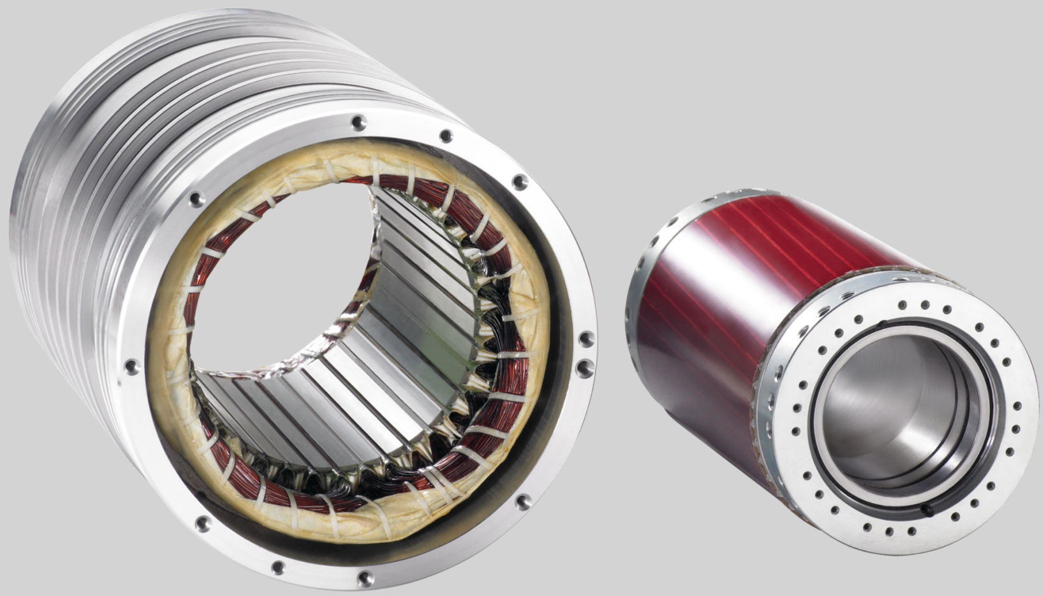
DBR AUTOMATION

rexroth
A Bosch Company

1MB

Asynchronous Spindle Motors

Project Planning Manual
R911264277
Edition 04



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Purpose of Documentation	This documentation ... • explains product features and applications, technical data as well as conditions and limits for operation and • provides information regarding product selection, handling and operation.

Revision history: Edition 04, 07/2022

See tab. 1-1 "Revision history" on page 3.

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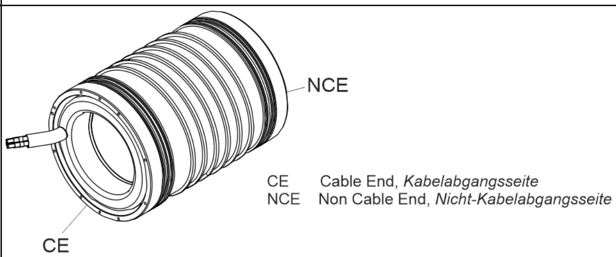
1 1MB Asynchronous Spindle Motors

1.1 Applications

Liquid cooled 1 MB asynchronous kit spindle motors of Rexroth are mainly used as direct drives in motor-driven spindles. The arrangement of the motor between the spindle main bearings enables a high rigidity of the motor-driven spindle. This means, for example, that main spindle and C-axis operation can be realized with only one drive on lathes.

Kit spindle motors are used for turning, milling and grinding in machine tools, transfer lines, machining centers and special machinery.

1.2 Basic features

Product	3~ PM motor
Type	1MB consist of 1MS and 1MR
Ambient temperature during operation	0 … 40 °C
Protection class (EN 60034-5)	IP00
Cooling mode (EN 60034-6)	IC3W7, water cooling
Installation altitude	0 ... 1000 m above MSL (without de-rating)
Thermal class (EN 60034-1)	155 (F)
Electrical connection	Wires with open ends (3x power, 4x KTY, 4x NTC, 4x bimetallic) (Special motors with double wires, 6x power)
Mechanical protection	Protective varnish on winding of 1MS Rust-protection varnish on rotor sheet metal package of 1MR
Motor ends	

1.3 Setup

The following figure shows the components of an AC main spindle drive with kit spindle motor.

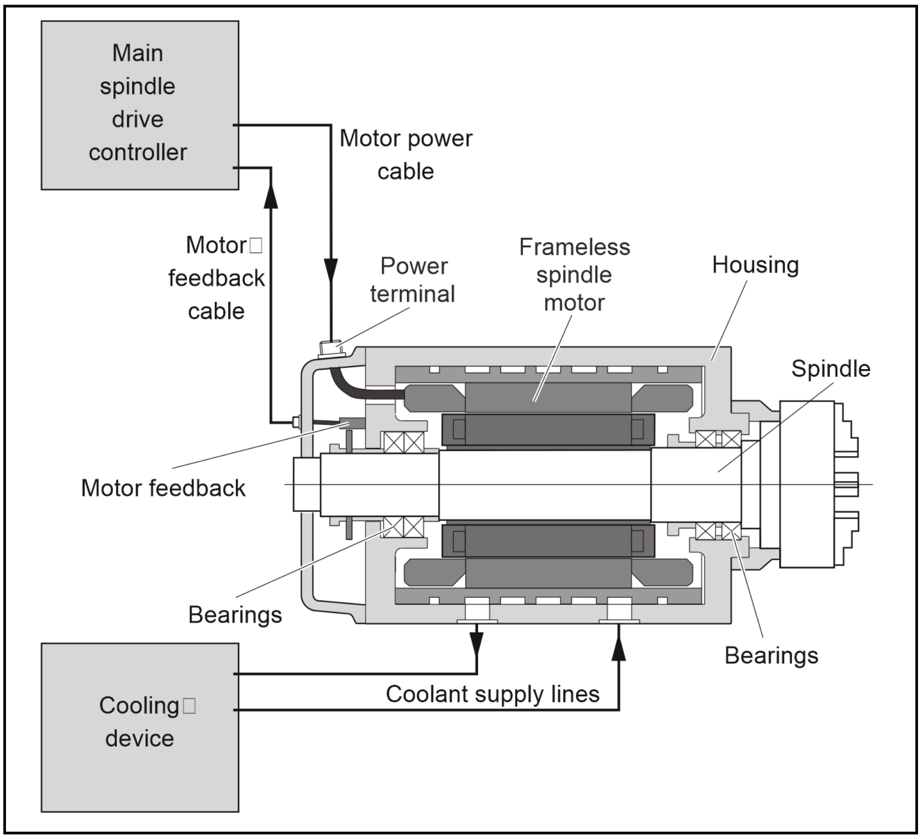


Fig. 1-1: Components of the AC main spindle drive with kit spindle motor 1MB

The motor spindle consists of the functional units spindle with housing, bearing, kit spindle motor with cooling and motor feedback.

The determination of the bearing type, its lubrication and the level of bearing preload as well as the protection of the stator interior against dirt, cooling lubricants, bearing grease, etc. depends on the application of the motor spindle and is the responsibility of the spindle designer.

Influences of the functional unit kit spindle motor on the design of the motor spindle are described in this documentation.

Motor feedback The motor feedback measures the rotor position and reports it to the control unit for controlling the speed and spindle position. It is integrated into the motor spindle as an independent assembly.

Controller In combination with a Bosch Rexroth main spindle controller, the motor spindle provides mechanical power or torque according to the operating characteristics of the motor-controller combination. Refer to documentation "AC Main Spindle Drives with Controlled Kit Spindle Motor 1MB, Selection Data", MNR R911263581.

Cooling Due to the liquid-cooled stator, the kit spindle motor has a high power density. The cooling liquid absorbs the power loss of the stator and most of the power loss of the rotor. In the cooling unit, the power loss is transferred to a higher-level cooling medium.

1.4 Power spectrum

The water-cooled asynchronous spindle motors 1MB offer new solutions due to a high-performance combination of motor technique with digital intelligent drive controllers. The spectrum of 1MB of Bosch Rexroth realized drives with torques of 50 Nm up to 2,200 Nm and maximum velocities of up to 20,000 rpm.

The following image gives an overview of the power spectrum:

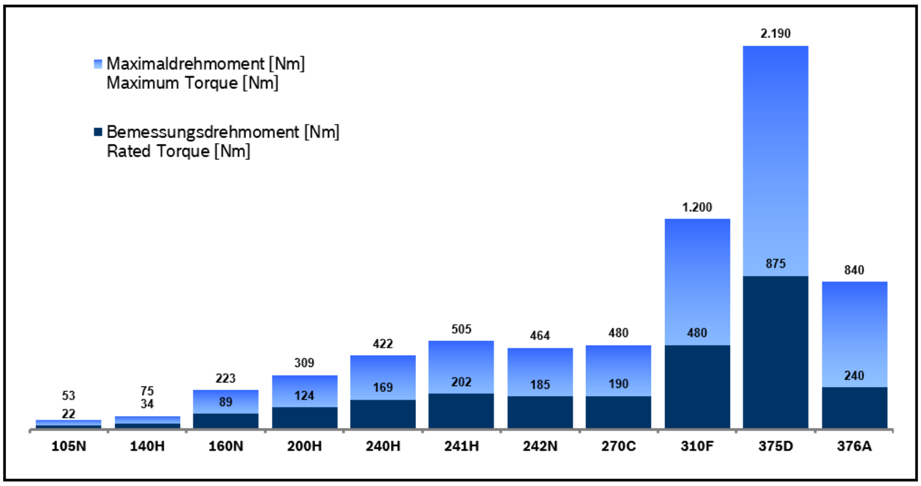


Fig. 1-2: Size and power grading

1.5 About this documentation

1.5.1 Editions of this documentation

Edition	Release date	Notes
01	12/1995	First edition
02	10/2003	Revision and amendment
03	04/2021	Revision and amendment
04	07/2022	Revision and amendment; EAC marking removed, UKCA marking added

Tab. 1-1: Revision history

1.5.2 Document structure

This documentation includes safety-related guidelines, technical data and operating instructions. The following table provides an overview of the contents of this documentation.

Chapter	Title	Content	
1	Introduction to the product	Introduction to the product and reading instructions	
2	Important instructions for use	Important safety instructions	
3	Safety		
4	Technical data	Product description	for designers and project developers
5	Dimensional sheets		
6	Type codes		
7	Accessories		
8	Connection technique		
9	Application instructions		
10	Handling & transport	Practice	for operating and maintenance personnel
11	Installation / Mounting instructions		
12	Operation		
13	Service & support		
14	Index	Additional information	

Tab. 1-2: Chapter structure

1.5.3 Presentation of information

Safety instructions

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

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

⚠ DANGER

Non-compliance with this safety instructions **will** result in death or severe personal injury.

⚠ WARNING

Non-compliance with this safety instructions **can** result in death or severe personal injury.

⚠ CAUTION

Non-compliance with this safety instructions **can** result in moderate or minor personal injury.

NOTICE

Non-compliance with this safety instructions **can** result in material damage.

1.5.4 Further documentation

For the project planning of drive systems with 1MB motors, you require additional documentation referring to the used devices. Rexroth provides the complete product documentation in PDF format in the following Bosch Rexroth media directory:

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

1.5.5 Standards

This documentation refers to German, European and international technical standards. Documents and sheets on standards underlie the protection by copyright and must not be passed on to third parties by Rexroth Indramat. If required, please contact the authorized sales outlets. In Germany, contact:

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

1.5.6 Additional components

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

For references to manufacturers, please refer to chapter 9.10 "Third-party components" on page 164.

1.5.7 Your feedback

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

Please send your feedback to:

Bosch Rexroth AG

Abt. DC-IA/EPI5 (fs)

Bürgermeister-Dr.-Nebel-Straße 2

97816 Lohr am Main, Germany

E-Mail: dokusupport@boschrexroth.de

2 Important instructions on use

2.1 Appropriate use

2.1.1 Introduction

Bosch Rexroth products are designed and manufactured using the latest state-of-the-art-technology. The products are tested prior to delivery to ensure operational safety and reliability.

⚠ WARNING **Personal injury and property damage by using products incorrectly!**

Only use the products as intended. Failure to use them in the intended way may cause situations resulting in property damage and personal injury.

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

- Personnel that in any way, shape or form uses our products must first read and understand the relevant safety instructions and be familiar with their appropriate use.
- Hardware products must be left in their original condition, i.e. no structural changes may be made. Software products must not be decompiled and their source code must not be changed.
- Damaged or defective products must not be installed or put into operation.
- It must be ensured that products are installed in compliance with all regulations specified in the documentation.

2.1.2 Areas of use and application

1MB motors or Rexroth are designed to be used as rotary main drive motors.

For application-specific use of the motors, device types with different drive power and different interfaces are available.

To control and monitor the motors, it may be necessary to connect additional sensors and actuators.

☞
- The motors may only be used with the accessories and attachments specified in this documentation. Components that are not explicitly specified must not be installed nor connected. The same applies for cables and lines.
- The device may only be operated in the explicitly specified configurations and combination of components and in compliance with the respective functional description of the software and firmware.

Before commissioning, every connected drive controller must be programmed according to the specified motor function for the specified application.

1MB motors may only be operated under the assembly and installation conditions specified in this documentation, in the specified position of normal use and under the specified ambient conditions (temperature, degree of protection, humidity, EMC, etc.).

2.2 Non-intended use

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

BA1N energy storage devices may not be used if ...

- they are exposed to operating conditions that do not meet the specified ambient conditions. This includes, for example, operation under water, under extreme temperature fluctuations or extreme maximum temperatures.
- the intended application range is not explicitly approved for Bosch Rexroth motors. Therefore, please carefully follow the specifications outlined in the general safety instructions!

☞ 1MB motors are not suited to be operated directly on the power supply.

Trademark right third parties

Observe the trademark rights of third parties during assembly and use of single components delivered from Bosch Rexroth. For any infringement of the right, the customer is liable for the accruing damage.

3 Danger-related notes

3.1 Protection against touch of electric parts and housings

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

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

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

- Operation, maintenance and/or repair of components of electric drive and control systems may only be done by qualified personnel.
- Observe the general construction and safety instructions about work on high voltage systems.
- Before switching on, establish the fixed connection of the protective conductor to all electric components according to the interconnection diagram.
- Operation, even for short-term measuring and testing purposes, is only permitted with the protective conductor securely connected to the component points provided.
- Disconnect electric components from the mains or from the power supply, before you have contact with electric parts with a voltage higher than 50 V. Secure the electric components against restarting.
- Observe for electrical components:

  Please, always wait **30 minutes**, after switch-off, so live capacitors discharge before they have access to electric components. To exclude any danger due to any contact, measure electric voltage of live parts before working.
- Before switch-on install the provided covers and protective devices for the touch guard.
- Do not touch any electric junctions of live components.
- Do not disconnect or connect connectors under voltage.

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

- Before switch-on and start-up, ground or connect the components of the drive and control system with the protective conductors on the grounding points.
- Connect the protective conductors of the electric drive and control systems always fix and continuously with the external supply network.
- Do a protective conductor connection with a minimum cross section according to the following table.

Cross-sectional area A of the live wires	Minimum cross-sectional area A_{PE} of the protective conductor
A ≤ 16 mm²	A
25 mm² < A ≤ 50 mm²	25 mm²
50 mm² < A	A / 2

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

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 Bosch Rexroth, all connections and terminals with voltages up to 50 volts are PELV ("Protective Extra-Low Voltage") systems. It is allowed to connect devices equipped with basic insulation (such as programming devices, PCs, notebooks, display units) to these connections.

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

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

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.

3.4 Protection against electromagnetic and magnetic fields during operation and mounting

Electromagnetic and magnetic fields!

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

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

3.5 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.

3.6 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!

3.7 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.

3.8 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.

4 Technical data

4.1 Explanations of the technical data

4.1.1 Introduction

All relevant technical data as well as the functional principle of the motors are provided in this chapter in terms of tables and characteristic curves. The following dependencies are taken into consideration:

- Frame size and frame length of the stator
- Winding design of the stator
- Available power connection or DC bus voltage

☞ All specified data and characteristic curves refer to the following conditions, unless otherwise specified:

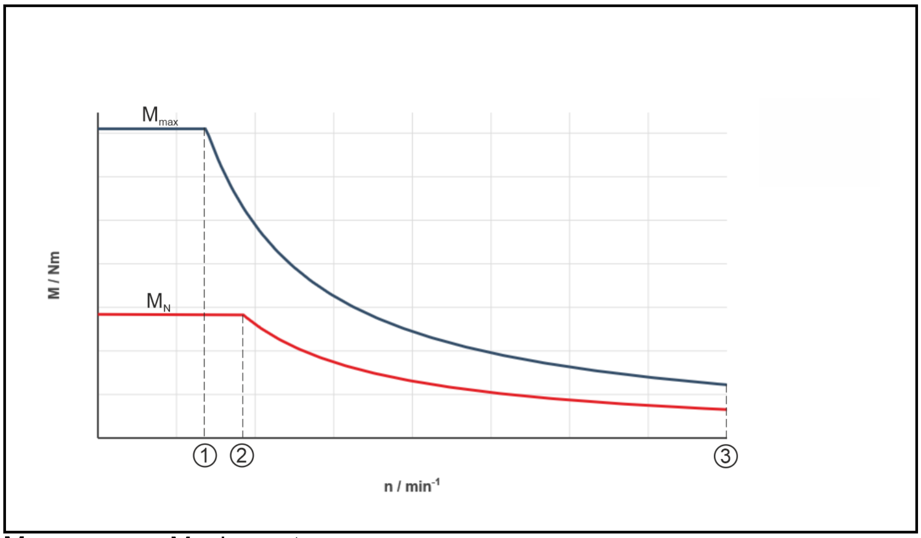
- Motor winding temperature 130 °C
- Water as cooling medium, supply temperature 30 °C
- DC bus voltage 540 V_{DC}

Resulting data from certain motor-controller combinations and deviating environmental conditions can differ from the given data. Refer to Chap.9.2 Environmental conditions.

☞ All relationships and data described in the following sections may only apply if exclusively stators and rotors of the same size and length are combined (e.g. 1MR105 with 1MS105).

4.1.2 Operating behavior

The following sample characteristic curve explains the operating behavior of the 1MB motors, based on the motor data sheet information. Further values of a motor characteristic curve that may not be specified in the data sheet can nevertheless be displayed and read out using the **IndraSize** tool (seeChap. 4.1.3)



M_{max}	Maximum torque
M_N	Rated torque
①	Maximum speed at maximum torque
②	Rated speed
①	Maximum speed

Fig. 4-1: 1MB sample curve

☞ The achievable motor torque depends on the drive controller used. The reference value for the motor characteristic curves is an unregulated DC bus voltage of 540 V_{DC}.

The maximum torque M_{max} is available up to the velocity n_{Mmax}. When the velocity increases, the available DC bus voltage is reduced by the velocity-dependent back electromotive force of the motor. This leads to a reduction of the maximum torque with increasing velocity.

PWM switching frequency

Both stator and rotor losses are strongly dependent on the harmonics generated in the current and thus on the pulse width modulation (PWM) frequency. The higher this is, the lower the harmonics and thus the losses. With an increase of the PWM switching frequency, the losses are reduced and higher speeds can be run permanently.

Conversion to DC bus voltage 750 V_{DC}

For deviating connection or DC bus voltages, the specified characteristic curves can be converted according to the existing voltages.

Example:

$$n_{(UCxxx)} = \frac{U_{DCxxx}}{540V} \times n_N$$

U_{DCxxx}	New DC bus voltage

Fig. 4-2: Conversion example

$$M_{\max 750V} = M_{\max} = cons\tan t \qquad M_{nenn750V}\, M_{nenn} = cons\tan t$$

$$n_{\max 750V} = \frac{750V}{540V} \times n_{\max} \qquad n_{nenn750V} = \frac{750V}{540V} \times n_{nenn}$$

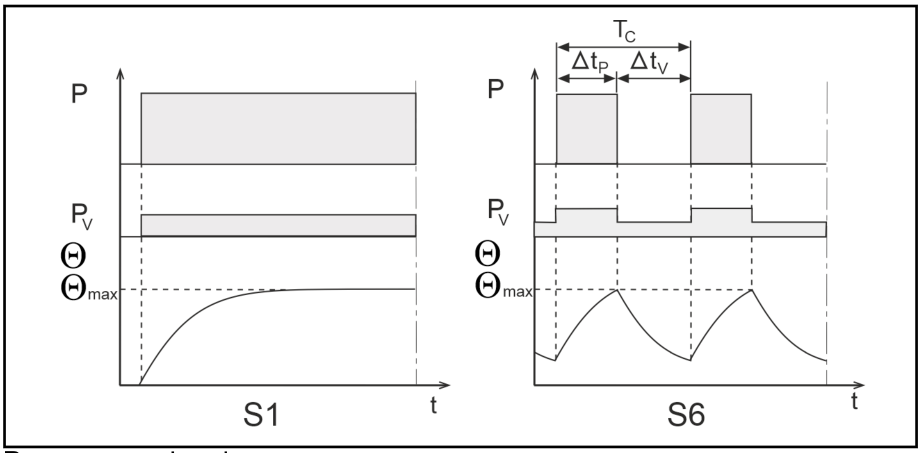
Fig. 4-3: Example conversion to DC bus voltage 750V_{DC}

4.1.3 IndraSize

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

4.1.4 Operation modes

Bosch Rexroth motors are documented according to the test criteria and measuring methods of DIN EN 60034-1. The technical data specified refer to operation mode S1 (continuous operation) and S6 (periodic operation), each with liquid cooling and water as cooling medium.



P	Load
P_V	Electric losses
Θ	Temperature
$Θ_{max}$	Highest temperature (stator)
t	Time
T_C	Cycle duration
$Δt_P$	Operating time with constant load
$Δt_V$	Idle time

Fig. 4-4: Operation modes according to DIN EN 60034-1

4.1.5 Duty cycle

Operation mode S6 is supplemented by specification of the duty cycle (ED). The duty cycle is calculated as follows:

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

ED Relative duty cycle in %

T_C Cycle duration

Δt_P Operating time with constant load

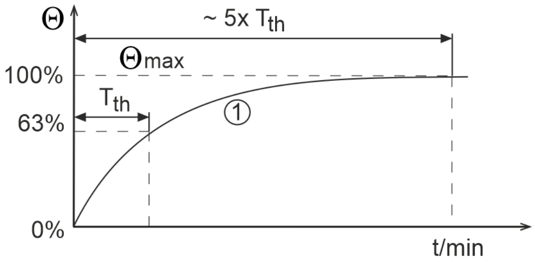
Fig. 4-5: Relative duty cycle

4.1.6 Parameters

Unless otherwise specified, the values specified in the data sheets are r.m.s. values according to DIN EN 60034-1. Reference value 540 V_{DC} DC bus voltage.

General technical data for stators 1MS

Designation	Symbol	Unit	Description
Rated torque	M_N	Nm	Available torque that can be output at the rated speed in operation mode S1 (continuous operation).
Rated power	P_N	kW	Power output of the motor at rated speed and load with rated torque.
Rated current	I_N	A	Phase current of the motor at rated speed and load with rated torque.
Rated speed	n_N	min^{-1}	Useful speed defined by the manufacturer. Depending on the application, other speeds are possible (see speed-torque characteristic curve).
Maximum torque	M_{max}	Nm	Maximum torque available at maximum current I_{max}. The achievable maximum torque depends on the drive controller used.
Maximum current	I_{max}	A	Maximum current (root-mean-square) of the motor at M_{max}.
Maximum speed	n_{max}	min^{-1}	Maximum permissible speed of the motor. Normally restricted by mechanical factors such as centrifugal forces or bearing stress.
Power wire cross section	A	mm²	Rated according to DIN VDE 0298-4 and laying type B2 according to DIN EN 60204-1 with conversion factor for Rexroth cables at 40 °C ambient temperature. The power wire cross section that is specified in the data sheets can vary depending on the selected type of motor connection - plug or terminal box. When selecting the power cable, refer to the specifications in chapter 8 ”Connection technique” and the documentation ”Rexroth Connecting Cables IndraDrive and IndraDyn" (DOK-CONNEC-CABLE*INDRV-AU□□-□□-P).
Torque constant	K_{M_N}	Nm/A	Ratio of generated torque M_N to motor phase current I_N at a winding overtemperature of 100 K. Manufacturing tolerance ±5 %.
Winding resistance at 20 °C	R_{12}	Ohm	Measured winding resistance between two strands.
Winding inductance	L_{12}	mH	Measured inductance between two strands.

Designation	Symbol	Unit	Description
Thermal time constant	T_{th_nom}	min	Time of the temperature increase to 63 % of the final temperature of the motor housing with the motor loaded with the permissible S1 continuous torque. The thermal time constant is determined by the cooling type used.  ①: Time course of the temperature on the motor housing Θmax: Highest temperature (motor housing) T_{th}: Thermal time constant Time of the temperature increase to 63 % of the final temperature of the motor housing with the motor loaded with the permissible S1 continuous torque. The thermal time constant is determined by the cooling type used.
Number of pole pairs	p	-	Quantity of pole pairs of the motor.
Stator mass	m_{stat}	kg	Mass of the components without mounting parts (brake, encoder, etc.).
Liquid cooling			
Power loss to be dissipated	P_V	W	Power loss in operation mode S1 (continuous operation) at nominal velocity v_N.
Permissible coolant temperature increase for P_V	ΔT_{max}	K	Temperature difference between coolant inlet and outlet temperature during operation with liquid cooling (cooling medium: water) and rated power loss P_V.
Rated coolant flow	Q_{min}	l/min	Necessary coolant flow to keep the specified continuous feed force.
Pressure drop at Q_{min}	Δp	bar	Pressure loss within the internal coolant circuit of the motor at Q_{min}.
Maximum allowed inlet pressure	p_{max}	bar	Maximum permitted inlet pressure of the liquid cooling on the motor with water as cooling medium.
Volume of coolant duct	V_{cool}	l	Coolant volume inside the motor.

General technical data for 1MR rotors

Designation	Symbol	Unit	Description
Moment of inertia of the rotor	J_{rot}	kgm^2	Moment of inertia of the rotor without brake, bearing and motor encoder.
Rotor mass	m_{rot}	kg	Mass of the components without mounting parts (brake, encoder, etc.).
Mechanical maximum speed	$n_{max,mech}$	min^{-1}	It depends on the mechanical construction of the rotor and can deviate from the electrical maximum speed n_{max}.

4.2 General technical data

For the sake of clarity, the following table contains data which is applicable to all motor frame sizes. In this context, however, the comments on the individual items in Chapter “Application notes” must be observed.

Designation	Symbol	Unit	1MS	1MR
Ambient temperature in operation (see also chapter 9.2.3 "Climatic environmental conditions" on page 148)	T_{um}	°C	0 ... +40	
Permissible transport temperature (see also tab. 10-2 "Permissible transport conditions" on page 173)	T_T	°C	-25 ... +70	
Permissible storage temperature (see also tab. 10-4 "Permissible storage conditions" on page 175)	T_L	°C	-25 ... +55	
Coolant inlet temperature (see also chapter 9.7.5 "Coolant inlet temperature " on page 157)	T_{in}	°C	+15 ... +40	
Permissible coolant temperature increase for P_V	ΔT_{max}	K	10	
Temperature class according to DIN EN 60034-1	-	-	155	/
Warning temperature (winding)	T_{warn}	°C	145	/
Shutdown temperature (winding)	T_{abst}	°C	155	/
Protection class 1MS and 1MR according to DIN EN 60034-5	-	-	IP00	
E-file number	-	-	E341734	
RoHS conformity according to EC directive 2002/95/EC For further acceptances and approvals refer to chapter 9.4 "Acceptances and approvals" on page 150.	-	-	RoHS conform	
Latest amendment: 2012-10-12				

Tab. 4-1: General technical data

4.3 1MB105

4.3.1 Stator 1MS105

Designation	Symbol	Unit	1MS105N-4A	1MS105N-4B
Rated torque	M_N	Nm	15	22
Rated speed	n_N	min^{-1}	4,500	2,400
Rated power	P_N	kW	7.0	5.5
Rated current	I_N	A	29.0	16.4
Maximum torque	M_{max}	Nm	48	53
Maximum current	I_{max}	A	73.7	35.1
Max. speed (electrical)	n_{max}	min^{-1}	15,000	12,000
Power wire cross-section	A	mm^2	4.0	2.5
Torque constant at 20 °C	K_{M_N}	Nm/A	0.68	1.56
Winding resistance at 20 °C	R_{12}	Ohm	0.429	1.901
Winding inductance	L_{12}	mH	1.916	9.284
Thermal time constant	T_{th_nom}	min	5.0	
Number of pole pairs	p	--	2	
Stator mass	m_{stat}	kg	11.2	
Details about liquid cooling				
Power loss to be dissipated	P_V	kW	2.1	
Permissible coolant temperature increase for P_V	ΔT_{max}	K	10	
Required coolant flow for P_V	Q_{min}	l/min	3.0	
Pressure drop at Q_{min}	Δp	bar	0.2	
Maximum permissible inlet pressure	p_{max}	bar	6.0	
Volume of coolant duct	V_{cool}	l	0.30	
Latest amendment: 2021-03-22				

Tab. 4-2: 1MS105 - Technical data

4.3.2 Rotor 1MR105

Designation	Symbol	Unit	1MR105N
Rotor inertia	J_{rot}	kg * m²	0.0034
Rotor mass	m_{rot}	kg	2.8
Maximum speed (mechanical)	$n_{max,mech}$	min^{-1}	22,000
Latest amendment: 2020-12-10			

Tab. 4-3: 1MR105 - Technical data

4.3.3 Characteristic curves of motor 1MS105

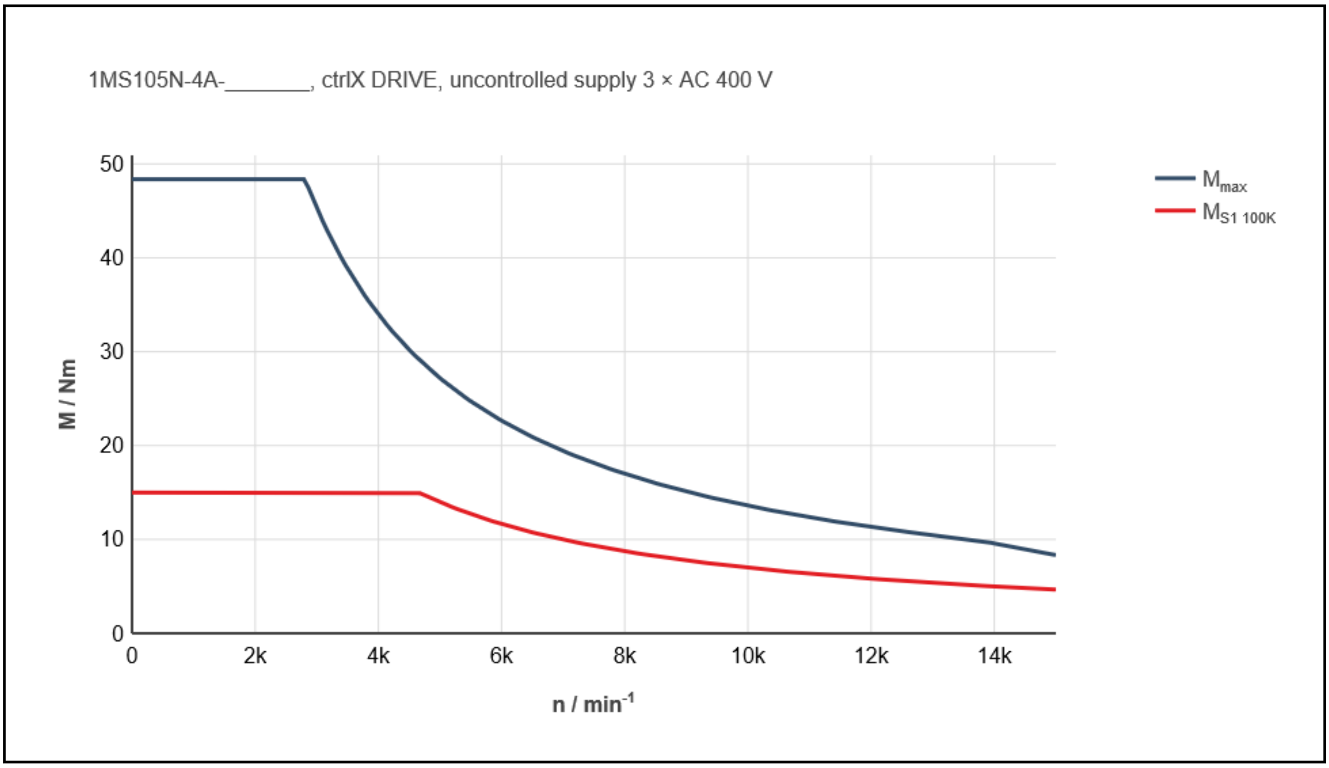


Fig. 4-6: Characteristic curve of motor 1MS105N-4A

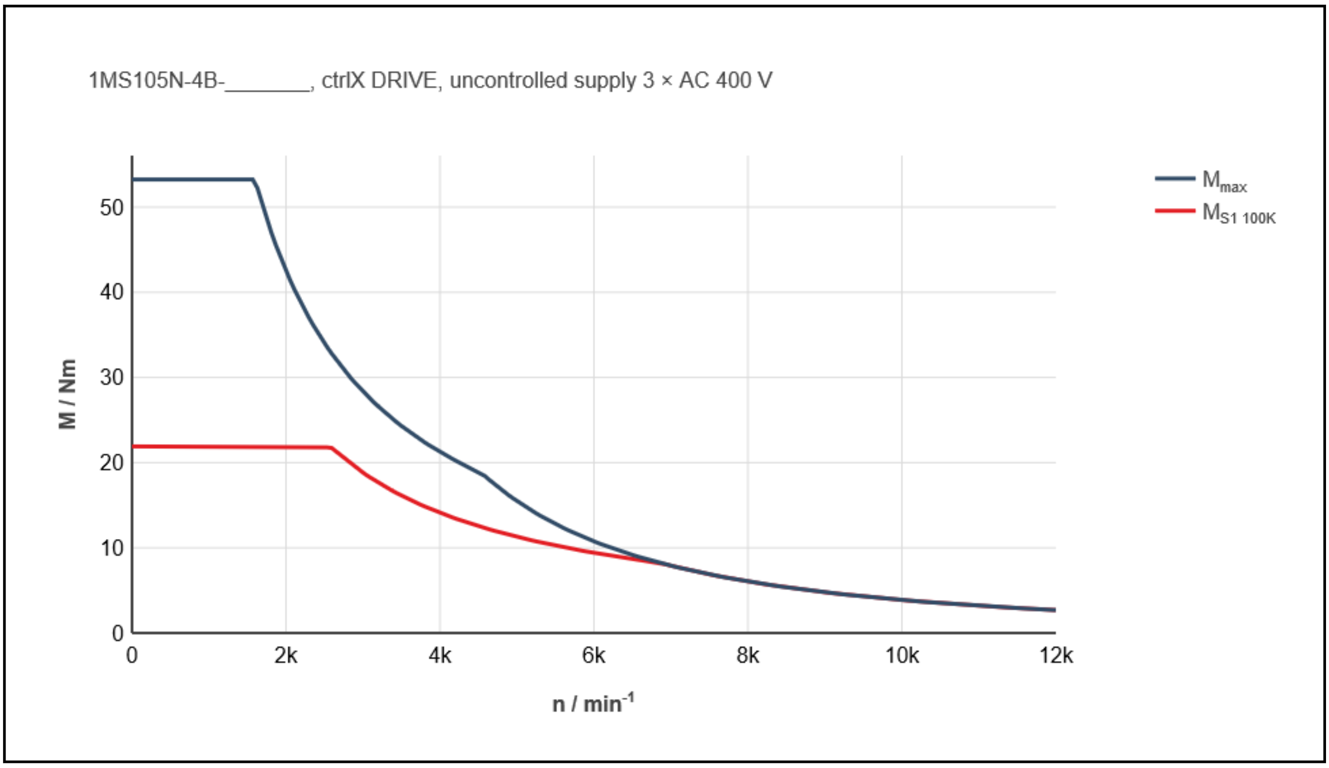


Fig. 4-7: Characteristic curve of motor 1MS105N-4B

4.4 1MB140

4.4.1 Stator 1MS140

Designation	Symbol	Unit	1MS140B-4A	1MS140B-4B	1MS140D-4B	1MS140F-4A	1MS140H-4B
Rated torque	M_N	Nm	7		14	24	34
Rated speed	n_N	min^{-1}	7,500	5,000	4000	3000	
Rated power	P_N	kW	5.5	3.7	6.0	7.5	10.5
Rated current	I_N	A	18.0	25.0	43.0		58.0
Maximum torque	M_{max}	Nm	17.5		35	60	75
Maximum current	I_{max}	A	41.8	52.7	89.4	111.3	127.3
Max. speed (electrical)	n_{max}	min^{-1}	20,000		16,000	15,000	
Power wire cross-section	A	mm^2	2.5	4.0	10.0		16.0
Torque constant at 20 °C	K_{M_N}	Nm/A	0.42	0.34	0.40	0.54	0.59
Winding resistance at 20 °C	R_{12}	Ohm	0.434	0.147	0.201	0.214	0.198
Winding inductance	L_{12}	mH	2.293	2.85	1.278	1.516	1.58
Thermal time constant	T_{th_nom}	min	5.0				
Number of pole pairs	p	--	2				
Stator mass	m_{stat}	kg	5.3		8.2	11.8	15.5
Details about liquid cooling							
Power loss to be dissipated	P_V	kW	1.0		1.6	2.4	3.2
Permissible coolant temperature increase for P_V	ΔT_{max}	K	10				
Required coolant flow for P_V	Q_{min}	l/min	1.4		2.3	3.4	4.6
Pressure drop at Q_{min}	Δp	bar	0.1				
Maximum permissible inlet pressure	p_{max}	bar	6.0				
Volume of coolant duct	V_{cool}	l	0.20		0.30	0.40	0.60
							Latest amendment: 2021-03-22

Tab. 4-4: 1MS140 - Technical data

4.4.2 Rotor 1MR140

Designation	Symbol	Unit	1MR140B	1MR140D	1MR140F	1MR140H
Rotor inertia	J_{rot}	kg * m²	0.0044	0.0061	0.0082	0.0103
Rotor mass	m_{rot}	kg	3.3	4.5	6.1	7.3
Maximum speed (mechanical)	$n_{max,mech}$	min^{-1}	23,000			
						Latest amendment: 2020-12-10

Tab. 4-5: 1MR140 - Technical data

4.4.3 Characteristic curves of motor 1MS140

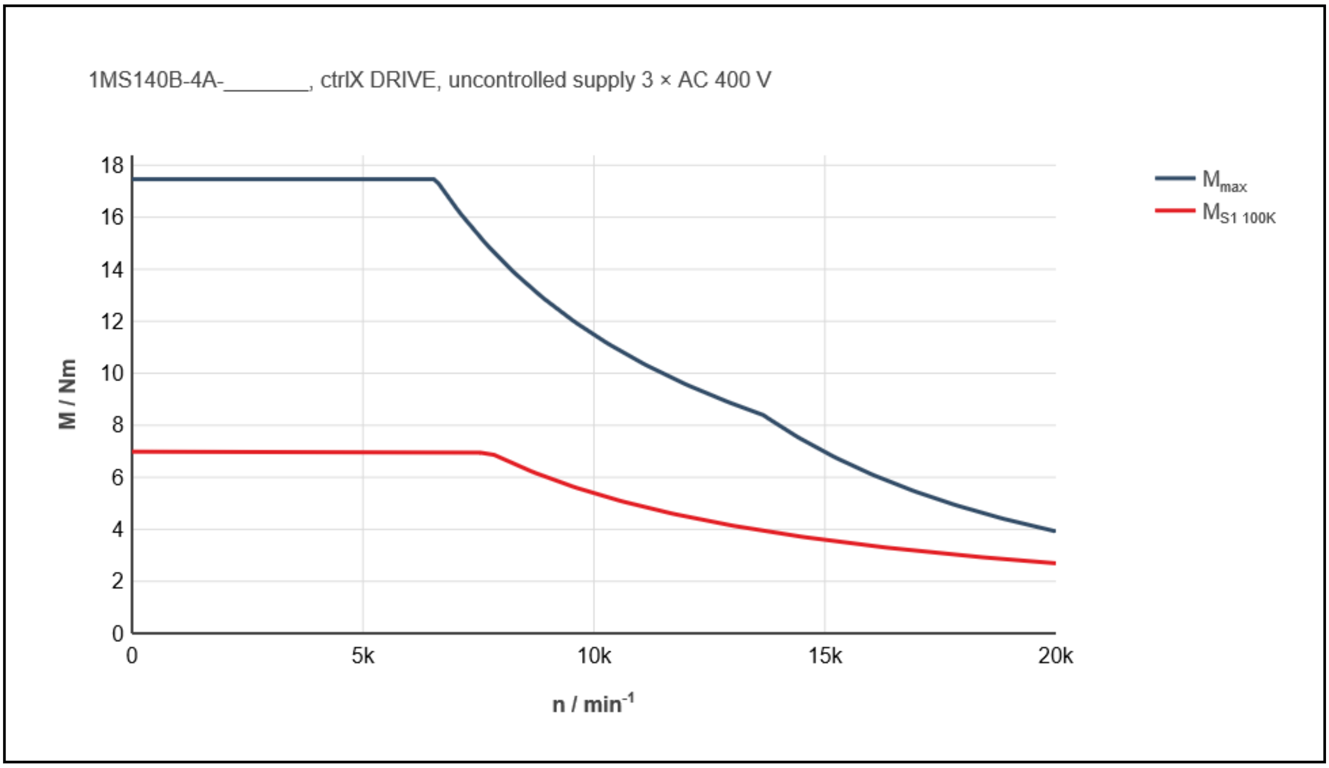


Fig. 4-8: Characteristic curve of motor 1MS140B-4A

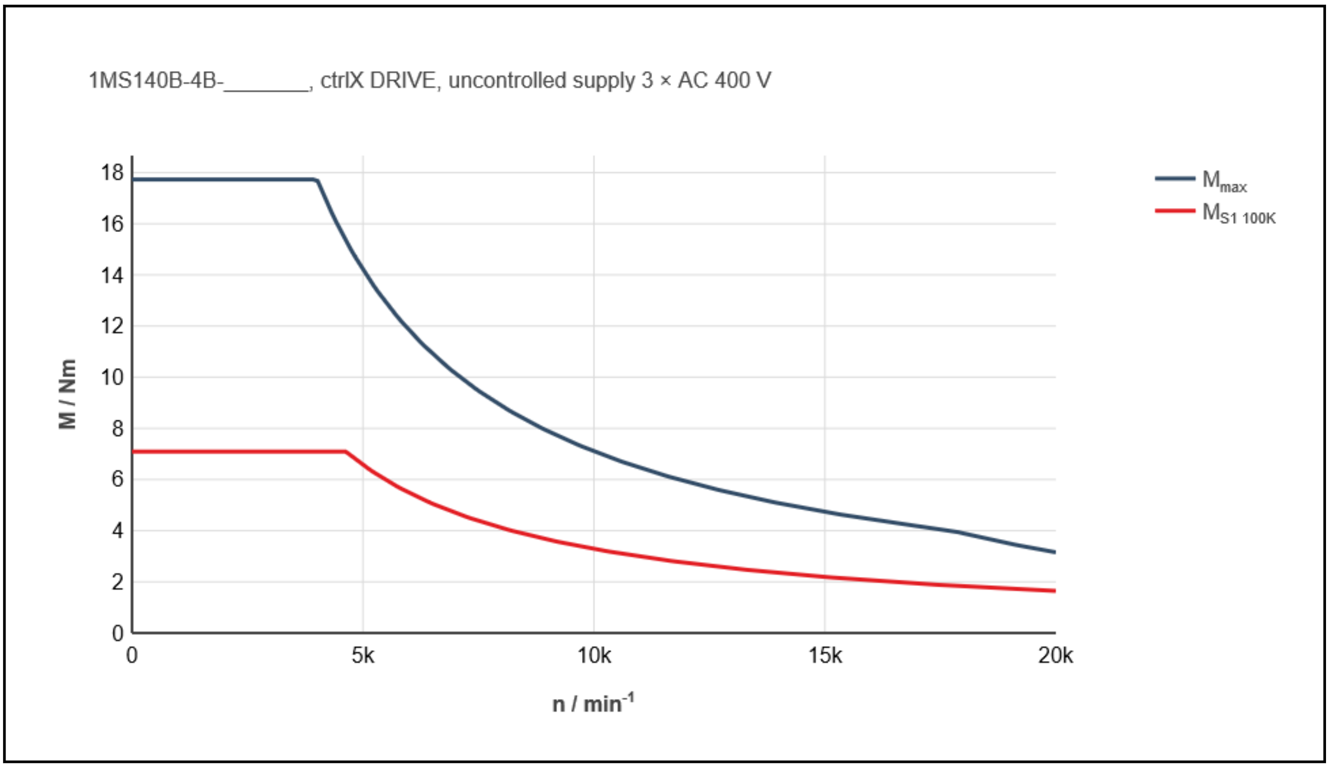


Fig. 4-9: Characteristic curve of motor 1MS140B-4B

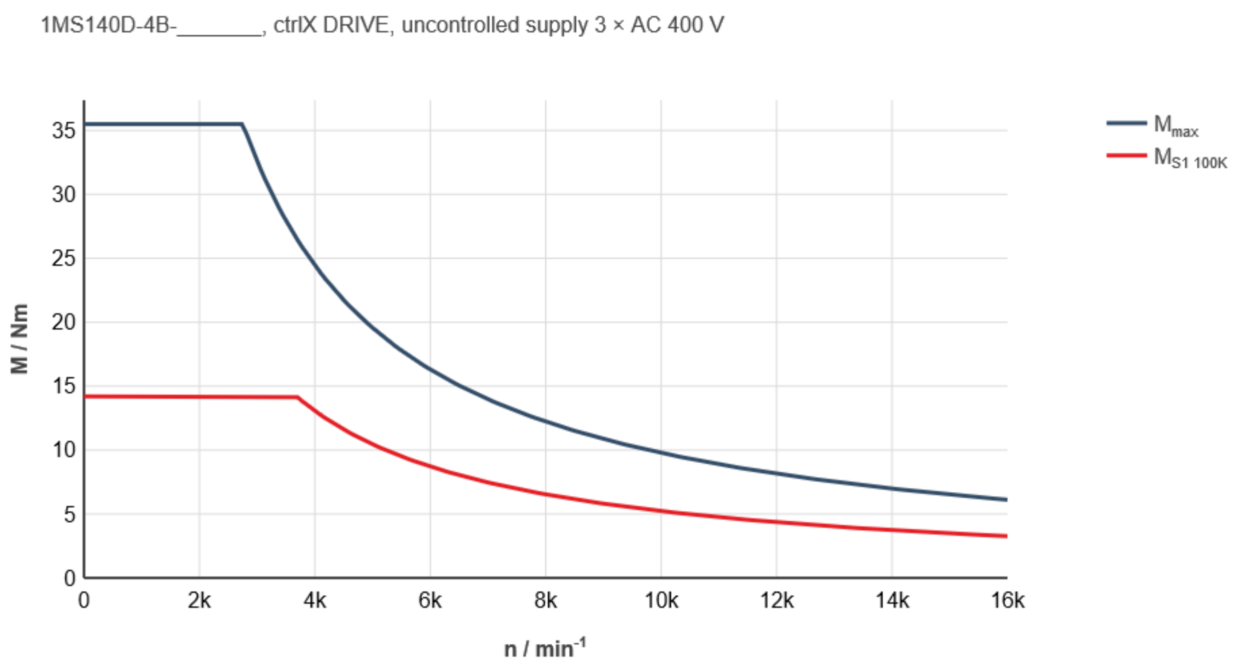


Fig. 4-10: Characteristic curve of motor 1MS140D-4B

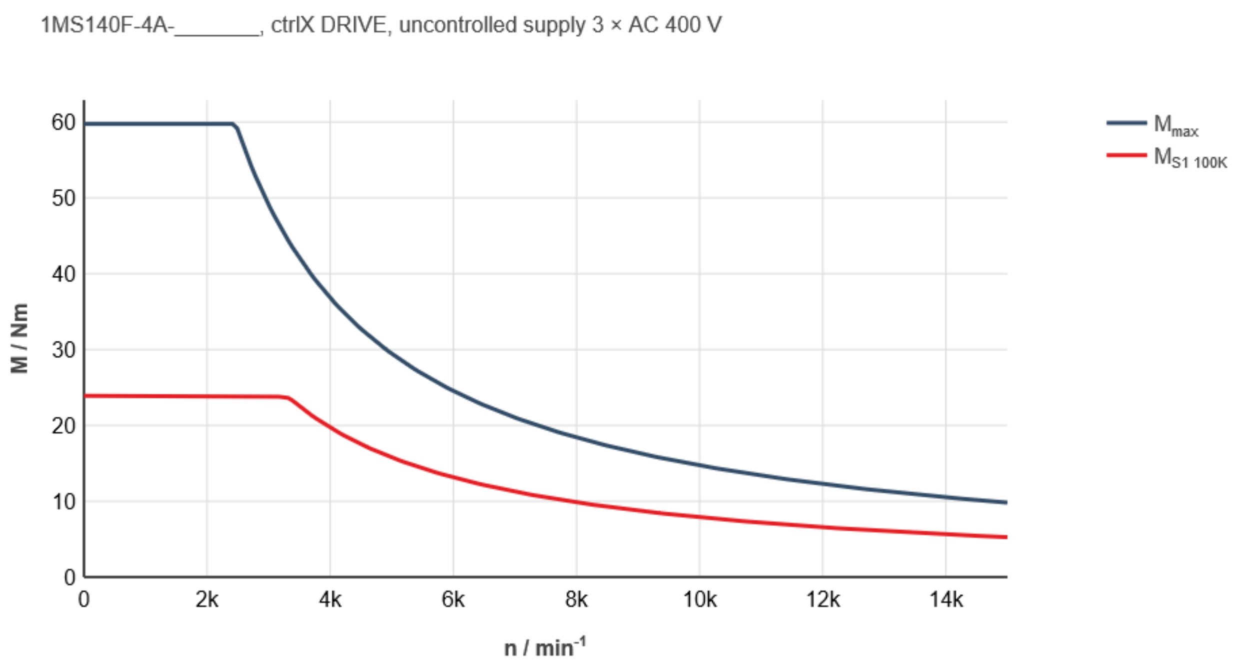


Fig. 4-11: Characteristic curve of motor 1MS140F-4A

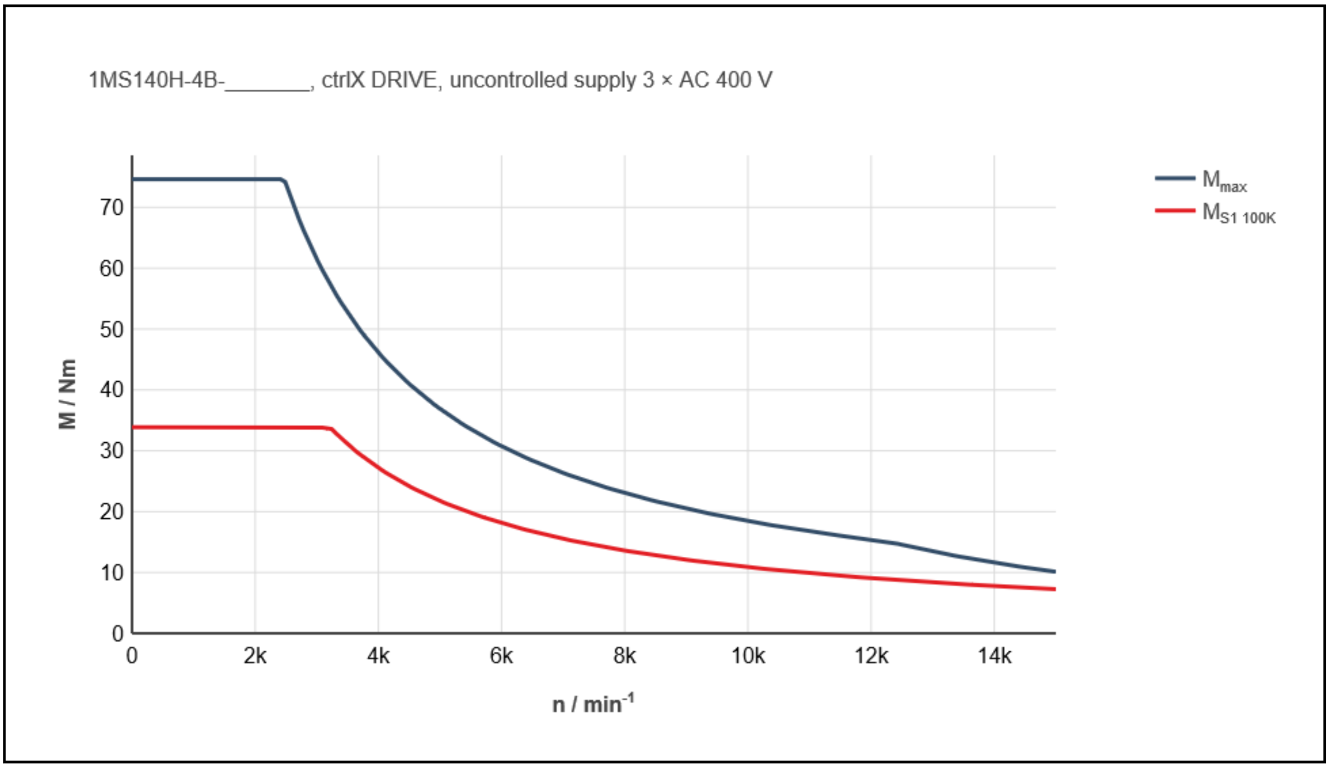


Fig. 4-12: Characteristic curve of motor 1MS140H-4B

4.5 1MB160

4.5.1 Stator 1MS160B/-D

Designation	Symbol	Unit	1MS160B-4A	1MS160D-4A	1MS160D-4B
Rated torque	M_N	Nm	16	32	
Rated speed	n_N	min^{-1}	3000		2,000
Rated power	P_N	kW	5.0	10.0	6.7
Rated current	I_N	A	36.0	48.0	23.8
Maximum torque	M_{max}	Nm	40	80	73
Maximum current	I_{max}	A	78.4	112.8	53.3
Max. speed (electrical)	n_{max}	min^{-1}	12,000		8,000
Power wire cross-section	A	mm^2	6.0	10.0	4.0
Torque constant at 20 °C	K_{M_N}	Nm/A	0.52	0.72	1.39
Winding resistance at 20 °C	R_{12}	Ohm	0.313	0.184	0.796
Winding inductance	L_{12}	mH	1.548	1.198	5.46
Thermal time constant	T_{th_nom}	min	5.0		
Number of pole pairs	p	--	2		
Stator mass	m_{stat}	kg	6.8	11.1	
Details about liquid cooling					
Power loss to be dissipated	P_V	kW	1.2	1.8	
Permissible coolant temperature increase for P_V	ΔT_{max}	K	10		
Required coolant flow for P_V	Q_{min}	l/min	1.7	2.6	
Pressure drop at Q_{min}	Δp	bar	0.1		
Maximum permissible inlet pressure	p_{max}	bar	6.0		
Volume of coolant duct	V_{cool}	l	0.20	0.30	
					Latest amendment: 2021-03-22

Tab. 4-6: 1MS160B/ -D - Technical data

4.5.2 Stator 1MS160E/-F

Designation	Symbol	Unit	1MS160E-4B	1MS160F-4A	1MS160F-4B	1MS160F-4D
Rated torque	M_N	Nm	33	48		
Rated speed	n_N	min^{-1}	1,000	3000		2,500
Rated power	P_N	kW	3.5	15.0		12.5
Rated current	I_N	A	19.0	74.0	45.0	23.2
Maximum torque	M_{max}	Nm	83	120		
Maximum current	I_{max}	A	34.8	169.4	99.9	54.1
Max. speed (electrical)	n_{max}	min^{-1}	4000	12,000		10,000
Power wire cross-section	A	mm^2	2.5	25.0	10.0	4.0
Torque constant at 20 °C	K_{M_N}	Nm/A	2.43	0.72	1.22	2.25
Winding resistance at 20 °C	R_{12}	Ohm	1.101	0.106	0.296	0.939
Winding inductance	L_{12}	mH	8.376	0.745	2.14	7.405
Thermal time constant	T_{th_nom}	min	5.0			
Number of pole pairs	p	--	2			
Stator mass	m_{stat}	kg	14.4	15.8		
Details about liquid cooling						
Power loss to be dissipated	P_V	kW	2.1	3.0		
Permissible coolant temperature increase for P_V	ΔT_{max}	K	10			
Required coolant flow for P_V	Q_{min}	l/min	3.0	4.3		
Pressure drop at Q_{min}	Δp	bar	0.1			
Maximum permissible inlet pressure	p_{max}	bar	6.0			
Volume of coolant duct	V_{cool}	l	0.50			
						Latest amendment: 2021-03-22

Tab. 4-7: 1MS160E/ -F - Technical data

4.5.3 Stator 1MS160H/-N

Designation	Symbol	Unit	1MS160H-4A	1MS160N-4A	1MS160N-4B	1MS160N-4C
Rated torque	M_N	Nm	64	89		
Rated speed	n_N	min^{-1}	3000		2,000	1500
Rated power	P_N	kW	20,0	28.0	18.6	14.0
Rated current	I_N	A	58.0	75.0	60.0	26.0
Maximum torque	M_{max}	Nm	162	223		
Maximum current	I_{max}	A	132.2	170.8	135.5	67.8
Max. speed (electrical)	n_{max}	min^{-1}	18,000	12,000	8,000	6000
Power wire cross-section	A	mm^2	16.0	25.0	16.0	4.0
Torque constant at 20 °C	K_{M_N}	Nm/A	1.23	1.32	1.67	3.34
Winding resistance at 20 °C	R_{12}	Ohm	0.201	0.154	0.241	1.098
Winding inductance	L_{12}	mH	1.543	1.251	2.02	9.844
Thermal time constant	T_{th_nom}	min	5.0			
Number of pole pairs	p	--	2			
Stator mass	m_{stat}	kg	18.6	28.1		
Details about liquid cooling						
Power loss to be dissipated	P_V	kW	3.8	4.8	4.0	3.6
Permissible coolant temperature increase for P_V	ΔT_{max}	K	10			
Required coolant flow for P_V	Q_{min}	l/min	5.4	6.9	5.7	4.5
Pressure drop at Q_{min}	Δp	bar	0.2	0.3		
Maximum permissible inlet pressure	p_{max}	bar	6.0			
Volume of coolant duct	V_{cool}	l	0.53	0.90		
Latest amendment: 2021-03-22						

Tab. 4-8: 1MS160H/ -N - Technical data

4.5.4 Rotor 1MR160

Designation	Symbol	Unit	1MR160 B	1MR160 D	1MR160 E	1MR160 F	1MR160 H	1MR160 N
Rotor inertia	J_{rot}	kg * m²	0.0084	0.0121	0.0149	0.0161	0.0201	0.0267
Rotor mass	m_{rot}	kg	4.3	7.6	7.1	10.2	9.9	12.9
Maximum speed (mechanical)	$n_{max,mech}$	min^{-1}	20,000					
Latest amendment: 2020-12-10								

