Operating Manual

PacDrive™
SH Servo Motor

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ELAU PACKAGING SOLUTIONS

Schneider Electric

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Schneider Electric	**Manufacturer's declaration** According to the EC machine guidelines 98/37/EC	ELN 128-00/02.08 page 1/1

The product we delivered:

PacDrive SH Servo motor

is intended for installation in a machine.

Commissioning is forbidden until it is established that the machine in which this product is to be installed complies with the provisions of the EC guideline. The manufacturer guarantees that the product delivered was manufactured in accordance with the applied harmonized standards/specifications.**The following standards were applied:**

- **EN 60204-1 (2007)** Safety of machinery: Electrical equipment of machines - General requirements
- **EN 50081-2 (3/1994)** Electromagnetic compatibility. Generic emission standard
- **EN 61000-6-2 (3/2000)** Electromagnetic compatibility. Resistance to jamming

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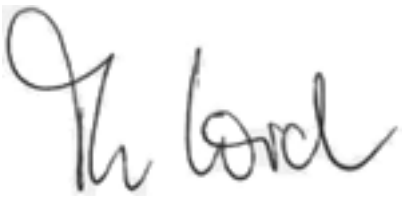

Thomas Cord
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Contents

1 About this manual

1.1 Introduction

Read and observe this manual before you work on the PacDrive Motor for the first time. Take particular note of the safety instructions. As described in section 2.2, only those persons who meet the "Selection and qualification of employees" are allowed to work on the PacDrive Motor.

A copy of this manual must always be available for personnel who are entrusted to work on the PacDrive Motor.

This manual is intended to help you use the PacDrive Motor and its intended applications safely and properly.
By observing this manual, you will help to

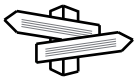
- avoid risks,
- reduce repair costs and down times of the PacDrive Motor,
- increase the life spanof the PacDrive Motor
- and increase reliability of the PacDrive Motor.

1.2 Symbols, designator and display format of safety notes

This manual divides the safety instructions into four different categories.
Hazards and their potential consequences are categorized using a combination of symbols and signal words:

Symbol / Signal word	Meaning
⚠ DANGER	Indicates an immediate hazardous situation that can lead to death or serious injury if the safety regulations are not observed.
⚠ WARNING	Indicates a potentially hazardous situation that can lead to serious injury or death if the safety regulations are not observed.
⚠ CAUTION	Indicates a potentially hazardous situation that may result in bodily harm if the safety regulations are not followed.
CAUTION	Indicates a potentially dangerous situation that may result in damage to the device if the safety regulations are not observed.

The following symbols and designators are used in this document:

Symbol/Character	Meaning
	**Information Symbol:** After this symbol, you will find important instructions and useful tips on using the components.
	**Marker:** After this symbol, you will find references for further information.
▪	**Prerequisite symbol:** This symbol indicates a prerequisite you have to fulfill before you start to implement an instruction.
▸	**Activity symbol:** After this symbol, you will find an instruction. Follow the instructions in sequence from top to bottom.
✓	**Result symbol:** The text after this symbol contains the result of an action.
•	First level **bullet point**
–	Second level **bullet point**
	**Orientation aid:** Information serving as an orientation aid regarding the section's contents follows this symbol.
bold	If the descriptive text contains **keywords**, such as parameters, they are highlighted in bold.
`lBufSelect:AXIS_BUF_SELECTION;` `(* Buffer Auswahl *)`	**Program code** is written in a different font.

2 Notes for working safely with the product

The following section contains information regarding safe work with the PacDrive Motor. Anyone using or working on the PacDrive Motor must read and observe this information. The ELAU Motor is state of the art and conform to recognized technical safety regulations. Nevertheless the use of the PacDrive Motor can present a hazard to life and limb or cause property damage.

2.1 Proper use

Use

The ELAU Motor is intended to be installed in a machine or assembled with other components to form a machine or system.

What do you need to observe?

Proper use includes that you observe the following points and the resulting rules:

- The regulative, warning and instruction signs on the connected components and in the switching cabinet
- The warning instructions on the PacDrive Motor on the connected components and in the switch cabinet
- The inspection and maintenance instructions
- The operating instructions of the other components
- All other documentation

Flawless condition

Operate the PacDrive Motor only when they are in a flawless technical condition. Observe the regulations, act with safety and hazards in mind If circumstances occur that impact safety or cause changes in the operating performance of the PacDrive Motor, switch the PacDrive Motor off immediately and contact the responsible service staff.

Use original-equipment only

Use only the options and mounting parts specified in the documentation and no third-party devices or components that are not expressly approved ELAU recommends. Do not change the PacDrive Motor inappropriately.

Provide for protective measures

Before installing, provide for appropriate protective devices in compliance with the local and national standards. Do not commission components without accordant protective devices. After installation, commissioning or repair, test the protective devices used.

Forbidden environments

The components must not be used in the following environments:

- In dangerous (explosive) atmospheres
- In mobile, movable or floating systems
- In life support systems
- In domestic appliances

Installation and operating conditions

You may only use them in accordance with the installation and operating conditions described in the documentation. The operating conditions at the installation location must be checked and maintained in accordance with the required technical data (performance data and ambient conditions). Commissioning is prohibited until it is guaranteed that the usable machine or system in which the PacDrive Motor is installed meets all requirements of EC Directive 98/37/EC (machinery directive).

In addition, the following standards, directives and regulations are to be observed:

- DIN EN 60204 Safety of machinery: Electrical equipment of machines
- DIN EN 292 Part 1 and Part 2 Safety of machinery: Basic Concepts, General Principles for Design
- DIN EN 50178 Electronic equipment for use in high-current electrical systems
- EMC directive 2004/108/EG
- The generally applicable local and national safety and accident prevention regulations.
- The rules and regulations on accident prevention and environmental protection that apply in the country where the product is used
- The applicable laws and ordinances

2.2 Selection and qualification of personnel

Target audience for this manual

This manual is geared exclusively toward technically qualified personnel, who have detailed knowledge in the field of automation technology. The description is mainly for construction and application engineers from the engineering and electro-technics division as well as service and commissioning engineers.

Professional or trained personnel

Work on the PacDrive Motor may only be carried out by qualified professional or by trained staff under the instruction and supervision of a qualified person in accordance with electrical regulations. Professionals are those persons who, as a result of their training, knowledge, and experience and knowledge of the pertinent regulations, can

- evaluate the transferred work,
- recognize the meaning of the safety instructions and implement them consistently,
- recognize possible hazards and
- take appropriate safety measures.

2.3 Rest dangers

Health risks arising from the PacDrive Motor have been reduced by means of safety technology and design engineering. However a residual risk remains, since the PacDrive Motor works with electrical voltage and electrical currents.

If activities involve residual risks, a safety note is made at the appropriate points. The note details the potential hazard and its effects and describes preventative measures to avoid it. The following section contains warnings about residual risks which can be assigned no concrete action. The structure of warning instructions is identical to that of safety instructions.

Mounting and handling

⚠ WARNING

CRUSHING, SHEARING, CUTTING AND HITTING DURING HANDLING

- Observe the general construction and safety regulations for handling and mounting.
- Use suitable mounting and transport equipment correctly and use special tools if necessary.
- Prevent clamping and crushing by taking appropriate precautions.
- Cover edges and angles to protect against cutting damage.
- Wear suitable protective clothing (e.g. safety goggles, safety boots, protective gloves) if necessary.

Failure to follow these instructions can result in death or serious injury.

Touching hot surfaces

As warning against housing temperatures of the motor exceeding 70°C during nominal operation, the symbol shown here is affixed on the motor.

⚠ WARNING

HOT SURFACES UP TO 100 °C

- Wear protective gloves or wait until the surface temperature has cooled to allow safe contact.
- Attach protective cover or touch guard.

Failure to follow these instructions can result in death or serious injury.

Touching electrical parts

⚠ DANGER

ELECTRICAL SHOCK, FIRE OR EXPLOSION

- Observe the general construction and safety regulations for working on high-current electrical systems.
- Operate electrical components only with connected protective conductor
- After installation, check the fixed connection of the protective conductor to all electrical devices to ensure that connection complies with the connection diagram.
- Make sure that the drives are at a standstill because potentially fatal voltage can occur on the motor lines in generator operation.
- Before enabling the device, safely cover the live components to prevent contact.
- Do not touch the electrical connection points of the components when the device is switched on.
- Provide protection against indirect contact (DIN EN 50178, Section 5.3.2).
- Disconnect/plug in power connector cables only when the system is deactivated.

Failure to follow these instructions will result in death or serious injury.

Protection against magnetic and electromagnetic fields

⚠ WARNING

RISK GROUPS IN THE IMMEDIATE VICINITY OF MAGNETIC AND ELECTRO-MAGNETIC FIELDS

- Do not allow personnel with pacemakers or similar sensitive implants to work in the immediate vicinity of live conductors and motor permanent magnets.

Failure to follow these instructions can result in death or serious injury.

Dangerous movements

There can be different causes of dangerous movements:

- Missing or faulty homing of the robot mechanics
- Wiring or cabling errors
- Errors in the application program
- Component errors
- Error in the measured value and signal transmitter
- Operation error

Personal safety must be guaranteed by primary equipment monitoring or measures. Don't just rely on the internal monitoring of the drive components. Monitoring or measures should be implemented based on the specific characteristics of the equipment, in line with a risk and error analysis. This includes the valid safety regulations for the equipment.

⚠ DANGER

MISSING PROTECTIVE DEVICE OR WRONG PROTECTION

- Prevent entry to a danger zone, for example with protective fencing, mesh guards, protective coverings, or light barriers.
- Dimension the protective devices properly and do not remove them.
- Do not carry out any changes that can invalidate the protection device.
- Before accessing the drives or entering the danger zone, safely bring the drives to a stop.
- Protect existing work stations and operating terminals against unauthorized operation.
- Position EMERGENCY OFF switches so that they are easily accessible and can be quickly reached.
- Check the functionality of EMERGENCY OFF equipment before start-up and during maintenance periods.
- Prevent unintentional start-ups by disconnecting the power connection of the drive using the EMERGENCY OFF circuit or using a safe start-up lock out.
- Check the system and installation before the initial start-up for possible malfunctions in all general purposes.
- Avoid operating high-frequency, remote control, and radio devices close to the system electronics and their feed lines.
- If necessary, perform a special EMC check of the system.

Failure to follow these instructions will result in death or serious injury.

3 Transport, storage, unpacking

3.1 Transport

- Avoid heavy shocks and/or vibrations during transport.
- Check the units for visible transport damage and inform the shipping company immediately if necessary.

3.2 Storage

- Store devices in a clean, dry room.
- Store devices at an air temperature between -25 °C and +70 °C.
- Avoid temperature variations exceeding 30 K per hour at the storage location

For further information.

3.3 Unpacking

- Remove packaging.
- Check that delivery is complete.
- Check the delivered goods for transport damage.

3.4 Type plate

Figure 3-1: Type plate on the SH-Motor

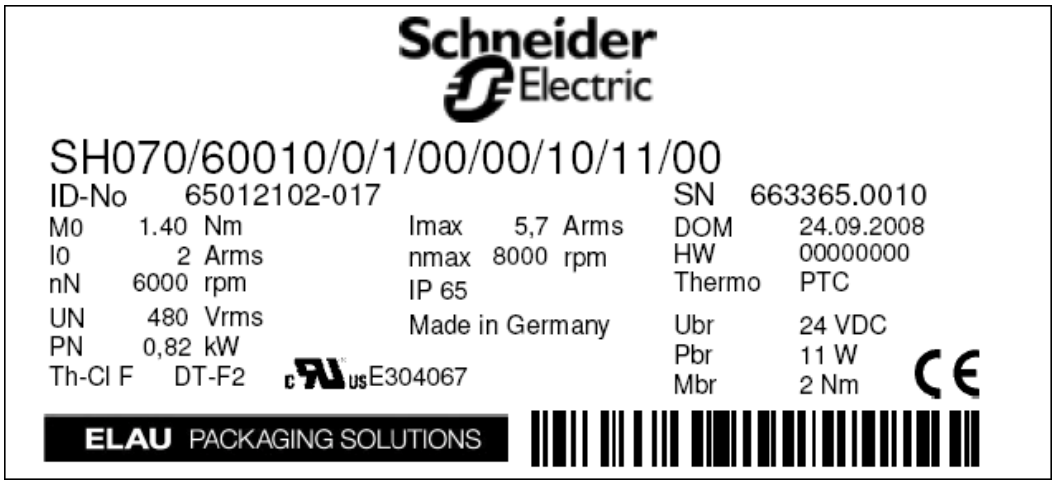


Figure 3-2: Type plate of an SH-Motor

Label	Meaning
SH070/60010/0/1/00/00/10/11/00	Motor type, see type code
ID no.	Item no.
P_N	Rated power
I_0	Standstill current
I_{max}	Peak current
n_N	Rated motor speed
n_{max}	Mechanical limit velocity
M_0	Standstill torque
SN	Serial Number
IP	Protection class
Th.- Cl.	Insulation material class of the motor
UBr	Brake measurement voltage
PBr	Brake measurement power
MBr	Brake measurement torque
DOM	Date of manufacture
HW	Hardware index
Exxxxxx	Approval number cUL
Thermo	Design of the temperature sensor
cUL	cUL mark
CE	CE mark

Table 3-1: Explanation of the type plate

4 Installation and maintenance

When carrying out the following steps, make sure to exercise with the necessary accuracy and make arrangements to avoid,

- injuries and material damage,
- incorrect installation and programming of components,
- the incorrect operation of components
- and the use of non-authorized cables or modified components

zu vermeiden.

For warranty reasons, we strongly recommend that you contact ELAU personnel for initial start-up. The ELAU personnel

- will check the equipment,
- determine the optimal configuration
- and instruct the operating staff.

4.1 Initial start-up

How to check the shipment and the installation location:

Testing

- ► Check that delivery is complete.
- ► Check device for sound condition.

⚠ WARNING

DAMAGED OR MODIFIED DRIVE SYSTEMS

- Damaged drive systems must be neither mounted nor commissioned.
- Do not modify the drive systems.
- Return defective devices to ELAU GmbH.

Failure to follow these instructions can result in death or serious injury.

- ► Check data against type plates.

CAUTION

SYSTEM FAULTS OR FAILURES DUE TO ELECTROMAGNETIC FIELDS

- Use mains filters and motor filters in accordance with the combination of the servo amplifier/motor, cable length and mains or motor filter..

Failure to follow these instructions can result in equipment damage.

- ► Observe requirements for the installation location.
- ► Observe requirements for the protection class and the EMC rules.

How to check the brake (if any):

Step 1:

- ▪ Make sure that the motor is off-circuit.
- ► Try to turn the motor shaft manually.
  - ✓ When off-circuit, it should **not** be possible to turn the shaft, or at least you should feel a very high resistance.
  - ✓ If the shaft can be turned without "perceptible" resistance, the brake is defective.

Step 2:

- ► Connect the control voltage to bleed the brake (pins A and B for P30 connector; pins + and - for P70 connector).

- ▶ Try to turn the motor shaft manually.
  - ✓ When the control voltage is connected, you should be able to turn the shaft.

Regrind the holding brake if a motor was stored for over 2 years before mounting.

How to regrind the holding brake:

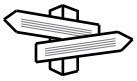
⚠ DANGER

HIGH VOLTAGE

- Grind the holding brake only when the motor is removed.

Failure to follow these instructions will result in death or serious injury.

- ▶ Move motor manually when the holding brake is closed by approx. 50 revolutions.
  - ✓ The holding brake is now ready for operation.



Please note the manuals for the servo amplifiers (MC-4).

- ▶ Then install PacDrive Motor.

How to wire the PacDrive Motor:

⚠ DANGER

HIGH LEAKAGE CURRENT

- Connect devices as of 3.5 mA AC via a fixed connection with the power supply network (according to DIN EN 50178 - Equipping high-current electrical systems).

Failure to follow these instructions will result in death or serious injury.

- ► Connect devices, beginning with the ground conductor.
- ► Check if the terminals are securely fastened and the necessary cable cross sections are correct.
- ► Tighten the locking nut with a tightening torque of 2 Nm for the power connector P30 **(1)** (7 - 8 Nm for P70) and 2.5 Nm for the signal connector **(3)**.

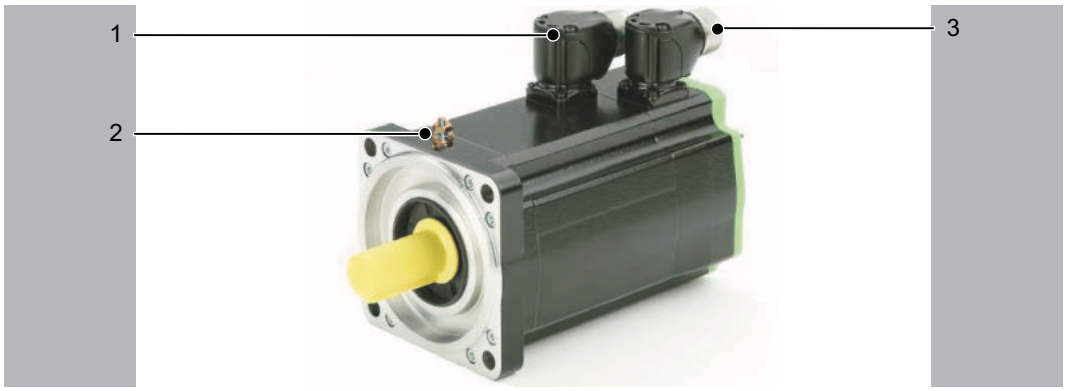


Figure 4-1: Electrical connections - SH motor

1	Brake/temperature/motor connection
2	Additional ground connection
3	Encoder Connection

- ► Check that shielding is completely correct.
- ► Eliminate the possibility of short circuits and interruptions.
- ► Check the continuity of the protective conductor system.

How to connect the motor to the protective conductor:

Option 1: (recommended configuration)

- Connect the motor with the protective conductor system using the additonal grounding connection on the motor flange **(1).**

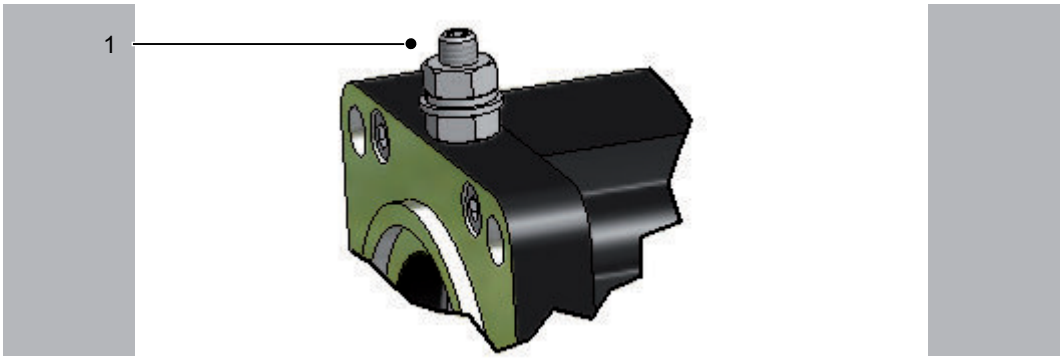


Figure 4-2: Ground connection on the motor

- Connection cross section of the grounding conductor appropriate for the mains connection-
  wiring has to be chosen for the connected upstream servo amplifier of the motor.
  (DIN EN 60204-1:2006, Section 5.2 Table 1).
- Use a grounding conductor with a minimum connection cross-section of 4 mm^2
  (DIN EN 61800-5-1:2008, section 4.3.5.4).

Option 2:

- Connect the motor to the grounded machine bed immediately above the motor flange.
- The size of the connection should be such that the ampacity is not impaired by mechanical, chemical or electromechanical factors.

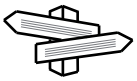
According to DIN EN 60204-1:2006 Section 18.2, the correct grounding of the motor has to be checked respectively proven on the completely installed machine at the installation location at all times.

How to finish the initial start-up:

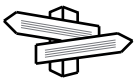
- Check safety functions such as the EMERGENCY OFF switch.
- Resume system operation according to the operating manual (from the machine manufacturer and servo amplifier).

4.2 Configuration, programming, diagnosis

The motor is matched by ELAU. The customer need not perform any aligning.



The respective servo amplifier documentation tells you how to adjust a servo amplifier to a motor.



Error diagnosis and monitoring of operating statuses are executed within the ELAU Controls. See also the relevant descriptions for these.

4.3 EMC Rules

To control and regulate the motors, the mains voltage is stored by rectification in the DC bus of the servo amplifier. This stored power is supplied to the motor by precise on and off switching using six semi-conductor switches. The steep increase/decrease in voltage places considerable demands on the dielectric strength of the motor winding. An important additional aspect to observe is the **e**lectro**m**agnetic **c**ompatibility (EMC) with other system components. The high rate of change of the clocked voltage generates harmonics of great intensity up into the high frequency range.

⚠ CAUTION

SYSTEM FAULTS OR FAILURES DUE TO ELECTROMAGNETIC FIELDS

- During installation, select the HF grounding option with the lowest ohm load (e.g. an uncoated mounting plate on the switching cabinet).
- Ensure largest possible contact surface area (skin effect).
- If necessary remove any existing paint to ensure contact.
- Lay the grounding in a star configuration from the **C**entral-**E**arthing-**P**oint.
- Current loops of earthing are prohibited and can cause unnecessary interference.
- Only use shielded cables.
- Supply large-area shielding bridges.
- Do not connect shields via the PIN contacts of connectors.
- Observe the circuit suggestions.
- Shorten the motor cables to a minimal length.
- Do not lay any cable loops in the switching cabinet.
- In conjunction with electronic controllers, do not switch inductive loads without suitable interference suppression.
- Provide for suitable interference suppression. For direct current operation, this is achieved by using recovery diodes and protector type-based, industry-standard quenching circuits during alternating current activity.
- Arrange the interference suppression immediately at the point of inductivity, as otherwise even more interference may be generated by the shock of the switching current on the interference suppression lines.
- Avoid sources of interference instead of eliminating the effects of existing interference.
- Do not arrange contacts with unsuppressed inductive loads in one room with the PacDrive Motor. The same applies for connection lines that do not lead suppressed, switched inductances and lines that run parallel to them.
- Isolate the controller from such interference sources using a Faraday cage (separately partitioned switching cabinet).
- Mains filters and motor filters may by used depending on the combination of the servo amplifier/motor and the cable length.

Failure to follow these instructions can result in equipment damage.

4.4 Maintenance, repair, cleaning

4.4.1 Maintenance.

Check brake function during operation at least once a year.

4.4.2 Repair

Proceed as follows in case of repair:

- ▶ Fill in the fault report form in the attachment (can also be sent per Fax).
- ▶ If possible, replace faulty components.
- ▶ Send faulty components back to ELAU.

4.4.3 Cleaning

How to remove dust and foreign objects from the PacDrive Motor:

- ▶ PacDrive Motor De-energize.
- ▶ Remove PacDrive Motor.

