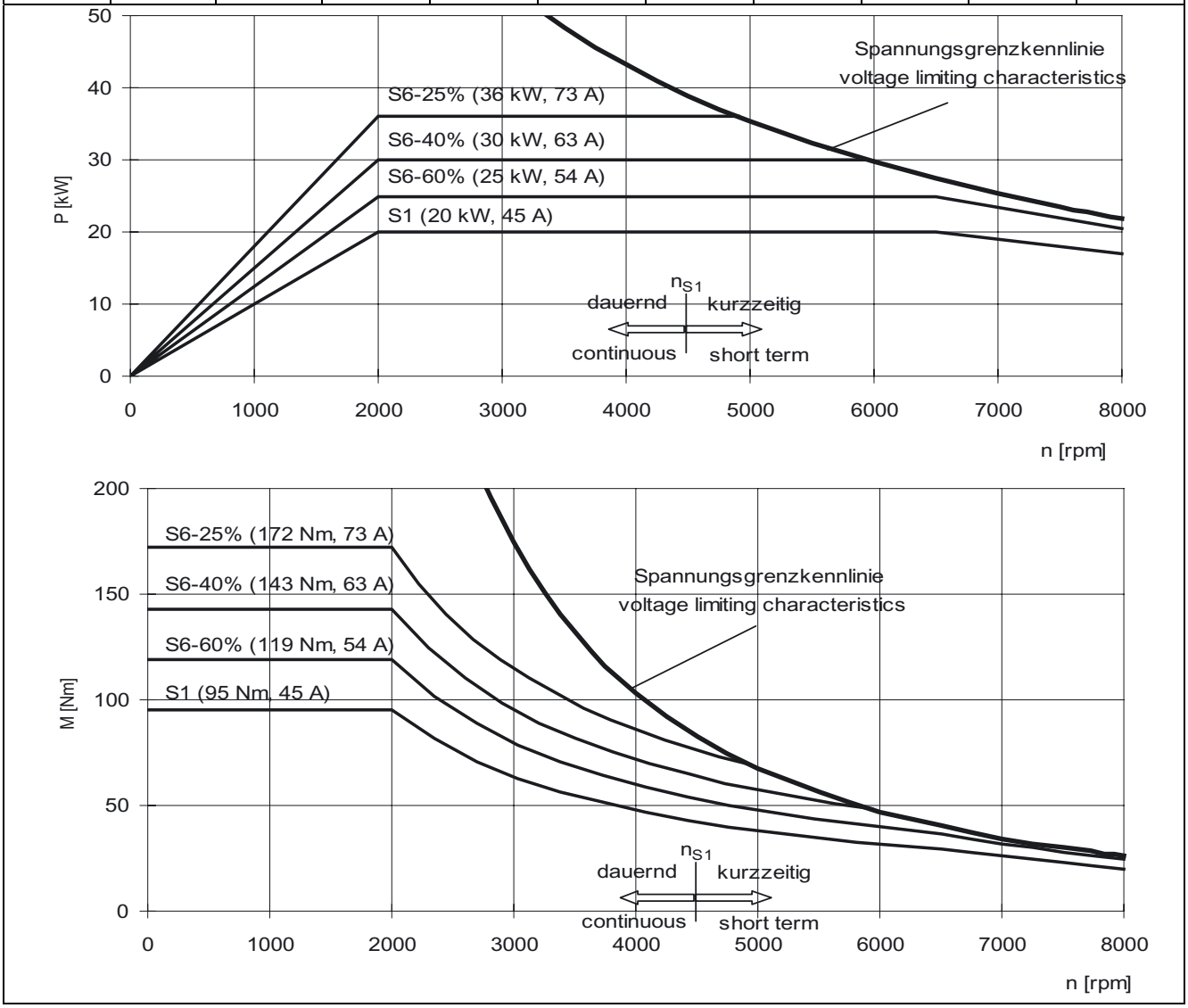




Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 25 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7133-□□G□□

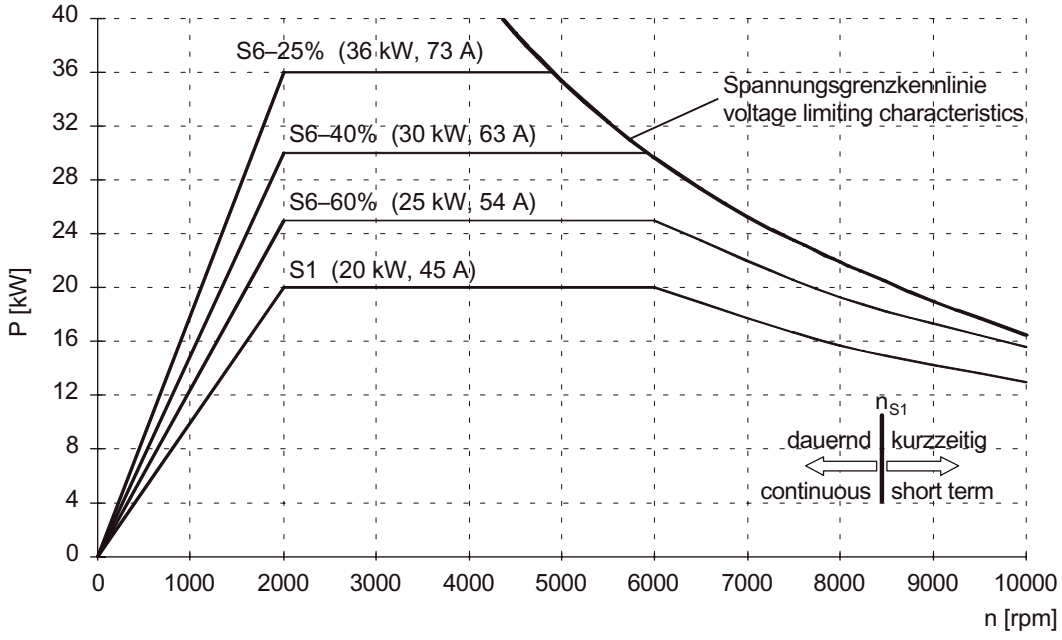
n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
2000	20	95	45	350	68.0	6500	8000	30	18	90

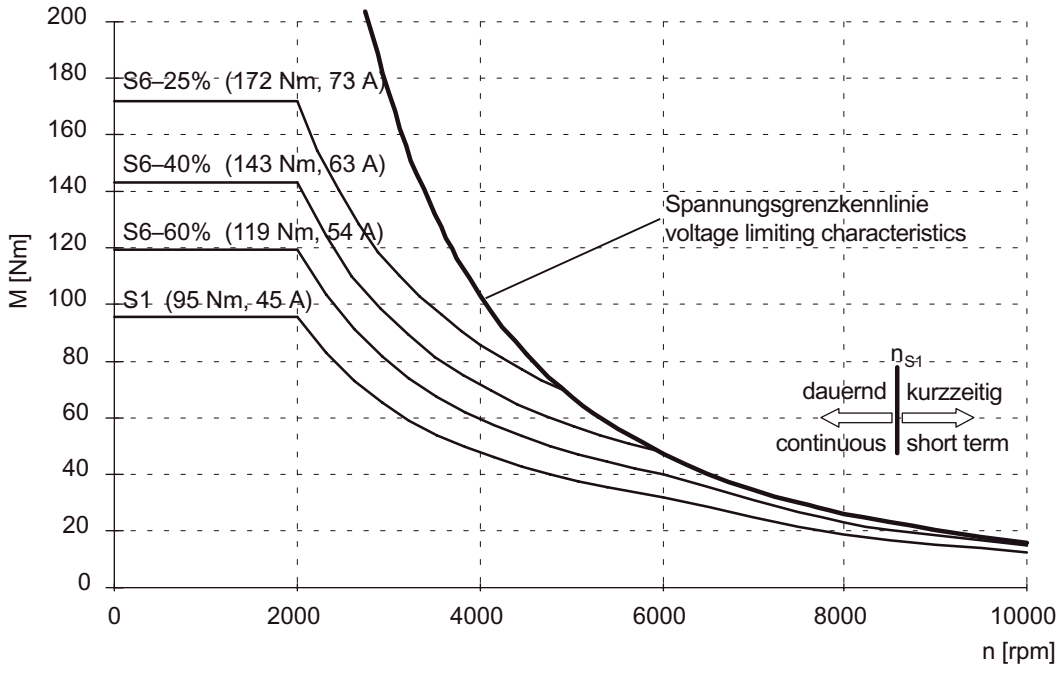


Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 26 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7133-□□G□□-0L

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
2000	20	95	45	350	68.0	6000	10000	30	18	90

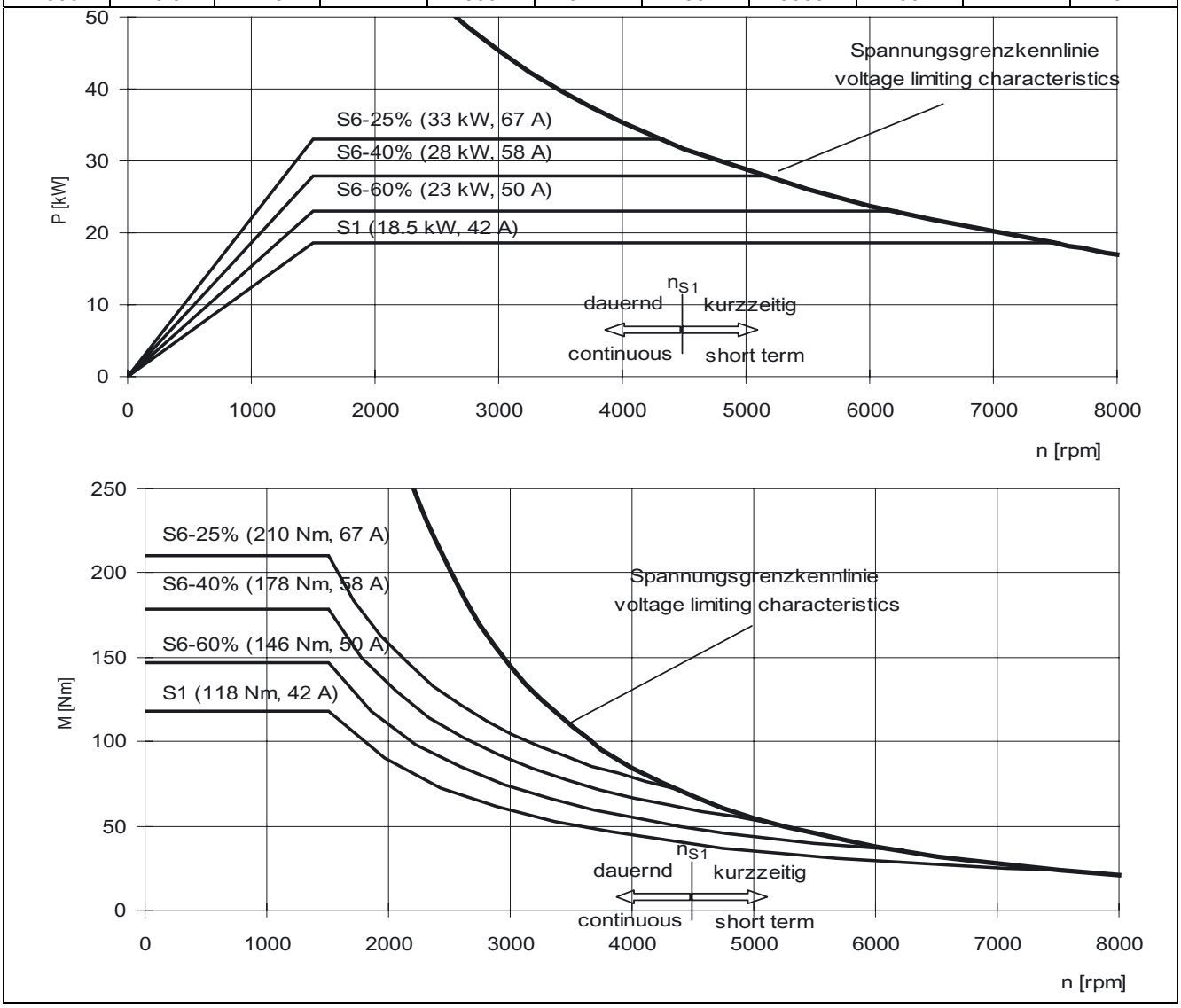




Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 27 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7135-□□F□□

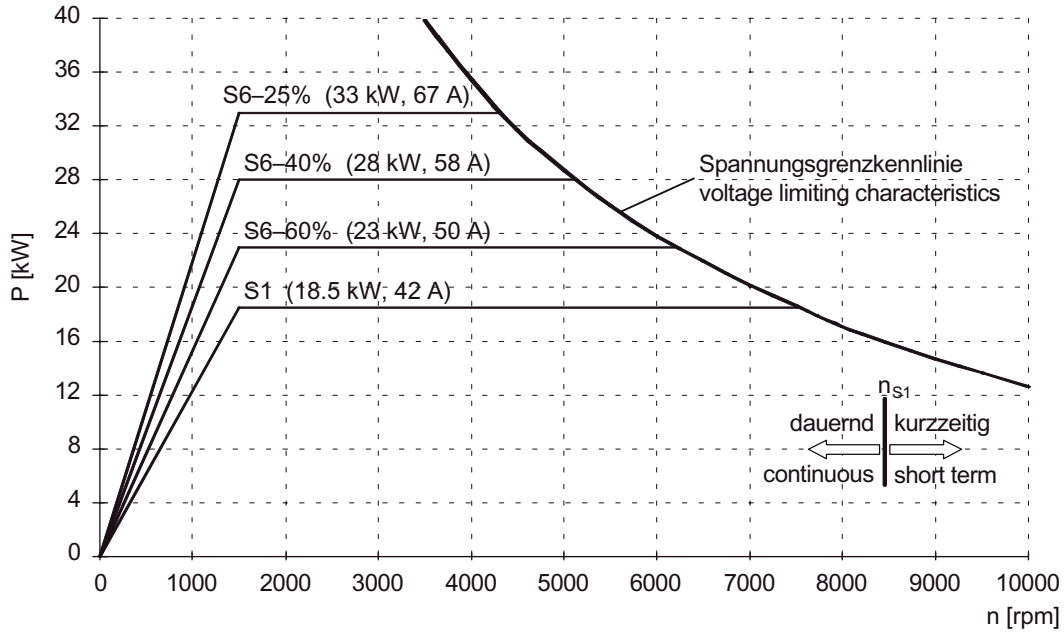
n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1500	18.5	118	42	350	51.1	7537	8000	30	17	84

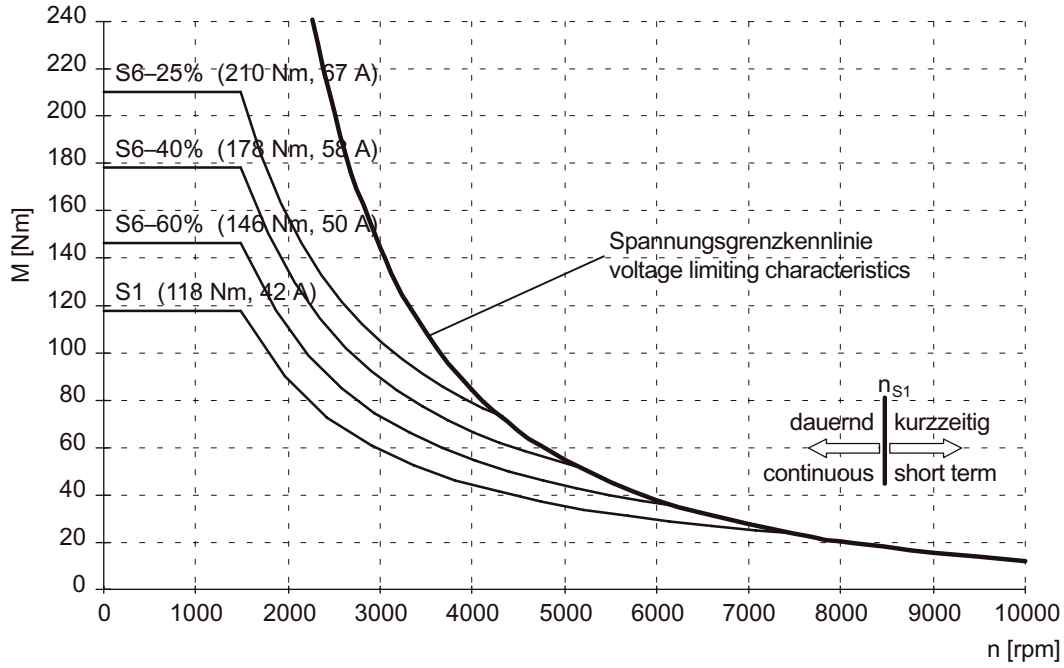


Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 28 SINAMICS, 3-ph. 400 V AC, Servo Control, (ALM), 1PH7135-□□F□□-0L

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1500	18.5	118	42	350	51.1	7537	10000	30	17	84

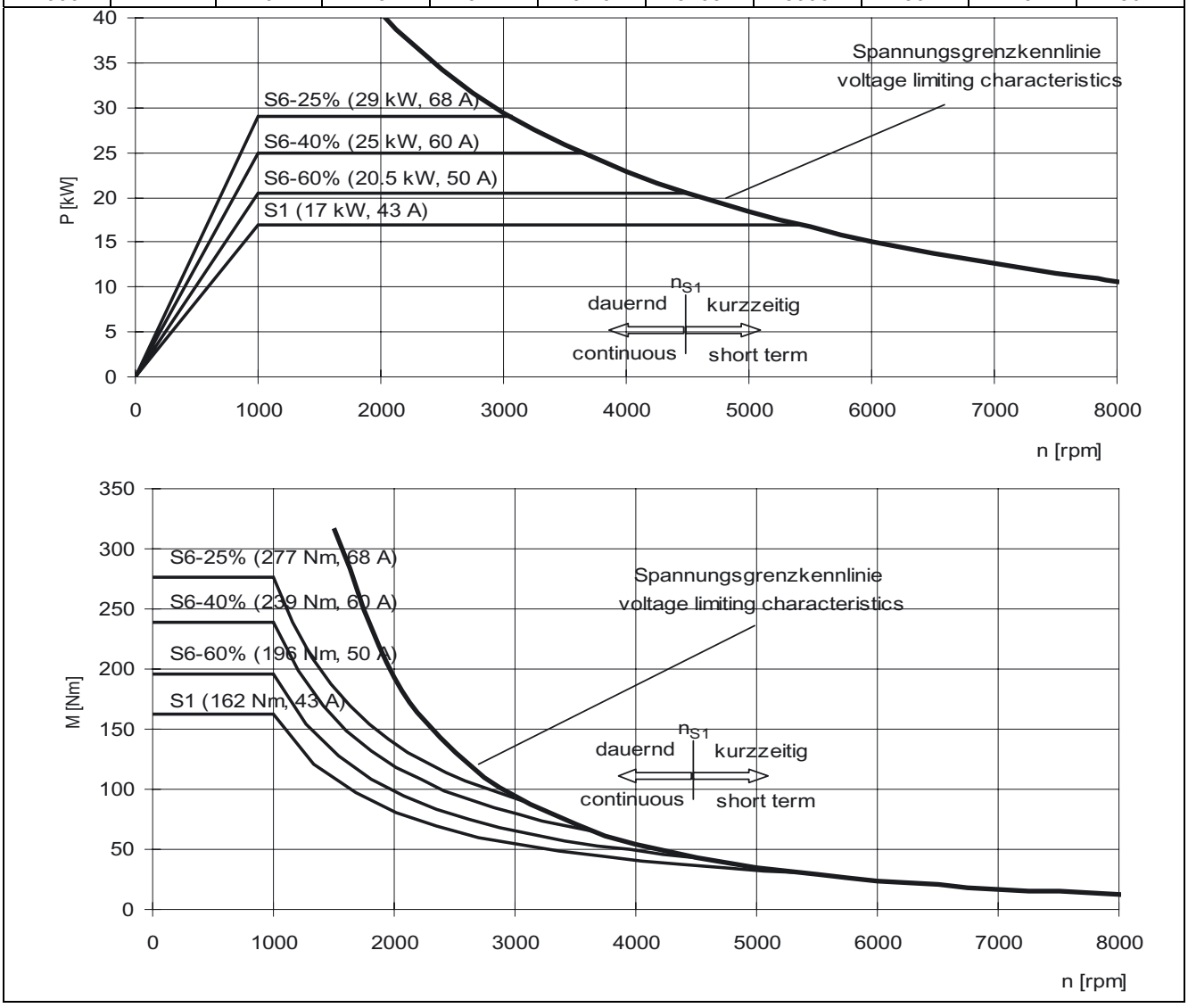




Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 29 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7137-□□D□□

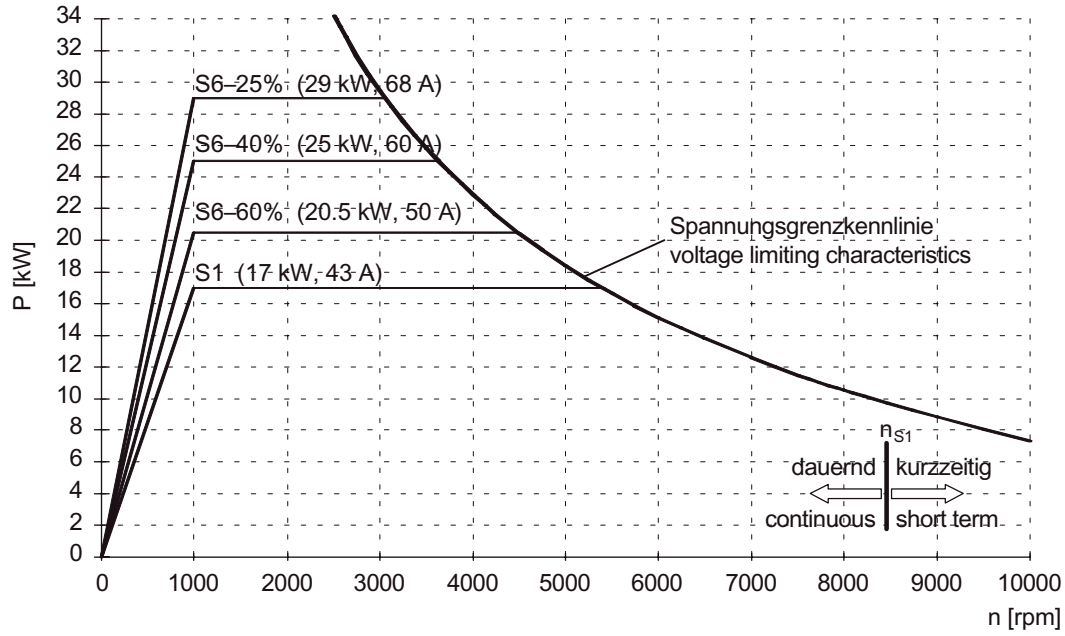
n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1000	17	162	43	322	34.6	5403	8000	30	19	86

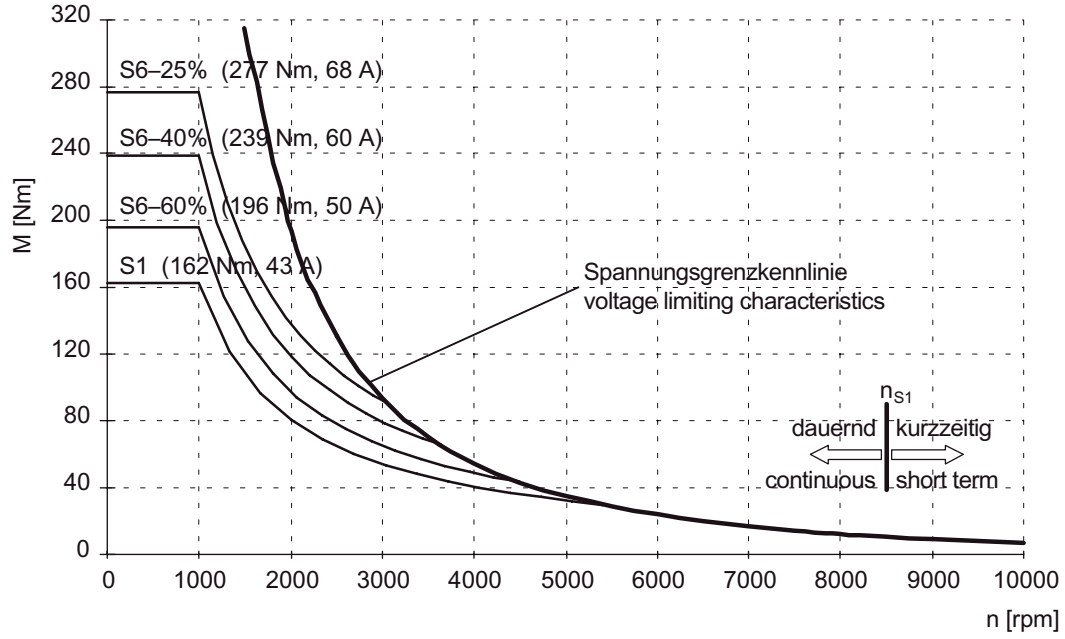


Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 30 SINAMICS, 3-ph. 400 V AC, Servo Control, (ALM), 1PH7137-□□D□□-0L

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1000	17	162	43	322	34.6	5403	10000	30	19	86

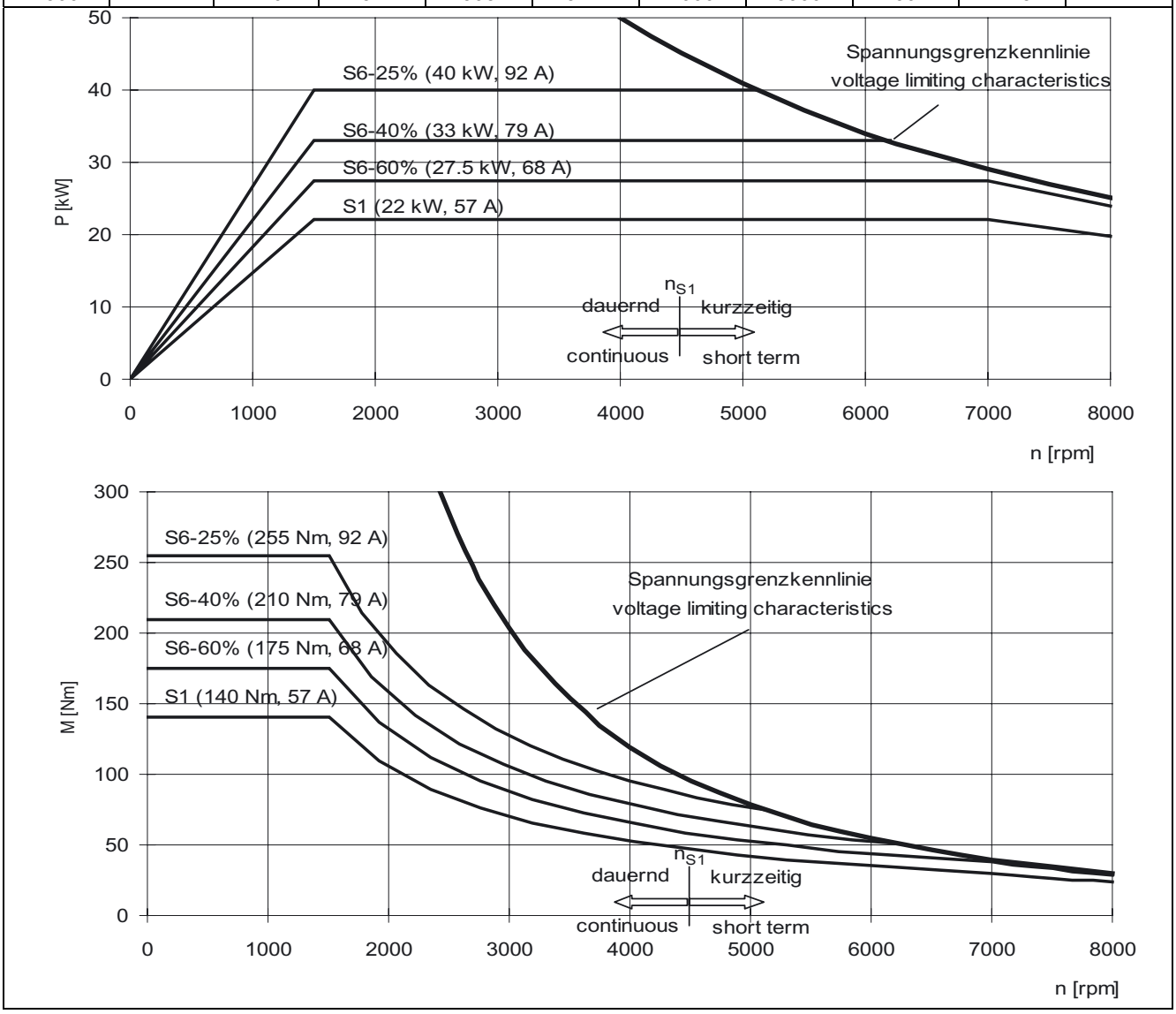




Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 31 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7137-□□F□□

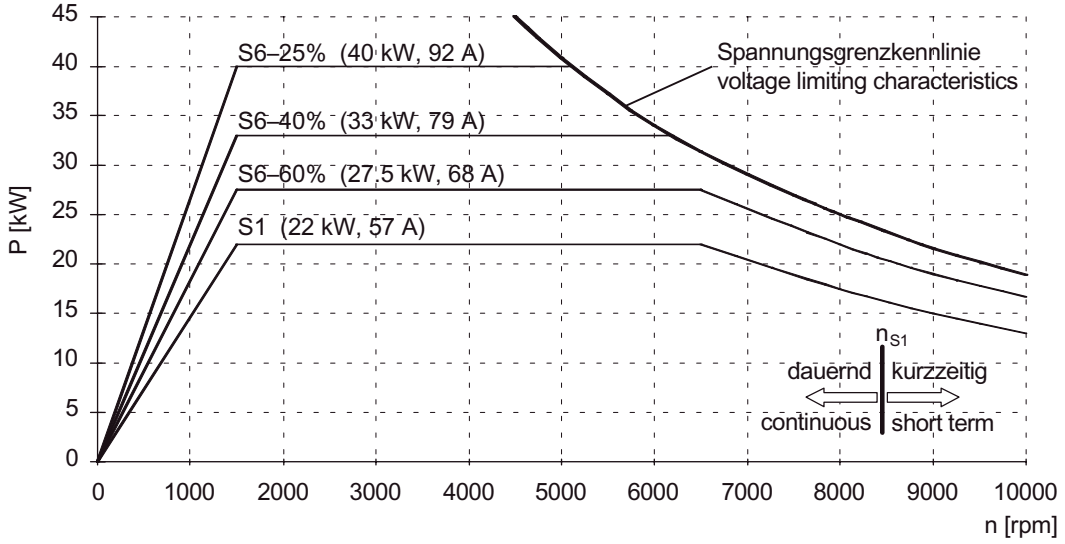
n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1500	22	140	57	308	51.2	7000	8000	30	22.8	112

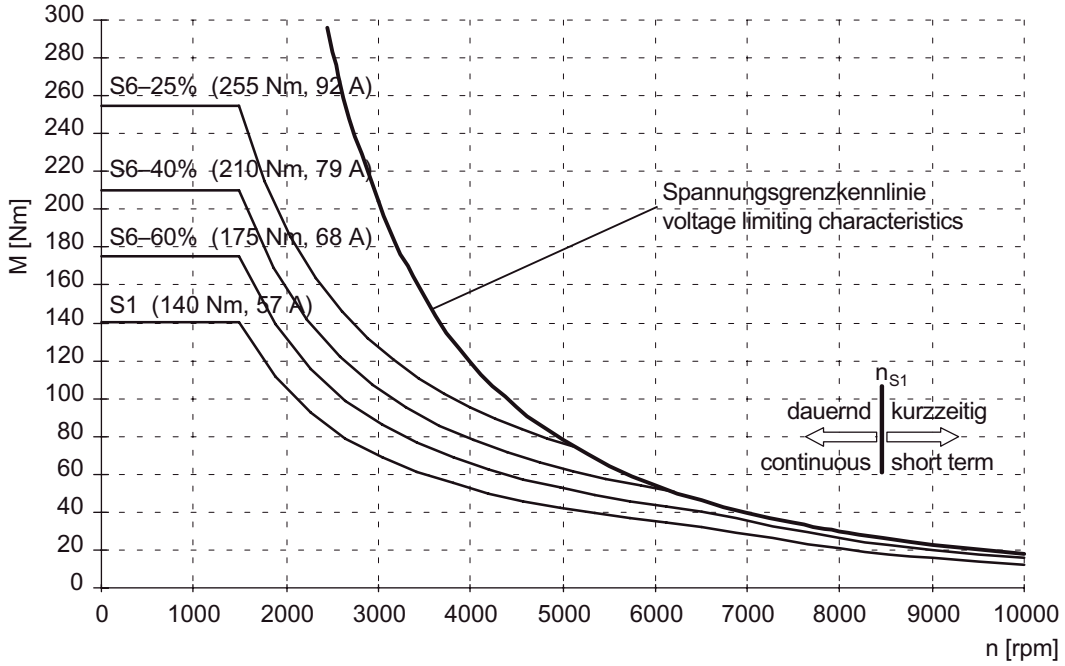


Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 32 SINAMICS, 3-ph. 400 V AC, Servo Control, (ALM), 1PH7137-□□F□□-0L

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1500	22	140	57	308	51.2	6500	10000	30	22.8	112

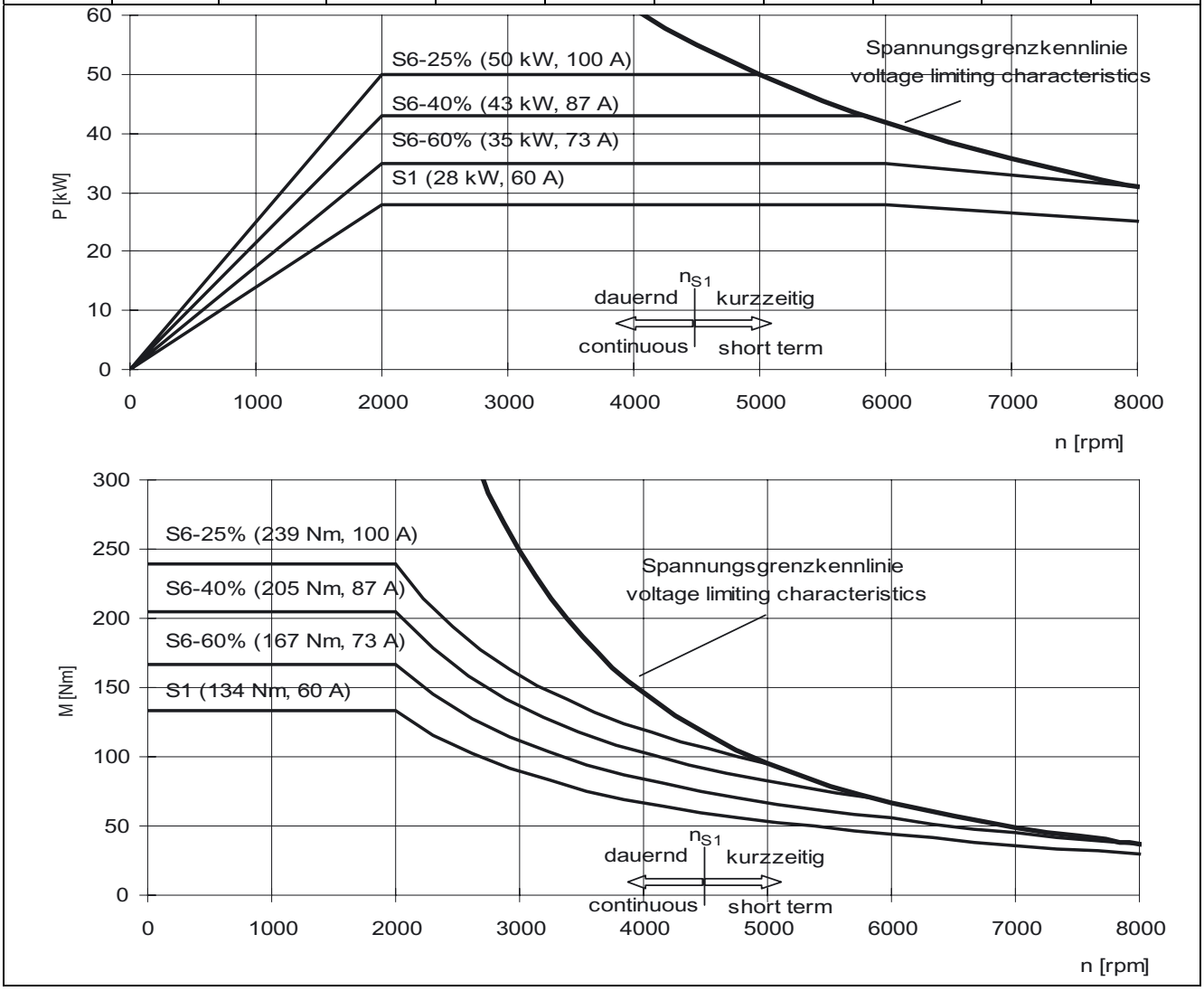




Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 33 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7137-□□G□□

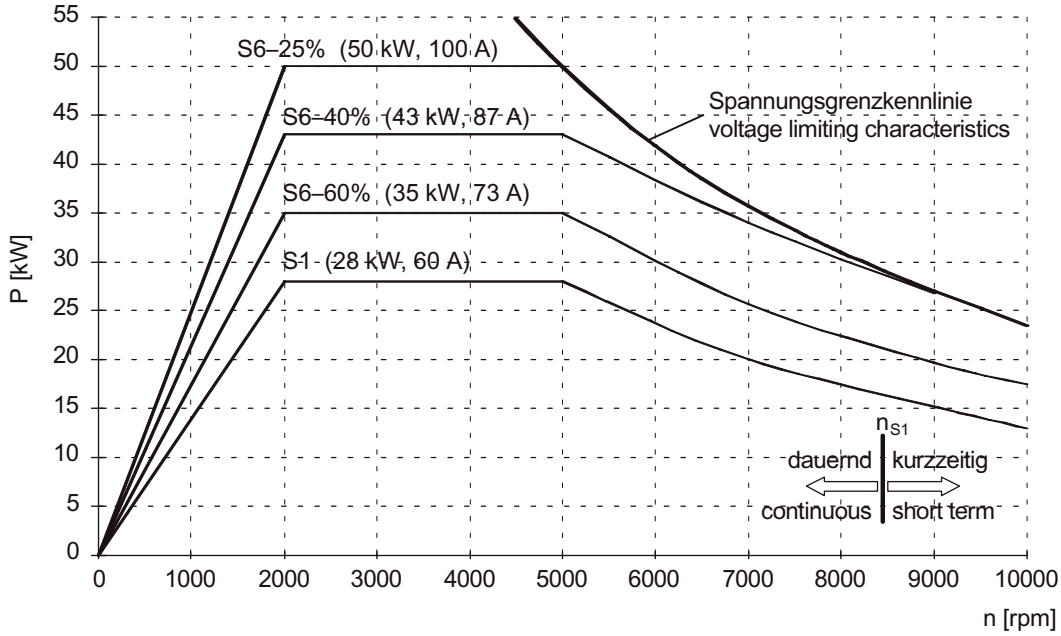
n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
2000	28	134	60	350	68.0	6000	8000	30	21	120

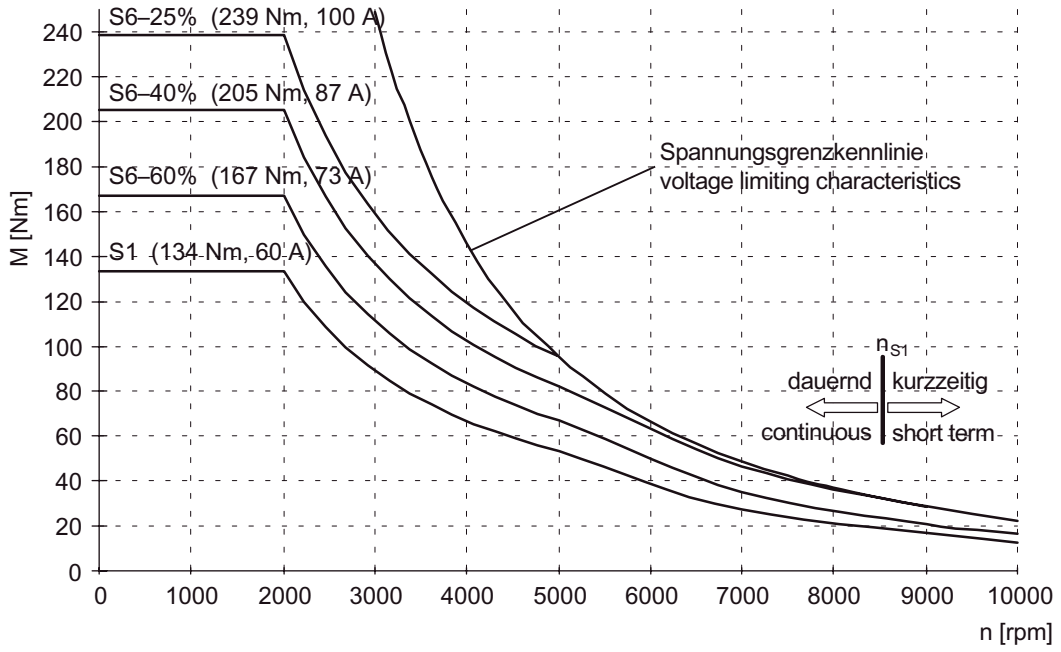


Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 34 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7137-□□G□□-0L

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
2000	28	134	60	350	68.0	5000	10000	30	21	120

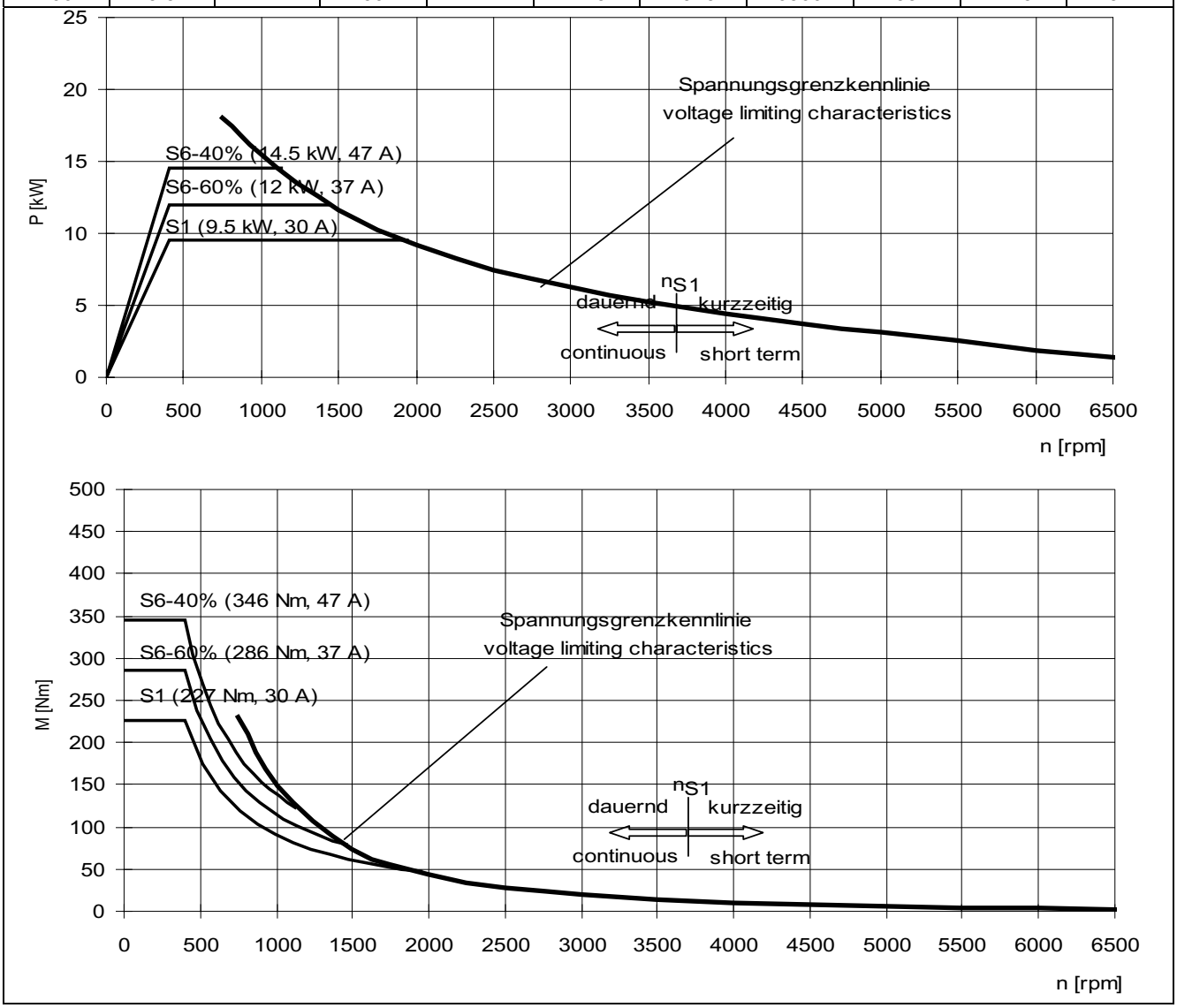




Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 35 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7163-□□B□□

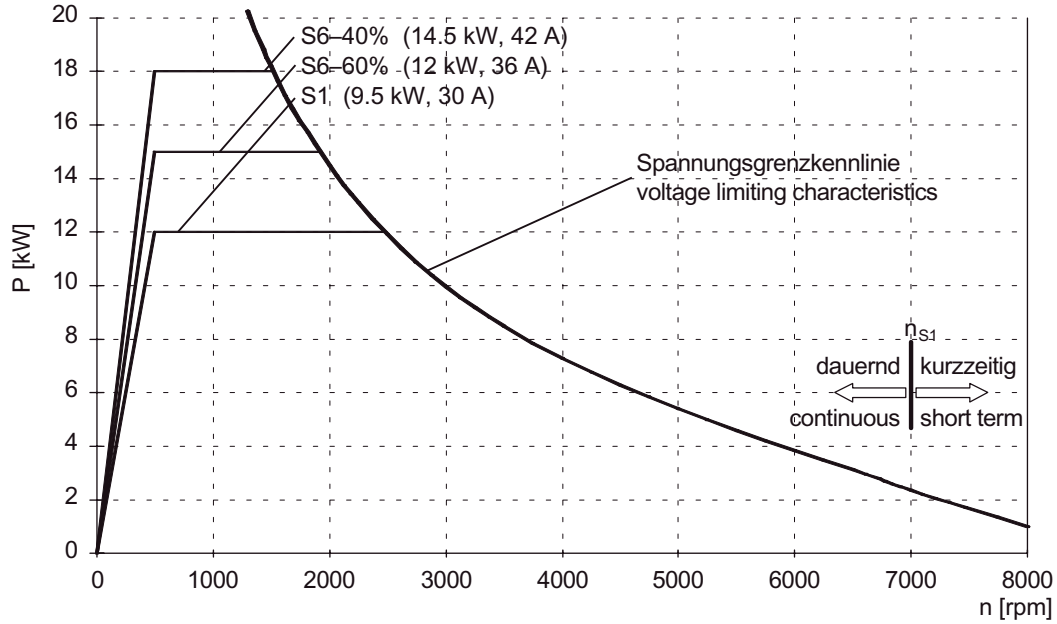
n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
400	9.5	227	30	274	14.3	1943	6500	35	11.5	51

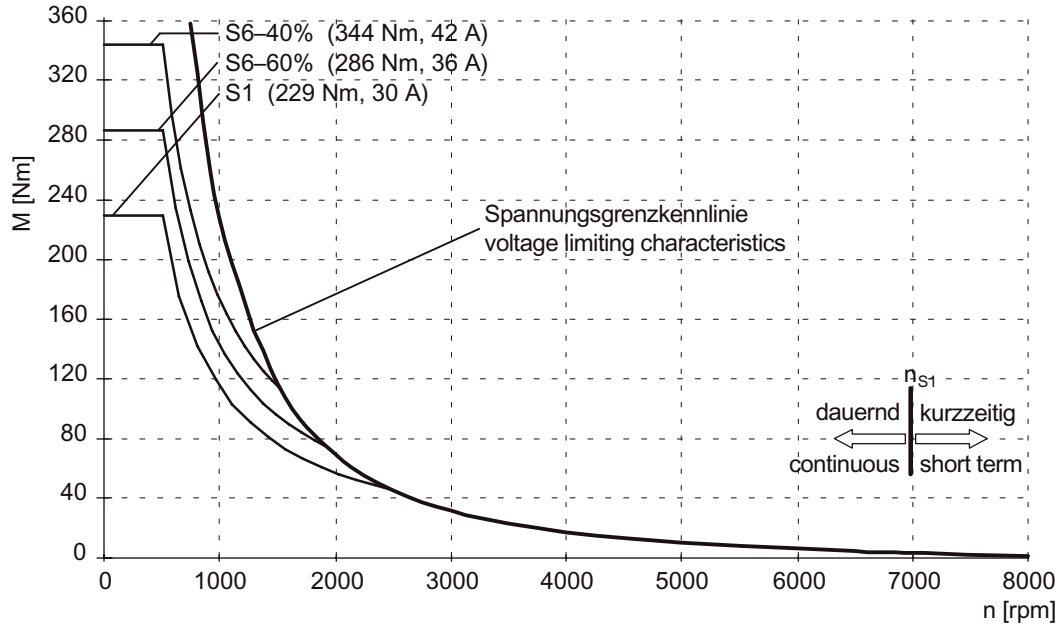


Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 36 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7163-□□B□□-0L

