



DYNAMIC LINE 4

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

Translation of original manual
Document 20220629 EN 06






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.

Table of Contents

Preface	3
Signal words and symbols	3
More symbols.....	3
Laws and guidelines.....	4
Warranty and liability.....	4
Support	4
Copyright.....	4
Table of Contents	5
List of Figures	8
List of Tables	9
Glossary	10
General standards	11
Standards for asynchronous and synchronous motors	12
1 Basic Safety Instructions	13
1.1 Target group.....	13
1.2 Transport, storage and proper use	13
1.3 Installation.....	14
1.4 Connection instructions	15
1.4.1 EMC-compatible installation.....	15
1.5 Start-up and operation	16
1.6 Maintenance.....	16
1.7 Repair	17
1.8 Disposal.....	17
2 Product description	18
2.1 Specified application.....	18
2.1.1 Residual risks	18
2.2 Unintended use.....	18
2.3 Type code	19
2.3.1 Configurable options	19
2.3.2 Rated material number.....	20
2.4 Nameplate	20
2.5 General speed-torque characteristic	21
2.6 General project design.....	21
2.6.1 Selection of the servo motor.....	21
2.6.2 Selection of the servo controller	22
2.6.3 Pretension factor	22
2.7 Construction and definition.....	23
2.7.1 Drive end and direction of rotation	23
2.7.2 Winding and insulation system.....	23
2.7.3 Holding brake (optional)	23

2.7.4	Speed and shaft position measuring system.....	25
2.7.5	Temperature monitoring	25
2.7.6	Temperature sensor Pt1000	26
2.7.7	Deep groove ball bearing	27
2.7.7.1	Initial start-up of deep groove ball bearings	27
3	Operating conditions.....	28
3.1	Product features of the DL4 servo motors.....	28
3.2	Ambient conditions	29
3.3	Derating of the motor depending on temperature / altitude.....	30
3.4	Test flange for thermal determinations	30
3.5	Degree of protection of servo motors	31
3.5.1	Usage of connector systems	31
4	Connection	32
4.1	DL4 motor with flange sockets (SE CS)	32
4.2	DL4 motor with terminal box (SE CF, SF..SG)	32
4.3	Connectors.....	33
4.4	Motor connection	34
4.4.1	Motor size SE CS	34
4.4.2	Motor size SE CF, SF..SG	35
4.4.2.1	Connection data motor size SE CF, SF..SG	36
4.4.2.2	Tightening torques.....	37
4.4.3	Auxiliary fan (optional).....	37
4.5	Encoder connection	38
4.5.1	Resolver terminal assignment.....	38
4.5.2	Hiperface terminal assignment.....	39
5	Technical Data.....	40
5.1	Permissible axial and radial forces.....	40
5.1.1	Axial forces	40
5.1.2	Maximum radial forces	41
5.2	Shaft end	42
5.3	Technical data servo motors SE CS	43
5.3.1	Technical data of the holding brake SE CS	46
5.3.2	Dimensions servo motors SE CS	46
5.4	Technical data servo motors SE CF	47
5.4.1	Technical data of the holding brake SE CF	50
5.4.2	Dimensions servo motors SE CF	50
5.5	Technical data servo motors SF CS	51
5.5.1	Technical data of the holding brake SF CS	54
5.5.2	Dimensions servo motors SF CS	54
5.6	Technical data servo motors SF CF.....	55

- 5.6.1 Technical data of the holding brake SF CF 58
- 5.6.2 Dimensions servo motors SF CF 58
- 5.7 Technical data servo motors SG CS 59**
 - 5.7.1 Technical data of the holding brake SG CS..... 62
 - 5.7.2 Dimensions servo motors SG CS (exclusive SG CS L8 SP30) 62
 - 5.7.3 Dimensions servo motors SG CS L8 SP30..... 63
- 5.8 Technical data servo motors SG CF 64**
 - 5.8.1 Technical data of the holding brake SG CF 67
 - 5.8.2 Dimensions servo motors SG CF (exclusive SG CF L8 SP30)..... 67
 - 5.8.3 Dimension servo motors SG CF L8 SP30 68
- 5.9 Performance diagrams..... 69**
 - 5.9.1 Speed-torque characteristics for motor size SE CS 69
 - 5.9.2 Speed-torque characteristics for motor size SE CF 71
 - 5.9.3 Speed-torque characteristics for motor size SF CS 73
 - 5.9.4 Speed-torque characteristics for motor size SF CF 75
 - 5.9.5 Speed-torque characteristics for motor size SG CS..... 77
 - 5.9.6 Speed-torque characteristics for motor size SG CF 79
- 6 Certification 81**
 - 6.1 CE marking..... 81
 - 6.2 UL Marking 83
 - 6.3 Further information and documentation 84
- 7 Revision history 85**

List of Figures

Figure 1:	Nameplate example	20
Figure 2:	General speed-torque characteristic.....	21
Figure 3:	Example image of a motor	23
Figure 4:	Varistor protective wiring.....	24
Figure 5:	Temperature sensor Pt1000.....	26
Figure 6:	Derating of the motor depending on temperature / altitude	30
Figure 7:	Top view of a DL4 motor with flange sockets.....	32
Figure 8:	Top view of a DL4 motor with terminal box	32
Figure 9:	Connectors with a view to the connection pins at the motor.....	33
Figure 10:	Motor connection motor size SE CS	34
Figure 11:	Motor connection motor size SE CF, SF...SG	35
Figure 12:	Resolver terminal assignment.....	38
Figure 13:	Hiperface terminal assignment	39
Figure 14:	Axial and radial forces.....	40
Figure 15:	Shaft end.....	42
Figure 16:	Dimensions servo motors SE CS.....	46
Figure 17:	Dimensions servo motors SE CF	50
Figure 18:	Dimensions servo motors SF CS.....	54
Figure 19:	Dimensions servo motors SF CF	58
Figure 20:	Dimensions servo motors SG CS (exclusive SG CS L8 SP30).....	62
Figure 21:	Dimensions servo motors SG CS L8 SP30	63
Figure 22:	Dimensions servo motors SG CF (exclusive SG CF L8 SP30)	67
Figure 23:	Dimension servo motors SG CF L8 SP30	68
Figure 24:	Speed-torque characteristics for motor size SE CS.....	70
Figure 25:	Speed-torque characteristics for motor size SE CF	72
Figure 26:	Speed-torque characteristics for motor size SF CS.....	74
Figure 27:	Speed-torque characteristics for motor size SF CF	76
Figure 28:	Speed-torque characteristics for motor size SG CS	78
Figure 29:	Speed-torque characteristics for motor size SG CF	80
Figure 30:	EU declaration of conformity.....	82
Figure 31:	UL Marking.....	83

List of Tables

Table 1:	Type code	19
Table 2:	Configurable options	19
Table 3:	Rated material number	20
Table 4:	Temperature sensor Pt1000.....	26
Table 5:	Value table temperature sensor Pt1000.....	26
Table 6:	Product features.....	28
Table 7:	Ambient conditions.....	29
Table 8:	Dimensions and material of the test flange.....	30
Table 9:	IP Degree of protection of servo motors	31
Table 10:	Motor cable	34
Table 11:	Connection data motor size SE CF, SF...SG.....	36
Table 12:	Tightening torques	37
Table 13:	Technical data auxiliary fan.....	37
Table 14:	Resolver encoder cable	38
Table 15:	Hiperface encoder cable.....	39
Table 16:	Maximum radial forces for length x (motor type SE L2...L6).....	41
Table 17:	Maximum radial forces for length x (motor type SE L8).....	41
Table 18:	Maximum radial forces for length x (motor type SF).....	41
Table 19:	Maximum radial forces for length x (motor type SG)	42
Table 20:	Technical data servo motors SE-CS-SP15	43
Table 21:	Technical data servo motors SE-CS-SP20	44
Table 22:	Technical data servo motors SE-CS-SP30	45
Table 23:	Technical data of the holding brake SE CS	46
Table 24:	Technical data servo motors SE-CF-SP15	47
Table 25:	Technical data servo motors SE-CF-SP20	48
Table 26:	Technical data servo motors SE-CF-SP30	49
Table 27:	Technical data of the holding brake SE CF.....	50
Table 28:	Technical data servo motors SF-CS-SP10	51
Table 29:	Technical data servo motors SF-CS-SP20	52
Table 30:	Technical data servo motors SF-CS-SP30	53
Table 31:	Technical data of the holding brake SF CS.....	54
Table 32:	Technical data servo motors SF-CF-SP10.....	55
Table 33:	Technical data servo motors SF-CF-SP20.....	56
Table 34:	Technical data servo motors SF-CF-SP30.....	57
Table 35:	Technical data of the holding brake SF CF.....	58
Table 36:	Technical data servo motors SG-CS-SP10.....	59
Table 37:	Technical data servo motors SG-CS-SP20.....	60
Table 38:	Technical data servo motors SG-CS-SP30.....	61
Table 39:	Technical data of the holding brake SG CS	62
Table 40:	Technical data servo motors SG-CF-SP10	64
Table 41:	Technical data servo motors SG-CF-SP20	65
Table 42:	Technical data servo motors SG-CF-SP30	66
Table 43:	Technical data of the holding brake SG CF	67

Glossary

0V	Earth-potential-free common point	MCM	American unit for large wire cross sections
1ph	1-phase mains	Modulation	Means in drive technology that the power semiconductors are controlled
3ph	3-phase mains	MTTF	Mean service life to failure
AC	AC current or voltage	NN	Sea level
Application	The application is the intended use of the KEB product.	PE	Protective earth
ASCL	Asynchronous sensorless closed loop	PELV	Protective Extra Low Voltage
Auto motor ident.	Automatically motor identification; calibration of resistance and inductance	PFD	Term used in the safety technology (EN 61508-1...7) for the size of error probability
AWG	American wire gauge	PFH	Term used in the safety technology (EN 61508-1...7) for the size of error probability per hour
B2B	Business-to-business	PLC	Programmable logic controller
BiSS	Open source real-time interface for sensors and actuators (DIN 5008)	PT100	Temperature sensor with R0=100Ω
COMBIVERT	KEB drive converters	PT1000	Temperature sensor with R0=1000Ω
COMBIVIS	KEB start-up and parameterizing software	PTC	PTC-resistor for temperature detection
Customer	The customer has purchased a KEB product from KEB and integrates the KEB product into his product (customer product) or resells the KEB product (dealer)	PWM	Pulse width modulation
DC	DC current or voltage	RJ45	Modular connector with 8 lines
DIN	German Institut for standardization	SCL	Synchronous sensorless closed loop
EMC	Electromagnetic compatibility	SELV	Safety Extra Low Voltage (<60V)
Emergency stop	Shutdown of a drive in emergency case (not de-energized)	SS1	Safety function „Safe stop 1“ in accordance with IEC 61800-5-2
Emergency switching off	Switching off the voltage supply in emergency case	SSI	Synchronous serial interface for encoder
EN	European standard	STO	Safety function „Safe Torque Off“ in accordance with IEC 61800-5-2
End customer	The end customer is the user of the customer product.	TTL	Incremental signal with an output voltage up to 5V
FE	Functional earth	VARAN	Real-time Ethernet bus system
FU	Drive converter		
GND	Reference potential, ground		
Hiperface	Bidirectional encoder interface of the company Sick-Stegmann		
HTL	Incremental signal with an output voltage (up to 30V) -> TTL		
IEC	International standard		
IP xx	Degree of protection (xx for level)		
KEB product	The KEB product is subject of this manual.		
KTY	Silicium temperature sensor (polarized)		
Manufacturer	The manufacturer is KEB, unless otherwise specified (e.g. as manufacturer of machines, engines, vehicles or adhesives).		

General standards

DGUV regulation 3	Electrical installations and equipment
DIN46228-1	Tubular end-sleeves without plastic sleeve
DIN46228-4	Tubular end-sleeves with plastic sleeve
DINIEC 60364-5-54	Low-voltage electrical installations - Part 5-54: Selection and erection of electrical equipment - Earthing arrangements, protective conductors and protective bonding conductors
EN60204-1	Safety of machinery - Electrical equipment of machines - Part 1: General requirements (IEC 44/709/CDV)
EN60439-1	Low-voltage switchgear and controlgear assemblies - Part 1: Type-tested and partially type-tested assemblies (IEC 60439-1)
EN60529	Degrees of protection provided by enclosures (IP Code) (IEC 60529)
EN60664-1	Insulation coordination for equipment within low-voltage systems - Part 1: Principles, requirements and tests (IEC 60664-1)
EN60721-3-1	Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 1: Storage (IEC 104/648/CD)
EN60721-3-2	Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 2: Transportation and handling (IEC 104/670/CD)
EN60721-3-3	Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities; section 3: Stationary use at weatherprotected locations (IEC 60721-3-3)
EN61800-2	Adjustable speed electrical power drive systems - Part 2: General requirements - Rating specifications for low voltage adjustable speed a.c. power drive systems (IEC 61800-2)
EN61800-3	Adjustable speed electrical power drive systems - Part 3: EMC requirements and specific test methods (IEC 22G/297A/CD)
EN61800-5-1	Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy (IEC 61800-5-1)
UL61800-5-1	American version of the EN 61800-5-1 with „National Deviations“
EN61800-5-2	Adjustable speed electrical power drive systems - Part 5-2: Safety requirements - Functional (IEC 61800-5-2:2016); German version EN 61800-5-2:2017

Standards for asynchronous and synchronous motors

EN 60034-1	Rotating electrical machines - Part 1: Rating and performance (IEC 2/1768/CD)
EN 60034-2-3	Rotating electrical machines - Part 2-3: Specific test methods for determining losses and efficiency of converter-fed AC motors (IEC 2/1841/CD)
EN 60034-5	Rotating electrical machines - Part 5: Degrees of protection provided by integral design of rotating electrical machines (IP code) - Classification (IEC 60034-5)
EN 60034-6	Rotating electrical machines - Part 6: Methods of cooling (IC-Code) (IEC 60034-6)
EN 60034-7	Rotating electrical machines - Part 7: Classification of types of construction, mounting arrangements and terminal box position (IM code) (IEC 60034-7)
EN 60034-8	Rotating electrical machines - Part 8: Terminal markings and direction of rotation (IEC 60034-8)
EN 60034-9	Rotating electrical machines - Part 9: Noise limits (IEC 60034-9)
EN 60034-11	Rotating electrical machines - Part 11: Thermal protection (IEC 60034-11)
EN 60034-14	Rotating electrical machines - Part 14: Mechanical vibration of certain machines with shaft heights 56 mm and higher - Measurement, evaluation and limits of vibration severity (IEC 60034-14)
IEC/TS 60034-17	Rotating electrical machines - Part 17: Cage induction motors when fed from converters - Application guide (IEC/TS 60034-17)
EN 60034-18-41	Rotating electrical machines - Part 18-41: Partial discharge free electrical insulation systems (Type I) used in rotating electrical machines fed from voltage converters - Qualification and quality control tests (IEC 60034-18-41)
EN 60034-18-42	Rotating electrical machines - Part 18-42: Partial discharge resistant electrical insulation systems (Type II) used in rotating electrical machines fed from voltage converters - Qualification tests (IEC 2/1798/CDV)
IEC/TS 60034-24	Rotating electrical machines - Part 24: Online detection and diagnosis of potential failures at the active parts of rotating electrical machines and of bearing currents - Application guide (IEC/TS 60034-24)
IEC 2/1689/CD	Rotating electrical machines - Part 25: AC machines when used in power drive systems - Application guide (IEC 2/1689/CD)
DIN EN 60034-30-1	Rotating electrical machines - Part 30-1: Efficiency classes of line operated AC motors (IE code) (IEC 60034-30-1)
DIN CLC/TS 60034-31	Rotating electrical machines - Part 31: Selection of energy-efficient motors including variable speed applications - Application guide (IEC/TS 60034-31)
DIN 748-3	Cylindrical shaft ends - Part 3: For rotating electrical machinery
DIN SPEC 42955	Shaft extension run out and of mounting flanges for rotating electrical machinery, frame size larger than 315 - Tolerances, test
DIN EN 50347	General purpose three-phase induction motors having standard dimensions and outputs - Frame numbers 56 to 315 and flange numbers 65 to 740
DIN 6885-1	Drive Type Fastenings without Taper Action; Parallel Keys, Keyways, Deep Pattern
DIN 332-2	Center holes 60° with thread for shaft ends for rotating electrical machines

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 *DIN IEC 60364-5-54*.
- 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 posses 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.

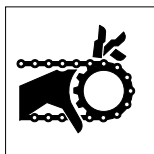
www.keb.de/fileadmin/media/Manuals/emv/0000neb0000.pdf



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) 1903000011216	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

00 SM 000-CMAT

Execution code DL4

Table 1: Type code

2.3.1 Configurable options

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
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:	400V

Table 2: Configurable options

¹⁾ Only for motor size SG CF.



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

PRODUCT DESCRIPTION

2.3.2 Rated material number

CM	SM	x	x	x	-x	x	x	x
Identifier				0000: starting with 0 and counting up ZZZZ: Final digit				
Length				1: Length 1 2: Length 2 3: Length 3 4: Length 4 5: Length 5 6: Length 6 7: Length 7 8: Length 8				
Size				E: Size E F: Size F G: Size G				
Type				4: DL4 servo motor				
Product group				SM: SM product group				
Configured material				CM: Configurable material				

Table 3: Rated material number

2.4 Nameplate




S/N ABCDEFG/001 - yyyy/ww 2022/48
 Made in Italy
 KEB Automation KG
 D-32683 Barntrop
 www.keb.de

Mat. No.:
 Type:

CE   **US E471175**

BCode BRV941042WN1340C001 *Brushless Servomotor*

Duty	<i>n_N</i> [rpm]	<i>T₀</i> [Nm]	<i>T_N</i> [Nm]	<i>I₀</i> [Arms]	<i>I_N</i> [Arms]	<i>P_N</i> [W]	<i>V_N</i> [Vrms]
S1	1000	310	250	62,8	54,4	26180	349

<i>k_t</i> [Nm/Arms]	5,24	<i>I_{max}</i> [Arms]	111	<i>f</i> [Hz]			67,0
--------------------------------	------	-------------------------------	-----	---------------	--	--	------

Feedback: Res. TS2640N1901E64 **J_m** [kgcm²] 482

Brake: 24Vdc 225 Nm **Poles** 8 **ΔT** [°C] 105

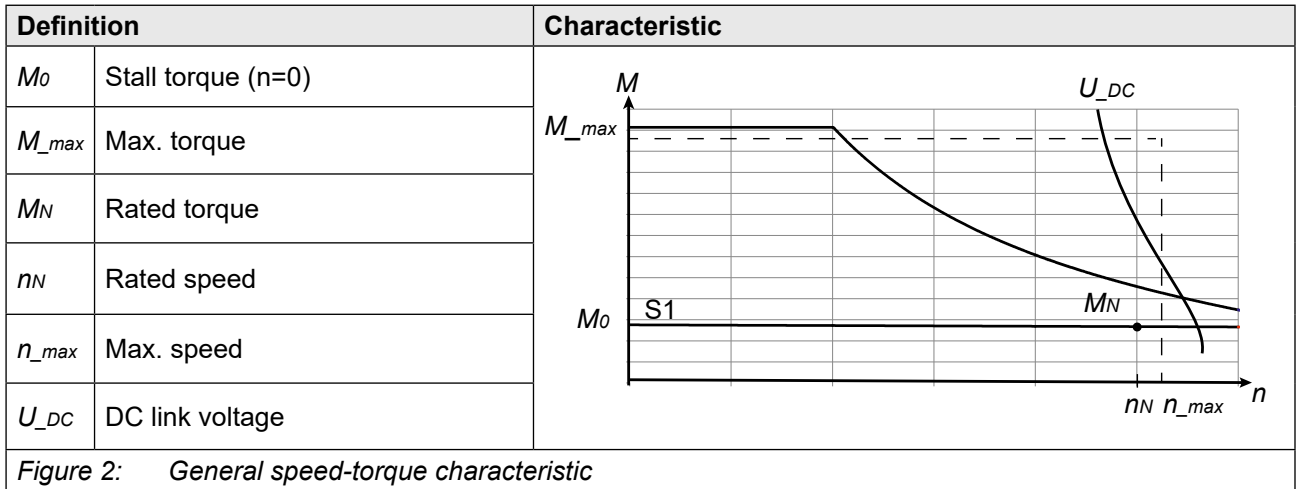
Cooling: Fan 230Vac 50/60Hz 1.4A IP54 **Ins. Class** F

Thermal sensor: Pt 1000 **IM B5 - IC 416 - IP 54**

3ph - IEC 60034-1 **Weight** [kg] 169

Figure 1: Nameplate example

2.5 General speed-torque characteristic



2.6 General project design

2.6.1 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.