CAUTION
IMPROPER CLEANING • Use cleaning processes appropriate to the protection class of the PacDrive Motor. • Do not use any alkaline detergent because the polycarbonate can loose its stability if you have contact with it. • Do not use any cleaning fluid, as this will damage the motor's aluminum housing. **Failure to follow these instructions can result in equipment damage.**

- ▶ Then blow out PacDrive Motor with dry pressurized air (max. 1 bar).

The standard cooling method of the motor is by natural convection. Therefore, keep the motor surfaces free from dirt.

4.5 Spare part inventory

Keep a stock of the most important components to ensure that the equipment is functioning and ready for operation at all times.

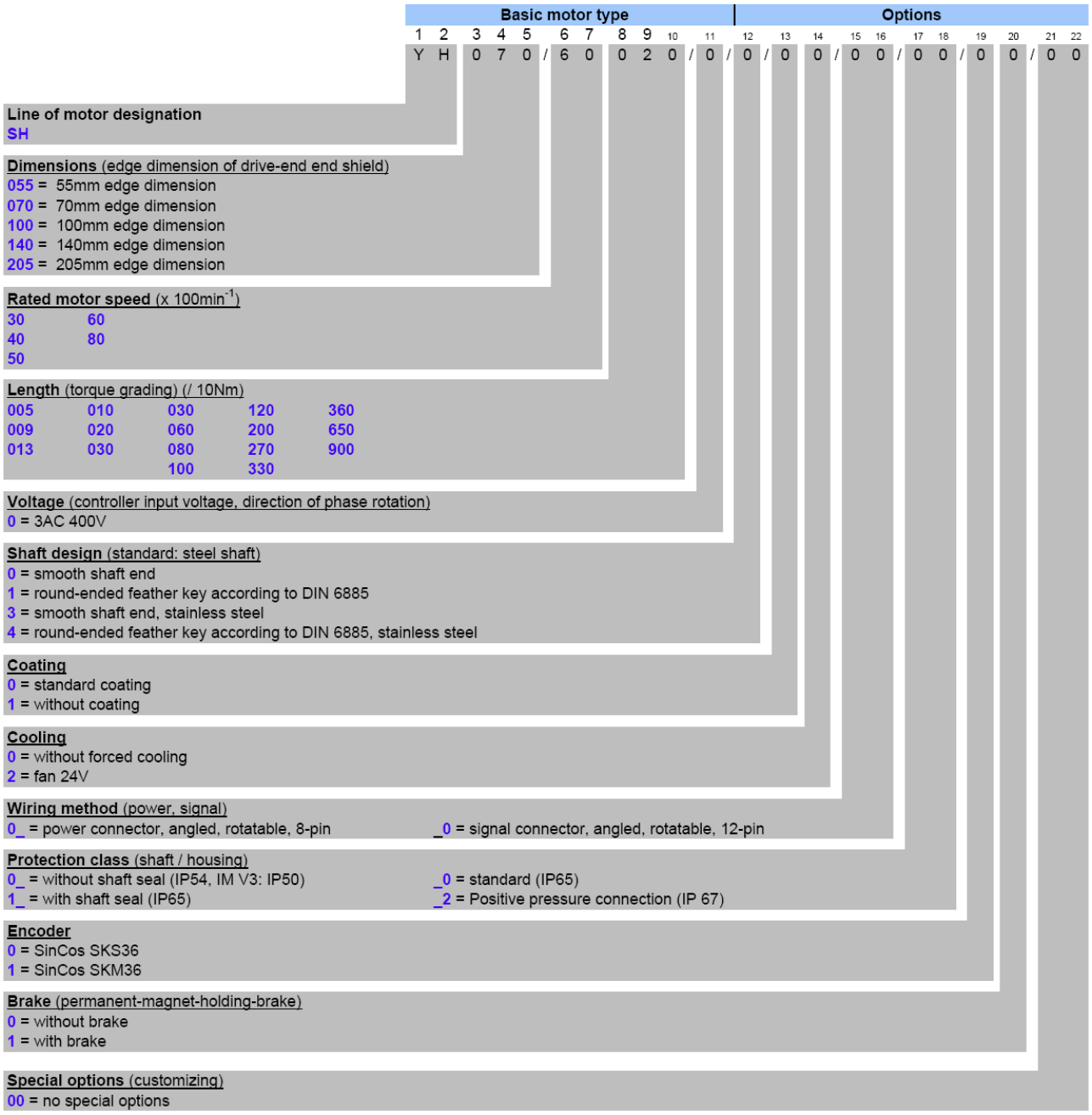
You may only exchange units with the same hardware configuration and the same software version.

Indicate the following information on the spare part order:

Item name:	e.g. PacDrive SH 070 60030-0-0-00-00-00-00-00
Item no.:	e.g. 65012102-XXX
Hardware code:	not specified
Software version:	not specified

You will find this information on the type plate and in the controller configuration of the PacDrive System.

4.6 Type code


Basic motor type
Options
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Y H 0 7 0 / 6 0 0 2 0 / 0 / 0 0 / 0 0 / 0 0 / 0 0 / 0 0 / 0 0
Line of motor designation
SH
Dimensions (edge dimension of drive-end end shield)
055 = 55mm edge dimension
070 = 70mm edge dimension
100 = 100mm edge dimension
140 = 140mm edge dimension
205 = 205mm edge dimension
Rated motor speed (x 100min-1)
30 60
40 80
50
Length (torque grading) (/ 10Nm)
005 010 030 120 360
009 020 060 200 650
013 030 080 270 900
100 330
Voltage (controller input voltage, direction of phase rotation)
0 = 3AC 400V
Shaft design (standard: steel shaft)
0 = smooth shaft end
1 = round-ended feather key according to DIN 6885
3 = smooth shaft end, stainless steel
4 = round-ended feather key according to DIN 6885, stainless steel
Coating
0 = standard coating
1 = without coating
Cooling
0 = without forced cooling
2 = fan 24V
Wiring method (power, signal)
0_ = power connector, angled, rotatable, 8-pin
_0 = signal connector, angled, rotatable, 12-pin
Protection class (shaft / housing)
0_ = without shaft seal (IP54, IM V3: IP50)
1_ = with shaft seal (IP65)
_0 = standard (IP65)
_2 = Positive pressure connection (IP 67)
Encoder
0 = SinCos SKS36
1 = SinCos SKM36
Brake (permanent-magnet-holding-brake)
0 = without brake
1 = with brake
Special options (customizing)
00 = no special options

4.7 Device replacement

How to replace the PacDrive Motor:

4.8 Cable replacement

⚠ DANGER

ELECTRICAL SHOCK, EXPLOSION OR ELECTRIC ARC

- Observe the general construction and safety regulations for working on high-current electrical systems.
- Operate electrical components only with connected protective conductor
- After installation, check the fixed connection of the protective conductor to all electrical devices to ensure that connection complies with the connection diagram.
- Make sure that the drives are at a standstill because potentially fatal voltage can occur on the motor lines in generator operation.
- Before enabling the device, safely cover the live components to prevent contact.
- Do not touch the electrical connection points of the components when the device is switched on.
- Provide protection against indirect contact (DIN EN 50178 : 1997, Section 5.3.2).
- Disconnect/plug in power connector cables only when the system is deactivated.

Failure to follow these instructions will result in death or serious injury.

Replacing cables

- ► Put main switch in "OFF" position to free system of voltage.
- ► Prevent main switch from being switched back on.
- ► Exchange the cable according to the machine manufacturer's specifications.

5 Technical data

5.1 Definition of technical data

Abbre-viation	Unit	Explanation
I_0	[A_{rms}]	Standstill current Effective value of the motor current at standstill torque M_0
I_N	[A_{rms}]	Rated current Effective value of the motor current at rated torque M_N
I_{max}	[A_{rms}]	Peak current Effective value of the motor current at peak torque M_{max}
J_M	[kgcm^2]	Rotor moment of inertia The rotor inertia refers to a motor without brake.
k_T	[Nm/A_{rms}]	Torque constant Quotient from standstill torque M_0 and standstill current I_0 (at 120°C winding temperature)
m	[kg]	Mass Motor mass without brake and without fan
M_0	[Nm]	Standstill torque; continuous torque (100 % ED) at 5 min^{-1} At an ambient temperature of 40 °C and a winding temperature of 120 °C
M_N	[Nm]	Rated torque; continuous torque (100 % ED) at n_N Due to motor speed-dependent losses less than M_0; At an ambient temperature of 40 °C and a winding temperature of 120 °C.
M_{max}	[Nm]	Peak torque The maximum torque that the servo motor can briefly deliver to the output shaft.
n_N	[min-1]	Rated motor speed
n_{max}	[min-1]	Mechanical limit velocity
P_N	[kW]	Mechanical rated power (power delivered to the shaft) At the rated motor speed and load with the rated torque
$R_{U-V, 20}$	[Ω]	Winding resistance Resistance between two phases at a winding temperature of 20 °C.
L_{U-V}	[mH]	Winding inductance between two phases
k_E	[V_{rms}/kmin^{-1}]	Voltage constant; induced voltage between two phases at 1000 min^{-1}
V	[m/s^2]	Maximum vibration (all directions)
Y	[m/s^2]	Maximum shock (all directions)
T_{TK}	[°C]	Response limit temperature sensor
t_{th}	[min]	Thermal time constant
p		Pole pair number

Table 5-1: Physical sizes with units and explanations

5.2 Mounting arrangement and protection class

The drive protection class depends on the mounting arrangement. The mounting flange for all drive types is designed in such a way that the installation type is possible according to the types of construction IM B5 (mounting flange with through hole). By the DIN 42950 Part 1 (Edition 08.77) the drives can be mounted to the machine according to the following listing types.:

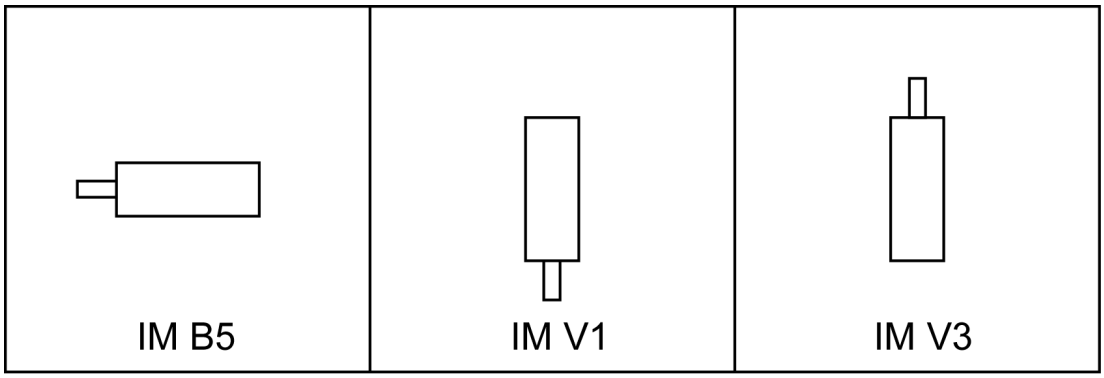


Figure 5-1: Drive installations

CAUTION

IMPERMISSIBLE MOUNTING POSITION AND PENETRATING LIQUIDS

- Liquids must be prevented from remaining on the motor shaft over an extended period of time when mounting the motor in the mounting position IM V3.

Failure to follow these instructions can result in equipment damage.

It also cannot be ruled out that liquids penetrate the motor housing along the motor shaft even if a shaft sealing ring has been installed.

Motor part	Protection class (according to EN 60529)	Mounting position (conforming to DIN 42 950)
Shaft	IP 50 IP 54 IP 65	IM V3 IM B5, IM V1 IM V3, IM V1, IM B5 (shaft sealing ring)
Surface/connections	IP 65 IP 67	IM V3, IM V1, IM B5 IM V3, IM V1, IMB5 (positive pressure)

Table 5-2: Protection class of SH Motor

Motor part	Protection class	Mounting position
Fan (optional)	IP 20	IM V1, IM V3, IM B5

Table 5-3: Protection class of the SH-Motor (option)

The SH-Motor with optional positive pressure

The optional positive pressure is suitable for using the motor in environments that place high requirements on protection against penetrating liquids.
For this, it should be taken into account that liquids with creep properties other than water are used, and that when the drives heats overpressure is caused, just as when the drive cools, underpressure is caused, which both provides favorable conditions for the penetration of liquids.

Positive pressure

Continuous protection against the penetration of liquids and gases is achieved when the housing is held under a slight overpressure with positive pressure. The air consumption is negligible since the system is closed.

Properties Single Body	Value	Comment
Pressure	0.1...0.3 bar	recommended
Pressure	0.4 bar	Max.
Operating conditions	Dust-free	using suitable micro filters
Operating conditions	Oil-free	using appropriate oil separators
Relative humidity	20...30%	

Table 5-4: Operating conditions for the usage of positive pressure

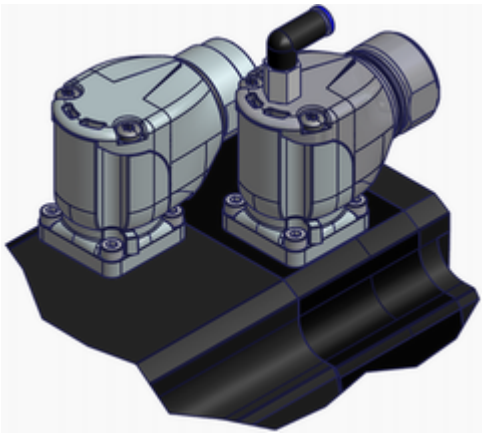


Figure 5-2: Positive pressure connection on the SH-Motor

5.3 Motor shaft and bearings

Design of the shaft end

Smooth shaft end (standard)

With a non-positive connection, torque transmission must be achieved only by surface pressure. That ensures safe power transmission without backlash.

Shaft end with round-ended feather key according to DIN 6885

Shaft connections with feather keys are positive. The feather key seating can deflect under continuous strain with changing torques and prolonged reverse operation, causing backlash. As a result, rotational quality is reduced due to backlash. Increasing deformation can lead to the feather key breaking and damage to the shaft. This type of shaft nub connection is only suitable for low requirements. Therefore, we recommend using smooth shaft ends.

Bearing

The back side bearing is designed as a fixed bearing and the bearing on shaft output side as a floating bearing.

Permissible shaft load

In case of technical correct use, the life of drives is limited by the bearing life. The customer may not replace the bearing, as the measuring systems integrated in the drive must then be reinitialized.

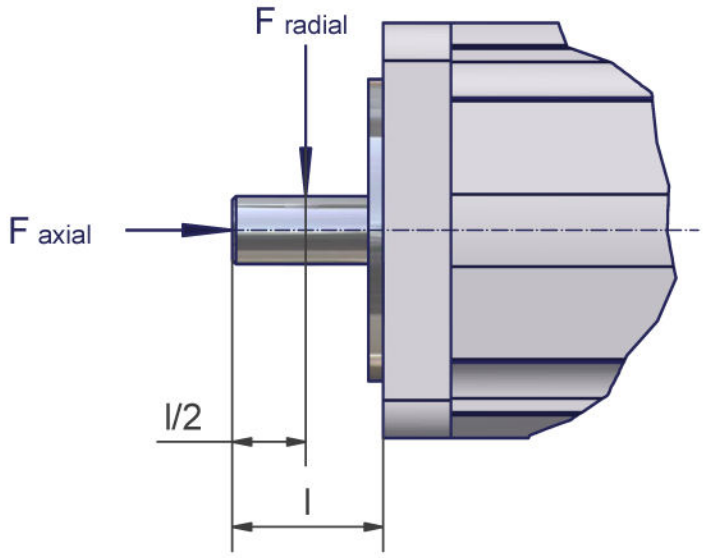


Figure 5-3: Definition of shaft load

motor	1000 min^{-1}	2000 min^{-1}	3000 min^{-1}	4000 min^{-1}	5000 min^{-1}	6000 min^{-1}	7000 min^{-1}	8000 min^{-1}
SH-055 80 005	340	270	240	220	200	190	180	170
SH-055 80 009	370	290	260	230	220	200	190	190
SH-055 80 013	390	310	270	240	230	210	200	190
SH-070 60 010	660	520	460	410	380	360	340	330
SH-070 60 020	710	560	490	450	410	390	370	350
SH-070 60 030	730	580	510	460	430	400	380	360
SH-100 50 030	900	720	630	570	530	-	-	-
SH-100 40 060	990	790	690	620	-	-	-	-
SH-100 40 080	1050	830	730	660	-	-	-	-
SH-100 30 100	1070	850	740	-	-	-	-	-
SH-140 30 120	2210	1760	1530	-	-	-	-	-
SH-140 30 200	2430	1930	1680	-	-	-	-	-
SH-140 30 270	2560	2030	1780	-	-	-	-	-
SH-140 30 330	2660	2110	1840	-	-	-	-	-
SH-205 30 360	3730	2960	2580	-	-	-	-	-
SH-205 20 650	4200	3330	-	-	-	-	-	-
SH-205 20 900	4500	3570	-	-	-	-	-	-

Table 5-5: Permissible radial force F_{radial} [N]

Basis for calculation:
The permissible axial force F_{axial} [N] is calculated according to:

$F_{axial} = 0.2 \times F_{radial}$

- Nominal bearing life L_{10h} = 20,000 h for a shaft without feather key nut (for operating hours at a 10% failure probability)
- Ambient temperature = 40 °C (approx. 100 °C storage temperature)
- Peak torque = 10 % ED
- Nominal torque = 100 % ED

5.4 Holding brake (optional)

To hold the axes without play during standstill or when the system is deactivated, you can order the servo motors with a holding brake. The permanent magnetic brake is a continuous surface unit with which the force of the permanent magnetic field is used for generating the braking effect (system opens electromagnetically).

Operating principle of the holding brake

The permanent magnetic field is compensated by an electromagnetic field for cancelling the braking effect. Reliable release without detent torque that is independent of the mounting position is ensured by a steel spring. In addition to frictionless axial armature movement, it also offers the transmission of braking torque without backlash. The motors are provided with a varistor for reducing excess voltage when the brake is engaged.

⚠ DANGER

JAMMING/SHEARING OF BODY PARTS DUE TO DANGEROUS MOVEMENT

- The holding brake alone does not ensure protection to persons.
- To ensure personal safety, higher-level constructive measures such as mesh guards or a second brake are necessary.

Failure to follow these instructions will result in death or serious injury.

⚠ CAUTION

PREMATURE WEAR DUE TO ENGAGING OF THE HOLDING BRAKE WHILE MACHINERY IS IN MOTION

- Use the holding brake only when the axes are at a standstill.
- Use the holding brake to brake an axis only in emergency stop situations. The number of emergency stops is limited by the size of the external mass used.

A non-observance of these instructions can cause bodily injury or damage the equipment.

The times mentioned in the following apply when switching in the direct current circuit, when the motor is warm, and at the rated voltage. The disconnection time is the period from the activation of the current to the dying out of the torque to 10% the rated torque of the brake. The coupling time counts as the period from when the current is switched off to the attainment of the rated torque.

The holding brake is designed differently for each series:

Technical data of the holding brake of the SH-055

Parameters	SH-055 80 005	SH-055 80 009	SH-055 80 013	Unit
Static holding torque at 120 °C	0.8	0.8	0.8	[Nm]
Coupling time	6	6	6	[ms]
Disconnection time	12	12	12	[ms]
Mass Motor mass without brake and without fan	0.08	0.08	0.08	[kg]
Moment of inertia	0.0213	0.0213	0.0213	[kgcm2]
Rated output	10	10	10	[W]
Rated voltage	24 +6/-10%	24 +6/-10%	24 +6/-10%	[VDC]

Table 5-6: Technical data of the holding brake of the SH-055

Technical data of the holding brake of the SH-070

Parameters	SH-070 60 010	SH-070 60 020	SH-070 60 030	Unit
Static holding torque at 120 °C	2.0	2.0	3.0	[Nm]
Coupling time	8	8	15	[ms]
Disconnection time	25	25	35	[ms]
Mass Motor mass without brake and without fan	0.22	0.22	0.32	[kg]
Moment of inertia	0.072	0.072	0.227	[kgcm2]
Rated output	11	11	12	[W]
Rated voltage	24 +6/-10%	24 +6/-10%	24 +6/-10%	[VDC]

Table 5-7: Technical data of the holding brake of the SH-070

Technical data of the holding brake of the SH-100

Parameters	SH-100 50 030	SH-100 40 060	SH-100 40 080	SH-100 30 100	Unit
Static holding torque at 120 °C	9.0	9.0	9.0	12.0	[Nm]
Coupling time	20	20	20	20	[ms]
Disconnection time	40	40	40	45	[ms]
Mass Motor mass without brake and without fan	0.45	0.45	0.45	0.69	[kg]
Moment of inertia	0.618	0.618	0.618	1.025	[kgcm2]
Rated output	18	18	18	17	[W]
Rated voltage	24 +6/-10%	24 +6/-10%	24 +6/-10%	24 +6/-10%	[VDC]

Table 5-8: Technical data of the holding brake of the SH-100

Technical data of the holding brake of the SH-140

Parameters	SH-140 30 120	SH-140 30 200	SH-140 30 270	SH-140 30 330	Unit
Static holding torque at 120 °C	23.0	23.0	36.0	36.0	[Nm]
Coupling time	40	40	45	45	[ms]
Disconnection time	50	50	100	100	[ms]
Mass Motor mass without brake and without fan	1.1	1.1	1.79	1.79	[kg]
Moment of inertia	1.8	1.8	5.5	5.5	[kgcm2]
Rated output	24	24	26	26	[W]
Rated voltage	24 +6/-10%	24 +6/-10%	24 +6/-10%	24 +6/-10%	[VDC]

Table 5-9: Technical data of the holding brake of the SH-140

Technical data of the holding brake of the SH-205

Parameters	SH-205 30 360	SH-205 20 650	SH-205 20 900	Unit
Static holding torque at 120 °C	80.0	80.0	80.0	[Nm]
Coupling time	50	50	50	[ms]
Disconnection time	200	200	200	[ms]
Mass Motor mass without brake and without fan	3.6	3.6	3.6	[kg]
Moment of inertia	16	16	16	[kgcm2]
Rated output	40	40	40	[W]
Rated voltage	24 +6/-10%	24 +6/-10%	24 +6/-10%	[VDC]

Table 5-10: Technical data of the holding brake of the SH-205

5.5 Ambient conditions

Procedure	Parameters	Value	Basis
Operation	**Class 3K3**		**IEC/EN 60721-3-3**
	Ambient temperature (from 0 to 1000 m above sea level)	+5°C...+40°C (At higher temperatures rated current reduction by 1% per °C)	
	Humidity	Class F (conforming to DIN 40040)	
	Condensation	no	
	Icing	no	
	another water	no	
	Class 3M6		
	Oscillations	20 m/s² (all directions in space)	
	Shock	250 m/s²	
Transport	**Class 2K3**		**IEC/EN 60721-3-2**
	Ambient temperature	-25°C...+70°C	
	Relative humidity	5% ... 95%	
	Condensation	no	
	Icing	no	
	another water	no	

Procedure	Parameters	Value	Basis
Long time storage in Transport packaging	Class 1K4		IEC/EN 60721-3-1
	Ambient temperature	-25°C...+55°C	
	Relative humidity	10% ... 100%	
	Condensation	no	
	Icing	no	
	another water	no	

Table 5-11: Ambient conditions PacDrive SH Servo motor

5.5.1 Power reduction depending on ambient temperature

If you operate the motors outside the specified rated data, the motors may be damaged. The following section describes the ambient temperature.