Tab. 4-9: 1MR160 - Technical data

4.5.5 Characteristic curves of motor 1MS160

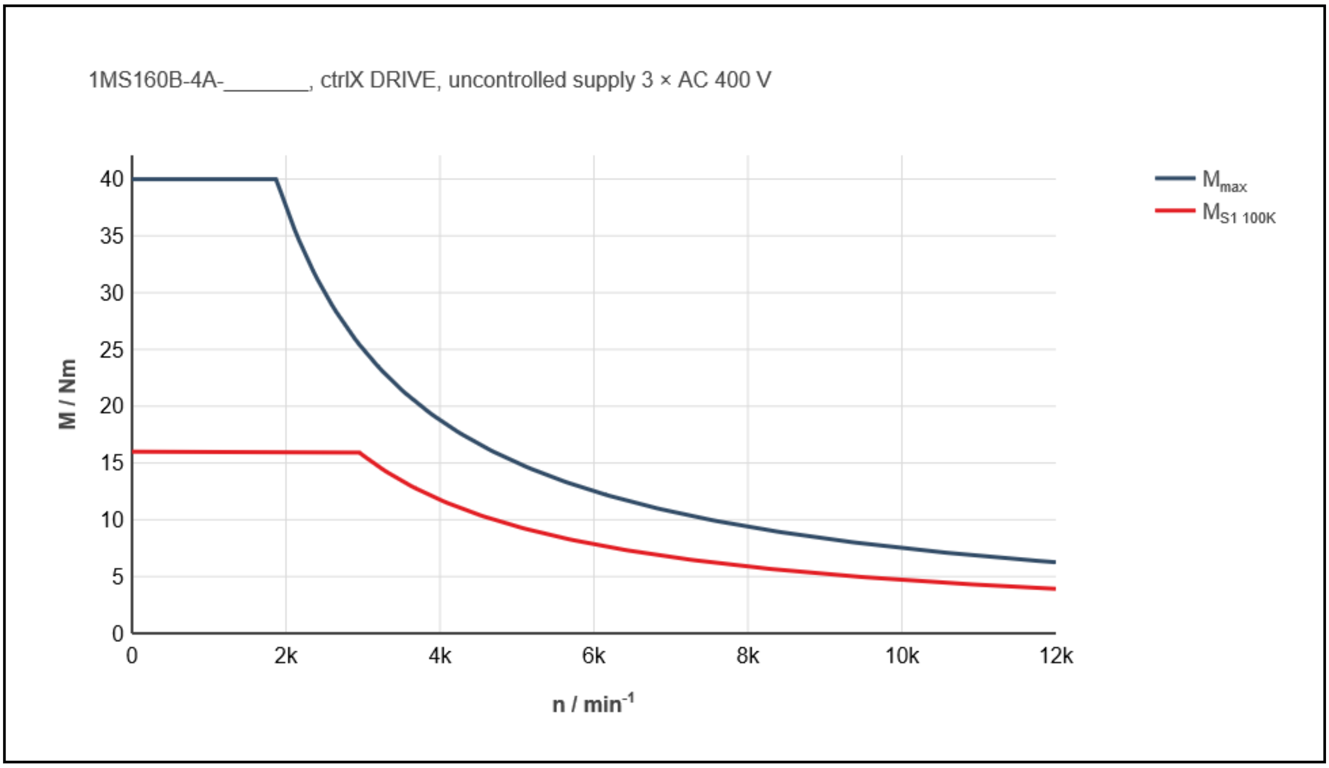


Fig. 4-13: Characteristic curve of motor 1MS160B-4A

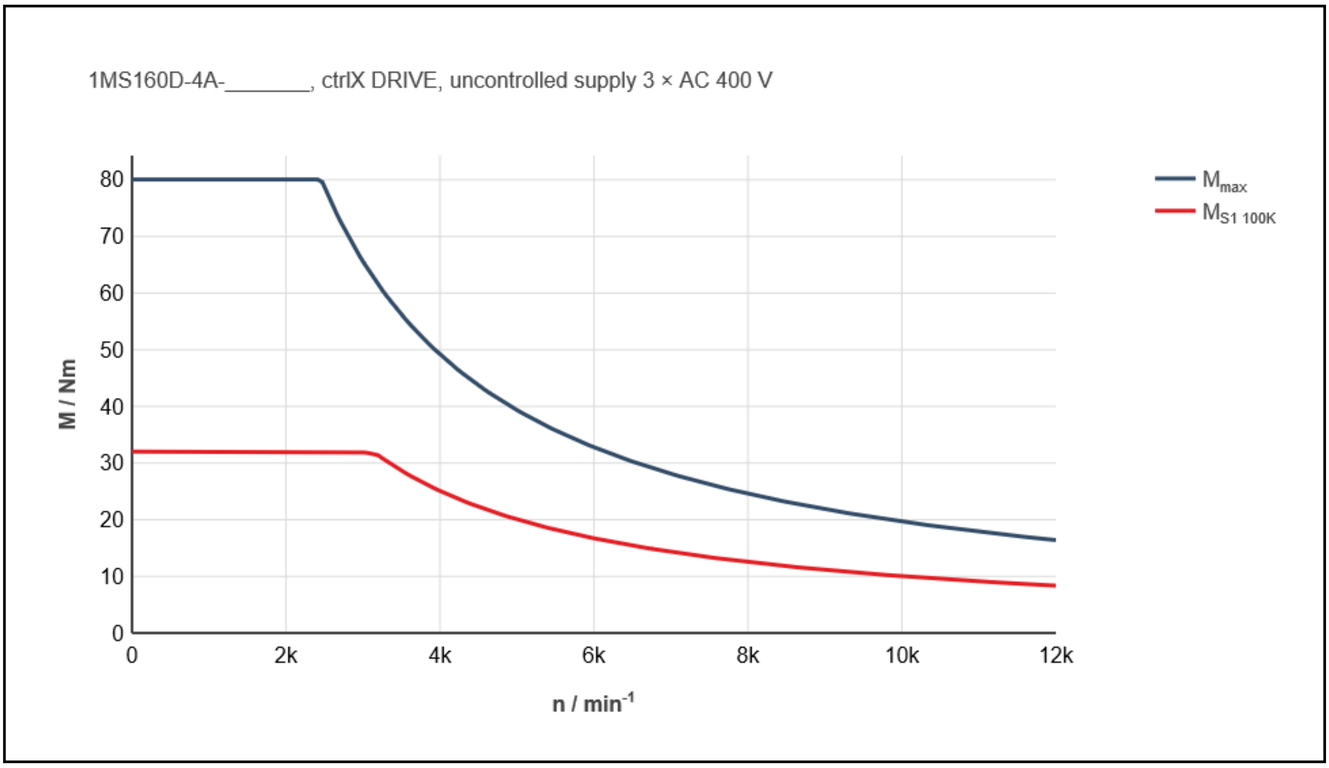


Fig. 4-14: Characteristic curve of motor 1MS160D-4A

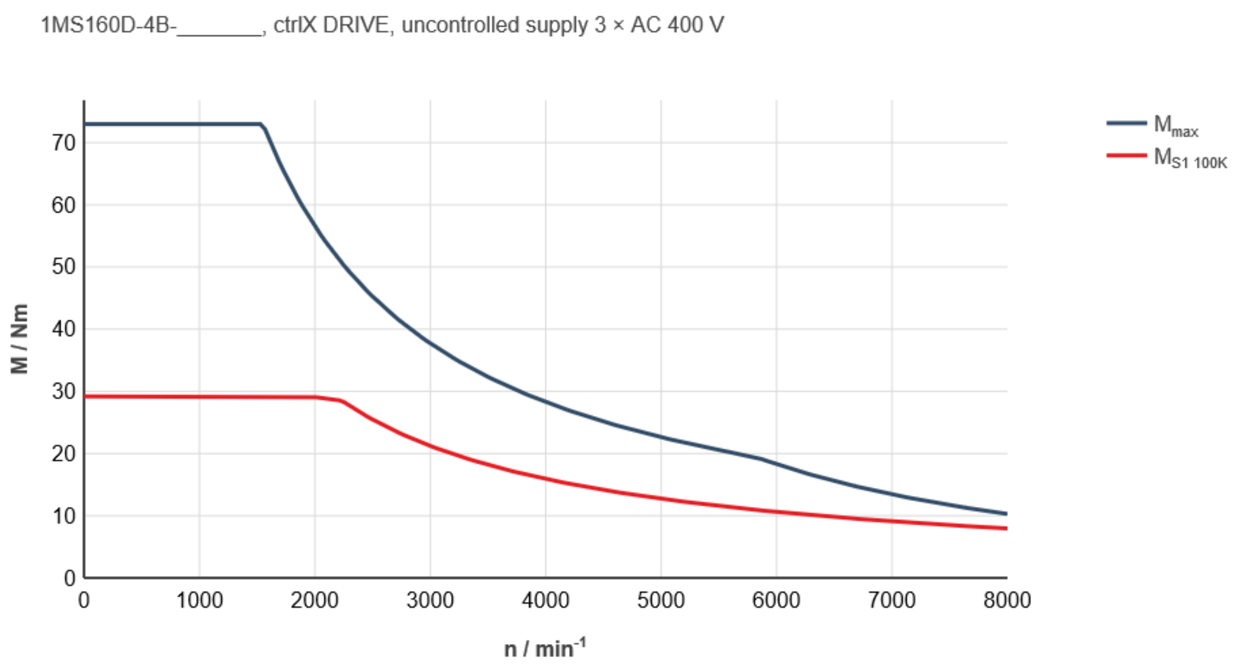


Fig. 4-15: Characteristic curve of motor 1MS160D-4B

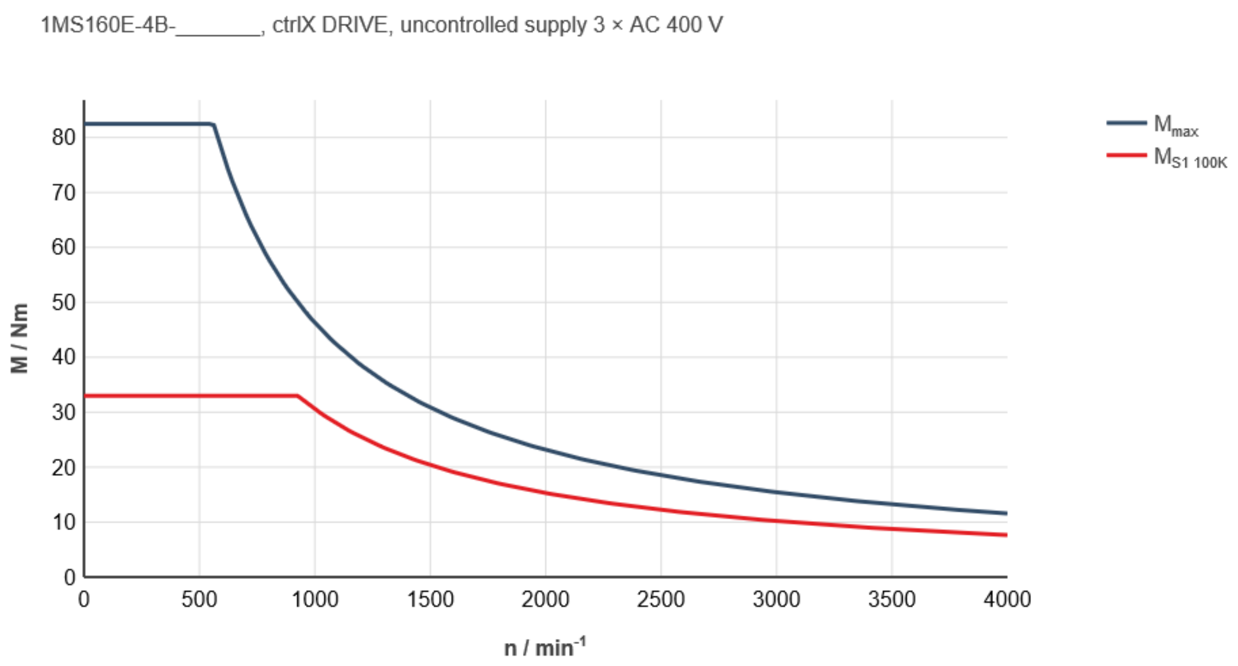


Fig. 4-16: Characteristic curve of motor 1MS160E-4B

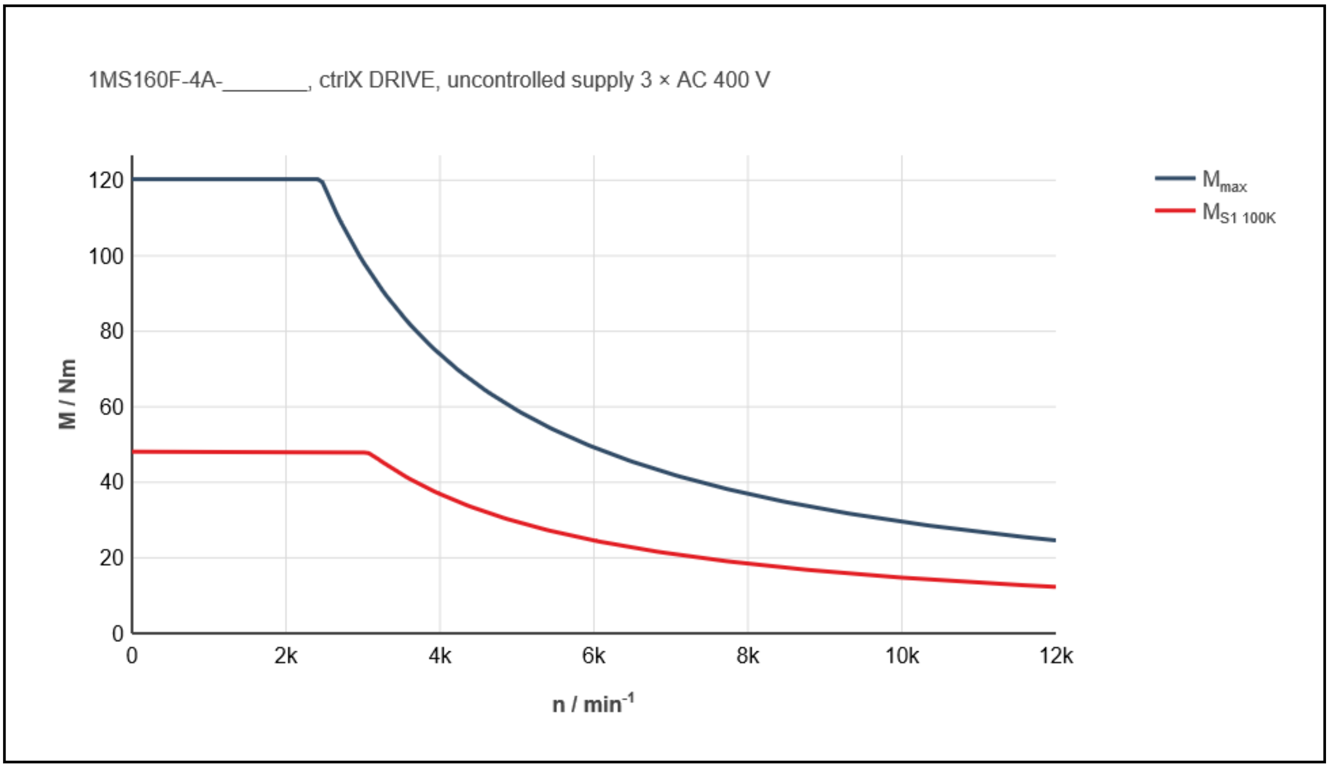


Fig. 4-17: Characteristic curve of motor 1MS160F-4A

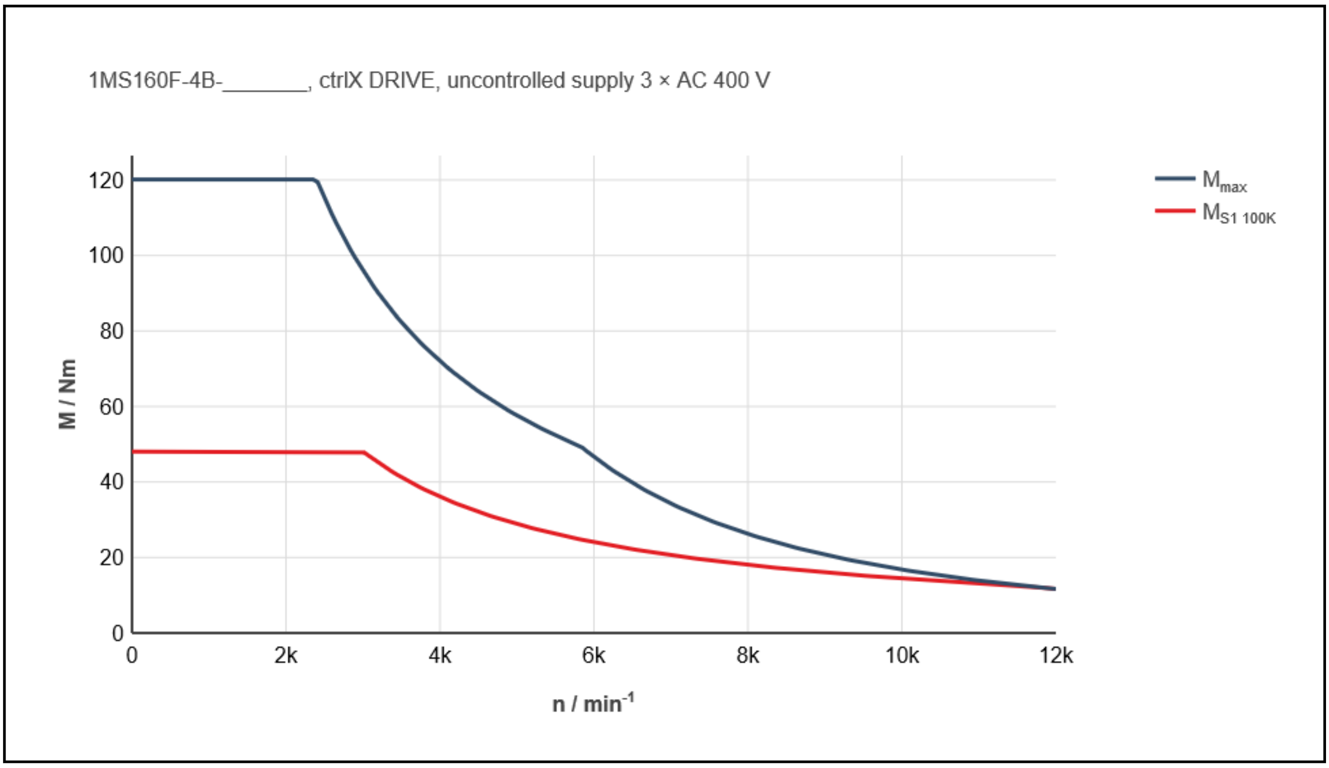


Fig. 4-18: Characteristic curve of motor 1MS160F-4B

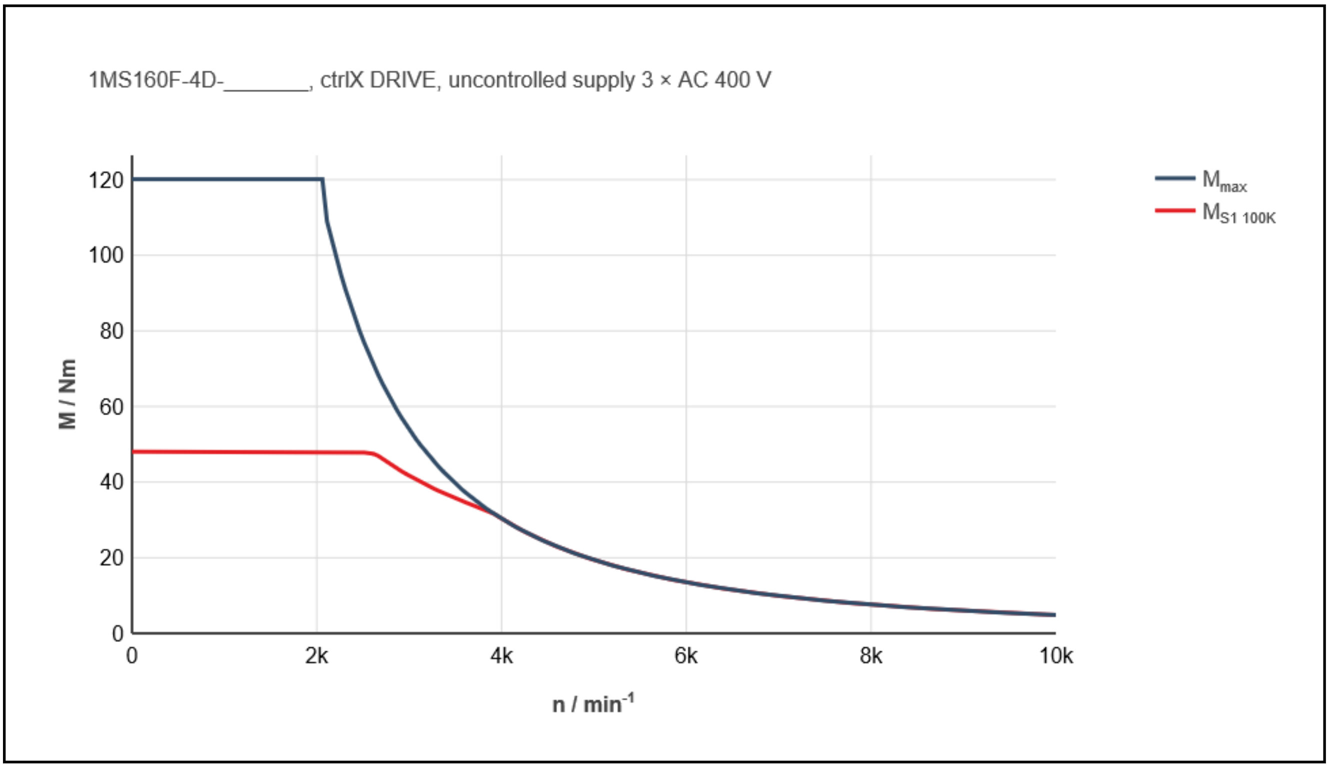


Fig. 4-19: Characteristic curve of motor 1MS160F-4D

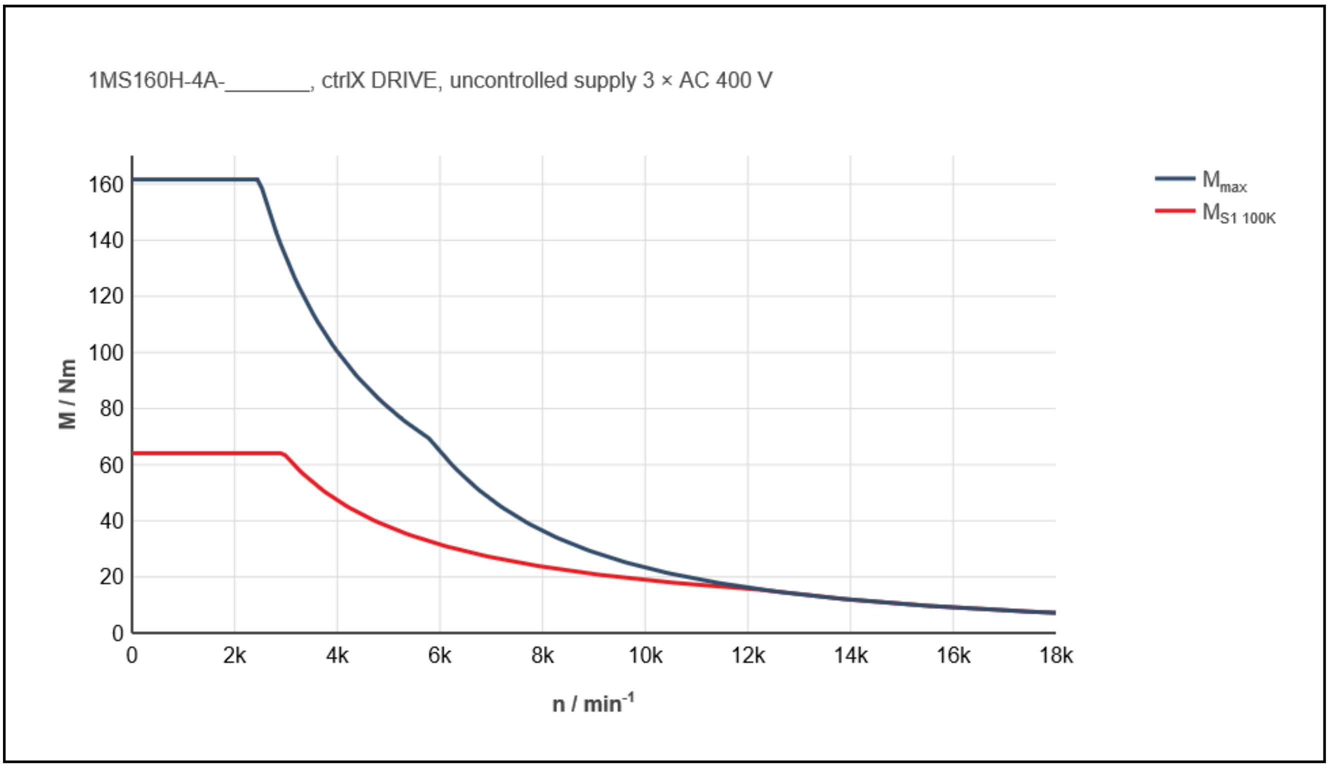


Fig. 4-20: Characteristic curve of motor 1MS160H-4A

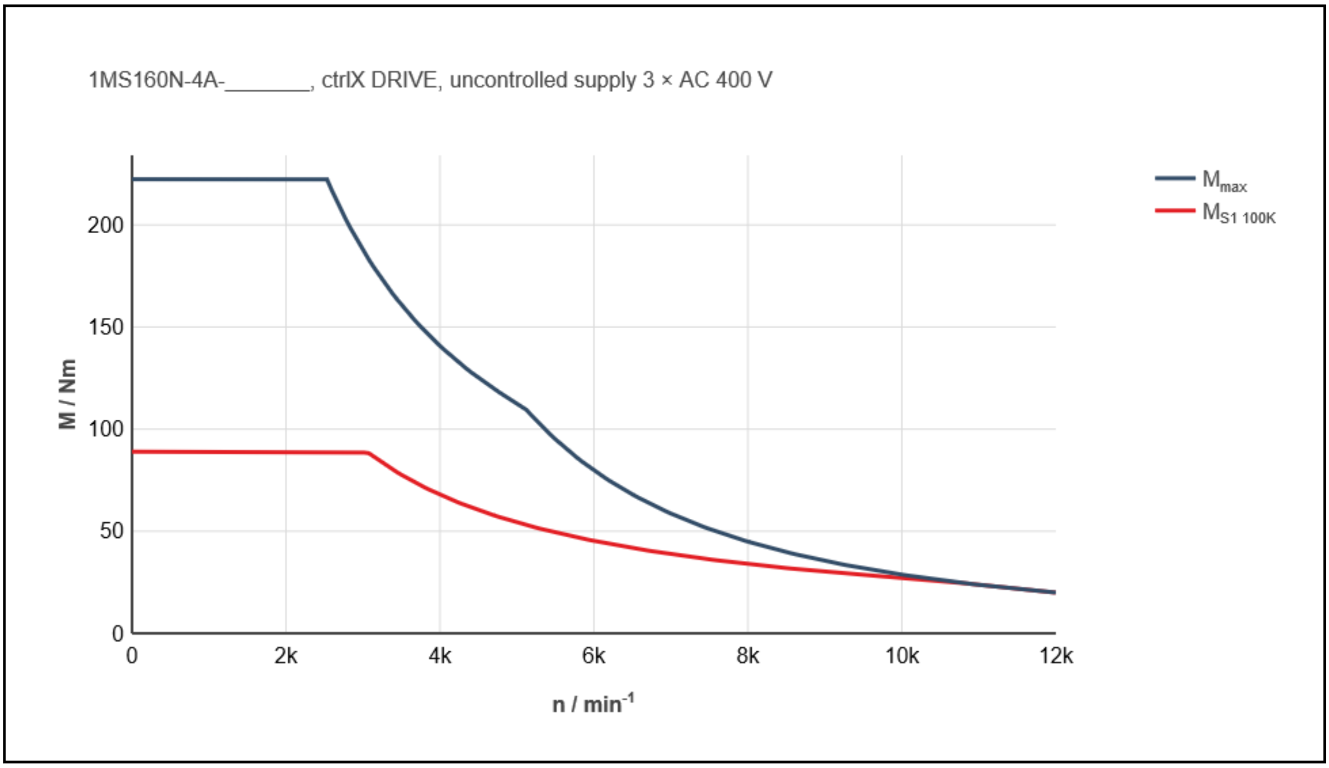


Fig. 4-21: Characteristic curve of motor 1MS160N-4A

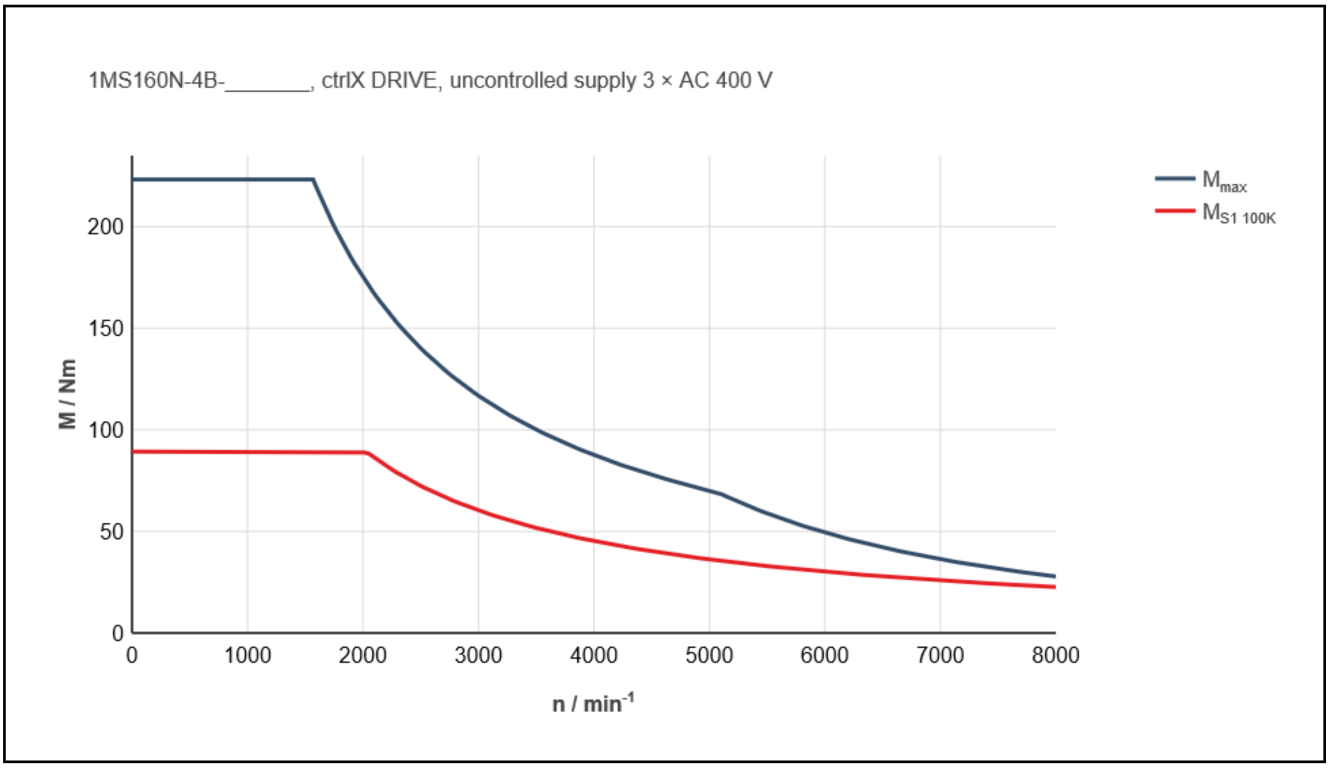


Fig. 4-22: Characteristic curve of motor 1MS160N-4B

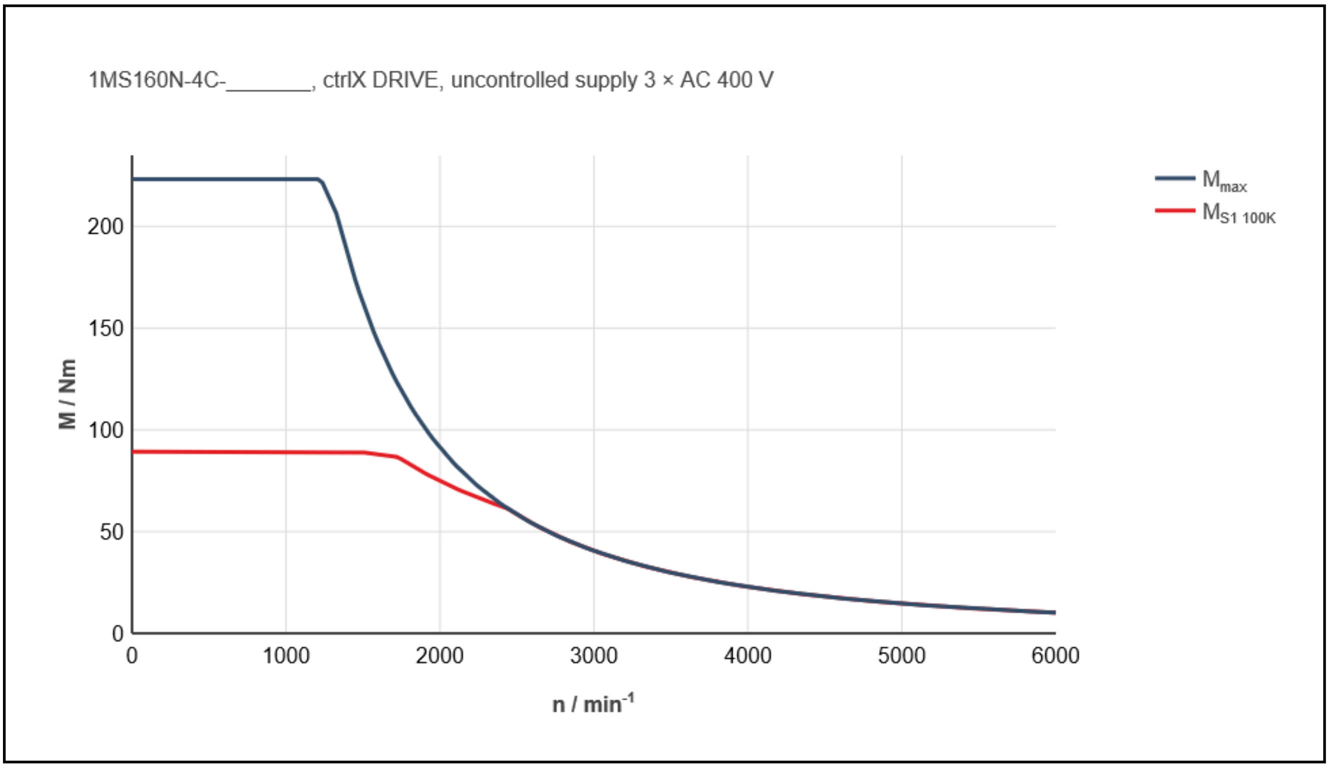


Fig. 4-23: Characteristic curve of motor 1MS160N-4C

4.6 1MB200

4.6.1 Stator 1MS200C/D

<table>
<tr><th>Designation</th><th>Symbol</th><th>Unit</th><th>1MS200 C-4A</th><th>1MS200 D-4B</th><th>1MS200 D-4C</th><th>1MS200 D-4D</th><th>1MS200 D-4E</th><th>1MS200 D-4F</th></tr>
<tr><td>Rated torque</td><td>M_N</td><td>Nm</td><td>57</td><td>85</td><td>59</td><td colspan="2">85</td><td>49</td></tr>
<tr><td>Rated speed</td><td>n_N</td><td>min^{-1}</td><td colspan="2">1500</td><td>5,000</td><td>2,500</td><td>1500</td><td>6000</td></tr>
<tr><td>Rated power</td><td>P_N</td><td>kW</td><td>9.0</td><td>13.5</td><td>31.0</td><td>22.0</td><td>13.5</td><td>31.0</td></tr>
<tr><td>Rated current</td><td>I_N</td><td>A</td><td>50.0</td><td>48.0</td><td>75.0</td><td>59.0</td><td>84.0</td><td>82.0</td></tr>
<tr><td>Maximum torque</td><td>M_{max}</td><td>Nm</td><td>143</td><td>213</td><td>148</td><td colspan="2">212</td><td>123</td></tr>
<tr><td>Maximum current</td><td>I_{max}</td><td>A</td><td>114.5</td><td>115.8</td><td>157.2</td><td>144.3</td><td>201.9</td><td>182.2</td></tr>
<tr><td>Max. speed (electrical)</td><td>n_{max}</td><td>min^{-1}</td><td colspan="2">6000</td><td>20,000</td><td>10,000</td><td>6000</td><td>18,000</td></tr>
<tr><td>Power wire cross-section</td><td>A</td><td>mm^2</td><td colspan="2">10.0</td><td>25.0</td><td>16.0</td><td colspan="2">25.0</td></tr>
<tr><td>Torque constant at 20 °C</td><td>K_{M_N}</td><td>Nm/A</td><td>1.26</td><td>1.85</td><td>0.96</td><td>1.48</td><td>1.06</td><td>0.69</td></tr>
<tr><td>Winding resistance at 20 °C</td><td>R_{12}</td><td>Ohm</td><td>0.236</td><td>0.314</td><td>0.086</td><td>0.202</td><td>0.103</td><td>0.045</td></tr>
<tr><td>Winding inductance</td><td>L_{12}</td><td>mH</td><td>1.87</td><td>2.277</td><td>0.596</td><td>1.481</td><td>0.743</td><td>0.314</td></tr>
<tr><td>Thermal time constant</td><td>T_{th_nom}</td><td>min</td><td colspan="6">7.0</td></tr>
<tr><td>Number of pole pairs</td><td>p</td><td>--</td><td colspan="6">2</td></tr>
<tr><td>Stator mass</td><td>m_{stat}</td><td>kg</td><td>21.0</td><td colspan="5">29.0</td></tr>
<tr><td>Details about liquid cooling</td><td></td><td></td><td colspan="6"></td></tr>
<tr><td>Power loss to be dissipated</td><td>P_V</td><td>kW</td><td>2.0</td><td>2.7</td><td>3.0</td><td colspan="2">2.7</td><td>3.5</td></tr>
<tr><td>Permissible coolant temperature increase for P_V</td><td>ΔT_{max}</td><td>K</td><td colspan="5">10</td><td>5</td></tr>
<tr><td>Required coolant flow for P_V</td><td>Q_{min}</td><td>l/min</td><td>2.9</td><td>3.9</td><td>4.3</td><td>4.0</td><td>3.9</td><td>6.3</td></tr>
<tr><td>Pressure drop at Q_{min}</td><td>Δp</td><td>bar</td><td colspan="6">0.1</td></tr>
<tr><td>Maximum permissible inlet pressure</td><td>p_{max}</td><td>bar</td><td colspan="6">6.0</td></tr>
<tr><td>Volume of coolant duct</td><td>V_{cool}</td><td>l</td><td>0.60</td><td colspan="5">0.80</td></tr>
<tr><td colspan="9">Latest amendment: 2021-03-22</td></tr>
</table>

Tab. 4-10: 1MS200C/ -D - Technical data

4.6.2 Stator 1MS200E/H

Designation	Symbol	Unit	1MS200E-4B	1MS200E-4C	1MS200H-4B	1MS200H-4D
Rated torque	M_N	Nm	85	74	124	
Rated speed	n_N	min^{-1}	1800	3,900	1500	
Rated power	P_N	kW	16.0	30.2	19.5	
Rated current	I_N	A	41.4	65.0	68.0	52.6
Maximum torque	M_{max}	Nm	255	185	309	
Maximum current	I_{max}	A	111.1	139.4	171.0	128.2
Max. speed (electrical)	n_{max}	min^{-1}	7,200	15,600	6000	
Power wire cross-section	A	mm^2	10.0	16.0		10.0
Torque constant at 20 °C	K_{M_N}	Nm/A	2.32	1.37	1.82	2.43
Winding resistance at 20 °C	R_{12}	Ohm	0.361	0.103	0.177	0.302
Winding inductance	L_{12}	mH	2.92	0.833	1.455	2.55
Thermal time constant	T_{th_nom}	min	7.0			
Number of pole pairs	p	--	2			
Stator mass	m_{stat}	kg	34.0		41.0	
Details about liquid cooling						
Power loss to be dissipated	P_V	kW	2.9	3.3	3.8	3.1
Permissible coolant temperature increase for P_V	ΔT_{max}	K	10	9	10	
Required coolant flow for P_V	Q_{min}	l/min	4.2	5.4		4.4
Pressure drop at Q_{min}	Δp	bar	0.1		0.2	
Maximum permissible inlet pressure	p_{max}	bar	6.0			
Volume of coolant duct	V_{cool}	l	0.90		1.10	
Latest amendment: 2021-03-22						

Tab. 4-11: 1MS200E/ -H - Technical data

4.6.3 Rotor 1MR200

Designation	Symbol	Unit	1MR200C	1MR200D	1MR200E	1MR200H
Rotor inertia	J_{rot}	kg * m²	0.041	0.037	0.059	0.069
Rotor mass	m_{rot}	kg	15.3	19.6	22.3	26.2
Maximum speed (mechanical)	$n_{max,mech}$	min^{-1}	18,000			
Latest amendment: 2020-12-10						

Tab. 4-12: 1MR200 - Technical data

4.6.4 Characteristic curves of motor 1MS200

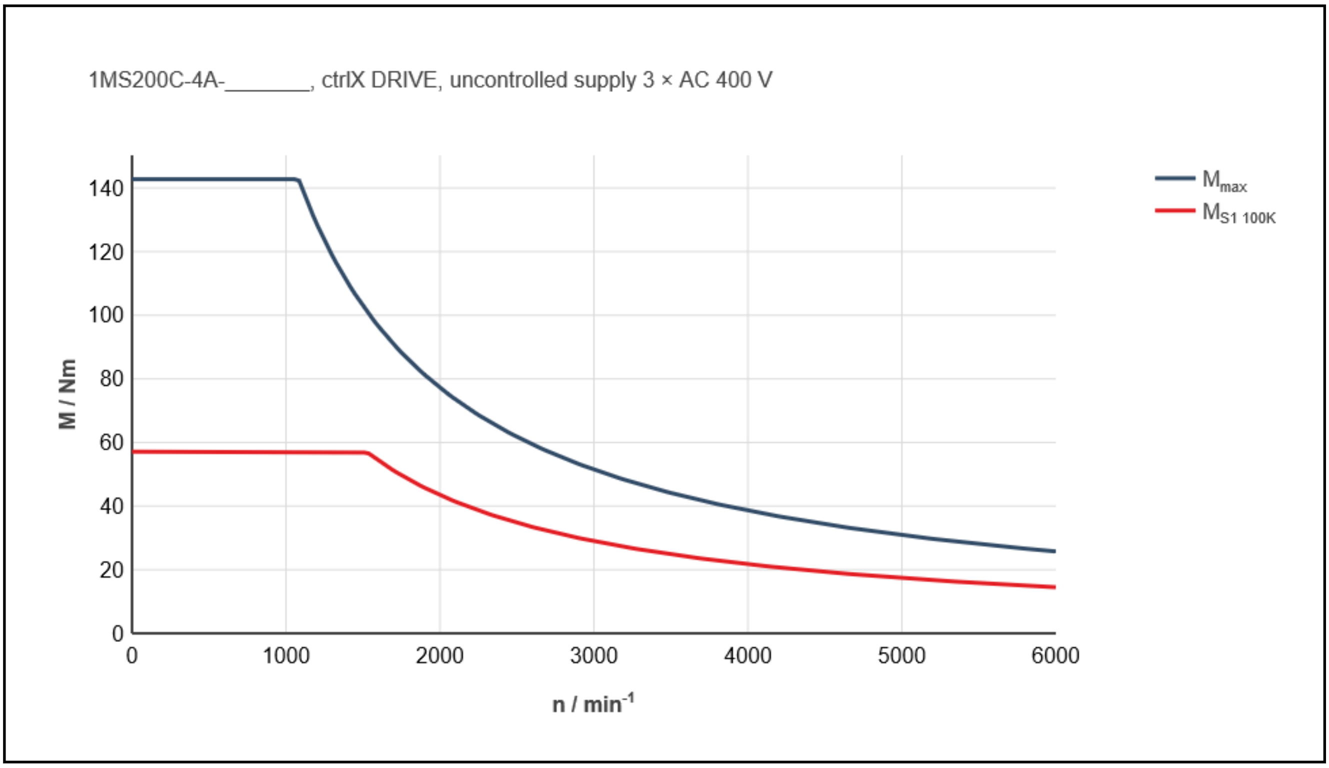


Fig. 4-24: Characteristic curve of motor 1MS200C-4A

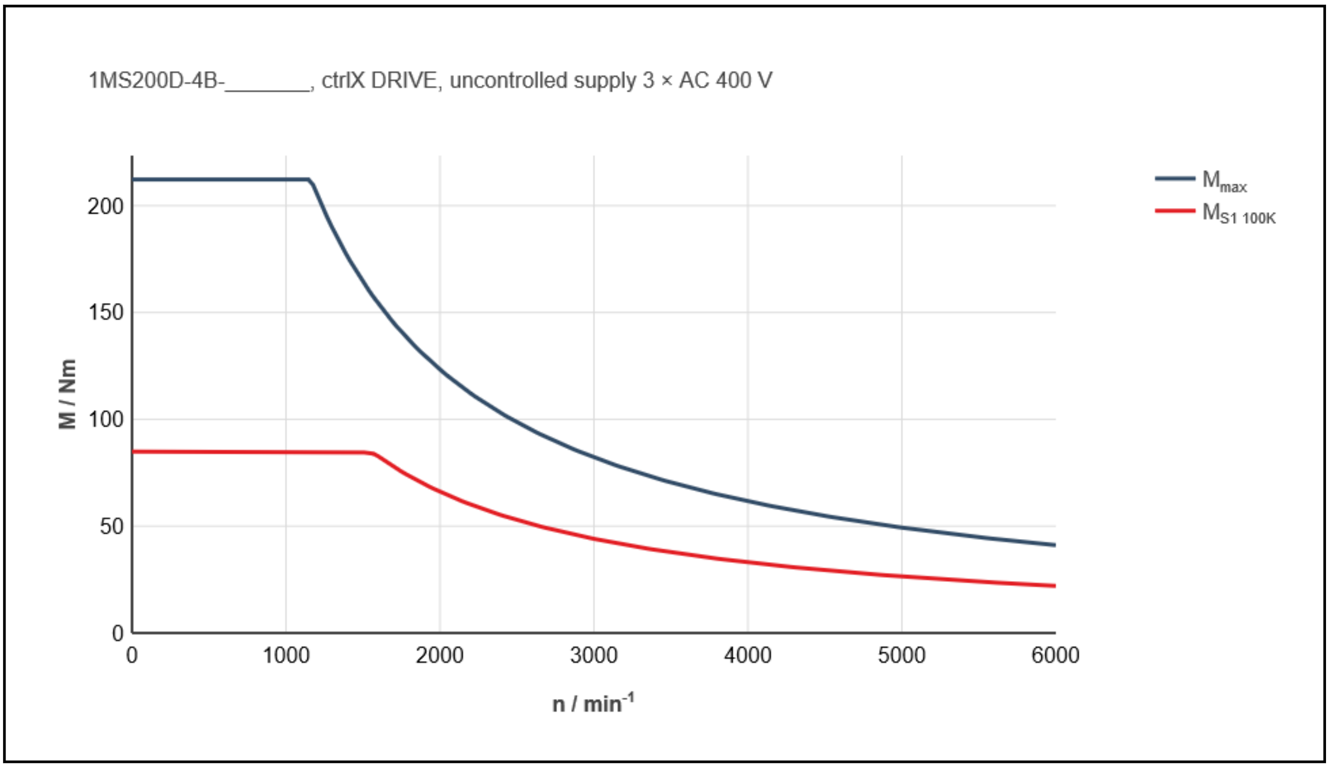


Fig. 4-25: Characteristic curve of motor 1MS200D-4B

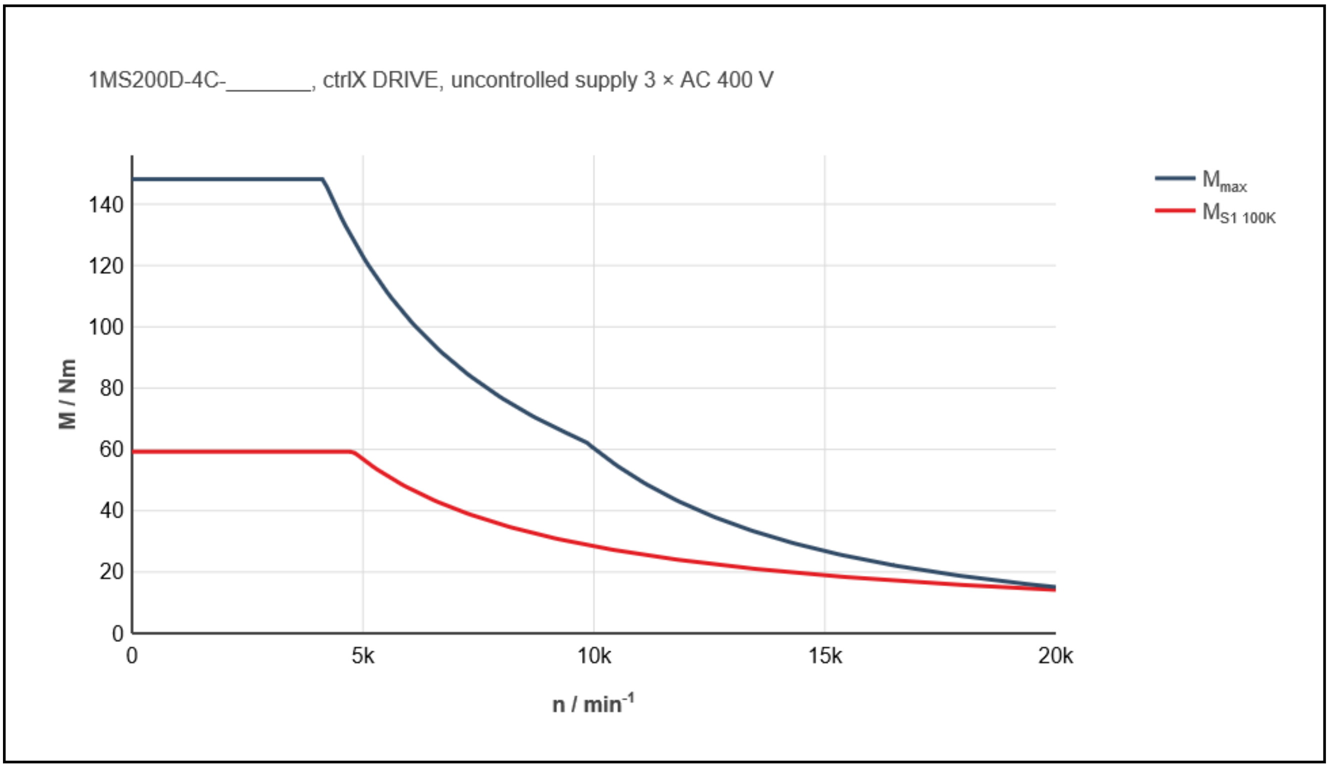


Fig. 4-26: Characteristic curve of motor 1MS200D-4C

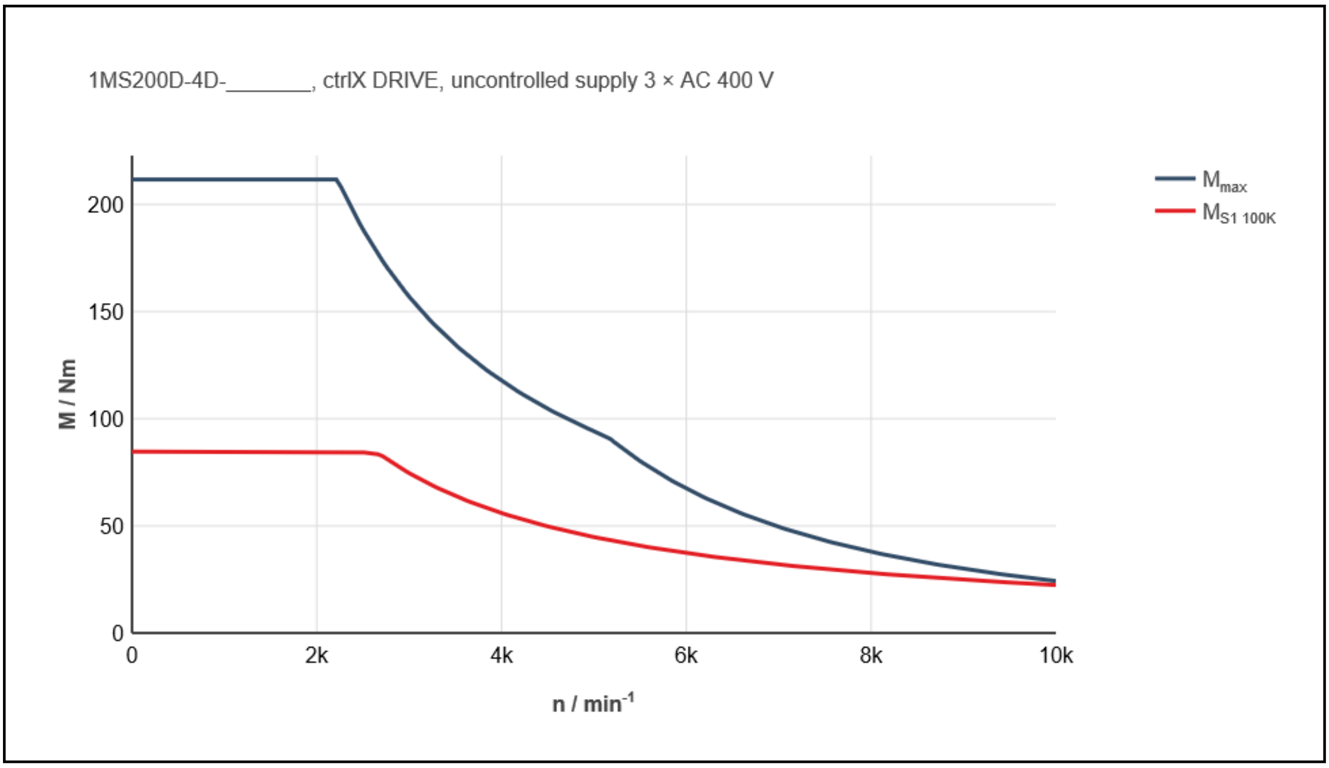


Fig. 4-27: Characteristic curve of motor 1MS200D-4D

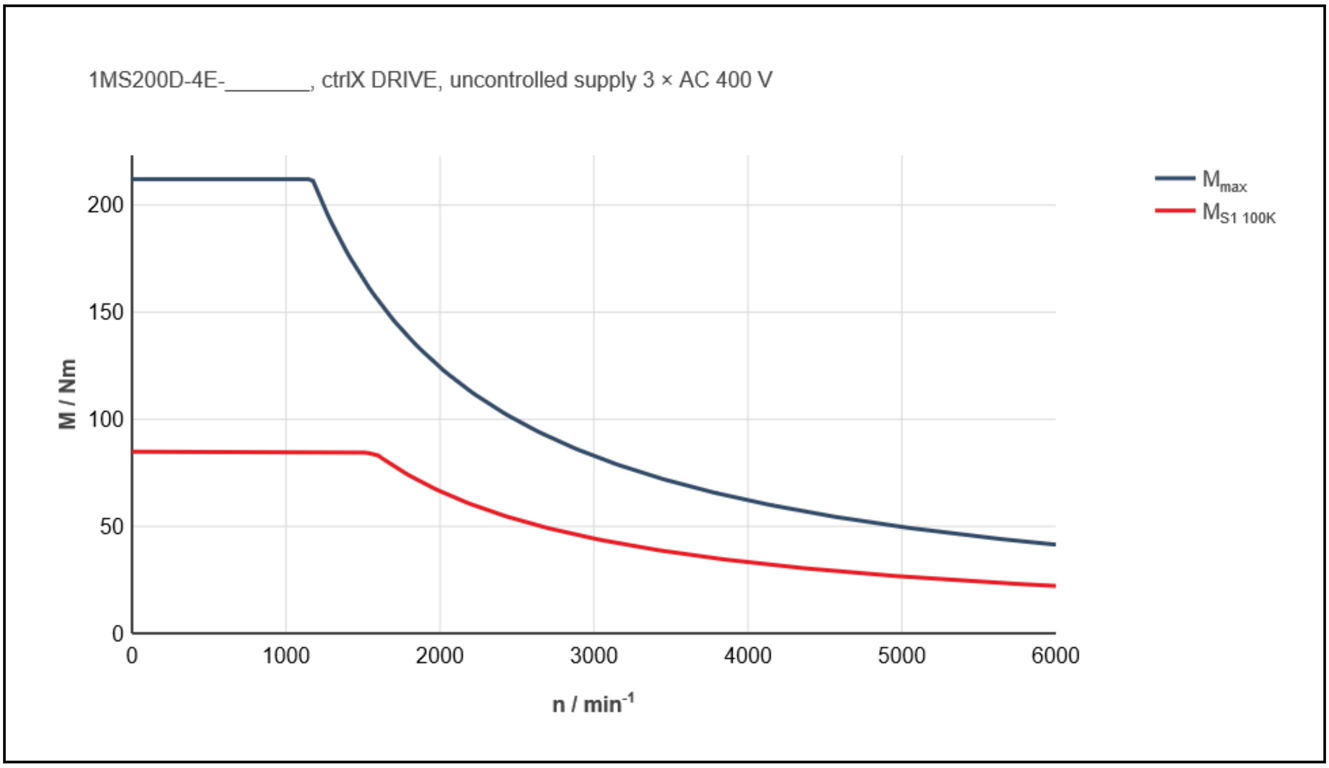


Fig. 4-28: Characteristic curve of motor 1MS200D-4E

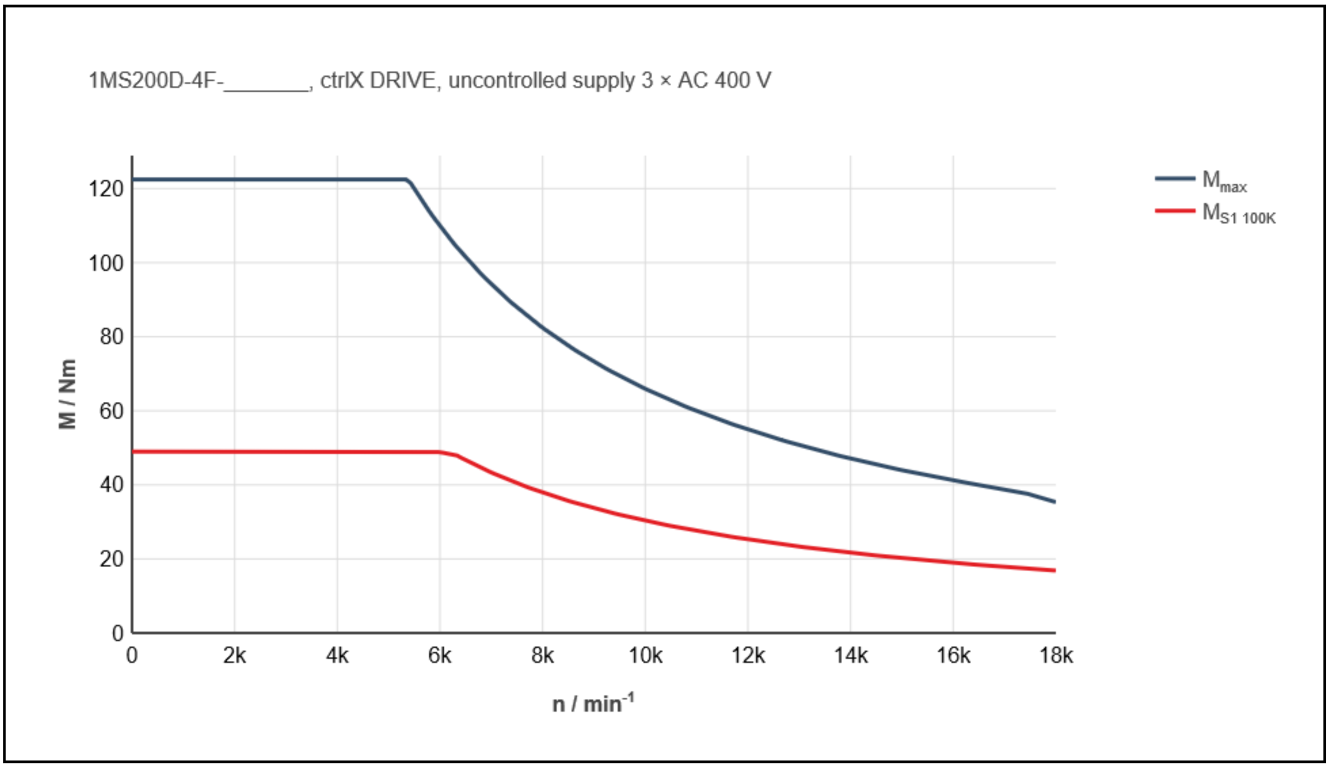


Fig. 4-29: Characteristic curve of motor 1MS200D-4F

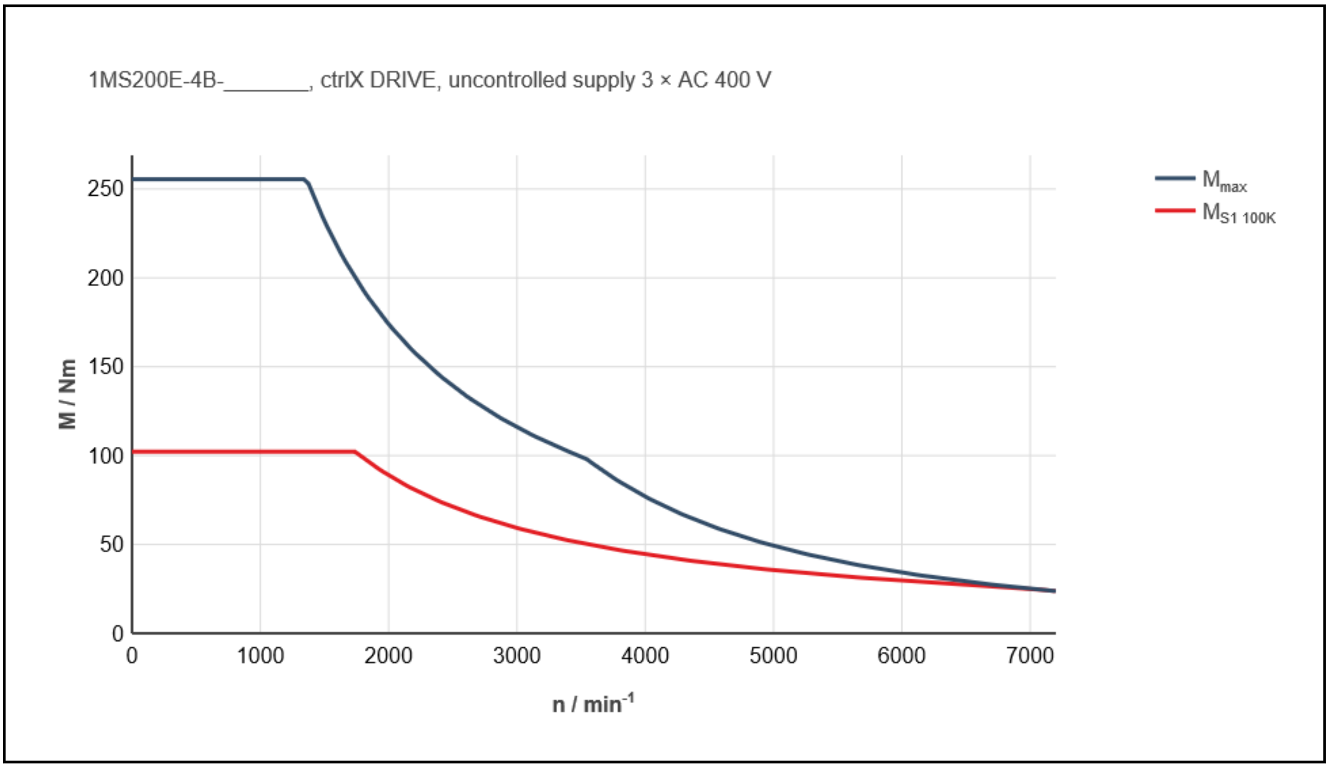


Fig. 4-30: Characteristic curve of motor 1MS200E-4B

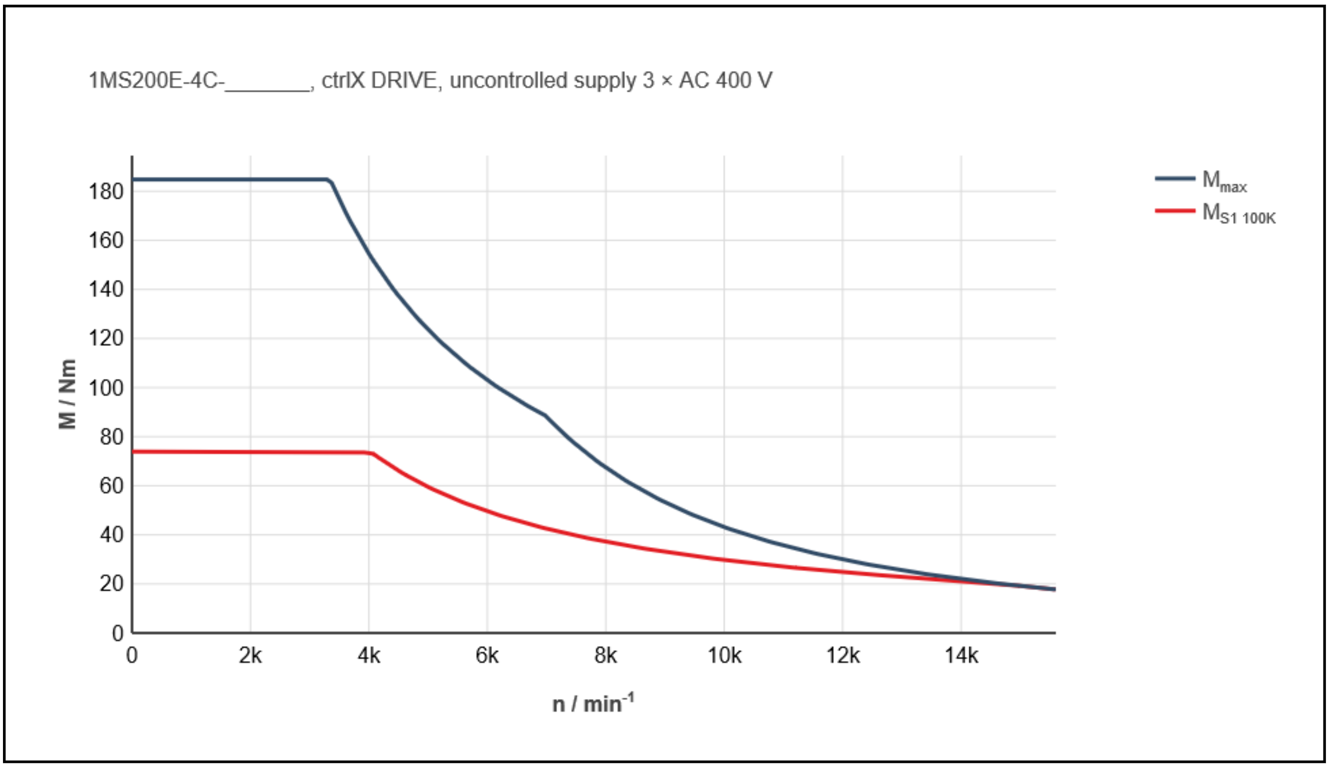


Fig. 4-31: Characteristic curve of motor 1MS200E-4C

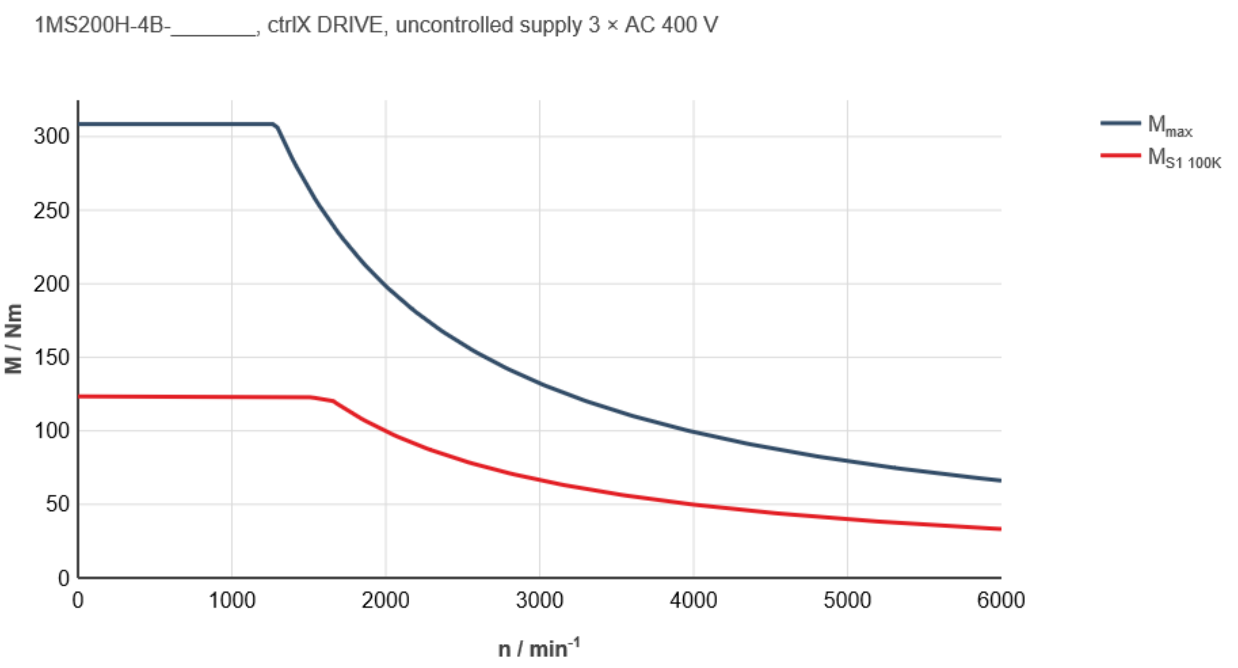


Fig. 4-32: Characteristic curve of motor 1MS200H-4B

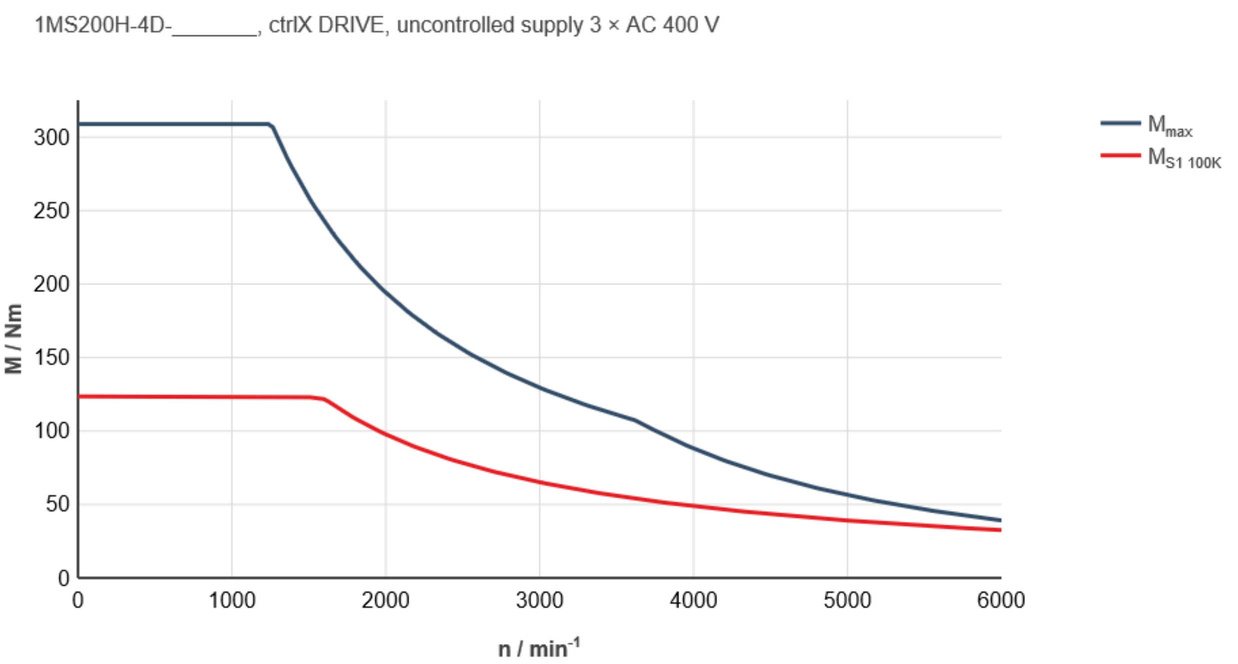


Fig. 4-33: Characteristic curve of motor 1MS200H-4D

4.7 1MB240

4.7.1 Stator 1MS240

Designation	Symbol	Unit	1MS240B-4A	1MS240F-4A	1MS240H-4B
Rated torque	M_N	Nm	62	123	169
Rated speed	n_N	min^{-1}	1,000		
Rated power	P_N	kW	6.5	13.0	18.0
Rated current	I_N	A	46.0	74.0	56.0
Maximum torque	M_{max}	Nm	155	307	422
Maximum current	I_{max}	A	101.1	164.2	124.2
Max. speed (electrical)	n_{max}	min^{-1}	4000		
Power wire cross-section	A	mm^2	10.0	25.0	16.0
Torque constant at 20 °C	K_{M_N}	Nm/A	1.57	1.91	3.46
Winding resistance at 20 °C	R_{12}	Ohm	0.213	0.143	0.259
Winding inductance	L_{12}	mH	1.665	1.29	2.75
Thermal time constant	T_{th_nom}	min	7.0		
Number of pole pairs	p	--	2		
Stator mass	m_{stat}	kg	29.0	48.0	62.0
Details about liquid cooling					
Power loss to be dissipated	P_V	kW	1.8	2.9	3.5
Permissible coolant temperature increase for P_V	ΔT_{max}	K	10		
Required coolant flow for P_V	Q_{min}	l/min	2.6	4.2	5.0
Pressure drop at Q_{min}	Δp	bar	0.1		0.2
Maximum permissible inlet pressure	p_{max}	bar	6.0		
Volume of coolant duct	V_{cool}	l	0.60	1.00	1.23
Latest amendment: 2021-03-22					

Tab. 4-13: 1MS240 - Technical data

4.7.2 Rotor 1MR240

Designation	Symbol	Unit	1MR240B	1MR240F	1MR240H
Rotor inertia	J_{rot}	kg * m²	0.078	0.12	0.153
Rotor mass	m_{rot}	kg	19.2	29.9	38.2
Maximum speed (mechanical)	$n_{max,mech}$	min^{-1}	11,000		
Latest amendment: 2020-12-10					

Tab. 4-14: 1MR240 - Technical data

4.7.3 Characteristic curves of motor 1MS240

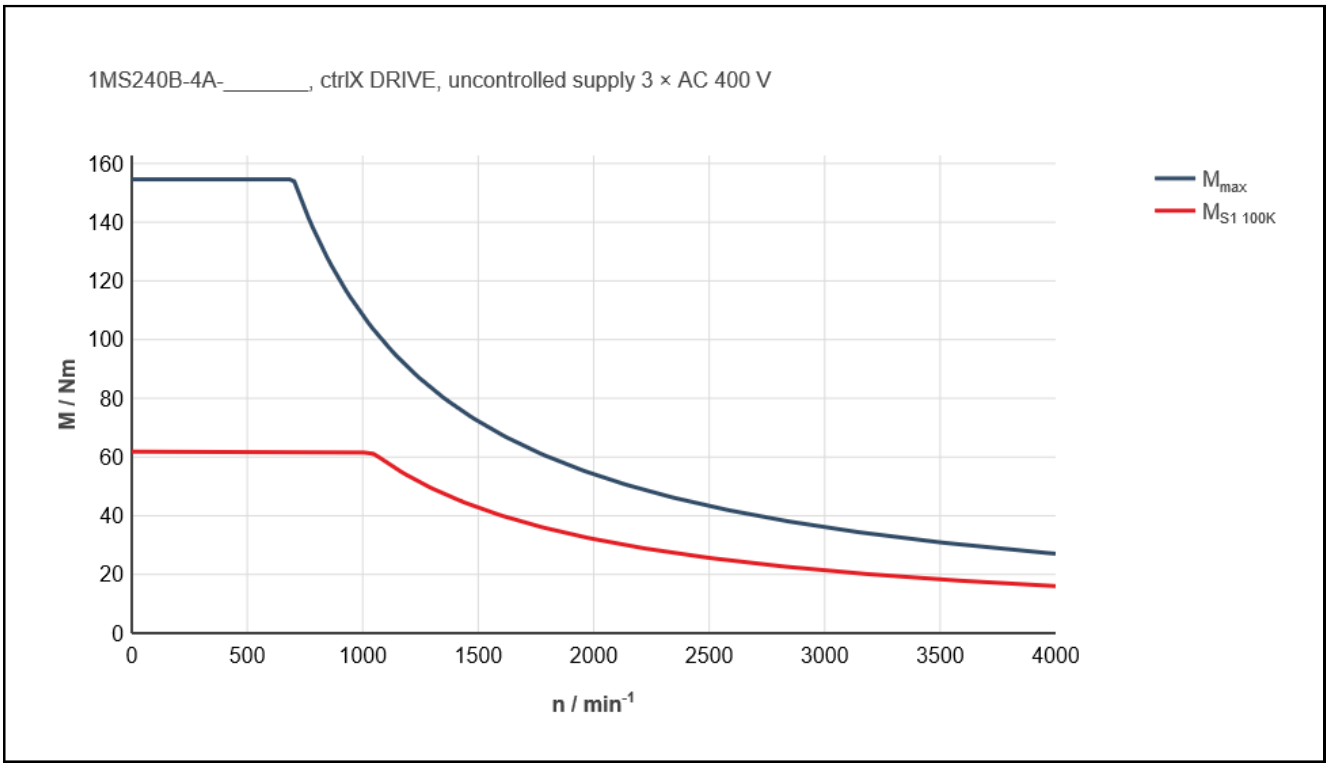


Fig. 4-34: Characteristic curve of motor 1MS240B-4A

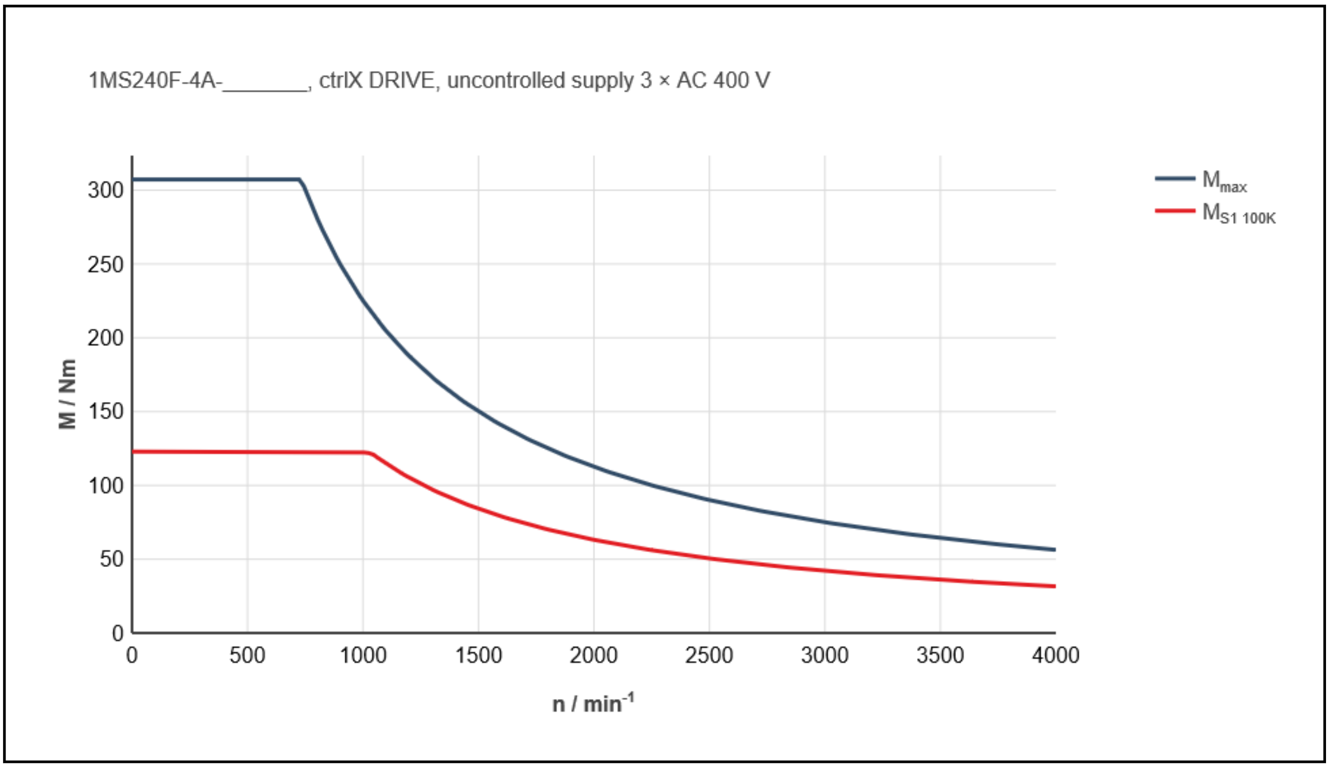


Fig. 4-35: Characteristic curve of motor 1MS240F-4A

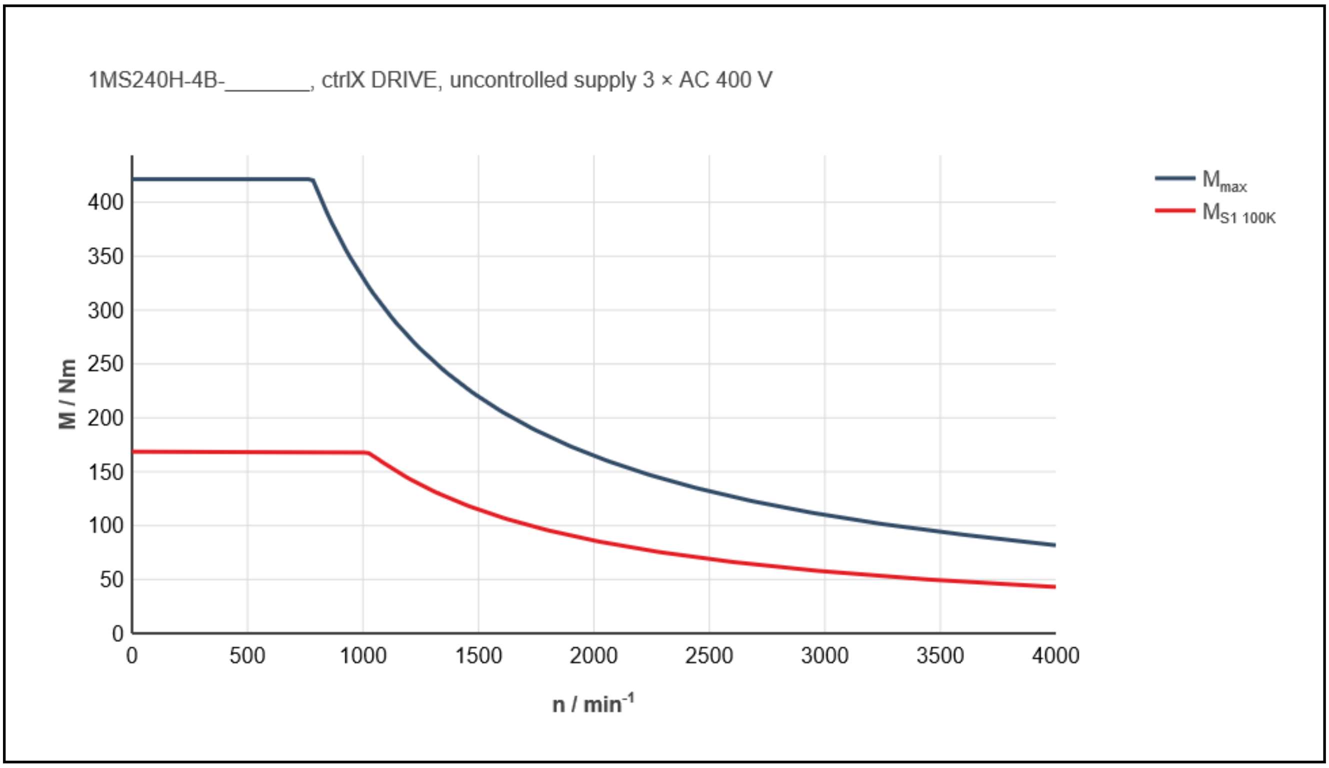


Fig. 4-36: Characteristic curve of motor 1MS240H-4B

4.8 1MB241

4.8.1 Stator 1MS241

Designation	Symbol	Unit	1MS241 C-6B	1MS241 D-6A	1MS241 D-6C	1MS241 D-6D	1MS241 H-6C	1MS241 H-6D
Rated torque	M_N	Nm	62.5	100	112	80.3	202	
Rated speed	n_N	min^{-1}	4000	2,400	1,000	3,900	1800	850
Rated power	P_N	kW	26.2	25.1	12.0	32.8	32.0	18.0
Rated current	I_N	A	81.7	57.0	27.0	66.2	75.5	66.4
Maximum torque	M_{max}	Nm	183	280			505	
Maximum current	I_{max}	A	181.2	139.5	59.7	165.5	184.5	127.9
Max. speed (electrical)	n_{max}	min^{-1}	10,000	6000	4000	9,000	7,200	3,400
Power wire cross-section	A	mm^2	25.0	16.0	4.0		25.0	16.0
Torque constant at 20 °C	K_{M_N}	Nm/A	0.92	2.05	4.82	1.24	2.81	4.06
Winding resistance at 20 °C	R_{12}	Ohm	0.066	0.2	0.888	0.104	0.142	0.298
Winding inductance	L_{12}	mH	0.298	1.29	6.172	0.614	1.124	2.257
Thermal time constant	T_{th_nom}	min	2.1	7.0				
Number of pole pairs	p	--	3					
Stator mass	m_{stat}	kg	26.0	38.0			63.0	
Details about liquid cooling								
Power loss to be dissipated	P_V	kW	2.9	2.0			4.5	3.0
Permissible coolant temperature increase for P_V	ΔT_{max}	K	10				10	
Required coolant flow for P_V	Q_{min}	l/min	4.1	2.9			6.7	4.3
Pressure drop at Q_{min}	Δp	bar	0.1					
Maximum permissible inlet pressure	p_{max}	bar	6.0					
Volume of coolant duct	V_{cool}	l	0.60	0.80			1.40	
Latest amendment: 2022-05-10								

Tab. 4-15: 1MS241 - Technical data

4.8.2 Rotor 1MR241

Designation	Symbol	Unit	1MR241C	1MR241D	1MR241H
Rotor inertia	J_{rot}	kg * m²	0.1055	0.135	0.227
Rotor mass	m_{rot}	kg	18.0	31.3	39.5
Maximum speed (mechanical)	$n_{max,mech}$	min^{-1}	10,000	9,000	
Latest amendment: 2020-12-07					

