



DYNAMIC LINE 4

INSTRUCTIONS FOR USE | **INSTALLATION SERVO MOTORS DL4**
SIZE SE...SG

Translation of original manual
Document 20220629 EN 07

Preface

The hardware and software described in this document are products of KEB. The information contained in this document is valid at the time of publishing. KEB reserves the right to update this document in response to misprints, mistakes or technical changes.

Signal words and symbols

Certain procedures within this document can cause safety hazards during the installation or operation of the device. Refer to the safety warnings in this document when performing these procedures. Safety signs are also located on the device where applicable. A safety warning is marked by one of the following warning signs:

 DANGER	Dangerous situation, which will cause death or serious injury if this safety warning is ignored.
 WARNING	Dangerous situation, which may cause death or serious injury if this safety warning is ignored.
 CAUTION	Dangerous situation, which may cause minor injury if this safety warning is ignored.
NOTICE	Situation, which can cause damage to property if this safety warning is ignored.

RESTRICTION

Used when the following statements depend on certain conditions or are only valid for certain ranges of values.



Used for informational messages or recommended procedures.

More symbols

- This arrow starts an action step.
- / - Enumerations are marked with dots or indents.
- => Cross reference to another chapter or another page.



Note to further documentation.
<https://www.keb-automation.com/search>



Laws and guidelines

KEB Automation KG confirms with the EC declaration of conformity and the CE mark on the device nameplate that it complies with the essential safety requirements.

The EC declaration of conformity can be downloaded on demand via our website.

Warranty and liability

The warranty and liability on design, material or workmanship for the acquired device is given in the general sales conditions.



Here you will find our general sales conditions.

<https://www.keb-automation.com/terms-conditions>



Further agreements or specifications require a written confirmation.

Support

Although multiple applications are referenced, not every case has been taking into account. If you require further information or if problems occur which are not referenced in the documentation, you can request the necessary information via the local KEB agency.

The use of our units in the target products is outside of our control and therefore lies exclusively in the area of responsibility of the customer.

The information contained in the technical documentation, as well as any user-specific advice in spoken and written and through tests, are made to best of our knowledge and information about the intended use. However, they are regarded as being only informal and changes are expressly reserved, in particular due to technical changes. This also applies to any violation of industrial property rights of a third-party. Selection of our units in view of their suitability for the intended use must be done generally by the user.

Tests can only be done within the intended end use of the product (application) by the customer. They must be repeated, even if only parts of hardware, software or the unit adjustment are modified.

Copyright

The customer may use the instructions for use as well as further documents or parts from it for internal purposes. Copyrights are with KEB and remain valid in its entirety.

This KEB product or parts thereof may contain third-party software, including free and/or open source software. If applicable, the license terms of this software are contained in the instructions for use. The instructions for use are already available to you, can be downloaded free of charge from the KEB website or can be requested from the respective KEB contact person.

Other wordmarks or/and logos are trademarks (™) or registered trademarks (®) of their respective owners.

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1 Basic Safety Instructions

The products are designed and constructed in accordance with state-of-the-art technology and the recognized safety rules and regulations. However, the use of such devices may cause functional hazards for life and limb of the user or third parties, or damages to the system and other material property.

The following safety instructions have been created by the manufacturer for the area of electric drive technology. They can be supplemented by local, country- or application-specific safety instructions. This list is not exhaustive. Violation of the safety instructions by the customer, user or other third party leads to the loss of all resulting claims against the manufacturer.

NOTICE



Hazards and risks through ignorance!

- ▶ Read the instructions for use!
- ▶ Observe the safety and warning instructions!
- ▶ If anything is unclear, please contact KEB Automation KG!

1.1 Target group

This instruction manual is determined exclusively for electrical personnel. Electrical personnel for the purpose of this instruction manual must have the following qualifications:

- Knowledge and understanding of the safety instructions.
- Skills for installation and assembly.
- Start-up and operation of the product.
- Understanding of the function in the used machine.
- Detection of hazards and risks of the electrical drive technology.
- Knowledge of [VDE 0100](#)
- Knowledge of national safety regulations.

1.2 Transport, storage and proper use

The transport is carried out by qualified persons in accordance with the environmental conditions specified in this manual. Motors shall be protected against excessive strains.



Damage due to improper transport

- ▶ Transport only on suitable devices (folding boxes, transport frames, flat pallets, etc.).
- ▶ Avoid any impacts, sharp sudden movements and strong vibrations.
- ▶ Motors must only be lifted and placed at creeping speed to prevent damage to the bearings.

Do not store Motors

- in the environment of aggressive and/or conductive liquids or gases.
- with direct sunlight.
- outside the specified environmental conditions.

To prevent damage to the motor:

- Check if necessary and do not remove anti-corrosive coat at the shaft ends, flange surfaces etc.
- No vibrations may occur in the storage location.
- In case of storage longer than 3 months, rotate the motor in both directions at a slow speed (< 100 rpm) to allow the grease to distribute evenly in the bearings.
- If necessary, rotate the rotor at least once a year several times, in order to avoid corrosion on the bearings.

1.3 Installation

DANGER



Do not operate in an explosive environment!

- ▶ The product is not intended for the use in potentially explosive environment.

CAUTION



Maximum design edges and high weight!

Contusions and bruises!

- ▶ Never stand under suspended loads.
- ▶ Wear safety shoes.
- ▶ Secure motor accordingly when using lifting gear.

To prevent damages to the motor:

- Make sure that isolation distances will be respected in the terminal box.
- Before commissioning motors with a shaft key, secure the key to ensure that it cannot be thrown out if this is not already prevented by driving elements such as a belt pulley, coupling, etc.
- The motor must not be put into operation in case of mechanical defects.
- Do not allow moisture or mist to penetrate the motor.
- Avoid dust permeating the device.
- Note installation position and minimum distances to surrounding elements. Do not cover the ventilation openings.
- Make sure that no small parts fall into the motor during assembly and wiring (drilling chips, screws etc.). This also applies to mechanical components, which can lose small parts during operation.
- Check for reliable fit of device connections in order to minimize contact resistance and avoid sparking.
- Do not climb on the motor housing.
- Follow all safety instructions!

1.4 Connection instructions

DANGER



Voltage at the terminals and in the motor!

Danger to life due to electric shock!

- ▶ Never work on the open device or touch exposed parts. During the operation (even at zero speed) the motors possess dangerous live parts.
- ▶ For any work on the motor switch off the supply voltage and secure it against switching on.
- ▶ Wait until the drive has stopped in order, that perhaps regenerative energy can be generated.
- ▶ Never bridge upstream protective devices (even for testing purposes.).
- ▶ Connect the protective earth conductor to drive converter and motor.
- ▶ Install all required covers and protective devices for operation.

For a trouble-free and safe operation, please pay attention to the following instructions:

- The electrical installation shall be carried out in accordance with the relevant requirements.
- The motors are not designed for direct connection to the three-phase system but are to be operated via an electronic power inverter.
- Connect the temperature sensor to protect the motor against slow thermal changes. Temperature sensors do not represent an all-around protection of the winding. Measures must be taken in the parameterisation of the inverter for the protection against fast thermal changes (e.g. $I^2 \times t$ - monitoring) !
- Check the proper functioning of the brake (optional).
- An optional holding brake is only designed for a limited number of emergency brakings. Never use it as a working brake. On motors with plug connector and built-in brake, it is the user's responsibility to install the varistor provided to control the brake.

Installations with additional safety or protective measures in accordance with their requirements have to be checked, when using drive converters, to be in accordance with the given application notes or recommendation when using these!

1.4.1 EMC-compatible installation

Observance of the limit values required by EMC law is the responsibility of the customer.



Notes on EMC-compatible installation in conjunction with drive controllers can be found here.

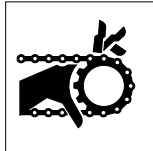
www.keb.de/fileadmin/media/Manuals/emv/0000neb0000.pdf



1.5 Start-up and operation

The start-up (i.e. for the specified application) is forbidden until it is determined that the installation complies with the machine directive; account is to be taken of [EN 60204-1](#).

⚠ WARNING



Software protection and programming!

Hazards caused by unintentional behavior of the drive!

- ▶ Check especially during initial start-up or replacement of the drive controller if parameterization is compatible to application.
- ▶ Securing a unit solely with software-supported functions is not sufficient. It is imperative to install external protective measures (e.g. limit switch) that are independent of the drive controller.
- ▶ Secure motors against automatic restart.

⚠ CAUTION



High temperatures at motor housing!

Burning of the skin!

- ▶ Cover hot surfaces safe-to-touch.
- ▶ Before working let the motor cool down.
- ▶ Before touching, check the surface and cooling water lines.
- ▶ If necessary, attach warning signs on the system.

1.6 Maintenance

The following maintenance work has to be carried out when required, but at least once per year by authorized and trained personnel. Check unit for loose screws and plugs and tighten if necessary.

- ▶ Check unit for loose screws and plugs and tighten if necessary.
- ▶ Clean motor from dirt and dust deposits. Pay attention especially to cooling fins and protective grid of the fans.
- ▶ Check the function of the auxiliary fans of the motors. The fans must be replaced in case of audible vibrations or squeaking.

1.7 Repair

In case of malfunction, unusual noises or smells inform a person in charge!

DANGER



Unauthorized exchange, repair and modifications!

Unpredictable malfunctions!

- ▶ Modification or repair is permitted only by KEB Automation KG authorized personnel.
- ▶ Only use original manufacturer parts.
- ▶ Infringement will annul the liability for resulting consequences.

In case of failure, please contact the machine manufacturer. Only the manufacturer can provide an appropriate replacement or induce the maintenance.

1.8 Disposal

Electronic devices of the KEB Automation KG are exclusively professional devices for further industrial processing (so-called B2B devices).

Manufacturers of B2B devices are obliged to take back and recycle devices manufactured after 14.08.2018. These devices may not be disposed at the collection centres of public sector disposal organisations.



If no deviating agreement has been made between the customer and KEB or no deviating mandatory legal regulation exists, KEB products marked in this way can be returned. Company and keyword to the return point can be taken from the list below. Shipping costs are paid by the customer. Thereupon the devices will be professionally recycled and disposed.

The entry numbers are listed country-specific in the following table. The corresponding KEB return addresses can be found on our website.

Withdrawal by	WEEE-Reg.-No.	Keyword
Austria		
KEB Automation GmbH	ERA: 51976	Stichwort „Rücknahme WEEE“
France		
RÉCYLUM - Recycle point	ADEME: FR021806	Mots clés „KEB DEEE“
Germany		
KEB Automation KG	EAR: DE12653519	Stichwort „Rücknahme WEEE“
Italy		
COBAT	AEE: (IT) 19030000011216	Parola chiave „Ritiro RAEE“
Spain		
KEB Automation KG	RII-AEE 7427	Palabra clave „Retirada RAEE“
Česko		
KEB Automation KG	RETELA 09281/20 ECZ	Klíčové slovo: Zpětný odběr OEEZ
Slowakei		
KEB Automation KG	ASEKOL: RV22EEZ0000421	Klíčové slovo: "Spätný odber OEEZ"

The packaging must be feed to paper and cardboard recycling.

2 Product description

The servo motors of the DL4 series are 8-pole permanent-field synchronous motors with a sine-wave inducted voltage.

2.1 Specified application

The KEB synchronous servo motors are exclusively designed for the operation at digital servo controllers. They are intended for industrial systems only. They comply with the harmonised standards of the series [EN 60034-1](#) / [VDE 0530](#).

The technical data and information for connection conditions can be found on the type plate and the instructions for use and must be complied with.

2.1.1 Residual risks

Despite intended use, the motor can reach unexpected operating conditions in case of error, with wrong parameterisation of the drive controller, by faulty wiring or non-professional interventions and repairs. This can be:

- wrong direction of rotation
- motor speed too high
- motor is running into limitation
- motor can be under voltage even in standstill
- automatic start
- motor coasts to standstill

2.2 Unintended use

The operation of our products outside the indicated limit values of the technical data leads to the loss of any liability claims.

2.3 Type code configurable material

xx	Sx	Lx	Cx	SPxx	-FKx	BRx	ENC0x	OP0x	
									Options
									OP00: Without
									OP01: IP65
									OP02: IM B35
									OP03: IP65/IM B35
									OP04: Special shaft
									OP05: IP65/special shaft
									OP06: IM B35/special shaft
									OP07: IP65/IM B35/special shaft
									Encoder
									ENC00: Without
									ENC01: Resolver
									ENC04: SRS50
									ENC05: SRM50
									Brake
									BR: With brake
									BRN: Without brake
									Shaft
									FK: With feather key
									FKN: Without feather key
									Speed
									SP10: 1000 rpm
									SP15: 1500 rpm
									SP20: 2000 rpm
									SP30: 2800 ¹⁾ / 3000 rpm
									Cooling
									CS: Self-cooling
									CF: Separate cooling
									Length
									L2
									L4
									L6
									L8
									Size
									SE
									SF
									SG
									Voltage
									V4: 400 V

Table 1: Type code configurable material

¹⁾ Only for motor size SG CF.



The type code is not used as order code, but exclusively for identification!

2.4 Type code 11-digit material number

x	x	D4	x	x	x	x	x	x	x	
Versioning									00: Standard	
									01: Special shaft (larger)	
									02: Special shaft (smaller)	
Encoder system									0: Without repatriation	
									1: Resolver	
									3: Hiperface SRM50	
									5: Hiperface SRS50	
Connection and temperature protection									1: M23 / M23 - PT1000	
									2: KK / M23 - PT1000	
									7: M23 / no encoder - PT1000	
									8: KK / no encoder - PT1000	
Mechanics (shaft, key, brake)									A: Key / no brake	
									B: No key / no brake	
									C: Special shaft / no brake	
									1: Key / PM brake ¹⁾	
									2: No key / PM brake ¹⁾	
									3: Special shaft / PM brake	
									4: Key / spring-loaded brake	
									5: No key / spring-loaded brake	
Cooling, design and protection class									1: CS - B5 - IP54	
									2: CS - B5 - IP65	
									3: CS - B35 - IP54	
									4: CS - B35 - IP65	
									A: CF - B5 - IP54	
									B: CF - B5 - IP65	
Speed and voltage									C: CF - B35 - IP54 ²⁾	
									D: CF - B35 - IP65 ²⁾	
									V: CW - B5 - IP54	
									W: CW - B5 - IP65	
Type									Y: CW - B35 - IP54	
									Z: CW - B35 - IP65	
									1: 1000 rpm	
									A: 1500 rpm	
Length									2: 2000 min ⁻¹ (1800 min ⁻¹ for CW)	
									3: 2800 ³⁾ / 3000 min ⁻¹ (2600 min ⁻¹ for CW)	
									2: L2	
									4: L4	
Size									6: L6	
									8: L8	
									E: SE	
									F: SF	
									G: SG	

Table 2: Type code 11-digit material number

Table 2: Type code 11-digit material number

¹⁾ Not for engine size SG.

²⁾ Not for engine size SE.

³⁾ Only for motor size SG CF.



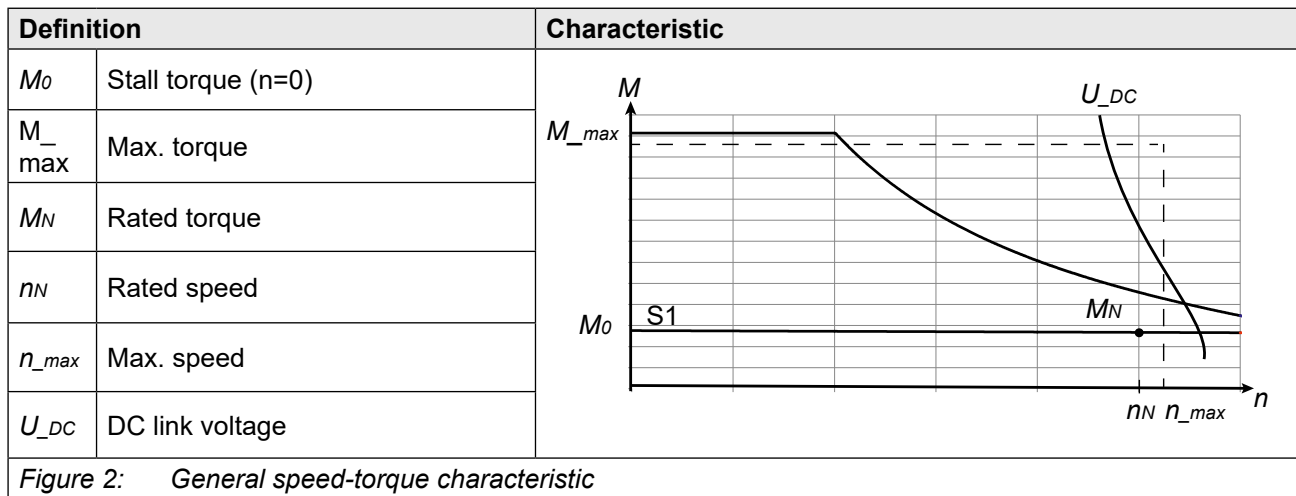
The type code is not used as order code, but exclusively for identification!

2.5 Nameplate



Figure 1: Nameplate example

2.6 General speed-torque characteristic



2.7 General project design

2.7.1 Selection of the servo motor

Calculate the following values before you selection the servo motor:

- Determine inertia (J_{App}) of the application without motor.
- Calculate required peak torque (M_{L_max}) of the application at the drive. The inertia of the motor (J_{Mot}) can be accepted here with 1/10 inertia (J_{App}) of the application.
- Determine the effective torque (M_{eff}) via the time.

Now the motor can be selected on the basis of the calculated values and the technical data of the following pages. The following selection features must be observed:

Calculated data of the application	Motor data
Maximum speed of the application (n_{max})	≤ Max. motor speed (n_{max})
required peak torque (M_{L_max})	≤ Maximum torque (M_{max})
Effective torque (M_{eff})	≤ Rated torque (M_N)
Inertia of the application (J_{App}) / 10	≤ Motor torque (J_{mot})



For examination or optimisation it can be calculated again with the real motor data.

2.7.2 Selection of the servo controller

The selection of the servo controller occurs via the max. short time current and the rated output current.

Max. short time current	=	$\frac{M_{L_max} \cdot \text{standstill continuous current } (I_0)}{\text{Stall torque } (M_0)}$
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Rated output current	=	$\frac{\text{effective torque } (M_{eff}) \cdot \text{standstill continuous current } (I_0)}{\text{Stall torque } (M_0)}$
----------------------	---	---

2.7.3 Pretension factor

Empirical values for the pretension factor k :

Pinion	$k \approx$	1,5
Toothed belt		1,2...2,0
Flat belt		2,2...3,0

For dynamic processes like braking and accelerating, the permissible lateral force F_R is not to be exceeded in order to avoid a mechanical destruction of the motor.

2.8 Construction and definition

2.8.1 Drive end and direction of rotation

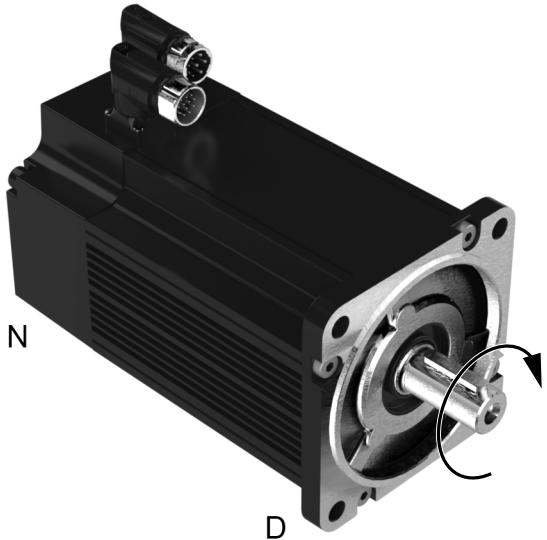
Drive end of the motor	View
In the EN 60034-7 standard, the two ends of a motor are defined as follows: D (Drive End): Drive end (AS) of the motor. N (Non-Drive End): Non-drive end (BS) of the motor.	
Direction of rotation of the motor	
When the motor terminals U1, V1, W1 are connected to the drive controller output with U, V, W (with this same phase order) the motor rotates in a clockwise direction when viewed facing the D-end.	

Figure 3: Example image of a motor

2.8.2 Winding and insulation system

The insulating materials used achieve insulation class 155 (F) [EN 60034-1](#). Therefore, the winding temperature may be max. $\Delta T = 105\text{K}$ at a coolant temperature of $+40^\circ\text{C}$.

The insulation system of the motors is designed such that they can be connected to a drive controller with a maximum DC link voltage $U_{DC_max} = \text{DC } 840\text{V}$ (constant DC 622V).



U_{DC_max} is the maximum value of the DC link voltage which is only transient and approximately equivalent to the inception voltage of the braking transistor or of the regenerative unit.

2.8.3 Holding brake (optional)

The optional built-in holding brake is used to fix the motor shaft when the motor is at standstill or de-energised. The permanent magnet or spring-applied brakes work according to the closed current principle. This means, the brake is effective when the motor is de-energised, thus the motor shaft is held.

Holding brakes are operated on DC current. The rated voltage is 24V. They can be connected to a central DC voltage supply. Overvoltages are not permitted, even not temporary. The excitation current ripple must be less than 20% to ensure reliable opening of the brake and prevent disturbing humming noises.

NOTICE

Do not use the holding brake as a working brake!

Brake failure due to overload!

- ▶ Check the proper functioning of the brake (optional) after installing the motor.
- ▶ The optional holding brake is only designed for a limited number of emergency brakings.
- ▶ Never use it as a working brake.

Modern (field-oriented) drive controllers are able to produce a high torque even at low motor speeds. If the drive controller has sufficient current reserve, a multiple of the rated motor torque can be generated. In this case the motor shaft may turn even if the holding brake is applied, because the holding torque of the brake is exceeded.

NOTICE

Malfunction in case of reverse polarity!

Motor rotation in spite of an active brake!

- ▶ Since the holding brakes are permanent-magnet brakes, be sure to observe the correct polarity of the DC voltage, otherwise the brake will not open.

NOTICE

Voltage peaks when switching off!

Destruction of the holding brake!

- ▶ If the excitation current of the holding brake is switched off on the DC side, a voltage peak occurs which can be higher than 1000 V. It is caused by the inductance of the holding brake. A varistor should be connected in parallel to the coil to prevent this voltage peak.
- ▶ On motors with plug connector and built-in brake, it is the user's responsibility to install the varistor provided to control the brake.

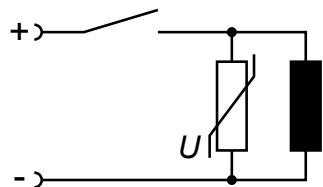


Figure 4: Varistor protective wiring

2.8.4 Speed and shaft position measuring system

The motors are equipped with a resolver, Sick Stegmann Hiperface Singleturn or Sick Stegmann Hiperface Multiturn for speed and shaft position control.

⚠ WARNING

Adjustment of the measuring system!

Injuries due to uncontrolled motor reactions!

- ▶ The measuring system of the synchronous motors is factory-adjusted to the respective drive controller. Any mis-adjustment may lead to uncontrolled motor response or complete failure of the motor.
- ▶ In order to avoid any risk, the motor must be put into operation only in no-load operation, without connection to the system.

2.8.5 Temperature monitoring

Pt1000 sensors are installed as standard in the N(BS) winding head to protect the motor against thermal overload when the temperature change is slow (temperature change in minutes or hours).

NOTICE

Operating values too high!

Destruction of the temperature sensor!

- ▶ The maximum operating voltage of the temperature sensor must not exceed DC 30 V.
- ▶ The maximum winding temperature of the temperature sensors must not exceed 130°C.

Due to the non-ideal thermal coupling, the temperature sensor follows rapid winding temperature changes only with delay, thus being unable to protect the winding if the thermal overload of the motor is transient and high. Therefore, additional protection is required (e.g. $I^2 \times t$ - monitoring by the drive controller) to protect the motor from fast-rising thermal overload (in the second range).

The evaluation of the temperature sensor belongs to the monitoring of the motor winding. The temperature sensor follows rapid temperature changes only with delay.

NOTICE

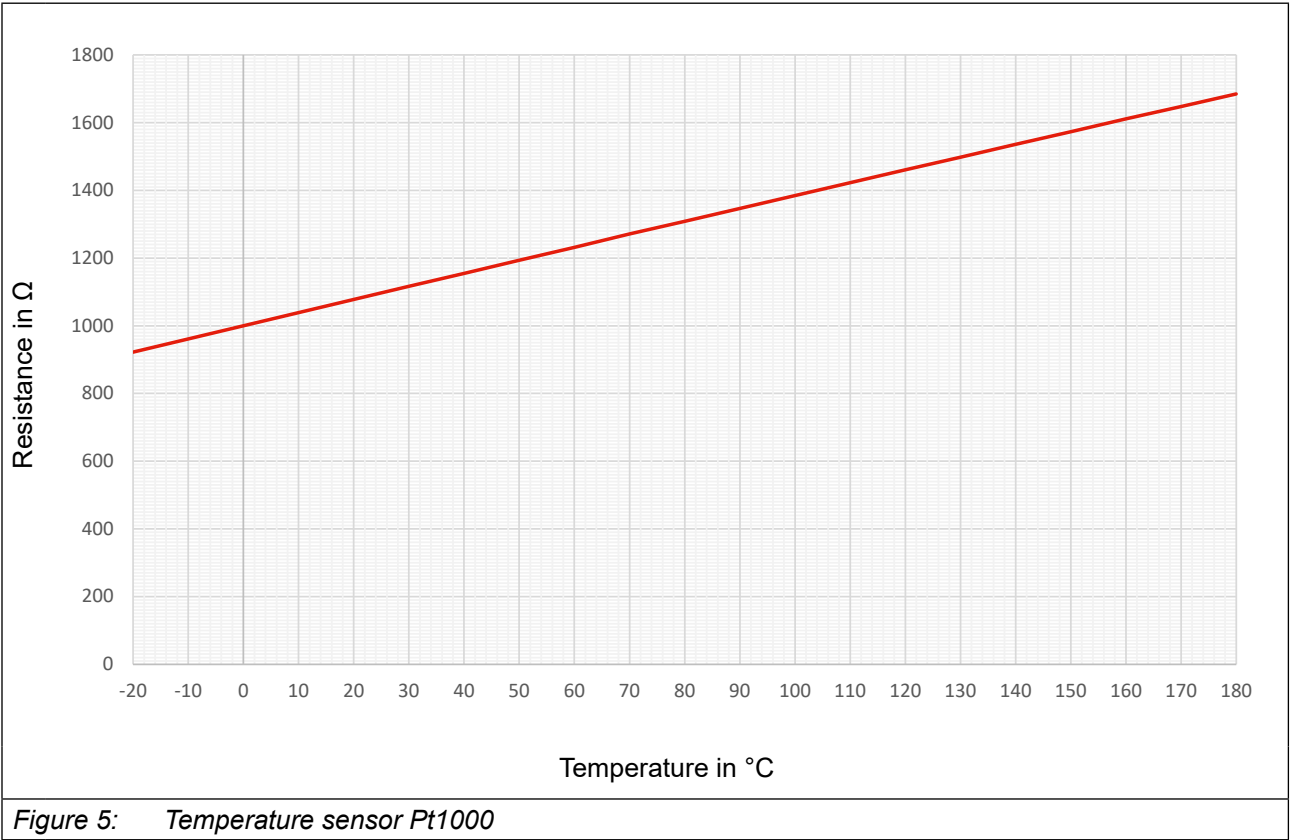
Damage to the motor winding due to overload!