When operating the motor. make sure that power loss (heat) from the motor is diverted sufficiently. If the structure is thermally isolated or convection cooling is insufficient, reduce the motor power accordingly.

Increased ambient temperature

The specified ambient temperature for the motor is 40 °C. At an increased ambient temperature up to a maximum of 55 °C, the rated current drops by 1% per °C.

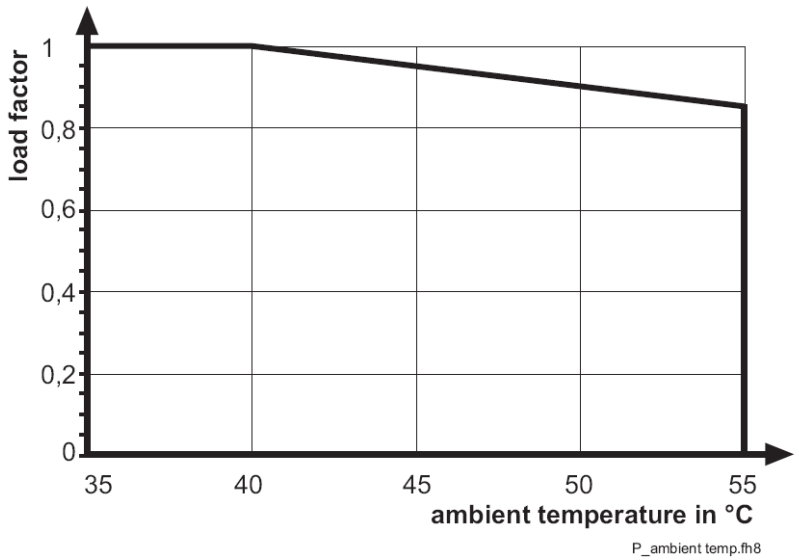


Figure 5-4: Power reduction at increased ambient temperature

In the limit range of 40 °C to 55 °C, the performance data is multiplied by the determined load factor for the ambient temperature.

5.5.2 Power reduction depending on geographic altitude of installation

If you operate the motors outside the specified rated data, the motors may be damaged. The following section describes the geographic installation altitude factors.

Low Air pressure

In environments lower than 1000 meters above sea level, no rated value power losses with the motors are expected based on the different air pressure ratio. At altitudes greater than 1000 meters above sea level and less than 3000 meters above sea level, available performance drops as shown in the diagram below.

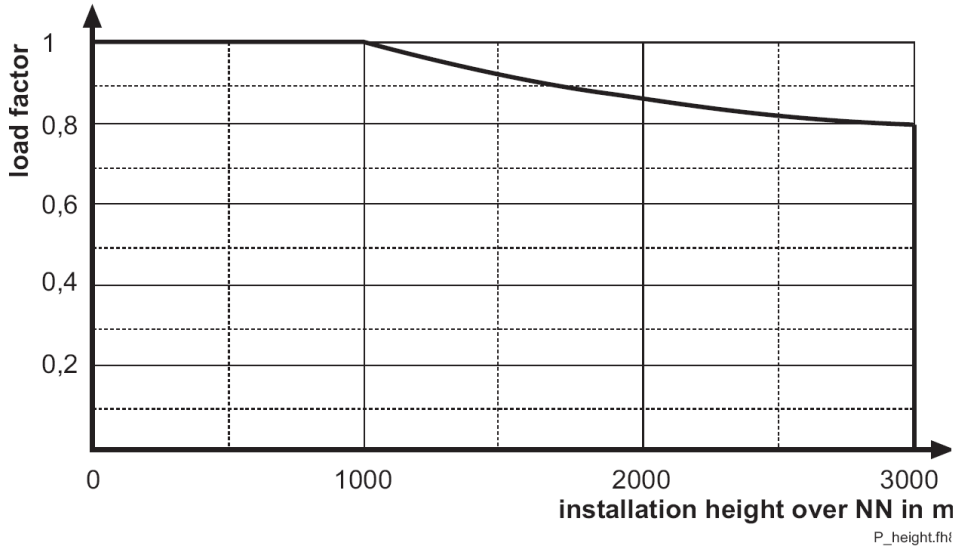


Figure 5-5: Power reduction when the installation altitude is exceeded

In the limit range of 1000 m to 3000 m, the performance data is multiplied by the load factor determined for the installation altitude.

You must multiply both load factors by the power values when reducing the power that resulted from both causes.

5.6 Motor options

Designation	Description
Motor shaft	Standard shaft with round-ended feather key according to DIN 6885 T1
Brake	Electromagnetic/permanently magnetic holding brake
Stainless steel shaft	Stainless steel shaft with/without round-ended feather key
Protection class housing	Positive pressure connection (IP 67)
Cooling	Air cooling (fan cover)
	Flange cooling (in preparation)

Table 5-12: Technical data of the motor options

5.7 Mechanical and electrical data

5.7.1 General technical features

Designation	Description
Motor type	Permanent magnet energized three-phase synchronous servomotor
Magnet material	Neodymium iron boron (NdFeB)
Isolation class (according to DIN VDE 0530)	Heat class F (155 °C)
Lubricant (according to FDA standard for servo motors)	Klübersynth UH1 64-62 food safe gearbox grease
Cooling	Self-Cooling
Motor coating, approval	Powder coating, acrylic resin-based Motor coating RAL 9005
Temperature monitoring	Three-core PTC thermistor in the stator winding, switching temperature 130 °C
Shaft end	Cylindrical shaft end according to DIN 748 with/without round-ended feather key
Rotational accuracy, concentricity, Axial runout (according to DIN 42 955)	Tolerance N (normal)
Balancing quality (according to DIN ISO 1940)	G 2.5
Installed measuring system	SinCos® SKS 36, SKM 36 with Hiperface® interface
Connection system	Round connector - straight (IP67) - angular, pivoted (IP67) - terminal box

5.7.2 Servo Motor SH-055 (self-cooling)

Category	Designation	Abbreviation [unit]	SH-055 80 005	SH-055 80 009	SH-055 80 013
General data	Standstill torque	M_0 [Nm]	0.5	0.8	1.2
	Peak Torque	M_{max} [Nm]	1.5	2.5	3.5
General data at mains voltage U_N = 230 V	Rated motor speed	n_N [min-1]	-	-	-
	Rated torque	M_N [Nm]	-	-	-
	Rated power	P_N [kW]	-	-	-
General data at mains voltage U_N = 400 V	Rated motor speed	n_N [min-1]	8000	8000	8000
	Rated torque	M_N [Nm]	0.48	0.72	1.05
	Rated power	P_N [kW]	0.4	0.6	0.88
Electrical data	Pole pair number	p	3	3	3
	Motor winding switch		Y	Y	Y
	Torque constant (120 °C)	k_T [Nm/Arms]	0.68	0.7	0.7
	Winding resistance Ph-Ph (20 °C)	R_{U-V} [Ohm]	41.8	17.4	10.4
	Winding inductance Ph-Ph	L_{U-V} [mH]	71.5	35.3	25
	Counter EMC Ph-Ph (120 °C)	k_E [V_{rms}/ $kmin^{-1}$]	40	40	41
	Standstill current	I_0 [A_{rms}]	0.73	1.2	1.7
	Rated current	I_N [A_{rms}]	0.62	1.1	1.35
	Peak current	I_{max} [A_{rms}]	2.9	4.8	6.5
Mechanical data	Moment of inertia of the rotor	J_M [kgcm²]	0.059	0.096	0.134
	Maximum permissible mechanical motor speed	n_{max} [min-1]	9000	9000	9000
	Maximum shock (all directions)	S [m/s^2]	200	200	200
	Maximum vibration	V [m/s^2]	50	50	50
	Weight	m [kg]	1.2	1.5	1.8
Thermal data	Thermal time constant	t_{th} [min]	21	26	33
	Response limit thermal contact	T_{TK} [°C]	130	130	130

Table 5-13: Technical data SH-055

5.7.3 Servo Motor SH-070 (self-cooling)

Category	Designation	Abbreviation [unit]	SH-070 60 010	SH-070 60 020	SH-070 60 030
General data	Standstill torque	M_0 [Nm]	1.4	2.2	3.1
	Peak Torque	M_{max} [Nm]	3.5	7.6	11.3
General data at mains voltage U_N = 230 V	Rated motor speed	n_N [min-1]	-	-	-
	Rated torque	M_N [Nm]	-	-	-
	Rated power	P_N [kW]	-	-	-
General data at mains voltage U_N = 400 V	Mains voltage U_N = 400V				
	Rated motor speed	n_N [min-1]	6000	6000	6000
	Rated torque	M_N [Nm]	1.3	1.9	2.3
	Rated power	P_N [kW]	0.82	1.19	1.45
Electrical data	Pole pair number	p	3	3	3
	Motor winding switch		Y	Y	Y
	Torque constant (120 °C)	k_T [Nm/Arms]	0.80	0.77	0.78
	Winding resistance Ph-Ph (20 °C)	R_{U-V} [Ohm]	10.4	4.2	2.7
	Winding inductance Ph-Ph	L_{U-V} [mH]	38.8	19	13
	Counter EMC Ph-Ph (120 °C)	k_E [V_{rms}/ $kmin^{-1}$]	46	48	49
	Standstill current	I_0 [A_{rms}]	1.8	2.9	4.1
	Rated current	I_N [A_{rms}]	1.6	2.6	3.0
	Peak current	I_{max} [A_{rms}]	5.7	11.8	17.0
Mechanical data	Moment of inertia of the rotor	J_M [kgcm²]	0.25	0.41	0.58
	Maximum permissible mechanical motor speed	n_{max} [min-1]	8000	8000	8000
	Maximum shock (all directions)	S [m/s^2]	200	200	200
	Maximum vibration	V [m/s^2]	50	50	50
	Weight	m [kg]	2.1	2.8	3.6
Thermal data	Thermal time constant	t_{th} [min]	35	38	51
	Response limit thermal contact	T_{TK} [°C]	130	130	130

Table 5-14: Technical data SH-070

5.7.4 Servo Motor SH-100 (self-cooling)

Category	Designation	Abbreviation [unit]	SH-100 50 030	SH-100 40 060	SH-100 40 080	SH-100 30 100
General data	Standstill torque	M_0 [Nm]	3.3	5.8	8.0	10.0
	Peak Torque	M_{max} [Nm]	9.6	18.3	28.3	40.5
General data at mains voltage U_N = 230 V	Rated motor speed	n_N [min-1]	-	-	-	-
	Rated torque	M_N [Nm]	-	-	-	-
	Rated power	P_N [kW]	-	-	-	-
General data at mains voltage U_N = 400 V	Rated motor speed	n_N [min-1]	5000	4000	4000	3000
	Rated torque	M_N [Nm]	2.7	4.6	5.7	7.9
	Rated power	P_N [kW]	1.41	1.93	2.39	2.48
Electrical data	Pole pair number	p	4	4	4	4
	Motor winding switch		Y	Y	Y	Y
	Torque constant (120 °C)	k_T [Nm/ Arms]	0.89	1.21	1.22	1.62
	Winding resistance Ph-Ph (20 °C)	R_{U-V} [Ohm]	3.80	2.40	1.43	1.81
	Winding inductance Ph-Ph	L_{U-V} [mH]	17.6	12.7	8.8	11.8
	Counter EMC Ph-Ph (120 °C)	k_E [V_{rms}/ $kmin^{-1}$]	60	77	77	103
	Standstill current	I_0 [A_{rms}]	3.5	4.8	6.6	6.2
	Rated current	I_N [A_{rms}]	2.8	3.8	4.9	5.3
	Peak current	I_{max} [A_{rms}]	12	17.1	28.3	32.3
Mechanical data	Moment of inertia of the rotor	J_M [kgcm²]	1.40	2.31	3.22	4.22
	Maximum permissible mechanical motor speed	n_{max} [min-1]	6000	6000	6000	6000
	Maximum shock (all directions)	S [m/s^2]	200	200	200	200
	Maximum vibration	V [m/s^2]	50	50	50	50
	Weight	m [kg]	4.3	5.8	7.5	9.2
Thermal data	Thermal time constant	t_{th} [min]	44	48	56	58
	Response limit thermal contact	T_{TK} [°C]	130	130	130	130

Table 5-15: Technical data SH-100 (self-cooling)

5.7.5 Servo Motor SH-100 (force-ventilated)

Category	Designation	Abbreviation [unit]	SH-100 50 030	SH-100 40 060	SH-100 40 080	SH-100 30 100
General data	Standstill torque	M_0 [Nm]	4.3	7.5	11.0	14.2
	Peak Torque	M_{max} [Nm]	9.6	18.3	28.3	40.5
General data at mains voltage U_N = 230 V	Rated motor speed	n_N [min-1]	-	-	-	-
	Rated torque	M_N [Nm]	-	-	-	-
	Rated power	P_N [kW]	-	-	-	-
General data at mains voltage U_N = 400 V	Rated motor speed	n_N [min-1]	5000	4000	4000	3000
	Rated torque	M_N [Nm]	3.5	6.4	9.0	12.8
	Rated power	P_N [kW]	1.83	2.68	3.77	4.02
Electrical data	Pole pair number	p	4	4	4	4
	Motor winding switch		Y	Y	Y	Y
	Torque constant (120 °C)	k_T [Nm/ Arms]	0.89	1.21	1.22	1.62
	Winding resistance Ph-Ph (20 °C)	R_{U-V} [Ohm]	3.80	2.40	1.43	1.81
	Winding inductance Ph-Ph	L_{U-V} [mH]	17.6	12.7	8.8	11.8
	Counter EMC Ph-Ph (120 °C)	k_E [V_{rms}/ $kmin^{-1}$]	60	77	77	103
	Standstill current	I_0 [A_{rms}]	4.7	6.3	9.0	8.9
	Rated current	I_N [A_{rms}]	4.0	5.7	7.8	8.5
	Peak current	I_{max} [A_{rms}]	12	17.1	28.3	32.3
Mechanical data	Moment of inertia of the rotor	J_M [kgcm²]	1.40	2.31	3.22	4.22
	Maximum permissible mechanical motor speed	n_{max} [min-1]	6000	6000	6000	6000
	Maximum shock (all directions)	S [m/s^2]	200	200	200	200
	Maximum vibration	V [m/s^2]	50	50	50	50
	Weight	m [kg]	4.3	5.8	7.5	9.2
Thermal data	Thermal time constant	t_{th} [min]	44	48	56	58
	Response limit thermal contact	T_{TK} [°C]	130	130	130	130

Table 5-16: Technical Data SH-100 (force-ventilated)

5.7.6 Servo Motor SH-140 (self-cooling)

Category	Designation	Abbreviation [unit]	SH-140 30 120	SH-140 30 200	SH-140 30 270	SH-140 30 330
General data	Standstill torque	M_0 [Nm]	11.1	19.5	27.8	33.4
	Peak Torque	M_{max} [Nm]	27.0	60.1	90.2	131.9
General data at mains voltage U_N = 230 V	Rated motor speed	n_N [min-1]	-	-	-	-
	Rated torque	M_N [Nm]	-	-	-	-
	Rated power	P_N [kW]	-	-	-	-
General data at mains voltage U_N = 400 V	Rated motor speed	n_N [min-1]	3000	3000	3000	3000
	Rated torque	M_N [Nm]	9.2	12.3	12.9	16.1
	Rated power	P_N [kW]	2.89	3.86	4.05	5.06
Electrical data	Pole pair number	p	5	5	5	5
	Motor winding switch		Y	Y	Y	Y
	Torque constant (120 °C)	k_T [Nm/ Arms]	1.43	1.47	1.58	1.57
	Winding resistance Ph-Ph (20 °C)	R_{U-V} [Ohm]	1.41	0.60	0.40	0.28
	Winding inductance Ph-Ph	L_{U-V} [mH]	15.6	7.4	5.1	3.9
	Counter EMC Ph-Ph (120 °C)	k_E [V_{rms}/ $kmin^{-1}$]	100	101	105	104
	Standstill current	I_0 [A_{rms}]	7.8	13.2	17.6	21.3
	Rated current	I_N [A_{rms}]	6.8	8.9	8.7	11.0
	Peak current	I_{max} [A_{rms}]	20.8	44.1	61.0	95.6
Mechanical data	Moment of inertia of the rotor	J_M [kgcm²]	7.41	12.68	17.94	23.70
	Maximum permissible mechanical motor speed	n_{max} [min-1]	4000	4000	4000	4000
	Maximum shock (all directions)	S [m/s^2]	200	200	200	200
	Maximum vibration	V [m/s^2]	50	50	50	50
	Weight	m [kg]	11.9	16.6	21.3	26.0
Thermal data	Thermal time constant	t_{th} [min]	64	74	79	83
	Response limit thermal contact	T_{TK} [°C]	130	130	130	130

Table 5-17: Technical data SH-140 (self-cooling)

5.7.7 Servo Motor SH-140 (force-ventilated)

Category	Designation	Abbreviation [unit]	SH-140 30 120	SH-140 30 200	SH-140 30 270	SH-140 30 330
General data	Standstill torque	M_0 [Nm]	15.6	30.8	42.4	54.8
	Peak Torque	M_{max} [Nm]	27 ,0	60.1	90.2	131.9
General data at mains voltage U_N = 230 V	Rated motor speed	n_N [min-1]	-	-	-	-
	Rated torque	M_N [Nm]	-	-	-	-
	Rated power	P_N [kW]	-	-	-	-
General data at mains voltage U_N = 400 V	Rated motor speed	n_N [min-1]	3000	3000	3000	3000
	Rated torque	M_N [Nm]	13.3	25.0	33.0	35.2
	Rated power	P_N [kW]	4.18	7.85	10.37	11.06
Electrical data	Pole pair number	p	5	5	5	5
	Motor winding switch		Y	Y	Y	Y
	Torque constant (120 °C)	k_T [Nm/ Arms]	1.43	1.47	1.58	1.57
	Winding resistance Ph-Ph (20 °C)	R_{U-V} [Ohm]	1.41	0.60	0.40	0.28
	Winding inductance Ph-Ph	L_{U-V} [mH]	15.6	7.4	5.1	3.9
	Counter EMC Ph-Ph (120 °C)	k_E [V_{rms}/ $kmin^{-1}$]	100	101	105	104
	Standstill current	I_0 [A_{rms}]	11.0	21.6	27.7	33.6
	Rated current	I_N [A_{rms}]	9.8	17.6	21.4	23.1
	Peak current	I_{max} [A_{rms}]	20.8	44.1	61.0	95.6
Mechanical data	Moment of inertia of the rotor	J_M [kgcm²]	7.41	12.68	17.94	23.70
	Maximum permissible mechanical motor speed	n_{max} [min-1]	4000	4000	4000	4000
	Maximum shock (all directions)	S [m/s^2]	200	200	200	200
	Maximum vibration	V [m/s^2]	50	50	50	50
	Weight	m [kg]	11.9	16.6	21.3	26.0
Thermal data	Thermal time constant	t_{th} [min]	64	74	79	83
	Response limit thermal contact	T_{TK} [°C]	130	130	130	130

Table 5-18: Technical data SH-140

5.7.8 Servo Motor SH-205 (self-cooling)

Category	Designation	Abbreviation [unit]	SH-205 30 360	SH-205 20 650	SH-205 20 900
General data	Standstill torque	M_0 [Nm]	36.9	64.9	94.4
	Peak Torque	M_{max} [Nm]	110	220	330
General data at mains voltage U_N = 230 V	Rated motor speed	n_N [min-1]	-	-	-
	Rated torque	M_N [Nm]	-	-	-
	Rated power	P_N [kW]	-	-	-
General data at mains voltage U_N = 400 V	Rated motor speed	n_N [min-1]	3000	2000	2000
	Rated torque	M_N [Nm]	17.5	38.1	50.7
	Rated power	P_N [kW]	5.5	7.98	10.62
Electrical data	Pole pair number	p	5	5	5
	Motor winding switch		Y	Y	Y
	Torque constant (120 °C)	k_T [Nm/Arms]	1.75	2.52	2.84
	Winding resistance Ph-Ph (20 °C)	R_{U-V} [Ohm]	0.3	0.3	0.2
	Winding inductance Ph-Ph	L_{U-V} [mH]	5.8	5.7	4.0
	Counter EMC Ph-Ph (120 °C)	k_E [V_{rms}/ $kmin^{-1}$]	116	162	172
	Standstill current	I_0 [A_{rms}]	21.0	25.7	33.2
	Rated current	I_N [A_{rms}]	11.5	17.8	20.4
	Peak current	I_{max} [A_{rms}]	87.2	96.8	136.1
Mechanical data	Moment of inertia of the rotor	J_M [kgcm²]	71.4	129.0	190.0
	Maximum permissible mechanical motor speed	n_{max} [min-1]	3800	3800	3800
	Maximum shock (all directions)	S [m/s^2]	200	200	200
	Maximum vibration	V [m/s^2]	50	50	50
	Weight	m [kg]	35	50	67
Thermal data	Thermal time constant	t_{th} [min]	73	88	101
	Response limit thermal contact	T_{TK} [°C]	130	130	130

Table 5-19: Technical data SH-205 (self-cooling)

5.7.9 Servo Motor SH-205 (force-ventilated)

Category	Designation	Abbreviation [unit]	SH-205 30 360	SH-205 20 650	SH-205 20 900
General data	Standstill torque	M_0 [Nm]	46.9	87.2	124.5
	Peak Torque	M_{max} [Nm]	110	220	330
General data at mains voltage U_N = 230 V	Rated motor speed	n_N [min-1]	-	-	-
	Rated torque	M_N [Nm]	-	-	-
	Rated power	P_N [kW]	-	-	-
General data at mains voltage U_N = 400 V	Rated motor speed	n_N [min-1]	3000	2000	2000
	Rated torque	M_N [Nm]	30.7	56.8	71.9
	Rated power	P_N [kW]	9.64	11.9	15.06
Electrical data	Pole pair number	p	5	5	5
	Motor winding switch		Y	Y	Y
	Torque constant (120 °C)	k_T [Nm/Arms]	1.62	2.34	2.64
	Winding resistance Ph-Ph (20 °C)	R_{U-V} [Ohm]	0.3	0.3	0.2
	Winding inductance Ph-Ph	L_{U-V} [mH]	5.8	5.7	4.0
	Counter EMC Ph-Ph (120 °C)	k_E [V_{rms}/ $kmin^{-1}$]	116	162	172
	Standstill current	I_0 [A_{rms}]	28.9	37.3	47.2
	Rated current	I_N [A_{rms}]	21.2	30.8	32.4
	Peak current	I_{max} [A_{rms}]	87.2	96.8	136.1
Mechanical data	Moment of inertia of the rotor	J_M [kgcm²]	71.4	129.0	190.0
	Maximum permissible mechanical motor speed	n_{max} [min-1]	3800	3800	3800
	Maximum shock (all directions)	S [m/s^2]	200	200	200
	Maximum vibration	V [m/s^2]	50	50	50
	Weight	m [kg]	35	50	67
Thermal data	Thermal time constant	t_{th} [min]	73	88	101
	Response limit thermal contact	T_{TK} [°C]	130	130	130