2.6.2 Selection of the servo controller

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

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

$\text{Rated output current} = \frac{\text{effective torque } (M_{eff}) \cdot \text{standstill continuous current } (I_0)}{\text{Stall torque } (M_0)}$

2.6.3 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.

2.7 Construction and definition

2.7.1 Drive end and direction of rotation

Drive end of the motor	View
<p>In EN 60034-7 the two ends of a motor are defined as follows:</p> <p>D (Drive End): Drive end (AS) of the motor.</p> <p>N (Non-Drive End): Non-drive end (BS) of the motor.</p>	
<p>Direction of rotation of the motor</p> <p>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.</p>	

Figure 3: Example image of a motor

2.7.2 Winding and insulation system

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

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

2.7.3 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.

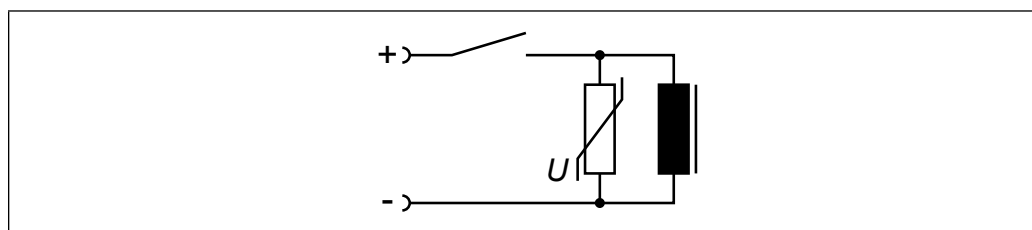


Figure 4: Varistor protective wiring

2.7.4 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.

2.7.5 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.

2.7.6 Temperature sensor Pt1000

Pt1000 temperature sensor	
Sensor type	RTD (Platinum Resistance Temperature Detectors)
Reference standard	<i>DIN EN 60751</i>
Degree of precision	Class B
ΔT	$\pm (0.3+0.005T)^\circ C$
R0	R (0 °C) = 1000 Ω
<i>Table 4: Temperature sensor Pt1000</i>	

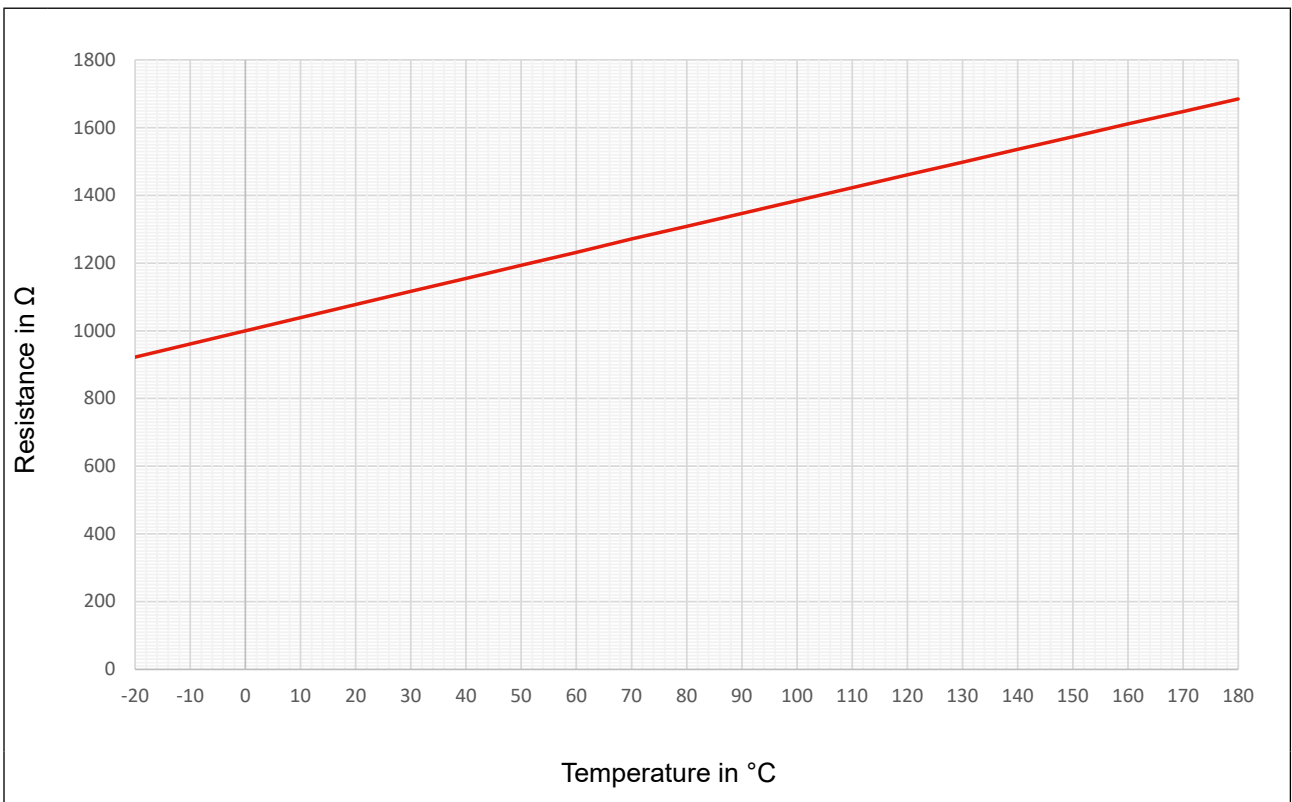


Figure 5: Temperature sensor Pt1000

Temperature	<i>t / °C</i>	-20	-10	0	10	20	30	40	50	60	70	80
Resistance	<i>R / Ω</i>	922	961	1000	1039	1078	1117	1155	1194	1232	1271	1309
Temperature	<i>t / °C</i>	90	100	110	120	130	140	150	160	170	180	–
Resistance	<i>R / Ω</i>	1347	1385	1423	1461	1498	1536	1573	1611	1648	1685	–

Table 5: Value table temperature sensor Pt1000

2.7.7 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.

2.7.7.1 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	
	Hiperface SRM50 - 16 bit/Multiturn - 12 bit	
Cooling	Self-cooling IC 410	
	Separate cooling IC 416	
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	With feather key	Without feather key
	<i>Table 6: Product features</i>	

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
<i>Table 7: Ambient conditions</i>	

⚠ WARNING



Damage due to permanent magnets!

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

⚠ WARNING

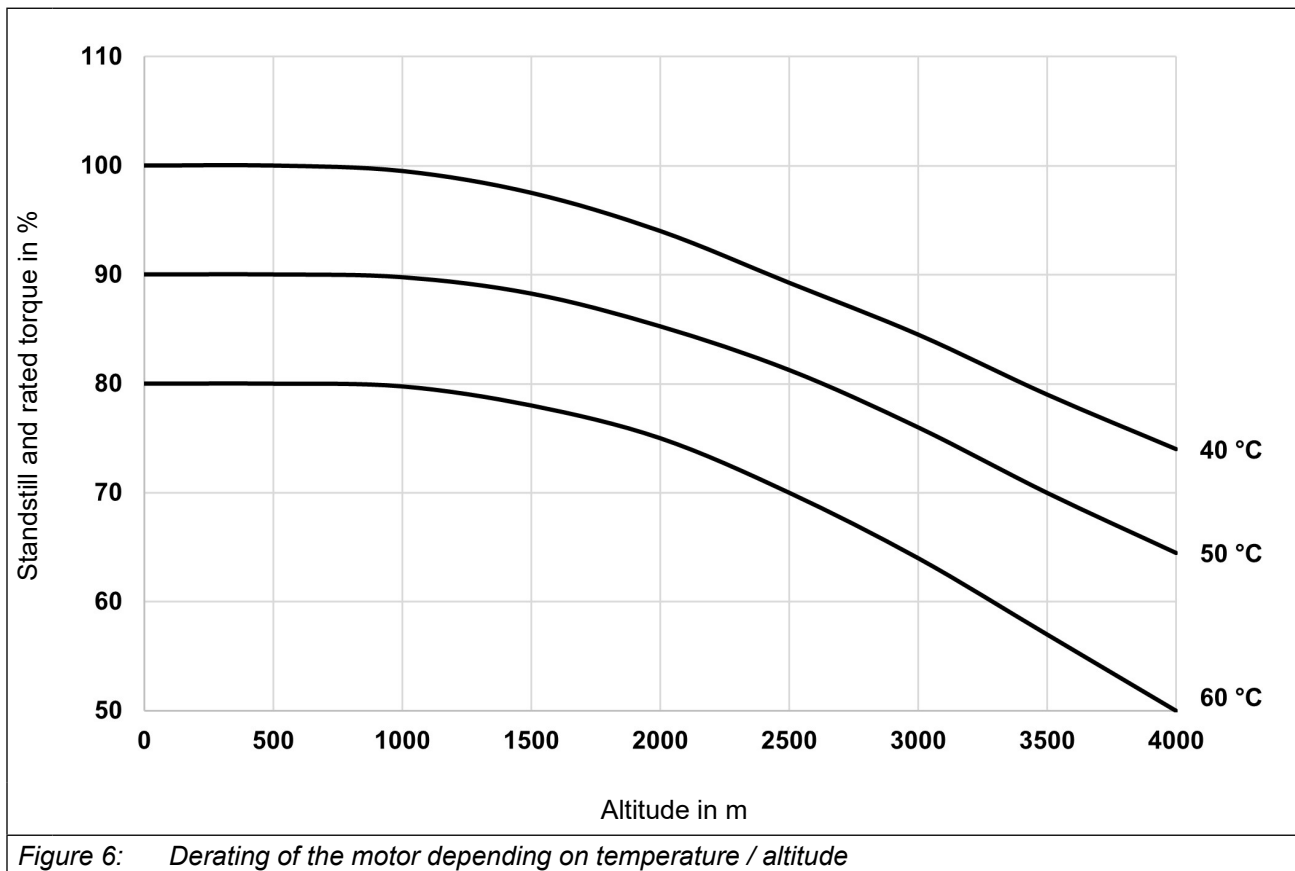


High noise level during operation!

Hearing damage possible!

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

3.3 Derating of the motor depending on temperature / altitude



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 ± 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 8: 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 servo motors DL4 series are generally designed to meet the degree of protection IP54 as specified in [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 9: 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

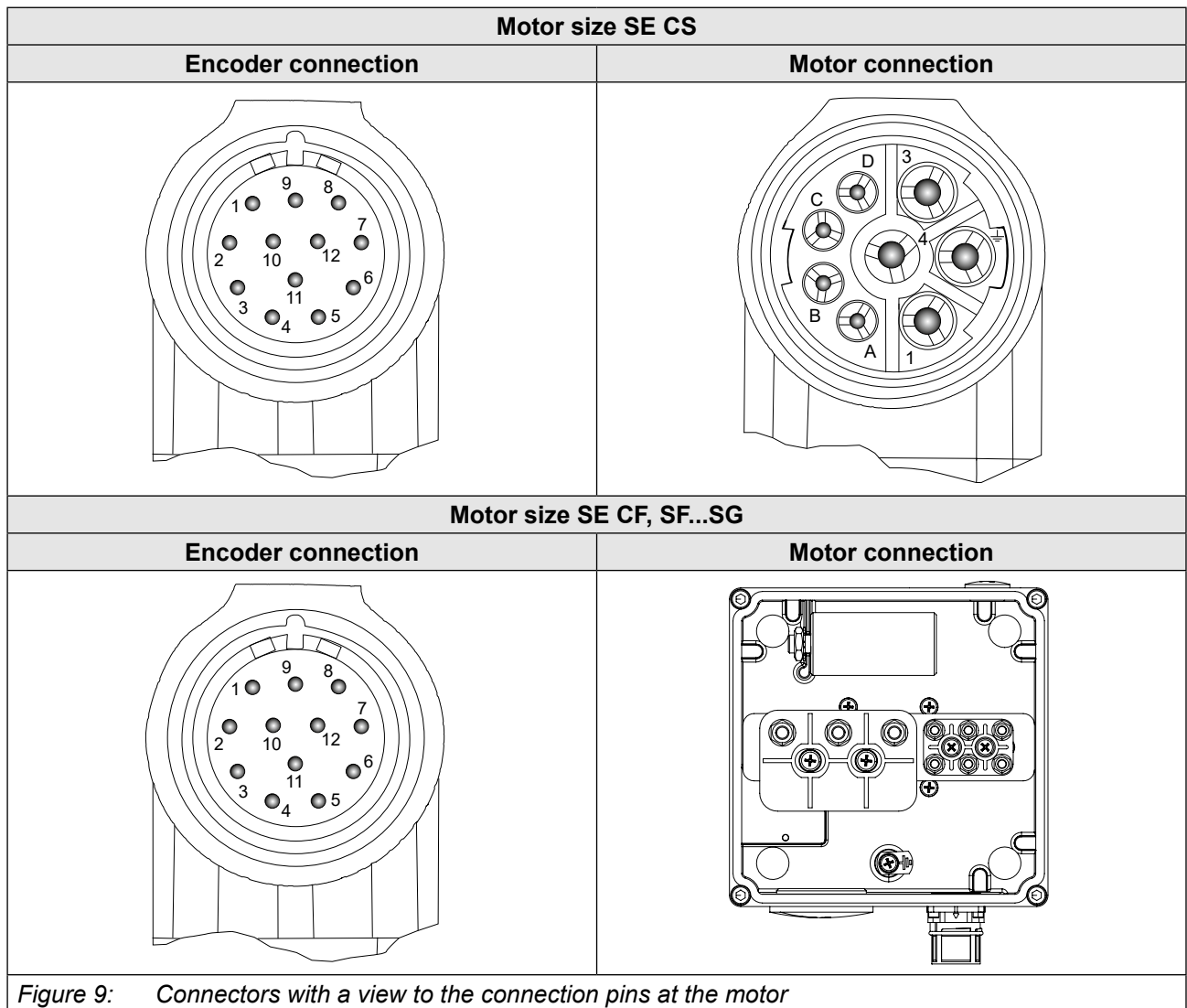



Figure 9: Connectors with a view to the connection pins at the motor



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

Motor size SE CS	
Connection	Signal
1	Motor phase U
4	Motor phase V
3	Motor phase W
	Protective earth
A	Brake +
B	Brake -
C	Temperature sensor +
D	Temperature sensor -

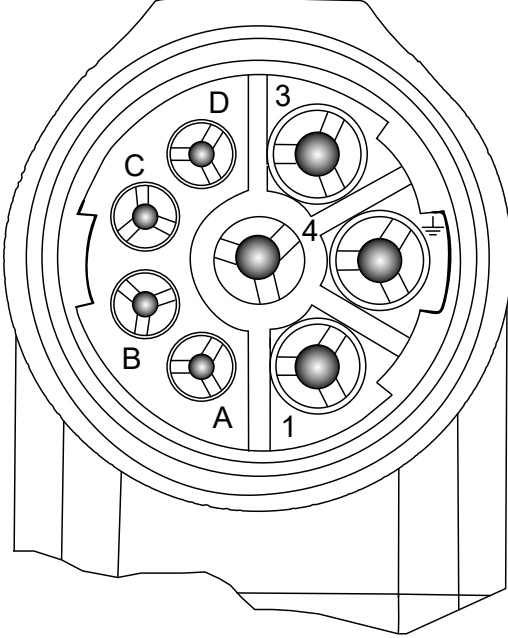
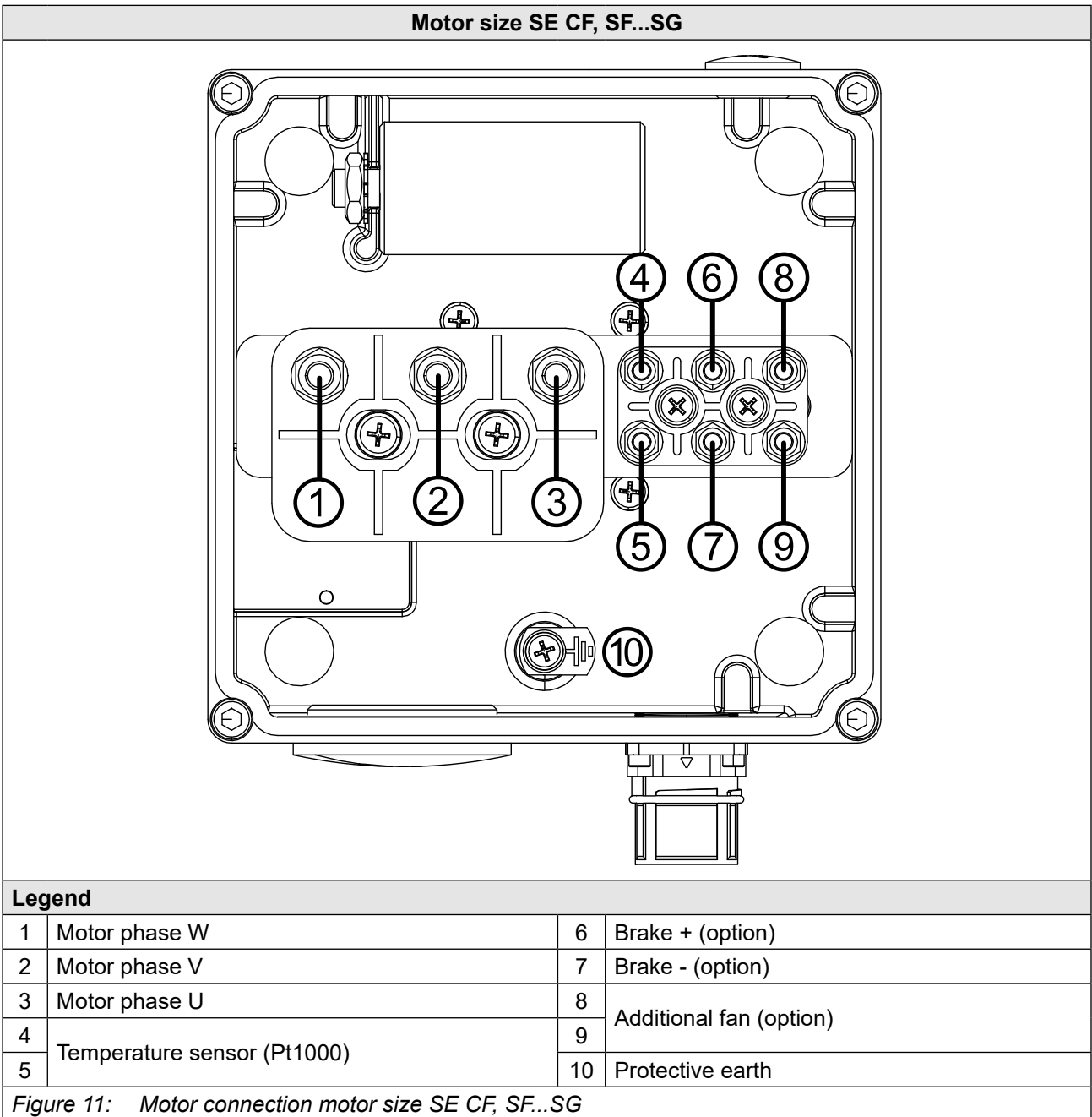


Figure 10: Motor connection motor size SE CS

Drive controller series		Required motor cable	
COMBIVERT	F6, S6	1.5 mm ² :	00S4519-xxxx
		2.5 mm ² :	00S4619-xxxx
		4.0 mm ² :	00S4719-xxxx

Table 10: 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 Connection data motor size SE CF, SF...SG“.
- ▶ Observe the tightening torques of the connections
=> „4.4.2.2 Tightening torques“.

