

Synchronous Servomotors MSK

For Potentially Explosive Areas

Project Planning Manual
R911312709

Edition 09



Title	Synchronous Servomotors MSK For Potentially Explosive Areas
Type of Documentation	Project Planning Manual
Document Typecode	DOK-MOTOR*-MSK*EXGIK3-PR09-EN-P
Internal File Reference	RS-d170bab768c990d90a6846a500789bc3-5-en-US-2
Record of revisions	Edition 12, 2018-07 See "Editions of this documentation" on page 7
Copyright	© Bosch Rexroth AG 2018 All rights reserved, also regarding any disposal, exploitation, reproduction, editing, distribution, as well as in the event of applications for industrial property rights.
Liability	The specified data is intended for product description purposes only and shall not be deemed to be a guaranteed characteristic unless expressly stipulated in the contract. All rights are reserved with respect to the content of this documentation and the availability of the product.

Table of Contents

	Page
1 About this documentation.....	7
1.1 Introduction.....	8
2 Important instructions on use.....	11
2.1 Intended use	11
2.1.1 Introduction.....	11
2.1.2 Areas of use and application.....	11
2.2 Inappropriate use.....	12
3 Safety notes for electric drives and controls.....	13
3.1 Term definition.....	13
3.2 General information.....	14
3.2.1 Using the Safety instructions and passing them on to others.....	14
3.2.2 Requirements for safe use.....	14
3.2.3 Hazards by improper use.....	15
3.3 Danger-related notes.....	16
3.3.1 Protection against Touch of Electric Parts and Housings.....	16
3.3.2 Protective extra-low voltage as protection against electric shock	17
3.3.3 Protection against dangerous movements.....	17
3.3.4 Protection against electromagnetic and magnetic fields during operation and mounting.....	19
3.3.5 Protection against contact with hot parts.....	19
3.3.6 Protection during handling and mounting.....	19
3.3.7 Battery safety.....	20
3.3.8 Protection against pressurized systems.....	20
3.4 Explanation of signal words and the Safety alert symbol.....	21
4 Explosion protection for MSK motors.....	23
4.1 Features.....	23
4.2 Conditions for Use of MSK Motors according to ATEX Classification, Equipment Group II, Category 3.....	25
4.3 Holding brake	27
4.4 Acceptance test.....	28
4.5 Residual risks.....	29
4.6 Labeling	30
4.6.1 Designation acc. to ATEX.....	30
4.6.2 UL marking for USA and Canada.....	30
5 Technical data.....	31
5.1 Description of the specified parameters.....	31
5.2 IndraSize.....	34
5.3 Technical data encoder for MSK motors.....	35
5.4 Technical data encoder MSK motors.....	36
5.5 Technical data holding brakes.....	37

Table of Contents

	Page
5.6	MSK030B-...-NSNN Technical data..... 38
5.7	MSK030C-...-NSNN Technical data..... 39
5.8	MSK040B-...-NSNN Technical data..... 40
5.9	MSK040C-...-NSNN Technical data..... 42
5.10	MSK050B-...-NSNN Technical data..... 44
5.11	MSK050C-...-NSNN Technical data..... 46
5.12	MSK060B-...-NSNN Technical data..... 48
5.13	MSK060C-...-NSNN Technical data..... 50
5.14	MSK061B-...-NSNN Technical data..... 52
5.15	MSK061C-...-NSNN Technical data..... 53
5.16	MSK070C-...-NSNN Technical data..... 55
5.17	MSK070D-...-NSNN Technical data..... 57
5.18	MSK070E-...-NSNN Technical data..... 59
5.19	MSK071C-...-NSNN Technical data..... 61
5.20	MSK071D-...-NSNN Technical data..... 63
5.21	MSK071E-...-NSNN Technical data..... 65
5.22	MSK100A-...-NSNN Technical data..... 67
5.23	MSK100B-...-NSNN Technical data..... 69
5.24	MSK100C-...-NSNN Technical data..... 72
5.25	MSK100D-...-NSNN Technical data..... 74
5.26	MSK101C-...-NSNN Technical data..... 76
5.27	MSK101D-...-NSNN Technical data..... 78
6	Specifications..... 81
6.1	Technical design 81
6.2	MSK030...-NSNN Specifications..... 82
6.3	MSK040...-NSNN Specifications..... 83
6.4	MSK050...-NSNN Specifications..... 84
6.5	MSK060...-NSNN Specifications..... 85
6.6	MSK061...-NSNN Specifications..... 86
6.7	MSK070...-NSNN Specifications..... 87
6.8	MSK071...-NSNN Specifications..... 88
6.9	MSK076...-NSNN Specifications..... 89
6.10	MSK100...-NSNN Specifications..... 90
6.11	MSK101...-NSNN Specifications..... 91
7	Type code..... 93
7.1	MSK type code - structure and description..... 93
7.2	MSK030 Type code..... 95
7.3	MSK040 Type code..... 96
7.4	MSK050 Type code..... 97
7.5	MSK060 Type code..... 98
7.6	MSK061 Type code..... 99
7.7	MSK070 Type code..... 100
7.8	MSK071 Type code..... 101

Table of Contents

	Page
7.9 MSK076 Type code.....	102
7.10 MSK100 Type code.....	103
7.11 MSK101 Type code.....	105
8 Accessories.....	107
8.1 Transmission.....	107
9 Connection technique.....	109
9.1 Overview of the electrical connection technique.....	109
9.2 Plug-in power connector.....	110
9.3 Encoder plug connector.....	111
9.4 Plug connector, rotatable.....	112
9.5 Connect equipotential bonding conductor.....	114
9.6 Connection cables.....	114
10 Operating conditions and application notes.....	115
10.1 Environmental conditions	115
10.1.1 Installation altitude and ambient temperature.....	115
10.1.2 Humidity / temperature	116
10.1.3 Vibrations.....	117
10.1.4 Shock.....	118
10.2 Degree of protection.....	119
10.3 Design and installation positions.....	120
10.4 Compatibility with foreign materials.....	121
10.5 Motor paint.....	122
10.6 Output shaft.....	123
10.6.1 Plain shaft.....	123
10.6.2 Output shaft with keyway.....	123
10.6.3 Output shaft with shaft sealing ring.....	123
10.7 Bearing and shaft load.....	125
10.7.1 Radial load, axial load.....	125
10.8 Bearing lifetime.....	129
10.9 Attachment of drive elements.....	130
10.10 Holding brakes.....	131
10.10.1 Holding brake electrically releasing.....	131
10.10.2 Holding brakes safety instructions.....	131
10.10.3 Design of holding brakes.....	133
10.10.4 Holding brake - commissioning and maintenance instructions.....	134
10.11 Acceptances and approvals.....	135
10.11.1 CE.....	135
10.11.2 cURus.....	135
10.11.3 EAC	135
10.11.4 RoHS	135
10.11.5 China RoHS 2.....	136
10.12 Motor cooling.....	137

Table of Contents

	Page
10.12.1 Natural convection.....	137
10.13 Motor temperature monitoring.....	138
10.13.1 General information.....	138
10.13.2 Temperature sensor.....	138
10.14 Operation on external controllers.....	139
11 Transport and storage.....	141
11.1 Transport Instructions.....	141
11.2 Storage instructions.....	142
11.2.1 Storage conditions.....	142
11.2.2 Storage times.....	143
12 Delivery condition, identification, handling.....	145
12.1 Delivery condition.....	145
12.1.1 General information.....	145
12.1.2 Factory inspection.....	145
12.1.3 Customer inspection.....	145
12.2 Identification	146
12.2.1 Scope of delivery.....	146
12.2.2 Type plate.....	146
12.3 Handling.....	148
13 Installation.....	151
13.1 Safety.....	151
13.2 Specialist personnel.....	152
13.3 Mechanical attachment.....	153
13.3.1 Flange attachment.....	153
13.3.2 Preparation.....	153
13.3.3 Motor mounting.....	154
13.4 Electrical connection - connect motor.....	155
13.4.1 General information.....	155
13.4.2 Connecting the plug-in connector.....	156
13.5 Connect equipotential bonding.....	156
14 Commissioning, operation and maintenance	157
14.1 Commissioning.....	157
14.2 Operation.....	158
14.3 Shutdown.....	158
14.4 Maintenance.....	159
14.4.1 General information.....	159
14.4.2 Cleaning.....	159
14.4.3 Bearings.....	160
14.4.4 Connecting cables.....	160
14.5 Information in case of malfunctions	161
14.6 Disassembly.....	163

Table of Contents

	Page
15 Environmental protection and disposal	165
15.1 Environmental protection.....	165
15.2 Disposal.....	165
16 Appendix.....	167
16.1 EU Declaration of conformity.....	167
17 Service and support.....	171
Index.....	173

1 About this documentation

Editions of this documentation

Edition	State	Note
01	2005-09	First edition
02	2005-11	Revision, amendment of the Declaration of conformity
03	2008-02	Revision, supplements
04	2008-09	Revision, supplements
05	2011-02	Revision, supplements
06	2014-06	Revision, supplements
08	2015-10	Revision, supplements
09	2018-07	Revision, corrections, supplements, Declaration of conformity, EAC, RoHS, China RoHS,

Tab. 1-1: Change history

About this documentation

1.1 Introduction

Synchronous servo motors for use in ATEX areas

MSK motors in ATEX design are suitable for the use in explosive atmospheres, according to ATEX directive 94/9/EC, in general automation technology. The motors are equipped with optical encoder systems, optional holding brake, output shafts with and without keyway.



The description in this documentation only refers to motors for use in potentially explosive atmospheres according to ATEX directives.

Document structure

This documentation focuses on the following topics:

Chapter	Title	Content
1	About this documentation	General information
2	Important instructions for use	Safety
3	Safety notes for electric drives and controls	
4	Explosion protection for MSK motors	
5	Technical data	
6	Specifications	Product description (for planners and designers)
7	Type code	
8	Accessories	
9	Connection technique	Practical application (for operating and maintenance personnel)
10	Operating conditions and application notes	
11	Transport and storage	
12	Delivery condition, identification, handling	
13	Installation	General information
14	Commissioning, operation and maintenance	
15	Environmental protection and disposal	
16	Appendix	
17	Service & support	General information
	Index	

Tab. 1-2: Document structure

Further documentation

For the project planning of drive systems with motors of the MSK-ATEX series, you will require further documentation, depending on the devices used. Rexroth provides the entire product documentation in the Bosch Rexroth media directory in PDF format.

<http://www.boschrexroth.com/various/utilities/mediadirectory/index.jsp>

Standards

This documentation refers to German, European and international technical standards. Standard typefaces and standard sheets are protected by copyright and may not be passed on by Rexroth. If need be, please contact the authorized sales outlets or, in Germany, directly:

BEUTH Verlag GmbH

Burggrafenstrasse 6

10787 Berlin

Phone +49-(0)30-26 01-22 60, Fax +49-(0)30-26 01-12 60

Internet: <http://www.din.de/beuth>

Email: postmaster@beuth.de

About this documentation

- External systems** Documentation for external systems connected with Rexroth components is not part of the scope of delivery and must be requested directly from these manufacturers.
- Feedback** For us, your experience is an important part of the improvement process for product and documentation.
Please send your comments to dokusupport@boschrexroth.de.

2 Important instructions on use

2.1 Intended use

2.1.1 Introduction

Rexroth products are developed and manufactured according to the state of the art. Before they are delivered, they are inspected to ensure that they operate safely.

WARNING

Improper product handling may result in personal injury and property damage!

The products must only be used as intended. If they are not used as intended, situations may arise that result in personal injuries or damage to property.



Rexroth, as the manufacturer, does not provide any warranty, assume any liability, or pay any damages for damage caused by products not being used as intended. Any risks resulting from the products not being used as intended are the sole responsibility of the user.

Before using Rexroth products, the following condition precedent must be fulfilled so as to ensure that they are used as intended:

- Everyone who in any way whatsoever handles one of our products must read and understand the corresponding notes regarding safety and regarding the intended use.
- The motors must be left in their original state. It is not allowed to do any constructional modifications. Software products may not be decompiled; their source codes may not be modified.
- Damaged or improperly working products may not be installed or put into operation.
- It must be ensured that the products are installed according to the regulations specified in the documentation.

2.1.2 Areas of use and application

The here described motors (components for Group II, Category 3G/3D) are only allowed to be used in an area (ATEX directive 94/9EG, Appendix II, cap. 1.5.1),

- 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**.



- MSK-ATEX motors must only be operated with IndraDrive drive control devices (converter operation).
- MSK-ATEX motors are not suited for direct mains operation on three-phase or single-phase network.

Important instructions on use

Device types with different driving powers and different interfaces are available for an application-specific use of the motors.

Controlling and monitoring of the motors may require connection of additional sensors and actuators.



MSK-ATEX motors may only be used with the accessories specified in this documentation. Components that are not explicitly mentioned may neither be attached nor connected. The same is applicable for cables and lines.

Operation is only allowed in the explicitly mentioned configurations and combinations of the component and with the software and firmware specified in the corresponding functional description.

Any connected drive controller must be programmed before startup in order to ensure that the motor executes the functions specifically to the particular application.

MSK-ATEX The motors may only be operated under the assembly, mounting and installation conditions, in the normal position, and under the environmental conditions (temperature, degree of protection, humidity, EMC etc.) specified in this documentation.

2.2 Inappropriate use

Any use MSK-ATEX of motors outside of the fields of application mentioned above or under operating conditions and technical data other than those specified in this documentation is considered as "non-intended use".

MSK-ATEX motors may not be used if . . .

- ambient conditions at the installation location requires a higher explosion protection than indicated at the motor type plate.
- they are subject to operating conditions which do not comply with the ambient conditions described above; for example, they may not be operated under water, under extreme temperature fluctuations or extreme maximum temperatures;
- the intended application is not explicitly released by Bosch Rexroth. Please be absolutely sure to comply with the instructions given in the general safety instructions!

3 Safety notes for electric drives and controls

3.1 Term definition

System	An installation consists of several devices or systems interconnected for a defined purpose and on a defined site which, however, are not intended to be placed on the market as a single functional unit.
Electrical drive system	An electric drive system comprises all components from mains supply to motor shaft; this includes, for example, electric motor(s), motor encoder(s), supply units and drive controllers, as well as auxiliary and additional components, such as mains filter, mains choke and the corresponding lines and cables.
User	A user is a person installing, commissioning or using a product which has been placed on the market.
User documentation	Application documentation comprises the entire documentation used to inform the user of the product about the use and safety-relevant features for configuring, integrating, installing, mounting, commissioning, operating, maintaining, repairing and decommissioning the product. The following terms are also used for this kind of documentation: Operating Instructions, Commissioning Manual, Instruction Manual, Project Planning Manual, Application Description, etc.
Electrical equipment	Electrical equipment encompasses all devices used to generate, convert, transmit, distribute or apply electrical energy, such as electric motors, transformers, switching devices, cables, lines, power-consuming devices, circuit board assemblies, plug-in units, control cabinets, etc.
Device	A device is a finished product with a defined function, intended for users and placed on the market as an individual piece of merchandise.
Manufacturer	The manufacturer is an individual or legal entity bearing responsibility for the design and manufacture of a product which is placed on the market in the individual's or legal entity's name. The manufacturer can use finished products, finished parts or finished elements, or contract out work to subcontractors. However, the manufacturer must always have overall control and possess the required authority to take responsibility for the product.
Components	A component is a combination of elements with a specified function, which are part of a piece of equipment, device or system. Components of the electric drive and control system are, for example, supply units, drive controllers, mains choke, mains filter, motors, cables, etc.
Machine	A machine is the entirety of interconnected parts or units at least one of which is movable. Thus, a machine consists of the appropriate machine drive elements, as well as control and power circuits, which have been assembled for a specific application. A machine is, for example, intended for processing, treatment, movement or packaging of a material. The term "machine" also covers a combination of machines which are arranged and controlled in such a way that they function as a unified whole.
Product	Examples of a product: Device, component, part, system, software, firmware, among other things.
Project planning manual	A Project Planning Manual is part of the application documentation used to support the sizing and planning of systems, machines or installations.
Qualified personnel	In terms of this application documentation, qualified persons are those persons who are familiar with the installation, mounting, commissioning and operation of the components of the electric drive and control system, as well as with the hazards this implies, and who possess the qualifications their work

Safety notes for electric drives and controls

requires. To comply with these qualifications, it is necessary, among other things,

- 1) to be trained, instructed or authorized to switch electric circuits and devices safely on and off, to ground them and to mark them
- 2) to be trained or instructed to maintain and use adequate safety equipment
- 3) to attend a course of instruction in first aid

Control system A control system comprises several interconnected control components placed on the market as a single functional unit.

3.2 General information

3.2.1 Using the Safety instructions and passing them on to others

Do not attempt to install and operate the components of the electric drive and control system without first reading all documentation provided with the product. Read and understand these safety instructions and all user documentation prior to working with these components. If you do not have the user documentation for the components, contact your responsible Rexroth sales partner. Ask for these documents to be sent immediately to the person or persons responsible for the safe operation of the components.

If the component is resold, rented and/or passed on to others in any other form, these safety instructions must be delivered with the component in the official language of the user's country.

Improper use of these components, failure to follow the safety instructions in this document or tampering with the product, including disabling of safety devices, could result in property damage, injury, electric shock or even death.

3.2.2 Requirements for safe use

Read the following instructions before initial commissioning of the components of the electric drive and control system in order to eliminate the risk of injury and/or property damage. You must follow these safety instructions.

- Rexroth is not liable for damages resulting from failure to observe the safety instructions.
- Read the operating, maintenance and safety instructions in your language before commissioning. If you find that you cannot completely understand the application documentation in the available language, please ask your supplier to clarify.
- Proper and correct transport, storage, mounting and installation, as well as care in operation and maintenance, are prerequisites for optimal and safe operation of the component.
- Only qualified persons may work with components of the electric drive and control system or within its proximity.
- Only use accessories and spare parts approved by Rexroth.
- Follow the safety regulations and requirements of the country in which the components of the electric drive and control system are operated.
- Only use the components of the electric drive and control system in the manner that is defined as appropriate. See chapter "Appropriate Use".
- The ambient and operating conditions given in the available application documentation must be observed.
- Applications for functional safety are only allowed if clearly and explicitly specified in the application documentation "Integrated Safety Technolo-

Safety notes for electric drives and controls

gy". If this is not the case, they are excluded. Functional safety is a safety concept in which measures of risk reduction for personal safety depend on electrical, electronic or programmable control systems.

- The information given in the application documentation with regard to the use of the delivered components contains only examples of applications and suggestions.

The machine and installation manufacturers must

- make sure that the delivered components are suited for their individual application and check the information given in this application documentation with regard to the use of the components,
- make sure that their individual application complies with the applicable safety regulations and standards and carry out the required measures, modifications and complements.
- Commissioning of the delivered components is only allowed once it is sure that the machine or installation in which the components are installed complies with the national regulations, safety specifications and standards of the application.
- Operation is only allowed if the national EMC regulations for the application are met.
- The instructions for installation in accordance with EMC requirements can be found in the section on EMC in the respective application documentation.

The machine or installation manufacturer is responsible for compliance with the limit values as prescribed in the national regulations.

- The technical data, connection and installation conditions of the components are specified in the respective application documentations and must be followed at all times.

National regulations which the user has to comply with

- European countries: In accordance with European EN standards
- United States of America (USA):
 - National Electrical Code (NEC)
 - National Electrical Manufacturers Association (NEMA), as well as local engineering regulations
 - Regulations of the National Fire Protection Association (NFPA)
- Canada: Canadian Standards Association (CSA)
- Other countries:
 - International Organization for Standardization (ISO)
 - International Electrotechnical Commission (IEC)

3.2.3 Hazards by improper use

- High electrical voltage and high working current! Danger to life or serious injury by electric shock!
- High electrical voltage by incorrect connection! Danger to life or injury by electric shock!
- Dangerous movements! Danger to life, serious injury or property damage by unintended motor movements!
- Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electric drive systems!

Safety notes for electric drives and controls

- Risk of burns by hot housing surfaces!
- Risk of injury by improper handling! Injury by crushing, shearing, cutting, hitting!
- Risk of injury by improper handling of batteries!
- Risk of injury by improper handling of pressurized lines!

3.3 Danger-related notes

3.3.1 Protection against Touch of Electric Parts and Housings



This section concerns components of electric drive and control systems with a voltage **over 50 volt**.

In the case of touching parts with a voltage higher than 50 volt, this can be dangerous for personnell and can lead to electric shock. During operation of components of electric drive and control systems, certain parts of these components are inevitably under dangerous voltage.

High electrical voltage! Danger of life, risk of injury due to electric shock or heavy bodily harm.

- Operation, maintenance and/or repair of components of electric drive and control systems may only be done by qualified personnel.
- Observe the general construction and safety instructions about work on high voltage systems.
- Before switching on, establish the fixed connection of the protective conductor to all electric components according to the interconnection diagram.
- Operation, even for short-term measuring and testing purposes, is only permitted with the protective conductor securely connected to the component points provided.
- Disconnect electric components from the mains or from the power supply, before you have contact with electric parts with a voltage higher than 50 V. Secure the electric components against restarting.
- Observe for electrical components:
Please, always wait **30 minutes**, after switch-off, so live capacitors discharge before they have access to electric components. To exclude any danger due to any contact, measure electric voltage of live parts before working.
- Before switch-on install the provided covers and protective devices for the touch guard.
- Do not touch any electric junctions of live components.
- Do not disconnect or connect connectors under voltage.

High housing voltage and high discharge current! Danger! Risk of injury due to electric shock!

- Before switch-on and start-up, ground or connect the components of the drive and control system with the protective conductors on the grounding points.

Safety notes for electric drives and controls

- Connect the protective conductors of the electric drive and control systems always fix and continuously with the external supply network.
- Do a protective conductor connection with a minimum cross section according to the following table.

Cross-sectional area A of the live wires	Minimum cross-sectional area A_{PE} of the protective conductor
$A \leq 16 \text{ mm}^2$	A
$25 \text{ mm}^2 < A \leq 50 \text{ mm}^2$	25 mm ²
$50 \text{ mm}^2 < A$	A / 2

Tab. 3-1: Minimum cross-section of protective conductor connection for motors

3.3.2 Protective extra-low voltage as protection against electric shock

Protective extra-low voltage is used to allow connecting devices with basic insulation to extra-low voltage circuits.

On components of an electric drive and control system provided by Rexroth, all connections and terminals with voltages up to 50 volts are PELV ("Protective Extra-Low Voltage") systems. It is allowed to connect devices equipped with basic insulation (such as programming devices, PCs, notebooks, display units) to these connections.

Danger to life, risk of injury by electric shock! High electrical voltage by incorrect connection!

If extra-low voltage circuits of devices containing voltages and circuits of more than 50 volts (e.g., the mains connection) are connected to Rexroth products, the connected extra-low voltage circuits must comply with the requirements for PELV ("Protective Extra-Low Voltage").

3.3.3 Protection against dangerous movements

Dangerous movements can be caused by faulty control of connected motors. Some common examples are:

- Improper or wrong wiring or cable connection
- Operator errors
- Wrong input of parameters before commissioning
- Malfunction of sensors and encoders
- Defective components
- Software or firmware errors

These errors can occur immediately after equipment is switched on or even after an unspecified time of trouble-free operation.

The monitoring functions in the components of the electric drive and control system will normally be sufficient to avoid malfunction in the connected drives. Regarding personal safety, especially the danger of injury and/or property damage, this alone cannot be relied upon to ensure complete safety. Until the integrated monitoring functions become effective, it must be assumed in any case that faulty drive movements will occur. The extent of faulty drive movements depends upon the type of control and the state of operation.

Safety notes for electric drives and controls

Dangerous movements! Danger to life, risk of injury, serious injury or property damage!

A **risk assessment** must be prepared for the installation or machine, with its specific conditions, in which the components of the electric drive and control system are installed.

As a result of the risk assessment, the user must provide for monitoring functions and higher-level measures on the installation side for personal safety. The safety regulations applicable to the installation or machine must be taken into consideration. Unintended machine movements or other malfunctions are possible if safety devices are disabled, bypassed or not activated.

To avoid accidents, injury and/or property damage:

- Keep free and clear of the machine's range of motion and moving machine parts. Prevent personnel from accidentally entering the machine's range of motion by using, for example:
 - Safety fences
 - Safety guards
 - Protective coverings
 - Light barriers
- Make sure the safety fences and protective coverings are strong enough to resist maximum possible kinetic energy.
- Mount emergency stopping switches in the immediate reach of the operator. Before commissioning, verify that the emergency stopping equipment works. Do not operate the machine if the emergency stopping switch is not working.
- Prevent unintended start-up. Isolate the drive power connection by means of OFF switches/OFF buttons or use a safe starting lockout.
- Make sure that the drives are brought to safe standstill before accessing or entering the danger zone.
- Additionally secure vertical axes against falling or dropping after switching off the motor power by, for example,
 - mechanically securing the vertical axes,
 - adding an external braking/arrester/clamping mechanism or
 - ensuring sufficient counterbalancing of the vertical axes.
- The standard equipment **motor holding brake** or an external holding brake controlled by the drive controller is **not sufficient to guarantee personal safety!**
- Disconnect electrical power to the components of the electric drive and control system using the master switch and secure them from reconnection ("lock out") for:
 - Maintenance and repair work
 - Cleaning of equipment
 - Long periods of discontinued equipment use
- Prevent the operation of high-frequency, remote control and radio equipment near components of the electric drive and control system and their supply leads. If the use of these devices cannot be avoided, check the machine or installation, at initial commissioning of the electric drive and control system, for possible malfunctions when operating such high-frequency, remote control and radio equipment in its possible positions of normal use. It might possibly be necessary to perform a special electromagnetic compatibility (EMC) test.

3.3.4 Protection against electromagnetic and magnetic fields during operation and mounting

Electromagnetic and magnetic fields!

Health hazard for persons with active implantable medical devices (AIMD) such as pacemakers or passive metallic implants.

- Hazards for the above-mentioned groups of persons by electromagnetic and magnetic fields in the immediate vicinity of drive controllers and the associated current-carrying conductors.
- Entering these areas can pose an increased risk to the above-mentioned groups of persons. They should seek advice from their physician.
- If overcome by possible effects on above-mentioned persons during operation of drive controllers and accessories, remove the exposed persons from the vicinity of conductors and devices.

3.3.5 Protection against contact with hot parts

Hot surfaces of components of the electric drive and control system. Risk of burns!

- Do not touch hot surfaces of, for example, braking resistors, heat sinks, supply units and drive controllers, motors, windings and laminated cores!
- According to the operating conditions, temperatures of the surfaces can be **higher than 60 °C (140 °F)** during or after operation.
- Before touching motors after having switched them off, let them cool down for a sufficient period of time. Cooling down can require **up to 140 minutes!** The time required for cooling down is approximately five times the thermal time constant specified in the technical data.
- After switching chokes, supply units and drive controllers off, wait **15 minutes** to allow them to cool down before touching them.
- Wear safety gloves or do not work at hot surfaces.
- For certain applications, and in accordance with the respective safety regulations, the manufacturer of the machine or installation must take measures to avoid injuries caused by burns in the final application. These measures can be, for example: Warnings at the machine or installation, guards (shieldings or barriers) or safety instructions in the application documentation.

3.3.6 Protection during handling and mounting

Risk of injury by improper handling! Injury by crushing, shearing, cutting, hitting!

- Observe the relevant statutory regulations of accident prevention.
- Use suitable equipment for mounting and transport.
- Avoid jamming and crushing by appropriate measures.
- Always use suitable tools. Use special tools if specified.
- Use lifting equipment and tools in the correct manner.
- Use suitable protective equipment (hard hat, safety goggles, safety shoes, safety gloves, for example).

Safety notes for electric drives and controls

- Do not stand under hanging loads.
- Immediately clean up any spilled liquids from the floor due to the risk of falling!

3.3.7 Battery safety

Batteries consist of active chemicals in a solid housing. Therefore, improper handling can cause injury or property damage.

Risk of injury by improper handling!

- Do not attempt to reactivate low batteries by heating or other methods (risk of explosion and cauterization).
- Do not attempt to recharge the batteries as this may cause leakage or explosion.
- Do not throw batteries into open flames.
- Do not dismantle batteries.
- When replacing the battery/batteries, do not damage the electrical parts installed in the devices.
- Only use the battery types specified for the product.



Environmental protection and disposal! The batteries contained in the product are considered dangerous goods during land, air, and sea transport (risk of explosion) in the sense of the legal regulations. Dispose of used batteries separately from other waste. Observe the national regulations of your country.

3.3.8 Protection against pressurized systems

According to the information given in the Project Planning Manuals, motors and components cooled with liquids and compressed air can be partially supplied with externally fed, pressurized media, such as compressed air, hydraulics oil, cooling liquids and cooling lubricants. Improper handling of the connected supply systems, supply lines or connections can cause injuries or property damage.

Risk of injury by improper handling of pressurized lines!

- Do not attempt to disconnect, open or cut pressurized lines (risk of explosion).
- Observe the respective manufacturer's operating instructions.
- Before dismounting lines, relieve pressure and empty medium.
- Use suitable protective equipment (safety goggles, safety shoes, safety gloves, for example).
- Immediately clean up any spilled liquids from the floor due to the risk of falling!



Environmental protection and disposal! The agents (e.g., fluids) used to operate the product might not be environmentally friendly. Dispose of agents harmful to the environment separately from other waste. Observe the national regulations of your country.

3.4 Explanation of signal words and the Safety alert symbol

The Safety Instructions in the available application documentation contain specific signal words (DANGER, WARNING, CAUTION or NOTICE) and, where required, a safety alert symbol (in accordance with ANSI Z535.6-2011).

The signal word is meant to draw the reader's attention to the safety instruction and identifies the hazard severity.

The safety alert symbol (a triangle with an exclamation point), which precedes the signal words DANGER, WARNING and CAUTION, is used to alert the reader to personal injury hazards.

DANGER

In case of non-compliance with this safety instruction, death or serious injury **will** occur.

WARNING

In case of non-compliance with this safety instruction, death or serious injury **could** occur.

CAUTION

In case of non-compliance with this safety instruction, minor or moderate injury could occur.

NOTICE

In case of non-compliance with this safety instruction, property damage could occur.

4 Explosion protection for MSK motors

4.1 Features

Rexroth MSK motors in ATEX design are suitable for the use in explosive atmospheres of the zones 2 and 22. The motors comply with device group II, category 3 according to European Directive ATEX 94/9/EC. The labeling of motors is made with an "S" on the 25th place of the type code.

Abbrev. Column	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7
Example:	M	S	K	0	3	0	B	-	0	9	0	0	-	N	N	-	S	1	-	U	G	0	-	N	S	N	N
Other Design																											

Fig. 4-1: Type codes for ATEX labeling

Category	Usable in zone	Also usable in zone	Basic requirements
1	0	1 2	Equipment designed to be operated in conformity with the operational parameters established by the manufacturer and ensuring a very high level of protection. Equipment of this category is intended for use in areas in which explosive atmospheres caused by mixtures of air and gases, vapors or mists or by air/dust mixtures are present continuously, for long periods or frequently . Equipment of this category must ensure the required level of protection, even if there are only rare incidents, and is characterized by means of protection, meaning that - in the event of failure of one means of protection, at least an independent second means of protection provides the required level of protection; or - in the event of two faults occurring independently of each other, the required protection is guaranteed.
	20	21 22	
2	1	2	Devices which are designed such that they can be operated in conformity with the parameters specified by the manufacturer while ensuring a high degree of safety. Devices of this category are intended for use in areas where it must be expected that an explosive atmosphere comprising dust-air mixtures occurs occasionally . The equipment-based explosion protection measures of this category ensure the required degree of safety, even in case of frequent device malfunctions or error conditions which must be usually expected.
	21	22	
3	2	-	Devices which are designed such that they can be operated in conformity with the parameters specified by the manufacturer while ensuring a normal degree of safety. Devices of this category are intended for use in areas where it is unlikely that dust whirling up generates an explosive atmosphere and, if such an atmosphere is indeed generated, that it occurs only rarely and for a short period . Devices of this category ensure the required degree of safety during normal operation.
	22	-	

Tab. 4-1: Explosion hazard category and zones according to ATEX (meaning)

The motors are prepared with an inlet and outlet for flushing. The flush does not influence the classification for Ex-protection valid for these motors and is not necessary for them. The motor can be flushed via the screwed connections. For the flushing, only a passive gas may be used (e.g. air or inert gas without any explosive particles). The flushing gas must be free of particles, such as water, oil, dust, chemicals or other conductive or aggressive substances in order to guarantee the type of protection. For motor purging, additional components are necessary. The qualification, examination and certification must be carried out by the system planner, the installation builder or the machine builder. The latter shall examine the suitability of components for

Explosion protection for MSK motors

their personal application and coordinate them with the safety instructions and standards applicable for their application and realize the required measures, modifications and amendments. A modification of the component and its use are the sole responsibility of the user and not of Bosch Rexroth.

Characteristic Features of ATEX Motors and Standard Motors

MSK-ATEX motors differ from standard MSK motors in the following ways:

- Flushing connection on the housing (with blind plug)
- Additional grounding connection
- Type plate with indication of the explosion protection classification according to ATEX

The differences between ATEX motors and standard MSK motors are described in the following chapters.

4.2 Conditions for Use of MSK Motors according to ATEX Classification, Equipment Group II, Category 3.

⚠ DANGER

Danger of explosion and life or high damage to property!

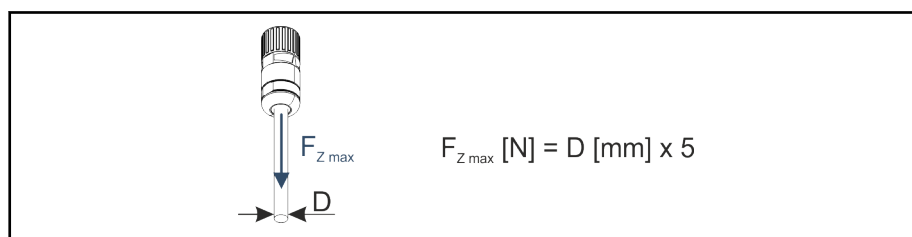
All used **components and accessory parts** must fulfill the requirements for explosion protection according to the 2014/34/EU directive.

The **conditions on use** given in this documentation must be taken into account for any project planning and be observed during operation.

Notes about test number

The Ex designation for MSK motors can be identified by the "X" at the end of the type plate or declaration of conformity. Please observe the following special conditions for a safe operation of the motors in your construction:

- The permissible ambient temperature range is 0 ... 40°C. Higher ambient temperatures up to max. 55 °C are allowed at corresponding derating [chapter 10.1.1 "Installation altitude and ambient temperature" on page 115](#).
- Servicing and repairs are only permitted by the certified Rexroth service.
- It is not allowed to exceed the specified values of the tensile loading via cables which are connected via connectors. The maximum allowed values are determined in the following context.



$F_{Z \max}$ Tensile load of connection cable (maximum value)

D Diameter cable outer jacket (maximum value)

Fig. 4-2: Determination of maximum tensile load of connection cables

⚠ 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 after approx. 30 cm, ...).

The following maximum tensile load must be kept when using ready-made cables.

Cable type ready-made RKL...	Raw cable INK...	$F_{Z \max} [N]$
0014, 0019, 0053, 4302, 4303, 4305	0653 (1.0 mm ²)	62.5
0015, 0016, 0017, 0045, 0050, 0054, 4300, 4301, 4304, 4306, 4307, 4320, 4325	0650 (1.5 mm ²)	63.5
0018, 0051, 0052, 4308, 4309, 4310, 4312, 4321, 4326, 4343	0602 (2.5 mm ²)	79
0056, 0058, 4313, 4314, 4315, 4316, 4322, 4327	0603 (4.0 mm ²)	87.5
0049, 0055, 4317, 4318, 4319, 4323, 4328	0604 (6.0 mm ²)	97.5

Explosion protection for MSK motors

Cable type ready-made RKL...	Raw cable INK...	F _{Z max} [N]
4324, 4329	0605 (10.0 mm ²)	116
4330, 4344, 4349	0606 (16.0 mm ²)	132.5

Tab. 4-2: Tensile load for ready-made Rexroth power cables

Ambient temperature The maximum operating temperature is 155 °C on the motor housing at an ambient temperature of 0 ... 40 °C. The ignition temperatures of materials that come into contact with the motors must be much higher than T=155 °C.

Connecting conditions The motors must only be operated with Rexroth IndraDrive drive control devices. Drive control devices of other manufacturers are not allowed.

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

⚠ WARNING

Damage to persons or property by disconnecting or connecting energized connectors!

- Connect and disconnect connectors only when they are dry and de-energized.
- During operation of the system, all connectors must be securely tightened or locked.

Grounding 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.

If the grounding connector in the motor cable and the second separate grounding conductor on the motor housing are not connected or are interrupted due to corrosion or other defects during their lifetime, the discharge current flows (as leakage current) over conducting housing parts. This has to be prevented with the above-mentioned measures. (ATEX directive 94/9/EC, appendix II, chapters 1.2.3 and 1.3.3, 1.4)

Corrosion Corrosion of the motor housing by aggressive materials (such as certain coolants, lubricants, cutting oils or salt mists) must be prevented.

Emergency stop 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 94/9/EC, appendix II, chapter 1.6.2)

The following options exist for the activation of the emergency stop device:

- Reduce the energy via an intermediate short circuit.
- 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.

Fan Operation of MSK motors according to the ATEX Directive 94/9/EG is only allowed **without** a fan.

Other environmental factors Heed the application notes [chapter 10 "Operating conditions and application notes" on page 115](#) regarding risks due to outer influences, like:

- Operation only within the specified ambient conditions
- Maximum vibration and impact loads
- Protection of protective conductor connections against dirt, corrosion, moisture and/or aggressive materials, etc.
- ...

4.3 Holding brake

In **normal operation**, use the optional holding brake only when at a standstill and when performing the drive-internal brake check. In these cases, only low temperatures ($T < 100\text{ °C}$) exist and no sparks are generated because critical sliding of the brake linings does not occur.

Control holding brake

The voltage supply of the holding brake is to be designed such that the voltage available at the motor for bleeding the holding brake is sufficient even in the most unfavorable case during installation and operation (see also Rexroth IndraDrive Drive Systems DOK-INDRV*-SYSTEM*****-PRxx-EN-P, Chapter "Specification of control voltage")

The voltage supply of the holding brake has to be designed so as to guarantee that a voltage of $24\text{ V} \pm 10\%$ is available at the motor in order to safely operate (release and apply) the holding brake.



The voltage arriving at the motor is influenced by cable length and the properties, e.g. conductor resistance.

If a fault occurs during operation, causing a voltage deviation, this fault must be detected and eliminated immediately. The failure can be identified, for example, using a monitoring device for undervoltage.

Event of fault

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.

Explosion protection for MSK motors

4.4 Acceptance test

Before initial start-up of the system or after changing a motor, do an acceptance test. The acceptance report must confirm compliance with the instructions and conditions of use given here. After repair and if safety-relevant components have been serviced, the unit test of the motor must be carried out again in accordance with EN 60079-15 if the explosion protection properties have been changed.

4.5 Residual risks

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

WARNING

Explosion hazard!

Due to the risks mentioned herein, the motors are not approved for use in areas, in which an explosive atmosphere or explosive materials

- permanently occur or occur over a longer period or
- may occur in case of frequent device malfunctions or typical error states

Overloading	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. 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 (see chapter 10.12 "Motor cooling" on page 137).
Grounding and discharge currents	Variable-speed drive systems cause unavoidable discharge currents. If the grounding connector in the motor cable and the second separate grounding connector on the motor housing are not connected as specified or are interrupted due to corrosion or other defects during their lifetime, the discharge current flows as leakage current over conducting housing parts, resulting in the risks of sparking at transfer points and, if explosive materials are present, explosions.
Material aging	The time of action and penetration of explosive materials depend on the application. It depends on the ageing degree of the seals, on the mechanical attachment of the motor, the properties of the explosive materials and the average temperature occurring during the operating time as a result of the load cycles.
Impermeability	Due to unavoidable temperature fluctuations as well as due to the deterioration of gaskets, the housing is not leak proof. Hence, explosive gases that occur within the equipment during a fault can penetrate into the motor. The design and checking of the impermeability are carried out according to the degree of protection IP 65 (EN 60034-5:2001). The maximum temperature of parts within the motor can reach 155 °C during normal operation at maximum ambient temperature.
Temperature monitoring	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.

Explosion protection for MSK motors

4.6 Labeling

4.6.1 Designation acc. to ATEX

The type plate contains details about the classification of the motors according to the ATEX directive 94/9/EC. The marking is differentiated for atmospheres with combustible gas and combustible dust:

 **II 3G Ex nA T155°C Gc X** (gas).

 **II 3D Ex tc IIIC T155°C Dc IP6X X** (dust).



Before installing the motor, make sure that it is marked accordingly and has a sufficiently high protection class for your application.

Explosion protection labeling and meaning

Code	Meaning
	Ex symbol
II	Equipment group II which is suitable for all potentially explosive areas other than firedamp-endangered excavations
3	Equipment category 3, i.e. equipment in this category is intended for use in areas in which an explosive atmosphere is unlikely to occur due to gases, vapors, mists or dust/air mixtures, but if it does occur, it is likely to occur only rarely and for a short period of time.
G	G = gas
D	D = dust
Ex	The European standard for explosion protection has been applied.
nA	Ignition protection type nA for EPL Gc
tc	Protection by housing for EPL Dc
T 155 °C	Maximum surface temperature inside and outside the housing, where explosive gas or dust can occur.
IIIC	Electric devices of group IIIC are intended for use in areas where an explosive dust atmosphere ("C": conductive dust) must be expected, excerpt areas susceptible to fire damp.
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.
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.
IP6X	Protection class acc. to EN 60034-5
X	For designation "Special Conditions" see notes about test number

4.6.2 UL marking for USA and Canada

UL marking according to UL1004 and CSA 22.2, No. 100.

5 Technical data

5.1 Description of the specified parameters

General information The torque-speed characteristics and technical data are given for

- 60K temperature increase on the housing

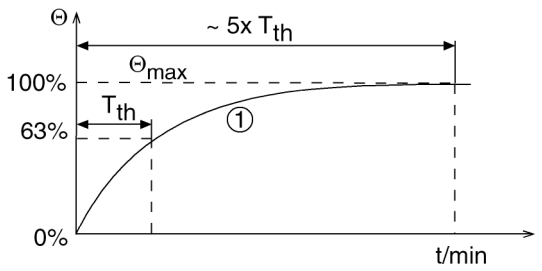
60K data The 60K data are given for MSK motors under the following conditions:

- Ambient temperature 40 °C
- Insulated construction
- Maximum temperature increase on housing $\Delta T = 60K$
- For motors with optional holding brake, data are always given for motors **with** holding brake.
- Motors with radial shaft sealing ring

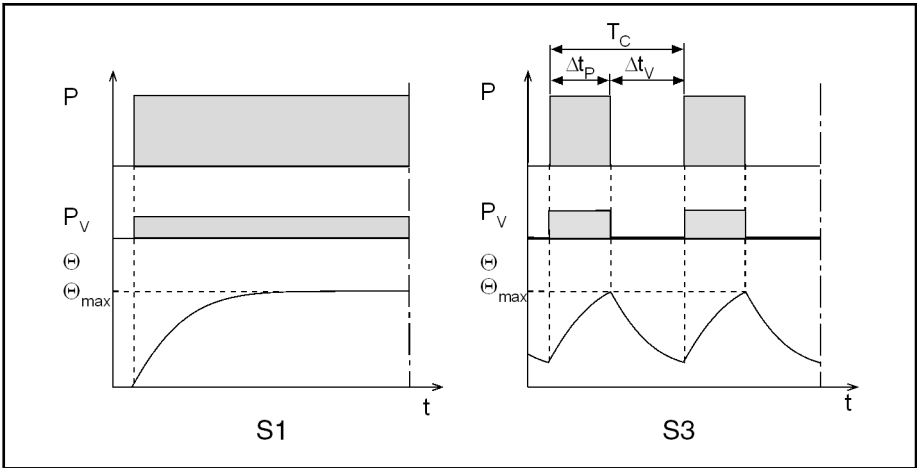
Parameters in the data sheet

Designation	Symbol	Unit	Description
Continuous torque at standstill 60K	M_{0_60}	Nm	Continuous torque that can be applied to the motor output shaft at a speed of ($f_{el} \geq 0.4$ Hz). At $n = 0$: $M_0 = 0.95 \cdot M_{0_60}$
Continuous current at standstill 60K	I_{0_60}	A	Phase current (crest value) of the motor M_{0_60} required for the continuous torque at standstill.
Maximum torque	M_{max}	M_{max}	For maximum current I_{max} , for approx. 400 ms exchangeable maximum torque. The maximum torque depends on the drive control unit. The only binding maximum torque is that specified in the selection lists.
Maximum current	$I_{max(eff)}$	A	Maximum, temporarily permissible phase current of the motor winding without adverse effect on the permanent magnet circuit of the motor.
Torque constant at 20 °C	K_{M_N}	Nm/A	Ratio of generated torque to motor phase current at motor temperature 20 °C. Valid up to approx. $i = 2 \times I_{0_60}$.
Voltage constant at 20 °C	K_{EMK_1000}	V/min ⁻¹	Root-mean-square value of the induced motor voltage at a motor temperature of 20 °C and 1,000 revolutions per minute.
Winding resistance at 20 °C	R_{12}	Ohm	Measured winding resistance among two strands.
Winding inductivity	L_{12}	mH	Measured inductivity between two strands.
Leakage capacitance	C_{dis}	nF	Capacity of short-circuited power connections U, V, W against the motor housing.
Number of pole pairs	p	-	Quantity of pole pairs of the motor.
Moment of inertia of the rotor	J_{red}	kgm ²	Moment of inertia of the rotor without optional holding brake. Moment of inertia of the holding brake must be added as well.