Table 5-20: Technical Data SH-205 (force-ventilated)

5.7.10 Fan cover

Parameters	Unit	SH100	SH140	SH205
Rated voltage	[V DC]	24	24	24
Power consumption	[Watt]	9.5	26	3.5

Table 5-21: Technical data of the fan 24V DC

5.7.11 Encoder

SinCos® (SKS36) single turn

Parameters	Value	Unit
Resolution	Dependent on the controller	
Number of sine/cosine periods	128	Per revolution
Absolute measuring range	1	Revolutions
Error limits of the digital absolute value	+/-5.3	Angular minutes
Error limits when evaluating the 128 signals (integral non-linearity)	+/-1.3	Angular minutes
Signal form	Sine	
Supply voltage	7 ... 12	Volts
Recommended supply voltage	8	Volts
Supply current	Max. 60 (without load)	Milliamperes

Table 5-22: Technical data of the SinCos encoder (SKS-36)

SinCos® (SKM36) multiturn

Parameters	Value	Unit
Resolution	Dependent on the controller	
Number of sine/cosine periods	128	Per revolution
Absolute measuring range	4096	Revolutions
Error limits of the digital absolute value	+/-5.3	Angular minutes
Error limits when evaluating the 128 signals (integral non-linearity)	+/-1.3	Angular minutes
Signal form	Sine	
Supply voltage	7 ... 12	Volts
Recommended supply voltage	8	Volts
Supply current	Max. 60 (without load)	Milliamperes

Table 5-23: Technical data of the SinCos® encoder (SKM-36)

5.8 Torque/speed characteristic curves

The torque-speed characteristic curve represents the following characteristics:

- The permissible permanent torque (operating type S 1)
- The peak torque when the mains voltage = 230 V 3 AC

- The peak torque when the mains voltage = 400 V 3 AC

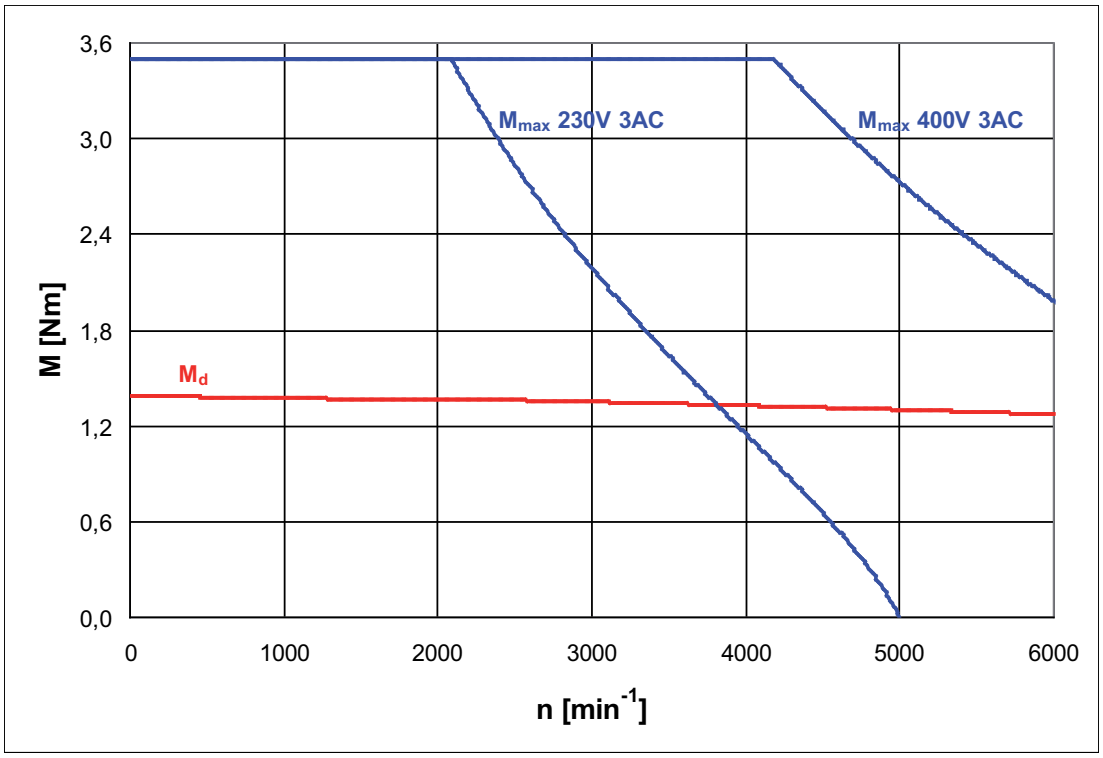


Figure 5-6: Example of a torque-speed characteristic curve

The characteristic curves refer to an ambient temperature of 40°C and a maximum winding temperature of 120°C.

With a one-phase mains connection (230 V), the characteristic curve shifts by approx. 20% further to the left due to lower DC bus voltage.

Self-cooling

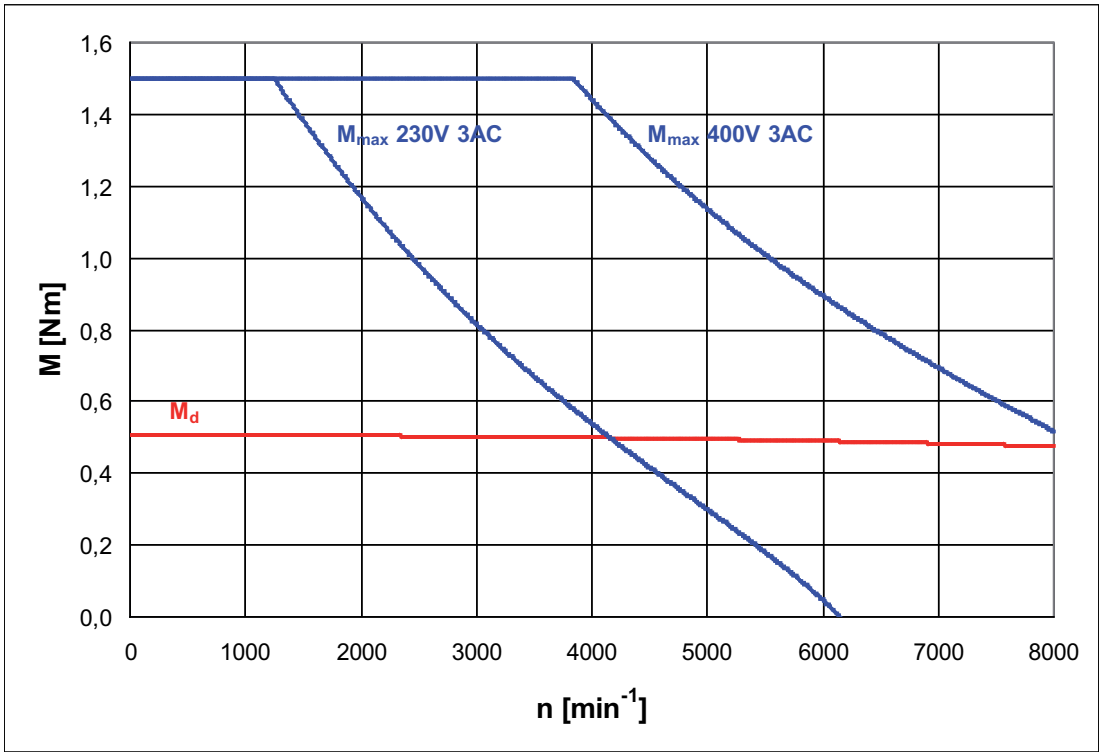


Figure 5-7: Torque-speed characteristics SH 055 80 005 (self-cooling)

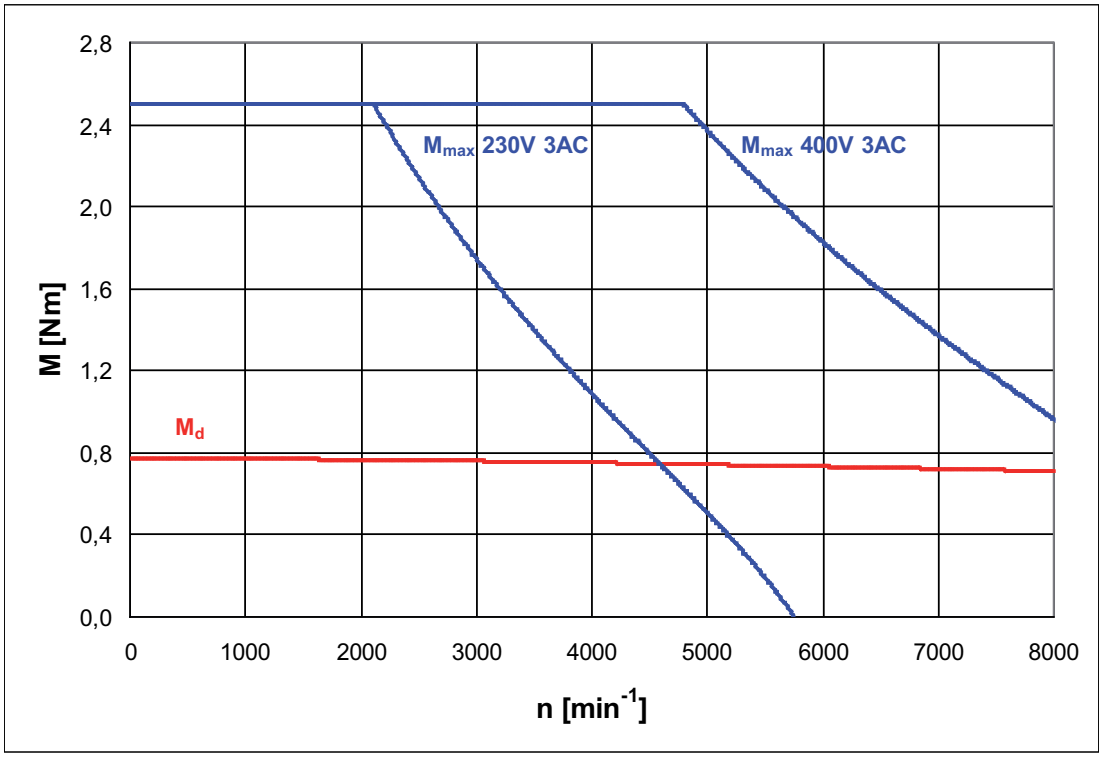


Figure 5-8: Torque-speed characteristics SH 055 80 009 (self-cooling)

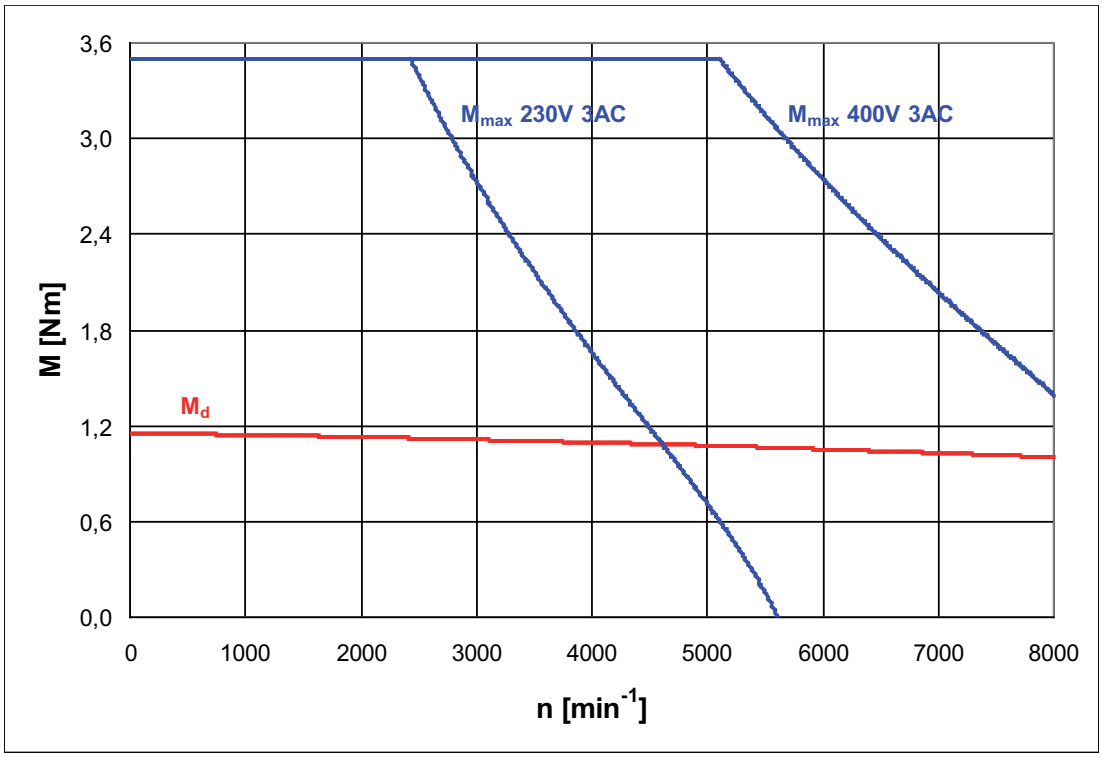


Figure 5-9: Torque-speed characteristics SH 055 80 013 (self-cooling)

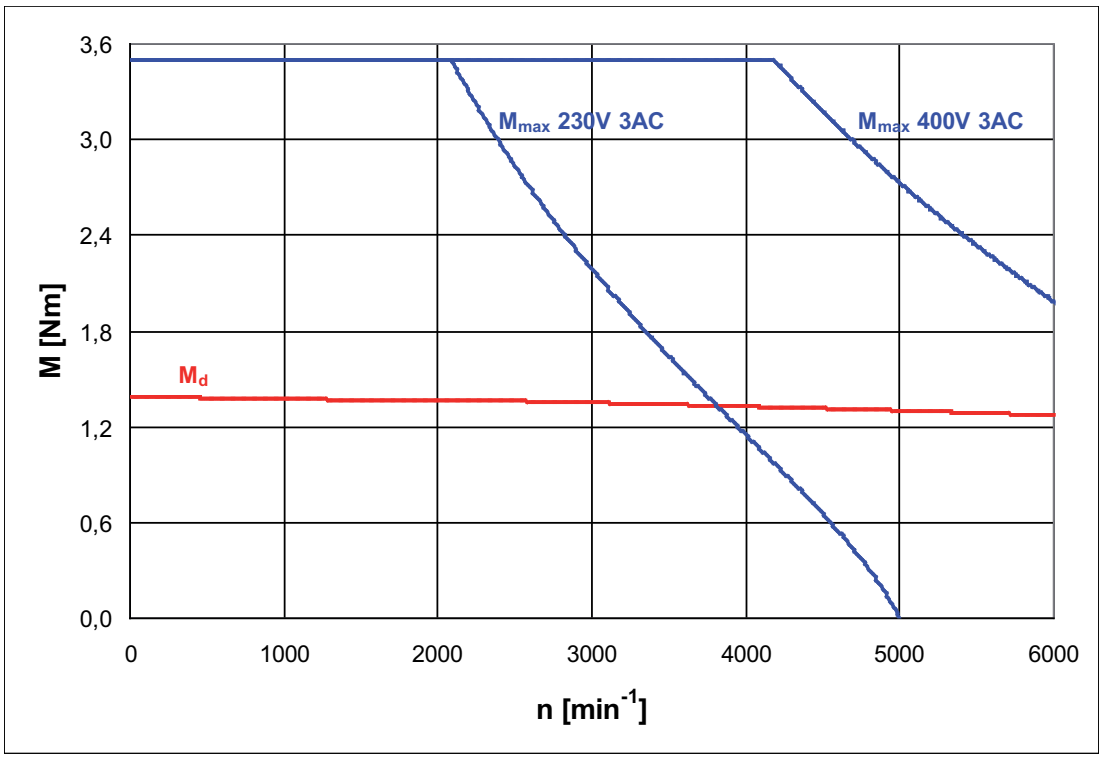


Figure 5-10: Torque-speed characteristics SH 070 60 010 (self-cooling)

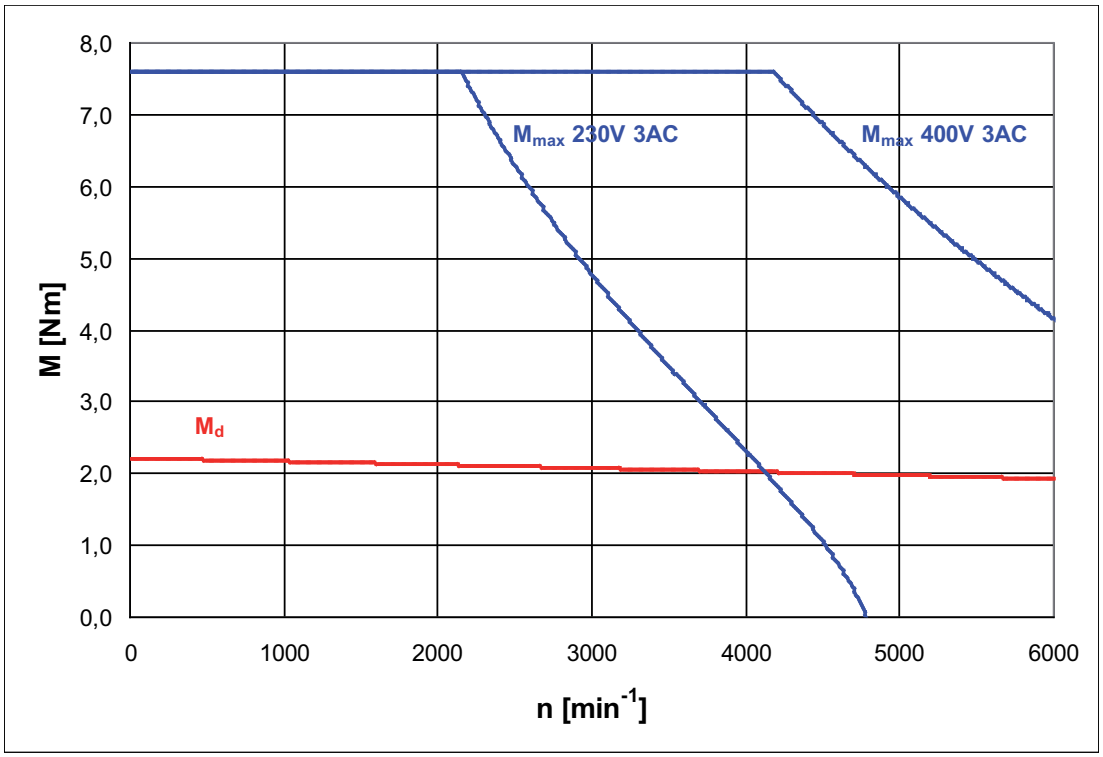


Figure 5-11: Torque-speed characteristics SH 070 60 020 (self-cooling)

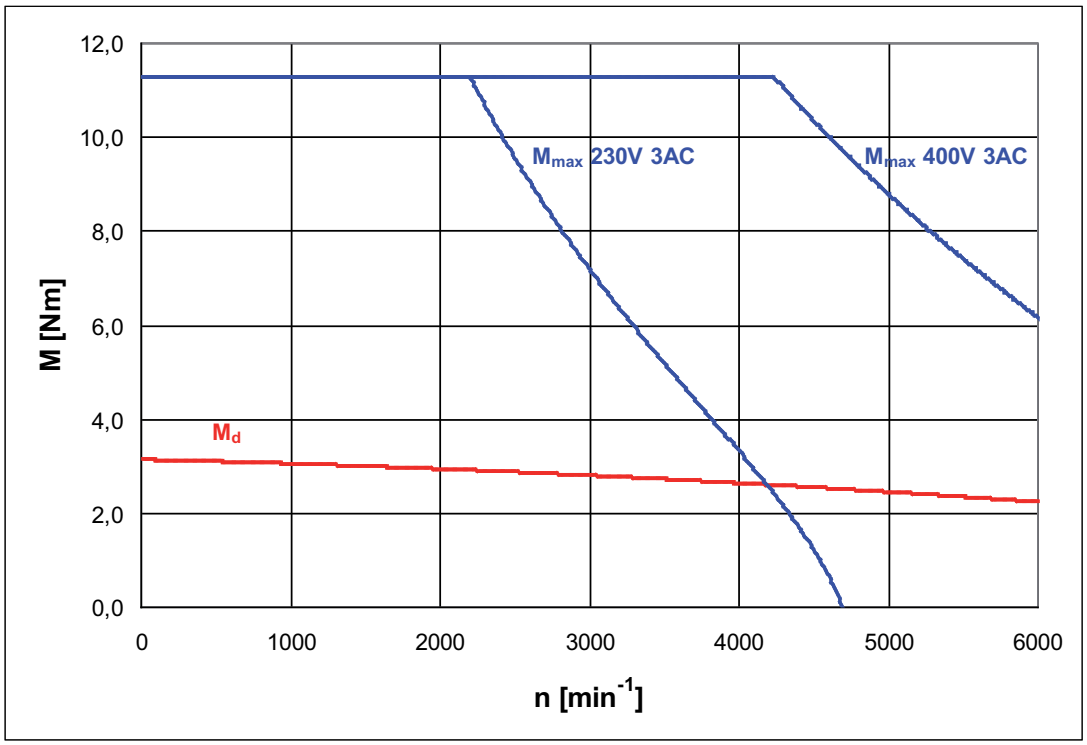


Figure 5-12: Torque-speed characteristics SH 070 60 030 (self-cooling)

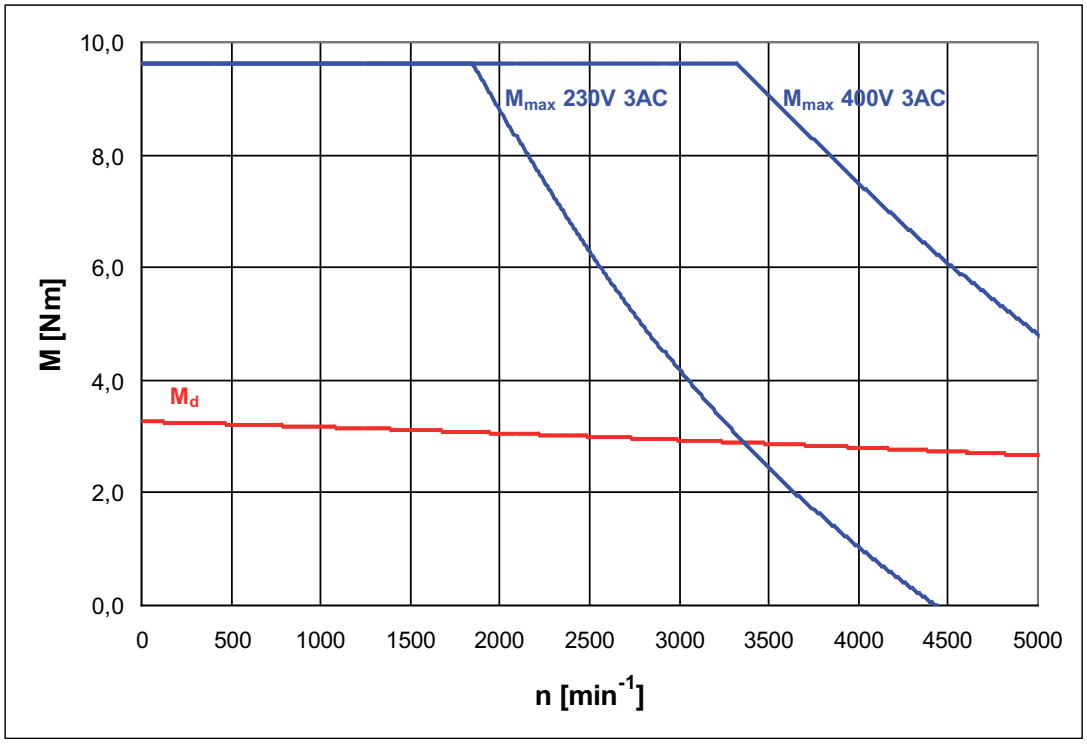


Figure 5-13: Torque-speed characteristics SH 100 50 030 (self-cooling)

