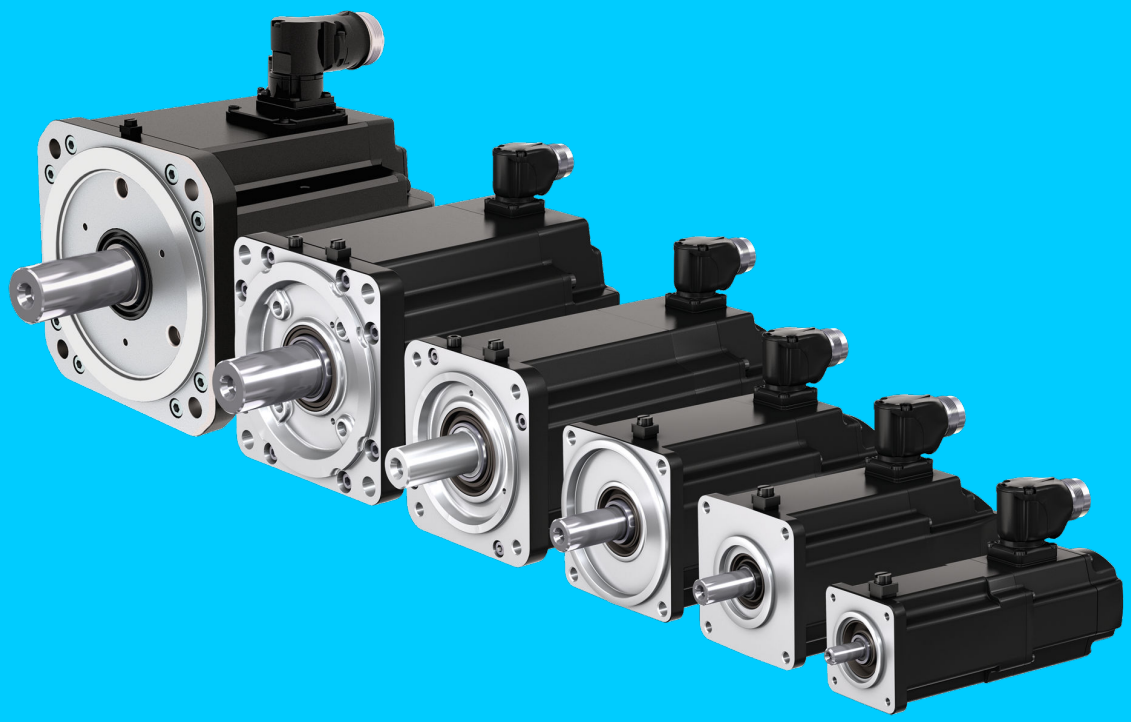
DBR AUTOMATION

rexroth
A Bosch Company

Project Planning Manual

MS2E
Synchronous Servomotors

ATEX Directives 2014/34/EU



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DOK-MOTOR*-MS2E********-PR03-EN-P DC-AE / EPI5 (jw/mb)

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1 About this documentation

1.1 Editions of this documentation

This documentation explains the product characteristics, application possibilities, operating conditions and the operational limits of the motors, contains the technical data of the available motors and provides information on product selection, handling and operation.

Table 1: Record of revisions

Edition	Release date	Notes
01	11/2018	First edition
02	11/2020	Extending product range MS2E10
03	04/2022	Revision, modified topic electrostatics

1.2 Presentation of information

Safety instructions

The safety instructions in this documentation include signal words (danger, warning, caution, note) and a signal symbol (acc. to ANSI Z535.6-2006).

The signal word is intended to draw your attention to the safety instructions and describes the seriousness of the danger. The warning triangle with exclamation mark indicates the danger for persons.

⚠ DANGER	Non-compliance with this safety instructions **will** result in death or severe personal injury.
⚠ WARNING	Non-compliance with this safety instructions **can** result in death or severe personal injury.
⚠ CAUTION	Non-compliance with this safety instructions **can** result in moderate or minor personal injury.
NOTICE	Non-compliance with this safety instructions **can** result in material damage.

Safety symbols

In the documentation, the following internationally standardized safety signs and graphic symbols are used. The meaning of the symbols is described in the table.

Table 2: Meaning of safety signs

Safety symbols	Meaning
	Warning against dangerous electric voltage
	Warning against hot surfaces
	Warning against rotating machine parts
	Warning against overhead load
	Electrostatic sensitive devices
	Prohibited for persons with active implantable medical devices (AIMD) or passive metallic implants (body aids) as well as for pregnant women

Safety symbols	Meaning
	Do not carry along metal parts or clocks.
	Hammer scales are forbidden

Meaning of symbols

Table 3: Meaning of symbols

Symbol	Meaning
	Reference to supplementary documentation
	Explosion protection identification
	The UL Recognized Component Mark identifies recognized component parts which are components of a bigger product or system.
	The letters “C” and “E” stand for “Conformité Européenne”. The CE-marking expresses the conformity of a product with relevant EC-regulations.
	Components for the use in systems for “integrated safety technique” prepared.
	The symbol indicating "separate collection" for all batteries and accumulators is the crossed-out wheeled bin.

Markup

The following markups are used for a user-friendly text information representation:

Remark

This note gives important information, which must be observed.

- Listings on the first level contain a bullet point
  - Listings on the second level contain a dash

Instruction

Instruction

➡ Result of one instruction

Instruction multilevel

1. Action step one
2. Action step two

➡ Result of an instruction

Please comply with the order of the handling instructions.

2 Safety instructions

2.1 Important directions on use

2.1.1 Intended use

Prerequisites for proper and safe use of the motors are proper transport, appropriate storage, proper assembly and connection, careful maintenance, operation and overhaul.

The motors have been exclusively designed for installation in industrial machinery. The motors have been designed and manufactured in compliance with the directives and harmonized standards specified in the following.

EU Product standard	
EN 60034-1:2010 + Cor.:2010	Rotating electrical machines - Part 1: Rating and performance (IEC 60034-1:2010, modified)

Valid within EU

EU Directives	
2014/34/EU	ATEX Directive 2014/34/EU
EN Standards	
EN IEC 60079-0:2018/AC:2020	Explosive atmospheres - Part 0: Equipment - General requirements (IEC 60079-0:2017)
EN IEC 60079-7:2015/A1:2018	Explosive atmospheres - Part 7: Equipment protection by increased safety "e" (IEC 60079-7:2015/A1:2017)
EN 60079-31:2014	Explosive atmospheres - Part 31: Equipment dust ignition protection by enclosure "t" (IEC 60079-31:2013)

The observance of and compliance with the specifications of the operating instructions (DOK-MOTOR*-MS2E*NN****-ITRS-**-P) are part of the intended use.

The here described motors are only allowed to be used in an area for components for Group II, Category 3G/3D or Gc, Dc.

- where no explosive atmosphere can occur during **normal operation**, as this is avoided by ventilation and monitoring.
- where explosive atmosphere can occasionally occur in an **event of fault** and this atmosphere can be eliminated and intercepted by the user immediately after occurrence. Thus the explosive atmosphere appears rarely and for a short period of time.

This corresponds to the use of motors in **zone 2** and **zone 22**.

The machine manufacturer must evaluate the electric and mechanic safety as well as environmental influences in the assembled state of the machine according to the Machine Directive 2006/42/EC and DIN EN 60204-1 (safety of machines).

The electrical installation must comply with the protection requirements of EMC Directive 2014/30/EU. The plant manufacturer is responsible for appropriate installation (for example: physical separation of signal and power cables, using shielded cables, ...). The EMC instructions of the converter manufacturer must be observed.

The motors must be left in their original state. It is not allowed to do any constructional modifications. In the case of contravention, applicability according to intended use will expire (e.g. safety technique or ATEX conformity...).

The machine may not be commissioned before conformity with these directives has been confirmed.

2.1.2 Electrostatic sensitive devices (ESD)

The motors contain parts which underlie an electrostatic danger. These components, especially temperature sensors of the motor winding can be destroyed by improper use.

Avoid, e.g. direct contact of open wires or contacts of the connection cable of temperature sensors without being electrostatically discharged or grounded.

Remark

Do suitable ESD protective measures before you handle imperiled components (e.g. ESD protective clothes, wristlets, conductive floor, grounded cabinets and working surfaces).

2.2 Qualification of personnel

Any work with or on the described product may only done by qualified or skilled personnel. For the purpose of this manual, qualified personnel means persons who are familiar with transporting, installing, mounting, commissioning and operating the components of the electrical drive and control system and the associated hazards.

Within the meaning of explosion protection, the plant application, selection of devices and their construction must be made by persons whose education contained instruction in several ignition protection types and installation techniques, correct regulations and rules as well as general principles of zoning. The person must be competent to do the mode of work. Qualification of personnel contains knowledge and observance of the specifications in EN 60079-14:2014 Explosive atmospheres - Part 14: Electrical installations design, selection and erection (IEC 60079-14:2013) ( ). The personnel must be trained in regular intervals.

All persons working on, with or in the vicinity of an electrical system must be informed of the relevant safety requirements, safety guidelines and internal instructionsEN 50110-1:2013 (Operation of electrical installations - Part 1: General requirements).

2.3 General safety instructions

Important! Please read all instructions before motor installation.

Do not install or operate motors or components of the electric drive and control system before you have not carefully read all delivered documents.

Please observe the particular applicable national, local and system-specific regulations, the safety instructions in the documentation and the warning and informative labels on the motors.

Improper use of the motors and failure to follow the safety instructions in this document may result in material damage, personal injury, electric shock or, in extreme cases, to death!

In the case of damage due to non-observance of the safety notes, Bosch Rexroth assumes no liability.

Applications for functional safety are only allowed if the motors have the SI-sign on the rating plate.

2.4 Product- and technology-dependent safety instructions

2.4.1 Protection against explosion hazard

Product use only in hazardous areas according to the specified labeling on the product

This product is only allowed to be used in an area of use which is specified on the type plate according to the explosion protection standards. In the case of several ATEX designations labelled on the type plate, likelike gas and dust protection, please observe that during operation only one hazardous atmosphere occurs (no combination of several). Simultaneous occurrence of gas and dust Ex atmospheres is not permitted.

Do any maintenance in non-hazard atmosphere.

Observe the conditions on use

Observe the notes in the application conditions and do not exceed the specified limit values.

Observe residual risks

Specified residual risks and special using conditions must be evaluated by the plant manufacturer and operator according to the product application. This makes own measures necessary to prevent risks.

2.4.2 Protection from electric voltage

Work required on the electric system may only be carried out by skilled electricians. Tools for electricians (VDE tools) are absolutely necessary.

Before working:

- Enable.
- Secure against reactivation.
- Ensure de-energization.
- Ground and short-circuit.
- Cover or shield any adjacent live parts.

After completing the job, cancel the measures in reverse order.

Dangerous voltage occurs during operation! Danger to life, risk of injury by electric shock!

- Before start-up, connect the protective conductors on all electric components according to the connection plan.
- Operation, even for short measuring purposes is only allowed with fixed connected protective conductor on the specified points of the components.

2.4.3 Protection from mechanical danger

Dangerous movements! Danger to life, risk of injury, heavy injury or material damage.

- Do not stay within the motion zone of the machine. Avoid unauthorized access into the danger zone.
- Additionally secure vertical axes to prevent them from sinking or descending after having shutdown the motor, for instance as follows:
  - Mechanically lock the vertical axis,
  - providing an external braking / catching / clamping device, or
  - ensure sufficient weight compensation of the axes.

  Only using the serially delivered **motor holding brake** or an external holding brake activated by the drive controller **is not suitable for personal protection!**

Rotating parts! Danger to life, risk of injury, heavy injury or material damage.

- Secure key and/or transmission elements against ejection.
- Install covers on dangerous rotating machine parts before start-up.

2.4.4 Protection against magnetic and electromagnetic fields

Health hazard for persons with active body aids or passive metallic implants and for pregnant women.

Magnetic and electromagnetic fields are created in the direct environment of live conductors or permanent magnets of electro motors and are a serious danger for persons.

Observe the country-specific regulations. For Germany, please observe the specifications of the occupational insurance association BGV B11 and BGR B11 regarding “electromagnetic fields”.

- For persons with active body aids (like heart pacemakers), passive metallic implants (like hip prosthesis) and pregnant women possible hazards exist due to electro magnetic or magnetic fields in direct environment of electric drive and control components and the corresponding live conductors.

  Access into these areas can be dangerous for these persons:
  - Areas, in which components of electrical drive and control systems and corresponding live conductors are mounted, activated or operated.
  - Areas in which motor parts with permanent magnets are stored, repaired or assembled.
- Above mentioned persons must contact their attending physician before entering these areas.
- Please observe the valid industrial safety regulations for plants which are fitted with components of electrical drive and control systems and corresponding live conductors.

Crushing hazard of fingers and hands due to strong attractive forces of the magnets!

- Handle only with protective gloves.

Risk of destruction of sensitive parts! Data loss!

- Keep watches, credit cards, check cards and identity cards and all ferromagnetic metal parts, such as iron, nickel and cobalt away from permanent magnets.

2.4.5 Protection against ignitable electrostatic discharges

Danger of explosion due to electrostatic discharge

Electrostatic discharges may ignite gases, vapors and dust. Electrostatic charges may be caused e.g. by the following processes:

- electrostatic painting
- pneumatically conveyed dust or bulk material
- hydraulically conveyed or flowing liquids and droplets
- mechanically driven belts, brushes and films, etc.

Danger of explosion due to highly charge-generating processes

Highly charge-generating processes may cause bush discharges or propagating bush discharges and lead to explosions. This must be prevented. This, in turn, may lead to death, severe injury and damage to property.

Carry out cleaning work only with a moist cloth

Clean the motor with a moist cloth to avoid electrostatic charge. Rubbing with non-conductive materials must be avoided to prevent electrostatic charges resulting in ignition hazards.

2.4.6 Protection against burns

Risk of burns due to hot motor surfaces!

- Avoid contact with hot motor surfaces. **Temperatures may rise over 60 °C**.
- Allow the motors to cool down long enough before touching them.
- Temperature-sensitive components may not come into contact with the motor surface. Ensure appropriate mounting distance of connection cables and other components.

2.4.7 Electrostatic sensitive devices (ESD)

The motors contain parts which underlie an electrostatic danger. These components, especially temperature sensors of the motor winding can be destroyed by improper use.

Avoid, e.g. direct contact of open wires or contacts of the connection cable of temperature sensors without being electrostatically discharged or grounded.

Remark

Do suitable ESD protective measures before you handle imperiled components (e.g. ESD protective clothes, wristlets, conductive floor, grounded cabinets and working surfaces).

3 Explosion protection

3.1 Product description

The MS2E03, -04, -05, -06, -07, 10 synchronous servomotors are used for operation with VPWM inverters (V = voltage DC link inverter) and PWM control methods (Pulse-Width-Modulation)(Versorgung durch Umrichter / For converter operation). Labeling on the type plate is "Inverter Duty VPWM". The motors are certified for gases and dusts.

The ignition protection type for gases, vapors is according to the protection principle “Increased safety" Ex ec.

The ignition protection type for dust is according to the protection principle “Protection by housing" Ex tc.

The housing design is made of aluminum / aluminum die casting. Cooling is done via heat exchange of the open coolant circuit by temperature difference between housing and surrounding coolant (self-cooling).

The motors can be fitted with an additional holding brake and with a Multiturn or Singleturn encoder.

The electrical connection is done by means of SpeedCon plug-in connectors. The permissible ambient temperatur range is: 0°C ... 40 °C

3.2 ATEX labeling for MS2E motors (gas)

MS2E motors are suited for use in hazardous areas with gas atmosphere according to the following labeling.

II 3G Ex ec IIB T155°C (T3) Gc X

Table 4: ATEX labeling und significance (gas)

Sign	Meaning
	Symbol Ex
II	Equipment group II which is suitable for all potentially explosive areas other than firedamp-endangered excavations
3	Device category 3 means, equipment in this category is intended for use in areas in which explosive atmospheres caused by gases, vapors, fog, dust/air mixtures are unlikely to occur or, if they do occur, are likely to do so only infrequently and for a short period only.
G	G = Gas
Ex	The European standard for explosion protection has been applied.
ec	Ignition protection type “Increased safety” for EPL Gc
IIB	Explosion group
T 155 °C	Maximum surface temperature of the motor
(T3)	Temperature class T3 <200°C
Gc	Device protection level (EPL) classification Gc for advanced safety level for use in potentially gas explosive atmospheres where there is no ignition risk during normal operation or have any additional safety measures which ensure in the event of foreseeable faults/ malfunctions no ignition risk exists.
X	Labeling “Special conditions on use”

3.3 ATEX labeling for MS2E motors (dust)

MS2E motors are suited for use in hazardous areas with gas atmosphere according to the following labeling.

II 3D Ex tc IIIC T155°C Dc X

Table 5: ATEX labeling und significance (dust)

Sign	Meaning
	Symbol Ex
II	Equipment group II which is suitable for all potentially explosive areas other than firedamp-endangered excavations
3	Device category 3 means, equipment in this category is intended for use in areas in which explosive atmospheres caused by gases, vapors, fog, dust/air mixtures are unlikely to occur or, if they do occur, are likely to do so only rarely and for a short period only.
D	D = dust
Ex	The European standard for explosion protection has been applied.
tc	Ignition protection type “Protection by housing” for EPL Dc
IIIC	Dust group
T 155 °C	Maximum surface temperature of the motor housing
Dc	Device protection level (EPL) classification Dc for advanced safety level for use in potentially flammable atmospheres where there is no ignition risk during normal operation or have any additional safety measures which ensure in the event of foreseeable faults/ malfunctions no ignition risk exists.
X	Labeling “Special conditions on use”

3.4 Special conditions on use X

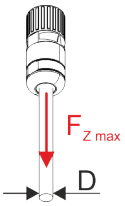
The ATEX designation for MS2E motors, specified in the declaration of conformity and on the type plate, is labeled with an "**X**“ at the end. Please observe the following special conditions for a safe operation of the motors in your construction:

Ambient temperature

Limited ambient temperature area according to EN IEC 60079-0:2018/AC:2020. The allowed area of ambient temperature for MS2E motors is 0 ... 40 °C (with de-rating 0 ... 60 °C ➦ Chapter 10.2 Derating in case of deviating ambient conditions. on page 148).

Tensile load

Limited values for tensile load according to EN IEC 60079-0:2018/AC:2020. It is not allowed to exceed the specified tensile stress values of the cables connected using connectors. The maximum allowed values are determined in the following context.



$F_{Z\,max} = 20\ [N/mm] \times D \times 0{,}25$

$F_{Z\,max}$: [N]
D: [mm]

Fig. 1: Determination of maximum tensile load of connection cables
$F_{Z\,max}$ Tensile load of connection cable (maximum value)
D Cable outer jacket diameter (maximum value)

⚠ WARNING	**Danger of explosion due to exalted tensile load of connection cables**
	Adherence of specified limits.
	Mechanical fastening of cable ends (e.g. use cable clamps, ...).

Impact strength of plug connectors in the case of mechanical danger

The impact strength of the plug connectors on MS2E motors correspond to a low degree of mechanical danger acc. to EN IEC 60079-0:2018/AC:2020, Tab. 15, line b).

The risk of mechanical endangerment onto the plug-in connectors on motors and cables due to impact from different directions must therfore be evaluated by the user. Possible risks due to a higher degree of endangerment can reduce the mechanical protection of the plug connectors.

The plug-in connectors fulfill the requirements about impact strength according to the following table.

Table 6: MS2E plug-in connector (special conditions: Mechanical hazard

Plug-in connector	Impact strength of plug-in connectors satisfies low degree of mechanical hazard, in the case of impact from ...		
	Top	Side	Below
M17 Encoder	Yes, with assembled plug-in connector protective cover SUP-M02-MS2E		No
M23 Hybrid	yes, with assembled plug connector protective cover SUP-M01-MS2E		No
M40 Power	Yes, with assembled plug-in connector protective cover SUP-M03-MS2E		No

- During machine construction avoid possible impacts onto the electric connections and plug connectors.
- Do a risk evaluation about mechanical hazard for connectors on motors and cables in the machine due to impacts from different directions.
- If necessary, assemble the plug connector protective cover SUP-M0x-MS2E.
- Avoid impacts onto the plug-in connectors if there is a higher degree of mechanical danger due to additional devices or design changes to the machine.

⚠ WARNING	**Danger of explosion due to mechanical hazard of plug connectors.**
	Provide arrangements to protect the plug-in connector mechanically (e.g. covers, protective plates, ...).

To protect the plug connector, Rexroth offers plug connector protective cover as an optional accessory, see➥ Chapter 9.7 Plug connector protective cover on page 140.

Avoid electrostatic charge resulting in propagating brush discharges

The type plate and the warning labels of MS2E motors are made of plastic foil and limited conducting (disruptive voltage > 4 kV, see EN IEC 60079-0:2018/AC:2020). Follow the instructions below.

⚠ WARNING	**Danger of explosion due to propagating brush discharges** Do a risk evaluation about occurance of highly charge-generating processes with the danger of propagating brush discharges. Avoid propagating brush discharges or provide measures to avoid propagating brush discharges.

➦ Chapter 2.4.5 Protection against ignitable electrostatic discharges on page 12

Maintenance and repair

Maintenance and repair of motors must exclusively be done by the certified Rexroth service.

3.5 Conditions for use of MS2E motors in Equipment Group II, Category 3.

⚠ WARNING	**Explosion hazard and danger to life, or substantial property damage!** All used **components and accessory parts** must fulfill the requirements for explosion protection according to the 2014/34/EU directive. The **conditions on use** given in this documentation must be taken into account for any project planning and be observed during operation.

3.5.1 Maximum housing temperature

In the case of intended use, the maximum housing temperature is significantly below 155 °C. Observe external heat and cooling sources when determining the operation temperature. Project-specific electrical/thermal evaluations must be carried out by the customer if they deviate from the Bosch Rexroth specification. If necessary, project-specific metrological verifications are required that reflect the actual ambient conditions at the place of use.

3.5.2 Connection conditions

The motors can be operated with Rexroth controllers (ctrlX / IndraDrive). In the case of using drive controllers of other manufacturers, the following special conditions must be fulfilled ➦ Chapter 10.3 Operation on foreign converters on page 150.

3.5.3 Plug-in connectors

Make sure the environment is dry and clean when connecting or disconnecting connectors.

Ignition sparks can occur, when motor connectors are disconnected or connected under load.

⚠ WARNING	**Risk of personal injury or damage to property due to disconnecting or connecting live plug connections!** – Only disconnect or connect plug connections when they are dry, clean and de-energized. – During operation of the system, all plug connections must be firmly locked or screwed tight.

3.5.4 Ground conductor

The motors must be grounded via a motor cable and via a second separate ground conductor with minimum **4 mm²** cross section. Check the proper installation of the protective and ground conductor connection before startup.

- Protective conductor motor cable
- Ground conductor see ➦ Chapter 9.8 Ground connection on page 144

The redundant protective conductor installation ensures a safe drain of occurring discharge currents even in error case (e.g. at interrupted protective conductor).

3.5.5 Corrision

Prevent motor corrosion which can occur due to aggressive substances like certain coolants and lubricants as well as cutting oils or salt mist.

3.5.6 Switch-off

Energies stored in the intermediate circuit have to be reduced or insulated as soon as possible through the activation of the emergency stop device, so that in the case of a failure the risk of an effect into the danger zone is reduced (ATEX directive 2014/34/EU).

For example, this can be achieved as follows:

- Reduce the energy via an intermediate short circuit. For information about functionality and availability, refer to the documentation of the control device; when using third-party inverters, contact the manufacturer.
- Isolation of the energies before they are transferred into the potentially explosive atmosphere by isolating the voltage of the lines and motors present in the potentially explosive atmosphere.

3.5.7 Holding brake

Use the optional holding brake in **normal operation** only in standstill time.

Malfunction

Only in an **event of fault**, i.e. in the case of a fault in the system, may the brake be activated when the motor is turning, e.g. in order to prevent a dangerous lowering of vertical axes. In this case, sparks may be generated in the brake and increased temperatures may occur within the motor. When a fault occurs, the operator must eliminate it immediately.

Functional test

Before commissioning and when operating the motor periodically, the functions of the brake are to be tested with a suitable braking test according to the risk analysis of the plant operator. Further information and data can be found in the respective functional descriptions of the drive controller firmware.

For further general notes about holding brakes see ➦ Chapter 5.10 Holding brake on page 33.

3.5.8 Acceptance test

Before initial start-up of the system or after changing a motor, check your installation with regard to the directives according to EN IEC 60079-0:2018/AC:2020. The acceptance report must confirm compliance with the instructions and conditions of use given here.

3.5.9 Residual risks

The existing residual risks are to be observed by the user, when the installation is designed.

- Overstress
  - When the motor is overloaded, including cases where errors in the mechanical or electrical equipment of the machine cause such overloading, high temperatures may occur that result in explosion hazards.
- Operation in explosive dust atmosphere.
  - An operation in explosive dust-atmosphere can built a layer on the motor during a residence time, which does no longer ensure a sufficient motor cooling.
- Grounding and discharge currents

  - Variable-speed drive systems cause unavoidable discharge currents. Please observe a proper installation of protective conductor and potential equalization line. In the case of interrupted protective conductor and potential equalization line due to occurring error cases during operation or faulty connections can raise sparks on transition points.
- Temperature control
  - The failure of the single-channel temperature monitor in the device system may occur, as the result of an error, and might not be detected, even if the motor is operated within the normal temperature range and load cycle.

4 Identification

4.1 Type plate

The type plate contains all essential electrical data, the serial number, date of manufacture, mark of conformity as well as the information provided by the manufacturer.

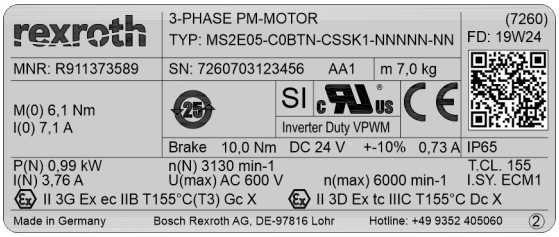


Fig. 2: Type plate MS2E (example)

Table 7: Type plate specification MS2E

Symbol	Meaning
TYPE	Motor type
SN	Serial number
P(N)	Rated power - 60 K
I(N)	Rated current - 60 K
n(N)	Rated speed - 60 K
M(0)	Standstill torque - 60K
I(0)	Standstill current - 60K
Ex	ATEX labeling explosion protection (gas) ATEX labeling explosion protection (dust)
Brake	Holding brake data (optional)
FD	Manufacturing date
n(max)	Maximum speed
U(max)	Maximum voltage UL
IP65	Degree of protection IPxx
m	Mass
T.CL.	Thermal class
I.SY.	Insulation system identification
SI	Use in systems for “Integrated Safety Technology” prepared

The following marks of conformity are used:

Table 8: Meaning of marks of conformity

Certification mark	Meaning
c UL us	The UL Recognized Component Mark (UL recognized) identifies recognized component parts which are components of a bigger product or system. The recognition relates on Standards UL 1004-1 „Rotating electrical machines –General requirements“, UL 1004-6 „Servo and stepper motors“, CSA C22.2 No. 100 „Motors and generators“.
CE	The CE-marking confirms the conformity of a product with relevant EC-regulations. The conformity of MS2E motors is confirmed according to Low voltage directive 2014/35/EU ATEX directive 2014/34/EU, EN 60034-1 and EN 60034-5.

Certification mark	Meaning
	Motors labelled with the symbol EFUP 25 (enviromental-friendly use period) can be used for 25 years as intended before substances limited in their concentration according to China RoHS2 may leak and subsequently pose a risk to environment and health.

4.2 Safety instructions on the product

Please note the safety and prohibitive sign on the motor. The sign significance is explained in the following.

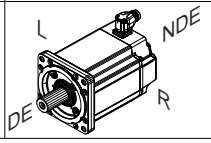
Table 9: Safety instructions on the product

Information	Meaning
	**Hot surfaces with temperatures over 60 °C may cause burns** Let the motors cool down before working on the motors or in close proximity to the motors. The thermal time constant stated in the technical data is a measure for the cooling time. Cooling down can require up to 140 minutes. - Wear safety gloves. - Do not work on hot surfaces.
	**Motor damage due to strikes onto the motor shaft** Do not strike the shaft end and do not exceed the allowed axial and radial forces of the motor.

⚠ WARNING	**Explosion hazard!** – NEVER DISCONNECT PLUG CONNECTORS UNDER LOAD – DANGER DUE TO ELECTROSTATIC DISCHARGES - SEE OPERATING INSTRUCTIONS – DO NOT OPEN INSIDE A POTENTIALLY EXPLOSIVE ATMOSPHERE – Use motor cables with a thermal stability of at least 80 °C (176 °F)

5 Features and functions

5.1 Basic data

Product	3~ PM motor
Type	MS2E
Ambient temperature during operation	0 ... 40 °C (without de-rating)
Type of protection	IP65 with shaft sealing ring (EN 60529:1991 + A1:2000 + A2:2013)
Cooling mode	IC410, Self-cooling (EN 60034-6:1993)
Motor design	IM B5 (EN 60034-7:1993 + A1:2001)
Coating	Varnish RAL 9005
Flange	similar to DIN 42948:1965-11
Shaft end	Cylindrical (DIN 748-3), centering hole with thread "DS" (DIN 332-2:1983-05), With keyway (half key balancing according to ISO 21940-32:2012)
Concentricity, run-out, alignment	Standard tolerance N (DIN 42955:1981-12)
Oscillating quantity level	Level A (EN 60079-14:2014) up to rated speed
Installation altitude	0 ... 1,000 m above MSL (without derating)
Sound pressure level	MS2E03 ... MS2E10: 75 dB(A) +3 dB(A)
Thermal class	155 (F) (EN 60034-1)
Encoder system	**Advanced Performance ACURO®link** Optical absolute value encoder 20 bit, digital in single or multiturn variant **High performance ACURO®link** Optical absolute value encoder 24 bit, digital in Single- or Multiturn design
Electrical connection	M23 **Single cable connection**, (rotatable, quick lock SPEEDCON®) **Double cable connection** (only MS2E10) with M40 Power connectors (rotatable, quick lock SPEEDCON®) Encoder connector M17 (rotatable, quick lock SPEEDCON®)
Holding brake (option)	Electrically released U_N 24V DC (±10%)
Motor ends	 DE Drive End, A-side NDE Non Drive End, B-side L Left R Right

Remark

In the case of special design, details named in the operating instructions can deviate. In this case, order the supplementary documentation.

5.2 Mechanical interfaces

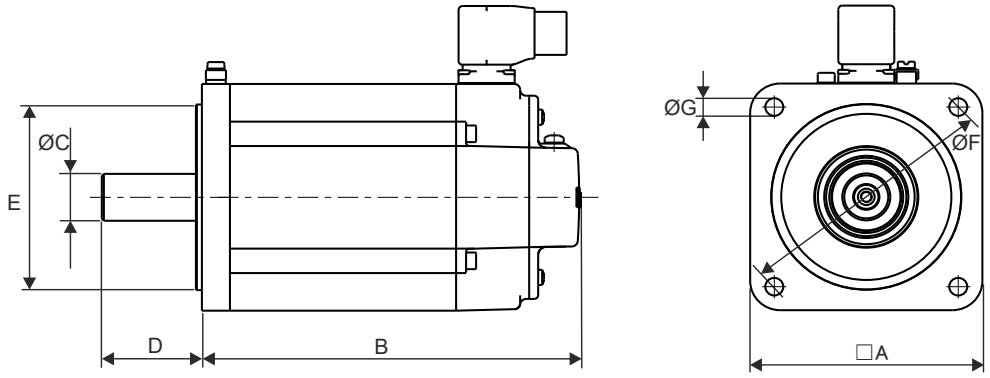


Table 10: Mechanical interface flange, shaft

Type	A Flange [mm]	B Length [mm]	C Shaft Ø [mm]	D Shaft length [mm]	E Cen-tering collar [mm]	F Hole circle [mm]	G Mountin g holes [mm]
MS2E03-B	58	*)	9	20	40	63	4.5
MS2E03-D	58	*)	11	23	40	63	4.5
MS2E04	82	*)	14	30	50	95	6.6
MS2E05	98	*)	19	40	95	115	9
MS2E06	116	*)	24	50	95	130	9
MS2E07	140	*)	32	58	130	165	11
MS2E10	196	*)	38	80	180	215	14
*) see specifications							

Use the following screws and washers for flange assembly.

Table 11: Tightening torque of mounting screws

Screw	M4	M6	M8	M10	M12	M14
Mounting holes Ø [mm]	4.5	6.6	9	11	14	18
Tightening torque M_A[Nm] at μ_K= 0.12	3.0	10.1	24.6	48	84	206
Washer DIN EN ISO 28738	-	-	yes	yes	yes	yes

5.3 Rotor inertia

Motors with low rotor inertia (type code designation 0) are optimizes for dynamic applications with maximum acceleration capacity.

In the mean rotor inertia design (type code designation 1), the motor is optimized for applications with increased requirements on controllability and synchronous operation.

5.4 Winding code

The speed to the corresponding winding designations are standard values. The specified rated speed can deviate from the specified in the technical data sheet. The speed is determined to define the winding designation on which the standstill torque on the voltage limit characteristic curve $U_{ZK\ 1}$ is reached (tolerance range ca. ± 250 1/min).

Table 12: Winding code acc. to type code (speed at DC bus voltage UZK 1)

Labeling	Nominal speed [1/min]
BF	1500
BH	2000
BN, CN	3000
BQ, CQ	4000
BR, CR	4500
BT	6000
BY	9000

5.5 Thermal motor protection

The motor temperature is monitored by two systems that are operated independently of each other. The mounted **temperature sensor** and the drive-internal **temperature model** ensure the best protection of motors against thermal overload.

The threshold values for motor temperature monitoring are contained in the encoder data memory and are read in and monitored automatically during the operation with Rexroth controllers. Threshold values for MS2E motors are:

- Motor-warning temperature (125°C)
- Motor-disconnection temperature (130°C)

Table 13: MS2E temperature sensor

Motor	Temperature sensor
MS2EXX-XXXXX-XXXXX-XX**N**XX-XX	PT1000

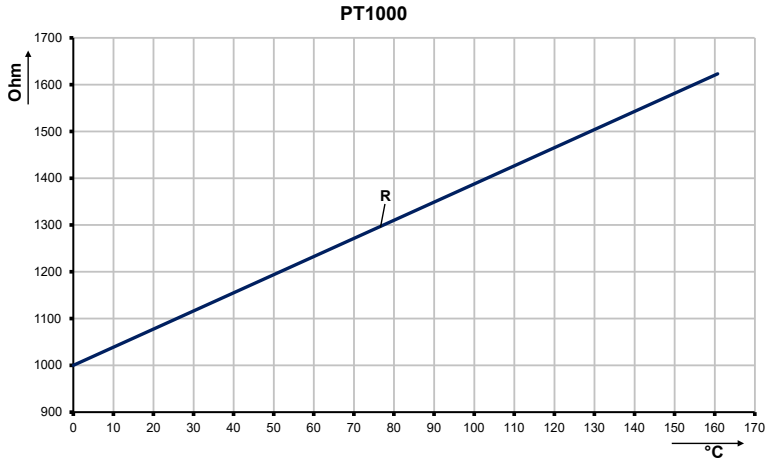


Fig. 3: Characteristic curve PT1000

In case of motors with digital encoder (E/F), the resistance values are transmitted digitally via the encoder interface (cyclic communication).

5.6 Cooling mode

5.6.1 Self-cooling (IC410)

In case of self-cooling motors, the heat dissipation is realized via natural convection and radiation to the ambient air as well as by heat conduction to the machine construction.

The specified nominal data is reached at ambient temperatures of up to 40 °C. Unhindered vertical convection has to be ensured by a sufficient distance of 100 mm to adjacent components. Any usage at increased ambient temperature (0 ... 60°C) is possible. Please note the details in ➦ Chapter 10.2 Derating in case of deviating ambient conditions. on page 148.

Pollution of the surface of the motor reduces heat dissipation and can result in thermal overload. The availability of the system can be increased by regular checks and cleaning of the motors. Please ensure access to the motors for maintenance purposes.

5.7 Encoder

ADVANCED-Encoder “ Cx ” use an optical sampling method. Data output of process and parameter data (electronic type plate) happens digitally via ACURO®link-Protocol. The encoder “ Cx ” fulfills the specification for safety technique according to SIL 2 and PL d. Temperature signals are transmitted digitally via the encoder interface.

HIGH-Geber " Dx " uses an optical sampling method. Data output of process and parameter data (electronic type plate) happens digitally via ACURO®link-Protocol. The encoder " Dx " fulfill the specifications for safety technique according to SIL 3 and PL e. Temperature signals are transmitted digitally via the encoder interface.

The singleturn design allows absolute, indirect position recording within one mechanical motor rotation.

The multiturn design allows absolute, indirect position recording within 4096 mechanical motor rotations.

5.7.1 Technical data of encoder

Table 14: Technical data of encoder

Designation	Symbol	Unit	Encoder			
			CM	CS	DM	DS
Encoder interface	-	-	ACURO®link			
Functional encoder resolution (singleturn)		-	20 bit		24 bit	
Distinguishable rotations	U_{turn}	-	4096	1	4096	1
System accuracy of encoder [1]	∢	''	± 36		± 20	
System accuracy typical/maximum [2)]	∢	''	±50 / ± 70		±20 / ± 30	
Encoder voltage supply	$VCC_{Encoder}$	V	7...12			
Encoder max. current consumption	$I_{Encoder}$	mA	60		130	
Functional safety						
Safety integrity level		-	SIL 2		SIL 3	
Performance level		-	PL d		PL e	

1) The installation mechanics can sporadically influence the accuracy of the overall system.

2) Reachable overall system accuracy by taking the installation mechanics into consideration, typical and maximum value.

For additional notes about integrated safety technique and prerequisites for using motors with encoder systems for using safety technique with IndraDrive refer to **Rexroth IndraDrive Integrated Safety Technology “Safe Motion” DOK-INDRV*-SI3*SMO-VRS-APxx-xx-P.**

5.8 Degree of protection

The protection type according to EN 60529:1991 + A1:2000 + A2:2013 is determined by the abbreviation IP (International Protection) and two code numbers for the degree of protection. The first reference number stands for the degree of protection against contact and ingress of foreign bodies, the second one stands for the degree of protection against ingress of water.

Standard motors (specification according to type plate)

- **IP65** with shaft sealing ring

5.9 Output shaft, balancing and extension elements

5.9.1 Shaft end

Table 15: Options according to type code

Shaft	Type
Smooth, with shaft sealing ring	G
Keyway, with shaft sealing ring	K

Smooth shaft

Cylindrical shaft end according to DIN 748-3 with frontal centering hole with "DS" thread according to DIN 332-2.

The standard design for a non-positive shaft-hub connection without play and excellent smooth running. Use clamping sets, pressure sleeves or clamping elements for coupling the machine elements to be driven.

Shaft with keyway

Cylindrical shaft end according to DIN 748-3 with frontal centering hole with "DS" thread according to DIN 332-2 and keyway.

The keyway design allows form-locking transmission of torques with constant direction and low requirements on the shaft-hub connection.

The machine elements to be driven have to be secured in axial direction via the centering hole.

Table 16: Keyway and centering holes

Type	Key DIN 6885-A	Centering hole DIN 332 Part 2
MS2E03-B	3×3×14	DS M3
MS2E03-D	4×4×16	DS M4
MS2E04	5×5×20	DS M5
MS2E05	6×6×32	DS M6
MS2E06	8×7×40	DS M8
MS2E07	10×8×45	DS M10
MS2E10	10×8×70	DS M12

Remark

Keys are not included in the scope of delivery.

We recommend regular visual inspections on shaft sealing rings. Depending on operating conditions, signs of wear may appear after 5,000 operating hours. If necessary, replace the shaft sealing rings.

Remark

We recommend to have these repairs made by Bosch Rexroth Service.

5.9.2 Balancing

MS2E motors with key are balanced with “half key”. Half key balancing according to DIN ISO 21940-32.

The balancing type is specified at the shaft front end with “ H ”for half key balancing.

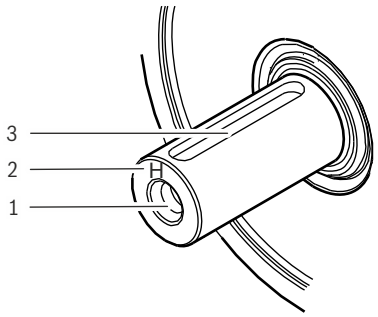


Fig. 4: Shaft end
1 Centering hole
2 Labeling balancing
3 Keyway

5.9.3 Attachment of drive elements

Observe the notes about mounting drive elements.

Explosion protection

When mounting drive elements, check their suitability and keep the ATEX directives during operation. Selecting of all mounting components underlies the sole responsibility of the plant manufacturer or operator.

⚠ WARNING	**Explosion hazard and danger to life, or substantial property damage!** The totality of a motor-machine combination must comply with the specifications for explosion protection according to Directive 2014/34/EU. Please observe the notes within the product documentation of the used components when projecting and during operation.

Gearboxes with approvals for use in hazardous areas according to Directive 2014/34/EU for the attachment to MS2E motors are delivered by Rexroth neither separately nor mounted on motors.

⚠ CAUTION	**Ingressing fluid may damage the motor!** Fluids (e.g., cooling lubricants, gear oil, etc.) may not be present at the output shaft. When attaching gearboxes, only use gearboxes with a closed (oil-tight) lubrication system. Gearbox oil should not be in permanent contact with the shaft sealing ring of the motors.

Overdetermined bearing

When installing drive elements, avoid overdetermined bearing as impermissibly high bearing reactions can be generated due to unfavorable tolerance ratios.

Remark

If overdetermined arrangement of bearings cannot be avoided, please contact Bosch Rexroth.

Couplings

The machine construction and the drive elements used must be carefully adapted to the motor type so as to make sure that the load limits of the shaft and the bearing are not exceeded.

Remark

When extremely stiff couplings are attached, the revolving radial force may cause an impermissibly high load on the shaft and bearing.

Bevel gear pinion or helical drive pinion

Due to thermal expansion, the DE side of the drive shaft can be displaced by up to 0.6 mm in relation to the motor housing. If helical drive pinions or bevel gear pinions directly attached to the output shaft are used, this change in the lengths will lead to

- a shift in the position of the axis, if the driving pinions are not axially fixed on the machine side.
- a thermally dependent component of the axial force, if the driving pinions are axially fixed on the machine side. This causes the risk of exceeding the maximum permissible axial force or of the gear backlash increasing to an impermissible degree.
- Damage of the NDE bearing by exceeding the maximum permissible axial force.

Remark

It is recommended to use drive elements with integrated bearings and mount them on the motor shaft via axially compensating couplings.

5.10 Holding brake

⚠ WARNING	**Danger to life or high damage to property, ignition and explosion hazard due to inappropriate use!**
	In order to prevent danger due to ignitable gases or explosive dust-air mixtures in the vicinity of the motors, the user must make sure that the holding brake does not present a source of ignition in the normal service. For this reason, the holding brake must never be used outside the design parameters and operating conditions! – Any commissioning and maintenance works must only be carried out in non-explosive environments. – The brakes must be designed so as to fulfill their function in normal service, if they are installed and used as intended. – The holding brake integrated in the motor must only be used at standstill and never as EMERGENCY STOP brake to stop the motor, see P-0-0119, Optimal shut-down(IndraDrive firmware - functional description). – The holding brake must not be used to brake or stop the motor or coupled loads from higher speeds or velocities.