- ▶ Avoid rapid temperature changes.

PRODUCT DESCRIPTION

2.8.6 Temperature sensor Pt1000

Pt1000 temperature sensor	
Sensor type	RTD (Platinum Resistance Temperature Detectors)
Reference standard	DIN EN 60751
Degree of precision	Class B
ΔT	$\pm (0.3+0.005T)^\circ\text{C}$
R0	R (0 °C) = 1000 Ω
Table 3: Temperature sensor Pt1000	



Temperature	$t / ^\circ\text{C}$	-20	-10	0	10	20	30	40	50	60	70	80
Resistance	R / Ω	922	961	1000	1039	1078	1117	1155	1194	1232	1271	1309
Temperature	$t / ^\circ\text{C}$	90	100	110	120	130	140	150	160	170	180	—
Resistance	R / Ω	1347	1385	1423	1461	1498	1536	1573	1611	1648	1685	—
Table 4: Value table temperature sensor Pt1000												

2.8.7 Deep groove ball bearing

The used deep groove ball bearings are suitable for high speeds and are lubricated with special greases that are resistant against high temperatures.

2.8.7.1 Initial start-up of deep groove ball bearings

When starting the motor for the first time, we recommend running in the bearings as follows:

- ▶ Gradually increase the motor speed from 0 to 70 % of the maximum speed in the first 20 minutes.
- ▶ During the first few minutes of operation, an above-average noise can be heard due to the uneven distribution of grease in the bearing.
- ▶ At the end of the running-in period, the noise level must normalise again and the motor can be operated at full load.

3 Operating conditions

3.1 Product features of the DL4 servo motors

Feature	Standard	Option
Type	IM B5	Foot/flange IM B3/IM B35
Degree of protection	IP54 - motor	IP65 - with shaft sealing ring D-side IP44 - fan
Motor type	Permanent magnet synchronous servo motor	
Nominal rating	Valid for S1 operation (if not marked otherwise)	
Vibration severity level	Grade A	
Flange accuracy	N	
Insulation class	ISO Kl. F	
Temperature sensor	Pt1000	
Therm. design	ISO Kl. F	
Winding	ISO Kl. F	
Connection	Speedtec connector M23 for SE CS	
	Terminal box for SE CF, SF...SG	
Encoder system connection	M23 connector (for SE CS rotatable)	
Encoder systems	without encoder (SCL operation)	
	Resolver	
	Hiperface SRS50 - 16 bit	Safety variant SRS50S
	Hiperface SRM50 - 16 bit/Multiturn - 12 bit	Safety variant SRM50S
Cooling	Self-cooling IC 410	
	Separate cooling IC 416	
	Liquid cooling IC 3W7	
Brake	–	Size SE, SF: Permanent magnet holding brake
		Size SG: Spring-applied holding brake
Motor coating	Varnishing RAL 9005	
Bearing	Radial groove ball bearings with lifetime lubrication	
Bearing - lifetime	The average storage- lifetime on rated conditions is 20.000 h	
Shaft end	Without feather key	With feather key
Table 5: Product features		

3.2 Ambient conditions

If the ambient conditions are incorrect, the power and torque of the motors may deviate from the specified values.

Storage	
Ambient temperature	-20 °C...70 °C
Operation	
Ambient temperature without brake	-20 °C...40 °C
Ambient temperature with brake	2 °C...40 °C
Relative humidity	< 90 % (no condensation)
Site altitude	≤ 1000 m above sea level
Table 6: Ambient conditions	

⚠ WARNING



Damage due to permanent magnets!

- ▶ Keep away from persons with internal medical devices (e.g. pace-makers).
- ▶ Do not use any material that can be damaged by magnetic fields.
- ▶ Install suitable warning signs.
- ▶ Install barriers to ensure safety.

⚠ WARNING



High noise level during operation!

Hearing damage possible!

- ▶ Take precautions to avoid hearing damage (e.g. wear hearing protection).

3.3 Derating of the motor depending on temperature / altitude

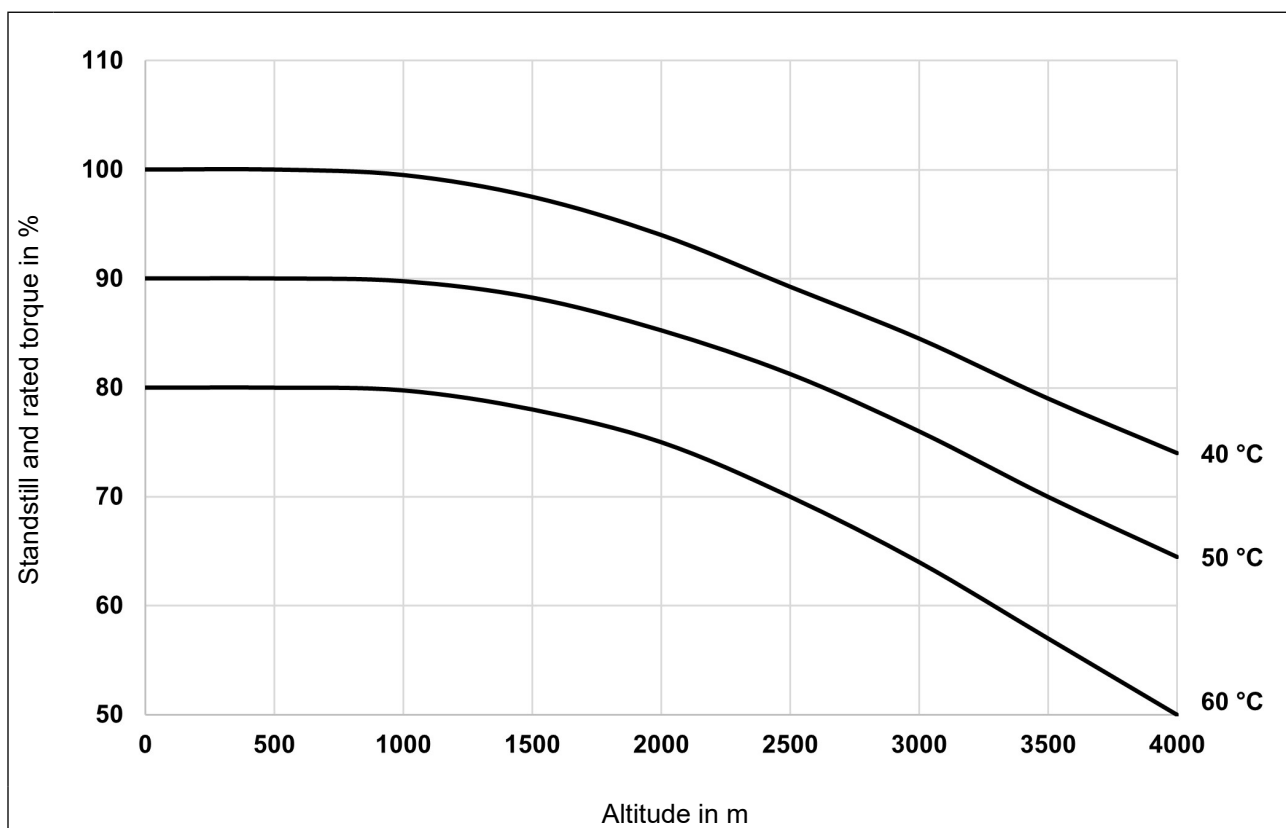


Figure 6: Derating of the motor depending on temperature / altitude

3.4 Test flange for thermal determinations

The rated power (rated torque) applies for continuous operation (duty type S1) at ambient temperature of 20°C; tolerance $\pm 10\%$.

Motor type	Material	Dimension of the test flange in mm
SE - flange	Steel	500 x 500 x 40
SF - flange	Steel	500 x 500 x 40
SG - flange	Steel	500 x 500 x 40

Table 7: Dimensions and material of the test flange



If the motor flange is thermally insulated, it is not able to dissipate the motor heat. This requires a reduction of the rated motor torque.

⚠ CAUTION



High surface temperatures!

Fire and burn protection

- ▶ The motors can reach a surface temperature of more than 100 °C.
- ▶ No temperature-sensitive parts shall be connected or fastened. If necessary, protective measures must be taken against touching.

3.5 Degree of protection of servo motors

The housings of the DL4 servo motors are generally designed to IP54 protection class according to EN [60034-5](#). See table below for the respective sealing.

Shaft sealing	Degree of protection	User information
Standard ¹⁾	IP54	The effect to moisture in the shaft and flange area must be kept to a minimum. No liquid may remain in the D end shield, if the motor is mounted with the "shaft end upward" (IM V3, IM V36).
Optionally with shaft seal ¹⁾	IP65	

Table 8: IP Degree of protection of servo motors

¹⁾ With optional fan IP44.



The specific degree of protection can only be complied, if the drive is mounted to a gear box and the motor plug is properly attached!

When using a shaft seal ring, note that the sealing lip needs to be sufficiently lubricated and cooled with a high-quality mineral oil such as SAE 20 to ensure the proper functioning of the seal. Excessive peripheral speeds destroy the sealing lip and its protective function is no longer guaranteed.

NOTICE

Insufficient lubrication of the motor!

Destruction of the sealing lip!

- ▶ Sufficient lubricant supply is required for proper heat dissipation.
- ▶ If the shaft seal is greased, the maximum permissible motor speed may need to be reduced.
- ▶ Regular regreasing is imperative.

3.5.1 Usage of connector systems

If connector systems are used, then the type of protection IP65 is only achieved with correctly wired and firmly tightened mating connector. It must be ensured that no mechanical forces act on the seals of the connectors. In the case of improper execution of the work the type of protection IP65 is no longer warranted.

NOTICE

Loss of degree of protection due to incorrect application!

- ▶ No mechanical forces on the seals of the connectors.



Permissible bending radii and the use of a strain relief prevent strain on the connector seals.

4 Connection

The connection must be carried out in such a way that a permanently safe, electrical connection is maintained.

4.1 DL4 motor with flange sockets (SE CS)

By manually turning the flange sockets any outgoing cable direction can be adjusted in the range of 300°. In addition, there are four locking points at 90°.



Figure 7: Top view of a DL4 motor with flange sockets

4.2 DL4 motor with terminal box (SE CF, SF...SG)

The terminal box can optionally also be ordered with the connections to the N-side.



Figure 8: Top view of a DL4 motor with terminal box

4.3 Connectors

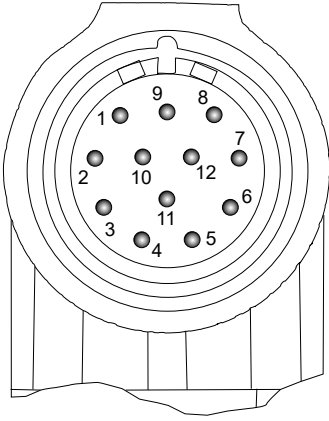
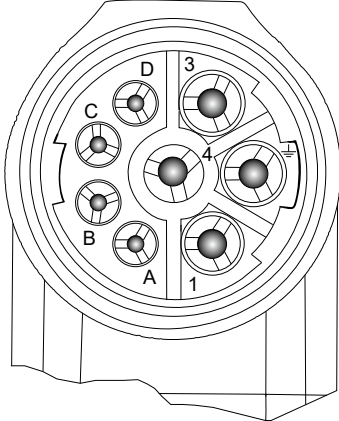
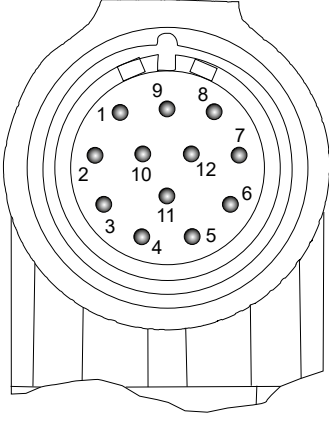
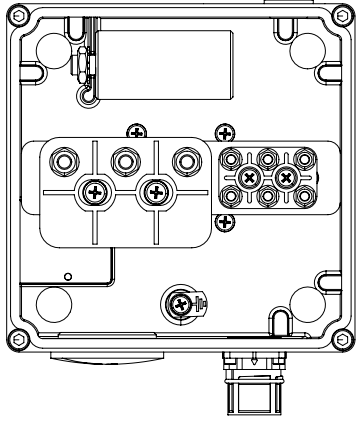
Motor size SE CS	
Encoder connection	Motor connection
	
Motor size SE CF, SF...SG	
Encoder connection	Motor connection
	

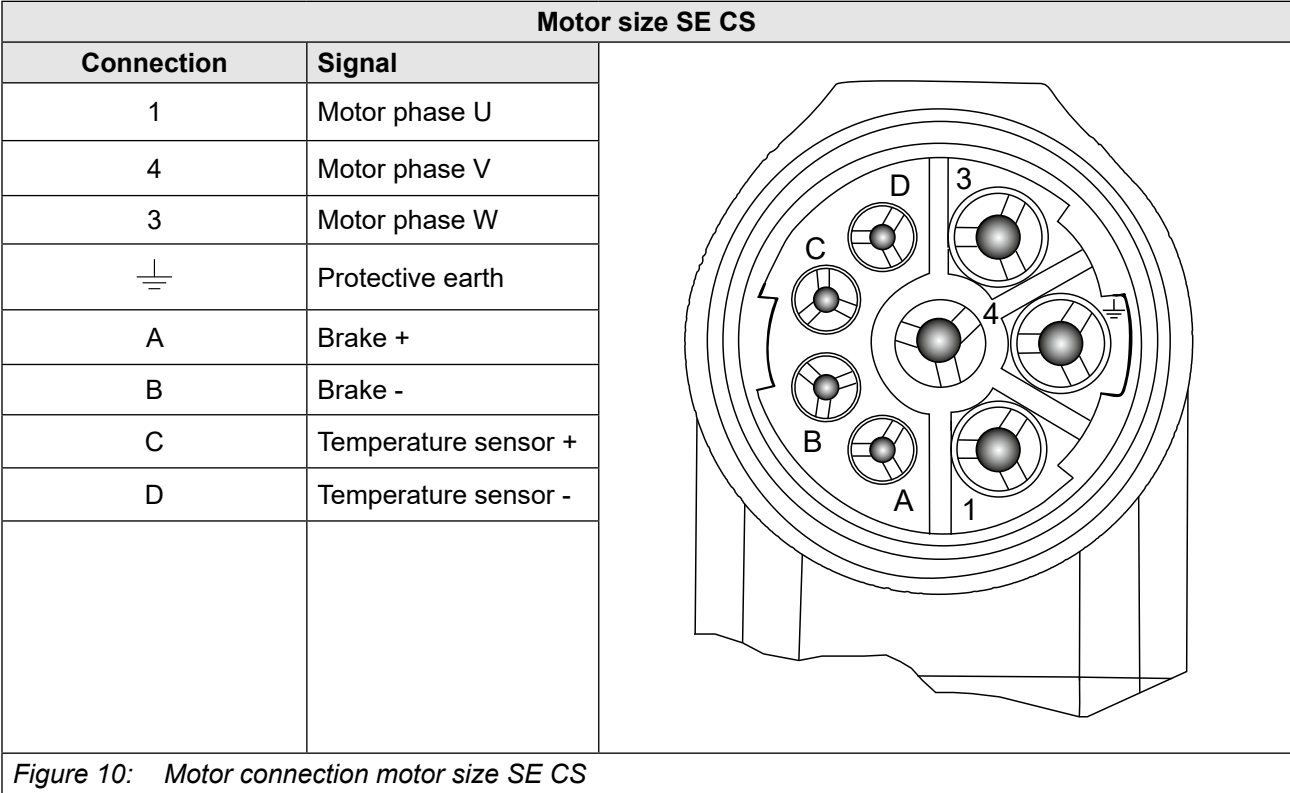
Figure 9: Connectors with a view to the connection pins at the motor



For motors without encoder system (e.g. for encoderless SCL operation) the complete encoder connection is not required.

4.4 Motor connection

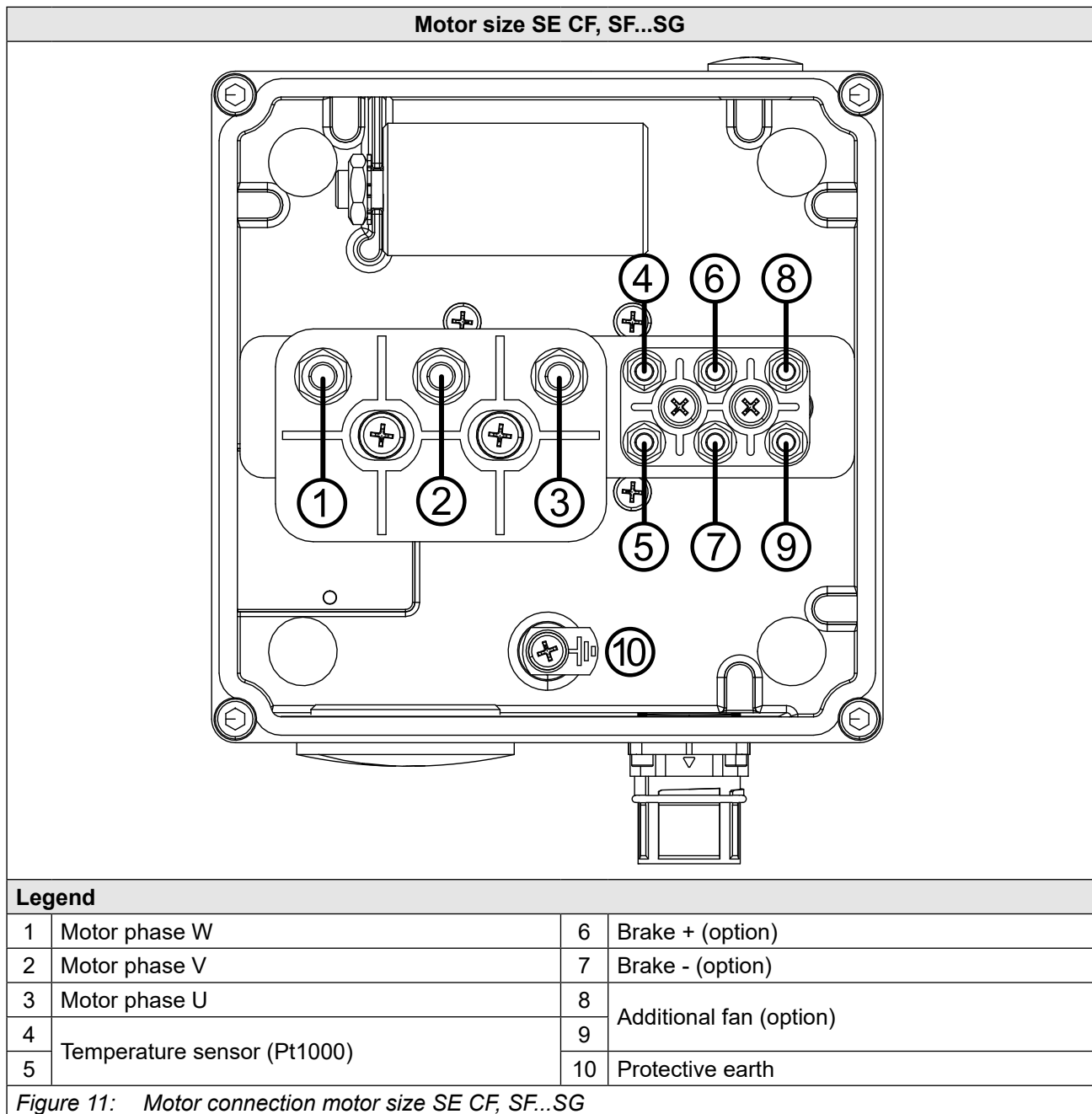
4.4.1 Motor size SE CS



Drive controller series		Required motor cable	
COMBIVERT	F6, S6	1.5 mm²:	00S4519-xxxx
		2.5 mm²:	00S4619-xxxx
		4.0 mm²:	00S4219-xxxx

Table 9: Motor cable

4.4.2 Motor size SE CF, SF...SG

**NOTICE****Malfunctions due to incorrect connection!**

- Observe the connection data of the motor sizes
=> „4.4.2.1 Anschlussdaten Motorgröße SE CF, SF...SG“.
- Observe the tightening torques of the connections
=> „4.4.2.2 Anzugsdrehmomente“.

4.4.2.1 Connection data motor size SE CF, SF...SG

Motor type		Speed in rpm	Cross-section connection terminals				
			1...3	4...9	10		
SE CF	L2...L8	1500...3000	M6	M4	M4		
SF CS	L2...L8	1000...3000					
SF CF	L2	1000	M6		M8		
		2000					
		3000					
	L4	1000					
		2000					
		3000					
	L6	1000					
		2000					
		3000					
		L8	1000			M8	
			M6				
SG CS	L2	1000	M8			M4	
		2000					
		3000					
	L4	1000					
		2000					
		3000					
	L6	1000					
		2000					
		3000					
	L8	1000	M10				
			M8				
SG CF	L2	1000	M8		M10 + 3x M6		
		2000					
		2800					
	L4	1000	M10				
		2000	M12				
		2800					
	L6	1000	M8				
		2000	M10				
		2800	M12				
	L8	1000	M10				
		2000	M12				
2800		M16					
					M12 + 3x M8		
Table 10: Connection data motor size SE CF, SF...SG							

Table 10: Connection data motor size SE CF, SF...SG

4.4.2.2 Tightening torques

Connection size	Tightening torque in Nm
M6	4
M8	8
M10	13
M12	20
M14	30
M16	40

Table 11: Tightening torques

4.4.3 Auxiliary fan (optional)

Externally cooled motors can optionally be equipped with an additional electric fan. The auxiliary fan must be externally supplied with voltage and switched on. The fan is mounted opposite the coupling side to ensure axial ventilation. The air is drawn in from the rear of the motor and directed to the flange side.

NOTICE**Damage due to overheating!**

- Keep the minimum distance for the supply air.
- Prevent external air turbulence at the motor inlet/outlet.
- Keep the motor away from additional heat sources (e.g. other devices, sunlight).

Motor type	SE CF		SF CF		SG CF		
Mains phases	1~						
Rated input voltage U_N / V	230						
Mains frequency f_N / Hz	50	60	50	60	50	60	
Rated input current I_N / A	0,11	0,14	0,18	0,22	0,68	0,95	
Minimum distance for the supply air l_{min} / mm	104		83		127		
Fan protection class	IP44						

Table 12: Technical data auxiliary fan

NOTICE**Use under difficult environmental conditions!****Blocking the fans!**

- Maintain the fan regularly to avoid dirt deposits on the impeller.

4.5 Encoder connection

⚠ WARNING

Subsequent adjustment of the measuring system!

Malfunction and uncontrolled reactions of the motor!

- The measuring system of the synchronous motors is factory-adjusted to the respective drive controller. Any mis-adjustment may lead to uncontrolled motor response or complete failure of the motor.
- In order to avoid any risk, the motor must be put into operation only in no-load operation, without connection to the system.

4.5.1 Resolver terminal assignment

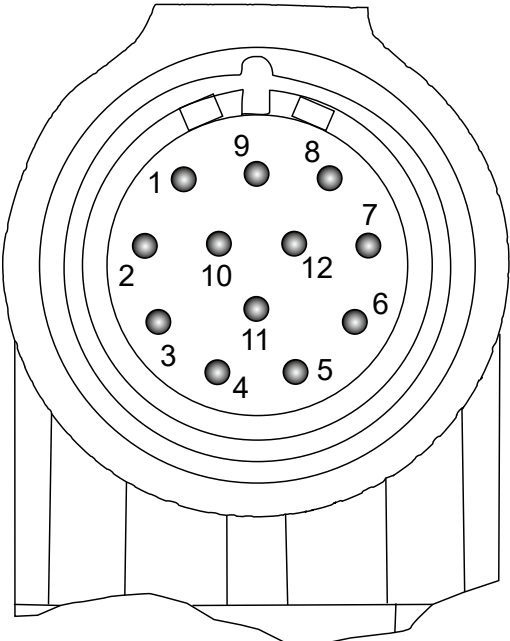
Description	View	Pin No.	Signal	Colour
View to the connector pins of the resolver connector at the motor		1	SIN-	red
		2	COS-	pink
		5	REF-	yellow
		7	REF+	green
		10	SIN+	blue
		11	COS+	grey
		All unspecified contacts are not assigned.		

Figure 12: Resolver terminal assignment

Drive controller series		Required encoder cable
COMBIVERT	F6, S6	00S6L50-10yy ¹⁾

Table 13: Resolver encoder cable

¹⁾ Assembled, shielded, towable, yy = cable length in metres.

4.5.2 Hiperface terminal assignment

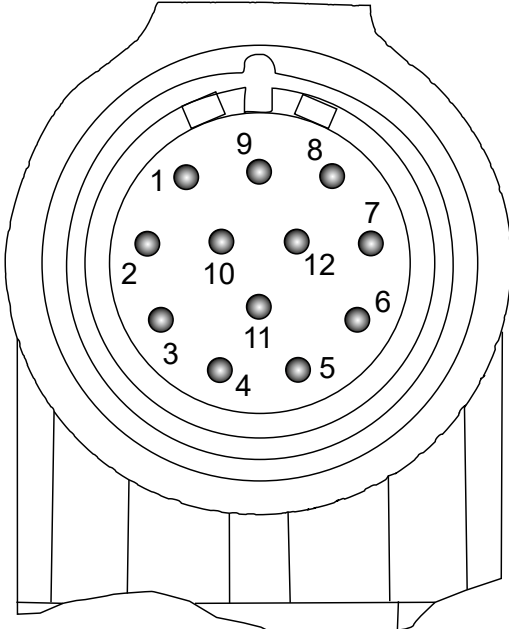
Description	View	Pin No.	Signal	Colour
View of the connection pins of the Hiperface connector on the motor		4	REF_SIN-	red
		5	REF_COS-	yellow
		6	Data+	grey
		7	Data-	pink
		8	SIN+	blue
		9	COS+	green
		10	+7.5V	brown
		11	COM	white
		All unspecified contacts are not assigned.		

Figure 13: Hiperface terminal assignment

Figure 13: Hiperface terminal assignment

Drive controller series		Required encoder cable
COMBIVERT	F6, S6	00S6L55-10yy ¹⁾

Table 14: Hiperface encoder cable

¹⁾ Assembled, shielded, towable, yy = cable length in metres.



The pin assignment for Hiperface single / multi-turn encoders is identical.