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	M4	M8	
		2000				
		3000				
		L4				1000
						2000
						3000
	L6	1000	M8			
		2000				
		3000				
	L8	1000	M6			
		2000	M8			
		3000				
L2	1000	M8				
	2000					
	3000					
	L4			1000	M4	
			2000			
			3000			
L6	1000	M10				
	2000					
	3000					
L8	1000	M8				
	2000	M10				
	3000					
SG CF	L2		1000	M8	M4	M10 + 3x M6
		2000				
		2800				
	L4	1000	M10			
		2000				
		2800				
	L6	1000	M8			
		2000				
		2800				
	L8	1000	M10			
		2000				
		2800				
			M14			

Table 11: 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

Table 12: 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 13: 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 14: 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 to the connector pins of the resolver connector at 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

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

Table 15: Hiperface encoder cable

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



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

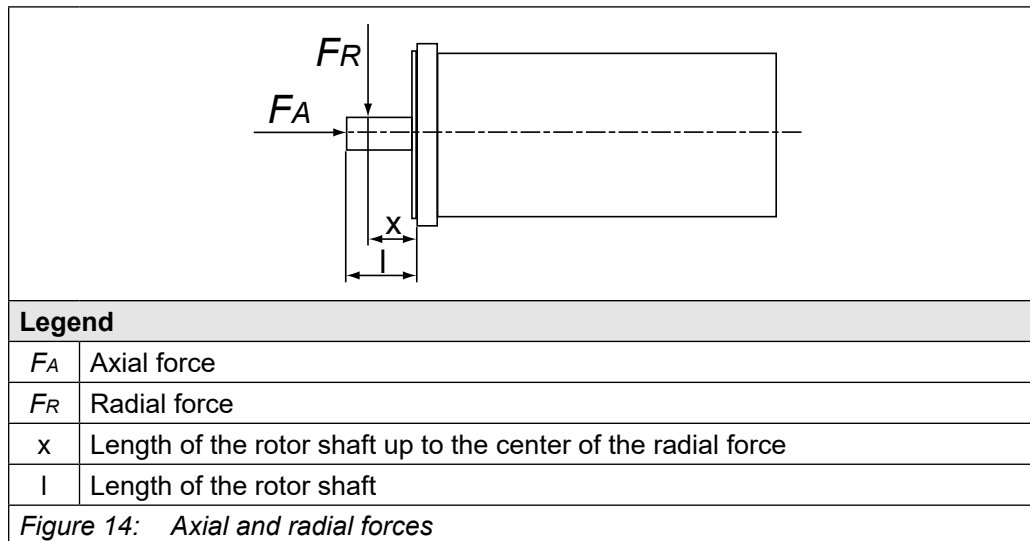
5 Technical Data

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										
<i>Table 16: Maximum radial forces for length x (motor type SE L2...L6)</i>										

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										
<i>Table 17: Maximum radial forces for length x (motor type SE L8)</i>										

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										
<i>Table 18: Maximum radial forces for length x (motor type SF)</i>										

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 19: 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 shafts ¹⁾	
	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

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			
Length		L2	L4	L6	L8
Cooling		Self-cooling			
Rated speed	n_N / rpm	1500			
Max. speed <i>Mech</i>	n_{max} / rpm	6000			
Rated voltage	U_N / V	330	343	326	318
Stall torque	⁴⁾ M_0 / Nm	11.6	22	30	38.7
Current at stall torque	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 (0 rpm)	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 _{pk} /1000rpm	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 20: Technical data servo motors SE-CS-SP15

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-SP20			
Length		L2	L4	L6	L8
Cooling		Self-cooling			
Rated speed	n_N / rpm	2000			
Max. speed <i>Mech</i>	n_{max} / rpm	6000			
Rated voltage	U_N / V	328	328	317	314
Stall torque	⁴⁾ M_0 / Nm	11.6	22	30	38.7
Current at stall torque	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 / Vpk/1000rpm	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 21: Technical data servo motors SE-CS-SP20

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-SP30			
Length		L2	L4	L6	L8
Cooling		Self-cooling			
Rated speed	n_N / rpm	3000			
Max. speed <i>Mech</i>	n_{max} / rpm	6000			
Rated voltage	U_N / V	326	322	317	313
Stall torque	⁴⁾ M_0 / Nm	11.6	22	30	38.7
Current at stall torque	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 (0rpm)	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 / Vpk/1000rpm	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 22: Technical data servo motors SE-CS-SP30

- 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).

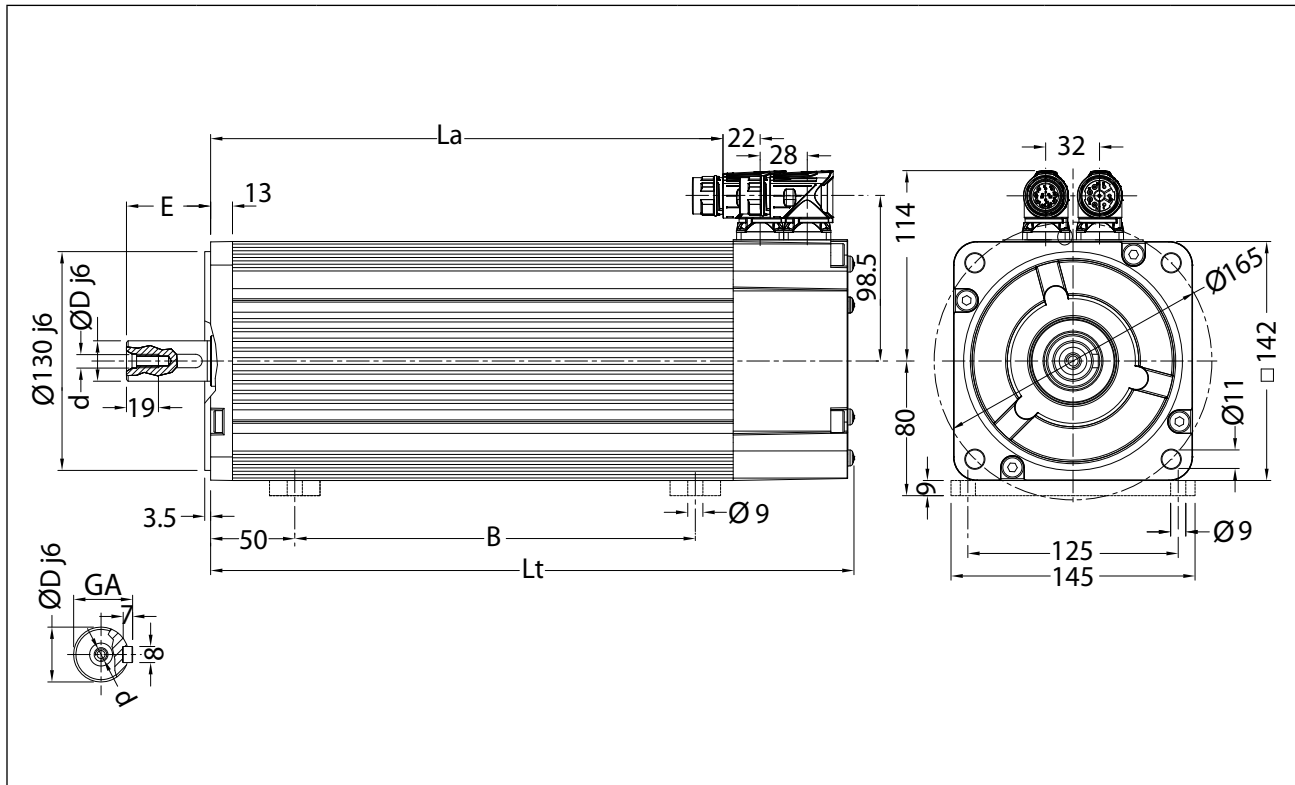
5.3.1 Technical data of the holding brake SE CS

Motor size		SE CS
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	5.9
Additional weight	¹⁾ m / kg	2.7

Table 23: Technical data of the holding brake SE CS

¹⁾ Additionally for the holding brake.

5.3.2 Dimensions servo motors SE CS



Motor size	Without brake			With brake			ØDxE	GA	d
	B	La	Lt	B	La	Lt			
SE CS L2	100	166	245	150	216	295	24x50	27	M8
SE CS L4	155	221	300	205	271	350			
SE CS L6	210	276	355	260	326	405			
SE CS L8	265	331	410	315	381	460	28x60	31	M10

All dimensions in mm.

Figure 16: Dimensions servo motors SE CS

5.4 Technical data servo motors SE CF

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			
Length		L2	L4	L6	L8
Cooling		Separate cooling			
Rated speed	n_N / rpm	1500			
Max. speed <i>Mech</i>	n_{max} / rpm	6000			
Rated voltage	U_N / V	357	356	342	333
Stall torque	⁴⁾ M_0 / Nm	15.4	31	42	54
Current at stall torque	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 (0 rpm)	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 _{pk} /1000rpm	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 24: Technical data servo motors SE-CF-SP15

- 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-SP20			
Length		L2	L4	L6	L8
Cooling		Separate cooling			
Rated speed	n_N / rpm	2000			
Max. speed <i>Mech</i>	n_{max} / rpm	6000			
Rated voltage	U_N / V	349	346	333	327
Stall torque	⁴⁾ M_0 / Nm	15.4	31	42	54
Current at stall torque	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 (0rpm)	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 / Vpk/1000rpm	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 25: Technical data servo motors SE-CF-SP20

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			
Length		L2	L4	L6	L8
Cooling		Separate cooling			
Rated speed	n_N / rpm	3000			
Max. speed <i>Mech</i>	n_{max} / rpm	6000			
Rated voltage	U_N / V	338	336	330	324
Stall torque	⁴⁾ M_0 / Nm	15.4	31	42	54
Current at stall torque	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 / Vpk/1000rpm	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 26: Technical data servo motors SE-CF-SP30

- 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).

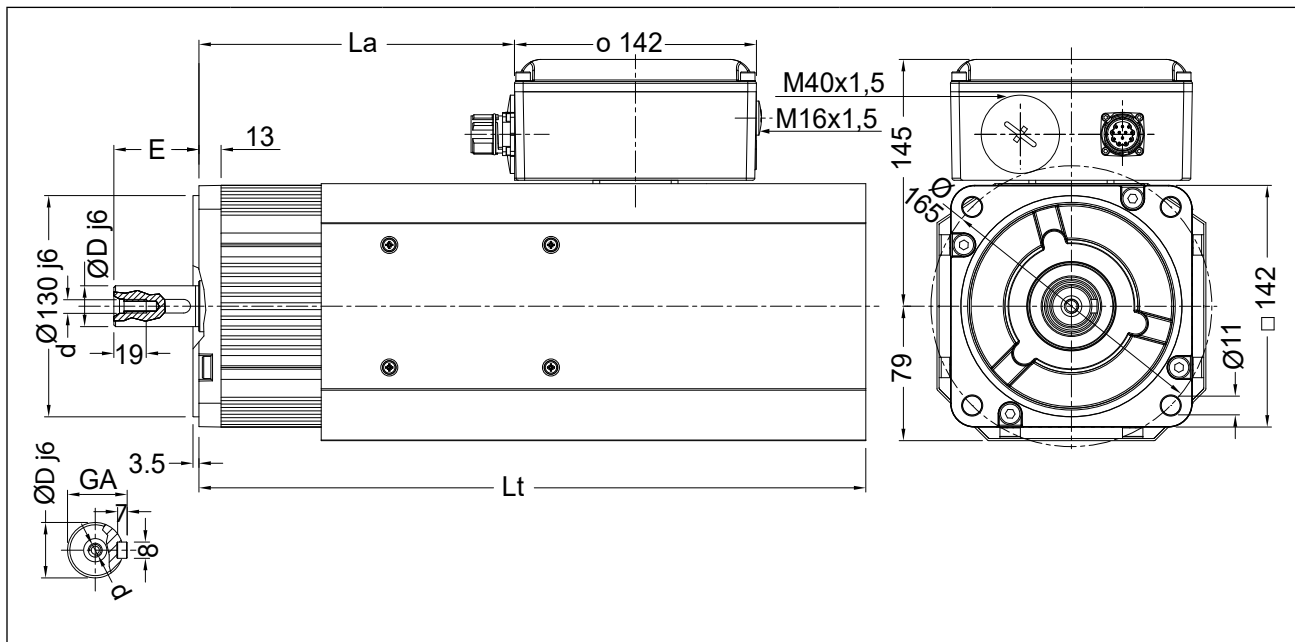
5.4.1 Technical data of the holding brake SE CF

Motor size		SE CF
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	5.9
Additional weight	¹⁾ m / kg	3.2

Table 27: Technical data of the holding brake SE CF

¹⁾ Additionally for the holding brake.

5.4.2 Dimensions servo motors SE CF



Motor size	Without brake		With brake		ØDxE	GA	d
	La	Lt	La	Lt			
SE CF L2	130	340	180	390	24x50	27	M8
SE CF L4	185	395	235	445			
SE CF L6	240	450	290	500			
SE CF L8	295	505	345	555	28x60	31	M10

All dimensions in mm.

Figure 17: Dimensions servo motors SE CF

5.5 Technical data servo motors SF CS

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			
Length		L2	L4	L6	L8
Cooling		Self-cooling			
Rated speed	n_N / rpm	1000			
Max. speed <i>Mech</i>	n_{max} / rpm	6000			
Rated voltage	U_N / V	351	302	321	308
Stall torque	⁴⁾ M_0 / Nm	33	60	82	102
Current at stall torque	⁴⁾ I_0 / A	6.7	13.6	17	21.7
Rated power	⁴⁾ P_N / kW	3.3	5.9	7.5	9.4
Rated current	⁴⁾ I_N / A	6.7	13.1	15.3	19.7
Rated torque	⁴⁾ M_N / Nm	31.5	56	72	90
Torque constant (0 rpm)	²⁾ k_M / Nm/A	5.03	4.57	5.03	4.88
Max. torque (ΔT 105 °C)	M_{max} / Nm	82	154	224	271
Max. current	I_{max} / A	18.4	37.9	49.9	62.4
Inertia	³⁾ J_L / kgcm ²	49	89	128	167
Voltage constant (20 °C)	²⁾ k_e / V _{pk} /1000rpm	304	276	304	295
Winding resistance	²⁾ R_{u-v} / Ω	4.86	1.34	0.9	0.62
Winding inductance	²⁾ L_{u-v} / mH	47.8	19.8	15.9	11.2
Weight	³⁾ m / kg	30	43	54	68
Number of pole pairs	p	4			
Rated motor frequency	f / Hz	66.66			

Table 28: Technical data servo motors SF-CS-SP10

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-CS-SP20			
Length		L2	L4	L6	L8
Cooling		Self-cooling			
Rated speed	n_N / rpm	2000			
Max. speed <i>Mech</i>	n_{max} / rpm	6000			
Rated voltage	U_N / V	300	307	281	297
Stall torque	⁴⁾ M_0 / Nm	33	60	82	102
Current at stall torque	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 / Vpk/1000rpm	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 29: Technical data servo motors SF-CS-SP20

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			
Length		L2	L4	L6	L8
Cooling		Self-cooling			
Rated speed	n_N / rpm	3000			
Max. speed <i>Mech</i>	n_{max} / rpm	6000			
Rated voltage	U_N / V	322	281	331	329
Stall torque	⁴⁾ M_0 / Nm	33	60	82	102
Current at stall torque	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 (0rpm)	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 / Vpk/1000rpm	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 30: Technical data servo motors SF-CS-SP30

- 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).

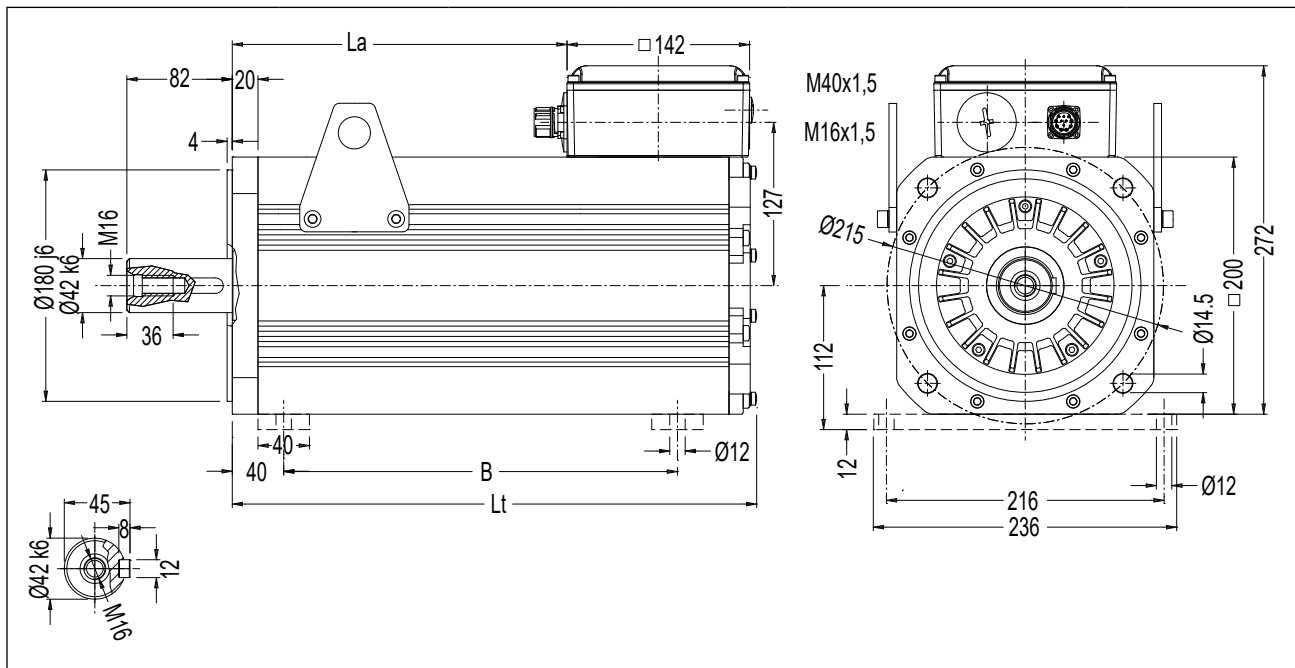
5.5.1 Technical data of the holding brake SF CS

Motor size		SF CS
Holding torque at 100 °C	M_{Br} / Nm	130
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	60
Additional weight	¹⁾ m / kg	11

Table 31: Technical data of the holding brake SF CS

¹⁾ Additionally for the holding brake.

5.5.2 Dimensions servo motors SF CS



Motor size	Without brake			With brake		
	B	La	Lt	B	La	Lt
SF CS L2	156	110	259	276	230	379
SF CS L4	231	185	333	351	305	453
SF CS L6	306	260	408	426	380	528
SF CS L8	380	334	483	500	454	603

All dimensions in mm.

Figure 18: Dimensions servo motors SF CS

5.6 Technical data servo motors SF CF

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			
Length		L2	L4	L6	L8
Cooling		Separate cooling			
Rated speed	n_N / rpm	1000			
Max. speed <i>Mech</i>	n_{max} / rpm	6000			
Rated voltage	U_N / V	380	332	355	338
Stall torque	⁴⁾ M_0 / Nm	45	89	130	163
Current at stall torque	⁴⁾ I_0 / A	9.3	20.2	26.9	34.7
Rated power	⁴⁾ P_N / kW	4.5	9.1	13	16.1
Rated current	⁴⁾ I_N / A	9.1	20.4	26.4	33.8
Rated torque	⁴⁾ M_N / Nm	42.7	87	124	154
Torque constant (0 rpm)	²⁾ k_M / Nm/A	5.03	4.57	5.03	4.88
Max. torque (ΔT 105 °C)	M_{max} / Nm	93	203	280	373
Max. current	I_{max} / A	21.9	52.4	65.6	90.2
Inertia	³⁾ J_L / kgcm ²	49	89	128	167
Voltage constant (20 °C)	²⁾ k_e / V _{pk} /1000rpm	304	276	304	295
Winding resistance	²⁾ R_{u-v} / Ω	4.86	1.34	0.9	0.62
Winding inductance	²⁾ L_{u-v} / mH	47.8	19.8	15.9	11.2
Weight	³⁾ m / kg	37	49	64	78
Number of pole pairs	p	4			
Rated motor frequency	f / Hz	66.66			

Table 32: Technical data servo motors SF-CF-SP10

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			
Length		L2	L4	L6	L8
Cooling		Separate cooling			
Rated speed	n_N / rpm	2000			
Max. speed <i>Mech</i>	n_{max} / rpm	6000			
Rated voltage	U_N / V	321	336	308	322
Stall torque	⁴⁾ M_0 / Nm	45	89	130	163
Current at stall torque	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 / Vpk/1000rpm	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 33: Technical data servo motors SF-CF-SP20

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			
Length		L2	L4	L6	L8
Cooling		Separate cooling			
Rated speed	n_N / rpm	3000			
Max. speed <i>Mech</i>	n_{max} / rpm	6000			
Rated voltage	U_N / V	346	306	360	351
Stall torque	⁴⁾ M_0 / Nm	45	89	130	163
Current at stall torque	⁴⁾ I_0 / A	27.9	60.7	73.9	92.7
Rated power	⁴⁾ P_N / kW	13.5	25.1	34.9	43
Rated current	⁴⁾ I_N / A	27.4	56.1	64.9	80.1
Rated torque	⁴⁾ M_N / Nm	43	80	111	137
Torque constant (0rpm)	²⁾ k_M / Nm/A	1.68	1.52	1.83	1.83
Max. torque (ΔT 105 °C)	M_{max} / Nm	93	205	280	374
Max. current	I_{max} / A	65.6	157	180	241
Inertia	³⁾ J_L / kgcm ²	49	89	128	167
Voltage constant (20°C)	²⁾ k_e / Vpk/1000rpm	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	1.5
Weight	³⁾ m / kg	37	49	64	78
Number of pole pairs	p	4			
Rated motor frequency	f / Hz	200			

Table 34: Technical data servo motors SF-CF-SP30

- 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).