MS2E motors can optionally be provided with permanent magnet brakes. The backlash-free holding brakes are operated according to the “electrically-released” principle (closed-circuit principle) and open upon applying the switching voltage.

- Number of operating cycles ≥ 5,000,000
- The holding brakes with emergency stop function are intended to secure motor shafts at standstill (normal operation). **The holding brakes are no operation brakes to decelerate motors in operation from speed**.
- Emergency stop situations are not a normal operation.
- In case of an emergency stop or voltage drop, the brake operation is only allowed to a limited extend. Up to 500 breaking cycles from speed 3000 1/min can be performed, whereas the maximum switched energy per emergency stop of the brake must not be exceeded. The number of brake applications per hour is 20, whereas a uniform scheduling is a precondition. For specifications about the max. switched energy per emergency stop, see ➦ Chapter 5.10.1 Technical data holding brakes on page 34
- Idle time after an emergency stop before restarting ≥3 minutes.

⚠ CAUTION	**Malfunctions due to wear**
	Impermissibly high wear due to breaking from speed by exceeding the specified emergency stop properties.

Ensure the functionality of the brake in normal operation, due to voltage control, current monitoring, cyclic control of the brake holding torque, for example.

The rated voltage to apply the brakes is 24VDC±10%.

The voltage supply of the holding brake has to be designed so as to guarantee under the worst installation and operation conditions that a sufficient voltage **24VDC±10%** is available at the motor in order to release the holding brake.

The voltage drop ΔU on the brake supply can approximately be calculated for copper conductors using the following formula:

$$\Delta U = \rho_{Cu} \cdot \left(\frac{2 \cdot l}{q} \right) \cdot I_N$$

Fig. 5: Voltage drop of brake supply for Cu (copper) conductor

ΔU Voltage drop [V]
ρ Cu Specific resistance of copper [Ω*mm²/m]
l Cable length [m]
q Conductor cross-section [mm²]
I N Rated current [A]

⚠ CAUTION **Malfunction in case of exceeded tolerance of the rated voltage (switching voltage)**

For safe switching of the holding brake, a rated voltage of **24 V DC ±10%** is required at the motor.

Ensure correct dimensioning of the supply wires (wire length and cross-section) for the holding brake.

The control voltage can be reduced using the energy saving function after safely releasing the brake, see ➥ Chapter 5.10.3 Energy saving function for holding brakes on page 36.

The holding brake in the motor is intended for direct connection to the IndraDrive controller.

The protective circuit for switching holding brakes (inductive load) is not integrated in the MS2E motors; in Bosch Rexroth drive systems it is integrated in the control units.

5.10.1 Technical data holding brakes

Table 17: Technical data holding brakes

Type	Holding torque	Dynamic braking torque	Rated voltage[1)]	Rated current	Maximum connection time	Maximum disconnection time	Maximum switched energy
	M_4 Nm	M_1 Nm	U_N V	I_N A	t_1 ms	t_2 ms	W_{max} J
MS2E03-B___-___1-____-__	1.80	1.3	24	0.46	8	35	300
MS2E03-D___-___1-____-__	1.80	1.3	24	0.46	8	35	300
MS2E04-B___-___1-____-__	5.00	4.5	24	0.63	30	45	400
MS2E04-C___-___1-____-__	5.00	4.5	24	0.63	30	45	400
MS2E05-B___-___1-____-__	10.00	4.5	24	0.73	30	80	400
MS2E05-C___-___1-____-__	10.00	4.5	24	0.73	30	80	400
MS2E05-D___-___1-____-__	10.00	4.5	24	0.73	30	80	400
MS2E06-C___-___1-____-__	10.00	4.5	24	0.73	30	80	400
MS2E06-D___-___2-____-__	15.00	11	24	0.75	50	135	888
MS2E06-E___-___2-____-__	15.00	11	24	0.75	50	135	888
MS2E07-C___-___1-____-__	20.00	12.5	24	0.78	40	100	340
MS2E07-D___-___2-____-__	36.00	16.5	24	0.94	60	200	850
MS2E07-E___-___2-____-__	36.00	16.5	24	0.94	60	200	850
MS2E10-C___-___2-____-__	53.00	23	24	1.00	70	220	850
MS2E10-D___-___2-____-__	53.00	23	24	1.00	70	220	850
MS2E10-E___-___3-____-__	90.00	33	24	1.50	65	250	1470
1) Tolerance ± 10%							

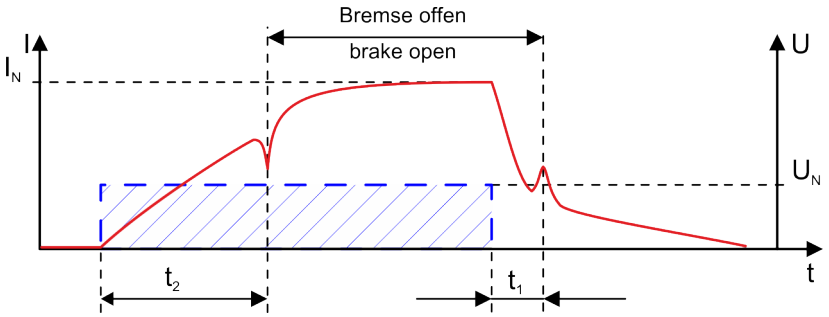


Fig. 6: Switching times of static hold mode
t_1 Connection time (close)
t_2 Disconnection time (open)

5.10.2 Sizing holding brakes

Static sizing

Check the load torque (M_6) with the available holding torque (M_4). The load torque has to be smaller than the holding torque. In case of unsafe assumed load, use a sufficient safety factor.

$$M_4 \geq S \cdot M_6$$

Fig. 7: Static load torque
M_4 Brake torque [Nm]
M_6 Load torque [Nm]
S Safety factor

Dynamic sizing if emergency stop

In case of an emergency stop, the load torque (M_6) has to be smaller than the minimum dynamic torque (M_1) of the brake. Otherwise the dynamic brake torque is not sufficient to set the axis to standstill.

$$M_1 \geq S \cdot M_6$$

Fig. 8: Dynamic load torque
M_1 Dynamic torque [Nm]
M_6 Load torque [Nm]
S Safety factor

If a mass has to be decelerated within a specified time or after a certain distance, the additional mass moment of inertia of the complete system (J_{ges}) has to be taken into consideration.

$$t_{Br} = \frac{J_{ges} \cdot n}{9{,}55 \cdot (M_1 \pm M_6)}$$

$$J_{ges} = J_{rot} + J_{fremd}$$

Fig. 9: Shutdown time
t_{Br} Deceleration time [s]
n Nominal speed [1/min]
M_1 Dynamic torque [Nm]
M_6 Load torque [Nm]

J_{ges} Moment of inertia of complete system [kgm²]
J_{rot} Moment of inertia of motor [kgm²]
J_{fremd} External inertia [kgm²]

The specified formula refers to idealized, linear correlations and can thus only be used for estimation purposes. A load torque M_6 inhibiting the brake application is displayed with "-", a brake application supporting the load torque M_6 is displayed with "+".

Thermal dimensioning

The brake can be thermally overexerted due to multiple repetitive brake applications (breaking capacity).

$$W_{max} > \frac{M_1}{M_1 - M_6} \cdot \frac{J_{ges} \cdot n^2}{182,5}$$

Fig. 10: Maximum switched energy

W_{max} Maximum switched energy [J]
n Nominal speed [1/min]
M_1 Dynamic torque [Nm]
M_6 Load torque [Nm]
J_{ges} Moment of inertia of complete system [kgm²]

5.10.3 Energy saving function for holding brakes

Decrease brake voltage

The control voltage of the holding brake in MS2E holding brakes can be reduced after executing the switching operation "Open brake" by using control modules (e.g. brake control module HAT02.1-003). By decreasing the control voltage, energy can be saved of up to 50% and the self-heating of the motor can be reduced.

To decrease the control voltage of MS2E holding brakes, the following conditions apply:

- Maximum decrease of control voltage to U_N ≥17 V DC at the motor.
- Waiting time after releasing the holding brake is at least 200 ms
- Decreasing the control voltage by voltage control or pulse width modulation with a PWM cycle frequency ≥4kHz
- Ensure the functionality of the holding brake.

Remark

Refer to the instructions in the control module documentation.

Refer to the notes for dimensioning of the cable length and cable cross-section of brake cables.

5.10.4 Safety and personal protection

The permanent magnet brake of MS2E motors is no safety brake. This means, a torque reduction by non-influenceable disturbance factors can occur. Especially for use in vertical axes.

⚠ WARNING	**Grievous bodily harm due to dangerous movements from falling or dropping axes!**
	Secure vertical axes against dropping or sinking after switching off by e.g.: – Mechanical locking of the vertical axis – External brake, arrestor, clamping device. – Weight compensation of the axes

The holding brake itself is not suitable for personal protection. Ensure protection of persons by superordinate fail-safe measures, like block danger zones via safety fences.

For European countries, additionally comply with the following standards and guidelines, e.g.

- EN ISO 13849-1:2015 "Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design (ISO 13849-1:2015)" and EN ISO 13849-2:2012 "Safety of machinery. Safety-related parts of control systems. General principles for design"
- Information sheet no. 005 “Gravity-loaded axes (vertical axes)” published by: DGUV Fachbereich Holz und Metall (German Employer's Liability Insurance Association Wood and Metal)

Determine the complete safety requirements valid for the specific case of application and observe them during plant design. Comply with all applicable national regulations!

5.10.5 Functionality test

⚠ WARNING	**Danger of explosion at maintenance work and check operation** Do maintenance work only outside of hazardous areas. Ensure that no hazardous gas or dust atmosphere exists during grind in procedures.

That is why the function and the holding brakes have to be checked in regular intervals and malfunctions must be removed in an appropriate period.

The braking effect can be reduced by:

- Corrosion on friction surfaces, vapor and sediment
- Over voltages and too high temperatures
- Wear (increasing the air gap between armature and pole)

The holding brake functionality can be checked mechanically by hand or automatically by means of the software function.

Manually check holding torque (M4)

1. De-energize the motor and ensure it cannot be restarted.
2. Measure the transferable holding torque (M4) of the holding brake with a torque wrench.

Check holding torque (M4) using the software function

For Bosch Rexroth drive controller

Start the P-0-0541, C2100 Command Holding system check in drive controller. The efficiency of the holding brake and the opened state are checked by starting the routine.

➥ If the holding torque (M4) **is not achieved**, the resurfacing routine can be used to reconstitute the holding torque. If you have any questions about grind in parameters, contact Bosch Rexroth service.

5.11 Flange exactness

The properties concentricity, run-out and alignment are defined in the flange accuracy. MS2E motors are delivered with tolerance N. The labeling is done in the motor type designation. See also ➥ Chapter 5.9 Output shaft, balancing and extension elements on page 30.

5.11.1 Concentricity tolerance of the shaft end

Table 18: Concentricity tolerance regarding the shaft diameter for MS2E motors

Diameter shaft end [d]	Concentricity tolerance in [mm]	
	N	R
9	0.03	-
11, 14	0.035	-
19, 24	0.04	-
32, 38	0.05	0.025 (MS2E10 only)

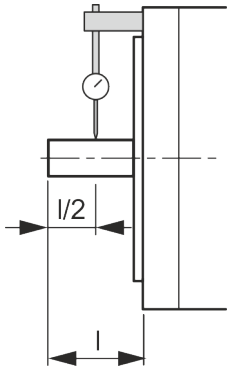


Fig. 11: Measuring system of concentricity tolerance

Measurement takes place in distance *l/2* (shaft end center), rectangular to the motor flange.

5.11.2 Concentricity and alignment

Table 19: Concentricity and alignment tolerance related to centering diameter in MS2E motors.

Centering diameter [mm]	Concentricity and alignment tolerance in [mm]	
	N	R
40, 50, 95	0.08	-
130, 180	0.1	0.05 (MS2E10 only)

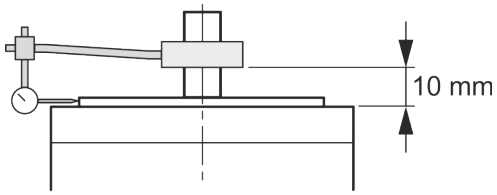


Fig. 12: Measuring system of coaxiality

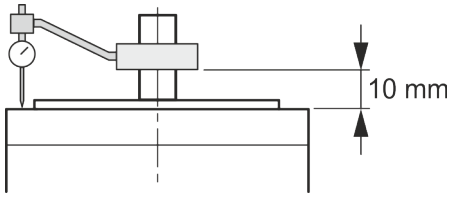


Fig. 13: Measuring system of alignment

The coaxiality and the alignment are measured in vertical motor position to exclude the influence of gravitational forces.

5.12 Vibration behavior

The oscillation behavior corresponds to oscillating quantity level A according to EN IEC 60034-14:2018 up to the rated speed.

5.13 Bearing

The motors are equipped with a deep-groove ball bearing with high-temperature grease for prelubrication.

Table 20: Bearing size MS2E

Type	Bearing size DE	Bearing size NDE	Floating bearing	Fixed bearing
MS2E03	6001	6000	DE	NDE
MS2E04	6003	6001	DE	NDE
MS2E05	6204	6303	DE	NDE
MS2E06	6206	6303	DE	NDE
MS2E07	6207	6205	DE	NDE
MS2E10	6308	6306	DE	NDE

5.13.1 Bearing service life

The bearing lifetime is an important criterion for the availability of motors. The operating conditions influence the bearing service life L_{10h} considerably.

The following boundary conditions apply to the bearing service life L_{10h}:

- Operation within the specified permissible loads (radial and axial force)
- Operation within the permissible ambient conditions (temperature range 0 ... 40 °C, vibration, and so on)
- Operation within the thermally permissible operating characteristic curve

The bearing lifetime also depends on the service life of the grease. A calculated grease service life was used for the mentioned specifications, taking into consideration the following boundary conditions.

- Horizontal installation
- Low vibration and impact loads
- No oscillating bearing movement < 180°
- Mean speed ➦ Table 21 Mean speed - basis of calculated grease service life on page 39

Table 21: Mean speed - basis of calculated grease service life

Type	Mean speed
MS2E03, -04, -05, -06	≤ 3500 1/min
MS2E07	≤ 3000 1/min
MS2E10	≤ 2000 1/min

The following standard values apply under the specified preconditions:

L_{10h} = 30.000 h, in case of utilization after S1-60K and max. load factor 95% during the runtime.

When exceeding or not complying with these conditions, a reduced service life is to be expected.

5.13.2 Explanation of radial and axial force

During operation, both radial and axial forces act upon the motor shaft and the motor bearing. The permissible radial force F_R in distance x from the shaft shoulder and the mean speed is specified in the radial force diagrams.

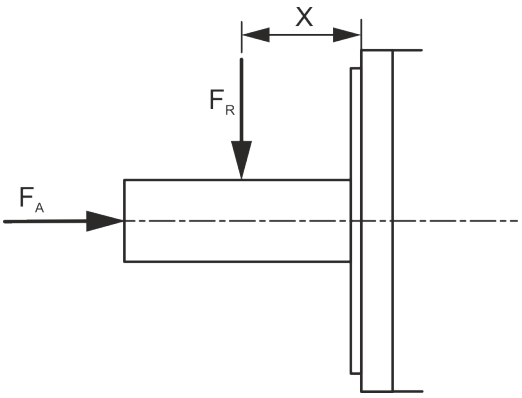


Fig. 14: Point of action of radial force F_R and axial force F_A

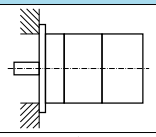
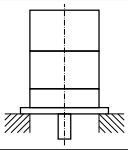
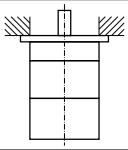
The axial force values are the minimum permissible axial forces F_A without limitations. A detailed dimensioning is only possible if more boundary conditions are known:

- Axial and radial force with force application point
- Installation position (horizontal, vertical with the shaft end pointing to the top or bottom)
- Mean speed

For radial force diagrams, refer to the technical data

5.14 Frame size, installation type

The motors can be installed horizontally and vertically with the shaft end pointing to the top or bottom. The mounting variants comply with the IM code according to EN 60034-7:1993 + A1:2001 for design and installation type.

Code I / Code II (EN 60034-7:1993 + A1:2001)		
IM B5 / IM 3001		Flange attachment on the drive side of the flange
IM V1 / IM 3011		Flange attachment on the drive side of the flange, drive side facing down
IM V3 / IM 3031		Flange attachment on the drive side of the flange, drive side facing up

Avoid liquid at the drive shaft or the shaft sealing ring in case of vertical installation according to IM V3.

5.15 Coating

One-layer standard varnish (1K), waterbased, in condutive form, RAL9005 jet black, nominal thickness 40 µm.

⚠ WARNING	**Danger of explosion due to improper change of the surface characteristics.**
	An additional varnish on motors for hazardous areas is not allowed in order not to negatively influence the surface characteristics (like e.g. insulation resistance, electrostatic charging).

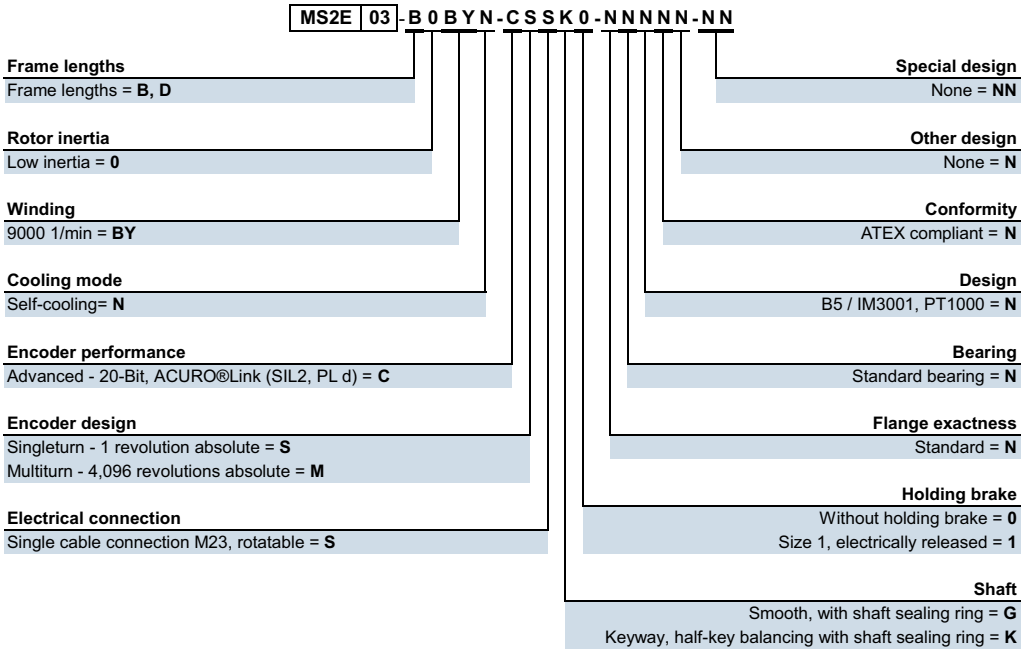
5.16 Noise emission

The typical sound pressure level Lp(A) is specified for the speed range 0 rpm up to the rated speed. The installation situation affects the noise emission.

6 Type codes

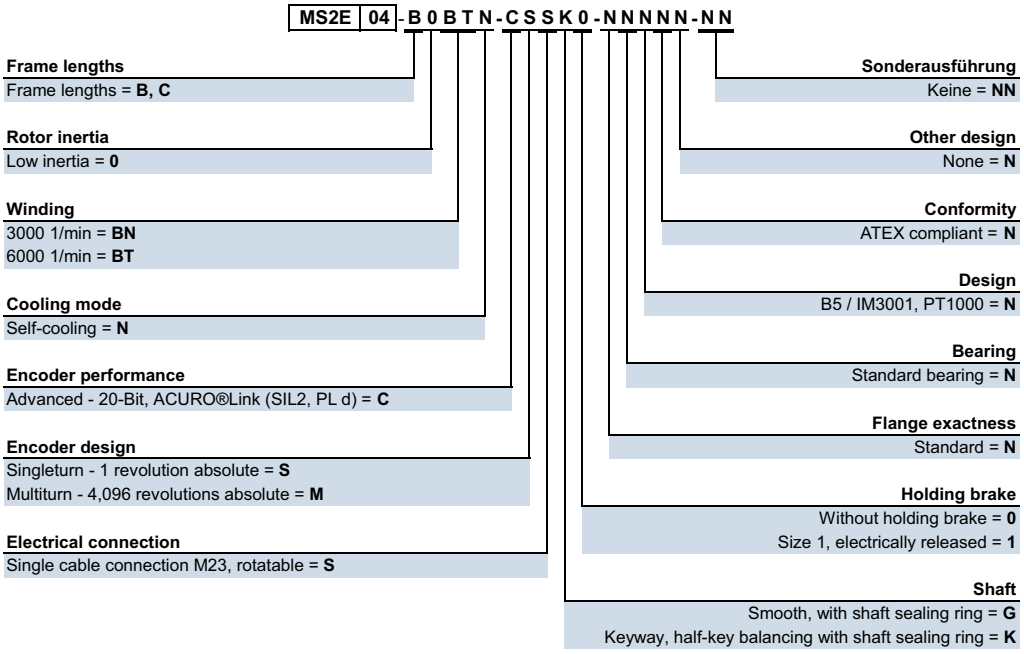
6.1 MS2E03 Type code

Features



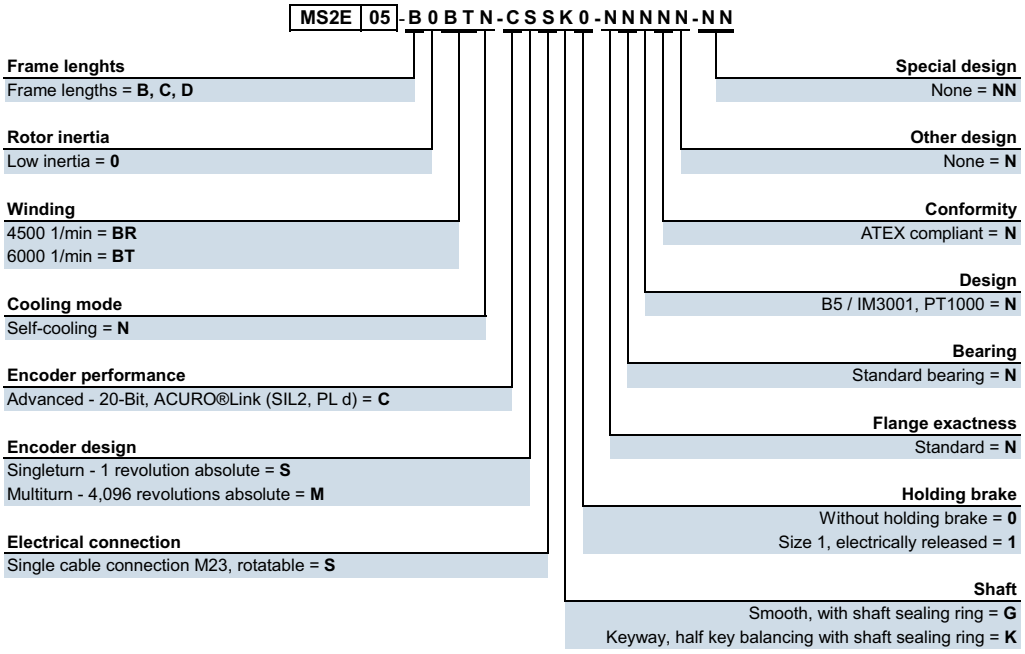
6.2 MS2E04 Type code

Features



6.3 MS2E05 Type code

Features



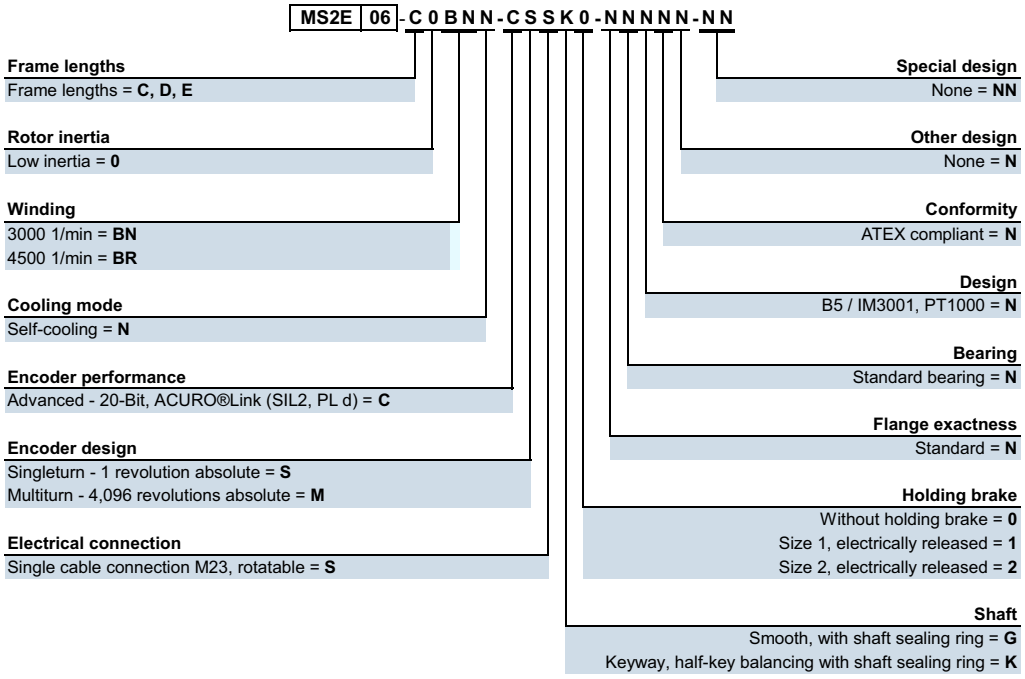
Options self-cooling

• available — not available

Cooling mode N - Self-cooling			Electrical Connection	Holding brake	
Frame length	Rotor inertia	Winding	S	0	1
B	0	BT	•	•	•
C	0	BT	•	•	•
D	0	BR	•	•	•

6.4 MS2E06 Type code

Features



Options self-cooling

• available — not available

Cooling mode N - Self-cooling			Electrical connection	Holding brake		
Frame lengths	Rotor inertia	Winding	S	0	1	2
C	0	BN	•	•	•	—
D	0	BN	•	•	—	•
		BR	•	•	—	•
E	0	BR	•	•	—	•

6.5 MS2E07 Type code

Features

MS2E 07 - C 0 B N N - C S S K 0 - N N N N N - N N

Frame lengths
Frame lengths = **C, D, E**

Rotor inertia
Low inertia = **0**

Winding
3000 1/min = **BN**
3000 1/min = **CN** 1)
4000 1/min = **BQ**
4000 1/min = **CQ** 1)
4500 1/min = **CR** 1)

Cooling mode
Self-cooling = **N**

Encoder performance
Advanced - 20-Bit, ACURO®Link (SIL2, PL d) = **C**

Encoder design
Singleturn - 1 revolution absolute = **S**
Multiturn - 4,096 revolutions absolute = **M**

Electrical connection
Single cable connection M23, rotatable = **S**

Special design
None = **NN**

Other design
None = **N**

Conformity
ATEX compliant = **N**

Design
B5 / IM3001, PT1000 = **N**

Bearing
Standard bearing = **N**

Flange exactness
Standard = **N**

Holding brake
Without holding brake = **0**
Size 1, electrically released = **1**
Size 2, electrically released = **2**

Shaft
Smooth, with shaft sealing ring = **G**
Keyway, half-key balancing with shaft sealing ring = **K**

Options self-cooling

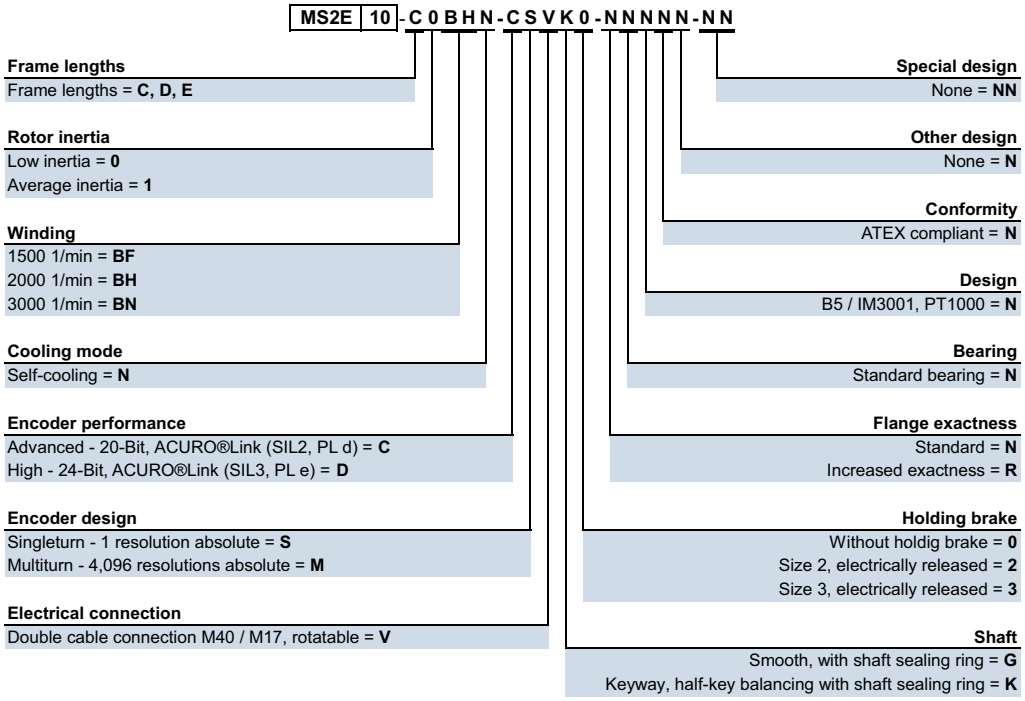
• available — not available

Cooling mode N - Self-cooling			Electrical connection	Holding brake		
Frame lengths	Rotor inertia	Winding	S	0	1	2
C	0	BN	•	•	•	—
		BQ	•	•	•	—
D	0	BN	•	•	—	•
		CR	•	•	—	•
E	0	CN	•	•	—	•
		CQ	•	•	—	•

1) Reduced standstill current for electrical connection "S"

6.6 MS2E10 Type code

Features



Options self-cooling

● available — not available

Cooling mode N - Self-cooling			Electrical connection	Holding brake		
Frame lengths	Rotor inertia	Winding	V	0	2	3
C	0	BH	●	●	●	—
D	0	BH	●	●	●	—
		BN	●	●	●	—
	1	BF	●	●	●	—
E	1	BF	●	●	—	●

7 Operating areas and characteristic curves

7.1 Operating area

The permissible operating ranges for MS2E motors are defined for ambient temperatures of 0 ... 40 °C and installation altitudes up to 1,000 m above MSL. The operating areas are characterized by characteristic curve fields according to ➥ Further information on page 49.

The individual characteristic curves are described in the following figure.

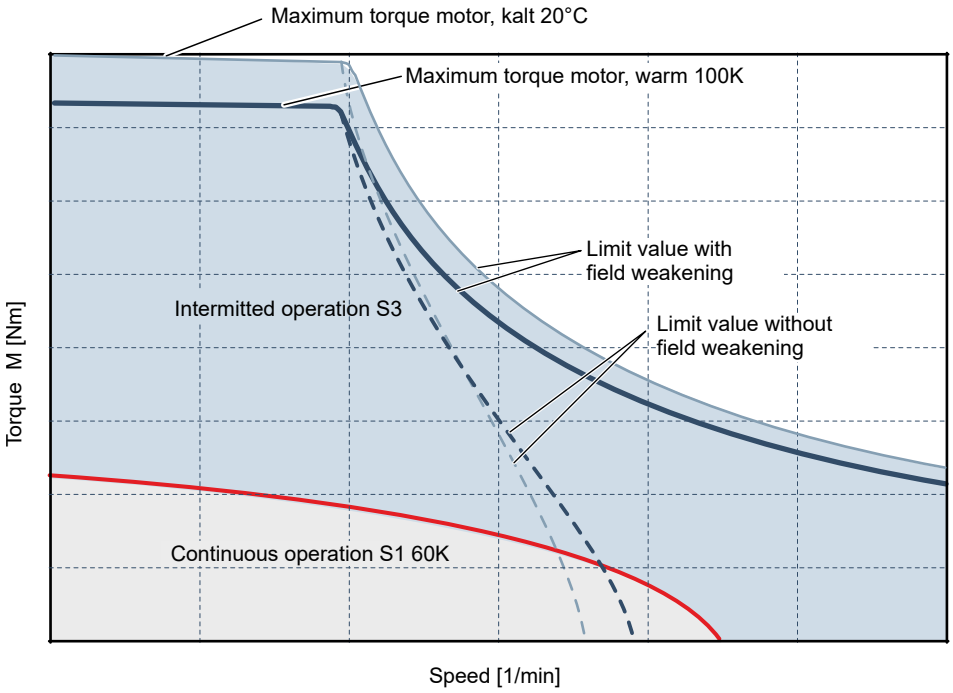


Fig. 15: Operating area of MS2E motors

The thermal motor installation determines the degree of power loss, discharged via the flange. The rated data for 60K specified in the technical data apply to the following installation conditions:

Table 22: Installation conditions for utilization according to the specified characteristic curves

Type	60 K data (thermally insulated) [1]
	Aluminum plate L x W x H [mm]
MS2E03, -04	140 × 210 × 10
MS2E05, -06	300 × 240 × 15
MS2E07, -10	300 × 270 × 15
1) insulated with laminated paper FR-2, material thickness 2 mm	

Operation with derating

In case of ambient temperatures above 40 °C and installation altitudes of 1,000 m above MSL, the high performance data have to be reduced (see ➥ Chapter 10.2 Derating in case of deviating ambient conditions. on page 148).

7.1.1 Continuous operation S1

The S1-60K characteristic curve specifies the thermal limit of the motors. To increase the machine availability, Bosch Rexroth recommends to project with a safety factor to the S1-60K characteristic curve.

Project with a safety factor regarding the thermal utilization of the motors to

- compensate unfavorable heat of the flange mounting.
- limit the housing temperature.
- avoid unfavorable machine heating due to the motor.
- increase the reliability of the motor (e.g. motor / encoder bearing).

NOTICE

Property damage due to thermal overload

Motors in continuous operation application must not be operated above the specified characteristic curve limits S1-60K.

7.1.2 Periodic intermitted operation S3

During periodic intermittent operation, the motor can tolerate a higher load depending on the ON time.

7.1.3 Operation in field weakening

Field weakening operation of MS2E motors is possible with ctrlX / IndraDrive controllers. In the case of operation of foreign converters please observe the information of the manufacturer and the general notes in ➥ Chapter 10.3 Operation on foreign converters on page 150.

7.1.4 Motor torque during operation at standstill

In applications such as joining or press machines, where motors have to produce torque continuously asymmetrical currents when the motor is in standstill (close angular range) will flow in the motor windings. This can result in motor overload during continuous operation. The values specified in the data sheet have to be reduced according to the following table. The continuous torque that can be output at standstill M_0* can be calculated by multiplying the data sheet values with the subsequent reduction factors F_0.

$$M_0^* = F_0 \cdot M_0$$

Table 23: Reduction factor F0

Type	Cooling type	Frame length				
		B	C	D	E	F
MS2E03, -04, -05	Self-cooling 60K	0.95			-	-
MS2E06	Self-cooling 60K	0.88	0.95			-
MS2E07	Self-cooling 60K	0.88	0.95			-
MS2E10	Self-cooling 60K	0.82	0.88	0.95		

7.2 Characteristic curves for DC bus voltage

The technical data sheets contain characteristic curves for two typical DC bus voltages. Depending on the DC bus voltage, the characteristic curves are offset.

S1 continuous operation curves depend on the DC bus voltage. The rated data on the type plate are defined with U_{ZK2} for the worst case scenario (cf. Fig. 16).

The characteristic curve apply to:

Table 24: DC bus voltages

Controller	Line voltage	DC bus
ctrlX IndraDrive	3 × 400 V ($U_{ZK\,1}$)	uncontrolled
	3 × 400 ... 480 V ($U_{ZK\,2}$)	controlled

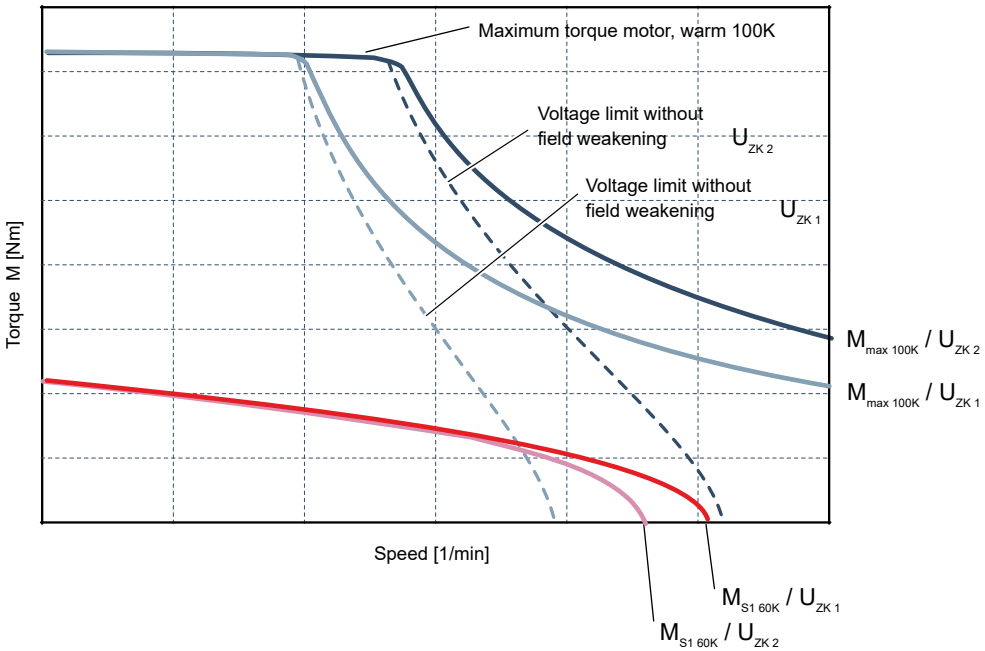


Fig. 16: Characteristic curve specifications

The specified characteristic curves are typical standard values. The actual performance data of a drive axis are subject to manufacturing-related tolerances.

7.3 Rated data

Rated data are defined for the following conditions:

- Rated speed is determined by the DC bus voltage $U_{ZK\,1}$. The voltage limit or the point of optimal performance are relevant variables to specify the rated speed.
- Rated data are applied to the rated speed and to the continuous operation characteristics at $U_{ZK\,2}$

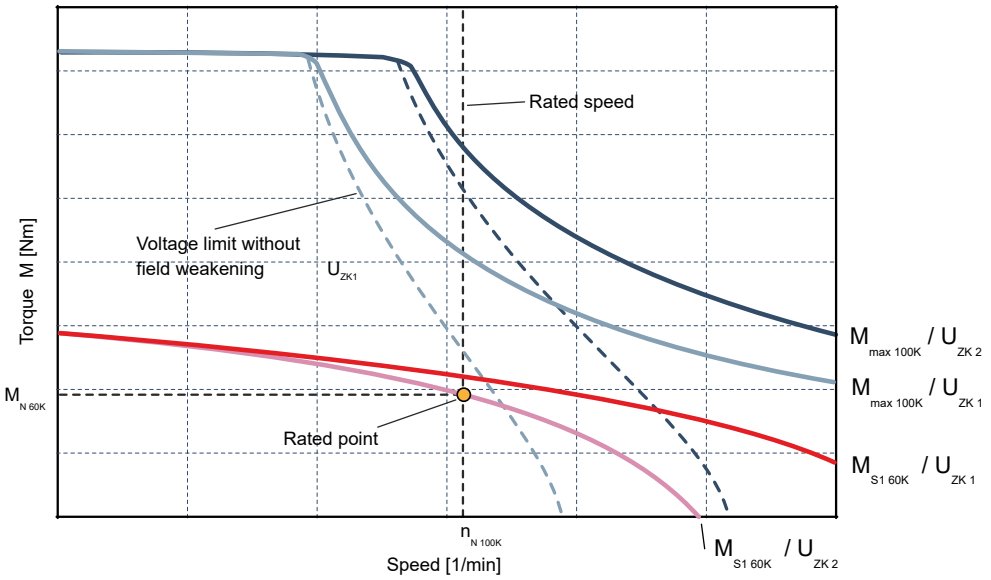


Fig. 17: Rated point

In case of motors with high speeds, the rated point of the characteristic voltage limit curve $U_{ZK\,1}$ can be displayed in the direction of the point of origin.

The rated data are specified on type place of the motors as well as in the technical data sheet.

7.4 Tolerances

The values specified in the technical data are subject to a natural dispersion. Observe the tolerance specifications for the following parameters.

Table 25: Tolerance specifications of the motor data

Designation	Symbol	Tolerance value
Standstill torque (60K)	$M_{0\ 60K}$	±± 5%
Rotor inertia	J_{rot}	± 10%
Rated torque - 60K	$M_{N\ 100K}$	±± 5%
Rated power - 60 K	$P_{N\ 100K}$	± 5%
Maximum torque 20 °C (cold)	$M_{max\ 20°C}$	± 5%
Maximum torque 100K (warm)	$M_{max\ 100K}$	± 5%
Torque constant at 20 °C	K_m	± 5%
Voltage constant at 20 °C	K_E	±± 5%

7.5 Temperature influence and tolerances

The torque-speed characteristic curves are specified for cold motors ($M_{max\ 20°C}$) as well as for motors at rated-load operating temperature ($M_{max\ 100K}$). Following figure shows the influence of motor temperature and material variation caused by manufacturing tolerances.

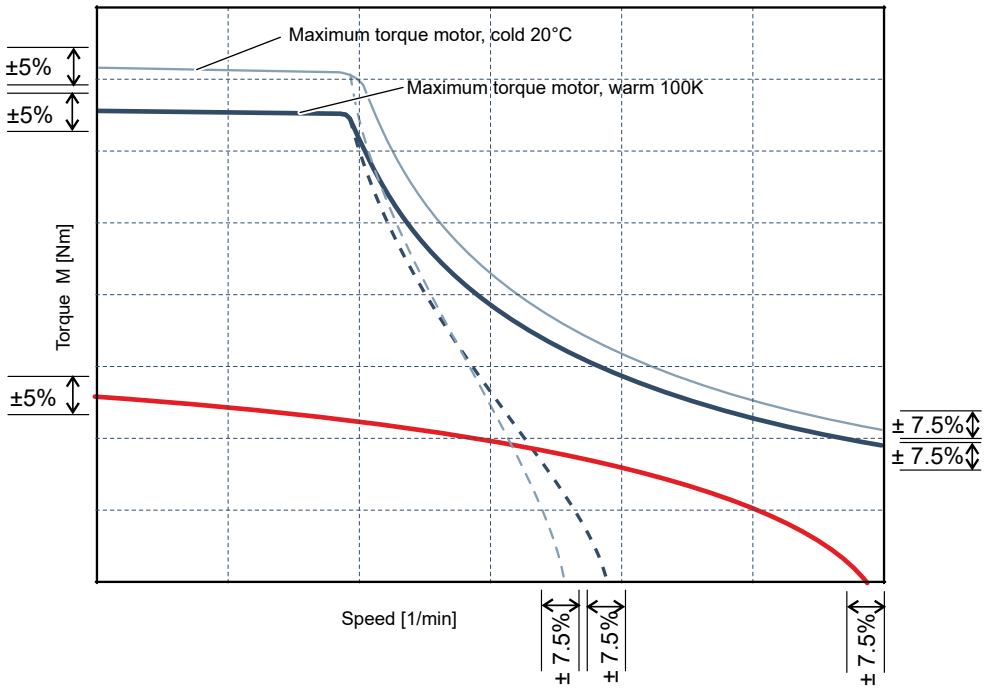


Fig. 18: Temperature influence and tolerance

The specified tolerances apply to MS2E motors with controlled and uncontrolled infeed.

