8JSA three-phase synchronous motors

User's manual

Version: **1.00 (June 2019)**
Model no.: **MAMOT5-ENG**

Translation of the original documentation

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Chapter 1 • General information

1 Manual history

Version	Date	Notes
1.00	2019-06-11	First edition

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 latest version.

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.

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.

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.

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.

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.

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 during short-term test 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 when the power is switched on, 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 when the power is switched on!**
- **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 even during short 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 power system.**
- **Before working on motors, gearboxes or servo drives or in the danger zone of your machine, disconnect them completely from the power system 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 when the power is switched off!**

Danger due to electromagnetic fields

Electromagnetic fields are generated by the operation of electrical power engineering equipment such as transformers, drives 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.**
- **Reduce electromagnetic fields at their source (using shielding, 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 machines 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 switching-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. Any holding brake present 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 power system.**
- **Always operate the motor with all safety equipment. Do this even during short 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 lead to 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 downtime.**
- **Allow motor and gearbox to cool sufficiently before working on it. This is because there is still a risk of burning for a prolonged period of time even after shutting down.**
- **Always operate the motor or gearbox with all safety devices. Do this even during short testing and trial operations!**

3.5 Provisions 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. wire 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.

3.6 Responsibilities 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:

- To know and implement the applicable industrial safety regulations.
- To know and implement national, local and plant-specific regulations.
- To identify in a risk assessment hazards that can arise due to on-site working conditions.
- To prepare documentation for operation of the finished system (with motors, gearboxes, servo drives, etc.) including safety notices.
- To regularly check whether the operating instructions and manuals issued correspond to current rules and standards.
- To clearly define and manage responsibilities for installation, operation, fault correction, maintenance and cleaning.
- To ensure that affected personnel have read and understood this user's manual.
- To regularly train and inform personnel about hazards.
- To provide personnel with the required protective equipment

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.

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

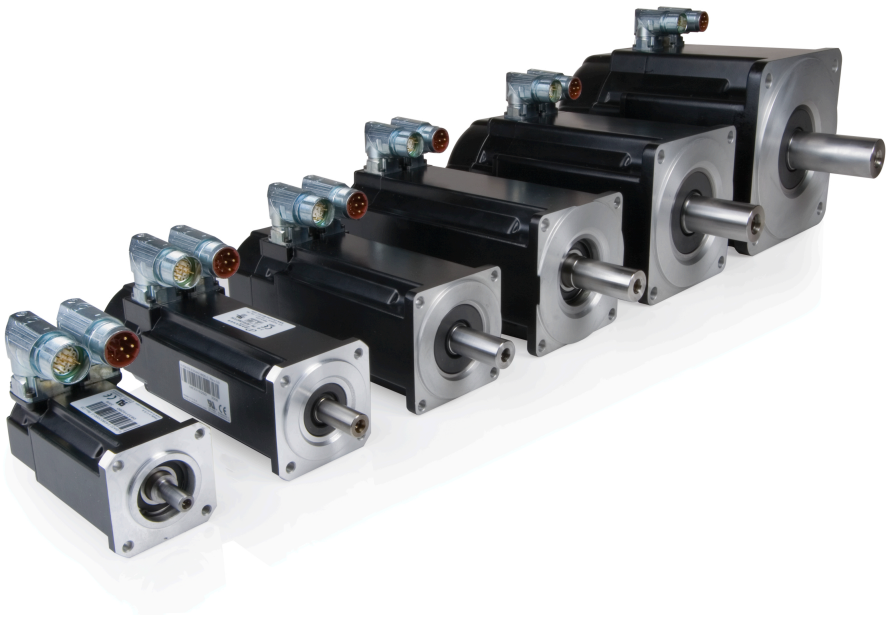
3.9 Protective equipment

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

4 8JSA three-phase synchronous motors

B&R's 8JSA three-phase synchronous motors have been specially developed for use in high-performance applications. Today, they are used to manufacture consumer goods and products in the plastics industry, packaging industry, metalworking industry, beverage and food industry and to palletize these products with handling systems. Complete solutions from a single source requires the right components as well as the right configuration for the application environment. The large selection of available 8JS three-phase synchronous motors makes it possible to easily meet conditions such as reducing the variety of parts, guaranteeing ease of service and maintaining minimum requirements on space.

An optimally adapted drive rounds off a successful design. In order to achieve this, specialists are available to users at B&R subsidiaries around the world who are happy to provide their mechatronic know-how. B&R automation components: the economical combination of mechanics, electronics, technology and innovation.



4.1 Nameplate

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

The label on the motor housing includes the following information:

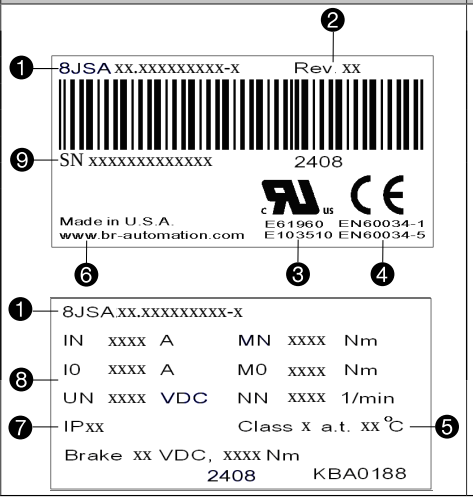
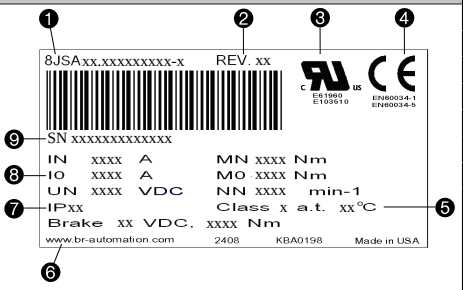
		Size 2 and 3	Size 4-7
1	Order code		
2	Revision		
3	UL-recognized component mark		
4	CE marking		
5	Insulation class		
6	Manufacturer		
7	Protection class		
8	Technical data: M_n Rated torque I_n Rated current M_0 Continuous stall torque I_0 Continuous stall current U_{DC} DC bus voltage n_n Rated speed		
9	Serial number (13-digit)		

Table 1: Nameplate

Note:

- **The nameplate must be visible at all times.**
- **The nameplate is not permitted to be removed from the motor.**

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. The only things that the user has to optimize are the speed and position controllers. 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.

Chapter 2 • Technical data

1 General description

Three-phase synchronous motors from the 8JSA series are permanent magnet, electronically commutated synchronous motors for applications that require excellent dynamic characteristics and positioning precision as well as compact size and reduced weight.

- Sinusoidal commutation with EnDat encoder or resolver as feedback unit
- Star-connected three-phase winding
- Small construction volume, thus low weight
- Minimized moments of inertia due to favorable rotor design, thus very good dynamic properties
- High overload capability / peak torques
- Optimized torque ripple
- High dynamic torque at high speeds
- Long service life, motors wear-free except for ball bearings
- Direct power dissipation in the stator via the housing to the flange
- Preloaded deep-groove ball bearings, closed on both sides with grease lubrication
- Continuous motor series with stall torques from 0.84 Nm to 53 Nm
- Connection via two speedtec circular connectors
- Control via B&R drive systems

2 8JSA order key

8JS	A	c	d	.	ee	nnn	ff	gg	-	h

Cooling / Construction type

A ... Self-cooling
see "Cooling / Construction type" on page 15

Size

Valid values: **2, 3, 4, 5, 6, 7**
see "Size (c)" on page 15

Length

Valid values: **1, 2, 3, 4, 5**
see "Length (d)" on page 15

Motor encoder system

Resolver: **R0**
Inductive EnDat encoders: **E6, E7, E8, E9, EA, EB**
Optical EnDat encoders: **E4, E5**
see "Motor encoder system (ee)" on page 16

Nominal speed

018 ... 1,100 rpm
020 ... 2,000 rpm
023 ... 2,250 rpm
024 ... 2,400 rpm
025 ... 2,500 rpm
028 ... 2,750 rpm
030 ... 3,000 rpm
035 ... 3,500 rpm
040 ... 4,000 rpm
045 ... 4,500 rpm
050 ... 5,000 rpm
055 ... 5,500 rpm
080 ... 8,000 rpm
see "Nominal speed (nnn)" on page 18

Motor options

Valid values: **D0, D1, D2, D3, D6, D7, D8, D9**
see "Motor options (ff)" on page 18

Special motor options

8JS**A**...**00** ... No special motor option
see "Special motor options (gg)" on page 21

Motor version

Valid value: 0 (value automatically assigned and therefore not freely selectable)

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).

2.1 Example order 1

A three-phase synchronous motor (type **8JSA44**) with a nominal speed of 4000 rpm was selected for an application. The motor should also be equipped with a holding brake, a keyed shaft and a 2048-line EnDat single-turn encoder.

The code (ee) for the encoder system is **E6**.

The code (nnn) for a nominal speed of 2000 rpm is **040**.

The code (ff) for the other options (oil seal, holding brake, keyed shaft and connection direction) is **D3**.

The model number for the necessary motor is therefore **8JSA44.E6040D300-0**.

2.2 Example order 2

A three-phase synchronous motor (type **8JSA54**) with a nominal speed of 5000 rpm was selected for an application. The motor should also be equipped with a holding brake, a smooth shaft, an oil seal and a 2048-line EnDat multi-turn encoder.

The code (ee) for the encoder system is **E7**.

The code (nnn) for a nominal speed of 2000 rpm is **050**.

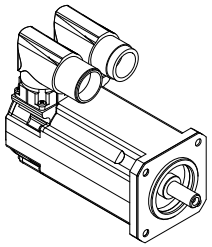
The code (ff) for the other options (oil seal, holding brake, keyed shaft and connection direction) is **D8**.

The model number for the necessary motor is therefore **8JSA54.E7050D800-0**.

3 Cooling / Construction type

8JS A c d . ee nnn ff gg - h see "Order key" on page 13

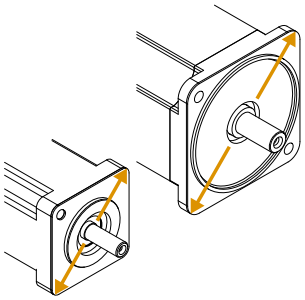
8JSA



Cooling type 8JSA 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.

4 Size (c)

8JS A c d . ee nnn ff gg - h see "Order key" on page 13



8JSA three-phase synchronous motors are available in six different sizes (2 ... 7). These differ in dimensions (especially flange dimensions) and power data.

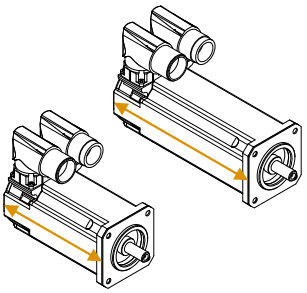
The sizes are distinguished by a number (c) in the model number. The larger this number, the larger the flange dimensions and power data of the respective motor.

Availability

Cooling type	Available sizes (c)					
	8JSA2	8JSA3	8JSA4	8JSA5	8JSA6	8JSA7
A	Yes	Yes	Yes	Yes	Yes	Yes

5 Length (d)

8JS A c d . ee nnn ff gg - h see "Order key" on page 13



8JSA three-phase synchronous motors are available in up to five different lengths. These differ in the power data with identical flange dimensions. The different lengths are distinguished by a number (d) in the model number.

Availability

	Available lengths (d)				
Size	8JSAx1	8JSAx2	8JSAx3	8JSAx4	8JSAx5
8JSA2	---	Yes	---	Yes	---
8JSA3	Yes	Yes	Yes	---	---
8JSA4	---	Yes	Yes	Yes	---
8JSA5	Yes	Yes	---	Yes	---
8JSA6	---	Yes	Yes	Yes	Yes
8JSA7	---	Yes	Yes	Yes	---

6 Motor encoder system (ee)

8JS	A	c	d	.	ee	nnn	ff	gg	-	h

see "Order key" on page 13

8JS three-phase synchronous motors are available with EnDat encoders as well as resolvers. The encoder system is specified as part of the model number in the form of a 2-digit code (ee).

Analog and digital transfer

A resolver is an analog encoder system. Resolvers are particularly robust against vibrations and high operating temperatures. Their disadvantage is the low precision of 6-10 arcminutes. There is still no multi-turn variant with resolvers.

Digital encoders use a serial transfer protocol. This protocol is called EnDat. The EnDat protocol is a developed standard that incorporates the advantages of absolute and incremental position measurement and also offers a read/write parameter memory in the encoder. The embedded parameter chip is stored by B&R in this encoder memory. This data and the B&R ACOPOS systems form a plug-and-play drive solution. Absolute positioning can be used within a revolution with the single-turn variants. A homing procedure is not required because of the absolute position measurement. For applications where the motor covers several revolutions for positioning, a multi-turn encoder that can save up to 65535 revolutions can be used. A solution with a single-turn encoder variant with a homing procedure is also possible. In EnDat 2.1 analog/digital sampling, a very fine resolution is achieved by the evaluation modules developed by B&R.

6.1 EnDat 2.1 encoders - Technical data

Motor sizes 2-3

Encoder type / Order code	E8	E9
Operating principle	Inductive	
EnDat protocol	2.1	2.1
Functional safety	---	---
Single-turn / Multi-turn	S	M
Revolutions	1	4096
Resolution [bits single-turn / bits multi-turn]	18/0	18/12
Precision ["]	280	280
Switching frequency ≥ [kHz]	6	6
Vibration during operation - Stator Max [m/s2]	300	300
Vibration during operation - Rotor Max [m/s2]	300	300
Shock during operation max [m/s²]	1000	1000
Manufacturer's product ID	ECI 1118 EnDat01	EQI 1130 EnDat01
Manufacturer's website	www.heidenhain.de	

Encoder type / Order code	E4	E5
Operating principle	Optical	Optical
EnDat protocol	2.1	2.1
Functional safety	---	---
Single-turn / Multi-turn	S	M
Revolutions	1	4096
Resolution [bits single-turn / bits multi-turn]	13/0	13/12
Precision ["]	60	60
Switching frequency ≥ [kHz]	190	190
Vibration during operation - Stator Max [m/s2]	200	200
Vibration during operation - Rotor Max [m/s2]	200	200
Shock during operation max [m/s²]	1000	1000
Manufacturer's product ID	ECN 1113 EnDat01	EQN 1125 EnDat01
Manufacturer's website	www.heidenhain.de	

Motor sizes 4 - 7

Encoder type / Order code	EA [1]	EB [1] [2]
Operating principle	Inductive	Inductive
EnDat protocol	2.1	2.1
Functional safety	---	---
Single-turn / Multi-turn	S	M
Revolutions	1	4096
Resolution [bits single-turn / bits multi-turn]	19/0	19/12
Precision ["]	180	180
Switching frequency ≥ [kHz]	6	6
Vibration during operation - Stator Max [m/s2]	200	200
Vibration during operation - Rotor Max [m/s2]	200	200
Shock during operation max [m/s²]	2000	2000
Manufacturer's product ID	ECI 1319 EnDat01	EQI 1331 EnDat01
Manufacturer's website	www.heidenhain.de	

1) The inductive encoders with product IDs "EA" and "EB" replace the encoder types with model numbers "E2" and "E3". These encoders should be used in all new applications.
2) The "EB" encoder type requires the following versions of our servo drives or inverter modules:

- ACOPOS: V2.090 or later
- ACOPOSmulti: V2.031 or later

Encoder type / Order code	E6	E7
Operating principle	Optical	Optical
EnDat protocol	2.1	2.1
Functional safety	---	---
Single-turn / Multi-turn	S	M
Revolutions	1	4096
Number of lines	2048 lines	2048 lines
Resolution [bits single-turn / bits multi-turn]	13/0	13/12
Precision ["]	20	20
Switching frequency ≥ [kHz]	400	400
Vibration during operation - Stator Max [m/s2]	300	300
Vibration during operation - Rotor Max [m/s2]	300	300
Shock during operation max [m/s²]	2000	2000
Manufacturer's product ID	ECN 1313 EnDat01	EQN 1325 EnDat01
Manufacturer's website	www.heidenhain.de	

6.2 Resolver

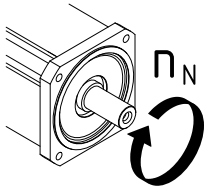
BRX resolvers are used in 8JSA servo motors. These resolvers are fed with a single sinusoidal signal (reference signal) and return as a result two sinusoidal signals whose amplitude changes sinusoidally or cosinusoidally with the angular position.

Description	Order code (ee)
	R0
Accuracy	10 angular minutes
Vibration during operation 10 < f ≤ 500 Hz	≤196 m/s²
Shock during operation Duration 11 ms	≤981 m/s²

7 Nominal speed (nnn)

8JS	A	c	d	.	ee	nnn	ff	gg	-	h

see "Order key" on page 13



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

	Order code (nnn)												
	018	020	023	024	025	028	030	035	040	045	050	055	080
Nominal speed n_N [rpm]	1800	2000	2250	2400	2500	2750	3000	3500	4000	4500	5000	5500	8000

8JSA three-phase synchronous motors can be delivered with different nominal speeds depending on the size and length.

Availability

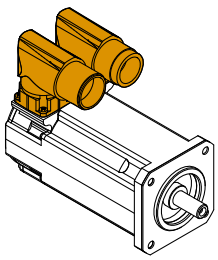
Size	Lengths				
	8JSAx1	8JSAx2	8JSAx3	8JSAx4	8JSAx5
8JSA2	---	8000	---	8000	---
8JSA3	5000	3000, 5500	4500	---	---
8JSA4	---	3500	5000	4000	---
8JSA5	4500	4500	---	2750, 5000	---
8JSA6	---	3000	2250	3000	2500
8JSA7	---	2000	2400	1800	---

8 Motor options (ff)

8JS	A	c	d	.	ee	nnn	ff	gg	-	h

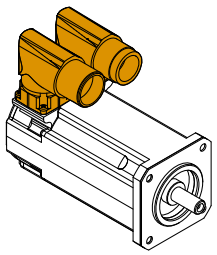
see "Order key" on page 13

See the following table for the corresponding code (ff) in the order key.

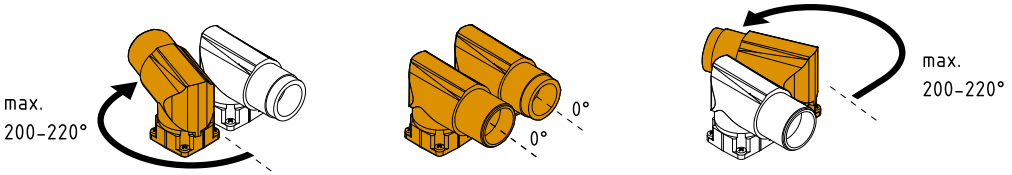
Motor option				Order code (ff)
Connection direction	Oil seal	Holding brake	Shaft end	
Angled (swivel connector)  Encoder and power cable: Separated with own connections	---	---	Smooth shaft	D0
			Keyed shaft	D1
		Standard holding brake	Smooth shaft	D2
			Keyed shaft	D3
	Yes	---	Smooth shaft	D6
			Keyed shaft	D7
		Standard holding brake	Smooth shaft	D8
			Keyed shaft	D9

8.1 Connection direction (ff)

8JSA three-phase synchronous motors can be delivered with angular, axial swivel connectors.

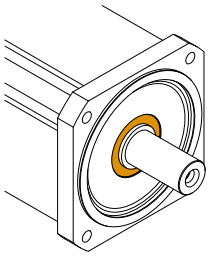


Angled built-in connector
Connection direction: Angled (swivel connector)
Encoder and power cable: Separated with own connections



Check the angle specifications (max. 200-220°) and the feasibility with regard to your requirements using the CAD configurator (cad.br-automation.com).

8.2 Oil seal



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

When equipped with an oil seal, the motors have IP65 protection per EN 60034-5.

Motor options (ff) - Overview (order code)

see "Motor options (ff)" on page 18

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!**

8.3 Holding brake (ff)

Operating principle

The holding brake is a spring-applied brake controlled by a B&R drive system. Based on principle, this type of holding brake exhibits a minimal amount of backlash.

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. If not enough information is known about the load torque, it is recommended to assume a safety factor of 2.

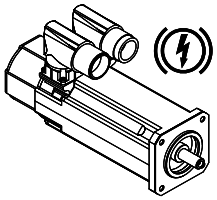
Warning!

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

Motor options (ff) - Overview (order code)

see "Motor options (ff)" on page 18

Standard holding brake (ff)



All 8JSA three-phase synchronous motors can be delivered with a holding brake. It is installed directly behind the B bearing on the motor and used to hold the motor shaft when no power is applied to the servo motor.

Technical data - Standard holding brake

Description	Motor size					
	2	3	4	5	6	7
Holding torque M_{Br} [Nm]	1.42	2.5	5.3	14.5	25	53
Connected load P_{On} [W]	8.4 ±7%	10.1 ±7%	12.8 ±7%	19.5 ±7%	25.7 ±7%	35.6 ±7%
Supply current I_{On} [A]	0.35	0.42	0.53	0.82	1.07	1.48
Supply voltage U_{On} [V] (+6% / -10%)	24 VDC	24 VDC	24 VDC	24 VDC	24 VDC	24 VDC
Moment of inertia J_{Br} [kgcm²]	0,011	0,011	0,068	0,173	0.61	1.64
Weight m_{Br} [kg]	0.27	0.35	0.63	1.1	2	2.9

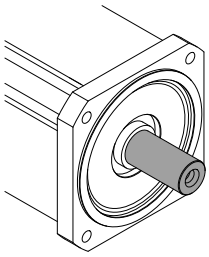
8.4 Shaft end

All 8JSA three-phase synchronous motor shafts comply with DIN 748 and are available with a smooth shaft end.

Motor options (ff) - Overview (order code)

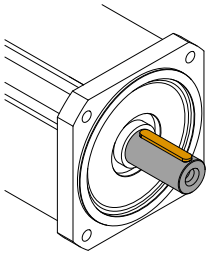
see "Motor options (ff)" on page 18

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 the 8JS 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 ISO 1940/1, G6.3.
The end of the shaft has a threaded center hole that can be used to mount machine actuators with shaft end cover plates.

Caution!

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

Preferably use smooth shaft ends with clamping elements.

9 Special motor options (gg)

8JS	A	c	d	.	ee	nnn	ff	gg	-	h

see "Order key" on page 13

The respective special motor option is specified as part of the model number in the form of a 2-digit code (**gg**).

8JSA...**00** ... No special motor option

10 General motor data

General information	Cooling type A
C-UR-US listed	Yes

Electrical properties	
Mains input voltage on servo drive	3x 400 VAC ... 3x 480 VAC ±10%
Connection type Motor connection Encoder connection	speedtec circular connector from Intercontec Size 1 Size 1

Thermal properties	
Insulation class per EN 60034-1	F
Methods of cooling per EN 60034-6 (IC code)	Self-cooling, free circulation surface cooling (IC4A0A0)
Thermal motor protection per EN 60034-11	Maximum winding temperature 140°C (limited by the thermal motor protection in the B&R drive system to 110°C with EnDat feedback and 130°C with resolver feedback)

Mechanical properties	
Vibration severity per EN 60034-14	Vibration severity stage A [1)]
Roller bearing, dynamic load rating and nominal service life	Based on DIN ISO 281
Shaft end per DIN 748	Form E
Oil seal per DIN 3760	Form A
Key and keyway per DIN 6885-1	Form A keys, form N1 keyway
Shaft balancing per ISO 1940/1, G6.3	Shaft and fitment key convention
Mounting flange	IEC 72-1
Radial runout, concentricity and axial runout of mounting flange per DIN 42955	Tolerance N
Coating Description Color	Polyester powder coating Mansfield 053-2006 polyester Similar to RAL 9005 flat

Operating conditions	
Rating class, operating mode per EN 60034-1	S1 - Continuous operation [2)]
Ambient temperature during operation	5°C to 40°C [3)]
Relative humidity during operation	5 to 95%, non-condensing
Maximum ambient temperature during operation	40°C [3)]
Reduction of the nominal current and stall current at temperatures above 40°C	5% per 5°C
Maximum installation elevation	1000 m above sea level [4)]
Reduction of rated and stall current at installation elevations Starting at 1000 m above sea level	5% per 1000 m
EN 60034-5 protection (IP code) With oil seal option	IP54 IP65
Type of construction and mounting arrangement per EN 60034-7 (IM code)	Horizontal (IM3001) Vertical, motor hangs on the machine (IM3011)[5)] Vertical, motor stands on the machine (IM3031)

Storage and transport conditions	
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 a shaft height greater than 56 mm.
2) The boundary conditions in section "Power dissipation" on page 25 must be taken into account.
3) Continuous operation of the servo motors at an ambient temperature of 40°C to max. 45°C is possible, but this results in premature aging.
4) Requirements that go beyond this must be arranged with B&R.
5) With the IM3011 type of construction and installation (vertical, motor hangs on the machine) there is a risk that production fluids or oils will penetrate the motor on the flange side. Motors or motor-gearbox combinations that should be used in this type of installation must therefore have at least IP65 protection on the flange side.

10.1 Reduction of nominal values depending on the motor option

The nominal values are reduced depending on the motor option selected (stall torque M_0 and nominal torque M_n) for the motor as seen in the following table (all values in [Nm]):

	Motor option (ff)							
Motor	**D0**	**D1**	**D2**	**D3**	**D6**	**D7**	**D8**	**D9**
8JSA22.R0nnnffgg-0	-	-	0.01	0.01	0.047	0.047	0.057	0.057
8JSA22.Exnnnffgg-0	-	-	0.02	0.02	0.047	0.047	0.067	0.067
8JSA24.R0nnnffgg-0	-	-	0.05	0.05	0.047	0.047	0.097	0.097
8JSA24.Exnnnffgg-0	-	-	0.12	0.12	0.047	0.047	0.167	0.167
8JSA31.R0nnnffgg-0	-	-	-	-	0.047	0.047	0.047	0.047
8JSA31.Exnnnffgg-0	-	-	-	-	0.047	0.047	0.047	0.047
8JSA32.R0nnnffgg-0	-	-	0.05	0.05	0.047	0.047	0.097	0.097
8JSA32.Exnnnffgg-0	-	-	0.1	0.1	0.047	0.047	0.147	0.147
8JSA33.R0nnnffgg-0	-	-	0.1	0.1	0.047	0.047	0.147	0.147
8JSA33.Exnnnffgg-0	-	-	0.2	0.2	0.047	0.047	0.247	0.247
8JSA42.R0nnnffgg-0	-	-	0.12	0.12	0.071	0.071	0.191	0.191
8JSA42.Exnnnffgg-0	0.1	0.1	0.36	0.36	0.171	0.171	0.431	0.431
8JSA43.R0nnnffgg-0	-	-	0.12	0.12	0.071	0.071	0.191	0.191
8JSA43.Exnnnffgg-0	0.2	0.2	0.55	0.55	0.271	0.271	0.621	0.621
8JSA44.R0nnnffgg-0	-	-	0.12	0.12	0.071	0.071	0.191	0.191
8JSA44.Exnnnffgg-0	0.3	0.3	0.76	0.76	0.371	0.371	0.831	0.831
8JSA51.R0nnnffgg-0	-	-	0.15	0.15	0.13	0.13	0.28	0.28
8JSA51.Exnnnffgg-0	0.15	0.15	0.39	0.39	0.28	0.28	0.52	0.52
8JSA52.R0nnnffgg-0	-	-	0.26	0.26	0.13	0.13	0.39	0.39
8JSA52.Exnnnffgg-0	0.34	0.34	0.76	0.76	0.47	0.47	0.89	0.89
8JSA54.R0nnnffgg-0	-	-	0.43	0.43	0.13	0.13	0.56	0.56
8JSA54.Exnnnffgg-0	0.86	0.86	1.55	1.55	0.99	0.99	1.68	1.68
8JSA62.R0nnnffgg-0	-	-	0.5	0.5	0.25	0.25	0.75	0.75
8JSA62.Exnnnffgg-0	0.9	0.9	1.6	1.6	1.15	1.15	1.85	1.85
8JSA63.R0nnnffgg-0	-	-	0.9	0.9	0.25	0.25	1.15	1.15
8JSA63.Exnnnffgg-0	1.2	1.2	2.4	2.4	1.45	1.45	2.65	2.65
8JSA64.R0nnnffgg-0	-	-	1.3	1.3	0.25	0.25	1.55	1.55
8JSA64.Exnnnffgg-0	1.5	1.5	3.1	3.1	1.75	1.75	3.35	3.35
8JSA65.R0nnnffgg-0	-	-	1.7	1.7	0.25	0.25	1.95	1.95
8JSA65.Exnnnffgg-0	1.8	1.8	4	4	2.05	2.05	4.25	4.25
8JSA72.R0nnnffgg-0	-	-	1	1	0.25	0.25	1.25	1.25
8JSA72.Exnnnffgg-0	2	2	3.9	3.9	2.25	2.25	4.15	4.15
8JSA73.R0nnnffgg-0	-	-	1	1	0.25	0.25	1.25	1.25
8JSA73.Exnnnffgg-0	2.7	2.7	5.1	5.1	2.95	2.95	5.35	5.35
8JSA74.R0nnnffgg-0	-	-	1	1	0.25	0.25	1.25	1.25
8JSA74.Exnnnffgg-0	3.4	3.4	6.2	6.2	3.65	3.65	6.45	6.45

10.2 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 ($n = n_N$) when the nominal current is being drawn. 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 RMS value for the phase current (current in the motor supply line) when generating the nominal torque at the 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 the speed n_0 and when the stall current is being applied. 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 when the motor is at a complete standstill.
Stall current	I_0	A	The stall current is the RMS value of the phase current (current in the motor supply line) for generating the stall torque at speed n_0. 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).
Peak torque	M_{max}	Nm	The peak torque is briefly output by the motor when the peak current is being drawn.
Peak current	I_{max}	A	The peak current is the RMS value of the phase current (current in the motor supply line) for generating the peak torque. This is only permitted 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}	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. 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

10.3 Power dissipation

Power from the servo motors is dissipated via the motor flange and the 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
8JSA2	250 x 250 x 6.5	Aluminum
8JSA3	250 x 250 x 6.5	Aluminum
8JSA4	250 x 250 x 6.5	Aluminum
8JSA5	310 x 310 x 13	Aluminum
8JSA6	460 x 460 x 13	Aluminum
8JSA7	460 x 460 x 13	Aluminum

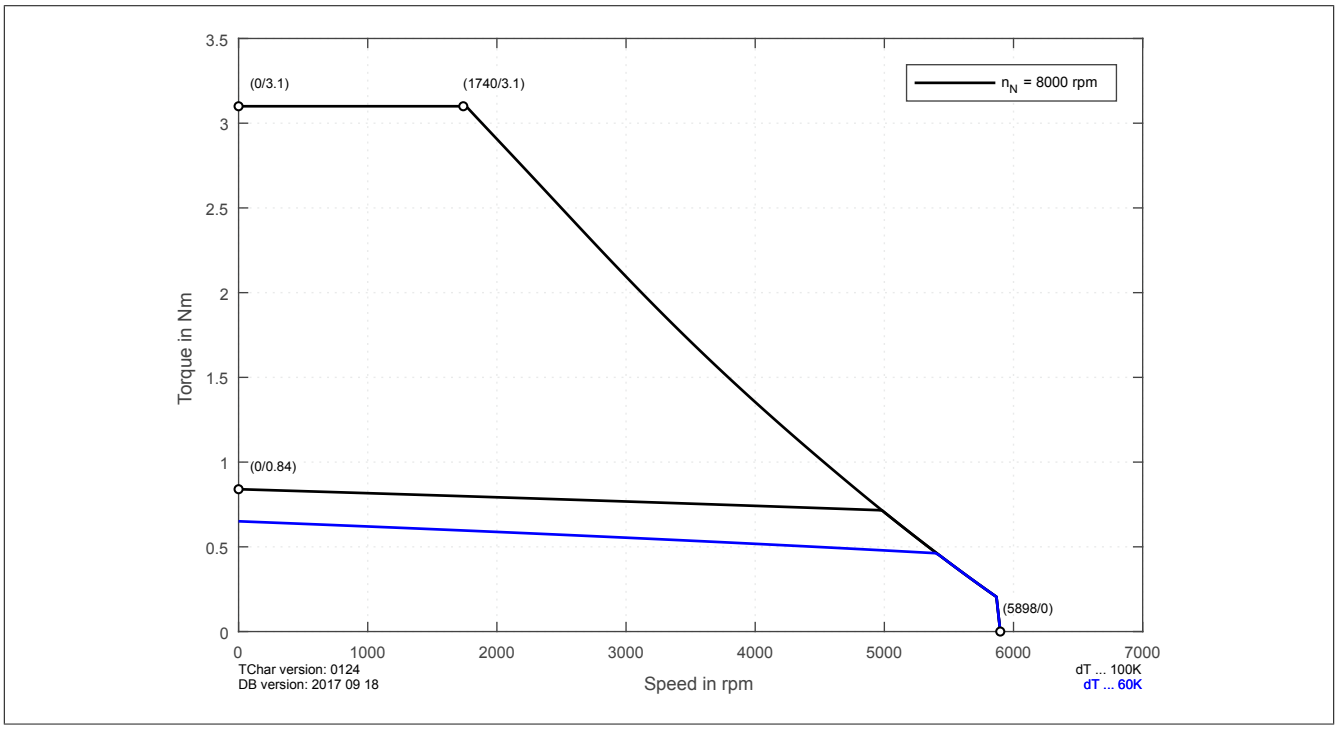
11 8JSA2 - Technical data

Model number	8JSA22.ee080ffgg-0	8JSA24.ee080ffgg-0
Motor		
Nominal speed n_N [rpm]	8000	
Number of pole pairs	3	
Nominal torque M_n [Nm]	0.63	1.06
Nominal power P_N [W]	528	888
Nominal current I_N [A]	1.04	1.67
Stall torque M_0 [Nm]	0.84	1.41
Stall current I_0 [A]	1.39	2.21
Maximum torque M_{max} [Nm]	3.1	5.6
Maximum current I_{max} [A]	7	11.1
Maximum speed n_{max} [rpm]	8100	
Torque constant K_T [Nm/A]	0.61	0.63
Voltage constant K_E [V/1000 rpm]	39	40.8
Stator resistance R_{2ph} [Ω]	19.98	9.02
Stator inductance L_{2ph} [mH]	35.5	18.7
Electrical time constant t_{el} [ms]	1.8	2.1
Thermal time constant t_{therm} [min]	9	11
Moment of inertia J [kgcm²]	0.16	0.27
Weight without brake m [kg]	1.1	1.66
Holding brake		
Holding torque of brake M_{Br} [Nm]	1.42	
Mass of brake [kg]	0.27	
Moment of inertia of brake J_{Br} [kgcm²]	0.011	
Recommendations		
ACOPOS 8Vxxxx.xx...	1016	1045
ACOPOSmulti 8BVIxxxx...	0014	0028
ACOPOS P3 8EIxxxx...	2X2X	4X5X
Cross section for B&R motor cables [mm²]	0.75	
Connector size	1.0	