Tab. 4-16: 1MR241 - Technical data

4.8.3 Characteristic curves of motor 1MS241

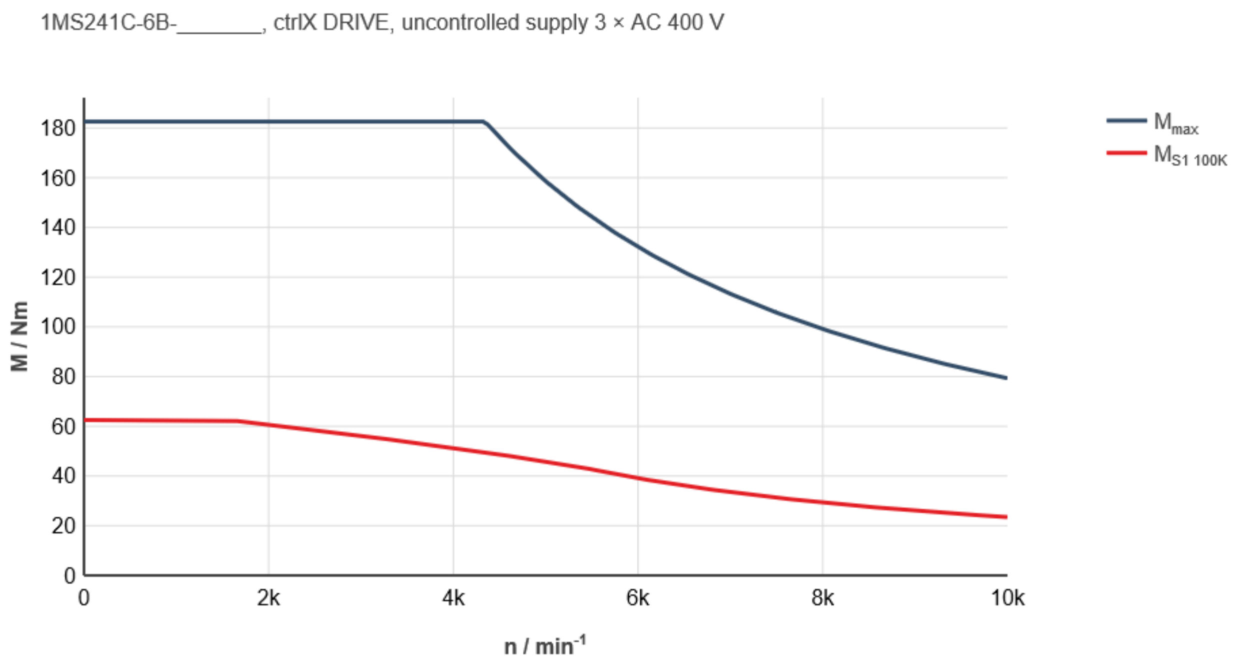


Fig. 4-37: Characteristic curve of motor 1MS241C-6B

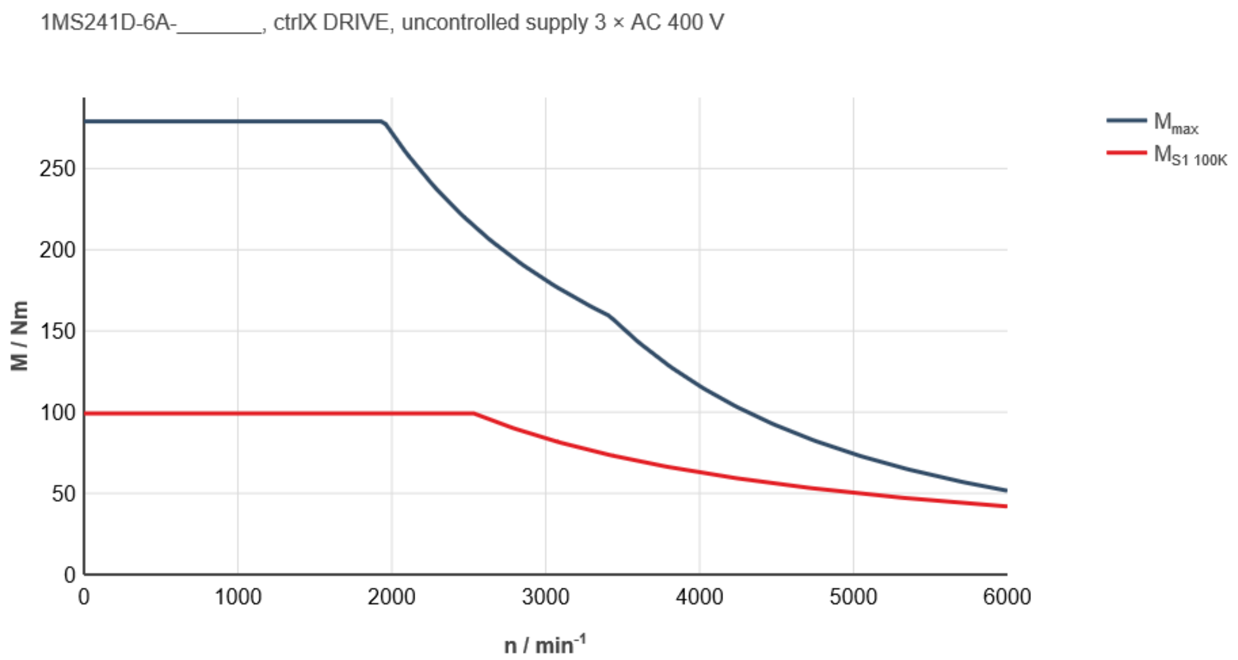


Fig. 4-38: Characteristic curve of motor 1MS241D-6A

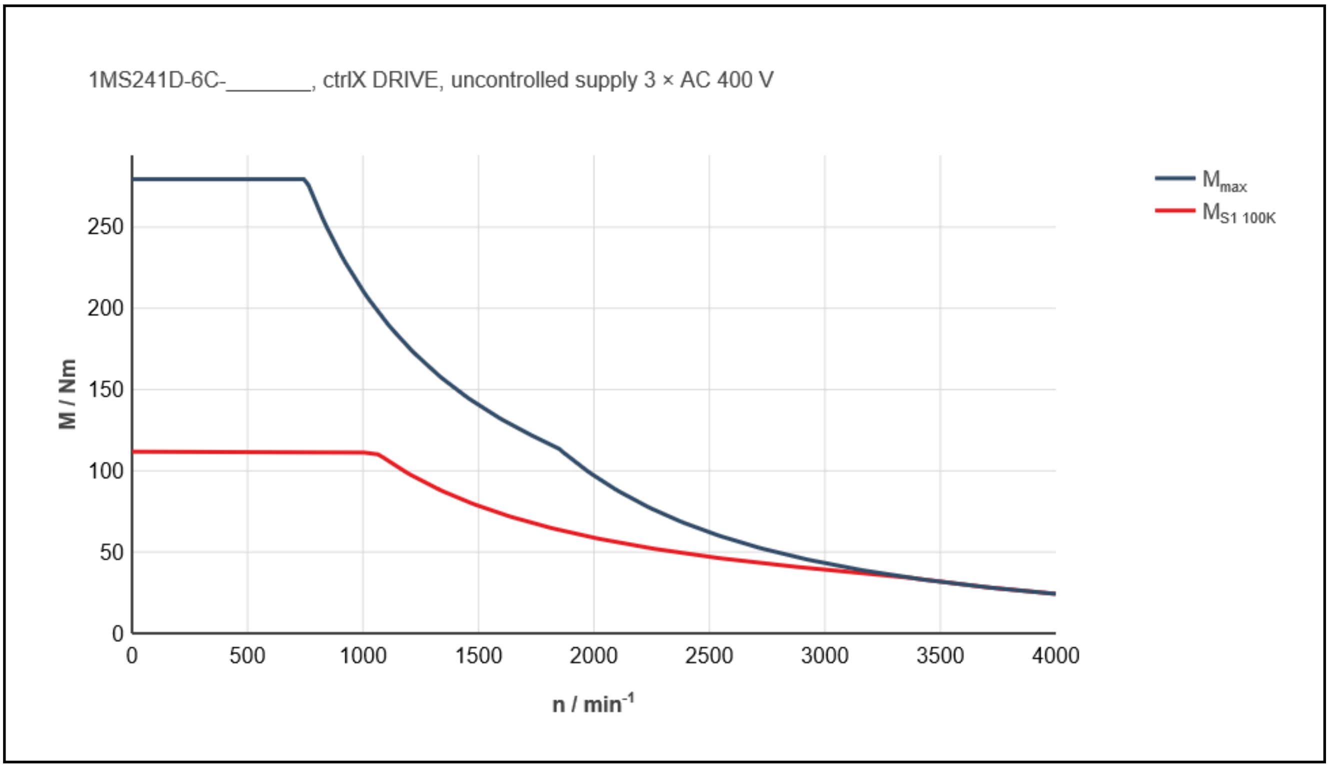


Fig. 4-39: Characteristic curve of motor 1MS241D-6C

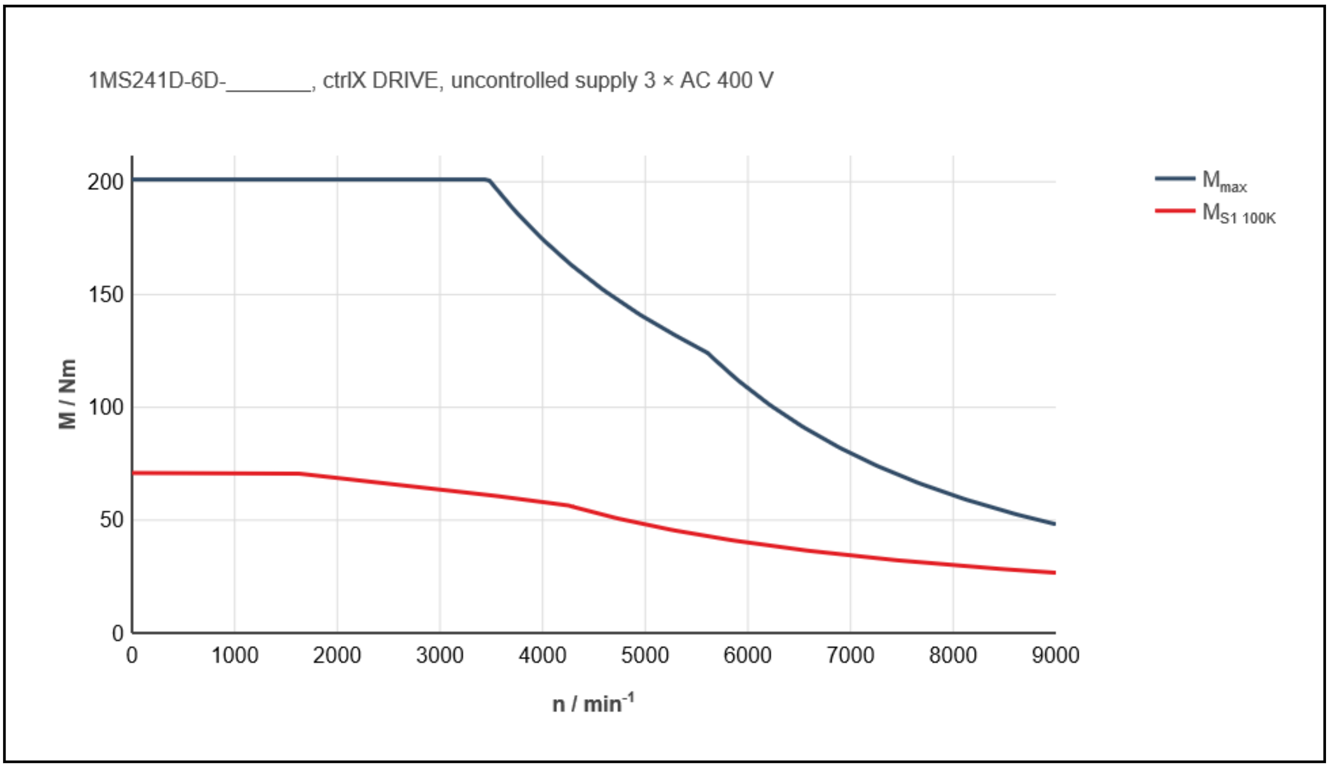


Fig. 4-40: Characteristic curve of motor 1MS241D-6D

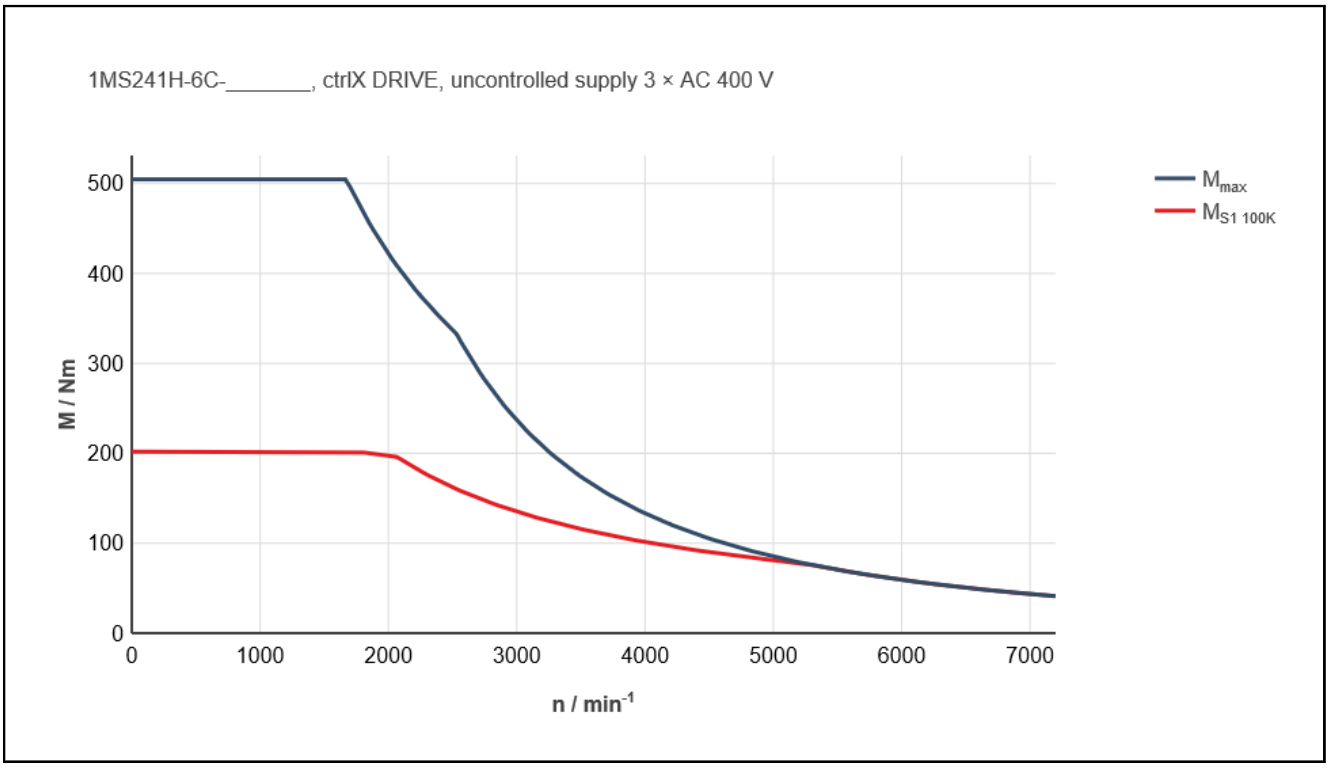


Fig. 4-41: Characteristic curve of motor 1MS241H-6C

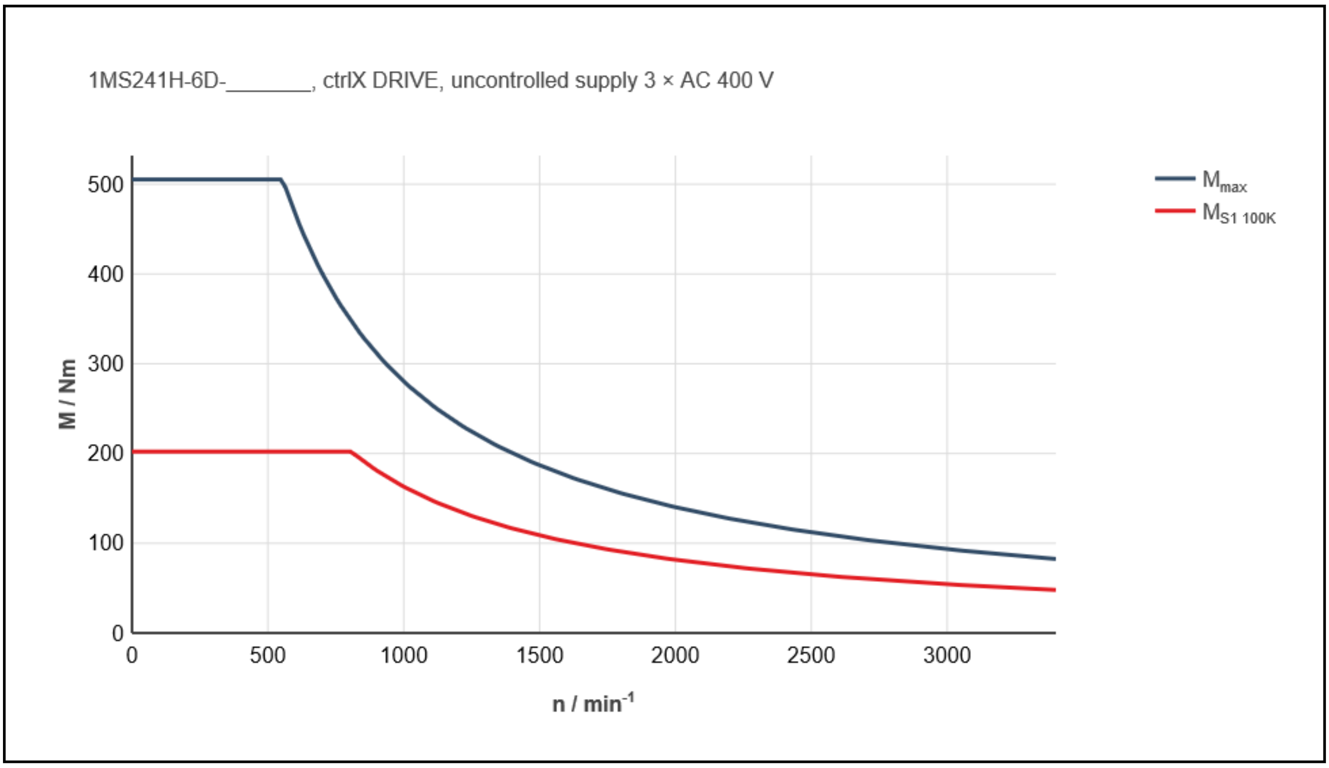


Fig. 4-42: Characteristic curve of motor 1MS241H-6D

4.9 1MB242

4.9.1 Stator 1MS242

Designation	Symbol	Unit	1MS242N-4B
Rated torque	M_N	Nm	185
Rated speed	n_N	min^{-1}	1,700
Rated power	P_N	kW	33.0
Rated current	I_N	A	98.0
Maximum torque	M_{max}	Nm	464
Maximum current	I_{max}	A	224.3
Max. speed (electrical)	n_{max}	min^{-1}	6,800
Power wire cross-section	A	mm^2	35.0
Torque constant at 20 °C	K_{M_N}	Nm/A	2.11
Winding resistance at 20 °C	R_{12}	Ohm	0.09
Winding inductance	L_{12}	mH	1.067
Thermal time constant	T_{th_nom}	min	7.0
Number of pole pairs	p	--	2
Stator mass	m_{stat}	kg	81.0
Details about liquid cooling			
Power loss to be dissipated	P_V	kW	3.0
Permissible coolant temperature increase for P_V	ΔT_{max}	K	10
Required coolant flow for P_V	Q_{min}	l/min	4.3
Pressure drop at Q_{min}	Δp	bar	0.1
Maximum permissible inlet pressure	p_{max}	bar	6.0
Volume of coolant duct	V_{cool}	l	1.40
			Latest amendment: 2021-03-22

Tab. 4-17: 1MS242 - Technical data

4.9.2 Rotor 1MR242

Designation	Symbol	Unit	1MR242N
Rotor inertia	J_{rot}	kg * m²	0.135
Rotor mass	m_{rot}	kg	36.9
Maximum speed (mechanical)	$n_{max,mech}$	min^{-1}	16,000
			Latest amendment: 2020-12-10

Tab. 4-18: 1MR242 - Technical data

4.9.3 Characteristic curve of motor 1MS242

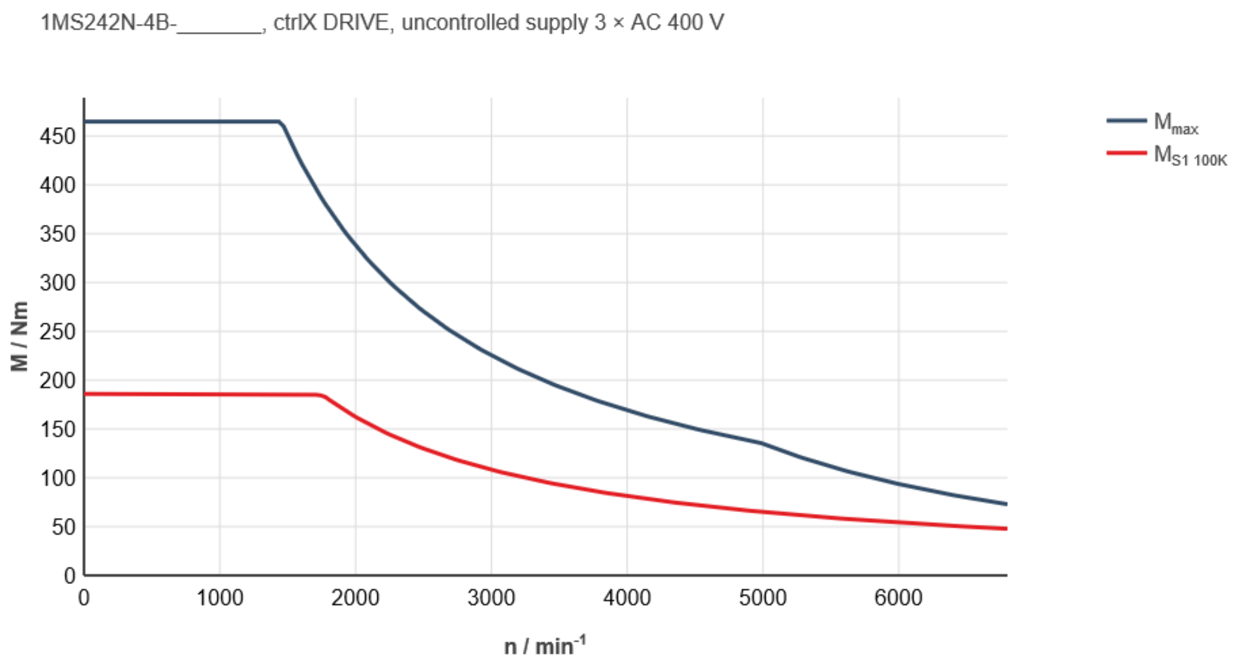


Fig. 4-43: Characteristic curve of motor 1MS242N-4B

4.10 1MB270

4.10.1 Stator 1MS270

Designation	Symbol	Unit	1MS270C-4B
Rated torque	M_N	Nm	190
Rated speed	n_N	min^{-1}	1500
Rated power	P_N	kW	30,0
Rated current	I_N	A	96.0
Maximum torque	M_{max}	Nm	480
Maximum current	I_{max}	A	228.5
Max. speed (electrical)	n_{max}	min^{-1}	6000
Power wire cross-section	A	mm^2	35.0
Torque constant at 20 °C	K_{M_N}	Nm/A	2.12
Winding resistance at 20 °C	R_{12}	Ohm	0.105
Winding inductance	L_{12}	mH	1.186
Thermal time constant	T_{th_nom}	min	10.0
Number of pole pairs	p	--	2
Stator mass	m_{stat}	kg	82.0
Details about liquid cooling			
Power loss to be dissipated	P_V	kW	3.6
Permissible coolant temperature increase for P_V	ΔT_{max}	K	10
Required coolant flow for P_V	Q_{min}	l/min	5.2
Pressure drop at Q_{min}	Δp	bar	0.1
Maximum permissible inlet pressure	p_{max}	bar	6.0
Volume of coolant duct	V_{cool}	l	1.30
			Latest amendment: 2021-03-22

Tab. 4-19: 1MS270 - Technical data

4.10.2 Rotor 1MR270

Designation	Symbol	Unit	1MR270C
Rotor inertia	J_{rot}	kg * m²	0.258
Rotor mass	m_{rot}	kg	53.3
Maximum speed (mechanical)	$n_{max,mech}$	min^{-1}	12,000
			Latest amendment: 2020-12-10

Tab. 4-20: 1MR270 - Technical data

4.10.3 Characteristic curve of motor 1MS270

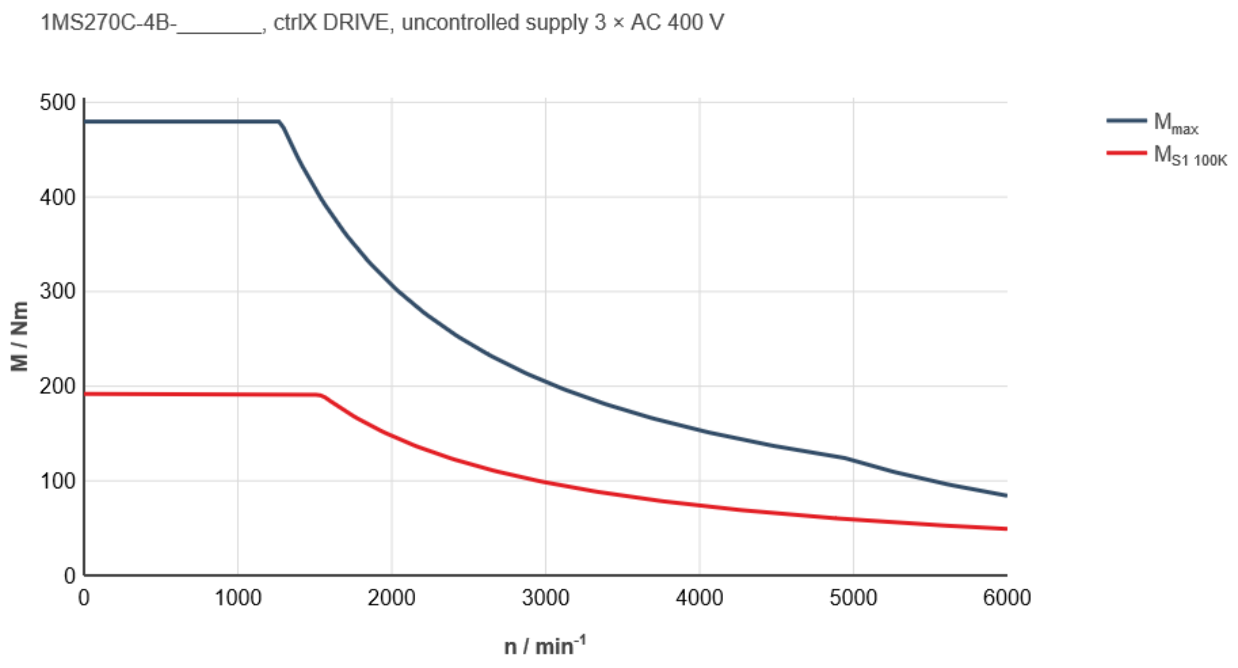


Fig. 4-44: Characteristic curve of motor 1MS270C-4B

4.11 1MB310

4.11.1 Stator 1MS310B

Designation	Symbol	Unit	1MS310B-6B	1MS310B-6D	1MS310B-6E
Rated torque	M_N	Nm	260		
Rated speed	n_N	min^{-1}	700	1,000	440
Rated power	P_N	kW	19.0	27.0	12.0
Rated current	I_N	A	75.0	81.0	58.0
Maximum torque	M_{max}	Nm	651		563
Maximum current	I_{max}	A	164.0	178.9	125.7
Max. speed (electrical)	n_{max}	min^{-1}	2,800	4000	1760
Power wire cross-section	A	mm^2	25.0		16.0
Torque constant at 20 °C	K_{M_N}	Nm/A	4.07	3.73	4.60
Winding resistance at 20 °C	R_{12}	Ohm	0.173	0.145	0.274
Winding inductance	L_{12}	mH	1.752	1.39	2.99
Thermal time constant	T_{th_nom}	min	10.0		
Number of pole pairs	p	--	3		
Stator mass	m_{stat}	kg	67.0		
Details about liquid cooling					
Power loss to be dissipated	P_V	kW	3.5		
Permissible coolant temperature increase for P_V	ΔT_{max}	K	10		
Required coolant flow for P_V	Q_{min}	l/min	5.0		
Pressure drop at Q_{min}	Δp	bar	0.2		
Maximum permissible inlet pressure	p_{max}	bar	6.0		
Volume of coolant duct	V_{cool}	l	1.40		
Latest amendment: 2021-03-22					

Tab. 4-21: 1MS310B - Technical data

4.11.2 Stator 1MS310D/F

Designation	Symbol	Unit	1MS310D-6B	1MS310F-6A	1MS310F-6B
Rated torque	M_N	Nm	340	480	
Rated speed	n_N	min^{-1}	800	400	900
Rated power	P_N	kW	28.5	20,0	45.2
Rated current	I_N	A	81.0	63.8	111.0
Maximum torque	M_{max}	Nm	850	1,200	
Maximum current	I_{max}	A	174.2	138.8	246.6
Max. speed (electrical)	n_{max}	min^{-1}	3,200	1,600	3,600
Power wire cross-section	A	mm^2	25.0	16.0	35.0
Torque constant at 20 °C	K_{M_N}	Nm/A	5.01	7.52	4.32
Winding resistance at 20 °C	R_{12}	Ohm	0.168	0.363	0.125
Winding inductance	L_{12}	mH	1.941	4.753	1.497
Thermal time constant	T_{th_nom}	min	10.0		
Number of pole pairs	p	--	3		
Stator mass	m_{stat}	kg	86.0	103.0	
Details about liquid cooling					
Power loss to be dissipated	P_V	kW	3.8	5.5	
Permissible coolant temperature increase for P_V	ΔT_{max}	K	10		
Required coolant flow for P_V	Q_{min}	l/min	5.4	7.9	
Pressure drop at Q_{min}	Δp	bar	0.2	0.3	
Maximum permissible inlet pressure	p_{max}	bar	6.0		
Volume of coolant duct	V_{cool}	l	1.80	2.20	
Latest amendment: 2021-03-22					

Tab. 4-22: 1MS310D/ -F - Technical data

4.11.3 Rotor 1MR310

Designation	Symbol	Unit	1MR310B	1MR310D	1MR310F
Rotor inertia	J_{rot}	kg * m²	0.477	0.492	0.723
Rotor mass	m_{rot}	kg	63.3	71.9	95
Maximum speed (mechanical)	$n_{max,mech}$	min^{-1}	8,000		
Latest amendment: 2012-10-19					

Tab. 4-23: 1MR310 - Technical data

4.11.4 Characteristic curves of motor 1MS310

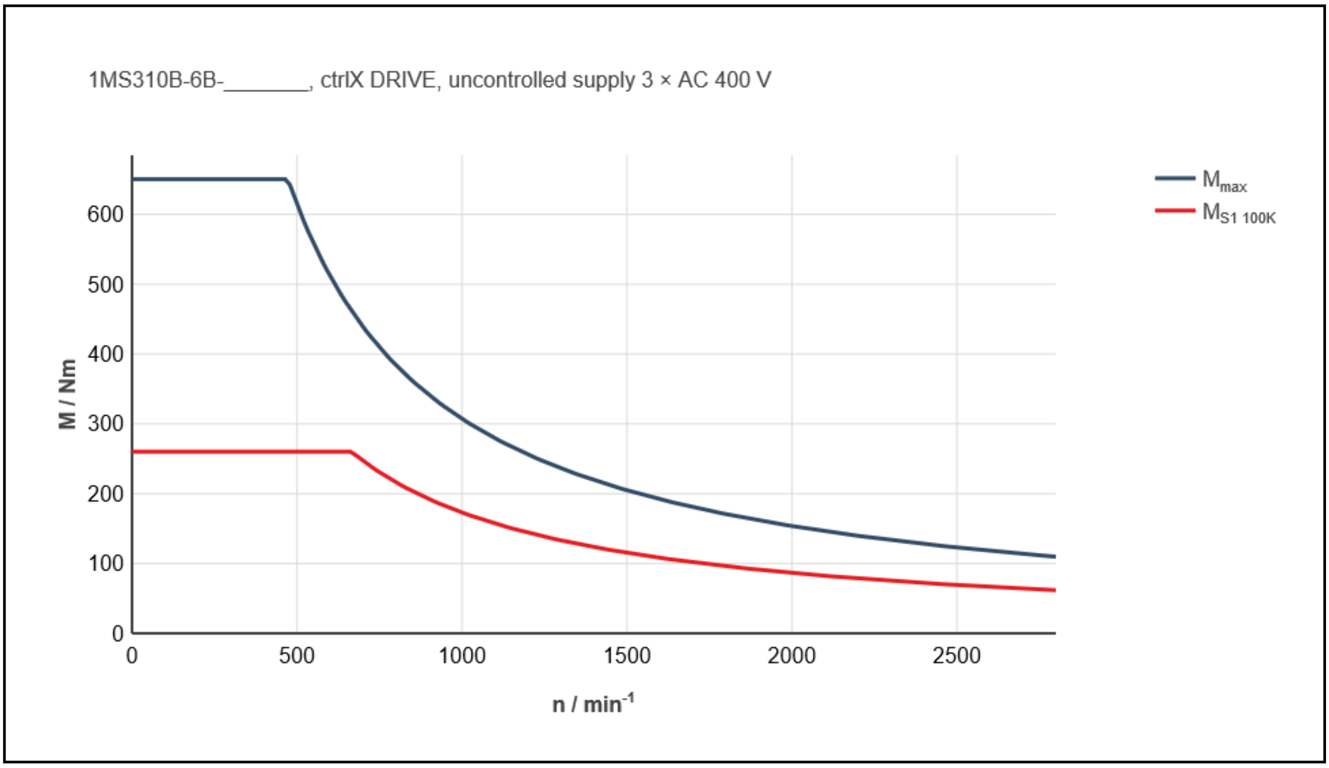


Fig. 4-45: Characteristic curve of motor 1MS310B-6B

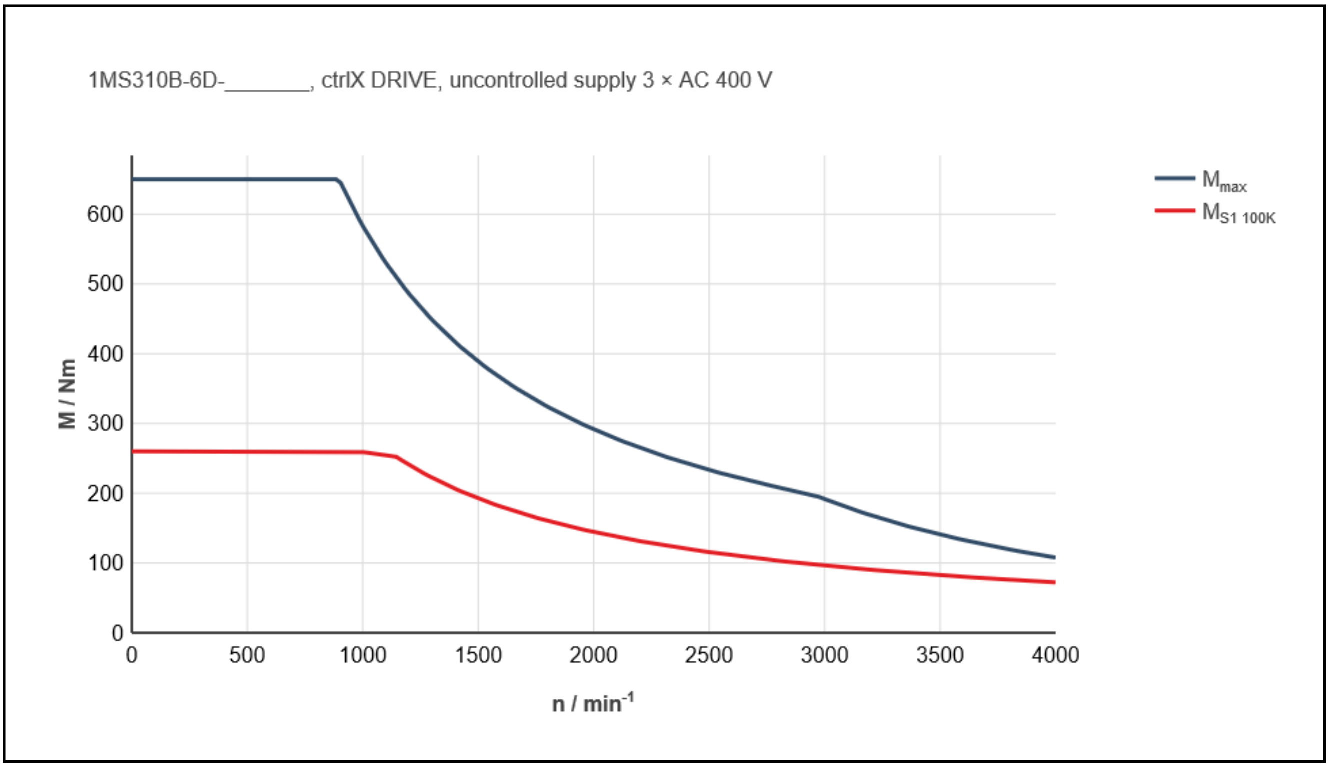


Fig. 4-46: Characteristic curve of motor 1MS310B-6D

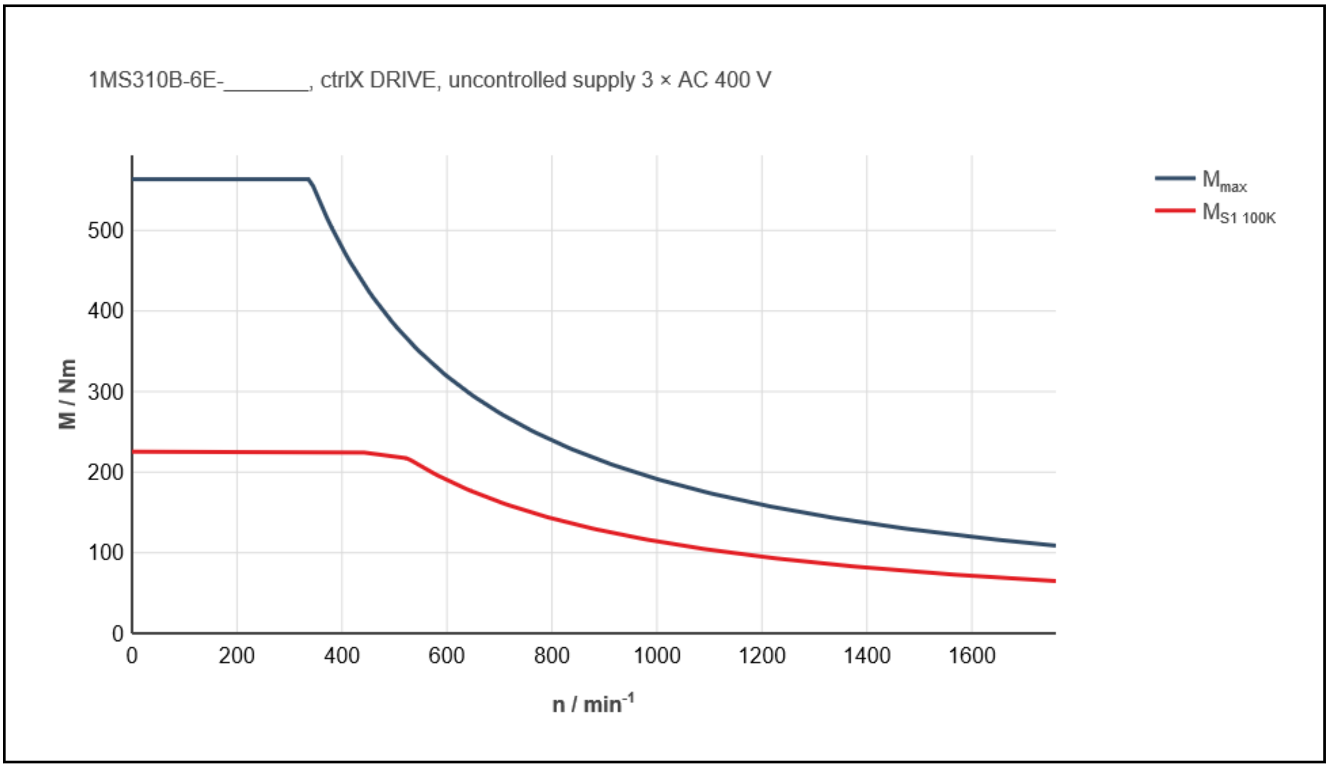


Fig. 4-47: Characteristic curve of motor 1MS310B-6E

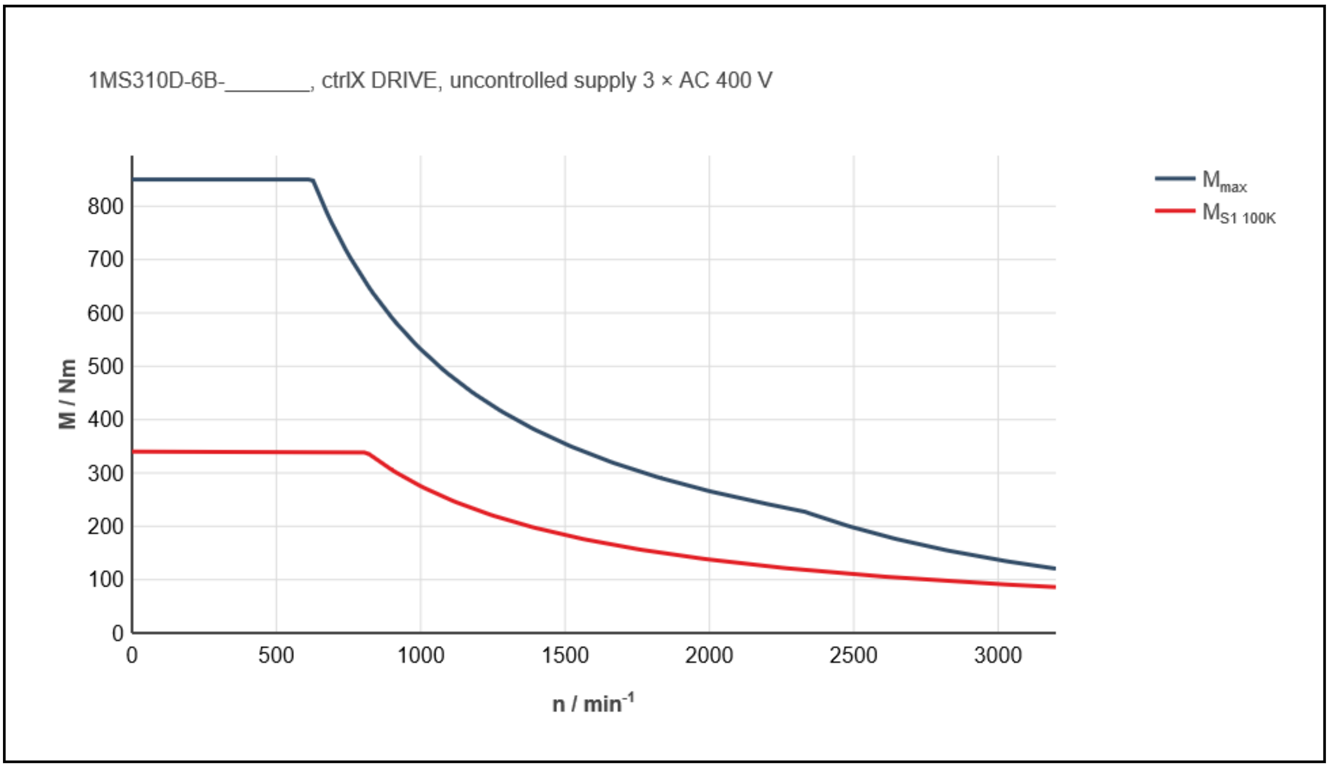


Fig. 4-48: Characteristic curve of motor 1MS310D-6B

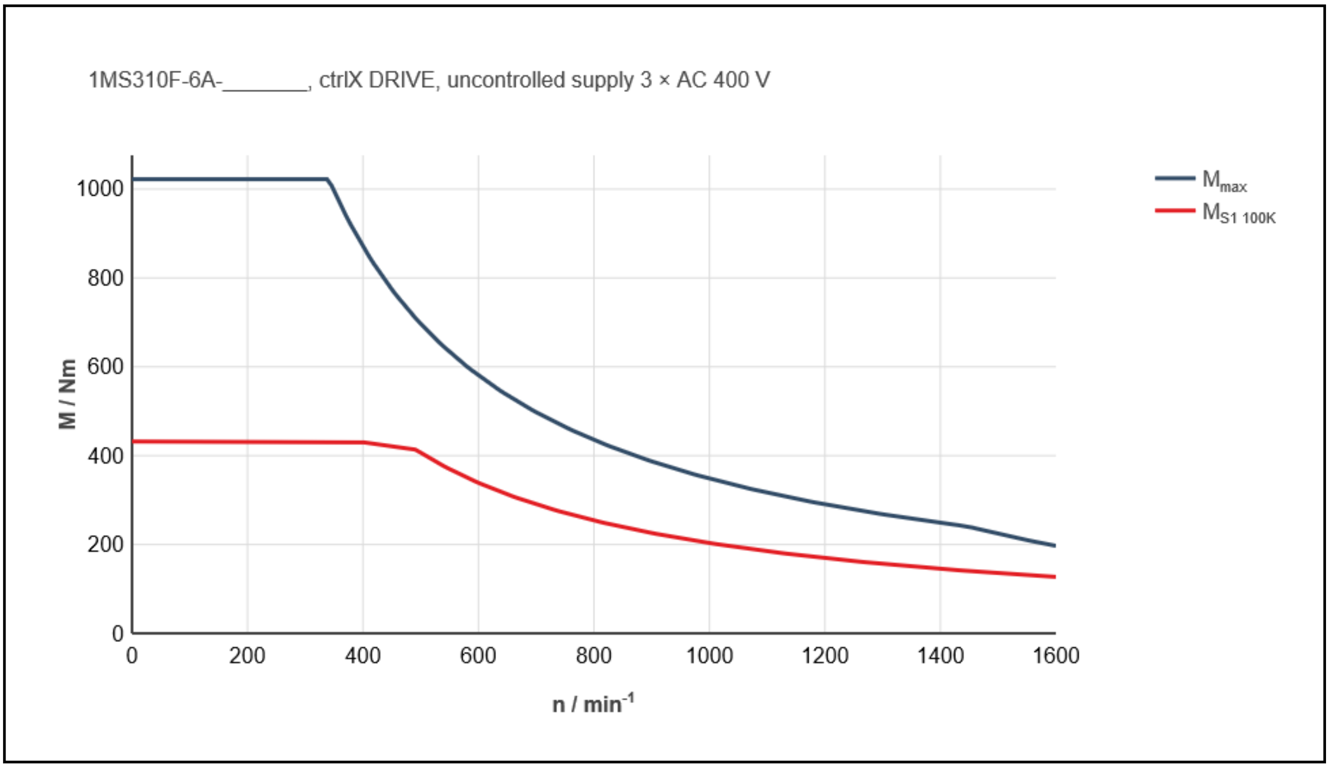


Fig. 4-49: Characteristic curve of motor 1MS310F-6A

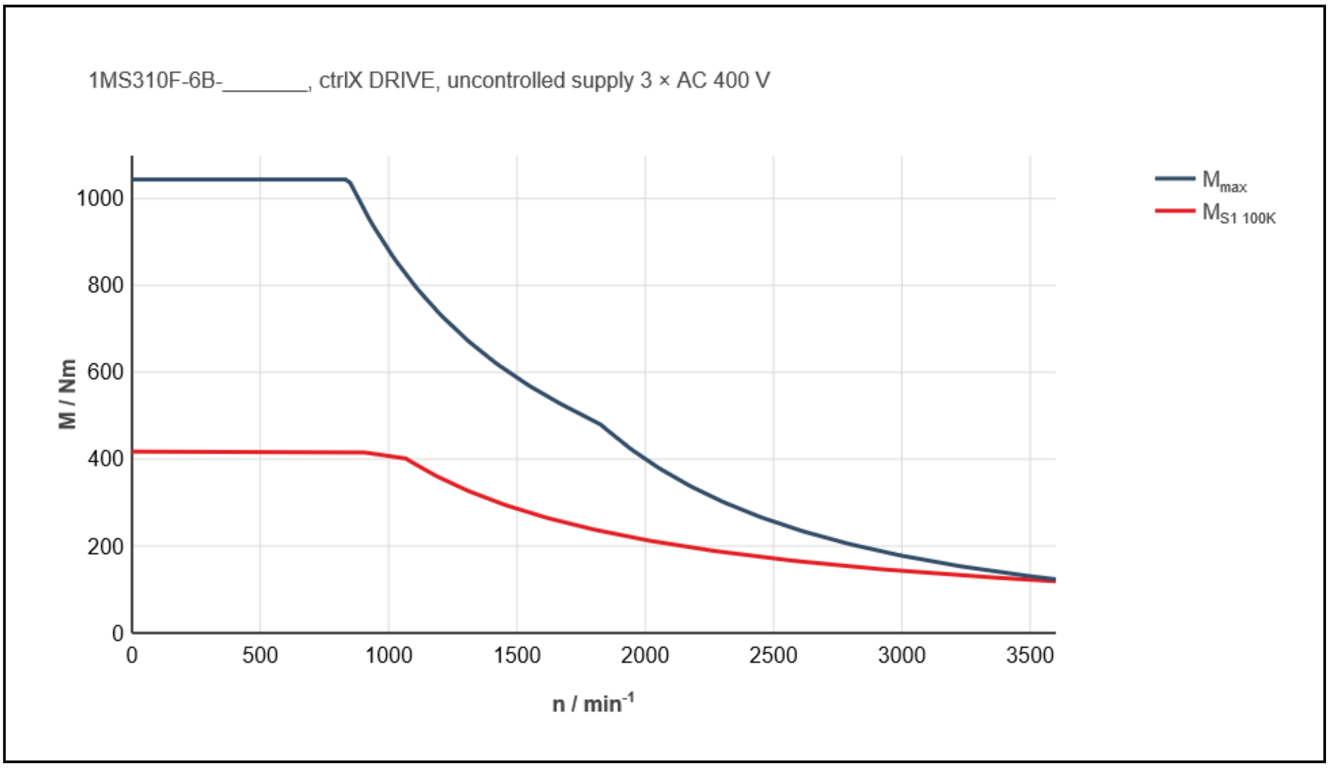


Fig. 4-50: Characteristic curve of motor 1MS310F-6B

4.12 1MB375

4.12.1 Stator 1MS375

Designation	Symbol	Unit	1MS375B-6B	1MS375D-6B	1MS375D-6D
Rated torque	M_N	Nm	636	875	
Rated speed	n_N	min^{-1}	600		300
Rated power	P_N	kW	40.0	55.0	27.5
Rated current	I_N	A	120.0	150.0	94.0
Maximum torque	M_{max}	Nm	1,589	2,190	
Maximum current	I_{max}	A	257.2	329.3	210.0
Max. speed (electrical)	n_{max}	min^{-1}	2,400		1,200
Power wire cross-section	A	mm^2	50.0	2x25	35.0
Torque constant at 20 °C	K_{M_N}	Nm/A	6.28	6.75	10.58
Winding resistance at 20 °C	R_{12}	Ohm	0.106	0.082	0.202
Winding inductance	L_{12}	mH	1.45	1.26	3.198
Thermal time constant	T_{th_nom}	min	10.0		
Number of pole pairs	p	--	3		
Stator mass	m_{stat}	kg	162.0	205.0	
Details about liquid cooling					
Power loss to be dissipated	P_V	kW	5.1	6.5	
Permissible coolant temperature increase for P_V	ΔT_{max}	K	10		
Required coolant flow for P_V	Q_{min}	l/min	7.3	9.3	
Pressure drop at Q_{min}	Δp	bar	0.3	0.5	
Maximum permissible inlet pressure	p_{max}	bar	6.0		
Volume of coolant duct	V_{cool}	l	2.70	3.50	
Latest amendment: 2021-03-22					

Tab. 4-24: 1MS375 - Technical data

4.12.2 Rotor 1MR375

Designation	Symbol	Unit	1MR375B	1MR375D
Rotor inertia	J_{rot}	kg * m²	1.39	1.73
Rotor mass	m_{rot}	kg	109.0	134.0
Maximum speed (mechanical)	$n_{max,mech}$	min^{-1}	6000	
Latest amendment: 2020-12-10				

Tab. 4-25: 1MR375 - Technical data

4.12.3 Characteristic curves of motor 1MS375

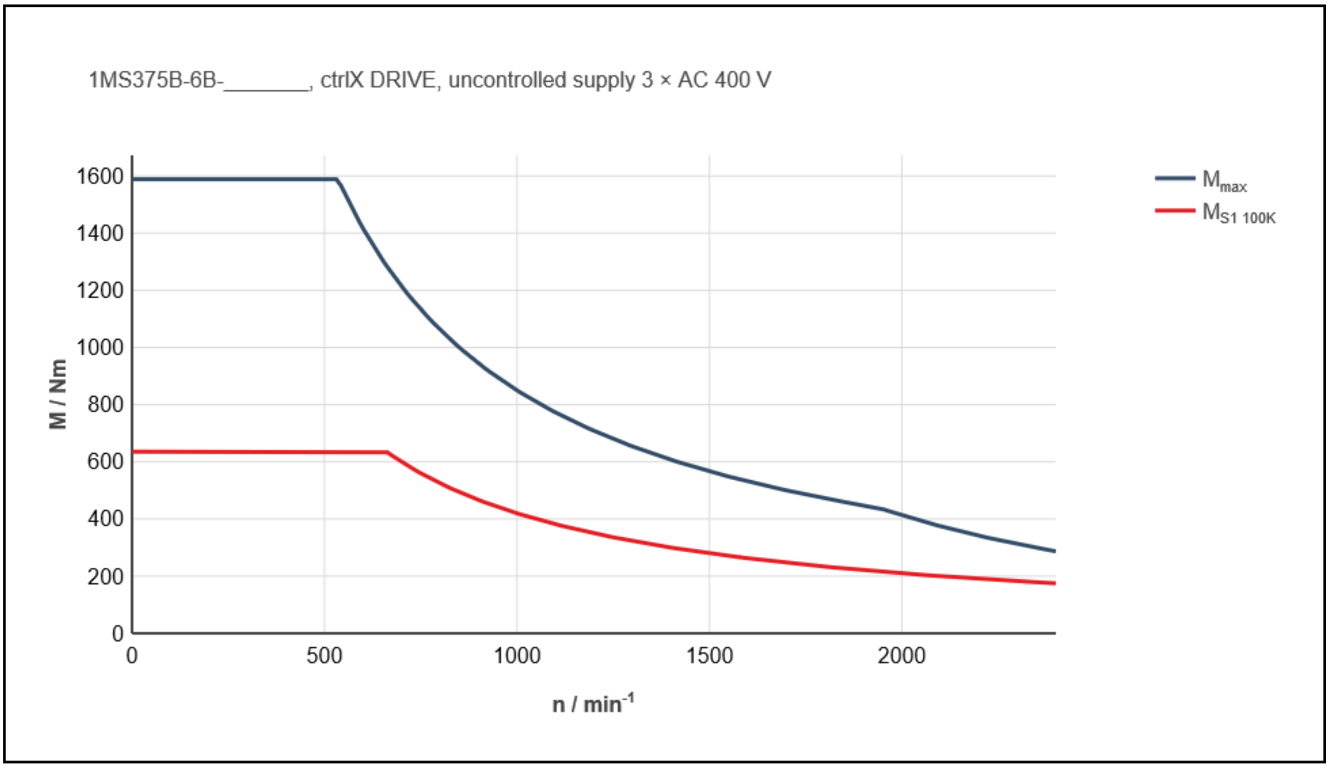


Fig. 4-51: Characteristic curve of motor 1MS375B-6B

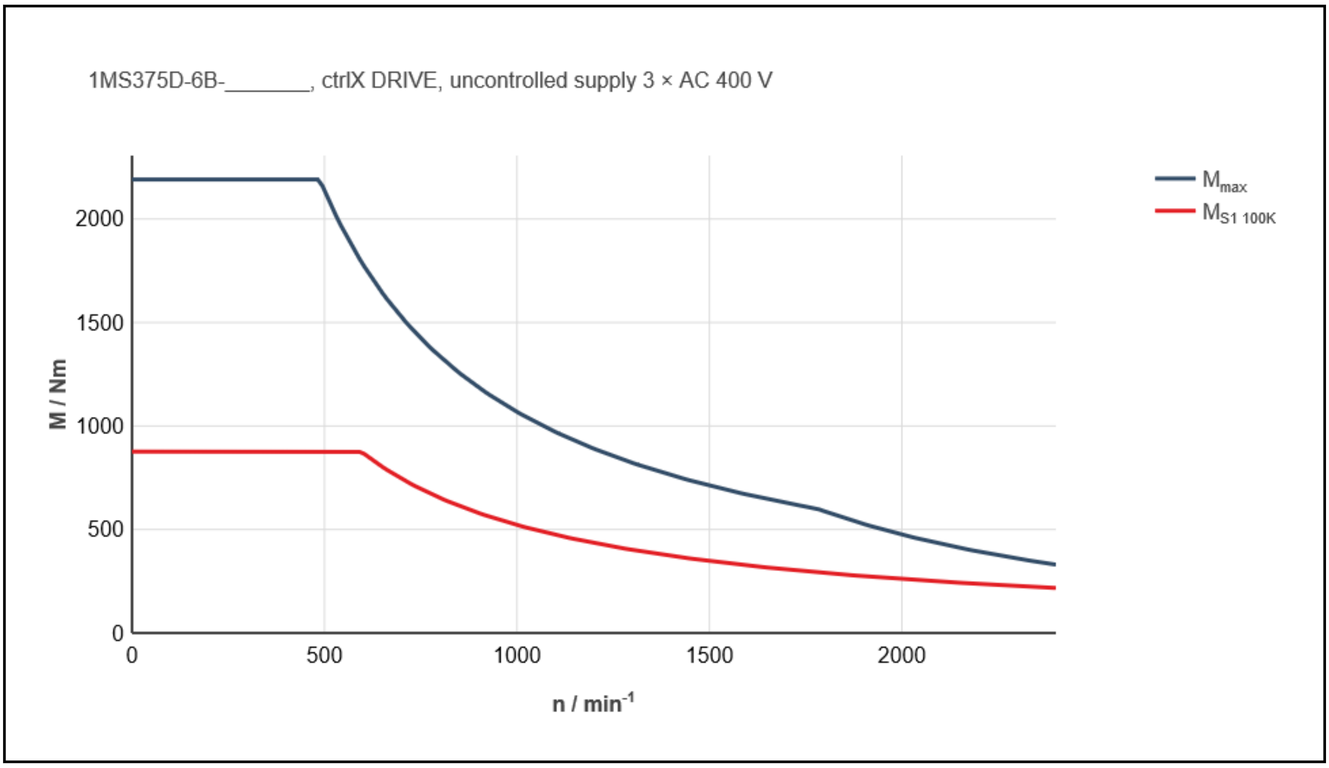


Fig. 4-52: Characteristic curve of motor 1MS375D-6B

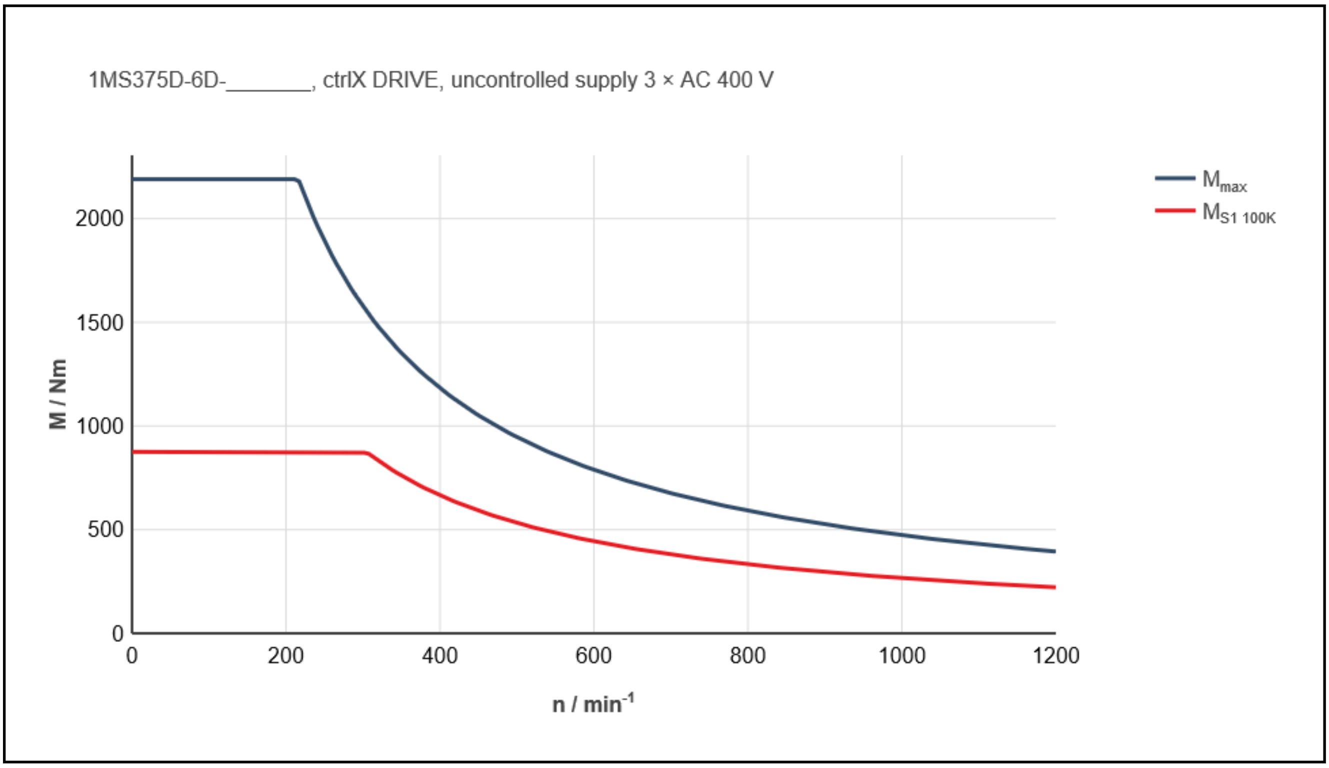


Fig. 4-53: Characteristic curve of motor 1MS375D-6D

4.13 1MB376

4.13.1 Stator 1MS376

Designation	Symbol	Unit	1MS376A-QA	1MS376A-QB
Rated torque	M_N	Nm	220	240
Rated speed	n_N	min^{-1}	450	240
Rated power	P_N	kW	10.4	6.0
Rated current	I_N	A	32.4	21.5
Maximum torque	M_{max}	Nm	840	
Maximum current	I_{max}	A	65.1	70.7
Max. speed (electrical)	n_{max}	min^{-1}	800	
Power wire cross-section	A	mm^2	10.0	4.0
Torque constant at 20 °C	K_{M_N}	Nm/A	8.49	12.06
Winding resistance at 20 °C	R_{12}	Ohm	0.742	1.898
Winding inductance	L_{12}	mH	6.097	15.69
Thermal time constant	T_{th_nom}	min	10.0	
Number of pole pairs	p	--	9	
Stator mass	m_{stat}	kg	33.0	
Details about liquid cooling				
Power loss to be dissipated	P_V	kW	2.5	
Permissible coolant temperature increase for P_V	ΔT_{max}	K	10	
Required coolant flow for P_V	Q_{min}	l/min	3.6	
Pressure drop at Q_{min}	Δp	bar	0.2	
Maximum permissible inlet pressure	p_{max}	bar	6.0	
Volume of coolant duct	V_{cool}	l	0.50	
Latest amendment: 2021-03-22				

Tab. 4-26: 1MS376 - Technical data

4.13.2 Rotor 1MR376

Designation	Symbol	Unit	1MR376A
Rotor inertia	J_{rot}	kg * m²	0.4600000
Rotor mass	m_{rot}	kg	26.4
Maximum speed (mechanical)	$n_{max,mech}$	min^{-1}	1,000
Latest amendment: 2020-12-10			

Tab. 4-27: 1MR376 - Technical data

4.13.3 Characteristic curves of motor 1MS376

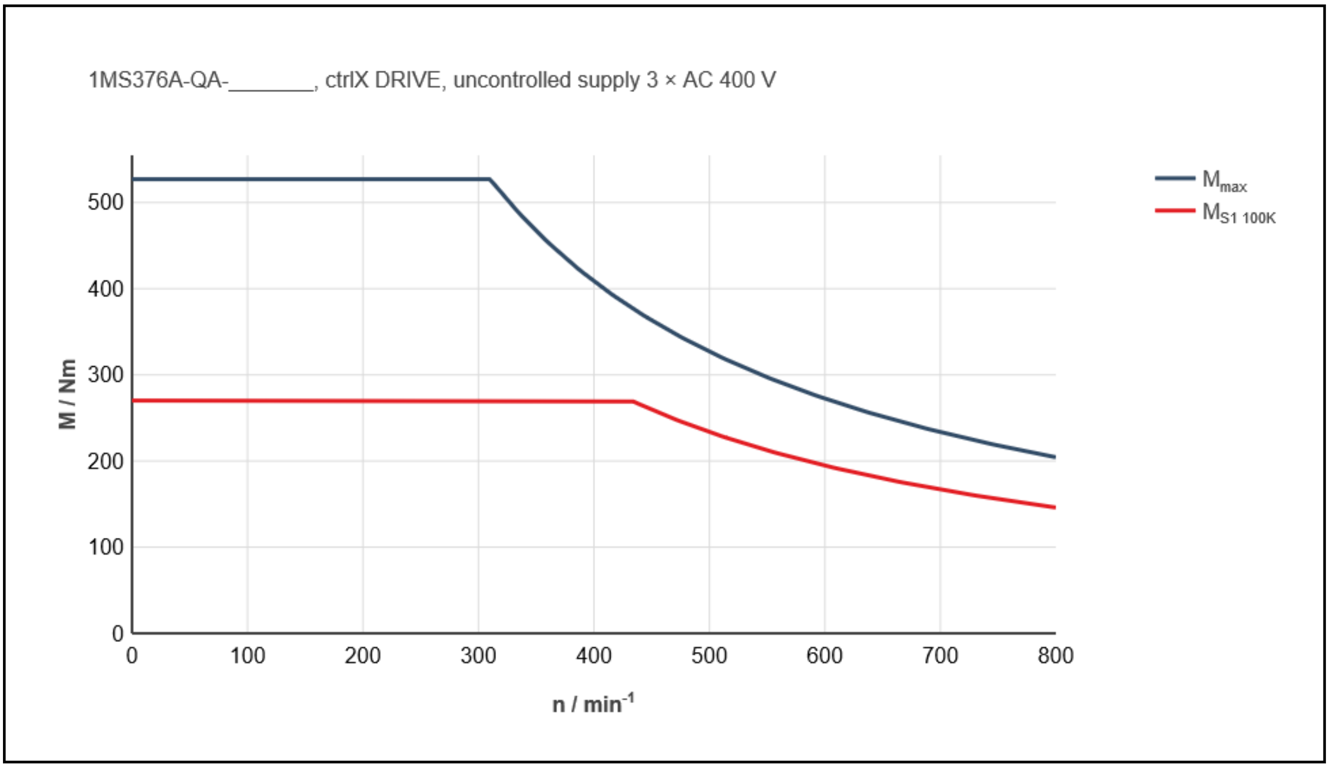


Fig. 4-54: Characteristic curve of motor 1MS376A-QA

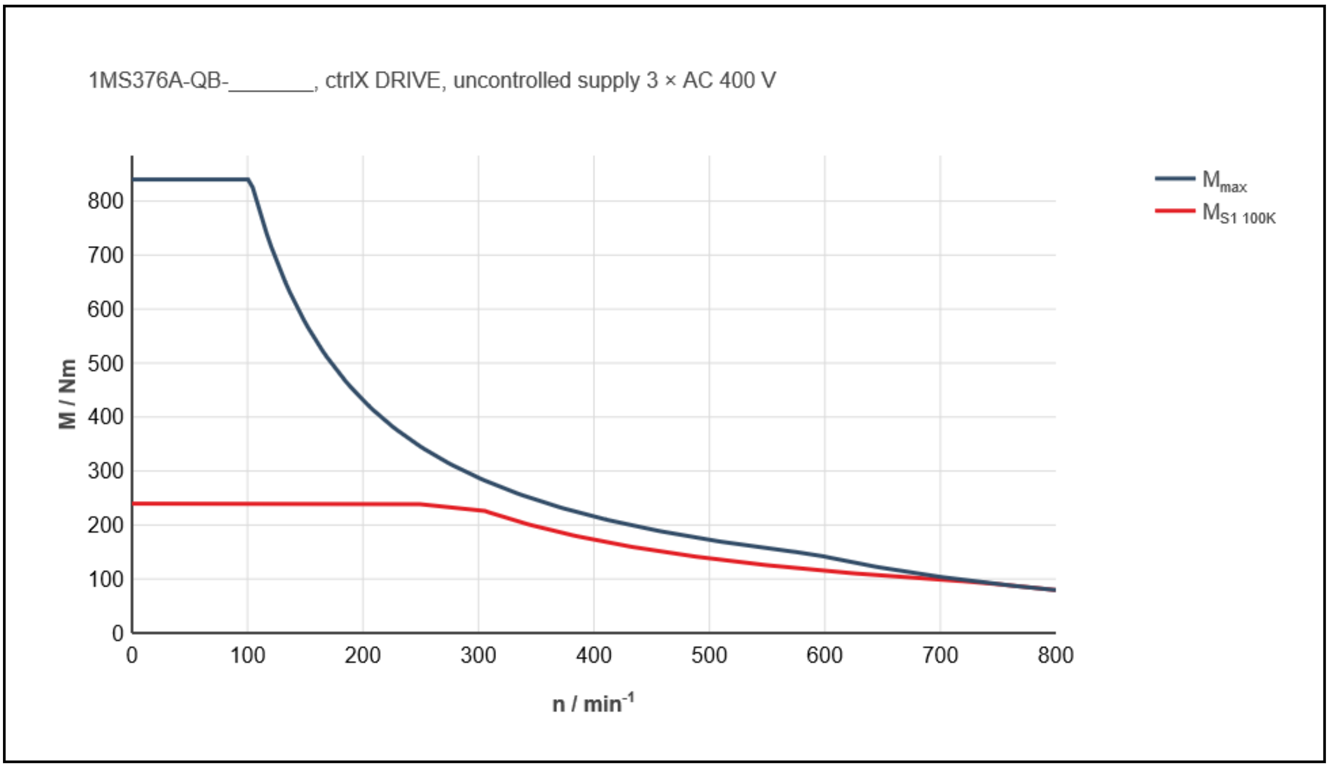


Fig. 4-55: Characteristic curve of motor 1MS376A-QB

5 Dimension sheets

5.1 General information

In this chapter, the dimensional sheets are summarized according to their size. The order of the drawings for each frame size complies with the following scheme:

- Standard dimension sheet of the complete motor.
- Component part drawing of the rotor.
- Component part drawing of the stator.

The dimensions and tolerances shown in the drawings are subject to the following standards:

Longitudinal dimensions: DIN ISO 2768, Part 1

Angular dimensions: DIN 7168 medium

Form and position tolerances: DIN ISO 1101

☞ Comply with the trademark rights of third parties during assembly and use of single components delivered by Bosch Rexroth. For any infringement of the right, the customer is liable for the accruing damage.

