Electric Drives and Controls | Hydraulics | Linear Motion and Assembly Technologies | Pneumatics | Service

Rexroth
Bosch Group

Rexroth IndraDyn S
MSK Synchronous Motors

R911296289
Edition 09

Project Planning Manual

Title
Rexroth IndraDyn S
MSK Synchronous Motors

Type of Documentation
Project Planning Manual

Document Typecode
DOK-MOTOR*-MSK********-PR09-EN-P

Internal File Reference
RS-e376b79b0a6846ac00f6d325fdbe2ed7-7-en-US-11

Purpose of Documentation
This documentation…

- explains the features of the product, possibilities for use, operating conditions and operational limits of MSK motors.
- contains technical data regarding available MSK motors.
- provides information regarding product selection, handling and operation

Record of Revision

Edition	Release Date	Notes
DOK-MOTOR*-MSK********-PR01-EN-P	06/2004	First edition
DOK-MOTOR*-MSK********-PR02-EN-P	10/2004	Revision / supplement
DOK-MOTOR*-MSK********-PR04-EN-P	06/2005	Revision / supplement
DOK-MOTOR*-MSK********-PR06-EN-P	12/2006	Revision / supplement fan units
DOK-MOTOR*-MSK********-PR07-EN-P	06/2008	Revision / supplement
DOK-MOTOR*-MSK********-PR08-EN-P	09/2008	Revision / supplement
DOK-MOTOR*-MSK********-PR09-EN-P	12/2010	Revision / supplement

Published by
Bosch Rexroth AG
Bgm.-Dr.-Nebel-Str. 2 ■ 97816 Lohr a. Main, Germany
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Note
This document has been printed on chlorine-free bleached paper.

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1 Introduction

1.1 Introduction to the Product IndraDyn S

IndraDyn S servo motors set new standards. Many innovations in synchronous servomotors combine past experiences and the most up-to-date motor technology to create a new standard.

IndraDyn S servo motors are characterized by

- dynamics
- a compact construction
- a high torque density
- an extremely high degree of precision due to new optical encoder systems

1.2 About this Documentation

1.2.1 Notes about Keeping

This documentation must be kept by the user during the whole period of use and lifetime of the product and be passed on in case of sale.

Save these instructions.

1.2.2 Document Structure

The present documentation contains safety regulations, technical data, and operating instructions for IndraDyn S motors. The individual chapters can be subdivided into the following focal points:

Chapter	Title	Contents
1	Introduction	**General Information**
2	Important Instructions on Use	**Safety**
3	Notes Regarding Safety	
4	Technical Data	**Product Description** (for planners and designers)
5	Specifications	
6	Type Codes	
7	Fan Units for MSK Motors	
8	Connection Technique	
9	Operating Conditions and Application Notes	
10	Transport and Storage	**Practice** (for operating and maintenance personnel)
11	Delivery status, identification, handling	
12	Installation	
13	Commissioning, Operation and Maintenance	
14	Environmental Protection and Disposal	**General Information**
15	Appendix	
16	Service & Support	
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Fig. 1-1: Document structure

1.2.3 Additional Documentation

As the case may be, you might need additional documentation referring to the used devices to project the drive systems of the MSK motor unit. Rexroth provides all product documentation in the Bosch Rexroth media directory in a PDF-format.

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

1.2.4 Standards

This documentation refers to German, European and international technical standards. Documents and sheets on standards are subject to copyright protection and may not be passed on to third parties by Rexroth. If need be, please contact the authorized sales outlets or, in Germany, directly:

BEUTH Verlag GmbH

Burggrafenstrasse 6

10787 Berlin, Germany

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

1.2.5 Foreign Systems

Documentation for external systems which are connected to Rexroth components are not included in the scope of delivery and must be ordered directly from the respective manufacturers.

1.2.6 Your Feedback

Your experiences are an essential part of the process of improving both the product and the documentation.

Please send your remarks to:

Bosch Rexroth AG

Dept. DC-IA/EDM3

Buergermeister-Dr.-Nebel-Strasse 2

97816 Lohr

Email: 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 **Personal injury and property damage coused by inappropriate use of the products!**

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.
- If the products are hardware, they must be kept in their original state, i.e. no constructional modifications must be made. Software products must not be decompiled; their source codes must not be modified.
- Damaged or improperly working products must 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

Rexroth IndraDyn A series asynchronous motors ApplicationsMSK are designed to be used as rotary main and servo drive motors. The following are typical fields of application:

- Machine tools
- Printing and paper-processing machines,
- Packaging and Food-processing machines,
- Metal-forming machines
- Robotics

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.

☞ MSKThe motors must only be used with the accessories specified in this documentation. Components that are not explicitly mentioned must neither be attached nor connected. The same is true for cables and lines.

The operation must only be carried out 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 control device must be programmed before startup in order to ensure that the motor executes the functions specifically to the particular application.

MSKThe 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 MSKof 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 motors may not be used if . . .

- They are subject to operating conditions which do not comply with the ambient conditions described above. For example, they must not be operated under water, under extreme temperature fluctuations or extreme maximum temperatures.
- the intended application is not explicitly released by Bosch Rexroth. Please make absolutely sure that the instructions given in the general safety notes are also complied with!

3 Safety Instructions for Electric Drives and Controls

3.1 Definitions of Terms

Application 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: User Guide, Operation Manual, Commissioning Manual, Instruction Manual, Project Planning Manual, Application Manual, etc.

Component 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.

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

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.

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.

Electric 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.

Installation 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.

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.

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.

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 Persons 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 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

User A user is a person installing, commissioning or using a product which has been placed on the market.

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 Technology". 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 must take into account

- 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!
- Risk of burns by hot housing surfaces!

Safety Instructions for Electric Drives and Controls

- 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 Instructions with Regard to Specific Dangers

3.3.1 Protection Against Contact With Electrical Parts and Housings

☞ This section concerns components of the electric drive and control system with voltages of **more than 50 volts**.

Contact with parts conducting voltages above 50 volts can cause personal danger and electric shock. When operating components of the electric drive and control system, it is unavoidable that some parts of these components conduct dangerous voltage.

High electrical voltage! Danger to life, risk of injury by electric shock or serious injury!

- Only qualified persons are allowed to operate, maintain and/or repair the components of the electric drive and control system.
- Follow the general installation and safety regulations when working on power installations.
- Before switching on, the equipment grounding conductor must have been permanently connected to all electric components in accordance with the connection diagram.
- Even for brief measurements or tests, operation is only allowed if the equipment grounding conductor has been permanently connected to the points of the components provided for this purpose.
- Before accessing electrical parts with voltage potentials higher than 50 V, you must disconnect electric components from the mains or from the power supply unit. Secure the electric component from reconnection.
- With electric components, observe the following aspects:

  Always wait **30 minutes** after switching off power to allow live capacitors to discharge before accessing an electric component. Measure the electrical voltage of live parts before beginning to work to make sure that the equipment is safe to touch.
- Install the covers and guards provided for this purpose before switching on.
- Never touch electrical connection points of the components while power is turned on.
- Do not remove or plug in connectors when the component has been powered.
- Under specific conditions, electric drive systems can be operated at mains protected by residual-current-operated circuit-breakers sensitive to universal current (RCDs/RCMs).
- Secure built-in devices from penetrating foreign objects and water, as well as from direct contact, by providing an external housing, for example a control cabinet.

High housing voltage and high leakage current! Danger to life, risk of injury by electric shock!

- Before switching on and before commissioning, ground or connect the components of the electric drive and control system to the equipment grounding conductor at the grounding points.

- Connect the equipment grounding conductor of the components of the electric drive and control system permanently to the main power supply at all times. The leakage current is greater than 3.5 mA.
- Establish an equipment grounding connection with a minimum cross section according to the table below. With an outer conductor cross section smaller than 10 mm^2 (8 AWG), the alternative connection of two equipment grounding conductors is allowed, each having the same cross section as the outer conductors.

Cross section outer conductor	Minimum cross section equipment grounding conductor Leakage current ≥ 3.5 mA	
	1 equipment grounding conductor	2 equipment grounding conductors
1.5 mm^2 (16 AWG)	10 mm^2 (8 AWG)	2 × 1.5 mm^2 (16 AWG)
2.5 mm^2 (14 AWG)		2 × 2.5 mm^2 (14 AWG)
4 mm^2 (12 AWG)		2 × 4 mm^2 (12 AWG)
6 mm^2 (10 AWG)		2 × 6 mm^2 (10 AWG)
10 mm^2 (8 AWG)		-
16 mm^2 (6 AWG)	16 mm^2 (6 AWG)	-
25 mm^2 (4 AWG)		-
35 mm^2 (2 AWG)		-
50 mm^2 (1/0 AWG)	25 mm^2 (4 AWG)	-
70 mm^2 (2/0 AWG)	35 mm^2 (2 AWG)	-
...	...	...

Fig.3-1: Minimum Cross Section of the Equipment Grounding Connection

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 between 5 and 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.

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 Magnetic and Electromagnetic Fields During Operation and Mounting

Magnetic and electromagnetic fields generated by current-carrying conductors or permanent magnets of electric motors represent a serious danger to persons with heart pacemakers, metal implants and hearing aids.

Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electric components!

- Persons with heart pacemakers and metal implants are not allowed to enter the following areas:
  - Areas in which components of the electric drive and control systems are mounted, commissioned and operated.
  - Areas in which parts of motors with permanent magnets are stored, repaired or mounted.
- If it is necessary for somebody with a heart pacemaker to enter such an area, a doctor must be consulted prior to doing so. The noise immunity of implanted heart pacemakers differs so greatly that no general rules can be given.
- Those with metal implants or metal pieces, as well as with hearing aids, must consult a doctor before they enter the areas described above.

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).
- 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 Z535.6-2006).

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 Technical Data

4.1 Characteristics

4.1.1 General Information

The speed-torque curves and technical data are specified for two different temperature models.

- 60 K temperature increase on the housing and
- 100 K temperature increase on the winding

☞ When selecting the technical data, observe the temperatures specified! The appropriate parameters are marked with **100 K** and **60 K**, respectively.

60K data 60K data for IndraDyn S motors are specified for the following conditions:

- Ambient temperature 40 °C
- Setup isolated
- Maximum temperature increase on the housing ΔT = 60 K
- In case of motors with the optional holding brake, the data are always specified for motors **with** a holding brake.
- Motors with radial shaft sealing ring

100K data 100K data for IndraDyn S motors are specified for the following conditions:

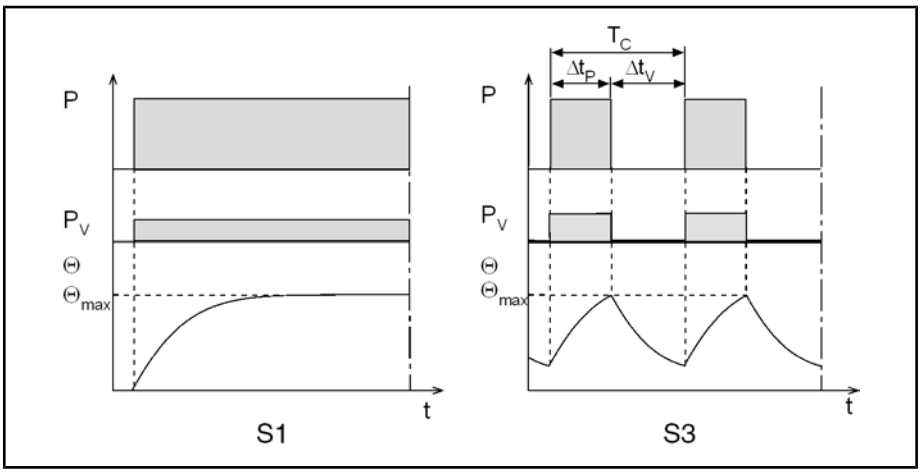
- Ambient temperature 40 °C
- Structure **not** insulated (attachment to steel flange, L×W×H = 450×30×350 or 120×40×100)
- Maximum temperature increase on the winding ΔT = 100 K
- In case of motors with the optional holding brake, the data are always specified for motors **with** a holding brake.
- Motors with radial shaft sealing ring

☞ The machine accuracy can be negatively affected by an increased linear expansion during 100 K operation. We recommend using 60 K data for the planning of systems.

Technical Data

4.1.2 Operating Modes

IndraDyn S motors are documented according to the inspection criteria and measurement procedures of EN 60034-1. The specified characteristic curves correspond to operating mode S1 or S3.



P	Load
PV	Electric losses
Θ	Temperature
Θmax	Highest temperature (motor housing)
t	Time
TC	Cycle time
ΔtP	Operating time with constant load
ΔtV	Idling time

Fig.4-1: Operating modes according to EN 60034-1:1998

4.1.3 Duty Cycle

Operating mode S3 is supplemented by the specification of the duty cycle (DC) in %. The duty cycle is calculated as follows:

$$ED = \frac{\Delta t_p}{T_c} \cdot 100\%$$

DC	Relative duty cycle in %
ΔtP	Operating time with constant load

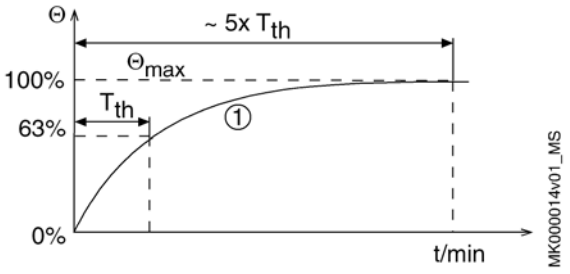
Fig.4-2: Relative duty cycle

The values specified in the documentation have been determined on the basis of the following parameters:

Cycle time: 10 min

Duty cycle (DC): 25 %

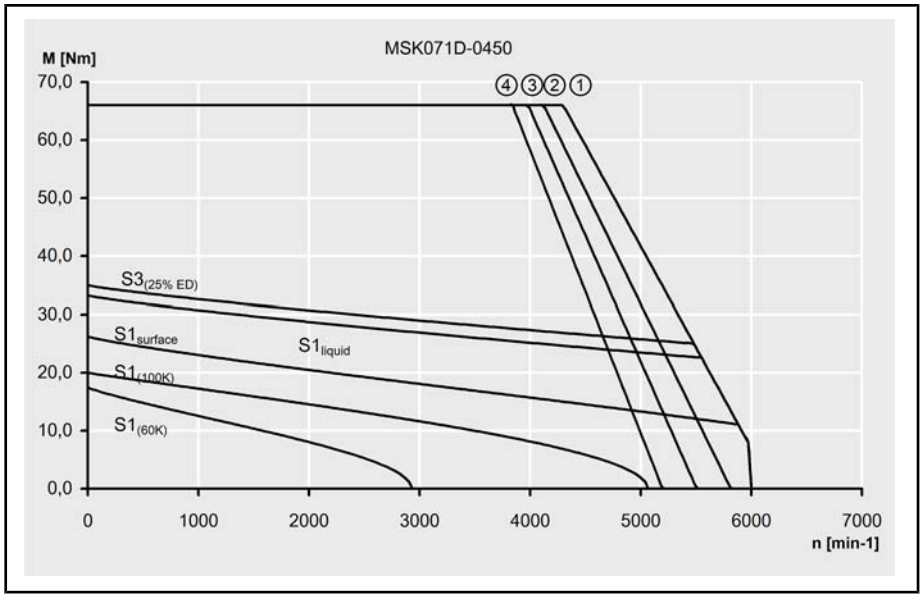
4.1.4 Definition of Parameters

Designation	Symbol	Unit	Description
UL files	-	-	UL File number
Continuous torque at standstill, 60K	M_{0_60}	Nm	Continuous torque that can be applied to the motor output shaft at a speed of n ≥ 0.1 Hz.
Continuous current at standstill, 60K	M_{0_60}	Nm	Continuous torque that can be applied to the motor output shaft at a speed of n ≥ 0.1 Hz.
Continuous torque at standstill, 100K	M_{0_100}	Nm	Continuous torque that can be applied to the motor output shaft at a speed of n ≥ 0.1 Hz.
Continuous current at standstill, 100K	$I_{0\_100(rms)}$	A	Phase current (crest value) of the motor M_{0_100} required for the continuous torque at standstill at a speed of n ≥ 0.1 Hz.
Continuous torque at standstill surface	M_{0_S}	Nm	Continuous torque that can be applied to the motor output shaft at a speed of n ≥ 0.1 Hz.
Continuous current at standstill surface	$I_{0\_S(rms)}$	A	Phase current (crest value) of the motor M_{0_S} required for the continuous torque at standstill at a speed of n ≥ 0.1 Hz.
Continuous torque at standstill liquid	M_{0_L}	Nm	Continuous torque that can be applied to the motor output shaft at a speed of n ≥ 0.1 Hz.
Continuous current at standstill liquid	$I_{0\_L(rms)}$	A	Phase current (crest value) of the motor M_{0_L} required for the continuous torque at standstill at a speed of n ≥ 0.1 Hz.
Maximum torque	M_{max}	M_{max}	Maximum torque that can be applied for about 400 ms at maximum current I_{max}. The maximum torque that can be attained depends on the drive control device used. Only the specified maximum torque in the selection lists is binding.
Maximum current	$I_{max(rms)}$	A	Maximum, briefly permissible phase current of the motor winding without adverse affect on the permanent magnet circuit of the motor.
Torque constant at 20° C	K_{M_N}	Nm/A	Ration of created torque to motor phase current at a motor temperature of 20°C. Valid up to approx. i = 2x 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}**	ohms	Measured winding resistance between two strands.
Winding inductivity	L_{12}	mH	Measured winding resistance between two strands.
Discharge capacity	C_{dis}	nF	Capacitiy 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_{rot}	kgm^2	Moment of inertia of the rotor without the optional holding brake. Moment of inertia of holding brake must eventually be added.
Thermal time constant	T_{th}	min	Time of the temperature increase to 63 % of the maximum temperature of the motor housing with the motor loaded with the permissible S1 continuous torque. The thermal time constant is defined by the cooling type used.  ①: chronological curse of the temperature on the motor housing Θmax: Highest temperature (motor housing) T_{th} : Thermal time constant Time of the temperature increase to 63 % of the maximum temperature of the motor housing with the motor loaded with the permissible S1 continuous torque. The thermal time constant is defined by the cooling type used.

Technical Data

Designation	Symbol	Unit	Description
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	Motor mass, value in brackets for motors with holding brakes.
Ambient temperature in operation	T_{amb}	°C	0 … 40 °C
Degree of protection	-	-	IP protection class acc. to EN 60529
Insulation class according to DIN EN 60034-1	-	-	Insulation class according to DIN EN 60034-1
Holding torque	M_4	Nm	Transferable holding torque of the holding brake.
Rated voltage (+/-10 %)	U_N	V	Input voltage of the holding brakechapter 9.10.1 "Holding brake electrically-releasing" on page 226..
Rated current	I_N	A	Current consumption of the holding brake.
Connection time	t_1	ms	Period until the holding brake is closed.
Disconnection time	t_2	ms	Period until the holding brake is opened.
Moment of inertia of the brake	J_{Br}	kgm^2	Moment of inertia of holding brake must be added to determine the total moment of inertia to moment of inertia of the motor.

4.1.5 Example of a Characteristic Curve of a Motor



S1 (60K)	Continuous operation curve S1 of the motor (according to EN 60034-1; 1998), natural convection
S1 (100K)	Continuous operation curve S1 of the motor (according to EN 60034-1; 1998), natural convection
S1 (surface)	Continuous operation curve S1 of the motor (according to EN 60034-1; 1998), surface cooling.
S3 (25 % DC)	Intermittent operation curve at 25 % DC of the motor (according to EN 60034-1; 1998) and max. cycle time of 10 min.
① - ④	Characteristic voltage limit curves. When a speed at the safe commutation limit is reached, the voltage limit curve limits the available maximum torque Mmax. The maximum motor speed is determined by the DC link voltage used. There are separate characteristic curves for the various drive control devices in connection with the power supply unit and the supply voltage used.
①	Mmax for IndraDrive, controlled feed, 3 × AC 400 V
②	Mmax for IndraDrive, uncontrolled feed, 3 × AC 480 V
③	Mmax for IndraDrive, uncontrolled feed, 3 × AC 440 V
④	Mmax for IndraDrive, uncontrolled feed, 3 × AC 400 V

Fig.4-3: Example of a characteristic curve of a motor

Technical Data

4.2 Technical Data Holding Brakes

Type	Holding torque	Rated voltage	Rated current	Connection time	Disconnection time	Moment of inertia of the holding brake
	M_4	U_N	I_N	t_1	t_2	J_{rot}
	Nm	V	A	ms	ms	kg*m²
MSK030□-□□□□-□□-□□-□□1	1.0	24	0.31	14	28	0.000010
MSK040□-□□□□-□□-□□-□□1	4.0	24	0.50	25	35	0.000023
MSK043C-□□□□-□□-□□-□□1	4.0	24	0.50	25	35	0.000023
MSK050□-□□□□-□□-□□-□□1	5.0	24	0.65	13	43	0.000107
MSK060□-□□□□-□□-□□-□□1	10.0	24	0.75	25	40	0.000059
MSK061□-□□□□-□□-□□-□□1	10.0	24	0.75	25	40	0.000059
MSK070□-□□□□-□□-□□-□□1	23.0	24	0.79	130	180	0.000300
MSK071□-□□□□-□□-□□-□□1	23.0	24	0.79	130	180	0.000300
MSK071□-□□□□-□□-□□-□□2	30.0	24	0.94	35	125	0.001060
MSK075□-□□□□-□□-□□-□□1	23.0	24	0.79	130	180	0.000300
MSK075□-□□□□-□□-□□-□□2	30.0	24	0.94	35	125	0.001060
MSK076C-□□□□-□□-□□-□□1	11.0	24	0.71	13	30	0.000360
MSK100A-□□□□-□□-□□-□□1 MSK100B-□□□□-□□-□□-□□1	32.0	24	0.93	15	115	0.001242
MSK100B-□□□□-□□-□□-□□2 MSK100C-□□□□-□□-□□-□□2 MSK100D-□□□□-□□-□□-□□2	70.0	24	1.29	53	97	0.003000
MSK101C-□□□□-□□-□□-□□2 MSK101D-□□□□-□□-□□-□□2 MSK101D-□□□□-□□-□□-□□2	70.0	24	1.29	53	97	0.003000
MSK101D-□□□□-□□-□□-□□3 MSK101E-□□□□-□□-□□-□□3	120.0	24	1.46	80	150	0.005750
MSK103A-□□□□-□□-□□-□□1 MSK103B-□□□□-□□-□□-□□1	33.0	24	0.94	40	270	0.001060
MSK103D-□□□□-□□-□□-□□2	60.0	24	1.04	60	300	0.001470
MSK131B-□□□□-□□-□□-□□1 MSK131D-□□□□-□□-□□-□□1	100.0	24	2.00	70	190	0.005300
MSK131D-□□□□-□□-□□-□□2	240.0	24	1.87	30	300	0.018800

MSK131D-□□□□-□□-□□-□□2
└── Holding brake acc. to type code

Fig.4-4: Holding brakes - Technical data (optional)

Technical Data

4.3 Technical Data Encoder for MSK Motors

Data Sheet Encoder

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	
Power supply voltage	$VCC_{Encoder}$	V	7...12		3,6...14		7...12	

Fig.4-5: Technical data MSK encoder

Calculate position resolution

The actual **position resolution** can be done for each encoder type according to the following calcuation example.

Calculation example: "Position resolution for encoder M1"

⇒ from table:
distinguishable revolutions **4,096**
number of lines **128**
⇒ from documentation about controller:
encoder resolution [1] **13 bit**

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

Position resolution = 128 × 2^{13} × 4,096 = **4,294,967,296** Information

[1] Encoder resolution depends on 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.

4.4 MSK030B - Technical Data

Designation	Symbol	Unit	MSK030B-0900-NN
UL Files (UL)			E335445
Continuous torque at standstill 60 K	M_{0_60}	Nm	0.4
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	1.5
Continuous torque at standstill 100 K	M_{0_100}	Nm	0.4
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	1.7
Maximum torque	M_{max}	Nm	1.8
Maximum current	$I_{max(rms)}$	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/min^{-1}	17.9
Winding resistance at 20 °C	R_{12}	ohms	7.20
Winding inductivity	L_{12}	mH	8.100
Discharge capacity of the component	C_{dis}	nF	0.7
Number of pole pairs	p	-	3
Moment of inertia of the rotor	J_{rot}	$kg*m^2$	0.00001
Thermal time constant	T_{th}	min	19.0
Maximum speed	n_{max}	min^{-1}	9,000
Sound pressure level	L_P	dB[A]	<75
Weight [2)]	m	kg	1.3 (1.6)
Ambient temperature in operation	T_{amb}	°C	0 ... 40
Type of protection according to IEC 60529	---	-	IP65
Insulation class according to DIN EN 60034-1	---	-	155
			Latest amendment: 2008-01-29

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-6: Technical Data

Technical Data

Characteristic Motor Curves

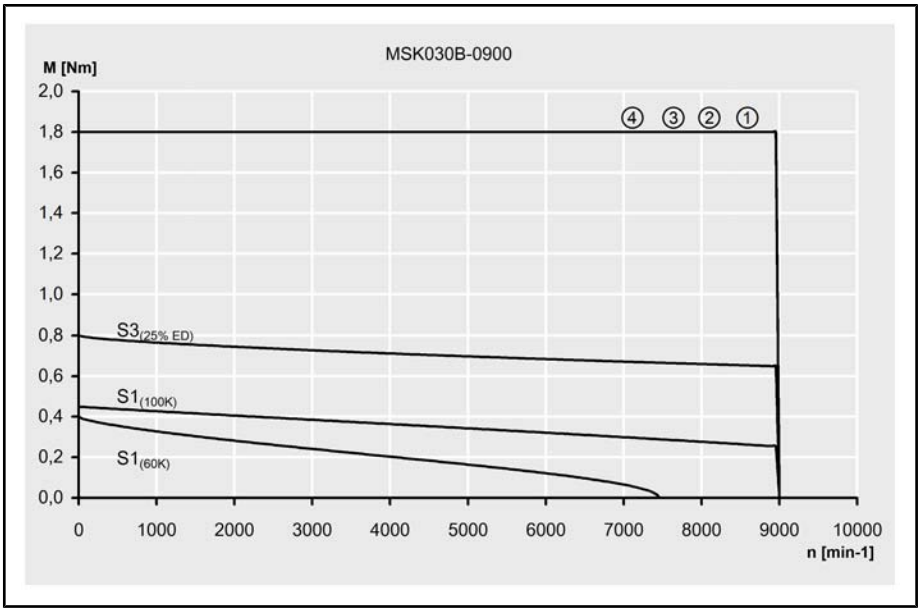


Fig.4-7: Characteristic curves MSK030B-0900

4.5 MSK030C - Technical Data

Designation	Symbol	Unit	MSK030C-0900-NN
UL Files (UL)			E335445
Continuous torque at standstill 60 K	M_{0_60}	Nm	0.8
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	1.5
Continuous torque at standstill 100 K	M_{0_100}	Nm	0.9
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	1.7
Maximum torque	M_{max}	Nm	4.0
Maximum current	$I_{max(rms)}$	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/min^{-1}	35.6
Winding resistance at 20 °C	R_{12}	ohms	9.80
Winding inductivity	L_{12}	mH	14.100
Discharge capacity of the component	C_{dis}	nF	1.3
Number of pole pairs	p	-	3
Moment of inertia of the rotor	J_{rot}	$kg*m^2$	0.00003
Thermal time constant	T_{th}	min	12.0
Maximum speed	n_{max}	min^{-1}	9000
Sound pressure level	L_P	dB[A]	<75
Weight [2)]	m	kg	1.9 (2.1)
Ambient temperature in operation	T_{amb}	°C	0 ... 40
Type of protection according to IEC 60529	---	-	IP65
Insulation class according to DIN EN 60034-1	---	-	155
			Latest amendment: 2009-06-22

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-8: Technical Data

Technical Data

Characteristic Motor Curves

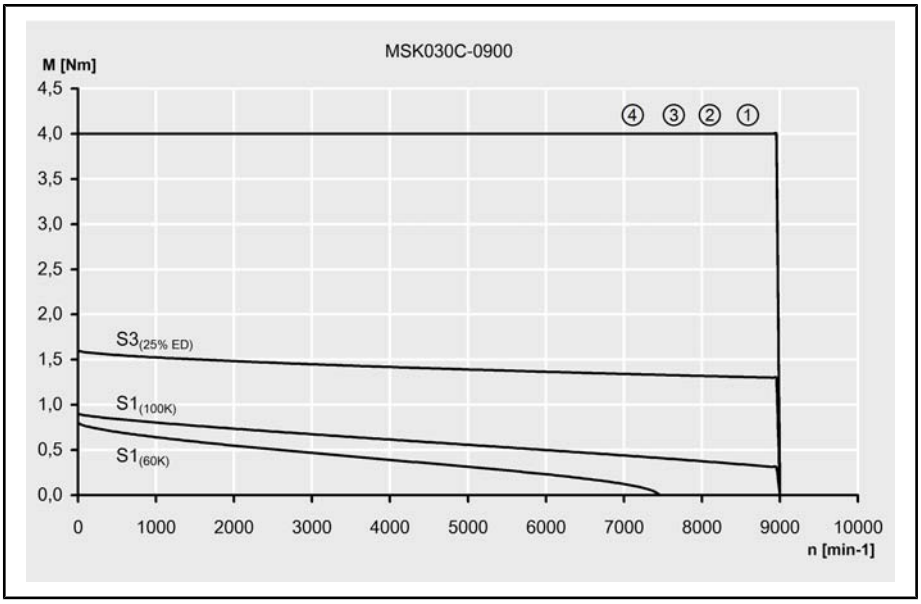


Fig.4-9: Characteristic curves MSK030C-0900

4.6 MSK040B - Technical Data

Designation	Symbol	Unit	MSK040B-0450-NN	MSK040B-0600-NN
UL Files (UL)			E335445	
Continuous torque at standstill 60 K	M_{0_60}	Nm	1.7	
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	1.5	2.0
Continuous torque at standstill 100 K	M_{0_100}	Nm	1.9	
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	1.7	2.2
Maximum torque	M_{max}	Nm	5.1	
Maximum current	$I_{max(rms)}$	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/min^{-1}	77.8	58.5
Winding resistance at 20 °C	R_{12}	ohms	14.70	8.40
Winding inductivity	L_{12}	mH	64.700	35.400
Discharge capacity of the component	C_{dis}	nF	1.3	1.5
Number of pole pairs	p	-	4	
Moment of inertia of the rotor	J_{rot}	$kg*m^2$	0.00010	
Thermal time constant	T_{th}	min	13.0	
Maximum speed	n_{max}	min^{-1}	6,000	7,500
Sound pressure level	L_P	dB[A]	<75	
Weight [2)]	m	kg	2.8 (3.1)	
Ambient temperature in operation	T_{amb}	°C	0 ... 40	
Type of protection according to IEC 60529	---	-	IP65	
Insulation class according to DIN EN 60034-1	---	-	155	
				Latest amendment: 2010-01-12

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-10: MSK - Technical data (standard cooling)

Technical Data

Characteristic Motor Curves

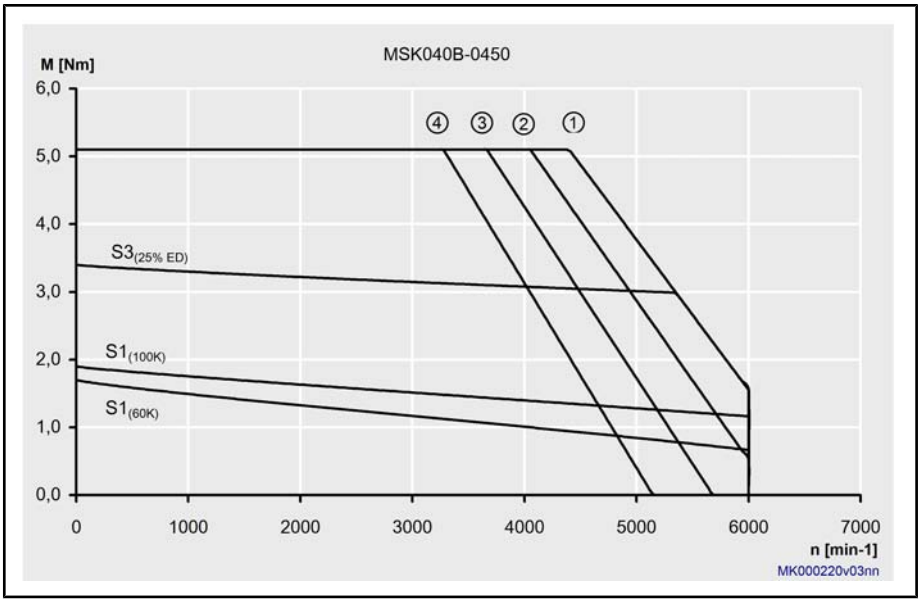


Fig.4-11: Characteristic curves MSK040B-0450

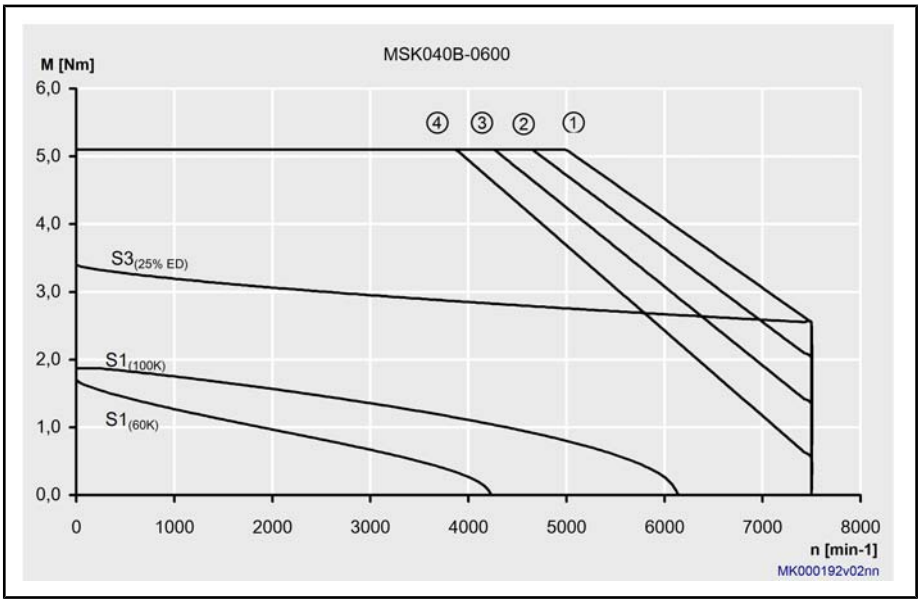


Fig.4-12: Characteristic curves MSK040B-0600

Technical Data

4.7 MSK040C - Technical Data

Designation	Symbol	Unit	MSK040C-0450-NN	MSK040C-0600-NN
UL Files (UL)			E335445	
Continuous torque at standstill 60 K	M_{0_60}	Nm	2.7	
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	2.4	3.1
Continuous torque at standstill 100 K	M_{0_100}	Nm	3.1	
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	3.1	4.7
Maximum torque	M_{max}	Nm	8.1	
Maximum current	$I_{max(rms)}$	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/min^{-1}	76.7	58.2
Winding resistance at 20 °C	R_{12}	ohms	7.40	3.90
Winding inductivity	L_{12}	mH	37.900	21.300
Discharge capacity of the component	C_{dis}	nF	2.0	
Number of pole pairs	p	-	4	
Moment of inertia of the rotor	J_{rot}	$kg*m^2$	0.00014	
Thermal time constant	T_{th}	min	16.0	
Maximum speed	n_{max}	min^{-1}	6,000	7,500
Sound pressure level	L_P	dB[A]	<75	
Weight [2)]	m	kg	3.6 (3.9)	
Ambient temperature in operation	T_{amb}	°C	0 ... 40	
Type of protection according to IEC 60529	---	-	IP65	
Insulation class according to DIN EN 60034-1	---	-	155	
				Latest amendment: 2008-10-13

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-13: MSK - Technical data (standard cooling)

Characteristic Motor Curves

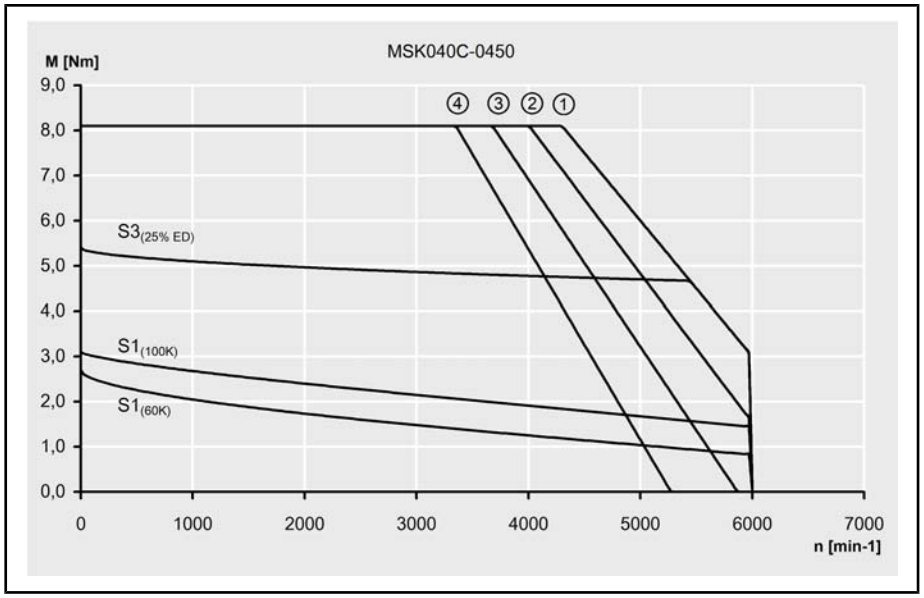


Fig.4-14: Characteristic curves MSK040C-0450

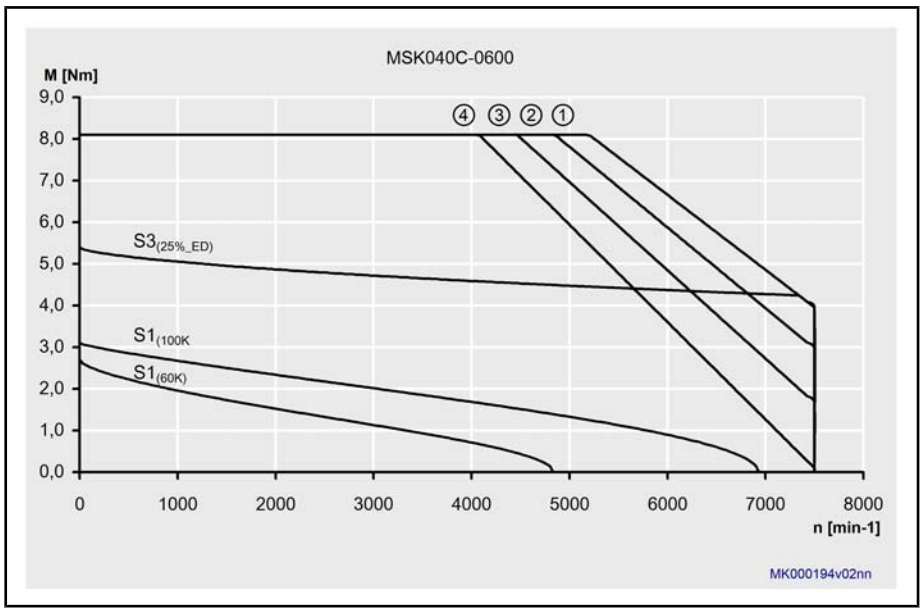


Fig.4-15: Characteristic curves MSK040C-0600

Technical Data

4.8 MSK043C - Technical Data

Designation	Symbol	Unit	MSK043C-0600-NN
UL Files (UL)			---
Continuous torque at standstill 60 K	M_{0_60}	Nm	2.7
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	3.6
Continuous torque at standstill 100 K	M_{0_100}	Nm	3.1
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	4.3
Maximum torque	M_{max}	Nm	12.5
Maximum current	$I_{max(rms)}$	A	18.5
Torque constant at 20 °C	K_{M_N}	Nm/A	0.78
Voltage constant at 20 °C[1)]	K_{EMK_1000}	V/min^{-1}	48.0
Winding resistance at 20 °C	R_{12}	ohms	2.75
Winding inductivity	L_{12}	mH	13.400
Discharge capacity of the component	C_{dis}	nF	2.1
Number of pole pairs	p	-	4
Moment of inertia of the rotor	J_{rot}	$kg*m^2$	0.00008
Thermal time constant	T_{th}	min	17.0
Maximum speed	n_{max}	min^{-1}	7,500
Sound pressure level	L_P	dB[A]	< 75
Weight [2)]	m	kg	3.6 (3.9)
Ambient temperature in operation	T_{amb}	°C	0 ... 40
Type of protection according to IEC 60529	---	-	IP 65
Insulation class according to DIN EN 60034-1	---	-	155
			Latest amendment: 2008-12-18

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-16: MSK - Technical data

Characteristic Motor Curves

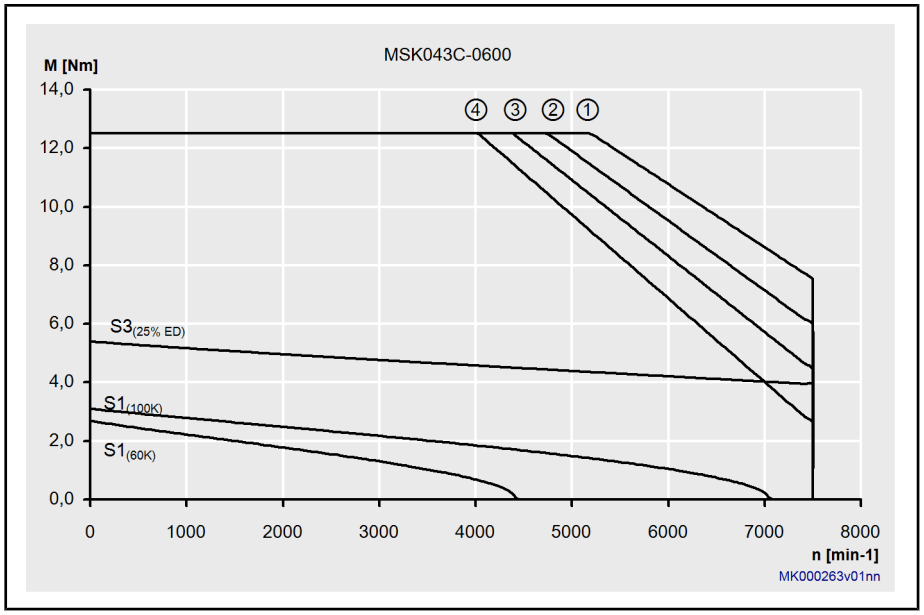


Fig.4-17: Characteristic curves MSK043C-0600

Technical Data

4.9 MSK050B - Technical Data

Designation	Symbol	Unit	MSK050B-0300-NN	MSK050B-0450-NN	MSK050B-0600-NN
UL Files (UL)			E335445		
Continuous torque at standstill 60 K	M_{0_60}	Nm	3.0		
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	1.8	2.8	3.7
Continuous torque at standstill 100 K	M_{0_100}	Nm	3.4		
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	2.0	3.2	4.2
Maximum torque	M_{max}	Nm	9.0		
Maximum current	$I_{max(rms)}$	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/min^{-1}	111.0	73.5	55.0
Winding resistance at 20 °C	R_{12}	ohms	13.10	5.70	3.30
Winding inductivity	L_{12}	mH	76.400	33.600	19.900
Discharge capacity of the component	C_{dis}	nF	2.1	1.4	2.1
Number of pole pairs	p	-	4		
Moment of inertia of the rotor	J_{rot}	kg*m^2	0.00028		
Thermal time constant	T_{th}	min	8.0		
Maximum speed	n_{max}	min^{-1}	4,300	6,000	
Sound pressure level	L_P	dB[A]	<75		
Weight [2)]	m	kg	4.0 (4.9)		
Ambient temperature in operation	T_{amb}	°C	0 ... 40		
Type of protection according to IEC 60529	---	-	IP65		
Insulation class according to DIN EN 60034-1	---	-	155		
Latest amendment: 2008-10-13					

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-18: Technical Data

Characteristic Motor Curves

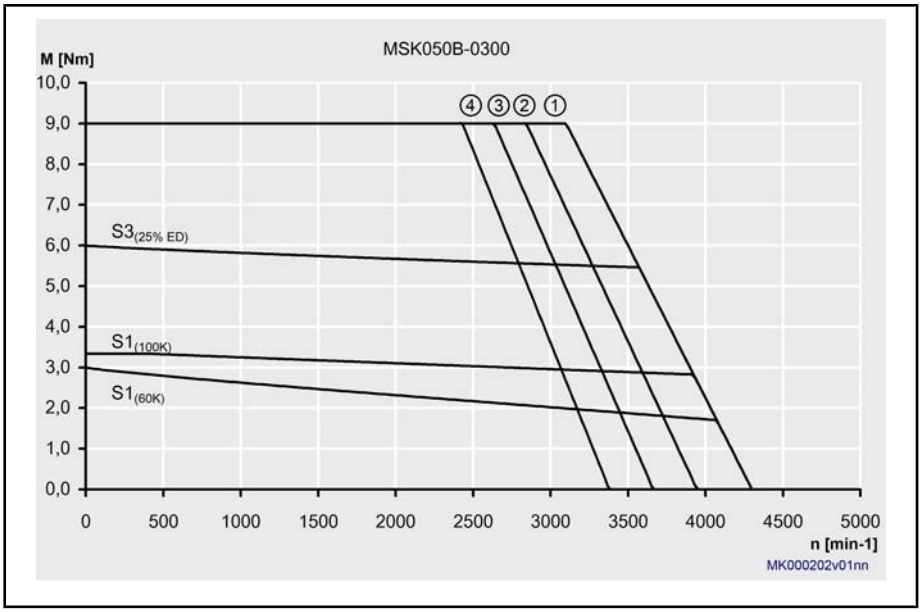


Fig.4-19: Characteristic curves MSK050B-0300

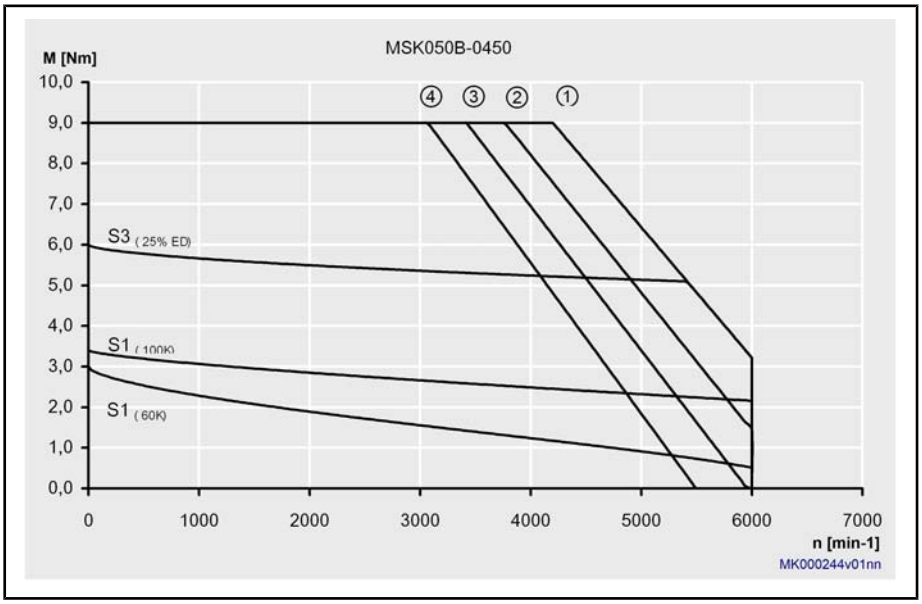


Fig.4-20: Characteristic curves MSK050B-0450

Technical Data

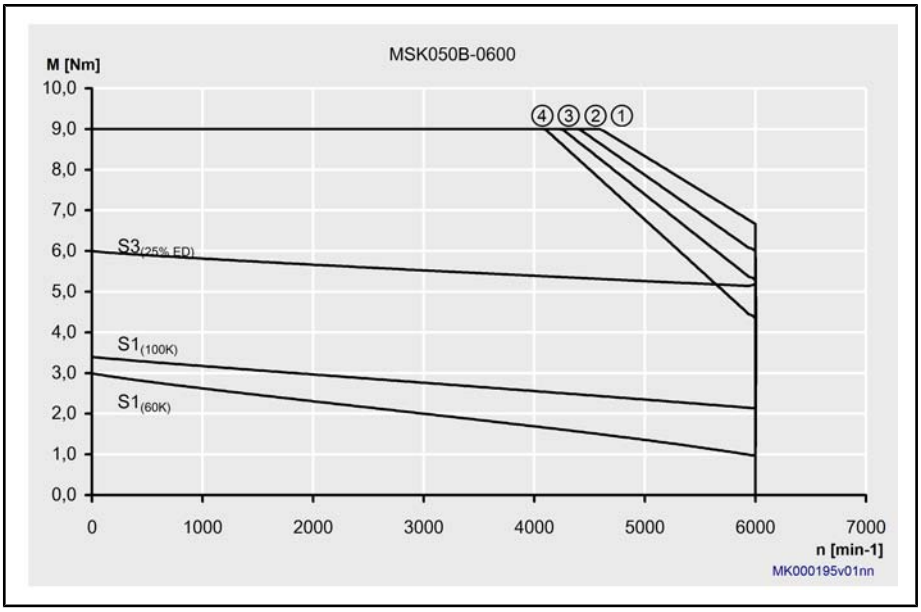


Fig.4-21: Characteristic curves MSK050B-0600

4.10 MSK050C - Technical Data

Designation	Symbol	Unit	MSK050C-0300-NN	MSK050C-0450-NN	MSK050C-0600-NN
UL Files (UL)			E335445		
Continuous torque at standstill 60 K	M_{0_60}	Nm	5.0		
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	3.1	4.7	6.2
Continuous torque at standstill 100 K	M_{0_100}	Nm	5.5		
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	3.4	5.2	6.8
Maximum torque	M_{max}	Nm	15.0		
Maximum current	$I_{max(rms)}$	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/min^{-1}	109.0	71.5	55.0
Winding resistance at 20 °C	R_{12}	ohms	6.60	3.20	1.70
Winding inductivity	L_{12}	mH	46.100	20.200	11.000
Discharge capacity of the component	C_{dis}	nF	2.6	2.4	2.6
Number of pole pairs	p	-	4		
Moment of inertia of the rotor	J_{rot}	kg*m^2	0.00033		
Thermal time constant	T_{th}	min	14.0		
Maximum speed	n_{max}	min^{-1}	4,700	6,000	
Sound pressure level	L_P	dB[A]	<75		
Weight [2)]	m	kg	5.4 (6.3)		
Ambient temperature in operation	T_{amb}	°C	0 ... 40		
Type of protection according to IEC 60529	---	-	IP65		
Insulation class according to DIN EN 60034-1	---	-	155		
Latest amendment: 2008-02-11					

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-22: Technical Data

Technical Data

Characteristic Motor Curves

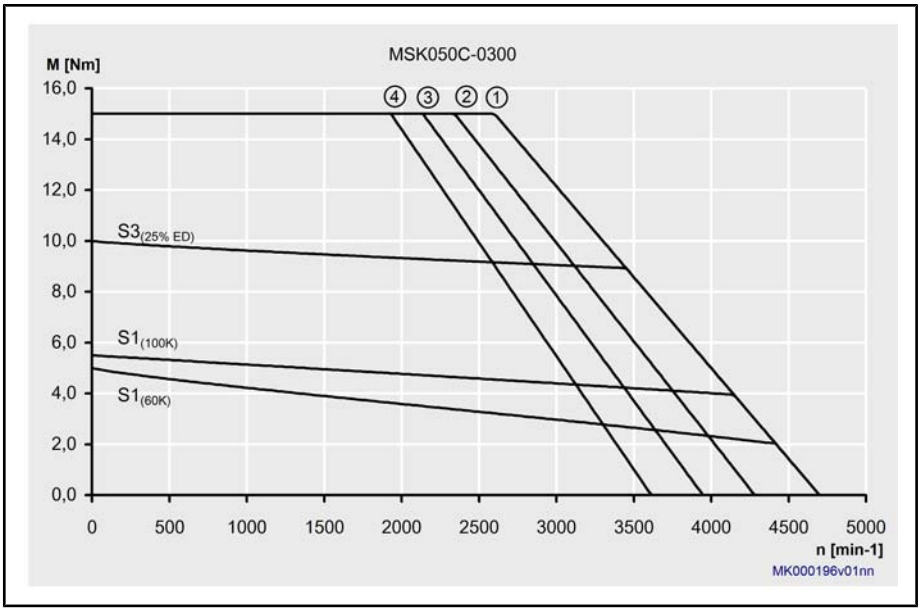


Fig.4-23: Characteristic curves MSK050C-0300

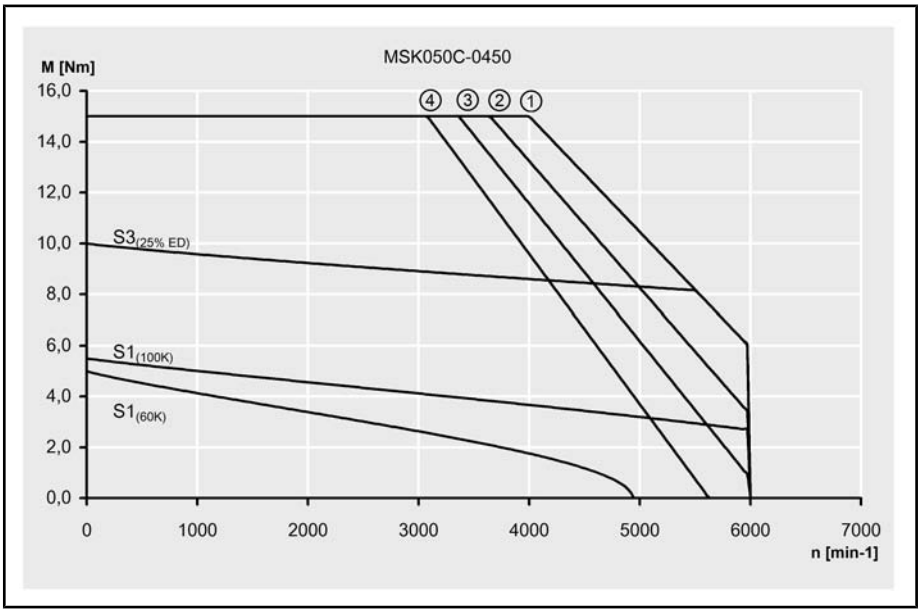


Fig.4-24: Characteristic curves MSK050C-0450

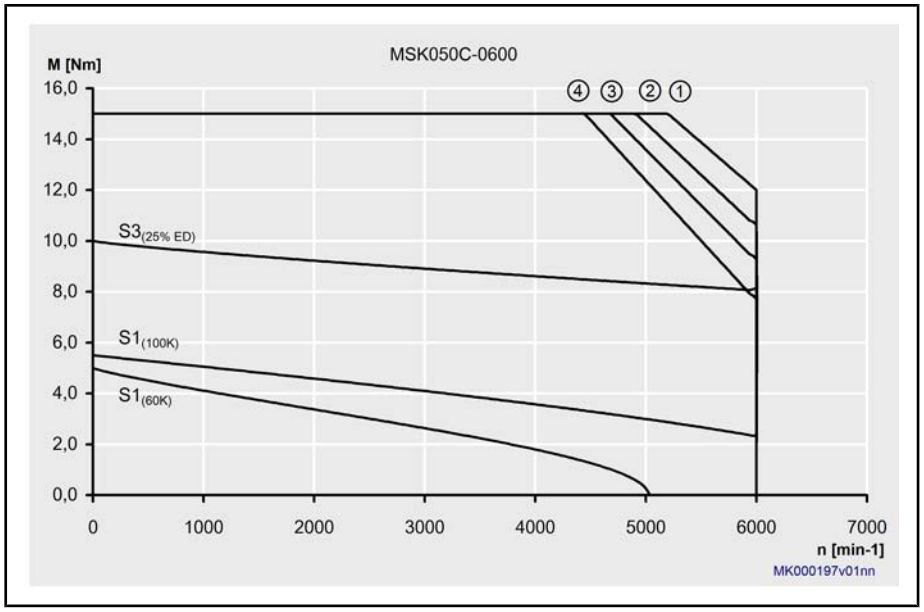


Fig.4-25: Characteristic curves MSK050C-0600

Technical Data

4.11 MSK060B - Technical Data

Designation	Symbol	Unit	MSK060B-0300-NN	MSK060B-0600-NN
UL Files (UL)			E335445	
Continuous torque at standstill 60 K	M_{0_60}	Nm	5.0	
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	3.0	6.1
Continuous torque at standstill 100 K	M_{0_100}	Nm	5.5	
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	3.3	6.7
Maximum torque	M_{max}	Nm	15.0	
Maximum current	$I_{max(rms)}$	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/min^{-1}	113.5	55.2
Winding resistance at 20 °C	R_{12}	ohms	7.30	1.85
Winding inductivity	L_{12}	mH	73.000	18.000
Discharge capacity of the component	C_{dis}	nF	2.1	
Number of pole pairs	p	-	4	
Moment of inertia of the rotor	J_{rot}	$kg*m^2$	0.00048	
Thermal time constant	T_{th}	min	16.0	
Maximum speed	n_{max}	min^{-1}	4,800	6,000
Sound pressure level	L_P	dB[A]	<75	
Weight [2)]	m	kg	5.7 (6.4)	
Ambient temperature in operation	T_{amb}	°C	0 ... 40	
Type of protection according to IEC 60529	---	-	IP65	
Insulation class according to DIN EN 60034-1	---	-	155	
				Latest amendment: 2008-02-11

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-26: Technical Data

Characteristic Motor Curves

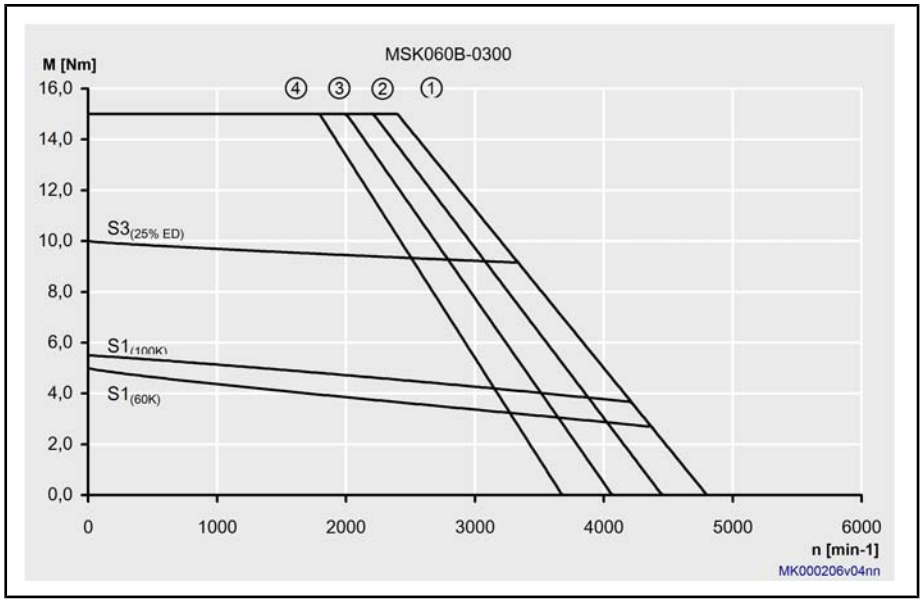


Fig.4-27: Characteristic curves MSK060B-0300

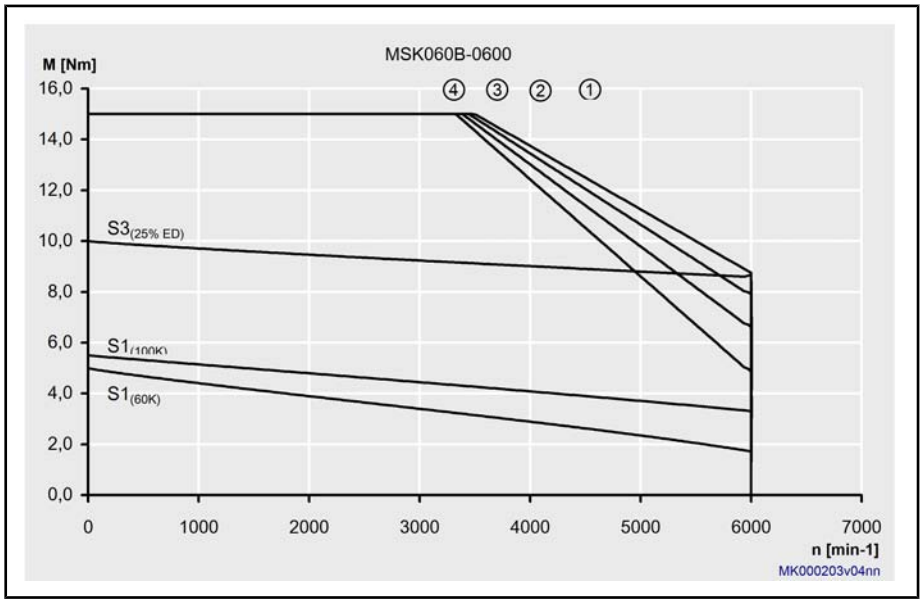


Fig.4-28: Characteristic curves MSK060B-0600

Technical Data

4.12 MSK060C - Technical Data

Designation	Symbol	Unit	MSK060C-0300-NN	MSK060C-0600-NN
UL Files (UL)			E335445	
Continuous torque at standstill 60 K	M_{0_60}	Nm	8.0	
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	4.8	9.5
Continuous torque at standstill 100 K	M_{0_100}	Nm	8.8	
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	5.3	10.5
Continuous torque at standstill. surface	M_{0_S}	Nm	12.0	
Continuous current at standstill. surface	$I_{0\_S(rms)}$	A	7.2	14.3
Maximum torque	M_{max}	Nm	24.0	
Maximum current	$I_{max(rms)}$	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/min^{-1}	114.0	57.0
Winding resistance at 20 °C	R_{12}	ohms	3.10	0.80
Winding inductivity	L_{12}	mH	35.900	8.600
Discharge capacity of the component	C_{dis}	nF	2.1	2.2
Number of pole pairs	p	-	4	
Moment of inertia of the rotor	J_{rot}	$kg*m^2$	0.00080	
Thermal time constant	T_{th}	min	14.0	
Maximum speed	n_{max}	min^{-1}	4,900	6,000
Sound pressure level	L_P	dB[A]	<75	
Weight [2)]	m	kg	8.4 (9.2)	
Ambient temperature in operation	T_{amb}	°C	0 ... 40	
Type of protection according to IEC 60529	---	-	IP65	
Insulation class according to DIN EN 60034-1	---	-	155	
				Latest amendment: 2008-02-11

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-29: Technical Data

Characteristic Motor Curves

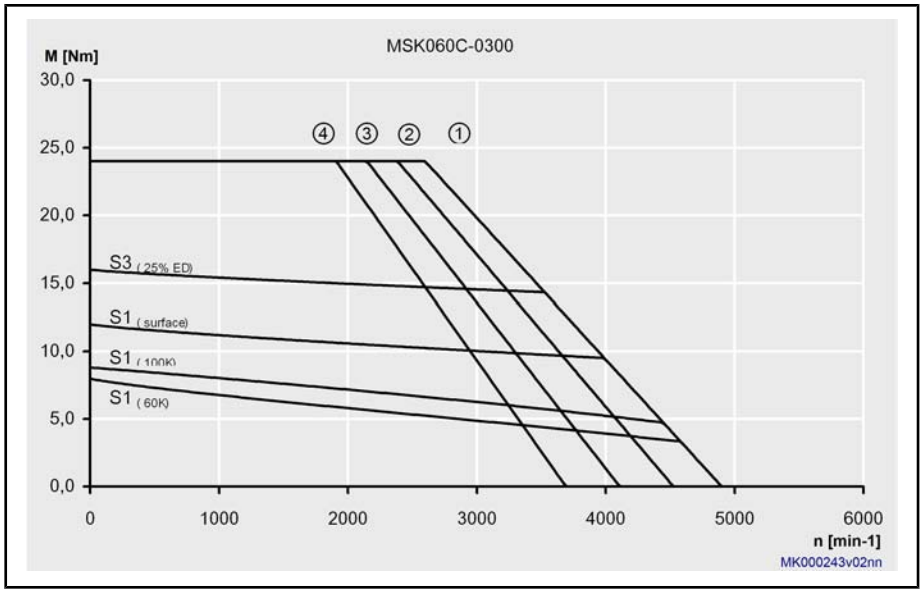


Fig.4-30: Characteristic curves MSK060C-0300

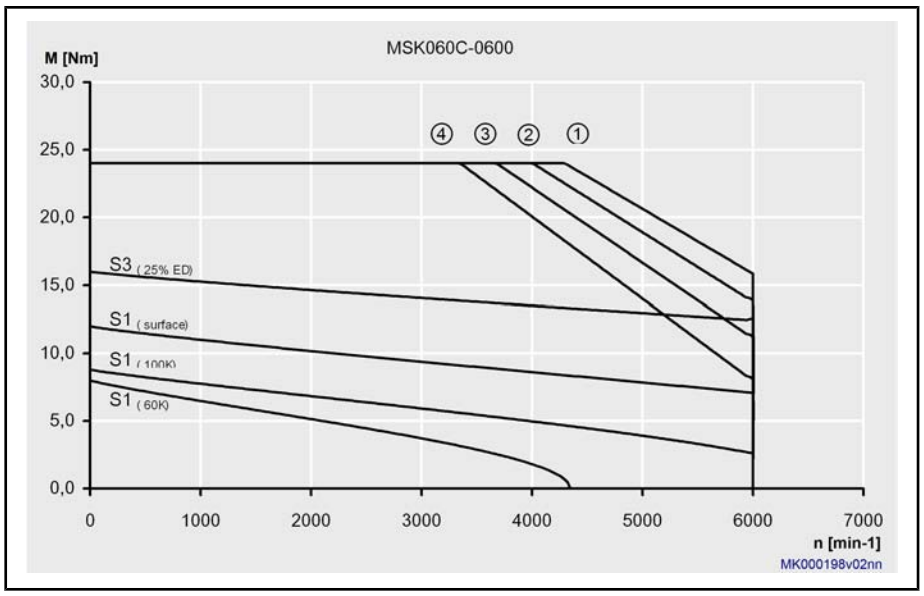


Fig.4-31: Characteristic curves MSK060C-0600

Technical Data

4.13 MSK061B - Technical Data

Designation	Symbol	Unit	MSK061B-0300-NN
UL Files (UL)			
Continuous torque at standstill 60 K	M_{0_60}	Nm	3.5
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	1.9
Continuous torque at standstill 100 K	M_{0_100}	Nm	3.9
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	2.1
Maximum torque	M_{max}	Nm	14.0
Maximum current	$I_{max(rms)}$	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/min^{-1}	126.4
Winding resistance at 20 °C	R_{12}	ohms	13.50
Winding inductivity	L_{12}	mH	44.000
Discharge capacity of the component	C_{dis}	nF	1.8
Number of pole pairs	p	-	4
Moment of inertia of the rotor	J_{rot}	$kg*m^2$	0.00044
Thermal time constant	T_{th}	min	15.0
Maximum speed	n_{max}	min^{-1}	4,200
Sound pressure level	L_P	dB[A]	<75
Weight [2)]	m	kg	5.7 (6.4)
Ambient temperature in operation	T_{amb}	°C	0 ... 40
Type of protection according to IEC 60529	---	-	IP65
Insulation class according to DIN EN 60034-1	---	-	155
			Latest amendment: 2010-10-28

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-32: MSK - Technical data

Characteristic Motor Curves

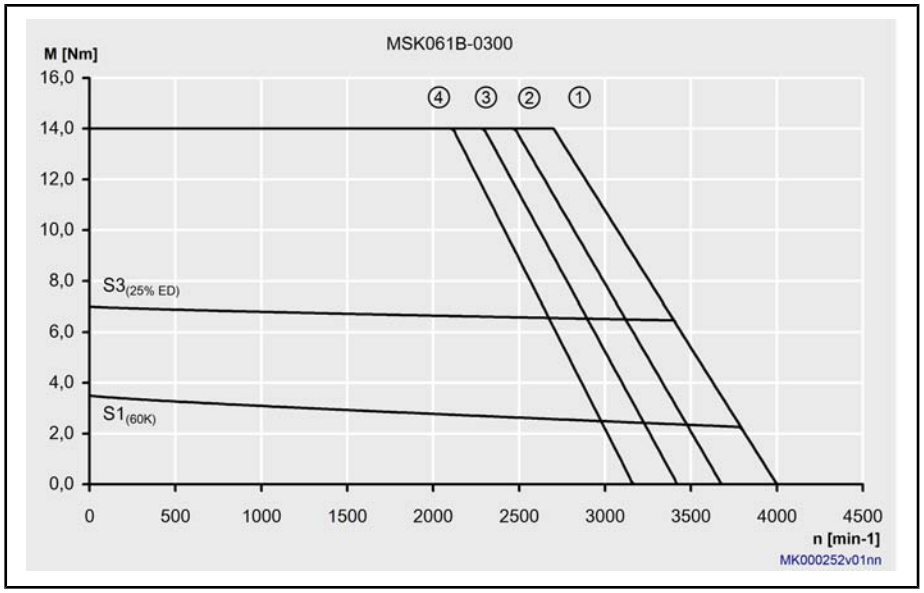


Fig.4-33: Characteristic curves MSK061B-0300

Technical Data

4.14 MSK061C - Technical Data

Designation	Symbol	Unit	MSK061C-0200-NN	MSK061C-0300-NN	MSK061C-0600-NN
UL Files (UL)			E335445		
Continuous torque at standstill 60 K	M_{0_60}	Nm	8.0		
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	3.2	4.3	7.7
Continuous torque at standstill 100 K	M_{0_100}	Nm	9.0		
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	3.6	4.8	8.7
Continuous torque at standstill. surface	M_{0_S}	Nm	12.0		
Continuous current at standstill. surface	$I_{0\_S(rms)}$	A	4.8	6.5	11.6
Maximum torque	M_{max}	Nm	32.0		
Maximum Current	$I_{max(rms)}$	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/min^{-1}	174.9	125.7	70.5
Winding resistance at 20 °C	R_{12}	ohms	8.10	4.50	1.55
Winding inductivity	L_{12}	mH	36.500	21.400	6.700
Discharge capacity of the component	C_{dis}	nF	2.7	2.4	2.1
Number of pole pairs	p	-	4		
Moment of inertia of the rotor	J_{rot}	kg*m^2	0.00075		
Thermal time constant	T_{th}	min	18.0		15.0
Maximum speed	n_{max}	min^{-1}	3,100	4,200	6,000
Sound pressure level	L_P	dB[A]	<75		
Weight [2)]	m	kg	8.3 (8.8)		
Ambient temperature in operation	T_{amb}	°C	0 ... 40		
Type of protection according to IEC 60529	---	-	IP65		
Insulation class according to DIN EN 60034-1	---	-	155		
Latest amendment: 2008-05-29					