Technical data

Designation	Symbol	Unit	Description
Thermal time constant	T_{th}	min	Duration of the temperature rise to 63% of the final temperature of the motor housing at motor load with permissible S1 continuous torque. The thermal time constant is determined by the cooling type used.  ①: time course of the temperature on the motor housing Θ_{max}: Highest temperature (motor housing) T_{th}: Thermal time constant Duration of the temperature rise to 63% of the final temperature of the motor housing at motor load with permissible S1 continuous torque. The thermal time constant is determined by the cooling type used.
Maximum speed	n_{max}	min^{-1}	Maximum permissible speed of the motor.
Sound pressure level	L_P	dB(A)	Determined values for 1 m distance from motor to measuring point.
Mass	m	kg	Mass of the motor.
Ambient temperature during operation	T_{amb}	°C	0 ... 40 °C
Protection class	-	-	IP protection class acc. to EN 60034
Insulation class	-	-	Insulation class according to DIN EN 60034-1
Holding torque	M_4	Nm	Transmittable holding torque of the holding brake.
Rated voltage	U_N	V	Input voltage of the holding brake.
Rated current	I_N	A	Current consumption of the holding brake.
Connection time	t_1	ms	Time until the holding brake is closed.
Disconnection time	t_2	ms	Time until the holding brake is released.
Moment of inertia of the brake	J_{Br}	kgm^2	Moment of inertia of the holding brake, must be added to the moment of inertia of the motors to determine the total moment of inertia.

Operation mode MSK motors are documented according to test criteria and measuring methods in compliance with EN 60034-1. The specified characteristic curves correspond to operation modes S1 or S3.



P	Load
PV	electrical losses
Θ	Temperature
Θmax	maximum temperature (motor housing)
t	Time
TC	Cycle duration
ΔtP	Operating time under constant load
ΔtV	Idle time

Fig. 5-1: Operation modes according to EN 60034-1 :1998

Duty cycle Operation mode S3 is specified along with the duty cycle (DC) %. The duty cycle is calculated:

$$ED = \frac{\Delta t_P}{T_C} \cdot 100\%$$

ED	relative duty cycle in %
ΔtP	Operating time under constant load

Fig. 5-2: Relative duty cycle

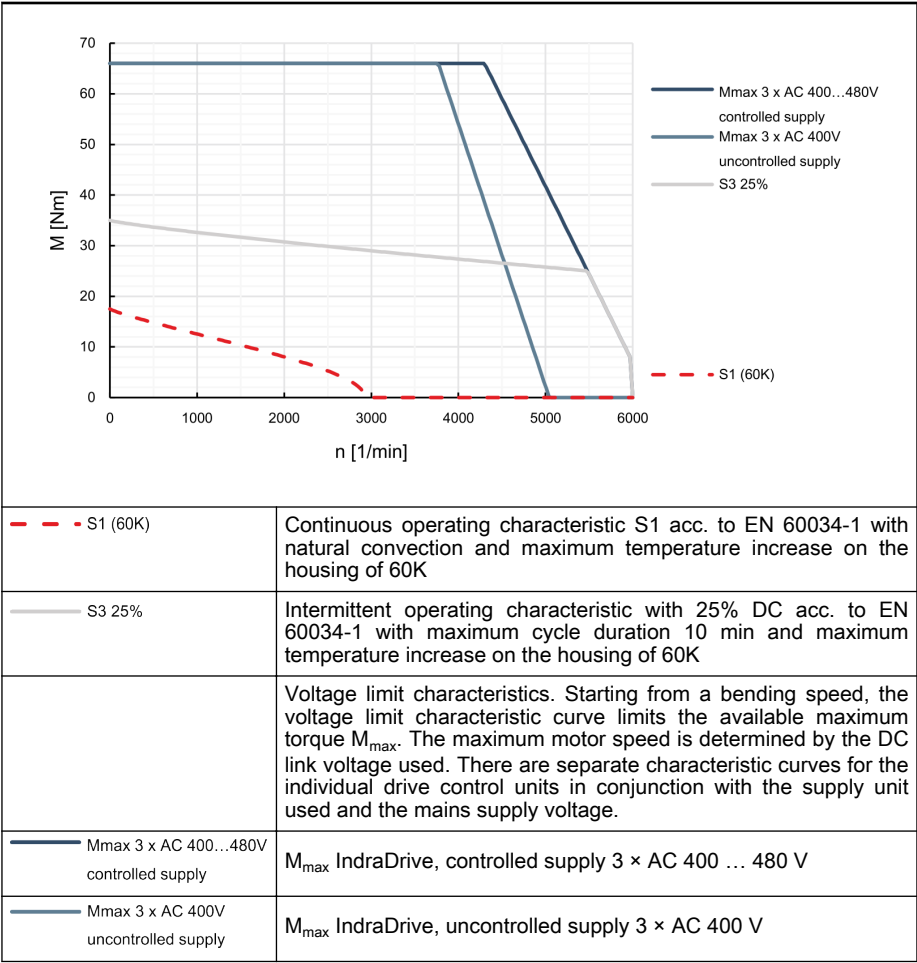
The values specified in the documentation are determined on the basis of the following values:

Cycle duration: 10 min

Duty cycle DC: 25%

Technical data

Speed-torque characteristic curve



Tab. 5-1: Characteristic curves of motor (example)

5.2 IndraSize

The IndraSize software makes it easy to dimension drive controllers, motors and mechanical gears. The engineering tool covers the entire range of Rexroth drives and motors. Calculate the characteristic curves for your application with IndraSize: www.boschrexroth.com/indraSize

5.3 Technical data encoder for MSK motors

Designation	Symbol	Unit	S1	M1	S2	M2
Interface			Hiperface		EnDat 2.1	
Encoder design			Singleturn absolute	Multiturn absolute	Singleturn absolute	Multiturn absolute
Distinguishable revolutions			1	4,096	1	4,096
Signal periods			128		2,048	
System accuracy		angular seconds	±120		±20	
Output signal			1Vss			
Maximum encoder speed		min ⁻¹	12,000	9,000	15,000	12,000
Current consumption max.	I _{Encoder}	mA	60		150	250
Power supply voltage	VCC _{Encoder}	V	7...12		3.6...14	

Tab. 5-2: MSK - technical data encoder

Calculate position resolution

The actual **position resolution** can be done for every encoder type according to the following calculation.

Calculation example: "Position resolution for M1 encoder"

from table:

Distinguishable revolutions: **4,096**

Number of lines: **128**

from documentation about the drive controller:

Encoder resolution ¹⁾: **13 bit**

Position resolution = Number of lines × encoder resolution × distinguishable revolutions

Position resolution = $128 \times 2^{13} \times 4,096 = 4.294.967.296$ information

¹⁾ Encoder resolution depends from the connected controller.

Encoder Singleturn S1, S2

These encoders permit absolute, indirect position recording within **one** mechanical rotation. The encoders replace separate incremental encoders on the motor.



After a power failure or after the first POWER ON, the axis must always at first be moved to its home position.

Exception: Applications in which the maximum working path is within one mechanical rotation of the motor.

Encoder Multiturn absolute M1, M2

These encoders permit absolute, indirect position recording within **4,096** mechanical rotations. The encoders replace a separate absolute value encoder on the motor. With this encoder version, the absolute position of the axis is preserved even after a switch-off.

Technical data

5.4 Technical data encoder MSK motors

Designation	Symbol	Unit	S1	M1	S2	M2	S3	M3
Interface			Hiperface		EnDat 2.1		Hiperface	
Encoder design			Singleturn absolute	Multiturn absolute	Singleturn absolute	Multiturn absolute	Singleturn absolute	Multiturn absolute
Distinguishable revolutions			1	4,096	1	4,096	1	4,096
Signal periods			128		2,048		16	
System accuracy		Angular seconds	±120		±20		±520	
Output signal			1Vss					
Maximum encoder speed		min ⁻¹	12,000	9,000	15,000	12,000		
Max. current consumption	I _{Encoder}	mA	60		150	250	50	
Supply voltage	VCC _{En-coder}	V	7...12		3.6...14		7...12	

Tab. 5-3: Technical data MSK encoder

Calculate position resolution

The actual **position resolution** can be done for every encoder type according to the following calculation.

Calculation example: "Position resolution for M1 encoder"

from table:

Distinguishable revolutions: **4,096**

Number of lines **128**

out of documentation about the controllers:

Encoder resolution ¹⁾: **13 bit**

Position resolution = number of lines x resolution of encoder x distinguishable revolutions

Position resolution = $128 \times 2^{13} \times 4,096 = \mathbf{4,294,967,296}$ Information

¹⁾ Encoder resolution depends from the connected controller.

Encoder Singleturn S1, S2, S3

These encoders permit absolute, indirect position recording within **one** mechanical rotation. The encoders replace separate incremental encoders on the motor.



After a power failure or after the first POWER ON, the axis must always at first be moved to its home position.

Exception: Applications in which the maximum working path is within one mechanical rotation of the motor.

Encoder Multiturn absolute M1, M2, M3

These encoders permit absolute, indirect position recording within **4,096** mechanical rotations. The encoders replace a separate absolute value encoder on the motor. With this encoder version, the absolute position of the axis is preserved even after a switch-off.

5.5 Technical data holding brakes

Type	Holding torque	Rated voltage ¹⁾	Rated current	Maximum connection time	Maximum disconnection time	Moment of inertia of the holding brake
	M ₄ Nm	U _N V	I _N A	t ₁ ms	t ₂ ms	J _{br} kg*m ²
MSK030B-____-____-____1-____	1.00	24	0.40	14	28	0.0000100
MSK030C-____-____-____1-____	1.00	24	0.40	14	28	0.0000100
MSK040B-____-____-____1-____	4.00	24	0.50	25	35	0.0000230
MSK040C-____-____-____1-____	4.00	24	0.50	25	35	0.0000230
MSK050B-____-____-____1-____	6.00	24	0.65	20	60	0.0001070
MSK050C-____-____-____1-____	6.00	24	0.65	20	60	0.0001070
MSK060B-____-____-____1-____	10.00	24	0.96	20	40	0.0000600
MSK060C-____-____-____1-____	10.00	24	0.96	20	40	0.0000600
MSK061B-____-____-____1-____	10.00	24	0.96	25	40	0.0000600
MSK061C-____-____-____1-____	10.00	24	0.96	25	40	0.0000600
MSK070C-____-____-____1-____	23.00	24	0.79	35	180	0.0003000
MSK070D-____-____-____1-____	23.00	24	0.79	35	180	0.0003000
MSK070E-____-____-____1-____	23.00	24	0.79	35	180	0.0003000
MSK071C-____-____-____1-____	23.00	24	0.79	35	180	0.0003000
MSK071C-____-____-____2-____	30.00	24	0.94	40	270	0.0010600
MSK071D-____-____-____1-____	23.00	24	0.79	35	180	0.0003000
MSK071D-____-____-____2-____	30.00	24	0.94	40	270	0.0010600
MSK071E-____-____-____1-____	23.00	24	0.79	35	180	0.0003000
MSK071E-____-____-____2-____	30.00	24	0.94	40	270	0.0010600
MSK076C-____-____-____1-____	11.00	24	0.71	10	50	0.0001660
MSK100A-____-____-____1-____	32.00	24	0.93	15	115	0.0012420
MSK100B-____-____-____1-____	32.00	24	0.93	15	115	0.0012420
MSK100B-____-____-____2-____	70.00	24	1.29	53	97	0.0030000
MSK100C-____-____-____1-____	32.00	24	0.93	15	115	0.0012420
MSK100C-____-____-____2-____	70.00	24	1.29	53	97	0.0030000
MSK100D-____-____-____1-____	32.00	24	0.93	15	115	0.0012420
MSK100D-____-____-____2-____	70.00	24	1.29	53	97	0.0030000
MSK101C-____-____-____2-____	70.00	24	1.29	53	97	0.0030000
MSK101D-____-____-____2-____	70.00	24	1.29	53	97	0.0030000
MSK101D-____-____-____3-____	120.00	24	1.46	80	150	0.0057500
MSK101E-____-____-____2-____	70.00	24	1.29	53	97	0.0030000
MSK101E-____-____-____3-____	120.00	24	1.46	80	150	0.0057500

1) Tolerance ± 10%

Tab. 5-4: Holding brakes - Technical data (optional)

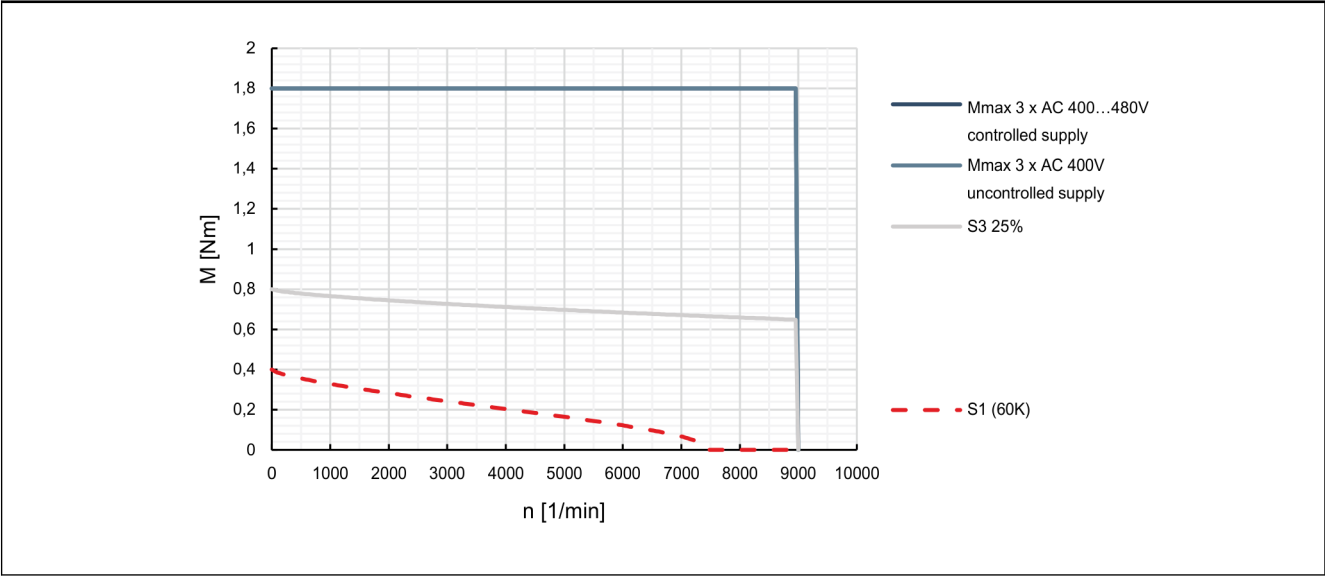
Technical data

5.6 MSK030B-...-NSNN Technical data

Designation	Symbol	Unit	MSK030B-0900-NN
Continuous torque at standstill 60 K	M _{0_60}	Nm	0.4
Continuous current at standstill 60 K	I _{0_60(eff)}	A	1.5
Maximum torque	M _{max}	Nm	1.8
Maximum current	I _{max(eff)}	A	6.8
Torque constant at 20 °C	K _{M_N}	Nm/A	0.29
Voltage constant at 20 °C ¹⁾	K _{EMK_1000}	V/1000 min-1	17.9
Winding resistance at 20 °C	R ₁₂	Ohm	7.2
Winding inductance	L ₁₂	mH	8.1
Leakage capacitance of the component	C _{dis}	nF	0.7
Number of pole pairs	p	-	3
Moment of inertia of rotor	J _{red}	kg*m²	0.00001
Thermal time constant	T _{th}	min	19.0
Maximum speed (electric)	n _{max el}	min ⁻¹	9000
Sound pressure level	L _p	dB[A]	< 75
Mass ²⁾	m	kg	1.3 (1.6)
Ambient temperature during operation	T _{amb}	°C	0 ... 40
Protection class (EN 60034-5)	-	-	IP65
Thermal class (EN 60034-1)	T.CL.	-	155

Last amended: 2014-01-21

1) Manufacturing tolerance ±5%
2) (...) Motors with holding brake 1, 2, ...
Tab. 5-5: Technical data MSK



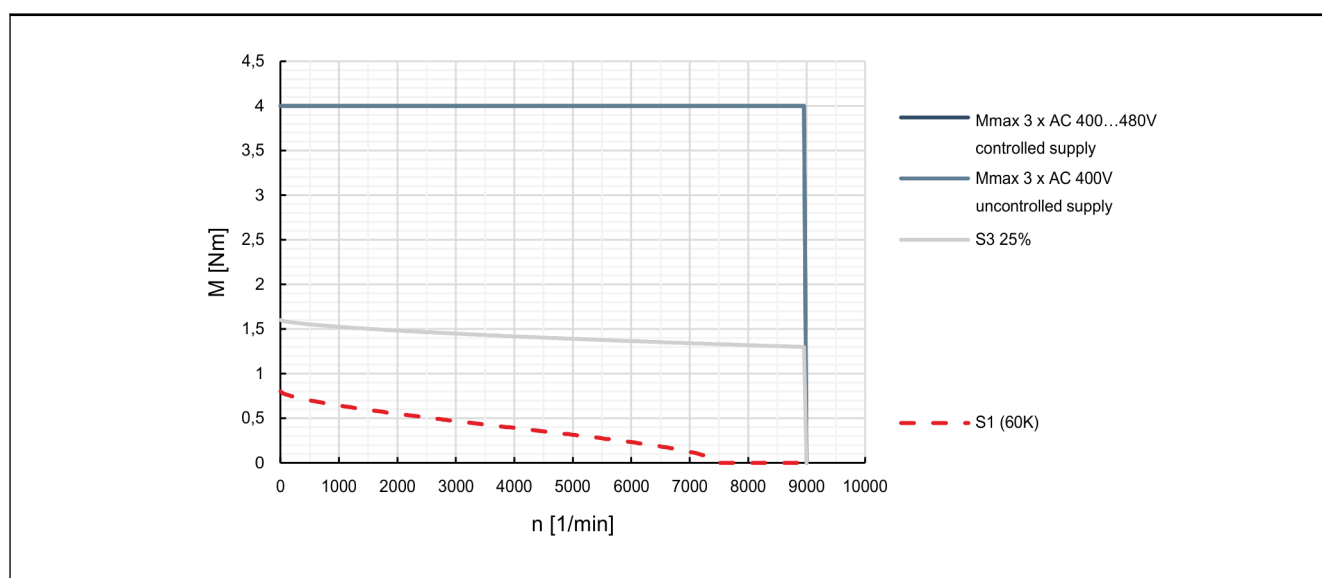
Tab. 5-6: Technical data MSK030B-0900-...-...-S

5.7 MSK030C-...-NSNN Technical data

Designation	Symbol	Unit	MSK030C-0900-NN
Continuous torque at standstill 60 K	M_{0_60}	Nm	0.8
Continuous current at standstill 60 K	$I_{0_60(eff)}$	A	1.5
Maximum torque	M_{max}	Nm	4.0
Maximum current	$I_{max(eff)}$	A	6.8
Torque constant at 20 °C	K_{M_N}	Nm/A	0.58
Voltage constant at 20 °C ¹⁾	K_{EMK_1000}	V/1000 min ⁻¹	35.6
Winding resistance at 20 °C	R_{12}	Ohm	9.8
Winding inductance	L_{12}	mH	14.1
Leakage capacitance of the component	C_{dis}	nF	1.3
Number of pole pairs	p	-	3
Moment of inertia of rotor	J_{red}	kg*m ²	0.00003
Thermal time constant	T_{th}	min	12.0
Maximum speed (electric)	$n_{max\ el}$	min ⁻¹	9000
Sound pressure level	L_P	dB[A]	Less than 75
Mass ²⁾	m	kg	1.9 (2.1)
Ambient temperature during operation	T_{amb}	°C	0 ... 40
Protection class (EN 60034-5)	-	-	IP65
Thermal class (EN 60034-1)	T.CL.	-	155

Last amended: 2014-01-21

1) Manufacturing tolerance ±5%
2) (...) Motors with holding brake 1, 2, ...
Tab. 5-7: Technical data MSK030C-...-NSNN



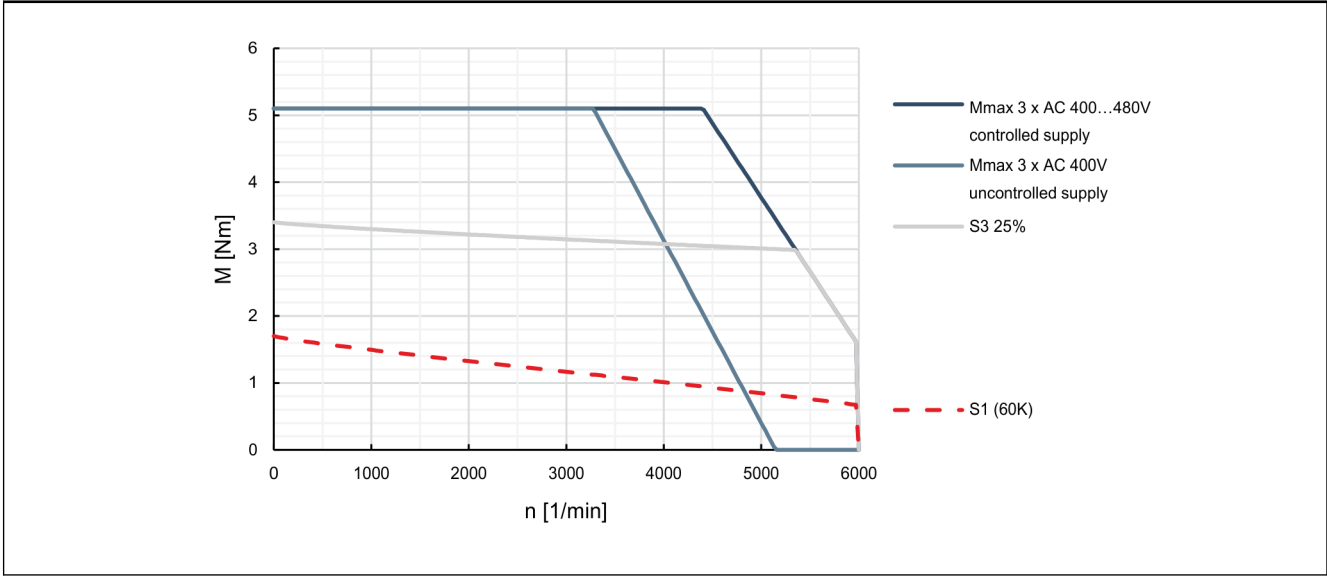
Tab. 5-8: Technical data MSK030C-0900-...-S

Technical data

5.8 MSK040B-...-NSNN Technical data

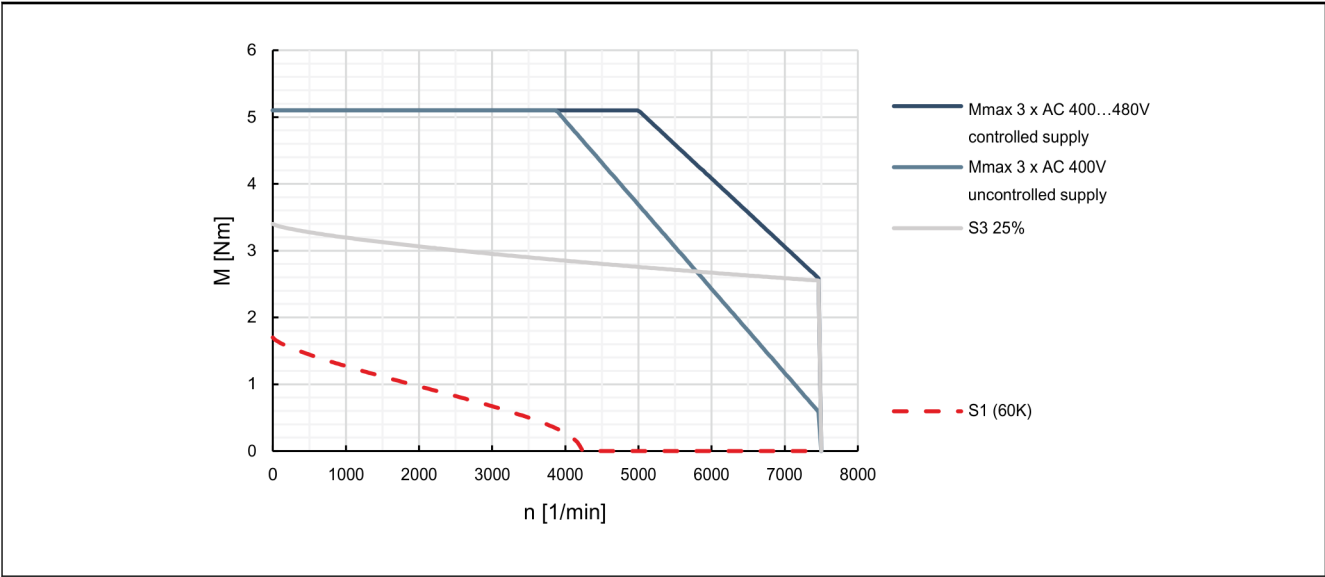
Designation	Symbol	Unit	MSK040B-0450-NN	MSK040B-0600-NN
Continuous torque at standstill 60 K	M _{0_60}	Nm	1.7	
Continuous current at standstill 60 K	I _{0_60(eff)}	A	1.5	2.0
Maximum torque	M _{max}	Nm	5.1	
Maximum current	I _{max(eff)}	A	6.0	8.0
Torque constant at 20 °C	K _{M_N}	Nm/A	1.26	0.92
Voltage constant at 20 °C ¹⁾	K _{EMK_1000}	V/1000 min-1	77.8	58.5
Winding resistance at 20 °C	R ₁₂	Ohm	14.7	8.4
Winding inductance	L ₁₂	mH	64.7	35.4
Leakage capacitance of the component	C _{dis}	nF	1.3	1.5
Number of pole pairs	p	-	4	
Moment of inertia of rotor	J _{red}	kg*m ²	0.00010	
Thermal time constant	T _{th}	min	13.0	
Maximum speed (electric)	n _{max el}	min ⁻¹	6000	7500
Sound pressure level	L _p	dB[A]	< 75	
Mass ²⁾	m	kg	2.8 (3.1)	
Ambient temperature during operation	T _{amb}	°C	0 ... 40	
Protection class (EN 60034-5)	-	-	IP65	
Thermal class (EN 60034-1)	T.CL.	-	155	
Last amended: 2014-04-29				

1) Manufacturing tolerance ±5%
2) (...) Motors with holding brake 1, 2, ...
Tab. 5-9: Technical data MSK040B-...-NSNN



Tab. 5-10: Technical data MSK040B-0450-...-S

Technical data



Tab. 5-11: Technical data MSK040B-0600- - - - S

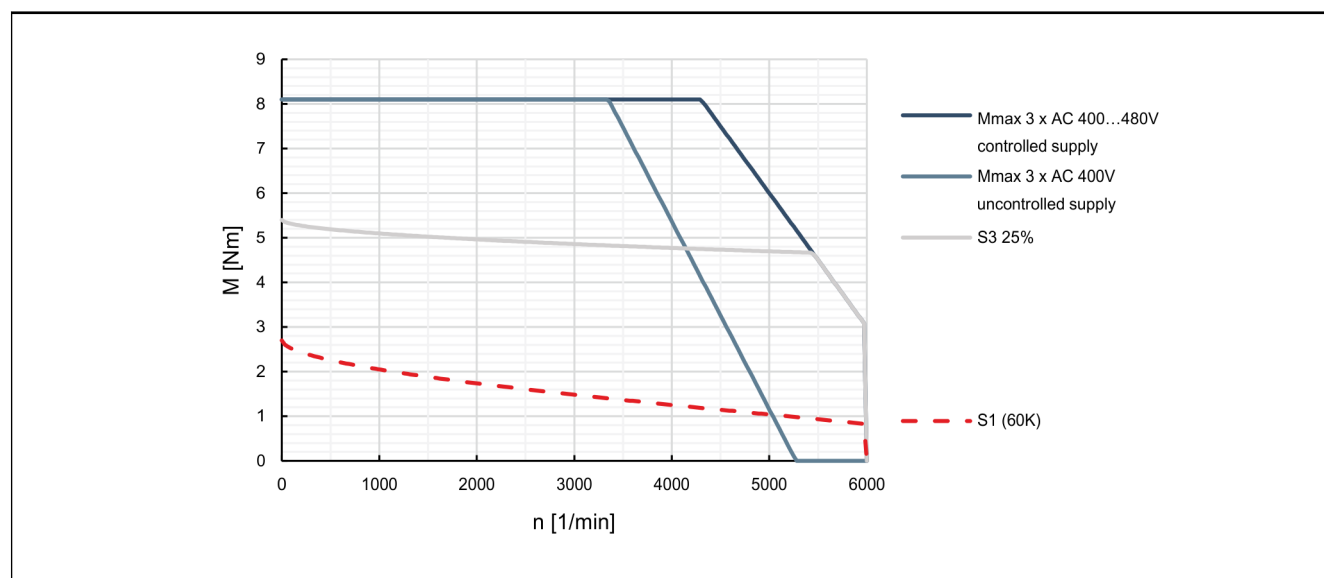
Technical data

5.9 MSK040C-...-NSNN Technical data

Designation	Symbol	Unit	MSK040C-0450-NN	MSK040C-0600-NN
Continuous torque at standstill 60 K	$M_{0,60}$	Nm	2.7	
Continuous current at standstill 60 K	$I_{0,60(\text{eff})}$	A	2.4	3.1
Maximum torque	M_{max}	Nm	8.1	
Maximum current	$I_{\text{max}(\text{eff})}$	A	9.6	12.4
Torque constant at 20 °C	$K_{M,N}$	Nm/A	1.25	0.95
Voltage constant at 20 °C ¹⁾	$K_{EMK,1000}$	V/1000 min ⁻¹	76.7	58.2
Winding resistance at 20 °C	R_{12}	Ohm	7.4	3.9
Winding inductance	L_{12}	mH	37.9	21.3
Leakage capacitance of the component	C_{dis}	nF	2.0	
Number of pole pairs	p	-	4	
Moment of inertia of rotor	J_{red}	kg*m ²	0.00014	
Thermal time constant	T_{th}	min	16.0	
Maximum speed (electric)	$n_{\text{max el}}$	min ⁻¹	6000	7500
Sound pressure level	L_P	dB[A]	< 75	
Mass ²⁾	m	kg	3.6 (3.9)	
Ambient temperature during operation	T_{amb}	°C	0 ... 40	
Protection class (EN 60034-5)	-	-	IP65	
Thermal class (EN 60034-1)	T.CL.	-	155	

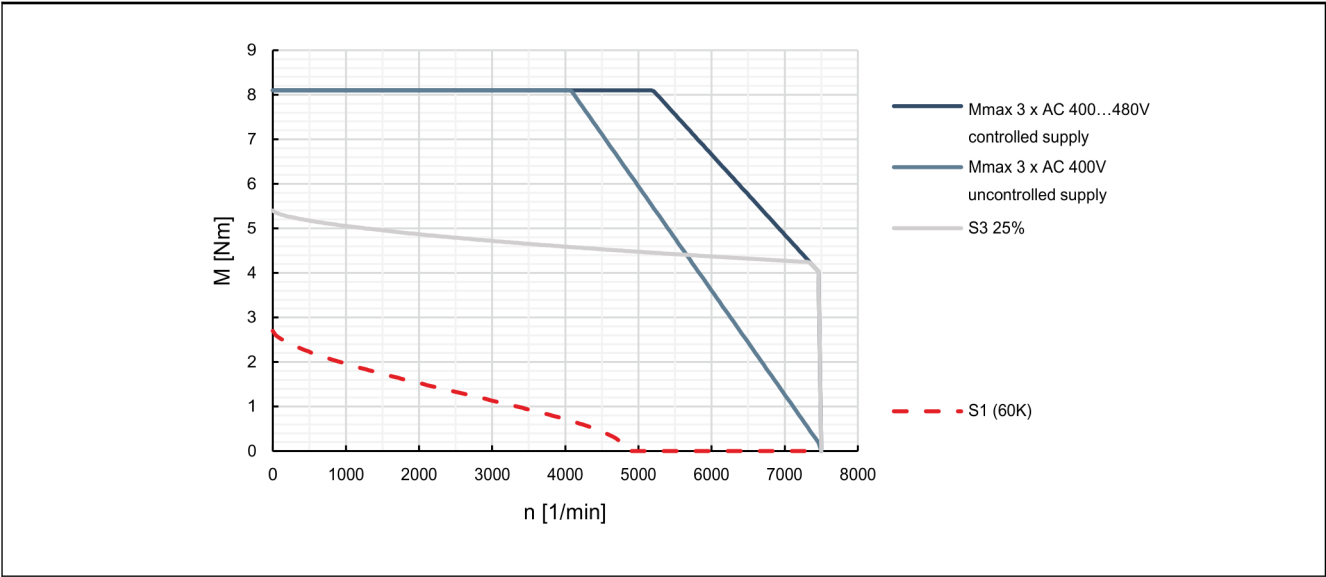
Last amended: 2014-01-21

- 1) Manufacturing tolerance $\pm 5\%$
 2) (...) Motors with holding brake 1, 2, ...
 Tab. 5-12: Technical data MSK040C-...-NSNN



Tab. 5-13: Technical data MSK040C-0450-...-S

Technical data



Tab. 5-14: Technical data MSK040C-0600-...-S

Technical data

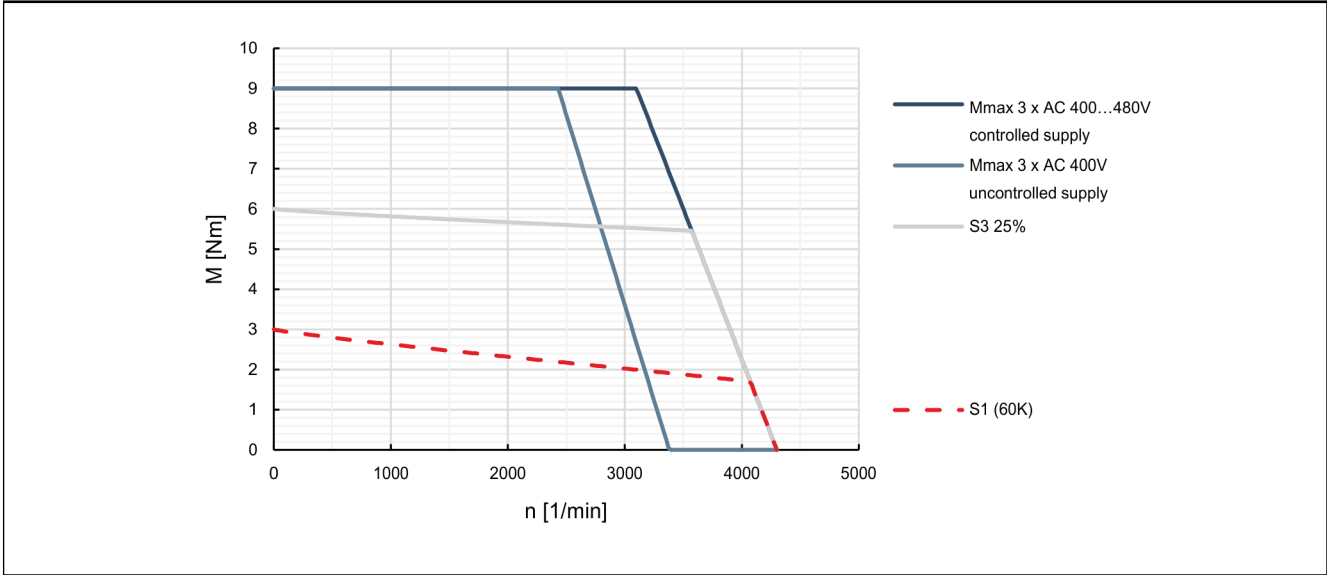
5.10 MSK050B-...-NSNN Technical data

Designation	Symbol	Unit	MSK050B-0300-NN	MSK050B-0450-NN	MSK050B-0600-NN
Continuous torque at standstill 60 K	M _{0_60}	Nm	3.0		
Continuous current at standstill 60 K	I _{0_60(eff)}	A	1.8	2.8	3.7
Maximum torque	M _{max}	Nm	9.0		
Maximum current	I _{max(eff)}	A	7.2	11.2	14.8
Torque constant at 20 °C	K _{M_N}	Nm/A	1.80	1.20	0.90
Voltage constant at 20 °C ¹⁾	K _{EMK_1000}	V/1000 min-1	111.0	73.5	55.0
Winding resistance at 20 °C	R ₁₂	Ohm	13	5.7	3.3
Winding inductance	L ₁₂	mH	76.4	33.6	19.9
Leakage capacitance of the compo- nent	C _{dis}	nF	2.1	1.4	2.1
Number of pole pairs	p	-	4		
Moment of inertia of rotor	J _{red}	kg*m²	0.00028		
Thermal time constant	T _{th}	min	8.0		
Maximum speed (electric)	n _{max el}	min ⁻¹	4300	6000	
Sound pressure level	L _p	dB[A]	< 75		
Mass ²⁾	m	kg	4.0 (4.9)		
Ambient temperature during operation	T _{amb}	°C	0 ... 40		
Protection class (EN 60034-5)	-	-	IP65		
Thermal class (EN 60034-1)	T.CL.	-	155		
Last amended: 2014-01-21					

1) Manufacturing tolerance ±5%

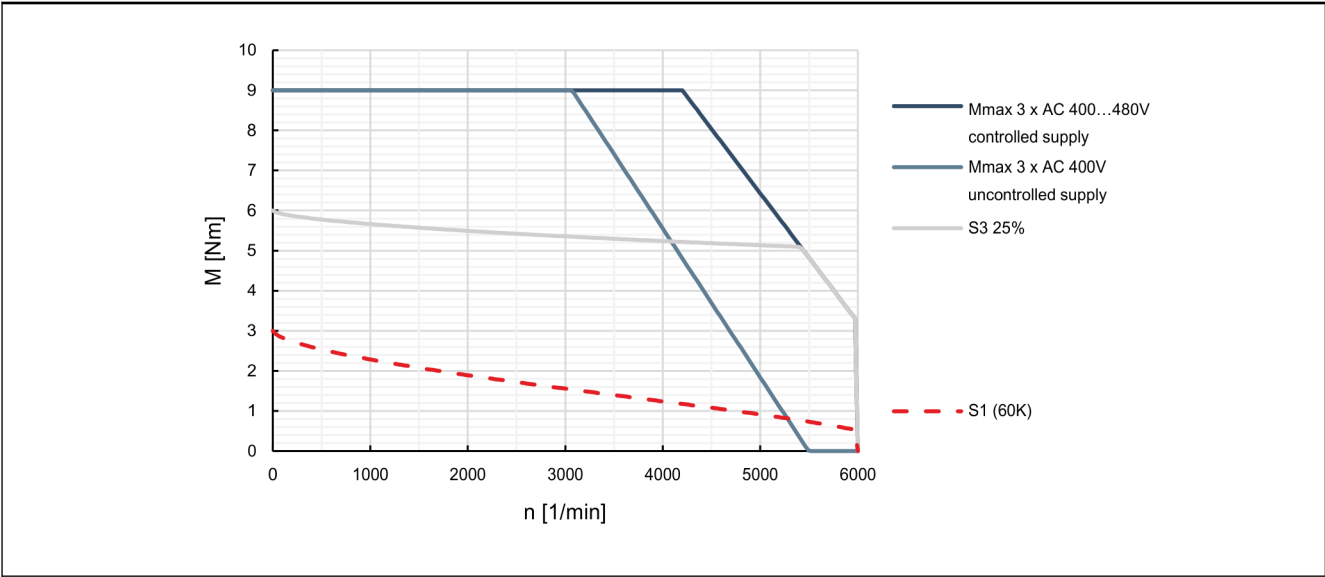
2) (...) Motors with holding brake 1, 2, ...

Tab. 5-15: Technical data MSK050B-...-NSNN

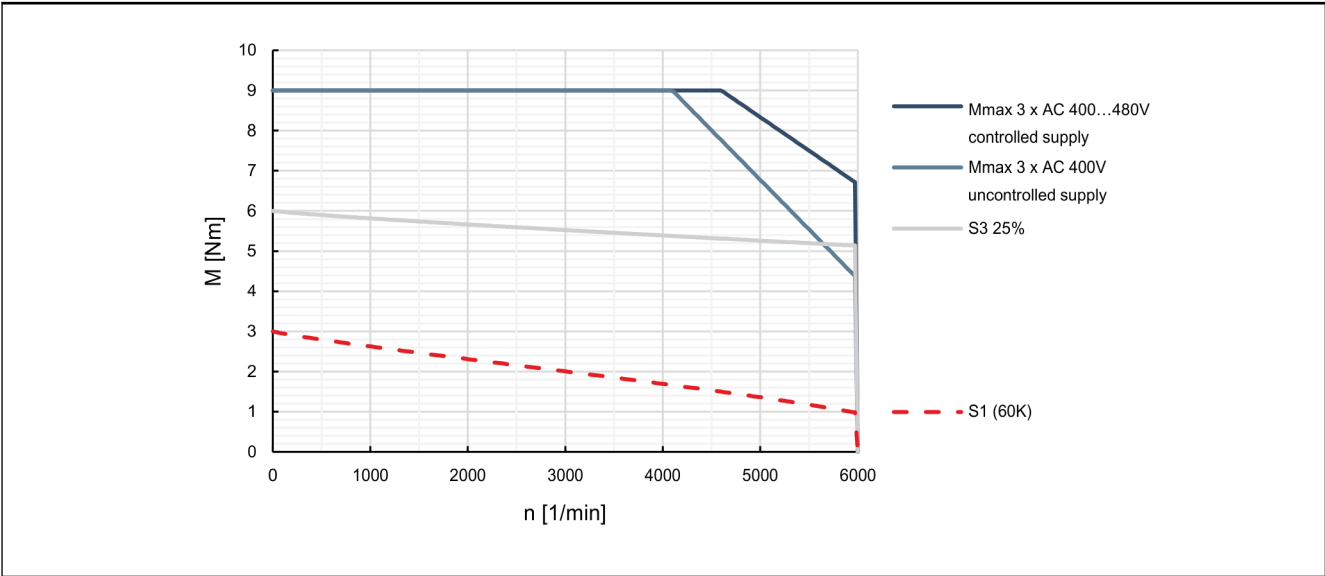


Tab. 5-16: Technical data MSK050B-0300-...-S

Technical data



Tab. 5-17: Technical data MSK050B-0450- - - - S



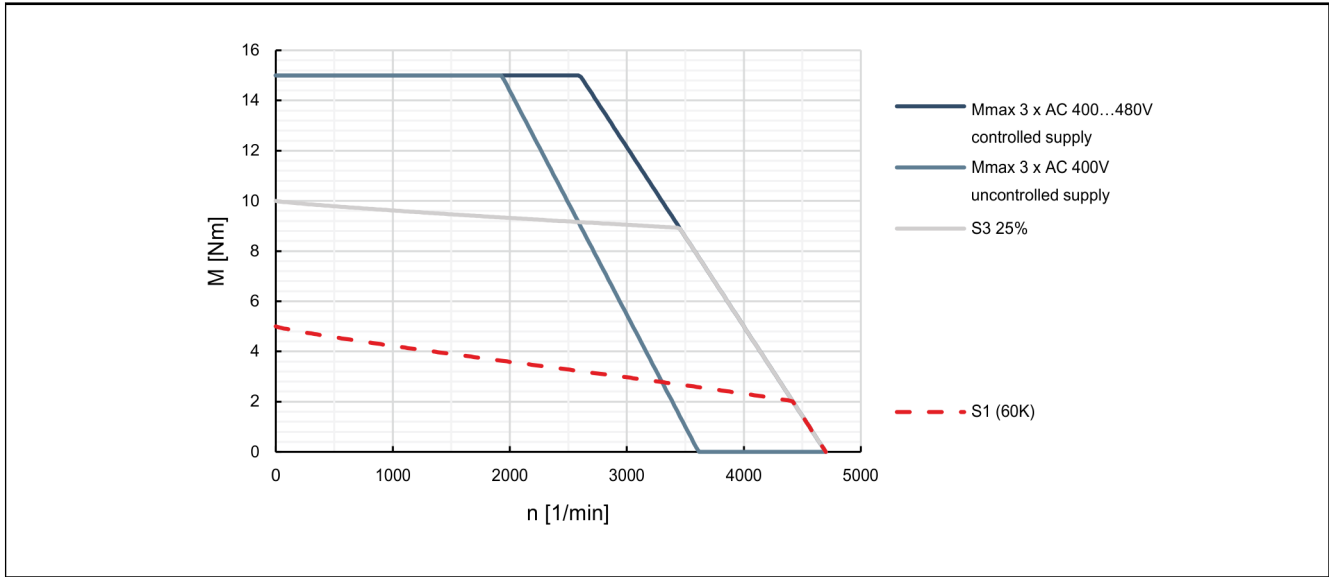
Tab. 5-18: Technical data MSK050B-0600- - - - S

Technical data

5.11 MSK050C-...-NSNN Technical data

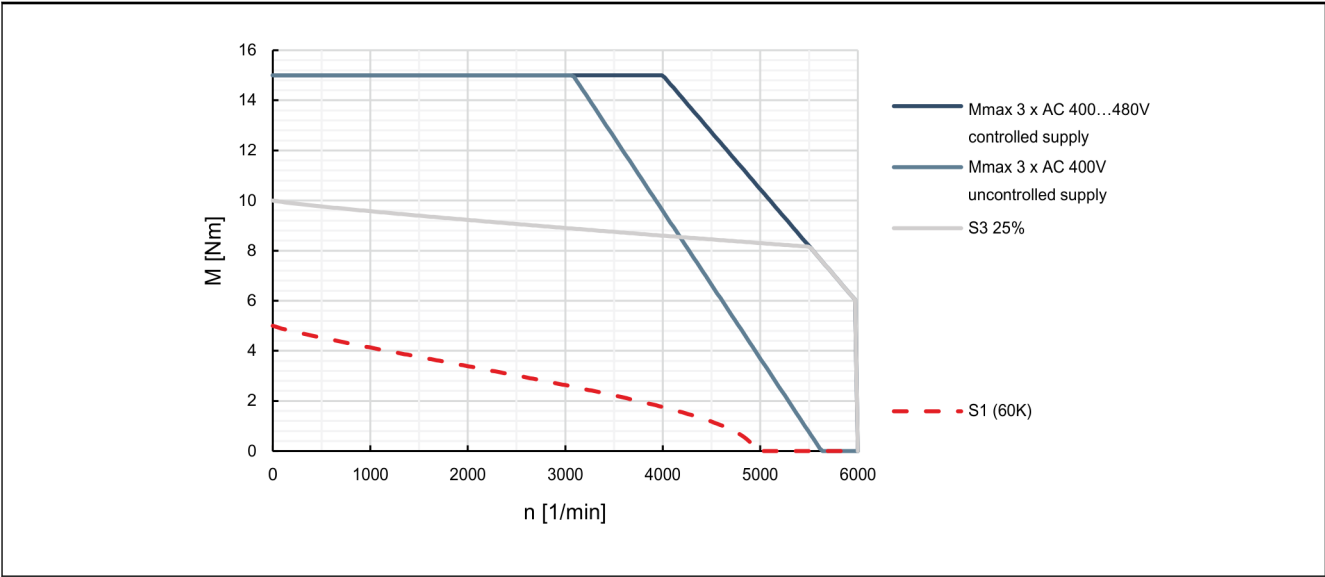
Designation	Symbol	Unit	MSK050C-0300-NN	MSK050C-0450-NN	MSK050C-0600-NN
Continuous torque at standstill 60 K	M _{0_60}	Nm	5.0		
Continuous current at standstill 60 K	I _{0_60(eff)}	A	3.1	4.7	6.2
Maximum torque	M _{max}	Nm	15.0		
Maximum current	I _{max(eff)}	A	12.4	18.8	24.8
Torque constant at 20 °C	K _{M_N}	Nm/A	1.77	1.16	0.89
Voltage constant at 20 °C ¹⁾	K _{EMK_1000}	V/1000 min ⁻¹	109.0	71.5	55.0
Winding resistance at 20 °C	R ₁₂	Ohm	6.6	3.2	1.7
Winding inductance	L ₁₂	mH	46.1	20.2	11
Leakage capacitance of the compo- nent	C _{dis}	nF	2.6	2.4	2.6
Number of pole pairs	p	-	4		
Moment of inertia of rotor	J _{red}	kg*m ²	0.00033		
Thermal time constant	T _{th}	min	14.0		
Maximum speed (electric)	n _{max el}	min ⁻¹	4700	6000	
Sound pressure level	L _p	dB[A]	< 75		
Mass ²⁾	m	kg	5.4 (6.3)		
Ambient temperature during operation	T _{amb}	°C	0 ... 40		
Protection class (EN 60034-5)	-	-	IP65		
Thermal class (EN 60034-1)	T.CL.	-	155		
Last amended: 2014-01-21					