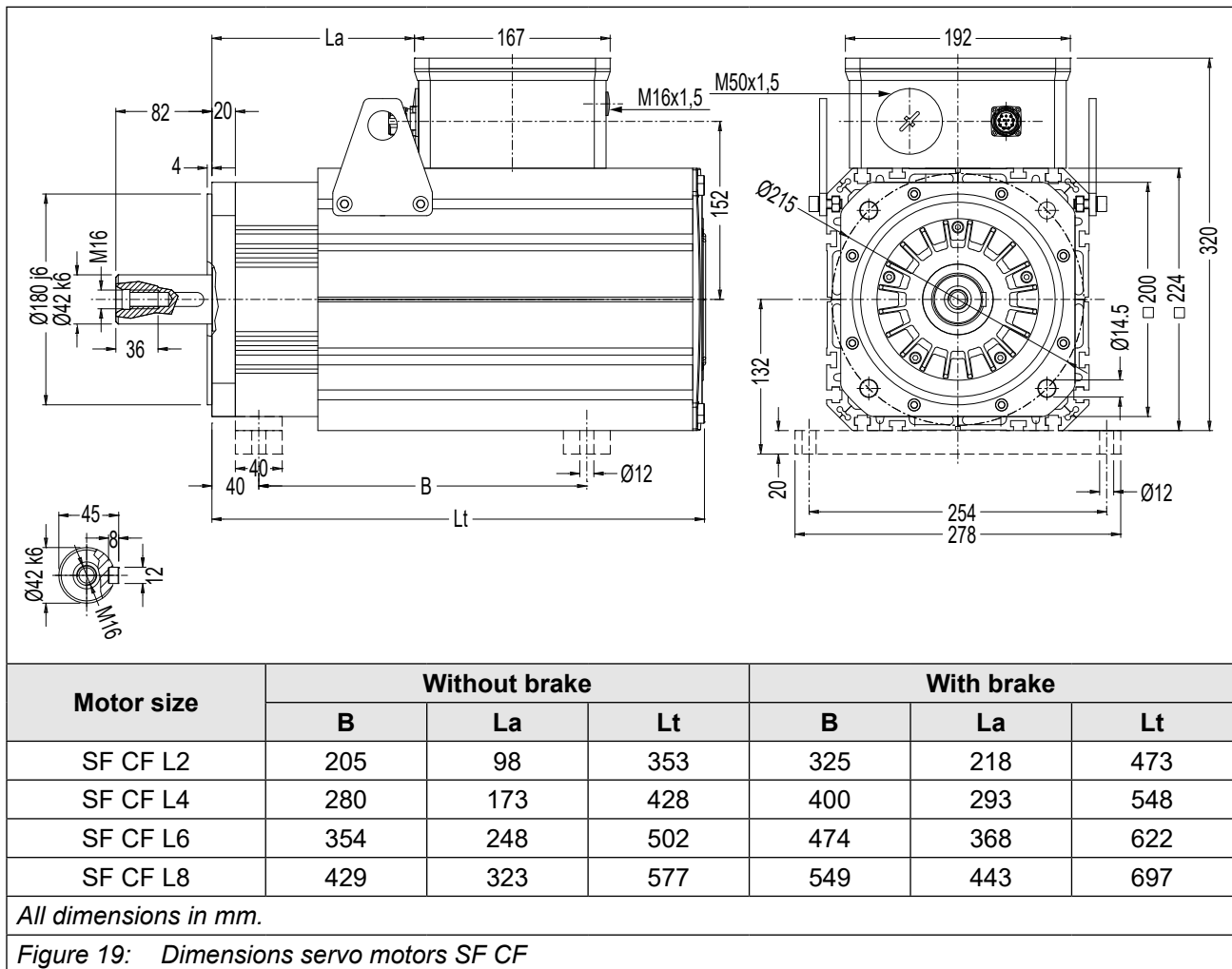
5.6.1 Technical data of the holding brake SF CF

Motor size		SF CF
Holding torque at 100 °C	M_{Br} / Nm	130
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	60
Additional weight	¹⁾ m / kg	13

Table 35: Technical data of the holding brake SF CF

¹⁾ Additionally for the holding brake.

5.6.2 Dimensions servo motors SF CF



5.7 Technical data servo motors SG CS

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			
Length		L2	L4	L6	L8
Cooling		Self-cooling			
Rated speed	n_N / rpm	1000			
Max. speed <i>Mech</i>	n_{max} / rpm	6000/4500 ¹⁾			
Rated voltage	$\frac{2)}{3)} U_N$ / V	323	325	303	325
		355	344	321	339
Stall torque	$\frac{2) 4)}{3)} M_0$ / Nm	100	182	270	340
		153	270	400	493
Current at stall torque	$\frac{2) 4)}{3)} I_0$ / A	21.6	36.8	58.3	68.8
		33	54.7	86.4	99.8
Rated power	$\frac{2)}{3)} P_N$ / kW	9.7	15.7	21.5	28.3
		14.9	24.1	33.5	38.7
Rated current	$\frac{2)}{3)} I_N$ / A	21.6	32.7	47.6	58.8
		33	50.1	74.3	80.6
Rated torque	$\frac{2)}{3)} M_N$ / 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 _{pk} /1000rpm	297	317	297	317
Winding resistance	⁵⁾ R_{u-v} / Ω	0.82	0.31	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 36: Technical data servo motors SG-CS-SP10

- 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.

Motor size		SG-CS-SP20			
Length		L2	L4	L6	L8
Cooling		Self-cooling			
Rated speed		2000			
Max. speed <i>Mech</i>		6000/4500 ¹⁾			
Rated voltage	²⁾ ³⁾ U_N / V	330	311	345	326
		367	321	357	315
Stall torque	^{2) 4)} ³⁾ M_0 / Nm	100	182	270	340
		151	270	400	493
Current at stall torque	^{2) 4)} ³⁾ I_0 / A	40.5	73.7	97.2	137.7
		61	109.3	158.3	199.6
Rated power	²⁾ ³⁾ P_N / kW	15.9	23.7	24.1	27.2
		27.2	44	69.1	71.6
Rated current	²⁾ ³⁾ I_N / A	33.1	49.2	44.5	56.6
		56.6	91.4	127.7	148.9
Rated torque	²⁾ ³⁾ M_N / Nm	76	113	115	130
		130	210	330	342
Torque constant (0rpm)	⁵⁾ $k_M / Nm/A$	2.62	2.62	2.95	2.62
Max. torque ($\Delta T 105^\circ C$)	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⁾ $k_e / V_{pk}/1000rpm$	158	158	178	158
Winding resistance	⁵⁾ R_{u-v} / Ω	0.22	6.8	4.9	2.7
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 37: Technical data servo motors SG-CS-SP20

- 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 100rpm.
- 5) At 20 °C and tolerance $\pm 10\%$.
- 6) With encoder connection, without holding brake.

Motor size		SG-CS-SP30			
Length		L2	L4	L6	L8
Cooling		Self-cooling			
Rated speed		3000			
Max. speed <i>Mech</i>		6000/4500 ¹⁾			
Rated voltage	²⁾ ³⁾ U_N / V	358	344	341	341
		377	364	363	356
Stall torque	²⁾⁴⁾ ³⁾ M_0 / Nm	100	182	270	340
		151	270	400	493
Current at stall torque	²⁾⁴⁾ ³⁾ I_0 / A	54	98.2	143	183.5
		82	145.8	215.9	266.1
Rated power	²⁾ ³⁾ P_N / kW	18.8	14.1	— ⁵⁾	— ⁵⁾
		29.2	47.1	70.7	77
Rated current	²⁾ ³⁾ I_N / A	34.8	26.1	— ⁵⁾	— ⁵⁾
		54	87.1	130.6	142.2
Rated torque	²⁾ ³⁾ M_N / Nm	60	45	— ⁵⁾	— ⁵⁾
		93	150	225	245
Torque constant (0 rpm)	⁶⁾ $k_M / Nm/A$	1.96	1.96	1.96	1.96
Max. torque ($\Delta T 105^\circ C$)	M_{max} / Nm	147	259	378	456
Max. current	I_{max} / A	95.8	168	251	302
Inertia	⁷⁾ $J_L / kgcm^2$	224	401	577	753
Voltage constant (20°C)	⁶⁾ $k_e / Vpk/1000rpm$	119	119	119	119
Winding resistance	⁶⁾ R_{u-v} / Ω	0.12	3.79	2.19	1.49
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 38: Technical data servo motors SG-CS-SP30

- 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 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.

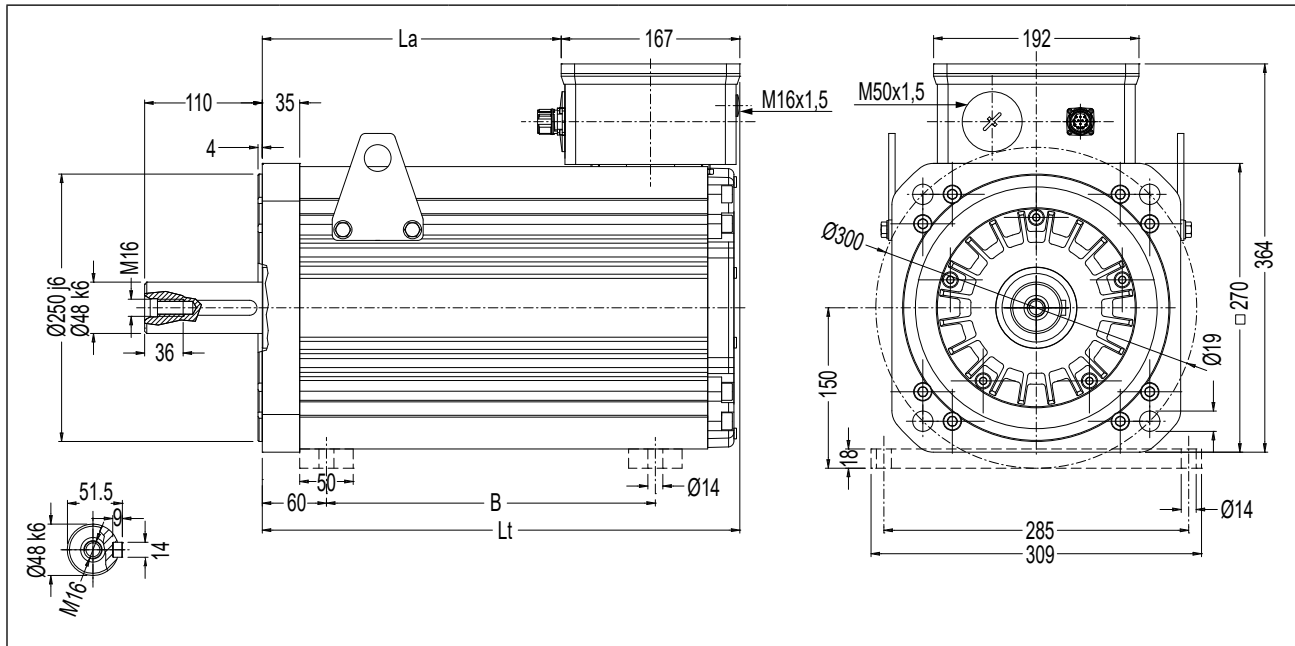
5.7.1 Technical data of the holding brake SG CS

Motor size		SG CS			
		L2	L4	L6	L8
Length					
Holding torque at 100 °C	M_{Br} / Nm	225		450	
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	15		120	
Brake release time	t_2 / ms	100		115	
Additional rotor inertia	¹⁾ J_{Br} / kgcm^2	84		149	
Additional weight	¹⁾ m / kg	33		39	

Table 39: Technical data of the holding brake SG CS

¹⁾ Additionally for the holding brake.

5.7.2 Dimensions servo motors SG CS (exclusive SG CS L8 SP30)

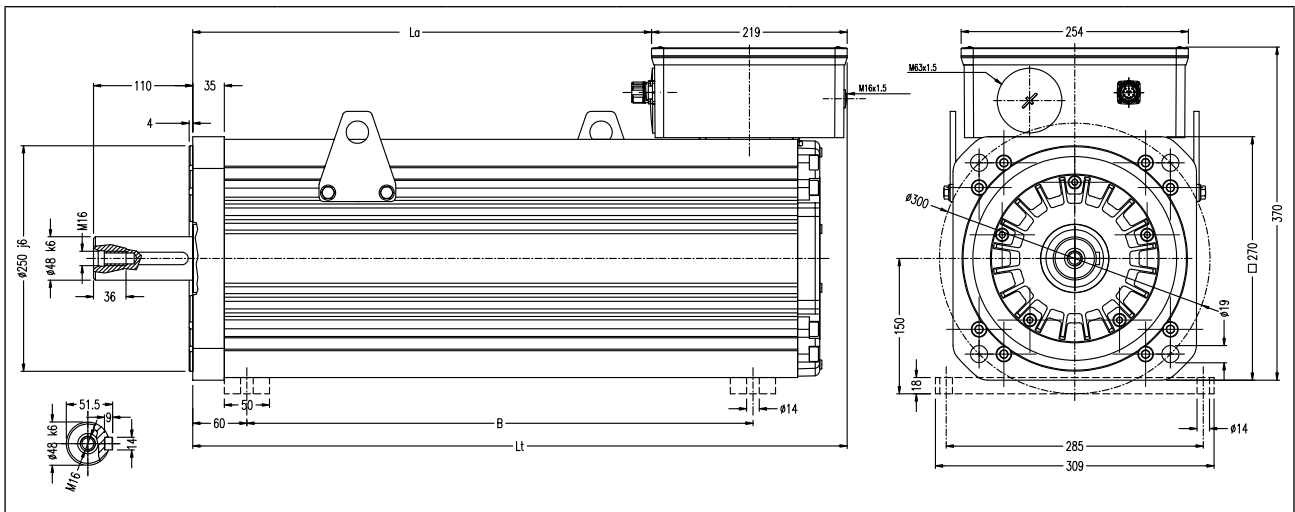


Motor size	Without brake			With brake		
	B	La	Lt	B	La	Lt
SG CS L2	200	172	340	335	307	475
SG CS L4	307	279	447	442	414	582
SG CS L6	414	386	554	549	521	689
SG CS L8	521	493	661	656	628	796

All dimensions in mm.

Figure 20: Dimensions servo motors SG CS (exclusive SG CS L8 SP30)

5.7.3 Dimensions servo motors SG CS L8 SP30



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 servo motors SG CS L8 SP30

5.8 Technical data servo motors SG CF

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			
Length		L2	L4	L6	L8
Cooling		Separate cooling			
Rated speed	n_N / rpm	1000			
Max. speed <i>Mech</i>	n_{max} / rpm	6000/4500 ¹⁾			
Rated voltage	U_N / V	356	360	336	366
Stall torque	⁵⁾ M_0 / Nm	145	310	440	580
Current at stall torque	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)	²⁾ 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	0.82	0.31	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 40: Technical data servo motors SG-CF-SP10

¹⁾ Only for motors with brake.

²⁾ Referring to 100 rpm.

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			
Length		L2	L4	L6	L8
Cooling		Separate cooling			
Rated speed		2000			
Max. speed <i>Mech</i>		6000/4500 ¹⁾			
Rated voltage	U_N / V	363	356	387	348
Stall torque	⁴⁾ M_0 / Nm	145	310	440	580
Current at stall torque	⁴⁾ I_0 / A	58.7	127.3	158.3	239.3
Rated power	⁴⁾ P_N / kW	26.2	54.5	73.3	98.4
Rated current	⁴⁾ I_N / A	54.4	110.2	135.5	204.7
Rated torque	⁴⁾ M_N / Nm	125	260	350	470
Torque constant (0 rpm)	²⁾ $k_M / Nm/A$	2.62	2.62	2.95	2.62
Max. torque ($\Delta T 105^\circ C$)	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⁾ $k_e / Vpk/1000rpm$	158	158	178	158
Winding resistance	³⁾ R_{u-v} / Ω	0.22	7	4.9	2.7
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 41: Technical data servo motors SG-CF-SP20

- 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.

Motor size		SG-CF-SP30			
Length		L2	L4	L6	L8
Cooling		Separate cooling			
Rated speed	n_N / rpm	2800			
Max. speed <i>Mech</i>	n_{max} / rpm	6000/4500 ¹⁾			
Rated voltage	U_N / V	368	363	353	341
Stall torque	⁵⁾ M_0 / Nm	145	300	440	580
Current at stall torque	⁵⁾ I_0 / A	78.3	161.9	237.5	313.1
Rated power	⁵⁾ P_N / kW	34.3	67.4	88	93.8
Rated current	⁵⁾ I_N / A	67.9	133.5	174.2	185.8
Rated torque	⁵⁾ M_N / Nm	117	230	300	320
Torque constant (0rpm)	²⁾ k_M / Nm/A	1.96	1.96	1.96	1.96
Max. torque (ΔT 105 °C)	M_{max} / Nm	267	526	658	772
Max. current	I_{max} / A	174	342	428	502
Inertia	⁴⁾ J_L / kgcm ²	224	401	577	753
Voltage constant (20°C)	³⁾ k_e / Vpk/1000rpm	119	119	119	119
Winding resistance	³⁾ R_{u-v} / Ω	0.12	3.79	2.19	1.49
Winding inductance	³⁾ L_{u-v} / mH	2.4	1.2	0.8	0.6
Weight	⁴⁾ m / kg	89	126	164	203
Number of pole pairs	p	4			
Rated motor frequency	f / Hz	186.7			

Table 42: Technical data servo motors SG-CF-SP30

- 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).

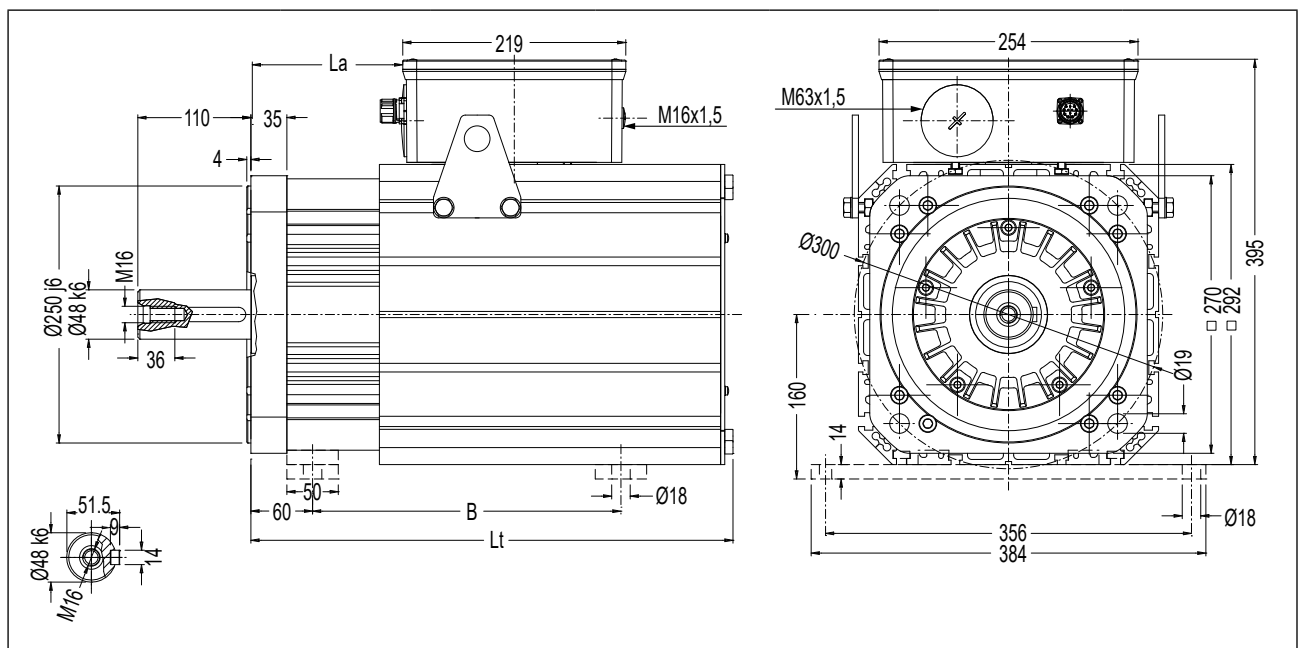
5.8.1 Technical data of the holding brake SG CF

Motor size		SG CF			
		L2	L4	L6	L8
Length					
Holding torque at 100 °C	M_{Br} / Nm	225		450	
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	15		120	
Brake release time	t_2 / ms	100		115	
Additional rotor inertia	¹⁾ J_{Br} / kgcm^2	84		149	
Additional weight	¹⁾ m / kg	37		43	

Table 43: Technical data of the holding brake SG CF

¹⁾ Additionally for the holding brake.