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-34: MSK - Technical data

Characteristic Motor Curves

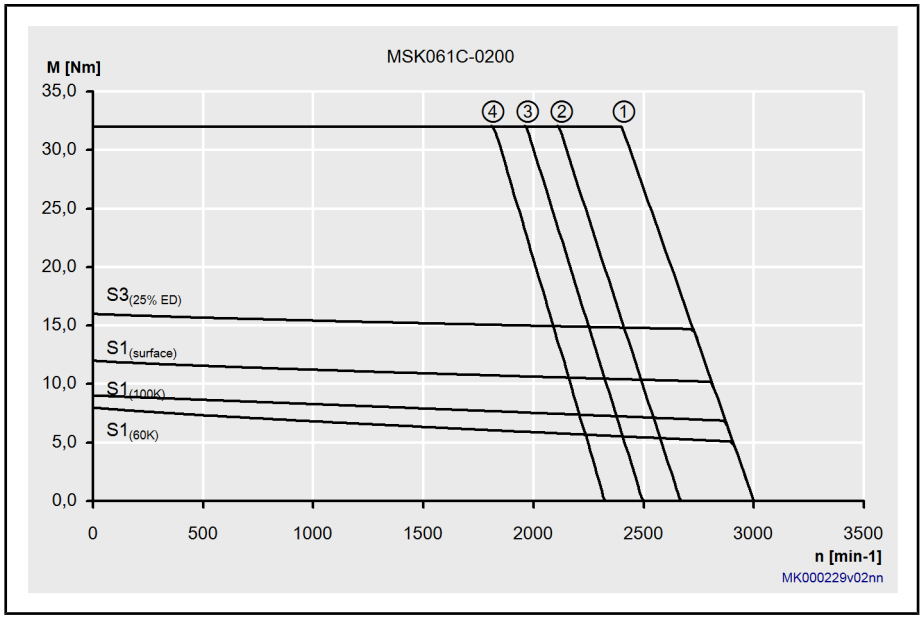


Fig.4-35: Characteristic curves MSK061C-0200

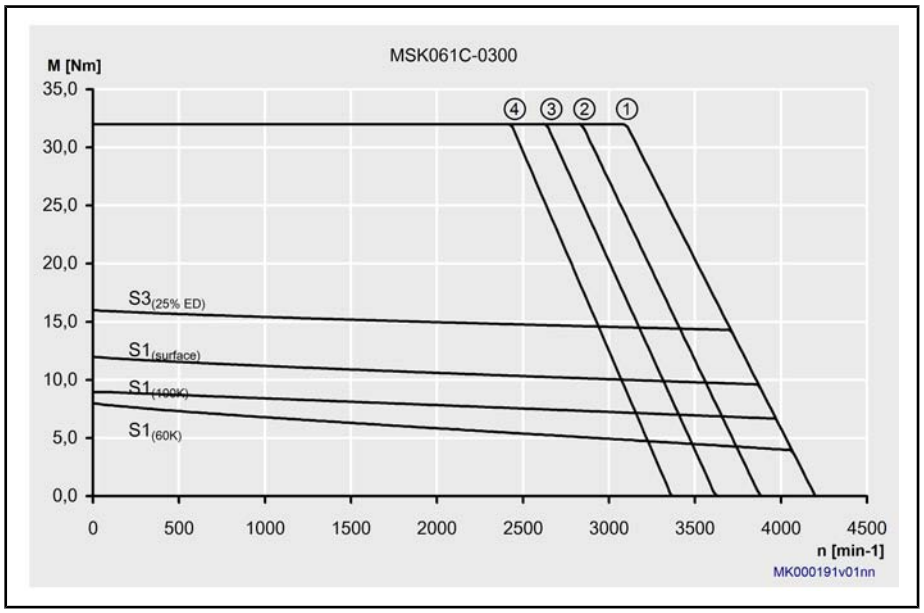


Fig.4-36: Characteristic curves MSK061C-0300

Technical Data

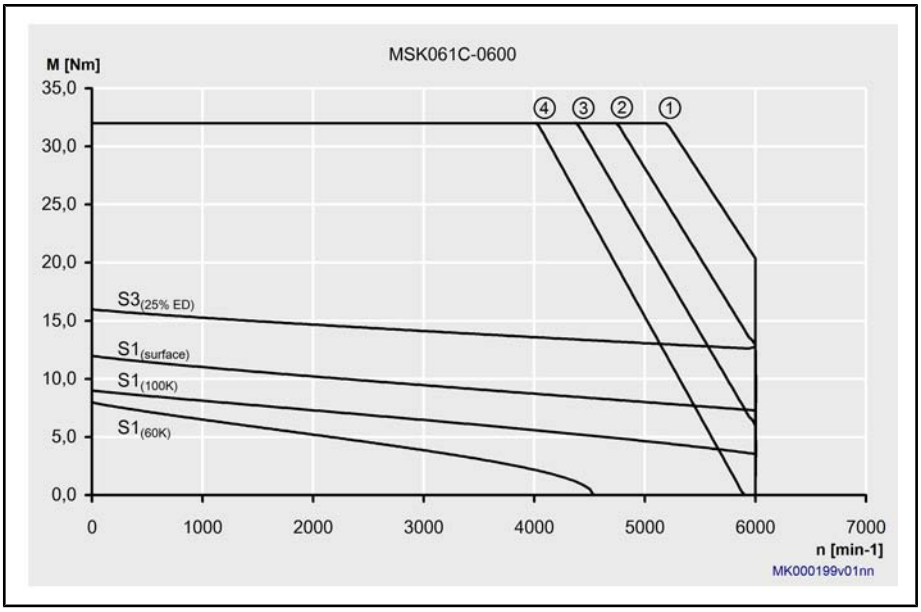


Fig.4-37: Characteristic curves MSK061C-0600

4.15 MSK070C - Technical Data

Designation	Symbol	Unit	MSK070C-0150-NN	MSK070C-0300-NN	MSK070C-0450-NN
UL Files (UL)			E335445		
Continuous torque at standstill 60 K	M_{0_60}	Nm	13.0		
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	4.1	8.2	12.3
Continuous torque at standstill 100 K	M_{0_100}	Nm	14.5		
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	4.6	9.2	13.7
Continuous torque at standstill. surface	M_{0_S}	Nm	19.5		
Continuous current at standstill. surface	$I_{0\_S(rms)}$	A	6.2	12.3	18.5
Maximum torque	M_{max}	Nm	33.0		
Maximum current	$I_{max(rms)}$	A	16.4	32.8	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/min^{-1}	213.2	107.0	71.3
Winding resistance at 20 °C	R_{12}	ohms	4.70	1.13	0.55
Winding inductivity	L_{12}	mH	34.900	8.300	4.000
Discharge capacity of the component	C_{dis}	nF	3.8	4.0	3.1
Number of pole pairs	p	-	6		
Moment of inertia of the rotor	J_{rot}	kg*m^2	0.00291		
Thermal time constant	T_{th}	min	22.0		31.0
Maximum speed	n_{max}	min^{-1}	2,500	5,500	6,000
Sound pressure level	L_P	dB[A]	<75		
Weight [2)]	m	kg	11.7 (13.2)		
Ambient temperature in operation	T_{amb}	°C	0 ... 40		
Type of protection according to IEC 60529	---	-	IP65		
Insulation class according to DIN EN 60034-1	---	-	155		
Latest amendment: 2008-01-29					

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-38: Technical Data

Technical Data

Characteristic Motor Curves

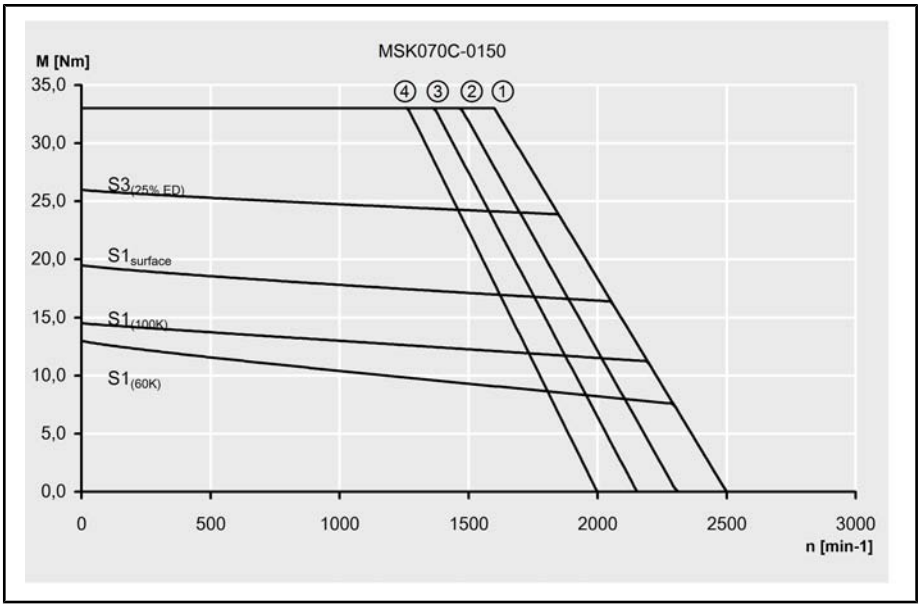


Fig.4-39: Characteristic curves MSK070C-0150

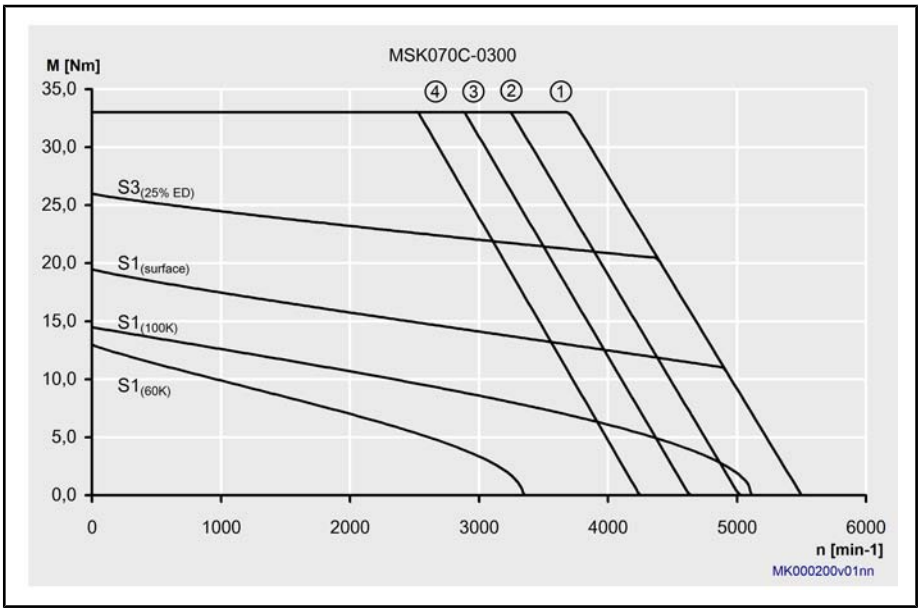


Fig.4-40: Characteristic curves MSK070C-0300

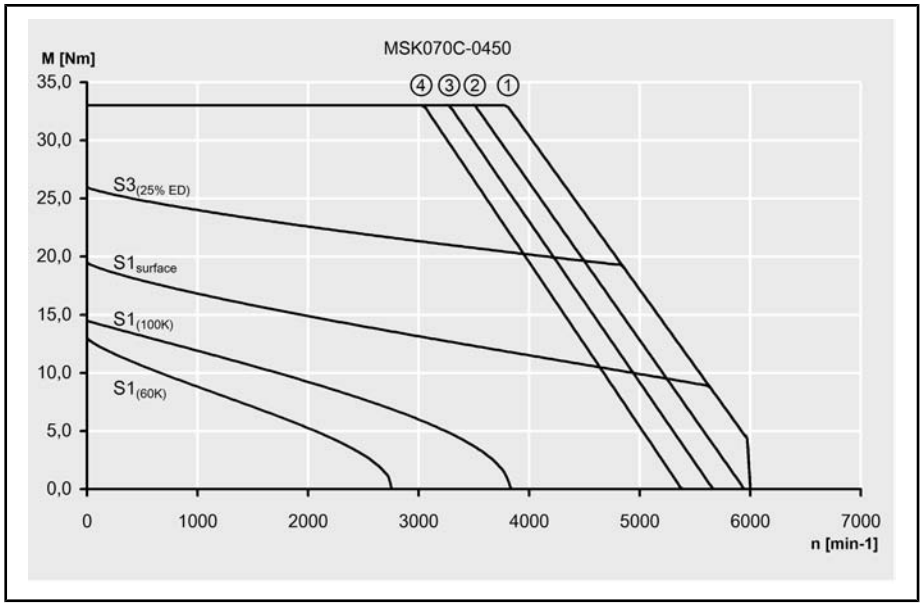


Fig.4-41: Characteristic curves MSK070C-0450

Technical Data

4.16 MSK070D - Technical Data

Designation	Symbol	Unit	MSK070D-0150-NN	MSK070D-0300-NN	MSK070D-0450-NN
UL Files (UL)			E335445		
Continuous torque at standstill 60 K	M_{0_60}	Nm	17.5		
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	6.2	11.0	16.6
Continuous torque at standstill 100 K	M_{0_100}	Nm	20.0		
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	7.1	12.6	22.0
Continuous torque at standstill. surface	M_{0_S}	Nm	26.3		
Continuous current at standstill. surface	$I_{0\_S(rms)}$	A	9.3	16.5	24.9
Maximum torque	M_{max}	Nm	52.5		
Maximum current	$I_{max(rms)}$	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/min^{-1}	210.0	107.3	71.1
Winding resistance at 20 °C	R_{12}	ohms	3.20	0.75	0.37
Winding inductivity	L_{12}	mH	25.900	6.000	3.000
Discharge capacity of the component	C_{dis}	nF	5.0	4.5	
Number of pole pairs	p	-	6		
Moment of inertia of the rotor	J_{rot}	kg*m^2	0.00375		
Thermal time constant	T_{th}	min	23.0		
Maximum speed	n_{max}	min^{-1}	2,700	4,900	6,000
Sound pressure level	L_P	dB[A]	<75		
Weight [2)]	m	kg	14.0 (15.6)		
Ambient temperature in operation	T_{amb}	°C	0 ... 40		
Type of protection according to IEC 60529	---	-	IP65		
Insulation class according to DIN EN 60034-1	---	-	155		
Latest amendment: 2010-05-05					

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-42: Technical Data

Characteristic Motor Curves

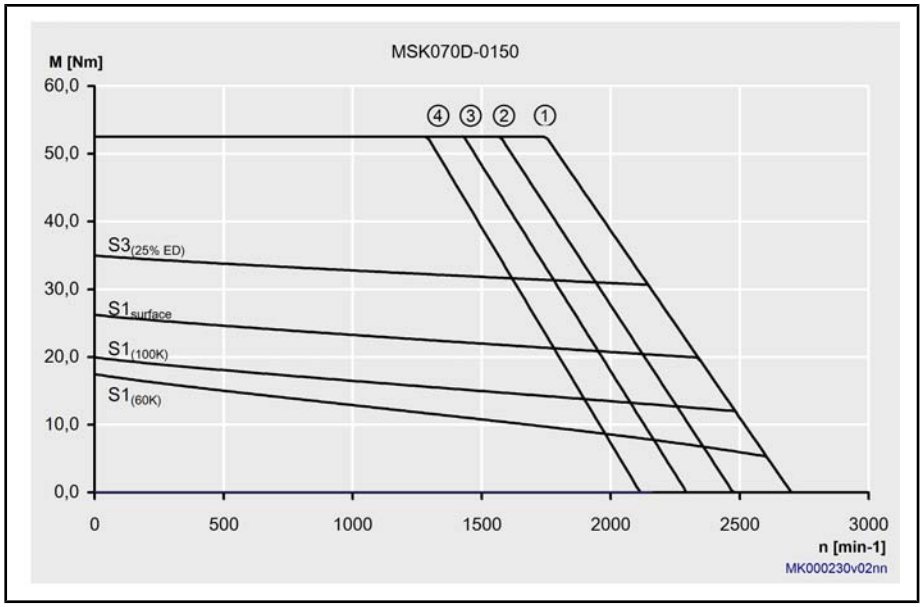


Fig.4-43: Characteristic curves MSK070D-0150

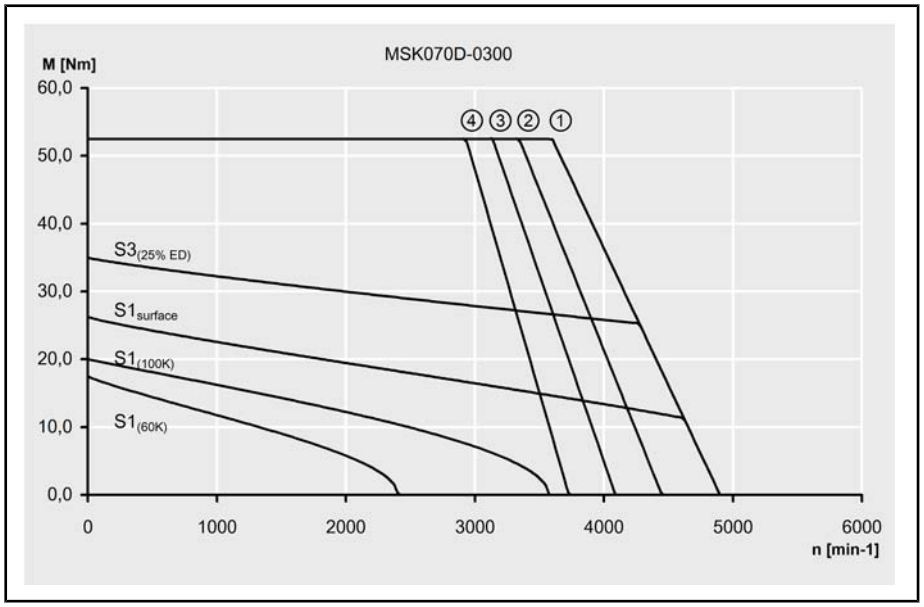


Fig.4-44: Characteristic curves MSK070D-0300

Technical Data

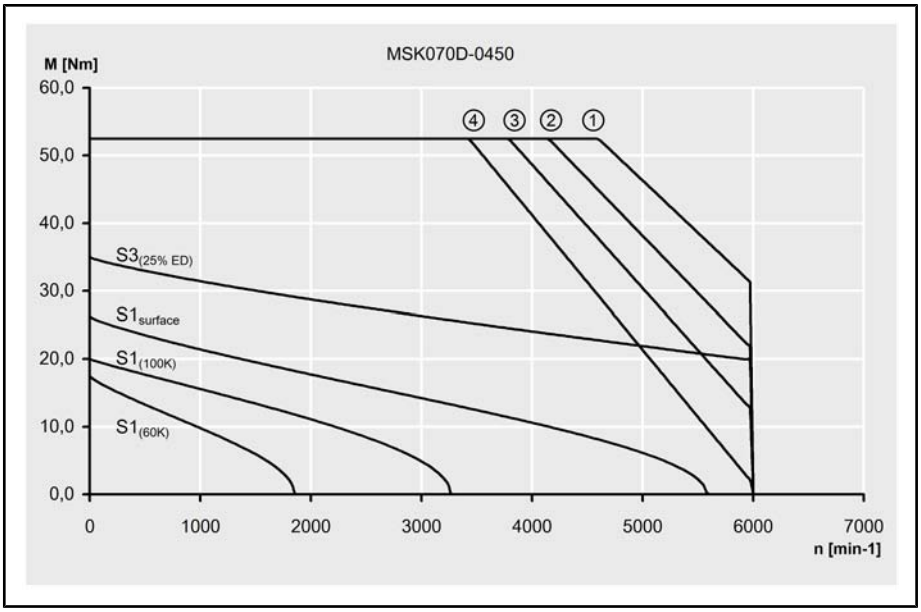


Fig.4-45: Characteristic curves MSK070D-0450

4.17 MSK070E - Technical Data

Designation	Symbol	Unit	MSK070E-0150-NN	MSK070E-0300-NN	MSK070E-0450-NN
UL Files (UL)			E335445		
Continuous torque at standstill 60 K	M_{0_60}	Nm	23.0		
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	6.4	15.4	19.3
Continuous torque at standstill 100 K	M_{0_100}	Nm	25.0		
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	7.0	16.7	21.0
Continuous torque at standstill. surface	M_{0_S}	Nm	34.5		
Continuous current at standstill, surface	$I_{0\_S(rms)}$	A	9.6	23.1	29.0
Maximum torque	M_{max}	Nm	70.0	65.0	60.0
Maximum current	$I_{max(rms)}$	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/min^{-1}	242.4	101.0	80.6
Winding resistance at 20 °C	R_{12}	ohms	3.10	0.53	0.36
Winding inductivity	L_{12}	mH	24.500	3.900	2.700
Discharge capacity of the component	C_{dis}	nF	6.3	3.5	6.7
Number of pole pairs	p	-	6		
Moment of inertia of the rotor	J_{rot}	kg*m^2	0.00458		
Thermal time constant	T_{th}	min	32.0		
Maximum speed	n_{max}	min^{-1}	2,200	5,300	6,000
Sound pressure level	L_P	dB[A]	<75		
Weight [2)]	m	kg	16.2 (17.8)		
Ambient temperature in operation	T_{amb}	°C	0 ... 40		
Type of protection according to IEC 60529	---	-	IP65		
Insulation class according to DIN EN 60034-1	---	-	155		
					Latest amendment: 2008-03-18

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-46: Technical Data

Technical Data

Characteristic Motor Curves

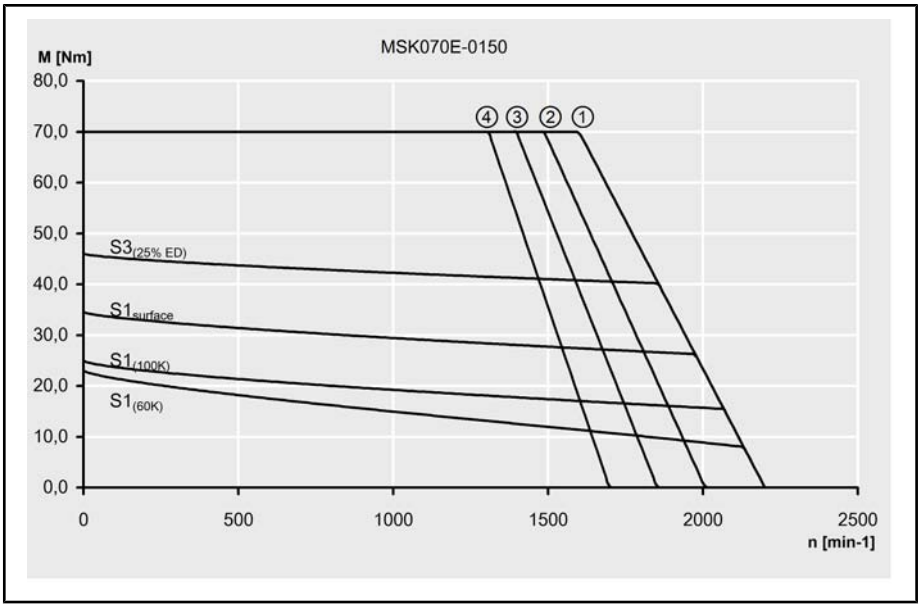


Fig.4-47: Characteristic curves MSK070E-0150

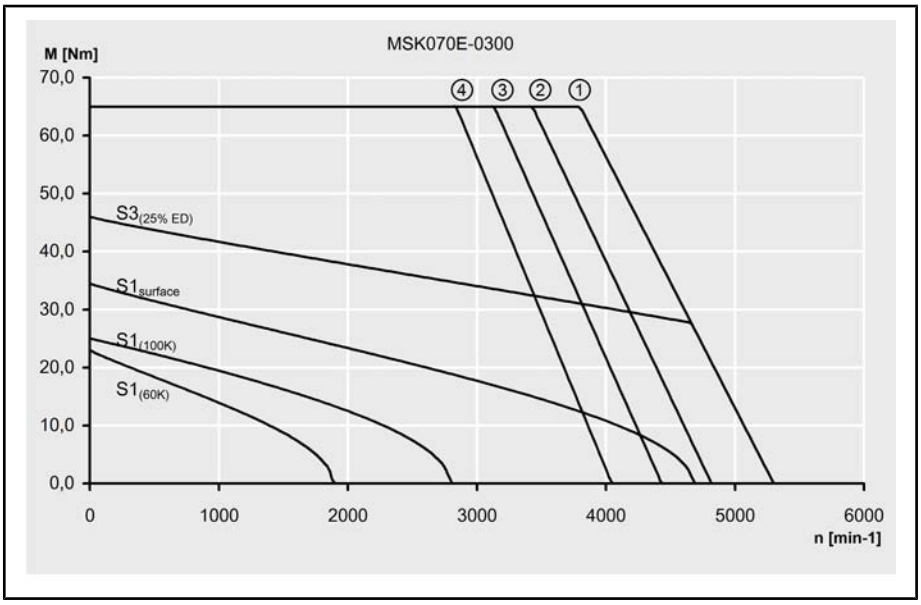


Fig.4-48: Characteristic curves MSK070E-0300

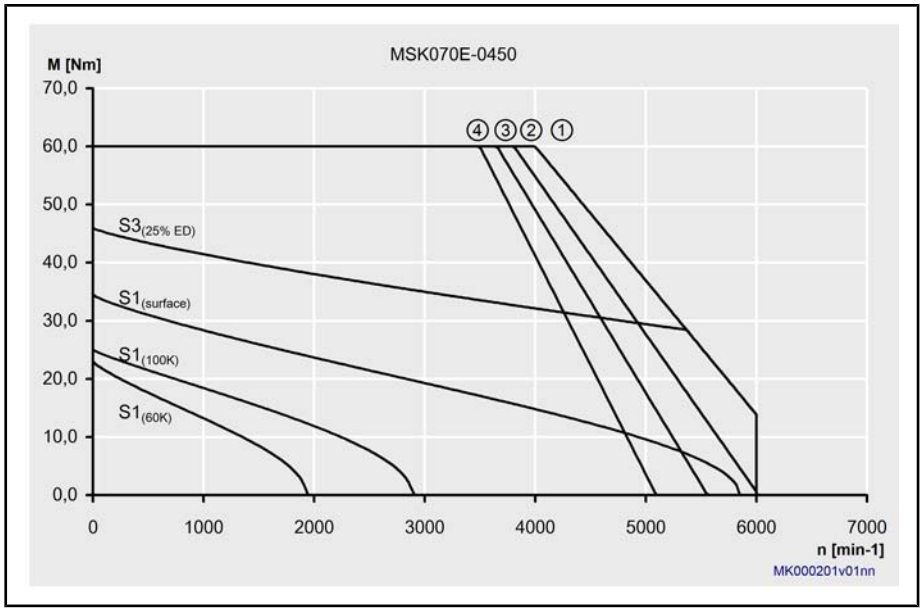


Fig.4-49: Characteristic curves MSK070E-0450

Technical Data

4.18 MSK071C - Technical Data

Data sheet - Motor

Designation	Symbol	Unit	MSK071C-0200-NN	MSK071C-0200-FN	MSK071C-0300-NN	MSK071C-0300-FN	MSK071C-0450-NN	MSK071C-0450-FN
UL Files (UL)			E335445					
Continuous torque at standstill 60 K	M_{0_60}	Nm	12.0					
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	5.2		7.3		8.9	
Continuous torque at standstill 100 K	M_{0_100}	Nm	14.0					
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	6.1		8.5		10.4	
Continuous torque at standstill. surface	M_{0_S}	Nm	18.0	---	18.0	---	18.0	---
Continuous current at standstill. surface	$I_{0\_S(rms)}$	A	7.8	---	11.0	---	13.4	---
Standstill continuous torque liquid	M_{0_L}	Nm	---	22.8	---	22.8	---	22.8
Continuous standstill current liquid	$I_{0\_L(rms)}$	A	---	9.9	---	13.9	---	16.9
Maximum torque	M_{max}	Nm	44.0					
Maximum current	$I_{max(rms)}$	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/min^{-1}	155.5		110.5		91.3	
Winding resistance at 20 °C	R_{12}	ohms	3.10		1.68		1.10	
Winding inductivity	L_{12}	mH	19.500		10.900		6.700	
Discharge capacity of the component	C_{dis}	nF	4.6				4.2	
Number of pole pairs	p	-	4					
Moment of inertia of the rotor	J_{rot}	kg*m^2	0.00173					
Thermal time constant	T_{th}	min	28.0	3.0	28.0	3.0	28.0	3.0
Maximum speed	n_{max}	min^{-1}	3500		5000		5800	
Sound pressure level	L_P	dB[A]	<75					
Weight [2)]	m	kg	13.9 (15.8)					
Ambient temperature in operation	T_{amb}	°C	0 ... 40					
Type of protection according to IEC 60529	---	-	IP65					
Insulation class according to DIN EN 60034-1	---	-	155					
Latest amendment: 2011-02-15								

Designation	Symbol	Unit	MSK071 C-0200- NN	MSK071 C-0200- FN	MSK071 C-0300- NN	MSK071 C-0300- FN	MSK071 C-0450- NN	MSK071 C-0450- FN
Data liquid cooling								
Power loss to be dissipated	P_V	kW	---	0.75	---	0.75	---	0.75
Coolant inlet temperature	T_{ein}	°C	---	10 ... 40	---	10 ... 40	---	10 ... 40
Allowed coolant temperature rise at P_V	ΔT_{max}	K	---	10	---	10	---	10
Necessary coolant flow at P_V	Q_{min}	l/min	---	1.1	---	1.1	---	1.1
Pressure loss at Q_{min}	Δp	bar	---	0.3	---	0.3	---	0.3
Maximum permitted inlet pressure	p_{max}	bar	---	6.0	---	6.0	---	6.0
Volume of coolant duct	V_{kuehl}	l	---	0.04	---	0.04	---	0.04
								Latest amendment: 2011-02-15

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-50: MSK - Technical data

Characteristic Motor Curves

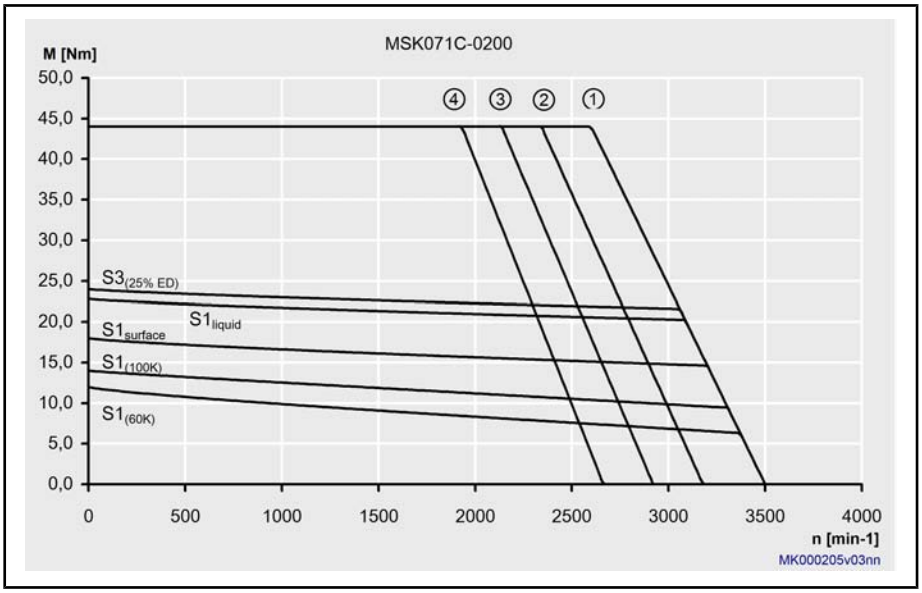


Fig.4-51: Characteristic curves MSK071C-0200

Technical Data

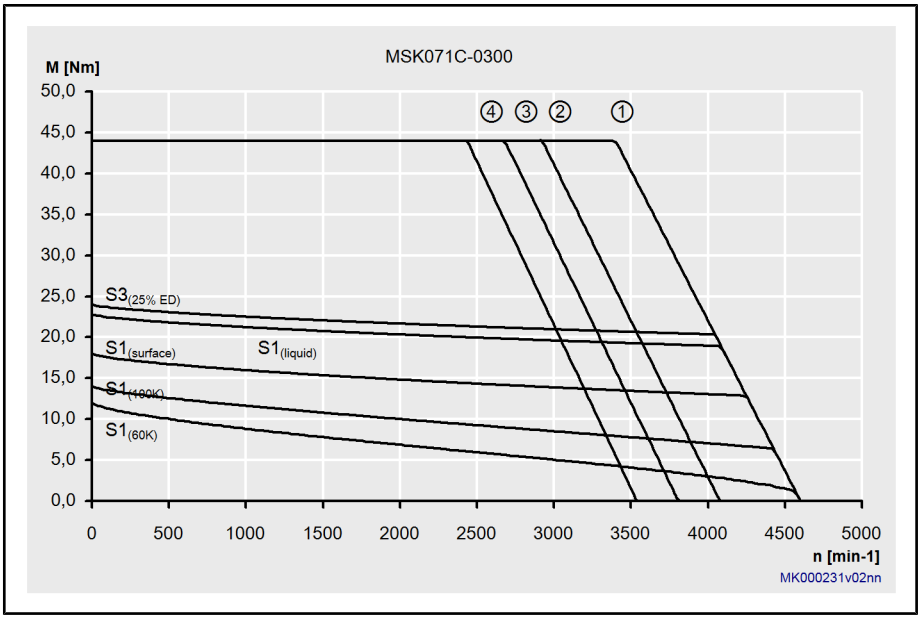


Fig.4-52: Characteristic curves MSK071C-0300

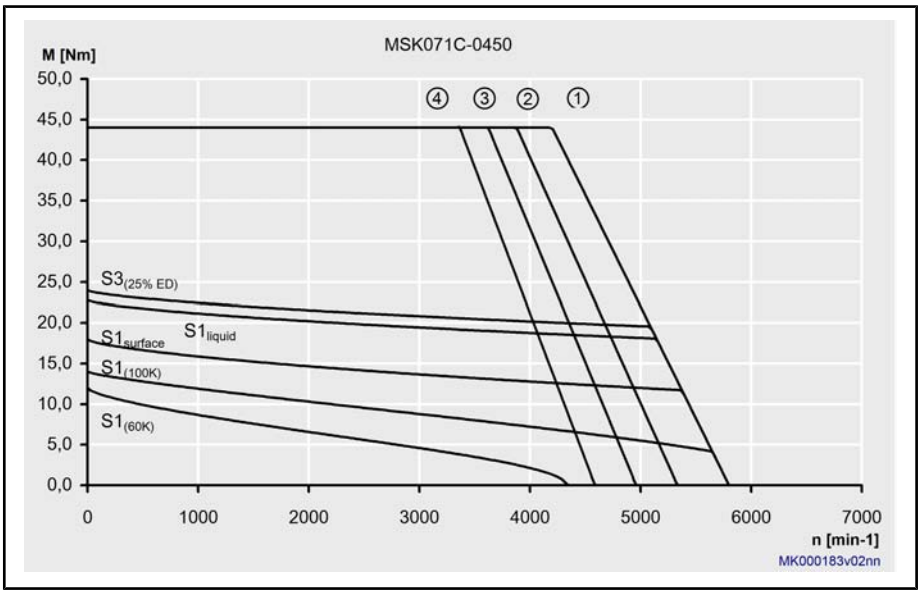


Fig.4-53: Characteristic curves MSK071C-0450

4.19 MSK071D - Technical Data

Data sheet - Motor

Designation	Symbol	Unit	MSK071 D-0200-NN	MSK071 D-0200-FN	MSK071 D-0300-NN	MSK071 D-0300-FN	MSK071 D-0450-NN	MSK071 D-0450-FN
UL Files (UL)			E335445					
Continuous torque at standstill 60 K	M_{0_60}	Nm	17.5					
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	7.3		9.1		15.4	
Continuous torque at standstill 100 K	M_{0_100}	Nm	20.0					
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	8.6		10.7		17.6	
Continuous torque at standstill. surface	M_{0_S}	Nm	26.3	---	26.3	---	26.3	---
Continuous current at standstill. surface	$I_{0\_S(rms)}$	A	11.0	---	13.5	---	23.1	---
Standstill continuous torque liquid	M_{0_L}	Nm	---	33.3	---	33.3	---	33.3
Continuous standstill current liquid	$I_{0\_L(rms)}$	A	---	13.9	---	17.2	---	30.3
Maximum torque	M_{max}	Nm	66.0					
Maximum current	$I_{max(rms)}$	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/min^{-1}	162.0		134.0		77.1	
Winding resistance at 20 °C	R_{12}	ohms	1.90		1.26		0.45	
Winding inductivity	L_{12}	mH	14.200		10.700		3.200	
Discharge capacity of the component	C_{dis}	nF	6.9		7.2		7.8	
Number of pole pairs	p	-	4					
Moment of inertia of the rotor	J_{rot}	kg*m^2	0.00230					
Thermal time constant	T_{th}	min	54.0	6.0	54.0	6.0	52.0	6.0
Maximum speed	n_{max}	min^{-1}	3,200		3,800		6,000	
Sound pressure level	L_P	dB[A]	<75					
Weight [2)]	m	kg	18.0 (19.6)					
Ambient temperature in operation	T_{amb}	°C	0 ... 40					
Type of protection according to IEC 60529	---	-	IP65					
Insulation class according to DIN EN 60034-1	---	-	155					

Latest amendment: 2011-02-15

Technical Data

Designation	Symbol	Unit	MSK071 D-0200- NN	MSK071 D-0200- FN	MSK071 D-0300- NN	MSK071 D-0300- FN	MSK071 D-0450- NN	MSK071 D-0450- FN
Data liquid cooling								
Power loss to be dissipated	P_V	kW	---	0.90	---	0.90	---	0.90
Coolant inlet temperature	T_{ein}	°C	---	10 ... 40	---	10 ... 40	---	10 ... 40
Allowed coolant temperature rise at P_V	ΔT_{max}	K	---	10	---	10	---	10
Necessary coolant flow at P_V	Q_{min}	l/min	---	1.3	---	1.3	---	1.3
Pressure loss at Q_{min}	Δp	bar	---	0.4	---	0.4	---	0.4
Maximum permitted inlet pressure	p_{max}	bar	---	6.0	---	6.0	---	6.0
Volume of coolant duct	V_{kuehl}	l	---	0.05	---	0.05	---	0.05
								Latest amendment: 2011-02-15

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1. holding brake 2 ...)

Fig.4-54: MSK - Technical data

Characteristic Motor Curves

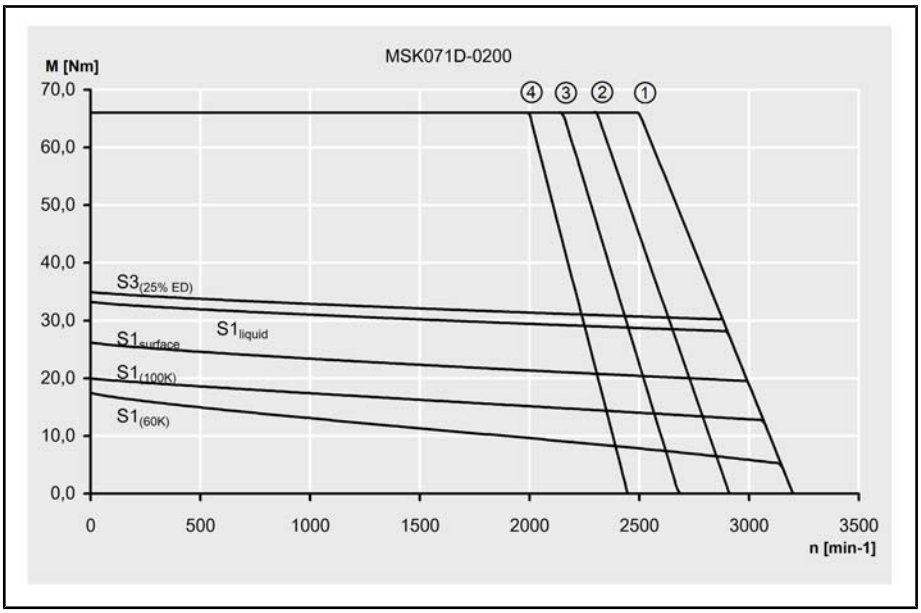


Fig.4-55: Characteristic curves MSK071D-0200

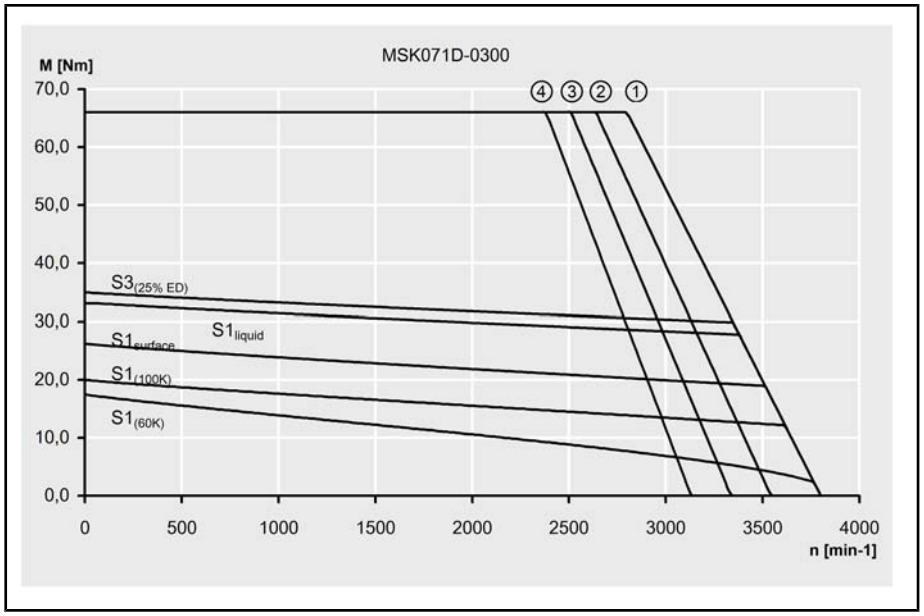


Fig.4-56: Characteristic curves MSK071D-0300

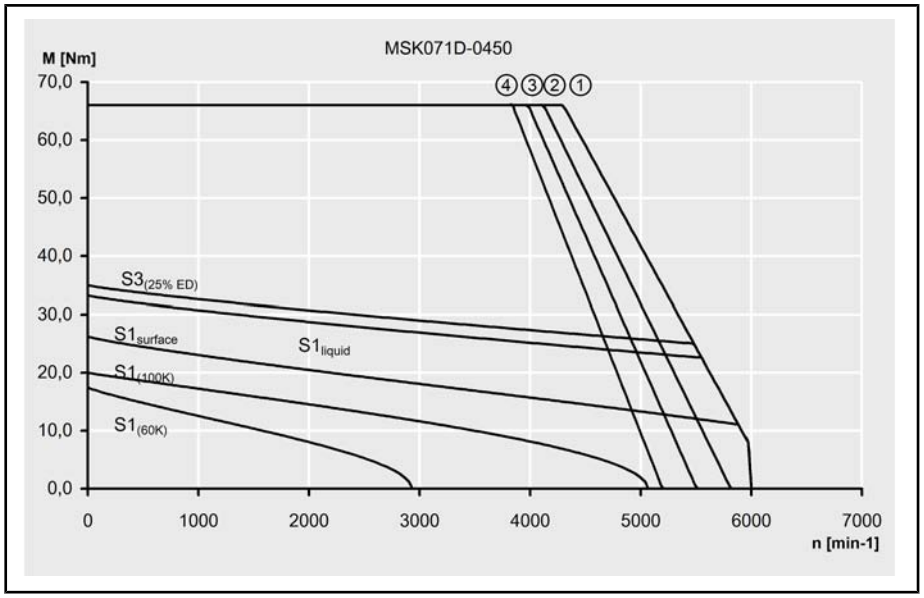


Fig.4-57: Characteristic curves MSK071D-0450

Technical Data

4.20 MSK071E - Technical Data

Data sheet - Motor

Designation	Symbol	Unit	MSK071E-0200-NN	MSK071E-0200-FN	MSK071E-0300-NN	MSK071E-0300-FN	MSK071E-0450-NN	MSK071E-0450-FN
UL Files (UL)			E335445					
Continuous torque at standstill 60 K	M_{0_60}	Nm	23.0					
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	10.1		12.5		20.0	
Continuous torque at standstill 100 K	M_{0_100}	Nm	28.0					
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	12.6		15.2		24.4	
Continuous torque at standstill. surface	M_{0_S}	Nm	34.5	---	34.5	---	34.5	---
Continuous current at standstill. surface	$I_{0\_S(rms)}$	A	15.2	---	18.8	---	30.0	---
Standstill continuous torque liquid	M_{0_L}	Nm	---	43.7	---	43.7	---	43.7
Continuous standstill current liquid	$I_{0\_L(rms)}$	A	---	19.0	---	24.9	---	38.0
Maximum torque	M_{max}	Nm	84.0					
Maximum current	$I_{max(rms)}$	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/min^{-1}	154.6		126.4		82.7	
Winding resistance at 20 °C	R_{12}	ohms	1.16		0.79		0.32	
Winding inductivity	L_{12}	mH	9.150		5.900		2.600	
Discharge capacity of the component	C_{dis}	nF	8.9		9.3		9.5	
Number of pole pairs	p	-	4					
Moment of inertia of the rotor	J_{rot}	kg*m^2	0.00290					
Thermal time constant	T_{th}	min	55.0	8.0	55.0	8.0	55.0	8.0
Maximum speed	n_{max}	min^{-1}	3,400		4,200		6,000	
Sound pressure level	L_P	dB[A]	<75					
Weight [2)]	m	kg	23.5 (25.1)					
Ambient temperature in operation	T_{amb}	°C	0 ... 40					
Type of protection according to IEC 60529	---	-	IP65					
Insulation class according to DIN EN 60034-1	---	-	155					

Latest amendment: 2011-02-15

Designation	Symbol	Unit	MSK071 E-0200- NN	MSK071 E-0200- FN	MSK071 E-0300- NN	MSK071 E-0300- FN	MSK071 E-0450- NN	MSK071 E-0450- FN
Data liquid cooling								
Power loss to be dissipated	P_V	kW	---	1.00	---	1.00	---	1.00
Coolant inlet temperature	T_{ein}	°C	---	10 ... 40	---	10 ... 40	---	10 ... 40
Allowed coolant temperature rise at P_V	ΔT_{max}	K	---	10	---	10	---	10
Necessary coolant flow at P_V	Q_{min}	l/min	---	1.5	---	1.5	---	1.5
Pressure loss at Q_{min}	Δp	bar	---	0.5	---	0.5	---	0.5
Maximum permitted inlet pressure	p_{max}	bar	---	6.0	---	6.0	---	6.0
Volume of coolant duct	V_{kuehl}	l	---	0.06	---	0.06	---	0.06
								Latest amendment: 2011-02-15

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-58: MSK - Technical data

Characteristic Motor Curves

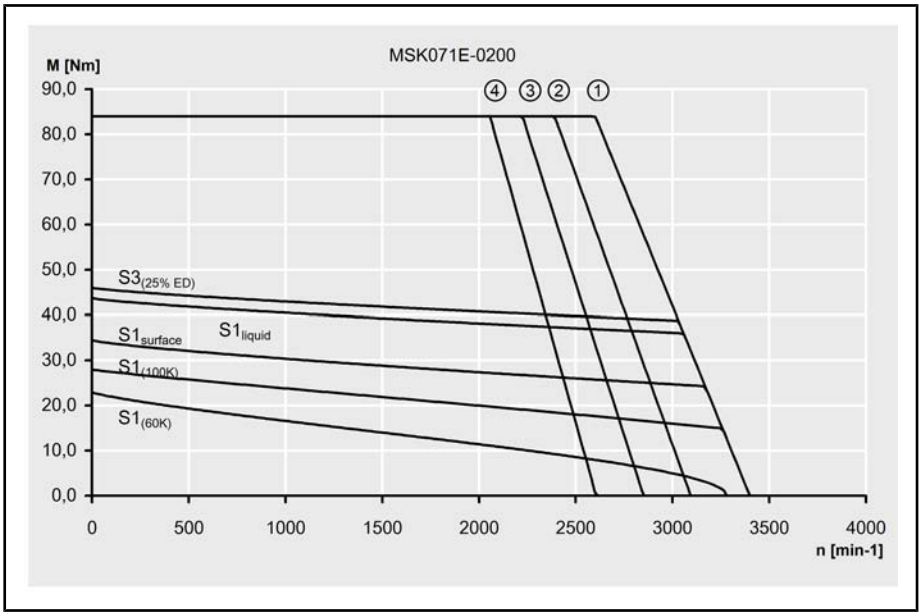


Fig.4-59: Characteristic curves MSK071E-0200

Technical Data

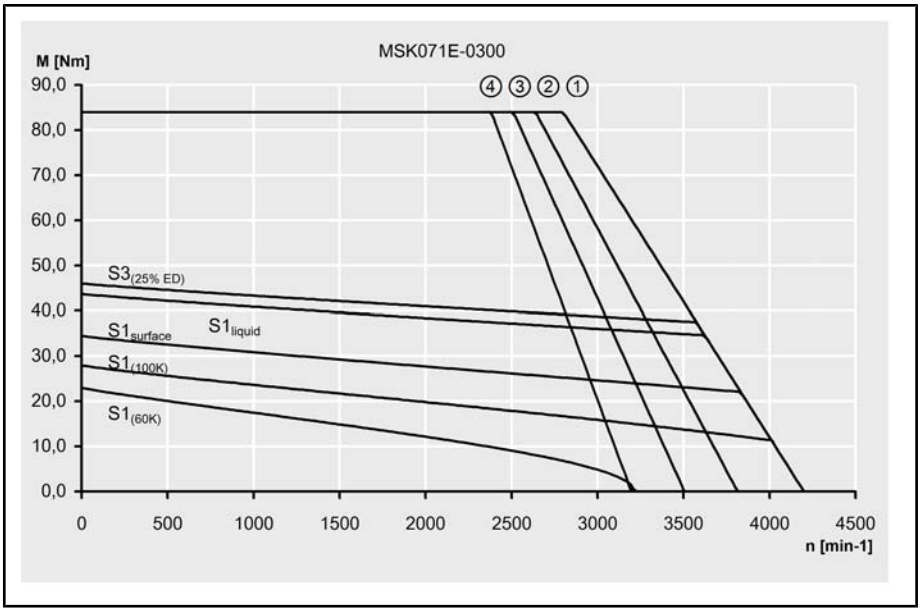


Fig.4-60: Characteristic curves MSK071E-0300

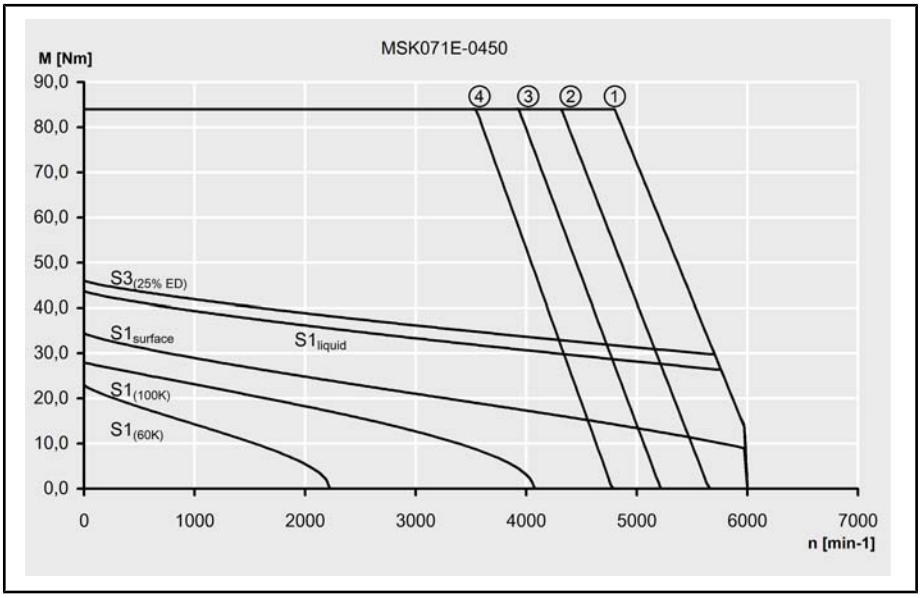


Fig.4-61: Characteristic curves MSK071E-0450

4.21 MSK075C - Technical Data

Designation	Symbol	Unit	MSK075C-0200-NN	MSK075C-0300-NN	MSK075C-0450-NN
UL Files (UL)			---		
Continuous torque at standstill 60 K	M_{0_60}	Nm	12.0		
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	6.3	8.4	12.6
Continuous torque at standstill 100 K	M_{0_100}	Nm	12.5		
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	7.3	8.8	13.1
Continuous torque at standstill. surface	M_{0_S}	Nm	18.0		
Continuous current at standstill. surface	$I_{0\_S(rms)}$	A	9.5	12.6	18.9
Maximum torque	M_{max}	Nm	44.0		
Maximum current	$I_{max(rms)}$	A	28.4	37.8	56.7
Torque constant at 20 °C	K_{M_N}	Nm/A	2.11	1.58	1.05
Voltage constant at 20 °C[1)]	K_{EMK_1000}	V/min^{-1}	129.5	97.0	64.8
Winding resistance at 20 °C	R_{12}	ohms	3.00	1.60	0.76
Winding inductivity	L_{12}	mH	16.600	8.800	4.200
Discharge capacity of the component	C_{dis}	nF	3.8	3.2	3.5
Number of pole pairs	p	-	4		
Moment of inertia of the rotor	J_{rot}	kg*m^2	0.00352		
Thermal time constant	T_{th}	min	29.0		17.5
Maximum speed	n_{max}	min^{-1}	4,100	5,000	6,000
Sound pressure level	L_P	dB[A]	<75		
Weight [2)]	m	kg	14.8(16.4)		
Ambient temperature in operation	T_{amb}	°C	0 ... 40		
Type of protection according to IEC 60529	---	-	IP65		
Insulation class according to DIN EN 60034-1	---	-	155		
					Latest amendment: 2010-10-28

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-62: MSK - Technical data

Technical Data

Characteristic Motor Curves

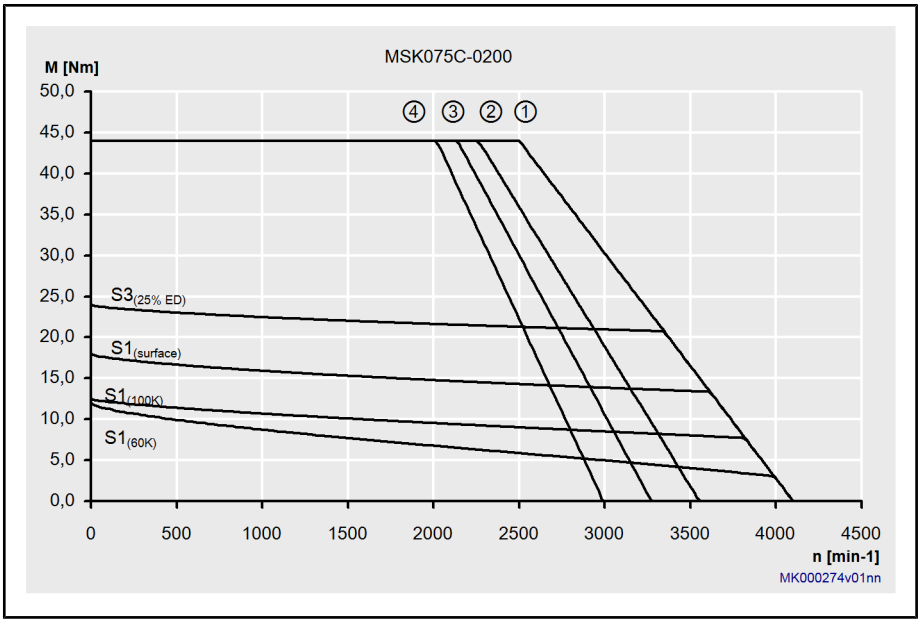


Fig.4-63: Characteristic curves MSK075C-0200

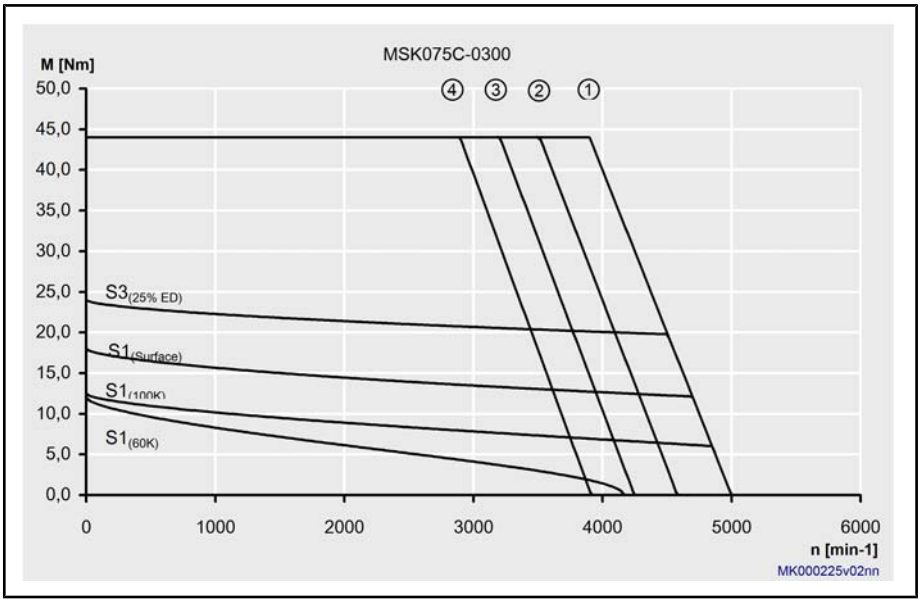


Fig.4-64: Characteristic curves MSK075C-300

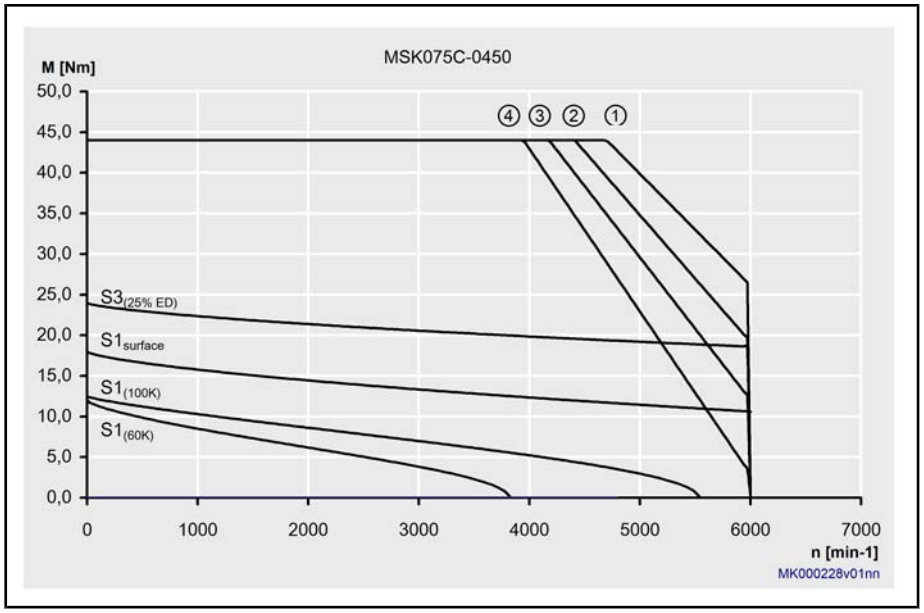


Fig.4-65: Characteristic curves MSK075C-0450

Technical Data

4.22 MSK075D - Technical Data

Designation	Symbol	Unit	MSK075D-0200-NN	MSK075D-0300-NN	MSK075D-0450-NN
UL Files (UL)			---		
Continuous torque at standstill 60 K	M_{0_60}	Nm	17.0		
Continuous current at standstill 60K	$I_{0\_60(rms)}$	A	8.3	11.7	16.5
Continuous torque at standstill 100K	M_{0_100}	Nm	18.5		
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	9.0	12.7	18.0
Continuous torque at standstill, surface	M_{0_S}	Nm	25.5		
Continuous current at standstill. surface	$I_{0\_S(rms)}$	A	12.5	17.6	24.8
Maximum torque	M_{max}	Nm	64.0	66.0	64.0
Maximum current	$I_{max(rms)}$	A	37.4	52.7	74.3
Torque constant at 20 °C	K_{M_N}	Nm/A	2.24	1.60	1.13
Voltage constant at 20 °C[1)]	K_{EMK_1000}	V/min^{-1}	138.0	98.2	69.3
Winding resistance at 20 °C	R_{12}	ohms	1.80	0.91	0.45
Winding inductivity	L_{12}	mH	11.700	5.700	2.900
Discharge capacity of the component	C_{dis}	nF	4.6	4.7	
Number of pole pairs	p	-	4		
Moment of inertia of the rotor	J_{rot}	kg*m^2	0.00490		
Thermal time constant	T_{th}	min	22.0	17.5	22.0
Maximum speed	n_{max}	min^{-1}	3,800	4,800	6,000
Sound pressure level	L_P	dB[A]	<75		
Weight [2)]	m	kg	19.0 (20.1)		
Ambient temperature in operation	T_{amb}	°C	0 ... 40		
Type of protection according to IEC 60529	---	-	IP65		
Insulation class according to DIN EN 60034-1	---	-	155		
Latest amendment: 2008-05-26					

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-66: MSK - Technical data

Characteristic Motor Curves

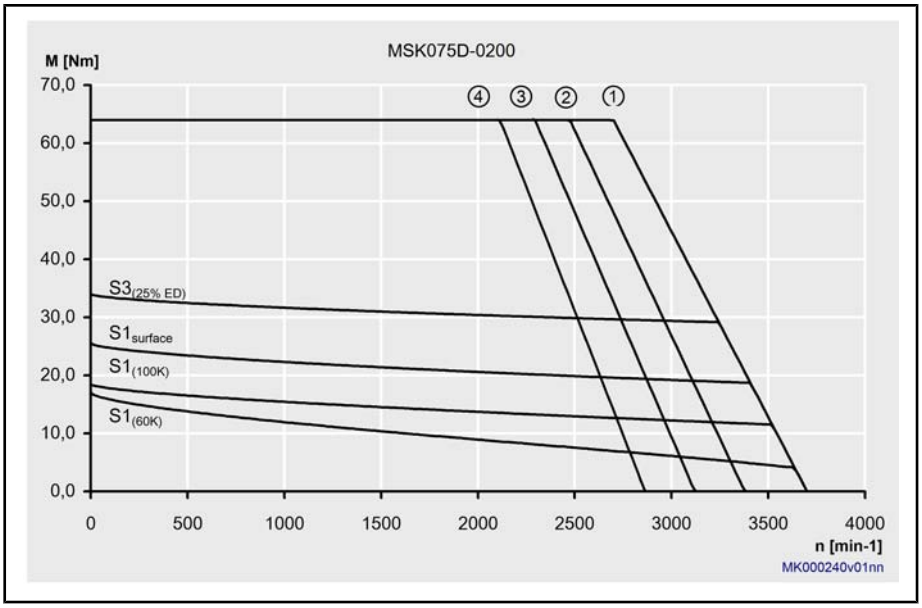


Fig.4-67: Characteristic curve MSK075D-0200

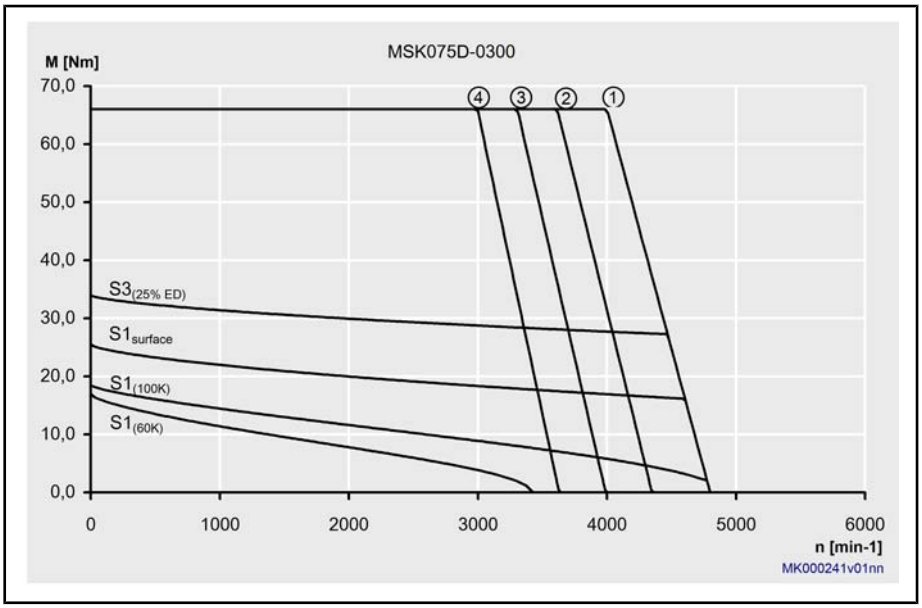


Fig.4-68: Characteristic curve MSK075D-0300

Technical Data

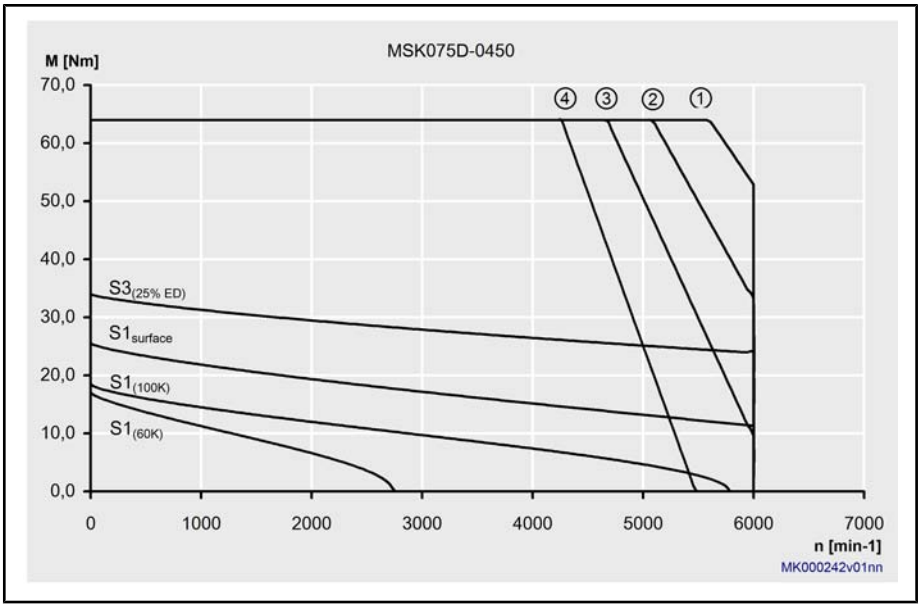


Fig.4-69: Characteristic curve MSK075D-0450

4.23 MSK075E - Technical Data

Data sheet - Motor

Designation	Symbol	Unit	MSK075E-0200-NN	MSK075E-0300-NN	MSK075E-0300-FN	MSK075E-0450-NN	MSK075E-0450-FN
UL Files (UL)			---				
Continuous torque at standstill 60 K	M_{0_60}	Nm	21.0				
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	10.2	14.2		18.6	
Continuous torque at standstill 100 K	M_{0_100}	Nm	23.0				
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	11.2	15.6		20.4	
Continuous torque at standstill. surface	M_{0_S}	Nm	31.5		---	31.5	---
Continuous current at standstill. surface	$I_{0\_S(rms)}$	A	15.3	21.3	---	27.9	---
Standstill continuous torque liquid	M_{0_L}	Nm	---		39.9	---	39.9
Continuous standstill current liquid	$I_{0\_L(rms)}$	A	---		27.0	---	35.3
Maximum torque	M_{max}	Nm	88.0				
Maximum current	$I_{max(rms)}$	A	45.9	63.9		83.7	
Torque constant at 20 °C	K_{M_N}	Nm/A	2.26	1.63		1.24	
Voltage constant at 20 °C[1)]	K_{EMK_1000}	V/min^{-1}	139.0	100.0		76.5	
Winding resistance at 20 °C	R_{12}	ohms	1.24	0.65		0.39	
Winding inductivity	L_{12}	mH	8.400	4.460		2.700	
Discharge capacity of the component	C_{dis}	nF	5.8	6.5		5.6	
Number of pole pairs	p	-	4				
Moment of inertia of the rotor	J_{rot}	kg*m^2	0.00613				
Thermal time constant	T_{th}	min	29.0		10.0	29.0	10.0
Maximum speed	n_{max}	min^{-1}	3,850	5,200		6,000	
Sound pressure level	L_P	dB[A]	<75				
Weight [2)]	m	kg	22.5 (23.6) (24.1)				
Ambient temperature in operation	T_{amb}	°C	0 ... 40				
Type of protection according to IEC 60529	---	-	IP65				
Insulation class according to DIN EN 60034-1	---	-	155				
Data liquid cooling							
Latest amendment: 2011-02-15							

Technical Data

Designation	Symbol	Unit	MSK075E-0200-NN	MSK075E-0300-NN	MSK075E-0300-FN	MSK075E-0450-NN	MSK075E-0450-FN
Power loss to be dissipated	P_V	kW	---		1.00	---	1.00
Coolant inlet temperature	T_{ein}	°C	---		10 ... 40	---	10 ... 40
Allowed coolant temperature rise at P_V	ΔT_{max}	K	---		10	---	10
Necessary coolant flow at P_V	Q_{min}	l/min	---		1.5	---	1.5
Pressure loss at Q_{min}	Δp	bar	---		0.5	---	0.5
Maximum permitted inlet pressure	p_{max}	bar	---		6.0	---	6.0
Volume of coolant duct	V_{kuehl}	l	---		0.06	---	0.06
Latest amendment: 2011-02-15							

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-70: MSK - Technical data

Characteristic Motor Curves

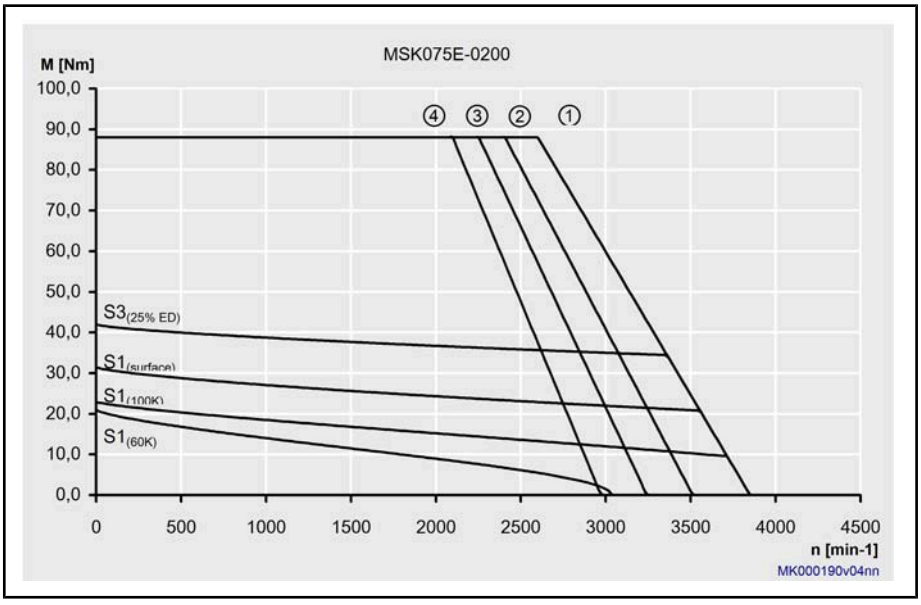


Fig.4-71: Characteristic curve MSK075E-0200

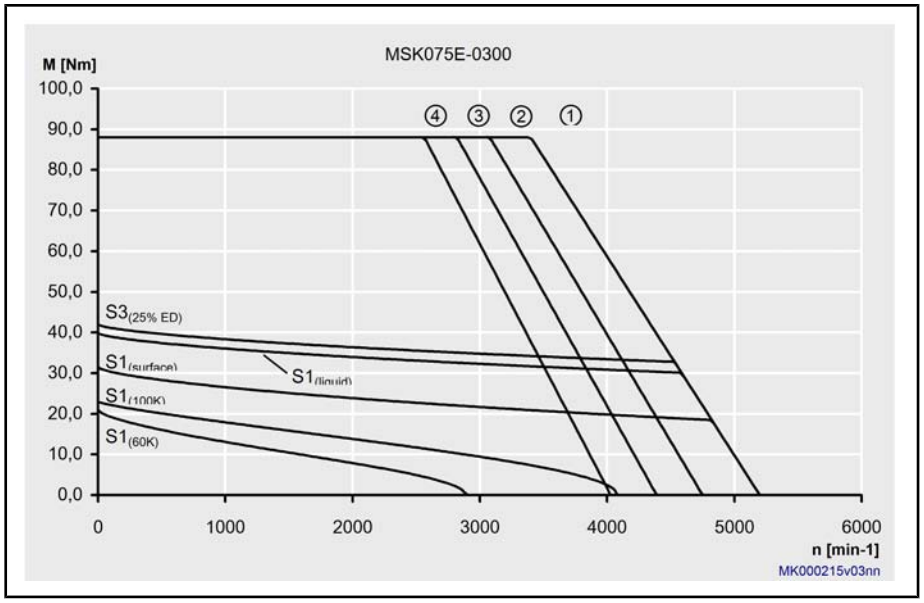


Fig.4-72: Characteristic curve MSK075E-300

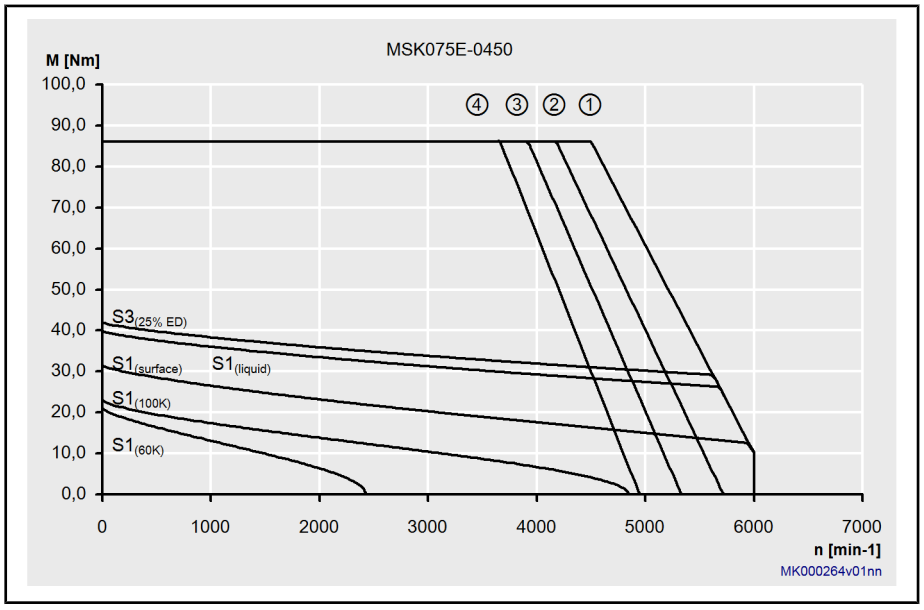


Fig.4-73: Characteristic curve MSK075E-0450

Technical Data

4.24 MSK076C - Technical Data

Designation	Symbol	Unit	MSK076C-0300-NN	MSK076C-0450-NN
UL Files (UL)			E335445	
Continuous torque at standstill 60 K	M_{0_60}	Nm	12.0	
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	7.2	12.2
Continuous torque at standstill 100 K	M_{0_100}	Nm	13.5	
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	8.1	13.7
Continuous torque at standstill. surface	M_{0_S}	Nm	18.0	
Continuous current at standstill. surface	$I_{0\_S(rms)}$	A	10.8	18.3
Maximum torque	M_{max}	Nm	43.5	
Maximum current	$I_{max(rms)}$	A	32.4	54.9
Torque constant at 20 °C	K_{M_N}	Nm/A	1.84	1.14
Voltage constant at 20 °C[1)]	K_{EMK_1000}	V/min^{-1}	113.0	70.5
Winding resistance at 20 °C	R_{12}	ohms	1.85	0.71
Winding inductivity	L_{12}	mH	12.600	4.700
Discharge capacity of the component	C_{dis}	nF	6.5	6.0
Number of pole pairs	p	-	4	
Moment of inertia of the rotor	J_{rot}	kg*m^2	0.00430	
Thermal time constant	T_{th}	min	25.0	
Maximum speed	n_{max}	min^{-1}	4,700	5,000
Sound pressure level	L_P	dB[A]	< 75	
Weight [2)]	m	kg	13.8 (14.9)	
Ambient temperature in operation	T_{amb}	°C	0 ... 40	
Type of protection according to IEC 60529	---	-	IP65	
Insulation class according to DIN EN 60034-1	---	-	155	
				Latest amendment: 2008-01-29