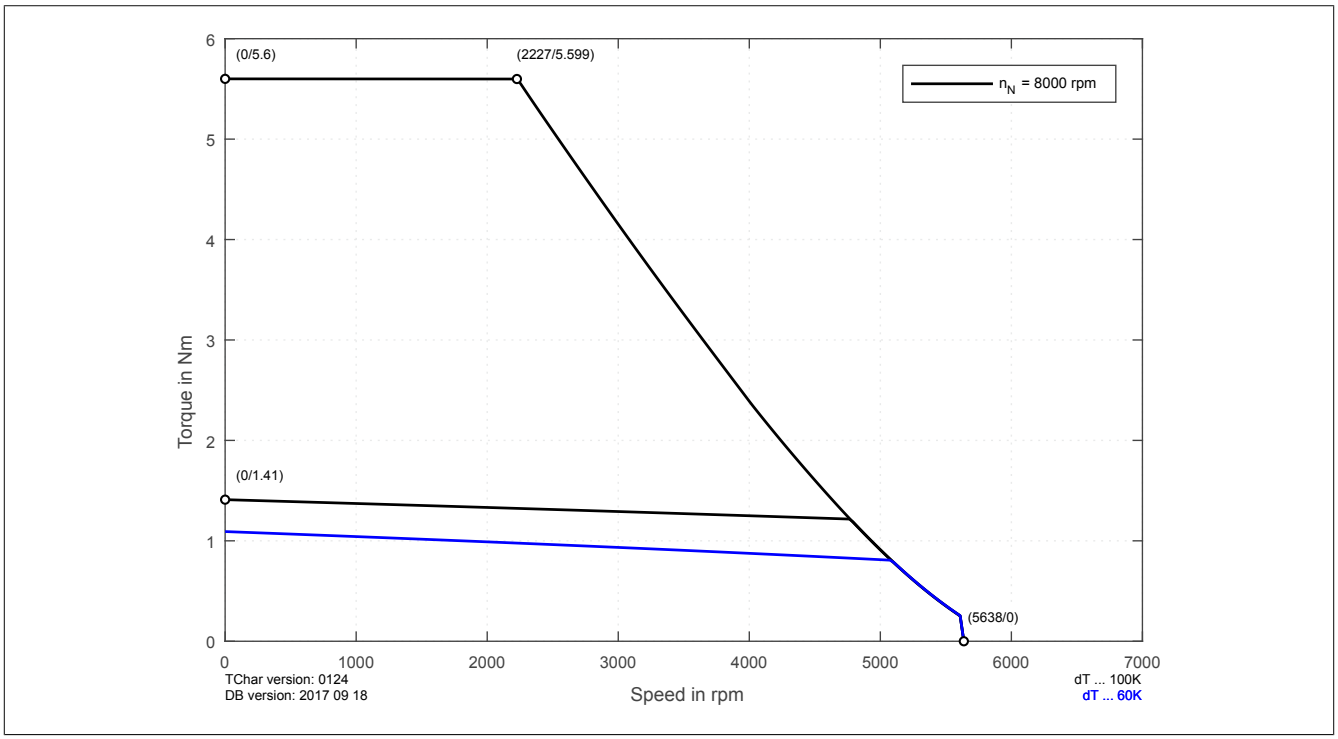
Table 2: 8JSA22.ee080ffgg-0, 8JSA24.ee080ffgg-0 - Technical data

11.1 Speed-torque characteristic curves at 325 VDC DC bus voltage

8JSA22.eennnffgg-0

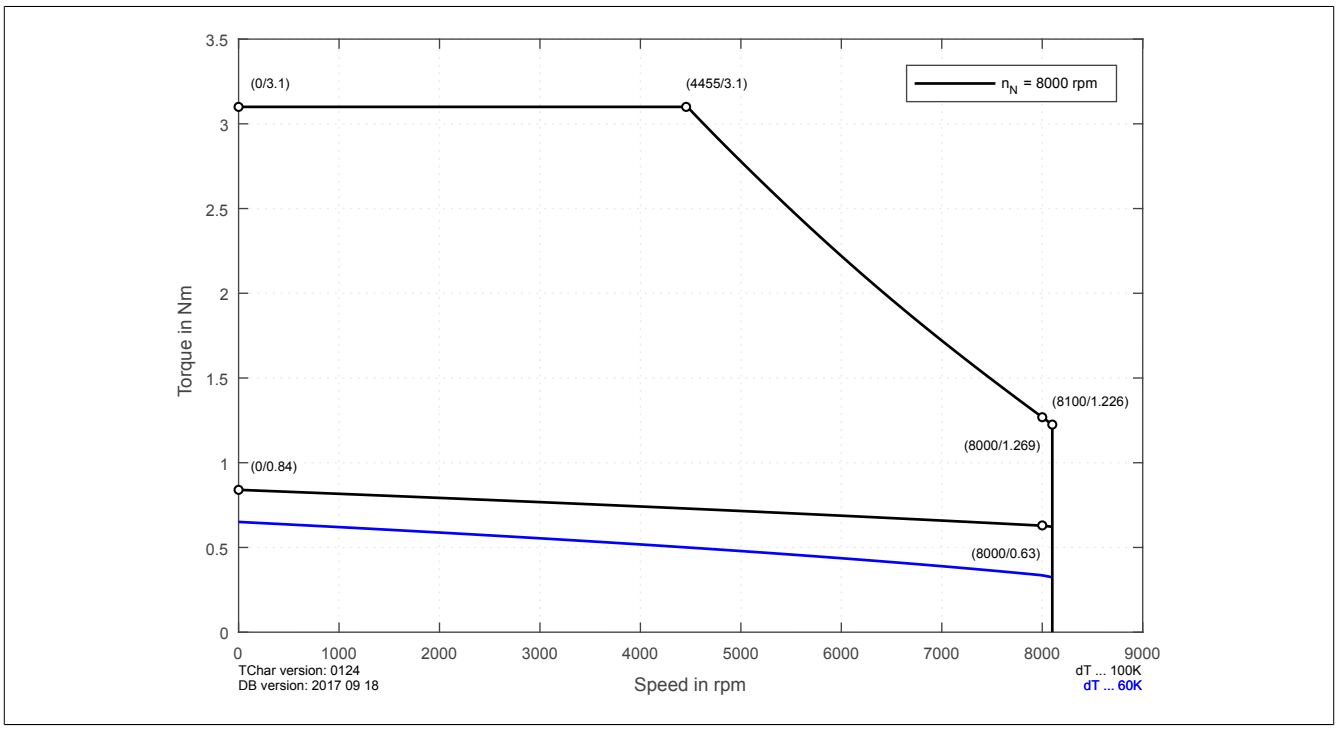


8JSA24.eennnffgg-0

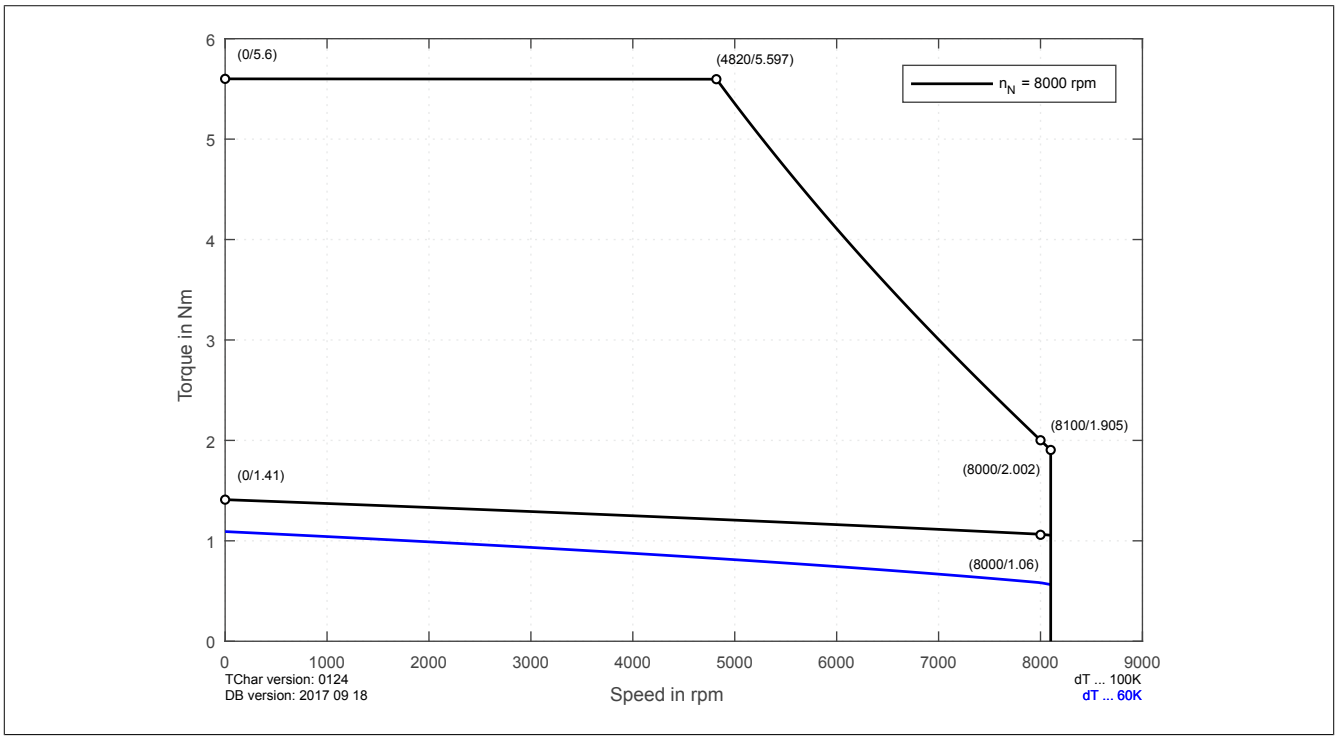


11.2 Speed-torque characteristic curves at 560 VDC DC bus voltage

8JSA22.eennnffgg-0

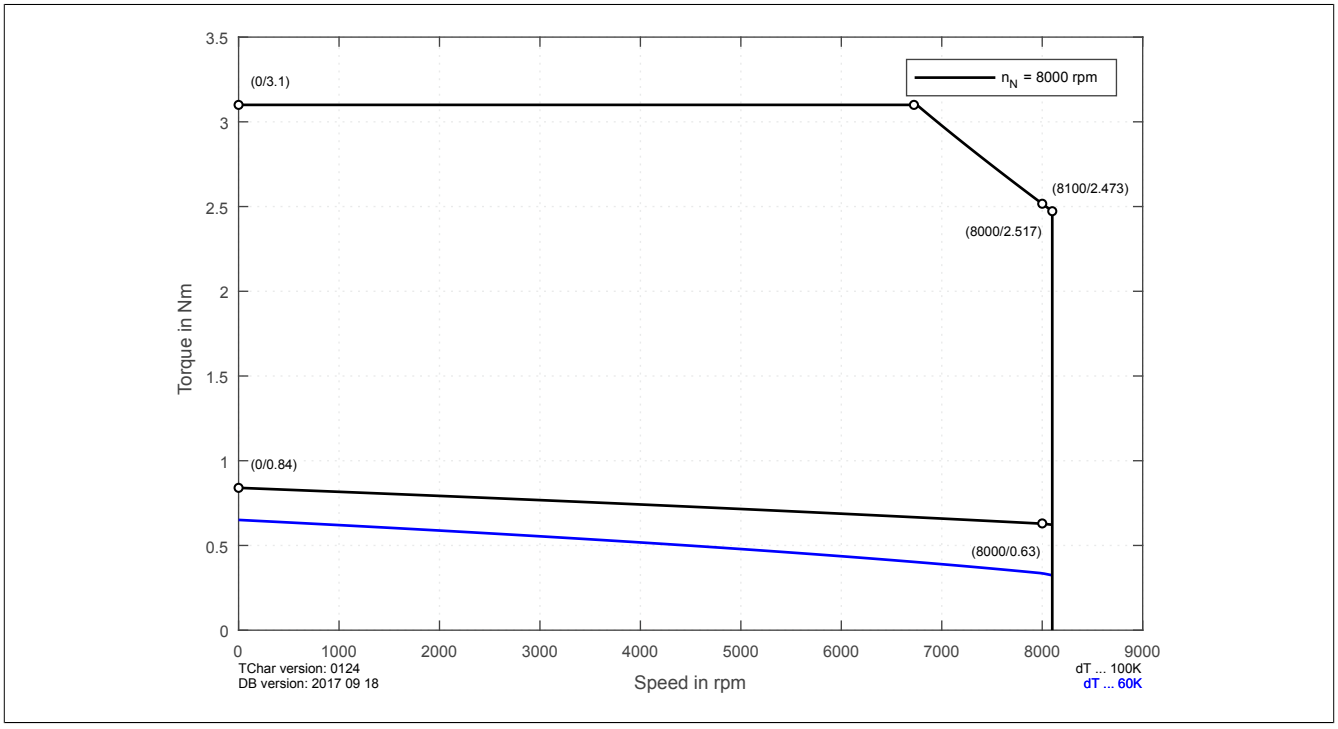


8JSA24.eennnffgg-0

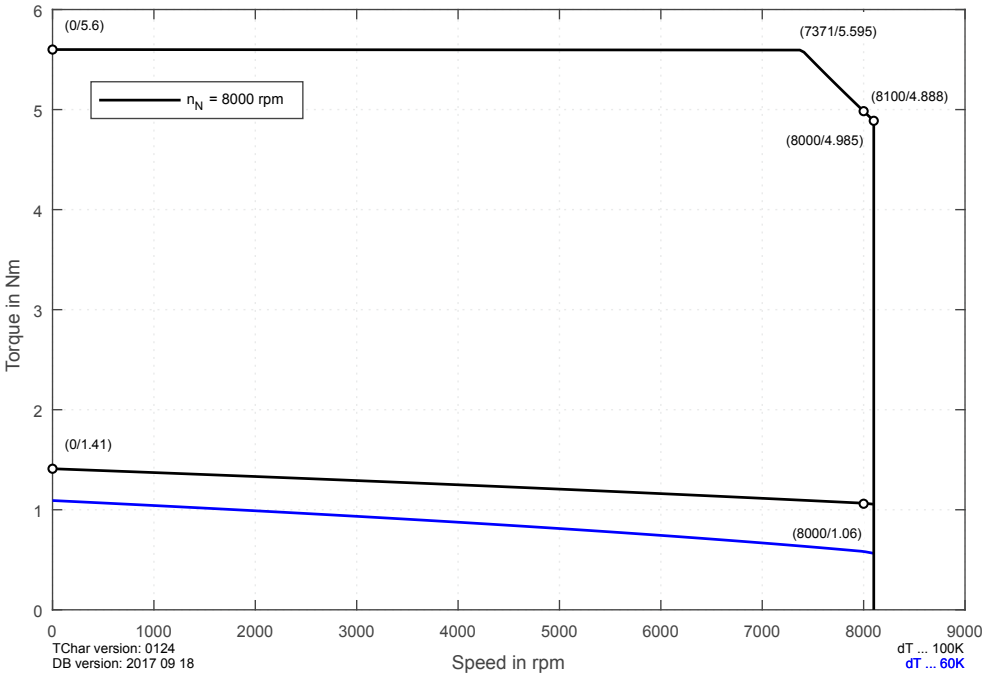


11.3 Speed-torque characteristic curves at 750 VDC DC bus voltage

8JSA22.eennnffgg-0

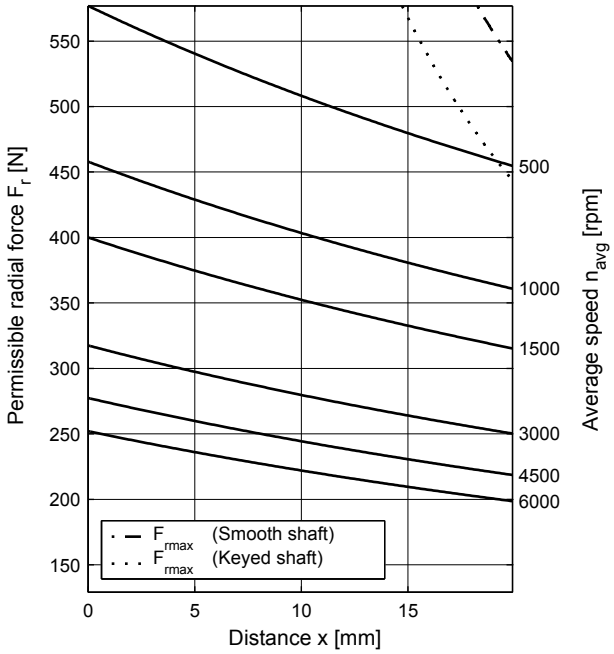


8JSA24.eennnffgg-0



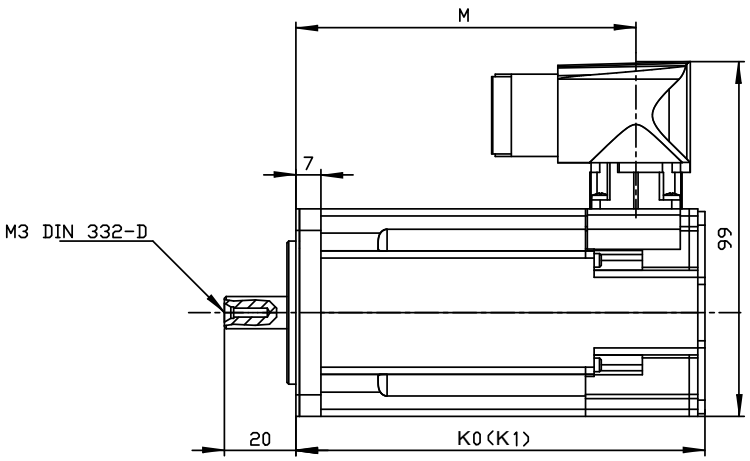
11.4 Maximum shaft load

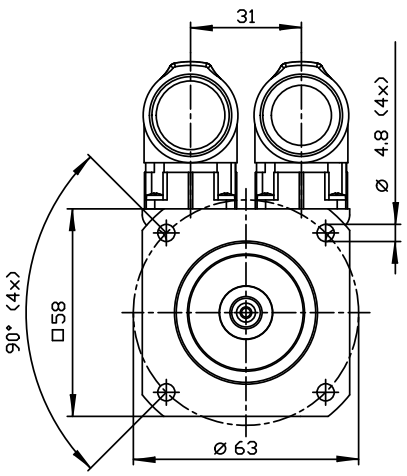
Note the information in section "Load capacity of the shaft end and bearing" on page 70 of chapter "Installation conditions".

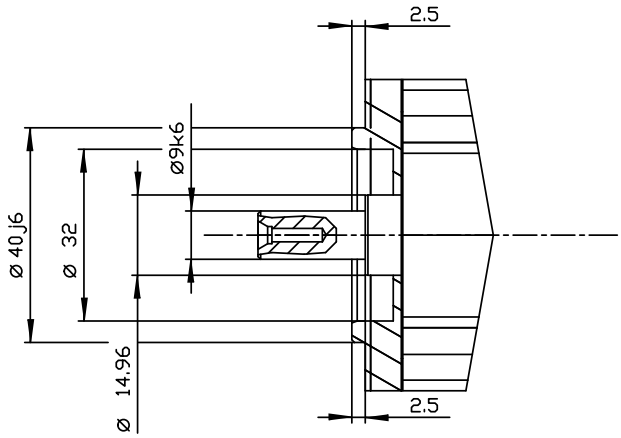


Maximum axial force: F_{amax} = 53 N

11.5 8JSA2 - Dimensions







EnDat/Resolver feedback				Extension of K_0 and K_1 depending on the motor option [mm]
Encoder assignments	**R0**	**E4, E5, E8, E9**		
Model number	**K_0**	**K_1**	**M**	**Holding brake**
8JSA21.eennnffgg-0	95.4	95.4	76.1	34.1
8JSA22.eennnffgg-0	114.4	114.4	95.1	34.1
8JSA23.eennnffgg-0	133.4	133.4	114.1	34.1
8JSA24.eennnffgg-0	152.4	152.4	133.1	34.1

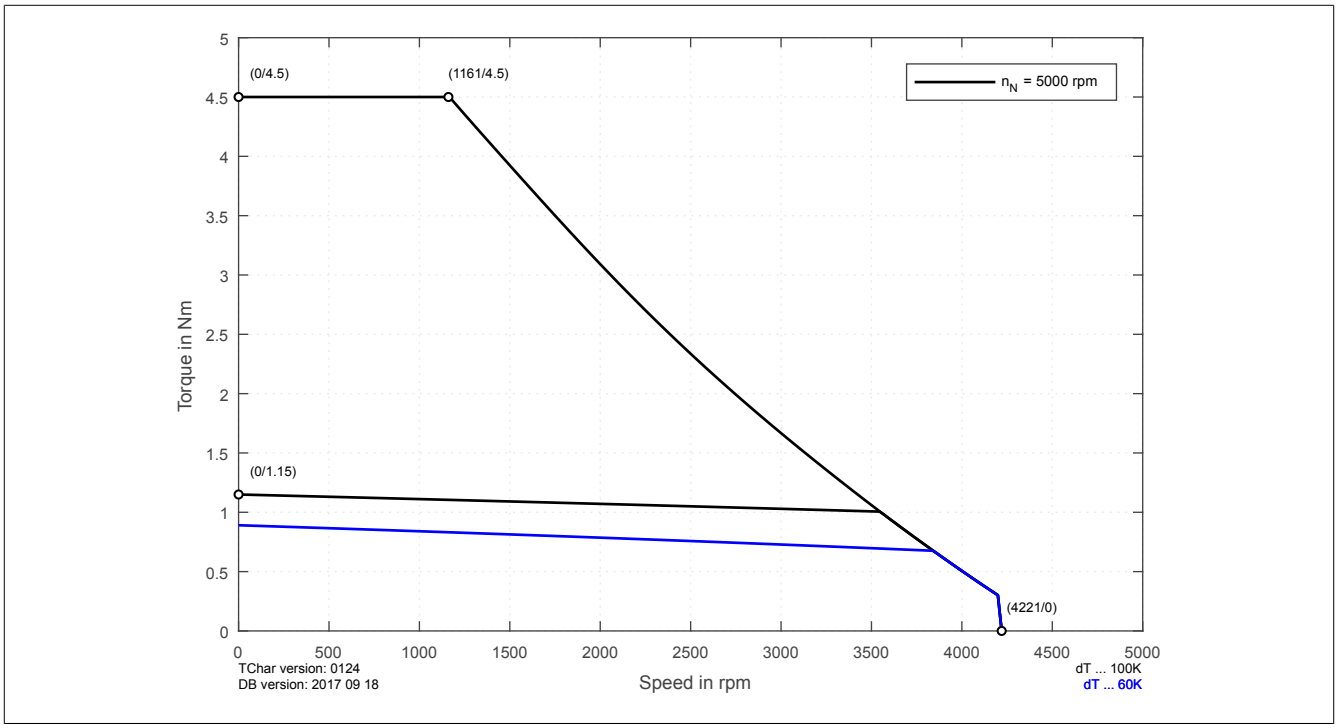
12 8JSA3 - Technical data

Model number	8JSA31.ee050ffgg-0	8JSA32.ee030ffgg-0	8JSA32.ee055ffgg-0	8JSA33.ee045ffgg-0
Motor				
Nominal speed n_N [rpm]	5000	3000	5500	4500
Number of pole pairs	4			
Nominal torque M_n [Nm]	0.95	1.81	1.6	2.29
Nominal power P_N [W]	497	569	922	1079
Nominal current I_N [A]	1.12	1.3	1.74	2.09
Stall torque M_0 [Nm]	1.15	2	2.04	2.79
Stall current I_0 [A]	1.37	1.44	2.23	2.58
Maximum torque M_{max} [Nm]	4.5	8.2	8.3	11.8
Maximum current I_{max} [A]	6.9	7.2	11.2	12.9
Maximum speed n_{max} [rpm]	8100			
Torque constant K_T [Nm/A]	0.85	1.4	0.92	1.1
Voltage constant K_E [V/1000 rpm]	54.5	89.8	59	70.6
Stator resistance R_{2ph} [Ω]	21.4	23.76	10.3	9.01
Stator inductance L_{2ph} [mH]	37.5	46.5	20.1	18.5
Electrical time constant t_{el} [ms]	1.8	2		2.1
Thermal time constant t_{therm} [min]	14	17		20
Moment of inertia J [kgcm²]	0.33	0.59		0.85
Weight without brake m [kg]	1.55	2.23		2.9
Holding brake				
Holding torque of brake M_{Br} [Nm]	2.5			
Mass of brake [kg]	0.27			
Moment of inertia of brake J_{Br} [kgcm²]	0.011			
Recommendations				
ACOPOS 8Vxxxx.xx...	1016		1045	
ACOPOSmulti 8BVIxxxx...	0014		0028	
ACOPOS P3 8EIxxxx...	2X2X		4X5X	
Cross section for B&R motor cables [mm²]	0.75			
Connector size	1.0			

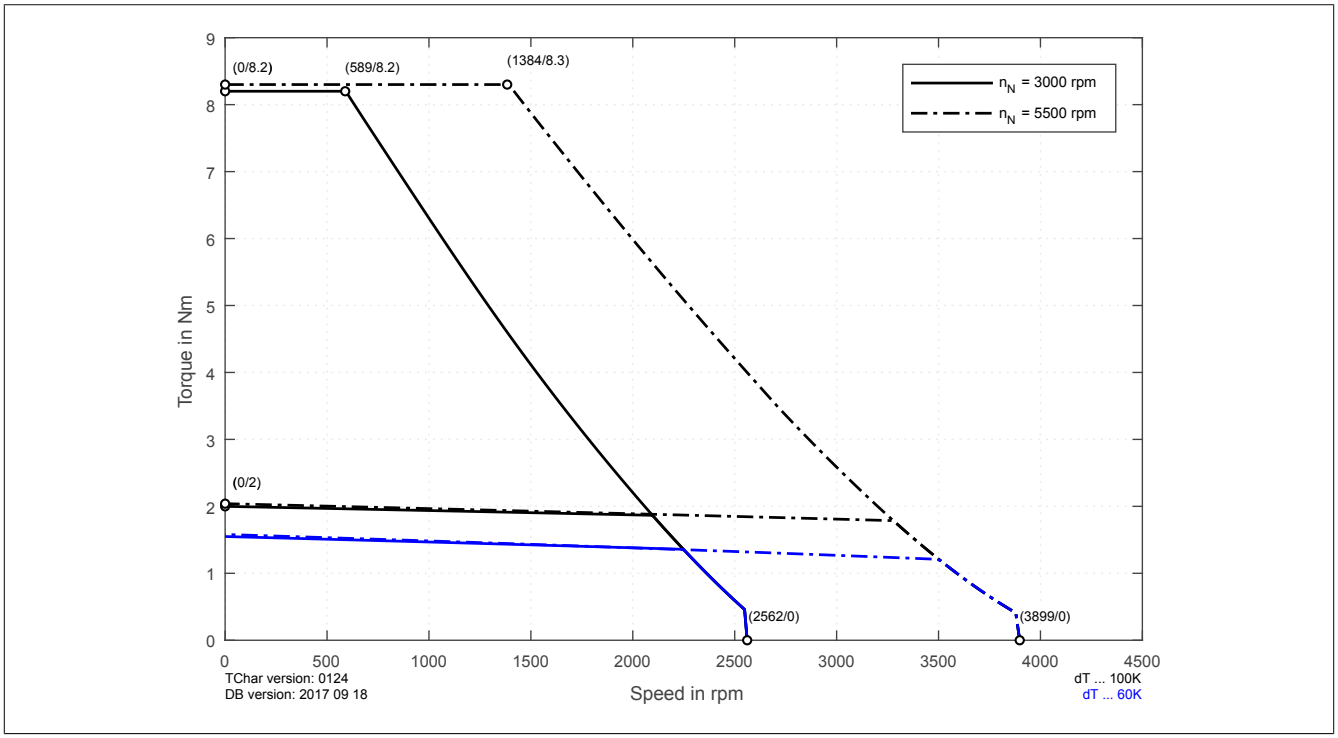
Table 3: 8JSA31.ee050ffgg-0, 8JSA32.ee030ffgg-0, 8JSA32.ee055ffgg-0, 8JSA33.ee045ffgg-0 - Technical data

