8MS...-4 three-phase synchronous motors

User's manual
1.00 (January 2026)
MAMOT2.4-ENG

Translation of the original documentation

Table of contents

1 General information

1.1 Manual history

Version	Date	Notes
1.00	January 2026	First edition for motor version 4 (8MS...-4)

Information:

B&R makes every effort to keep user's manuals as current as possible. New versions are available in electronic form on the B&R website (www.br-automation.com). Check regularly to determine if you have the most current version.

1.2 About this user's manual

This user's manual describes the product, informs you how to use it and warns of possible dangers.

The personnel responsible for installation, operation, fault rectification, maintenance and cleaning must read and understand this manual before starting any work. The machine documentation must also be taken into account; the product described here is a component of this. This, along with observing all specifications and safety guidelines, will ensure safe functionality and a long service life.

As a component of the machine, this manual must be made freely accessible and stored in the immediate vicinity of the machine.

In addition to the information in this manual, local accident prevention regulations and national industrial safety regulations apply.

Information:

This document is not intended for end customers! The safety guidelines required for end customers must be incorporated into the operating instructions for end customers in the respective national language by the machine manufacturer or system provider.

1.3 Safety

This chapter provides you with safety-related information about working with the product.

Safety guidelines relevant to certain phases of the product's service life have been documented in the relevant chapters in this manual.

1.3.1 Organization of safety notices

Safety notices in this manual are organized as follows:

Safety notice	Description
Danger!	Failure to observe these safety guidelines and notices can result in death.
Warning!	Failure to observe these safety guidelines and notices can result in severe injury or substantial damage to property.
Caution!	Failure to observe these safety guidelines and notices can result in injury or damage to property.
Note:	These instructions are important for avoiding malfunctions.

1.3.2 Intended use

B&R motors and gear motors are components designed for installation in electrical systems or machines. They were designed, developed and manufactured for general industrial use. They are intended to be operated in covered rooms and under normal climatic conditions, which is usually the case in modern production halls. When used in residential areas, commercial areas or small businesses, additional filtering measures are required or must be provided by the user. Only operate the motor with B&R drive systems.

Use in accordance with the intended purpose is prohibited until:

- It has been determined that the machine complies with the provisions of EC Directive 2006/42/EC (Machinery Directive) and EMC Directive 2014/30/EU.
- All values specified on the nameplate and in the user's manual (e.g. connection and ambient conditions) have been observed.

1.3.3 Reasonably foreseeable misuse

Use of this product in areas with fatal risks or dangers is prohibited!

Danger!

Severe personal injury and damage to property due to failure!

When used without ensuring exceptionally high safety measures, death, injury, severe physical impairments or other serious losses are possible.

Do not use the product in the following areas, as well as other areas associated with fatal risks or dangers:

- **Explosive areas**
- **Monitoring nuclear reactions in nuclear power plants**
- **Flight control systems and air traffic control**
- **Controlling mass transport systems**
- **Medical life support systems**
- **Controlling weapons systems**

In special cases – use in non-commercial installations – with additional requirements (e.g. protection of children's fingers), these requirements must be satisfied during setup on the system side.

1.3.4 General sources of danger

Tampering of protection or safety devices

Protective and/or safety devices protect you and other persons from dangerous voltage, rotating or moving elements and hot surfaces.

Danger!

Personal injury and damage to property due to tampering of protective equipment!

If protective or safety devices are removed or put out of operation, there is no longer any personal protection and serious personal injury and damage to property can occur.

- **Do not remove any safety devices.**
- **Do not put any safety devices out of operation.**
- **Always use all safety devices also for temporary testing and trial operations!**

Dangerous voltage

To operate the motors, dangerous voltage must be applied to certain parts.

Danger!

Risk of injury due to electric shock!

If live parts are touched, there is immediate danger of fatal electric shock.

If connections are connected or disconnected in the incorrect order or while voltage is applied, electric arcs can occur and persons and contacts can be damaged.

Even if the motor is not rotating or is running as a generator driven externally, the control and power connections can still carry voltage!

- **Never touch connections when the power is switched on.**
- **Never disconnect or connect electrical connections to the motor and servo drive while voltage is applied!**
- **Do not stay in the danger zone during operation and secure it against access by unauthorized persons.**
- **Always operate the motor with all safety equipment. Do this also for temporary testing and trial operations!**
- **Keep all covers and control cabinet doors closed during operation and as long as the machine is not disconnected from the mains.**
- **Before working on motors, gearboxes or servo drives or in the danger zone of your machine, disconnect them completely from the mains and secure them against being switched on again by other persons or automatic systems.**
- **Note the discharge time of any existing DC bus.**
- **Only connect measuring instruments in a current- and voltage-free state!**

Danger due to electromagnetic fields

Electromagnetic fields are generated by the operation of electrical power engineering equipment such as transformers, inverters and motors.

Danger!

Danger to health due to electromagnetic fields!

The functionality of a heart pacemaker can be impaired by electromagnetic fields to such an extent that the wearer experiences harm to his or her health, possibly with a fatal outcome.

- **Observe relevant national health and safety regulations.**
- **Persons with pacemakers are not allowed to be in endangered areas.**
- **Warn staff by providing information, warnings and safety identification.**
- **Secure the danger zone by means of barriers.**
- **Ensure that electromagnetic fields are reduced at their source (using shields, for example).**

Dangerous motion

By rotating and positioning motions of the motors, machine elements are moved or driven and loads conveyed.

After switching on the machine, movements of the motor shaft must always be expected! For this reason, higher-level protective measures must be put in place to ensure that personnel and the machine are protected. This type of protection can be achieved, for example, by using stable mechanical protective equipment such as protective covers, protective fences, protective gates or photoelectric sensors.

In the immediate vicinity of the machine, provide sufficient and easily accessible emergency switch-off devices to stop the machine as quickly as possible in the event of an accident.

Danger!

Danger of injury due to rotating or moving elements and loads!

By rotating or moving elements, body parts can be drawn in or severed or subjected to impacts.

- **Do not stay in the danger zone during operation and secure it against access by unauthorized persons.**
- **Before working on the machine, secure it against unwanted movements. A holding brake is not suitable for this!**
- **Keep all covers and control cabinet doors closed during operation and as long as the machine is not disconnected from the mains.**
- **Always operate the motor with all safety equipment. Do this also for temporary testing and trial operations!**
- **Motors can be started automatically via remote control! If appropriate, a corresponding warning symbol must be applied, and protective measures must be implemented to prevent entry into the high-risk area!**

Warning!

Danger of injury due to incorrect control or a defect!

Improper control of motors or a defect can result in injuries and unintended and hazardous movements of motors.

Such incorrect behavior can be triggered by:

- **Incorrect installation or faults when handling components**
- **Improper or incomplete wiring**
- **Defective devices (servo drive, motor, position encoder, cables, brake)**
- **Incorrect control (e.g. caused by software error)**

Risk due to hot surfaces

Due to the power dissipation from the motor and friction in the gearbox, these components as well as their environment can reach a temperature of more than 100°C.

The resulting heat is released to the environment via the housing and the flange.

Warning!

Risk of burns due to hot surfaces!

Touching hot surfaces (e.g. motor and gearbox housings, as well as connected components), can result in very severe burns due to the very high temperature of these parts.

- **Do not stay in the danger zone during operation and secure it against access by unauthorized persons.**
- **Never touch the motor or gearbox housing as well as adjacent surfaces during nominal load operation.**
- **Be aware of hot surfaces also during standstill.**
- **Allow the motor and gearbox to cool down sufficiently before working on them; there remains the risk of burns for a long period of time after they are switched off.**
- **Always operate the motor or gearbox with all safety devices. Do this also for temporary testing and trial operations!**

1.3.5 Regulations and safety guidelines

To ensure proper commissioning and safe operation, be sure to observe the following:

- General safety regulations
- The applicable work safety regulations
- National accident prevention regulations (e.g. VBG 4) for working with high-voltage systems
- National, local and plant-specific regulations for your end product
- Relevant regulations for electrical installations (e.g. line cross section, fuses, protective conductor connection). The values provided in chapter "Technical data" must also be taken into account here.

The operator is solely responsible for these and all other regulations applicable at the place of use!

1.3.6 Responsibility of the operator

The operator is the person who uses the motor for commercial purposes or who provides it for use by a 3rd party while carrying legal product responsibility for the protection of the user, personnel or other 3rd parties.

Obligations of the operator

- Applicable industrial safety regulations must be observed.
- National, local and plant-specific regulations must be observed.
- A risk assessment must identify hazards that can arise due to on-site working conditions.
- Documentation including safety guidelines must be prepared for operating the finished system (with motors, gearboxes, servo drives, etc.).
- Whether the applicable operating instructions and manuals correspond to current rules and standards must be checked regularly.
- Responsibilities for installation, operation, fault correction, maintenance and cleaning must be clearly regulated and defined.
- It must be ensured that responsible personnel have read and understood this user's manual.
- Personnel must receive training on a regular basis and be informed of hazards.
- Personnel must be provided with the required protective equipment.

1.3.7 Qualified personnel

All tasks such as the transport, installation, commissioning and servicing of devices are only permitted to be carried out by qualified personnel. Qualified personnel are those familiar with the transport, mounting, installation, commissioning and operation of devices who also have the appropriate qualifications to perform these tasks (e.g. IEC 60364). National accident prevention regulations must be observed.

The safety guidelines, information about connection conditions (nameplate and documentation) and limit values specified in the technical data must be read carefully before installation and commissioning and must be strictly observed.

1.3.8 Safety notices

A "hot surface" warning label is provided with the product. Attach it to the assembled product so that it is visible at all times.

"Hot surface" warning label

1.3.9 Protective equipment

Always wear suitable safety clothing and equipment for your personal protection.

1.4 8MS...-4 three-phase synchronous motors

8MS...-4 synchronous motors have been specially developed for use in high-performance applications. The large selection in this product family makes it easy to reduce spare parts inventory, guarantee serviceability and keep space requirements to a minimum.

The most common motor configurations of the 8MSA...-4 series are available as standard motors (preferred motors). If required, standard motors are available on short notice using express delivery.

1.4.1 Nameplate

The nameplate clearly identifies each motor. The serial number ensures traceability.

The nameplate adhesive label on the motor housing contains the following information:

1	Order code
2	11-digit serial number
3	Serial number as a barcode (Code 128)
4	CE marking
5	Technical data (rated torque M_n, rated current I_n, continuous stall torque M_0, continuous stall current I_0, rated voltage U_N, rated speed n_n, cooling type)
6	Manufacturer
7	UL Recognized Component mark
8	Protection class
9	Insulation class
10	Production period (week/year)
11	Revision
12	UKCA marking

1.4.1.1 Embedded parameter chip

All relevant mechanical and electrical information and data is stored in the EnDat encoder used for B&R motors. This means that the user does not have to configure settings on the servo drive. As soon as the encoder is connected to the servo drive and the power supply to the electronics is switched on, the motor is automatically identified. The motor sends its nominal parameters and limit parameters to the servo drive. The drive then automatically determines the current limits and current control parameters required for optimal control of the motor. Only the speed and position controllers must still be optimized by the user. Support for this is provided by the integrated commissioning environment of B&R Automation Studio™.

In addition to assistance during commissioning, routine service work is also simplified, and motors can be replaced without having to take extra time to set parameters.

2 Technical data

2.1 General description

Three-phase synchronous motors from the 8MS-4 series are permanent magnet, electronically commutated synchronous motors for applications with high demands on dynamics and positioning accuracy combined with compact size and reduced weight.

- Compact size, reduced weight and highest power density
- High-performance motor for highly dynamic requirements
- Reduced cogging resulting in very good transmission accuracy
- Universal use with high overload capacity
- No maintenance required throughout the entire service life
- Cost-optimized due to higher torque density
- Optimized braking torque
- Embedded parameter chip

2.2 8MS...-4 order key

8MS	b	c	d	.	ee	nnn	ff	gg	-	4

Cooling / Construction type

A ... Built-in connector, self-cooling
see "Cooling type / Construction type (b)" on page 14

Size

Valid values: **2, 3, 4, 5** see "Size (c)" on page 14

Length

Valid values: **3, 4, 6** see "Length (d)" on page 14

Motor encoder system

Inductive EnDat encoders:**I8, I9**
see "Motor encoder system (ee)" on page 15

Nominal speed

030 ... 3,000 rpm **060** ... 6,000 rpm
see "Nominal speed (nnn)" on page 16

Motor options

Valid values: **I2, J6, etc.**
see "8MS...-4 - Motor options (ff)" on page 17

Special motor options

8MS**A**...**00** ... No special motor option / cooling type: Self-cooling

Motor version

4 ... Version 4 (the motor version is specified as a code (h) in the order number)

Note:

Order keys only provide information about possible combinations in exceptional cases. Information about possible combinations is available in the CAD configurator (cad.br-automation.com).

2.2.1 Example order 1

A three-phase synchronous motor of type **8MSA34...-4** with a nominal speed of 3000 rpm was selected for an application. Because of the construction, the cables can only be connected on the top side of the motor (single-cable solution, "top" connection direction). The motor should also be equipped with a holding brake, a keyed shaft and a 19-bit EnDat single-turn encoder.

The code (ee) for the encoder system is **I8**.

The (nnn) code for a nominal speed of 3000 rpm is **030**.

The code (ff) for the other options (holding brake, keyed shaft and angled single-cable solution) is **I3**.

The order number for the necessary motor is therefore **8MSA34.I8030I300-4**.

2.2.2 Example order 2

A three-phase synchronous motor of type **8MSA56...-4** with a nominal speed of 3000 rpm was selected for an application. Because of the construction, cables can only be connected to the rear of the motor (swivel connectors). They should also take up as little space as possible. The single-cable solution (hybrid) is desired. The motor should also be equipped with a holding brake, smooth shaft, oil seal and 19-bit single-turn / 12-bit EnDat multi-turn encoder.

The code (ee) for the encoder system is **I9**.

The (nnn) code for a nominal speed of 3000 rpm is **030**.

The code (ff) for the other options (oil seal, holding brake, smooth shaft end and angled single-cable solution, swivel connector) is **J8**.

The order number for the necessary motor is therefore **8MSA56.I9030J800-4**.

2.3 Cooling type / Construction type (b)

8MS	b	c	d	.	ee	nnn	ff	gg	-	4

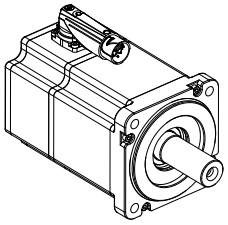
see "Order key" on page 12

8MS...-4 three-phase synchronous motors are available with cooling type A. All motors are based on cooling type A (elongated, slim) and can deviate in cooling type and cable connection.

The cooling types are differentiated by a letter (**b**) in the order number.

Cooling type (b)		Connection type	Mounting type
8MS**A**	Self-cooling	Connector	Mounting flange

8MSA

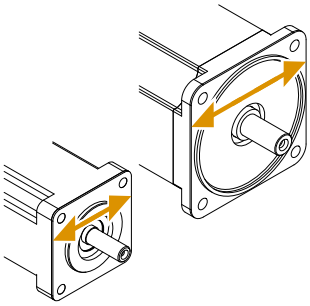


Cooling type A is self-cooling and has a slim, elongated design.
These motors must be attached to the machine with the mounting flange, which also serves as a cooling surface.

2.4 Size (c)

8MS	b	c	d	.	ee	nnn	ff	gg	-	4

see "Order key" on page 12



8MS...-4 three-phase synchronous motors are available in various sizes (2, 3, 4 and 5). These differ in dimensions (especially flange dimensions) and power data.

The sizes are differentiated by a character (**c**) in the order number. The larger this number, the larger the flange dimensions and power data of the respective motor.

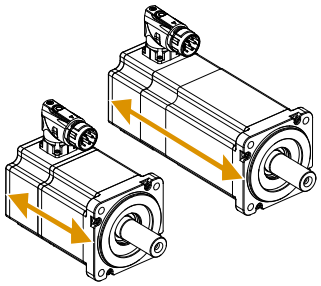
Availability

	Available sizes (c)			
	8MSx2	8MSx3	8MSx4	8MSx5
8MSA	Yes	Yes	Yes	Yes

2.5 Length (d)

8MS	b	c	d	.	ee	nnn	ff	gg	-	4

see "Order key" on page 12



8MS...-4 three-phase synchronous motors are available in different lengths. These differ in the power data with identical flange dimensions.

The lengths are differentiated by a number (**d**) in the order number. The larger this number, the longer the respective motor.

Availability

	Available lengths (d)		
	8MSxx3	8MSxx4	8MSxx6
8MSA2	---	Yes	Yes
8MSA3	Yes	Yes	Yes
8MSA4	---	Yes	Yes
8MSA5	Yes	Yes	Yes

2.6 Motor encoder system (ee)

8MS	b	c	d	.	ee	nnn	ff	gg	-	4

see "Order key" on page 12

8MS...-4 three-phase synchronous motors are available with EnDat encoders. The motor encoder system is specified as part of the order number in the form of a 2-digit code (**ee**).

2.6.1 EnDat 3.0

EnDat 3.0 combines the features and benefits of EnDat 2.2 in a new architecture. The advantage of this new architecture is a higher resistance to disturbance and a higher bandwidth when using only 2 wires for the data and encoder power supply.

2.6.2 General safety encoder

Safety-related position measurement systems

In machine and system manufacturing, the topic of safety is becoming more and more important. This is mirrored in legislation and stricter safety criteria in national and international standards. Most importantly, stricter requirements serve to protect personnel, but they also increasingly serve to protect property and the environment. The goal of functional safety is to minimize or eliminate dangerous situations that can occur in machines and systems either with or without operational errors. This is generally achieved by implementing redundant systems. Moving axes in safety applications require position information in order to be able to carry out their corresponding safety functions. Different system configurations can be implemented to get independent position values. One possibility is using two measuring instruments per axis. To keep costs down, the aim is often to create a solution with only one position measuring instrument. Until now, analog measuring instruments with sine/cosine signals were used for this purpose. The encoder manufacturer Heidenhain – as the first manufacturer with the purely serial EnDat 3.0 protocol for safety position measurement systems – offers a serial single-encoder solution per IEC 61 508 SIL 2. All the advantages of serial data transfer – such as cost optimization, diagnostics possibilities, automatic commissioning and high-speed generation of position values – can now benefit safety applications as well.

100% inspection during production and additional measures during final testing ensure errors have not occurred related to shaft and coupling connections on rotary encoders when using motors with safety encoders (per EN ISO 13849-2).

2.6.3 Information: SafeMOTION

For information about the area of application and procedure for setting up the various safety functions, see the SafeMOTION user's manual (MAACPMSAFEMC-ENG) in the Downloads section of the B&R website (www.br-automation.com).

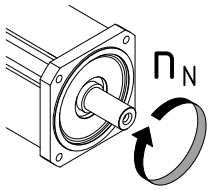
2.6.4 Inductive EnDat encoders for sizes 2 - 5

Technical data	Encoder type / Order code (ee)	
	I8	I9
Operating principle	Inductive	
EnDat protocol	3.0	3.0
Functional safety	Yes	Yes
Single-turn/Multi-turn	S	M
Revolutions	1	4096
Resolution [bits single-turn / bits multi-turn]	19/0	19/12
Accuracy ["]	65	
Cutoff frequency ≥ [kHz]	Digital pos. in the encoder	
Stator - Vibration during operation Max. [m/s2]	400	
Rotor - Vibration during operation Max. [m/s2]	600	
Max. shock during operation [m/s²]	2000	
Probability of dangerous failure per hour (PFH) SIL 2	≤15 * 10^{-9}	
Manufacturer's product ID	ECI 1119 FS E30-R2	EQI 1131 FS E30-R2

2.7 Nominal speed (nnn)

8MS	b	c	d	.	ee	nnn	ff	gg	-	4

see "Order key" on page 12



8MS...-4 three-phase synchronous motors are available with different nominal speeds.

The nominal speed is specified as part of the order number in the form of a 3-digit code (**nnn**).

	Order code (nnn)	
	030	060
Nominal speed n_N [rpm]	3000	6000

2.7.1 8MSA...-4 - Availability

8MSA2

	Available nominal speeds n_N [rpm]	
	3000	6000
8MSA24	Yes	Yes
8MSA26	Yes	Yes

8MSA3

	Available nominal speeds n_N [rpm]	
	3000	6000
8MSA33	Yes	Yes
8MSA34	Yes	Yes
8MSA36	Yes	Yes

8MSA4

	Available nominal speeds n_N [rpm]	
	3000	6000
8MSA44	Yes	Yes
8MSA46	Yes	Yes

8MSA5

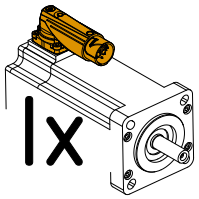
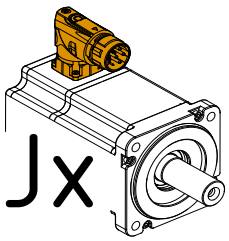
	Available nominal speeds n_N [rpm]
	3000
8MSA54	Yes
8MSA56	Yes

2.8 8MS...-4 - Motor options (ff)

8MS	b	c	d	.	ee	nnn	ff	gg	-	4

see "Order key" on page 12

See the following table for the corresponding code (**ff**) in the order key.
The first position in the code (**ff**) defines the connection direction with options **I**x**,** and **J**x. The second position (x**0**, x**1**, x**2**, x**3**, etc.) defines all other motor options according to the table.

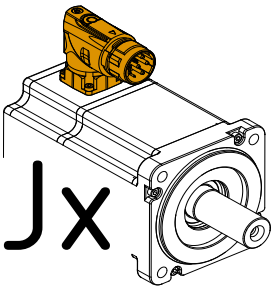
Motor option					
Connection direction	**Oil seal**	**Holding brake**		**Shaft end**	**Order code (ff)**
Single-cable solution (hybrid) - 915 itec, angled, rotatable  Encoder and power cable combined in one cable	---	---		Smooth shaft	**I0**
	---	---		With key	**I1**
	---	Standard holding brake	(ϟ)	Smooth shaft	**I2**
	---			With key	**I3**
	Yes	---		Smooth shaft	**I6**
	Yes	---		With key	**I7**
	Yes	Standard holding brake	(ϟ)	Smooth shaft	**I8**
	Yes			With key	**I9**
Single-cable solution (hybrid) - 923 speedtec, angled, rotatable  Encoder and power cable combined in one cable	---	---		Smooth shaft	**J0**
	---	---		With key	**J1**
	---	Standard holding brake	(ϟ)	Smooth shaft	**J2**
	---			With key	**J3**
	Yes	---		Smooth shaft	**J6**
	Yes	---		With key	**J7**
	Yes	Standard holding brake	(ϟ)	Smooth shaft	**J8**
	Yes			With key	**J9**

See the following table for the corresponding code (**ff**) in the order key.
The first position in the code (**ff**) defines the connection direction with options **I**x and **J**x. The second position (x**0**, x**1**, x**2**, x**3**, etc.) defines all other motor options according to the table.

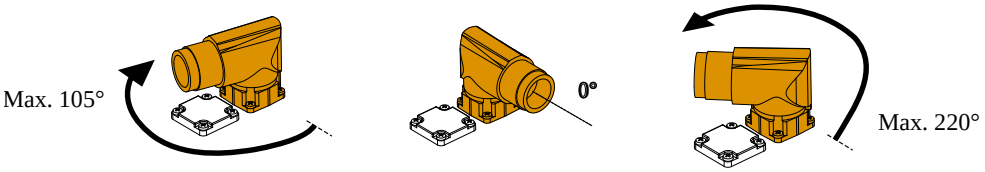
2.8.1 Connection direction (ff)

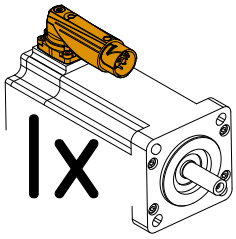
Power and encoder connections

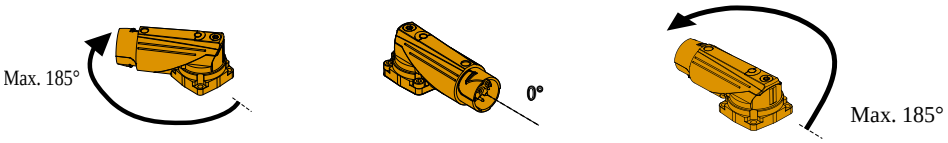
8MSA...-4 three-phase synchronous motors are available with various connection options.



Single-cable solution (hybrid)
Connection direction: Angled (swivel[1])
Encoder and power cable: Combined in one cable

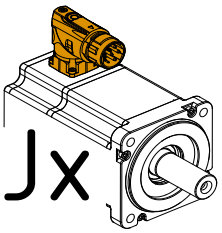






1) Check the angle specifications and the feasibility with regard to requirements using the CAD configurator (cad.br-automation.com).

2.8.2 Availability of the speedtec system (ff)

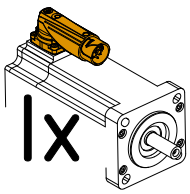


The 923 speedtec system is only available for EnDat 3 (I8, I9 encoders).

Motor options (ff) - Overview (order code)

see "8MS...-4 - Motor options (ff)" on page 17

2.8.3 Availability of the itec system (ff)

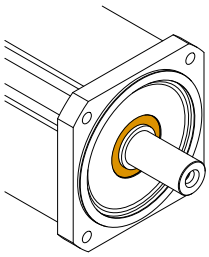


The itec system is only available for sizes 2 and 3 (8MSA2...-4 and 8MSA3...-4) and EnDat 3 (I8, I9 encoders).

Motor options (ff) - Overview (order code)

see "8MS...-4 - Motor options (ff)" on page 17

2.8.4 Oil seal (ff)



All 8MS...-4 three-phase synchronous motors are available with a form A oil seal per DIN 3760.

With an oil seal, the motors have IP65 protection per EN 60034-5.

Motor options (ff) - Overview (order code)

see "8MS...-4 - Motor options (ff)" on page 17

Servicing

To maintain functionality of the oil seal, it must be lubricated regularly with oil. An oil seal that is not lubricated will harden due to increased frictional heat and will eventually provide only dust protection.

Note:

Proper lubrication of the oil seal must be ensured throughout the entire service life of the motor.

For this reason, mounting a gearbox on motors with an oil seal is not permitted!

2.8.5 Holding brake (ff)

Operating principle

The holding brake is a permanent magnet brake and can be controlled by the B&R drive system. Based on principle, this type of holding brake exhibits a minimal amount of backlash. Voltage (see the technical data) must be applied to release the brake.

The brake is designed as a holding brake. It not permitted to be used for operational braking! Under these conditions, the brake has a service life of approximately 5,000,000 cycles (opening and closing the brake is one cycle). Loaded braking during an emergency stop is permitted but reduces its service life.

Information:

The required brake holding torque is determined based on the actual load torque. It is recommended by the brake manufacturer to take into account a safety factor of 2.

Warning!

The holding brake is not intended for normal braking. The maximum motor torque far exceeds the holding torque for the brake.

Personnel protection

Information:

If the holding brake should be used for the purpose of protecting personnel, the user must check via the MTTF values of the respective holding brake whether the performance level per EN ISO 13849 required for the respective application can be achieved with this holding brake. B&R recommends cyclical function testing of the holding brake.

The $\mathbf{B_{10d}}$ value required for calculating the performance level can be calculated as follows:

$$\mathbf{B_{10d}} = MTTF_d \times (0.1 \times n_{op})$$

B_{10d} Average number of cycles until dangerous failure occurs on 10% of the components.
$MTTF_d$ Mean time to dangerous failure.
$MTTF_d$ = MTTF x 2
To find the MTTF value, see the technical data for the holding brakes.
n_{op} Average number of annual actuations.