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-74: MSK - Technical data (standard and air cooling)

Characteristic Motor Curves

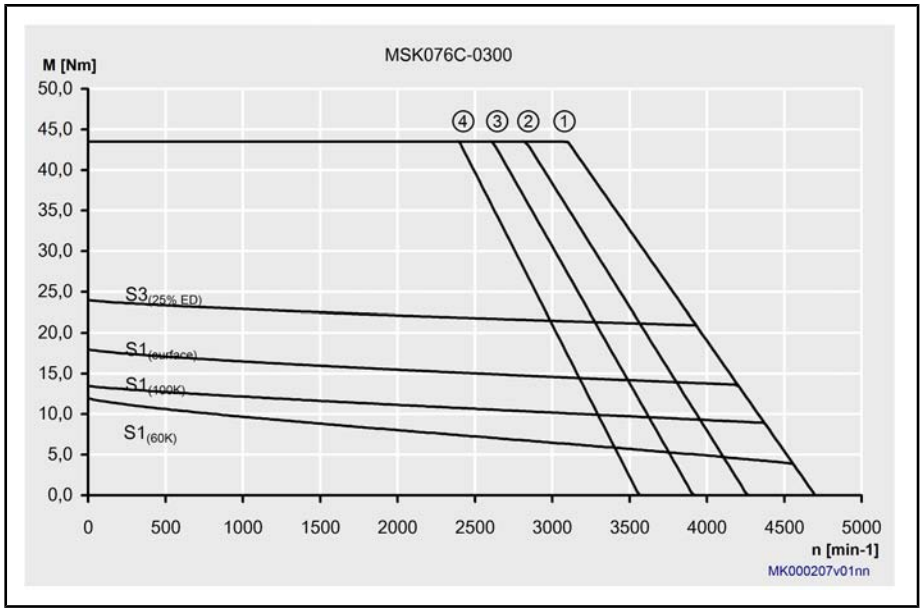


Fig.4-75: Characteristic curves MSK076C-0300

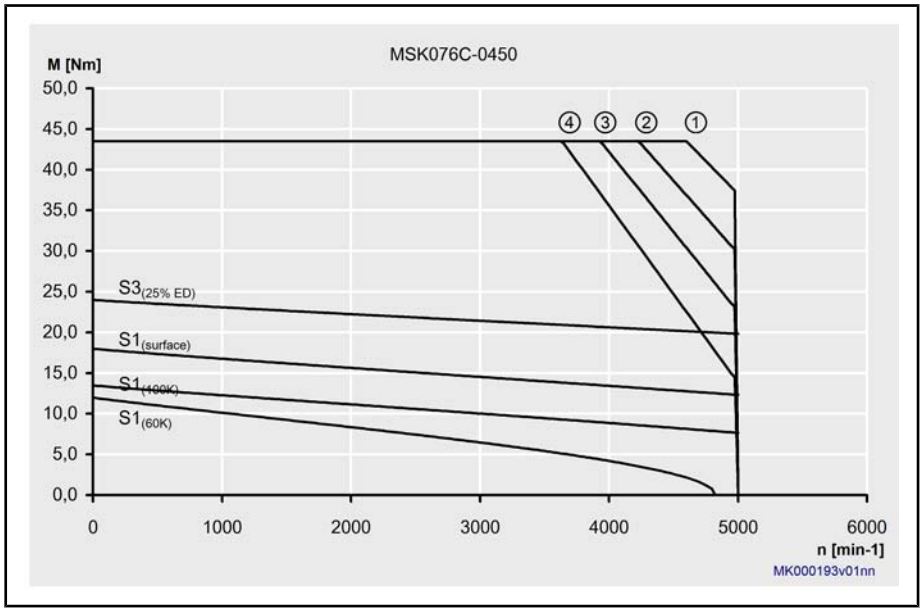


Fig.4-76: Characteristic curves MSK076C-0450

Technical Data

4.25 MSK100A - Technical Data

Data sheet - Motor

Designation	Symbol	Unit	MSK100A-0200-NN	MSK100A-0300-NN	MSK100A-0450-NN
UL Files (UL)			E335445		
Continuous torque at standstill 60 K	M_{0_60}	Nm	15.0		
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	9.2	10.2	12.0
Continuous torque at standstill 100 K	M_{0_100}	Nm	17.0		
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	10.4	11.6	13.6
Continuous torque at standstill, surface	M_{0_S}	Nm	22.5		
Continuous current at standstill. surface	$I_{0\_S(rms)}$	A	13.8	15.3	18.0
Maximum torque	M_{max}	Nm	54.0		
Maximum Current	$I_{max(rms)}$	A	41.4	45.9	54.0
Torque constant at 20 °C[1)]	K_{M_N}	Nm/A	1.89	1.70	1.45
Voltage constant at 20 °C[2)]	K_{EMK_1000}	V/min^{-1}	116.4	104.5	89.4
Winding resistance at 20 °C	R_{12}	ohms	1.45	1.10	0.81
Winding inductivity	L_{12}	mH	13.900	11.200	7.800
Discharge capacity of the component	C_{dis}	nF	4.8	4.6	4.9
Number of pole pairs	p	-	4		
Moment of inertia of the rotor	J_{rot}	kg*m^2	0.01100		
Thermal time constant	T_{th}	min	48.0	39.0	
Maximum speed	n_{max}	min^{-1}	4,400	5,200	6,000
Sound pressure level	L_P			<75	
Weight [3)]	m	kg	23.0 (25.4)		
Ambient temperature in operation	T_{amb}	°C	0 ... 40		
Type of protection according to IEC 60529	---	-	IP65		
Insulation class according to DIN EN 60034-1	---	-	155		
Latest amendment: 2008-07-31					

1) 2) Manufacturing tolerance ±5 %

3) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-77: MSK - Technical data (standard and air cooling)

Characteristic Motor Curves

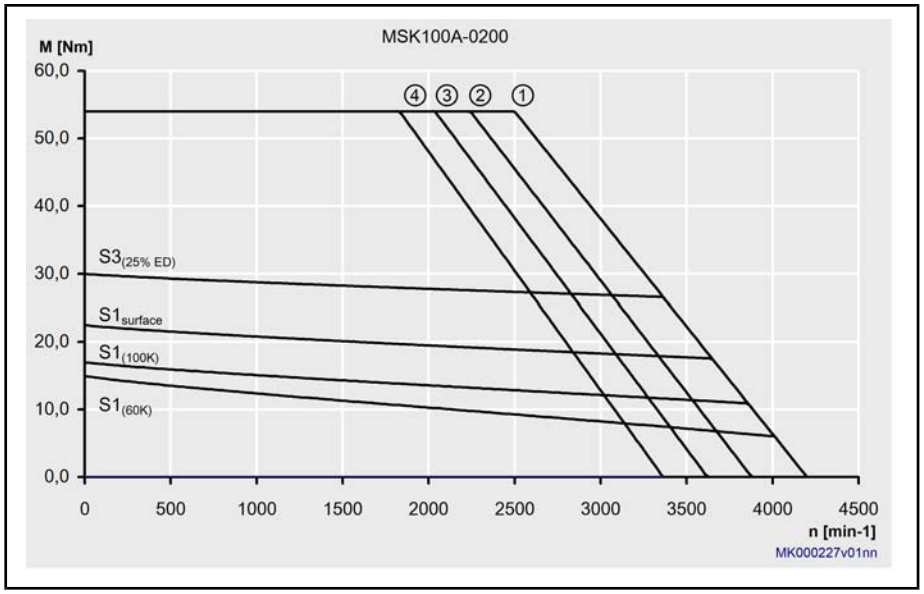


Fig.4-78: Characteristic curve MSK100A-0200

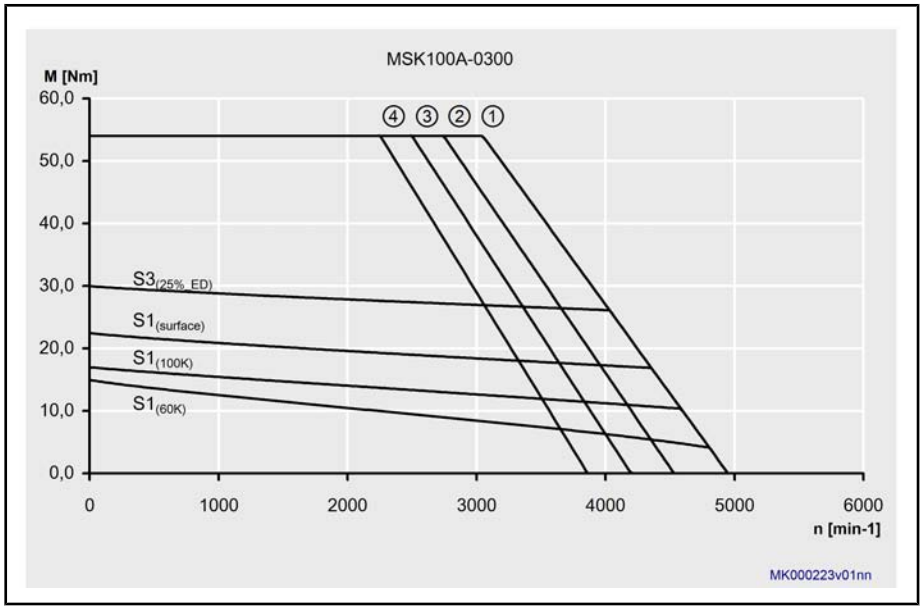


Fig.4-79: Characteristic curve MSK100A-0300

Technical Data

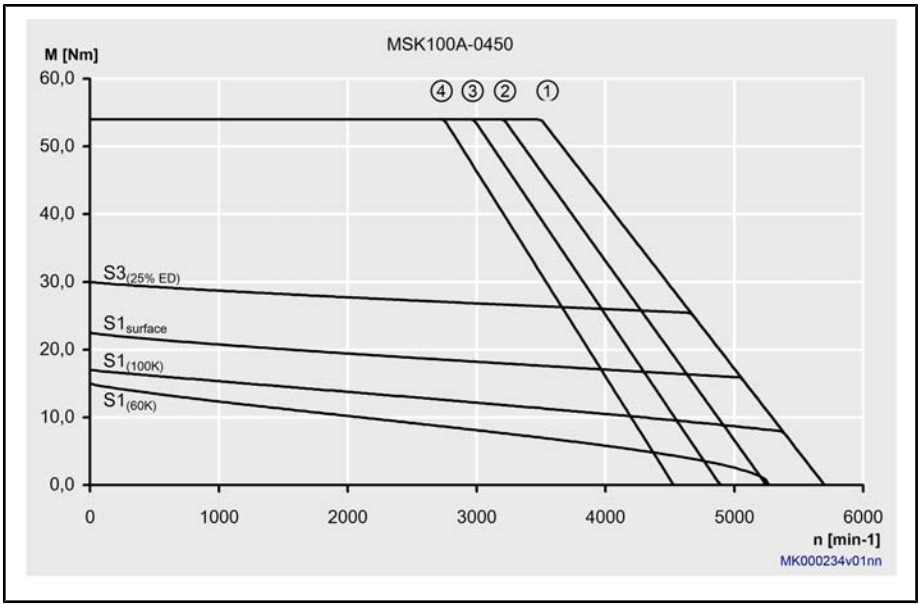


Fig.4-80: Characteristic curve MSK100A-0450

4.26 MSK100B - Technical Data

Designation	Symbol	Unit	MSK100B-020 0-NN	MSK100B-030 0-NN	MSK100B-040 0-NN	MSK100B-045 0-NN
UL Files (UL)			E335445			
Continuous torque at standstill 60 K	M_{0_60}	Nm	28.0			
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	14.7	17.4	24.5	28.5
Continuous torque at standstill 100 K	M_{0_100}	Nm	33.0			
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	17.3	20.5	29.5	33.6
Continuous torque at standstill, surface	M_{0_S}	Nm	42.0			
Continuous current at standstill, surface	$I_{0\_S(rms)}$	A	22.1	26.1	35.6	42.8
Maximum torque	M_{max}	Nm	102.0			
Maximum current	$I_{max(rms)}$	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/min^{-1}	129.5	108.5	80.0	70.0
Winding resistance at 20 °C	R_{12}	ohms	0.58	0.43	0.23	0.17
Winding inductivity	L_{12}	mH	7.600	5.500	3.100	2.200
Discharge capacity of the component	C_{dis}	nF	10.3	9.3	10.3	
Number of pole pairs	p	-	4			
Moment of inertia of the rotor	J_{rot}	kg*m^2	0.01920			
Thermal time constant	T_{th}	min	40.0			
Maximum speed	n_{max}	min^{-1}	4,100	4,500		
Sound pressure level	L_P	dB[A]	<75			
Weight [2)]	m	kg	34.0 (36.5) (37.8)			
Ambient temperature in operation	T_{amb}	°C	0 ... 40			
Type of protection according to IEC 60529	---	-	IP65			
Insulation class according to DIN EN 60034-1	---	-	155			
Latest amendment: 2008-11-28						

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-81: Technical Data

Technical Data

Characteristic Motor Curves

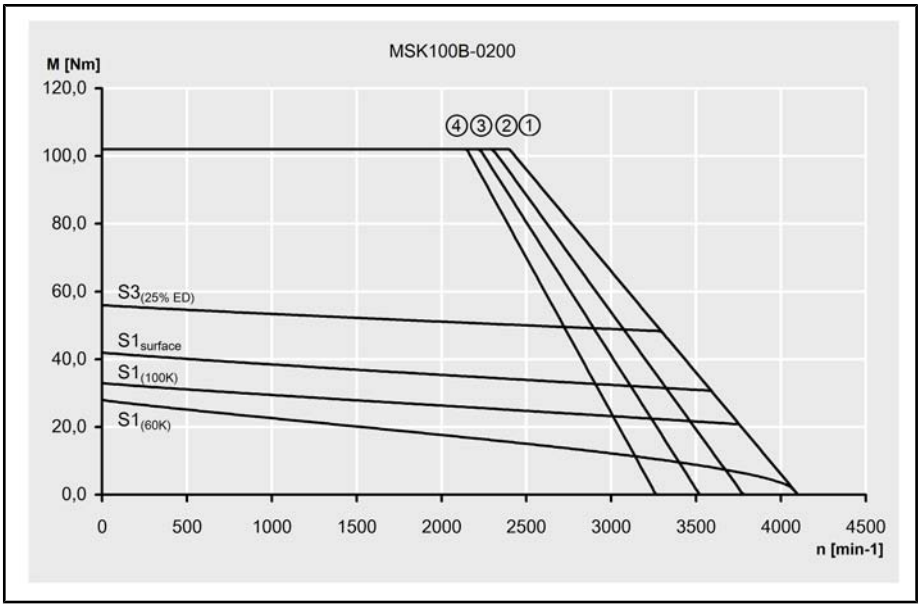


Fig.4-82: Characteristic curve MSK100B-0200

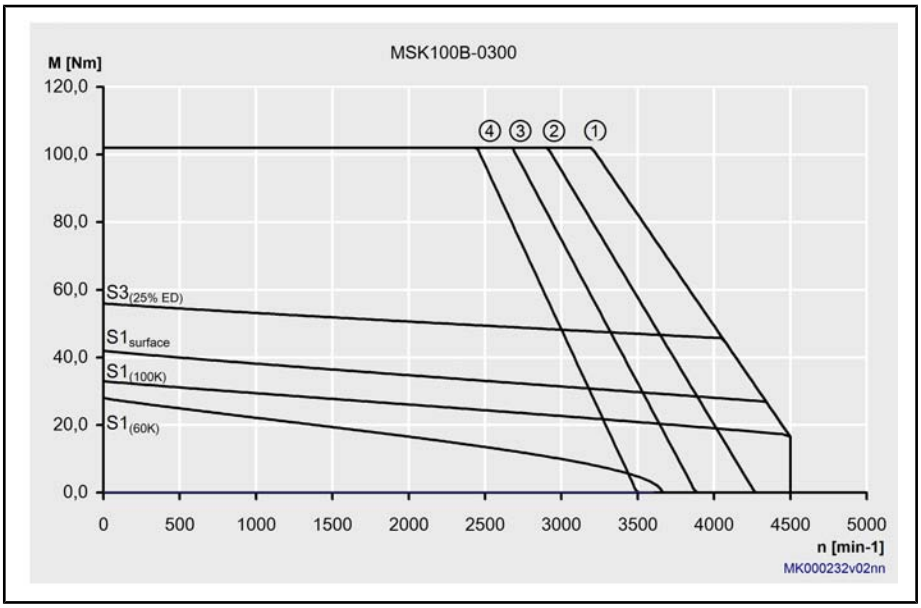


Fig.4-83: Characteristic curve MSK100B-0300

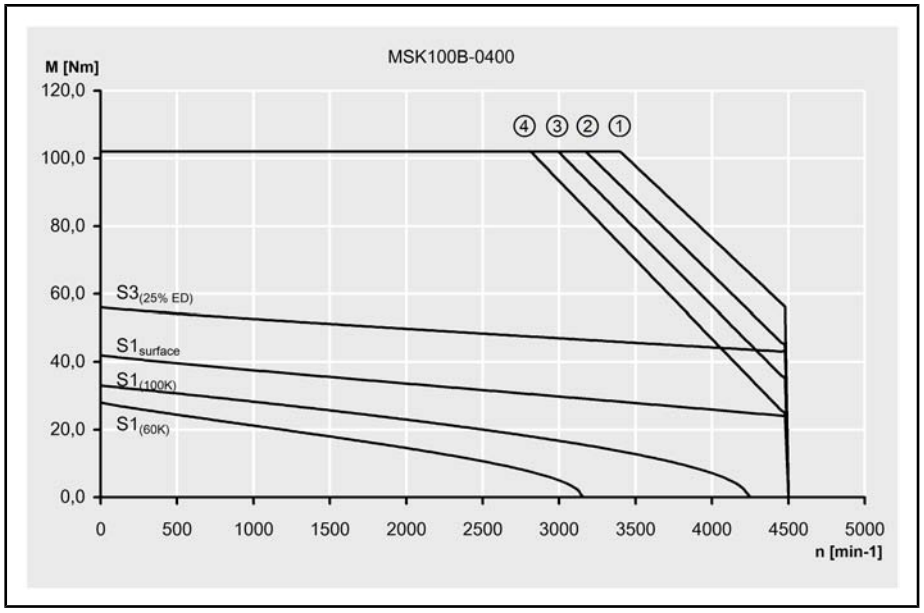


Fig.4-84: Characteristic curve MSK100B-0400

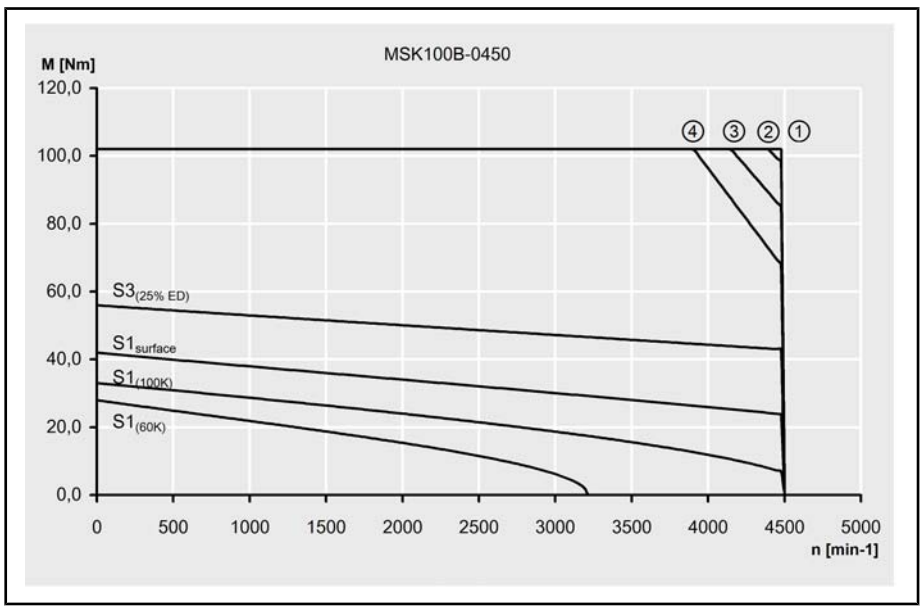


Fig.4-85: Characteristic curve MSK100B-0450

Technical Data

4.27 MSK100C - Technical Data

Designation	Symbol	Unit	MSK100C-0200-NN	MSK100C-0300-NN	MSK100C-0450-NN
UL Files (UL)			E335445		
Continuous torque at standstill 60 K	M_{0_60}	Nm	38.0		
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	17.7	21.6	35.4
Continuous torque at standstill 100 K	M_{0_100}	Nm	43.5		
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	20.3	27.0	43.5
Continuous torque at standstill. surface	M_{0_S}	Nm	57.0		
Continuous current at standstill. surface	$I_{0\_S(rms)}$	A	26.6	32.4	52.9
Maximum torque	M_{max}	Nm	148.0		
Maximum current	$I_{max(rms)}$	A	79.7	97.2	159.3
Torque constant at 20 °C	K_{M_N}	Nm/A	2.37	1.94	1.18
Voltage constant at 20 °C[1)]	K_{EMK_1000}	V/min^{-1}	145.5	119.1	72.7
Winding resistance at 20 °C	R_{12}	ohms	0.46	0.30	0.12
Winding inductivity	L_{12}	mH	6.700	4.200	1.600
Discharge capacity of the component	C_{dis}	nF	12.8	14.3	13.2
Number of pole pairs	p	-	4		
Moment of inertia of the rotor	J_{rot}	kg*m^2	0.02730		
Thermal time constant	T_{th}	min	90.0		
Maximum speed	n_{max}	min^{-1}	3,500	4,500	4,000
Sound pressure level	L_P	dB[A]	<75		
Weight [2)]	m	kg	45.1 (48.9)		
Ambient temperature in operation	T_{amb}	°C	0 ... 40		
Type of protection according to IEC 60529	---	-	IP65		
Insulation class according to DIN EN 60034-1	---	-	155		
					Latest amendment: 2008-07-31

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-86: Technical Data

Characteristic Motor Curves

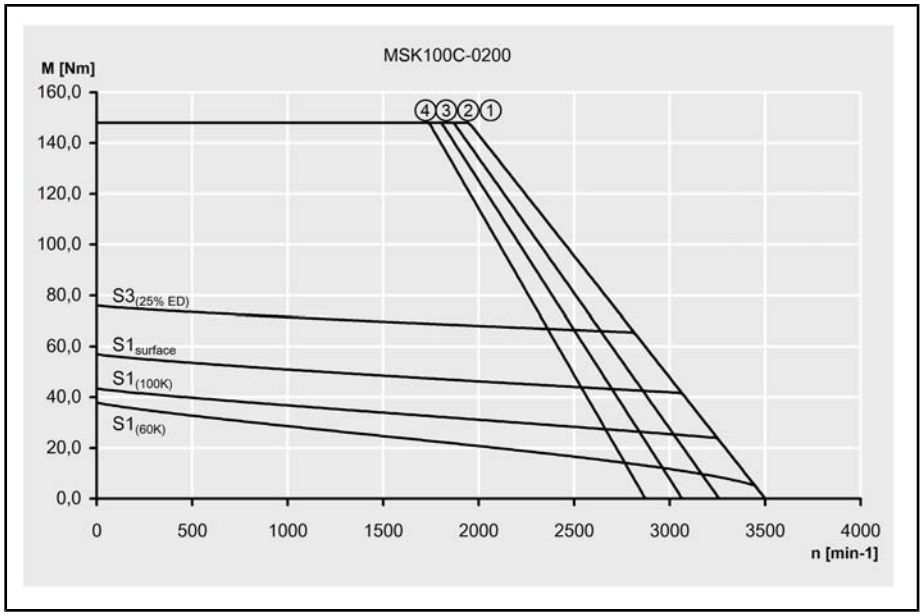


Fig.4-87: Characteristic curve MSK100C-0200

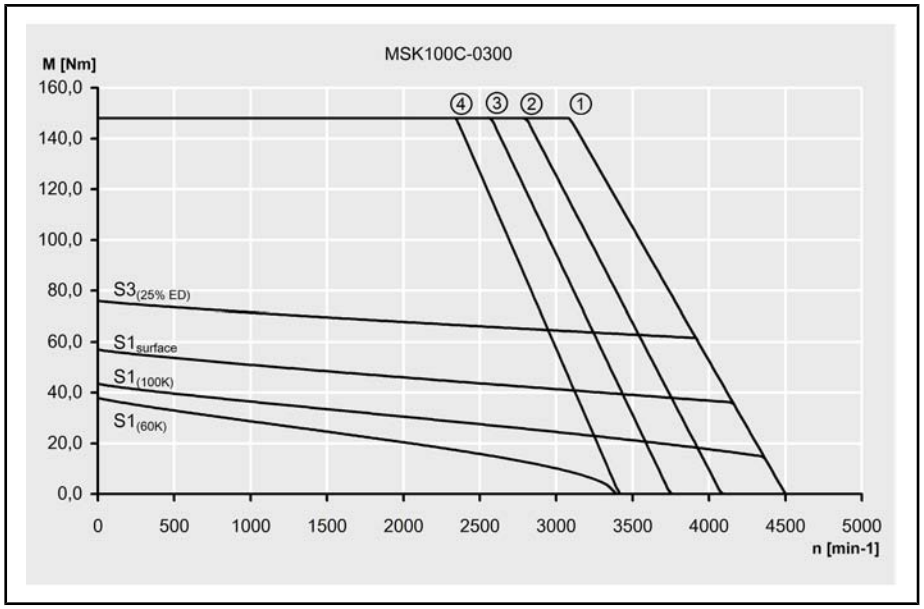


Fig.4-88: Characteristic curve MSK100C-0300

Technical Data

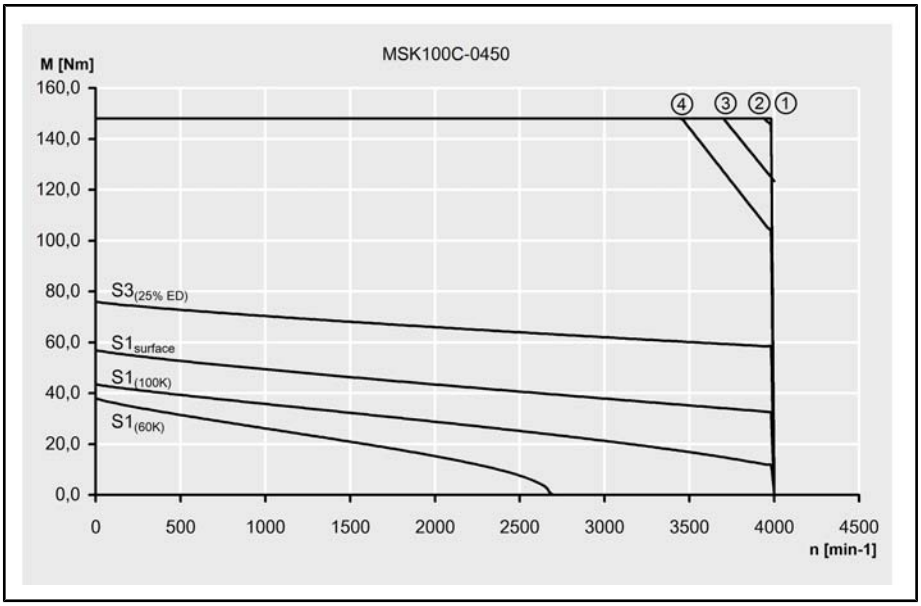


Fig.4-89: Characteristic curve MSK100C-0450

4.28 MSK100D - Technical Data

Designation	Symbol	Unit	MSK100D-0200-NN	MSK100D-0300-NN	MSK100D-0350-NN
UL Files (UL)			E335445		
Continuous torque at standstill 60 K	M_{0_60}	Nm	48.0		
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	13.0	20.7	29.9
Continuous torque at standstill 100 K	M_{0_100}	Nm	57.0		
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	15.4	24.8	35.5
Continuous torque at standstill. surface	M_{0_S}	Nm	72.0		
Continuous current at standstill. surface	$I_{0\_S(rms)}$	A	19.5	31.1	44.9
Maximum torque	M_{max}	Nm	187.0		185.0
Maximum current	$I_{max(rms)}$	A	58.5	93.2	135.0
Torque constant at 20 °C[1)]	K_{M_N}	Nm/A	4.28	2.55	1.86
Voltage constant at 20 °C[2)]	K_{EMK_1000}	V/min^{-1}	263.5	157.0	114.5
Winding resistance at 20 °C	R_{12}	ohms	0.97	0.35	0.20
Winding inductivity	L_{12}	mH	14.800	5.650	3.200
Discharge capacity of the component	C_{dis}	nF	17.6	16.0	18.0
Number of pole pairs	p	-	4		
Moment of inertia of the rotor	J_{rot}	kg*m^2	0.03500		
Thermal time constant	T_{th}	min	90.0		
Maximum speed	n_{max}	min^{-1}	2,000	3,000	
Sound pressure level	L_P	dB[A]	<75		
Weight [3)]	m	kg	56.0 (59.8)		
Ambient temperature in operation	T_{amb}	°C	0 ... 40		
Type of protection according to IEC 60529	---	-	IP65		
Insulation class according to DIN EN 60034-1	---	-	155		
Latest amendment: 2009-03-10					

1) 2) Manufacturing tolerance ±5 %
3) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-90: Technical Data

Technical Data

Characteristic Motor Curves

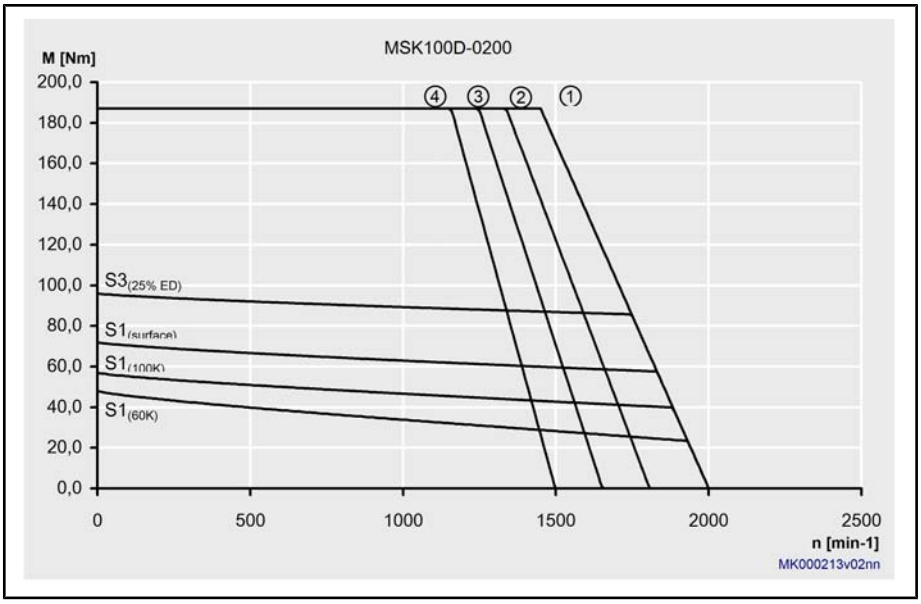


Fig.4-91: Characteristic curve MSK100D-0200

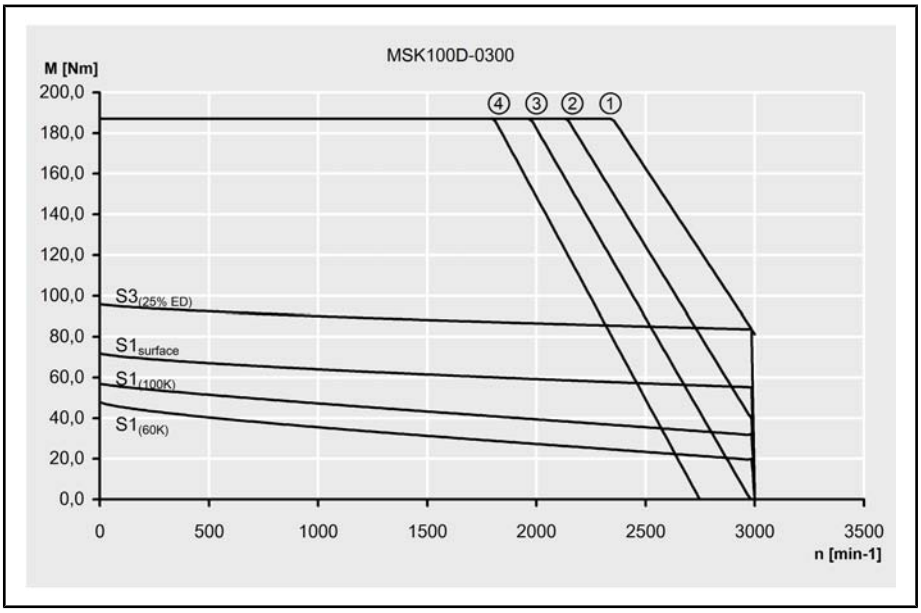


Fig.4-92: Characteristic curve MSK100D-0300

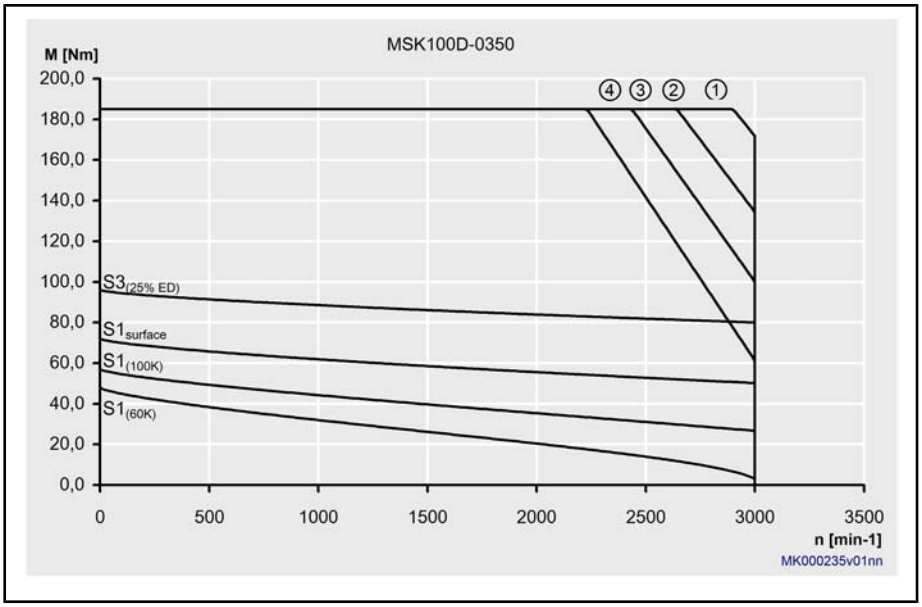


Fig.4-93: Characteristic curve MSK100D-0350

Technical Data

4.29 MSK101C - Technical Data

Data sheet - Motor

Designation	Symbol	Unit	MSK101C-0200-NN	MSK101C-0200-FN	MSK101C-0300-NN	MSK101C-0300-FN	MSK101C-0450-NN	MSK101C-0450-FN
UL Files (UL)			E335445					
Continuous torque at standstill 60 K	M_{0_60}	Nm	32.0					
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	14.9		18.7		25.1	
Continuous torque at standstill 100 K	M_{0_100}	Nm	36.5					
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	17.0		21.3		28.6	37.7
Continuous torque at standstill. surface	M_{0_S}	Nm	48.0	---	48.0	---	48.0	---
Continuous current at standstill. surface	$I_{0\_S(rms)}$	A	22.4	---	28.1	---	37.7	---
Standstill continuous torque liquid	M_{0_L}	Nm	---	60.8	---	60.8	---	60.8
Continuous standstill current liquid	$I_{0\_L(rms)}$	A	---	28.3	---	35.3	---	47.7
Maximum torque	M_{max}	Nm	110.0					
Maximum current	$I_{max(rms)}$	A	67.1		84.2		113.0	
Torque constant at 20 °C	K_{M_N}	Nm/A	2.37		1.88		1.40	
Voltage constant at 20 °C[1)]	K_{EMK_1000}	V/min^{-1}	146.0		115.7		86.3	
Winding resistance at 20 °C	R_{12}	ohms	0.68		0.45		0.23	
Winding inductivity	L_{12}	mH	9.700		6.000		3.300	
Discharge capacity of the component	C_{dis}	nF	6.2				6.8	
Number of pole pairs	p	-	4					
Moment of inertia of the rotor	J_{rot}	kg*m^2	0.00650					
Thermal time constant	T_{th}	min	36.0	5.0	38.0	5.0	36.0	5.0
Maximum speed	n_{max}	min^{-1}	3,300		4,500		5,800	
Sound pressure level	L_P	dB[A]	<75					
Weight [2)]	m	kg	28.3 (32.1)					
Ambient temperature in operation	T_{amb}	°C	0 ... 40					
Type of protection according to IEC 60529	---	-	IP65					
Insulation class according to DIN EN 60034-1	---	-	155					

Latest amendment: 2010-10-28

Designation	Symbol	Unit	MSK101C-0200-NN	MSK101C-0200-FN	MSK101C-0300-NN	MSK101C-0300-FN	MSK101C-0450-NN	MSK101C-0450-FN
Data liquid cooling								
Power loss to be dissipated	P_V	kW	---	1.20	---	1.20	---	1.20
Coolant inlet temperature	T_{ein}	°C	---	10 ... 40	---	10 ... 40	---	10 ... 40
Allowed coolant temperature rise at P_V	ΔT_{max}	K	---	10	---	10	---	10
Necessary coolant flow at P_V	Q_{min}	l/min	---	1.7	---	1.7	---	1.7
Pressure loss at Q_{min}	Δp	bar	---	0.6	---	0.6	---	0.6
Maximum permitted inlet pressure	p_{max}	bar	---	6.0	---	6.0	---	6.0
Volume of coolant duct	V_{kuehl}	l	---	0.09	---	0.09	---	0.09
								Latest amendment: 2010-10-28

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-94: MSK - Technical data

Characteristic Motor Curves

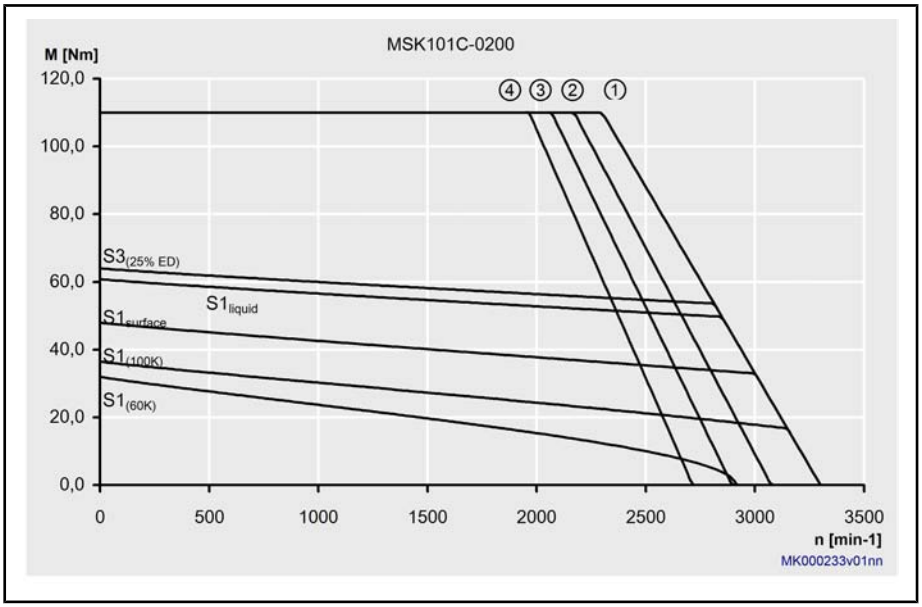


Fig.4-95: Characteristic curve MSK101C-0200

Technical Data

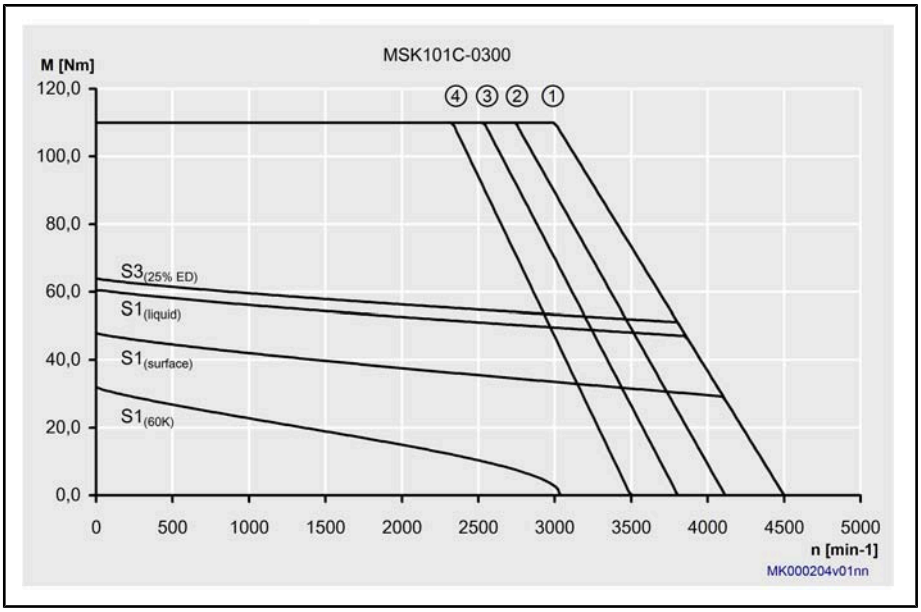


Fig.4-96: Characteristic curve MSK101C-300

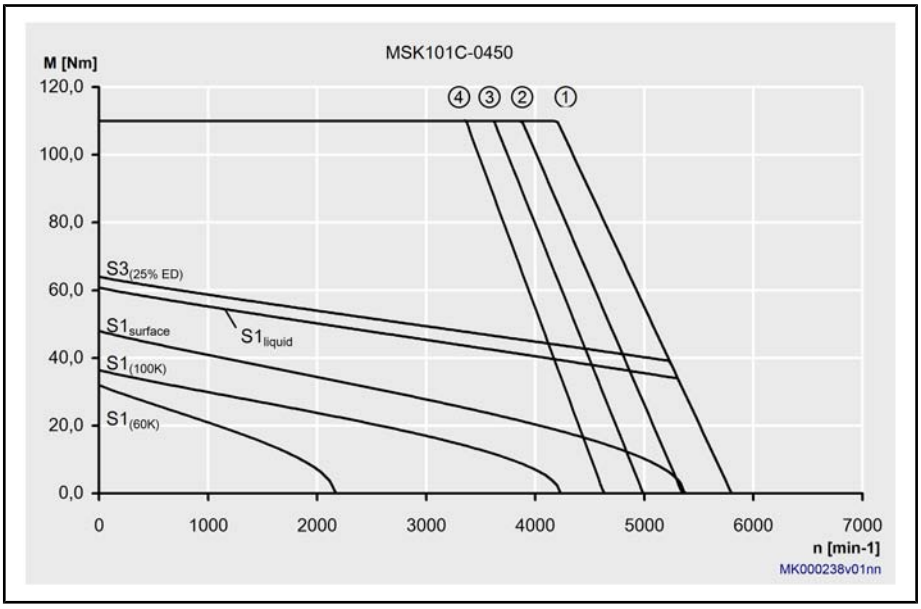


Fig.4-97: Characteristic curve MSK101C-0450

4.30 MSK101D - Technical Data

Data sheet - Motor

Designation	Symbol	Unit	MSK101 D-0200-NN	MSK101 D-0200-FN	MSK101 D-0300-NN	MSK101 D-0300-FN	MSK101 D-0450-NN	MSK101 D-0450-FN
UL Files (UL)			E335445					
Continuous torque at standstill 60 K	M_{0_60}	Nm	50.0					
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	22.2		30.6		41.7	
Continuous torque at standstill 100 K	M_{0_100}	Nm	57.0					
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	26.8		34.9		50.6	
Continuous torque at standstill. surface	M_{0_S}	Nm	75.0	---	75.0	---	75.0	---
Continuous current at standstill. surface	$I_{0\_S(rms)}$	A	33.3	---	45.9	---	66.0	---
Standstill continuous torque liquid	M_{0_L}	Nm	---	95.0	---	95.0	---	95.0
Continuous standstill current liquid	$I_{0\_L(rms)}$	A	---	43.3	---	58.1	---	79.2
Maximum torque	M_{max}	Nm	160.0					
Maximum current	$I_{max(rms)}$	A	99.9		137.7		187.7	
Torque constant at 20 °C	K_{M_N}	Nm/A	2.48		1.80		1.32	
Voltage constant at 20 °C[1)]	K_{EMK_1000}	V/min^{-1}	152.0		113.0		81.0	
Winding resistance at 20 °C	R_{12}	ohms	0.35		0.19		0.10	
Winding inductivity	L_{12}	mH	6.000		3.200		1.700	
Discharge capacity of the component	C_{dis}	nF	13.2		9.1		13.2	
Number of pole pairs	p	-	4					
Moment of inertia of the rotor	J_{rot}	kg*m^2	0.00932					
Thermal time constant	T_{th}	min	100.0	5.0	100.0	5.0	100.0	5.0
Maximum speed	n_{max}	min^{-1}	3,400		4,600		6,000	
Sound pressure level	L_P	dB[A]	<75					
Weight [2)]	m	kg	40.0 (43.8) (46.2)					
Ambient temperature in operation	T_{amb}	°C	0 ... 40					
Type of protection according to IEC 60529	---	-	IP65					
Insulation class according to DIN EN 60034-1	---	-	155					

Latest amendment: 2011-02-15

Technical Data

Designation	Symbol	Unit	MSK101 D-0200-NN	MSK101 D-0200-FN	MSK101 D-0300-NN	MSK101 D-0300-FN	MSK101 D-0450-NN	MSK101 D-0450-FN
Data liquid cooling								
Power loss to be dissipated	P_V	kW	---	1.35	---	1.35	---	1.35
Coolant inlet temperature	T_{ein}	°C	---	10 ... 40	---	10 ... 40	---	10 ... 40
Allowed coolant temperature rise at P_V	ΔT_{max}	K	---	10	---	10	---	10
Necessary coolant flow at P_V	Q_{min}	l/min	---	2.0	---	2.0	---	2.0
Pressure loss at Q_{min}	Δp	bar	---	0.7	---	0.7	---	0.7
Maximum permitted inlet pressure	p_{max}	bar	---	6.0	---	6.0	---	6.0
Volume of coolant duct	V_{kuehl}	l	---	0.11	---	0.11	---	0.11
								Latest amendment: 2011-02-15

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-98: MSK - Technical data

Characteristic Motor Curves

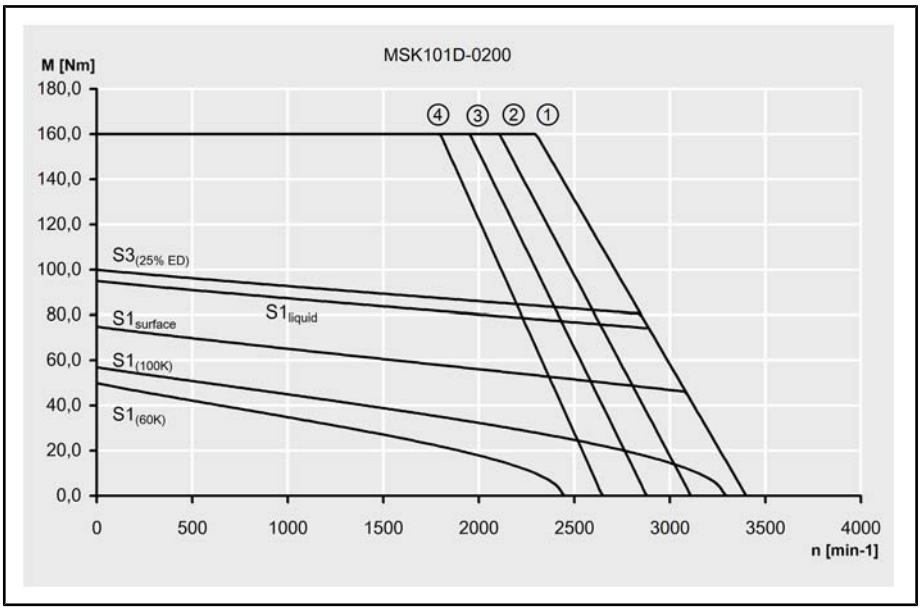


Fig.4-99: Characteristic curve MSK101D-0200

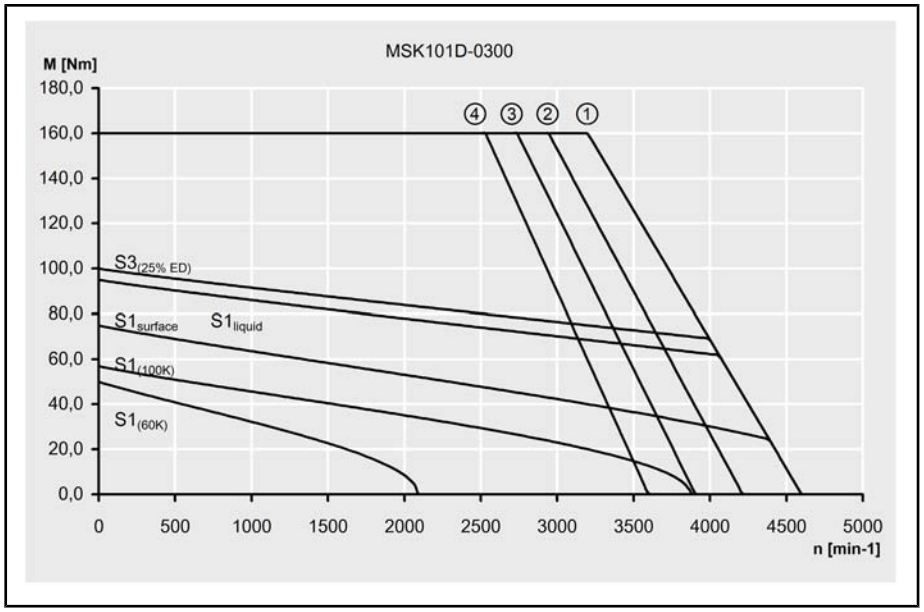


Fig.4-100: Characteristic curve MSK101D-300

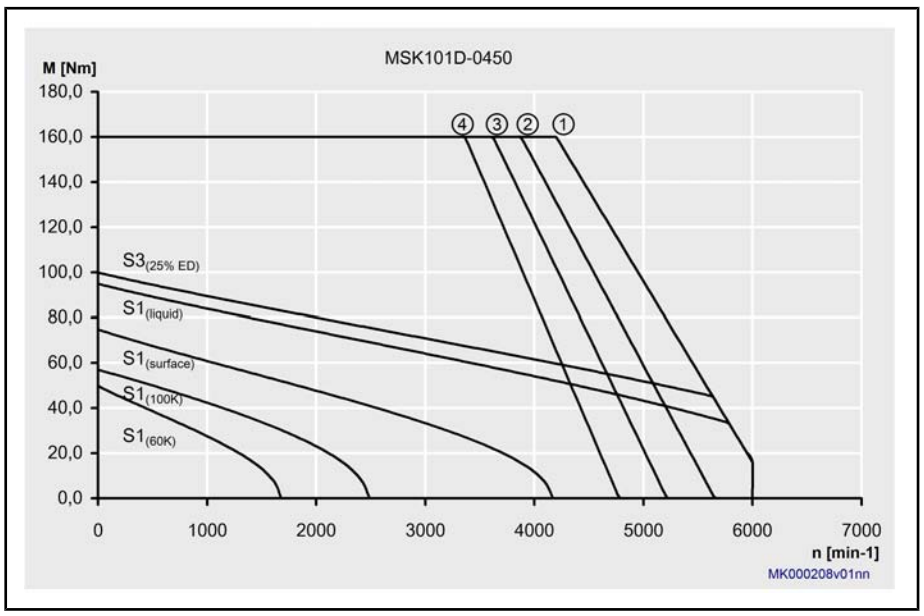


Fig.4-101: Characteristic curve MSK101D-0450

Technical Data

4.31 MSK101E - Technical Data

Data sheet - Motor

Designation	Symbol	Unit	MSK101E-0200-NN	MSK101E-0200-FN	MSK101E-0300-NN	MSK101E-0300-FN	MSK101E-0450-NN	MSK101E-0450-FN
UL Files (UL)			E335445					
Continuous torque at standstill 60 K	M_{0_60}	Nm	70.0					
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	32.1		41.6		58.3	
Continuous torque at standstill 100 K	M_{0_100}	Nm	80.5					
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	39.0		47.8		67.6	
Continuous torque at standstill. surface	M_{0_S}	Nm	105.0	---	105.0	---	105.0	---
Continuous current at standstill. surface	$I_{0\_S(rms)}$	A	48.2	---	62.4	---	87.5	---
Standstill continuous torque liquid	M_{0_L}	Nm	---	133.0	---	133.0	---	116.0
Continuous standstill current liquid	$I_{0\_L(rms)}$	A	---	63.8	---	79.0	---	97.0
Maximum torque	M_{max}	Nm	231.0					
Maximum current	$I_{max(rms)}$	A	144.5		187.4		262.4	
Torque constant at 20 °C	K_{M_N}	Nm/A	2.40		1.85		1.32	
Voltage constant at 20 °C[1)]	K_{EMK_1000}	V/min^{-1}	148.0		113.8		81.2	
Winding resistance at 20 °C	R_{12}	ohms	0.18		0.11		0.06	
Winding inductivity	L_{12}	mH	3.300		1.960		1.080	
Discharge capacity of the component	C_{dis}	nF	15.2		16.7			
Number of pole pairs	p	-	4					
Moment of inertia of the rotor	J_{rot}	kg*m^2	0.01380					
Thermal time constant	T_{th}	min	100.0	5.0	100.0	5.0	100.0	5.0
Maximum speed	n_{max}	min^{-1}	4,500		4,600		6,000	
Sound pressure level	L_P	dB[A]	<75					
Weight [2)]	m	kg	53.5 (57.3) (59.7)					
Ambient temperature in operation	T_{amb}	°C	0 ... 40					
Type of protection according to IEC 60529	---	-	IP65					
Insulation class according to DIN EN 60034-1	---	-	155					

Latest amendment: 2011-02-15

Designation	Symbol	Unit	MSK101 E-0200- NN	MSK101 E-0200- FN	MSK101 E-0300- NN	MSK101 E-0300- FN	MSK101 E-0450- NN	MSK101 E-0450- FN
Data liquid cooling								
Power loss to be dissipated	P_V	kW	---	1.50	---	1.50	---	1.50
Coolant inlet temperature	T_{ein}	°C	---	10 ... 40	---	10 ... 40	---	10 ... 40
Allowed coolant temperature rise at P_V	ΔT_{max}	K	---	10	---	10	---	10
Necessary coolant flow at P_V	Q_{min}	l/min	---	2.2	---	2.2	---	2.2
Pressure loss at Q_{min}	Δp	bar	---	0.8	---	0.8	---	0.8
Maximum permitted inlet pressure	p_{max}	bar	---	6.0	---	6.0	---	6.0
Volume of coolant duct	V_{kuehl}	l	---	0.14	---	0.14	---	0.14
								Latest amendment: 2011-02-15

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-102: MSK - Technical data

Characteristic Motor Curves

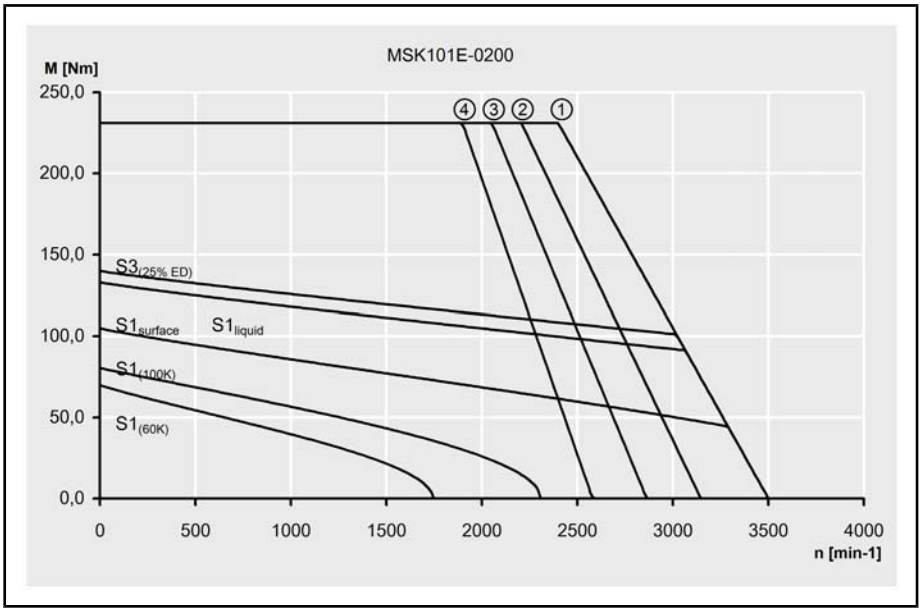


Fig.4-103: Characteristic curve MSK101E-0200

Technical Data

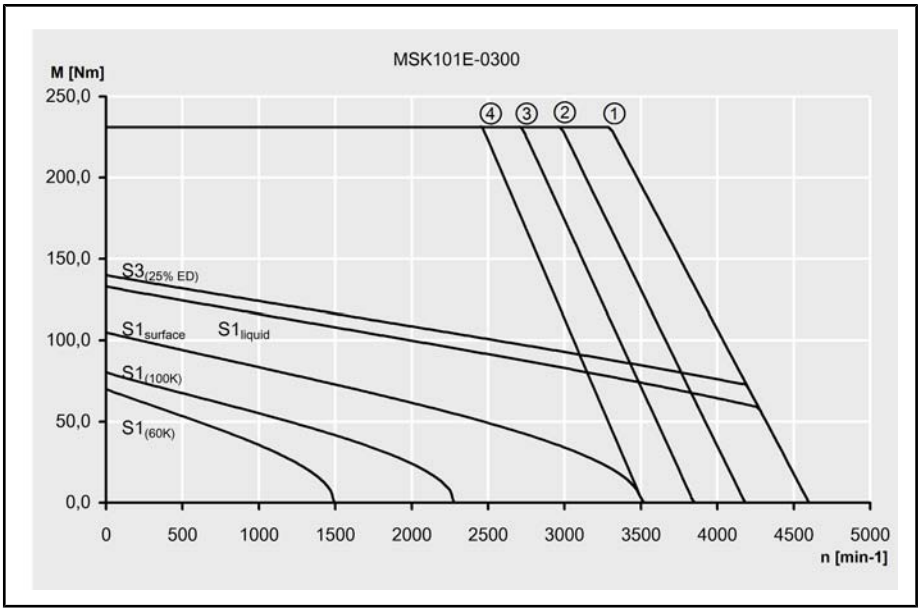


Fig.4-104: Characteristic curve MSK101E-300

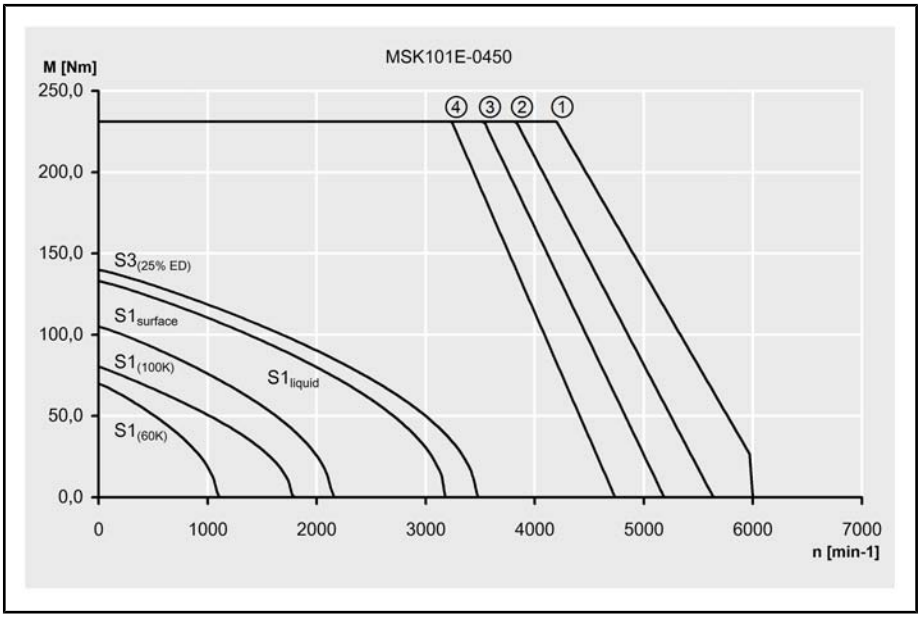


Fig.4-105: Characteristic curve MSK101E-0450

4.32 MSK103A - Technical Data

Designation	Symbol	Unit	MSK103A-0300-NN
UL Files (UL)			E355455
Continuous torque at standstill 60 K	M_{0_60}	Nm	21.0
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	12.5
Continuous torque at standstill 100 K	M_{0_100}	Nm	24.0
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	14.3
Maximum torque	M_{max}	Nm	51.0
Maximum current	$I_{max(rms)}$	A	40.0
Torque constant at 20 °C	K_{M_N}	Nm/A	1.74
Voltage constant at 20 °C[1)]	K_{EMK_1000}	V/min^{-1}	111.0
Winding resistance at 20 °C	R_{12}	ohms	0.59
Winding inductivity	L_{12}	mH	12.800
Discharge capacity of the component	C_{dis}	nF	1.5
Number of pole pairs	p	-	4
Moment of inertia of the rotor	J_{rot}	$kg*m^2$	0.00442
Thermal time constant	T_{th}	min	25.0
Maximum speed	n_{max}	min^{-1}	4800
Sound pressure level	L_P	dB[A]	<75
Weight [2)]	m	kg	18.0 (21.5)
Ambient temperature in operation	T_{amb}	°C	0 ... 40
Type of protection according to IEC 60529	---	-	IP65
Insulation class according to DIN EN 60034-1	---	-	155
			Latest amendment: 2009-08-13

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-106: MSK - Technical data

Technical Data

Characteristic Motor Curves

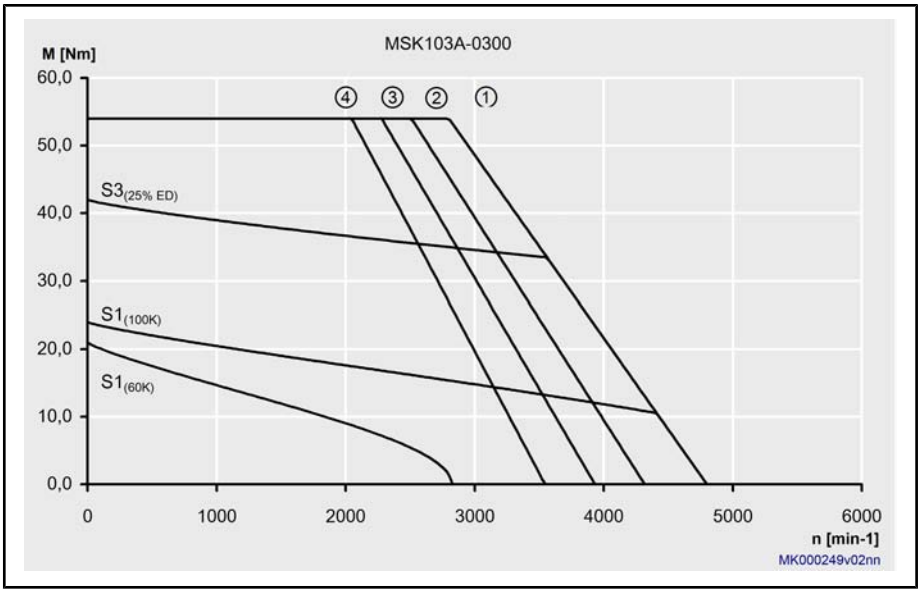


Fig.4-107: Characteristic curve MSK103A-0300

4.33 MSK103B - Technical Data

Designation	Symbol	Unit	MSK103B-0300-NN
UL Files (UL)			E335445
Continuous torque at standstill 60 K	M_{0_60}	Nm	28.0
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	17.0
Continuous torque at standstill 100 K	M_{0_100}	Nm	31.0
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	19.0
Maximum torque	M_{max}	Nm	85.0
Maximum current	$I_{max(rms)}$	A	63.0
Torque constant at 20 °C	K_{M_N}	Nm/A	1.76
Voltage constant at 20 °C[1)]	K_{EMK_1000}	V/min^{-1}	108.0
Winding resistance at 20 °C	R_{12}	ohms	0.36
Winding inductivity	L_{12}	mH	8.000
Discharge capacity of the component	C_{dis}	nF	2.1
Number of pole pairs	p	-	4
Moment of inertia of the rotor	J_{rot}	$kg*m^2$	0.00594
Thermal time constant	T_{th}	min	27.0
Maximum speed	n_{max}	min^{-1}	4,700
Sound pressure level	L_P	dB[A]	<75
Weight [2)]	m	kg	22.5 (26.0)
Ambient temperature in operation	T_{amb}	°C	0 ... 40
Type of protection according to IEC 60529	---	-	IP65
Insulation class according to DIN EN 60034-1	---	-	155
			Latest amendment: 2009-03-11

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-108: MSK - Technical data

Technical Data

Characteristic Motor Curves

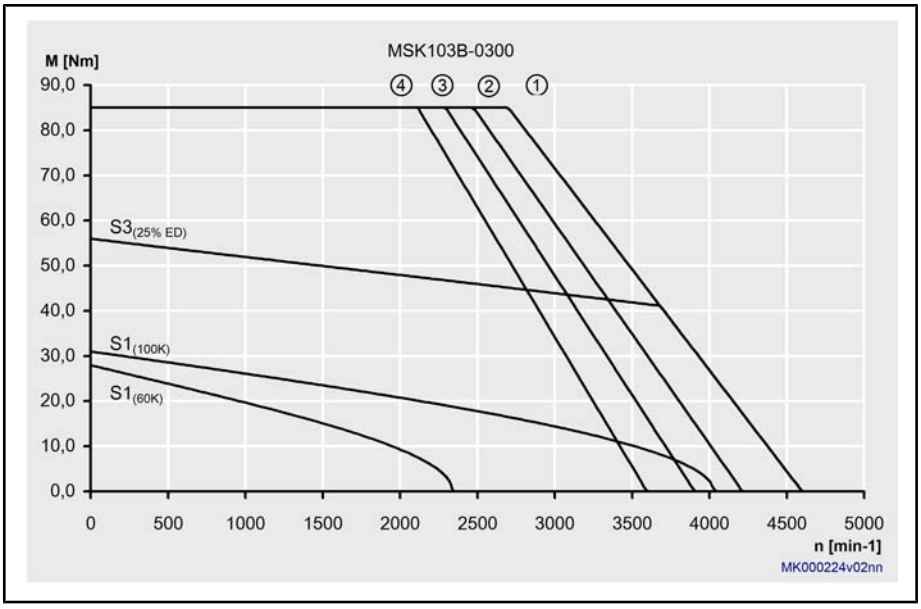


Fig.4-109: Characteristic curve MSK103B-0300

4.34 MSK103D - Technical Data

Designation	Symbol	Unit	MSK103D-0300-NN
UL Files (UL)			E335445
Continuous torque at standstill 60 K	M_{0_60}	Nm	46.0
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	26.3
Continuous torque at standstill 100 K	M_{0_100}	Nm	53.0
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	30.8
Maximum torque	M_{max}	Nm	138.0
Maximum current	$I_{max(rms)}$	A	94.7
Torque constant at 20 °C	K_{M_N}	Nm/A	1.84
Voltage constant at 20 °C[1)]	K_{EMK_1000}	V/min^{-1}	113.0
Winding resistance at 20 °C	R_{12}	ohms	0.20
Winding inductivity	L_{12}	mH	4.870
Discharge capacity of the component	C_{dis}	nF	6.0
Number of pole pairs	p	-	4
Moment of inertia of the rotor	J_{rot}	$kg*m^2$	0.00894
Thermal time constant	T_{th}	min	36.0
Maximum speed	n_{max}	min^{-1}	4,600
Sound pressure level	L_P	dB[A]	<75
Weight [2)]	m	kg	31.6 (36.1)
Ambient temperature in operation	T_{amb}	°C	0 ... 40
Type of protection according to IEC 60529	---	-	IP65
Insulation class according to DIN EN 60034-1	---	-	155
			Latest amendment: 2009-03-11

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-110: MSK - Technical data

Technical Data

Characteristic Motor Curves

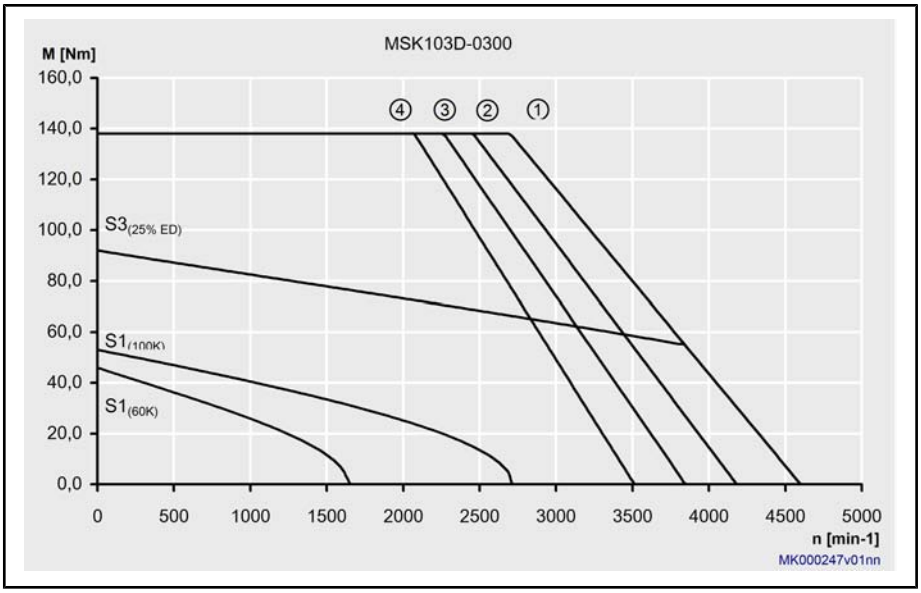


Fig.4-111: Characteristic curve MSK103D-0300

4.35 MSK131B - Technical Data

Designation	Symbol	Unit	MSK131B-0200-NN
UL Files (UL)			E335445
Continuous torque at standstill 60 K	M_{0_60}	Nm	85.0
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	36.7
Continuous torque at standstill 100 K	M_{0_100}	Nm	---
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	---
Continuous torque at standstill. surface	M_{0_S}	Nm	127.5
Continuous current at standstill. surface	$I_{0\_S(rms)}$	A	55.1
Maximum torque	M_{max}	Nm	250.0
Maximum current	$I_{max(rms)}$	A	165.0
Torque constant at 20 °C	K_{M_N}	Nm/A	2.55
Voltage constant at 20 °C[1)]	K_{EMK_1000}	V/min^{-1}	155.0
Winding resistance at 20 °C	R_{12}	ohms	0.16
Winding inductivity	L_{12}	mH	5.300
Discharge capacity of the component	C_{dis}	nF	14.3
Number of pole pairs	p	-	4
Moment of inertia of the rotor	J_{rot}	kg*m^2	0.02320
Thermal time constant	T_{th}	min	50.0
Maximum speed	n_{max}	min^{-1}	3200
Sound pressure level	L_P	dB[A]	<75
Weight [2)]	m	kg	84.0 (89.4)
Ambient temperature in operation	T_{amb}	°C	0 ... 40
Type of protection according to IEC 60529	---	-	IP65
Insulation class according to DIN EN 60034-1	---	-	155
			Latest amendment: 2011-02-15

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-112: MSK - Technical data

Technical Data

Characteristic Motor Curves

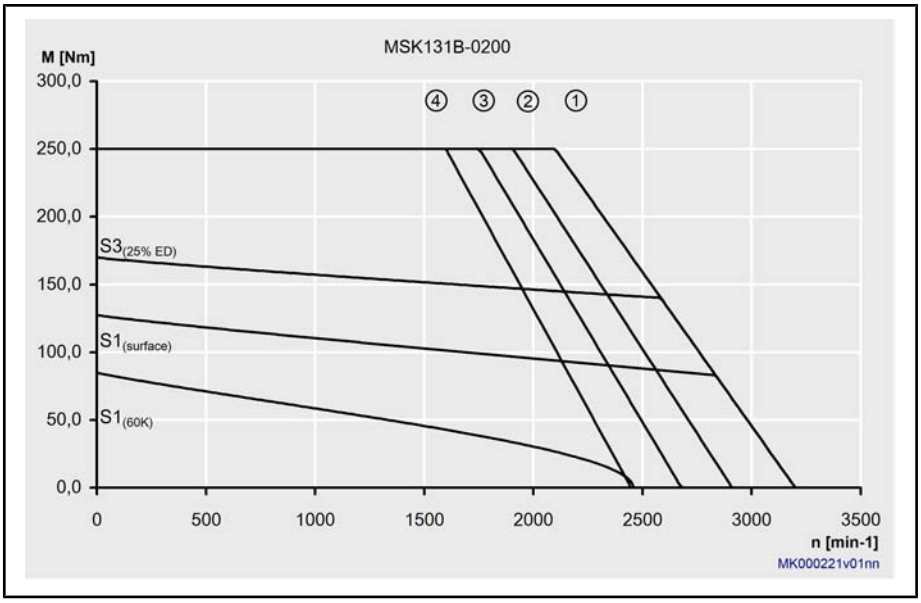


Fig.4-113: Characteristic curve MSK131B-0200

4.36 MSK131D - Technical Data

Designation	Symbol	Unit	MSK131D-0200-NN
UL Files (UL)			E335445
Continuous torque at standstill 60 K	M_{0_60}	Nm	160.0
Continuous current at standstill 60 K	$I_{0\_60(rms)}$	A	65.2
Continuous torque at standstill 100 K	M_{0_100}	Nm	---
Continuous current at standstill 100 K	$I_{0\_100(rms)}$	A	---
Continuous torque at standstill. surface	M_{0_S}	Nm	240.0
Continuous current at standstill. surface	$I_{0\_S(rms)}$	A	97.8
Maximum torque	M_{max}	Nm	495.0
Maximum current	$I_{max(rms)}$	A	293.4
Torque constant at 20 °C	K_{M_N}	Nm/A	2.70
Voltage constant at 20 °C[1)]	K_{EMK_1000}	V/min^{-1}	170.0
Winding resistance at 20 °C	R_{12}	ohms	0.08
Winding inductivity	L_{12}	mH	3.000
Discharge capacity of the component	C_{dis}	nF	27.7
Number of pole pairs	p	-	4
Moment of inertia of the rotor	J_{rot}	kg*m^2	0.03820
Thermal time constant	T_{th}	min	64.0
Maximum speed	n_{max}	min^{-1}	3,000
Sound pressure level	L_P	dB[A]	<75
Weight [2)]	m	kg	116.0 (121.4) (128.0)
Ambient temperature in operation	T_{amb}	°C	0 ... 40
Type of protection according to IEC 60529	IP	-	IP65
Temperature class according to DIN EN 60034-1	I.CL.	-	155
			Latest amendment: 2011-02-11

1) Manufacturing tolerance ±5 %
2) (...) Values for motors with holding brake, sorted (holding brake 1, holding brake 2 ...)