5.2 Frame size 1MB105

5.2.1 1MB105

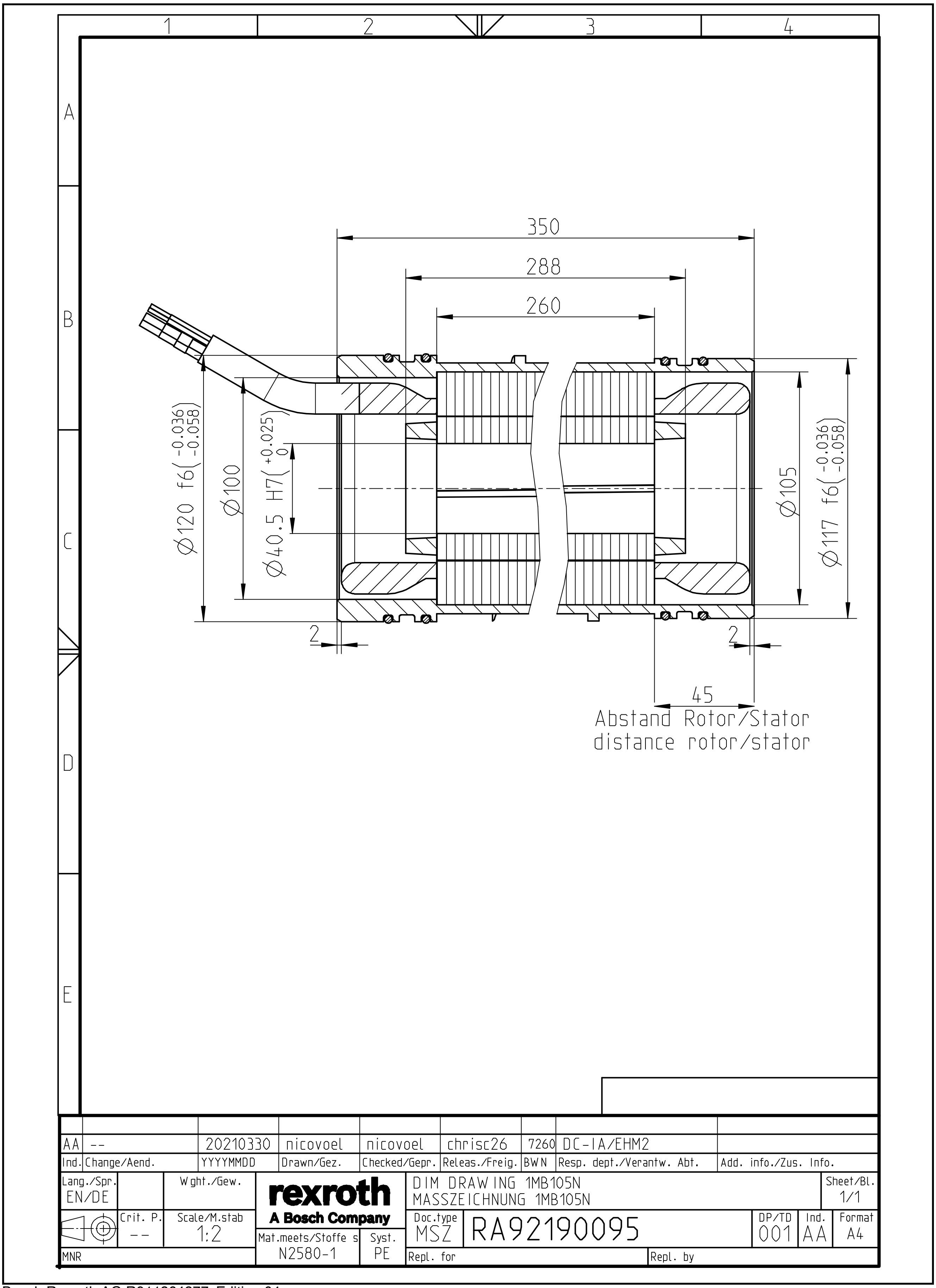


Fig. 5-1: 1MB105 Dimension sheets

5.2.2 Rotor 1MR105

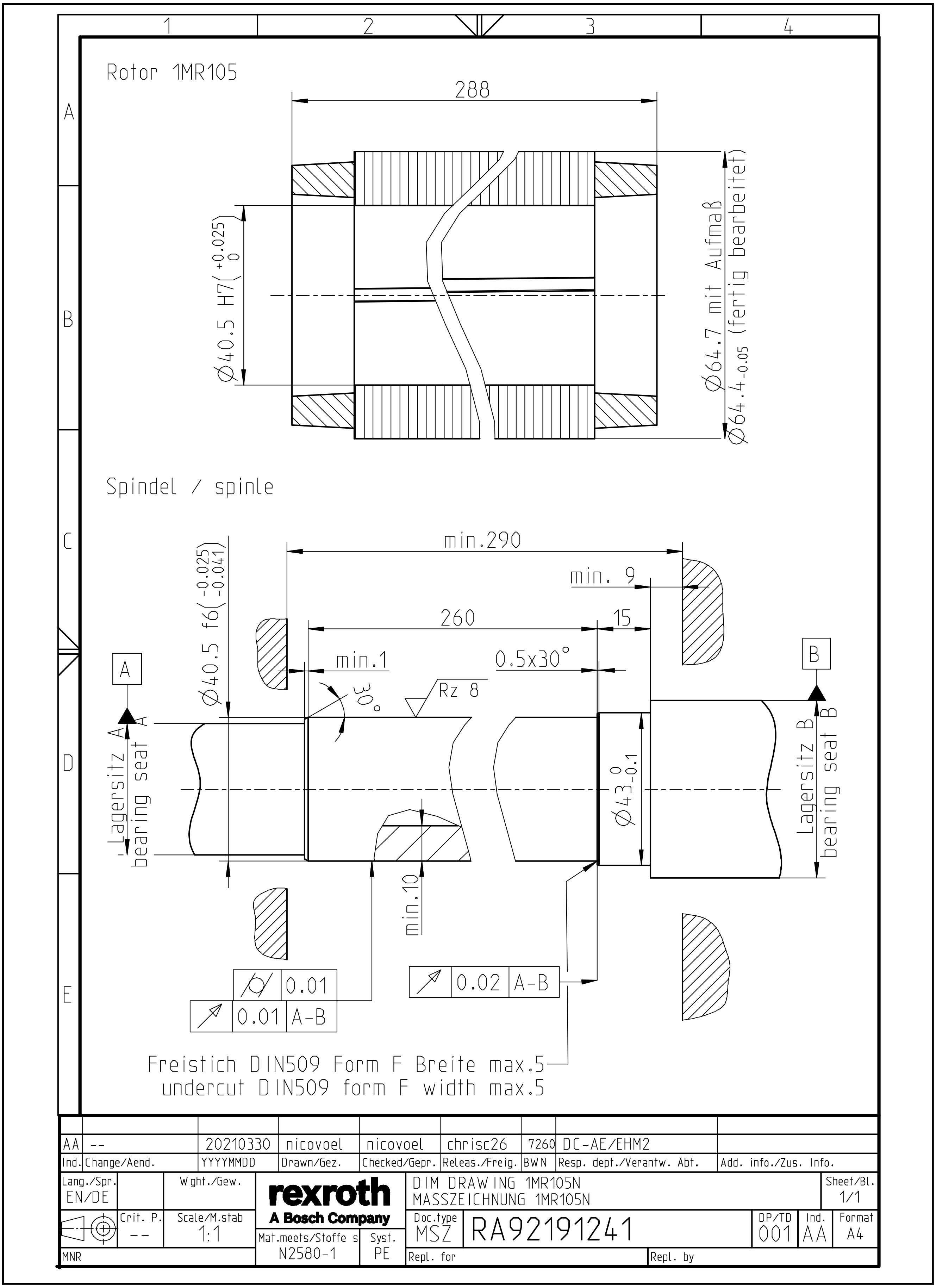


Fig. 5-2: Dimension sheets 1MR105

5.2.3 Rotor 1MR105 mounted

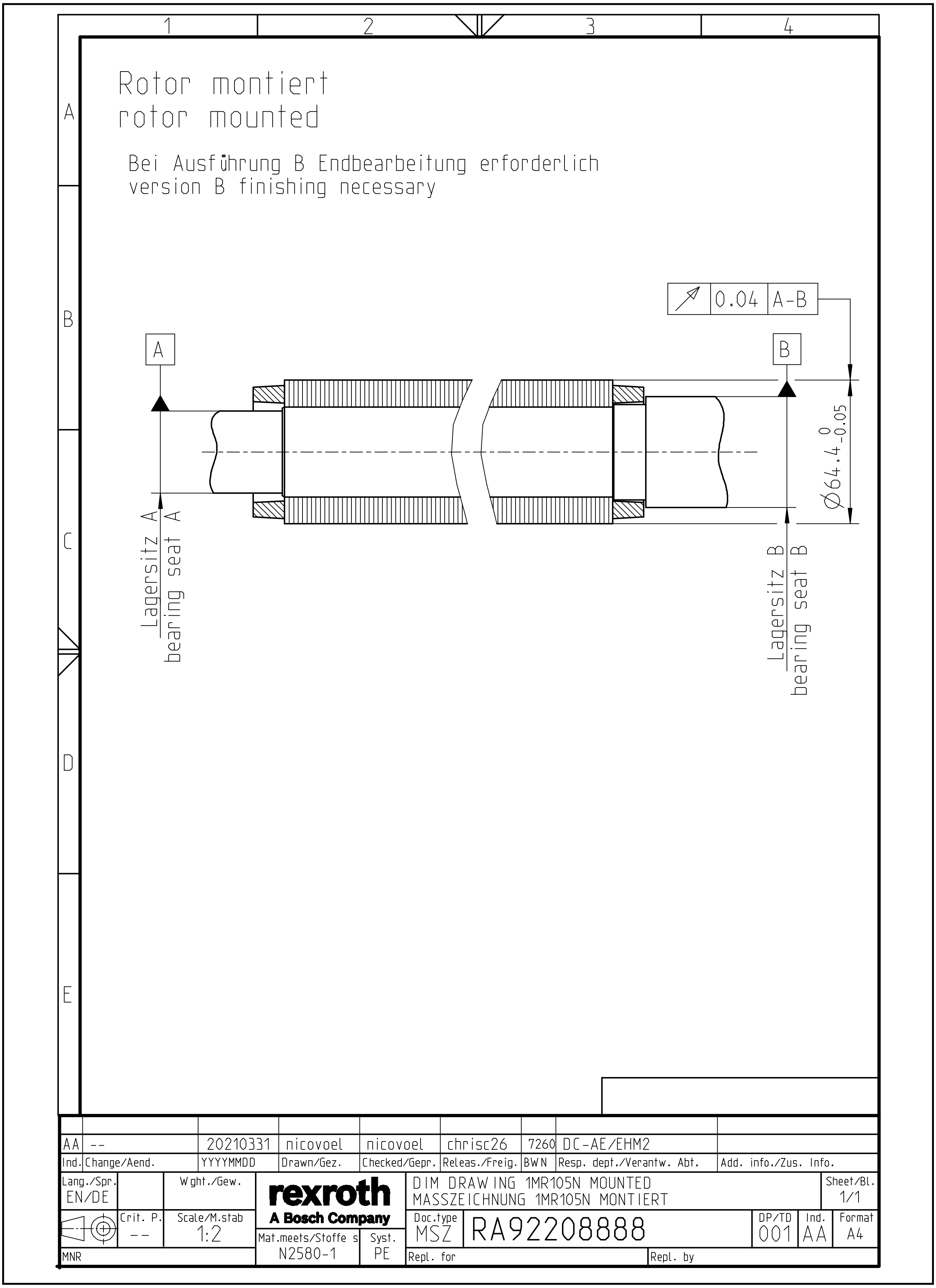


Fig. 5-3: Dimension sheet 1MR105, mounted

5.2.4 Stator 1MS105

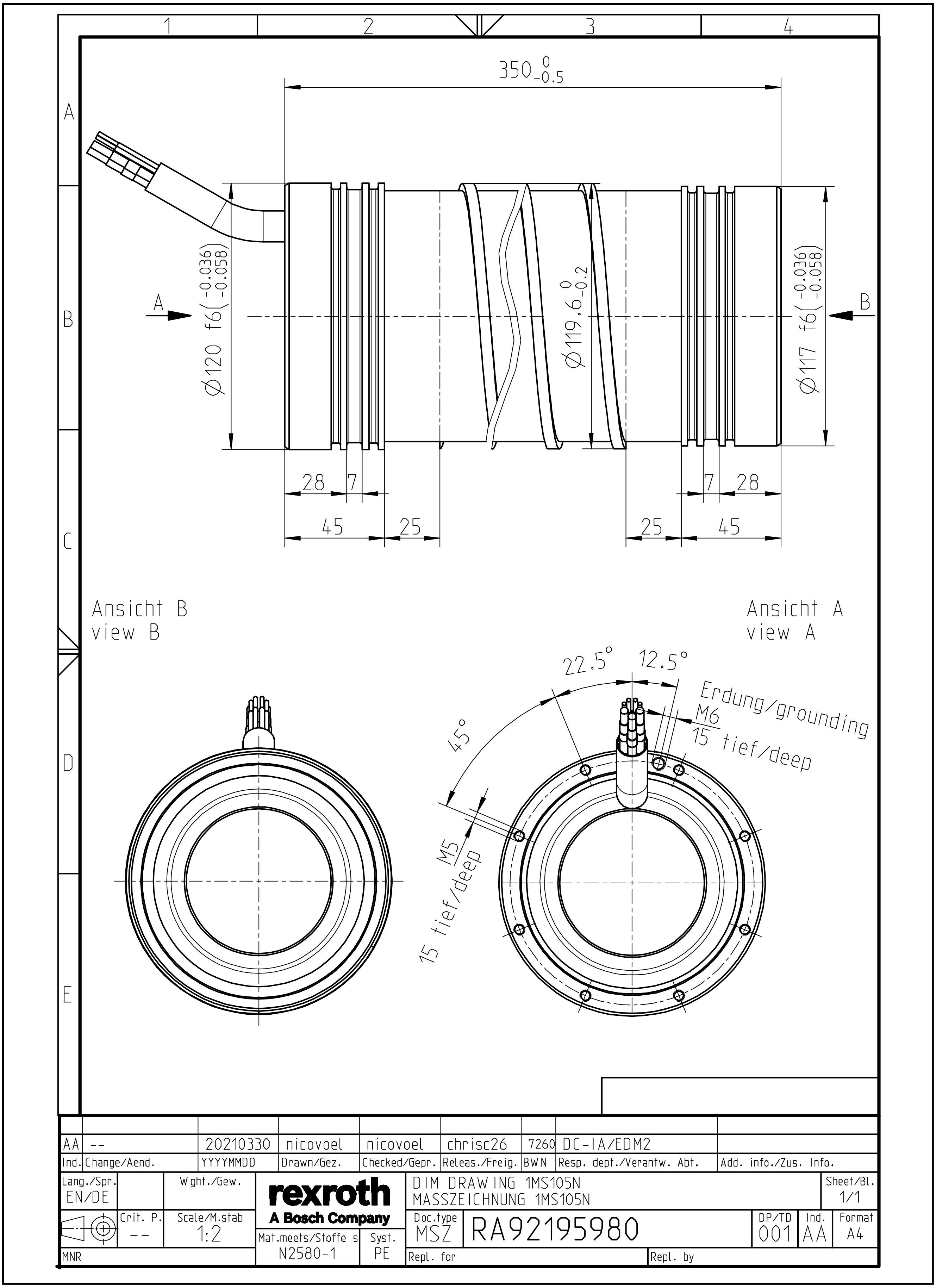
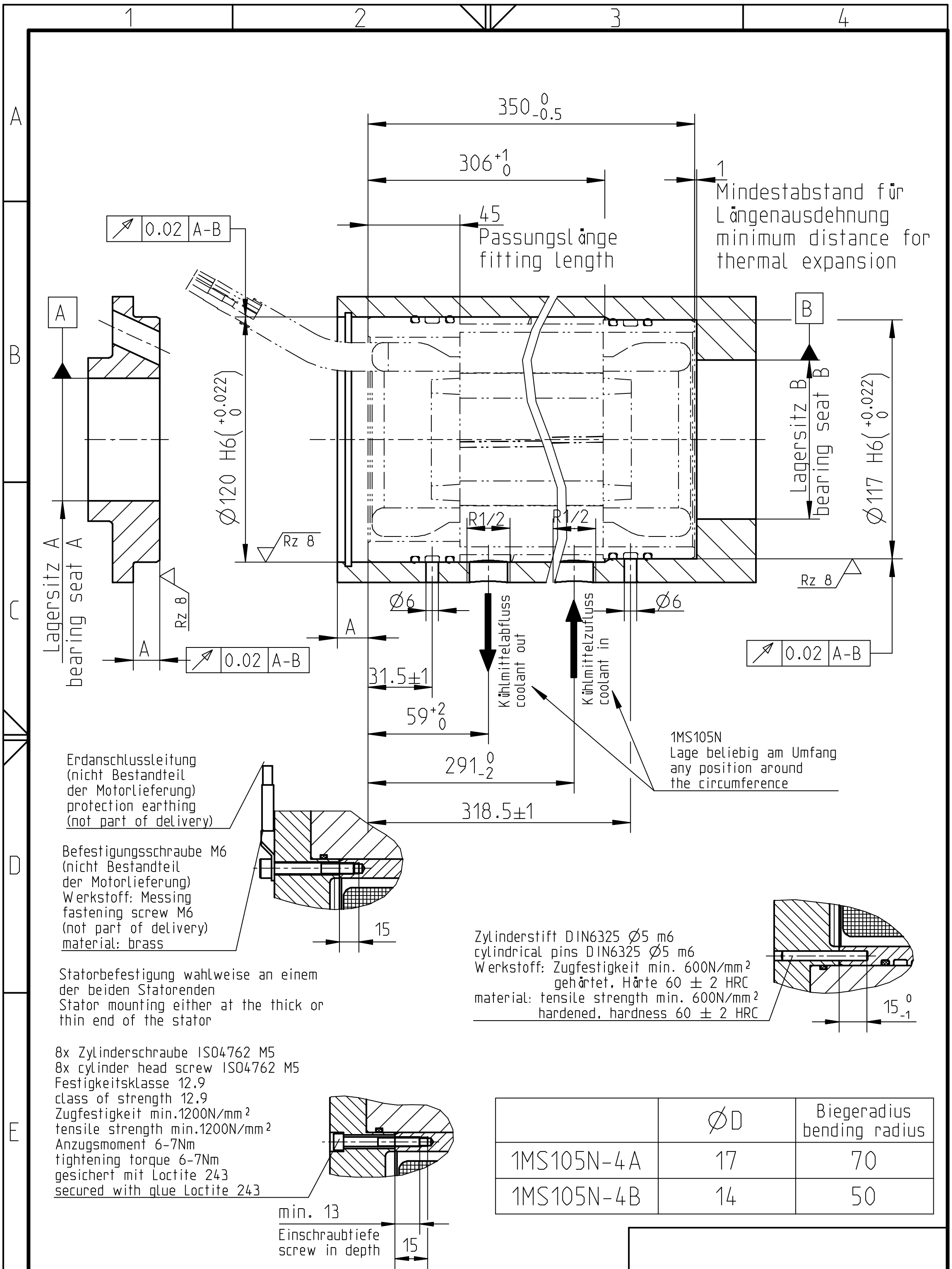


Fig. 5-4: Dimension sheets 1MS105

5.2.5 Stator 1MS105 mounted



	ØD	Biegeradius bending radius
1MS105N-4A	17	70
1MS105N-4B	14	50

Ind.	Change/Aend.	YYYYMMDD	Drawn/Gez.	Checked/Gepr.	Releas./Freig.	BWN	Resp. dept./Verantw. Abt.	Add. info./Zus. Info.
AA	--	20210330	nicovoel	nicovoel	chrisc26	7260	DC-AE/EHM2	

Lang./Spr.: EN/DE | Wght./Gew. | rexroth A Bosch Company | DIM DRAWING 1MS105N MOUNTED / MASSZEICHNUNG 1MS105N MONTIERT | Sheet/Bl. 1/1

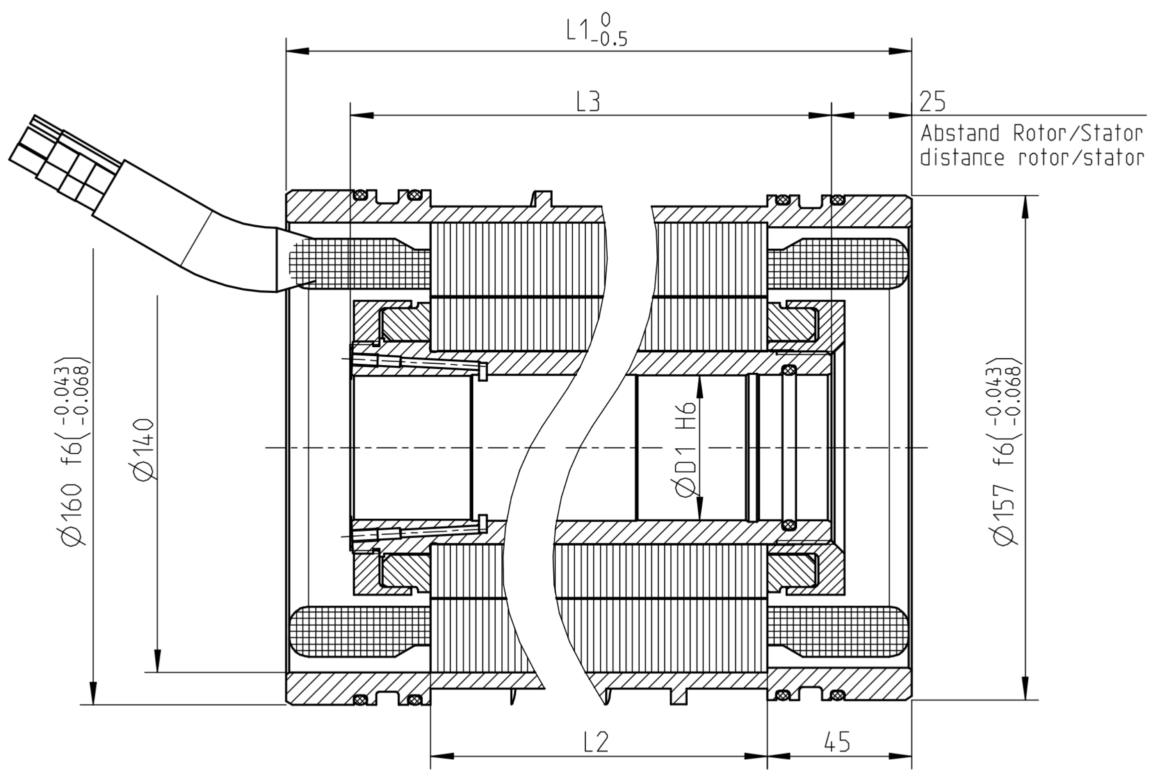
Crit. P.: -- | Scale/M.stab: 2:5 | Mat.meets/Stoffe s: N2580-1 | Syst.: PE | Doc.type: MSZ | RA92196546 | DP/TD: 001 | Ind.: AA | Format: A4

MNR | Repl. for | Repl. by

Fig. 5-5: Dimension sheet 1MS105, mounted

5.3 Frame size 1MB140

5.3.1 1MB140



	ØD1 H6	L1 0 -0.5	L2	L3
1MB140B	45 +0.016 0	150	60	105
1MB140D		190	100	145
1MB140F		240	150	195
1MB140H		290	200	245

Ind.	Change/Aend.	YYYYMMDD	Drawn/Gez.	Checked/Gepr.	Releas./Freig.	BWN	Resp. dept./Verantw. Abt.	Add. info./Zus. Info.
AA	--	20170601	wes5lo	janerant	stefste1	7260	DC-IA/EDM1	

Lang./Spr. EN/DE — Wght./Gew. — rexroth A Bosch Company — DIM DRAWING 1MB140 / MASSZEICHNUNG 1MB140 — Sheet/Bl. 1/1

Crit. P. -- — Scale/M.stab 1:2 — Doc.type MSZ — RA63498680 — DP/TD 001 — Ind. AA — Format A4

MNR — Mat.meets/Stoffe s N2580-1 — Syst. PE — Repl. for — Repl. by

Fig. 5-6: Dimension sheet 1MB140

5.3.2 Rotor 1MR140

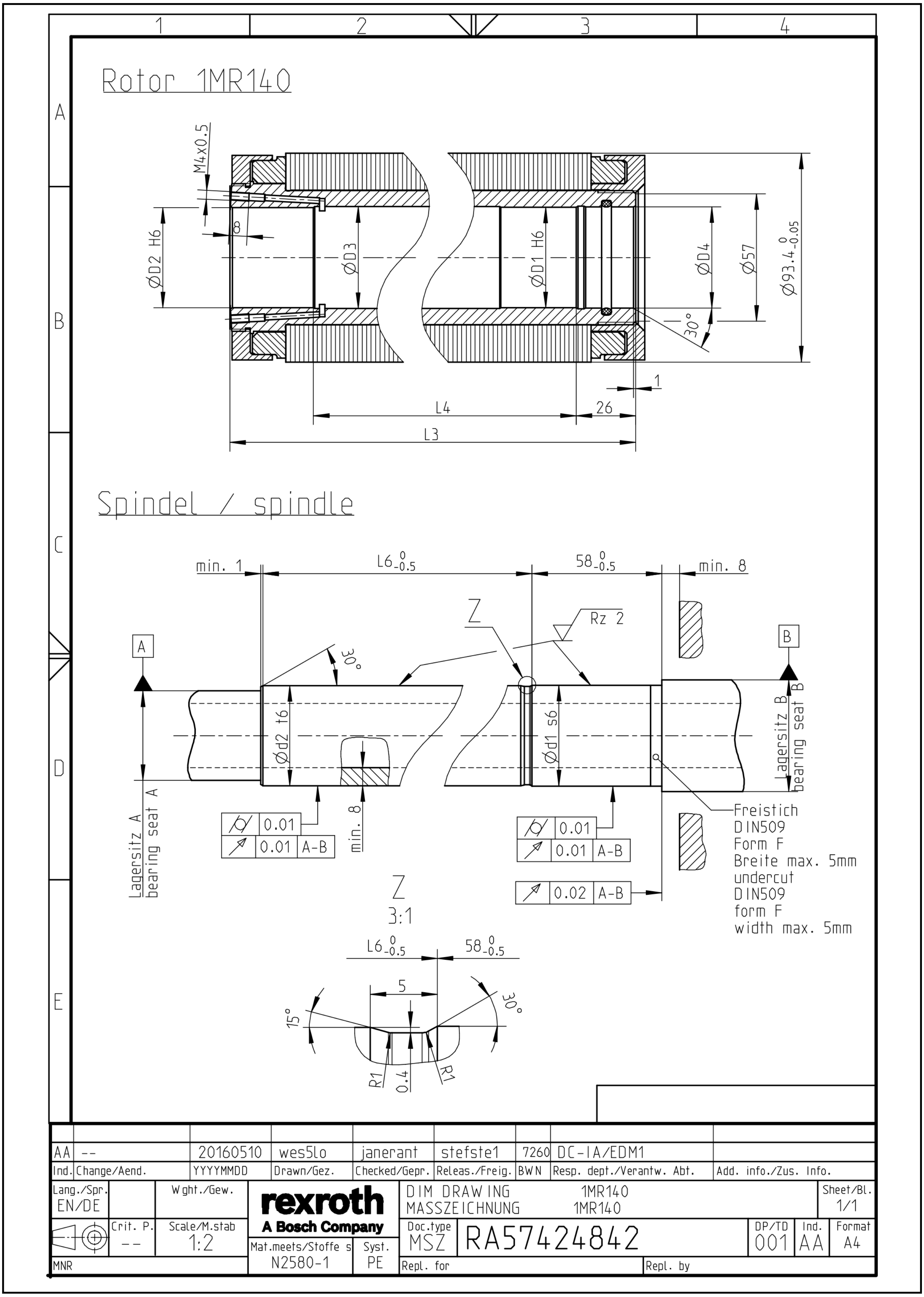


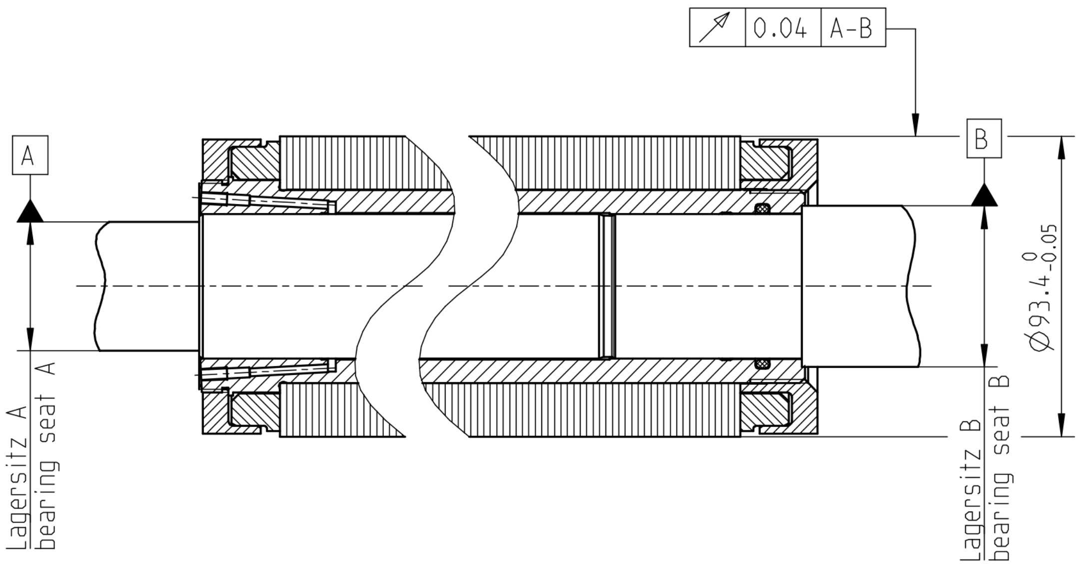
Fig. 5-7: Dimension sheets 1MR140

5.3.3 Rotor 1MR140 mounted

1 2 3 4

A B C D E

Rotor montiert / mounted



	ROTOR						SPINDEL SPINDLE		
	L3	L4	ØD1 H6	ØD2 H6	ØD3	ØD4	L6 $^{0}_{-0.5}$	Ød1 s6	Ød2 t6
1MR140B-A045	105	42	$45^{+0.016}_{0}$	$44.8^{+0.016}_{0}$	45.5	45.2	45	$45^{+0.059}_{+0.043}$	$44.8^{+0.070}_{+0.054}$
1MR140D-A045	145	82					85		
1MR140F-A045	195	132					135		
1MR140H-A045	245	182					185		

AA	--	20160512	wes5lo	janerant	stefste1	7260	DC-IA/EDM1	
Ind.	Change/Aend.	YYYYMMDD	Drawn/Gez.	Checked/Gepr.	Releas./Freig.	BWN	Resp. dept./Verantw. Abt.	Add. info./Zus. Info.

Lang./Spr. EN/DE | Wght./Gew. | rexroth A Bosch Company | DIM DRAWING 1MR140 MOUNTED / MASSZEICHNUNG 1MR140 MONTIERT | Sheet/Bl. 1/1

Crit. P. -- | Scale/M.stab 1:2 | Doc.type MSZ | RA57454878 | DP/TD 001 | Ind. AA | Format A4

Mat.meets/Stoffe s N2580-1 | Syst. PE

MNR | Repl. for | Repl. by

Fig. 5-8: Dimension sheet 1MR140, mounted

5.3.4 Stator 1MS140

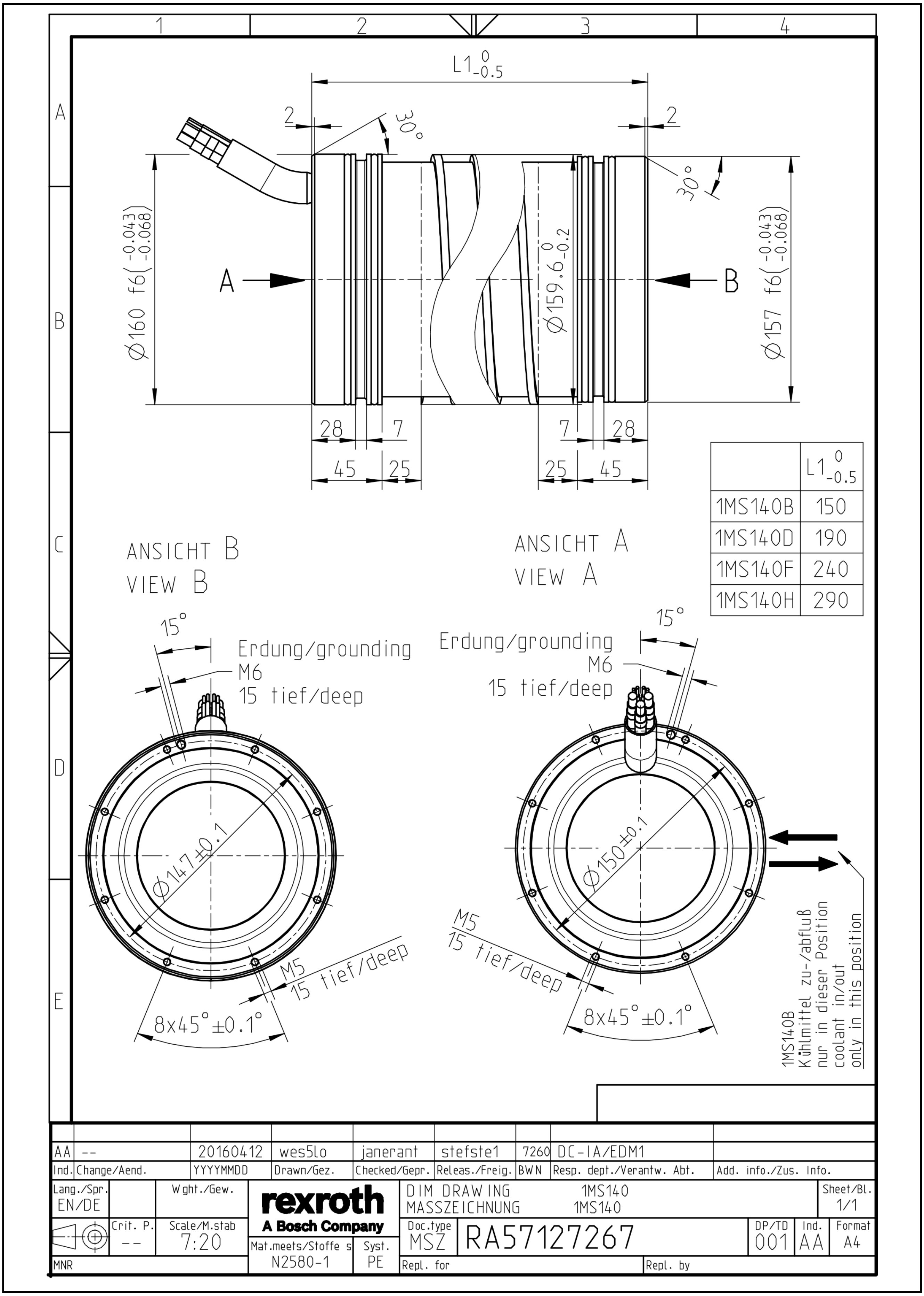
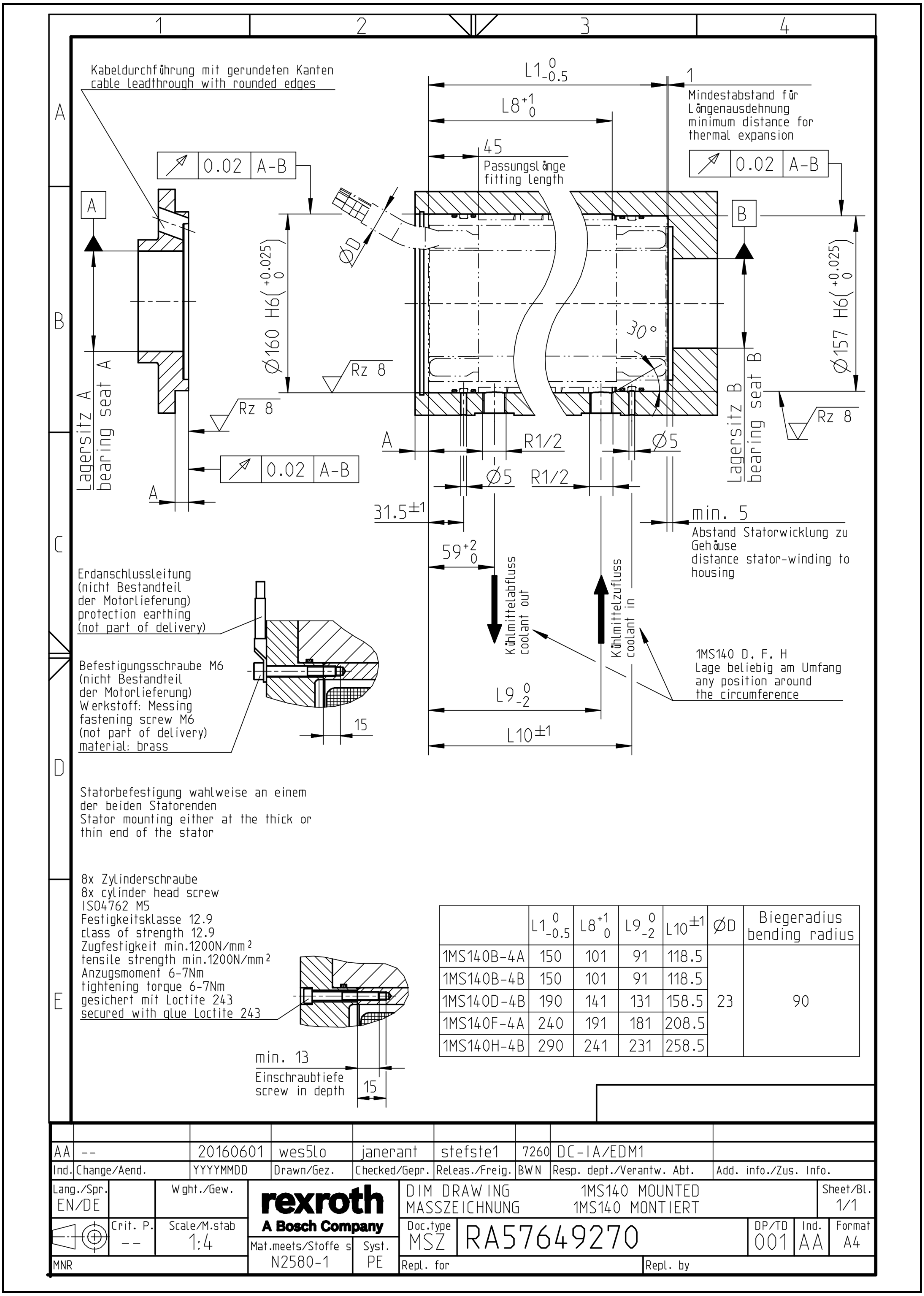


Fig. 5-9: Dimension sheet 1MS140

5.3.5 Stator 1MS140

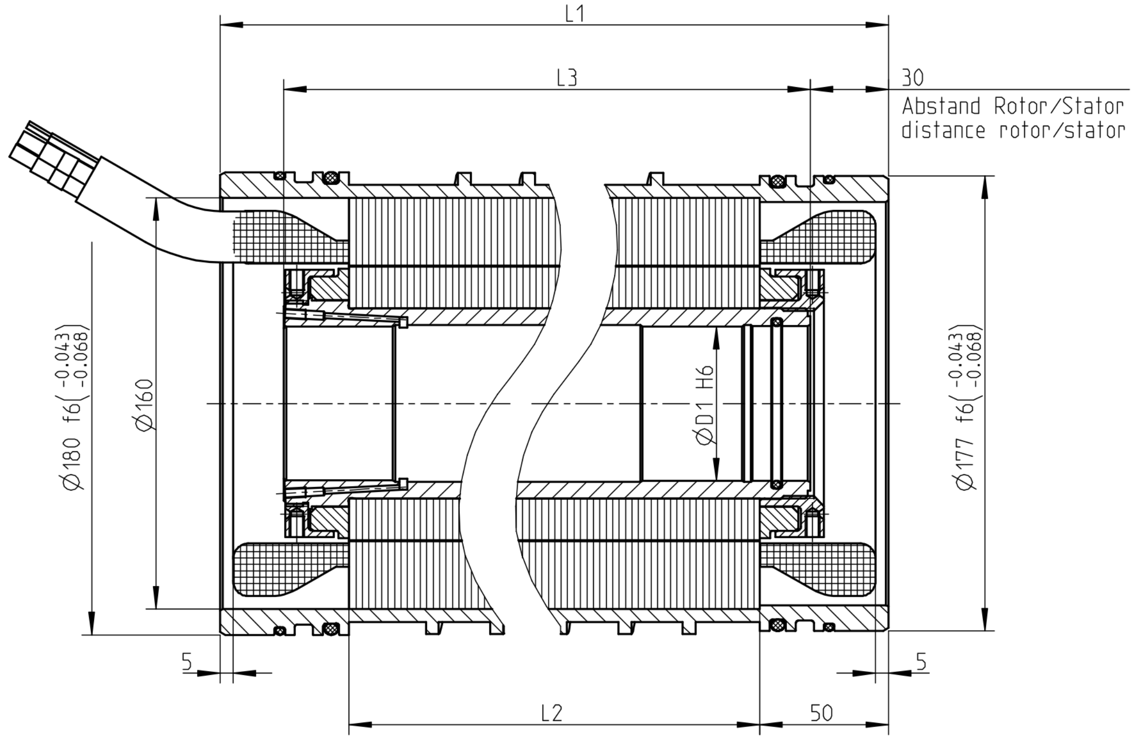


	L1 0/-0.5	L8 +1/0	L9 0/-2	L10 ±1	ØD	Biegeradius bending radius
1MS140B-4A	150	101	91	118.5	23	90
1MS140B-4B	150	101	91	118.5		
1MS140D-4B	190	141	131	158.5		
1MS140F-4A	240	191	181	208.5		
1MS140H-4B	290	241	231	258.5		

Fig. 5-10: Dimension sheet 1MS140, mounted

5.4 Frame size 1MB160

5.4.1 1MB160



<table>
<tr><th></th><th colspan="4">ØD1 H6</th><th>L1</th><th>L2</th><th>L3</th></tr>
<tr><td>1MB160B</td><td>-</td><td rowspan="2">55 +0.019 / 0</td><td rowspan="6">60 +0.019 / 0</td><td>-</td><td>160</td><td>60</td><td>105</td></tr>
<tr><td>1MB160D</td><td>40 +0.016 / 0</td><td>60.3 +0.019 / 0</td><td>205</td><td>105</td><td>150</td></tr>
<tr><td>1MB160E</td><td>-</td><td>-</td><td>-</td><td>240</td><td>140</td><td>185</td></tr>
<tr><td>1MB160F</td><td>40 +0.016 / 0</td><td>55 +0.019 / 0</td><td rowspan="3">60.3 +0.019 / 0</td><td>255</td><td>155</td><td>200</td></tr>
<tr><td>1MB160H</td><td>-</td><td>-</td><td>310</td><td>210</td><td>255</td></tr>
<tr><td>1MB160N</td><td>-</td><td>-</td><td>385</td><td>285</td><td>330</td></tr>
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Lang./Spr. EN/DE Wght./Gew. rexroth A Bosch Company DIM DRAWING 1MB160 MASSZEICHNUNG 1MB160 Sheet/Bl. 1/1
Crit. P. -- Scale/M.stab 2:5 Doc.type MSZ RA56424282 DP/TD 001 Ind. AA Format A4
MNR Mat.meets/Stoffe s N2580-1 Syst. PE Repl. for Repl. by

Fig. 5-11: Dimension sheet 1MB160

5.4.2 Rotor 1MR160

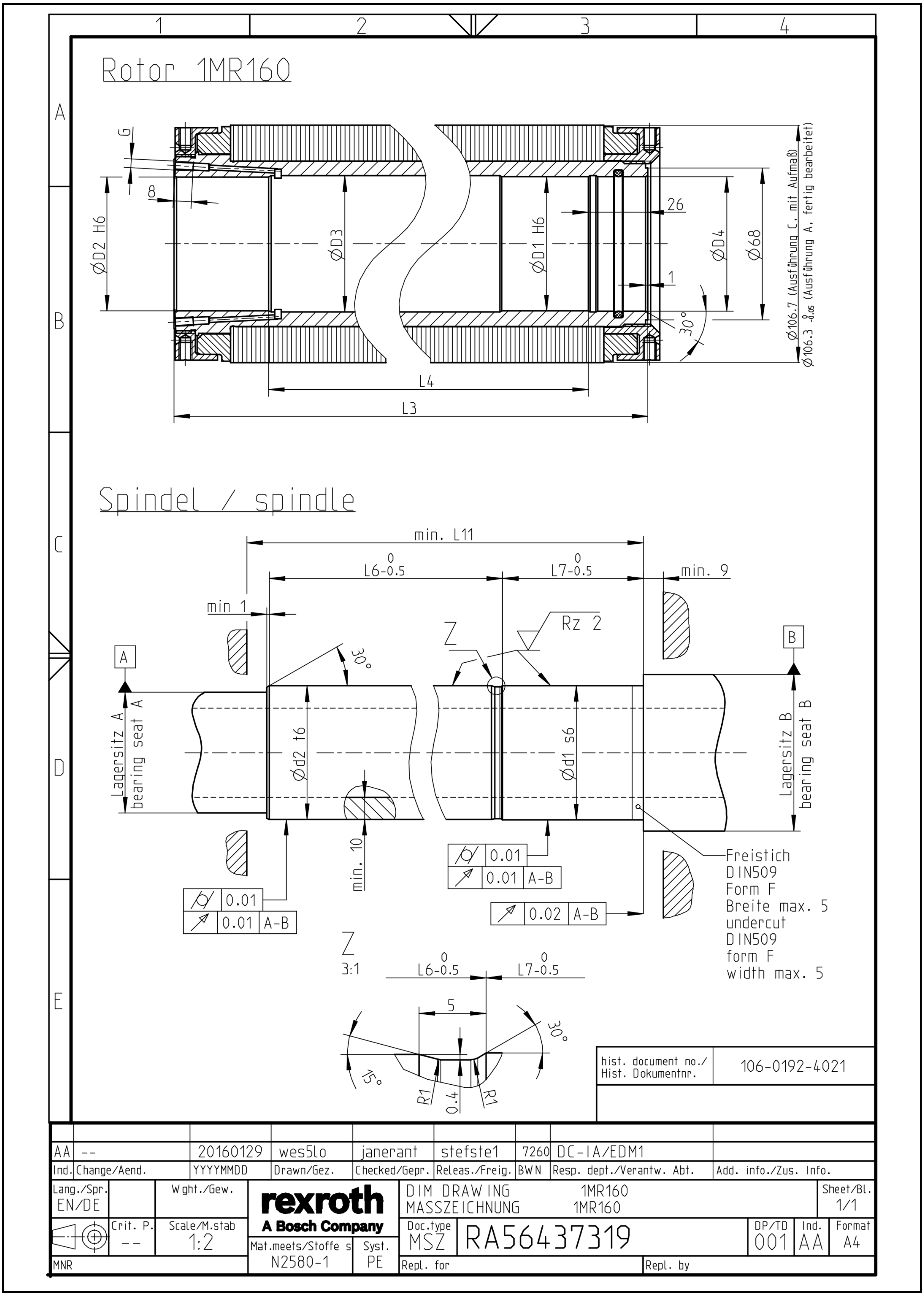
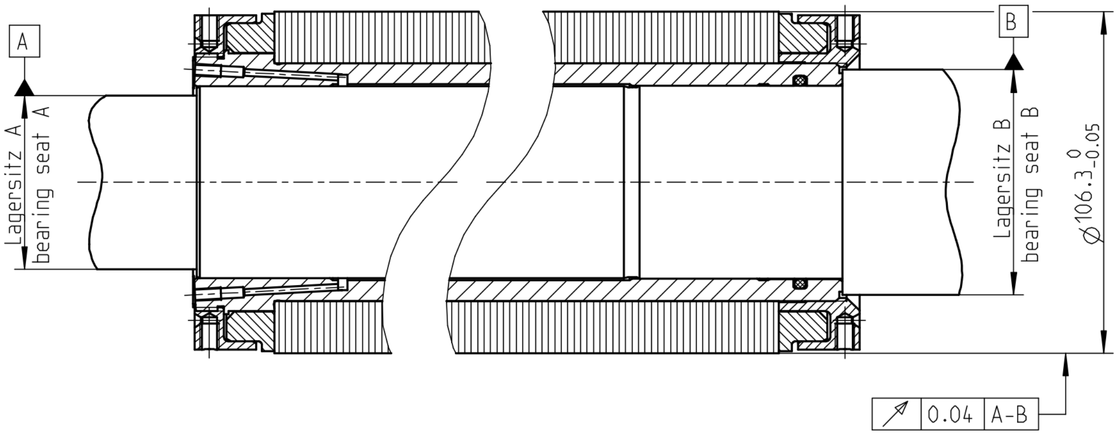


Fig. 5-12: Dimension sheets 1MR160

5.4.3 Rotor 1MR160, mounted

Rotor montiert / mounted

Bei Ausführung C Endbearbeitung erforderlich
version C finishing necessary



	ROTOR							SPINDEL SPINDLE				
	L3	L4	G	ØD1 H6	ØD2 H6	ØD3	ØD4	$L6_{-0.5}$	$L7_{-0.5}$	Ød1 s6	Ød2 t6	L11
1MR160D-x040	150	82	M6	$40^{+0.016}_{0}$	$39.8^{+0.016}_{0}$	41	40.2	85	63	$40^{+0.059}_{+0.043}$	$39.8^{+0.064}_{+0.048}$	min. 152
1MR160F-x040	200	132						135				min. 202
1MR160B-x055	105	42	M4 x0.5	$55^{+0.019}_{0}$	$54.8^{+0.019}_{0}$	56	55.2	45	58	$55^{+0.072}_{+0.053}$	$54.8^{+0.085}_{+0.066}$	min. 107
1MR160D-x055	150	82						85	63			min. 152
1MR160F-x055	200	132						135				min. 202
1MR160B-x060	105	42		$60^{+0.019}_{0}$	$59.8^{+0.019}_{0}$	61	60.2	45	58	$60^{+0.072}_{+0.053}$	$59.8^{+0.085}_{+0.066}$	min. 107
1MR160D-x060	150	82						85	63			min. 152
1MR160E-x060	185	117						120				min. 187
1MR160F-x060	200	132						135				min. 202
1MR160H-x060	255	187						190				min. 257
1MR160N-x060	330	262						265				min. 332
1MR160D-x061	150	82		$60.3^{+0.019}_{0}$	$60.1^{+0.019}_{0}$	61	60.5	85	63	$60.3^{+0.072}_{+0.053}$	$60.1^{+0.085}_{+0.066}$	min. 152
1MR160F-x061	200	132						135				min. 202
1MR160H-x061	255	187						190				min. 257
1MR160N-x061	330	262						265				min. 332

x = Rotorausführung A oder C
rotor version A or C

hist. document no./ Hist. Dokumentnr.: 106-0192-4022

AA	--	20160318	wes5lo	janerant	stefste1	7260	DC-IA/EDM1
Ind.	Change/Aend.	YYYYMMDD	Drawn/Gez.	Checked/Gepr.	Releas./Freig.	BWN	Resp. dept./Verantw. Abt.

Add. info./Zus. Info.

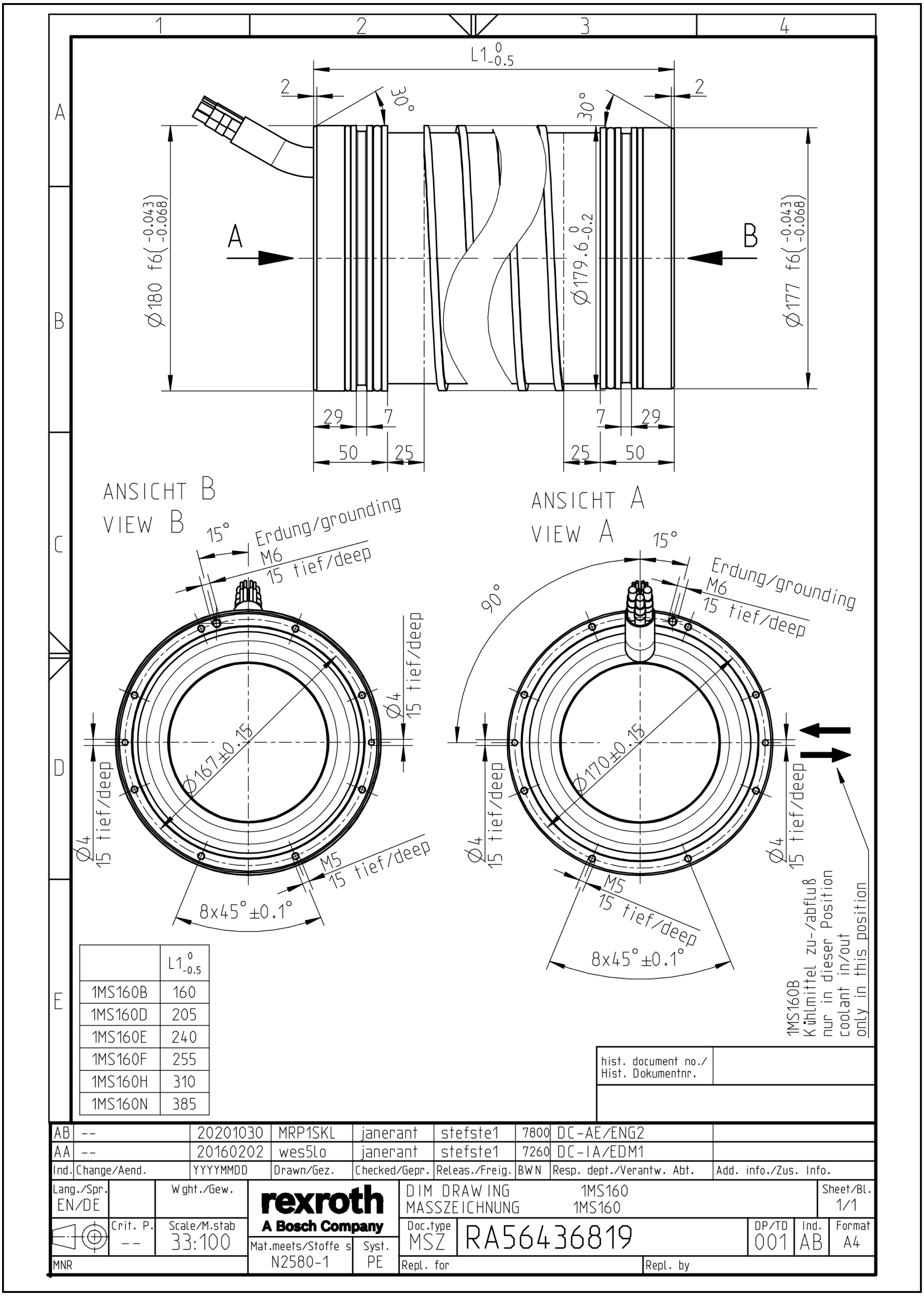
Lang./Spr.: EN/DE — Wght./Gew. — rexroth A Bosch Company — DIM DRAWING 1MR160 MOUNTED / MASSZEICHNUNG 1MR160 MONTIERT — Sheet/Bl. 1/1

Crit. P.: -- — Scale/M.stab 1:2 — Mat.meets/Stoffe s N2580-1 — Syst. PE — Doc.type MSZ — RA56371812 — DP/TD 001 — Ind. AA — Format A4

MNR — Repl. for — Repl. by

Fig. 5-13: Dimension sheet 1MR160, mounted

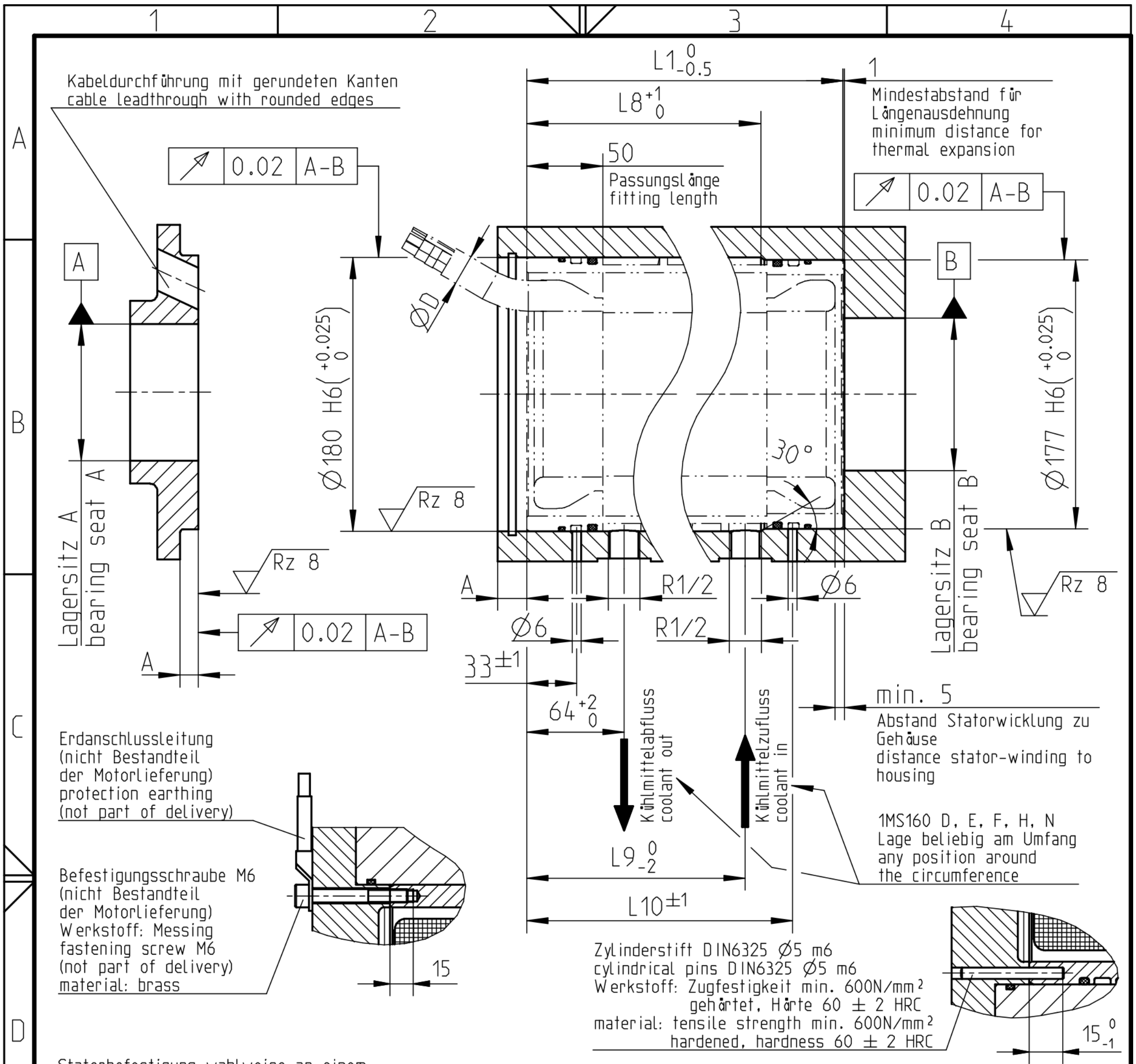
5.4.4 Stator 1MS160



	L1 0/-0.5
1MS160B	160
1MS160D	205
1MS160E	240
1MS160F	255
1MS160H	310
1MS160N	385

Fig. 5-14: Dimension sheet 1MS160

5.4.5 Stator 1MS160, mounted



	$L1_{-0.5}^{0}$	$L8_{0}^{+1}$	$L9_{-2}^{0}$	L10±1	ØD	Biegeradius bending radius
1MS160B-4A	160	106	96	127	23	90
1MS160D-4A	205	151	141	172		
1MS160D-4B					13	50
1MS160E-4B	240	186	176	207		
1MS160F-4A					23	90
1MS160F-4B	255	201	191	222		
1MS160F-4D					13	50
1MS160H-4A	310	256	246	277		
1MS160N-4A					23	90
1MS160N-4B	385	331	321	352		
1MS160N-4C					13	50

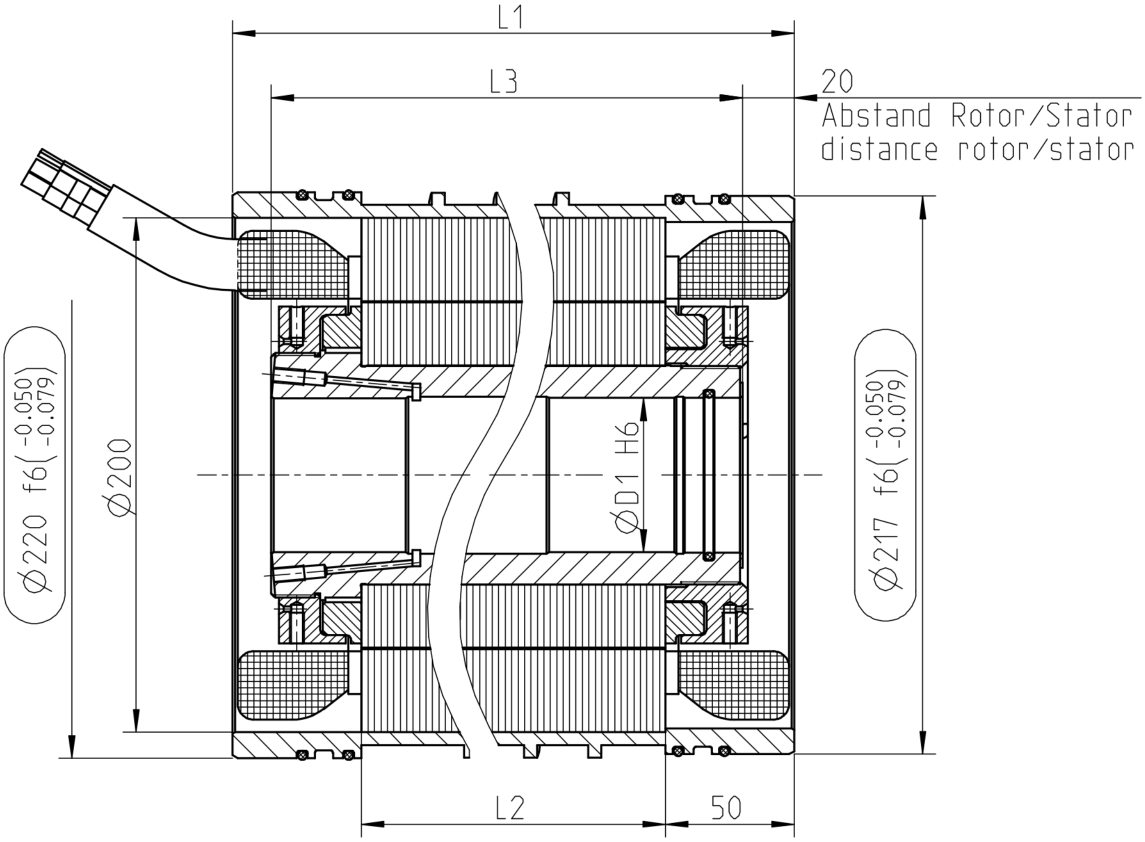
Ind.	Change/Aend.	YYYYMMDD	Drawn/Gez.	Checked/Gepr.	Releas./Freig.	BWN	Resp. dept./Verantw. Abt.	Add. info./Zus. Info.
AC	--	20200922	MRP1SKL	janerant	stefste1	7800	DC-AE/ENG2	
AB	--	20200526	MRP1SKL	janerant	stefste1	7800	DC-AE/ENG2	

Lang./Spr.: EN/DE — Wght./Gew. — rexroth A Bosch Company — DIM DRAWING 1MS160 MOUNTED / MASSZEICHNUNG 1MS160 MONTIERT — Sheet/Bl. 1/1
Crit. P.: -- — Scale/M.stab 1:4 — Mat.meets/Stoffe s N2580-1 — Syst. PE — Doc.type MSZ — RA56464628 — DP/TD 001 — Ind. AC — Format A4
MNR — Repl. for — Repl. by

Fig. 5-15: Dimension sheet 1MS160, mounted

5.5 Frame size 1MB200

5.5.1 1MB200



	ØD1 H6		L1	L2	L3
1MB200C	$60^{+0.019}_{0}$	$66^{+0.019}_{0}$	240	140	205
1MB200D			295	195	260
1MB200E			330	230	295
1MB200H			380	280	345

hist. document no./ Hist. Dokumentnr. 106-0200-4020

AA	--	20160721	wes5lo	janerant	stefste1	7260	DC-IA/EDM1	
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Lang./Spr. EN/DE | Wght./Gew. | rexroth A Bosch Company | DIM DRAWING 1MB200 MASSZEICHNUNG 1MB200 | Sheet/Bl. 1/1

Crit. P. -- | Scale/M.stab 2:5 | Doc.type MSZ | RA58306446 | DP/TD 001 | Ind. AA | Format A4

MNR | Mat.meets/Stoffe s N2580-1 | Syst. PE | Repl. for | Repl. by

Fig. 5-16: Dimension sheet 1MB200

5.5.2 Rotor 1MR200

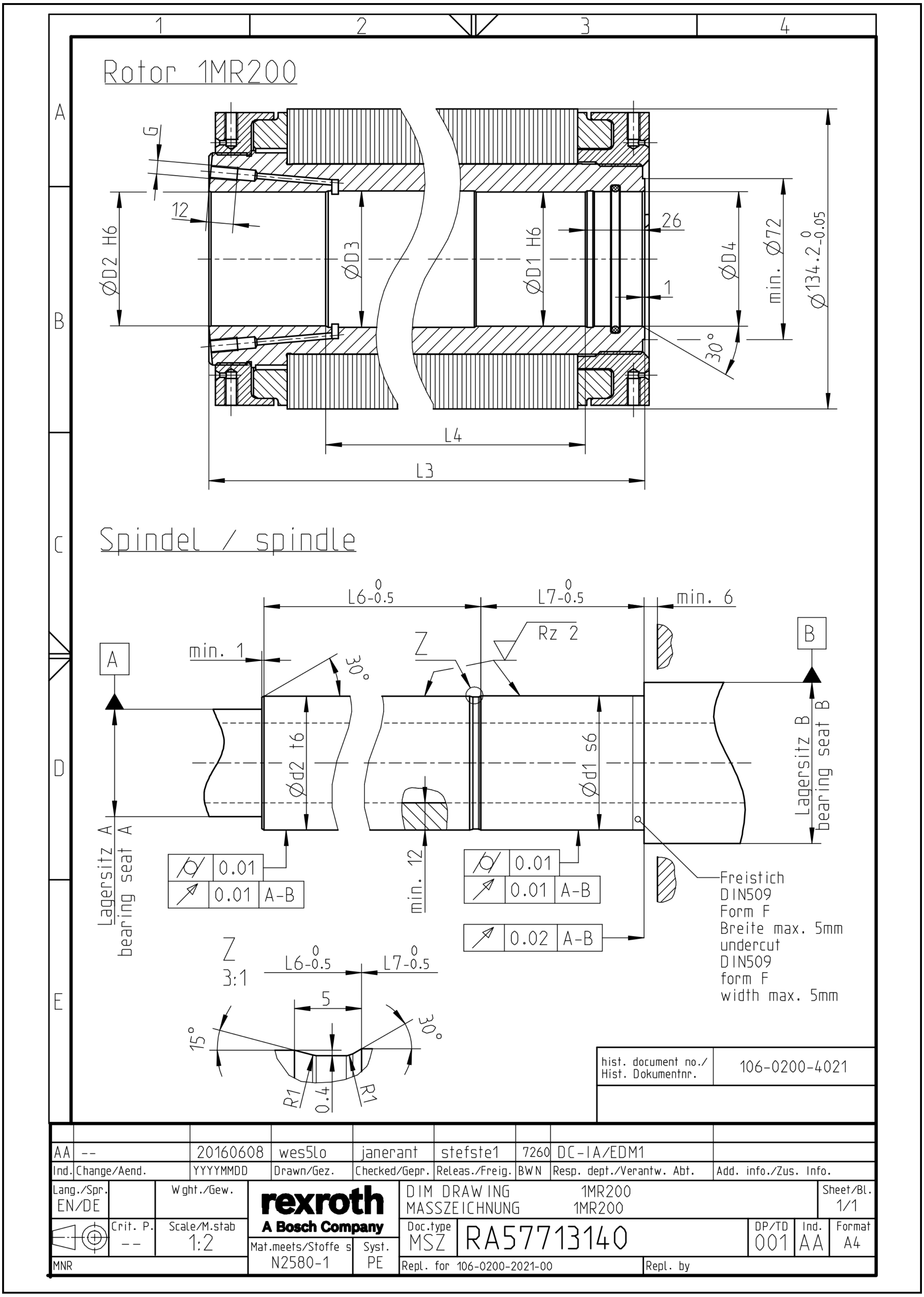


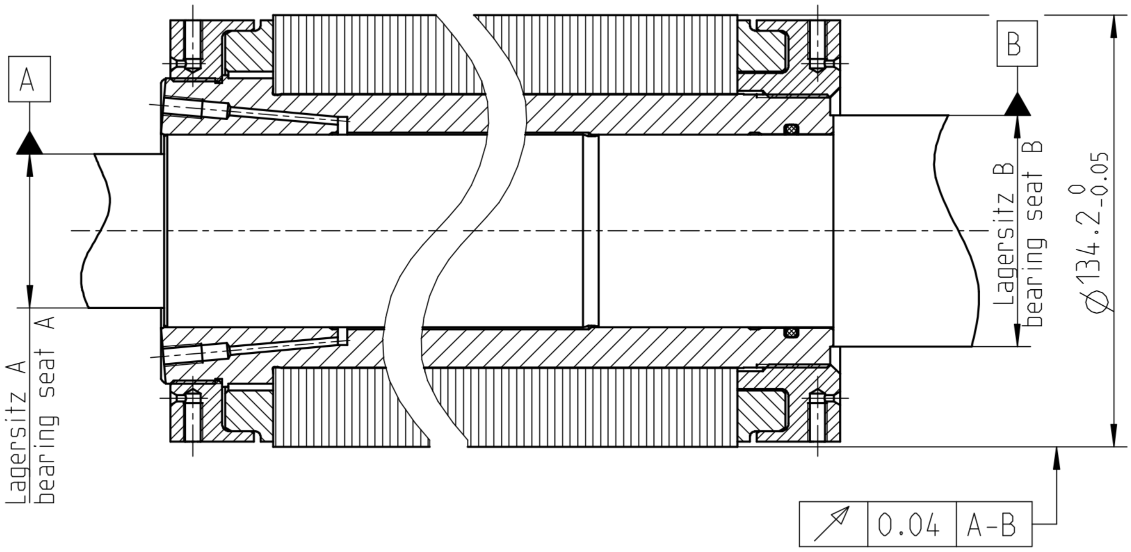
Fig. 5-17: Dimension sheet Rotor 1MR200

5.5.3 Rotor 1MR200, mounted

1 2 3 4

A B C D E

Rotor montiert / mounted



	ROTOR							SPINDEL SPINDLE			
	L3	L4	G	ØD1 H6	ØD2 H6	ØD3	ØD4	$L6_{-0.5}^{0}$	$L7_{-0.5}^{0}$	Ød1 s6	Ød2 t6
1MR200C-A060	205	127	M6	$60^{+0.019}_{0}$	$59.8^{+0.019}_{0}$	61	60.2	130	73	$60^{+0.072}_{+0.053}$	$59.8^{+0.085}_{+0.066}$
1MR200D-A060	260	182						185			
1MR200E-A060	295	217						220			
1MR200H-A060	345	267						270			
1MR200C-A066	205	127		$66^{+0.019}_{0}$	$65.8^{+0.019}_{0}$	67	66.2	130		$66^{+0.078}_{+0.059}$	$65.8^{+0.094}_{+0.075}$
1MR200D-A066	260	182						185			
1MR200E-A066	295	217						220			
1MR200H-A066	345	267						270			

hist. document no./ Hist. Dokumentnr.: 106-0200-4022

AA	--	20160610	wes5lo	janerant	stefste1	7260	DC-IA/EDM1	
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Lang./Spr.: EN/DE | Wght./Gew. | rexroth A Bosch Company | DIM DRAWING MASSZEICHNUNG 1MR200 MOUNTED 1MR200 MONTIERT | Sheet/Bl.: 1/1

Crit. P.: -- | Scale/M.stab: 1:2 | Mat.meets/Stoffe s: N2580-1 | Syst.: PE | Doc.type: MSZ | RA57738687 | DP/TD: 001 | Ind.: AA | Format: A4

MNR | Repl. for | Repl. by

Fig. 5-18: Dimension sheet 1MR200, mounted

5.5.4 Stator 1MS200

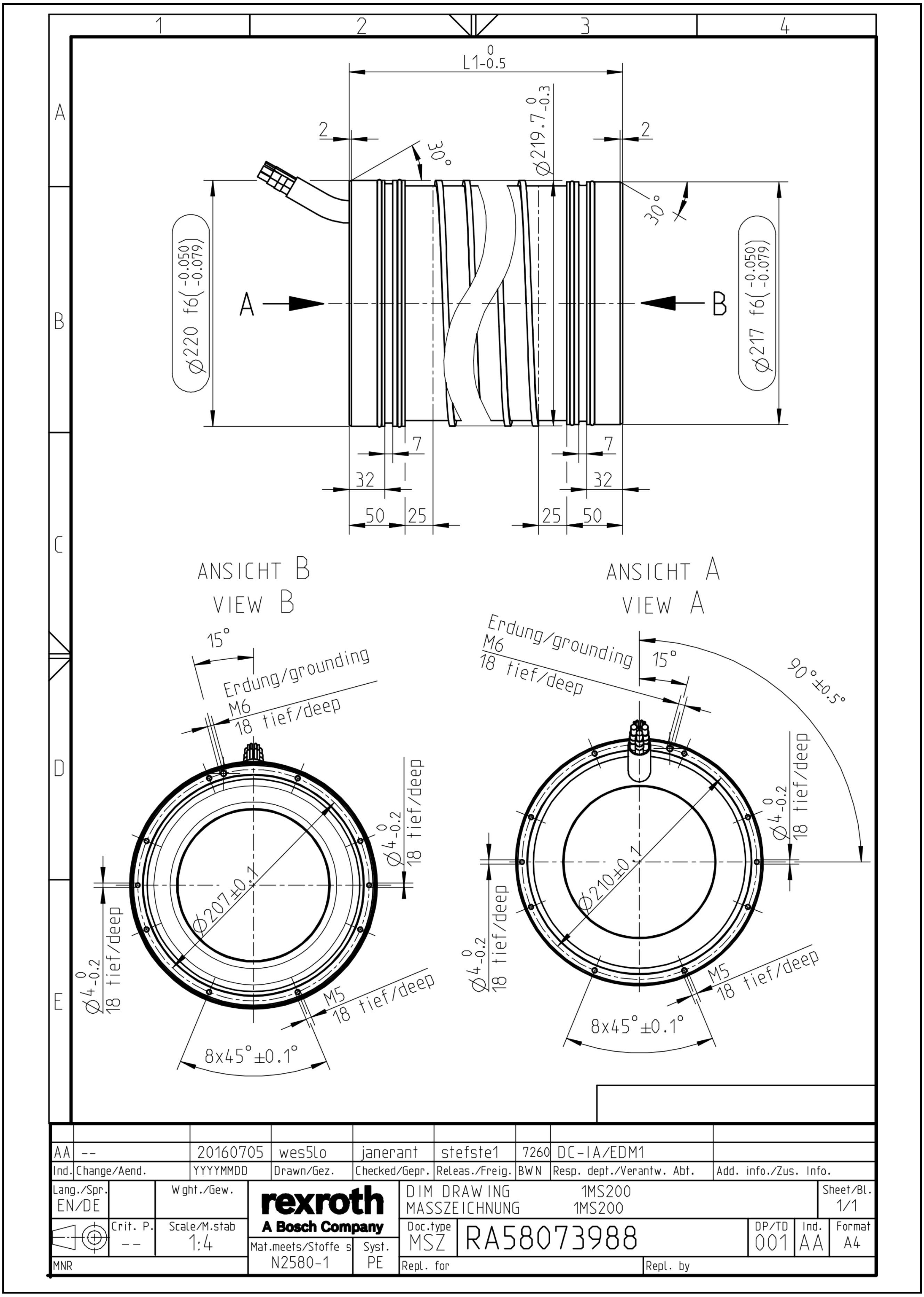
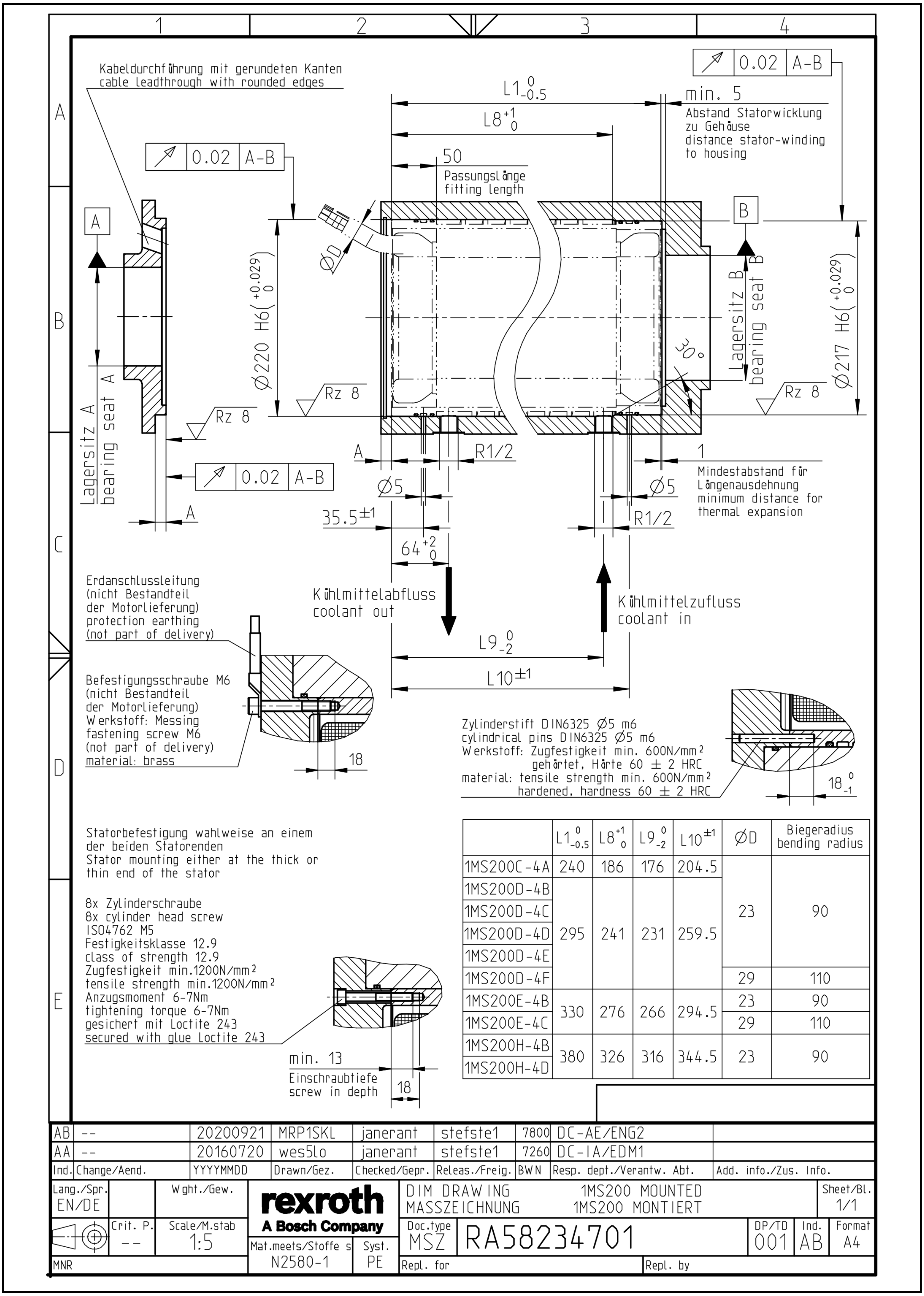


Fig. 5-19: Dimension sheet 1MS200

5.5.5 Stator 1MS200, mounted

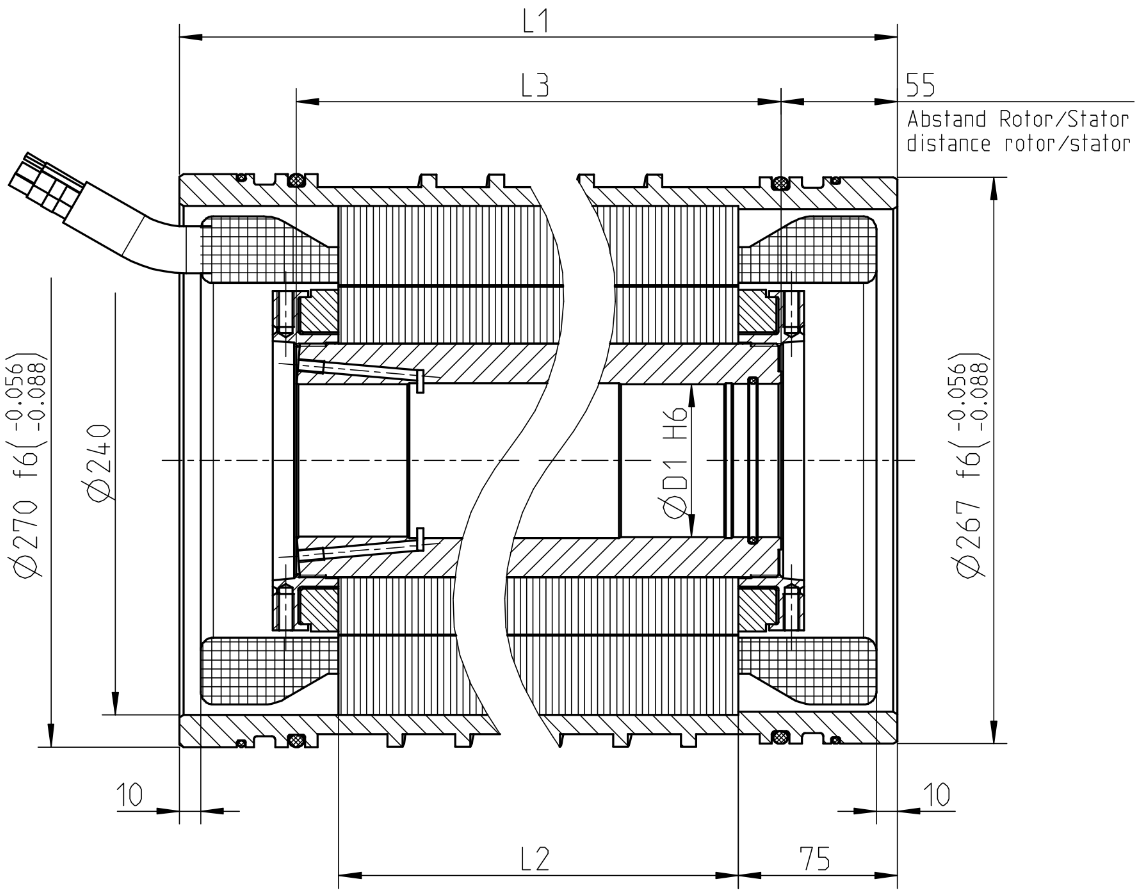


	$L1^{0}_{-0.5}$	$L8^{+1}_{0}$	$L9^{0}_{-2}$	$L10^{\pm1}$	ØD	Biegeradius bending radius
1MS200C-4A	240	186	176	204.5	23	90
1MS200D-4B	295	241	231	259.5		
1MS200D-4C						
1MS200D-4D						
1MS200D-4E						
1MS200D-4F					29	110
1MS200E-4B	330	276	266	294.5	23	90
1MS200E-4C					29	110
1MS200H-4B	380	326	316	344.5	23	90
1MS200H-4D						

Fig. 5-20: Dimension sheet 1MS200, mounted

5.6 Frame size 1MB240

5.6.1 1MB240



	ØD1 H6		L1	L2	L3
1MB240B	$72^{+0.019}_{0}$	-	270	120	160
1MB240F	-	$87^{+0.022}_{0}$	360	210	250
1MB240H	$72^{+0.019}_{0}$		430	280	320

AA	--	20160810	wes5lo	janerant	stefste1	7260	DC-IA/EDM1	
Ind.	Change/Aend.	YYYYMMDD	Drawn/Gezeichnet	Checked/Gepr.	Releas./Freig.	BWN	Resp. dept./Verantw. Abt.	Add. info./Zus. Info.