5.8.2 Dimensions servo motors SG CF (exclusive SG CF L8 SP30)

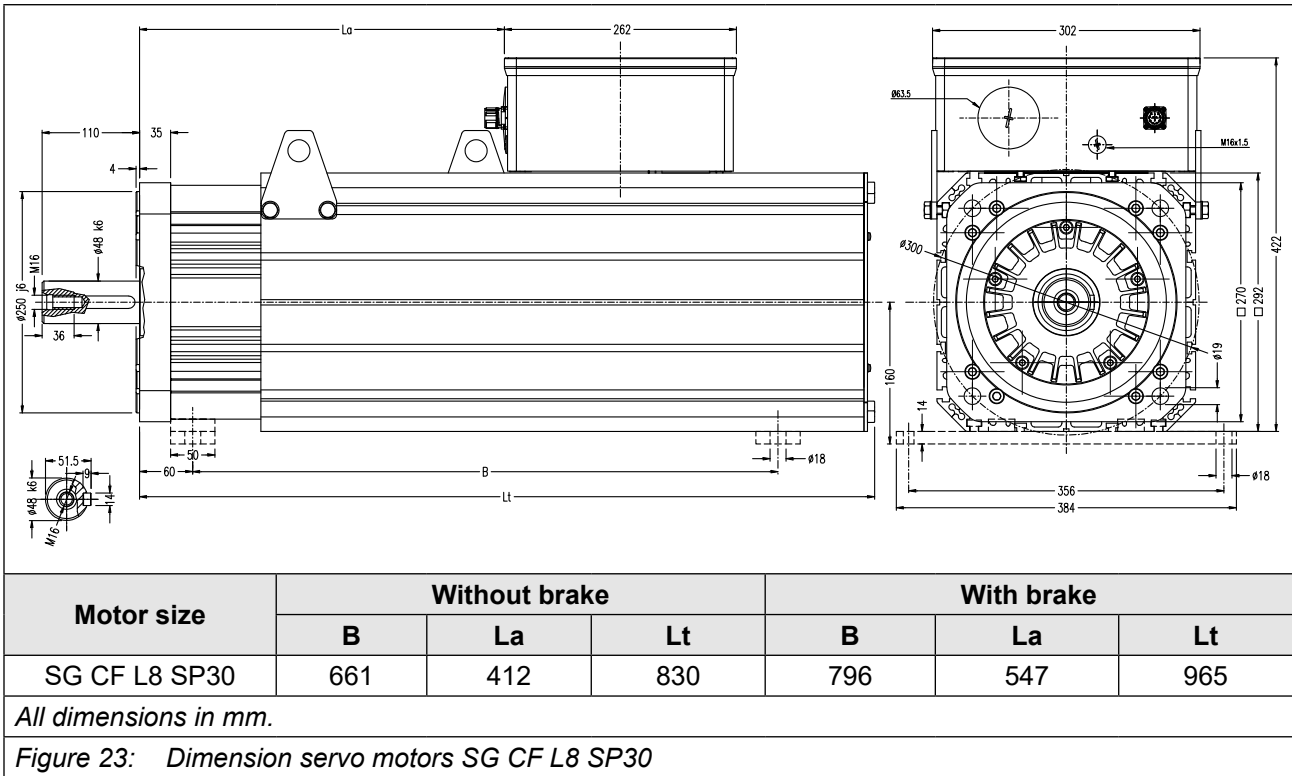


Motor size	Without brake			With brake		
	B	La	Lt	B	La	Lt
SG CF L2	300	146.5	470	435	281.5	605
SG CF L4	407	253.5	577	542	388.5	712
SG CF L6	514	360.5	684	649	495.5	819
SG CF L8	621	467.5	791	756	602.5	926

All dimensions in mm.

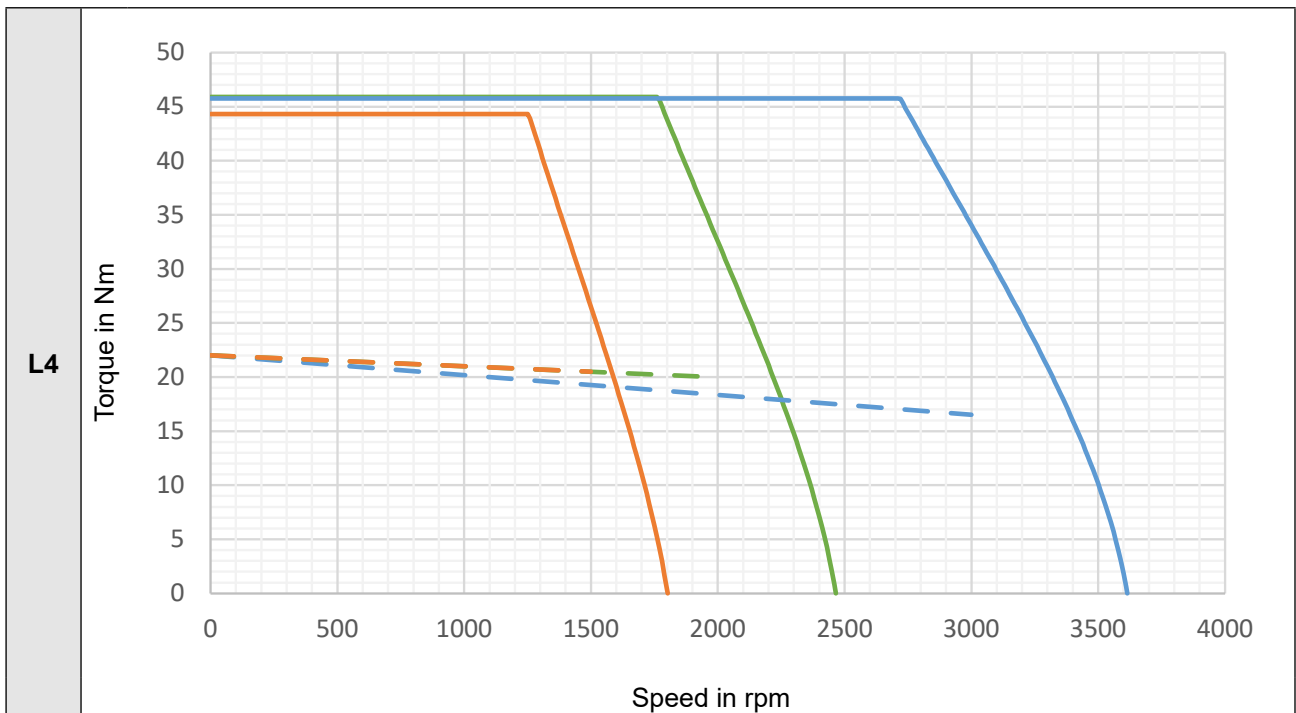
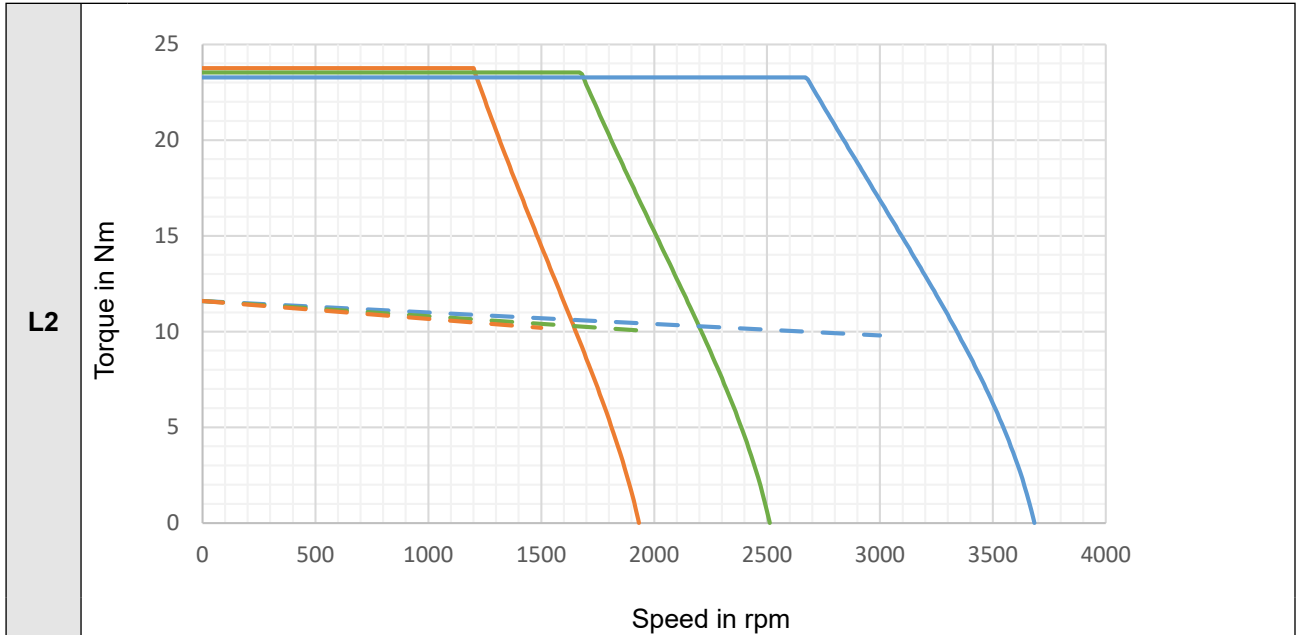
Figure 22: Dimensions servo motors SG CF (exclusive SG CF L8 SP30)

5.8.3 Dimension servo motors SG CF L8 SP30



5.9 Performance diagrams

5.9.1 Speed-torque characteristics for motor size SE CS



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

PERFORMANCE DIAGRAMS

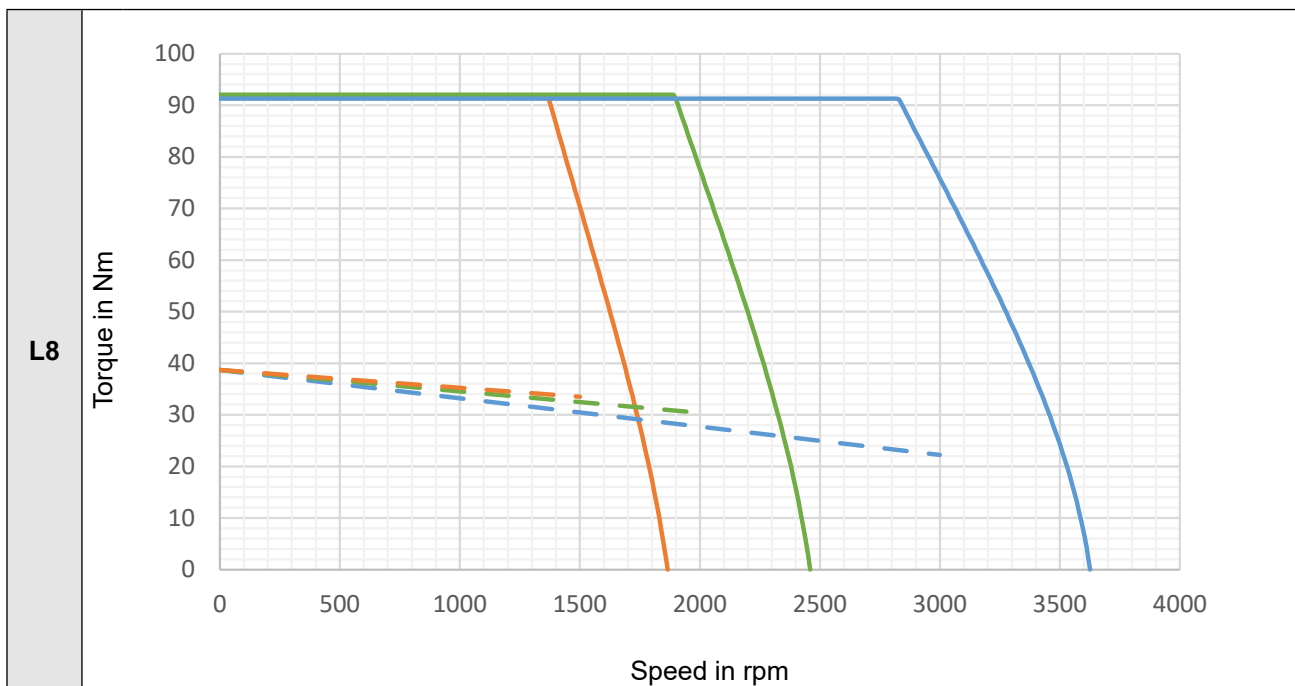
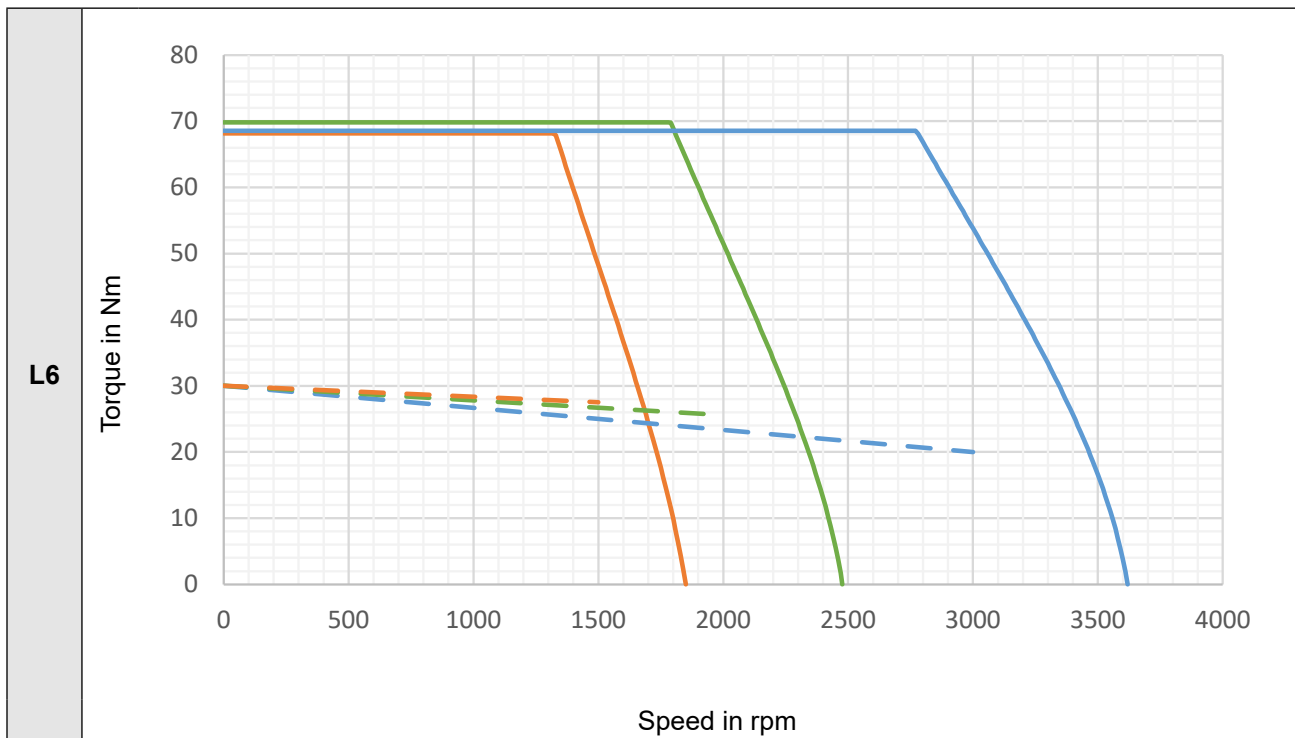
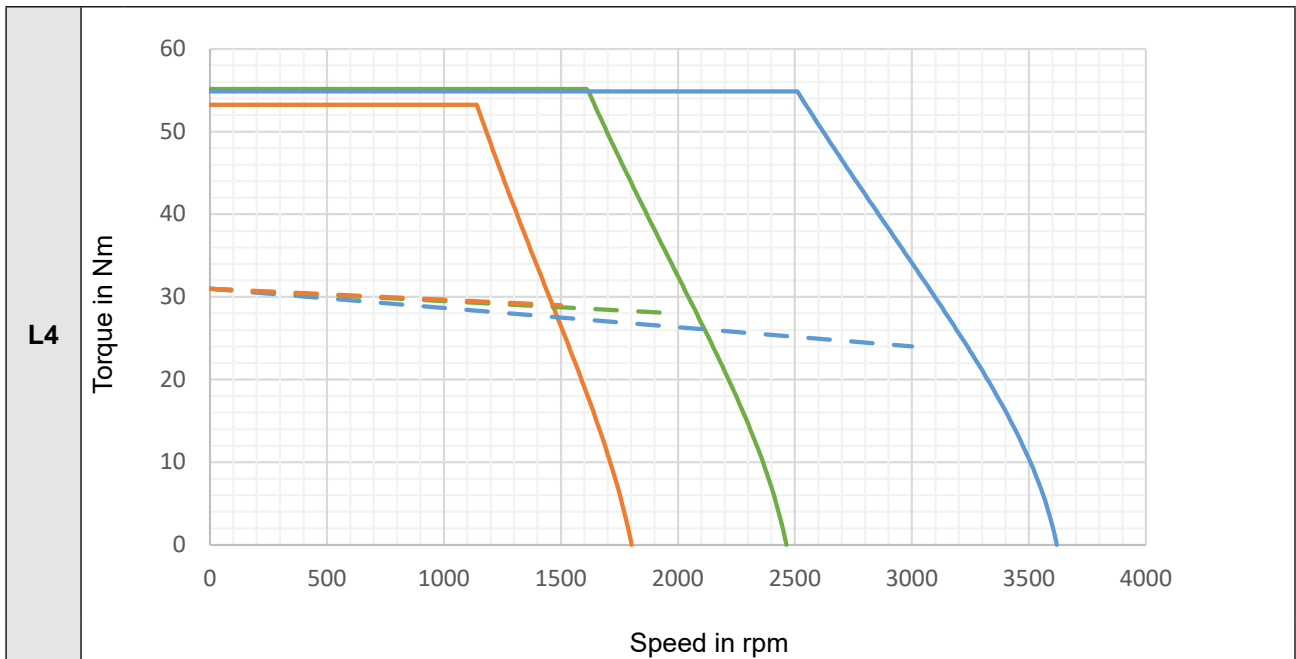
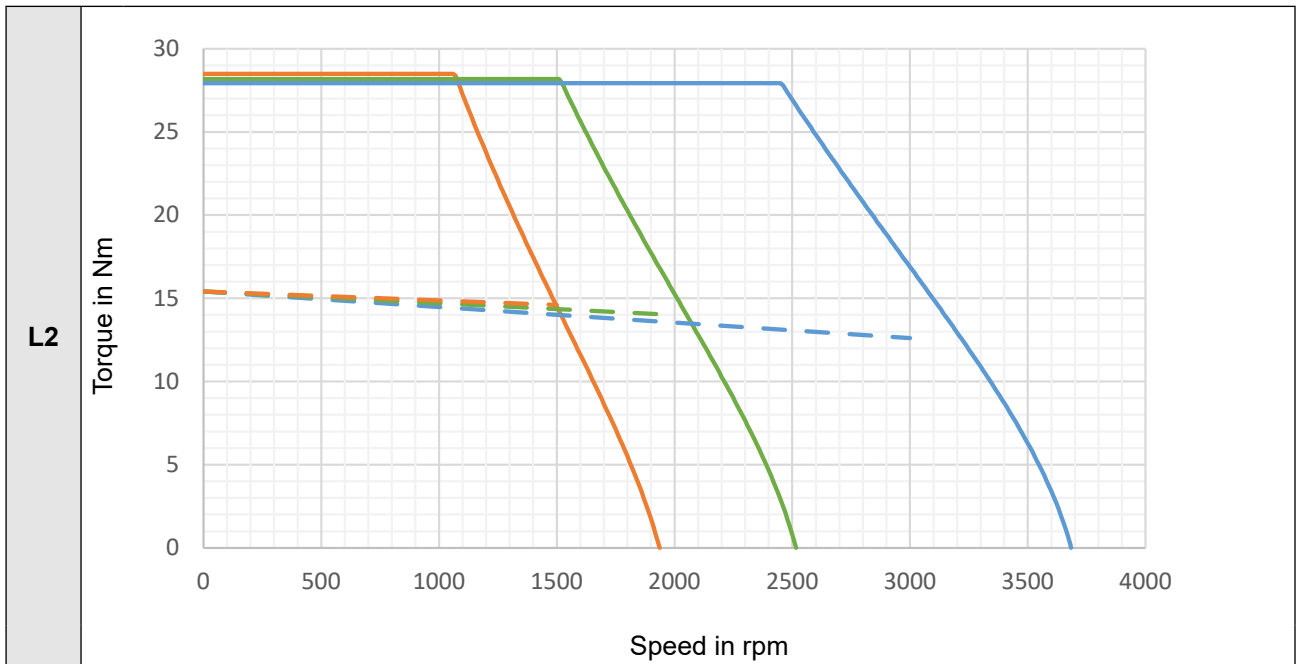