12.1 Speed-torque characteristic curves at 325 VDC DC bus voltage

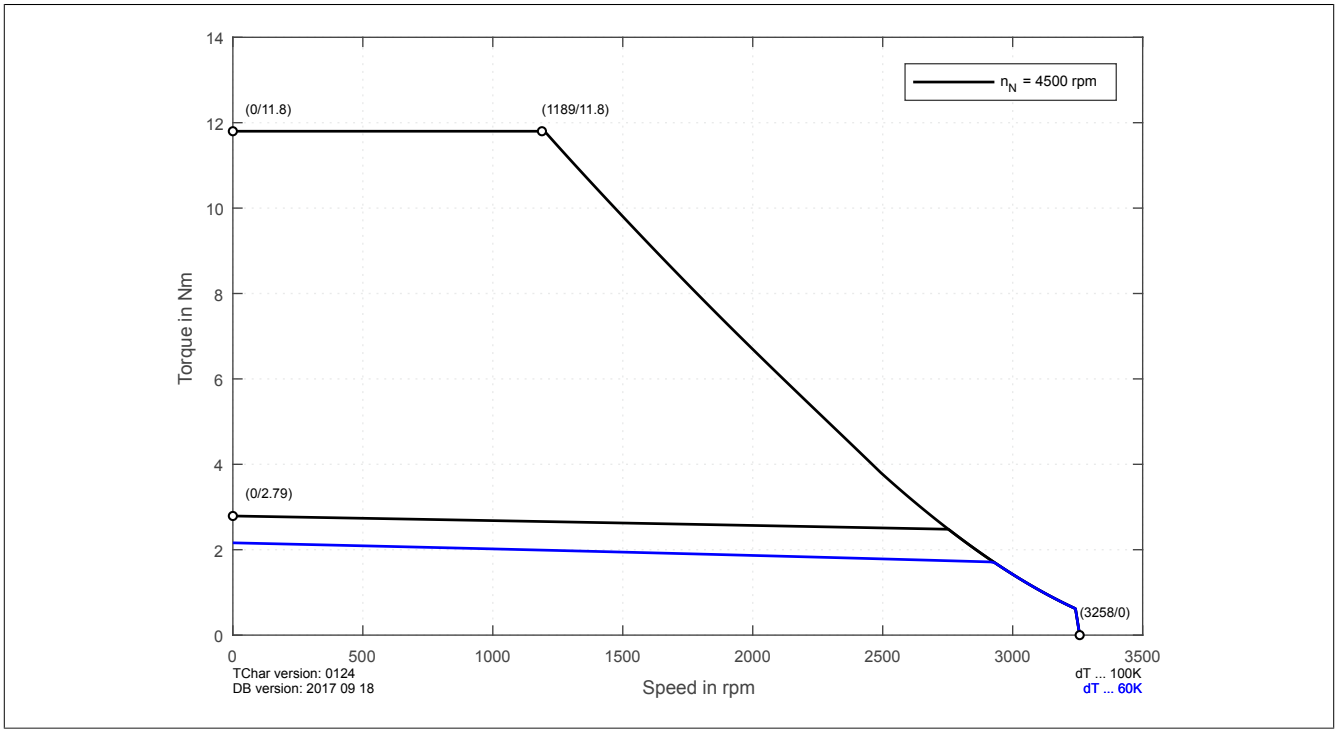
8JSA31.eennnffgg-0



8JSA32.eennnffgg-0

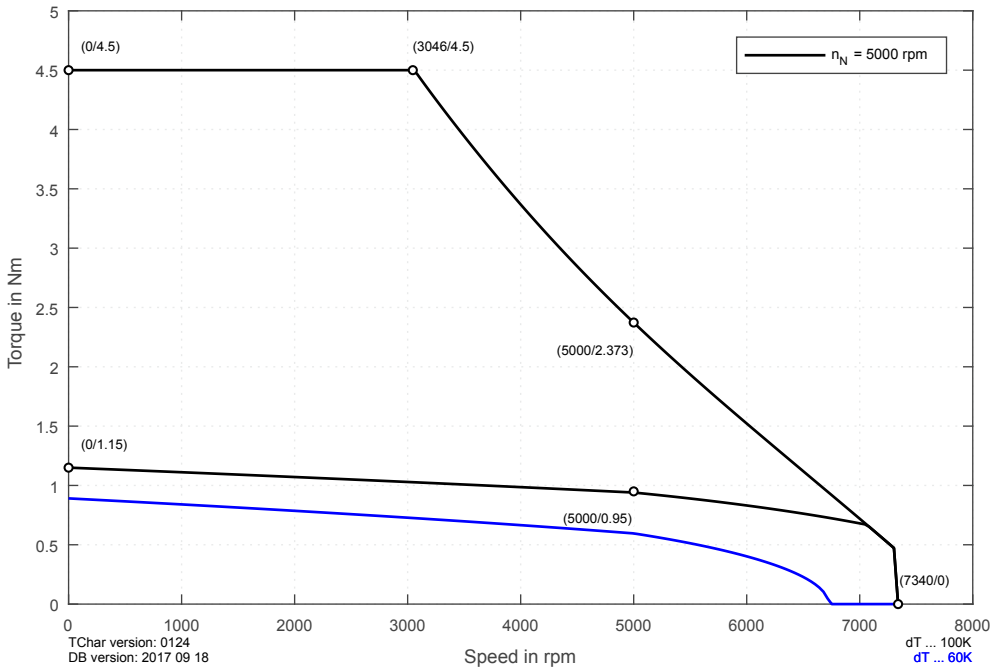


8JSA33.eennnffgg-0

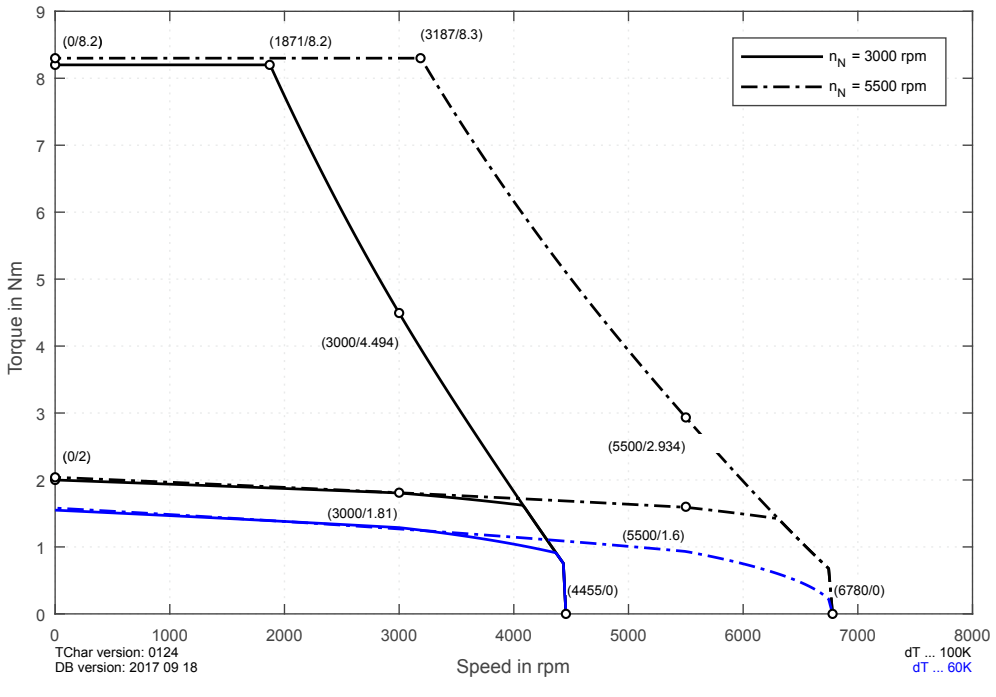


12.2 Speed-torque characteristic curves at 560 VDC DC bus voltage

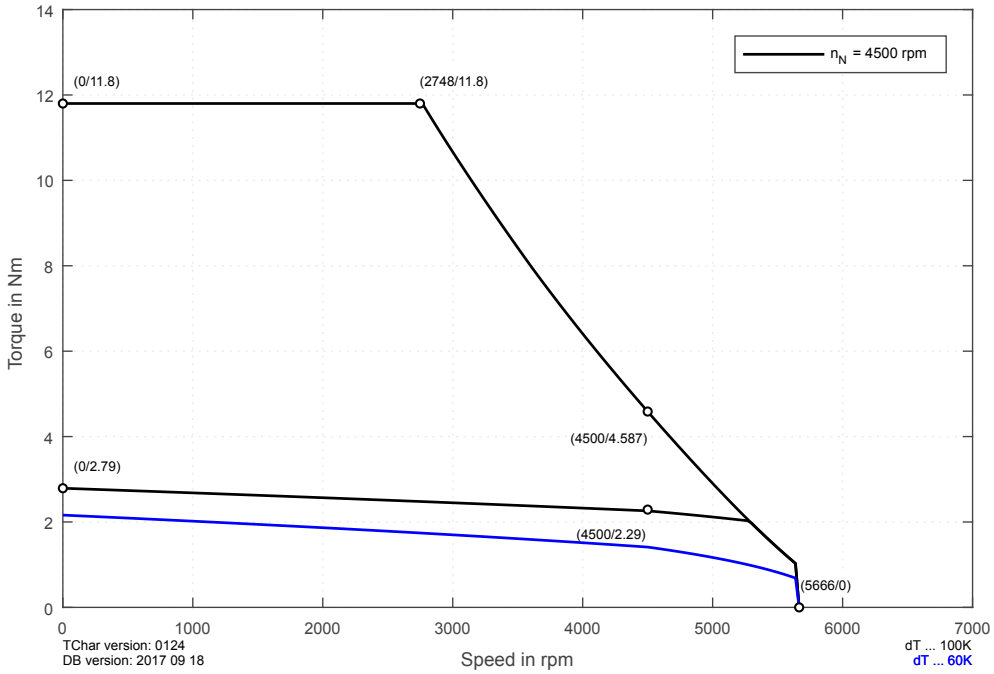
8JSA31.eennnffgg-0



8JSA32.eennnffgg-0

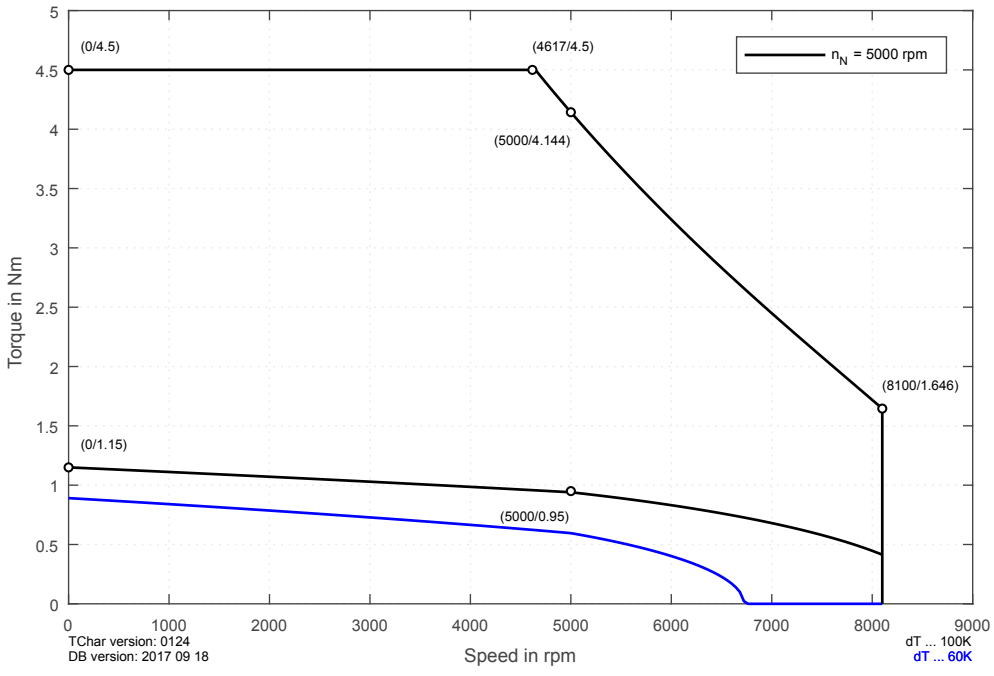


8JSA33.eennnffgg-0

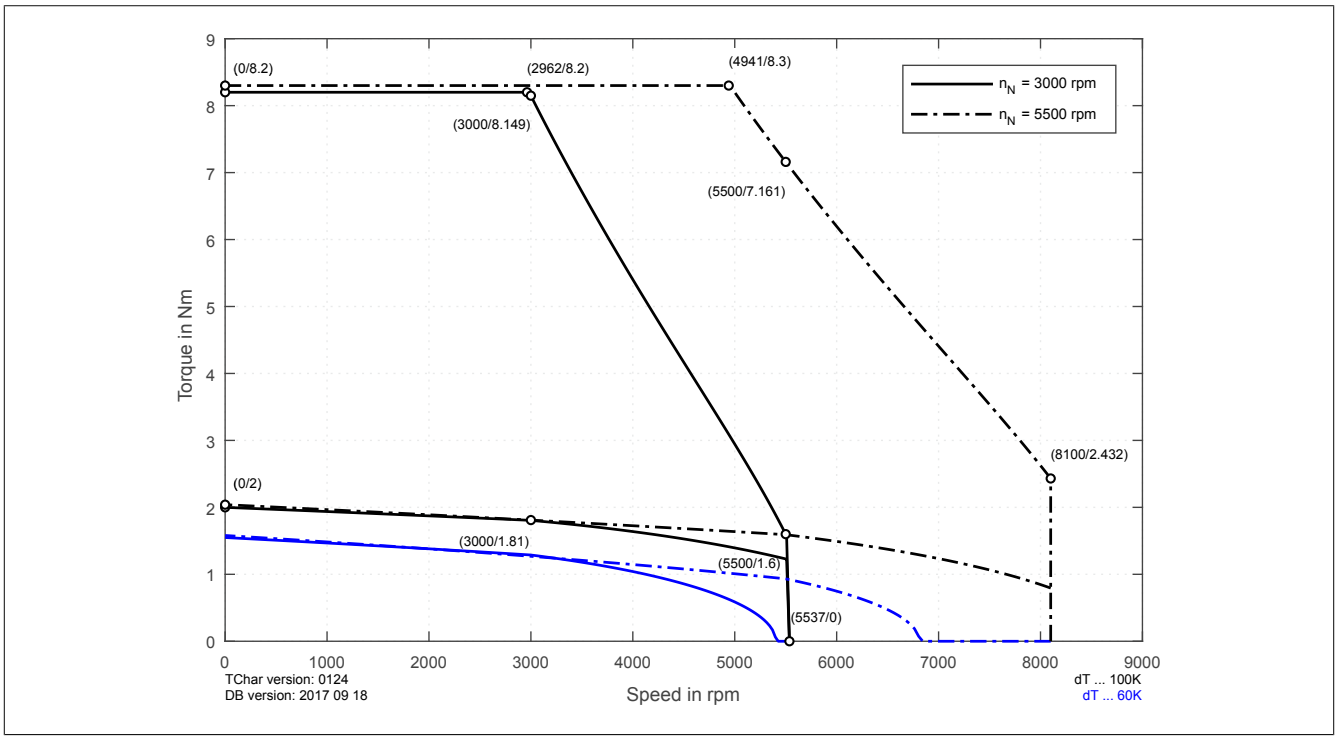


12.3 Speed-torque characteristic curves at 750 VDC DC bus voltage

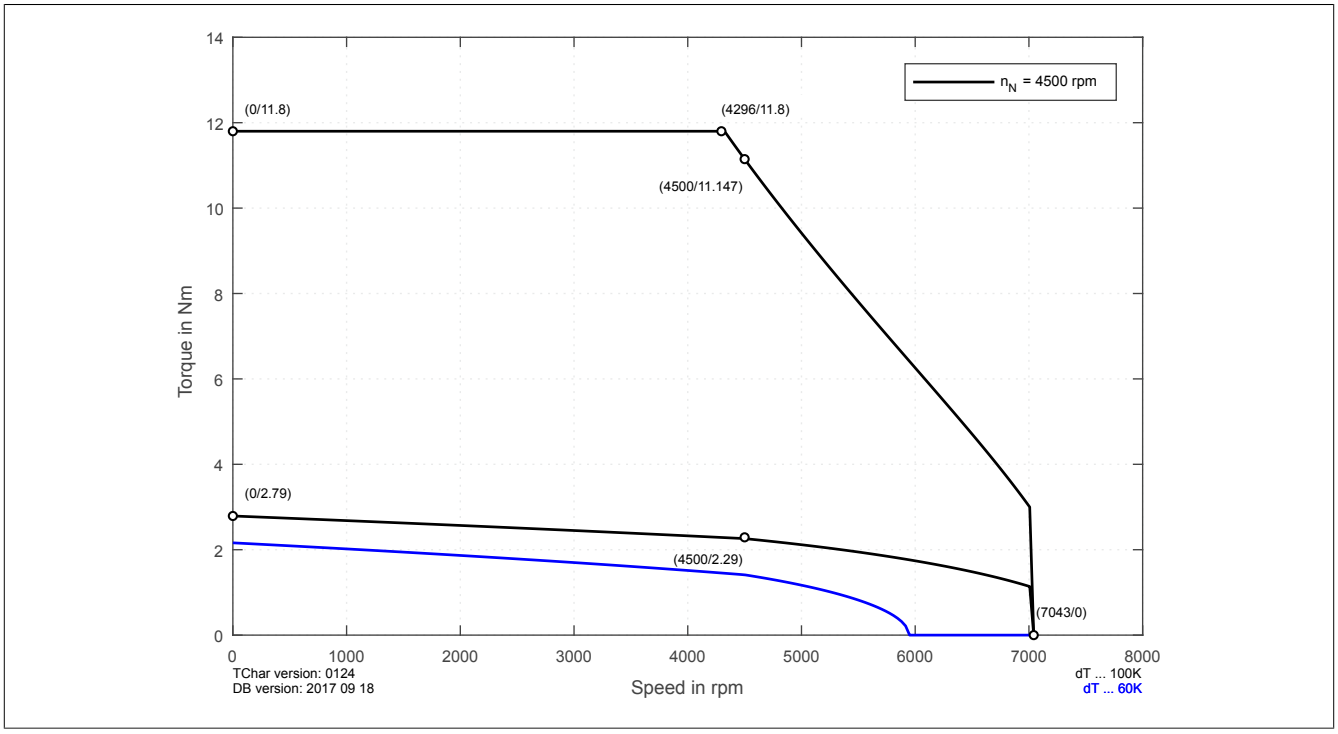
8JSA31.eennnffgg-0



8JSA32.eennnffgg-0

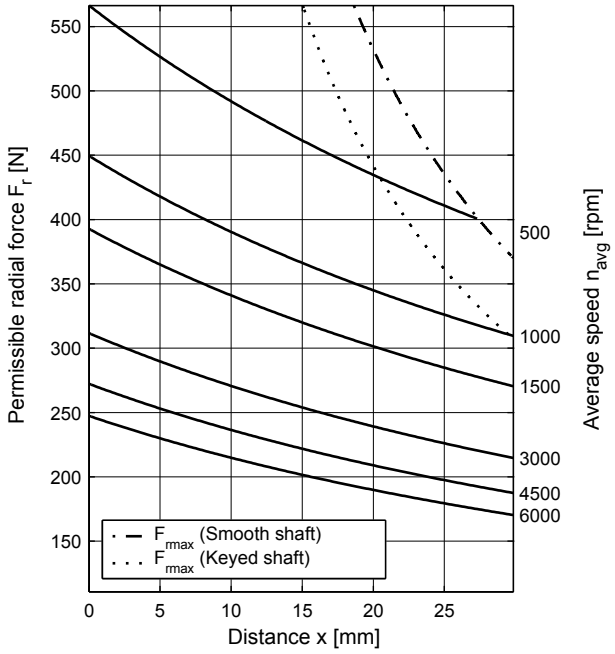


8JSA33.eennnffgg-0



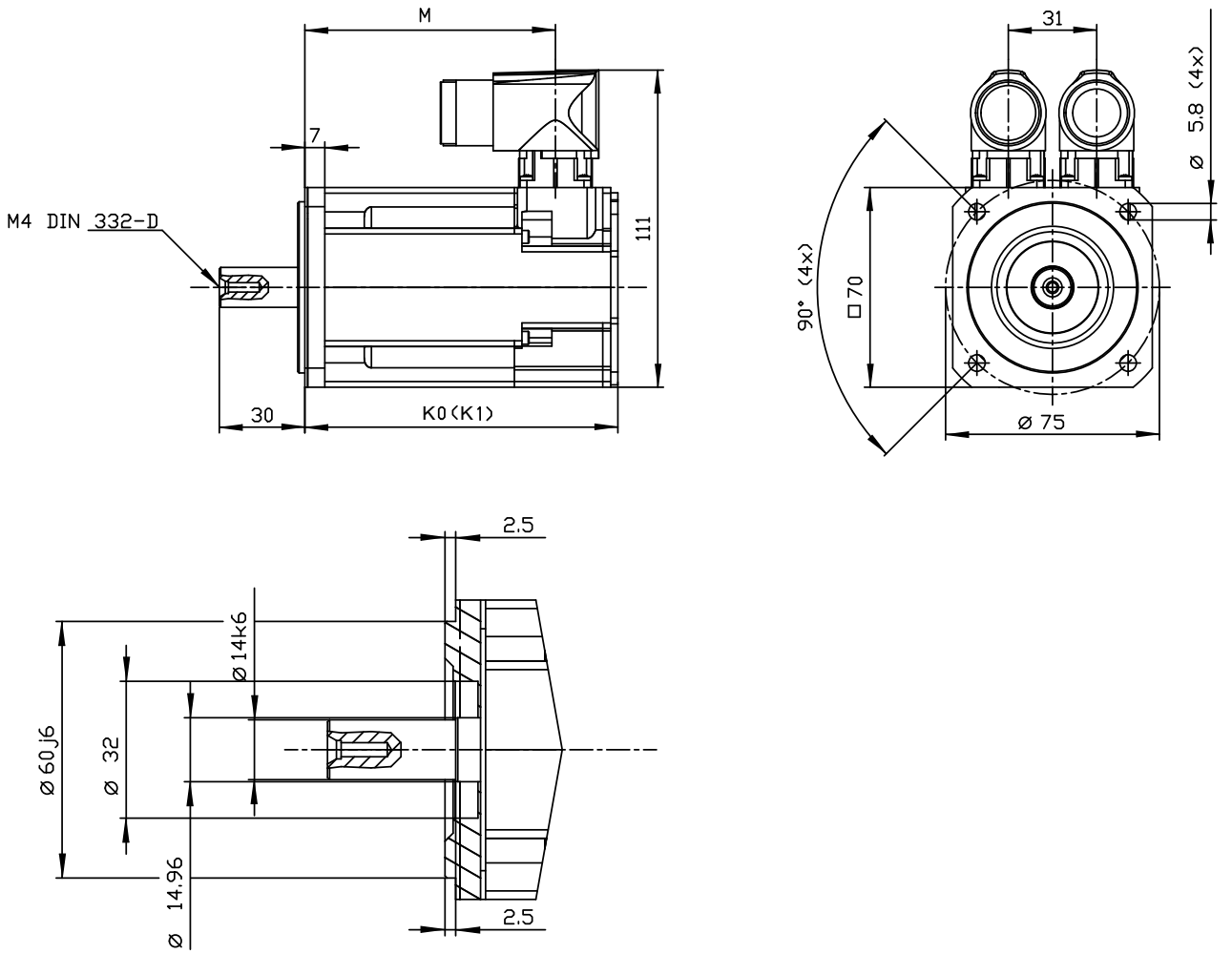
12.4 Maximum shaft load

Note the information in section "Load capacity of the shaft end and bearing" on page 70 of chapter "Installation conditions".



Maximum axial force: F_{amax} = 48 N

12.5 8JSA3 - Dimensions



EnDat/Resolver feedback				Extension of K_0 and K_1 depending on the motor option [mm]
Encoder assignments	**R0**	**E4, E5, E8, E9**		
Model number	**K_0**	**K_1**	**M**	**Holding brake**
8JSA31.eennnffgg-0	110	110	88	31.5
8JSA32.eennnffgg-0	141	141	119	31.5
8JSA33.eennnffgg-0	172	172	150	31.5

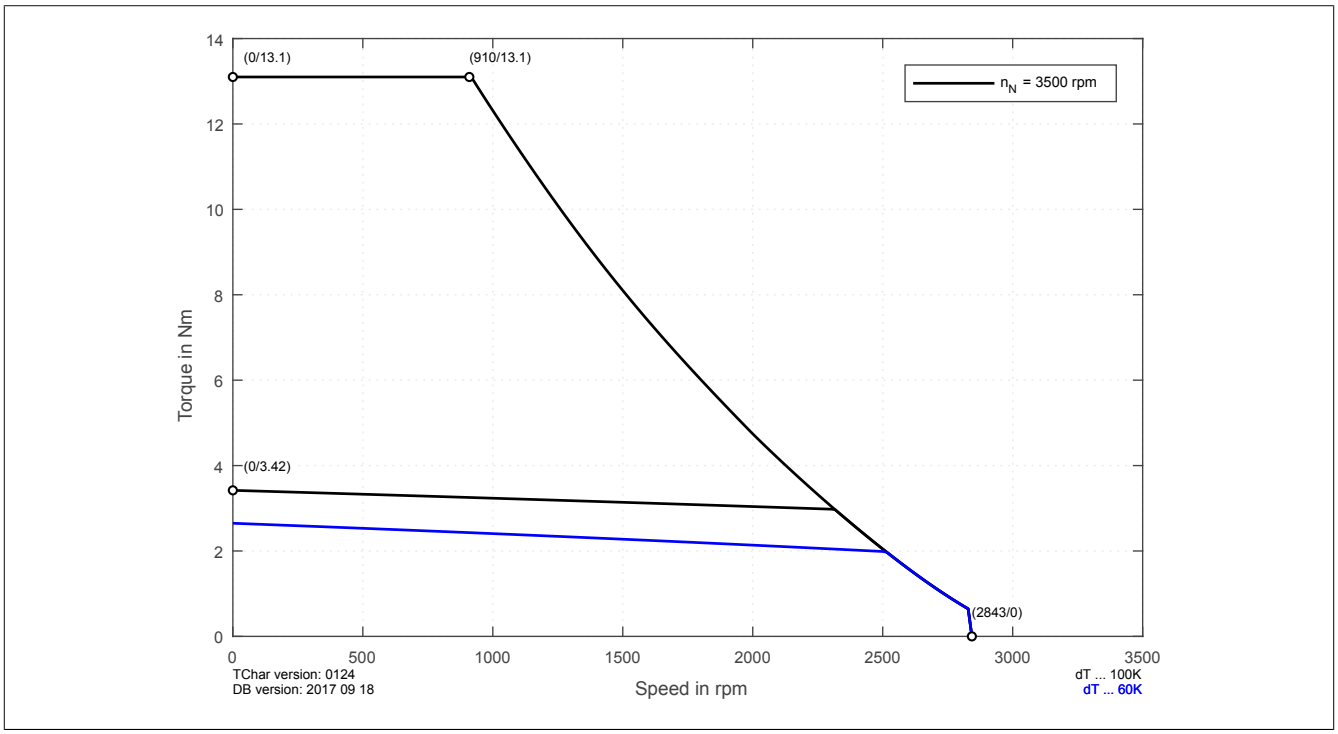
13 8JSA4 - Technical data

Model number	8JSA42.ee035ffgg-0	8JSA43.ee050ffgg-0	8JSA44.ee040ffgg-0
Motor			
Nominal speed n_N [rpm]	3500	5000	4000
Number of pole pairs		5	
Nominal torque M_n [Nm]	2.74	2.94	3.69
Nominal power P_N [W]	1004	1539	1546
Nominal current I_N [A]	2.18	2.96	3.1
Stall torque M_0 [Nm]	3.42	4.8	5.88
Stall current I_0 [A]	2.74	4.87	5
Maximum torque M_{max} [Nm]	13.1	18.8	23.8
Maximum current I_{max} [A]	13.7	24.3	25
Maximum speed n_{max} [rpm]		6100	
Torque constant K_T [Nm/A]	1.26	0.99	1.19
Voltage constant K_E [V/1000 rpm]	80.9	63.9	76.6
Stator resistance R_{2ph} [Ω]	7.78	2.81	2.8
Stator inductance L_{2ph} [mH]	26.8	10.8	11.5
Electrical time constant t_{el} [ms]	3.4	3.8	4.1
Thermal time constant t_{therm} [min]	17	20	24
Moment of inertia J [kgcm²]	1.5	2.1	2.7
Weight without brake m [kg]	3.39	4.35	5.3
Holding brake			
Holding torque of brake M_{Br} [Nm]		5.3	
Mass of brake [kg]		0.63	
Moment of inertia of brake J_{Br} [kgcm²]		0.068	
Recommendations			
ACOPOS 8Vxxxx.xx...	1045	1090	
ACOPOSmulti 8BVIxxxx...	0028	0055	
ACOPOS P3 8EIxxxx...	4X5X	8X8X	
Cross section for B&R motor cables [mm²]		0.75	
Connector size		1.0	

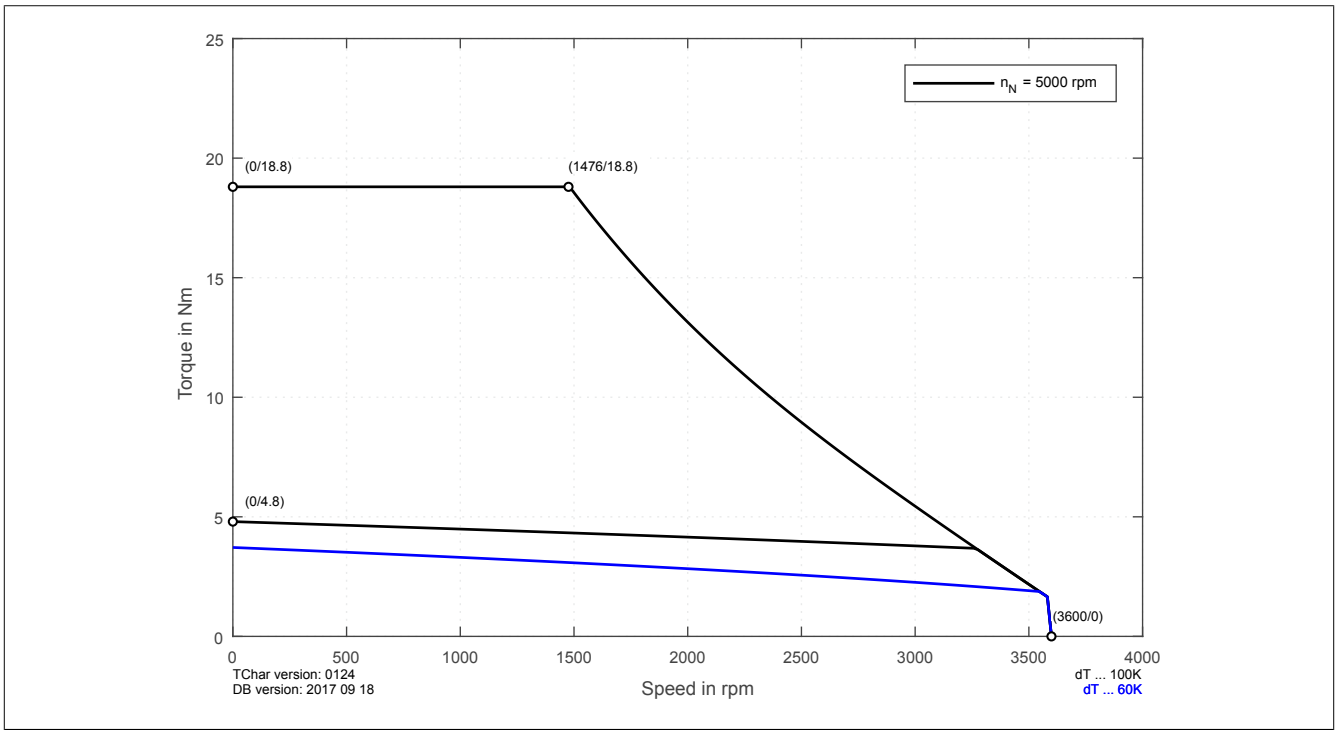
Table 4: 8JSA42.ee035ffgg-0, 8JSA43.ee050ffgg-0, 8JSA44.ee040ffgg-0 - Technical data