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
500	12	229	30	340	17.6	2487	8000	35	11.5	54

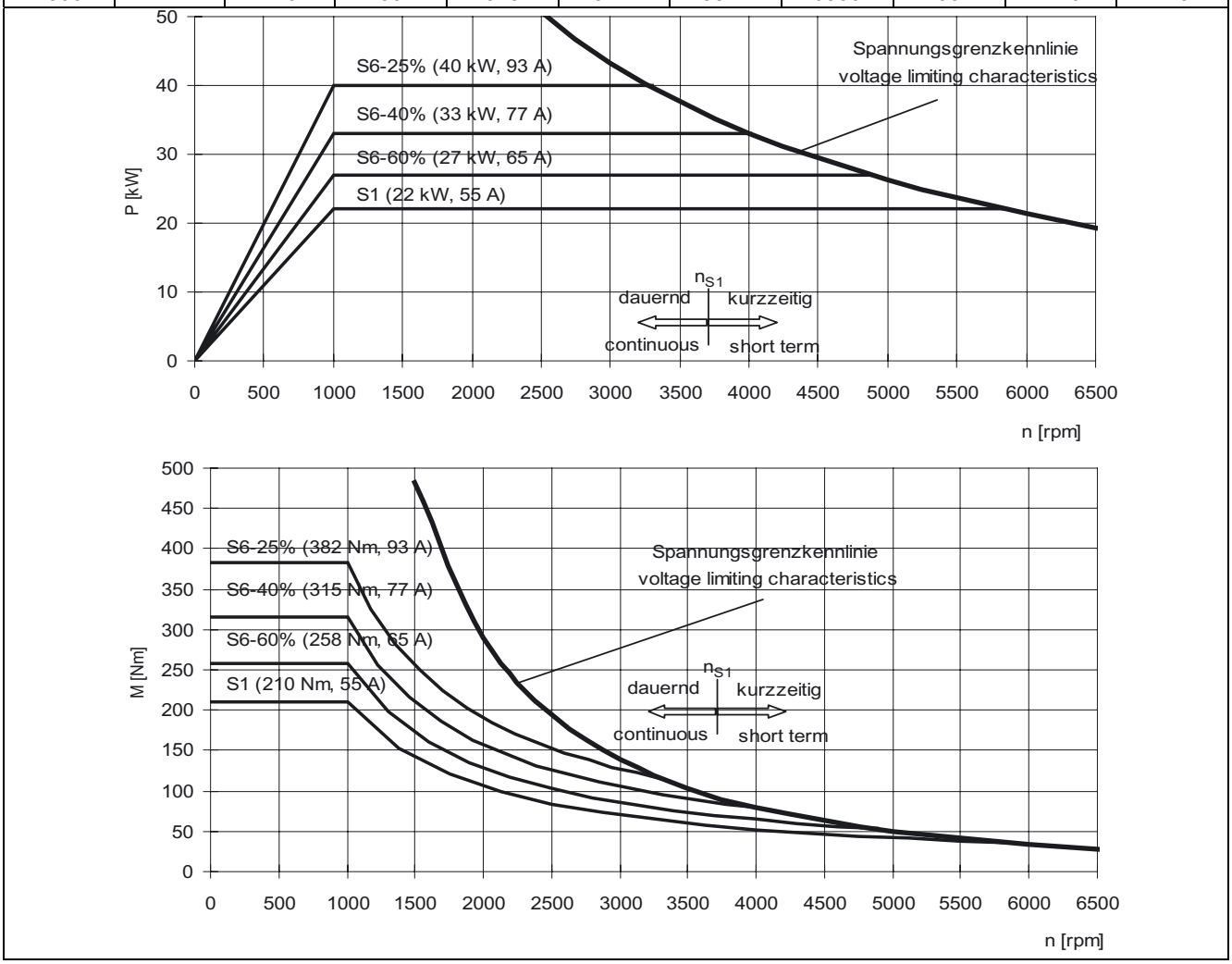




Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 37 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7163-□□D□□

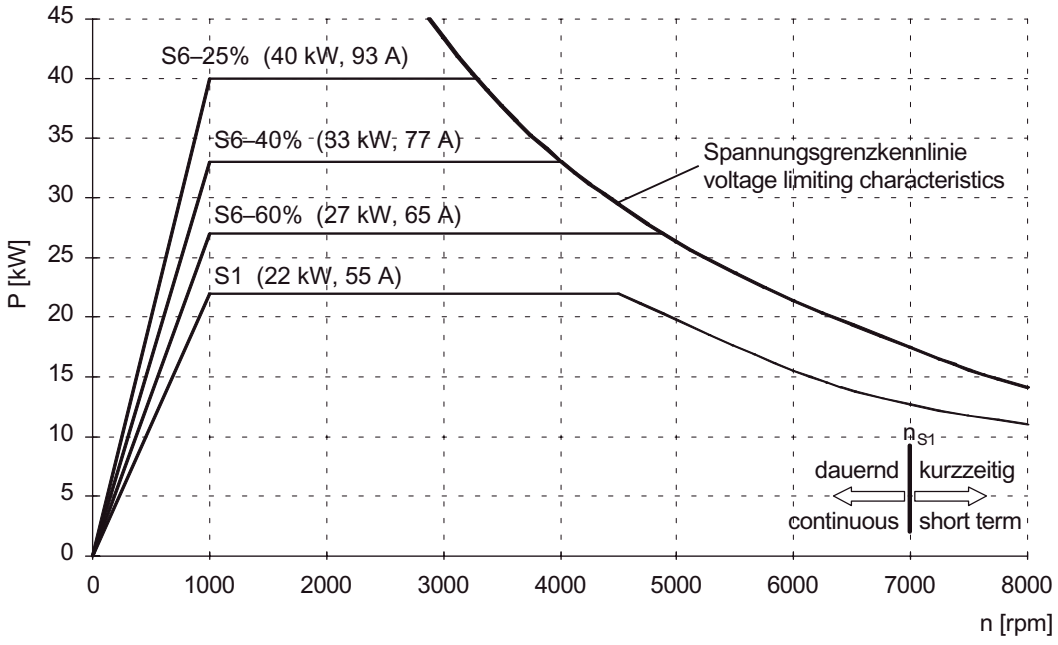
n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1000	22	210	55	315	34.2	5871	6500	35	24.0	110

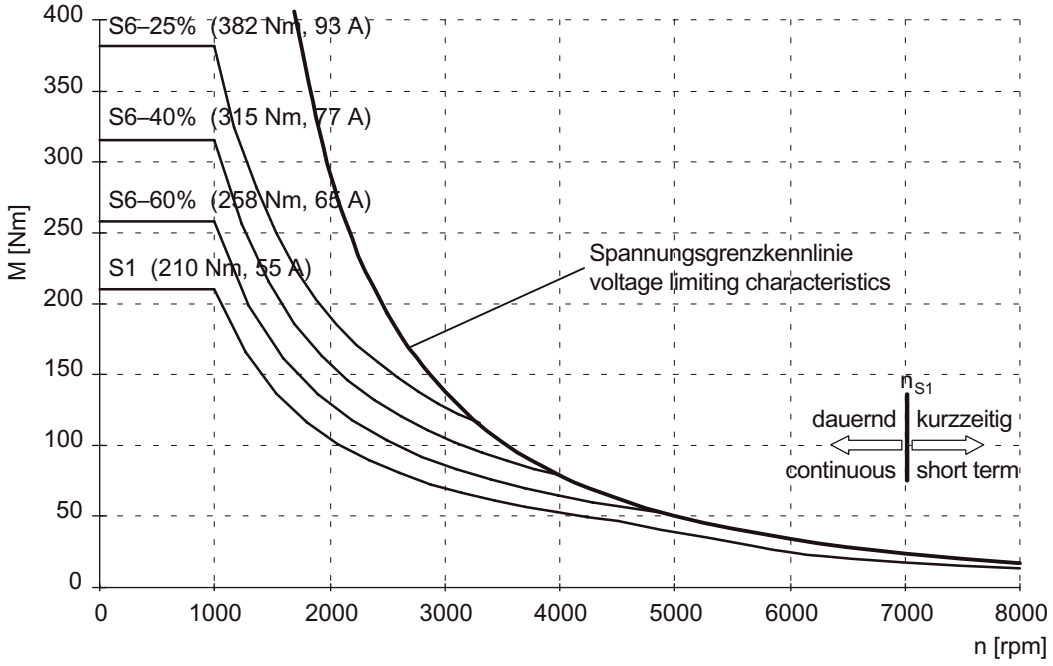


Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 38 SINAMICS, 3-ph. 400 V AC, Servo Control, (ALM), 1PH7163-□□D□□-0L

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1000	22	210	55	315	32.2	4000	8000	35	24	110

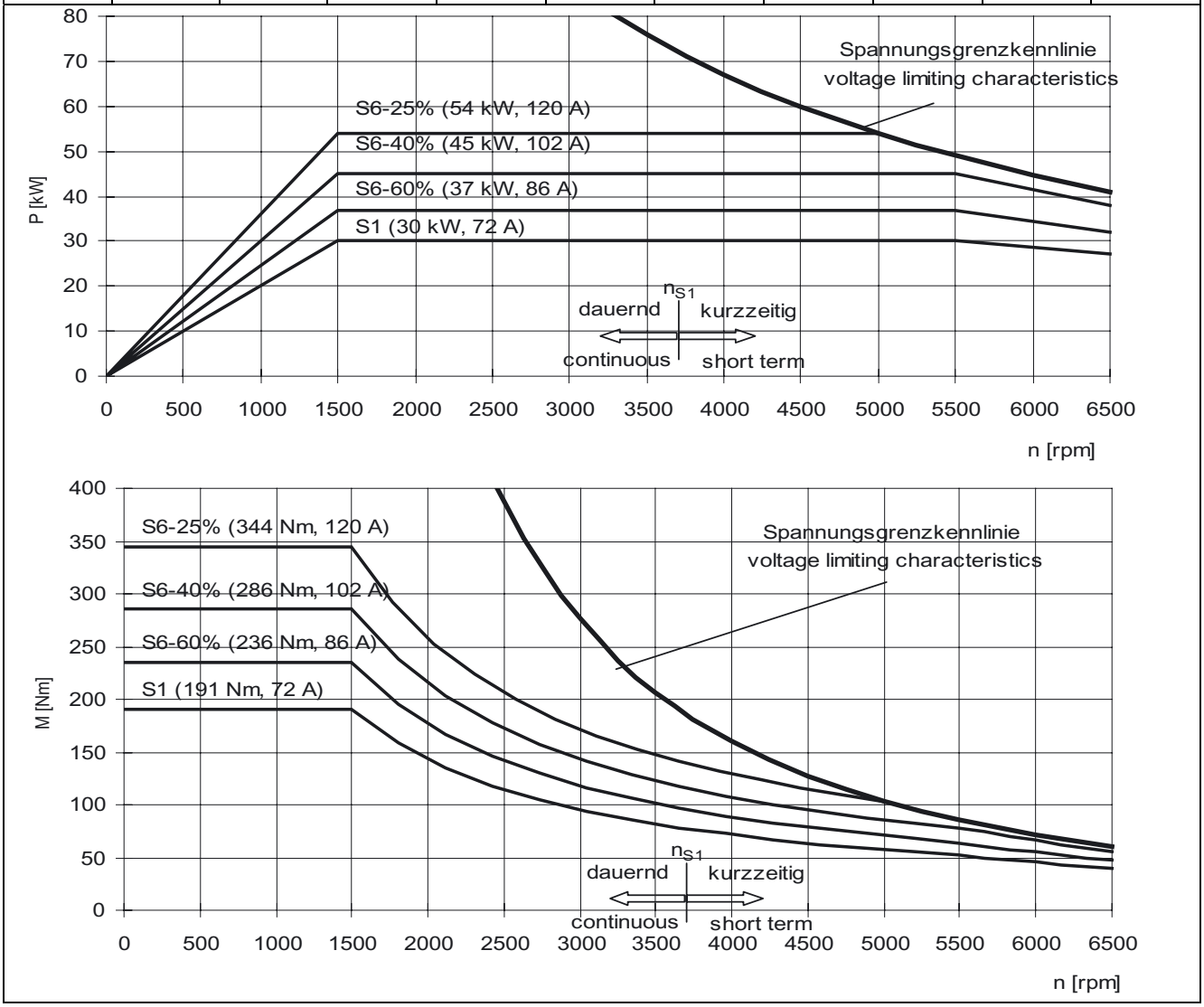




Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 39 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7163-□□F□□

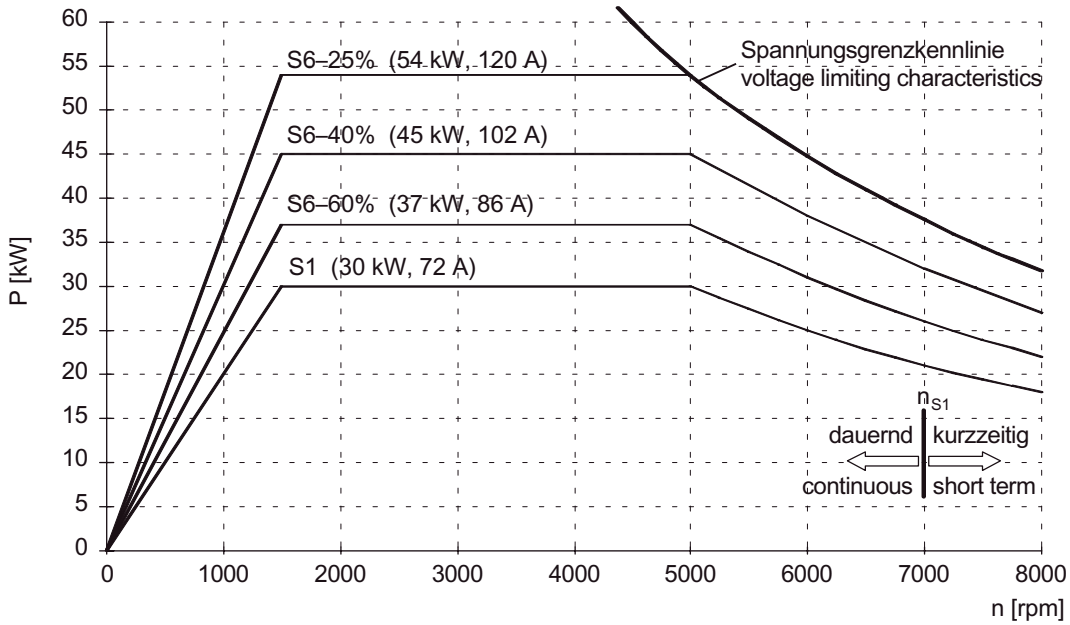
n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1500	30.0	191	72	319	50.9	5500	6500	35	30	144

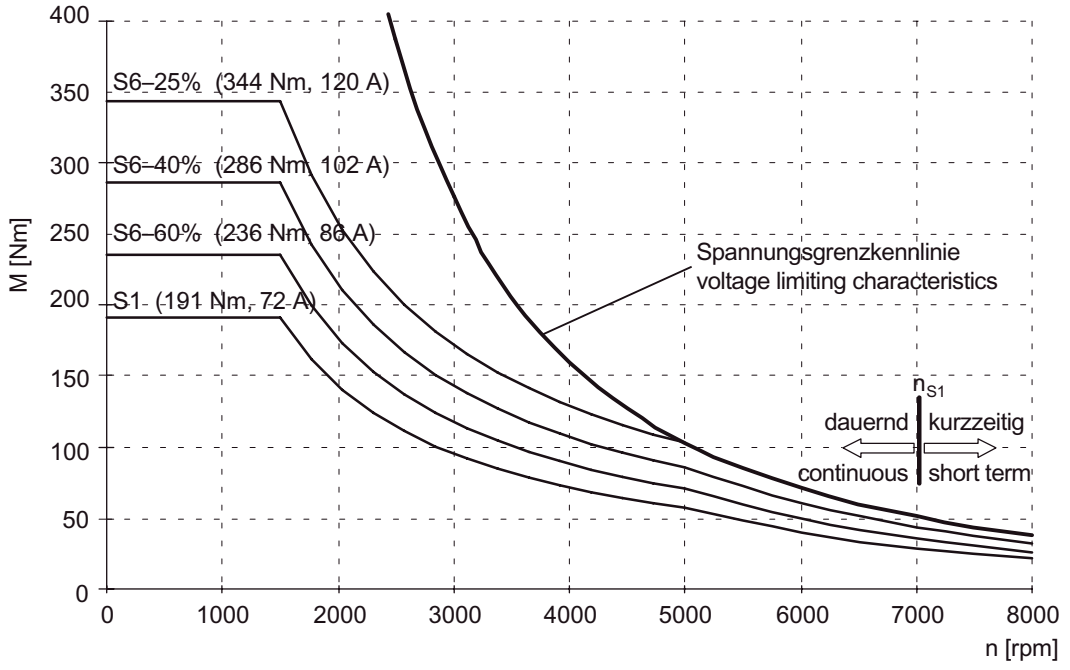


Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 40 SINAMICS, 3-ph. 400 V AC, Servo Control, (ALM), 1PH7163-□□F□□-0L

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1500	30	191	72	319	50.9	5000	8000	35	30	144

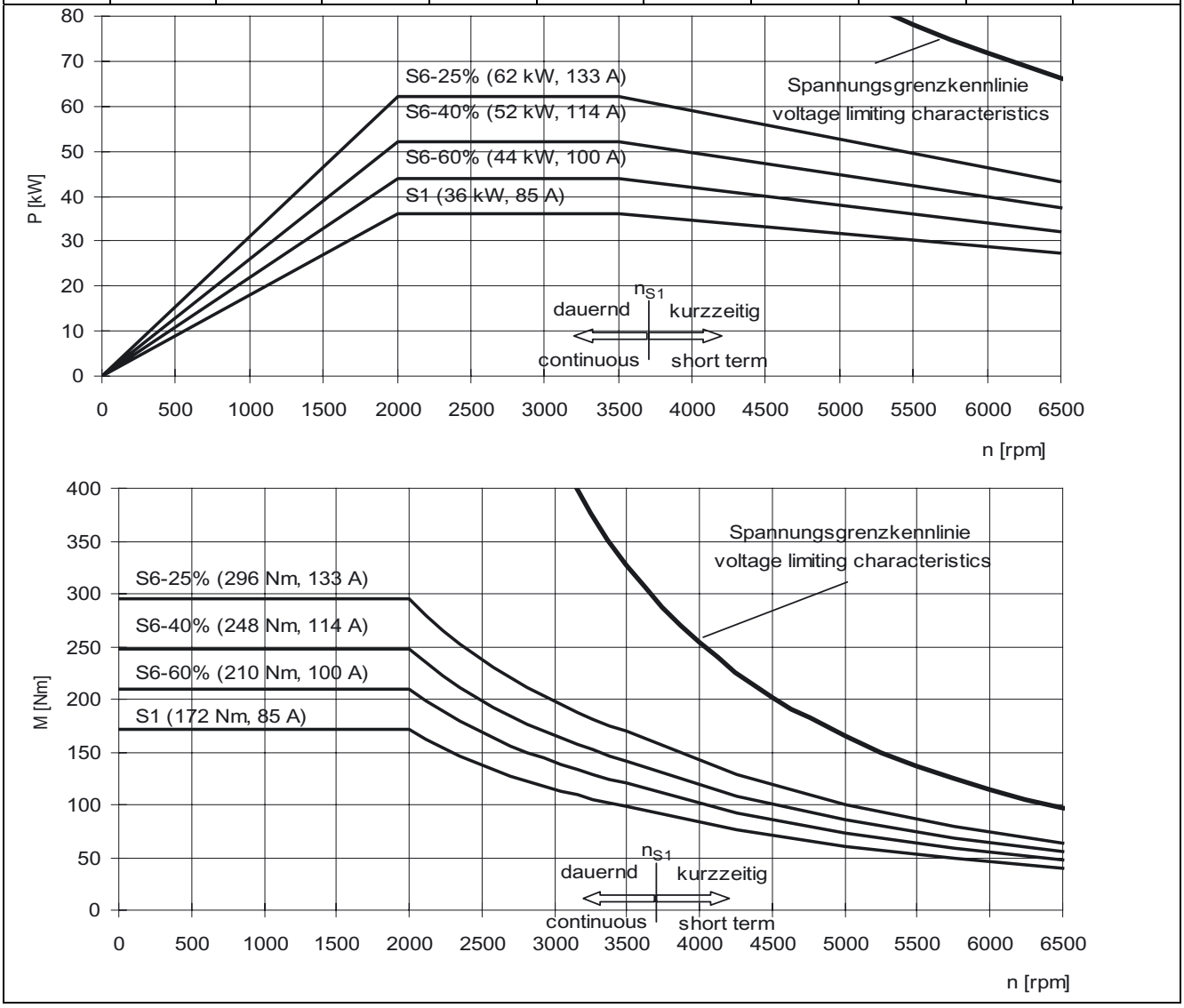




Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 41 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7163-□□G□□

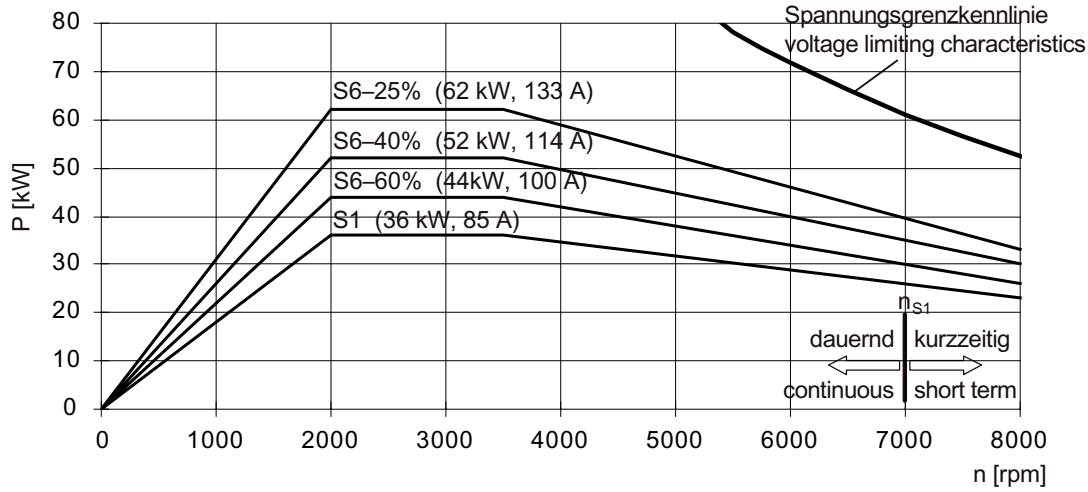
n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
2000	36	172	85	333	67.5	3500	6500	35	37	170

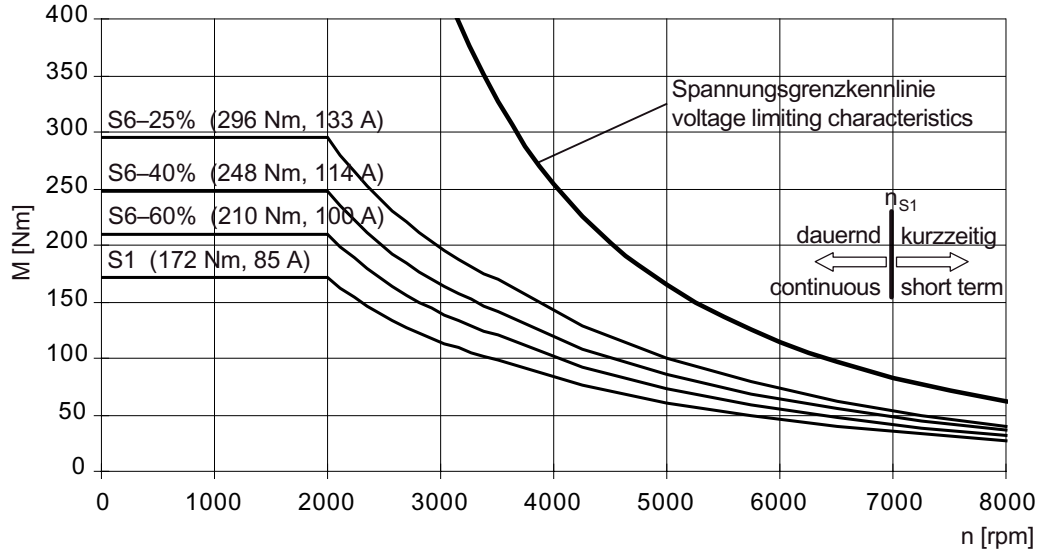


Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 42 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7163-□□G□□-0L

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
2000	36	172	85	333	67.5	3500	8000	35	37	170

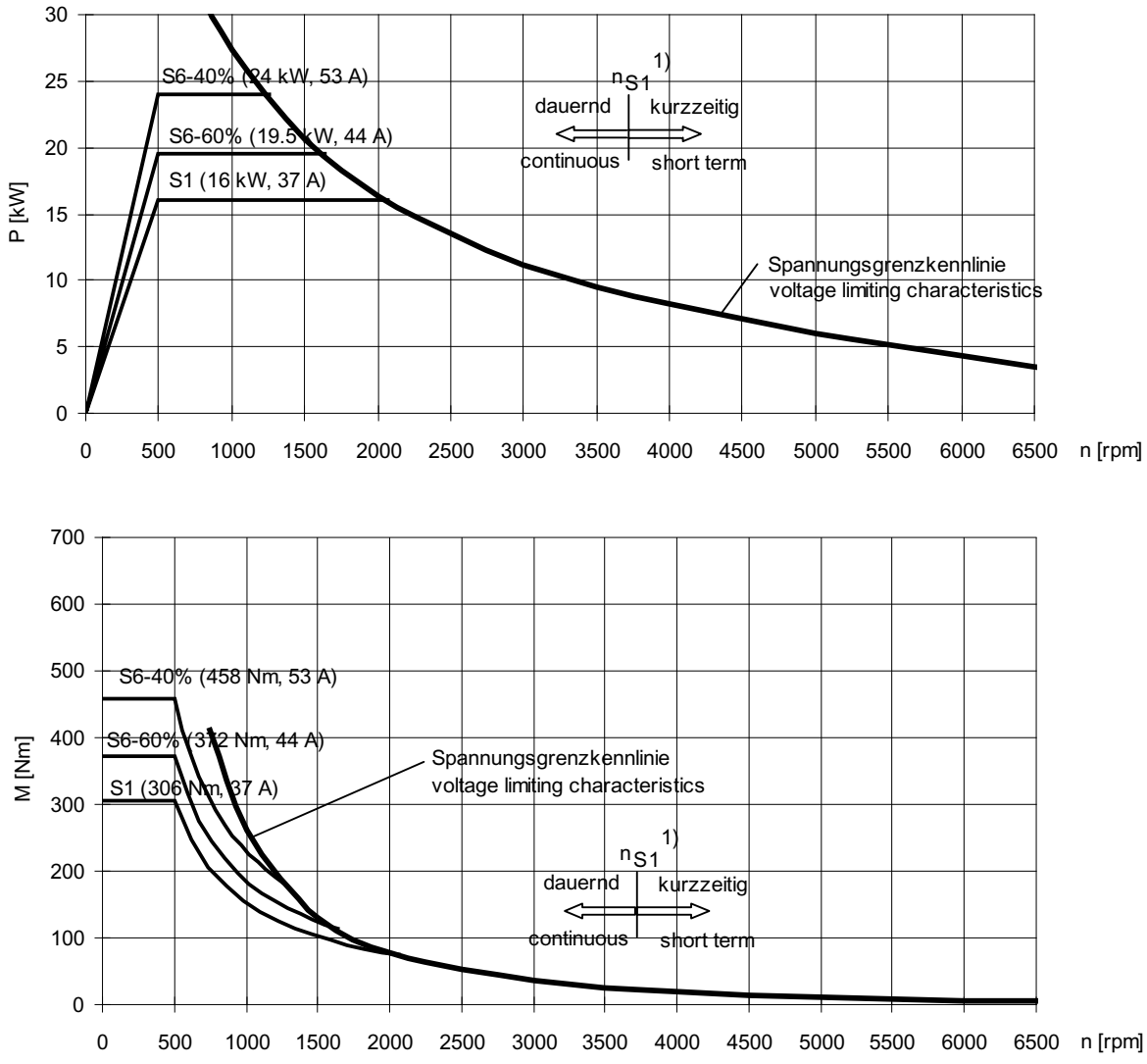




Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 43 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7167-□□B□□

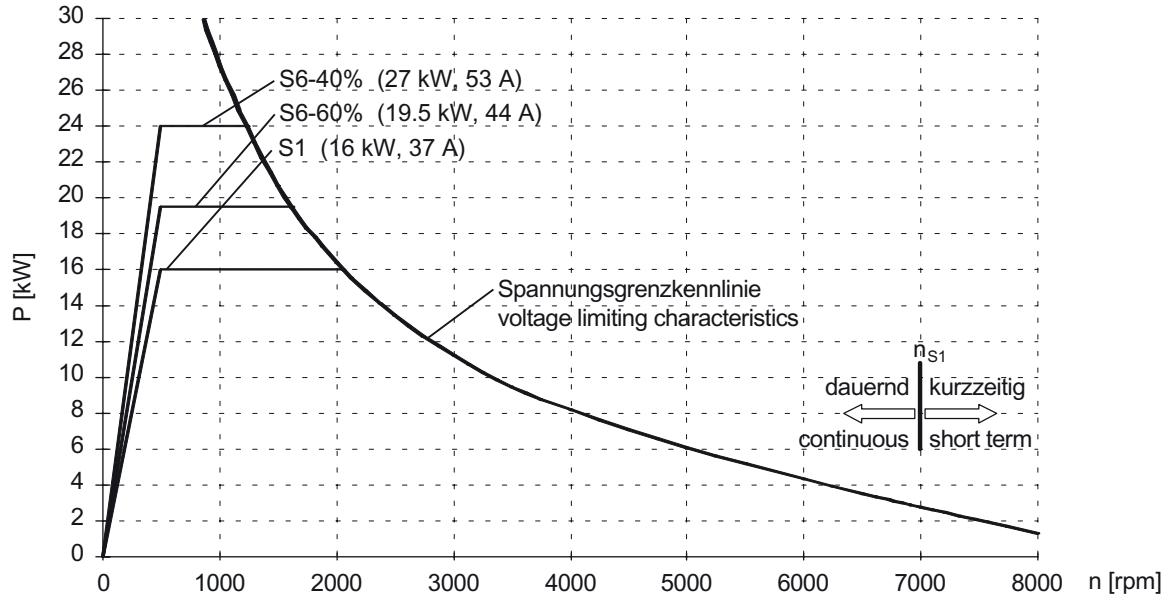
n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
500	16	306	37	294	14.3	2065	6500	35	14	74

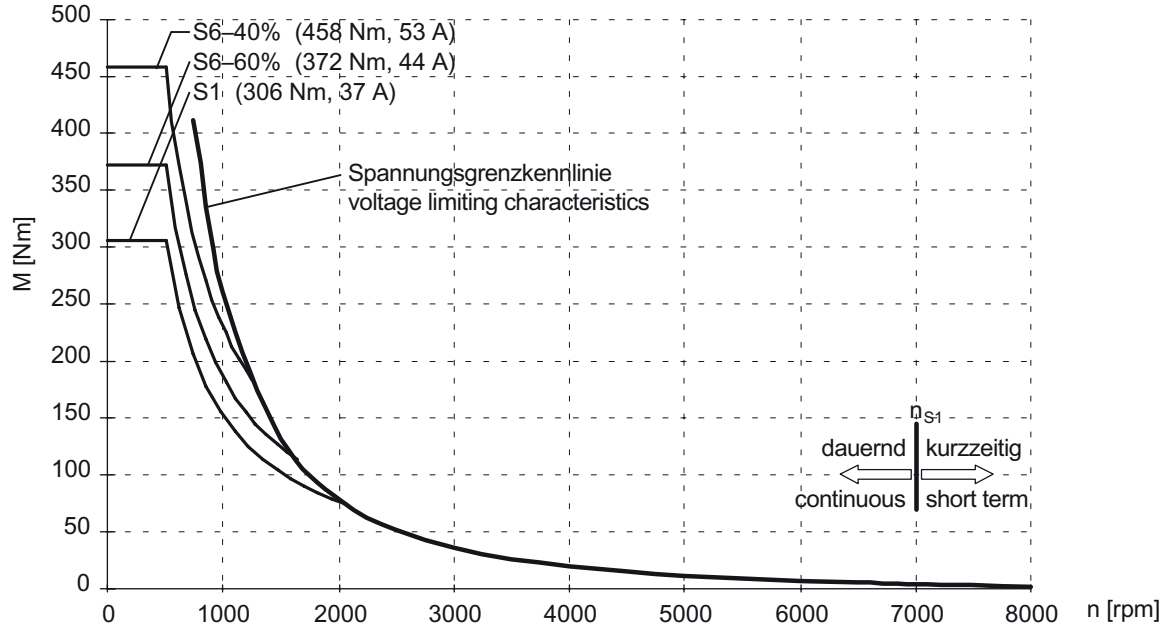


Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 44 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7167-□□B□□-0L

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
500	16	306	37	294	14.3	2065	8000	35	14	74

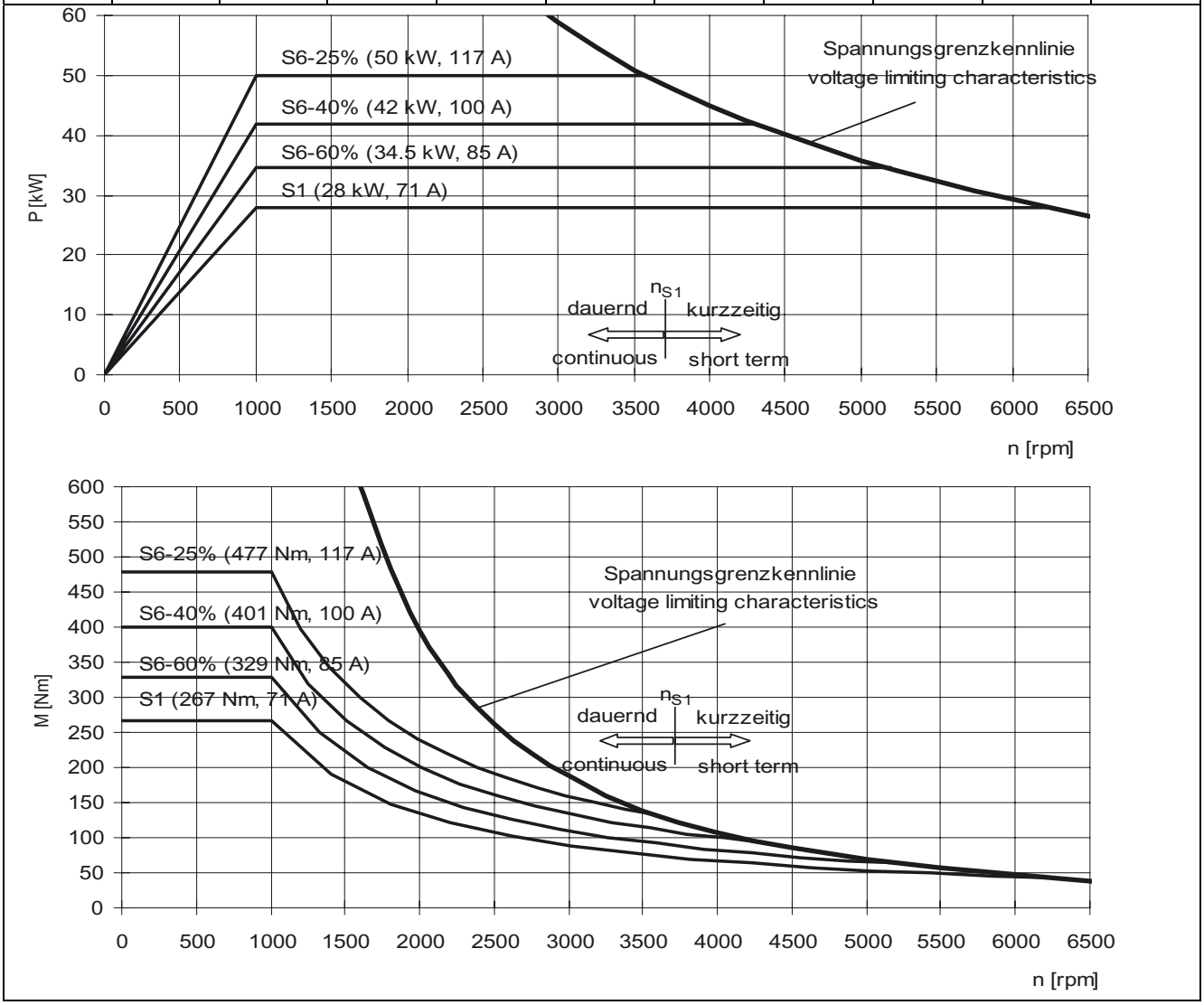




Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 45 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7167-□□D□□

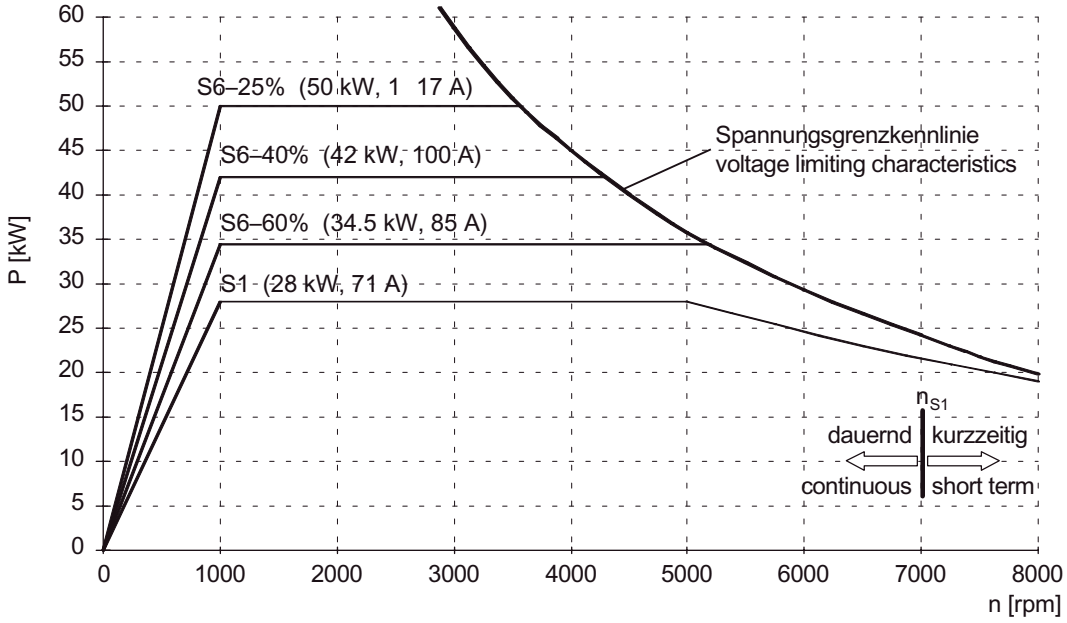
n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1000	28	267	71	312	34.2	6239	6500	35	33	142

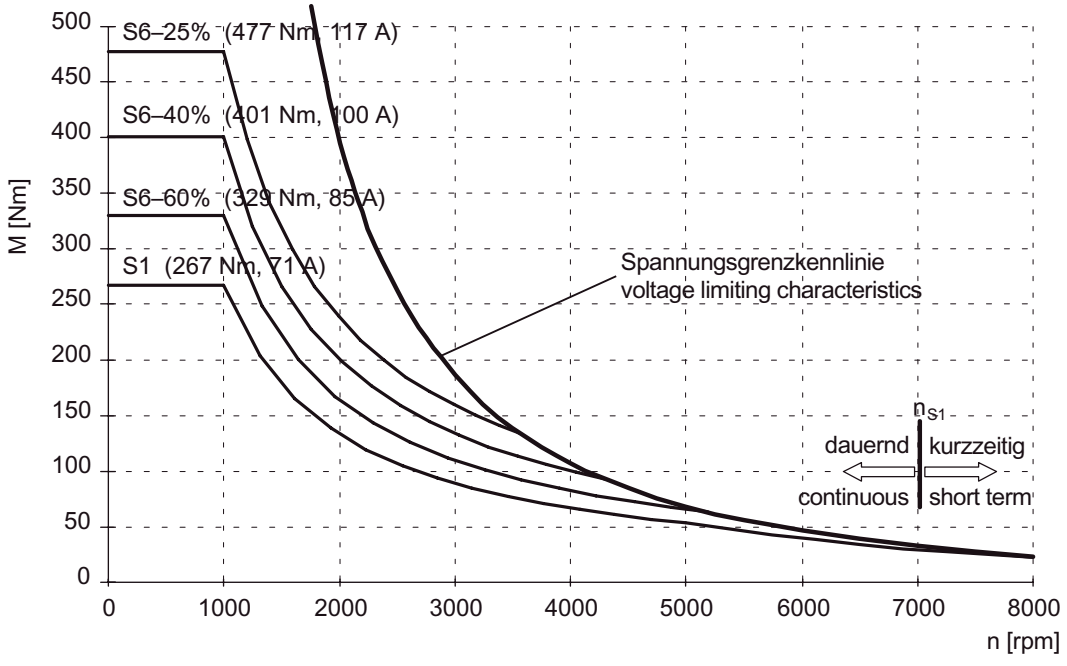


Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 46 SINAMICS, 3-ph. 400 V AC, Servo Control, (ALM), 1PH7167-□□D□□-0L

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1000	28	267	71	312	3.42	5000	8000	35	33	142

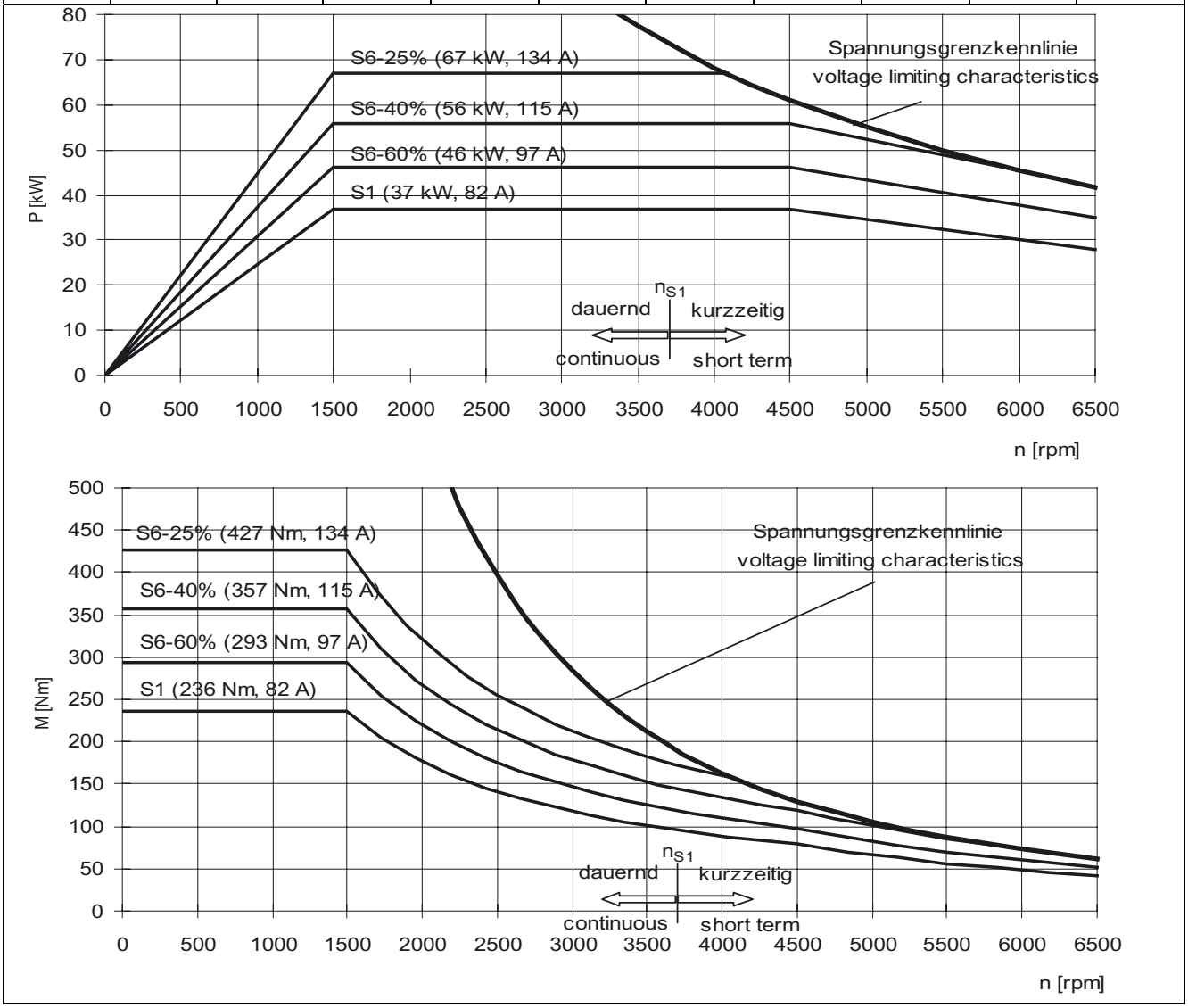




Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 47 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7167-□□F□□

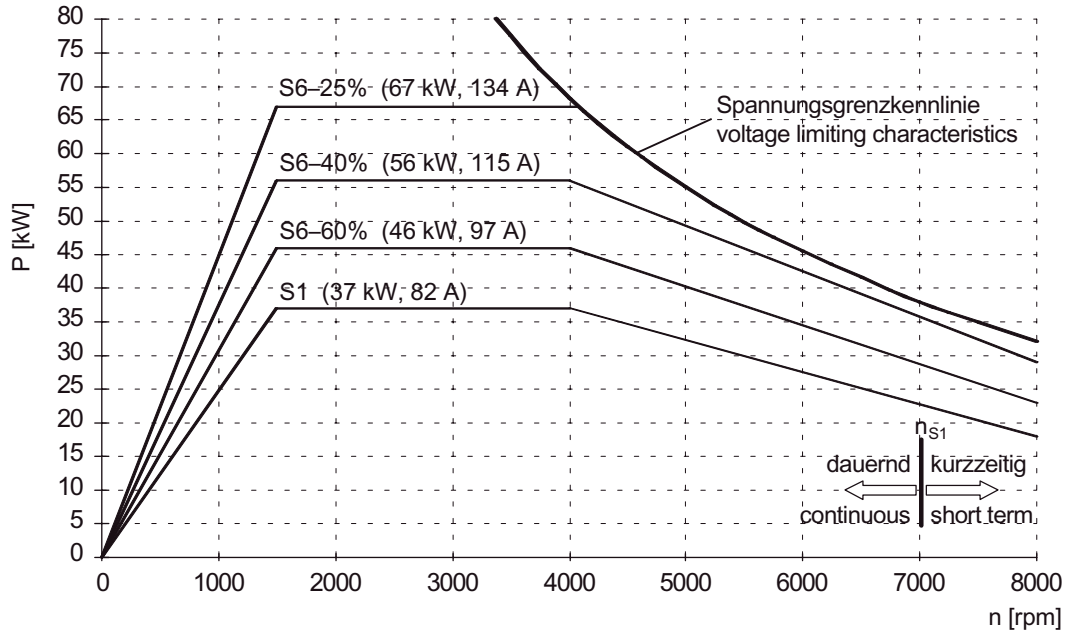
n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1500	37	236	82	350	50.8	4500	6500	35	32	164

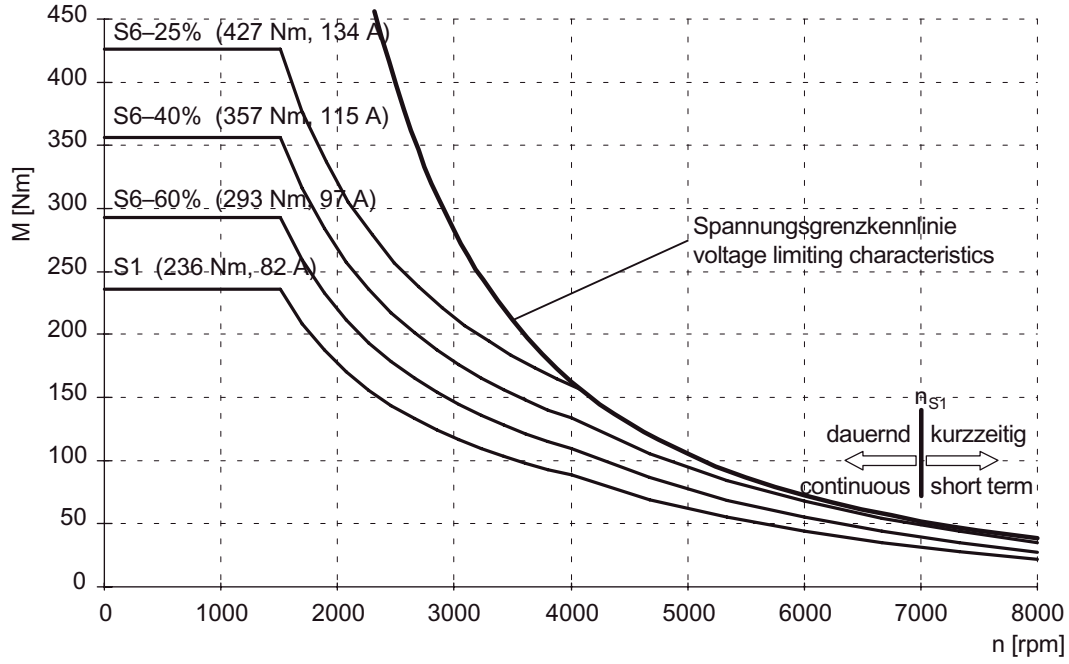


Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 48 SINAMICS, 3-ph. 400 V AC, Servo Control, (ALM), 1PH7167-□□F□□-0L