1) Manufacturing tolerance ±5%
2) (...) Motors with holding brake 1, 2, ...
Tab. 5-19: Technical data MSK050C-...-NSNN

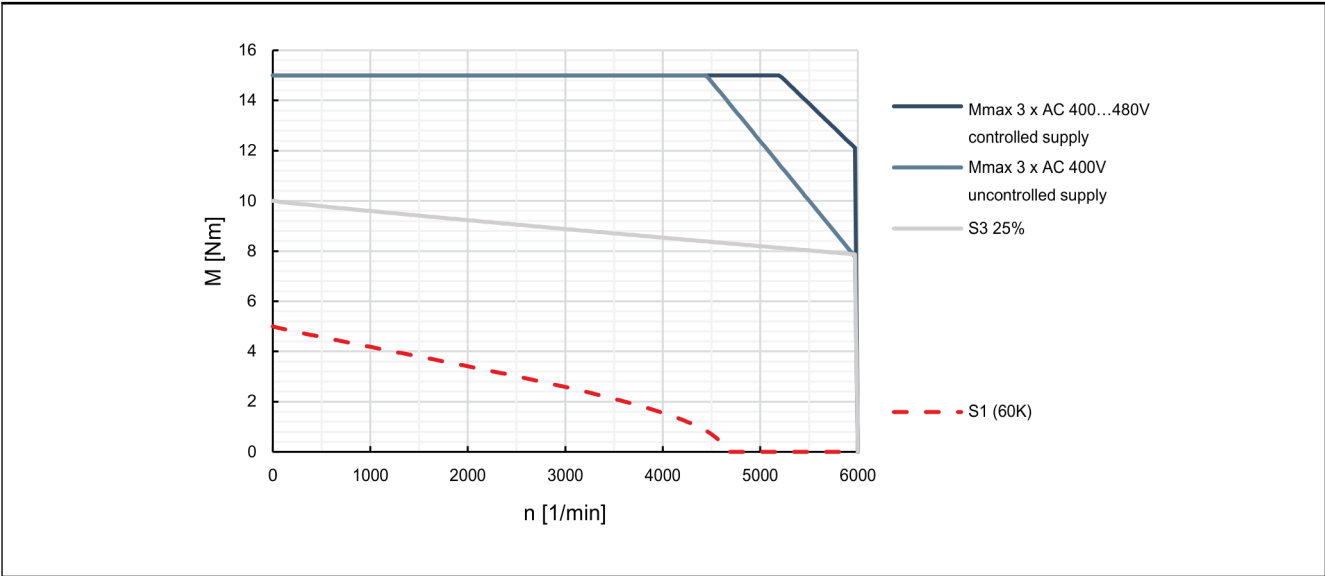


Tab. 5-20: Technical data MSK050C-0300-...-S

Technical data



Tab. 5-21: Technical data MSK050C-0450- - - - S



Tab. 5-22: Technical data MSK050C-0600- - - - S

Technical data

5.12 MSK060B-...-NSNN Technical data

Designation	Symbol	Unit	MSK060B-0300-NN	MSK060B-0600-NN
Continuous torque at standstill 60 K	M _{0_60}	Nm	5.0	
Continuous current at standstill 60 K	I _{0_60(eff)}	A	3.0	6.1
Maximum torque	M _{max}	Nm	15.0	
Maximum current	I _{max(eff)}	A	12.0	24.4
Torque constant at 20 °C	K _{M_N}	Nm/A	1.85	0.90
Voltage constant at 20 °C ¹⁾	K _{EMK_1000}	V/1000 min-1	113.5	55.2
Winding resistance at 20 °C	R ₁₂	Ohm	7.3	1.85
Winding inductance	L ₁₂	mH	73	18
Discharge capacity of the component	C _{dis}	nF	2.1	
Number of pole pairs	p	-	4	
Moment of inertia of rotor	J _{red}	kg*m²	0.00048	
Thermal time constant	T _{th}	min	16.0	
Maximum speed (electric)	n _{max el}	min ⁻¹	4800	6000
Sound pressure level	L _p	dB[A]	< 75	
Mass ²⁾	m	kg	5.7 (6.4)	
Ambient temperature during operation	T _{amb}	°C	0 ... 40	
Protection class (EN 60034-5)	-	-	IP65	
Thermal class (EN 60034-1)	T.CL.	-	155	

Last amended: 2014-01-21

1)

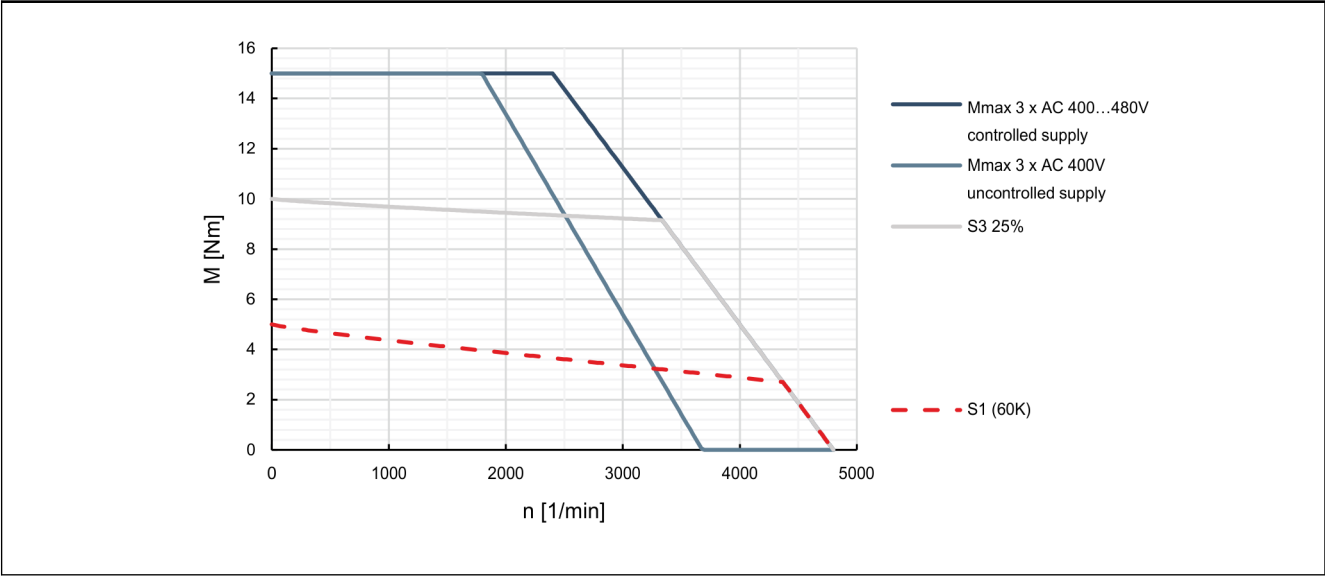
2)

Manufacturing tolerance ±5%

(...) Motors with holding brake 1, 2, ...

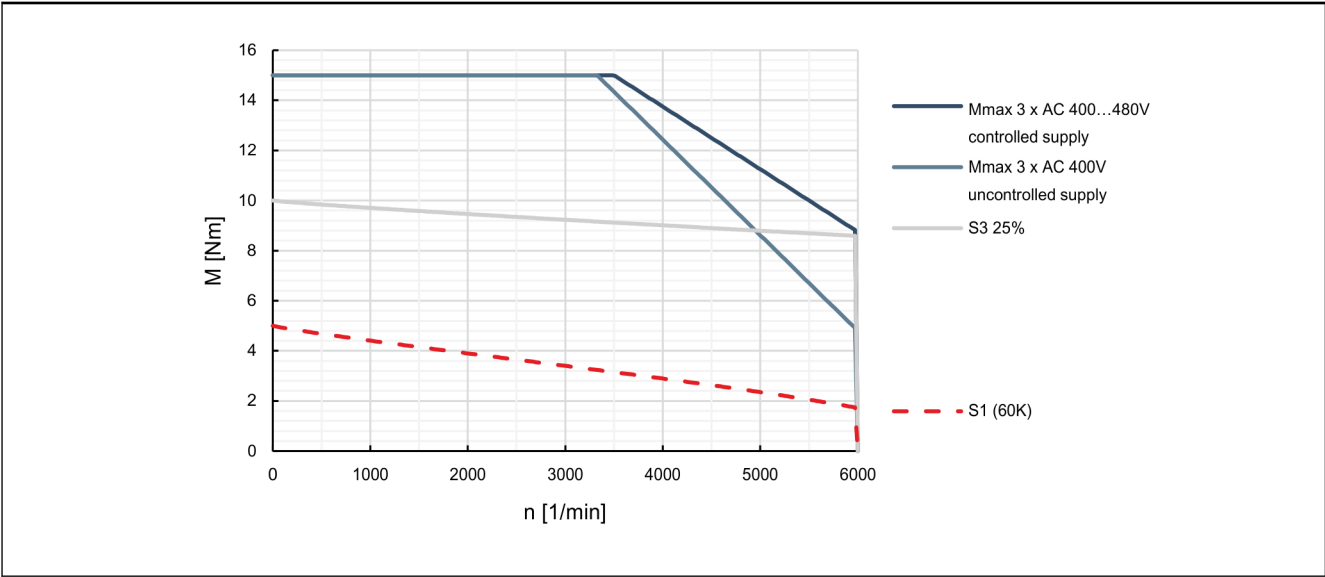
Tab. 5-23:

Technical data MSK060B-...-NSNN



Tab. 5-24: Technical data MSK060B-0300-...-...-S

Technical data



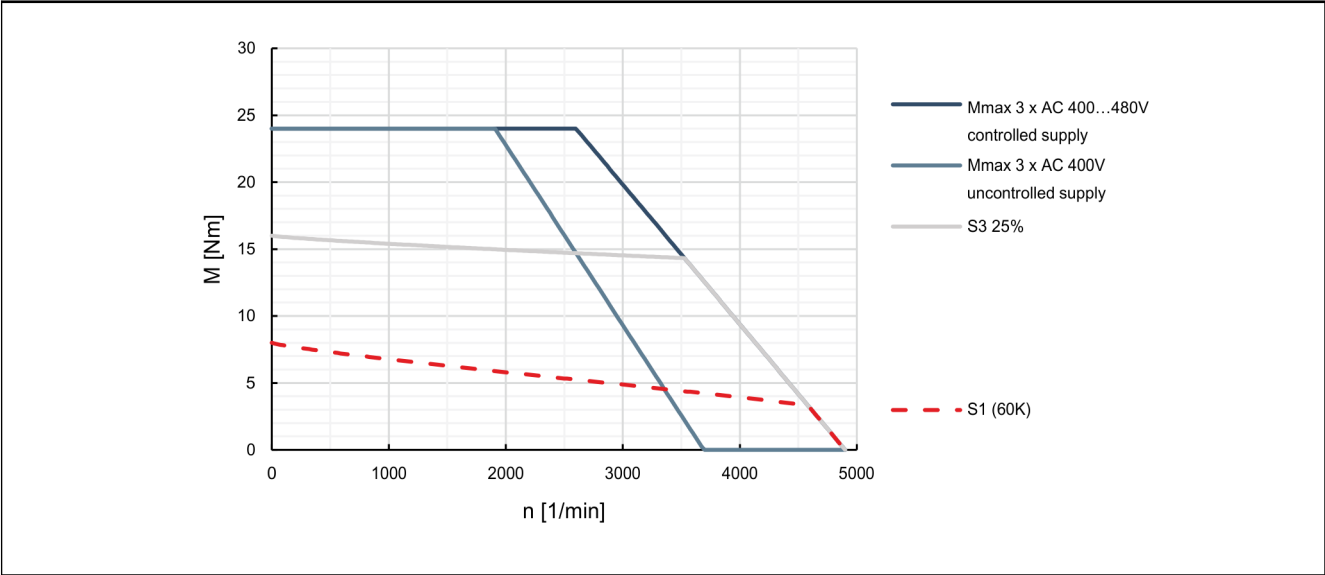
Tab. 5-25: Technical data MSK060B-0600-...-S

Technical data

5.13 MSK060C-...-NSNN Technical data

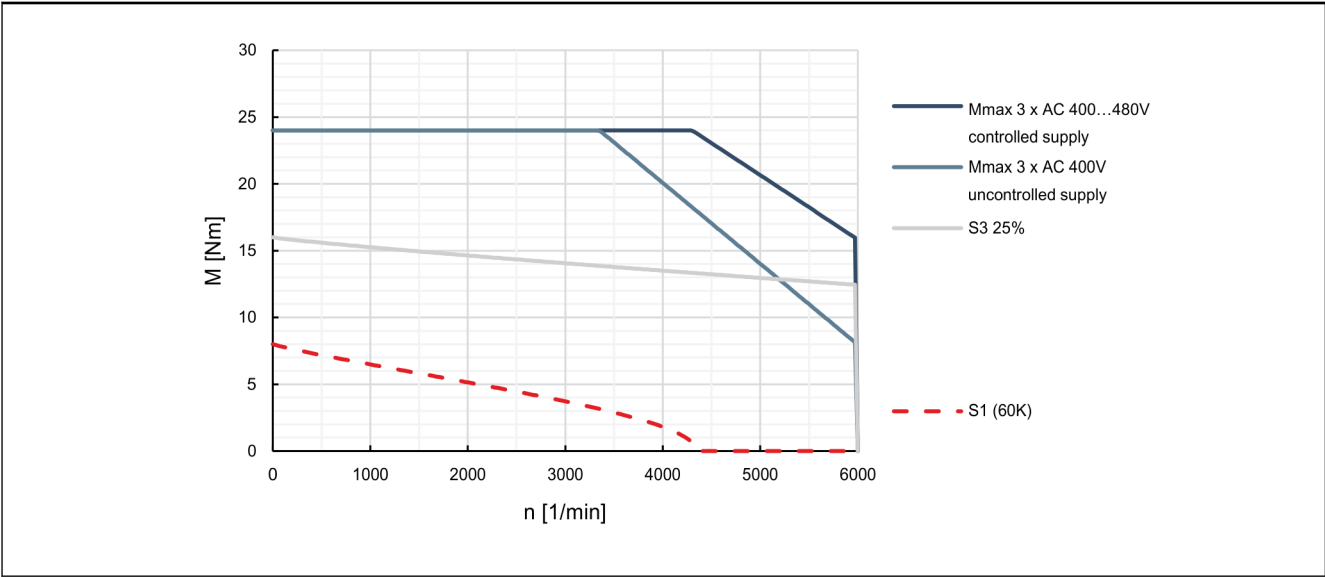
Designation	Symbol	Unit	MSK060C-0300-NN	MSK060C-0600-NN
Continuous torque at standstill 60 K	M _{0_60}	Nm	8.0	
Continuous current at standstill 60 K	I _{0_60(eff)}	A	4.8	9.5
Maximum torque	M _{max}	Nm	24.0	
Maximum current	I _{max(eff)}	A	19.2	38.0
Torque constant at 20 °C	K _{M_N}	Nm/A	1.85	0.93
Voltage constant at 20 °C ¹⁾	K _{EMK_1000}	V/1000 min ⁻¹	114.0	57.0
Winding resistance at 20 °C	R ₁₂	Ohm	3.1	0.8
Winding inductance	L ₁₂	mH	35.9	8.6
Leakage capacitance of the component	C _{dis}	nF	2.1	2.2
Number of pole pairs	p	-	4	
Moment of inertia of rotor	J _{red}	kg*m ²	0.00080	
Thermal time constant	T _{th}	min	14.0	
Maximum speed (electric)	n _{max el}	min ⁻¹	4900	6000
Sound pressure level	L _p	dB[A]	< 75	
Mass ²⁾	m	kg	8.4 (9.2)	
Ambient temperature during operation	T _{amb}	°C	0 ... 40	
Protection class (EN 60034-5)	-	-	IP65	
Thermal class (EN 60034-1)	T.CL.	-	155	
Last amended: 2014-01-21				

1) Manufacturing tolerance ±5%
2) (...) Motors with holding brake 1, 2, ...
Tab. 5-26: Technical data MSK060C-...-NSNN



Tab. 5-27: Technical data MSK060C-0300-...-S_

Technical data



Tab. 5-28: Technical data MSK060C-0600-__-__-__-S__

Technical data

5.14 MSK061B-...-NSNN Technical data

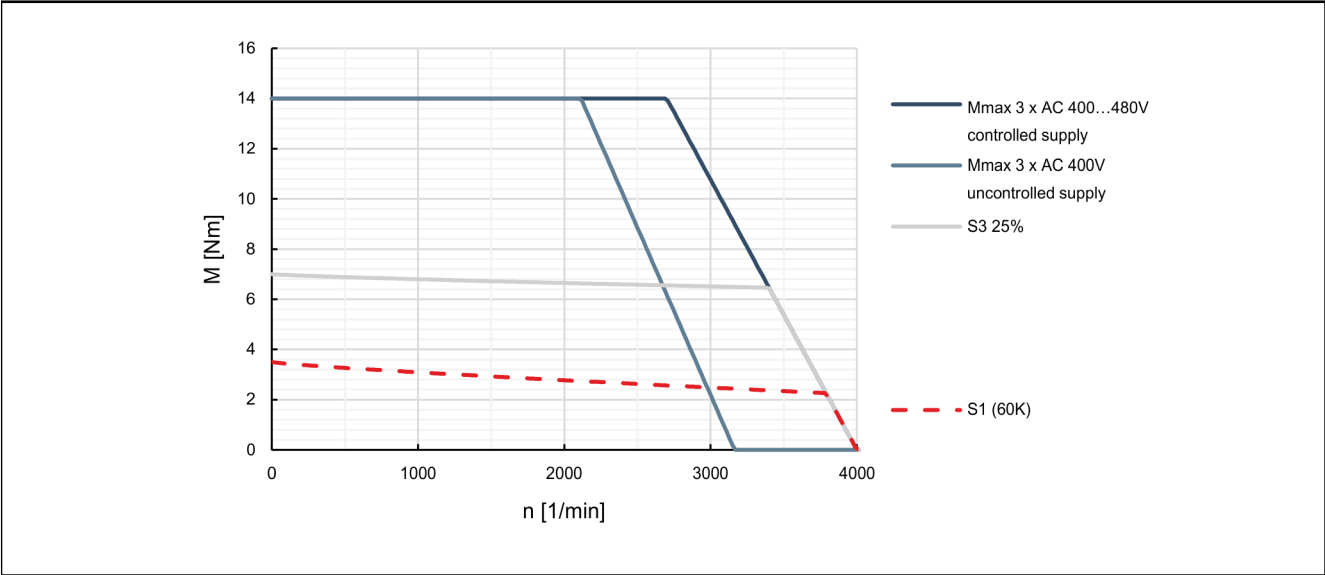
Designation	Symbol	Unit	MSK061B-0300-NN
Continuous torque at standstill 60 K	M_{0_60}	Nm	3.5
Continuous current at standstill 60 K	$I_{0_60(eff)}$	A	1.9
Maximum torque	M_{max}	Nm	14.0
Maximum current	$I_{max(eff)}$	A	8.6
Torque constant at 20 °C	K_{M_N}	Nm/A	2.05
Voltage constant at 20 °C ¹⁾	K_{EMK_1000}	V/1000 min-1	126.4
Winding resistance at 20 °C	R_{12}	Ohm	13.5
Winding inductance	L_{12}	mH	44.0
Leakage capacitance of the component	C_{dis}	nF	1.8
Number of pole pairs	p	-	4
Moment of inertia of rotor	J_{red}	kg*m²	0.00044
Thermal time constant	T_{th}	min	15.0
Maximum speed (electric)	$n_{max\ el}$	min ⁻¹	4200
Sound pressure level	L_P	dB[A]	< 75
Mass ²⁾	m	kg	5.7 (6.4)
Ambient temperature during operation	T_{amb}	°C	0 ... 40
Protection class (EN 60034-5)	-	-	IP65
Thermal class (EN 60034-1)	T.CL.	-	155

Last amended: 2014-01-21

1) Manufacturing tolerance ±5%

2) (...) Motors with holding brake 1, 2, ...

Tab. 5-29: Technical data MSK060B-...-NSNN



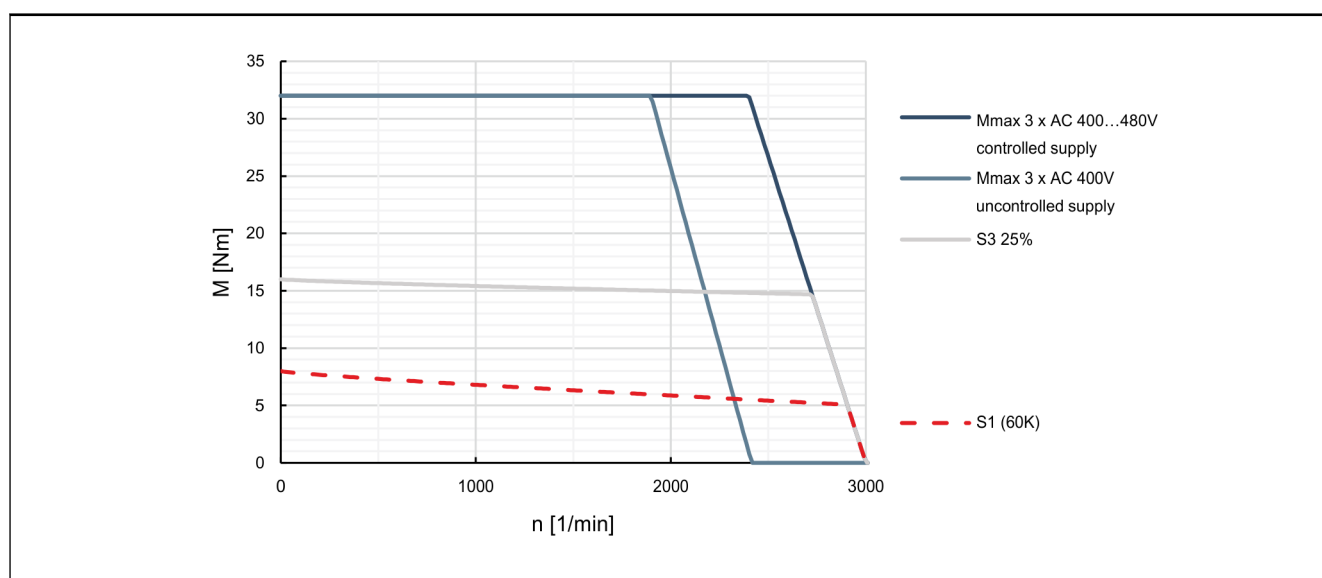
Tab. 5-30: Technical data MSK061B-0300-...-S_

5.15 MSK061C-...-NSNN Technical data

Designation	Symbol	Unit	MSK061C-0200-NN	MSK061C-0300-NN	MSK061C-0600-NN
Continuous torque at standstill 60 K	M_{0_60}	Nm	8.0		
Continuous current at standstill 60 K	$I_{0_60(\text{eff})}$	A	3.2	4.3	7.7
Maximum torque	M_{max}	Nm	32.0		
Maximum current	$I_{\text{max}(\text{eff})}$	A	14.4	19.4	34.7
Torque constant at 20 °C	K_{M_N}	Nm/A	2.80	2.04	1.14
Voltage constant at 20 °C ¹⁾	K_{EMK_1000}	V/1000 min ⁻¹	174.9	125.7	70.5
Winding resistance at 20 °C	R_{12}	Ohm	8.1	4.5	1.55
Winding inductance	L_{12}	mH	36.5	21.4	6.7
Leakage capacitance of the component	C_{dis}	nF	2.7	2.4	2.1
Number of pole pairs	p	-	4		
Moment of inertia of rotor	J_{red}	kg*m ²	0.00075		
Thermal time constant	T_{th}	min	18.0		15.0
Maximum speed (electric)	$n_{\text{max el}}$	min ⁻¹	3,100	4200	6000
Sound pressure level	L_p	dB[A]	< 75		
Mass ²⁾	m	kg	8.3 (8.8)		
Ambient temperature during operation	T_{amb}	°C	0 ... 40		
Protection class (EN 60034-5)	-	-	IP65		
Thermal class (EN 60034-1)	T.CL.	-	155		

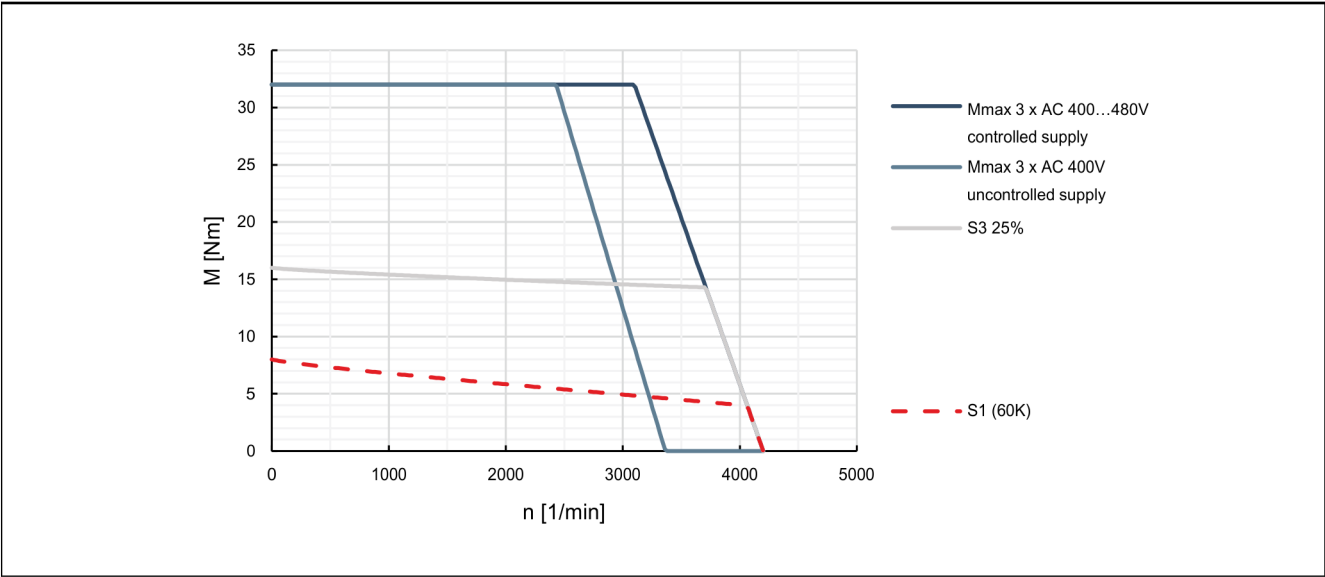
Last amended: 2014-01-21

1) Manufacturing tolerance $\pm 5\%$
2) (...) Motors with holding brake 1, 2, ...
Tab. 5-31: Technical data MSK061C-...-NSNN

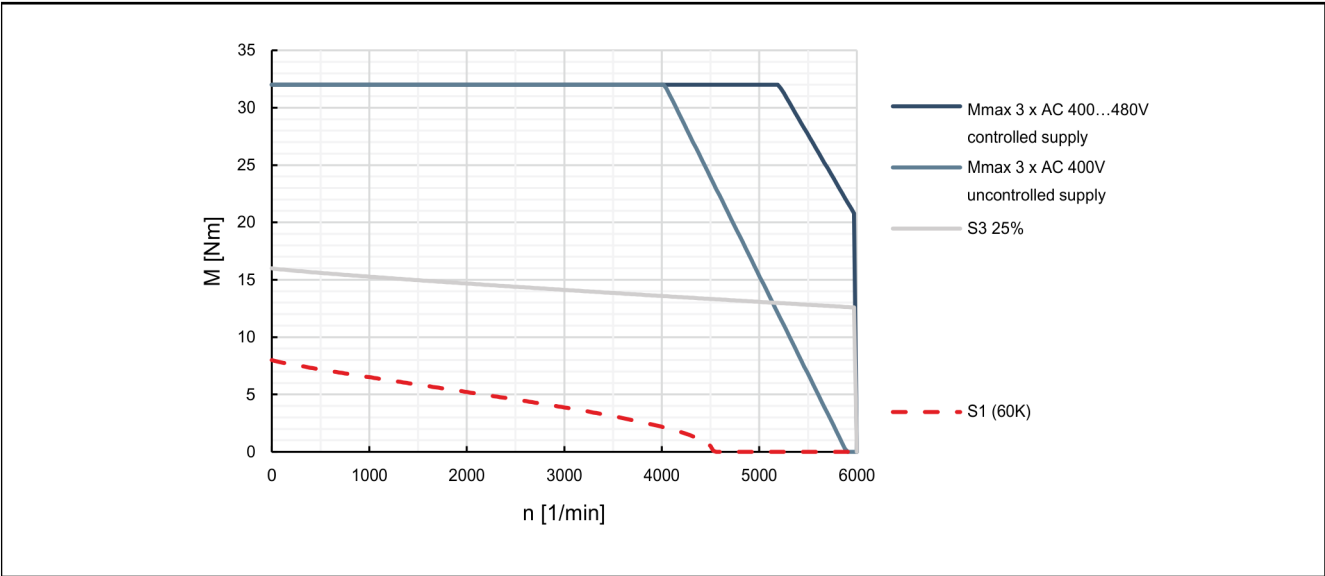


Tab. 5-32: Technical data MSK061C-0200-...-S

Technical data



Tab. 5-33: Technical data MSK061C-0300- - - - S



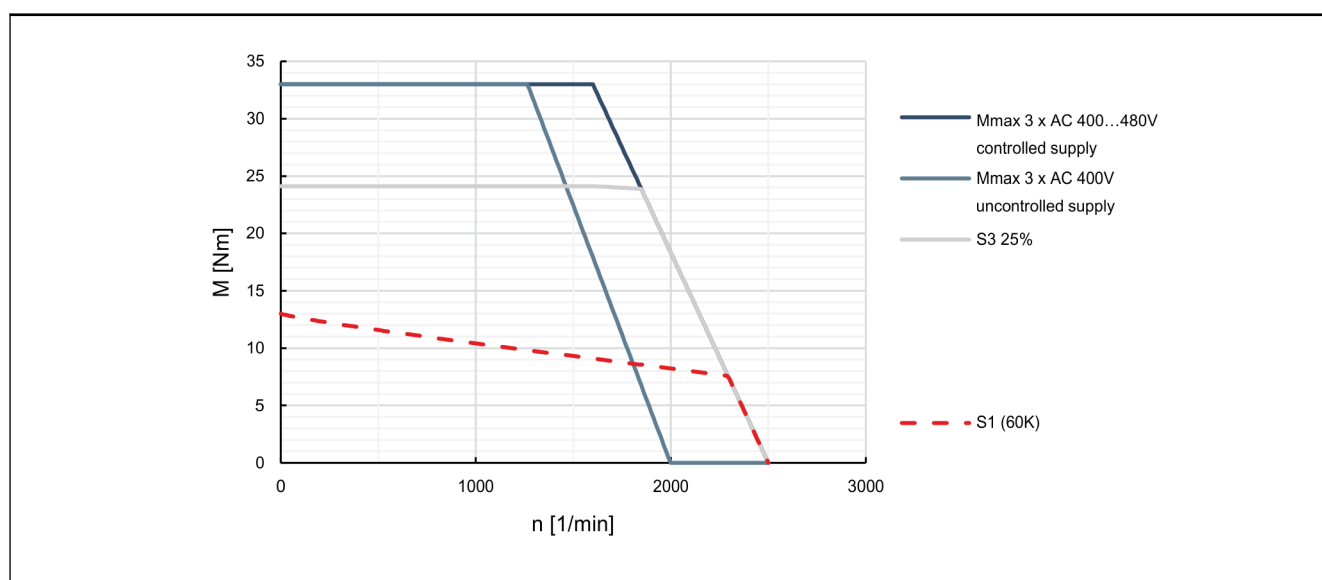
Tab. 5-34: Technical data MSK061C-0600- - - - S

5.16 MSK070C-...-NSNN Technical data

Designation	Symbol	Unit	MSK070C-0150-NN	MSK070C-0300-NN	MSK070C-0450-NN
Continuous torque at standstill 60 K	M_{0_60}	Nm	13.0		
Continuous current at standstill 60 K	$I_{0_60(eff)}$	A	4.1	8.2	12.3
Maximum torque	M_{max}	Nm	33.0		
Maximum current	$I_{max(eff)}$	A	12.6	25.0	36.9
Torque constant at 20 °C	K_{M_N}	Nm/A	3.47	1.74	1.16
Voltage constant at 20 °C ¹⁾	K_{EMK_1000}	V/1000 min ⁻¹	213.2	107.0	71.3
Winding resistance at 20 °C	R_{12}	Ohm	4.7	1.13	0.55
Winding inductance	L_{12}	mH	34.9	8.3	4.0
Leakage capacitance of the component	C_{dis}	nF	3.8	4.0	3.1
Number of pole pairs	p	-	6		
Moment of inertia of rotor	J_{red}	kg*m ²	0.00291		
Thermal time constant	T_{th}	min	22.0		31.0
Maximum speed (electric)	$n_{max\ el}$	min ⁻¹	2,500	5,500	6000
Sound pressure level	L_P	dB[A]	< 75		
Mass ²⁾	m	kg	11.7 (13.2)		
Ambient temperature during operation	T_{amb}	°C	0 ... 40		
Protection class (EN 60034-5)	-	-	IP65		
Thermal class (EN 60034-1)	T.CL.	-	155		

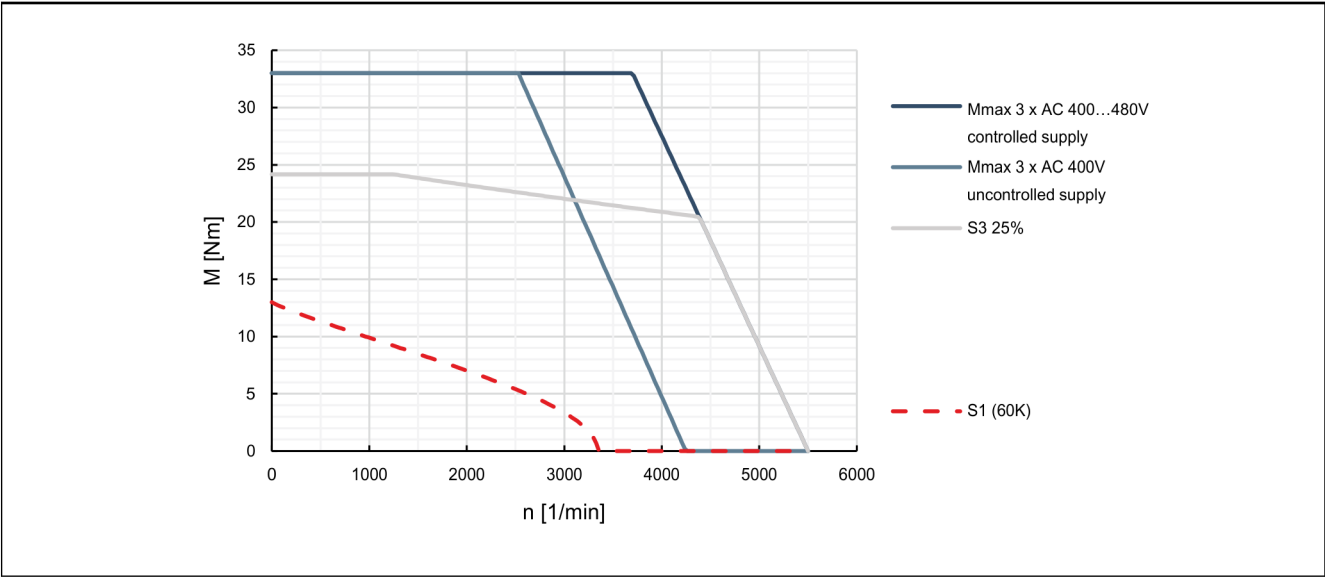
Last amended: 2014-01-21

1) Manufacturing tolerance ±5%
2) (...) Motors with holding brake 1, 2, ...
Tab. 5-35: Technical data MSK070C-...-NSNN

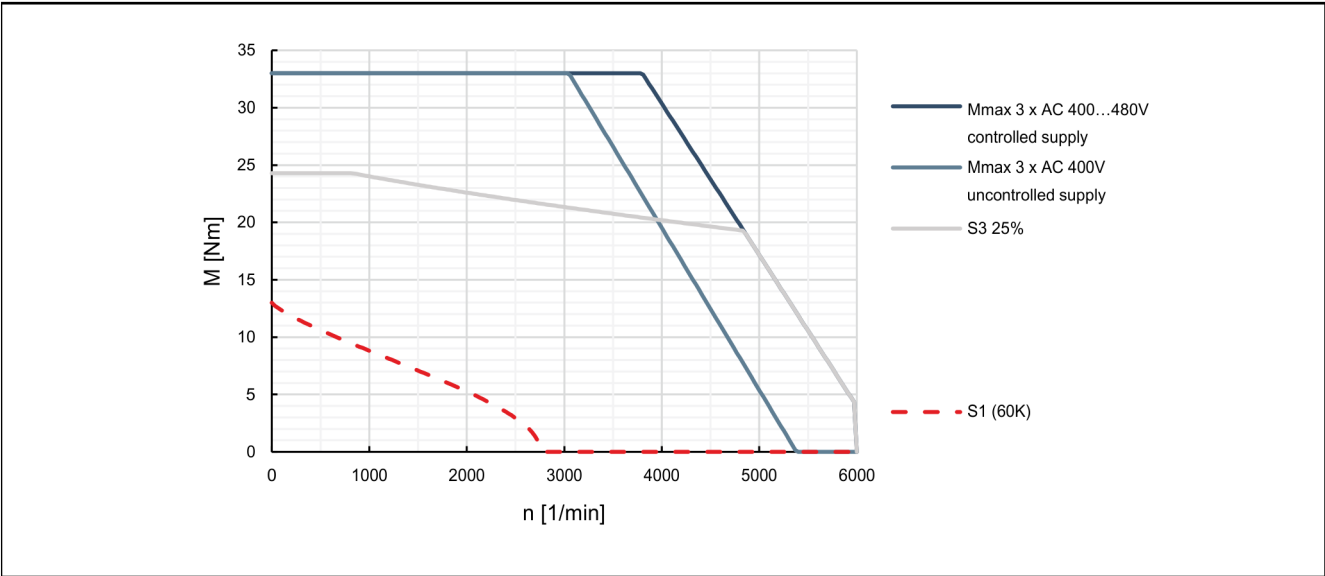


Tab. 5-36: Technical data MSK070C-0150-...-S

Technical data



Tab. 5-37: Technical data MSK070C-0300- - - - S

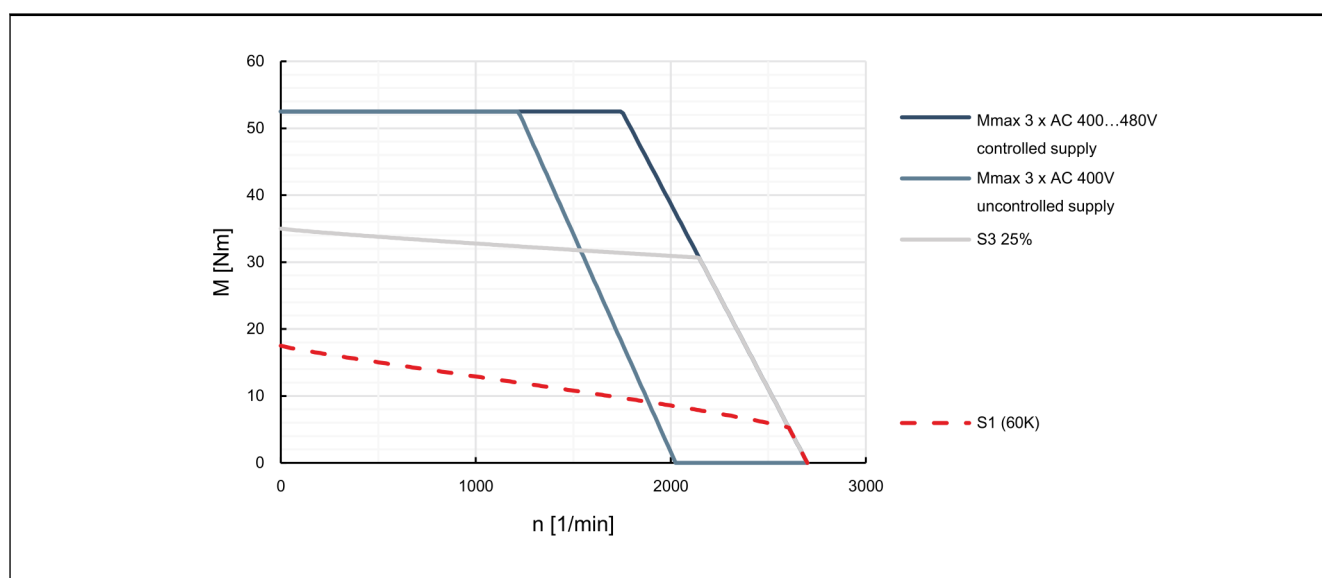


Tab. 5-38: Technical data MSK070C-0450- - - - S

5.17 MSK070D-...-NSNN Technical data

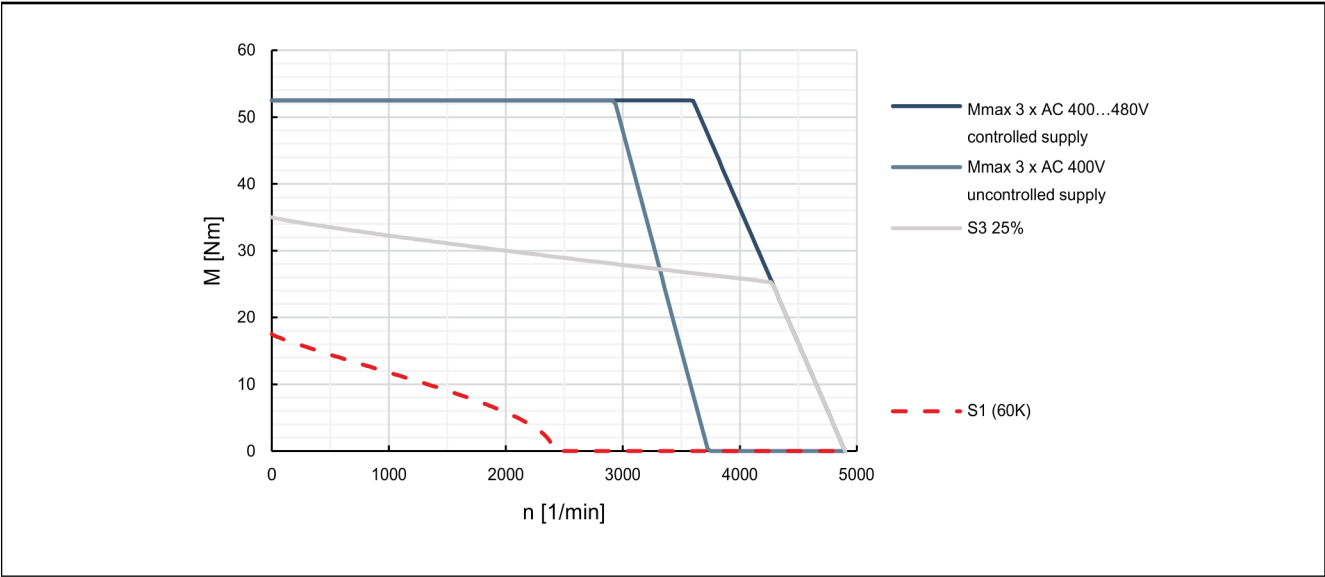
Designation	Symbol	Unit	MSK070D-0150-NN	MSK070D-0300-NN	MSK070D-0450-NN
Continuous torque at standstill 60 K	M _{0_60}	Nm	17.5		
Continuous current at standstill 60 K	I _{0_60(eff)}	A	6.2	11.0	16.6
Maximum torque	M _{max}	Nm	52.5		
Maximum current	I _{max(eff)}	A	24.8	33.0	49.8
Torque constant at 20 °C	K _{M_N}	Nm/A	3.10	1.75	1.16
Voltage constant at 20 °C ¹⁾	K _{EMK_1000}	V/1000 min ⁻¹	210.0	107.3	71.1
Winding resistance at 20 °C	R ₁₂	Ohm	3.2	0.75	0.37
Winding inductance	L ₁₂	mH	25.9	6.0	3.0
Leakage capacitance of the compo- nent	C _{dis}	nF	5.0	4.5	
Number of pole pairs	p	-	6		
Moment of inertia of rotor	J _{red}	kg*m ²	0.00375		
Thermal time constant	T _{th}	min	23.0		
Maximum speed (electric)	n _{max el}	min ⁻¹	2,700	4900	6000
Sound pressure level	L _p	dB[A]	< 75		
Mass ²⁾	m	kg	14.0 (15.6)		
Ambient temperature during operation	T _{amb}	°C	0 ... 40		
Protection class (EN 60034-5)	-	-	IP65		
Thermal class (EN 60034-1)	T.CL.	-	155		
Last amended: 2014-01-21					