Motor options (ff) - Overview (order code)

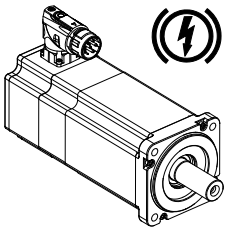
see "8MS...-4 - Motor options (ff)" on page 17

2.8.5.1 Standard holding brake (ff)

Standard holding brake - Technical data

8MSA2, 8MSA3, 8MSA4, 8MSA5

	8MSA2	8MSA3	8MSA4	8MSA5
Holding torque M_{Br} [Nm]	1.30	2.50	6.50	32.00
Connected load P_{On} [W]	11.40	10.20	17.25	30.00
Supply current I_{On} [A]	0.48	0.43	0.72	1.25
Supply voltage U_{On} [VDC]	24 (±15%)			
Moment of inertia J_{Br} [kgcm²]	0.007	0.024	0.033	0.782
MTTF[h]	TBC		TBC	



8MSA...-4 three-phase synchronous motors are available with a standard holding brake. It is installed directly at the A-side flange on the motor and used to hold the motor shaft in a voltage-free state of the servo motor.

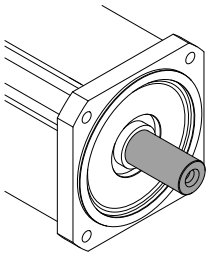
2.8.6 Shaft end (ff)

All 8MS...-4 three-phase synchronous motors have shaft ends per DIN 748. The shaft end is available in several variants, and availability can be determined in the corresponding table.

Motor options (ff) - Overview (order code)

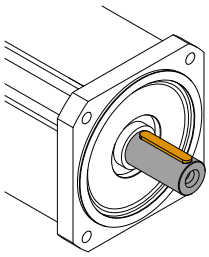
see "8MS...-4 - Motor options (ff)" on page 17

Variants



Smooth shaft end

A smooth shaft end is used for a force-fit shaft-hub connection and guarantees a backlash-free connection between the shaft and hub as well as a high degree of operating smoothness. The end of the shaft has a threaded center hole.



Keyed shaft end

A keyed shaft end is used for a form-fit torque transfer with low demands on the shaft-hub connection and for handling torque in a constant direction.
The keyways for 8MS three-phase synchronous motors conform to keyway form N1 per DIN 6885-1. Form A keyed shafts that conform to DIN 6885-1 are used. Balancing motors with keyways is done using the shaft and fitment key convention per DIN ISO 8821.
The end of the shaft has a threaded center hole that can be used to install machine actuators with shaft end cover plates.

Caution!

Shaft breakage due to heavy reverse operation.

The shaft key can become dislodged during heavy reverse operation. In extreme cases, the shaft could brake!

- **Preferably use smooth shaft ends with clamping elements.**

Caution!

Motor damage due to imbalance.

If motors with a keyed shaft end are operated without the shaft key, this can result in imbalances and subsequently motor damage.

- **In these cases, use a smooth shaft end.**

Warning!

Personal injury and damage to property due to ejected elements!

With freely rotating motors, ejected elements can cause personal injury and damage to property.

- **The following safety precautions apply also for temporary testing and trial operations!**
- **Secure the keys.**
- **Secure or remove mounting screws or other mounting elements.**
- **A shaft protection sleeve for transport and storage must also be removed.**

2.9 8MS...-4 - General motor data

General information	8MSA
C-UR-US listed	Yes
UL file number	E360421

Electrical properties	8MSA
Mains input voltage on the servo drive	3x 400 VAC ... 3x 480 VAC ±10%
Connection type - Conventional:	Circular connector
Connection type - Single-cable solution (hybrid)	915 itec system / 923 speedtec system

Thermal properties	8MSA
Insulation class of the isolation system per EN 60034-1	F
Cooling method per EN 60034-6 (IC code)	Self-cooling, free circulation surface cooling (IC4A0A0)
Thermal motor protection per EN 60034-11	Maximum winding temperature 155°C (limited to 130°C by the thermal motor protection in the ACOPOS servo drive; thermal protection is not provided by a temperature sensor but by means of an adaptive temperature model)

Mechanical properties	8MSA
Vibration severity per EN 60034-14	Vibration severity level A[1)]
Bearing service life calculation	DIN ISO 281
Center hole per DIN 332	Form D
Eye bolts	No
Shaft end per DIN 748	Form E [2)]
Oil seal per DIN 3760	Form A
Key and keyway per DIN 6885-1	Form A keys, form N1 keyway
Balancing of shaft per DIN ISO 8821	Shaft and fitment key convention
Mounting flange per DIN 42948	Form A
Radial runout, concentricity and axial runout of mounting flange per DIN 42955	Tolerance R
Coating: Name: Color:	Water-based coating 98160 *IDROLIN/E SM SEMIOPACO NERO RAL 9005-C.452 RAL 9005 flat; shaft end and flange front metallic glossy

Operating conditions	8MSA
Rating class, operating mode per EN 60034-1	S1 - Continuous operation
Ambient temperature during operation	-15°C to +40°C
Reduction of nominal and stall current as well as nominal and stall torque at temperatures above 40°C	3% per 5°C
Max. ambient temperature during operation	+55°C[3)]
Reduction of nominal and stall current as well as nominal and stall torque at installation elevations starting at 1,000 m above sea level	10% per 1,000 m
Max. installation elevation[4)]	923 speedtec, max. 4000 m with active and passive power supply 915 itec, max. 4000 m with passive power supply and max. 2000 m with active power supply
Max. flange temperature	90°C
Degree of protection per EN 60034-5 (IP code) Without oil seal: With oil seal:	 IP64[5)] IP65
Type of construction and mounting arrangement per EN 60034-7 (IM code)	Horizontal, motor shaft aligned horizontally (IM 3001) Vertical, motor standing on the machine (IM 3011) Vertical, motor hanging on the machine (IM 3031)[9)]

Storage and transport conditions	8MSA
Storage temperature	-20 to +60°C
Relative humidity during storage	Max. 90%, non-condensing
Transport temperature	-20 to +60°C
Relative humidity during transport	Max. 90%, non-condensing

1) Valid for all motors with an axis height greater than 60 mm.
2) Except size 2
3) Continuous operation of the servo motors at an ambient temperature of +40°C to max. +55°C is possible, but this results in premature aging.
4) Requirements that go beyond this must be arranged with B&R.
5) For IP64, the motor must be mounted with the mounting flange and this mounting must correspond at least to IP64 protection. Otherwise, only IP54 applies instead of IP64.
9) With the IM 3031 type of construction and mounting arrangement (vertical, motor hanging on the machine), there is a risk of production fluids or oils penetrating the motor on the flange side. Motors or motor-gearbox combinations that should be used with this mounting arrangement must therefore have at least IP65 protection on the flange side.

2.9.1 Formula symbols

Term	Symbol	Unit	Description
Nominal speed	n_N	rpm	Nominal speed of the motor
Nominal torque	M_N	Nm	The nominal torque is output by the motor with n = n_N when the nominal current is absorbed. This is possible for any length of time if the ambient conditions are correct.
Nominal power	P_N	kW	The nominal power is supplied by the motor when n = n_N. This is possible for any length of time if the ambient conditions are correct.
Nominal current	I_N	A	The nominal current is the effective value of the phase current (current in the motor supply line) for the development of the nominal torque at nominal speed. This is possible for any length of time if the ambient conditions are correct.
Stall torque	M_0	Nm	The stall torque is output by the motor at speed n_0 and when the stall current is absorbed. This is possible for any length of time if the ambient conditions are correct. Speed n_0 must be high enough for the temperature in all windings to be homogeneous and stationary (for B&R motors, n_0 = 50 rpm). The continuous torque is reduced at a real standstill.
Stall current	I_0	A	The stall current is the effective value of the phase current (current in the motor supply line) for the development of the standstill torque at speed n_0. This can be output for any length of time if the ambient conditions are maintained. Speed n_0 must be high enough for the temperature in all windings to be homogeneous and stationary (for B&R motors, n_0 = 50 rpm).
Peak torque	M_{max}	Nm	The peak torque is briefly output by the motor when the peak current is absorbed.
Peak current	I_{max}	A	The peak current is the effective value of the phase current (current in the motor supply line) for the development of the peak torque. This is only permitted to be used for a short time. The peak current is determined by the magnetic circuit. Exceeding this value for a short time can cause irreversible damage (demagnetization of the magnet material).
Maximum speed	n_{max}	rpm	Maximum motor speed. This is a mechanical condition (centrifugal force, bearing wear).
Average speed	$n_{average}$	rpm	Average speed for one cycle.
Torque constant	K_T	Nm/A	The torque constant specifies the torque generated by the motor at 1 Arms phase current. This value applies at a motor temperature of 20°C. If the temperature increases, the torque constant is reduced (typically down to 10%). If the current increases, the torque constant is reduced (typically starting at twice the value of the nominal current).
Voltage constant	K_E	V/1000 rpm	The voltage constant specifies the RMS value (phase-phase) of the reverse voltage induced by the motor at a speed of 1000 rpm (EMF). This value applies at a motor temperature of 20°C. When the temperature increases, the voltage constant is reduced (usually down to 5%). If the current increases, the voltage constant is reduced (typically starting at twice the value of the nominal current).
Stator resistance	R_{2ph}	Ω (Ohm)	Resistance measured in ohms between two motor leads (phase-phase) at 20°C winding temperature. On B&R motors, the windings use a star connection.
Stator inductance	L_{2ph}	mH	Winding inductance measured between two motor leads. The stator inductance depends on the rotor position.
Electrical time constant	t_{el}	ms	Corresponds to 1/5 of the time needed for the stator current to stabilize with constant operating conditions.
Thermal time constant	t_{therm}	min	Corresponds to 1/5 of the time needed for the motor temperature to stabilize with constant operating conditions.
Moment of inertia without brake	J	kgcm²	Moment of inertia for a motor without a holding brake.
Weight without brake	m	kg	Mass of motor without holding brake.
Moment of inertia of brake	J_{Br}	kgcm²	Moment of inertia for the built-in holding brake.
Mass of brake	m_{Br}	kg	Mass of built-in holding brake.
Brake holding torque	M_{Br}	Nm	Minimum torque required to hold the rotor when the brake is activated.
Installed load	P_{On}	W	Installed load for the built-in holding brake.
Installed current	I_{on}	A	Installed current for the built-in holding brake.
Connection voltage	U_{on}	V	Operating voltage for the built-in holding brake.
Activation delay	t_{on}	ms	Delay time required for the holding torque of the brake to be established after the operating voltage has been removed from the holding brake.
Release delay	t_{off}	ms	Delay time required until the holding torque of the holding brake is reduced by 90% (the brake is released) after operating voltage has been returned to the holding brake.

2.9.2 Power dissipation

Power dissipation from the servo motors takes place via the motor flange and surface of the motor. The following factors are important to ensure optimal heat dissipation:

- Thermally open installation
- Free convection

The motor data specified for the nominal operating point apply to a motor installed in a thermally open system. The dimensions of the flange plates used for the measurement are shown in the table below.

Generally speaking, the larger the flange, the better the heat dissipation.

Size	Dimensions [mm]	Material
8MSA2...-4	250 x 250 x 6	Aluminum
8MSA3...-4	250 x 250 x 6	Aluminum
8MSx4...-4	350 x 350 x 12	Aluminum
8MSx5...-4	350 x 350 x 12	Aluminum

2.10 8MS...-4 - Technical data

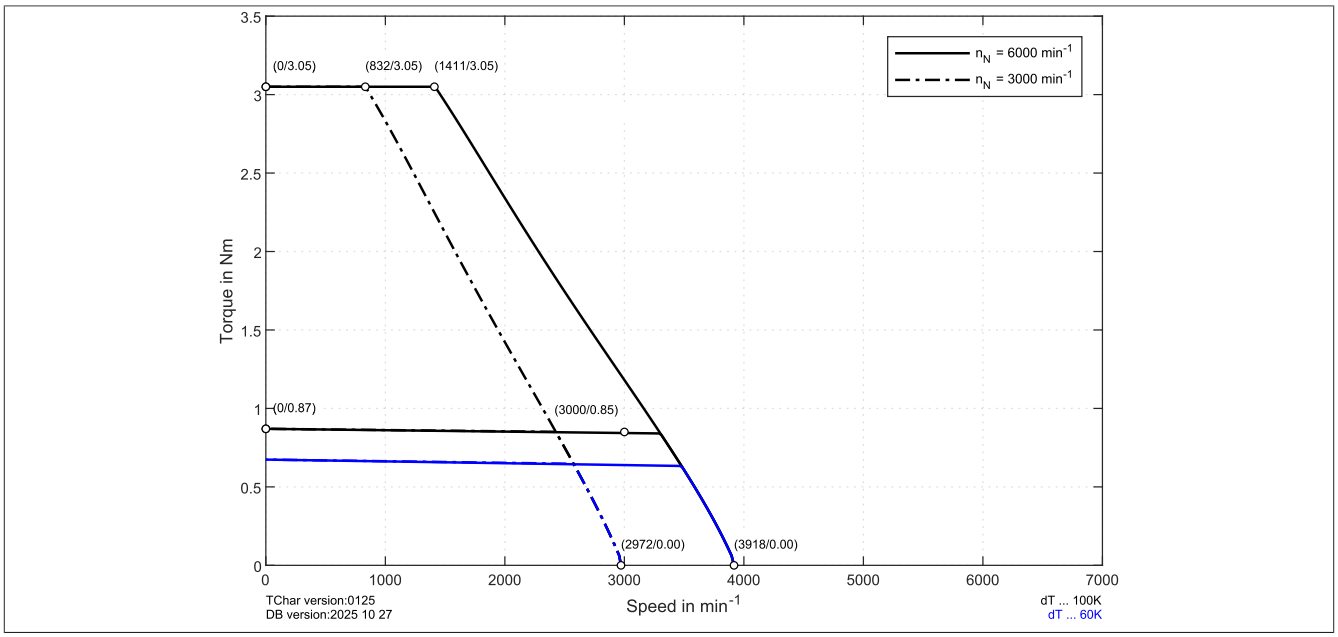
2.10.1 8MSA2...-4 - Technical data

Motor	8MSA24...-4		8MSA26...-4	
Nominal speed n_N [rpm]	3000	6000	3000	6000
Number of pole pairs	5	5	5	5
Nominal torque M_n [Nm]	0.85	0.82	1.52	1.35
Nominal power P_N [W]	267	515	478	848
Nominal current I_N [A]	0.71	0.90	1.27	1.48
Stall torque M_0 [Nm]	0.87	0.87	1.62	1.62
Stall current I_0 [A]	0.73	0.96	1.35	1.78
Maximum torque M_{max} [Nm]	3.05	3.05	5.60	5.60
Maximum current I_{max} [A]	3.18	4.19	5.41	7.13
Maximum speed n_{max} [rpm]	7200	7200	7200	7200
Torque constant K_T [Nm/A]	1.20	0.91	1.20	0.91
Voltage constant K_E [V/1000 rpm]	72.55	55.00	72.50	55.00
Stator resistance R_{2ph} [Ω]	51.63	31.75	19.55	11.77
Stator inductance L_{2ph} [mH]	77.18	44.50	40.29	22.93
Electrical time constant t_{el} [ms]	1.49	1.40	2.06	1.95
Thermal time constant t_{therm} [min]	10	10	15	15
Moment of inertia J [kgcm²]	0.23	0.23	0.42	0.42
Mass without brake m [kg]	1.01	1.01	1.41	1.41
Holding brake				
Holding torque of brake M_{Br} [Nm]	1.30	1.30	1.30	1.30
Mass of brake [kg]	0.37	0.37	0.35	0.35
Moment of inertia of brake J_{Br} [kgcm²]	0.0074	0.0074	0.0074	0.0074
Recommendations				
ACOPOS P3 8EIxxxx...	1X6X	1X6X	1X6X	2X2X
Cable cross section for B&R motor cable [mm²]	0.75	0.75	0.75	0.75
Connector size	1	1	1	1

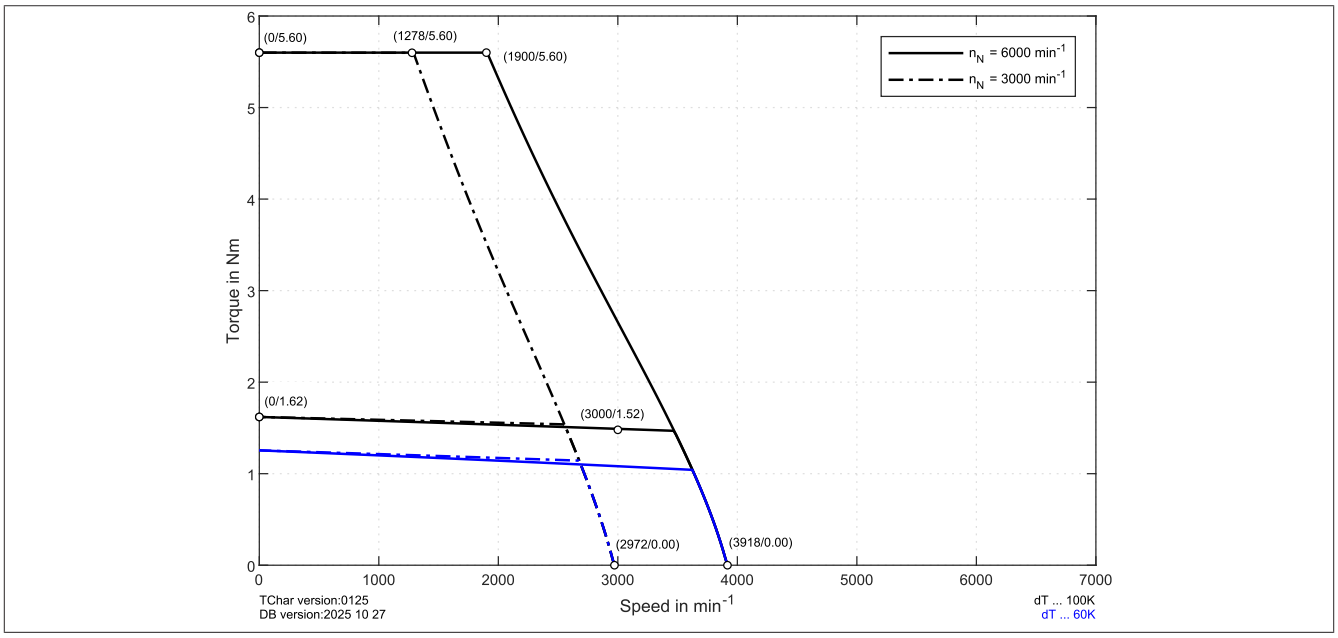
NOTE about servo drives: The recommended servo drive / inverter module is designed for 1.1x the stall current. If more than double the amount is needed during the acceleration phase, the next larger servo drive should be selected. This recommendation is only a guide value; detailed inspection of the corresponding speed/torque characteristic curve can result in deviations of the servo drive size (larger or smaller).
NOTE about cable cross section: The B&R motor cables with this cable cross section are produced optimally (cables stripped to the correct length) for the ACOPOS servo drive or the recommended ACOPOS inverter module. B&R motor cables with other cable cross sections can also be used (within the specified terminal cross section range) and can be obtained from B&R in the desired design on request. Note the type of wiring.

2.10.1.1 Speed-Torque characteristic curves at 325 VDC DC bus voltage

8MSA24.ee030ffgg-4

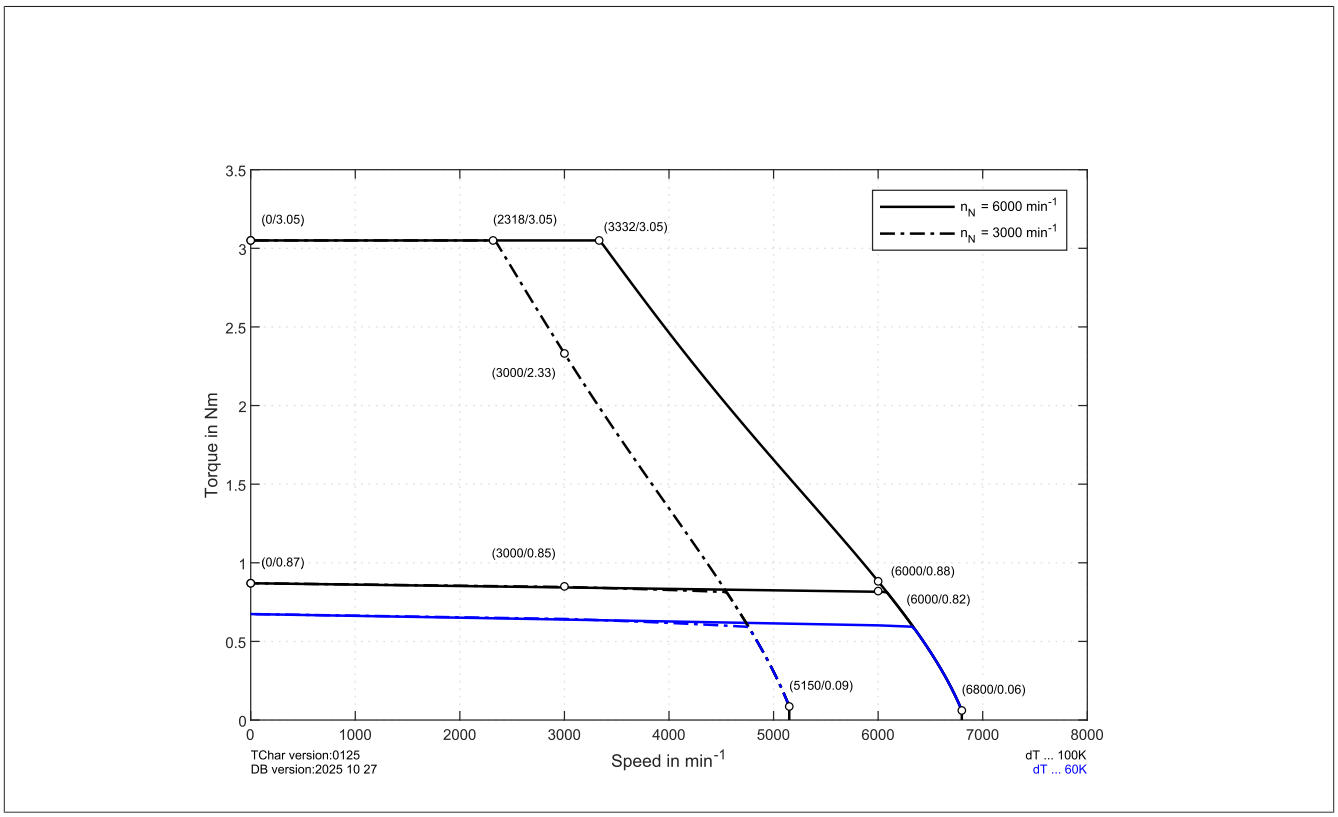


8MSA26.ee030ffgg-4



2.10.1.2 Speed-Torque characteristic curves at 560 VDC DC bus voltage

8MSA24.eennnffgg-4



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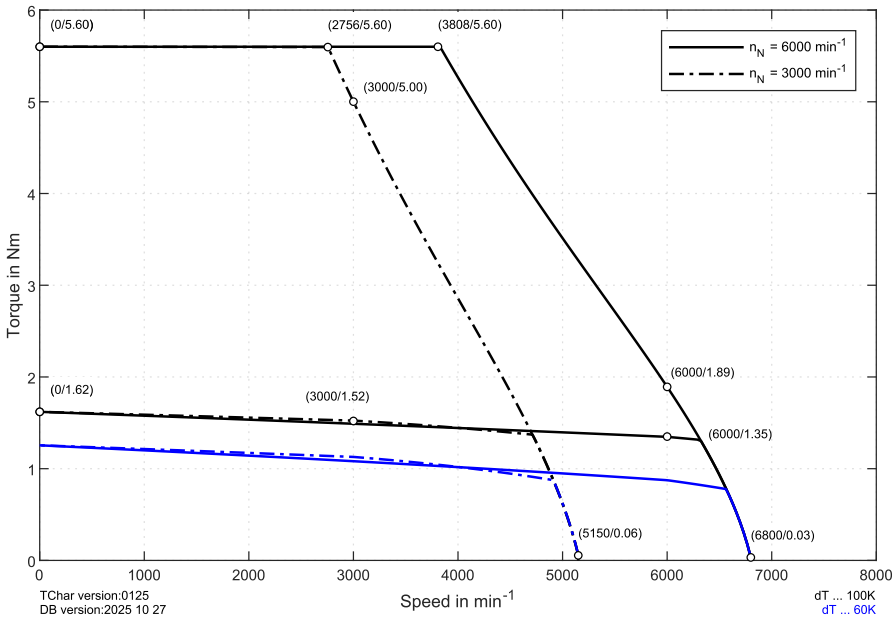
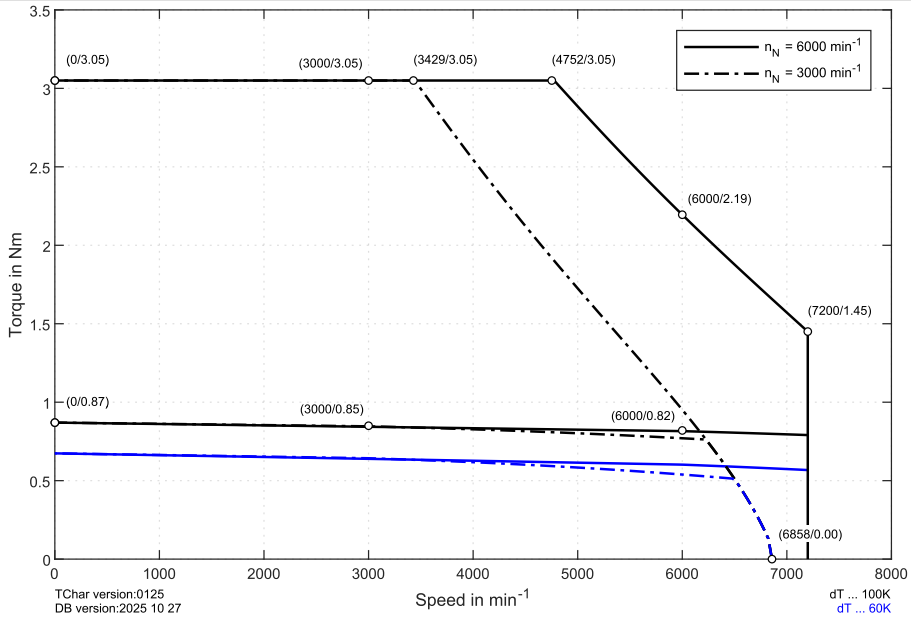
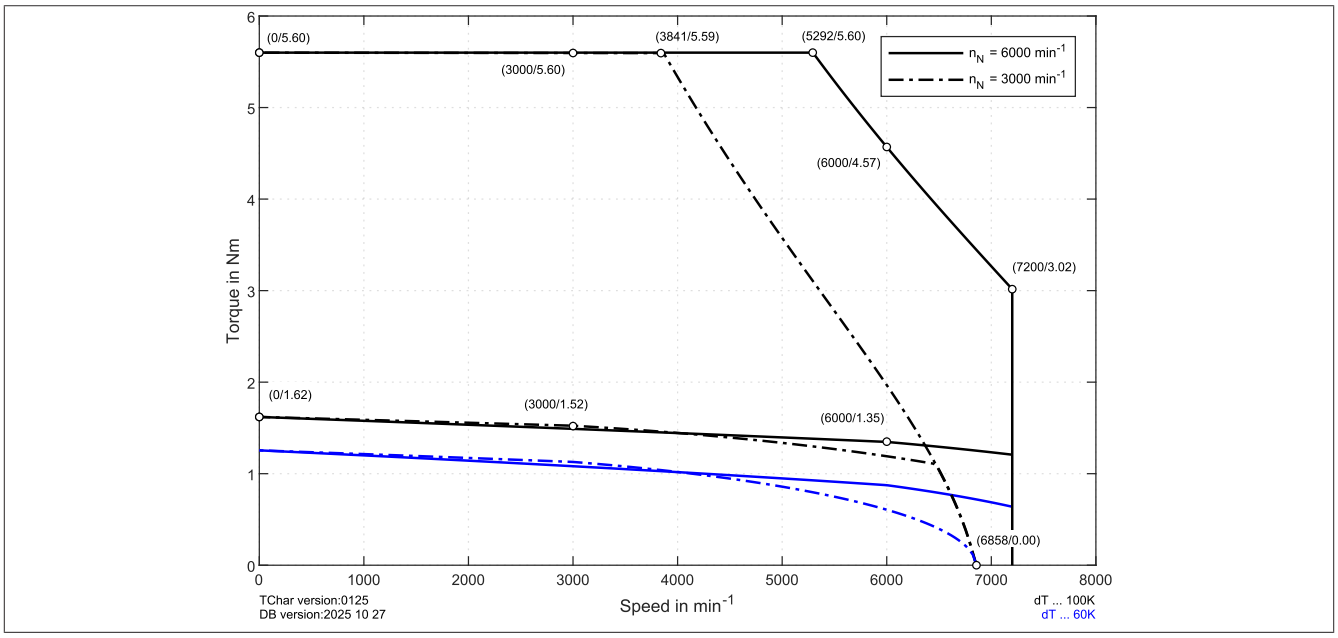