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1500	37	236	82	350	50.8	4000	8000	35	32	164

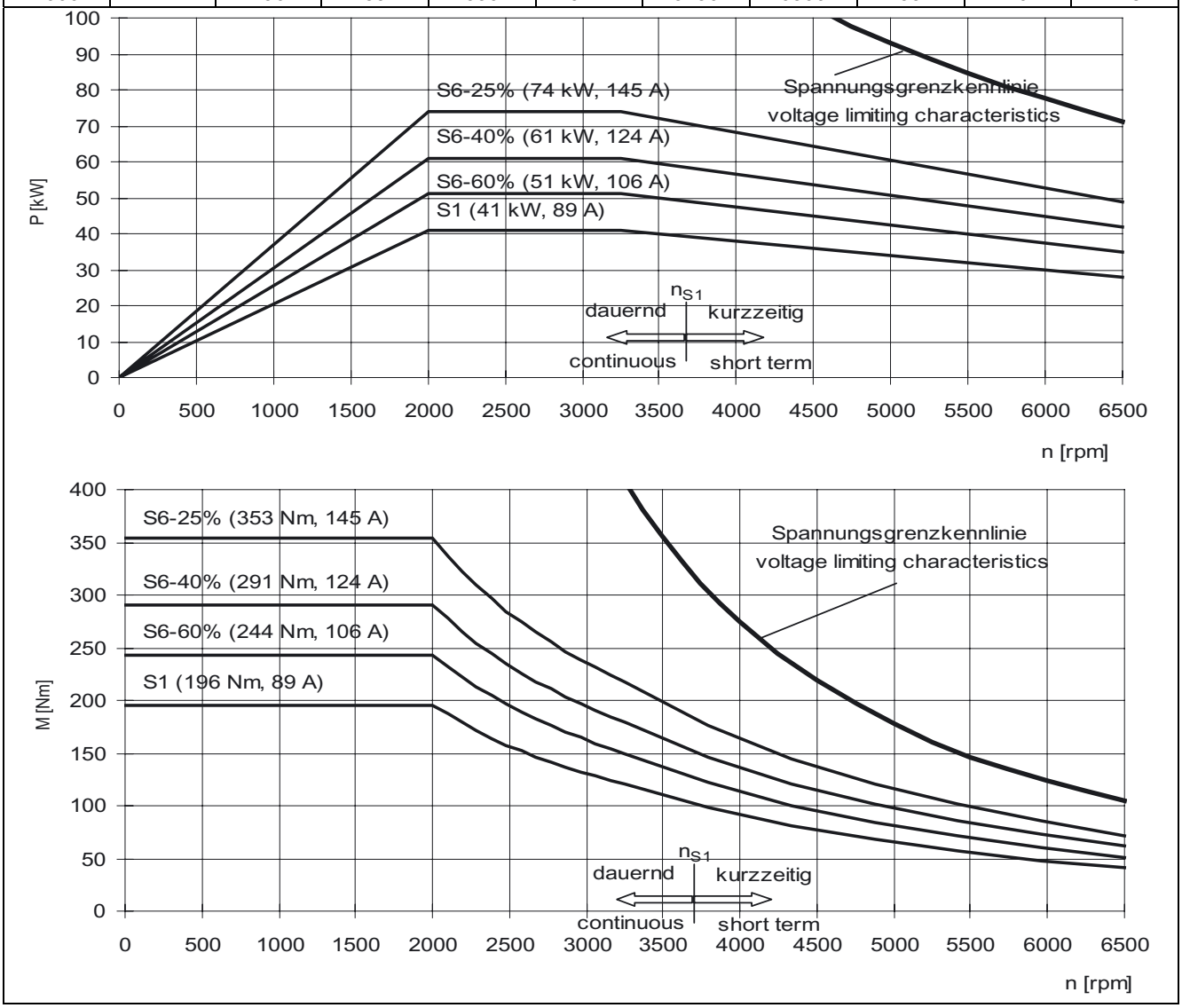




Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 49 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7167-□□G□□

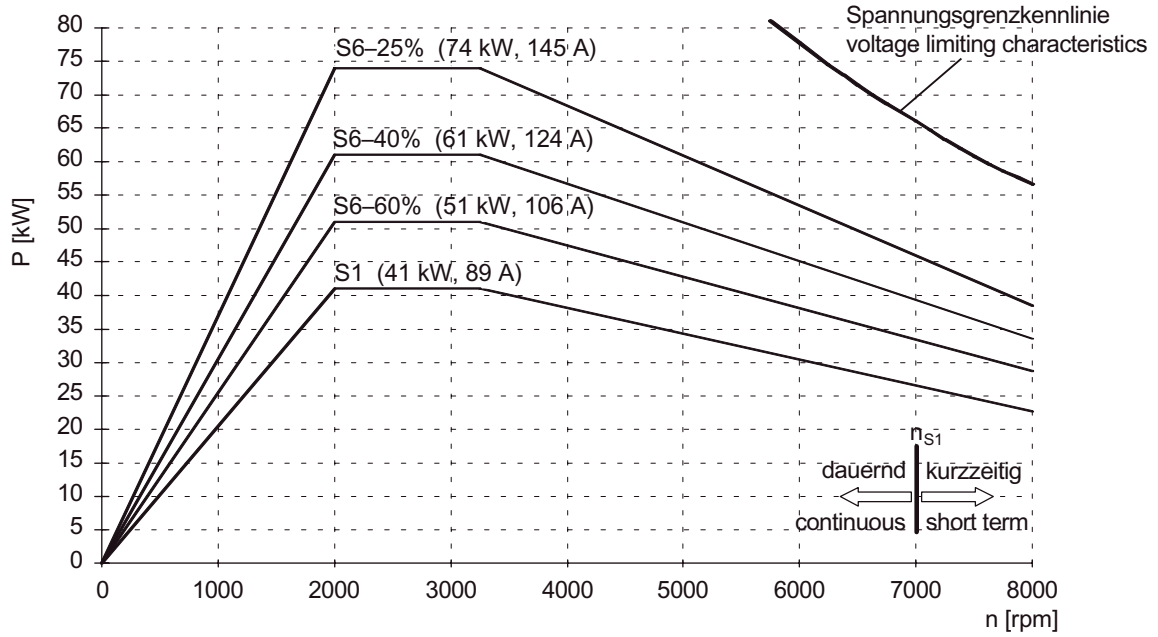
n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
2000	41	196	89	350	67.4	3250	6500	35	40	178

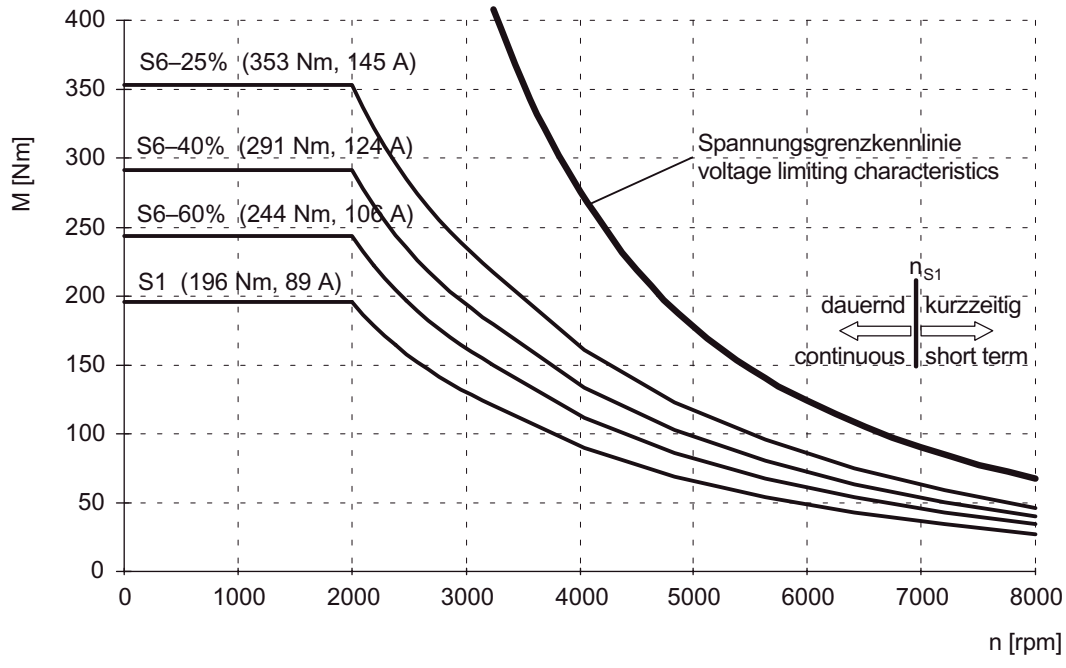


Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 50 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7167-□□G□□-0L

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
2000	41	196	89	350	67.4	3250	8000	35	40	178

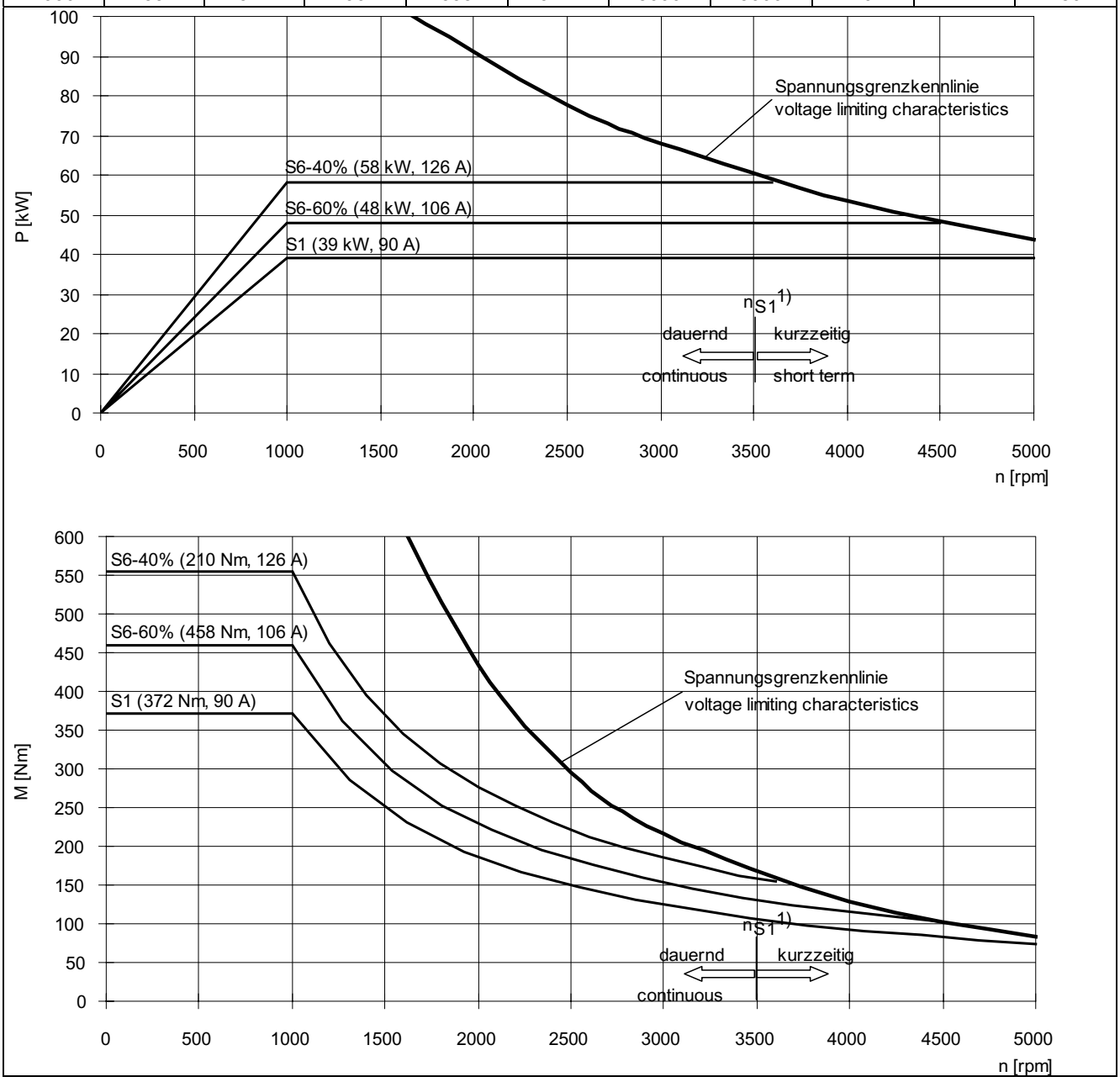




Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 51 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7184-□□D□□

$0n_N$ [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1000	39	372	90	335	34.2	5000	5000	40	44	180

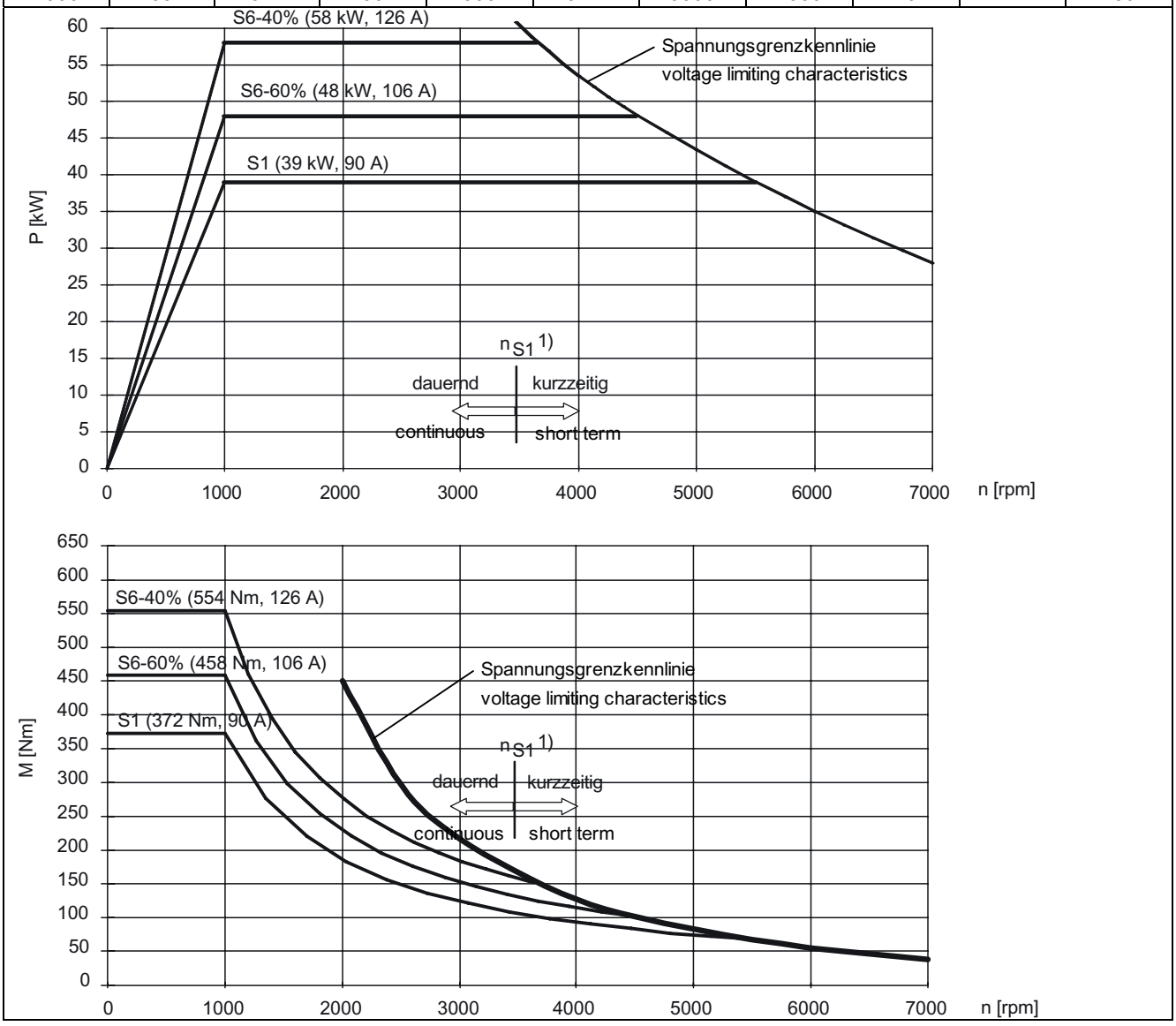


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 3000 rpm.
For the bearing version "increased maximum speed", this limit is n = 4500 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 52 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7184-□□D□□-0J

$0n_N$ [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1000	39	372	90	335	34.2	5000	7000	40	44	180

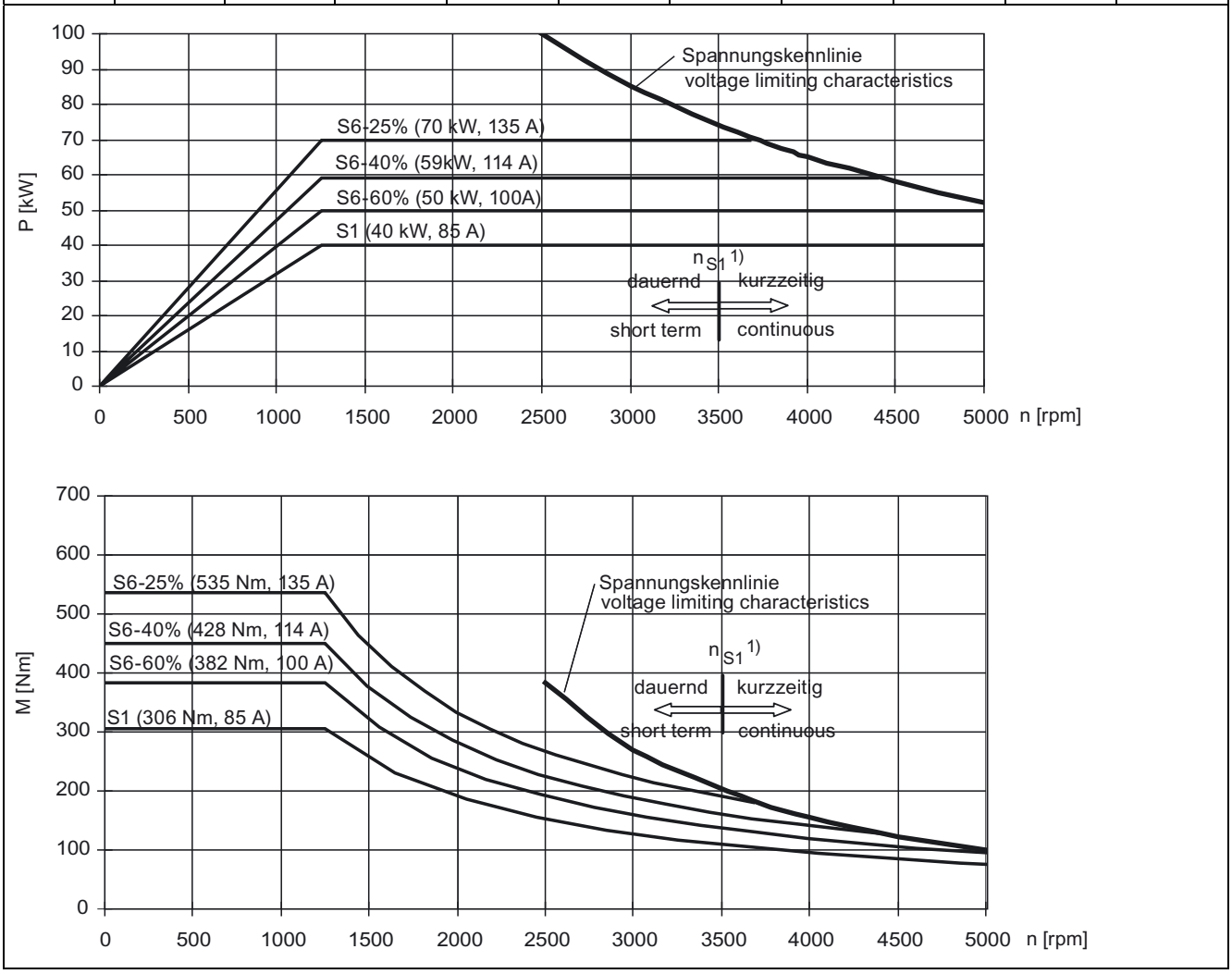


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 3000 rpm.
For the bearing version "increased maximum speed", this limit is n = 4500 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 53 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7184-□□E□□

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1250	40	306	85	380	42	5000	5000	40	46.2	170

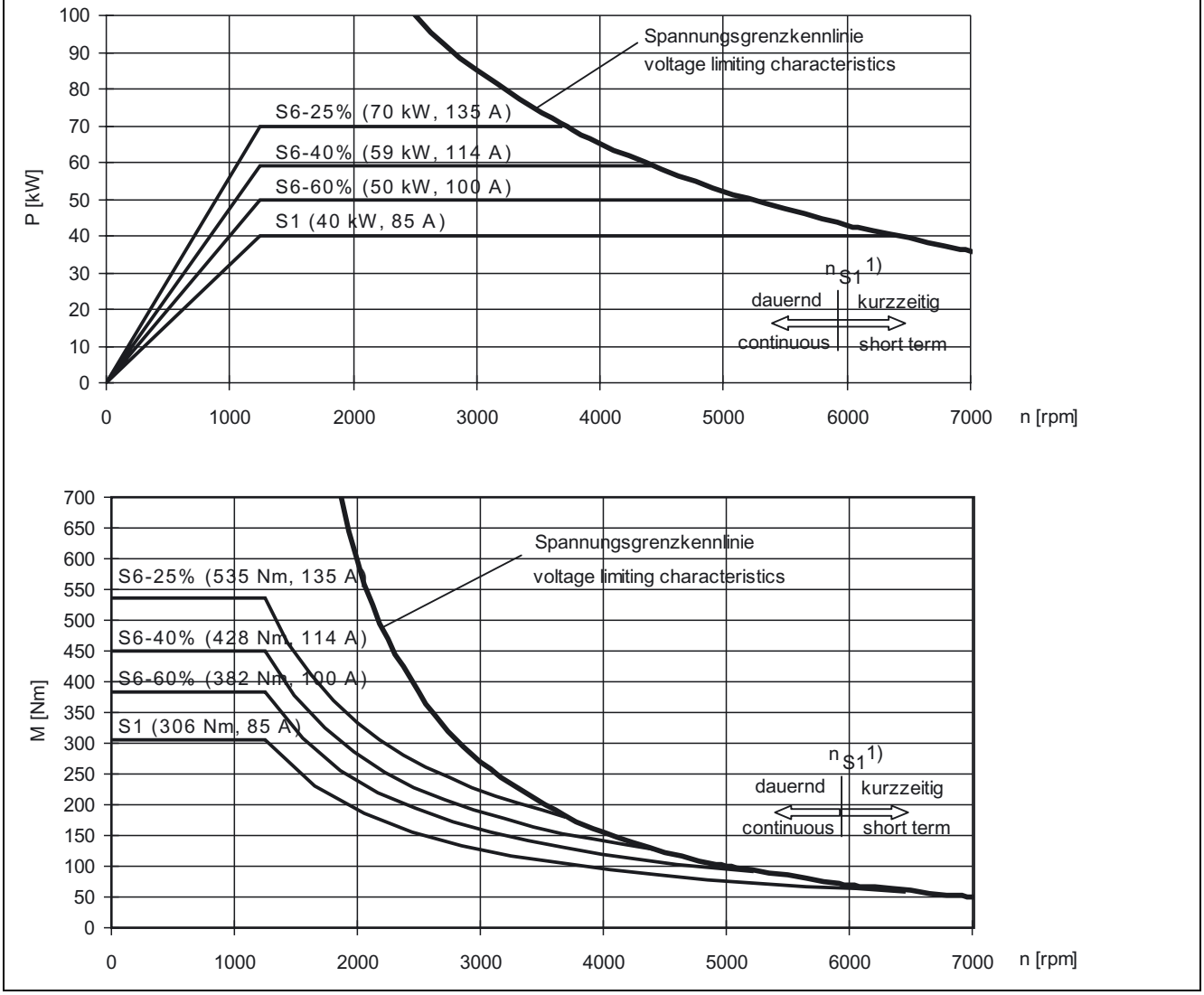


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 3000 rpm.
For the bearing version "increased maximum speed", this limit is n = 4500 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 54 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7184-□□E□□-0J

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1250	40	306	85	380	42	6400	7000	40	46.2	170

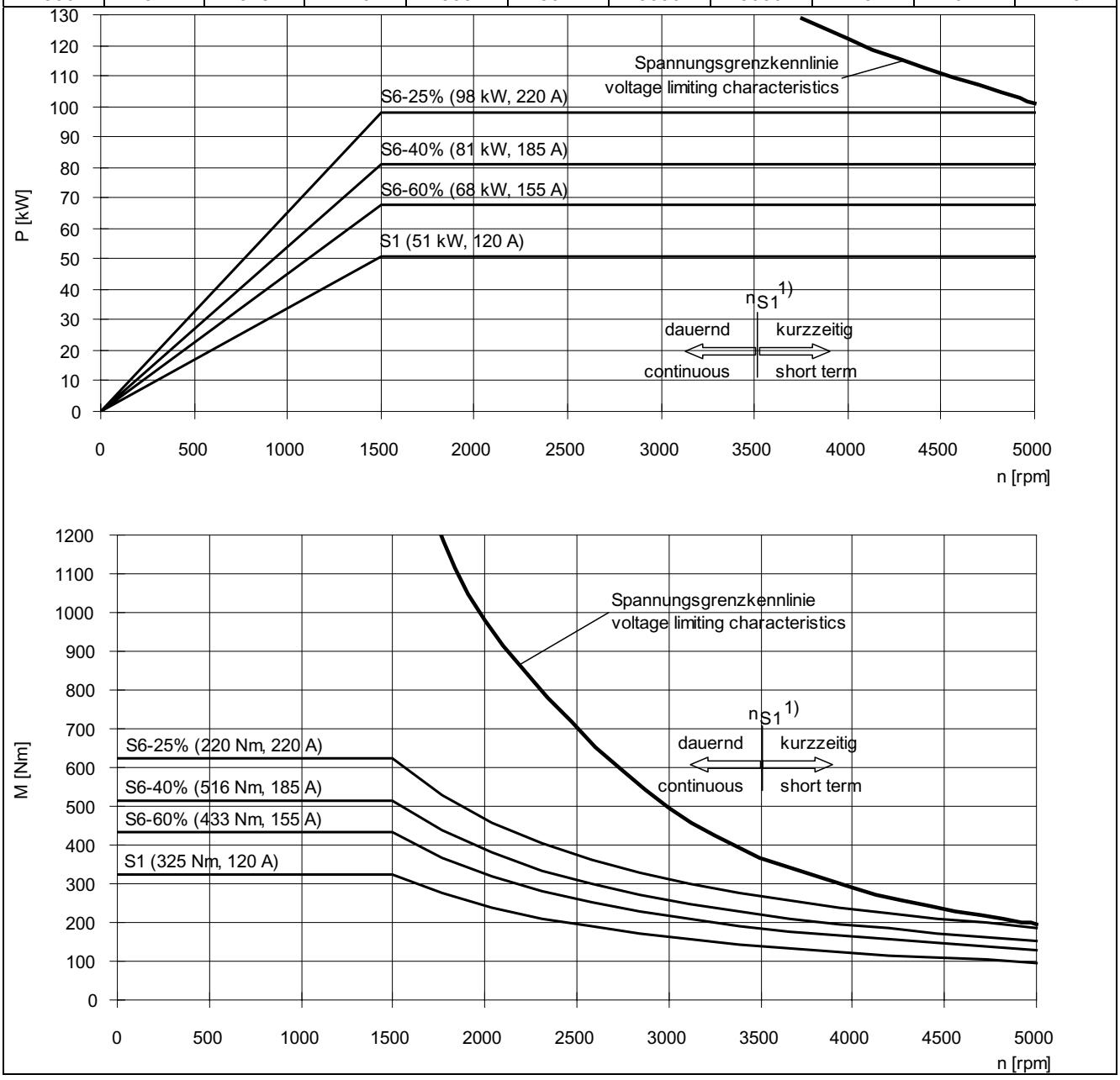


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 3000 rpm.
For the bearing version "increased maximum speed", this limit is n = 4500 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 55 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7184-□□F□□

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1500	51	325	120	335	50.7	5000	5000	40	64	240

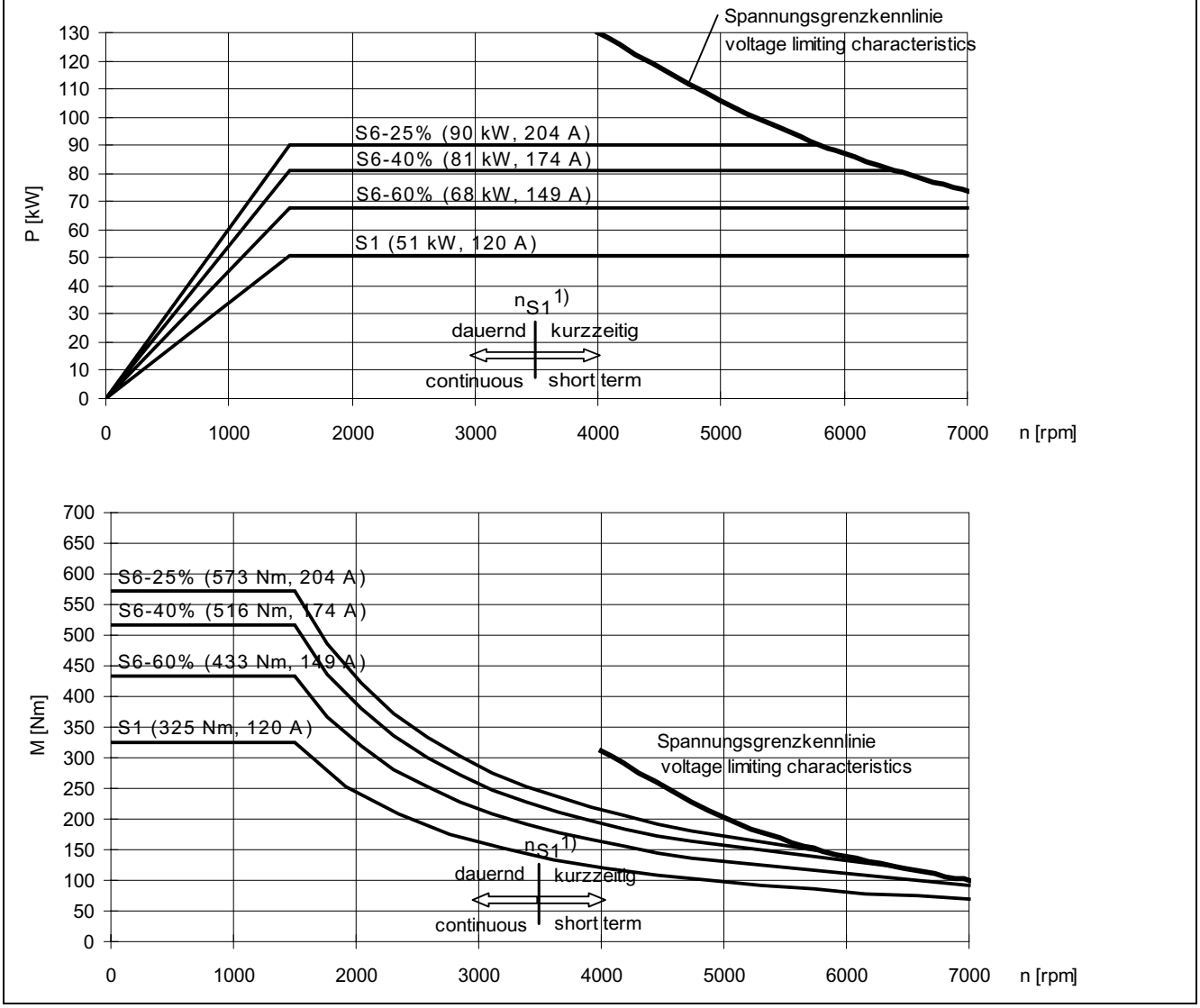


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 3000 rpm.
For the bearing version "increased maximum speed", this limit is n = 4500 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 56 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7184-□□F□□-0J

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1500	51	325	120	335	50.7	5000	7000	40	64	240

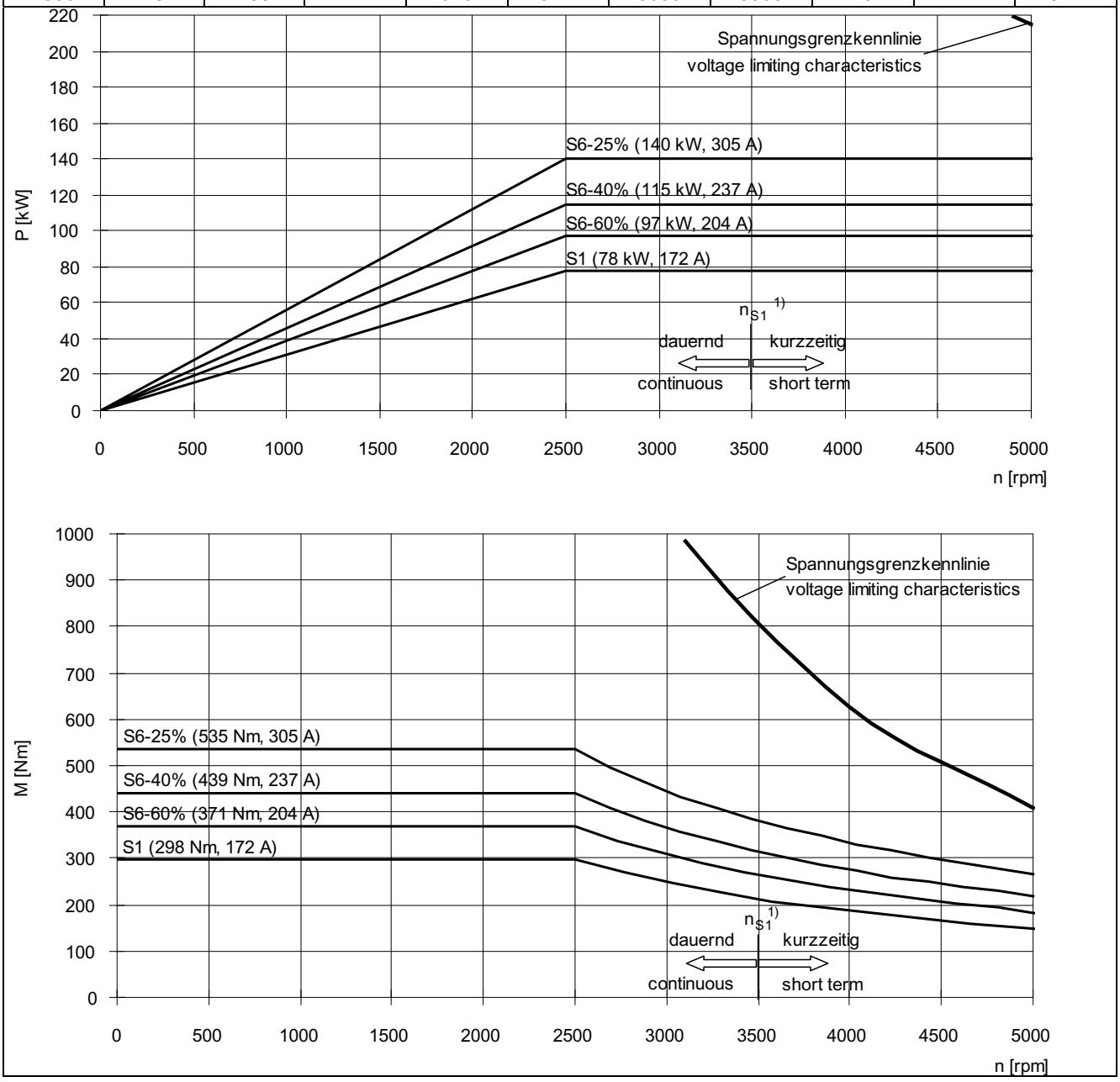


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 3000 rpm.
For the bearing version "increased maximum speed", this limit is n = 4000 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 57 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7184-□□L□□

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
2500	78	298	172	340	84.1	5000	5000	40	77	342

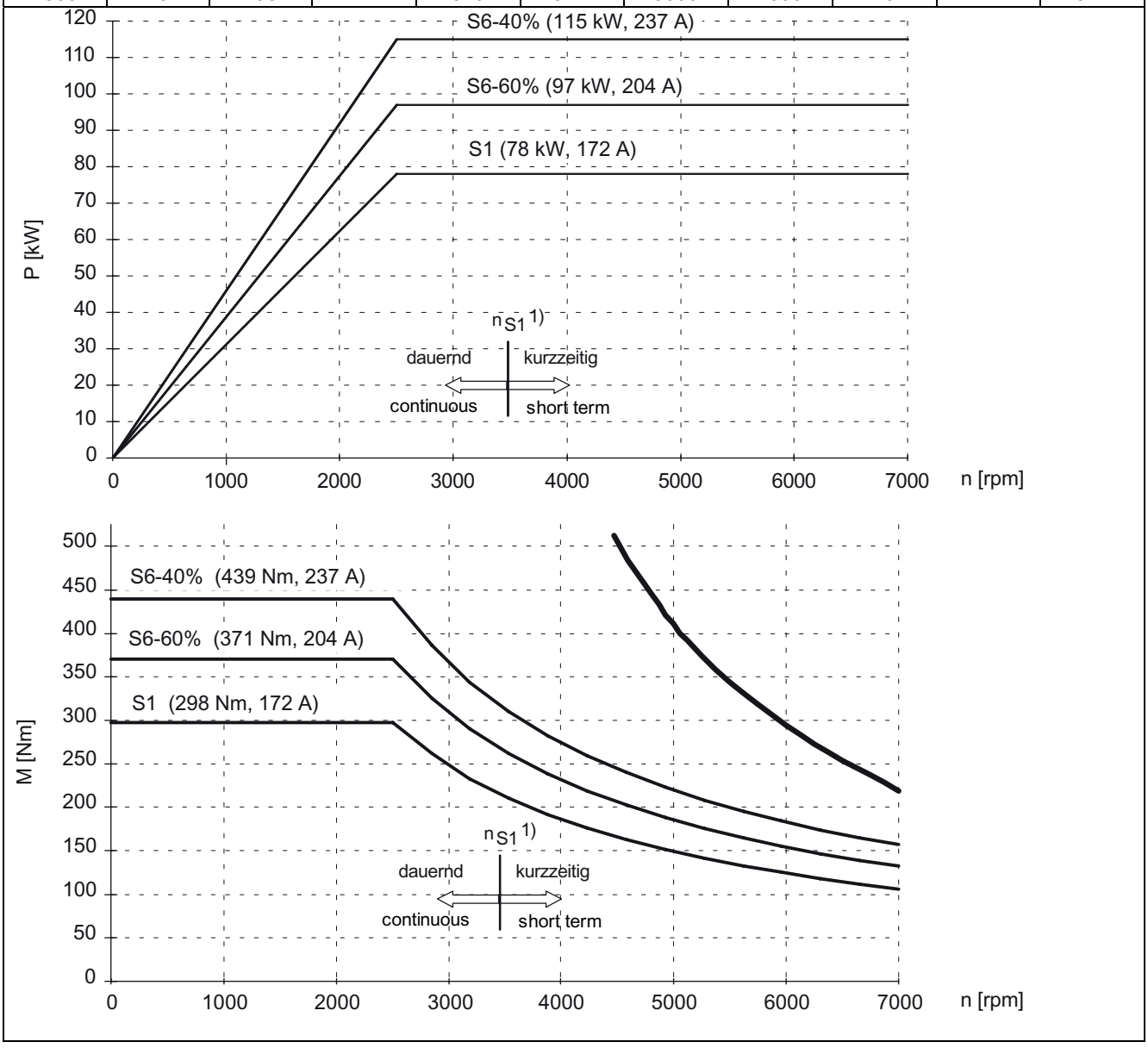


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 3000 rpm.
For the bearing version "increased maximum speed", this limit is n = 4500 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 58 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7184-□□L□□-0J

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
2500	78	298	172	340	84.1	5000	7000	40	77	342

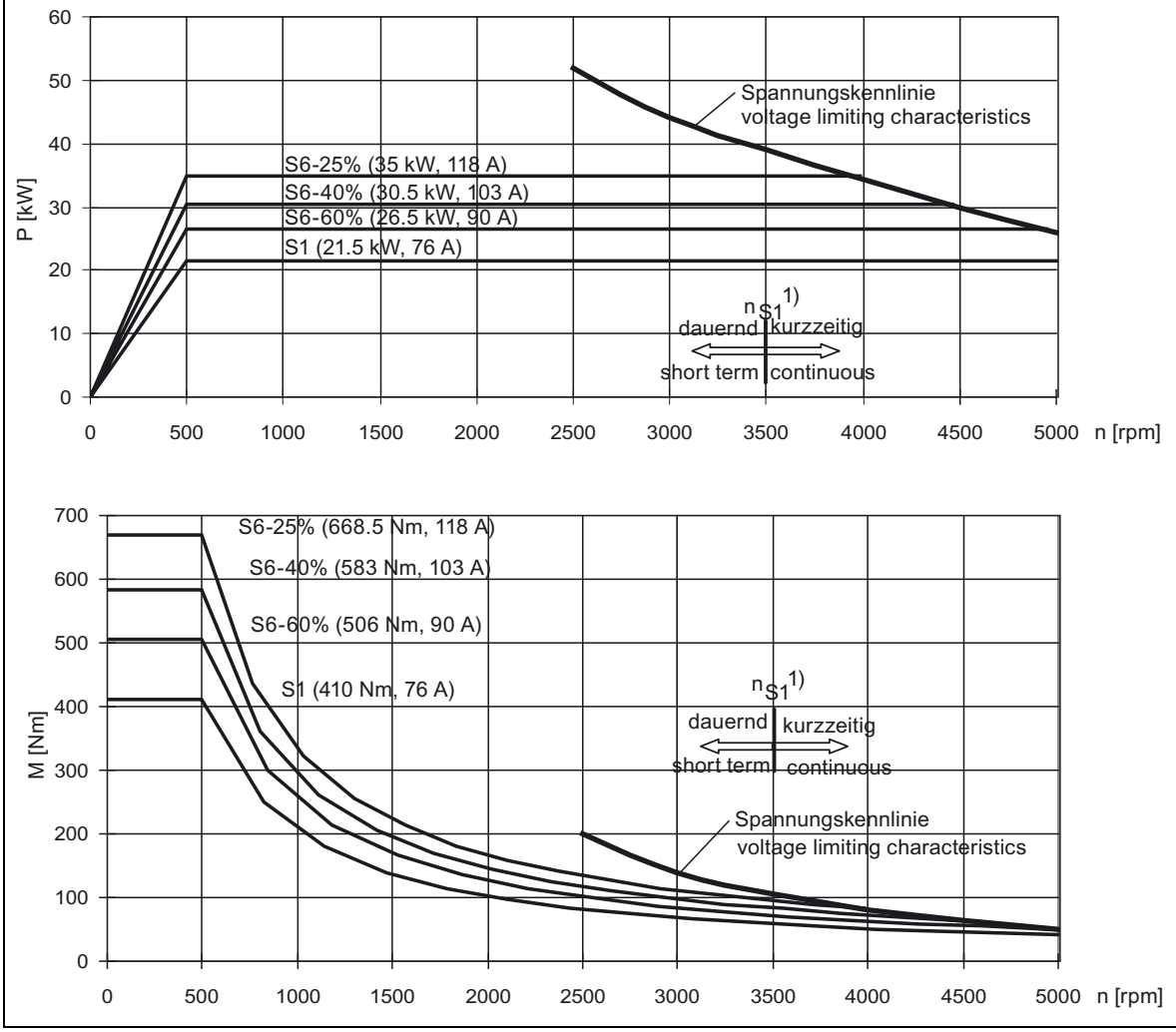


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 3000 rpm.
For the bearing version "increased maximum speed", this limit is n = 4500 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 59 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7184-□□T□□

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
500	21.5	410	76	235	17	5000	5000	40	40	160

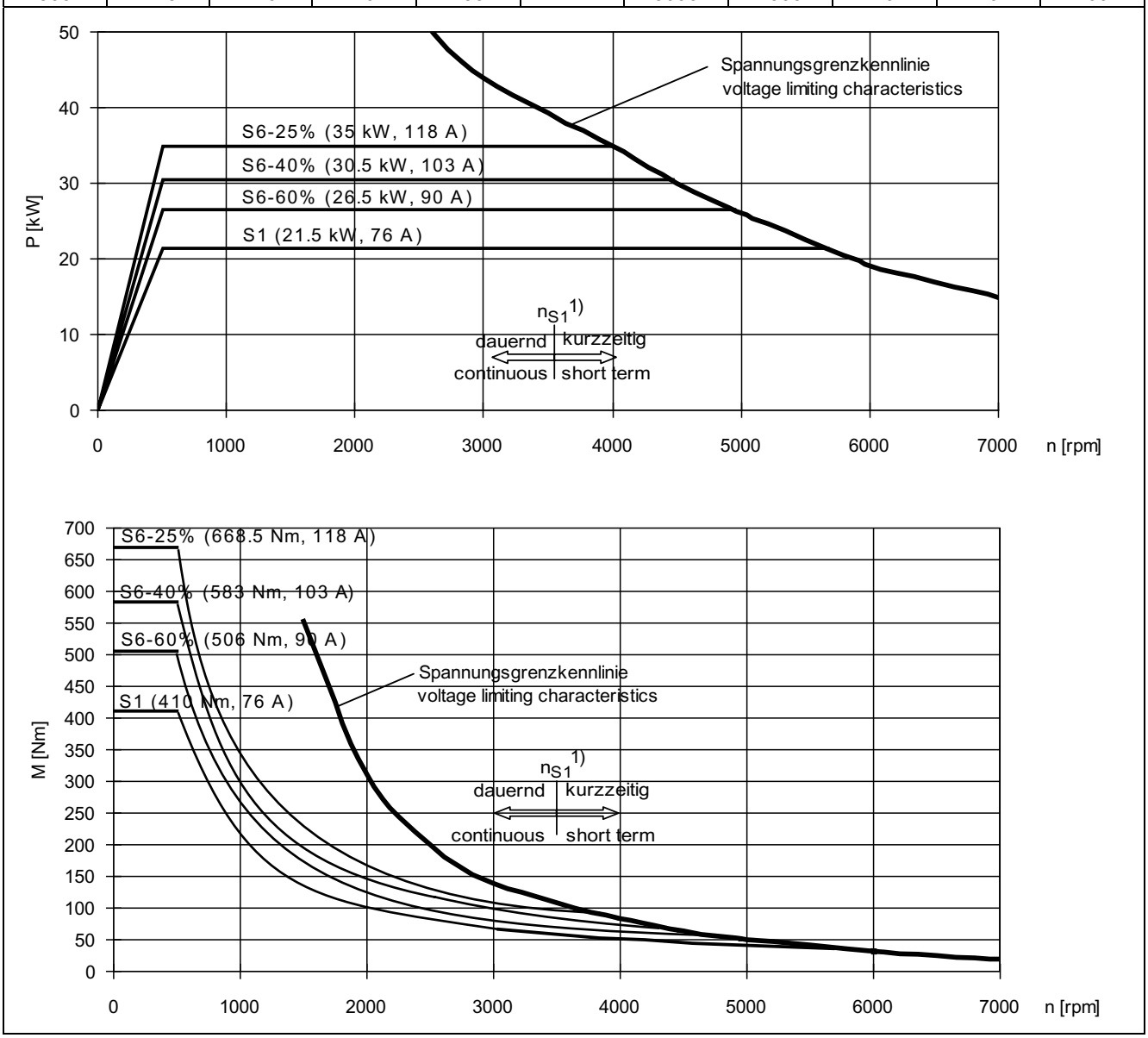


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 3000 rpm.
For the bearing version "increased maximum speed", this limit is n = 4500 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 60 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7184-□□T□□-0J

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
500	21.5	410	76	235	17	5600	7000	40	40	160