Lang./Spr. EN/DE | Wght./Gew. | rexroth A Bosch Company | DIM DRAWING 1MB240 | MASSZEICHNUNG 1MB240 | Sheet/Bl. 1/1

Crit. P. -- | Scale/M.stab 33:100 | Mat.meets/Stoffe s N2580-1 | Syst. PE | Doc.type MSZ | RA58647678 | DP/TD 001 | Ind. AA | Format A4

MNR | Repl. for | Repl. by

Fig. 5-21: Dimension sheet 1MB240

5.6.2 Rotor 1MR240

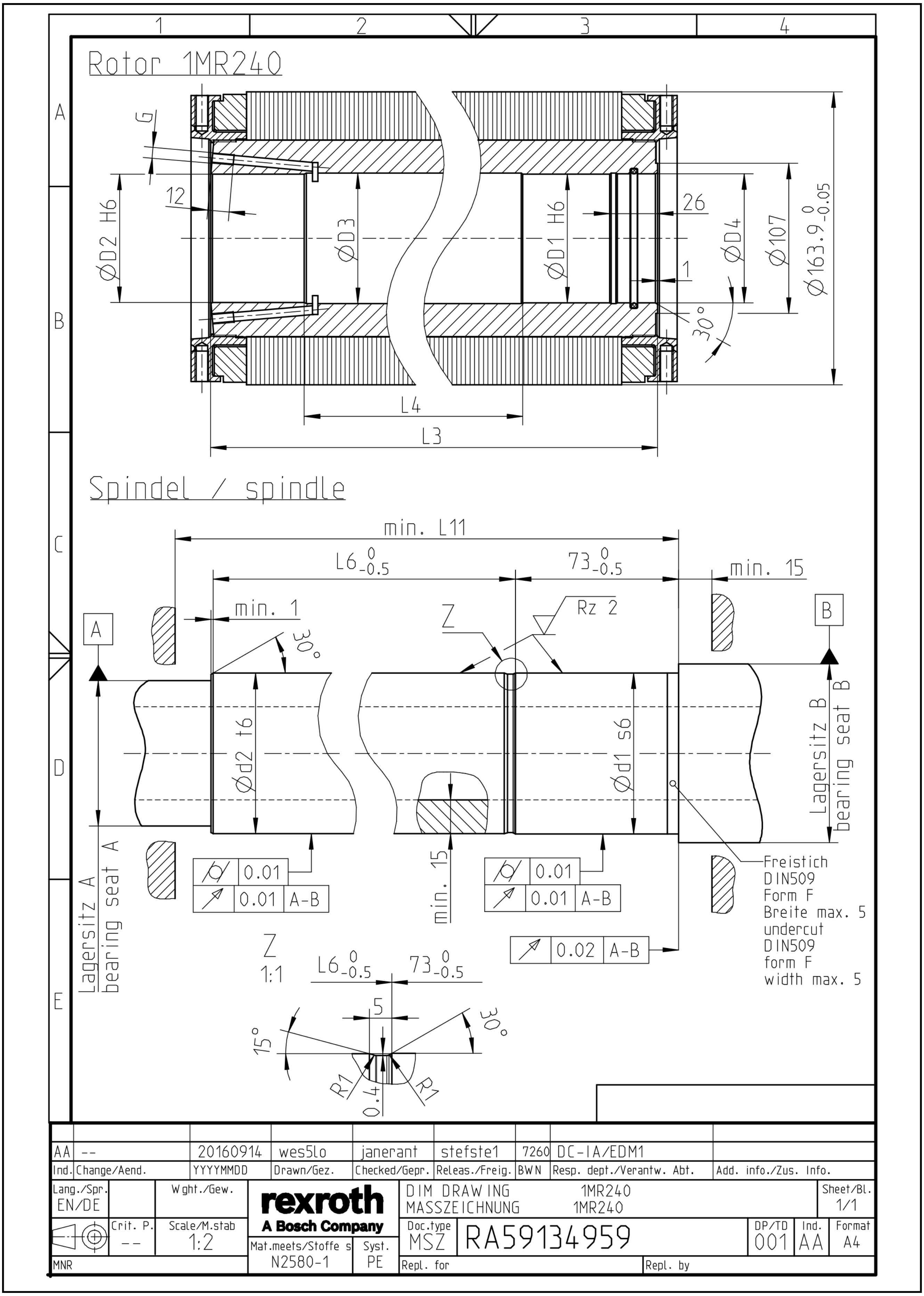
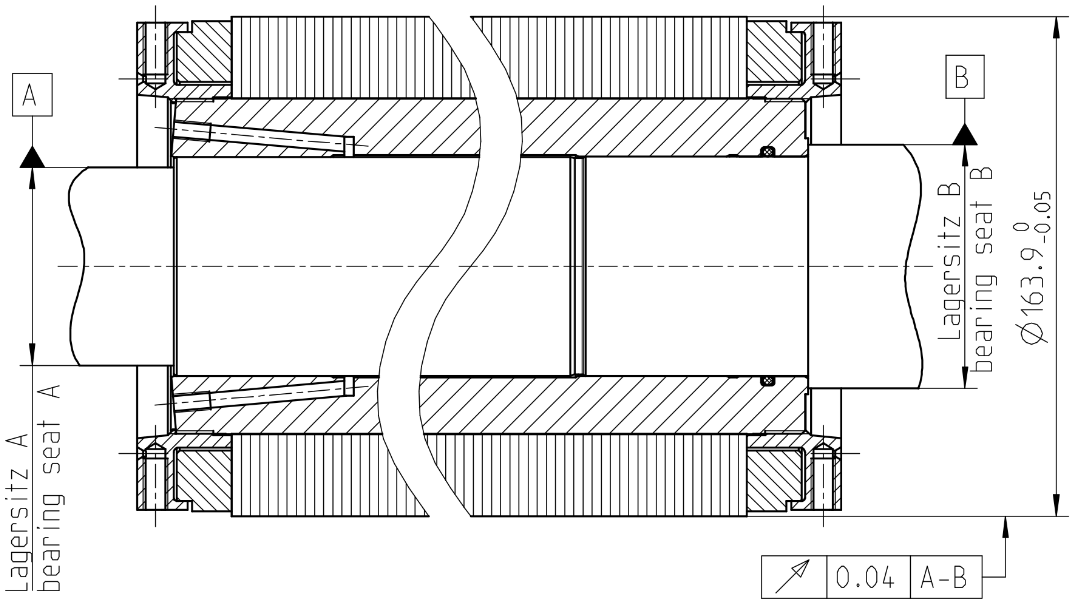


Fig. 5-22: Dimension sheet rotor 1MR240

5.6.3 Rotor 1MR240, mounted

Rotor montiert / mounted



	ROTOR							SPINDEL SPINDLE			
	L3	L4	G	ØD1 H6	ØD2 H6	ØD3	ØD4	$L6^{0}_{-0.5}$	Ød1 s6	Ød2 t6	L11
1MR240B-A072	160	82	M6	$72^{+0.019}_{0}$	$71.8^{+0.019}_{0}$	73	72.2	85	$72^{+0.078}_{+0.059}$	$71.8^{+0.094}_{+0.075}$	min. 175
1MR240H-A072	320	242						245			min. 335
1MR240F-A087	250	172	M4x0.5	$87^{+0.022}_{0}$	$86.8^{+0.022}_{0}$	88	87.2	175	$87^{+0.093}_{+0.071}$	$86.8^{+0.113}_{+0.091}$	min. 265
1MR240H-A087	320	242						245			min. 335

AA	--	20161019	wes5lo	janerant	stefste1	7260	DC-IA/EDM1
Ind.	Change/Aend.	YYYYMMDD	Drawn/Gez.	Checked/Gepr.	Releas./Freig.	BWN	Resp. dept./Verantw. Abt.

Add. info./Zus. Info.

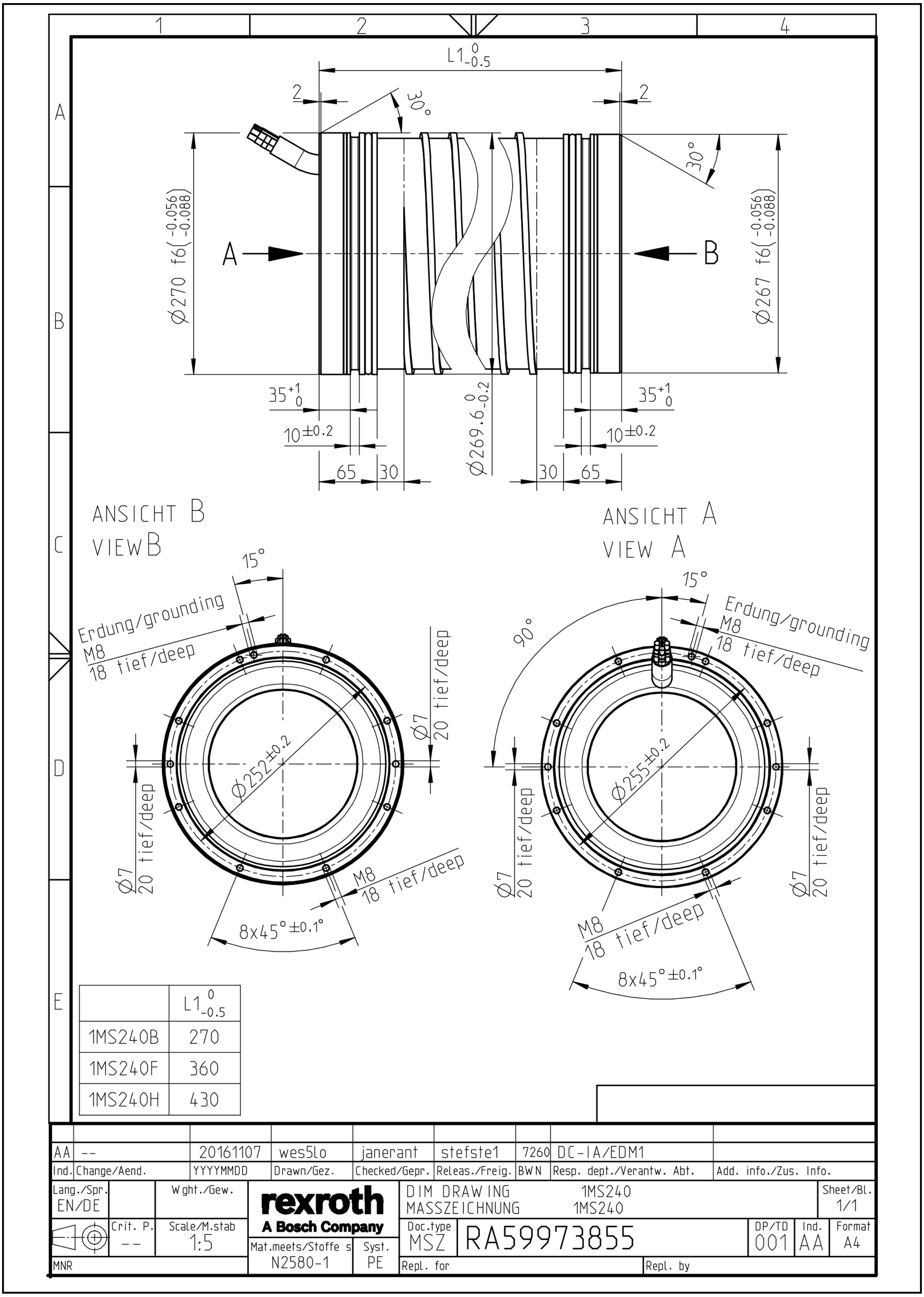
Lang./Spr. EN/DE | Wght./Gew. | rexroth A Bosch Company | DIM DRAWING 1MR240 MOUNTED | MASSZEICHNUNG 1MR240 MONTIERT | Sheet/Bl. 1/1

Crit. P. -- | Scale/M.stab 1:2 | Doc.type MSZ | RA59646402 | DP/TD 001 | Ind. AA | Format A4

Mat.meets/Stoffe s N2580-1 | Syst. PE | MNR | Repl. for | Repl. by

Fig. 5-23: Dimension sheet 1MR240, mounted

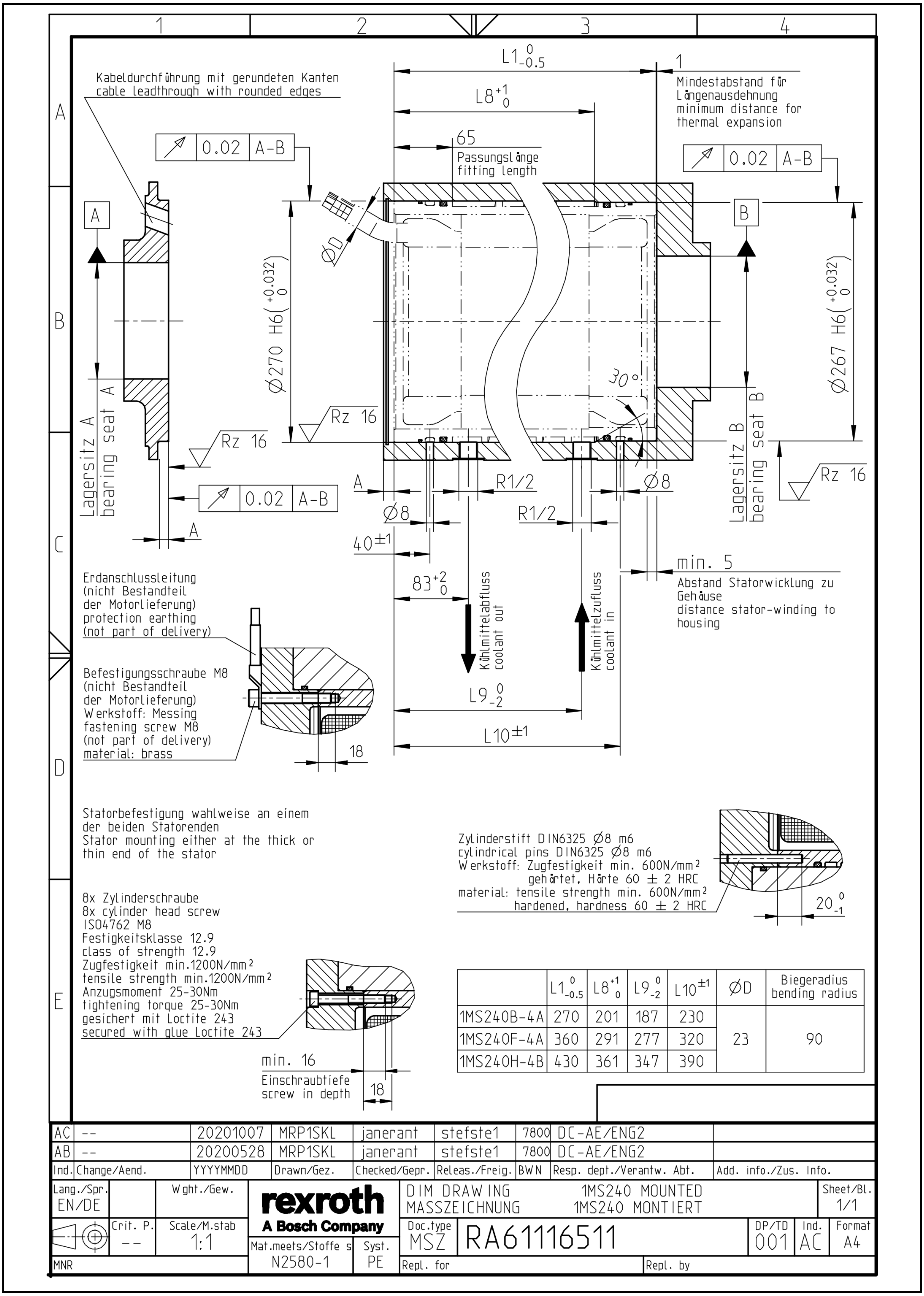
5.6.4 Stator 1MS240



	$L1^{0}_{-0.5}$
1MS240B	270
1MS240F	360
1MS240H	430

Fig. 5-24: Dimension sheet 1MS240

5.6.5 Stator 1MS240, mounted

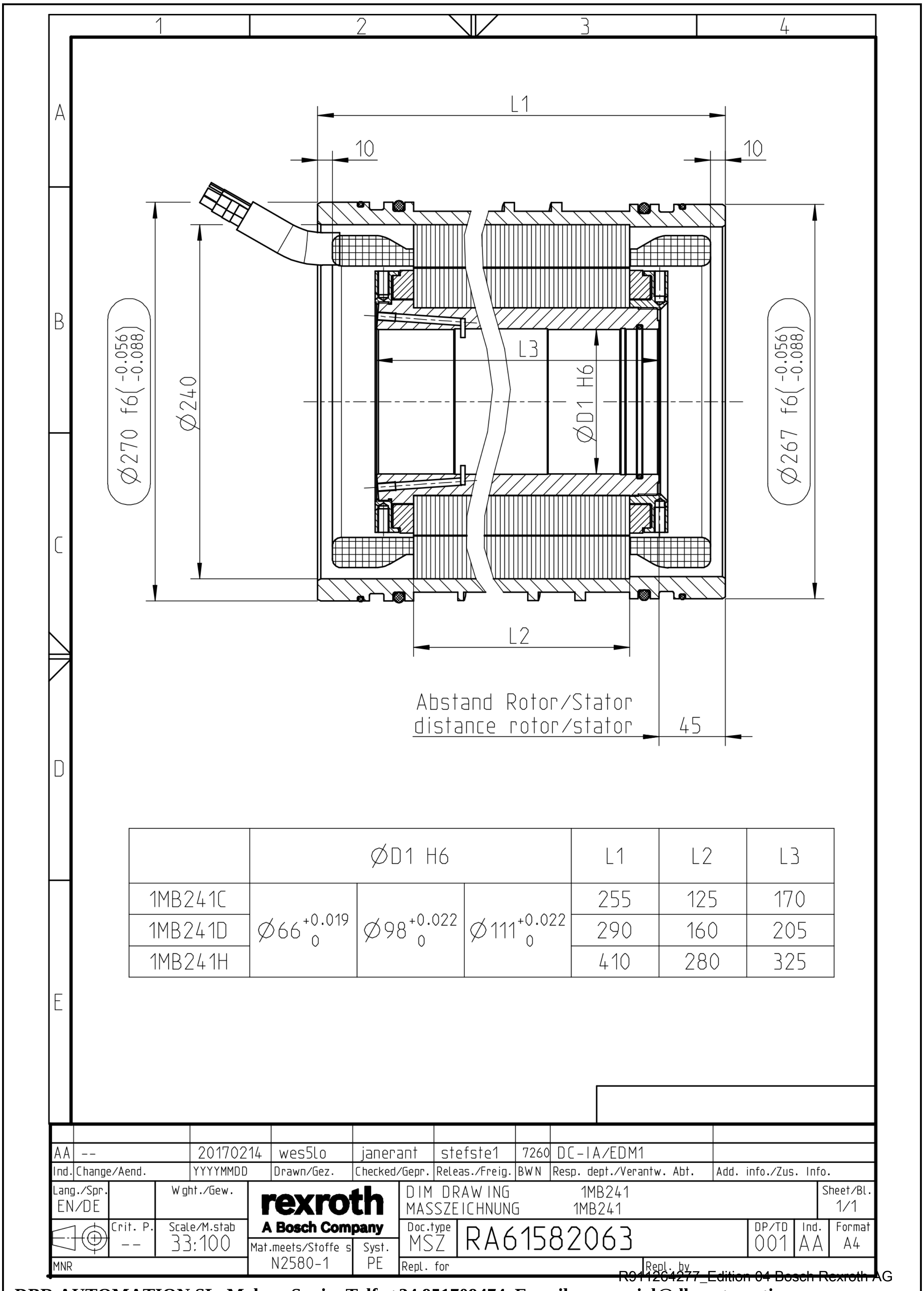


	$L1^{0}_{-0.5}$	$L8^{+1}_{0}$	$L9^{0}_{-2}$	$L10^{\pm1}$	ØD	Biegeradius bending radius
1MS240B-4A	270	201	187	230	23	90
1MS240F-4A	360	291	277	320		
1MS240H-4B	430	361	347	390		

Fig. 5-25: Dimension sheet 1MS240, mounted

5.7 Frame size 1MB241

5.7.1 1MB241



	ØD1 H6			L1	L2	L3
1MB241C	Ø66 $^{+0.019}_{0}$	Ø98 $^{+0.022}_{0}$	Ø111 $^{+0.022}_{0}$	255	125	170
1MB241D				290	160	205
1MB241H				410	280	325

Fig. 5-26: Dimension sheet 1MB241

5.7.2 Rotor 1MR241

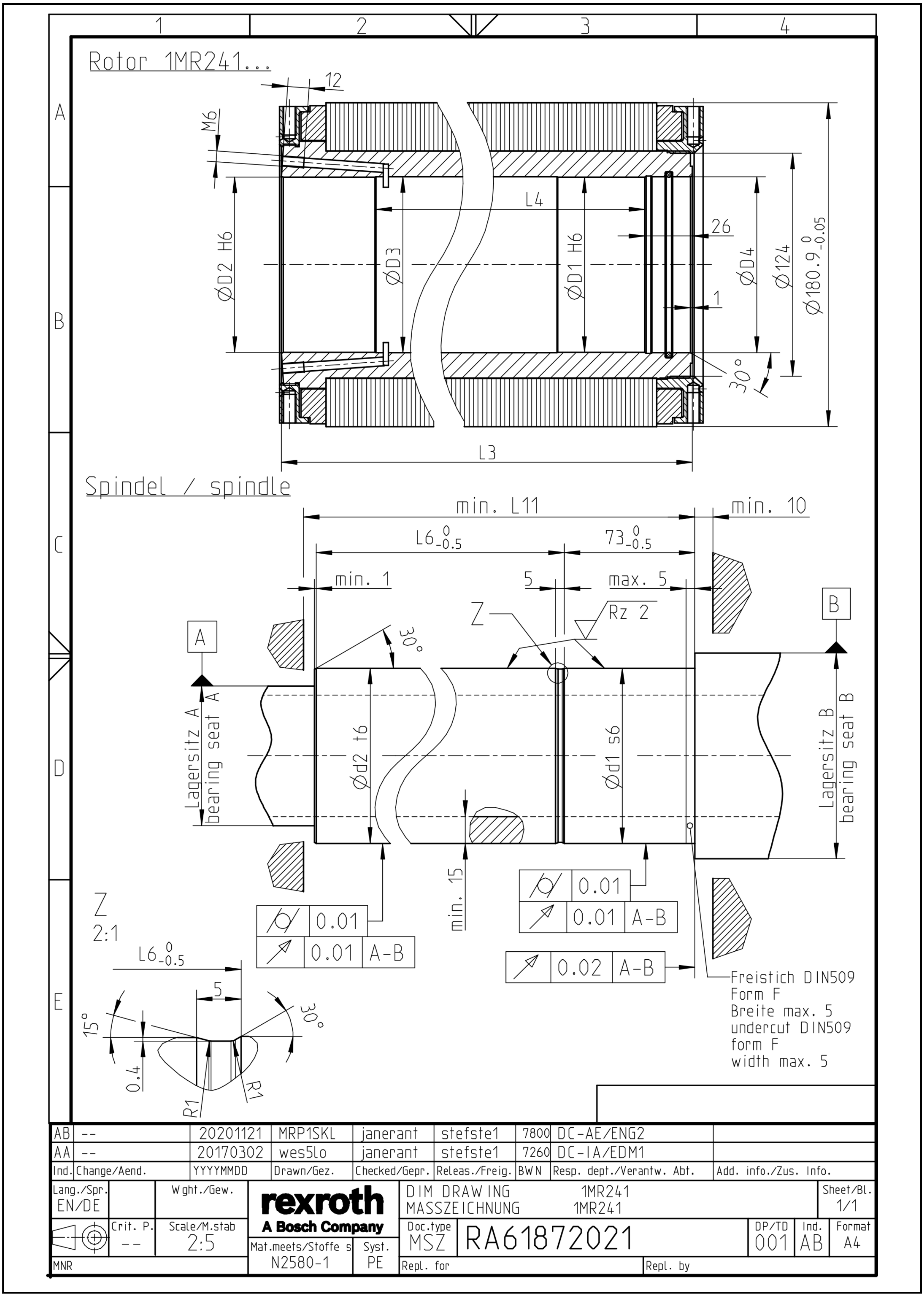
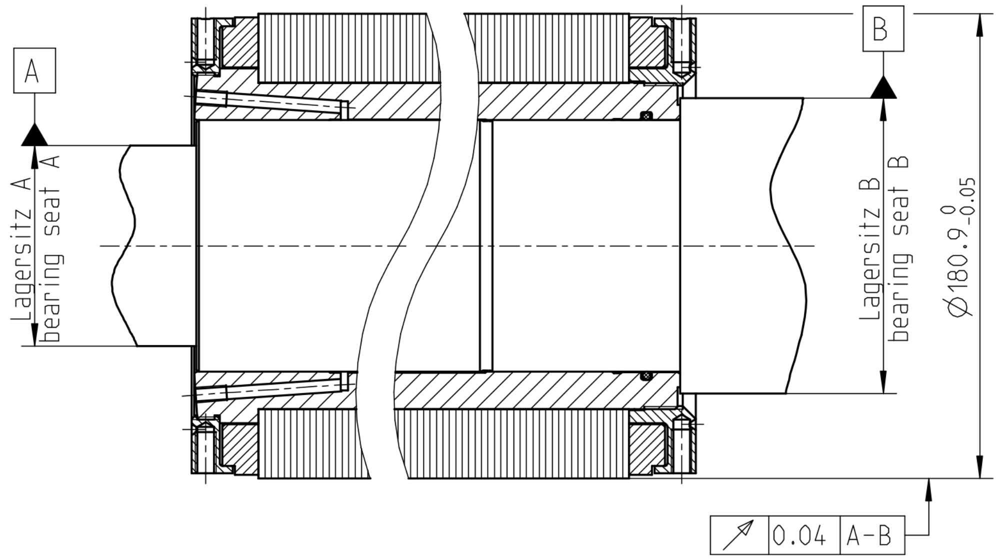


Fig. 5-27: Dimension sheet rotor 1MR241

5.7.3 Rotor 1MR241, mounted

Rotor mit Stufenpreßverband, montiert
rotor with step interference fit, mounted



	Rotor						Spindel spindle			
	L3	L4	ØD1 H6	ØD2 H6	ØD3	ØD4	$L6^{0}_{-0.5}$	L11	Ød1 s6	Ød2 t6
1MR241C-A066	170	92	$Ø66^{+0.019}_{0}$	$Ø65.8^{+0.019}_{0}$	Ø66.5	Ø66.2	95	174	$Ø66^{+0.078}_{+0.059}$	$Ø65.8^{+0.094}_{+0.075}$
1MR241D-A066	205	127					130	209		
1MR241H-A066	325	247					250	329		
1MR241C-A098	170	92	$Ø98^{+0.022}_{0}$	$Ø97.8^{+0.022}_{0}$	Ø99	Ø98.2	95	174	$Ø98^{+0.093}_{+0.071}$	$Ø97.8^{+0.113}_{+0.091}$
1MR241D-A098	205	127					130	209		
1MR241H-A098	325	247					250	329		
1MR241C-A111	170	92	$Ø111^{+0.022}_{0}$	$Ø110.8^{+0.022}_{0}$	Ø112	Ø111.2	95	174	$Ø111^{+0.101}_{+0.079}$	$Ø110.8^{+0.126}_{+0.104}$
1MR241D-A111	205	127					130	209		
1MR241H-A111	325	247					250	329		

Ind.	Change/Aend.	YYYYMMDD	Drawn/Gez.	Checked/Gepr.	Releas./Freig.	BWN	Resp. dept./Verantw. Abt.	Add. info./Zus. Info.
AB	--	20201121	MRP1SKL	janerant	stefste1	7800	DC-AE/ENG2	
AA	--	20170314	wes5lo	janerant	stefste1	7260	DC-IA/EDM1	

Lang./Spr. EN/DE | Wght./Gew. | rexroth A Bosch Company | DIM DRAWING / MASSZEICHNUNG | 1MR241 MOUNTED / 1MR241 MONTIERT | Sheet/Bl. 1/1

Crit. P. -- | Scale/M.stab 2:5 | Mat.meets/Stoffe s N2580-1 | Syst. PE | Doc.type MSZ | RA62051604 | DP/TD 001 | Ind. AB | Format A4

MNR | Repl. for | Repl. by

Fig. 5-28: Dimension sheet 1MR241, mounted

5.7.4 Stator 1MS241

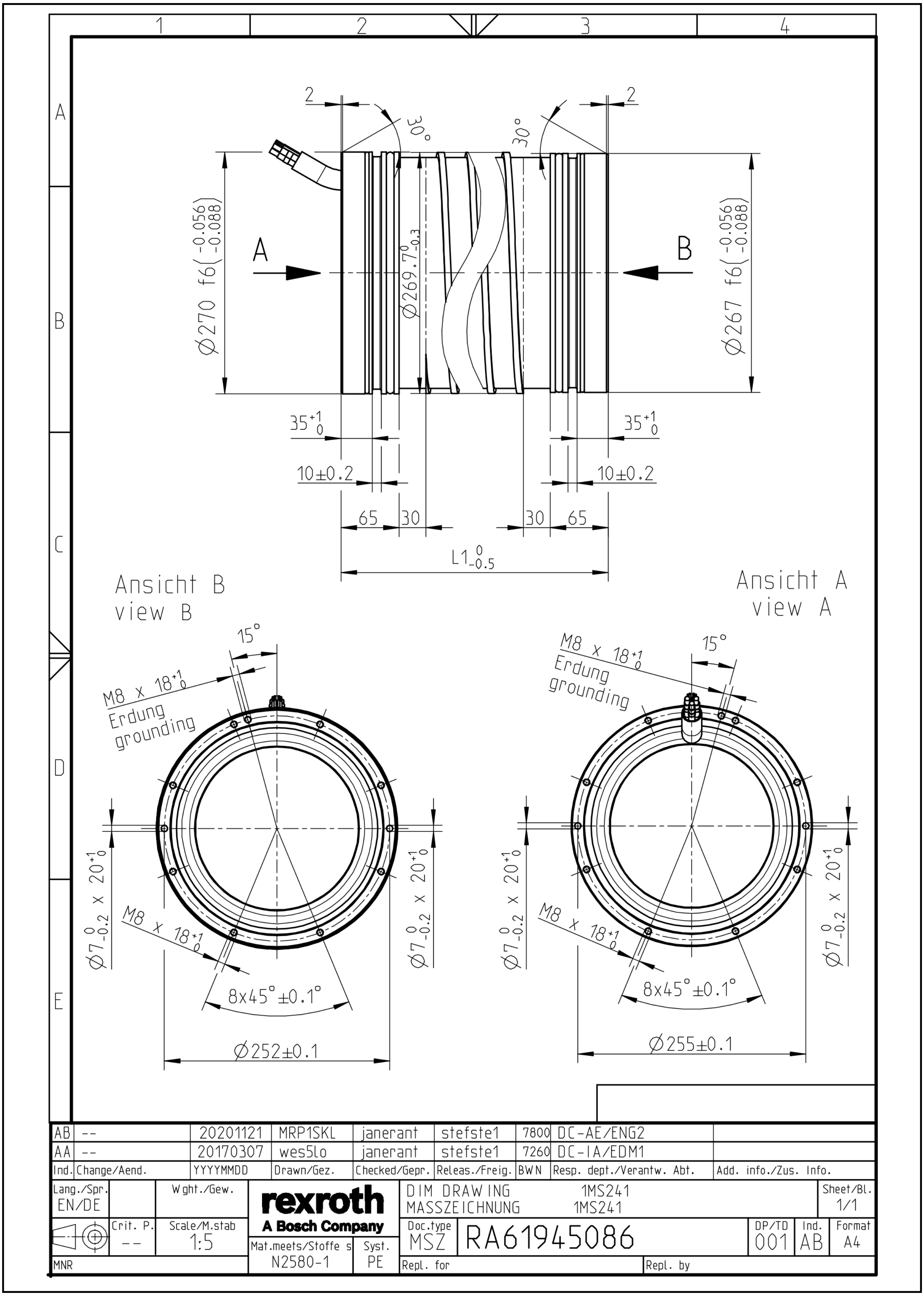
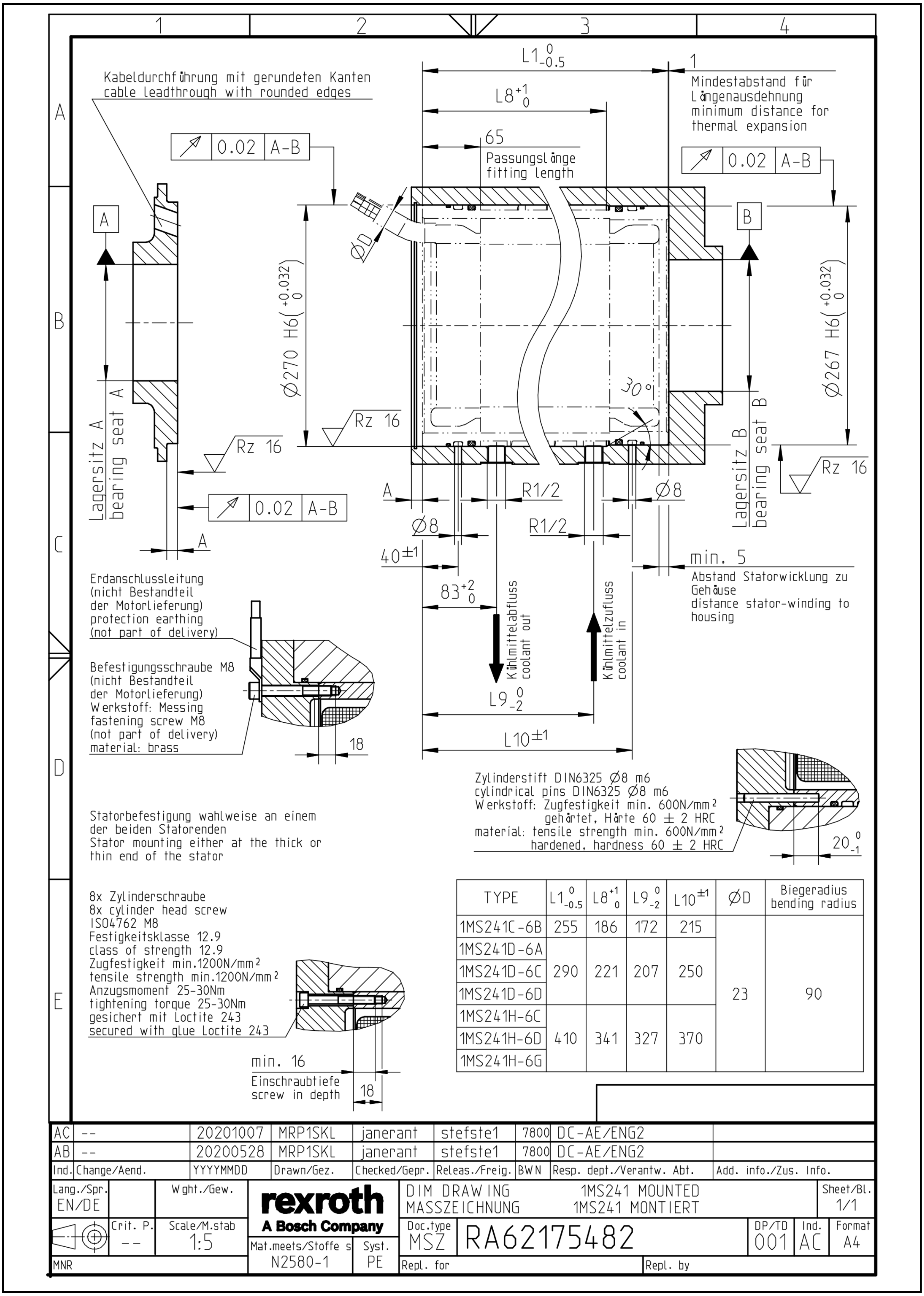


Fig. 5-29: Dimension sheet 1MS241

5.7.5 Stator 1MS241, mounted

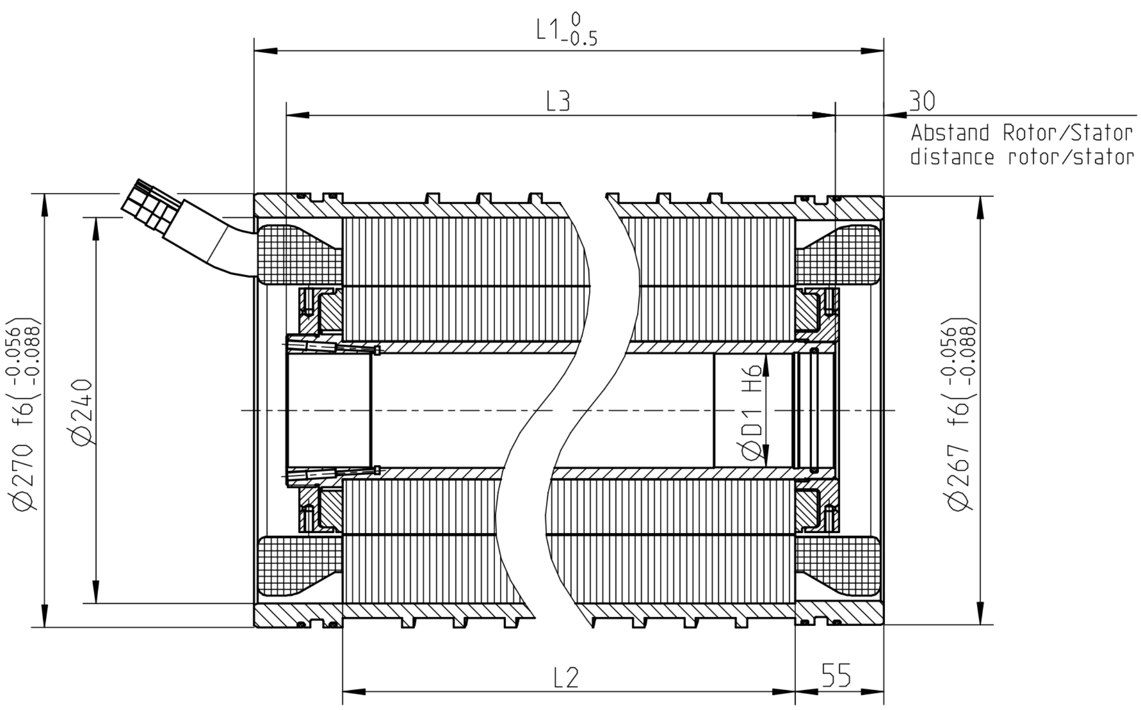


TYPE	$L1_{-0.5}^{0}$	$L8_{0}^{+1}$	$L9_{-2}^{0}$	$L10^{\pm1}$	ØD	Biegeradius bending radius
1MS241C-6B	255	186	172	215	23	90
1MS241D-6A	290	221	207	250		
1MS241D-6C						
1MS241D-6D						
1MS241H-6C	410	341	327	370		
1MS241H-6D						
1MS241H-6G						

Fig. 5-30: Dimension sheet 1MS241, mounted

5.8 Frame size 1MB242

5.8.1 1MB242



	ØD1 H6	L1 $^{0}_{-0.5}$	L2	L3
1MB242N	71 $^{+0.019}_{0}$	440	330	390

AA	--	20170504	wes5lo	janerant	stefste1	7260	DC-IA/EDM1
Ind.	Change/Aend.	YYYYMMDD	Drawn/Gez.	Checked/Gepr.	Releas./Freig.	BWN	Resp. dept./Verantw. Abt.

Add. info./Zus. Info.

Lang./Spr. EN/DE | Wght./Gew. | rexroth A Bosch Company | DIM DRAWING 1MB242 MASSZEICHNUNG 1MB242 | Sheet/Bl. 1/1

Crit. P. -- | Scale/M.stab 1:4 | Doc.type MSZ | RA63090382 | DP/TD 001 | Ind. AA | Format A4

MNR | Mat.meets/Stoffe s N2580-1 | Syst. PE | Repl. for | Repl. by

Fig. 5-31: Dimension sheet 1MB242

5.8.2 Rotor 1MR242

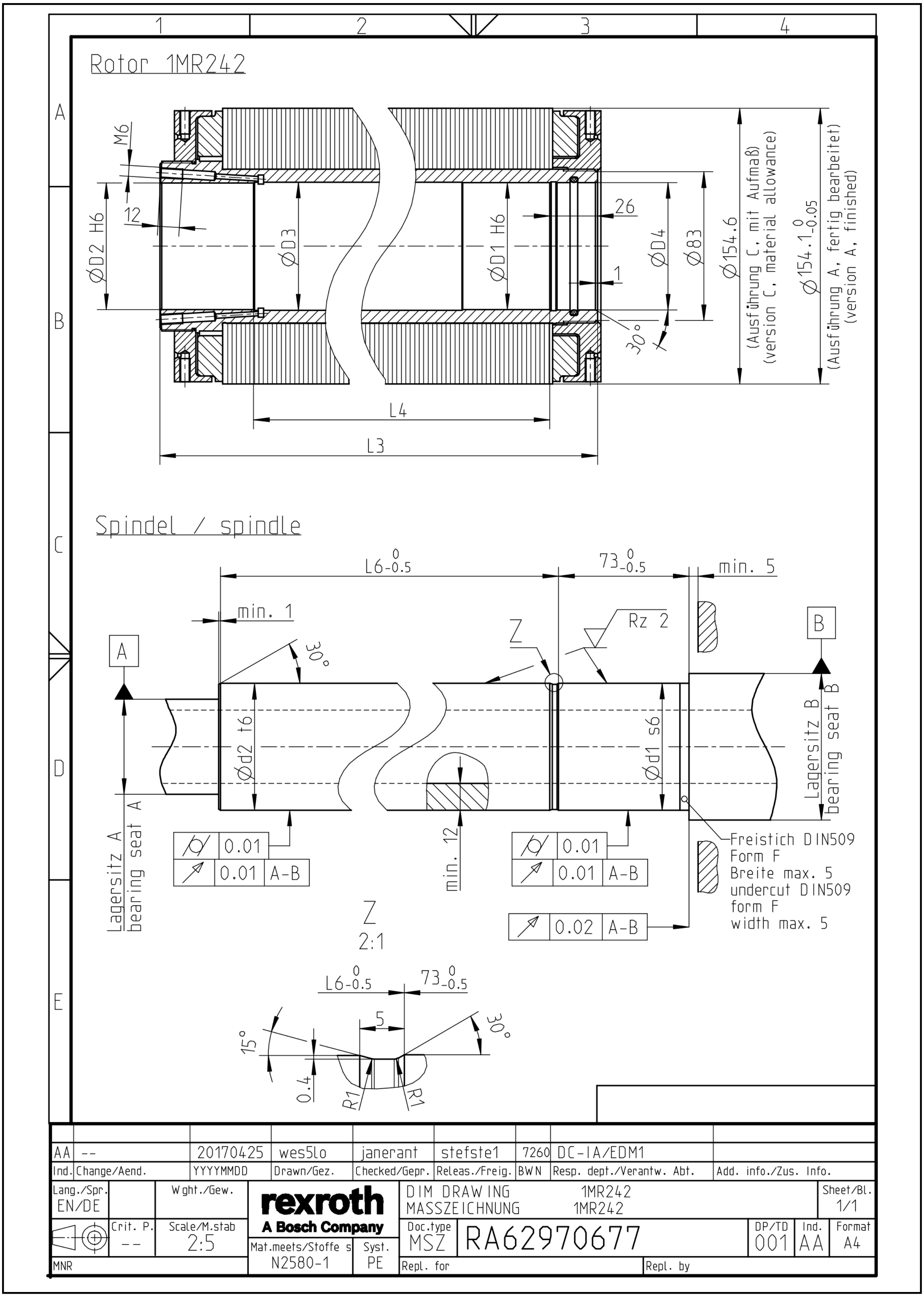
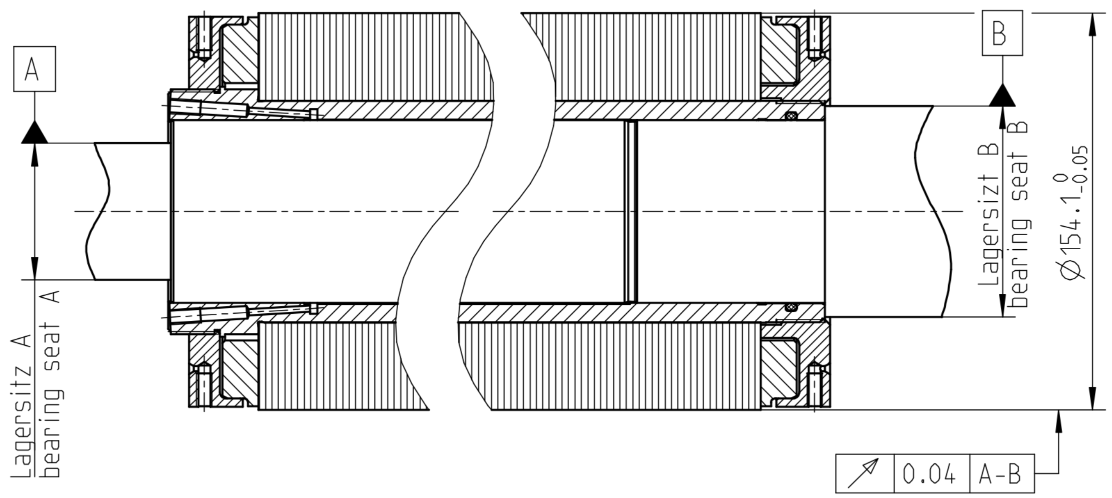


Fig. 5-32: Dimension sheet rotor 1MR242

5.8.3 Rotor 1MR242, mounted

Rotor montiert / mounted

Bei Ausführung C Endbearbeitung erforderlich
version C finishing necessary



	ROTOR						SPINDEL SPINDLE		
	L3	L4	ØD1 H6	ØD2 H6	ØD3	ØD4	$L6^{0}_{-0.5}$	Ød1 s6	Ød2 t6
1MR242N-x071	390	312	$Ø71^{+0.019}_{0}$	$Ø70.8^{+0.019}_{0}$	Ø72	Ø71.2	315	$Ø71^{+0.078}_{+0.059}$	$Ø70.8^{+0.094}_{+0.075}$

x = Rotorausführung A oder C
rotor version A or C

Ind.	Change/Aend.	YYYYMMDD	Drawn/Gez.	Checked/Gepr.	Releas./Freig.	BWN	Resp. dept./Verantw. Abt.	Add. info./Zus. Info.
AA	--	20170427	wes5lo	janerant	stefste1	7260	DC-IA/EDM1	

Lang./Spr. EN/DE | Wght./Gew. | rexroth A Bosch Company | DIM DRAWING 1MR242 MOUNTED | MASSZEICHNUNG 1MR242 MONTIERT | Sheet/Bl. 1/1

Crit. P. -- | Scale/M.stab 2:5 | Mat.meets/Stoffe s N2580-1 | Syst. PE | Doc.type MSZ | RA63013399 | DP/TD 001 | Ind. AA | Format A4

MNR | Repl. for | Repl. by

Fig. 5-33: Dimension sheet 1MR242, mounted

5.8.4 Stator 1MS242

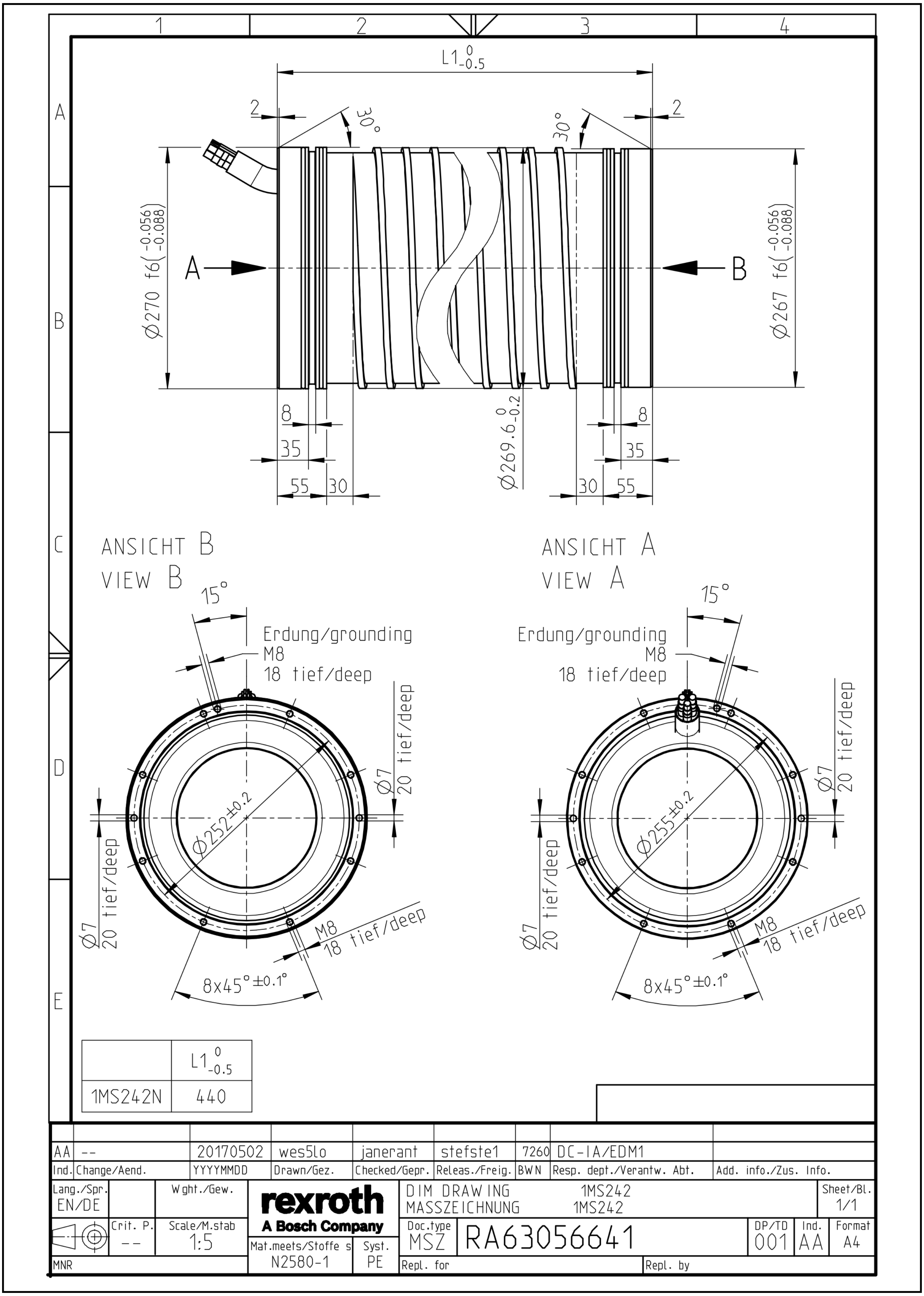
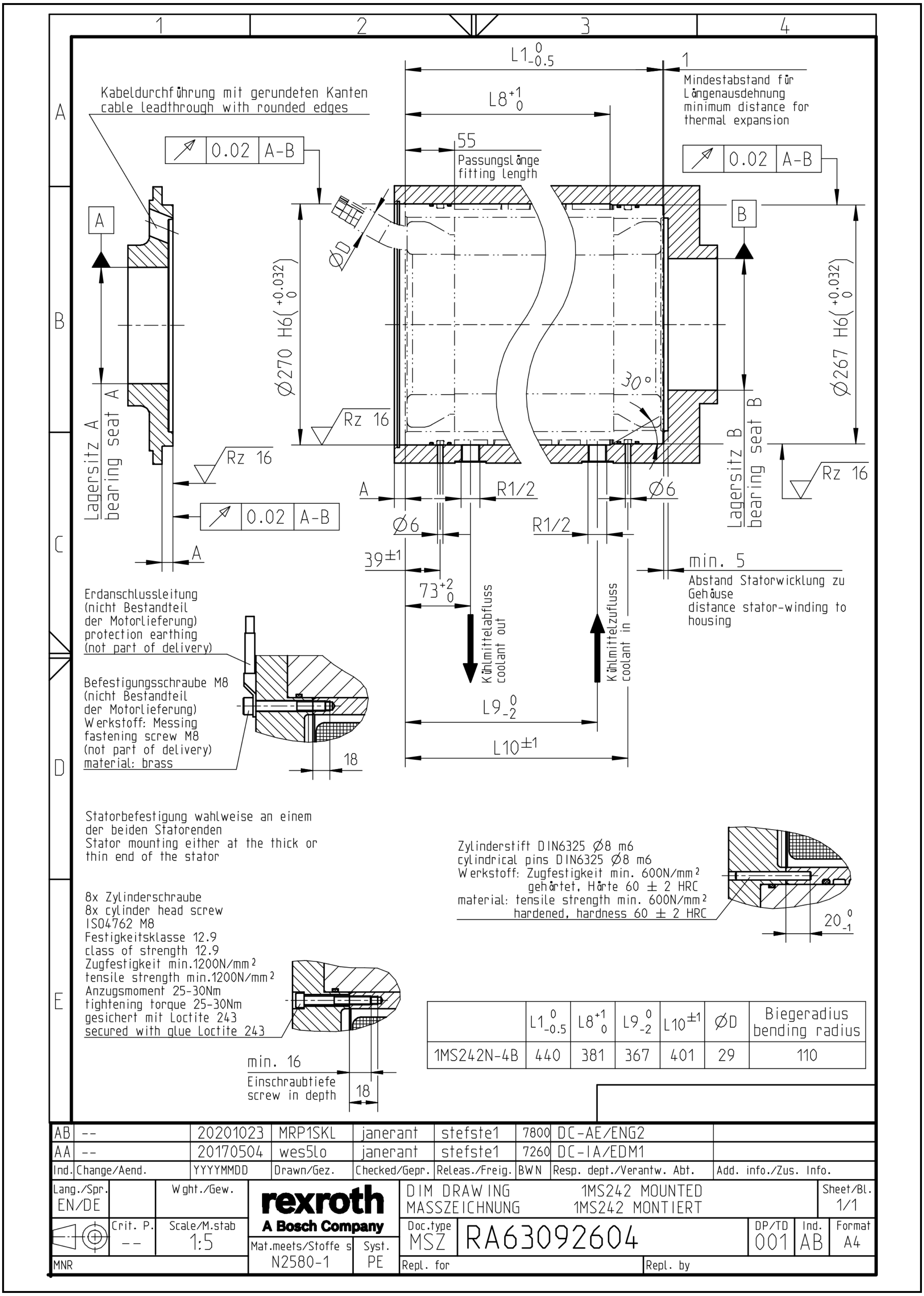


Fig. 5-34: Dimension sheets 1MS242

5.8.5 Stator 1MS242

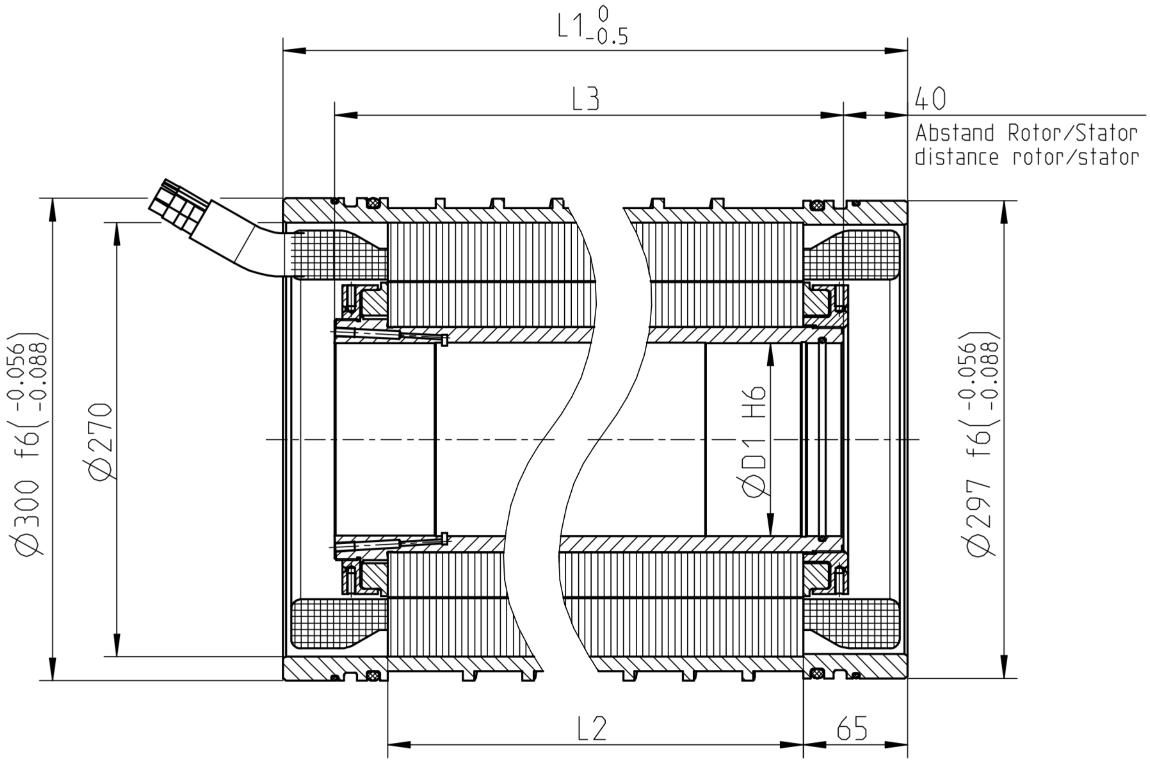


	$L1^{0}_{-0.5}$	$L8^{+1}_{0}$	$L9^{0}_{-2}$	$L10^{\pm1}$	ØD	Biegeradius bending radius
1MS242N-4B	440	381	367	401	29	110

Fig. 5-35: Dimension sheet 1MS242, mounted

5.9 Frame size 1MB270

5.9.1 1MB270



	ØD1 H6		$L1^{0}_{-0.5}$	L2	L3
1MB270C	$90^{+0.022}_{0}$	$120^{+0.022}_{0}$	400	270	328

AA	--	20170517	wes5lo	janerant	stefste1	7260	DC-IA/EDM1	
Ind.	Change/Aend.	YYYYMMDD	Drawn/Gez.	Checked/Gepr.	Releas./Freig.	BWN	Resp. dept./Verantw. Abt.	Add. info./Zus. Info.

Lang./Spr. EN/DE; Wght./Gew.; rexroth A Bosch Company; DIM DRAWING 1MB270; MASSZEICHNUNG 1MB270; Sheet/Bl. 1/1
Crit. P. --; Scale/M.stab 1:4; Doc.type MSZ; RA63256929; DP/TD 001; Ind. AA; Format A4
MNR; Mat.meets/Stoffe s N2580-1; Syst. PE; Repl. for; Repl. by

Fig. 5-36: Dimension sheet 1MB270

5.9.2 Rotor 1MR270

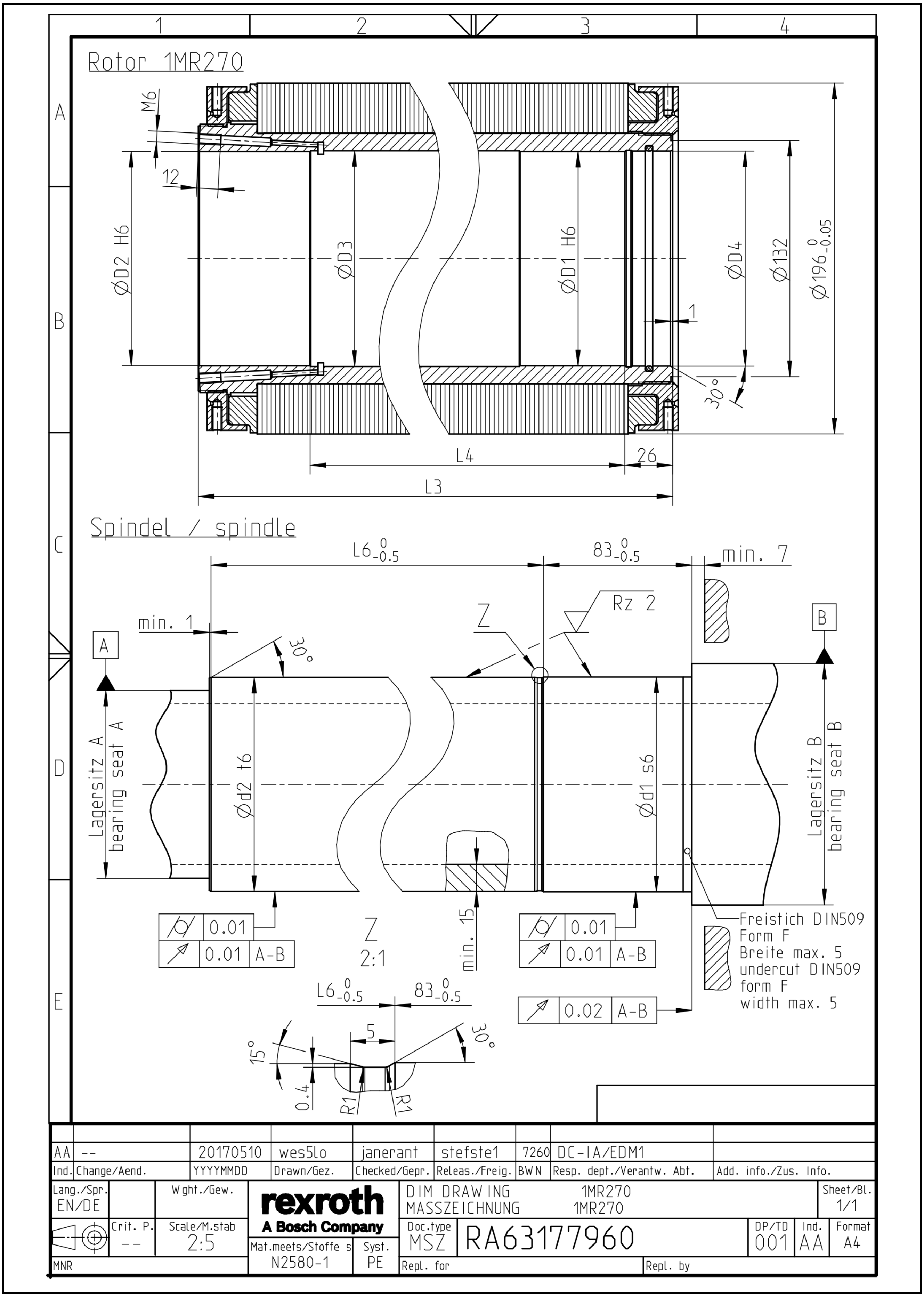
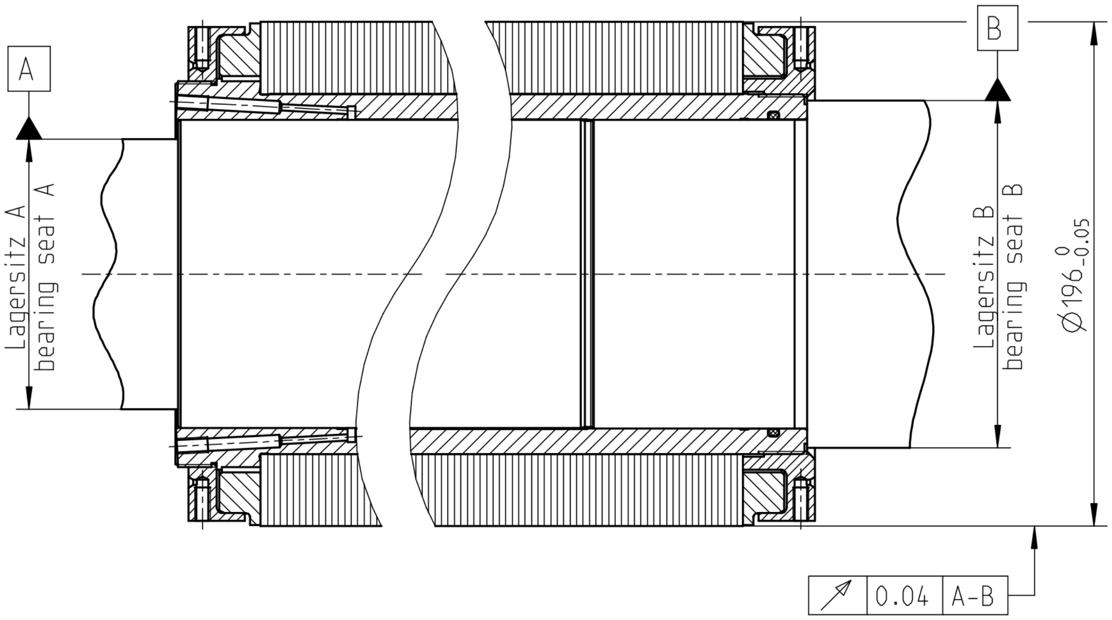


Fig. 5-37: Dimension sheet 1MR270

5.9.3 Rotor 1MR270, mounted

Rotor montiert / mounted



	ROTOR						SPINDEL SPINDLE		
	L3	L4	ØD1 H6	ØD2 H6	ØD3	ØD4	$L6^{0}_{-0.5}$	Ød1 s6	Ød2 t6
1MR270C-A090	328	240	$\varnothing 90^{+0.022}_{0}$	$\varnothing 89.8^{+0.022}_{0}$	Ø91	Ø90.2	243	$\varnothing 90^{+0.093}_{+0.071}$	$\varnothing 89.8^{+0.113}_{+0.091}$
1MR270C-A120	328	240	$\varnothing 120^{+0.022}_{0}$	$\varnothing 119.8^{+0.022}_{0}$	Ø121	Ø120.2	243	$\varnothing 120^{+0.101}_{+0.079}$	$\varnothing 119.8^{+0.126}_{+0.104}$

Ind.	Change/Aend.	YYYYMMDD	Drawn/Gez.	Checked/Gepr.	Releas./Freig.	BWN	Resp. dept./Verantw. Abt.	Add. info./Zus. Info.
AA	--	20170517	wes5lo	janerant	stefste1	7260	DC-IA/EDM1	

Lang./Spr. EN/DE | Wght./Gew. | rexroth A Bosch Company | DIM DRAWING 1MR270 MOUNTED / MASSZEICHNUNG 1MR270 MONTIERT | Sheet/Bl. 1/1

Crit. P. -- | Scale/M.stab 2:5 | Doc.type MSZ | RA63255896 | DP/TD 001 | Ind. AA | Format A4

Mat.meets/Stoffe s N2580-1 | Syst. PE

MNR | Repl. for | Repl. by

Fig. 5-38: Dimension sheet 1MR270, mounted

5.9.4 Stator 1MS270

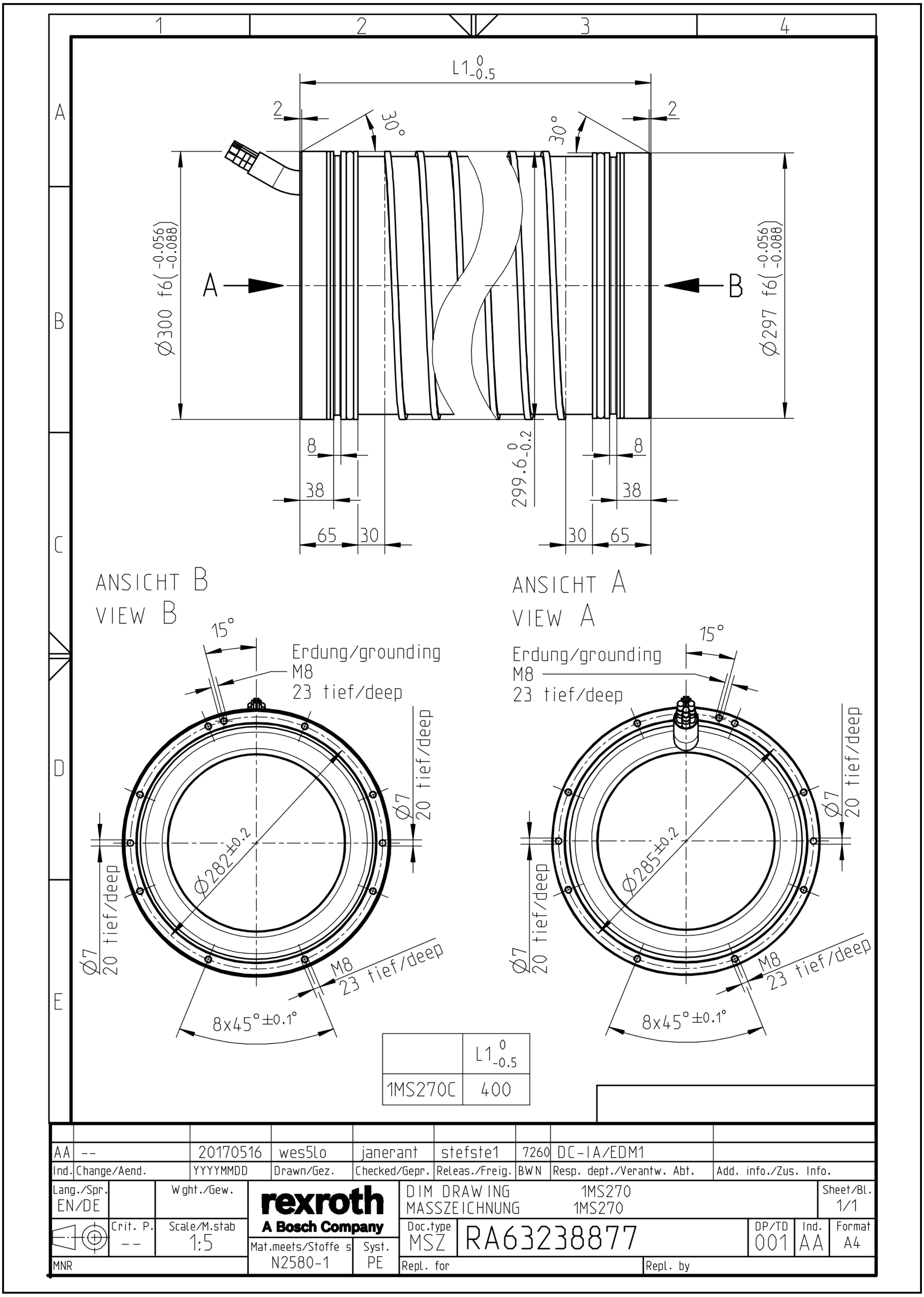
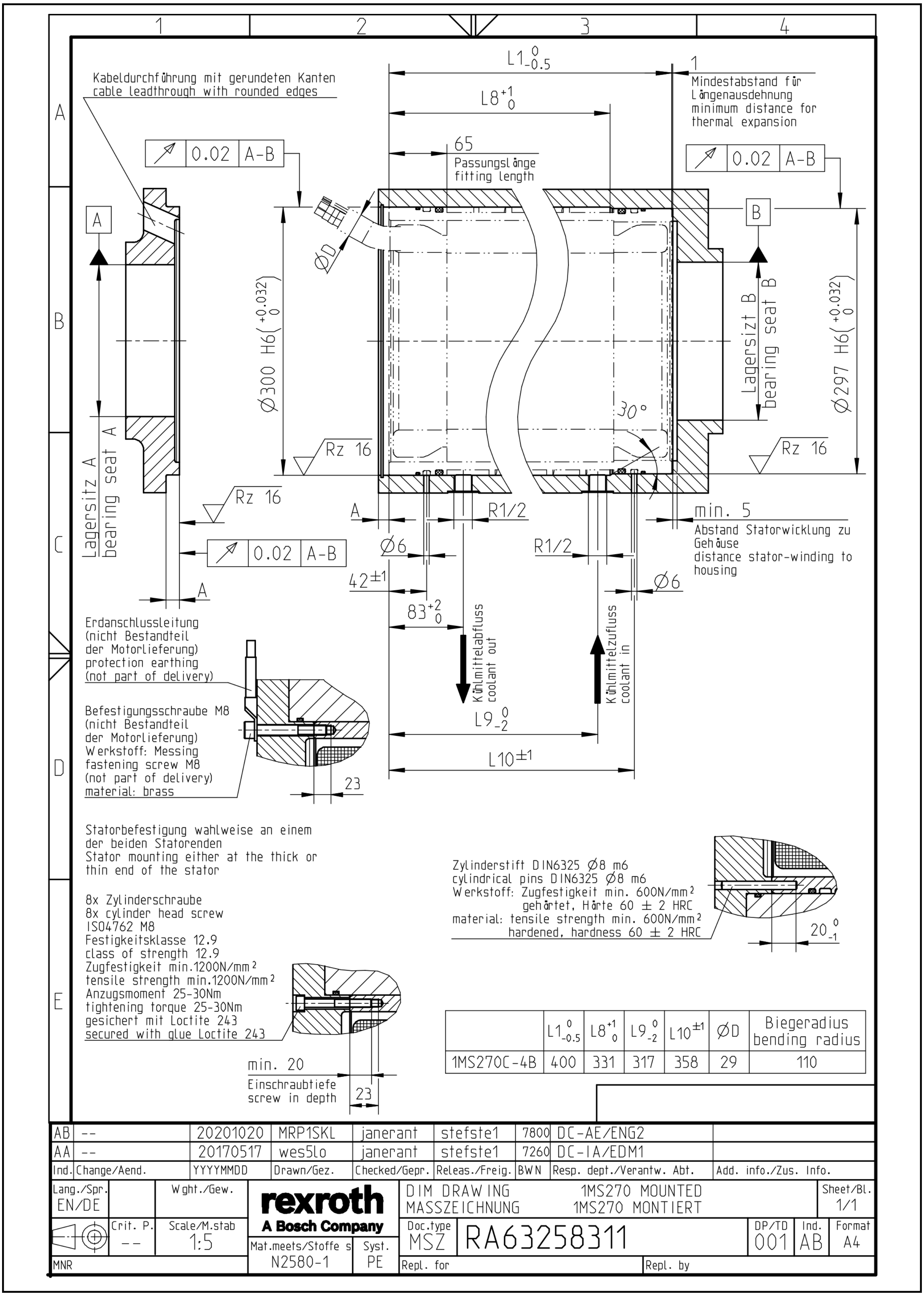


Fig. 5-39: Dimension sheet 1MS270

5.10 Stator 1MS270, mounted

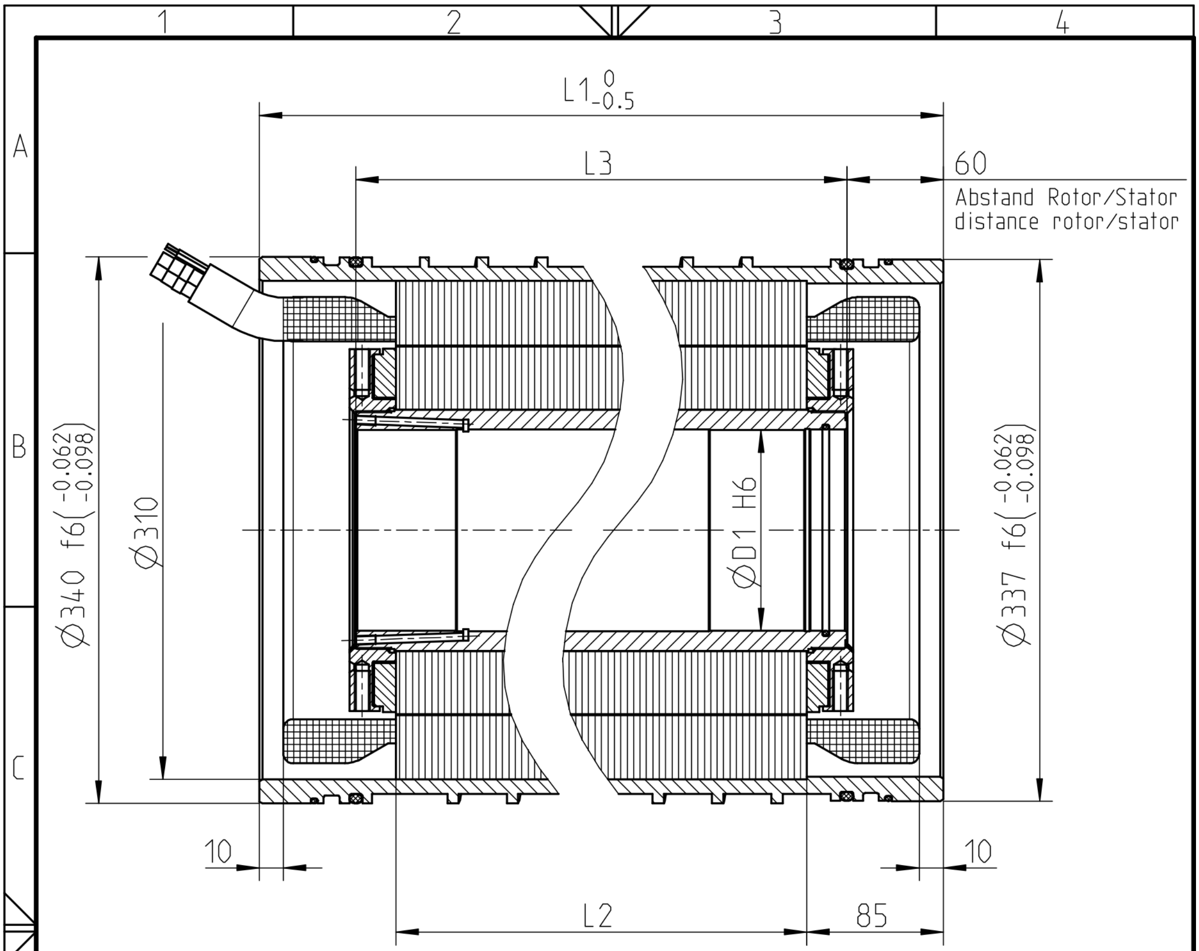


	L1 0/-0.5	L8 +1/0	L9 0/-2	L10 ±1	ØD	Biegeradius bending radius
1MS270C-4B	400	331	317	358	29	110

Fig. 5-40: Dimension sheet 1MS270, mounted

5.11 Frame size 1MB310

5.11.1 1MB310



	ØD1 H6						$L1^{0}_{-0.5}$	L2	L3
1MB310B							385	215	265
1MB310D	$94^{+0.022}_{0}$	$108^{+0.022}_{0}$	$112^{+0.022}_{0}$	$118^{+0.022}_{0}$	$120^{+0.022}_{0}$	$125^{+0.025}_{0}$	450	280	330
1MB310F							520	350	400

AA	--	20170531	wes5lo	janerant	stefste1	7260	DC-IA/EDM1	
Ind.	Change/Aend.	YYYYMMDD	Drawn/Gez.	Checked/Gepr.	Releas./Freig.	BWN	Resp. dept./Verantw. Abt.	Add. info./Zus. Info.