1) Manufacturing tolerance $\pm 5\%$
2) (...) Motors with holding brake 1, 2, ...
Tab. 5-39: Technical data MSK070D-...-NSNN

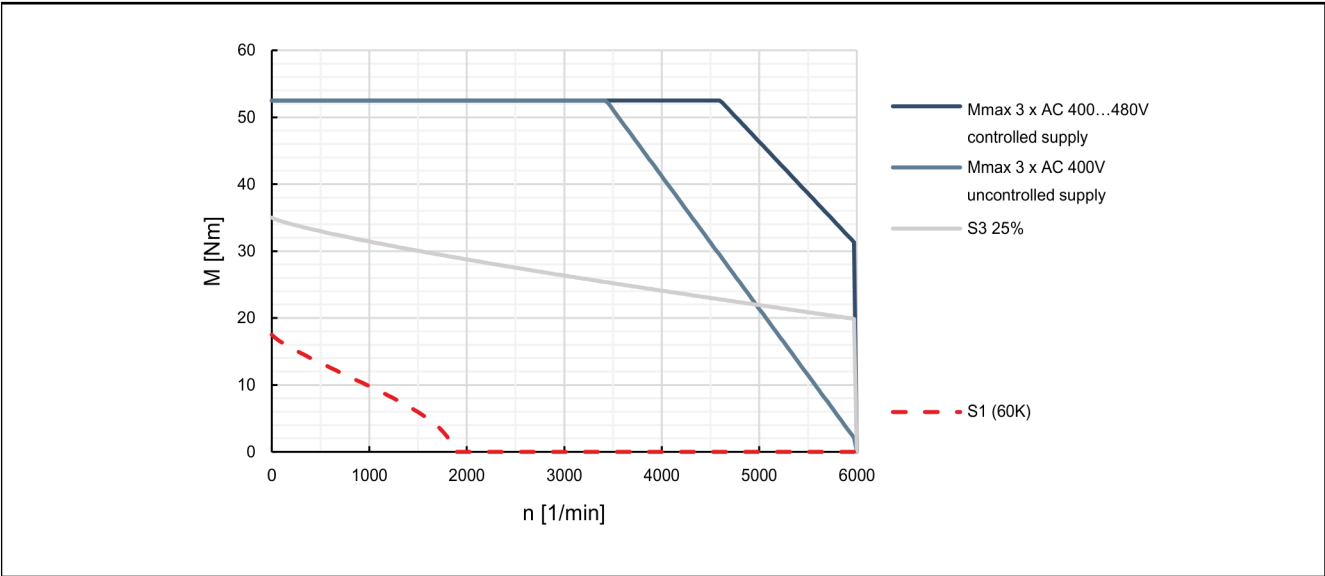


Tab. 5-40: Technical data MSK070D-0150-...-S

Technical data



Tab. 5-41: Technical data MSK070D-0300- - - - S



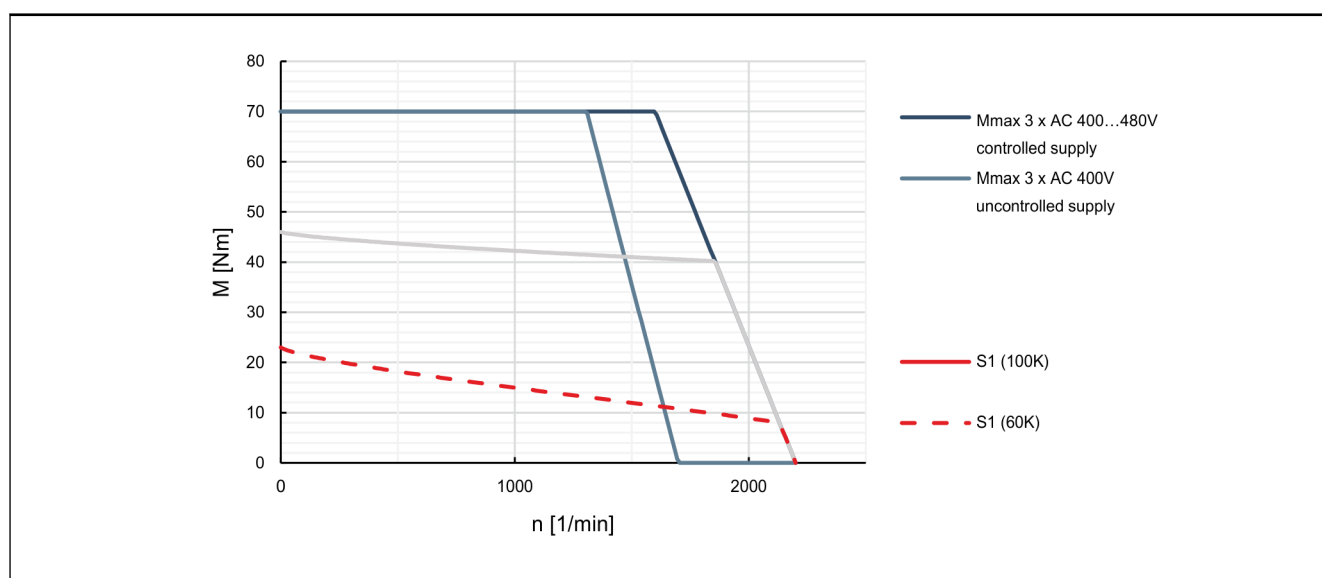
Tab. 5-42: Technical data MSK070D-0450- - - - S

5.18 MSK070E-...-NSNN Technical data

Designation	Symbol	Unit	MSK070E-0150-NN	MSK070E-0300-NN	MSK070E-0450-NN
Continuous torque at standstill 60 K	M_{0_60}	Nm	23.0		
Continuous current at standstill 60 K	$I_{0_60(\text{eff})}$	A	6.4	15.4	19.3
Maximum torque	M_{max}	Nm	70.0	65.0	60.0
Maximum current	$I_{\text{max}(\text{eff})}$	A	25.6	49.3	57.9
Torque constant at 20 °C	K_{M_N}	Nm/A	3.94	1.64	1.31
Voltage constant at 20 °C ¹⁾	K_{EMK_1000}	V/1000 min ⁻¹	242.4	101.0	80.6
Winding resistance at 20 °C	R_{12}	Ohm	3.1	0.53	0.36
Winding inductance	L_{12}	mH	24.5	3.9	2.7
Leakage capacitance of the component	C_{dis}	nF	6.3	3.5	6.7
Number of pole pairs	p	-	6		
Moment of inertia of rotor	J_{red}	kg*m ²	0.00458		
Thermal time constant	T_{th}	min	32.0		
Maximum speed (electric)	$n_{\text{max el}}$	min ⁻¹	2200	5300	6000
Sound pressure level	L_P	dB[A]	Less than 75		
Mass ²⁾	m	kg	16.2 (17.8)		
Ambient temperature during operation	T_{amb}	°C	0 ... 40		
Protection class (EN 60034-5)	-	-	IP65		
Thermal class (EN 60034-1)	T.CL.	-	155		

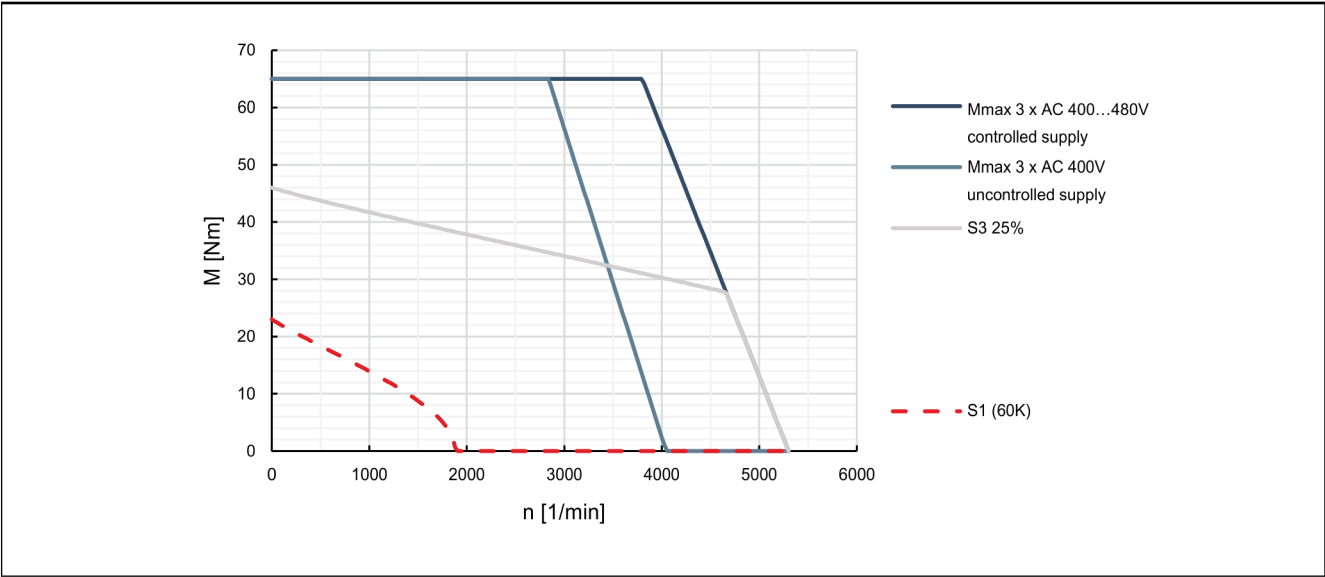
Last amended: 2014-01-21

1) Manufacturing tolerance ±5%
2) (...) Motors with holding brake 1, 2, ...
Tab. 5-43: Technical data MSK070E-...-NSNN

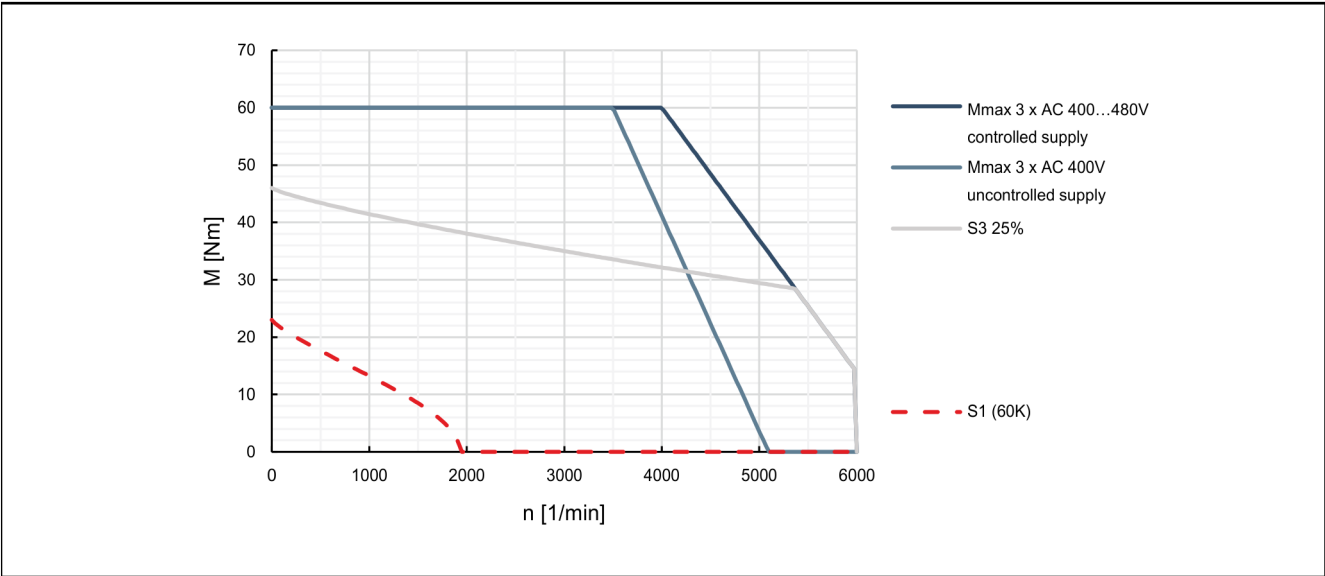


Tab. 5-44: Technical data MSK070E-0150-...-NSNN

Technical data



Tab. 5-45: Technical data MSK070E-0300- - - - S



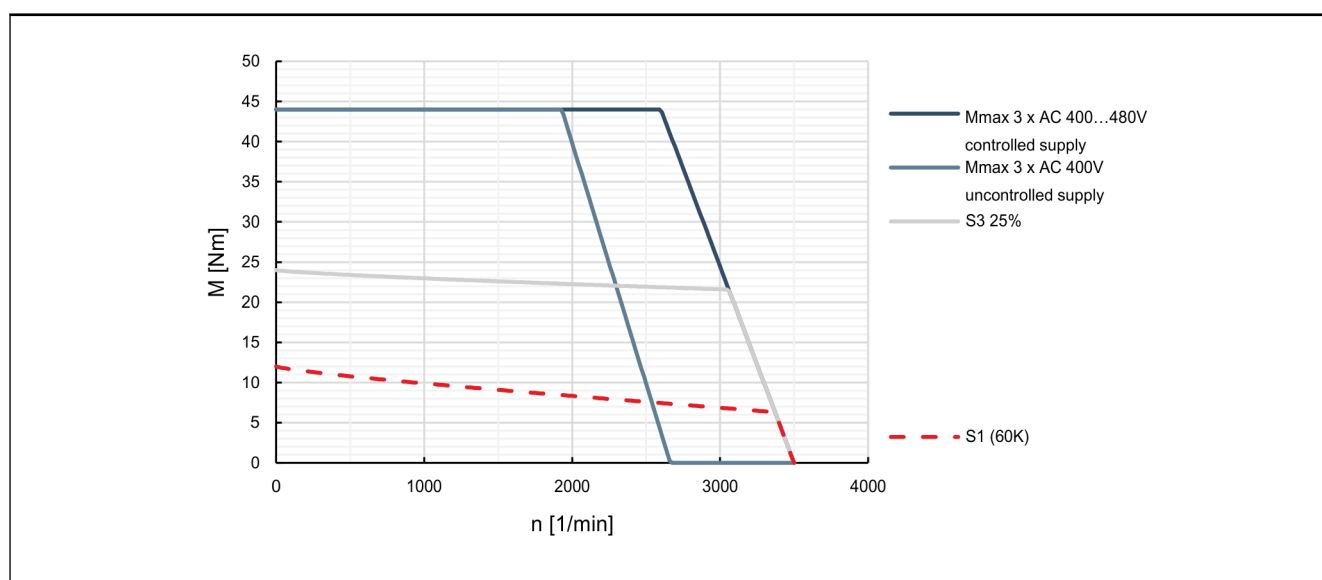
Tab. 5-46: Technical data MSK070E-0450- - - - S

5.19 MSK071C-...-NSNN Technical data

Designation	Symbol	Unit	MSK071C-0200-NN	MSK071C-0300-NN	MSK071C-0450-NN
Continuous torque at standstill 60 K	$M_{0,60}$	Nm	12.0		
Continuous current at standstill 60 K	$I_{0,60(\text{eff})}$	A	5.2	7.3	8.9
Maximum torque	M_{max}	Nm	44.0		
Maximum current	$I_{\text{max}(\text{eff})}$	A	23.4	32.9	40.1
Torque constant at 20 °C	$K_{M,N}$	Nm/A	2.50	1.80	1.49
Voltage constant at 20 °C ¹⁾	$K_{EMK,1000}$	V/1000 min ⁻¹	155.5	110.5	91.3
Winding resistance at 20 °C	R_{12}	Ohm	3.1	1.68	1.1
Winding inductance	L_{12}	mH	19.5	10.9	6.7
Leakage capacitance of the component	C_{dis}	nF	4.6		4.2
Number of pole pairs	p	-	4		
Moment of inertia of rotor	J_{red}	kg*m ²	0.00173		
Thermal time constant	T_{th}	min	28.0		
Maximum speed (electric)	$n_{\text{max el}}$	min ⁻¹	3500	5000	5800
Sound pressure level	L_P	dB[A]	Less than 75		
Mass ²⁾	m	kg	13.9 (15.8)		
Ambient temperature during operation	T_{amb}	°C	0 ... 40		
Protection class (EN 60034-5)	-	-	IP65		
Thermal class (EN 60034-1)	T.CL.	-	155		

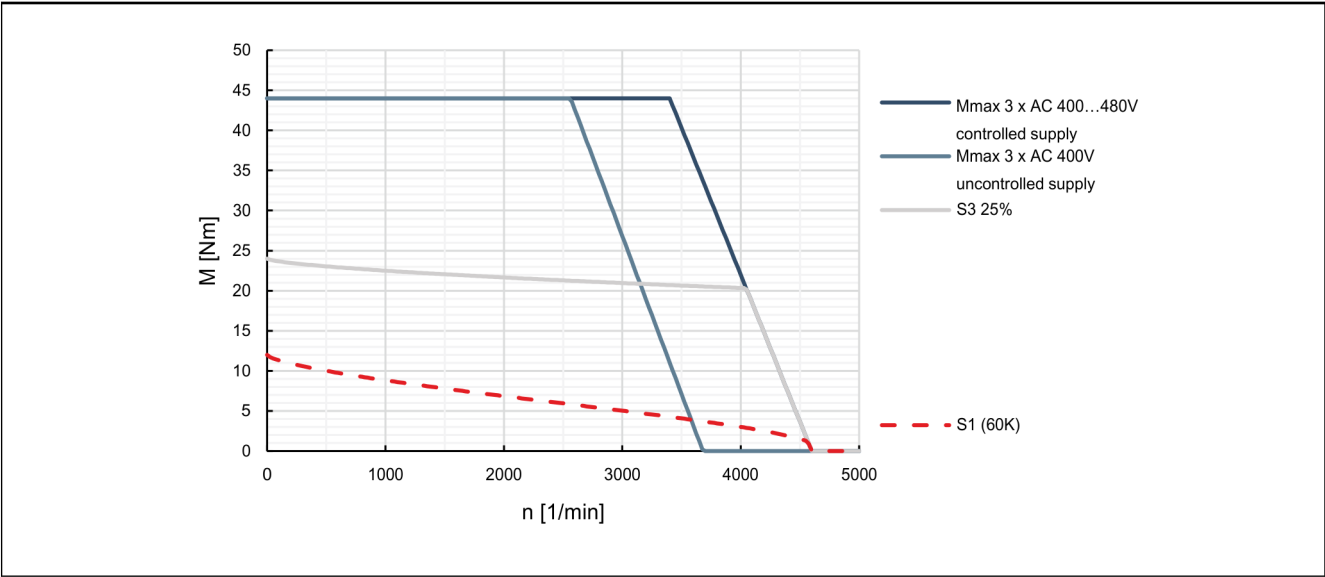
Last amended: 2014-01-21

1) Manufacturing tolerance $\pm 5\%$
2) (...) Motors with holding brake 1, 2, ...
Tab. 5-47: Technical data MSK071C-...-NSNN

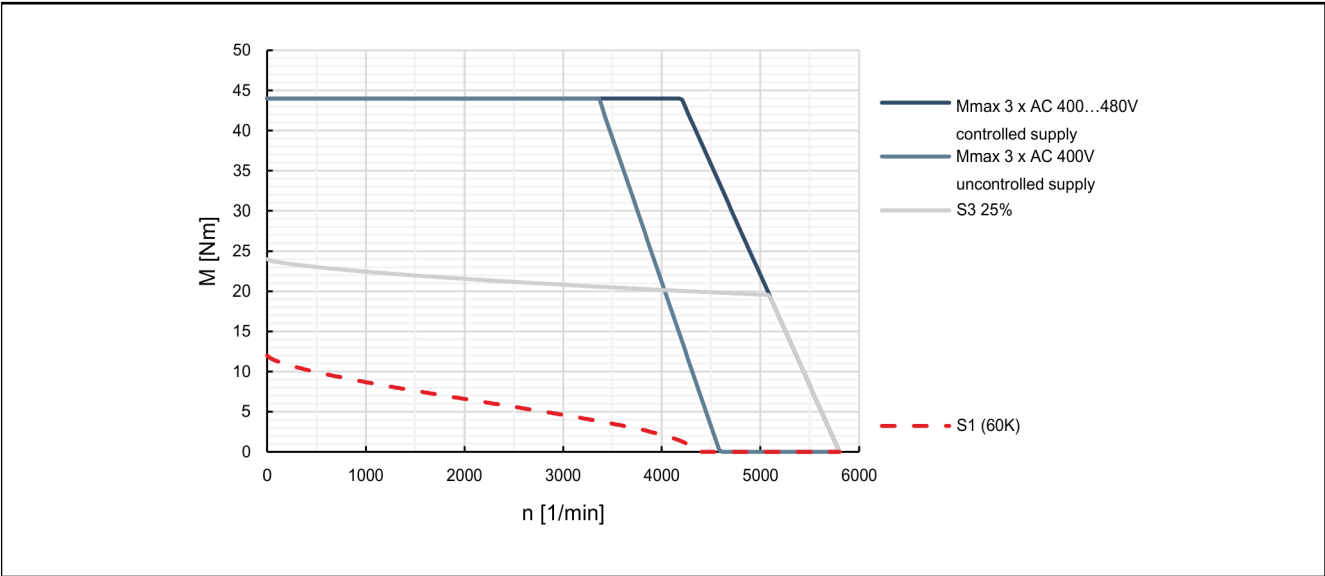


Tab. 5-48: Technical data MSK071C-0200-...-S

Technical data



Tab. 5-49: Technical data MSK071C-0300- - - - S



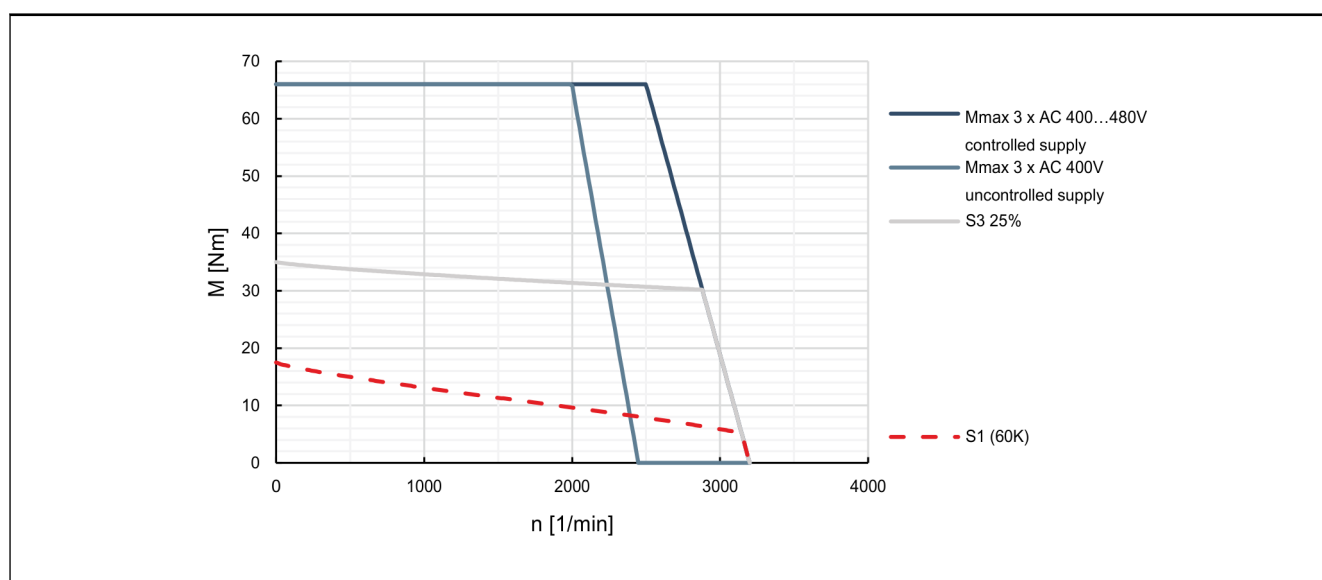
Tab. 5-50: Technical data MSK071C-0450- - - - S

5.20 MSK071D-...-NSNN Technical data

Designation	Symbol	Unit	MSK071D-0200-NN	MSK071D-0300-FN	MSK071D-0450-NN
Continuous torque at standstill 60 K	$M_{0,60}$	Nm	17.5		
Continuous current at standstill 60 K	$I_{0,60(eff)}$	A	7.3	9.1	15.4
Maximum torque	M_{max}	Nm	66.0		
Maximum current	$I_{max(eff)}$	A	32.8	40.5	69.3
Torque constant at 20 °C	$K_{M,N}$	Nm/A	2.63	2.12	1.25
Voltage constant at 20 °C ¹⁾	$K_{EMK,1000}$	V/1000 min ⁻¹	162.0	134.0	77.1
Winding resistance at 20 °C	R_{12}	Ohm	1.9	1.26	0.45
Winding inductance	L_{12}	mH	14.2	10.7	3.2
Leakage capacitance of the component	C_{dis}	nF	6.9	7.2	7.8
Number of pole pairs	p	-	4		
Moment of inertia of rotor	J_{red}	kg*m ²	0.00230		
Thermal time constant	T_{th}	min	54.0	6.0	52.0
Maximum speed (electric)	$n_{max el}$	min ⁻¹	3,200	3800	6000
Sound pressure level	L_p	dB[A]	< 75		
Mass ²⁾	m	kg	18.0 (19.6)		
Ambient temperature during operation	T_{amb}	°C	0 ... 40		
Protection class (EN 60034-5)	-	-	IP65		
Thermal class (EN 60034-1)	T.CL.	-	155		

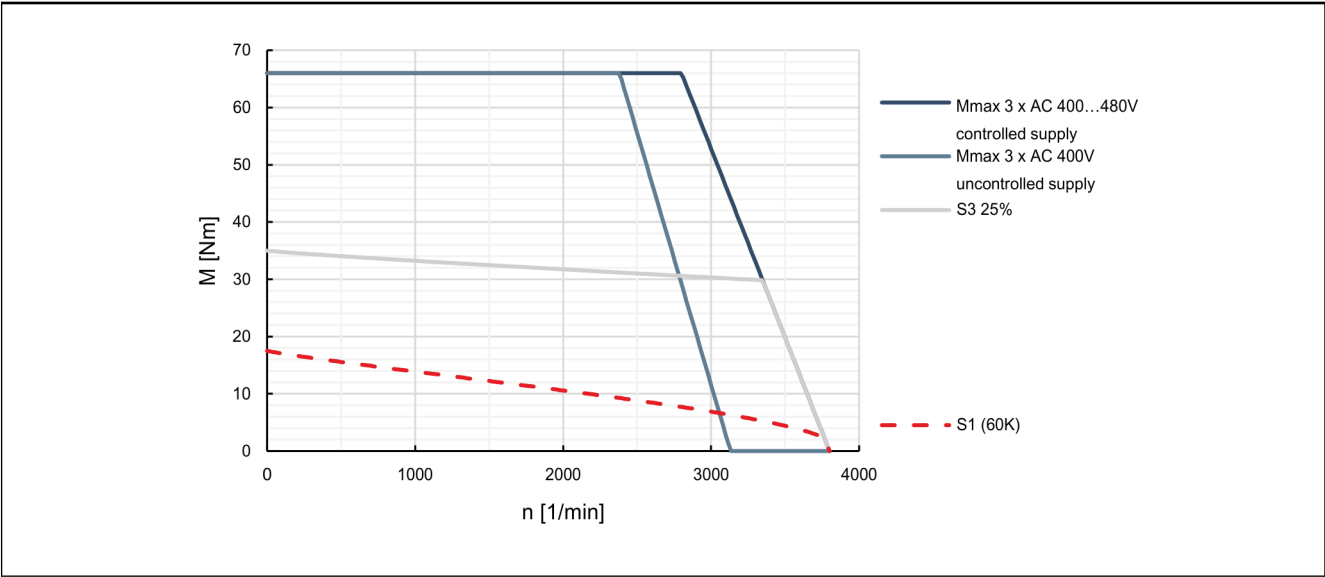
Last amended: 2014-01-21

1) Manufacturing tolerance ±5%
2) (...) Motors with holding brake 1, 2, ...
Tab. 5-51: Technical data MSK071D-...-NSNN

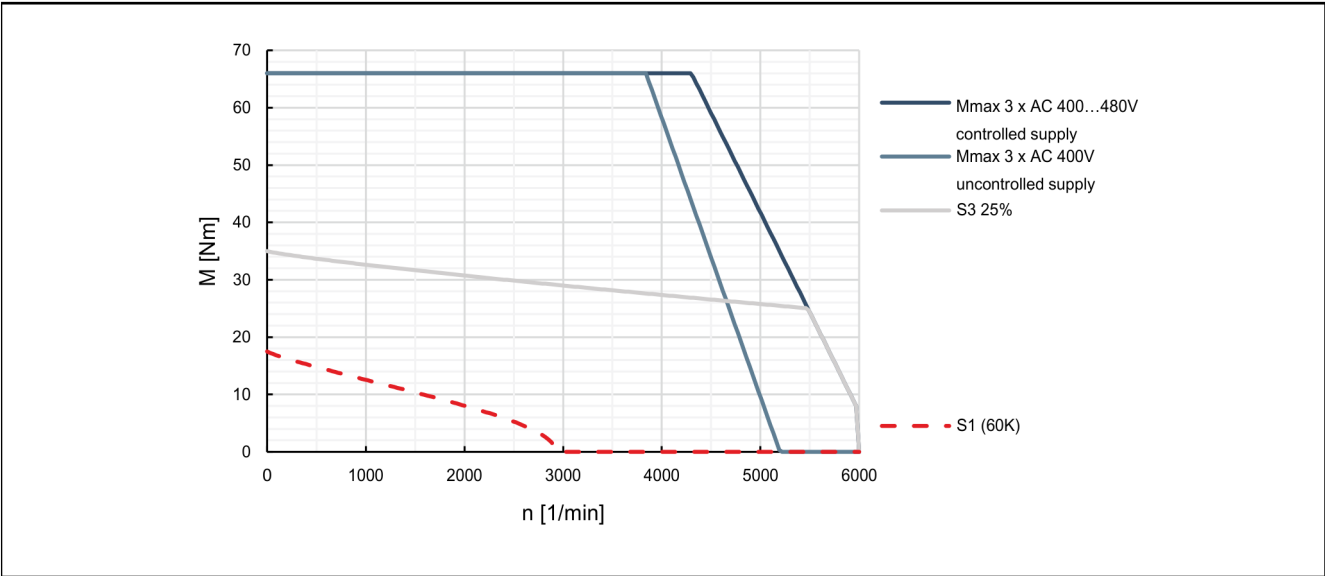


Tab. 5-52: Technical data MSK071D-0200-...-S

Technical data



Tab. 5-53: Technical data MSK071D-0300- - - - S



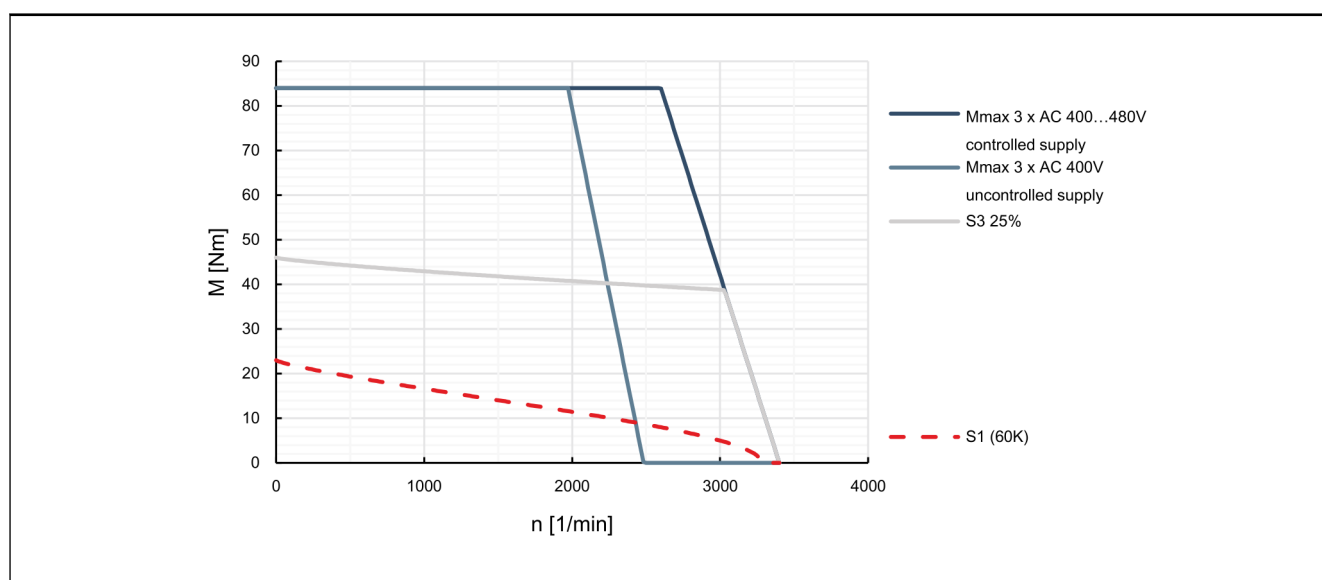
Tab. 5-54: Technical data MSK071D-0450- - - - S

5.21 MSK071E-...-NSNN Technical data

Designation	Symbol	Unit	MSK071E-0200-NN	MSK071E-0300-NN	MSK071E-0450-NN
Continuous torque at standstill 60 K	$M_{0,60}$	Nm	23.0		
Continuous current at standstill 60 K	$I_{0,60(\text{eff})}$	A	10.1	12.5	20.0
Maximum torque	M_{max}	Nm	84.0		
Maximum current	$I_{\text{max}(\text{eff})}$	A	45.5	56.3	90.1
Torque constant at 20 °C	$K_{M,N}$	Nm/A	2.51	2.05	1.29
Voltage constant at 20 °C ¹⁾	$K_{EMK,1000}$	V/1000 min ⁻¹	154.6	126.4	82.7
Winding resistance at 20 °C	R_{12}	Ohm	1.16	0.79	0.32
Winding inductance	L_{12}	mH	9.15	5.9	2.6
Leakage capacitance of the component	C_{dis}	nF	8.9	9.3	9.5
Number of pole pairs	p	-	4		
Moment of inertia of rotor	J_{red}	kg*m ²	0.00290		
Thermal time constant	T_{th}	min	55.0		
Maximum speed (electric)	$n_{\text{max el}}$	min ⁻¹	3400	4200	6000
Sound pressure level	L_P	dB[A]	< 75		
Mass ²⁾	m	kg	23.5 (25.1)		
Ambient temperature during operation	T_{amb}	°C	0 ... 40		
Protection class (EN 60034-5)	-	-	IP65		
Thermal class (EN 60034-1)	T.CL.	-	155		

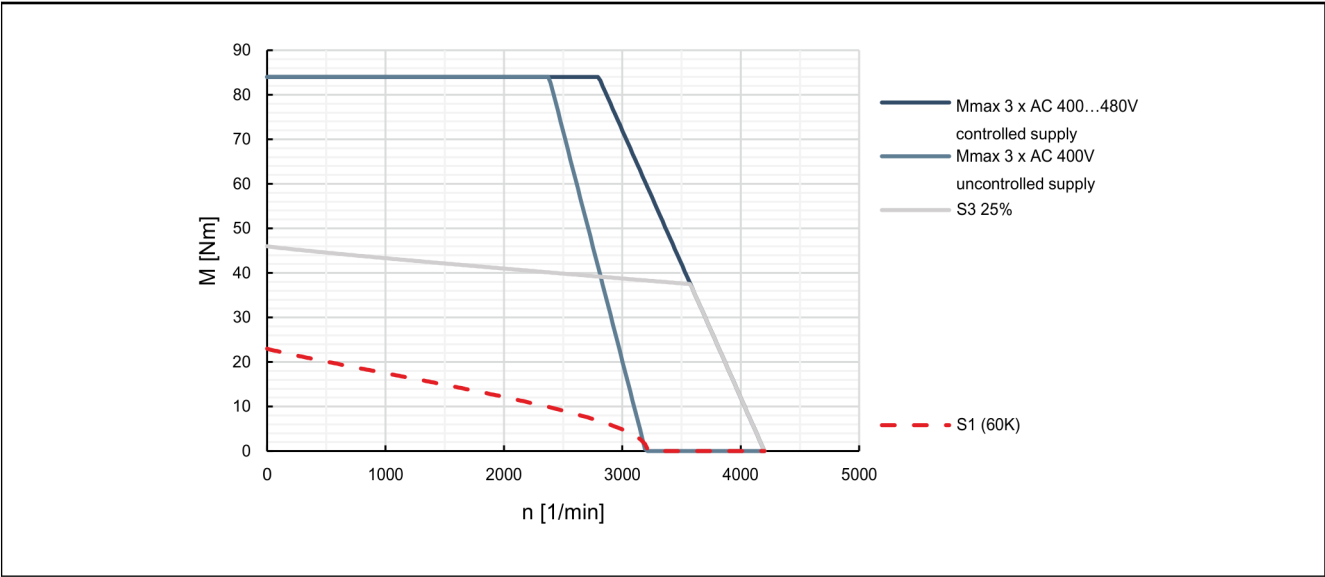
Last amended: 2014-01-21

1) Manufacturing tolerance $\pm 5\%$
2) (...) Motors with holding brake 1, 2, ...
Tab. 5-55: Technical data MSK071E-...-NSNN

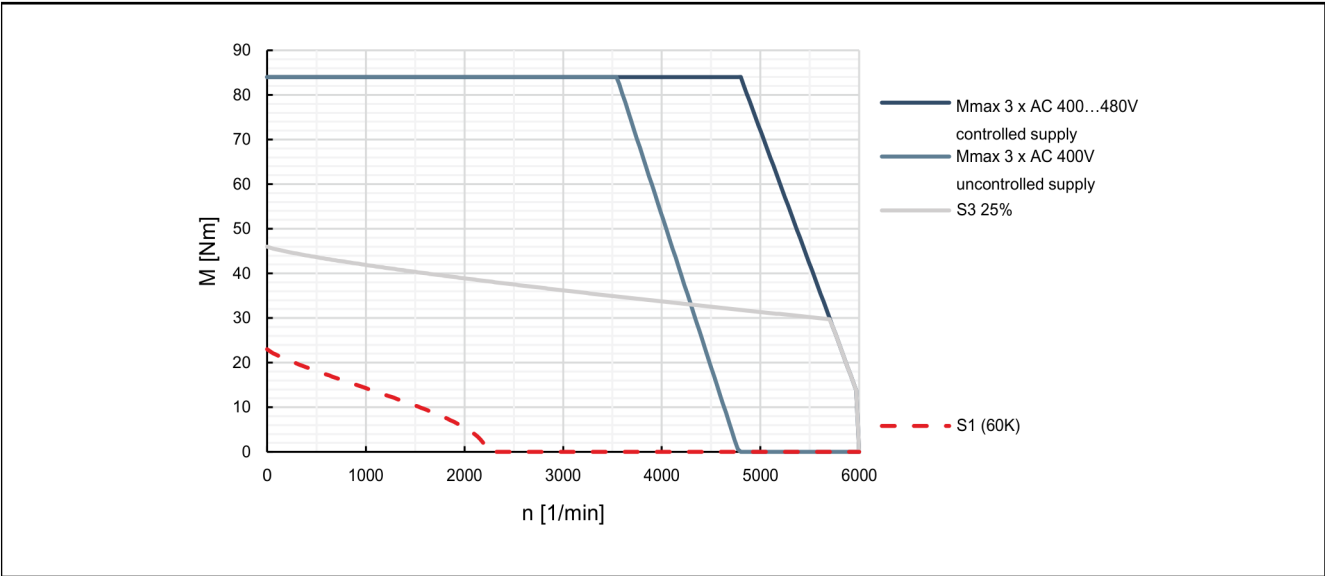


Tab. 5-56: Technical data MSK071E-0200-...-...-S...