Fig.4-114: MSK - Technical data

Technical Data

Characteristic Motor Curves

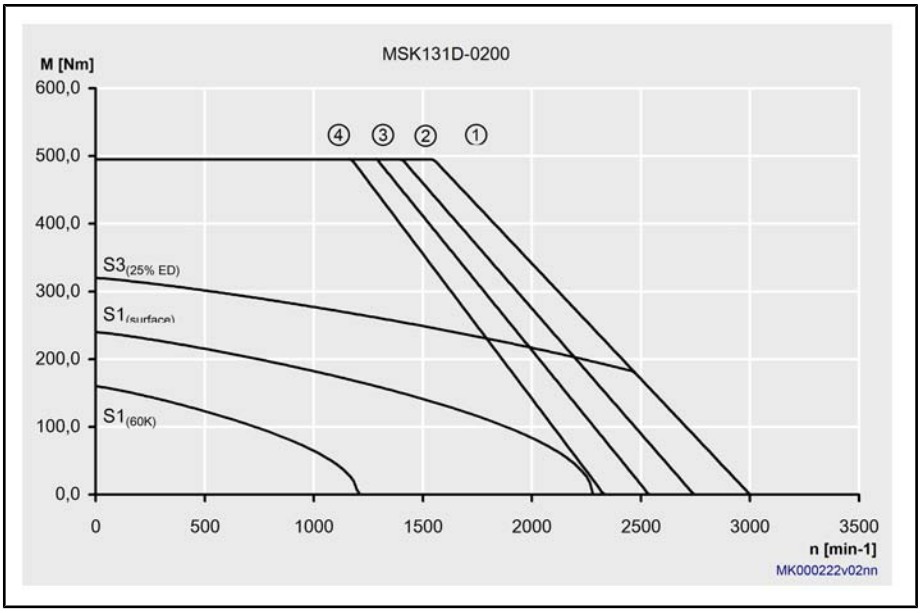


Fig.4-115: Characteristic curve MSK131D-0200

5 Specifications

5.1 Technical Design

Motor Design

Motor frame size B5 acc. to EN60034-7 (for additional information see chapter 9.3 "Design and Installation Positions" on page 213)

Housing painting

Black (RAL 9005)

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		Run-out and alignment tolerance	
S1, S3, M1, M3	N	---	N	---
S2, M2	---	R	---	R

Fig.5-1: Tolerance for concentricity, run-out and alignment dependend 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	**Corresponding key** according to DIN 6885-A (does not belong to scope of delivery of the motors)	**Centering hole**, according to DIN 332 Part 2, Edition 05.83
MSK030	3×3×16	DS M3
MSK040	5×5 ×20	DS M5
MSK043 [1)]	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
MSK075 [1)]	10×8×45	DS M10
MSK076	8×7×40	DS M8
MSK100	10×8×45	DS M10
MSK101	10×8×70	DS M12
MSK103 [1)]	-	DS M12
MSK131 [1)]	14×10×80	DS M16