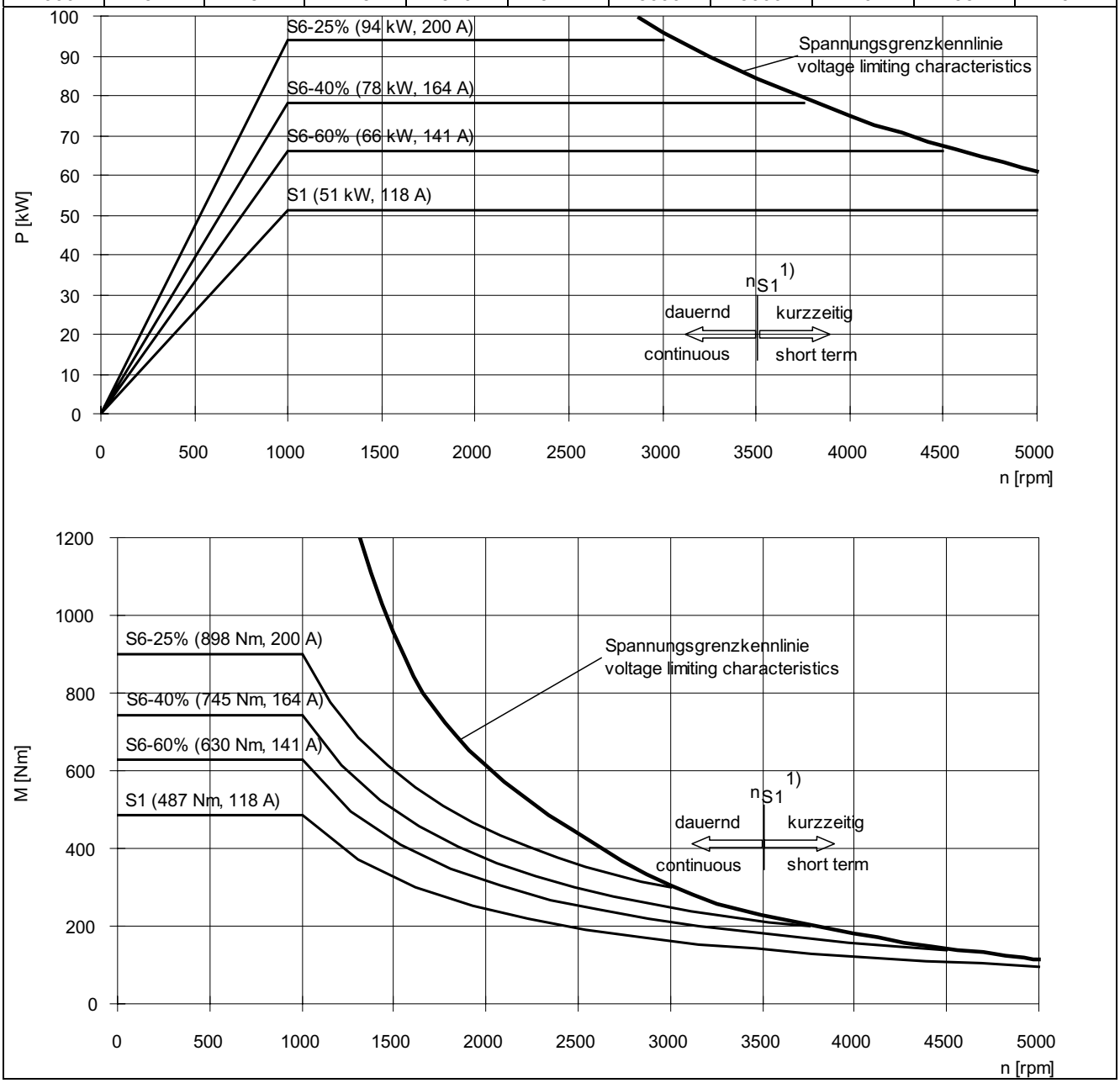


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 3000 rpm.
For the bearing version "increased maximum speed", this limit is n = 4500 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 61 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7186-□□D□□

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1000	51	487	118	340	34.1	5000	5000	40	58	232

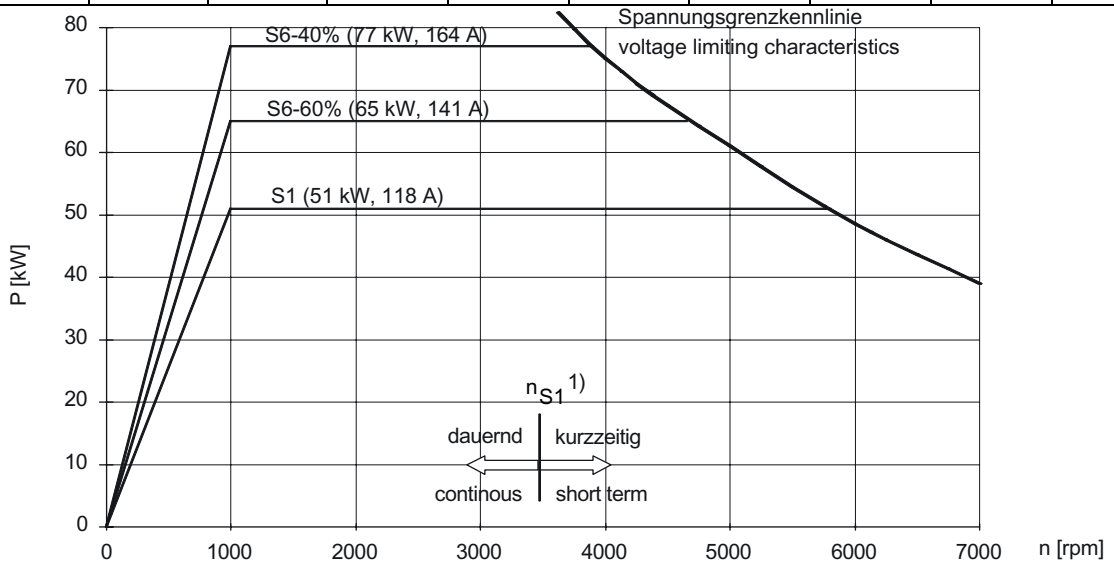


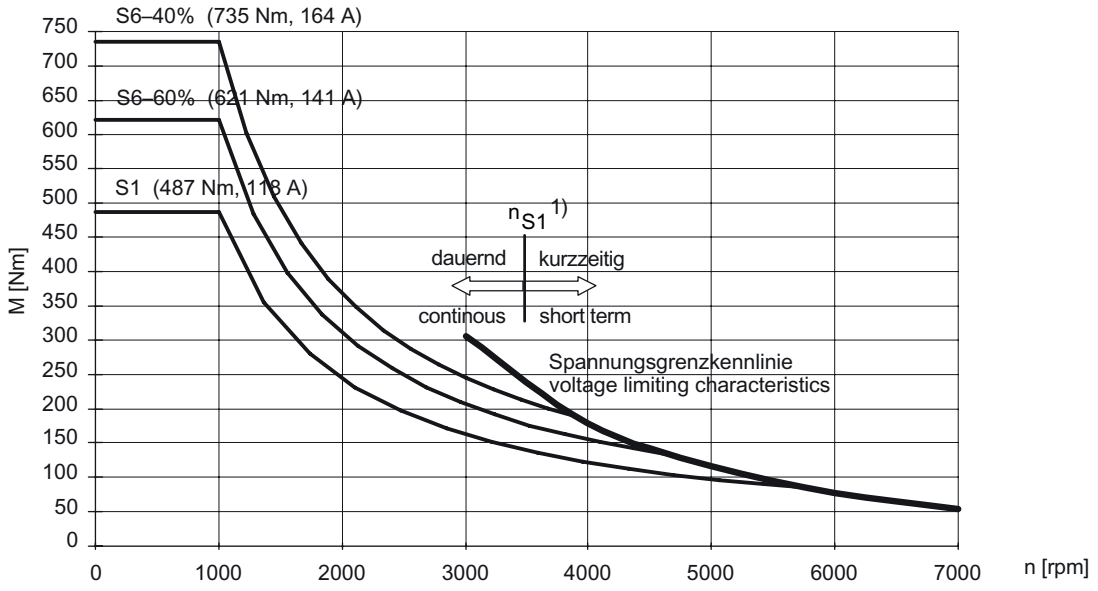
1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 3000 rpm.
For the bearing version "increased maximum speed", this limit is n = 4500 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 62 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7186-□□D□□-0J

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1000	51	487	118	340	34.1	5000	7000	40	58	232



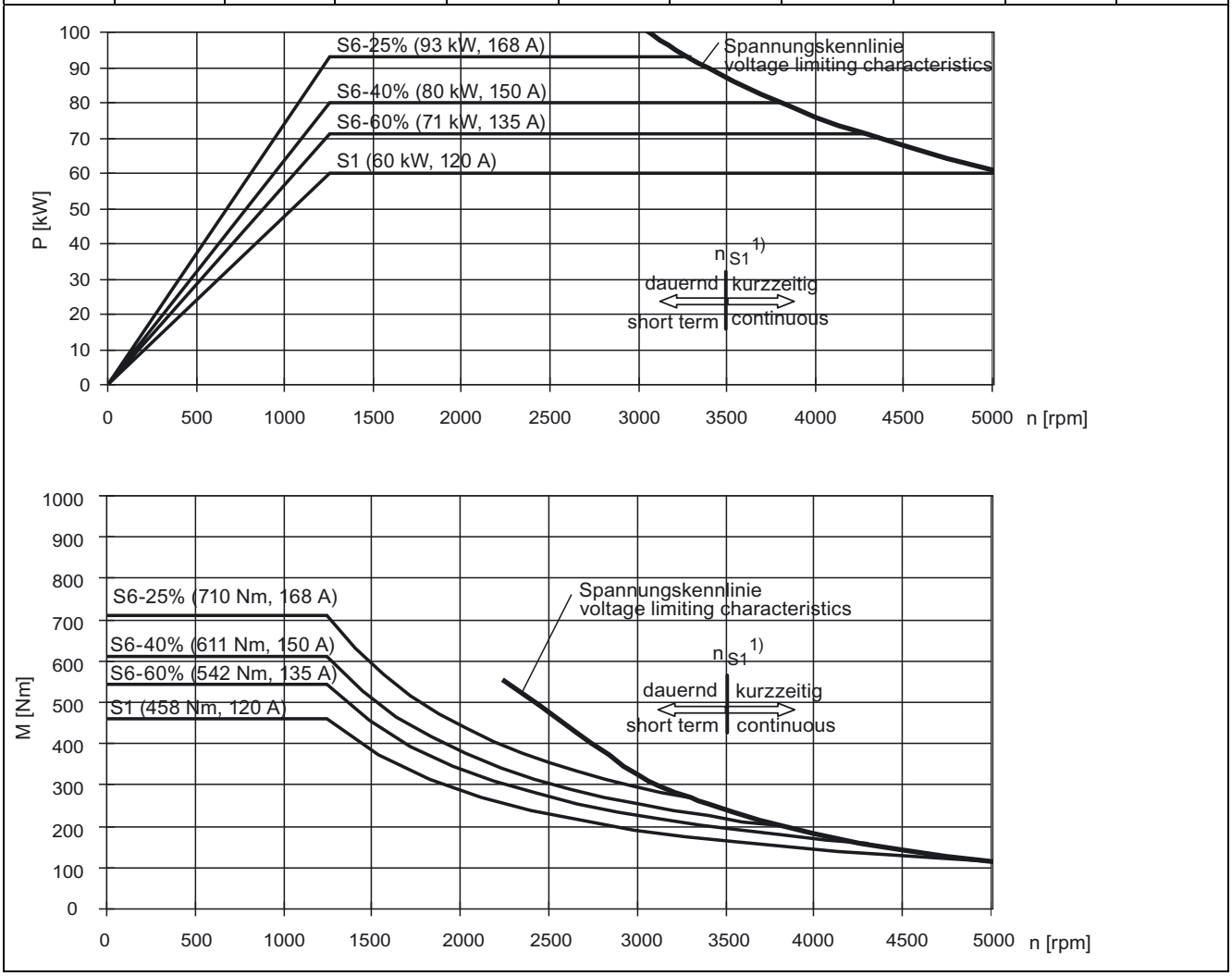


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 3000 rpm.
For the bearing version "increased maximum speed", this limit is n = 4500 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 63 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7186-□□E□□

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1250	60	458	120	400	42	5000	5000	40	63	240

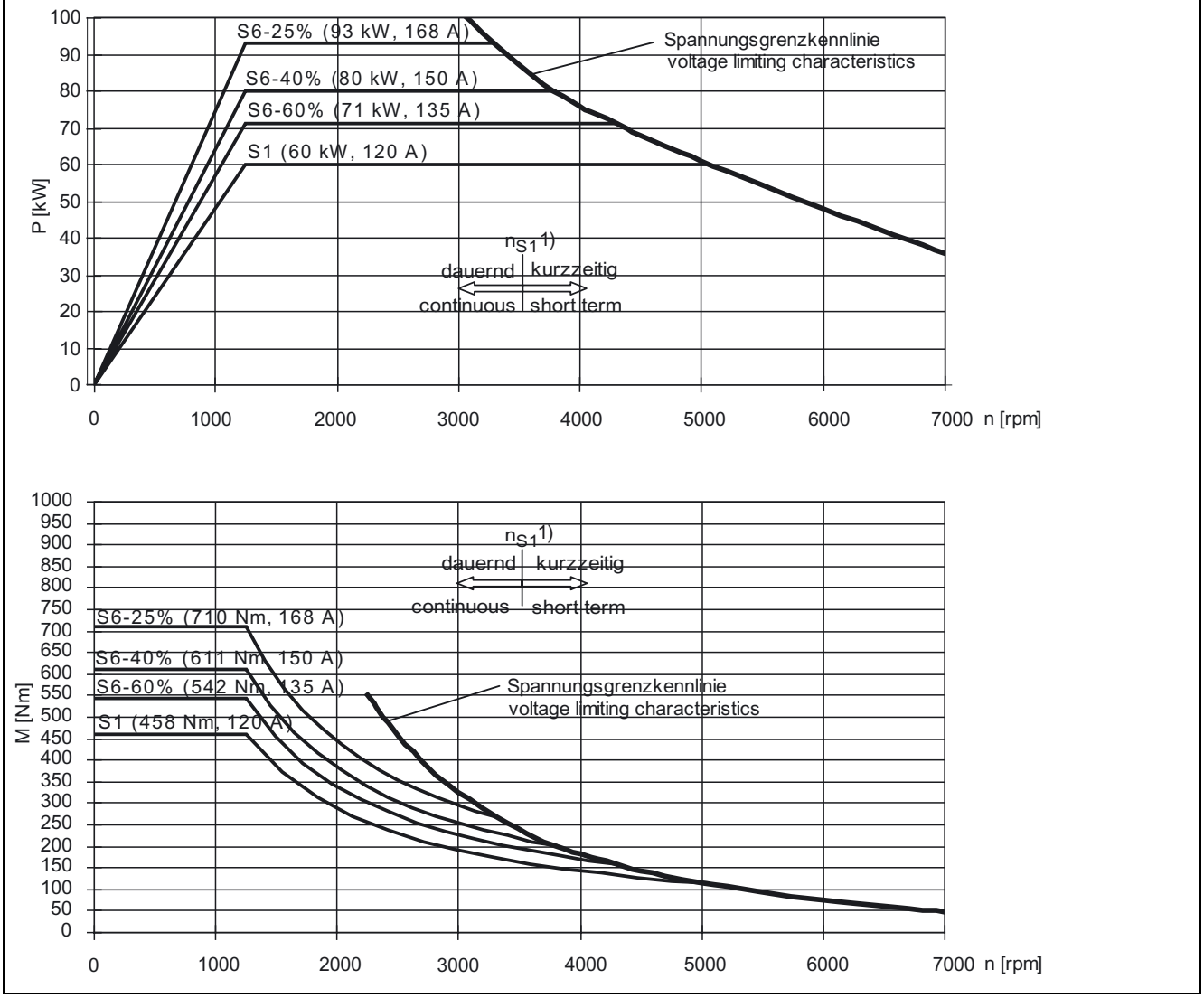


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 3000 rpm.
For the bearing version "increased maximum speed", this limit is n = 4500 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 64 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7186-□□E□□-0J

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1250	60	458	120	400	42	5050	7000	40	63	240

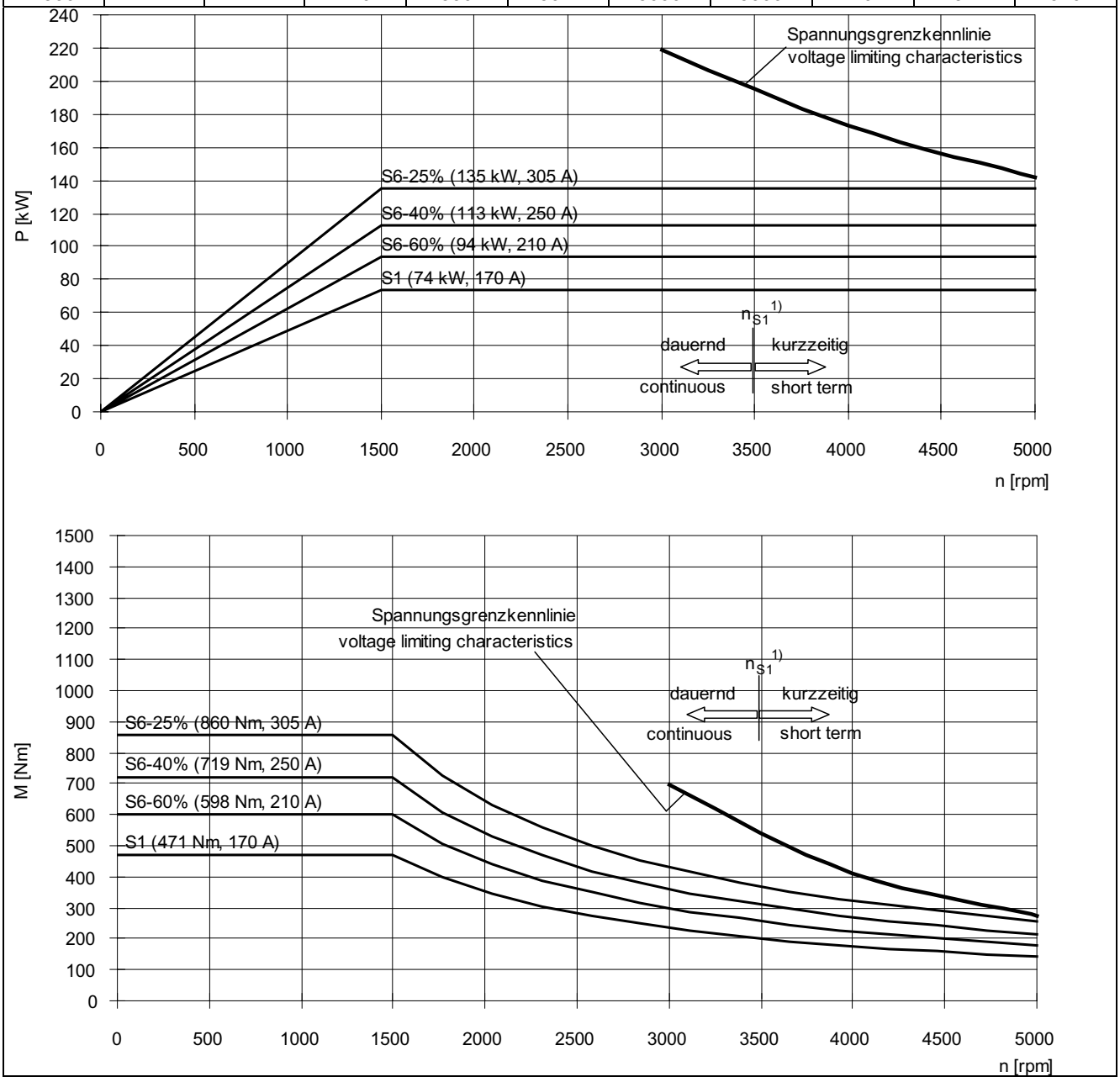


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 3000 rpm.
For the bearing version "increased maximum speed", this limit is n = 4500 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 65 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7186-□□F□□

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1500	74	471	170	330	50.7	5000	5000	40	84	310

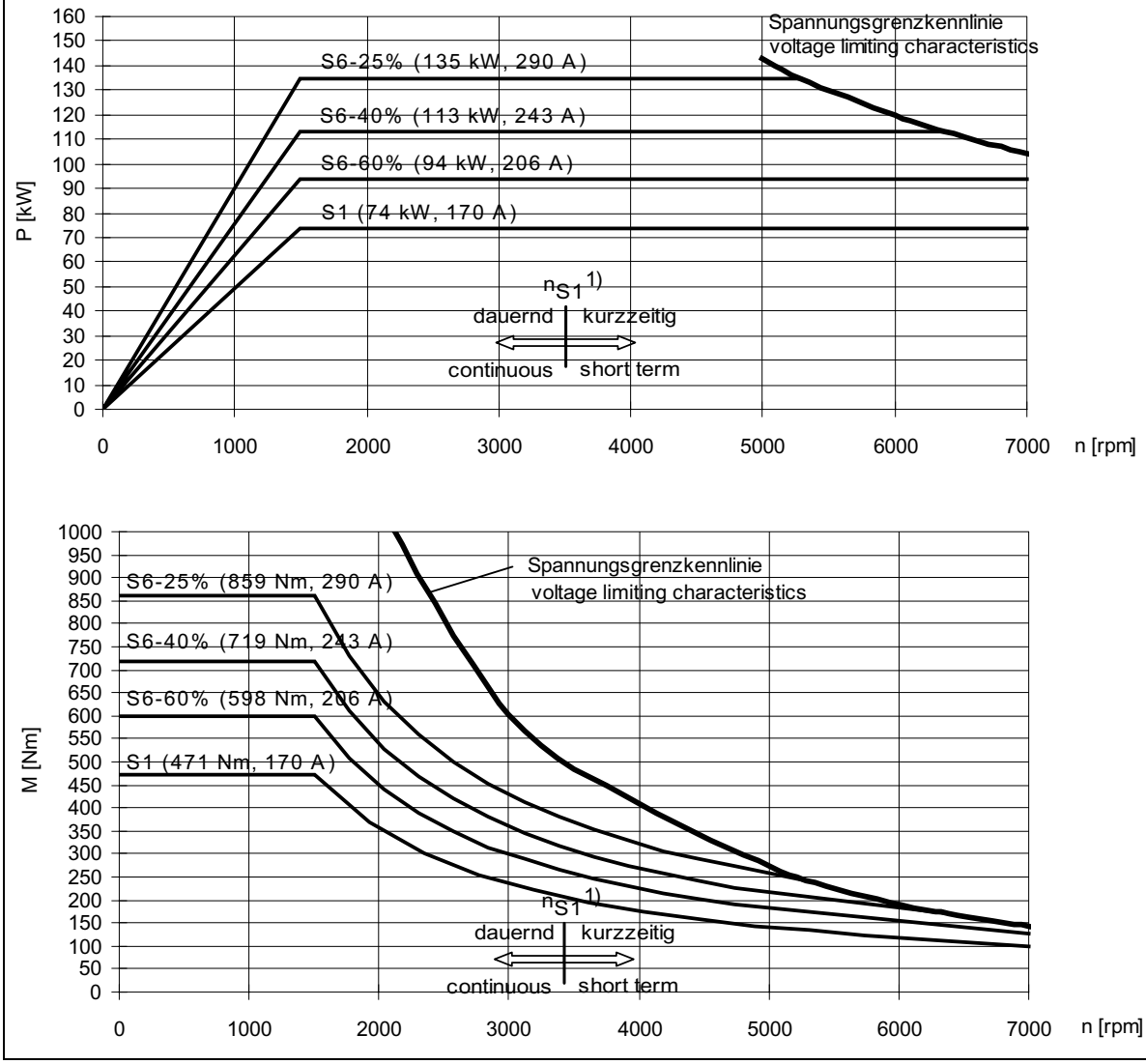


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 3000 rpm.
For the bearing version "increased maximum speed", this limit is n = 4500 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 66 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7186-□□F□□-0J

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1500	74	471	170	330	50.7	7000	7000	40	84	310

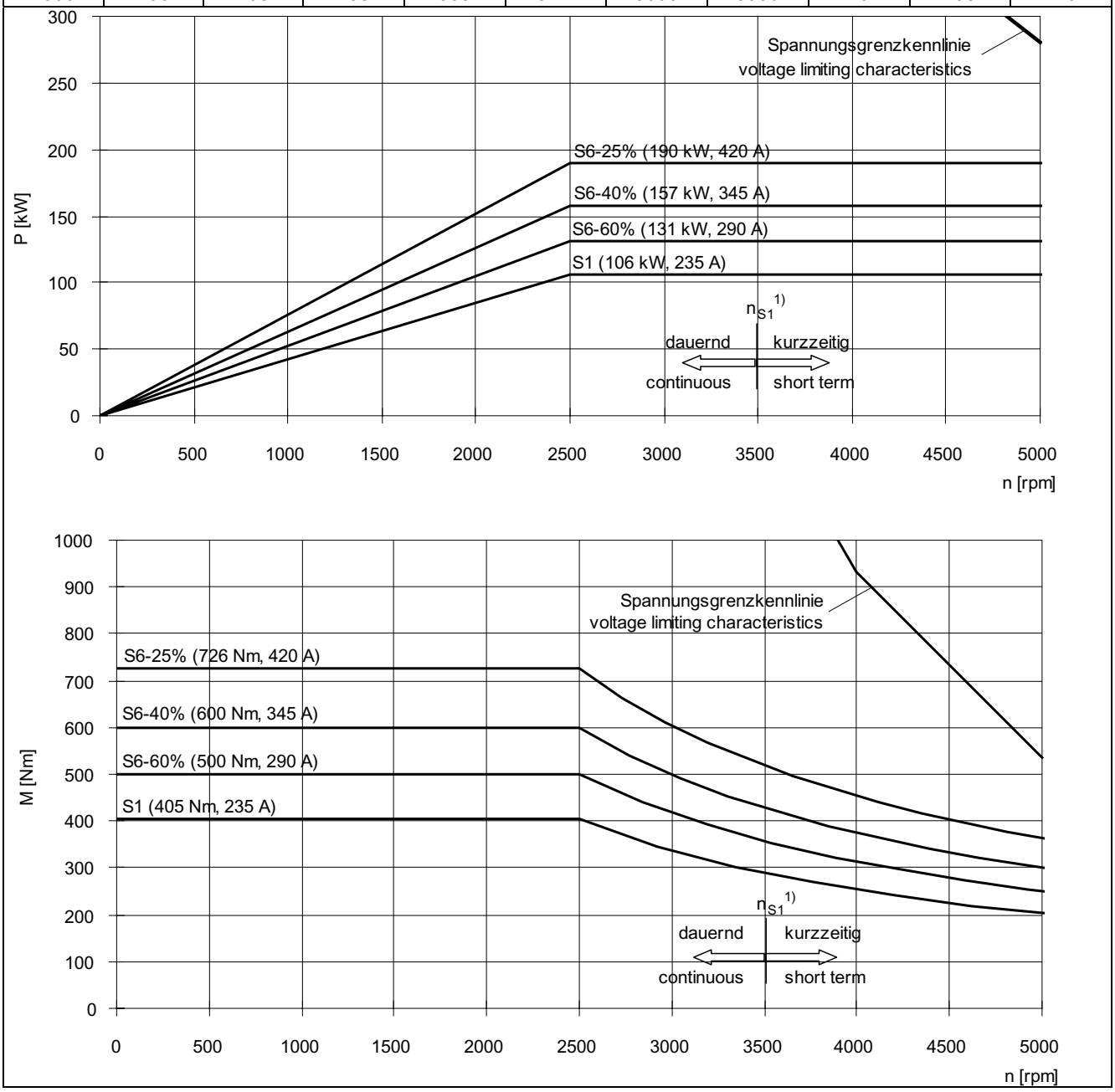


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 3000 rpm.
For the bearing version "increased maximum speed", this limit is n = 4500 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 67 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7186-□□L□□

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
2500	106	405	235	335	84.1	5000	5000	40	108	470

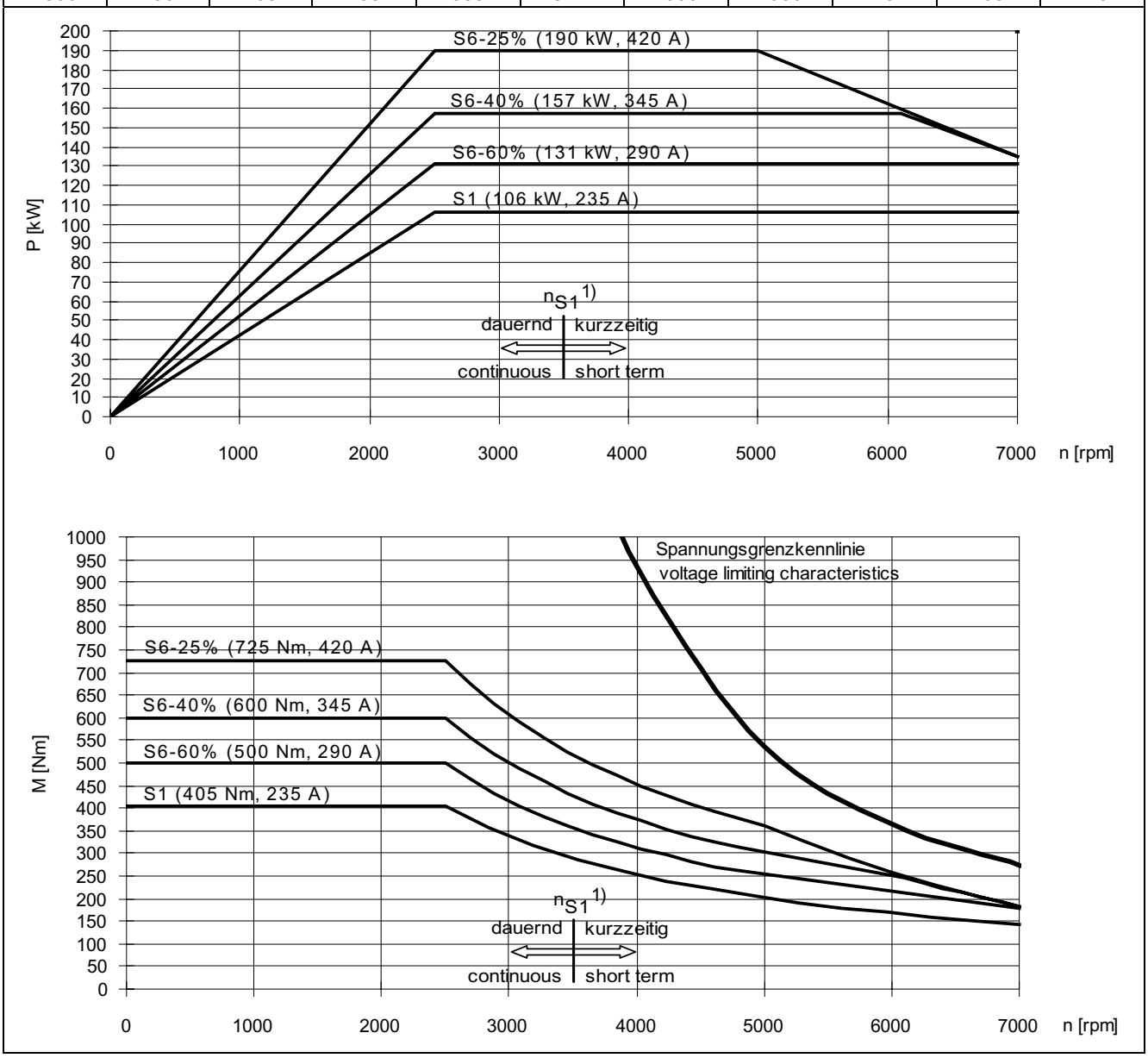


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 3000 rpm.
For the bearing version "increased maximum speed", this limit is n = 4500 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 68 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7186-□□L□□-0J

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
2500	106	405	235	335	84.1	7000	7000	40	108	470

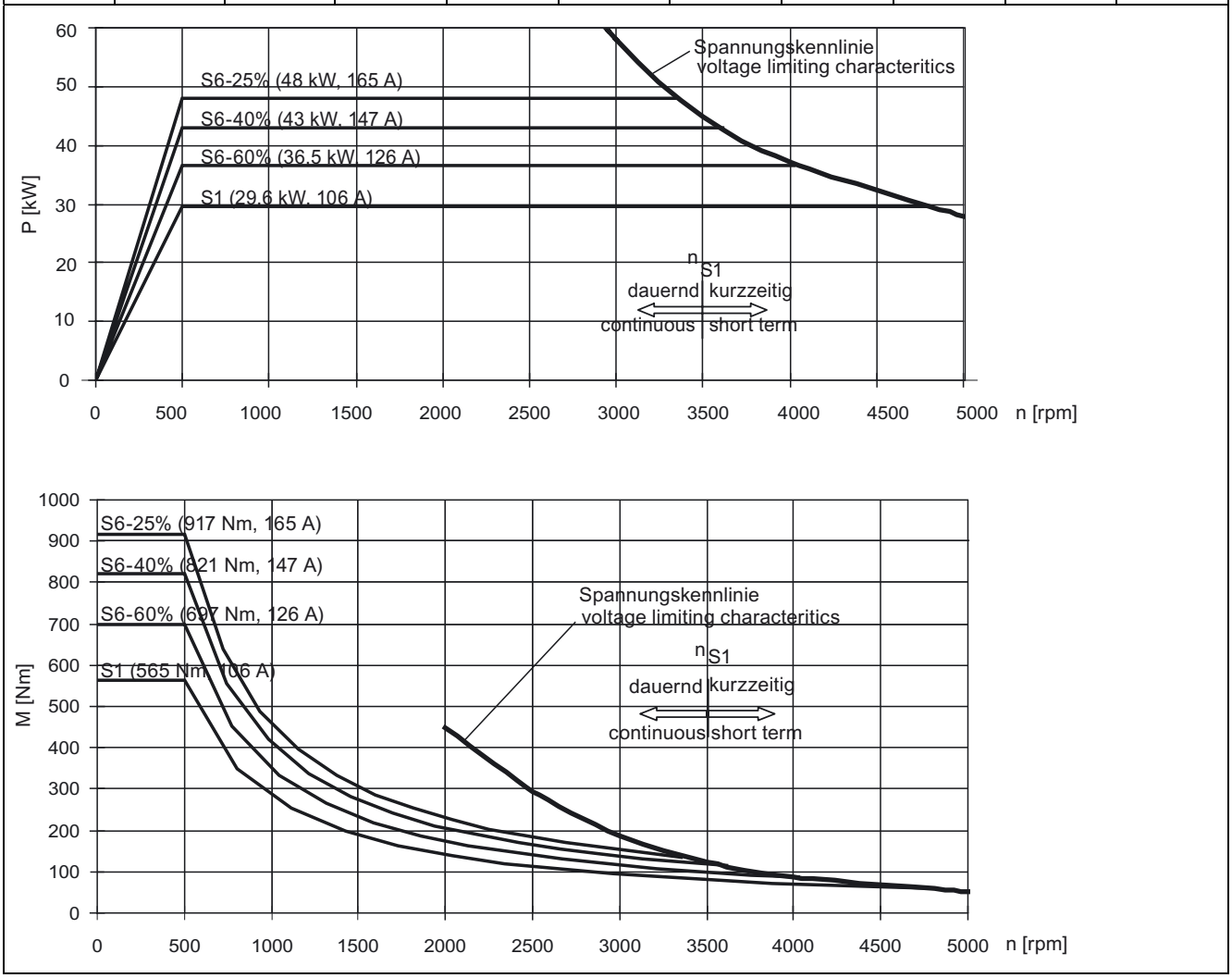


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 3000 rpm.
For the bearing version "increased maximum speed", this limit is n = 4500 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 69 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7186-□□T□□

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
500	29.6	565	106	228	17	4800	5000	40	56	215

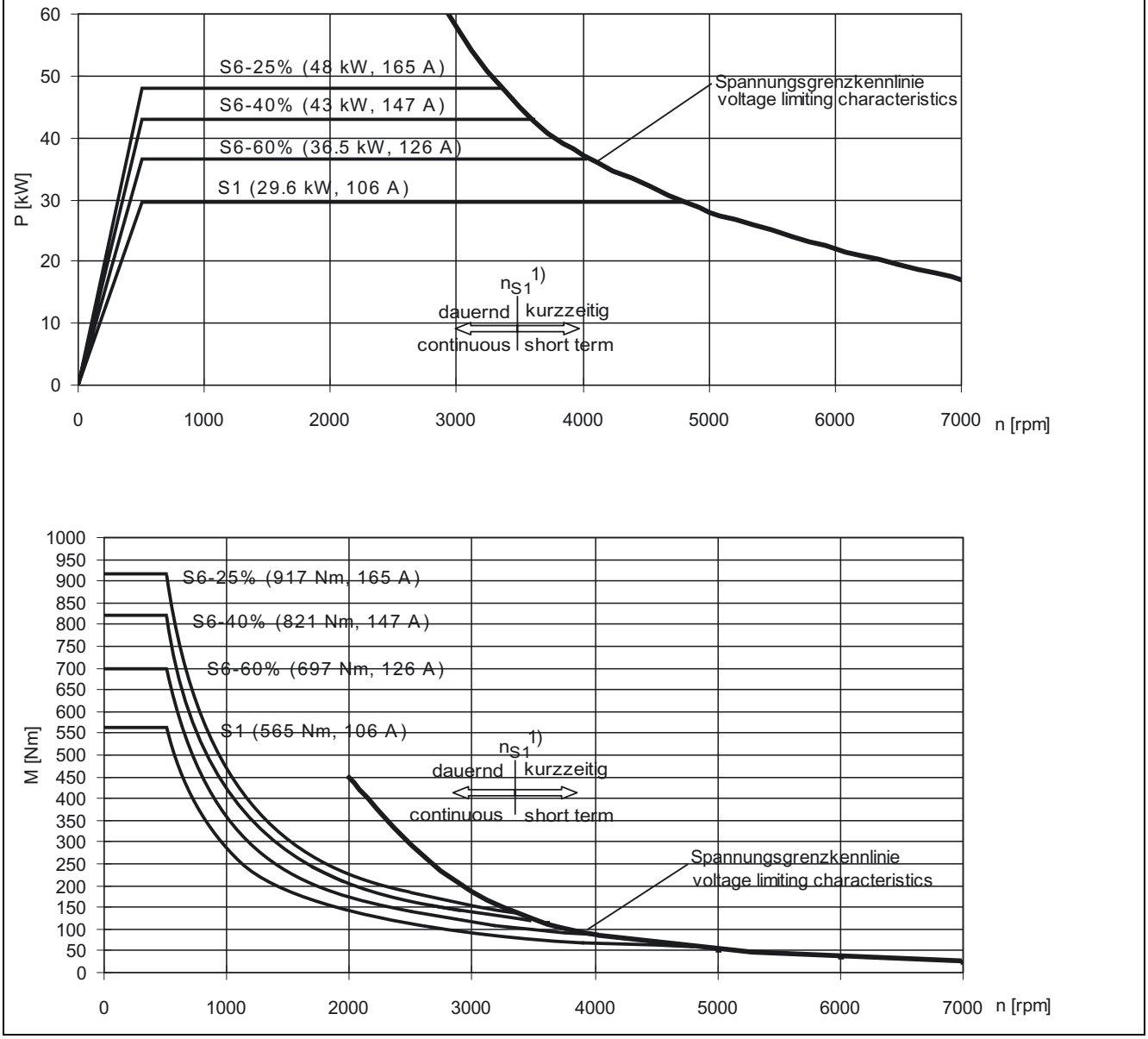


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 3000 rpm.
For the bearing version "increased maximum speed", this limit is n = 4500 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 70 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7186-□□T□□-0J

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
500	29.6	565	106	228	17	4800	7000	40	56	215

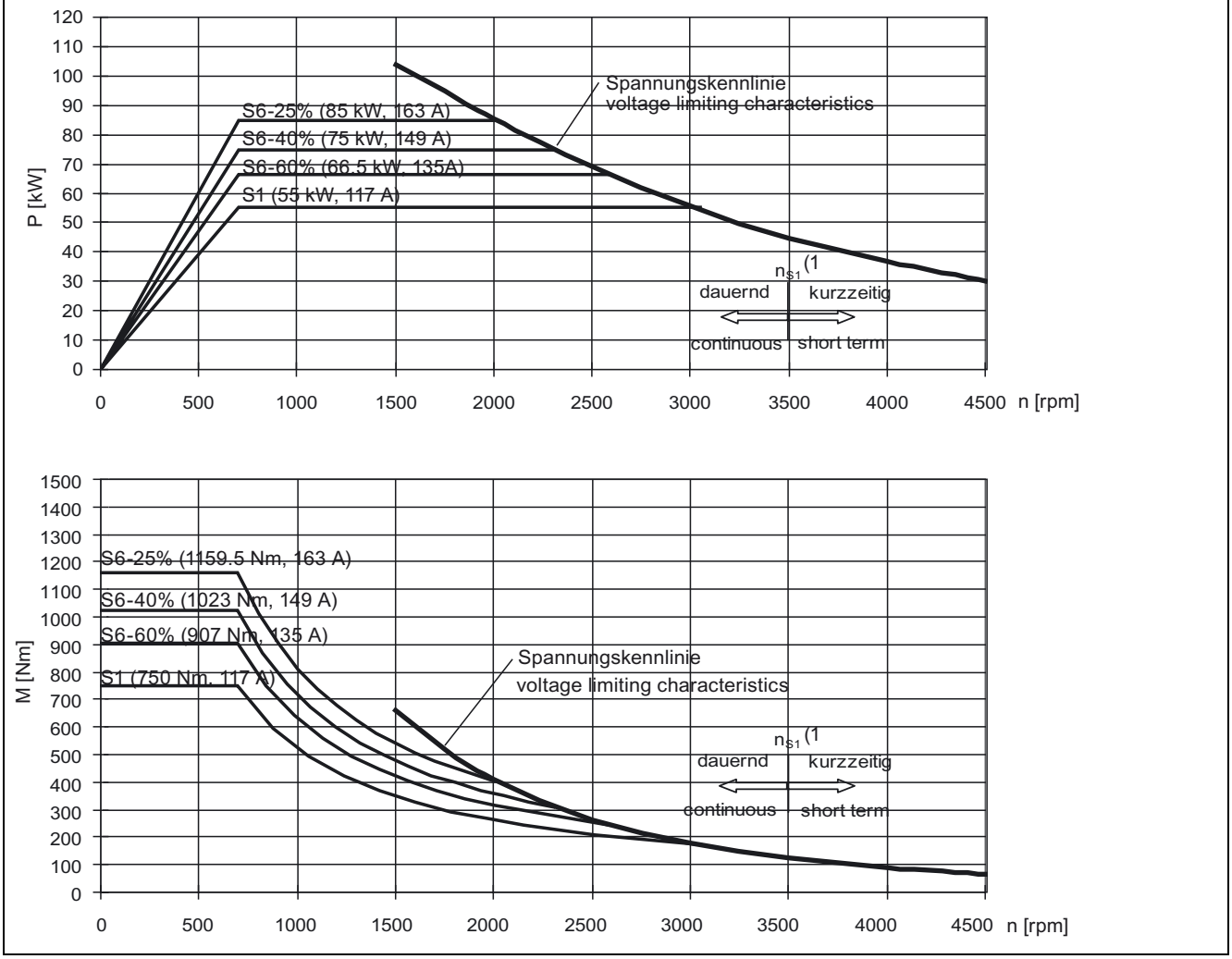


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 3000 rpm.
For the bearing version "increased maximum speed", this limit is n = 4500 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 71 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7224-□□C□□

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
700	55	750	114	380	24	3050	4500	40	63.5	230

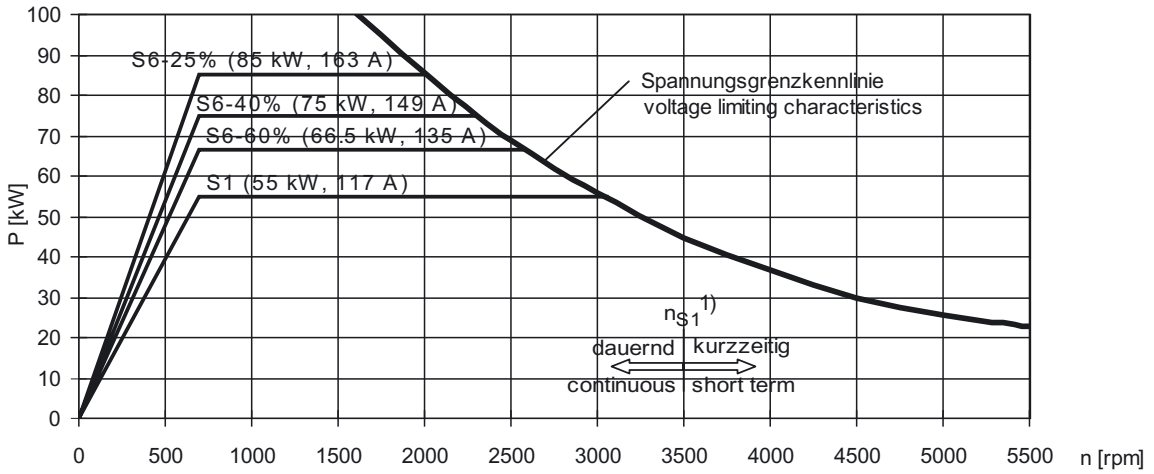


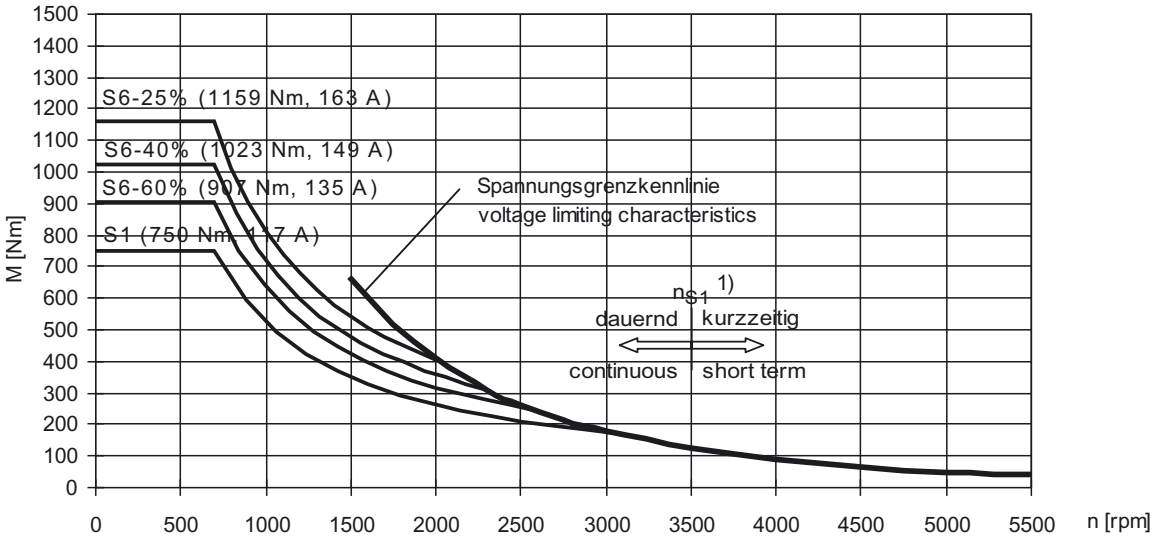
1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 2700 rpm.
For the bearing version "increased maximum speed", this limit is n = 3600 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 72 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7224-□□C□□-0J

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
700	55	750	117	380	24	3050	5500	40	63.5	230



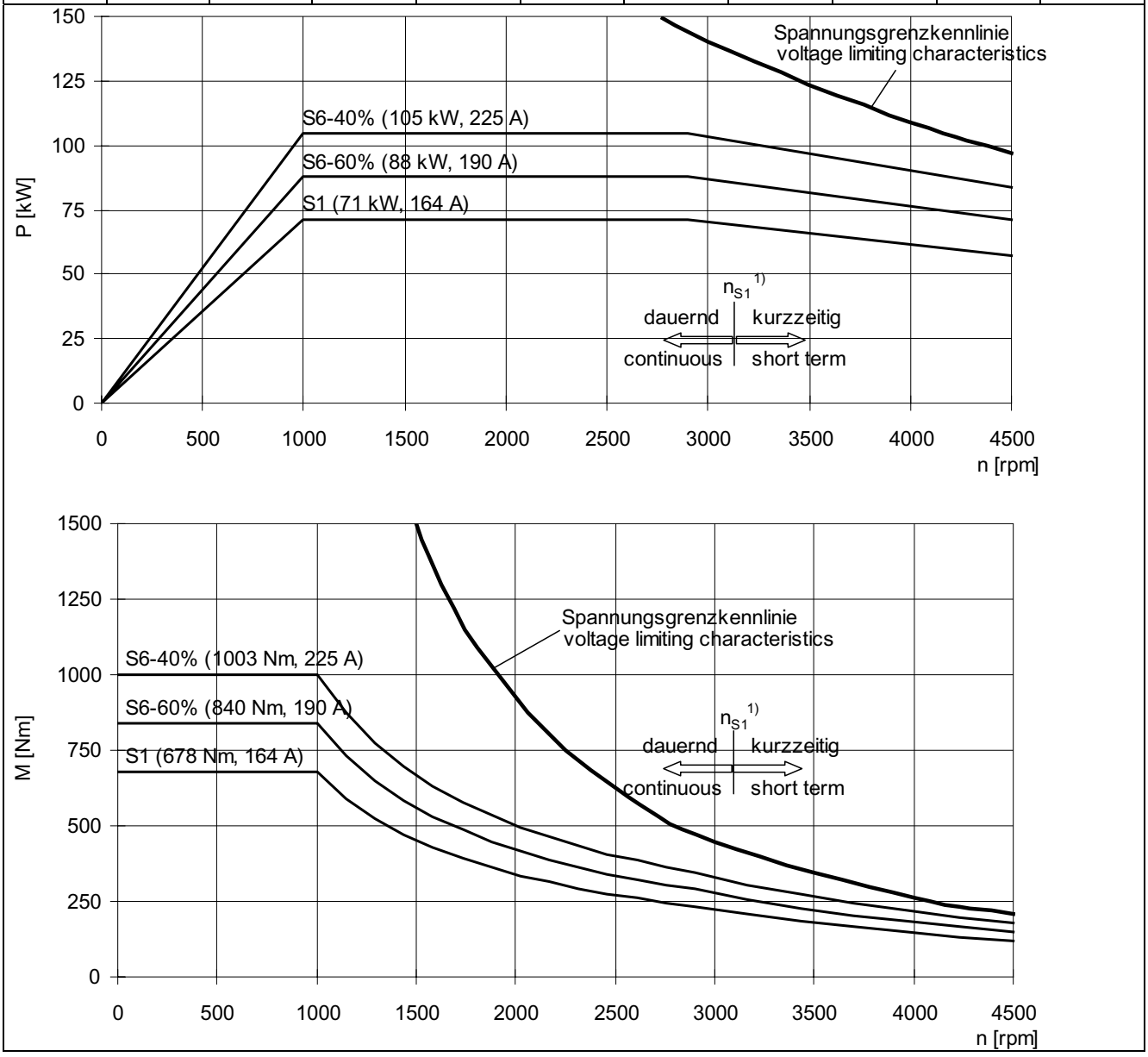


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 2700 rpm.
For the bearing version "increased maximum speed", this limit is n = 3600 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 73 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7224-□□D□□