Lang./Spr. EN/DE | Wght./Gew. | rexroth A Bosch Company | DIM DRAWING 1MB310 / MASSZEICHNUNG 1MB310 | Sheet/Bl. 1/1

Crit. P. -- | Scale/M.stab 1:4 | Mat.meets/Stoffe s N2580-1 | Syst. PE | Doc.type MSZ | RA63477948 | DP/TD 001 | Ind. AA | Format A4

MNR | Repl. for | Repl. by

Fig. 5-41: Dimension sheets 1MB310

5.11.2 Rotor 1MR310

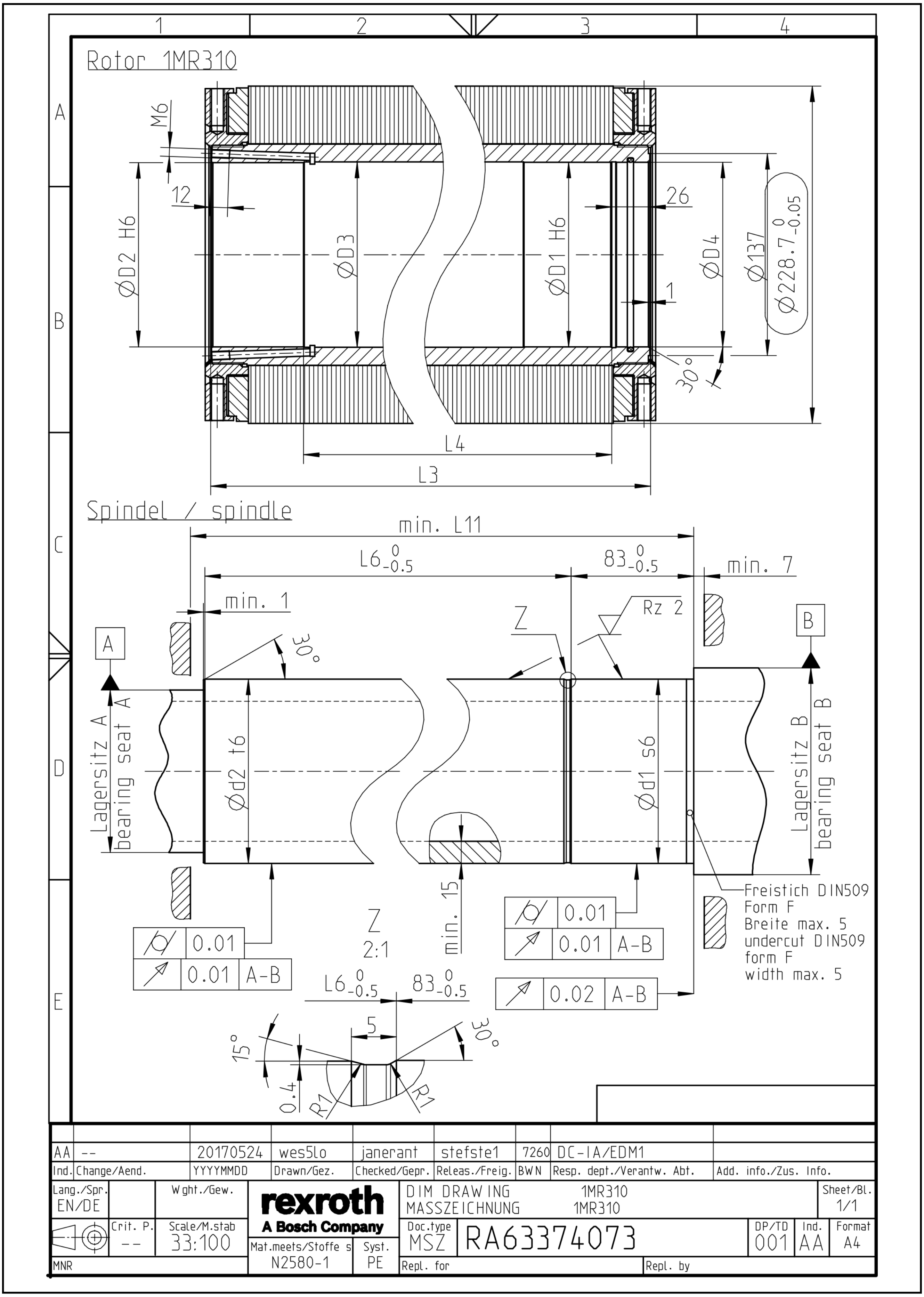
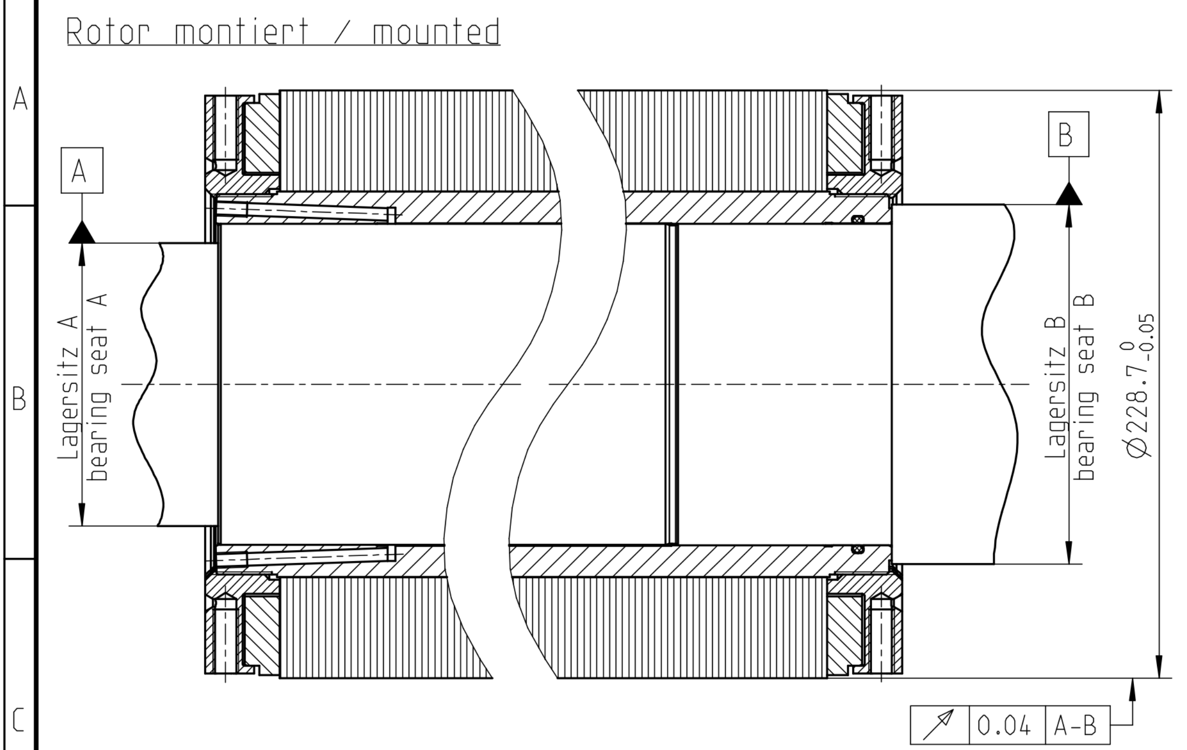


Fig. 5-42: Dimension sheet rotor 1MR310

5.11.3 Rotor 1MR310, mounted



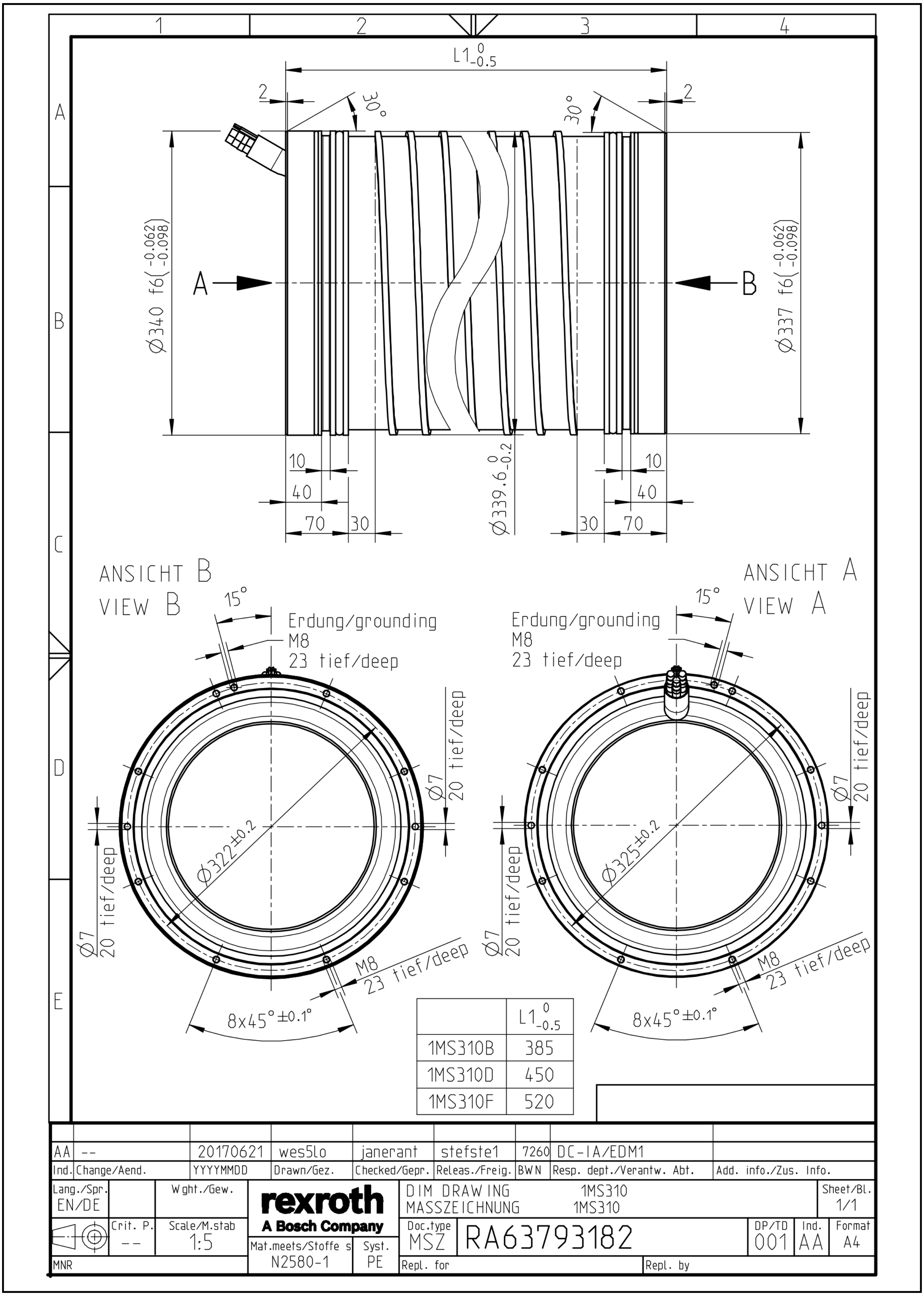
	ROTOR						SPINDEL SPINDLE			
	L3	L4	ØD1 H6	ØD2 H6	ØD3	ØD4	L6 $^{0}_{-0.5}$	Ød1 s6	Ød2 t6	L11
1MR310B-A094	265	177					180			min. 273
1MR310D-A094	330	242	$94^{+0.022}_{0}$	$93.8^{+0.022}_{0}$	94.5	94.2	245	$94^{+0.093}_{+0.071}$	$93.8^{+0.113}_{+0.091}$	min. 338
1MR310F-A094	400	312					315			min. 408
1MR310B-A108	265	177					180			min. 273
1MR310D-A108	330	242	$108^{+0.022}_{0}$	$107.8^{+0.022}_{0}$	108.5	108.2	245	$108^{+0.101}_{+0.079}$	$107.8^{+0.126}_{+0.104}$	min. 338
1MR310F-A108	400	312					315			min. 408
1MR310B-A112	265	177					180			min. 273
1MR310D-A112	330	242	$112^{+0.022}_{0}$	$111.8^{+0.022}_{0}$	112.5	112.2	245	$112^{+0.101}_{+0.079}$	$111.8^{+0.126}_{+0.104}$	min. 338
1MR310F-A112	400	312					315			min. 408
1MR310B-A118	265	177					180			min. 273
1MR310D-A118	330	242	$118^{+0.022}_{0}$	$117.8^{+0.022}_{0}$	119	118.2	245	$118^{+0.101}_{+0.079}$	$117.8^{+0.126}_{+0.104}$	min. 338
1MR310F-A118	400	312					315			min. 408
1MR310B-A120	265	177					180			min. 273
1MR310D-A120	330	242	$120^{+0.022}_{0}$	$119.8^{+0.022}_{0}$	120.5	120.2	245	$120^{+0.101}_{+0.079}$	$119.8^{+0.126}_{+0.104}$	min. 338
1MR310F-A120	400	312					315			min. 408
1MR310B-A125	265	177					180			min. 273
1MR310D-A125	330	242	$125^{+0.025}_{0}$	$124.8^{+0.025}_{0}$	125.5	125.2	245	$125^{+0.117}_{+0.092}$	$124.8^{+0.147}_{+0.122}$	min. 338
1MR310F-A125	400	312					315			min. 408

Ind.	Change/Aend.	YYYYMMDD	Drawn/Gez.	Checked/Gepr.	Releas./Freig.	BWN	Resp. dept./Verantw. Abt.	Add. info./Zus. Info.
AA	--	20170531	wes5lo	janerant	stefste1	7260	DC-IA/EDM1	

Lang./Spr. EN/DE
Wght./Gew.
rexroth A Bosch Company
DIM DRAWING 1MR310 MOUNTED
MASSZEICHNUNG 1MR310 MONTIERT
Sheet/Bl. 1/1
Crit. P. --
Scale/M.stab 2:5
Mat.meets/Stoffe s N2580-1
Syst. PE
Doc.type MSZ
RA63471625
DP/TD 001
Ind. AA
Format A4
MNR
Repl. for
Repl. by

Fig. 5-43: Dimension sheet 1MR310, mounted

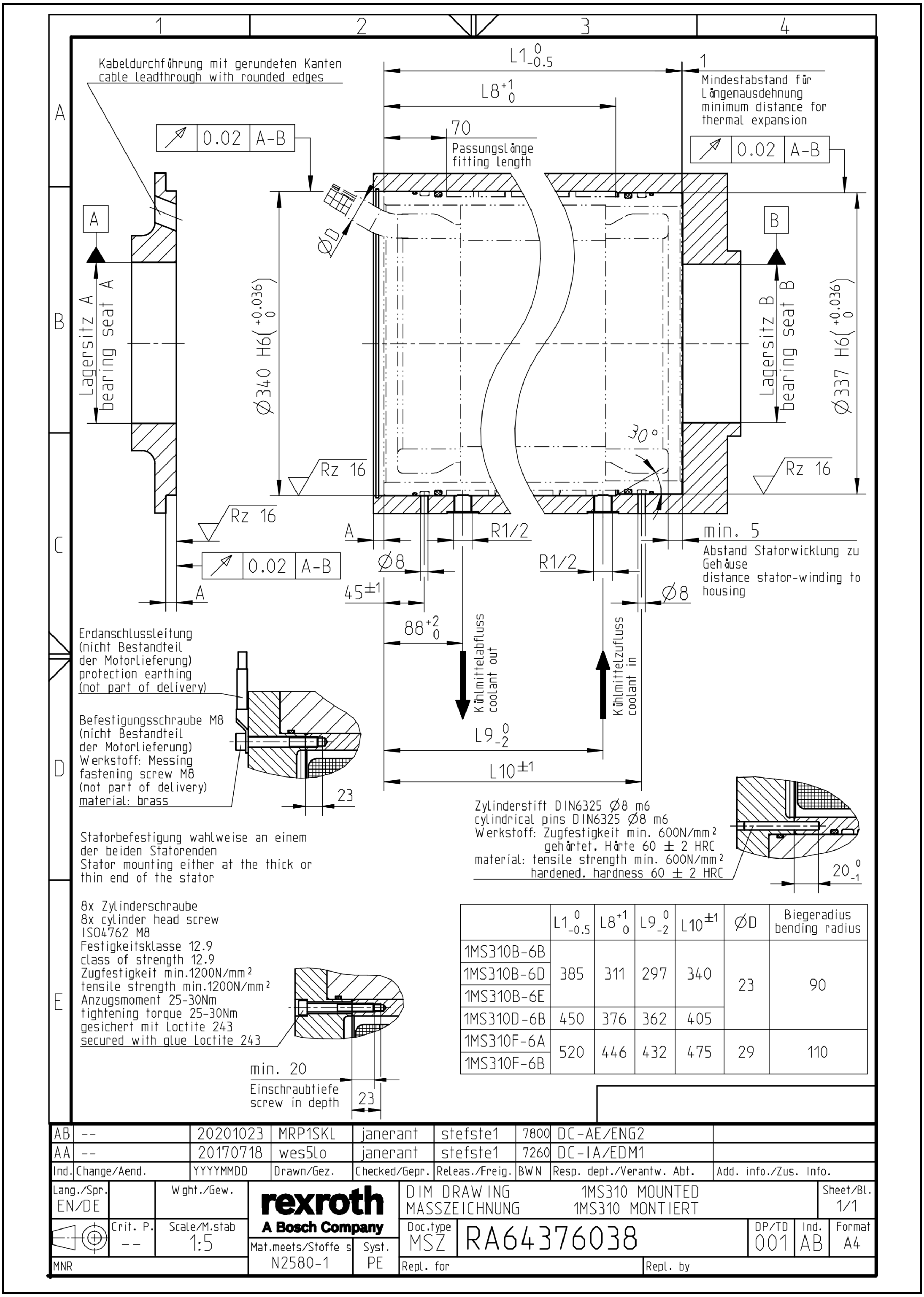
5.11.4 Stator 1MS310



	$L1_{-0.5}^{0}$
1MS310B	385
1MS310D	450
1MS310F	520

Fig. 5-44: Dimension sheet 1MS310

5.12 Stator 1MS310, mounted

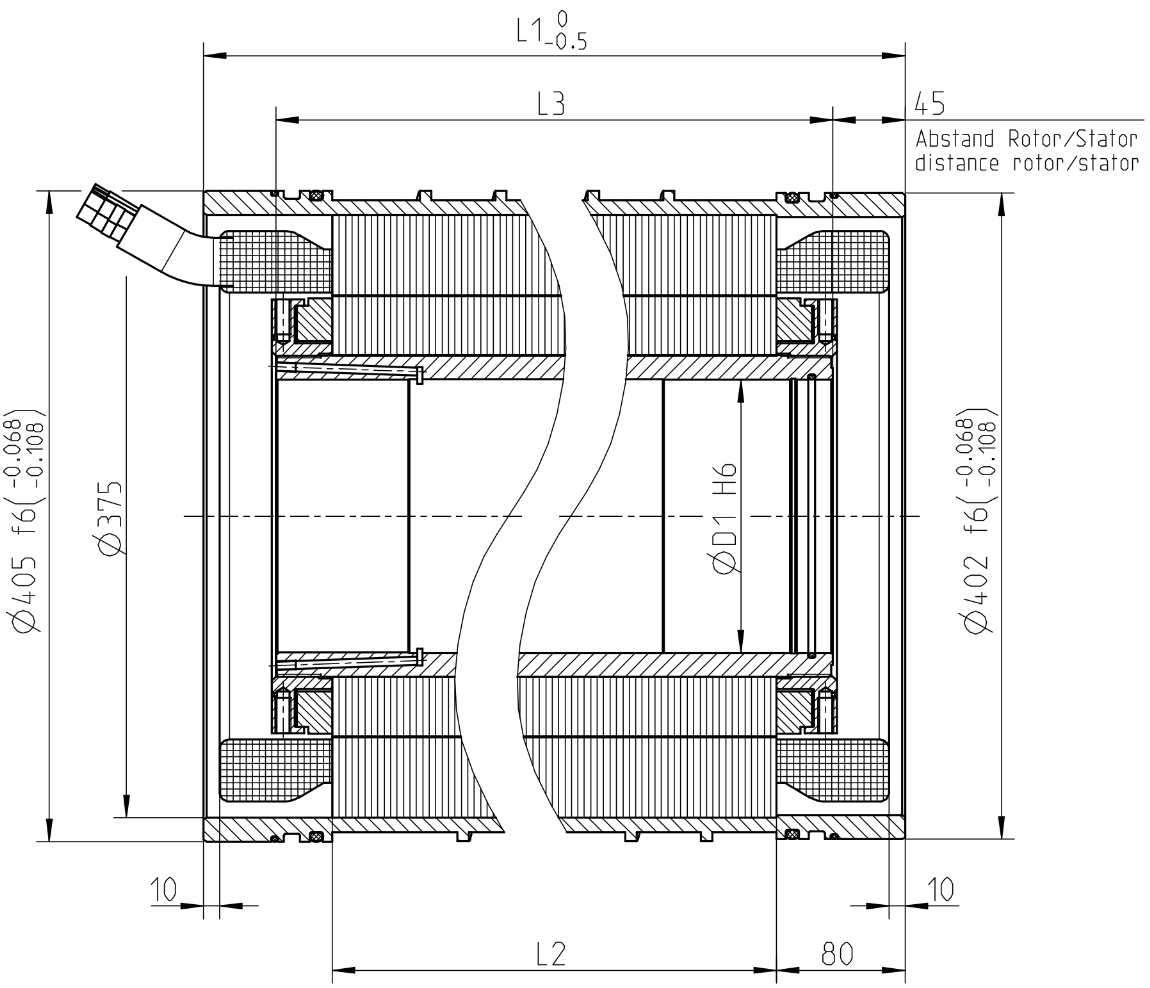


	L1 0/-0.5	L8 +1/0	L9 0/-2	L10 ±1	ØD	Biegeradius bending radius
1MS310B-6B	385	311	297	340	23	90
1MS310B-6D						
1MS310B-6E						
1MS310D-6B	450	376	362	405		
1MS310F-6A	520	446	432	475	29	110
1MS310F-6B						

Fig. 5-45: Dimension sheet 1MS310, mounted

5.13 Frame size 1MB375

5.13.1 1MB375



	ØD1 H6	$L1^{0}_{-0.5}$	L2	L3
1MB375B	$170^{+0.025}_{0}$	520	360	430
1MB375D		620	460	530

AA -- 20180613 wes5lo janerant stefste1 7260 DC-IA/EDM1
Ind. Change/Aend. YYYYMMDD Drawn/Gez. Checked/Gepr. Releas./Freig. BWN Resp. dept./Verantw. Abt. Add. info./Zus. Info.
Lang./Spr. EN/DE Wght./Gew. rexroth A Bosch Company DIM DRAWING 1MB375 MASSZEICHNUNG 1MB375 Sheet/Bl. 1/1
Crit. P. -- Scale/M.stab 1:4 Doc.type MSZ RA70406968 DP/TD 001 Ind. AA Format A4
MNR Mat.meets/Stoffe s N2580-1 Syst. PE Repl. for Repl. by

Fig. 5-46: Dimension sheet 1MB375

5.13.2 Rotor 1MR375

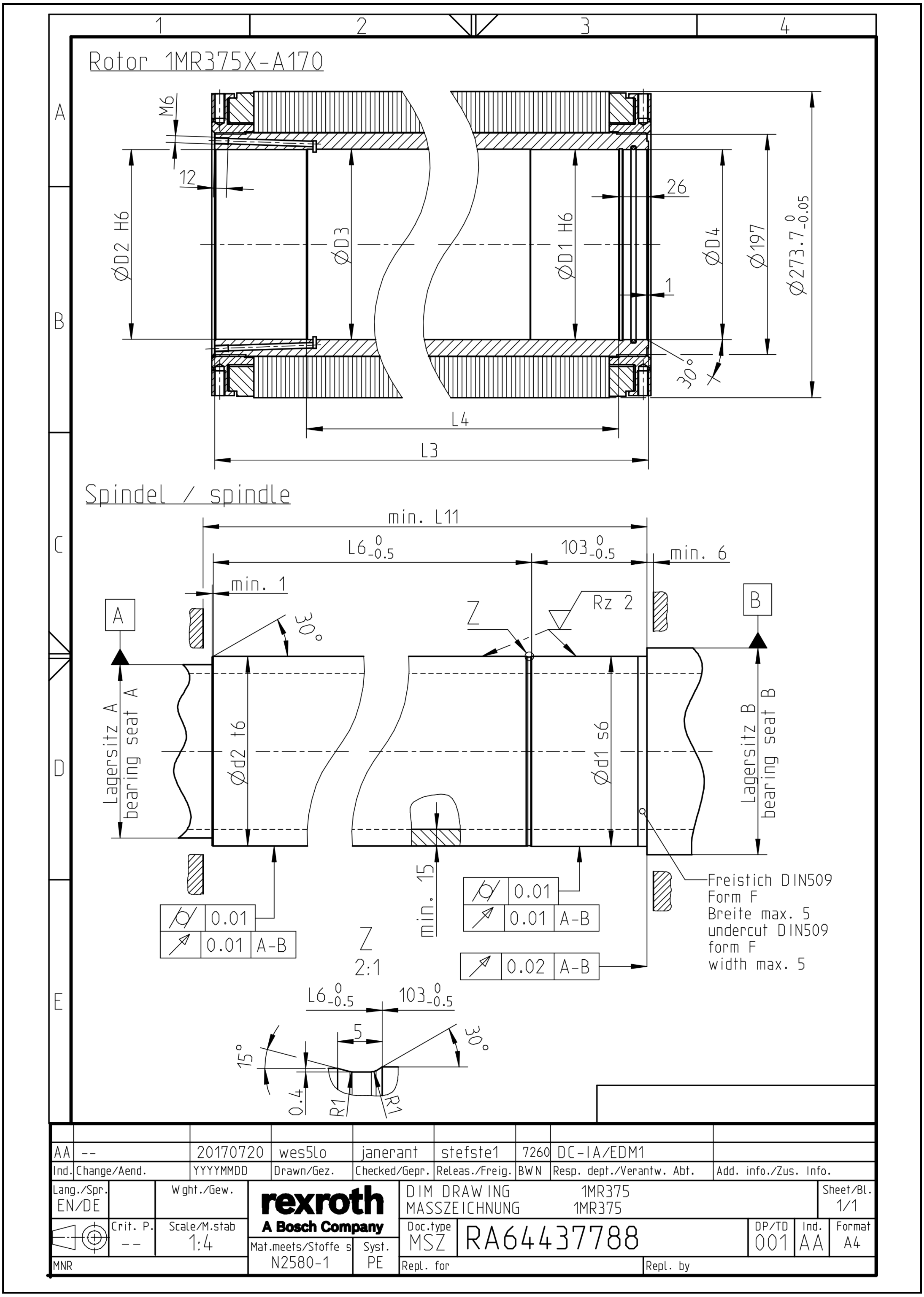
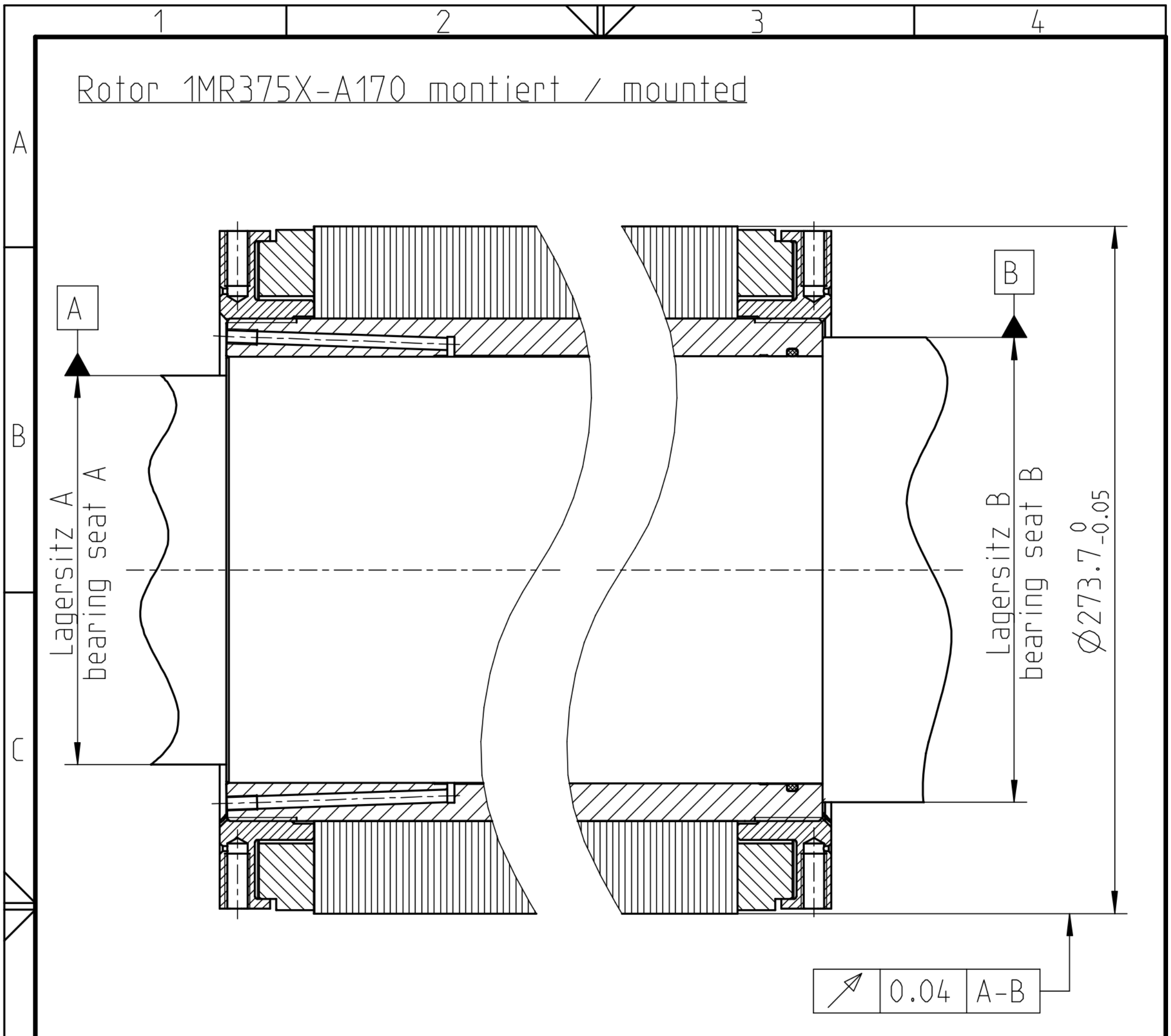


Fig. 5-47: Dimension sheet rotor 1MR375

5.13.3 Rotor 1MR375, mounted



	ROTOR						SPINDEL / SPINDLE			
	L3	L4	ØD1 H6	ØD2 H6	ØD3	ØD4	$L6_{-0.5}^{0}$	Ød1 s6	Ød2 t6	L11
1MR375B-A170	430	322	$170_{0}^{+0.025}$	$169.7_{0}^{+0.025}$	171	170.2	325	$170_{+0.108}^{+0.133}$	$169.7_{+0.146}^{+0.171}$	min. 437
1MR375D-A170	530	422					425			min. 537

AA	--	20170801	wes5lo	janerant	stefste1	7260	DC-IA/EDM1
Ind.	Change/Aend.	YYYYMMDD	Drawn/Gez.	Checked/Gepr.	Releas./Freig.	BWN	Resp. dept./Verantw. Abt. / Add. info./Zus. Info.

Lang./Spr. EN/DE; Wght./Gew.; rexroth A Bosch Company; DIM DRAWING / MASSZEICHNUNG; 1MR375 MOUNTED / 1MR375 MONTIERT; Sheet/Bl. 1/1

Crit. P. --; Scale/M.stab 2:5; Mat.meets/Stoffe s N2580-1; Syst. PE; Doc.type MSZ; RA64670612; DP/TD 001; Ind. AA; Format A4

MNR; Repl. for; Repl. by

Fig. 5-48: Dimension sheet 1MR375, mounted

5.13.4 Stator 1MS375

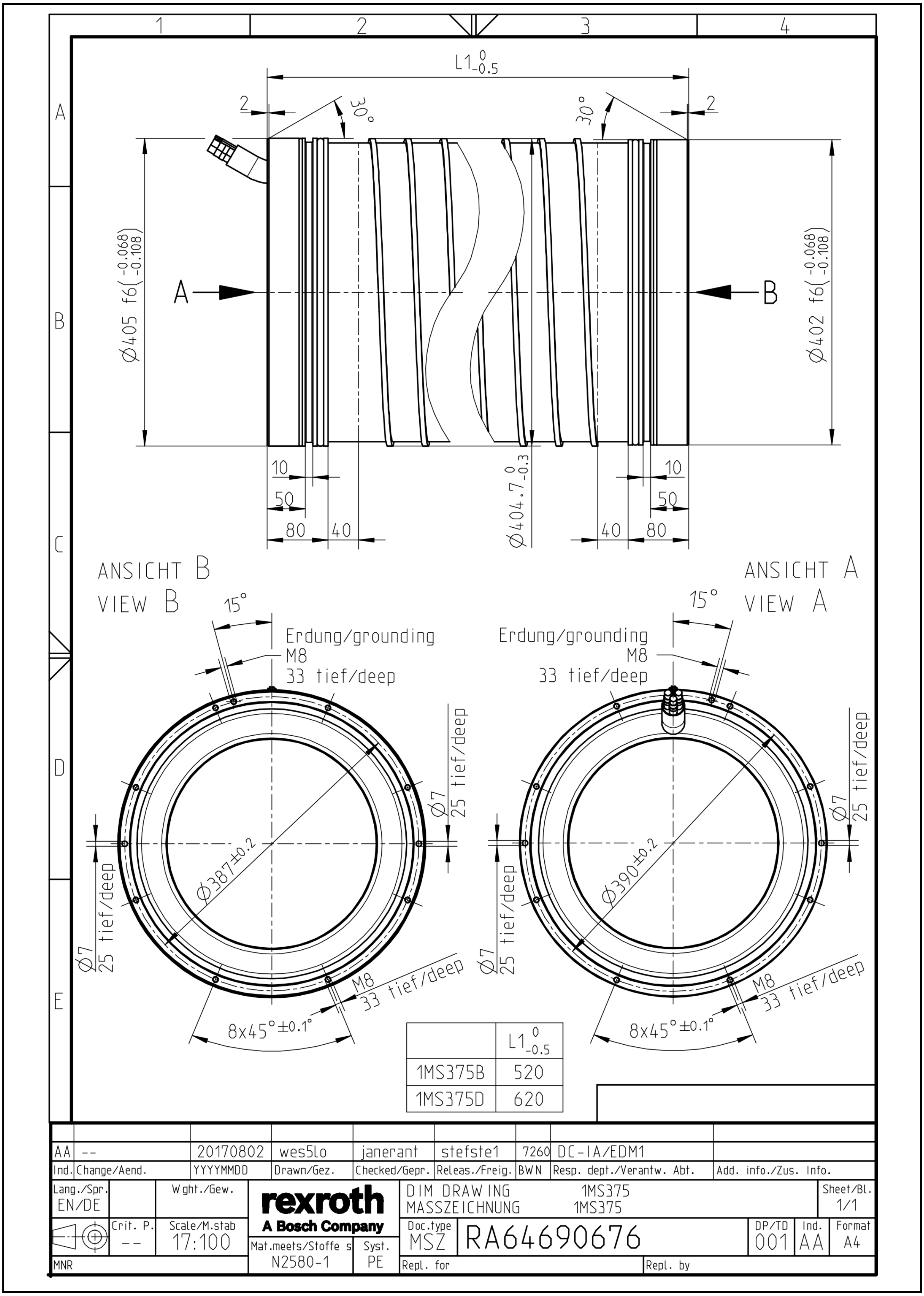
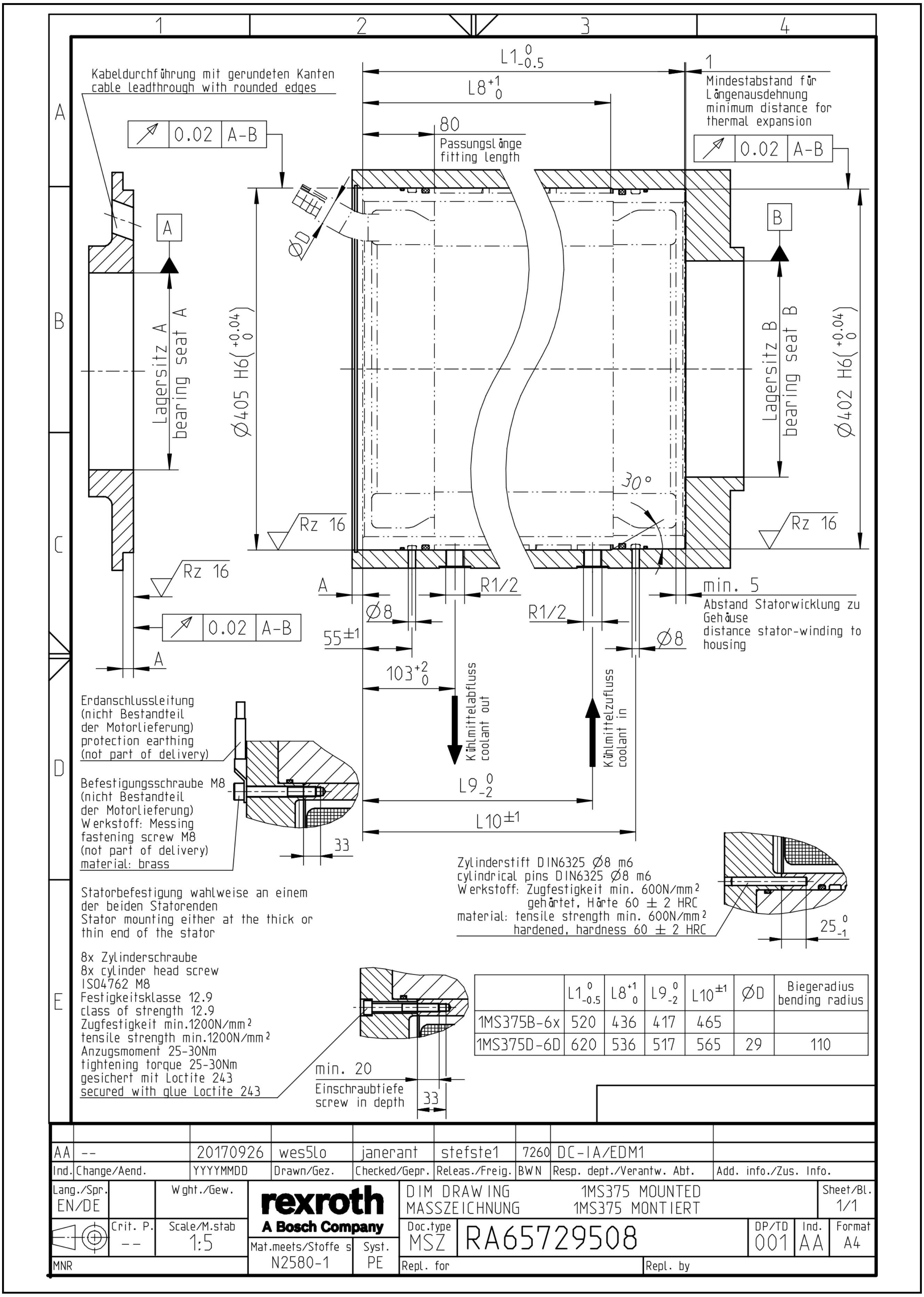


Fig. 5-49: Dimension sheet 1MS375

	L1 0/-0.5
1MS375B	520
1MS375D	620

5.13.5 Stator 1MS375, mounted



	$L1^{0}_{-0.5}$	$L8^{+1}_{0}$	$L9^{0}_{-2}$	$L10^{\pm1}$	ØD	Biegeradius bending radius
1MS375B-6x	520	436	417	465		
1MS375D-6D	620	536	517	565	29	110

Fig. 5-50: Dimension sheet 1MS375, mounted

5.14 Frame size 1MB376

5.14.1 1MB376

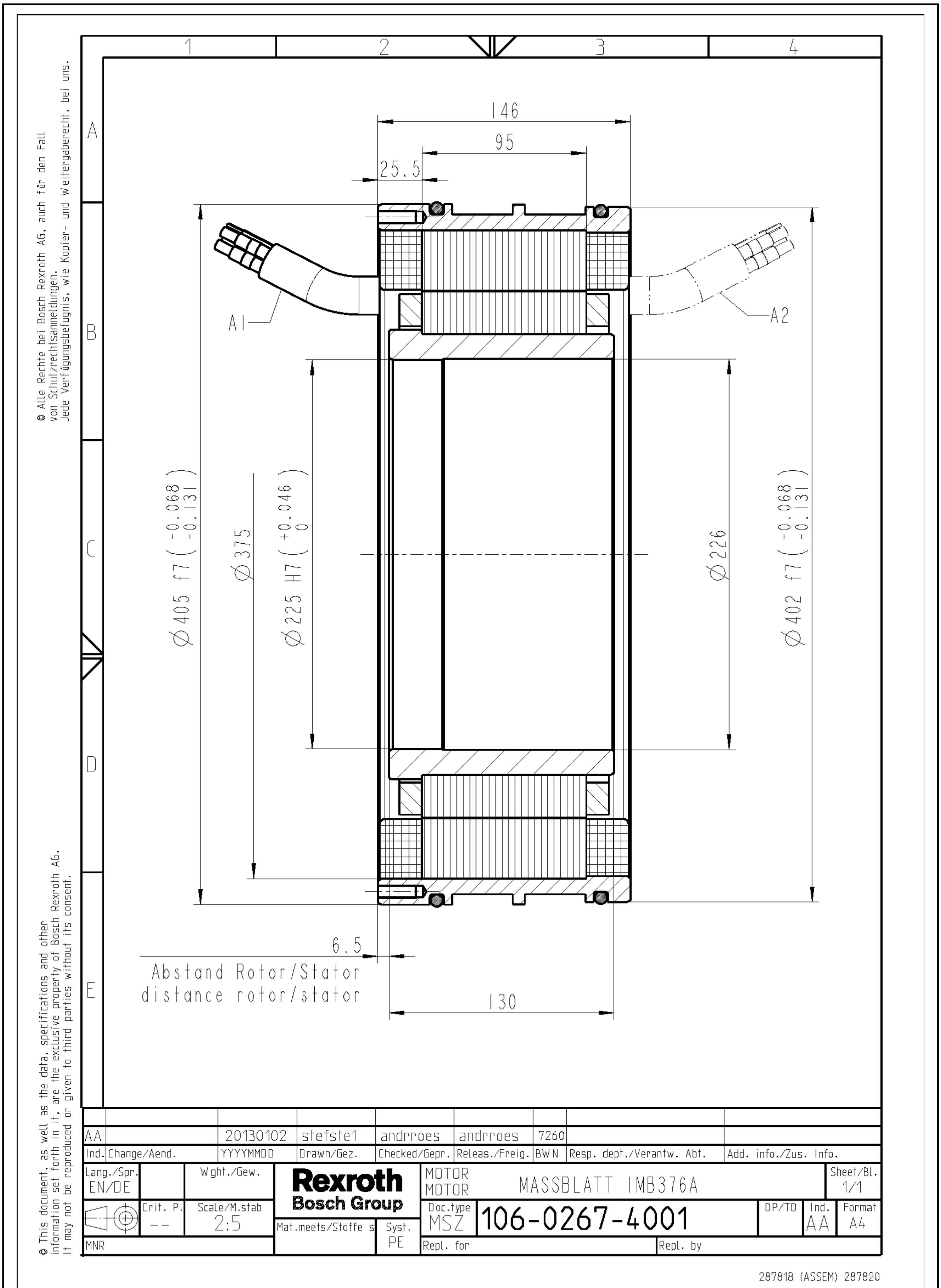


Fig. 5-51: Dimension sheet 1MB376

5.14.2 Rotor 1MR376

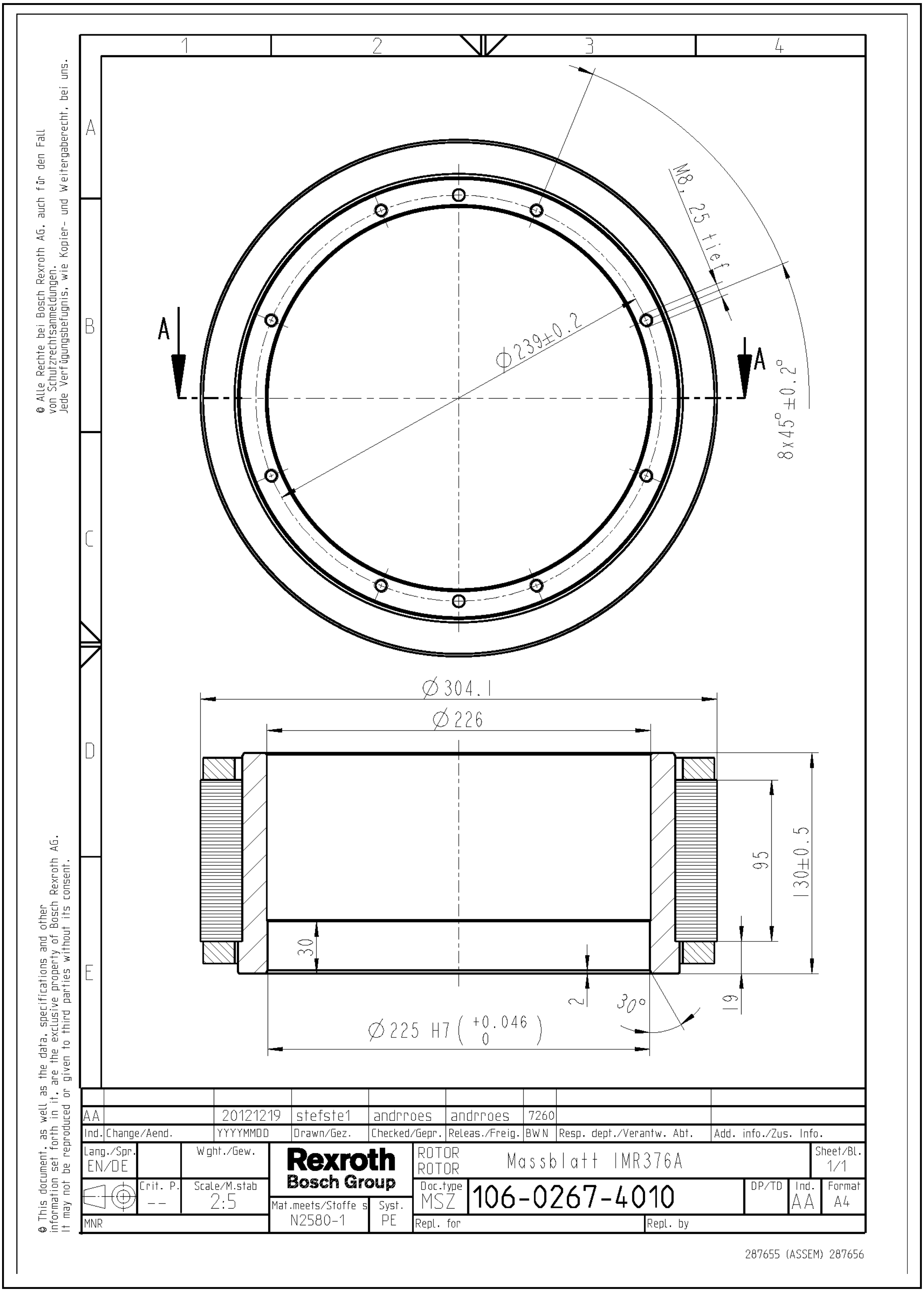


Fig. 5-52: Dimension sheet rotor 1MR376

5.14.3 Stator 1MS376

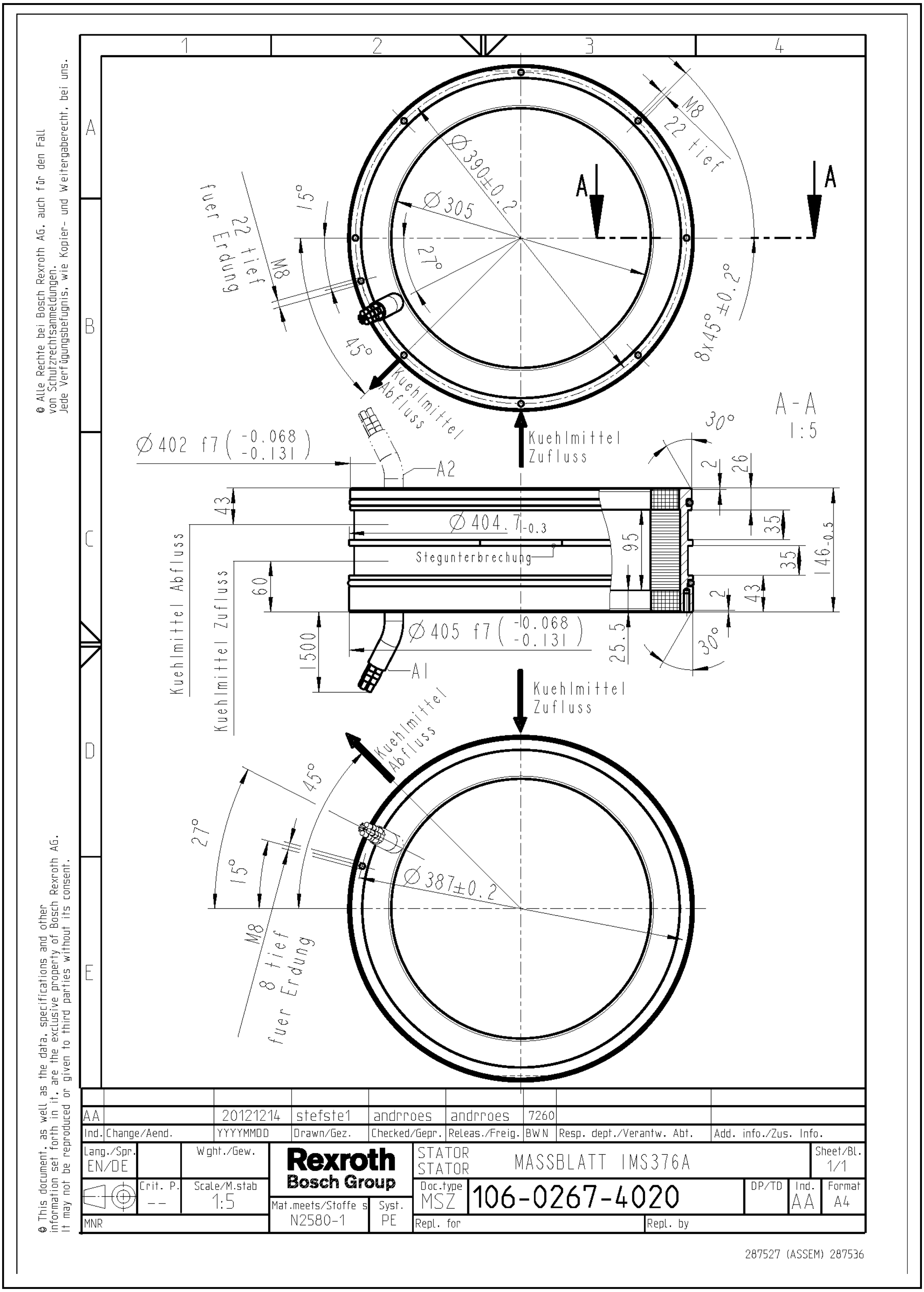


Fig. 5-53: Dimension sheet 1MS376

6 Product information

6.1 Type codes

6.1.1 General

The type code describes the available motor variants. The type code is the basis for selecting and ordering products from Bosch Rexroth. This applies to new products as well as to spare parts and repairs.

1MB motors of Rexroth consist of the components "stator" and "rotor". The type code is divided into “Type code stator 1MS..." and “Type code rotor 1MR...".

The following descriptions give an overview of the separate columns of the type code ("abbrev. column") and their meaning.

6.1.2 Type codes rotor 1MR

Product

Example: **1MR**□□□□-□□□□

1MR is the rotor of a asynchronous kit spindle motor of the 1MB series.

Frame size

Example: 1MR**140**□-□□□□

The frame size is derived from the mechanical motor dimensions and represents different power ranges.

Frame length

Example: 1MR140**B**-□□□□

Within a series, increasing motor frame length is graded by means of code letters. Frame lengths are, for example, B, C, D...

Rotor design

Example: 1MR140B-**A**□□□

The frame size denotes the condition of the rotor hole.

Option	Description
A	with step interference fit, rotor outer diameter completely processed
B	without rotor sleeve
C	with step interference fit, rotor outer diameter with measurement

Tab. 6-1: 1MR - Frame size

Inside rotor diameter

Example: 1MR140B-A**061**

Stands for the inside diameter of the rotor in millimeters (mm).

Notes

More important information about the handling of the type code can be found here. The information can comprise descriptions of footnotes or information on delivery options, for example.

6.1.3 Type code stator 1MS

Product
Example: **1MS**□□□□-□□-□□

1MS is the stator of an asynchronous kit spindle motor of the 1MB series.

Frame size
Example: 1MS**140**□-□□-□□

The frame size is derived from the mechanical motor dimensions and represents different power ranges.

Frame length
Example: 1MS**140**□-□□-□□

Within a series, increasing stator frame length is graded by means of code letters. The torque increases with increasing frame length while the nominal velocity decreases. Frame lengths are, for example, B, C, D...

Winding
Example: 1MS140B-**4A**-□□

The winding code, e.g. 4A, 4B, 6A..., is to differentiate the winding variants.

The reference value is a DC bus voltage of 540 V_{DC}.

Stator designs
Example: 1MS140B-4A-**A**□

1MS stators are generally fitted with a stator-cooling jacket for operation with liquid cooling.

Option	Design	Detail
A	Aluminum cooling jacket in the housing	Standard cooling mode is liquid cooling

Tab. 6-2: 1MS Stator design

Electrical connection
Example: 1MS140B-4A-A**1**

Option	Description
1	Connection cables (length 1.5m) coming out radially on stator side with larger outside diameter.
2	Connection cables (length 1.5m) on stator side with smaller outside diameter.

Tab. 6-3: 1MS Electrical connection

Other designs
Example: 1MS140B-4A-A1**/S010**

Reserved for optional designs.

Option	Description
-	This field is not required for standard stators
/S010	1MS stators in S010 design are equipped with special hot conductors, PTC thermistors and bimetal for temperature monitoring. This version is suitable for various third-party drive controllers.