[1)] Motor not available in ATEX design

Fig.5-2: Key and centering hole

Specifications

5.2 MSK030 Specifications

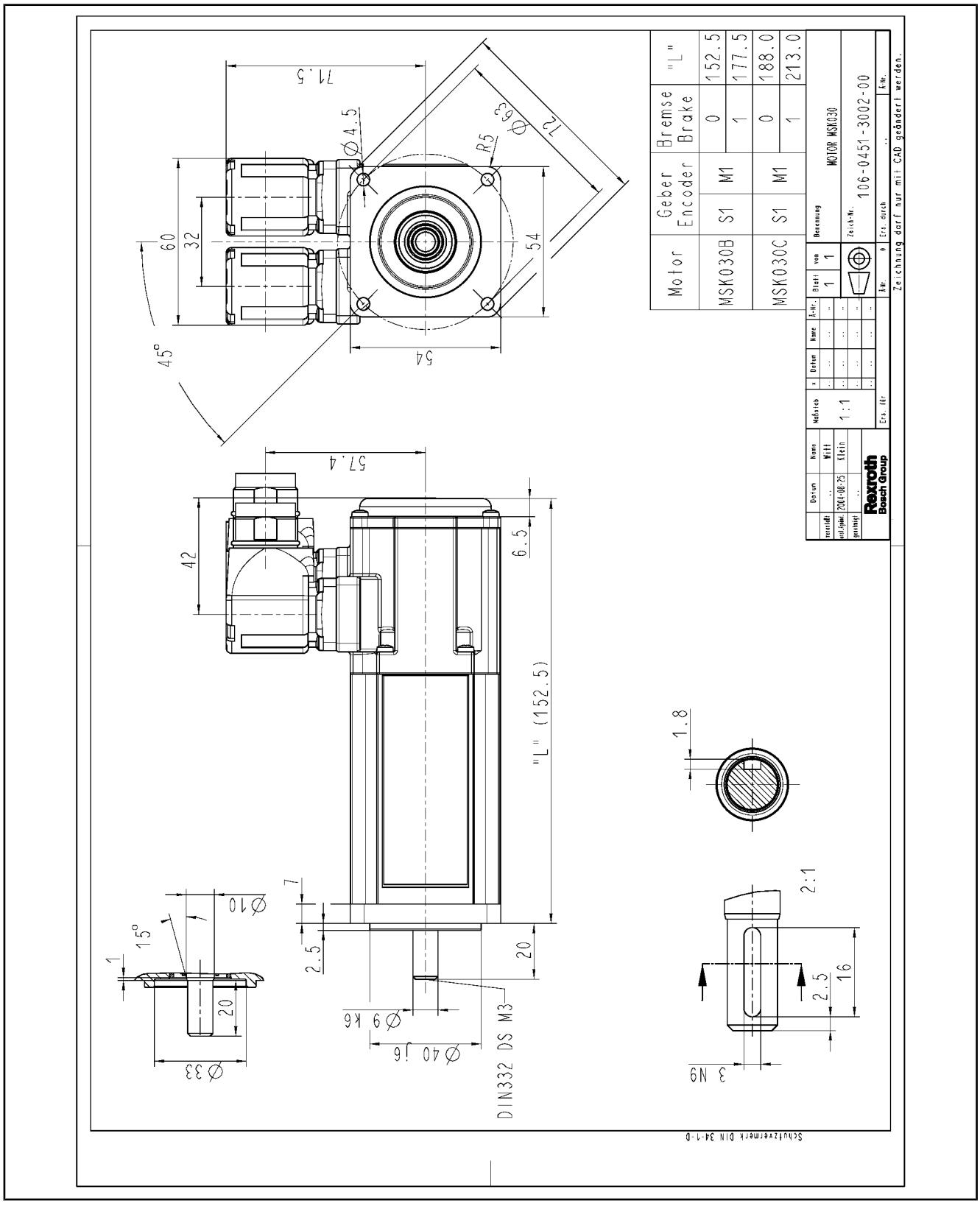


Fig.5-3: MSK030 specifications

5.3 MSK040 Specifications

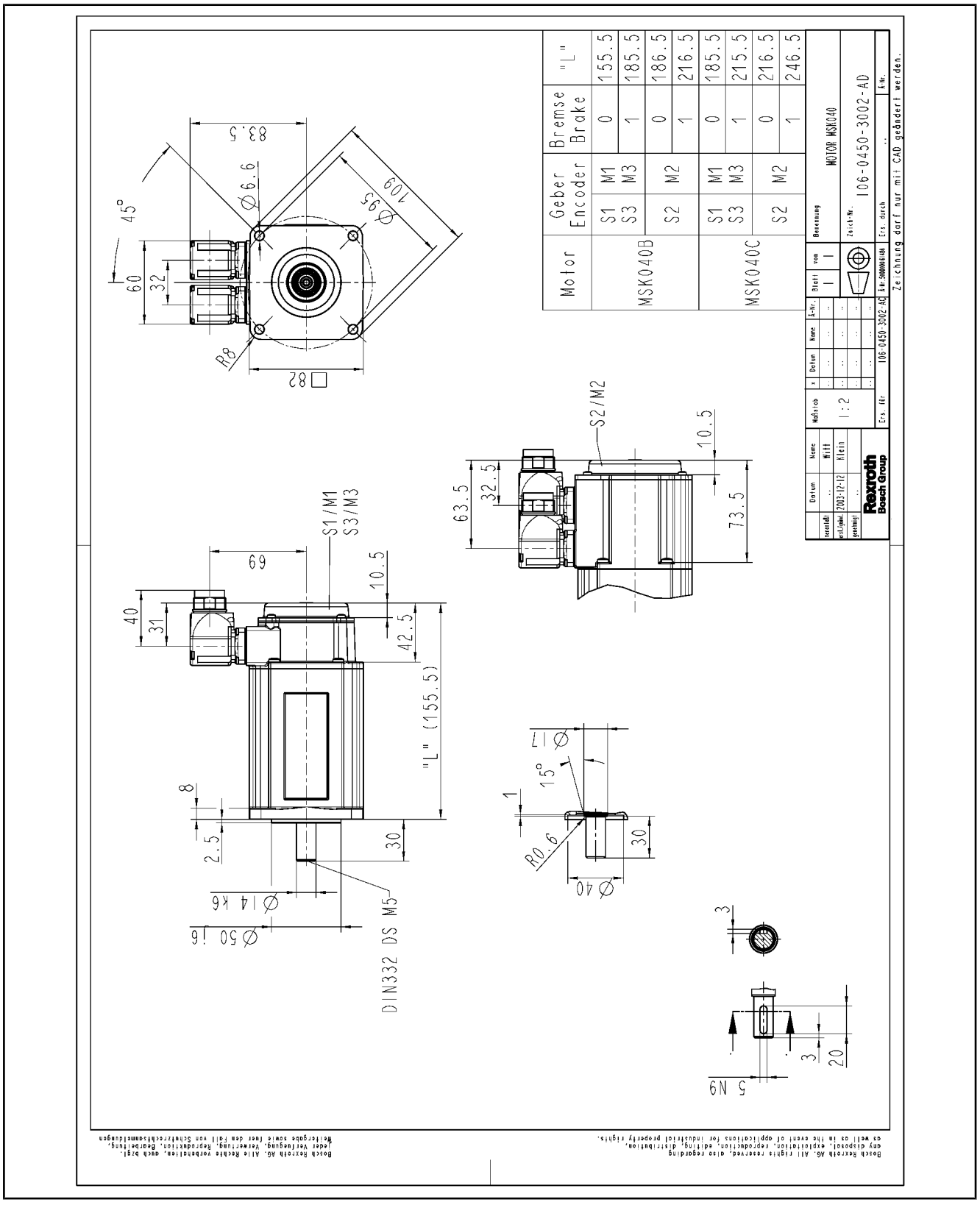


Fig.5-4: MSK040 specifications

Specifications

5.4 MSK043 Specifications

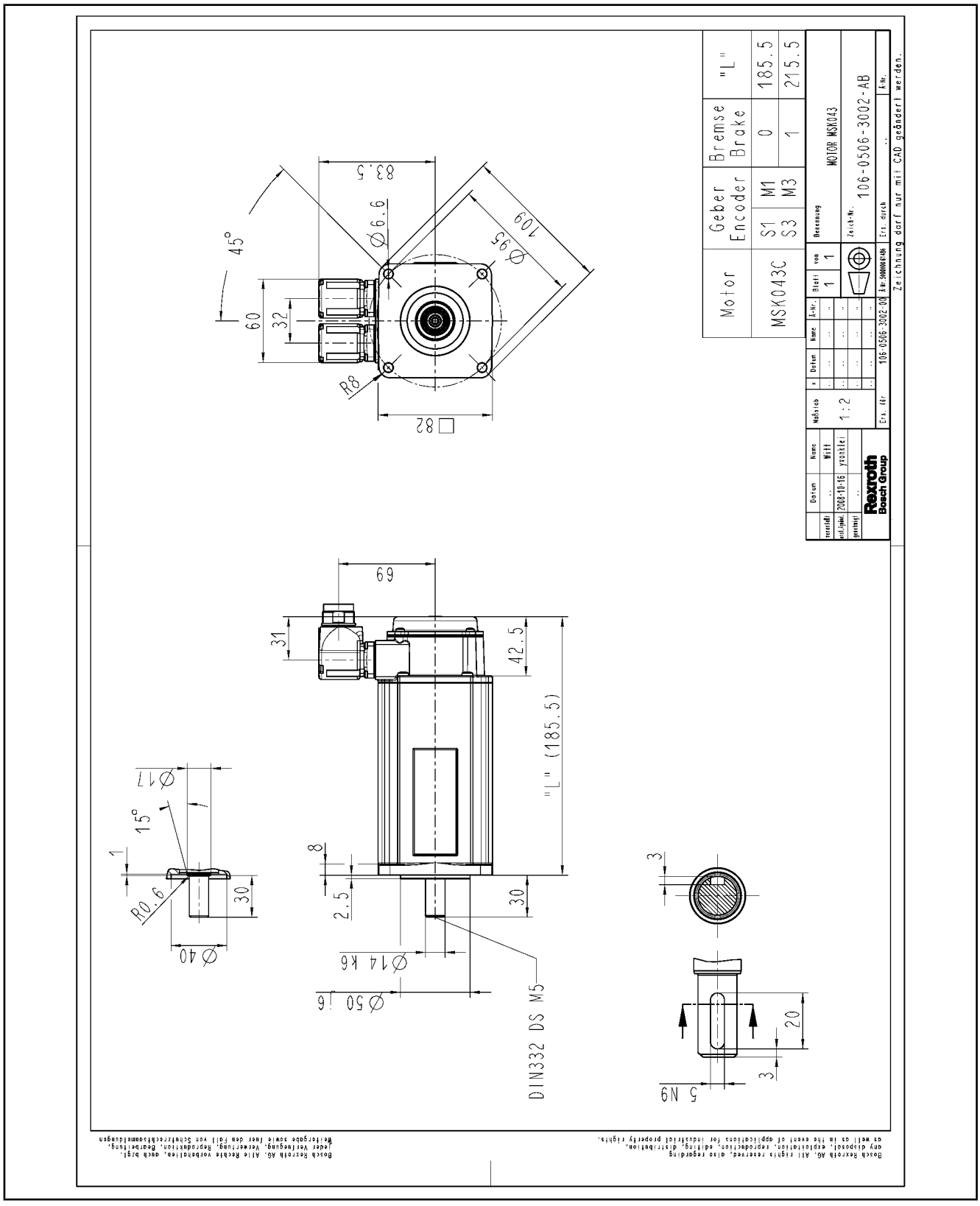


Fig.5-5: MSK043 specifications

5.5 MSK050 Specifications

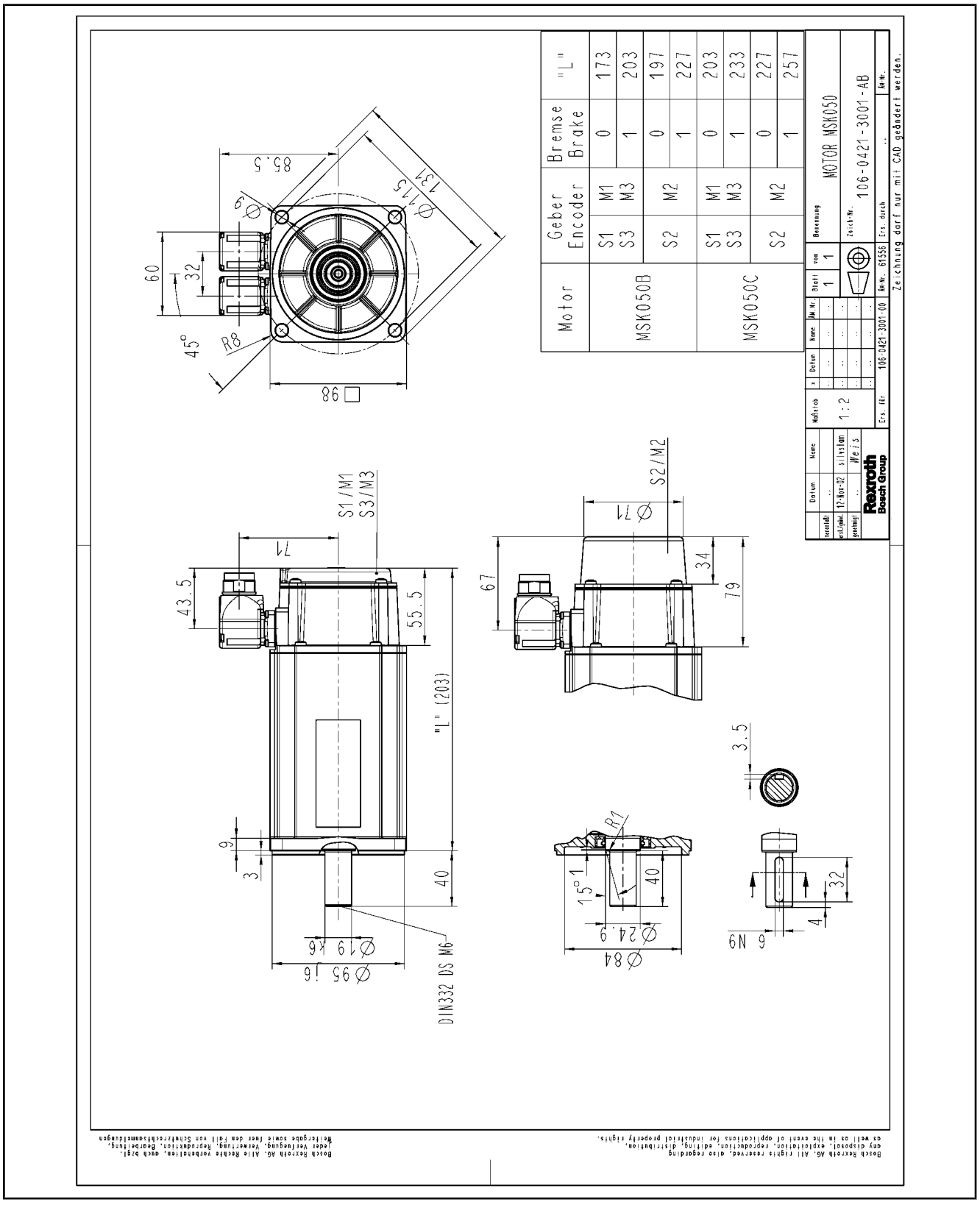


Fig.5-6: MSK050 specifications

Specifications

5.6 MSK060 Specifications

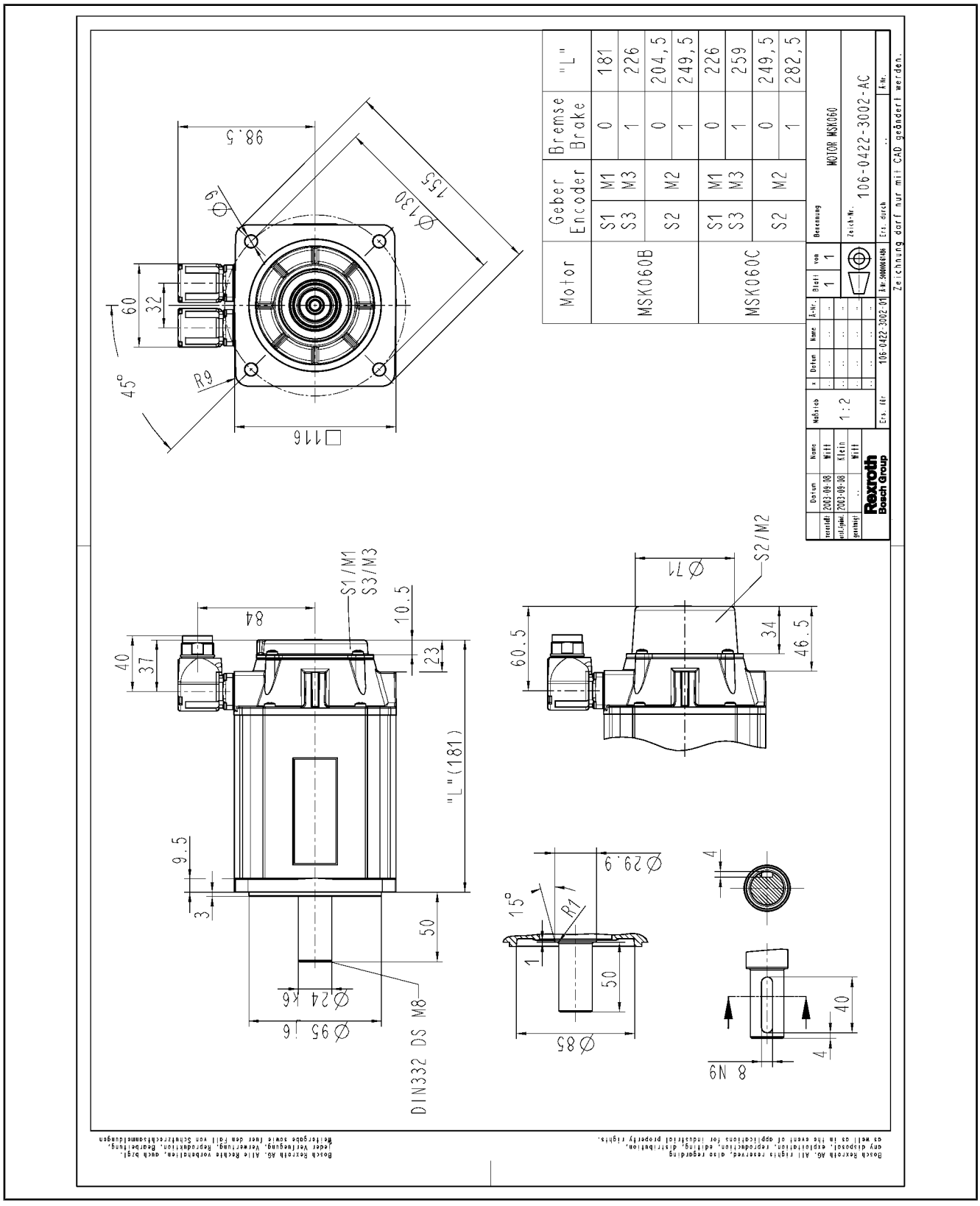


Fig.5-7: MSK060 specifications

5.7 MSK060 Specifications Fan Unit Axial

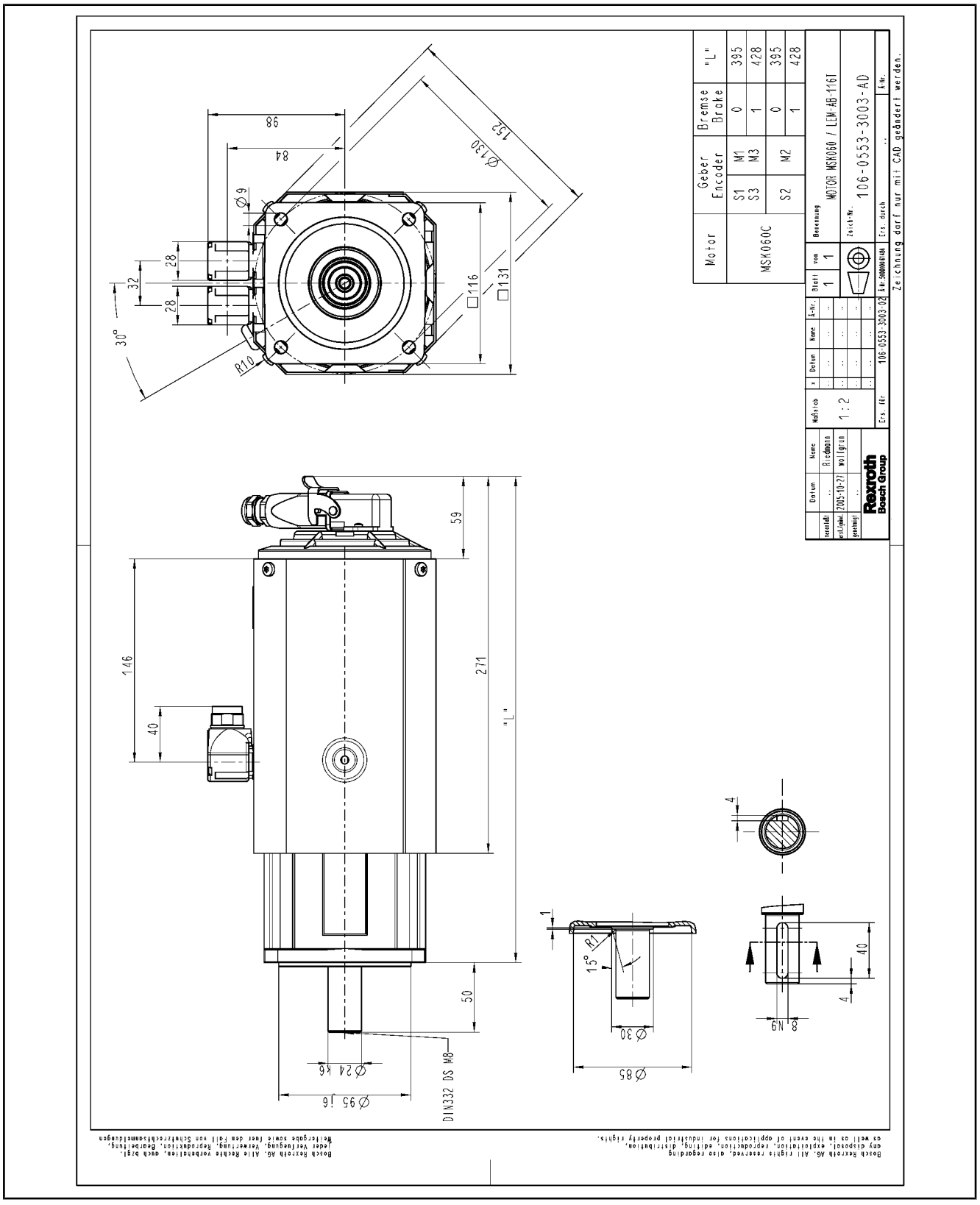


Fig.5-8: MSK060 specifications with axial fan unit

Specifications

5.8 MSK060 Specifications Fan Unit Radial

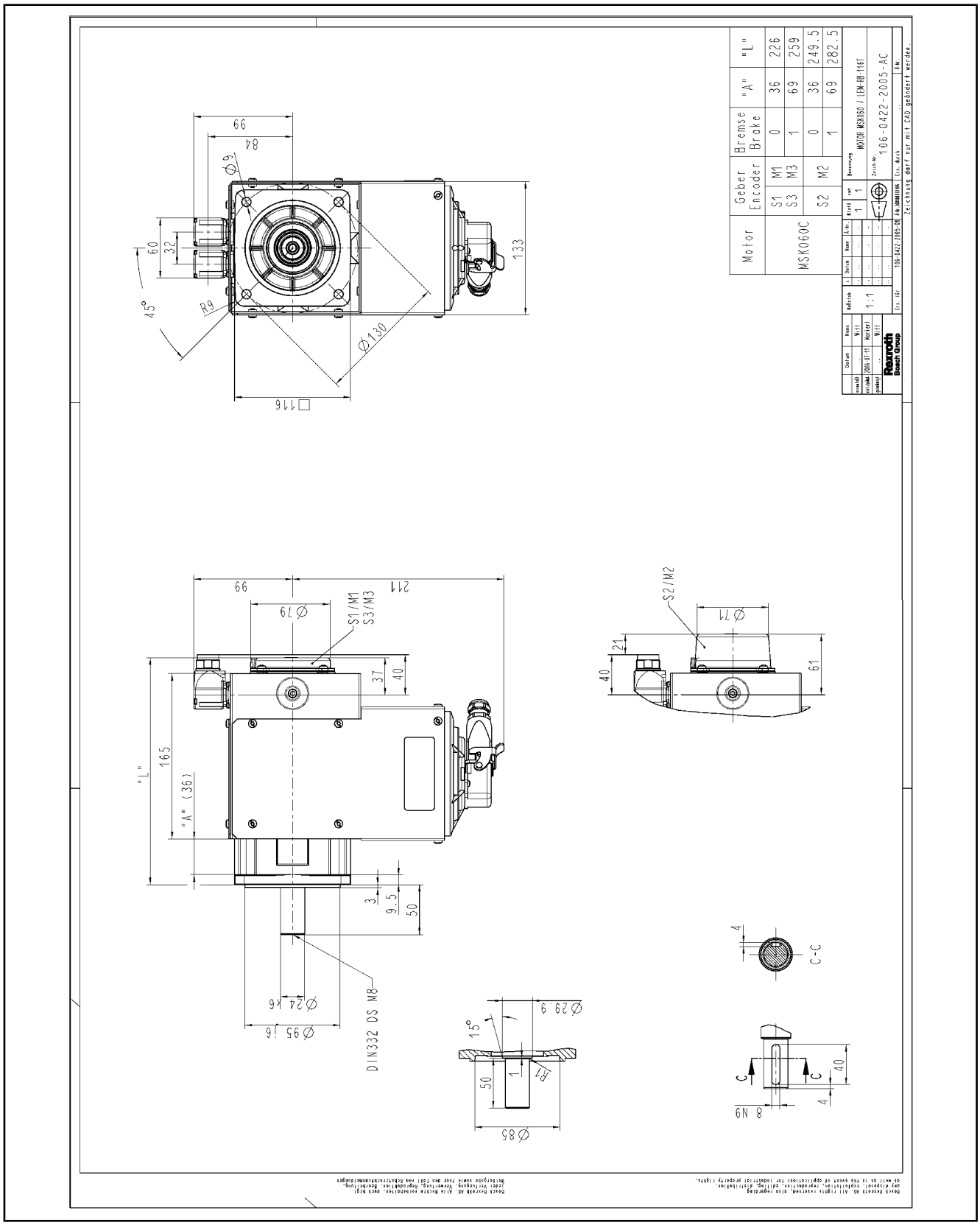


Fig.5-9: MSK060 specifications with radial fan unit

5.9 MSK061 Specifications

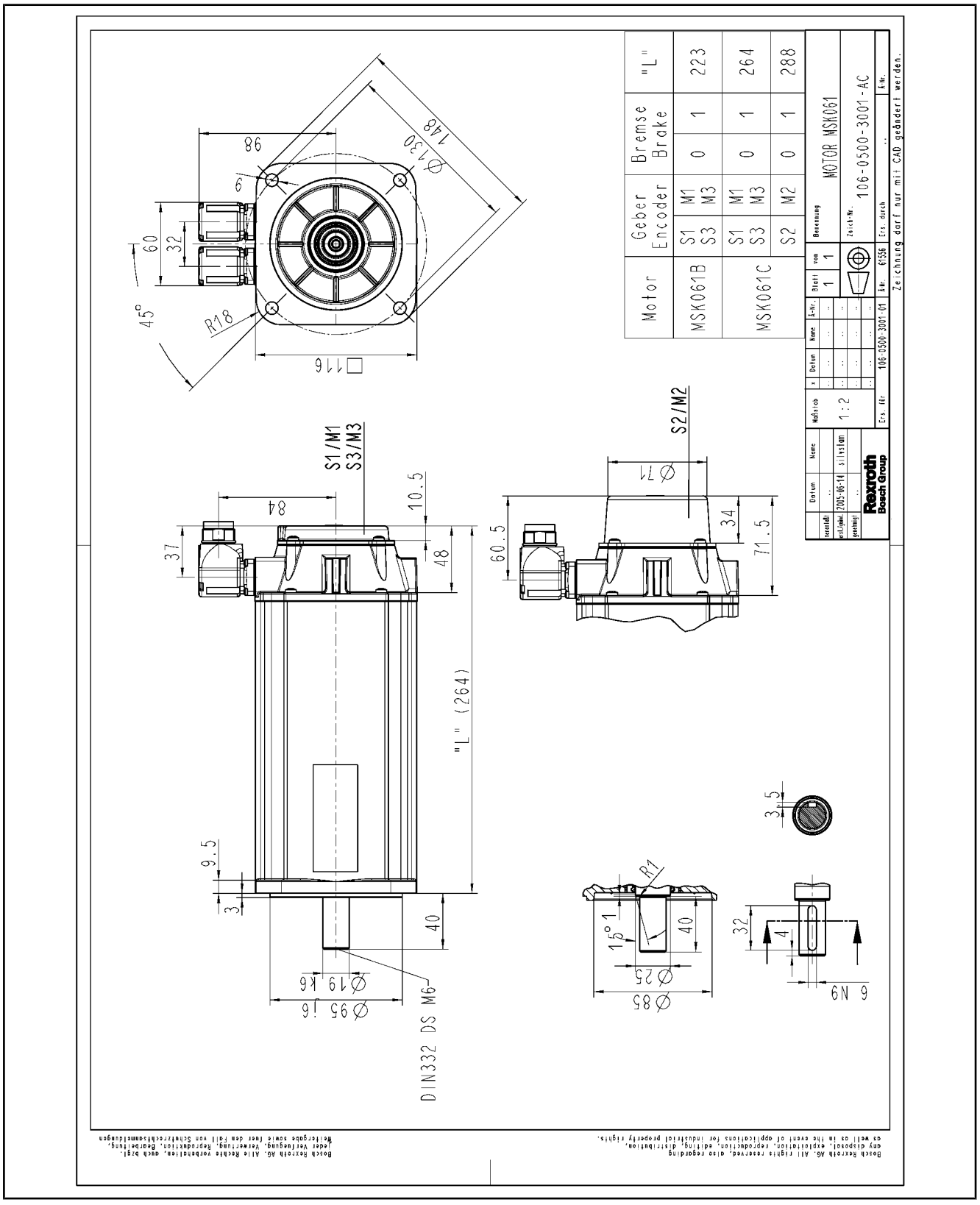


Fig.5-10: MSK061 specifications

Specifications

5.10 MSK061 Specifications Fan Unit Axial

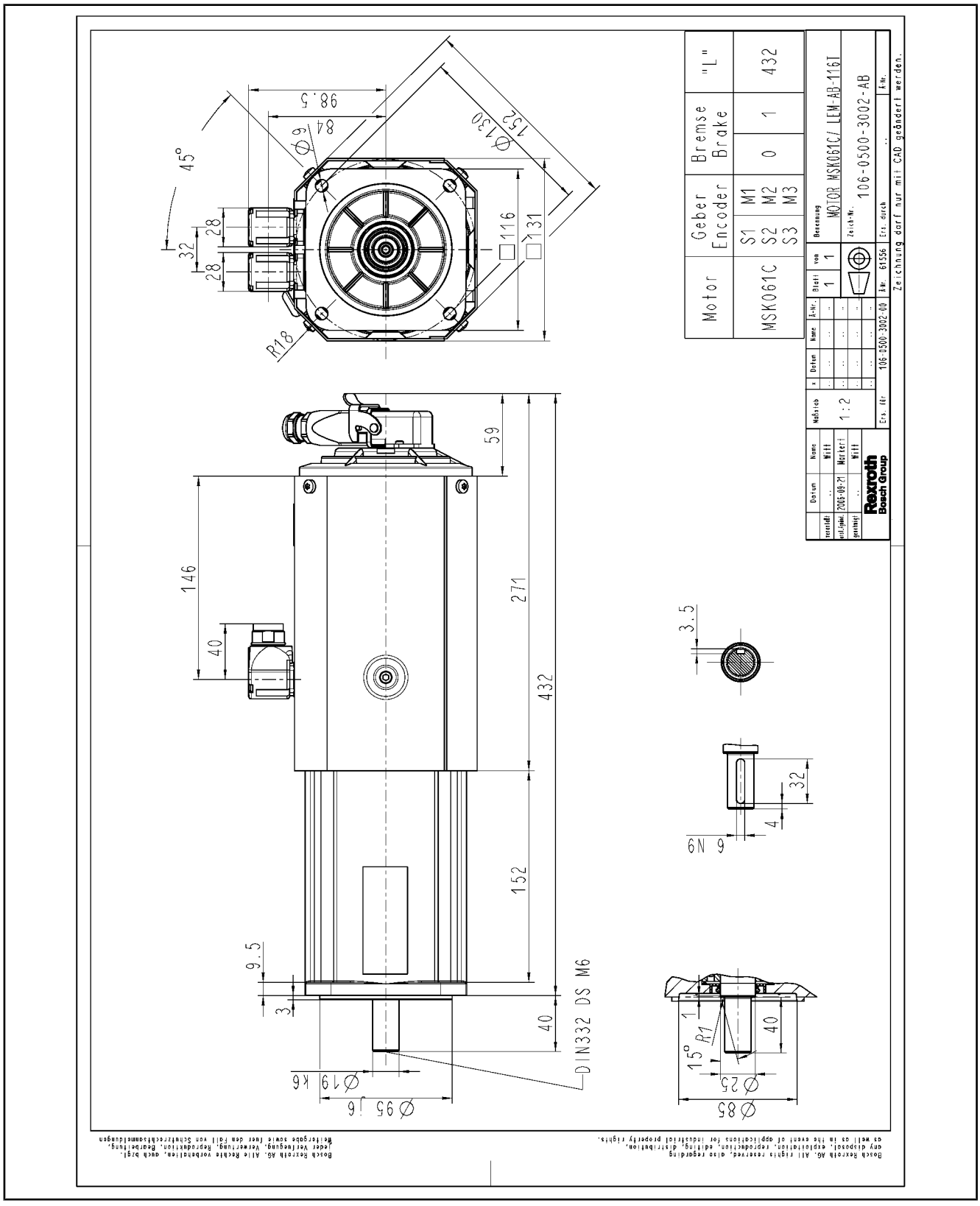


Fig.5-11: MSK061 specifications with axial fan unit

5.11 MSK061 Specifications Fan Unit Radial

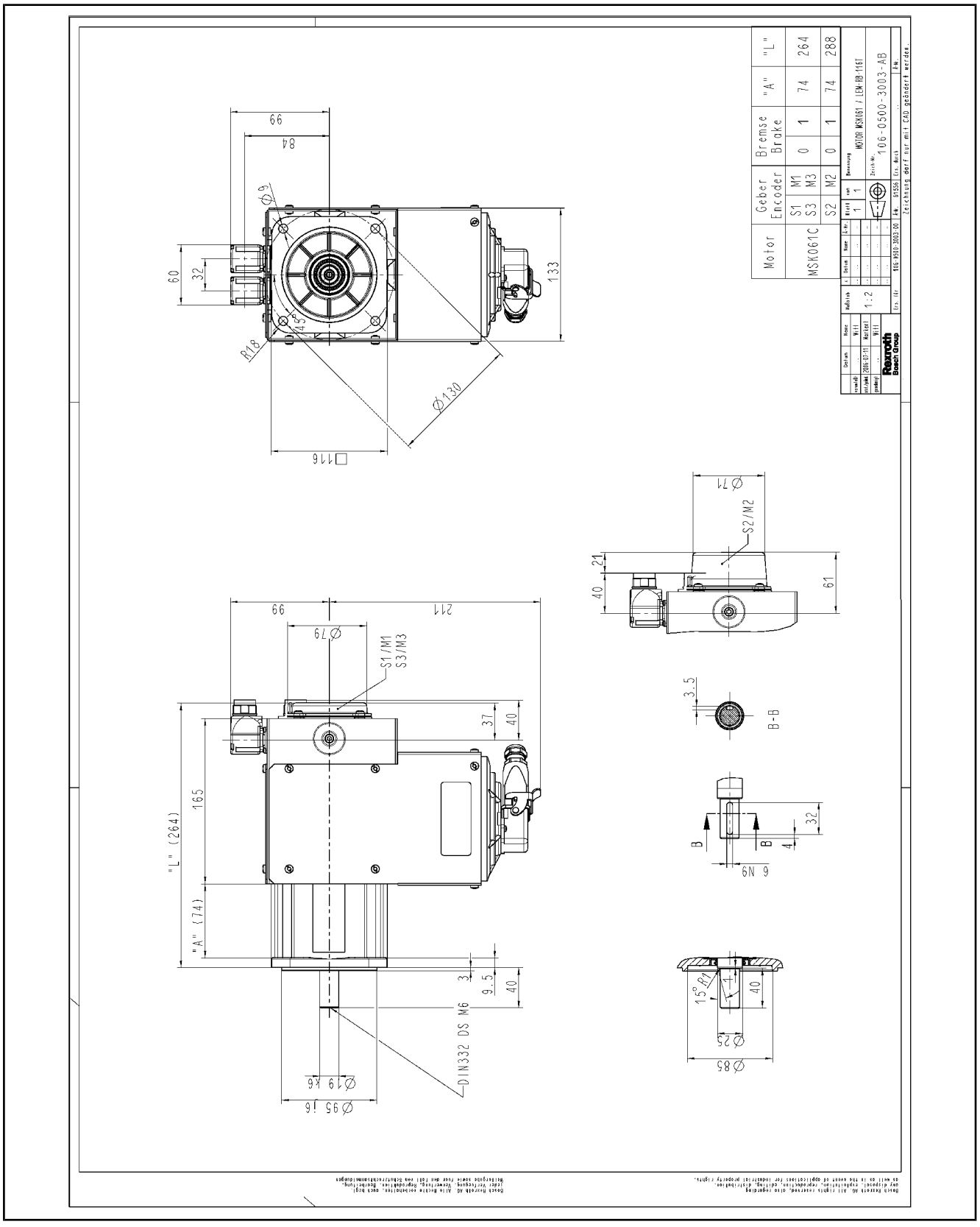


Fig.5-12: MSK061 specifications with radial fan unit

Specifications

5.12 MSK070 Specifications

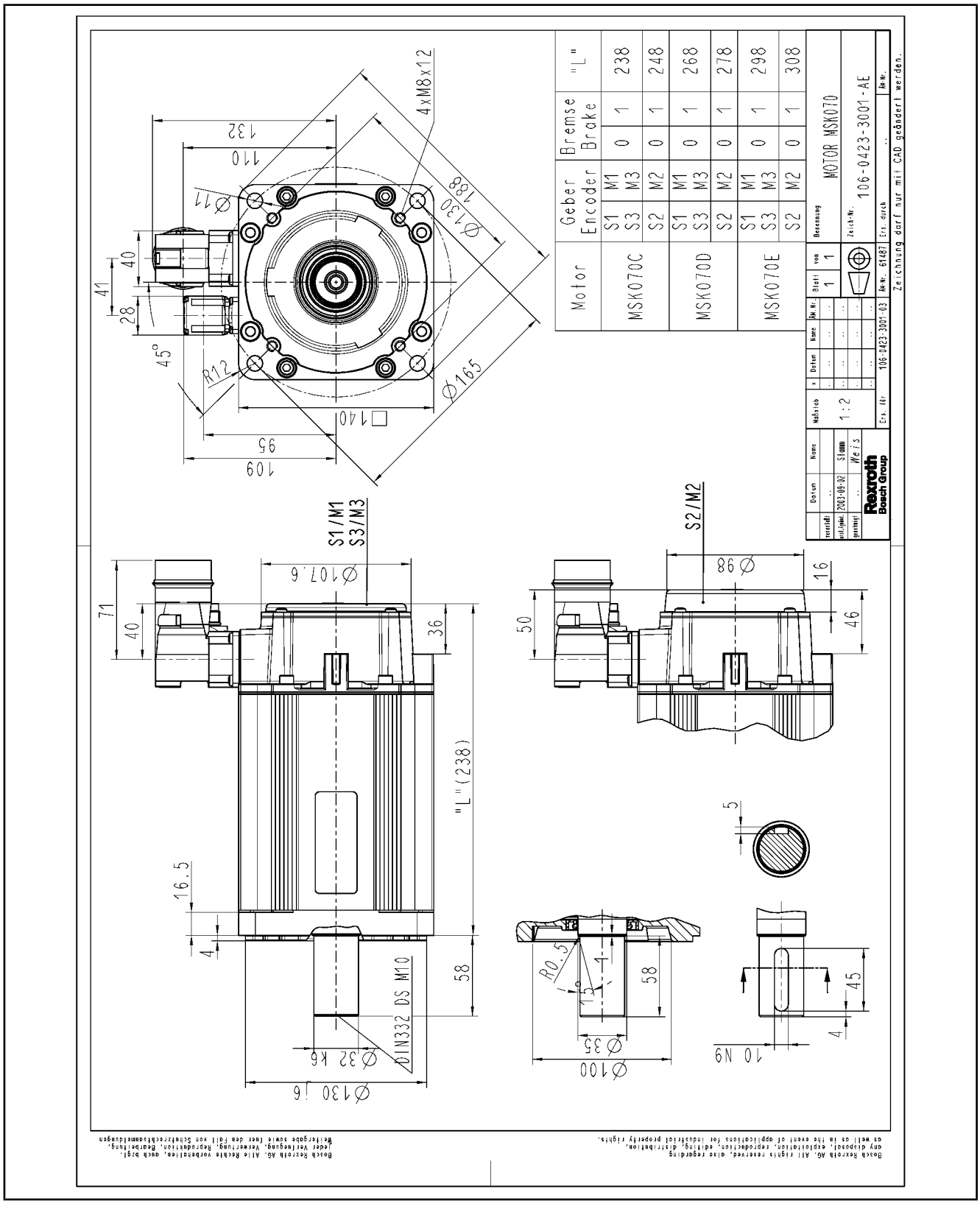


Fig.5-13: MSK070 specifications

5.13 MSK070 Specifications Fan Unit Axial

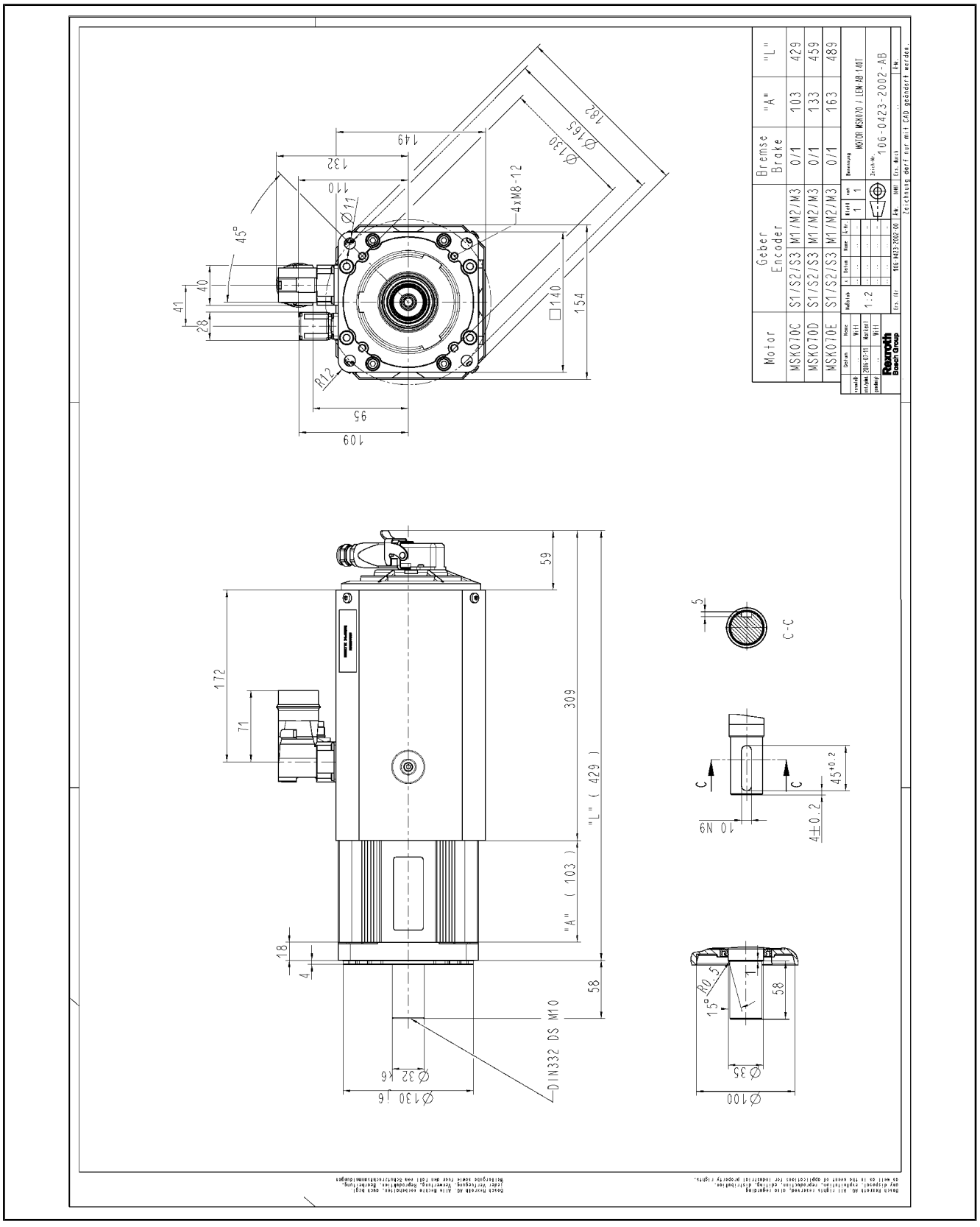


Fig.5-14: MSK070 specifications with axial fan unit

Specifications

5.14 MSK070 Specifications Fan Unit Radial

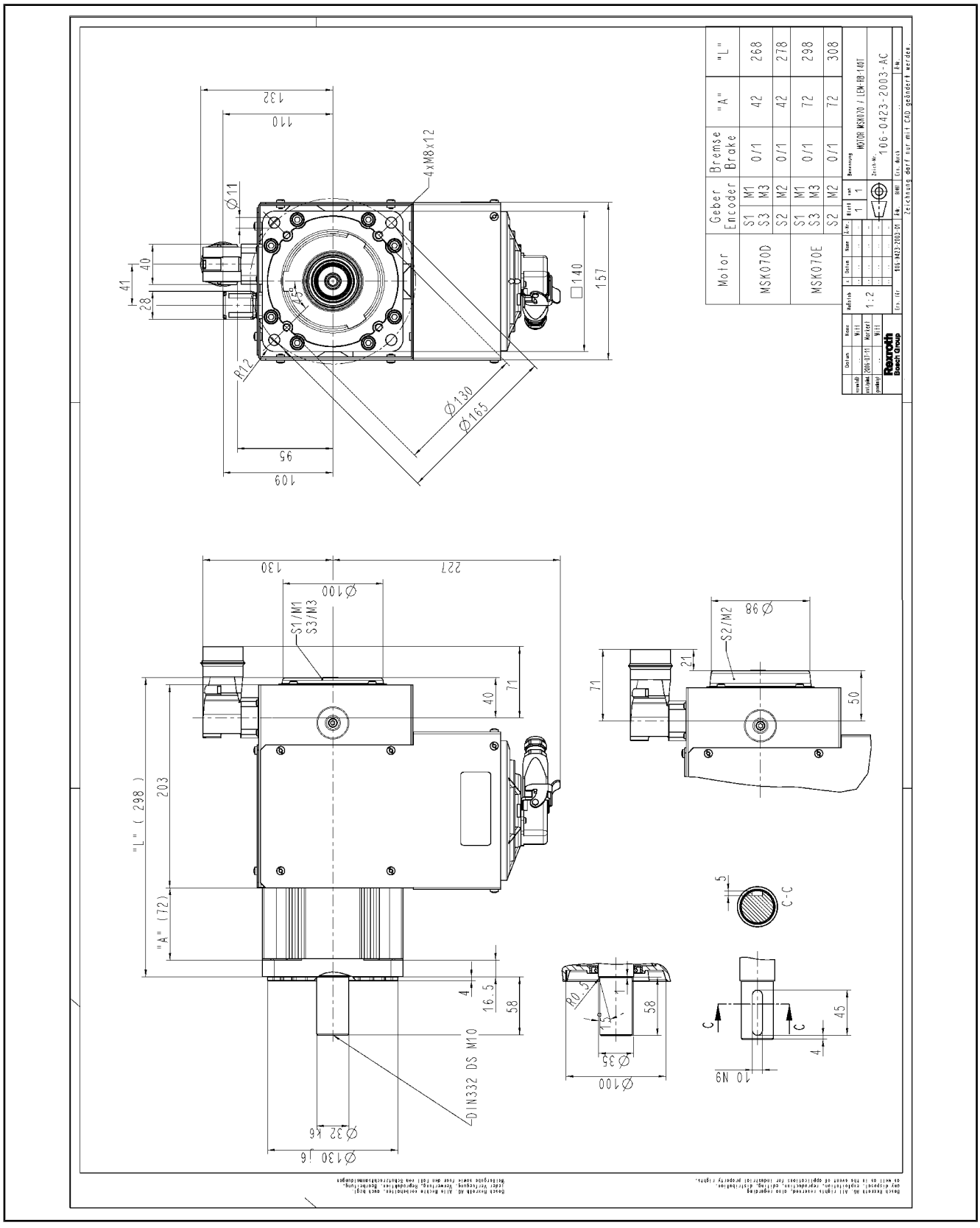


Fig.5-15: MSK070 specifications with radial fan unit

5.15 MSK071 Specifications

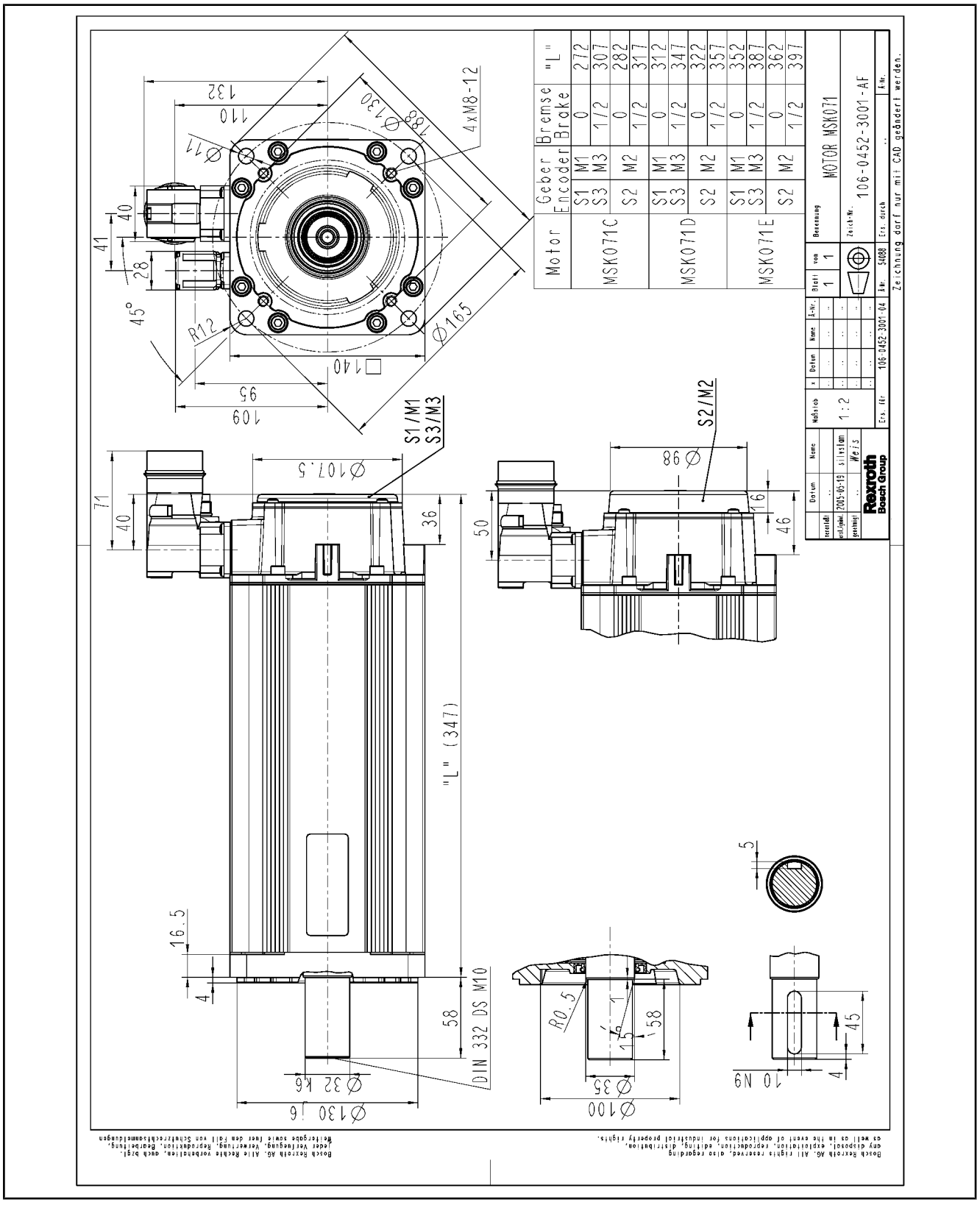


Fig.5-16: MSK071...NN specifications

Specifications

5.16 MSK071 Specifications Liquid Cooling

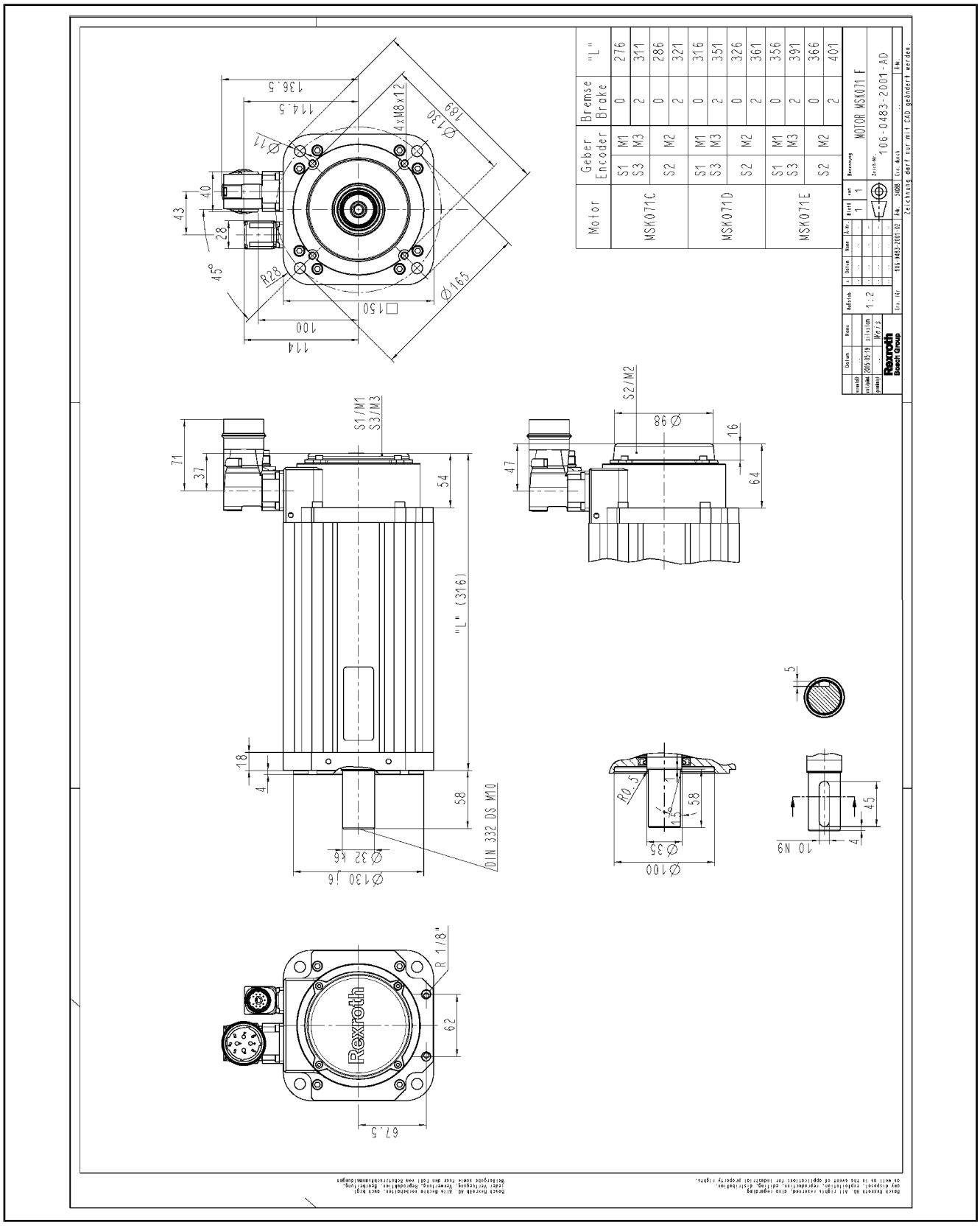


Fig.5-17: MSK071...FN specifications

5.17 MSK071 Specifications Fan Unit Axial

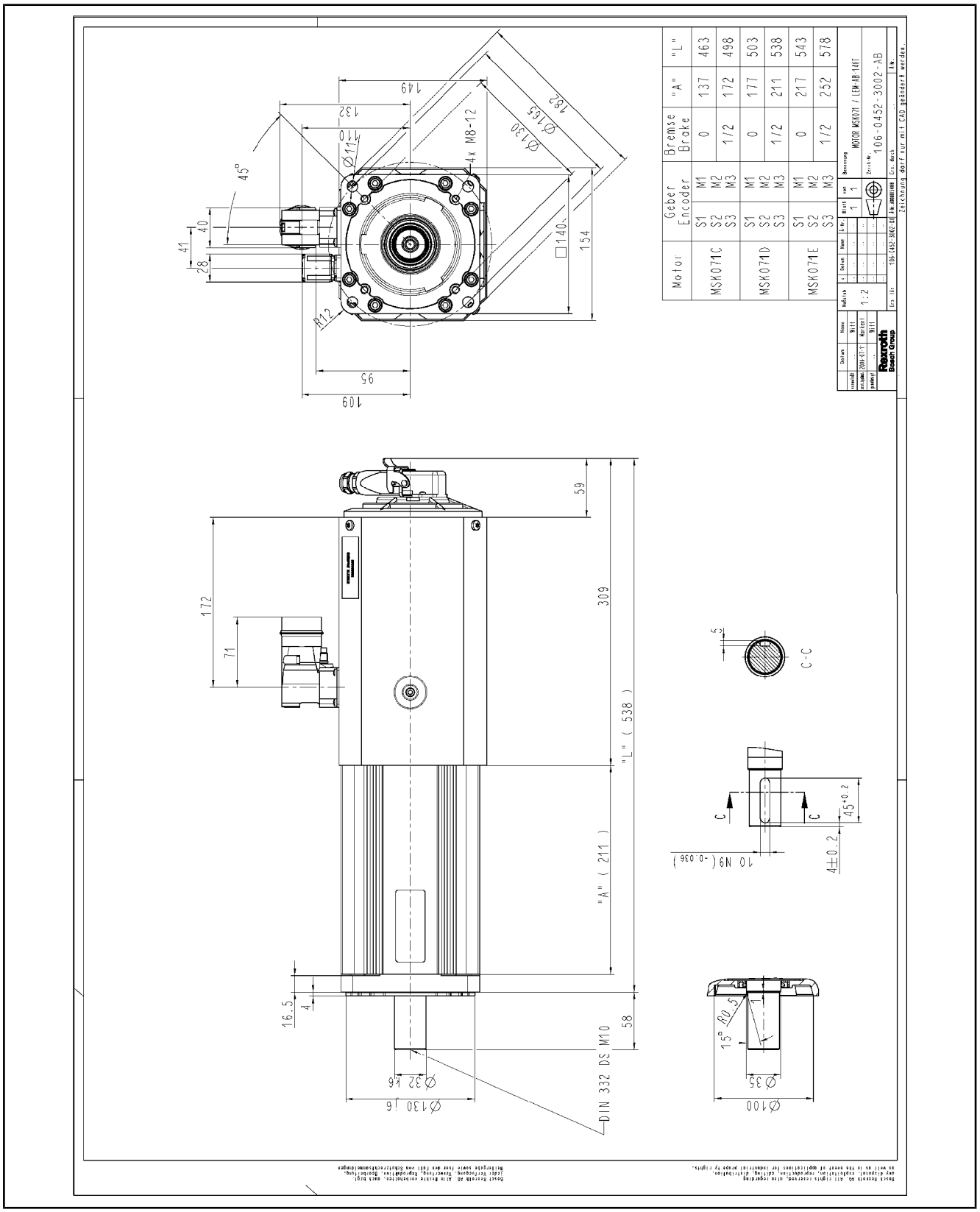


Fig.5-18: MSK071 specifications with axial fan unit

Specifications

5.18 MSK071 Specifications Fan Unit Radial

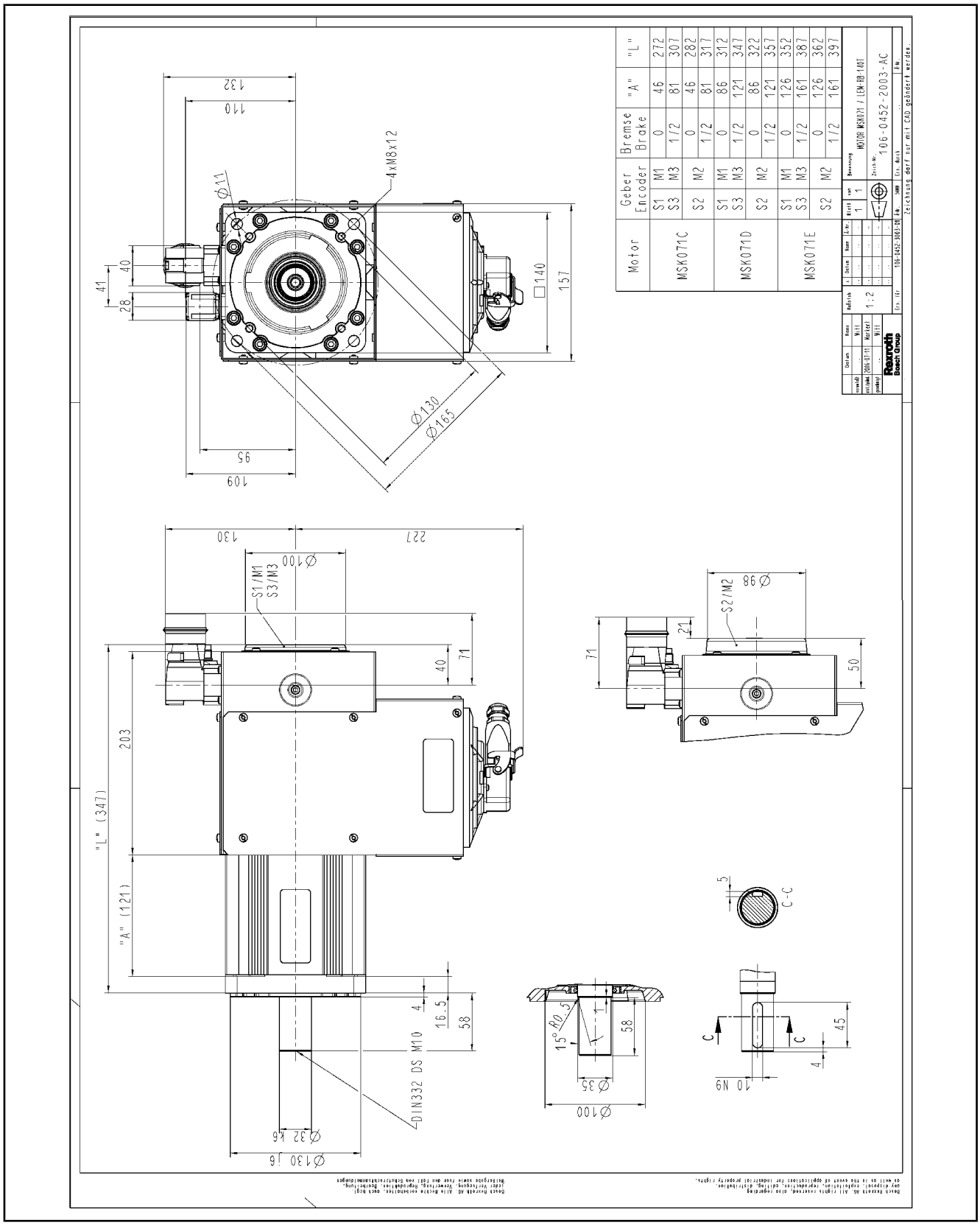


Fig.5-19: MSK071 specifications with radial fan unit

5.19 MSK075 Specifications

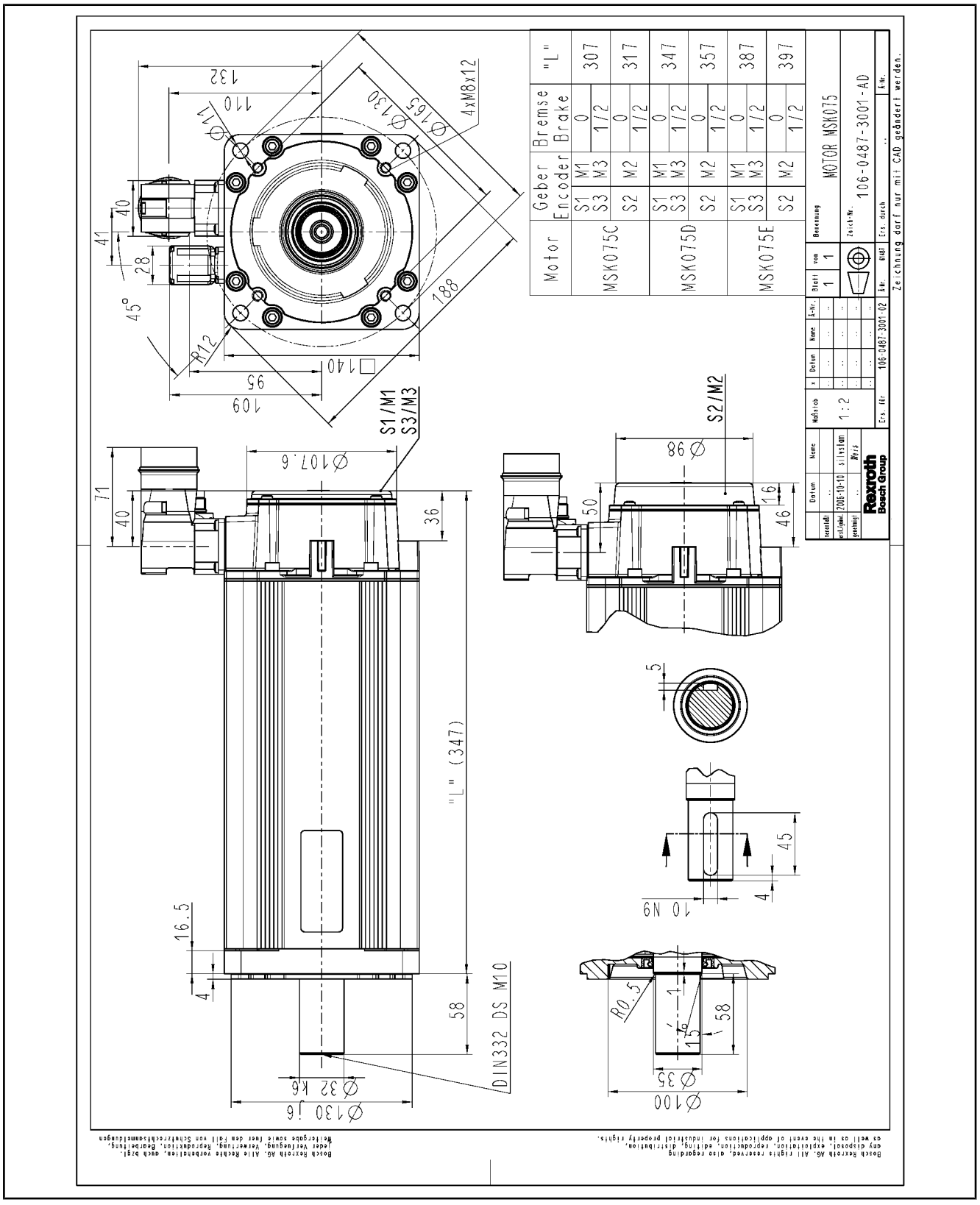


Fig.5-20: MSK075...NN specifications

Specifications

5.20 MSK075 Specifications Liquid Cooling

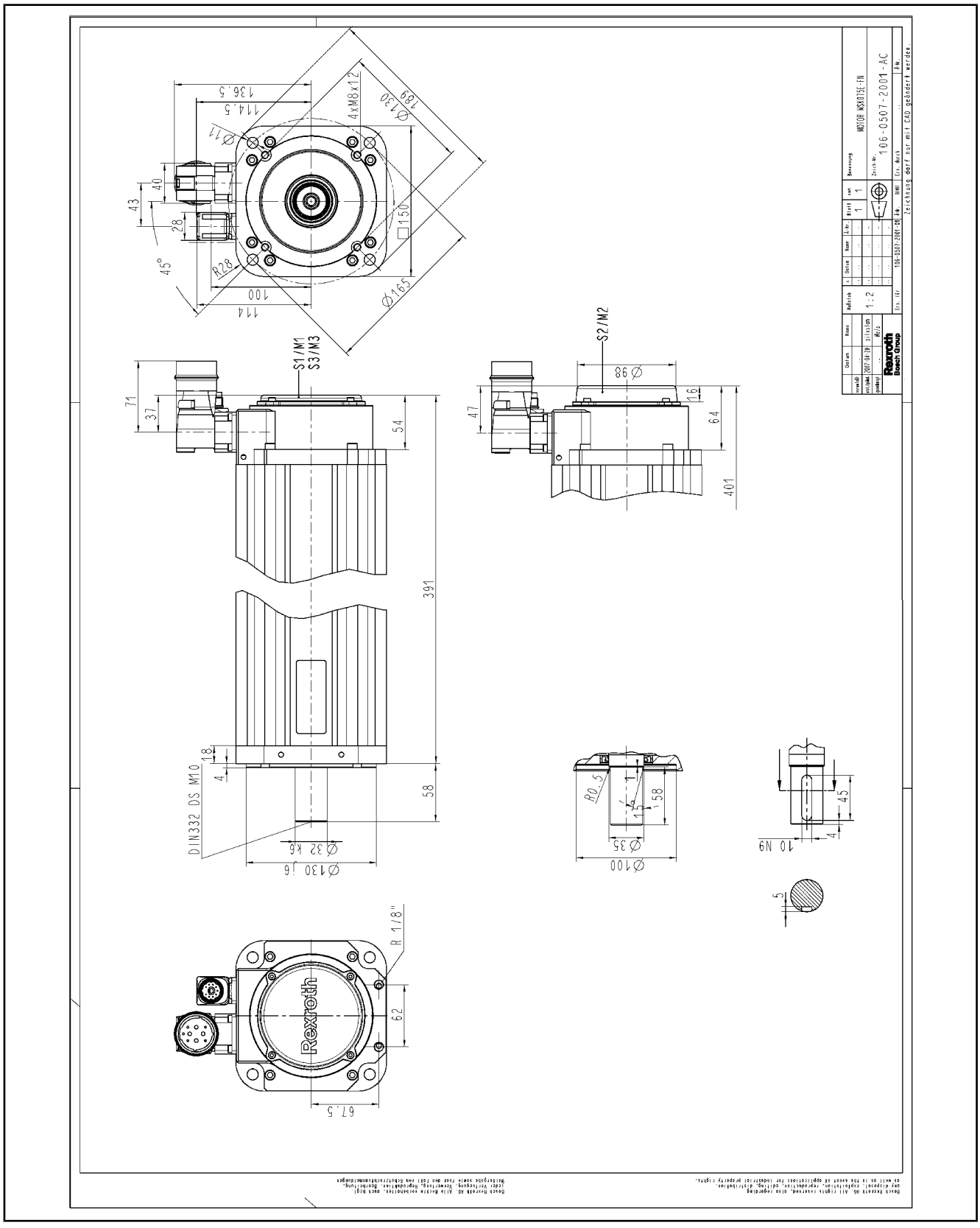


Fig.5-21: MSK075...FN specifications

5.21 MSK075 Specifications Fan Unit Axial

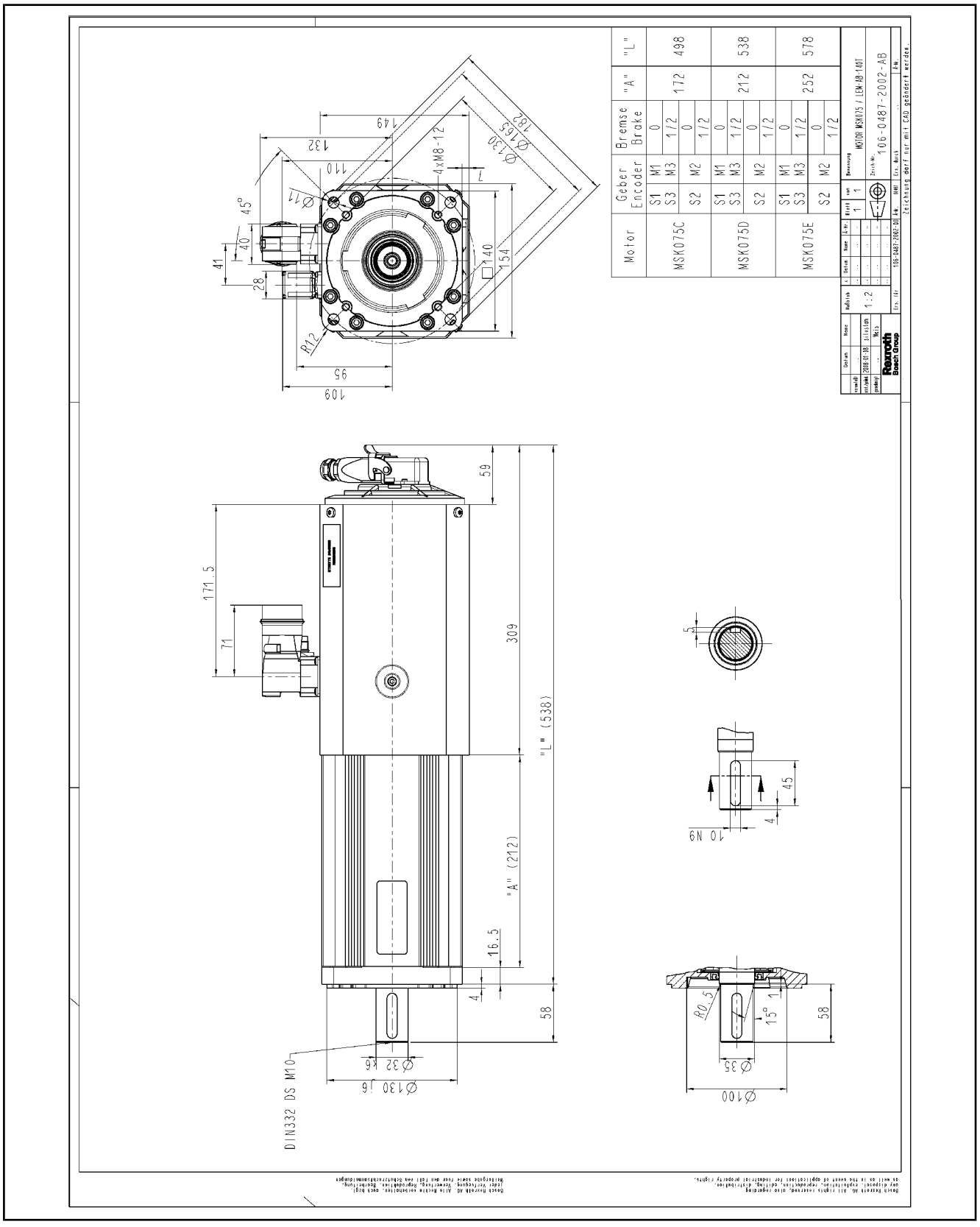


Fig.5-22: MSK075 specifications with axial fan unit

Specifications

5.22 MSK075 Specifications Fan Unit Radial

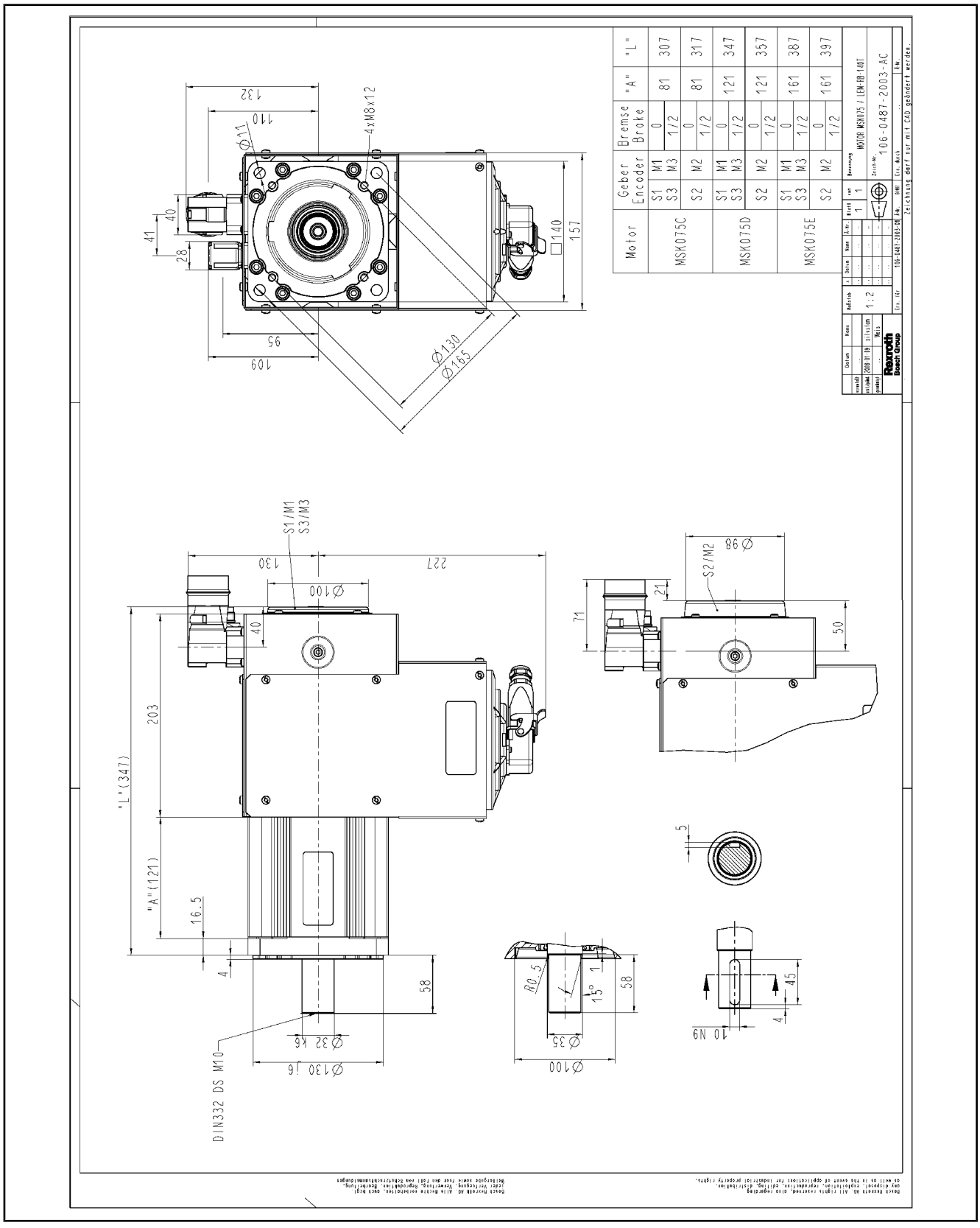


Fig.5-23: MSK075 specifications with radial fan unit

5.23 MSK076 Specifications

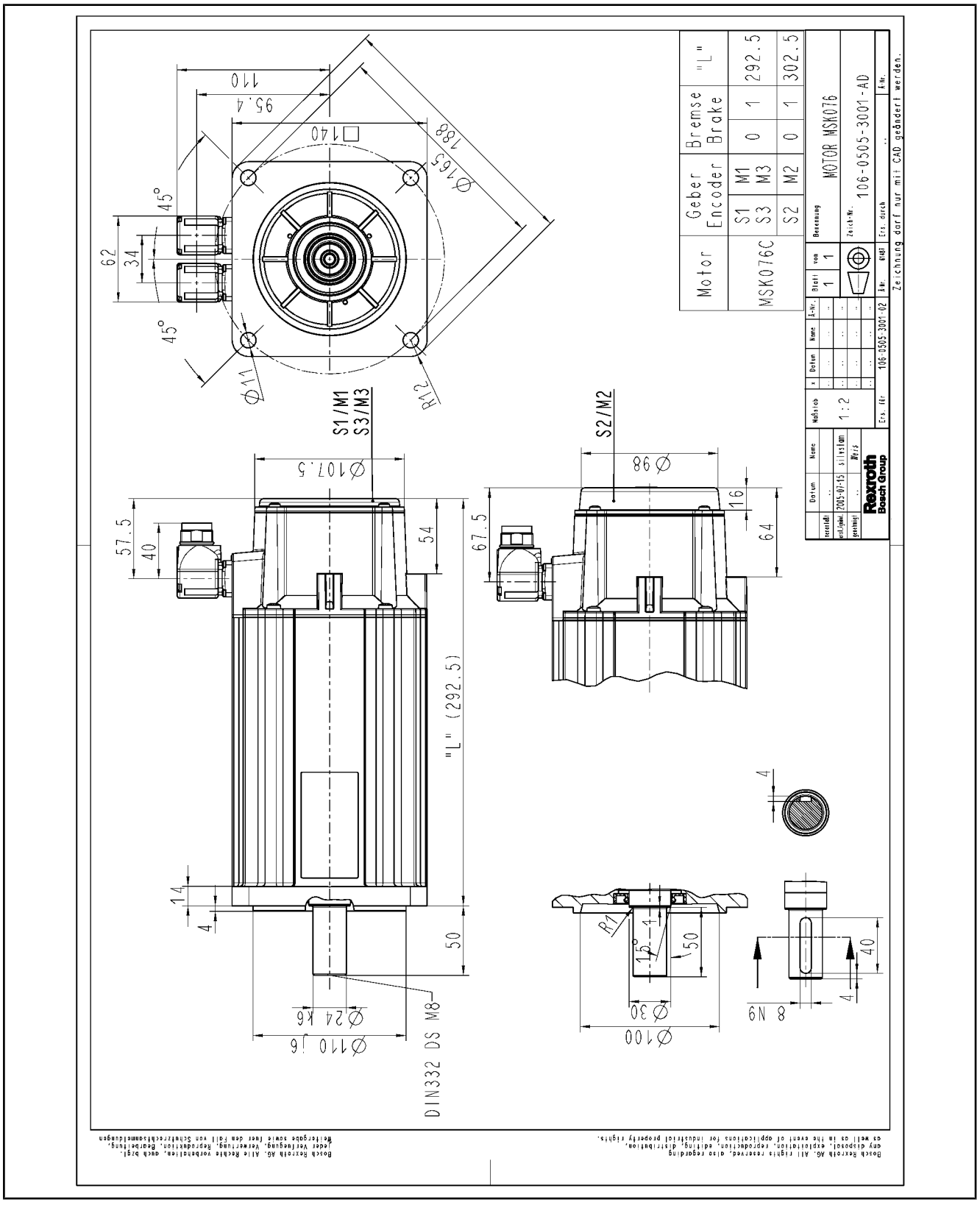


Fig.5-24: MSK076 specifications

Specifications

5.24 MSK076 Specifications Fan Unit Axial

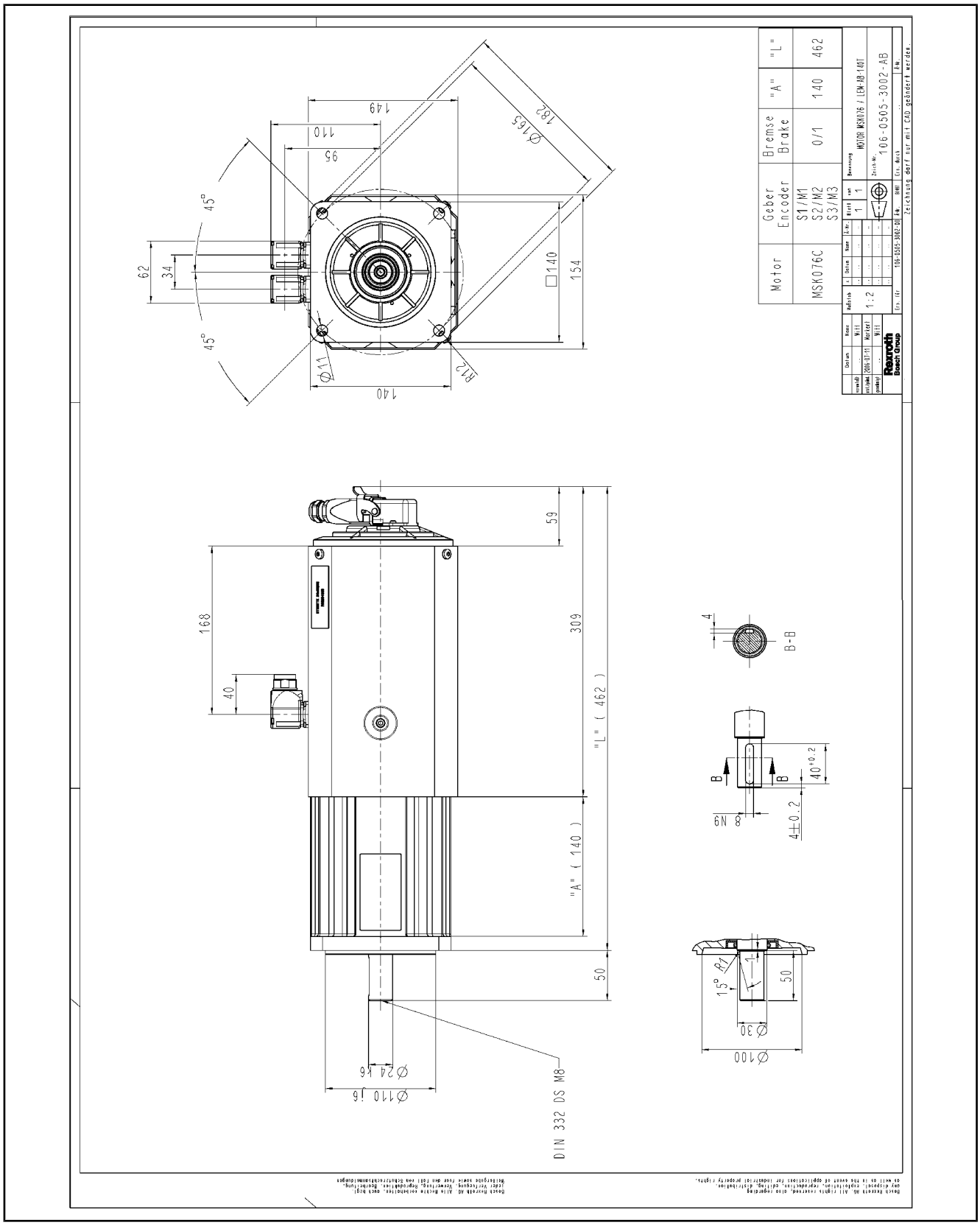


Fig.5-25: MSK076 specifications with axial fan unit

5.25 MSK076 Specifications Fan Unit Radial

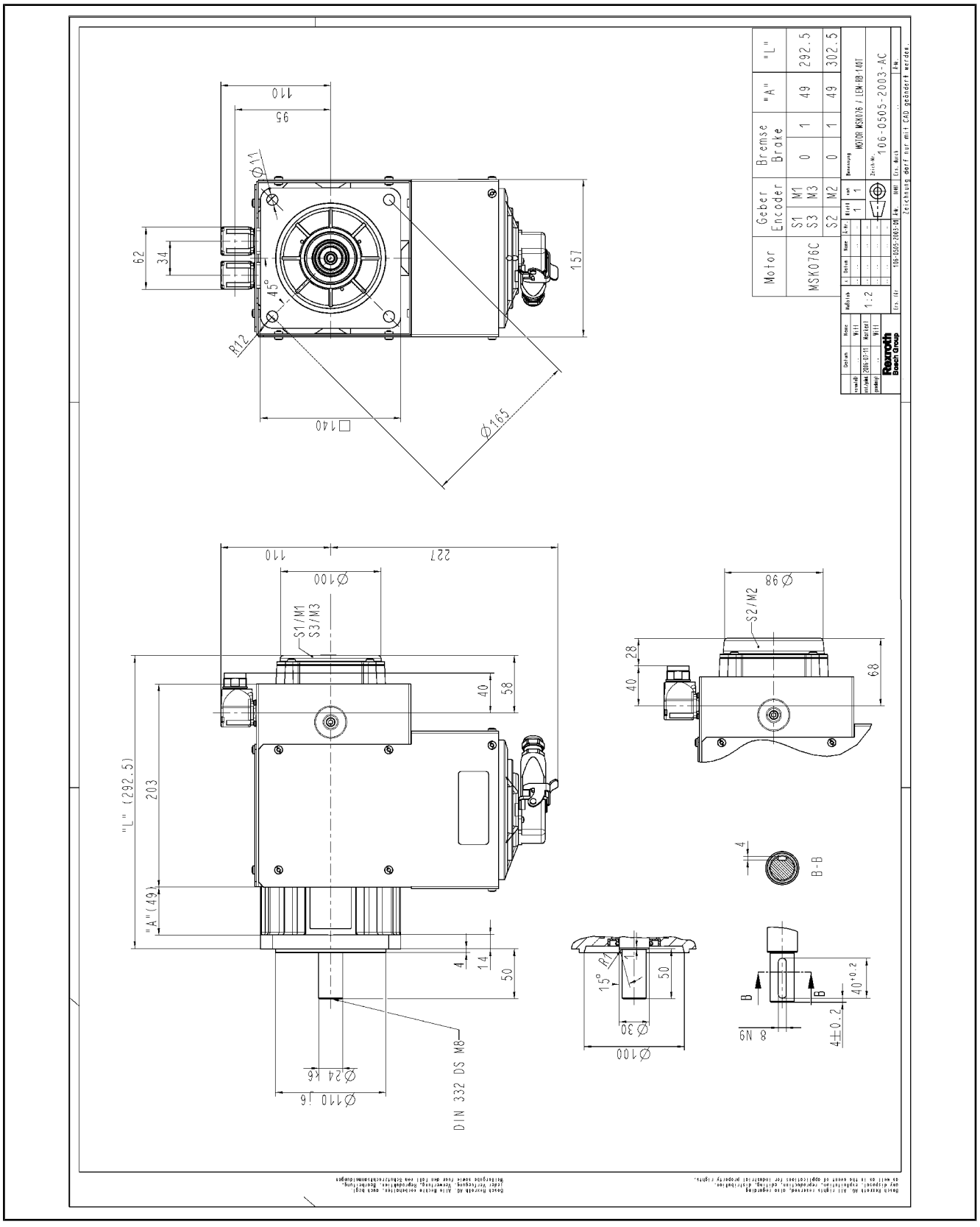


Fig.5-26: MSK076 specifications with radial fan unit

Specifications

5.26 MSK100 Specifications

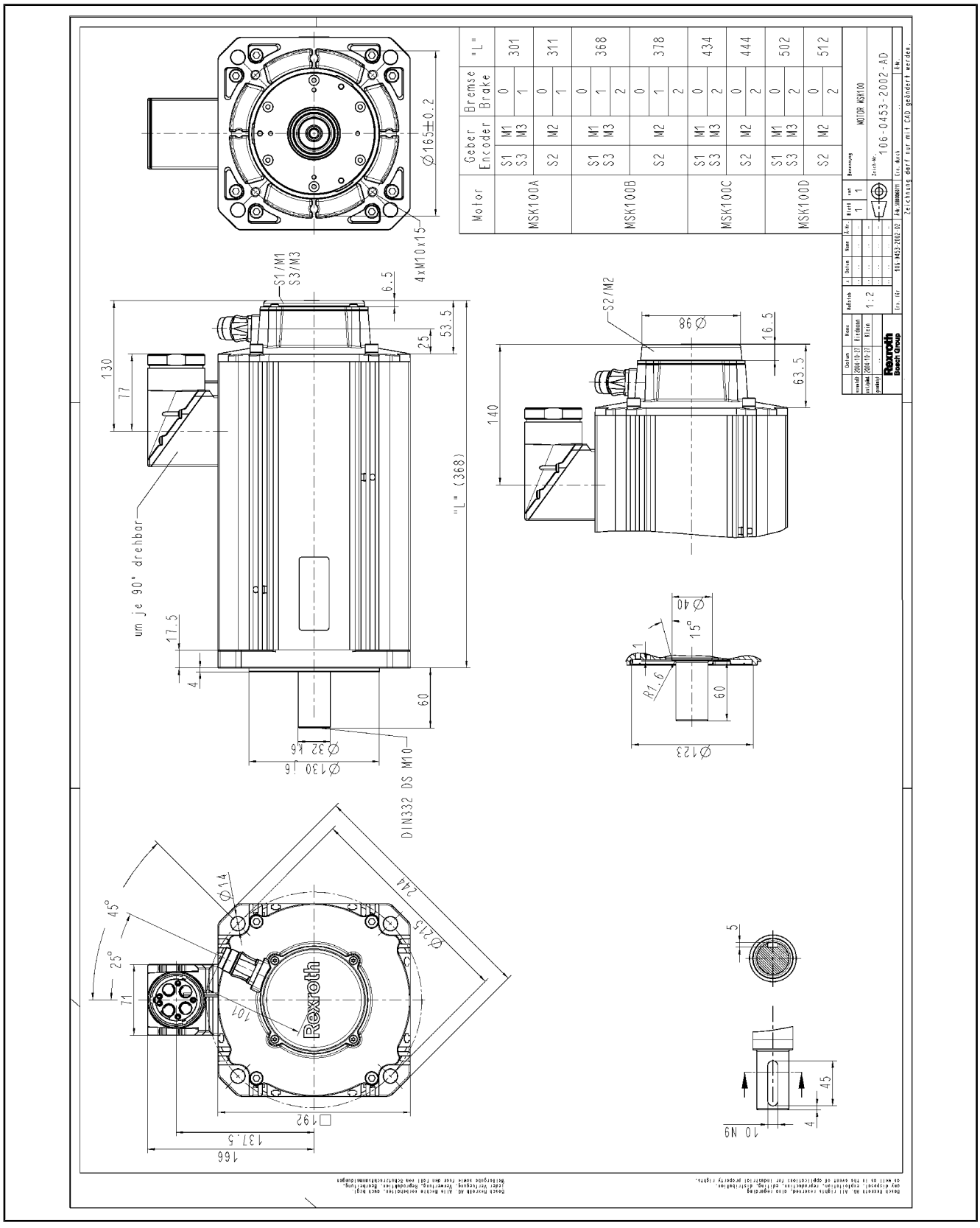


Fig.5-27: MSK100 specifications

5.27 MSK100 Specifications Fan Unit Axial

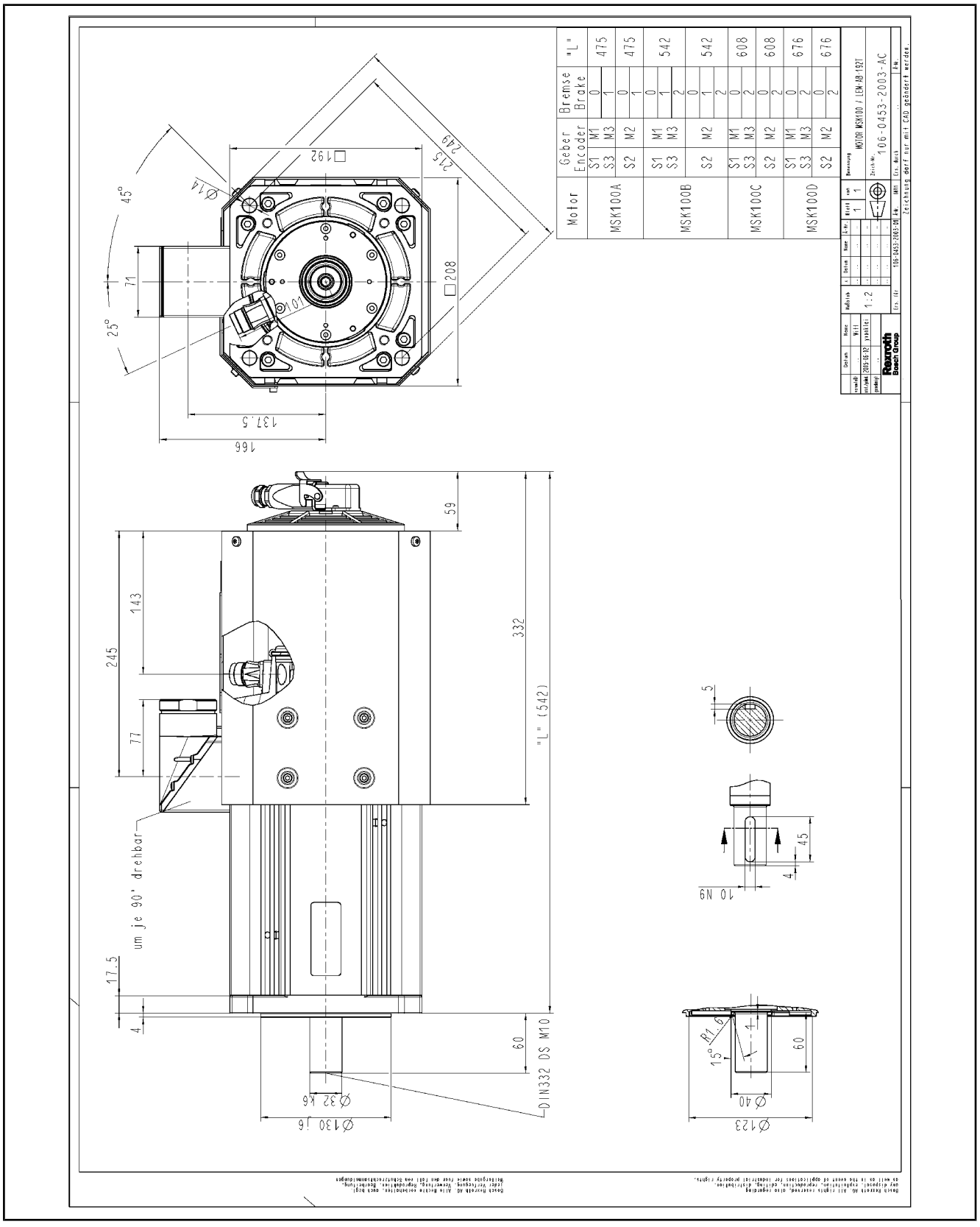


Fig.5-28: MSK100 specifications with axial fan unit

Specifications

5.28 MSK100 Specifications Fan Unit Radial

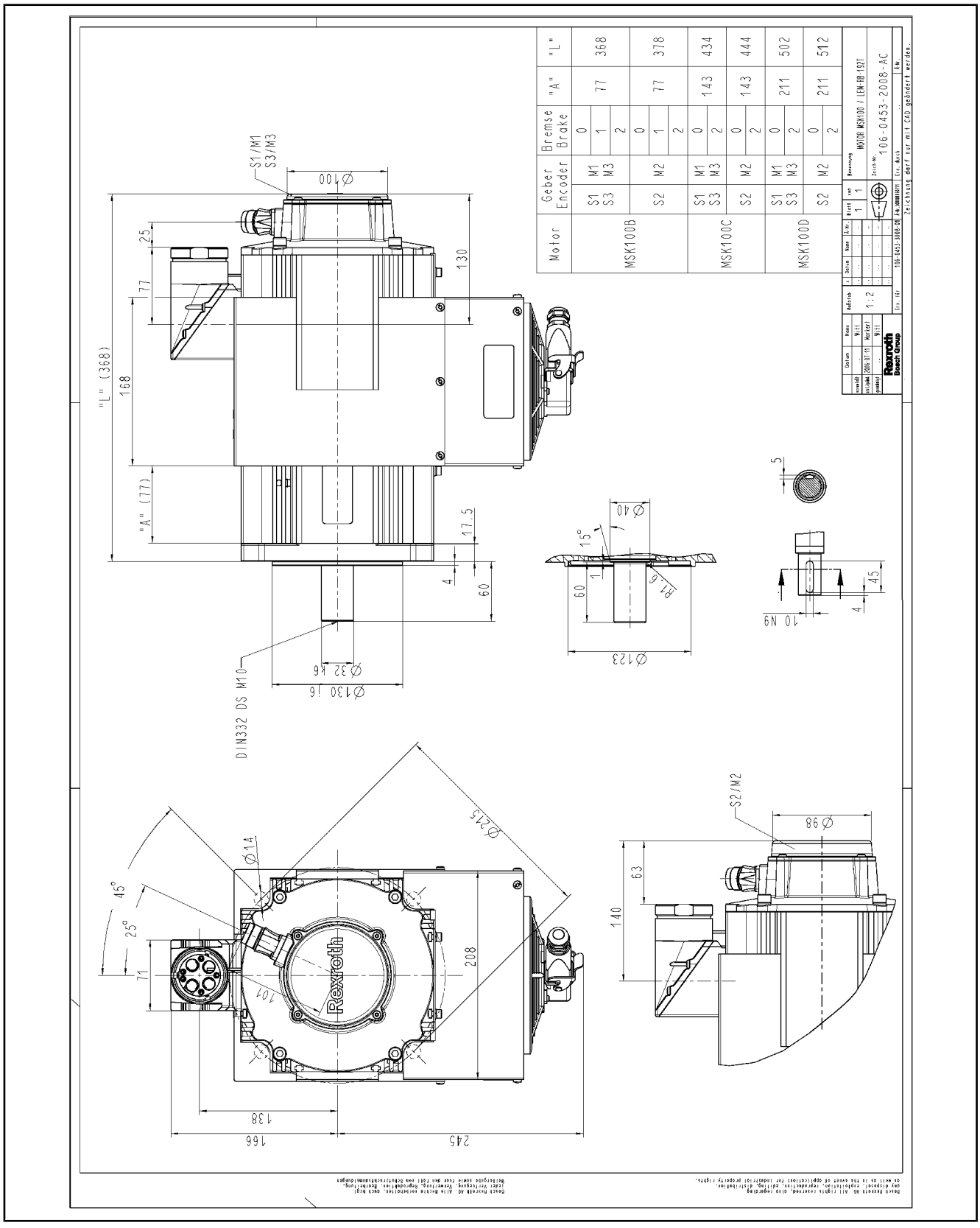


Fig.5-29: MSK100 specifications with radial fan unit

5.29 MSK101 Specifications

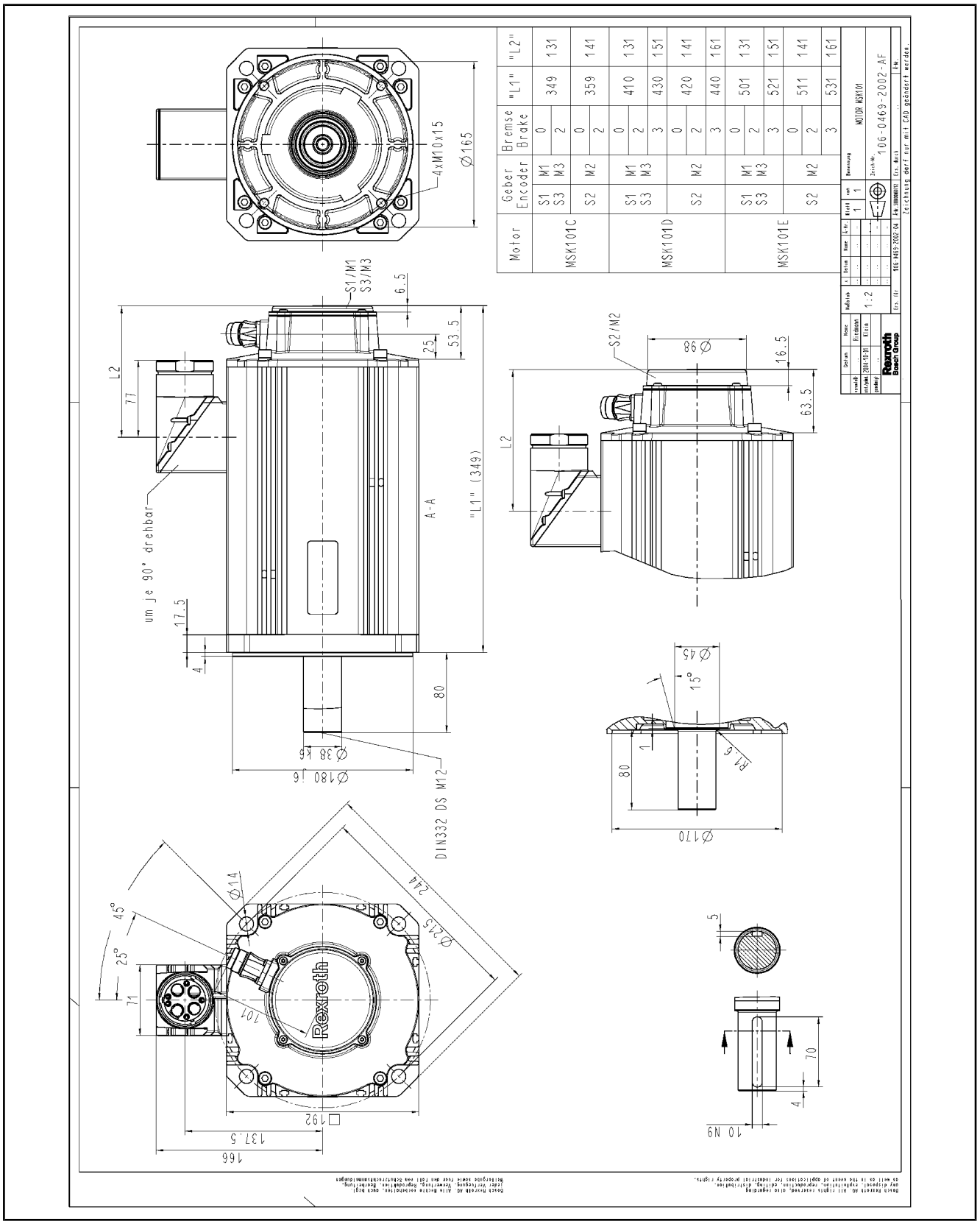


Fig.5-30: MSK101 specifications

Specifications

5.30 MSK101 Specifications Liquid Cooling

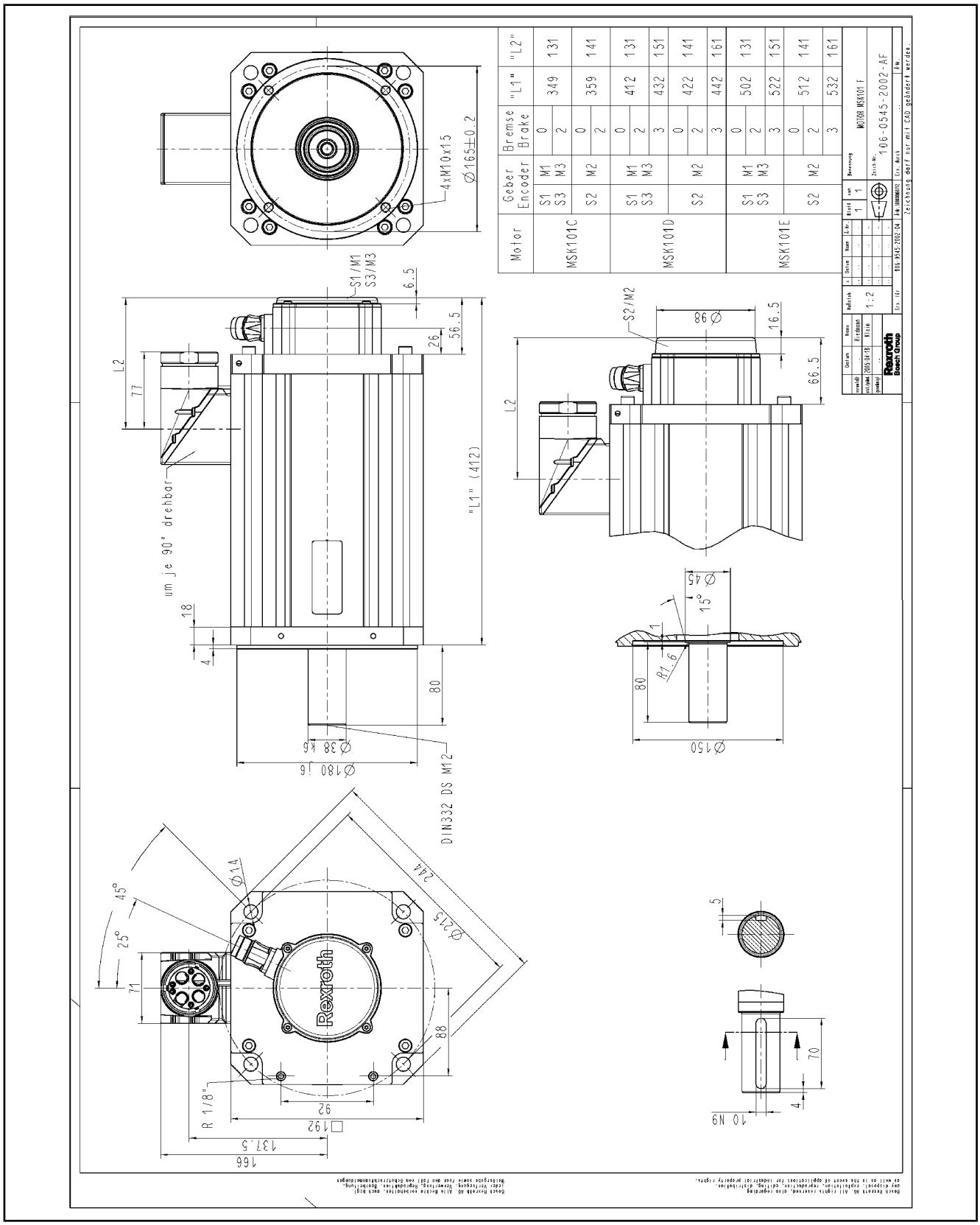


Fig.5-31: MSK101...FN specifications

5.31 MSK101 Specifications Fan Unit Axial

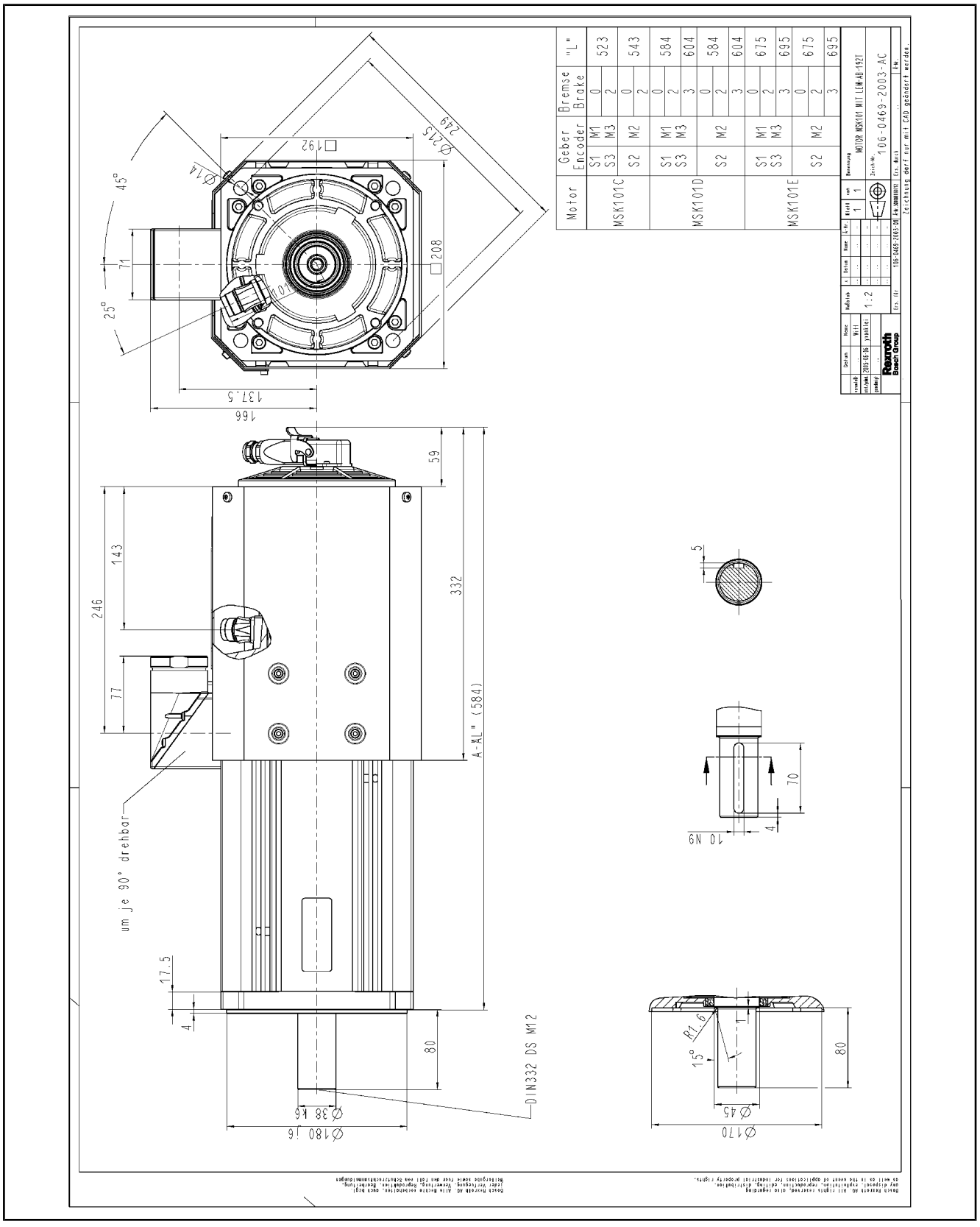


Fig.5-32: MSK101 specifications with axial fan unit

Specifications

5.32 MSK101 Specifications Fan Unit Radial

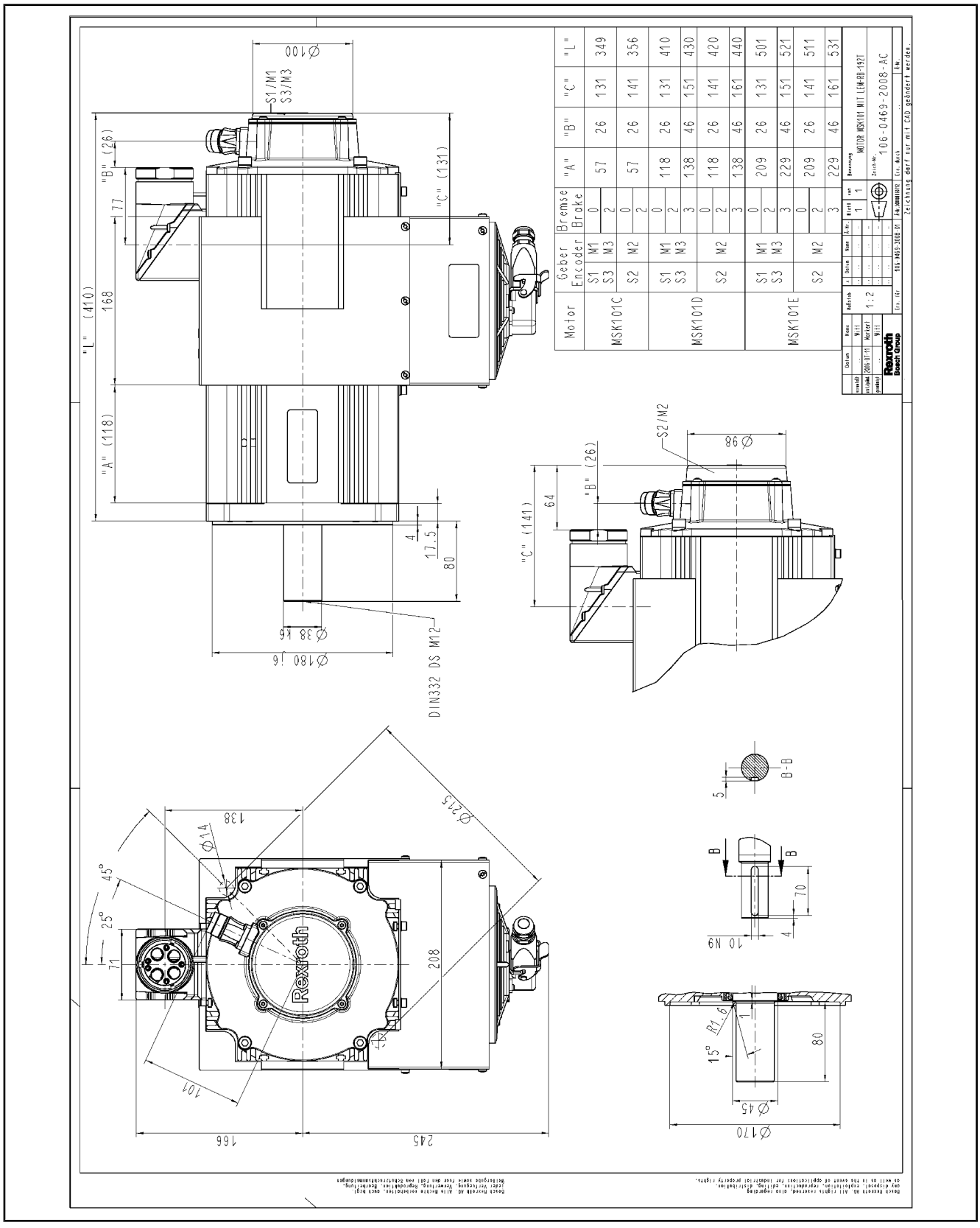
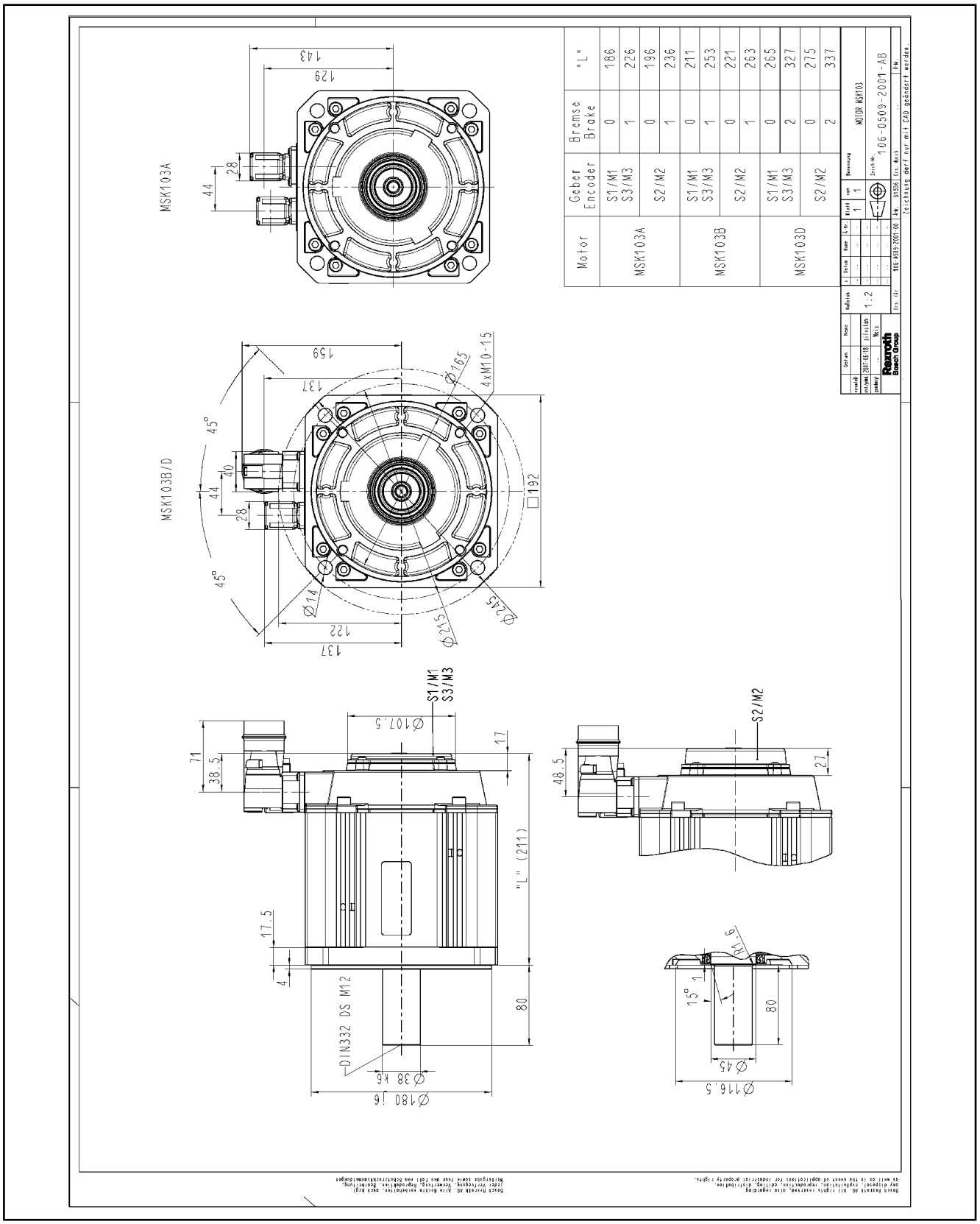


Fig.5-33: MSK101 specifications with radial fan unit

5.33 MSK103 Specifications



Motor	Geber Encoder	Bremse Brake	"L"
MSK103A	S1/M1 S3/M3	0	186
		1	226
	S2/M2	0	196
		1	236
MSK103B	S1/M1 S3/M3	0	211
		1	253
	S2/M2	0	221
		1	263
MSK103D	S1/M1 S3/M3	0	265
		2	327
	S2/M2	0	275
		2	337

Fig.5-34: MSK103 specifications

Specifications

5.34 MSK131 Specifications

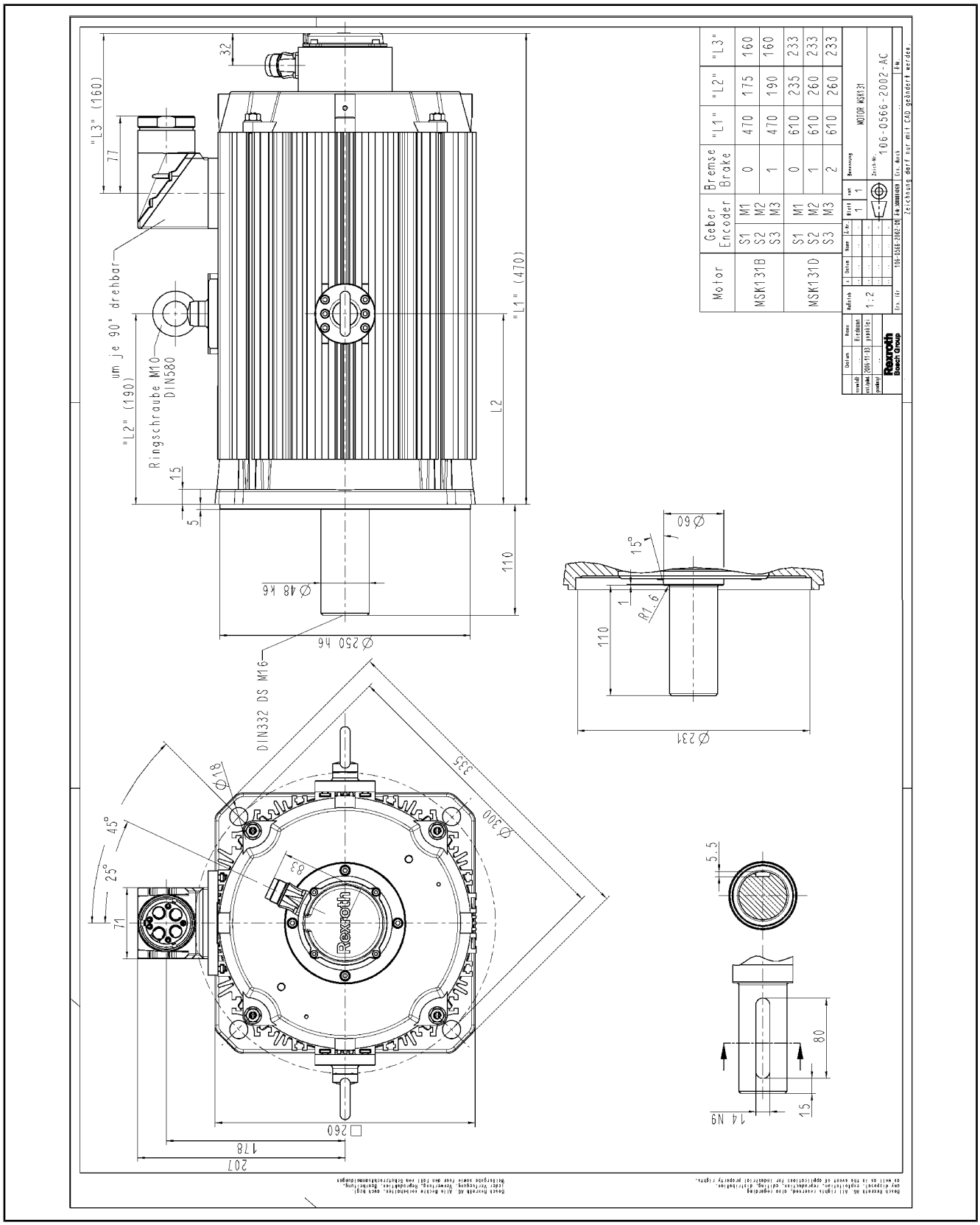


Fig.5-35: MSK131 specifications

5.35 MSK131 Specifications Fan Unit Axial

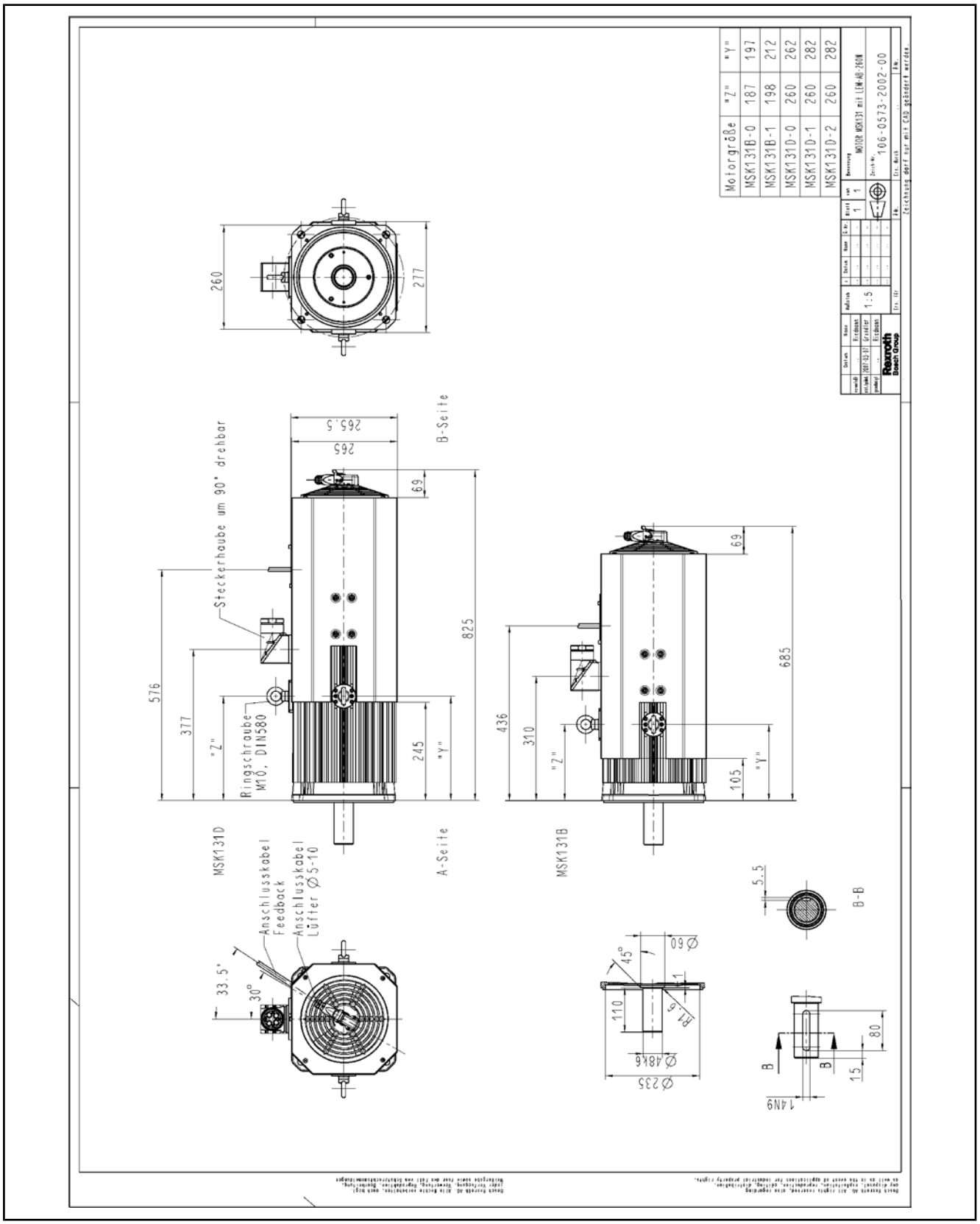


Fig.5-36: MSK131 specifications with axial fan unit

6 Type Codes

6.1 MSK Type Code - Structure and Description

General Information

Each order of a Rexroth product must be based on the type code. All available motor variants are uniquely described by their type code. The individual characters of the type code (abbrev. column) and their meaning are described below.

☞ Before ordering, please check the availability of the separate options with your Bosch Rexroth sales partner.

Product

Example: **MSK**□□□□-□□□□-□□-□□-□□□-□□□□

MSK three-digit Rexroth-specific designation of a servomotor series.

Frame size

Example: MSK**050**□-□□□□-□□-□□-□□□-□□□□

The motor size determines important mechanical motor specifications and is proportional to the performance variables.

Frame Length

Example: MSK050**B**-□□□□-□□-□□-□□□-□□□□

Within a series, the graduation of the increasing motor length is indicated by ID letters in alphabetic order. Frame lengths are, for example, B, C, D and E.

Winding

Example: MSK050B-**0300**-□□-□□-□□□-□□□□

The four-digit sequence of figures identifies the rated speed applicable for the respective type of winding.

Cooling Type

Example: MSK050B-0300-**NN**-□□-□□□-□□□□

Option	Design	Detail
NN	Natural Convection	Fan mounting possible [1]
FN	Liquid cooling	Standard connection for coolant ducts 1/8", fan mounting not possible

1) Not admissible for ATEX version

Fig.6-1: Cooling types for IndraDyn S motors

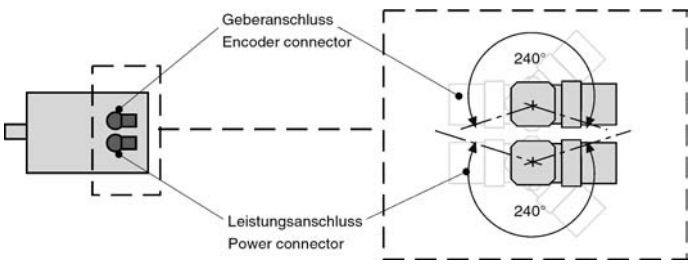
Encoder

Example: MSK050B-0300-NN-**S1**-□□□-□□□□

IndraDyn S motors are equipped with integrated encoder system. To control the motor speed and / or to position the motor, the drive control device must know the current motor position.

Electrical Connection

Example: MSK050B-0300-NN-S1-**U**□□-□□□□

Option	Description
U[1]	Rotating power and encoder connector 
A[2]	Power connector, side A
B[2]	Power connector, side B

Type Codes

Option	Description
L[2)]	Power connector, to the left
R[2)]	Power connector, to the right

1) for MSK030, -040, -043, -050, -060, -070, -071,-075, -076, -103 motors
2) for MSK100, -101, -131 motors

Fig.6-2: IndraDyn S connectors with fixed output direction

Drive shaft

Example: MSK050B-0300-NN-S1-U**G**□-□□□□

In order to connect the machine elements to be driven to the motor drive shafts, the following options are available for all IndraDyn S motors:

Option	Design	Detail
G	Plain shaft	With frontal centering hole with "DS" thread according to DIN 332, Part 2, Edition 05.83
P	Shaft with keyway [1)]	
1) Keyway according to DIN 6885, sheet 1, ed. 08.68. For details, refer to the dimension sheets.		

Fig.6-3: IndraDyn S output shafts

☞ IndraDyn S motors are balanced with a key. The related key is not included in the scope of delivery.

Holding brake

Example: MSK050B-0300-NN-S1-UG**1**-□□□□

As an option, IndraDyn S motors are available with electrically releasing holding brakes with various 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.

Fig.6-4: IndraDyn S holding brakes

☞ The holding brake is not suitable for the protection of personnel or as a service brake! Please also observe the installation and safety instructions on the motor holding brakes in the chapter entitled "Application Notes".

Design

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

NNNN = standard design

NSNN = standard and explosion protection design according to equipment group II, categories 3G and 3D according to DIN EN 60079 et seqq.

RNNN = design with increased concentricity

RSNN = design with increased concentricity and explosion protection design according to equipment group II, categories 3G and 3D according to DIN EN 60079 et seqq.

Reference to Standards

The item "Reference to Standards" indicates standards referred to in the type code (e.g. DIN, EN, ISO, etc.) or factory standards (RNC ...) that are also applicable. The version listed is always that valid at the time the type code is issued.

Comment Please refer to this item for additionally required information concerning the handling of the type code. This includes, for example, descriptions on footnotes or notes on availability.