13.1 Speed-torque characteristic curves at 325 VDC DC bus voltage

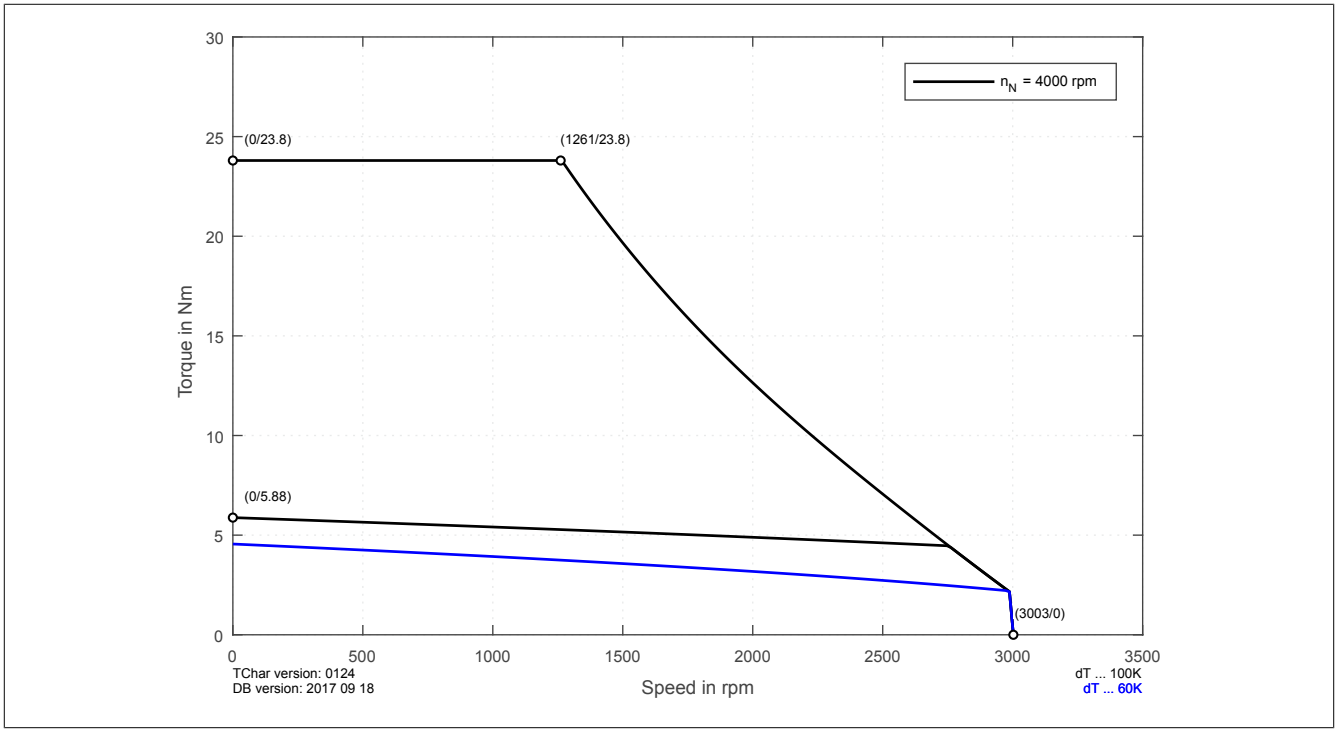
8JSA42.eennnffgg-0



8JSA43.eennnffgg-0

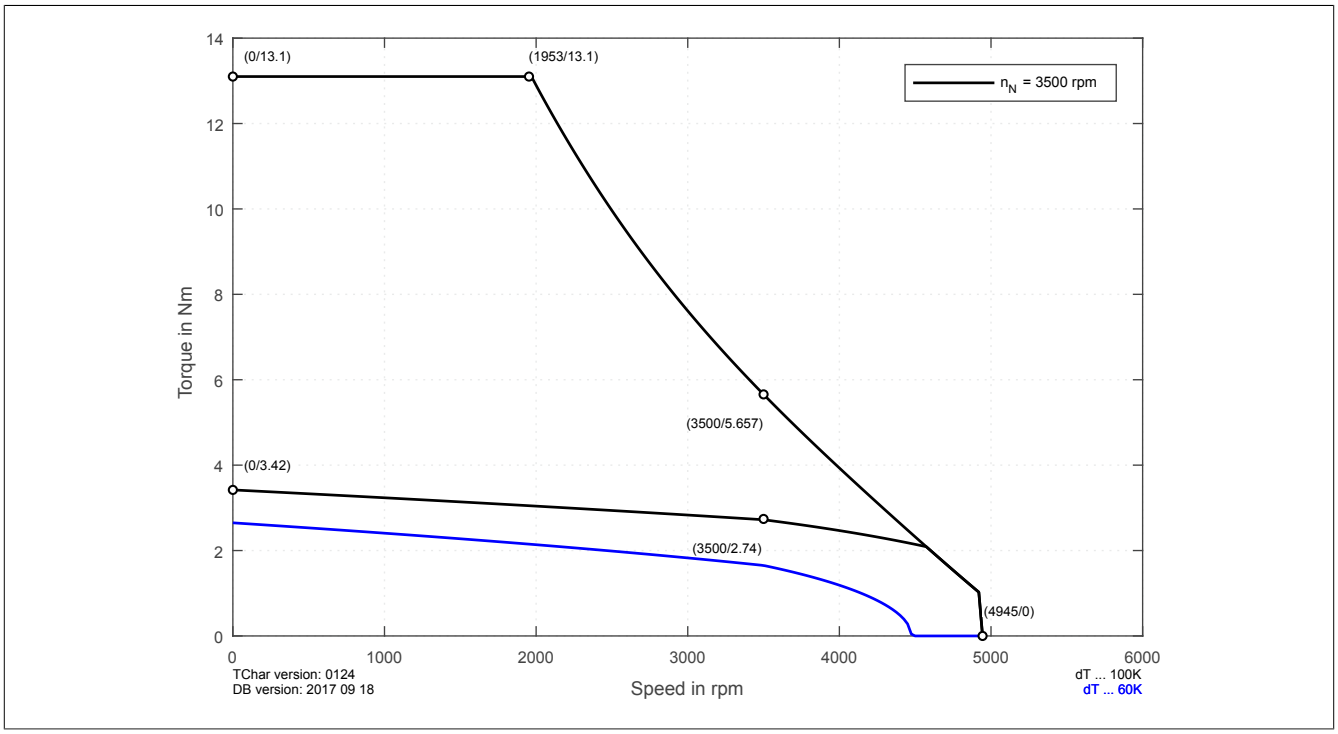


8JSA44.eennnffgg-0

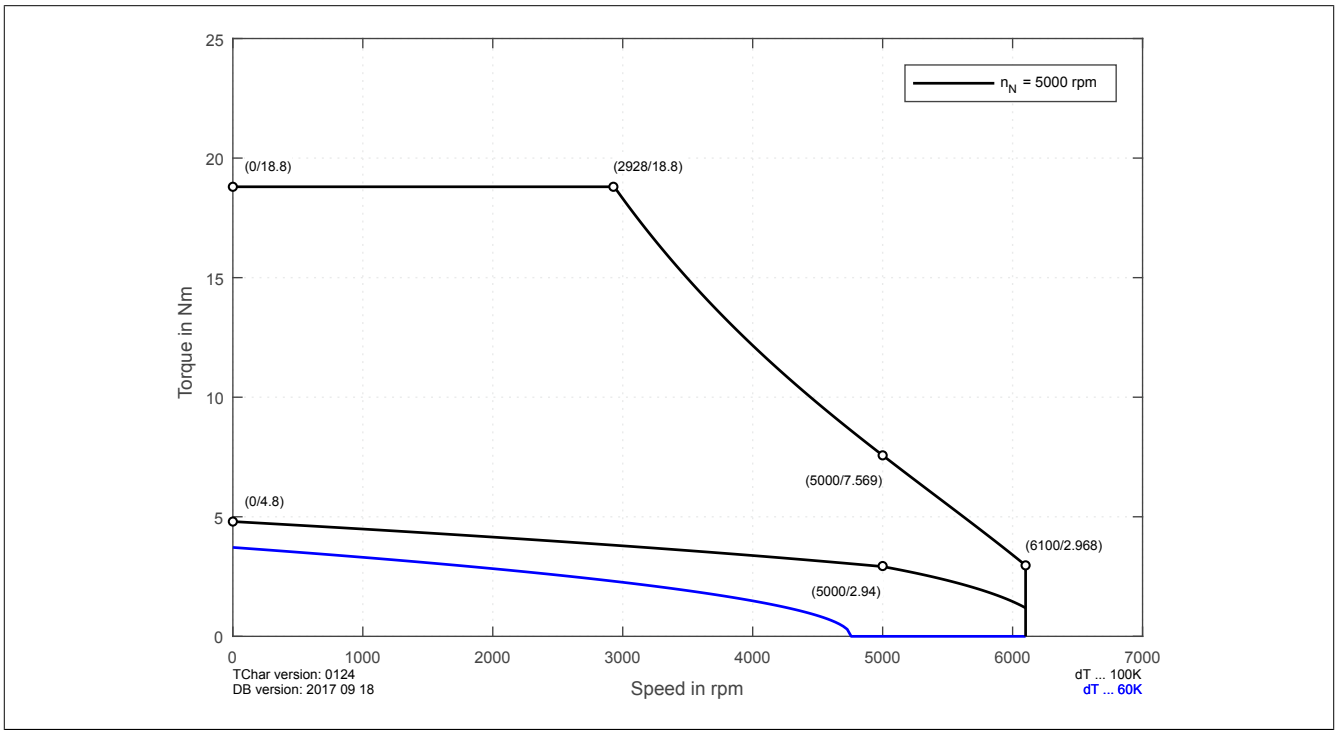


13.2 Speed-torque characteristic curves at 560 VDC DC bus voltage

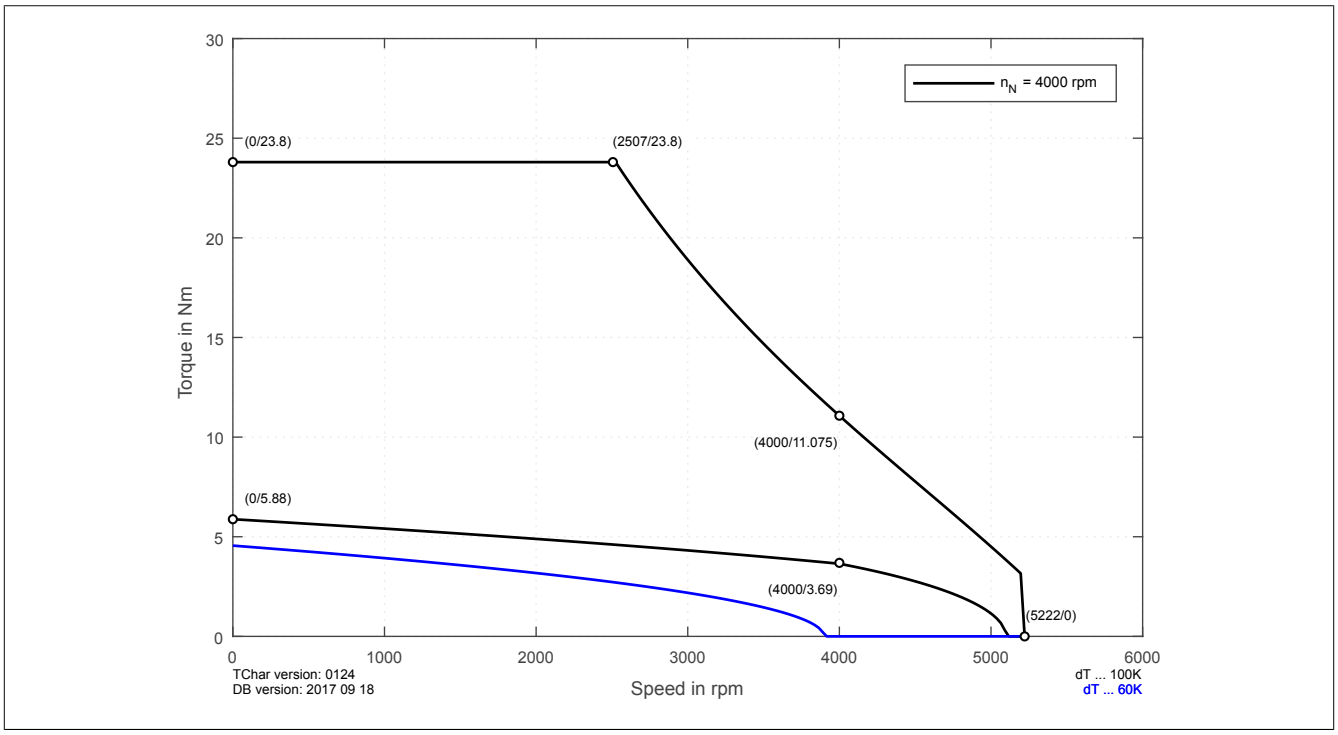
8JSA42.eennnffgg-0



8JSA43.eennnffgg-0

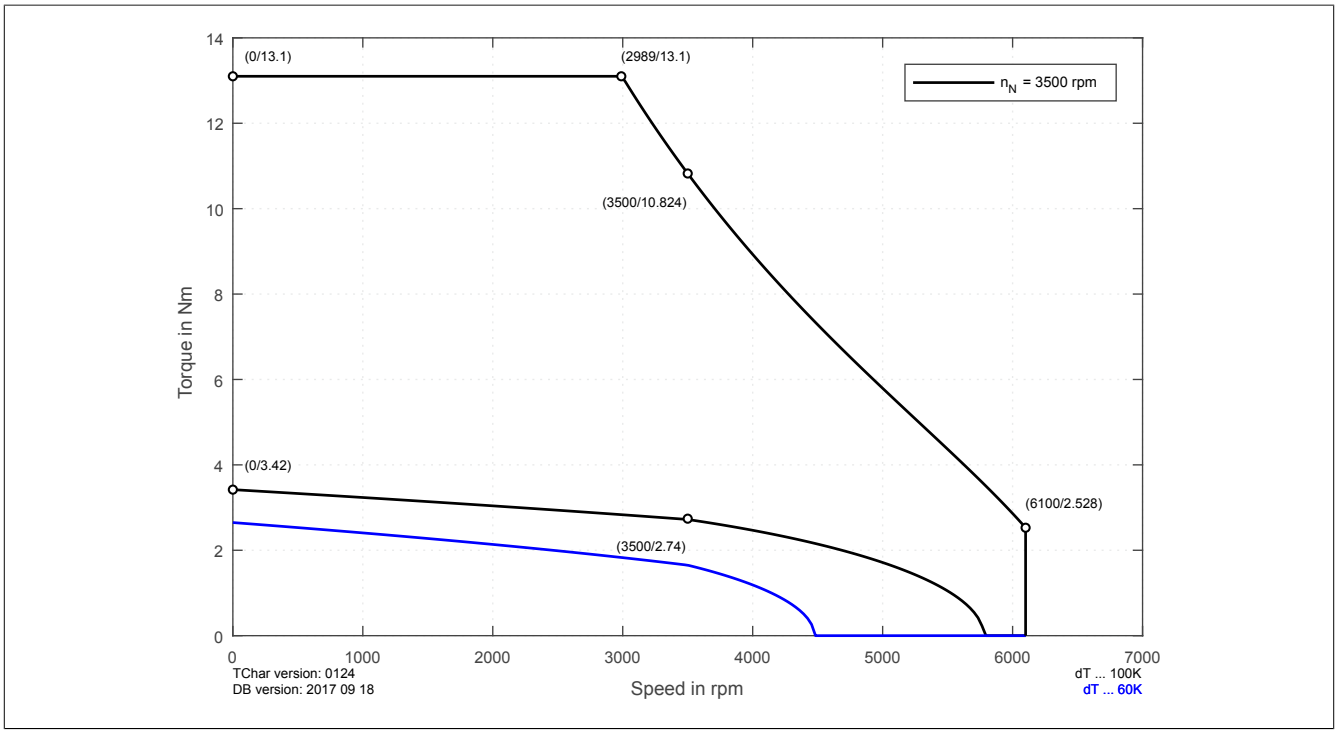


8JSA44.eennnffgg-0

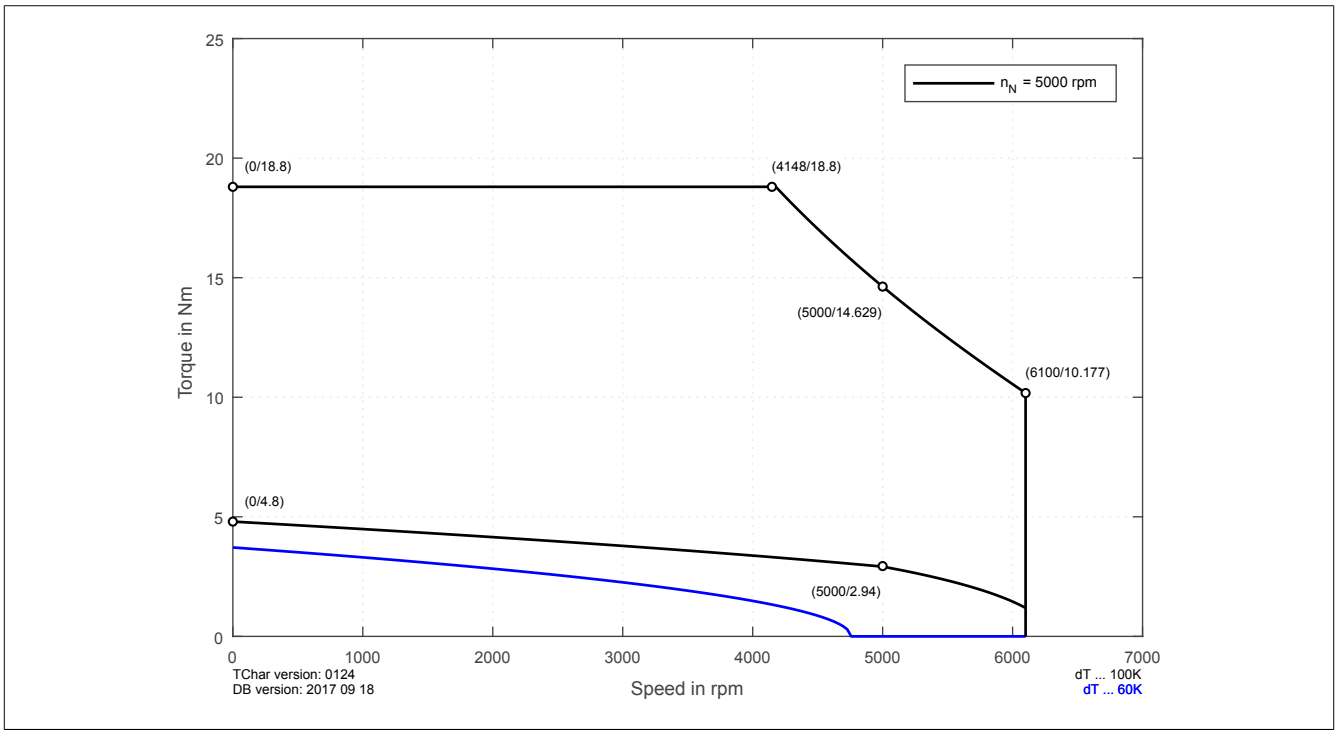


13.3 Speed-torque characteristic curves at 750 VDC DC bus voltage

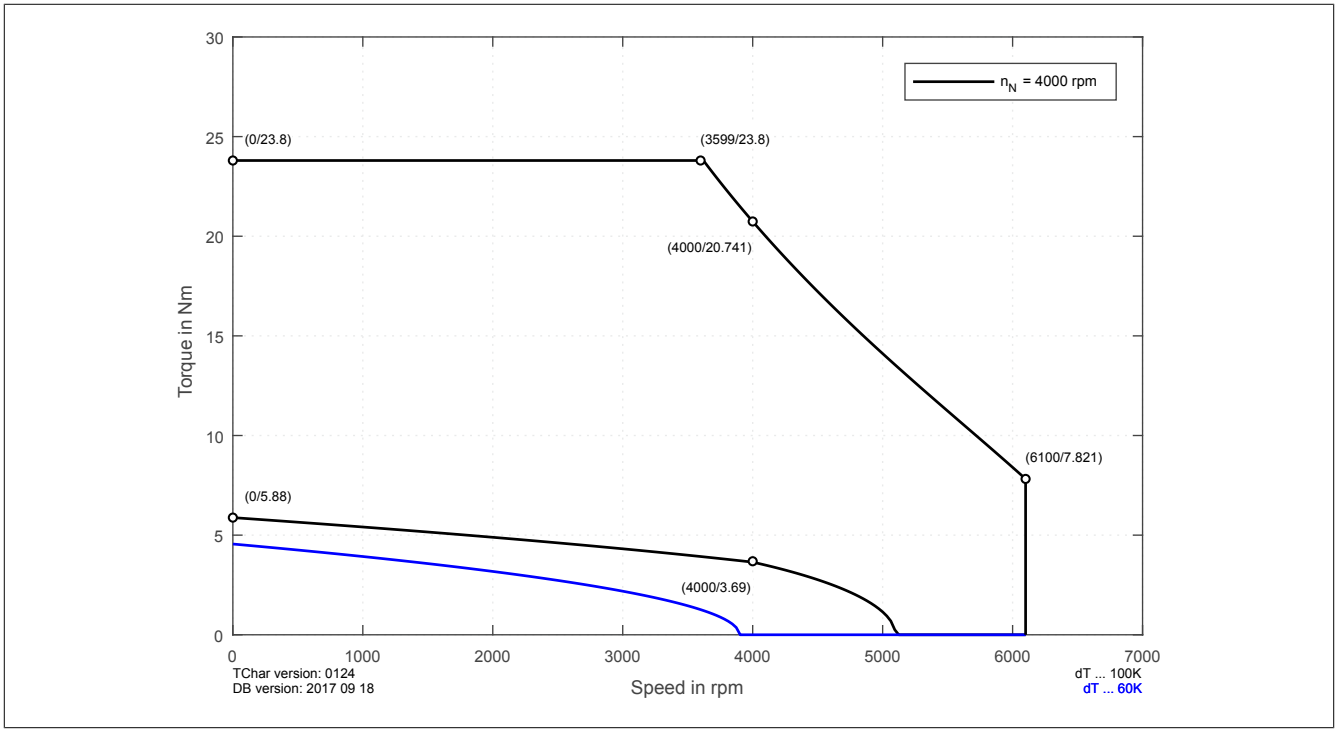
8JSA42.eennnffgg-0



8JSA43.eennnffgg-0

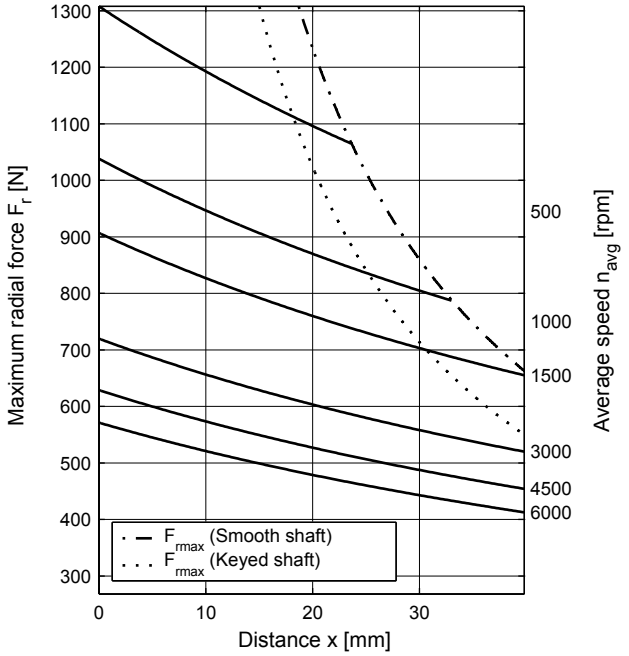


8JSA44.eennnffgg-0



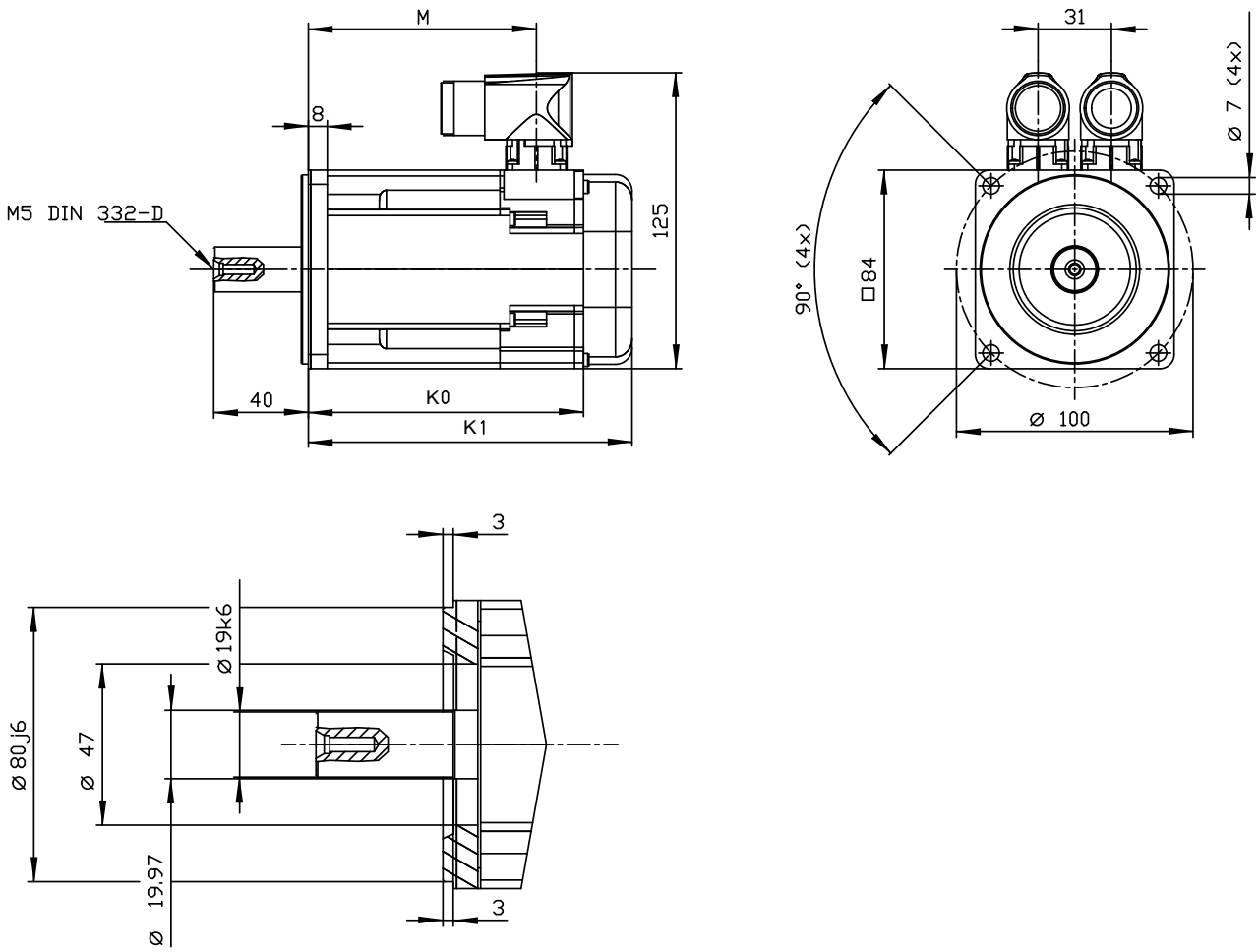
13.4 Maximum shaft load

Note the information in section "Load capacity of the shaft end and bearing" on page 70 of chapter "Installation conditions".



Maximum axial force: F_{amax} = 115 N

13.5 8JSA4 - Dimensions



EnDat/Resolver feedback				Extension of K_0 and K_1 depending on the motor option [mm]
Encoder assignments	**R0**	**E6, E7, EA, EB**		
Model number	**K_0**	**K_1**	**M**	**Holding brake**
8JSA41.eennnffgg-0	118.8	136.8	96.4	33.5
8JSA42.eennnffgg-0	147.8	165.8	125.4	33.5
8JSA43.eennnffgg-0	176.8	194.8	1154.4	33.5
8JSA44.eennnffgg-0	205.8	223.8	183.4	33.5

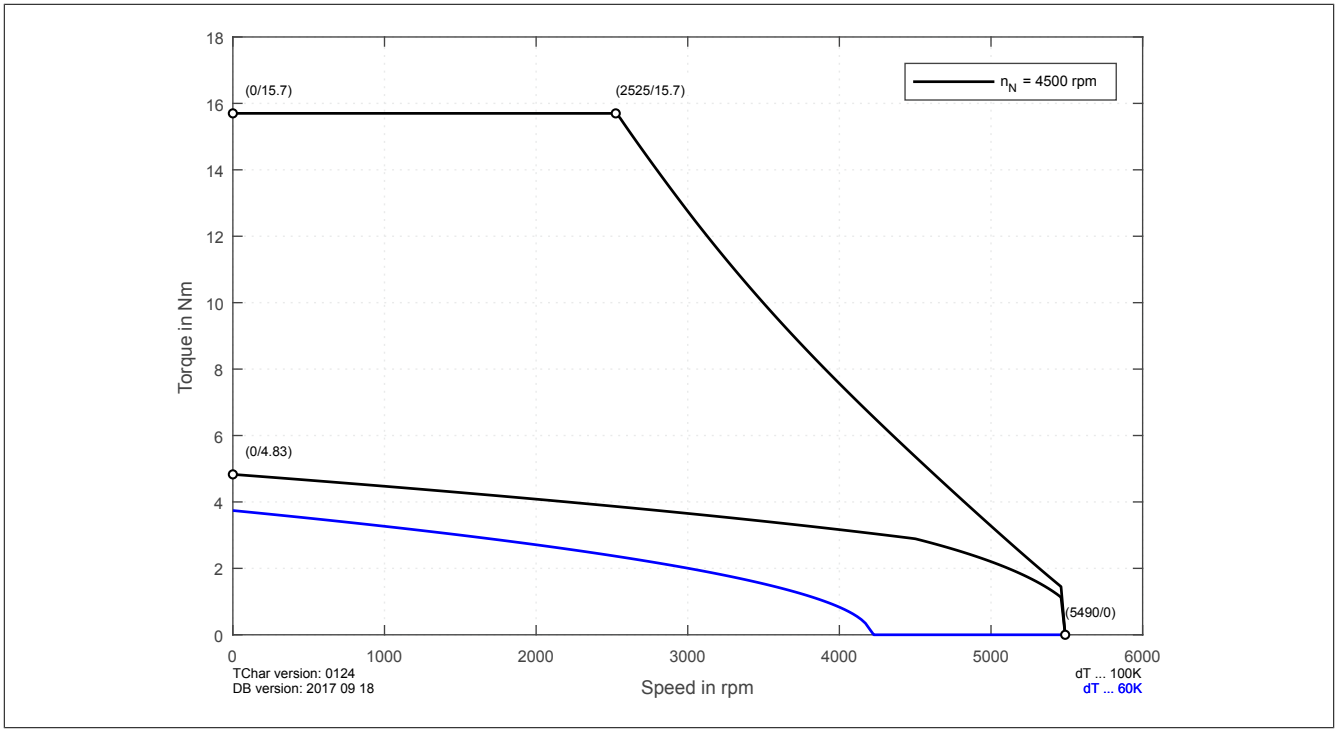
14 8JSA5 - Technical data

Model number	8JSA51.ee045ffgg-0	8JSA52.ee045ffgg-0	8JSA54.ee028ffgg-0	8JSA54.ee050ffgg-0
Motor				
Nominal speed n_N [rpm]	4500		2750	5000
Number of pole pairs	5			
Nominal torque M_n [Nm]	2.89	5.02	11.17	6.92
Nominal power P_N [W]	1362	2366	3217	3623
Nominal current I_N [A]	4.49	4.31	5.98	6.11
Stall torque M_0 [Nm]	4.83	8.5	14.4	14.11
Stall current I_0 [A]	7.5	7.4	7.8	12.5
Maximum torque M_{max} [Nm]	15.7	29.9	54.5	53.9
Maximum current I_{max} [A]	37.5	37	38.5	62.5
Maximum speed n_{max} [rpm]	6100			
Torque constant K_T [Nm/A]	0.64	1.16	1.87	1.13
Voltage constant K_E [V/1000 rpm]	41.9	74.9	120.3	72.9
Stator resistance R_{2ph} [Ω]	1.16	1.45	1.58	0.65
Stator inductance L_{2ph} [mH]	5.2	7.8	9.6	3.5
Electrical time constant t_{el} [ms]	4.5	5.4	6.1	5.4
Thermal time constant t_{therm} [min]	20	24	31	
Moment of inertia J [kgcm²]	3.4	6.2	12	
Weight without brake m [kg]	4.2	5.8	9	
Holding brake				
Holding torque of brake M_{Br} [Nm]	14.5			
Mass of brake [kg]	1.1			
Moment of inertia of brake J_{Br} [kgcm²]	0.173			
Recommendations				
ACOPOS 8Vxxxx.xx...	1090			1180
ACOPOSmulti 8BVIxxxx...	0110			
ACOPOS P3 8EIxxxx...	8X8X			017X
Cross section for B&R motor cables [mm²]	0.75			1.5
Connector size	1.0			

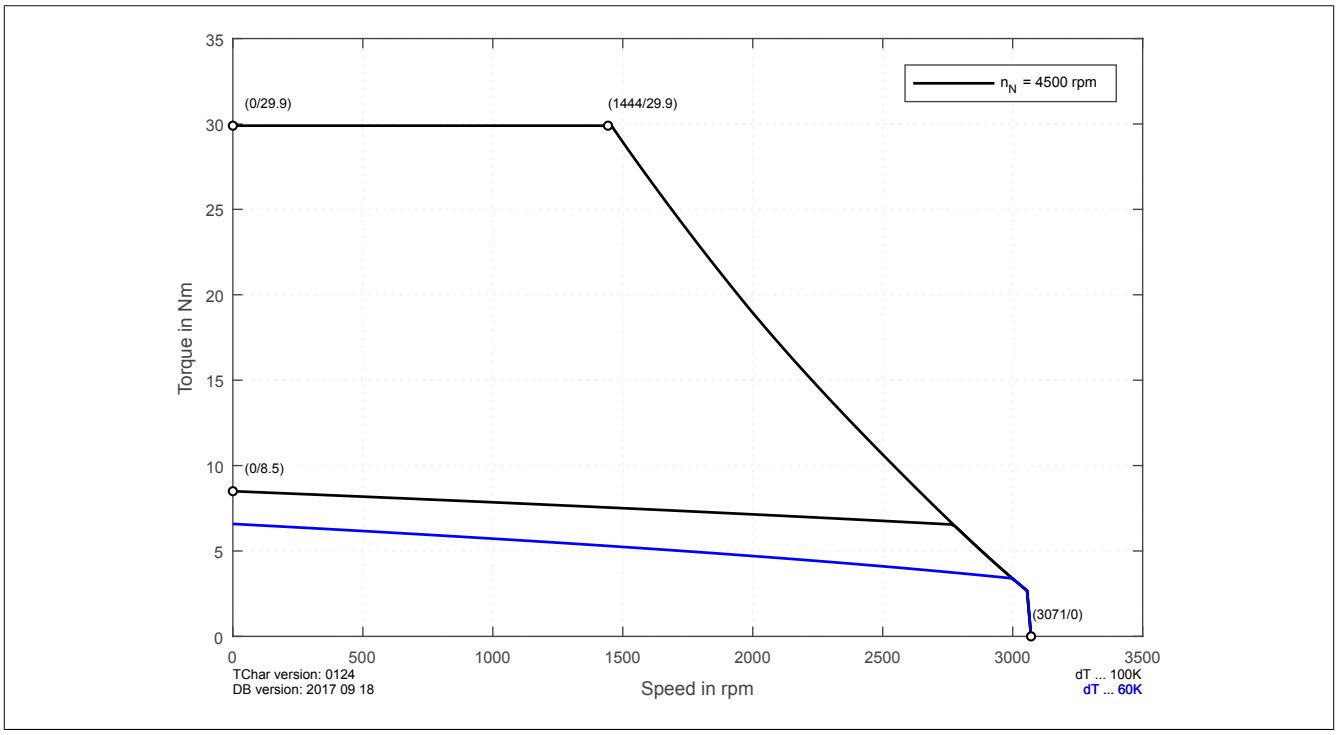
Table 5: 8JSA51.ee045ffgg-0, 8JSA52.ee045ffgg-0, 8JSA54.ee028ffgg-0, 8JSA54.ee050ffgg-0 - Technical data