2.10.1.3 Speed-Torque characteristic curves at 750 VDC DC bus voltage

8MSA24.eennnffgg-4



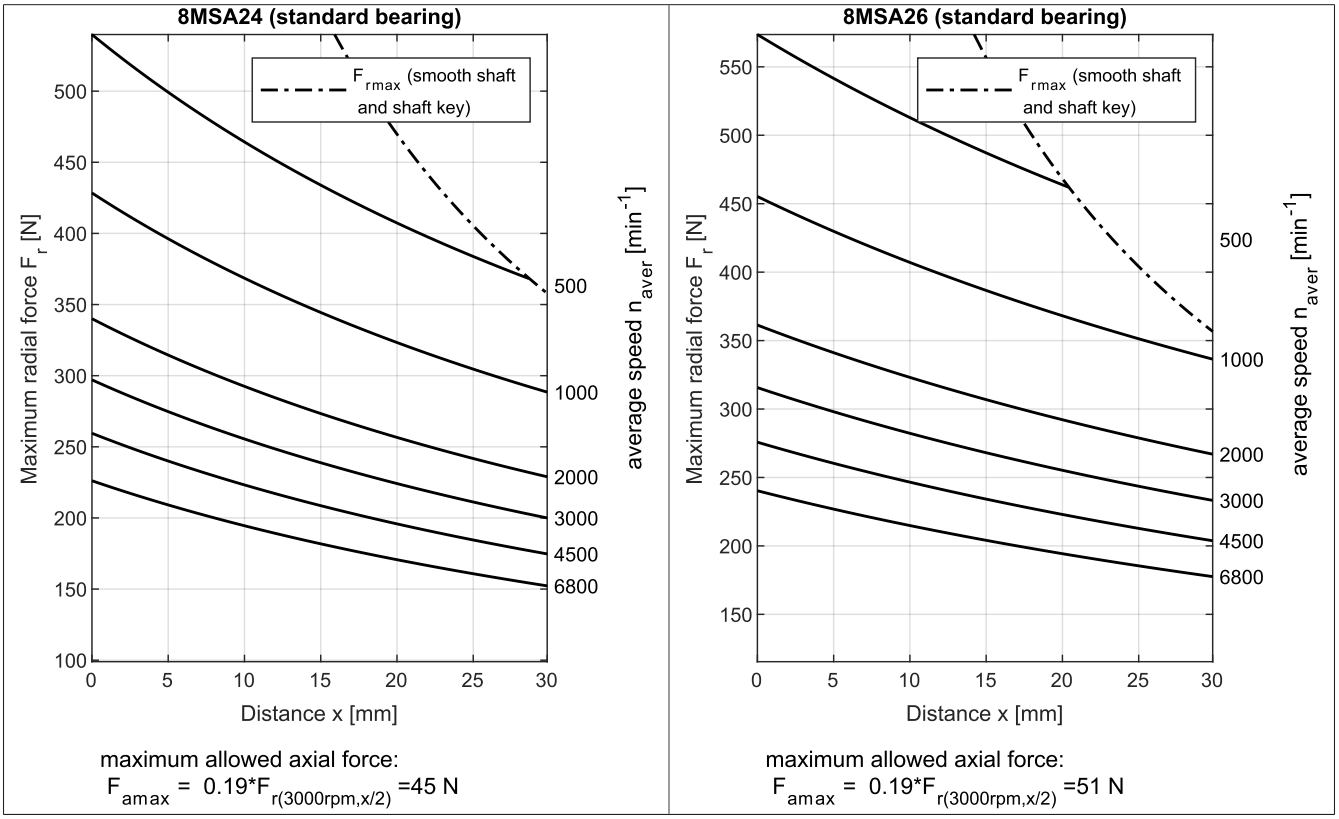
8MSA26.eennnffgg-4



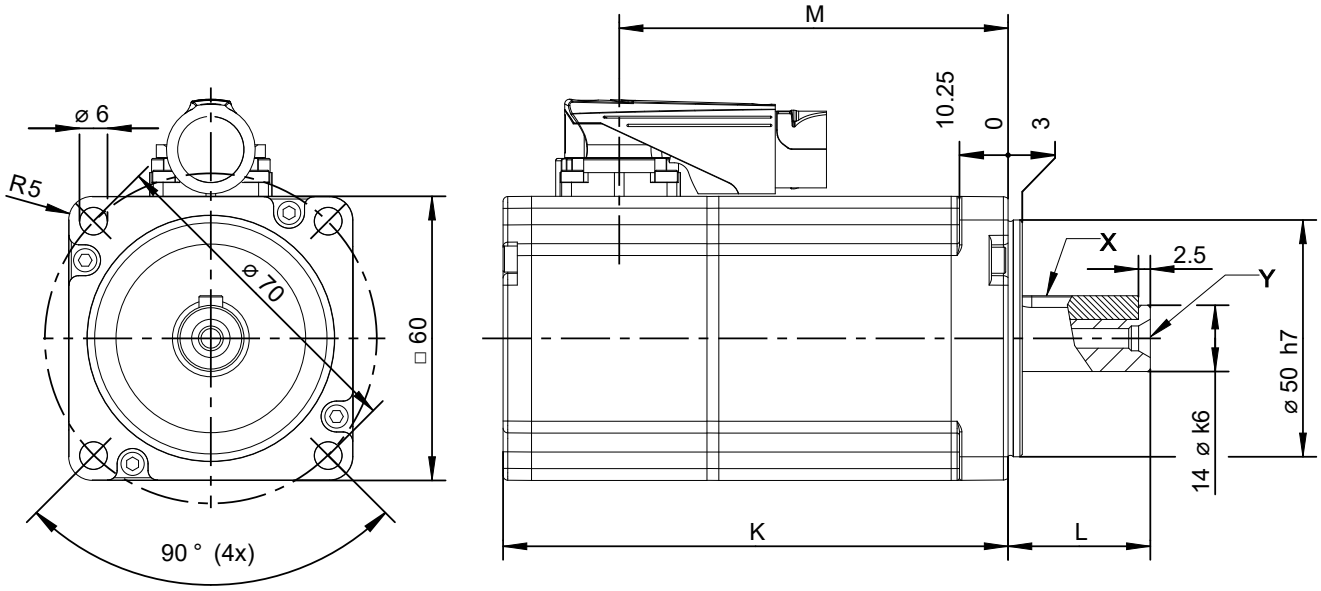
2.10.1.4 Permissible shaft load

Note the information in section "Load capacity of the shaft end and bearing" on page 53 of chapter "Installation conditions".

2.10.1.4.1 8MSA2...-4 - Standard bearing



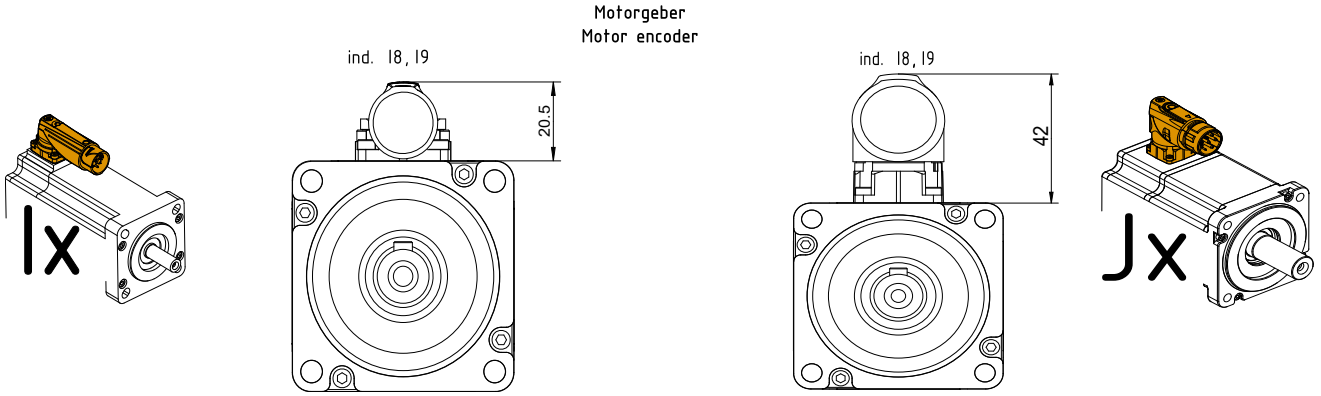
2.10.1.5 8MSA2...-4 - Dimensions



Extension of K and M depending on motor option [mm]						Key	Shaft end	
	K [1]	L	M [1]	Holding brake	Oil seal	X	Y	D
Motor encoder	I8, I9						Drill hole	Ø
8MSA24...-4	106,5	30	82	29.5	0	A5x5x25	M5 / 12.5mm	14k6
8MSA26...-4	129,5	30	105	29.5	0	A5x5x25	M5 / 12.5mm	14k6

1) The holding brake and oil seal motor options extend dimensions "K" and "M".

Connection dimensions



2.10.2 8MSA3...-4 - Technical data

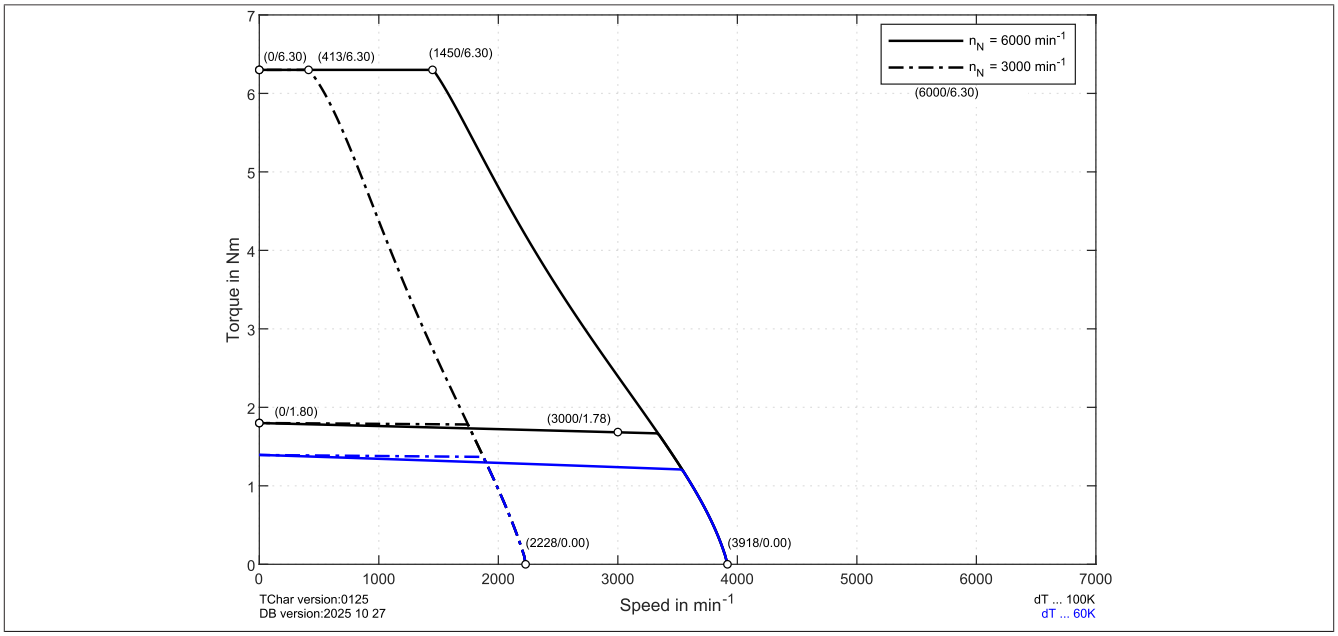
Motor	8MSA33...-4		8MSA34...-4		8MSA36...-4	
Nominal speed n_N [rpm]	3000	6000	3000	6000	3000	6000
Number of pole pairs	5	5	5	5	5	5
Nominal torque M_n [Nm]	1.78	1.56	3.45	2.60	3.91	2.88
Nominal power P_N [W]	559	980	1084	1634	1228	1810
Nominal current I_N [A]	1.11	1.71	2.16	2.86	2.44	3.17
Stall torque M_0 [Nm]	1.80	1.80	3.80	3.80	4.60	4.60
Stall current I_0 [A]	1.13	1.98	2.38	4.18	2.88	5.06
Maximum torque M_{max} [Nm]	6.30	6.30	13.30	13.30	16.10	16.10
Maximum current I_{max} [A]	5.70	10.02	10.84	19.06	12.43	21.85
Maximum speed n_{max} [rpm]	7200	7200	7200	7200	7200	7200
Torque constant K_T [Nm/A]	1.60	0.91	1.60	0.91	1.60	0.91
Voltage constant K_E [V/1000 rpm]	96.70	55.00	96.70	55.00	96.70	55.00
Stator resistance R_{2ph} [Ω]	33.42	10.35	8.13	2.60	6.38	2.05
Stator inductance L_{2ph} [mH]	88.97	29.00	37.53	12.31	28.80	9.40
Electrical time constant t_{el} [ms]	2.66	2.80	4.62	4.73	4.51	4.59
Thermal time constant t_{therm} [min]	15	15	20	20	24	24
Moment of inertia J [kgcm²]	0.80	0.80	1.44	1.44	2.04	2.04
Mass without brake m [kg]	2.10	2.10	2.60	2.60	3.08	3.08
Holding brake						
Holding torque of brake M_{Br} [Nm]	2.50	2.50	2.50	2.50	2.50	2.50
Mass of brake [kg]	0.80	0.80	0.67	0.67	0.61	0.61
Moment of inertia of brake J_{Br} [kgcm²]	0.024	0.024	0.024	0.024	0.024	0.024
Recommendations						
ACOPOS P3 8EIxxxx...	2X2X	2X2X	4X5X	8X8X	4X5X	8X8X
Cable cross section for B&R motor cable [mm²]	0.75	0.75	0.75	0.75	0.75	0.75
Connector size	1	1	1	1	1	1

NOTE about servo drives: The recommended servo drive / inverter module is designed for 1.1x the stall current. If more than double the amount is needed during the acceleration phase, the next larger servo drive should be selected. This recommendation is only a guide value; detailed inspection of the corresponding speed/torque characteristic curve can result in deviations of the servo drive size (larger or smaller).

NOTE about cable cross section: The B&R motor cables with this cable cross section are produced optimally (cables stripped to the correct length) for the ACOPOS servo drive or the recommended ACOPOS inverter module. B&R motor cables with other cable cross sections can also be used (within the specified terminal cross section range) and can be obtained from B&R in the desired design on request. Note the type of wiring.

2.10.2.1 Speed-Torque characteristic curves at 325 V DC bus voltage

8MSA33.eennnffgg-4



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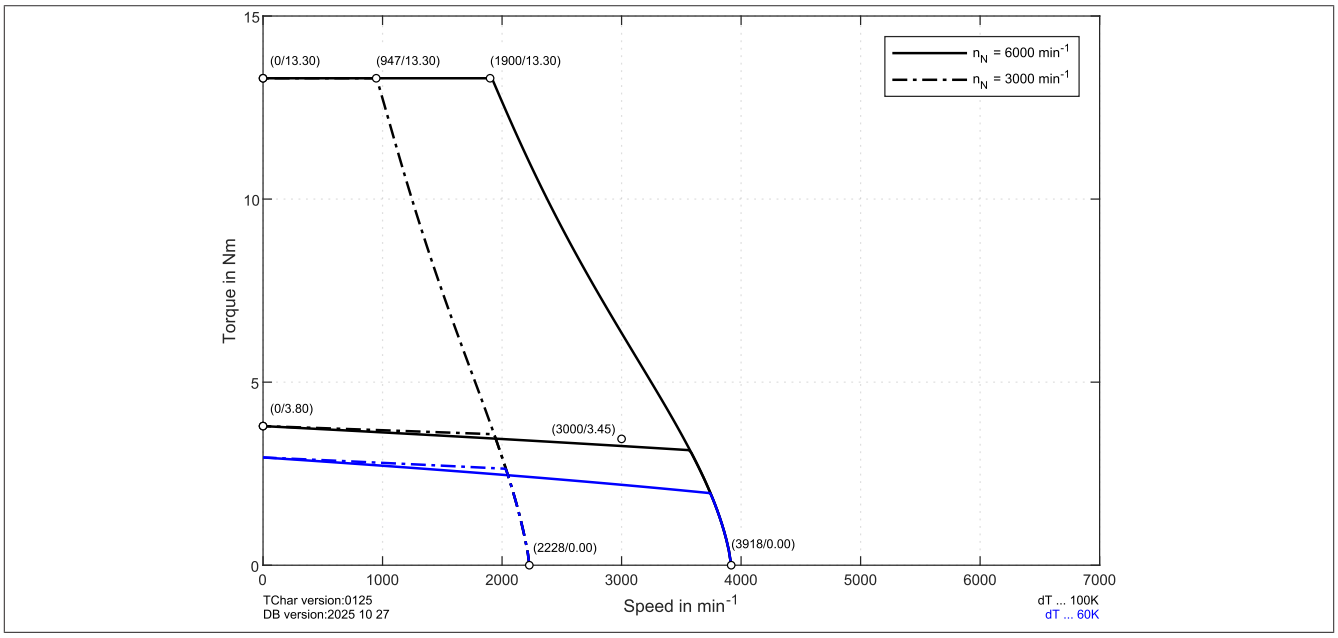
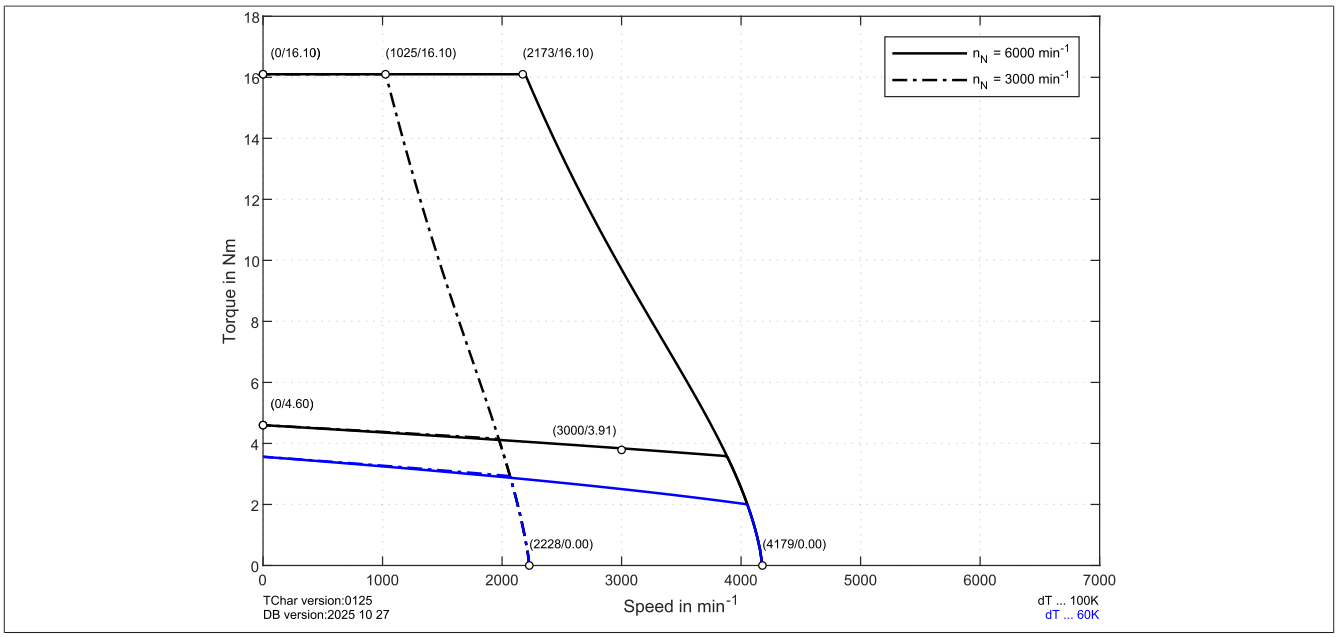
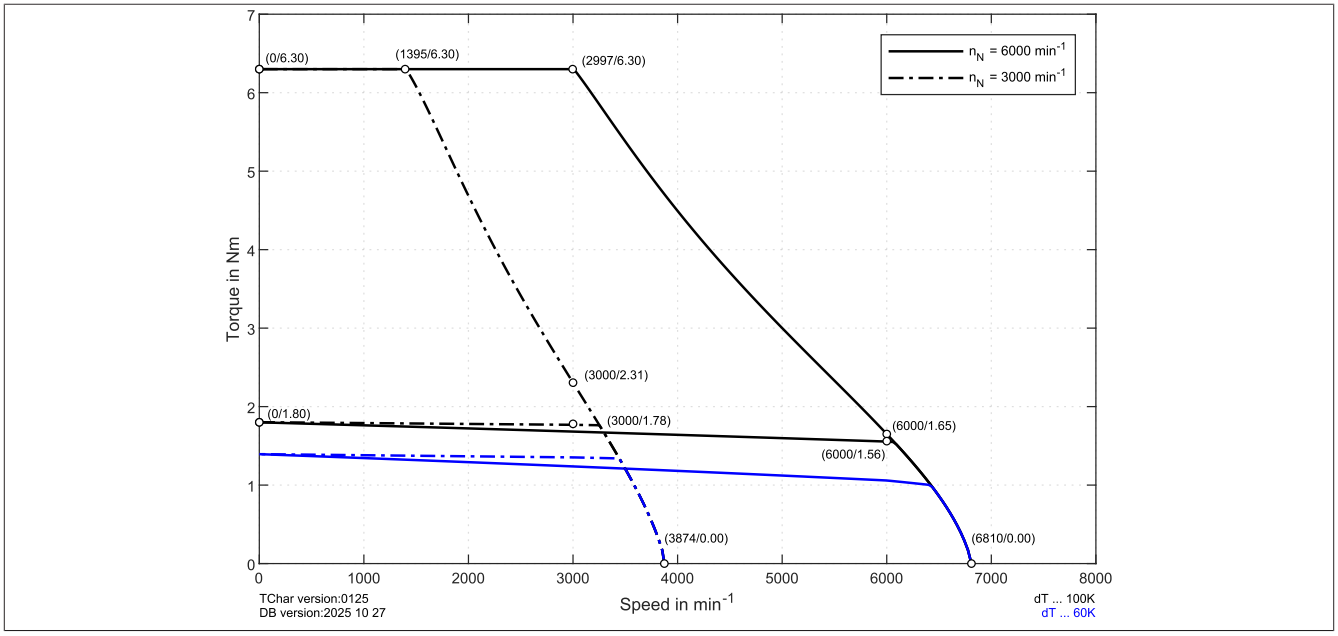