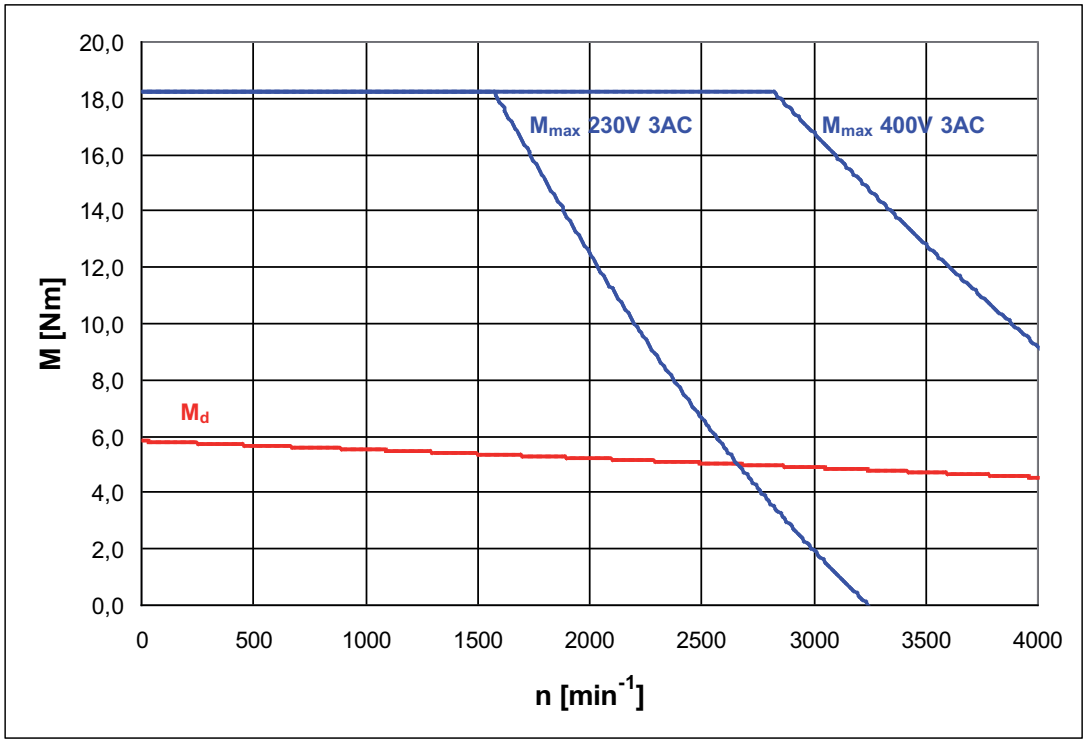


Figure 5-14: Torque-speed characteristics SH 100 40 060 (self-cooling)

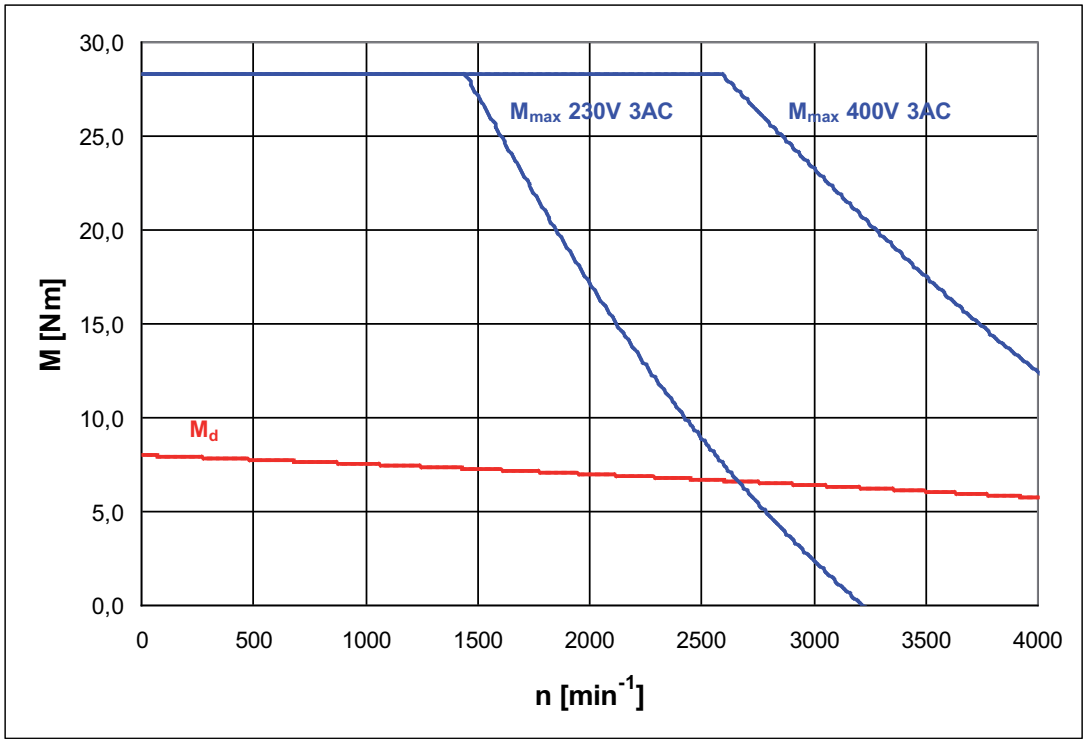


Figure 5-15: Torque-speed characteristics SH 100 40 080 (self-cooling)

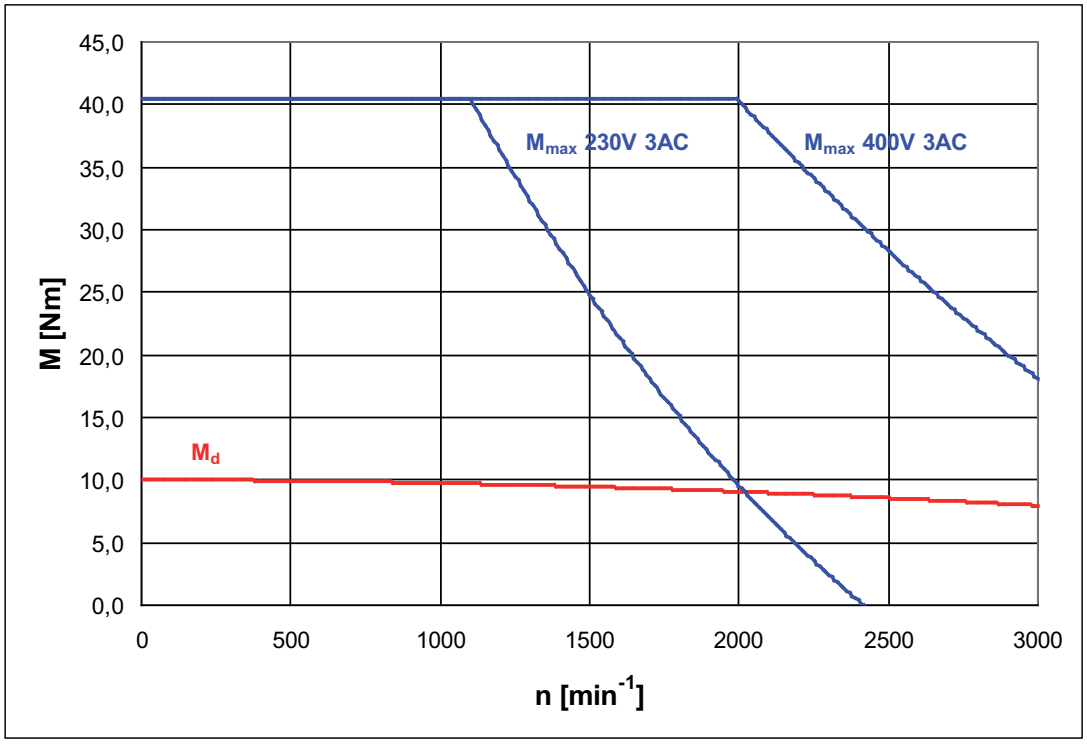


Figure 5-16: Torque-speed characteristics SH 100 30 100 (self-cooling)

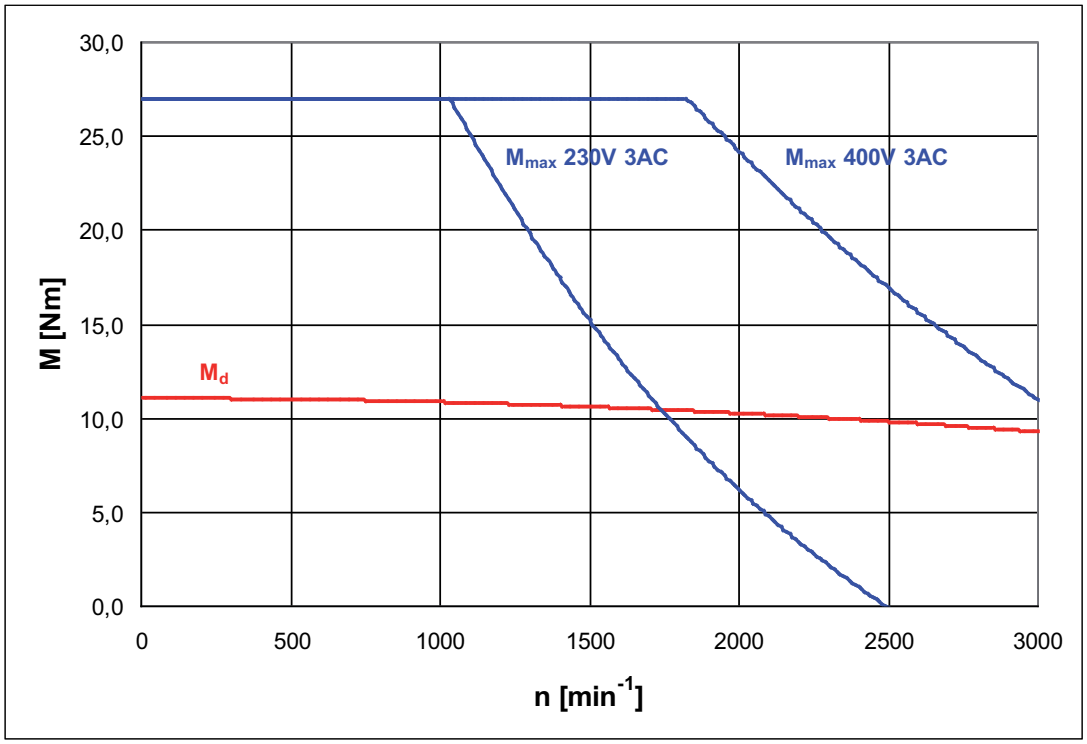


Figure 5-17: Torque-speed characteristics SH 140 30 120 (self-cooling)

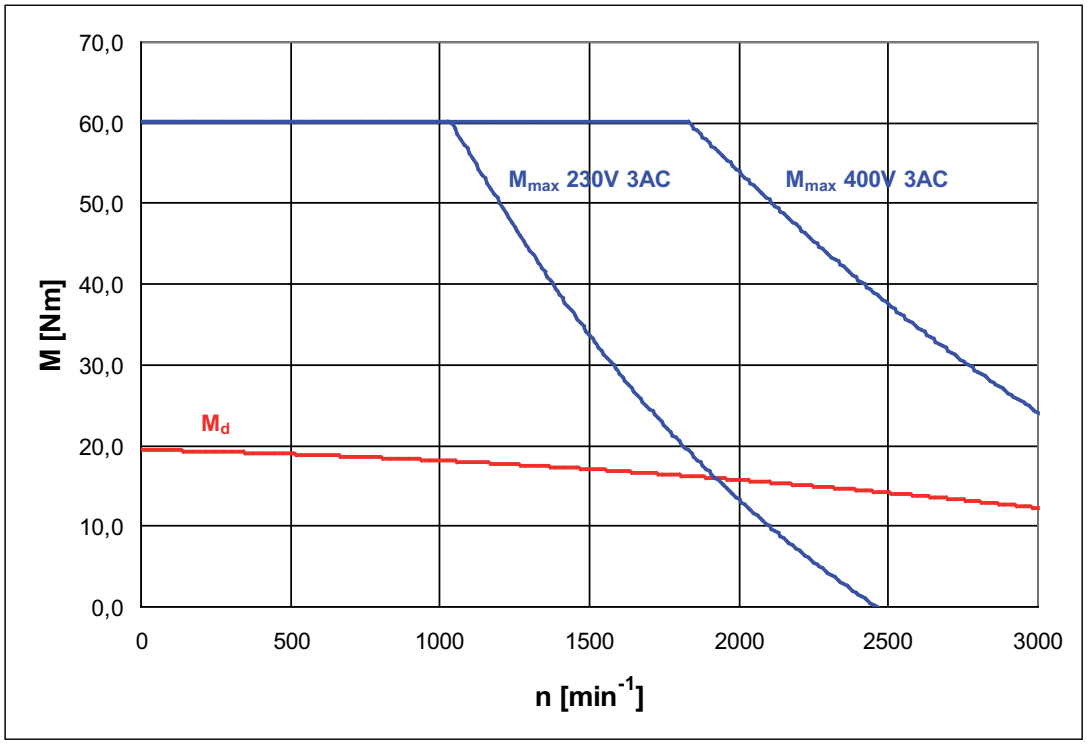


Figure 5-18: Torque-speed characteristics SH 140 30 200 (self-cooling)

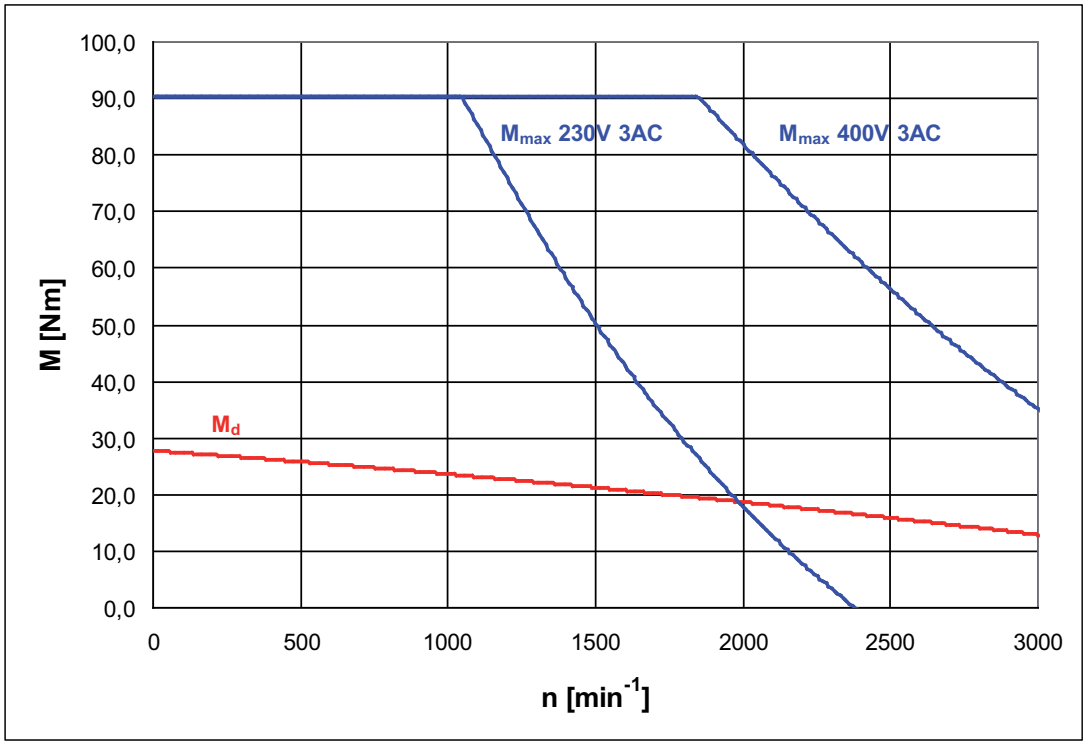


Figure 5-19: Torque-speed characteristics SH 140 30 270 (self-cooling)

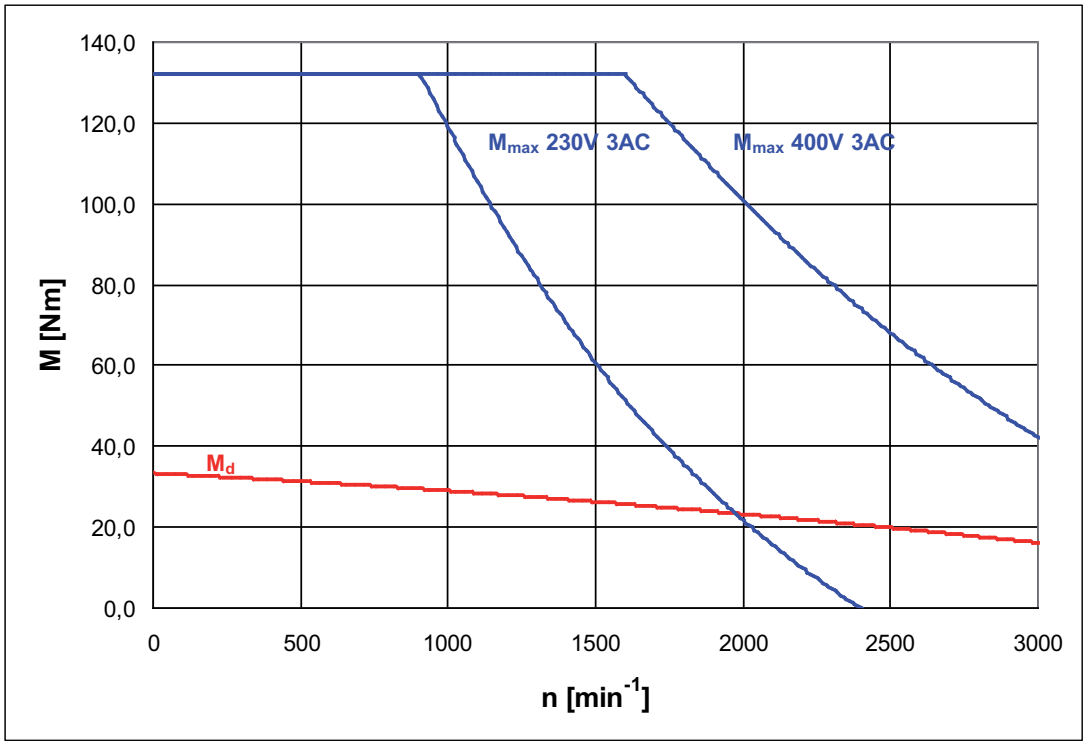


Figure 5-20: Torque-speed characteristics SH 140 30 330 (self-cooling)

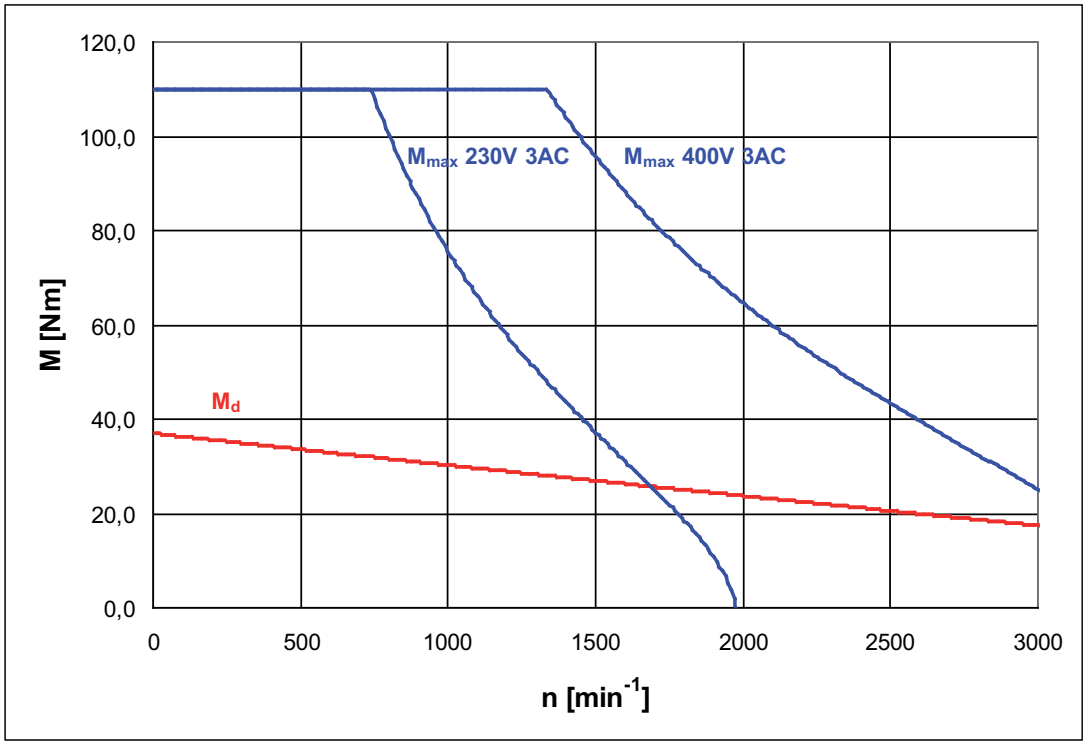


Figure 5-21: Torque-speed characteristics SH 205 30 360 (self-cooling)