14.1 Speed-torque characteristic curves at 325 VDC DC bus voltage

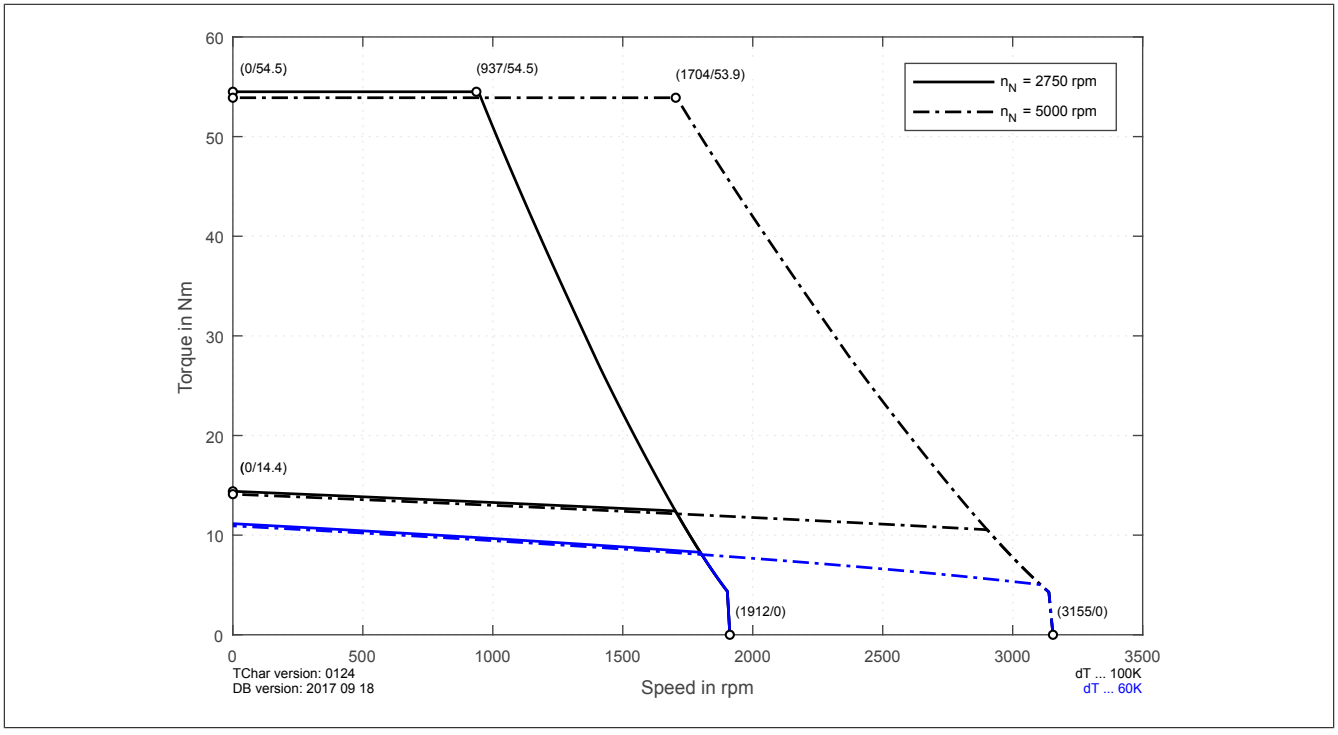
8JSA51.eennnffgg-0



8JSA52.eennnffgg-0

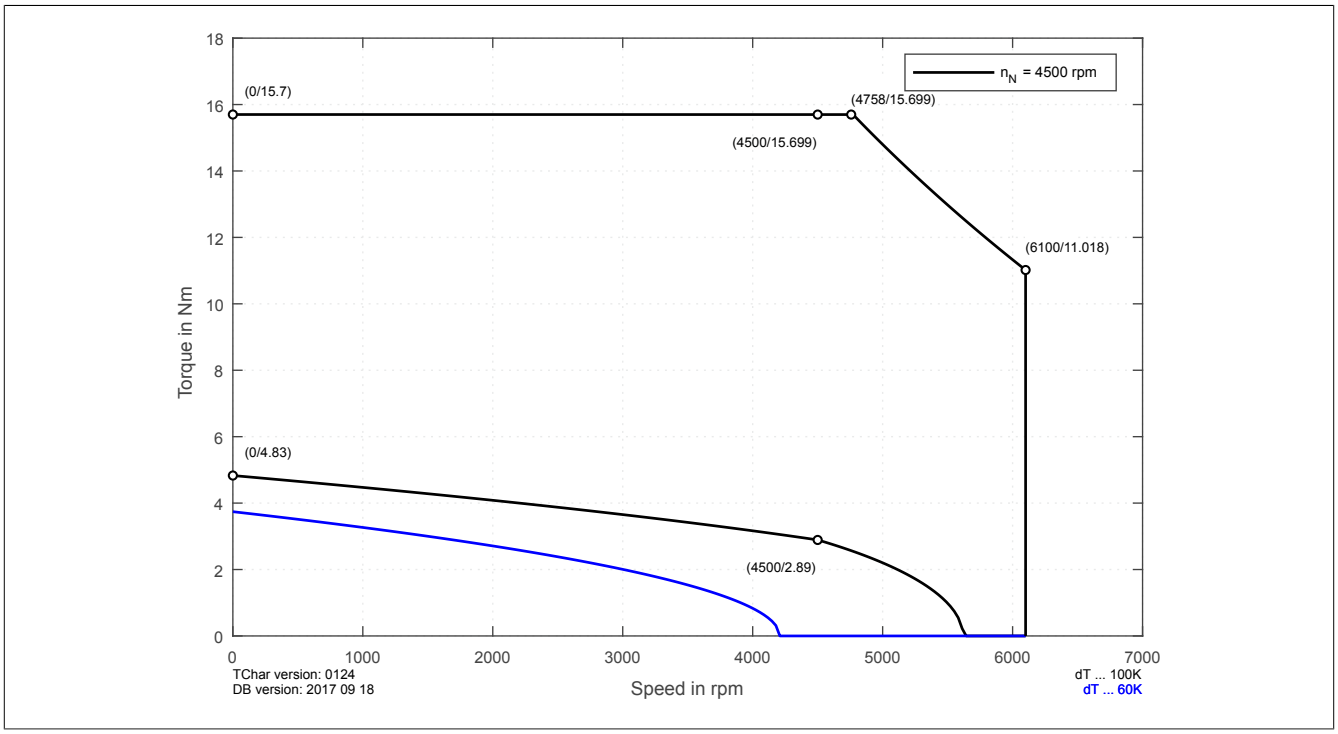


8JSA54.eennnffgg-0

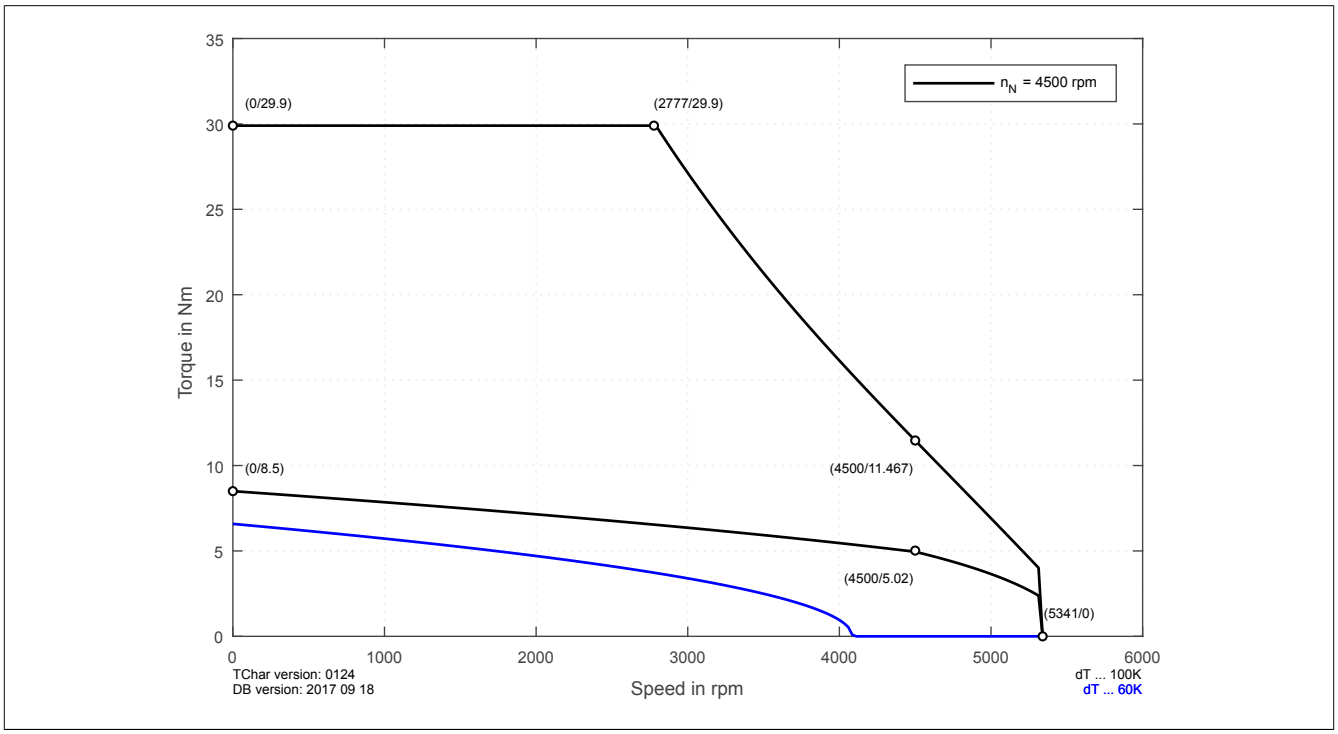


14.2 Speed-torque characteristic curves at 560 VDC DC bus voltage

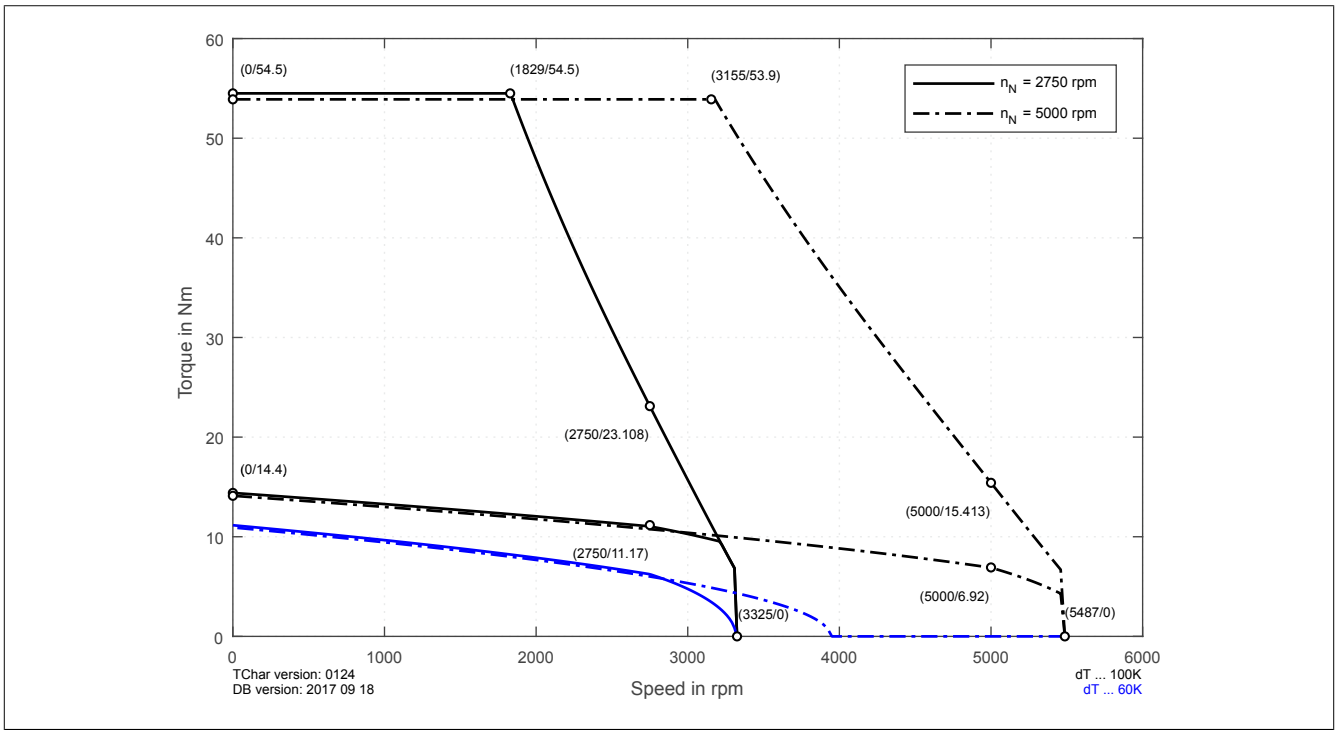
8JSA51.eennnffgg-0



8JSA52.eennnffgg-0

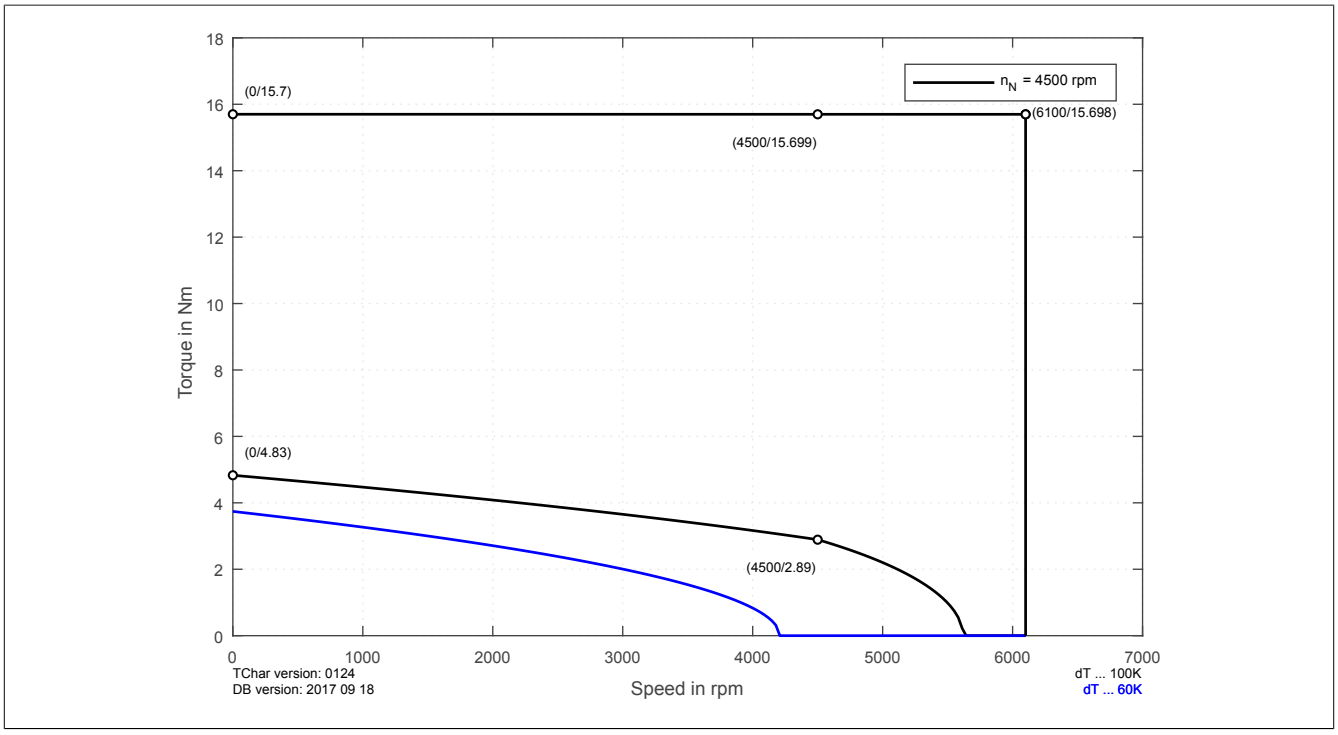


8JSA54.eennnffgg-0

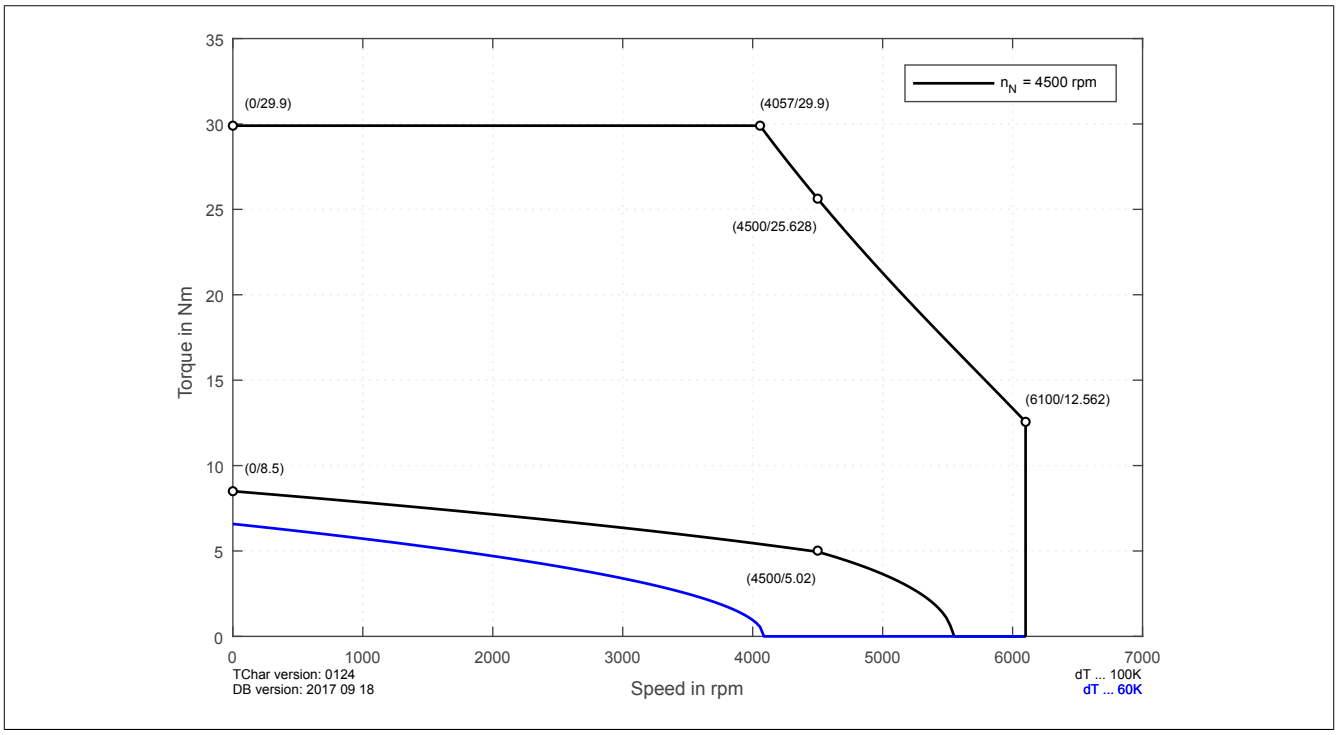


14.3 Speed-torque characteristic curves at 750 VDC DC bus voltage

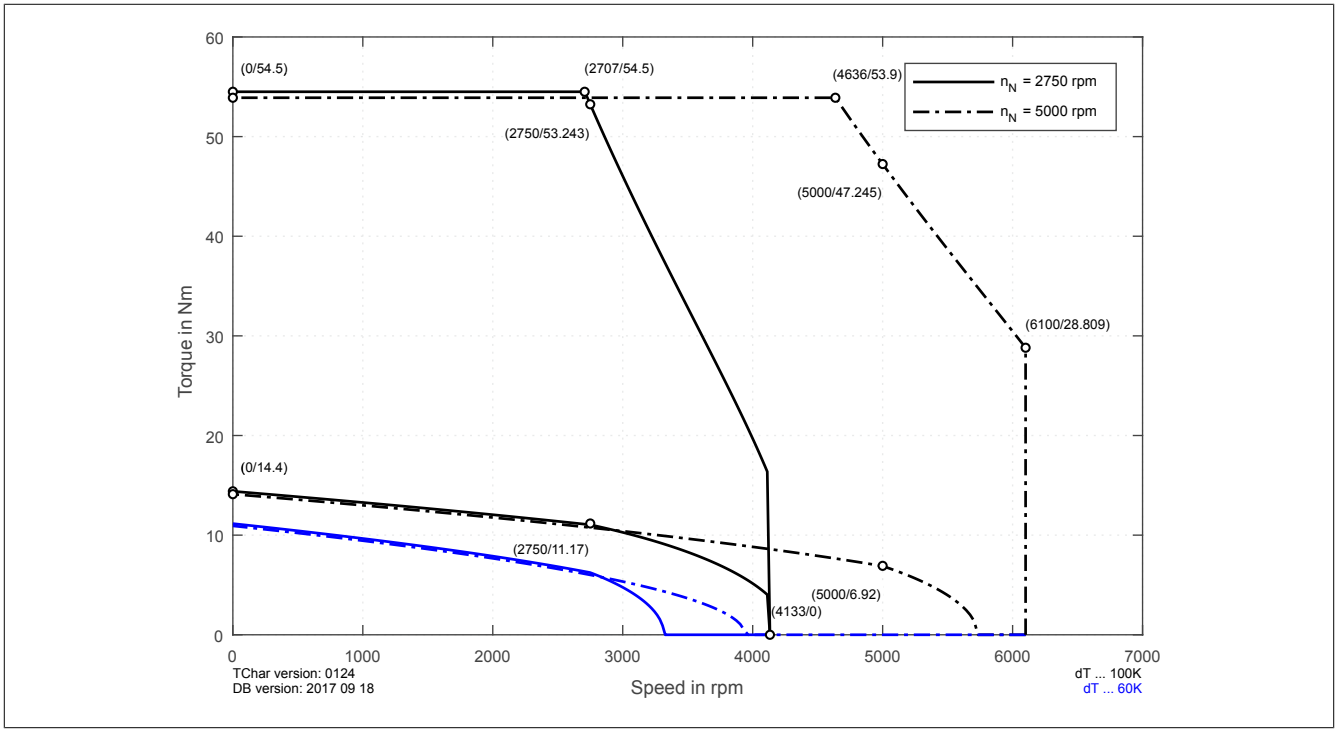
8JSA51.eennnffgg-0



8JSA52.eennnffgg-0

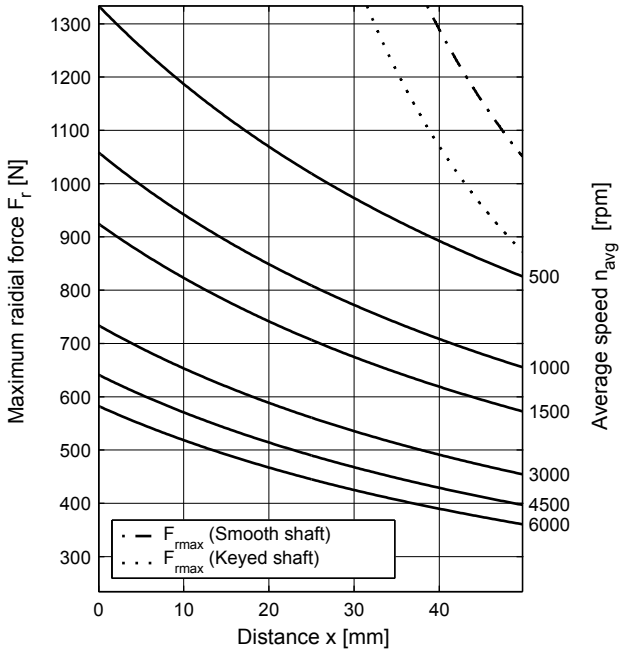


8JSA54.eennnffgg-0



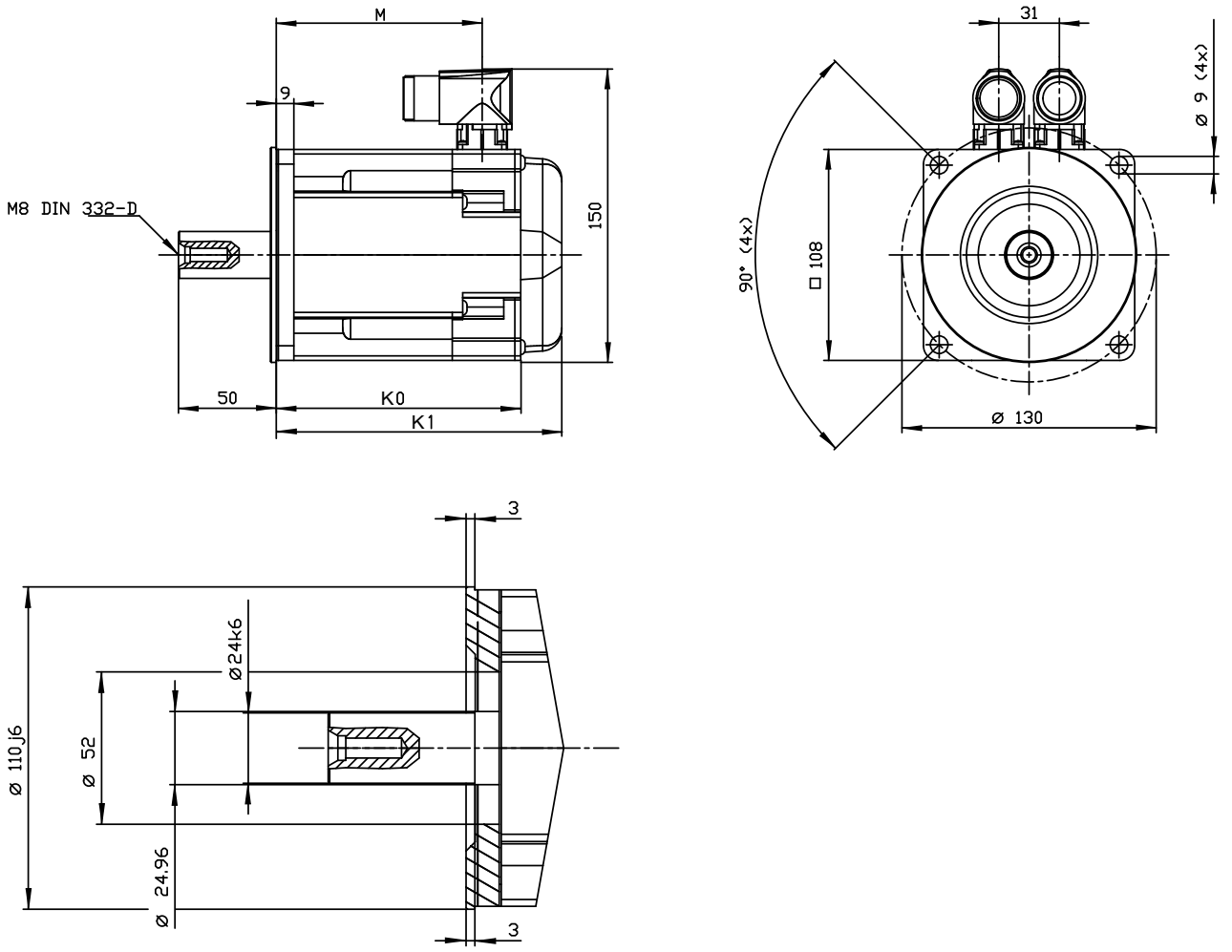
14.4 Maximum shaft load

Note the information in section "Load capacity of the shaft end and bearing" on page 70 of chapter "Installation conditions".