Technical data



Tab. 5-57: Technical data MSK071E-0300- - - - S



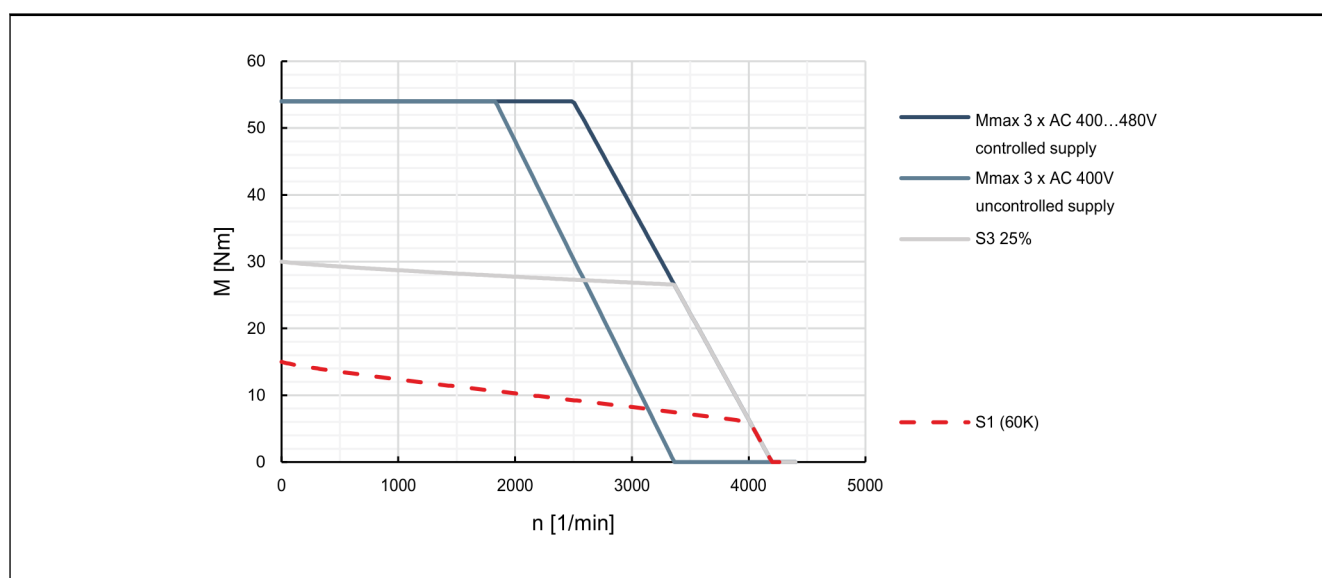
Tab. 5-58: Technical data MSK071E-0450- - - - S

5.22 MSK100A-...-NSNN Technical data

Designation	Symbol	Unit	MSK100A-0200-NN	MSK100A-0300-NN	MSK100A-0450-NN
Continuous torque at standstill 60 K	$M_{0,60}$	Nm	15.0		
Continuous current at standstill 60 K	$I_{0,60(\text{eff})}$	A	9.2	10.2	12.0
Maximum torque	M_{max}	Nm	54.0		
Maximum current	$I_{\text{max}(\text{eff})}$	A	41.4	45.9	54.0
Torque constant at 20 °C	$K_{M,N}$	Nm/A	1.89	1.70	1.45
Voltage constant at 20 °C ¹⁾	$K_{EMK,1000}$	V/1000 min ⁻¹	116.4	104.5	89.4
Winding resistance at 20 °C	R_{12}	Ohm	1.45	1.1	0.81
Winding inductance	L_{12}	mH	13.9	11.2	7.8
Leakage capacitance of the component	C_{dis}	nF	4.8	4.6	4.9
Number of pole pairs	p	-	4		
Moment of inertia of rotor	J_{red}	kg*m ²	0.01100		
Thermal time constant	T_{th}	min	48.0	39.0	
Maximum speed (electric)	$n_{\text{max el}}$	min ⁻¹	4400	5200	6000
Sound pressure level	L_P	dB[A]	61.1 (±3)	Less than 75	
Mass ²⁾	m	kg	23.0 (25.4)		
Ambient temperature during operation	T_{amb}	°C	0 ... 40		
Protection class (EN 60034-5)	-	-	IP65		
Thermal class (EN 60034-1)	T.CL.	-	155		

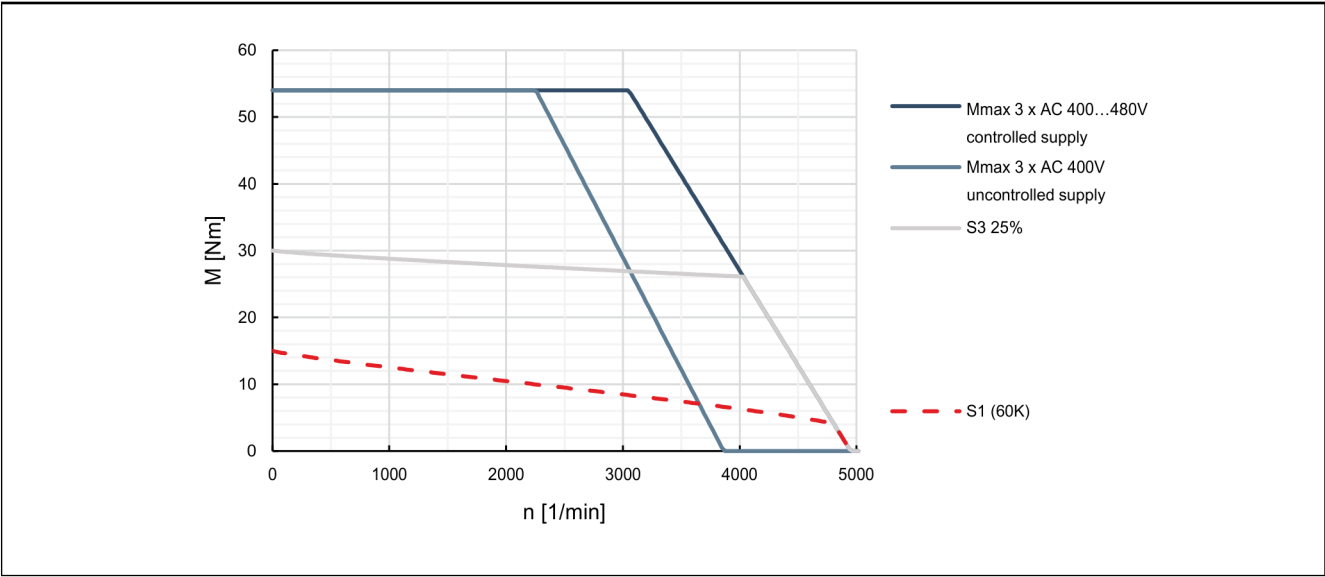
Last amended: 2014-01-21

1) Manufacturing tolerance ±5%
2) (...) Motors with holding brake 1, 2, ...
Tab. 5-59: Technical data MSK100A-...-NSNN

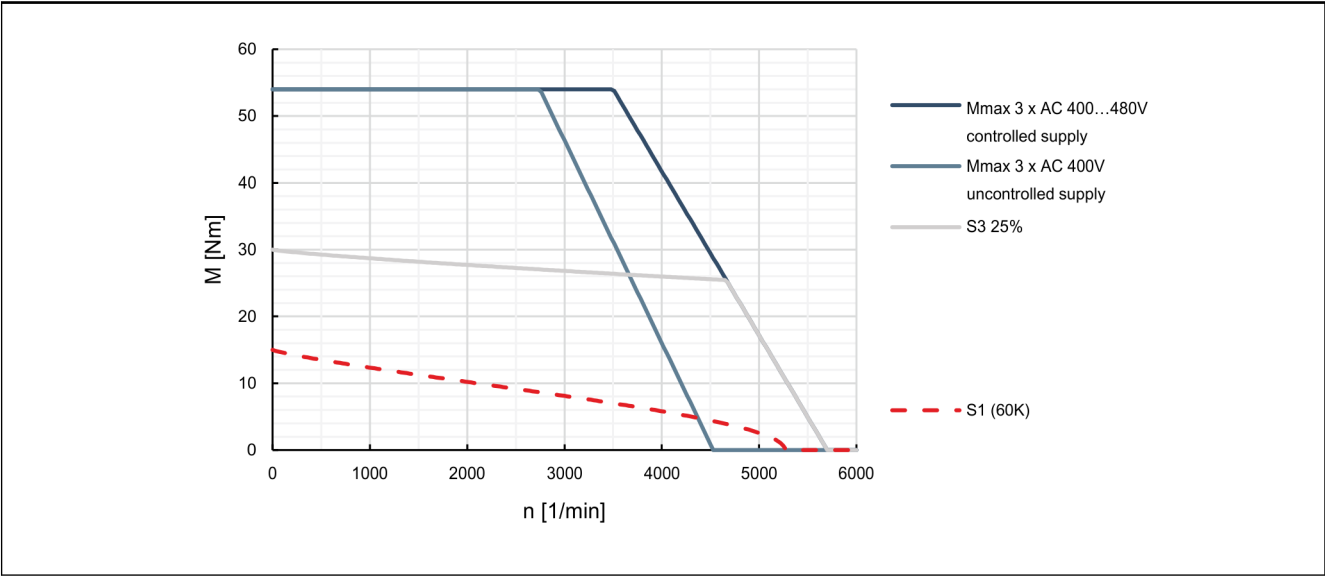


Tab. 5-60: Technical data MSK100A-0200-...-...-S

Technical data



Tab. 5-61: Technical data MSK100A-0300-__-__-__-S__



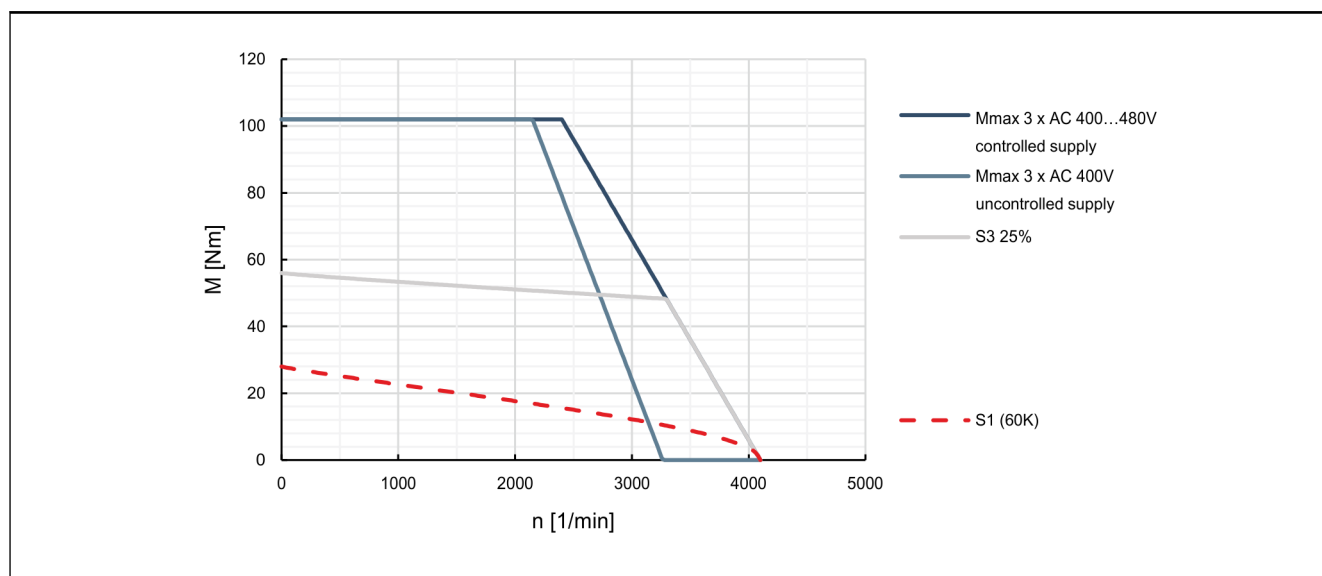
Tab. 5-62: Technical data MSK100A-0450-__-__-__-S__

5.23 MSK100B-...-NSNN Technical data

Designation	Symbol	Unit	MSK100B-0200 -NN	MSK100B-0300 -NN	MSK100B-0400 -NN	MSK100B-0450 -NN
Continuous torque at standstill 60 K	M _{0_60}	Nm	28.0			
Continuous current at standstill 60 K	I _{0_60(eff)}	A	14.7	17.4	24.5	28.5
Maximum torque	M _{max}	Nm	102.0			
Maximum current	I _{max(eff)}	A	66.2	78.3	106.7	110.7
Torque constant at 20 °C	K _{M_N}	Nm/A	2.10	1.77	1.30	1.14
Voltage constant at 20 °C ¹⁾	K _{EMK_1000}	V/1000 min ⁻¹	129.5	108.5	80.0	70.0
Winding resistance at 20 °C	R ₁₂	Ohm	0.58	0.43	0.23	0.17
Winding inductance	L ₁₂	mH	7.6	5.5	3.1	2.2
Leakage capacitance of the compo- nent	C _{dis}	nF	10.3	9.3	10.3	
Number of pole pairs	p	-	4			
Moment of inertia of rotor	J _{red}	kg*m ²	0.01920			
Thermal time constant	T _{th}	min	40.0			
Maximum speed (electric)	n _{max el}	min ⁻¹	4,100	4500		
Sound pressure level	L _p	dB[A]	< 75			
Mass ²⁾	m	kg	34.0 (36.5) (37.8)			
Ambient temperature during operation	T _{amb}	°C	0 ... 40			
Protection class (EN 60034-5)	-	-	IP65			
Thermal class (EN 60034-1)	T.CL.	-	155			
Last amended: 2014-01-21						

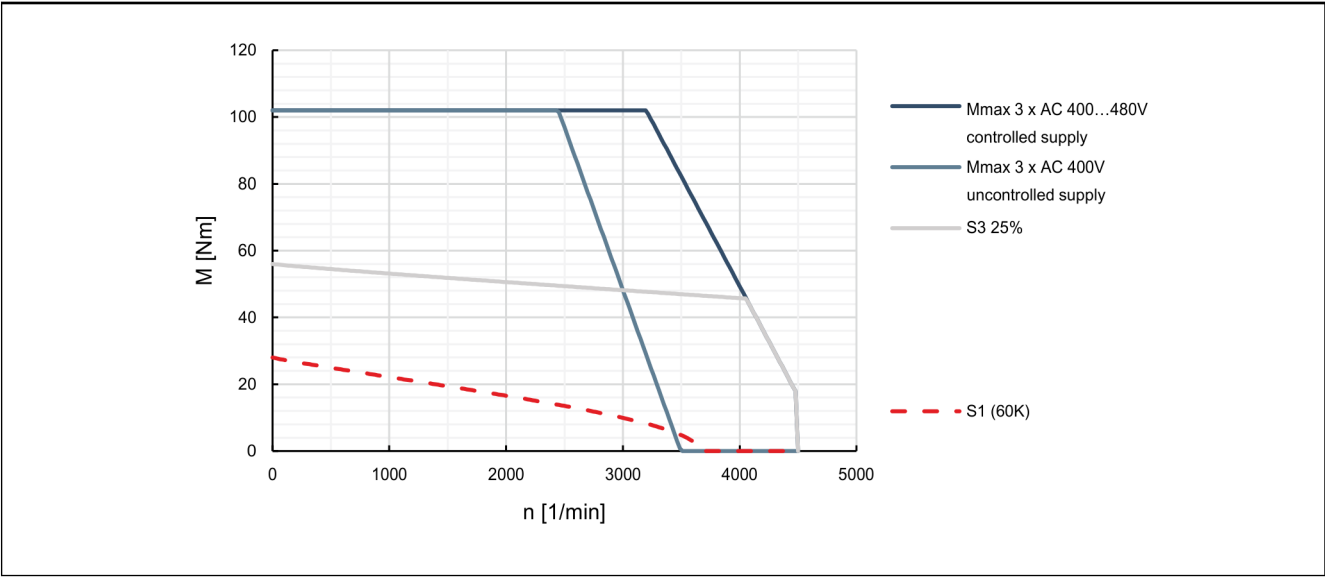
Last amended: 2014-01-21

- 1) Manufacturing tolerance $\pm 5\%$
2) (...) Motors with holding brake 1, 2, ...
Tab. 5-63: Technical data MSK100B-...-NSNN

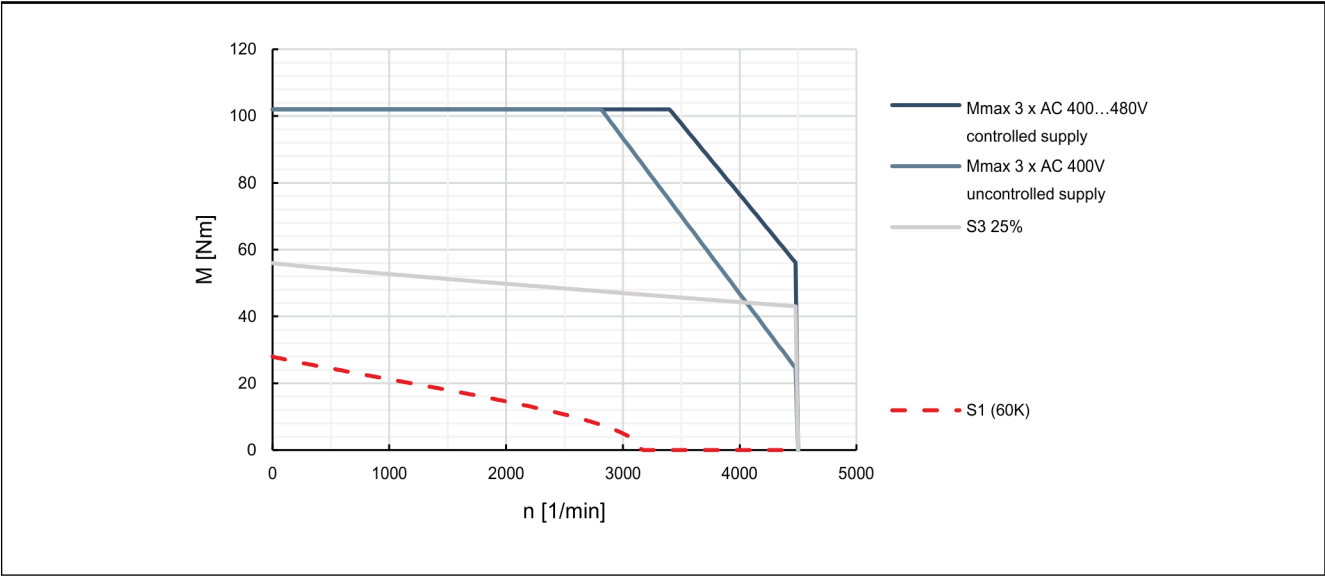


Tab. 5-64: Technical data MSK100B-0200-...-S

Technical data

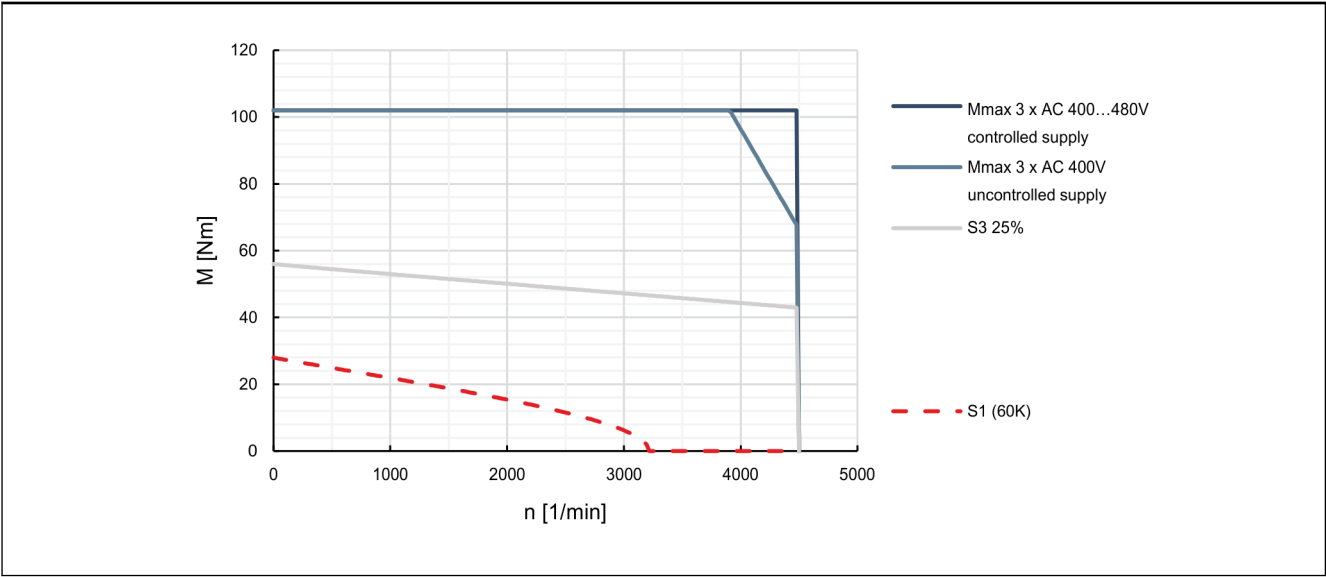


Tab. 5-65: Technical data MSK100B-0300-__-__-__-S__



Tab. 5-66: Technical data MSK100B-0400-__-__-__-S__

Technical data



Tab. 5-67: Technical data MSK100B-0450- - - - S

Technical data

5.24 MSK100C-...-NSNN Technical data

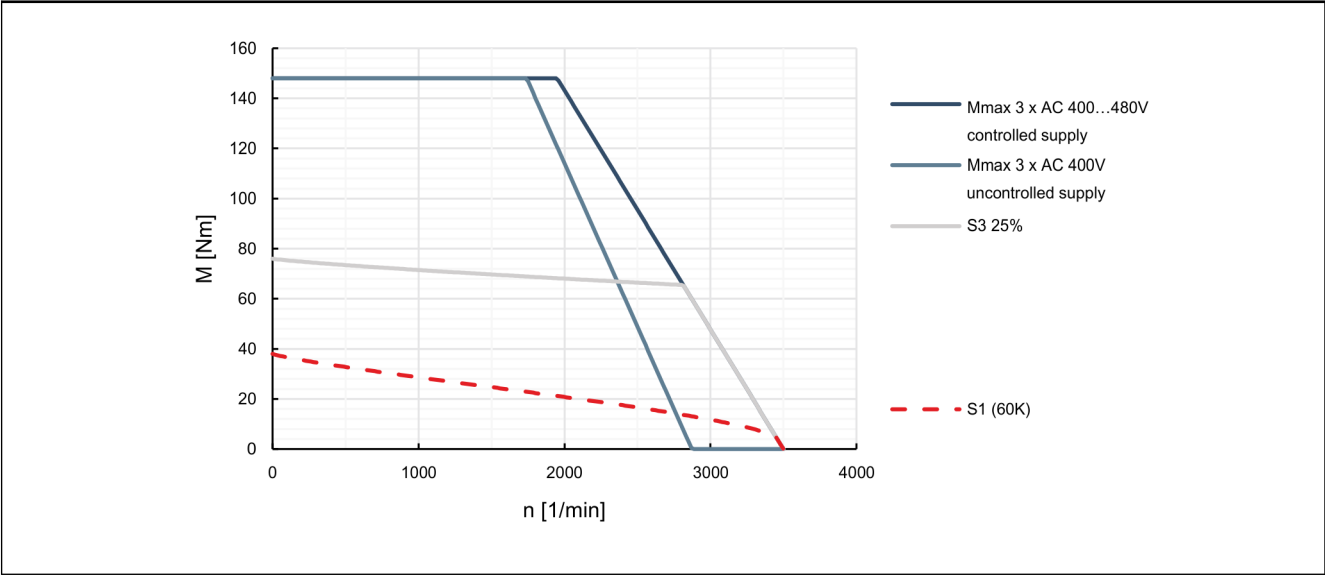
Designation	Symbol	Unit	MSK101C-0200-NN	MSK101C-0301-NN
Continuous torque at standstill 60 K	M _{0_60}	Nm	32.0	
Continuous current at standstill 60 K	I _{0_60(eff)}	A	14.9	18.7
Maximum torque	M _{max}	Nm	110.0	
Maximum current	I _{max(eff)}	A	67.1	84.2
Torque constant at 20 °C	K _{M_N}	Nm/A	2.37	1.88
Voltage constant at 20 °C ¹⁾	K _{EMK_1000}	V/1000 min ⁻¹	146.0	115.7
Winding resistance at 20 °C	R ₁₂	Ohm	0.68	0.45
Winding inductance	L ₁₂	mH	9.7	6.0
Leakage capacitance of the component	C _{dis}	nF	6.2	
Number of pole pairs	p	-	4	
Moment of inertia of rotor	J _{red}	kg*m ²	0.00650	
Thermal time constant	T _{th}	min	36.0	38.0
Maximum speed (electric)	n _{max el}	min ⁻¹	3300	4000
Sound pressure level	L _p	dB[A]	< 75	
Mass ²⁾	m	kg	28.3 (32.1)	
Ambient temperature during operation	T _{amb}	°C	0 ... 40	
Protection class (EN 60034-5)	-	-	IP65	
Thermal class (EN 60034-1)	T.CL.	-	155	

Last amended: 2014-01-21

1) Manufacturing tolerance ±5%

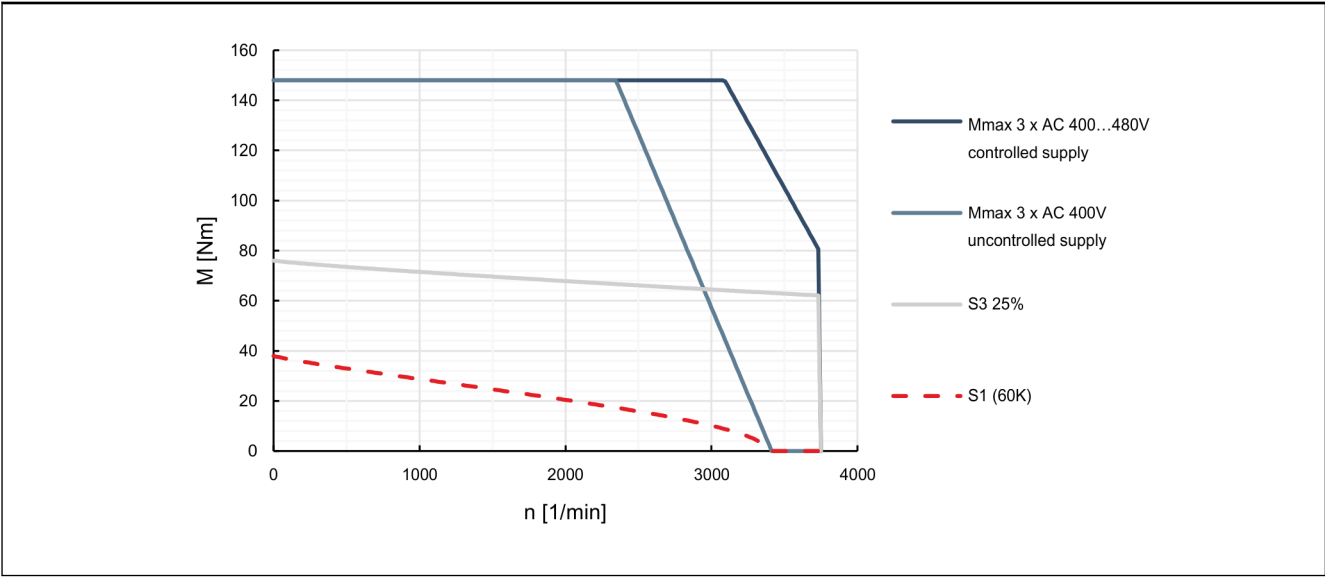
2) (...) Motors with holding brake 1, 2, ...

Tab. 5-68: Technical data MSK100C-...-NSNN



Tab. 5-69: Technical data MSK100C-0200-...-S_

Technical data



Tab. 5-70: Technical data MSK100C-0301- - - - S

Technical data

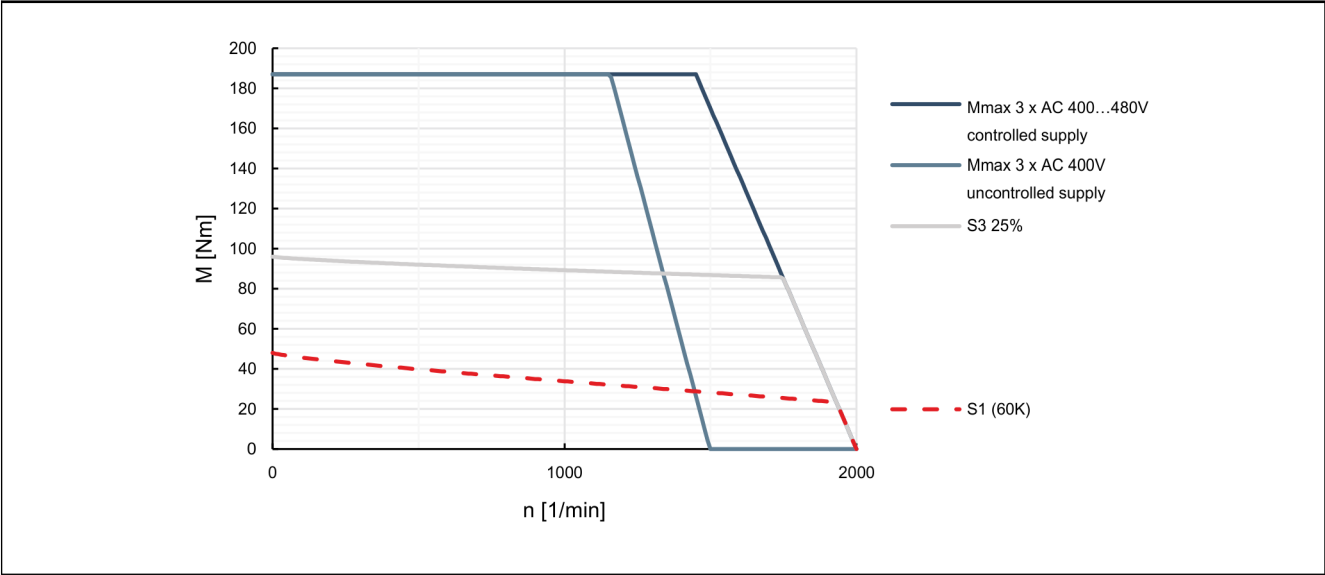
5.25 MSK100D-...-NSNN Technical data

Designation	Symbol	Unit	MSK100D-0200-NN	MSK100D-0300-NN	MSK100D-0350-NN
Continuous torque at standstill 60 K	M _{0_60}	Nm	48.0		
Continuous current at standstill 60 K	I _{0_60(eff)}	A	13.0	20.7	29.9
Maximum torque	M _{max}	Nm	187.0		185.0
Maximum current	I _{max(eff)}	A	58.5	93.2	135.0
Torque constant at 20 °C	K _{M_N}	Nm/A	4.28	2.61	1.86
Voltage constant at 20 °C ¹⁾	K _{EMK_1000}	V/1000 min-1	263.5	161.0	114.5
Winding resistance at 20 °C	R ₁₂	Ohm	0.97	0.35	0.2
Winding inductance	L ₁₂	mH	14.8	5.65	3.2
Leakage capacitance of the component	C _{dis}	nF	17.6	16.0	18.0
Number of pole pairs	p	-	4		
Moment of inertia of rotor	J _{red}	kg*m²	0.03500		
Thermal time constant	T _{th}	min	90.0		
Maximum speed (electric)	n _{max el}	min ⁻¹	2000	3000	
Sound pressure level	L _p	dB[A]	< 75		
Mass ²⁾	m	kg	56.0 (59.8)		
Ambient temperature during operation	T _{amb}	°C	0 ... 40		
Protection class (EN 60034-5)	-	-	IP65		
Thermal class (EN 60034-1)	T.CL.	-	155		
Last amended: 2017-03-15					

1) Manufacturing tolerance ±5%

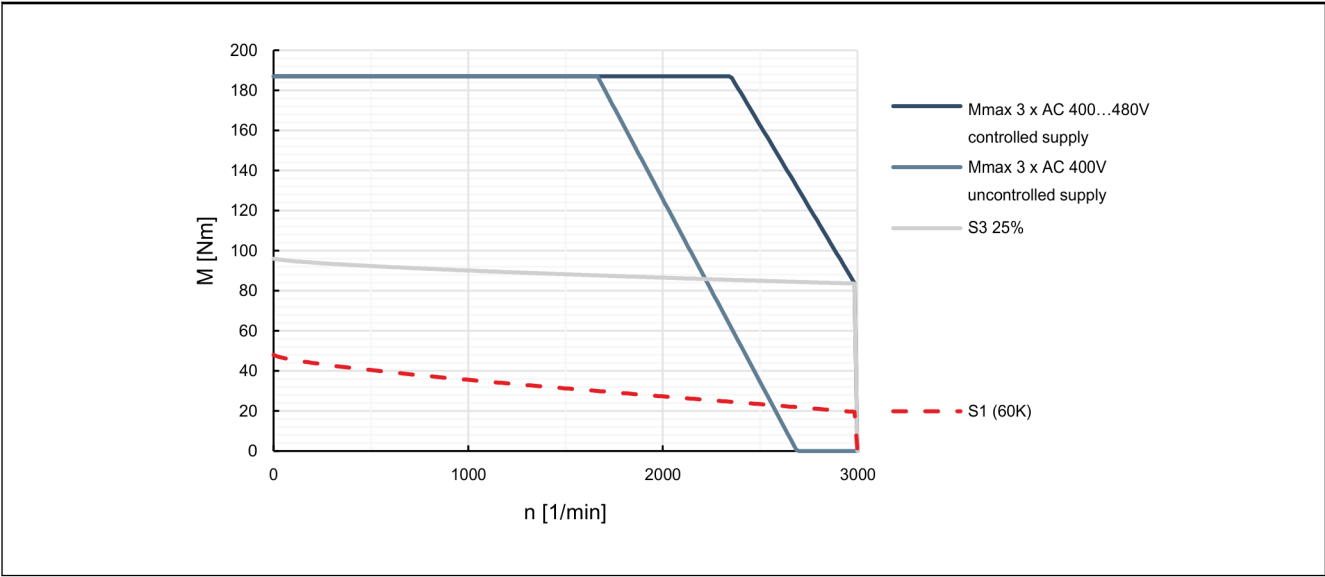
2) (...) Motors with holding brake 1, 2, ...

Tab. 5-71: Technical data MSK100D-...-NSNN

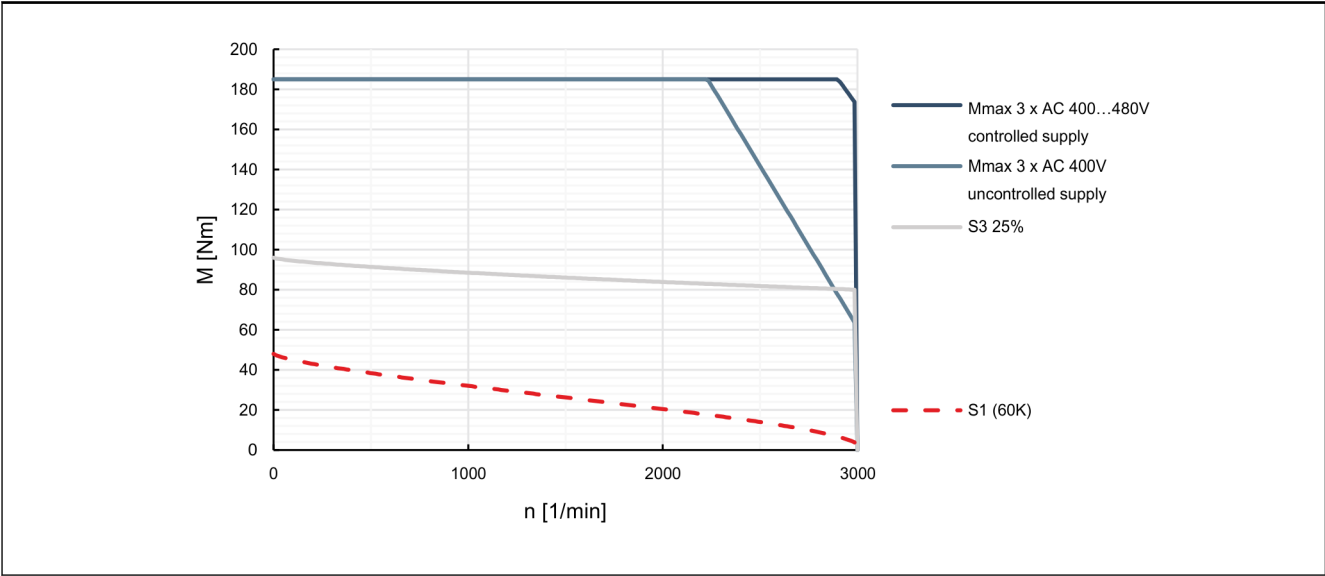


Tab. 5-72: Technical data MSK100D-0200-...-S_

Technical data



Tab. 5-73: Technical data MSK100D-0300- - - - S_



Tab. 5-74: Technical data MSK100D-0350- - - - S_

Technical data

5.26 MSK101C-...-NSNN Technical data

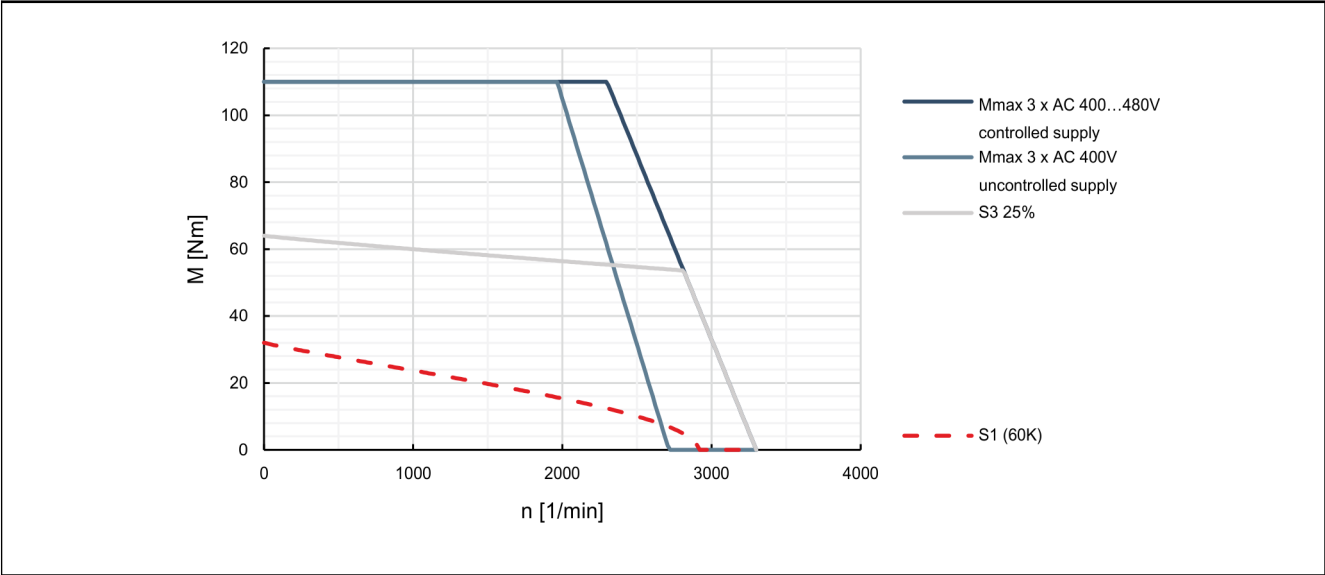
Designation	Symbol	Unit	MSK101C-0200-NN	MSK101C-0301-NN
Continuous torque at standstill 60 K	M _{0_60}	Nm	32.0	
Continuous current at standstill 60 K	I _{0_60(eff)}	A	14.9	18.7
Maximum torque	M _{max}	Nm	110.0	
Maximum current	I _{max(eff)}	A	67.1	84.2
Torque constant at 20 °C	K _{M_N}	Nm/A	2.37	1.88
Voltage constant at 20 °C ¹⁾	K _{EMK_1000}	V/1000 min-1	146.0	115.7
Winding resistance at 20 °C	R ₁₂	Ohm	0.68	0.45
Winding inductance	L ₁₂	mH	9.7	6.0
Leakage capacitance of the compo- nent	C _{dis}	nF	6.2	
Number of pole pairs	p	-	4	
Moment of inertia of rotor	J _{red}	kg*m²	0.00650	
Thermal time constant	T _{th}	min	36.0	38.0
Maximum speed (electric)	n _{max el}	min ⁻¹	3300	4000
Sound pressure level	L _p	dB[A]	< 75	
Mass ²⁾	m	kg	28.3 (32.1)	
Ambient temperature during operation	T _{amb}	°C	0 ... 40	
Protection class (EN 60034-5)	-	-	IP65	
Thermal class (EN 60034-1)	T.CL.	-	155	

Last amended: 2014-01-21

1)
2)

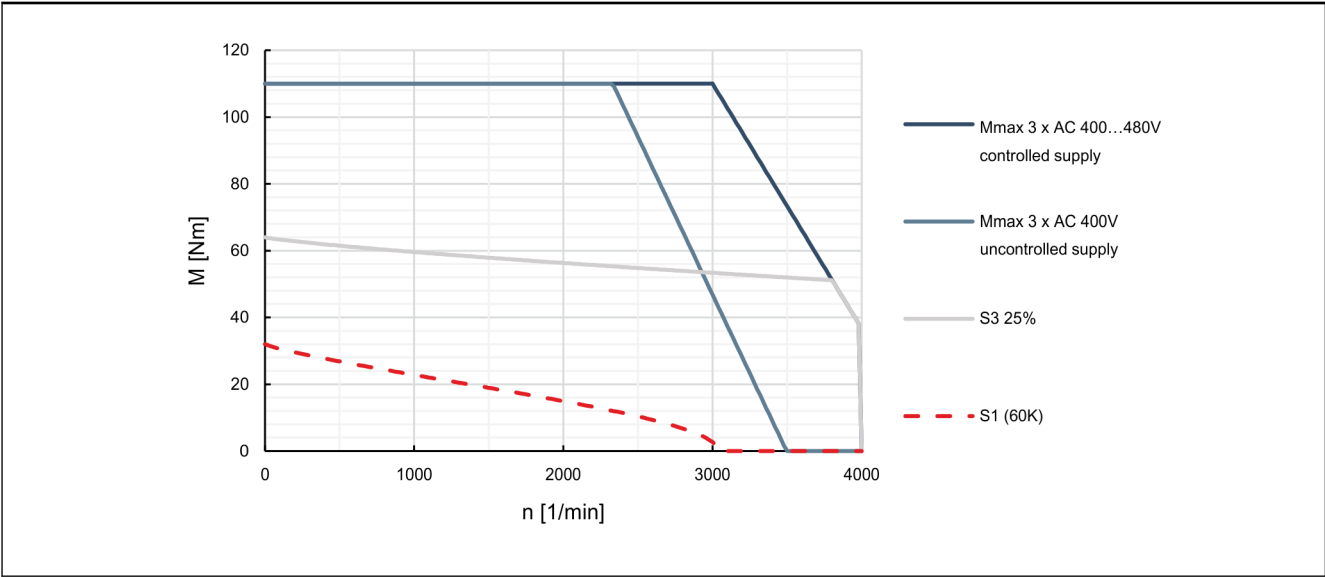
Manufacturing tolerance ±5%
(...) Motors with holding brake 1, 2, ...

Tab. 5-75: Technical data MSK101C-...-NSNN



Tab. 5-76: Technical data MSK101C-0200-__-__-__-S__

Technical data



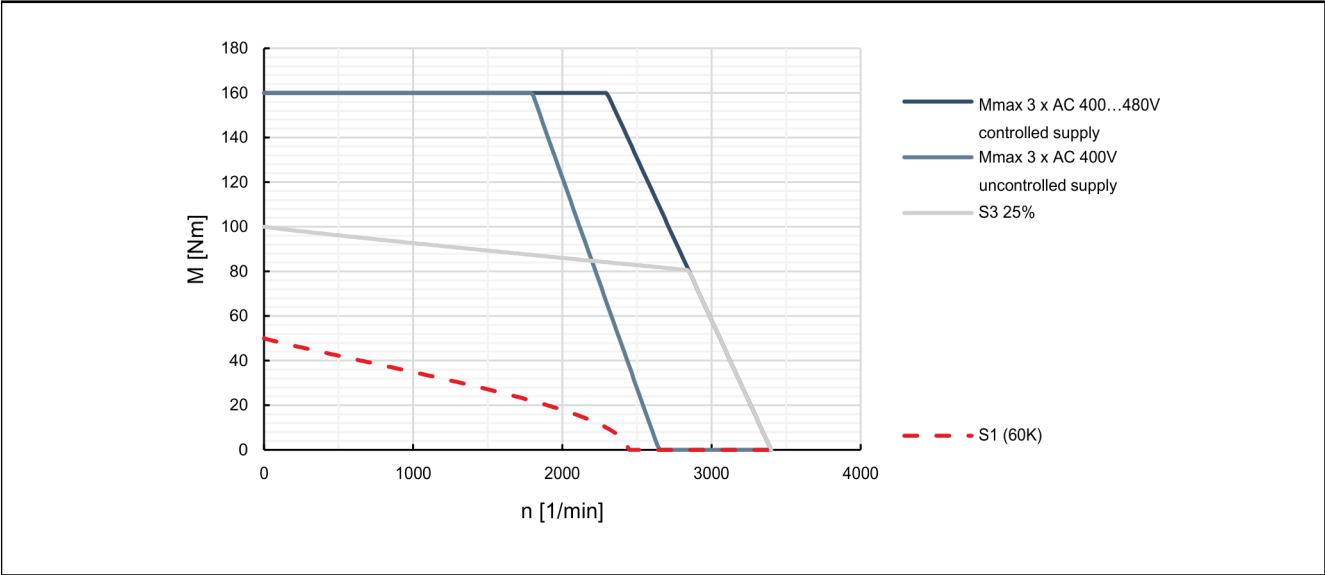
Tab. 5-77: Technical data MSK101C-0301- - - - S

Technical data

5.27 MSK101D-...-NSNN Technical data

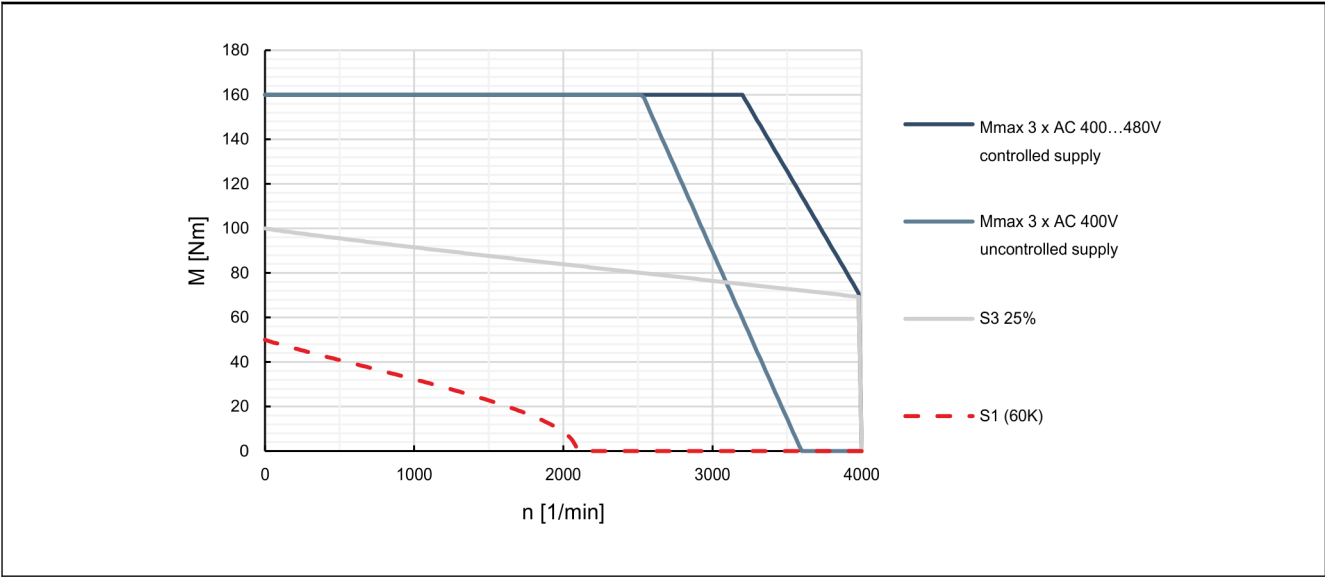
Designation	Symbol	Unit	MSK101D-0200-NN	MSK101D-0301-NN
Continuous torque at standstill 60 K	M _{0_60}	Nm	50.0	
Continuous current at standstill 60 K	I _{0_60(eff)}	A	22.2	30.6
Maximum torque	M _{max}	Nm	160.0	
Maximum current	I _{max(eff)}	A	99.9	137.7
Torque constant at 20 °C	K _{M_N}	Nm/A	2.48	1.80
Voltage constant at 20 °C ¹⁾	K _{EMK_1000}	V/1000 min ⁻¹	152.0	113.0
Winding resistance at 20 °C	R ₁₂	Ohm	0.35	0.19
Winding inductance	L ₁₂	mH	6.0	3.2
Leakage capacitance of the component	C _{dis}	nF	13.2	9.1
Number of pole pairs	p	-	4	
Moment of inertia of rotor	J _{red}	kg*m ²	0.00932	
Thermal time constant	T _{th}	min	100.0	
Maximum speed (electric)	n _{max el}	min ⁻¹	3400	4000
Sound pressure level	L _p	dB[A]	< 75	
Mass ²⁾	m	kg	40.0 (43.8) (46.2)	
Ambient temperature during operation	T _{amb}	°C	0 ... 40	
Protection class (EN 60034-5)	-	-	IP65	
Thermal class (EN 60034-1)	T.CL.	-	155	
Last amended: 2014-01-21				

1) Manufacturing tolerance ±5%
2) (...) Motors with holding brake 1, 2, ...
Tab. 5-78: Technical data MSK101D-...-NSNN



Tab. 5-79: Technical data MSK101D-0200-...-S_

Technical data



Tab. 5-80: Technical data MSK101D-0301-__-__-__-S__

6 Specifications

6.1 Technical design

Motor Design	Motor frame size B5 acc. to EN60034-7 (for additional information see chapter 10.3 "Design and installation positions" on page 120)
Housing varnish	Black (RAL9005)
Vibration severity grade (quality of vibration)	Level A, acc. to EN 60034-14:2004
Concentricity, run-out and alignment	according to DIN 42955, Edition 12.81 (IEC 60072-1)

Encoder	Concentricity tolerance		Concentricity and alignment tolerance	
S1, M1,	N	---	N	---
S2, M2	---	R	---	R

Tab. 6-1: Tolerance for concentricity, run-out and alignment depend from the encoder option

Flange	according to DIN 42948, ed. 11.65.
Output shaft, shaft end and centering hole	All motors with keyway are balanced with complete key. The machine element to be driven must be balanced without a key. Shaft end cylindrical according to DIN 748, Part 3, ed. 07.75. IEC 60072 (-1). Centering hole, according to DIN 332 Part 2, Edition 05.83

Motor	Key DIN 6885-A ¹⁾	Centering hole DIN 332 Part 2
MSK030	3×3×16	DS M3
MSK040	5×5 ×20	DS M5
MSK050	6×6×32	DS M6
MSK060	8×7×40	DS M8
MSK061	6×6×32	DS M6
MSK070	10×8×45	DS M10
MSK071	10×8×45	DS M10
MSK076	8×7×40	DS M8
MSK100	10×8×45	DS M10
MSK101	10×8×70	DS M12