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1000	71	678	164	335	33.9	2900	4500	40	78.5	320

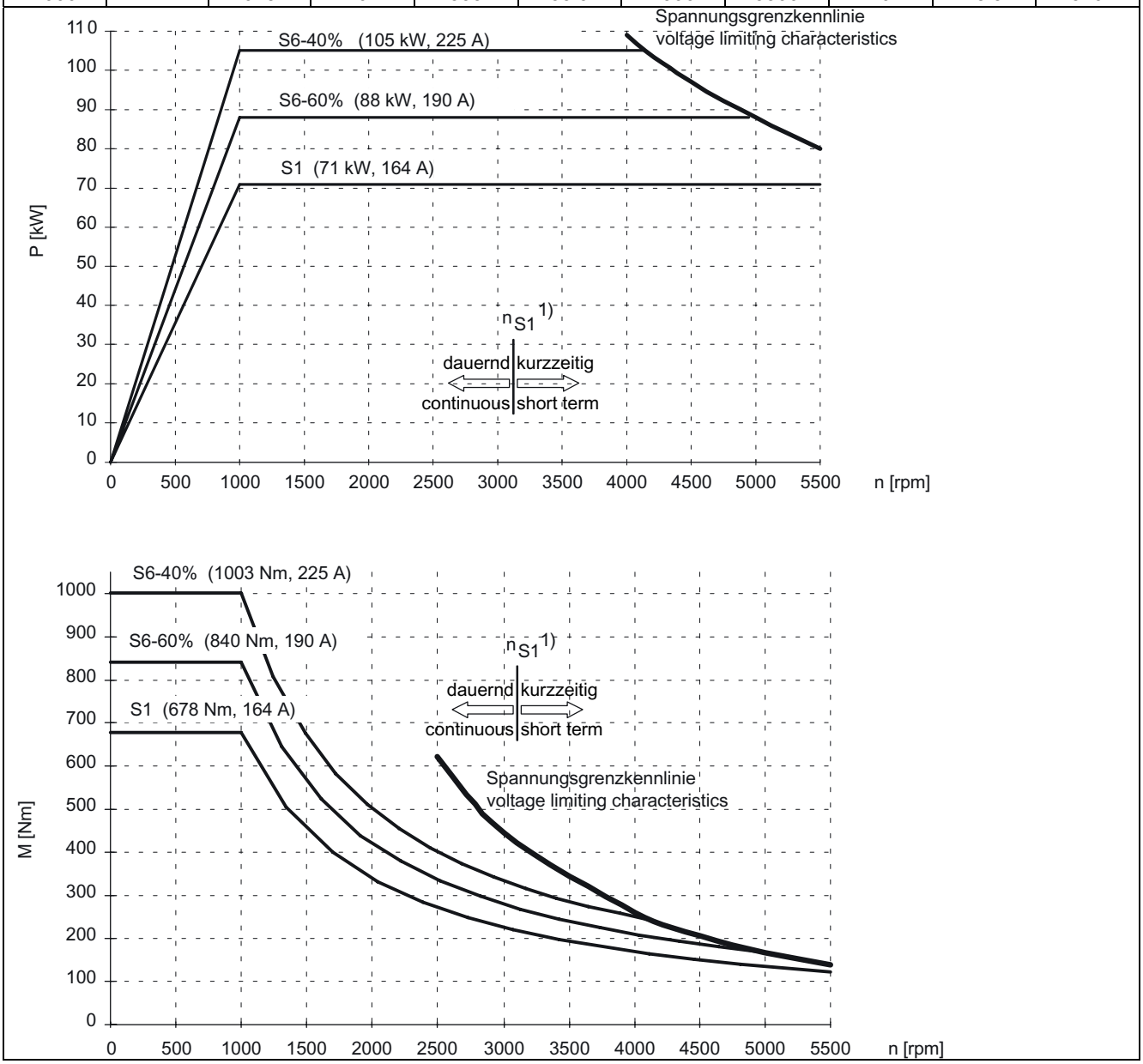


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 2700 rpm.
For the bearing version "increased maximum speed", this limit is n = 3600 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 74 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7224-□□D□□-0J

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1000	71	678	164	335	33.9	2900	5500	40	78.5	320

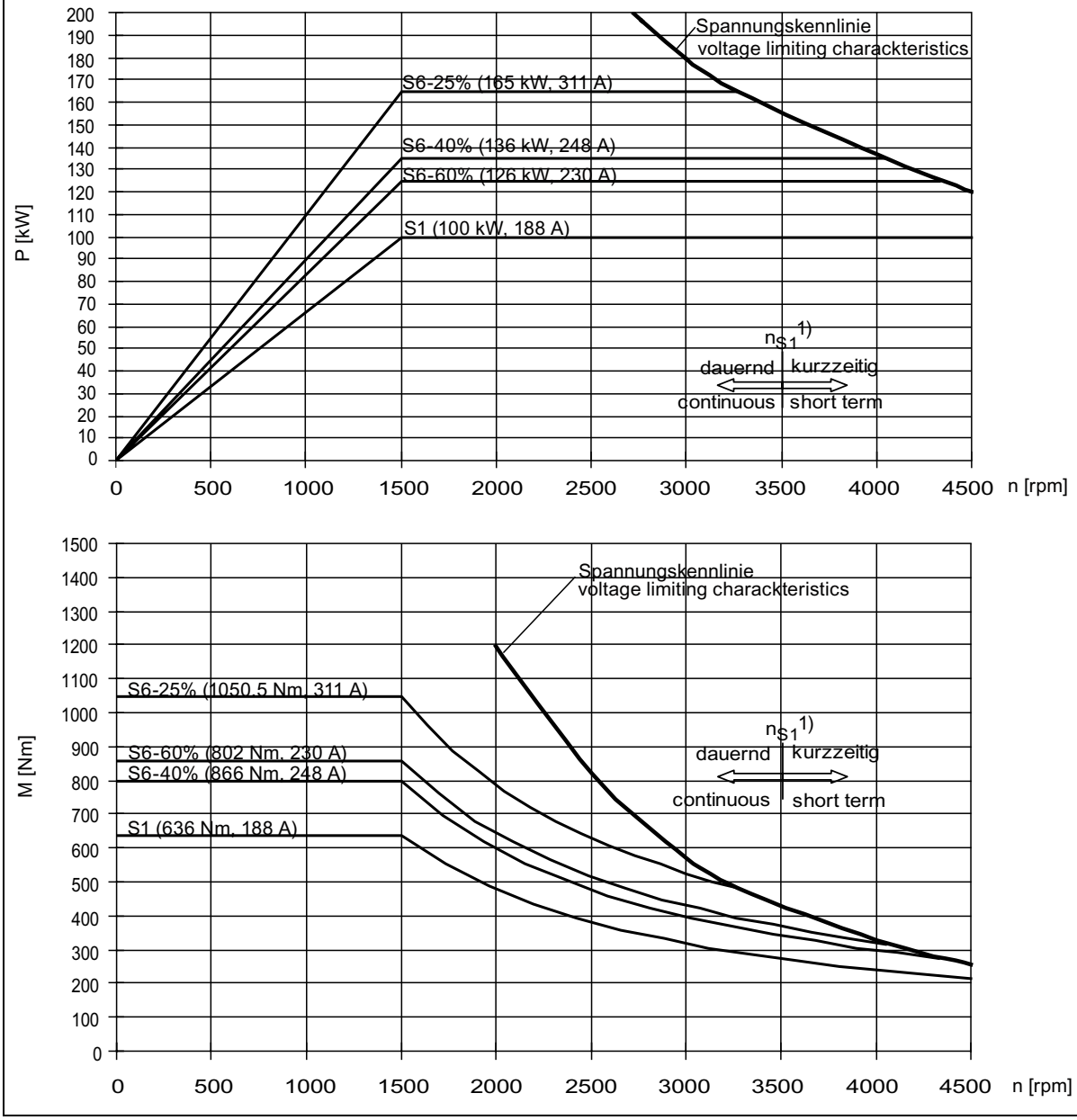


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 2700 rpm.
For the bearing version "increased maximum speed", this limit is n = 3600 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 75 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7224-□□F□□

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1500	100	636	188	385	51	4500	4500	40	73	385

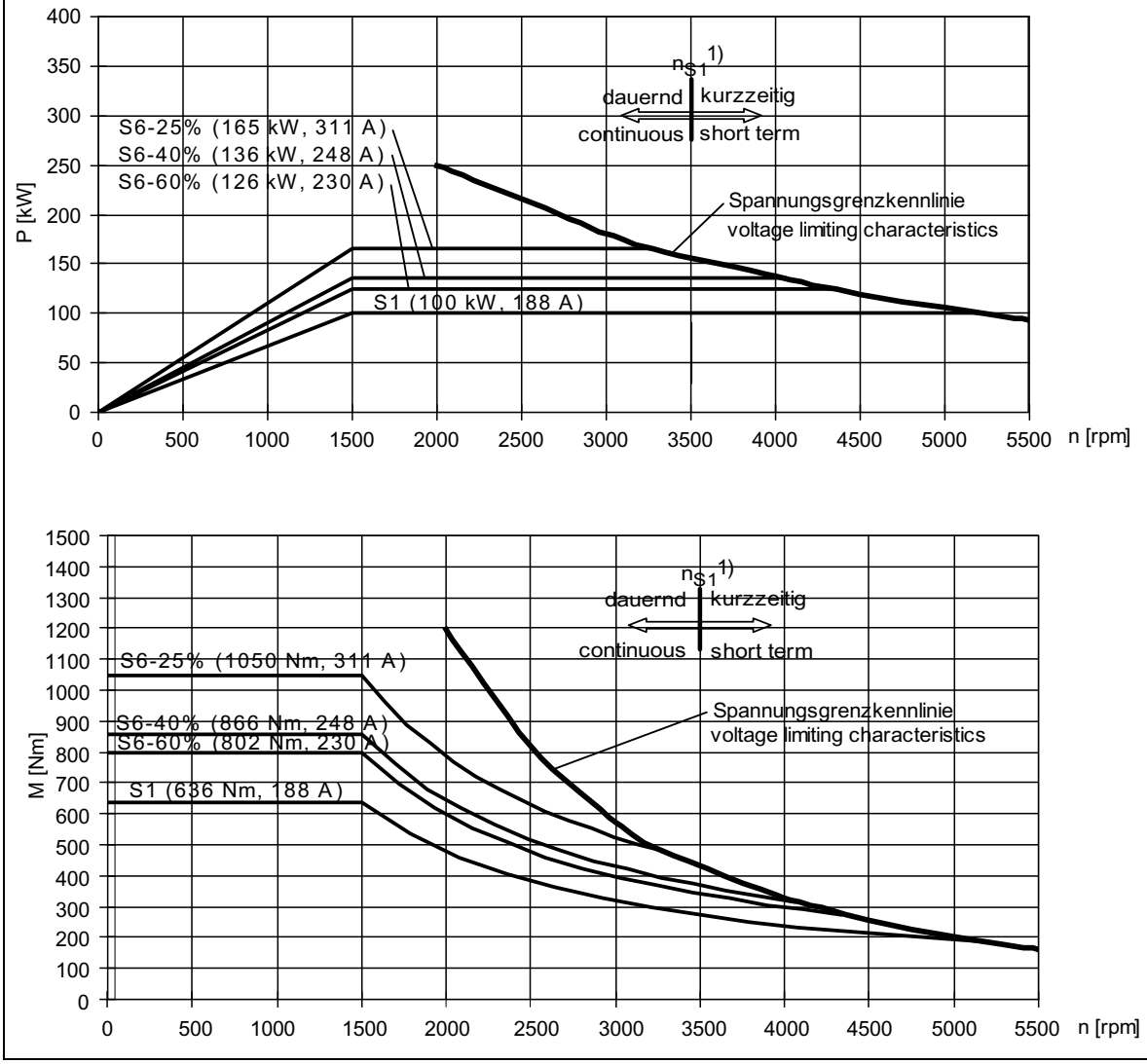


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 2700 rpm.
For the bearing version "increased maximum speed", this limit is n = 3600 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 76 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7224-□□F□□-0J

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1500	100	636	188	385	51	4500	5500	40	73	385

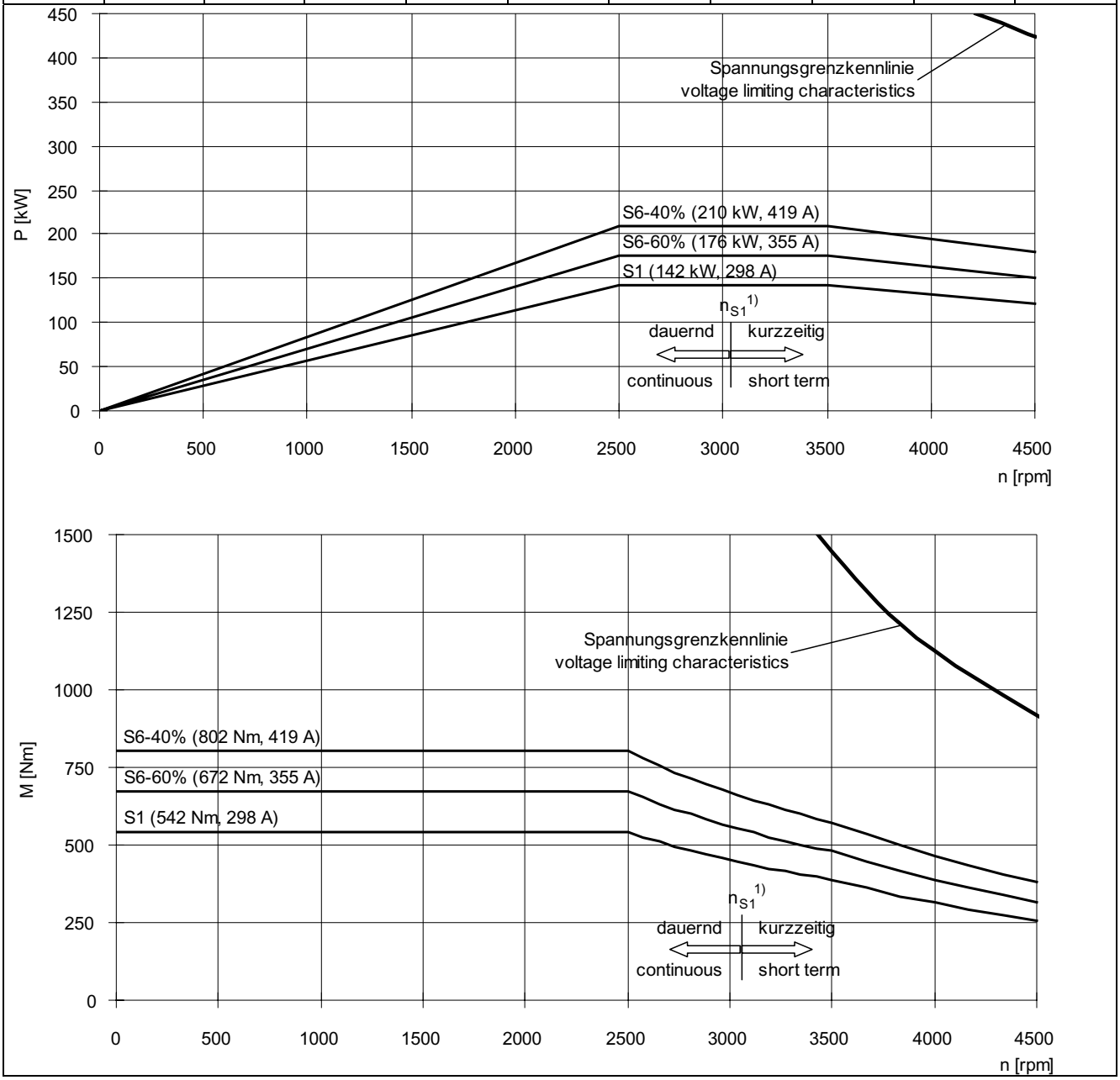


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 2700 rpm.
For the bearing version "increased maximum speed", this limit is n = 3600 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 77 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7224-□□L□□

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
2500	142	542	298	340	84.0	3500	4500	40	115	600

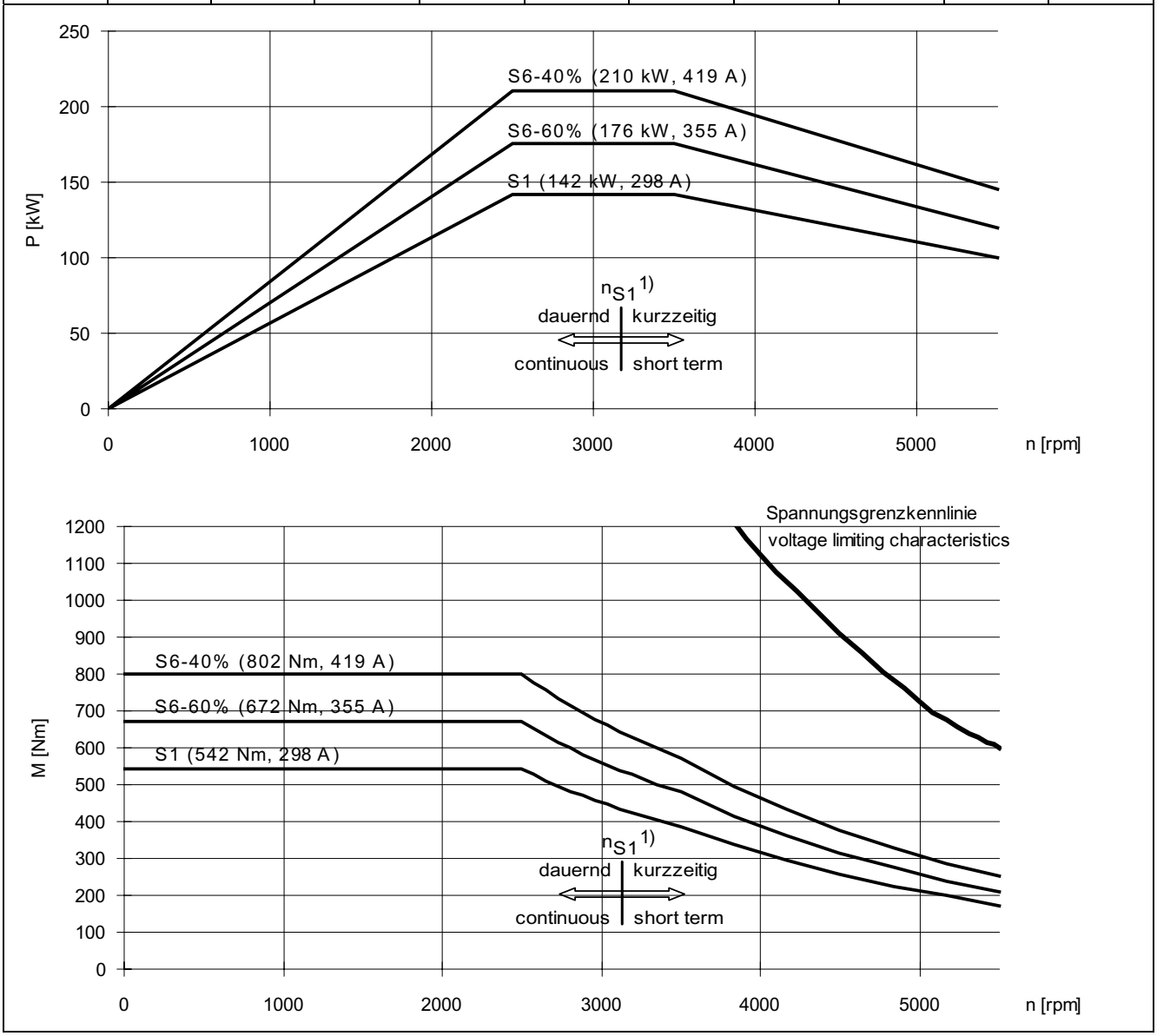


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 2700 rpm.
For the bearing version "increased maximum speed", this limit is n = 3600 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 78 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7224-□□L□□-0J

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
2500	142	542	298	340	84.0	3500	5500	40	115	600

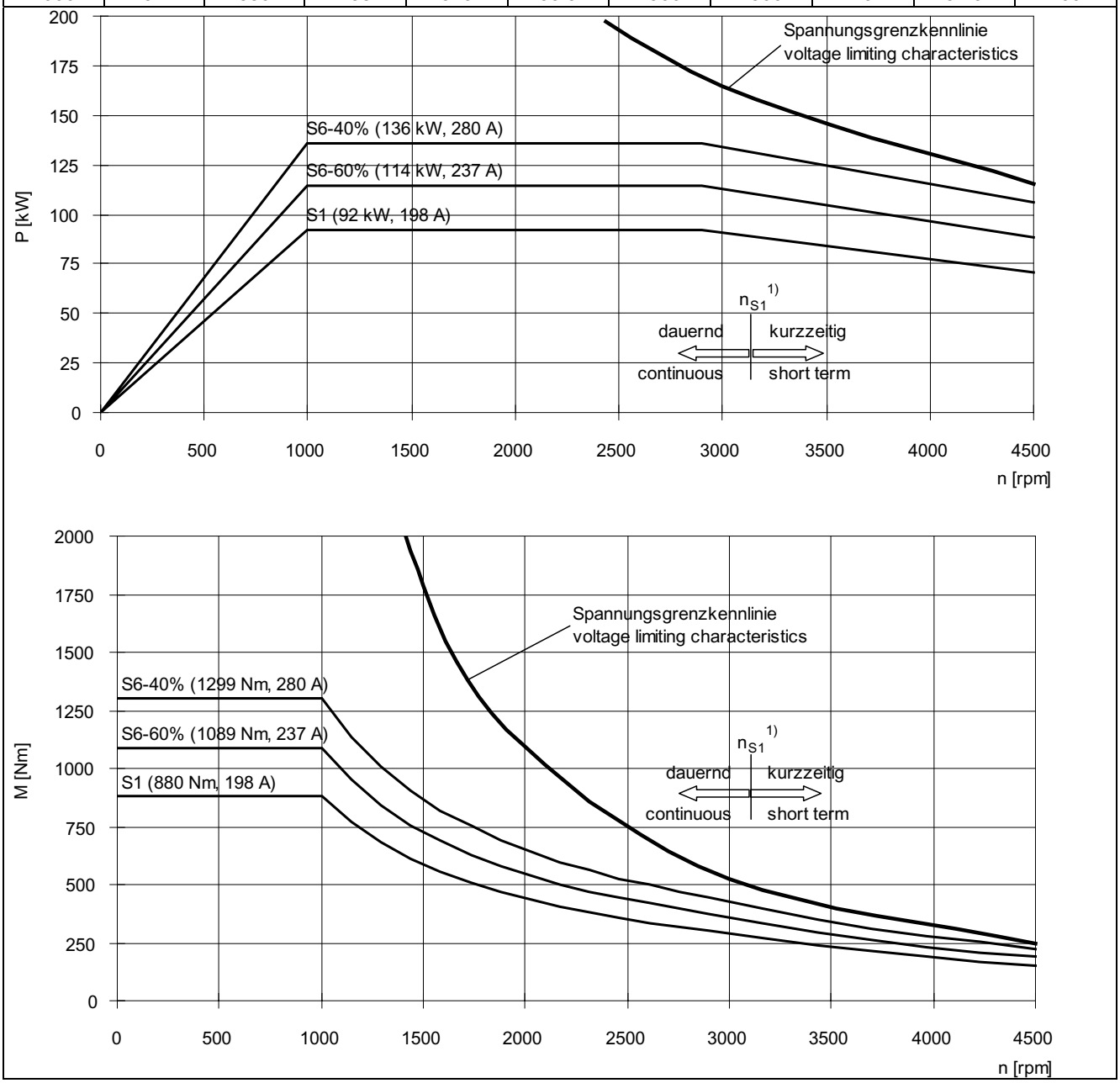


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 2700 rpm.
For the bearing version "increased maximum speed", this limit is n = 3600 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 79 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7226-□□D□□

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1000	92	880	198	340	33.9	2900	4500	40	87.5	400

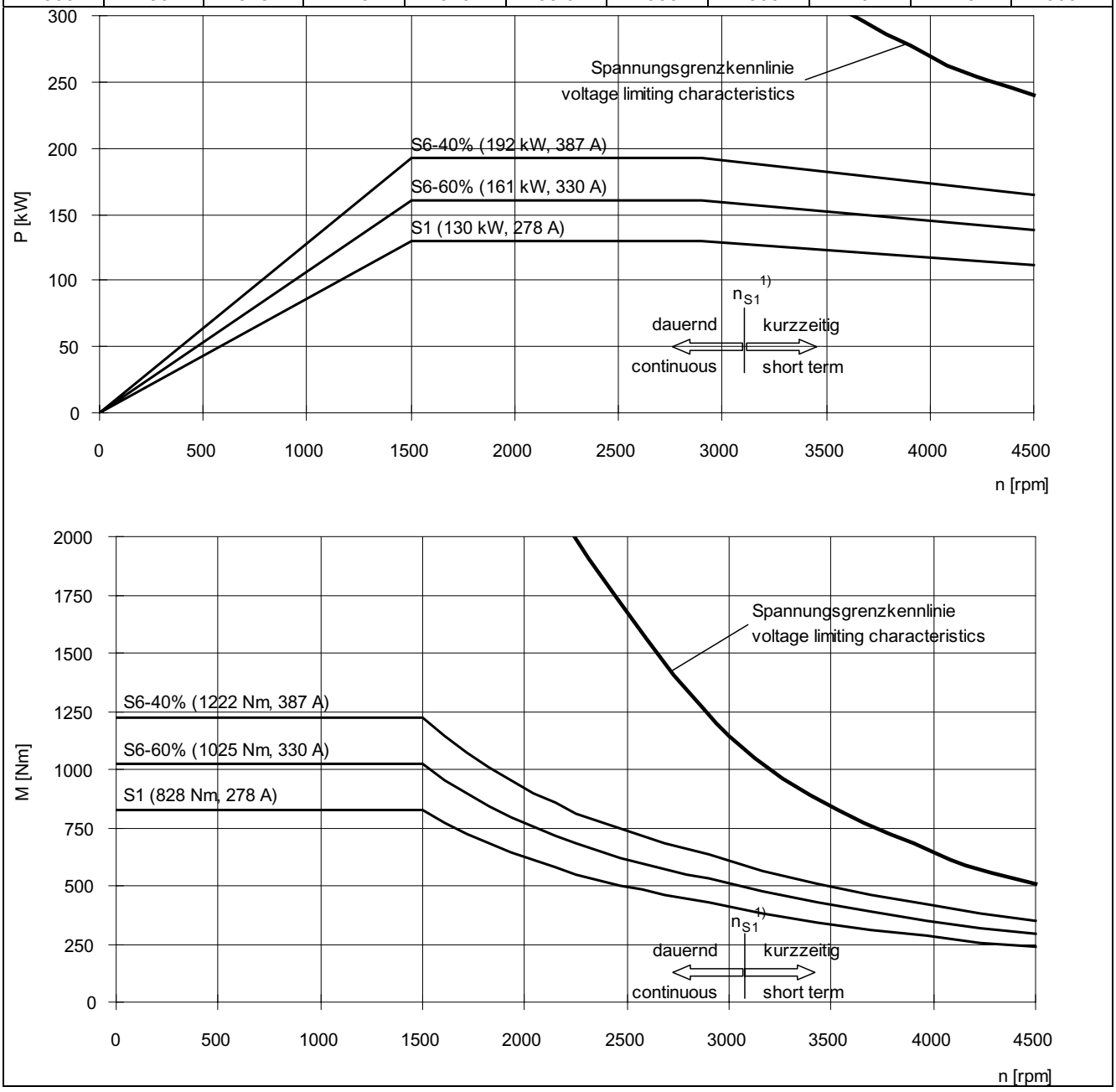


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 2700 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 80 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7226-□□F□□

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1500	130	828	278	340	50.6	2900	4500	40	120	560

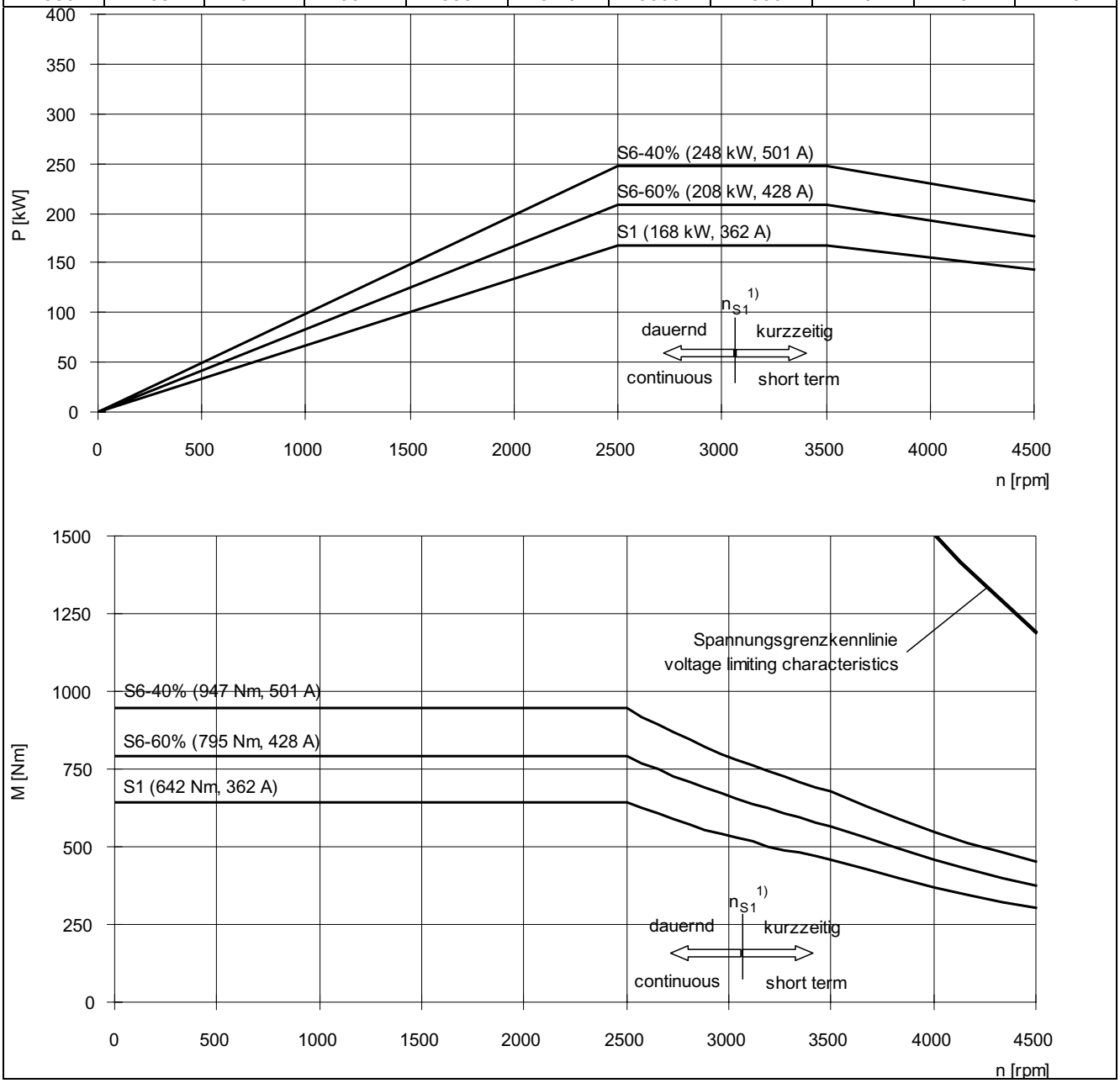


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 2700 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 81 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7226-□□L□□

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
2500	168	642	362	335	84.0	3500	4500	40	154	725

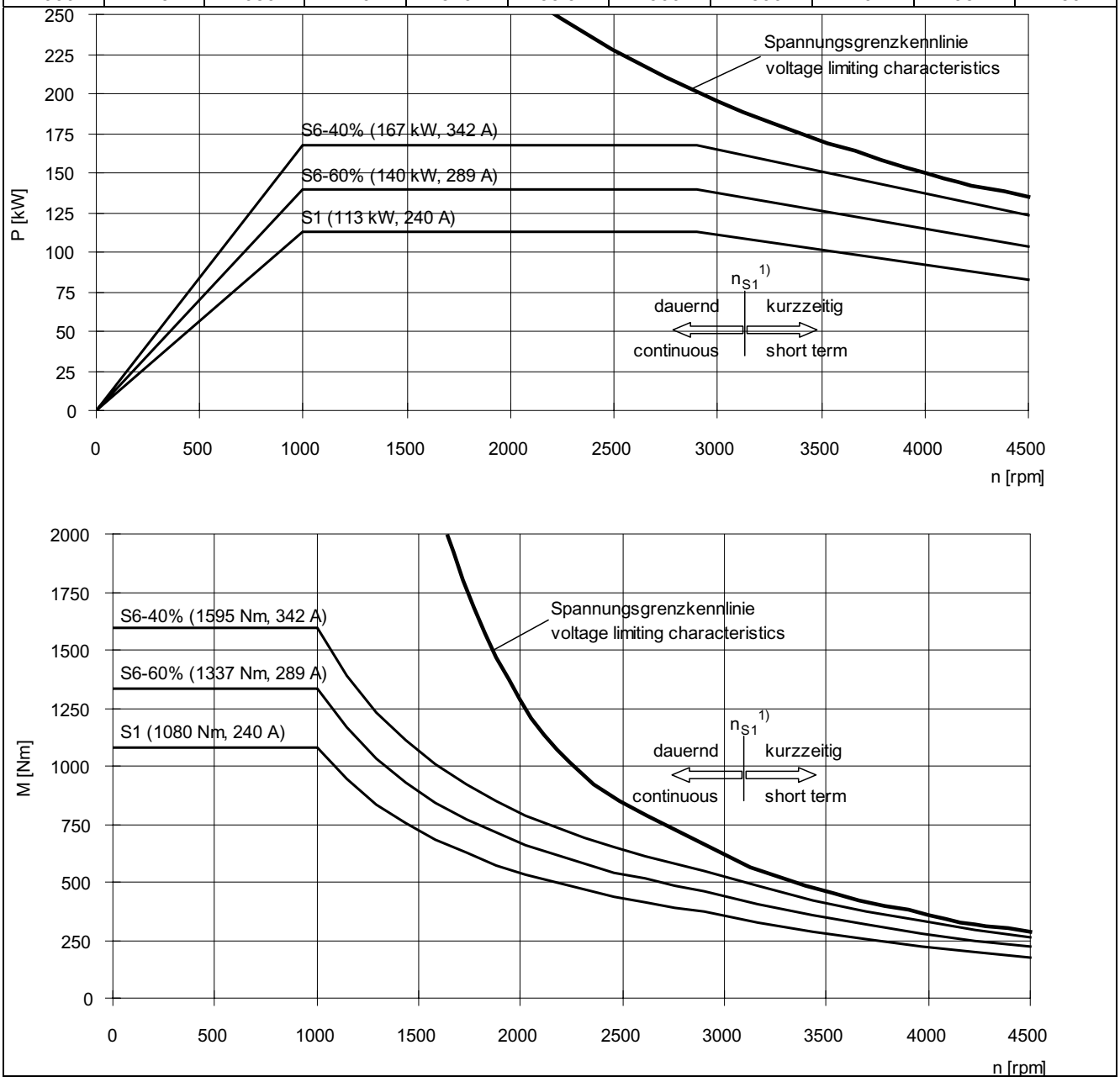


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 2700 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 82 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7228-□□D□□

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1000	113	1080	240	340	33.9	2900	4500	40	98	480

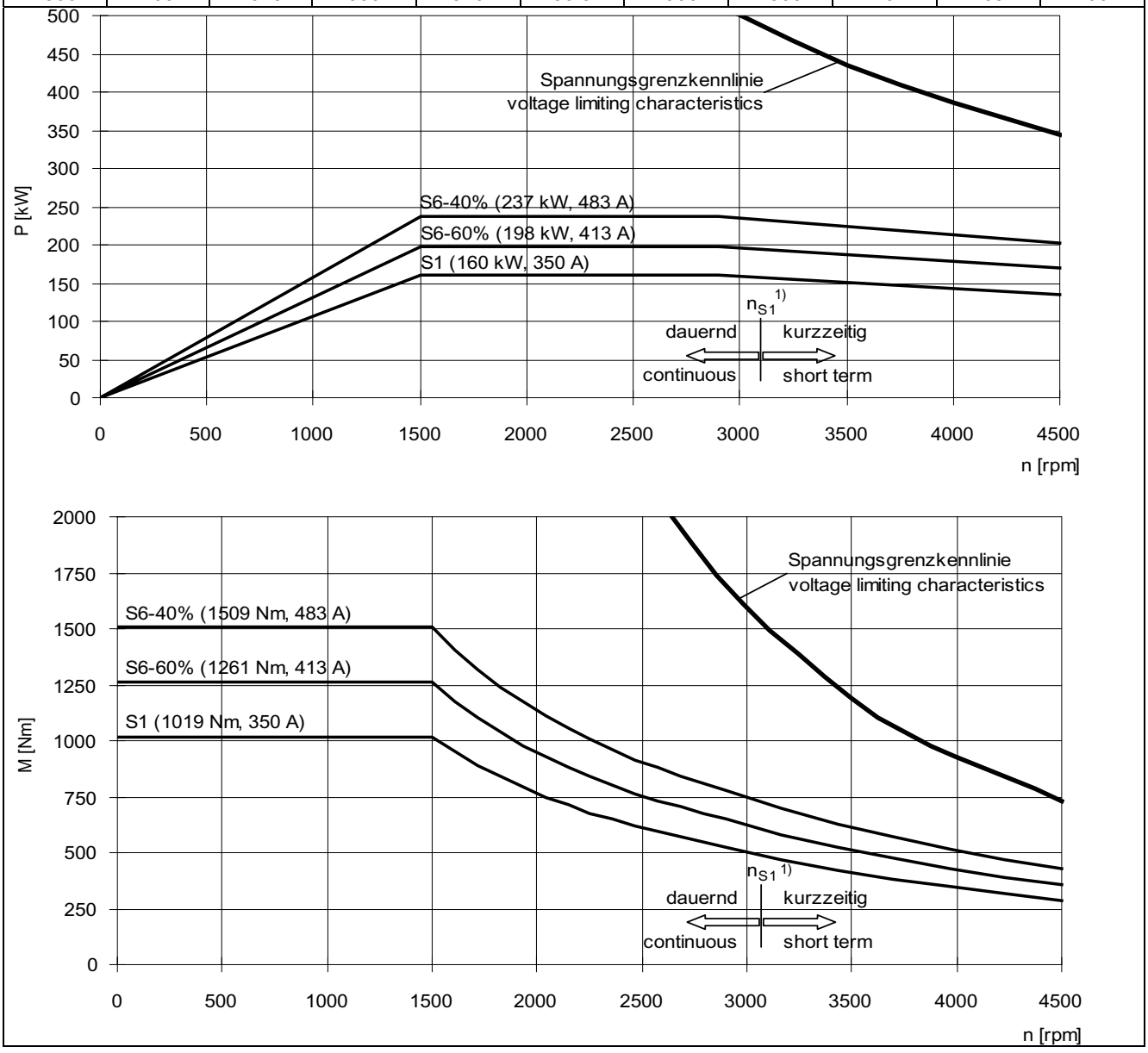


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 2700 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 83 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7228-□□F□□

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
1500	160	1019	350	340	50.5	2900	4500	40	169	700

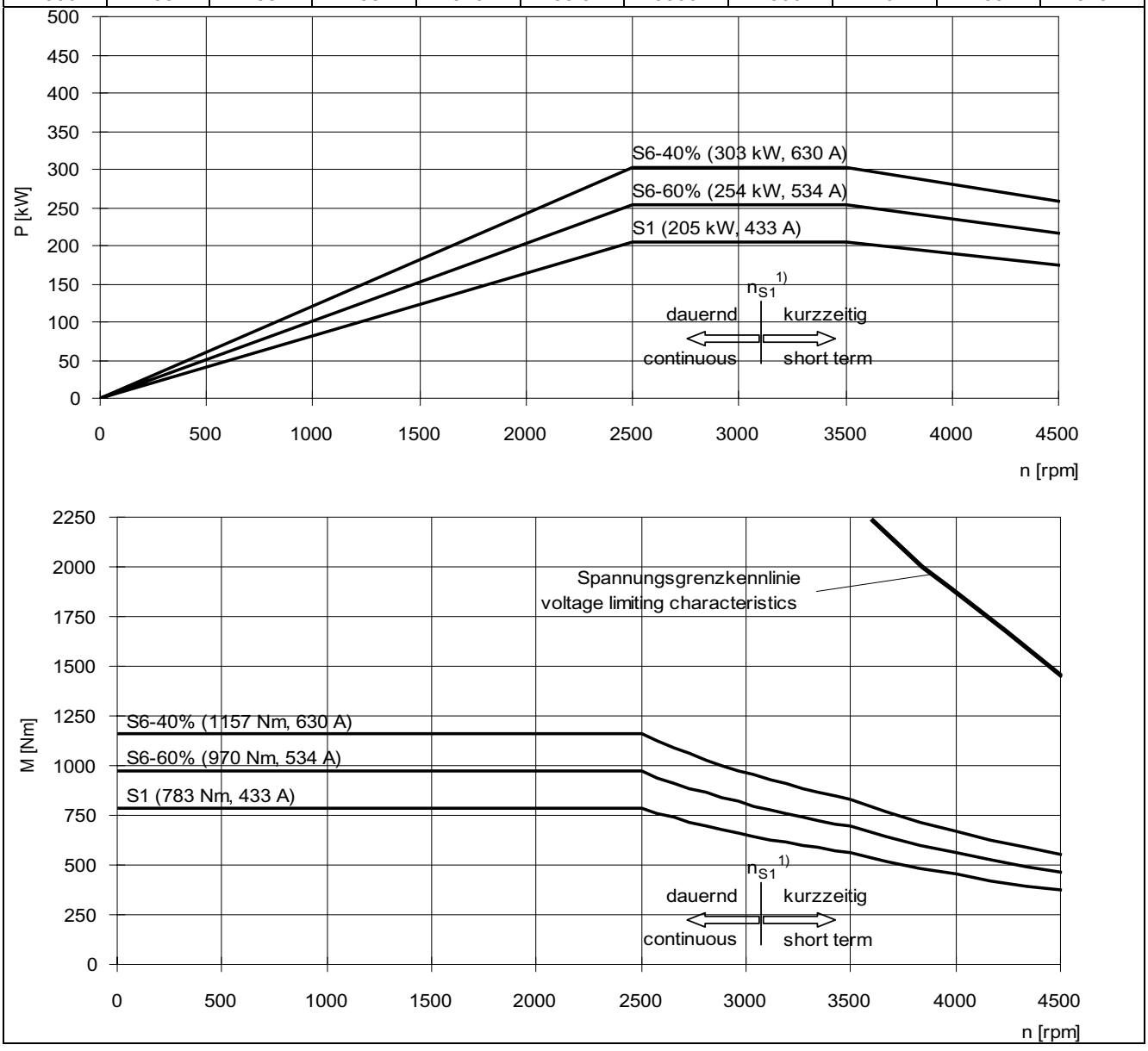


1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 2700 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

Table 4- 84 SINAMICS, 3-ph. 400 V AC, Servo Control (ALM), 1PH7228-□□L□□

n_N [rpm]	P_N [kW]	M_N [Nm]	I_N [A]	V_N [V]	f_N [Hz]	n_2 [rpm]	n_{max} [rpm]	T_{th} [min]	I_μ [A]	I_{max} [A]
2500	205	783	433	340	83.9	3500	4500	40	185	870



1) Only valid for bearing versions for coupling output/belt coupling.
For the bearing version "increased radial force" this limit is n = 2700 rpm.

Briefly: For continuous operation (with 30 % n_{max}, 60 % 2/3 n_{max}, 10 % standstill) for a duty cycle duration of 10 min.

4.5 Dimension drawings

CAD CREATOR

Using a configuration interface that is very easy to understand, CAD CREATOR allows you to quickly find

- technical data
- dimension drawings
- 2D/3D CAD data

and supports you when generating plant/system documentation regarding project-specific information and parts lists.

In the online version the data for motors, drives and CNC controllers are currently available to you. On the Intranet at http://www.siemens.com/cad-creator

Motors

- 1FK7, 1FT6, 1FT7, 1FE1 synchronous motors
- 1FW3 complete torque motors
- 1FK7, 1FK7 DYA, 1FT6, 1FT7 geared motors
- 1PH7, 1PH4, 1PL6, 1PH8 SH 355 induction motors
- 1PM4, 1PM6 induction motors
- 2SP1 spindle motors

SINAMICS S120

- Control Units
- Booksize Line Modules
- Line-side components
- Booksize Motor Modules
- DC link components
- Additional system components
- Encoder system connection
- MOTION-CONNECT connection system

SIMOTION D

- SIMOTION D410 DP, D410 PN, D425. D435, D445

SINUMERIK solution line

- Controllers
- Operator components for CNC controls

How up-to-date are the dimension drawings

Note

Siemens AG reserves the right to change the dimensions of the motors as part of mechanical design improvements without prior notice. This means that dimensions drawings can go out-of-date. Up-to-date dimension drawings can be requested at no charge from your local SIEMENS representative.

4.5.1 Dimension drawings IM B3

For motor			Dimensions in mm (in)															
Shaft height	Type	DIN IEC	a B	b A	c LA	e M	f AB	h H	k LB	k_1 –	m BA	m_1 –	m_2 –	n AA	p HD	s K	s_3 –	w_1 C
1PH7, type IM B3, forced ventilation																		
100	1PH7101		202.5 (7.97)	160 (6.30)	11 (0.43)	263 (10.35)	196 (7.72)	100 (3.94)	411 (16.18)	434 (17.09)	52 (2.05)	64 (2.52)	27 (1.06)	39 (1.54)	220 (8.66)	12 (0.47)	Pg 29	40 (1.57)
	1PH7103 1PH7105		297.5 (11.71)			358 (14.09)			506 (19.92)	529 (20.83)								
	1PH7107																	
132	1PH7131		265.5 (10.45)	216 (8.50)	14 (0.55)	341 (13.43)	260 (10.24)	132 (5.20)	538 (21.18)	561 (22.09)	63 (2.48)	75 (2.95)	33 (1.30)	52 (2.05)	275 (10.83)	12 (0.47)	Pg 36	50 (1.97)
	1PH7133 1PH7135		350.5 (13.80)			426 (16.77)			623 (24.53)	646 (25.43)								
	1PH7137																	
160	1PH7163		346.5 (13.64)	254 (10.00)	17 (0.67)	438 (17.24)	314 (12.36)	160 (6.30)	640 (25.20)	663 (26.10)	78 (3.07)	81 (3.19)	42 (1.65)	62 (2.44)	330 (12.99)	14 (0.55)	Pg 42	64 (2.52)
	1PH7167		406.5 (16.00)			498 (19.61)			700 (27.56)	723 (28.46)								

			DE shaft extension				
Shaft height	Type	DIN IEC	d D	d_6 –	l E	t GA	u F
100	1PH7101		38 (1.50)	M12	80 (3.15)	41 (1.61)	10 (0.39)
	1PH7103 1PH7105 1PH7107						
132	1PH7131		42 (1.65)	M16	110 (4.33)	45 (1.77)	12 (0.47)
	1PH7133 1PH7135 1PH7137						
160	1PH7163		55 (2.17)	M20	110 (4.33)	59 (2.32)	16 (0.63)
	1PH7167						

For deviating and additional dimensions for 1PH7 motors with DRIVE-CLiQ, see "1PH7 motors with DRIVE-CLiQ".

1PH710 .
1PH713 .
1PH716 .