7.6 IndraSize

By using the IndraSize software, drive controllers, motors and mechanic gearboxes can be easily sized. The engineering tool covers the entire range of IndraDrive drives and motors. Calculate the characteristic curves for your application with IndraSize sizing and calculation tool: ➦www.boschrexroth.com/indraSize

8 Technical data

8.1 MS2E03

8.1.1 Self-cooling

MS2E03-B0BYN

Designation	Symbol	Unit	MS2E03-B0BYN-___0-_N	MS2E03-B0BYN-___1-_N
Standstill torque - 60K [1]	$M_{0\ 60K}$	Nm	0.73	
Standstill current - 60K	$I_{0\ 60K}$	A	1.31	
Moment of inertia of rotor [1]	J_{rot}	kg*m²	0.000023	0.000030
Rated speed - 60K	$n_{N\ 60K}$	1/min	5760	
Rated torque - 60K [1]	$M_{N\ 60K}$	Nm	0.35	
Rated current - 60K	$I_{N\ 60K}$	A	0.72	
Rated power - 60K [1]	$P_{N\ 60K}$	kW	0.21	
Maximum torque 20 °C (cold) [1]	$M_{max\ 20°C}$	Nm	3.75	
Maximum torque 100K (warm) [1]	$M_{max\ 100K}$	Nm	3.46	
Maximum current	$I_{max(rms)}$	A	7.25	
Maximum speed (electrical)	$n_{max\ el}$	1/min	9000	
Maximum speed (mechanical)	$n_{max\ mech}$	1/min	9000	
Number of pole pairs	p		5	
Torque constant at 20 °C [1]	K_m	Nm/A	0.61	
Voltage constant at 20 °C [1]	K_E	V/1000 min^{-1}	36.9	
Winding resistance at 20 °C	R_{12}	Ohm	14.3	
Winding inductance	L_{12_min}	mH	20.22	
Leakage capacitance of the component	C_{ab}	nF	0.83	
Thermal time constant of winding	T_{th_W}	s	12.1	
Thermal time constant of motor	T_{th_M}	min	11.3	
Mass	m_{mot}	kg	1.4	1.8
Holding brake				
Holding torque	M_4	Nm	0	1.80
Rated voltage	U_N	V	0	24
Rated current	I_N	A	0	0.46
Maximum connection time	t_1	ms	0	8
Maximum disconnection time	t_2	ms	0	35
1) For tolerance details refer to ➥ chapter 7.4 Tolerances				Latest amendment 2016-12-14

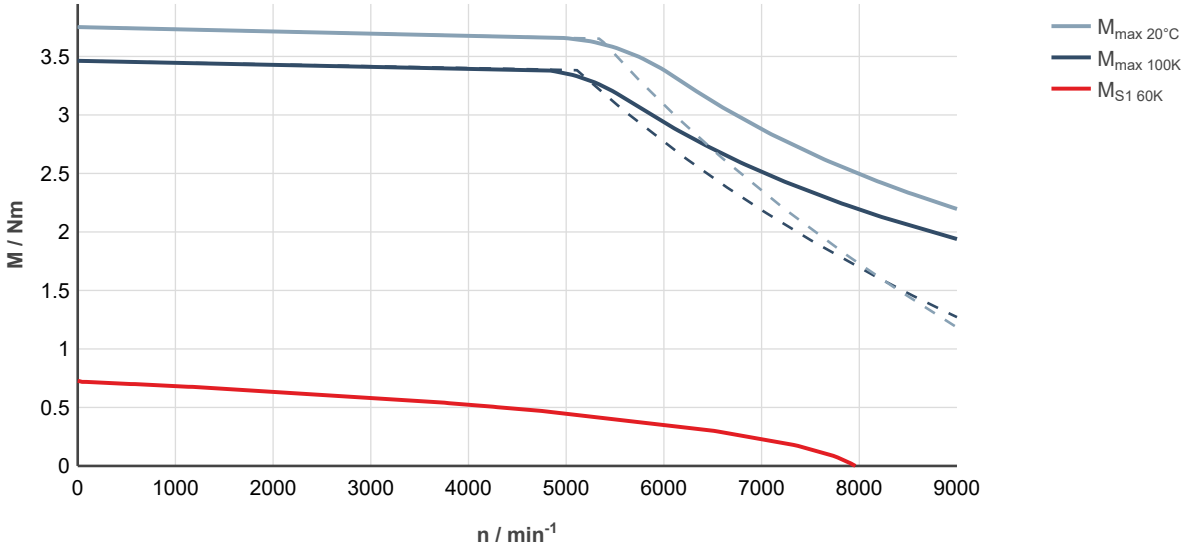


Fig. 19: MS2E03-B0BYN-___0-____-__, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

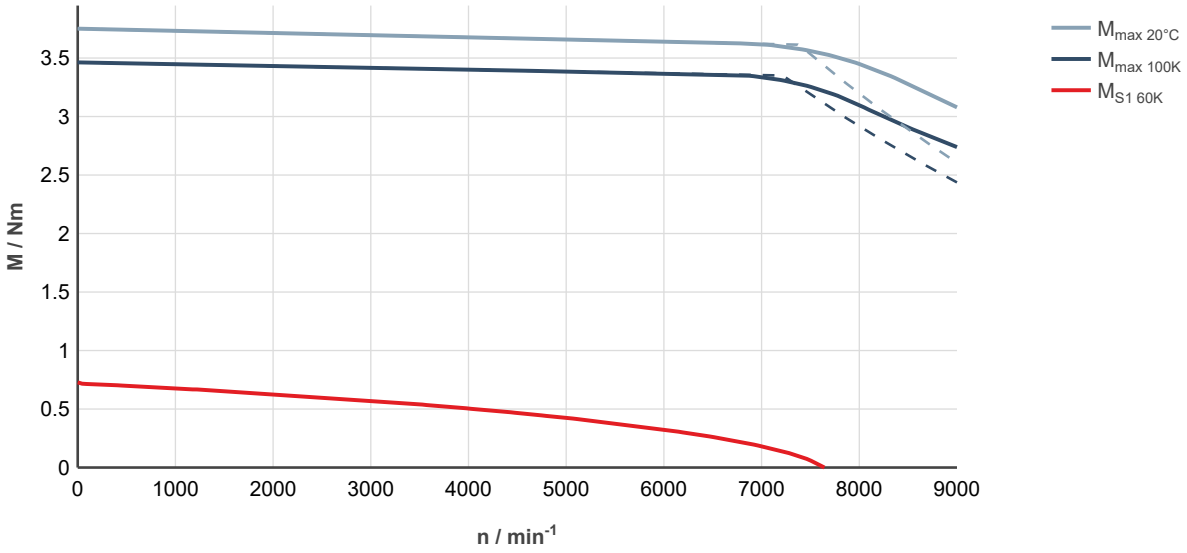


Fig. 20: MS2E03-B0BYN-___0-____-__, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

MS2E03-D0BYN

Designation	Symbol	Unit	MS2E03-D0BYN-___0-_N	MS2E03-D0BYN-___1-_N
Standstill torque - 60K [1]	$M_{0\ 60K}$	Nm	1.15	
Standstill current - 60K	$I_{0\ 60K}$	A	2.07	
Moment of inertia of rotor [1]	J_{rot}	kg*m²	0.000037	0.000044
Rated speed - 60K	$n_{N\ 60K}$	1/min	3930	
Rated torque - 60K [1]	$M_{N\ 60K}$	Nm	0.58	
Rated current - 60K	$I_{N\ 60K}$	A	1.17	
Rated power - 60K [1]	$P_{N\ 60K}$	kW	0.24	
Maximum torque 20 °C (cold) [1]	$M_{max\ 20°C}$	Nm	7.4	
Maximum torque 100K (warm) [1]	$M_{max\ 100K}$	Nm	6.8	
Maximum current	$I_{max(rms)}$	A	14.5	
Maximum speed (electrical)	$n_{max\ el}$	1/min	9000	
Maximum speed (mechanical)	$n_{max\ mech}$	1/min	9000	
Number of pole pairs	p		5	
Torque constant at 20 °C [1]	K_m	Nm/A	0.6	
Voltage constant at 20 °C [1]	K_E	V/1000 min^{-1}	36.2	
Winding resistance at 20 °C	R_{12}	Ohm	6.29	
Winding inductance	L_{12_min}	mH	9.56	
Leakage capacitance of the component	C_{ab}	nF	1.6	
Thermal time constant of winding	T_{th_W}	s	14.5	
Thermal time constant of motor	T_{th_M}	min	12.1	
Mass	m_{mot}	kg	2.0	2.4
Holding brake				
Holding torque	M_4	Nm	0	1.80
Rated voltage	U_N	V	0	24
Rated current	I_N	A	0	0.46
Maximum connection time	t_1	ms	0	8
Maximum disconnection time	t_2	ms	0	35

1) For tolerance details refer to ➦chapter 7.4 Tolerances Latest amendment: 2018-11-12

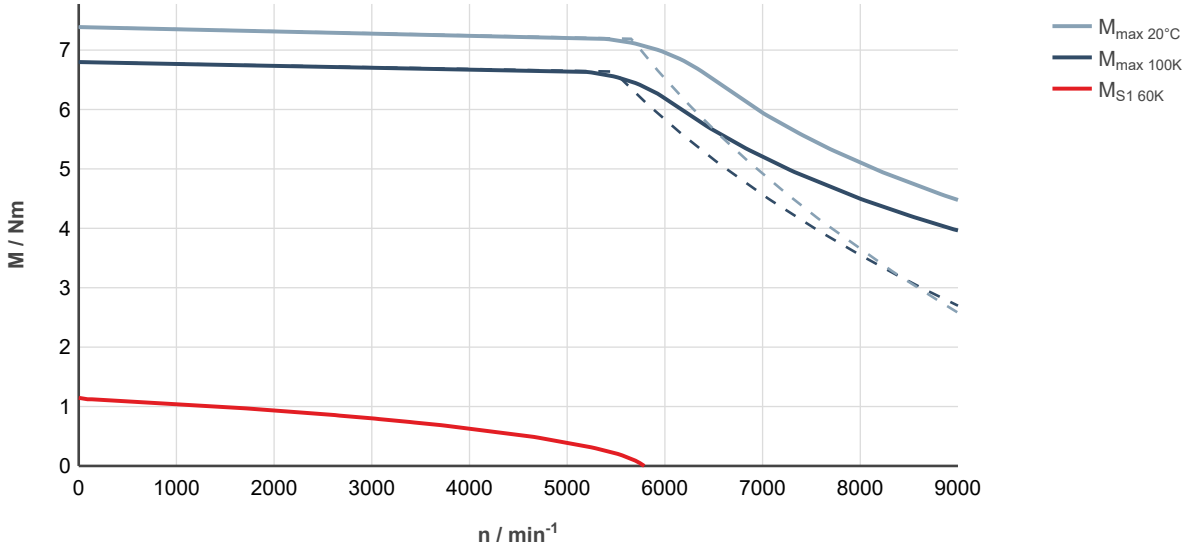


Fig. 21: MS2E03-D0BYN-___0-____-__, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

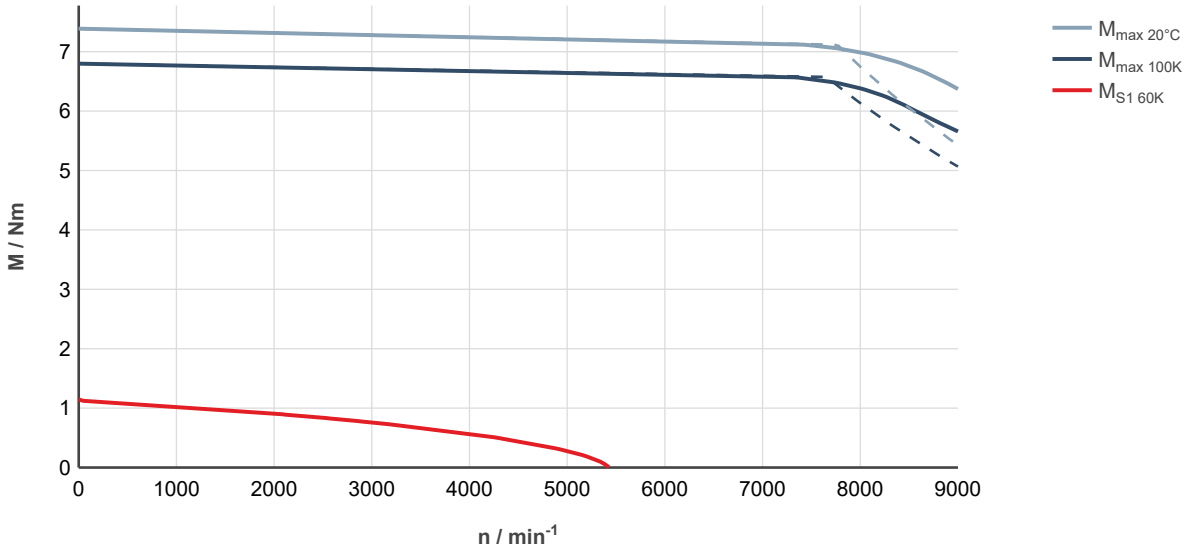
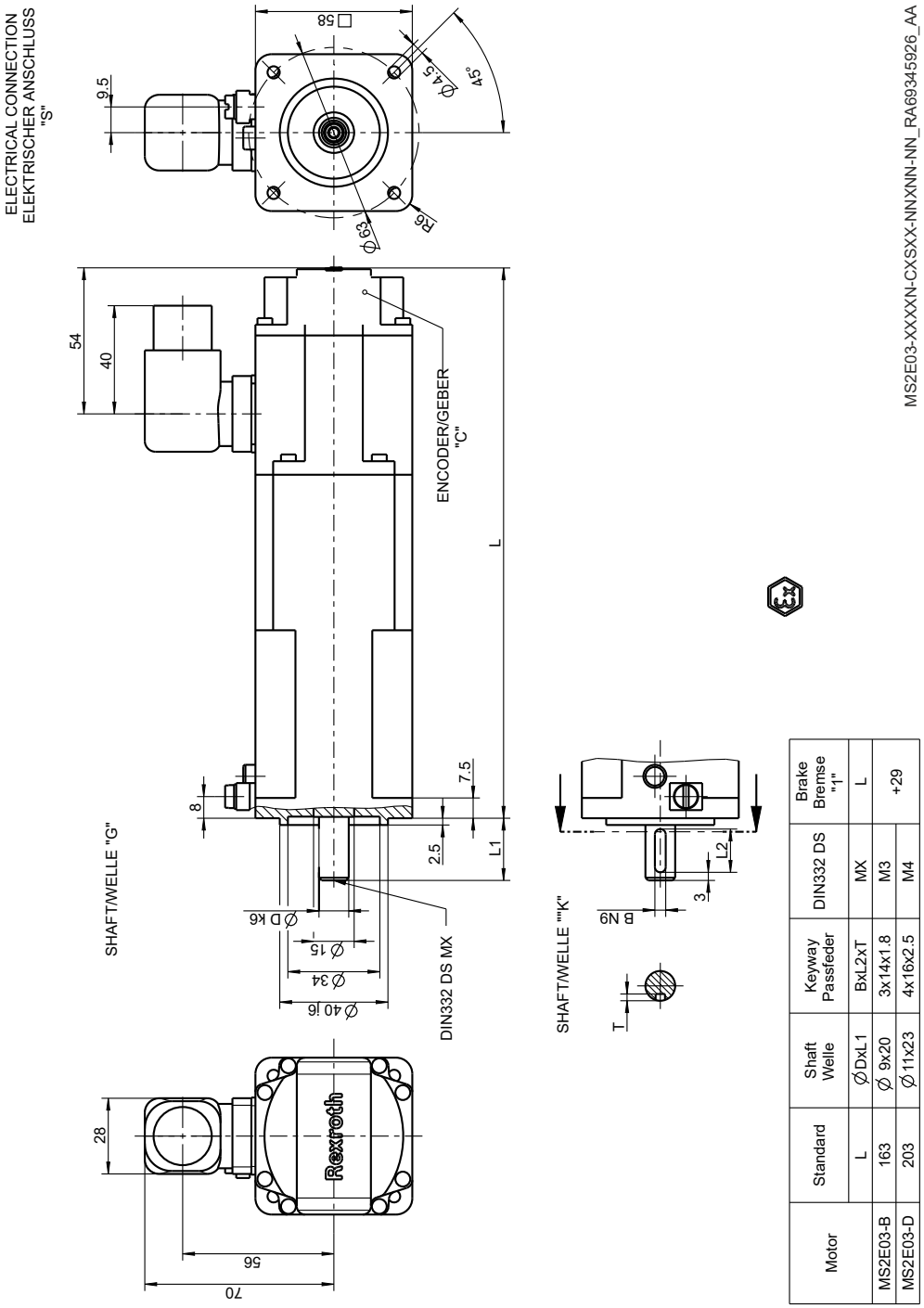


Fig. 22: MS2E03-D0BYN-___0-____-__, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

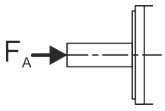
8.1.2 MS2E03 Specifications



Motor	Standard	Shaft Welle	Keyway Passfeder	DIN332 DS	Brake Bremse "1"	
	L	∅DxL1	BxL2xT	MX	L	+29
MS2E03-B	163	∅ 9x20	3x14x1.8	M3		
MS2E03-D	203	∅11x23	4x16x2.5	M4		

Fig. 23: MS2E03-xxxxN

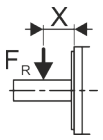
8.1.3 MS2E03 Axial force



Axial forces F_A only allowed after a detailed dimensioning by your distribution partner at Bosch Rexroth. For evaluation purposes, please specify the following information:

- Axial and radial force with force application point
- Installation position (horizontal, vertical with the shaft end pointing to the top or bottom)
- Mean speed

8.1.4 MS2E03-B Radial force



The permissible radial force F_R is specified in distance x from the shaft shoulder, depending on the mean speed in the following diagram.

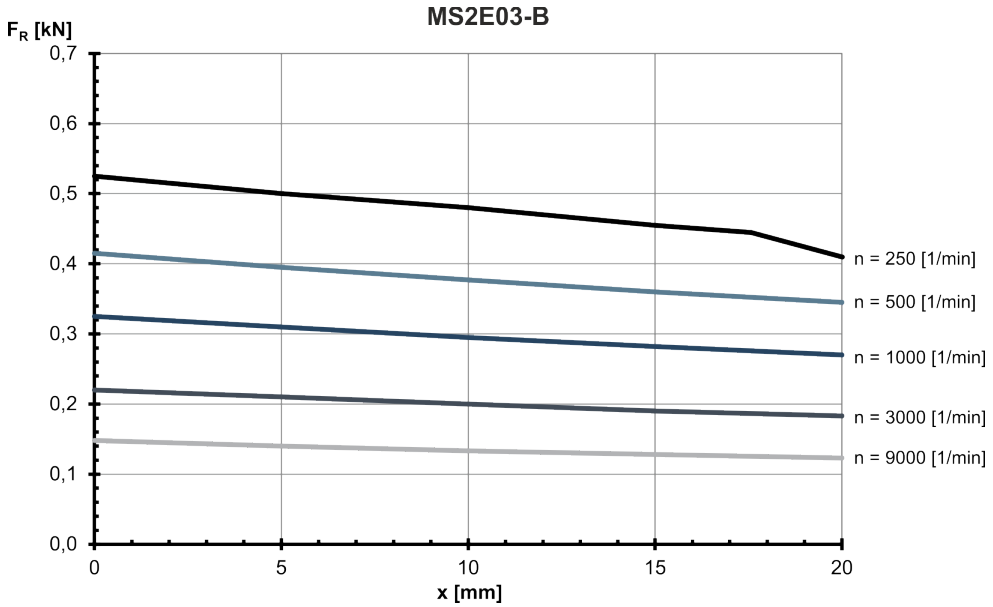
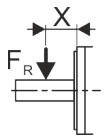


Fig. 24: MS2E03-B: Radial force in distance x from the shaft shoulder at a nominal bearing service life of Lh10 = 30000 h

8.1.5 MS2E03-D Radial force



The permissible radial force F_R is specified in distance x from the shaft shoulder, depending on the mean speed in the following diagram.

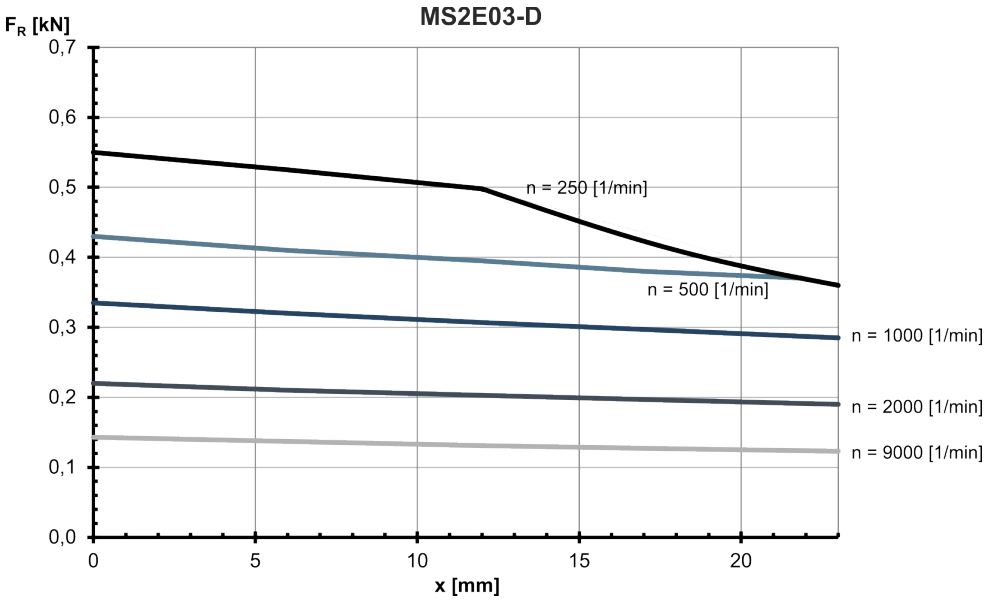


Fig. 25: MS2E03-D: Radial force in distance x from the shaft shoulder at a nominal bearing service life of Lh10 = 30000 h

8.2 MS2E04

8.2.1 Self-cooling

MS2E04-B0BNN

Designation	Symbol	Unit	MS2E04-B0BNN-___0-_N	MS2E04-B0BNN-___1-_N
Standstill torque - 60K [1]	$M_{0\ 60K}$	Nm	1.75	
Standstill current - 60K	$I_{0\ 60K}$	A	1.11	
Moment of inertia of rotor [1]	J_{rot}	kg*m²	0.00007	0.00011
Rated speed - 60K	$n_{N\ 60K}$	1/min	3000	
Rated torque - 60K [1]	$M_{N\ 60K}$	Nm	1.29	
Rated current - 60K	$I_{N\ 60K}$	A	0.86	
Rated power - 60K [1]	$P_{N\ 60K}$	kW	0.41	
Maximum torque 20 °C (cold) [1]	$M_{max\ 20°C}$	Nm	6.4	
Maximum torque 100K (warm) [1]	$M_{max\ 100K}$	Nm	5.9	
Maximum current	$I_{max(rms)}$	A	4.9	
Maximum speed (electrical)	$n_{max\ el}$	1/min	6000	
Maximum speed (mechanical)	$n_{max\ mech}$	1/min	6000	
Number of pole pairs	p		5	
Torque constant at 20 °C [1]	K_m	Nm/A	1.73	
Voltage constant at 20 °C [1]	K_E	V/1000 min^{-1}	104.9	
Winding resistance at 20 °C	R_{12}	Ohm	26.2	
Winding inductance	L_{12_min}	mH	110.1	
Leakage capacitance of the component	C_{ab}	nF	1.1	
Thermal time constant of winding	T_{th_W}	s	90	
Thermal time constant of motor	T_{th_M}	min	16	
Mass	m_{mot}	kg	2.7	3.4
Holding brake				
Holding torque	M_4	Nm	0	5.00
Rated voltage	U_N	V	0	24
Rated current	I_N	A	0	0.63
Maximum connection time	t_1	ms	0	30
Maximum disconnection time	t_2	ms	0	45
1) For tolerance details refer to ➥ chapter 7.4 Tolerances				Latest amendment: 2017-02-10

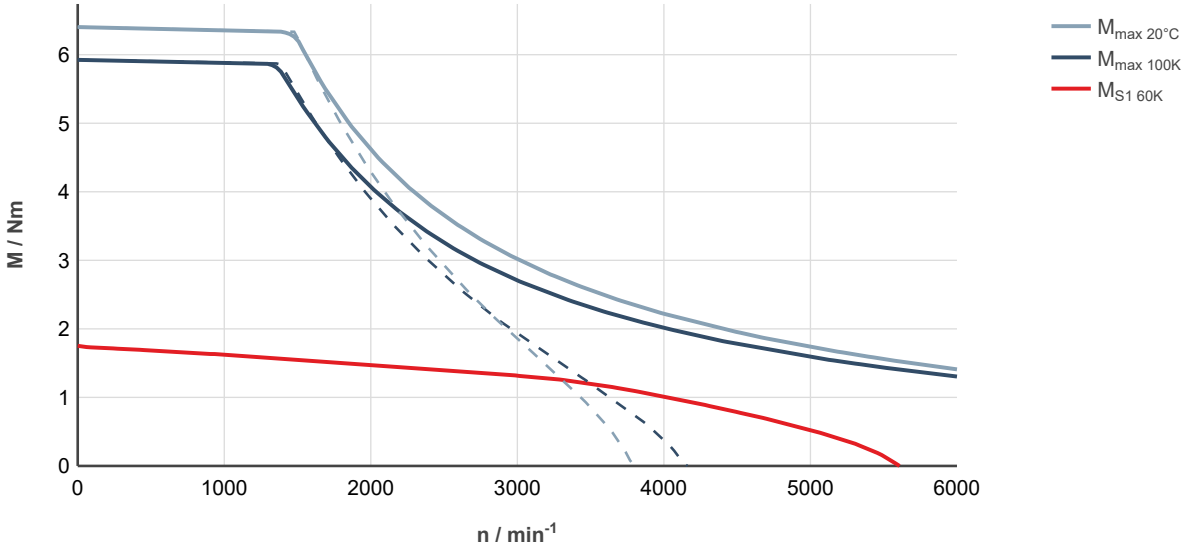


Fig. 26: MS2E04-B0BNN-___0-____-__, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

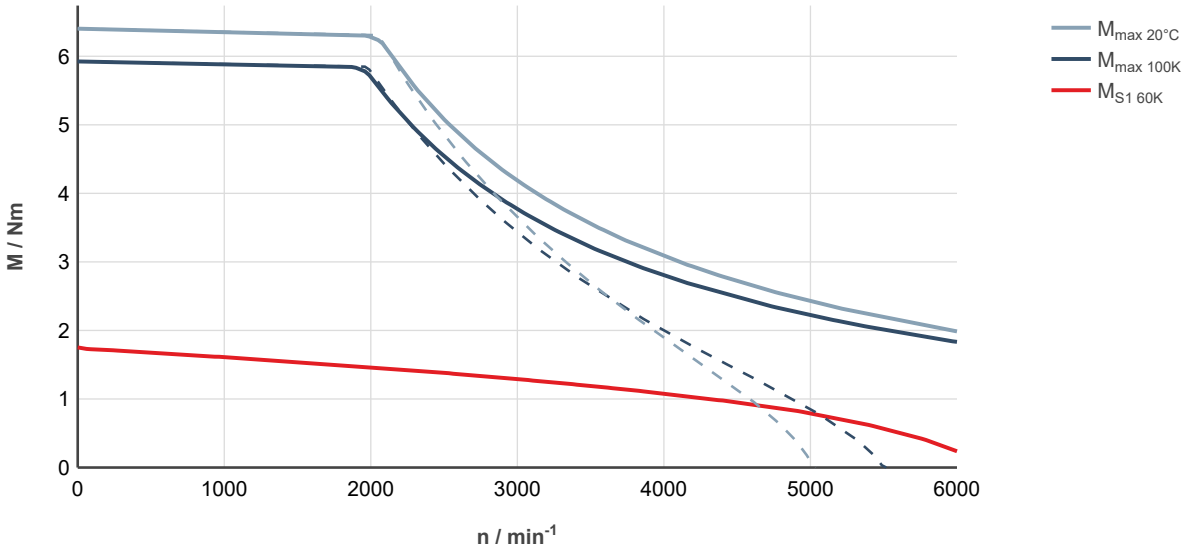


Fig. 27: MS2E04-B0BNN-___0-____-__, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

MS2E04-B0BTN

Designation	Symbol	Unit	MS2E04-B0BTN-___0-_N	MS2E04-B0BTN-___1-_N
Standstill torque - 60K 1)	$M_{0\ 60K}$	Nm	1.75	
Standstill current - 60K	$I_{0\ 60K}$	A	2.2	
Moment of inertia of rotor 1)	J_{rot}	kg*m²	0.00007	0.00011
Rated speed - 60K	$n_{N\ 60K}$	1/min	4330	
Rated torque - 60K 1)	$M_{N\ 60K}$	Nm	0.80	
Rated current - 60K	$I_{N\ 60K}$	A	1.12	
Rated power - 60K 1)	$P_{N\ 60K}$	kW	0.36	
Maximum torque 20 °C (cold) 1)	$M_{max\ 20°C}$	Nm	6.4	
Maximum torque 100K (warm) 1)	$M_{max\ 100K}$	Nm	5.9	
Maximum current	$I_{max(rms)}$	A	9.8	
Maximum speed (electrical)	$n_{max\ el}$	1/min	6000	
Maximum speed (mechanical)	$n_{max\ mech}$	1/min	6000	
Number of pole pairs	p		5	
Torque constant at 20 °C 1)	K_m	Nm/A	0.87	
Voltage constant at 20 °C 1)	K_E	V/1000 min^{-1}	52.7	
Winding resistance at 20 °C	R_{12}	Ohm	6.55	
Winding inductance	L_{12_min}	mH	27.52	
Leakage capacitance of the component	C_{ab}	nF	1.1	
Thermal time constant of winding	T_{th_W}	s	90	
Thermal time constant of motor	T_{th_M}	min	16	
Mass	m_{mot}	kg	2.7	3.4
Holding brake				
Holding torque	M_4	Nm	0	5.00
Rated voltage	U_N	V	0	24
Rated current	I_N	A	0	0.63
Maximum connection time	t_1	ms	0	30
Maximum disconnection time	t_2	ms	0	45
1) For tolerance details refer to ➥chapter 7.4 Tolerances				Latest amendment: 2016-12-20

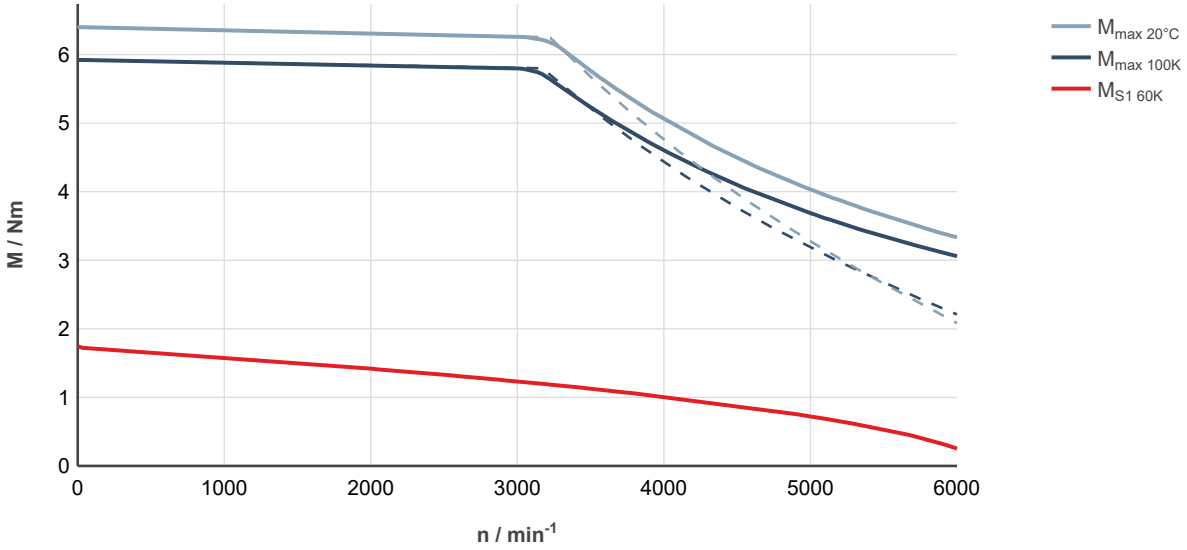


Fig. 28: MS2E04-B0BTN-___0-____-__, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

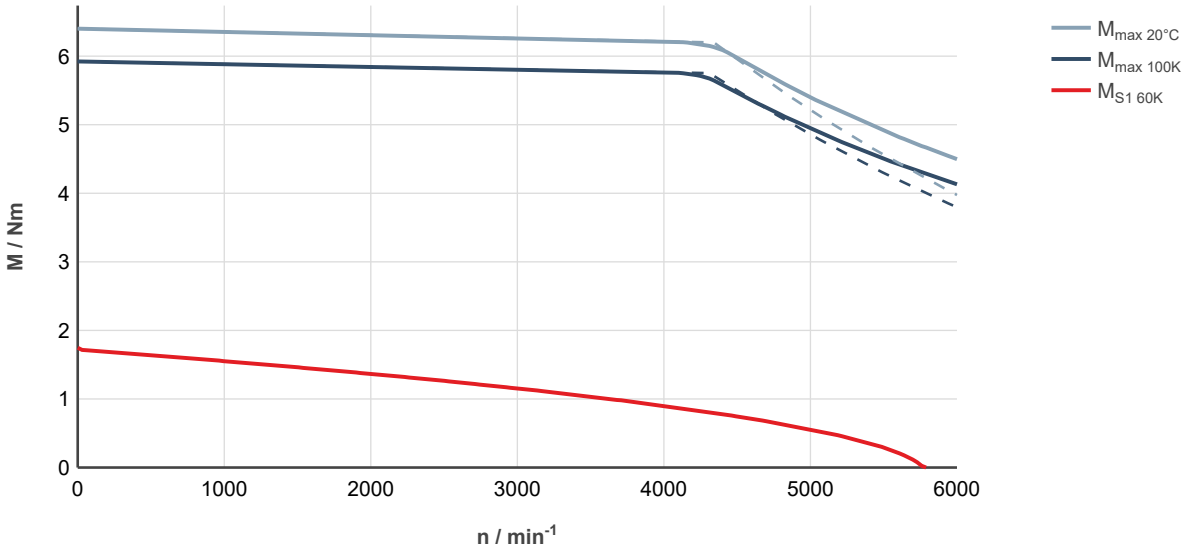


Fig. 29: MS2E04-B0BTN-___0-____-__, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

MS2E04-C0BNN

Designation	Symbol	Unit	MS2E04-C0BNN-___0-_N	MS2E04-C0BNN-___1-_N
Standstill torque - 60K [1]	$M_{0\ 60K}$	Nm	2.8	
Standstill current - 60K	$I_{0\ 60K}$	A	1.78	
Moment of inertia of rotor [1]	J_{rot}	kg*m²	0.00011	0.00016
Rated speed - 60K	$n_{N\ 60K}$	1/min	3230	
Rated torque - 60K [1]	$M_{N\ 60K}$	Nm	1.62	
Rated current - 60K	$I_{N\ 60K}$	A	1.1	
Rated power - 60K [1]	$P_{N\ 60K}$	kW	0.55	
Maximum torque 20 °C (cold) [1]	$M_{max\ 20°C}$	Nm	13.05	
Maximum torque 100K (warm) [1]	$M_{max\ 100K}$	Nm	12.00	
Maximum current	$I_{max(rms)}$	A	9.7	
Maximum speed (electrical)	$n_{max\ el}$	1/min	6000	
Maximum speed (mechanical)	$n_{max\ mech}$	1/min	6000	
Number of pole pairs	p		5	
Torque constant at 20 °C [1]	K_m	Nm/A	1.74	
Voltage constant at 20 °C [1]	K_E	V/1000 min^{-1}	105.7	
Winding resistance at 20 °C	R_{12}	Ohm	10.9	
Winding inductance	L_{12_min}	mH	52.4	
Leakage capacitance of the component	C_{ab}	nF	2.2	
Thermal time constant of winding	T_{th_W}	s	35.3	
Thermal time constant of motor	T_{th_M}	min	16.0	
Mass	m_{mot}	kg	3.7	4.4
Holding brake				
Holding torque	M_4	Nm	0	5.00
Rated voltage	U_N	V	0	24
Rated current	I_N	A	0	0.63
Maximum connection time	t_1	ms	0	30
Maximum disconnection time	t_2	ms	0	45
1) For tolerance details refer to ➥ chapter 7.4 Tolerances				Latest amendment: 2020-08-04

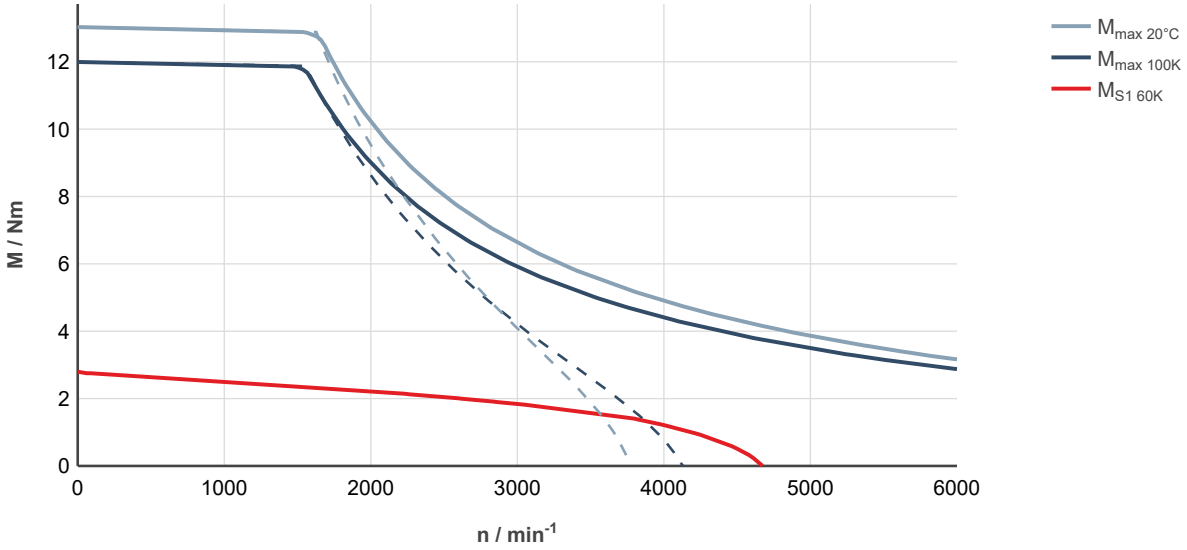


Fig. 30: MS2E04-C0BNN-___0-____-__, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

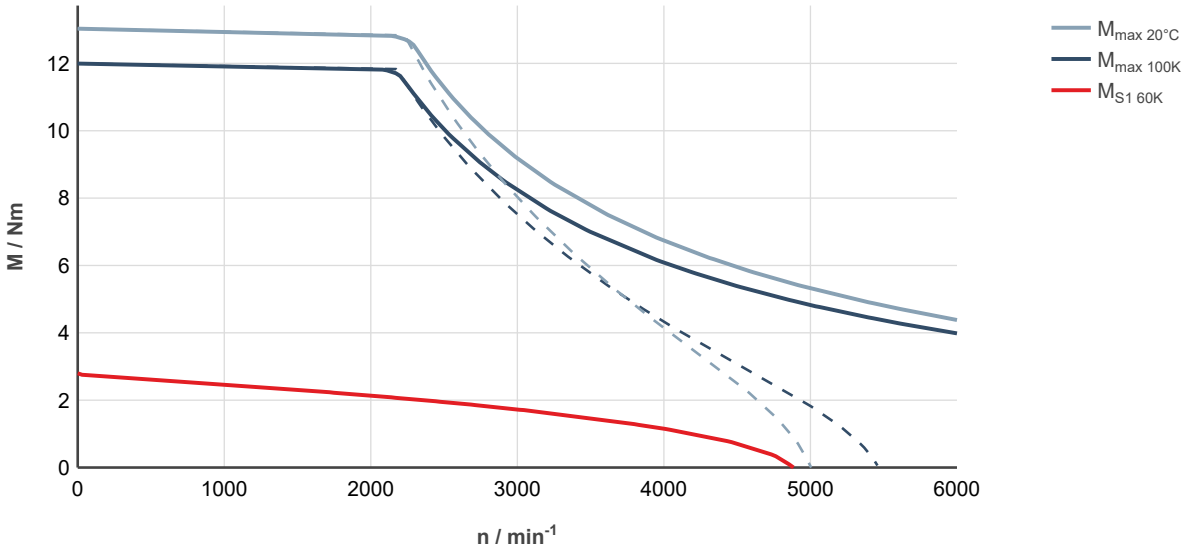


Fig. 31: MS2E04-C0BNN-___0-____-__, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

MS2E04-C0BTN

Designation	Symbol	Unit	MS2E04-C0BTN-___0-_N	MS2E04-C0BTN-___1-_N
Standstill torque - 60K 1)	$M_{0\ 60K}$	Nm	2.80	
Standstill current - 60K	$I_{0\ 60K}$	A	3.11	
Moment of inertia of rotor 1)	J_{rot}	kg*m²	0.00011	0.00016
Rated speed - 60K	$n_{N\ 60K}$	1/min	2965	
Rated torque - 60K 1)	$M_{N\ 60K}$	Nm	1.24	
Rated current - 60K	$I_{N\ 60K}$	A	1.51	
Rated power - 60K 1)	$P_{N\ 60K}$	kW	0.39	
Maximum torque 20 °C (cold) 1)	$M_{max\ 20°C}$	Nm	13.05	
Maximum torque 100K (warm) 1)	$M_{max\ 100K}$	Nm	12.00	
Maximum current	$I_{max(rms)}$	A	17.3	
Maximum speed (electrical)	$n_{max\ el}$	1/min	6000	
Maximum speed (mechanical)	$n_{max\ mech}$	1/min	6000	
Number of pole pairs	p		5	
Torque constant at 20 °C 1)	K_m	Nm/A	0.98	
Voltage constant at 20 °C 1)	K_E	V/1000 min^{-1}	59.8	
Winding resistance at 20 °C	R_{12}	Ohm	3.5	
Winding inductance	L_{12_min}	mH	17.9	
Leakage capacitance of the component	C_{ab}	nF	1.8	
Thermal time constant of winding	T_{th_W}	s	130	
Thermal time constant of motor	T_{th_M}	min	18	
Mass	m_{mot}	kg	3.7	4.4
Holding brake				
Holding torque	M_4	Nm	0	5.00
Rated voltage	U_N	V	0	24
Rated current	I_N	A	0	0.63
Maximum connection time	t_1	ms	0	30
Maximum disconnection time	t_2	ms	0	45
1) For tolerance details refer to ➥chapter 7.4 Tolerances				Latest amendment: 2017-12-07