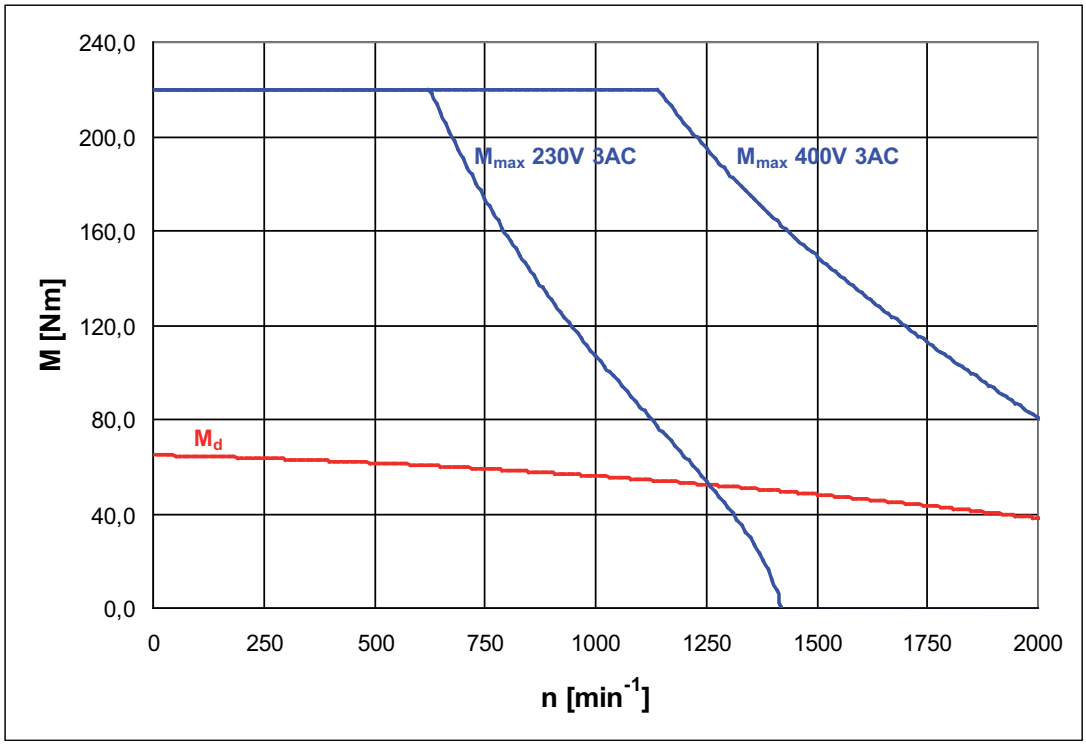


Figure 5-22: Torque-speed characteristics SH 205 20 650 (self-cooling)

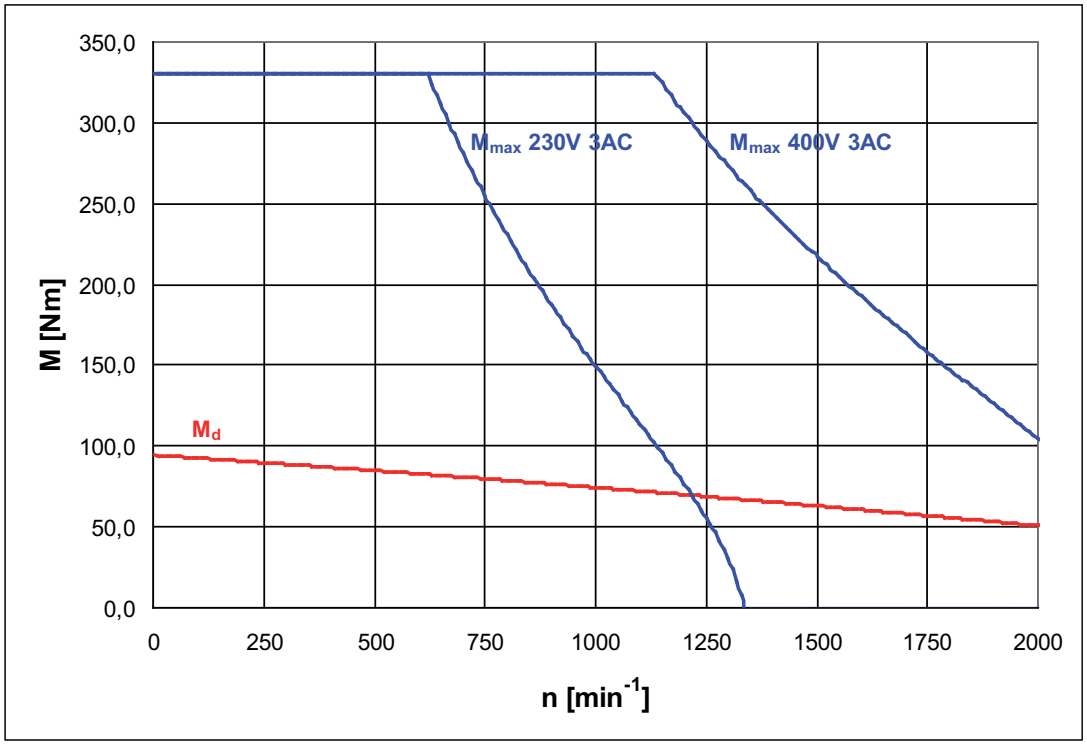


Figure 5-23: Torque-speed characteristics SH 205 20 900 (self-cooling)

Force-ventilated

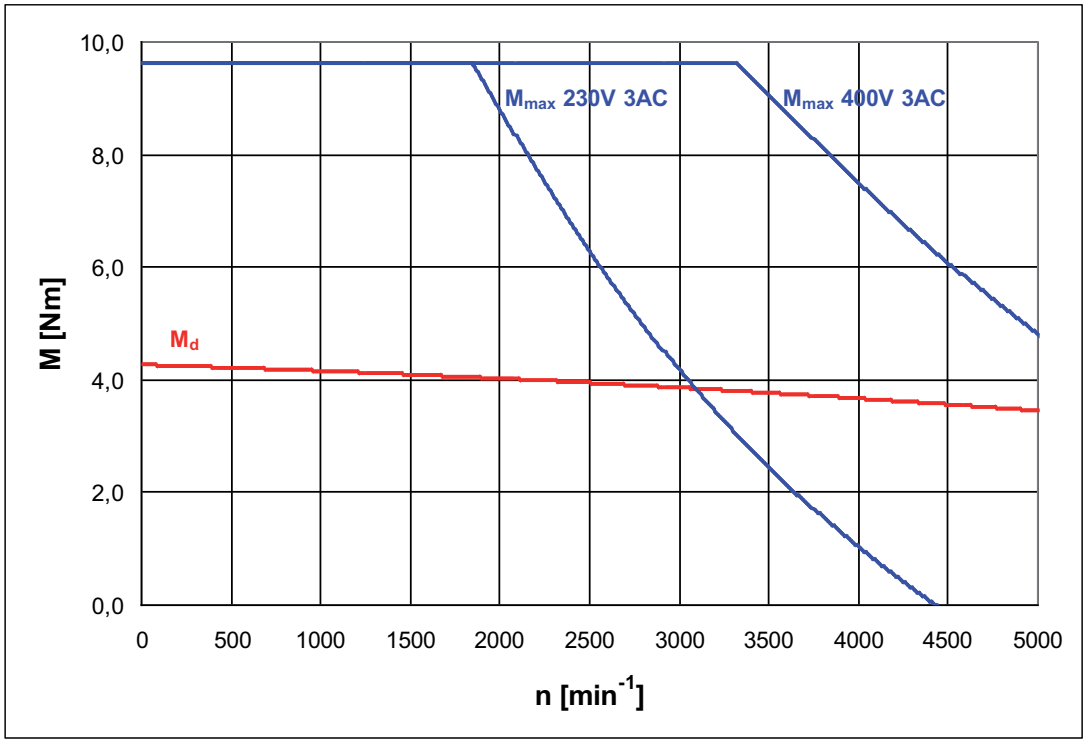


Figure 5-24: Torque-speed characteristics SH 100 50 030 (force-ventilated)

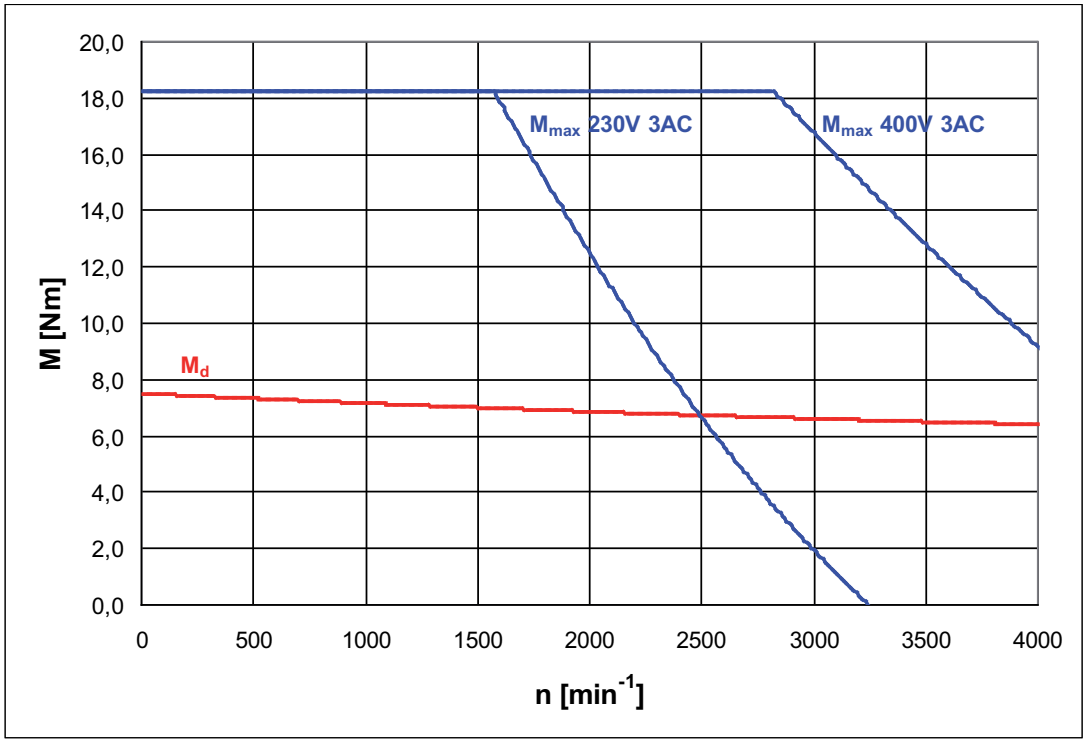


Figure 5-25: Torque-speed characteristics SH 100 40 060 (force-ventilated)

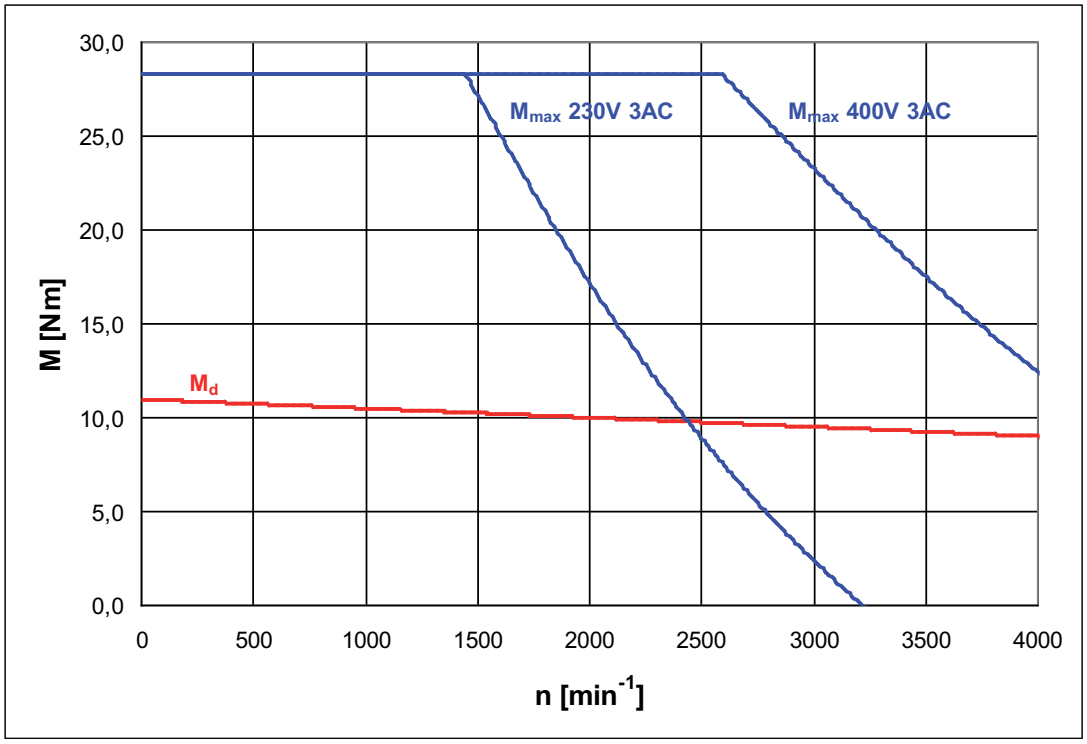


Figure 5-26: Torque-speed characteristics SH 100 40 080 (force-ventilated)

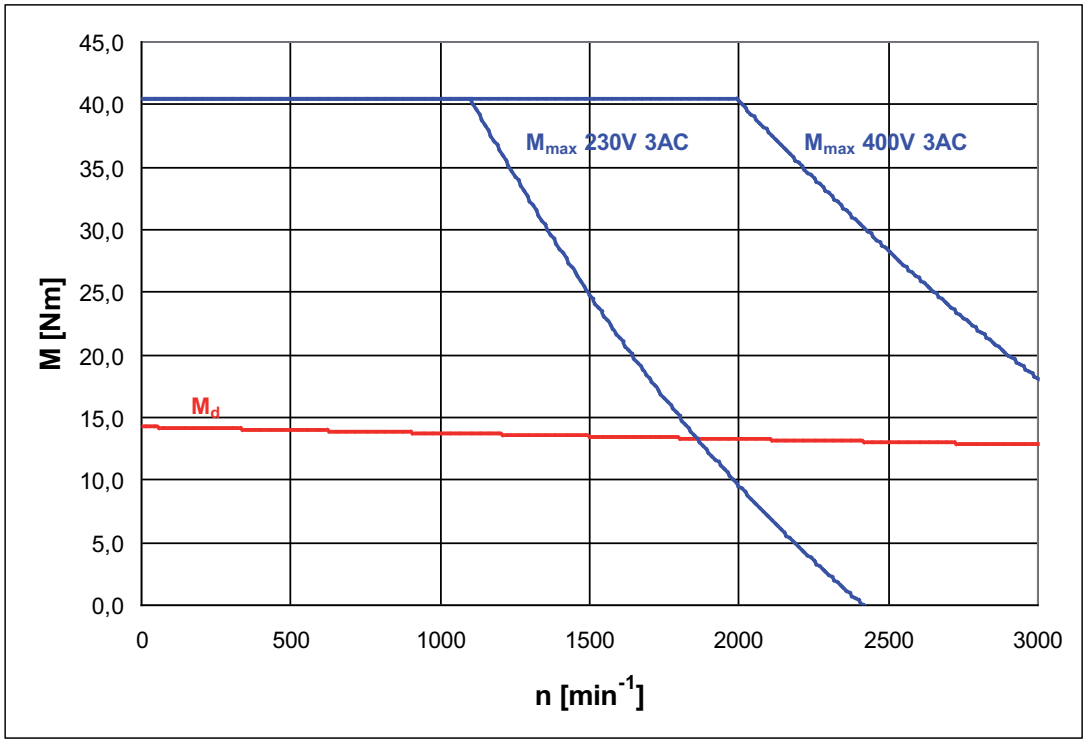


Figure 5-27: Torque-speed characteristics SH 100 30 100 (force-ventilated)

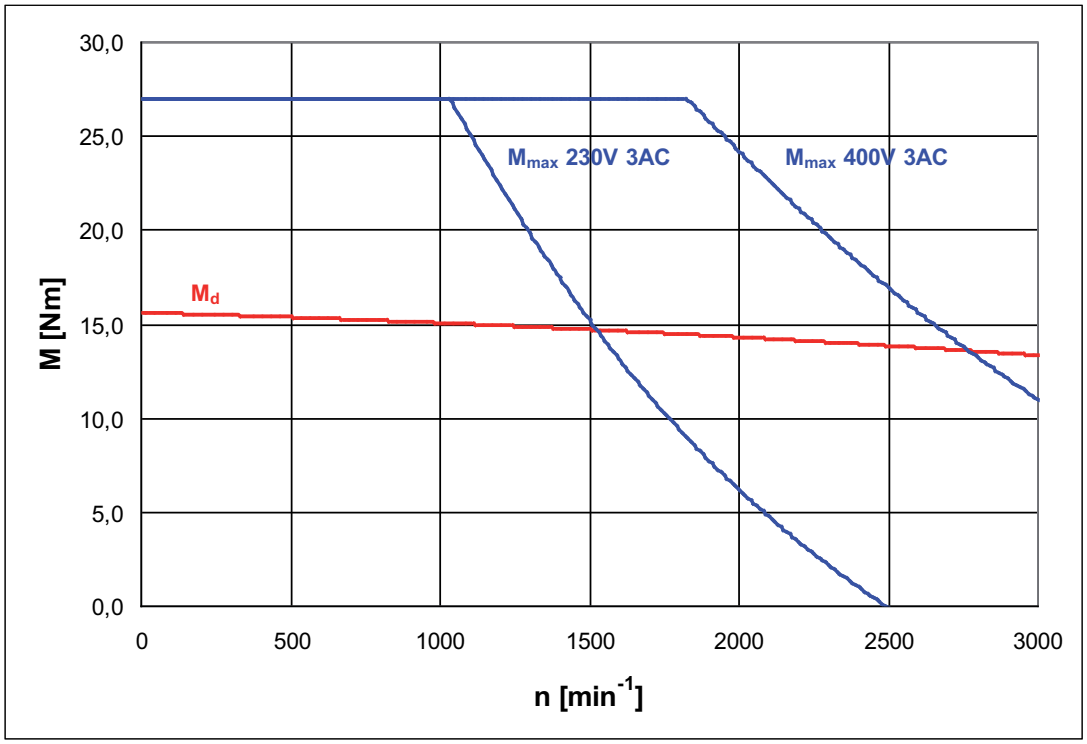


Figure 5-28: Torque-speed characteristics SH 140 30 120 (force-ventilated)

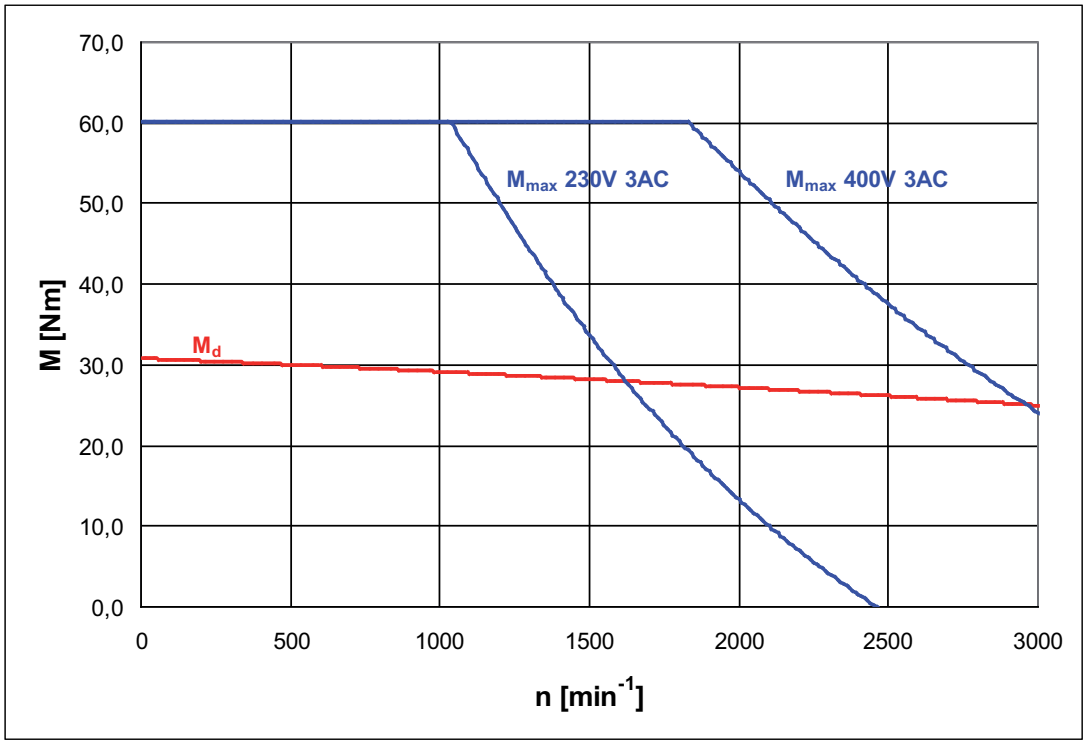


Figure 5-29: Torque-speed characteristics SH 140 30 200 (force-ventilated)

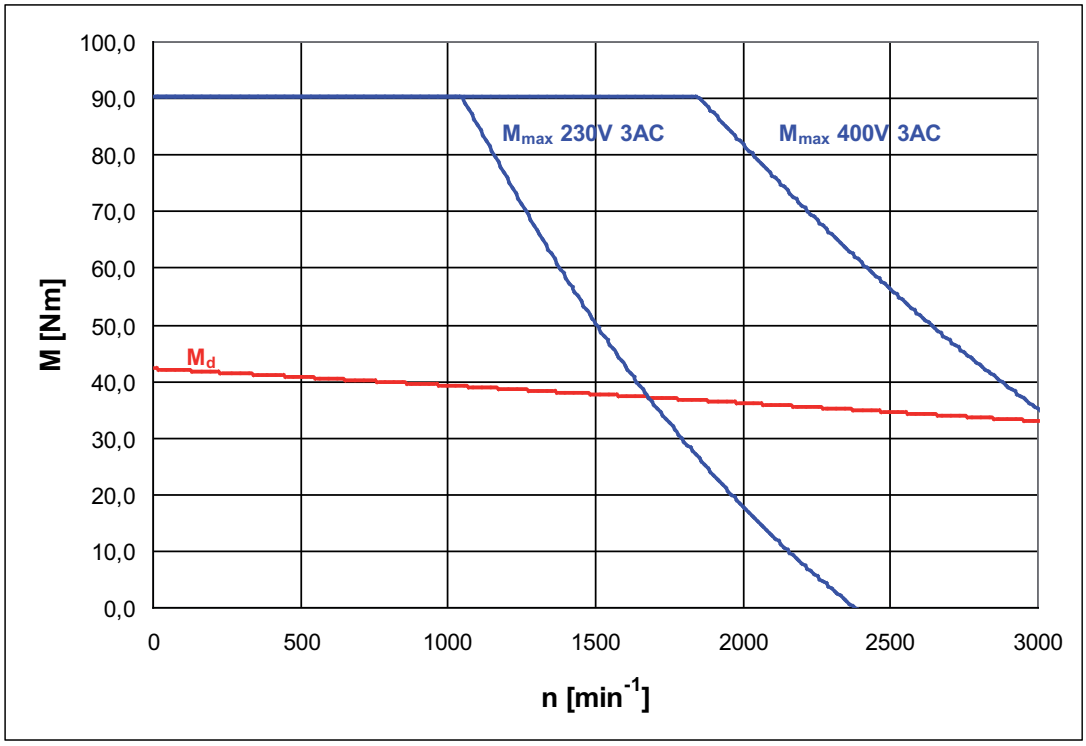


Figure 5-30: Torque-speed characteristics SH 140 30 270 (force-ventilated)