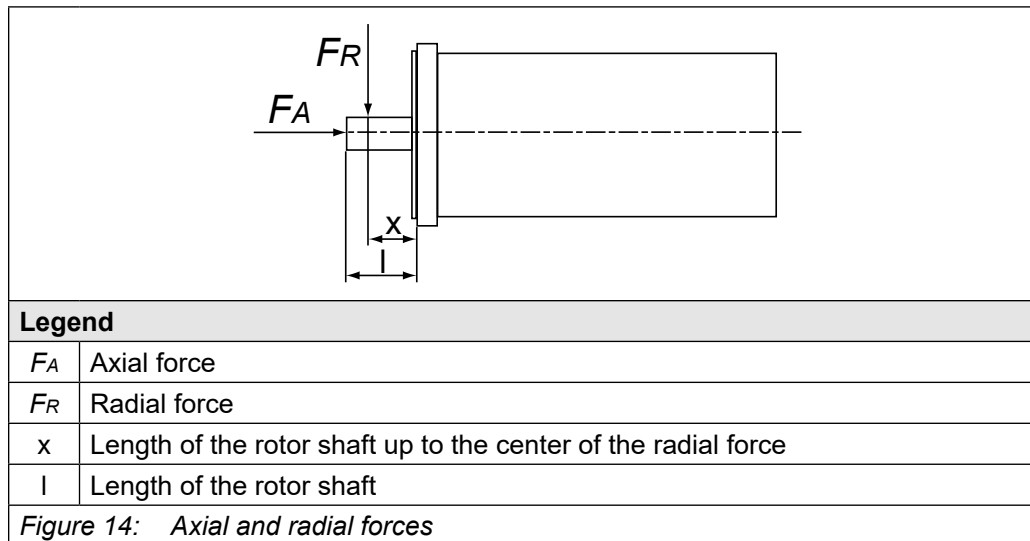
5 Technical Data

5.1 Permissible axial and radial forces

The maximum permissible axial and radial forces must not be exceeded in order to ensure smooth running of the motor.

- The forces charge the mid-shaft end.
- The radial forces F_R are depending on the speed n
- The axial forces F_A are depending on the radial forces F_R

The endurance strength of the shaft and the bearing life (20,000 h) are decisive for the permissible radial forces F_R . Taking the endurance strength into consideration F_R is not permitted to be exceeded even during dynamic processes (acceleration, braking).



5.1.1 Axial forces

NOTICE

Damage to the motor and the motor shaft!

- Ensure that the axial loads do not exceed 20 % of the maximum radial load at rated speed.

5.1.2 Maximum radial forces

Motor type SE L2...L6 (bearing type DE / NDE: 6206 ZZ / 6205 ZZ)										
Length x in mm	Speed / rpm									
	50	100	250	500	750	1000	1500	2000	2500	3000
50	2300	2300	1825	1442	1256	1139	991	898	831	780
43,75	2300	2300	1887	1492	1299	1178	1025	928	860	807
37,50	2300	2300	1954	1545	1345	1219	1061	961	890	836
31,25	2300	2300	2026	1601	1395	1264	1100	997	923	867
25	2300	2300	2104	1663	1448	1313	1142	1035	958	900
18,75	2300	2300	2187	1729	1506	1365	1188	1076	996	935
12,50	2300	2300	2278	1800	1568	1421	1237	1120	1038	974
6,25	2300	2300	2300	1878	1636	1483	1290	1169	1082	1016
0	2300	2300	2300	1963	1710	1550	1349	1222	1131	1062
Maximum radial force in N										
Table 15: Maximum radial forces for length x (motor type SE L2...L6)										

Motor type SE L8 (bearing type DE / NDE: 6206 ZZ / 6205 ZZ)										
Length x in mm	Speed / rpm									
	50	100	250	500	750	1000	1500	2000	2500	3000
60	2983	2362	1733	1370	1193	1081	941	852	789	741
52,50	3100	2455	1801	1423	1240	1124	978	886	820	770
45	3227	2555	1874	1481	1290	1170	1018	922	854	802
37,50	3300	2664	1954	1545	1345	1219	1061	961	890	836
30	3300	2782	2041	1613	1405	1274	1108	1004	930	873
22,50	3300	2912	2136	1689	1471	1333	1160	1051	973	914
15	3300	3054	2241	1771	1543	1398	1217	1102	1021	958
7,50	3300	3211	2356	1862	1622	1470	1279	1159	1073	1008
0	3300	3300	2484	1963	1710	1550	1349	1222	1131	1062
Maximum radial force in N										
Table 16: Maximum radial forces for length x (motor type SE L8)										

Motor type SF (bearing type DE / NDE: 6309 ZZ / 6306 ZZ)										
Length x in mm	Speed / rpm									
	50	100	250	500	750	1000	1500	2000	2500	3000
82	5750	5750	4622	3660	3192	2896	2525	2290	2123	1996
71,75	5750	5750	4809	3808	3321	3013	2627	2383	2209	2076
61,50	5750	5750	5011	3968	3461	3140	2738	2483	2302	2164
51,25	5750	5750	5231	4143	3613	3278	2858	2592	2403	2259
41	5750	5750	5472	4333	3779	3429	2989	2712	2514	2363
30,75	5750	5750	5735	4542	3961	3594	3133	2842	2635	2476
20,50	5750	5750	5750	4772	4162	3776	3292	2986	2768	2602
10,25	5750	5750	5750	5026	4383	3977	3467	3145	2916	2740
0	5750	5750	5750	5309	4630	4201	3663	3322	3080	2895
Maximum radial force in N										
Table 17: Maximum radial forces for length x (motor type SF)										

Motor type SG (bearing type DE / NDE: 6313 ZZ NR / 6309 ZZ)										
Length x in mm	Speed / rpm									
	50	100	250	500	750	1000	1500	2000	2500	3000
110	7450	7450	7450	6561	5721	5190	4523	4102	3802	3573
96,25	7450	7450	7450	6822	5948	5397	4703	4265	3953	3715
82,50	7450	7450	7450	7105	6195	5620	4898	4442	4117	3869
68,75	7450	7450	7450	7412	6463	5864	5110	4634	4295	4037
55	7450	7450	7450	7450	6756	6129	5342	4844	4490	4219
41,25	7450	7450	7450	7450	7076	6419	5595	5074	4702	4419
27,50	7450	7450	7450	7450	7427	6738	5873	5326	4936	4639
13,75	7450	7450	7450	7450	7450	7091	6180	5605	5195	4882
0	7450	7450	7450	7450	7450	7450	6521	5914	5481	5151
Maximum radial force in N										
Table 18: Maximum radial forces for length x (motor type SG)										

5.2 Shaft end

Motors of the DL4 series have cylindrical shaft ends according to [DIN 748](#). Use suitable devices for mounting and pulling off driving elements such as gears, pulleys, couplings, etc. Support the device at the D(AS) shaft end.

NOTICE



No impacts or axial forces on the shaft end!

Damage to the motor and the motor shaft!

- Motor and motor shaft must be protected against shocks and impacts!

	Motor type	Shaft end
		D1 x L1 in mm
	SE L2...L6	Ø 24 j6 x 50
	SE L8	Ø 28 j6 x 60
	SF	Ø 42 k6 x 82
	SG	Ø 48 k6 x 110
	Special shafts¹⁾	
	SE L2...L6 (OP04)	Ø 28 j6 x 60
	SF (OP04)	Ø 38 k6 x 80

Figure 15: Shaft end

¹⁾ Special shaft optional upon request.

5.3 Technical data servo motors SE CS / E_x_D4_x_1-4

The torque values refer to a motor flanged in horizontal position (steel flange dimensions 500 x 500 x 40 mm). Min. PWM 8kHz, DC link voltage DC 560V.

Motor size		SE-CS-SP15 / E_x_D4_A_1-4			
Length		L2	L4	L6	L8
Cooling		Self-cooling			
Rated speed	n_N / rpm	1500			
Max. speed $_{Mech}$	n_{max} / rpm	6000			
Rated voltage	⁴⁾ U_N / V	330	343	326	318
Stall torque	^{1) 4)} M_0 / Nm	11,6	22	30	38,7
Current at stall torque	^{1) 4)} I_0 / A	3,7	6,6	9,2	12
Rated power	⁴⁾ P_N / kW	1,6	3,2	4,3	5,3
Rated current	⁴⁾ I_N / A	3,4	6,4	8,8	10,8
Rated torque	⁴⁾ M_N / Nm	10,2	20,5	27,5	33,5
Torque constant (0rpm)	²⁾ k_M / Nm/A	3,26	3,49	3,41	3,38
Max. torque (ΔT 105 °C)	M_{max} / Nm	23,8	44,3	68,2	91,7
Max. current	I_{max} / A	8,6	14,9	23,6	32
Inertia	³⁾ J_L / kgcm ²	8,5	15,1	21,6	28,2
Voltage constant (20 °C)	²⁾ k_e / V _{rms} /1000min ⁻¹	197	211	206	204
Winding resistance	²⁾ R_{u-v} / Ω	8,02	3,4	1,93	1,37
Winding inductance	²⁾ L_{u-v} / mH	50,2	26,4	15,5	10,7
Weight	³⁾ m / kg	11,9	16,6	21,3	26
Number of pole pairs	p	4			
Rated motor frequency	f / Hz	100			
Table 19: Technical data servo motors SE-CS-SP15 / E_x_D4_A_1-4					

¹⁾ Referring to 100rpm.

²⁾ At 20 °C and tolerance $\pm 10\%$.

³⁾ With encoder connection, without holding brake.

⁴⁾ Continuous operation S1 (at $\Delta T = 105$ K)

Motor size		SE-CS-SP20 / E_x_D4_2_1-4			
Length		L2	L4	L6	L8
Cooling		Self-cooling			
Rated speed n_N / rpm		2000			
Max. speed n_{Mech} / rpm		6000			
Rated voltage	⁴⁾ U_N / V	328	328	317	314
Stall torque	^{1) 4)} M_0 / Nm	11,6	22	30	38,7
Current at stall torque	^{1) 4)} I_0 / A	4,9	9	12,4	15,9
Rated power	⁴⁾ P_N / kW	2,1	4,2	5,4	6,4
Rated current	⁴⁾ I_N / A	4,4	8,5	11	12,9
Rated torque	⁴⁾ M_N / Nm	10	20	25,6	30,4
Torque constant (0rpm)	²⁾ k_M / Nm/A	2,5	2,56	2,53	2,56
Max. torque (ΔT 105 °C)	M_{max} / Nm	23,5	45,9	69,6	91,7
Max. current	I_{max} / A	11	21,1	32,4	42,2
Inertia	³⁾ J_L / kgcm ²	8,5	15,1	21,6	28,2
Voltage constant (20°C)	²⁾ k_e / V _{rms} /1000min ⁻¹	151	155	153	155
Winding resistance	²⁾ R_{U-v} / Ω	4,59	1,83	1,07	0,78
Winding inductance	²⁾ L_{U-v} / mH	29,3	14,2	9,3	5,9
Weight	³⁾ m / kg	11,9	16,6	21,3	26
Number of pole pairs	p	4			
Rated motor frequency	f / Hz	133,33			
Table 20: Technical data servo motors SE-CS-SP20 / E_x_D4_2_1-4					

¹⁾ Referring to 100 rpm.

²⁾ At 20 °C and tolerance $\pm 10\%$.

³⁾ With encoder connection, without holding brake.

⁴⁾ Continuous operation S1 (at $\Delta T = 105$ K).

Motor size		SE-CS-SP30 / E_x_D4_3_1-4			
Length		L2	L4	L6	L8
Cooling		Self-cooling			
Rated speed n_N / rpm		3000			
Max. speed n_{Mech} / rpm		6000			
Rated voltage	⁴⁾ U_N / V	326	322	317	313
Stall torque	^{1) 4)} M_0 / Nm	11,6	22	30	38,7
Current at stall torque	^{1) 4)} I_0 / A	7,2	13,4	18,2	23,5
Rated power	⁴⁾ P_N / kW	3,1	5,2	6,3	7
Rated current	⁴⁾ I_N / A	6,2	10,3	12,5	13,9
Rated torque	⁴⁾ M_N / Nm	9,8	16,5	20	22,2
Torque constant (0 rpm)	²⁾ k_M / Nm/A	1,72	1,75	1,75	1,75
Max. torque (ΔT 105 °C)	M_{max} / Nm	23,3	45,9	68,8	91,7
Max. current	I_{max} / A	16	30,9	46,4	61,8
Inertia	³⁾ J_L / kgcm ²	8,52	15,1	21,69	28,27
Voltage constant (20 °C)	²⁾ k_e / V _{rms} /1000min ⁻¹	104	106	106	106
Winding resistance	²⁾ R_{u-v} / Ω	2,19	0,84	0,51	0,36
Winding inductance	²⁾ L_{u-v} / mH	12,4	6,4	4,1	2,9
Weight	³⁾ m / kg	11,9	16,6	21,3	26
Number of pole pairs	p	4			
Rated motor frequency	f / Hz	200			
Table 21: Technical data servo motors SE-CS-SP30 / E_x_D4_3_1-4					

¹⁾ Referring to 100rpm.

²⁾ At 20 °C and tolerance $\pm 10\%$.

³⁾ With encoder connection, without holding brake.

⁴⁾ Continuous operation S1 (at $\Delta T = 105$ K).

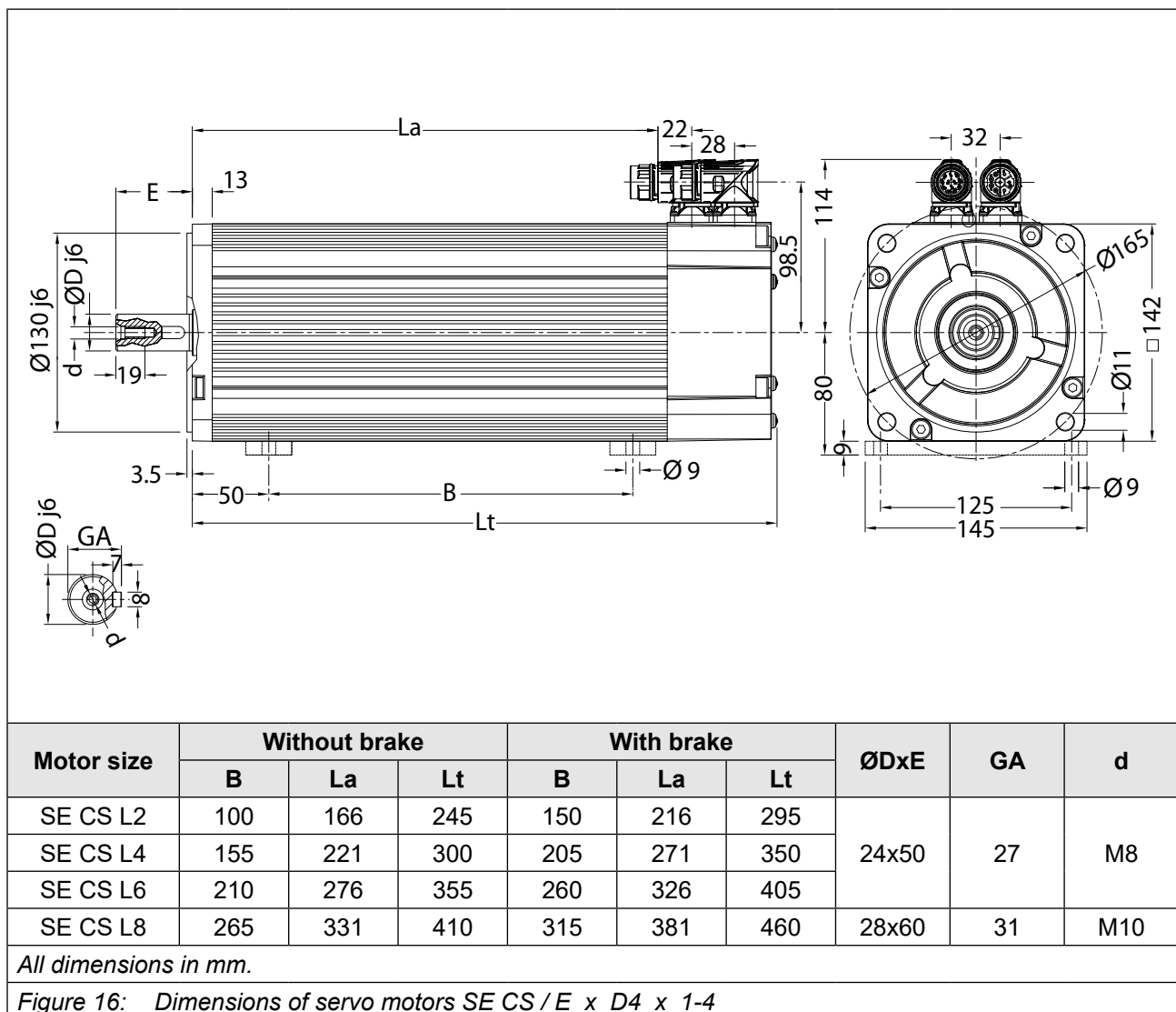
5.3.1 Technical data of the holding brake SE CS / E_x_D4_x_1-4

Motor size		SE CS / E_x_D4_x_1-4
Holding torque at 100 °C	M_{Br} / Nm	32
Rated voltage	U_{Br_dc} / V	$24 \pm 5\%$
Holding voltage	U_{HS_dc} / V	12
Power input at 24V	P_{Br} / W	26
Brake closing time	t_1 / ms	≤ 35
Brake release time	t_2 / ms	≤ 135
Additional rotor inertia	¹⁾ J_{Br} / kgcm^2	5,5
Additional weight	¹⁾ m / kg	2,7
Type of brake		Permanent magnet brake

Table 22: Technical data of the holding brake SE CS / E_x_D4_x_1-4

¹⁾ Additionally for the holding brake.

5.3.2 Dimensions of servo motors SE CS / E_x_D4_x_1-4



5.4 Technical data servo motors SE CF / E_x_D4_x_A-D

The torque values refer to a motor flanged in horizontal position (steel flange dimensions 500 x 500 x 40 mm). Min. PWM 8kHz, DC link voltage DC 560V.

Motor size		SE-CF-SP15 / E_x_D4_A_A-D			
Length		L2	L4	L6	L8
Cooling		Separate cooling			
Rated speed	n_N / rpm	1500			
Max. speed $_{Mech}$	n_{max} / rpm	6000			
Rated voltage	⁴⁾ U_N / V	357	356	342	333
Stall torque	^{1) 4)} M_0 / Nm	15,4	31	42	54
Current at stall torque	^{1) 4)} I_0 / A	5	9,3	12,9	16,8
Rated power	⁴⁾ P_N / kW	2,3	4,6	6,1	7,7
Rated current	⁴⁾ I_N / A	4,9	9	12,5	15,8
Rated torque	⁴⁾ M_N / Nm	14,6	29	39	49
Torque constant (0rpm)	²⁾ k_M / Nm/A	3,26	3,49	3,41	3,38
Max. torque (ΔT 105 °C)	M_{max} / Nm	28,5	53,2	81,9	110,1
Max. current	I_{max} / A	10,3	17,9	28,3	38,4
Inertia	³⁾ J_L / kgcm ²	8,52	15,1	21,69	28,27
Voltage constant (20 °C)	²⁾ k_e / V _{rms} /1000min ⁻¹	197	211	206	204
Winding resistance	²⁾ R_{u-v} / Ω	8,02	3,4	1,93	1,37
Winding inductance	²⁾ L_{u-v} / mH	50,2	26,4	15,5	10,7
Weight	³⁾ m / kg	14	19,1	24,3	29,5
Number of pole pairs	p	4			
Rated motor frequency	f / Hz	100			
Table 23: Technical data servo motors SE-CF-SP15 / E_x_D4_A_A-D					

¹⁾ Referring to 100rpm.

²⁾ At 20 °C and tolerance $\pm 10\%$.

³⁾ With encoder connection, without holding brake.

⁴⁾ Continuous operation S1 (at $\Delta T = 105$ K).

Motor size		SE-CF-SP20 / E_x_D4_2_A-D			
Length		L2	L4	L6	L8
Cooling		Separate cooling			
Rated speed n_N / rpm		2000			
Max. speed n_{max} / rpm		6000			
Rated voltage	⁴⁾ U_N / V	349	346	333	327
Stall torque	^{1) 4)} M_0 / Nm	15,4	31	42	54
Current at stall torque	^{1) 4)} I_0 / A	6,5	12,7	17,4	22,1
Rated power	⁴⁾ P_N / kW	2,9	5,9	7,9	9,8
Rated current	⁴⁾ I_N / A	6,1	11,9	16,1	20
Rated torque	⁴⁾ M_N / Nm	14	28	37,5	47
Torque constant (0 rpm)	²⁾ k_M / Nm/A	2,5	2,56	2,53	2,56
Max. torque (ΔT 105 °C)	M_{max} / Nm	28,2	55	83,5	110,1
Max. current	I_{max} / A	13,2	25,3	38,8	50,6
Inertia	³⁾ J_L / kgcm ²	8,52	15,1	21,69	28,27
Voltage constant (20°C)	²⁾ k_e / V _{rms} /1000min ⁻¹	151	155	153	155
Winding resistance	²⁾ R_{U-v} / Ω	4,59	1,83	1,07	0,78
Winding inductance	²⁾ L_{U-v} / mH	29,3	14,2	9,3	5,9
Weight	³⁾ m / kg	14	19,1	24,3	29,5
Number of pole pairs	p	4			
Rated motor frequency	f / Hz	133,33			
Table 24: Technical data servo motors SE-CF-SP20 / E x D4 2 A-D					

¹⁾ Referring to 100 rpm.

²⁾ At 20 °C and tolerance $\pm 10\%$.

³⁾ With encoder connection, without holding brake.

⁴⁾ Continuous operation S1 (at $\Delta T = 105$ K).

Motor size		SE-CF-SP30 / E_x_D4_3_A-D			
Length		L2	L4	L6	L8
Cooling		Separate cooling			
Rated speed n_N / rpm		3000			
Max. speed n_{Mech} / rpm		6000			
Rated voltage	⁴⁾ U_N / V	338	336	330	324
Stall torque	^{1) 4)} M_0 / Nm	15,4	31	42	54
Current at stall torque	^{1) 4)} I_0 / A	9,4	18,6	25,3	32,5
Rated power	⁴⁾ P_N / kW	4	7,5	10,4	12,3
Rated current	⁴⁾ I_N / A	8	15	20,6	24,3
Rated torque	⁴⁾ M_N / Nm	12,6	24	33	39
Torque constant (0rpm)	²⁾ k_M / Nm/A	1,72	1,75	1,75	1,75
Max. torque (ΔT 105°C)	M_{max} / Nm	28	55	82,6	110,1
Max. current	I_{max} / A	19,2	37,1	55,7	74,2
Inertia	³⁾ J_L / kgcm ²	8,52	15,1	21,69	28,27
Voltage constant (20°C)	²⁾ k_e / V _{rms} /1000min ⁻¹	104	106	106	106
Winding resistance	²⁾ R_{u-v} / Ω	2,19	0,84	0,51	0,36
Winding inductance	²⁾ L_{u-v} / mH	12,4	6,4	4,1	2,9
Weight	³⁾ m / kg	14	19,1	24,3	29,5
Number of pole pairs	p	4			
Rated motor frequency	f / Hz	200			
Table 25: Technical data servo motors SE-CF-SP30 / E_x_D4_3_A-D					

¹⁾ Referring to 100 rpm.

²⁾ At 20 °C and tolerance $\pm 10\%$.

³⁾ With encoder connection, without holding brake.

⁴⁾ Continuous operation S1 (at $\Delta T = 105$ K).

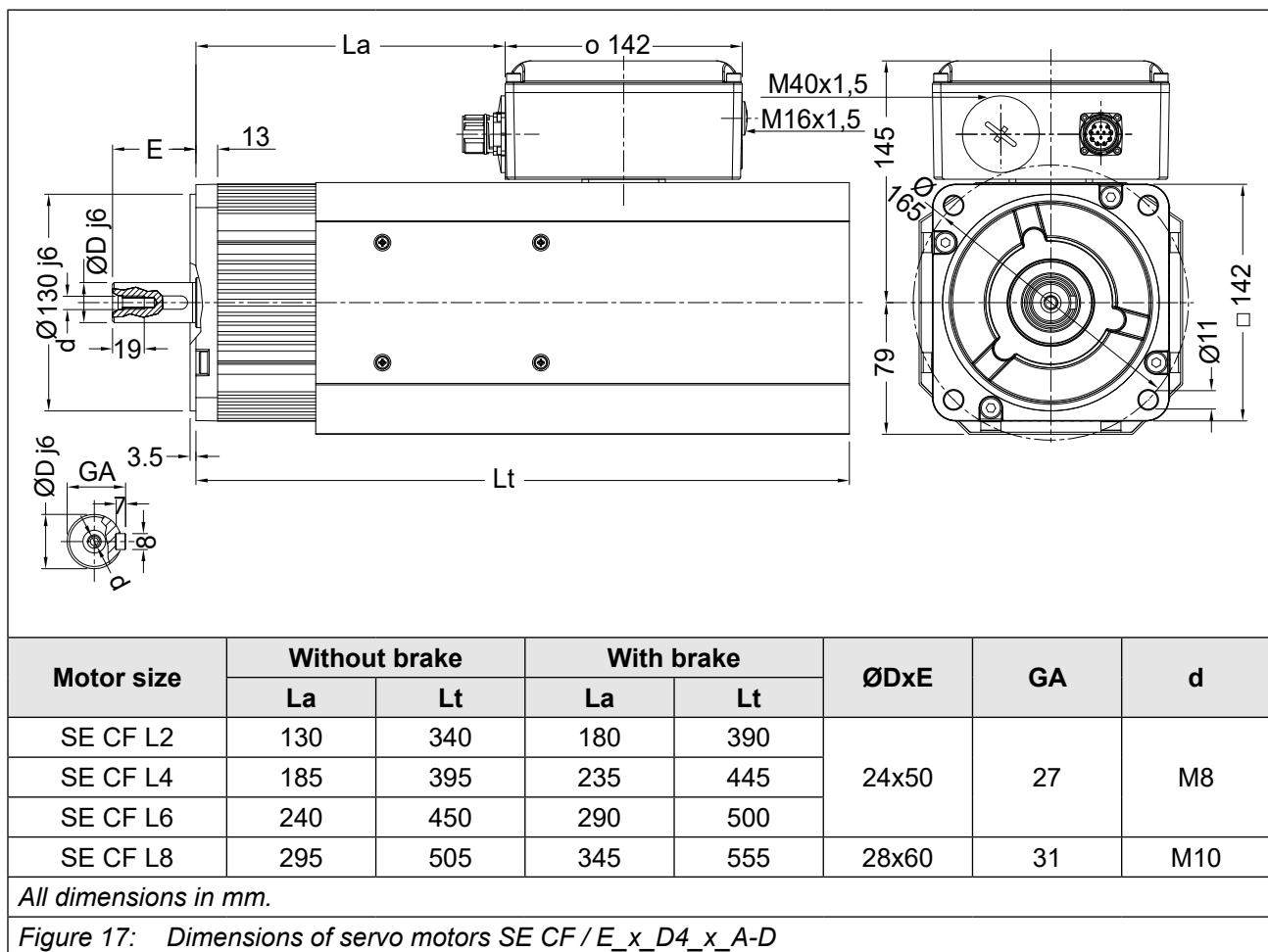
5.4.1 Technical data of the holding brake SE CF / E_x_D4_x_A-D

Motor size		SE CF / E_D4_x_A-D
Holding torque at 100 °C	M_{Br} / Nm	32
Rated voltage	U_{Br_dc} / V	$24 \pm 5\%$
Holding voltage	U_{HS_dc} / V	12
Power input at 24V	P_{Br} / W	26
Brake closing time	t_1 / ms	≤ 35
Brake release time	t_2 / ms	≤ 135
Additional rotor inertia	¹⁾ J_{Br} / kgcm^2	5,5
Additional weight	¹⁾ m / kg	3,2
Type of brake		Permanent magnet brake

Table 26: Technical data of the holding brake SE CF / E_x_D4_x_A-D

¹⁾ Additionally for the holding brake.