Maximum axial force: F_{amax} = 107 N

14.5 8JSA5 - Dimensions



EnDat/Resolver feedback				Extension of K_0 and K_1 depending on the motor option [mm]	
Encoder assignments	**R0**	**E6, E7, EA, EB**		**Holding brake**	
Model number	**K_0**	**K_1**	**M**	**K_0**	**K_1**
8JSA51.eennnffgg-0	127.5	146	105.3	45	43
8JSA52.eennnffgg-0	158.5	177	136.3	45	43
8JSA53.eennnffgg-0	189.5	208	167.3	45	43
8JSA54.eennnffgg-0	220.5	239	198.3	45	43

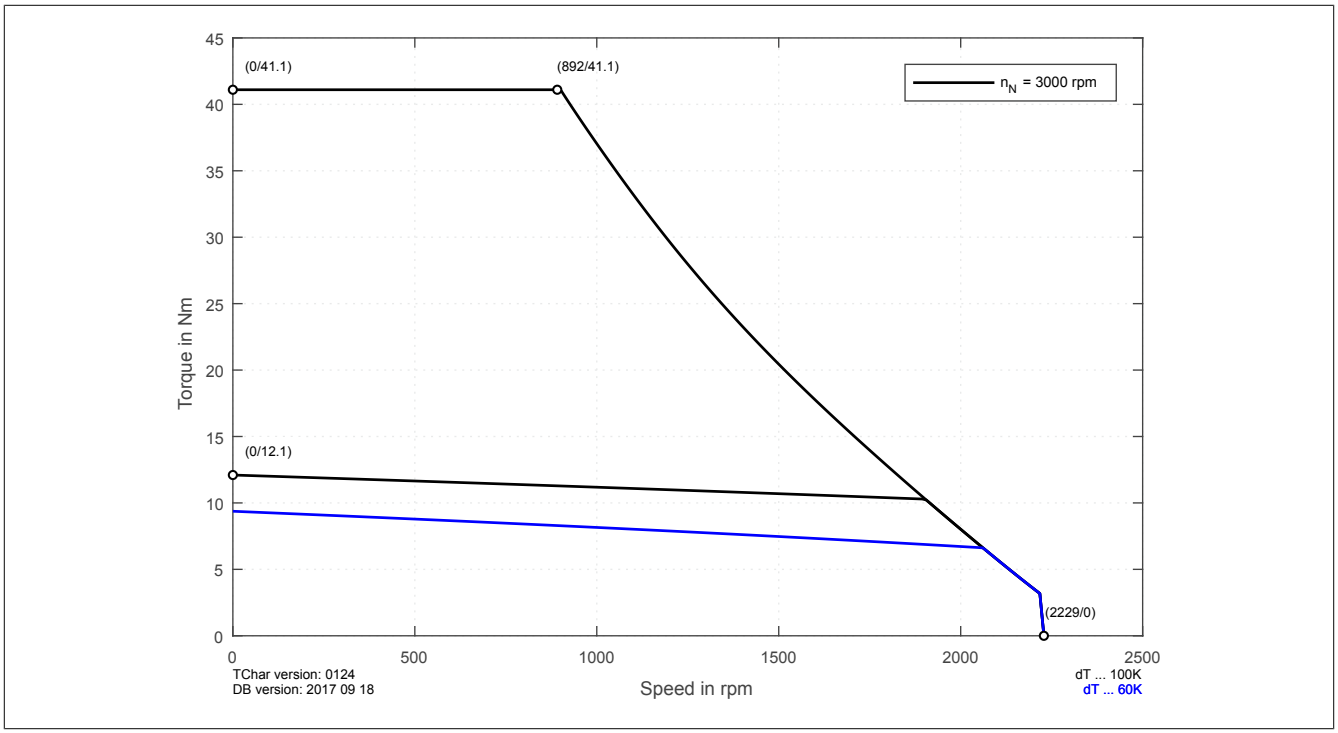
15 8JSA6 - Technical data

Model number	8JSA62.ee030ffgg-0	8JSA63.ee023ffgg-0	8JSA64.ee030ffgg-0	8JSA65.ee025ffgg-0
Motor				
Nominal speed n_N [rpm]	3000	2250	3000	2500
Number of pole pairs	5			
Nominal torque M_n [Nm]	9.14	13.61	15.4	19
Nominal power P_N [W]	2871	3207	4838	4974
Nominal current I_N [A]	5.7	6.34	9.3	10.25
Stall torque M_0 [Nm]	12.1	16.8	21	25
Stall current I_0 [A]	7.6	7.9	12.8	13.6
Maximum torque M_{max} [Nm]	41.1	59.3	76.6	93.2
Maximum current I_{max} [A]	38	39.3	64	68.2
Maximum speed n_{max} [rpm]	6100			
Torque constant K_T [Nm/A]	1.6	2.15	1.66	1.85
Voltage constant K_E [V/1000 rpm]	103.2	138.2	107	119
Stator resistance R_{2ph} [Ω]	1.65	1.7	0.75	0.73
Stator inductance L_{2ph} [mH]	13.4	14.6	6.2	6.1
Electrical time constant t_{el} [ms]	8.1	8.6	8.3	8.4
Thermal time constant t_{therm} [min]	20	25	30	35
Moment of inertia J [kgcm²]	17	24.2	32	40
Weight without brake m [kg]	8.9	11.1	13.3	15.4
Holding brake				
Holding torque of brake M_{Br} [Nm]	25			
Mass of brake [kg]	2			
Moment of inertia of brake J_{Br} [kgcm²]	0.605			
Recommendations				
ACOPOS 8Vxxxx.xx...	1090		1180	
ACOPOSmulti 8BVIxxxx...	0110			
ACOPOS P3 8EIxxxx...	8X8X		017X	
Cross section for B&R motor cables [mm²]	0.75		1.5	
Connector size	1.0			

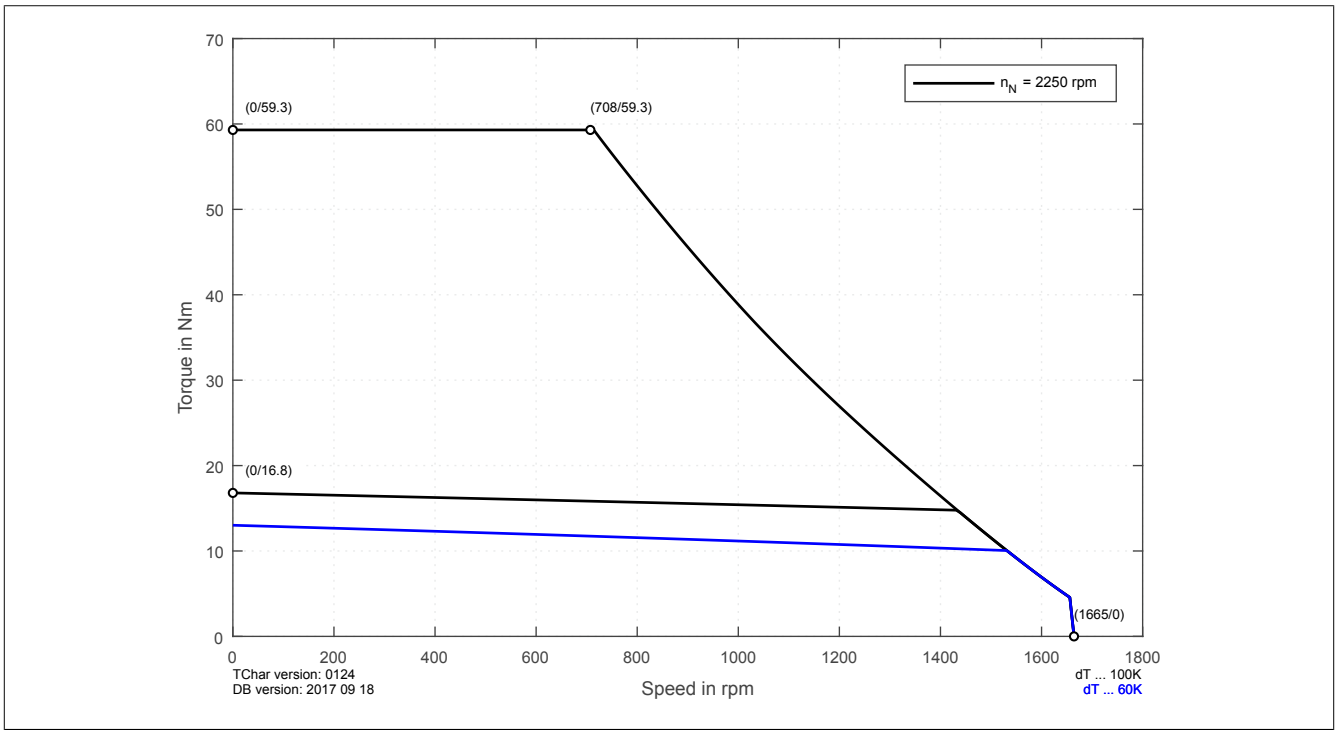
Table 6: 8JSA62.ee030ffgg-0, 8JSA63.ee023ffgg-0, 8JSA64.ee030ffgg-0, 8JSA65.ee025ffgg-0 - Technical data