8MSA36.eennnffgg-4

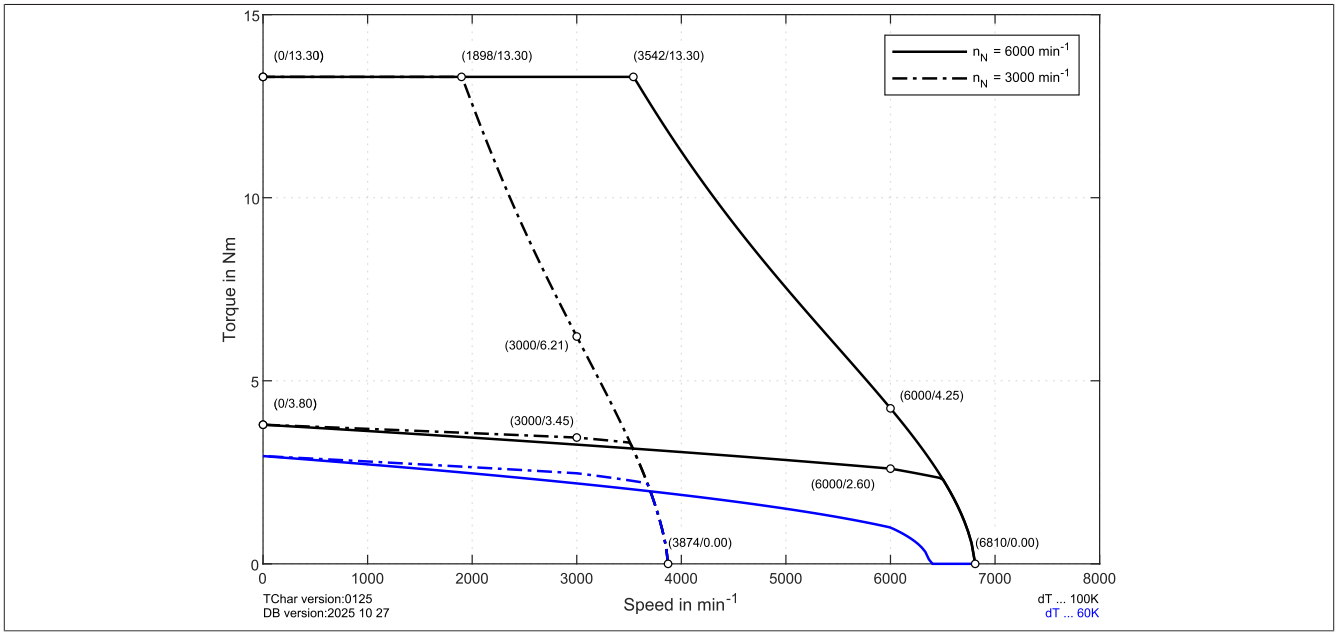


2.10.2.2 Speed-Torque characteristic curves at 560 VDC DC bus voltage

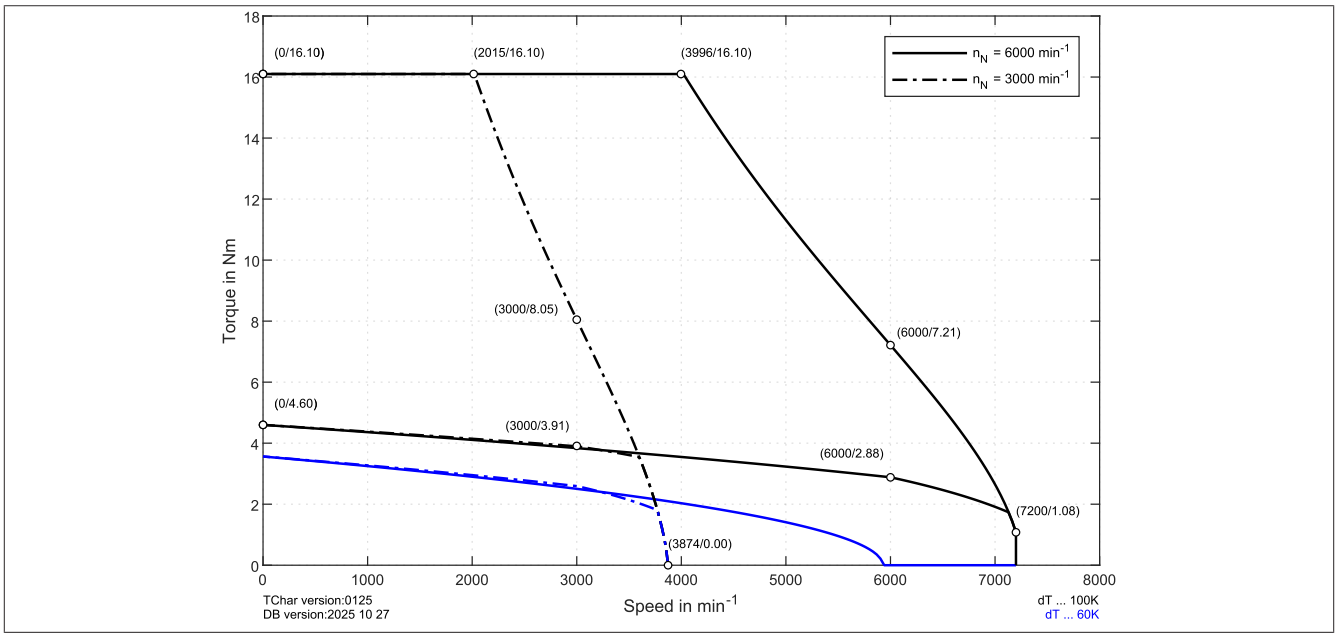
8MSA33.eennnffgg-4



8MSA34.eennnffgg-4

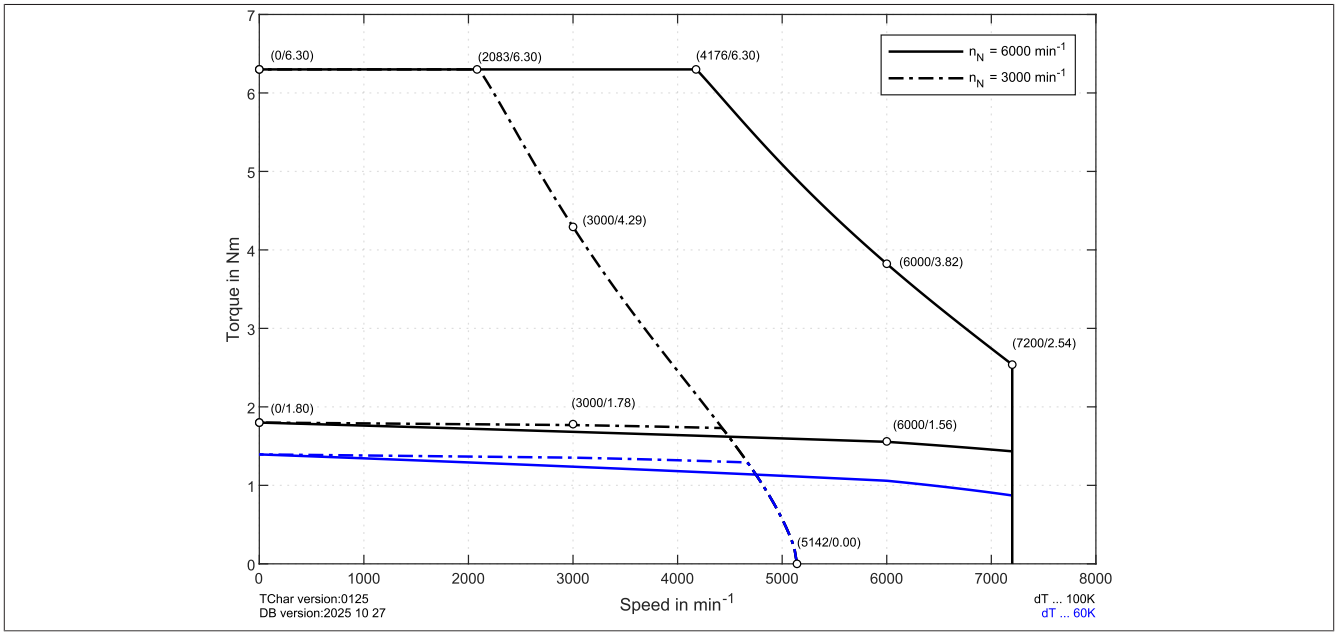


8MSA36.eennnffgg-4

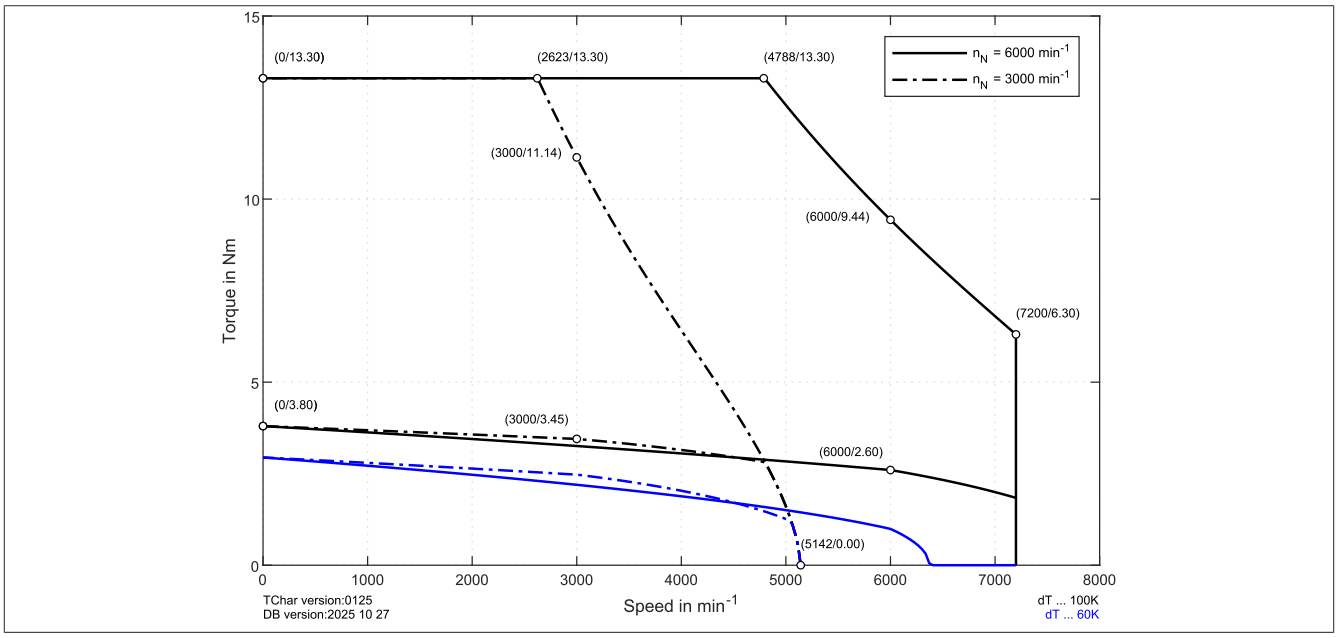


2.10.2.3 Speed-Torque characteristic curves at 750 VDC DC bus voltage

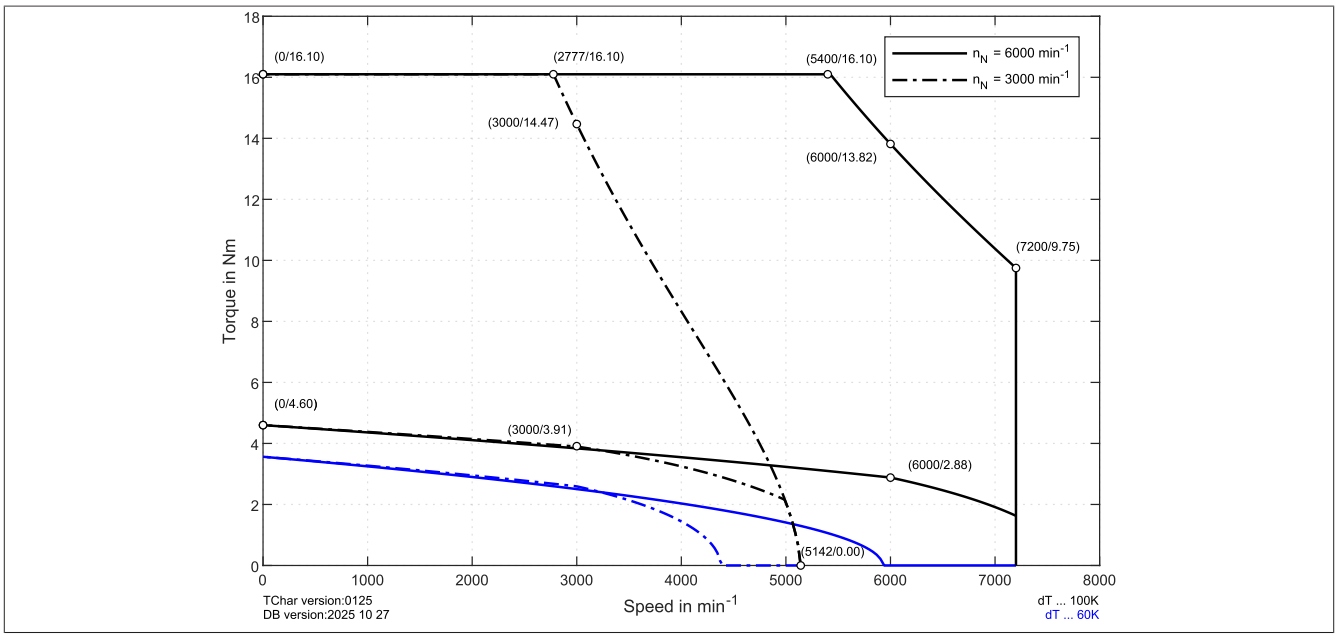
8MSA33.eennnffgg-4



8MSA34.eennnffgg-4



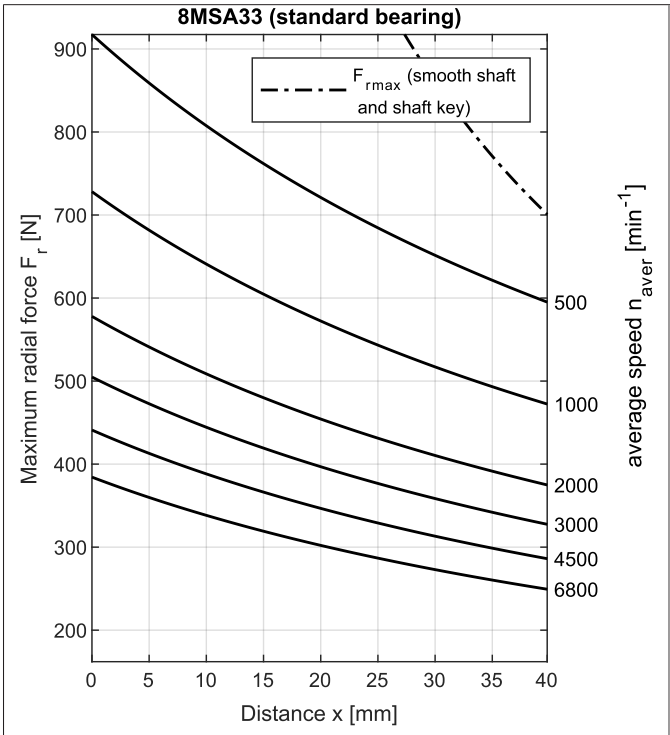
8MSA36.eennnffgg-4



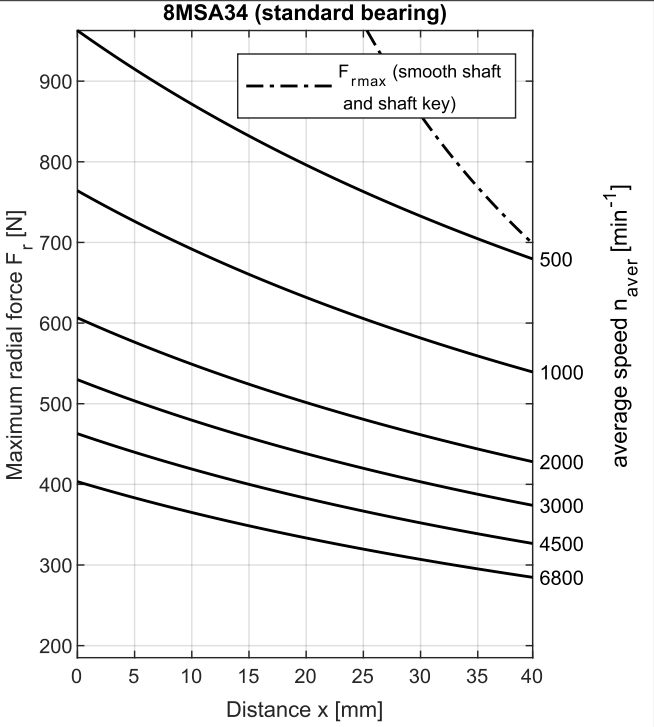
2.10.2.4 Permissible shaft load

Note the information in section "Load capacity of the shaft end and bearing" on page 53 of chapter "Installation conditions".

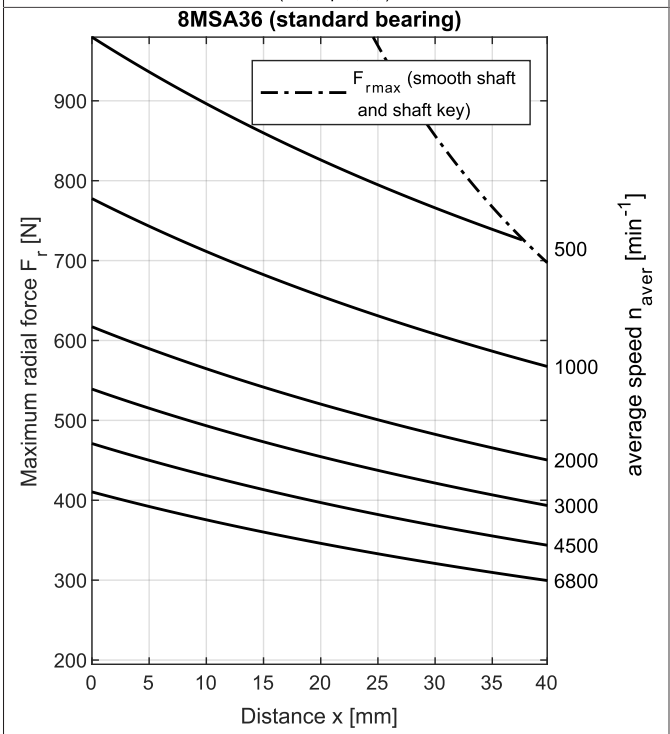
2.10.2.4.1 8MSA3...-4 - Standard bearing



maximum allowed axial force:
$F_{amax} = 0.19*F_{r(3000rpm,x/2)} = 76\ N$

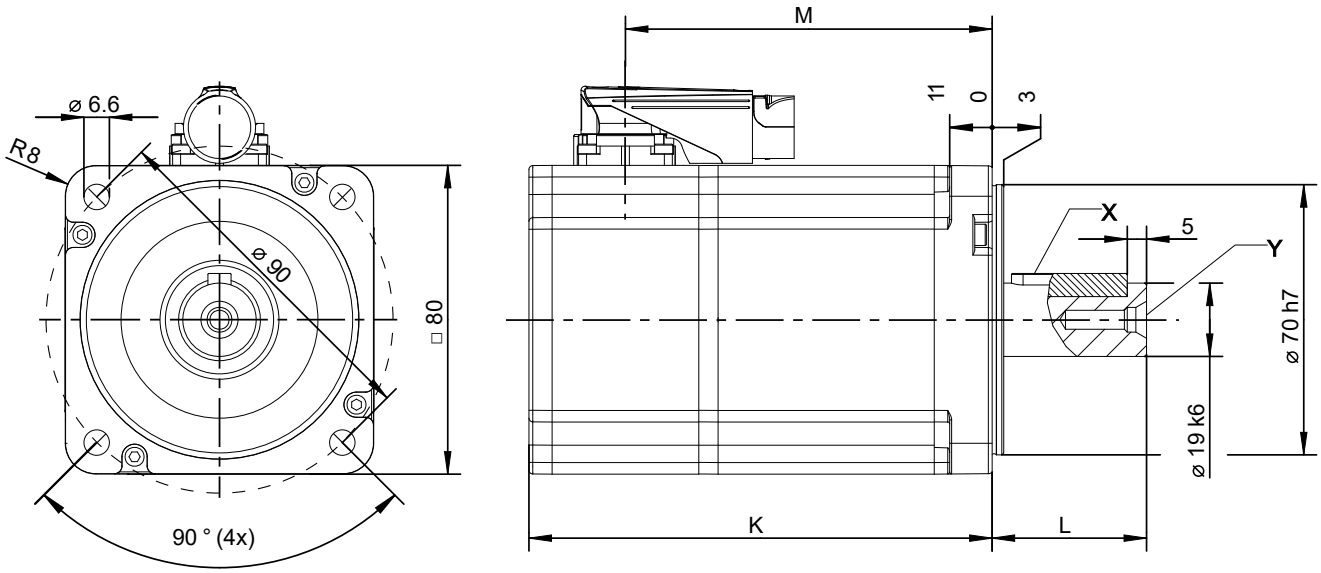


maximum allowed axial force:
$F_{amax} = 0.19*F_{r(3000rpm,x/2)} = 83\ N$



maximum allowed axial force:
$F_{amax} = 0.19*F_{r(3000rpm,x/2)} = 87\ N$

2.10.2.5 8MSA3...-4 - Dimensions

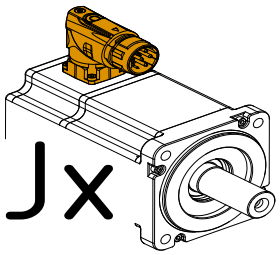


Extension of K and M depending on motor option [mm]						Key	Shaft end	
	K [1]	L	M [1]	Holding brake	Oil seal	X	Y	D
Motor encoder	I8, I9						Drill hole	Ø
8MSA33...-4	120	40	95	29	0	A6x6x30	M6 / 16mm	19k6
8MSA34...-4	142	40	117	29	0	A6x6x30	M6 / 16mm	19k6
8MSA36...-4	154	40	129	29	0	A6x6x30	M6 / 16mm	19k6

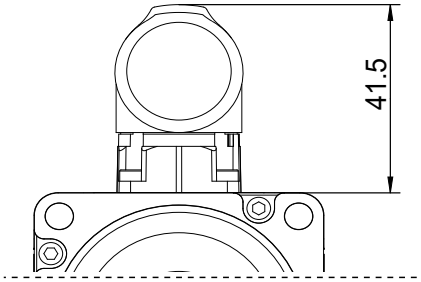
1) The holding brake and oil seal motor options extend dimensions "K" and "M".

Connection dimensions

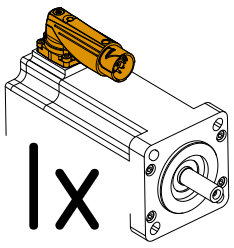
Motorgeber
Motor encoder



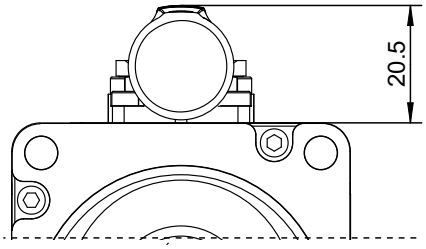
ind. I8, I9



Motorgeber
Motor encoder



ind. I8, I9



2.10.3 8MSA4...-4 - Technical data

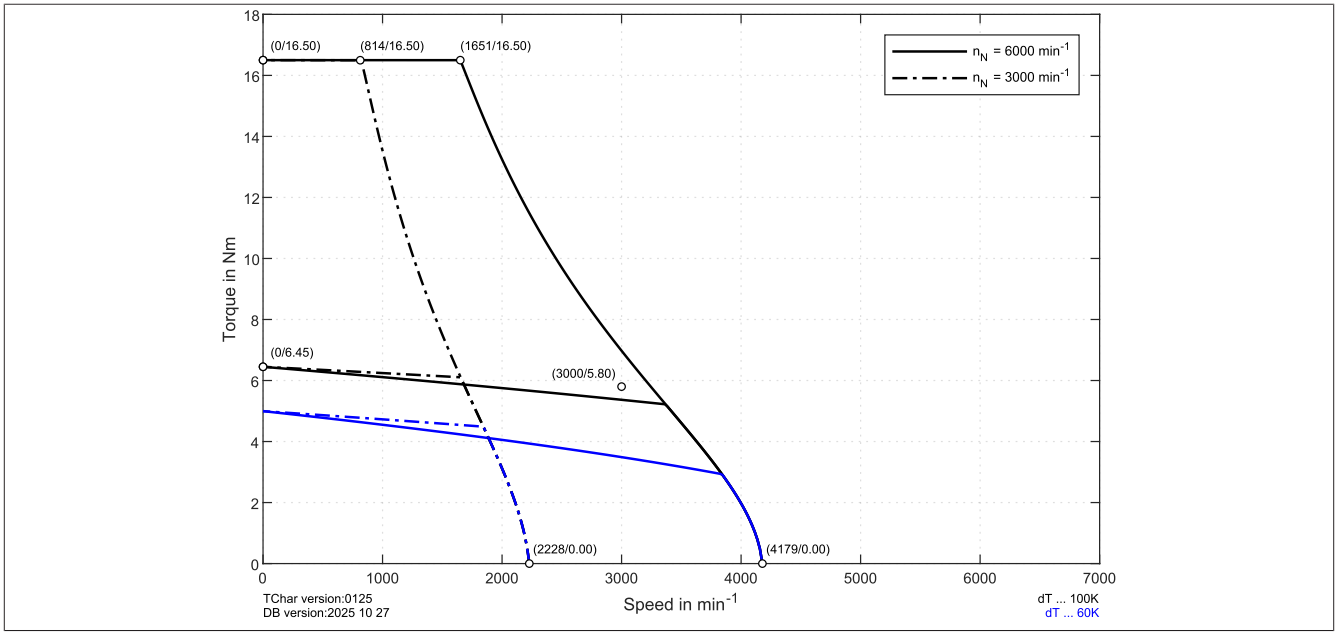
Motor	8MSA44...-4		8MSA46...-4	
Nominal speed n_N [rpm]	3000	6000	3000	6000
Number of pole pairs	5	5	5	5
Nominal torque M_n [Nm]	5.80	4.00	8.36	6.08
Nominal power P_N [W]	1822	2513	2626	3820
Nominal current I_N [A]	3.63	4.40	5.23	6.68
Stall torque M_0 [Nm]	6.45	6.45	10.16	10.16
Stall current I_0 [A]	4.03	7.09	6.35	11.17
Maximum torque M_{max} [Nm]	16.50	16.50	33.0	33.0
Maximum current I_{max} [A]	14.29	25.12	28.82	50.66
Maximum speed n_{max} [rpm]	7200	7200	7200	7200
Torque constant K_T [Nm/A]	1.60	0.91	1.60	0.91
Voltage constant K_E [V/1000 rpm]	96.70	55.00	97.00	55.00
Stator resistance R_{2ph} [Ω]	4.20	1.50	1.94	0.61
Stator inductance L_{2ph} [mH]	44.43	14.28	22.22	7.14
Electrical time constant t_{el} [ms]	10.58	9.52	11.45	11.70
Thermal time constant t_{therm} [min]	28	28	30	30
Moment of inertia J [kgcm²]	2.56	2.56	4.64	4.64
Mass without brake m [kg]	4.81	4.81	7.00	7.00
Holding brake				
Holding torque of brake M_{Br} [Nm]	6.50	6.50	6.50	6.50
Mass of brake [kg]	0.83	0.83	0.83	0.83
Moment of inertia of brake J_{Br} [kgcm²]	0.033	0.033	0.033	0.033
Recommendations				
ACOPOS P3 8EIxxxx...	4X5X	8X8X	8X8X	013X
Cable cross section for B&R motor cable [mm²]	1.5	1.5	1.5	1.5
Connector size	1	1	1	1

NOTE about servo drives: The recommended servo drive / inverter module is designed for 1.1x the stall current. If more than double the amount is needed during the acceleration phase, the next larger servo drive should be selected. This recommendation is only a guide value; detailed inspection of the corresponding speed/torque characteristic curve can result in deviations of the servo drive size (larger or smaller).

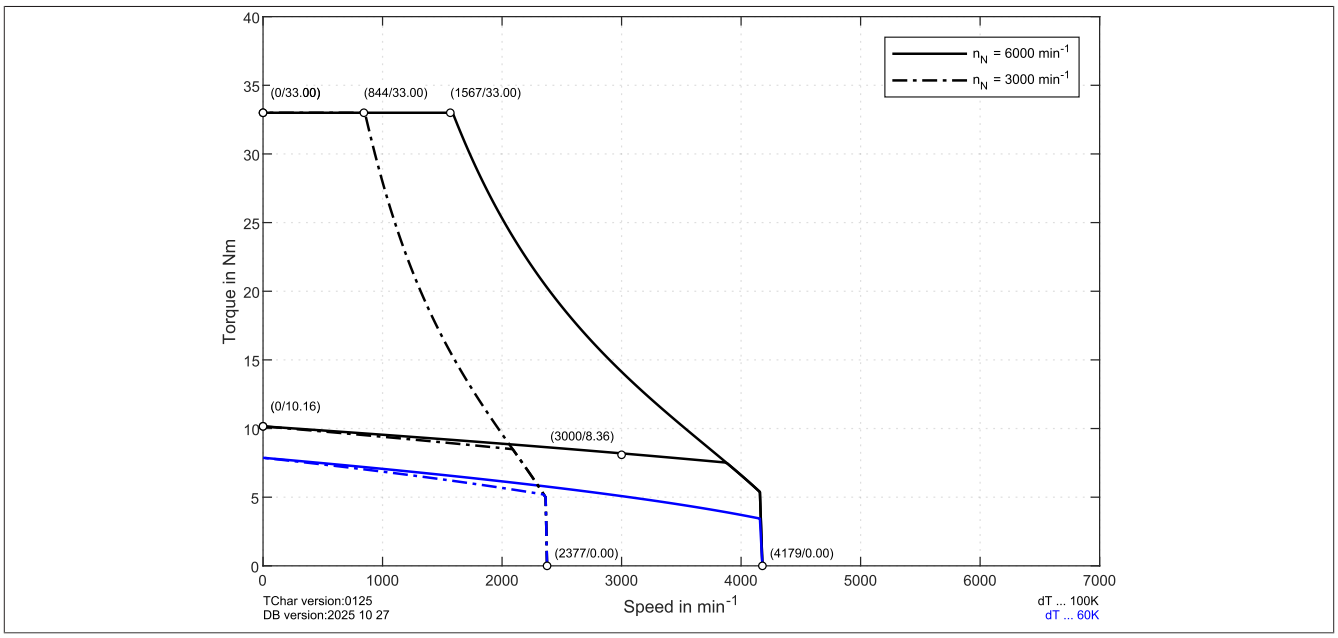
NOTE about cable cross section: The B&R motor cables with this cable cross section are produced optimally (cables stripped to the correct length) for the ACOPOS servo drive or the recommended ACOPOS inverter module. B&R motor cables with other cable cross sections can also be used (within the specified terminal cross section range) and can be obtained from B&R in the desired design on request. Note the type of wiring.