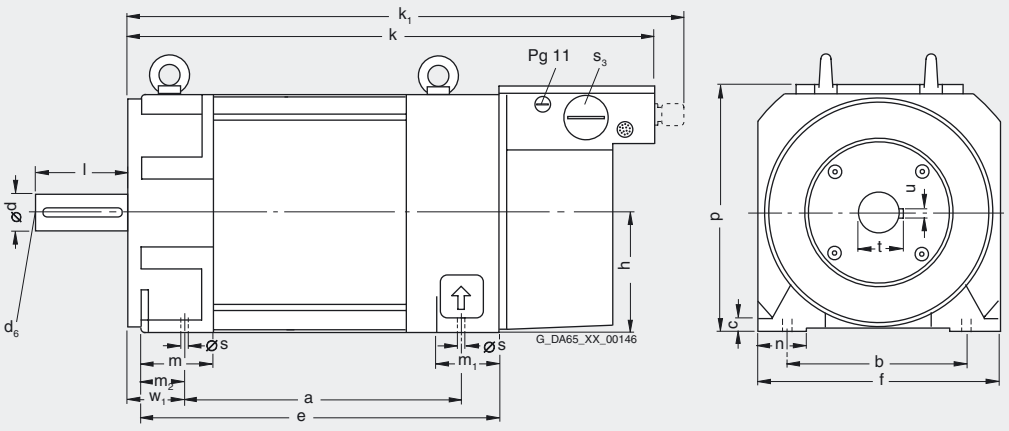
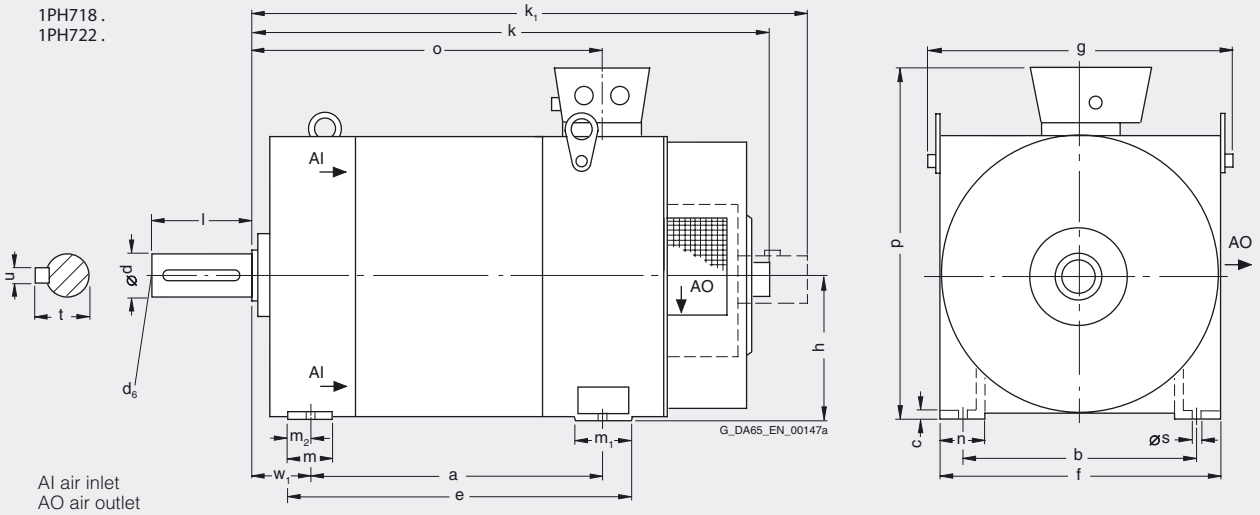


Figure 4-3 1PH7, type of construction IM B3, forced ventilation

For motor		Dimensions in mm (in)														
Shaft height	Type	DIN IEC	a B	b A	c LA	e M	f AB	g AC	h H	k LB	k_1 –	m BA	m_1 –	m_2 –	n AA	o –
1PH7, type IM B3, forced ventilation, air-flow direction DE to NDE																
180	1PH7184 1PH7186		430 (16.93) 520 (20.47)	279 (10.98)	14 (0.55)	510 (20.08) 600 (23.62)	360 (14.17)	408 (16.09)	180 (7.09)	835 (32.87) 925 (36.42)	–	60 (2.36)	120 (4.72)	35 (1.38)	65 (2.56)	541 (21.30) 631 (24.84)
225	1PH7224 1PH7226 1PH7228		445 (17.52) 545 (21.46) 635 (25.00)	356 (14.02)	18 (0.71)	530 (20.87) 630 (24.80) 720 (28.35)	450 (17.72)	498 (19.61)	225 (8.86)	–	1100 (43.31) 1200 (47.24) 1290 (50.79)	60 (2.36)	120 (4.72)	40 (1.57)	85 (3.35)	629 (24.76) 729 (28.70) 819 (32.24)

			Terminal box type 1XB7...			DE shaft extension						
			...322	...422	...700							
Shaft height	Type	DIN IEC	$p^{1)}$ HD	$p^{1)}$ HD	$p^{1)}$ HD	s K	w_1 C	d D	d_6 –	l E	t GA	u F
180	1PH7184		495 (19.49)	–	–	14.5 (0.57)	121 (4.76)	60 (2.36)	M20	140 (5.51)	64 (2.52)	18 (0.72)
	1PH7186			545 (21.46)	–			65 (2.56)			69 (2.72)	
225	1PH7224		595 (23.43)	645 (25.39)	680 (26.77)	18.5 (0.73)	149 (5.87)	75 (2.95)	M20	140 (5.51)	79.5 (3.13)	20 (0.79)
	1PH7226 1PH7228			–								

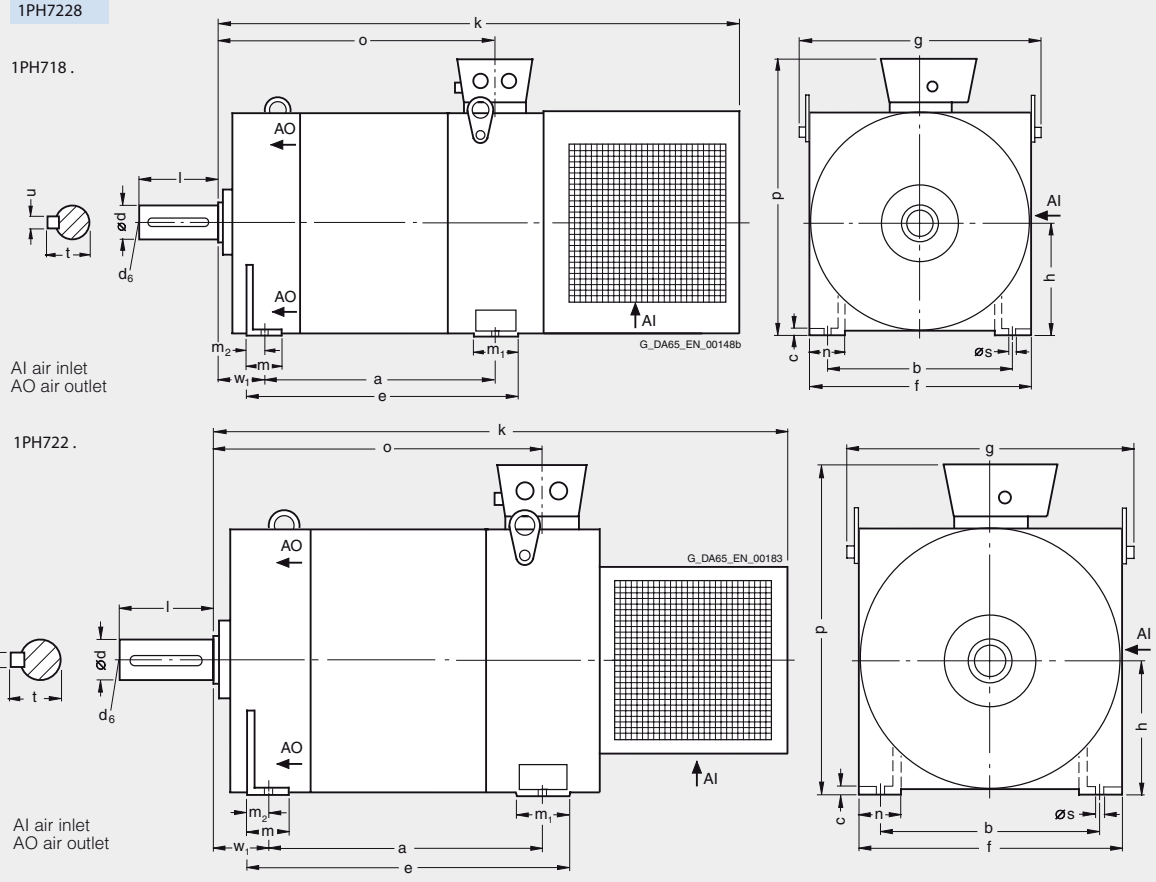


[1] Maximum dimensions, depending on electrical version (terminal box type).

Figure 4-4 1PH7, type of construction IM B3, forced ventilation, direction of air flow DE-NDE

For motor		Dimensions in mm (in)														Terminal box type 1XB7...		
																...322	...422	...700
Shaft height	Type	DIN IEC	a B	b A	c LA	e M	f AB	g AC	h H	k LB	m BA	m_1 –	m_2 –	n AA	o –	p[1] HD	p[1] HD	p[1] HD
1PH7, type IM B3, forced ventilation, air-flow direction NDE to DE																		
180	1PH7184		430 (16.93)	279 (10.98)	14 (0.55)	510 (20.08)	360 (14.17)	405 (15.94)	180 (7.09)	1010 (39.76)	60 (2.36)	120 (4.72)	35 (1.38)	65 (2.56)	541 (21.30)	495 (19.49)	–	–
	1PH7186		520 (20.47)			600 (23.62)				1100 (43.31)					631 (24.84)		560 (22.05)	–
225	1PH7224		445 (17.52)	356 (14.02)	18 (0.71)	530 (20.87)	450 (17.72)	498 (19.61)	225 (8.86)	1090 (42.91)	60 (2.36)	120 (4.72)	40 (1.57)	85 (3.35)	629 (24.76)	595 (23.43)	645 (25.39)	680 (26.77)
	1PH7226		545 (21.46)			630 (24.80)				1190 (46.85)					729 (28.70)			
	1PH7228		635 (25.00)			720 (28.35)				1280 (50.39)					819 (32.24)		–	

For motor			DE shaft extension						
Shaft height	Type	DIN IEC	s K	w_1 C	d D	d_6 –	l E	t GA	u F
180	1PH7184		14.5 (0.57)	121 (4.76)	60 (2.36)	M20	140 (5.51)	64 (2.52)	18 (0.71)
	1PH7186				65 (2.56)			69 (2.72)	
225	1PH7224		18.5 (0.73)	149 (5.87)	75 (2.95)	M20	140 (5.51)	79.5 (3.13)	20 (0.79)
	1PH7226 1PH7228								



[1] Maximum dimensions, depending on electrical version (terminal box type).

Figure 4-5 1PH7, type of construction IM B3, forced ventilation, direction of air flow DE-NDE

For motor		Dimensions in mm (in)														
Shaft height	Type	DIN IEC	a B	b A	c LA	e M	f AB	h H	k LB	k_1 –	m BA	m_1 –	m_2 –	n AA	o –	p HD
Type IM B3, with external fan unit, with pipe connection at NDE																
100	1PH7101 1PH7103 1PH7105 1PH7107		202.5 (7.97) 297.5 (11.71)	160 (6.30)	11 (0.43)	263 (10.35) 358 (14.09)	196 (7.72)	100 (3.94)	441 (17.36) 536 (21.10)	411 (16.18) 506 (19.92)	52 (2.05)	64 (2.52)	25 (0.98)	39 (1.54)	161 (6.34)	220 (8.66)
132	1PH7131 1PH7133 1PH7135 1PH7137		265.5 (10.45) 350.5 (13.80)	216 (8.50)	14 (0.55)	341 (13.43) 426 (16.77)	260 (10.24)	132 (5.20)	573 (22.56) 658 (25.91)	538 (21.18) 623 (24.53)	63 (2.48)	75 (2.95)	30 (1.18)	52 (2.05)	211.5 (8.33)	275 (10.83)
160	1PH7163 1PH7167		346.5 (13.64) 406.5 (16.00)	254 (10.00)	17 (0.67)	438 (17.24) 498 (19.61)	314 (12.36)	160 (6.30)	674 (26.54) 734 (28.90)	640 (25.20) 700 (27.56)	78 (3.07)	81 (3.19)	36 (1.42)	62 (2.44)	253 (9.96)	330 (12.99)

			DE shaft extension								
Shaft height	Type	DIN IEC	s K	s_3 –	v –	w_1 C	d D	d_6 –	l E	t GA	u F
100	1PH710 .		12 (0.47)	Pg 29	10.5 (0.41)	40 (1.57)	38 (1.50)	M12	80 (3.15)	41.3 (1.63)	10 (0.39)
132	1PH713 .		12 (0.47)	Pg 36	17 (0.67)	50 (1.97)	42 (1.65)	M16	110 (4.33)	45.3 (1.78)	12 (0.47)
160	1PH716 .		14 (0.55)	Pg 42	17 (0.67)	64 (2.52)	55 (2.17)	M20	110 (4.33)	56.3 (2.22)	16 (0.63)

For deviating and additional dimensions for 1PH7 motors with DRIVE-CLiQ, see "1PH7 motors with DRIVE-CLiQ".

1PH710 .
1PH713 .
1PH716 .

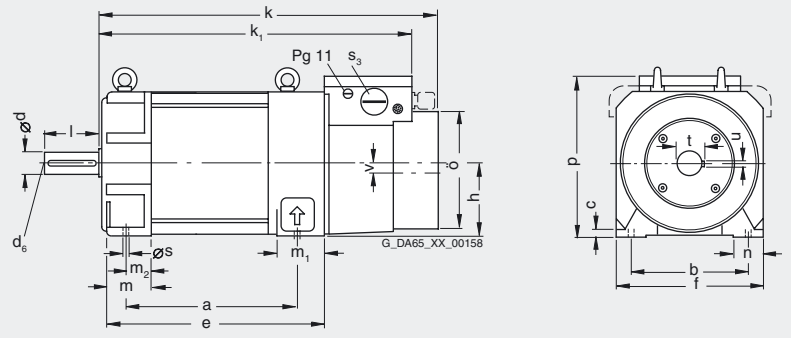
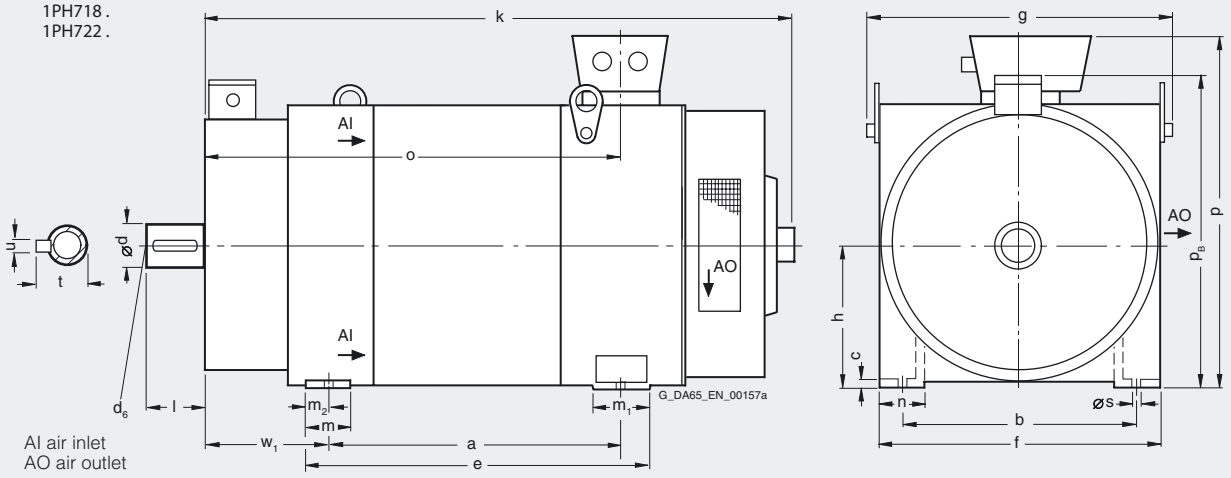


Figure 4-6 1PH7, type of construction IM B3, forced ventilation, with pipe connection, NDE

For motor		Dimensions in mm (in)														Terminal box type 1XB7...		
																...322	...422	...700
Shaft height	Type	DIN IEC	a B	b A	c LA	e M	f AB	g AC	h H	k LB	m BA	m_1 –	m_2 –	n AA	o –	$p^{1)}$ HD	$p^{1)}$ HD	$p^{1)}$ HD
Type IM B3, with external fan unit, with brake module, air-flow direction DE to NDE																		
180	1PH7184		430 (16.93)	279 (10.98)	14 (0.55)	510 (20.08)	360 (14.17)	408 (16.06)	180 (7.09)	945 (37.20)	60 (2.36)	120 (4.72)	35 (1.38)	65 (2.56)	644 (25.35)	495 (19.49)	–	–
	1PH7186		520 (20.47)			600 (23.62)				1035 (40.75)					734 (28.90)		560 (22.05)	–
225	1PH7224		445 (17.52)	356 (14.02)	18 (0.71)	530 (20.87)	450 (17.72)	498 (19.61)	225 (8.86)	1230 (48.43)	60 (2.36)	120 (4.72)	40 (1.57)	80 (3.15)	758 (29.84)	595 (23.43)	645 (25.39)	680 (26.77)
	1PH7226		545 (21.46)			630 (24.80)				1330 (52.36)					858 (33.78)			
	1PH7228		635 (25.00)			720 (28.35)				1420 (55.91)					948 (37.32)		–	

			DE shaft extension							
Shaft height	Type	DIN IEC	p_B –	s K	w_1 C	d D	d_6 –	l E	t GA	u F
180	1PH7184		390 (15.35)	14.5 (0.57)	224 (8.82)	90 (3.54)	M20	90 (3.54)	95 (3.74)	25 (0.98)
	1PH7186									
225	1PH7224		450 (17.72)	18.5 (0.73)	278 (10.94)	100 (3.94)	M20	100 (3.94)	106 (4.17)	28 (1.10)
	1PH7226									
	1PH7228									

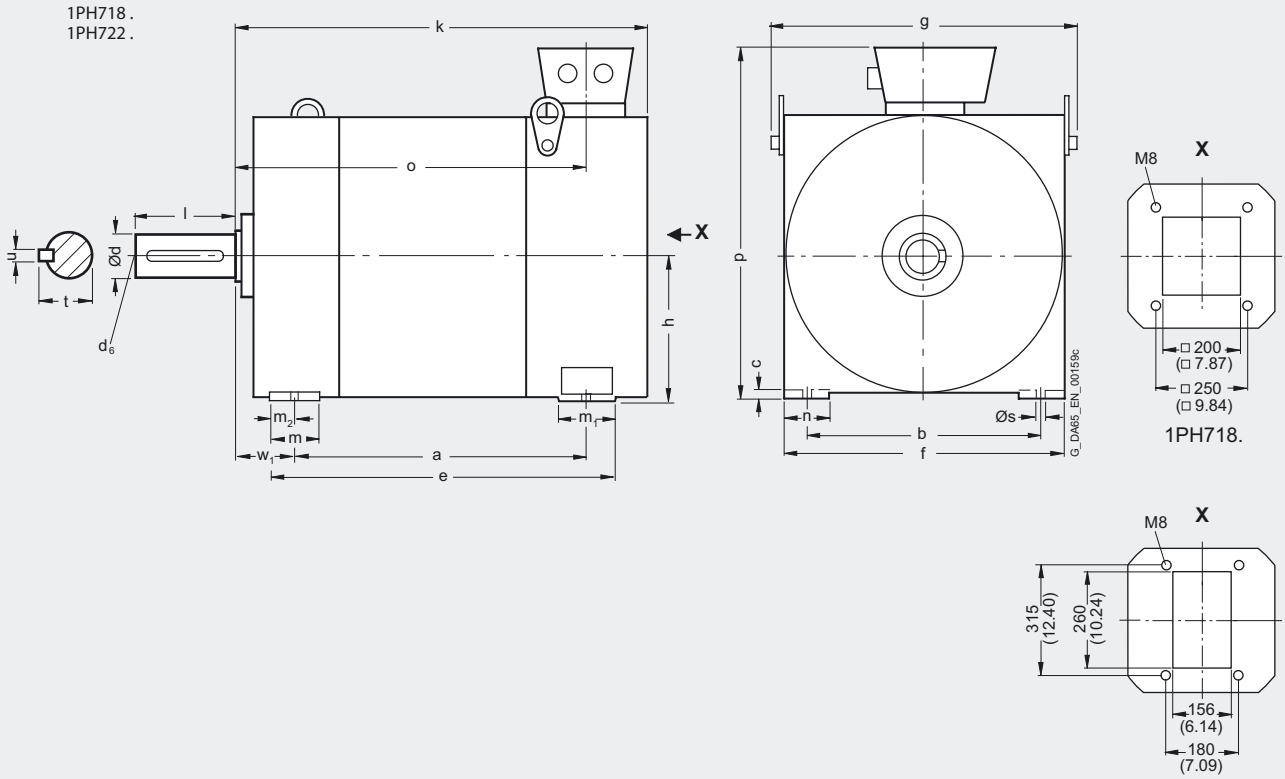


1) Maximum dimensions, depending on electrical version (terminal box type).

Figure 4-7 1PH7, type of construction IM B3, forced ventilation, with braking module, direction of air flow DE-NDE

For motor		Dimensions in mm (in)													
Shaft height	Type	DIN IEC	a B	b A	c LA	e M	f AB	g AC	h H	k LB	m BA	m_1 –	m_2 –	n AA	o –
Type IM B3, with external fan unit, with pipe connection at NDE															
180	1PH7184		430 (16.93)	279 (10.98)	14 (0.55)	510 (20.08)	360 (14.17)	408 (16.06)	180 (7.09)	830 (32.68)	60 (2.36)	120 (4.72)	35 (1.38)	65 (2.56)	541 (21.30)
	1PH7186		520 (20.47)			600 (23.62)				920 (36.22)					631 (24.84)
225	1PH7224		445 (17.52)	356 (14.02)	18 (0.71)	530 (20.78)	450 (17.72)	498 (19.61)	225 (8.86)	950 (37.40)	60 (2.36)	120 (4.72)	40 (1.57)	80 (3.15)	629 (24.76)
	1PH7226		545 (21.46)			630 (24.80)				1050 (41.34)					729 (28.70)
	1PH7228		635 (25.00)			720 (28.35)				1140 (44.88)					819 (32.24)

			Terminal box type 1XB7...					DE shaft extension				
			...322	...422	...700							
Shaft height	Type	DIN IEC	p[1] HD	p[1] HD	p[1] HD	s K	w_1 C	d D	d_6 –	l E	t GA	u F
180	1PH7184		495 (19.49)	–	–	14.5 (0.57)	121 (4.76)	60 (2.36)	M20	140 (5.51)	64 (2.52)	18 (0.71)
	1PH7186			560 (22.05)	–			65 (2.56)			69 (2.72)	
225	1PH7224		595 (23.43)	645 (25.39)	680 (26.77)	18.5 (0.73)	149 (5.87)	75 (2.95)	M20	140 (5.51)	79.5 (3.13)	20 (0.79)
	1PH7226 1PH7228			–								



[1] Maximum dimensions, depending on electrical version (terminal box type).

Figure 4-8 1PH7, type of construction IM B3, forced ventilation, with pipe connection, NDE

4.5.2 Dimension drawings IM B5

For motor		Dimensions in mm (in)													DE shaft extension					
Shaft height	Type	DIN IEC	a_1 P	b_1 N	c_1 LA	e_1 M	f AB	f_1 T	i_2 –	k LB	k_1 –	p HD	s_2 S	s_3 –	d D	d_6 –	l E	t GA	u F
1PH7, type IM B5, forced ventilation																				
100	1PH7101		250 (9.84)	180 (7.09)	10 (0.39)	215 (8.46)	196 (7.72)	4 (0.16)	80 (3.15)	411 (16.18)	434 (17.09)	218 (8.58)	14 (0.55)	Pg 29	**38 (1.50)**	M12	80 (3.15)	41 (1.61)	10 (0.39)
	1PH7103																		
	1PH7105									506 (19.92)	529 (20.83)								
	1PH7107																		
132	1PH7131		350 (13.78)	250 (9.84)	16 (0.63)	300 (11.81)	260 (10.24)	5 (0.20)	110 (4.33)	538 (21.18)	561 (22.09)	273 (10.75)	18 (0.71)	Pg 36	**42 (1.65)**	M16	110 (4.33)	45 (1.77)	12 (0.47)
	1PH7133																		
	1PH7135									623 (24.53)	646 (25.43)								
	1PH7137																		
For deviating and additional dimensions for 1PH7 motors with DRIVE-CLiQ, see "1PH7 motors with DRIVE-CLiQ".																				

1PH710 .
1PH713 .

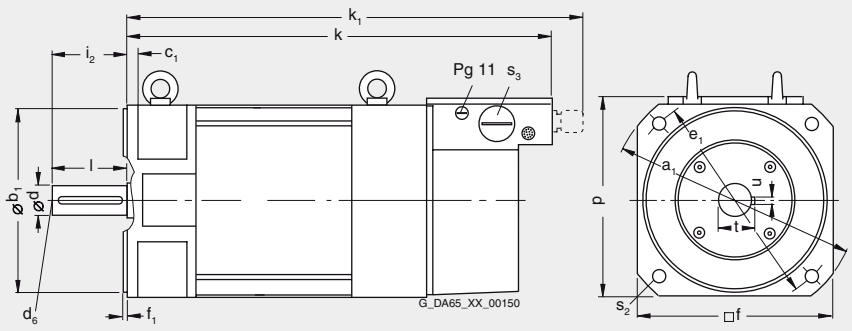


Figure 4-9 1PH7, type of construction IM B5, forced ventilation

For motor		Dimensions in mm (in)														
Shaft height	Type	DIN IEC	a_1 P	b_1 N	c_1 LA	e_1 M	f AB	f_1 T	i_2 –	k LB	k_1 –	o –	p HD	s_2 S	s_3 –	v –
Type IM B5, with external fan unit, with pipe connection at NDE																
100	1PH7101 1PH7103 1PH7105 1PH7107		250 (9.84)	180 (7.09)	10 (0.39)	215 (8.46)	196 (7.72)	4 (0.16)	80 (3.15)	441 (17.36) 536 (21.10)	411 (16.18) 506 (19.92)	161 (6.34)	120 (4.72)	14 (0.55)	Pg 29	10.5 (0.41)
132	1PH7131 1PH7133 1PH7135 1PH7137		350 (13.78)	250 (9.84)	16 (0.63)	300 (11.81)	260 (10.24)	5 (0.20)	110 (4.33)	573 (22.56) 658 (25.91)	538 (21.18) 623 (24.53)	211.5 (8.33)	143 (5.63)	18 (0.71)	Pg 36	17 (0.67)

		DE shaft extension				
Shaft height	Type	DIN IEC	d D	d_6 –	l E	t GA	u F
100	1PH7101 1PH7103 1PH7105 1PH7107		38 (1.50)	M12	80 (3.15)	41 (1.61)	10 (0.39)
132	1PH7131 1PH7133 1PH7135 1PH7137		42 (1.65)	M16	110 (4.33)	45 (1.77)	12 (0.47)

For deviating and additional dimensions for 1PH7 motors with DRIVE-CLiQ, see "1PH7 motors with DRIVE-CLiQ".

1PH710 .
1PH713 .

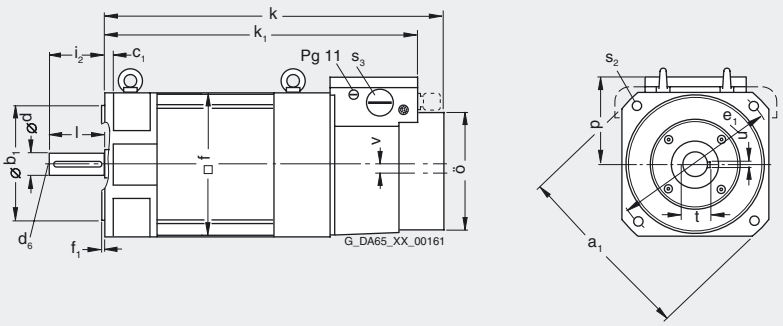


Figure 4-10 1PH7, type of construction IM B5, forced ventilation, with pipe connection, NDE

For motor		Dimensions in mm (in)															
Shaft height	Type	DIN IEC	a_1 P	b_1 N	c_1 LA	e_1 M	f AB	f_1 T	f_2 –	g_2 AB	g_3 T	i_2 –	k LB	k_1 –	p HD	s_2 S	s_3 S
Type IM B 5, with external fan unit, with brake module																	
100	1PH7101 1PH7103 1PH7105 1PH7107		250 (9.84)	180 (7.09)	13 (0.51)	215 (8.46)	196 (7.72)	4 (0.16)	220 (8.66)	149 (5.87)	224 (8.82)	80 (3.15)	541 (21.30) 636 (25.04)	564 (22.20) 659 (25.94)	120 (4.72)	14 (0.55)	Pg 29
132	1PH7131 1PH7133 1PH7135 1PH7137		–	250 (9.84)	18 (0.71)	300 (11.81)	260 (10.24)	5 (0.20)	278 (10.94)	174 (6.85)	269 (10.59)	110 (4.33)	700 (27.56) 785 (30.91)	723 (28.46) 808 (31.81)	143 (5.63)	18 (0.71)	Pg 36

		DE shaft extension					
Shaft height	Type	DIN IEC	d D	d_6 –	l E	t GA	u F
100	1PH7101 1PH7103 1PH7105 1PH7107		38 (1.50)	M12	80 (3.15)	1.61 (41)	0.39 (10)
132	1PH7131 1PH7133 1PH7135 1PH7137		42 (1.65)	M16	110 (4.33)	45 (1.77)	12 (0.47)

For deviating and additional dimensions for 1PH7 motors with DRIVE-CLiQ, see "1PH7 motors with DRIVE-CLiQ".

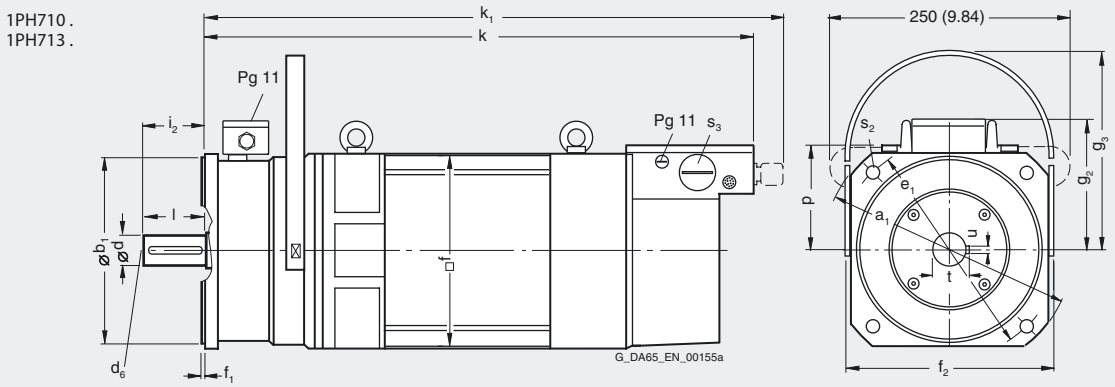


Figure 4-11 1PH7, type of construction IM B5, forced ventilation, with braking module

4.5.3 Dimension drawings IM B35

For motor		Dimensions in mm (in)																
Shaft height	Type	DIN IEC	a B	a_1 P	b A	b_1 N	c LA	e_1 M	f AB	f_1 T	h H	i_2 –	k LB	k_1 –	m BA	m_1 –	m_2 –	n AA	p HD
1PH7, type IM B35, forced ventilation																			
100	1PH7101 1PH7103		202.5 (7.97)	250 (9.84)	160 (6.30)	180 (7.09)	11 (0.43)	215 (8.46)	196 (7.72)	4 (0.16)	100 (3.94)	80 (3.15)	411 (16.18)	435 (17.13)	52 (2.05)	64 (2.52)	27 (1.06)	39 (1.54)	220 (8.66)
	1PH7105 1PH7107		297.5 (11.71)										506 (19.92)	529 (20.83)					
132	1PH7131 1PH7133		265.5 (10.45)	350 (13.78)	216 (8.50)	250 (9.84)	14 (0.55)	300 (11.81)	260 (10.24)	5 (0.20)	132 (5.20)	110 (4.33)	538 (21.18)	561 (22.09)	63 (2.48)	75 (2.95)	33 (1.30)	52 (2.05)	275 (10.83)
	1PH7135 1PH7137		350.5 (13.80)										623 (24.53)	646 (25.43)					
160	1PH7163		346.5 (13.64)	400 (15.75)	254 (10.00)	300 (11.81)	17 (0.67)	350 (13.78)	314 (12.36)	5 (0.20)	160 (6.30)	110 (4.33)	640 (25.20)	663 (26.10)	78 (3.07)	81 (3.19)	42 (1.65)	62 (2.44)	330 (12.99)
	1PH7167		406.5 (16.00)										700 (27.56)	723 (28.46)					

			DE shaft extension										
Shaft height	Type	DIN IEC	n AA	p HD	s K	s_2 S	s_3 –	w_1 C	d D	d_6 –	l E	t GA	u F
100	1PH7101 1PH7103 1PH7105 1PH7107		39 (1.54)	220 (8.66)	12 (0.47)	14 (0.55)	Pg 29	40 (1.57)	38 (1.50)	M12	80 (3.15)	41 (1.61)	10 (0.39)
132	1PH7131 1PH7133 1PH7135 1PH7137		52 (2.05)	275 (10.83)	12 (0.47)	18 (0.71)	Pg 36	50 (1.97)	42 (1.65)	M16	110 (4.33)	45 (1.77)	12 (0.47)
160	1PH7163 1PH7167		62 (2.44)	330 (12.99)	14 (0.47)	18 (0.71)	Pg 42	64 (2.52)	55 (2.17)	M20	110 (4.33)	59 (2.32)	16 (0.63)

For deviating and additional dimensions for 1PH7 motors with DRIVE-CLiQ, see "1PH7 motors with DRIVE-CLiQ".

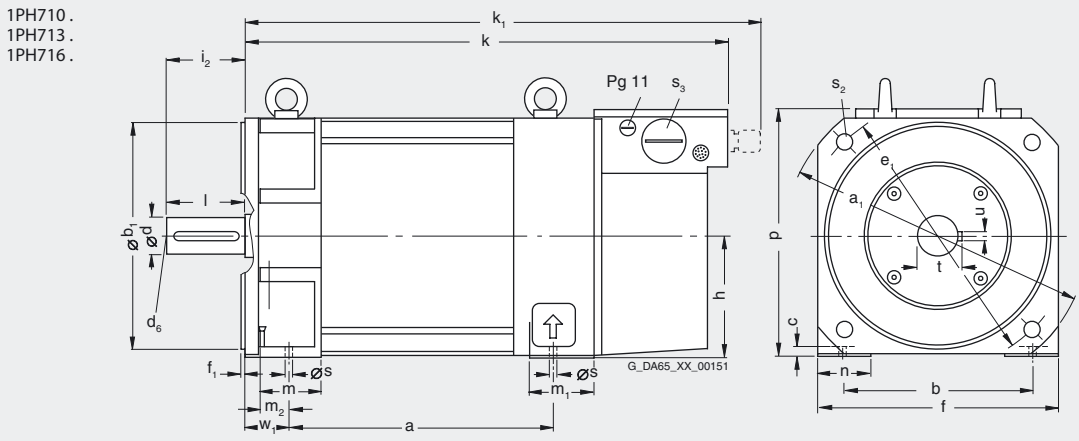
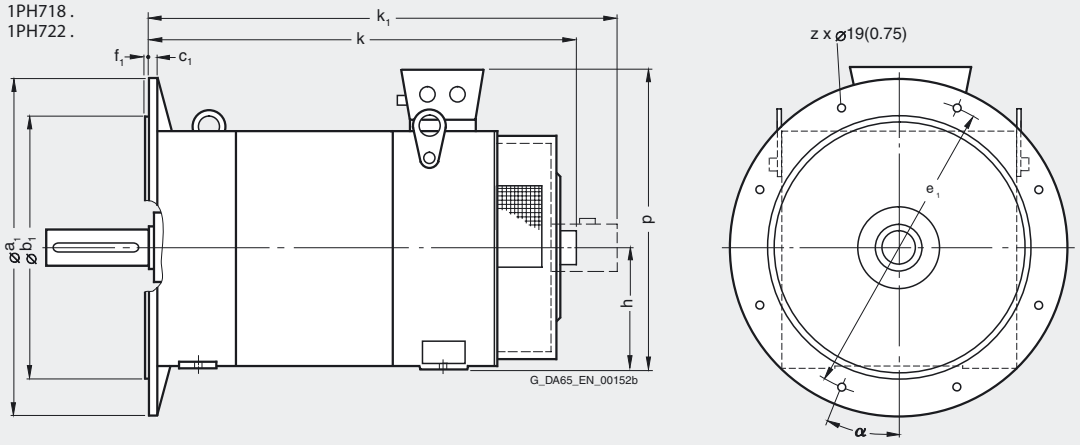


Figure 4-12 1PH7, type of construction IM B35, forced ventilation

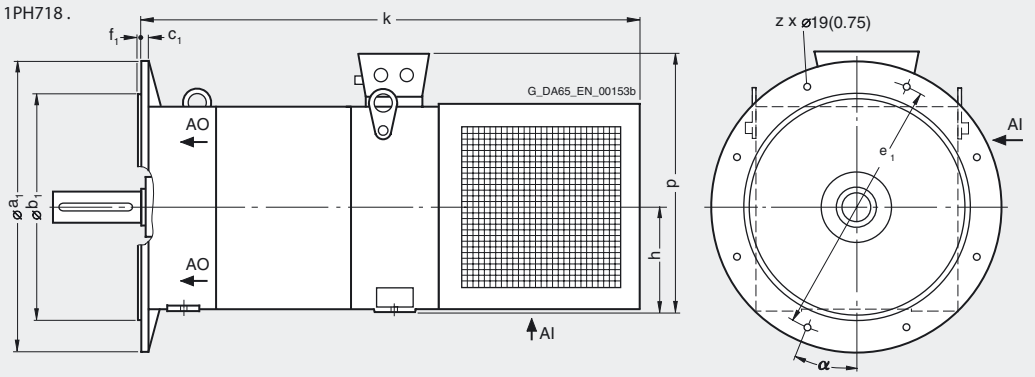
For motor		Dimensions in mm (in)									For dimensions of the shaft and terminal box foot installation, see dimension drawing of 1PH718. and 1PH722. motors type IM B3. Terminal box type 1XB7...				
Shaft height	Type	DIN IEC	a_1 P	b_1 N	c_1 LA	e_1 M	f_1 T	h H	k LB	k_1 –	...322 p [1]	...422 p [1]	...700 p [1]	z –	α –
1PH7, type IM B35, forced ventilation, air-flow direction DE to NDE															
180	1PH7184 [2]		400 (15.75)	300 (11.81)	15 (0.59)	350 (13.78)	5 (0.20)	180 (7.09)	835 (32.87)	–	495 (19.49)	–	–	4	45°
	1PH7184 [2]		450 (17.72)	350 (13.78)	16 (0.63)	400 (15.75)			835 (32.87)			–	–	8	22.5°
	1PH7186								925 (36.42)			560 (22.05)	–		
225	1PH7224		550 (21.65)	450 (17.72)	18 (0.71)	500 (19.69)	5 (0.20)	225 (8.86)	–	1100 (43.31)	595 (23.43)	645 (25.39)	680 (26.77)	8	22.5°
	1PH7226									1200 (47.24)					
	1PH7228									1290 (50.79)		–			



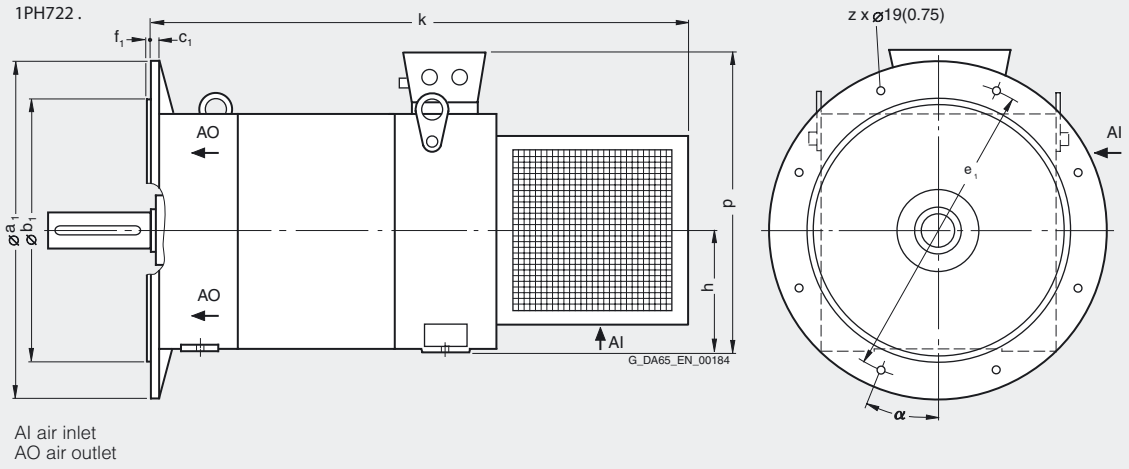
[1] Maximum dimensions, depending on electrical version (terminal box type).
[2] See Order No. supplement for shaft heights 180 and 225.

Figure 4-13 1PH7, type of construction IM B35, forced ventilation, direction of air flow DE-NDE

For motor		Dimensions in mm (in)								For dimensions of the shaft and terminal box foot installation, see dimension drawing of 1PH718. and 1PH722. motors type IM B3. Terminal box type 1XB7...				
Shaft height	Type	DIN IEC	a_1 P	b_1 N	c_1 LA	e_1 M	f_1 T	h H	k LB	...322 p [1]	...422 p [1]	...700 p [1]	z –	α –
1PH7, type IM B35, forced ventilation, air-flow direction NDE to DE														
180	1PH7184 [2]		400 (15.75)	300 (11.81)	15 (0.59)	350 (13.78)	5 (0.20)	180 (7.09)	1010 (39.76)	495 (19.49)	–	–	4	45°
	1PH7184 [2]		450 (17.72)	350 (13.78)	16 (0.63)	400 (15.75)			1010 (39.76)		–	–	8	22.5°
	1PH7186								1100 (43.31)		560 (22.05)	–		
225	1PH7224		550 (21.65)	450 (17.72)	18 (0.71)	500 (19.69)	5 (0.20)	225 (8.86)	1090 (42.91)	595 (23.43)	645 (25.39)	680 (26.77)	8	22.5°
	1PH7226								1190 (46.85)					
	1PH7228								1280 (50.39)		–			



AI air inlet
AO air outlet



AI air inlet
AO air outlet

[1] Maximum dimensions, depending on electrical version (terminal box type).
[2] See Order No. supplement for shaft heights 180 and 225.

Figure 4-14 1PH7, type of construction IM B35, forced ventilation, direction of air flow NDE-DE

For motor		Dimensions in mm (in)															
Shaft height	Type	DIN IEC	a B	a_1 P	b A	b_1 N	c LA	c_1 –	e_1 –	f AB	f_1 T	h H	k LB	k_1 –	m BA	m_1 –	m_2 –
Type IM B35, with external fan unit, with pipe connection at NDE																	
100	1PH7101 1PH7103 1PH7105 1PH7107		202.5 (7.97) 297.5 (11.71)	250 (9.84)	160 (6.30)	180 (7.09)	11 (0.43)	13 (0.51)	215 (8.46)	196 (7.72)	4 (0.16)	100 (3.94)	441 (17.36) 536 (21.10)	411 (16.18) 506 (19.92)	52 (2.05)	64 (2.52)	25 (0.98)
132	1PH7131 1PH7133 1PH7135 1PH7137		265.5 (10.45) 350.5 (13.80)	350 (13.78)	216 (8.50)	250 (9.84)	14 (0.55)	17 (0.67)	300 (11.81)	260 (10.24)	5 (0.20)	132 (5.20)	573 (22.56) 658 (25.91)	538 (21.18) 623 (24.53)	63 (2.48)	75 (2.95)	30 (1.18)
160	1PH7163 1PH7167		346.5 (13.64) 406.5 (16.00)	400 (15.75)	254 (10.00)	300 (11.81)	17 (0.67)	22 (0.87)	350 (13.78)	314 (12.36)	5 (0.20)	160 (6.30)	674 (26.54) 734 (28.90)	640 (25.20) 700 (27.56)	78 (3.07)	81 (3.19)	36 (1.42)

											DE shaft extension					
Shaft height	Type	DIN IEC	n AA	o –	p HD	s K	s_2 K	s_3 –	v –	w_1 C	d D	d_6 –	l E	t GA	u F	
100	1PH710.		39 (1.54)	161 (6.34)	220 (8.66)	12 (0.47)	14 (0.55)	Pg 29	10.5 (0.41)	40 (1.57)	38 (1.50)	M12	80 (3.15)	41 (1.61)	10 (0.39)	
132	1PH713.		52 (2.05)	211.5 (8.33)	275 (10.83)	12 (0.47)	18 (0.71)	Pg 36	17 (0.67)	50 (1.97)	42 (1.65)	M16	110 (4.33)	45 (1.77)	12 (0.47)	
160	1PH716.		62 (2.44)	253 (9.96)	330 (12.99)	14 (0.55)	18 (0.71)	Pg 42	17 (0.67)	64 (2.52)	55 (2.17)	M20	110 (4.33)	59 (2.32)	16 (0.63)	

For deviating and additional dimensions for 1PH7 motors with DRIVE-CLiQ, see "1PH7 motors with DRIVE-CLiQ".

1PH710.
1PH713.
1PH716.

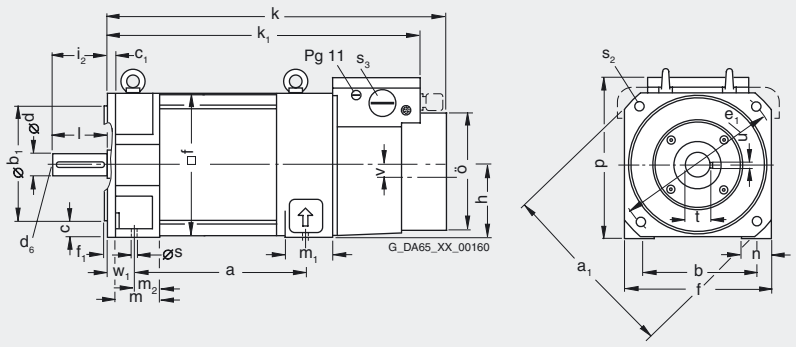


Figure 4-15 1PH7, type of construction IM B35, forced ventilation, with pipe connection, NDE

For motor		Dimensions in mm (in)														
Shaft height	Type	DIN IEC	a B	a_1 P	b A	b_1 N	c LA	e_1 M	f AB	f_1 T	f_2 –	g_2 –	g_3 –	h H	i_2 –	k LB	k_1 –
Type IM B 35, with external fan unit, with brake module																	
100	1PH7101 1PH7103		202.5 (7.97)	250 (9.84)	160 (6.30)	180 (7.09)	11 (0.43)	215 (8.46)	196 (7.72)	4 (0.16)	220 (8.66)	149 (5.87)	224 (8.82)	100 (3.94)	80 (3.15)	541 (21.30)	564 (22.20)
	1PH7105 1PH7107		297.5 (11.71)													636 (25.04)	659 (25.94)
132	1PH7131 1PH7133		265.5 (10.45)	–	216 (8.50)	250 (9.84)	14 (0.55)	300 (11.81)	260 (10.24)	5 (0.20)	278 (10.94)	174 (6.85)	269 (10.59)	132 (5.20)	110 (4.33)	700 (27.56)	723 (28.46)
	1PH7135 1PH7137		350.5 (13.80)													785 (30.91)	808 (31.81)
160	1PH7163		346.5 (13.64)	400 (15.75)	254 (10.00)	300 (11.81)	17 (0.67)	350 (13.78)	314 (12.36)	5 (0.20)	327 (12.87)	199 (7.83)	328 (12.91)	160 (6.30)	110 (4.33)	808 (31.81)	831 (32.72)
	1PH7167		406.5 (16.00)													868 (34.17)	891 (35.08)

												DE shaft extension				
Shaft height	Type	DIN IEC	m BA	m_1 –	m_2 –	n AA	p –	s K	s_2 –	s_3 –	w_1 C	d D	d_6 –	l E	t GA	u F	
100	1PH7101 1PH7103 1PH7105 1PH7107		52 (2.05)	64 (2.52)	27 (1.06)	39 (1.54)	220 (8.66)	12 (0.47)	14 (0.55)	Pg 29	170 (6.69)	**38 (1.50)**	M12	80 (3.15)	41 (1.61)	10 (0.39)	
132	1PH7131 1PH7133 1PH7135 1PH7137		63 (2.48)	75 (2.95)	33 (1.30)	52 (2.05)	275 (10.83)	12 (0.47)	18 (0.71)	Pg 36	212 (8.35)	**42 (1.65)**	M16	110 (4.33)	45 (1.77)	12 (0.47)	
160	1PH7163 1PH7167		78 (3.07)	81 (3.19)	42 (1.65)	62 (2.44)	330 (12.99)	14 (0.55)	18 (0.71)	Pg 42	232 (9.13)	**55 (2.17)**	M20	110 (4.33)	59 (2.32)	16 (0.63)	

For deviating and additional dimensions for 1PH7 motors with DRIVE-CLiQ, see "1PH7 motors with DRIVE-CLiQ".

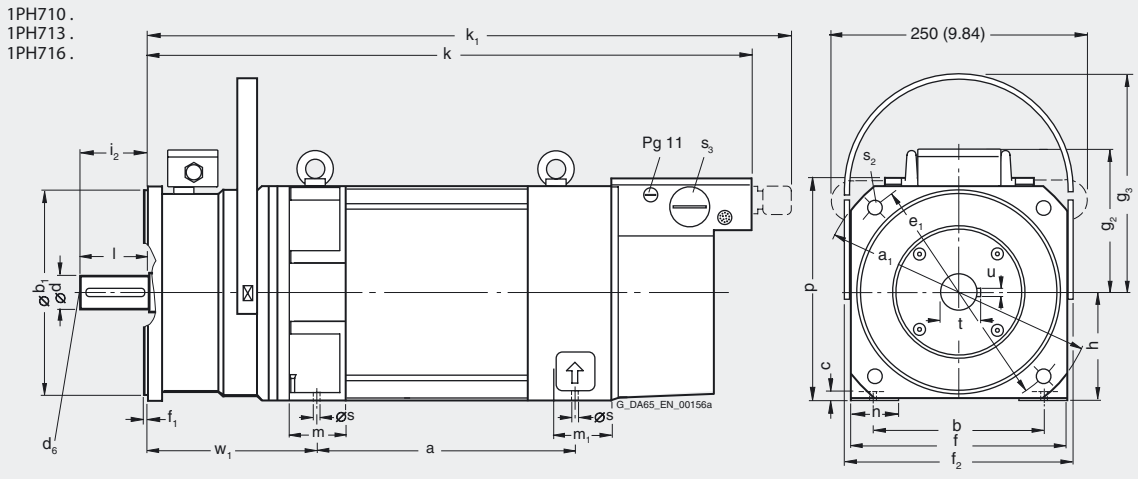


Figure 4-16 1PH7, type of construction IM B35, forced ventilation, with braking module

4.5.4 1PH7 motors with DRIVE-CLiQ, deviating and additional dimensions

For motor		Dimensions in mm (in)					
Shaft height	Type	DIN IEC	k LB	k_1 –	p_1 –	x –	y –
Deviating and additional dimensions for 1PH7 motors with DRIVE-CLiQ to those given in dimension tables 1PH7, forced ventilation							
100	1PH7101		411 (16.18)	453 (17.83)	81 (3.19)	52.5 (2.07)	63.5 (2.50)
	1PH7103 1PH7105		506 (19.92)	548 (21.57)			
	1PH7107						
132	1PH7131		538 (21.18)	580 (22.83)	103.5 (4.07)	66 (2.60)	63.5 (2.50)
	1PH7133 1PH7135		623 (24.53)	665 (26.18)			
	1PH7137						
160	1PH7163		640 (25.20)	682 (26.85)	127 (5.00)	75 (2.95)	63.5 (2.50)
	1PH7167		700 (27.56)	742 (29.21)			

1PH710 .
1PH713 .
1PH716 .