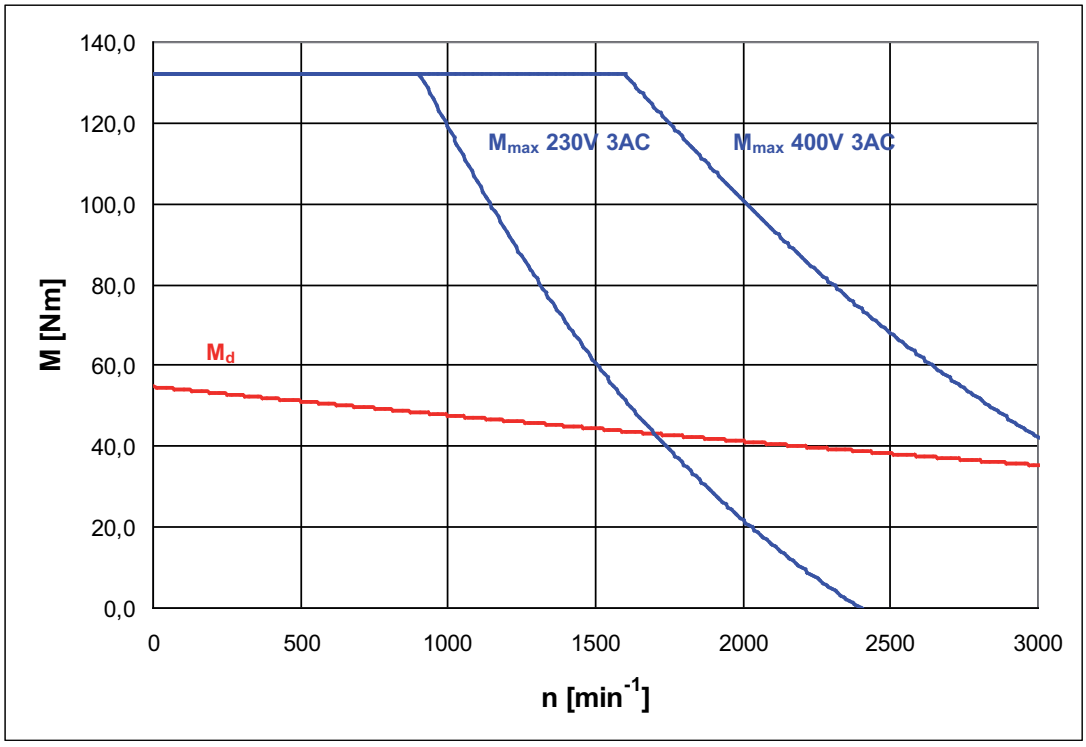


Figure 5-31: Torque-speed characteristics SH 140 30 330 (force-ventilated)

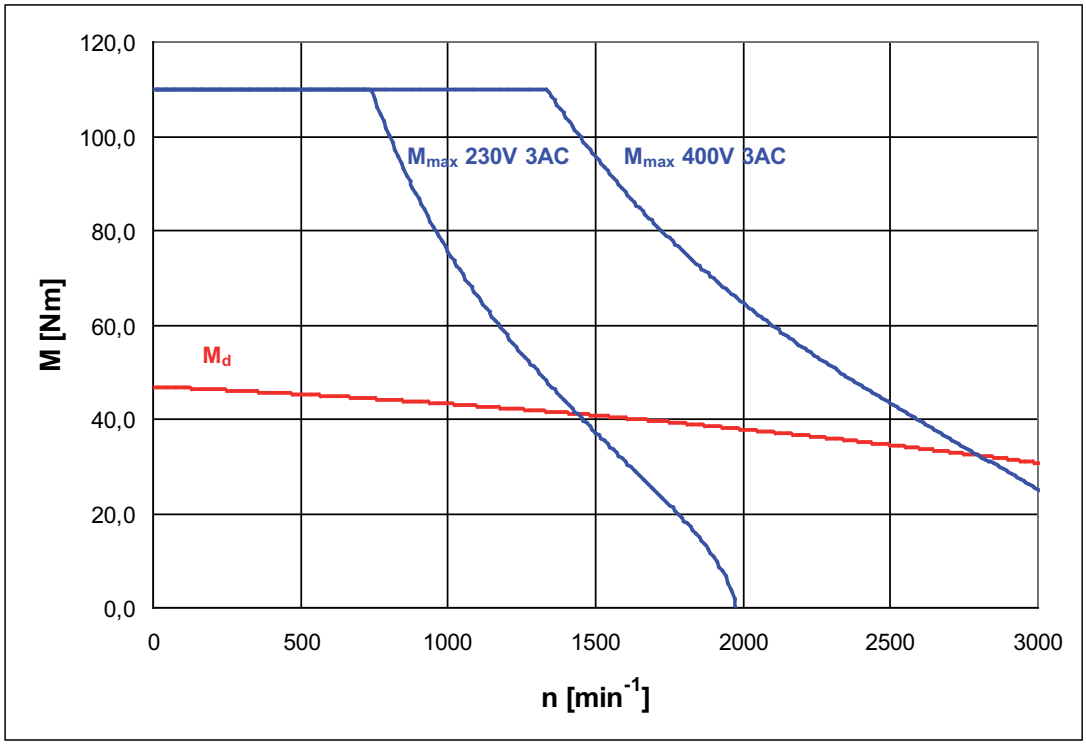


Figure 5-32: Torque-speed characteristics SH 205 30 360 (force-ventilated)

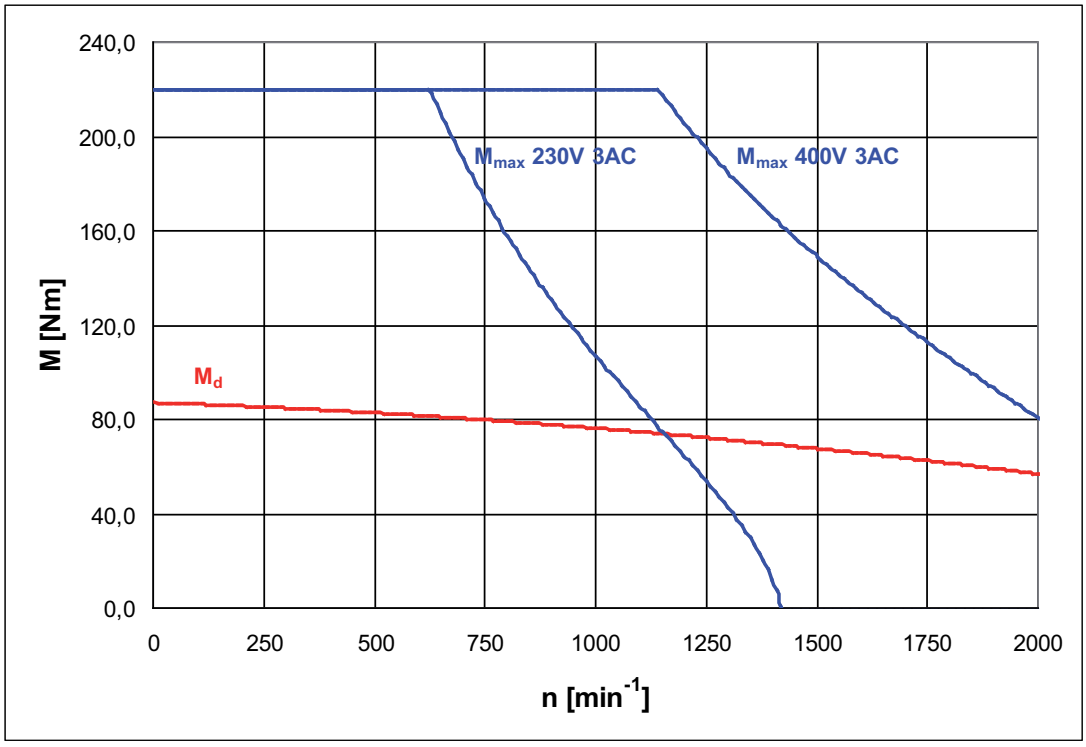


Figure 5-33: Torque-speed characteristics SH 205 20 650 (force-ventilated)

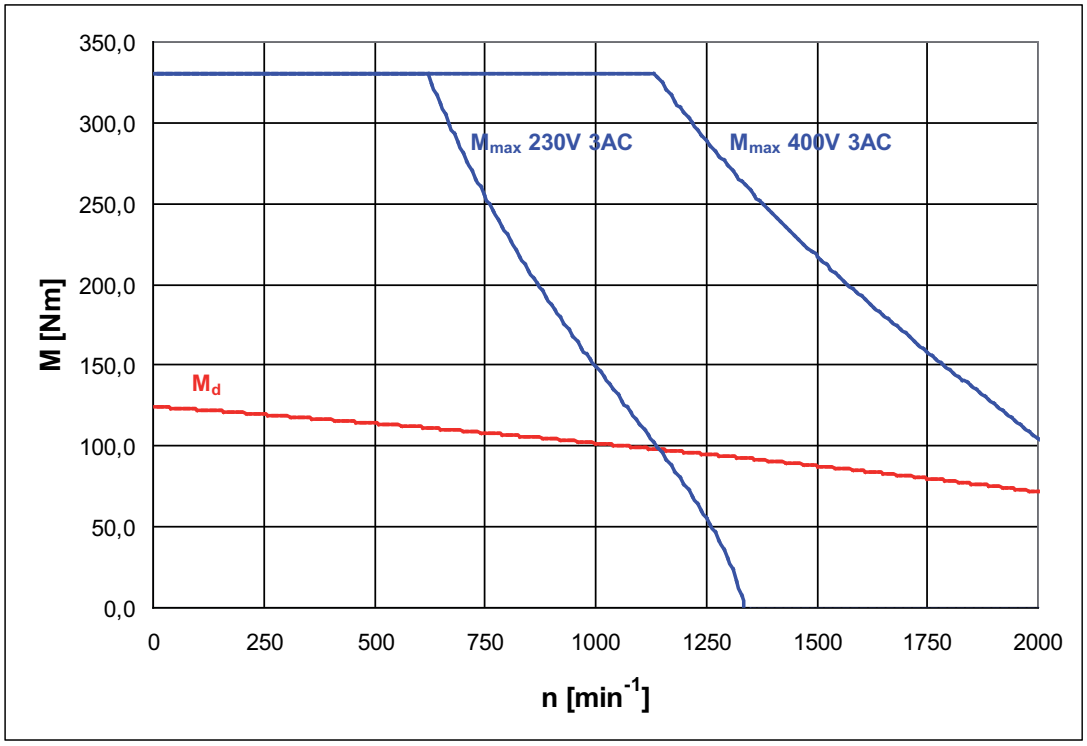


Figure 5-34: Torque-speed characteristics SH 205 20 900 (force-ventilated)

5.9 Electrical connections

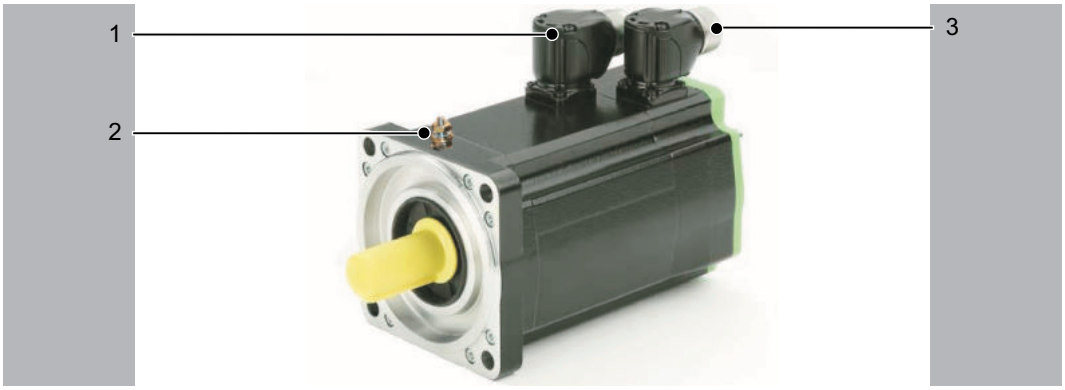


Figure 5-35: SH-Motor connection overview

1	Brake/temperature/motor connection
2	Additional ground connection
3	Encoder Connection

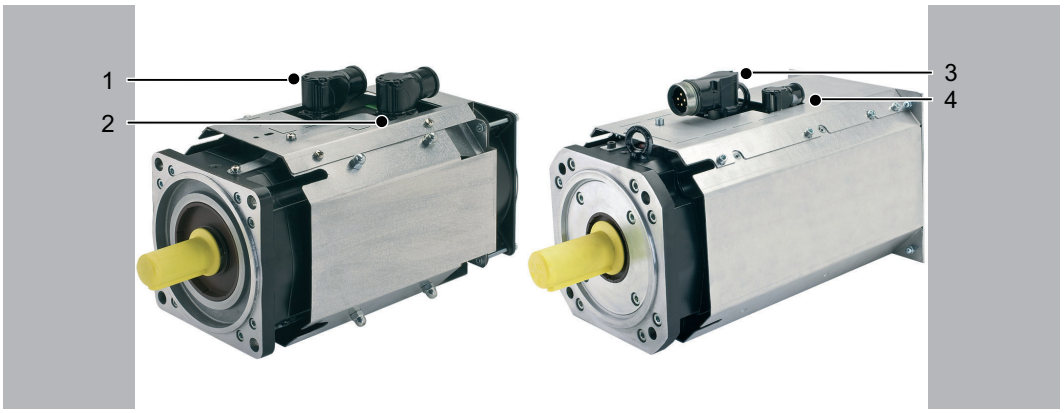


Figure 5-36: SH-100, SH-140 and SH-205 with fan cover

1	Brake/temperature/motor connection - SH-100/SH-140
2	Encoder connection - SH-100/SH-140
3	Brake/temperature/motor connection - SH-205
4	Encoder connection - SH-205

Motor connecting cable

Only for motor types SH-140 30 200 and smaller:

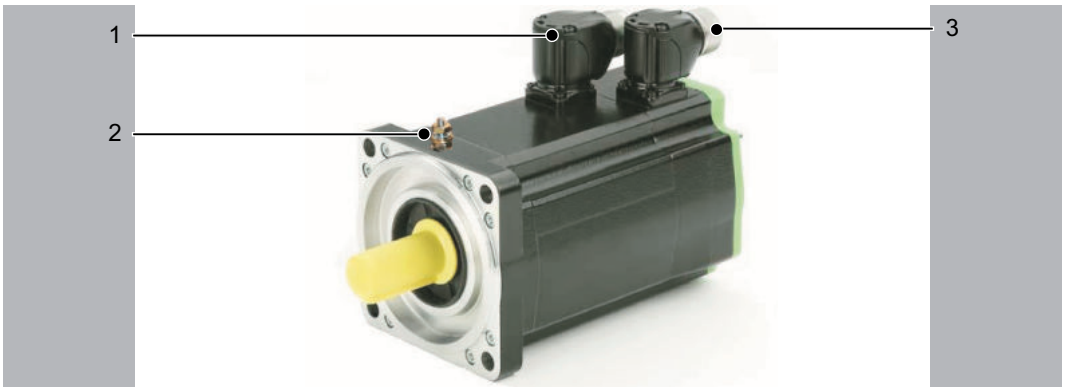


Figure 5-37: Electrical connections - SH motor

1	Brake/temperature/motor connection
2	Additional ground connection
3	Encoder Connection

Connection power P30 (size 1)

Pin	Designation (wire no.)	Meaning	Range
1	W	Output	3 AC 0 - 480 V
2	PE	Ground conductor	-
3	U	Output	3 AC 0 - 480 V
4	V	Output	3 AC 0 - 480 V
A	Brake +	Brake	DC 24 V
B	Brake -	Brake	DC 0 V
C	PTC	Temperature sensor	-
D	PTC	Temperature sensor	-

Table 5-24: Connection power, brake, and temperature sensor

Only for motor types SH-140 30 270, SH-140 30 330, and SH-205:

Connection power P70 (size 1.5)

Pin	Designation (wire no.)	Meaning	Range
U	U	Output	3 AC 0 - 480 V
V	V	Output	3 AC 0 - 480 V
W	W	Output	3 AC 0 - 480 V
PE	PE	Ground conductor	
+	Brake +	Brake	DC 24 V
-	Brake -	Brake	DC 0 V
1	PTC	Temperature sensor	
2	PTC	Temperature sensor	

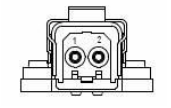
Table 5-25: Connection power, brake, and temperature sensor

Encoder Connection

Pin	Designation (wire no.)	Meaning	Range
1	REF COS	Reference Signal Cosinus	
2	RS 485 +	Parameter channel +	
3	-		
4	-		
5	SIN	Sinus trace	
6	REF SIN	Reference Signal Sinus	
7	RS 485 -	Parameter channel -	
8	COS	Cosine track	
9	-		
10	GND	Supply voltage	DC 0 V
11	-		
12	U_s	Supply voltage	DC 7...12 V

Table 5-26: Encoder SKS/SKM-36

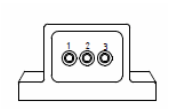
Connection fan cover STASAP-2B for SH100 and SH140



Pin	Designation	Range
1	Supply voltage	DC 0 V
2	Supply voltage	DC 24V (12...30V)

Table 5-27: Connection fan cover STASAP-2B for SH100 and SH140

Connection fan cover STASAP-3N for SH205



Pin	Designation	Range
1	Supply voltage	DC 0 V
2	Supply voltage	DC 24V (12…28V)
3	Not used	

Table 5-28: Connection fan cover STASAP-3N for SH205

5.10 Dimensions

5.10.1 SH-055

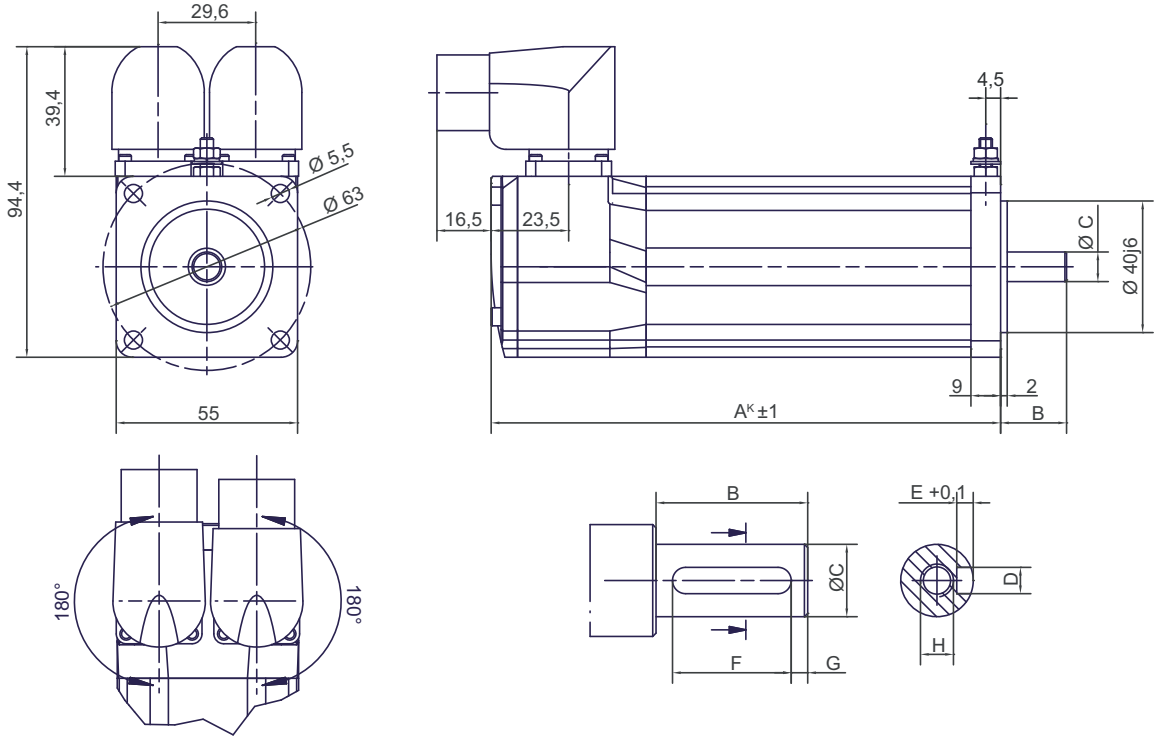


Figure 5-38: Dimension diagram SH-055

Dimensions	SH-055 80 005	SH-055 80 009	SH-055 80 013
A^{K}* (with brake)	132.5 (159)	154.5 (181)	176.5 (203)
B	20	20	20
C	9 k6	9 k6	9 k6
D	3 N9	3 N9	3 N9
E	1.8	1.8	1.8
F	12	12	12
G	4	4	4
H	DIN 332-D M3	DIN 332-D M3	DIN 332-D M3
Feather key (N9)	DIN 6885-A3x3x12	DIN 6885-A3x3x12	DIN 6885-A3x3x12

Table 5-29: Dimensions of the SH-055 (dimension specifications in mm); AK = self-cooling*

5.10.2 SH-070

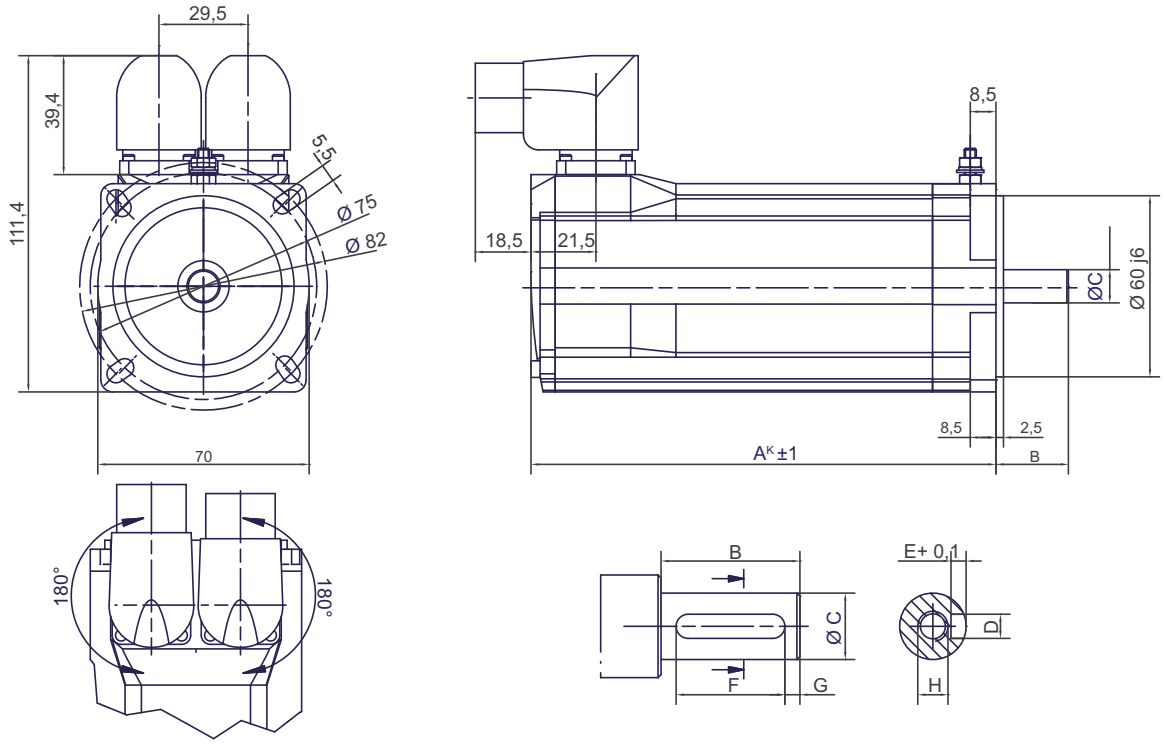


Figure 5-39: Dimension diagram SH-070

Dimensions	SH-070 60 010	SH-070 60 020	SH-070 60 030
A^{K}* (with brake)	154 (180)	187 (213)	220 (256)
B	23	23	30
C	11 k6	11 k6	14 k6
D	4 N9	4 N9	5 N9
E	2.5	2.5	3
F	18	18	20
G	2.5	2.5	5
H	DIN 332-D M4	DIN 332-D M4	DIN 332-D M5
Feather key (N9)	DIN 6885-A4x4x18	DIN 6885-A4x4x18	DIN 6885-A5x5x20