Figure 24: Speed-torque characteristics for motor size SE CS

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

5.9.2 Speed-torque characteristics for motor size SE CF



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

PERFORMANCE DIAGRAMS

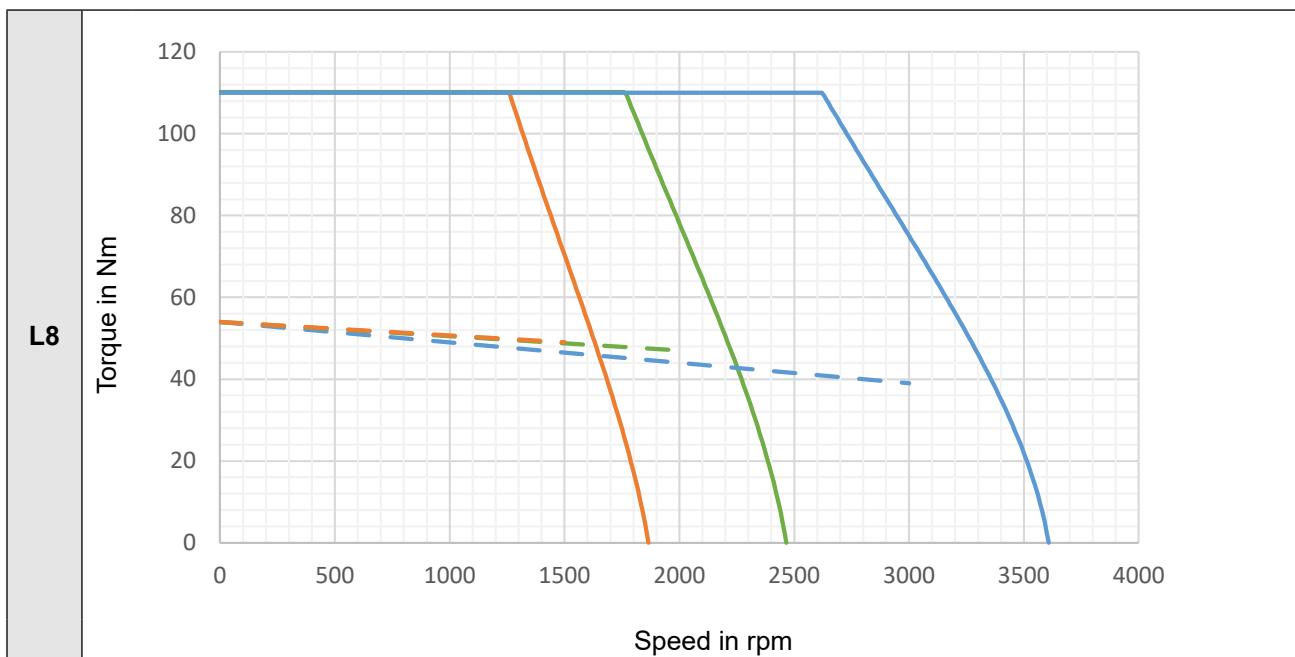
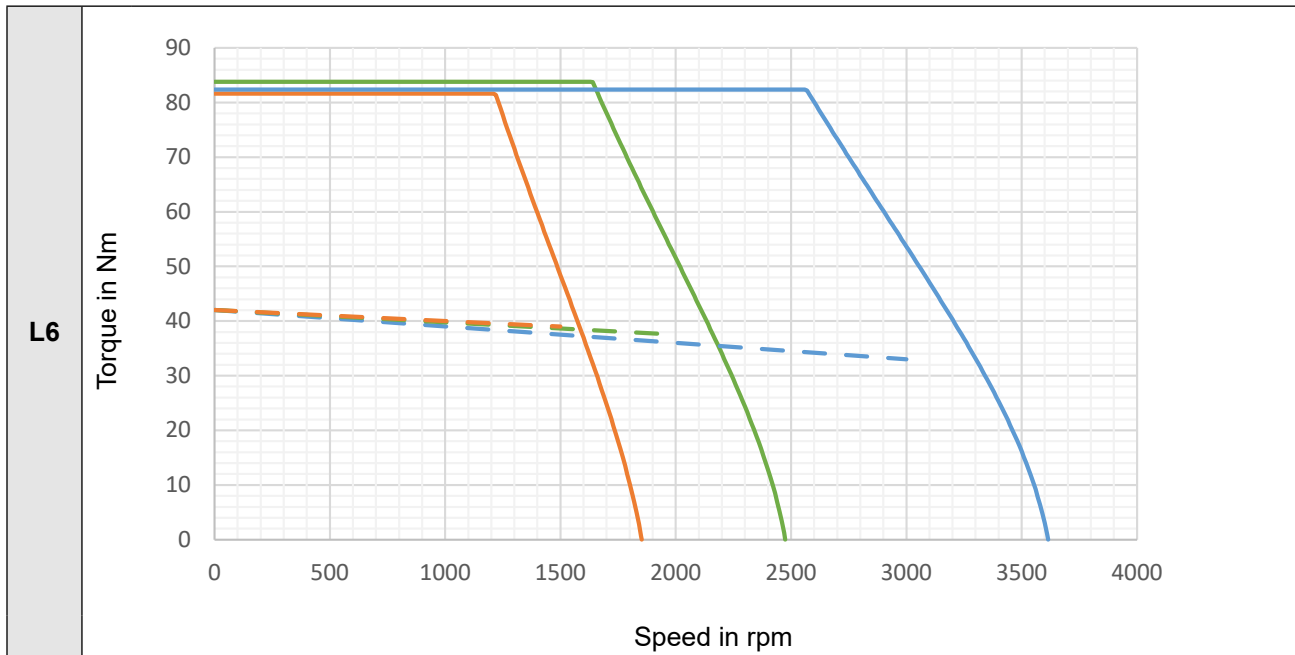
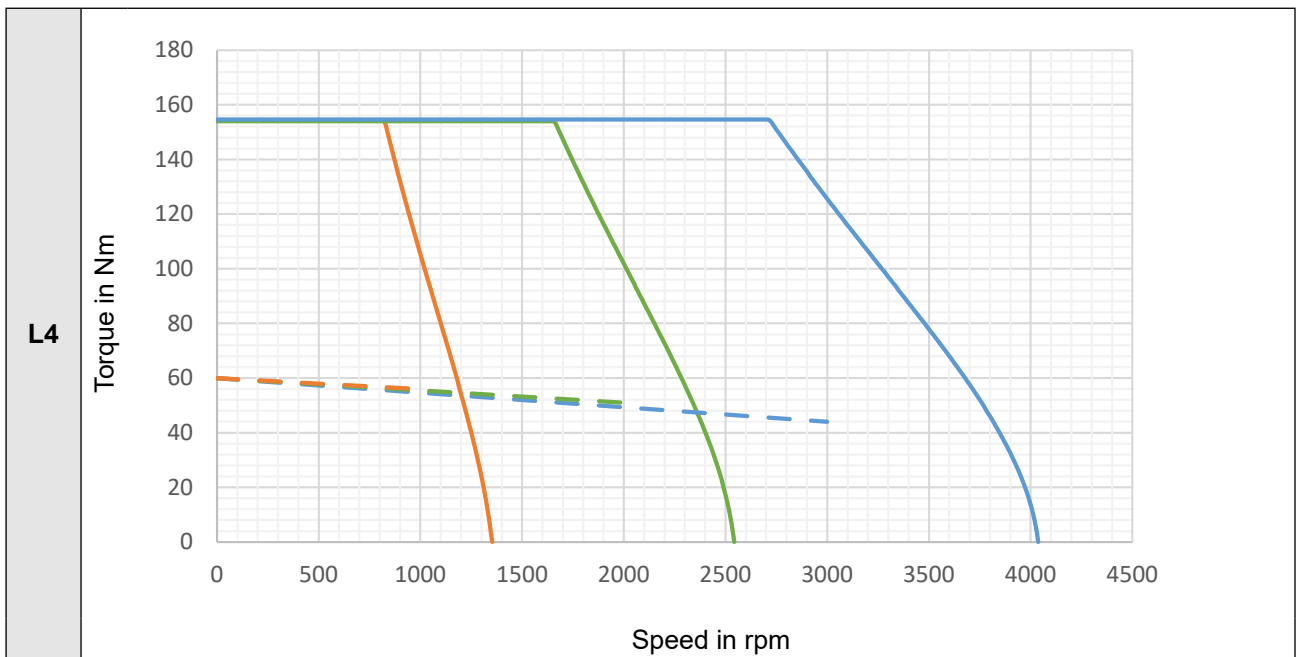
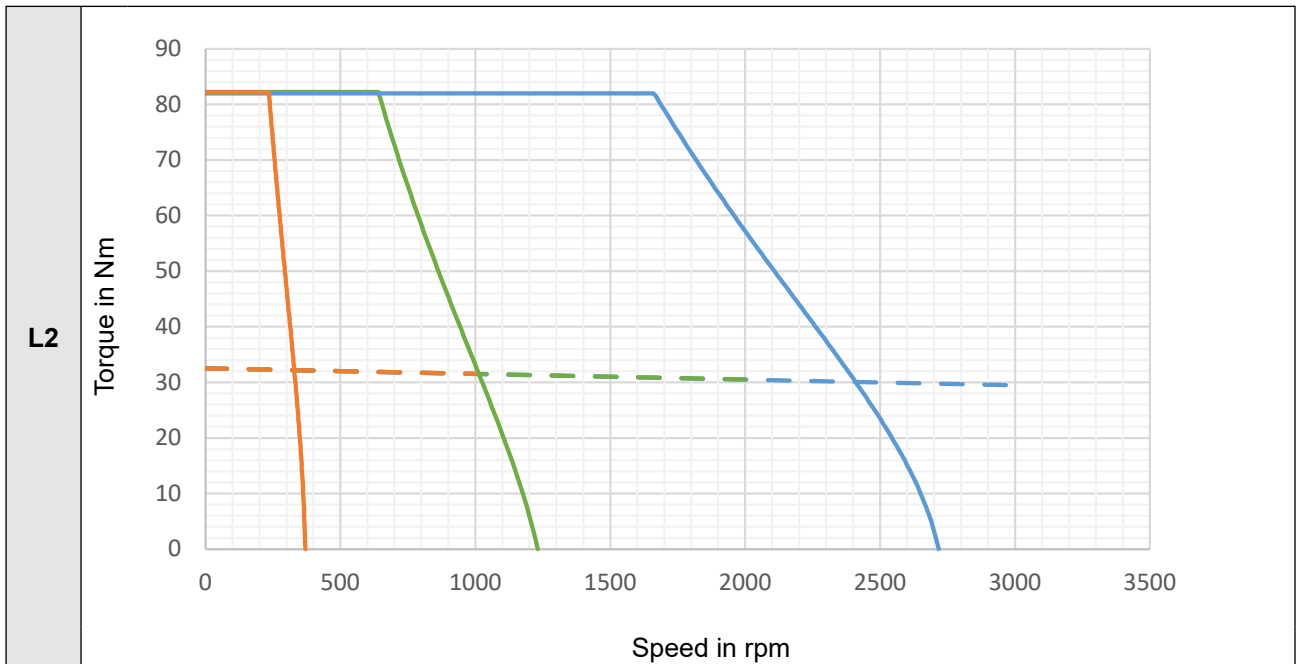


Figure 25: Speed-torque characteristics for motor size SE CF

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

5.9.3 Speed-torque characteristics for motor size SF CS



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

PERFORMANCE DIAGRAMS

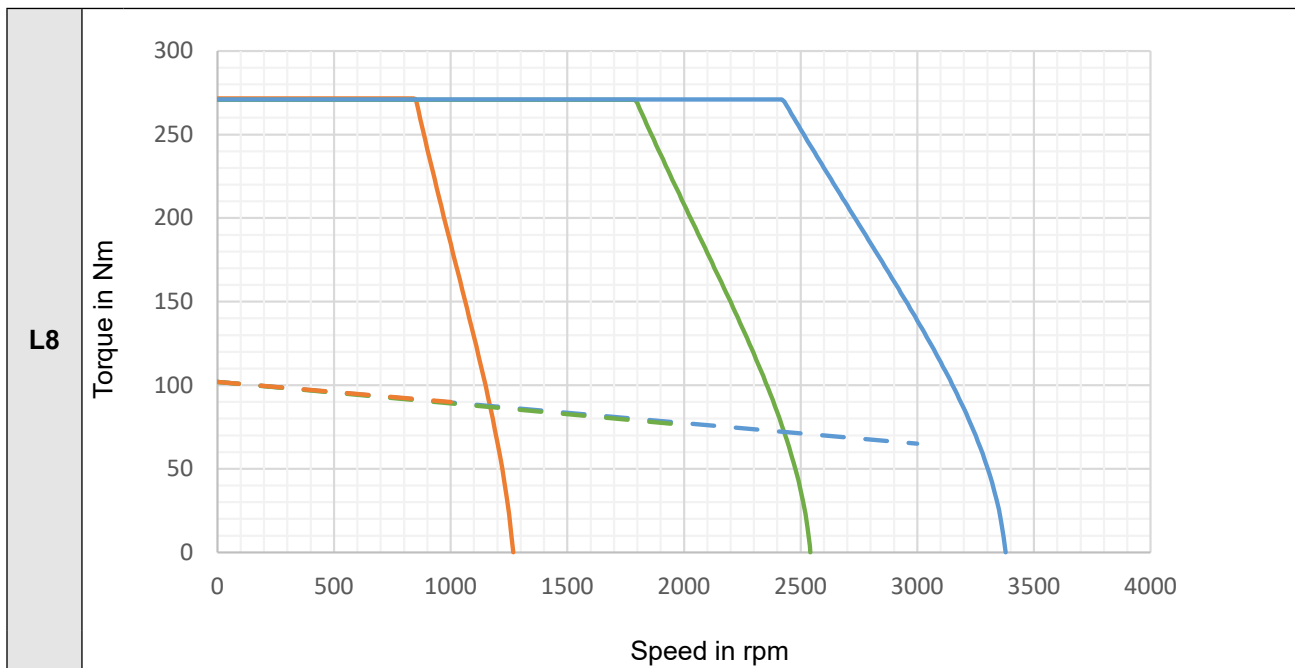
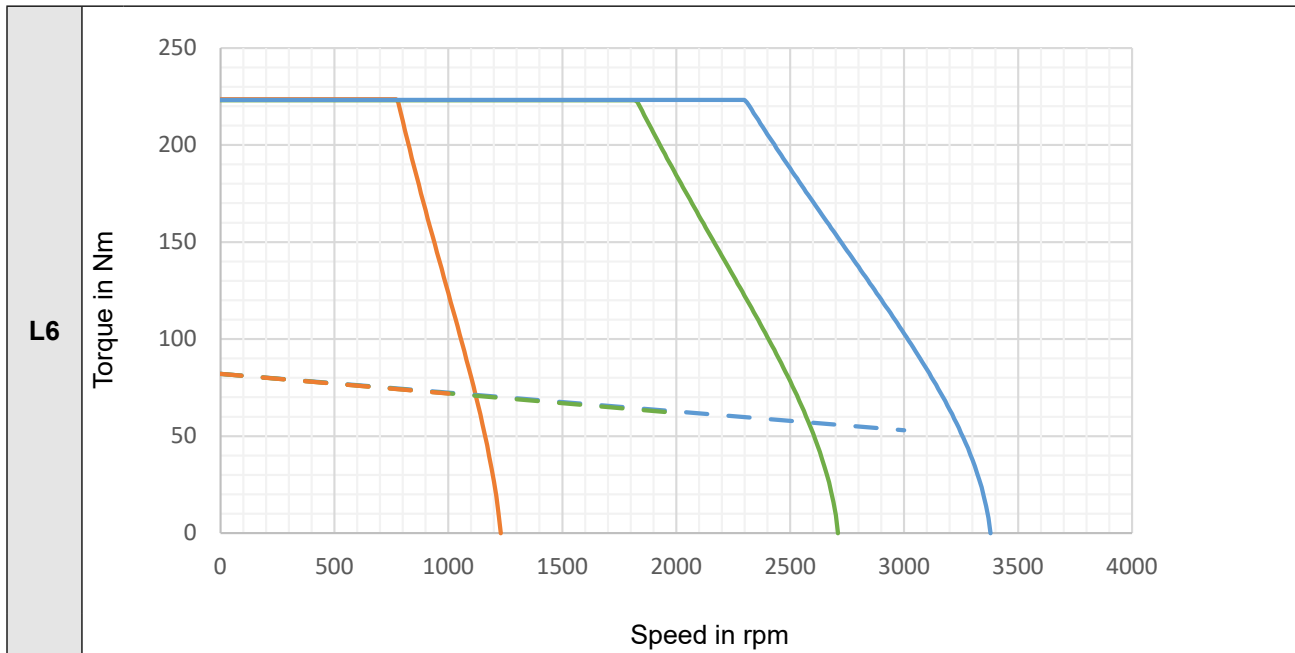
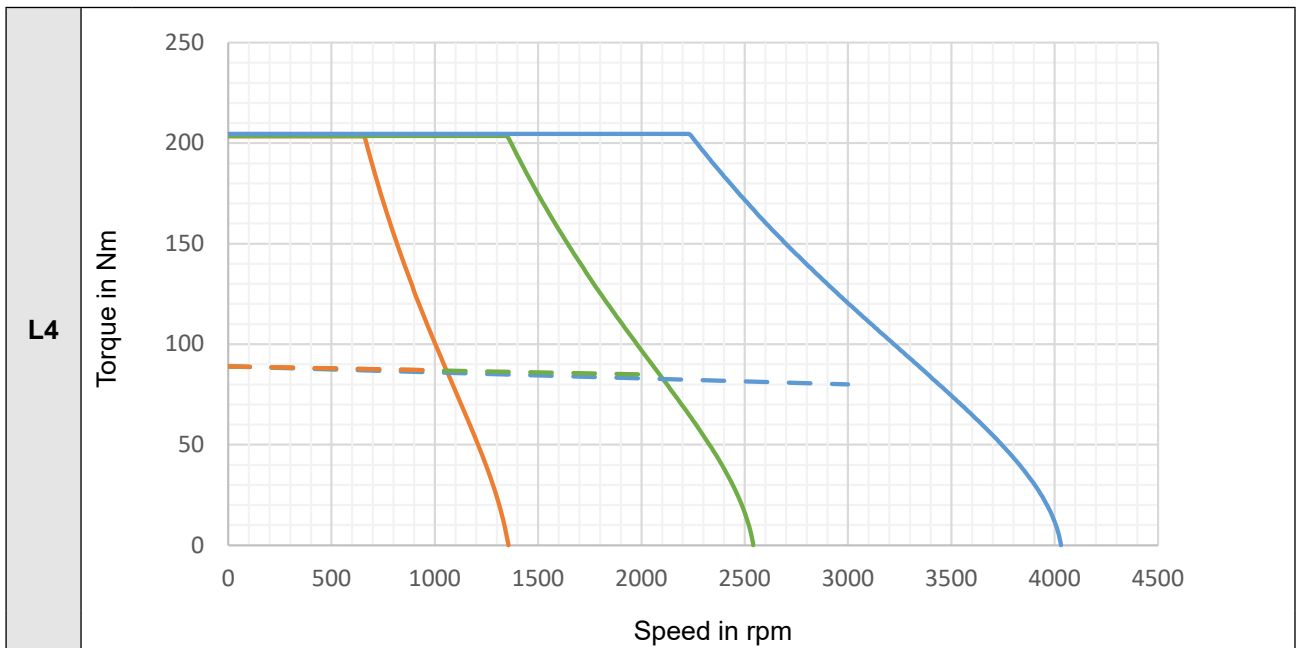
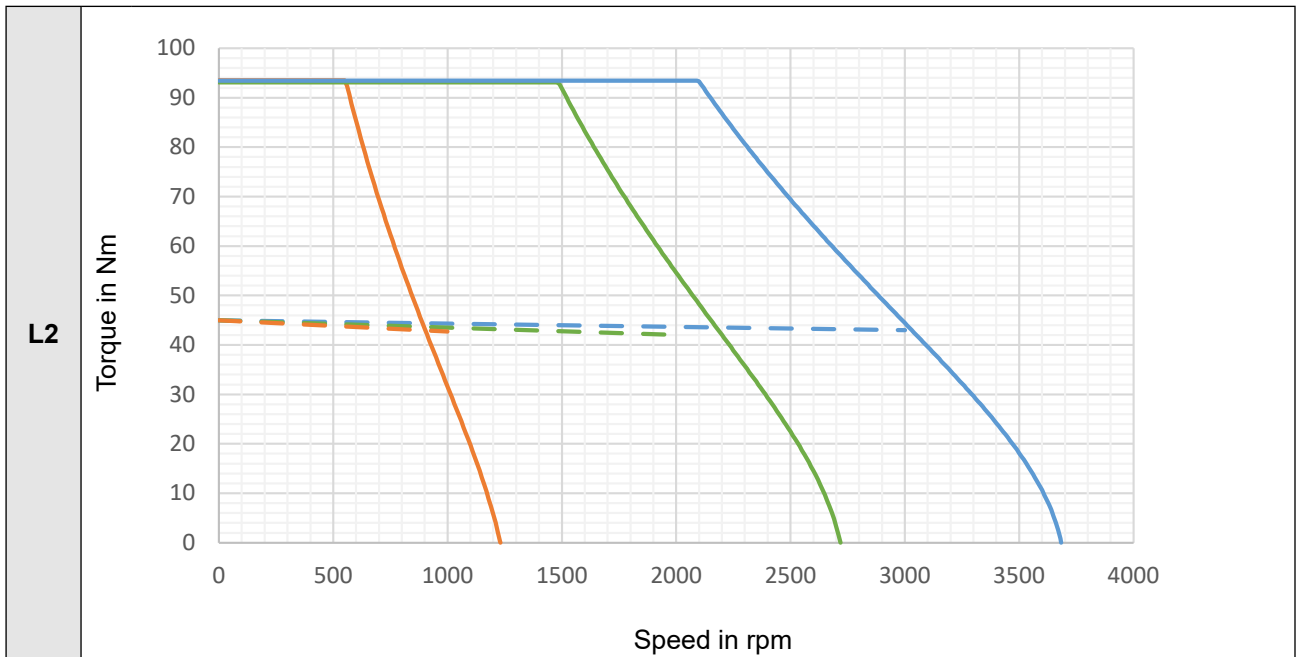