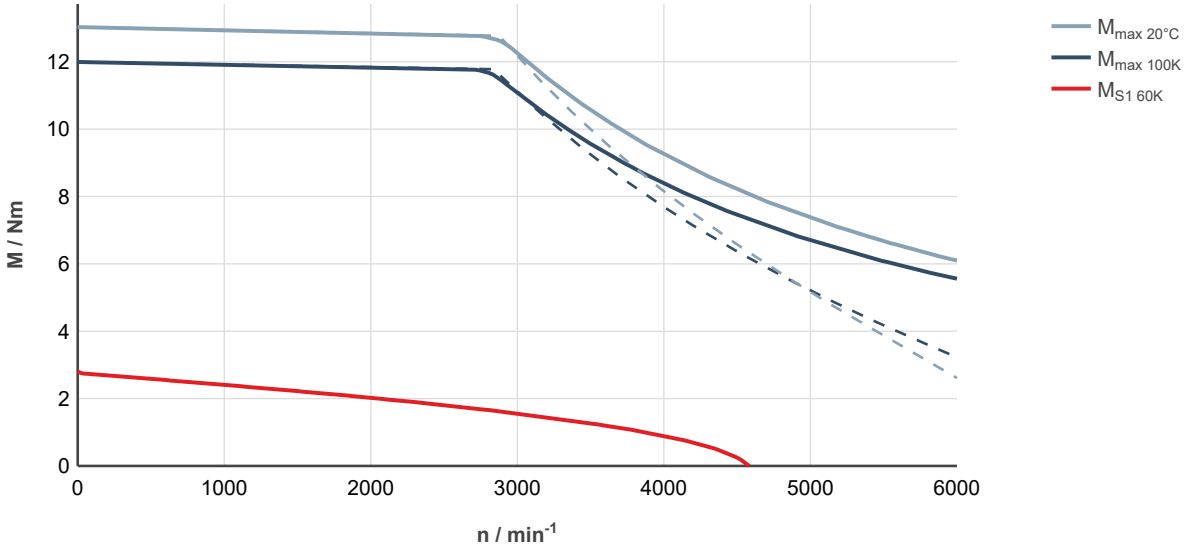


Fig. 32: MS2E04-C0BTN-___0-____-__, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

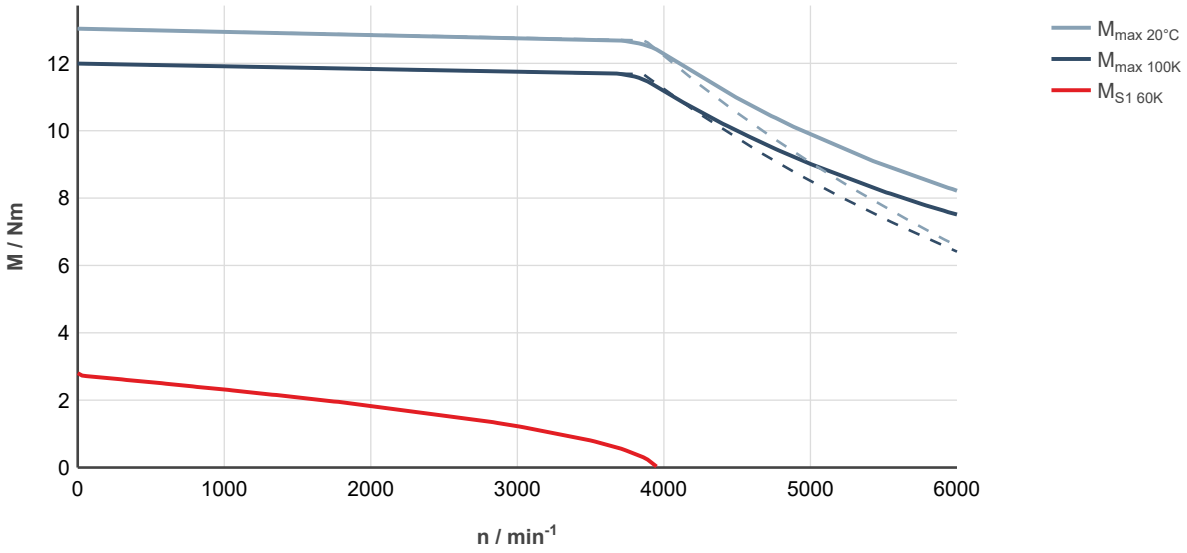
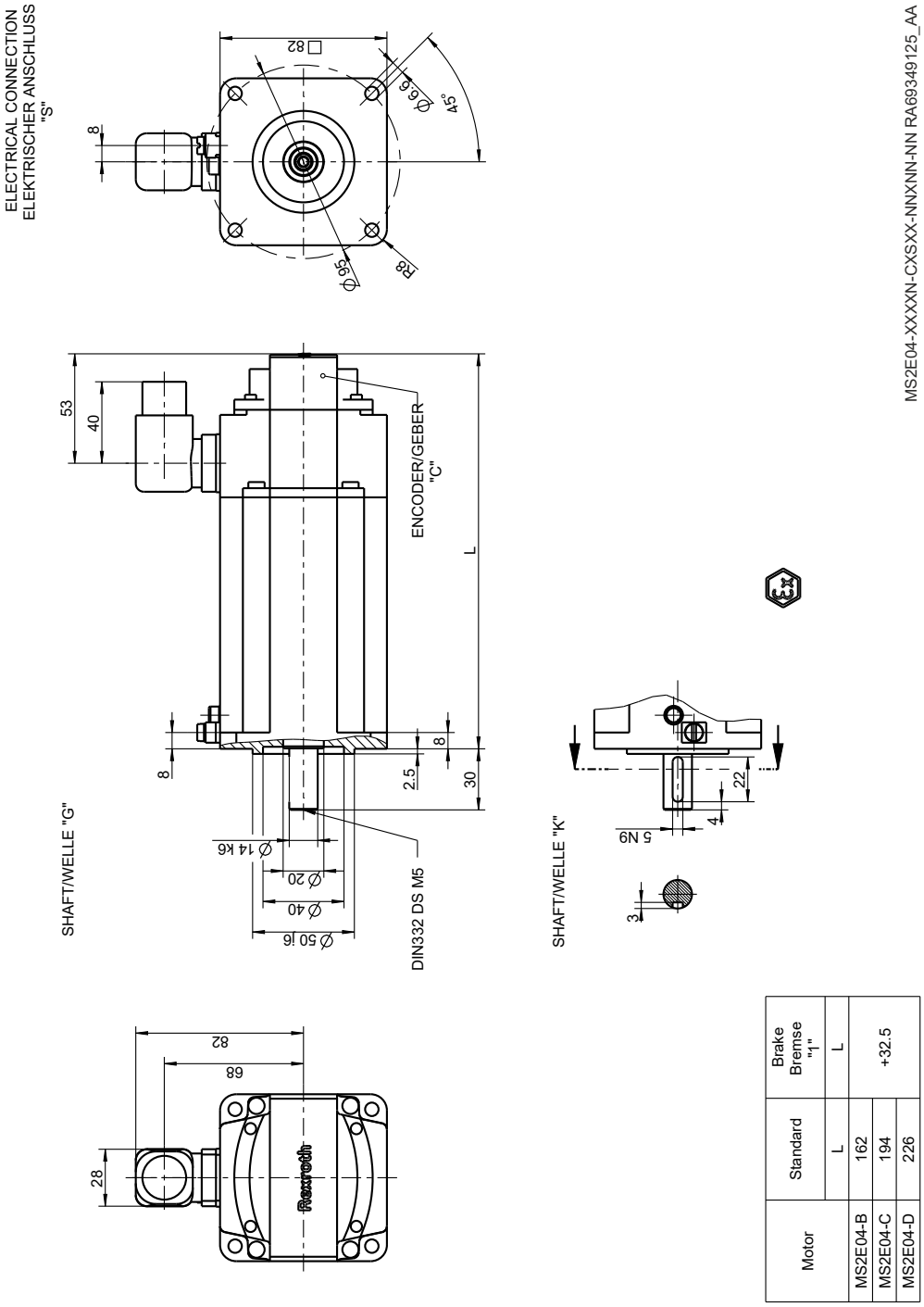


Fig. 33: MS2E04-C0BTN-___0-____-__, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

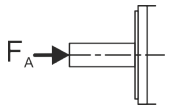
8.2.2 MS2E04 Specifications



Motor	Standard	Brake Bremse "1"
	L	L
MS2E04-B	162	+32.5
MS2E04-C	194	
MS2E04-D	226	

Fig. 34: MS2E04-xxxxN

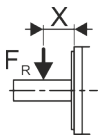
8.2.3 MS2E04 Axial force



Axial forces F_A are permissible without limitation up to 30 N. Higher axial forces only after a detailed dimensioning by your distribution partner at Bosch Rexroth. For evaluation purposes, please specify the following information:

- Axial and radial force with force application point
- Installation position (horizontal, vertical with the shaft end pointing to the top or bottom)
- Mean speed

8.2.4 MS2E04-B Radial force



The permissible radial force F_R is specified in distance x from the shaft shoulder, depending on the mean speed in the following diagram.

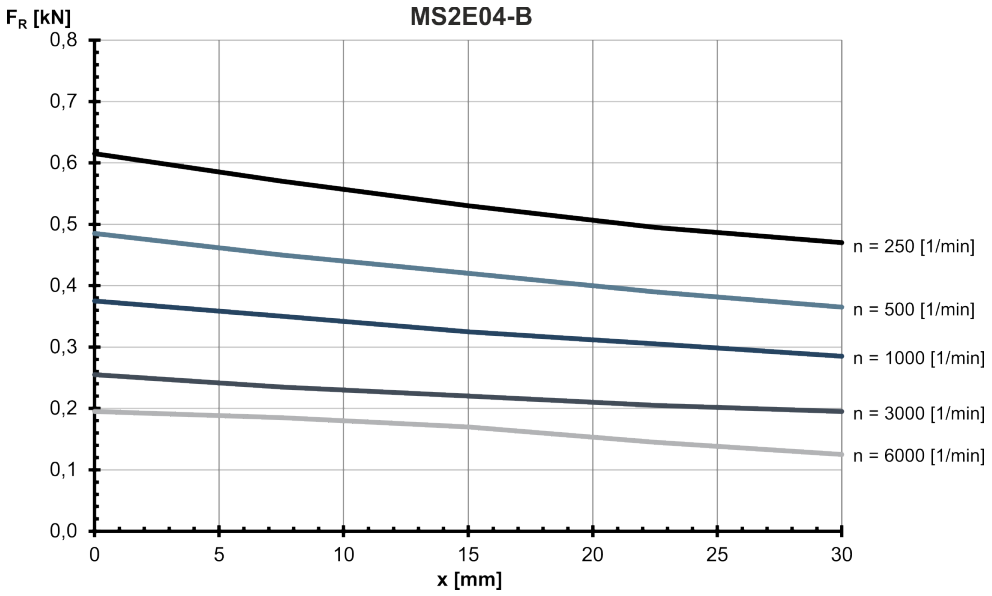
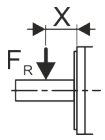


Fig. 35: MS2E04-B: Radial force in distance x from the shaft shoulder at a nominal bearing service life of Lh10 = 30000 h

8.2.5 MS2E04-C Radial force



The permissible radial force F_R is specified in distance x from the shaft shoulder, depending on the mean speed in the following diagram.

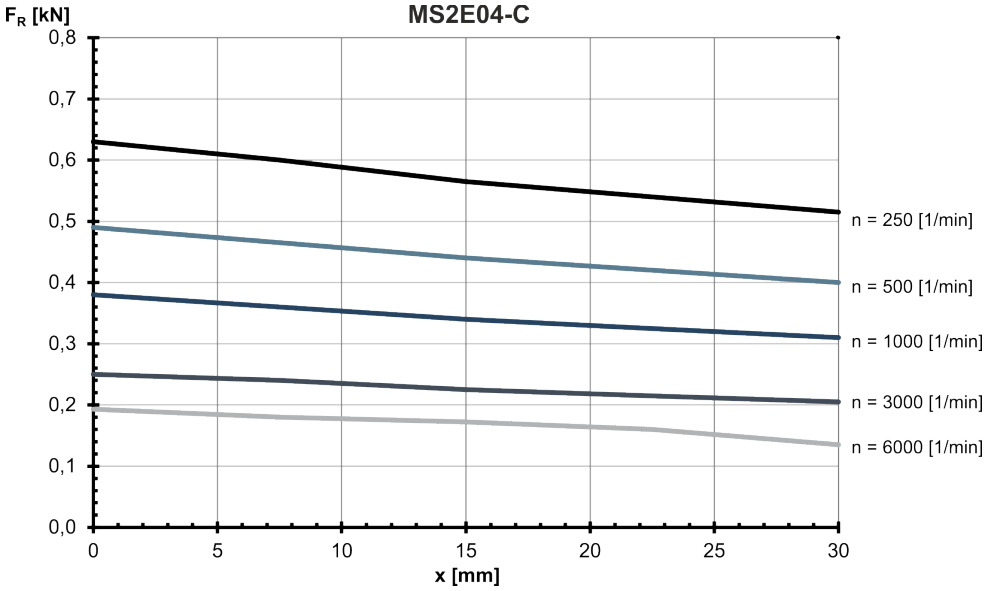


Fig. 36: MS2E04-C: Radial force in distance x from the shaft shoulder at a nominal bearing service life of Lh10 = 30000 h

8.3 MS2E05

8.3.1 Self-cooling

MS2E05-B0BTN

Designation	Symbol	Unit	MS2E05-B0BTN-___0-_N	MS2E05-B0BTN-___1-_N
Standstill torque - 60K [1]	$M_{0\ 60K}$	Nm	3.75	
Standstill current - 60K	$I_{0\ 60K}$	A	4.55	
Moment of inertia of rotor [1]	J_{rot}	kg*m²	0.00017	0.00028
Rated speed - 60K	$n_{N\ 60K}$	1/min	4390	
Rated torque - 60K [1]	$M_{N\ 60K}$	Nm	1.82	
Rated current - 60K	$I_{N\ 60K}$	A	2.39	
Rated power - 60K [1]	$P_{N\ 60K}$	kW	0.84	
Maximum torque 20 °C (cold) [1]	$M_{max\ 20°C}$	Nm	11.5	
Maximum torque 100K (warm) [1]	$M_{max\ 100K}$	Nm	10.6	
Maximum current	$I_{max(rms)}$	A	16.8	
Maximum speed (electrical)	$n_{max\ el}$	1/min	6000	
Maximum speed (mechanical)	$n_{max\ mech}$	1/min	6000	
Number of pole pairs	p		5	
Torque constant at 20 °C [1]	K_m	Nm/A	0.89	
Voltage constant at 20 °C [1]	K_E	V/1000 min^{-1}	54.2	
Winding resistance at 20 °C	R_{12}	Ohm	2.7	
Winding inductance	L_{12_min}	mH	14.09	
Leakage capacitance of the component	C_{ab}	nF	1.21	
Thermal time constant of winding	T_{th_W}	s	21.2	
Thermal time constant of motor	T_{th_M}	min	12.7	
Mass	m_{mot}	kg	4.0	5.1
Holding brake				
Holding torque	M_4	Nm	0	10.00
Rated voltage	U_N	V	0	24
Rated current	I_N	A	0	0.73
Maximum connection time	t_1	ms	0	30
Maximum disconnection time	t_2	ms	0	80
1) For tolerance details refer to ➥ chapter 7.4 Tolerances				Latest amendment: 2016-11-07

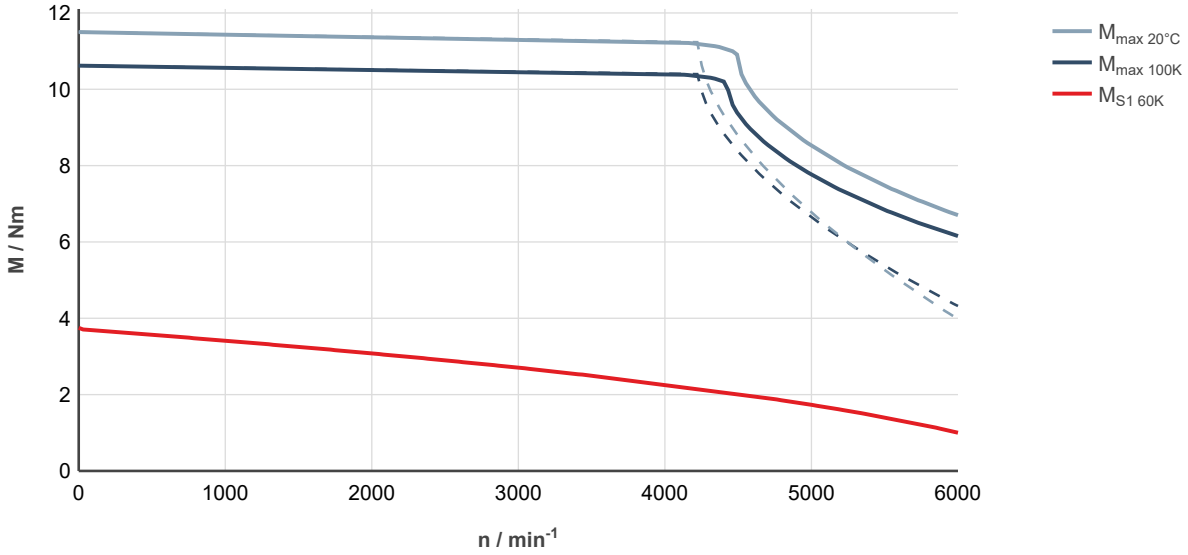


Fig. 37: MS2E05-B0BTN-___0-____-__, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

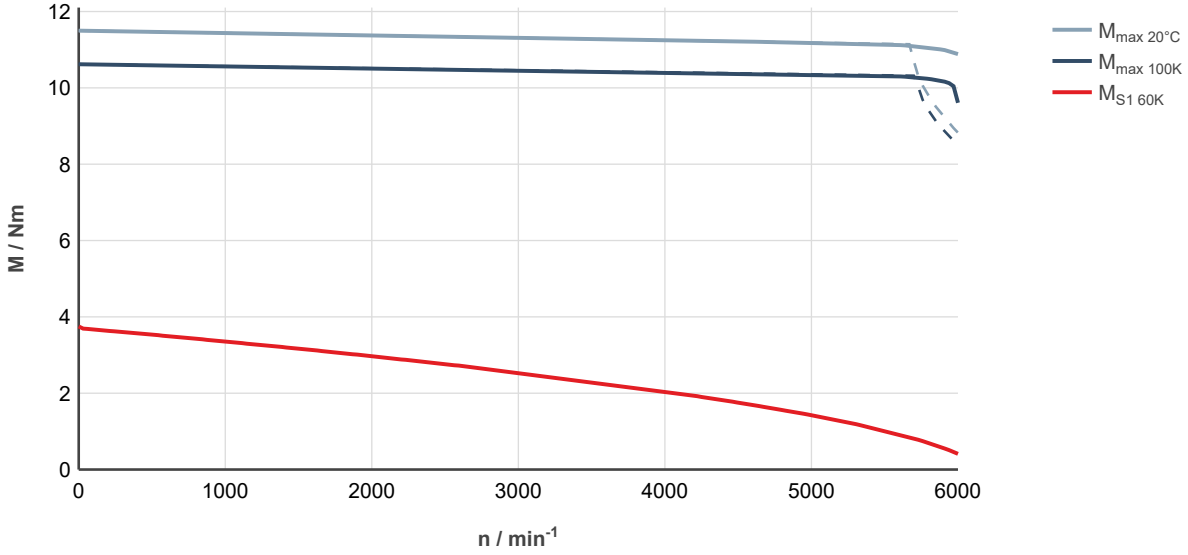


Fig. 38: MS2E05-B0BTN-___0-____-__, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

MS2E05-C0BTN

Designation	Symbol	Unit	MS2E05-C0BTN-___0-_N	MS2E05-C0BTN-___1-_N
Standstill torque - 60K 1)	$M_{0\ 60K}$	Nm	6.1	
Standstill current - 60K	$I_{0\ 60K}$	A	7.1	
Moment of inertia of rotor 1)	J_{rot}	kg*m²	0.00029	0.00040
Rated speed - 60K	$n_{N\ 60K}$	1/min	3130	
Rated torque - 60K 1)	$M_{N\ 60K}$	Nm	3.04	
Rated current - 60K	$I_{N\ 60K}$	A	3.77	
Rated power - 60K 1)	$P_{N\ 60K}$	kW	1.00	
Maximum torque 20 °C (cold) 1)	$M_{max\ 20°C}$	Nm	22.6	
Maximum torque 100K (warm) 1)	$M_{max\ 100K}$	Nm	20.8	
Maximum current	$I_{max(rms)}$	A	30.2	
Maximum speed (electrical)	$n_{max\ el}$	1/min	6000	
Maximum speed (mechanical)	$n_{max\ mech}$	1/min	6000	
Number of pole pairs	p		5	
Torque constant at 20 °C 1)	K_m	Nm/A	0.93	
Voltage constant at 20 °C 1)	K_E	V/1000 min^{-1}	56.3	
Winding resistance at 20 °C	R_{12}	Ohm	1.26	
Winding inductance	L_{12_min}	mH	7.6	
Leakage capacitance of the component	C_{ab}	nF	1.5	
Thermal time constant of winding	T_{th_W}	s	36.2	
Thermal time constant of motor	T_{th_M}	min	16.0	
Mass	m_{mot}	kg	5.9	7.0
Holding brake				
Holding torque	M_4	Nm	0	10.00
Rated voltage	U_N	V	0	24
Rated current	I_N	A	0	0.73
Maximum connection time	t_1	ms	0	30
Maximum disconnection time	t_2	ms	0	80
1) For tolerance details refer to ➥ chapter 7.4 Tolerances				Latest amendment: 2016-11-07

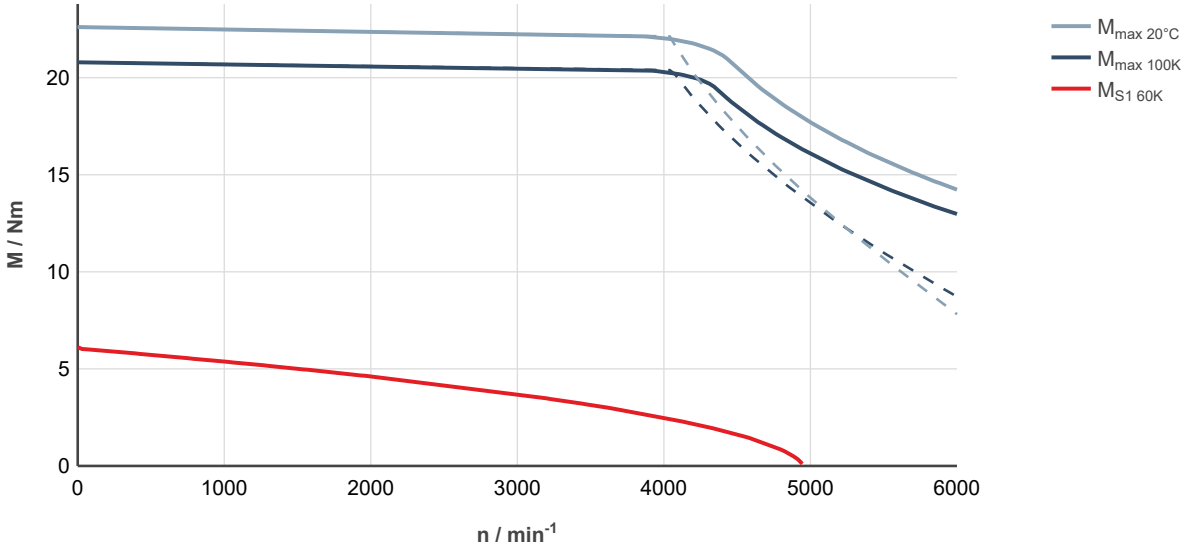


Fig. 39: MS2E05-C0BTN-___0-____-__, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

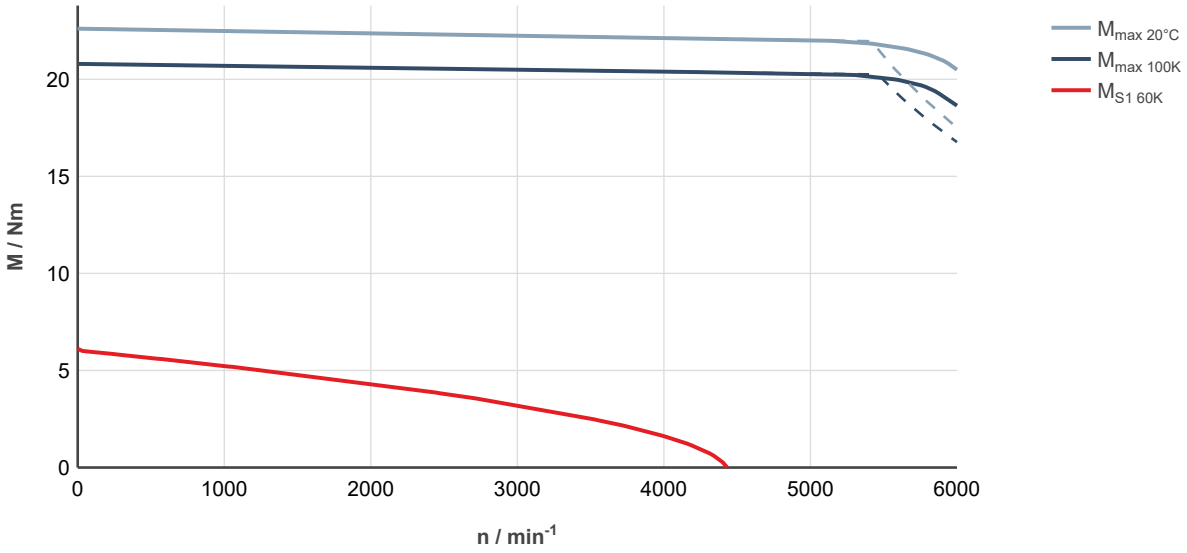


Fig. 40: MS2E05-C0BTN-___0-____-__, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

MS2E05-D0BRN

Designation	Symbol	Unit	MS2E05-D0BRN-___0-_N	MS2E05-D0BRN-___1-_N
Standstill torque - 60K 1)	$M_{0\ 60K}$	Nm	7.9	
Standstill current - 60K	$I_{0\ 60K}$	A	6.05	
Moment of inertia of rotor 1)	J_{rot}	kg*m²	0.00040	0.00051
Rated speed - 60K	$n_{N\ 60K}$	1/min	2915	
Rated torque - 60K 1)	$M_{N\ 60K}$	Nm	3.50	
Rated current - 60K	$I_{N\ 60K}$	A	2.91	
Rated power - 60K 1)	$P_{N\ 60K}$	kW	1.07	
Maximum torque 20 °C (cold) 1)	$M_{max\ 20°C}$	Nm	34.0	
Maximum torque 100K (warm) 1)	$M_{max\ 100K}$	Nm	31.3	
Maximum current	$I_{max(rms)}$	A	30.3	
Maximum speed (electrical)	$n_{max\ el}$	1/min	6000	
Maximum speed (mechanical)	$n_{max\ mech}$	1/min	6000	
Number of pole pairs	p		5	
Torque constant at 20 °C 1)	K_m	Nm/A	1.4	
Voltage constant at 20 °C 1)	K_E	V/1000 min^{-1}	84.8	
Winding resistance at 20 °C	R_{12}	Ohm	1.76	
Winding inductance	L_{12_min}	mH	11.18	
Leakage capacitance of the component	C_{ab}	nF	3.29	
Thermal time constant of winding	T_{th_W}	s	45.8	
Thermal time constant of motor	T_{th_M}	min	18.5	
Mass	m_{mot}	kg	7.3	8.4
Holding brake				
Holding torque	M_4	Nm	0	10.00
Rated voltage	U_N	V	0	24
Rated current	I_N	A	0	0.73
Maximum connection time	t_1	ms	0	30
Maximum disconnection time	t_2	ms	0	80

1) For tolerance details refer to ➥chapter 7.4 Tolerances Latest amendment: 2017-02-23

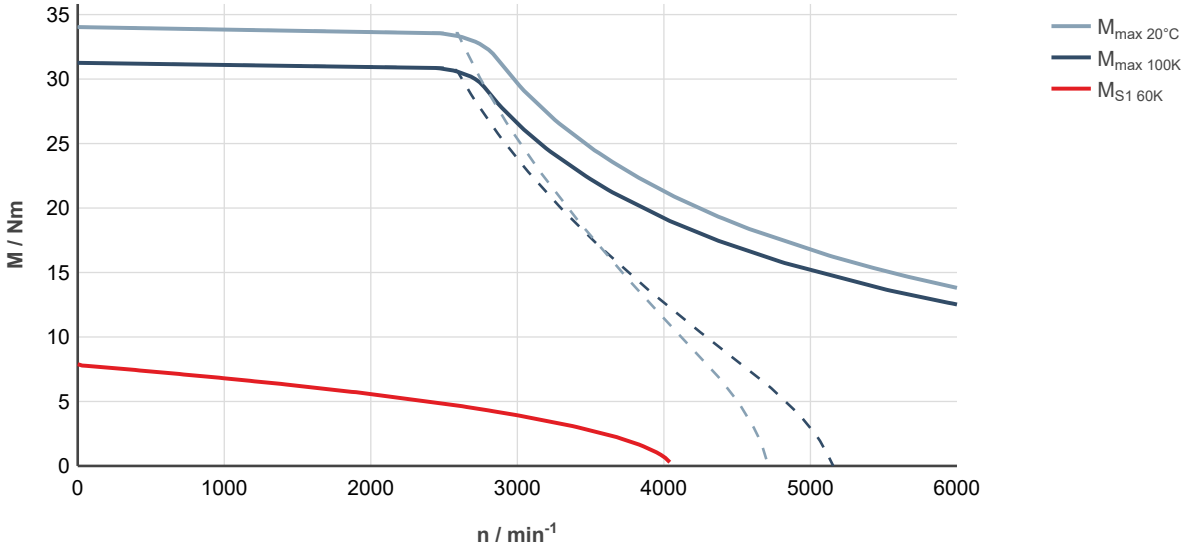


Fig. 41: MS2E05-D0BRN-___0-____-__, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

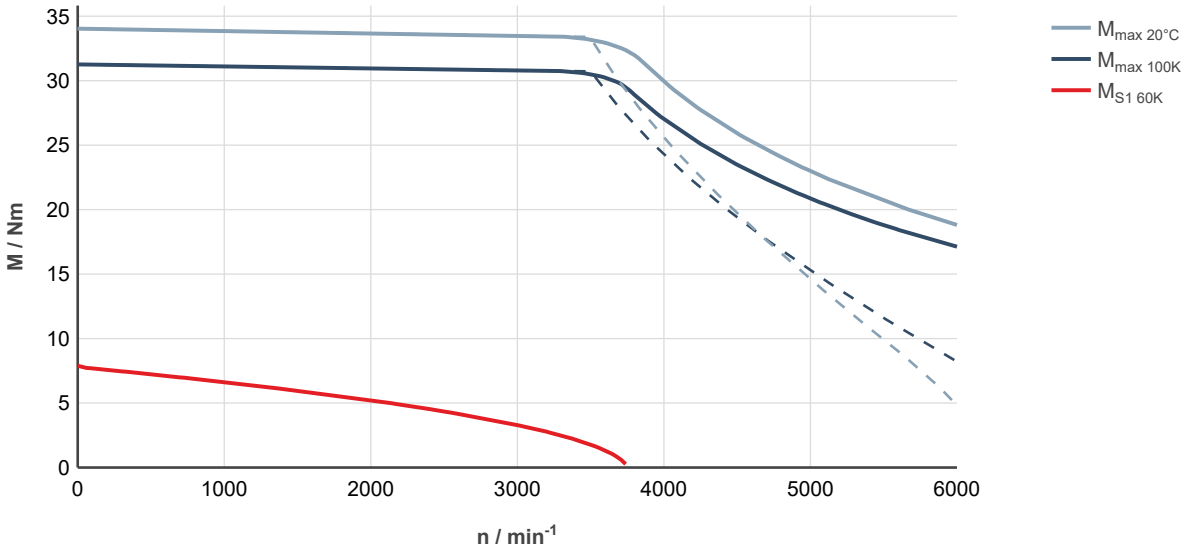
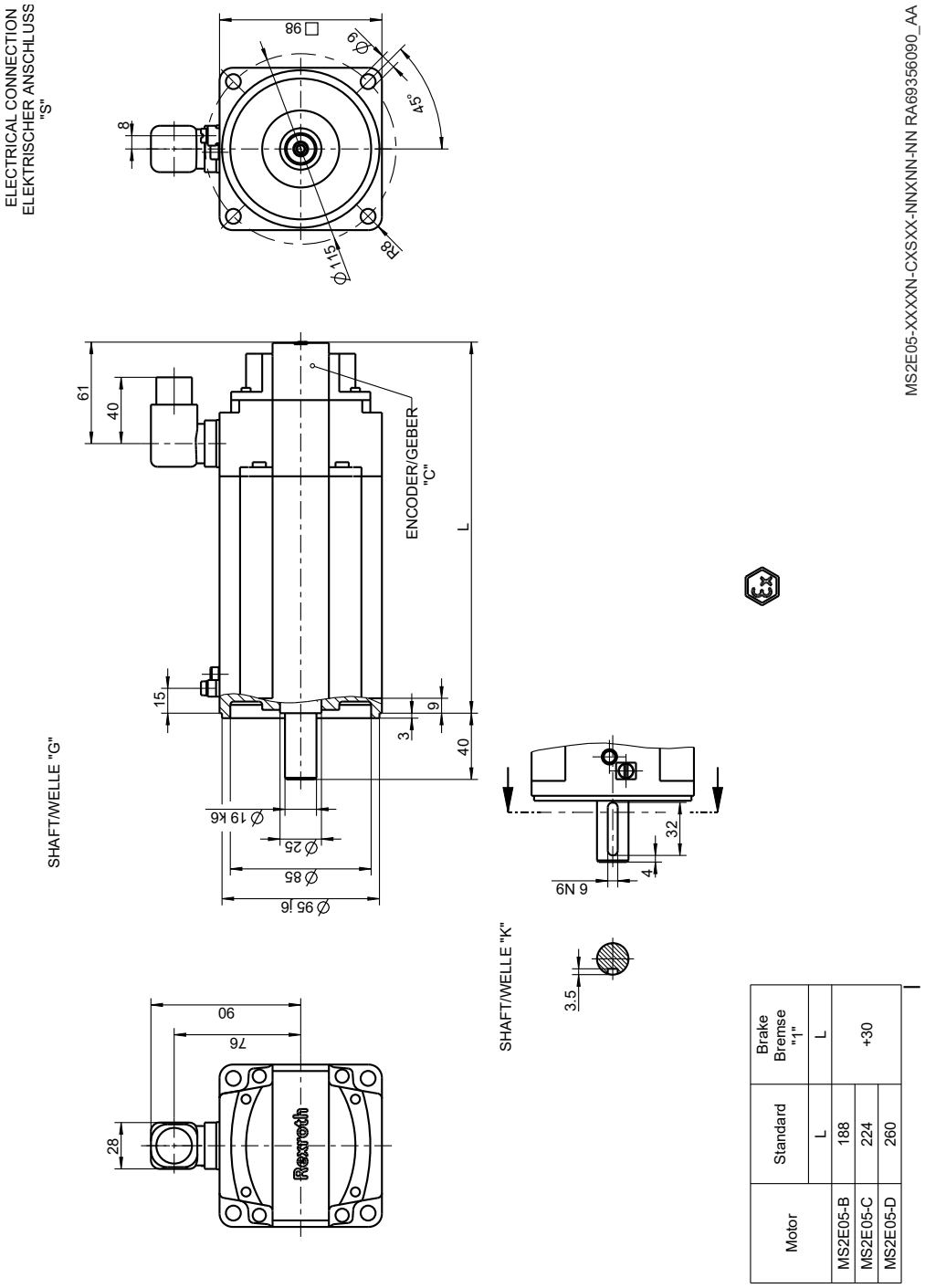


Fig. 42: MS2E05-D0BRN-___0-____-__, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

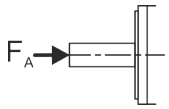
8.3.2 MS2E05 Specifications



Motor	Standard		Brake Bremse "1"	
	L		L	
MS2E05-B	188		+30	
MS2E05-C	224			
MS2E05-D	260			

Fig. 43: MS2E05-xxxxN

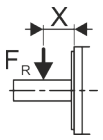
8.3.3 MS2E05 Axial force



Axial forces F_A are permissible without limitation up to 40 N. Higher axial forces only after a detailed dimensioning by your distribution partner at Bosch Rexroth. For evaluation purposes, please specify the following information:

- Axial and radial force with force application point
- Installation position (horizontal, vertical with the shaft end pointing to the top or bottom)
- Mean speed

8.3.4 MS2E05-B Radial force



The permissible radial force F_R is specified in distance x from the shaft shoulder, depending on the mean speed in the following diagram.

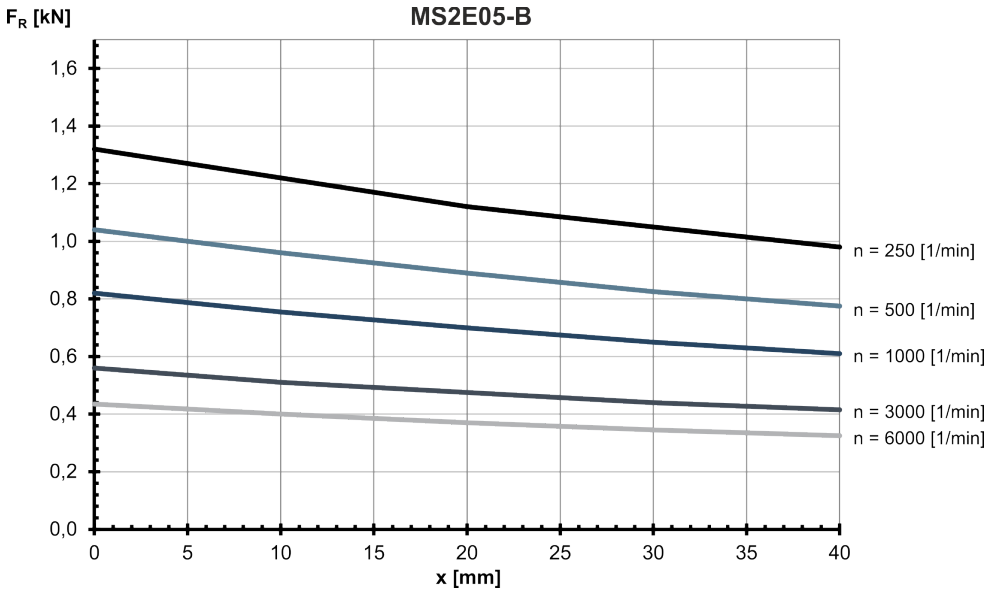
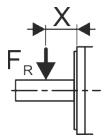


Fig. 44: MS2E05-B: Radial force in distance x from the shaft shoulder at a nominal bearing service life of Lh10 = 30000 h

8.3.5 MS2E05-C Radial force



The permissible radial force F_R is specified in distance x from the shaft shoulder, depending on the mean speed in the following diagram.

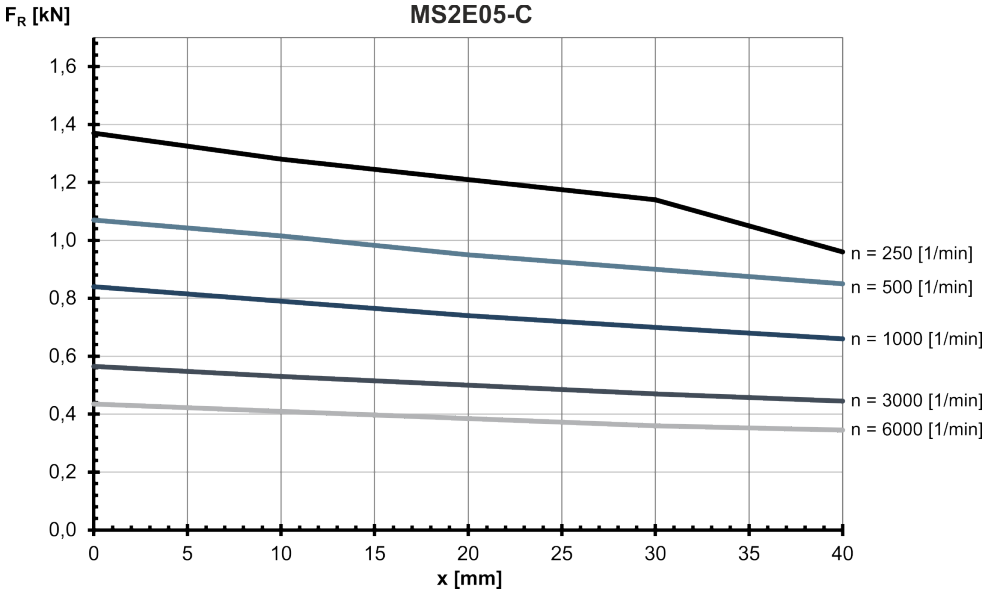
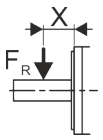


Fig. 45: MS2E05-C: Radial force in distance x from the shaft shoulder at a nominal bearing service life of Lh10 = 30000 h

8.3.6 MS2E05-D Radial force



The permissible radial force F_R is specified in distance x from the shaft shoulder, depending on the mean speed in the following diagram.