Tab. 6-4: 1MS Other design

Notes
More important information about the handling of the type code can be found here. The information can comprise descriptions of footnotes or information on delivery options, for example

6.2 Type code frame size 105

6.2.1 Rotor 1MR105

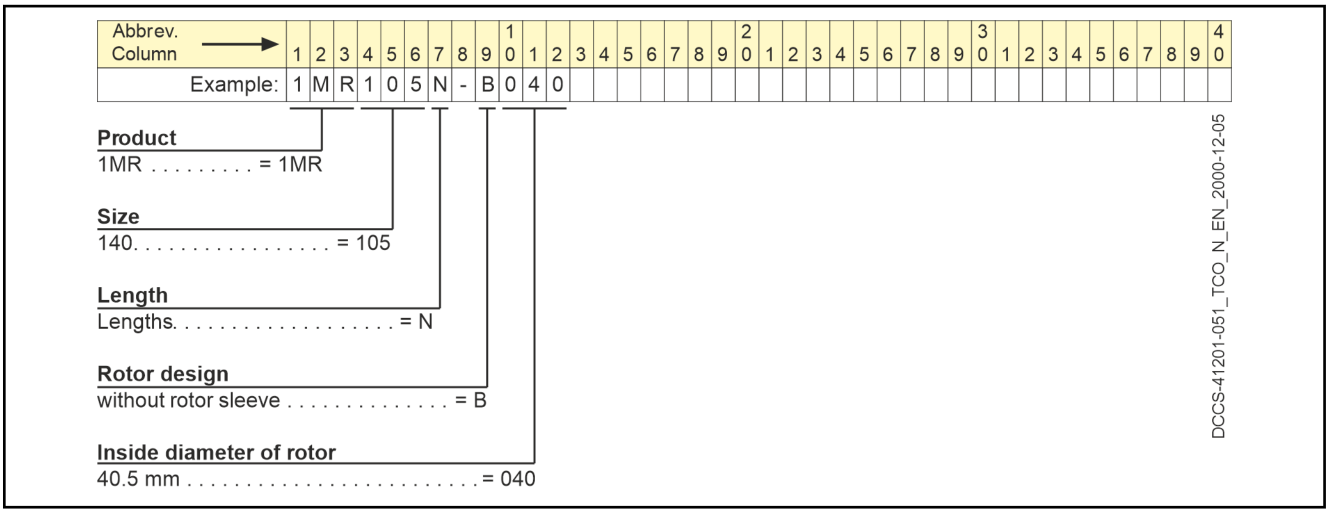


Fig. 6-1: Type code rotor 1MR105

6.2.2 Stator 1MS105

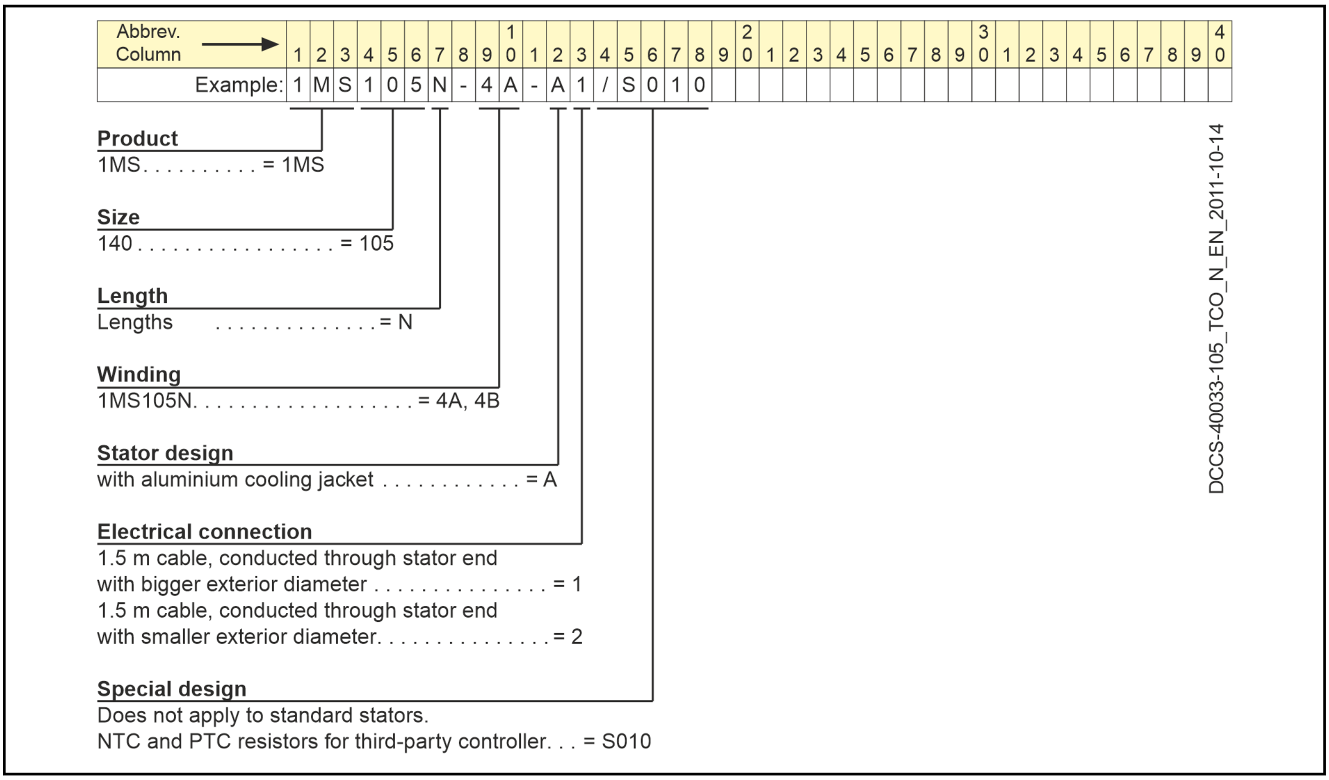


Fig. 6-2: Type code stator 1MS105

6.3 Type code frame size 140

6.3.1 Rotor 1MR140

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

1. Product
1.1 1MR . . . . = 1MR

2. Motor frame size
2.1 140. . . . . = 140

3. Motor frame lengths
3.1 Frame lengths. . . . . = B, D, F, H

4. Rotor design
4.1 with step interference fit. . . . . = A

5. Inside diameter of rotor
5.1 45 mm . . . . = 045

DCCS-40044-140_TCO_N_DE_2019-10-16

Fig. 6-3: Type code rotor 1MR140

6.3.2 Stator 1MS140

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

1. **Product**
1.1 1MS . . . . = 1MS

2. **Motor frame size**
2.1 140 . . . . = 140

3. **Motor frame lengths**
3.1 Frame lengths . . . . = B, D, F, H

4. **Winding designations**
4.1 1MS140B . . . . = 4A, 4B
4.2 1MS140D . . . . = 4B
4.3 1MS140F . . . . = 4A
4.4 1MS140H . . . . = 4B

5. **Stator design**
5.1 With aluminum jacket . . . . = A

6. **Electrical connection**
6.1 Cable 1.5 m, lead out at stator side with bigger outer diameter . . . . = 1
6.2 Cable 1.5 m, lead out at stator side with smaller outer diameter . . . . = 2

7. **Special design**
7.1 This field is omitted for standard stators
7.2 PTC and NTC for foreign controllers = S010

DCCS-41201-402_TCO_N_DE_2001-10-04

Fig. 6-4: Type code stator 1MS140

6.4 Type code frame size 160

6.4.1 Rotor 1MR160

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:	1	M	R	1	6	0	D	-	A	0	4	0																												

1. **Product group**
1.1 1MR .... = 1MR

2. **Motor size**
2.1 160 .... = 160

3. **Motor length** ①
3.1 Lengths .... = B, D, E, F, H, N

4. **Rotor design**
4.1 step interference fit, finished .... = A
4.2 step interference fit, with allowancer = C ②

5. **Inside diameter of rotor** ①
5.1 40.0 mm .... = 040
5.2 55.0 mm .... = 055
5.3 60.0 mm .... = 060
5.4 60.3 mm .... = 061

Note:
① Motor length "B" is only a vailab le with inside diameter of rotor "055" and "060"
Motor length "E" is only a vailab le with inside diameter of rotor "060"
Motor lengths "H" and "N" are only available with inside diameter of rotor "060" and "061"
② Rotor type "C" is only a vailab le with motor lengths"F", "H" and "N"

DCCS-41201-602_TCO_N_DE_2000-12-06

Fig. 6-5: Type code rotor 1MR160

6.4.2 Stator 1MS160

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:	1	M	S	1	6	0	D	-	4	A	-	A	1	/	S	0	1	0																						

1. **Product**
1.1 1MS .... = 1MS

2. **Motor size**
2.1 160 .... = 160

3. **Motor length**
3.1 Lengths .... = B, D, E, F, H, N

4. **Windings code**
4.1 1MS160B .... = 4A
4.2 1MS160D .... = 4A, 4B
4.3 1MS160E .... = 4B
4.4 1MS160F .... = 4A, 4B, 4D
4.5 1MS160H .... = 4A
4.6 1MS160N .... = 4A, 4B, 4C

5. **Stator design**
5.1 with aluminum cooling jacket .... = A

6. **Electrical connection**
6.1 1.5 m cable, conducted through stator end with bigger exterior diameter .... = 1
6.2 1.5 m cable, conducted through stator end with smaller exterior diameter .... = 2

7. **Special design**
7.1 Does not apply to standard stators
7.2 NTC and PTC resistors for third-party controllers. . . .= S010

DCCS-41201-602_TCO_N_EN_2000-12-06

Fig. 6-6: Type code stator 1MS160

6.5 Type code frame size 200

6.5.1 Rotor 1MR200

Abbre v. 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:	1	M	R	2	0	0	D	-	A	0	6	0																												

1. **Product group**
1.1 1MR . . . . = 1MR

2. **Motor size**
2.1 200 . . . . = 200

3. **Motor length**
3.1 Lengths. . . . . = C, D, E, H

4. **Rotor design**
4.1 step interference fit . . . . = A

5. **Inside diameter of rotor**
5.1 60 mm . . . . = 060
5.2 66 mm . . . . = 066

DCCS-41202-001_TCO_N_EN_2000-12-07

Fig. 6-7: Type code rotor 1MR200

6.5.2 Stator 1MS200

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:	1	M	S	2	0	0	E	-	4	B	-	A	1	/	S	0	1	0																						

1. **Product**
1.1 1MS. . . . . = 1MS

2. **Motor size**
2.1 200 . . . . = 200

3. **Motor length**
3.1 Lengths . . . . = C, D, E, H

4. **Windings code**
4.1 1MS200C. . . . . = 4A
4.2 1MS200D. . . . . = 4B, 4C, 4D, 4E, 4F
4.3 1MS200E. . . . . = 4B, 4C
4.4 1MS200H. . . . . = 4B, 4D

5. **Stator design**
5.1 with aluminum cooling jacket. . . . . = A

6. **Electrical connection**
6.1 1.5 m cable, conducted through stator end with bigger exterior diameter. . . . . = 1
6.2 1.5 m cable, conducted through stator end with smaller exterior diameter . . . . = 2

7. **Special design**
7.1 Does not apply to standard stators
7.2 NTC and PTC resistors for third-party controllers. . . .= S010

DCCS-41202-002_TCO_N_EN_2001-09-04

Fig. 6-8: Type code stator 1MS200

6.6 Type code frame size 240

6.6.1 Rotor 1MR240

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:	1	M	R	2	4	0	H	-	A	0	7	2																												

1. **Product group**
1.1 1MR . . . . = 1MR

2. **Motor size**
2.1 240 . . . . = 240

3. **Motor length** ①
3.1 Lengths . . . . = B, F, H

4. **Rotor design**
4.1 with step interference fit . . . . = A

5. **Inside diameter of rotor** ①
5.1 72 mm . . . . = 072
5.2 87 mm . . . . = 087

Note:
① Motor length "B" is only available with inside diameter of rotor "072"
Motor length "F" is only available with inside diameter of rotor "087"

DCCS-41202-401_TCO_N_EN_2000-12-06

Fig. 6-9: Type code rotor 1MR240

6.6.2 Stator 1MS240

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:	1	M	S	2	4	0	F	-	4	A	-	A	1	/	S	0	1	0																						

1. **Product**
1.1 1MS . . . . = 1MS

2. **Motor size**
2.1 240 . . . . = 240

3. **Motor length**
3.1 Lengths . . . . = B, F, H

4. **Windings code**
4.1 1MS240B . . . . = 4A
4.2 1MS240F . . . . = 4A
4.3 1MS240H . . . . = 4B

5. **Stator design**
5.1 with aluminum cooling jacket . . . . = A

6. **Electrical connection**
6.1 1.5 m cable, conducted through stator end with bigger exterior diameter . . . . = 1
6.2 1.5 m cable, conducted through stator end with smaller exterior diameter . . . . = 2

7. **Special design**
7.1 Does not apply to standard stators.
7.2 NTC and PTC resistors for third-party controllers. . . .= S010

DCCS-41202-402_TCO_N_EN_2000-12-06

Fig. 6-10: Type code stator 1MS240

6.7 Type code frame size 241

6.7.1 Rotor 1MR241

Typ short-description	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
Beispiel:	1	M	R	2	4	1	H	-	A	1	1	1																												

1. **Product**
1.1 1MR . . . . = 1MR

2. **Motor size**
2.1 241 . . . . = 241

3. **Motor length**
3.1 Length . . . . = C, D, H

4. **Rotor design**
4.1 mit Stufenpressverband. . . . . = A

5. **Inside diameter of rotor**
5.1 66 mm . . . . = 066
5.2 98 mm . . . . = 098
5.3 111 mm . . . . = 111

DCCS-40032-241_TCO_N_EN_2020-12-04

Fig. 6-11: Type code rotor 1MR241

6.7.2 Stator 1MS241

Typ short-description	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:	1	M	S	2	4	1	H	-	6	D	-	A	1	/	S	0	1	0																						

1. Product
1.1 1MS. . . . . = 1MS

2. Motor size
2.1 241 . . . . = 241

3. Motor length
3.1 Length . . . . = C, D, H

4. Winding code
4.1 1MS241C . . . . = 6B
4.1 1MS241D. . . . . = 6A, 6C, 6D
4.2 1MS241H. . . . . = 6C, 6D

5. Stator design
5.1 with aluminium cooling jacket . . . . = A

6. Elektrical connection
6.1 1,5 m cable, conducted through stator end with bigger exterior diameter . . . .= 1
6.2 1,5 m cable, conducted through stator end with smaller exterior diameter . . . .= 2

7. Special design
7.1 Doest not apply to standard stators.
7.2 NTC and PTC resistor for third-party controllers = S010

DCCS-40033-241_TCO_N-EN_fs

Fig. 6-12: Type code stator 1MS241

6.8 Type code frame size 242

6.8.1 Rotor 1MR242

Abbre v. 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:	1	M	R	2	4	2	N	-	A	0	7	1																												

1. Product group
1.1 1MR. . . . . = 1MR

2. Motor size
2.1 242 . . . . = 242

3. Motor length
3.1 Length . . . . = N

4. Rotor type
4.1 step interference fit, finished. . . . . = A
4.2 step interference fit, with allowancer. . = C

5. Inside diameter of rotor
5.1 71 mm . . . . = 071

DCCS-41202-421_TCO_N_EN_2000-06-15

Fig. 6-13: Type code rotor 1MR242

6.8.2 Stator 1MS242

Abbr ev. 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:	1	M	S	2	4	2	N	-	4	B	-	A	1	/	S	0	1	0																						

1. Product
1.1 1MS . . . . = 1MS

2. Motor size
2.1 242 . . . . = 242

3. Motor length
3.1 Length . . . . = N

4. Windings code
4.1 1MS242N. . . . . = 4B

5. Stator design
5.1 with aluminum cooling jacket . . . . = A

6. Electrical connection
6.1 1.5 m cable, conducted through stator end with bigger exterior diameter . . . . = 1
6.2 1.5 m cable, conducted through stator end with smaller exterior diameter. . . . . = 2

7. Special design
7.1 Does not apply to standard stators.
7.2 NTC and PTC resistors for third-party controllers . . . . = S010

DCCS-41202-422_TCO_N_EN_2001-09-28

Fig. 6-14: Type code stator 1MS242

6.9 Type code frame size 270

6.9.1 Rotor 1MR270

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:	1	M	R	2	7	0	C	-	A	1	2	0																												

1. Product group
1.1 1MR . . . . = 1MR

2. Motor size
2.1 270 . . . . = 270

3. Motor length
3.1 Length . . . . = C

4. Rotor type
4.1 with step interference fit . . . . = A

5. Inside diameter of rotor
5.1 90 mm . . . . = 090
5.2 120 mm . . . . = 120

DCCS-41202-701_TCO_N_EN_2000-06-02

Fig. 6-15: Type code rotor 1MR270

6.9.2 Stator 1MS270

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:	1	M	S	2	7	0	C	-	4	B	-	A	1	/	S	0	1	0																						

1. Product
1.1 1MS . . . . = 1MS

2. Motor size
2.1 270 . . . . = 270

3. Motor length
3.1 Length . . . . = C

4. Windings code
4.1 1MS270C . . . . = 4B

5. Stator design
5.1 with aluminum cooling jacket . . . . = A

6. Electrical connection
6.1 1.5 m cable, conducted through stator end with bigger exterior diameter . . . . = 1
6.2 1.5 m cable, conducted through stator end with smaller exterior diameter. . . . . = 2

7. Special design
7.1 Does not apply to standard stators.
7.2 NTC and PTC resistors for third-party controllers. . . = S010

DCCS-41202-702_TCO_N_EN_2001-09-28

Fig. 6-16: Type code stator 1MS270

6.10 Type code frame size 310

6.10.1 Rotor 1MR310

Abbre v. 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:	1	M	R	3	1	0	D	-	A	0	9	4																												

1. Product group
1.1 1MR . . . . = 1MR

2. Motor size
2.1 310 . . . . = 310

3. Motor length ①
3.1 Lengths. . . . . = B, D, F

4. Rotor design
4.1 with step interference fit . . . . = A

5. Inside diameter of rotor ①
5.1 94 mm . . . . = 094
5.2 108 mm . . . . = 108
5.3 112 mm . . . . = 112
5.4 118 mm . . . . = 118
5.5 120 mm . . . . = 120
5.6 125 mm . . . . = 125

Note:
① Motor length "B" is not available with inside diameter of rotor "118" and "125"
Motor length "D" is not available with inside diameter of rotor "118"
Motor length "F" is not available with inside diameter of rotor "120"

DCCS-41203-101_TCO_N_EN_2000-12-06

Fig. 6-17: Type code rotor 1MR310

6.10.2 Stator 1MS310

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:	1	M	S	3	1	0	B	-	6	B	-	A	2	/	S	0	1	0																						

1. Product
1.1 1MS. . . . . = 1MS

2. Motor size
2.1 310 . . . . = 310

3. Motor length
3.1 Lengths . . . . = B, D, F

4. Windings code
4.1 1MS310B. . . . . = 6B, 6D, 6E
4.2 1MS310D. . . . . = 6B
4.3 1MS310F. . . . . = 6A, 6B

5. Stator design
5.1 with aluminum cooling jacket . . . . = A

6. Electrical connection
6.1 1.5 m cable, conducted through stator end with bigger exterior diameter . . . . = 1
6.2 1.5 m cable, conducted through stator end with smaller exterior diameter. . . . . = 2

7. Special design
7.1 Does not apply to standard stators.
7.2 NTC and PTC resistors for third-party controllers. . . . = S010

DCCS-41203-102_TCO_N_EN_1999-11-24

Fig. 6-18: Type code stator 1MS310

6.11 Type code frame size 375

6.11.1 Rotor 1MR375

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:	1	M	R	3	7	5	B	-	A	1	7	0																												

1. Product group
   1.1 1MR. . . . . = 1MR

2. Motor size
   2.1 375 . . . . = 375

3. Motor length ①
   3.1 Lengths . . . . = B, D

4. Rotor design
   4.1 with step interference fit. . . . . = A

5. Inside diameter of rotor
   5.1 170 mm . . . . = 170

Note:
① Motor length "B" is only available with rotor design "A" and inside diameter of rotor "170"

DCCS-40032-375_TCO_N_EN_2020-07-23

Fig. 6-19: Type code rotor 1MR375

6.11.2 Stator 1MS375

Abbre v. 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:	1	M	S	3	7	5	D	-	6	D	-	A	1	/	S	0	1	0																						

1. Product
   1.1 1MS . . . . = 1MS

2. Motor size
   2.1 375 . . . . = 375

3. Motor length
   3.1 Lengths . . . . = B, D

4. Windings code
   4.1 1MS375D. . . . . = 6D

5. Stator design
   5.1 with aluminum cooling jacket . . . . = A

6. Electrical connection
   6.1 1.5 m cable, conducted through stator end with bigger exterior diameter. . . . . = 1
   6.2 1.5 m cable, conducted through stator end with smaller exterior diameter. . . . . = 2

7. Special design
   7.1 Does not apply to standard stators.
   7.2 NTC and PTC resistors for third-party controllers. . . = S010

DCCS-40033-375_TCO_N_EN_2020-08-04

Fig. 6-20: Type code stator 1MS375

6.12 Type code frame size 376

6.12.1 Rotor 1MR376

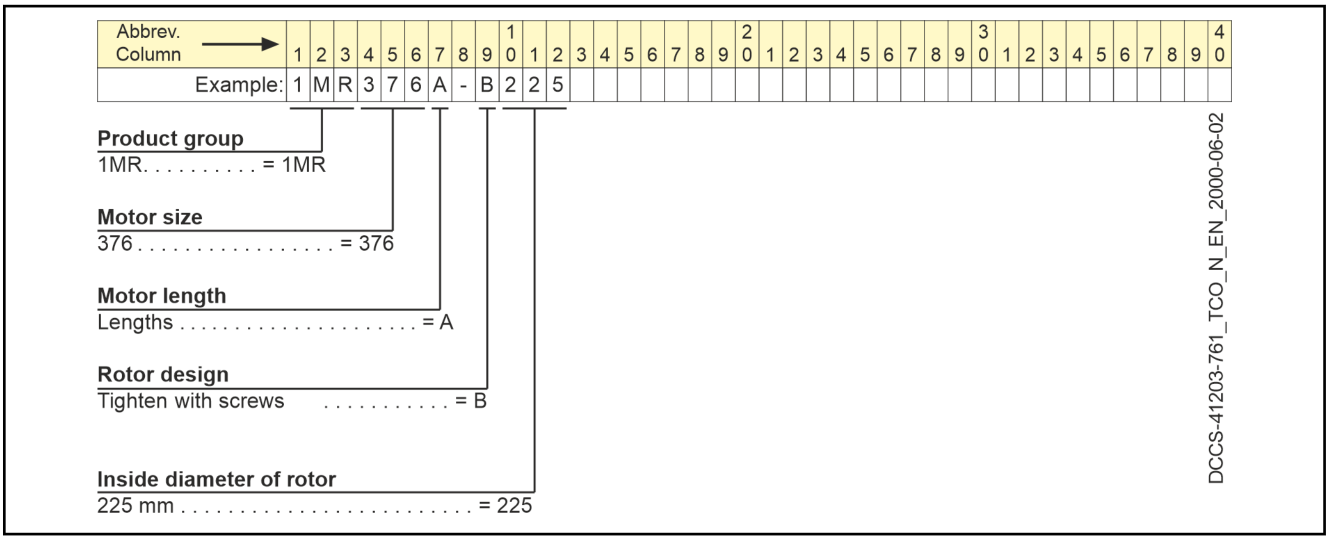


Fig. 6-21: Type code rotor 1MR376

6.12.2 Stator 1MS376

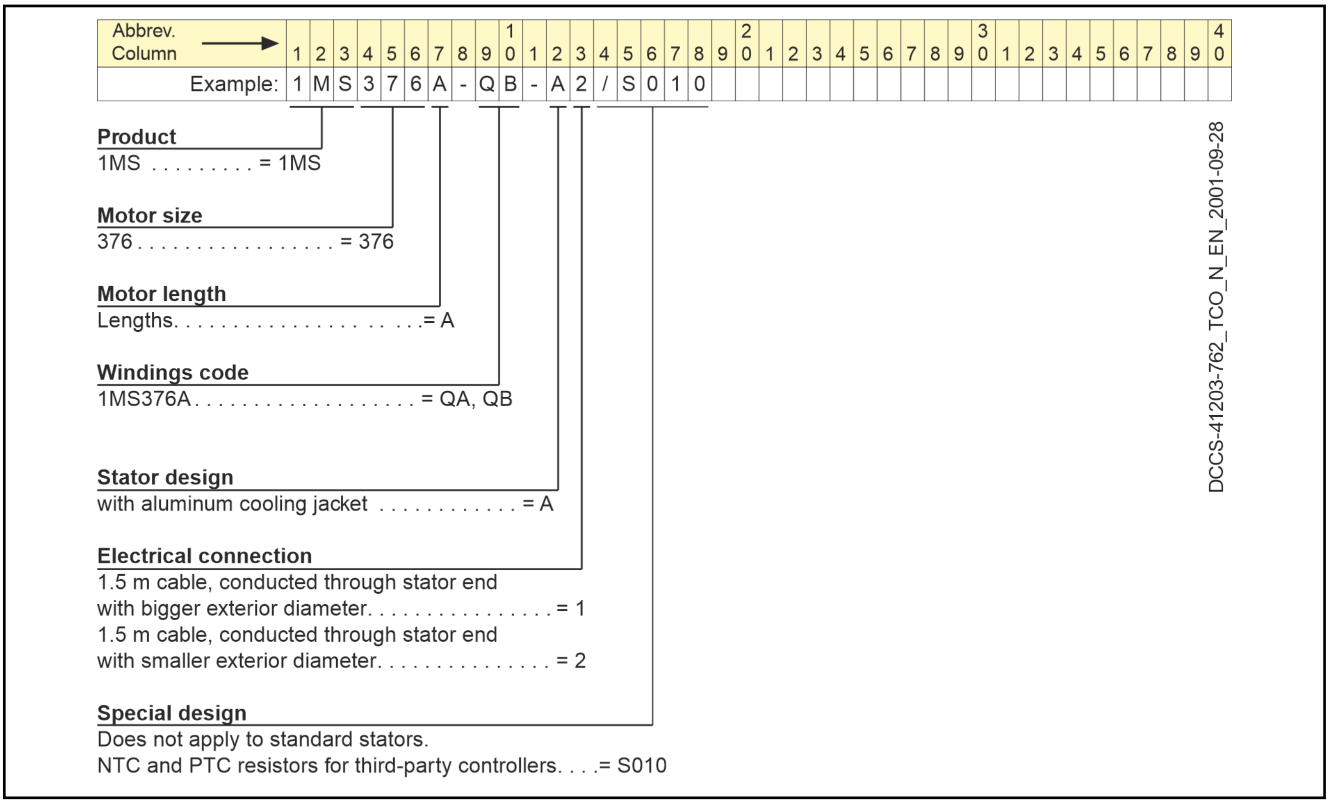


Fig. 6-22: Type code stator 1MS376

7 Accessories

Actually, Bosch Rexroth does not offer any accessories for 1MB asynchronous spindle motors.

8 Connection system

8.1 Notes

NOTICE	Direct connection to the 50/60Hz - external supply network (three-wire or single-phase network) results in motor destruction!

The motors described here can only be operated with suitable drive controllers with variable output voltage and frequency (converter mode) as specified by Rexroth.

Rexroth offers a wide range of ready-made cables for connecting 1MB motors. These cables are optimally adapted to the products and a great variety of requirements.

☞

- **Note that self assembled cables or cable systems of other manufactures possibly do not meet these requirements. Rexroth shall not be held responsible for resulting malfunction states or damage.**

☞ Additional information...

- On the **selection** of power and encoder cables for 1MB motors in documentation "Rexroth Connection Cables IndraDrive and IndraDyn" (DOK-CONNEC-CABLE*INDRV-AU□□-□□-P),
- on "**Electromagnetic Compatibility** in Drive and Control Systems" (DOK-GENERL-EMC********-PR□□-□□-P).

8.2 Electrical connection

8.2.1 General

The stator is provided with an approx. 1.5m long connection strand. The connection strand is encased in a protective tube and contains the power wires as well as the conductor pairs for the temperature sensors located in the winding head.

The power connection of the stators can be made via a terminal box or a device connector.

Starting from this junction, a power cable can be laid to supply power to the controller. Rexroth provides power cables.

8.2.2 Power connection

For the electrical connection of the 1MS stators, a basic distinction must be made between two versions depending on the type code option selected.

1. Stators in standard design
2. Stators in special design “S010” (with additional temperature sensors)

The connecting lead is optionally led out on the stator side with the larger or smaller outer diameter.

NOTICE **Irreparable damage (e.g. due to cable breakage or penetrating liquids) to the stator!**

Avoid bending, pulling and pushing loads as well as continuous movements of the connection cable at the point at the cable outlet at the stator. Loads of this type may lead to irreversible damage at the stator.

Cable type	Smallest permissible bending radius [mm]
Wires	3 x D* (for fix installation)

* Wire diameter

Tab. 8-1: Smallest permissible bending radius

The cross-sections of the power wires in the connection strand depend on the rated current of the motor. For information on wire cross-section, refer to the following tableTab. 8-2.

The cross-section of the conductor pairs of the temperature sensors is AWG 22 (PTC) or 0.5 mm² (NTC and bimetal).

☞ The connection strand is a motor-internal connection. For this reason, the insulation of the connection strand is designed for higher temperatures than the power cables (connection between stator and controller). For this reason, the minimum cross-sections for further power wires specified in the motor data sheet may deviate from the power wire cross-sections in the connection strand specified below.

Stator	Cross section Power wires	Connection strand Ø ±1 [mm]	Necessary required power wire cross section [mm²] [2)]
1MS105N-4A	AWG[1)] 10	17	10.0
1MS105N-4B	AWG (16)	14	2.5
1MS140B-4A	10 mm²	22	2.5
1MS140B-4B	10 mm²	22	4.0
1MS140D-4B	10 mm²	22	10.0
1MS140F-4A	10 mm²	22	10.0
1MS140H-4B	16 mm²	22	16.0
1MS160B-4A	10 mm²	22	6.0
1MS160D-4A	10 mm²	22	10.0
1MS160D-4B	AWG 12	14	4.0
1MS160E-4B	10 mm²	22	2.5
1MS160F-4A	16 mm²	22	25.0
1MS160F-4B	10 mm²	22	10.0
1MS160F-4D	AWG 12	14	4.0
1MS160H-4A	10 mm²	22	16.0
1MS160N-4A	16 mm²	30	25.0
1MS160N-4B	16 mm²	30	16.0

Stator	Cross section Power wires	Connection strand Ø ±1 [mm]	Necessary required power wire cross section [mm²] 2)
1MS160N-4C	AWG 10	14	4.0
1MS200C-4A	10 mm²	22	10.0
1MS200D-4B	16 mm²	22	10.0
1MS200D-4C	16 mm²	22	25.0
1MS200D-4D	16 mm²	22	16.0
1MS200D-4E	16 mm²	22	25.0
1MS200D-4F	25 mm²	30	25.0
1MS200E-4B	16 mm²	22	10.0
1MS200E-4C	25 mm²	30	16.0
1MS200H-4B	16 mm²	22	16.0
1MS200H-4D	16 mm²	22	10.0
1MS200H-4D-...S010	16 mm²	30	10.0
1MS240B-4A	10 mm²	22	10.0
1MS240F-4A	16 mm²	22	25.0
1MS240H-4B	16 mm²	22	16.0
1MS241C-6B	25 mm²	30	25.0
1MS241D-6A	10 mm²	22	16.0
1MS241D-6C	10 mm²	22	4.0
1MS241D-6D	16 mm²	22	16.0
1MS241H-6C	16 mm²	22	25.0
1MS241H-6D	16 mm²	22	16.0
1MS242N-4B	35 mm²	30	35.0
1MS270C-4B	25 mm²	30	35.0
1MS310B-6B	16 mm²	22	25.0
1MS310B-6D	16 mm²	22	25.0
1MS310B-6E	16 mm²	22	16.0
1MS310D-6B	16 mm²	22	25.0
1MS310F-6A	25 mm²	30	16.0
1MS310F-6B	25 mm²	30	35.0
1MS375B-6B	25 mm²	30	50.0
1MS375D-6B	25 mm²	30	2 x 25.0
1MS375D-6D	25 mm²	30	35.0
1MS376A-QA	10 mm²	22	10.0
1MS376A-QB	10 mm²	22	4.0

1) AWG = American Wire Gauge: codes for wire diameters of electrical lines which are predominately used in North America.

2) Layout according to DIN VDE 0298-4. The required power wire cross sections apply to laying type B2 (single laying). Laying type E (multiple installation) and a reduction factor of 0.8 was taken into account for double cabling.

Tab. 8-2: Connection wires at the stator

The wire designation at the motors with connection cable depends on the selected stator design and has to be done as follows:Fig. 8-4 and Fig. 8-5 .

Before connecting the motor, the following steps have to be taken by the machine manufacturer:

1. Decision on the type of connection and procurement of the required components.
2. Shortening the power cable to the desired length (only if required).
3. Cutting the cables to length for the connection at the motor, according to documentation "Rexroth Connection Cables IndraDrive and IndraDyn", MNR R911322949.

Pay particular attention to the following issues when cutting the cables to length and installing the connections:

- Careful execution of the ground connection and the shield connection to meet EMC directives.
- Careful execution of the tightening and plug-in connections to comply with the safety class.
- Power cables for connection to the controller or drive are not included in the scope of delivery of the motor and have to be ordered separately.
- The coolants, lubricants and fuels used at the machine should not damage the lines and connection cables used nor modify them chemically or with regard to the structure.

Power connection via terminal box

Terminal boxes or single components for connecting stators with connection cable are not delivered by Rexroth. Possible suppliers are:

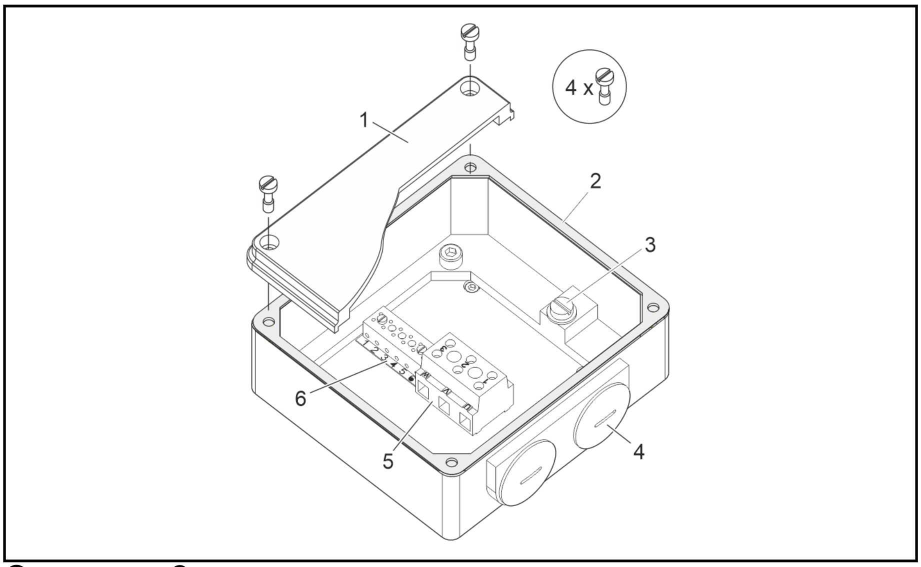
Components	Supplier
Terminal box	**KIENLE & SPIESS** GmbH Bahnhofstrasse 23 74343 Sachsenheim, Germany Phone: +49 (0) 71 47 29 - 0 Fax: +49 (0) 71 47 29 - 1488 Internet: www.kienle-spiess.de
Terminal board	**REKOFA WENZEL** GmbH & Co. KG Walporzheimer Strasse 100 53474 Bad Neuenahr - Ahrweiler, Germany Phone: +49 (0) 26 41 / 387 - 0 Fax: +49 (0) 26 41 / 387 - 33 95
Terminal strip	**WIELAND ELECTRIC** GmbH Benzstrasse 9 96052 Bamberg, Germany Internet: www.wieland-electric.com

Tab. 8-3: Suppliers of terminal boxes

When selecting the components, take the following into consideration...

- that the components have to be suitable for currents and voltage of the chosen drive system. In particular for high DC bus voltages up to 750 V_{DC}.
- required cross sections and connection threads of the cable gland.
- tightness of the housing. Minimum protection class IP65 is recommended.

A complete terminal box consists, for example, of the following assemblies:



①	Cover
②	Seal
③	PE connection
④	Cable entry
⑤	U-V-W power connection
⑥	Terminal strip

Fig. 8-1: Terminal box

Observe the notes about connecting terminal boxes under "Connecting the cable loom in the terminal box" on page 202.

Power connection via device connector

With the plug-in connection, the cable harness of the stator is connected to the motor power cable via device connectors.

☞ Coupling and connector required for connecting 1MB motors are not in the scope of motor delivery and have to be ordered separately.

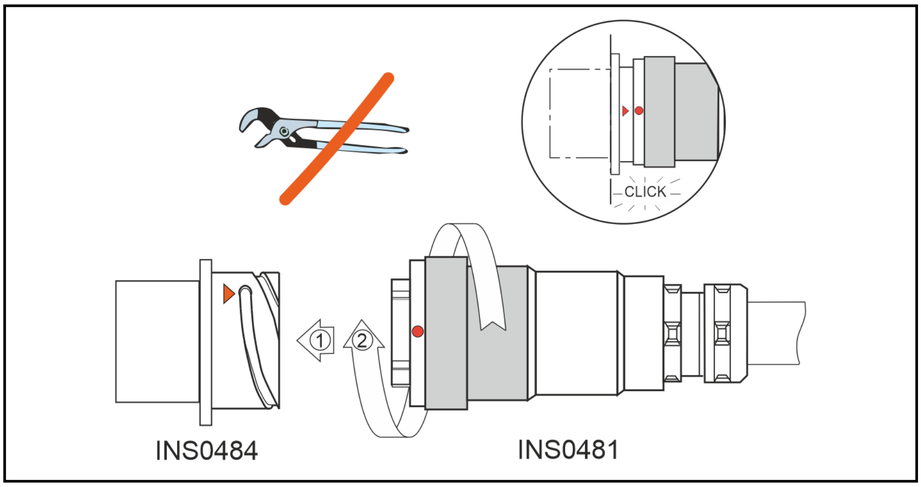
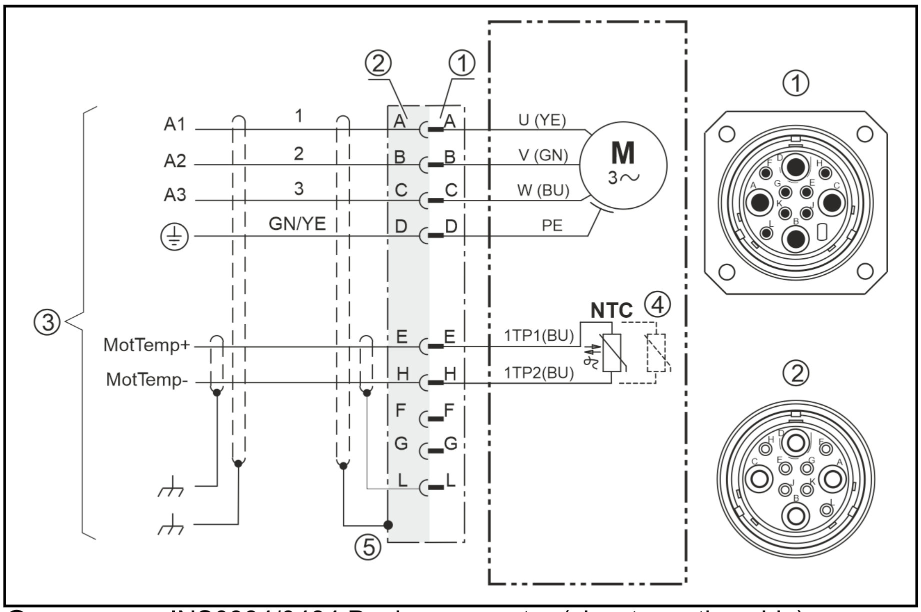


Fig. 8-2: Example for power connection

Proceed as follows to connect motors with connector socket:

1. Push the coupling into the connector socket and observe the coding.
2. Manually tighten the union nut until it you can hear it click into place.
3. The marker points on the coupling and the connector socket must be opposite to each other with the bayonet lock clicked into place.

The wires of the power connection and the pairs of wires of the motor heat conductors are soldered to the back of the device connector (INS0384/484). The device connector is screwed on the spindle housing.



① INS0384/0484 Device connector (view to mating side)
② INS0381/0481 Device connector (view to mating side)
③ Connection designations on the Rexroth drive controller
④ Only one PTC sensor is applied (spare sensor lines are in the socket housing)
⑤ The shield is clamped to the strain relief.

Fig. 8-3: Example of connecting INS38x/48x device connectors of Rexroth

Device connector	Coupling	Terminal range [mm²]	Current carrying capacity
INS0484	INS048x	1.5 ... 10	max. 41 A
INS0384	INS038x	6 ... 35	max. 100 A

Tab. 8-4: Device connector overview

Please observe the notes about connecting the device connector under "Connecting the cable loom to the device connector" on page 202.

8.2.3 Ground connection

The grounding connection of the stator must be realized after installation into the machine by means of a separate cable. For this purpose, the stator is equipped with threaded bores for grounding connection at both face ends. Fasten the ground cable with a ring terminal at one of these threaded holes. For grounding connection, observe all applicable standards. See also "Attaching the grounding cable to the spindle housing" on page 201.

For details on the exact position and the connection thread of the threaded hole, refer to the dimensional drawing of the respective stator. The power wire cross-section specified in the data sheet of the motor is also applies for the grounding cable and must be complied with.

8.3 Sensors

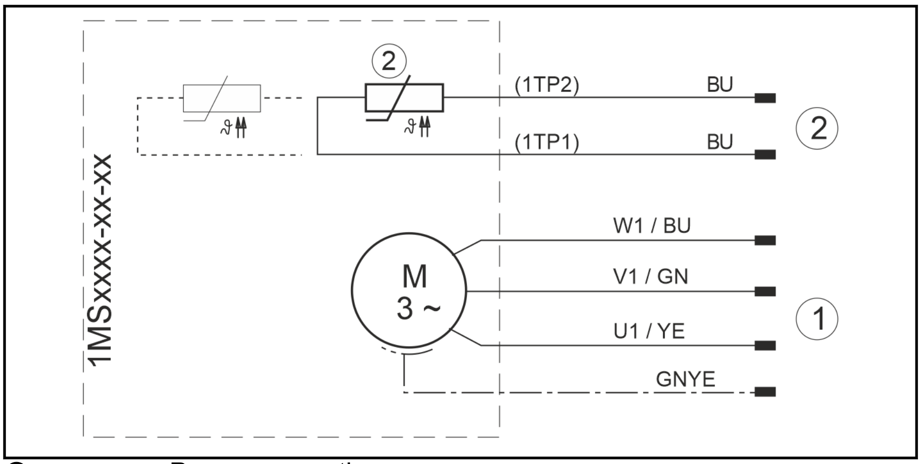
8.3.1 Encoder connection

Encoder and encoder connection components are not included in the scope of delivery of the motor. Select the components according to the machine and controller requirements.

8.3.2 Temperature sensor

1MS stators in standard design

In 1MS stators of standard design, two temperature sensors (NTC) are permanently installed in the motor winding. The wires for connecting the sensors are led out in the connection strand. Only one of the two sensors is connected. If the connected sensor fails, the replacement sensor can continue to be used.



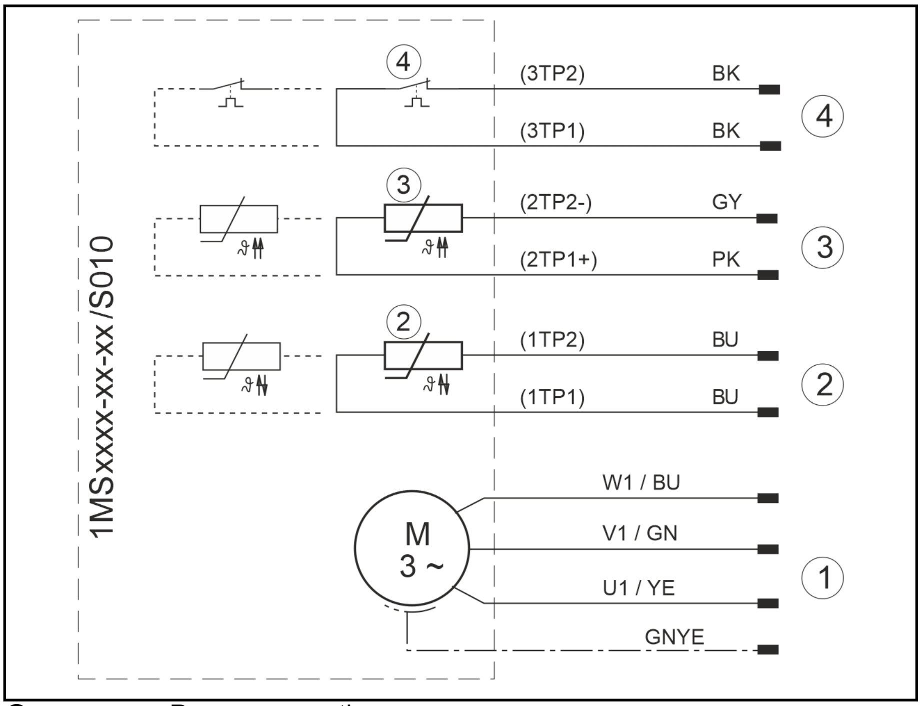
① Power connection
② Temperature sensor NTC

Fig. 8-4: Wire designation on 1MS stators in “Standard” design

☞
- The polarity within the wire pair is not relevant for the function of the hot wire.
- The function of the replacement sensor cannot be guaranteed.

1MS stator in design "S010"

In the case of 1MS stators in the "S010" design, various temperature sensors are permanently installed in the motor winding. All sensors are duplicated, with only one sensor connected. If a connected sensor fails, the replacement sensor can continue to be used.



① Power connection
② Temperature sensor (NTC)
③ Temperature sensor (PTC)
④ Temperature switch (bimetal)

Fig. 8-5: Wire designation on 1MS stators in "S010" design

☞
- The polarity within the wire pair is not relevant for the function of the thermistor (NTC).
- Ensure correct polarity when connecting the temperature sensor KTY84-130 for external temperature measurement (see Fig. 8-5).
- Temperature sensor KTY84-130 is a component that might by damaged by ESD! For this reason, the wires of the sensor are protected by a protective foil at the connection cable. Before connecting the sensor, take appropriate measures for ESD protection (ESD = electrostatic discharge).
- The function of the replacement sensor cannot be guaranteed.

8.4 Motor cooling

8.4.1 Coolant connection

1MB motors are supplied as kit motors without motor housing for installation in machines. The selection and dimensioning of the connection technique is to be made by the machine manufacturer.

☞

- Note that inlet and outlet of the coolant are only allowed in the position specified in the dimension sheet.

  The assignment of inlets and outlets does not have any influence on the performance data of the motor. For standardization and easier handling, an arrangement once established should be retained.
- Install systems in the cooling circuit for monitoring flow, pressure and temperature.

8.4.2 Operating pressure

The maximum coolant supply pressure of **6 bar** applies to all 1MB motors based on the effective current pressure directly at the coolant connection of the motor. Pressure fluctuations in the cooling circuit must not exceed ± 1 bar during engine operation.

☞ Please note that additional glands or branches in the cooling circuit can reduce the flow and supply pressure of the coolant. Therefore select amply dimensioned connection glands and line cross sections.

⚠ WARNING	Motor destruction!

- Observe the permissible inlet pressure of the coolant.
- Eliminate impermissible pressure fluctuations and pressure peaks by design measures.

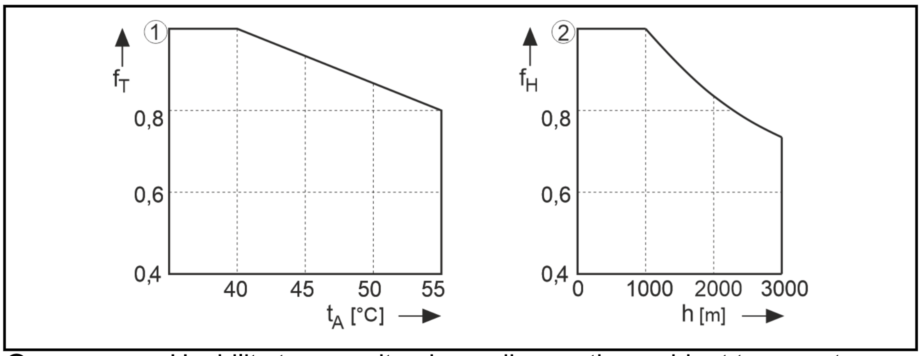
9 Application notes

9.1 Installation altitude and ambient temperature

The specified motor performance data applies for operation at

- ambient temperatures from 0 ºC to +40 ºC
  (+5 °C to +40 °C for liquid-cooled motors)
- Installation altitudes from 0 m to 1000 m above MSL

The performance data of motors used outside of the above ranges is reduced according to the following figure.



①	Usability to capacity, depending on the ambient temperature
②	Usability to capacity, 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: Utilization factors

If either the ambient temperature or the installation altitude is above the nominal data:

1. Multiply the motor data specified in the selection data by the determined utilization factor.
2. Ensure that your application does not exceed the reduced motor data.

If both the ambient temperature and the installation altitude are above the nominal data:

1. Multiply the calculated utilization factors f_T and f_H.
2. Multiply the resulting value by the motor data specified in the selection data.
3. Ensure that your application does not exceed the reduced motor data.

9.2 Environmental conditions

9.2.1 General information

According to DIN EN 60721-3-3, 1MB motors in stationary and weather-protected applications may be operated under the following mechanical and climatic environmental conditions.

9.2.2 Mechanical environmental conditions

Vibration/sinusoidal vibrations

Direction	Maximum allowed load due to vibrations (10-2000 Hz)
Axial	10 m/s²
Radial	30 m/s²

Tab. 9-1: Maximum values for sinusoidal vibrations

Shock/impacts

Motor frame size	Maximum allowed shock load (6 ms)	
	Axial	Radial
105 ... 375	100 m/s²	100 m/s²

Tab. 9-2: Maximum values for shock load

☞

- Ensure that the maximum values specified above for vibrations and impacts are not exceeded during storage, transport, and operation of the motors.
- The design and effectiveness of shock-absorbing or shock-decoupling built-on accessories depend on the particular application and have to be determined by measurement. This does not lie in the responsibility of the motor manufacturer.

  Modifications of the motor design result in loss of the warranty.

9.2.3 Climatic environmental conditions

Humidity/temperature

Climatic environmental conditions are defined according to different classes as specified in DIN EN 60721-3-3, Table 1. They are based on worldwide long-term experiences and take all influencing variables into account, e.g., air temperature and air humidity.

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

The following table provides extracts of this class.

Environmental factor	Unit	Class 3K4
Low air temperature	°C	+5 [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

Environmental factor	Unit	Class 3K4
Temperature change rate	°C/min	0.5
[1]) Rexroth allows 0 °C for non-liquid-cooled motors.		

Tab. 9-3: Classification of climatic environmental conditions according to DIN EN 60721-3-3, Table 1

9.3 Degree of protection

The degree of protection is indicated by IP (International Protection) and two digits. The first code number describes the degree of protection against contact and penetration of foreign substances; the second code number describes the degree of protection against ingress of water.

Protection class **IP00** applies to the stator (1MS) and the rotor (1MR) of the 1MB series according to DIN EN 60034-5. The applicability of the motor under specific conditions has to be checked thoroughly.

Refer to the following list (the list is not exhaustive).

Problem areas

- Use of the motor in a damp environment, in a foggy atmosphere.
- Use of coolants, aggressive materials or other liquids.
- Cleaning procedures under high pressures, steam or jets of water.

Possible effects

- Chemical or electro-chemical interactions with subsequent corrosion or disintegration of motor parts.
- Damage to the winding insulation and irreparable damage to the motor.

Possible countermeasures

- Provide suitable covers or seals to protect the motor.
- Use only such cooling lubricants and other media which do not have any aggressive or disintegrating effect on the motor parts.
- Do not clean under high pressures, steam or jets of water.

The machine manufacturer is responsible for conducting the tests and for providing suitable measures.

9.4 Acceptances and approvals

9.4.1 CE

Declarations of conformity certifying the design and the compliance with the valid EN standards and EC guidelines are available for all 1MB motors. If required, the declarations of conformity can be requested from the responsible sales office.

The CE label is applied to the motor type plate.

9.4.2 UR/cUR listing

1MB motors were presented to “Underwriters Laboratories Inc.®” and have been approved by this UL authority. The issued E-File Number can be found in tab. 4-1 "General technical data" on page 20. The appropriate identification of the motors is specified on the motor type plate.

9.4.3 UKCA label

1MB motors fulfill the requirements acc. to UKCA. The appropriate identification of the motors is specified on the motor type plate.

9.4.4 China RoHS 2

Motors of the 1MB series are according to the specifications of standard SJ/T11364 and have an EFUP (Environmentally friendly use period) of 25 years. A corresponding labeling is in preparation). For more information, refer to https://www.boschrexroth.com.cn/zh/cn/home_2/china_rohs2 www.boschrexroth.com.cn/zh/cn/home_2/china_rohs2 in section "Kit motors".

9.5 Compatibility test

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

As it is not possible to follow the continuing development of all materials (e. g. lubricants in machine tools) which may interact with our controls and drives, it cannot be completely ruled out that any reactions with the materials used by Bosch Rexroth might occur.

For this reason, before using the respective material a compatibility test has to be carried out for new materials (e. g. lubricants and cleaning agents) and our housing or our housing materials.

9.6 Magnetic fields

During operation of electric motors, electromagnetic fields are generated at live components and connection lines of these motors. The secondary parts equipped with permanent magnets of synchronous linear motors and rotors of synchronous kit motors are magnetically not shielded and permanently generate a static magnetic field (DC field) even if not activated. This is indicated by a warning label attached to each package with open permanent magnet components.

If all regulations and safety measures are complied with, synchronous kit motors with open permanent magnet components do not cause any inadmissible hazards. As of a distance of approx. 100 mm to the surface of open permanent magnet parts, there is practically no effective magnetic attraction of ferromagnetic parts. However, for people with implants, a minimum safety distance of 1 meter (1000 mm) is recommended.

Depending on the operating location, transport ways and storage of the machine and its components, local regulations and laws apply and have to be complied with during construction, transport and operation of the machine.

⚠ WARNING

Electromagnetic / magnetic fields! Health hazard for persons with heart pacemakers, metal implants or hearing aids! Material damage.

Hazards due to magnetic and electromagnetic fields at live components or permanent magnets of electric motors.

Persons with active implantable medical devices (AIMD) or passive metallic implants must keep clear from these motor components.

The above-specified persons are prohibited from accessing areas where such drive components are installed and operated or access is subject to prior medical consultation.

Keep magnetic data carriers, credit cards, check cards and identity cards and all ferromagnetic metal parts away from magnetic fields. Do not wear jewelry, particularly made of ferromagnetic material, during work at magnetic components.

Safety measures for operating personnel

In the European Community (EU), directive 2004/40/EC specifies minimum requirements for protection of the safety and health of employees from hazards due to electromagnetic and magnetic fields. Regulations and guides for machine manufacturers and machine operators are included in the following documents:

- Standard EN 50499 (Germany: DIN EN 50 499, DIN VDE 0808-499)
- Standard EN 50527 (Germany: DIN VDE 0848-3)
- In Germany: Accident prevention regulations BGV/GUV-V B11

This list does not claim to be exhaustive. Machine manufacturers and machine operators are required to define the regulations applicable on site and the occupational health and safety measures to be applied for working in the area of exposition. The decisive factors are not the electromagnetic properties of individual machine components but the effective overall exposition in electrical, magnetic and electromagnetic fields in the actual working area.

Construction information

During construction of the machine, suitable covers and safety equipment for safe operation must be applied.

- During construction of the machine, observe applicable standards and regulations on marking of and access to exposition areas.
- Prevent any access of operating personnel in the motion range of motors during operation.
- Prevent any contamination, chips and dirt in the motion range of motors.

9.7 Motor cooling

9.7.1 General information

The motor power loss P_V is converted into heat and then dissipated via the liquid cooling system. 1MB motors may therefore only be operated if the coolant supply is ensured. The machine manufacturer has to realize the cooling system so that all requirements regarding flow, pressure, cleanliness, temperature gradient, etc. are complied with in every operating state.

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

- It is essential that you take into account the motor data and the explanations on the design of cooling systems in the documentation "Liquid Cooling..., Dimensioning, Selection", MNR R911265836.
- Observe the manufacturer's instructions when designing and operating cooling systems.
- Do not use any cooling lubricants or cutting materials from machining processes.
- Avoid contamination of the cooling medium as well as modifications of chemical composition and pH.

9.7.2 Coolant

General information

All details and technical data are based on water as coolant. If other coolants are used, these data are not applicable any longer and must be redetermined.

It is not recommended to use cooling with running tap water. Calcareous tap water can cause sediments and damage the motor and the cooling system.

For corrosion protection and for chemical stabilization, an additive which is suitable for mixed installations with the materials AlSi5Mg (cooling jacket) and FPM (O-ring) has to be added to the cooling water.

1MB motors can be damaged irreparably by use of aggressive coolants, additives and cooling lubricants or by contaminations of the coolant.

- Use systems with a closed circuit and a fine filter ≤ 100 µm.
- Avoid contamination of the cooling medium as well as modifications of chemical composition and pH.
- Refer to the environmental protection and waste disposal instructions at the place of installation when selecting the coolant.

Rexroth does not make any general statements and does not contact any research regarding the suitability of system-specific coolants or operating conditions.

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

Aqueous solution

Aqueous solutions ensure reliable corrosion protection without significant changes to the physical properties of the water. The recommended additives do not contain any substances hazardous to water.

Emulsion with corrosion protection

Corrosion protection oils for coolant circuits 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 ducts against corrosion and cavitation. Here, an oil content of 0.5 to 2 volume percent has proved successful.

If the corrosion protection oil is intended to lubricate the coolant pump in addition to providing corrosion protection, the required oil content is approx. 5 volume percent.

Comply with instructions of the pump manufacturer!

Cleaning the coolant circuit

Inspect and clean (purge) the cooling system at regular intervals as specified in the machine and cooling system manufacturer's maintenance schedule.

Note that the utilization of unsuitable cleaning agents may cause irreversible damage to the motor cooling system. This type of damage does not lie within the responsibility of Bosch Rexroth.

⚠ CAUTION **Risk of damage to the motor cooling system by improper cleaning agents! Loss of warranty!**

- The only liquids or materials allowed for cleaning and motor cooling are liquids which do not corrode the motor cooling system and do not react aggressively to the materials used in Bosch Rexroth motors.
- Observe the instructions of the manufacturers of the cleaning agent and the cooling system.

9.7.3 Coolant additives

☞ Bosch Rexroth does not make any general statement and does not conduct any surveys regarding the suitability of device-specific cooling media, additives or operating conditions and does not assume any warranty for third-party products.

The performance test for the used cooling media and the design of the liquid cooling system is the responsibility of the machine manufacturer. The selected coolant additives have to comply with the materials within the cooling system.

Comply with the environmental protection and waste disposal instructions at the place of installation when selecting the 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.

Bosch Rexroth recommends using coolant additives of 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”.

☞
- Use of the following chemicals is designed for closed cooling systems and the following metallurgy: Stainless steel, aluminum, copper and non-ferrous metal.
- The container size and its ingredients of a water treatment kit are adjusted for the specified system volume and can be poured into the coolant tank without regard to other mixture ratios.

Ready-to-use cooling water (Company NALCO)

System volume in liters	Order code	Additives NALCO...
0.5 ... 50	Nalco CCL100.11R	CCL100

Tab. 9-4: Ready-to-use cooling water (Company NALCO)

Cooling water NALCO CCL100

Nalco CCL100 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 CCL100 contains a corrosion inhibitor protecting ferrous metal, copper, copper alloys and aluminum against corrosion. Nalco CCL100 is free of nitrite and minimizes the micro-biological growth.

Water Treatment Kits (Fa. NALCO)

System volume in liters	Order code	Additives NALCO...
50 ... 99	480-BR100-100.88	TRAC100 7330 73199
100 ... 199	480-BR100-200.88	
200 ... 349	480-BR100-350.88	
350 ... 500	480-BR100-500.88	

Tab. 9-5: 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.

Water quality of additional water

Conductivity	< 20 µS/cm (e.g. purified water, osmosis water, a.s.o.)
Total hardness	< 0.5 °dH bzw. < 10 mg/l $CaCO_3$
Microbiology	< 100 KBE/ml (CFU/ml)
Iron / copper	< 0.1 mg/l
Turbidity	free from turbidity substances

Tab. 9-6: Water quality of additional water

The water treatment program is a specification for the user and describes the necessary minimum.

Additional equipment, tests and service must be coordinated with Nalco to reach optimum performance and system protection for the cooling system.

For further information or ordering please contact

NALCO Deutschland GmbH

http://www.nalco.com

Recommended manufacturers of coolant additives

Coolant additives can be purchased from the following manufacturers, too.

Manufacturer of chemical additives	
FUCHS PETROLUB AG	http://www.fuchs-oil.com
Clariant Produkte (Germany) GmbH	http://www.antifrogen.de
hebro chemie GmbH	http://www.hebro-chemie.de
TYFOROP Chemie GmbH	http://www.tyfo.de
Schweizer-Chemie GmbH	http://www.schweitzer-chemie.de

9.7.4 Materials used

At 1MB motors, the coolant comes into contact with the following materials:

1MS frame size	Cooling jacket	O-ring
105 ... 376	AlSi5Mg	Viton

Tab. 9-7: Materials coming into contact with the coolant

For dimensioning and operation of the cooling system, the machine manufacturer has to ensure that the components of the motor do not get into contact with materials with chemical or electro-chemical impact leading to corrosion or disintegration.

9.7.5 Coolant inlet temperature

1MB motors are designed in compliance with DIN EN 60034-1 for operation at coolant temperatures of +10 ... +40 °C. This temperature range must be complied with. Higher coolant temperatures cause a higher reduction of the available torque. Due to high temperature gradients, lower coolant temperatures can result in the destruction of the motor.

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

Setting the inlet temperature

Observe the specified temperature range and take into account the existing ambient temperature when setting the coolant inlet temperature.

The lower limit of the recommended coolant inlet temperature can be adjusted dependent on the existing ambient temperature. To avoid condensation, the minimum temperature is limited to max. 5 °C under the existing ambient temperature.

Example 1:

Permissible coolant temperature setting range: +10 ... +40 °C

Ambient temperature: 20 °C

Coolant inlet temperature to be set: +15 ... +40 °C

Example 2:

Permissible coolant inlet temperature range: +10 ... +40 °C

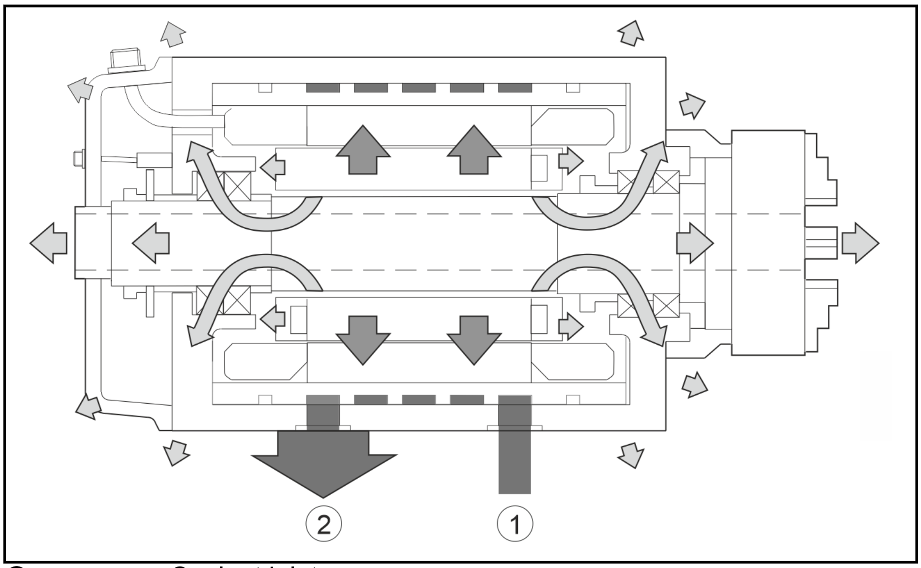
Ambient temperature: 30 °C

Coolant inlet temperature to be set: +25 ... +40 °C

☞ The coolant inlet temperature must be set in a temperature range of +10 ... +40 °C and is limited to no more than 5 °C under the existing ambient temperature to avoid condensation.

9.7.6 Notes on heat dissipation of the kit spindle motor

The heat loss of the kit spindle motor in the motor spindle is mainly dissipated via the liquid cooling system. However, the bearing shields and rotating spindle also contribute to heat dissipation.



① Coolant inlet

② Heat dissipation through coolant

Fig. 9-2: Heat flows in the motor spindle

Heat dissipation of the stator

The kit spindle motor is designed so that the major part of the heat loss occurs in the stator. Due to the cooling jacket of the stator, around which liquid flows, this heat is very quickly transferred effectively to the cooling liquid. In addition, the cooling liquid creates a uniformly tempered spindle housing.

The specifications for dimensioning the liquid cooling system are included in the technical data of the respective motor. Guidance on sizing and selecting a cooling system is provided in the documentation "Liquid Cooling of Indramat Drive Components" MNR R911265836.

Heat dissipation of the rotor

About one third of the power dissipation of the kit spindle motor occurs in the rotor. Most of this heat loss is dissipated to the stator via the air gap. A small part of the thermal energy is dissipated via the spindle, bearing and end shield. This heat dissipation depends on the type and volume of materials over which the heat flows.

The bearing temperature increase due to heat dissipation depends on the

- degree of utilization of the motor (heat input) and
- on the mechanical design (heat dissipation).

The temperature distribution depends on the particular situation and can be determined by means of a heat transfer calculation based on the FEM method (finite element method).

Heat transfer calculation example

A heat transfer calculation was performed for a motor spindle design using the 1MB310D kit spindle motor as an example. The temperature curve was calculated at nominal power output for a spindle with bore.

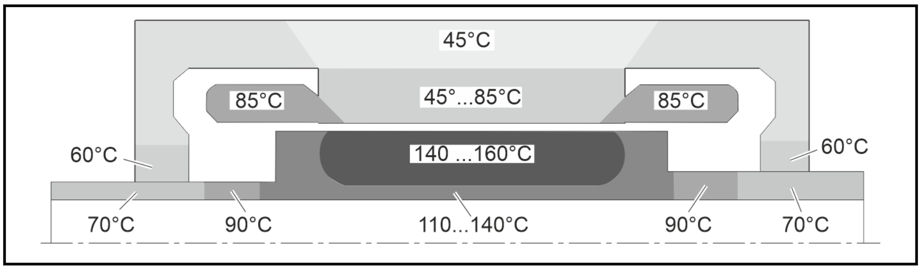


Fig. 9-3: Example of a calculated temperature curve (spindle with bore)

☞ The temperature curve adjusts individually for each spindle design and motor type. The temperature curves cannot be generalized. They serve only as a first approximation for similar designs.

Design measures can additionally keep heat away from the bearings. As an example, liquid-cooled sleeves are shown in the following figure, which provide additional cooling in the immediate vicinity of the rotor and spindle. Depending on the flow connection, the pressure drop or the flow rate of the motor spindle must be taken into account!

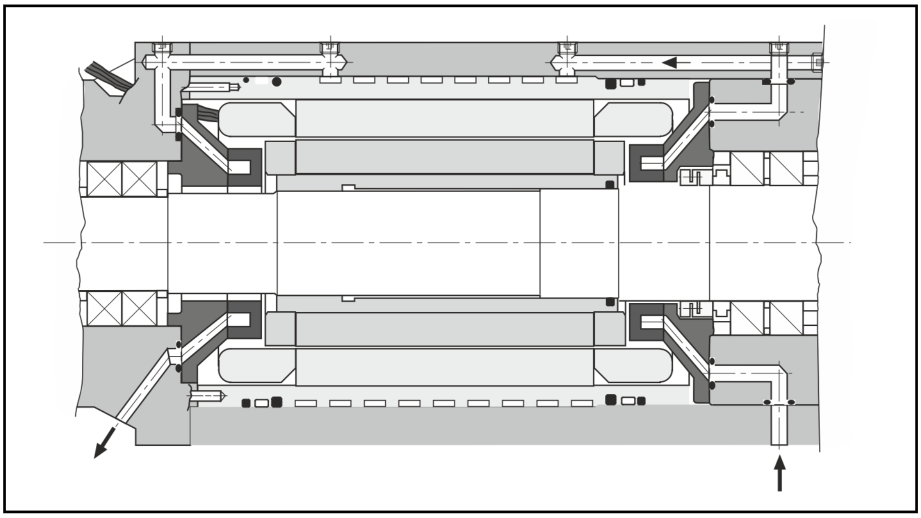


Fig. 9-4: Liquid-cooled sleeves mounted near the rotor

Temperature gradient in the spindle bearing

The bearings are radially pre-tensioned by the fits and tolerances for the shaft seat and housing bore. A temperature gradient between the inner ring and outer ring of the spindle bearings increases this pre-tension due to the different thermal expansions. This increases friction losses and the bearings heat up additionally. Overheating of the spindle bearings leads to bearing damage.

When designing the motor spindle, it is therefore also important to ensure a small temperature difference in the spindle bearing. Alternatively, additional heat can be conducted to the outer ring of the bearing by design measures.

Cooling rings, for example, as shown in the figure below, conduct part of the heat generated by the rotor directly into the end shield. As a result, the outer ring of the bearing heats up and the temperature gradient is reduced.

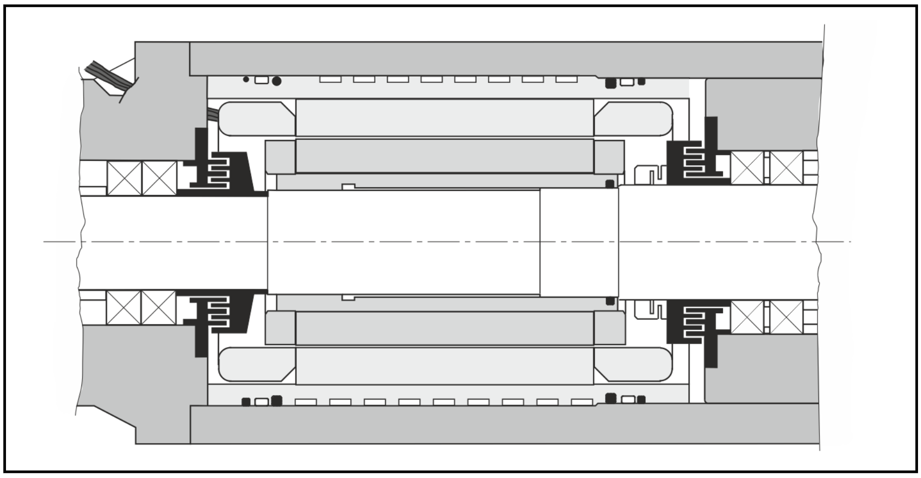


Fig. 9-5: Cooling rings mounted near the rotor

9.8 Motor temperature monitoring

Stators in “Standard” design

Stators of 1MB motors in standard design are equipped with two NTC temperature sensors, which are permanently installed in the motor winding. Only one of the two sensors is connected. If the connected sensor fails, the replacement sensor can continue to be used. Resistance values and characteristic curve of the NTC can be found in Tab. 9-8. To connect the sensors, observe the notes in chapterchapter 8.3.2 "Temperature sensor" on page 143.

☞
- The NTC sensors are not safety devices and are not designed for integration into safety systems for personal or machine protection.
- The NTC sensors are neither designed nor suitable for detecting the temperature at the motor housing, in the rotor or at the bearings.
- Additional temperature control requirements have to be realized by the machine manufacturer.

Stators in “S010” design

Stators of 1MB motors in version "S010" are equipped with various sensors for temperature monitoring, which are permanently installed in the motor winding.

- NTC temperature sensor (K227/33)
- PTC temperature sensor (KTY84-130)
- Bimetallic switch (S01.155.05.*)

Sensors of each type are available twice. However, only one sensor is connected at a time. If the connected sensor fails, the replacement sensor can continue to be used. To connect the sensors, observe the notes in chapterchapter 8.3.2 "Temperature sensor" on page 143.

Temperature sensor K227/33 (NTC)

K227/33 (NTC)	Value (±10 %)
Resistance at 25 °C	32.76 kOhm
Resistance at 100 °C	1.8 kOhm

Tab. 9-8: Standard values at temperature sensors NTC

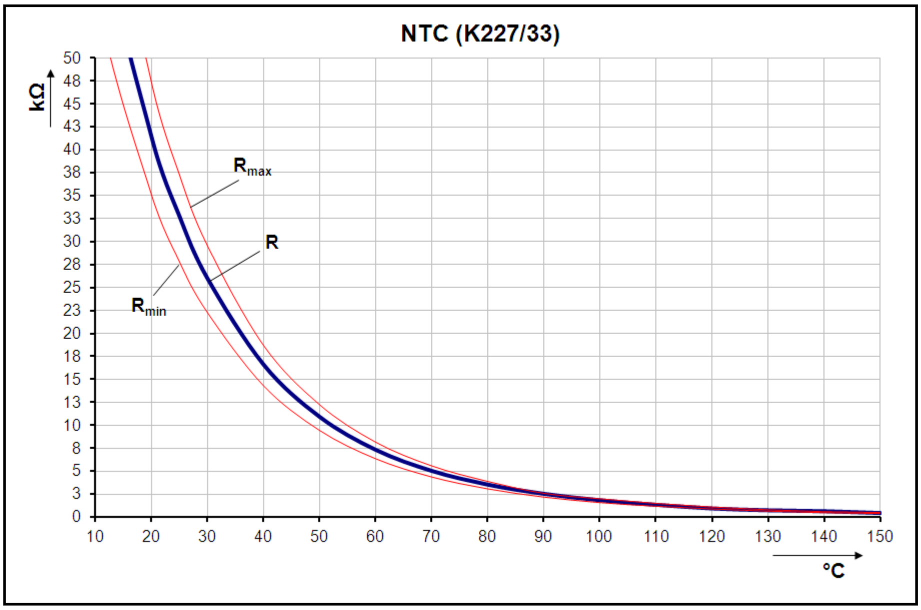


Fig. 9-6: *Characteristic thermistor (NTC)*

Temperature sensor KTY84-130 (PTC)

KTY84-130 (PTC)	Value
Resistance at 25 °C	min. 577 ... max. 629 Ohm
Resistance at 100 °C	min. 970 ... max. 1000 Ohm
Continuous current at 100 °C	2 mA

Tab. 9-9: *Standard values at temperature sensors PTC*

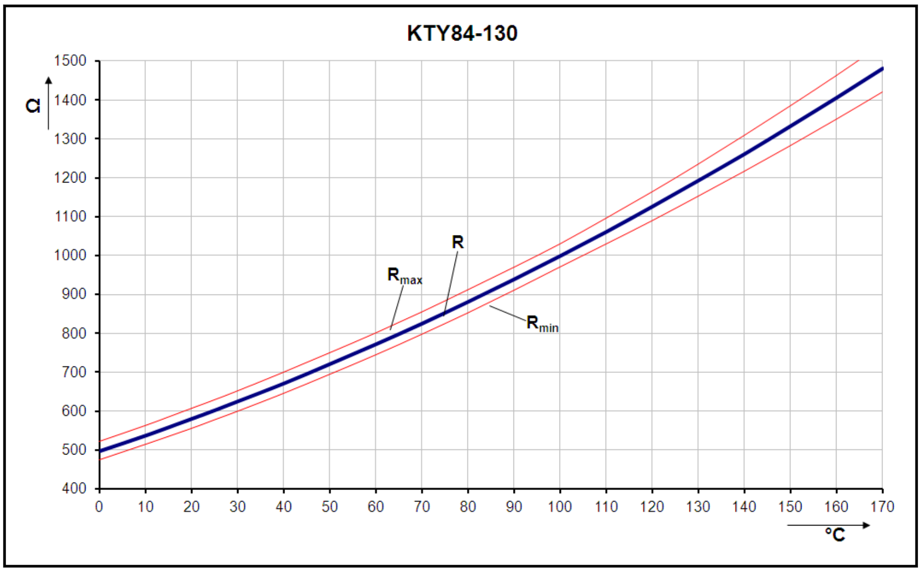


Fig. 9-7: *Characteristics PTC resistor*

- Temperature sensor KTY84-130 is a component that might by damaged by ESD! For this reason, the stranded wires of the sensor are protected by a protective foil at the connecting cable. Before connecting the sensor, take appropriate measures for ESD protection (ESD = electrostatic discharge).
- The used temperature sensors are equipped with double or reinforced insulation according to DIN EN 50178, so separation exists according to DIN EN 61800-5-1.

Bimetallic switch S01.155.05.* The bimetallic temperature switch is used for automatic temperature monitoring. It limits the temperature of the motor winding to 155 °C and protects it from overheating by opening the circuit. The bimetallic switch returns to its initial position after response/switching due to overtemperature only by a significant drop in temperature and is then ready to respond again.

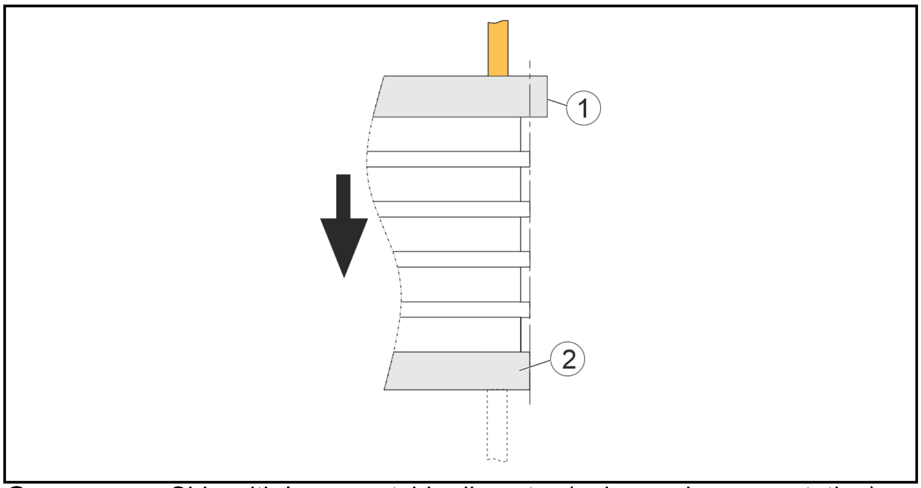
9.9 Fastening of motor components

9.9.1 Stator fastening

The stator is fastened by screw connections to one of the two front faces of the stator. Under no circumstances should both front faces be screwed down. The stator faces have different diameters, which simplifies assembly (seeFig. 9-8).

When planning the assembly process, refer to the selected output direction of the power cable as well as the details of the dimension sheets referring to

- the quantity and type of the mounting thread,
- the tightening torque,
- the screw-in depth.



① Side with larger outside diameter (enhanced representation)
② Side with smaller outside diameter

Fig. 9-8: Example of 1MB stator assembly

- The screw length required depends on the machine construction.
- Under no circumstances should both stator front faces be screwed down.
- The screw connections have to be able to take up both the force due to the weight of the motor and the forces acting during operation.
- Observe the minimum screw-in depth for screw connections on the 1MS stator.
- For detailed instructions about assembly refer to Chapter 11 , Installation.

9.9.2 Rotor fastening

Rotor and spindle shaft are connected by shrink-fitting (thermal fitting). Due to the design of the rotor, however, a distinction must be made during assembly between rotor

- with **step interference fit** (type code designation **A** and **C**)
- **without rotor sleeve** (type code designation **B**)

Due to shrink-fitting, there is a favorable thermal connection between rotor and shaft. In case of high speeds, additional losses may occur in the rotor leading to an additional increase in temperature. To prevent inadmissible temperatures, heat energy dissipation via the shaft must be ensured.

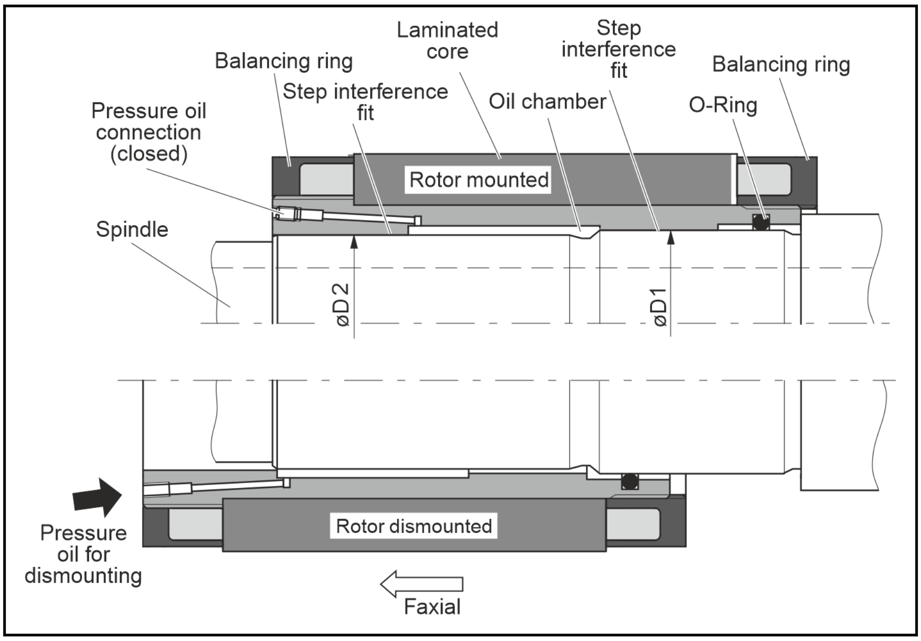


Fig. 9-9: Rotor installation and step interference fit function

You can find detailed instructions for rotor assembly in Chapter 11 , Installation.

Rotor

The rotor consists of a sleeve and a laminated core with balancing rings arranged on the face. The spindle has two adjacent mating surfaces with slightly graduated diameters (Ø D1 > Ø D2). The friction-fit connection of rotor and spindle is realized by what is referred to as step interference fit. The graded fitting surfaces align the assembled rotor to the spindle and are required for disassembly of the rotor without damaging it.

The design of the spindle in the area of the step interference fit must be carried out according to the specifications in the dimension sheets of the respective motor.

The rotor is installed on the spindle by means of shrink-fitting and disassembled by means of hydraulic oil.

Assembly/Disassembly

The rotor is heated to approx. 200 °C before assembly. Due to material expansion, the dimensions at the D1 and D2 diameters are increased. Rotor and spindle can be connected without any pressure.

For disassembly, hydraulic oil is pressed into the step interference fit. The resulting axial force enables sliding of the rotor from the spindle if a separating oil film is applied between the fitting surfaces. The step interference fit becomes loose first at diameter D1. At this side, oil leakage is prevented by the O-ring.

Balancing

After assembly, the rotor is balanced according to the required vibration severity grade (DIN EN 60034-14). For weight balancing of the rotor, threaded pins are screwed in radially around the balancing ring and secured by adhesion.

9.10 Third-party components

9.10.1 Motor encoder

General information

A motor encoder is required for measuring the position and the velocity. Particularly high requirements are imposed on the motor encoder and its mechanical connection.

☞ The motor encoder is not included in the scope of delivery of 1MB motors. Suitable motor encoders have to be selected by the machine manufacturer based on the requirements of your application or machinery.

In case of questions on the selection and on the technical compatibility of the motor encoder with Rexroth drive controllers, please contact the Rexroth customer support.

Selection

The accuracy of the 1MB motors is generally defined by the

- mechanical rigidity of the overall system.

For selection of the motor encoder to achieve the required accuracy, the following points have to be taken into consideration:

- Speed range of the motor
- Speed range of the encoder
- Encoder resolution/accuracy
- Compatibility with controller

Measuring principle

For detailed information on the individual encoder types, please refer to the respective publications of the encoder manufacturers.

Suppliers for encoder systems include:

Components	Supplier
Angle measuring instruments ER....	**DR. JOHANNES HEIDENHAIN GmbH** Dr.-Johannes-Heidenhain-Straße 5 83301 Traunreut, Germany Tel.: +49 (0) 86 69 31 – 0 Fax: +49 (0) 86 69 50 61 Internet: www.heidenhain.de
Angle measuring systems RESR	**RENISHAW GmbH** Karl-Benz Straße 12 72124 Pliezhausen, Germany Tel.: +49 (0) 71 27 / 98 10 Fax: +49 (0) 71 27 / 88 23 7 Internet: www.renishaw.de
Gear wheel encoder GEL....	**Lenord, Bauer & Co. GmbH** Dohlenstraße 32 46145 Oberhausen, Germany Tel.: +49 (0) 208 / 9963 – 0 Fax: +49 (0) 208 / 6762 – 92 Internet: www.lenord.de

Tab. 9-10: Motor encoder suppliers

9.10.2 Bearings

☞ Bearings are not included in the scope of delivery of an 1MB motor. Suitable bearings have to be selected by the machine manufacturer based on the requirements of your application or machinery.