Type Codes

6.2 MSK030 Type Code

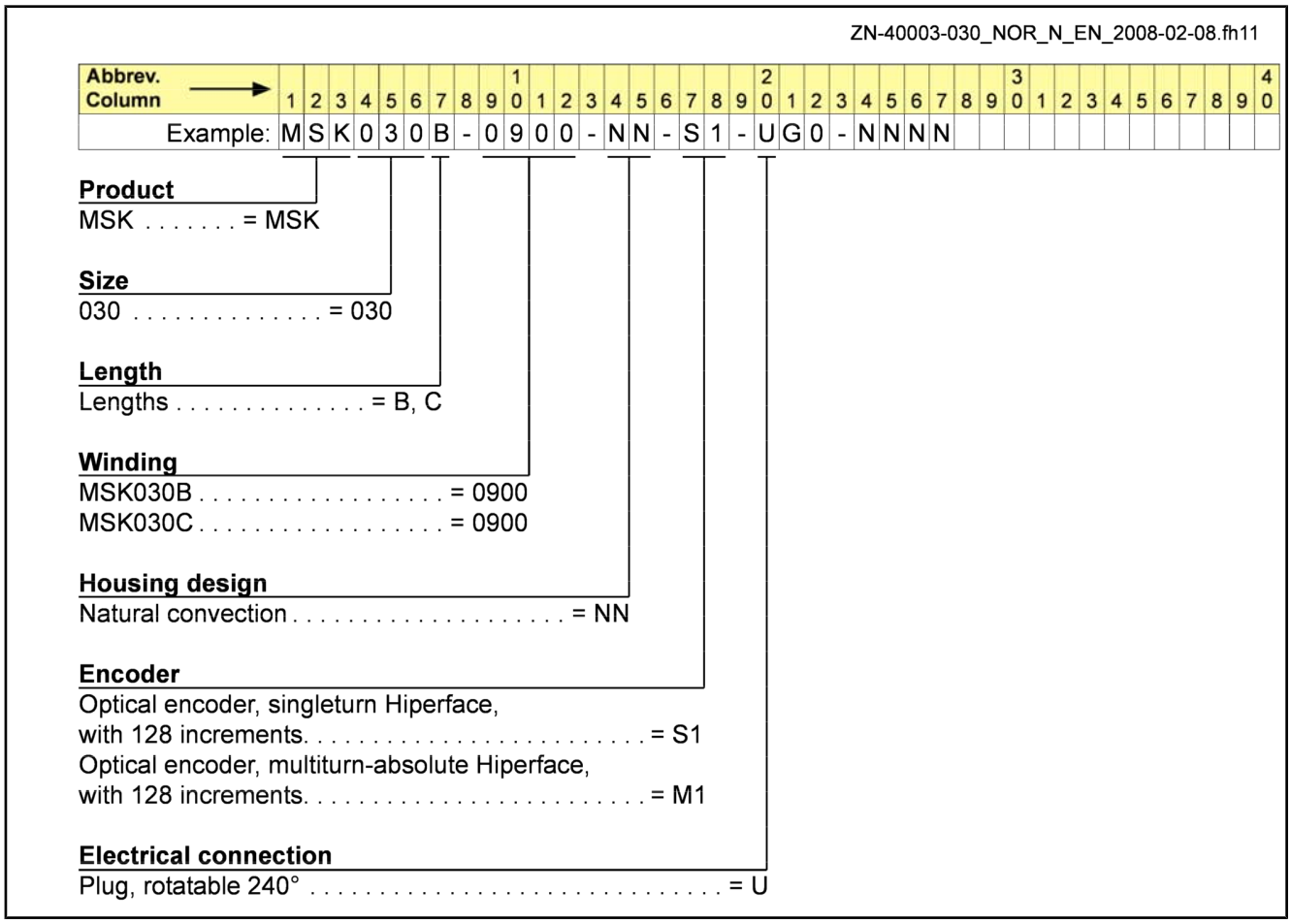


Fig.6-5: MSK030 type code (page 1)

Type Codes

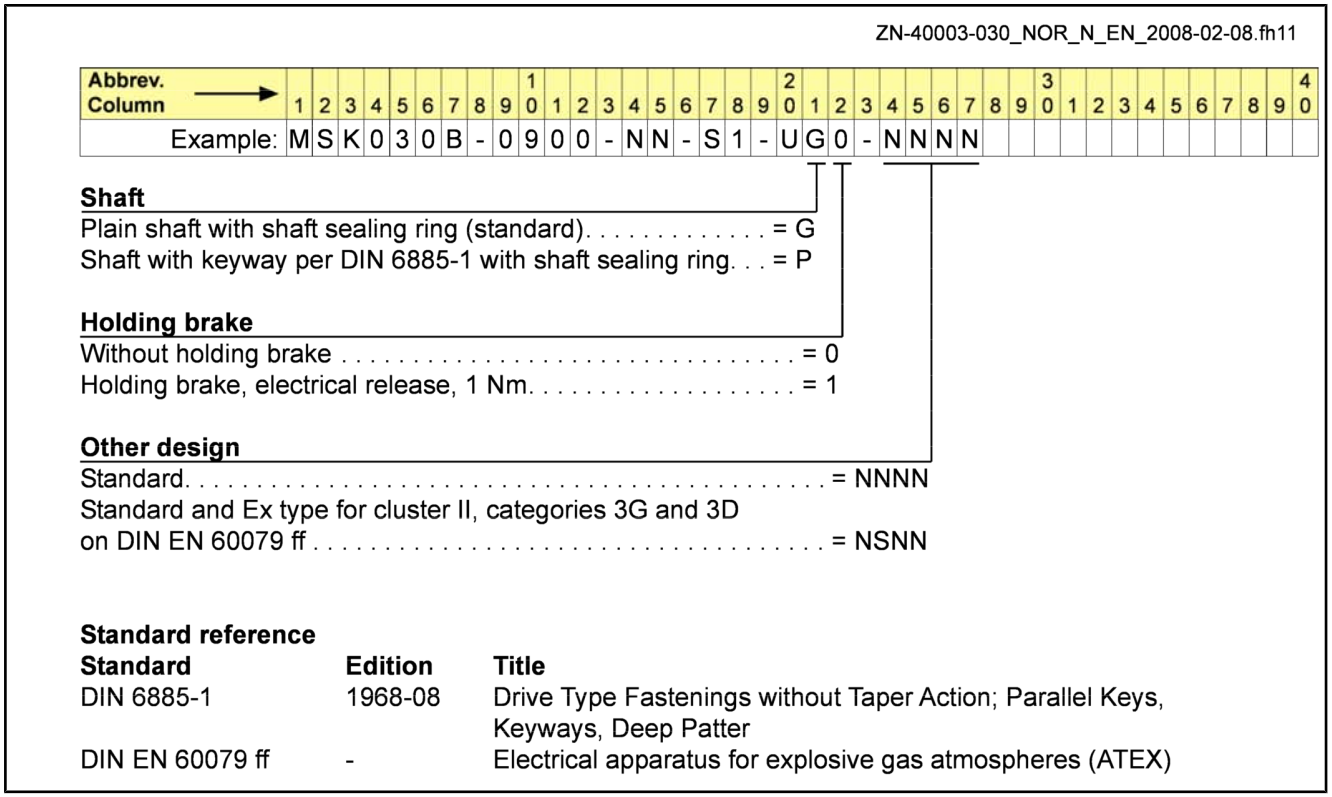


Fig.6-6: MSK030 type code (page 2)

Type Codes

6.3 MSK040 Type Code

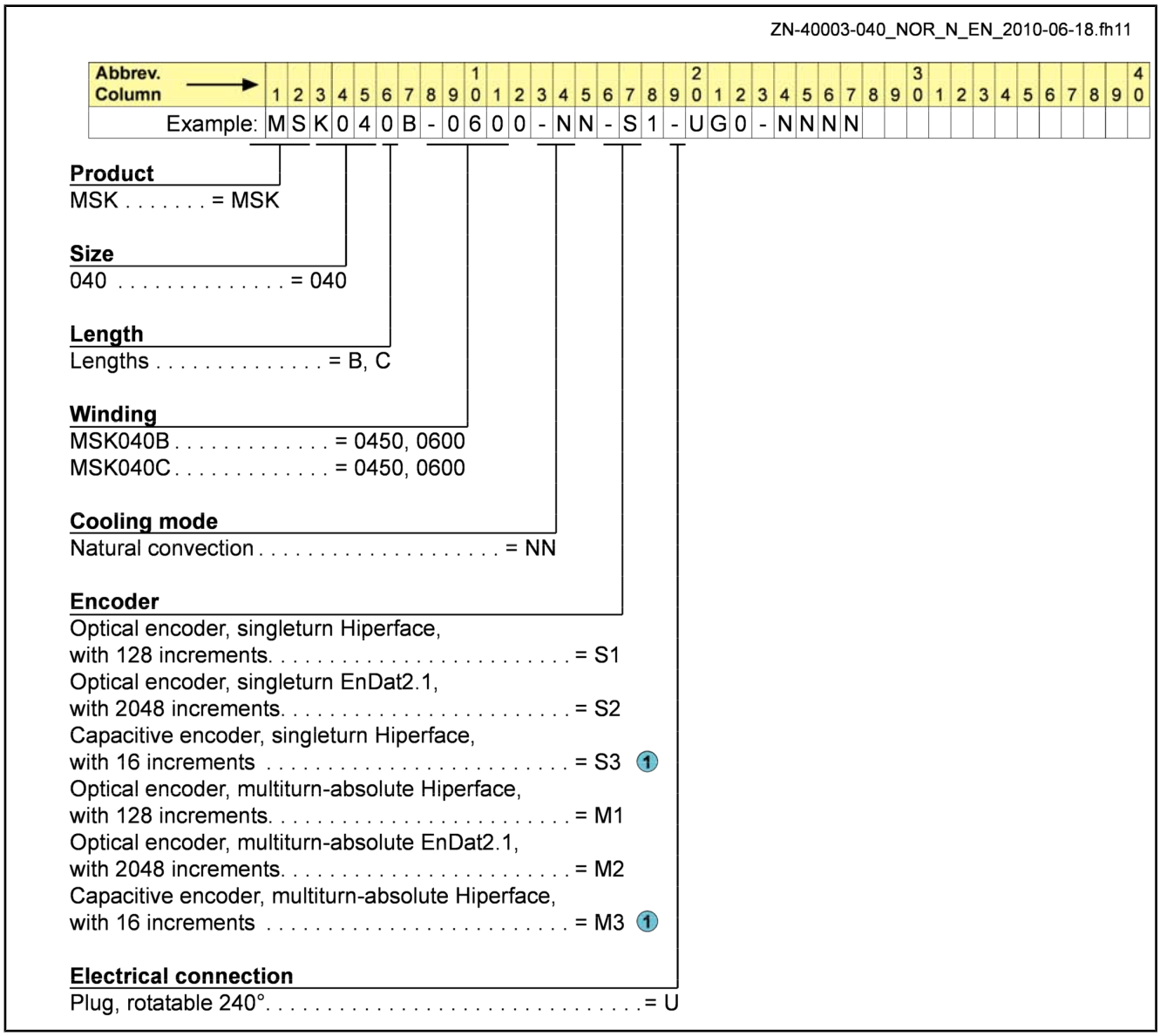


Fig.6-7: MSK040 type code (page 1)

Type Codes

ZN 40003-040_NOR_N_EN_2010-06-18.fh11

Abbrev. 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	0	4	0	B	-	0	6	0	0	-	N	N	-	S	1	-	U	G	0	-	N	N	N	N														

Shaft
Plain shaft with shaft sealing ring (standard). . . . . = G
Shaft with key per DIN 6885-1 with
shaft sealing ring . . . . . = P

Holding brake
Without holding brake. . . . . = 0
Holding brake, electrically-released, 4 Nm . . . . . = 1

Other design
Standard. . . . . = NNNN
Standard and Ex type for cluster II, categories 3G and 3D
on DIN EN 60079 ff . . . . . = NSNN

Note:
(1) Encoder "S3" and "M3" are only available with other design "NNNN"

Standard reference

Standard	Title	Edition
DIN 6885-1	1968-08	Drive Type Fastenings without Taper Action; Parallel Keys, Keyways, Deep Pattern
DIN EN 60079 ff	-	Electrical apparatus for explosive gas atmospheres (ATEX)

Fig.6-8: MSK040 type code (page 2)

Type Codes

6.4 MSK043 Type Code

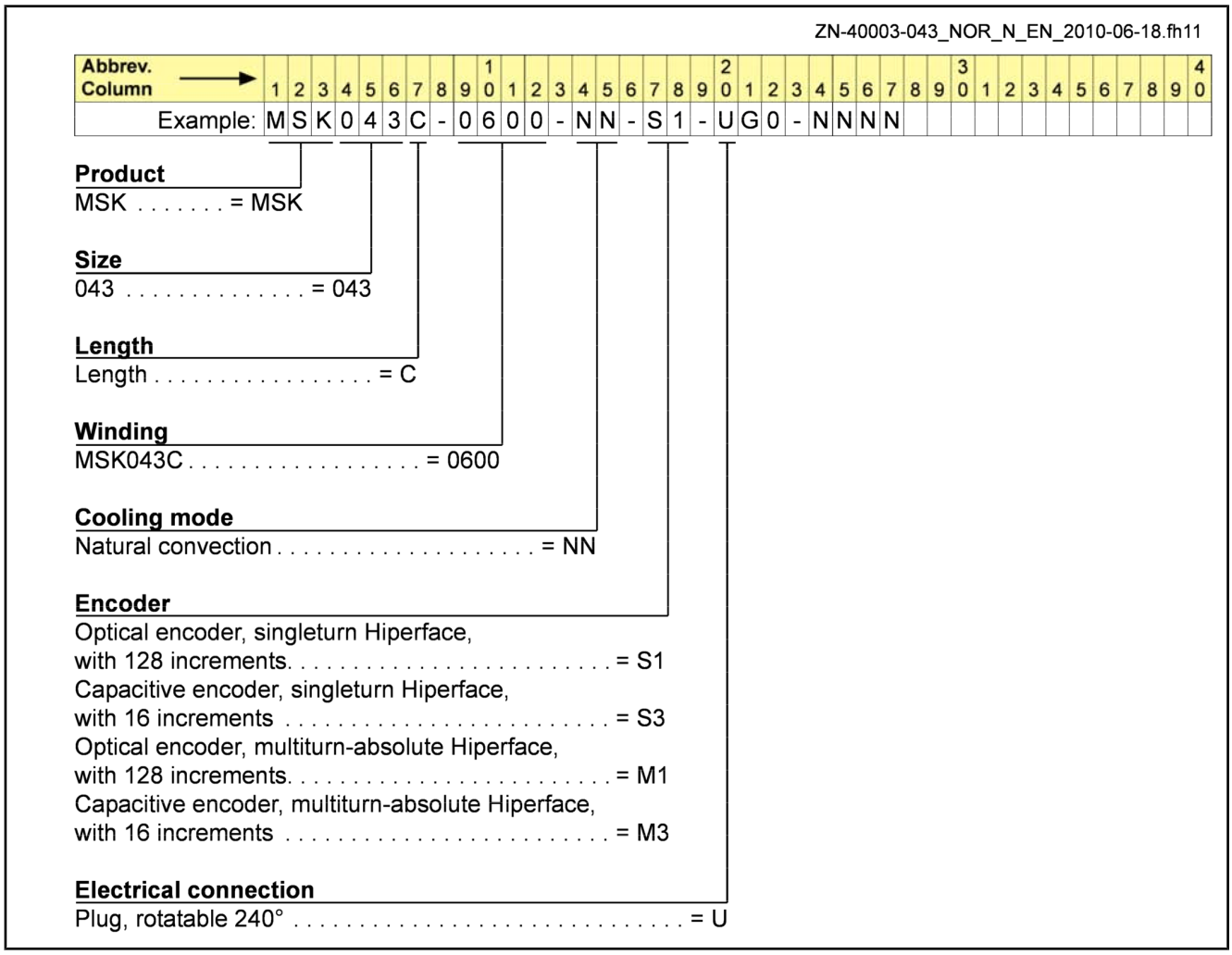


Fig.6-9: MSK043 type code (page 1)

Type Codes

ZN 40003-043_NOR_N_EN_2010-06-18.fh11

Abbrev. Column →	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1	2	3	4	5	6	7	8	9	40
Example:	M	S	K	0	4	3	C	-	0	6	0	0	-	N	N	-	S	1	-	U	G	0	-	N	N	N	N														

Shaft
Plain shaft with shaft sealing ring (Standard). . . . . = G
Shaft with keyway per DIN 6885-1 with shaft sealing ring. . . = P

Holding brake
Without holding brake . . . . . = 0
Holding brake, electrically-released, 4 Nm . . . . . = 1

Other design
Standard. . . . . = NNNN

Standard reference

Standard	Edition	Title
DIN 6885-1	1968-08	Drive Type Fastenings without Taper Action; Parallel Keys, Keyways, Deep Pattern

Fig.6-10: MSK043 type code (page 2)

Type Codes

6.5 MSK050 Type Code

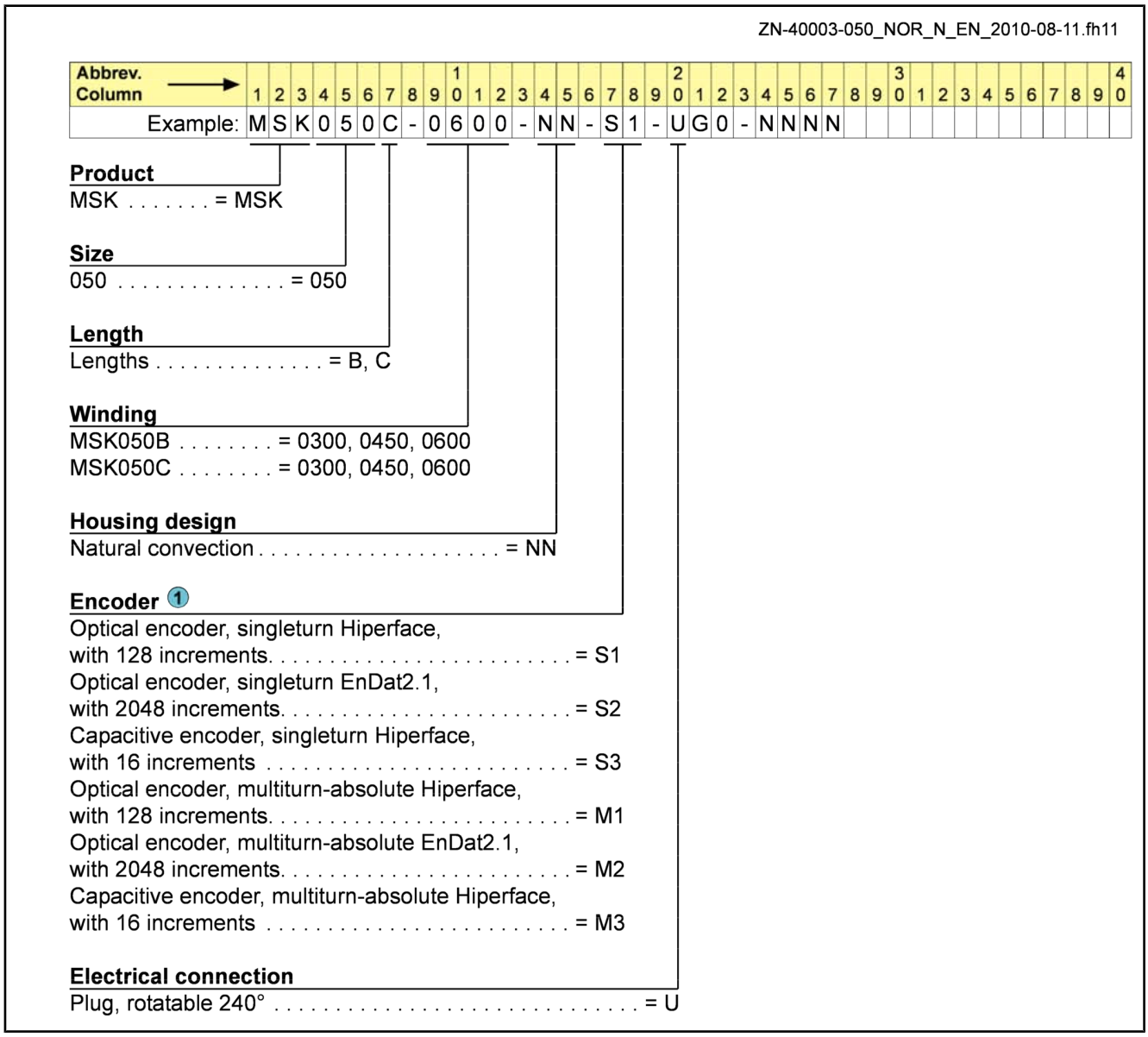


Fig.6-11: MSK050 type code (page 1)

Type Codes

ZN-40003-050_NOR_N_EN_2010-08-11.fh11

Abbrev. Column →	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1	2	3	4	5	6	7	8	9	40
Example:	M	S	K	0	5	0	C	-	0	6	0	0	-	N	N	-	S	1	-	U	G	0	-	N	N	N	N														

Shaft

Plain shaft with shaft sealing ring (standard). . . . . = G
Shaft with keyway per DIN 6885-1 with shaft sealing ring. . . = P

Holding brake

Without holding brake . . . . . = 0
Holding brake, electrical release, 6 Nm. . . . . = 1

Other design

Standard. . . . . = NNNN
Standard and Ex type for cluster II, categories 3G and 3D
on DIN EN 60079 ff . . . . . = NSNN
Reduced shaft run-out, axial run-out according to DIN 42955. . . . = RNNN
Reduced shaft run-out, axial run-out according to DIN 42955 and
Ex type for cluster II, categories 3G and 3D on DIN EN 60079 ff = RSNN

Note:

(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"

Standard reference

Standard	Edition	Title
DIN 6885-1	1968-08	Drive Type Fastenings without Taper Action; Parallel Keys, Keyways, Deep Patter
DIN 42955	1981-12	Tolerances of shaft extension run-out of mounting flanges for rotating electrical machinery, test
DIN EN 60079 ff	-	Electrical apparatus for explosive gas atmospheres (ATEX)

Fig.6-12: MSK050 type code (page 2)

Type Codes

6.6 MSK060 Type Code

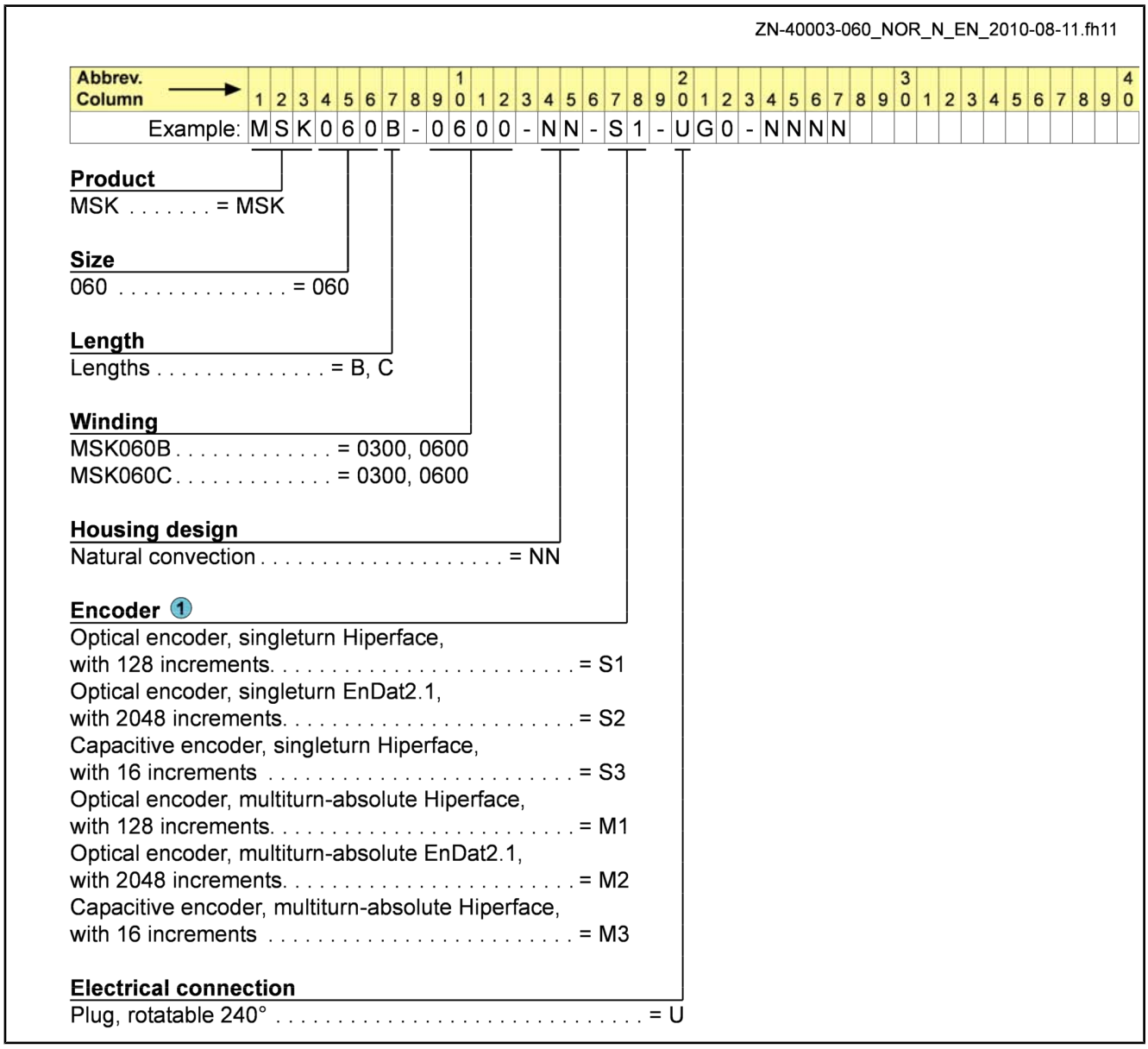


Fig.6-13: MSK060 type code (page 1)

Type Codes

ZN-40003-060_NOR_N_EN_2010-08-11.fh11

Abbrev. 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	0	6	0	B	-	0	6	0	0	-	N	N	-	S	1	-	U	G	0	-	N	N	N	N														

Shaft
Plain shaft with shaft sealing ring (standard). . . . . = G
Shaft with keyway per DIN 6885-1 with shaft sealing ring. . . = P

Holding brake
Without holding brake . . . . . = 0
Holding brake, electrical release, 10 Nm. . . . . = 1

Other design
Standard. . . . . = NNNN
Standard and Ex type for cluster II, categories 3G and 3D
on DIN EN 60079 ff . . . . . = NSNN
Reduced shaft run-out, axial run-out according to DIN 42955. . . . = RNNN
Reduced shaft run-out, axial run-out according to DIN 42955 and
Ex type for cluster II, categories 3G and 3D on DIN EN 60079 ff = RSNN

Note:
(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"

Standard reference

Standard	Edition	Title
DIN 6885-1	1968-08	Drive Type Fastenings without Taper Action; Parallel Keys, Keyways, Deep Patter
DIN 42955	1981-12	Tolerances of shaft extension run-out of mounting flanges for rotating electrical machinery, test
DIN EN 60079 ff	-	Electrical apparatus for explosive gas atmospheres (ATEX)

Fig.6-14: MSK060 type code (page 2)

Type Codes

6.7 MSK061 Type Code

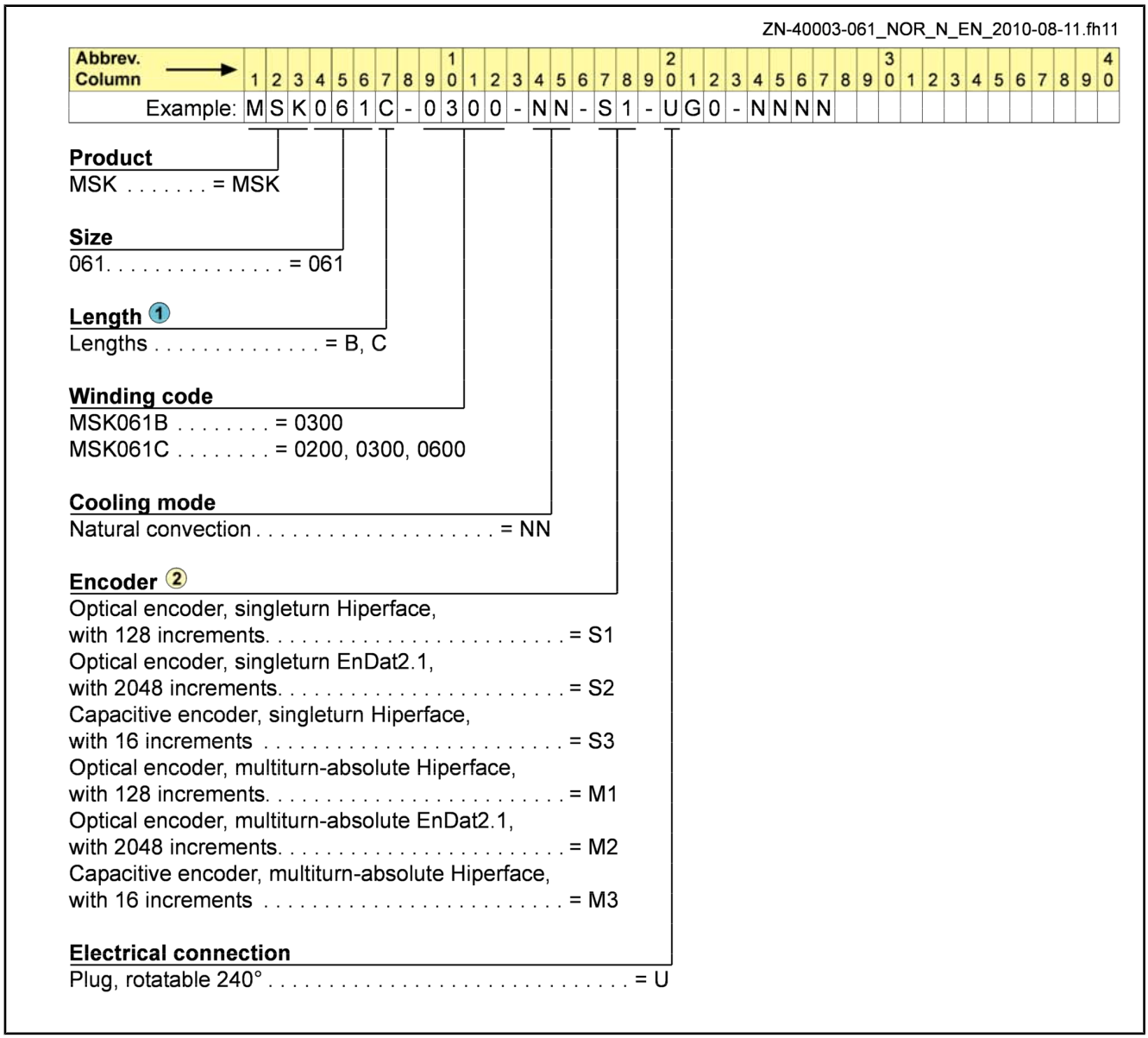


Fig.6-15: MSK061 type code (page 1)

Type Codes

ZN-40003-061_NOR_N_EN_2010-08-11.fh11

Abbrev. 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	0	6	1	C	-	0	3	0	0	-	N	N	-	S	1	-	U	G	0	-	N	N	N	N														

Shaft
Plain shaft with shaft sealing ring (standard). . . . . = G
Shaft with keyway per DIN 6885-1 with shaft sealing ring. . . = P

Holding brake
Without holding brake . . . . . = 0
Holding brake, electrically-released, 10 Nm . . . . . = 1

Other design ③
Standard. . . . . = NNNN
Standard and Ex type for cluster II, categories 3G and 3D
on DIN EN 60079 ff . . . . . = NSNN
Reduced shaft run-out, axial run-out according to DIN 42955. . . . = RNNN
Reduced shaft run-out, axial run-out according to DIN 42955 and
Ex type for cluster II, categories 3G and 3D on DIN EN 60079 ff = RSNN

Note:
① Length "B" is only available with encoder "S1", "S3", "M1" and "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"

Standard reference

Standard	Title	Edition
DIN 6885-1	1968-08	Drive Type Fastenings without Taper Action; Parallel Keys, Keyways, Deep Patter
DIN 42955	1981-12	Tolerances of shaft extension run-out of mounting flanges for rotating electrical machinery, test
DIN EN 60079 ff	-	Electrical apparatus for explosive gas atmospheres (ATEX)

Fig.6-16: MSK061 type code (page 2)

Type Codes

6.8 MSK070 Type Code

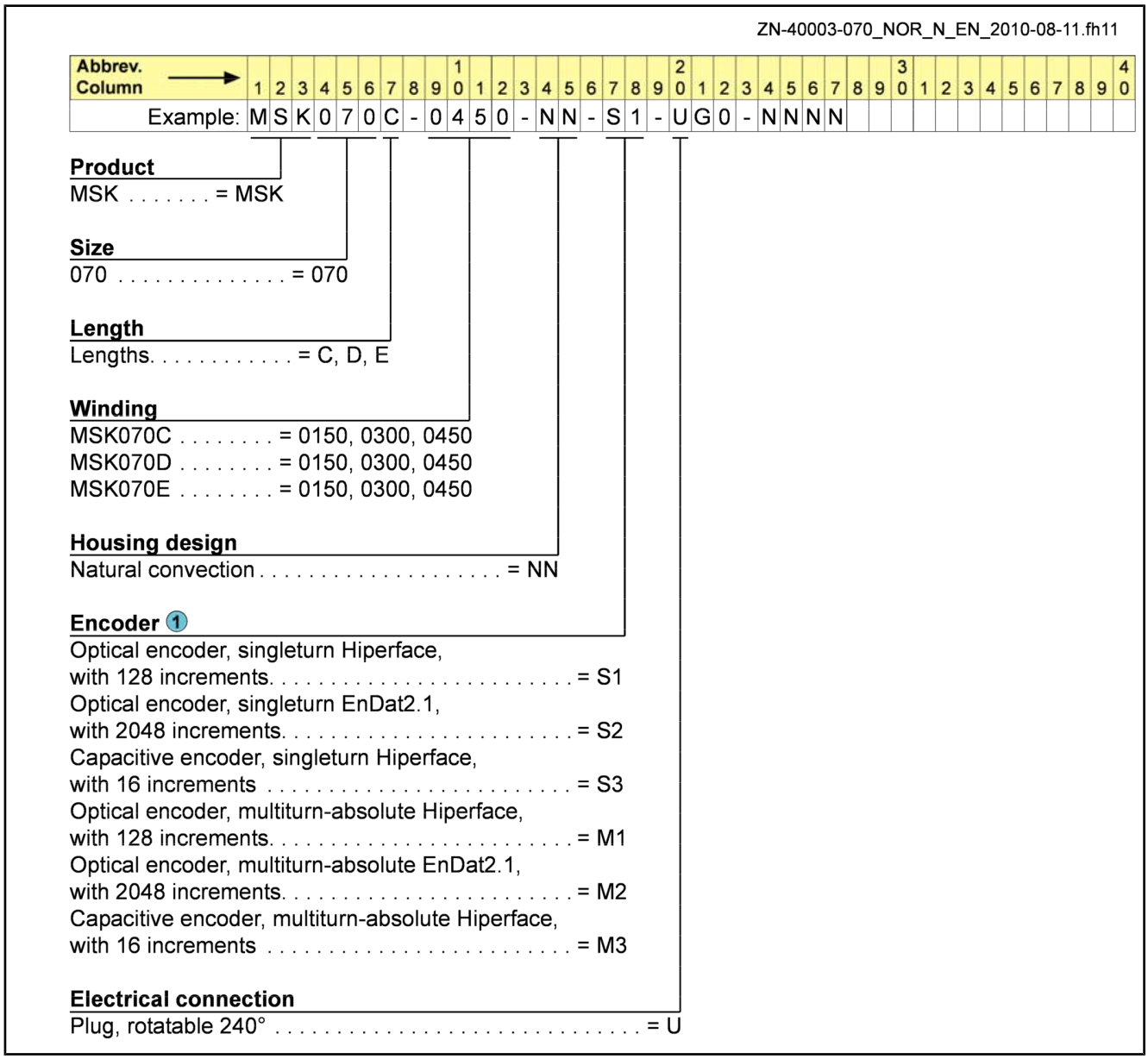


Fig.6-17: MSK070 type code (page 1)

Type Codes

ZN-40003-070_NOR_N_EN_2010-08-11.fh11

Abbrev. 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	0	7	0	C	-	0	4	5	0	-	N	N	-	S	1	-	U	G	0	-	N	N	N	N														

Shaft
Plain shaft with shaft sealing ring (standard). . . . . = G
Shaft with keyway per DIN 6885-1 with shaft sealing ring. . . = P

Holding brake
Without holding brake . . . . . = 0
Holding brake, electrical release, 23 Nm. . . . . = 1

Other design
Standard. . . . . = NNNN
Standard and Ex type for cluster II, categories 3G and 3D
on DIN EN 60079 ff . . . . . = NSNN
Reduced shaft run-out, axial run-out according to DIN 42955. . . . = RNNN
Reduced shaft run-out, axial run-out according to DIN 42955 and
Ex type for cluster II, categories 3G and 3D on DIN EN 60079 ff = RSNN

Note:
(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"

Standard reference

Standard	Edition	Title
DIN 6885-1	1968-08	Drive Type Fastenings without Taper Action; Parallel Keys, Keyways, Deep Patter
DIN 42955	1981-12	Tolerances of shaft extension run-out of mounting flanges for rotating electrical machinery, test
DIN EN 60079 ff	-	Electrical apparatus for explosive gas atmospheres (ATEX)

Fig.6-18: MSK070 type code (page 2)

Type Codes

6.9 MSK071 Type Code

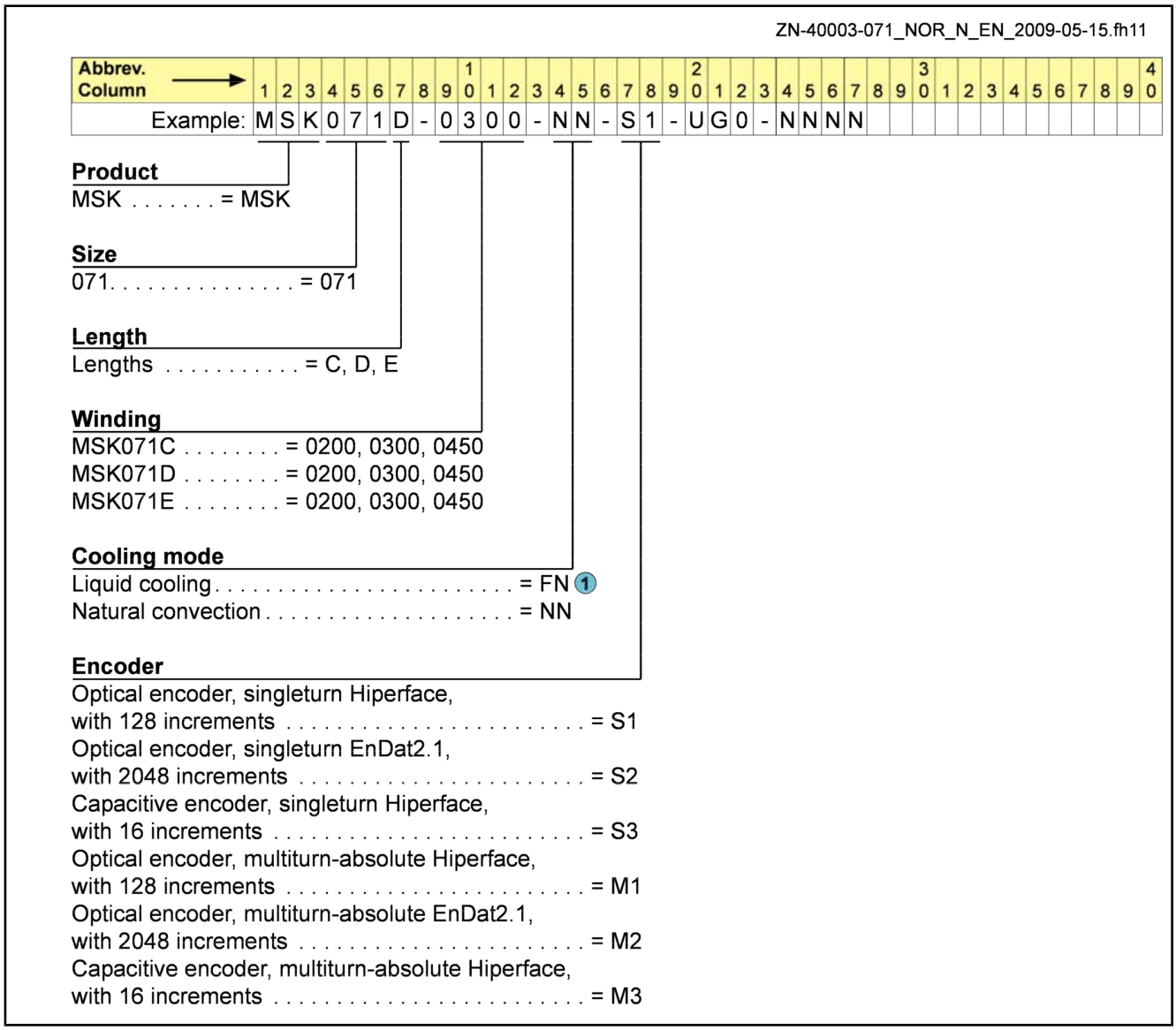


Fig.6-19: MSK071 type code (page 1)

Type Codes

ZN-40003-071_NOR_N_EN_2009-05-15.fh11

Abbrev. 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	0	7	1	D	-	0	3	0	0	-	N	N	-	S	1	-	U	G	0	-	N	N	N	N														

Electrical connection
Plug, rotatable 240° . . . . . = U

Shaft
Plain shaft with shaft sealing ring (Standard). . . . . = G
Shaft with keyway per DIN 6885-1 with shaft sealing ring. . . = P

Holding brake
Without holding brake . . . . . = 0
Holding brake, electrically-released, 23 Nm . . . . . = 1
Holding brake, electrically-released, 30 Nm . . . . . = 2

Other design
Standard. . . . . = NNNN
Standard and Ex type for cluster II, categories 3G and 3D
on DIN EN 60079 ff . . . . . = NSNN
Reduced shaft run-out, axial run-out according to DIN 42955. . . . = RNNN
Reduced shaft run-out, axial run-out according to DIN 42955 and
Ex type for cluster II, categories 3G and 3D on DIN EN 60079 ff = RSNN

Note:
1. Cooling mode "FN" is only available with holding brake "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"

Standard reference

Standard	Edition	Title
DIN 6885-1	1968-08	Drive Type Fastenings without Taper Action; Parallel Keys, Keyways, Deep Patter
DIN 42955	1981-12	Tolerances of shaft extension run-out of mounting flanges for rotating electrical machinery, test
DIN EN 60079 ff	-	Electrical apparatus for explosive gas atmospheres (ATEX)

Fig.6-20: MSK071 type code (page 2)

Type Codes

6.10 MSK075 Type Code

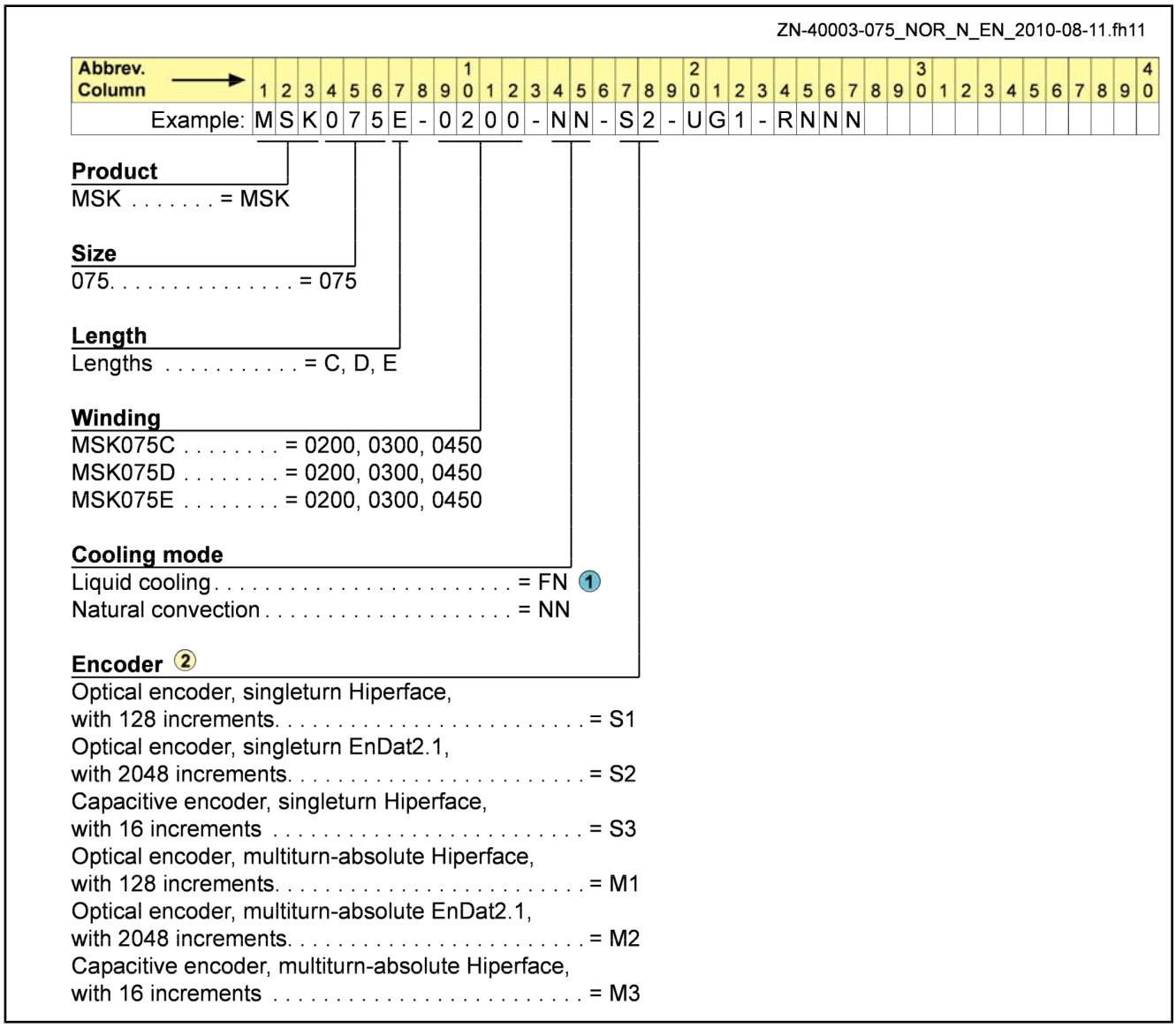


Fig.6-21: MSK075 type code (page 1)

Type Codes

ZN-40003-075_NOR_N_EN_2010-08-11.fh11

Abbrev. Column →	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1	2	3	4	5	6	7	8	9	40
Example:	M	S	K	0	7	5	E	-	0	2	0	0	-	N	N	-	S	2	-	U	G	1	-	R	N	N	N														

Electrical connection
Plug, rotatable 240° . . . . . = U

Shaft
Plain shaft with shaft sealing ring (standard). . . . . = G
Shaft with keyway per DIN 6885-1 with shaft sealing ring. . . = P

Holding brake
Without holding brake . . . . . = 0
Holding brake, electrically-released, 23 Nm . . . . . = 1
Holding brake, electrically-released, 30 Nm . . . . . = 2

Other design
None . . . . . = NNNN
Reduced shaft run-out, axial run-out according to DIN 42955 . . . = RNNN

Note:
1. Cooling mode "FN" is only available with length "E" and winding "0300" and "0450"
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"

Standard reference

Standard	Edition	Title
DIN 6885-1	1968-08	Drive Type Fastenings without Taper Action; Parallel Keys, Keyways, Deep Patter
DIN 42955	1981-12	Tolerances of shaft extension run-out of mounting flanges for rotating electrical machinery, test

Fig.6-22: MSK075 type code (page 2)

Type Codes

6.11 MSK076 Type Code

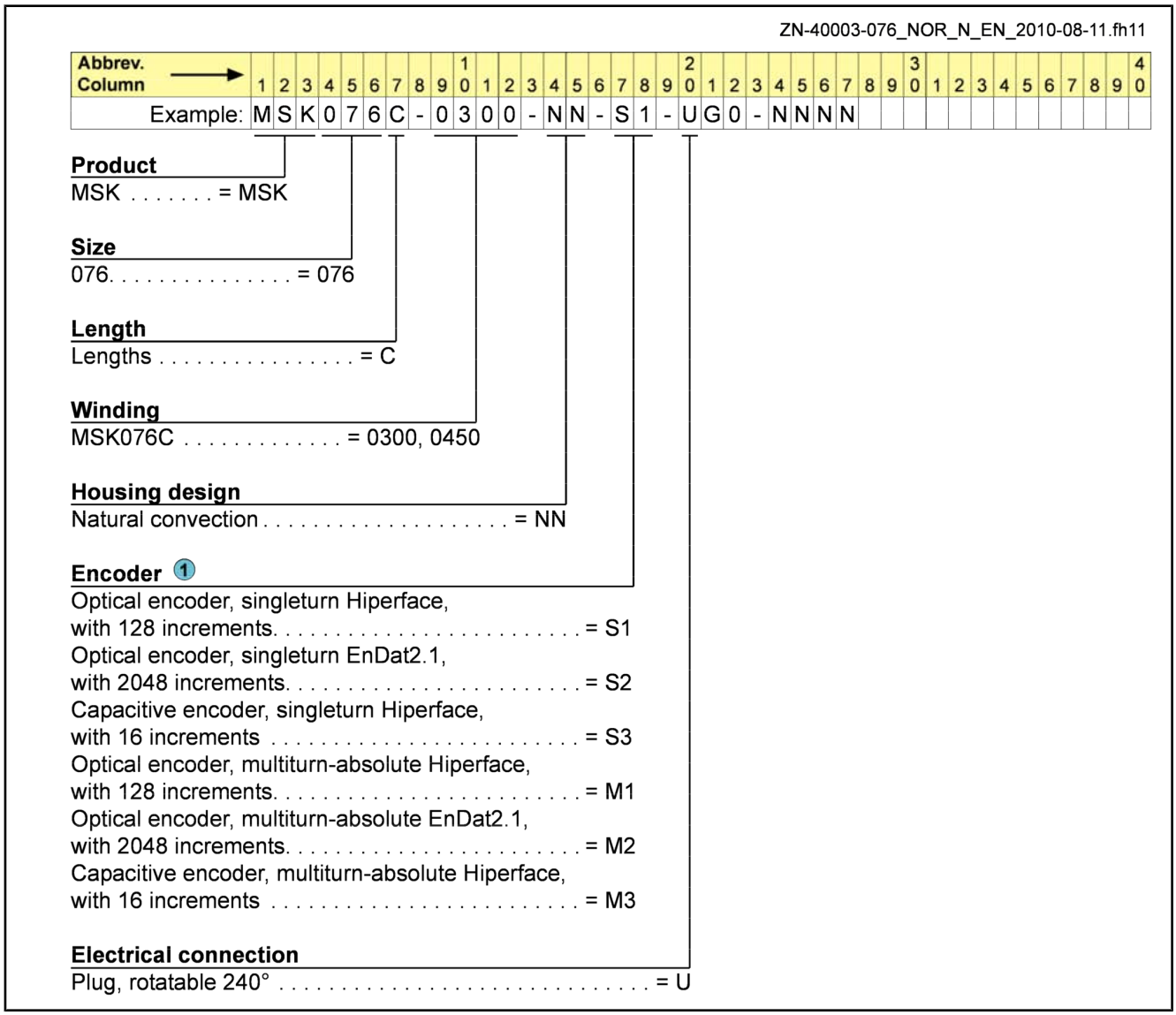


Fig.6-23: MSK076 type code (page 1)

Type Codes

ZN-40003-076_NOR_N_EN_2010-08-11.fh11

Abbrev. 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	0	7	6	C	-	0	3	0	0	-	N	N	-	S	1	-	U	G	0	-	N	N	N	N														

Shaft
Plain shaft with shaft sealing ring (standard). . . . . = G
Shaft with keyway per DIN 6885-1 with shaft sealing ring. . . = P

Holding brake
Without holding brake . . . . . = 0
Holding brake, electrical release, 11 Nm. . . . . = 1

Other design
Standard . . . . . = NNNN
Standard and Ex type for cluster II, categories 3G and 3D
on DIN EN 60079 ff . . . . . = NSNN
Reduced shaft run-out, axial run-out according to DIN 42955 . . . = RNNN
Reduced shaft run-out, axial run-out according to DIN 42955 and
Ex type for cluster II, categories 3G and 3D on DIN EN 60079 ff = RSNN

Note:
(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"

Standard reference

Standard	Edition	Title
DIN 6885-1	1968-08	Drive Type Fastenings without Taper Action; Parallel Keys, Keyways, Deep Patter
DIN 42955	1981-12	Tolerances of shaft extension run-out of mounting flanges for rotating electrical machinery, test
DIN EN 60079 ff	-	Electrical apparatus for explosive gas atmospheres (ATEX)

Fig.6-24: MSK076 type code (page 2)

Type Codes

6.12 MSK100 Type Code

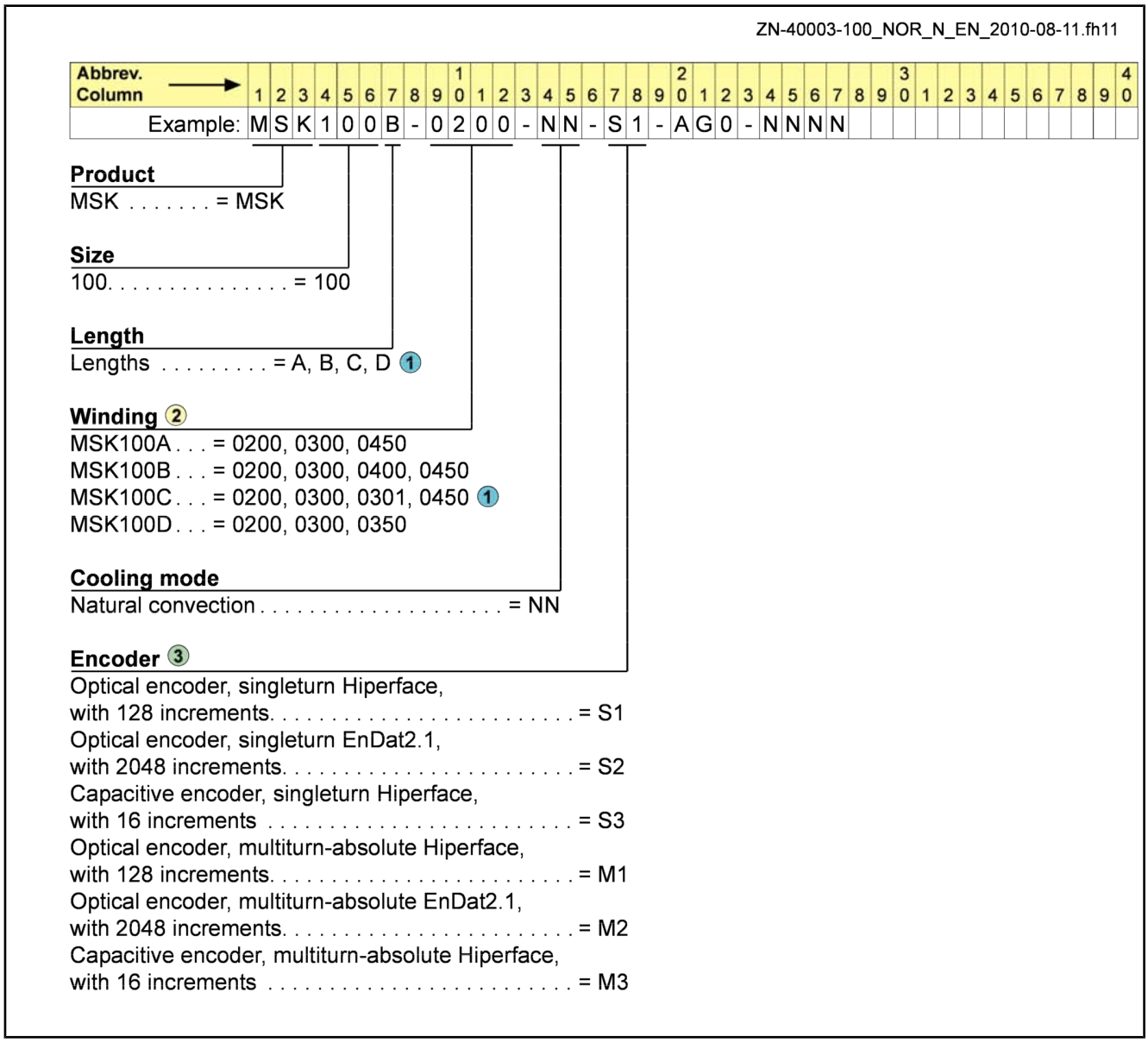


Fig.6-25: MSK100 type code (page 1)

Type Codes

ZN-40003-100_NOR_N_EN_2010-08-11.fh11

Abbrev. 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													

Electrical connection (4)

Connector, A-Side . . . . . = A
Connector, B-Side . . . . . = B
Connector, left . . . . . = L
Connector, right . . . . . = R

Shaft

Plain shaft with shaft sealing ring (standard). . . . . = G
Shaft with keyway per 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

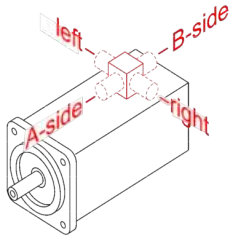
Standard. . . . . = NNNN
Standard and Ex type for cluster II, categories 3G and 3D
on DIN EN 60079 ff . . . . . = NSNN
Reduced shaft run-out, axial run-out according to DIN 42955. . . . = RNNN
Reduced shaft run-out, axial run-out according to DIN 42955 and
Ex type for cluster II, categories 3G and 3D on DIN EN 60079 ff = RSNN

Note:

(1) Length "C" and winding "300" are only available with other design "NNNN" and "RNNN"
(2) Windings "0450" is only available with other design "NNNN" and "RNNN"
Windings "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) Looking from front onto driven shaft (see picture 1)
(5) Holding brake "1" is only available with length "A" and "B"
Holding brake "2" is not available with length "A"

Illustration example

Position of power connection = top



Picture 1

Standard reference

Standard	Edition	Title
DIN 6885-1	1968-08	Drive Type Fastenings without Taper Action; Parallel Keys, Keyways, Deep Patter
DIN 42955	1981-12	Tolerances of shaft extension run-out of mounting flanges for rotating electrical machinery, test
DIN EN 60079 ff	-	Electrical apparatus for explosive gas atmospheres (ATEX)

Fig.6-26: MSK100 type code (page 2)

Type Codes

6.13 MSK101 Type Code

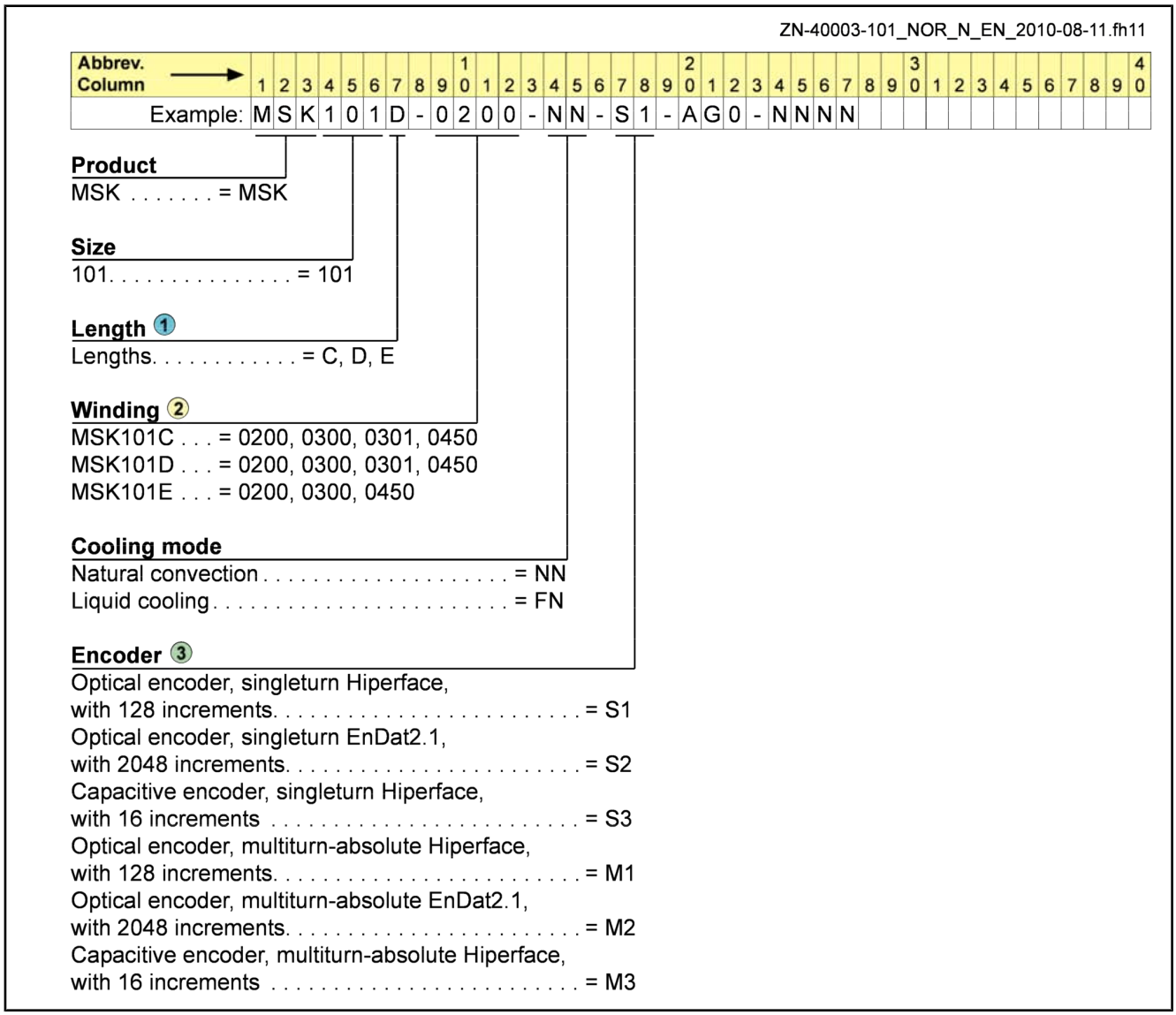


Fig.6-27: MSK101 type code (page 1)

Type Codes

ZN-40003-101_NOR_N_EN_2010-08-11.fh11

Abbrev. 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	1	D	-	0	2	0	0	-	N	N	-	S	1	-	A	G	0	-	N	N	N	N														

Electrical connection ④
Connector, A-Side . . . . . = A
Connector, B-Side . . . . . = B
Connector, left. . . . . = L
Connector, right. . . . . = R

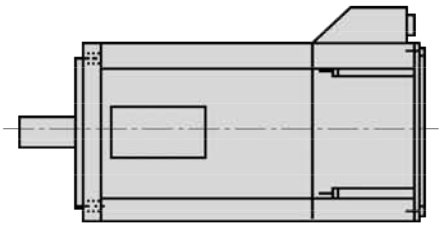
Shaft
Plain shaft with shaft sealing ring (standard). . . . . = G
Shaft with keyway per DIN 6885-1 with shaft sealing ring. . . = P

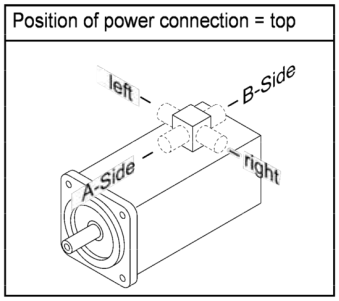
Holding brake ⑤
Without holding brake. . . . . = 0
Holding brake, electrically-released, 70 Nm . . . . . = 2
Holding brake, electrically-released, 120 Nm . . . . . = 3

Other design ⑥
Standard. . . . . = NNNN
Standard and Ex type for cluster II, categories 3G and 3D
on DIN EN 60079 ff . . . . . = NSNN
Reduced shaft run-out, axial run-out according to DIN 42955. . . . = RNNN
Reduced shaft run-out, axial run-out according to DIN 42955 and
Ex type for cluster II, categories 3G and 3D on DIN EN 60079 ff = RSNN

Note:
① Length "E" is only available with other design "NNNN" and "RNNN"
② Windings "0300" and "0450" are 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 Looking from front onto driven shaft (see picture 1)
⑤ Holding brake "3" is not available with length "C"
⑥ Other design "NSNN" and "RSNN" are not availalble with cooling mode "FN" and holding brake "3"

Illustration example





Picture 1

Standard reference

Standard	Edition	Title
DIN 6885-1	1968-08	Drive Type Fastenings without Taper Action; Parallel Keys, Keyways, Deep Patter
DIN 42955	1981-12	Tolerances of shaft extension run-out of mounting flanges for rotating electrical machinery, test
DIN EN 60079 ff	-	Electrical apparatus for explosive gas atmospheres (ATEX)

Fig.6-28: MSK101 type code (page 2)

Type Codes

6.14 MSK103 Type Code

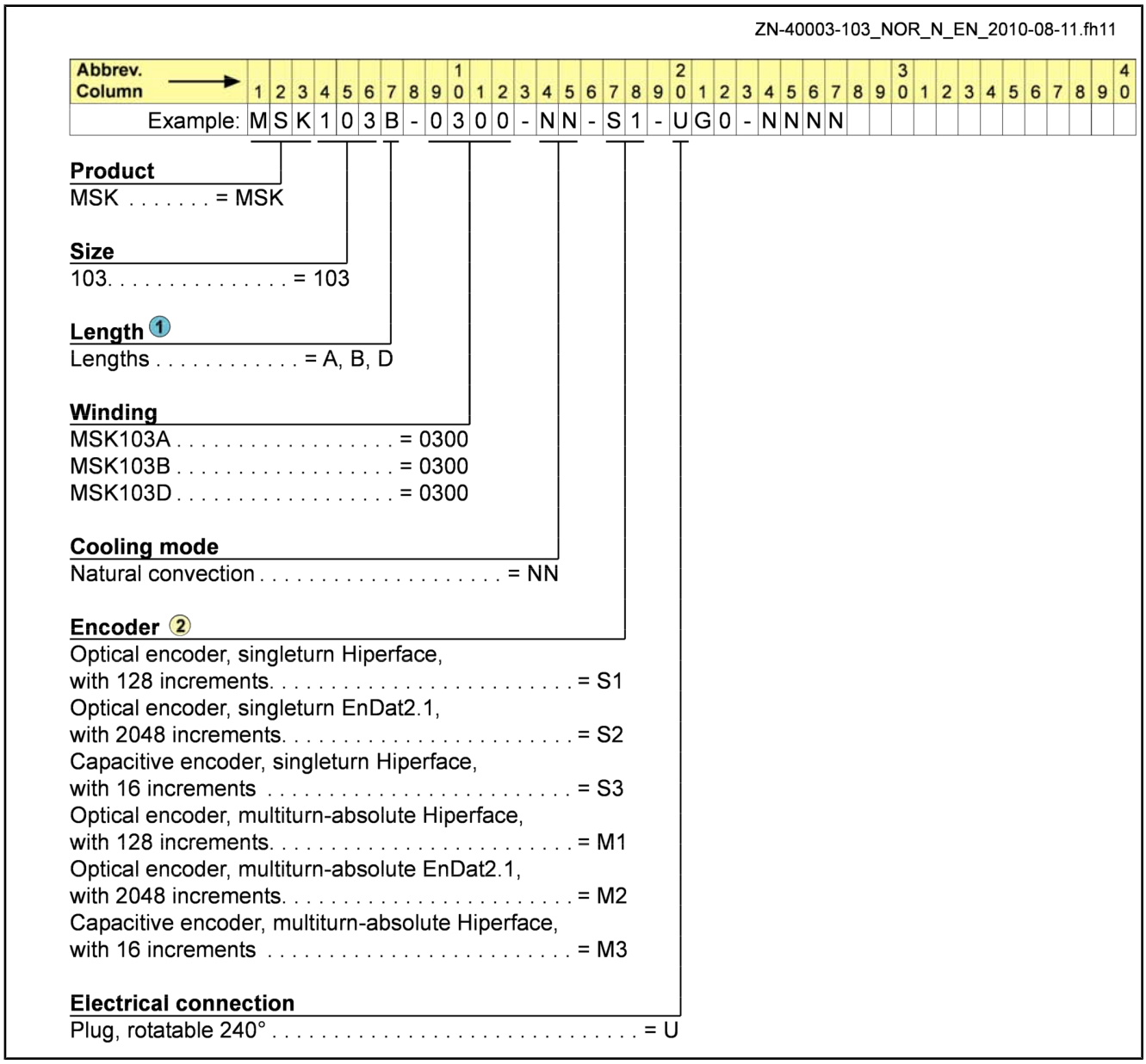


Fig.6-29: MSK103 type code (page 1)

Type Codes

ZN-40003-103_NOR_N_EN_2010-08-11.fh11

Abbrev. 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	3	B	-	0	3	0	0	-	N	N	-	S	1	-	U	G	0	-	N	N	N	N														

Shaft
Plain shaft with shaft sealing ring (standard). . . . . = G

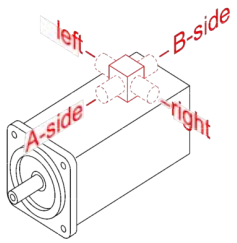
Holding brake ③
Without holding brake. . . . . = 0
Holding brake, electrically-released, 33 Nm . . . . . = 1
Holding brake, electrically-released, 60 Nm . . . . . = 2

Other design
Standard. . . . . = NNNN
Reduced shaft run-out, axial run-out according to DIN 42955 . . . = RNNN

Note:
① Length "A" is only available with other design "NNNN"
② Encoder "S1", "S3", M1" and "M3" are only available with other design "NNNN"
Encoder "S2" and "M2" are only available with other design "RNNN"
③ Holding brake "1" is only available with length "A" and "B"
Holding brake "2" is only available with length "D"

Illustration example

Position of power connection = top



Picture 1

Standard reference

Standard	Edition	Title
DIN 42955	1981-12	Tolerances of shaft extension run-out of mounting flanges for rotating electrical machinery, test

Fig.6-30: MSK103 type code (page 2)

Type Codes

6.15 MSK131 Type Code

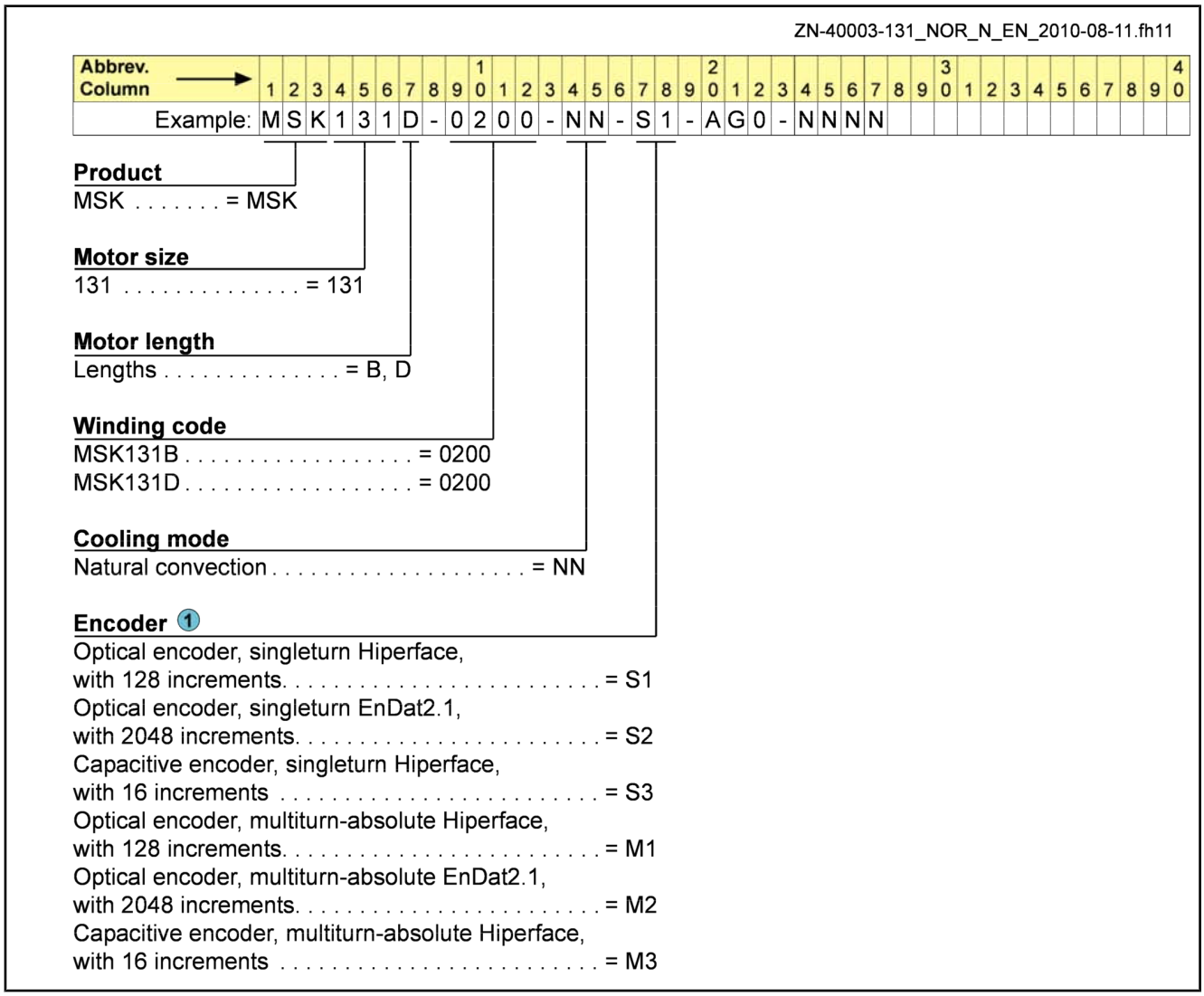


Fig.6-31: MSK131 type code (page 1)

Type Codes

ZN-40003-131_NOR_N_EN_2010-08-11.fh11

Abbrev. 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	3	1	D	-	0	2	0	0	-	N	N	-	S	1	-	A	G	0	-	N	N	N	N														

Electrical connection (2)
Connector, A-Side . . . . . = A
Connector, B-Side . . . . . = B
Connector, left. . . . . = L
Connector, right. . . . . = R

Shaft
Plain shaft with shaft sealing ring (standard). . . . . = G
Shaft with keyway per DIN 6885-1 with shaft sealing ring. . . = P

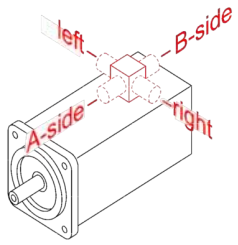
Holding brake
Without holding brake. . . . . = 0
Holding brake, electrically-released, 100 Nm . . . . . = 1
Holding brake, electrically-released, 240 Nm . . . . . = 2 (3)

Other design
None. . . . . = NNNN
Increased shaft run-out, axial run-out according to DIN 42955. . . = RNNN

Note:
(1) Encoder "S1", "S3", M1" and "M3" are only available with other design "NNNN"
Encoder "S2" and "M2" are only available with other design "RNNN"
(2) Looking from front onto driven shaft (see picture 1)
(3) Holding brake "2" is only available with length "D"

Illustration example

Position of power connection = top



Picture 1

Standard reference

Standard	Edition	Title
DIN 6885-1	1968-08	Drive Type Fastenings without Taper Action; Parallel Keys, Keyways, Deep Patter
DIN 42955	1981-12	Tolerances of shaft extension run-out of mounting flanges for rotating electrical machinery, test

Fig.6-32: MSK131 type code (page 2)

7 Fan Units for MSK Motors

7.1 Field of Application of Fan Units

MSK motors from size 060 can be equipped with fan units. The fan units LEM are available as accessory. Special motors can be delivered with factory-mounted fan units. Fan units are intended for mounting on motors used in high repetition rates or continuous operation.

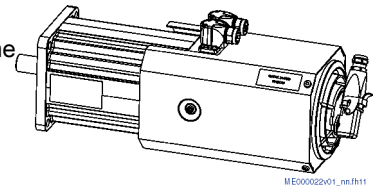
NOTICE **Damage to property due to improper application of motors with fan units**

Motors with mounted fan units are not suited for applications with continuous shock load, e.g. pressing, squeezing, chargers, ...

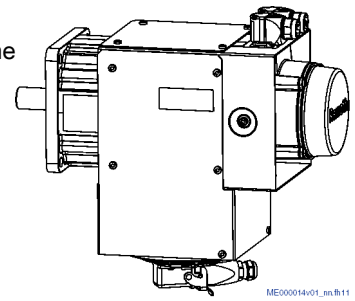
In such a case, use motors with bigger performance without fan units .

The following frame sizes are available.

Axial
For applications that make a slight frame size necessary.



Radial
For applications that make a short frame size necessary.



Fan Units for MSK Motors

7.2 Technical Data of Fan Units

Type	Degree of protection [1]	UL	U_N [V]	f_N [Hz]	I_N [A]	L_P [dB(A)]	m_L[kg]
LEM-AB-116T-11-NNNN	IP 65	self protected	115 ±10%	60	042	<75	2.3
LEM-RB-116T-11-NNNN							3.0
LEM-AB-116T-21-NNNN	IP 65	self protected	230 ±10%	50/60	0.19 / 0.17	<75	2.3
LEM-RB-116T-21-NNNN							3.0
LEM-AB-140T-11-NNNN	IP 65	self protected	115 ±10%	60	0.44	<75	3.1
LEM-RB-140T-11-NNNN							3.5
LEM-AB-140T-21-NNNN	IP 65	self protected	230 ±10%	50/60	0.20 / 0.18	<75	3.1
LEM-RB-140T-21-NNNN							3.5
LEM-AB-192T-11-NNNN	IP 65	self protected	115 ±10%	60	0.48	<75	4.3
LEM-RB-192T-11-NNNN							3.6
LEM-AB-192T-21-NNNN	IP 65	self protected	230 ±10%	50/60	0.21 / 0.20	<75	4.3
LEM-RB-192T-21-NNNN							3.6
LEM-AB-260N-32-NNNN	IP 65	-	400 … 480	50/60	0.12 / 0.15 [2]	<75	8.6

1) specified protection mode valid for fan motor; for further information about protection modes refer to chapter 9.2 "Degree of Protection" on page 212.