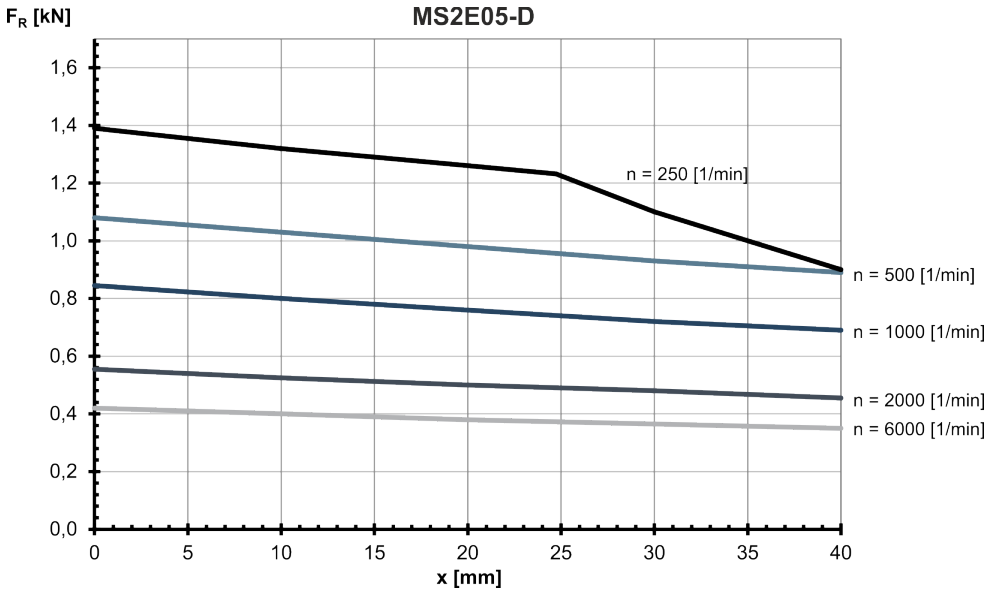


Fig. 46: MS2E05-D: Radial force in distance x from the shaft shoulder at a nominal bearing service life of Lh10 = 30000 h

8.4 MS2E06

8.4.1 Self-cooling

MS2E06-C0BNN

Designation	Symbol	Unit	MS2E06-C0BNN-___0-_N	MS2E06-C0BNN-___1-_N
Standstill torque - 60K [1]	$M_{0\ 60K}$	Nm	6.0	
Standstill current - 60K	$I_{0\ 60K}$	A	3.75	
Moment of inertia of rotor [1]	J_{rot}	kg*m²	0.00039	0.00050
Rated speed - 60K	$n_{N\ 60K}$	1/min	3000	
Rated torque - 60K [1]	$M_{N\ 60K}$	Nm	4.18	
Rated current - 60K	$I_{N\ 60K}$	A	2.71	
Rated power - 60K [1]	$P_{N\ 60K}$	kW	1.31	
Maximum torque 20 °C (cold) [1]	$M_{max\ 20°C}$	Nm	17.3	
Maximum torque 100K (warm) [1]	$M_{max\ 100K}$	Nm	16.0	
Maximum current	$I_{max(rms)}$	A	12.75	
Maximum speed (electrical)	$n_{max\ el}$	1/min	6000	
Maximum speed (mechanical)	$n_{max\ mech}$	1/min	6000	
Number of pole pairs	p		5	
Torque constant at 20 °C [1]	K_m	Nm/A	1.73	
Voltage constant at 20 °C [1]	K_E	V/1000 min^{-1}	105.4	
Winding resistance at 20 °C	R_{12}	Ohm	4.48	
Winding inductance	L_{12_min}	mH	39.5	
Leakage capacitance of the component	C_{ab}	nF	1.24	
Thermal time constant of winding	T_{th_W}	s	27.3	
Thermal time constant of motor	T_{th_M}	min	14.1	
Mass	m_{mot}	kg	6.4	7.4
Holding brake				
Holding torque	M_4	Nm	0	10.00
Rated voltage	U_N	V	0	24
Rated current	I_N	A	0	0.73
Maximum connection time	t_1	ms	0	30
Maximum disconnection time	t_2	ms	0	80
1) For tolerance details refer to ➥ chapter 7.4 Tolerances				Latest amendment: 2016-11-07

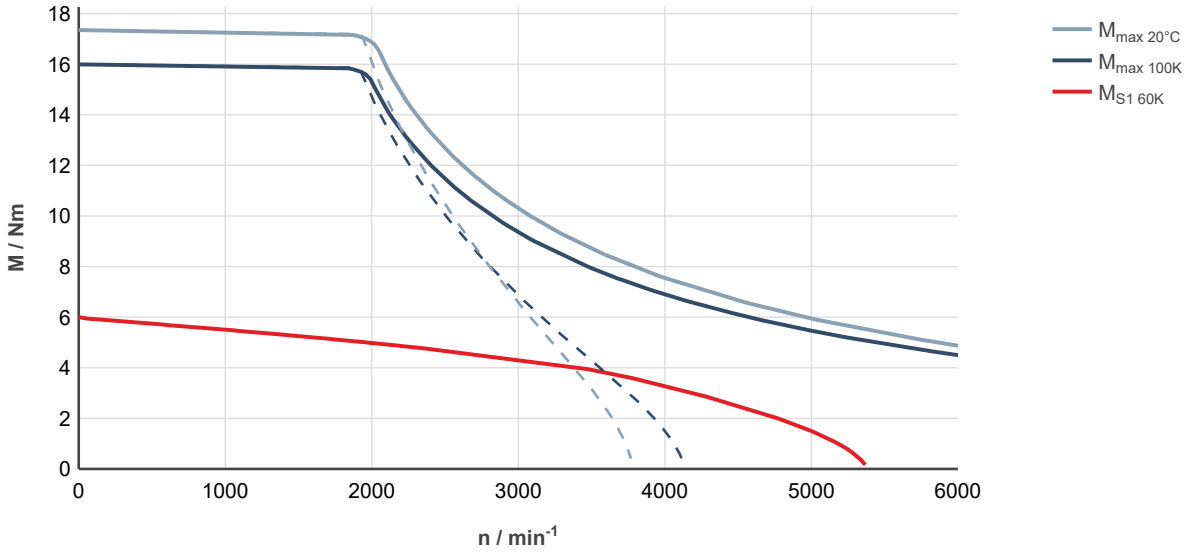


Fig. 47: MS2E06-C0BNN-___0-____-__, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

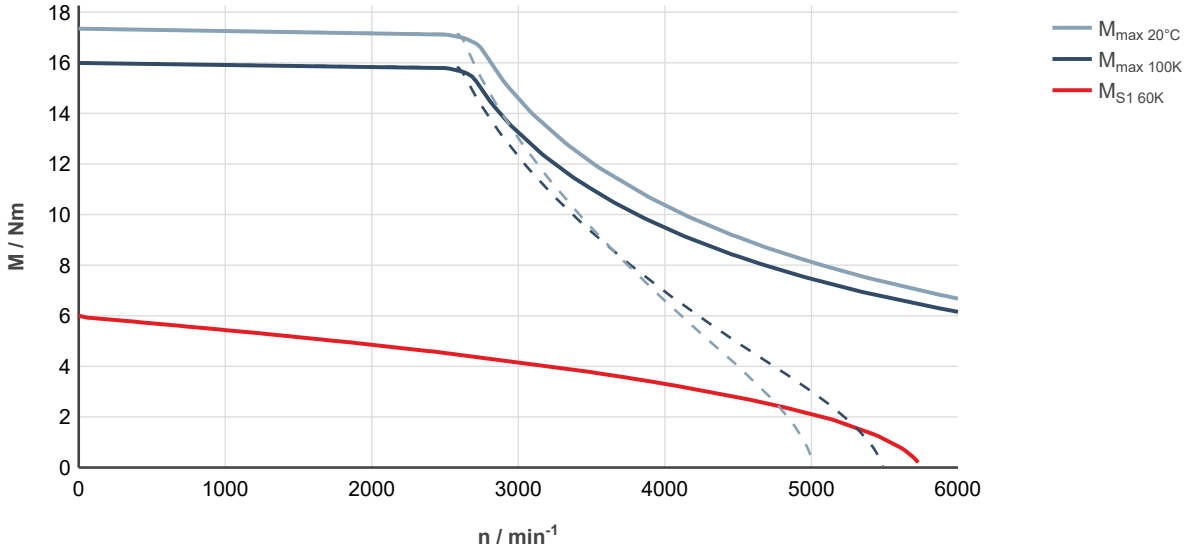


Fig. 48: MS2E06-C0BNN-___0-____-__, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

MS2E06-D0BNN

Designation	Symbol	Unit	MS2E06-D0BNN-___0-_N	MS2E06-D0BNN-___2-_N
Standstill torque - 60K 1)	$M_{0\ 60K}$	Nm	9.7	
Standstill current - 60K	$I_{0\ 60K}$	A	6.1	
Moment of inertia of rotor 1)	J_{rot}	kg*m²	0.00065	0.00079
Rated speed - 60K	$n_{N\ 60K}$	1/min	2900	
Rated torque - 60K 1)	$M_{N\ 60K}$	Nm	5.20	
Rated current - 60K	$I_{N\ 60K}$	A	3.45	
Rated power - 60K 1)	$P_{N\ 60K}$	kW	1.58	
Maximum torque 20 °C (cold) 1)	$M_{max\ 20°C}$	Nm	34.8	
Maximum torque 100K (warm) 1)	$M_{max\ 100K}$	Nm	32.0	
Maximum current	$I_{max(rms)}$	A	25.4	
Maximum speed (electrical)	$n_{max\ el}$	1/min	6000	
Maximum speed (mechanical)	$n_{max\ mech}$	1/min	6000	
Number of pole pairs	p		5	
Torque constant at 20 °C 1)	K_m	Nm/A	1.70	
Voltage constant at 20 °C 1)	K_E	V/1000 min^{-1}	103.5	
Winding resistance at 20 °C	R_{12}	Ohm	1.85	
Winding inductance	L_{12_min}	mH	18	
Leakage capacitance of the component	C_{ab}	nF	5	
Thermal time constant of winding	T_{th_W}	s	38.6	
Thermal time constant of motor	T_{th_M}	min	17.4	
Mass	m_{mot}	kg	9.0	10.5
Holding brake				
Holding torque	M_4	Nm	0	15.00
Rated voltage	U_N	V	0	24
Rated current	I_N	A	0	0.75
Maximum connection time	t_1	ms	0	50
Maximum disconnection time	t_2	ms	0	135

1) For tolerance details refer to ➥ chapter 7.4 Tolerances Latest amendment: 2016-11-08

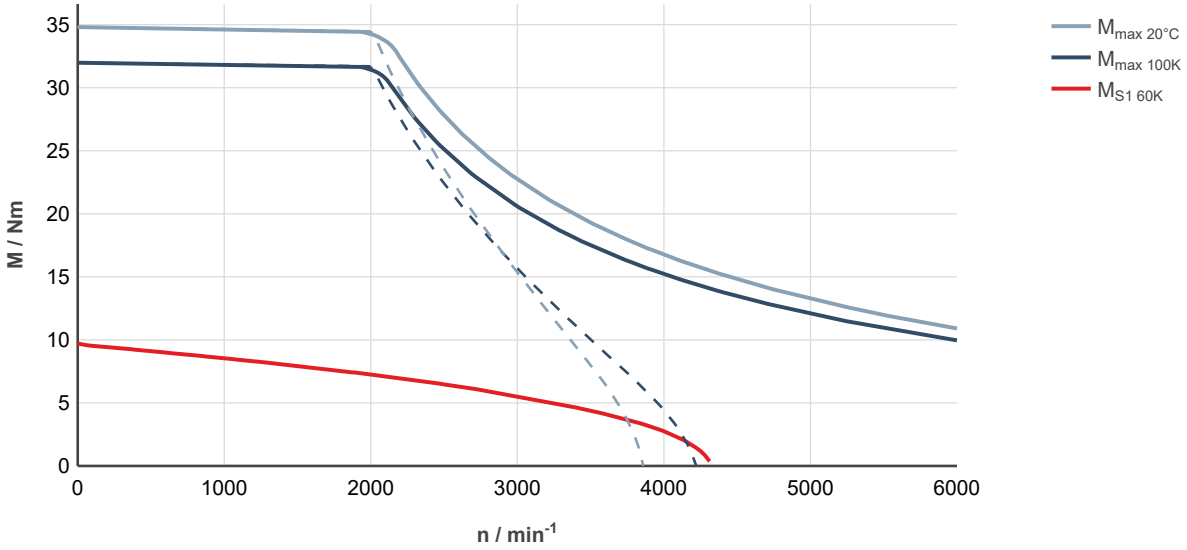


Fig. 49: MS2E06-D0BNN-___0-____-__, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

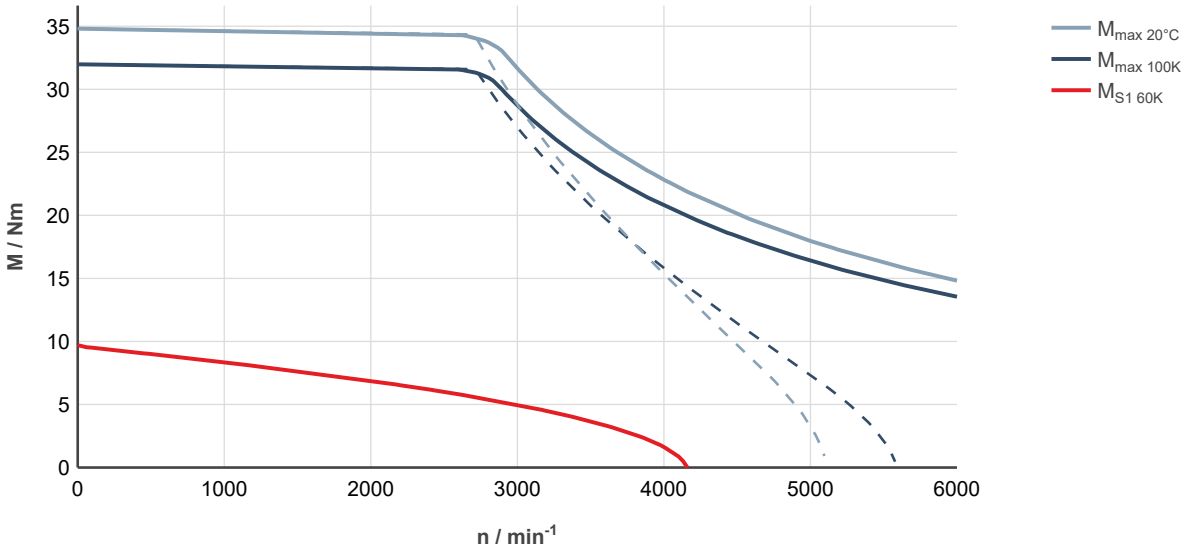


Fig. 50: MS2E06-D0BNN-___0-____-__, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

MS2E06-D0BRN

Designation	Symbol	Unit	MS2E06-D0BRN-___0-_N	MS2E06-D0BRN-___2-_N
Standstill torque - 60K [1]	$M_{0\ 60K}$	Nm	9.7	
Standstill current - 60K	$I_{0\ 60K}$	A	7.85	
Moment of inertia of rotor [1]	J_{rot}	kg*m²	0.00065	0.00079
Rated speed - 60K	$n_{N\ 60K}$	1/min	2870	
Rated torque - 60K [1]	$M_{N\ 60K}$	Nm	4.73	
Rated current - 60K	$I_{N\ 60K}$	A	4.06	
Rated power - 60K [1]	$P_{N\ 60K}$	kW	1.42	
Maximum torque 20 °C (cold) [1]	$M_{max\ 20°C}$	Nm	34.8	
Maximum torque 100K (warm) [1]	$M_{max\ 100K}$	Nm	32.0	
Maximum current	$I_{max(rms)}$	A	32.7	
Maximum speed (electrical)	$n_{max\ el}$	1/min	6000	
Maximum speed (mechanical)	$n_{max\ mech}$	1/min	6000	
Number of pole pairs	p		5	
Torque constant at 20 °C [1]	K_m	Nm/A	1.33	
Voltage constant at 20 °C [1]	K_E	V/1000 min^{-1}	80.5	
Winding resistance at 20 °C	R_{12}	Ohm	1.13	
Winding inductance	L_{12_min}	mH	11.06	
Leakage capacitance of the component	C_{ab}	nF	2.55	
Thermal time constant of winding	T_{th_W}	s	38.6	
Thermal time constant of motor	T_{th_M}	min	17.4	
Mass	m_{mot}	kg	9.0	10.5
Holding brake				
Holding torque	M_4	Nm	0	15.00
Rated voltage	U_N	V	0	24
Rated current	I_N	A	0	0.75
Maximum connection time	t_1	ms	0	50
Maximum disconnection time	t_2	ms	0	135

1) For tolerance details refer to ➥ chapter 7.4 Tolerances

Latest amendment: 2016-11-08

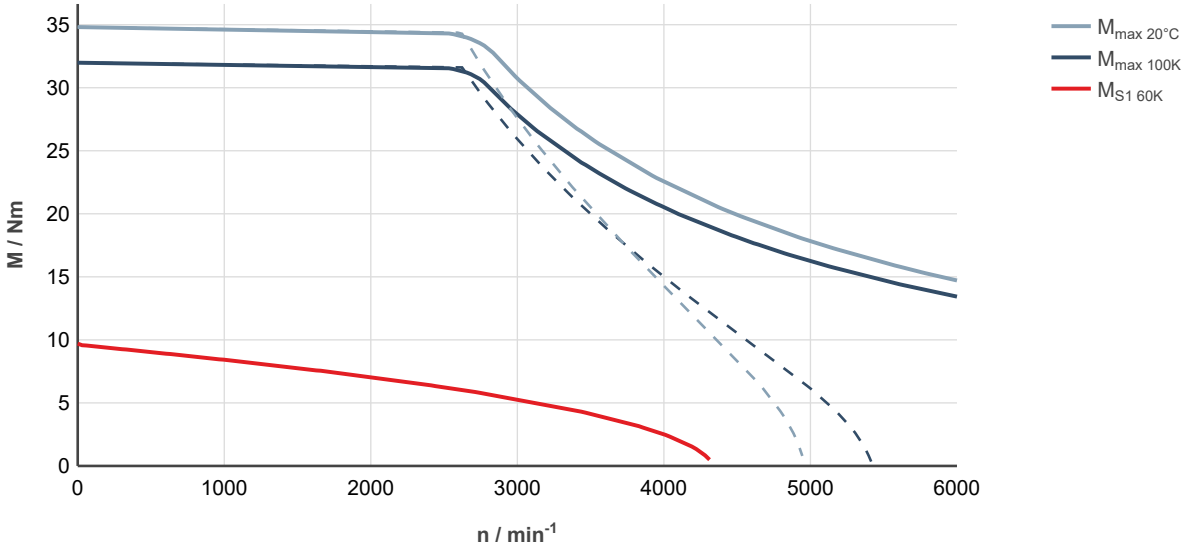


Fig. 51: MS2E06-D0BRN-___0-____-__, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

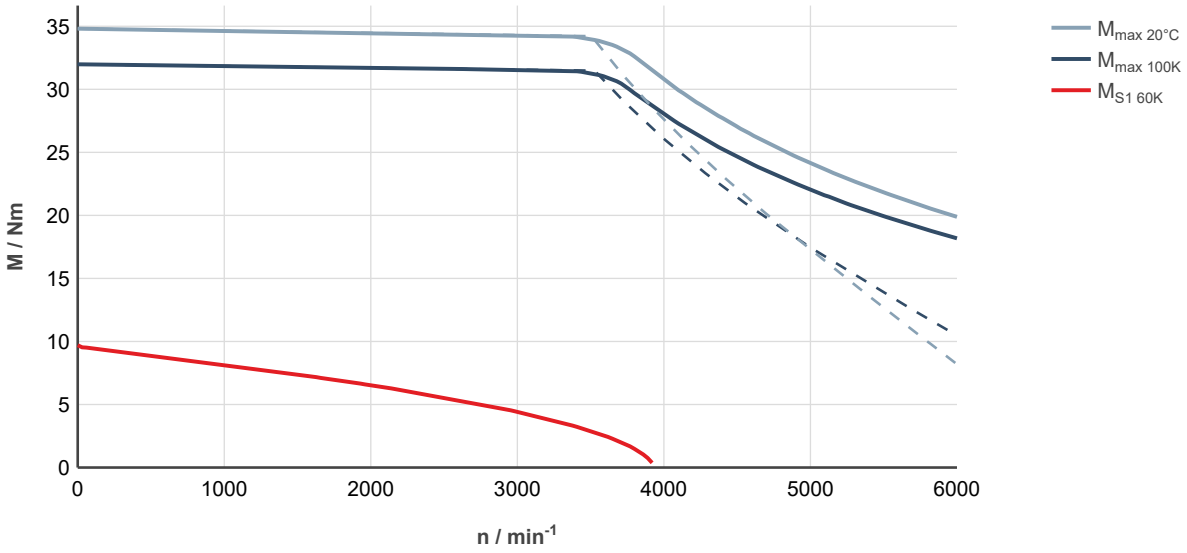


Fig. 52: MS2E06-D0BRN-___0-____-__, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

MS2E06-E0BRN

Designation	Symbol	Unit	MS2E06-E0BRN-___0-_N	MS2E06-E0BRN-___2-_N
Standstill torque - 60K 1)	$M_{0\ 60K}$	Nm	13.0	
Standstill current - 60K	$I_{0\ 60K}$	A	10.85	
Moment of inertia of rotor 1)	J_{rot}	kg*m²	0.00089	0.00103
Rated speed - 60K	$n_{N\ 60K}$	1/min	2110	
Rated torque - 60K 1)	$M_{N\ 60K}$	Nm	6.35	
Rated current - 60K	$I_{N\ 60K}$	A	5.6	
Rated power - 60K 1)	$P_{N\ 60K}$	kW	1.41	
Maximum torque 20 °C (cold) 1)	$M_{max\ 20°C}$	Nm	53.4	
Maximum torque 100K (warm) 1)	$M_{max\ 100K}$	Nm	49.0	
Maximum current	$I_{max(rms)}$	A	50.8	
Maximum speed (electrical)	$n_{max\ el}$	1/min	6000	
Maximum speed (mechanical)	$n_{max\ mech}$	1/min	6000	
Number of pole pairs	p		5	
Torque constant at 20 °C 1)	K_m	Nm/A	1.29	
Voltage constant at 20 °C 1)	K_E	V/1000 min^{-1}	78.4	
Winding resistance at 20 °C	R_{12}	Ohm	0.638	
Winding inductance	L_{12_min}	mH	6.895	
Leakage capacitance of the component	C_{ab}	nF	3.87	
Thermal time constant of winding	T_{th_W}	s	48.6	
Thermal time constant of motor	T_{th_M}	min	20.0	
Mass	m_{mot}	kg	11.5	13.0
Holding brake				
Holding torque	M_4	Nm	0	15.00
Rated voltage	U_N	V	0	24
Rated current	I_N	A	0	0.75
Maximum connection time	t_1	ms	0	50
Maximum disconnection time	t_2	ms	0	135

1) For tolerance details refer to ➥chapter 7.4 Tolerances Latest amendment: 2016-11-08

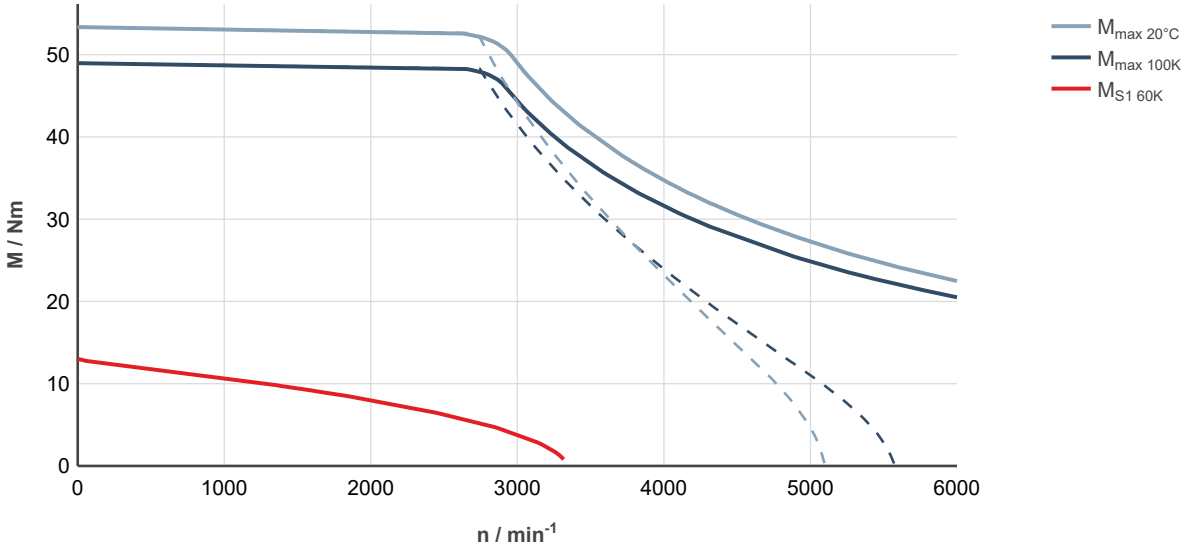


Fig. 53: MS2E06-E0BRN-___0-____-__, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

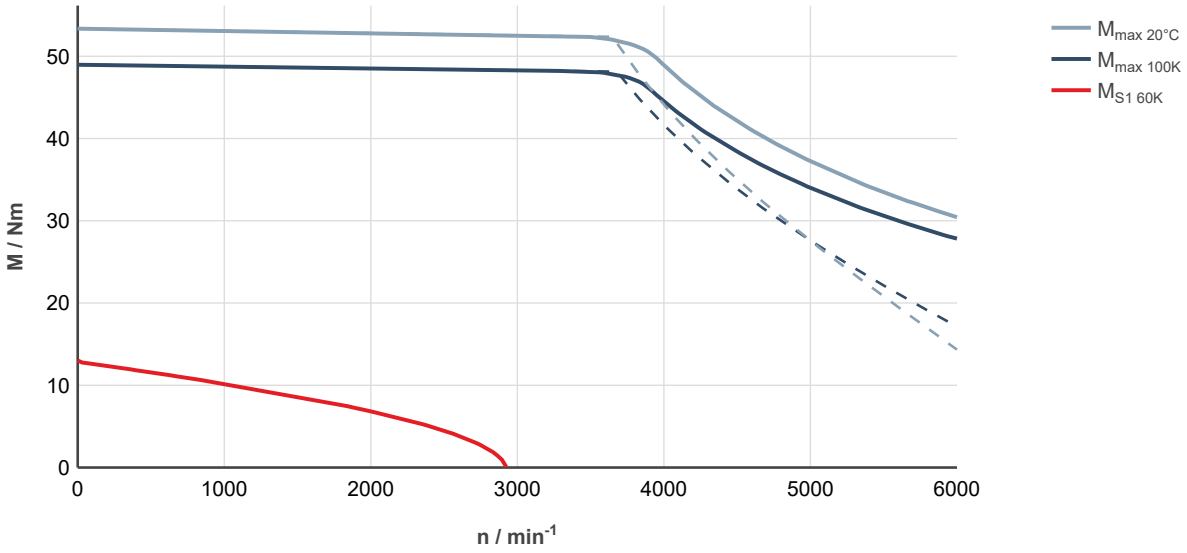
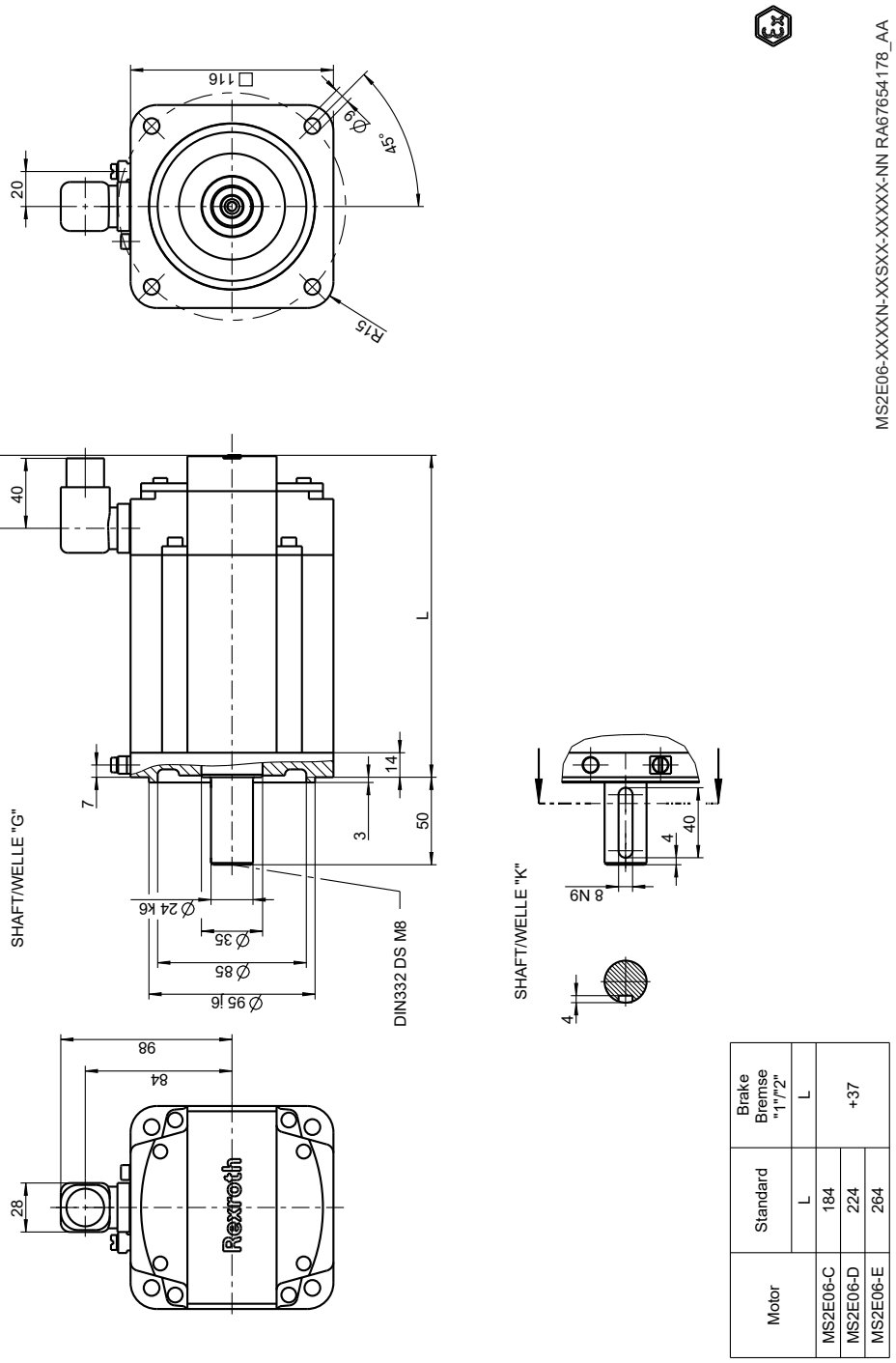


Fig. 54: MS2E06-E0BRN-___0-____-__, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

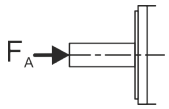
8.4.2 MS2E06 Specifications



Motor	Standard L	Brake Bremse "1"/"2" L
MS2E06-C	184	+37
MS2E06-D	224	
MS2E06-E	264	

Fig. 55: MS2E06-xxxxN

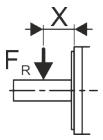
8.4.3 MS2E06 Axial force



Axial forces F_A are permissible without limitation up to 40 N. Higher axial forces only after a detailed dimensioning by your distribution partner at Bosch Rexroth. For evaluation purposes, please specify the following information:

- Axial and radial force with force application point
- Installation position (horizontal, vertical with the shaft end pointing to the top or bottom)
- Mean speed

8.4.4 MS2E06-C Radial force



The permissible radial force F_R is specified in distance x from the shaft shoulder, depending on the mean speed in the following diagram.

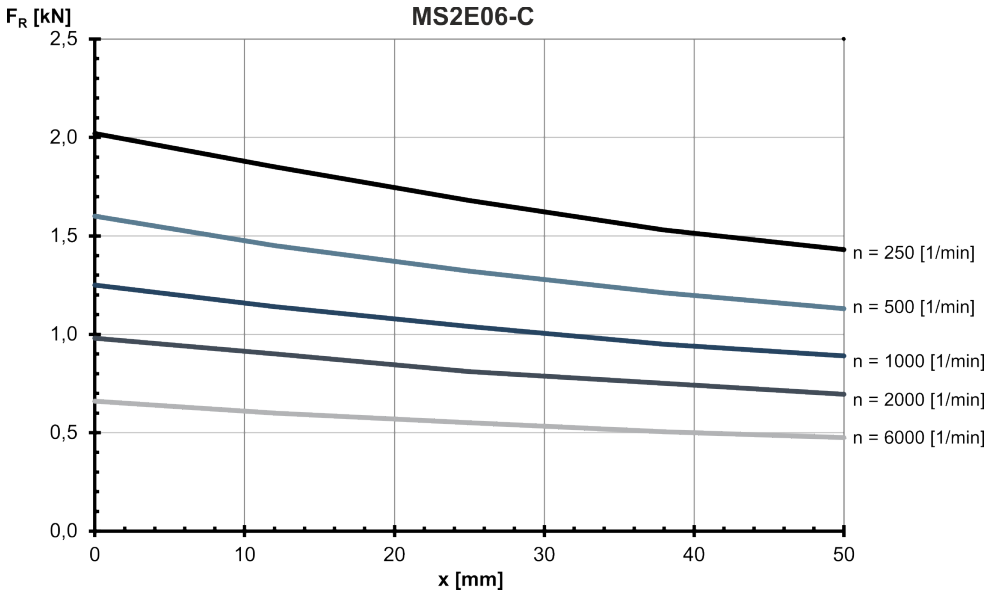
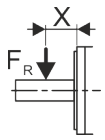


Fig. 56: MS2E06-C: Radial force in distance x from the shaft shoulder at a nominal bearing service life of Lh10 = 30000 h

8.4.5 MS2E06-D Radial force



The permissible radial force F_R is specified in distance x from the shaft shoulder, depending on the mean speed in the following diagram.

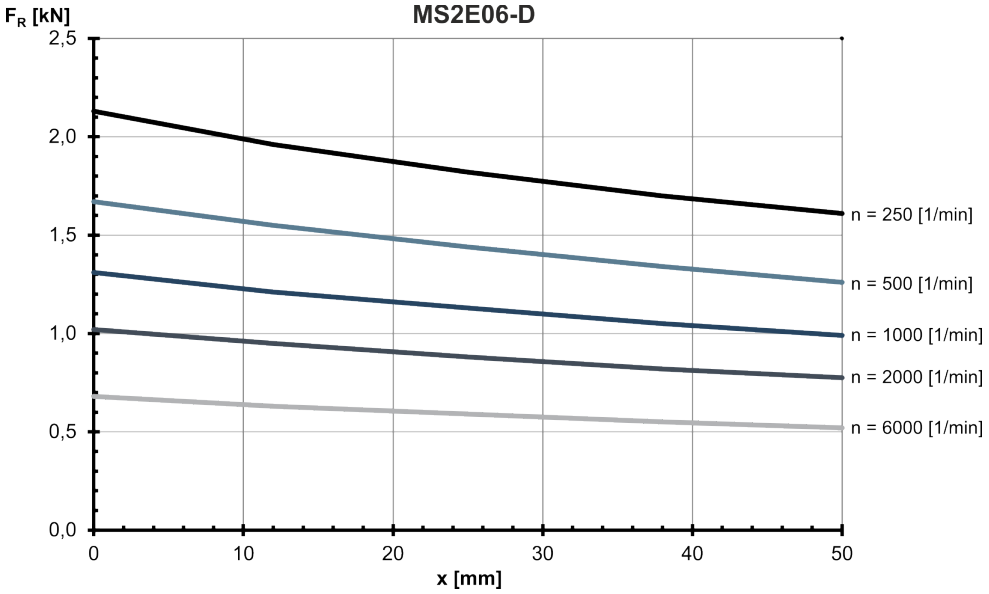
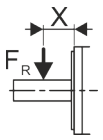


Fig. 57: MS2E06-D: Radial force in distance x from the shaft shoulder at a nominal bearing service life of Lh10 = 30000 h

8.4.6 MS2E06 Radial force



The permissible radial force F_R is specified in distance x from the shaft shoulder, depending on the mean speed in the following diagram.

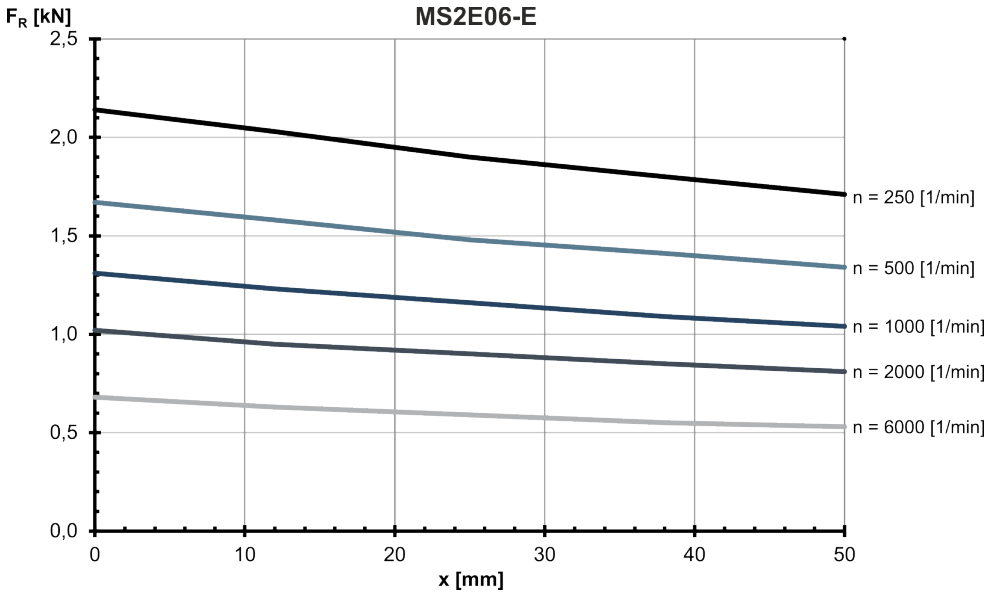


Fig. 58: MS2E06-E: Radial force in distance x from the shaft shoulder at a nominal bearing service life of Lh10 = 30000 h

8.5 MS2E07

8.5.1 Self-cooling

MS2E07-C0BNN

Designation	Symbol	Unit	MS2E07-C0BNN-___0-_N	MS2E07-C0BNN-___1-_N
Standstill torque - 60K [1]	$M_{0\ 60K}$	Nm	12.8	
Standstill current - 60K	$I_{0\ 60K}$	A	6.9	
Moment of inertia of rotor [1]	J_{rot}	kg*m²	0.0012	0.00146
Rated speed - 60K	$n_{N\ 60K}$	1/min	2650	
Rated torque - 60K [1]	$M_{N\ 60K}$	Nm	8.5	
Rated current - 60K	$I_{N\ 60K}$	A	4.72	
Rated power - 60K [1]	$P_{N\ 60K}$	kW	2.36	
Maximum torque 20 °C (cold) [1]	$M_{max\ 20°C}$	Nm	38.8	
Maximum torque 100K (warm) [1]	$M_{max\ 100K}$	Nm	35.7	
Maximum current	$I_{max(rms)}$	A	24.8	
Maximum speed (electrical)	$n_{max\ el}$	1/min	6000	
Maximum speed (mechanical)	$n_{max\ mech}$	1/min	6000	
Number of pole pairs	p		5	
Torque constant at 20 °C [1]	K_m	Nm/A	2.01	
Voltage constant at 20 °C [1]	K_E	V/1000 min^{-1}	122.0	
Winding resistance at 20 °C	R_{12}	Ohm	1.58	
Winding inductance	L_{12_min}	mH	23.2	
Leakage capacitance of the component	C_{ab}	nF	2.42	
Thermal time constant of winding	T_{th_W}	s	46.4	
Thermal time constant of motor	T_{th_M}	min	14.8	
Mass	m_{mot}	kg	12.0	14.0
Holding brake				
Holding torque	M_4	Nm	0	20.00
Rated voltage	U_N	V	0	24
Rated current	I_N	A	0	0.78
Maximum connection time	t_1	ms	0	40
Maximum disconnection time	t_2	ms	0	100
1) For tolerance details refer to ➥ chapter 7.4 Tolerances				Latest amendment: 2017-11-16

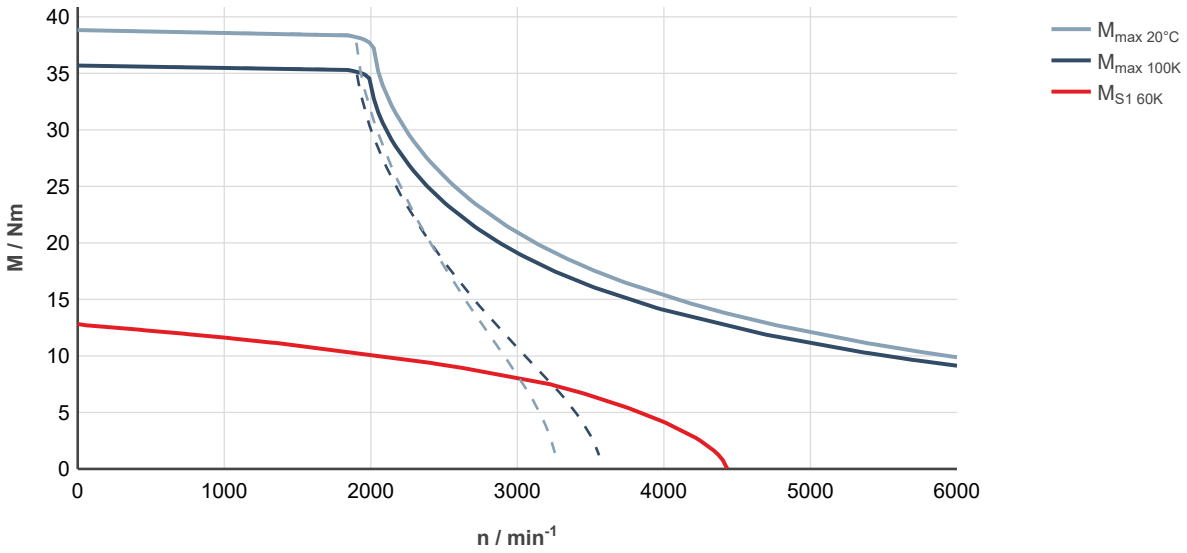


Fig. 59: MS2E07-C0BNN-___0-____-__, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

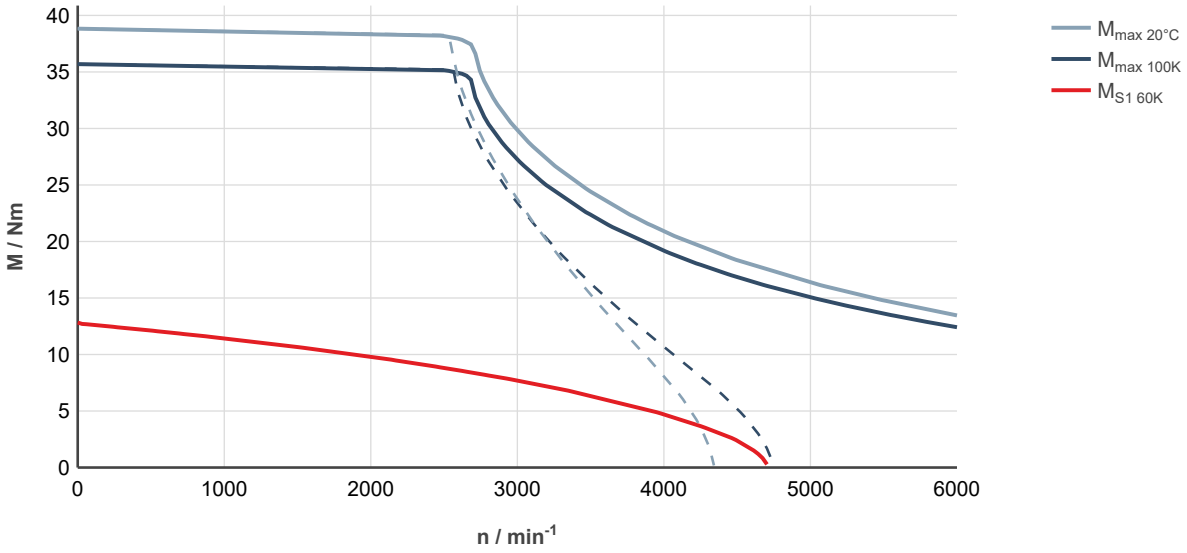


Fig. 60: MS2E07-C0BNN-___0-____-__, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