5.4.2 Dimensions of servo motors SE CF / F_D4



5.5 Technical data servo motors SF CS / F_x_D4_x_1-4

The torque values refer to a motor flanged in horizontal position (steel flange dimensions 500 x 500 x 40 mm). Min. PWM 8kHz, DC link voltage DC 560V.

Motor size		SF-CS-SP10 / F_x_D4_1_1-4			
Length		L2	L4	L6	L8
Cooling		Self-cooling			
Rated speed <i>n_N</i> / rpm		1000			
Max. speed <i>n_{Mech}</i> <i>n_{max}</i> / rpm		6000			
Rated voltage	⁴⁾ <i>U_N</i> / V	351	302	321	308
Stall torque	^{1) 4)} <i>M₀</i> / Nm	33	60	82	102
Current at stall torque	^{1) 4)} <i>I₀</i> / A	6,7	13,6	17	21,7
Rated power	⁴⁾ <i>P_N</i> / kW	3,3	5,9	7,5	9,4
Rated current	⁴⁾ <i>I_N</i> / A	6,7	13,1	15,3	19,7
Rated torque	⁴⁾ <i>M_N</i> / Nm	31,5	56	72	90
Torque constant (0rpm)	²⁾ <i>k_M</i> / Nm/A	5,03	4,57	5,03	4,88
Max. torque (ΔT 105 °C)	<i>M_{max}</i> / Nm	82	154	224	271
Max. current	<i>I_{max}</i> / A	18,4	37,9	49,9	62,4
Inertia	³⁾ <i>J_L</i> / kgcm²	49	89	128	167
Voltage constant (20 °C)	²⁾ <i>k_e</i> / V _{rms} /1000min ⁻¹	304	276	304	295
Winding resistance	²⁾ <i>R_{u-v}</i> / Ω	4,86	1,34	0,9	0,62
Winding inductance	²⁾ <i>L_{u-v}</i> / mH	47,8	19,8	15,9	11,2
Weight	³⁾ <i>m</i> / kg	30	43	54	68
Number of pole pairs	<i>p</i>	4			
Rated motor frequency	<i>f</i> / Hz	66,66			
Table 27: Technical data servo motors SF-CS-SP10 / F_x_D4_1_1-4					

¹⁾ Referring to 100rpm.

²⁾ At 20 °C and tolerance $\pm 10\%$.

³⁾ With encoder connection, without holding brake.

⁴⁾ Continuous operation S1 (at $\Delta T = 105$ K).

Motor size		SF-CS-SP20 / F_x_D4_2_1-4			
Length		L2	L4	L6	L8
Cooling		Self-cooling			
Rated speed n_N / rpm		2000			
Max. speed n_{Mech} / rpm		6000			
Rated voltage	⁴⁾ U_N / V	300	307	281	297
Stall torque	^{1) 4)} M_0 / Nm	33	60	82	102
Current at stall torque	^{1) 4)} I_0 / A	14,8	25,6	37,3	43,5
Rated power	⁴⁾ P_N / kW	6,4	10,7	13	16
Rated current	⁴⁾ I_N / A	14,3	22,4	29	33,5
Rated torque	⁴⁾ M_N / Nm	30,5	51	62	76,3
Torque constant (0rpm)	²⁾ k_M / Nm/A	2,29	2,44	2,29	2,44
Max. torque (ΔT 105 °C)	M_{max} / Nm	82	154	223	271
Max. current	I_{max} / A	40,4	71	110	125
Inertia	³⁾ J_L / kgcm ²	49	89	128	167
Voltage constant (20°C)	²⁾ k_e / V _{rms} /1000min ⁻¹	138	148	138	148
Winding resistance	²⁾ R_{u-v} / Ω	0,95	0,39	0,19	0,16
Winding inductance	²⁾ L_{u-v} / mH	9,9	5,6	3,3	2,8
Weight	³⁾ m / kg	30	43	54	68
Number of pole pairs	p	4			
Rated motor frequency	f / Hz	133,33			
Table 28: Technical data servo motors SF-CS-SP20 / F_x_D4_2_1-4					

¹⁾ Referring to 100rpm.

²⁾ At 20 °C and tolerance $\pm 10\%$.

³⁾ With encoder connection, without holding brake.

⁴⁾ Continuous operation S1 (at $\Delta T = 105$ K).

Motor size		SF-CS-SP30 / F_x_D4_3_1-4			
Length		L2	L4	L6	L8
Cooling		Self-cooling			
Rated speed n_N / rpm		3000			
Max. speed n_{Mech} / rpm		6000			
Rated voltage	⁴⁾ U_N / V	322	281	331	329
Stall torque	^{1) 4)} M_0 / Nm	33	60	82	102
Current at stall torque	^{1) 4)} I_0 / A	20,2	40,9	46,6	58
Rated power	⁴⁾ P_N / kW	9,3	13,8	16,7	20,4
Rated current	⁴⁾ I_N / A	18,8	30,9	31	38
Rated torque	⁴⁾ M_N / Nm	29,5	44	53	65
Torque constant (0 rpm)	²⁾ k_M / Nm/A	1,68	1,52	1,83	1,83
Max. torque (ΔT 105 °C)	M_{max} / Nm	82	155	223	271
Max. current	I_{max} / A	55,1	114	137	166
Inertia	³⁾ J_L / kgcm ²	49	89	128	167
Voltage constant (20 °C)	²⁾ k_e / V _{rms} /1000min ⁻¹	102	92	111	111
Winding resistance	²⁾ R_{u-v} / Ω	0,49	0,15	0,13	0,09
Winding inductance	²⁾ L_{u-v} / mH	5,3	2,2	2,1	1,6
Weight	³⁾ m / kg	30	43	54	68
Number of pole pairs	p	4			
Rated motor frequency	f / Hz	200			
Table 29: Technical data servo motors SF-CS-SP30 / F_x_D4_3_1-4					

¹⁾ Referring to 100rpm.

²⁾ At 20 °C and tolerance $\pm 10\%$.

³⁾ With encoder connection, without holding brake.

⁴⁾ Continuous operation S1 (at $\Delta T = 105$ K).

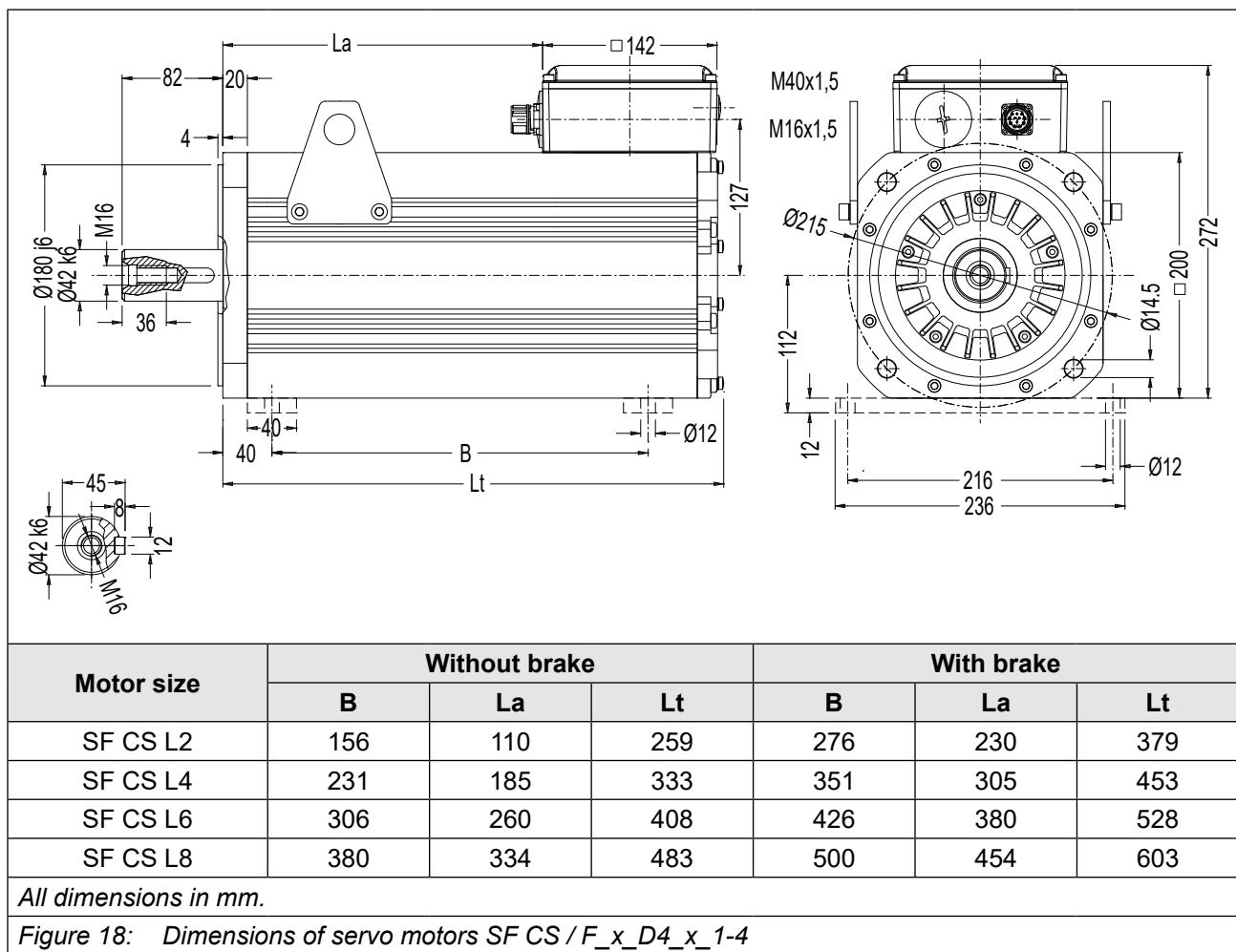
5.5.1 Technical data of the holding brake SF CS / F_x_D4_x_1-4

Motor size		SF CS
Holding torque at 100 °C	M_{Br} / Nm	145
Rated voltage	U_{Br_dc} / V	$24 \pm 5 \%$
Holding voltage	U_{HS_dc} / V	12
Power input at 24V	P_{Br} / W	50
Brake closing time	t_1 / ms	≤ 100
Brake release time	t_2 / ms	≤ 240
Additional rotor inertia	¹⁾ J_{Br} / kgcm^2	53
Additional weight	¹⁾ m / kg	11
Type of brake		Permanent magnet brake

Table 30: Technical data of the holding brake SF CS / F_x_D4_x_1-4

¹⁾ Additionally for the holding brake.

5.5.2 Dimensions servo motors SF CS



5.6 Technical data servo motors SF CF / F_x_D4_x_A-D

The torque values refer to a motor flanged in horizontal position (steel flange dimensions 500 x 500 x 40 mm). Min. PWM 8kHz, DC link voltage DC 560V.

Motor size		SF-CF-SP10 / F_x_D4_1_A-D			
Length		L2	L4	L6	L8
Cooling		Separate cooling			
Rated speed <i>n_N</i> / rpm		1000			
Max. speed <i>n_{Mech}</i> <i>n_{max}</i> / rpm		6000			
Rated voltage	⁴⁾ <i>U_N</i> / V	380	332	355	338
Stall torque	^{1) 4)} <i>M₀</i> / Nm	45	89	130	163
Current at stall torque	^{1) 4)} <i>I₀</i> / A	9,3	20,2	26,9	34,7
Rated power	⁴⁾ <i>P_N</i> / kW	4,5	9,1	13	16,1
Rated current	⁴⁾ <i>I_N</i> / A	9,1	20,4	26,4	33,8
Rated torque	⁴⁾ <i>M_N</i> / Nm	42,7	87	124	154
Torque constant (0rpm)	²⁾ <i>k_M</i> / Nm/A	5,03	4,57	5,03	4,88
Max. torque (ΔT 105 °C)	<i>M_{max}</i> / Nm	93	203	280	373
Max. current	<i>I_{max}</i> / A	21,9	52,4	65,6	90,2
Inertia	³⁾ <i>J_L</i> / kgcm²	49	89	128	167
Voltage constant (20 °C)	²⁾ <i>k_e</i> / V _{rms} /1000min ⁻¹	304	276	304	295
Winding resistance	²⁾ <i>R_{u-v}</i> / Ω	4,86	1,34	0,9	0,62
Winding inductance	²⁾ <i>L_{u-v}</i> / mH	47,8	19,8	15,9	11,2
Weight	³⁾ <i>m</i> / kg	37	49	64	78
Number of pole pairs	<i>p</i>	4			
Rated motor frequency	<i>f</i> / Hz	66,66			
Table 31: Technical data servo motors SF-CF-SP10 / F_x_D4_1_A-D					

¹⁾ Referring to 100 rpm.

²⁾ At 20 °C and tolerance $\pm 10\%$.

³⁾ With encoder connection, without holding brake.

⁴⁾ Continuous operation S1 (at $\Delta T = 105$ K).

Motor size	SF-CF-SP20 / F_x_D4_2_A-D				
Length	L2	L4	L6	L8	
Cooling	Separate cooling				
Rated speed	2000				
Max. speed <i>Mech</i>	6000				
Rated voltage	4) U_N / V	321	336	308	322
Stall torque	1) 4) M_0 / Nm	45	89	130	163
Current at stall torque	1) 4) I_0 / A	20,5	37,9	59,1	69,5
Rated power	4) P_N / kW	8,8	17,8	24,7	30,2
Rated current	4) I_N / A	19,7	37,3	55,2	63,2
Rated torque	4) M_N / Nm	42	85	118	144
Torque constant (0rpm)	2) k_M / Nm/A	2,29	2,44	2,29	2,44
Max. torque (ΔT 105 °C)	M_{max} / Nm	93	204	280	374
Max. current	I_{max} / A	48,1	98,3	144	180
Inertia	3) J_L / kgcm ²	49	89	128	167
Voltage constant (20°C)	2) k_e / V _{rms} /1000min ⁻¹	138	148	138	148
Winding resistance	2) R_{u-v} / Ω	0,95	0,39	0,19	0,16
Winding inductance	2) L_{u-v} / mH	9,9	5,6	3,3	2,8
Weight	3) m / kg	37	49	64	78
Number of pole pairs	p	4			
Rated motor frequency	f / Hz	133,33			
Table 32: Technical data servo motors SF-CF-SP20 / F_x_D4_2_A-D					

¹⁾ Referring to 100 rpm.

²⁾ At 20 °C and tolerance $\pm 10\%$.

³⁾ With encoder connection, without holding brake.

⁴⁾ Continuous operation S1 (at $\Delta T = 105$ K).

Motor size		SF-CF-SP30 / F_x_D4_3_A-D			
Length		L2	L4	L6	L8
Cooling		Separate cooling			
Rated speed <i>n_N</i> / rpm		3000			
Max. speed <i>n_{Mech}</i> / rpm		6000			
Rated voltage	⁴⁾ <i>U_N</i> / V	346	306	360	351
Stall torque	^{1) 4)} <i>M₀</i> / Nm	45	89	130	163
Current at stall torque	^{1) 4)} <i>I₀</i> / A	27,9	60,7	73,9	92,7
Rated power	⁴⁾ <i>P_N</i> / kW	13,5	25,1	34,9	43
Rated current	⁴⁾ <i>I_N</i> / A	27,4	56,1	64,9	80,1
Rated torque	⁴⁾ <i>M_N</i> / Nm	43	80	111	137
Torque constant (0rpm)	²⁾ <i>k_M</i> / Nm/A	1,68	1,52	1,83	1,83
Max. torque (ΔT 105°C)	<i>M_{max}</i> / Nm	93	205	280	374
Max. current	<i>I_{max}</i> / A	65,6	157	180	241
Inertia	³⁾ <i>J_L</i> / kgcm ²	49	89	128	167
Voltage constant (20°C)	²⁾ <i>k_e</i> / V _{rms} /1000min ⁻¹	102	92	111	111
Winding resistance	²⁾ <i>R_{u-v}</i> / Ω	0,49	0,15	0,13	0,09
Winding inductance	²⁾ <i>L_{u-v}</i> / mH	5,3	2,2	2,1	1,5
Weight	³⁾ <i>m</i> / kg	37	49	64	78
Number of pole pairs	<i>p</i>	4			
Rated motor frequency	<i>f</i> / Hz	200			
Table 33: Technical data servo motors SF-CF-SP30 / F_x_D4_3_A-D					

¹⁾ Referring to 100rpm.

²⁾ At 20 °C and tolerance $\pm 10\%$.

³⁾ With encoder connection, without holding brake.

⁴⁾ Continuous operation S1 (at $\Delta T = 105$ K).

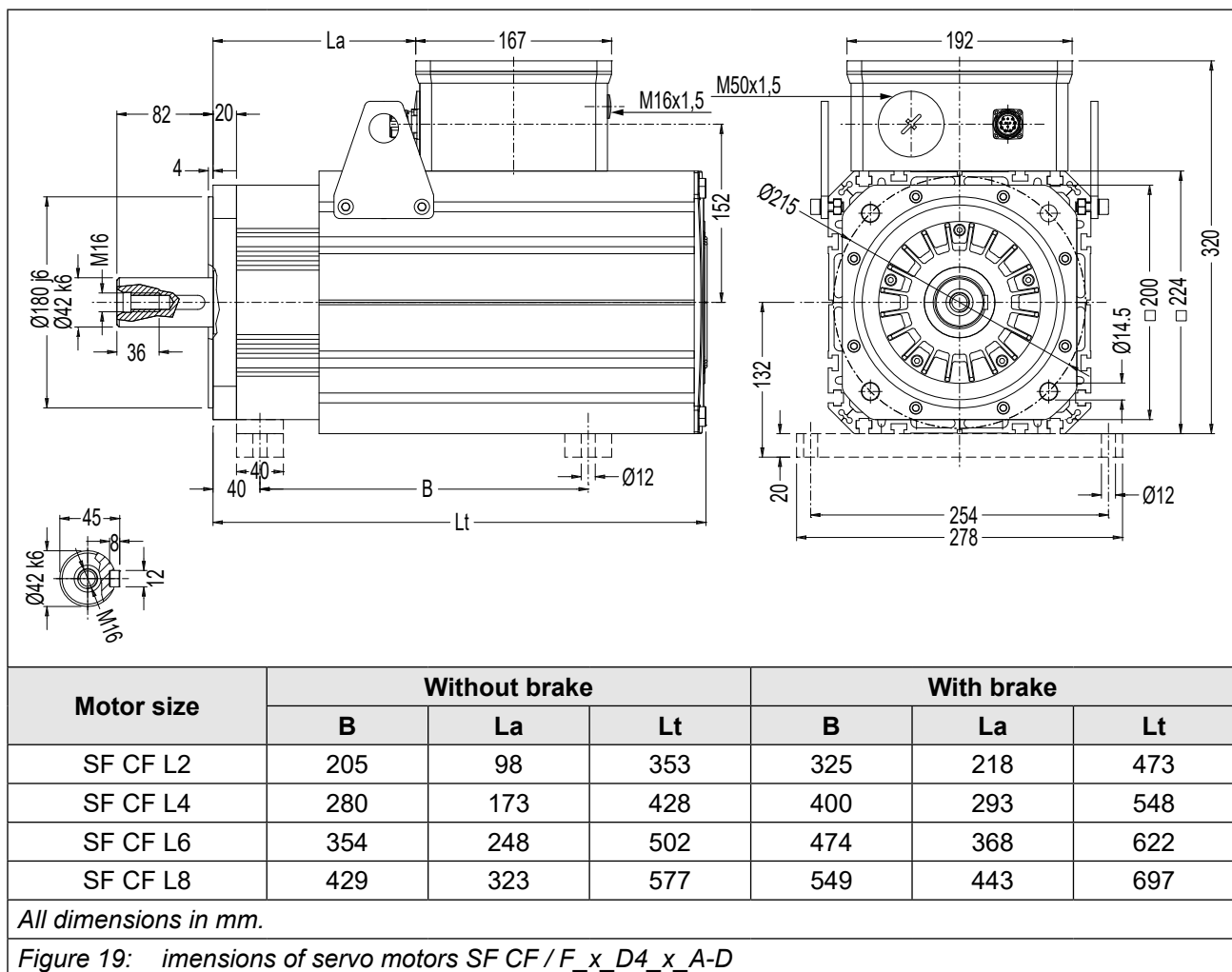
5.6.1 Technical data of the holding brake SF CF / F_x_D4_x_A-D

Motor size		SF CF
Holding torque at 100 °C	M_{Br} / Nm	145
Rated voltage	U_{Br_dc} / V	$24 \pm 5 \%$
Holding voltage	U_{HS_dc} / V	12
Power input at 24V	P_{Br} / W	50
Brake closing time	t_1 / ms	≤ 100
Brake release time	t_2 / ms	≤ 240
Additional rotor inertia	¹⁾ J_{Br} / kgcm^2	53
Additional weight	¹⁾ m / kg	13
Type of brake		Permanent magnet brake

Table 34: Technical data of the holding brake SF CF / F_x_D4_x_A-D

¹⁾ Additionally for the holding brake.

5.6.2 Dimensions servo motors SF CF



5.7 Technical data servo motors SG CS / G_x_D4_x_1-4

The torque values refer to a motor flanged in horizontal position (steel flange dimensions 500 x 500 x 40 mm). Min. PWM 4 kHz, DC link voltage DC 560 V.

Motor size		SG-CS-SP10 / G_x_D4_1_1-4			
Length		L2	L4	L6	L8
Cooling		Self-cooling			
Rated speed n_N / rpm		1000			
Max. speed <i>Mech</i>	⁷⁾ n_{max} / rpm	6000 / 4500 ¹⁾			
Rated voltage	²⁾ U_N / V	319	323	303	325
		348	341	321	339
Stall torque	^{2) 4)} M_0 / Nm	100	182	270	340
		153	270	400	493
Current at stall torque	^{2) 4)} I_0 / A	21,6	36,8	58,3	68,8
		33	54,7	86,4	99,8
Rated power	²⁾ P_N / kW	9,7	15,7	21,5	28,3
		14,9	24,1	33,5	38,7
Rated current	²⁾ I_N / A	21,6	32,7	47,6	58,8
		33	50,1	74,3	80,6
Rated torque	²⁾ M_N / Nm	93	150	205	270
		142	230	320	370
Torque constant (0 rpm)	⁵⁾ k_M / Nm/A	4,91	5,24	4,91	5,24
Max. torque (ΔT 105 °C)	M_{max} / Nm	147	259	386	465
Max. current	I_{max} / A	38,3	63,1	100	113
Inertia	⁶⁾ J_L / kgcm ²	224	401	577	753
Voltage constant (20 °C)	⁵⁾ k_e / V _{rms} /1000min ⁻¹	297	317	297	317
Winding resistance	⁵⁾ R_{u-v} / Ω	0,63	0,25	0,15	0,11
Winding inductance	⁵⁾ L_{u-v} / mH	13,2	6,5	4,4	4,3
Weight	⁶⁾ m / kg	75	109	143	177
Number of pole pairs	p	4			
Rated motor frequency	f / Hz	66,66			

Table 35: Technical data servo motors SG-CS-SP10 / G_x_D4_1_1-4

- ¹⁾ Only for motors with brake.
- ²⁾ Continuous operation S1 (at $\Delta T = 105$ K).
- ³⁾ Intermittent operation S3 at 40 % for 1 minute.
- ⁴⁾ Referring to 100 rpm.
- ⁵⁾ At 20 °C and tolerance ± 10 %.
- ⁶⁾ With encoder connection, without holding brake.
- ⁷⁾ Drive controllers connected to these motors must have a field weakening option in order to reach the rated speed.

Motor size	SG-CS-SP20 / G_x_D4_2_1-4			
Length	L2	L4	L6	L8
Cooling	Self-cooling			
Rated speed ⁷⁾ n_N / rpm	2000			
Max. speed <i>Mech</i> n_{max} / rpm	6000/4500 ¹⁾			
Rated voltage ²⁾ U_N / V	328	311	345	326
	364	321	357	315
Stall torque ^{2) 4)} M_0 / Nm	100	182	270	340
	151	270	400	493
Current at stall torque ^{2) 4)} I_0 / A	40,5	73,7	97,2	137,7
	61	109,3	158,3	199,6
Rated power ²⁾ P_N / kW	15,9	23,7	24,1	27,2
	27,2	44	69,1	71,6
Rated current ²⁾ I_N / A	33,1	49,2	44,5	56,6
	56,6	91,4	127,7	148,9
Rated torque ²⁾ M_N / Nm	76	113	115	130
	130	210	330	342
Torque constant (0 rpm) ⁵⁾ k_M / Nm/A	2,62	2,62	2,95	2,62
Max. torque (ΔT 105 °C) M_{max} / Nm	147	259	386	465
Max. current I_{max} / A	71,9	126,2	167,3	226,7
Inertia ⁶⁾ J_L / kgcm ²	224	401	577	753
Voltage constant (20 °C) ⁵⁾ k_e / V _{rms} /1000min ⁻¹	158	158	178	158
Winding resistance ⁵⁾ R_{U-V} / Ω	0,18	0,06	0,04	0,02
Winding inductance ⁵⁾ L_{U-V} / mH	4,4	2,1	1,7	1,1
Weight ⁶⁾ m / kg	75	109	143	177
Number of pole pairs p	4			
Rated motor frequency f / Hz	133,33			

Table 36: Technical data servo motors SG-CS-SP20 / G_x_D4_2_1-4

¹⁾ Only for motors with brake.

²⁾ Continuous operation S1 (at $\Delta T = 105$ K).

³⁾ Intermittent operation S3 at 40 % for 1 minute.

⁴⁾ Referring to 100 rpm.

⁵⁾ At 20 °C and tolerance ± 10 %.

⁶⁾ With encoder connection, without holding brake.

⁷⁾ Drive controllers connected to these motors must have a field weakening option in order to reach the rated

Motor size	SG-CS-SP30 / G_x_D4_3_1-4			
Length	L2	L4	L6	L8
Cooling	Self-cooling			
Rated speed ⁸⁾ n_N / rpm	3000			
Max. speed <i>Mech</i> n_{max} / rpm	6000/4500 ¹⁾			
Rated voltage ²⁾ U_N / V	358	344	341	341
	376	364	363	356

Stall torque	$\frac{2) \ 4)}{3)} \ M_0 / \text{Nm}$	100	182	270	340
		151	270	400	493
Current at stall torque	$\frac{2) \ 4)}{3)} \ I_0 / \text{A}$	54	98,2	143	183,5
		82	145,8	215,9	266,1
Rated power	$\frac{2)}{3)} \ P_N / \text{kW}$	18,8	14,1	— ⁵⁾	— ⁵⁾
		29,2	47,1	70,7	77
Rated current	$\frac{2)}{3)} \ I_N / \text{A}$	34,8	26,1	— ⁵⁾	— ⁵⁾
		54	87,1	130,6	142,2
Rated torque	$\frac{2)}{3)} \ M_N / \text{Nm}$	60	45	— ⁵⁾	— ⁵⁾
		93	150	225	245
Torque constant (0rpm)	⁶⁾ $k_M / \text{Nm/A}$	1,96	1,96	1,96	1,96
Max. torque (ΔT 105 °C)	$M_{\text{max}} / \text{Nm}$	147	259	378	456
Max. current	$I_{\text{max}} / \text{A}$	95,8	168	251	302
Inertia	⁷⁾ J_L / kgcm^2	224	401	577	753
Voltage constant (20 °C)	⁶⁾ $k_e / \text{V}_{\text{rms}}/\text{1000min}^{-1}$	119	119	119	119
Winding resistance	⁶⁾ R_{u-v} / Ω	0,1	0,03	0,02	0,01
Winding inductance	⁶⁾ L_{u-v} / mH	2,4	1,2	0,8	0,6
Weight	⁷⁾ m / kg	75	109	143	177
Number of pole pairs	p	4			
Rated motor frequency	f / Hz	200			
Table 37: Technical data servo motors SG-CS-SP30 / G x D4 3 1-4					

¹⁾ Only for motors with brake.