2) Power consumption at 400V

Fig.7-1: Technical data of fan units

7.3 Type Code for Fan Units

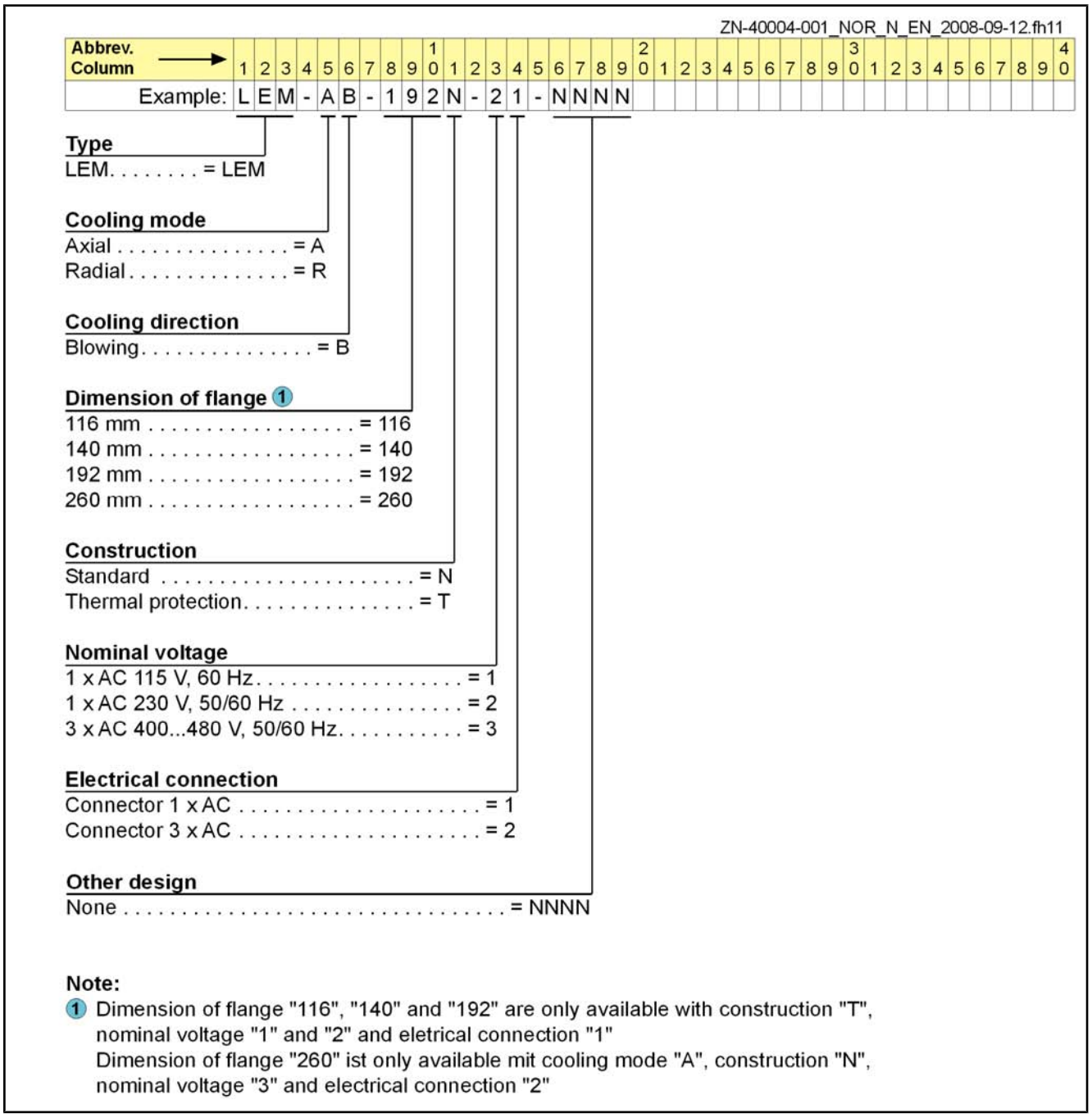


Fig.7-2: Type code of fan units LEM for MSK motors

Fan Units for MSK Motors

7.4 Fan Units Selection Table

Select the fan unit for the motor type required from the following table

	LEM-AB-116T-□□-NNNN	LEM-RB-116T-□□-NNNN	LEM-AB-140T-□□-NNNN	LEM-RB-140T-□□-NNNN	LEM-AB-192T-□□-NNNN	LEM-RB-192T-□□-NNNN	LEM-AB-260N-□□-NNNN
MSK060B-□□□□-NN-□□-□□0-□□□□	-	-	-	-	-	-	-
MSK060B-□□□□-NN-□□-□□1-□□□□	-	-	-	-	-	-	-
MSK060C-□□□□-NN-□□-□□0-□□□□	■	□	-	-	-	-	-
MSK060C-□□□□-NN-□□-□□1-□□□□	■	■	-	-	-	-	-
MSK061B-□□□□-NN-□□-□□0-□□□□	-	-	-	-	-	-	-
MSK061B-□□□□-NN-□□-□□1-□□□□	-	-	-	-	-	-	-
MSK061C-□□□□-NN-□□-□□0-□□□□	■	■	-	-	-	-	-
MSK061C-□□□□-NN-□□-□□1-□□□□	■	■	-	-	-	-	-
MSK070C-□□□□-NN-□□-□□0-□□□□	-	-	■	-	-	-	-
MSK070C-□□□□-NN-□□-□□1-□□□□	-	-	■	-	-	-	-
MSK070D-□□□□-NN-□□-□□0-□□□□	-	-	■	□	-	-	-
MSK070D-□□□□-NN-□□-□□1-□□□□	-	-	■	□	-	-	-
MSK070E-□□□□-NN-□□-□□0-□□□□	-	-	■	■	-	-	-
MSK070E-□□□□-NN-□□-□□1-□□□□	-	-	■	■	-	-	-
MSK071C-□□□□-NN-□□-□□0-□□□□	-	-	■	■	-	-	-
MSK071C-□□□□-NN-□□-□□1-□□□□	-	-	■	■	-	-	-
MSK071C-□□□□-NN-□□-□□2-□□□□	-	-	■	■	-	-	-
MSK071D-□□□□-NN-□□-□□0-□□□□	-	-	■	■	-	-	-
MSK071D-□□□□-NN-□□-□□1-□□□□	-	-	■	■	-	-	-
MSK071D-□□□□-NN-□□-□□2-□□□□	-	-	■	■	-	-	-
MSK071E-□□□□-NN-□□-□□0-□□□□	-	-	■	■	-	-	-
MSK071E-□□□□-NN-□□-□□1-□□□□	-	-	■	■	-	-	-
MSK071E-□□□□-NN-□□-□□2-□□□□	-	-	■	■	-	-	-
MSK075C-□□□□-NN-□□-□□0-□□□□	-	-	■	■	-	-	-
MSK075C-□□□□-NN-□□-□□1-□□□□	-	-	■	■	-	-	-
MSK075C-□□□□-NN-□□-□□2-□□□□	-	-	■	■	-	-	-
MSK075D-□□□□-NN-□□-□□0-□□□□	-	-	■	■	-	-	-
MSK075D-□□□□-NN-□□-□□1-□□□□	-	-	■	■	-	-	-
MSK075E-□□□□-NN-□□-□□0-□□□□	-	-	■	■	-	-	-
MSK075E-□□□□-NN-□□-□□1-□□□□	-	-	■	■	-	-	-
MSK075E-□□□□-NN-□□-□□2-□□□□	-	-	■	■	-	-	-
MSK075E-□□□□-NN-□□-□□3-□□□□	-	-	■	■	-	-	-
MSK076C-□□□□-NN-□□-□□0-□□□□	-	-	■	□	-	-	-
MSK076C-□□□□-NN-□□-□□1-□□□□	-	-	■	□	-	-	-
MSK100A-□□□□-NN-□□-□□0-□□□□	-	-	-	-	■	-	-
MSK100A-□□□□-NN-□□-□□1-□□□□	-	-	-	-	■	-	-
MSK100B-□□□□-NN-□□-□□0-□□□□	-	-	-	-	■	■	-
MSK100B-□□□□-NN-□□-□□1-□□□□	-	-	-	-	■	■	-
MSK100B-□□□□-NN-□□-□□2-□□□□	-	-	-	-	■	■	-
MSK100C-□□□□-NN-□□-□□0-□□□□	-	-	-	-	■	■	-
MSK100C-□□□□-NN-□□-□□1-□□□□	-	-	-	-	■	■	-
MSK100C-□□□□-NN-□□-□□2-□□□□	-	-	-	-	■	■	-
MSK100D-□□□□-NN-□□-□□0-□□□□	-	-	-	-	■	■	-
MSK100D-□□□□-NN-□□-□□1-□□□□	-	-	-	-	■	■	-
MSK100D-□□□□-NN-□□-□□2-□□□□	-	-	-	-	■	■	-
MSK101C-□□□□-NN-□□-□□0-□□□□	-	-	-	-	■	□	-
MSK101C-□□□□-NN-□□-□□2-□□□□	-	-	-	-	■	□	-
MSK101D-□□□□-NN-□□-□□0-□□□□	-	-	-	-	■	■	-
MSK101D-□□□□-NN-□□-□□1-□□□□	-	-	-	-	■	■	-
MSK101D-□□□□-NN-□□-□□2-□□□□	-	-	-	-	■	■	-
MSK101D-□□□□-NN-□□-□□3-□□□□	-	-	-	-	■	■	-
MSK101E-□□□□-NN-□□-□□0-□□□□	-	-	-	-	■	■	-
MSK101E-□□□□-NN-□□-□□1-□□□□	-	-	-	-	■	■	-

	LEM-AB-116T-□□-NNNN	LEM-RB-116T-□□-NNNN	LEM-AB-140T-□□-NNNN	LEM-RB-140T-□□-NNNN	LEM-AB-192T-□□-NNNN	LEM-RB-192T-□□-NNNN	LEM-AB-260N-□□-NNNN
MSK101E-□□□□-NN-□□-□□2-□□□□	-	-	-	-	■	■	-
MSK101E-□□□□-NN-□□-□□3-□□□□	-	-	-	-	■	■	-
MSK103A-□□□□-NN-□□-□□0-□□□□	-	-	-	-	-	-	-
MSK103A-□□□□-NN-□□-□□1-□□□□	-	-	-	-	-	-	-
MSK103B-□□□□-NN-□□-□□0-□□□□	-	-	-	-	-	-	-
MSK103B-□□□□-NN-□□-□□1-□□□□	-	-	-	-	-	-	-
MSK103D-□□□□-NN-□□-□□0-□□□□	-	-	-	-	-	-	-
MSK103D-□□□□-NN-□□-□□2-□□□□	-	-	-	-	-	-	-
MSK131B-□□□□-NN-□□-□□0-□□□□	-	-	-	-	-	-	■
MSK131B-□□□□-NN-□□-□□1-□□□□	-	-	-	-	-	-	■
MSK131D-□□□□-NN-□□-□□0-□□□□	-	-	-	-	-	-	■
MSK131D-□□□□-NN-□□-□□1-□□□□	-	-	-	-	-	-	■
MSK131D-□□□□-NN-□□-□□2-□□□□	-	-	-	-	-	-	■

- not deliverable, assembly not possible
■ ex works mounted deliverable
□ deliverable as adapter kit.

Fig.7-3: Selection table motor - fan unit

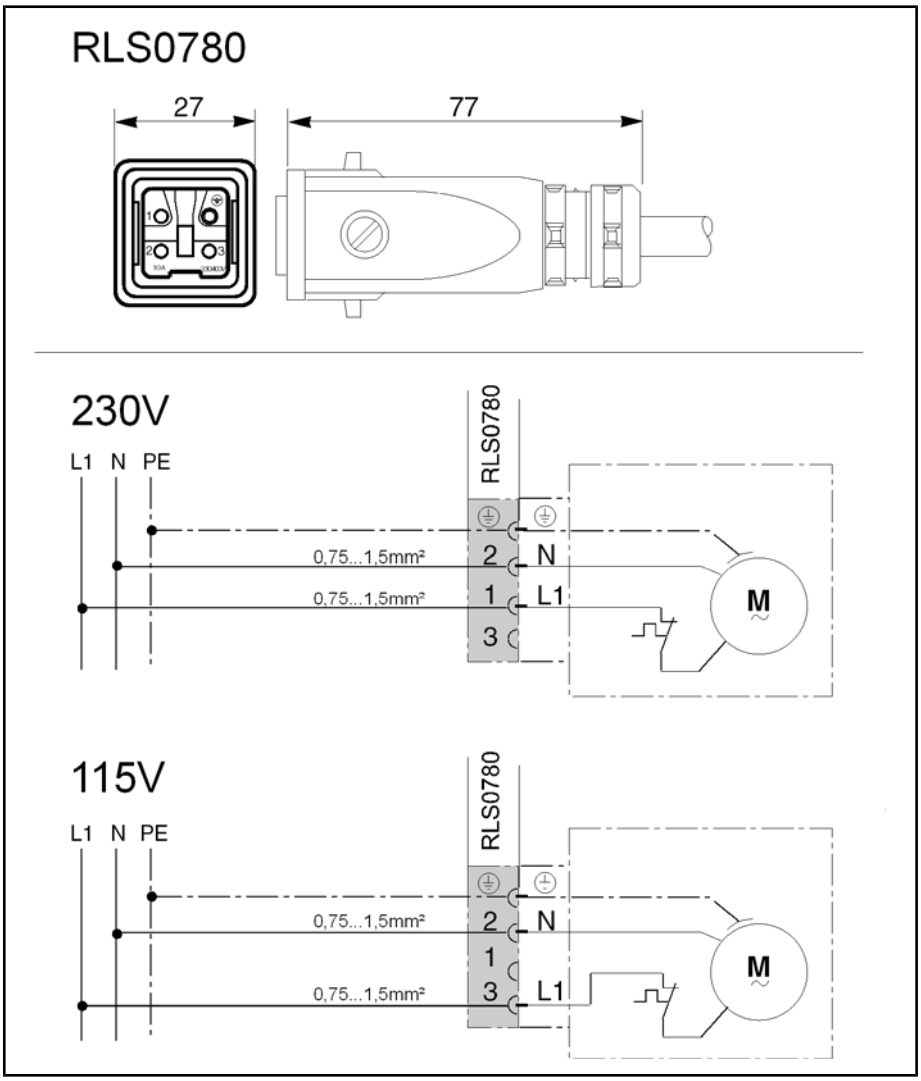
☞ Mounting order for as "adapter kit □" delivered fan units:

1. Flange on the motor without fan unit onto the machine
2. Mount the fan unit

Fan Units for MSK Motors

7.5 Fan Units Electrical Connection

7.5.1 Connection 1-phase



RLS0780 Clamping area cable gland 7 ... 10 mm

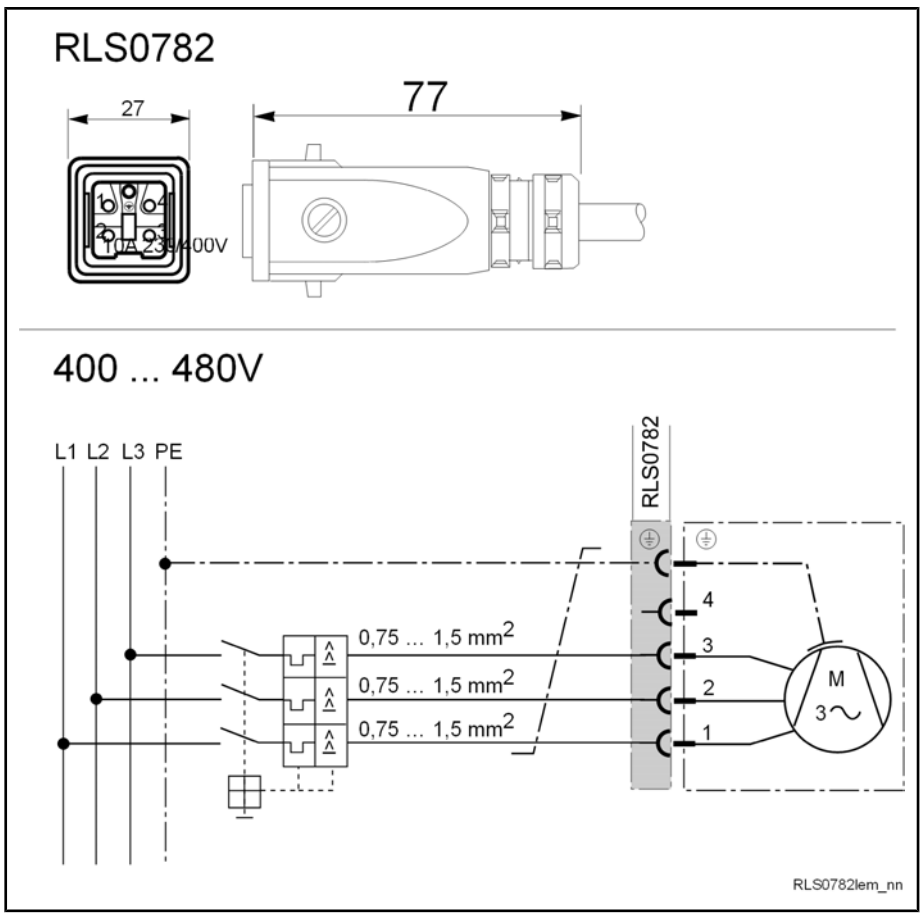
Fig.7-4: Fan connection 1-phase with protection switch

LEM fan units in design "T" with integrated thermo protection do not need any circuit with external motor protection switch.

Protection from false connection!

- 230V: L1 auf Pin 1
- 115V: L1 auf Pin 3

7.5.2 Connection 3-phase



RLS0782 Clamping area cable gland 7 ... 10 mm

Fig.7-5: Fan connection 3-phase with protection switch

Protection due to motor protection switch

The activation of the fan units is done via the adjustable motor protection device.

The activate principle of the motor protection switch is based on the fact that the motor current-carrying bimetal trip heats up faster than the motor winding and it separates this from the mains before critical temperature values are reached.

The motor protection switches are adjusted to the rated current of the fan unit. Heed when selecting the motor protection switch that the adjustable range must agree with the rated current of the fan unit.

7.6 Ordering Fan Units

Motor with attached fan unit

In order to procure a motor with attached fan unit, the type designation of the fan unit must be specified as an ordering subitem of the motor with the fan arrangement desired.

Ordering item	Ordering designation
1	Synchronous motor MSK100B-0300-NN-S1-BG1-NNNN
1.1	Fan unit LEM-AB-192T-11-NNNN mounted on position 1

Motor with separate fan unit

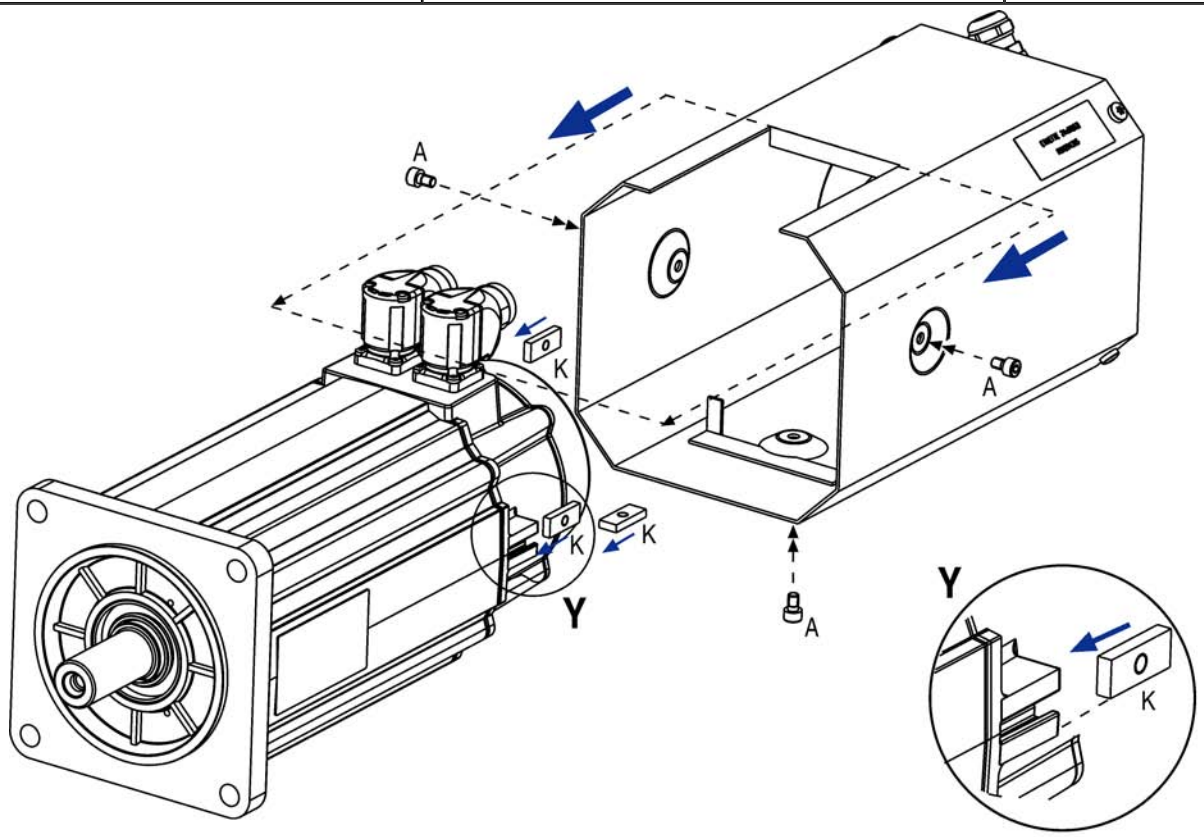
If it is specified as an independent ordering item, the fan unit is supplied separately from the motor (i.e. not attached to the latter).

Ordering item	Ordering designation
1	Synchronous motor MSK100B-0300-NN-S1-BG1-NNNN
2	Fan unit LEM-AB-192T-11-NNNN

7.7 Assemble Fan Units

7.7.1 Assembly Fan Unit Axial, Flange dimension 116/140

Valid for types:	LEM-AB116T-xx-NNNN LEM-AB140T-xx-NNNN	



Part	Designation	Type	L/B/H [mm]	Screw type	M_{GA}[Nm]	Number
K	Ridge	LEM-AB116T	25/8/3	-	-	3
K	Ridge	LEM-AB140T	25/10/4	-	-	3
A	Fastening screw	LEM-AB116T	-	M5 x 8	4.0	3
A	Fastening screw	LEM-AB140T	-	M5 x 8	6.0	3

Mounting instructions:

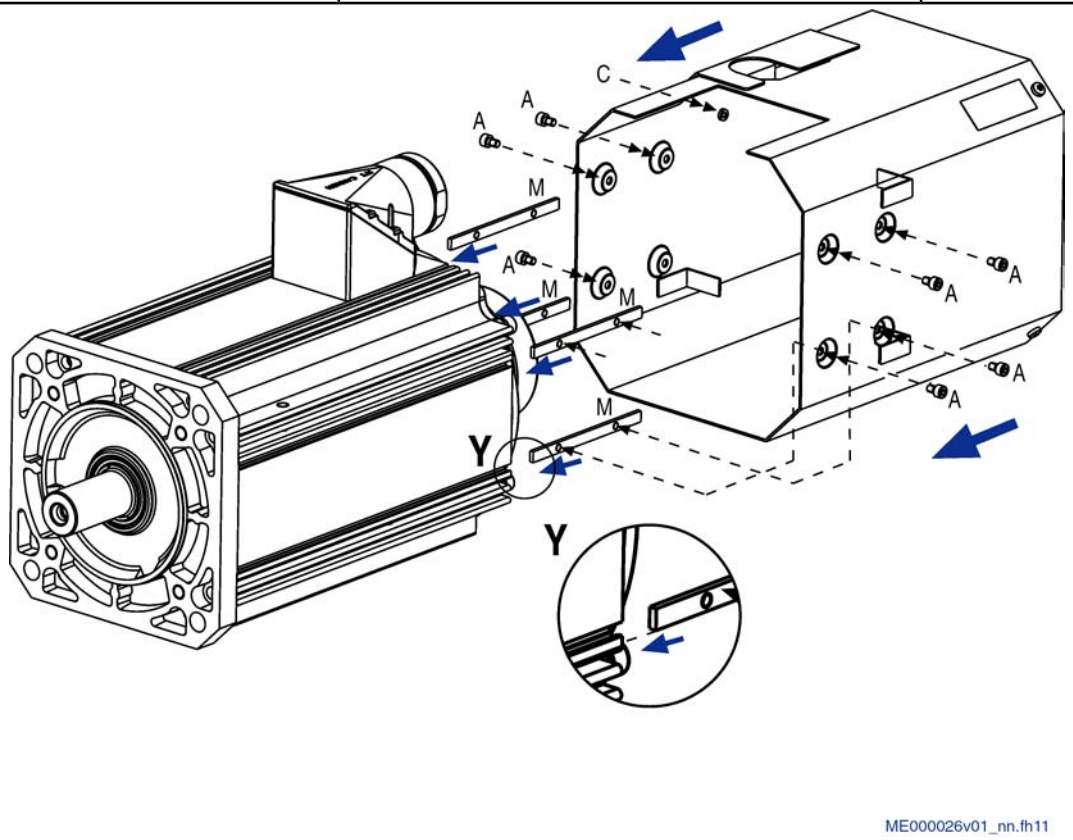
1. Insert the ridges K as far as it will go into the groovings on the end shield.
2. Insert the fan unit onto the end shield.
3. Tighten the fastening screws A. For tightening torque see table. Use screw fastener **Loctite® 243™**.
4. Electrical connection according to the connection plan.

Fig.7-6: Assembly fan unit sxial, flange dimension 116/140

Fan Units for MSK Motors

7.7.2 Assembly Fan Unit Axial, Flange Dimension 192

Valid for types:	LEM-AB-192N-xx-NNNN LEM-AB-192T-xx-NNNN	



Part	Designation	Type	L/B/H [mm]	Screw type	M_{GA}[Nm]	Number
M	Ridge	LEM-AB192N / ...T	113/8/3	-	-	4
A	Fastening screw	LEM-AB192N / ...T	-	M5 x 8	4.0	8
C	Cover of encoder cable output	LEM-AB192N / ...T	-	M4 x 8	3.1	3

Mounting instructions:

1. Insert the ridges M into the groovings on the housing.
2. Insert the fan unit as far as it will go onto the housing.
3. Tighten the fastening screws A. Tightening torque see table. Use screw fastener **Loctite® 243™**.
4. If necessary loosen the cover of the encoder cable output, connect the encoder cable and mount the cover. Refer to the table for tightening torque of the fastening screws for the cover encoder cable output.
5. Electrical connection according to the connection plan.

Fig.7-7: Assembly fan unit axial, flange dimension 192

Fan Units for MSK Motors

7.7.3 Assembly Fan Unit Axial, Flange Dimension 116/140

Valid for types:	LEM-RB-116T-xx-NNNN LEM-RB-140T-xx-NNNN	

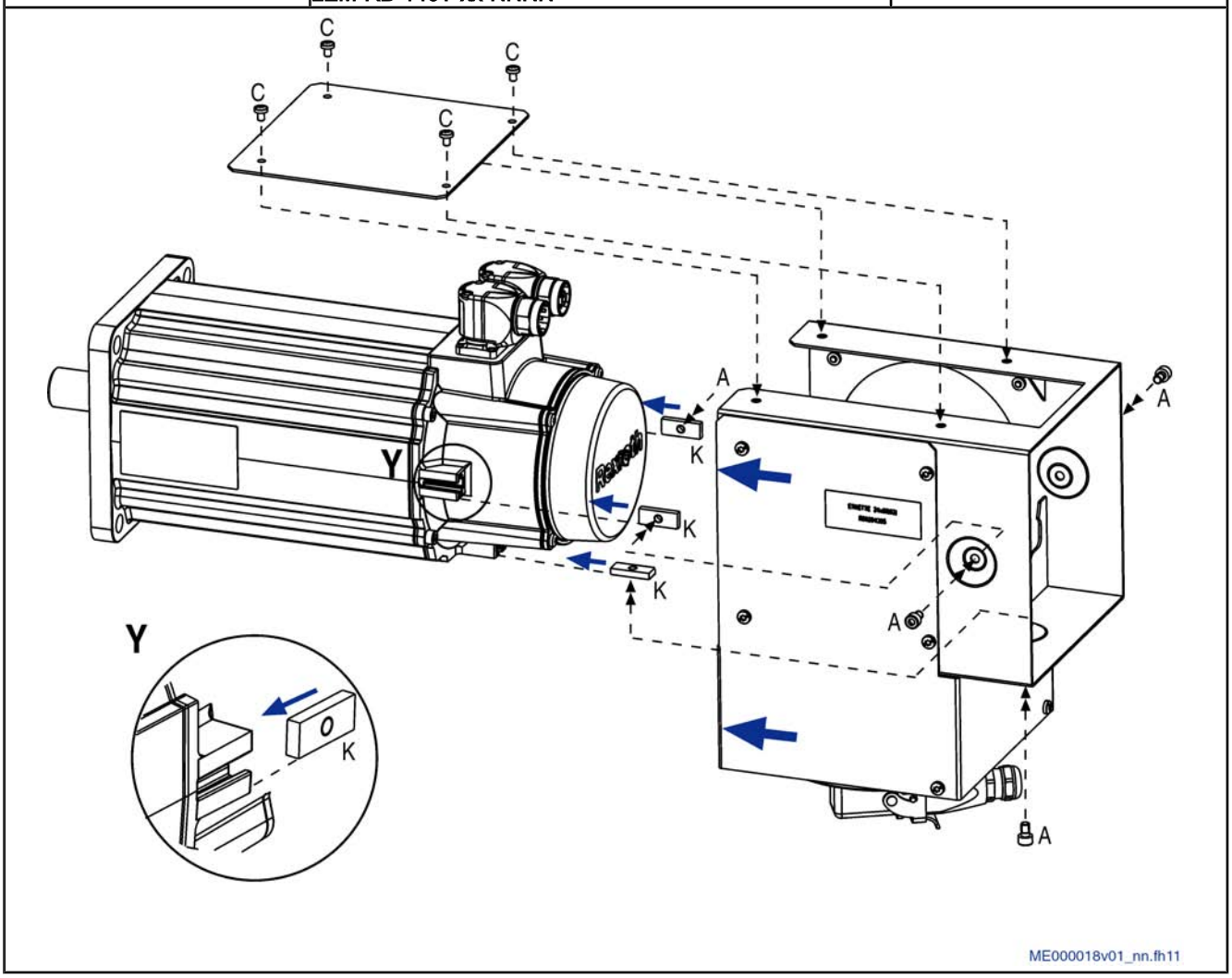


Fig.7-8: Assembly Fan Unit Radial, Flange Dimension 116/140

Part	Designation	Type	L/B/H [mm]	Screw type	M_{GA}[Nm]	Number
K	Ridge	LEM-AB116T	25/8/3	-	-	3
K	Ridge	LEM-AB140AT	25/10/4	-	-	3
A	Fastening screw	LEM-AB116N T	-	M5 x 8	4.0	3
A	Fastening screw	LEM-AB140AT	-	M5 x 8	6.0	3
C	Fastening screw	LEM-AB116NT	-	M4 x 6	3.1	4

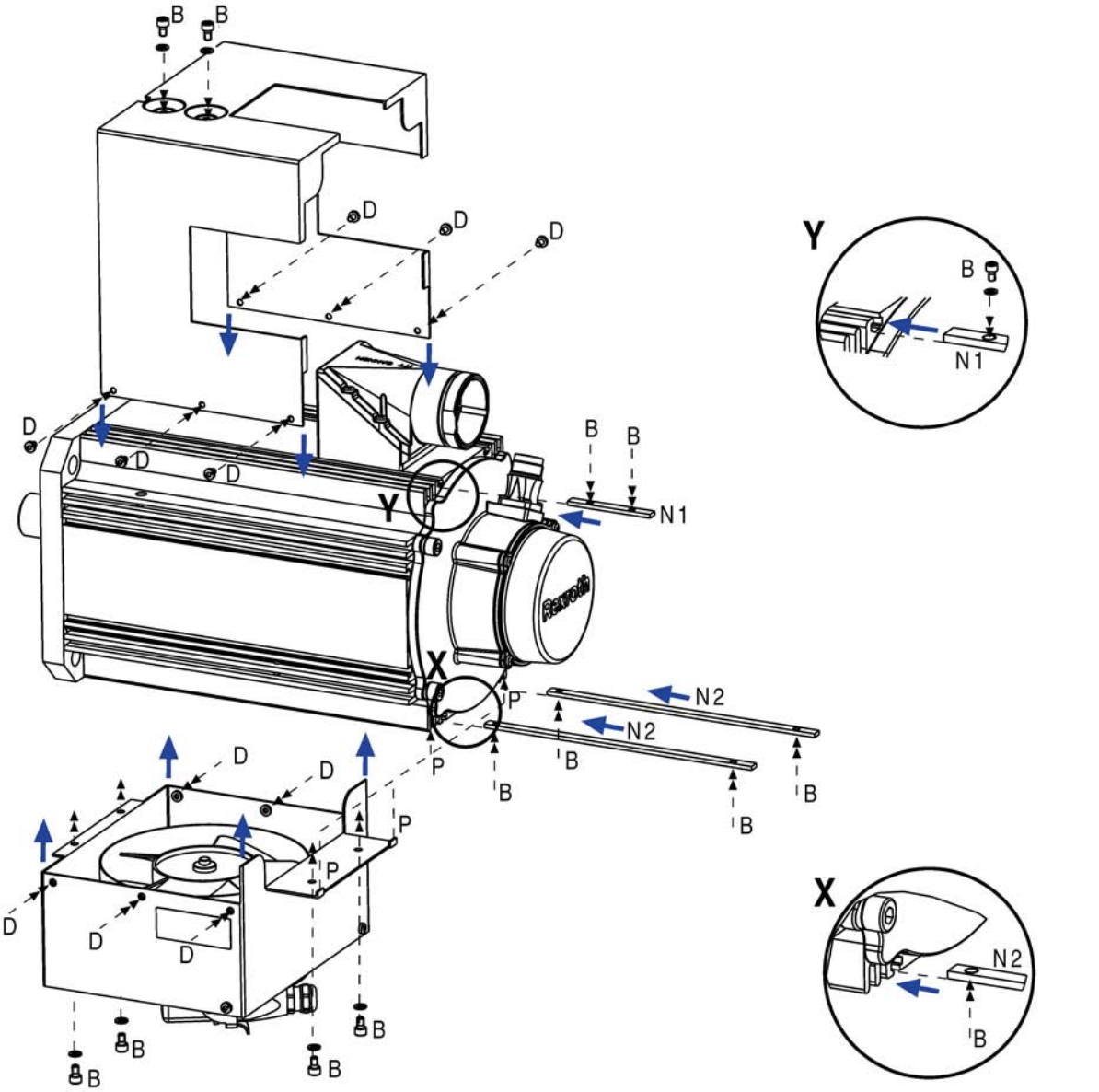
Part	Designation	Type	L/B/H [mm]	Screw type	M_{GA}[Nm]	Number
C	Fastening screw	LEM-AB140AT	-	M4 x 6	3.1	4
Mounting instructions: 1. Insert the ridges K as far as it will go into the groovings on the end shield. 2. Insert the fan unit onto the end shield. 3. Tighten the fastening screws A. For tightening torque see table. Use screw fastener **Loctite® 243™**. 4. Mount the cover plate with fastening screws C. For tightening torque see table. 5. Electrical connection according to the connection plan.						

Fig.7-9: Assembly fan unit radial, flange dimension 116/140

Fan Units for MSK Motors

7.7.4 Assembly Fan Unit Radial, Flange Dimension 192

Valid for types:	LEM-RB-192T-xx-NNNN	



Part	Designation	Type	L/B/H [mm]	Screw type	M_{GA}[Nm]	Number
N1	Ridge	LEM-RB192T	73/8/3	-	-	1
N2	Ridge	LEM-RB192T	223/8/3	-	-	2
B	Fastening screw	LEM-RB192T	-	M5 x 10	4.0	6

Part	Designation	Type	L/B/H [mm]	Screw type	M_{GA}[Nm]	Number
D	Fastening screw	LEM-RB192T	-	M4 x 8	3.1	6

Mounting instructions:

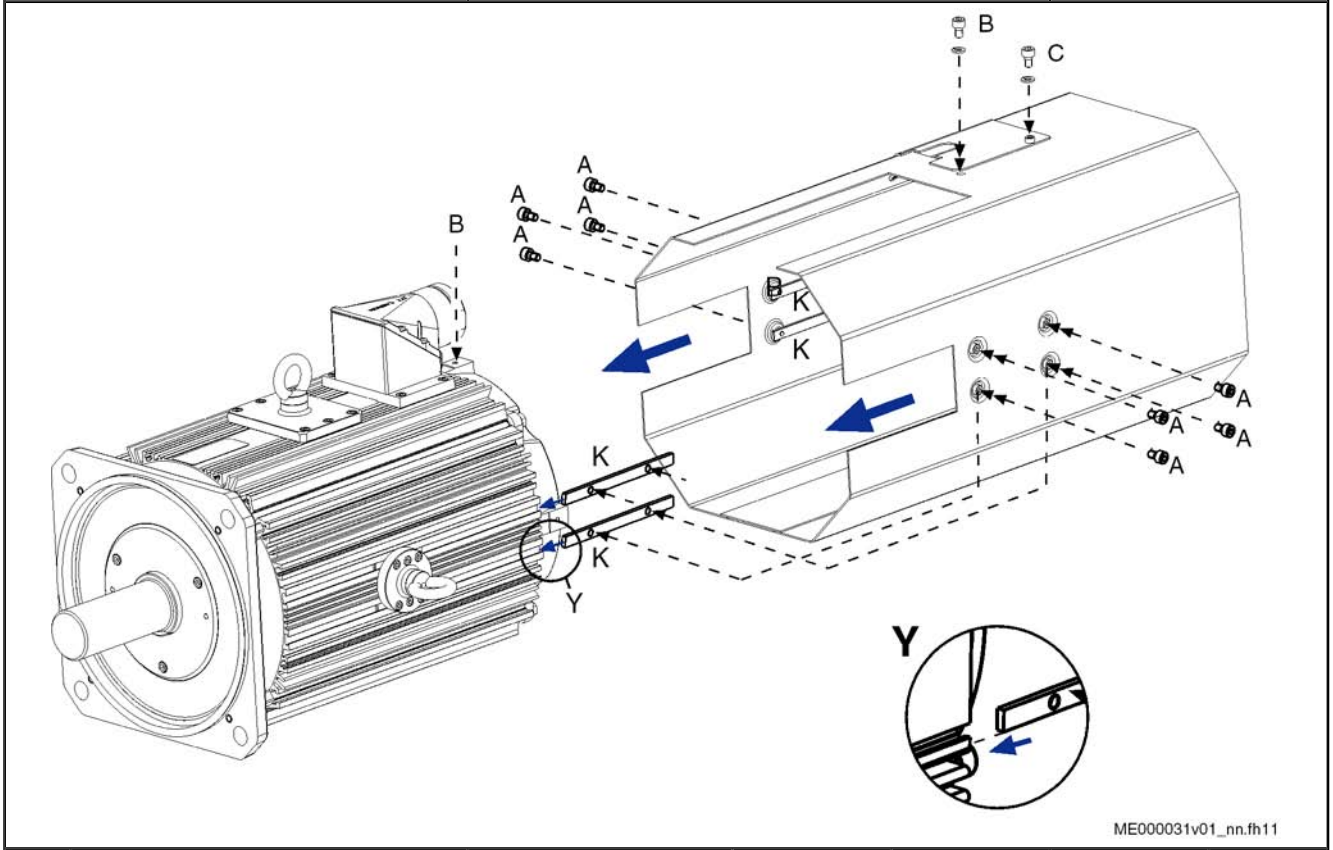
1. Insert the ridges N2 into the groovings onto the housing (see item X).
2. Fasten the fan top with the fastening screws B (4 pieces) into the ridges N2 on the motor housing. Use the limit stop P for positioning. For tightening torque see table.
3. Mount the cover with the fastinging screws D on the fan top. For tightening torque see table. Use screw fastener **Loctite® 243™**.
4. Insert the ridges N1 into the groovings onto the housing (see item Y).
5. Screw the cover with fastening screws B (2 pieces) into the ridge N1. For tightening torque see table.
6. Electrical connection according to the connection plan.

Fig.7-10: Assembly fan unit radial, flange dimension 192

Fan Units for MSK Motors

7.7.5 Assembly Fan Unit Axial, Flange Dimension 260

Valid for types:	LEM-AB-260N-xx-NNNN	



Part	Designation	Type	L/B/H [mm]	Screw type	M_{GA}[Nm]	Number
K	Ridge	LEM-AB260N	110x10x3	-	-	4
A	Fastening screw	LEM-AB260N	-	M5x6	6,1	8
B	Fastening screw	LEM-AB260N	-	M5x8	4,0	1
C	Fastening screw encoder cover	LEM-AB260N	-	M5x6	6,1	2

Mounting instructions:

1. Insert the ridges K into the groovings onto the housing (see item Y).

2. Fasten the fan top with the fastening screws A (8 pieces) into the ridges K on the motor housing. Use the fastening screws C for positioning. For tightening torque see table. Use screw fastener **Loctite® 243™**.

3. If necessary loosen the cover of the encoder cable output, connect the encoder cable and mount the cover. Refer to the table for tightening torque of the fastening screws for the cover encoder cable output.

4. Electrical connection according to the connection plan.

Fig.7-11: Assembly Fan Unit Axial, Flange Dimension 260

8 Connection Technique

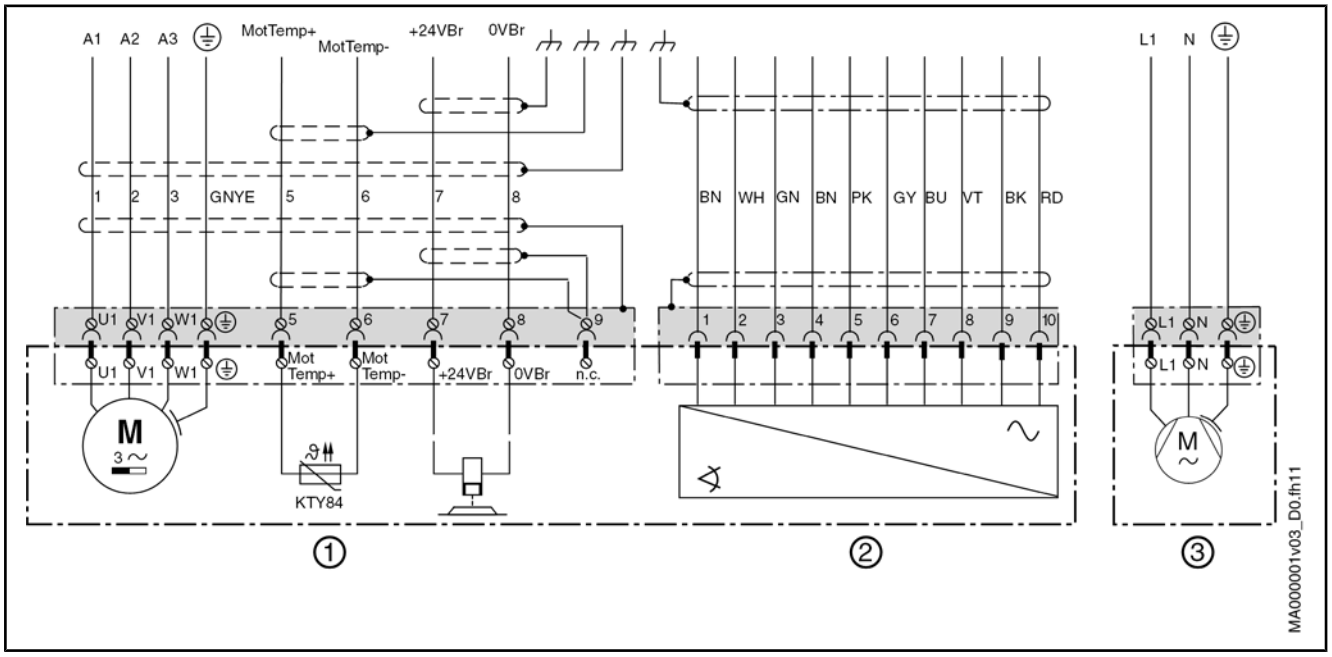
8.1 Electric Connection Technique Overview

The electrical connections of IndraDyn S motors are standardized over all frame sizes. IndraDyn S motors are provided with

- a power connector, incl. connection for temperature sensor and holding brake,
- an encoder connection.

Both connectors are designed as plug-in connectors. When ready-made cables of Rexroth are used, a simple, fast and error-free assembly and commissioning is ensured.

The interconnection diagram applies to all IndraDyn S motors.



① Power connection with temperature sensor and holding brake
② Encoder connection
③ optional fan connection (operation with a fan unit is not permitted for motors in ATEX design!)

Fig.8-1: Overview of IndraDyn S connections I

Motor	Flange socket power	Flange socket encoder
MSK030	RLS1100	RGS1000
MSK040	RLS1100	RGS1000
MSK043 [1)]	RLS1100	RGS1000
MSK050	RLS1100	RGS1000
MSK060	RLS1100	RGS1000
MSK061	RLS1100	RGS1000
MSK070	RLS1200	RGS1000
MSK071	RLS1200	RGS1000
MSK075 [1)]	RLS1200	RGS1000
MSK076	RLS1100	RGS1000
MSK100	RLS1300	RGS1003
MSK101	RLS1300	RGS1003
MSK103A [1)]	RLS1100	RGS1000

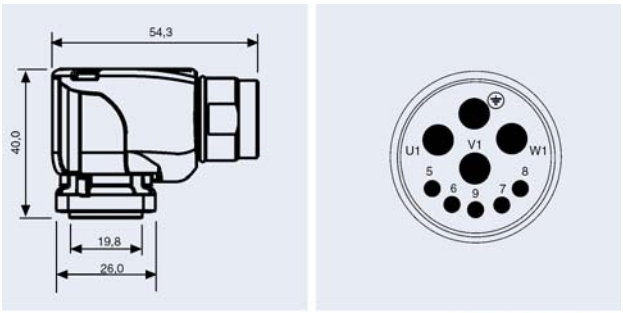
Connection Technique

Motor	Flange socket power	Flange socket encoder
MSK103B [1)] MSK103D [1)]	RLS1200	RGS1000
MSK131 [1)]	RLS1300	RGS1003

1) Motor not availabe in ATEX design

Fig.8-2: Connector on MSK motors

8.2 Flange Socket RLS1100



Pin Assignment RLS1100, Flange Socket

Designation	Description
U1, V1, W1	Power
PE	Grounding conductor
5	Temperature sensor KTY84 (MotTemp+)
6	Temperature sensor KTY84 (MotTemp-)
7 (optional)	Holding brake (+24VBr)
8 (optional)	Holding brake (0VBr)
9	n.c.

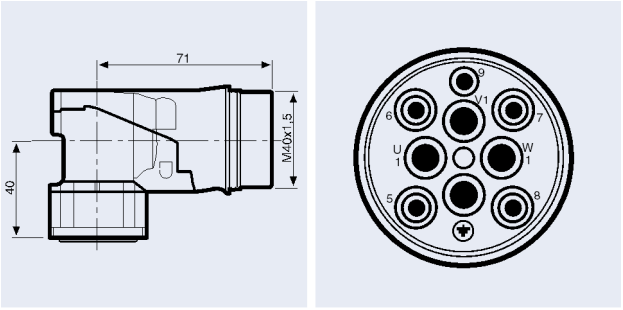
Technical Data RLS 1100, Flange Socket

Designation	Description
Degree of Protection	IP67 (connected)
Temperature range	-40 … +125 °C
Ambient temperature in operation	40 °C
Contact type	Pins
Rated voltage	630 V / 125 V
Rated current	23 A
Degree of pollution	3
Overvoltage category	III (according to DIN VDE 0110)
Power connector (related)	RLS1101, RLS1108[1)]

1) RLS1101 for power wire cross-section 1.0 and 1.5 mm²; RLS1108 for power wire cross-section 2.5 mm²

Connection Technique

8.3 Flange Socket RLS1200



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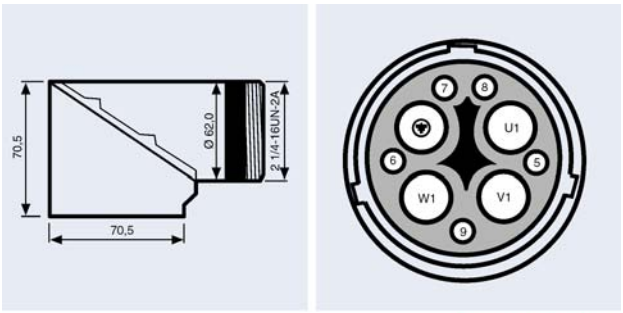
Pin Assignment RLS1200, Flange Socket

Designation	Description
U1, V1, W1	Power
PE	Grounding conductor
5	Temperature sensor KTY84 (MotTemp+)
6	Temperature sensor KTY84 (MotTemp-)
7 (optional)	Holding brake (+24VBr)
8 (optional)	Holding brake (0VBr)
9	n.c.

Technical Data - Flange Socket RLS1200

Designation	Description
Degree of Protection	IP67 (connected)
Temperature range	-40 … +125 °C
Ambient temperature in operation	40 °C
Contact type	Pins
Rated voltage	630 V / 125 V
Rated current	57 A
Degree of pollution	3
Overvoltage category	III (according to DIN VDE 0110)
Power connector (related)	RLS1201

8.4 Flange Socket RLS1300



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Pin Assignment RLS1300, Flange Socket

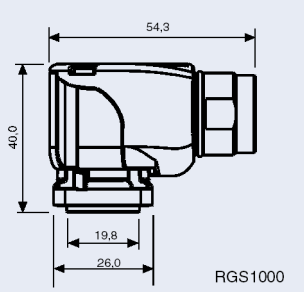
Designation	Description
U1, V1, W1	Power
PE	Grounding conductor
5	Temperature sensor KTY84 (MotTemp+)
6	Temperature sensor KTY84 (MotTemp-)
7 (optional)	Holding brake (+24VBr)
8 (optional)	Holding brake (0VBr)
9	n.c.

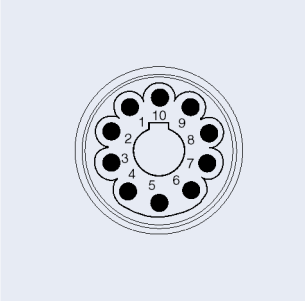
Technical Data - Flange Socket RLS1300

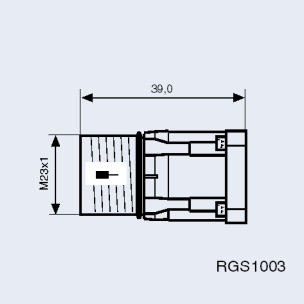
Designation	Description
Degree of Protection	IP67 (connected)
Temperature range	-40 … +125 °C
Ambient temperature in operation	40 °C
Contact type	Pins
Rated voltage	600 V
Rated current	100 A (acc. to VDE and UL); 87 A (acc. to CSA)
Degree of pollution	3
Overvoltage category	III
Power connector (related)	RLS1301

Connection Technique

8.5 Flange Sockets RGS1000 / RGS1003







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Pin Assignment Flange Socket RGS1000

Designation	S1, S3, M1, M3	S2, M2
1	VCC_Encoder	VCC_Encoder
2	GND_Encoder	GND_Encoder
3	A +	A +
4	A -	A -
5	B +	B +
6	B -	B -
7	EncData +	EncData +
8	EncData -	EncData -
9	n.c.	EncCLK +
10	n.c.	EncCLK -

Technical Data - Flange Socket RLS1200

Designation	Description
Degree of Protection	IP67 (connected)
Temperature range	-40 … +125 °C
Ambient temperature in operation	40 °C
Contact type	Pin
Rated voltage	125 V
Rated current	0.5 A
Degree of pollution	3
Overvoltage category	III (according to DIN VDE 0110)
Power connector (related)	RGS1101

8.6 Connecting Cables

8.6.1 Ready-Made Connection Cables

Rexroth provides ready-made power and encoder cables. The following documentation is available to help select cables.

You will find more information in the documentation **"Rexroth Connection Cables IndraDrive and IndraDyn"; DOK-CONNEC-CABLE*INDRV-CAxx-EN-P"See Selection Lists MSK"**. All available power and encoder cables, as well as the combinations for IndraDyn S motors, are described here.

Basic installation recommendations for ready-made cables

The reachable operating time of cables mainly depends on the mode of installation and environmental factors at the place of use. However, due to the variety of application conditions, the general recommendations for the handling of cables listed below must only be considered as an auxiliary guidance in order to ensure failure-free operation of the cables for as long as possible.

- Never apply tensile or torsional loads to the cable (torsion-resistant cables available on request)

  The ends of the cable must be mechanically fastened after 30 cm (e.g. cable saddle, shielded connection of the controllers)
- Disconnect connectors always by traction on the connector, not on the cable.
- Do not bend the cables
- Do not fall below the bending radius of the cable
- Do not expose cables to high temperature differences and extreme climatic influences; do not store them outside, store them dry
- Always unwind cables, do not unreel over head
- Do not use damaged cables (damaged by pressure, clamping or squeezing, for example). In the case of damaged cables, bring installation to a standstill and replace cables.

Please note the detailed assembly and installation notes for ready-made cables in the documentation "DOK-CONNEC-CABLE*INDRV-CAxx-DE-P".

8.7 Connection Technique Fan Units

Fan units are designed with a connector with protection class IP 65. Connectors are delivered with the fan units, which must be connected on the customer-side. Please, observe the notes in chapter 7 "Fan Units for MSK Motors" on page 185.

8.8 Connection Technique Liquid Cooling

MSK motors with liquid cooling are connected via **G1/8"** connectors with the coolant supply system.

Installation material like tubes and fastening clamps do not belong to the scope of delivery. Choose a supply-tube with coorect inner diameter d_i. The following figure shows the connection variants possible.

Connection Technique

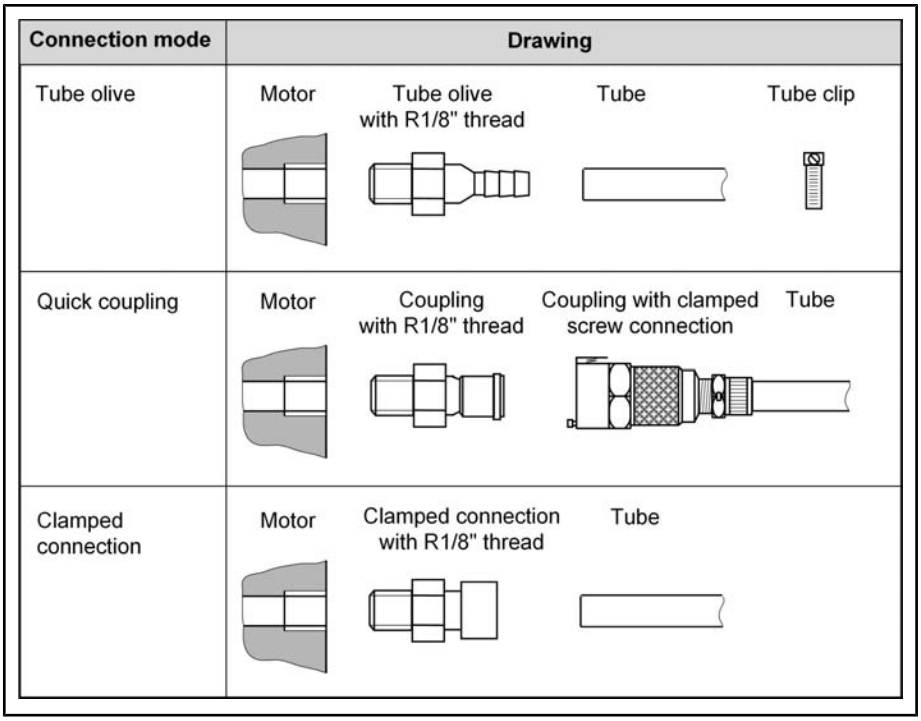


Fig.8-3: Connection variants liquid cooling

9 Operating Conditions and Application Notes

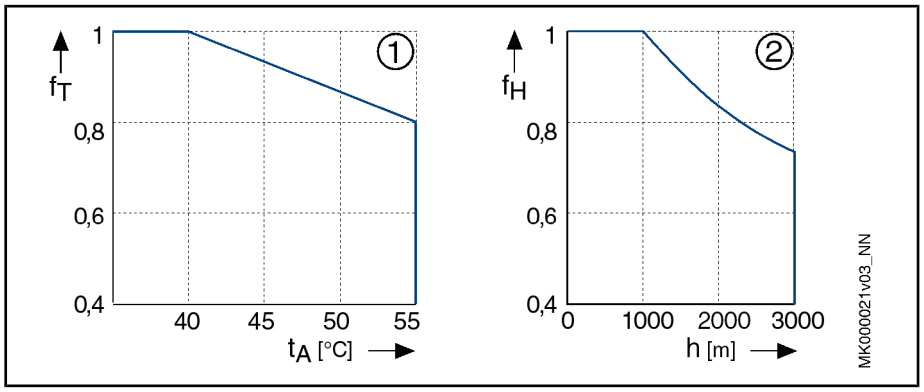
9.1 Ambient Conditions

9.1.1 Setup Elevation and Ambient Temperature

According to DIN EN 60034-1, the motor performance data specified below are valid for:

- Ambient temperatures 0 … 40 °C
- Setup elevation 0 … 1,000 m above sea level

When exceeding the given limits, 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 in degrees Celsius
f_H	Height utilization factor
h	Installation altitude in meters

Fig.9-1: Derating of ambient temperature, installation altitude (in operation)

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

Ambient temperature > 40 °C

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

Iinstallation altitude > 1,000 m

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

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

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

9.1.2 Humidity / Temperature

Ambient climatic conditions are defined in different classes according to DIN EN 60721-3-3, Table 1. They are based on observations made over long periods of time throughout the world and take into account all influencing quantities that could have an effect, such as the air temperature and humidity.

Based on this table, Rexroth recommends class 3K4 for continuous use of the motors.

This class is excerpted in the following table.

Operating Conditions and Application Notes

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/m³	1
High absolute air humidity	g/m³	29
Speed of temperature change	°C/min	0.5

1) Differs from DIN EN 60721-3-2
1) Rexroth permits 0 °C as the lowest air temperature.

Fig.9-2: Classification of ambient climatic conditions according to DIN EN 60721-3-3, Table 1

9.1.3 Vibration

Sinusoidal Vibrations

Sinusoidal vibrations occur in stationary use; depending on their intensity, they have different effects on the robustness of the motors.

The robustness of the overall system is determined by the weakest component.

Based on DIN EN 60721-3-3 and DIN EN 60068-2-6, the following values result for Rexroth motors:

Direction	Maximum permissible vibration load (10-2,000 Hz)	
	Encoder S1, S3, M1, M3	Encoder S2, M2
axial	10 m/s²	10 m/s²
radial	30 m/s²	10 m/s²

Fig.9-3: Permissible vibration load for MSK motors

☞ Motors with mounted fan units are not suited for applications with continuous shock load, e.g. pressing, squeezing, chargers, ...

In such cases, use motors with higher performance without fan unit or liquid cooled motors.

9.1.4 Shock

The shock load of the motors is indicated by providing the maximum permitted acceleration in non-stationary use, such as during transport.

Damage to functions is prevented by maintaining the limit values specified.

Based on DIN EN 60721-3-3 and DIN EN 60068-2-6, the following values result for Rexroth motors:

Frame size	Maximum permitted shock load (6 ms)	
	axial	radial
MSK030 MSK040 MSK043 1) MSK050	10 m/s²	1,000 m/s²
MSK060 MSK061	10 m/s²	500 m/s²
MSK070 MSK071 MSK075 1) MSK076	10 m/s²	300 m/s²
MSK100 MSK101 MSK103 1) MSK131 1)	10 m/s²	200 m/s²

1) Motor not availabe in ATEX design

Fig.9-4: Permitted shock load for MSK motors

Operating Conditions and Application Notes

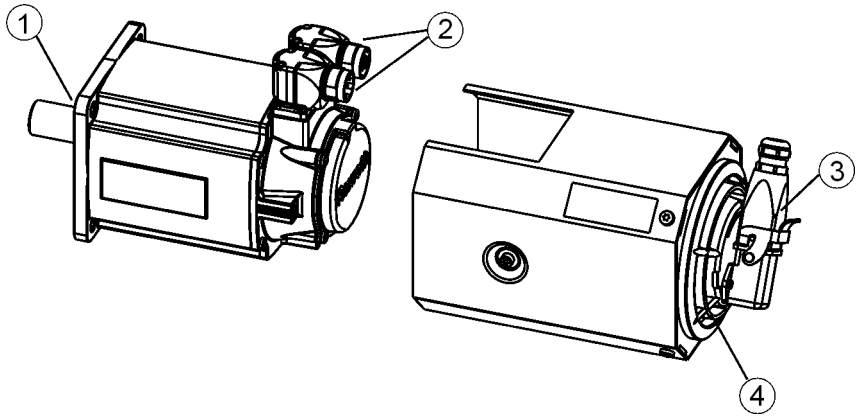
9.2 Degree of Protection

The motors are subdivided into corresponding types of protection (IP) regarding their applicability for different ambient conditions. The protection of the device acc. to EN 60529 is characterized by a two-digit number. The **first digit** defines the degree of protection against contact and penetration of foreign particles. The **second digit** defines the degree of protection against water.

1st digit	Degree of protection
6	Protection against penetration of dust (dust-proof); complete contact protection
4	Protection against intrusion of solid foreign bodies, more than 1mm in diameter
2	Protection against intrusion of solid foreign bodies, more than 12.5 mm in diameter
2nd digit	**Degree of protection**
7	Protection against harmful effects if temporarily immersed in water.
5	Protection against a water jet from a nozzle directed against the housing from all directions (jet water)
4	Protection against water splashing against the housing from all directions (splash water)

Fig.9-5: IP types of protection

The construction of IndraDyn S motors is according to the following protection classes acc. to EN 60529.

Motor area	Degree of Protection	Comment
		
Motor housing, output shaft, motor connector at professional assembly in connected state	IP 65	Standard design
Motor housing, output shaft, motor connector at professional assembly in connected state **and** use of sealing air	approx. IP 67	Only with sealing air kit!

Motor area	Degree of Protection	Comment
Fan motor and connector in connected state	IP 65	Accessory fan unit
Fan grid	IP 24	Accessory fan unit

① Output shaft with shaft sealing ring
② Connector for power and encoder connection (optionally retrofitable for sealing air)
③ Fan motor with connector
④ Fan grid

Fig.9-6: IP-protection area with MSK motors

The inspections for the second digit are carried out with fresh water. If cleaning is effected using high pressure and/or solvents, coolants, or penetrating oils, it might be necessary to select a higher degree of protection.

9.3 Design and Installation Positions

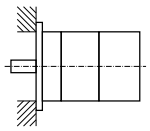
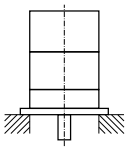
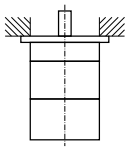
Motor design B05		
IM B5	IM V1	IM V3
		
Flange mounting on the drive side of the flange	Flange mounting on the drive side of the flange; drive side pointing down	Flange mounting on the drive side of the flange; drive side pointing up

Fig.9-7: 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.

9.4 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

9.5 Motor Varnish

Color Black (RAL9005)

Resistance

Resistant against

- diluted acids/alkaline solutions
- water, sea-water, sewage
- current mineral oils

Limited resistance against

- organic solvents
- hydraulic oil

No resistance against

- concentrated acids and alkaline solutions

Additional varnish

Permitted for:

standard products.

It is permitted to provide the housing with additional varnish (coat thickness no more than 40 µm). Check the adhesion and resistance of the new varnish before applying it.

NOT permitted for:

products for potentially explosive areas.

Overcoating the motors in ATEX design is not allowed in order to not to affect the surface properties (such as insulation resistance, electrostatic charge) adversely.

☞ Protect all safety notes, type plates and open connectors with a painting protection when painting additionally.

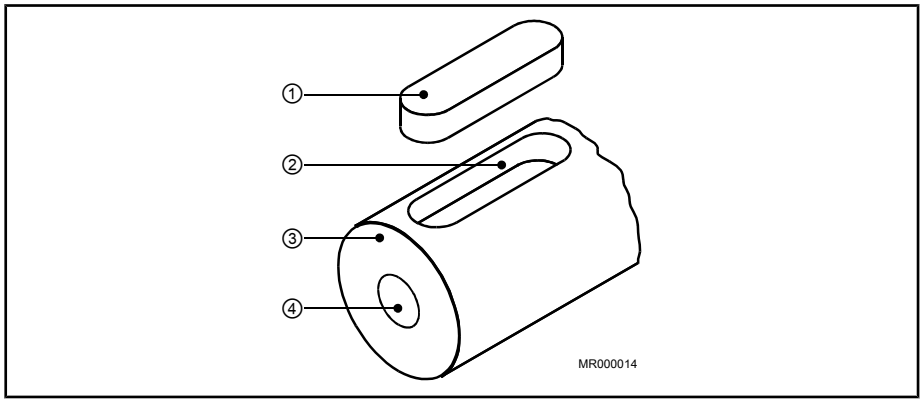
9.6 Output Shaft

9.6.1 Plain Shaft

The standard design recommended for IndraDyn S motors provides a non-positive shaft-hub connection without play and excellent running smoothness. Use clamping sets, clamping sleeves or clamping elements to couple the machine elements to be driven.

9.6.2 Output Shaft with Keyway

The optional key according to DIN 6885, sheet 1, version 08-1968, permits the form-fitting transmission of torques with constant direction, with low requirements for the shaft-hub connection.



① Key
② Keyway
③ Motor shaft
④ Centering hole

Fig.9-8: IndraDyn S Output shaft with key

The machine elements to be driven must additionally be secured in the axial direction via the centering hole on the end face.

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 a Complete Key

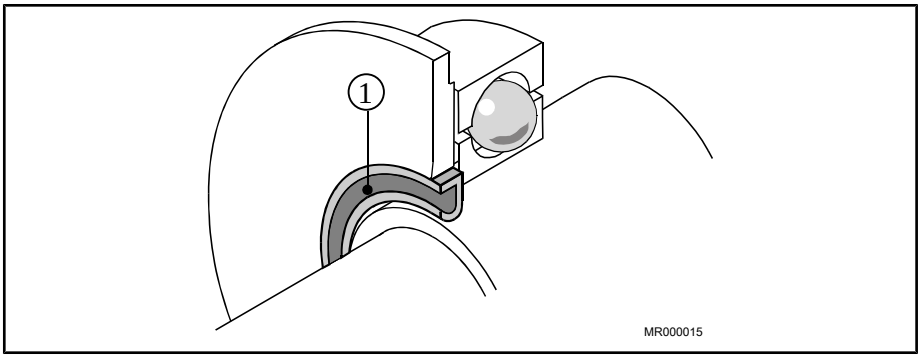
IndraDyn S motors are balanced with the **complete** key. Hence, the machine element to be driven must be balanced without a key.

Modifications to keys may be made only by the user himself and on his own responsibility. Bosch Rexroth does not assume any warranty for modified keys or motor shafts.

9.6.3 Output Shaft with Shaft Sealing Ring

IndraDyn S motors are designed with according to DIN 3760 – design A.

Operating Conditions and Application Notes



① Radial shaft sealing ring
Fig.9-9: IndraDyn S motors radial shaft sealing ring

Wear

Radial shaft sealing rings are friction seals. Hence, they are subject to wear and generate frictional heat.

Wear of the friction seal can be reduced only if lubrication is adequate and the sealing point is clean. Here, the lubricant also acts as a coolant, supporting the discharge of frictional heat from the sealing point.

- Prevent the sealing point from becoming dry and dirty. Make sure everything is clean.

☞ Under normal environmental conditions, the shaft seal is greased for its lifetime. Under unfavorable environmental conditions (e.g. grinding dust, metal shavings), however, maintenance intervals could be necessary.

Resistance

The materials used for the radial shaft sealing rings are highly resistant to oils and chemicals. The performance test for the particular operating conditions lies, however, within the machine manufacturer's responsibility.

The complex interactions between the sealing ring, the shaft and the sealing fluid, as well as the particular operating conditions (frictional heat, soiling, etc.), do not allow calculation of the lifetime of the shaft sealing ring.

Vertical Installation Positions IM V3

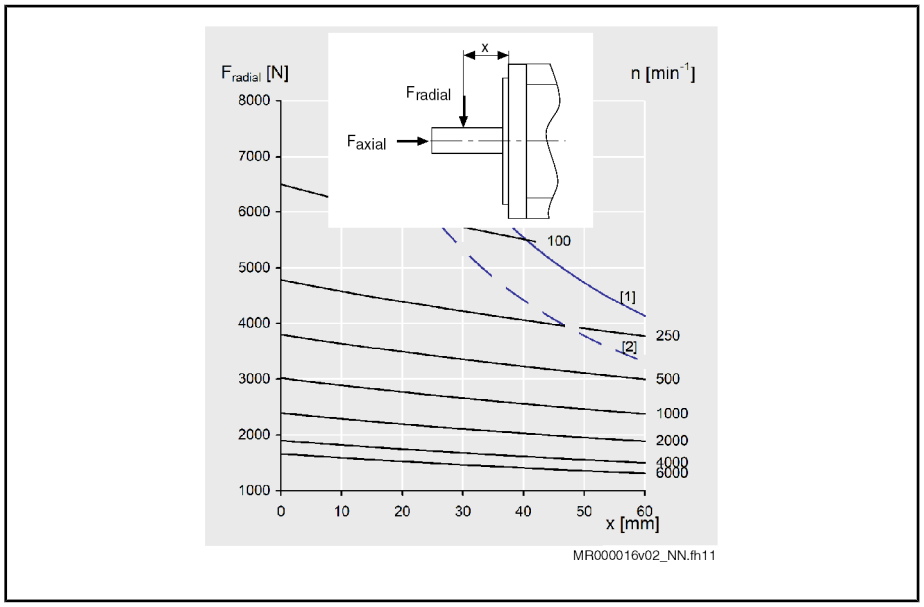
The degree of protection on the flange side of motors with a shaft sealing ring is IP 65. Hence, tightness is ensured only in case of splashing fluids. Fluid levels present on the A-side require a higher degree of protection. For vertical installation position (shaft at the top) of the motor, please observe the additional notes in chapter 9.3 "Design and Installation Positions" on page 213 .

☞ Rexroth recommends that any direct contact of the drive shaft and the radial shaft sealing ring with the processing medium (coolant, material corrosion) caused by the machine or system construction be avoided.

9.7 Bearing and Shaft Load

9.7.1 Radial Load, Axial Load

During operation, both radial and axial forces act upon the motor shaft and the motor bearings. The construction of the machine, the selected motor type and the attachment of driving elements on the shaft side must be adapted to each other to ensure that the load limits specified are not exceeded.



[1] Shaft, plain
[2] Shaft with keyway
n Arithmetic average speed
x Force application point
Fig.9-10: Example of a shaft load diagram

Maximum Permissible Radial Force

The maximum permissible radial force F_{radial_max} depends on the following factors:

- Shaft-breaking load
- Point of force application x (see chapter 9.7.2 "Shaft Load MSK Motors" on page 219)
- Shaft plain or with keyway

Permissible Radial Force

The permitted radial force F_{radial} depends on the following factors:

- Arithmetic mean speed (n_{mean})
- Point of force application x (see chapter 9.7.2 "Shaft Load MSK Motors" on page 219)
- Bearing Lifetime

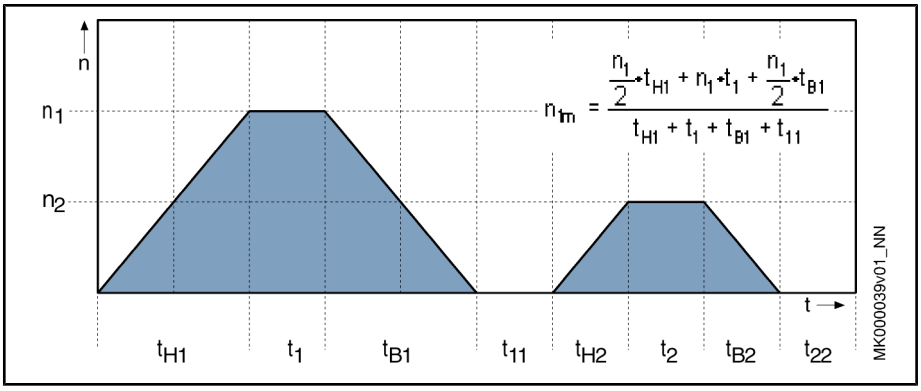
Permissible Axial Force

The maximum permitted axial force F_{axial} is proportional to the radial force. The maximum permissible axial force F_{axial} is indicated in the section on the radial force.

Mean Speed

The initialization and braking times can be ignored in the calculation if the time in which the drive is operated at a constant speed is significantly greater than the acceleration and deceleration times. In the exact calculation of the mean speed according to the following example, the run-up and braking times are taken into account.