MS2E07-C0BQN

Designation	Symbol	Unit	MS2E07-C0BQN-___0-_N	MS2E07-C0BQN-___1-_N
Standstill torque - 60K 1)	$M_{0\ 60K}$	Nm	12.8	
Standstill current - 60K	$I_{0\ 60K}$	A	10.1	
Moment of inertia of rotor 1)	J_{rot}	kg*m²	0.0012	0.00146
Rated speed - 60K	$n_{N\ 60K}$	1/min	3100	
Rated torque - 60K 1)	$M_{N\ 60K}$	Nm	6.40	
Rated current - 60K	$I_{N\ 60K}$	A	5.30	
Rated power - 60K 1)	$P_{N\ 60K}$	kW	2.07	
Maximum torque 20 °C (cold) 1)	$M_{max\ 20°C}$	Nm	38.8	
Maximum torque 100K (warm) 1)	$M_{max\ 100K}$	Nm	35.7	
Maximum current	$I_{max(rms)}$	A	36.4	
Maximum speed (electrical)	$n_{max\ el}$	1/min	6000	
Maximum speed (mechanical)	$n_{max\ mech}$	1/min	6000	
Number of pole pairs	p		5	
Torque constant at 20 °C 1)	K_m	Nm/A	1.37	
Voltage constant at 20 °C 1)	K_E	V/1000 min^{-1}	83.1	
Winding resistance at 20 °C	R_{12}	Ohm	0.776	
Winding inductance	L_{12_min}	mH	10.5	
Leakage capacitance of the component	C_{ab}	nF	2.2	
Thermal time constant of winding	T_{th_W}	s	76.5	
Thermal time constant of motor	T_{th_M}	min	19.8	
Mass	m_{mot}	kg	12.0	14.0
Holding brake				
Holding torque	M_4	Nm	0	20.00
Rated voltage	U_N	V	0	24
Rated current	I_N	A	0	0.78
Maximum connection time	t_1	ms	0	40
Maximum disconnection time	t_2	ms	0	100

1) For tolerance details refer to ➥ chapter 7.4 Tolerances Latest amendment: 2016-11-08

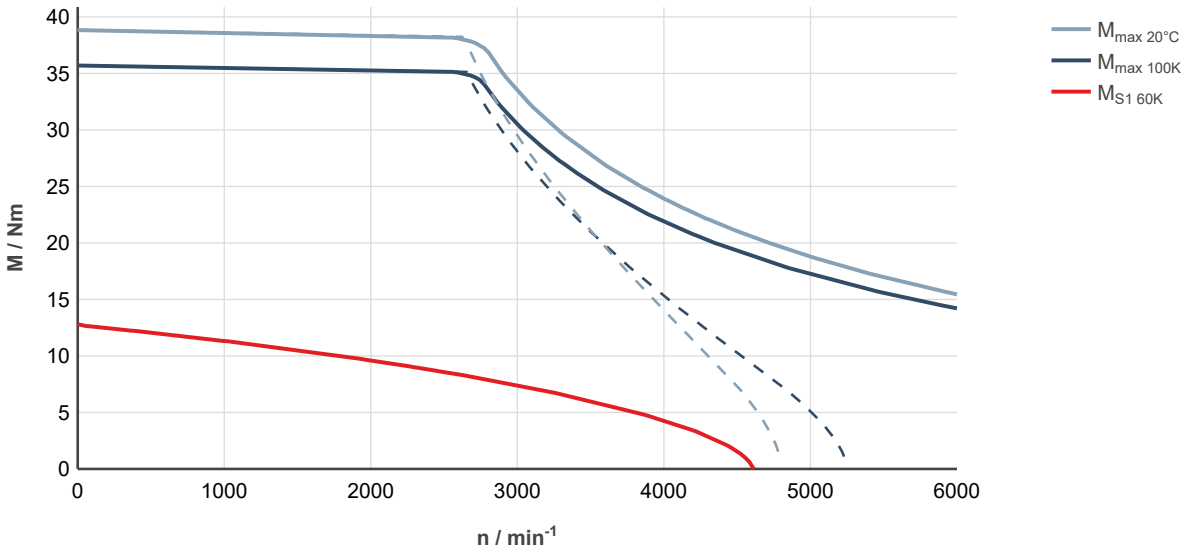


Fig. 61: MS2E07-C0BQN-___0-____-__, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

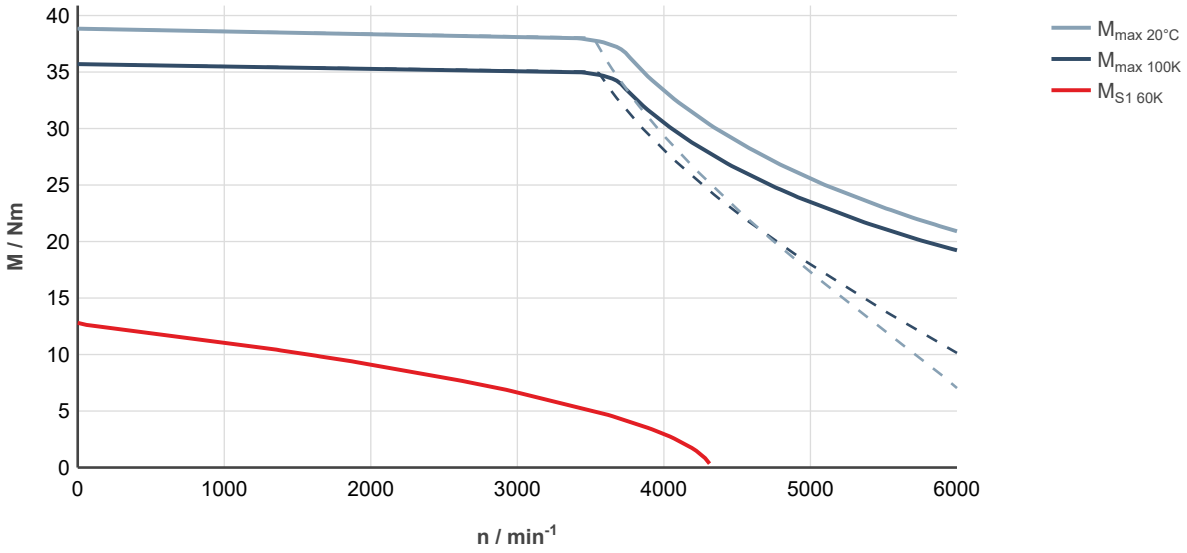


Fig. 62: MS2E07-C0BQN-___0-____-__, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

MS2E07-D0BNN

Designation	Symbol	Unit	MS2E07-D0BNN-___0-_N	MS2E07-D0BNN-___2-_N
Standstill torque - 60K [1]	$M_{0\ 60K}$	Nm	22.0	
Standstill current - 60K	$I_{0\ 60K}$	A	11.55	
Moment of inertia of rotor [1]	J_{rot}	kg*m²	0.0021	0.00251
Rated speed - 60K	$n_{N\ 60K}$	1/min	2215	
Rated torque - 60K [1]	$M_{N\ 60K}$	Nm	11.9	
Rated current - 60K	$I_{N\ 60K}$	A	6.5	
Rated power - 60K [1]	$P_{N\ 60K}$	kW	2.76	
Maximum torque 20 °C (cold) [1]	$M_{max\ 20°C}$	Nm	79.7	
Maximum torque 100K (warm) [1]	$M_{max\ 100K}$	Nm	73.2	
Maximum current	$I_{max(rms)}$	A	49.5	
Maximum speed (electrical)	$n_{max\ el}$	1/min	6000	
Maximum speed (mechanical)	$n_{max\ mech}$	1/min	6000	
Number of pole pairs	p		5	
Torque constant at 20 °C [1]	K_m	Nm/A	2.04	
Voltage constant at 20 °C [1]	K_E	V/1000 min^{-1}	124.1	
Winding resistance at 20 °C	R_{12}	Ohm	0.671	
Winding inductance	L_{12_min}	mH	10.0	
Leakage capacitance of the component	C_{ab}	nF	4.0	
Thermal time constant of winding	T_{th_W}	s	54.0	
Thermal time constant of motor	T_{th_M}	min	18.7	
Mass	m_{mot}	kg	17.5	20
Holding brake				
Holding torque	M_4	Nm	0	36.00
Rated voltage	U_N	V	0	24
Rated current	I_N	A	0	0.94
Maximum connection time	t_1	ms	0	60
Maximum disconnection time	t_2	ms	0	200

1) For tolerance details refer to ➦ chapter 7.4 Tolerances

Latest amendment: 2017-04-26

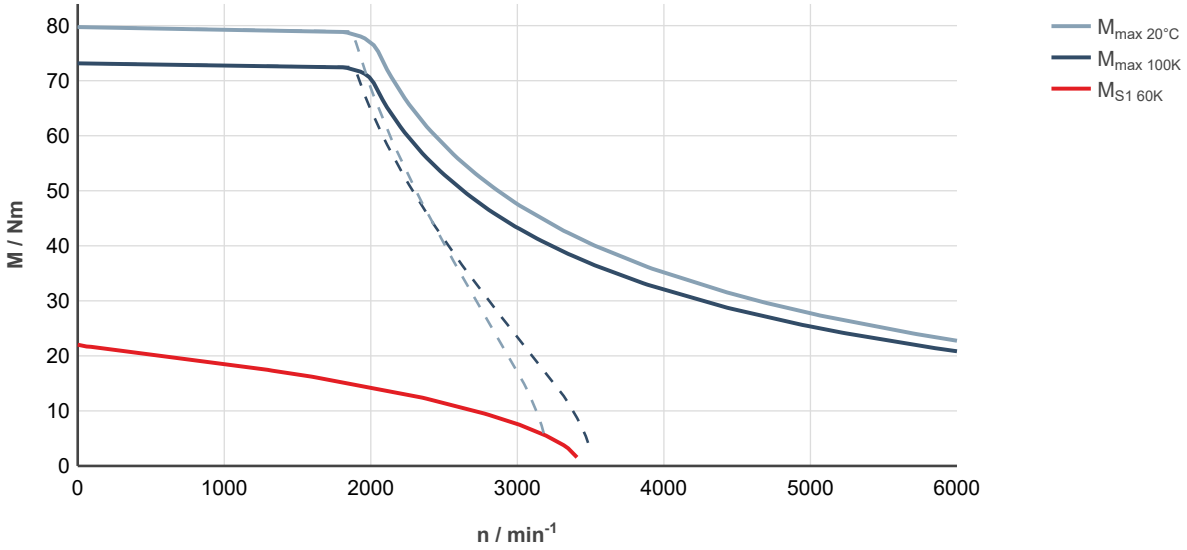


Fig. 63: MS2E07-D0BNN-___0-____-__, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

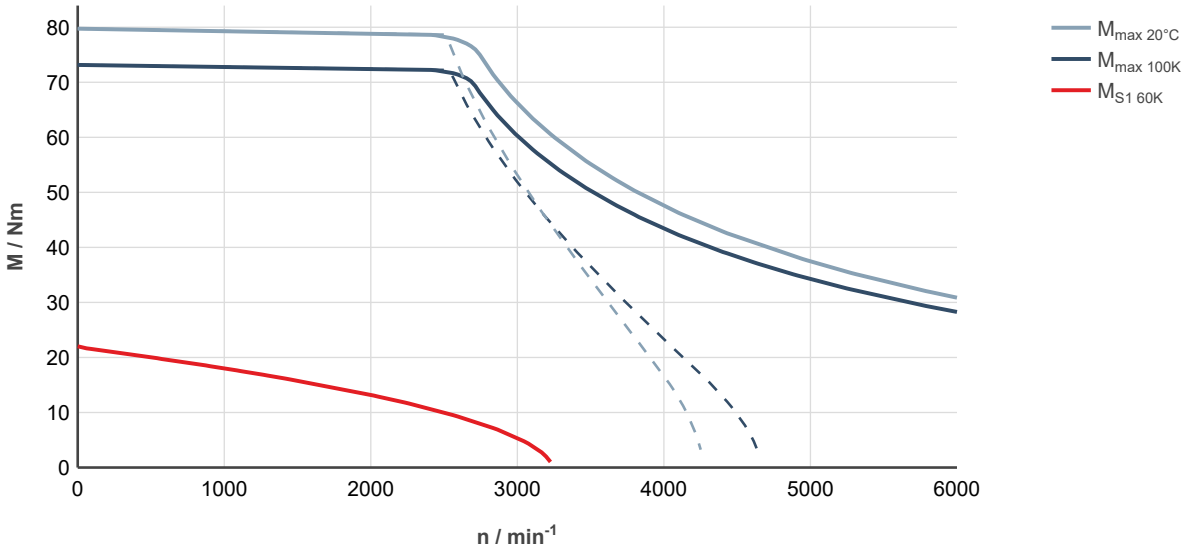


Fig. 64: MS2E07-D0BNN-___0-____-__, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

MS2E07-D0CRN

Designation	Symbol	Unit	MS2E07-D0CRN-___0-_N	MS2E07-D0CRN-___2-_N
Standstill torque - 60K [1]	$M_{0\ 60K}$	Nm	19.9	
Standstill current - 60K	$I_{0\ 60K}$	A	15.5	
Moment of inertia of rotor [1]	J_{rot}	kg*m²	0.0021	0.00251
Rated speed - 60K	$n_{N\ 60K}$	1/min	2180	
Rated torque - 60K [1]	$M_{N\ 60K}$	Nm	10.35	
Rated current - 60K	$I_{N\ 60K}$	A	8.45	
Rated power - 60K [1]	$P_{N\ 60K}$	kW	2.36	
Maximum torque 20 °C (cold) [1]	$M_{max\ 20°C}$	Nm	79.7	
Maximum torque 100K (warm) [1]	$M_{max\ 100K}$	Nm	73.2	
Maximum current	$I_{max(rms)}$	A	72.7	
Maximum speed (electrical)	$n_{max\ el}$	1/min	6000	
Maximum speed (mechanical)	$n_{max\ mech}$	1/min	6000	
Number of pole pairs	p		5	
Torque constant at 20 °C [1]	K_m	Nm/A	1.38	
Voltage constant at 20 °C [1]	K_E	V/1000 min^{-1}	83.9	
Winding resistance at 20 °C	R_{12}	Ohm	0.327	
Winding inductance	L_{12_min}	mH	5.06	
Leakage capacitance of the component	C_{ab}	nF	3.95	
Thermal time constant of winding	T_{th_W}	s	80	
Thermal time constant of motor	T_{th_M}	min	20	
Mass	m_{mot}	kg	17.5	20
Holding brake				
Holding torque	M_4	Nm	0	36.00
Rated voltage	U_N	V	0	24
Rated current	I_N	A	0	0.94
Maximum connection time	t_1	ms	0	60
Maximum disconnection time	t_2	ms	0	200

1) For tolerance details refer to ➦ chapter 7.4 Tolerances

Latest amendment: 2018-11-14

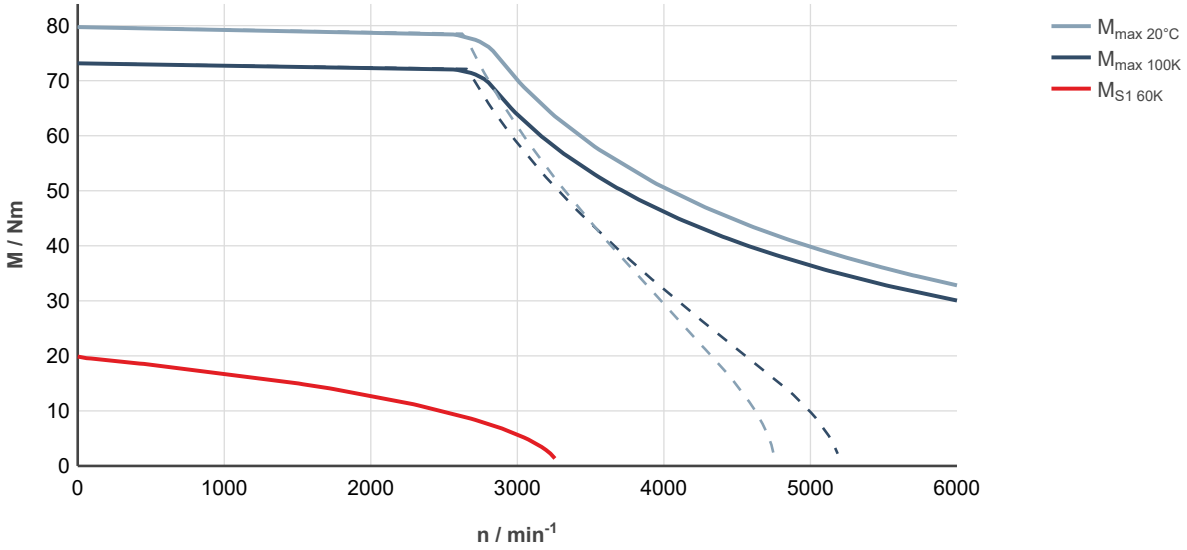


Fig. 65: MS2E07-D0CRN-___0-____-__, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

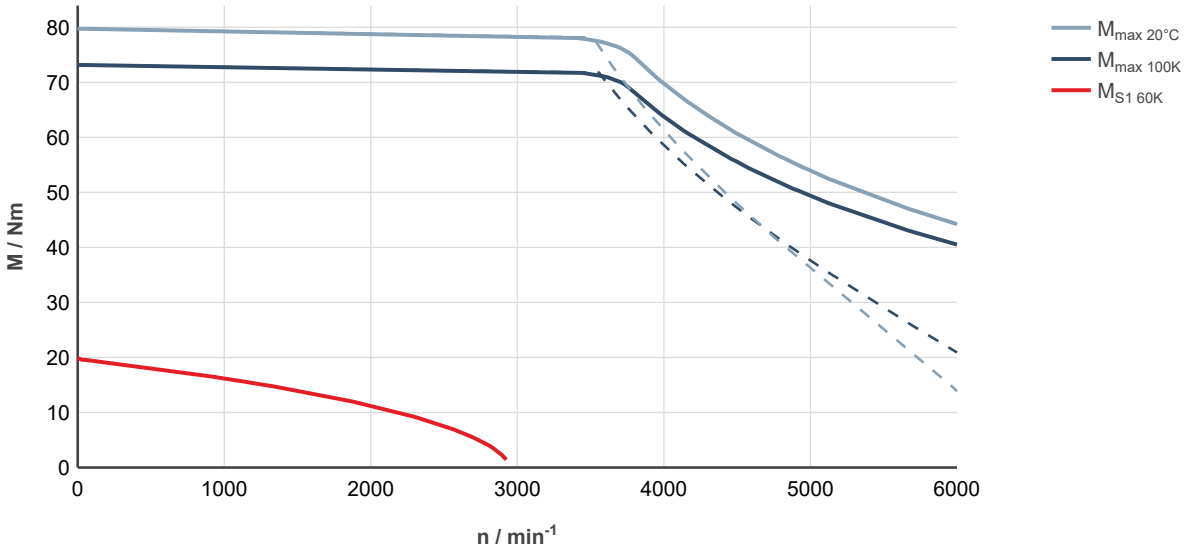


Fig. 66: MS2E07-D0CRN-___0-____-__, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

MS2E07-E0CNN

Designation	Symbol	Unit	MS2E07-E0CNN-___0-_N	MS2E07-E0CNN-___2-_N
Standstill torque - 60K [1]	$M_{0\ 60K}$	Nm	29.2	
Standstill current - 60K	$I_{0\ 60K}$	A	15.1	
Moment of inertia of rotor [1]	J_{rot}	kg*m²	0.003	0.00341
Rated speed - 60K	$n_{N\ 60K}$	1/min	1890	
Rated torque - 60K [1]	$M_{N\ 60K}$	Nm	15.2	
Rated current - 60K	$I_{N\ 60K}$	A	8.20	
Rated power - 60K [1]	$P_{N\ 60K}$	kW	3.00	
Maximum torque 20 °C (cold) [1]	$M_{max\ 20°C}$	Nm	119.5	
Maximum torque 100K (warm) [1]	$M_{max\ 100K}$	Nm	109.5	
Maximum current	$I_{max(rms)}$	A	72.7	
Maximum speed (electrical)	$n_{max\ el}$	1/min	6000	
Maximum speed (mechanical)	$n_{max\ mech}$	1/min	6000	
Number of pole pairs	p		5	
Torque constant at 20 °C [1]	K_m	Nm/A	2.08	
Voltage constant at 20 °C [1]	K_E	V/1000 min^{-1}	126.2	
Winding resistance at 20 °C	R_{12}	Ohm	0.455	
Winding inductance	L_{12_min}	mH	7.50	
Leakage capacitance of the component	C_{ab}	nF	6.11	
Thermal time constant of winding	T_{th_W}	s	65	
Thermal time constant of motor	T_{th_M}	min	28	
Mass	m_{mot}	kg	23	26
Holding brake				
Holding torque	M_4	Nm	0	36.00
Rated voltage	U_N	V	0	24
Rated current	I_N	A	0	0.94
Maximum connection time	t_1	ms	0	60
Maximum disconnection time	t_2	ms	0	200

1) For tolerance details refer to ➦chapter 7.4 Tolerances Latest amendment: 2018-10-26

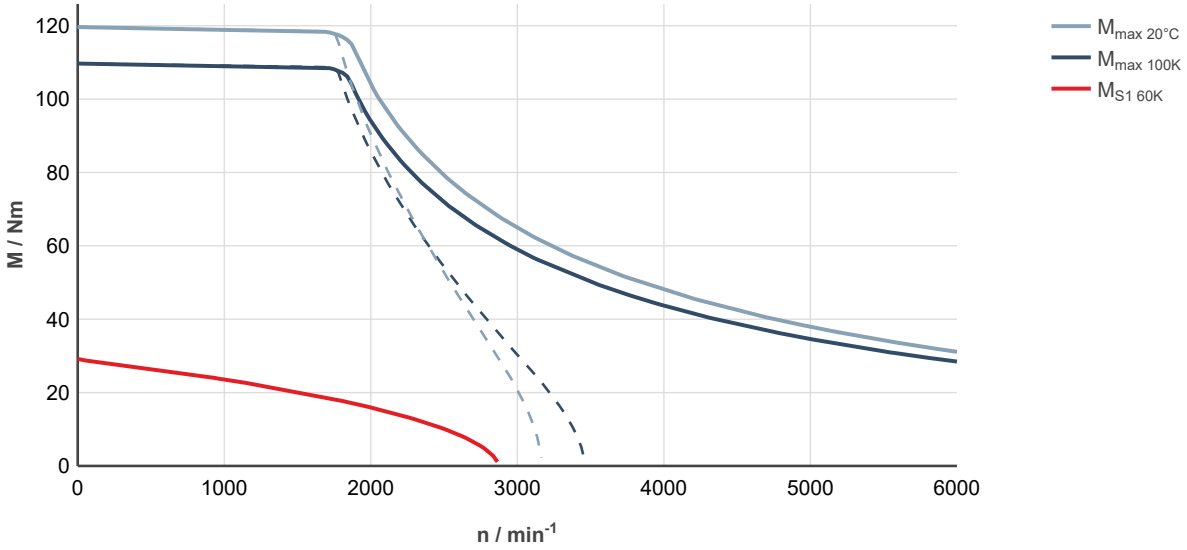


Fig. 67: MS2E07-E0CNN-___0-____-__, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

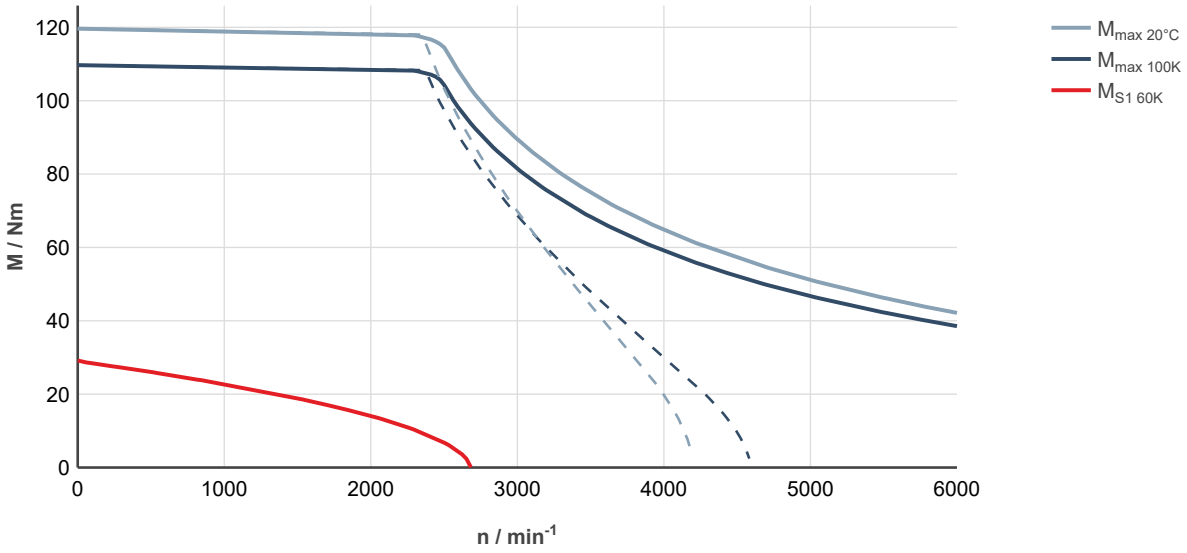


Fig. 68: MS2E07-E0CNN-___0-____-__, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

MS2E07-E0CQN

Designation	Symbol	Unit	MS2E07-E0CQN-___0-_N	MS2E07-E0CQN-___2-_N
Standstill torque - 60K 1)	$M_{0\ 60K}$	Nm	23.6	
Standstill current - 60K	$I_{0\ 60K}$	A	15.5	
Moment of inertia of rotor 1)	J_{rot}	kg*m²	0.003	0.00341
Rated speed - 60K	$n_{N\ 60K}$	1/min	1750	
Rated torque - 60K 1)	$M_{N\ 60K}$	Nm	14.4	
Rated current - 60K	$I_{N\ 60K}$	A	9.85	
Rated power - 60K 1)	$P_{N\ 60K}$	kW	2.64	
Maximum torque 20 °C (cold) 1)	$M_{max\ 20°C}$	Nm	119.5	
Maximum torque 100K (warm) 1)	$M_{max\ 100K}$	Nm	109.5	
Maximum current	$I_{max(rms)}$	A	92.3	
Maximum speed (electrical)	$n_{max\ el}$	1/min	6000	
Maximum speed (mechanical)	$n_{max\ mech}$	1/min	6000	
Number of pole pairs	p		5	
Torque constant at 20 °C 1)	K_m	Nm/A	1.64	
Voltage constant at 20 °C 1)	K_E	V/1000 min^{-1}	99.3	
Winding resistance at 20 °C	R_{12}	Ohm	0.282	
Winding inductance	L_{12_min}	mH	4.64	
Leakage capacitance of the component	C_{ab}	nF	6.21	
Thermal time constant of winding	T_{th_W}	s	65	
Thermal time constant of motor	T_{th_M}	min	28	
Mass	m_{mot}	kg	23	26
Holding brake				
Holding torque	M_4	Nm	0	36.00
Rated voltage	U_N	V	0	24
Rated current	I_N	A	0	0.94
Maximum connection time	t_1	ms	0	60
Maximum disconnection time	t_2	ms	0	200
1) For tolerance details refer to ➦chapter 7.4 Tolerances				Latest amendment: 2018-11-14

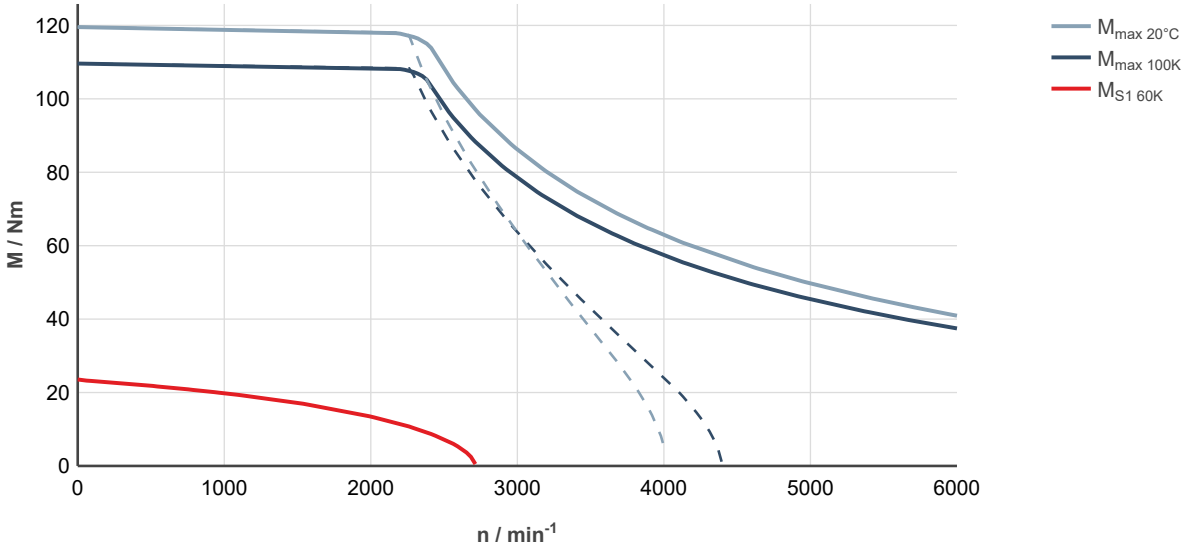


Fig. 69: MS2E07-E0CQN-___0-____-__, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

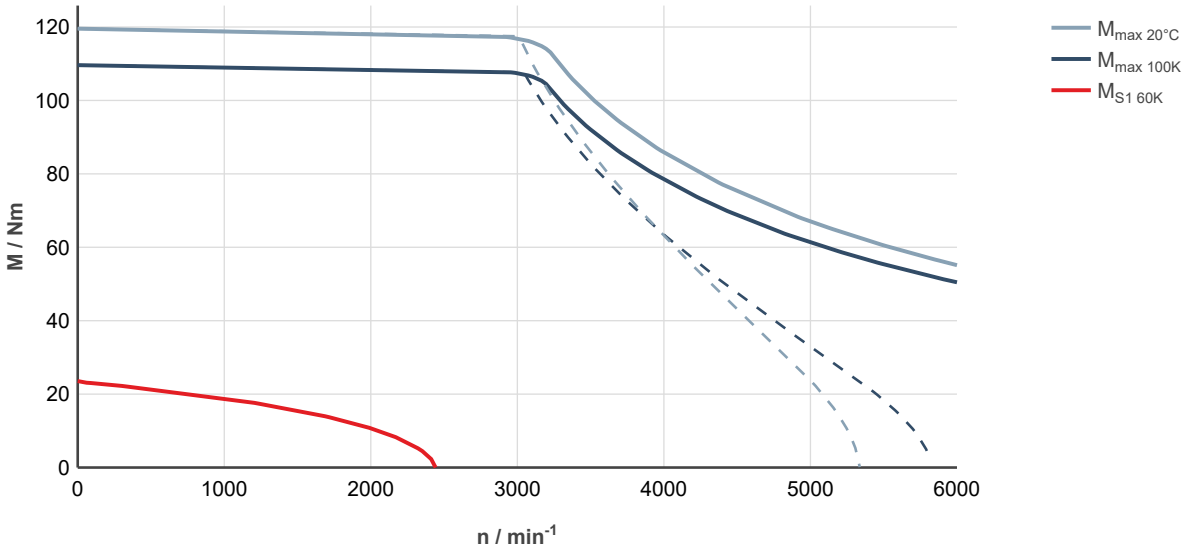
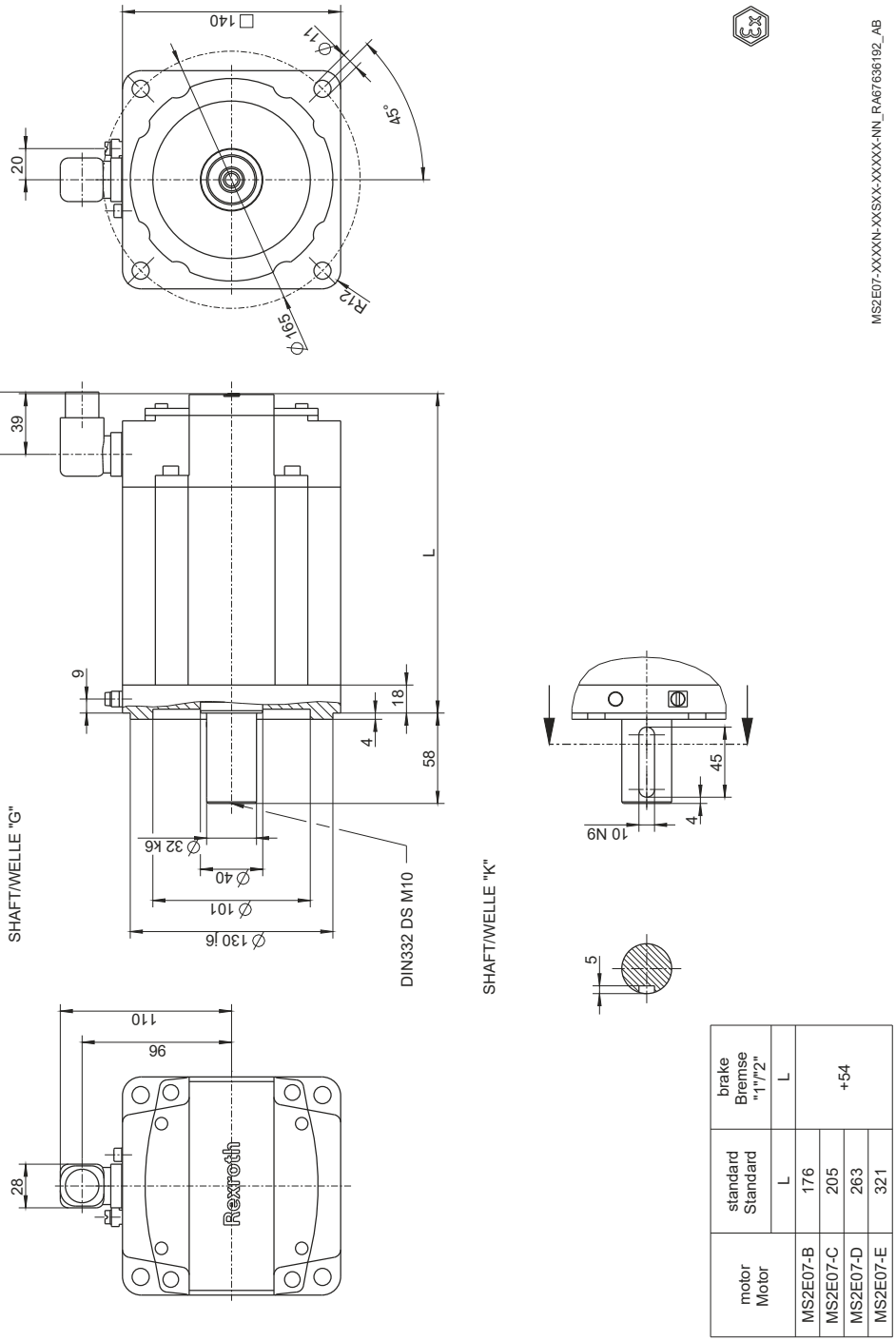


Fig. 70: MS2E07-E0CQN-___0-____-__, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

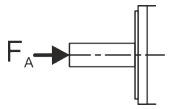
8.5.2 MS2E07 Specifications



motor Motor	standard Standard L	brake Bremse "1"/"2" L
MS2E07-B	176	+54
MS2E07-C	205	
MS2E07-D	263	
MS2E07-E	321	

Fig. 71: MS2E07-xxxxN

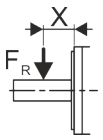
8.5.3 MS2E07 Axial force



Axial forces F_A are permissible without limitation up to 60 N. Higher axial forces only after a detailed dimensioning by your distribution partner at Bosch Rexroth. For evaluation purposes, please specify the following information:

- Axial and radial force with force application point
- Installation position (horizontal, vertical with the shaft end pointing to the top or bottom)
- Mean speed

8.5.4 MS2E07-C Radial force



The permissible radial force F_R is specified in distance x from the shaft shoulder, depending on the mean speed in the following diagram.

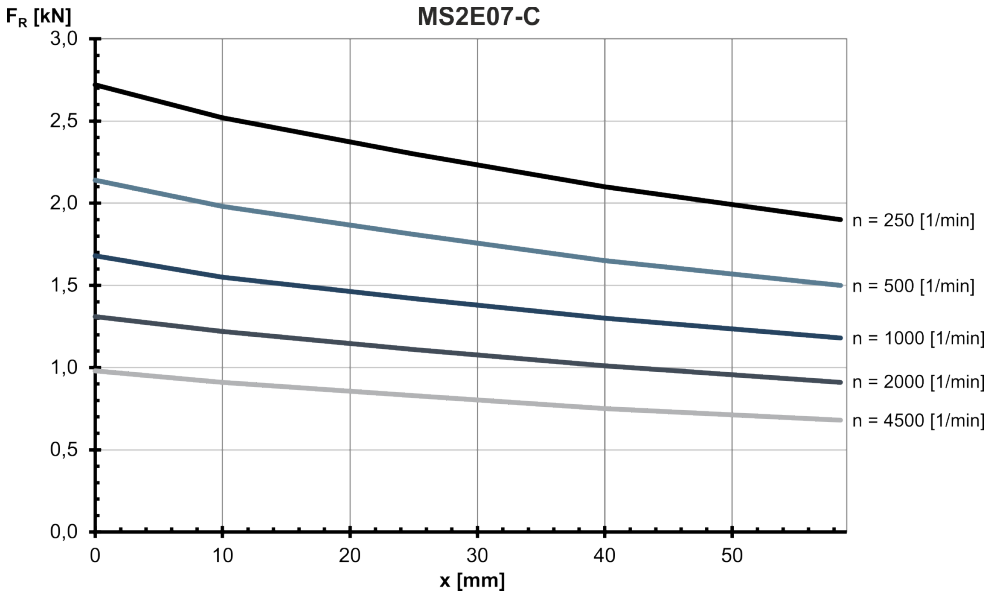
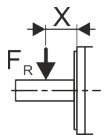


Fig. 72: MS2E07-C: Radial force in distance x from the shaft shoulder at a nominal bearing service life of Lh10 = 30000 h

8.5.5 MS2E07-D Radial force



The permissible radial force F_R is specified in distance x from the shaft shoulder, depending on the mean speed in the following diagram.

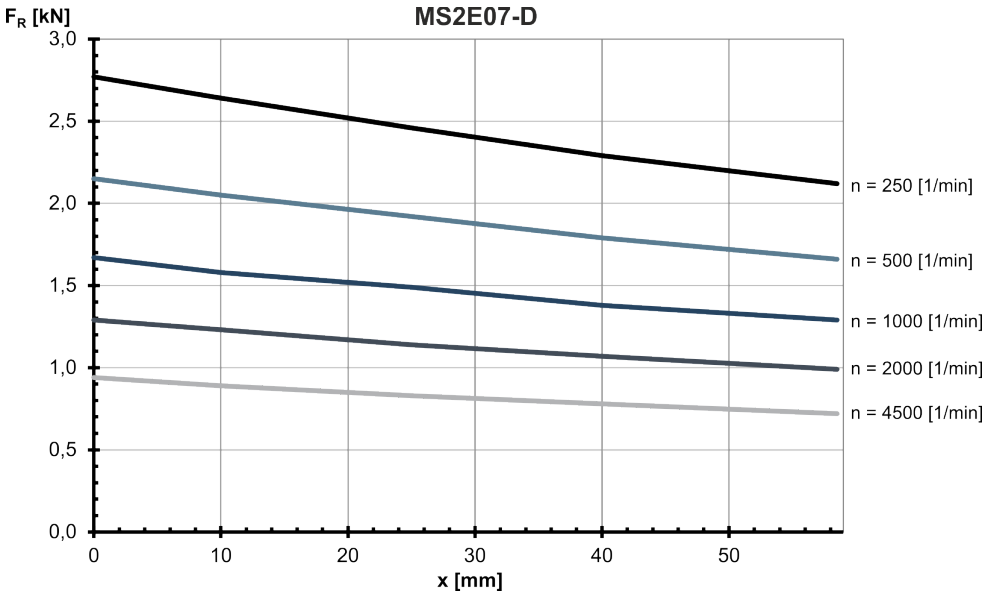
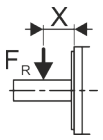


Fig. 73: MS2E07-D: Radial force in distance x from the shaft shoulder at a nominal bearing service life of Lh10 = 30000 h

8.5.6 MS2E07-E Radial force



The permissible radial force F_R is specified in distance x from the shaft shoulder, depending on the mean speed in the following diagram.