²⁾ Continuous operation S1 (at $\Delta T = 105 \text{ K}$).

³⁾ Intermittent operation S3 at 40 % for 1 minute.

⁴⁾ Referring to 100rpm.

⁵⁾ Not defined for S1 operation. See data S3 operation.

⁶⁾ At 20°C and tolerance $\pm 10\%$.

⁷⁾ With encoder connection, without holding brake.

⁸⁾ Drive controllers connected to these motors must have a field weakening option in order to reach the rated speed.

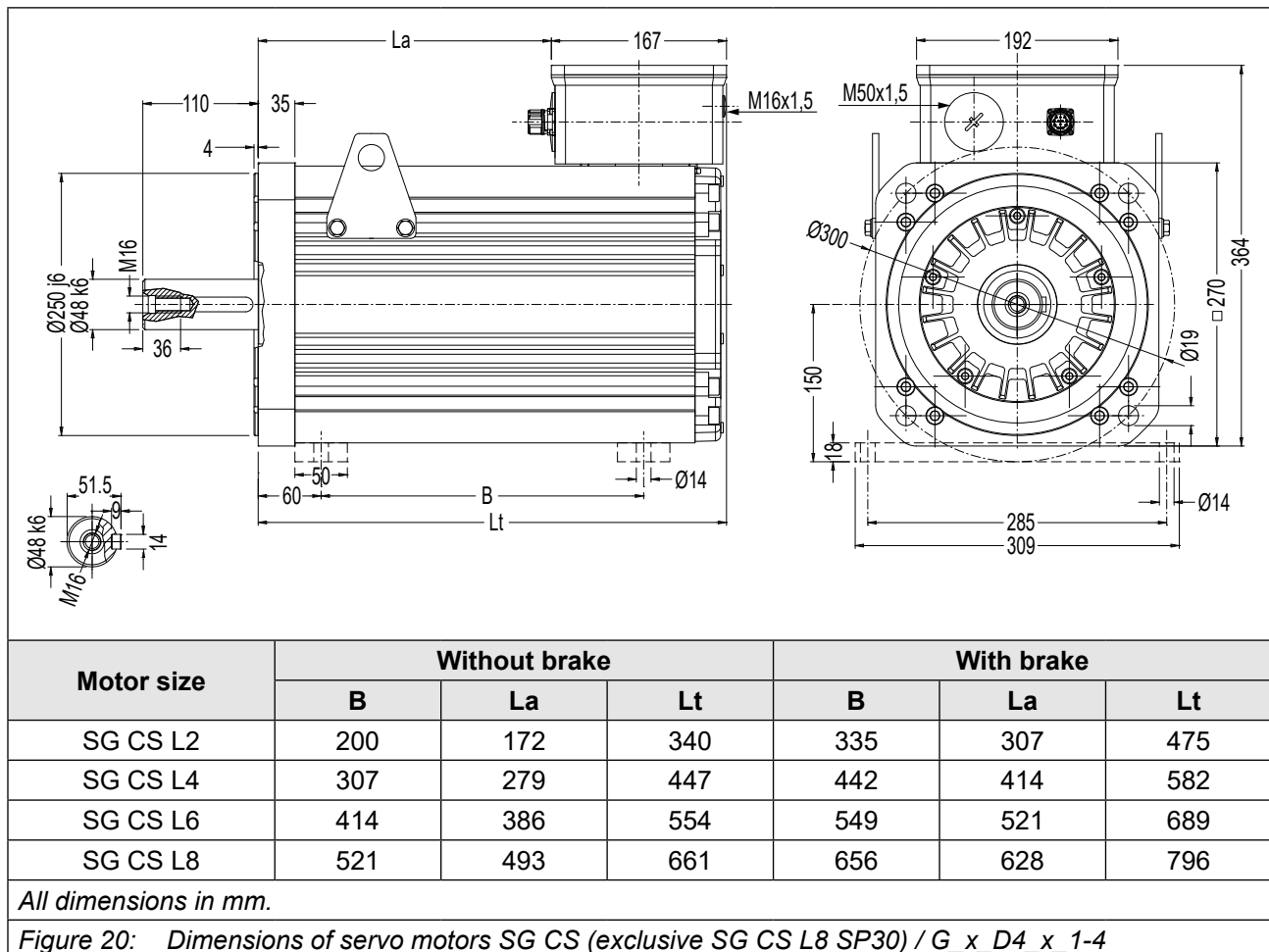
5.7.1 Technical data of the holding brake SG CS / G_x_D4_x_1-4

Motor size		SG CS			
Length		L2	L4	L6	L8
Holding torque at 100 °C	M_{Br} / Nm	350		700	
Rated voltage	U_{Br_dc} / V	24 ±5 %			
Holding voltage	U_{HS_dc} / V	12			
Power input at 24V	P_{Br} / W	75			
Brake closing time	t_1 / ms	≤100		≤140	
Brake release time	t_2 / ms	300		400	
Additional rotor inertia	¹⁾ J_{Br} / kgcm ²	93,12		186,24	
Additional weight	¹⁾ m / kg	33		39	
Type of brake		Spring brake			

Table 38: *Technical data of the holding brake SG CS / G_x_D4_x_1-4*

¹⁾ Additionally for the holding brake.

5.7.2 Dimensions of servo motors SG CS (exclusive SG CS L8 SP30) / G_x_D4_x_1-4



Technical drawing of servo motor SG CS L8 SP30 showing side, front, and detail views with dimensions in mm.

Side View Dimensions:

- Overall length: L_a
- Motor body length: 219
- Mounting bracket width: 110
- Mounting bracket thickness: 35
- Mounting bracket hole diameter: $\phi 48$
- Mounting bracket hole offset: 36
- Mounting bracket hole diameter: $\phi 16$
- Mounting bracket hole offset: 4
- Mounting bracket hole diameter: $\phi 250$
- Mounting bracket hole offset: 51.5
- Mounting bracket hole diameter: $\phi 16$
- Mounting bracket hole offset: 14
- Mounting bracket hole diameter: $\phi 14$

Front View Dimensions:

- Overall width: 254
- Motor body width: 285
- Motor body height: 309
- Mounting bracket width: 150
- Mounting bracket height: 18
- Mounting bracket hole diameter: $\phi 300$
- Mounting bracket hole offset: $\phi 19$
- Mounting bracket hole diameter: $\phi 14$

Motor size	Without brake			With brake		
	B	La	Lt	B	La	Lt
SG CS L8 SP30	521	467	687	656	602	822

All dimensions in mm.

Figure 21: Dimensions of servo motors SG CS L8 SP30 / G_8_D4_x_1-4

5.8 Technical data servo motors SG CF / G_x_D4_x_A-D

The torque values refer to a motor flanged in horizontal position (steel flange dimensions 500 x 500 x 40 mm). Min. PWM 4 kHz, DC link voltage DC 560 V.

Motor size	SG-CF-SP10 / G_x_D4_1_A-D			
Length	L2	L4	L6	L8
Cooling	Separate cooling			
Rated speed n_N / rpm	1000			
Max. speed n_{max} / rpm	6000/4500 ¹⁾			
Rated voltage ⁵⁾ U_N / V	349	356	336	366
Stall torque ^{2) 5)} M_0 / Nm	145	310	440	580
Current at stall torque ^{2) 5)} I_0 / A	31,3	62,8	95	117,4
Rated power ⁵⁾ P_N / kW	15	30,4	41,4	55,5
Rated current ⁵⁾ I_N / A	33,2	63,1	91,7	115,4
Rated torque ⁵⁾ M_N / Nm	143	290	395	530
Torque constant (0rpm) ³⁾ k_M / Nm/A	4,91	5,24	4,91	5,24
Max. torque (ΔT 105 °C) M_{max} / Nm	267	544	737	965
Max. current I_{max} / A	69,5	133	192	235
Inertia ⁴⁾ J_L / kgcm ²	224	401	577	753
Voltage constant (20°C) ³⁾ k_e / V _{pk} /1000rpm	297	317	297	317
Winding resistance ³⁾ R_{u-v} / Ω	0,63	0,25	0,15	0,11
Winding inductance ³⁾ L_{u-v} / mH	13,2	6,5	4,4	4,3
Weight ⁴⁾ m / kg	89	126	164	203
Number of pole pairs p	4			
Rated motor frequency f / Hz	66,66			

Table 39: Technical data servo motors SG-CF-SP10 / G_x_D4_1_A-D

- ¹⁾ Only for motors with brake.
²⁾ Referring to 100rpm.
³⁾ At 20 °C and tolerance $\pm 10\%$.
⁴⁾ With encoder connection, without holding brake.
⁵⁾ Continuous operation S1 (at $\Delta T = 105$ K).

Motor size		SG-CF-SP20 / G_x_D4_2_A-D			
Length		L2	L4	L6	L8
Cooling		Separate cooling			
Rated speed	n_N / rpm	2000			
Max. speed $_{Mech}$	n_{max} / rpm	6000/4500 ¹⁾			
Rated voltage	⁵⁾ U_N / V	360	356	387	348
Stall torque	^{2) 5)} M_0 / Nm	145	310	440	580
Current at stall torque	^{2) 5)} I_0 / A	58,7	127,3	158,3	239,3
Rated power	⁵⁾ P_N / kW	26,2	54,5	73,3	98,4
Rated current	⁵⁾ I_N / A	54,4	110,2	135,5	204,7
Rated torque	⁵⁾ M_N / Nm	125	260	350	470
Torque constant (0rpm)	³⁾ k_M / Nm/A	2,62	2,62	2,95	2,62
Max. torque (ΔT 105 °C)	M_{max} / Nm	267	559	737	833
Max. current	I_{max} / A	130	265	319	406
Inertia	⁴⁾ J_L / kgcm ²	224	401	577	753
Voltage constant (20°C)	³⁾ k_e / V _{pk} /1000rpm	158	158	178	158
Winding resistance	³⁾ R_{u-v} / Ω	0,18	0,07	0,04	0,02
Winding inductance	³⁾ L_{u-v} / mH	4,4	2,1	1,7	1,1
Weight	⁴⁾ m / kg	89	126	164	203
Number of pole pairs	p	4			
Rated motor frequency	f / Hz	133,33			
Table 40: Technical data servo motors SG-CF-SP20 / G_x_D4_2_A-D					

¹⁾ Only for motors with brake.

²⁾ Referring to 100rpm.

³⁾ At 20 °C and tolerance $\pm 10\%$.

⁴⁾ With encoder connection, without holding brake.

⁵⁾ Continuous operation S1 (at $\Delta T = 105$ K).

Motor size	SG-CF-SP30 / G_x_D4_3_A-D			
Length	L2	L4	L6	L8
Cooling	Separate cooling			
Rated speed ⁶⁾ <i>n_N</i> / rpm	2800			
Max. speed <i>Mech</i> <i>n_{max}</i> / rpm	6000/4500 ¹⁾			
Rated voltage ⁵⁾ <i>U_N</i> / V	367	363	353	341
Stall torque ^{2) 5)} <i>M₀</i> / Nm	145	300	440	580
Current at stall torque ^{2) 5)} <i>I₀</i> / A	78,3	161,9	237,5	313,1
Rated power ⁵⁾ <i>P_N</i> / kW	34,3	67,4	88	93,8
Rated current ⁵⁾ <i>I_N</i> / A	67,9	133,5	174,2	185,8
Rated torque ⁵⁾ <i>M_N</i> / Nm	117	230	300	320
Torque constant (0rpm) ³⁾ <i>k_M</i> / Nm/A	1,96	1,96	1,96	1,96
Max. torque (ΔT 105 °C) <i>M_{max}</i> / Nm	267	526	658	772
Max. current <i>I_{max}</i> / A	174	342	428	502
Inertia ⁴⁾ <i>J_L</i> / kgcm ²	224	401	577	753
Voltage constant (20 °C) ³⁾ <i>k_e</i> / V _{pk} /1000rpm	119	119	119	119
Winding resistance ³⁾ <i>R_{u-v}</i> / Ω	0,1	0,03	0,02	0,01
Winding inductance ³⁾ <i>L_{u-v}</i> / mH	2,4	1,2	0,8	0,6
Weight ⁴⁾ <i>m</i> / kg	89	126	164	203
Number of pole pairs <i>p</i>	4			
Rated motor frequency <i>f</i> / Hz	186,7			
Table 41: Technical data servo motors SG-CF-SP30 / G_x_D4_3_A-D				

¹⁾ Only for motors with brake.

²⁾ Referring to 100rpm.

³⁾ At 20 °C and tolerance $\pm 10\%$.

⁴⁾ With encoder connection, without holding brake.

⁵⁾ Continuous operation S1 (at $\Delta T = 105$ K).

8) Drive controllers connected to these motors must have a field weakening option in order to reach the rated speed. **Technical data of the holding brake SG CF / G x D4 x A-D**

Motor size		SG CF / G_x_D4_x_A-D			
Length		L2	L4	L6	L8
Holding torque at 100 °C	M_{Br} / Nm	350		700	
Rated voltage	U_{Br_dc} / V	24 ± 5 %			
Holding voltage	U_{HS_dc} / V	12			
Power input at 24V	P_{Br} / W	75			
Brake closing time	t_1 / ms	≤ 100		≤ 140	
Brake release time	t_2 / ms	300		400	
Additional rotor inertia	¹⁾ J_{Br} / kgcm ²	93,12		186,24	
Additional weight	¹⁾ m / kg	37		43	
Type of brake		Spring brake			

Table 42: *Technical data of the holding brake SG CF / G_x_D4_x_A-D*

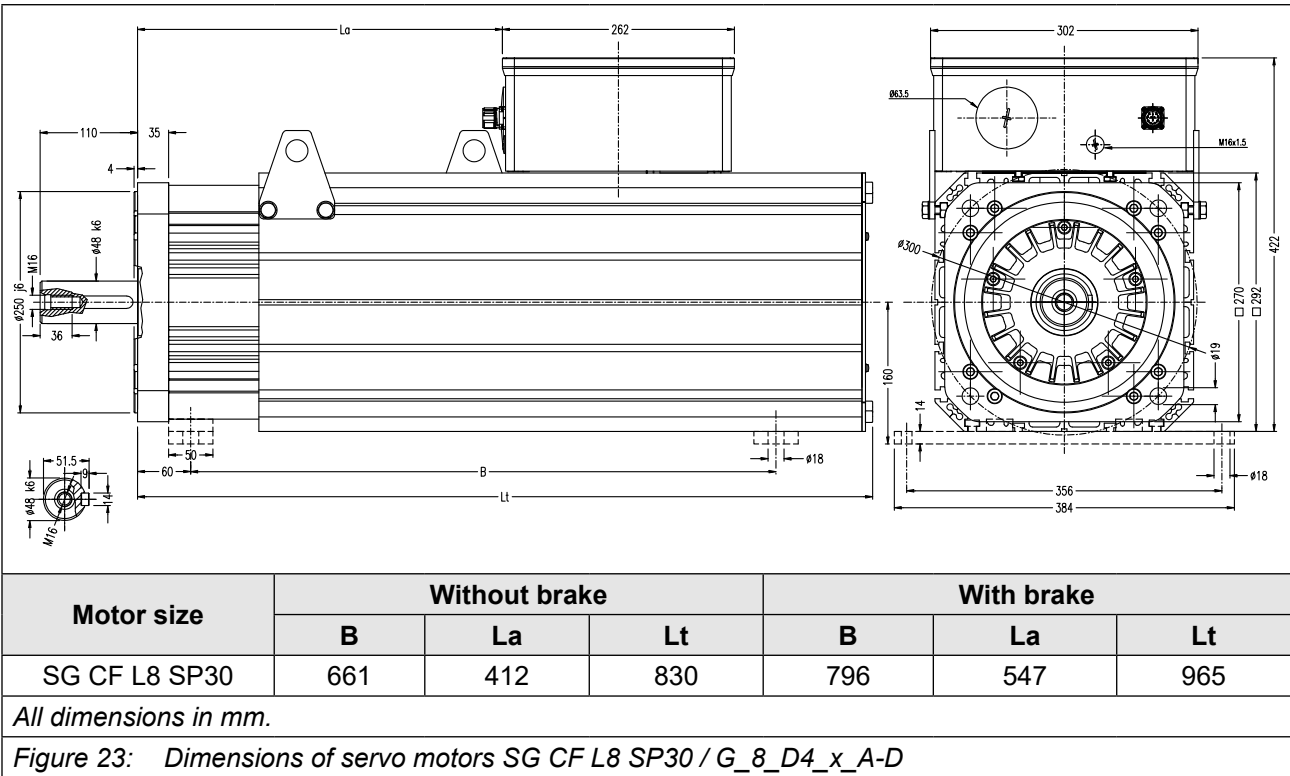
¹⁾ Additionally for the holding brake.

Motor size	Without brake			With brake		
	B	La	Lt	B	La	Lt
SG CF L2	300	146,5	470	435	281,5	605
SG CF L4	407	253,5	577	542	388,5	712
SG CF L6	514	360,5	684	649	495,5	819
SG CF L8	621	467,5	791	756	602,5	926

All dimensions in mm.

Figure 22: Dimensions of servo motors SG CF (exclusive SG CF L8 SP30) / G_x_D4_x_A-D

5.8.2 Dimensions of servo motors SG CF L8 SP30 / G_8_D4_x_A-D



5.9 Technical data servo motors SG CW / G_x_D4_x_V-Z

The torque values refer to a motor flanged in horizontal position (steel flange dimensions 500 x 500 x 40 mm). Min. PWM 4 kHz, DC link voltage DC 560 V.

Motor size	SG-CW-SP10 / G_x_D4_1_V-Z			
Length	L2	L4	L6	L8
Cooling	Liquid cooling			
Rated speed n_N / rpm	1000			
Max. speed n_{max} / rpm	6000			
Rated voltage ⁴⁾ U_N / V	361	330	358	347
Stall torque ^{1) 4)} M_0 / Nm	185	385	555	770
Current at stall torque ^{1) 4)} I_0 / A	47	97	126	188
Rated power ⁴⁾ P_N / kW	17,4	36,6	53,4	75,3
Rated current ⁴⁾ I_N / A	48	90	118	181
Rated torque ⁴⁾ M_N / Nm	167	350	510	720
Torque constant (0 rpm) ²⁾ k_M / Nm/A	4,14	4,15	4,46	4,18
Max. torque (ΔT 105 °C) M_{max} / Nm	290	590	810	1100
Max. current I_{max} / A	85	168	196	287
Inertia ³⁾ J_L / kgcm ²	224	401	577	753
Voltage constant (20 °C) ²⁾ k_e / V _{pk} /1000rpm	281	283	302	284
Winding resistance ²⁾ R_{u-v} / Ω	0,58	0,21	0,16	0,08
Winding inductance ²⁾ L_{u-v} / mH	12	5	4,4	3,1
Weight ³⁾ m / kg	83	115	147	180
Number of pole pairs p	4			
Rated motor frequency f / Hz	66,66			
Min. volume flow Q / l/min	6	8	10	12
Operating pressure p / bar	2,7	3,9	3,9	5,5

Table 43: Technical data servo motors SG-CW-SP10 / G_x_D4_1_V-Z

¹⁾ Referring to 100 rpm.

²⁾ At 20 °C and tolerance $\pm 10\%$.

³⁾ With encoder connection, without holding brake.

⁴⁾ Continuous operation S1 (at $\Delta T = 105$ K).

TECHNICAL DATA

Motor size		SG-CW-SP20 / G_x_D4_2_V-Z			
Length		L2	L4	L6	L8
Cooling		Liquid cooling			
Rated speed n_N / rpm		1800			
Max. speed n_{max} / rpm		6000			
Rated voltage	⁴⁾ U_N / V	365	351	376	350
Stall torque	^{1) 4)} M_0 / Nm	185	385	555	770
Current at stall torque	^{1) 4)} I_0 / A	82	170	209	314
Rated power	⁴⁾ P_N / kW	29,5	62,2	90,4	129,1
Rated current	⁴⁾ I_N / A	79	149	185	301
Rated torque	⁴⁾ M_N / Nm	157	330	480	685
Torque constant (0 rpm)	²⁾ k_M / Nm/A	2,37	2,37	2,68	2,39
Max. torque (ΔT 105 °C)	M_{max} / Nm	290	590	810	1100
Max. current	I_{max} / A	149	288	327	501
Inertia	³⁾ J_L / kgcm ²	224	401	577	753
Voltage constant (20 °C)	²⁾ k_e / V _{pk} /1000rpm	160	162	181	162
Winding resistance	²⁾ R_{u-v} / Ω	0,19	0,07	0,05	0,02
Winding inductance	²⁾ L_{u-v} / mH	4,4	2,1	1,7	1,06
Weight	³⁾ m / kg	83	115	147	180
Number of pole pairs	p	4			
Rated motor frequency	f / Hz	133,33			
Min. volume flow	Q / l/min	6	8	10	12
Operating pressure	p / bar	2,7	3,9	3,9	5,5

Table 44: Technical data servo motors SG-CW-SP20 / G_x_D4_2_V-Z

¹⁾ Referring to 100 rpm.

²⁾ At 20 °C and tolerance $\pm 10\%$.

³⁾ With encoder connection, without holding brake.

⁴⁾ Continuous operation S1 (at $\Delta T = 105$ K).

Motor size		SG-CW-SP30 / G_x_D4_3_V-Z			
Length		L2	L4	L6	L8
Cooling		Liquid cooling			—
Rated speed	n_N / rpm	2600			—
Max. speed <i>Mech</i>	n_{max} / rpm	6000			—
Rated voltage	⁴⁾ U_N / V	342	366	356	—
Stall torque	^{1) 4)} M_0 / Nm	185	385	555	—
Current at stall torque	^{1) 4)} I_0 / A	132	227	314	—
Rated power	⁴⁾ P_N / kW	39,4	84,4	121,1	—
Rated current	⁴⁾ I_N / A	116	187	257	—
Rated torque	⁴⁾ M_N / Nm	145	310	445	—
Torque constant (0 rpm)	²⁾ k_M / Nm/A	1,48	1,78	1,78	—
Max. torque (ΔT 105 °C)	M_{max} / Nm	290	590	810	—
Max. current	I_{max} / A	227	355	505	—
Inertia	³⁾ J_L / kgcm ²	224	401	577	—
Voltage constant (20°C)	²⁾ k_e / V _{pk} /1000rpm	100	121	121	—
Winding resistance	²⁾ R_{u-v} / Ω	0,07	0,03	0,02	—
Winding inductance	²⁾ L_{u-v} / mH	2,1	1,2	0,8	—
Weight	³⁾ m / kg	83	115	147	—
Number of pole pairs	p	4			—
Rated motor frequency	f / Hz	186,7			—
Min. volume flow	Q / l/min	6	8	10	—
Operating pressure	p / bar	2,7	3,9	3,9	—

Table 45: Technical data servo motors SG-CW-SP30 / G_x_D4_3_V-Z

¹⁾ Referring to 100rpm.²⁾ At 20 °C and tolerance $\pm 10\%$.³⁾ With encoder connection, without holding brake.⁴⁾ Continuous operation S1 (at $\Delta T = 105$ K).

5.9.1 Technical data for liquid cooling

The type of coolant is of decisive importance for the service life of the engine. A heavily contaminated liquid can impair the function of the entire system. To keep the cooling channels clean, we recommend using a filter at the inlet of the circuit.

Clear water with the addition of anti-rust, anti-corrosion and anti-algae agents must be used.

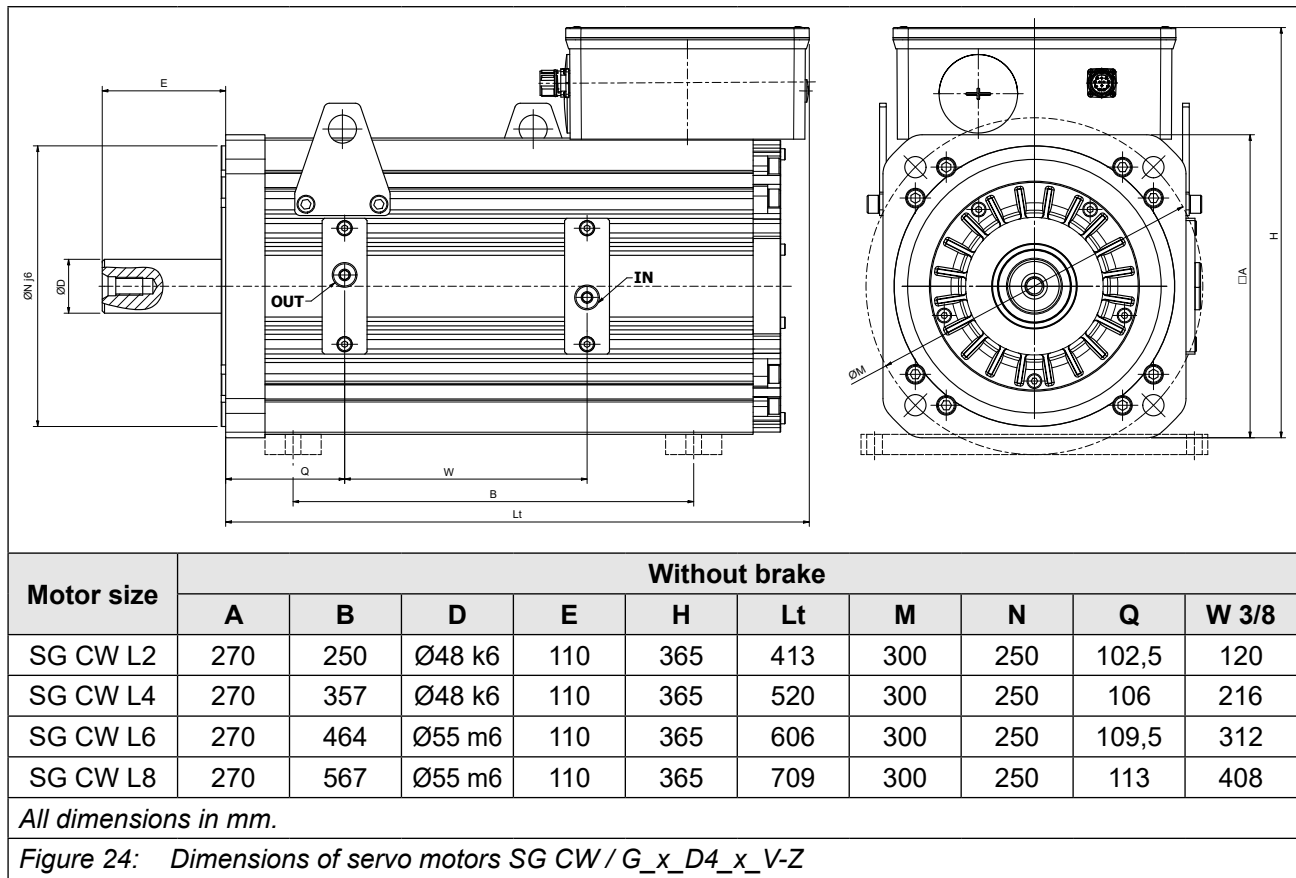
When installing the motor in environments where the temperature may fall below 5 °C, an antifreeze agent must be added to prevent the coolant from freezing and damaging the circuit.