¹⁾ not in the scope of delivery

Tab. 6-2: Key and centering hole

Specifications

6.2 MSK030...-NSNN Specifications

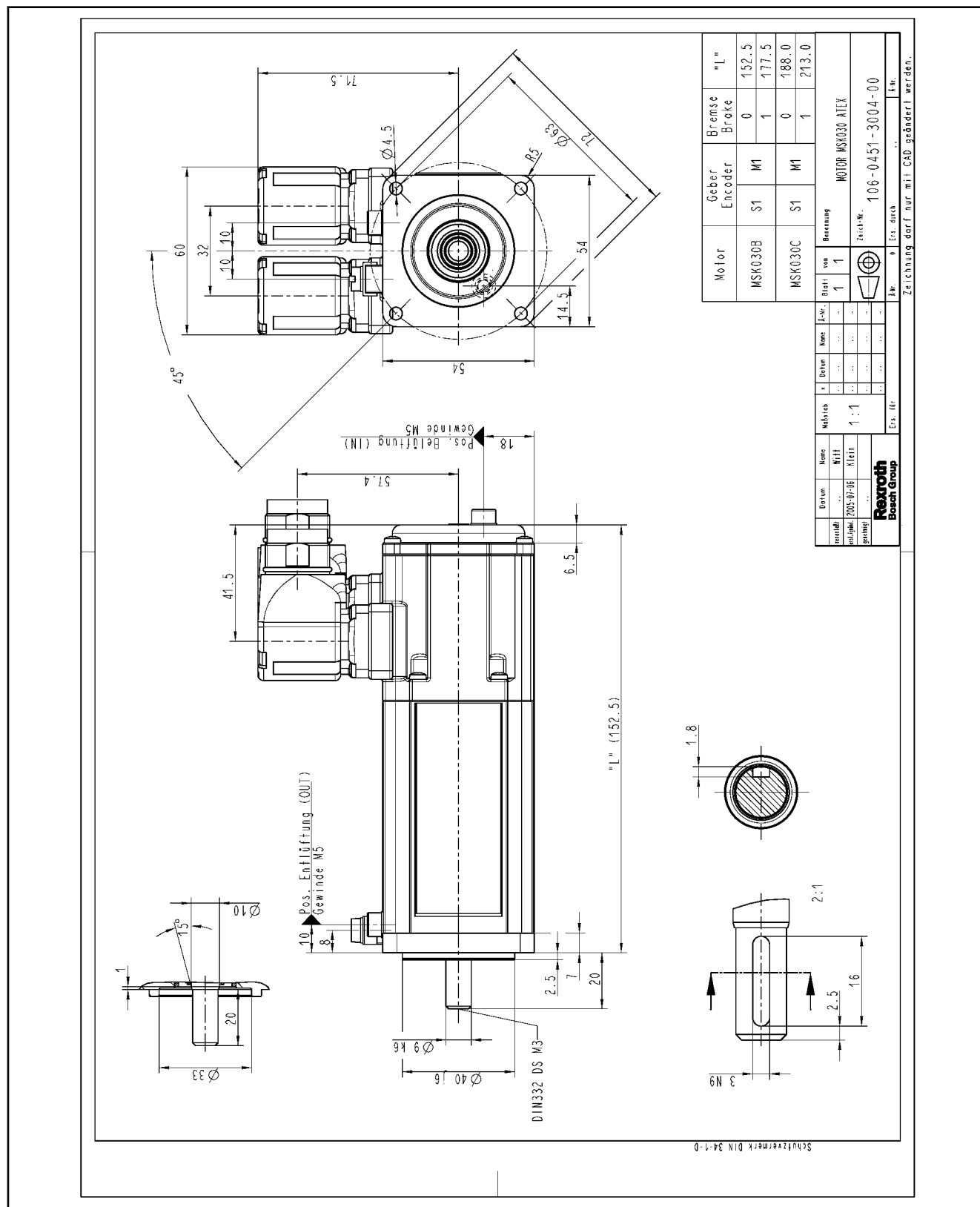


Fig. 6-1: MSK030 specification (ATEX design)

6.3 MSK040...-NSNN Specifications

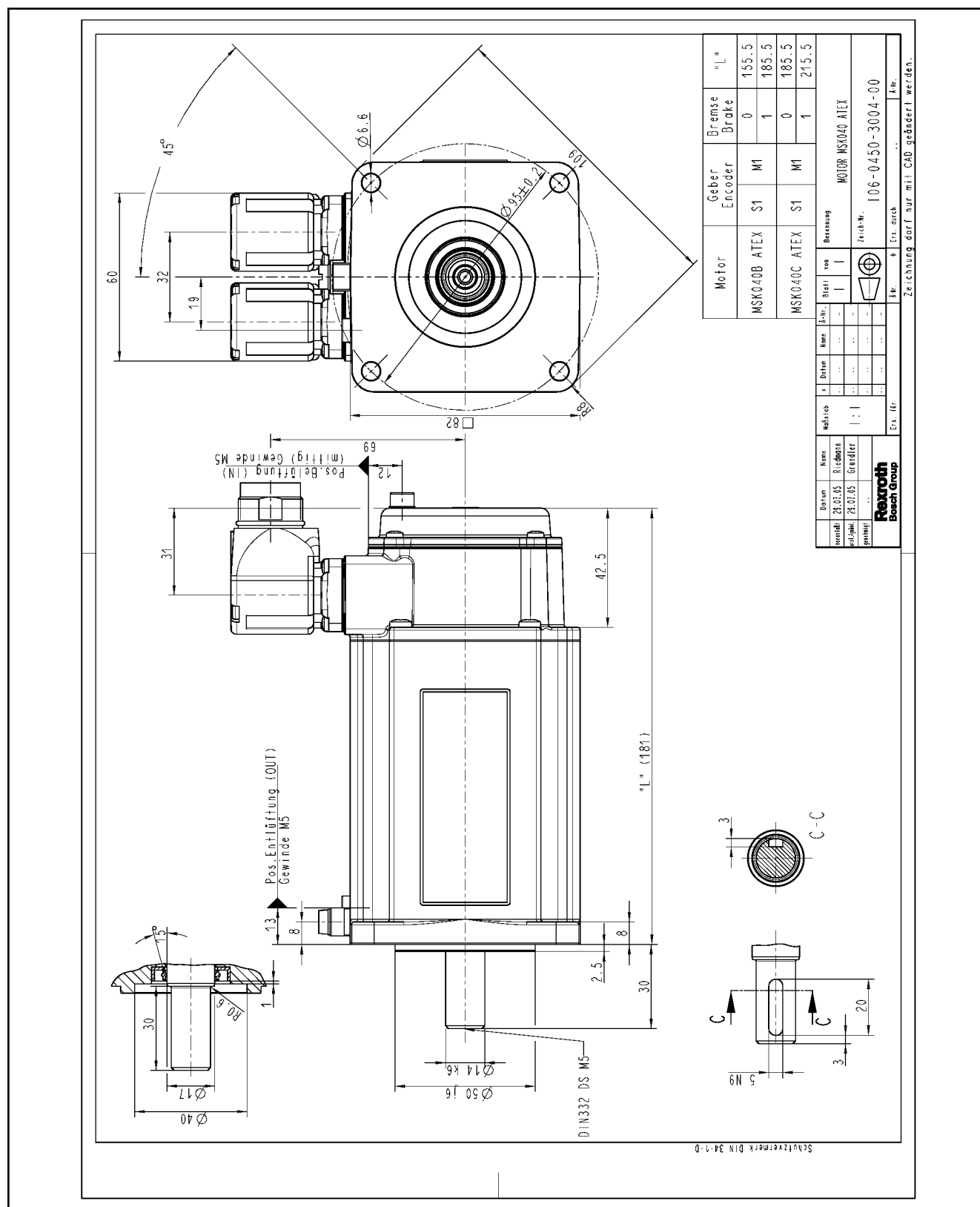


Fig. 6-2: MSK040 specification (ATEX design)

Specifications

6.4 MSK050...-NSNN Specifications

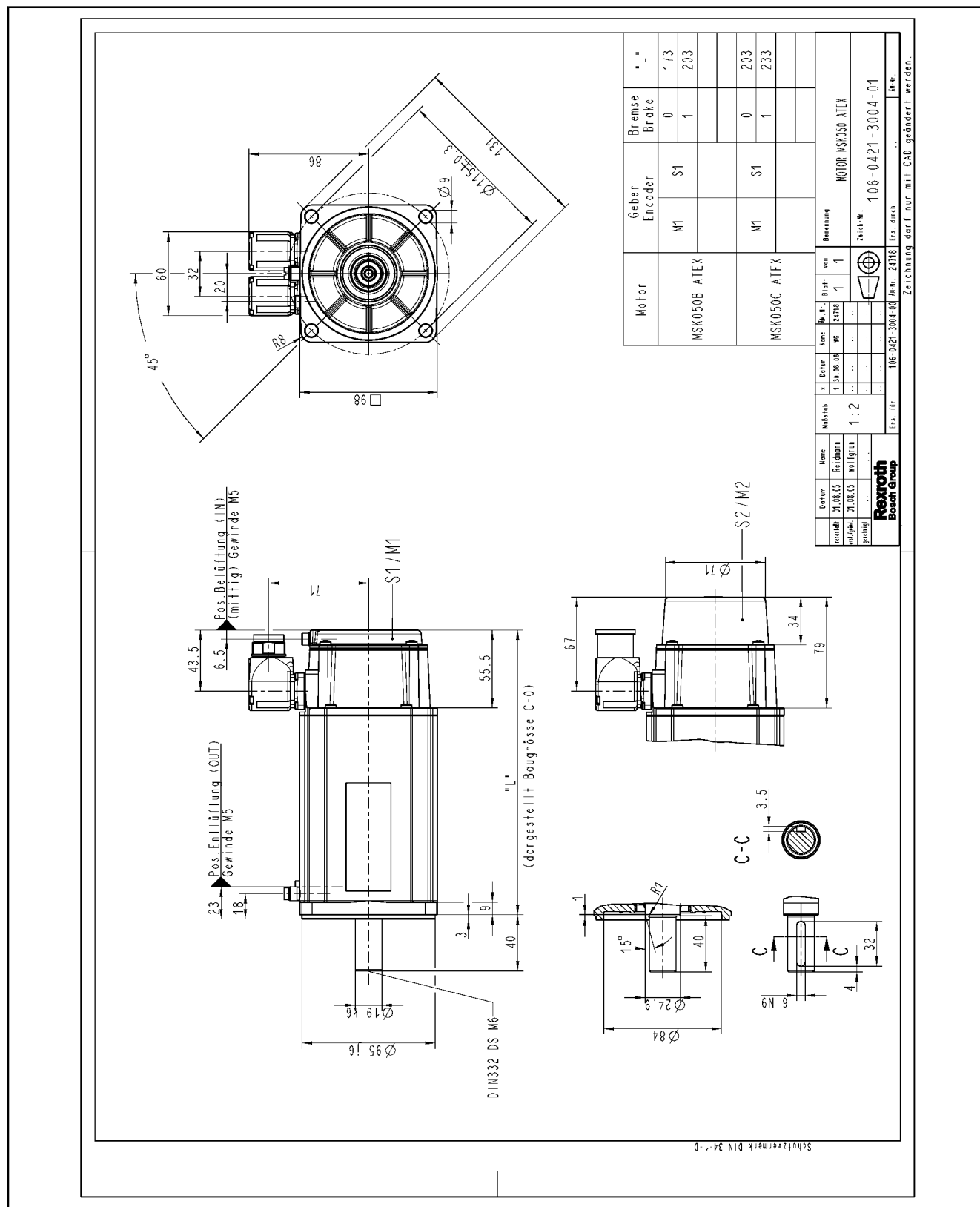


Fig. 6-3: MSK050 specification (ATEX design)

6.5 MSK060...-NSNN Specifications

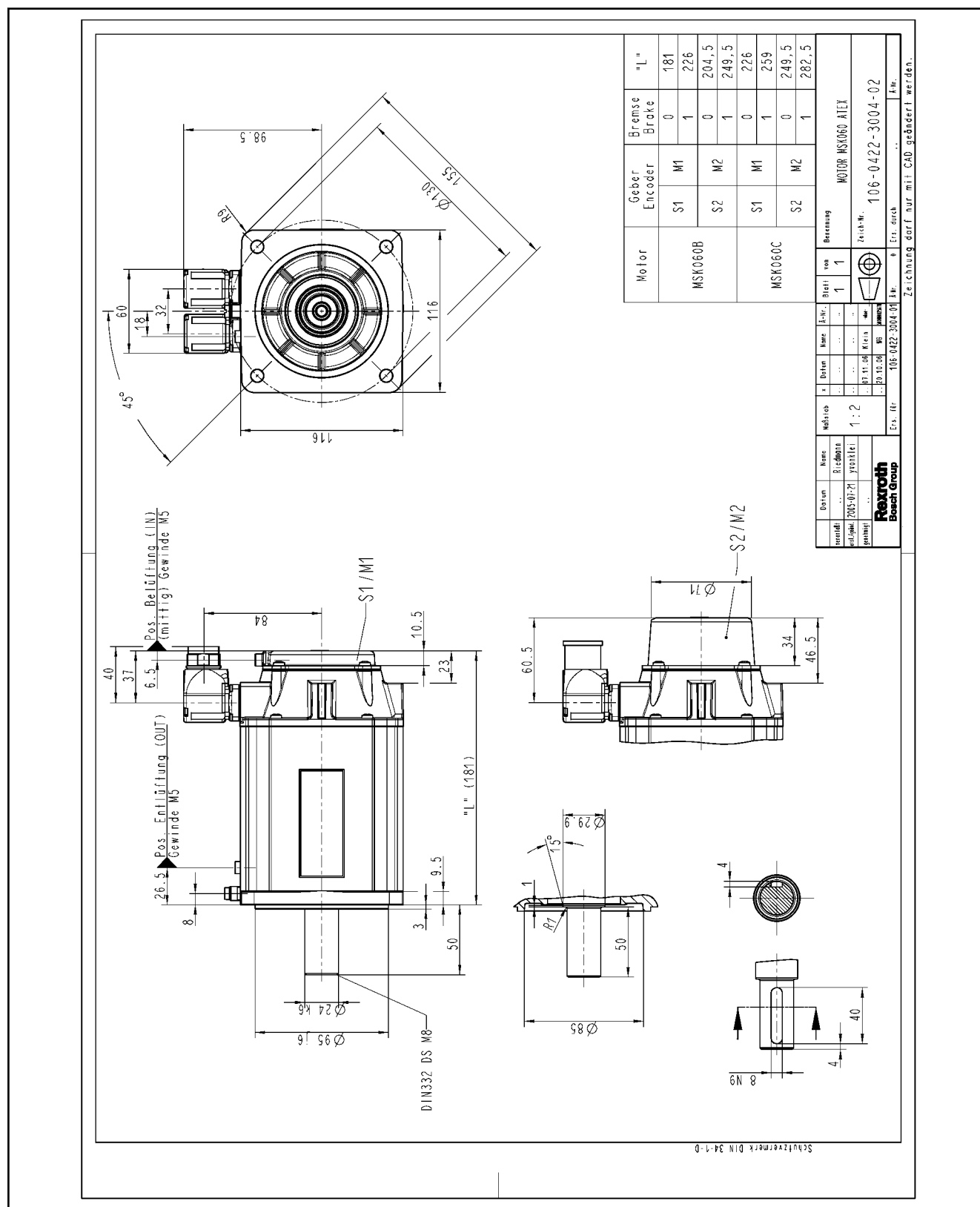


Fig. 6-4: MSK060 specification (ATEX design)

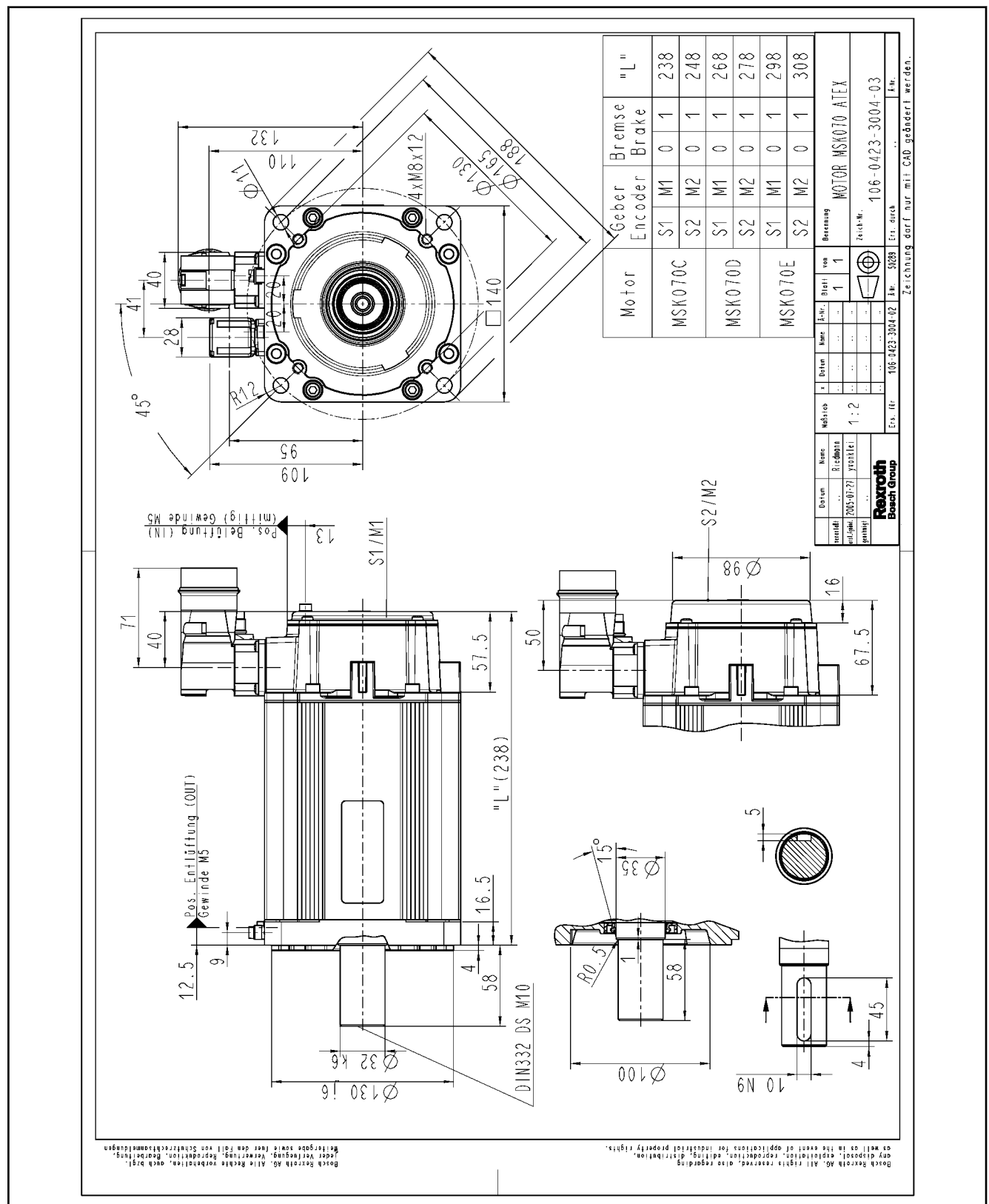
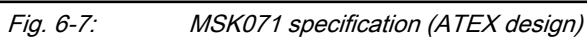


Fig. 6-6: MSK070 specification (ATEX design)

6.8 MSK071...-NSNN Specifications



6.9 MSK076...-NSNN Specifications

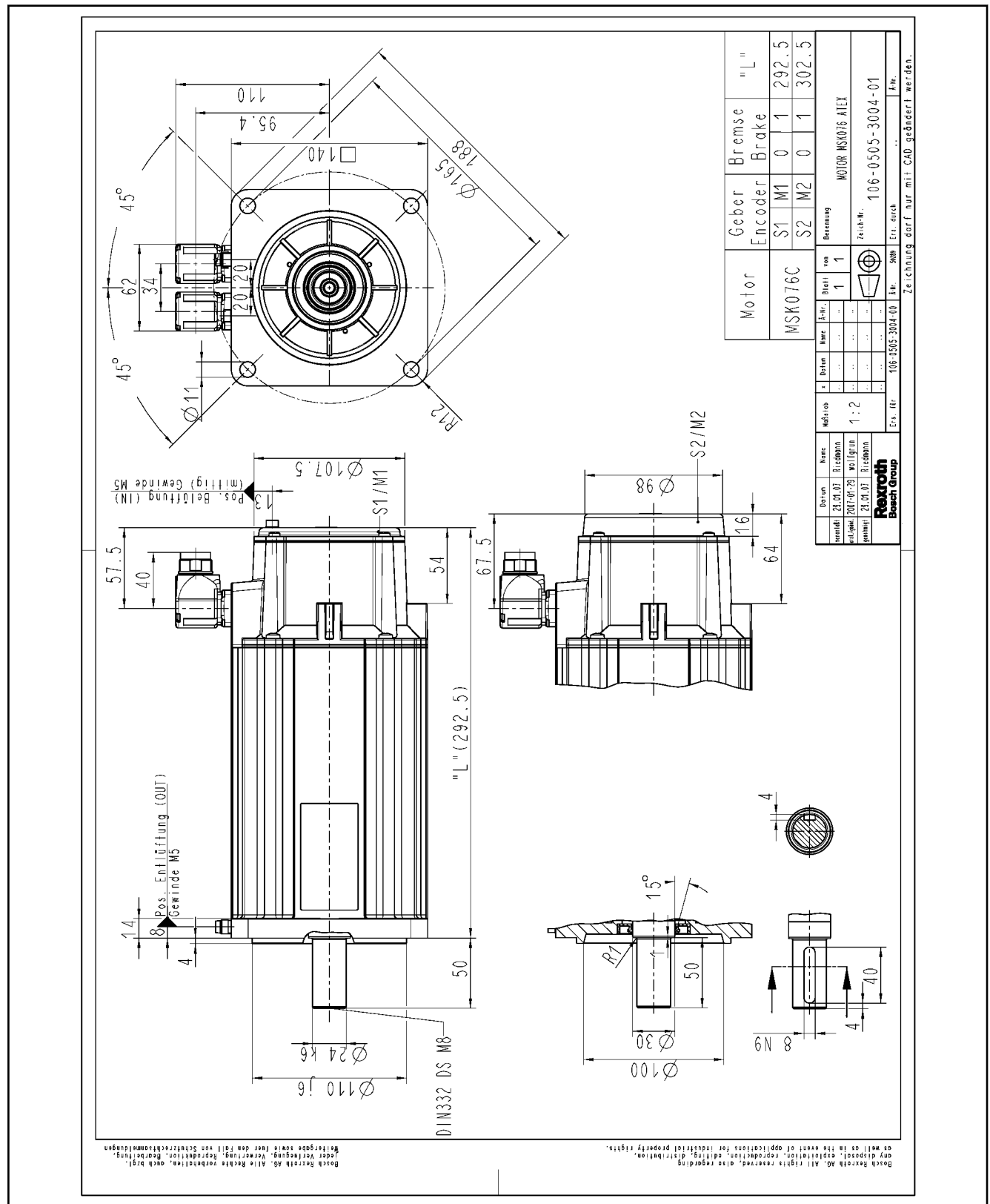


Fig. 6-8: MSK076 specification (ATEX design)

6.11 MSK101...-NSNN Specifications

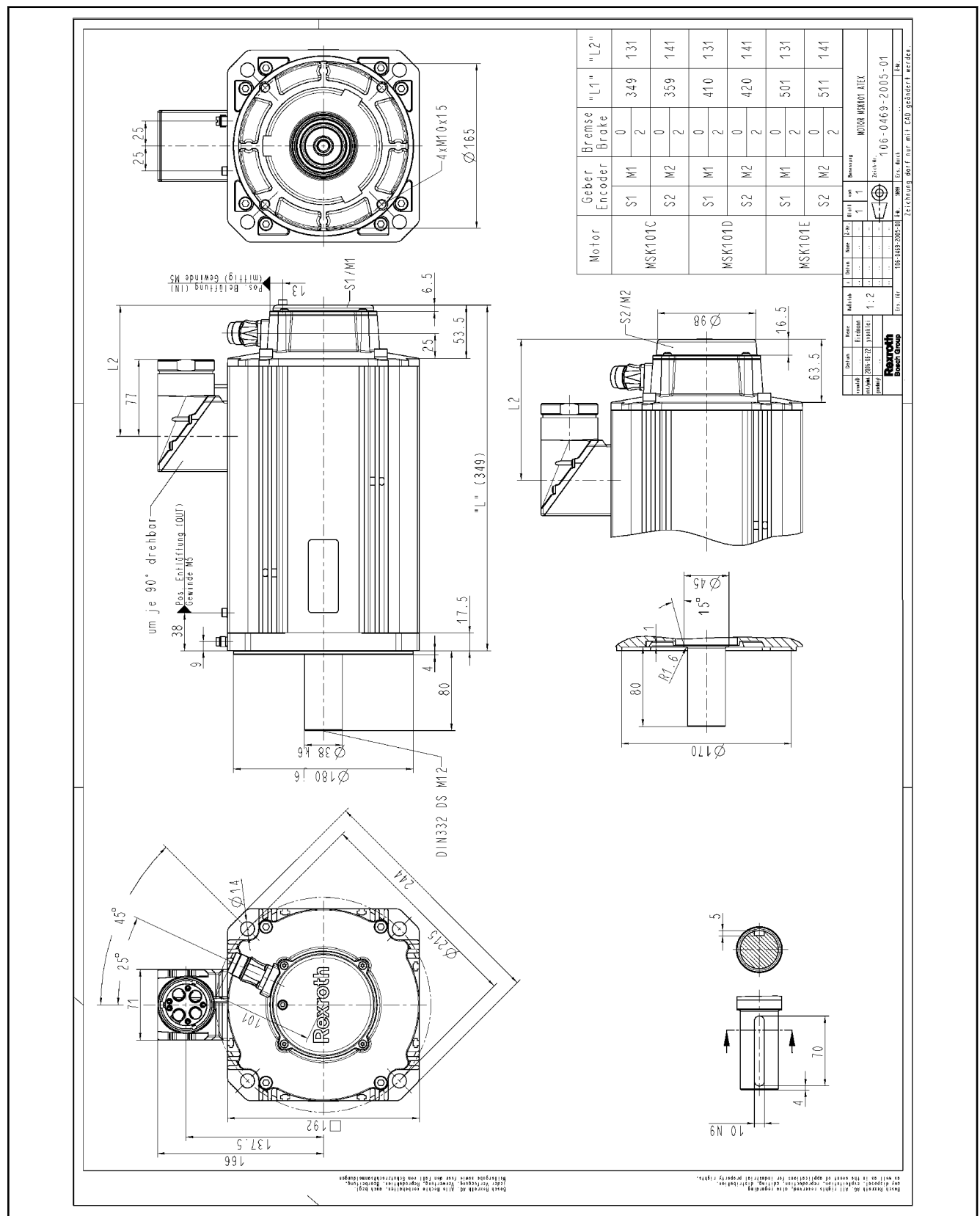


Fig. 6-10: MSK101 specification (ATEX design)

7 Type code

7.1 MSK type code - structure and description

General information The basis for every order for a Rexroth product is the type code. All available motor variants are clearly described by the type code. The individual type code positions (short text column) and their meaning are described below.



Have your Bosch Rexroth sales partner check the availability of individual options before placing an order.

Product Example: **MSK**-...

MSK three-digit Rexroth specific designation of a servo motors series

Frame size Example: **MSK050**-...

The motor size determines important mechanical motor dimensions and is proportional to the power rating.

Frame length Example: **MSK050B**-...

Within a series, increasing motor frame length is graded by means of code letters in alphabetical order. Frame lengths are e.g. B, C, D and E.

Winding Example: **MSK050B-0300**-...

The four-digit number sequence indicates the rated speed which applies to the respective winding variant.

Cooling type Example: **MSK050B-0300-NN**-...

Option	Design	Note
NN	Natural convection	Fan installation in ATEX motors not possible

Tab. 7-1: Cooling type

Encoder Example: **MSK050B-0300-NN-S1**-...

MSK motors are equipped with built-in encoder systems. For controlling the motor speed and/or positioning of the motor, the drive control unit requires the current motor position.

Electrical connection Example: **MSK050B-0300-NN-S1-U**-...

Option	Description
U	Power and encoder connector, rotatable
A	Cable connector, A side
B	Cable connector, B side
L	Cable connector to the left
R	Cable connector to the right
Detailed description of the plug connectors see chapter 9 "Connection technique" on page 109	

Tab. 7-2: Electrical connection

Shaft Example: **MSK050B-0300-NN-S1-UG**-...

MSK motors provide the following options to connect the machine elements to be driven to the motor shafts.

Type code

Option	Design	Detail
G	Smooth shaft	With frontal centering hole with "DS" thread according to DIN 332, part 2, edition 05.83
P	Shaft with keyway	Keyway according to DIN 6885, sheet 1, edition 08.68 (details see dimensional drawing)

Tab. 7-3: Output shafts



MSK motors are balanced with key. The corresponding key is not included in the scope of delivery.

Holding brake

Example: MSK050B-0300-NN-S1-UG1-...

MSK motors are optionally available with electrically released holding brakes and different holding torques.

Option	Holding brakes
0	Without holding brake
1, 2, 3	With holding brake The holding torques are specified in the motor type codes.

Tab. 7-4: Holding brakes



The holding brake is not suitable for personal protection and cannot be used as a service brake. Observe the installation and safety instructions for the motor holding brakes in the chapter "Application instructions"!

Design

Example: MSK050B-0300-NN-S1-UG1-**NNNN**

NNNN = standard version

NSNN = standard and Ex version according to equipment group II, categories 3G and 3D according to DIN EN 60079 et seq.

RNNN = version with increased concentricity quality

RSNN = version with increased concentricity quality and Ex version according to equipment group II, categories 3G and 3D according to DIN EN 60079 et seq.

Note

Further necessary information concerning the handling of the type code can be found here. These can be, for example, descriptions of footnotes or information on delivery options.

7.2 MSK030 Type code

Abbreviation	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	2	1	2	3	4	5	6	7	8	9	0	3	1	2	3	4	5	6	7	8	9	0	4			
column																																														
Example:	M	S	K	0	3	0	C	-	0	9	0	0	-	N	N	-	S	1	-	U	G	0	-	N	N	N	N																			
Product																																														
MSK																																														
Size																																														
030																																														
Lengths																																														
Winding																																														
MSK030B																																														
MSK030C																																														
Cooling																																														
Natural convection																																														
Encoder ¹⁾																																														
Optical encoder, Singleturn Hiperface, with 128 signal periods																																														
Capacitive encoder, Singleturn Hiperface, with 16 signal periods																																														
Optical encoder, Multiturn absolute Hiperface, with 128 signal periods																																														
Capacitive encoder, Multiturn absolute Hiperface, with 16 signal periods																																														
Electrical Connection																																														
Connector, rotatable 240°																																														
Shaft																																														
Smooth shaft with shaft sealing ring (standard)																																														
Shaft with keyway acc. to DIN 6885-1 with shaft sealing ring																																														
Holding Brake																																														
Without holding brake																																														
Holding brake, electrically-released, 1 Nm																																														
Other Design																																														
Standard																																														
Standard and Ex-design acc. to device group II, categories 3G and 3D acc. to EN 60079 ff																																														
Remark																																														
1) Encoder "S3" and "M3" are only available with other design "NNNN"																																														

Fig. 7-1: MSK030 Type Code

Type code

7.3 MSK040 Type code

[illegible]

Remark

- 1) Encoder "S3" and "M3" are only available with other design "NNNN"

Fig. 7-2: Type code MSK040

7.4 MSK050 Type code

Abbreviation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40		
Example:	M	S	K	0	5	0	C	-	0	6	0	0	-	N	N	-	S	1	-	U	G	0	-	N	N	N	N															
Product																																										
MSK	= MSK																																									
Size																																										
050	=050																																									
Lengths																																										
Lengths	= B, C																																									
Winding																																										
MSK050B	= 0300, 0450, 0600																																									
MSK050C	= 0300, 0450, 0600																																									
Cooling																																										
Natural convection	= NN																																									
Encoder ¹⁾																																										
Optical encoder, Singleturn Hiperface, with 128 signal periods	= S1																																									
Optical encoder, Singleturn EnDat2.1, with 2,048 signal periods	= S2																																									
Capacitive encoder, Singleturn Hiperface, with 16 signal periods	= S3																																									
Optical encoder, Multiturn-absolute Hiperface, with 128 signal periods	= M1																																									
Optical encoder, Multiturn-absolute EnDat2.1, with 2,048 signal periods	= M2																																									
Capacitive encoder, Multiturn-absolute Hiperface, with 16 signal periods	= M3																																									
Electrical Connection																																										
Connector, rotatable 240°	= U																																									
Shaft																																										
Smooth shaft with shaft sealing ring (standard)	= G																																									
Shaft with keyway acc. to DIN 6885-1 with shaft sealing ring	= P																																									
Holding Brake																																										
Without holding brake	= 0																																									
Holding brake, electrically-released, 6 Nm	= 1																																									
Other Design																																										
Standard	= NNNN																																									
Standard and Ex design acc. to device group II, category 3G and 3D acc. to EN 60079 ff	= NSNN																																									
With increased concentricity, run-out acc. to DIN 42955	= RNNN																																									
With increased concentricity, run-out acc. to DIN 42955 and Ex-design acc. to device group II, category 3G and 3D acc. to EN 60079 ff	= RSNN																																									
Remark																																										
1) Encoder "S1" and "M1" are only available with other design "NNNN" and "NSNN"																																										
Encoder "S2" and "M2" are only available with other design "RNNN" and "RSNN"																																										
Encoder "S3" and "M3" are only available with other design "NNNN"																																										

Fig. 7-3: MSK050 type code

Type code

7.5 MSK060 Type code

Abbreviation	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	
Example:	M	S	K	0	6	0	C	-	0	6	0	0	-	N	N	-	S	1	-	U	G	0	-	N	N	N	N														
Product																																									
MSK	= MSK																																								
Size																																									
060	=060																																								
Lengths																																									
Lengths	= B, C																																								
Winding																																									
MSK060B	= 0300, 0600																																								
MSK060C	= 0300, 0600																																								
Cooling																																									
Natural convection											= NN																														
Encoder ¹⁾																																									
Optical encoder, Singleturn Hiperface, with 128 signal periods																					= S1																				
Optical encoder, Singleturn EnDat2.1, with 2,048 signal periods																					= S2																				
Capacitive encoder, Singleturn Hiperface, with 16 signal periods																					= S3																				
Optical encoder, Multiturn-absolute Hiperface, with 128 signal periods																					= M1																				
Optical encoder, Multiturn-absolute EnDat2.1, with 2,048 signal periods																					= M2																				
Capacitive encoder, Multiturn-absolute Hiperface, with 16 signal periods																					= M3																				
Electrical Connection																																									
Connector, rotatable 240°																					= U																				
Shaft																																									
Smooth shaft with shaft sealing ring (standard)																					= G																				
Shaft with keyway acc. to DIN 6885-1 with shaft sealing ring																					= P																				
Holding Brake																																									
Without holding brake																					= 0																				
Holding brake, electrically-released, 10 Nm																					= 1																				
Other Design																																									
Standard																					= NNNN																				
Standard and Ex design acc. to device group II, categories 3G and 3D acc. to EN 60079 ff																					= NSNN																				
With increased concentricity, run-out acc. to DIN 42955																					= RNNN																				
With increased concentricity, run-out acc. to DIN 42955 and Ex design acc. to device group II, categories 3G and 3D acc. to EN 60079 ff																					= RSSN																				
Remark																																									
1) Encoders "S1" and "M1" are only available with other design "NNNN" and "NSNN"																																									
Encoders "S2" and "M2" are only available with other design "RNNN" and "RSSN"																																									
Encoders "S3" and "M3" are only available with other design "NNNN"																																									

Fig. 7-

7.6 MSK061 Type code

[illegible]

Remark

- 1) Frame length "B" is only available with encoder "S1", "S3", "M1" or "M3" and other design "NNNN"
- 2) Encoder "S1" and "M1" are only available with other design "NNNN" and "NSNN"
Encoder "S2" and "M2" are only available with other design "RNNN" and "RSNN"
Encoder "S3" and "M3" are only available with other design "NNNN"

Fig. 7-5: MSK061 Type Code

Type code

7.7 MSK070 Type code

Abbreviation	column																																										
	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0			
Example:	M	S	K	0	7	0	C	-	0	4	5	0	-	N	N	-	S	1	-	U	G	0	-	N	N	N	N																

7.8 MSK071 Type code

[illegible]

Remark

- 1) Cooling mode "FN" is only available with holding brakes "0" and "2" and other design "NNNN" and "RNNN"
- 2) Encoder "S1" and "M1" are only available with other design "NNNN" and "NSNN"
Encoder "S2" and "M2" are only available with other design "RNNN" and "RSNN"
Encoder "S3" and "M3" are only available with other design "NNNN"

Fig. 7-7: Type code MSK071

Type code

7.9 MSK076 Type code

[illegible]

Remark

- 1) Encoders "S1" and "M1" are only available with other design "NNNN" and "NSNN"
Encoders "S2" and "M2" are only available with other design "RNNN" and "RSNN"
Encoders "S3" and "M3" are only available with other design "NNNN"

Fig. 7-8: MSK076 Type Code

7.10 MSK100 Type code

Abbreviation	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	
Example:	M	S	K	1	0	0	B	-	0	2	0	0	-	N	N	-	S	1	-	A	G	O	-	N	N	N	N														
Product																																									
MSK	= MSK																																								
Size																																									
100	=100																																								
Lengths ¹⁾																																									
Frame lengths	= A, B, C, D																																								
Windings ²⁾																																									
MSK100A	= 0200, 0300, 0450																																								
MSK100B	= 0200, 0300, 0400, 0450																																								
MSK100C	= 0200, 0300, 0301, 0450 ¹⁾																																								
MSK100D	= 0200, 0300, 0350																																								
Cooling																																									
Natural convection	= NN																																								
Encoder ³⁾																																									
Optical encoder, Singleturn Hiperface, with 128 signal periods																					= S1																				
Optical encoder, Singleturn EnDat2.1, with 2,048 signal periods																					= S2																				
Capacitive encoder, Singleturn Hiperface, with 16 signal periods																					= S3																				
Optical encoder, Multiturn absolute Hiperface, with 128 signal periods																					= M1																				
Optical encoder, Multiturn absolute EnDat2.1, with 2,048 signal periods																					= M2																				
Capacitive encoder, Multiturn absolute Hiperface, with 16 signal periods																					= M3																				
Electrical Connection ⁴⁾																																									
Connector, A-side																					= A																				
Connector, B-side																					= B																				
Connector, left																					= L																				
Connector, right																					= R																				
Shaft																																									
Smooth shaft with shaft sealing ring (standard)																					= G																				
Shaft with key as acc. to DIN 6885-1 with shaft sealing ring																					= P																				
Holding Brake ⁵⁾																																									
Without holding brake																					= 0																				
Holding brake, electrically-released, 32 Nm																					= 1																				
Holding brake, electrically-released, 70 Nm																					= 2																				
Other Design ⁶⁾																																									
Standard																					= NNNN																				
Standard and Ex-design acc. to device group II, categories 3G and 3D acc. to DIN EN 60079 ff																					= NSNN																				
With increased concentricity, run-out acc. to DIN 42955																					= RNNN																				
With increased concentricity, run-out acc. to DIN 42955 and Ex-design acc. to device group II, categories 3G and 3D acc. to DIN EN 60079 ff																					= NSNN																				

Type code

Abbreviation column	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
Example:	M	S	K	1	0	0	B	-	0	2	0	0	-	N	N	-	S	1	-	A	G	0	-	N	N	N	N														

Remark

- 1) Length "C" and winding "0300" are only available with other design "NNNN" and "RNNN"
- 2) Winding "0450" is only available with other design "NNNN" and "RNNN"
Winding "0301" is only available with other design "NSNN" and "RSNN"
- 3) Encoder "S1" and "M1" are only available with other design "NNNN" and "NSNN"
Encoder "S2" and "M2" are only available with other design "RNNN" and "RSNN"
Encoder "S3" and "M3" are only available with other design "NNNN"
- 4) View from front onto output shaft
- 5) Holding brake "1" is only available with lengths "A" and "B"
Holding brake "2" is not available with length "A"

Fig. 7-10: MSK100 type code (page 2)

7.11 MSK101 Type code

Abbreviation	column	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	
Example:		M	S	K	1	0	1	D	-	0	2	0	0	-	N	N	-	S	1	-	A	G	O	-	N	N	N	N														

Type code

Abbreviation	1										2										3										4
column	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	
Example:	M	S	K	1	0	1	D	-	0	2	0	0	-	N	N	-	S	1	-	A	G	0	-	N	N	N	N				

Remark

1)

Frame length "E" is only available with other design "NNNN" and "RNNN"

2)

Windings "0300" and "0450" is only available with other design "NNNN" and "RNNN"

3)

Encoders "S1" and "M1" are only available with other design "NNNN" and "NSNN"

Encoders "S2" and "M2" are only available with other design "RNNN" and "RSNN"

Encoders "S3" and "M3" are only available with other design "NNNN"

4)

View from the front onto the ouptut shaft

5)

Holding brake "3" is not available with frame length "C"

6)

Other designs "NSNN" and "RSNN" are not available with cooling mode "FN" and holding brake "3"

Fig. 7-12: MSK101 type code (page 2)

8 Accessories

8.1 Transmission

ATEX motors

⚠ WARNING

Danger of explosion and life or high damage to property!

Gearboxes which are mounted and operated on MSK ATEX motors must correspond to the demand for Ex-protection according to the 94/9/EG directive.

Please observe the notes within the product documentations of the used components when projecting and during operation.

Rexroth does not offer or supply ATEX-compliant servo planetary gears for the attachment to MSK-ATEX motors, either individually or mounted on motors.

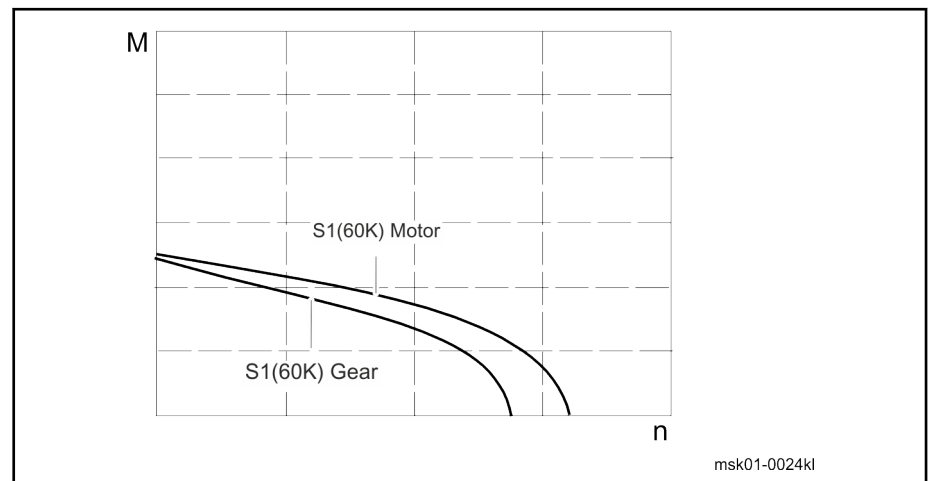
Various transmission manufacturers have explosion-protected transmissions in their scope of supply. If necessary, contact the following supplier recommended by Rexroth, for example:

Neugart GmbH, Keltenstr. 16, 77971 Kippenheim, Germany

www.neugart.de

Attachment of transmissions on motors

If transmissions are attached to motors, the thermal coupling of the motors to the machine or system design changes. Depending on the type of transmission, the amount of heat generated at the transmission varies. In any case, the heat dissipation of the motor via the flange is reduced when the transmission is attached. This must be taken into account when planning the system. In order not to thermally overload motors when using transmissions, it is necessary to reduce the specified performance data.



S1(60K) motor Continuous operating characteristic curves S1 motor
S1(60K) gear Continuous operating characteristic curves S1 motor with transmission attachment

Fig. 8-1: S1 characteristic curve transmission



The torques specified in the motor characteristics must be reduced by approx. **20-30%** when attaching transmissions.

Observe all other notes and requirements in the documentation for the transmissions used.

9 Connection technique

9.1 Overview of the electrical connection technique

Standard design

The electrical connection of MSK ATEX motors is made via circular connectors M23, M40 or M58 for power and encoder connection. An additional connection for equipotential bonding is provided on the flange.

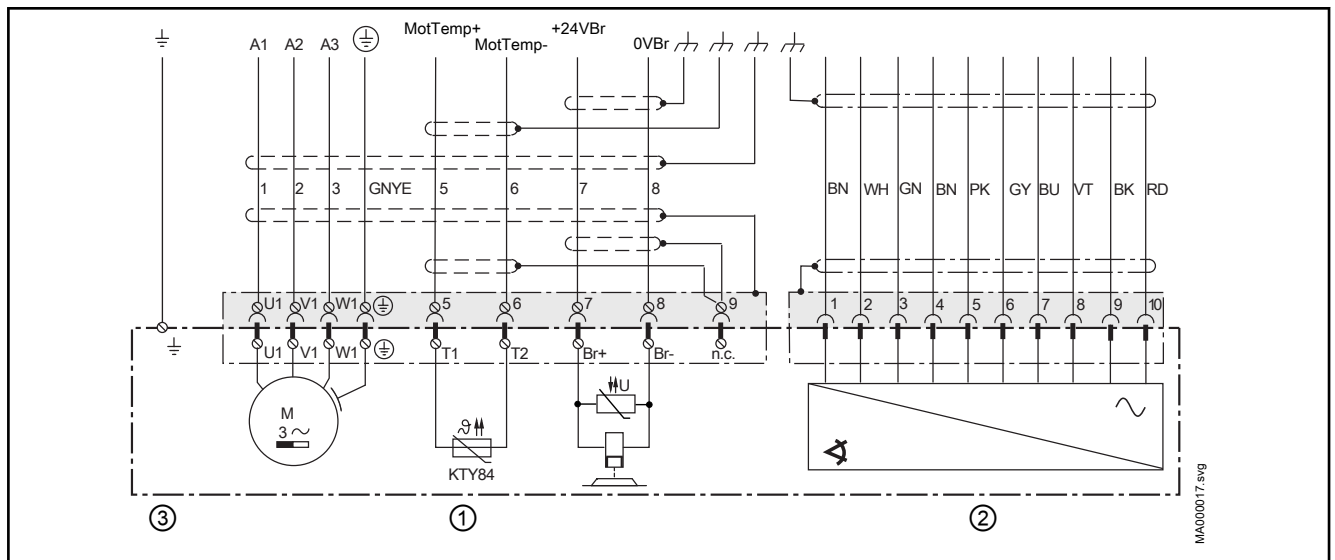
The electrical connections are made according to the following table.