2.10.3.1 Speed-Torque characteristic curves at 325 VDC DC bus voltage

8MSA44.eennnffgg-4

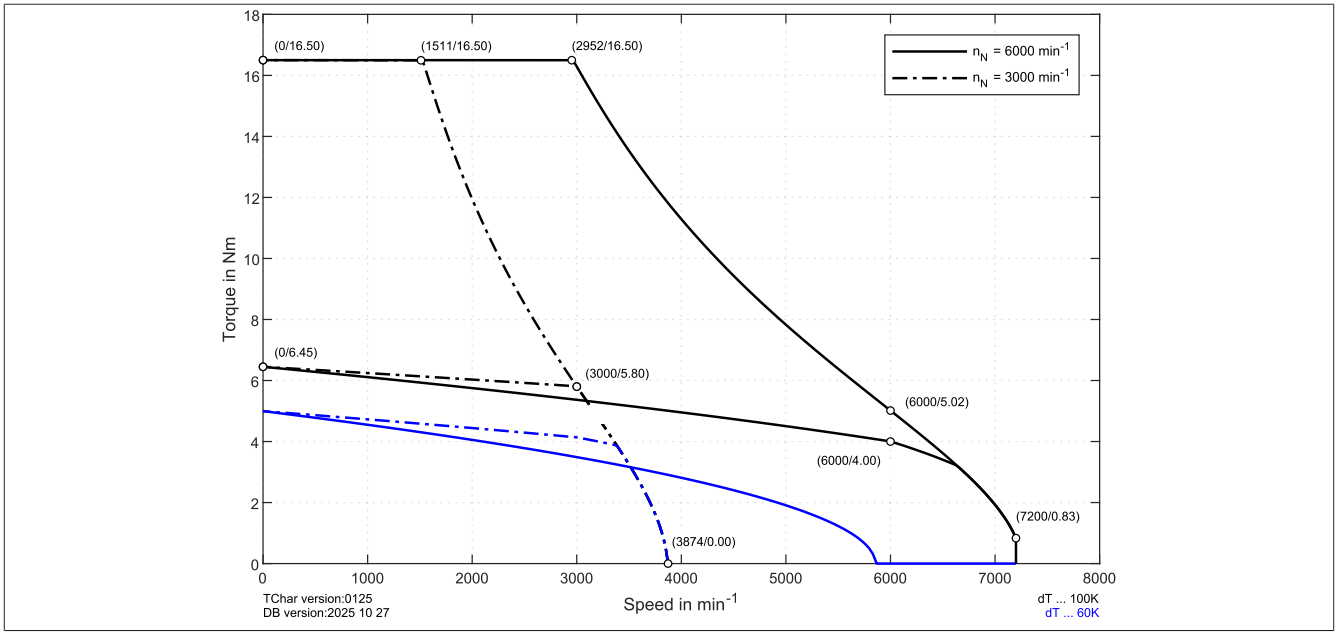


8MSA46.eennnffgg-4

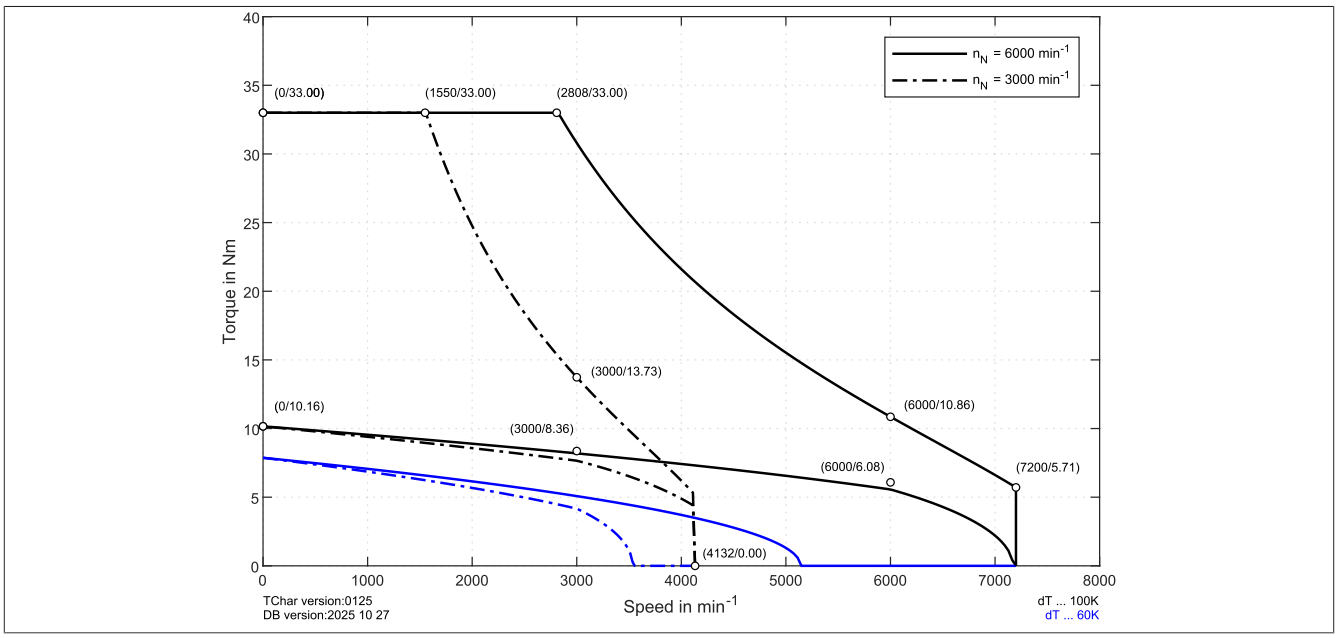


2.10.3.2 Speed-Torque characteristic curves at 560 VDC DC bus voltage

8MSA44.eennnffgg-4

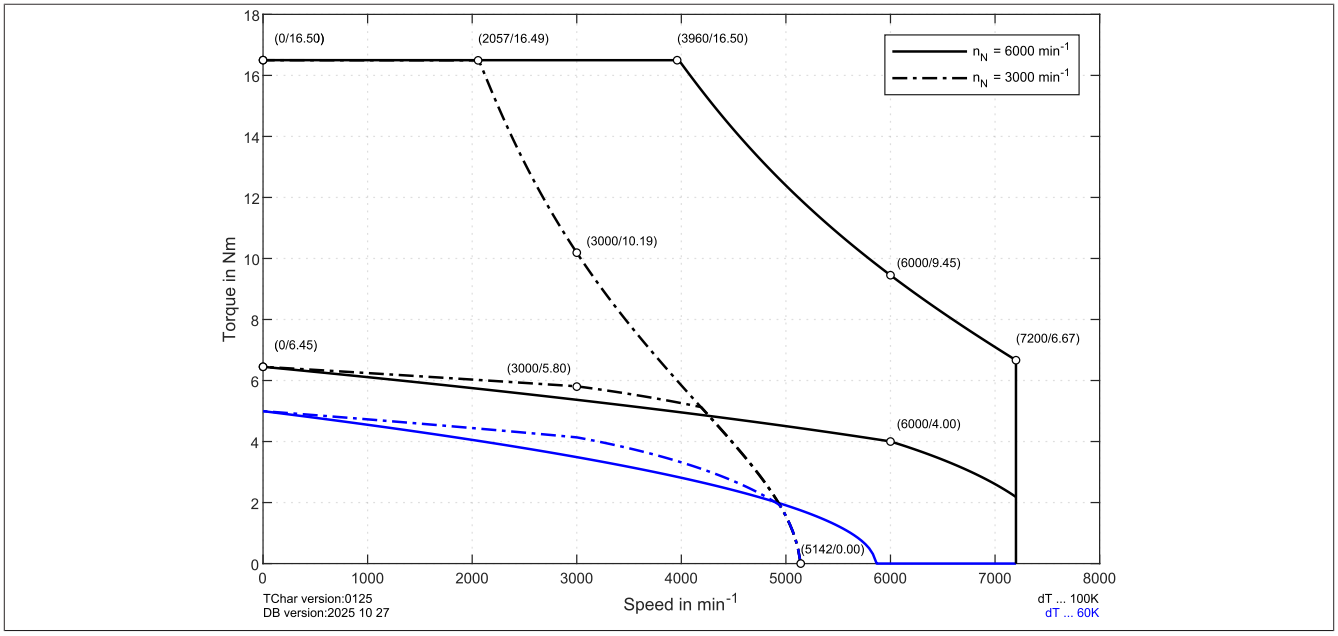


8MSA46.eennnffgg-4

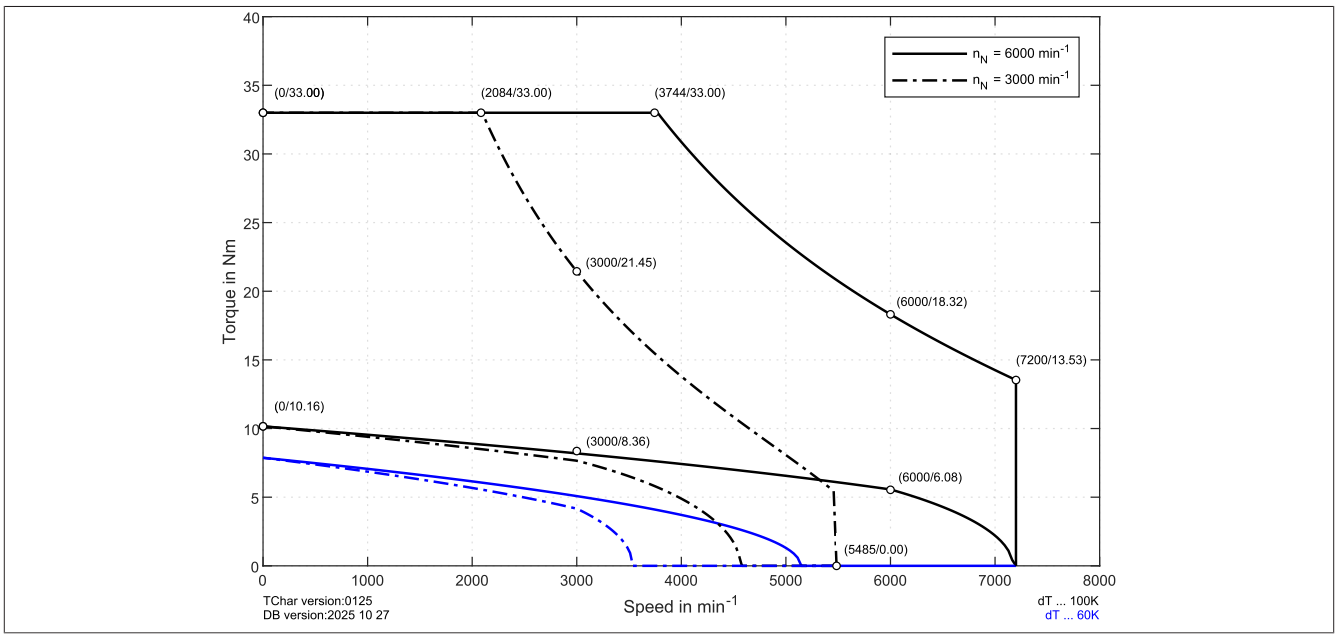


2.10.3.3 Speed-Torque characteristic curves at 750 VDC DC bus voltage

8MSA44.eennnffgg-4



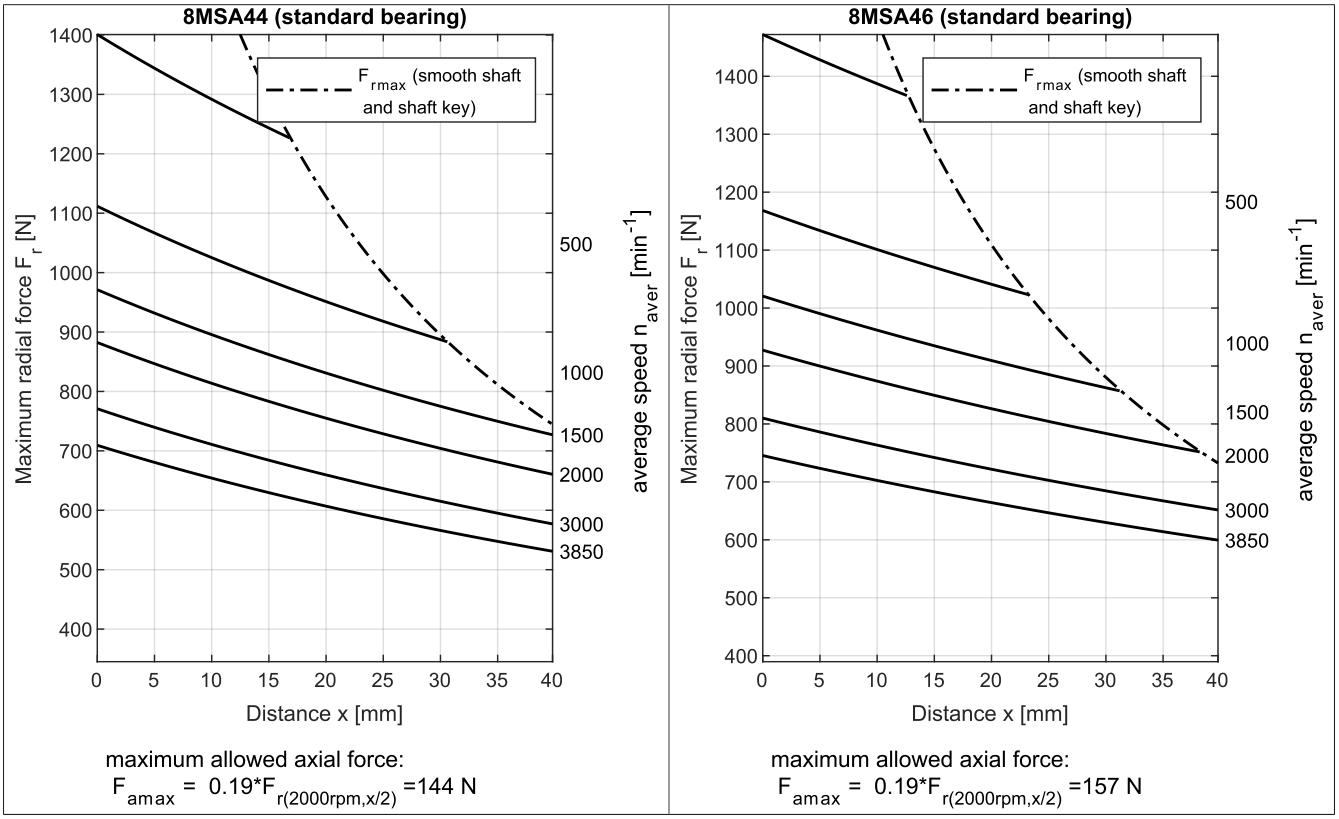
8MSA46.eennnffgg-4



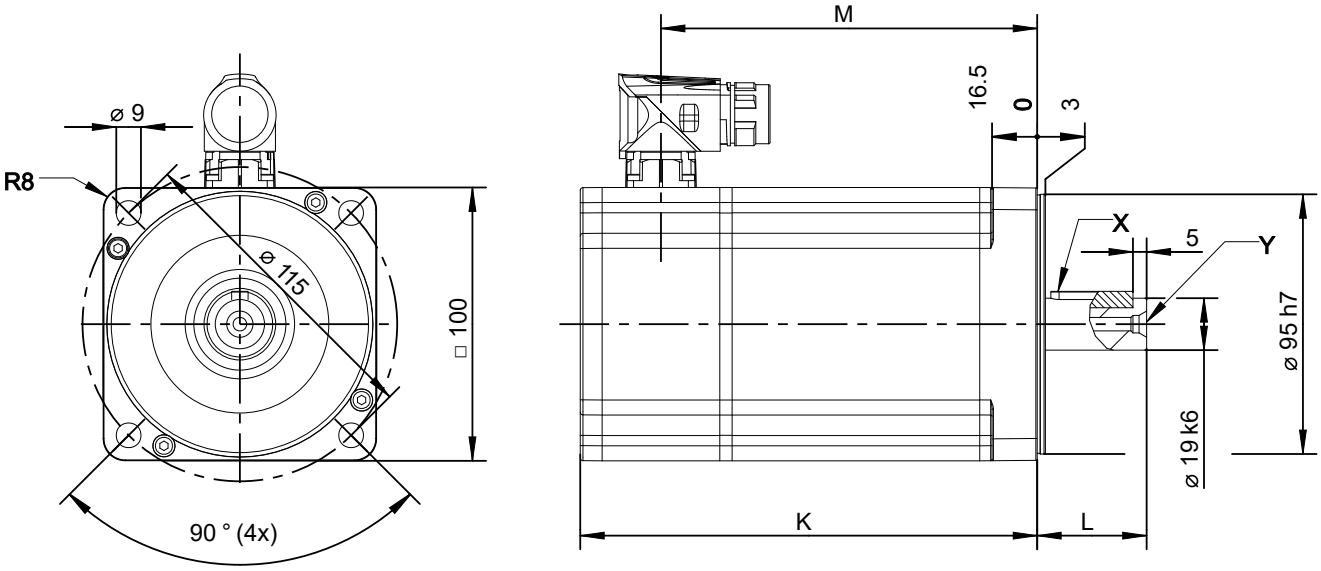
2.10.3.4 Permissible shaft load

Note the information in section "Load capacity of the shaft end and bearing" on page 53 of chapter "Installation conditions".

2.10.3.4.1 8MSA4...-4 - Standard bearing



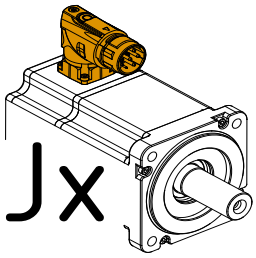
2.10.3.5 8MSA4...-4 - Dimensions



Extension of K and M depending on motor option [mm]						Key	Shaft end	
	K [1]	L	M [1]	Holding brake	Oil seal	X	Y	D
Motor encoder	I8, I9						Drill hole	Ø
8MSA44...-4	167	40	137.5	30	0	A6x6x30	M6 / 16 mm	19k6
8MSA46...-4	212	40	182.5	30	0	A6x6x30	M6 / 16 mm	19k6

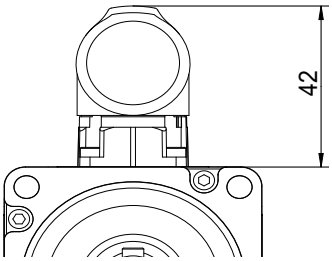
1) The holding brake and oil seal motor options extend dimensions "K" and "M".

Connection dimensions



Motorgeber
Motor encoder

ind. I8, I9



2.10.4 8MSA5...-4 - Technical data

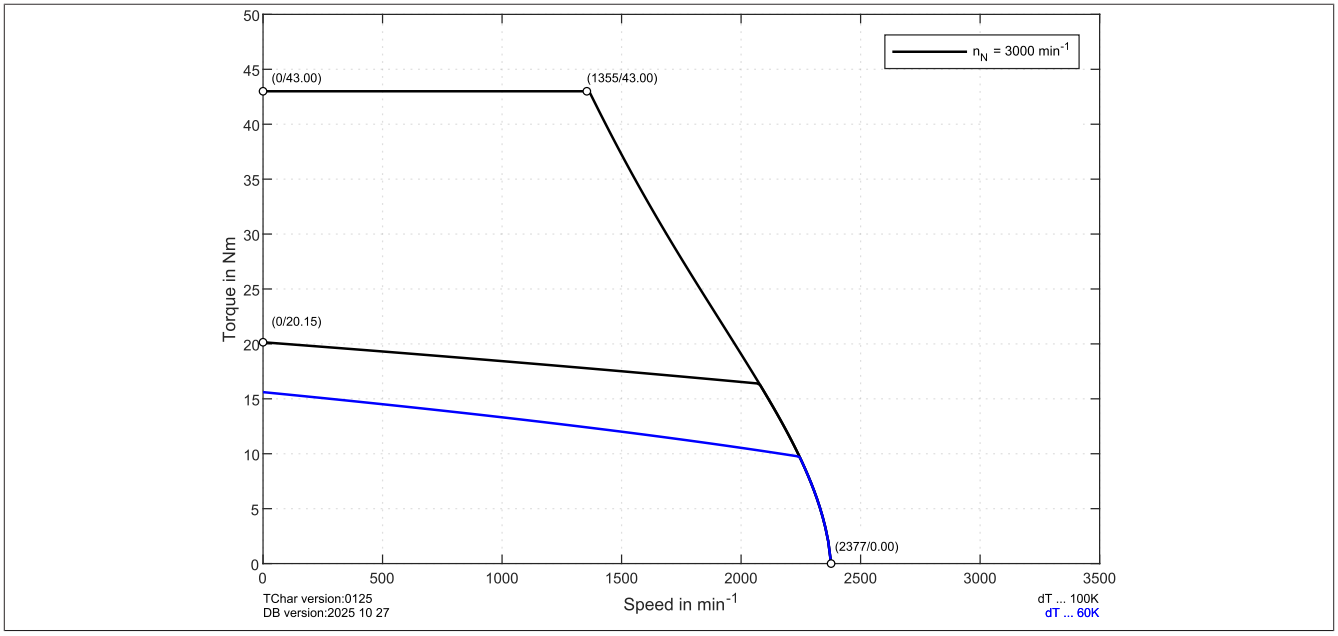
Motor	8MSA54...-4	8MSA56...-4
Nominal speed n_N [rpm]	3000	3000
Number of pole pairs	5	5
Nominal torque M_n [Nm]	14.10	20.00
Nominal power P_N [W]	4524	6283
Nominal current I_N [A]	9.00	12.50
Stall torque M_0 [Nm]	20.15	29.40
Stall current I_0 [A]	12.60	18.38
Maximum torque M_{max} [Nm]	43.00	68.50
Maximum current I_{max} [A]	32.87	53.87
Maximum speed n_{max} [rpm]	4000	4000
Torque constant K_T [Nm/A]	1.60	1.60
Voltage constant K_E [V/1000 rpm]	97	96.70
Stator resistance R_{2ph} [Ω]	0.68	0.36
Stator inductance L_{2ph} [mH]	10.40	6.78
Electrical time constant t_{el} [ms]	15.29	18.83
Thermal time constant t_{therm} [min]	38.00	42.00
Moment of inertia J [kgcm²]	12.30	18.10
Mass without brake m [kg]	10.71	13.72
Holding brake		
Holding torque of brake M_{Br} [Nm]	32	32
Mass of brake [kg]	3.13	3.00
Moment of inertia of brake J_{Br} [kgcm²]	0.78	0.78
Recommendations		
ACOPOS P3 8EIxxxx...	017X	022X
Cable cross section for B&R motor cable [mm²]	1.5	4
Connector size	1	1

NOTE about servo drives: The recommended servo drive / inverter module is designed for 1.1x the stall current. If more than double the amount is needed during the acceleration phase, the next larger servo drive should be selected. This recommendation is only a guideline; detailed inspection of the corresponding speed/torque characteristic curve can result in deviations of the servo drive size (larger or smaller).

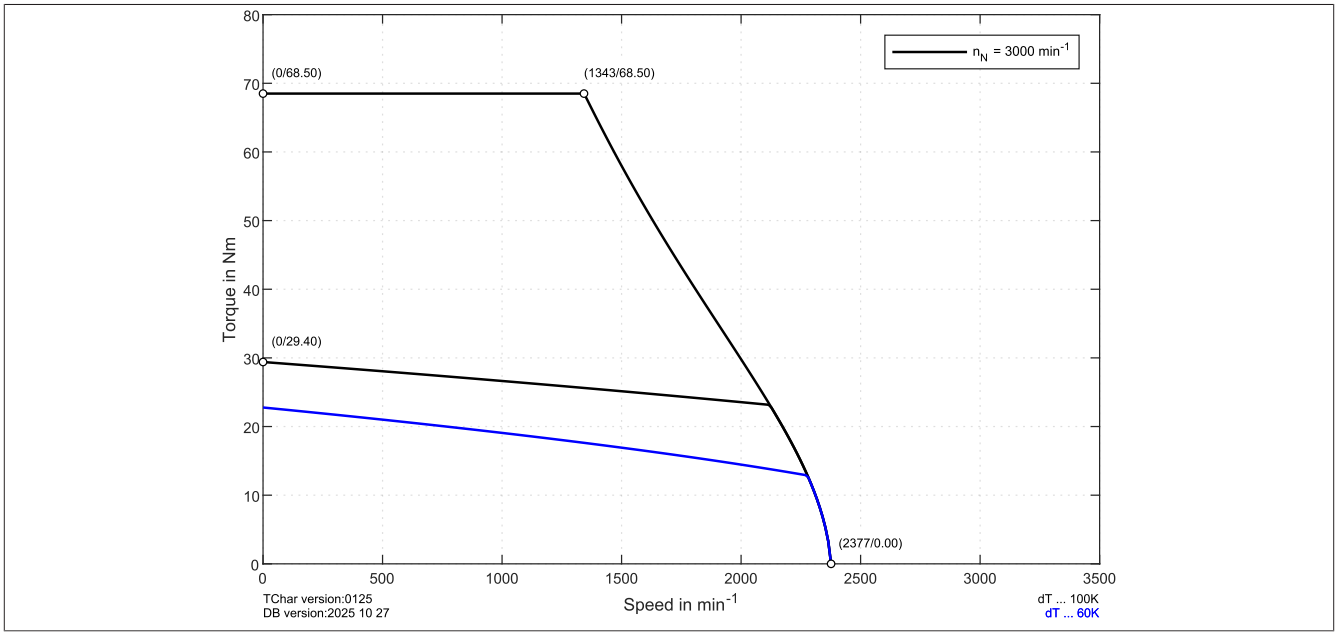
NOTE about cable cross section: The B&R motor cables with this cable cross section are produced optimally (cables stripped to the correct length) for the ACOPOS servo drive or the recommended ACOPOS inverter module. B&R motor cables with other cable cross sections can also be used (within the specified terminal cross section range) and can be obtained from B&R in the desired design on request. Note the type of wiring.