15.1 Speed-torque characteristic curves at 325 VDC DC bus voltage

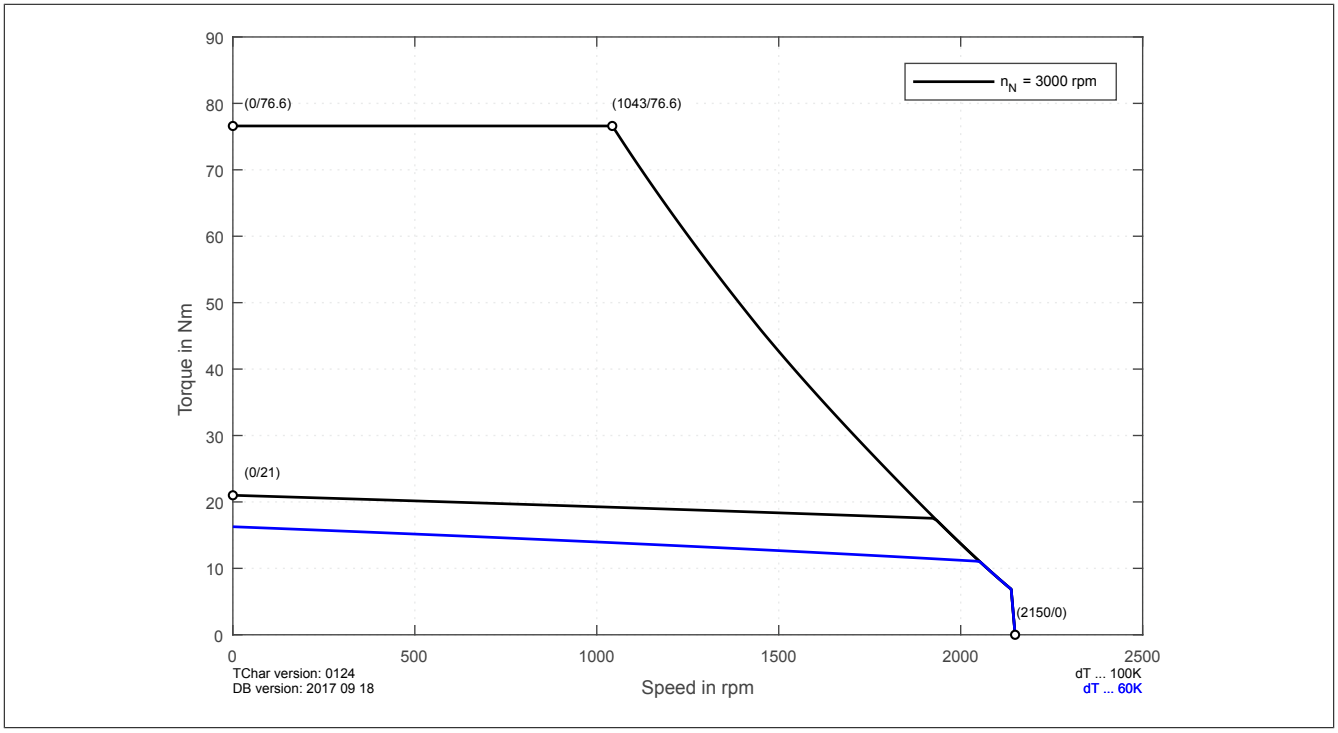
8JSA62.eennnffgg-0



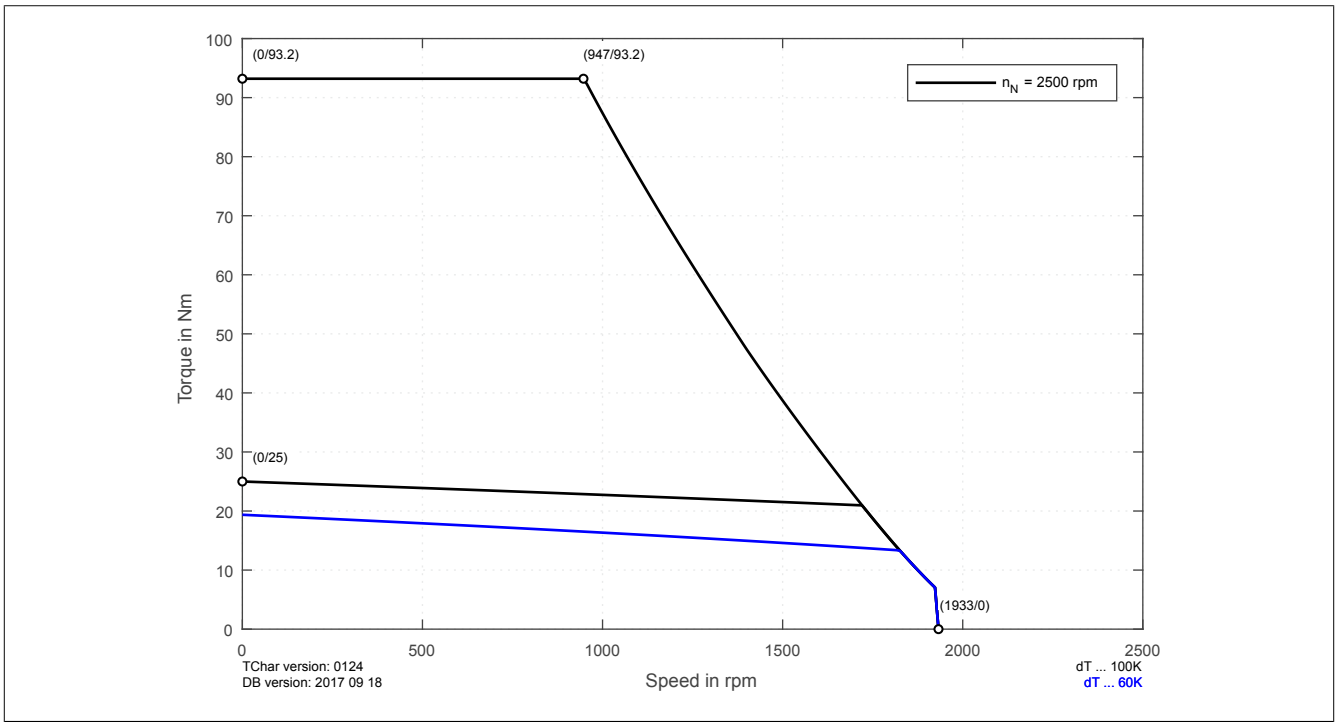
8JSA63.eennnffgg-0



8JSA64.eennnffgg-0

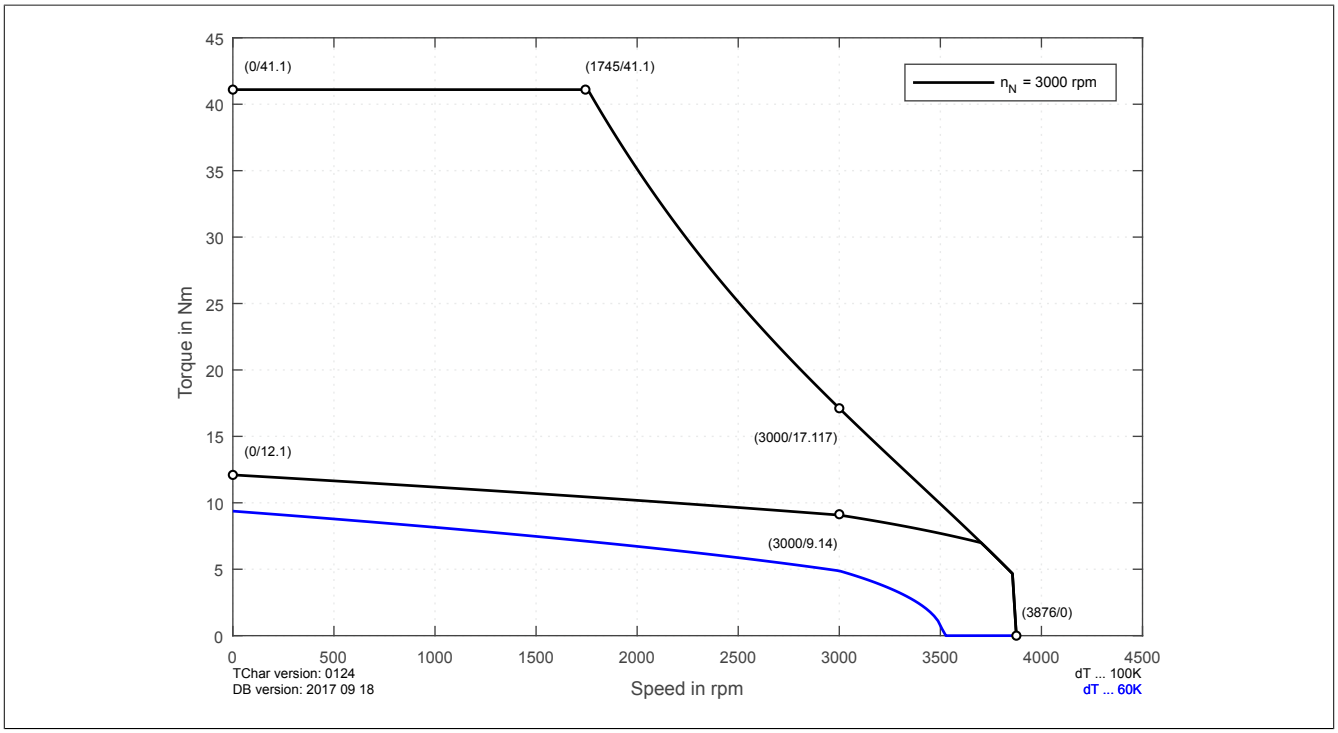


8JSA65.eennnffgg-0

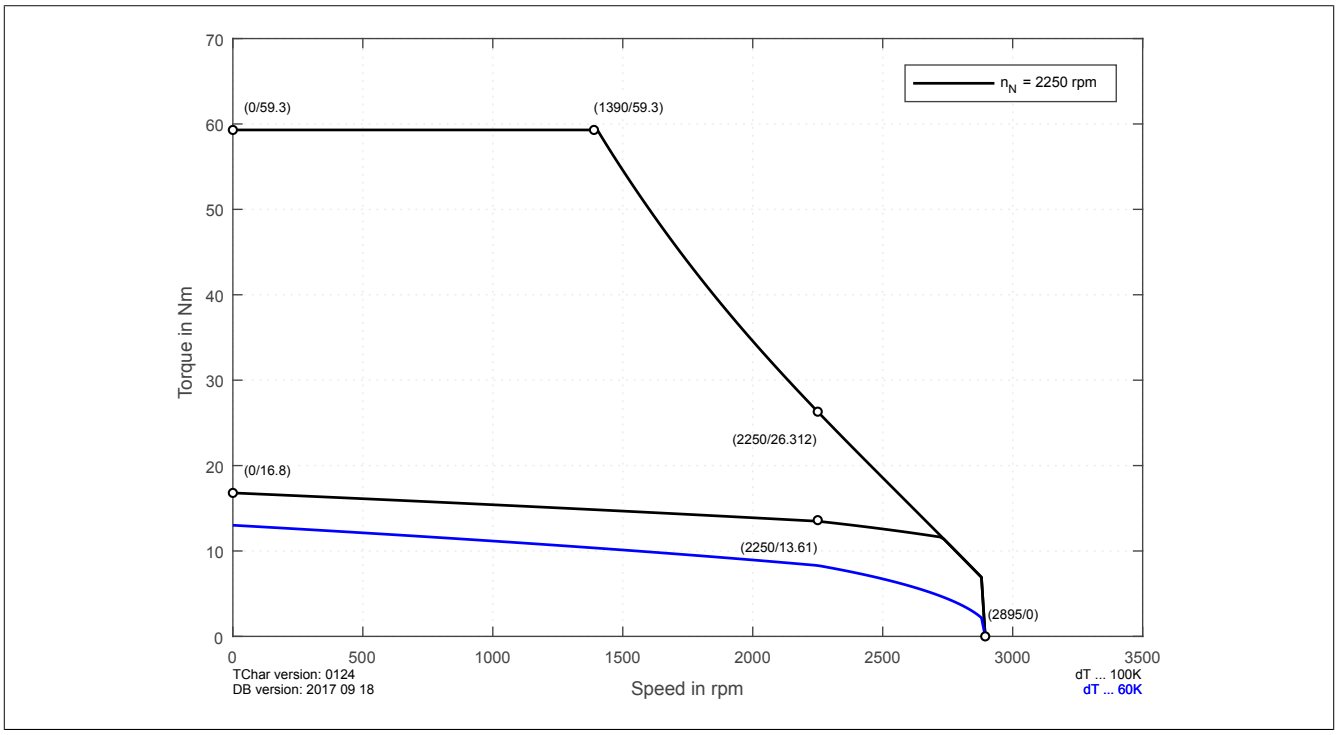


15.2 Speed-torque characteristic curves at 560 VDC DC bus voltage

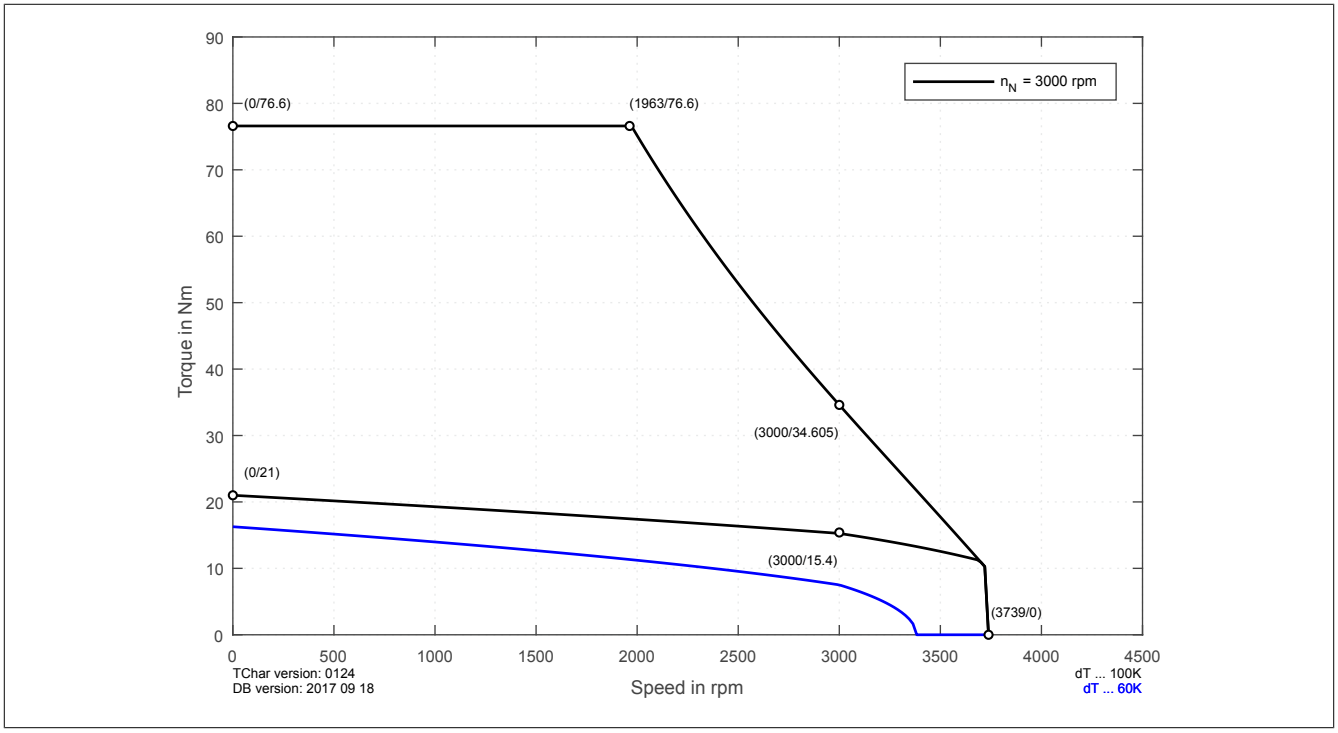
8JSA62.eennnffgg-0



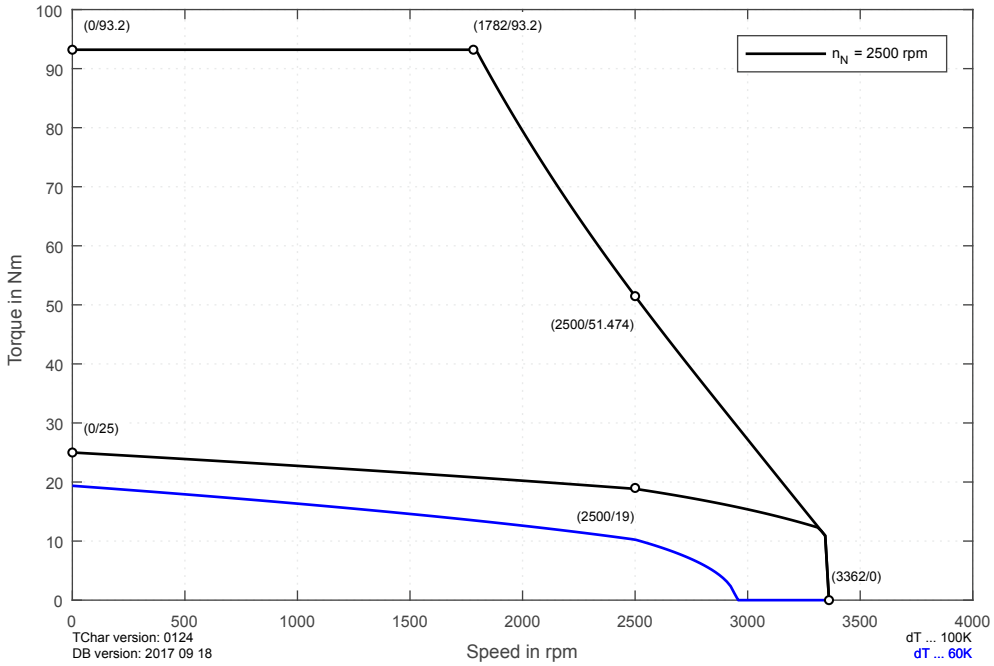
8JSA63.eennnffgg-0



8JSA64.eennnffgg-0

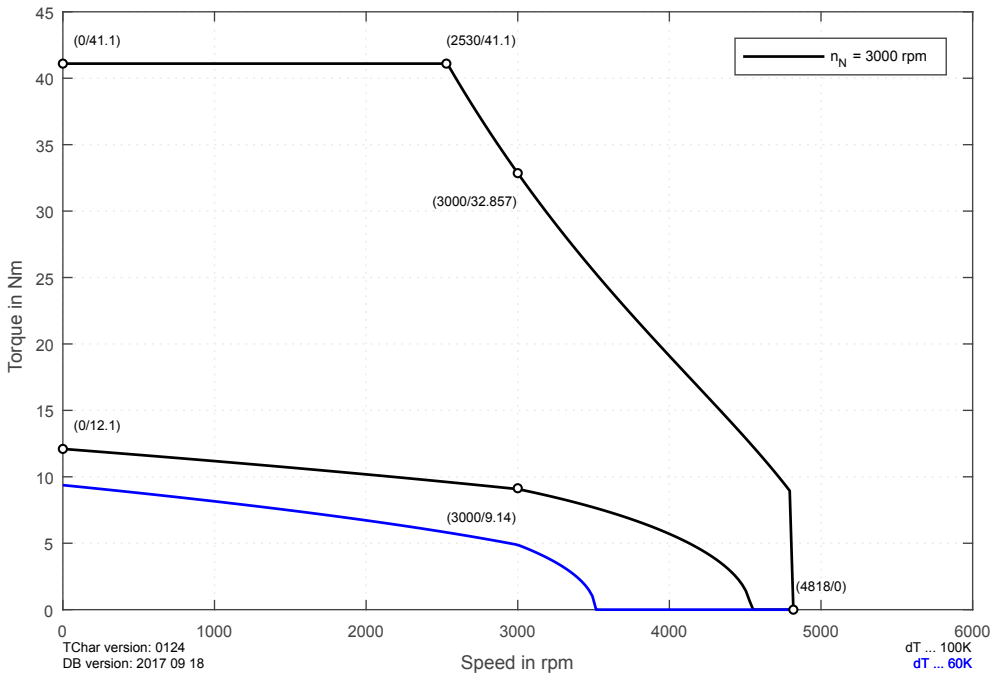


8JSA65.eennnffgg-0

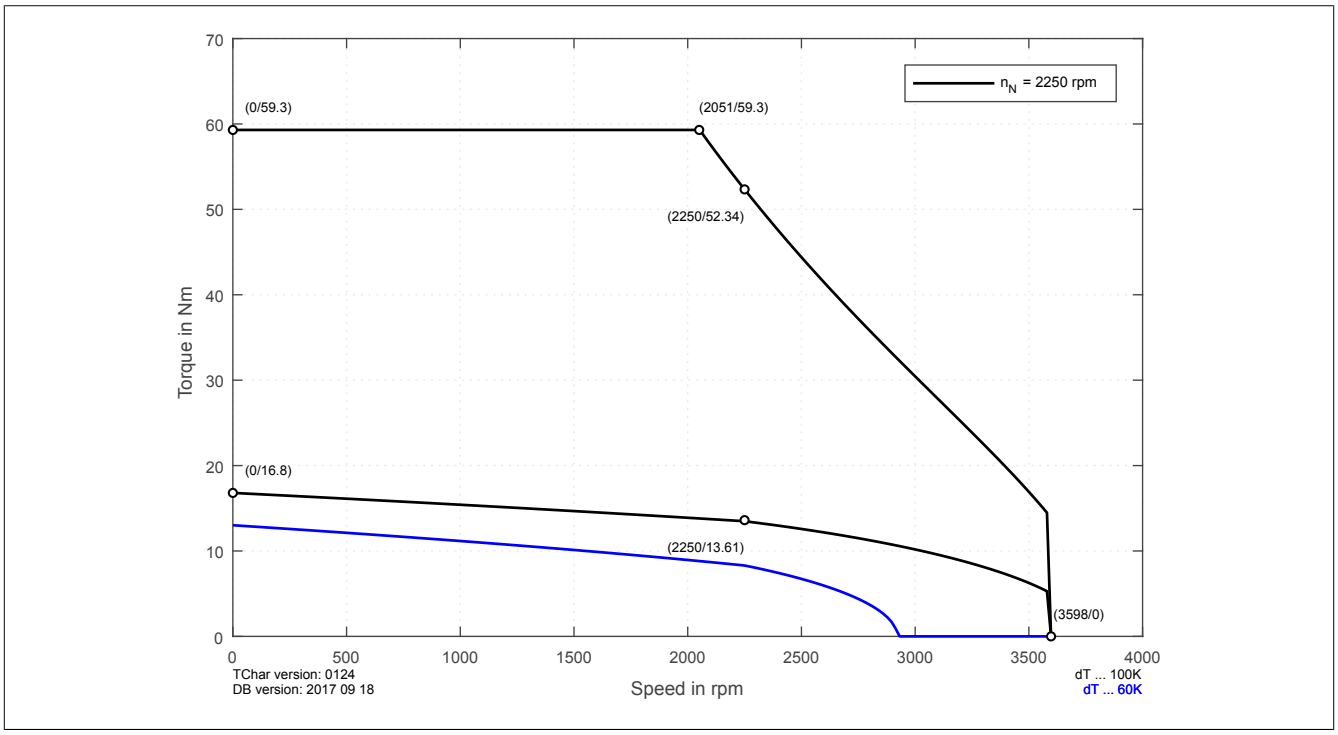


15.3 Speed-torque characteristic curves at 750 VDC DC bus voltage

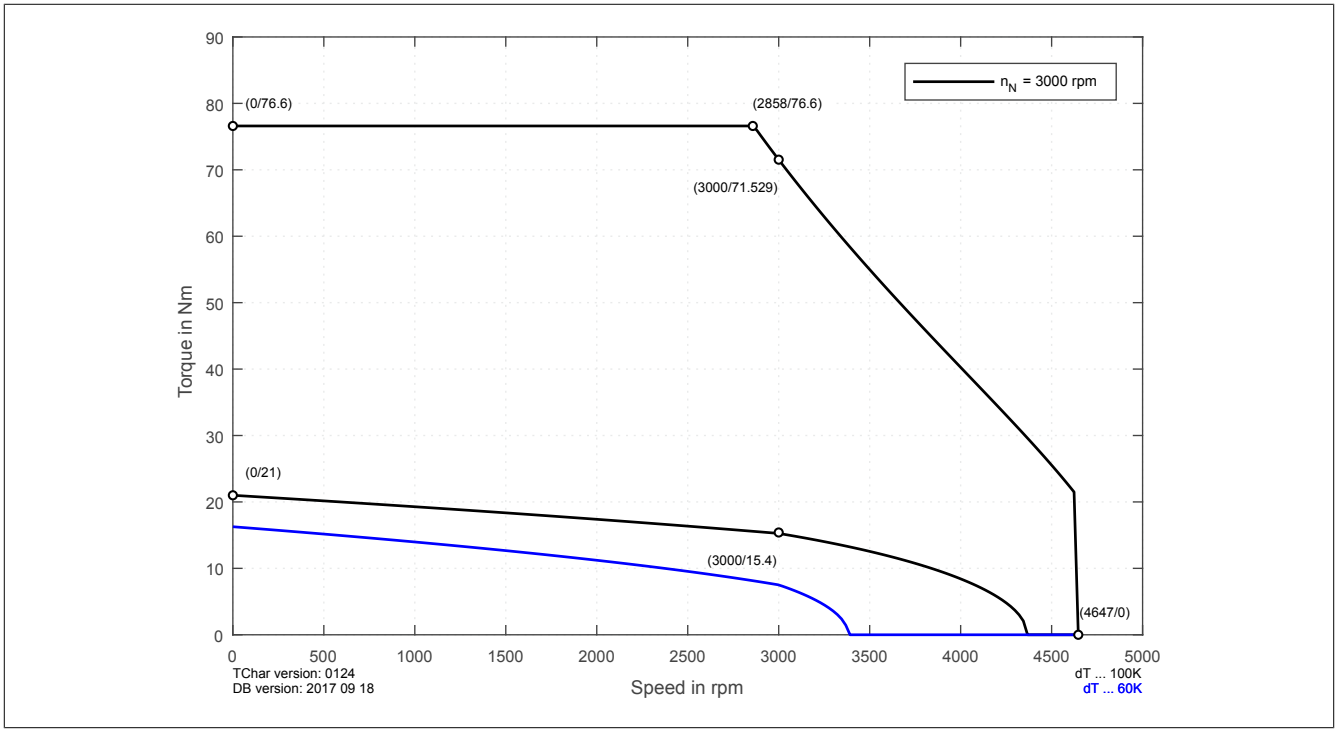
8JSA62.eennnffgg-0



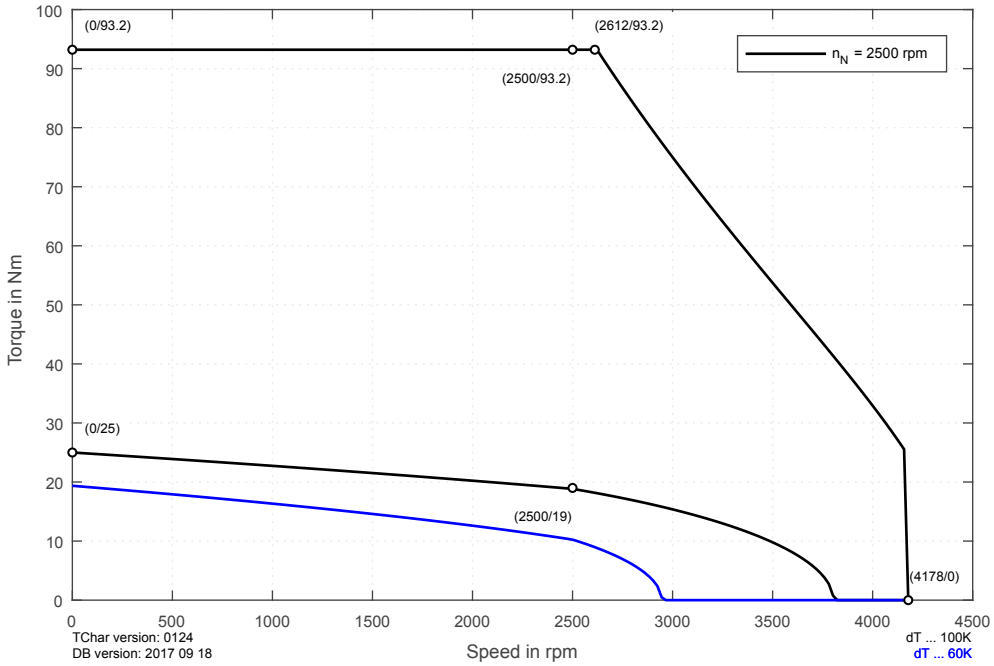
8JSA63.eennnffgg-0



8JSA64.eennnffgg-0

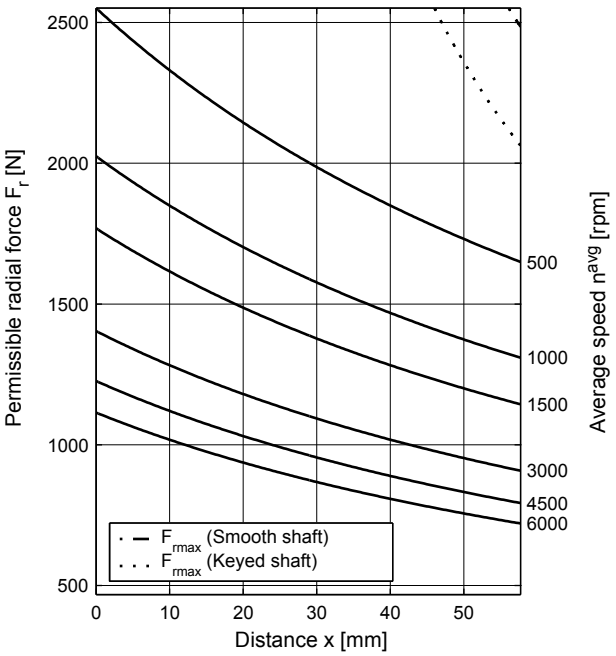


8JSA65.eennnffgg-0



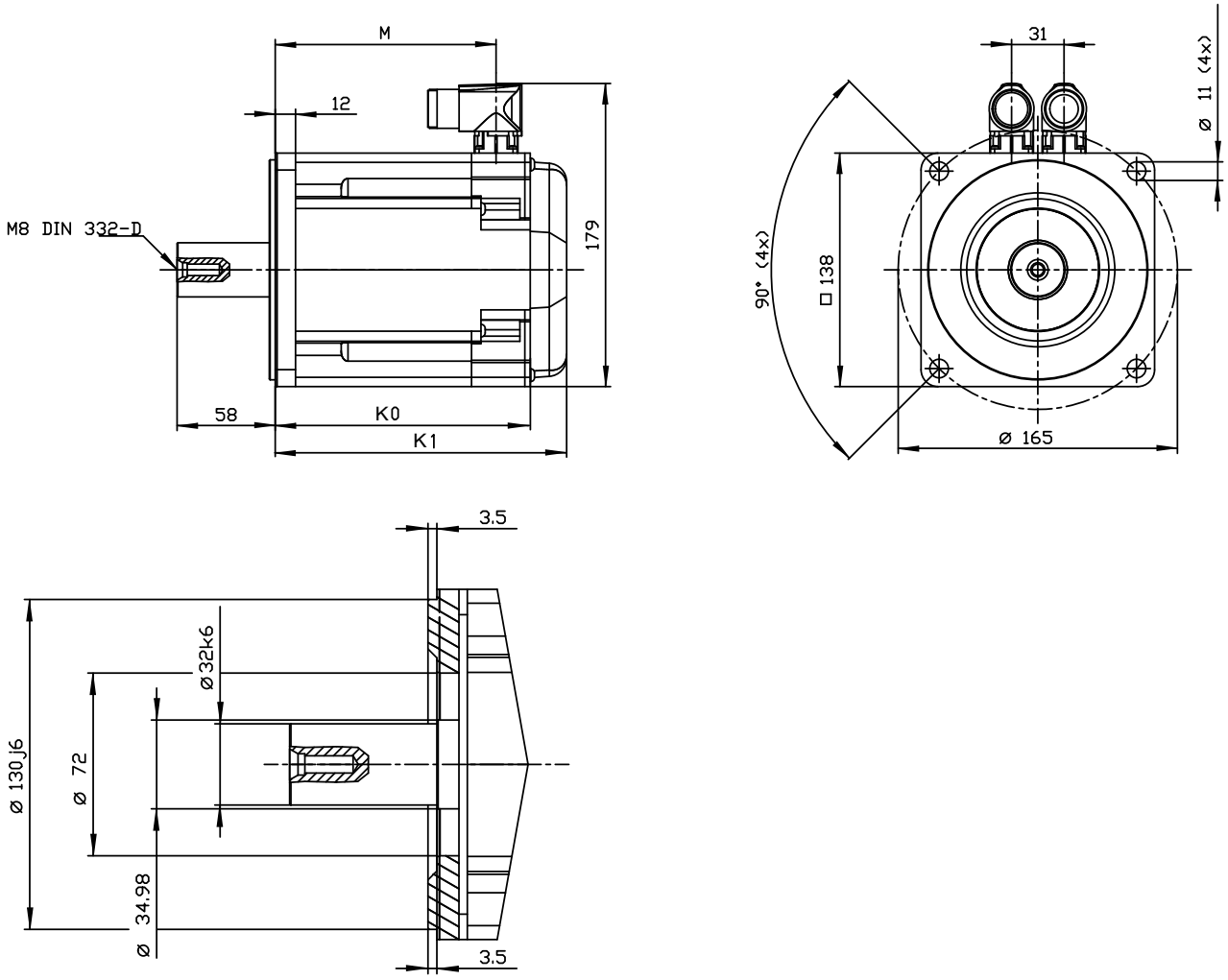
15.4 Maximum shaft load

Note the information in section "Load capacity of the shaft end and bearing" on page 70 of chapter "Installation conditions".



Maximum axial force: F_{amax} = 210 N

15.5 8JSA6 - Dimensions



EnDat/Resolver feedback				Extension of K_0 and K_1 depending on the motor option [mm]	
Encoder assignments	**R0**	**E6, E7, EA, EB**		**Holding brake**	
Model number	**K_0**	**K_1**	**M**	**K_0**	**K_1**
8JSA62.eennnffgg-0	153.7	172.2	130.5	47	47.5
8JSA63.eennnffgg-0	178.7	197.2	155.5	47	47.5
8JSA64.eennnffgg-0	203.7	222.2	180.5	47	47.5
8JSA65.eennnffgg-0	228.7	247.2	205.5	47	47.5

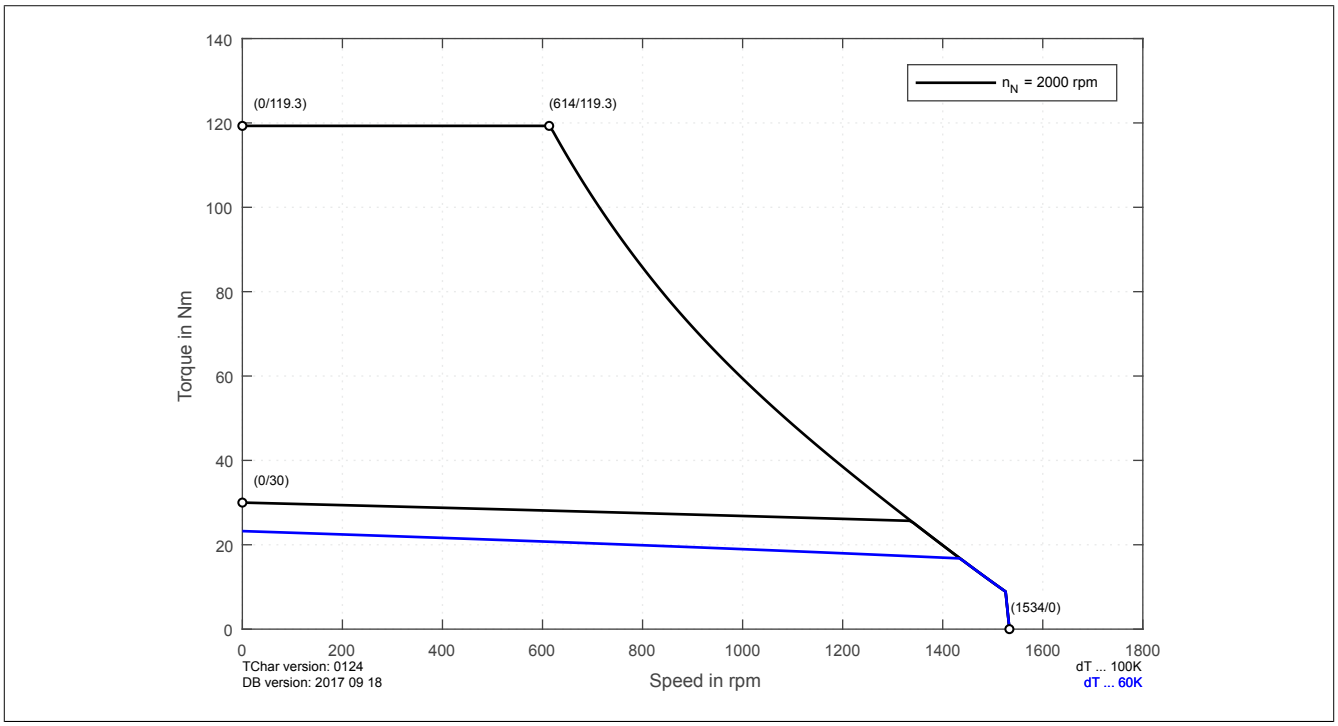
16 8JSA7 - Technical data

Model number	8JSA72.ee020ffgg-0	8JSA73.ee024ffgg-0	8JSA74.ee018ffgg-0
Motor			
Nominal speed n_N [rpm]	2000	2400	1800
Number of pole pairs		5	
Nominal torque M_n [Nm]	23.4	28.2	39.3
Nominal power P_N [W]	4901	7087	7408
Nominal current I_N [A]	10.06	13.22	13.82
Stall torque M_0 [Nm]	30	41.6	52.5
Stall current I_0 [A]	13	19.5	18.5
Maximum torque M_{max} [Nm]	119.3	167.9	214.6
Maximum current I_{max} [A]	65	97.4	92.1
Maximum speed n_{max} [rpm]		6100	
Torque constant K_T [Nm/A]	2.33	2.13	2.84
Voltage constant K_E [V/1000 rpm]	150	137	183
Stator resistance R_{2ph} [Ω]	0.69	0.38	0.47
Stator inductance L_{2ph} [mH]	10.8	5.9	7.7
Electrical time constant t_{el} [ms]	15.7	15.5	16.4
Thermal time constant t_{therm} [min]	46	53	60
Moment of inertia J [kgcm²]	65	92	120
Weight without brake m [kg]	19.7	26.7	33.6
Holding brake			
Holding torque of brake M_{Br} [Nm]		53	
Mass of brake [kg]		2.9	
Moment of inertia of brake J_{Br} [kgcm²]		1.644	
Recommendations			
ACOPOS 8Vxxxx.xx...	1180	1320	
ACOPOSmulti 8BVIxxxx...	0110	0220	
ACOPOS P3 8EIxxxx...	017X	024X	
Cross section for B&R motor cables [mm²]	1.5	4	
Connector size		1.0	

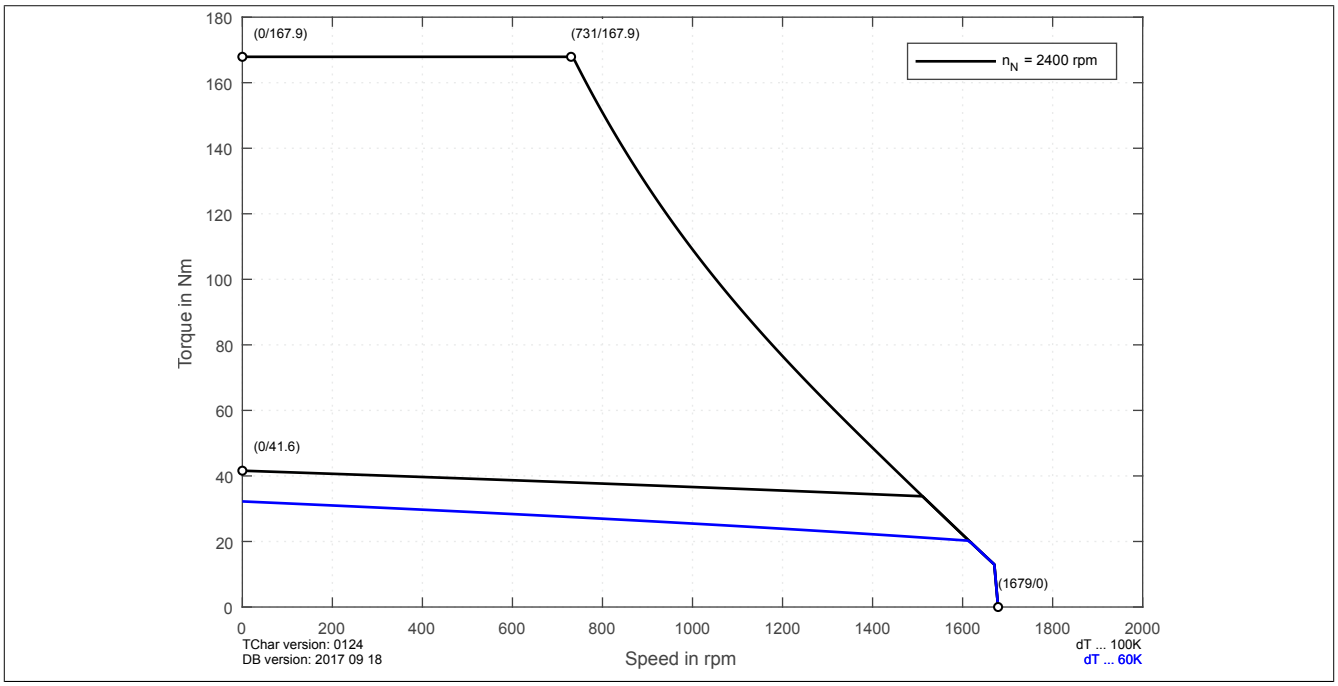
Table 7: 8JSA72.ee020ffgg-0, 8JSA73.ee024ffgg-0, 8JSA74.ee018ffgg-0 - Technical data