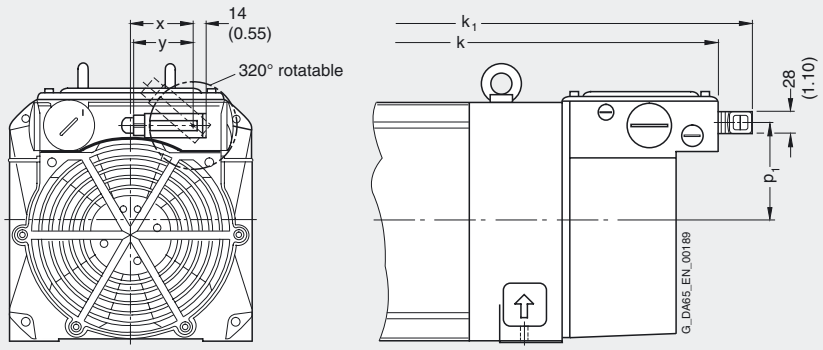


Figure 4-17 Deviating and additional dimensions for 1PH7 motors with DRIVE-CLiQ to those given in dimension tables 1PH7, forced ventilation

Motor components (options) 5

5.1 Thermal motor protection

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

The sensor is evaluated in the converter whose closed-loop control takes into account the temperature characteristic of the motor winding. When a fault occurs, an appropriate message is output at the converter. When the motor temperature increases, a message "Alarm motor overtemperature" is output; this must be externally evaluated. If this message is ignored, the converter shuts down with the appropriate fault message after a preset time period or when the motor limiting temperature or the shutdown temperature is exceeded.

⚠ WARNING

Sufficient protection is no longer provided for thermally critical load situations, e.g. for a high overload condition at motor standstill. In this case, other protective measures must be provided, e.g. a thermal overcurrent relay. The "thermal motor model i2t monitoring" function must be activated in the converter.

The temperature sensor is part of a SELV circuit, which can be destroyed if a high voltage is applied. The temperature sensor is designed so that the DIN/EN requirement for "protective separation" is fulfilled.

5.2 Encoder (option)

The encoder is selected in the motor Order No. (MLFB) using the appropriate letter at the 9th position.

Note

The letter ID at the 9th position of the Order No. (MLFB) differs for motors with and without DRIVE-CLiQ.

Table 5- 1 Encoder types for motors without DRIVE-CLiQ

Encoder type	9th position of the Order No. (MLFB)
Without encoder	A
Absolute encoder 2048 S/R singleturn, 4096 revolutions multiturn, with EnDat interface (AM2048S/R encoder)	E
Incremental encoder, sin/cos 1 Vpp, 2048 S/R with C and D tracks (encoder IC2048S/R)	M
Incremental encoder sin/cos 1 Vpp 2048 S/R with C and D tracks (encoder IN2048S/R)	N

Table 5- 2 Encoder types for motors with DRIVE-CLiQ

Encoder type	9th position of the Order No. (MLFB)
Incremental encoder 22 bit (resolution 4194304, internal 2048 S/R) + commutating position 11 bit (encoder IC22DQ)	D
Absolute encoder 22 bit singleturn (resolution 4194304, internal 2048 S/R) + 12 bit multiturn (traversing range 4096 revolutions) (encoder AM22DQ)	F
Incremental encoder 22 bit (resolution 4194304, internal 2048 S/R), without commutating position (encoder IN19DQ)	Q

5.2.1 Incremental encoder sin/cos 1Vpp

Function:

- Angular measuring system for the commutation
- Speed actual value sensing
- Indirect incremental measuring system for the position control loop
- One zero pulse (reference mark) per revolution

Table 5- 3 Properties and technical data

Properties	**Incremental encoder sin/cos 1 Vpp (IC2048S/R encoder and IN2048S/R encoder)**
Coupling	At NDE, for SH 180 and 225, integrated in the motor
Max. limit speed	12000 rpm
Operating voltage	5 V ± 5 %
Current consumption	Max. 150 mA
A-B track: Resolution, incremental (sin/cos periods per revolution)	2048 S/R (1 Vpp)
C-D track: Rotor position (sin/cos periods per revolution), only for IC2048S/R encoder	1 S/R (1 Vpp)
Reference signal	1 per revolution
Angular error	± 40"

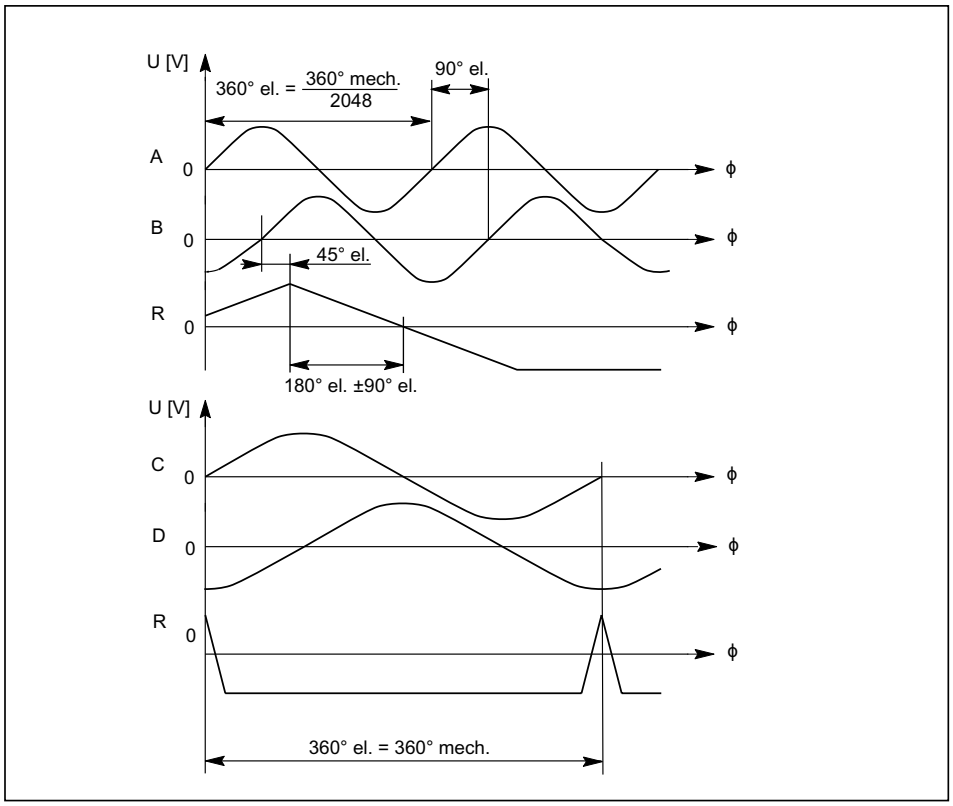


Figure 5-1 Signal sequence and assignment for a positive direction of rotation

5.2.2 Absolute encoder (EnDat)

Function:

- Angular measuring system for the commutation
- Speed actual value sensing
- Indirect measuring system for absolute position determination within one revolution
- Indirect measuring system for absolute position determination within a traversing range of 4096 revolutions
- Indirect incremental measuring system for the position control loop

Table 5- 4 Properties and technical data

Properties	Absolute encoder EnDat (AM2048S/R encoder)
Coupling	At NDE, for SH 180 and 225, integrated in the motor
Operating voltage	+5 V ± 5 %
Current consumption	max. 300 mA
Absolute resolution (singleturn)	8192
Traversing range (multiturn)	4096 revolutions
A-B track: Resolution, incremental (sin/cos periods per revolution)	2048 S/R (1 Vpp)
Angular error	±40"
Serial absolute position interface	EnDat 2.1

5.3 Radial sealing ring

For mounting a ZF gearbox, a radial shaft sealing ring according to DIN 3760 is optionally installed in the motor at the DE.

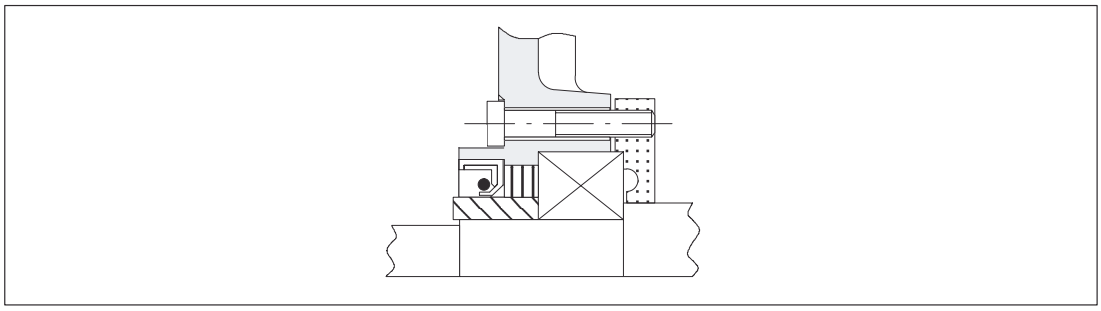


Figure 5-2 Radial sealing ring

The sealing lip must be adequately cooled and lubricated using the gearbox oil to guarantee reliable and safe functioning of the radial shaft sealing ring.

Note

Radial shaft sealing rings are seals that are in constant contact. This is the reason that they are subject to wear and generate heat due to friction.

Sealing ring wear can only be reduced using adequate lubrication and ensuring that the sealing location is clean. In this case, the lubricant also acts as a cooling medium and supports the dissipation of heat caused by friction from the sealing location.

If a radial shaft sealing ring runs dry, then this has a significant negative impact on the functionality and the lifetime.

Degree of protection

1PH7 motors with radial shaft sealing ring have, on the flange side, degree of protection IP65. This means that the sealing effect is only guaranteed when the appropriate liquid is sprayed onto it. Liquid must be prevented from collecting at the DE as well as jets of oil. Otherwise, a higher degree of protection is required or additional measures must be taken.

Note

The complex interaction between the sealing ring, shaft and liquid to be sealed as well as the application conditions (heat due to friction, accumulated dirt etc.) make it impossible to calculate the lifetime of the shaft sealing ring. Under unfavorable conditions, from experience, an increased probability of failure can occur after 2000 operating hours.

5.4 Gearbox

5.4.1 Overview

A gearbox must be mounted, if

- the drive torque is not sufficient at low speeds
- the constant power range is not sufficient in order to utilize the cutting power over the complete speed range.

For questions regarding gearboxes, please directly contact the gearbox manufacturer:

Company	ZF Friedrichshafen AG
	Internet: http://www.zf.com

In order to mount a gearbox, depending on the shaft height, various prerequisites must be fulfilled (see table).

Table 5- 5 Prerequisites for mounting a gearbox

Prerequisites for mounting a gearbox for shaft height 100 to 160	
	Type of construction IM B5, IM B35 or IM V15
	Shaft with feather key and full-key balancing
Prerequisites for mounting a gearbox for shaft height 180 and 225	
	Type of construction IM B35
	Bearing design for coupling output
	Vibration severity level R
	Radial eccentricity, concentricity and axial eccentricity: Tolerance level R
	Shaft with feather key and full-key balancing
	DE flange with shaft sealing ring

5.4.2 Properties

Gearbox properties

- Version as planetary gear
- Gearbox efficiency: above 95 %
- Gearboxes are available for motors, shaft heights 100 to 225
- Selector gearboxes are available up to a drive output of 100 kW
- Types of construction: IM B35 (IM V15) and IM B5 (IM V1) are possible

Note

1PH7 motors are only designed for stress levels in accordance with the specifications (refer to the radial force diagram and maximum torque).

For drive units which, for example, are mounted to the gearbox flange or gearbox enclosure, the motors with type of construction IM B35 must be supported at the NDE without subjecting the motor frame to any stress.

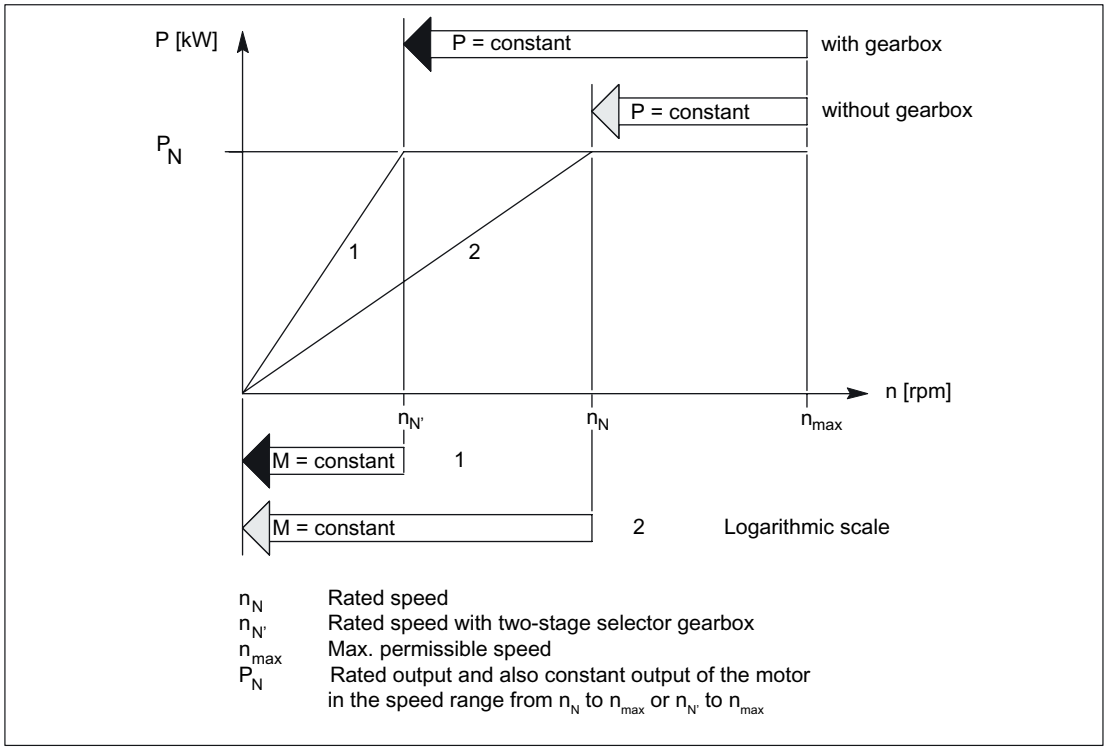


Figure 5-3 Speed-power diagram when using a two-stage selector gearbox to extend the constant power speed range of main spindle drive motors

Examples

Motor without selector gearbox

For P = constant from n_N = 1500 rpm to n_{max} = 6300 rpm a constant power control range greater than 1:4 is possible.

Motor with selector gearbox

For gearbox stage i_1 = 4 and i_2 = 1 a constant power control range of greater than 1:16 is possible (n_N' = 375 rpm to n_{max} = 6300 rpm).

Vibration levels

Motor + gearbox: Tolerance R (acc. to DIN ISO 2373)

This is also valid if motor tolerance level S is ordered.

Information regarding spindle applications

- The following advantages are obtained by locating the gearbox outside the spindle box:
- Gearbox vibration is not transferred.
- Separate lubricating systems for the main spindle (grease) and selector gearbox (oil).
- No noise and no temperature fluctuations caused by the gearbox pinion wheels in the spindle box.
- Instead of using belts, the drive power can also be transferred from the gearbox output using a pinion (on request) or co-axially through an compensating coupling.

5.4.3 Gearbox design

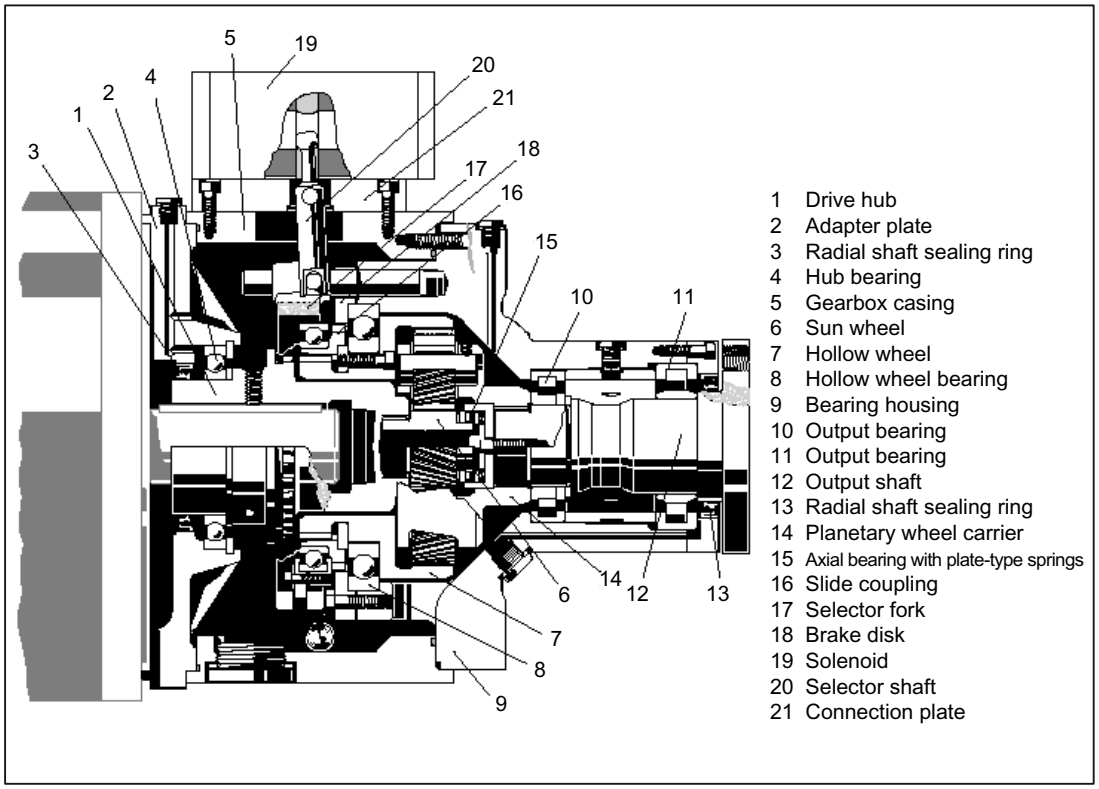


Figure 5-4 Gearbox design for 1PH7, SH 100 to 160

The following applies to selector gearboxes:	Switch position I:	i1 = 4
	Switch position II:	i2 = 1

Both gearbox ratios are electrically selected and the setting is monitored using limit switches. The gearbox output shaft lies coaxially to the motor shaft.

Torsional backlash (measured on gearbox output):

Standard for SH 100-160	30 angular minutes
Standard for SH 180-225	On request

Belt pulley

- The belt pulley should be in the form of a cup wheel.
- The gearbox output shaft has a flange with outer centering and tapped holes to retain the belt pulley.
- The complete drive should be designed to be as stiff as possible using large belt cross-sections. This has a positive impact on the smooth running properties of the drive.

5.4.4 Technical data

Table 5- 6 Technical data for gearbox

ZF designation	Motor shaft height	Order No.	n_{max} [rpm]	Rated torque [Nm] (S1 duty)			Maximum torque [Nm] (S6 duty, 10 min. cycle duration, max. 60 % on period)			Weight [kg]	Output housing a10 [mm]
				Drive	Output		Drive	Output			
					i=1	i=4		i=1	i=4		
2K120	100	2LG4312-...	8000 [1] 9000 [2]	120	120	480	140	140	560	30	100
2K250	132	2LG4315-...	6300 8000 [2]	250	250	1000	400	400	1600	62	116
2K300	160	2LG4320-...	6300 8000 [2]	300	300	1200	400	400	1600	70	140
2K800 [3]	184	2LG4250-...	5000	800	800	3200	900	900	3600	110	200
2K801 [3]	186	2LG4260-...	5000	800	800	3200	900	900	3600	110	200
2K802	225	2LG4570-...	5000	800	800	3200	900	900	3600	110	200

[1] Higher maximum speed from 8000 ... 9000 rpm for more than 20% on-period is only possible with injection lubrication.

[2] Permissible with gearbox oil cooling for gearbox stage i = 1.

[3] Can be supplied with holding brake (option).

NOTICE

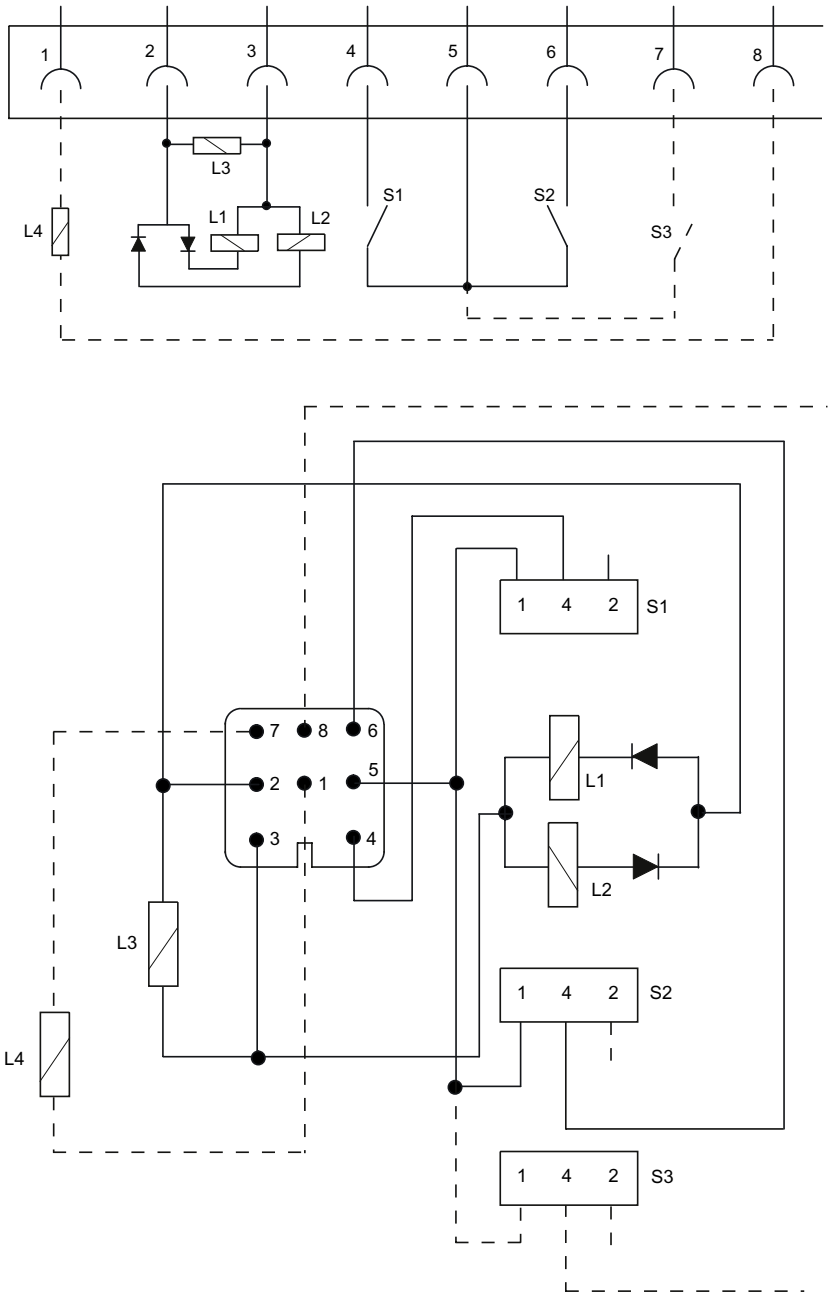
When designing the complete drive unit (motor with gear) the gearbox data is decisive.

For example, for the 1PH7167-2NB motor, the torque should be reduced to 300 Nm. For motors, shaft heights 100 and 132, the maximum motor speed should be limited to the permissible gearbox speed 2K120/2K250.

For other binding technical data and engineering information/instructions (e.g. lubrication, temperature rise, permissible radial forces and examples), please refer to Catalog from ZF Friedrichshafen AG.

5.4.5 Electrical connection

Electrical connection with solenoid



Coil L1 Selects stage 1
Coil L2 Selects stage 2
Coil L3 Withdraws the locking when changing a gear stage
Coil L4 Selects the neutral position (option)

Figure 5-5 Circuit diagram for the solenoid

Electrical connection for the motorized selector unit

Power supply for the selector unit: 24 V DC ±10 %
The mechanical selector unit requires a separate supply.

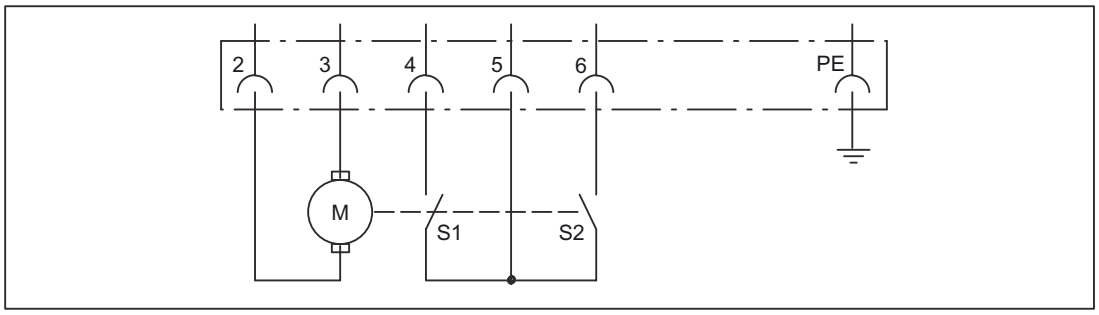


Figure 5-6 Circuit diagram

Connector (incl. in the scope of supply): Manufacturer, Harting; 7-pin + PE, type HAN 7D

Table 5- 7 Explanation of the connections

Connector contact No.	Number and designation	input	Output	Voltage	Current
2 and 3	1 selector unit	0	–	24 V DC	I_{max} = 5 A (inrush current)
4 and 6	2 limit switches	0	0	24 V DC V_{max} = 42 V DC	I_{max} = 5 A

5.4.6 Gearbox stage selection

When changing the gearbox stage, the following information must be carefully observed:

- Only change over the gearbox stage at standstill; e.g. while changing the tool.
- During selection, the direction of rotation should be changed approximately 5 times per second. The gears normally mesh at the first direction of rotation change so that selection times of between 300 and 400 ms can be achieved.
- The motor may only start to accelerate 200 ms after the changeover has been completed.
- The selection must be monitored using a time relay.
  Changeover should be withdrawn if the changeover command was not able to be executed after 2s.
  A time limit of 10 s should be applied for approximately 4 to 5 additional attempts to change the gearbox stage.

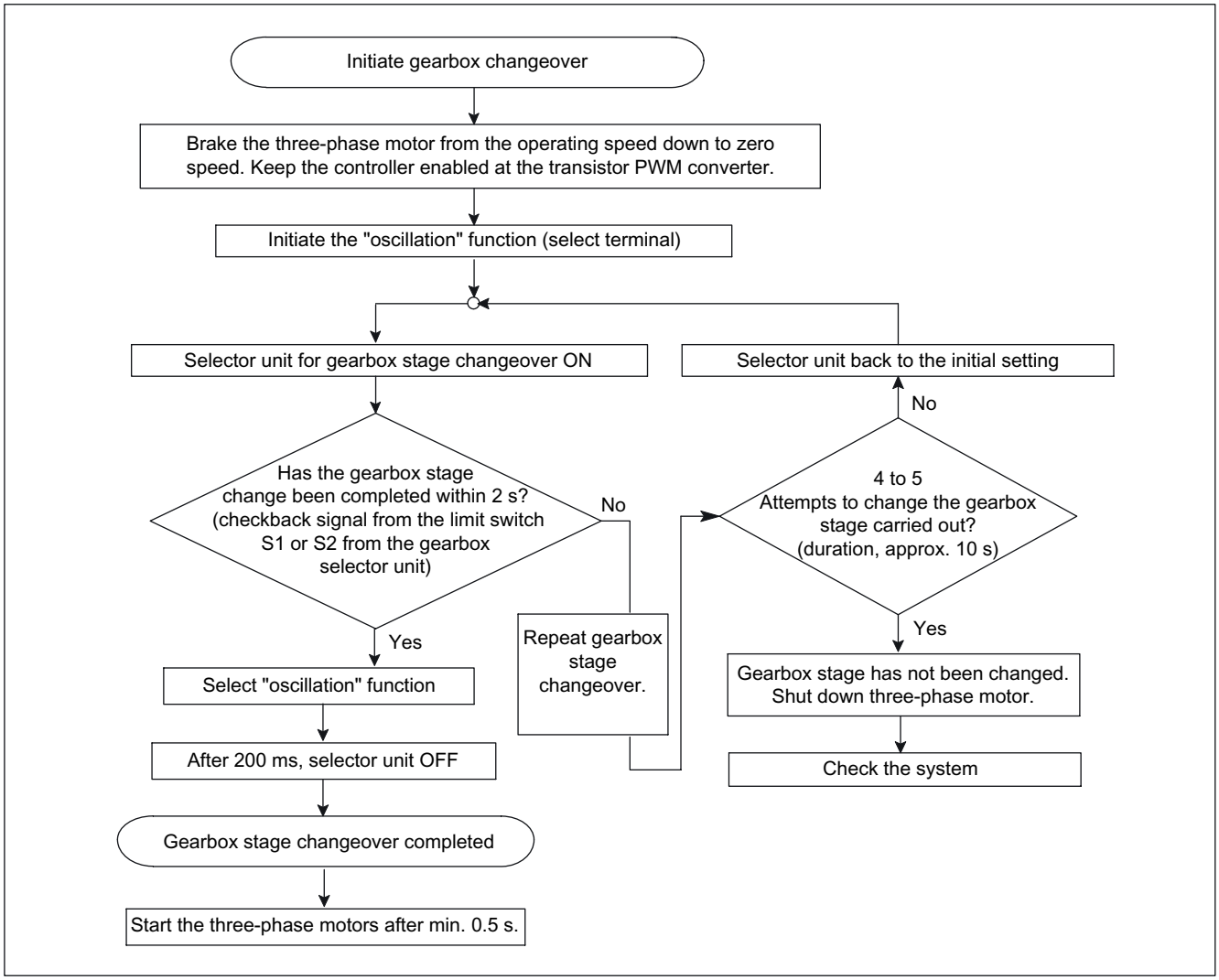


Figure 5-7 Function sequence when changing the gearbox stage

Table 5- 8 Control sequence when selecting the gearbox stage

Gearbox stage selection	Connector contact No.			
	2	3	4/5 (S1)	5/6 (S2)
When changing the ratio from stage i_2 to i_1				
a Initial setting (f) b Selection sequence c Mechanical selection carried out up to endstop 1)	+24 V DC	0 V	0 0 L	L 0 0
When changing the ratio from stage i_1 to i_2				
d Initial setting (c) e Selection sequence f Mechanical selection carried out up to endstop 1)	0 V	+24 V DC	L 0 0	0 0 L

L Contact closed

0 Contact open

1) After a gear stage has been selected a limit switch (S1 or S2) sends a signal to the control to switch off the selector unit.

5.4.7 Lubrication

Splash lubrication

Oil level check:	Visually using a sight glass
The oil level depends on the mounting position:	
horizontally and vertically:	Middle of sight glass1)
For an inclined mounting position:	Mark on the angled oil level indicator (mount additionally)
Oils which can be used:	HLP 32 acc. to ISO-VG 68
Oil drain bolts:	on both sides

1) The oil volume data on the rating plate is only an approximate value

Circulating oil lubrication

Circulating oil lubrication is required for the following applications:

- for continuous operation
- for operation over a longer period of time in one gearbox stage
- for intermittent operation with short no-load intervals

The type of circulating oil lubrication depends on which operating temperature level is required in use. Several applications require a low operating temperature level.
We recommend, in these cases, circulating oil lubrication.

The oil flow rate is between 1 and 1.5 l/min with an oil pressure of approx. 1.5 bar.

The approximate oil intake and outlet positions are shown in the following diagrams.

- "Selector gearbox with selector unit for frame size 100"
- "Selector gearbox with selector unit for frame sizes 132 and 160"

The precise dimensions can be taken from the relevant mounting drawings.

The following gearboxes must always be operated with circulating oil lubrication (also refer to the mounting drawings):

- Gearbox 2K800
- Gearbox 2K801
- Gearbox 2K802
- Gearbox 2K2100

For the following gearboxes, circulating oil lubrication is required for V1 or V3 vertical mounting positions:

- Gearbox 2K120
- Gearbox 2K121
- Gearbox 2K250
- Gearbox 2K300

5.4.8 Flange dimensions

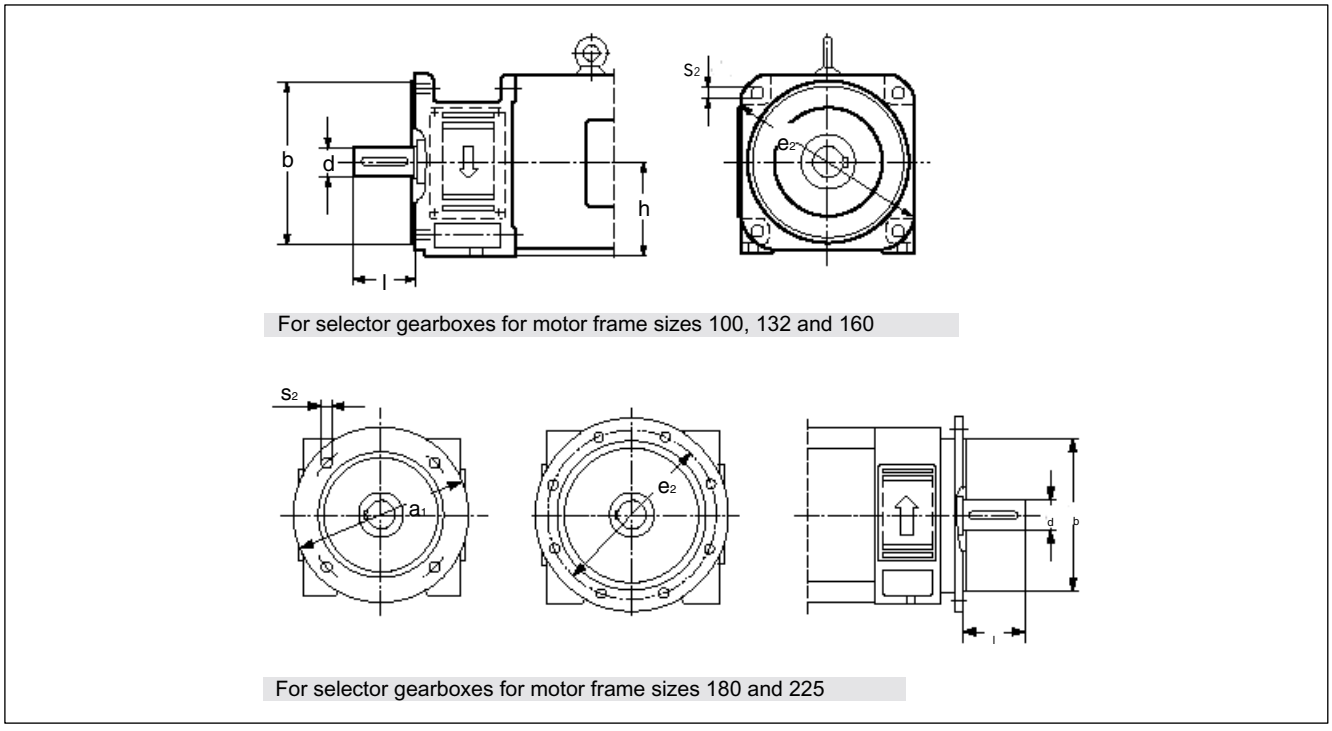


Figure 5-8 Flange dimensions for motors

Table 5- 9 Flange dimensions for motors

Two-stage Selector gearbox	Size	Standard motor companion dimensions						
		h	d	l	b	e_2	a_1	s_2
2K120	101, 103, 105, 107	100 $^{-0.5}$	38 k_6	80	180 j_6	215 $^{\pm 0.5}$	–	14 $^{\pm 0.2}$
2K250	131, 132, 133, 135, 137	132 $^{-0.5}$	42 k_6	110	250 h_6	300 $^{\pm 0.5}$	–	18 $^{\pm 0.2}$
2K300	163, 167	160 $^{-0.5}$	55 k_6	110	300 h_6	350 $^{\pm 0.5}$	–	18 $^{\pm 0.2}$
2K800	184	On request						
2K801	186	On request						
2K802	224	On request						

5.4.9 Connections, circulating oil lubrication, frame size 100

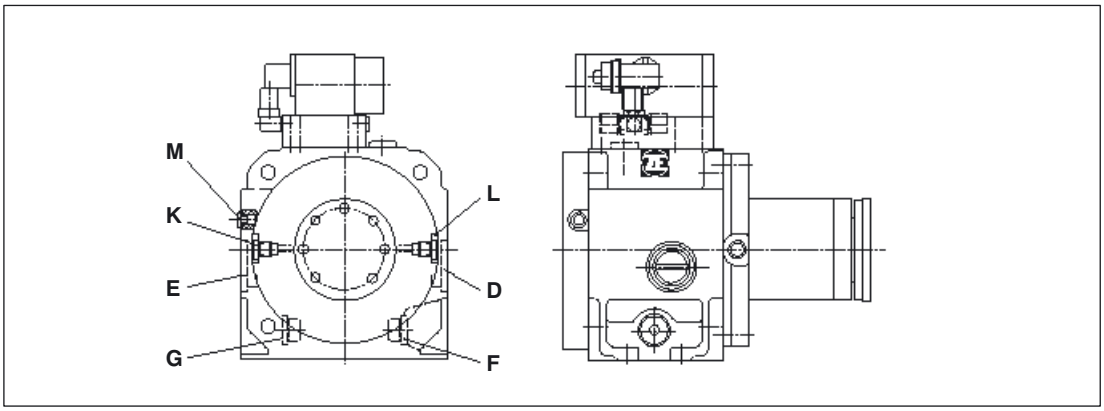


Figure 5-9 Selector gearbox with selector unit for frame size 100

Table 5- 10 Connections for circulating oil lubrication

Max. pressure	Connection Oil return	Connection Oil inlet	Mounting position
0.2 bar 1.5 bar	**D** Main direction of rotation Clockwise[1)] **E** Main direction of rotation Counter-clockwise[1)]	**M** (0.5 dm^3/min) **K/L** (1.0 dm^3/min)	V1 (closed version)
1.5 bar			
1.5 bar		**G** (1.5 dm^3/min) Main direction of rotation clockwise **F** (1.5 dm^3/min) Main direction of rotation counter-clockwise	B5 V1
Note: Circulating oil lubrication is required for certain gearboxes and V1 or V3 vertical mounting positions (refer to Chapter "Lubrication")			

1) When viewing the gearbox drive from the motor

5.4.10 Connections, circulating oil lubrication, frame sizes 132 and 160

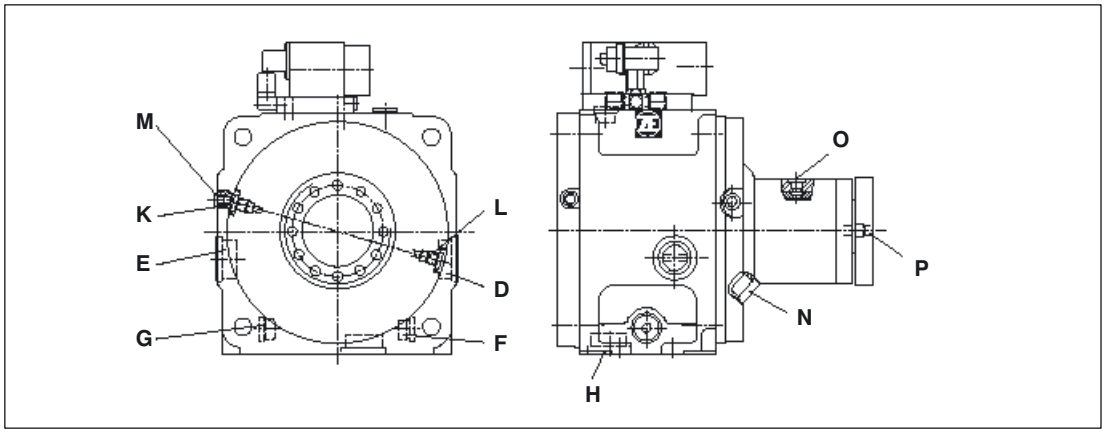


Figure 5-10 Selector gearbox with selector unit for frame sizes 132 and 160

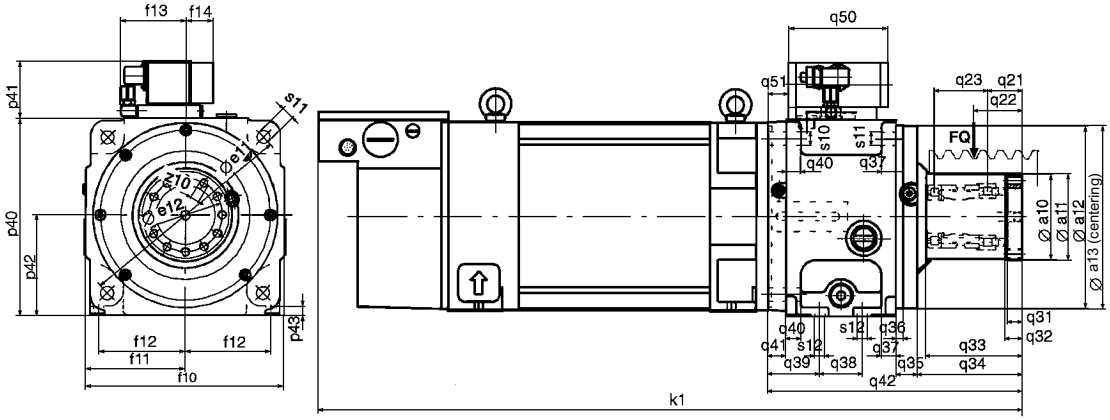
Table 5- 11 Connections for circulating oil lubrication

Max. pressure	Connection Oil return	Connection Oil inlet	Mounting position
2 bar	**H**	**P** (1.5 dm³/min)	V3
0.5 bar 1.5 bar	**D** Main direction of rotation clockwise [1] **E** Main direction of rotation counter-clockwise[1]	**M** (0.5 dm³/min) **N** (1.5 dm³/min)	V1 (closed version)
1.5 bar			
1.5 bar		**G** (1.5 dm³/min) Main direction of rotation clockwise **F** (1.5 dm³/min) Main direction of rotation counter-clockwise	B5 V1
Note: Circulating oil lubrication is required for certain gearboxes and V1 or V3 vertical mounting positions (refer to Chapter "Lubrication")			
Connection O is additionally possible (0.5 dm³/min)			

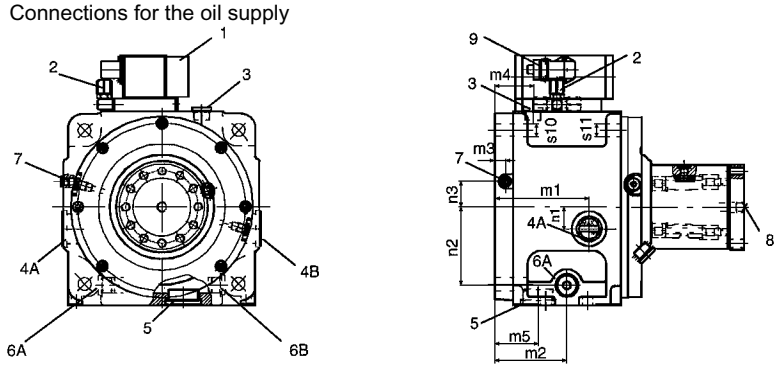
[1] When viewing the gearbox drive from the motor

5.4.11 Gearbox dimensions

Gearbox dimensions



Connections for the oil supply



For selector gearboxes for motor frame sizes 100 to 160

1 Selelctor unit (solenoid 24 V DC, 5 A)
2 Vent valve
3 Oil filling plug
4A Oil sight glass and oil return for CCW main direction of rotation and circulating-oil lubrication
4B Oil sight glass and oil return for CW main direction of rotation and circulating-oil lubrication
5 Oil drain plug for type of construction IM B35
6A Oil intake for main direction of rotation CW and circulating oil lubrication
6B Oil intake for main direction of rotation CCW and circulating oil lubrication
7 Oil intake for type construction IM V15 (must be connected)
8 Oil intake for type of construction IM V36
9 Harting connector, type HAN 8 U

Figure 5-11 Motor and gearbox dimensions

Table 5- 12 Two-stage selector gearbox (dimensions, a - f)

Motor		Dimensions [mm]										
Size	**Type**	**a10 Output housing**	**a11 k6**	**a12**	**a13 g6**	**e11 ±0.2**	**e12**	**f10**	**f11**	**f12**	**f13**	**f14**
100	1PH7 101 1PH7 103 1PH7 105 1PH7 107	100	100	188	190	215	80	208	104	92	86.6	42.4
132	1PH7 131 1PH7 133 1PH7 135 1PH7 137	116	118	249	250	300	100	270	135	117	89.5	39.5
160	1PH7 163 1PH7 167	140	130	249	250	350	100	326	163	145	89.5	39.5

Table 5- 13 Two-stage selector gearbox (dimensions, m - n)

Motor		Dimensions [mm]							
Size	**Type**	**m1**	**m2**	**m3**	**m4**	**m5**	**n1**	**n2**	**n3**
100	1PH7 101 1PH7 103 1PH7 105 1PH7 107	107	90.5	15	45	---	17	80	30
132	1PH7 131 1PH7 133 1PH7 135 1PH7 137	131	100	15	53	60	30	108	35
160	1PH7 163 1PH7 167	131	100	15	53	60	30	135	35

Table 5- 14 Two-stage selector gearbox (dimensions, p - q)

Motor		Dimensions [mm]												
Size	**Type**	**p40**	**p41**	**p42**	**p43**	**q21**	**q22**	**q23**	**q31**	**q32**	**q33**	**q34**	**q35**	**q36**
100	1PH7 101 1PH7 103 1PH7 105 1PH7 107	209	92	108	12	42	57–67	75	15	17.5	---	116	26	10
132	1PH7 131 1PH7 133 1PH7 135 1PH7 137	268	78	136	12	46.9	57–66	72.1	20	22.5	129.5	142.5	29	10
160	1PH7 163 1PH7 167	324	78	164	17	48.2	74–83	69.8	20	22.5	---	142.5	29	10

Table 5- 15 Two-stage selector gearbox (dimension, q)

Motor		Dimensions [mm]							
Size	**Type**	**q37**	**q38**	**q39**	**q40**	**q41**	**q42**	**q50**	**q51**
100	1PH7 101 1PH7 103 1PH7 105 1PH7 107	18	55	63	18	25	298	136	12
132	1PH7 131 1PH7 133 1PH7 135 1PH7 137	20	58	71	20	25	346.5	136	28
160	1PH7 163 1PH7 167	20	58	71	23	25	346.5	136	28

Table 5- 16 Two-stage selector gearbox (dimensions, s - z)

Motor		Dimensions [mm]					
Size	**Type**	**s10**	**s11**	**s12**	**z10** **Thread**	**No. of tapped holes**	**Motor with gearbox** **Total length k1**
100	1PH7 101 1PH7 103 1PH7 105 1PH7 107	14	14	14	M8	8 x 45°	709 709 804 804
132	1PH7 131 1PH7 133 1PH7 135 1PH7 137	18	18	14	M12	12 x 30°	885 885 970 970
160	1PH7 163 1PH7 167	18	18	14	M12	12 x 30°	987 1047

5.4.12 Permissible dimension deviations

Table 5- 17 Permissible dimension deviations

Dimension	Permissible deviations		
a, b	up to 250 mm from 250 mm to 500 mm from 500 mm to 750 mm		±0.75 mm ±1.0 mm ±1.5 mm
b_1	up to 230 mm over 230 mm	DIN 7160	j6 h6
d, d_1	up to 11 mm from 11 mm to 50 mm over 50 mm	DIN 7160	j6 k6 m6
e_1	up to 200 mm from 200 mm to 500 mm		±0.25 mm ±0.5 mm
h	from 50 mm to 250 mm DIN 747 from 250 mm to 500 mm		–0.5 mm –1.0 mm
i, i_1, i_2	up to 85 mm from 85 mm to 130 mm from 130 mm to 240 mm		±0.75 mm ±1.0 mm ±1.5 mm
u, t, u_1, t_1	acc. to DIN 6885 Sheet 1		

Connection system

6

6.1 SINAMICS drive I/O

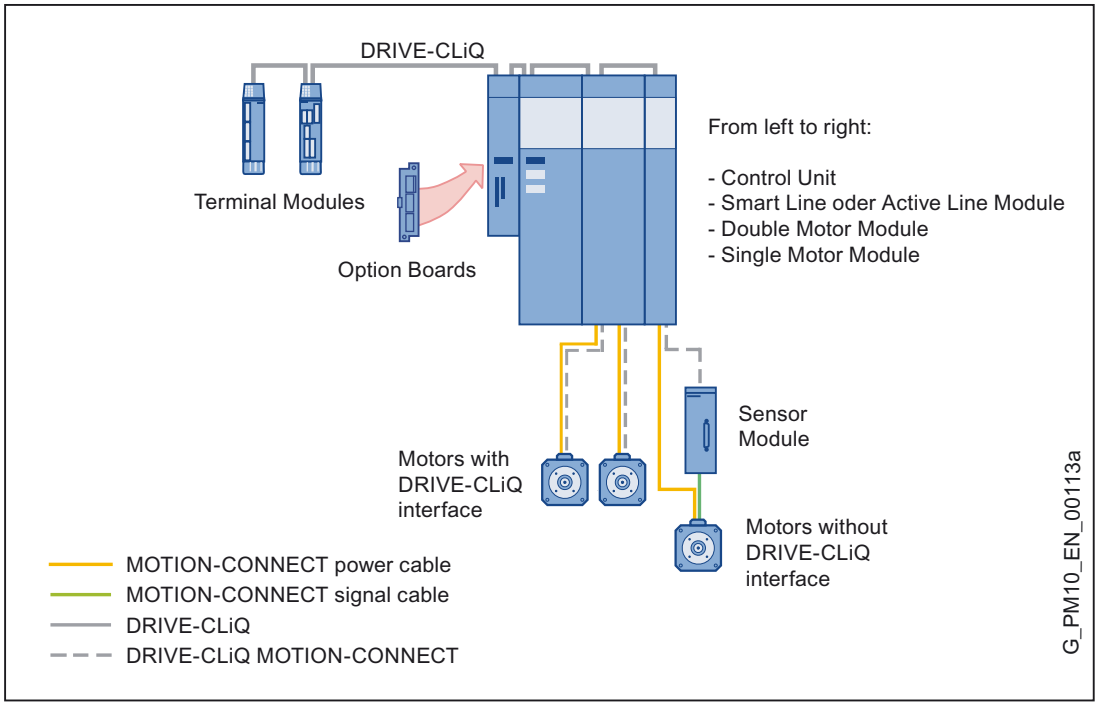


Figure 6-1 SINAMICS S120 system overview

6.2 Power connection

⚠ CAUTION

Carefully observe the current which the motor draws for your particular application!
Adequately dimension the connecting cables according to IEC 60204-1.