2.10.4.1 Speed-Torque characteristic curves at 325 VDC DC bus voltage

8MSA54.eennnffgg-4

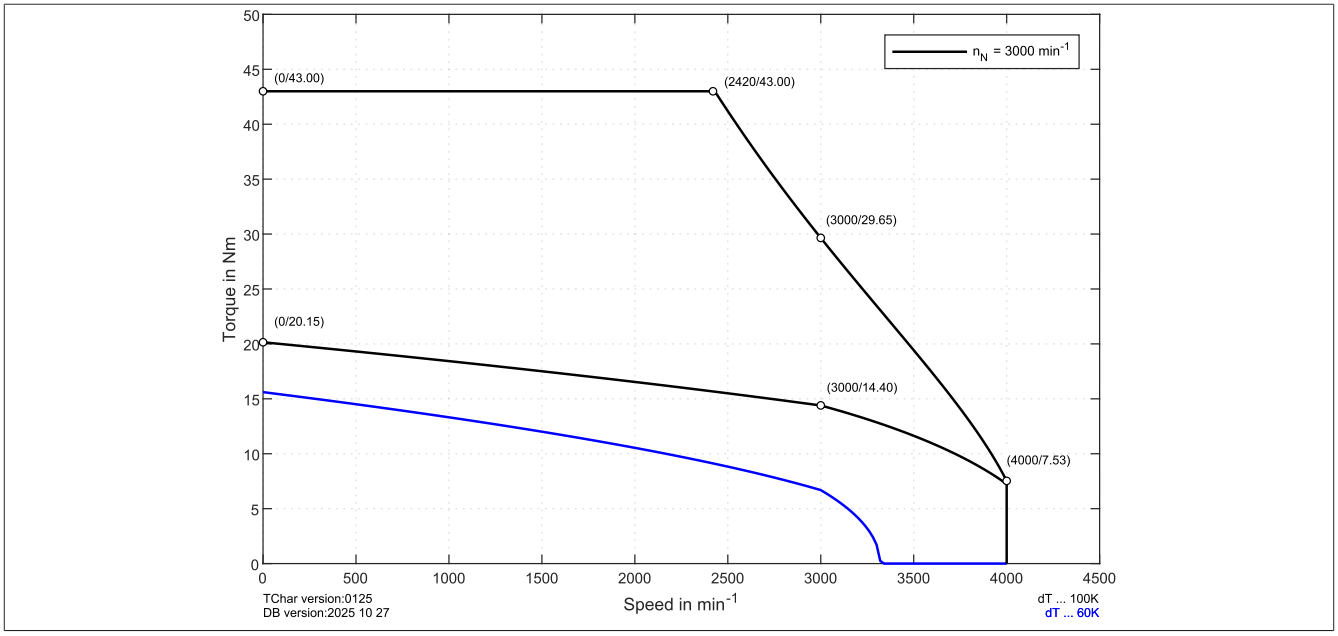


8MSA56.eennnffgg-4

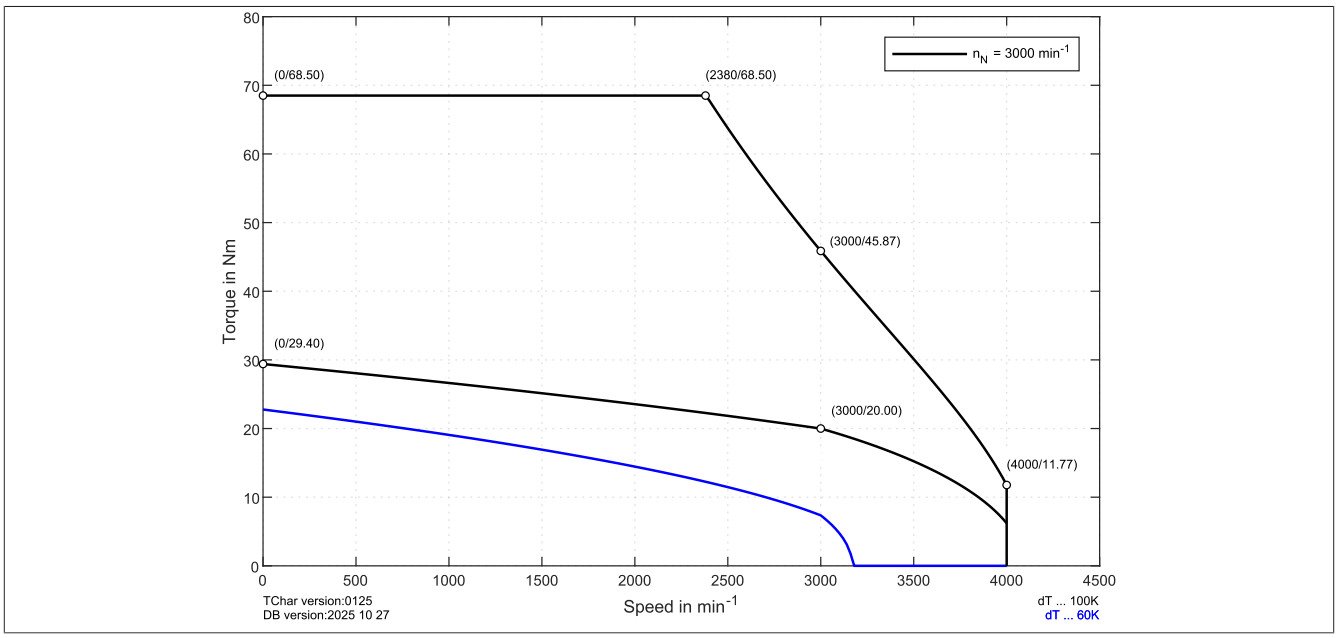


2.10.4.2 Speed-Torque characteristic curves at 560 VDC DC bus voltage

8MSA54.eennnffgg-4

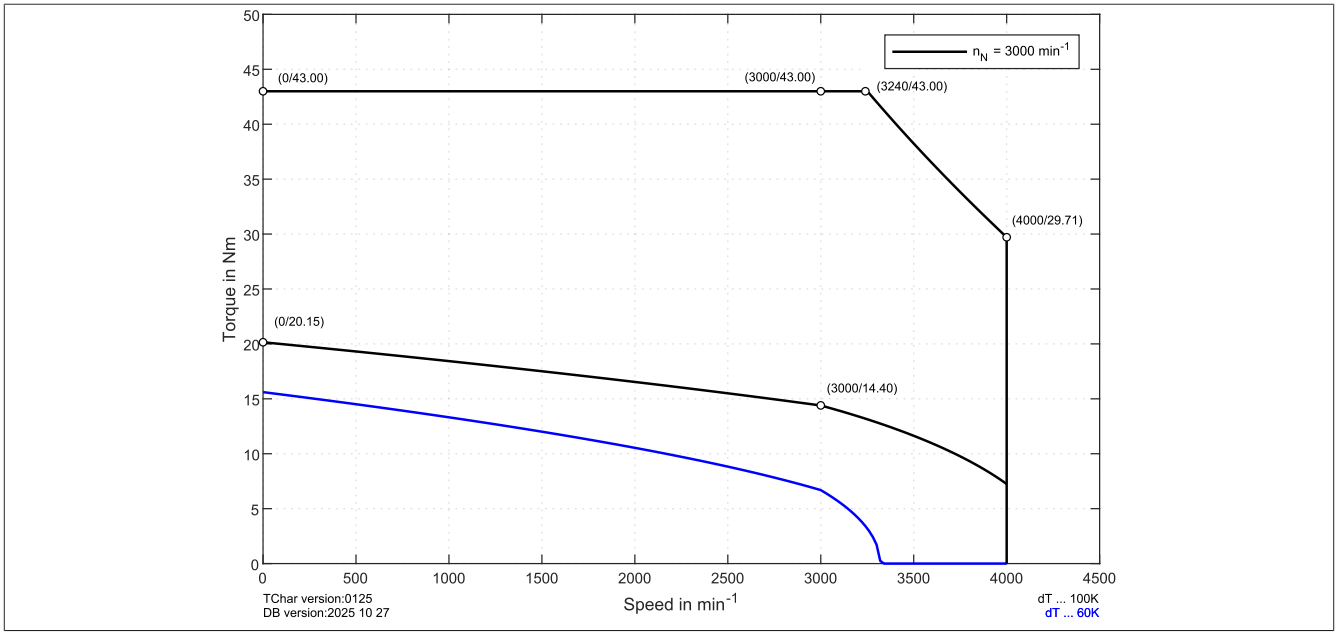


8MSA56.eennnffgg-4

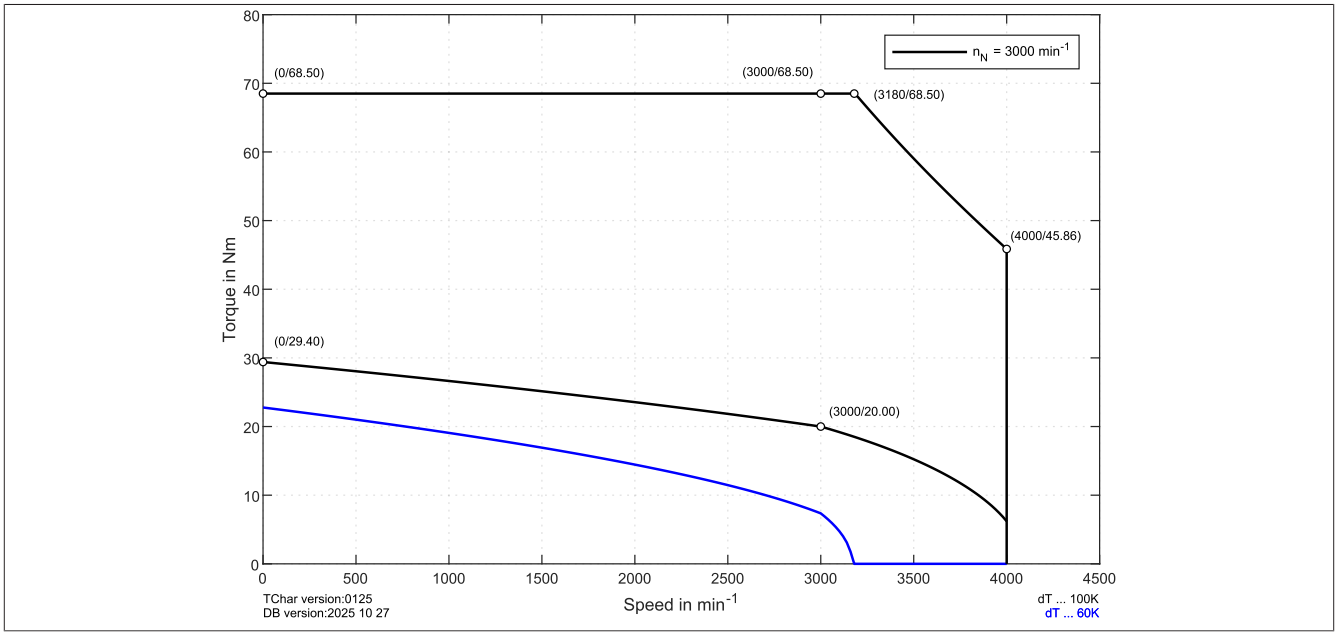


2.10.4.3 Speed-Torque characteristic curves at 750 VDC DC bus voltage

8MSA54.eennnffgg-4



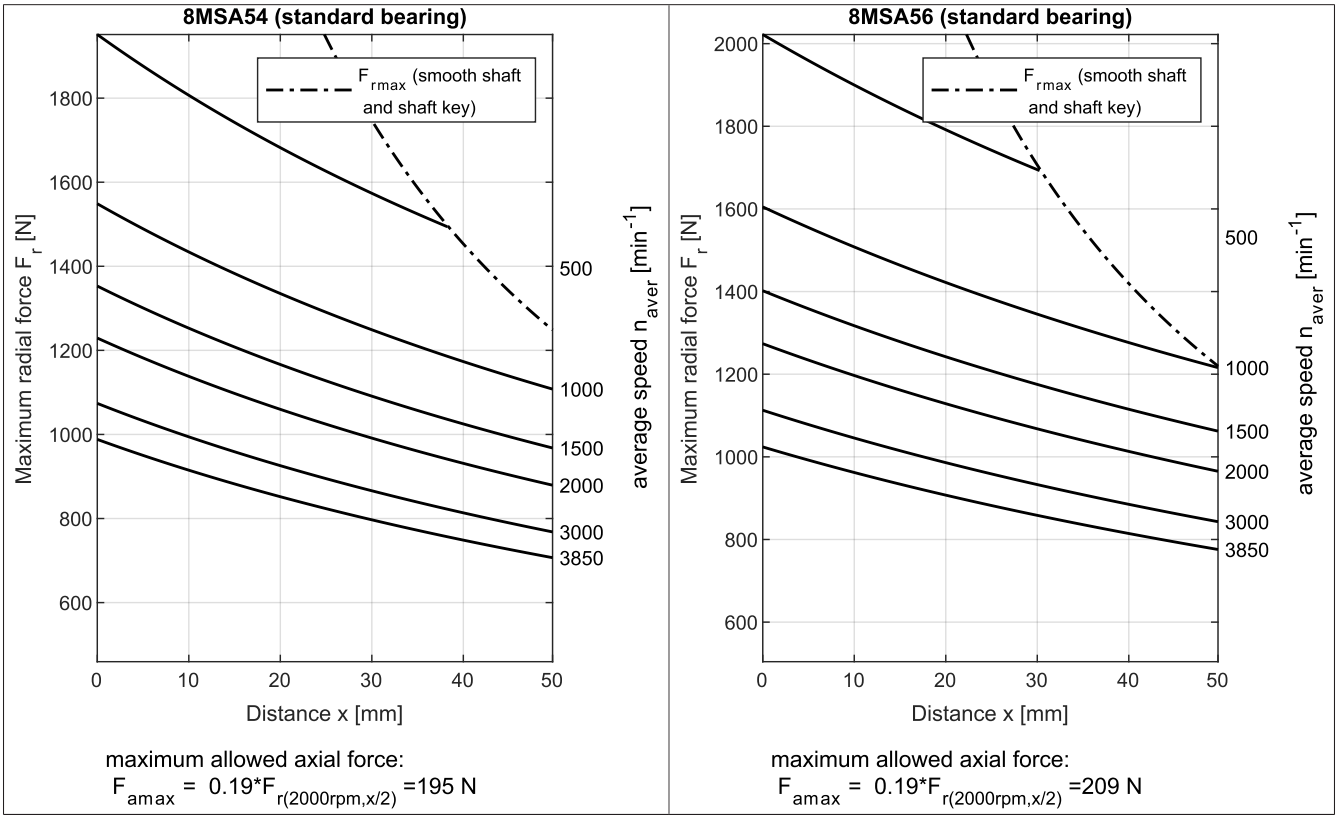
8MSA56.eennnffgg-4



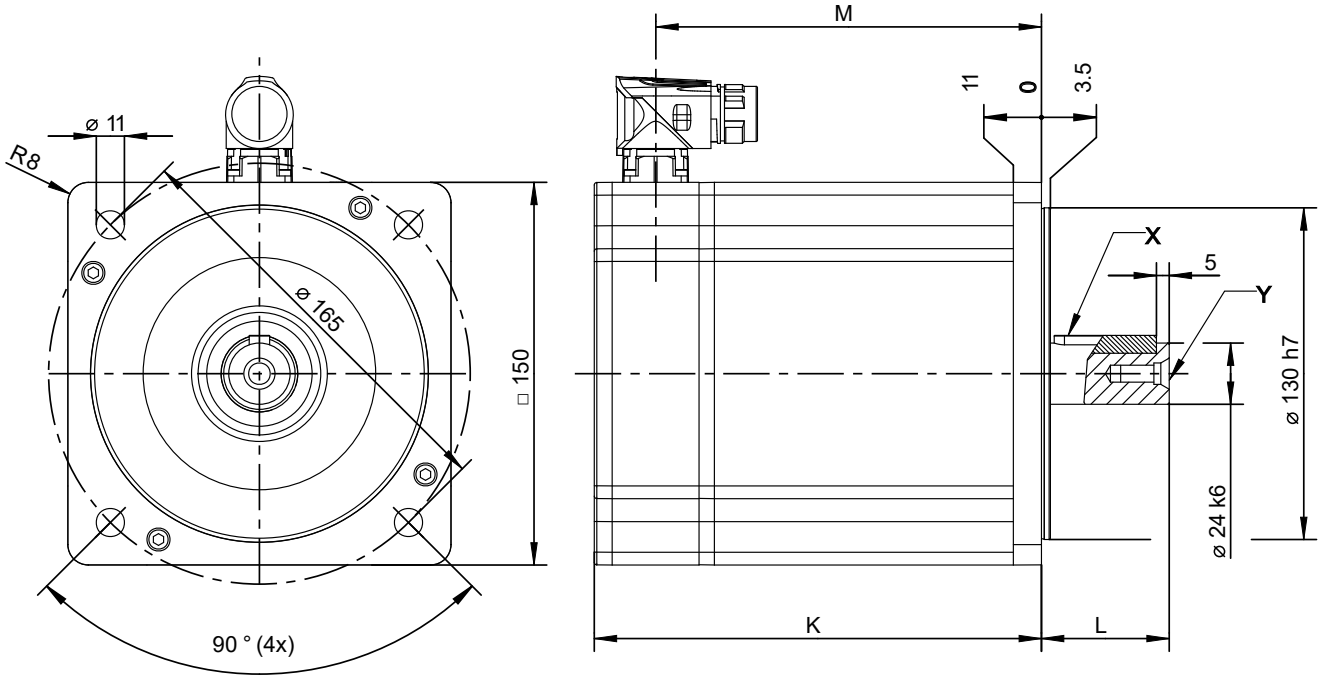
2.10.4.4 Permissible shaft load

Note the information in section "Load capacity of the shaft end and bearing" on page 53 of chapter "Installation conditions".

2.10.4.4.1 8MSA5...-4 - Standard bearing



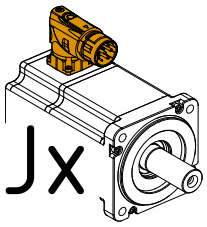
2.10.4.5 8MSA5...-4 - Dimensions

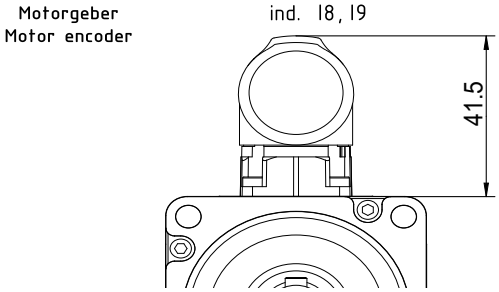


Extension of K and M depending on motor option [mm]						Key	Shaft end	
	K [1]	L	M [1]	Holding brake	Oil seal	X	Y	D
Motor encoder	I8, I9						Drill hole	Ø
8MSA54...-4	175	50	151	46	0	A8x7x40	M8 / 19 mm	24k6
8MSA56...-4	205	50	181	46	0	A8x7x40	M8 / 19 mm	24k6

1) The holding brake and oil seal motor options extend dimensions "K" and "M".

Connection dimensions





3 Transport and storage

During transport and storage, the product must be protected against undue stress (mechanical loads, temperature, moisture, corrosive atmospheres, etc.).

If necessary, also protect existing electrostatically sensitive components such as the encoders in motors against electrostatic discharge (ESD).

Never use attachment parts (cable connection, terminal boxes, fans, etc.) as transport locks or supporting surfaces.

Transport and storage conditions

- The room must be dry, dust-free and free of vibrations.
- The room must be well ventilated and free from drafts.
- The air in the room is not permitted to contain aggressive or hazardous gases.

Storage and transport conditions	8MSA
Storage temperature	-20 to +60°C
Relative humidity during storage	Max. 90%, non-condensing
Transport temperature	-20 to +60°C
Relative humidity during transport	Max. 90%, non-condensing

Radial or axial forces on the shaft

Caution!

Damage to property due to excessive radial or axial forces on the shaft.

Excessive radial or axial forces on the shaft can damage the bearing and impair the effect of any holding brake present to such an extent that the braking effect is non-existent or reduced. Similarly, encoder errors or damage to the gearbox can occur as a result.

- **Transport and store the product only in its original packaging and lying on the housing.**
- **Avoid pressure and impact on the shaft end and housing.**
- **Do not use the shaft as a transport lock.**
- **Transport and lift heavy output shaft components separately and not installed on the shaft end.**

Transport

Check product deliveries immediately for transport damage and report any damage immediately to the carrier. In the event of damage, discontinue use where applicable.

Danger!

Danger of injury due to loads!

Suspended loads can result in personal injury or death if they fall down. Heavy loads can tilt and trap people or severely injure them.

Failure to comply with instructions, guidelines and regulations or use of unsuitable or damaged tools and devices can result in serious injury and/or damage to property.

- **Motors should only be lifted without any additional load from other products (e.g. gears, pulleys, couplings).**
- **If motors have eye bolts, only lift the motors using the eye bolts.**
- **Only use permitted lifting, transport and aids with sufficient lifting capacity.**
- **Never stand in the danger zone or under suspended loads.**
- **Secure the product against dropping and tilting.**
- **Wear safety shoes, protective clothing and a safety helmet.**
- **Comply with the national and local regulations.**

Storage

Caution!

Damage caused by degraded material properties.

Storage for long periods of time or storage under improper conditions can cause certain materials to age prematurely, to have degraded properties and to become damaged. Damaged components can then result in further damage to property.

Recommendations to avoid damage during storage:

- **Reduce the storage time to a minimum and do not exceed the maximum storage time of 2 years.**
- **Rotate the motor shaft a few turns at least every 6 months either by hand or at a low speed (max. 50 rpm). Bearing noise can occur during the run-in phase, which is perfectly normal and is not a sign of bearing damage.**
- **Apply a preservative coating to unprotected components such as the shaft end.**
- **Avoid contact corrosion.**
- **Use the original packaging.**
- **Use covers to protect against dust.**
- **Check the seals for damage when the item is issued or prior to use.**

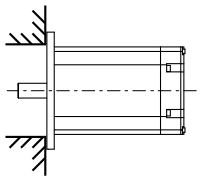
4 8MS...-4 - Installation conditions

Before every commissioning procedure, the motor must be checked by qualified personnel. The check must include the proper condition in terms of mounting and installation, the installation conditions and safe operation.

Operating conditions	8MSA
Rating class, operating mode per EN 60034-1	S1 - Continuous operation
Ambient temperature during operation	-15°C to +40°C
Reduction of nominal and stall current as well as nominal and stall torque at temperatures above 40°C	3% per 5°C
Max. ambient temperature during operation	+55°C[3)]
Reduction of nominal and stall current as well as nominal and stall torque at installation elevations starting at 1,000 m above sea level	10% per 1,000 m
Max. installation elevation[4)]	923 speedtec, max. 4000 m with active and passive power supply 915 itec, max. 4000 m with passive power supply Max. 2000 m with active power supply
Max. flange temperature	90°C
Degree of protection per EN 60034-5 (IP code) Without oil seal: With oil seal:	 IP64[5)] IP65
Type of construction and mounting arrangement per EN 60034-7 (IM code)	Horizontal, motor shaft aligned horizontally (IM 3001) Vertical, motor standing on the machine (IM 3011) Vertical, motor hanging on the machine (IM 3031)[9)]

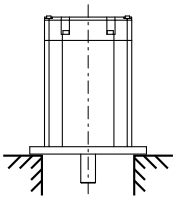
Image of type of construction and mounting arrangement per EN 60034-7 (IM code)

IM 3001



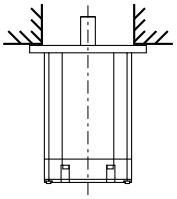
Horizontal
Horizontally-aligned motor shaft

IM 3011



Vertical
Motor standing on the machine

IM 3031



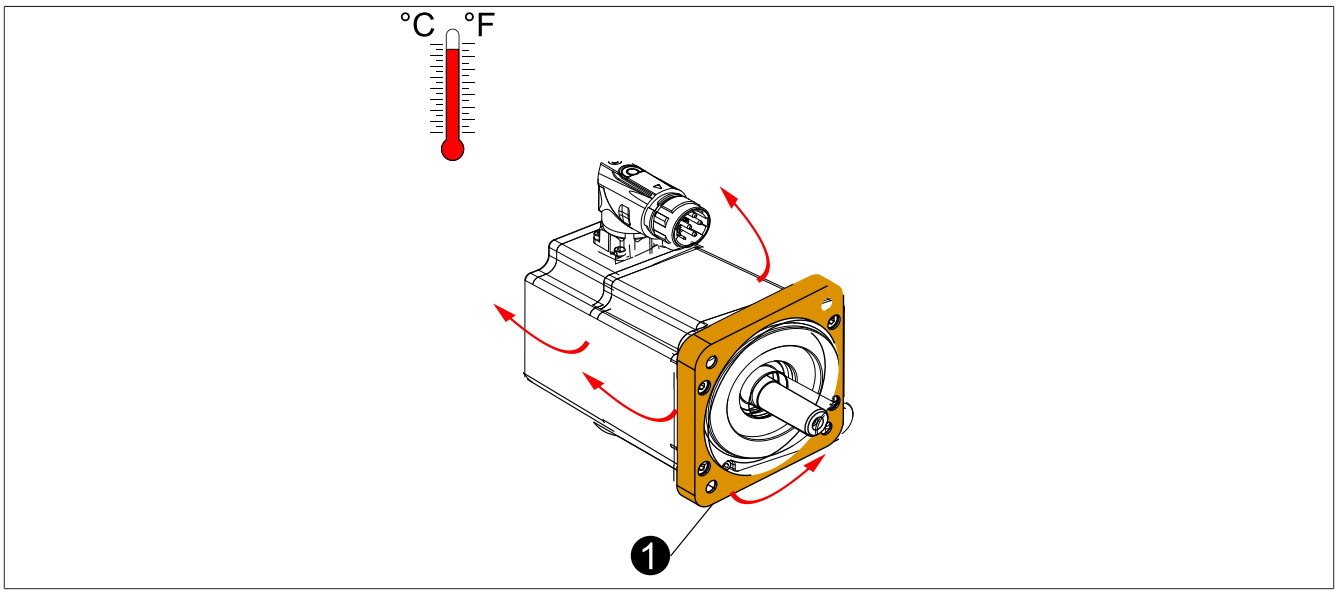
Vertical
Motor hanging on the machine

3) Continuous operation of the servo motors at an ambient temperature of +40°C to max. +55°C is possible, but this results in premature aging.
4) Requirements that go beyond this must be arranged with B&R.
5) For IP64, the motor must be mounted with the mounting flange and this mounting must correspond at least to IP64 protection. Otherwise, only IP54 applies instead of IP64.
9) With the IM 3031 type of construction and mounting arrangement (vertical, motor hanging on the machine), there is a risk of production fluids or oils penetrating the motor on the flange side. Motors or motor-gearbox combinations that should be used with this mounting arrangement must therefore have at least IP65 protection on the flange side.

4.1 Mounting type and cooling

Ensure unobstructed air circulation and cooling so that no heat accumulation can build up on the motor.

Attach the motor with the **motor flange** (1), which also serves as a **cooling surface**, directly onto the machine.



It is important to note the following:

- Power or heat from the motors is dissipated via the mounting flange and surface of the motor housing.
- The motor can heat up due to external heat sources.

Caution!

Personal injury and damage to property due to failure or overheating of the drive.

If the maximum permissible operating temperature is exceeded, a drive defect with consequential damage is very probable.

The cause of a defect could insufficient lubrication due to overheating, for example.

- **For safety reasons, switch off the machine if the maximum permissible temperature is exceeded.**
- **Ensure unobstructed air circulation and cooling so that no heat accumulation can build up in the drive or machine.**

4.2 Load capacity of the shaft end and bearing

8MS three-phase synchronous motors are equipped with grooved ball bearings that are sealed on both sides and lubricated. Radial and axial forces (F_r, F_a) applied to the shaft end during operation and installation must be within the specifications listed below. Bearing elements are not permitted to be subjected to shocks or impacts! Incorrect handling will reduce the service life and result in damage to the bearings.

Radial force

The radial force F_r on the shaft end is a function of the loads during installation (e.g. belt tension on pulleys) and operation (e.g. load torque on the pinion). The maximum radial force F_r depends on the shaft end type, bearing type, average speed, the position where the radial force is applied and the desired service life of the bearings.

Axial force, shift in shaft position caused by axial force

The axial force F_a on the shaft end is a function of the loads during installation (e.g. stress caused by mounting) and operation (e.g. thrust caused by slanted tooth pinions). The maximum axial force F_a depends on the bearing type and the desired service life of the bearings. The fixed bearing is secured on the B-side flange with a retaining ring. The floating bearing on the B-side flange is preloaded with a spring in the direction of the A-side flange. Axial forces in the direction of the B-side flange can cause the spring bias to be overcome, which shifts the shaft by the amount of axial backlash in the bearing (approx. 0.1 - 0.2 mm). This shift can cause problems on motors with holding brakes or all motors with inductive encoder systems. As a result, no axial force in excess of the calculated values is permitted in the direction of the B-side flange when using these motors. (See "Determining permissible values for F_r and F_a".)

Axial loads are not permitted on shaft ends of motors with holding brakes. It is especially important to prevent axial forces in the direction of the B flange since these forces can cause the brake to fail!

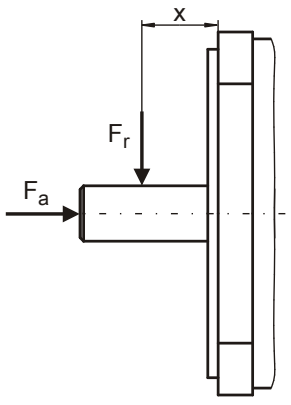
Permissible values of F_r and F_a

For the permissible values of F_r and F_a, see the technical data of the respective gearbox.

Determining permissible values of F_r and F_a

For information about determining the permissible values of F_r and F_a, see the diagrams in chapter Technical data (section "Permissible shaft load" for the respective motor).

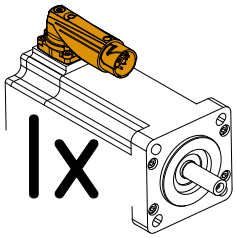
The permissible values in the diagrams are based on a mechanical bearing service life of 20,000 operating hours (bearing service life calculation based on DIN ISO 281).

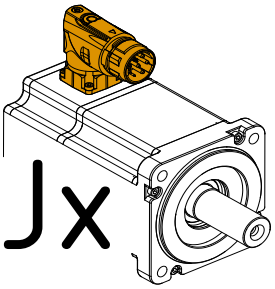


F_r..... Radial force
F_a..... Axial force
x..... Distance between the motor flange and the point where radial force F_r is applied.

Figure 1: Definition of shaft load

4.3 Single-cable solution (hybrid)





Information:

For motors with the EnDat 3 single-cable solution (options Ix and Jx), the temperature of the motor winding is not determined using a sensor, but with the aid of an adaptive temperature model.

Important: The temperature model is therefore not permitted to be disabled for the Ix and Jx options for 8MS-4 motors!

The EnDat 3 protocol is available for the ACOPOS P3 starting with mapp Motion and ACP10 versions 5.30.x for Automation Studio 4.12 and mapp Motion and ACP10 versions 6.2 for Automation Studio 6.