Motor	Power connection	Encoder connection
MSK030	RLS1100 (M23 flange socket)	RGS1000 (M23 flange socket)
MSK040	RLS1100 (M23 flange socket)	RGS1000 (M23 flange socket)
MSK050	RLS1100 (M23 flange socket)	RGS1000 (M23 flange socket)
MSK060	RLS1100 (M23 flange socket)	RGS1000 (M23 flange socket)
MSK061	RLS1100 (M23 flange socket)	RGS1000 (M23 flange socket)
MSK070	RGS1200 (M40 flange socket)	RGS1000 (M23 flange socket)
MSK071	RGS1200 (M40 flange socket)	RGS1000 (M23 flange socket)
MSK076	RLS1100 (M23 flange socket)	RGS1000 (M23 flange socket)
MSK100	RGS1300 (M58 flange socket)	RGS1003 (M23 flange socket)
MSK101	RGS1300 (M58 flange socket)	RGS1003 (M23 flange socket)

Tab. 9-1: MSK motors - electrical connections

Ready-made connection cables are available for all connection variants, ensuring simple, fast and fail-safe installation and commissioning.

Wiring diagram



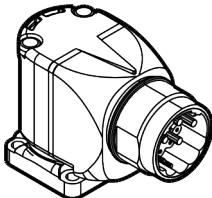
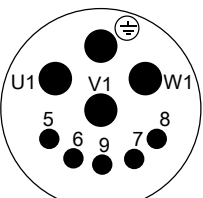
- ① Power connection with temperature sensor and holding brake
- ② Encoder connection
- ③ Equipotential bonding conductor

Fig. 9-1: Connection overview MSK ATEX motors

Connection technique

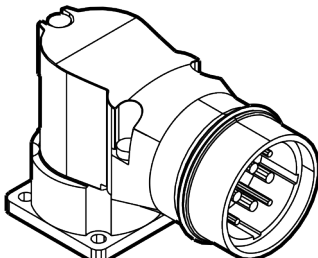
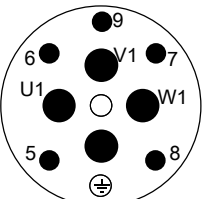
9.2 Plug-in power connector

M23 flange socket RLS1100

View 	Pole pattern  U1 A1 V1 A2 W1 A3 ⊕ PE 5 MotTemp+ 6 MotTemp- 7 +24VBr 8 0VBr 9 n.c.
Technical data	
Connector size	M23, rotatable
Degree of protection	IP67 (plugged)
Temperature range	-40 ... +125 °C
Ambient temperature during operation	40 °C
Contact type	Pins
Rated voltage	630 V / 125 V
Rated current	23 A
Degree of contamination	3
Overvoltage category	III (DIN VDE 0110)
Flange socket, associated	RLS1101 for line cross-section 1.0 and 1.5 mm ² RLS1108 for line cross-section 2.5 mm ²

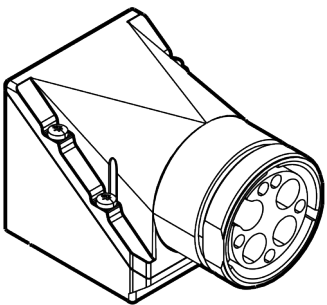
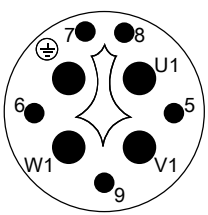
Tab. 9-2: Technical data RLS1100

M40 flange socket RLS1200

View 	Pole pattern  U1 A1 V1 A2 W1 A3 ⊕ PE 5 MotTemp+ 6 MotTemp- 7 +24VBr 8 0VBr 9 n.c.
Technical data	
Connector size	M40, rotatable
Degree of protection	IP67 (plugged)
Temperature range	-40 ... +125 °C
Ambient temperature during operation	40 °C
Contact type	Pins
Rated voltage	630 V / 125 V
Rated current	57 A
Degree of contamination	3
Overvoltage category	III (DIN VDE 0110)
Flange socket, associated	RLS1201

Tab. 9-3: Technical data RLS1200

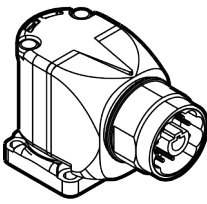
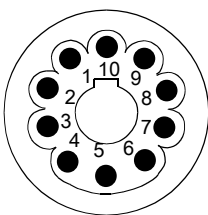
M58 flange socket RLS1300

View 	Pole pattern  - U1 A1 - V1 A2 - W1 A3 ⊕ PE 5 MotTemp+ 6 MotTemp- 7 +24VBr 8 0VBr 9 n.c.
Technical data	
Connector size	M58, fixed
Degree of protection	IP67 (plugged)
Temperature range	-40 ... +125 °C
Ambient temperature during operation	40 °C
Contact type	Pins
Rated voltage	600 V
Rated current	100 A (according to VDE, UL); 87 A (according to CSA)
Degree of contamination	3
Overvoltage category	III (DIN VDE 0110)
Flange socket, associated	RLS1301

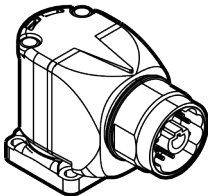
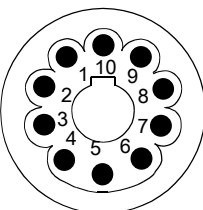
Tab. 9-4: Technical data RLS1300

9.3 Encoder plug connector

M23 flange socket RGS1000

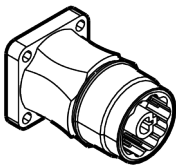
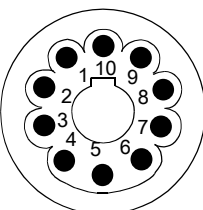
View 	Pole pattern  1 VCC_Encoder 2 GND_Encoder 3 A+ 4 A- 5 B+ 6 B- 7 Enc_Data+ 8 Enc_Data- 9 Enc_CLK+ 10 Enc_CLK-
Technical data	
Connector size	M23, rotatable
Degree of protection	IP67 (plugged)
Temperature range	-40 ... +125 °C
Ambient temperature during operation	40 °C
Contact type	Pins
Rated voltage	125 V
Rated current	0.5 A
Degree of contamination	3

Connection technique

View	Pole pattern
	 1 VCC_Encoder 2 GND_Encoder 3 A+ 4 A- 5 B+ 6 B- 7 Enc_Data+ 8 Enc_Data- 9 Enc_CLK+ 10 Enc_CLK-
Overvoltage category	III (DIN VDE 0110)
Flange socket, associated	RGS1001

Tab. 9-5: Technical data RGS1000

M23 flange socket RGS1003

View	Pole pattern
	 1 VCC_Encoder 2 GND_Encoder 3 A+ 4 A- 5 B+ 6 B- 7 Enc_Data+ 8 Enc_Data- 9 Enc_CLK+ 10 Enc_CLK-
Technical data	
Connector size	M23, fixed
Degree of protection	IP67 (plugged)
Temperature range	-40 ... +125 °C
Ambient temperature during operation	40 °C
Contact type	Pins
Rated voltage	125 V
Rated current	0.5 A
Degree of contamination	3
Overvoltage category	III (DIN VDE 0110)
Flange socket, associated	RGS1001

Tab. 9-6: Technical data RGS1003

9.4 Plug connector, rotatable

The orientation of the flange socket is adjustable. To change the orientation, screw a coupling completely onto the flange socket. Then move the flange socket with the coupling to the desired position. The adjustment possibilities are shown in the following figure.

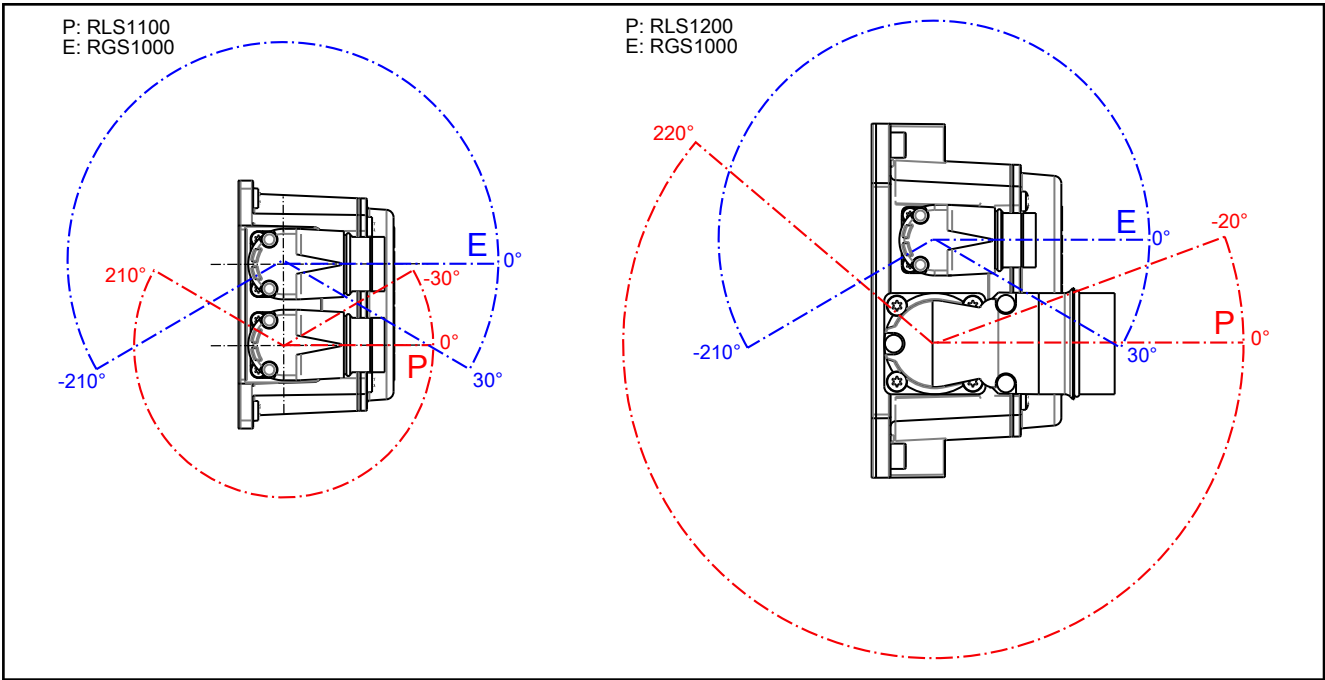


Fig. 9-2: Adjustment range of flange socket, rotatable

Flange socket	Twisting moment ¹⁾ maximum [Nm]
RGS1000	12
RLS1100	
RLS1200	18

1) Maximum torque to change the orientation of the flange sockets

Tab. 9-7: Twisting moments of flange sockets

9.5 Connect equipotential bonding conductor

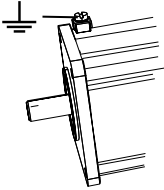
WARNING

Explosion hazard due to improper handling during the connection of the motor!

A separate potential equalization line with a cross section of at least 4 mm² must be connected to the motor, in addition to the grounding connector.

It is only allowed to connect the motor in the de-energized state.

The motors for potentially explosive areas have an additional terminal on the motor flange for connecting the equipotential bonding. Connect the equipotential bonding on the motor to the equipotential bonding of the machine or system and tighten the screw connections tightly.

Terminal of equipotential bonding conductor	Nominal cross-section	Clamping range
	4 mm ²	4 mm ² (fine-wired) 6 mm ² (single-wired)

Tab. 9-8: Terminal for equipotential bonding conductor

9.6 Connection cables

Rexroth supplies ready-made power and encoder cables. The documentation "Selecting the IndraDrive connection cable"; DOK-CONNEC-CABLE*INDRV-CAxx-EN-P is available for selecting the cables.

The achievable service life of the cables depends on the type of installation and environmental influences at the place of use. Observe the following recommendations for handling the cables to ensure long and trouble-free operation of the cables.

- Do not load the cables with tension or torsion
Fasten the cable ends after approx. 30 cm (e.g. cable clamp, shield connection of the controllers).
- Always pull the plug when disconnecting plug connections. Do not pull the cable.
- Do not bend the cable.
- Do not undercut the bending radius of the cable.
- Do not expose the cable to large temperature fluctuations and extreme weather conditions. Do not store outdoors. Store in a dry place.
- Always unwind the cable, do not unreel it "overhead".
- Do not use damaged cables (e.g. due to pressure, clamping or crushing). If the cable is damaged, shut down the system and replace the cable.

Observe the assembly and installation instructions for ready-made cables in the documentation "DOK-CONNEC-CABLE*INDRV-CAxx-EN-P".

10 Operating conditions and application notes

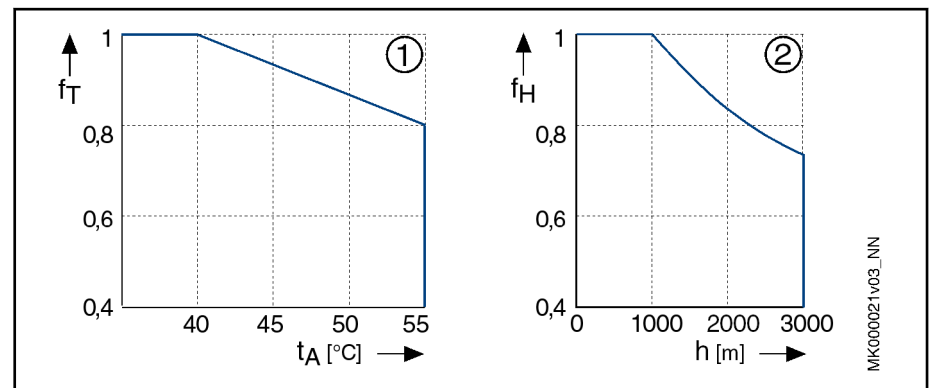
10.1 Environmental conditions

10.1.1 Installation altitude and ambient temperature

The stated performance data of the motors are valid according to DIN EN 60034-1 for:

- Ambient temperature 0 ... 40 °C
- Installation altitude 0 ... 1000 m above sea level

If the specified limits are exceeded, the performance data of the motors must be reduced.



① Utilization depending on the ambient temperature

② Utilization depending on the installation altitude

f_T Temperature utilization factor

t_A Ambient temperature

f_H Height utilization factor

h Installation altitude in meters

Fig. 10-1: Derating of ambient temperature, installation altitude (in operation)

Calculation of performance data in case the limits specified are exceeded:

Ambient temperature > 40 °C

$$M_{0_red} = M_0 \times f_T$$

Installation altitude > 1,000 m

$$M_{0_red} = M_0 \times f_H$$

Ambient temperature > 40 °C and setup elevation > 1,000 m

$$M_{0_red} = M_0 \times f_T \times f_H$$

Operating conditions and application notes

10.1.2 Humidity / temperature

Climatic environmental conditions are defined according to different classes as specified in DIN EN 60721-3-3, Table 1. The conditions are based on observations made over long periods of time worldwide and take into account all influencing variables, such as the air temperature and humidity.

On the basis of this table, Rexroth recommends Class 3K4 for permanent use of the motors.

The following table provides extracts from this class.

Environmental factor	Unit	Class 3K4
Low air temperature	°C	0 ¹⁾
High air temperature	°C	+40
Low rel. air humidity	%	5
High rel. air humidity	%	95
Low absolute air humidity	g/m ³	1
High absolute air humidity	g/m ³	29
Temperature change rate	°C/min	0.5

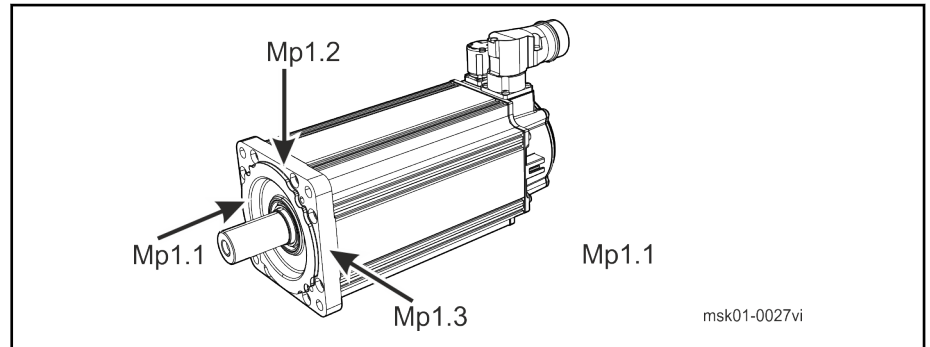
1) Differs from DIN EN 60721-3-3, permissible

Tab. 10-1: *Classification of climatic environmental conditions according to DIN EN 60721-3-3, table 1*

10.1.3 Vibrations

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 10-2,000 Hz during stimulation on the motor flange. Limitations can be necessary for occurring resonances depending from the application and installation situation.



Mp1.1 Measuring point motor flange axial
Mp1.2, -1.3 Measuring point motor flange radial

Fig. 10-2: Vibration load measuring point

The following limitation values are valid for MSK motors acc. to EN 60721-3-3 und EN 60068-2-6:

Direction	Measuring point	Maximum allowed vibration load (10-2,000 Hz)	
		MSK with encoder S1, M1	MSKwith encoder S2, M2
axial	Mp1.1	10 m/s ²	10 m/s ²
radial	Mp1.2 Mp1.3	30 m/s ²	10 m/s ²

Tab. 10-2: Allowed vibration load MSK-ATEX motors

Operating conditions and application notes

10.1.4 Shock

MSK motors fulfill the demands on transport conditions of class 2M1 (state of shock during transport) acc. to EN 60721-3-2 compare with [chapter 11.1 "Transport Instructions"](#) on page 141.

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

Frame size	Maximum allowed shock load (11 ms)	
	Axial	Radial
MSK030 MSK040 MSK050	100 m/s ²	1,000 m/s ²
MSK060 MSK061		500 m/s ²
MSK070 MSK071 MSK076		300 m/s ²
MSK100 MSK101		200 m/s ²

Tab. 10-3: Permitted shock load for MSK motors

The specified limit values are not valid for half-sinus-shaped single shock load acc. to EN 60068-2-27. This details are **not valid for motor operation**.

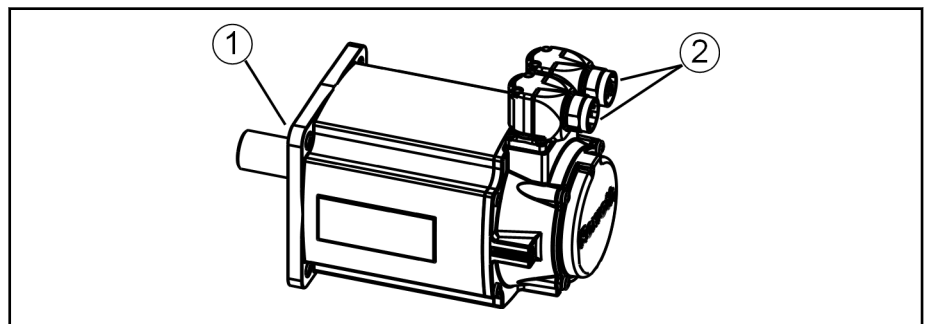
Applications with continuous shock load make a case-by-case review necessary.

10.2 Degree of protection

The protection type according to EN 60034-5 is determined by the abbreviation IP (International Protection) and two code numbers for the degree of protection. The first code number describes the degree of protection against contact with and ingress of foreign bodies, the second code number describes the degree of protection against ingress of water.

first code number	Degree of protection
6	Protection against penetration of dust (dust-proof); complete contact protection
second code number	Degree of protection
5	Protection against a jet of water from a nozzle which is directed against the housing from all directions (jet water)

Tab. 10-4: IP protection types



- ① Motor housing and output shaft with shaft sealing ring
- ② Connector in mated condition

Fig. 10-3: IP protection type ranges for MSK motors in ATEX version

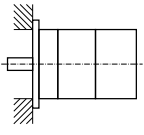
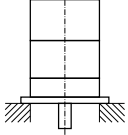
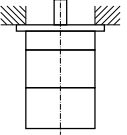
Motor area	Degree of protection
① Motor housing, output shaft	IP 65
② Connector with properly connected cable socket	IP 67

Tab. 10-5: Motor protection type

The tests for the second code number are carried out with fresh water. If cleaning processes with high pressure and/or solvents, cooling lubricants or creep oils are used, a higher degree of protection may be required.

Operating conditions and application notes

10.3 Design and installation positions

Motor design B05		
IM B5	IM V1	IM V3
		
Flange attachment on the drive side of the flange	Flange attachment on the drive side of the flange, drive side facing down	Flange attachment on the drive side of the flange, drive side facing up

Tab. 10-6: Permissible conditions of installation according to EN 60034-7:1993

NOTICE

Motor damage due to penetration of liquids!

If motors are attached according to IM V3, fluid present at the output shaft over a prolonged time may penetrate and cause damage to the motors. Ensure that fluid cannot be present at the output shaft.

10.4 Compatibility with foreign materials

All Rexroth controls and drives are developed and tested according to the state of the art.

However, since it is impossible to follow the continuing further development of every material with which our controls and drives could come into contact (e.g. lubricants on tool machines), reactions with the materials that we use cannot be ruled out in every case.

For this reason, you must execute a compatibility test between new lubricants, cleansers, etc. and our housings and device materials before using these products.

Operating conditions and application notes

10.5 Motor paint

As standard, the motors are **black (RAL9005)**.



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).

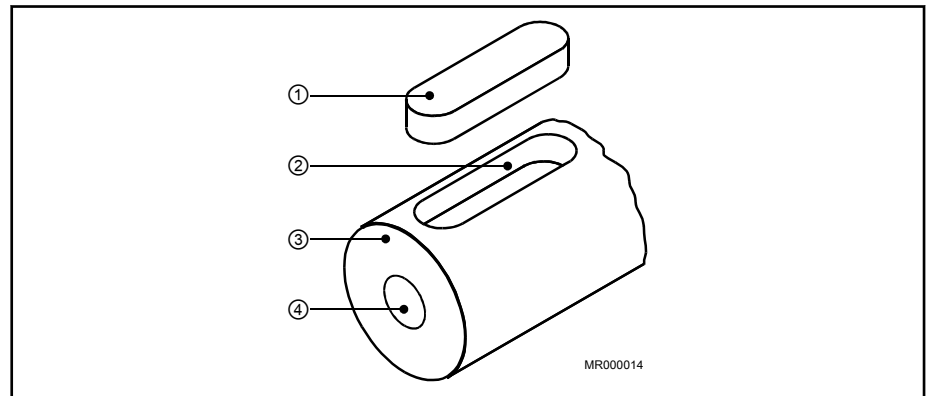
10.6 Output shaft

10.6.1 Plain shaft

The recommended standard version for MSK motors offers a force-fit, backlash-free shaft-hub connection with very quiet running. Use clamping sets, clamping sleeves or tensioning elements to couple the machine elements to be driven.

10.6.2 Output shaft with keyway

The optional key according to DIN 6885, Sheet 1, Edition 08-1968, allows form-locking transmission of torques with constant direction and low requirements for the shaft-hub connection.



- ① Key
- ② Keyway
- ③ Motor shaft
- ④ Centering hole

Fig. 10-4: Output shaft with keyway

In addition, the machine elements to be driven must be secured axially via the frontal centering hole.

NOTICE

Damage to property due to reversing mode!

Shaft damage! In case of intense reversing operation, the seat of the fitting spring may deflect. Increasing deformations can lead to a break of shaft.

Preferably, use plain output shafts.

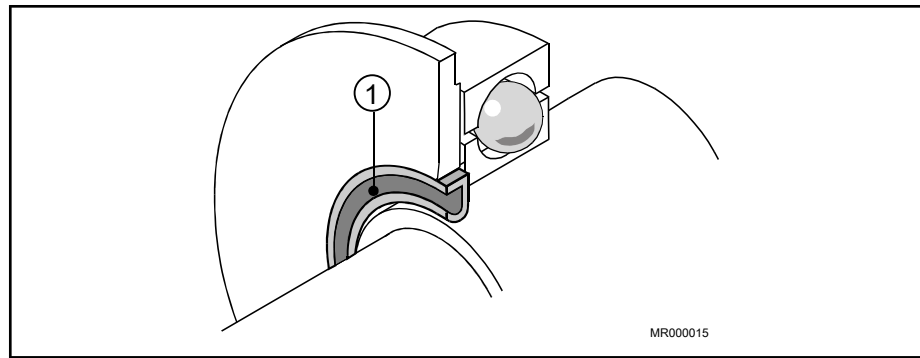
Balancing with full key

MSK motors are balanced with **full** key. The machine element to be driven must therefore be balanced without key.

10.6.3 Output shaft with shaft sealing ring

MSK motors are designed with radial shaft sealing rings according to DIN 3760 - version A.

Operating conditions and application notes



① Radial shaft sealing ring

Fig. 10-5: Radial shaft sealing ring

Wear Radial shaft sealing rings are abrasive seals. Wear and tear can only be reduced with sufficient lubrication and cleanliness of the sealing point. The lubricant simultaneously acts as a coolant and supports the dissipation of frictional heat from the sealing point.

Avoid dry running and soiling of the sealing point.



Under normal ambient conditions, shaft seals are greased for life. However, unfavorable environmental conditions (e.g. grinding dust, metal chips) may require maintenance intervals.

Stability The materials used for radial shaft sealing rings are highly resistant against oils and chemicals. However, the machine manufacturer is responsible for the suitability test for the respective operating conditions.

Vertical mounting positions IM V3 Motors with shaft sealing ring have protection class IP65 on the flange side. The tightness is therefore only guaranteed for splash liquids. Liquid levels on the A side require a higher protection type. If the motor is installed vertically (shaft upwards), also observe the instructions in [chapter 10.3 "Design and installation positions" on page 120](#).

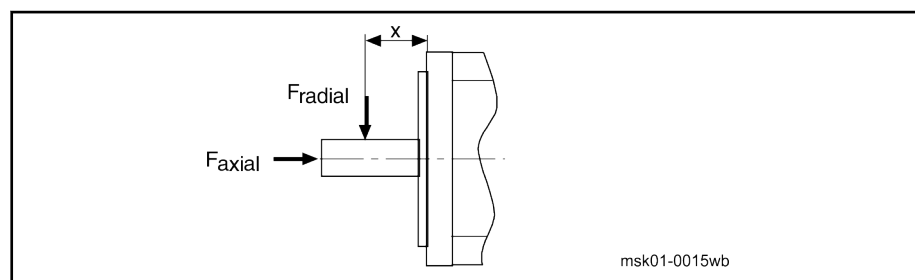


Rexroth recommends avoiding direct contact of the output shaft and radial shaft seal with the machining medium (cooling lubricant, material abrasion) due to the machine or system design.

10.7 Bearing and shaft load

10.7.1 Radial load, axial load

During operation, radial and axial forces act on the motor shaft and the motor bearings. The design of the machine, the selected motor type and the shaft-side mounting of drive elements must be coordinated to ensure that the specified load limits are not exceeded.



x Point of application of force

Fig. 10-6: Example diagram of shaft load

Maximum allowed radial force

The maximum permissible radial force $F_{\text{radial_max}}$ depends on the following factors

- Shaft breaking load
- Force action point x
- Shaft plain or with keyway

Permissible radial force

The permissible radial load F_{radial} depends on the following factors

- Arithmetically averaged speed (n_{average})
- Force action point x
- Bearing service life

Permissible axial force

The maximum permissible axial force F_{axial} for the individual motor sizes is shown in the following table.

Motor	F_{axial} [N]	Motor	F_{axial} [N]
MSK030	0	MSK070	60
MSK04x	30	MSK071	60
MSK050	40	MSK076	60
MSK060	40	MSK100	80
MSK061	40	MSK101	80

Tab. 10-7: Maximum permissible axial force F_{axial}

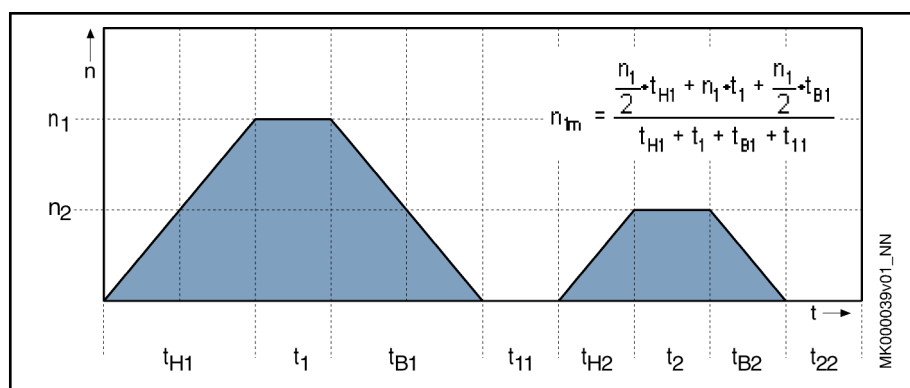
Axial forces are permissible without restriction up to the specified values. Larger axial forces may be possible after detailed examination by your Rexroth sales partner. Specify the following information for the valuation:

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

Average speed

Run-up and braking times can be omitted from the calculation if the time during which the drive is operated at constant speed is considerably longer than the acceleration and braking times. In the exact calculation of the average speed according to the following pattern, acceleration and braking times are taken into account.

Operating conditions and application notes

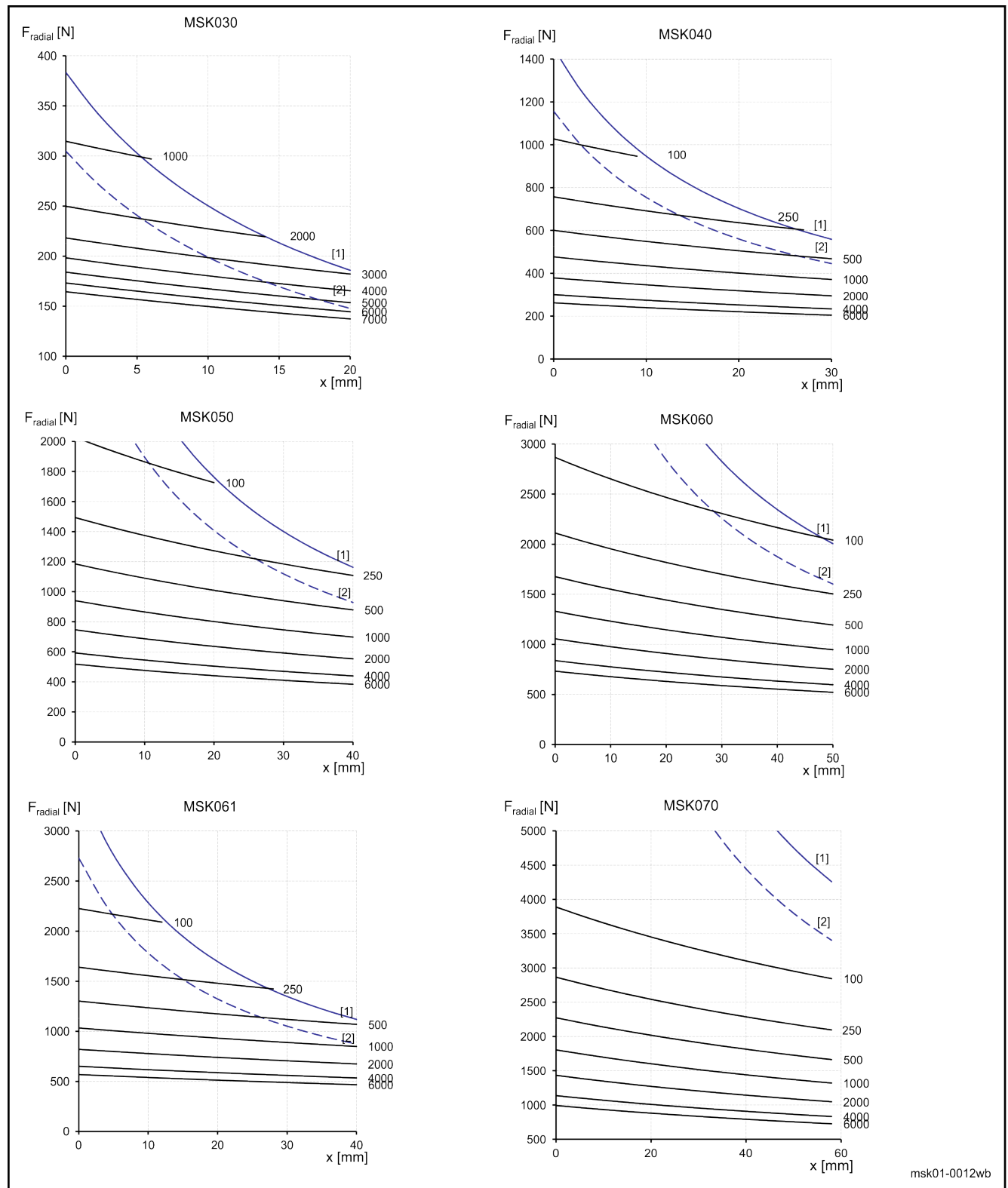


$n_{1m}; n_{2m}$	Average speed section x
$n_1; n_2$	Processing speed
$t_{H1}; t_{H1}$	Run-up time
$t_1; t_2$	Processing time
$t_{B1}; t_{B2}$	Braking time
$t_{11}; t_{22}$	Downtime

Fig. 10-7: Average speed

A complete processing cycle can consist of several sections with different speeds. In this case, the average of all sections shall be calculated.

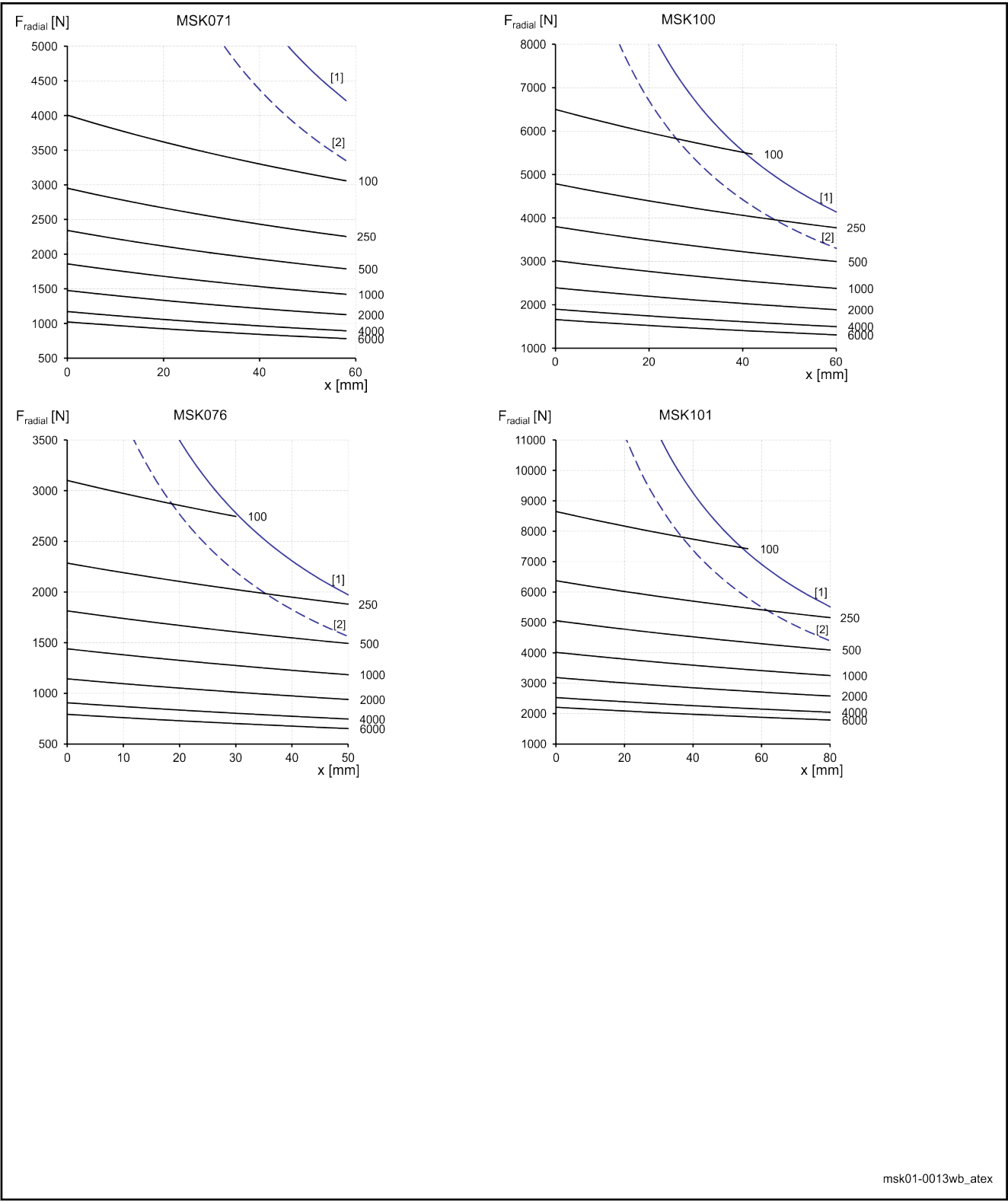
Operating conditions and application notes



msk01-0012wb

[1] Shaft plain
[2] Shaft with keyway
 n [min⁻¹] Average speed
Fig. 10-8: Radial force $F_{\text{radial}}(1)$

Operating conditions and application notes



[1] Shaft plain
[2] Shaft with keyway
 n [min⁻¹] Average speed
Fig. 10-9: Radial force $F_{\text{radial}}(2)$

10.8 Bearing lifetime

The bearing lifetime for MSK-ATEX motors for operation within the specified limits for radial and axial load and for ambient conditions is:

$L_{10h} = 30000 \text{ h}$ (calculation acc. to ISO 281, edition 12/1990)

Different loads may have the following effects:

- Premature failure of the bearing due to increased wear or mechanical damage.
- Reduction of the grease lifetime leads to premature failure of the bearing.

Bearing lifetime with increased radial force

Calculation of mechanical bearing lifetime at increased radial force:

$$L_{10h} = \left(\frac{F_{radial}}{F_{radial_act}} \right)^3 \cdot 30000$$

L_{10h} Bearing service life (according to ISO 281, Version 12/1990)

F_{radial} Determined allowed radial force in N (newton)

F_{radial_act} Actually acting radial force in N (newton)

Fig. 10-10: Calculation of bearing lifetime L_{10h} at increased radial force:



The actually acting radial force F_{radial_act} may never be higher than the maximum allowed radial force F_{radial_max} .

10.9 Attachment of drive elements

CAUTION

Motor damage by intrusion of liquid!

Pending liquids (e.g. cooling lubricants, gearbox oil, etc.) at the drive shaft are inadmissible.

When installing gearboxes please use gearboxes with closed (oil-proof) lubrication system only. Gearbox oil should not be in permanent contact with the shaft sealing ring of the motors.

For any type of attachment of drive elements to the output shaft, such as:

- Couplings
- Pinions

the following instructions must absolutely be observed.

Ex protection

When mounting drive elements, check their suitability and keep the ATEX directives.

Attachment of transmissions on motors

Notes [chapter 8.1 "Transmission" on page 107](#).

Over-determined arrangement

In general, an over-determined arrangement must be avoided when mounting drive elements. The indispensable existing tolerances lead to additional forces on the bearing of the motor shaft and, if necessary, to a significantly reduced bearing life.



If an over-determined arrangement cannot be avoided, please contact Bosch Rexroth.

Couplings

The machine design and the attachment elements used must be carefully matched to the motor type so that the load limits of shaft and bearing are not exceeded.



When mounting extremely rigid couplings, an unacceptably high load on the shaft and bearing can occur due to a radial force which constantly changes the angular position.

Bevel pinion or helical drive pinions

Due to thermal effects, the flange end of the output shaft can shift by up to 0.6 mm in relation to the motor housing. When using helical drive pinions or bevel gear pinions mounted directly on the output shaft, this change in length leads 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. There is a risk that the maximum permissible axial force will be exceeded or that the backlash within the gearing will increase excessively.
- Damage to the B-side motor fixed bearing due to exceeding the maximum permissible axial force.



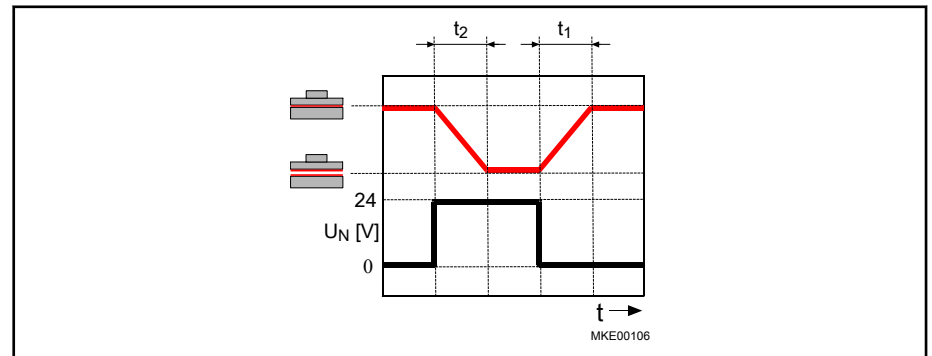
Preferably use self-supported drive elements which are connected to the motor shaft via axially compensating couplings!

10.10 Holding brakes

10.10.1 Holding brake electrically releasing

Holding brakes of MSK motors work according to the principle of "electrically releasing". The holding brakes are released when applying the switching voltage.

The power supply of the holding brake must be designed in such a way as to guarantee under the worst installation and operation conditions that sufficient voltage of **24 V $\pm 10\%$** is available on the motor in order to bleed the holding brake.



t_1 Connection time

t_2 Disconnection time

Fig. 10-11: Switching condition holding brake over time

The holding brake is used to hold axes at standstill and with drive enable switched off. If the supply voltage fails or the drive enable is switched off, electrically releasing holding brakes close automatically.



Do not use the holding brake as a service brake for moving axes.

If the holding brake is repeatedly activated while the drive is rotating or the permissible braking energy is exceeded, premature wear may occur.

10.10.2 Holding brakes safety instructions

Observe the safety requirements when designing the system.

Operating conditions and application notes

 WARNING**Danger of 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 (cf. standard EN 13463-1)!

- When the motors are delivered, they are to be checked as regards an ATEX-compliant marking subject to the application area, as regards the accordance with the ordering details as well as for completeness and any transport damages.
- The holding brake integrated in the motor must only be used at standstill and never as EMERGENCY STOP brake to stop the motor ($n < 10 \text{ min}^{-1}$) (intended use), see P-0-0119, "Optimal shutdown "(IndraDrive firmware - functional description).
- The holding brake must not be used to brake or stop the motor or coupled loads from higher speeds ($n \geq 10 \text{ min}^{-1}$) or velocities (non-intended use)
- 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 is available at the motor in order to release the holding brake.
- The brakes must be designed so as to fulfill their function in normal service, if they are installed and used as intended.
- Commissioning and maintenance activities must only be carried out in non-explosive environments.

 WARNING**Serious bodily injury due to dangerous movements caused by dropping or sinking 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.
- Axis weight compensation



The holding brakes supplied as standard and controlled by the controller alone are **not** suitable for personal protection!

Personal protection must be achieved by means of overriding fail-safe measures, such as e.g. danger zones that are sealed off by protective fences or protective grids.

In addition to the information and notes on the holding brake given here, additional standards and guidelines must be observed when designing the system.

In the area of European countries e.g.:

- EN 954; ISO 13849-1 and ISO 13849-2 Safety-related parts of control units

Operating conditions and application notes

- Information Sheet No. 005 "Gravity loaded axes (vertical axes)" - published by: Technical Committee Mechanical Engineering, Manufacturing Systems, Steel Construction

For the US:

- See National Electrical Code (NEC), National Electrical Equipment Manufacturers Association (NEMA) and regional building codes.

The national regulations must be observed!

The permanent magnetic brake is no safety brake. This means, a torque reduction by non-influenceable disturbance factors can occur (see EN 954; ISO 13849-1; ISO 13849-2 or Information Sheet No. 005 "Gravity loaded axes (vertical axes)").

Particular attention must be paid to this:

- Corrosion on the friction surfaces as well as vapors, exhalations and deposits reduce the braking effect.
- Lubricants must not get onto the friction surface.
- Over-voltages and excessively high temperatures can permanently weaken the permanent magnets and thus render the holding brake unusable.

If the air gap between armature and pole increases due to wear, the function of the holding brake is no longer guaranteed.

Checking the holding brake during operation (recommendation)

Faults which occur during the operating period and which may change the design parameters or the operating conditions must be detected and eliminated within a reasonable period of time. In this case, we recommend checking the function and condition of the holding brake at regular intervals.

10.10.3 Design of holding brakes

Holding brakes on motors are generally not designed for service braking. The effective braking torques are physically different in static operation and dynamic operation.

Normal operation and EMERGENCY STOP	Malfunction
In normal operation, using the holding brake for clamping an axis in standstill, the "static holding torque" (M_4) – static friction takes effect. At an EMERGENCY STOP for stopping an axis ($n < 10 \text{ min}^{-1}$), a "dynamic braking torque" (M_{dyn}) - sliding friction - takes effect.	In the event of a malfunction, using the holding brake to stop an axis in motion ($n \geq 10 \text{ min}^{-1}$), a "dynamic braking torque" (M_{dyn}) - sliding friction - takes effect.
$M_4 > M_{\text{dyn}}$ Therefore, please note the following description of the dynamic design.	

Tab. 10-8: Dynamic design

Dynamic design

The load torque must be lower than the minimum dynamic torque M_{dyn} which the holding brake can provide. Otherwise the deceleration effect of the holding brake is not sufficient to stop the axis.

In order to decelerate a mass in a defined time or over a defined distance, the mass inertia of the whole system must be additionally taken into account.

Operating conditions and application notes

Project planning recommendation In order to ensure plant safety, the holding torque required by the application must be reduced to 60% of the static holding torque (M4) of the holding brake.

10.10.4 Holding brake - commissioning and maintenance instructions

⚠ WARNING

Danger of life or material damage, danger of explosion due to inappropriate use!

- Any commissioning and maintenance works must only be carried out in **non-explosive** environments. The environment must be free from explosive gas or dust.
- Before commissioning and maintenance works are carried out, the rooms are to be ventilated, if applicable, in order to remove any existing explosive gas.

To ensure the function of the holding brake, the holding brake must be checked before commissioning the motors. The check and, if necessary, the loop-in can be carried out "mechanically by hand" or "automatically by software function".

Manual check and loop-in of the holding brakes

Measure the holding torque (M4) of the holding brake, if necessary loop in the holding brake.

Measure the holding torque (M4) of the holding brake

1. Disconnect the motor from the power supply and secure it against being switched on again.
2. Measure the transferable holding torque (M4) of the holding brake with a torque wrench. Holding torque (M4): see technical data.

When the specified holding torque (M4) is reached, the motor is ready for installation.

If the specified holding torque (M4) **is not reached**, the holding torque can be restored by the subsequent loop-in process.