16.1 Speed-torque characteristic curves at 325 VDC DC bus voltage

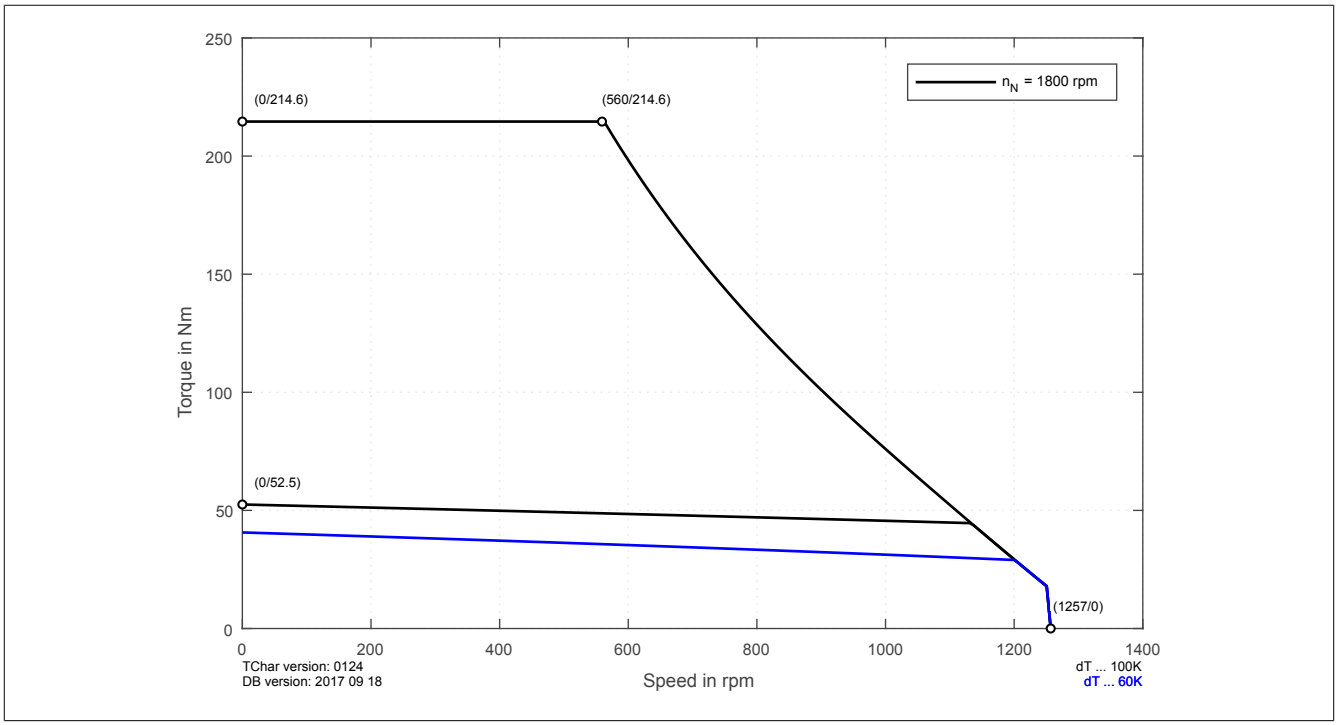
8JSA72.eennnffgg-0



8JSA73.eennnffgg-0

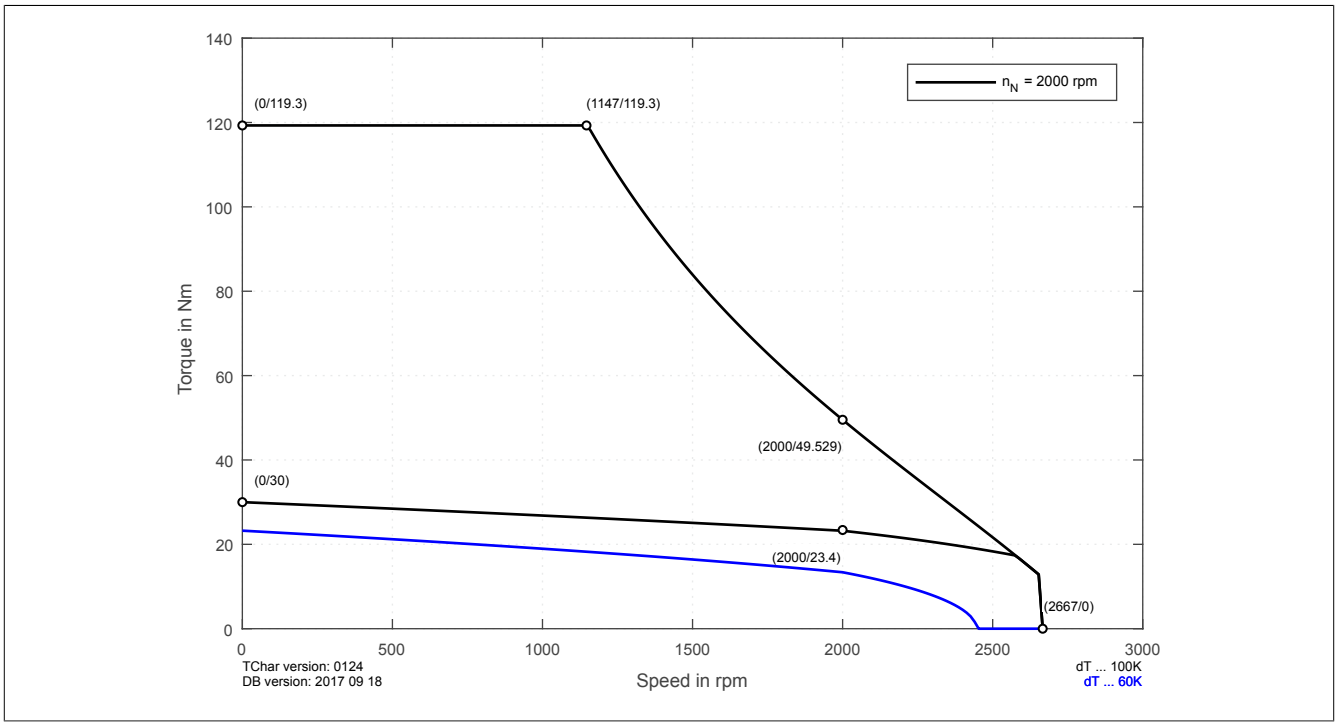


8JSA74.eennnffgg-0

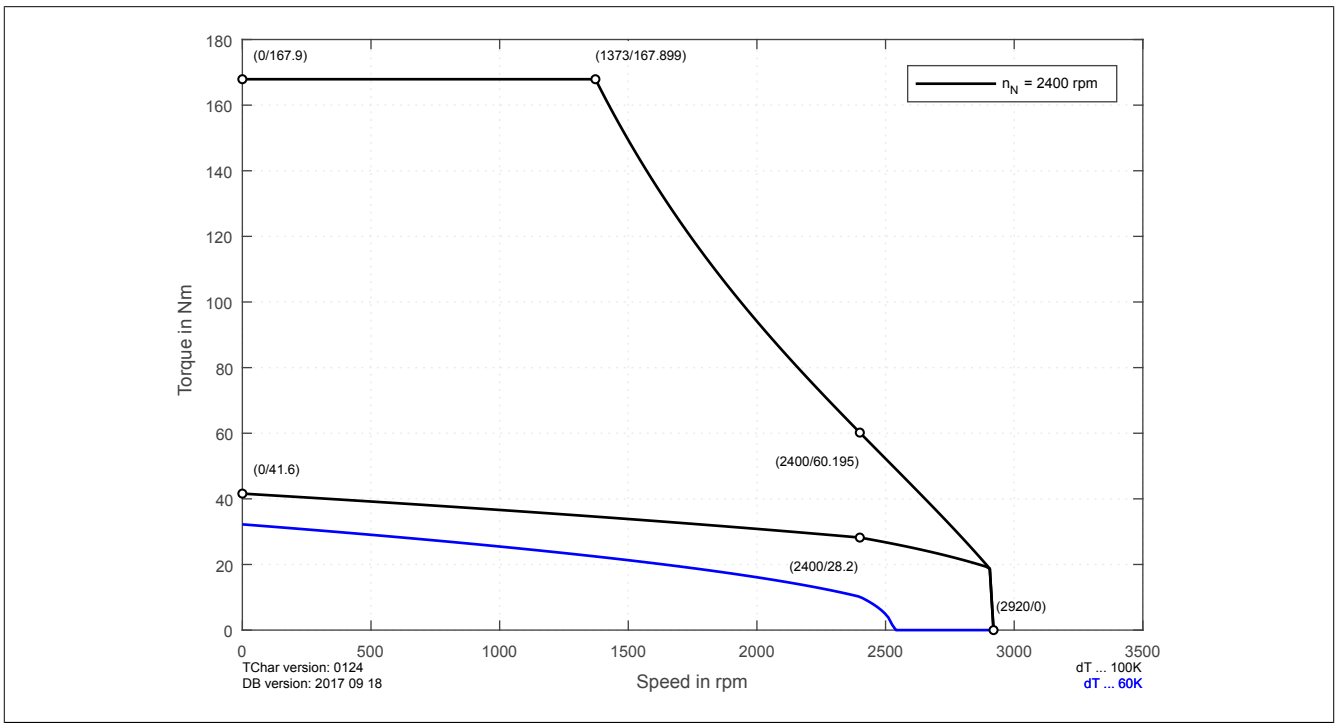


16.2 Speed-torque characteristic curves at 560 VDC DC bus voltage

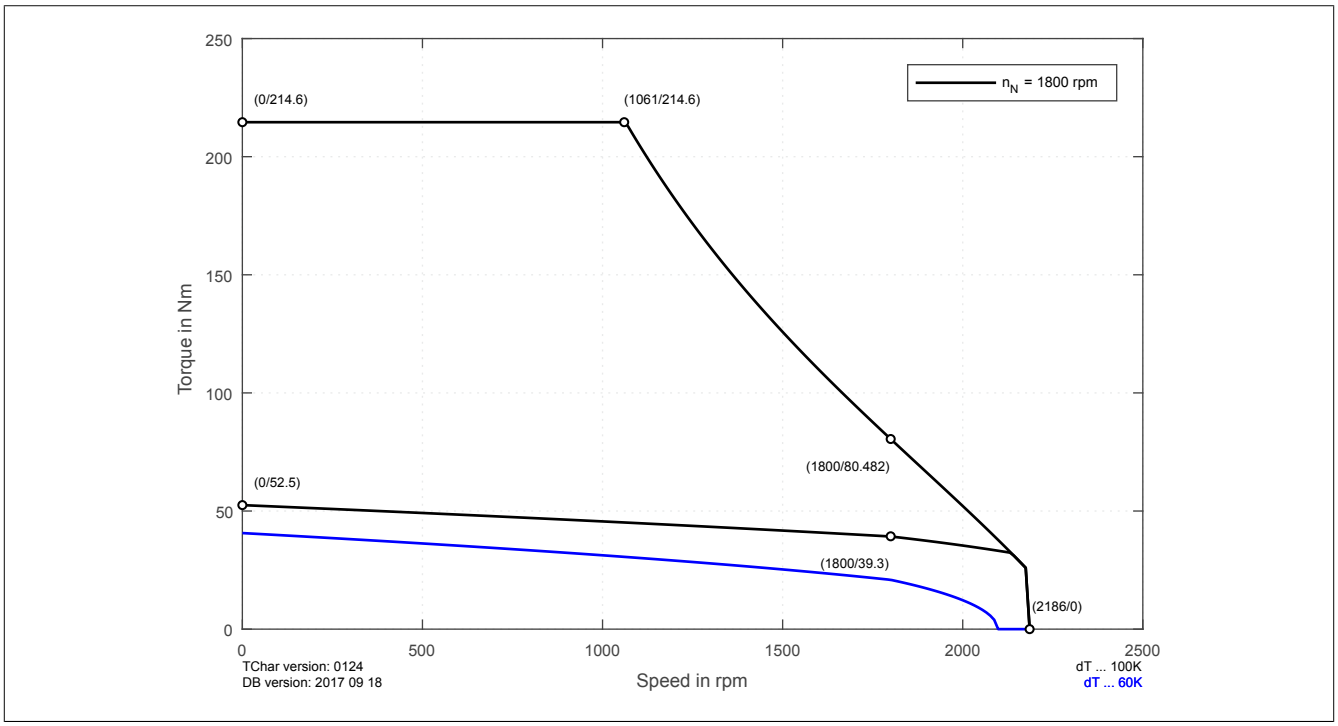
8JSA72.eennnffgg-0



8JSA73.eennnffgg-0

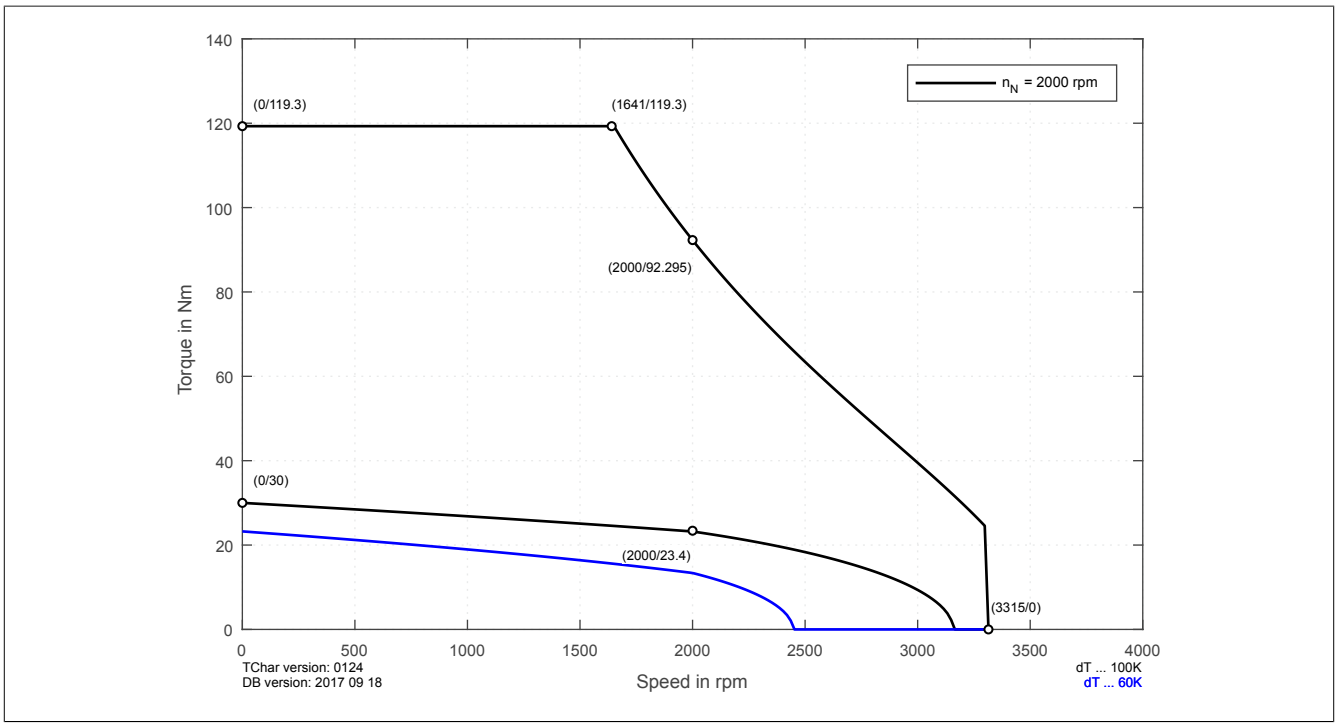


8JSA74.eennnffgg-0

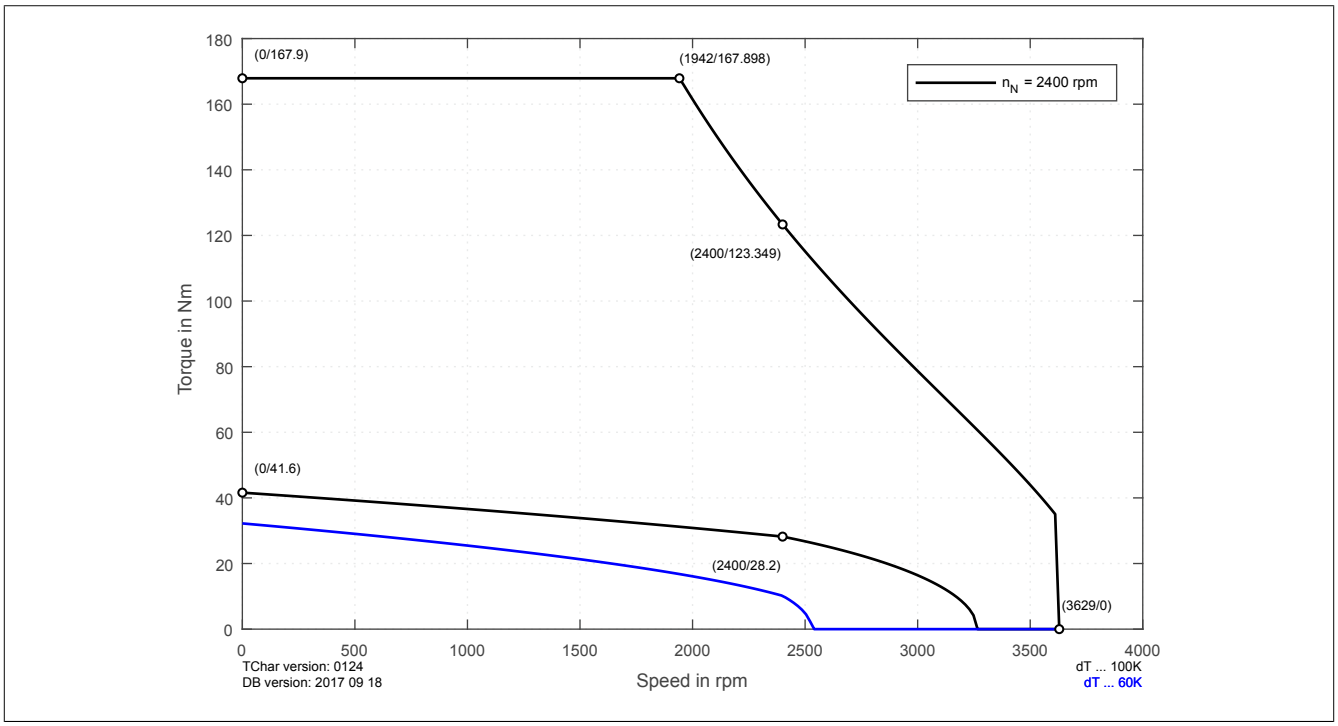


16.3 Speed-torque characteristic curves at 750 VDC DC bus voltage

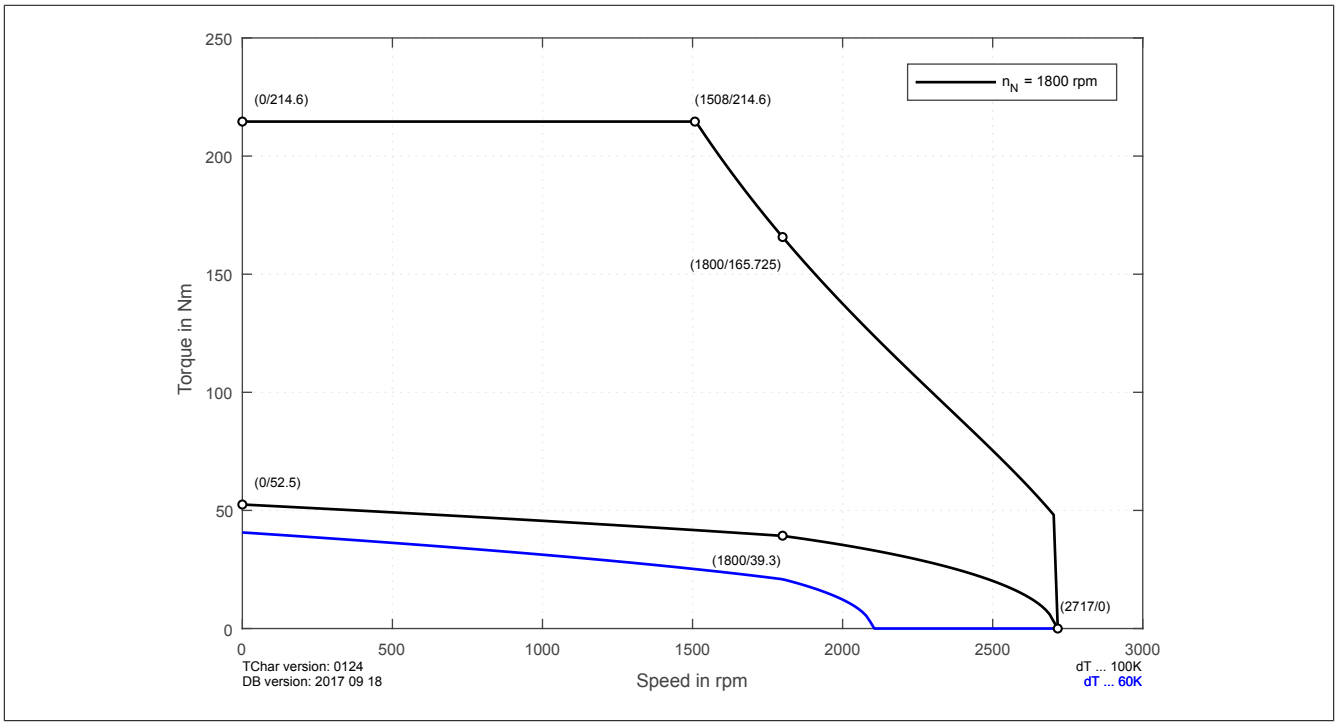
8JSA72.eennnffgg-0



8JSA73.eennnffgg-0

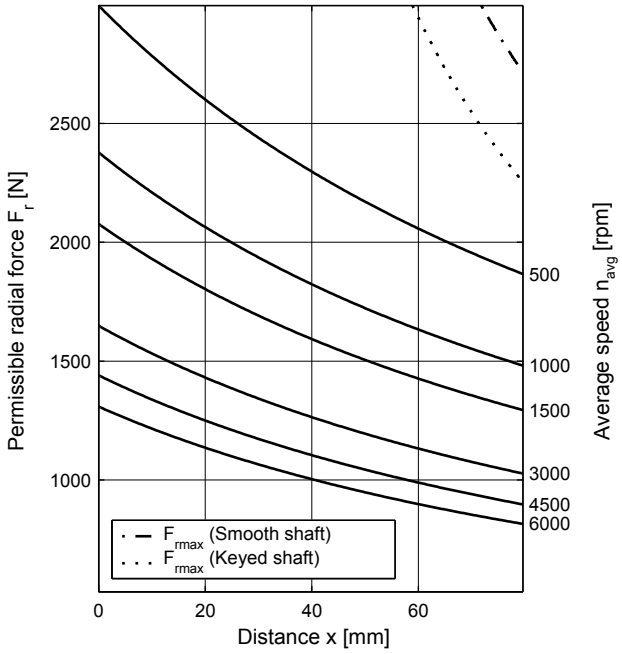


8JSA74.eennnffgg-0



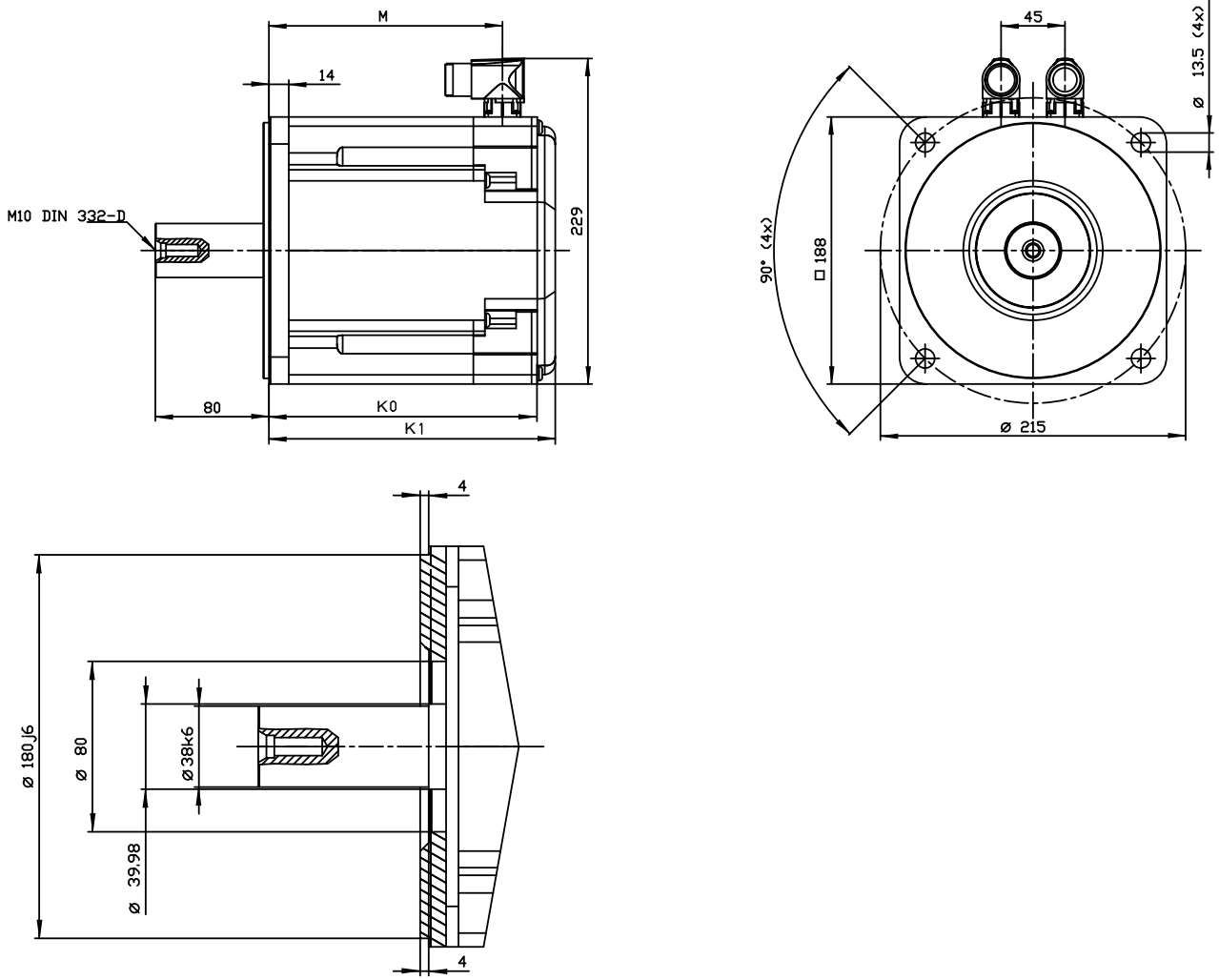
16.4 Maximum shaft load

Note the information in section "Load capacity of the shaft end and bearing" on page 70 of chapter "Installation conditions".



Maximum axial force: F_{amax} = 241 N

16.5 8JSA7 - Dimensions



EnDat/Resolver feedback				Extension of K_0 and K_1 depending on the motor option [mm]	
Encoder assignments	R0	E6, E7, EA, EB		Holding brake	
Model number	K_0	K_1	M	K_0	K_1
8JSA72.eennnffgg-0	192.5	201.7	164.5	42	51.6
8JSA73.eennnffgg-0	226.5	235.7	198.5	42	51.6
8JSA74.eennnffgg-0	260.5	269.7	232.5	42	51.6

Chapter 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.) for securing during transport or as 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	
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 for securing during transport.**
- **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 lead to 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, etc.).**
- **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.**

Chapter 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.

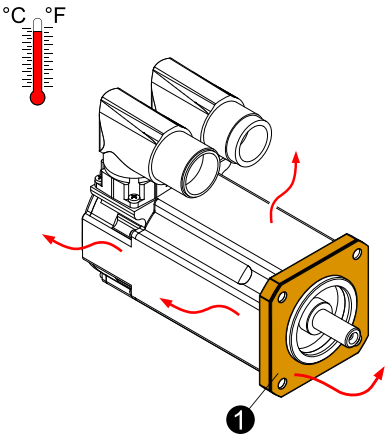
Operating conditions	
Rating class, operating mode per EN 60034-1	S1 - Continuous operation
Ambient temperature during operation	5°C to 40°C [1]
Relative humidity during operation	5 to 95%, non-condensing
Maximum ambient temperature during operation	40°C [1]
Reduction of the nominal current and stall current at temperatures above 40°C	5% per 5°C
Maximum installation elevation	1000 m above sea level [2]
Reduction of rated and stall current at installation elevations Starting at 1000 m above sea level	5% per 1000 m
EN 60034-5 protection (IP code) With oil seal option	IP54 IP65
Type of construction and mounting arrangement per EN 60034-7 (IM code)	Horizontal (IM3001) Vertical, motor hangs on the machine (IM3011)[3] Vertical, motor stands on the machine (IM3031)

1) Continuous operation of the servo motors at an ambient temperature of 40°C to max. 45°C is possible, but this results in premature aging.
2) Requirements that go beyond this must be arranged with B&R.
3) With the IM3011 type of construction and installation (vertical, motor hangs on the machine) there is a risk that production fluids or oils will penetrate the motor on the flange side. Motors or motor-gearbox combinations that should be used in this type of installation must therefore have at least IP65 protection on the flange side.

1 Installation 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 on the machine.



The following points must be observed:

- The opposite side of the mounting flange is not permitted to be thermally insulated. Heat from the motor must be allowed to dissipate sufficiently.
- Air circulation must not be impeded. There must be sufficient cooling air on the motor housing.
- Exceeding the specified maximum values for motor temperature is not permitted.

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.**

2 Load capacity of the shaft end and bearing

8JSA three-phase synchronous motors are equipped with grooved ball bearings that are sealed on both side and lubricated. 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.

Installation

The permissible axial forces F_a during the installation of pinion gears, couplings, etc. depend on the motor size and are listed in the following table:

Motor size	Permissible axial force F_a [N]	Permissible radial force F_r [N]
2	600	150
3	600	340
4	1400	500
5	1740	830
6	2200	1940
7	3000	2300

Operation

Radial force

Radial force Fr 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.

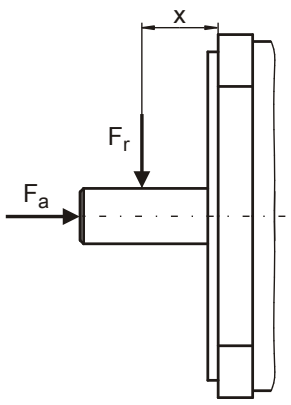
Axial force, shift in shaft position caused by axial force

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 lead to problems with motors with EnDat encoders (E8, E9, EA, EB). As a result, **no** axial force is permitted in the direction of the B-side flange when using these motors.

Determining permissible values of F_r and F_a

For information about determining permissible values of$_{Fr}$ and$_{Fa}$, see th diagrams in chapter "Technical data" (section "Permissible shaft load" for the respective motor).

The permissible values in the diagram are based on a mechanical bearing lifespan of 20,000 h (bearing lifespan 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

Chapter 5 • Installation and connection

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.

2 Safety

Work on motors and their wiring is only permitted to be carried out by qualified personnel [2)] without voltage applied. The control cabinet must first be disconnected from the power supply 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.**

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 during short-term test and trial operations!**

Dangerous voltage

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

2) see "Qualified personnel" on page 9

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 when the power is switched on, 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 when the power is switched on!**
- **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 even during short 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 power system.**
- **Before working on motors, gearboxes or servo drives or in the danger zone of your machine, disconnect them completely from the power system 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 when the power is switched off!**

Danger due to electromagnetic fields

Electromagnetic fields are generated by the operation of electrical power engineering equipment such as transformers, drives 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.**
- **Reduce electromagnetic fields at their source (using shielding, 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 machines 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 switching-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. Any holding brake present 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 power system.**
- **Always operate the motor with all safety equipment. Do this even during short 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 lead to 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 lead to 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 downtime.**
- **Allow motor and gearbox to cool sufficiently before working on it. This is because there is still a risk of burning for a prolonged period of time even after shutting down.**
- **Always operate the motor or gearbox with all safety devices. Do this even during short testing and trial operations!**

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.**

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

Warning!

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.

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 power system 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.

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 lead to 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 mounting flange, which also serves as a cooling surface, directly to 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.

4.1 Fasteners and tightening torques

TBA

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 lead to serious personal injury and damage to property.

- **Properly (also during short-term test and trial operation!) connect the motor housing and the servo drive to the 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 when the power is switched on, 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 when the power is switched on!**
- **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 even during short 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 power system.**
- **Before working on motors, gearboxes or servo drives or in the danger zone of your machine, disconnect them completely from the power system 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 when the power is switched off!**

Warning!

Risk of burns due to hot surfaces!

Touching hot surfaces (e.g. motor and gearbox housings, as well as connected components), can lead to 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 downtime.**
- **Allow motor and gearbox to cool sufficiently before working on it. This is because there is still a risk of burning for a prolonged period of time even after shutting down.**
- **Always operate the motor or gearbox with all safety devices. Do this even during short testing and trial operations!**

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.
They are available in the Downloads section of the B&R website (www.br-automation.com).

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.**

5.1.2 Connectors from other manufacturers

Note:

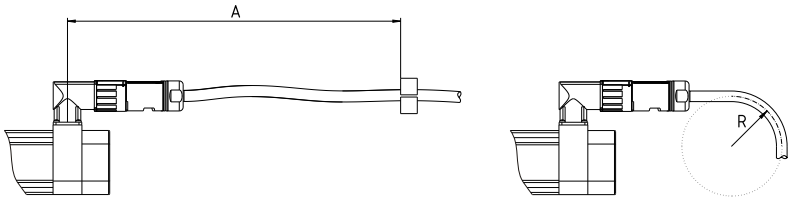
Disturbances caused by electrical or electromagnetic effects!

When using connectors from other manufacturers, EMC faults 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.**

5.1.3 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)

- The minimum radius values can be taken from the current technical data sheet for the cable

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 when the power is switched on, 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 when the power is switched on!**
- **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 even during short 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 power system.**
- **Before working on motors, gearboxes or servo drives or in the danger zone of your machine, disconnect them completely from the power system 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 when the power is switched off!**

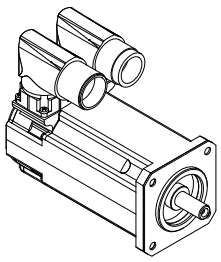
Danger!

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 between -DC1 and +DC1 and less than 42 VDC before starting work with a suitable measuring instrument. 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.

Separate connections for motor and encoder



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 power connector to the motor.
4. Connect the encoder connector to the motor.

Disconnecting

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

5.3 Connecting connectors properly

The power and encoder connectors are available in different variants.

Caution!

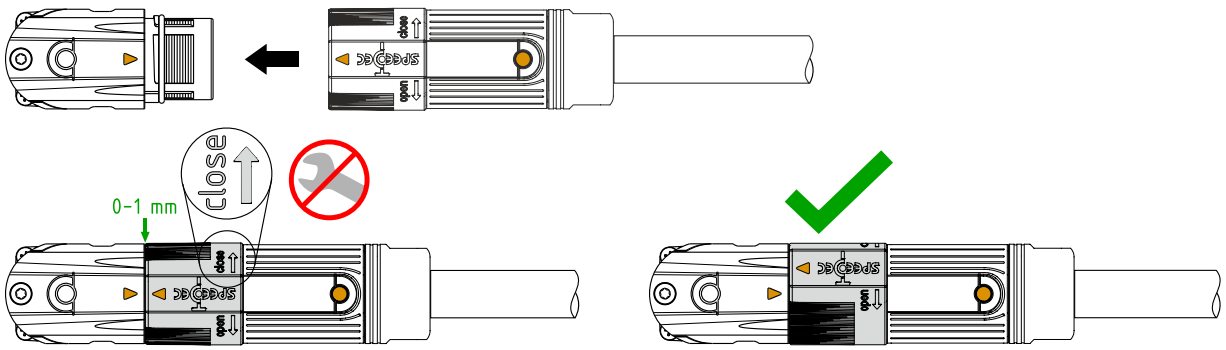
Damage due to improper connector installation!

Incorrectly attached connectors can lead to malfunctions and damage to the motor and encoder!

- **Always attach the connectors without excessive force or the use of tools.**
- **Make sure that the connectors are fully attached and locked if necessary.**

5.3.1 speedtec system

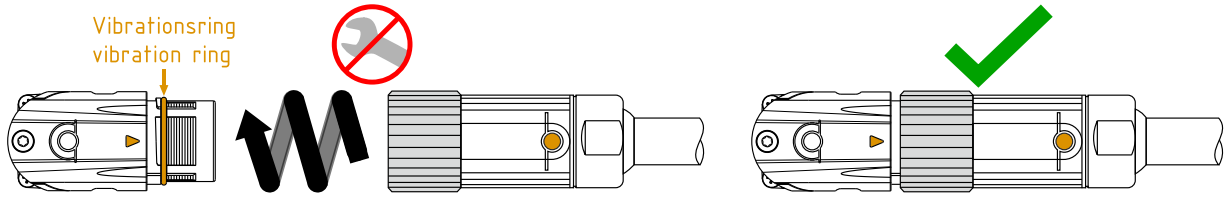
The speedtec system has a tool-free quick-release fastener. During installation, make sure that the connectors are tightly connected and locked.
In addition to the quick-release fastener, the speedtec connector also has internal threads, making it compatible with built-in connectors that use a screw connection.



5.3.2 Screw terminal

The screw terminal does not require a tool. During installation, make sure that the connector is screwed on straight.

If strong vibrations (>4-6 g) are expected during operation, the screw connection must be secured with a **vibration ring**. This prevents the screw connection from coming loose (does not function as a seal).
The vibration rings can be pushed onto the power/signal connector on the motor without requiring a tool. The vibration ring is only permitted to be pushed into the first mounting groove (immediately after the fine thread).



Vibration ring order data

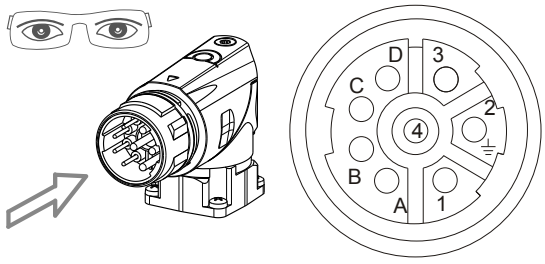
Model number: 8PX000.00-1 50-piece anti-vibration ring size 1 for speedtec connector
Model number: 8PX001.00-1 10-piece anti-vibration ring size 1.5 for speedtec connector

5.4 Connection type

5.4.1 Power connection

5.4.1.1 Pinout power connection.

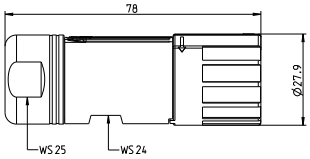
Built-in connector, size 1



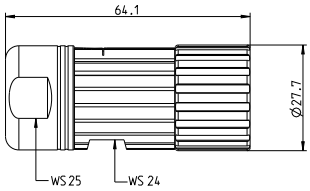
Pin	Description	Function
1	U	Motor connection U
4	V	Motor connection V
3	W	Motor connection W
2	PE	Grounding
A	T+	Temperature +
B	T-	Temperature -
C	B+	Brake +
D	B-	Brake -

5.4.1.2 Power connector dimensions

Size 1 (speedtec)

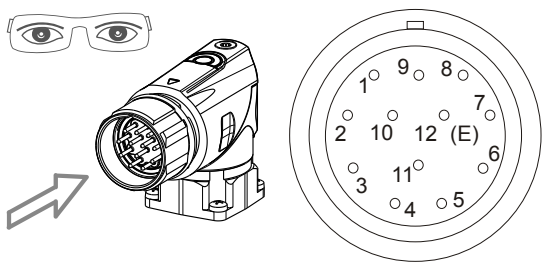


Size 1 (screwed in)



5.4.2 Encoder connection

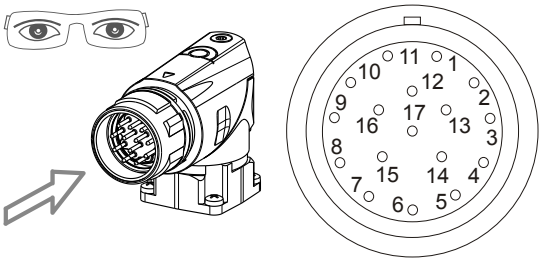
5.4.2.1 Resolver pinout



Pin	Color (LTN)	Description
1	---	---
2	---	---
3	Blue	S4
4	Red	S1
5	Black/White	R2
6	---	---
7	Yellow	S2
8	Black	S3
9	Red/White	R1
10	---	---
11	---	---
12	---	---

5.4.2.2 EnDat connection - Pinout

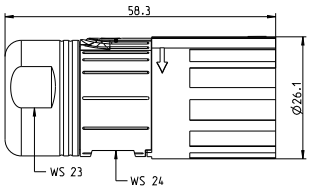
EnDat 2.1



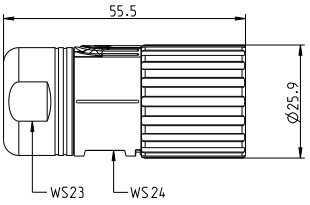
Pin	Color	Description	Function
1	Blue	Sense +5 V	Sense output +5 V
2	---	---	---
3	---	---	---
4	White	Sense COM	Sense output 0 V
5	---	---	---
6	---	---	---
7	Brown/Green	+5 V output / 0.25A	Encoder power supply +5 V
8	Violet	T	Clock input
9	Yellow	T\	Clock input inverted
10	White/Green	COM (1, 3-9, 11, 13-15)	0 V encoder power supply
11	---	---	---
12	Blue/Black	B	Channel B
13	Red/Black	B\	Channel B inverted
14	Gray	D	Data output
15	Green/Black	A	Channel A
16	Yellow/Black	A\	Channel A inverted
17	Pink	D\	Data inverted

5.4.2.3 Encoder connector dimensions

EnDat 2.1 / Resolver (speedtec)



EnDat 2.1 / Resolver (screw connection)



Chapter 6 • Commissioning and operation

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 (e.g. the B&R drive system) as well as the finished machine.

2 Safety

Commissioning is only permitted to be carried out by qualified personnel [1)]

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.**

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 during short-term test and trial operations!**

Dangerous voltage

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

[1)] You can find the definition of "qualified personnel" in chapter "General", subchapter "Safety".

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 when the power is switched on, 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 when the power is switched on!**
- **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 even during short 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 power system.**
- **Before working on motors, gearboxes or servo drives or in the danger zone of your machine, disconnect them completely from the power system 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 when the power is switched off!**

Danger due to electromagnetic fields

Electromagnetic fields are generated by the operation of electrical power engineering equipment such as transformers, drives 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.**
- **Reduce electromagnetic fields at their source (using shielding, 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 machines 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 switching-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. Any holding brake present 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 power system.**
- **Always operate the motor with all safety equipment. Do this even during short 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 lead to 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 lead to 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 downtime.**
- **Allow motor and gearbox to cool sufficiently before working on it. This is because there is still a risk of burning for a prolonged period of time even after shutting down.**
- **Always operate the motor or gearbox with all safety devices. Do this even during short testing and trial operations!**

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 lead to severe damage!

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

2.3 Freely rotating motors

With freely rotating motors, remove any existing shaft keys (or mounting screws or other mounting elements) before operation or implement measures to prevent their ejection. Any shaft protection sleeve present, such as used 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, an existing shaft key (or mounting screws or other mounting elements) can be ejected and cause personal injury and damage to property.

- **Remove or secure shaft keys (or mounting screws or other assembly elements) before operation (even during short-term testing and trial operations!).**
- **Any shaft protection sleeve present, such as used for transport and storage, is not appropriate protection and must also be removed.**

2.4 Holding brake

The motors can be equipped with an optional holding brake. It is only used to hold the motor shaft in place when no power is applied to the motor.

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 protect personnel! The holding brake does not provide protection for personnel!**
- **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".

3 Verification

3.1 To verify before commissioning

Before commissioning, ensure the following:

- The drive is not damaged and the motor is not in the danger zone for other devices.
- The motor is properly set up and mounted.
- The screw connections are tightened correctly.
- Any unused connection threads on the flanged end shield are sealed.
- All components attached to the output shaft are secured against unintentional release.
- Shaft keys and other mounting elements have been removed from freely rotating motors. They can be ejected due to centrifugal force.
- All the necessary protective equipment (mechanical, thermal, electrical) is installed.
- The motor connections are properly installed.
- The protective ground conductor is installed properly and verified.
- The wires are not touching the motor surface.
- The drive is free (release brake).
- The emergency switch-off functions have been checked.
- The fan, if present, has been properly connected and checked to ensure that it is operational.

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 lead to 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.**

3.2 To verify during commissioning

During commissioning, check the following:

- The functionality of all the motor's components and assemblies (e.g. protective equipment, encoder, brake, cooling, gearbox, etc.) has been verified.
- The operating conditions (see chapter "Installation conditions") are observed.
- The holding brake, if present, is released.
- All electrical attachments and connections are properly designed and secured.
- All protective measures 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 have been installed and set up in accordance with the manufacturer's specifications.
- Measures are in place to ensure that the maximum permissible speed n_{max} of the motor cannot be exceeded. The maximum permissible speed n_q is the maximum speed that is permissible for short-time duty.

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.

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	Fix
Motor will not start	Controller enable missing	Activate controller enable
	Controller error, encoder error	Read error listing on inverter/controller, correct error Check the connector to ensure it is connected correctly (see chapter "Installation and connection", section "Ensure proper connections")
	Power supply not present	Check connection and power supply Check the connector to ensure it is connected correctly (see chapter "Installation and connection", section "Ensure proper connections")
	Rotating field	Check phase sequence, replace connection line if necessary
	Brake will not release	Check triggering, connections and power supply
	Brake defective	If necessary, contact B&R.
Runs noisily	Insufficient shielding in connection lines	Check shielding connection and grounding
	Controller parameters too high	Optimize controller parameters
Vibrations	Coupling element or machine not properly balanced	Adjust balance
	Power transmission system misaligned	Realign power transmission system
	Mounting screws loose	Check and tighten 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 motor load and compare with data on nameplate
	Insufficient heat dissipation	Ensure sufficient heat dissipation.
	Brake not releasing sufficiently, causing friction	If necessary, contact B&R.
Current consumption too high - motor torque too low	Rest angle is incorrect	Check rest angle and adjust as needed

If necessary, contact B&R.

For this, the following information should be provided:

- Order description 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)

Chapter 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:

- A maintenance plan and the documentation of inspections and maintenance work is created.
- Motors and cooling air-supplying construction are checked for dirt, moisture and leaks.
- Motors and cooling air-supplying construction are cleaned.
- Checking cables and connectors for damage.
- All safety devices are tested for safe operation.

1 Safety

Work on motors and their wiring is only permitted to be carried out by qualified personnel [2)] without voltage applied. The control cabinet must first be disconnected from the power supply 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.**

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 during short-term test and trial operations!**

Dangerous voltage

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

[2)] see "Qualified personnel" on page 9

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 when the power is switched on, 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 when the power is switched on!**
- **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 even during short 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 power system.**
- **Before working on motors, gearboxes or servo drives or in the danger zone of your machine, disconnect them completely from the power system 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 when the power is switched off!**

Danger due to electromagnetic fields

Electromagnetic fields are generated by the operation of electrical power engineering equipment such as transformers, drives 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.**
- **Reduce electromagnetic fields at their source (using shielding, 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 machines 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 switching-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. Any holding brake present 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 power system.**
- **Always operate the motor with all safety equipment. Do this even during short 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 lead to 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 lead to 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 downtime.**
- **Allow motor and gearbox to cool sufficiently before working on it. This is because there is still a risk of burning for a prolonged period of time even after shutting down.**
- **Always operate the motor or gearbox with all safety devices. Do this even during short testing and trial operations!**

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. It is used to hold the motor shaft when no power is applied to the motor. 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 protect personnel! The holding brake does not provide protection for personnel!**
- **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.

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.**

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 matter 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.**

Chapter 8 • Standards, guidelines and certifications

The motors are intended for use in commercial plants and subject to the following standards and guidelines:

Standards

EN 60034-1	Rotating electrical machines - Rating and performance
EN 60034-5	Degrees of protection provided by integral design of rotating electrical machines
EN 60529	Degrees of protection provided by enclosures
EN 61800-5-1	Safety requirements - Electrical, thermal and energy
UL 1004-1	Rotating electrical machines, general requirements
UL 1004-6	Servo and stepper motors
C22.2 no. 100-14	Motors and generators

Guidelines

Low Voltage Directive 2014/35/EU	The motors correspond to the low voltage directive (conformity).
EMC Directive 2014/30/EU	To operate the motor in accordance with its intended use, it must comply with the protection requirements of the EMC directive. Proper installation (e.g. spatial separation of signal lines and power cables, shielded lines and cables) is the responsibility of the plant installer and system provider. If operating with a power converter, then the EMC guidelines of the power converter, encoder and brake manufacturers must be observed.
RoHS Directive 2011/65/EU	The motors in this series comply with the RoHS Directive (2011/65/EU) for the assessment of electrical and electronic products with respect to the restriction of hazardous substances.

Note:

National, local and plant-specific regulations must also be taken into account!

Certifications

General information	8JSA
C-UR-US listed	Yes
UL file number	E61960

Chapter 9 • Disposal

Separation of materials

To ensure that devices can be recycled in an environmentally friendly manner, it is necessary to separate out the different materials. Disposal must be carried out in accordance with applicable legal regulations.

Component	Disposal	Note
Motors	Electronic recycling	A magnetized rotor is not permitted to be transported or delivered outside the stator under any circumstances!
Gearbox (without oil)	Metal waste	
Waste oil (gearbox)	Special waste	
Modules, cables	Electronic recycling	
Batteries	Special waste	Danger of fire: Do not store batteries together with conductive materials during disposal.
Cardboard/Paper packaging	Paper/Cardboard recycling	

1 Safety

1.1 Protective equipment

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

1.2 Rotor with rare earth magnets

In B&R motors, rotors are installed with rare earth magnets with high magnetic energy densities.

Warning!

Personal injury and damage to property due to rare earth magnets!

The motors are not permitted to be disassembled into individual parts.

A magnetized rotor is not permitted to be transported or delivered outside the stator under any circumstances!

- **Due to the surrounding magnetic fields, the functionality of a pacemaker can be impaired in such a way that it can lead to bodily harm or even death of the carrier.**
- **The surrounding magnetic fields can affect or destroy electronic and mechanical measuring instruments.**
- **The strong magnetic attractive force can lead to uncontrolled movements of the magnet or the attraction of other objects. Personal injury due to impacts or trapping is possible. If magnets are splintered during collision, personal injury cannot be ruled out.**
- **In potentially explosive atmospheres, a spark generated by magnets can lead to serious explosions and cause personal injury and damage to property.**

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