5 Installation and connection

5.1 Before installation

Read this user's manual completely before performing any work activities.

In addition, take into account the technical documentation for all other machine components as well as the finished machine.

5.2 Safety

Work on motors and their wiring is only permitted to be carried out by qualified personnel [2)] in a voltage-free state. The control cabinet must first be de-energized and secured against being switched on again.

Only use appropriate equipment and tools. Protect yourself with safety equipment.

Warning!

Personal injury and damage to property due to unauthorized modifications!

As a result of unauthorized modifications to the product, the performance and limit values can be negatively affected and dangers can arise. Due to this, severe damage to property and injuries cannot be excluded.

Unauthorized modifications are therefore prohibited!

- **Do not carry out any unauthorized modifications or alterations to the product.**
- **If necessary, contact B&R.**

5.2.1 General sources of danger

Tampering of protection or safety devices

Protective and/or safety devices protect you and other persons from dangerous voltage, rotating or moving elements and hot surfaces.

Danger!

Personal injury and damage to property due to tampering of protective equipment!

If protective or safety devices are removed or put out of operation, there is no longer any personal protection and serious personal injury and damage to property can occur.

- **Do not remove any safety devices.**
- **Do not put any safety devices out of operation.**
- **Always use all safety devices also for temporary testing and trial operations!**

Dangerous voltage

To operate the motors, dangerous voltage must be applied to certain parts.

[2)] see "Qualified personnel" on page 8

Danger!

Risk of injury due to electric shock!

If live parts are touched, there is immediate danger of fatal electric shock.

If connections are connected or disconnected in the incorrect order or while voltage is applied, electric arcs can occur and persons and contacts can be damaged.

Even if the motor is not rotating or is running as a generator driven externally, the control and power connections can still carry voltage!

- **Never touch connections when the power is switched on.**
- **Never disconnect or connect electrical connections to the motor and servo drive while voltage is applied!**
- **Do not stay in the danger zone during operation and secure it against access by unauthorized persons.**
- **Always operate the motor with all safety equipment. Do this also for temporary testing and trial operations!**
- **Keep all covers and control cabinet doors closed during operation and as long as the machine is not disconnected from the mains.**
- **Before working on motors, gearboxes or servo drives or in the danger zone of your machine, disconnect them completely from the mains and secure them against being switched on again by other persons or automatic systems.**
- **Note the discharge time of any existing DC bus.**
- **Only connect measuring instruments in a current- and voltage-free state!**

Danger due to electromagnetic fields

Electromagnetic fields are generated by the operation of electrical power engineering equipment such as transformers, inverters and motors.

Danger!

Danger to health due to electromagnetic fields!

The functionality of a heart pacemaker can be impaired by electromagnetic fields to such an extent that the wearer experiences harm to his or her health, possibly with a fatal outcome.

- **Observe relevant national health and safety regulations.**
- **Persons with pacemakers are not allowed to be in endangered areas.**
- **Warn staff by providing information, warnings and safety identification.**
- **Secure the danger zone by means of barriers.**
- **Ensure that electromagnetic fields are reduced at their source (using shields, for example).**

Dangerous motion

By rotating and positioning motions of the motors, machine elements are moved or driven and loads conveyed.

After switching on the machine, movements of the motor shaft must always be expected! For this reason, higher-level protective measures must be put in place to ensure that personnel and the machine are protected. This type of protection can be achieved, for example, by using stable mechanical protective equipment such as protective covers, protective fences, protective gates or photoelectric sensors.

In the immediate vicinity of the machine, provide sufficient and easily accessible emergency switch-off devices to stop the machine as quickly as possible in the event of an accident.

Danger!

Danger of injury due to rotating or moving elements and loads!

By rotating or moving elements, body parts can be drawn in or severed or subjected to impacts.

- **Do not stay in the danger zone during operation and secure it against access by unauthorized persons.**
- **Before working on the machine, secure it against unwanted movements. If a holding brake is available, it must be checked for functionality after machine actuators have been attached and after maintenance and repair work has been carried out!**
- **Keep all covers and control cabinet doors closed during operation and as long as the machine is not disconnected from the mains.**
- **Always operate the motor with all safety equipment. Do this also for temporary testing and trial operations!**
- **Motors can be started automatically via remote control! If appropriate, a corresponding warning symbol must be applied, and protective measures must be implemented to prevent entry into the high-risk area!**

Danger!

Danger of injury due to loads!

Suspended loads can result in personal injury or death if they fall down. Heavy loads can tilt and trap people or severely injure them.

Failure to comply with instructions, guidelines and regulations or use of unsuitable or damaged tools and devices can result in serious injury and/or damage to property.

- **Motors should only be lifted without any additional load from other products (e.g. connection elements).**
- **Only use permitted lifting, transport and aids with sufficient lifting capacity.**
- **Never stand in the danger zone or under suspended loads.**
- **Secure the product against dropping and tilting.**
- **Wear safety shoes, protective clothing and a safety helmet.**
- **Comply with the national and local regulations.**

Warning!

Danger of injury due to incorrect control or a defect!

Improper control of motors or a defect can result in injuries and unintended and hazardous movements of motors.

Such incorrect behavior can be triggered by:

- **Incorrect installation or faults when handling components**
- **Improper or incomplete wiring**
- **Defective devices (servo drive, motor, position encoder, cables, brake)**
- **Incorrect control (e.g. caused by software error)**

Risk due to hot surfaces

Due to the power dissipation from the motor and friction in the gearbox, these components as well as their environment can reach a temperature of more than 100°C.

The resulting heat is released to the environment via the housing and the flange.

Warning!

Risk of burns due to hot surfaces!

Touching hot surfaces (e.g. motor and gearbox housings, as well as connected components), can result in very severe burns due to the very high temperature of these parts.

- **Do not stay in the danger zone during operation and secure it against access by unauthorized persons.**
- **Never touch the motor or gearbox housing as well as adjacent surfaces during nominal load operation.**
- **Be aware of hot surfaces also during standstill.**
- **Allow the motor and gearbox to cool down sufficiently before working on them; there remains the risk of burns for a long period of time after they are switched off.**
- **Always operate the motor or gearbox with all safety devices. Do this also for temporary testing and trial operations!**

5.2.2 Noise emissions

Take into account the health of personnel in proximity to the machine.

Warning!

Hearing damage due to noise levels.

During operation, the motor can exceed the permissible workplace noise level and also cause hearing damage.

- **Implement suitable noise reduction measures (e.g. housings, covers or other sound-insulating measures).**
- **Take into account applicable industrial safety regulations.**

5.3 Shaft end and bearing

The motor shaft is supported on both sides with grease-lubricated grooved ball bearings. Protect the motor from damage due to excessive radial and axial forces!

Under all circumstances, avoid the following loads on the front shaft end or the rear motor housing cover:

- Excessive pressure
- Impacts
- Hammer blows

Caution!

Damage due to excessive axial forces!

The motor bearings can be damaged or the service life reduced by excessive axial forces (e.g. by impacting or pressing) on the shaft. Damage to the encoder or any installed options (holding brake, gearbox) is also possible.

- **Do not hit the motor or output shaft with a hammer. The impact of a hammer certainly exceeds the permissible values.**
- **In addition, avoid impact and excessive pressure on the motor and output shaft.**

Overdetermined bearing

Avoid an overdetermined bearing when attaching drive elements onto the output shaft!. The necessarily occurring tolerances cause additional forces on the output shaft bearing. This can damage or significantly reduce the service life of the bearings!

Lifting and transporting

The weight of attachment elements (toothed gears, pulleys, couplings, etc.) can have a harmful effect on the bearing during lifting and transportation from the motor. Take into account these radial and axial loads during these operations!

Installing and removing attachment elements

Always install and remove the attachment elements (toothed gears, pulleys, couplings, etc.) at the shaft end without any axial load on the motor bearings and all other parts installed in the motor. For this, use suitable clamping sets, pressure sleeves, other clamping elements, retractors, etc. The centering hole on the face side of the shaft end can be used for this work.

Pay attention to balanced connection elements or corresponding assembly.

Secure the attachments against unintended loosening after installation and before operation.

5.4 Installing in the system

Before working on motors, gearboxes or servo drives or in the danger zone of your machine, disconnect them completely from the mains and secure them against being switched on again by other persons or automatic systems.

Inspection

Before installation, inspect the components to determine whether they are suitable and undamaged. Gearboxes must also be checked for leak tightness.

Warning!

Personal injury and damage to property due to damaged or unsuitable machine components!

Operating a machine with damaged or unsuitable components is a safety risk and can result in failures. Severe damage to property and injuries cannot be excluded.

- **Never operate a machine with a damaged motor or gearbox or any other damaged component.**
- **Never install a damaged component in a machine.**
- **Do not use motors or gearboxes that have already been overloaded during operation.**
- **Before installation, ensure that the motor or gearbox is suitable for the machine.**
- **It is better not to carry out short-term test and trial operations with damaged or inappropriate machine components.**
- **Label damaged or non-operational components in a readily visible location and clearly.**

Cleaning

Clean anti-corrosive agents and dirt off the output shaft and flange of the motor as well as the opposite side of the shaft and flange on the machine.

Caution!

Damage to property caused by improper cleaning.

Contact with cleaning agents can damage oil seals, sealing lips and gaskets.

- **Only use suitable and material-friendly cleaning agents.**
- **Ensure that oil seals, sealing lips and gaskets do not come into contact with cleaning agents.**

Installation with the mounting flange

Attach the motor with the motor flange, which also serves as a cooling surface, directly onto the machine.

For this, the motor must be screwed to the machine via the flange.

Apply tightening torque in accordance with the standard when tightening the screws and use a screw locking mechanism.
Only fasten and loosen gear wheels, pulleys, couplings, etc. on the output shaft using suitable clamping sets, pressure sleeves, etc.

Note:

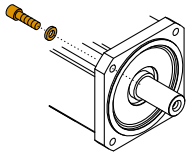
The nameplate should be visible at all times in installed state.

Safety notices

A "hot surface" warning label is provided with the product. Attach it to the assembled product so that it is visible at all times.

"Hot surface" warning label

5.4.1 Fasteners and tightening torques



Use socket head cap screws (ISO 4762 - Property class min. 8.8) and flat washers.

Tighten the screws evenly in diagonally opposite sequence and with the correct tightening torque to avoid distorting the flange and excessively straining screws.

The specified values for screws are calculated values and based on the following requirements:

- Coefficient of friction μ = 0.14
- Screwing into steel

If the motor is screwed onto other materials or if there are different surface roughnesses, the user must determine the correct tightening torque.

	Screw	Flat washer [mm]	Tightening torque [Nm]
8MSA2...-4	M5	5 x 8.8	6
8MSA3...-4	M6	6 x 9.9	10
8MSA4...-4	M8	8 x 12.7	25
8MSA5...-4	M10	10 x 16	49

5.5 Connecting and disconnecting the motor

Observe the following safety guidelines and instructions when connecting and disconnecting the motor:

The protective ground conductor must be connected via the power connection or motor connector.

Danger!

Personal injury and damage to property due to missing ground potential!

If there is no proper ground potential on the motor housing or servo drive, fault currents can result in serious personal injury and damage to property.

- **Connect (also for temporary testing and trial operations!) the motor housing and servo drive properly to ground potential (PE rail).**

Danger!

Personal injury and damage to property due to direct mains connection!

Connecting the motor directly to the mains results in severe personal injury and damage to property.

- **Only operate the motor with B&R drive systems.**

Danger!

Risk of injury due to electric shock!

If live parts are touched, there is immediate danger of fatal electric shock.

If connections are connected or disconnected in the incorrect order or while voltage is applied, electric arcs can occur and persons and contacts can be damaged.

Even if the motor is not rotating or is running as a generator driven externally, the control and power connections can still carry voltage!

- **Never touch connections when the power is switched on.**
- **Never disconnect or connect electrical connections to the motor and servo drive while voltage is applied!**
- **Do not stay in the danger zone during operation and secure it against access by unauthorized persons.**
- **Always operate the motor with all safety equipment. Do this also for temporary testing and trial operations!**
- **Keep all covers and control cabinet doors closed during operation and as long as the machine is not disconnected from the mains.**
- **Before working on motors, gearboxes or servo drives or in the danger zone of your machine, disconnect them completely from the mains and secure them against being switched on again by other persons or automatic systems.**
- **Note the discharge time of any existing DC bus.**
- **Only connect measuring instruments in a current- and voltage-free state!**

Warning!

Risk of burns due to hot surfaces!

Touching hot surfaces (e.g. motor and gearbox housings, as well as connected components), can result in very severe burns due to the very high temperature of these parts.

- **Do not stay in the danger zone during operation and secure it against access by unauthorized persons.**
- **Never touch the motor or gearbox housing as well as adjacent surfaces during nominal load operation.**
- **Be aware of hot surfaces also during standstill.**
- **Allow the motor and gearbox to cool down sufficiently before working on them; there remains the risk of burns for a long period of time after they are switched off.**
- **Always operate the motor or gearbox with all safety devices. Do this also for temporary testing and trial operations!**

5.5.1 Cables and connectors

Information:

To find the technical data and order data for the cables, see the current user's manual for the B&R drive system being used.
This is available in the Downloads section of the B&R website (www.br-automation.com).

5.5.1.1 Cables from other manufacturers

Caution!

Damage caused by voltage rise!

Cables from other manufacturers can have a negative effect on voltage rise on the winding. The winding can become damaged as a result of voltage rise.

- **If non-B&R cables are used, you must provide documented evidence of conformity with voltage class A per EN 60034-25.**
- **If this evidence has not been provided, there is no claim to warranty due to winding damage that can be attributed to a rise in voltage on the winding.**

5.5.1.2 Connectors from other manufacturers

Note:

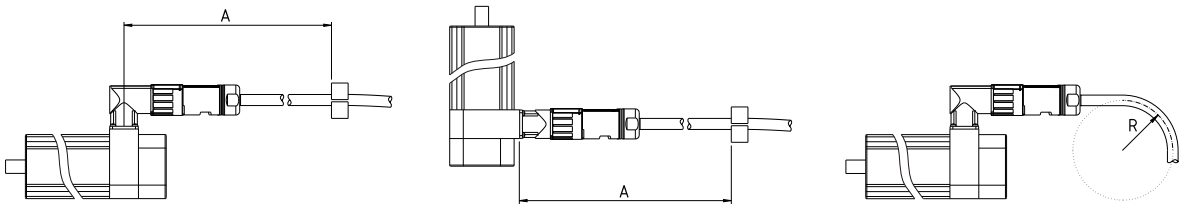
Disturbances caused by electrical or electromagnetic effects!

When using connectors from other manufacturers, EMC interference cannot be excluded.

- **Use B&R connectors to ensure compliance with the EMC limit values of the connection.**
- **Ensure proper assembly and that cable shields are connected correctly.**

5.5.1.3 Cable clamp and bend radius

To ensure that cables and connectors are not exposed to harmful loads, the cable clamp **(A)** and minimum bend radius **(R)** must be observed during installation.



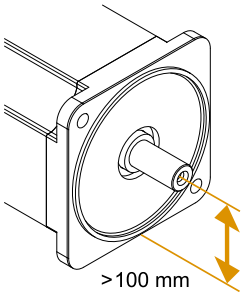
Cable clamp (A)

- A = Max. 300 mm along longitudinal axis of connector
- The connection must be free of force and torque.
- Movement relative to the connector is not permitted!
- Tensile stress on cables and connectors is not permitted!

Bend radius (R)

- For the minimum radius values, see the current technical data sheet for the cable.

5.5.1.4 Avoiding bearing currents (common-mode currents)



When operating servo motors with an axis height greater than 100 mm, bearing currents (common-mode currents) can cause damage to the surface of the motor bearings. This damage results in loud operating noises, typically occur after an operating period of one to two years and can result in irreparable damage to the motor bearings.

To reduce the bearing currents to a permissible minimum, B&R recommends the use of 8BXC ring cores when wiring the motors. The required number of 8BXC ring cores depends on the axis height of the respective motor.

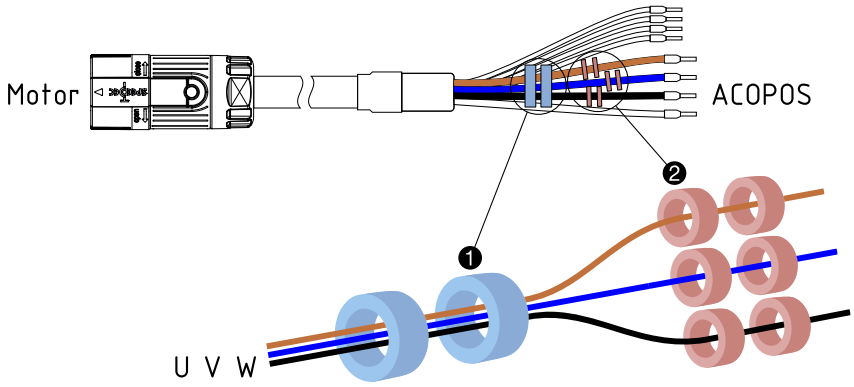
Motor axis height	Ring core ø 68 x 36 mm	Ring core ø 43.1 x 17.5 mm
100 - 131 mm	1 pcs.	1 piece (for each phase)
132 - 159 mm	2 pcs.	1 piece (for each phase)
>160 mm	3 pcs.	2 pieces (for each phase)

Table 1: Dimensioning the ring cores

Information:

Table 1 contains typical values.
If the 8BXC ring cores show temperatures greater than 80°C during operation for a certain axis height, the bearing currents are so high that the number of 8BXC ring cores must be increased by 1.

Installing 8BXC ring cores



Thread the 3 motor phases U, V and W together through the ø 68 x 36 ring cores **(1)** and the individual phases U, V and W each through the ø 43.1 x 17.5 mm ring cores **(2)**.

Order data

ø 68 x 36 mm - 16 pieces

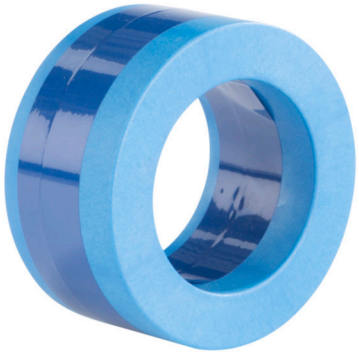
Order number	Short description	Figure
	Accessory sets	
8BXC006.0000-00	ACOPOSmulti accessory set: 16x ring core ø 68 x 36 mm, 23.3 to 46.6 µH [10 kHz]	

Table 2: 8BXC006.0000-00 - Order data

ø 68 x 36 mm - 1 piece

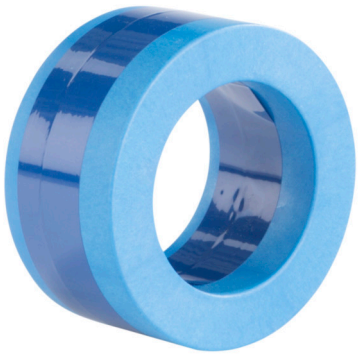
Order number	Short description	Figure
	Accessory sets	
8BXC006.0010-00	ACOPOSmulti accessory set: 1x ring core ø 68 x 36 mm, 23.3 to 46.6 µH [10 kHz]	

Table 3: 8BXC006.0010-00 - Order data

ø 43.1 x 17.5 mm - 120 pieces

Order number	Short description	Figure
	Accessory sets	
8BXC008.0000-00	ACOPOSmulti accessory set: 120x ring core ø 43.1 x 17.5 mm, 33 to 99 µH [10 kHz], 8.4 to 15.6 [100 kHz]	

Table 4: 8BXC008.0000-00 - Order data

ø 43.1 x 17.5 mm - 3 pieces

Order number	Short description	Figure
	Accessory sets	
8BXC008.0030-00	ACOPOSmulti accessory set: 3x ring core ø 43.1 x 17.5 mm, 33 to 99 µH [10 kHz], 8.4 to 15.6 µH [100 kHz]	

Table 5: 8BXC008.0030-00 - Order data

5.5.2 Order of connection

When connecting or disconnecting the servo motor, the following safety guidelines and orders must be observed.

Danger!

Risk of injury due to electric shock!

If live parts are touched, there is immediate danger of fatal electric shock.

If connections are connected or disconnected in the incorrect order or while voltage is applied, electric arcs can occur and persons and contacts can be damaged.

Even if the motor is not rotating or is running as a generator driven externally, the control and power connections can still carry voltage!

- **Never touch connections when the power is switched on.**
- **Never disconnect or connect electrical connections to the motor and servo drive while voltage is applied!**
- **Do not stay in the danger zone during operation and secure it against access by unauthorized persons.**
- **Always operate the motor with all safety equipment. Do this also for temporary testing and trial operations!**
- **Keep all covers and control cabinet doors closed during operation and as long as the machine is not disconnected from the mains.**
- **Before working on motors, gearboxes or servo drives or in the danger zone of your machine, disconnect them completely from the mains and secure them against being switched on again by other persons or automatic systems.**
- **Note the discharge time of any existing DC bus.**
- **Only connect measuring instruments in a current- and voltage-free state!**

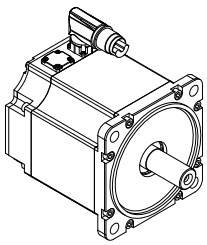
Danger!

After switching off the servo drive, wait for the DC bus to discharge for at least five minutes. To avoid a hazard, the current voltage on the DC bus must be measured with a suitable measuring instrument between -DC1 and +DC1 and less than 42 VDC before starting work. An unlit operating LED does not indicate that the device is de-energized!

Caution!

The temperature sensor on the motor is sensitive to electrostatic discharge (ESD). For this reason, the attachment cables on the drive system side (ACOPOS) must first be completely assembled and connected. Only then are the connectors permitted to be connected to the motor in the order described.

Single-cable solution (hybrid)



Connecting

1. Disconnect the machine from the power system and secure it against being switched on again.
2. Connect the cable to the drive system (ACOPOS).
3. Connect the connector (hybrid) to the motor.

Disconnecting

1. Disconnect the machine from the power system and secure it against being switched on again.
2. Disconnect the connector (hybrid) from the motor.
3. Disconnect the cable from the drive system (ACOPOS).

5.5.3 Connecting connectors properly

The connectors for the power and encoder connection of B&R motors are available as speedtec system and itec system. The systems differ in the type of locking mechanism.

Caution!

Damage due to improperly connected connectors!

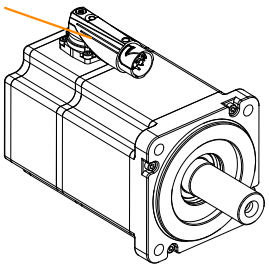
Incorrectly connected connectors can result in disturbances and damage to the motor and encoder!

- **Always connect or disconnect the connector straight in/out, without force and without tools.**
- **It is important to ensure that connectors are fully connected and locked.**

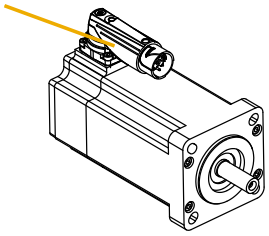
5.5.3.1 System overview

8MSA...-4 (with EnDat 3.0)

speedtec system
Power and encoder connection
- EnDat 3.0



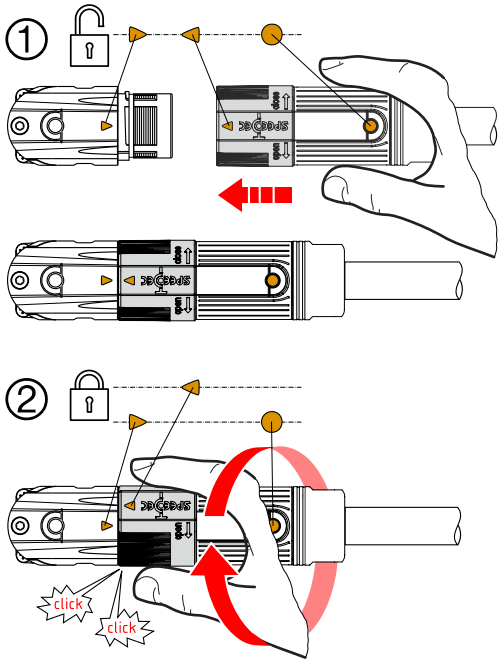
itec system
Power and encoder connection
- EnDat 3.0



5.5.3.2 speedtec system

The speedtec system is equipped with a tool-free quick-release fastener and an internal thread, making it compatible with built-in connectors that use a screw terminal.

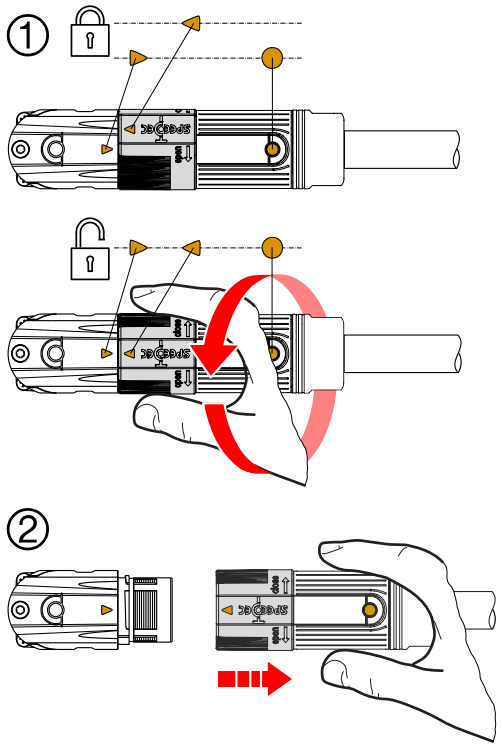
Connecting and locking



1. Align the ►◄• markings with each other.
   Push the connector straight and without gaps onto the built-in connector.

2. Tighten the locking ring clockwise (direction of arrow "close").
   The locking mechanism must be turned until at least **2** "**click**" sounds can be heard. To ensure correct locking, the ►◄• markings must also be **offset** from each other (see step 2 in the figure on the left).

Unlocking and disconnecting the connector



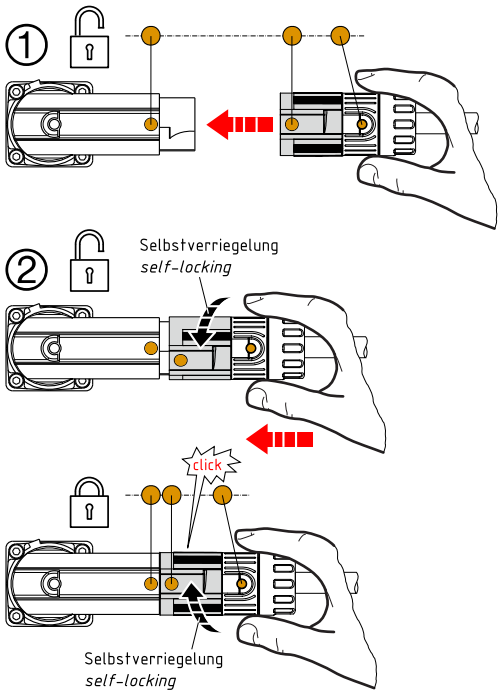
1. Turn the locking ring counterclockwise (direction of arrow "open") until the ►◄• markings are aligned with each other.

2. Disconnect the connector straight out and without force from the built-in connector.
   It is only permitted to pull the connector during removal, not the cable.

5.5.3.3 itec system

The tool-free self-locking itec system twists the frontmost ring of the connector during connection and returns it to the middle position after it has been locked.

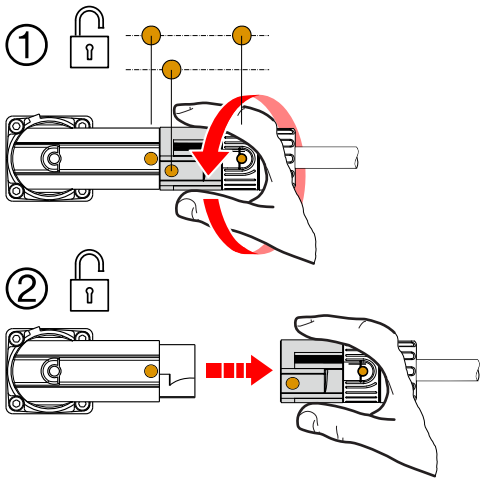
Connecting and locking



1. Align the • • • markings with each other.
   Push the connector straight and without gaps.

2. While pushing, the front ring of the connector turns counterclockwise and jumps back to the middle position after locking.
   Correct locking is indicated by the middle position of the front ring and a "**click**" sound.