The coolant must have the following properties:

Motor size		SG CW / G_x_D4_x_V-Z
Max. operating pressure	p / bar	8
Coolant temperature	t / °C	10...25
PH value (20 °C)	pH	6,5...9
Water hardness	mmol/l	1,43...2,5
Chloridium (Cl)	mg/l	<200
Sulfat (SO ₄ ²⁻)	mg/l	<200
Oil	mg/l	<1
Permissible particle size for foreign bodies ¹⁾	mm	<0.1
Table 46: Technical data for liquid cooling		

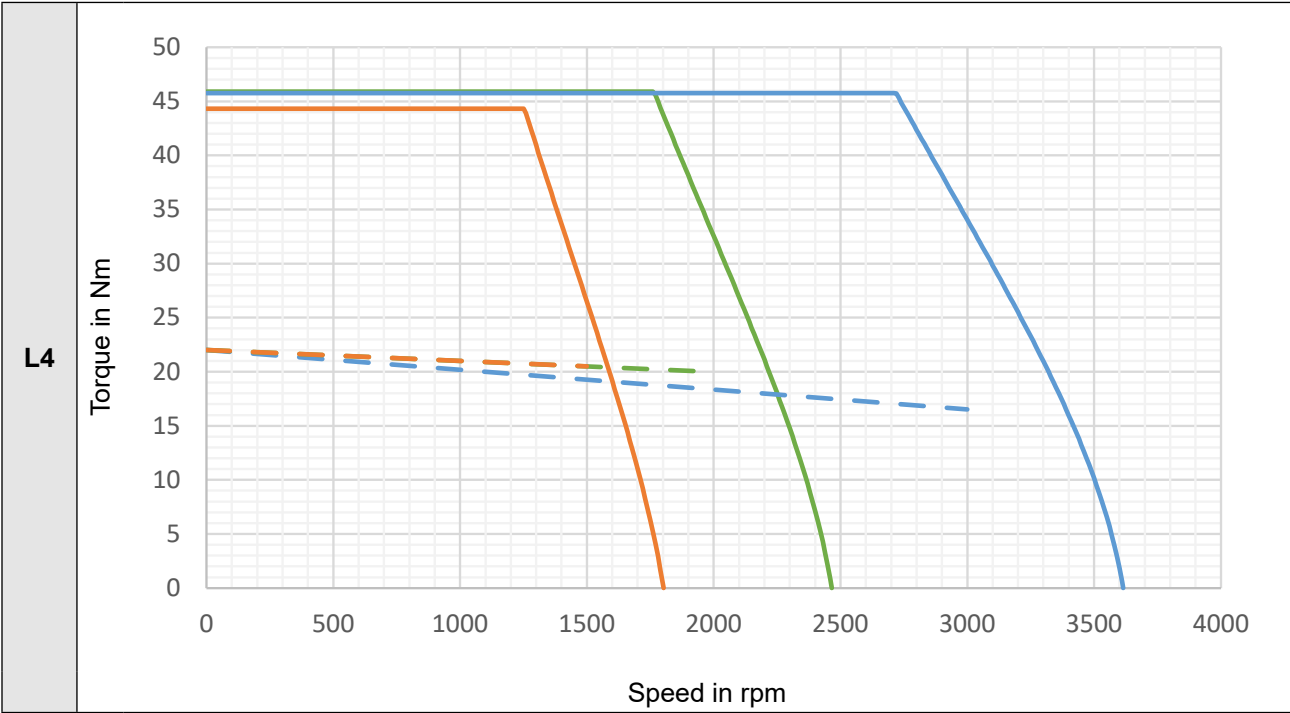
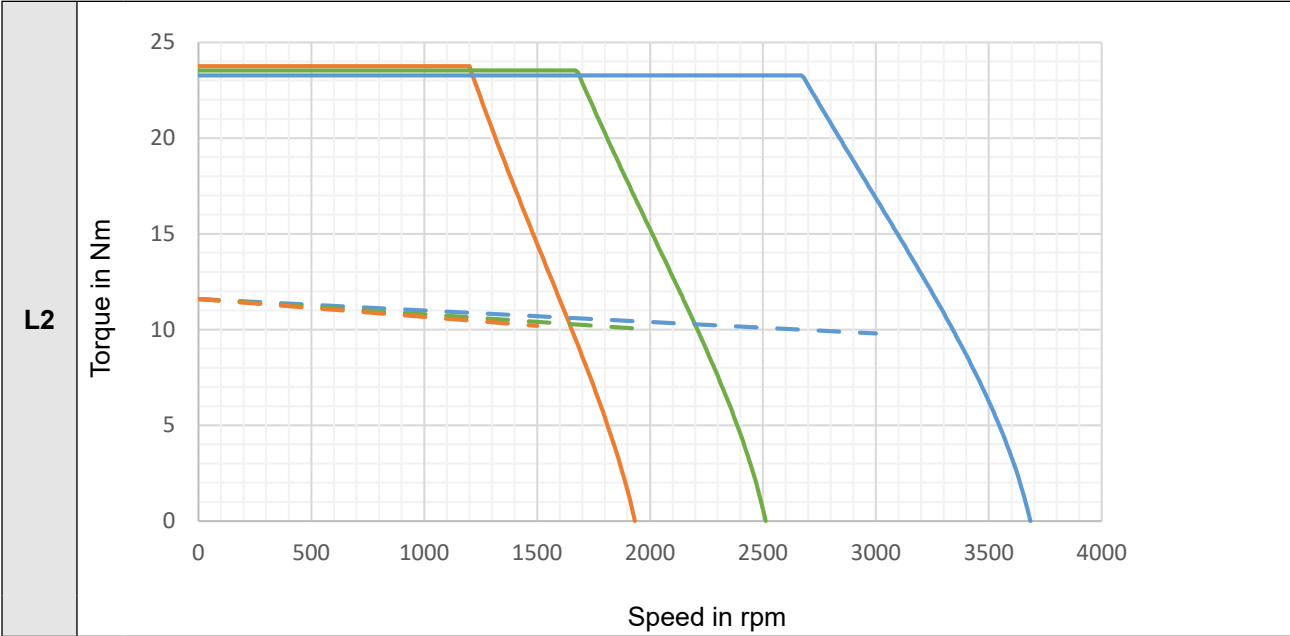
¹⁾ Value that must be taken into account when selecting the filter to be applied to the circuit.

5.9.2 Dimensions of servo motors SG CW / G_x_D4_x_V-Z



5.10 Performance diagrams

5.10.1 Speed-torque characteristics for motor size SE CS / E_x_D4_x_1-4



Legend		Voltage	Current
	SP10/SP15 motors	360 V	I_{max}
	SP20 motors		
	SP30 motors		
	Max. torque	—	—
	Continuous torque in continuous operation S1 ($\Delta T = 105K$)		

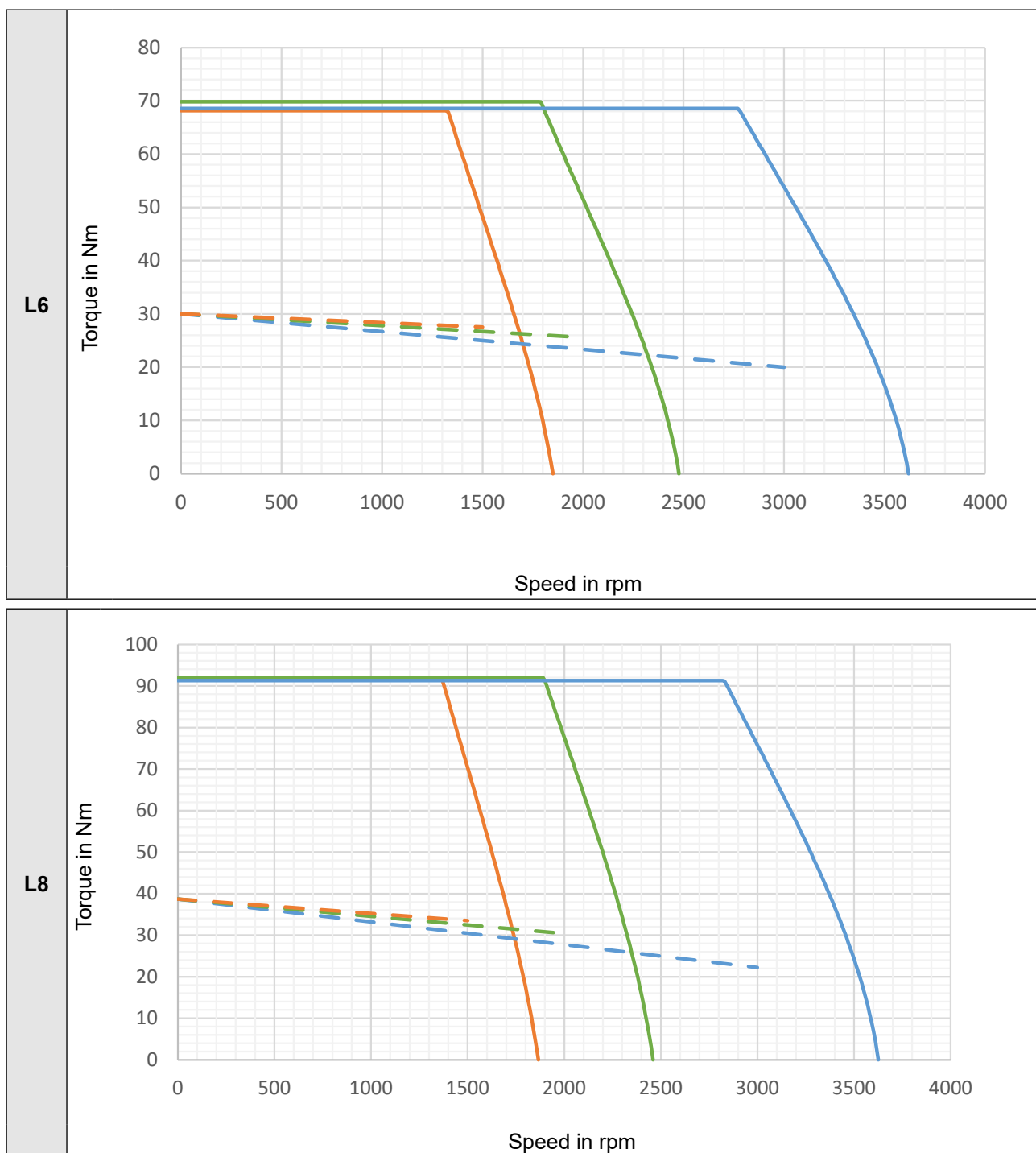
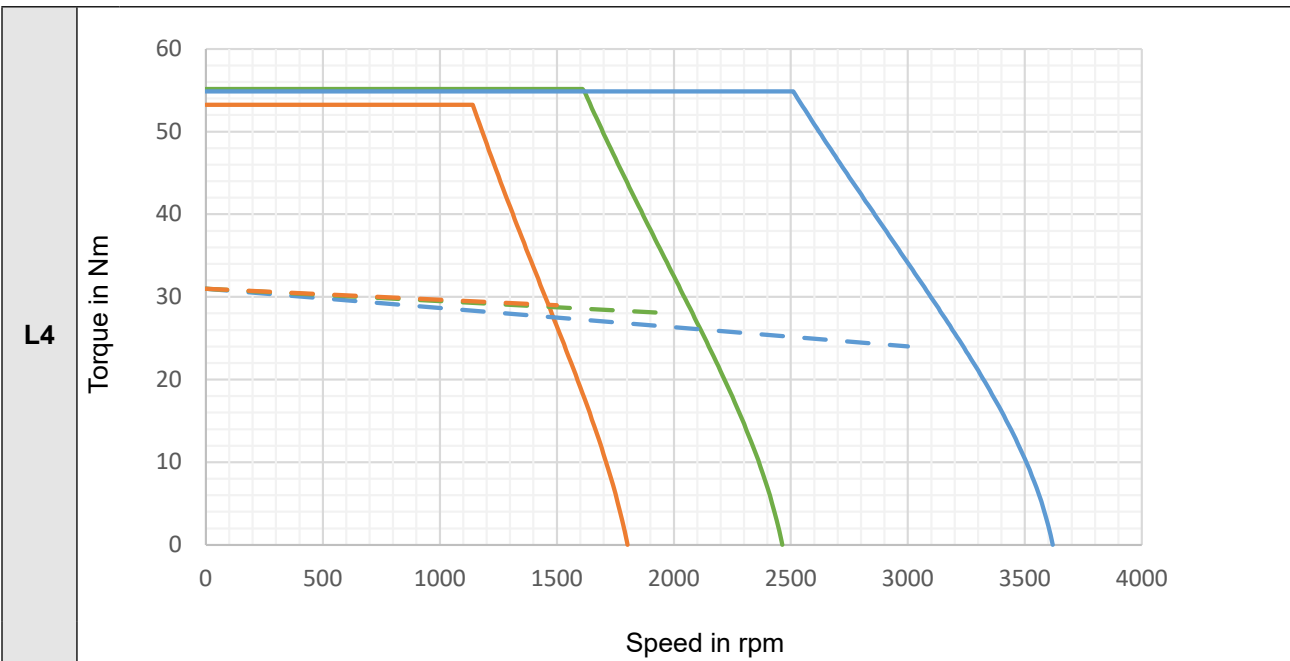
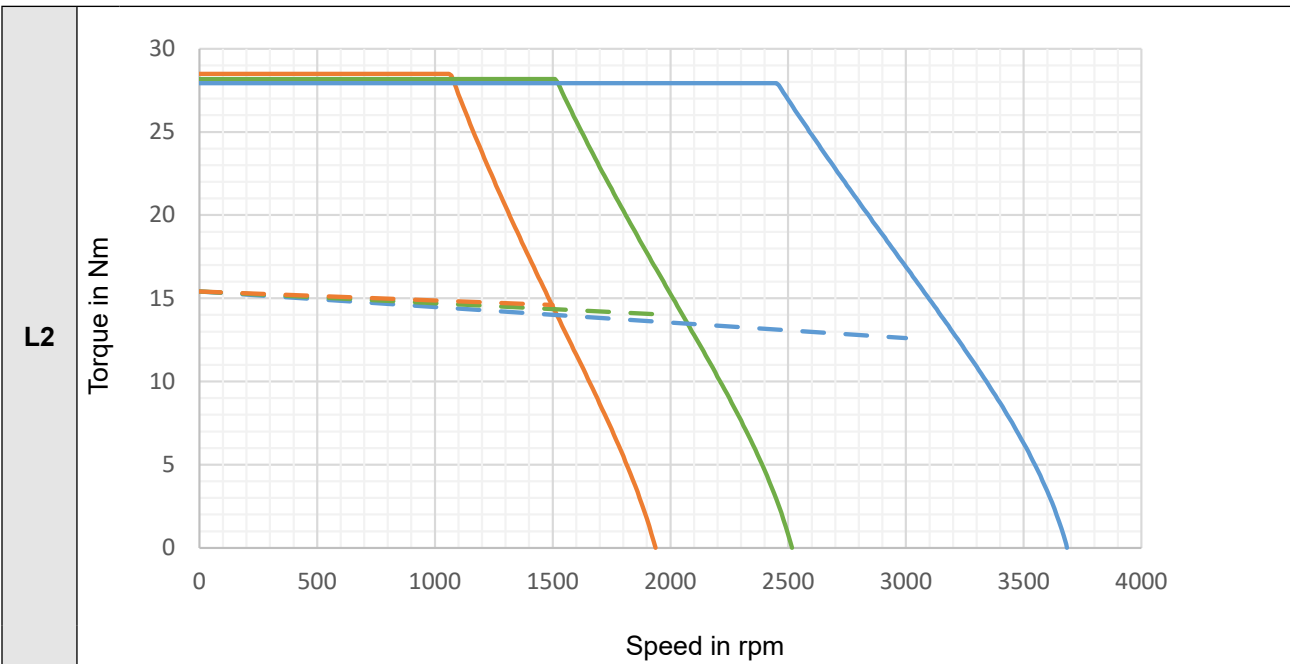


Figure 25: Speed-torque characteristics for motor size SE CS / E_x_D4_x_1-4

Legend		Voltage	Current
—	SP10/SP15 motors	360 V	I_{max}
—	SP20 motors		
—	SP30 motors		
—	Max. torque	—	—
- - - - -	Continuous torque in continuous operation S1 ($\Delta T = 105 K$)		

5.10.2 Speed-torque characteristics for motor size SE CF / E_x_D4_x_A-D



Legend		Voltage	Current
	SP10/SP15 motors	360 V	I_{max}
	SP20 motors		
	SP30 motors		
	Max. torque	—	—
	Continuous torque in continuous operation S1 ($\Delta T = 105K$)		

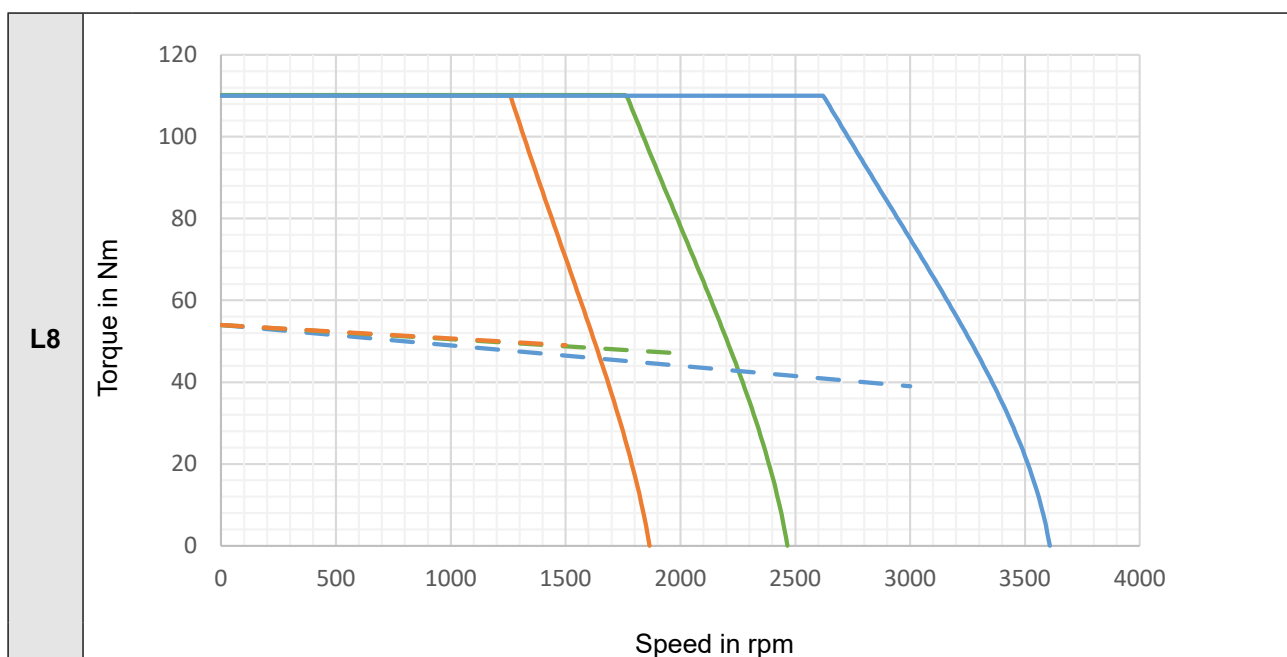
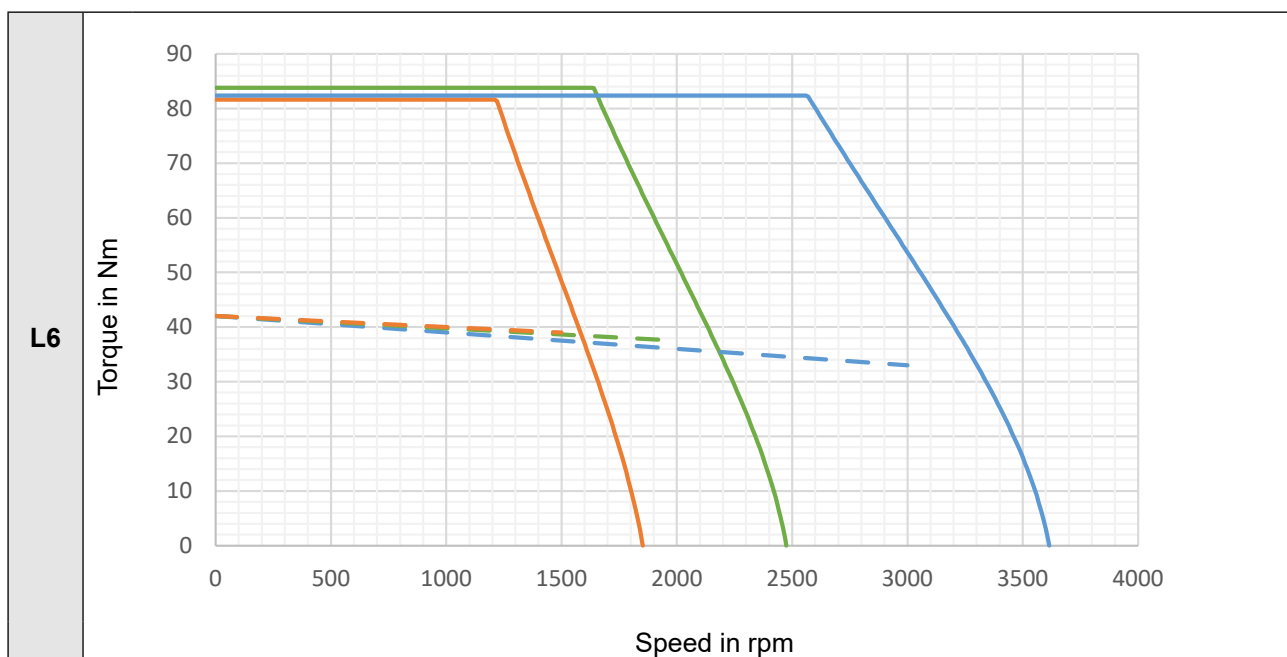
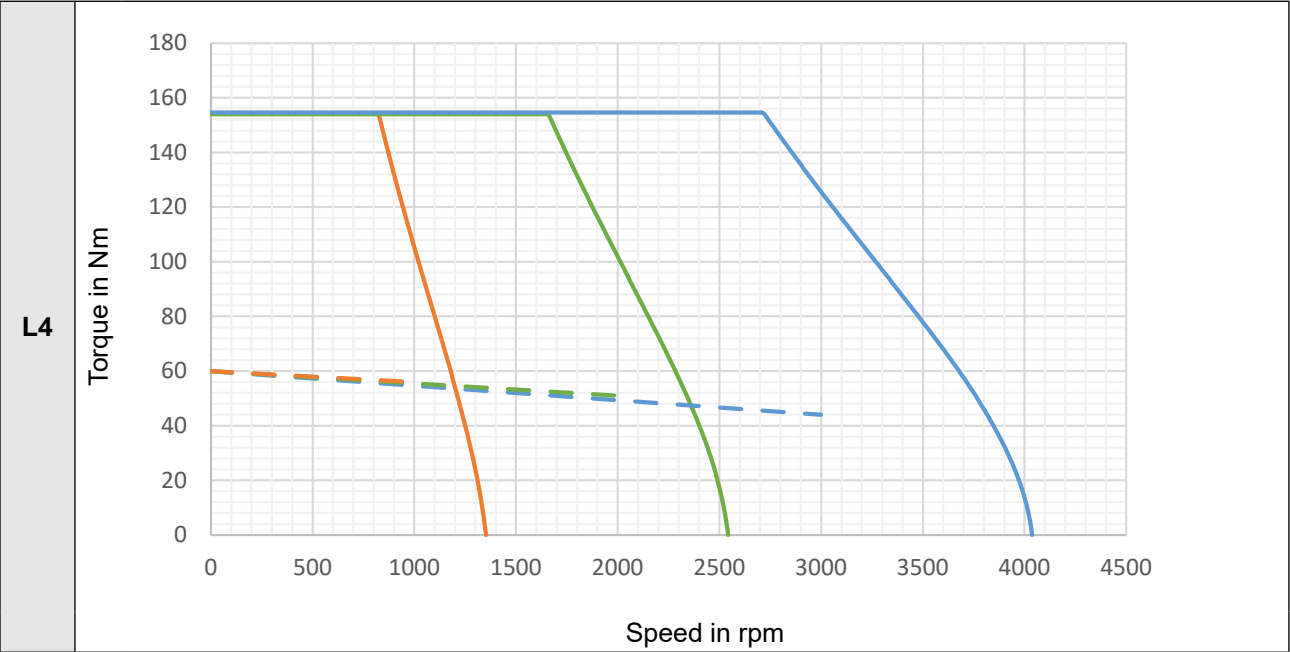
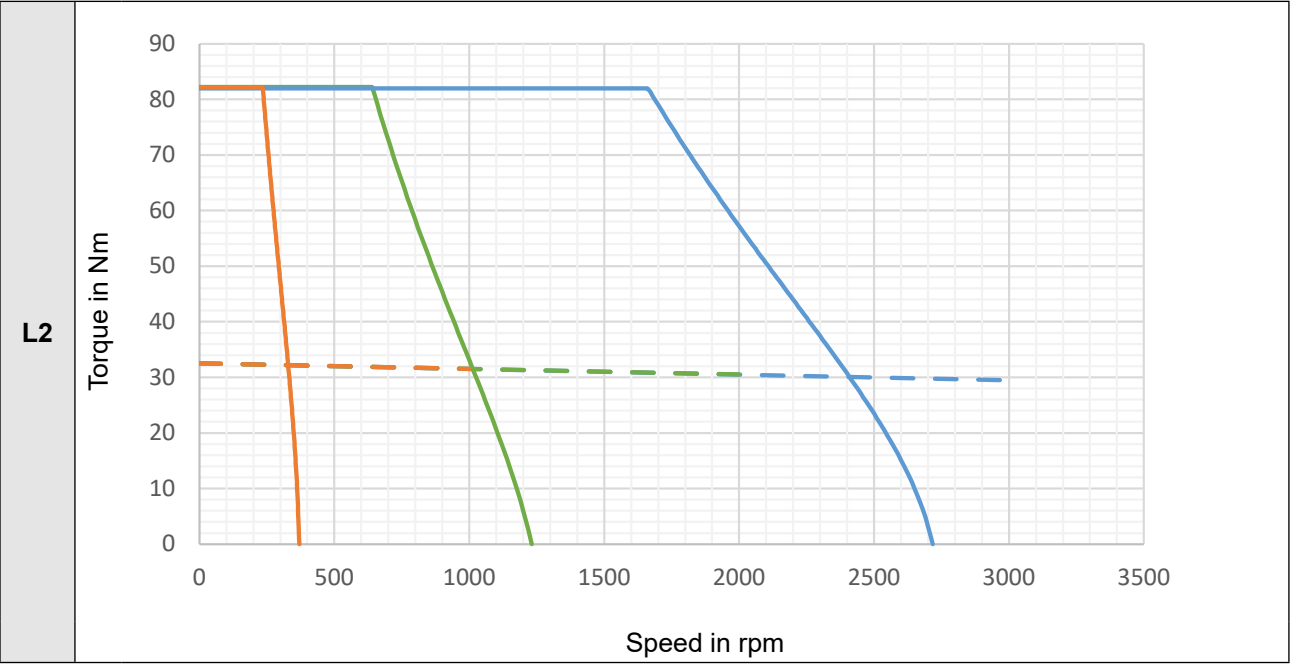