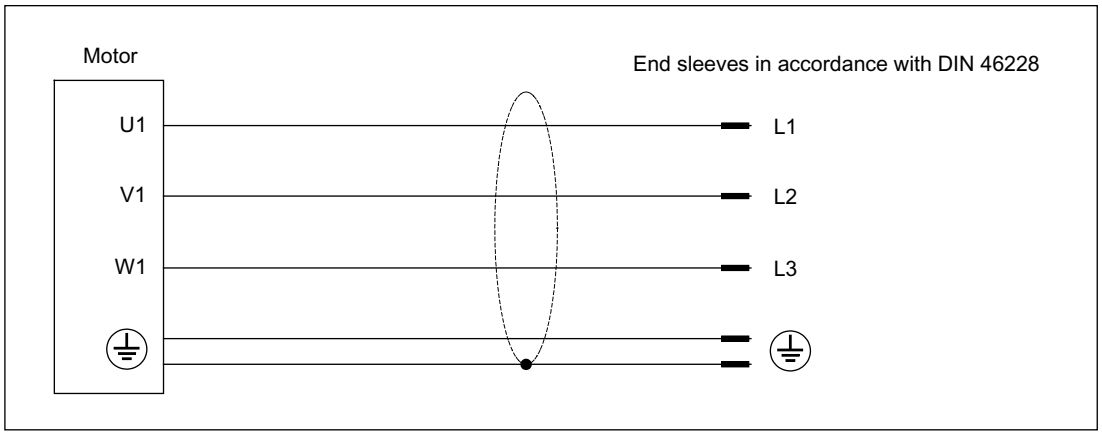


Figure 6-2 Power cable

Terminal box connection

The designation of the mounted terminal box as well as the details on the power connection for the line supply cables can be taken from the following table. A circuit diagram to connect-up the motor winding is provided in the terminal box when the motors are shipped.

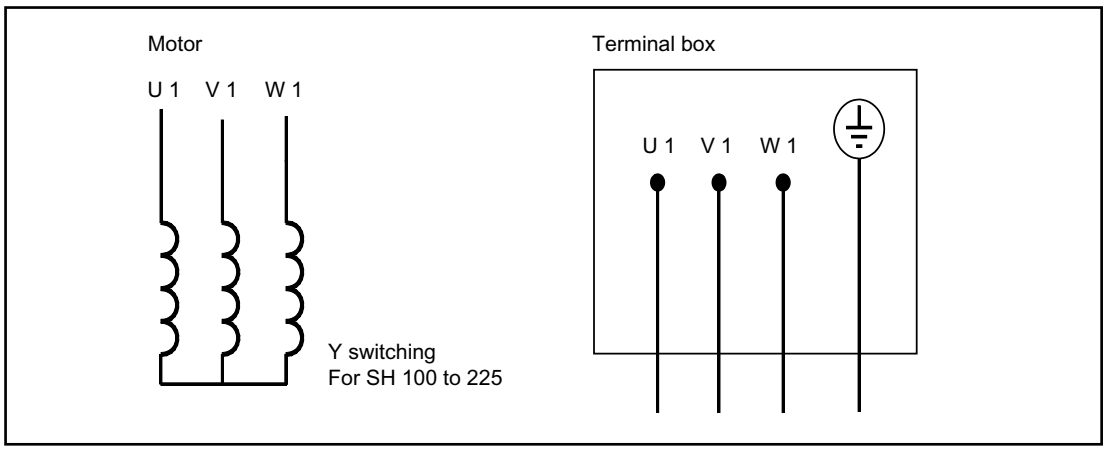


Figure 6-3 Circuit diagram

Assignment, terminal boxes and max. cross-sections

Table 6- 1 Assignment, terminal boxes and max. cross-sections

Shaft height	Motor type	Terminal box type	Cable entry	Max. possible outer cable diameter [2]	Cable entry	Max. possible outer cable diam-eter [2]	Number of main terminals	Max. connect able cross-section per terminal [mm²]	Max. pos-sible current for each ter-minal [1] [A]
			Valid for the 8th position of the Order No. "2", "4", "6"		Valid for the 8th position of the Order No. "7", "8"				
100	1PH710□-□□□	integrated	PG 29	28	M 32 x 1.5	21	6 x M 5	25	84
132	1PH713□-□□□	integrated	PG 36	34	M 40 x 1.5	28	6 x M 6	35	104
160	1PH716□-□□□	integrated	PG 40	40	M 50 x 1.5	38	6 x M 6	50	123
180	1PH7184-□□□	1XB7322	2 x PG 42	40	2 x M 50 x 1.5	38	3 x M 12	2 x 50	191
	1PH7186-□□D	1XB7322	2 x PG 42	40	2 x M 50 x 1.5	38	3 x M 12	2 x 50	191
	1PH7186-□□E	1XB7322	2 x PG 42	40	2 x M 50 x 1.5	38	3 x M 12	2 x 50	191
	1PH7186-□□F	1XB7422	2 x M 72 x 2	56	2 x M 63 x 1.5	53	3 x M 12	2 x 70	242
	1PH7186-□□L	1XB7422	2 x M 72 x 2	56	2 x M 63 x 1.5	53	3 x M 12	2 x 70	242
	1PH7186-□□T	1XB7322	2 x PG 42	40	2 x M 50 x 1.5	38	3 x M 12	2 x 50	191
225	1PH7224-□□C	1XB7322	2 x PG 42	40	2 x M 50 x 1.5	38	3 x M 12	2 x 50	191
	1PH7224-□□D	1XB7322	2 x PG 42	40	2 x M 50 x 1.5	38	3 x M 12	2 x 50	191
	1PH7224-□□F	1XB7322	2 x PG 42	40	2 x M 50 x 1.5	38	3 x M 12	2 x 50	191
	1PH7224-□□L	1XB7700	3 x M 72 x 2	56	3 x M 75 x 1.5	68	3 x 2 x M 12	3 x 150	583
	1PH7226-□□D	1XB7422	2 x M 72 x 2	56	2 x M 63 x 1.5	53	3 x M 12	2 x 70	242
	1PH7226-□□F	1XB7700	3 x M 72 x 2	56	3 x M 75 x 1.5	68	3 x 2 x M 12	3 x 150	583
	1PH7226-□□L	1XB7700	3 x M 72 x 2	56	3 x M 75 x 1.5	68	3 x 2 x M 12	3 x 150	583
	1PH7228-□□D	1XB7700	3 x M 72 x 2	56	3 x M 75 x 1.5	68	3 x 2 x M 12	3 x 150	583
	1PH7228-□□F	1XB7700	3 x M 72 x 2	56	3 x M 75 x 1.5	68	3 x 2 x M 12	3 x 150	583
	1PH7228-□□L	1XB7700	3 x M 72 x 2	56	3 x M 75 x 1.5	68	3 x 2 x M 12	3 x 150	583

[1] Current load capability based on IEC 60204-1, routing type C, Table 5.

[2] Depending on design of the metric cable gland

Current-carrying capacity for power and signal cables

The current-carrying capacity of PVC/PUR-insulated copper cables is specified for routing types B1, B2 and C under continuous operating conditions in the table with reference to an ambient air temperature of 40 °C. For other ambient temperatures, the values must be corrected by the factors from the "Derating factors" table.

Table 6- 2 Cable cross section and current-carrying capacity

Cross section	Current-carrying capacity rms; AC 50/60 Hz or DC for routing type:		
[mm²]	B1 [A]	B2 [A]	C [A]
Electronics (according to EN 60204-1)			
0.20	-	4.3	4.4
0.50	-	7.5	7.5
0.75	-	9	9.5
Power (according to EN 60204-1)			
0.75	8.6	8.5	9.8
1.00	10.3	10.1	11.7
1.50	13.5	13.1	15.2
2.50	18.3	17.4	21
4	24	23	28
6	31	30	36
10	44	40	50
16	59	54	66
25	77	70	84
35	96	86	104
50	117	103	125
70	149	130	160
95	180	165	194
120	208	179	225
Power (according to IEC 60364-5-52)			
150	-	-	344
185	-	-	392
> 185	Values must be taken from the standard		

Table 6- 3 Derating factors for power and signal cables

Ambient air temperature [°C]	Derating factor according to EN 60204-1 Table D1
30	1.15
35	1.08
40	1.00
45	0.91
50	0.82
55	0.71
60	0.58

6.3 Cable outlet at NDE (integrated terminal box)

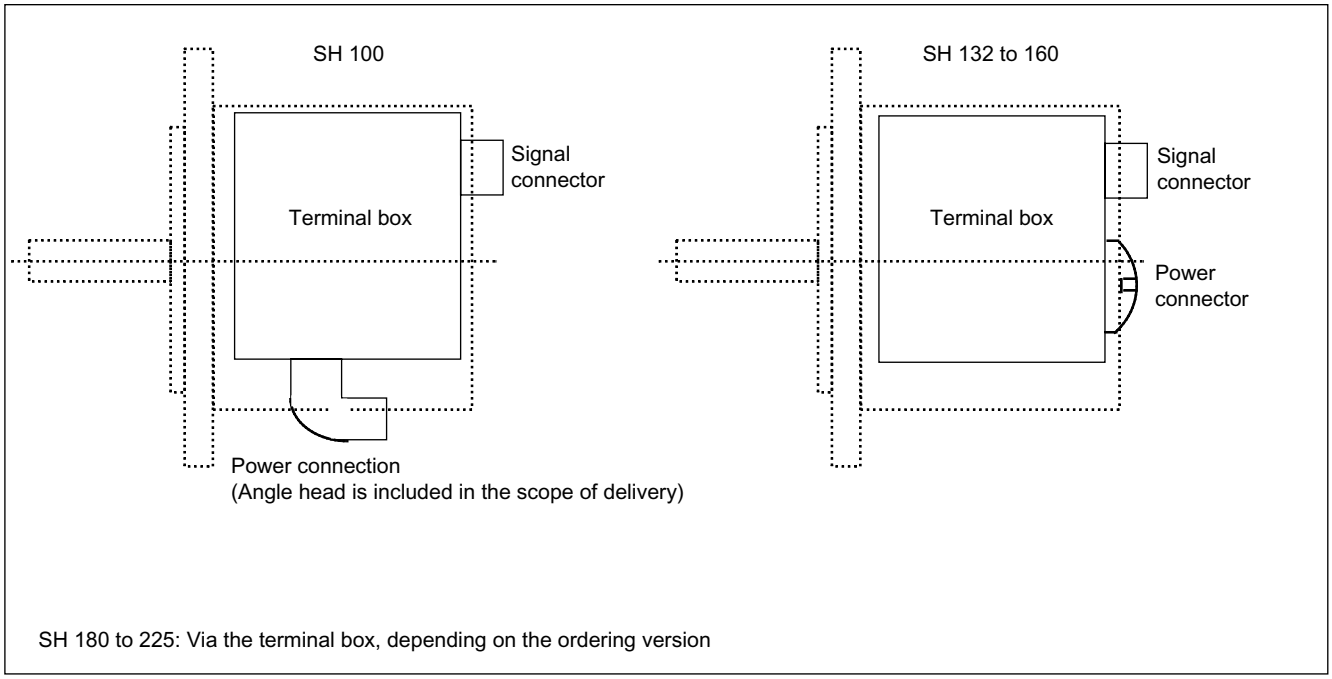


Figure 6-4 Cable outlet up to SH 225

Note

For SH 100 and "cable outlet at the NDE", the cable cannot be connected at the NDE because of the restricted space. In this case, the cable must be connected at the side using a 90° pipe connection element ("angled element").

6.4 Connecting-up information

Note

The system compatibility is only guaranteed if shielded power cables are used, the shield is connected to the metal motor terminal box through the largest possible surface area (using metal EMC cable glands).

Shields must be incorporated in the protective grounding concept. Protective ground should be connected to conductors that are open-circuit and that are not being used and also electrical cables that can be touched. If the brake feeder cables in the SIEMENS cable accessories are not used, then the brake conductor cores and shields must be connected to the cabinet ground (open-circuit cables result in capacitive charges!)

Use EMC cable glands for fixed cable entries. The cable glands are screwed into the threaded holes of the cable entry plate that can be removed.

Openings that are not used must be closed using an appropriate metal cap.

⚠WARNING

Before carrying-out any work on the motor and the fan, please ensure that it is powered-down and the system is locked-out so that the motor cannot re-start!

Please observe the rating plate data (type plate) and circuit diagram in the terminal box. Adequately dimension the connecting cables.

Internal potential bonding

The potential bonding between the ground terminal in the terminal box and the motor frame is established through the retaining bolts of the terminal box. The contact locations underneath the screw/bolt heads are bare and are protected against corrosion.

The standard screws that are used to connect the terminal box cover to the terminal box are sufficient as potential bonding between the terminal box cover and the terminal box enclosure.

Motor and connecting cables

- Twisted or three-core cables with additional ground conductor should be used as motor feeder cables. The insulation should be removed from the ends of the conductors so that the remaining insulation extends up to the cable lug or terminal.
- The connecting cables should be freely arranged in the terminal box so that the protective conductor has an overlength and the cable conductor insulation cannot be damaged. Connecting cables should be appropriately strain relieved.
- Take special care that the required air clearances are actually maintained:
  - Up to SH 160, a minimum of 4.5 mm
  - From SH 180 and above, at least 10 mm

After connecting-up, the following points should be checked/tested

- The inside of the terminal box must be clean and free of any cable pieces
- All of the terminal screws must be tight
- The minimum air distances must be maintained
- The cable glands must be reliably sealed
- Unused cable glands must be closed and the plugs must be tightly screwed in place
- All of the sealing surfaces must be in a perfect condition

Connecting the ground conductor

The ground conductor cross-section must be in full conformance with the installation regulations, e.g. acc. to IEC/EN 60204-1.

For shaft height 225, the ground conductor must be additionally connected to the motor bearing shield. There is a terminal lug for the ground cable at the designated connection point. This is suitable for connecting multi-conductor cables with cable lugs or flat cables with the appropriately prepared conductor end.

Please note the following when connecting-up:

- The connecting surface must be bare and must be protected against corrosion using a suitable medium, e.g. with acid-free Vaseline
- There is a spring washer and normal washer underneath the screw head
- The minimum necessary screw-in depth and the tightening torque for the clamping bolts must be maintained

Table 6- 4 Screw-in depth and tightening torque

Screw	Penetration depth:	Tightening torque
M8 x 30	> 8 mm	20 Nm

6.5 Supply data for separately-driven fans

Table 6- 5 Supply data for separately-driven fans

Shaft height	Air flow direction	Max. current drain at		
		400 V/50 Hz (±10%)	400 V/60 Hz (±10%)	480 V/60 Hz (±5%, -10%)
100	DE --> NDE	0.20	0.13	0.20
	NDE --> DE	0.19	0.13	0.18
132	DE --> NDE	0.37	0.24	0.33
	NDE --> DE	0.35	0.24	0.32
160	DE --> NDE	0.30	0.33	0.34
	NDE --> DE	0.29	0.31	0.33
180	DE --> NDE	0.8	1.1	1.1
	NDE --> DE	0.8	1.1	1.1
225	DE --> NDE	2.8	2.8	2.8
	NDE --> DE	1.9	2.2	2.2

Recommended connection

The connection is realized through the terminal box or through the terminal box of the separately-driven fan. The fan should be operated through motor protection circuit-breakers. The tripping current must be set to the I_{max} value of the fan.

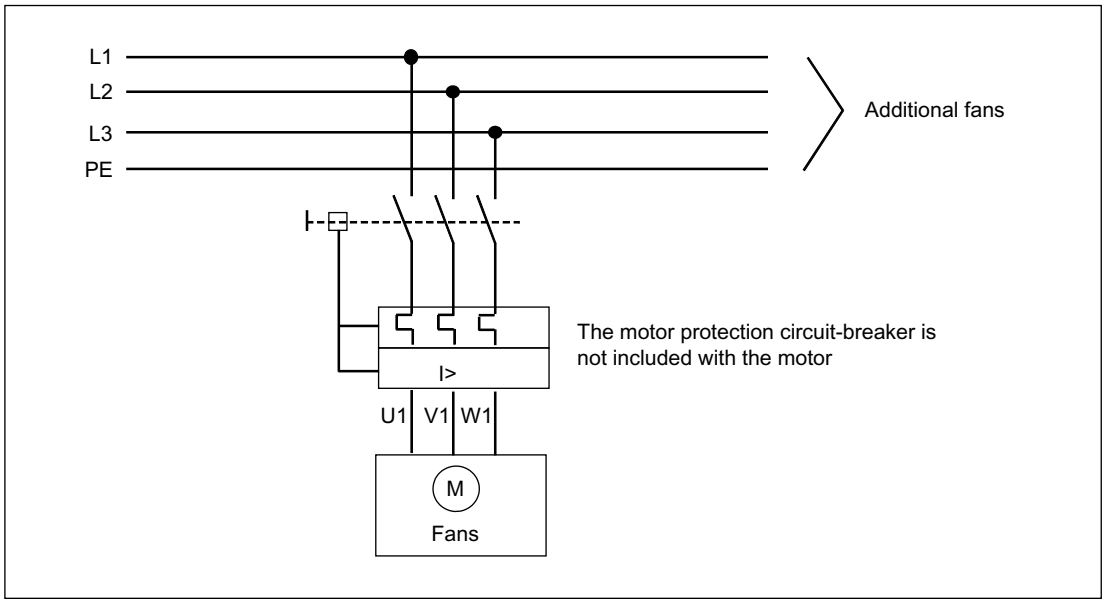


Figure 6-5 Recommended connection

6.6 Signal connection

DRIVE-CLiQ is the preferred method for connecting the encoder systems to SINAMICS.

Motors with a DRIVE-CLiQ interface can be ordered for this purpose. Motors with a DRIVE-CLiQ interface can be directly connected to the associated motor module via the available MOTION-CONNECT DRIVE-CLiQ cables. The MOTION-CONNECT DRIVE-CLiQ cable is connected to the motor in degree of protection IP67. The DRIVE-CLiQ interface supplies power to the motor encoder via the integrated 24 VDC supply and transfers the motor encoder and temperature signals and the electronic type plate data, e.g. a unique identification number, rating data (voltage, current, torque) to the control unit. The MOTION-CONNECT DRIVE-CLiQ cable is used universally for connecting the various encoder types. These motors simplify commissioning and diagnostics, as the motor and encoder type are identified automatically.

Encoder connection on motors with DRIVE-CLiQ

Motors with DRIVE-CLiQ interfaces can be directly connected to the corresponding Motor Module via the available MOTION-CONNECT DRIVE-CLiQ cables. This data is transferred directly to the Control Unit.

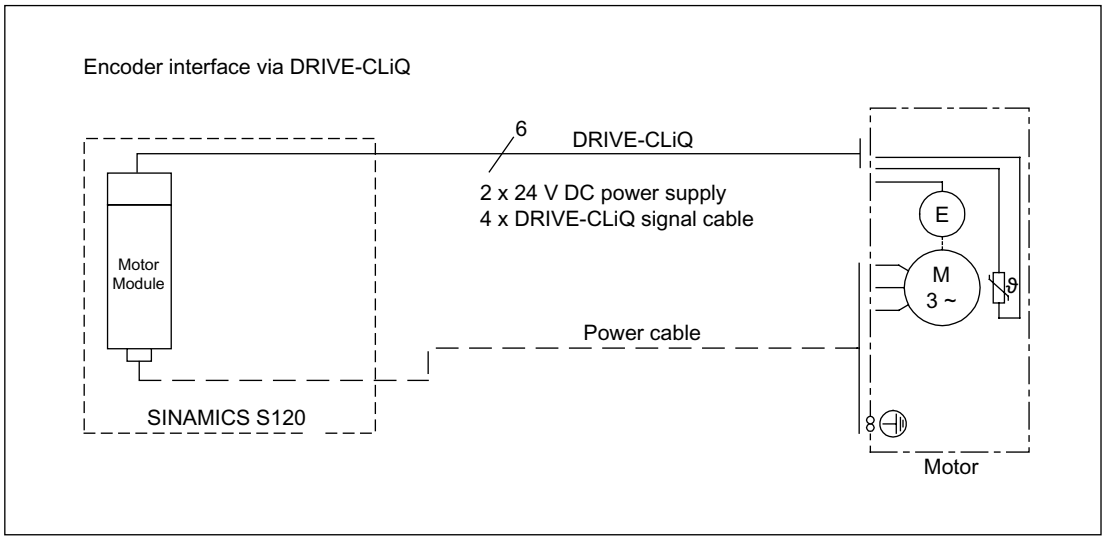


Figure 6-6 Encoder connection on motors with DRIVE-CLiQ

Cables on motors with DRIVE-CLiQ

With DRIVE-CLiQ, the same cable is used for all encoder types. Only pre-assembled cables from Siemens (MOTION-CONNECT) may be used.

Table 6- 6 Pre-assembled cable

6FX	□	002	-	□DC□□	-	□□□	0
	↓					↓ ↓ ↓	
	↓					Length	
	5 MOTION-CONNECT®500					max. cable length 100 m	
	8 MOTION-CONNECT®800					max. cable length 50 m	

For other technical data and length code, refer to Catalog, Chapter "MOTION-CONNECT connection system"

Encoder connection for motors without DRIVE-CLiQ

Motors that are not equipped with DRIVE-CLiQ require a Cabinet-Mounted Sensor Module when operated with SINAMICS S120. The Sensor Modules evaluate the signals from the connected motor encoders or external encoders and convert them to DRIVE-CLiQ. In conjunction with motor encoders, the motor temperature can also be evaluated using Sensor Modules. For additional information, refer to the SINAMICS Manual.

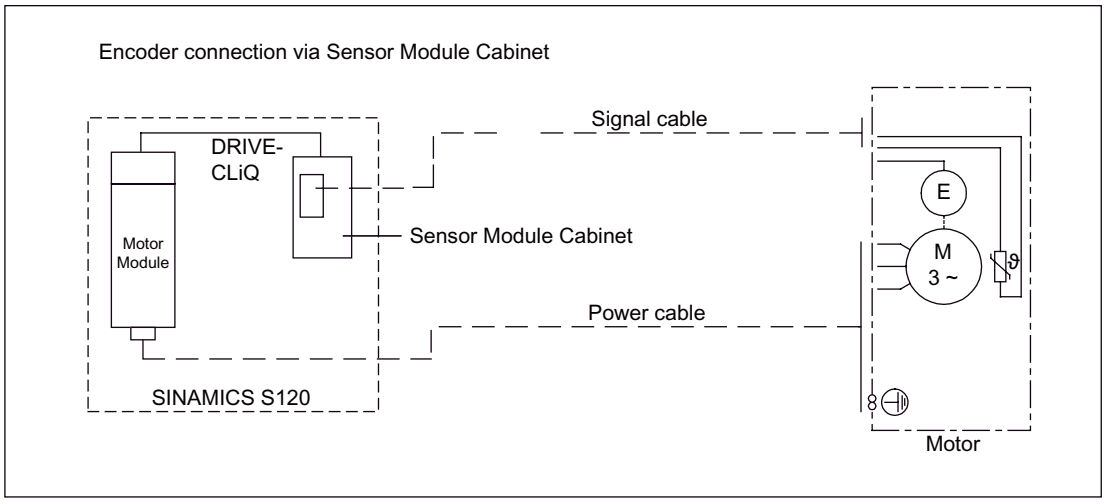


Figure 6-7 Encoder connection for motors without DRIVE-CLiQ

Cables for motors without DRIVE-CLiQ

Only pre-fabricated cables from Siemens (MOTION-CONNECT) may be used.

Table 6- 7 Pre-fabricated cable for incremental encoder

6FX	□	002	-	2AC31	-	□□□	0
	↓					↓ ↓ ↓	
	↓					Length	
	5 MOTION-CONNECT®500					max. cable length 100 m	
	8 MOTION-CONNECT®800					max. cable length 50 m	

Table 6- 8 Pre-fabricated cable for absolute encoder

6FX	□	002	-	2EQ10	-	□□□	0
	↓					↓ ↓ ↓	
	↓					Length	
	5 MOTION-CONNECT®500					max. cable length 100 m	
	8 MOTION-CONNECT®800					max. cable length 50 m	

For other technical data and length code, refer to Catalog, Chapter "MOTION-CONNECT connection system"

Information for using the motors

7

7.1 Transportation/storage before use

The motors should be stored indoors in dry, low-dust and low-vibration (v_{rms} < 0.2 mm/s) rooms. The motors should not be stored longer than two years at room temperature (+5° C to +40° C) to retain the service life of the grease.

Observe the information provided in the operating instructions for transport and storage.

7.2 Ambient conditions

Operating temperature range: -15° C to +40° C (without any restrictions).

Storage: T = -20 °C to +70 °C

All of the catalog data refer to an ambient temperature of 40° C, mounted so that the motors are not thermally insulated and an installation altitude up to 1000 m above sea level.

For conditions other than those specified above (ambient temperature > 40°C or installation altitude > 1000 m above sea level), the permissible torque/power must be determined using the factors from the following table. Ambient temperatures and installation altitudes are rounded-off to 5° C or 500 m respectively.

Table 7- 1 Factors to reduce the torque/power (de-rating)

Installation altitude above sea level	Ambient temperature in °C		
	40	45	50
1000	1.00	0.96	0.92
1500	0.97	0.93	0.89
2000	0.94	0.90	0.86
2500	0.90	0.86	0.83
3000	0.86	0.82	0.79
3500	0.82	0.79	0.75
4000	0.77	0.74	0.71

NOTICE
For ambient temperatures > 50 °C, please contact your local Siemens office.

7.3 Routing cables in a damp environment

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

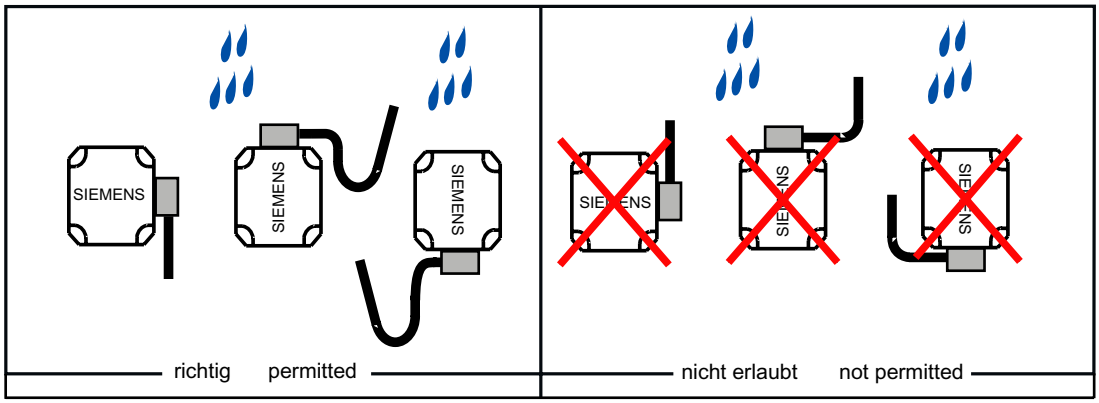
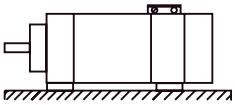
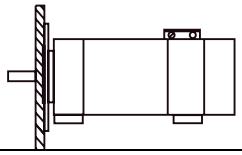
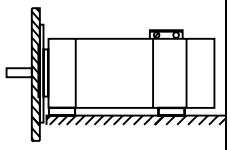
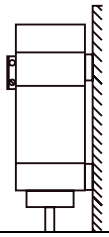
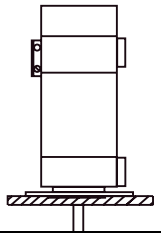
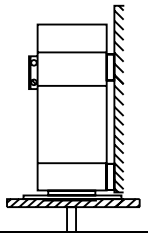
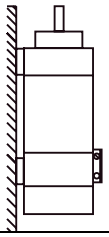
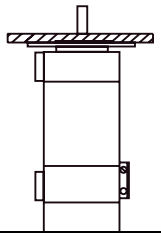
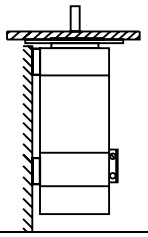


Figure 7-1 Principle of cable routing in a wet/moist environment

7.4 Mounting position/types of construction

Table 7- 2 Designation of types of construction (acc. to IEC 60034-7)

Type of construction	Designation	Type of construction	Designation	Type of construction	Designation
	IM B3		IM B5		IM B35
	IM V5		IM V1		IM V15
	IM V6		IM V3		IM V36

7.5 Mounting

⚠WARNING

These motors are electrically operated. When electrical equipment is operated, certain parts of these motors are at hazardous voltage levels. If this motor is not correctly handled/operated, this can result in death or severe bodily injury as well as significant material damage. Please carefully observe the warning information in this section an on the product itself.

Only **qualified personnel** may carry-out service or repair work on this motor.

Before starting any work, the motor must be disconnected from the line supply and grounded.

Only spare parts, certified by the manufacturer, may be used.

The specified service/maintenance intervals and measures as well as the procedures for repair and replacement must be carefully maintained and observed.

⚠WARNING

When transporting the motors, use all of the hoisting lugs provided!

A suitable crane/lifting device must be used. Incorrect execution, unsuitable or damaged equipment and resources can result in injury and material damage. The hoisting and transport equipment as well as the load suspension equipment must be in full compliance with the appropriate regulations.

All work should be undertaken with the system in a no-voltage condition!

Other information and instructions in the Operating Instructions must be carefully observed.

The motor should be connected up according to the circuit diagram provided.

In the terminal box it must be ensure that the connecting cables are insulated with respect to the terminal board cover.

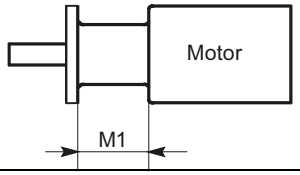
After the motor has been installed, the brake (if one is used) must be checked to ensure that it is functioning perfectly!

Flange mounting

For shaft heights 100 to 160 and with type of construction IM B35, it is only possible to flange mount the motor using cylinder head screws.

For SH 180 to 225, flange mounting is only possible using studs and nuts. Clearance M1 for threading the nut or screw between the motor flange and motor frame acc. to DIN 42948.

Table 7- 3 Flange mounting with threaded studs and nuts

Shaft height	M1 [mm]	
100	44	
132	50	
160	65	
180	32	
225	91	

7.6 Mounting and mounting instructions

In order to ensure smooth, vibration-free motor operation, a stable foundation design is required, the motor must be precisely aligned, and the components that are to be mounted on the shaft end must be correctly balanced.

The following mounting instructions must be carefully observed:

- For high-speed machines, we recommend that the complete unit is dynamically balanced after couplings or belt pulleys have been mounted.
- Use suitable equipment when mounting drive elements. Use the thread at the shaft end.
- Do not apply any blows or axial pressure to the shaft end.
- Especially for high-speed motors with flange mounting, it is important that the mounting is stiff in order to locate any resonant frequency as high as possible so that it remains above the maximum rotational frequency.
- Thin sheets (shims) can be placed under the motor mounting feet to align the motor and to avoid mechanically stressing the motor. The number of shims placed below should be kept to a minimum.
- In order to securely mount the motors and reliably and safely transfer the drive torque, bolts with strength class 8.8 acc. to ISO 898-1 should be used.

Note

All motors with type of construction IM B35, IM V35 must be mounted to the machine with flange and bearing shield feet. It must be ensured that the flange mounting is stiff. When commissioning the motors, it must be ensured that the permissible vibration values in accordance with DIN ISO 10816 are maintained (foot/flange-mounting type of construction, also see Chapter "Vibration severity level").

The bearing shield feet do not have to be supported if the following conditions are maintained:

- For flange-mounted motors, there is a stable motor suspension design

- The maximum speed is limited (refer to Table "Restricting the maximum speed")

Motors that are mounted, as a result of their type of construction, to the wall using the motor feet, must be retained in place using an adequately dimensioned positive form fit (e.g. using studs or mounting rails).

Table 7- 4 Limiting the maximum speed

Shaft height [mm]	Max. permissible speed [rpm]
160	3000
180	3000
225	2500

⚠ CAUTION

Liquid must be prevented from collecting in the flange, both in the vertical as well as horizontal mounting positions. This would have a negative impact on the bearing and bearing grease.

After the motors have been mounted, the caps for the screw holes in the mounting feet must be re-located.

Note

1PH7 motors are force-ventilated. When mounting the motors, it must be ensured that the motor can be well ventilated. This is especially true when mounting the motors in enclosures. It is not permissible that the hot discharged air is drawn in again.

Mount air-cooled motors so that the cooling air can enter and be discharged without any restrictions (also refer to Section "Cooling").

7.7 Natural frequency when mounted

The motor is a system which is capable of vibration at its natural frequency. For all motors, this resonant frequency lies above the specified maximum speed.

When the motor is mounted onto a machine, a new system, which is capable of vibration, is created with modified natural frequencies. These can lie within the motor speed range.

This can result in undesirable vibrations in the mechanical drive transmission.

NOTICE
Motors must be carefully mounted on adequately stiff foundations or bedplates. Additional elasticities of the foundation/bedplates can result in resonance effects of the natural frequency at the operating speed and therefore result in inadmissibly high vibration values.

The magnitude of the natural frequency when the motor is mounted depends on various factors and can be influenced by the following points:

- Mechanical transmission elements (gearboxes, belts, couplings, pinions, etc.)
- Stiffness of the machine design to which the motor is mounted
- Stiffness of the motor in the area around the foot or customer flange
- Motor weight
- Machine weight and the weight of the mechanical system in the vicinity of the motor
- Damping properties of the motor and the driven machine
- Mounting type, mounting position (IM B5, IM B3, IM B35, IM V1 etc.)
- Motor weight distribution, i.e. length, shaft height

After the motors have been mounted, the caps for the screw holes in the mounting feet must be re-located.

7.8 Vibration stressing

External vibrations are introduced into the motor through the motor foundation and/or the drive mechanical transmission through the motor frame and/or through the rotor. In order to ensure perfect functioning of the drive as well as a long motor lifetime, these types of vibrations, introduced into the drive system, should not exceed the specific limit values of the motor.

Vibration caused by the rotor must be minimized by appropriately balancing the motor.

Table 7- 5 Vibration values for SH 100 to 160 [1)]

Vibration frequency	Vibration values
< 6.3 Hz	Vibration displacement s ≤ 0.16 mm
6.3 ... 250 Hz	Vibration velocity v_{rms} ≤ 4.5 mm/s
> 250 Hz	Vibration acceleration a ≤ 2.55 m/s^2

Table 7- 6 Vibration values for SH 180 to 225 [1)]

Vibration frequency	Vibration values
< 6.3 Hz	Vibration displacement s ≤ 0.25 mm
6.3 ... 63 Hz	Vibration velocity v_{rms} ≤ 5.0 mm/s
> 63 Hz	Vibration acceleration a ≤ 4.0 m/s^2

To ensure problem-free operation and a long service life, the vibration values specified to ISO 10816 must not be exceeded at the defined measuring points on the motor.

Table 7- 7 Max. permissible radial and axial vibration values[1)]

Vibration velocity V_{rms} [mm/s]	Vibration acceleration a_{peak} [m/s^2]
4.5	10 radial
4.5	2.25 axial

1) Both values must be observed simultaneously

To measure the vibration velocity, the measuring equipment must fulfill the requirements of ISO 2954. The vibration acceleration must be measured as a peak value in the time range in a frequency band of 10 to 2000 Hz.

If appreciable vibration excitation in excess of 2000 Hz (e.g. gear teeth meshing frequencies) can be expected, the measurement range must be adapted accordingly. This does not alter the maximum permissible values.

Note

Uninterrupted duty within the natural frequencies

Uninterrupted duty in the natural frequencies of the installed/mounted system must be avoided, as this generally leads to the permissible vibration values being exceeded and the system being damaged. To reduce vibration, the flanged-mounted motors can be supported at the NDE.

7.9 Misalignment

In order to avoid misalignment or to keep it as low as possible, a compensating coupling should be used (refer to the diagram).

If possible, the motor should not be directly and rigidly coupled to an output transmission shaft which has its own bearings.

However, if a rigid coupling is absolutely necessary due to mechanical design reasons, misalignment deviations must be avoided. In this case, a careful check must be made by making the appropriate measurements.

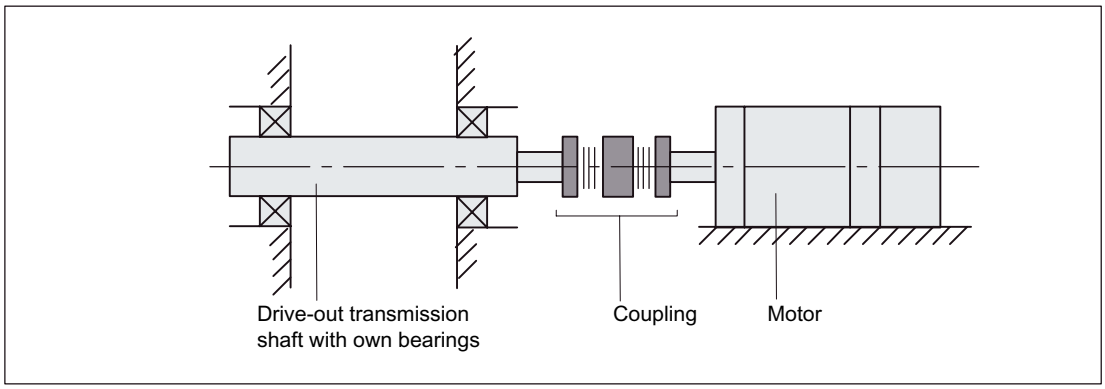


Figure 7-2 Mechanical output transmission shaft with its own bearings and compensating coupling

7.10 Flywheels

Flywheels with a high mass, which are rigidly mounted to the end of the motor shaft, modify the vibration characteristics of the motor and shift the critical rotational frequencies of the motor into the lower speed ranges.

The overall system should be precision balanced in order to minimize/avoid exciting vibration, when external masses are directly mounted onto the motor shaft.

Operation in the resonance range should be avoided.

7.11 Insulated bearings (NDE) (option L27)

Relevant, additional bearing currents

When compared to a pure sinusoidal supply, the pulsed output voltage of a frequency converter results in additional motor bearing currents. The relevant additional bearing currents are:

- Circulating currents
- EDM currents
- Rotor ground currents

Factors that influence bearing currents

Above a certain magnitude, bearing currents result in localized melting at the bearing rings and rolling assemblies as well as lubricant wear. This reduces the bearing lifetime. Essential influencing factors include:

- Motor speed and associated operating time
- Pulse frequency of the frequency converter
- Grounding relationships between the motor and the connected load

Application for option L27

At speeds < 500 rpm, the load due to bearing currents increases significantly. Option L27 is always required if the motor is operated in the speed range between 0 ... 500 rpm for a longer period of time. Without option L27, the total operating time in the speed range 0 ... 500 rpm may be a maximum of 800 h (for an assumed bearing change interval (t_{LW}) of the bearings of 20,000 h.

Table 7- 8 Measures that are required for operation in the speed range < 500 rpm

Shaft height	Bearing change interval (t_{LW}) for lifetime lubrication [h] 1)	Options that are required	Remarks
100 - 160	20000	-	Due to the experience from the field (in practice) no dangers have been identified due to bearing currents
180		L27	Insulated NDE bearings
225		_	Generally insulated NDE bearings

1) Definition, refer to the table "Recommended bearing change intervals (standard bearing design)"

Motor grounding

In order to avoid rotor ground currents, the motor frame should be well grounded - e.g. by using shielded motor cables. The motor cable shield should be connected at both ends through the largest possible surface area.

For specific applications, the grounding of the motor Z_{hg} can be more unfavorable than the grounding of the connected loads Z_{rg}, e.g. for long motor cables and when the motor is mounted in an insulated fashion. In this case, the capacitive discharge (leakage) current of the motor flows from the motor frame through the motor shaft to the connected load and from there to ground.

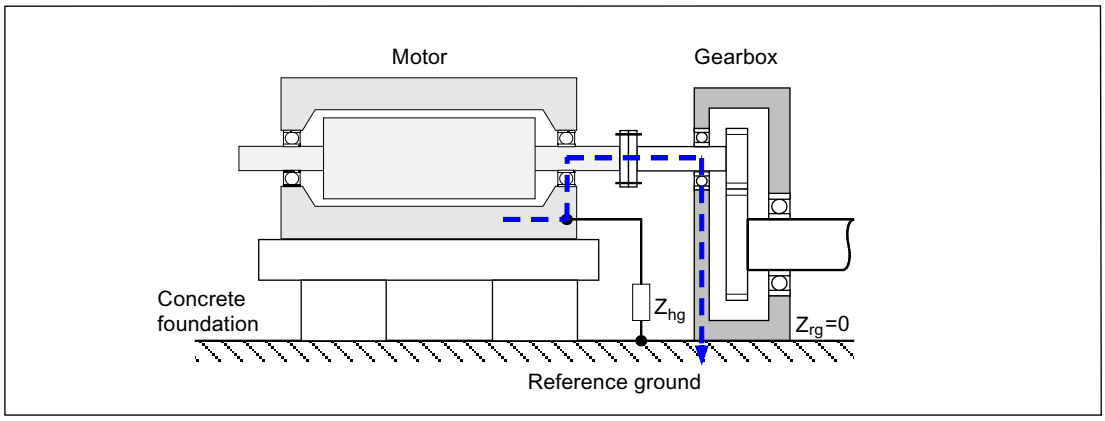


Figure 7-3 Bearing current due to the grounding situation (= rotor ground current)

The rotor ground current should be avoided by using an electrically insulating coupling.
If such a coupling cannot be used for mechanical reasons, then the motor frame must be connected to the load through the largest possible surface area. The capacitive discharge (leakage) current then flows from the motor frame to the load and not through the bearings. The connection between the motor frame and load is only effective if it represents an extremely low impedance for the high-frequency discharge (leakage) current. To achieve this, use several flat straps, e.g. grounding straps, metal plates.

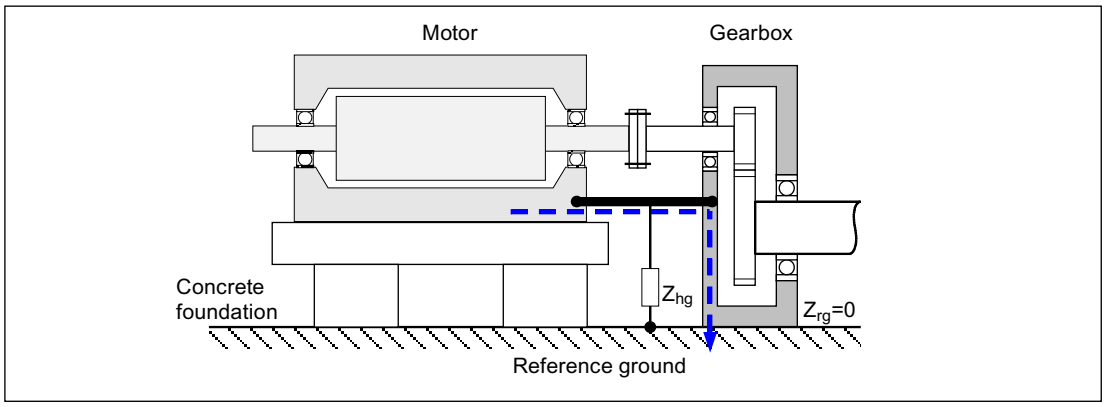


Figure 7-4 Connection between the motor frame and load to avoid rotor ground currents

Appendix

A

A.1 Description of terms

DE

Drive end

Maximum continuous speed n_{S1}

The maximum permissible speed that is continuously permitted without speed duty cycles.

Maximum current I_{max}

This is the maximum current (rms phase value) that can briefly flow for dynamic operations (e.g. when accelerating) without damaging the motor.

Maximum speed n_{max}

The maximum permissible speed n_{max} is determined by mechanical factors. The maximum speed n_{max} must not be exceeded.

⚠ CAUTION

If the speed n_{max} is exceeded, this can result in damage to the bearings, short-circuit end rings, press fits etc. It should be ensured that higher speeds are not possible by appropriately designing the control or by activating the speed monitoring in the drive system.

The motor may not operate continuously at maximum speed n_{max}. Unless a different duty cycle is specified, the speed must be reduced as stated below:

Duty cycle for a 10-minute cycle	
3 min	n_{max}
6 min	2/3 n_{max}
1 min	Standstill

Maximum torque M_{max}

Torque which is briefly available for dynamic operations (e.g. when accelerating). $M_{max} = 2 \bullet M_N$

Modes

The operating modes (duty types) are defined in IEC 60034, Part 1. The maximum duty cycle duration for duty types S1 and S6 is 10 minutes unless otherwise specified.

NDE

Non-drive end

No-load current I_μ

This is the current (rms phase current) that is required in order to operate the motor under no-load conditions at rated speed without load torque. The no-load current defines the motor magnetization in the base speed range (low speed at the start of field weakening).

Rated current I_N

This is the the current (rms phase value) that flows at the rated speed and rated torque and can be thermally provided according to the specified operating mode (duty type) according to IEC 60034-1.

Rated frequency f_N

Frequency required to obtain the performance ratings (P_N, n_N, etc.).

Rated power P_N

The rated power is the power that is mechanically available at the shaft that can be thermally provided corresponding to the specified operating mode (duty type) according to IEC 60034-1.

Rated speed n_N

This is the speed for which the rated power and the rated torque are defined corresponding to the specified operating mode (duty type) according to IEC 60034-1.

Rated torque M_N

The rated torque is the torque that is mechanically available at the shaft that can be thermally provided corresponding to the specified operating mode (duty type) according to IEC 60034-1.

Rated voltage V_N

Voltage between two motor phases for which the rating data (P_N, n_N, etc.) are defined.
The rated voltage definition takes into account magnetic (iron saturation) and thermal factors.

S1 duty (continuous operation)

Operation with a constant load, the duration of which is sufficient that the motor goes into a thermal steady-state condition.

S6 duty (intermittent operation)

S6 duty is operation which comprises a sequence of identical duty cycles; each of these duty cycles comprises a time with constant motor load and a no-load time. Unless otherwise specified, the load period refers to a duty cycle of 10 min.

S6-40 % =	4 min load operation, 6 min no-load operation
S6-60 % =	6 min load operation, 4 min no-load operation

Speed for field weakening with constant power n_2

Maximum achievable speed at rated power corresponding to the specified operating mode (duty type) according to IEC 60034-1.

Thermal time constant T_{th}

The thermal time constant defines the temperature rise of the motor winding when the motor load is suddenly increased (step increase) up to the permissible S1 torque. The motor has reached 63% of its S1 final temperature after T_{th}.

A.2 References

Overview of publications of planning manuals

An updated overview of publications is available in a number of languages on the Internet at:
http://www.siemens.com/motioncontrol
Select "Support" → "Technical Documentation" → "Ordering Documentation" → "Printed Documentation".

Catalogs

Abbreviations	Catalog name
NC 61	SINUMERIK & SINAMICS
NC 60	SINUMERIK & SIMODRIVE
PM 21	SIMOTION & SINAMICS
DA 65.3	Servo motors
DA 65.4	SIMODRIVE 611 universal and POSMO
DA 65.10	SIMOVERT MASTERDRIVES VC
DA 65.11	SIMOVERT MASTERDRIVES MC

Electronic Documentation

Abbreviations	DOC ON CD
CD1	The SINUMERIK System (includes all SINUMERIK 840D/810D and SIMODRIVE 611D)
CD2	The SINAMICS System

A.3 Suggestions/corrections

Should you come across any printing errors when reading this publication, please notify us on this sheet. We would also be grateful for any suggestions and recommendations for improvement.

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Suggestions and/or corrections

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V

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