Unlocking and disconnecting the connector

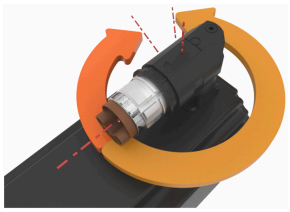


1. Turn the front ring of the connector one eighth of a turn counterclockwise and hold it in this position.
2. Disconnect the connector straight out and without force.
   It is only permitted to pull the connector during removal, not the cable.

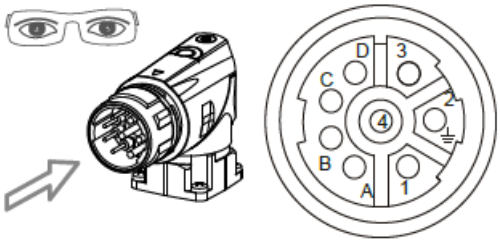
5.5.4 Connection type

5.5.4.1 Single-cable solution (hybrid) - 923 speedtec

- 300° swivel speedtec connection
- Encoder and power cable: Combined in one cable
- Quick-release self-locking connector system
- Robust industrial connectors with optimal EMC shielding
- Robust metal housing



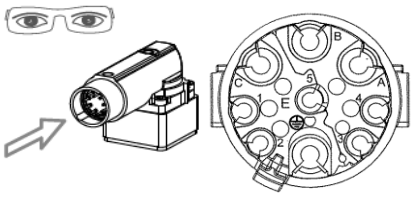
5.5.4.1.1 Single-cable solution (hybrid) - 923 speedtec - Pinout

	Pin	Function
	1	Motor connection U
	4	Motor connection V
	3	Motor connection W
	2	Grounding
	A	EnDat 3 power supply / data
	B	EnDat 3 ground/data inverted
	C	Brake +
	D	Brake -

5.5.4.2 Single-cable solution (hybrid) - 915 itec

- Encoder and power cable: Combined in one cable
- Quick-release self-locking connector system
- Robust industrial connectors with optimal EMC shielding
- Robust metal housing

5.5.4.2.1 Single-cable solution (hybrid) - 915 itec - Pinout

	Pin	Function
	A	Motor connection U
	B	Motor connection V
	C	Motor connection W
	⏚	Grounding
	1	EnDat 3 power supply / data
	2	EnDat 3 ground/data inverted
	3	Brake +
	4	Brake -

6 Commissioning and operation

6.1 Before commissioning and operation

Read this user's manual completely before starting any commissioning activities or operation.

In addition, take into account the technical documentation for all other machine components as well as the finished machine.

6.2 Safety

Commissioning is only permitted to be carried out by qualified personnel[2)].

Only use appropriate equipment and tools. Protect yourself with safety equipment.

Caution!

Severe personal injury and damage to property due to failure of the servo drive!

If the servo drive fails, an uncontrolled motor can cause damage.

Electronic devices are generally not failsafe!

- **Ensure that the motor is brought into a safe state if the servo drive fails.**

6.2.1 General sources of danger

Tampering of protection or safety devices

Protective and/or safety devices protect you and other persons from dangerous voltage, rotating or moving elements and hot surfaces.

Danger!

Personal injury and damage to property due to tampering of protective equipment!

If protective or safety devices are removed or put out of operation, there is no longer any personal protection and serious personal injury and damage to property can occur.

- **Do not remove any safety devices.**
- **Do not put any safety devices out of operation.**
- **Always use all safety devices also for temporary testing and trial operations!**

Dangerous voltage

To operate the motors, dangerous voltage must be applied to certain parts.

[2)] see "Qualified personnel" on page 8

Danger!

Risk of injury due to electric shock!

If live parts are touched, there is immediate danger of fatal electric shock.

If connections are connected or disconnected in the incorrect order or while voltage is applied, electric arcs can occur and persons and contacts can be damaged.

Even if the motor is not rotating or is running as a generator driven externally, the control and power connections can still carry voltage!

- **Never touch connections when the power is switched on.**
- **Never disconnect or connect electrical connections to the motor and servo drive while voltage is applied!**
- **Do not stay in the danger zone during operation and secure it against access by unauthorized persons.**
- **Always operate the motor with all safety equipment. Do this also for temporary testing and trial operations!**
- **Keep all covers and control cabinet doors closed during operation and as long as the machine is not disconnected from the mains.**
- **Before working on motors, gearboxes or servo drives or in the danger zone of your machine, disconnect them completely from the mains and secure them against being switched on again by other persons or automatic systems.**
- **Note the discharge time of any existing DC bus.**
- **Only connect measuring instruments in a current- and voltage-free state!**

Danger due to electromagnetic fields

Electromagnetic fields are generated by the operation of electrical power engineering equipment such as transformers, inverters and motors.

Danger!

Danger to health due to electromagnetic fields!

The functionality of a heart pacemaker can be impaired by electromagnetic fields to such an extent that the wearer experiences harm to his or her health, possibly with a fatal outcome.

- **Observe relevant national health and safety regulations.**
- **Persons with pacemakers are not allowed to be in endangered areas.**
- **Warn staff by providing information, warnings and safety identification.**
- **Secure the danger zone by means of barriers.**
- **Ensure that electromagnetic fields are reduced at their source (using shields, for example).**

Dangerous motion

By rotating and positioning motions of the motors, machine elements are moved or driven and loads conveyed.

After switching on the machine, movements of the motor shaft must always be expected! For this reason, higher-level protective measures must be put in place to ensure that personnel and the machine are protected. This type of protection can be achieved, for example, by using stable mechanical protective equipment such as protective covers, protective fences, protective gates or photoelectric sensors.

In the immediate vicinity of the machine, provide sufficient and easily accessible emergency switch-off devices to stop the machine as quickly as possible in the event of an accident.

Danger!

Danger of injury due to rotating or moving elements and loads!

By rotating or moving elements, body parts can be drawn in or severed or subjected to impacts.

- **Do not stay in the danger zone during operation and secure it against access by unauthorized persons.**
- **Before working on the machine, secure it against unwanted movements. If a holding brake is available, it must be checked for functionality after machine actuators have been attached and after maintenance and repair work has been carried out!**
- **Keep all covers and control cabinet doors closed during operation and as long as the machine is not disconnected from the mains.**
- **Always operate the motor with all safety equipment. Do this also for temporary testing and trial operations!**
- **Motors can be started automatically via remote control! If appropriate, a corresponding warning symbol must be applied, and protective measures must be implemented to prevent entry into the high-risk area!**

Danger!

Danger of injury due to loads!

Suspended loads can result in personal injury or death if they fall down. Heavy loads can tilt and trap people or severely injure them.

Failure to comply with instructions, guidelines and regulations or use of unsuitable or damaged tools and devices can result in serious injury and/or damage to property.

- **Motors should only be lifted without any additional load from other products (e.g. connection elements).**
- **Only use permitted lifting, transport and aids with sufficient lifting capacity.**
- **Never stand in the danger zone or under suspended loads.**
- **Secure the product against dropping and tilting.**
- **Wear safety shoes, protective clothing and a safety helmet.**
- **Comply with the national and local regulations.**

Warning!

Danger of injury due to incorrect control or a defect!

Improper control of motors or a defect can result in injuries and unintended and hazardous movements of motors.

Such incorrect behavior can be triggered by:

- **Incorrect installation or faults when handling components**
- **Improper or incomplete wiring**
- **Defective devices (servo drive, motor, position encoder, cables, brake)**
- **Incorrect control (e.g. caused by software error)**

Risk due to hot surfaces

Due to the power dissipation from the motor and friction in the gearbox, these components as well as their environment can reach a temperature of more than 100°C.

The resulting heat is released to the environment via the housing and the flange.

Warning!

Risk of burns due to hot surfaces!

Touching hot surfaces (e.g. motor and gearbox housings, as well as connected components), can result in very severe burns due to the very high temperature of these parts.

- **Do not stay in the danger zone during operation and secure it against access by unauthorized persons.**
- **Never touch the motor or gearbox housing as well as adjacent surfaces during nominal load operation.**
- **Be aware of hot surfaces also during standstill.**
- **Allow the motor and gearbox to cool down sufficiently before working on them; there remains the risk of burns for a long period of time after they are switched off.**
- **Always operate the motor or gearbox with all safety devices. Do this also for temporary testing and trial operations!**

6.2.2 Reversing operation

Warning!

Personal injury and damage to property due to shaft breakage!

The shaft key can become dislodged during heavy reverse operation. In extreme cases, this can cause the shaft end to break, which can result in severe damage!

- **It is therefore preferable to use a smooth shaft during heavy reversing operation.**

6.2.3 Freely rotating motors

With freely rotating motors, measures must be taken to prevent the key (if present) from being ejected. Measures must be taken to prevent mounting screws or other mounting elements from being ejected or removed prior to operation. A shaft protection sleeve for transport and storage is not appropriate protection and must also be removed.

Warning!

Personal injury and damage to property due to ejected elements!

With freely rotating motors, ejected elements can cause personal injury and damage to property.

- **The following safety precautions apply also for temporary testing and trial operations!**
- **Secure the keys.**
- **Secure or remove mounting screws or other mounting elements.**
- **A shaft protection sleeve for transport and storage must also be removed.**

6.2.4 Holding brake

The motors can be equipped with an optional holding brake. This is only used to hold the motor shaft in place when the motor is in a voltage-free state.

The maximum motor torque far exceeds the holding torque of the brake.

Danger!

Personal injury and damage to property due to non-intended use of the holding brake!

If the holding brake is used differently than intended, functional failures and accidents involving personal injury or damage to property are possible.

- **Do not use the holding brake for braking under normal operating conditions! It is not intended for normal braking.**
- **Do not use the holding brake to hold loads! They do not ensure a securing function (e.g. against lowering in the case of lifted loads).**
- **Do not load motors with holding brakes axially either during assembly or during operation. It is especially important to prevent axial forces in the direction of the B flange since these forces can cause the brake to fail!**

Note:

Loaded braking during an emergency stop is permitted but reduces its service life.

For additional information about the holding brake, see chapter "Technical data".

6.3 Verification

6.3.1 To verify before commissioning

The following must be ensured before commissioning:

- The drive is not permitted to be damaged.
- The motor must be properly aligned and secured and is not permitted to be within the danger zone of other equipment.
- The screw connections must be tightened correctly.
- Any unused connection threads on the flanged end shield must be sealed.
- All components attached to the output shaft must be secured against unintentional detachment.
- Motors that have a keyed shaft end are not permitted be operated without a key. The resulting imbalance can result in motor damage.
- For freely rotating motors, keys must be secured against ejection and mounting screws; other mounting elements must be secured or removed.
- All the necessary protective equipment (mechanical, thermal, electrical) must be installed.
- All motor connections must be properly made.
- The protective ground conductor must be installed properly and verified.
- The lines are not permitted to touch the motor surface.
- The drive must be free (release brake).
- The emergency switch-off functions must be checked.
- A holding brake must be functional if available.
- If a fan is present, it must be properly connected and functional.
- If a liquid cooling system is present, it must be properly connected, functional and leak-proof.

Warning!

Personal injury and damage to property due to damaged or unsuitable machine components!

Operating a machine with damaged or unsuitable components is a safety risk and can result in failures. Severe damage to property and injuries cannot be excluded.

- **Never operate a machine with a damaged motor or gearbox or any other damaged component.**
- **Never install a damaged component in a machine.**
- **Do not use motors or gearboxes that have already been overloaded during operation.**
- **Before installation, ensure that the motor or gearbox is suitable for the machine.**
- **It is better not to carry out short-term test and trial operations with damaged or inappropriate machine components.**
- **Label damaged or non-operational components in a readily visible location and clearly.**

6.3.2 To verify during commissioning

The following must be ensured during commissioning:

- The functionality of all the motor's components and assemblies (protective equipment, encoder, brake, cooling, gearbox, etc.) must have been verified.
- The operating conditions (see chapter "Installation conditions") must be observed.
- A holding brake, if present, must be released when the motor is rotating.
- If a liquid cooling system is present, it must be functional and leak-proof.
- All electrical attachments and connections must be properly designed and secured.
- All protective measures must have been implemented in order to prevent contact with voltage-carrying components, hot surfaces and rotating or moving parts and assemblies. Also check whether these protective measures are working properly.
- All output elements must be installed and set up in accordance with the manufacturer's specifications.
- The max. permissible speed n_{max} of the motor must be limited and is not permitted to be exceeded. The maximum permissible speed n_q is the maximum speed that is permissible for short-time duty.

6.3.3 During operation

During operation, be aware of the following signs that can indicate a malfunction:

- Unusual noises
- Unusual vibrations
- Unusual odors
- Smoke generation
- Unusual temperature development
- Increased power consumption
- Lubricant outlet
- The monitoring or safety device responds

If possible, switch off the machine as soon as possible in order to avoid damage or accidents. Always ensure the safety of other persons as well as your own safety during shutdowns and causal investigation!

In the case of shutdowns, please inform the responsible qualified personnel immediately.

6.4 Faults during operation

In the following table, you can find possible causes of error broken down by malfunction as well as information about how to fix them.

Fault	Possible cause of fault	Correction
Motor will not start	Run enable missing	Activate controller enable
	Controller error, encoder error	Read error listing on inverter/controller, correct error Check the connector for correct installation (see section "Connecting connectors properly" in chapter "Installation and connection")
	Power supply not present	Check the connection and power supply. Check the connector for correct installation (see section "Connecting connectors properly" in chapter "Installation and connection")
	Rotating field	Check the phase sequence; replace the attachment cable if necessary.
	Brake will not release (optional equipment may be available).	Check the control, connections and power supply.
	Brake defective (optional equipment may be available)	If necessary, contact B&R.
Runs noisily	Insufficient shielding in connection lines	Check the shielding connection and grounding.
	Controller parameters too high	Optimize the controller parameters.
Vibrations	Coupling element or machine not properly balanced	Adjust the balance.
	Power transmission system misaligned	Realign the power transmission system.
	Mounting screws loose	Check and tighten the screw connections.
Noise during operation	Foreign bodies in the motor	If necessary, contact B&R.
	Bearing damage	If necessary, contact B&R.
The motor becomes too warm - the temperature monitoring responds	Power transmission system overloaded	Check the motor load and compare with the data on the nameplate.
	Insufficient heat dissipation	Ensure sufficient heat dissipation.
	Brake will not release sufficiently - Grinding brake (optional equipment may be available)	If necessary, contact B&R.
Current consumption too high - motor torque too low	Incorrect rest angle	Check the rest angle and adjust as needed.

If necessary, contact B&R.

For this, the following information should be provided:

- Order number and serial number (see nameplate)
- Type and extent of fault
- Circumstances under which the fault occurred
- Application data (cycle of torque, speed and forces over time, ambient conditions)

7 Inspection and maintenance

Various operating conditions (e.g. operating mode, temperature, speed, load, mounting orientation), can have a significant impact on the service life of lubricants, seals and bearings.

Depending on the pollution degree, clean regularly on site to ensure heat is being dissipated properly, for example.

The following tasks are the responsibility of the operator:

- Creating a maintenance plan and documentation of inspections and maintenance tasks.
- Checking motors and the structure supplying cooling air for contamination, moisture and leaks.
- Cleaning motors and the structure supplying cooling air.
- Checking connectors and lines for damage.
- Testing all safety measures for safe operation.

7.1 Safety

Work on motors and their wiring is only permitted to be carried out by qualified personnel [2)] in a voltage-free state. The control cabinet must first be de-energized and secured against being switched on again.

Only use appropriate equipment and tools. Protect yourself with safety equipment.

Warning!

Personal injury and damage to property due to unauthorized modifications!

As a result of unauthorized modifications to the product, the performance and limit values can be negatively affected and dangers can arise. Due to this, severe damage to property and injuries cannot be excluded.

Unauthorized modifications are therefore prohibited!

- **Do not carry out any unauthorized modifications or alterations to the product.**
- **If necessary, contact B&R.**

7.1.1 General sources of danger

Tampering of protection or safety devices

Protective and/or safety devices protect you and other persons from dangerous voltage, rotating or moving elements and hot surfaces.

Danger!

Personal injury and damage to property due to tampering of protective equipment!

If protective or safety devices are removed or put out of operation, there is no longer any personal protection and serious personal injury and damage to property can occur.

- **Do not remove any safety devices.**
- **Do not put any safety devices out of operation.**
- **Always use all safety devices also for temporary testing and trial operations!**

Dangerous voltage

To operate the motors, dangerous voltage must be applied to certain parts.

[2)] see "Qualified personnel" on page 8

Danger!

Risk of injury due to electric shock!

If live parts are touched, there is immediate danger of fatal electric shock.

If connections are connected or disconnected in the incorrect order or while voltage is applied, electric arcs can occur and persons and contacts can be damaged.

Even if the motor is not rotating or is running as a generator driven externally, the control and power connections can still carry voltage!

- **Never touch connections when the power is switched on.**
- **Never disconnect or connect electrical connections to the motor and servo drive while voltage is applied!**
- **Do not stay in the danger zone during operation and secure it against access by unauthorized persons.**
- **Always operate the motor with all safety equipment. Do this also for temporary testing and trial operations!**
- **Keep all covers and control cabinet doors closed during operation and as long as the machine is not disconnected from the mains.**
- **Before working on motors, gearboxes or servo drives or in the danger zone of your machine, disconnect them completely from the mains and secure them against being switched on again by other persons or automatic systems.**
- **Note the discharge time of any existing DC bus.**
- **Only connect measuring instruments in a current- and voltage-free state!**

Danger due to electromagnetic fields

Electromagnetic fields are generated by the operation of electrical power engineering equipment such as transformers, inverters and motors.

Danger!

Danger to health due to electromagnetic fields!

The functionality of a heart pacemaker can be impaired by electromagnetic fields to such an extent that the wearer experiences harm to his or her health, possibly with a fatal outcome.

- **Observe relevant national health and safety regulations.**
- **Persons with pacemakers are not allowed to be in endangered areas.**
- **Warn staff by providing information, warnings and safety identification.**
- **Secure the danger zone by means of barriers.**
- **Ensure that electromagnetic fields are reduced at their source (using shields, for example).**

Dangerous motion

By rotating and positioning motions of the motors, machine elements are moved or driven and loads conveyed.

After switching on the machine, movements of the motor shaft must always be expected! For this reason, higher-level protective measures must be put in place to ensure that personnel and the machine are protected. This type of protection can be achieved, for example, by using stable mechanical protective equipment such as protective covers, protective fences, protective gates or photoelectric sensors.

In the immediate vicinity of the machine, provide sufficient and easily accessible emergency switch-off devices to stop the machine as quickly as possible in the event of an accident.

Danger!

Danger of injury due to rotating or moving elements and loads!

By rotating or moving elements, body parts can be drawn in or severed or subjected to impacts.

- **Do not stay in the danger zone during operation and secure it against access by unauthorized persons.**
- **Before working on the machine, secure it against unwanted movements. If a holding brake is available, it must be checked for functionality after machine actuators have been attached and after maintenance and repair work has been carried out!**
- **Keep all covers and control cabinet doors closed during operation and as long as the machine is not disconnected from the mains.**
- **Always operate the motor with all safety equipment. Do this also for temporary testing and trial operations!**
- **Motors can be started automatically via remote control! If appropriate, a corresponding warning symbol must be applied, and protective measures must be implemented to prevent entry into the high-risk area!**

Danger!

Danger of injury due to loads!

Suspended loads can result in personal injury or death if they fall down. Heavy loads can tilt and trap people or severely injure them.

Failure to comply with instructions, guidelines and regulations or use of unsuitable or damaged tools and devices can result in serious injury and/or damage to property.

- **Motors should only be lifted without any additional load from other products (e.g. connection elements).**
- **Only use permitted lifting, transport and aids with sufficient lifting capacity.**
- **Never stand in the danger zone or under suspended loads.**
- **Secure the product against dropping and tilting.**
- **Wear safety shoes, protective clothing and a safety helmet.**
- **Comply with the national and local regulations.**

Warning!

Danger of injury due to incorrect control or a defect!

Improper control of motors or a defect can result in injuries and unintended and hazardous movements of motors.

Such incorrect behavior can be triggered by:

- **Incorrect installation or faults when handling components**
- **Improper or incomplete wiring**
- **Defective devices (servo drive, motor, position encoder, cables, brake)**
- **Incorrect control (e.g. caused by software error)**

Risk due to hot surfaces

Due to the power dissipation from the motor and friction in the gearbox, these components as well as their environment can reach a temperature of more than 100°C.

The resulting heat is released to the environment via the housing and the flange.

Warning!

Risk of burns due to hot surfaces!

Touching hot surfaces (e.g. motor and gearbox housings, as well as connected components), can result in very severe burns due to the very high temperature of these parts.

- **Do not stay in the danger zone during operation and secure it against access by unauthorized persons.**
- **Never touch the motor or gearbox housing as well as adjacent surfaces during nominal load operation.**
- **Be aware of hot surfaces also during standstill.**
- **Allow the motor and gearbox to cool down sufficiently before working on them; there remains the risk of burns for a long period of time after they are switched off.**
- **Always operate the motor or gearbox with all safety devices. Do this also for temporary testing and trial operations!**

7.2 Motor bearing and holding brake

Motor bearing

In the case of trouble-free operation, we recommend changing the motor bearing after approx. 20,000 operating hours as a general maintenance guideline (calculated bearing mission time L_{h10}: 20,000 operating hours).

Holding brake

Over time, exposure to moisture and contamination can reduce the braking torque. The application should therefore check the braking torque from time to time using the brake test function with the safety factor required for the application.

If the brake is no longer achieving the necessary torque, a refresh cycle can help it achieve the necessary torque again.

- The brake test function in the ACOPOS servo drive used must be enabled.
- During a refresh cycle, the motor is allowed to turn one revolution at a speed of 50 rpm with the brake engaged. This cleans the brake pads and generally helps the brake to once again achieve the torque it needs.
- After the refresh cycle, the brake should be tested again.
- If the brake is still not achieving the necessary torque after 5 refresh cycles, the motor must be replaced.

Replace the motor when the brake no longer reaches its required torque.

If necessary, contact B&R. Repairs to the motor and brake are only permitted to be carried out by B&R!

Note:

The motors can be equipped with an optional holding brake. This is used to hold the motor shaft in place when the motor is in a voltage-free state. The maximum motor torque far exceeds the holding torque of the brake.

Danger!

Personal injury and damage to property due to non-intended use of the holding brake!

If the holding brake is used differently than intended, functional failures and accidents involving personal injury or damage to property are possible.

- **Do not use the holding brake for braking under normal operating conditions! It is not intended for normal braking.**
- **Do not use the holding brake to hold loads! They do not ensure a securing function (e.g. against lowering in the case of lifted loads).**
- **Do not load motors with holding brakes axially either during assembly or during operation. It is especially important to prevent axial forces in the direction of the B flange since these forces can cause the brake to fail!**

Note:

Loaded braking during an emergency stop is permitted but reduces its service life.

Danger!

Personal injury and damage to property due to non-intended use of the holding brake!

If the holding brake is used differently than intended, functional failures and accidents involving personal injury or damage to property are possible.

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- **Do not load motors with holding brakes axially either during assembly or during operation. It is especially important to prevent axial forces in the direction of the B flange since these forces can cause the brake to fail!**

Note:

Loaded braking during an emergency stop is permitted but reduces its service life.

7.3 Oil seal

Motors can optionally be equipped with an oil seal (form A per DIN 3760). The motors thus satisfy the requirements for IP65 protection per EN 60034-5.

Note:

Gearbox mounting is not permitted as a result, however, since maintenance of the oil seal is impeded by the gearbox.

- **Ensure sufficient lubrication of the oil seal throughout the entire service life of the motor.**

7.4 Cleaning

Clean the motors regularly to ensure good heat dissipation.

Information:

- **During cleaning work, hold the drive cable/connector in place.**
- **Remove fibers and foreign bodies from the motor housing by hand without damaging the motor surface or shaft end.**
- **Use a cloth moistened with water to remove dust and dirt from the motor housing (excluding the shaft end).**

Caution!

- **Cleaning is only permitted to be carried out by qualified personnel.**
- **Before starting cleaning work, make sure that the motor is switched off, disconnected from power, stopped and cooled down.**
- **Compressed air tools, high-pressure cleaners, wire brushes, scrapers, etc. are not suitable for cleaning the motor and cables.**

8 Standards and certifications

8.1 International and national certifications

Products and services from B&R comply with applicable regulations, directives and standards. These are national, European and international regulations, mainly from organizations such as ISO, IEC and CENELEC. We are committed to ensuring the reliability of our products in industrial environments.

Information:

Certifications that apply to a particular motor are available at the following places:

- **Under "General motor data → General information" in the user's manual**
- **On the website (www.br-automation.com) and corresponding product page under "General motor data → General information"**
- **On the nameplate of the motor.**

8.1.1 Mark

Mark	Explanation	Region
CE	CE marking	Europe (EU)
c UL us FILE:	Underwriters Laboratories Inc. (UL)	Canada USA

8.1.2 EU directives and standards (CE)

CE marking

CE

Europe (EU)

The respective product complies with all applicable EU directives and relevant harmonized standards.

Certification of these products is performed in cooperation with accredited testing laboratories.

EMC Directive 2014/30/EU

All devices meet the protection requirements of the "Electromagnetic Compatibility" directive and are designed for use in typical industrial environments.

Applicable standards from this directive:

EN 61800-3	Adjustable speed electrical power drive systems - Part 3: EMC requirements and specific test methods

Low Voltage Directive 2014/35/EU

The low voltage directive applies to electrical equipment with a nominal voltage from 50 to 1000 VAC and from 75 to 1500 VDC.
All devices within the area of application of this directive satisfy the its protection requirements.

Applicable standard from this directive:

EN 60034-1	Rotating electrical machines - Part 1: Rating and performance

The corresponding declaration of conformity is available for download on the B&R website. The editions of the applied standards are located in the declaration of conformity.

Declaration of conformity

Website > Downloads > Certificates > Declarations of conformity > Motors > Declaration motors dreh-sync

Ecodesign Directive (EU) No. 2019/1781

B&R motors are not induction motors, but servo and synchronous motors. These cannot be connected directly to the public power grid and also cannot be operated with a sinusoidal voltage with a frequency of 50 Hz, 60 Hz or 50/60Hz. B&R motors are used exclusively in combination with B&R drives and are operated with variable voltage and frequency.

B&R motors are therefore excluded from the scope of Regulation (EU) 2019/1781.

8.1.2.1 Overview of standards

The following overview contains standards that are partially or completely taken into account for product certification.

Standard	Description
EN 60034-1	Rotating electrical machines - Rating and performance
EN 60034-5	Degrees of protection provided by integral design of rotating electrical machines
EN 60034-6	Rotating electrical machines - Cooling types
EN 60034-7	Rotating electrical machines - Classification of types of construction, installation arrangements
EN 60034-11	Rotating electrical machines - Thermal protection
EN 60034-14	Mechanical vibration of certain machines with shaft heights 56 mm and higher
UL 1004-1	Rotating electrical machines, general requirements
UL 1004-6	Servo and stepper motors
C22.2 No.100-14	Motors and Generators

8.1.2.2 Climate conditions

For operating conditions and the conditions for transport and storage per **EN 60034-1**, see the following chapters:

see "Operating conditions" on page 51

see "Transport and storage conditions" on page 49

8.1.3 UL / CSA

c UL us
FILE:

Underwriters Laboratories (UL)
Products with this mark are tested by Underwriters Laboratories and listed with the file number E360421.

The mark is valid for the **USA and Canada** and simplifies the certification of your machines and systems in this economic area.

Standards applied:

UL 1004-1	Rotating electrical machines - General requirements
UL 1004-6	Servo and stepper motors
CSA-C22.2 No. 100-14	Motors and generators

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