Figure 26: Speed-torque characteristics for motor size SE CF / E_x_D4_x_A-D

Legend		Voltage	Current
	SP10/SP15 motors	360V	I_{max}
	SP20 motors		
	SP30 motors		
	Max. torque	—	—
	Continuous torque in continuous operation S1 ($\Delta T = 105K$)		

5.10.3 Speed-torque characteristics for motor size SF CS / F_x_D4_x_1-4



Legend		Voltage	Current
	SP10/SP15 motors	360 V	I_{max}
	SP20 motors		
	SP30 motors		
	Max. torque	—	—
	Continuous torque in continuous operation S1 ($\Delta T = 105K$)		

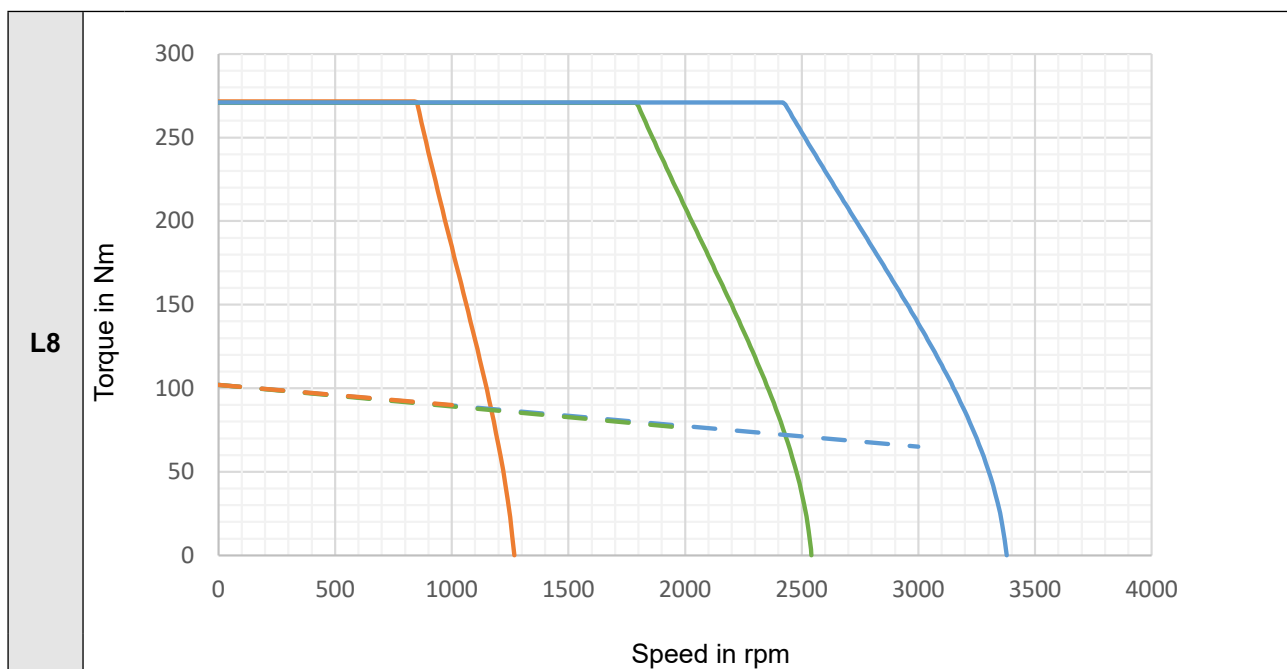
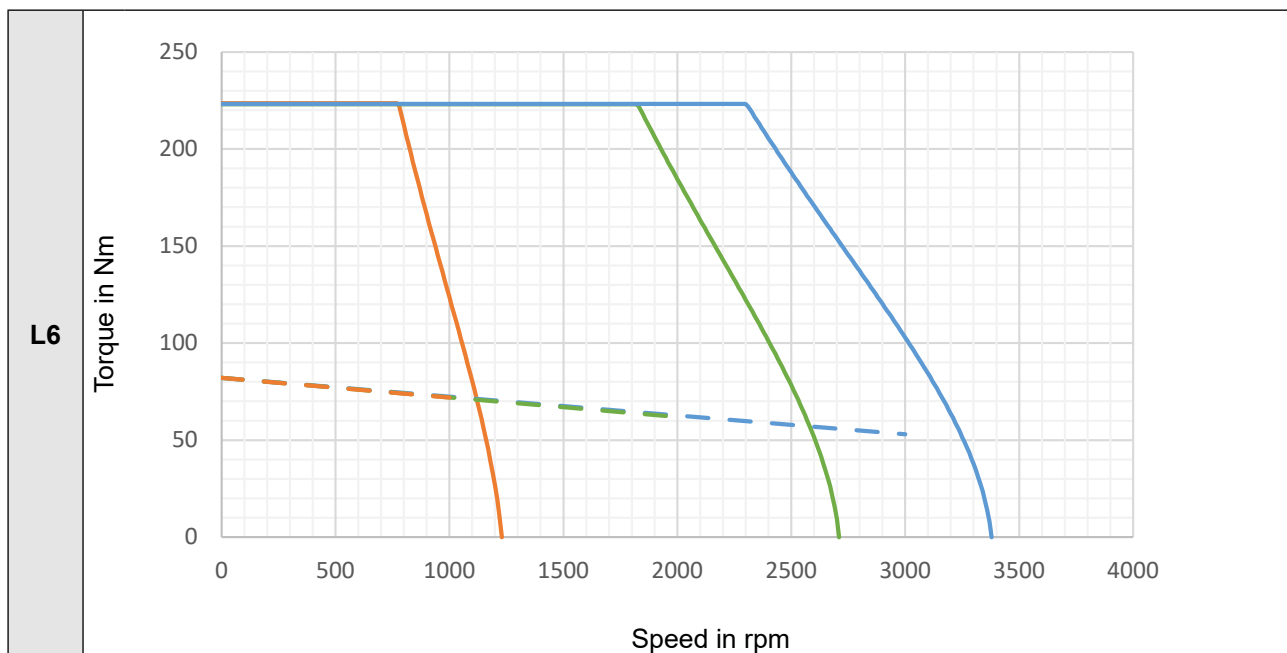
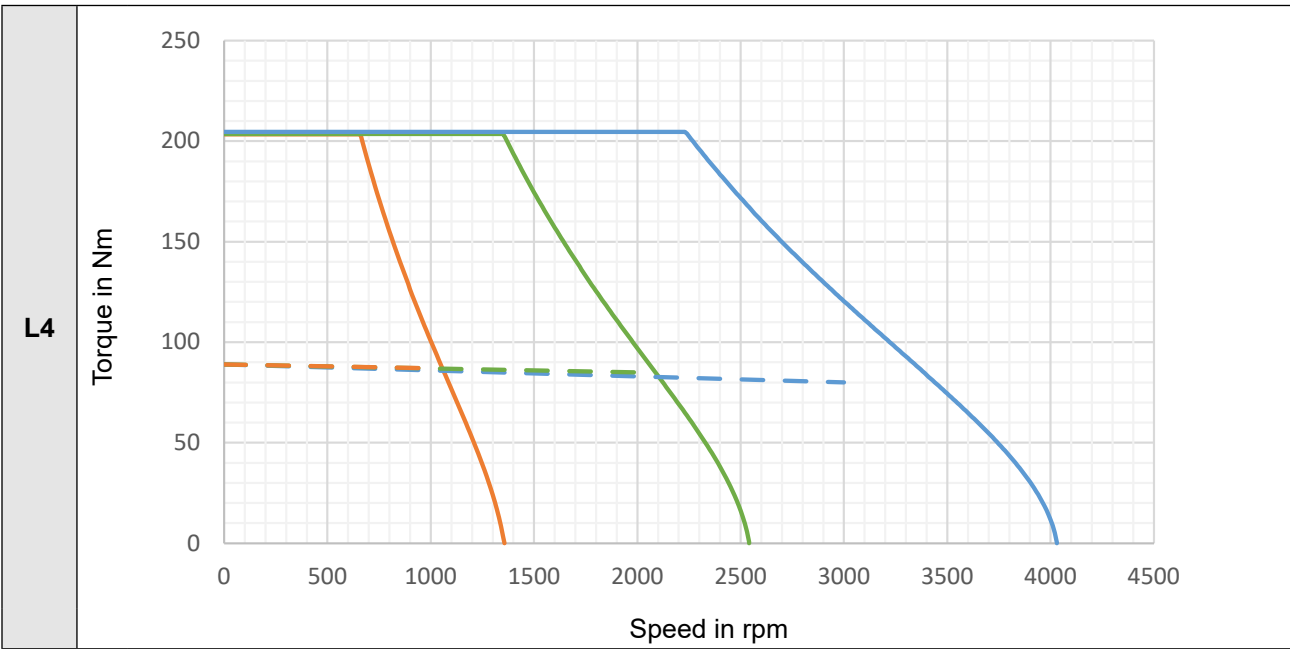
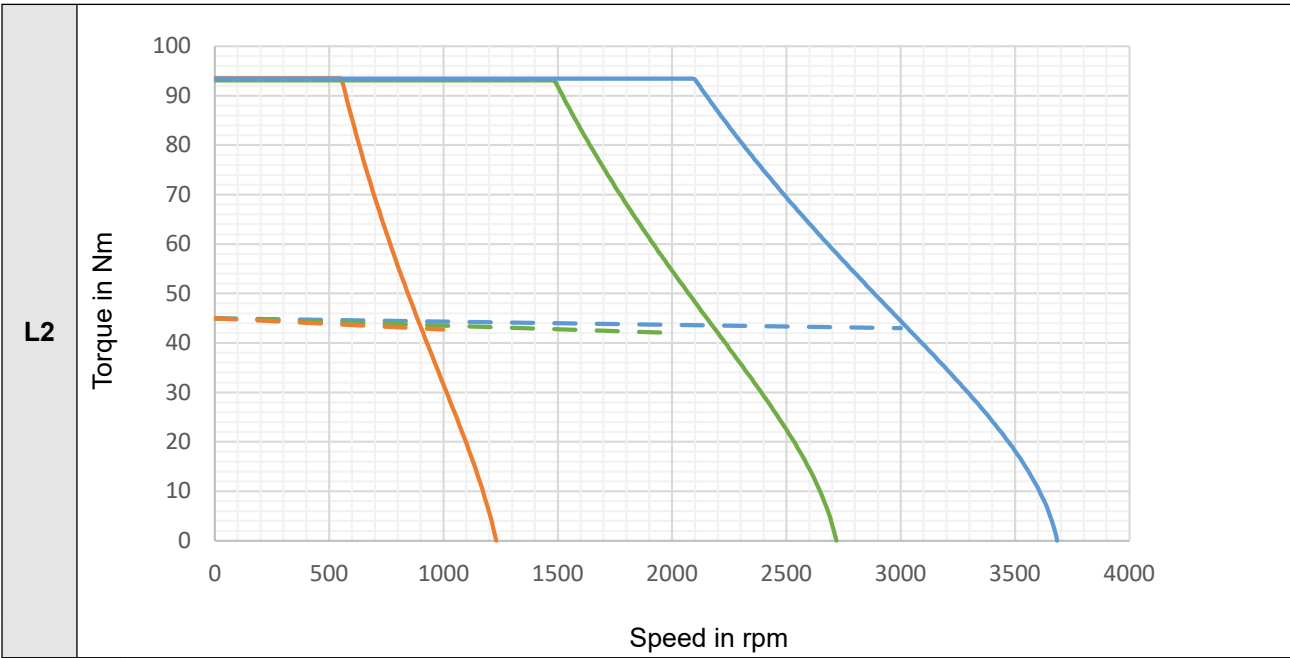


Figure 27: Speed-torque characteristics for motor size SF CS / F_x_D4_x_1-4

Legend		Voltage	Current
	SP10/SP15 motors	360 V	I_{max}
	SP20 motors		
	SP30 motors		
	Max. torque	—	—
	Continuous torque in continuous operation S1 ($\Delta T = 105 K$)		

5.10.4 Speed-torque characteristics for motor size SF CF / F_x_D4_x_A-D



Legend		Voltage	Current
	SP10/SP15 motors	360 V	I_{max}
	SP20 motors		
	SP30 motors		
	Max. torque	—	—
	Continuous torque in continuous operation S1 ($\Delta T = 105K$)		

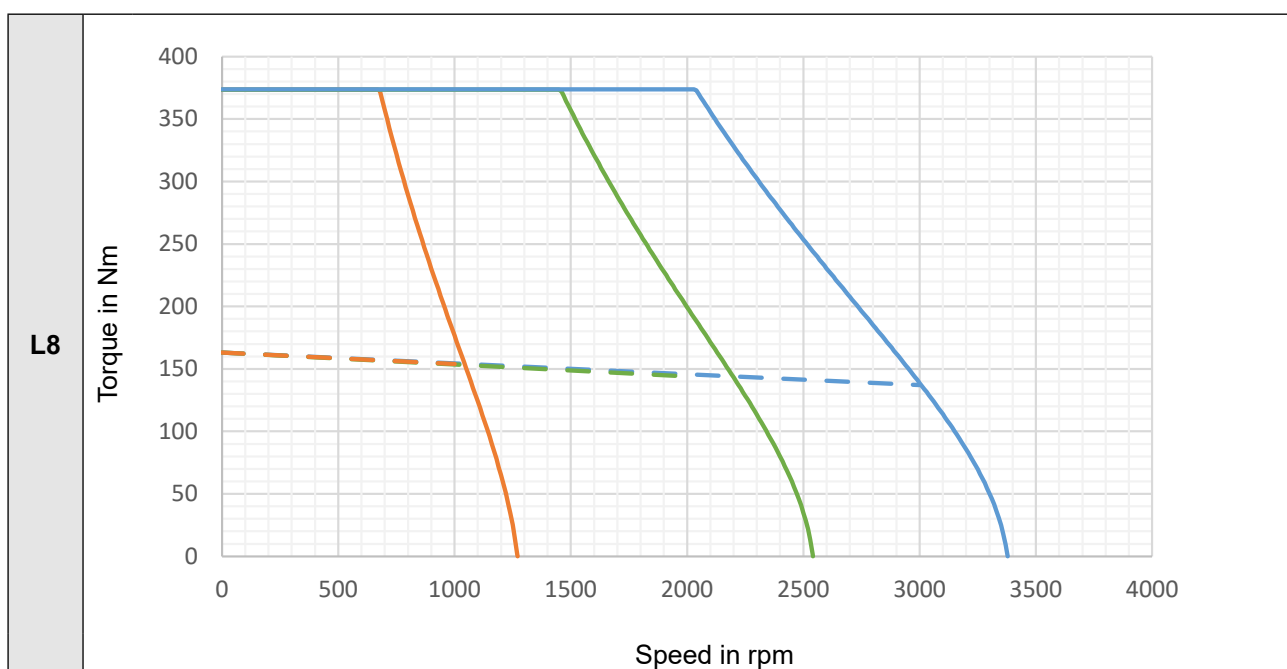
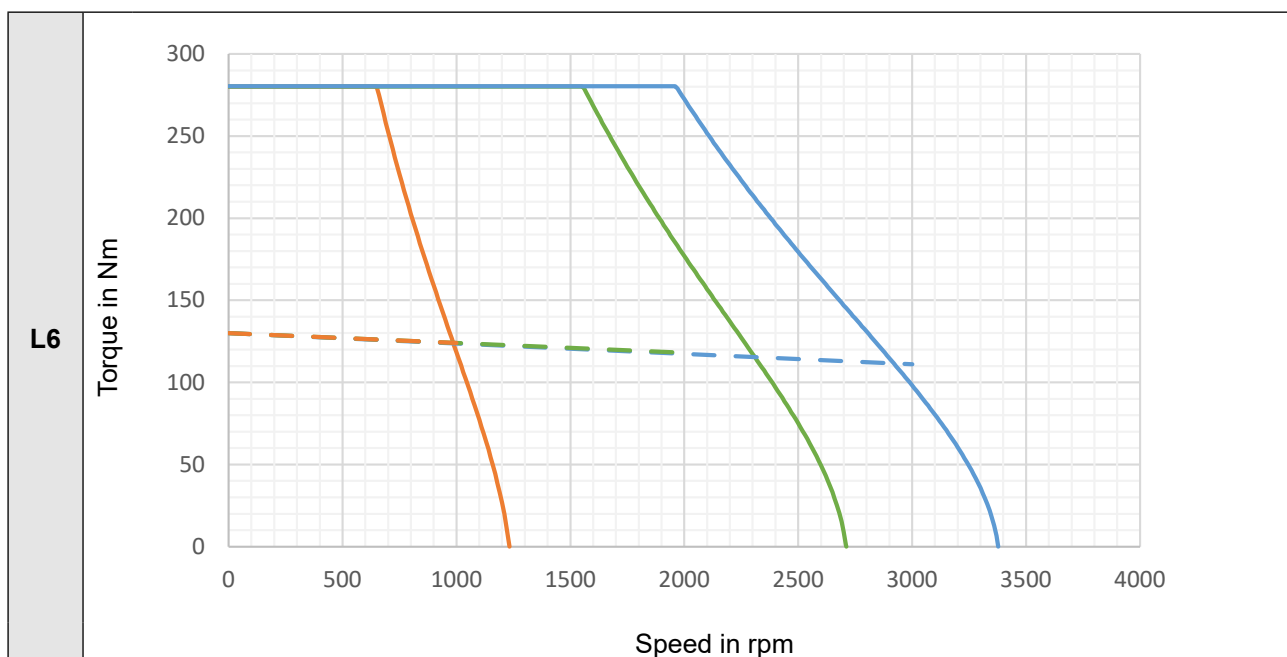
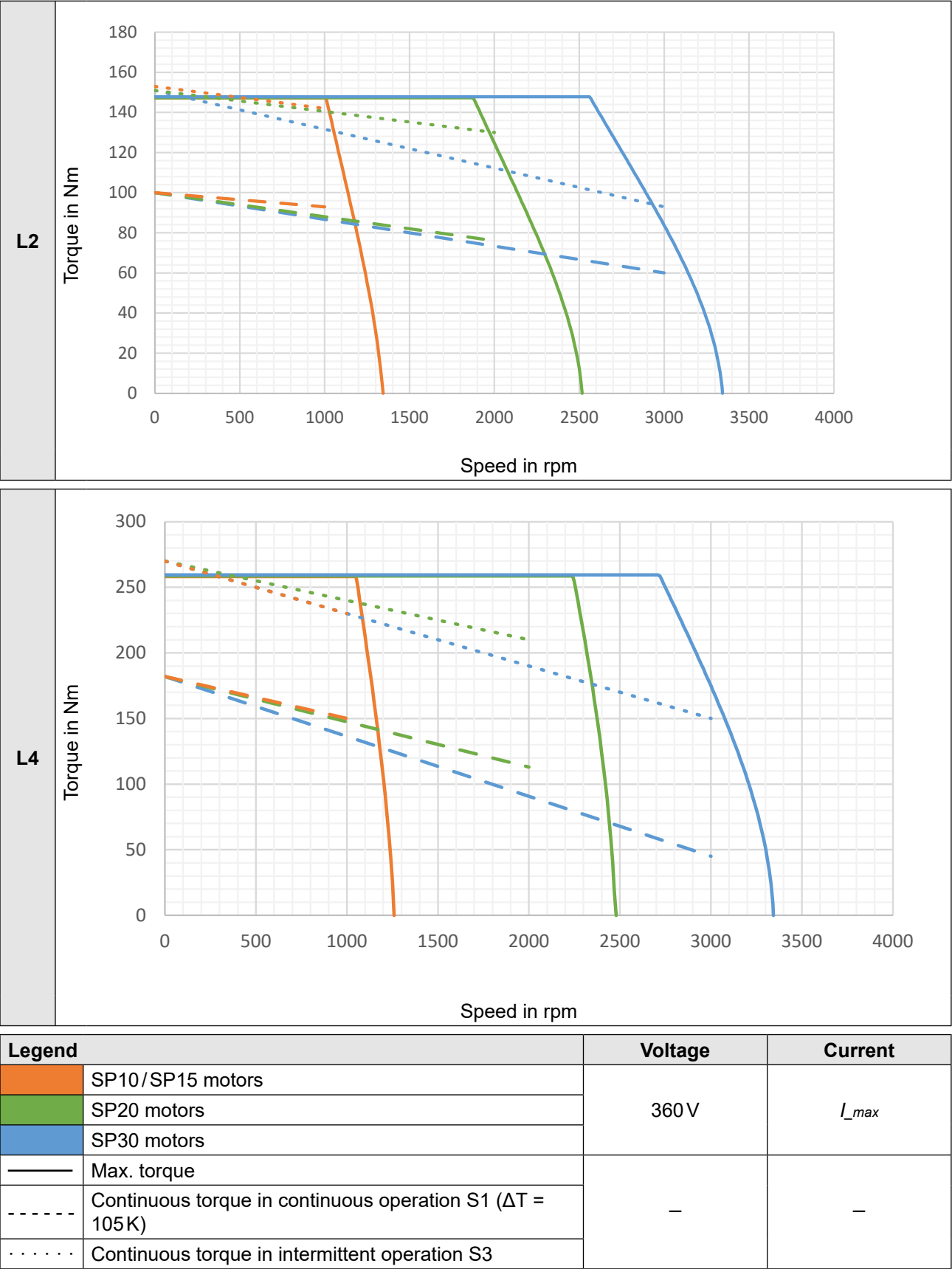


Figure 28: Speed-torque characteristics for motor size SF CF / F_x_D4_x_A-D

Legend		Voltage	Current
	SP10/SP15 motors	360 V	I_{max}
	SP20 motors		
	SP30 motors		
—	Max. torque	—	—
- - - -	Continuous torque in continuous operation S1 ($\Delta T = 105 K$)		