Table 5-30: Dimensions of the SH-070 (dimension specifications in mm); AK = self-cooling*

5.10.3 SH-100

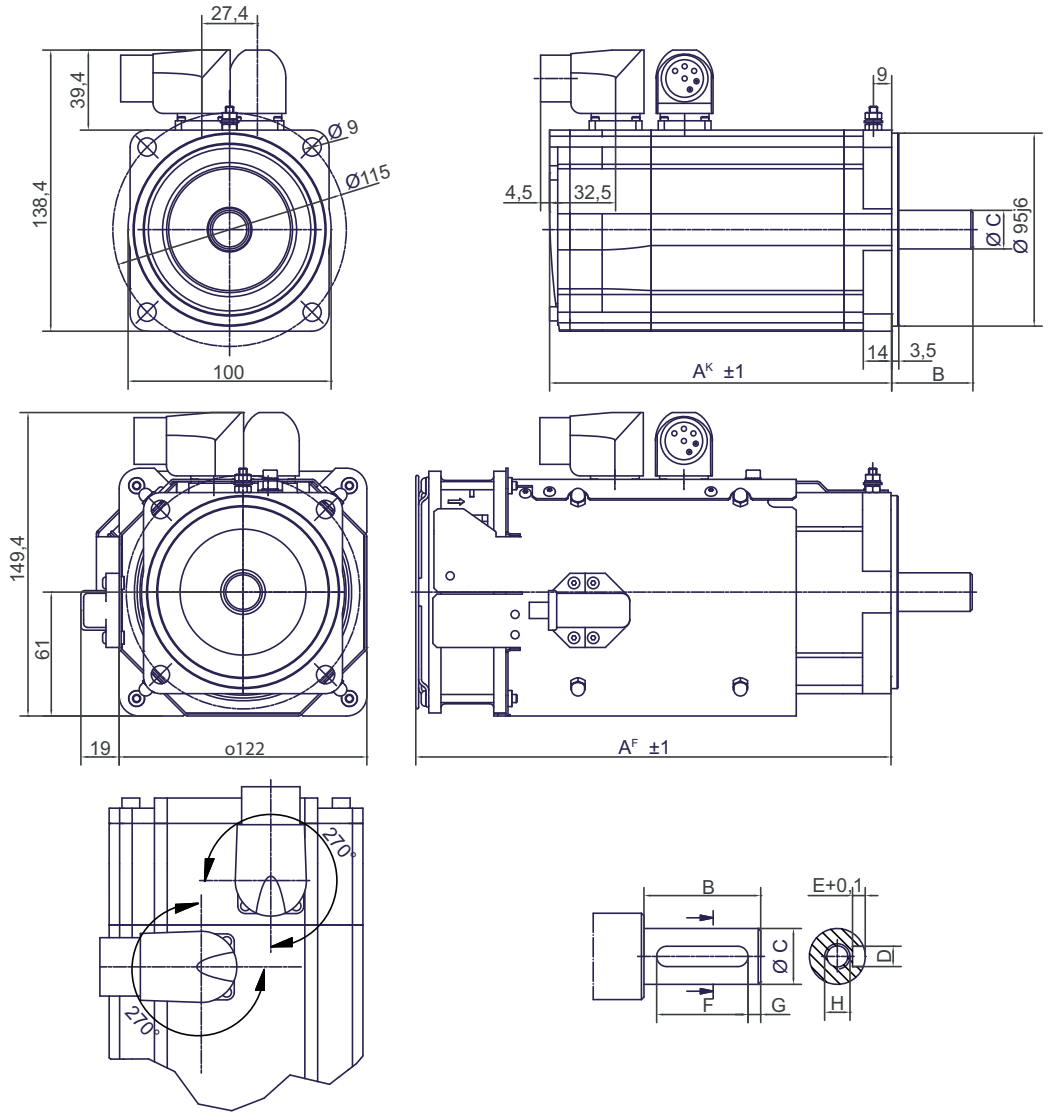


Figure 5-40: Dimension diagram SH-100

Dimensions	SH-100 50 030		SH-100 40 060		SH-100 40 080		SH-100 30 100	
without brake	A^{K*}	A^{F*}	A^{K*}	A^{F*}	A^{K*}	A^{F*}	A^{K*}	A^{F*}
(with brake)	169 (200)	233 (264)	205 (236)	269 (300)	241 (272)	305 (340)	277 (308)	341 (372)
B	40		40		40		50	
C	19 k6		19 k6		19 k6		24 k6	
D	6 N9		6 N9		6 N9		8 N9	
E	3.5		3.5		3.5		4	
F	30		30		30		40	
G	5		5		5		5	
H	DIN 332-D M6		DIN 332-D M6		DIN 332-D M6		DIN 332-D M8	
Feather key (N9)	DIN 6885-A6x6x30		DIN 6885-A6x6x30		DIN 6885-A6x6x30		DIN 6885-A8x7x40	

Table 5-31: Dimensions of the SH-100 (dimension specifications in mm); AF = force-ventilated*

5.10.4 SH-140

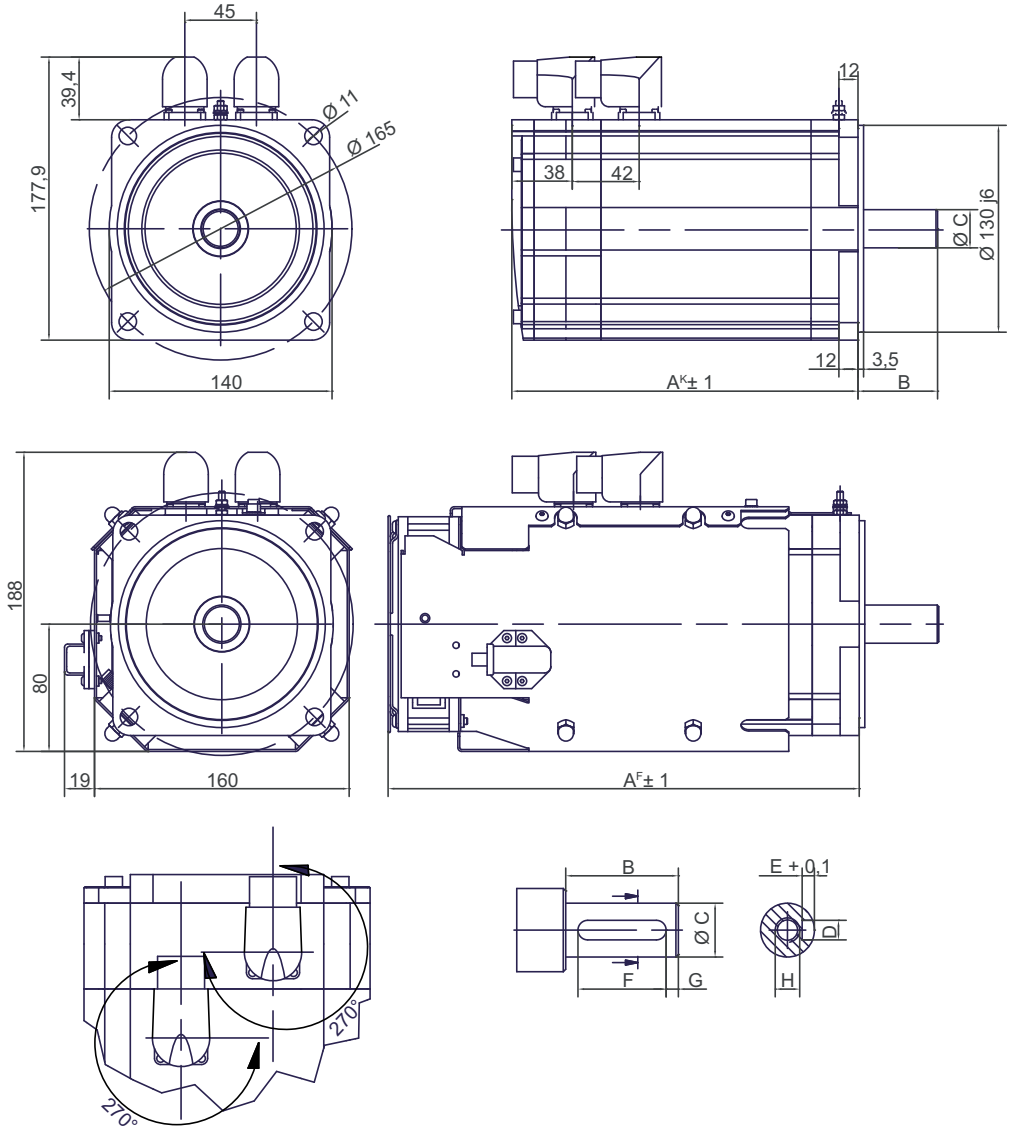


Figure 5-41: Dimension diagram SH-140 with P30

Dimensions	SH-140 30 120		SH-140 30 200	
	A^K*	A^F *	A^K*	A^F *
without brake (with brake)	218 (256)	342 (380)	273 (311)	397 (435)
B	50		50	
C	24 k6		24 k6	
D	8 N9		8 N9	
E	4		4	
F	40		40	
G	5		5	
H	DIN 332-D M8		DIN 332-D M8	
Feather key (N9)	DIN 6885-A8x7x40		DIN 6885-A8x7x40	

Table 5-32: Dimensions of the SH-140 (dimension specifications in mm); AF = force-ventilated*

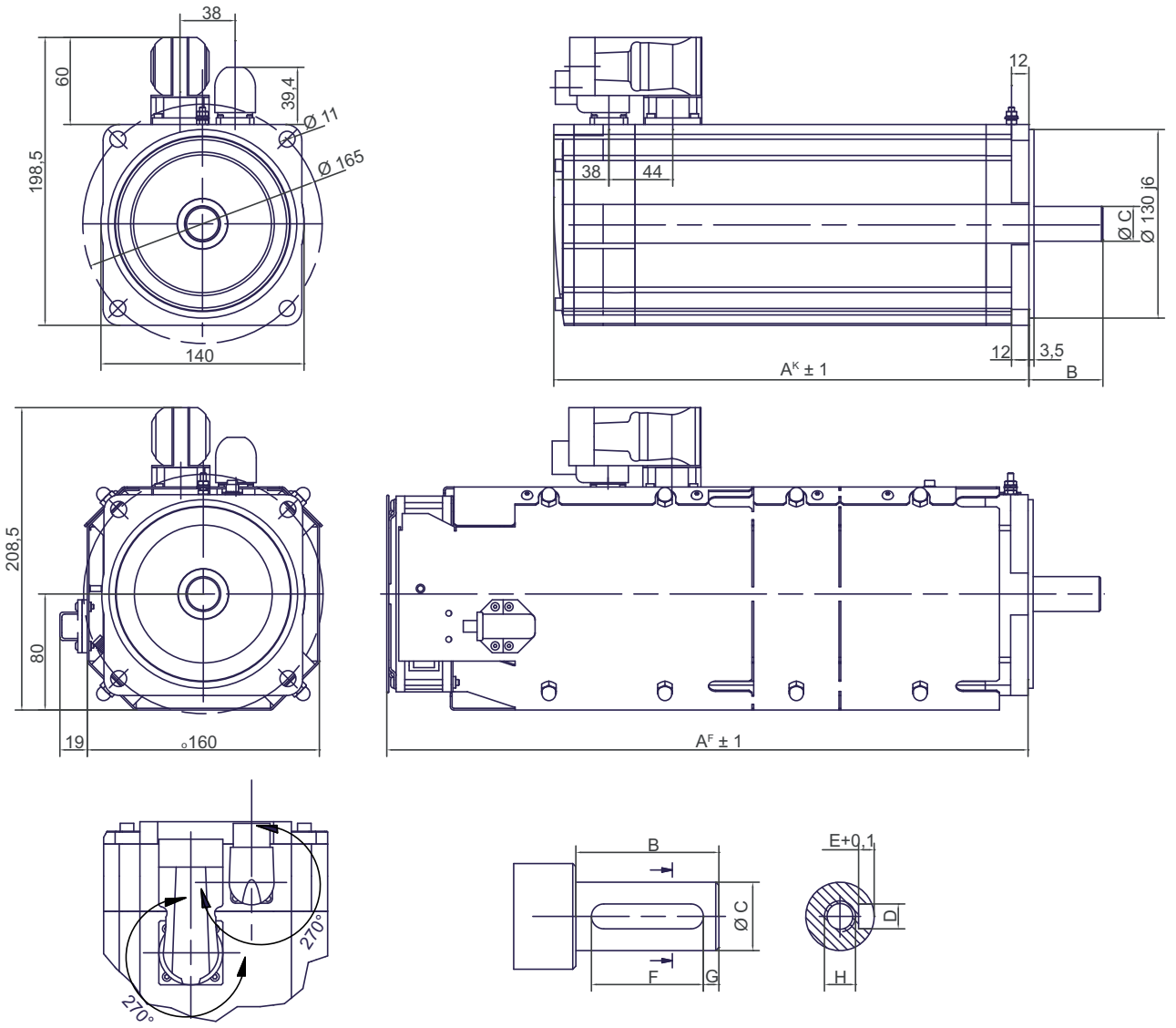


Figure 5-42: Dimension diagram SH-140 with P70

Dimensions	SH-140 30 270		SH-140 30 330	
	A^K*	A^F*	A^K*	A^F*
without brake (with brake)	328 (366)	452 (490)	383 (421)	507 (545)
B	50		50	
C	24 k6		24 k6	
D	8 N9		8 N9	
E	4		4	
F	40		40	
G	5		5	
H	DIN 332-D M8		DIN 332-D M8	
Feather key (N9)	DIN 6885-A8x7x40		DIN 6885-A8x7x40	

Table 5-33: Dimensions of the SH-140 (dimension specifications in mm); AF = force-ventilated*

5.10.5 SH-205

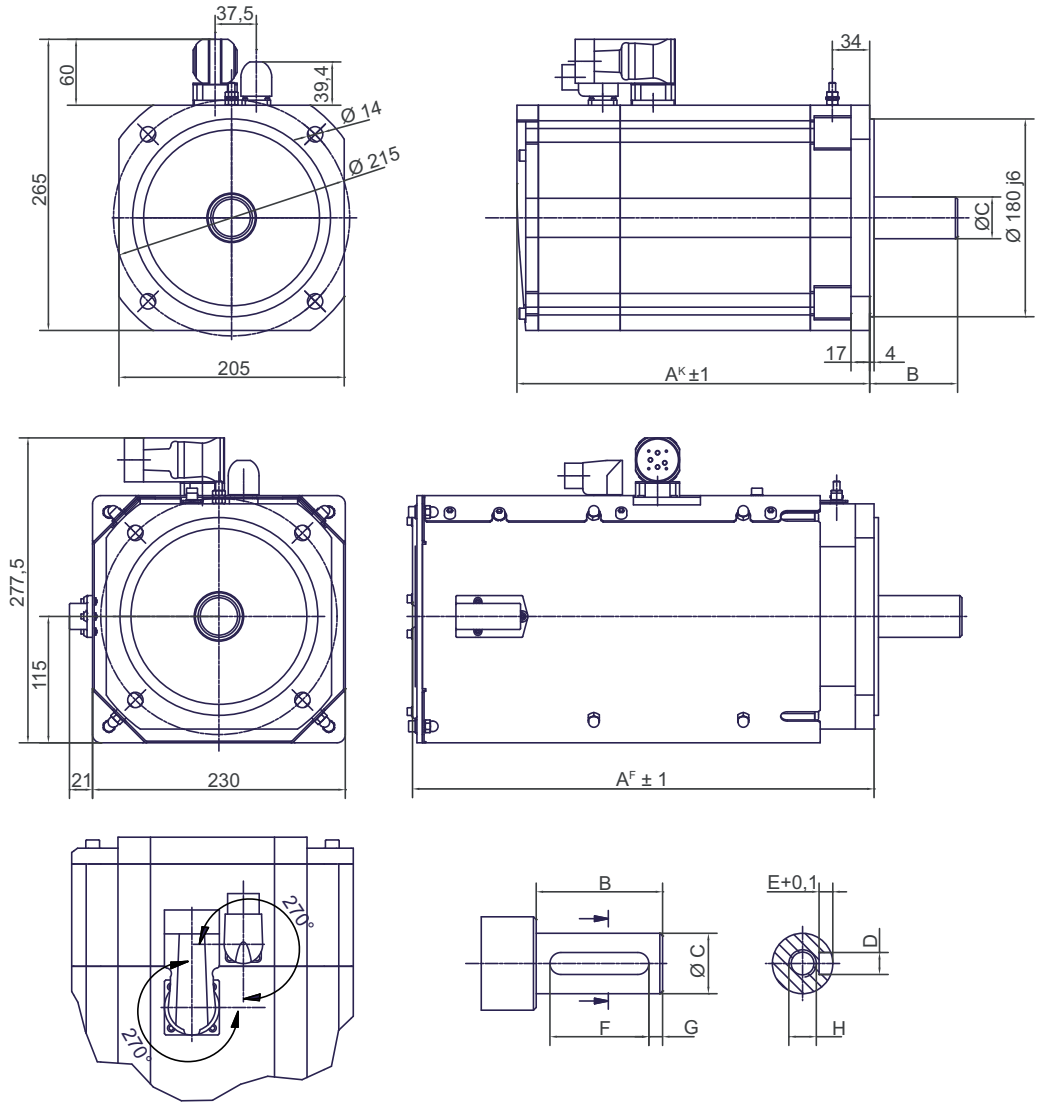


Figure 5-43: Dimensional diagram SH-205 with connector variant

Dimensions	SH-205 30 360		SH-205 20 650		SH-205 20 900	
without brake	A^{K*}	A^{F*}	A^{K*}	A^{F*}	A^{K*}	A^{F*}
(with brake)	321 (370.5)	421(470.5)	405 (454.5)	505 (554.5)	489 (538.5)	589 (638.5)
B	80		80		80	
C	38 k6		38 k6		38 k6	
D	10 N9		10 N9		10 N9	
E	5		5		5	
F	70		70		70	
G	5		5		5	
H	DIN 332-D M12		DIN 332-D M12		DIN 332-D M12	
Feather key (N9)	DIN 6885-A10x8x70		DIN 6885-A10x8x70		DIN 6885-A10x8x70	

Table 5-34: Dimensions of the SH-205 with connector (dimension specifications in mm); AK = self-cooling, AF* = force-ventilated*

6 Appendix

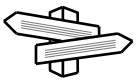
6.1 Contact addresses

ELAU GmbH Deutschland

Dillberg 12 - 16
D-97828 Marktheidenfeld, Germany
Tel.: +49 (0) 9391 / 606 - 0
Fax: 09391/606-300
e-mail: info@elau.de
Internet: www.elau.de

ELAU GmbH Customer Service

P.O. Box 1255
D-97821 Marktheidenfeld, Germany
Phone: +49 (0) 9391 / 606 - 142
Fax: +49 (0) 9391 / 606 - 340
e-mail: info@elau.de
Internet: www.elau.de

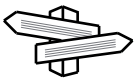


See the ELAU Homepage (www.elau.de) for additional contact addresses.

6.2 Product training courses

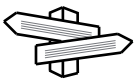
We also offer a number of training courses about our products.

Our seminar leaders with several years of experience will help you take advantage of the extensive possibilities offered by the PacDrive™ System.



See the ELAU Homepage (www.elau.de) for further information and our current seminar schedule.

6.3 Modifications



The latest product documentation, application notes and the change service are always available on the ELAU Homepage.

10/2005

- Revisions

06/2006

- Series SH-055 and SH-205 added
- Torque-speed characteristic curves added
- Technical data supplemented
- Positive pressure option added
- Various corrective actions

08/2007

- Torque-speed characteristics for series SH-100, SH-140, SH-205 (force-ventilated) added
- Dimensions for series SH-100, SH-140, SH-205 (force-ventilated) added
- Technical data supplemented
- Various corrective actions

03/2008

- Update of type plates
- Update of torque-speed characteristic curves
- Update of manufacturer's declaration

11/2008

- Update of dimensional drawings
- Update of fan cover data
- Update of torque-speed characteristic curves
- Update of the structure of chapter "Technical Data"

01/2009

- Update of chapter "Installation and maintenance"

6.4 Fault report form

This fault report is required without fail to enable efficient processing.

Send the fault report to your ELAU GmbH-representative or to:

ELAU GmbH
Customer Service Department
Dillberg 12
97828 Marktheidenfeld, Germany
Fax: +49 (0) 93 91 / 606 - 340

Return address:

Company:	**City:**	**Date:**
Department:	Name:	Phone:

Specifications regarding product in question

Item name: .....

Item no.: .....

Serial number: .....

Software version: .....

Hardware code: .....

Parameter included: Yes [ ] No [ ]

IEC - Program included: Yes [ ] No [ ]

Information about machine on which the error occurred:

Machine manufacturer: .....

Type: .....

Operating hours: .....

Machine no.: .....

Date of commissioning: .....

Manufacturer / Type of machine control:

.....

How did the error present:

.....

.....

.....

Additional information:

Condition of error:	**Causes:**	**Accompanying side effects:**
[ ] is always available	[ ] unknown	[ ] problems in the mechanism
[ ] during commissioning	[ ] wiring error	[ ] power failure (24V)
[ ] occurs sporadically	[ ] mechan. damage	[ ] controller failure

[ ] occurs after approx. hours
[ ] occurs by concussion
[ ] depends on the temperature
[ ] foreign objects in the device
[ ] moisture in device
[ ] defect encoder
[ ] motor failure
[ ] broken cable
[ ] insufficient ventilation

Is there an air conditioner in the switch cabinet? Y / N [ ]

Have there been similar errors in the same axis previously?
How often: .....

Did the errors always occur on certain days or at certain times of day?

.....

Further information:

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Index