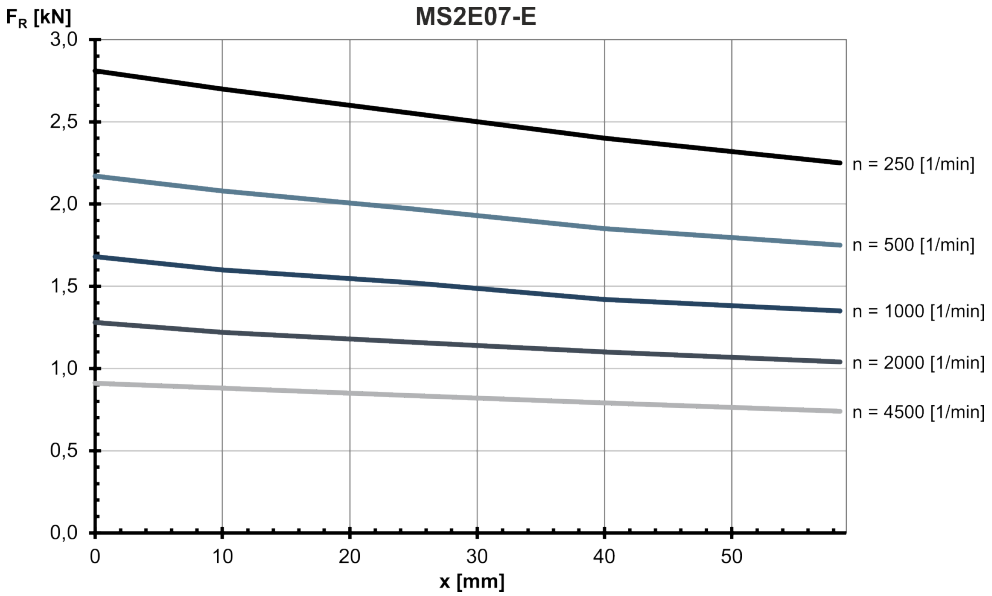


Fig. 74: MS2E07-E: Radial force in distance x from the shaft shoulder at a nominal bearing service life of Lh10 = 30000 h

8.6 MS2E10

8.6.1 Self-cooling

MS2E10-C0BHN

Designation	Symbol	Unit	MS2E10-C0BHN-___0-_N	MS2E10-C0BHN-___2-_N
Standstill torque - 60K [1]	$M_{0\ 60K}$	Nm	30.2	
Standstill current - 60K	$I_{0\ 60K}$	A	12.6	
Moment of inertia of rotor [1]	J_{rot}	kg*m²	0.0048	0.00627
Rated speed - 60K	$n_{N\ 60K}$	1/min	2000	
Rated torque - 60K [1]	$M_{N\ 60K}$	Nm	21.9	
Rated current - 60K	$I_{N\ 60K}$	A	9.25	
Rated power - 60K [1]	$P_{N\ 60K}$	kW	4.6	
Maximum torque 20 °C (cold) [1]	$M_{max\ 20°C}$	Nm	76.8	
Maximum torque 100K (warm) [1]	$M_{max\ 100K}$	Nm	70.5	
Maximum current	$I_{max(rms)}$	A	38.5	
Maximum speed (electrical)	$n_{max\ el}$	1/min	4000	
Maximum speed (mechanical)	$n_{max\ mech}$	1/min	6000	
Number of pole pairs	p		5	
Torque constant at 20 °C [1]	K_m	Nm/A	2.60	
Voltage constant at 20 °C [1]	K_E	V/1000 min^{-1}	157.8	
Winding resistance at 20 °C	R_{12}	Ohm	0.74	
Winding inductance	L_{12_min}	mH	18.7	
Leakage capacitance of the component	C_{ab}	nF	1.9	
Thermal time constant of winding	T_{th_W}	s	99.3	
Thermal time constant of motor	T_{th_M}	min	33.0	
Mass	m_{mot}	kg	23.5	28.5
Holding brake				
Holding torque	M_4	Nm	0	53.00
Rated voltage	U_N	V	0	24
Rated current	I_N	A	0	1.00
Maximum connection time	t_1	ms	0	70
Maximum disconnection time	t_2	ms	0	220
1) For tolerance details refer to ➥ chapter 7.4 Tolerances				Latest amendment: 2020-10-26

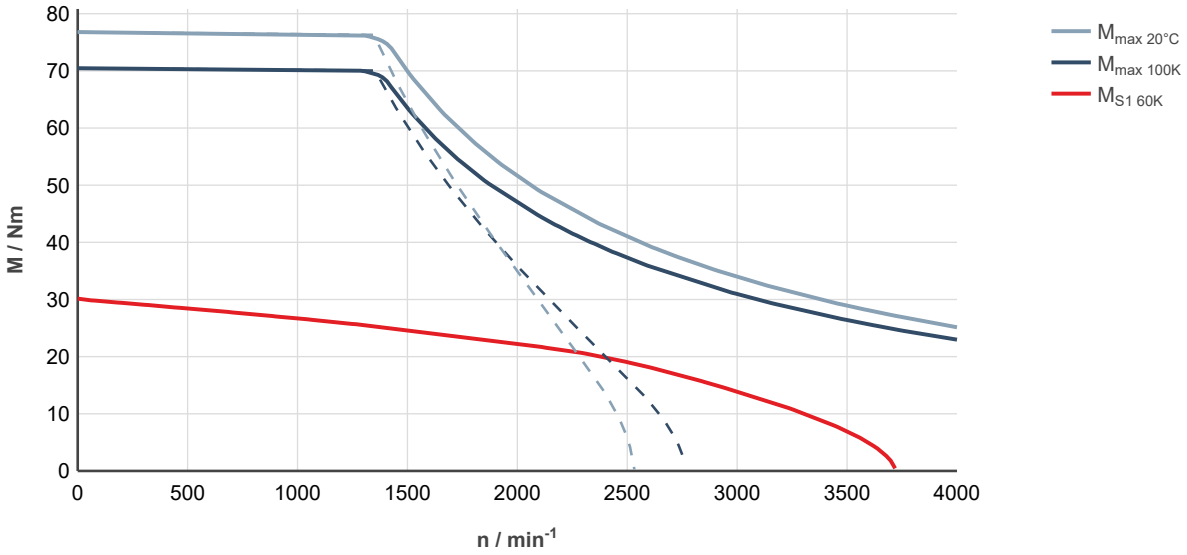


Fig. 75: MS2E10-C0BHN-___0-____-__, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

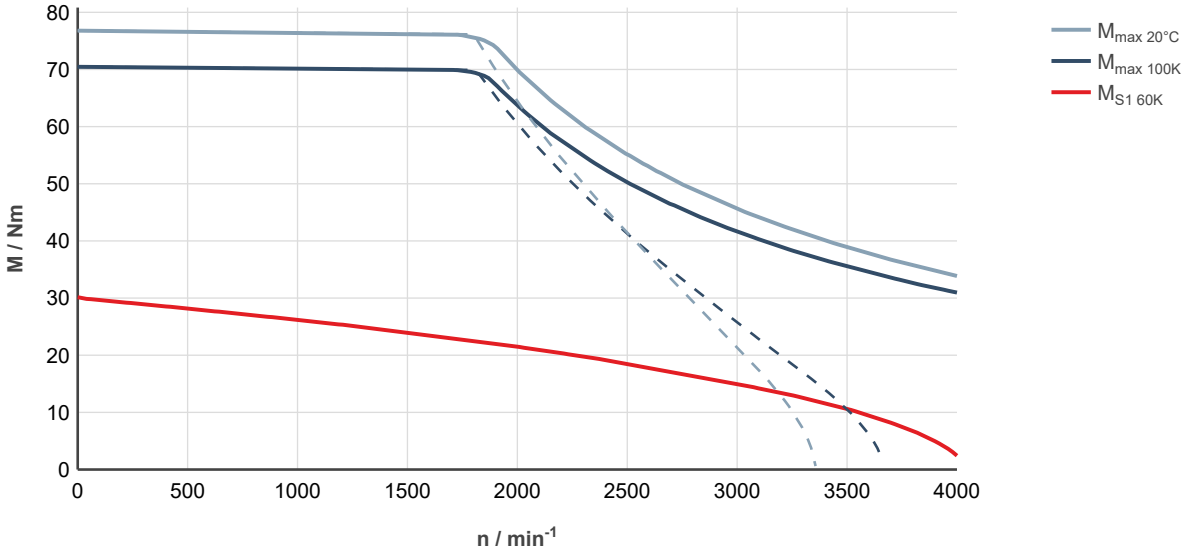


Fig. 76: MS2E10-C0BHN-___0-____-__, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

MS2E10-D0BHN

Designation	Symbol	Unit	MS2E10-D0BHN-___0-_N	MS2E10-D0BHN-___2-_N
Standstill torque - 60K [1]	$M_{0\ 60K}$	Nm	51	
Standstill current - 60K	$I_{0\ 60K}$	A	19.1	
Moment of inertia of rotor [1]	J_{rot}	kg*m²	0.0081	0.00957
Rated speed - 60K	$n_{N\ 60K}$	1/min	2000	
Rated torque - 60K [1]	$M_{N\ 60K}$	Nm	30.4	
Rated current - 60K	$I_{N\ 60K}$	A	11.7	
Rated power - 60K [1]	$P_{N\ 60K}$	kW	6.4	
Maximum torque 20 °C (cold) [1]	$M_{max\ 20°C}$	Nm	155	
Maximum torque 100K (warm) [1]	$M_{max\ 100K}$	Nm	142	
Maximum current	$I_{max(rms)}$	A	70	
Maximum speed (electrical)	$n_{max\ el}$	1/min	4000	
Maximum speed (mechanical)	$n_{max\ mech}$	1/min	6000	
Number of pole pairs	p		5	
Torque constant at 20 °C [1]	K_m	Nm/A	2.86	
Voltage constant at 20 °C [1]	K_E	V/1000 min^{-1}	173.5	
Winding resistance at 20 °C	R_{12}	Ohm	0.386	
Winding inductance	L_{12_min}	mH	10.3	
Leakage capacitance of the component	C_{ab}	nF	3.15	
Thermal time constant of winding	T_{th_W}	s	113.6	
Thermal time constant of motor	T_{th_M}	min	38.8	
Mass	m_{mot}	kg	34	39
Holding brake				
Holding torque	M_4	Nm	0	53.00
Rated voltage	U_N	V	0	24
Rated current	I_N	A	0	1.00
Maximum connection time	t_1	ms	0	70
Maximum disconnection time	t_2	ms	0	220

1) For tolerance details refer to ➥ chapter 7.4 Tolerances Latest amendment: 2020-10-26

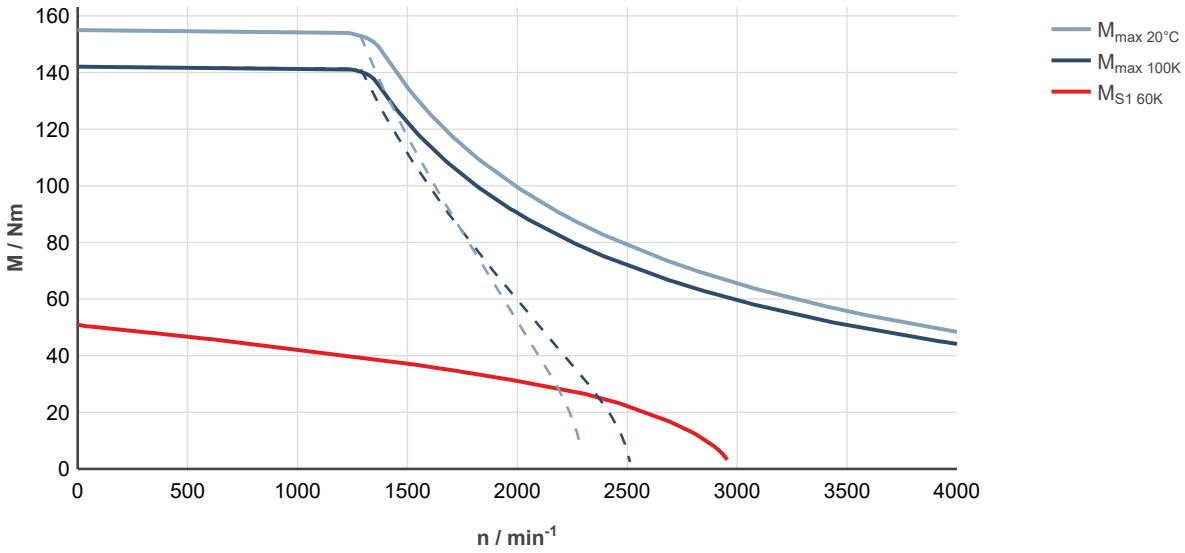


Fig. 77: MS2E10-D0BHN-___0-____-__, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

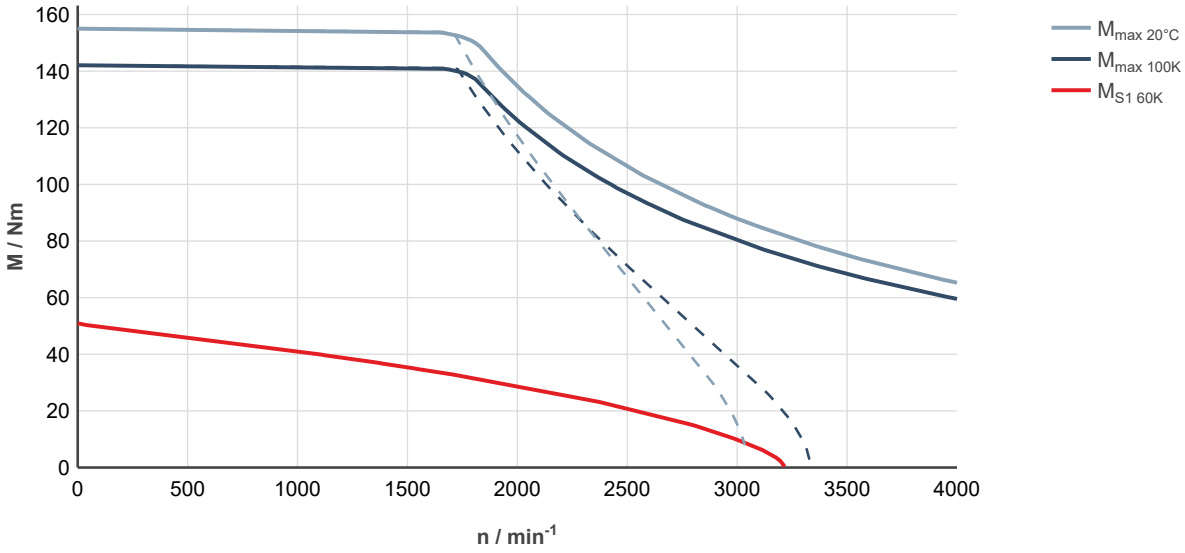


Fig. 78: MS2E10-D0BHN-___0-____-__, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

MS2E10-D0BNN

Designation	Symbol	Unit	MS2E10-D0BNN-___0	MS2E10-D0BNN-___2
Standstill torque - 60K [1]	$M_{0\ 60K}$	Nm	51.0	
Standstill current - 60K	$I_{0\ 60K}$	A	28.2	
Moment of inertia of rotor [1]	J_{rot}	kg*m²	0.0081	0.00957
Rated speed - 60K	$n_{N\ 60K}$	1/min	2030	
Rated torque - 60K [1]	$M_{N\ 60K}$	Nm	23.5	
Rated current - 60K	$I_{N\ 60K}$	A	13.4	
Rated power - 60K [1]	$P_{N\ 60K}$	kW	4.99	
Maximum torque 20 °C (cold) [1]	$M_{max\ 20°C}$	Nm	155	
Maximum torque 100K (warm) [1]	$M_{max\ 100K}$	Nm	142	
Maximum current	$I_{max(rms)}$	A	102.5	
Maximum speed (electrical)	$n_{max\ el}$	1/min	6000	
Maximum speed (mechanical)	$n_{max\ mech}$	1/min	6000	
Number of pole pairs	p		5	
Torque constant at 20 °C [1]	K_m	Nm/A	1.95	
Voltage constant at 20 °C [1]	K_E	V/1000 min^{-1}	118.5	
Winding resistance at 20 °C	R_{12}	Ohm	0.18	
Winding inductance	L_{12_min}	mH	5.0	
Leakage capacitance of the component	C_{ab}	nF	4.1	
Thermal time constant of winding	T_{th_W}	s	113.6	
Thermal time constant of motor	T_{th_M}	min	38.8	
Mass	m_{mot}	kg	34	39
Holding brake				
Holding torque	M_4	Nm	0	53.00
Rated voltage	U_N	V	0	24
Rated current	I_N	A	0	1.00
Maximum connection time	t_1	ms	0	70
Maximum disconnection time	t_2	ms	0	220

1) For tolerance details refer to ➥ chapter 7.4 Tolerances Letzte Änderung: 2020-11-27

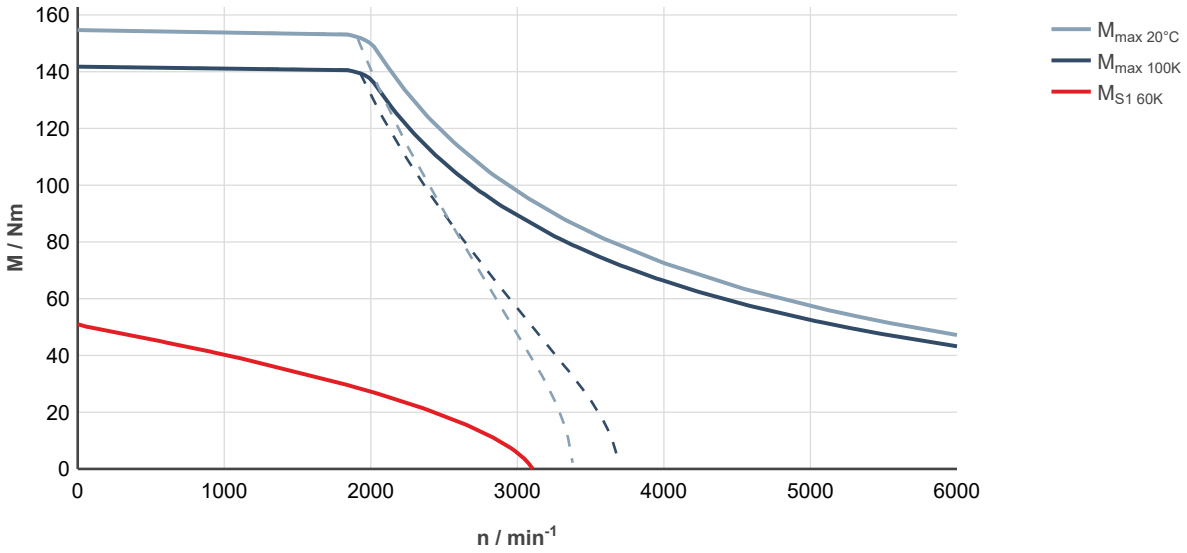


Fig. 79: MS2E10-D0BNN-___0-____-__, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

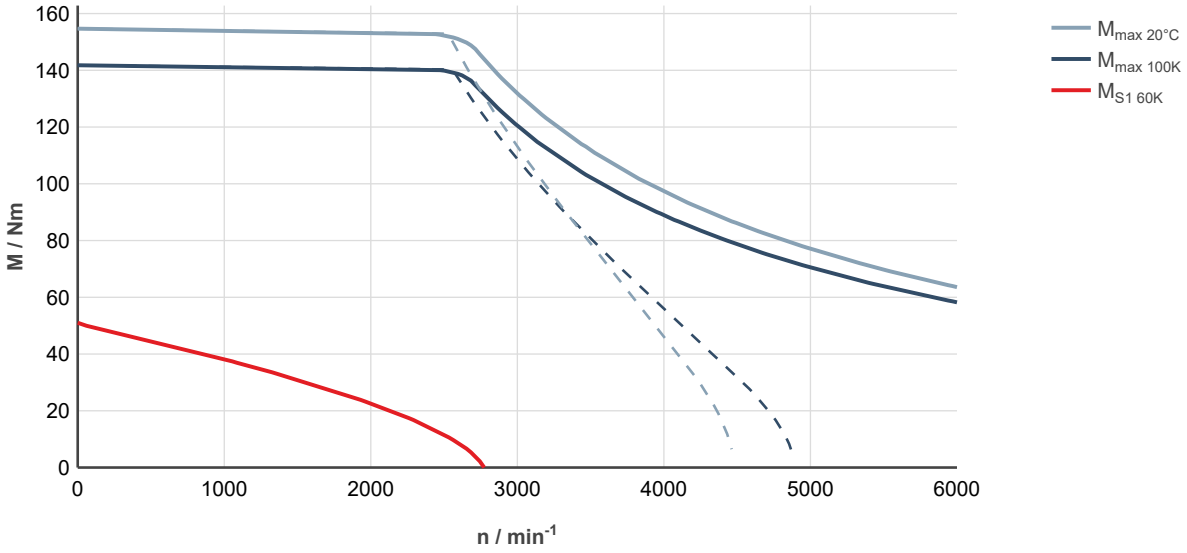


Fig. 80: MS2E10-D0BNN-___0-____-__, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

MS2E10-D1BFN

Designation	Symbol	Unit	MS2E10-D1BFN-___0-_N	MS2E10-D1BFN-___2-_N
Standstill torque - 60K 1)	$M_{0\ 60K}$	Nm	47.2	
Standstill current - 60K	$I_{0\ 60K}$	A	14.3	
Moment of inertia of rotor 1)	J_{rot}	kg*m²	0.0171	0.01857
Rated speed - 60K	$n_{N\ 60K}$	1/min	1600	
Rated torque - 60K 1)	$M_{N\ 60K}$	Nm	32.9	
Rated current - 60K	$I_{N\ 60K}$	A	10.25	
Rated power - 60K 1)	$P_{N\ 60K}$	kW	5.5	
Maximum torque 20 °C (cold) 1)	$M_{max\ 20°C}$	Nm	174	
Maximum torque 100K (warm) 1)	$M_{max\ 100K}$	Nm	160	
Maximum current	$I_{max(rms)}$	A	60.7	
Maximum speed (electrical)	$n_{max\ el}$	1/min	3000	
Maximum speed (mechanical)	$n_{max\ mech}$	1/min	6000	
Number of pole pairs	p		5	
Torque constant at 20 °C 1)	K_m	Nm/A	3.53	
Voltage constant at 20 °C 1)	K_E	V/1000 min^{-1}	214.5	
Winding resistance at 20 °C	R_{12}	Ohm	0.70	
Winding inductance	L_{12_min}	mH	12.2	
Leakage capacitance of the component	C_{ab}	nF	3.3	
Thermal time constant of winding	T_{th_W}	s	93.3	
Thermal time constant of motor	T_{th_M}	min	38.8	
Mass	m_{mot}	kg	36	41
Holding brake				
Holding torque	M_4	Nm	0	53.00
Rated voltage	U_N	V	0	24
Rated current	I_N	A	0	1.00
Maximum connection time	t_1	ms	0	70
Maximum disconnection time	t_2	ms	0	220

1) For tolerance details refer to ➥ chapter 7.4 Tolerances Latest amendment: 2020-10-26

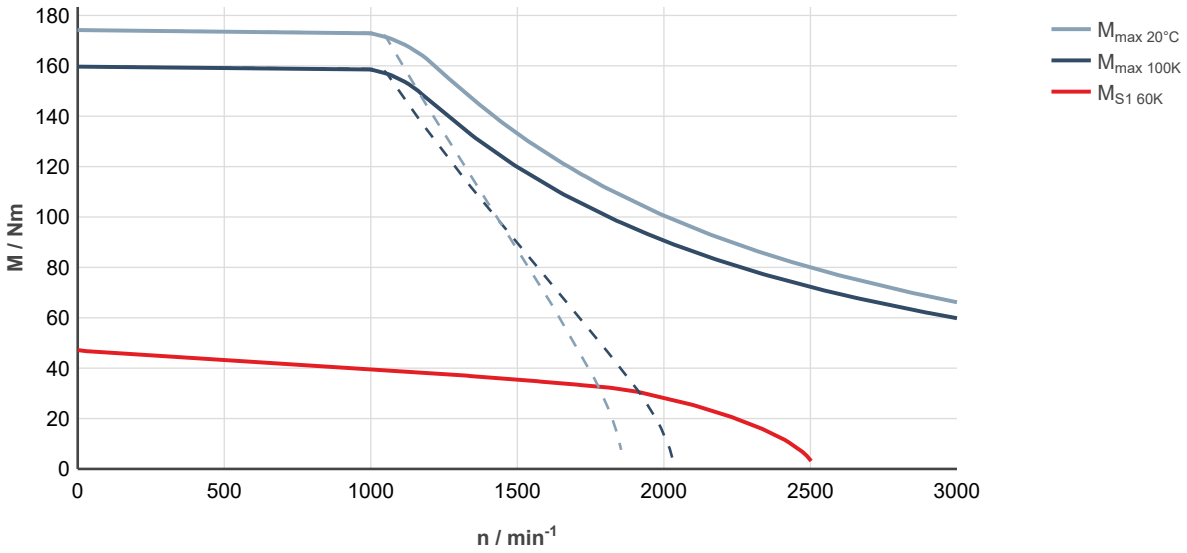


Fig. 81: MS2E10-D1BFN-___0-____-__, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

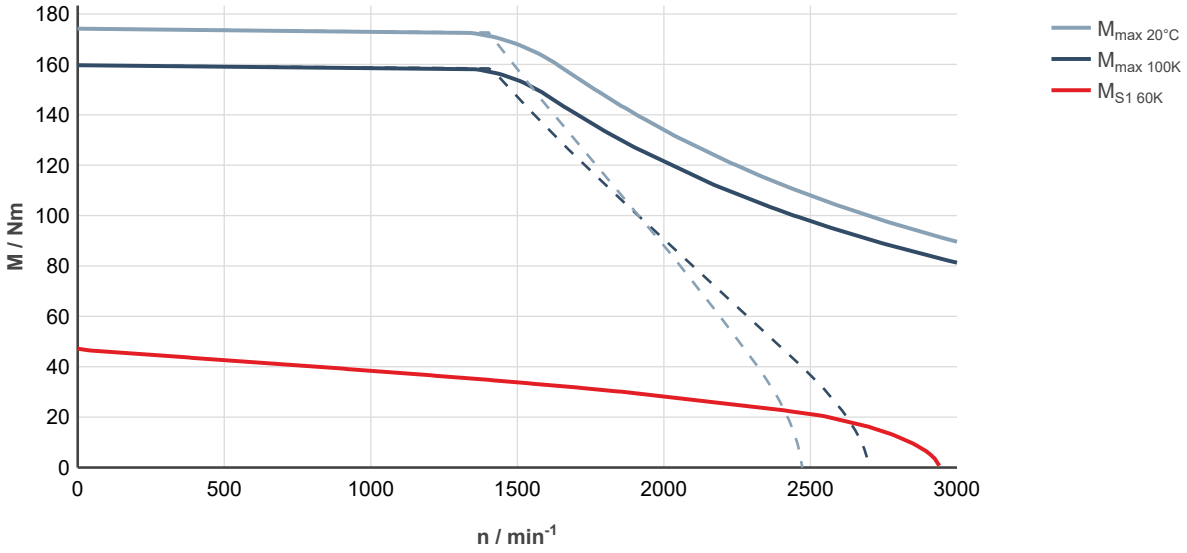


Fig. 82: MS2E10-D1BFN-___0-____-__, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

MS2E10-E1BFN

Designation	Symbol	Unit	MS2E10-E1BFN-___0-_N	MS2E10-E1BFN-___3-_N
Standstill torque - 60K 1)	$M_{0\ 60K}$	Nm	64.0	
Standstill current - 60K	$I_{0\ 60K}$	A	17.1	
Moment of inertia of rotor 1)	J_{rot}	kg*m²	0.025	0.0277
Rated speed - 60K	$n_{N\ 60K}$	1/min	1500	
Rated torque - 60K 1)	$M_{N\ 60K}$	Nm	42.5	
Rated current - 60K	$I_{N\ 60K}$	A	11.65	
Rated power - 60K 1)	$P_{N\ 60K}$	kW	6.7	
Maximum torque 20 °C (cold) 1)	$M_{max\ 20°C}$	Nm	266	
Maximum torque 100K (warm) 1)	$M_{max\ 100K}$	Nm	244	
Maximum current	$I_{max(rms)}$	A	81	
Maximum speed (electrical)	$n_{max\ el}$	1/min	3000	
Maximum speed (mechanical)	$n_{max\ mech}$	1/min	6000	
Number of pole pairs	p		5	
Torque constant at 20 °C 1)	K_m	Nm/A	4.0	
Voltage constant at 20 °C 1)	K_E	V/1000 min^{-1}	243	
Winding resistance at 20 °C	R_{12}	Ohm	0.53	
Winding inductance	L_{12_min}	mH	10.0	
Leakage capacitance of the component	C_{ab}	nF	5.12	
Thermal time constant of winding	T_{th_W}	s	100.5	
Thermal time constant of motor	T_{th_M}	min	44.6	
Mass	m_{mot}	kg	47	54
Holding brake				
Holding torque	M_4	Nm	0	90.00
Rated voltage	U_N	V	0	24
Rated current	I_N	A	0	1.50
Maximum connection time	t_1	ms	0	65
Maximum disconnection time	t_2	ms	0	250
1) For tolerance details refer to ➥chapter 7.4 Tolerances				Latest amendment: 2020-10-26

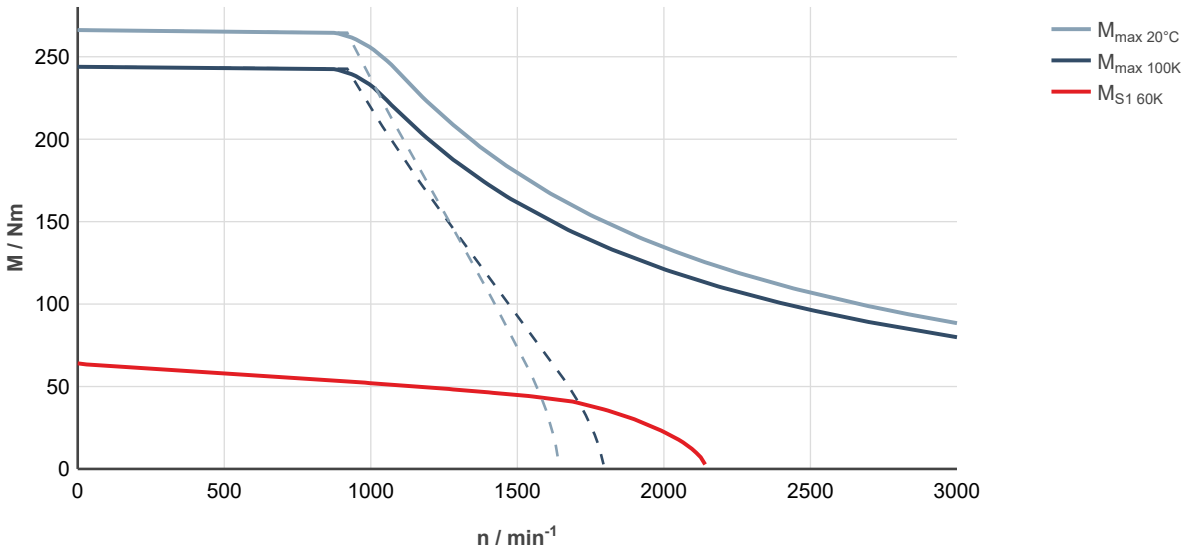


Fig. 83: MS2E10-E1BFN-___0-____-__, ctrlX DRIVE, uncontrolled supply 3 × AC 400 V

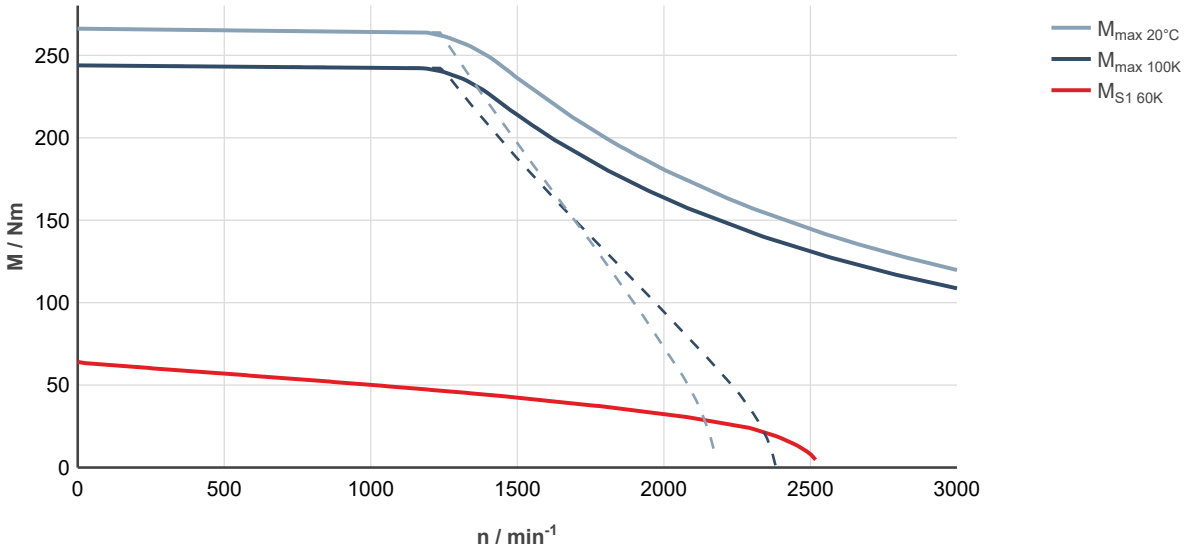
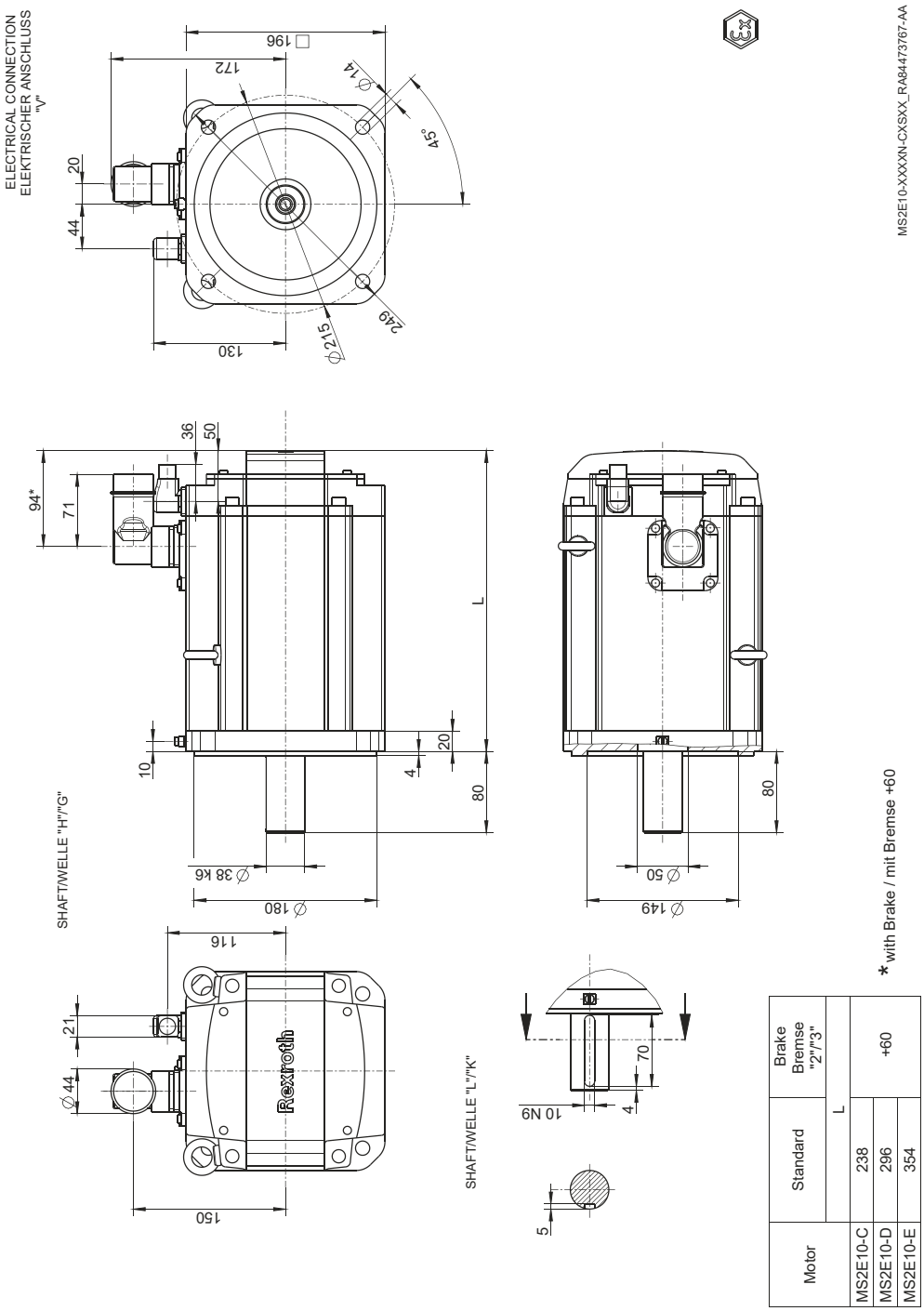


Fig. 84: MS2E10-E1BFN-___0-____-__, ctrlX DRIVE, controlled supply 3 x AC 400 ... 480 V

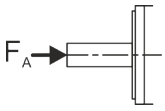
8.6.2 MS2E10 Specifications



Motor	L		
	Standard		Brake Bremse "2"/"3"
MS2E10-C	238		+60
MS2E10-D	296		+60
MS2E10-E	354		+60

Fig. 85: MS2E10-XXXXN

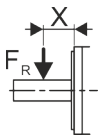
8.6.3 MS2E10 Axial force



Axial forces F_A are permissible without limitation up to 80 N. Higher axial forces only after a detailed dimensioning by your distribution partner at Bosch Rexroth. For evaluation purposes, please specify the following information:

- Axial and radial force with force application point
- Installation position (horizontal, vertical with the shaft end pointing to the top or bottom)
- Mean speed

8.6.4 MS2E10-C Radial force



The permissible radial force F_R is specified in distance x from the shaft shoulder, depending on the mean speed in the following diagram.

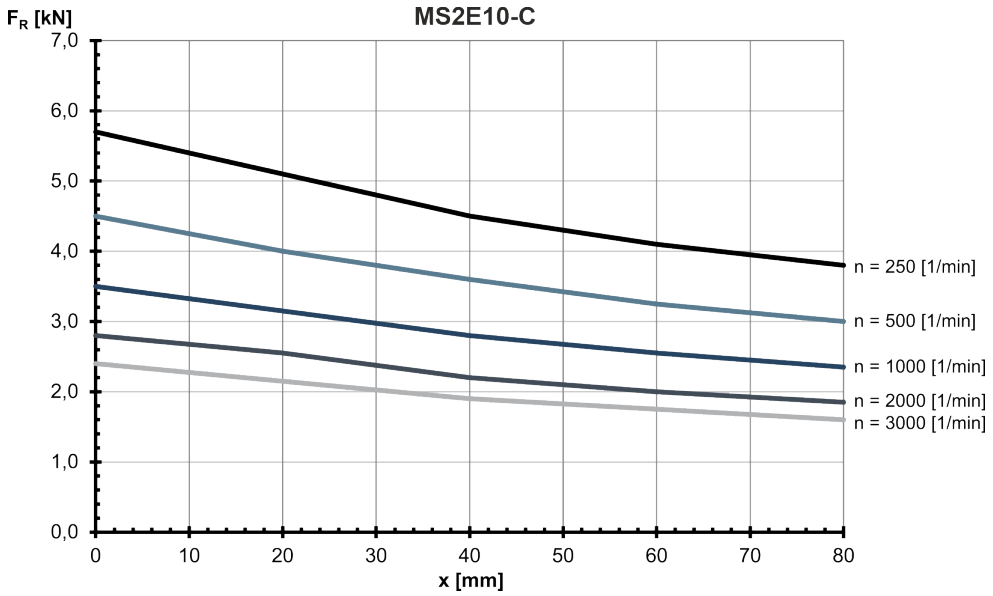
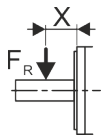


Fig. 86: MS2E10-C: Radial force in distance x from the shaft shoulder at a nominal bearing service life of Lh10 = 30000 h

8.6.5 MS2E10-D Radial force



The permissible radial force F_R is specified in distance x from the shaft shoulder, depending on the mean speed in the following diagram.

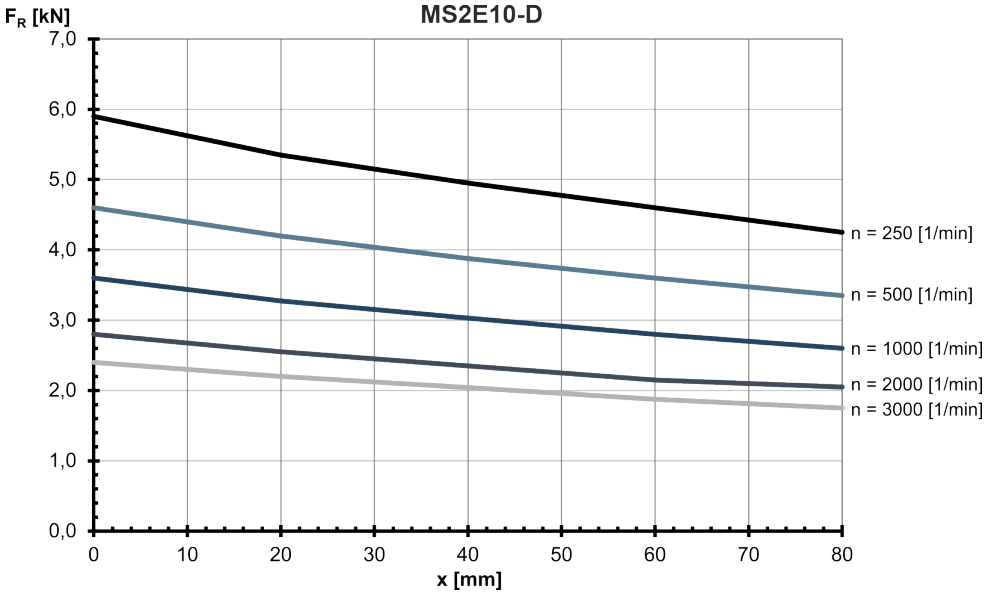
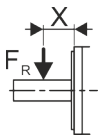


Fig. 87: MS2E10-D: Radial force in distance x from the shaft shoulder at a nominal bearing service life of Lh10 = 30000 h

8.6.6 MS2E10-E Radial force



The permissible radial force F_R is specified in distance x from the shaft shoulder, depending on the mean speed in the following diagram.

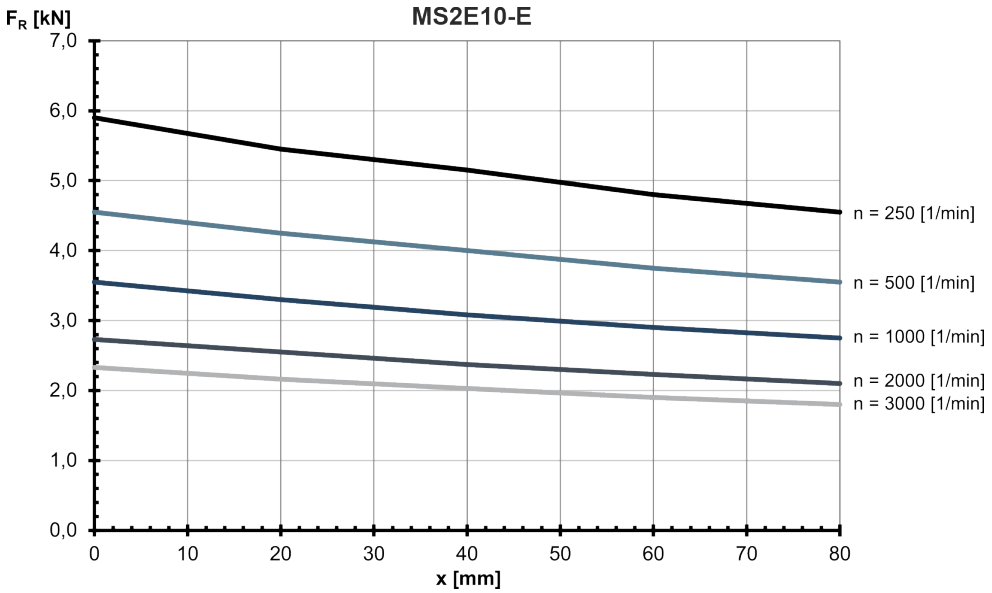
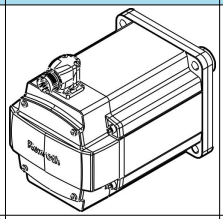
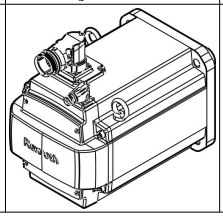


Fig. 88: MS2E10-E: Radial force in distance x from the shaft shoulder at a nominal bearing service life of Lh10 = 30000 h

9 Electrical connection

9.1 Overview

MS2E connection system overview

Type	View	Design	Size	Locking	Output direction
MS2E__-____-__S		Single cable connection	M23	SpeedCon	rotatable
MS2E__-____-__V		Power Encoder	M40 M17	SpeedCon SpeedCon	rotatable rotatable

9.2 Circuit diagram

9.2.1 Single cable connection for MS2E with encoder (digital C) and optional brake

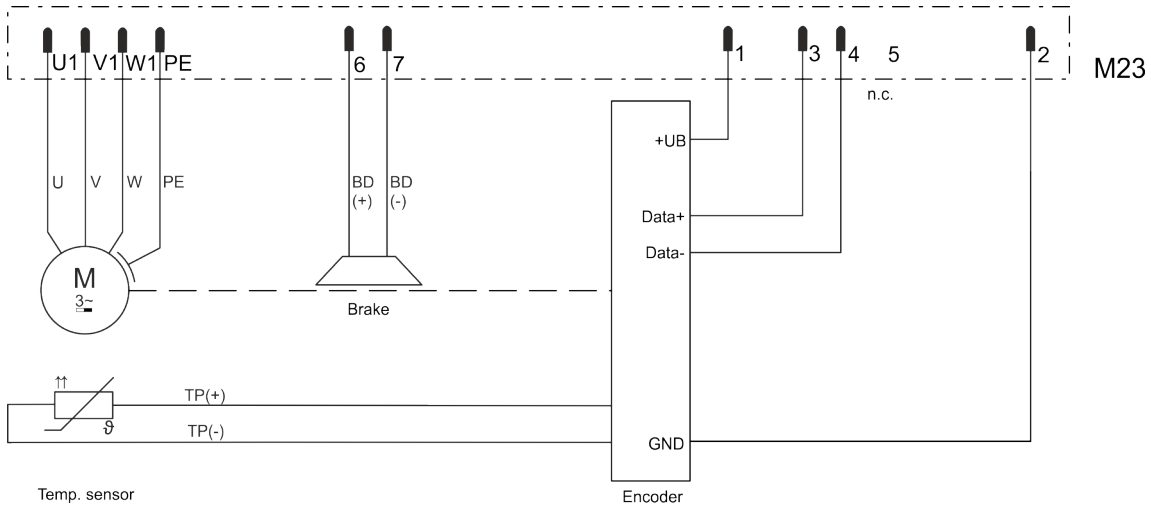


Fig. 89: Single cable connection, digital encoder C, optional brake

9.2.2 Double cable connection for MS2E with encoder (digital C, D) and optional brake

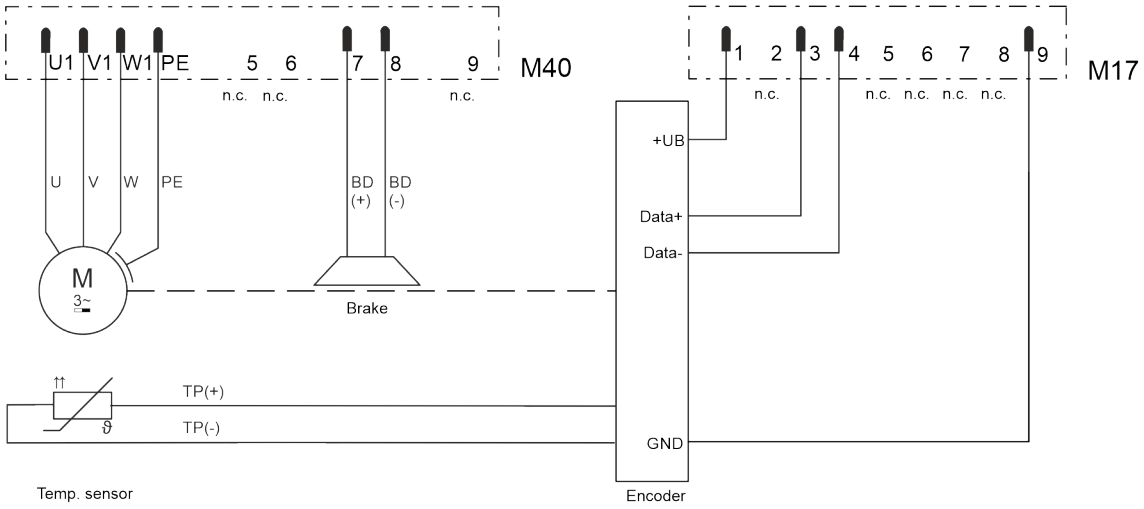


Fig. 90: Double cable connection, digital encoder C and D, brake optional

9.3 M23 single cable connector, rotatable (SpeedCon)

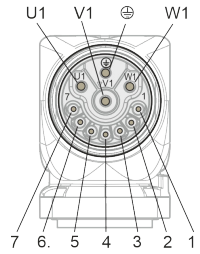
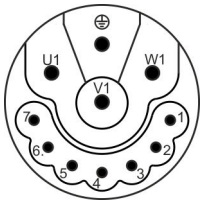


Fig. 91: Cable view of single cable connection M23

Connector size M23, Pin assignment of single cable connection), Encoder Cx		
 Pole pattern M23	**Pin**	**Signal**
	U1	A1
	V1	A2
	W1	A3
	⏚	PE
	1	+UB
	2	GND
	3	Data+
	4	Data-
	5	Shld
	6	BD(+) *)
	7	BD(-) *)
*) n.c. for a motor without holding brake		

Adjustment range

The output direction of the single cable connector M23 is adjustable. The device connectors can be manually rotated of a plug connector has been installed. Do not use any tools (e.g. pliers or screwdrivers) to turn the device connector to avoid damage.