Figure 26: Speed-torque characteristics for motor size SF CS

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

5.9.4 Speed-torque characteristics for motor size SF CF



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

PERFORMANCE DIAGRAMS

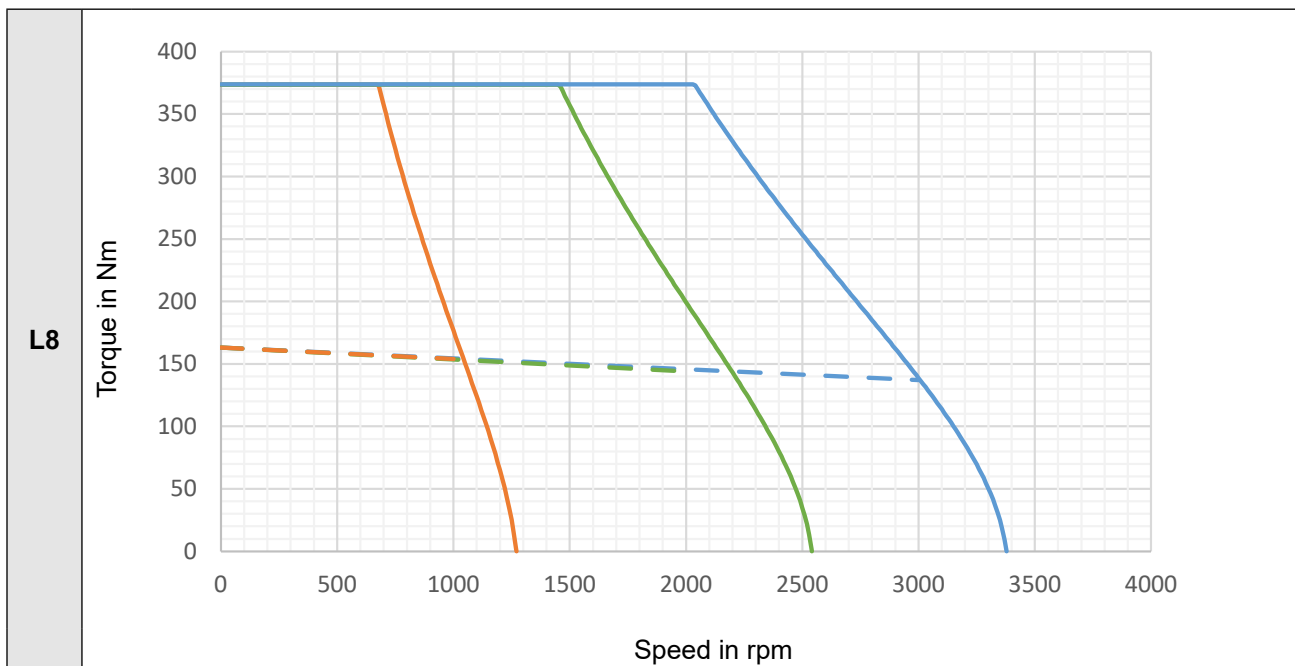
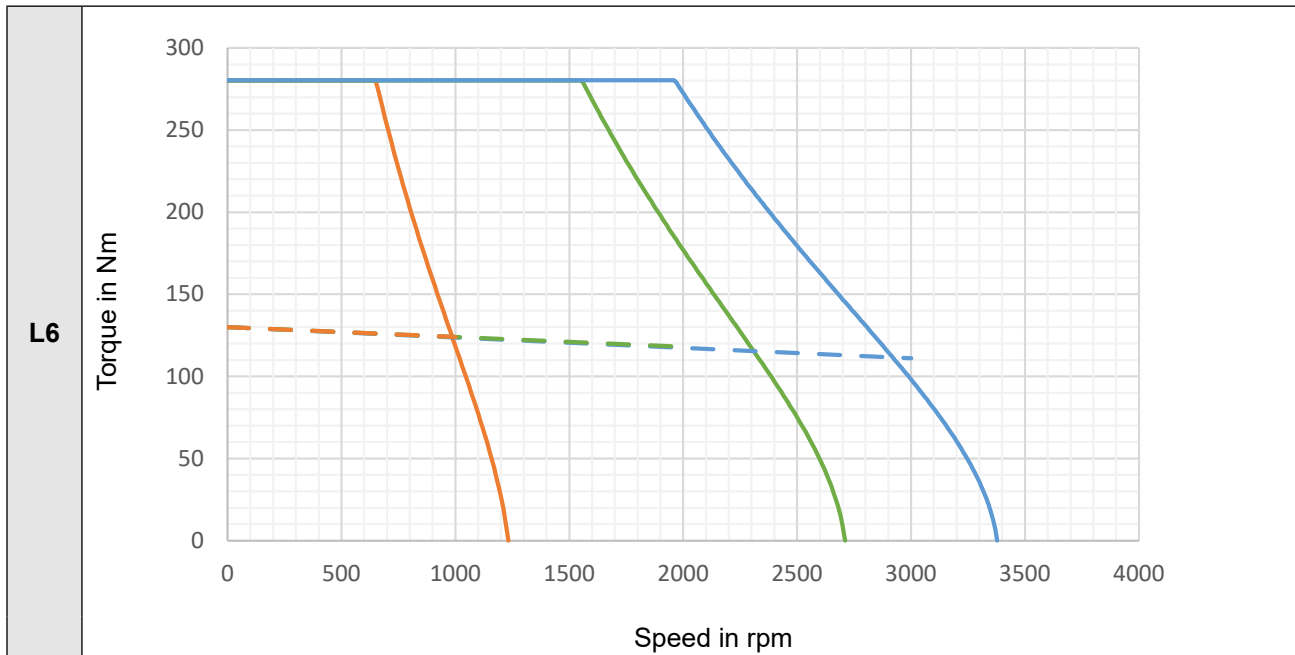
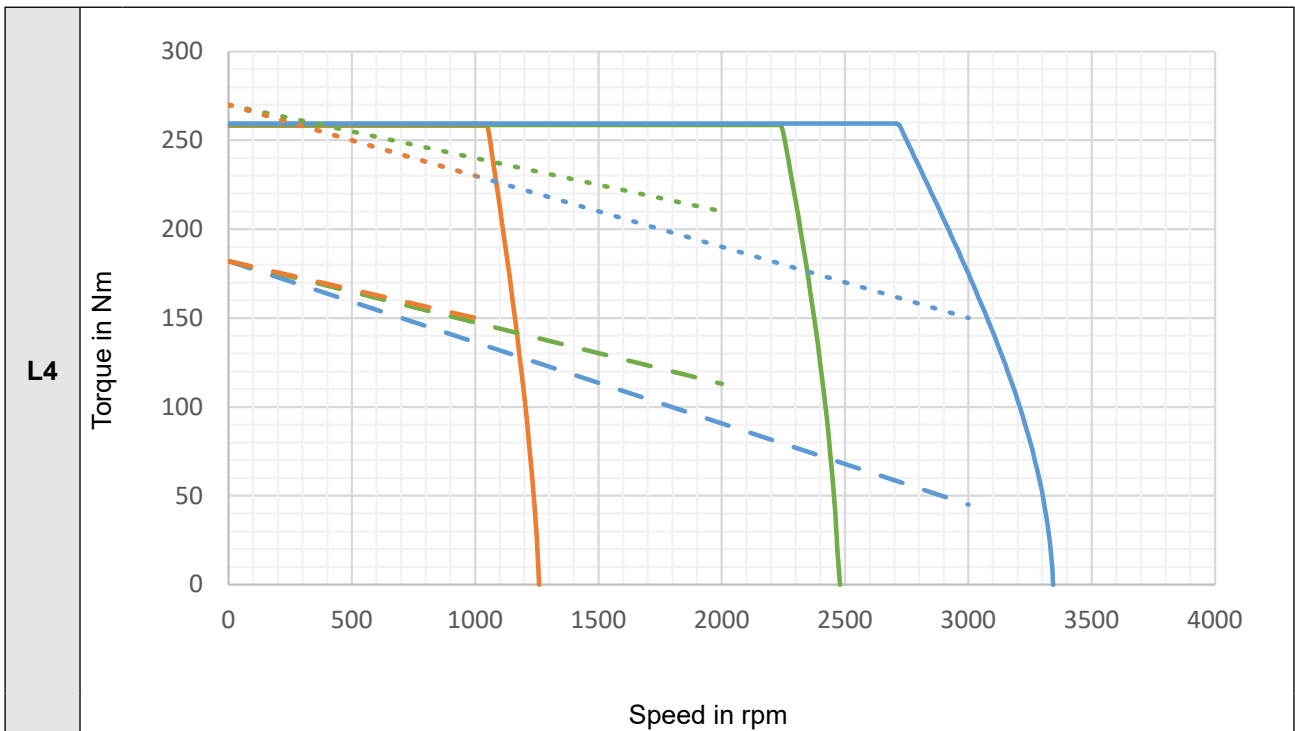
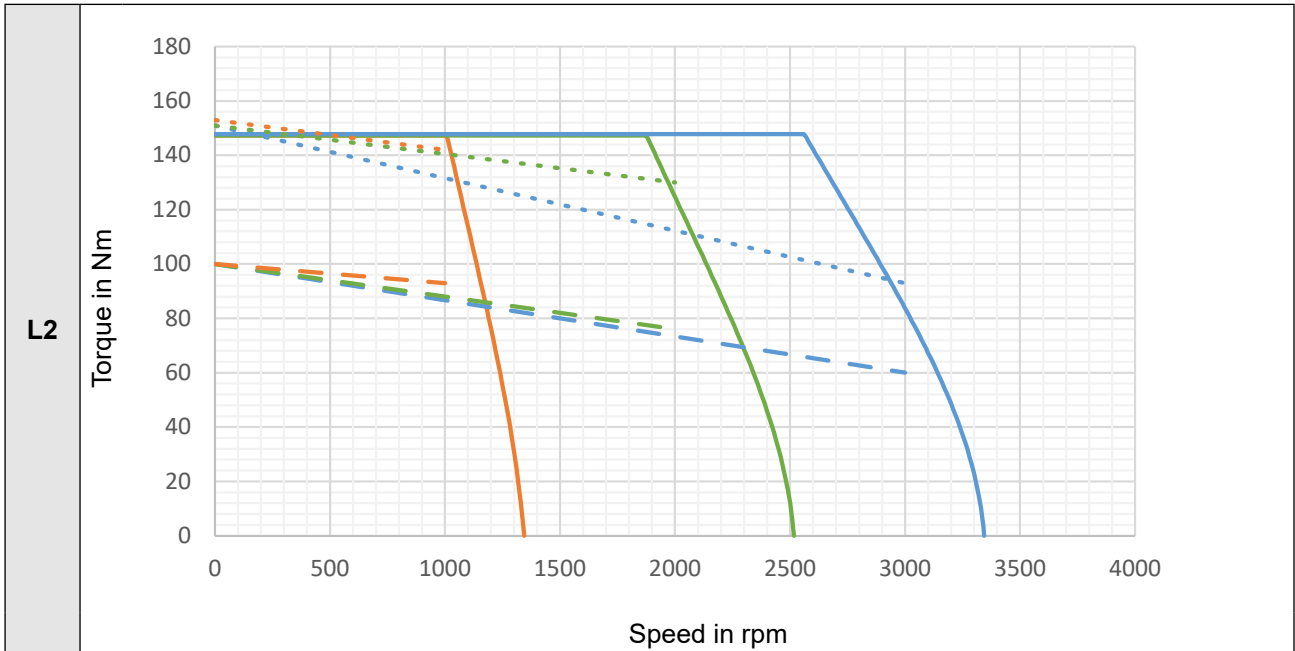