Operating Conditions and Application Notes

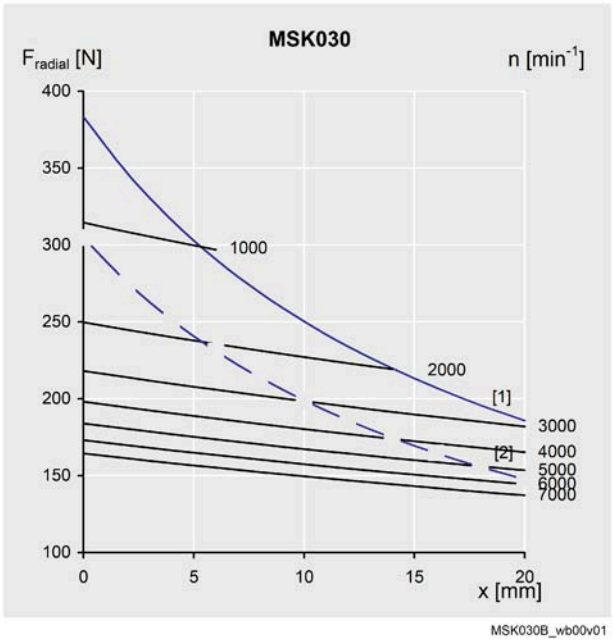


n_{1m}; n_{2m}	Mean speed in section x
n_1; n_2	Processing speed
t_{H1}; t_{H1}	Run-up time
t_1; t_2	Processing time
t_{B1}; t_{B2}	Braking time
t_{11}; t_{22}	Standstill time

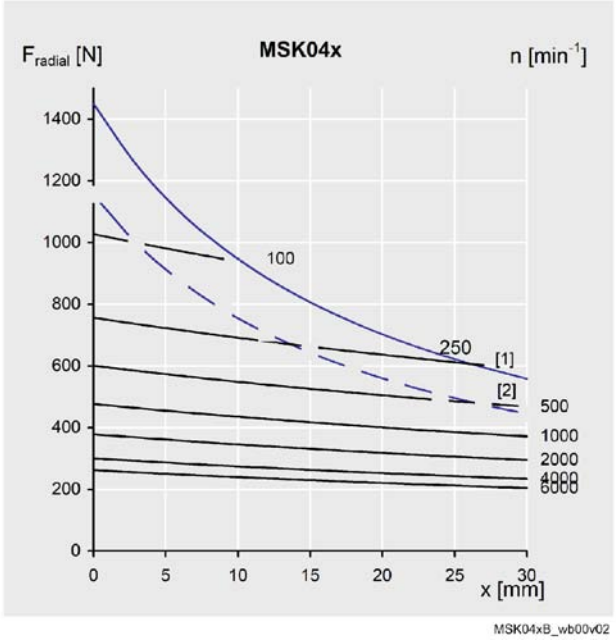
Fig.9-11: Mean speed

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

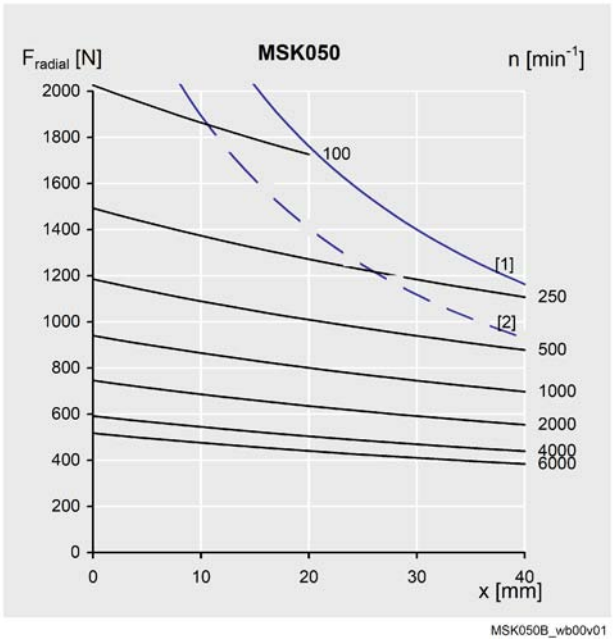
9.7.2 Shaft Load MSK Motors



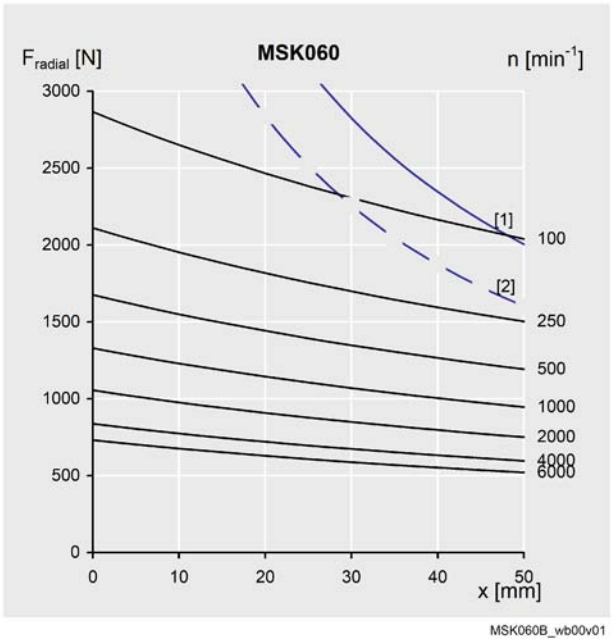
Admissible axial force F_{axial} 0 N



Admissible axial force F_{axial} 30 N

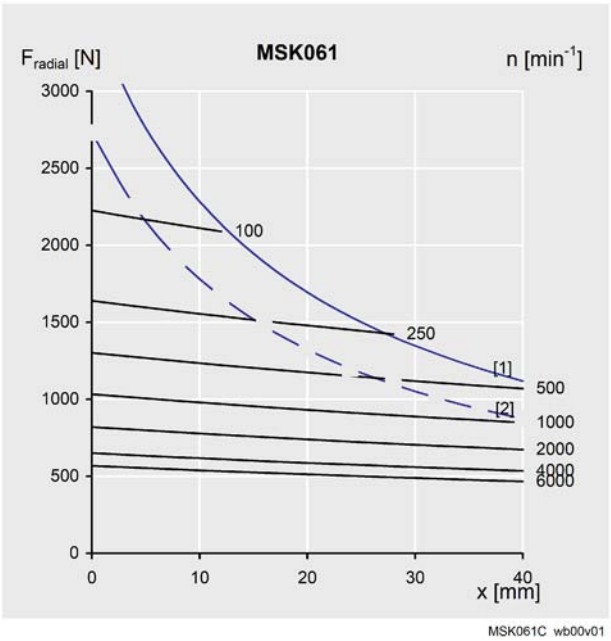


Admissible axial force F_{axial} 40 N

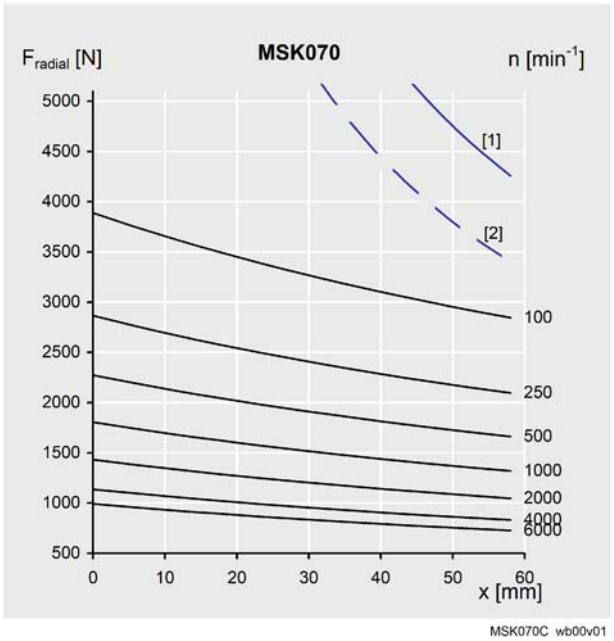


Admissible axial force F_{axial} 40 N

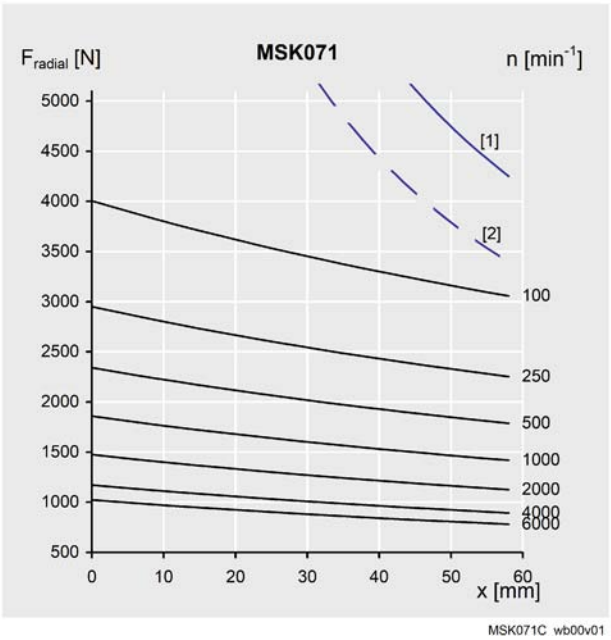
Operating Conditions and Application Notes



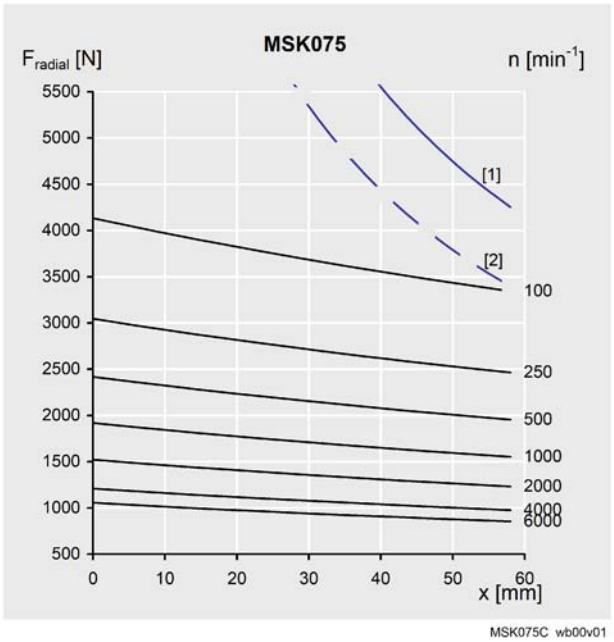
Admissible axial force F_{axial} 40 N



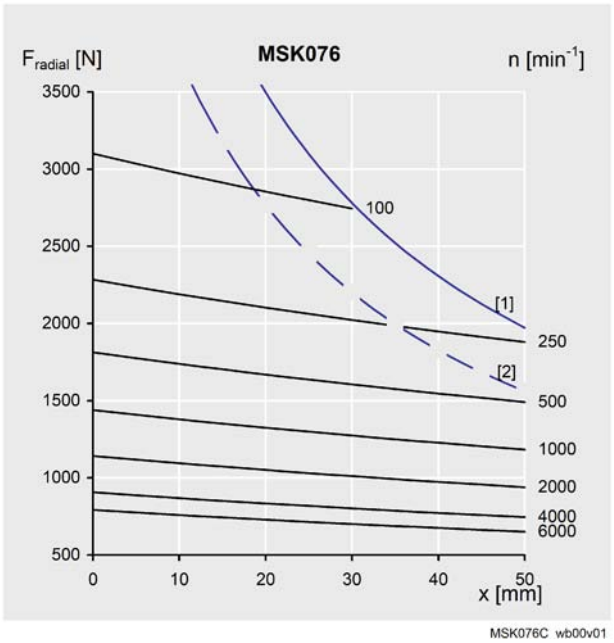
Admissible axial force F_{axial} 60 N



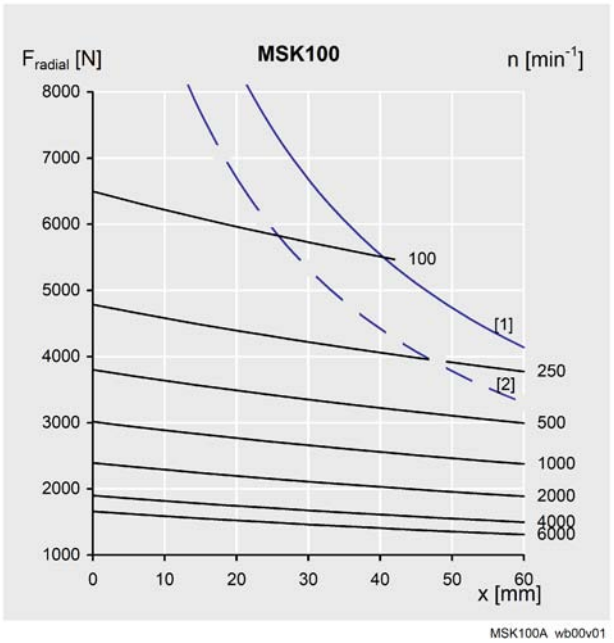
Admissible axial force F_{axial} 60 N



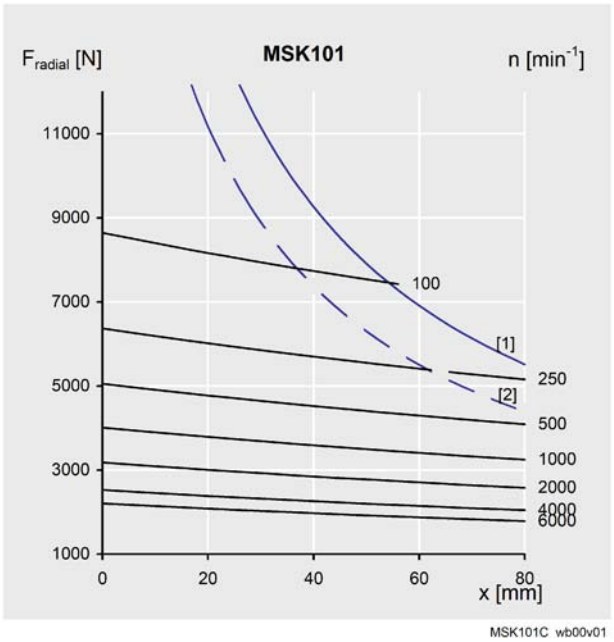
Admissible axial force F_{axial} 60 N



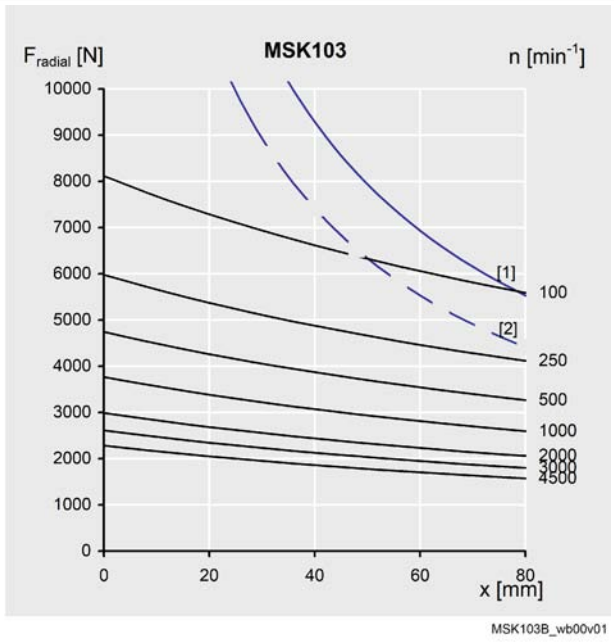
Admissible axial force F_{axial} 60 N



Admissible axial force F_{axial} 80 N

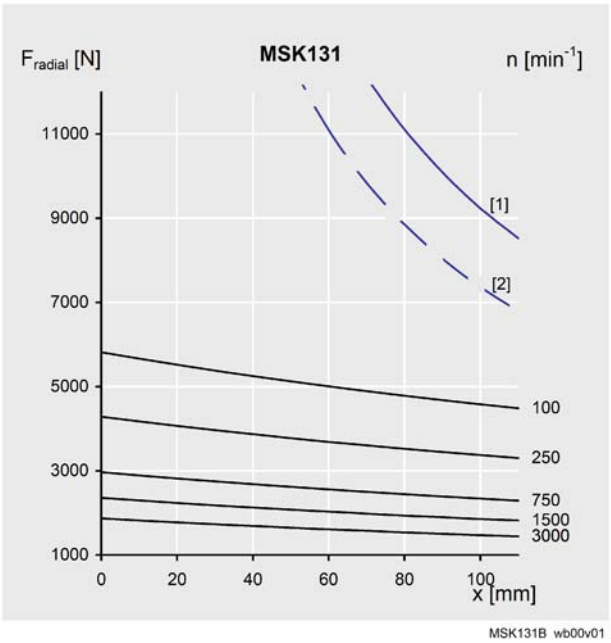


Admissible axial force F_{axial} 80 N



Admissible axial force F_{axial} 80 N

Operating Conditions and Application Notes



Admissible axial force F_{axial} 50 N

[1] Shaft, plain
[2] Shaft with keyway
n [min^{-1}] Mean speed
Fig.9-12: MSK shaft load

9.8 Bearing Lifetime

The bearing lifetime is an important criterion for the availability of IndraDyn motors.

If IndraDyn S-motors are operated within the limits specified for radial and axial loads, the bearing lifetime is as follows:

Bearing Lifetime

L_{10h} = 30,000 operating hours

(calculated according to ISO 281, ed. 12/1990)

This applies to all IndraDyn motors based on the following:

- The permitted loads from the corresponding chapter "Technical Data" are never exceeded.
- The motor is operated under the permitted conditions for use and in the permitted ambient temperature range of 0 °C to +40 °C.

Differing loads can 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.
- Avoid exceeding the load limits.

Mechanical Bearing Lifetime in case of Increased Radial Force

In other cases, the bearing lifetime is reduced as follows:

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

L_{10h}	Bearing lifetime (according to ISO 281, ed. 12/1990)
F_{radial}	Determined permissible radial force in N (Newtons)
F_{radial_act}	Actually acting radial force in N (Newtons)

Fig.9-13: Calculation of the bearing service life L10h, if the permissible radial force Fradial is exceeded

☞ Under no circumstances may the actually acting radial force F_{radial_ist} be higher than the maximum permissible radial force F_{radial_max}.

9.9 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.

Whenever attaching drive elements to the output shaft, such as

- Gearboxes
- Couplings
- Gear pinion

please be sure to observe the following notes.

Gearbox mounting on motors

Are gearboxes mounted on motors, the thermal coupling of the motors on machines or constructions changes.

Depending on the gearbox type, the heat development on the gearbox is different. The heat dissipation of the motor via the flange is reduced in every case when a gearbox is mounted. This must be heeded at the project planning.

A reduction of the given performance data is necessary, to do not overload motors when using gearboxes.

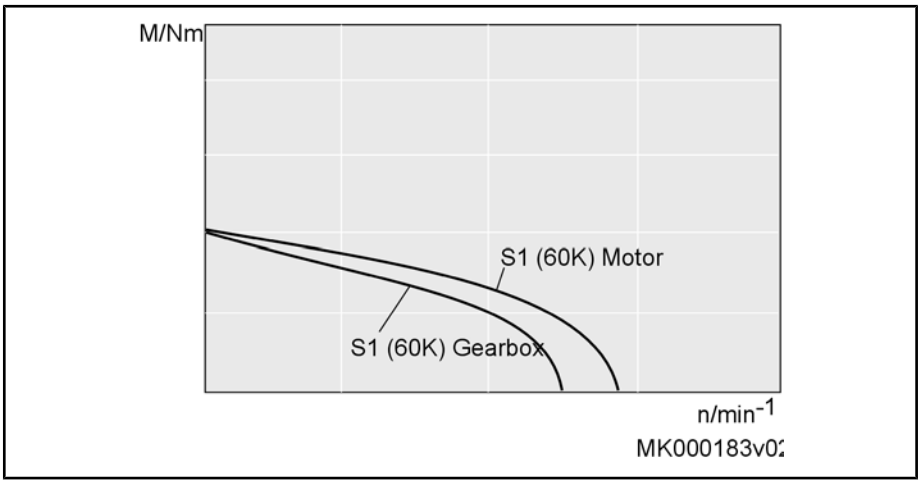


Fig.9-14: S1 characteristic curve of gearboxes

☞ The indicated torques in the characteristic curves of the motor have to be reduced by **20-30%** when mounting gearboxes.

Please, heed all further notes and specifications within this documentation for the used gearboxes.

Overdetermined Bearing

Generally, overtermined bearings are to be avoided by all means when connecting drive elements. The tolerances inevitably present in such cases will lead to additional forces acting on the bearing of the motor shaft and, as the case may be, to a distinctly reduced service life of the bearing.

☞ If redundant attachment cannot be avoided, it is absolutely necessary to consult with Bosch Rexroth.

Couplings

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

☞ When extremely stiff couplings are attached, the radial force which constantly changes the angular position may cause an impermissibly high load on the shaft and bearing.

Ball bearing pinion or helical drive pinion

Owing to thermal effects, the flange-sided end of the output shaft may shift by 0.6 mm in relation to the motor housing. If helical drive pinions or bevel gear pinions directly attached to the output shaft are used, this change in position will lead to

- a shift in the position of the axis, if the driving pinions are not defined axially on the machine side,
- a thermally dependent component of the axial force, if the driving pinions are defined axially on the machine side. This causes the risk of exceeding the maximum permissible axial force or of the play within the gears increasing to an impermissible degree.
- Damage of the motor bearing on the B-side due to exceeding of the maximum permissible axial force.

☞ In such cases, drive elements should preferably be used with their own bearings which are connected to the motor drive shaft via axially compensating couplings.

Operating Conditions and Application Notes

9.10 Holding Brakes

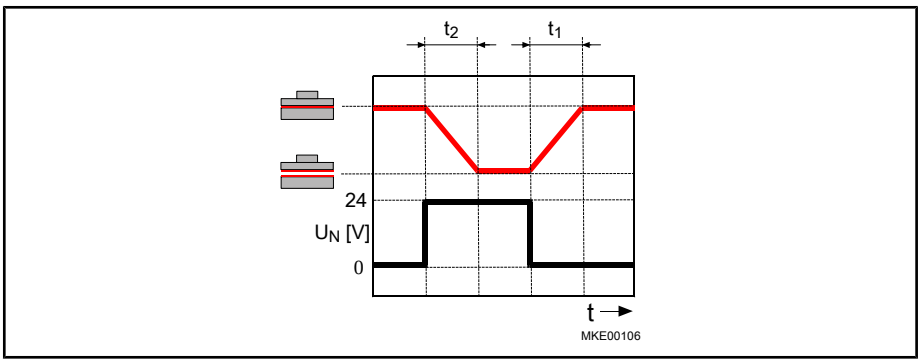
9.10.1 Holding brake electrically-releasing

The holding brake of the IndraDyn S motors works according to the principle "electrically-released". Non-operative closed holding brakes open when applying the operating voltage.

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. (Please also refer to Rexroth IndraDrive Drive System DOK-INDRV*-SYSTEM*****-PRxx-EN-P, Chapter "Project Planning of Control Voltage ")

☞ The switching voltage arriving on the motor is influenced by the cable length and the cable features, e.g. the conductor resistance.

- We recommend a minimum voltage of 22.8 V (24 V - 5%) onto the drive device for Bosch Rexroth ready-made power cables up to max. 50 m.
- We recommend a minimum voltage of 24.7 V (26 V - 5%) onto the drive device for Bosch Rexroth ready-made power cables longer than 50 m.



t_1 Connection time
t_2 Disconnection time
Fig.9-15: Switching status of holding brake over time

The electrically-releasing holding brake is used to hold the axes at a standstill and when the ”controller enable” signal is off. When the supply voltage fails and the controller is enabled, the electrically-releasing holding brake will close automatically.

☞ Do not use the holding brake as an operational brake for moving axes.

If the holding brake is engaged repeatedly on a drive in motion or the rated brake torque is exceeded, premature brake wear can occur.

9.10.2 Holding Brakes - Notes Regarding Safety

Observe the safety requirements for the system planning and development.

⚠ DANGER **Personal injury through hazardous movements caused by falling or descending axes!**

Secure vertical axes against falling or descending after disconnection:

- lock the vertical axes mechanically,
- provide an external braking / collecting / clamping device, or
- Ensure sufficient weight compensation of the axes.

The serially delivered holding brakes which are driven by the control device are **not** suited for personal safety!

Personal protection must be realized by superordinate fail-safe measures, such as e.g. the locking off of the danger zone by means of a protective fence or grill.

☞ Beside the specified details and notes about holding brakes, heed the additional standards and directives when planning the system.

For Europian countries:

- **EN 954 and ISO 13849-1 and ISO 13849-2 Safety-related components of controls**
- **Information sheet no. 005 "Gravity-loaded axes (vertical axes)" published by: Fachausschuss Maschinenbau, Fertigungssysteme, Stahlbau**

For the USA:

- See National Electric Code (NEC), National Electrical Manufacturers Association (NEMA) as well as local building regulations.

The following is generally valid: Comply with all applicable national regulations!

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

Please pay particular attention to the following:

- Corrosion on friction surfaces, as well as dust, perspiration and sediments reduce the braking effect.
- Grease must not hit the friction surface.
- Overvoltage and too high temperatures can durably weaken the permanent magnets and thus the brake.

Engaging of the holding brake is no longer ensured, if the air gap between armature and pole is improperly increased due to deterioration. In this case, no braking occurs.

9.10.3 Layout of Holding Brakes

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

Normal operation and EMERGENCY STOP	event of faults
In **normal operation**, using the holding brake for clamping of a standstill axes, the ”statistic holding torque” (M4), applies as indicated in the data sheets. For **EMERGENCY STOP** to deactivate an axis ($n < 10\ min^{-1}$), a "dynamic braking moment" acts (M_{dyn}) - sliding friction.	For **fault conditions** to deactivate a moving axis ($n \geq 10\ min^{-1}$), a "dynamic braking moment" acts (M_{dyn}) - sliding friction.
$M4 > M_{dyn}$ Therefore, note the following description of dynamic sizing.	

Fig.9-16: Dynamic Sizing

Dynamic Sizing

The load torque must be smaller than the minimum dynamic moment M_{dyn} which the holding brake can provide. Otherwise the dynamic holding brake torque is not sufficient to stop the axes.

If a mass is to be decelerated in a defined time or in a defined route, the additional mass moment of inertia of the whole system must be taken into account.

Project planning recommendation

To ensure construction safety, reduce the required holding torque to 60% of the static holding torque (M4) of the holding brake.

9.10.4 Holding Brake–Commissioning and Maintenance Instructions

In order to ensure proper functioning of the holding brake, it must be checked before the motors are commissioned. The test as well as the resurfacing may be carried out "mechanically by hand" **or** "automatically by means of the software function".

Checking and Resurfacing of Holding Brakes by Hand

Measure the holding torque (M4) of the holding brake. If necessary, resurface the holding brake.

Measuring the Holding Torque (M4) of the Holding Brake

1. De-energize the motor and secure it against re-energization.
2. Measure the transferable holding torque of the holding brake with a torque wrench. For holding torque (M4) refer to the technical data.

   If the holding torque (M4) is achieved, the motor is ready for assembly.
   If the holding torque (M4) **is not achieved**, the subsequent resurfacing-process can be used to reconstitute the holding torque.

Resurfacing the Holding Brake

1. At closed holding brake, turn the output shaft by hand, e.g. with the help of a torque wrench, by about 5 revolutions.
2. Measure the holding torque (M4).

   If the holding torque (M4) is achieved, the motor is ready for assembly.
   If the specified holding torque (M4) is not attained after several grinding-in processes, the holding brake is not operable. Please, contact the Rexroth Service.

Checking and Resurfacing of Holding Brakes by means of the Software Function

Checking the Holding Torque (M4) via P-0-0541, C2100 Command Holding system check

1. The efficiency of the holding brake and the opened state are checked by the control device by starting the routine "P-0-0541, C2100 Command Holding system check".

   If the holding brake is operational, the drive is in an operational state after the routine was run through. If the braking torque is too low, the control device outputs a corresponding message.

☞ The brake test can also be carried out cyclically in the framework of a preventive maintenance.

Restoring the Holding Torque (M4) by means of the Software Function

The following possibilities are available:

1. Realization of the resurfacing routine IndraDrive "Restoring the holding torque "(see"P-0-0544, C3900 Command Resurfacing of motor holding brake"). A repeated realization of the resurfacing routine is possible.

   Upon the execution of the command C3900 it is not checked whether the resurfacing of the holding brake was successful. It is recommended to execute the command C2100 (Command Holding system check) once again.

2. Resurfacing routine by superior control. Here, special control programs adapted to the machine and system concepts are required. If necessary, please contact your Bosch Rexroth distribution partner and discuss the resurfacing routine parameters for your application.

For more detailed information about software functions refer to the functional description "Rexroth IndraDrive Firmware for Drive Control Devices MPx-xx, DOK-INDRV*-MP*-xxVRS**-FKxx-EN-P."

Operating Conditions and Application Notes

9.11 Acceptances and Authorizations

9.11.1 CE Symbol

Declaration of Conformity

Certificate of conformity confirming the structure of and compliance with the valid EN standards and EC directives are available for all IndraDyn S motors. If necessary, these certificates of conformity can be requested from the responsible sales office.

The CE symbol is attached to the motor type label of IndraDyn S motors.

Fig.9-17: CE symbol

9.11.2 cURus-Symbol

Motors authorized by the UL authorization (Underwriters Laboratories Inc.®) are labeled with the following sign on the motor type plate, the authorization number of the motors (file number) is given in the technical data.

Fig.9-18: cURus - symbol

9.12 Motor Cooling System

9.12.1 Natural Convection

Rexroth motors of the standard design are self-cooling motors. The heat dissipation is realized over the natural convection to the ambient air and heat conduction onto the machine construction.

☞ Pollution of the motors reduces the heat dissipation. Ensure tidiness!

9.12.2 Fan Units

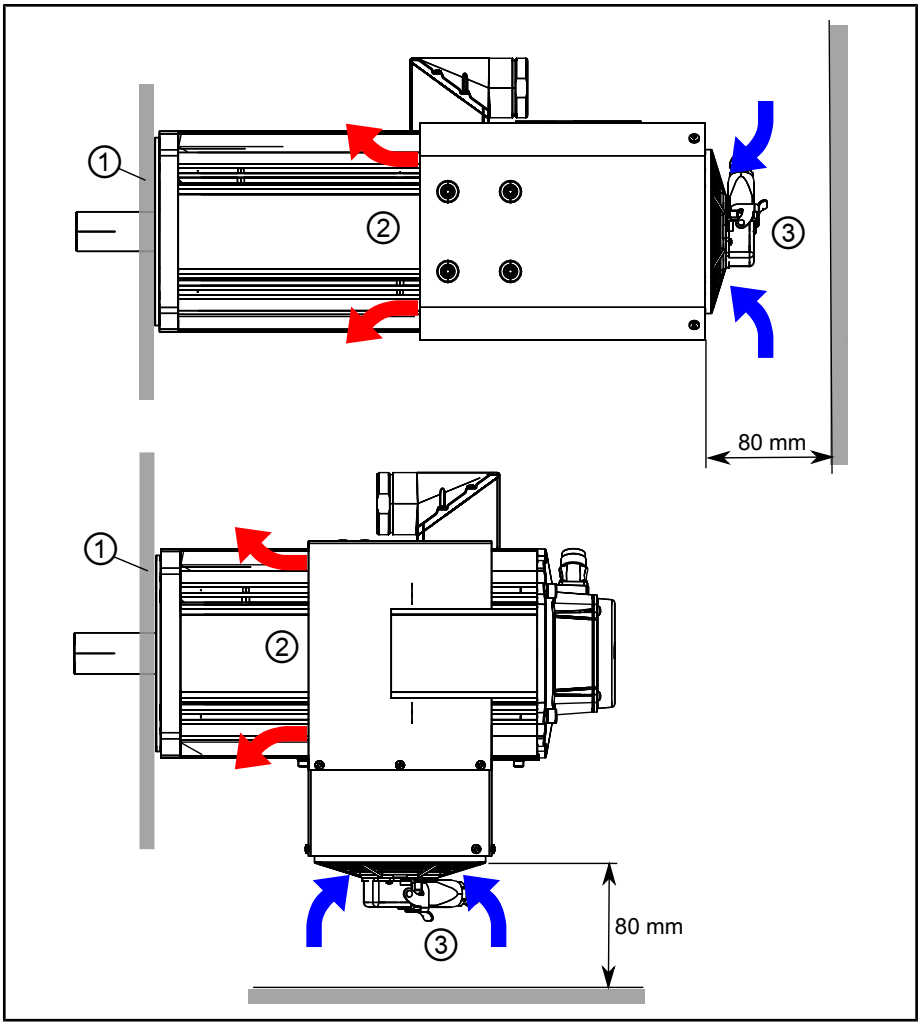
Fan units are deliverable for certain motor types. The power data given in the technical data are labeled with the index "S" for surface You will find a description of the technical data of the available fan units in chapter 7 "Fan Units for MSK Motors" on page 185.

Cooling occurs using air flows that are guided through air plates over the surface of the motor. The fan is designed in such a way, that clean air from its environment is used to cool the motor.

Explicitely not suitable is using the fan under the following conditions:

- Intake air, which contains abrasive (erode) particles.
- Intake air, which is corrosive, e.g. salt mist.
- Intake air, which contains high dust loading, e.g. suction of saw dust.
- Intake of flammable gas/particles
- Using fan units as safety related part or for assumption of safety related funktions

In order to ensure that the required air amount of the fan unit can be routed by the fan, a minimum distance between the fan screen and the machine to suction/blow the air must be taken into account. The distance is determined by the motor construction.



① Machine
② Air flow-off space
③ Air suck-in space

Fig.9-19: Fan units installation space, minimum distance

Notice the minimum distance of air supply ③ for maschine construction.

Pollution can reduce the performance of the fans and lead to thermal overload of the motors. When the machine is operated in a polluted environment, increase the system availability by regularly cleaning the fan and motor radiator fins. The machine construction must allow easy access to the motor and the fans for maintenance work. You will find special notes about maintenance and troubleshooting on motor fans in chapter 13.4 "Maintenance" on page 261.

9.12.3 Liquid cooling

General Information

Rexroth motors in liquid-cooled design are suited for extreme loads, e.g. duration, start, stop-operation with high repetition rates. MSK motors with possible liquid coolant are marked in the type code under point 5 “**Cooling type**” with “**FN**”.

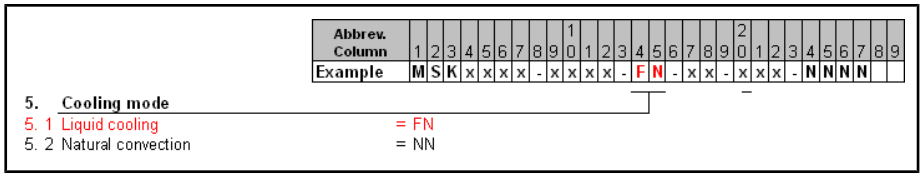


Fig.9-20: MSK motors with liquid cooling (type code designation)

The heat dissipation occurs over the used coolant, released via a downstream heat exchanger to the ambient air.

Coolant Ducts

Coolant lines can be designed either as

- pipeline or as
- tubing system.

depending on the corresponding motor.

Owing to the turning points inevitably present in pipeline systems (e.g. 90-degree elbows), high pressure losses develop in the cooling lines. For that reason, we recommend that tubing systems be used.

When selecting the coolant lines, please be absolutely sure to take the pressure drop within the system into consideration. If greater lengths are used, the inside diameter of the lines should, therefore, at least be 9 mm and be reduced only shortly before being connected to the motor.

Operating Pressure

Fo all MSK motors, the maximum coolant inlet pressure is **6 bar**. Limit the inlet pressure of 3 bar for motors up to manufacturing date of 2010-01-01 **FD 10W01**.

Please note that additional screwed or branch connections in the cooling circuit can reduce the flow and supply pressure of the coolant.

Pressure Drop

The flow in the coolant in the drive components is subject to changes in cross-section and direction. For that reason, there are friction and turning losses. These losses show as the pressure drop Δp.

The pressure drop Δp_n of the liquid-cooled motors is specified in the technical data. It relates to the specified flow volume of water as coolant. If the flow volume is converted to a different temperature increase, the pressure drop must be taken from the characteristic curve below.

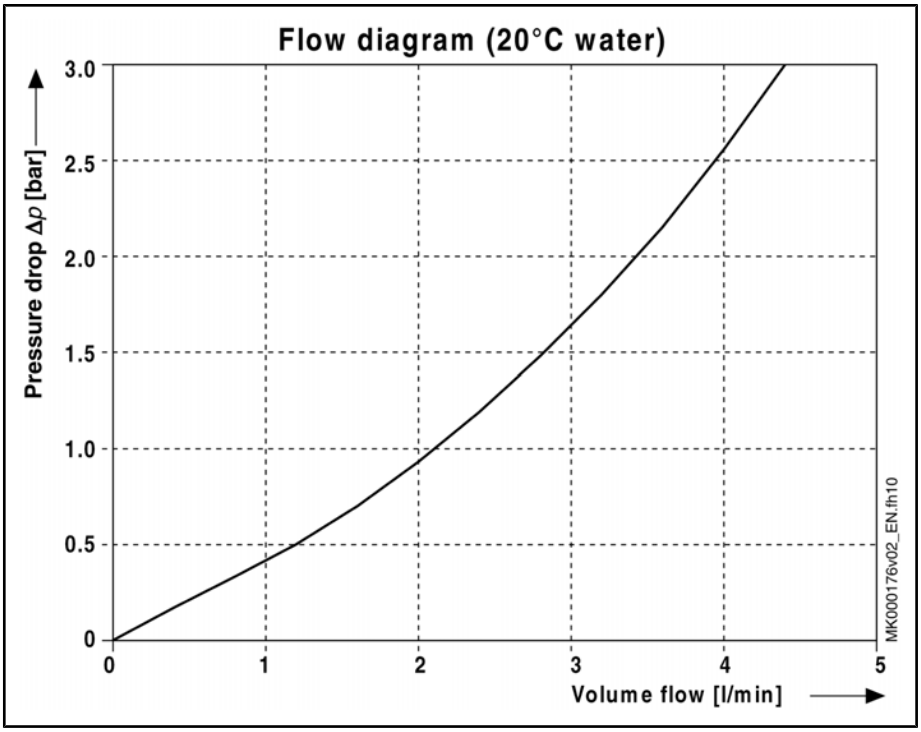


Fig.9-21: Flow diagram for MSK motors

☞ If a different coolant is used, a different coolant-specific flow diagram is applicable.

Coolants

The data specified in the documentation relate to **water as coolant.**. If other coolants are used, these data no longer apply and must be recalculated.

Only MSK motors with the option "FN" can be operated via an externally connected cooling system.

The motor power loss P_V is conducted via the coolant. Accordingly, MSK motors may only be operated if coolant supply is ensured. The cooling system must be rated by the machine manufacturer in such a way that all requirements regarding flow, pressure, cleanliness, temperature gradient etc. are maintained in every operating state.

⚠ CAUTION **Impairment or failure of motor, machine or cooling system!**

⇒ Heed the manufacturer's instructions when constructing and operating cooling systems.

⇒ Do not use any lubricants or cutting materials from operating processes.

A cooling with floating water from the supply network is not recommended. Calcareous water can cause deposits or corrosion and damage the motor and the cooling system.

For corrosion protection and for chemical stabilization, the cooling water must have an additional additive which is suitable for mixed-installations.

Use of aggressive coolants, additives, or cooling lubricants can cause irreparable motor damages.

- Use systems with a closed circulation and a fine filter ≤ 100 µm.

- Observe the environmental protection and waste disposal instructions at the place of installation when selecting the coolant.

Aqueous Solution

Aqueous solutions ensure reliable corrosion protection without significant changes to the physical properties of the water. The recommended additives contain no materials hazardous to water.

Emulsion with Corrosion Protection

Corrosion protection oils for coolant systems contain emulsifiers which ensure a fine distribution of the oil in the water. The oily components of the emulsion protect the metal surfaces of the coolant duct against corrosion and cavitation. An oil content of 0.5 – 2 volume percent has proved to be of value.

If, in addition to its function of corrosion protection, the corrosion protection oil also assumes the function of lubricating the coolant pump, the oil content must approx. be 5 vol.%.

Observe the instructions of the pump manufacturer!

☞ Bosch Rexroth can give no general statements or investigations regarding applicability of process-related coolants, additives, or operating conditions.

The performance test for the used coolants and the design of the liquid coolant system are generally the responsibility of the machine manufacturer.

Coolant Additives

Recommended Manufacturers of Coolant Additives

The proper chemical treatment of the closed water systems is precondition to prevent corrosion, to maintain thermal transmission, and to minimize the growth of bacteria in all parts of the system.

Rexroth recommends using coolant additives of the company NALCO Deutschland GmbH.

Depending on the size of the cooling system, the user may use different additives in form of "ready-to-use cooling water" and "water treatment kits".

☞ The packaging size and the ingredients of the water treatment kit are completely adapted to the corresponding system volume and the user may fill them into the coolant reservoir without observing further mixing ratios.

Ready-to-Use Cooling Water (Company NALCO)

System volume in liters	Order code	Additives NALCO...
0.5 ... 50	Nalco PCCL100.11R	PCCL100

Fig.9-22: Ready-to-Use Cooling Water (Company NALCO)

Cooling Water NALCO PCCL100

Nalco PCCL100 is a ready-to-use, preserved cooling water for the use in closed cooling water systems. It is supplied directly to the closed systems and contains all reagents in the proper treatment concentration.

Nalco PCCL100 contains a corrosion inhibitor protecting ferrous metal, copper, copper alloys and aluminum against corrosion. Nalco PCCL100 is free of nitrite and minimizes the micro-biological growth.

Operating Conditions and Application Notes

Water Treatment Kits (Company NALCO)

System volume in liters	Order code	Additives NALCO...
50 ... 100	480-BR100-100.88	TRAC100 7330 73199
100 ... 200	480-BR100-200.88	
200 ... 350	480-BR100-350.88	
350 ... 500	480-BR100-500.88	

Fig.9-23: Water Treatment Kits (Company NALCO)

Coolant Additive NALCO TRAC100

Nalco TRAC100 is a liquid corrosion and film inhibitor for the use in closed cooling systems. Optionally with TRASAR technology: It monitors, shows and dosages the product automatically to its target concentration and continuously protects the system. NALCO TRAC100 is a complete inhibitor protecting ferrous metal, copper alloys and aluminum against corrosion. NALCO TRAC100 is free of nitrite and minimizes the requirements for micro-biological control.

Coolant Additive NALCO 7330

Nalco 7330 is a non-oxidizing broad band biocide and suitable for application in closed cooling circuit systems.

Coolant Additive NALCO 73199

Nalco 73199 is an organic corrosion inhibitor supporting a fast own protection layer and covering protection layer for non-ferrous metals.

The above additives are part of the preventive water treatment program by Nalco. It comprises not only the chemicals but also test methods, service and equipment. All these are made available to the user of the products.

The water treatment program is a specification for the user and describes the minimum requirements. Consult Nalco on any additional equipment, tests and services to ensure optimum performance and system protection of the cooling systems.

For additional information and order placement, please contact:

NALCO Deutschland GmbH

Planckstr. 26

71691 Freiberg/Neckar, Germany

Fax +49(0)7141-703-239

www.nalco.com

☞ Rexroth is not in a position to give general statements or carry out investigations regarding applicability of process-related coolants, additives, or operating conditions.

The performance test for the used coolants and the design of the liquid coolant system are generally the responsibility of the machine manufacturer.

Used Materials

When used with MSK motors, the coolant comes into contact with the following materials:

Materials with coolant contact

Flange, end shield	Al Mg 5 F32
Profile	Al Mg Si 0,5 F22
O-ring	Viton

In dimensioning and operating the cooling system, the machine manufacturer has to exclude all chemical or electro-chemical interactions with subsequent corrosion or decomposition of motor parts.

Coolant Inlet Temperature

IndraDyn S motors (option "FN") are designed according to DIN EN 60034-1 for operating with +10...+40 °C coolant inlet temperature. This temperature range must be strictly observed. At higher coolant temperatures, the reduction of the available torque is increased. Because of high coolant temperature gradients, lower temperatures may lead to destruction of the motor.

☞ Install systems in the cooling circuit for monitoring flow, pressure and temperature.

Setting the Inlet Temperature

Observe the temperature range permitted and consider the existing ambient temperature when setting the coolant inlet temperature.

The lower limit of the recommended coolant inlet temperature can be limited in dependence on the existing ambient temperature. To avoid condensation, a value of max. 5 °C below the existing ambient temperature is permitted as the lowest temperature to be set.

	Example 1:	Example 2:
Permitted coolant inlet temperature range:	+10 … +40 °C	+10 … +40 °C
Ambient temperature:	+20 °C	+30 °C
Coolant inlet temperature to be set:	+15 … +40 °C	+25 … +40 °C

☞ The coolant inlet temperature must be set in a temperature range of +10 ... +40°C and may be only max. 5°C under the existing ambient temperature to avoid condensation.

Operating Conditions and Application Notes

9.13 Motor Temperature Monitoring

9.13.1 General Information

The motor temperature is monitored by two systems that are operated independently of each other

- Temperature sensor
- Temperature model

and ensures thus the best protection of motors against irreversible damage by thermal overload.

9.13.2 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 motor temperature measured is controlled via the following threshold values:

- Motor - warning temperature (140 °C)
- Motor - switch-off temperature (150 °C)

The threshold values are filed within the encoder memory of the MSK motors.

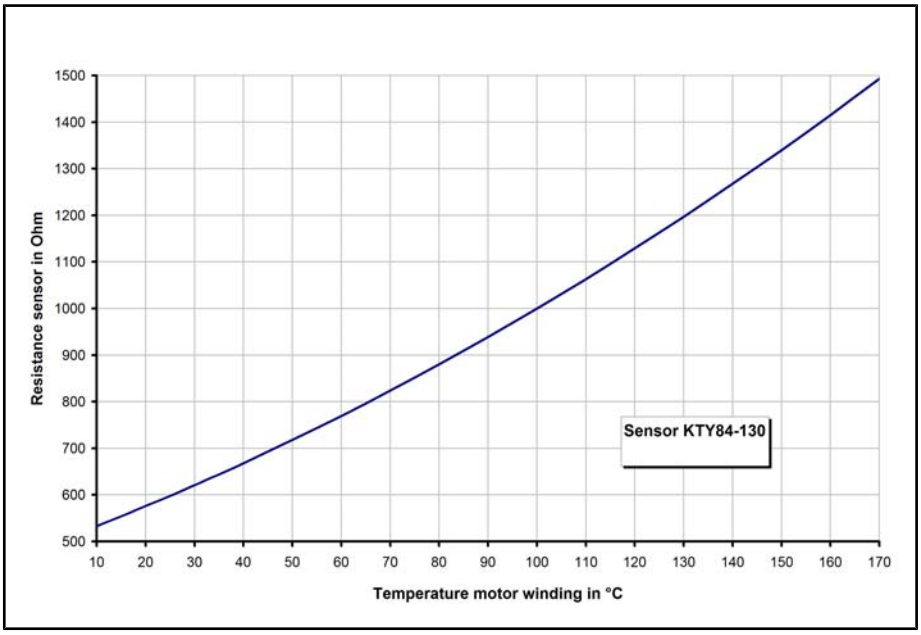


Fig.9-24: Characteristic curve KTY84-130

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

For further information, please refer to the functional description of IndraDrive control devices.

9.14 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 occured 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 depencence of the rise time.

☞ Outputs of IndraDrive converters keep this limits.

10 Transport and Storage

10.1 Notes about Transport

Transport our products only in original package. Additionally, heed specific ambient factors to protect the products from transport damage.

With regard to the DIN EN 60721-3-2, the following classifications and limit values are specified, which our products undergo during transport by road, water or sea. Please observe the described classifications in details to heed all factors, which are specified in their particular class.

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

Classification mode	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

Fig. 10-1: Allowed classes of ambient conditions during transport

The following significant ambient factors of the aforementioned classifications are named to receive a better overview. The specified values are the values of the particular class, if no others are given. Bosch Rexroth reserves the right, due to future experiences or changed ambient factors, to adjust these values at any time.

Permissible 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)
Occurence of salt mist			Not permitted [1)]

1) Differs from DIN EN 60721-3-2

Fig. 10-2: Permissible transport conditions

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

10.2 Notes about Storage

10.2.1 Storage Conditions

Generally, Bosch Rexroth recommends to store all components, up to their real installation into the machine, as follows:

- in their original package
- dry and dustfree
- at room temperature
- vibration free
- protected against light or direct insolation

Factory attached protective sleeves and covers can be mounted onto our motors. They must stay on the motor for transport and storage. Remove these parts just before assembly.

With regard to the DIN EN 60721-3-1, the following classifications and limit values are specified, which our products undergo during storage. Please observe the described classifications in details to heed all factors, which are specified in their particular classification.

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

Classification mode	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

Fig.10-3: Allowed classes of ambient conditions during storage

The following significant ambient factors of the aforementioned classifications are named to receive a better overview. The specified values are the values of the particular class, if no others are given. Bosch Rexroth reserves the right, due to future experiences or changed ambient factors, to adjust these values at any time.

Allowed classes of ambient conditions during storage acc. to DIN 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	ρw	g/m³	1 … 29
Condensation	- -	- -	not permissible
Icing	- -	- -	not permissible
Direct insolation	- -	- -	Not permitted [1)]
Occurence of salt mist	- -	- -	Not permitted [1)]

1) Differs from DIN EN 60721-3-1

Fig.10-4: Permitted storage conditions

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

10.2.2 Storage Periods

Independend from storage duration, which can exceed the guarantee period of our products, the function remains under observance and realization of additional measures for start-up. Thereof, an additional warranty claim cannot be derived.

Motors

Storage period	Measures for start-up
< 1 year	Resurfacing the Holding Brake
1 ... 5 years	1. Check the electric contact whether they are free of corrosion 2. Run in the motor without load for one hour at 800 ... 1,000 rpm 3. Resurfacing the Holding Brake
> 5 years	1. Change the bearing 2. Change the encoder 3. Resurfacing the Holding Brake 4. Check the electric contact whether they are free of corrosion

Fig. 10-5: Measures before start-up of long-term storage motors

Cables and Connectors

Storage period	Measures before start-up
< 1 year	none
1 ... 5 years	⇒ Check the electric contact whether they are free of corrosion
> 5 years	⇒ Should the cable or the cable jacket have porous parts, change them, otherwise check the electric contacts if they are free of corrosion.

Fig. 10-6: Measure before start-up of long-term storaged cables and connectors

11 Delivery Status, Identification, Handling

11.1 State of Delivery

11.1.1 General Information

On delivery, the IndraDyn S motors are packed in cardboard boxes or wooden crates. Packing units on pallets are secured by means of retaining straps.

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

Maintain a sufficient distance and carefully cut the bandages.

Upon delivery from the factory, the motor drive shaft and the connectors have protective sleeves. Remove the protective sleeves just before assembly.

11.1.2 Inspection at the Factory

All IndraDyn S motors undergo the following tests, among others, at the factory:

Electrical Test

- High voltage test
- Isolation resistance test
- Protective conductor connection
- Test of winding resistance

Mechanical Test

- Concentricity and position tolerances of shaft end and fastening flange
- Axial eccentricity of the flange face to the shaft
- Coaxiality of the centering shoulder to the shaft
- Test of brake holding torque (option)

11.1.3 Test Realized by the Customer

Since all IndraDyn S motors undergo a standardized inspection procedure, high-voltage tests on the customer side are not required. Motors and components could be damaged if they undergo several high-voltage inspections.

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.

11.2 Identification

11.2.1 Scope of delivery

The total scope of a delivery can be seen in the delivery note or waybill. However, the contents of a delivery can be distributed over several packages. Each individual package can be identified using the shipment label attached. Please, check after receiving the delivery, if the delivered goods comply with your order and the shipping documents.

Complain any deviation at your responsible Rexroth sales partner, immediately.

Complain any visible transport damage directly at the deliverer.

11.2.2 Type Plate

Each motor has an individual type plate showing the device designation and providing technical information. Additionally, a second type plate is delivered with the motor.

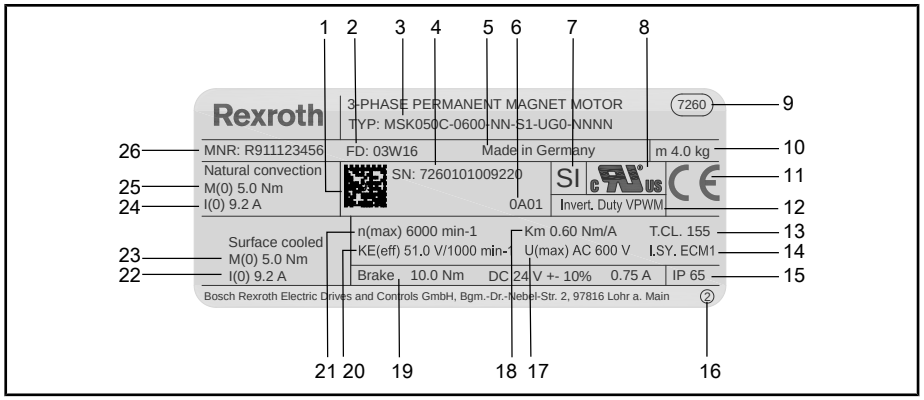
If the original type plate of the motor is obscured by the machine construction, use the second type plate to an easily visible portion of the machine. This type plate is either enclosed to the motor or is removably glued onto the original type plate.

The type plate is provided for

- Identification of the motor
- Procurement of spare parts in case of a fault
- Service information.

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

Motor Name Plate



1	Barcode
2	Production date
3	Motor type (ordering designation according to the type code)
4	Serial number
5	Country of origin
6	Revision state
7	Designation motor prepared for safety technique
8	Designation cURus (UL)
9	Factory number
10	Netto weight
11	CE conformity
12	UL Inverter Duty VPWM
13	Thermal temperature class
14	Designation insulation system (UL)
15	Degree of protection housing
16	Type plate designation
17	Voltage class (UL)
18	Torque constant at 20°C
19	Data about holding brakes, optional (holding brake, rated voltage, rated current)
20	Voltage constant
21	Maximum speed
22	Standstill current surface (surface or liquid)
23	Continuous torque at standstill (surface or liquid)
24	Continuous current at standstill 60K
25	Continuous torque at standstill 60K
26	Material number

Fig.11-1: Type plate MSK

11.3 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!**

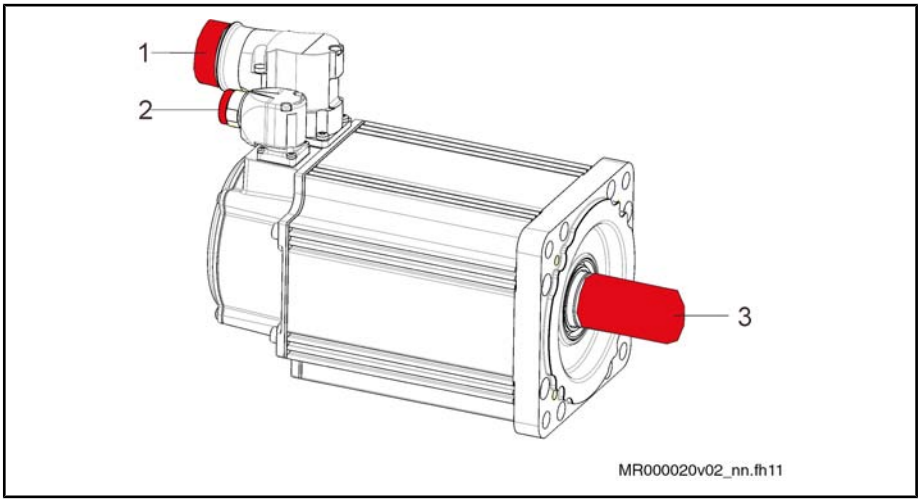
Store the motors horizontally in their original packaging in a dust-free, dry, vibration-free and sun-protected environment.

Also observe the notes regarding storage and transport on the packaging.

Handling

On delivery, the IndraDyn S motors have protective caps and covers on the output shaft and on the flange sockets. During transport and storage, the protective sleeves must remain on the motor.

- Remove the protective sleeves just before assembly.
- Also use the protective sleeves if you return the goods.
- Avoid any damage to the motor flange and drive shaft.



③ Power connector protective sleeve
② Encoder connector protective sleeve
① Shaft protective sleeve
Fig. 11-2: IndraDyn S protective sleeves

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

Please, observe the following points during transport:

- Use suitable means of transport and consider the weight of the components (you can find the weight information on the data sheets or on the type plate of the motor).
- Provide appropriate shock absorbers, if strong vibrations may occur during transport.
- Transport the motors only in the horizontal position.
- Use cranes with lifting sling belts to lift the motors.

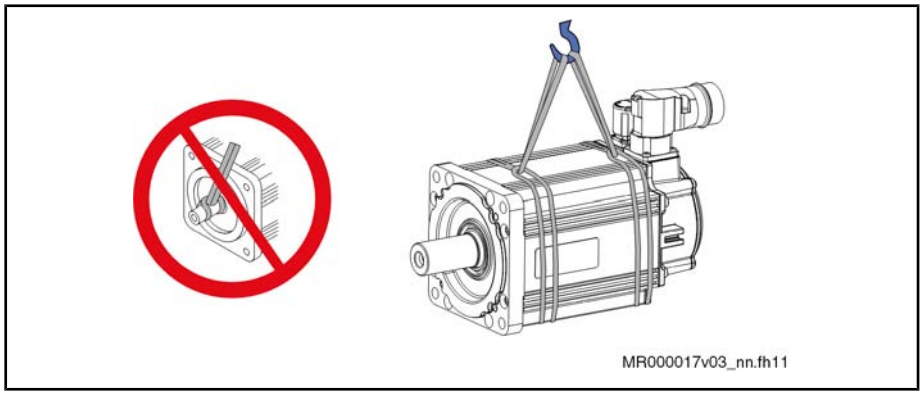


Fig.11-3: Lifting and transporting motors by means of lifting sling belts

12 Installation

12.1 Safety

⚠ DANGER **Death by electrocution possible due to live parts with more than 50V!**

Open connectors of the motor only when the system has been de-energized.

Heed the safety instructions according to DIN EN 50110-1:

1. Disconnect.
2. Protect the system or plant against restart.
3. Determine de-energization.
4. Ground and short-out.
5. Cover or shield any adjacent live parts.

Before starting to work, check with an appropriate measuring device (e.g. an multimeter) whether parts of the system are still under residual voltage (e.g. caused by capacitors, etc.). Wait for their discharging time.

⚠ 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 working steps very carefully. In this way, you minimize the risk of accidents and damage.

12.2 Skilled Personnel

Any works on the system and on the drives or in their vicinity must only be carried out by appropriately trained technical personnel.

Please make sure that all persons carrying out

- installation works
- maintenance, or
- operating activities

on the system are adequately familiar with the contents of this documentation as well as with all warnings and precautionary measures contained therein.

Qualified technical personnel are those persons who have been trained, instructed or are authorized to activate and deactivate, ground and mark electric circuits and equipment according to the technical safety regulations. Qualified technical personnel must possess appropriate safety equipment and have been trained in first aid.

12.3 Mechanical Attachment

12.3.1 Flange Assembly

In order to attach the motors correctly and safely to the machine, Bosch Rexroth recommends the following screws and washers for motor mounting.

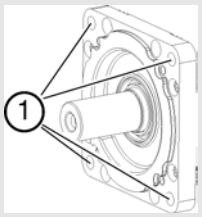
The screwed connections must be able to take up both the force due to the weight of the motor and the forces acting during operation.

Usually, use cylinder head screws DIN 912 M... x ...- 8.8 and related washers according to DIN EN 28738. In case of several motors, the integration of washers is not required, see table.

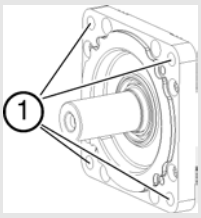
If the screws and washers used do not comply with this recommendation, the property class of the screws and the hardness class must be equivalent in order to transmit the required tightening torques (see fig. 12-1 "MSK mounting accessories (flange assembly)" on page 253).

IndraDyn S motors are designed for flange assembly (B05). Details on the mounting holes are given in the corresponding dimension sheet. For the fastening, the following general assignment applies:

Recommended screws for flange fastening of the MSK motors

	B05 (flange assembly)			
	Hole	Screw (8.8)		Washer DIN EN 28738
	Ø [mm]	Type [1]	M_{GA} [Nm]	Ø [mm]
MSK030	4.5	M4×20	3.1	none
MSK040	6.6	M6×20	10.4	none
MSK043 [2]				
MSK050	9.0	M8×20	25	10
MSK060				
MSK061				
MSK070	11.0	M10×30	51	12
MSK071				
MSK075 [2]				
MSK076				

Installation



	B05 (flange assembly)			
	Hole	Screw (8.8)		Washer DIN EN 28738
	Ø [mm]	Type 1)	M_{GA} [Nm]	Ø [mm]
MSK100	14.0	M12×40	87	14
MSK101				
MSK103 2)				
MSK131 2)	18.0	M16×35	215	none

① Mounting hole
M_{GA} Tightening torque in Newton meters
1) Minimum screw length for screwing into steel.
2) Motor not available in ATEX version.
Fig. 12-1: MSK mounting accessories (flange assembly)

12.3.2 Preparation

Prepare motor assembly as follows:

1. Procure tools, supplies, measuring and test equipment.
2. Check all components for visible damage. Defective components must not be mounted.
3. Ensure that dimensions and tolerances on the system side are suitable for motor attachment (for details, see the dimension sheet).
4. Check that all components, mounting surfaces and threads are clean.
5. Make sure that the assembly can be carried out in a dry and dust-free environment.
6. Make sure that the holder for the motor flange is deburred.
7. Remove the protective sleeve of the motor drive shaft and keep it for further use.
8. Only for motors with holding brake:

   Check whether the motor holding brake reaches the holding torque specified in the data sheet. Should the brake fail to reach the torque specified, first resurface the holding brake as described in chapter 9.10.4.

12.3.3 Motor Assembly

Mount the motor and observe the following:

1. Avoid pinching or jamming the centering collar on the motor side.
2. Avoid damage to the insertion fitting on the system side.
3. Connect the motor with the machine and observe the tightening torques.
4. Check the fit and accuracy of the connection before you proceed.

After having mounted the motor mechanically as prescribed, establish the electrical connections.

12.4 Electrical Connection – Connecting the Motor

12.4.1 General Information

It is recommended that you use ready-made Rexroth connection cables. These cables provide a number of advantages, such as UL/CSA authorization, extreme load capability and resistance as well as a design suitable for EMC.

⚠ DANGER **Danger of life due to electrical power! Handling within the area of live parts is extremely dangerous.**

- Any work required on the electric system must only be carried by skilled electricians. It is absolutely necessary to use power tools.
- Before working
  1. Disconnect.
  2. Protect the system or plant against restart.
  3. Determine de-energization.
  4. Ground and short-out.
  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.

⚠ 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.

12.4.2 Attaching the Connectors

Power/Encoder Connectors

When fitting the encoder connector with a screwed end fitting, proceed as follows:

1. Place the power connector in the correct position onto the thread of the connection housing.
2. Tighten the union nut of the power connector manually. By leading the cable in further, the power connector can be steadily brought to its final position.
3. Completely tighten the union nut.

Installation

☞ Only completely tightened union nuts guarantee the indicated IP65 protection against water and activate the vibration protection.

12.4.3 Adjusting the Output Direction

The output direction of the connected power and encoder cables is adjustable for many MSK motors. This can be done via rotary flange sockets. The adjustable flange sockets can be turned through 240°. Please refer to the following table, for which flange socket, the output direction can be adjusted.

Flange socket	adjustable	not adjustable	Comment
RGS1000	■		-
RGS1003		■	-
RLS1000	■		-
RLS1200	■		-
RLS1300		■	The output direction can be selected when ordering

The motor flange socket can be turned if an appropriate connector has been attached. Owing to the leverage of the attached connector, the flange socket can be turned manually to the desired position.

1. Connect the motor power cable to the flange socket.
2. Move the flange socket to the desired output direction by turning the plugged-in connector.

☞ Do not use any tools (e.g. pliers or screwdrivers) to turn the motor flange socket. Mechanical damage to the flange socket when using tools cannot be excluded.

The desired output direction is set.

☞ Whenever the flange socket is turned, the holding torque in the set position is reduced. To ensure the required holding torque of the flange socket, the output direction should be changed no more than 5 times!

13 Commissioning, Operation and Maintenance

13.1 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 notes on commissioning refer to IndraDyn S motors as part of a drive system with drive and control devices.

Preparation

1. Keep the documentation of all products you are using ready.
2. Check the products for damage.
3. Check all mechanical and electrical connections.
4. Activate the safety and monitoring equipment of the system.
5. Make sure that the optional holding brakes are ready for operation (cf. chapter 9.10.4 Holding Brake–Commissioning and Maintenance Instructions).

Bulk head connector

When all requirements are met, proceed as follows:

1. Activate the optional motor cooling fan unit or liquid cooling.
2. Carry out the commissioning of the drive system according to the instructions provided in the respective documentation. You can find the respective information in the functional description of the drive control devices.

   Commissioning of drive controllers and the control unit may require additional steps. The inspection of the functioning and performance of the systems is not part of the commissioning of the motor; instead, it is carried out within the framework of the commissioning of the machine as a whole. Observe the instructions and regulations given by the machine manufacturer.

Commissioning, Operation and Maintenance

13.2 Operation

Keep the described ambient conditions during operation (cf. chapter 9 "Operating Conditions and Application Notes" on page 209).

13.3 Deactivation

In the case of malfunctions or maintenance, or to deactivate the motors, proceed as follows:

1. Observe the instructions of the machine documentation.
2. Use the machine-side control commands to bring the drive to a controlled standstill.
3. Switch off the power and control voltage of the drive controller.
4. **Only for motors with blowers:** Switch off the motor protection switch for the motor blower.
5. Switch off the main switch of the machine.
6. Secure the machine against accidental movements and against unauthorized operation.
7. Wait for the discharge time of the electrical systems to expire and then disconnect all electrical connections.
8. Before dismounting the motor and - if applicable - the fan unit, secure them against dropping or movement before detaching the mechanical connections.

13.4 Maintenance

13.4.1 General Information

Synchronous motors of the IndraDyn S series operate maintenance-free within the given operating conditions. However, operation under unfavorable conditions can lead to limitations in availability.

Increase availability with regular preventive maintenance measures. Observe the information in the maintenance schedule of the machine manufacturer and the service measures described below.

⚠ DANGER **Danger of life due to electrical power! Handling within the area of live parts is extremely dangerous.**

- Any work required on the electric system must only be carried by skilled electricians. It is absolutely necessary to use power tools.
- Before working
  1. Disconnect.
  2. Protect the system or plant against restart.
  3. Determine de-energization.
  4. Ground and short-out.
  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 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!

Use safety gloves.

Do not work on hot surfaces.

⚠ WARNING **Damage to persons and property at maintenance during operation!**

Do not carry out any maintenance measures, while the machine is running.

During maintenance work, secure the system against restarting and unauthorized use.

13.4.2 Cleaning

Excessive dirt, dust or chips may adversely affect the functionality of the motors and, in extreme cases, even cause a failure of the motors. 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 ribs are partially covered with dirt, sufficient heat dissipation via the ambient air is no longer guaranteed.

An insufficient heat radiation may have undesired consequences. The bearing lifetime is reduced by operation at impermissibly high temperatures (the bearing

grease is decomposing). Switch-off caused by overtemperature despite operation on the basis of selected data, because the appropriate cooling is missing.

13.4.3 Bearings

The nominal lifetime of the bearings is L10h = 30,000 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.

13.4.4 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.

13.5 Notice at Malfunctions

⚠ WARNING **Electrocution by live parts of more than 50 V!**

Before working on live parts: De-energize the machine and secure the mains switch again unintendet or unauthorized re-energization.

Check if the voltage is dropped down under 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 principle, heed the notice about malfunctions in the project planning manual and the commissioning manual. Contact the manufacturer if necessary chapter 16 "Service and Support" on page 271.

Malfunction	Failure cause	Measures
The motor does not run	Release of the controller is missing	Activate the release of the controller
	Failure of the controller	Troubleshooting according to the documentation of the controller.
	Supply voltage is missing	Control the supply voltage
	Brake is not ventilated	Control the drive of the brake
Vibrations	The coupling element or the attachments are badly balanced	Re-balancing
	Adjustment of shaft end attachments (like coupling, gearbox...) is insufficient	Re-align the attachments.
	The fastening screws are loose.	Lock the screw connections as specified
Running noise	Foreign bodies within the motor	Set the motor on standstill -> repair by manufacturer
	Bearing is damaged	Set the motor on standstill -> repair by manufacturer
High motor temperature The motor temperature approaches	Operation outside of the characteristics	Reduce the weight
	The heat flow is impeded	Clean the motor Clean the fan grill of the fan unit and check the function of the fan Control the coolant circuit at liquid cooling.
Wrong or incorrect temperature displayed	Temperature sensor not connected	Connect the temperature sensor.
	Temperature sensor is damaged	Set the motor on standstill -> repair by manufacturer

Fig. 13-1: Malfunctions at MSK motors

13.6 Dismantling

⚠ WARNING **Damage to persons and property at installation work!**

- Do not work on unsecured and operating machines.
- Before working, secure the machine against accidental movements and against unauthorized operation.
- Before dismantling, secure the motor and power supply against falling or movements before disconnecting the mechanical connections.

⚠ CAUTION **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!

Use safety gloves.

Do not work on hot surfaces.

- Observe the instructions of the machine documentation.
- Please observe the safety notes.
- Dismantle the motor from the machine. Store the motor properly!

14 Environmental Protection and Disposal

14.1 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 negativ 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

14.2 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 improper 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.

15 Appendix

15.1 List of standards

Document number	Title	Edition
06/42/EG * 06/42/CE * 06/42/EC	Directive 2006/42/EG of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC (recast)	17.05.2006
06/108/EG * 06/108/CE * 06/108/EC	Directive 2004/108/EC of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC	15.12.2004
06/95/EG * 06/95/CE * 06/95/EC	Directive 2006/95/EC of the European Parliament and of the Council of 12 December 2006 on the harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits	12.12.2006
DIN 332-2	Center holes 60° with thread for shaft ends for rotating electrical machines	1983-05
DIN 748-1	Cylindrical Shaft Ends; Dimensions, Nominal Transmissible Torques	1970-01
DIN 6885-1	Drive Type Fastenings without Taper Action; Parallel Keys, Keyways, Deep Pattern	1968-08
DIN 42955	Tolerances of shaft extension run-out and of mounting flanges for rotating electrical machinery, test	1981-12
DIN EN 60034-1 Corrigenda 1 * VDE 0530-1 Corrigenda 1	Rotating electrical machines - Part 1: Rating and performance (IEC 60034-1:2004); German version EN 60034-1:2004, Corrigenda to DIN EN 60034-1 (VDE 0530-1):2005-04	2007-09
DIN EN 60034-7; VDE 0530-7	Rotating electrical machines - Part 7: Classification of types of constructions and mounting arrangements (IM code) (IEC 60034-7:1992); German version EN 60034-7:1993	2001-12
DIN EN 60034-9 Corrigenda 1 * VDE 0530-9 Corrigenda 1	Rotating electrical machines - Part 9: Noise limits (IEC 60034-9:2003, modified + A1:2007); German version EN 60034-9:2005 + A1:2007, Corrigenda to DIN EN 60034-9 (VDE 0530-9):2008-01	2008-04
DIN EN 60034-11; VDE 0530-11	Rotating electrical machines - Part 11: Thermal protection (IEC 60034-11:2004); German version EN 60034-11:2004	2005-04
DIN EN 60034-14; VDE 0530-14	Rotating electrical machines - Part 14: Mechanical vibration of certain machines with shaft heights 56 mm and higher - Measurement, evaluation and limits of vibration severity (IEC 60034-14:2003 + A1:2007); German version EN 60034-14:2004 + A1:2007	2008-03
DIN EN 60204-1 Corrigenda 1 * VDE 0113-1 Corrigenda 1	Safety of machinery - Electrical equipment of machines - Part 1: General requirements (IEC 60204-1:2005, modified); German version EN 60204-1:2006, Corrigendum to DIN EN 60204-1 (VDE 0113-1):2007-06; German version CENELEC-Cor. :2010 to EN 60204-1:2006	2010-05
DIN EN 60529; VDE 0470 Part 1	Degrees of protection provided by enclosures (IP code) (IEC 60529:1989 + A1:1999); German version EN 60529:1991 + A1:2000	2000-09
DIN EN 60721-1	Classification of environmental conditions - Part 1: Environmental parameters and their severities (IEC 60721-1:1990 + A1:1992 + A2:1995); German version EN 60721-1:1995 + A2:1995	1997-02
DIN EN 60721-3-3	Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities; section 3: Stationary use at weatherprotected locations (IEC 60721-3-3:1994); German version EN 60721-3-3:1995	1995-09

Appendix

Document number	Title	Edition
DIN ISO 281	Rolling bearings - Dynamic load ratings and rating life (ISO 281:2007)	2010-10
DIN VDE 0298-4; VDE 0298 Part -4	Application of cables and cords in power installations - Part 4: Recommended current-carrying capacity for sheathed and nonsheathed cables for fixed wirings in and around buildings and for flexible cables and cords	2003-08

Fig.15-1: List of standards

Appendix

15.2 Declaration of Conformity

Electric Drives and Controls | Hydraulics | Linear Motion and Assembly Technologies | Pneumatics | Service

Rexroth Bosch Group

Konformitätserklärung

Dok.-Nr.: **TC30318-1**
Datum: **2010-12-13**

- ☐ nach Maschinenrichtlinie 2006/42/EG
- ☒ nach Niederspannungsrichtlinie 2006/95/EG
- ☐ nach EMV-Richtlinie 2004/108/EG
- ☐ nach Druckgeräte-Richtlinie 97/23/EG
- ☐ nach ATEX-Richtlinie 94/9/EG

Hiermit erklärt der Hersteller,

Bosch Rexroth Electric Drives and Controls GmbH
Bürgermeister-Dr.-Nebel-Straße 2
97816 Lohr a. Main / Germany

dass das nachstehende Produkt

Bezeichnung:	AC-Motor
Typ:	MSK030, MSK040, MSK043, MSK050, MSK060, MSK061, MSK070, MSK071, MSK075, MSK076, MSK100, MSK101, MSK103, MSK131
Ab Herstelldatum:	2009-01-08

in Übereinstimmung mit der oben genannten EU-Richtlinie entwickelt, konstruiert und gefertigt wurde.

Angewandte harmonisierte Normen:

Norm	Titel	Ausgabe
EN 60034-1	Drehende elektrische Maschinen – Teil 1: Bemessung und Betriebsverhalten	2004
EN 60034-5	Drehende elektrische Maschinen – Teil 5: Schutzarten aufgrund der Gesamtkonstruktion von drehenden elektrischen Maschinen (IP-Code) – Einteilung	2001 + A1:2007

Weitere Erläuterungen:

Dieses Produkt ist eine Einbaukomponente, die aufgrund ihrer Einbaueigenschaften nicht vorneherein den Vorschriften für Endgeräte, Maschinen oder Anlagen entsprechen kann. Es darf daher nur zu Einbauzwecken verwendet werden.
Die Bewertung der elektrischen und mechanischen Sicherheit, der Umwelteinflüsse (Fremdkörper, Feuchtigkeit) muss im eingebauten Zustand am Endprodukt erfolgen.
Im eingebauten Zustand können sich die EMV-Eigenschaften dieses Produktes ändern.
Deshalb ist für das Endprodukt (Endgerät, Maschine, Anlagen) eine Überprüfung der EMV-Eigenschaften durch den Endproduktthersteller zweckmäßig.

Lohr a. Main (Ort), den 2010-12-13 (Datum) ppa. Joachim Hennig, Werkleitung LoP2 i.V. Eberhard Schemm, Entwicklungsbereichsleiter Antriebe

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

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Fig. 15-2: Conformity

Appendix

Electric Drives and Controls | Hydraulics | Linear Motion and Assembly Technologies | Pneumatics | Service

Rexroth
Bosch Group

Declaration of Conformity

(Translation of the original Declaration of Conformity)

Doc. No.: **TC30318-1**

Date: **2010-12-13**

- ☐ in accordance with Machinery Directive 2006/42/EC
- ☒ in accordance with Low Voltage Directive 2006/95/EC
- ☐ in accordance with EMC Directive 2004/108/EC
- ☐ in accordance with Pressure Equipment Directive 97/23/EC
- ☐ in accordance with ATEX Directive 94/9/EC

The manufacturer

Bosch Rexroth Electric Drives and Controls GmbH
Bürgermeister-Dr.-Nebel-Straße 2
97816 Lohr a. Main / Germany

hereby declares that the product below

Name: AC motor
Type: MSK030, MSK040, MSK043, MSK050, MSK060, MSK061, MSK070, MSK071, MSK075, MSK076, MSK100, MSK101, MSK103, MSK131

From date of manufacture: 2009-01-08

was developed, designed and manufactured in compliance with the above-mentioned EU directive.

Harmonized Standards applied:

Standard	Title	Edition
EN 60034-1	Rotating electrical machines – Part 1: Rating and performance	2004
EN 60034-5	Rotating electrical machines – Part 5: Degrees of protection provided by integral design of rotating electrical machines (IP code) - Classification	2001 + A1:2007

Further explanations:

This product is a built-in unit which, owing to its installation characteristics, is not able to comply with the regulations for complete apparatus, machines or installations from the outset. For this reason, it may only be used for built-in purposes. The product may only be assessed with regard to its electrical and mechanical safety as well as to environmental effects (foreign bodies, moisture) after it has been installed in the product intended for the final user.
After the product has been installed, its EMC properties may change. Hence the product intended for the final user (complete apparatus, machines or installations) should be inspected with regard to its EMC properties by the manufacturer of the product intended for the final user.

Place/date/signature as indicated in the original declaration.

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

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Fig. 15-3: Conformity

16 Service and Support

Our service helpdesk at our headquarters in Lohr, Germany and our worldwide service will assist you with all kinds of enquiries. You can reach us **around the clock - even on weekend and on holidays**.

	Helpdesk	Service Hotline Worldwide
Phone	**+49 (0) 9352 40 50 60**	Outwith Germany please contact our sales/service office in your area first. For hotline numbers refer to the sales office addresses on the Internet.
Fax	**+49 (0) 9352 40 49 41**	
E-mail	service.svc@boschrexroth.de	
Internet	http://www.boschrexroth.com You will also find additional notes regarding service, maintenance (e.g. delivery addresses) and training.	

Preparing Information

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

- Detailed description of the fault and the circumstances
- Information on the type plate of the affected products, especially type codes and serial numbers
- Your phone, fax numbers and e-mail address so we can contact you in case of questions.

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Notes

Rexroth
Bosch Group

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R911296289

Printed in Germany
DOK-MOTOR*-MSK********-PR09-EN-P