Looping in the holding brake

1. With the holding brake closed, turn the output shaft approx. 5 turns by hand, for example with a torque wrench.
2. Measure holding torque (M4).

When the specified holding torque (M4) is reached, the motor is ready for installation.

If the specified holding torque (M4) is not reached after several loops, the holding brake is not functional. Please contact the service of Rexroth.

Check and loop-in of the holding brakes via software function**Check holding torque (M4) by command Holding system check P-0-0541, C2100**

1. The effectiveness of the holding brake and the open state is checked by the drive controller by starting the routine "P-0-0541, C2100 command Holding system check".

If the holding brake is OK, the drive is ready for operation after the routine has expired. If the braking torque is too low, the drive control unit issues a corresponding message.



The brake test can also be carried out cyclically as part of preventive maintenance.

Restore holding torque (M4) via software function

The following options are available:

1. Execution of the loop-in routine "Restoring of the holding torque" (see "P-0-0544, C3900 Command Looping in the motor holding torque"). Multiple execution of this loop-in routine is possible.
Executing command C3900 does not check whether the holding brake was successfully looped in. It is recommended to re-execute command C2100 (Holding system check).
2. Loop-in routine by higher-level control. Here, control programs tailored to the machine and system concepts are required. If required, contact your sales partner at Rexroth and discuss the parameters of the loop-in routine for your application.



For further information on software functions, see firmware function description.

10.11 Acceptances and approvals

10.11.1 CE



Certificate of conformity certifying the structure of and the compliance with the valid EN-standards and EC-guidelines are available for all MSK-motors. If required, the declarations of conformity can be requested from the responsible sales office.

The CE-mark is applied to the motor type label of the MSK-motors.

10.11.2 cURus



MSK motors are listed by the UL authority (Underwriters Laboratories Inc.®) under **file number E335445**. Approved engines are marked with the following symbol on the motor type label. Current information on UL approvals can be found at <http://www.ul.com/global/eng/pages/>.

10.11.3 EAC



In accordance with EAC certificate DCTC 30834-005, we confirm the conformity of our products with the prescribed technical requirements of the member states of the customs union EAC. The member states are Russia, Belarus and Kazakhstan.

10.11.4 RoHS



Operating conditions and application notes

In accordance with our manufacturer's declaration DCTC 30806-001, we confirm that our products conform to the directive 2011/65/EG "**RoHS II** Restriction of the use of certain hazardous substances in electrical and electronic equipment".

10.11.5 China RoHS 2

www.boschrexroth.com.cn/zh/cn/home_2/china_rohs2

10.12 Motor cooling

10.12.1 Natural convection

Rexroth motors in standard design are self-cooling. The heat dissipation is realized via natural radiation to the ambient air and by heat conduction to the machine structure. The nominal data are achieved at ambient temperatures of up to 40 °C. Sufficient heat radiation must be ensured by the installation situation. Unhindered vertical convection has to be ensured by a sufficient distance of 100 mm to adjacent components on the side surfaces.



Contamination of the motors reduces heat dissipation. Pay attention to cleanliness!

Operating conditions and application notes

10.13 Motor temperature monitoring

10.13.1 General information

The motor temperature is monitored by the two independently operating systems

- Temperature sensor
- Temperature model

and thus the highest possible protection of the motors against irreversible damage caused by thermal overload is ensured.

10.13.2 Temperature sensor

The monitoring of the motor temperature is ensured via the temperature sensor of the KTY84 type, which is built into the stator. The measured motor temperature is monitored for the following threshold values:

- Motor-warning temperature (140 °C)
- Motor shutdown temperature (150 °C)

The threshold values are stored in the encoder data memory of the MSK motors.

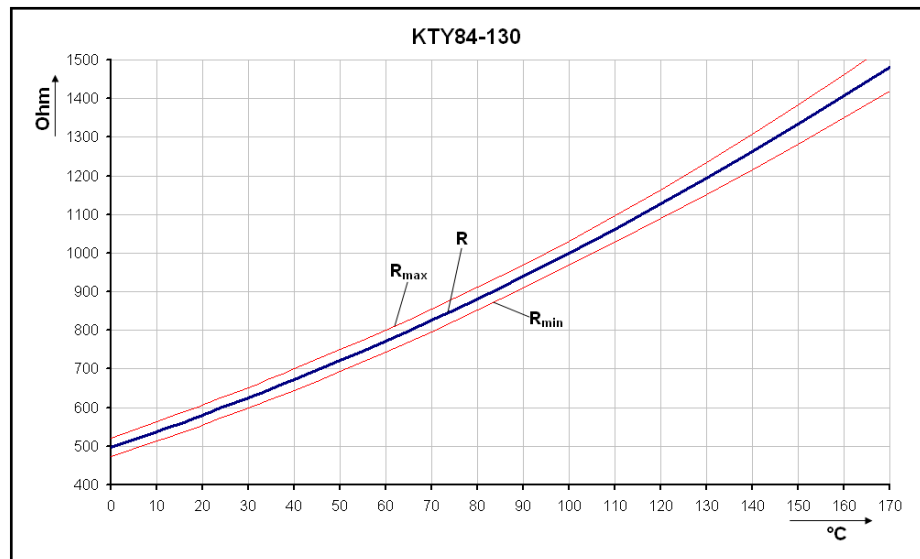


Fig. 10-12: Characteristic curve KTY84-130

The IndraDrive control devices monitor the functionality of the temperature sensors.

For more information, please refer to the functional description for IndraDrive controllers.

10.14 Operation on external controllers

Rate of rise of voltage

The isolation system of the motor underlies a higher dielectric load in converter operation than in a sinusoidal source voltage only. The voltage stress of the winding isolation in converter operation is mainly defined by the following factors:

- Crest value of voltage
- Rise time of impulse on the motor terminal
- Switching frequency of converter output
- Length of power cable to the motor

Main components are the switching times of converter output and the length of the power cable to the motor. The occurred rates of rise of voltage on the motor may not exceed the specified limits from **DIN VDE 0530-25 (VDE 0530-25):2009-08 (picture 14, limit curve A)** of impulse voltage, measured on the motor terminals of two strands in dependence of the rise time.



Outputs of IndraDrive converters keep this limits.

11 Transport and storage

11.1 Transport Instructions

Transport our products only in their original package. Also observe specific ambient factors to protect the products from transport damage.

Based on EN 60721-3-2, the tables below specify classifications and limit values which are allowed for our products while they are transported by land, sea or air. Observe the detailed description of the classifications to take all of the factors which are specified in the particular class into account.

Allowed classes of ambient conditions during transport acc. to EN 60721-3-2

Classification type	Allowed class
Classification of climatic ambient conditions	2K2
Classification of biological ambient conditions	2B1
Classification of chemically active materials	2C2
Classification of mechanically active materials	2S2
Classification of mechanical ambient conditions	2M1

Tab. 11-1: Allowed classes of ambient conditions during transport

For the sake of clarity, a few essential environmental factors of the aforementioned classifications are presented below. Unless otherwise specified, the values given are the values of the particular class. However, Bosch Rexroth reserves the right to adjust these values at any time based on future experiences or changed ambient factors.

Allowed transport conditions

Environmental factor	Symbol	Unit	Value
Temperature	T_T	°C	-20 ... +80 ¹⁾
Air humidity (relative air humidity, not combinable with quick temperature change)	φ	%	75 (at +30 °C)
Occurrence of salt mist			Not permitted ¹⁾

1) Differs from EN 60721-3-2

Tab. 11-2: Allowed transport conditions



Before transport, empty the liquid coolant from the liquid-cooled motors to avoid frost damage.

Transport by air

If motor components with permanent magnets are shipped by air, the DGR (Dangerous Goods Regulations) of the IATA (International Air Transport Association) for hazardous materials of class 9 which also include magnetized substances and objects must be observed. For example, these regulations are applicable for

- Secondary parts of synchronous linear motors
- Rotors of synchronous kit motors
- Rotors of synchronous housing motors (if shipped as motor components, i.e., separated from the stator or motor housing in case service work is required)

For information on the maximum allowed magnetic strengths and methods of measuring such magnetic field strengths, please refer to the current IATA DGR (chapter 3.9.2.2).

Transport and storage

11.2 Storage instructions

11.2.1 Storage conditions

Generally, Bosch Rexroth recommends to store all components until they are actually installed in the machine as follows:

- In their original package
- At a dry and dustfree location
- At room temperature
- Free from vibrations
- Protected against light or direct insolation

On delivery, protective sleeves and covers may be attached to our motors. They must remain on the motor for transport and storage. Do not remove these parts until shortly before assembly.

Based on EN 60721-3-1, the tables below specify classifications and limit values which are allowed for our products while they are stored. Observe the detailed description of the classifications to take all of the factors which are specified in the particular classification into account.

Allowed classes of ambient conditions during storage acc. to EN 60721-3-1

Classification type	Class
Classification of climatic ambient conditions	1K2
Classification of biological ambient conditions	1B1
Classification of chemically active materials	1C2
Classification of mechanically active materials	1S1
Classification of mechanical ambient conditions	1M2

Tab. 11-3: Allowed classes of ambient conditions during storage

For the sake of clarity, a few essential environmental factors of the aforementioned classifications are presented below. Unless otherwise specified, the values given are the values of the particular class. However, Bosch Rexroth reserves the right to adjust these values at any time based on future experiences or changed ambient factors.

Allowed classes of ambient conditions during storage acc. to EN 60721-3-1

Environmental factor	Symbol	Unit	Value
Air temperature	T_L	°C	-20 ... +60 ¹⁾
Relative air humidity	φ	%	5 ... 95
Absolute air humidity	p_w	g/m ³	1 ... 29
Condensation	--	--	Not allowed
Ice formation/freezing	--	--	Not allowed
Direct solar radiation	--	--	Not allowed ¹⁾
Occurrence of salt mist	--	--	Not allowed ¹⁾

1) Differs from EN 60721-3-1

Tab. 11-4: Allowed storage conditions



Before re-storage, empty the liquid coolant from the liquid-cooled motors to avoid frost damage.

11.2.2 Storage times

Additional measures must be taken on commissioning to preserve proper functioning – irrespective of the storage time which may be longer than the warranty period of our products. However, this does not involve any additional warranty claims.

Motors

Bearing 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.
		■	Exchange bearings
		■	Exchange encoders

Tab. 11-5: Measures before commissioning motors that have been stored over a prolonged period of time

Cables and Connectors

Bearing time / months			Measures for commissioning
> 1	> 12	> 60	
■	■	■	Visual inspection of all parts to be damage-free
	■	■	Check the electric contacts to verify that they are free from corrosion
		■	Visually inspect the cable jacket. Do not use the cable if you detect any abnormalities (squeezed or kinked spots, color deviations, ...).

Tab. 11-6: Measure before commissioning cables and connectors that have been stored over a prolonged period of time

12 Delivery condition, identification, handling

12.1 Delivery condition

12.1.1 General information

Upon delivery, MSK motors are packed in cartons or wooden boxes. Packing units on pallets are secured with straps.

⚠ CAUTION

Injuries due to uncontrolled movement of the retaining straps when cutting!

Maintain a sufficient distance and carefully cut the bandages.

Motor shaft and plug connections are provided with protective sleeves ex works. Only remove the protective sleeves immediately before starting assembly.

12.1.2 Factory inspection

Factory testing of MSK motors includes:

- | | |
|---------------------------|--|
| Electrical testing | <ul style="list-style-type: none">• High-voltage test• Insulation resistance test• Protective conductor connection• Winding resistance test |
| Mechanical testing | <ul style="list-style-type: none">• Concentricity and position tolerances of shaft end and mounting flange• Axial run-out of the flange surface to the shaft• Coaxiality of the centering edge to the shaft• Brake holding torque test (option) |

12.1.3 Customer inspection

Since all MSK motors are subjected to a standardized test procedure, high-voltage tests by the customer are not necessary. Repeated high-voltage tests can damage motors and components.

NOTICE

Destruction of motor components due to improperly executed high-voltage inspection! Invalidation of warranty!

Avoid repeated inspections.

Please observe the target values of the EN 60034-1.

Delivery condition, identification, handling

12.2 Identification

12.2.1 Scope of delivery

The total scope of a delivery is stated on the delivery note or shipping document. The scope of a delivery can be distributed over several packages. Each individual package can be identified with the attached shipping label. On receipt of the delivery, check that the goods delivered are in accordance with your order and the shipping documents.

Immediately notify your responsible Rexroth sales partner of any deviations.

Directly notify the carrier in case of noticeable transport damage.

12.2.2 Type plate

Each motor has an individual type plate containing the device designation and technical information. In addition, a second type plate is attached to the motor delivered.

If the original type plate on the motor is covered by a machine contour, use the second supplied type plate and attach it clearly visible on the machine. This type plate is either attached loosely to the motor or glued to the original type plate and can be removed.

The type plate is used for

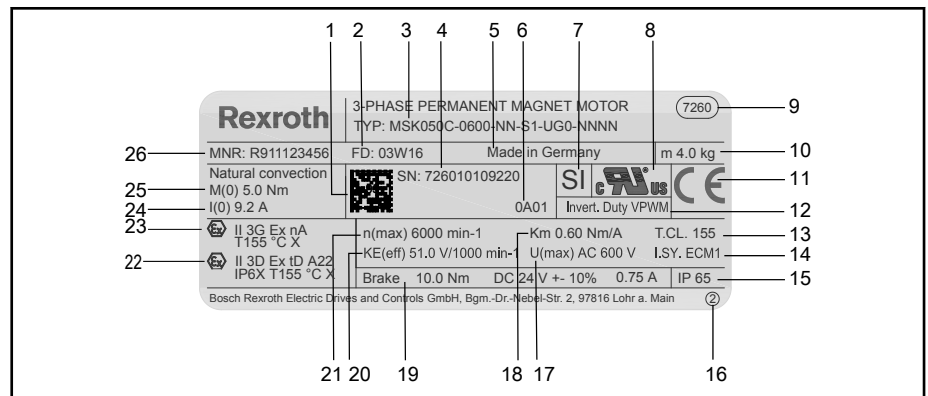
- Identification of the motor
- Procurement of spare parts in case of malfunction
- Service information



The type designation of the motor is also stored in the encoder data memory.

Delivery condition, identification, handling

Motor type plate



- 1 Barcode
- 2 Date of manufacture
- 3 Motor type (order designation according to type code)
- 4 Serial number
- 5 Country of origin
- 6 Change status
- 7 Marking "motor prepared for safety technology"
- 8 Labeling cURus (UL)
- 9 Factory number
- 10 Net weight
- 11 EC declaration of conformity
- 12 Inverter Duty VPWM (UL)
- 13 Temperature class
- 14 Labeling insulation system (UL)
- 15 Degree of protection of the housing
- 16 Type plate labeling
- 17 Voltage class (UL)
- 18 Torque constant at 20 °C
- 19 Information on holding brake, optional (holding torque, rated voltage, rated current)
- 20 Voltage constant
- 21 Maximum speed
- 22 Electrical apparatus marking for use with combustible dust
- 23 Electrical apparatus marking for use with combustible gas
- 24 Continuous current at standstill 60K
- 25 Continuous torque at standstill 60K
- 26 Material number

Fig. 12-1: MSK ATEX type plate

Delivery condition, identification, handling

12.3 Handling

⚠ CAUTION

Injuries due to improper handling during transport of motors!

Do only use suitable lifting devices (e.g. lifting sling belts, eyebolts, chain suspension ...).

Use protective equipment and personal protective clothing (gloves, safety shoes, ...).

Never walk under hanging loads.

NOTICE

Damage of property and invalidation of the warranty due to incorrect storage!

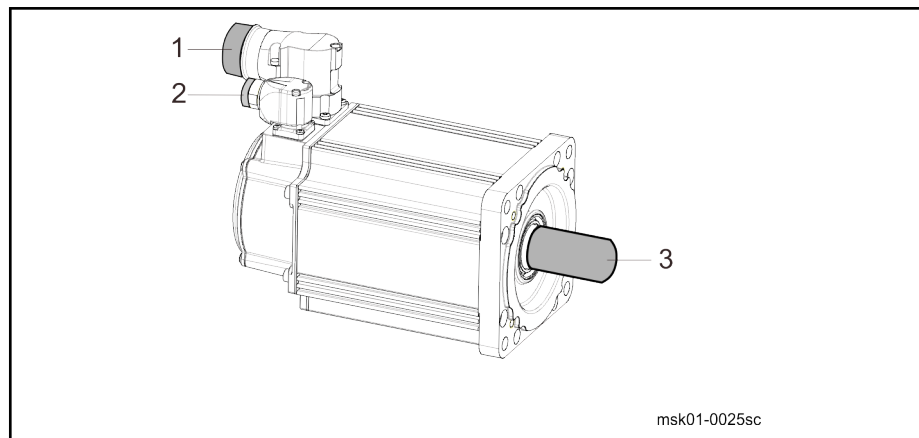
Store the motors horizontally in their original packaging in a dust-free, dry, vibration-free and sun-protected environment.

Observe the storage and transport instructions on the package.

Handling

On delivery, MSK motors are protected by shaft protection and covers. Covers and shaft protection must remain on the motor during transport and storage.

- Do not remove covers and shaft protection until immediately before installation.
- Use covers and shaft protection also when returning goods.
- Avoid damage to the motor flange and drive shaft.



msk01-0025sc

- ① Cable connector cover
- ② Encoder connector cover
- ③ Shaft protection

Fig. 12-2: Covers and shaft protection

NOTICE

Motor damage due to beats onto the motor shaft

Do never beat onto the shaft end and do not exceed the allowed axial and radial forces of the motor.

Transport

Observe the following points during transport:

Delivery condition, identification, handling

- Use suitable means of transport and take into account the weight of the components (weight specifications can be found in the data sheets or on the type plate of the motor).
- Use suitable shock absorbers if heavy vibrations can occur during transport.
- Transport the motors in a horizontal position only.
- Use cranes with loop lifting straps to lift the motors.

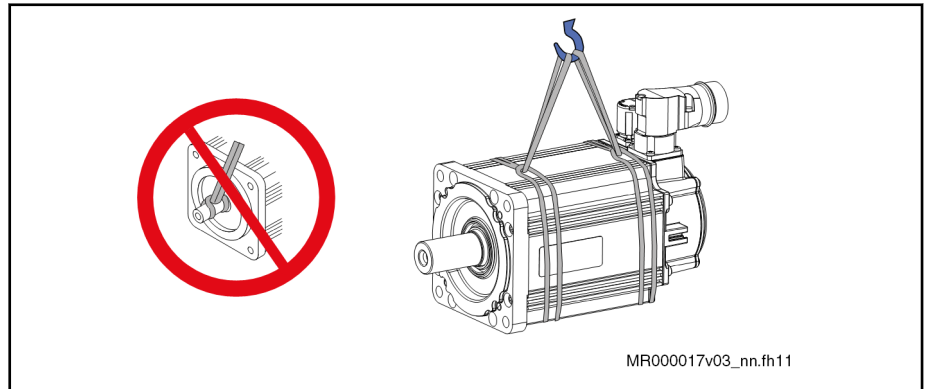


Fig. 12-3: *Lifting and transporting the motors with the aid of loop lifting belts*

13 Installation

13.1 Safety

WARNING

Danger! Electric voltage! Operations in the vicinity of live parts are extremely dangerous.

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



Prior to commencing work:

1. Isolate (even auxiliary circuits).
2. Protect the system or plant against restart.
3. Ensure de-energization.
4. Ground and short-circuit.
5. Cover or shield any adjacent live parts.

Before starting to work, check with an appropriate measuring device whether parts of the system are still under residual voltage (e.g. caused by capacitors, etc.). If yes, wait until these parts have discharged.

CAUTION

Injuries due to improper handling during transport of motors!

Do only use suitable lifting devices (e.g. lifting sling belts, eyebolts, chain suspension ...).

Use protective equipment and personal protective clothing (gloves, safety shoes, ...).

Never walk under hanging loads.

Carry out all work steps with particular care. This minimizes the risk of accidents and damage.

Installation

13.2 Specialist personnel

All work on the system and the drives may only be carried out by suitably trained specialist personnel.

Make sure that all persons who carry out

- installation work
- maintenance work or
- operating work

on the system are sufficiently familiar with the contents, all warnings and precautions according to this documentation.



Qualified specialist personnel are trained, instructed or authorized to switch circuits and devices on and off as well as to ground and to mark them according to the regulations of safety engineering. Qualified personnel have adequate safety equipment and are trained in first aid.

13.3 Mechanical attachment

13.3.1 Flange attachment

The screw connection must be adapted to the installation situation (screw length, strength class, screw-in depth, material, ...) The dimensioning of the screw connection is the responsibility of the customer.

Rexroth recommends the following screws and washers for attaching the motors to the machine in a professional and safe manner.

Fixing screws MSK motors

Boring ø [mm]	Screw 8.8 DIN EN ISO 4762 DIN EN ISO 4014	Tightening torque M _A [Nm] at μ _K = 0.12	Washer DIN EN ISO 28738
4.5	M4 × 20	3	-
6.6	M6 × 20	10.1	-
9	M8 × 20	24.6	yes
11	M10 × 30	48	yes
14	M12 × 40	84	yes
18	M16 × 35	206	yes

Tab. 13-1: Mounting screws tightening torque



The bolted connections for flange mounting must be able to absorb both the weight force of the motor and the forces occurring during operation.

If screws and washers that deviate from this recommendation are used, the strength class of the screws and the hardness class of the washers must be equivalent in order to transmit the required tightening torques.

MSK motors are manufactured ex works for flange mounting (B05). Details on the mounting holes are contained in the respective dimension sheet.

13.3.2 Preparation

Prepare the motor mounting as follows:

1. Procure tools, auxiliary materials, measuring and testing equipment.
2. Check all components for visible damage. Damaged components must not be mounted.
3. Make sure that all system dimensions and tolerances are suitable for motor mounting (see dimension sheet for details).
4. Check all components, mounting surfaces and threads for cleanliness.
5. Ensure that installation can be carried out in a dry, dust-free environment.
6. Make sure that the holder for the motor flange is free of burrs.
7. Remove the protective sleeve from the motor shaft and keep the sleeve for future use.
8. Only for motors with holding brake

Check whether the motor holding brake reaches the holding torque specified in the data sheet. If the brake does not reach the specified torque, first loop in the holding brake at [chapter 10.10.4 "Holding brake - commissioning and maintenance instructions"](#) on page 134.

Installation

13.3.3 Motor mounting

Mount the motor and pay attention:

1. Avoid clamping or jamming the centering collar on the motor side.
2. Avoid damaging the holder on the system side.
3. Connect the motor to the machine and observe the tightening torques.
4. Check strength and accuracy of connection before proceeding.

After proper mechanical assembly, carry out the electrical connection.

13.4 Electrical connection - connect motor

13.4.1 General information

Preferably use ready-made connection cables from Rexroth. These cables offer numerous advantages, such as UL/CSA approval, extreme load capacity and resistance as well as EMC-compliant design.

WARNING

Danger! Electric voltage! Operations in the vicinity of live parts are extremely dangerous.

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



Prior to commencing work:

1. Isolate (even auxiliary circuits).
2. Protect the system or plant against restart.
3. Ensure de-energization.
4. Ground and short-circuit.
5. Cover or shield any adjacent live parts.

Before starting to work, check with an appropriate measuring device whether parts of the system are still under residual voltage (e.g. caused by capacitors, etc.). If yes, wait until these parts have discharged.

WARNING

Damage to persons or property by disconnecting or connecting energized connectors!

- Connect and disconnect connectors only when they are dry and de-energized.
- During operation of the system, all connectors must be securely tightened or locked.

WARNING

Risk of short-circuit caused by liquid coolant, lubricant or pollution! Short-circuits of live lines may cause unpredictable dangerous situations or lead to damage to property.

When installing or replacing drive components, provide open sides of power connectors with protective caps.

Do only open terminal boxes for connection purpose and close them immediately after the connection is done.

Installation

13.4.2 Connecting the plug-in connector

Power, encoder connector Proceed as follows to connect the threaded connectors:

1. Place the power connector on the thread of the terminal box in the correct position.
2. Tighten the cap nut of the power connector by hand. By feeding more cable, the power connector can be brought up to its end position.
3. Tighten the cap nut up to the stop.



Only fully tightened cap nuts guarantee the specified protection against water (IP65) and activate the vibration protection.

Set output direction (option "U")

For MSK motors, the output direction of the connected power and encoder cables can be set with the option Electrical connection "U". The adjustable flange sockets can be rotated in a range of 240°, see [chapter 9.4 "Plug connector, rotatable" on page 112](#).

The flange socket can be rotated if an appropriate plug-in connector has been connected. The flange socket can be brought into the desired position by hand due to the lever effect of the connected plug-in connector.

1. Connect plug-in connector to flange socket
2. Move the flange socket in the desired output direction by turning the connected plug-in connector.



Do not use any tools (e.g. pliers or screwdrivers) to turn the motor flange socket. Mechanical damage to the flange socket by tools cannot be ruled out.

The desired output direction is set.



Each rotation of the flange socket reduces the holding torque in the set position. Change the output direction no more than 5 times.

Select output direction (option "A, B, L, R")

The output direction of the connected power cables can be selected for MSK motors with the option Electrical connection "A, B, L, R" when ordering. The output direction of the encoder connectors cannot be changed for these motors.

13.5 Connect equipotential bonding

Please note [chapter 9.5 "Connect equipotential bonding conductor" on page 114](#).

14 Commissioning, operation and maintenance

14.1 Commissioning

CAUTION

Damage to property due to errors in the controls of motors and moving elements! Unclear operating states and product data!

Do not perform a commissioning, if ...

- the connections, operating states or product data are unclear or faulty.
- the safety equipment and monitoring of the system is damaged or not in operation.

Never use any damaged products.

Contact Rexroth for missing information or support during commissioning.

The following commissioning notes refer to MSK motors as part of a drive system with drive controller and control unit.

Preparation

1. Have the documentations of all products used ready at hand.
2. Check the products for damage.
3. Check all mechanical and electrical connections.
4. Enable the safety devices and monitoring systems of the machine.
5. Ensure that the optional holding brakes are ready for operation (see [chapter 10.10 "Holding brakes" on page 131](#)).

Procedure

Once all requirements are met, proceed as follows:

1. Enable the optional motor cooling fan unit or liquid cooling.
2. Perform the commissioning of the drive system according to the instructions in the respective product documentation. The corresponding information can be found in the functional descriptions of the drive control units.



The commissioning of control units and control systems may require further steps. Testing the functionality and performance of the systems is not part of the motor commissioning, but is carried out as part of the overall commissioning of the machine. Observe the information and instructions of the machine manufacturer.

Commissioning, operation and maintenance

14.2 Operation

During operation, ensure that the ambient conditions described are observed (see [chapter 10 "Operating conditions and application notes" on page 115](#)).

14.3 Shutdown

In the event of malfunctions, maintenance measures or shutting down the motors, please proceed as follows:

1. Follow the instructions in the machine documentation.
2. Use the machine-side control commands to decelerate the drive to a controlled standstill.
3. Switch off the power and control voltage of the control unit.
4. **Only for motors with fan unit:** Switch off the motor protection switch for the fan unit.
5. Switch off the main switch of the machine.
6. Secure the machine against unpredictable movements and against operation by unauthorized persons.
7. Wait until the discharging time of the electrical systems has elapsed and then disconnect all electrical connections.
8. Before disassembling the motor and, if applicable, the fan unit, secure them against dropping or moving and afterwards, disconnect the mechanical connections.

14.4 Maintenance

14.4.1 General information

MSK motors operate maintenance-free within the specified operating conditions and service life. Operation under unfavorable conditions can, however, lead to restrictions in availability.

Increase availability with regular preventive maintenance measures. Observe the information of the machine manufacturer in the machine maintenance plan and the maintenance measures described in the following.

WARNING

Danger! Electric voltage! Operations in the vicinity of live parts are extremely dangerous.

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



Prior to commencing work:

1. Isolate (even auxiliary circuits).
2. Protect the system or plant against restart.
3. Ensure de-energization.
4. Ground and short-circuit.
5. Cover or shield any adjacent live parts.

Before starting to work, check with an appropriate measuring device whether parts of the system are still under residual voltage (e.g. caused by capacitors, etc.). If yes, wait until these parts have discharged.

CAUTION

Combustions via hot surface with temperatures over 60 °C

Let the motor cool down, before maintenance. The thermal time constant stated in the technical data is a measure for the cooling time. A cooling time up to 140 minutes can be necessary!

Use safety gloves.

Do not work on hot surfaces.

WARNING

Personal and material damage during maintenance work in operation!

Never carry out maintenance work on running machines.

Before starting maintenance work, secure the machine against switching on, operation and unauthorized use.

14.4.2 Cleaning

Excessive dirt, chips or dust can negatively influence the motor functions. In extreme cases lead to motor loss. Clean the cooling fins of the motors at regular intervals (after one year at the latest) to reach a sufficiently high heat emission surface. If the cooling fins are partially covered with dirt, sufficient heat dissipation via the ambient air is no longer ensured.

Insufficient heat dissipation can have undesirable consequences. The bearing life is reduced by operation at inadmissibly high temperatures (bearing grease decomposes). Overtemperature switch-off despite operation on the basis of selected data, because the appropriate cooling is missing.

Commissioning, operation and maintenance

14.4.3 Bearings

The nominal lifetime of the bearings is $L_{10h} = 30,000 \text{ h}$ according to DIN ISO 281, ed. 1990, provided the permissible radial and axial forces are not exceeded.

The motor bearings should be replaced if

- the nominal bearing service life has been reached,
- running noises occur.



We recommend that bearings be replaced by the Bosch Rexroth Service.

14.4.4 Connecting cables

⚠ DANGER

Death by electrocution possible due to live parts!

If the slightest defect is detected in the cable sheath, the system must be shut down immediately. Then the cable must be replaced.

Do not repair any connection lines provisionally.

- Check connection cables for damage at regular intervals and replace them, if necessary.
- Check any optional energy management chains (drag chains) for defects.
- Check the protective conductor connection for proper state and tight seat at regular intervals and replace it, if necessary.

14.5 Information in case of malfunctions

WARNING

Fatal electric shock from live parts with more than 50 V!

Before starting work on live parts: Disconnect the machine from the power supply and secure the mains switch against unintentional or unauthorized re-connection.

Check whether the voltage has fallen below 50 V before touching live parts!

WARNING

Combustions via hot surface with temperatures over 100 °C

Let the motor cool down, before maintenance. The thermal time constant stated in the technical data is a measure for the cooling time. A cooling time up to 140 minutes can be necessary!

Do not work on hot surfaces.

Use safety gloves.

In the event of faults, always observe the information in the project planning and commissioning instructions. If necessary, contact the manufacturer [chapter 17 "Service and support" on page 171](#).

Malfunction	Error cause	Measures
Motor does not run	Controller enable signal missing	Activate controller enable signal
	Controller fault	Troubleshoot acc. to documentation of controller
	Voltage supply missing	Control voltage supply
	Brake is not released	Check the brake activation
Vibrations	Coupling elements or attachments are poorly balanced	Re-balance
	Adjustment of shaft end attachments (coupling, gearbox, ...) is insufficient	Re-align the attachments
	Mounting screws loose	Lock screw connections acc. to specifications
Running noise	Foreign bodies within the motor	Stop the motor --> repair by manufacturer
	Bearing is damaged	Stop the motor --> repair by manufacturer
High motor temperatures Motor temperature monitoring is activated	Operation outside the parameters	Reduce load
	Heat dissipation obstructed	Clean the motor For fan units, clean fan grille and check the fan function For liquid cooling, check cooling circuit.

Commissioning, operation and maintenance

Malfunction	Error cause	Measures
Wrong or defective temperature display	Temperature sensor not connected	Connect temperature sensor
	Temperature sensor defective	Stop the motor --> repair by manufacturer

Tab. 14-1: Malfunctions in MSK motors

14.6 Disassembly

WARNING

Personal injury and material damage during assembly works!

- Do not work on running or unsecured machines.
 - Before starting work, secure the machine against unpredictable movements and against unauthorized operation.
 - Before disconnecting the mechanical connections, secure the motor and supply lines against falling.
-

CAUTION

Combustions via hot surface with temperatures over 60 °C

Let the motor cool down, before maintenance. The thermal time constant stated in the technical data is a measure for the cooling time. A cooling time up to 140 minutes can be necessary!

Use safety gloves.

Do not work on hot surfaces.

- Follow the instructions in the machine documentation.
- Observe the safety instructions.
- Dismount the motor from the machine. Store the motor properly.

15 Environmental protection and disposal

15.1 Environmental protection

Production processes	The products are made with energy- and resource-optimized production processes which allow re-using and recycling the resulting waste. We regularly try to replace pollutant-loaded raw materials and supplies by more environment-friendly alternatives.	
No release of hazardous substances	Our products do not contain any hazardous substances which may be released in the case of appropriate use. Normally, our products will not have any negative influences on the environment.	
Significant components	Basically, our products contain the following components:	
	Electronic devices • steel • aluminum • copper • synthetic materials • electronic components and modules	Motors • steel • aluminum • copper • brass • magnetic materials • electronic components and modules

15.2 Disposal

Return of products	Our products can be returned to our premises free of charge for disposal. It is a precondition, however, that the products are free of oil, grease or other dirt. Furthermore, the products returned for disposal must not contain any undue foreign material or foreign components. Send the products "free domicile" to the following address: Bosch Rexroth AG Electric Drives and Controls Buergermeister-Dr.-Nebel-Strasse 2 97816 Lohr am Main, Germany	
Packaging	The packaging materials consist of cardboard, wood and polystyrene. These materials can be recycled anywhere without any problem. For ecological reasons, please refrain from returning the empty packages to us.	
Batteries and accumulators	Batteries and accumulators can be labeled with this symbol.  The symbol indicating "separate collection" for all batteries and accumulators is the crossed-out wheeled bin. The end user within the EU is legally obligated to return used batteries. Outside the validity of the EU Directive 2006/66/EC keep the stipulated directives. Used batteries can contain hazardous substances, which can harm the environment or the people's health when they are improperly stored or disposed of. After use, the batteries or accumulators contained in Rexroth products have to be properly disposed of according to the country-specific collection.	
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 modules.	

Environmental protection and disposal

Metals contained in electric and electronic modules can also be recycled by means of special separation processes.

Products made of plastics can contain flame retardants. These plastic parts are labeled according to EN ISO 1043. They have to be recycled separately or disposed of according to the valid legal requirements.

16 Appendix

16.1 EU Declaration of conformity

According to ATEX directive 2014/34/EU, the manufacturer,

Bosch Rexroth AG

Bürgermeister-Dr.-Nebel-Straße 2

97816 Lohr am Main, Germany

declares that the following products

3-PHASE SYNCHRONOUS PM-MOTOR		
MSK030...-NSNN, MSK060...-NSNN, MSK071...-NSNN, MSK101...-NSNN,	MSK040...-NSNN MSK061...-NSNN, MSK076...-NSNN,	MSK050...-NSNN, MSK070...-NSNN, MSK100...-NSNN,

from the date of manufacture 2016-04-20 were developed, designed and manufactured in compliance with the above-mentioned EU directive.

Applied harmonized standards:

Standard	Title	Edition
EN 60079-0 (IEC 60079-0)	Potentially explosive areas – Part 0: Equipment – General requirements	2012 + A11:2013 (2011, modified + Cor.:2012 + Cor.: 2013)
EN 60079-15 (IEC 60079-15)	Potentially explosive atmospheres – Part 15: Device protection by ignition protection type “n”	2010 (2010)
EN 60079-31 (IEC 60079-31)	Potentially explosive atmosphere – Part 31: Equipment dust ignition protection by enclosure “t”	2014 (2013)

The motors have the following markings:

⊕II 3G Ex nA T155°C Gc X

⊕II 3D Ex tc IIIC T155°C Dc IP6X X

Further explanations:

The product is intended solely for installation in an machine. The intended use of the product requires compliance with the terms of use and conditions of use specified in the operating instructions (DOK-MOTOR*-MSK*EXGIIK3-ITRS-xx-x) by the user.

Appendix



EU-Konformitätserklärung - Original

Dok.-Nr.: DCTC-30502-001

Datum: 2016-04-20

- ☐ nach Maschinenrichtlinie 2006/42/EG
☐ nach Niederspannungsrichtlinie 2014/35/EU
☐ nach EMV-Richtlinie 2014/30/EU
☒ nach ATEX-Richtlinie 2014/34/EU

Hiermit erklärt der Hersteller,
Bosch Rexroth AG, Bürgermeister-Dr.-Nebel-Straße 2, 97816 Lohr am Main / Germany,

dass die nachstehenden Produkte

Bezeichnung: 3-PHASE SYNCHRONOUS PM-MOTOR

Typ:	MSK030...-NSNN	MSK040...-NSNN	MSK050...-NSNN	MSK060...-NSNN
	MSK061...-NSNN	MSK070...-NSNN	MSK071...-NSNN	MSK076...-NSNN
	MSK100...-NSNN	MSK101...-NSNN		

Ab Herstelldatum: 2016-04-20

in Übereinstimmung mit den oben genannten EU-Richtlinien entwickelt, konstruiert und gefertigt wurden.

Angewandte harmonisierte Normen:

Norm	Titel	Ausgabe
EN 60079-0 (IEC 60079-0)	Explosionsfähige Atmosphäre – Teil 0: Geräte – Allgemeine Anforderungen	2012 + A11:2013 (2011, modifiziert + Cor.:2012 + Cor.: 2013)
EN 60079-15 (IEC 60079-15)	Explosionsfähige Atmosphäre – Teil 15: Geräteschutz durch Zündschutzarte „n“	2010 (2010)
EN 60079-31 (IEC 60079-31)	Explosionsfähige Atmosphäre – Teil 31: Geräte-Staubexplosionsschutz durch Gehäuse „t“	2014 (2013)

Die Motoren haben folgende Kennzeichnungen:

Ex II 3G Ex nA T155°C Gc X

Ex II 3D Ex tc III C T155°C Dc IP6X X

Weitere Erläuterungen:

Das Produkt ist ausschließlich zum Einbau in eine Maschine bestimmt.

Der bestimmungsgemäße Gebrauch des Produktes setzt die Einhaltung der Benutzungsbestimmungen und Anwendungsbedingungen, die in der Betriebsanleitung (DOK-MOTOR*-MSK*EXGIK3-ITRS-xx-x) angegeben werden, durch den Nutzer voraus.

Lohr a. Main
Ort

2016-04-20
Datum

ppa.

Joachim Hennig
Werkleitung LoP2

i.v.

Eberhard Schemm
Entwicklungsbereichsleiter Antriebe

Änderungen im Inhalt der EU-Konformitätserklärung sind vorbehalten. Derzeit gültige Ausgabe auf Anfrage.

Fig. 16-1: EU Declaration of conformity - original, German



EU declaration of conformity - original

Doc. No.: DCTC-30502-001

Date: 2016-04-20

- ☐ in accordance with Machinery Directive 2006/42/EC
- ☐ in accordance with Low Voltage Directive 2014/35/EU
- ☐ in accordance with EMC Directive 2014/30/EU
- ☒ in accordance with ATEX Directive 2014/34/EU

The manufacturer,
Bosch Rexroth AG, Bürgermeister-Dr.-Nebel-Straße 2, 97816 Lohr am Main / Germany

hereby declares that the products below

Name: 3-PHASE SYNCHRONOUS PM-MOTOR

Type: MSK030...-NSNN MSK040...-NSNN MSK050...-NSNN MSK060...-NSNN
MSK061...-NSNN MSK070...-NSNN MSK071...-NSNN MSK076...-NSNN
MSK100...-NSNN MSK101...-NSNN

From the date of manufacture: 2016-04-20

were developed, designed and manufactured in compliance with the above-mentioned EU directives.

Harmonized Standards applied:

Standard	Title	Edition
EN 60079-0 (IEC 60079-0)	Explosive atmospheres – Part 0: Equipment – General requirements	2012 + A11:2013 (2011, modified + Cor.:2012 + Cor.: 2013)
EN 60079-15 (IEC 60079-15)	Explosive atmospheres – Part 15: Equipment protection by type of protection „n“	2010 (2010)
EN 60079-31 (IEC 60079-31)	Explosive atmospheres – Part 31: Equipment dust ignition protection by enclosure "t"	2014 (2013)

The motors have the following markings:

⊕ II 3G Ex nA T155°C Gc X
⊕ II 3D Ex tc IIIC T155°C Dc IP6X X

Further explanations:

The product is intended solely for installation in a machine.
For the product to be used as intended the user must comply with the provisions of use and conditions of application laid down in the instructions (DOK-MOTOR*-MSK*EXGIIK3-ITRS-xx-x).

Lohr a. Main ,
Place

2016-04-20
Date

Joachim Hennig
Plant Manager LoP2

Eberhard Schemm
Head of Development Drives Solutions

We reserve the right to make changes to the content of the EU Declaration of Conformity. Current issue on request.

17 Service and support

Our worldwide service network provides an optimized and efficient support. Our experts offer you advice and assistance should you have any queries. You can contact us **24/7**.

Service Germany Our technology-oriented Competence Center in Lohr, Germany, is responsible for all your service-related queries for electric drive and controls.

Contact the **Service Hotline** and **Service Helpdesk** under:

Phone: **+49 9352 40 5060**
Fax: **+49 9352 18 4941**
E-mail: service.svc@boschrexroth.de
Internet: <http://www.boschrexroth.com>

Additional information on service, repair (e.g. delivery addresses) and training can be found on our internet sites.

Service worldwide Outside Germany, please contact your local service office first. For hotline numbers, refer to the sales office addresses on the internet.

Preparing information To be able to help you more quickly and efficiently, please have the following information ready:

- Detailed description of malfunction and circumstances
- Type plate specifications of the affected products, in particular type codes and serial numbers
- Your contact data (phone and fax number as well as your e-mail address)

Index

A

Accumulators.....	165
Alignment.....	81
Ambient temperature.....	26, 115
Ambient temperature during operation.....	32
Attachments.....	130
Average speed.....	125
Axial load.....	125

B

Balancing.....	81, 123
Batteries.....	165
Bearing	
Wear.....	129
Bearing failure.....	129
Bearing lifetime.....	129
Bearing load.....	125
Bevel pinion.....	130
Braking energy.....	131

C

CE.....	135
Centering hole.....	81
Climatic environmental conditions	116
Compatibility.....	121
Concentricity.....	81
Conditions of installation.....	120
Connecting conditions.....	26
Connection cables	160
Connection time.....	32
Connectors.....	26
Contained substances	
see "Significant components".....	165
Continuous current at standstill.....	31
Continuous torque at standstill.....	31
Cooling fins.....	159
Couplings.....	130

D

Design.....	120
Disconnection time.....	32
Disposal.....	165
Drag chains.....	160
Drive system.....	13

E

EAC.....	135
Electric drive system.....	13
Emergency stop.....	26
Energy management chains.....	160
Environmental protection.....	165
Equipotential bonding conductor.....	114

F

Fan.....	26
Fixing screws.....	153
Flange.....	81
Flange attachment.....	153
Foreign materials.....	121
Frame length.....	93
Frame size.....	93

G

Grounding.....	26
----------------	----

H

Hazardous substances.....	165
Heat dissipation.....	159
Helical gearing.....	130
Helpdesk.....	171
Holding brake.....	27, 94
Commissioning.....	134
electrically releasing.....	131
Warning.....	132
Holding brake (control).....	27
Holding brake (fault)	27
Holding brakes.....	131
Holding torque.....	32
Hotline.....	171
Housing varnish.....	81
Humidity	
absolute air humidity.....	116
relative air humidity	116

I

Identification.....	146
Inappropriate use	
Consequences, exclusion of liability.....	11
IndraSize.....	34
Installation altitude.....	115
Installation positions.....	120
Insulation class according to DIN EN 60034-1...	32
Intended use.....	11
Case of operation.....	11
IP protection type.....	119

K

Key.....	123
----------	-----

L

Leakage capacitance.....	31
Loop lifting straps.....	149

M

Mass.....	32
Maximum current.....	31
Maximum speed.....	32

Index

Maximum torque.....	31
Minimum distance	
Motor.....	137
Moment of inertia of the brake.....	32
Moment of inertia of the rotor.....	31
Motor attachment.....	153
Motor frame size.....	81
Motor mounting.....	154
Motor paint	
Additional paint.....	122
Motor type plate.....	147
Motor variants available.....	93

N

Non-intended use.....	12
Number of pole pairs.....	31

O

Operating hours.....	129
Output shaft.....	81, 123
Key balancing.....	94
Plain output shaft.....	123
Over-determined arrangement.....	130

P

Packaging.....	165
PELV.....	17
Pinion.....	130
Processing cycle.....	126
Product.....	93
Production processes.....	165
Protection class acc. to EN 60034-1.....	32
Protection type.....	119
Protective extra-low voltage.....	17

R

Radial load.....	125
Radial shaft sealing ring.....	31, 123
Rated current.....	32
Rated voltage.....	32
Recycling.....	165
Residual risks (aging).....	29
Residual risks (impermeability).....	29
Residual risks (overloading).....	29
Residual risks (temperature monitoring).....	29
Return of products.....	165
Risk of corrosion.....	26
RoHS	
China RoHS 2.....	136
RoHS II.....	135
Run-out.....	81
Running noises.....	160

S

Safety notes for electric drives and controls.....	13
Service hotline.....	171
Shaft.....	93

plain.....	123
with keyway.....	123
Shaft end.....	81
Shaft load.....	125
Shaft sealing ring.....	123
Shock.....	118
Shock absorbers.....	149
Shutdown temperature.....	138
Significant components.....	165
sine-wave oscillations.....	117
Sound pressure level.....	32
Standards.....	8
state of the art.....	11
Storage time.....	143
Strength.....	154
Support.....	171

T

temperature increase on the housing 60K.....	31
Temperature sensor.....	138
Thermal time constant.....	32
Tightness.....	124
Torque constant at 20 °C.....	31
Twisting moment	113

U

UL approval.....	135
Use	
Inappropriate use.....	12
Intended use.....	11

V

Vibration severity grade (quality of vibration).....	81
Vibrations.....	117
Voltage constant at 20 °C.....	31

W

Warning temperature.....	138
Winding.....	93
Winding inductivity.....	31
Winding resistance at 20 °C.....	31
Wiring diagram.....	109

Notes

Bosch Rexroth AG

Electric Drives and Controls

P.O. Box 13 57

97803 Lohr, Germany

Bgm.-Dr.-Nebel-Str. 2

97816 Lohr, Germany

Phone +49 9352 18 0

Fax +49 9352 18 8400

www.boschrexroth.com/electrics



R911312709