Figure 27: Speed-torque characteristics for motor size SF CF

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

5.9.5 Speed-torque characteristics for motor size SG CS



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

PERFORMANCE DIAGRAMS

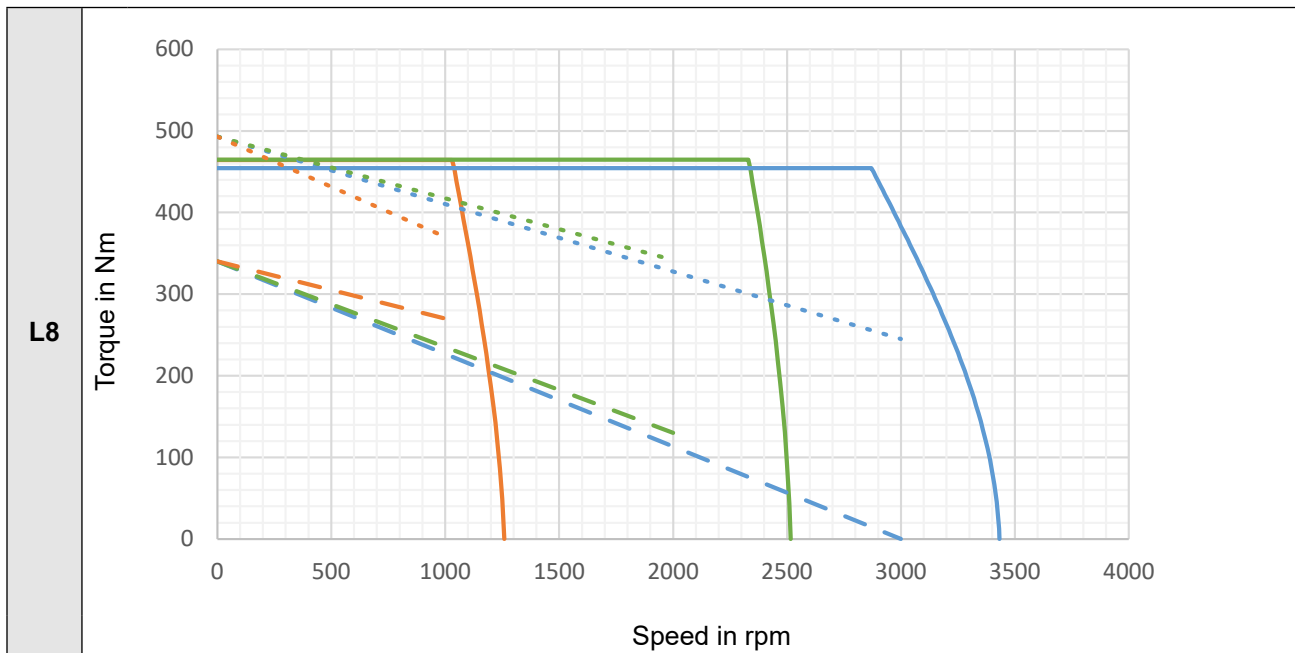
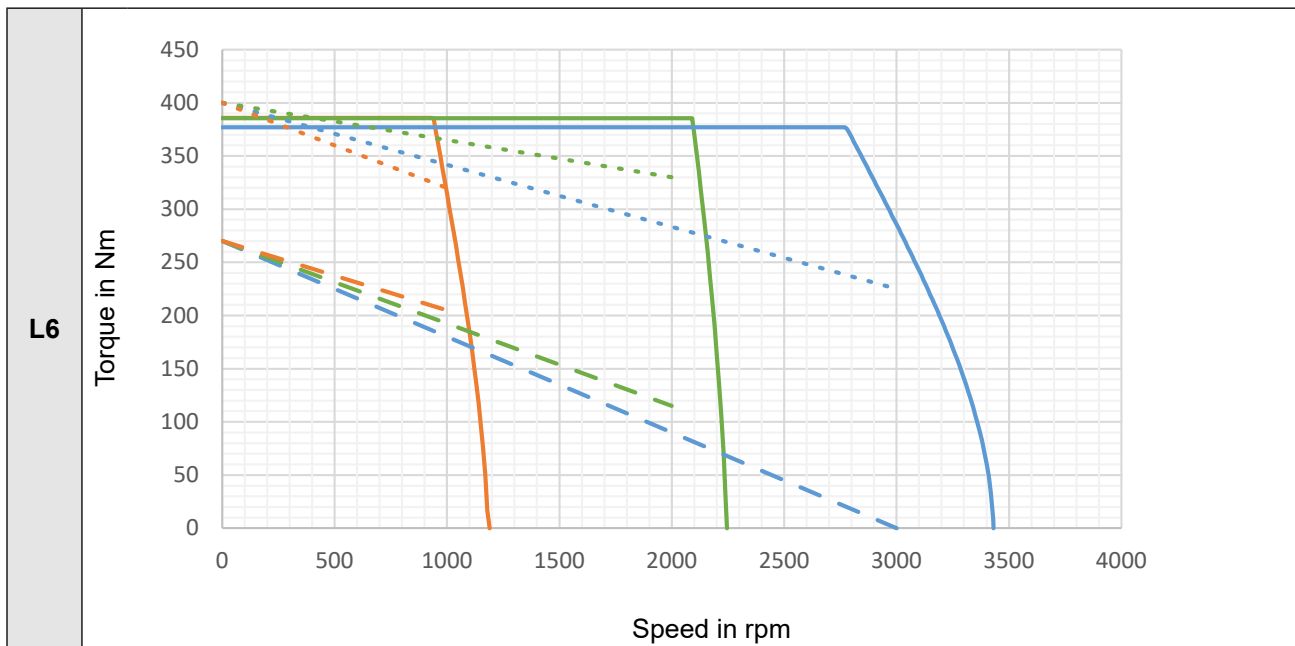
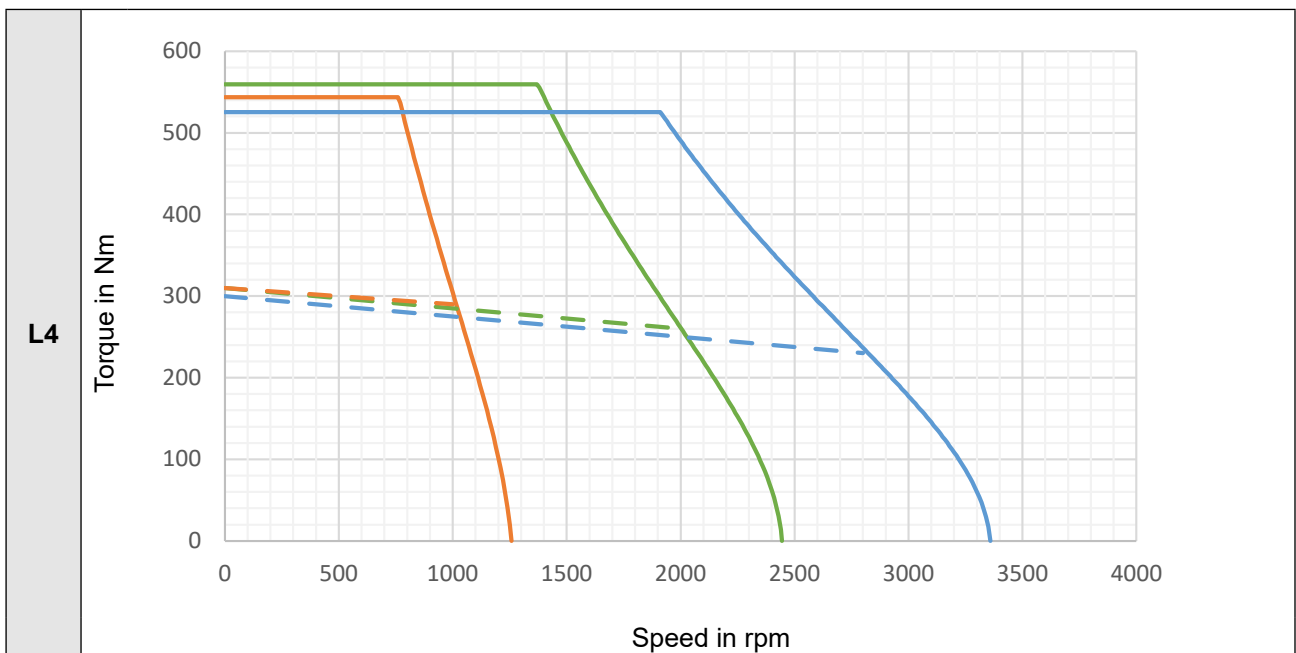
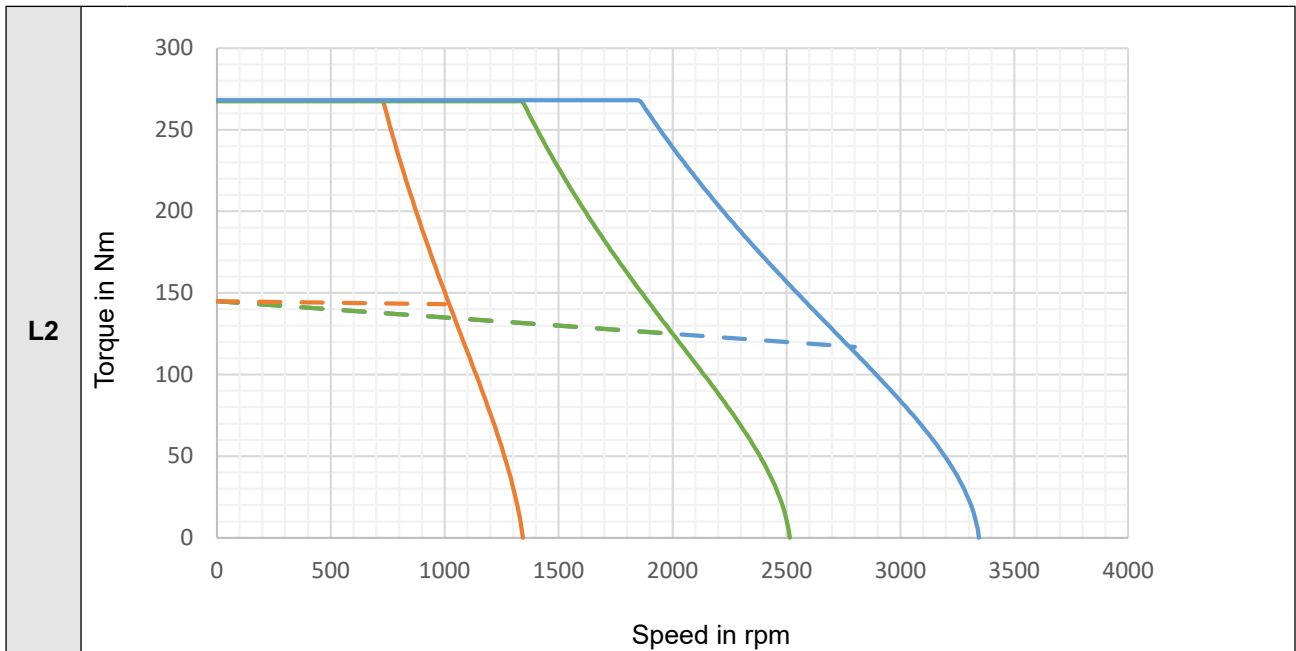


Figure 28: Speed-torque characteristics for motor size SG CS

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

5.9.6 Speed-torque characteristics for motor size SG CF



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

PERFORMANCE DIAGRAMS

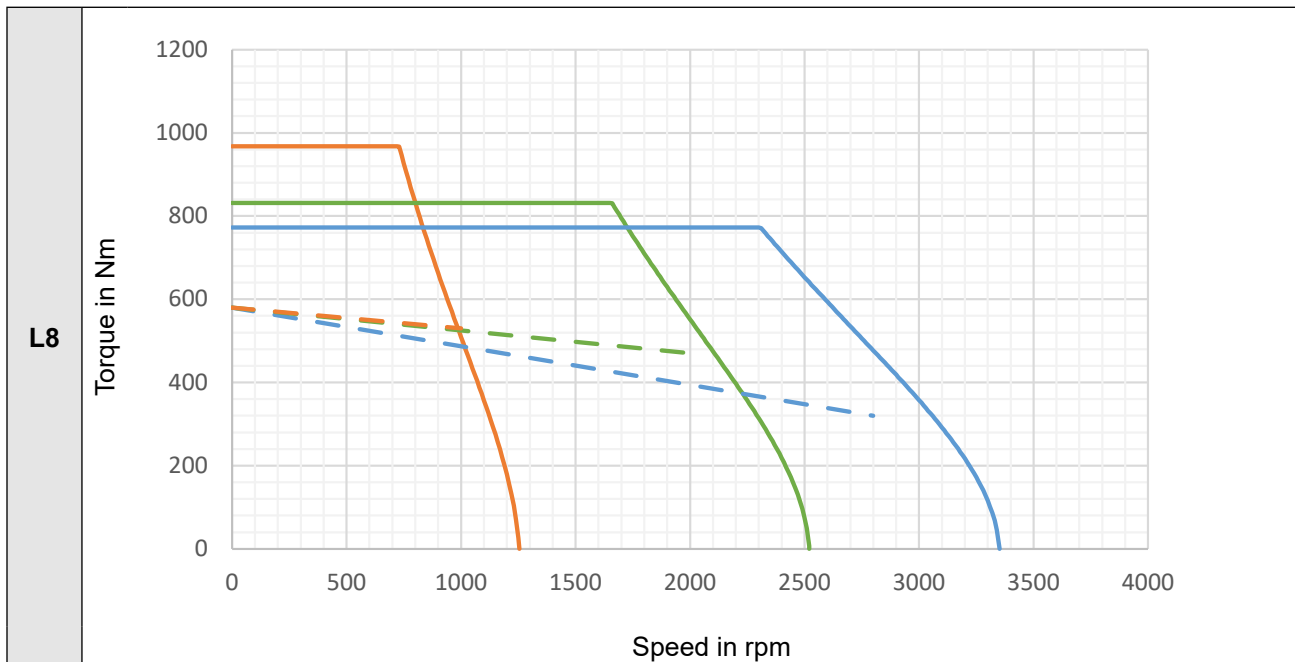
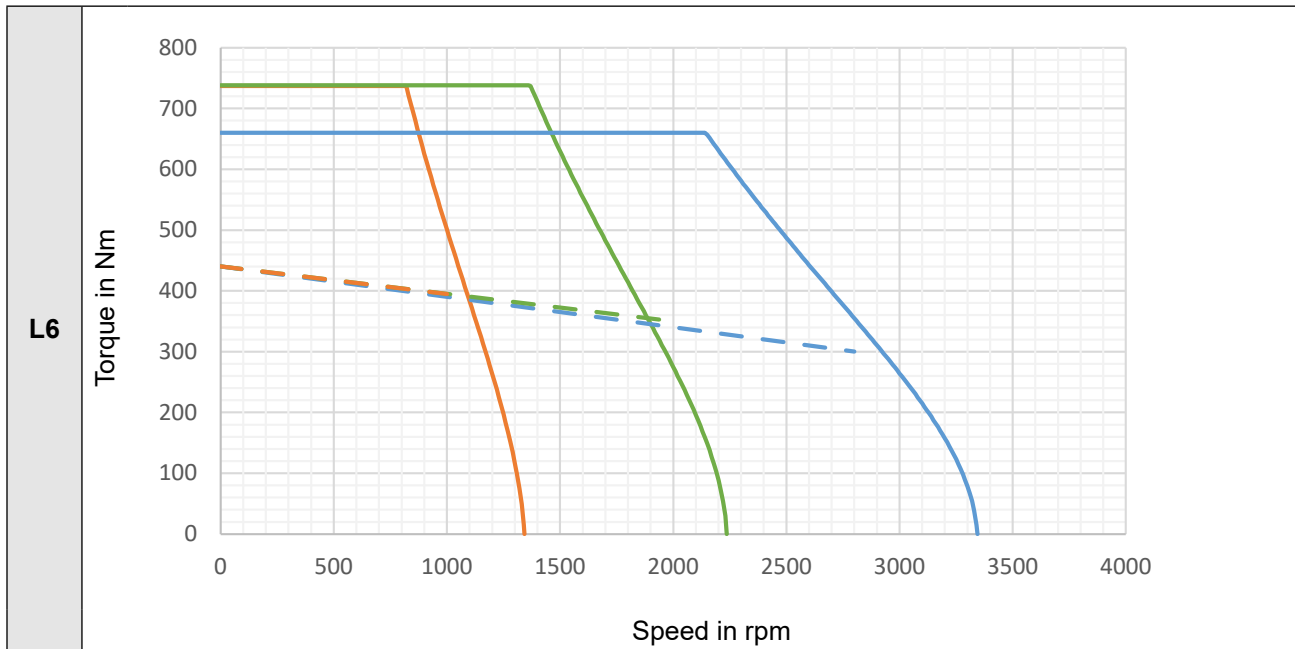


Figure 29: Speed-torque characteristics for motor size SG CF

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

6.1 CE marking

CE marked servo motors were developed in accordance with the guidelines and standards of the EU declaration of conformity listed below.

EU DECLARATION OF CONFORMITY



Document No. / month.year: ce_gm_ens-sm-j_en.docx / 12.2023

Manufacturer: KEB Automation KG
Südstraße 38
32683 BARNTRUP
Germany

Type of product : Servo motor yySMxxx-xxxx 7606xxx-xxxx or 7607xxx-xxxx or 7608xxx-xxxx

Size yy = 11 bis 84
yy = A1 bis F3

Servo motor Type 00SM000-CMAT/DL4 CMSM4xy-zzzz
V4SxLyCzSPnn -
x = E or F or G x = E or F or G
y = 0 up to 9 y = 0 up to 9
z = S or F z = any letter or number
n = 0 up to 9

Voltage category 190 up to 380 V ac

This declaration of conformity is issued under the sole responsibility of KEB Automation KG.

The above given product is in accordance with the following directives of the European Union

Number: **Low voltage : 2014 / 35 / EU**
Text: Directive on the approximation of the laws of the Member States relating to all electrical equipment that has a voltage rating between 50V and 1000V AC or 75V and 1500V DC.

Number: **Hazardous Substances: 2011 / 65 / EEC (incl. 2015 / 863 / EU)**
Text: Directive on the approximation of the laws of the Member States relating on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

Responsible: KEB Automation KG
Südstraße 38
32683 BARNTRUP

Place, date Barntrup, 05. December 2023

Issued by:

i. A. W. Hovestadt / Conformance Officer

W. Wiele / Technical Manager

This declaration certifies the conformity with the named directives, but does not contain any assurance of quality.

The safety instructions, described in the instruction manual are to be followed.

EU DECLARATION OF CONFORMITY



Annex 1

Document-Nr. / Month.year: ce_gm_ens-sm-j_en.docx / 12/2023

Type of product :	Servo motor	yySMxxx-xxxx	7606xxx-xxxx or 7607xxx-xxxx or 7608xxx-xxxx
	Size	yy = 11 bis 84 yy = A1 bis F3	
	Servo motor Type	00SM000-CMAT/DL4 V4SxLyCzSPnn - x = E or F or G y = 0 up to 9 z = S or F n = 0 up to 9	CMSM4xy-zzzz x = E or F or G y = 0 up to 9 z = any letter or number
	Voltage category		190 up to 380 V ac

The conformity of the above given product to the European Directive 2014/35/EU (for electrical equipment designed for use within certain voltage limits) is given by complete approval / testing to the following European harmonized standards:

EN - standard	
EN 60034 – 1 Version 2010	Rotating electric machines – Part 1: Rating and performance
EN 60034 – x	Rotating electric machines – other parts relevant for synchronous and asynchronous motors

Additional information:

Electrical motors are not covered by the Directive for EMC. They are passive components for emission and immunity for high frequency phenomena.

When using them together with power drive unit (EN 61800) the manufacturer of the machine is responsible for EMC of the complete wiring / system based on given recommendations of the inverter / motor manufacturer.

The conformity of the above given product to the European Directive 2011/65/EU with changes of 2015/863/EU (for restrictions of the use for certain hazardous substances in electrical and electronic equipment) is given by qualification of components and manufacturing process within the ISO 9001 QM system. The necessary information and declarations are documented and memorized.

EN 63000: 2018 Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

The above given product was developed, manufactured and tested within an internal quality management system. This ISO 9001 QM system was approved by:

Notified body:	TÜV - CERT
Address:	Zertifizierungsstelle des RWTÜV Steubenstrasse 53 D - 45138 Essen
No. of approval	041 004 500
Dated:	20.10.1994
Valid until:	December 2024

Figure 30: EU declaration of conformity

6.2 UL Marking

Servo and Stepper Motors - Component

<p>COMPANY</p> <p>KEB Automation KG Suedstrasse 38 Barntrup, Nordrhein-Westfalen 32683 Germany</p>	<p>E471175</p>
---	----------------

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

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 31: UL Marking

6.3 Further informations and documentation

You find supplementary manuals and instructions for the download under www.keb.de/de/service/downloads

General instructions

- EMC and safety instructions
- Manuals for additional 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 parameterization of drive converters 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	2024-02	Text correction

Austria | KEB Automation GmbH
Ritzstraße 8 4614 Marchtrenk Austria
Tel: +43 7243 53586-0 Fax: +43 7243 53586-21
E-Mail: info@keb.at Internet: www.keb.at

Benelux | KEB Automation KG
Bd Paapsemiaan 20 1070 Anderlecht Belgium
Tel: +32 2 447 8580
E-Mail: info.benelux@keb.de Internet: www.keb.de

Brazil | KEB South America - Regional Manager
Rua Dr. Omar Pacheco Souza Riberio, 70
CEP 13569-430 Portal do Sol, São Carlos Brazil
Tel: +55 16 31161294 E-Mail: roberto.arias@keb.de

Czech Republic | KEB Automation GmbH
Videnska 188/119d 61900 Brno Czech Republic
Tel: +420 544 212 008
E-Mail: info@keb.cz Internet: www.keb.cz

France | Société Française KEB SASU
Z.I. de la Croix St. Nicolas 14, rue Gustave Eiffel
94510 La Queue en Brie France
Tel: +33 149620101 Fax: +33 145767495
E-Mail: info@keb.fr Internet: www.keb.fr

Germany | Gearing Motors
KEB Antriebstechnik GmbH
Wildbacher Straße 5 08289 Schneeberg Germany
Telefon +49 3772 67-0 Telefax +49 3772 67-281
Internet: www.keb-drive.de E-Mail: info@keb-drive.de

Italy | KEB Italia S.r.l. Unipersonale
Via Newton, 2 20019 Settimo Milanese (Milano) Italia
Tel: +39 02 3353531 Fax: +39 02 33500790
E-Mail: info@keb.it Internet: www.keb.it

Japan | KEB Japan Ltd.
41-1-601 Kanda, Higashimatsushitacho, Chiyoda Ward
Tokyo 101 - 0042 Japan
Tel: +81 3 3525-7351 Fax: +81 3 3525-7352
E-Mail: info@keb.jp Internet: www.keb.jp

P. R. China | KEB Power Transmission Technology (Shanghai) Co. Ltd.
No. 435 QianPu Road Chedun Town Songjiang District
201611 Shanghai P.R. China
Tel: +86 21 37746688 Fax: +86 21 37746600
E-Mail: info@keb.cn Internet: www.keb.cn

Poland | KEB Automation KG
Tel: +48 60407727
E-Mail: roman.trinczek@keb.de Internet: www.keb.de

Republic of Korea | KEB Automation KG
Deoksan-Besttel 1132 ho Sangnam-ro 37
Seongsan-gu Changwon-si Gyeongsangnam-do Republic of Korea
Tel: +82 55 601 5505 Fax: +82 55 601 5506
E-Mail: jaeok.kim@keb.de Internet: www.keb.de

Spain | KEB Automation KG
c / Mitjer, Nave 8 - Pol. Ind. LA MASIA
08798 Sant Cugat Sesgarrigues (Barcelona) Spain
Tel: +34 93 8970268 Fax: +34 93 8992035 E-Mail: vb.espana@keb.de

Switzerland | KEB Automation AG
Witzbergstrasse 24 8330 Pfaeffikon/ZH Switzerland
Tel: +41 43 2886060 Fax: +41 43 2886088
E-Mail: info@keb.ch Internet: www.keb.ch

United Kingdom | KEB (UK) Ltd.
5 Morris Close Park Farm Industrial Estate
Wellingborough, Northants, NN8 6 XF United Kingdom
Tel: +44 1933 402220 Fax: +44 1933 400724
E-Mail: info@keb.co.uk Internet: www.keb.co.uk

United States | KEB America, Inc
5100 Valley Industrial Blvd. South
Shakopee, MN 55379 United States
Tel: +1 952 2241400 Fax: +1 952 2241499
E-Mail: info@kebameric.com Internet: www.kebameric.com



MORE KEB PARTNERS WORLDWIDE:

www.keb-automation.com/contact



Automation with Drive

www.keb.de

KEB Automation KG Suedstrasse 38 32683 Barntrup Tel. +49 5263 401-0 E-Mail: info@keb.de