Change the output direction a maximum of ten times and do not exceed the specified adjustment torques and the angle of rotation.

The theoretical setting range is shown below.

Adjustment range/angle of rotation MS2Exx-xxxxx-xxS

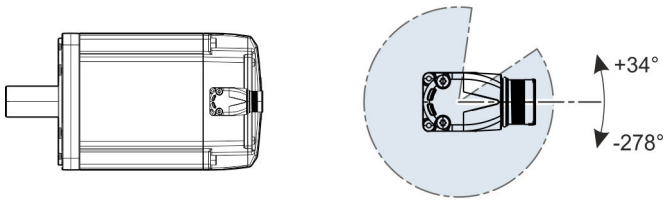


Fig. 92: Rotating area electrical connection “S”

Table 26: .Adjustment torque single cable connector / M23

Connector/size	Adjustment torque
Single cable connector / M23	4 ... 10 Nm

9.4 M40 cable connector, rotatable (SpeedCon)

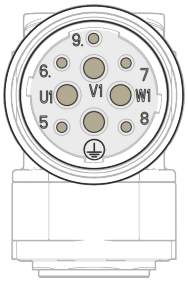
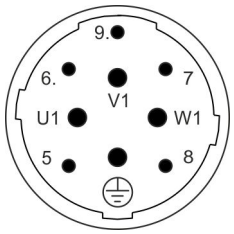


Fig. 93: Connector view of M40 power

Connector size M40, pin assignment of single cable connection, encoder Cx, Dx		
 Pole pattern M40	**Pin**	**Signal**
	U1	A1
	V1	A2
	W1	A3
	⏚	PE
	5	n.c.
	6	n.c.
	7	BD(+) *)
	8	BD(-)*)
	9	n.c.
*) n.c. for a motor without holding brake		

The output direction of the power connector and the encoder connector can be adjusted. The device connectors can be manually rotated of a plug connector has been installed. Do not use any tools (e.g. pliers or screwdrivers) to turn the device connector to avoid damage.

Change the output direction a maximum of ten times and do not exceed the specified adjustment torques and the angle of rotation.

Adjustment ranges can be limited by adjacent plug connectors. In the following, the designs and possible adjustment ranges are represented.

Adjustment range/angle of rotation MS2Exx-xxxxx-xxV

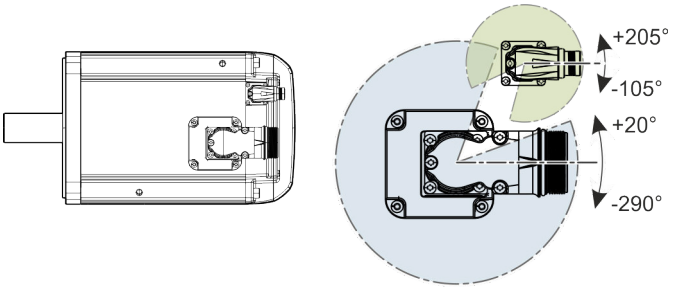


Fig. 94: : Rotating area electrical connection “V”

Table 27: Adjustment torque plug connector power / M40

Connector/size	Adjustment torque
Power / M40	12 ... 18 Nm

9.5 M17 Encoder connector

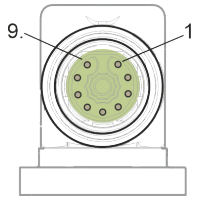
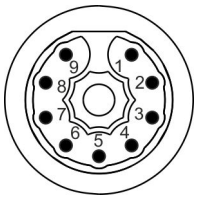


Fig. 95: M17 encoder connector, rotatable (SpeedCon)

Connector size M17, Pin assignment encoder Cx, Dx		
 Pole pattern M17	**Pin**	**Signal**
	1	+UB
	2	n.c.
	3	Data+
	4	Data-
	5	n.c.
	6	n.c.
	7	n.c.
	8	n.c.
	9	GND

Adjustment ranges

The output direction of the encoder connector M17 is adjustable. The device connectors can be manually rotated of a plug connector has been installed. Do not use any tools (e.g. pliers or screwdrivers) to turn the device connector to avoid damage.

Change the output direction a maximum of ten times and do not exceed the specified adjustment torques and the angle of rotation.

Adjustment ranges can be limited by adjacent plug connectors. In the following, the designs and possible adjustment ranges are represented.

Adjustment range/angle of rotation MS2Exx-xxxxx-xxV

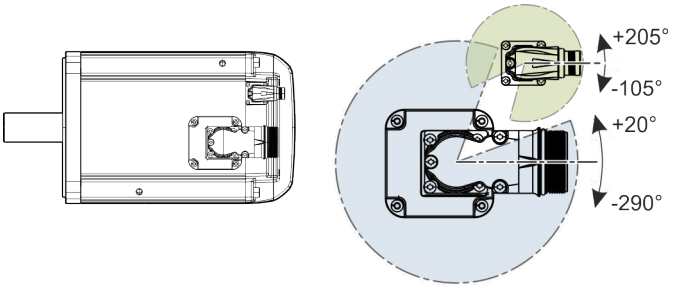


Fig. 96: Rotating area electrical connection “V”

Table 28: Adjustment torque plug connector encoder / M17

Connector/size	Adjustment torque
Encoder / M17	2 ... 6 Nm

9.6 Protective cable glands for connectors

At delivery, the connectors are locked with protective cable glands, which meet the requirements for ATEX applications. The cable gland protects the motor from humidity, dirt and mechanical damage.

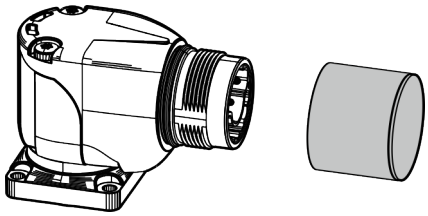


Fig. 97: Protective cable glands

Remove the protective cable glands right before connecting the mating connector. Always use protective cable glands, if no plug-connector is connected (e.g. storage and maintenance).

9.7 Plug connector protective cover

The plug connector protective cover fulfills the required protection against impact onto the plug connector according to the ATEX directive. In the special conditions on use X we refer to the responsibility of the plant manufacturer to do a risk evaluation.

NOTICE	**Loss of protective function! Replace a damaged connector protective cover** Immediately replace the connector protective cover after an impact to ensure the required device safety according to EN IEC 60079-0:2018/AC:2020.

Optionally, the connector protective cover can be used as disassembly protection. It fulfills the required protection against unintended loosening the plug connector during motor operation according to the ATEX directive. The connector can be disassembled only if the protective cover is removed. Assembly tools are required to remove the protective cover. Unintened loosening of the connector under load is excluded, if the protective cover is assembled.

Order number	Designation	Size
R911404719	SUP-M02-MS2E	M17
R911392284	SUP-M01-MS2E	M23
R911412835	SUP-M03-MS2E	M40

9.7.1 Assemble connector protective cover

To assemble the connector protective cover, prepare the fitting panel. Deviate the base (0500 A) and bend the connector protective cover in the specified order into the specified form as follows.

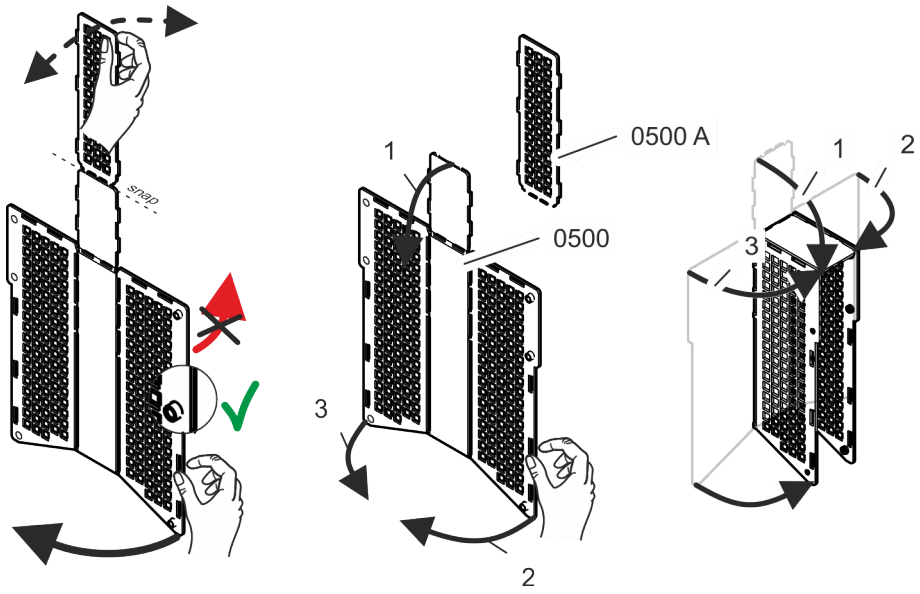


Fig. 98: Prepare connector protective cover

Position the connector protective cover over the motor connector. Observe that the output direction of the connector is adjusted to a 90° position.

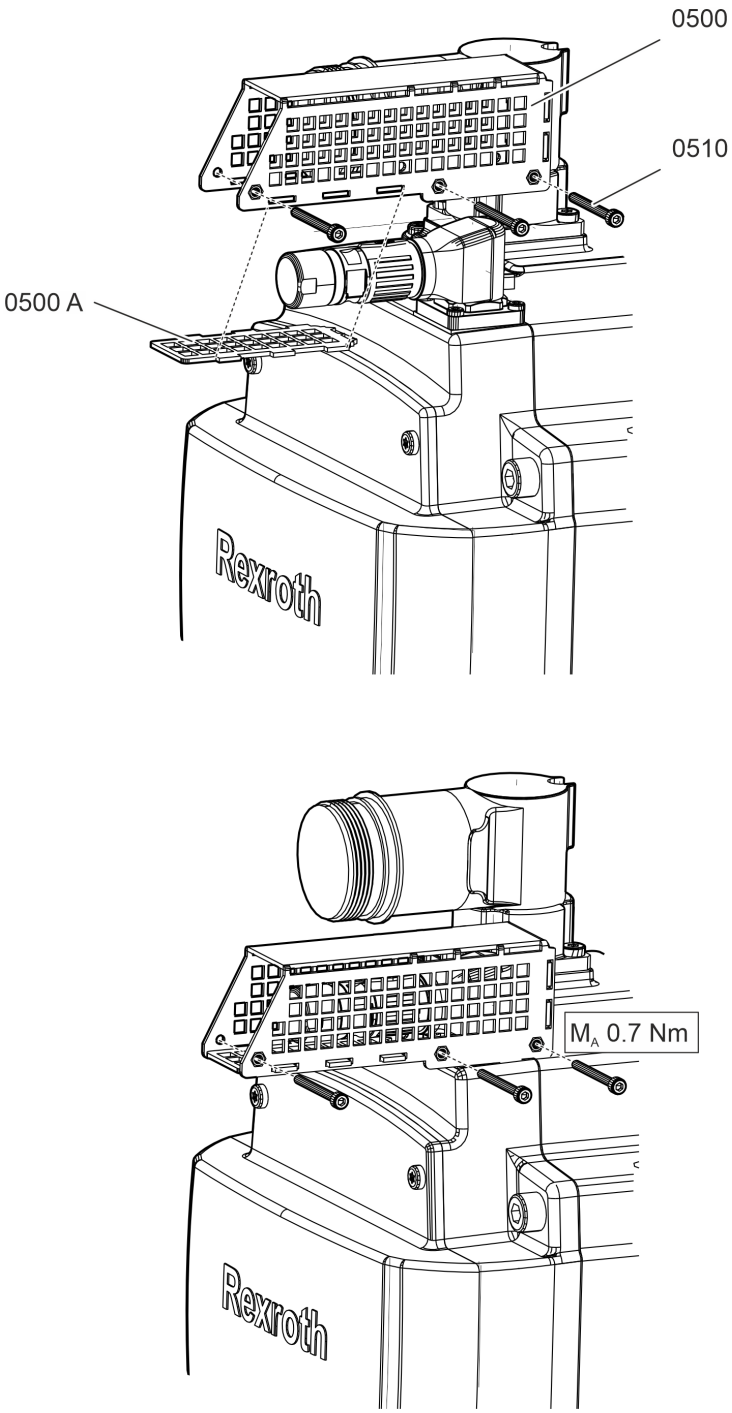


Fig. 99: Assemble plug connector protective cover M17

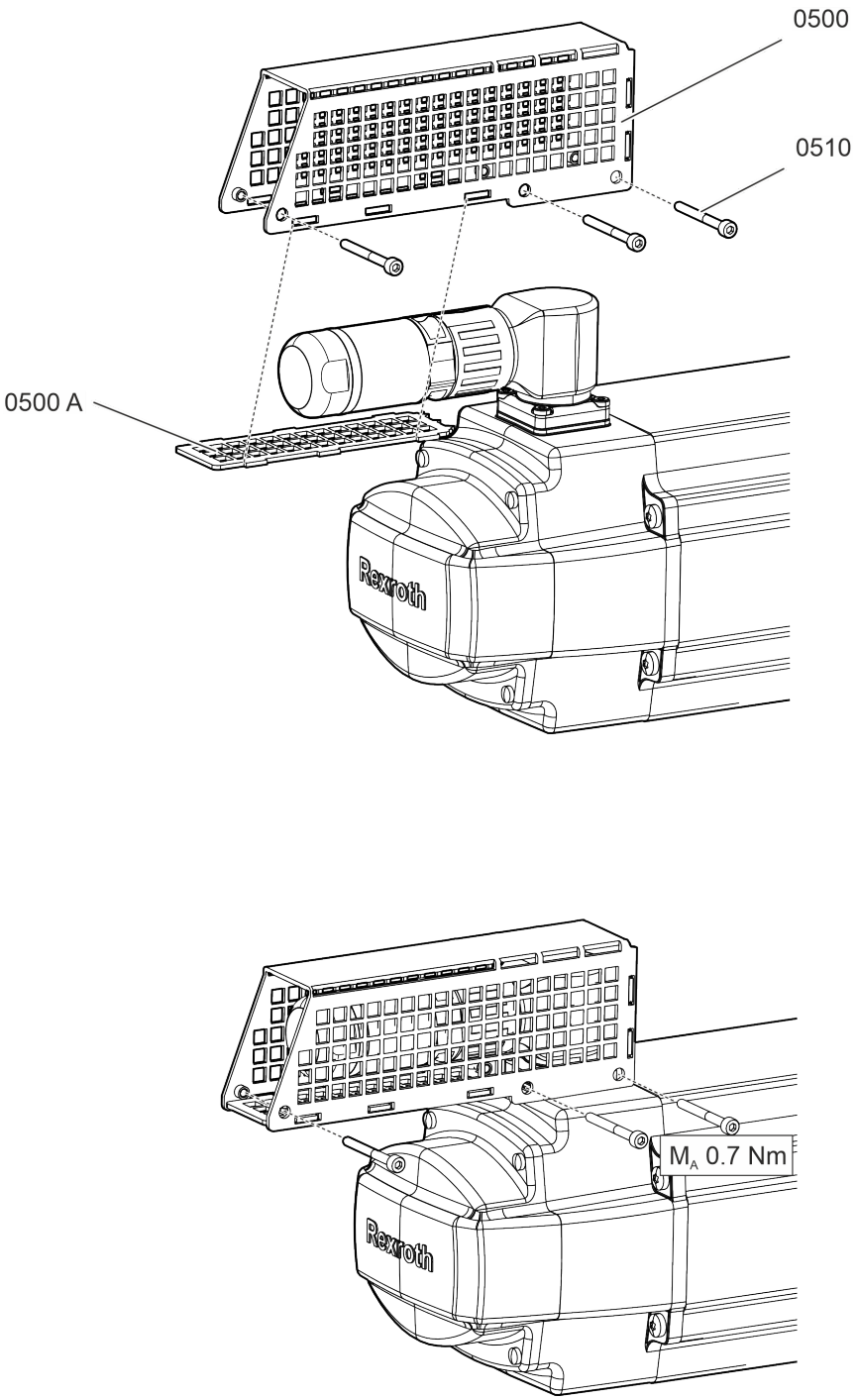


Fig. 100: Assemble plug connector protective cover M23

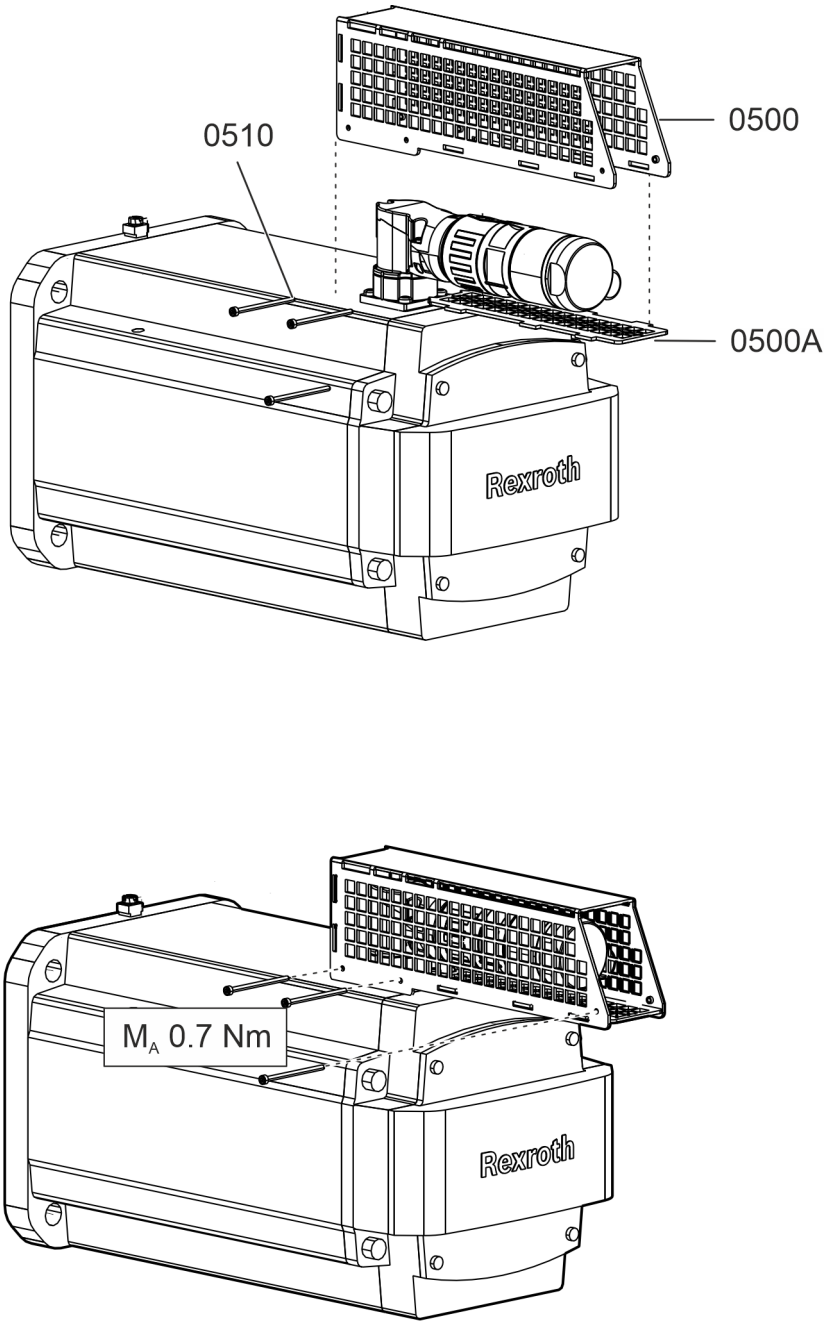


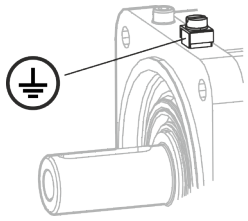
Fig. 101: Plug connector protective cover M40 assembly

The rotatable plug connector is set to a 90° position.

1. Position the connector protective cover onto the plug connector
2. Join the base (0500A) form-fitting into the grooves of the protective cover (0500).
3. Tighten (tightening torque 0.7 Nm) the fastening screws (0510)
   ➡ The connector protective cover is ready to use.

9.8 Ground connection

Motors for hazardous areas must be grounded via a separate ground conductor and a grounding conductor within the motor power cable. An additional connection clamp is provided on the motor flange to connect the grounding conductor.



Ground connection	Screw M5
Nominal cross-section	4 mm²
Clamping range	4 mm² (fine-wired); 6 mm² (single stranded)
Tightening torque	2 Nm

9.9 Shielding concept

Converter-fed drives can generate high-frequency discharge currents in motor cables and motors. By using shielded cables and a large-area, low-impedance connection of the shield connections at motor and controller, impedances can be minimized and the discharge currents can be lead from the motor to the controller. Ready-made cables of Bosch Rexroth are designed and tested according to the requirements of installed motor components.

For more information about Electromagnetic compatibility (EMC), refer to the project planning manual of the respective drive system.

9.10 Ready-made connecting cable

Preassembled power cables, encoder cables and hybrid cables can be provided for the motors. Motors with double cable technology are connected with a power and an encoder cable each. Motors with single cable technology are connected using a hybrid cable. The hybrid cable combines the functionality of power and encoder cable.

Die maximum cable length is 75 meters. The maximum cable length can be limited in case of certain motor control unit combinations. Please refer to the documentation about the control unit.

Available preassembled connection cables upon request. Please contact your sales partner in case of questions about available connection cables.

10 Ambient conditions

10.1 Ambient conditions during operation

Climatic conditions are defined in classes according to DIN EN IEC 60721. The classes are differentiated in the areas storage, transport and operation. They are based on long-term experiences and take all influencing variables into account, e.g., air temperature and air humidity.

A permanent use of the motors is possible when the specified class 3K22 according to DIN EN IEC 60721-3-3 is observed. Deviations and enhancements according to the follwing table must be observed.

Table 29: Ambient conditions

Operation	
Installation altitude	0 ... 1,000 m above sea level
Ambient temperature	0 ... +40 °C
Relative humidity	5 ... 95 %
Absolute humidity	1 ... 29 g/m^3

10.1.1 Vibration load during operation

Vibrations are sine-wave oscillations in stationary use, which vary in their effect on the resistance of the motors depending on their intensity.

The specified limit values are valid for frequencies of 10-2000 Hz during stimulation on the motor flange. Limitations can be necessary for occurring resonances depending on the application and installation situation.

The following limit values apply according to EN 60068-2-6 for MS2E motors:

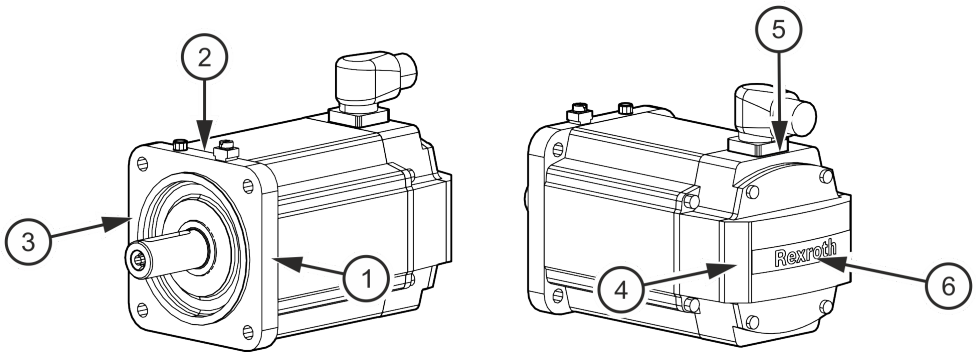


Fig. 102: Vibration load on measuring points

Table 30: Allowed vibration load MS2E motors.

Direction	Measuring point	Limit value (10-2000 Hz)
		Self-cooling
radial	1, 2 (radial motor flange)	30 m/s²
	4, 5 (radial, bearing shield)	50 m/s²
axial	3 (axial motor flange)	10 m/s²
	6 (axial bearing shield)	25 m/s²

The specified values must not be exceeded.

10.2 Derating in case of deviating ambient conditions.

Reduce high performance data:

1. Reduce the standstill torque $M_{0\ 60K}$, specified in the data sheet, with the following factors.

   We have:

   $M_{0\ red} = M_{0\ 60K} \times f_{TH\ 60K}$

2. Pan the S1-characteristic curve M_{S1} parallel to the speed axis to the junction of the S1-characteristic curve and to the calculated point $M_{0\ red}$ on the torque axis.

   ➡ The determined characteristic curve $M_{S1\ red}$ shows approximately the S1-characteristic curve with appropriate derating.

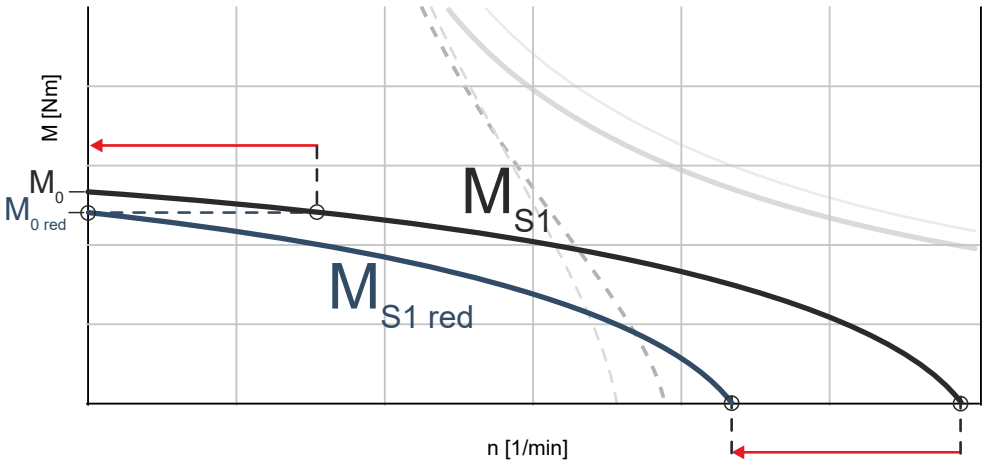


Fig. 103: Determine S1-characteristic curve $M_{S1\ red}$ with derating factor f_{TH}

Table 31: Derating factors for self-cooling 60K

Height [m]	40 °C	45 °C	50°C	55 °C	60 °C
1000	1.00	0.94	0.88	0.83	0.78
1500	0.97	0.91	0.85	0.81	0.76
2000	0.94	0.88	0.83	0.78	0.73
2500	0.90	0.85	0.79	0.75	0.70
3000	0.86	0.81	0.76	0.71	0.67

10.3 Operation on foreign converters

Principally, operating MS2E motors on foreign converters is possible, but the following requirements and limitations on foreign converters must be observed.

The MS2E motors are used for operation with **VPWM** inverters (**V** = voltage DC link inverter) and PWM control methods (**P**ulse-**W**idth-**M**odulation)(**Versorgung durch Umrichter / For converter operation**). The designation at the type plate is "**Inverter Duty VPWM**".

⚠ WARNING	**Danger of explosion or material damage due to overload!** Observe the following requirements for safe motor operation on foreign converters. Connection of all necessary sensors and additional devices for a safe operation and their evaluation lies in the sole responsibility of the plant manufacturer or operator.

Requirements on the power output stage

- Converter with pulse width modulation
- Pulse frequency 4 kHz ...16 kHz

Voltage load of the motor

During converter operation, the motor underlies a higher voltage load (insulation system, bearing) than on a sinusoidal source voltage only.

Standard values for peak voltage and rate of rise of voltage:

- Peak voltage U_{pk} on motor clamps ≤ 1.56 kV
- Rate of rise of voltage du/dt ≤ 5 kV/µs

Maximum allowed limit load:

In the case of critical rate of rise of off-state voltage du/dt ≥ 5 kV/µs, the limit values (peak voltage, voltage rise time) according to limit curves A according to **DIN VDE 0530-25 (VDE 0530-25):2009-08 (Figure 14 Limit curve A)** must be kept. Therefore, observe the limit values for voltage rise time and critical rate of rise of off-state voltage.

Limit values for voltage rise time and critical rate of rise of off-state voltage:

- Voltage rise time > 0.17 µs
- Rate of rise of off-state voltage du/dt < 8 kV/µs

Monitoring functions

- Speed monitoring of maximum permissible speed
- The motor load must not exceed the allowed continuous operation characteristic curve. The converter setting data for controlling and monitoring must comply with the type code data.
- Temperature control to protect from thermal overload
  - The temperature sensor of the motor winding must be connected and evaluated on the converter (ensure monitoring function, observe polarity of temperature sensor, limit switch-off temperature according to ➥Chapter 5.5 Thermal motor protection on page 27).
  - Temperature model or I^2t-monitoring within converter. Due to the coupling time of the temperature sensor, an additional suitable temperature model or an I^2t-monitoring must be used.

Switch-off

Please observe the notes in section .

Requirements for motor operation with holding brake

- Ensure the brake functionality during normal operation due to voltage control, current monitoring, cyclic control of the brake holding torque, for example.
- Provide an external or an integrated protective circuit within the foreign converter to switch the holding brake (inductive load).
- Never use the holding brake of the motor as an operating brake.
- Idle time after an emergency stop before restarting ≥ 3 minutes.

General notes

- The motors must be grounded via a motor cable and via a second separate ground conductor with minimum **4 mm²** cross section. Check that the position of the grounded conductor is fixed before commissioning.
- Use cables with a thermal stability of at least 80°C (176°F).
- Plug connector: Never connect or disconnect plug connectors under load!
- Connect and operate MS2E motors only with origin connection accessories. Use ready-made cables by Bosch Rexroth or with origin connectors ready-made connection cables. In the case of self-assembled cables, observe the notes about tensile load in the section “Special conditions “X” “ in chapter ➦ Chapter 3.4 Special conditions on use X on page 17.

⚠ WARNING	**Danger of explosion due to exalted tensile load of connection cables** Adherence of specified limits. Mechanical fastening of cable ends (e.g. use cable clamps, ...).

- The plant manufacturer and operator is responsible for test and documentation of the tensile load.
- Observe the limit values for bearing load. If necessary, change the bearing according to ➦ Chapter 5.13.1 Bearing service life on page 39.

After maintenance and repair work, Bosch Rexroth always recommends to do a safety and functionality test on basis of the risk analysis provided by the customer (e.g. for thermal protection, holding brake).

10.4 Transport

The motors must be transported in their original package taking classes 2K11, 2B1, 2C1, 2S5, 2M4 specified acc. to DIN EN 60721-3-2 into account.

Deviations and enhancements according to the follwing table must be observed.

Table 32: Deviations and enhancements of classification (DIN EN IEC 60721-3-2)

Transport	
Ambient temperature	-25 ... +70 °C
Relative humidity	5 ... 75 %
Shock load	➦ Chapter 10.6 Shock load during transport und storage on page 153

Instructions on transport by air

If motor components with permanent magnets are shipped by air, the DGR (**D**angerous **G**oods **R**egulations) of the IATA (International Air Transport Association) for hazardous materials of class 9 which also include magnetized substances and objects has to be complied with. This involves, for example:

- Secondary parts of synchronous linear motors
- Rotors of synchronous kit motors
- Rotors of synchronous housing motors (if these are dispatched as motor component, i.e. separate from the stator or motor housing, in service cases)

For details on the maximum allowed magnetic field strengths as well as information on measurement methods for these magnetic field strengths, please refer to the current IATA DGR (see chapter 3.9.2.2).

10.4.1 Instructions on machine transport

NOTICE	**Never touch the connection points of electrostatic sensitive devices!** – Mounted components (e.g. temperature sensors, encoder) can contain parts susceptible to electrical discharge (ESD). Observe the ESD safety measures.
⚠ WARNING	**Risk of injury and material damage due to improper handling during transport!** – Only use hoisting gear suited for the weight of the motors. Use lifting sling belts or lifting eye bolts. Secure the lifting eye bolts before use. Never walk under hanging loads. – Do not lift the motor at the shaft or on the optional fan housing. – Use suitable protective equipment and protective clothing during transport, and wear safety shoes.

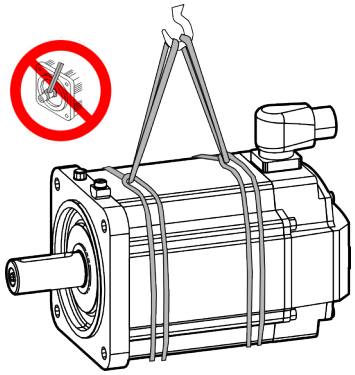


Fig. 104: Lifting and transporting motors

- Before transporting the motor, determine the weight of the motor. For more details about motor weight, please refer to the type plate or the project planning manual (Technical data).
- Adjust the carrying capacity of the lifting device to the motor weight.
- If provided by the manufacturer, all lifting eye bolts must be used and tightened before use.
- Avoid increased transport vibrations.
- Remove any existing transport locks prior to commissioning and keep them.

10.5 Storage

Store the motors in their original packaging in a dry, dust-free, vibration-free and light-protected place without direct solar radiation. Please observe classes 1K21, 1B1, 1C1, 1S10, 1M11 specified for storage acc. to DIN EN 60721-3-1.

Deviations and enhancements according to the follwing table must be observed.

Table 33: Deviations and enhancements of classification (DIN EN IEC 60721-3-1)

Bearing	
Ambient temperature	-25 ... +55 °C
Relative air humidity	5 ... 75 %
Absolute air humidity	1 ... 29 g/m³
Direct solar radiation	Not permitted
Shock load	➦ Chapter 10.6 Shock load during transport und storage on page 153

NOTICE

Damage due to moisture and humidity!

- Protect the products from dampness and corrosion.
- Store them only in rainproof and dry rooms.

Additional measures have to taken upon commissioning to ensure smooth functioning – irrespective of the storage time which may be longer than the warranty period of our products. Warranty extension is not a consequence.

Table 34: Measures before commissioning motors that have been stored over a prolonged period of time

Storage time / months			Measures for commissioning
> 1	> 12	> 60	
●	●	●	Visual inspection of all parts to be damage-free
●	●	●	Resurface the holding brake
	●	●	Check the electric contacts to verify that they are free from corrosion
	●	●	Let the motor run in without load for one hour at 800 ... 1000 rpm.
	●	●	Measure insulation resistance. Dry the winding at a value of < 1kOhm per volt rated voltage.
		●	Replace bearings
		●	Replace encoder

10.6 Shock load during transport und storage

Function-impairing effects are avoided as long as the specified limits are complied with.

Table 35: Permissible shock load for MS2E motors

Frame size	Maximum allowed shock load (11 ms)	
	Axial	radial
MS2E03, -04, -05	100 m/s²	1,000 m/s²
MS2E06	100 m/s²	500 m/s²
MS2E07	100 m/s²	300 m/s²
MS2E10	100 m/s²	200 m/s²

11 Service repair, maintenance and spare parts

Wearing parts are reliably and professionally repaired and replaced by the Rexroth Service in shopfloor-oriented quality.

MS2E may only repaired in the manufacturer´s works or in a workshop authorized by Rexroth. The following repairs, for example, can be carried out in authorized workshops:

- Replace motor encoder
- Replace shaft sealing ring
- ...

The service lives of motor components, such as seals and bearings, may vary depending on the operating conditions, such as operation mode, speed, vibration and shock load, and frequent reverse mode. We recommend to change the bearing after 30,000 operating hours. Shorter replacement intervals may be necessary; cf. checks during operation . We recommend regular visual inspections on shaft sealing rings. Depending on operating conditions, signs of wear may appear after 5,000 operating hours. If necessary, replace the shaft sealing rings.

The Bosch Rexroth service helpdesk at our headquarters in Lohr, Germany and our worldwide service provide You can contact us **24/7**.

Telephone:	**+49 (0) 9352 40 50 60**
Fax:	**+49 (0) 9352 18 49 41**
Email:	service.svc@boschrexroth.de
Internet:	➦ https://www.boschrexroth.com

Preparing information

For quick and efficient help, please have the following information ready:

- Detailed description of the fault and the circumstances
- Information on the rating plate of the products in question, particularly type codes and serial numbers
- Your contact data (phone number, fax number, email address)

12 Environmental protection and disposal

Disposal of the motor components can be done according to the applicable legal process in normal recycling process.

Recycling

Most of the products can be recycled due to their high content of metal. In order to recycle the metal in the best possible way, the products must be disassembled into individual assemblies. Metals contained in electric and electronic assemblies can also be recycled by means of special separation processes.

Basic components

Basically, our motors consist of the following components:

- Steel, stainless steel, aluminum, copper, brass
- Plastic parts, insulation and composite material
- Electronic components
- Permanent magnets

Plastic parts of the products may contain flame retardants. These plastic parts are labeled according to EN ISO 1043-1:2011 + A1:2016. They have to be recycled separately or disposed of according to the applicable legal provisions.

Magnets

⚠ WARNING	Danger due to permanent magnets!
	– Health hazard for persons with heart pacemakers, metallic implants and hearing aids in direct environment of permanent magnets. – Crushing hazard of fingers and hand due to heavy attractive forces of the magnets. – Risk of destruction of sensitive parts like watches, credit cards, ...

Remark

The permanent magnets of the rotor or secondary part must be demagnetized before disposal to avoid injuries or damage.

The demagnetization is reached via special thermal treatment. The handling duration is influenced by the rotor frame size. The rotor or the secondary part has to remain in the oven for a minimum of 30 minutes, starting at the time, the magnetic surface has reached 300 °C. If the magnets are surrounded by a bandage or a cover plate, it is recommended to remove it before heating in the oven to expose the magnets.

If demagnetization is successful, the magnets can be separated from the rotor or secondary part after cooling without applying force.

Packaging

Our packaging materials do not contain any problematic materials and can therefor be easily disposed. Packaging materials are: wood, cardboard and polystyrene.

Batteries and accumulators

The symbol indicating "separate collection" for all batteries and accumulators is the crossed-out wheeled bin. End users in the EU are legally bound to return used batteries and accumulators. Outside the scope of the EU Directive 2006/66/EC, the applicable regulations must be followed. Batteries and accumulators can contain hazardous substances which can harm the environment

or people's health when improperly stored or disposed of. The batteries or accumulators must be returned to the country-specific collection systems for proper disposal.

Disposal by the manufacturer

Our products can be returned to us for disposal. However, this requires that the products are free from oil, grease or other dirt. The motor components must be returned in a suitable packaging (origin package if possible). In the case of a transport by air freight, please observe the dangerous goods regulations (IATA) for the secondary part.
Send the products to the following address, carriage free:

Bosch Rexroth AG
Bgm.-Dr.-Nebel-Str. 2
97816 Lohr a.Main, Germany

13 Appendix

13.1 CE conformity

CE

The motors described in these operating instructions comply with the requirements and objective of EU Directive 2014/30/EU and with following the harmonized European standards:

Table 36: Applied harmonized standards

Standard, edition	Meaning
EN IEC 60079-0:2018/ AC:2020	Explosive atmospheres - Part 0: Equipment - General requirements (IEC 60079-0:2017)
EN IEC 60079-7:2015/ A1:2018	Explosive atmospheres - Part 7: Equipment protection by increased safety "e" (IEC 60079-7:2015/A1:2017)
EN 60079-31:2014	Explosive atmospheres - Part 31: Equipment dust ignition protection by enclosure "t" (IEC 60079-31:2013)

The CE Declaration of Conformity can be found in the Bosch Rexroth Media Directory: ➦ www.boschrexroth.com/MediaDirectory, keyword ➦ "DCTC-30502-002".

13.2 UL / CSA

c US

The UL/CSA conformity of MS2E motors can be found on the type plate of the motors.

MS2E motors are “UL Recognized”. Information can be found under UL file number E335445 on the website ➦ www.ul.com.

13.3 China RoHS 2

The China RoHS 2 conformity can be found on the type plate of the motors.
Information about listing: ➦ https://www.boschrexroth.com.cn/zh/cn/certificates/china-rohs2/

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