5.10.5 Speed-torque characteristics for motor size SG CS / G_x_D4_x_1-4



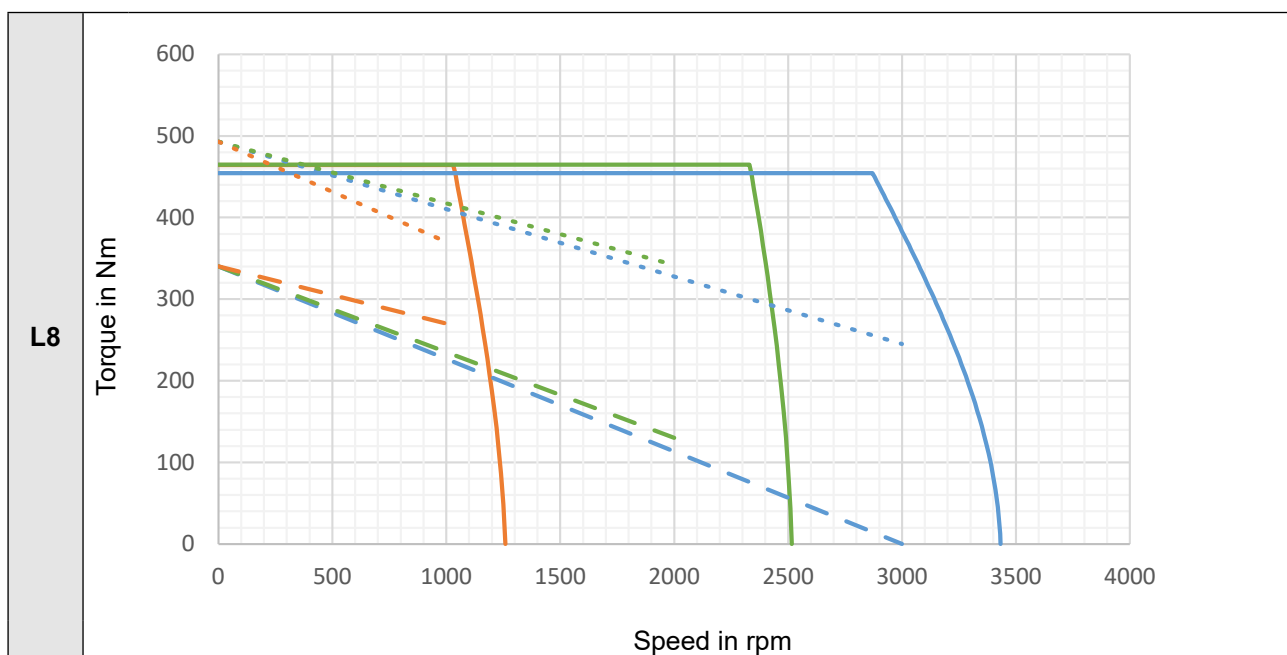
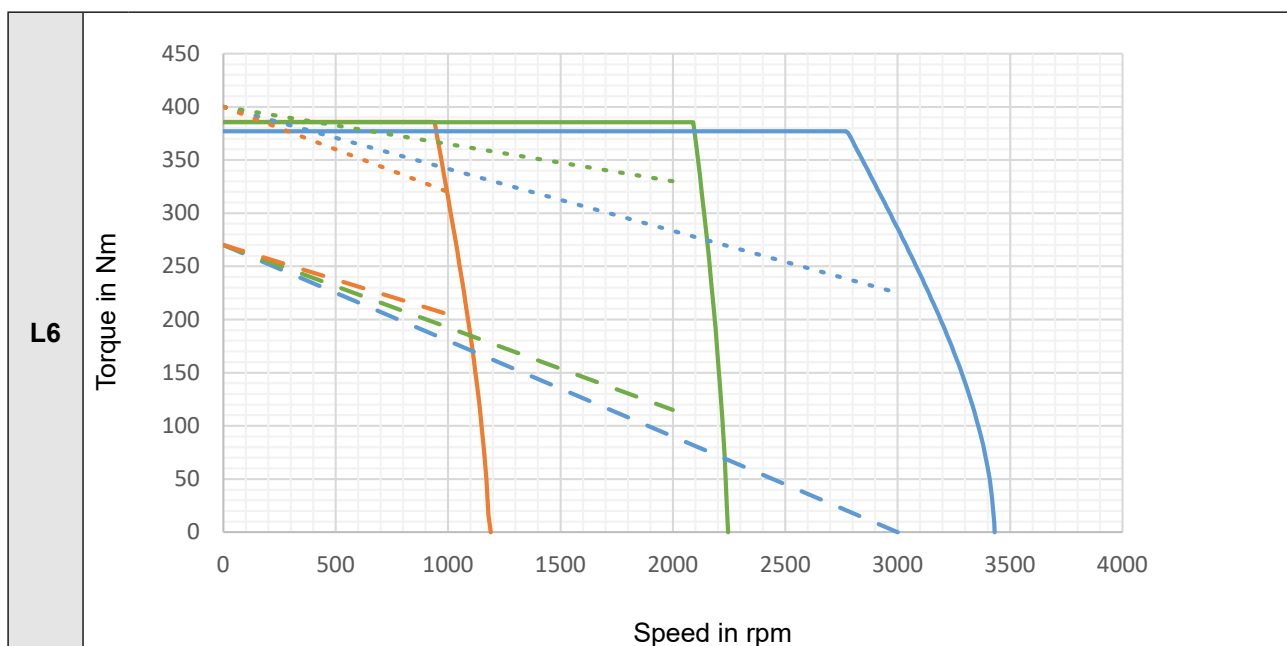
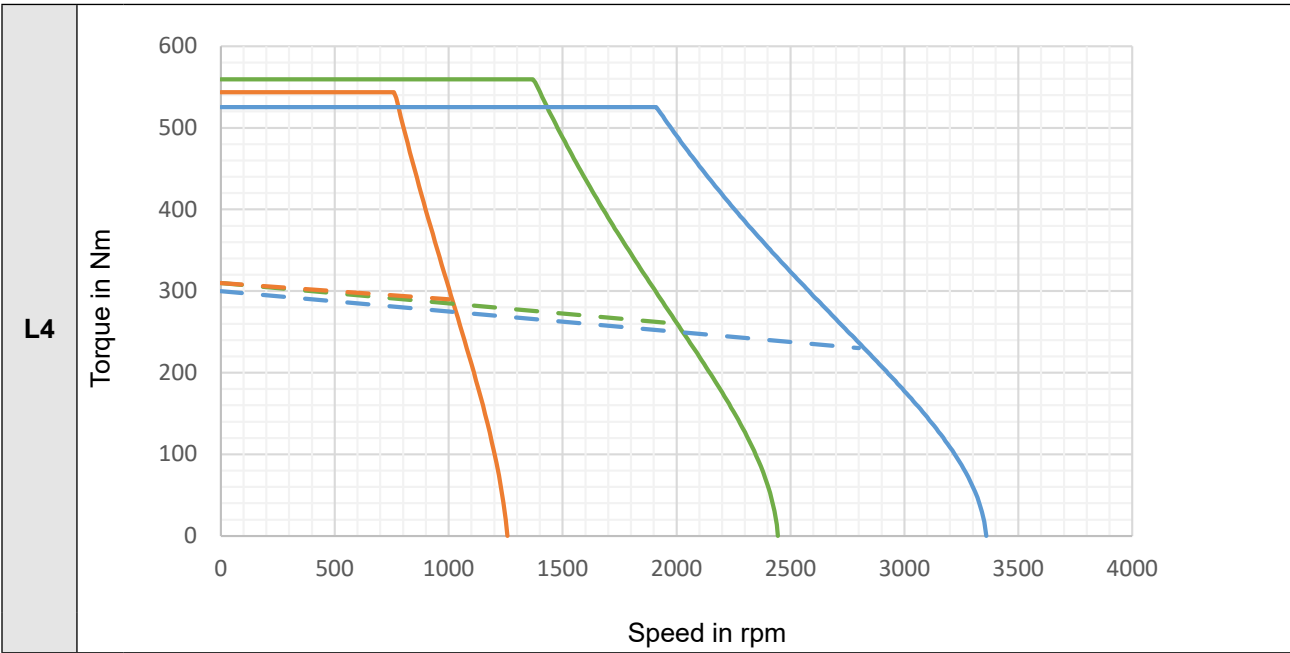
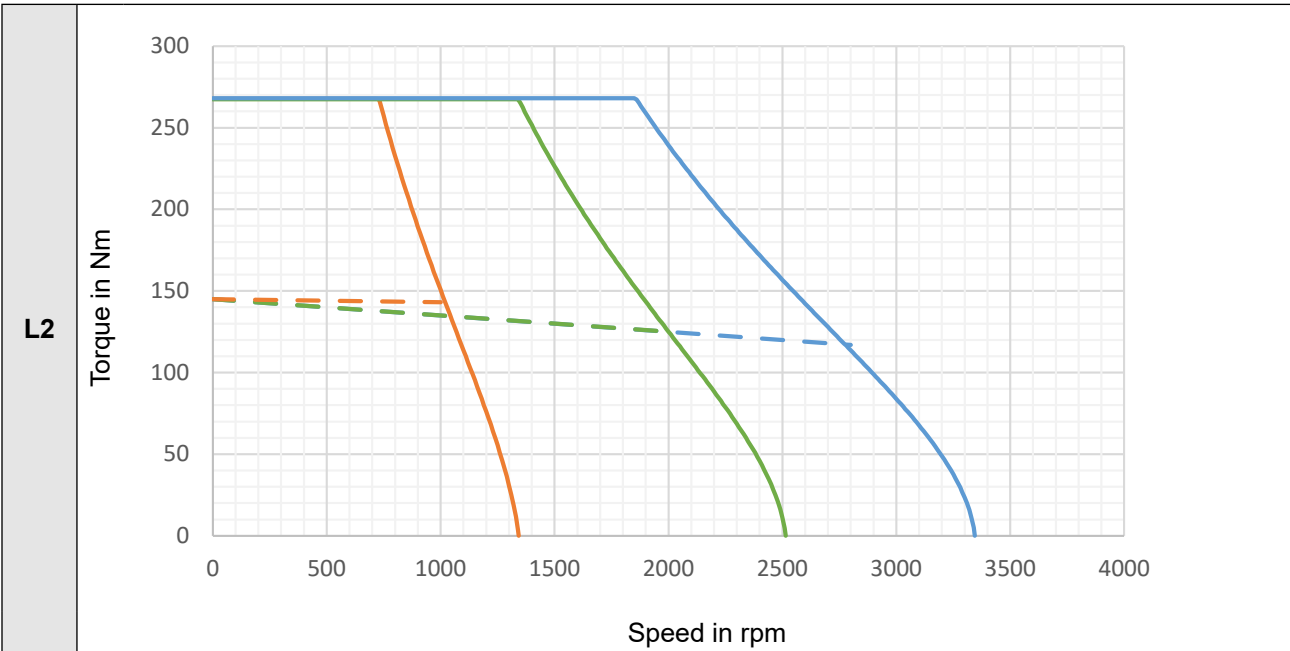
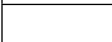


Figure 29: Speed-torque characteristics for motor size SG CS / G_x_D4_x_1-4

Legend		Voltage	Current
	SP10/SP15 motors	360 V	I_{max}
	SP20 motors		
	SP30 motors		
	Max. torque	—	—
	Continuous torque in continuous operation S1 ($\Delta T = 105 K$)		
	Continuous torque in intermittent operation S3		

5.10.6 Speed-torque characteristics for motor size SG CF / G_x_D4_x_A-D



Legend		Voltage	Current
	SP10/SP15 motors	360 V	I_{max}
	SP20 motors		
	SP30 motors		
	Max. torque	—	—
	Continuous torque in continuous operation S1 ($\Delta T = 105K$)		

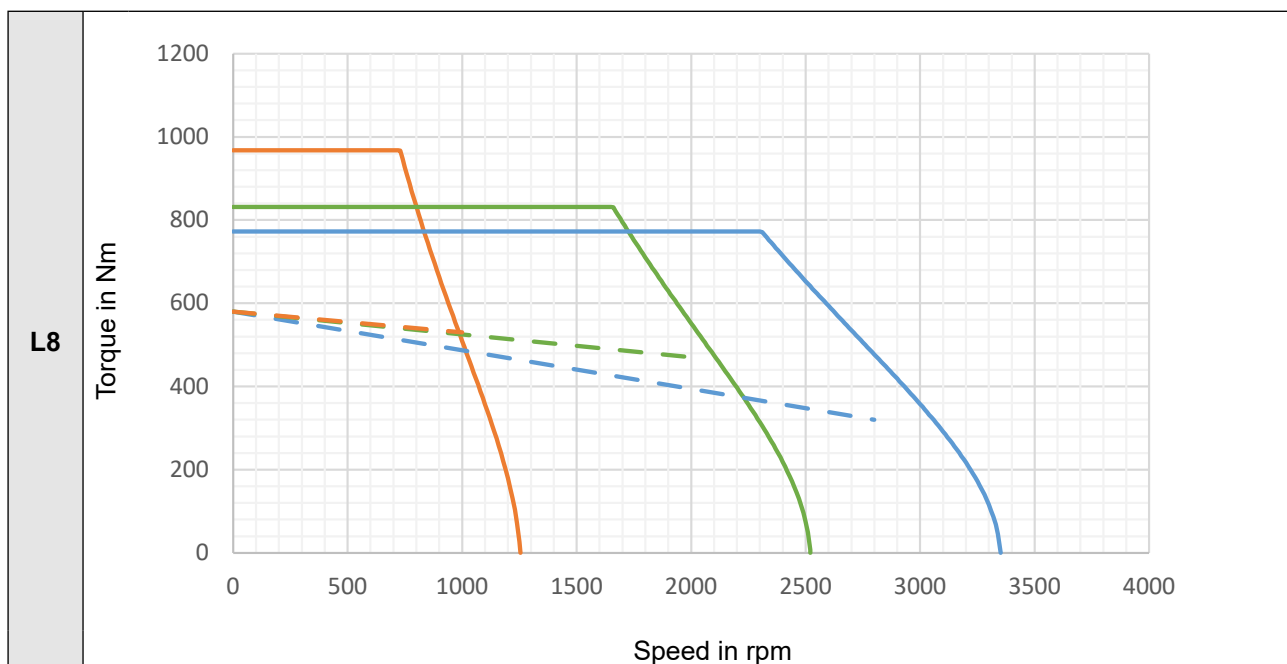
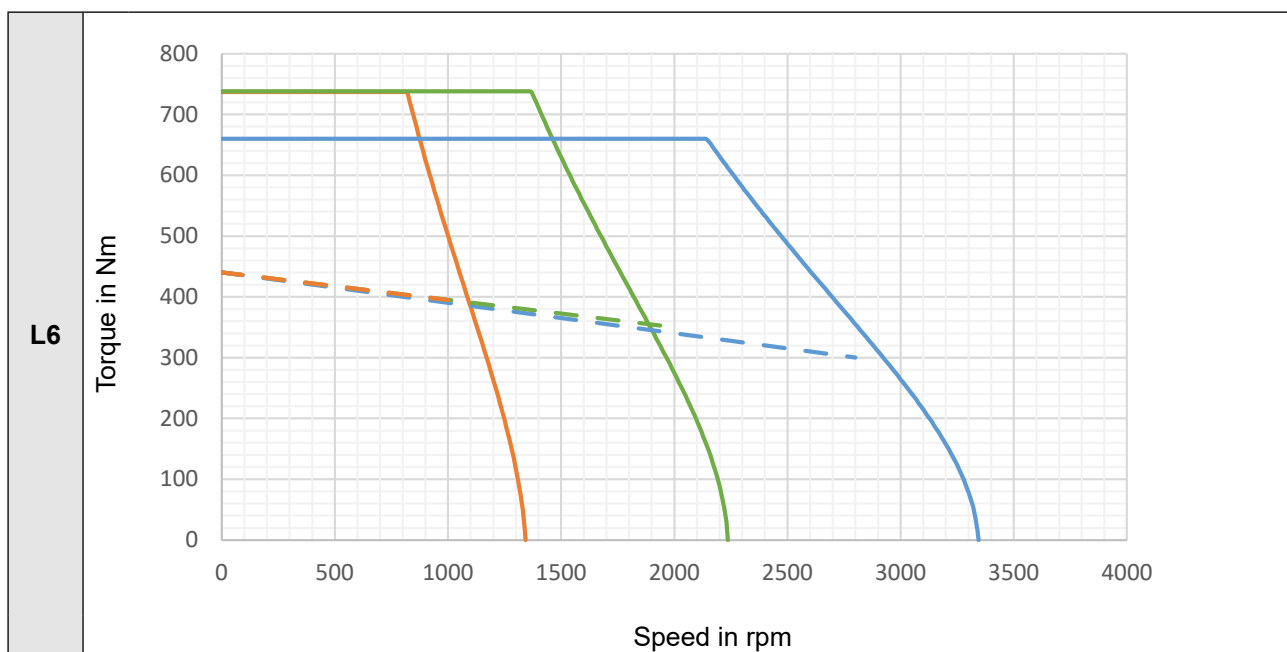
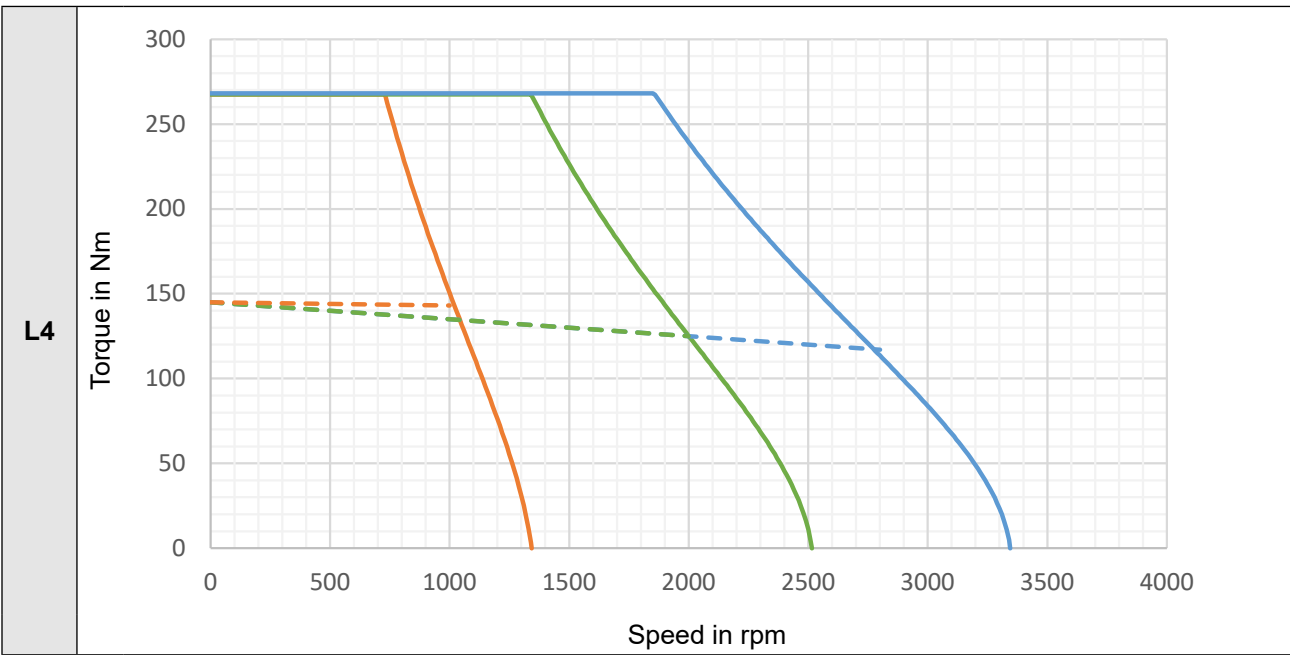
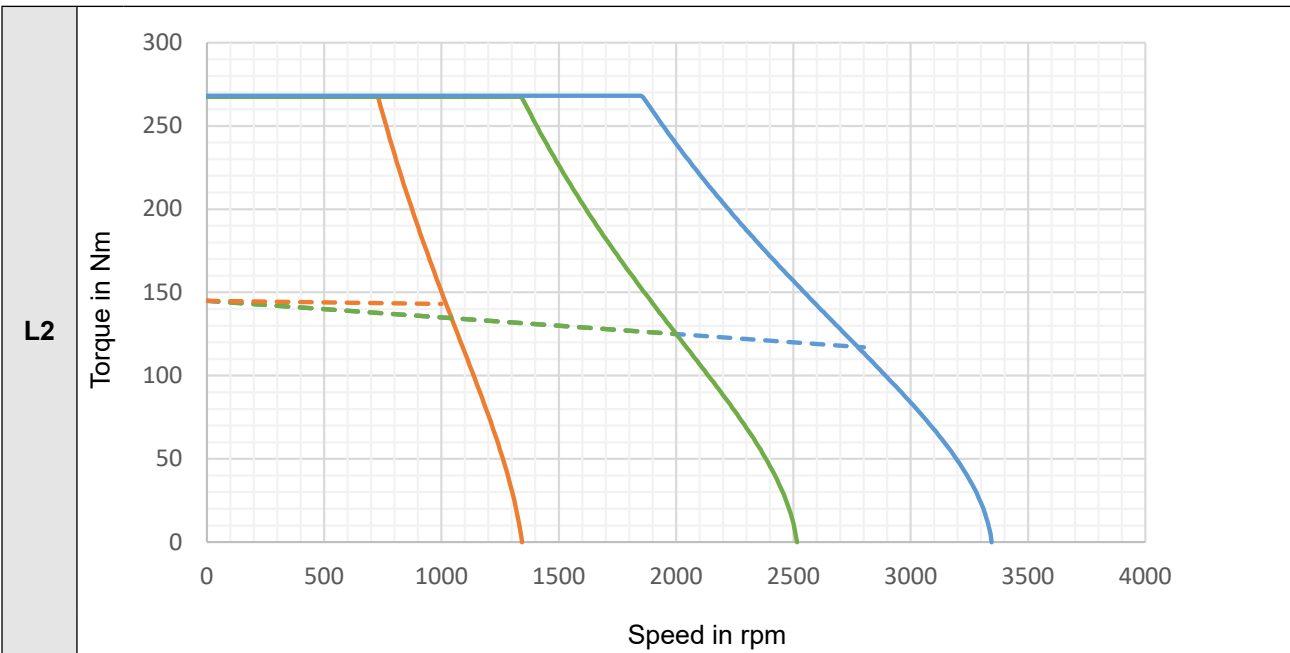


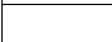
Figure 30: Speed-torque characteristics for motor size SG CF / G_x_D4_x_A-D

Legend		Voltage	Current
	SP10/SP15 motors	360 V	I_{max}
	SP20 motors		
	SP30 motors		
	Max. torque	—	—
	Continuous torque in continuous operation S1 ($\Delta T = 105 K$)		

PERFORMANCE DIAGRAMS

5.10.7 Speed-torque characteristics for motor size SG CW / G_x_D4_x_V-Z



Legend		Voltage	Current
	SP10/SP15 motors	360 V	I_{max}
	SP20 motors		
	SP30 motors		
	Max. torque	—	—
	Continuous torque in continuous operation S1 ($\Delta T = 105K$)		

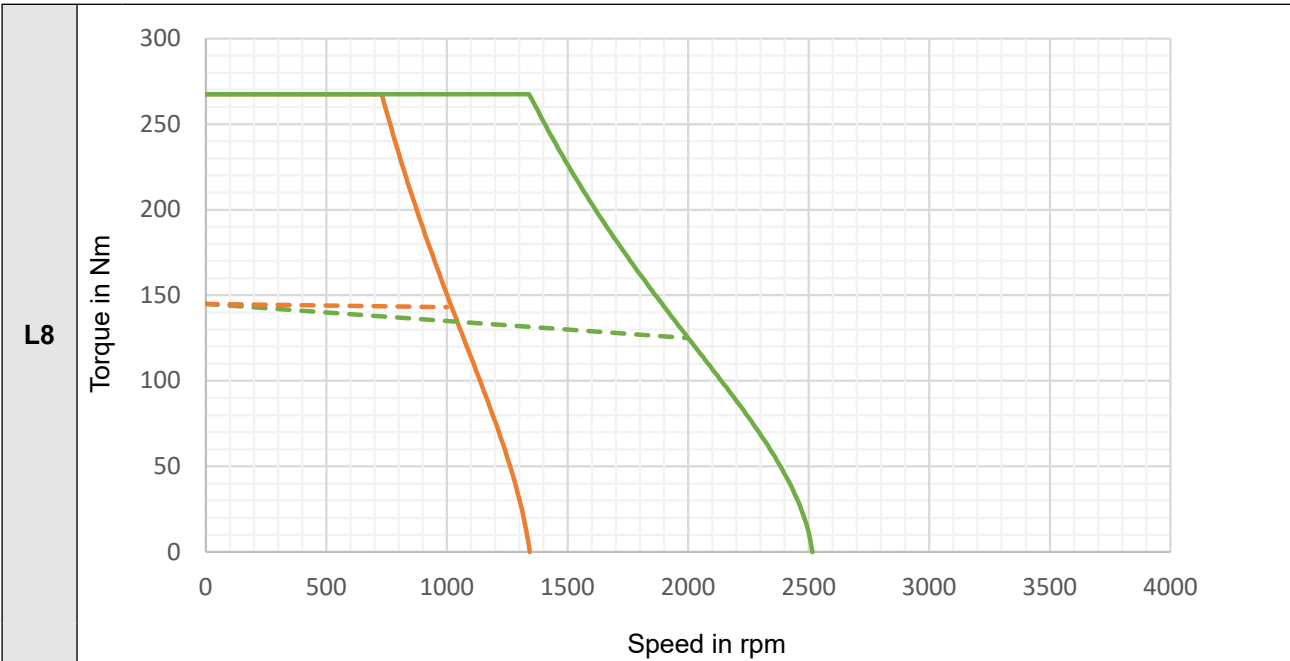
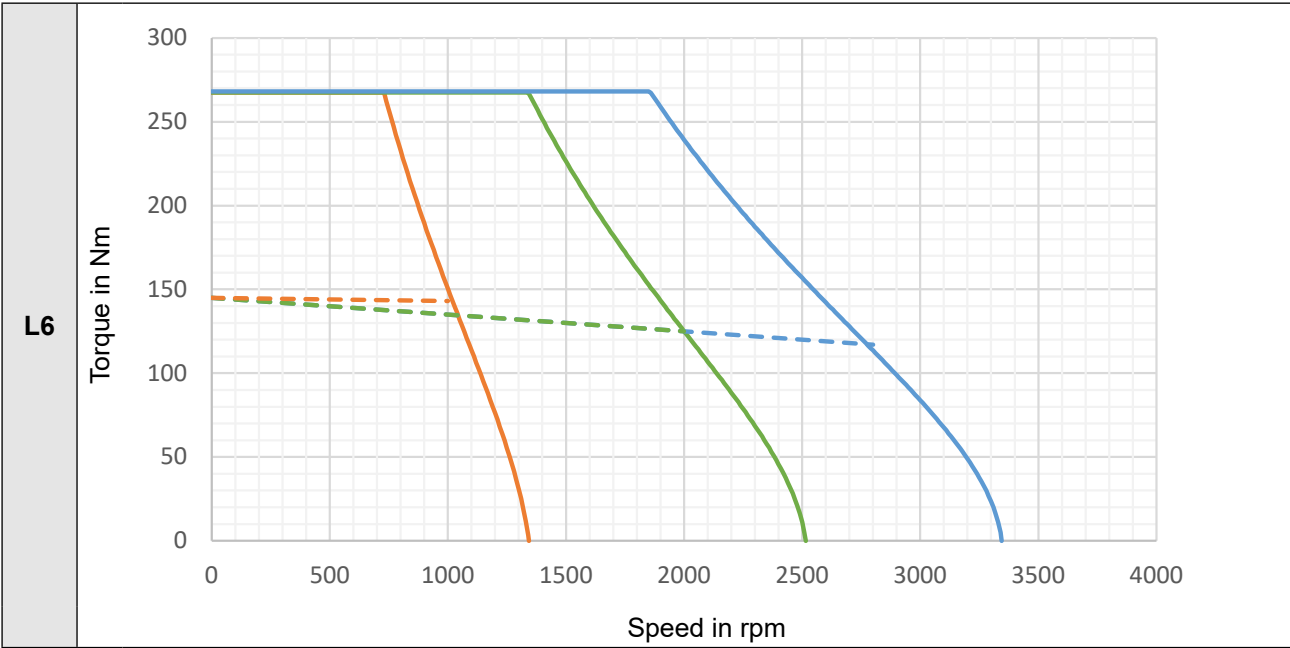


Figure 31: Speed-torque characteristics for motor size SG CW / G_x_D4_x_V-Z

Legend		Voltage	Current
	SP10/SP15 motors	360 V	I_{max}
	SP20 motors		
	SP30 motors		
	Max. torque	—	—
	Continuous torque in continuous operation S1 ($\Delta T = 105 K$)		

6 Certification

Current certificates, declarations and revision lists for your product are available for viewing or downloading on our website at the following link:

keb-automation.com/search

By entering the part number, you will receive a list of the associated documents in the “certificates” drop-down menu.

If you need help or additional documentation, our customer service team will be happy to assist you.

6.1 CE marking

Conformity with the EU directives and standards applicable on the date of production is confirmed by the CE mark on the name plate.

The current EU declaration of conformity for this product is available via the link above.

6.2 UL Marking

Servo and Stepper Motors - Component

COMPANY

KEB Automation KG
Suedstrasse 38
Barntrup, Nordrhein-Westfalen 32683 Germany

E4711175

Marking: Company name model designation, and the Recognized Component Mark 

Note: For additional marking information, refer to the [Guide Information Page](#).

Model(s): 7608200-400 followed by any character, followed by other suffixes and numbers.

Model(s): A, B, C, D, E, or F A, B, C, D, E, or F followed by 1, 2 or 3, followed by SMH, followed by any digits or letters.

Model(s): xx SE L(a) Where xx can be any characters. Where (a) can be digit 1 to 8 (motor length), followed by CS SP, followed by two digits for motor speed, followed by other suffixes and numbers.

Model(s): xx SE L(b) Where xx can be any characters. Where (b) can be digit 1 to 8 (motor length), followed by CF SP, followed by two digits for motor speed, followed by other suffixes and numbers.

Model(s): xx SF L(a) Where xx can be any characters. Where (a) can be digit 1 to 8 (motor length), followed by CS SP, followed by two digits for motor speed, followed by other suffixes and numbers.

Model(s): xx SF L(b) Where xx can be any characters. Where (b) can be digit 1 to 8 (motor length), followed by CF SP, followed by two digits for motor speed, followed by other suffixes and numbers.

Model(s): xx SG L(a) Where xx can be any characters. Where (a) can be digit 1 to 8 (motor length), followed by CF SP, followed by two digits for motor speed, followed by other suffixes and numbers.

Model(s): xx SG L(b) Where xx can be any characters. Where (b) can be digit 1 to 8 (motor length), followed by CS SP, followed by two digits for motor speed, followed by other suffixes and numbers.

[Last Updated](#) on 2023-05-23

Figure 32: UL Marking

6.3 Further information and documentation

You find supplementary manuals and instructions for the download under keb-automation.com/search

General instructions

- EMC and safety instructions
- Instructions for further control boards, safety modules, fieldbus modules, etc.

Instruction and information for construction and development

- Input fuses in accordance with UL
- Programming manual for control and power unit
- Motor configurator to select the appropriate drive converter and to create downloads for parameterizing the drive converter

Approvals and approbations

- Declaration of conformity CE
- TÜV certificate
- FS certification

Others

- COMBIVIS, the software for comfortable parameterisation of drive controllers via PC (available per download)
- EPLAN drawings

7 Revision history

Version	Date	Description
00	2020-10	Completion of pre-series on the basis of the DL3 manual
01	2021-01	Adaptation of the connection plugs, preparation for series release
02	2021-12	Completion of series version
03	2022-03	Adaptation of technical data and diagrams, editorial changes
04	2022-11	General adjustments
05	2023-12	Nameplate, UL description, editorial changes
06	2024-01	Text correction
07	2025-08	Adaptation of technical data, general corrections

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