Selection

For selection of bearings regarding the service life, comply with the following:

- speed range of the motor
- radial and axial load on the bearing during operation.

For detailed information on bearing selection, please refer to the respective publications of the bearing manufacturers.

Suppliers for bearings include:

Components	Supplier
Bearings	INA-SCHAEFFLER KG Industriestraße 1-3 91074 Herzogenaurach, Germany Tel.: +49 (0) 91 32 / 82 - 0 Fax: +49 (0) 91 32 / 82 - 49 50 Internet: www.ina.de
	SKF GmbH Gunnar-Wester-Straße 12 97421 Schweinfurt, Germany Tel.:+49 (0)-9721-56-0 Fax: +49 (0)-9721-56-6000 Internet: www.skf.com
	NSK Deutschland GmbH Hauptverwaltung Harkortstraße 15 40880 Ratingen, Germany Tel:+49 (0)-21-02-4810 Fax: +49 (0)-21-02-4812290 Internet: www.nsk.com
	NTN Wälzlager GmbH Max-Planck-Straße 23 40699 Erkrath, Germany Tel.:+49 (0)-211-2508-0 Fax: +49 (0)-211-2508-400 Internet: www.ntn-snr.com

Tab. 9-11: Motor bearing suppliers

10 Handling, transport and storage

10.1 Delivery condition

10.1.1 General information

On delivery, 1MB motors are packed in a cardboard box with polystyrene half-shells or in wooden crates depending on the respective frame size.

The goods are delivered on pallets or in a lattice box. Packing units on pallets are secured with straps.

The rotor and stator are packed separately and are thus protected against mechanical damage caused by bumping against each other during transport.

If several kit spindle motors or components are ordered at the same time, they will be combined into one package if possible.

An envelope with the delivery note is attached on the wooden box or carton.

There are more labels on the package:

- 1 label with notes about safe handling
- 1 label with instructions about safe transport
- Bar code label (amount depends on the contents) with details about:
  - Customer
  - Delivery number
  - Commission
  - Commissioned forwarder

⚠ WARNING **Injuries due to uncontrolled movement of the tightening straps when cutting them!**

1. Keep sufficient distance
2. Carefully remove the retaining straps

When selecting the transport and lifting devices, the different weights and sizes of the individual designs must be taken into account. For information on the weight of the rotor and stator, refer to the data sheetchapter 4 "Technical data" on page 15.

Special care is also required for models transported by hand and transport and storage instructions must always be observed.

10.1.2 Motor component marking

Bar code A bar code label is attached to each packaging of rotors and stators. The bar code label is provided for identifying the contents of the packages during processing of the order.

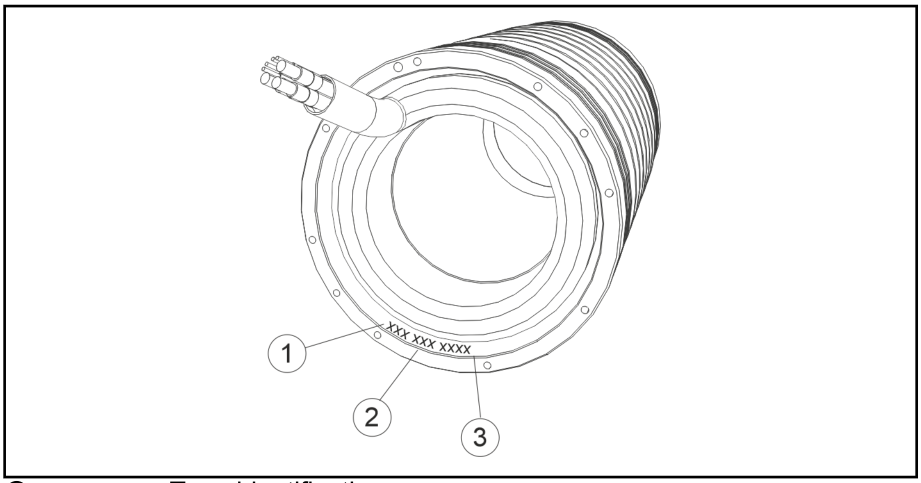
Type plate Stator 1MS and rotor 1MR are each delivered with 2 type plates.

Attach one of the type plates each to a clearly visible place on the machine. This allows you to read the motor data at any time without having to work in hard-to-reach places.

☞ Before contacting Bosch Rexroth, always specify the full type designations and serial numbers of the products involved.

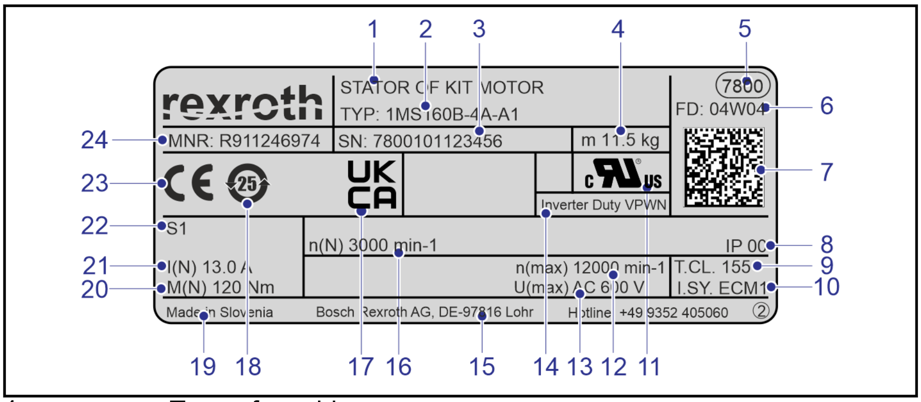
Stator marking The stator is marked on the face with the larger outside diameter. The data of this marking are identical with the data of the associated stator type plate and consist of

- Type identification
- Serial number
- Manufacturing month and year



① Type identification
② Serial number
① Manufacturing month and year

Fig. 10-1: Stator marking



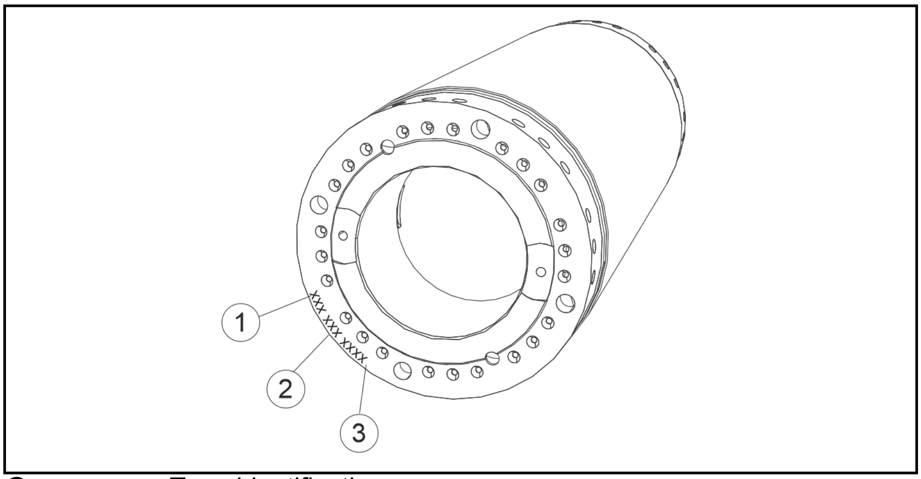
1	Type of machine
2	Type identification
3	Serial number
4	Mass
5	Factory (SAP)
6	Date of manufacture
7	Bar code
8	Degree of protection by housing
9	Thermal class
10	Insulation system
11	UL sign
12	Highest permissible velocity (mechanical)
13	Maximum input voltage
14	UL text 1
15	Company address
16	Rated speed
17	UK Conformity Assessed (UKCA)
18	China RoHs 2 labels
19	Designation of origin
20	Rated torque in operation mode S1
21	Rated current in star connection in operation mode S1
22	Operation mode S1
23	CE mark of conformity
24	Material number

Fig. 10-2: Type plate of stator (example)

Rotor identification

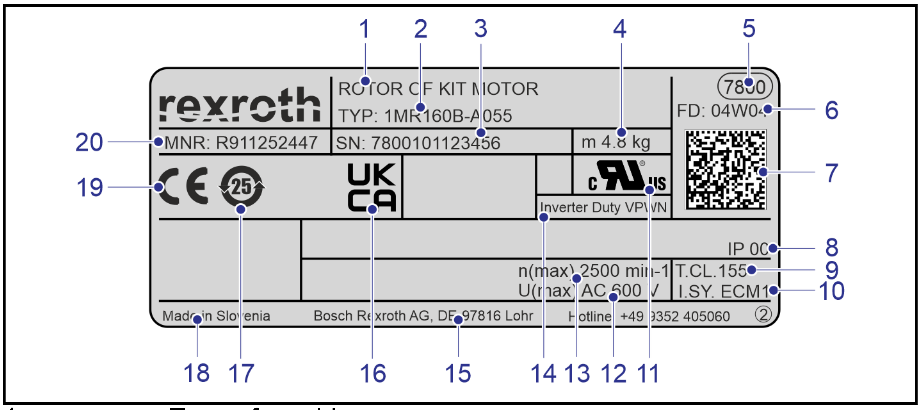
As with the stator, the rotor is also marked on one of the two end faces. The following marking is done:

- Type identification
- Serial number
- Manufacturing month and year



① Type identification
② Serial number
① Manufacturing month and year

Fig. 10-3: Rotor designation



1	Type of machine
2	Type identification
3	Serial number
4	Mass
5	Factory (SAP)
6	Date of manufacture
7	Bar code
8	Degree of protection by housing
9	Thermal class (insulation class)
10	Insulation system
11	UL sign
12	Maximum input voltage
13	Highest permissible velocity (mechanical)
14	UL text 1
15	Company address
16	UK Conformity Assessed (UKCA)
17	China RoHs 2 labels
18	Designation of origin
19	CE conformity mark
20	Material number

Fig. 10-4: Type plate of rotor (example)

10.1.3 Factory testing

All 1MB motors are subjected to the following tests at the factory:

- High voltage test according to DIN EN 60034-1.
- Insulation resistance according to DIN EN 60204-1/1.92, section 20.3.
- Geometric measurement of all mounting sizes.

10.1.4 Customer testing

Since all motors undergo a standardized test procedure, high-voltage tests on the customer side are not required. Motors and components could be damaged if they are subjected to repeated high-voltage tests. If a new test is nevertheless to be carried out, it is essential that you consult Rexroth.

⚠ CAUTION **Destruction of motor components due to improperly executed high-voltage test! Loss of warranty!**

- Avoid repeated inspections.
- Observe the guidelines of DIN EN 60034-1.

10.1.5 Scope of delivery

The total scope of delivery can be seen from the delivery note or the accompanying document. The content, however, can be delivered in several packages. Each package can be identified by a forwarding label.

For stator and rotor, 2 type plates each are provided. Additionally, a shipping note with information on handling is provided.

☞ Compare the ordered and delivered types after receipt of the goods. Immediately complain about any deviations.

10.2 Transport and storage

10.2.1 General information

⚠ CAUTION **Damage or injuries and loss of the warranty due to improper handling! Heavy weight!**

- Protect the products against moisture and corrosion .
- Avoid mechanical loads, strokes, throwing, tilting or dropping of the products.
- Use only suitable lifting gear.
- Do not lift the motor at its connectors, cables or connection fittings.
- Use suitable protective equipment and protective clothing during transport.
- **Transport** the motors horizontally in a dry, vibration-free, dust-free and corrosion-protected condition.
- **Store** the motors horizontally in a dry, vibration-free, dust-free and corrosion-protected condition.

10.2.2 Transport instructions

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

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

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

Classification type	Permissible class
Classification of climatic environmental conditions	2K11
Classification of biological environmental conditions	2B1
Classification of chemically active materials	2C1
Classification of mechanically active materials	2S5
Classification of mechanical environmental conditions	2M4

Tab. 10-1: Permissible classes of environmental conditions during transport

For a better overview, some essential environmental variables of the previously mentioned classifications are listed. Unless otherwise specified, the values given are the values of the particular class. However, Bosch Rexroth reserves the right to adjust these values at any time based on future experiences or different environmental factors.

Permissible transport conditions

Environmental factor	Symbol	Unit	Value
Temperature	T_T	°C	-25 ... +70
Relative air humidity	φ	%	5 ... 75
Absolute air humidity	ρw	g/m³	1 ... +29

Tab. 10-2: Permissible transport conditions

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

To lift the motor out of the transport crate or to install it in the machine, use the transport or lifting eyebolts at the motor.

The lifting eyebolts at least meet the requirements of DIN 580. Before each transport, ensure that the lifting eyebolts have been screwed down fully to the contact surface and that your selected lifting gear and lifting method does not overstress the lifting eyebolts.

☞ Please comply with DIN 580 on the transport of motors using the attached lifting eyebolts. Non-observance of the information in this standard can cause overstress to the lifting eyebolts and result in personal injury and/or product damage.

Lifting and transporting the rotor

During transport be careful not to damage the fit on the inside of the rotor. Damage in this area may make it impossible to disassemble the rotor from the spindle if necessary.

⚠ CAUTION **Damage caused by lifting gear!**

The rotor may only be lifted and transported with loop lifting slings made of plastic or with a special hook covered with plastic.

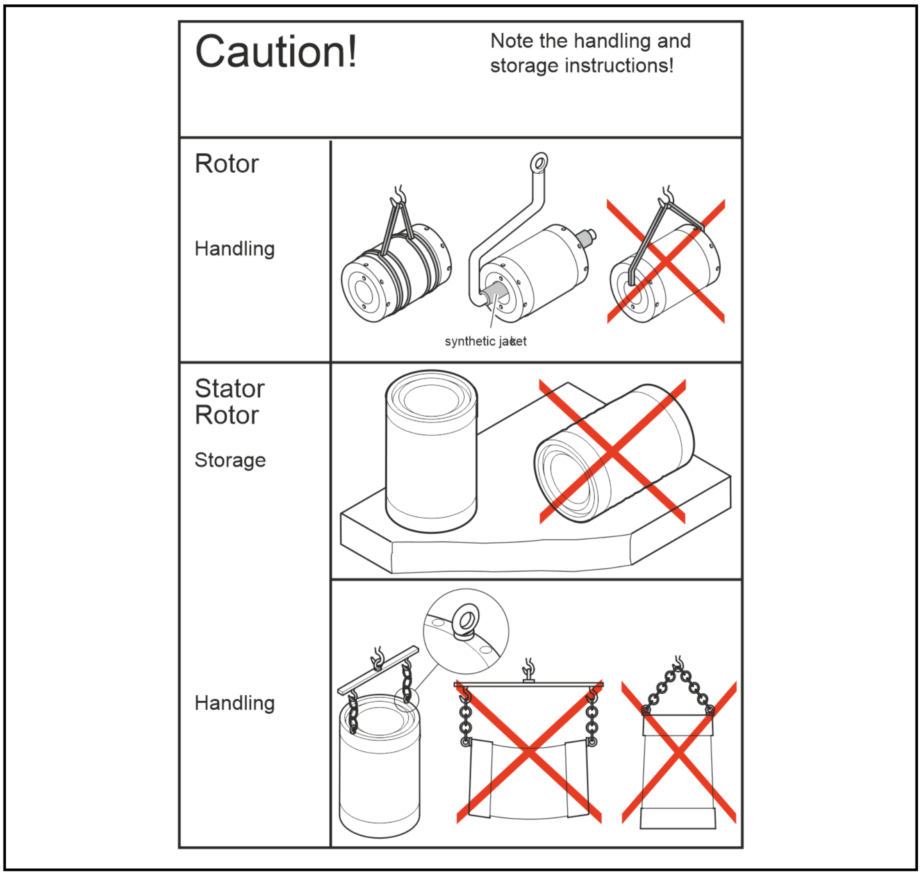


Fig. 10-5: Transport of 1MS and 1MR

Please note:

- Use lifting eye bolts during transport in opposite holes only. Use only suitable lifting gear.
- Place the rotor and stator on a clean and level surface. If possible, both assemblies should be stored in vertical position and secured against falling over. If horizontal storage cannot be avoided for some frame sizes of rotors or stators, the components have to be secured against rolling.
- Damage to the fitting at the stator flanges has to be prevented to ensure that installation is not impeded.

10.2.3 Storage instructions

Storage conditions

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

- in their original packaging
- at a dry and dust-free location
- at room temperature
- free from vibrations and oscillations
- protected against light or direct sunlight

Upon delivery, protective sleeves and covers can be attached to Bosch Rexroth motors. They have to remain on the motor for transport and storage. Do not remove these parts until shortly before assembly.

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

Permissible classes of environmental conditions during storage acc. to EN 60721-3-1

Classification type	Class
Classification of climatic environmental conditions	1K21
Classification of biological environmental conditions	1B1
Classification of chemically active materials	1C1
Classification of mechanically active materials	1S10
Classification of mechanical environmental conditions	1M11

Tab. 10-3: Permissible classes of environmental conditions during storage

For a better overview, some essential environmental variables of the previously mentioned classifications are listed. Unless otherwise specified, the values given are the values of the particular class. However, Bosch Rexroth reserves the right to adjust these values at any time based on future experiences or different environmental factors.

Permissible classes of environmental conditions during storage acc. to EN 60721-3-1

Environmental factor	Symbol	Unit	Value
Air temperature	T_L	°C	-25 ... +55
Relative air humidity	φ	%	5 … 75
Absolute air humidity	ρw	g/m³	1 … 29
Condensation	-	-	Not permitted
Direct solar radiation	-	-	Not permitted

Tab. 10-4: Permissible storage conditions

Storage times

Additional measures have to be taken upon commissioning to ensure smooth functioning – irrespective of the storage duration which may be longer than the warranty period of our products. However, this does not entail any additional warranty claims.

Motors

Storage time/months			Measures for commissioning
> 1	> 12	> 60	
■	■	■	Visual inspection of all parts to be damage-free
	■	■	Check the electric contacts to verify that they are free from corrosion
	■	■	Measure insulation resistance. Dry the winding at a value of < 1kOhm per volt rated voltage.

Tab. 10-5: Measures before commissioning motors that have been stored over a prolonged period of time

Cables and plug connectors

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

Tab. 10-6: Measures before commissioning cables and connectors that have been stored over a prolonged period of time

11 Installation

11.1 General notes

In addition to technical features, this chapter describes how

- the rotor is mounted on the spindle,
- the rotor is disassembled from the spindle,
- the stator is installed in the spindle housing and electrically connected,
- the motor spindle is electrically tested,
- the stator is removed from the spindle housing.

Thorough execution of the described work steps ensures:

- correct and safe assembly and disassembly of the components,
- the proper functioning of the kit spindle motor.

Bindingness

The basic procedure for installing and removing the components is always the same. However, it may differ from the design of the spindle and the spindle housing, from the procedure described here. This assembly instruction only provides a basis and must be adapted to the respective requirements. The spindle and spindle housing designer's assembly instructions are binding and take precedence over the procedures described here.

Assembly procedure

For an overview of the individual assembly steps, please refer to the following sequence plan.

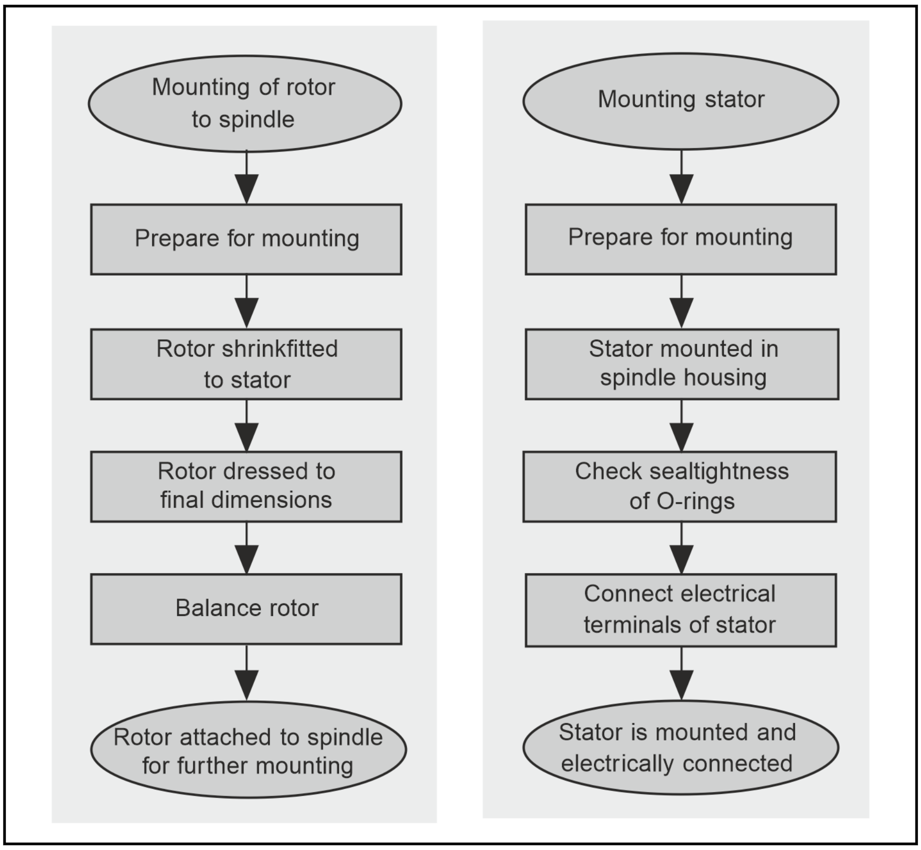


Fig. 11-1: Sequence plan of assembly of the rotor and the stator

11.2 General safety instructions

In addition to the chapter chapter 3 "Danger-related notes" on page 9, further safety instructions are listed in this chapter. They are specified directly at the location of the hazard or where hazards may occur. They support the prevention of accidents and damage at material due to incorrect handling.

Oil pump

Only **manually operated** oil pumps may be used when disassembling the rotor from the spindle. Manually operated oil pumps ensure that the oil pressure drops immediately to 0 bar in the event of leaks in the step interference fit, the connection thread or the pump piping system. For safety reasons, the oil pump must also be equipped with overpressure protection to prevent oil pressures over 1500 bar.

Securing the threaded pins

To prevent loosening of the threaded pins in the rotor during operation and any related hazards for personnel and property, the pins have to be secured. For this purpose, the threaded pins must be bonded with a liquid screw lock. Also refer to Chap.11.3 .

Accident prevention

Wear appropriate protective clothing during assembly. In particular, there is a risk of burns when shrinking the rotor onto the spindle. Heat-resistant clothing must be worn.

The accident prevention regulation “Electrical systems and equipment” (VBG 4) has to be complied with:

Prior to working on active parts of electrical systems and equipment, ensure that these parts are de-energized and remain de-energized during the duration of the work. The electrical systems and equipment have to be checked before initial startup by an electrician to ensure that they are in proper condition.

The user is responsible for proper grounding of the complete system. To prevent accidents due to touching of live parts, protective measures against direct and indirect touch are necessary. For notes, refer to DIN VDE 0100, Part 410.

Handling and transport

Observe the respective notes in chapter 10 "Handling, transport and storage" on page 167.

11.3 Screw lock

All screw connections have to be secured against potential impacts and vibrations during operation of the machine. A suitable and field-tested screw lock for all metal thread connections is, e.g., Loctite 243.

Loctite 243 is a liquid screw lock (medium-hard) and is applied to the parts to be mounted immediately prior to assembly. For detailed information on correct handling and processing, please refer to the manufacturer's data sheets under http://www.loctite.de. The manufacturer's homepage also provides information on hardening accelerators or other screw locks.

11.4 Accessories for assembly and disassembly

Tools and equipment	Mount rotor onto spindle	Dismount rotor from spindle	Install stator	Electrically check the motor spindle	Remove stator
Crane (size sufficient for weight of part)	x	x	x		x
Lifting device (size sufficient for weight of part)	x	x	x		x
Work fixture for attaching the rotor 1)	x				
Heating cabinet (+ 200 °C minimum)	x				
Lathe (to finish the rotor design“C“)	x				
Balancing equipment	x				
Test assembly to determine radial runout	x				
Spindle rotor clamping device 1)	(x)				
Compressed air device	(x)				
Oil pump (manually operated, max. 1,500 bar) with accessories 1)	(x)	x			
Fixture 1)		x			
Drilling jig			x		
Water pump for tightness test (up to 6 bar)			x		
Ohmmeter				x	
High voltage testing unit				x	
Inductance measuring equipment				x	
Torque wrench up to 35 Nm			x		
Conventional tools and cleaning equipment	x	x	x		x
Aids					
LOCTITE 243			x		
LOCTITE 620	x				
LOCTITE Cleaner 7061	x		x		
LOCTITE Activator 7649	x		x		
Mineral oil: viscosity 300 mm^2/s at 20°C	(x)				
Mineral oil: viscosity 900 mm^2/s at 20°C		x			
Oil, conventional type, for lubrication	x				
Grease, conventional type	x		x		
Vaseline			x		
Coolant			x		

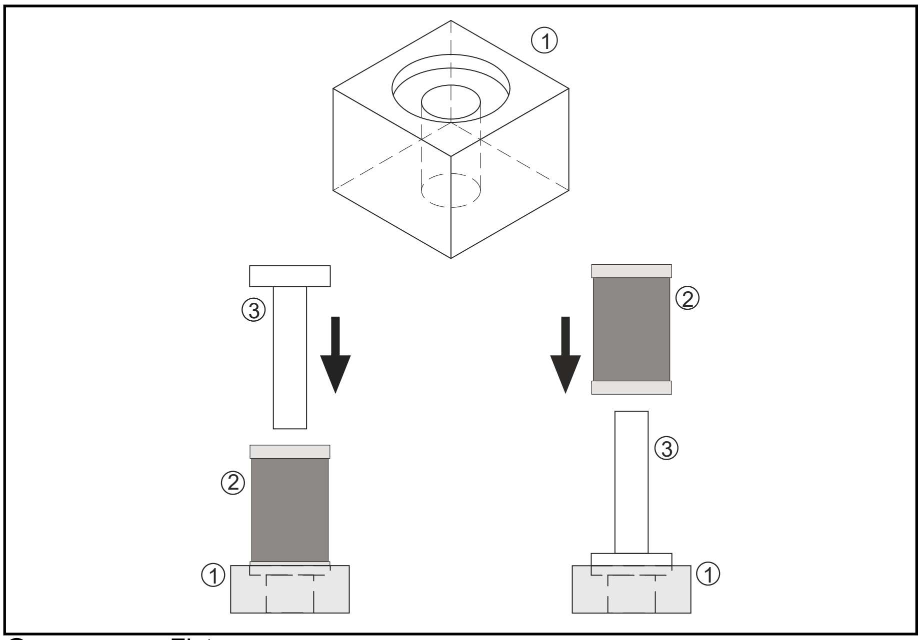
1) See explanations on the next page
(x) Only in case of assembly errors

Fig. 11-2: Accessories for assembly / disassembly

Explanations

Rotor fixture:

The fixture must be heat-resistant at least up to +200 °C and offer sufficient load-bearing capacity for the weight of the rotor and the spindle. It must also provide the rotor with a level and horizontal stand. An example for possible realization is provided below.



① Fixture
② Rotor
③ Spindle

Fig. 11-3: Fixture principle

Manually operated oil pump and accessories: Oil pressure: 1500 bar with overpressure protection; connection thread of high-pressure hose: M6 or M4 x 0.5 (depending on rotor type)

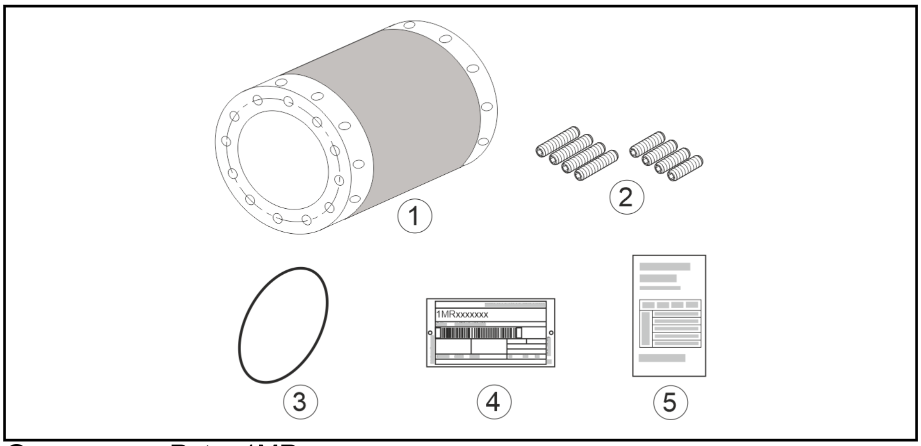
Oil pumps and accessories are generally available from the manufacturers of roller bearings.

Spindle rotor clamping device: If deformation of the spindle is detected after the rotor has been shrunk on, a clamping device is required, among other things, to correct this deformation. This clamping device must ensure secure retention of the rotor on the spindle and prevent axial motion of the rotor. For a respective example, refer to fig. 11-14 "Example of a fixture for disassembly" on page 193.

Attachment fixture: When disassembling the rotor from the spindle, the rotor can slide off the spindle abruptly. For this reason, a fixture has to be attached to the spindle. For a respective example, refer to fig. 11-14 "Example of a fixture for disassembly" on page 193. The assembly dimensions must be observed (see tab. 11-3 "Assembly dimension A for various rotor types" on page 193).

11.5 Assemble the rotor with step interference fit

11.5.1 Components/scope of delivery of the rotor



①	Rotor 1MR
②	Threaded pins for rotor balancing (number and type acc. to rotor type)
③	O-ring for step interference fit (options "A" and "C")
④	Type plate (2)
⑤	Accompanying document

Fig. 11-4: Scope of delivery

11.5.2 Before assembly

Assembly should be carried out in a dry and dust-free environment. For this purpose, the following preparation have to be made:

- Check the delivery for completeness.
- Visually check the rotor for visible damage.
- Attach the type plate visibly to the spindle housing.
- Make sure that there are no burrs at chamfers and edges at the pressure fittings of the spindle. Deburr as necessary.

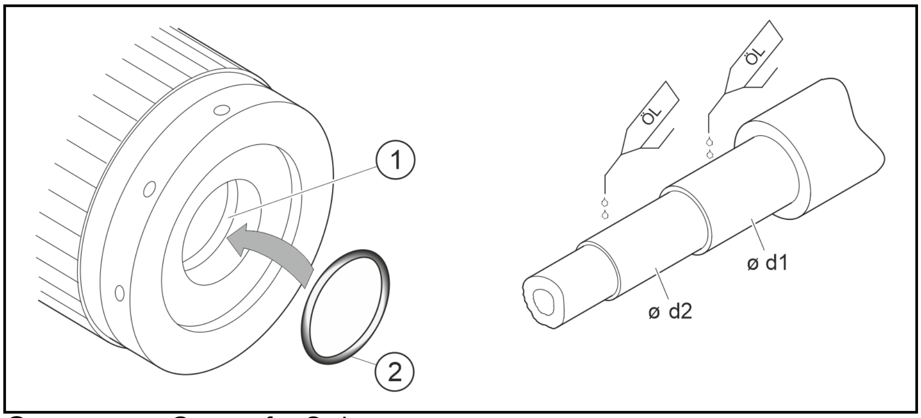
☞ **The sheet metal package is protected against corrosion!**

The rotor is coated with a red anti-corrosion paint for transport and storage.

- Remove protective varnish before assembly.
- Wear suitable protective clothing.
- Used detergents must be removed completely before heating the rotor in the heating cabinet.

If necessary, protect the rotor against corrosion again after assembly.

- Thoroughly clean the internal rotor diameter, the oil port and the pressure fittings at the spindle from dirt, dust, metal chipping, etc.
- Grease the O-ring and insert it in the groove in the rotor. Do not twist the O-ring. Pay attention to cleanliness.
- Oil the pressure fittings Ø d1 and Ø d2 on the spindle.



① Groove for O-ring
② Greased O-ring

Fig. 11-5: Preparing the rotor and spindle for assembly

- Prepare the rotor fixture for vertical rotor support to assemble the spindle.

11.5.3 Shrink-fitting of the rotor on the spindle

1. Heat the rotor in a heating chamber to at least +180 °C, however, no more than +200 °C.

☞ If the rotor is not heated to at least +180 °C, the spindle will get stuck during shrinking before it reaches the end position.

⚠ WARNING **Hot surfaces with temperatures over 50 °C may cause burns!**

⇒The rotor is hot! Contact leads to severe injury from burning!

⇒ Wear heat-resistant work clothes and safety gloves!

2. Place the rotor in the prepared fixture.
3. Lift the spindle and slide it quickly into the rotor.

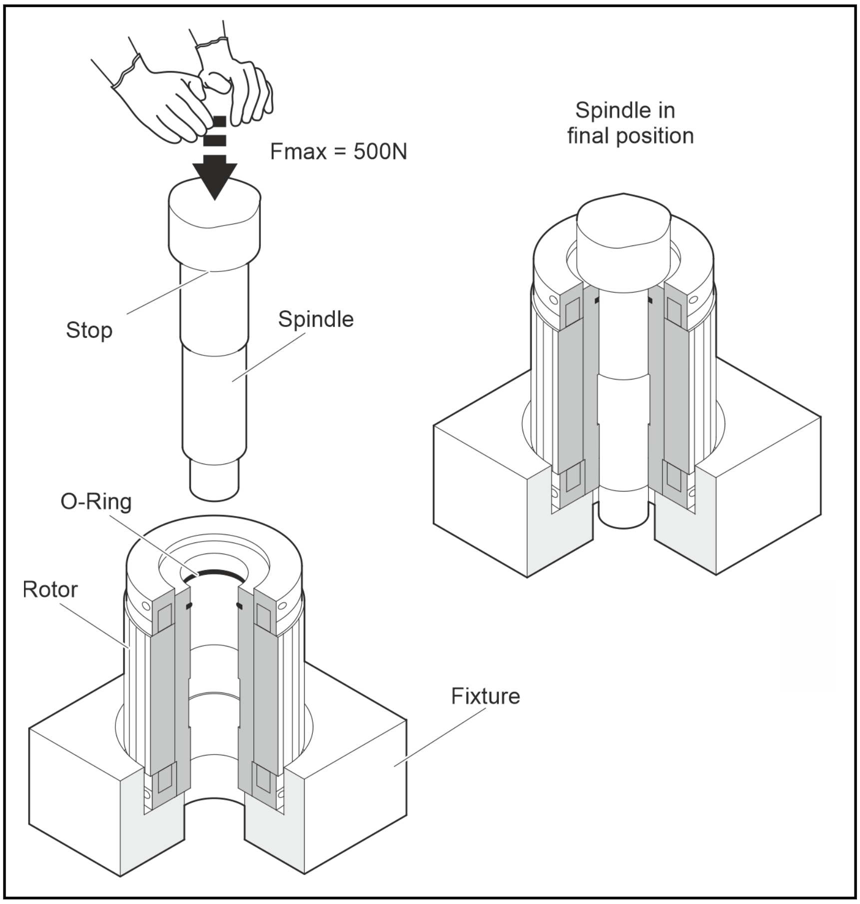


Fig. 11-6: Joining of rotor and spindle

Usually, the spindle slides into its intended end position (end stop at spindle) without any additional force. If the actual weight of the spindle is not sufficient to completely slide it into its end position, push it into the rotor with an external force of no more than 500 N (body weight of the installing technician).

4. Let the rotor and spindle cool down to room temperature.
5. Check proper shrink-fitting connection of the rotor on the spindle:
   - Visual inspection whether the spindle is inserted into the rotor up to its end stop
   - Check spindle rotation:

     Make sure that the rotation of the spindle is not compromised by the shrink-fitting process. If the rotation is compromised, minor deformation occurred at the spindle. The deformation is caused by stress that may occur during cooling in the step interference fit.

11.5.4 Measures in case of assembly faults

☞ In the case of rotors with step interference fit (options A and C), the rotor can be disassembled and, if necessary, reinstalled. In order to assemble the rotor again after the disassembly, a perfect O-ring is required.

Check the O-ring. Replacement O-rings can be purchased through Rexroth's service. For a list of the required types, refer to the end of this section and the operating instructions.

Rotor type	Part number of O-ring
1MR...-A040	R911252848
1MR...-A045	R911253051
1MR...-A055	R911245299
1MR...-A060	R911245300
1MR...-C060	R911245300
1MR...-A061	R911245300
1MR...-C061	R911245300
1MR...-A066	R911251262
1MR...-A071	R911245305
1MR...-C071	R911245305
1MR...-A072	R911245305
1MR...-A087	R911245306
1MR...-A090	R911261062
1MR...-A094	R911245307
1MR...-A098	R911254638
1MR...-A108	R911245308
1MR...-A111	R911245309
1MR...-A112	R911245309
1MR...-A118	R911245268
1MR...-A120	R911245268
1MR...-A125	R911245310
1MR...-A170	R911245297

Tab. 11-1: Material numbers of the O-rings on the 1MR

During shrink-fitting, the spindle gets stuck in the rotor before its end position.

1. Let the rotor and spindle cool down.
2. Seal one of the two hydraulic oil ports at the rotor with a threaded pin. To do this, screw in the threaded pin completely and glue it in place to prevent it from twisting (seeChapter 11.3). The threaded pin must be glued in place so that it completely seals the connection against oil pressure.
3. Remove the rotor by means of hydraulic oil from the spindle (as described under "Disassembling the rotor from the spindle").
4. Check pressure fitting tolerances.
5. If necessary, grind off burrs on the inner diameter of the rotor and on the interference fits Ø d1 and Ø d2 of the spindle.

☞ There must not be any burrs at the spindle and rotor!

6. Shrink-fit the rotor to the spindle again.

After shrink-fitting on the rotor, the spindle is deformed.

During fitting, tensions may occur in the step interference fit. These can lead to micrometer deformation of the spindle. Injecting pressurized oil into the step interference fit releases these tensions and reverses the deformation of the spindle.

1. Let the rotor and spindle cool down.
2. Seal one of the two hydraulic oil ports at the rotor with a threaded pin. To do this, screw in the threaded pin completely and glue it in place to prevent it from twisting (see Chapter 11.3). The threaded pin must be glued in place so that it completely seals the connection against oil pressure.
3. Secure the rotor and spindle with a suitable assembly tool in such a way that the rotor is securely held in its position on the spindle.

☞ The rotor must not slide in axial direction on the spindle while the pressure oil is pressed in.

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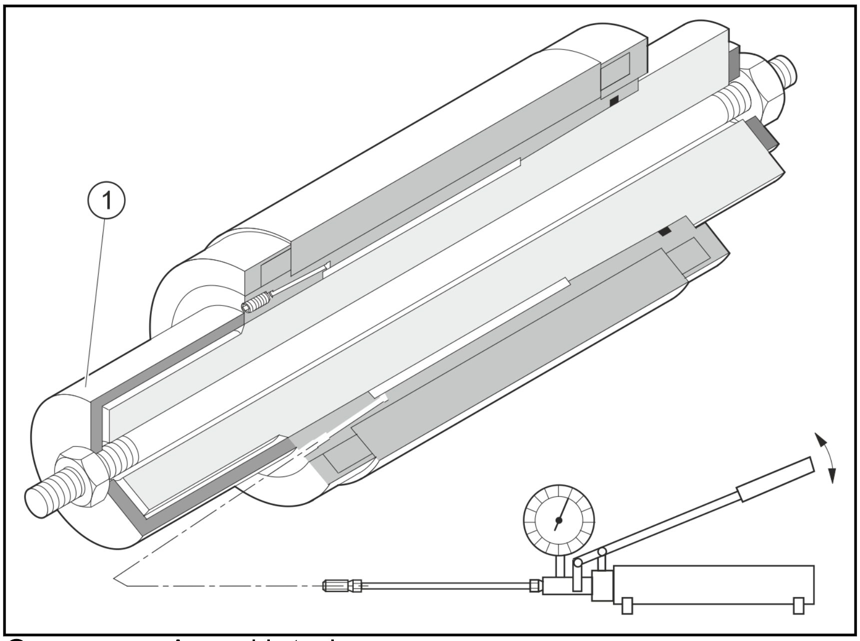
4. Connect an oil pump.

   Use oil with a viscosity of 300 mm^2/s at +20 °C! This way, it can be ensured that the oil is drained fully after "floating".



① Assembly tool

Fig. 11-7: "Floating" of the rotor

5. Pump oil into the step interference fit.

☞ Oil is leaking!

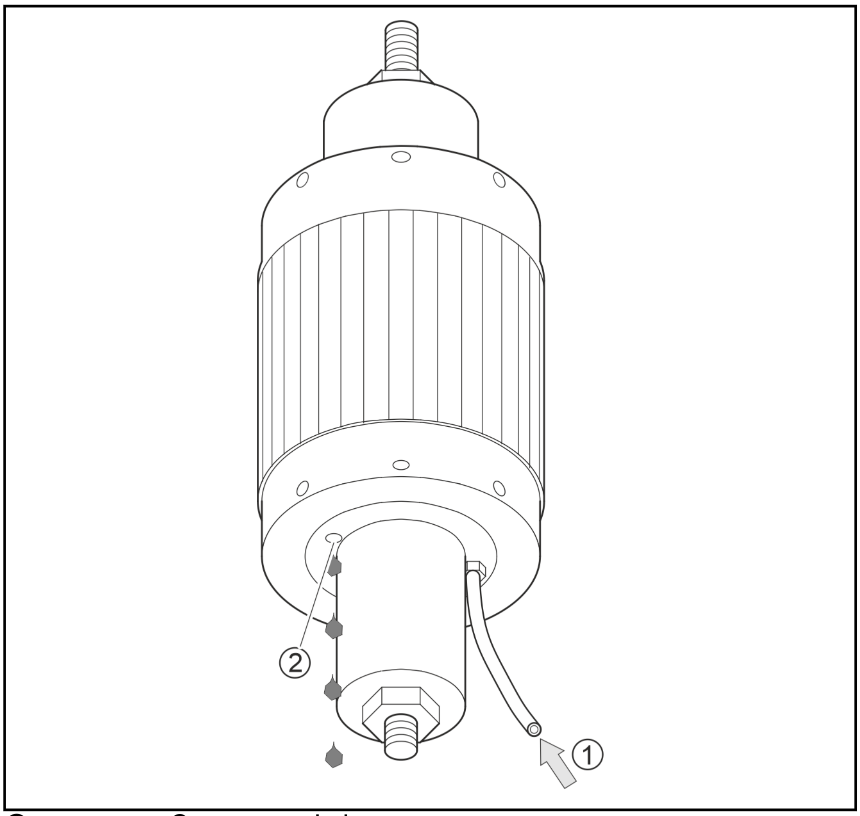
Have ready a collection tray.

   Slowly increase the oil pressure until the oil is leaking at the face of the pressing groove.

   A separating oil film forms between the rotor and spindle. This "floating" of the rotor on the spindle enables the release of tensions that occurred during shrink-fitting.

6. Depressurize the oil pump, feed lines and interference fit.

7. Open both hydraulic oil ports.
8. Bring the spindle with the clamping device in a vertical position and press the oil out of the step interference fit with compressed air.



① Compressed air
② Oil leakage

Fig. 11-8: Press out the oil with compressed air

9. Completely drain the oil from the step interference fit.

☞ Wait 24 hours before fully loading the step interference fit!

10. Close both pressure oil connections with the threaded pins supplied and bond them with liquid screw lock (seeChapter 11.3)

11.5.5 Machine rotor to final dimension

☞ This step is only required for rotors with rotor design "C".

After the rotor and the spindle are firmly connected, the outer diameter of the rotor must be dry machined (without coolant, cutting fluid) in the area of the sheet metal package. The prescribed final dimension of the outer diameter depends on the respective motor type and can be taken from the corresponding dimension sheets.

While machining, make sure that the max. radial runout to the bearing seats A and B does not exceed the specified value.

The value for the max. radial runout for the various motor types is given in the corresponding dimension sheets.

☞ The rotor may not be grinded nor machined wet.

No material may be removed from the shorting rings and the balancing rings.

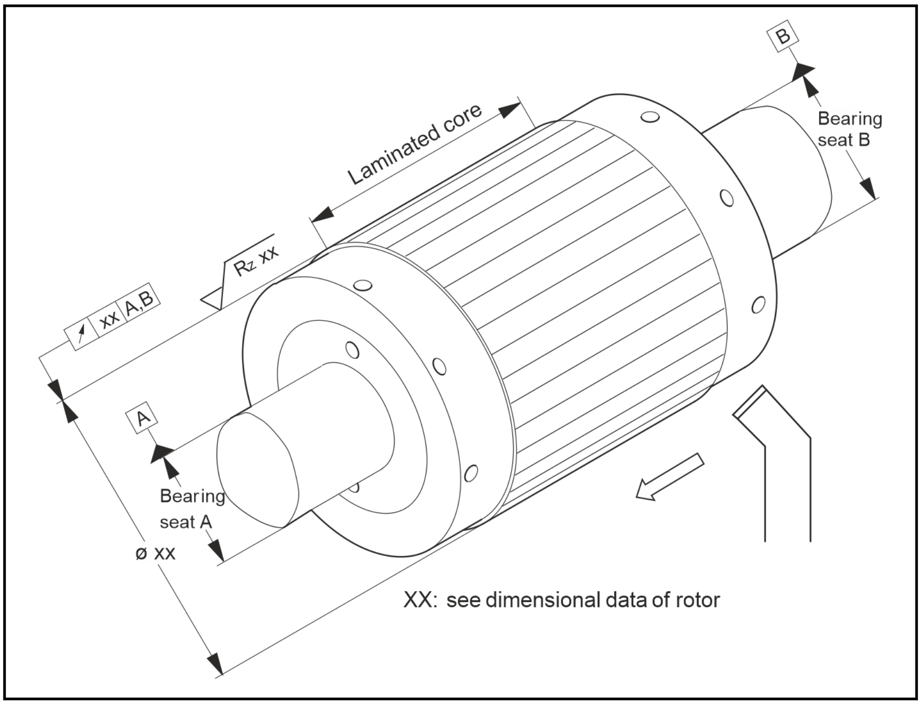


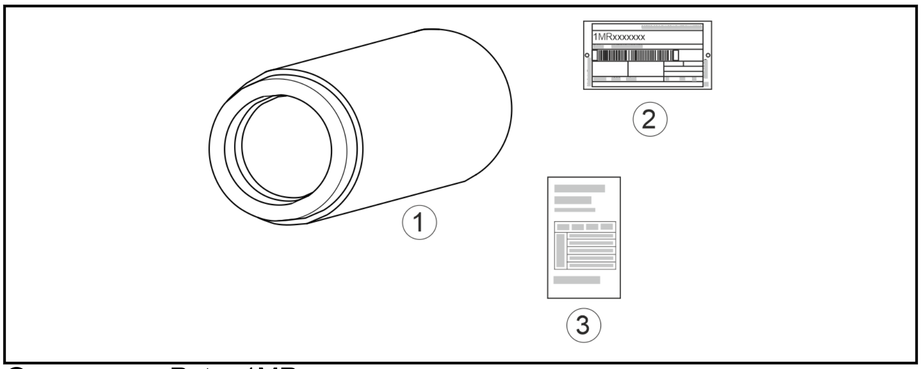
Fig. 11-9: Machining the rotor

☞ The specified final dimension to which the outside diameter must be machined must be strictly adhered to.

If too much material is machined, the operating characteristic of the drive changes.

11.6 Assembly of 1MR105 rotor with rotor design "B" (without rotor sleeve)

11.6.1 Components/scope of delivery of the rotor



① Rotor 1MR
② Type plate (2)
③ Accompanying document

Fig. 11-10: Scope of delivery of 1MR105

11.6.2 Before assembly

Assembly should be carried out in a dry and dust-free environment. For this purpose, the following preparation have to be made:

- Check the delivery for completeness.
- Visually check the rotor for visible damage.
- Attach the type plate visibly to the spindle housing.
- Make sure that there are no burrs at chamfers and edges at the pressure fittings of the spindle. Deburr as necessary.

☞ **The sheet metal package is protected against corrosion!**

The rotor is coated with a red anti-corrosion paint for transport and storage.

- Remove protective varnish before assembly.
- Wear suitable protective clothing.
- Used detergents must be removed completely before heating the rotor in the heating cabinet.

If necessary, protect the rotor against corrosion again after assembly.

11.6.3 Shrink-fitting of the rotor on the spindle

1. Heat the rotor in a heating chamber to at least +180 °C, however, no more than +200 °C.

☞ If the rotor is not heated to at least +180 °C, the spindle will get stuck during shrinking before it reaches the end position.

In this case, the rotor and shaft cannot be separated and replaced without causing damage.

⚠ WARNING **Hot surfaces with temperatures over 50 °C may cause burns!**

⇒The rotor is hot! Contact leads to severe injury from burning!

⇒ Wear heat-resistant work clothes and safety gloves!

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2. Place the rotor in the prepared fixture.
3. Lift the spindle and slide it quickly into the rotor.

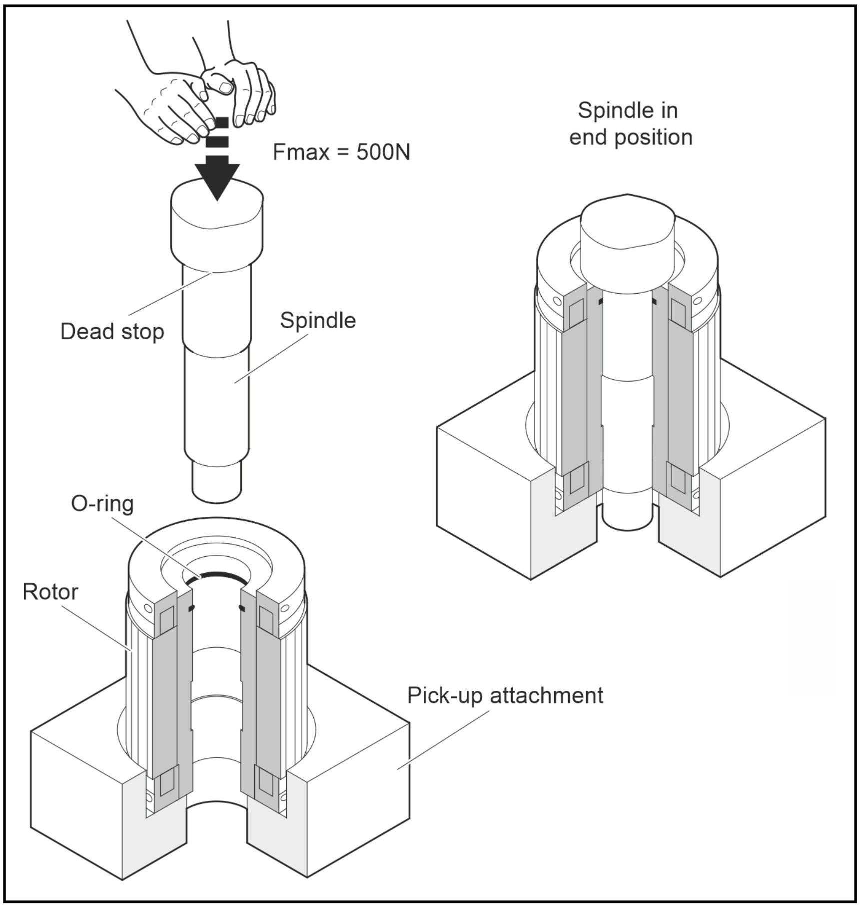


Fig. 11-11: Joining of rotor and spindle

Usually, the spindle slides into its intended end position (end stop at spindle) without any additional force. If the actual weight of the spindle is not sufficient to completely slide it into its end position, push it into the rotor with an external force of no more than 500 N (body weight of the installing technician).

4. Let the rotor and spindle cool down to room temperature.
5. Check proper shrink-fitting connection of the rotor on the spindle:
   - Visual inspection whether the spindle is inserted into the rotor up to its end stop
   - Check spindle rotation:

     Make sure that the rotation of the spindle is not compromised by the shrink-fitting process. If the rotation is compromised, minor deformation occurred at the spindle. The deformation is caused by stress that may occur during cooling in the step interference fit.

11.6.4 Machine rotor to final dimension

After the rotor and the spindle are firmly connected, the outer diameter of the rotor must be dry machined (without coolant, cutting fluid) in the area of the sheet metal package. The prescribed final dimension of the outer diameter depends on the respective motor type and can be taken from the corresponding dimension sheets.

While machining, make sure that the max. radial runout to the bearing seats A and B does not exceed the specified value.

The value for the max. radial runout for the various motor types is given in the corresponding dimension sheets.

☞ The rotor may not be grinded nor machined wet.

No material may be removed from the shorting rings and the balancing rings.

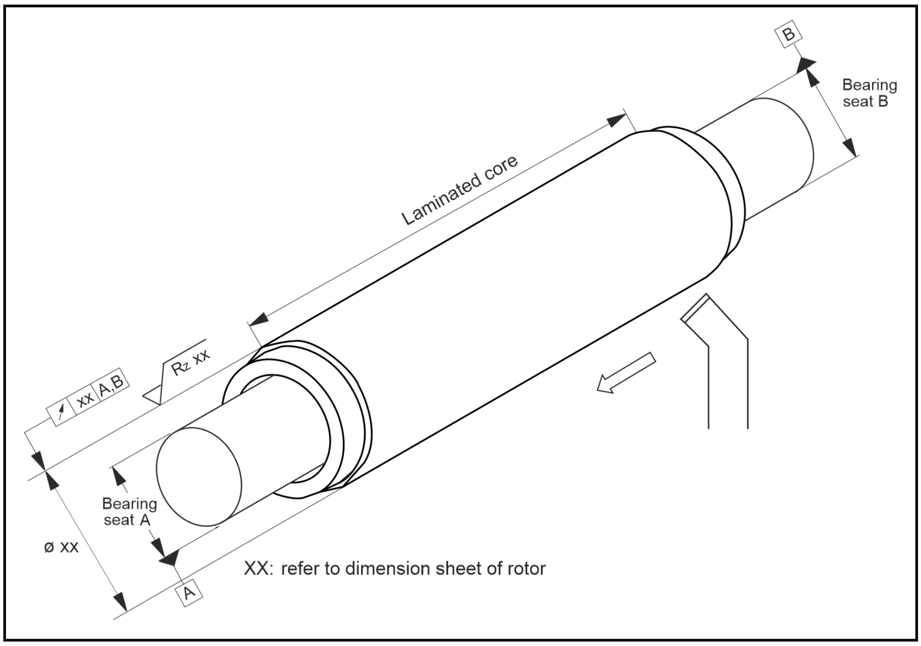


Fig. 11-12: Machining the rotor 1MR105

☞ The specified final dimension to which the outside diameter must be machined must be strictly adhered to.

If too much material is machined, the operating characteristic of the drive changes.

11.7 Assembly of 1MR376 rotor with rotor design "B" (fastening by screws)

Shrinking and subsequent overwinding of the rotor 1MR105 in rotor design "B" is essentially carried out as described inChapter 11.5 .

Comply with the details in the particular dimension sheet during assembly, such as

- the quantity and type of the mounting holes,
- min. screw-in depth and screw-dependent tightening torques.

☞
- The screw length required depends on the machine construction.
- The screw connections have to be able to take up both the force due to the weight of the motor and the forces acting during operation.
- All screw connections are to be equipped with a liquid screw lock. Refer to Chap.11.3 .

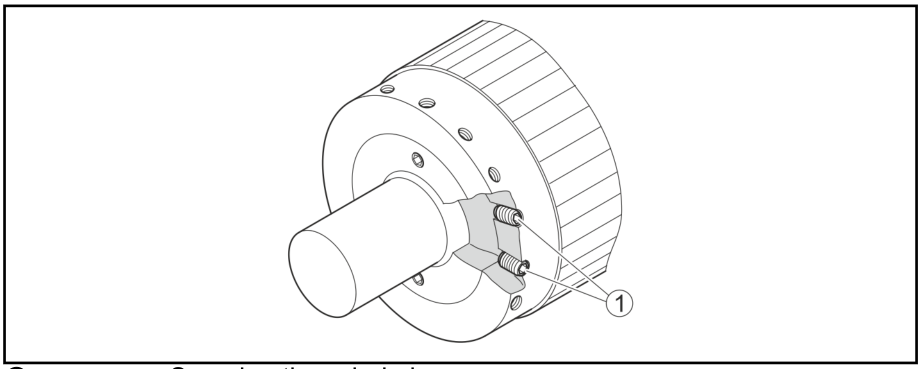
11.8 Balancing the rotor

☞ This section is not relevant for 1MR105 because there are no integrated threaded holes for balancing.

To achieve the desired vibration severity grade of the spindle, the rotor and the spindle have to be balanced. Balancing rings with threaded bores can be found at the face end of the rotor. For balancing, threaded pins have to be screwed in as necessary. The provided threaded pins are listed in Fig. 11-4.

The required vibration severity grade depends on the machining accuracy of the motor spindle and is defined by the engineer of the motor spindle.

☞ For spindle balancing, no material may be removed from the balancing rings!



① Securing threaded pins

Fig. 11-13: Balancing by screwing in of threaded pins

☞ Depending on necessary balancing, the depth for screwing in the threaded pins can be adjusted. However, they must not protrude over the balancing rings! Full tightening is not necessary!

The threaded pins must be secured against loosening by themselves. For this purpose, they must be bonded with liquid screw lock (seeChapter 11.3).

Threaded pins DIN 913	Number / 1MR ...									Mass g/pc
	140	160	200	240	241	242	270	310	375	
M5 x 5	10									0.44
M6 x 6		5	5			5	5			0.76
M6 x 8		5	5			5	5			1.11
M6 x 12			5			5	5			1.81
M8 x 8				5	5					1.89
M8 x 10				5	5					2.52
M8 x 16				5	5					4.41
M10 x 10								5	5	3.78

Threaded pins DIN 913	Number / 1MR ...									Mass g/pc
	140	160	200	240	241	242	270	310	375	
M10 x 12								5	5	4.78
M10 x 20								5	5	8.76

Tab. 11-2: Overview of provided threaded pins

☞ If further threaded pins are required in addition to those supplied, these can be ordered from the service department, stating the exact rotor type 1MR... or serial number SN....

11.9 Rotor disassembly

11.9.1 Disassembly of the rotor with step interference fit

In the following cases, it may be necessary to remove the rotor from the spindle again:

- Bearing damage at the spindle
- Rotor damage
- Assembly fault

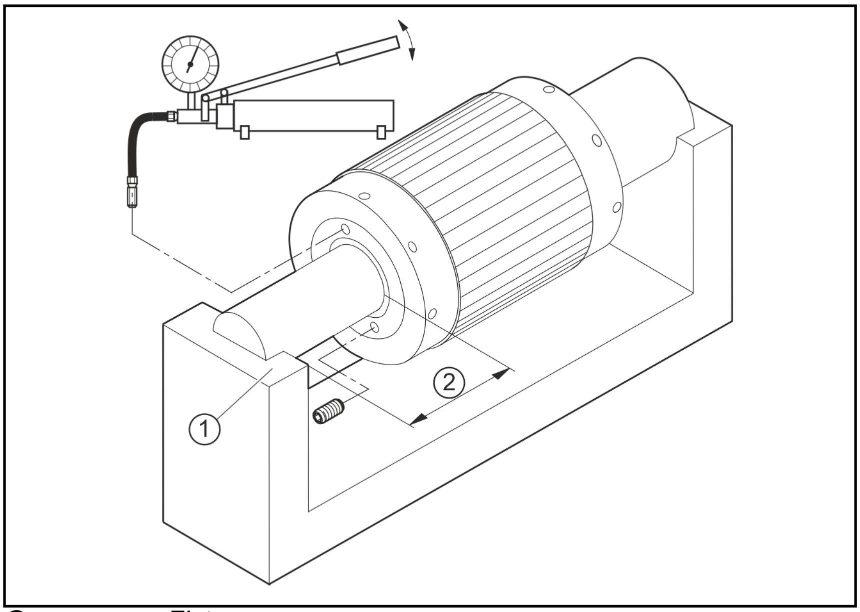
☞ Before disassembly, the angular position of the rotor must be marked on the spindle.

When reassembling, the rotor must then be shrunk onto the associated spindle in the marked position. This means that the concentricity tolerance of the rotor outer diameter to the bearing seats is still maintained.

Procedure:

1. Mark the angular position of the rotor on the spindle.
2. Open one hydraulic oil port.

   The second port must remain sealed. If necessary, close with a threaded pin supplied. To do this, screw in the threaded pin completely and glue it in place to prevent it from twisting (see Chapter 11.3). The threaded pin must be glued in place so that it completely seals the connection against oil pressure.
3. Attach the fixture and observe the assembly dimension (A) for the fixture.



① Fixture

② Assembly dimension "A"

Fig. 11-14: Example of a fixture for disassembly

Rotor 1MR...	Dimension A (mm)
140	min. 60
160	min. 70
200	min. 80
240	min. 80
241	min. 80
242	min. 80
270	min. 90
310	min. 90
375	min. 110

Tab. 11-3: Assembly dimension A for various rotor types

4. Connecting an oil pump
5. Use oil with a viscosity of 900 mm^2/s at +20 °C!

⚠ WARNING **Injury due to sudden rotor motion!**

⇒ The rotor may suddenly slide off the spindle while oil is pumped into the step interference fit.

⇒ While oil is pumped in, a fixture has to be attached to the spindle.

6. Pump oil into the step interference fit.

☞ Oil is leaking!

Keep ready a collection tray.

7. Slowly increase the oil pressure until the axial force in the step interference fit leads to sliding off of the rotor from the spindle.

If oil is already leaking from the face of the step interference fit without the rotor coming off the spindle, help it along with light hammer blows (plastic hammer) against the rotor in the direction of the fixture.

11.9.2 Disassemble the rotor with screw fastening

For disassembly of the motor spindle, proceed in reverse order of assembly. For this reason, use a suitable fitting for disassembly and removal of the rotor from the stator that enables pulling or pushing the rotor out of the stator without any contact (for example, refer to fig. 11-15 "Motor spindle disassembly" on page 195).

Procedure:

1. Loosen and remove the mounting screws between end shield and spindle housing.
2. Centrally pull or push the rotor package out of the stator package with a suitable tool.

☞ Prevent contact with and damage at the interior surfaces of the rotor and stator during pulling it out.

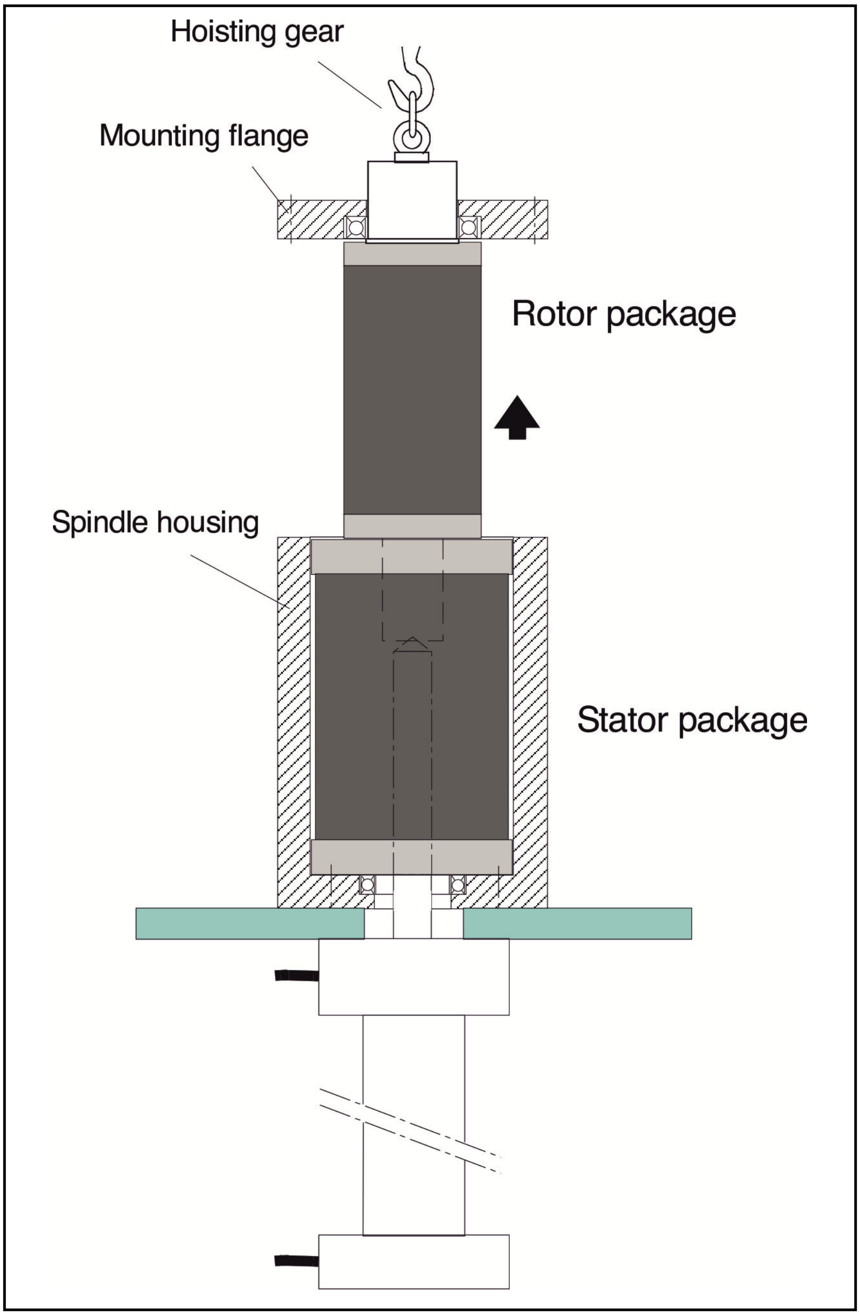


Fig. 11-15: Motor spindle disassembly

11.10 Stator installation - Principle

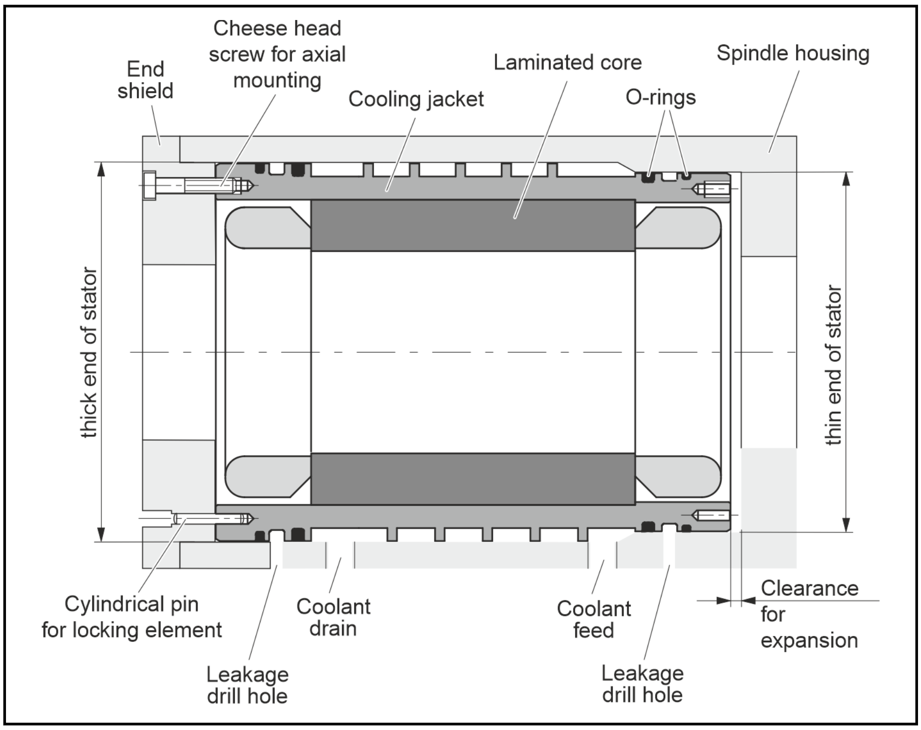


Fig. 11-16: Stator installation

Stator

The stator consists of a metal package with end winding heads and the cooling jacket. The outer diameter of the cooling jacket is stepped. The ends of the stator are therefore referred to as the thick and thin stator ends.

The installation hole in the spindle housing must be made according to the specifications in the dimension sheets of the respective motor.

Stator attachment

In the motor spindle, the stator is axially attached either at the thick or thin stator end and secured against rotation. For this purpose, threads for axial attachment and holes for dowel pins (not on 1MB140) are provided on the end face to prevent rotation.

At the respectively opposite stator end, a clearance of at least 1 mm must be ensured between the stator and spindle housing to enable expansion in length of the stator. The expansion in length occurs due to the increase in temperature during operation of the motor spindle.

The stator is designed for low weight and low volume. For this reason, its final bending rigidity cannot be ensured before it is installed in the spindle housing.

Cooling

The coiled groove machined into the cooling jacket forms a cooling channel with the spindle housing, which is sealed on both sides by two O-rings. There is a circumferential leakage groove between the O-rings. The coolant leakage must be drained through one leakage hole each at the lowest point of the spindle housing.

Corrosion protection

The spindle housing must be protected against corrosion. This can be done by a suitable coolant, or by a suitable coolant additive.

Further information for dimensioning and selection of cooling systems can be found in the documentation "Liquid cooling of Indramat drive components" MNR R911265836.

Electrical connection

The power connection is led out of a winding head of the stator. In addition, there is at least one thermistor in this winding head for measuring the winding temperature by the control device.

The power connection and the thermistor connection are routed together as a cable loom in a tube. The cable loom can be located at the thick or thin end of the stator, depending on the order.

When connecting the cables at the spindle housing, it must be ensured that

- the intended bending radius of the cable loom is not undercut
- the edges of the through holes at the spindle housing are rounded.

11.11 Installing the stator in the spindle housing

11.11.1 Components/scope of delivery of the stator

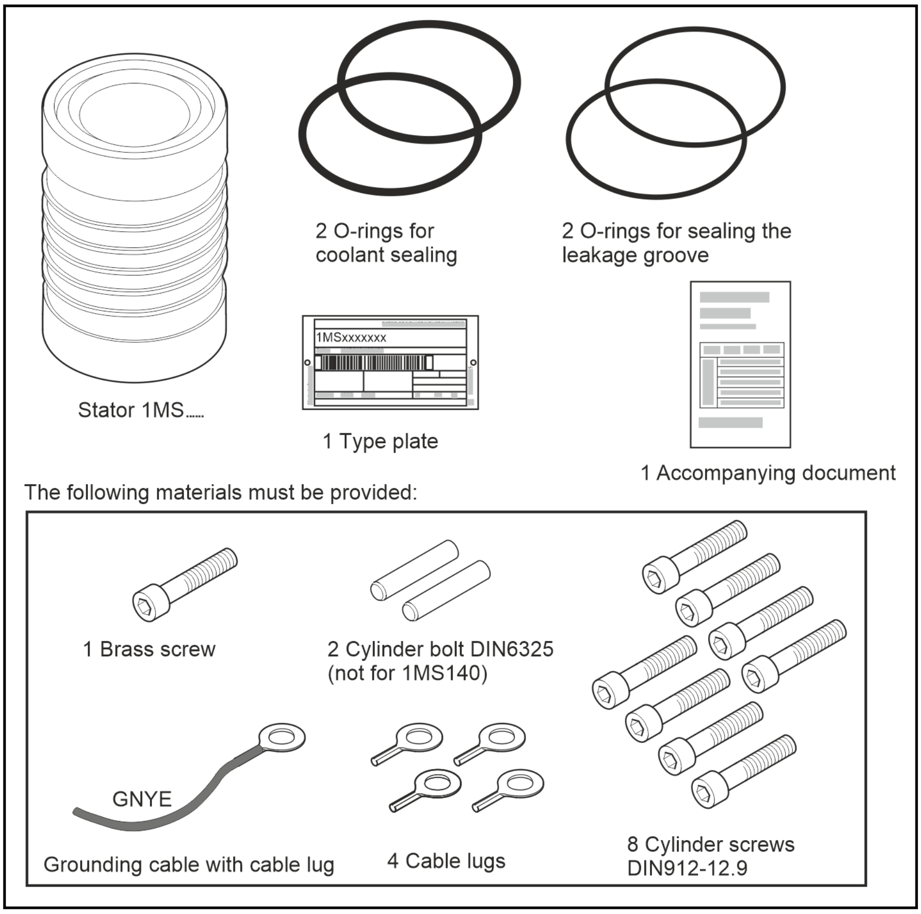


Fig. 11-17: Scope of delivery of the stator and additional materials

11.11.2 Before assembly

Installation should be carried out in a dry and dust-free environment. For this purpose, the following preparation have to be made:

- Check the delivery for completeness.
- Provide additional materials. The precise dimensions of materials are specified in the construction drawings.
- Visually check the stator for visible damage.
- Attach the type plate visibly to the spindle housing.
- Clean O-ring grooves on stator of dirt, dust, metal chips, etc.
- Check O-rings for perfect condition. The stator may only be installed with perfect O-rings.

  Replacement O-rings can be purchased through Rexroth's service. For a list of the types required, see Tab. 11-4 and the operating instructions for these motors.
- Check holes for connections in the spindle housing for freedom from burrs, deburr if necessary.

☞ The inner edges of the holes (connections for coolant and leakage holes) must be absolutely free of burrs so that the stator is not damaged during installation.

Stator type	Number of O-rings	Material number of O-rings
1MS105	4	R911264285
1MS140	4	R911258429
1MS160	2 each	R911247665, R911269166
1MS200	4	R911245301
1MS240	2 each	R911234303, R911234304
1MS241	2 each	R911234303, R911234304
1MS242	4	R911234303
1MS270	2 each	R911254809, R911254810
1MS310	2 each	R911245267, R911269165
1MS375	2 each	R911253811, R911253812
1MS376	2 each	R911253811, R911253812

Tab. 11-4: Material numbers of the O-rings on the 1MS

11.11.3 Installing the stator in the spindle housing

For stator attachment inside the spindle housing, threaded bores are provided on both end faces of the stator.

☞ The stator can be attached to either the thick or thin stator end, but never to both!

The general approach for stator attachment inside the housing is always the same. However, there may be minor deviations from the described approach depending on the design of the spindle housing. The following describes the procedure for attaching the stator to the rear end shield.

Procedure:

1. Grease the O-rings.
2. Insert O-rings (position ①; according to stator accessories list) into the grooves located further inside (coolant seal). Do not twist the O-rings! Pay attention to cleanliness.
3. Insert O-rings (position ②; see stator accessories list) into the grooves located further out (leakage groove). Do not twist the O-rings! Pay attention to cleanliness.

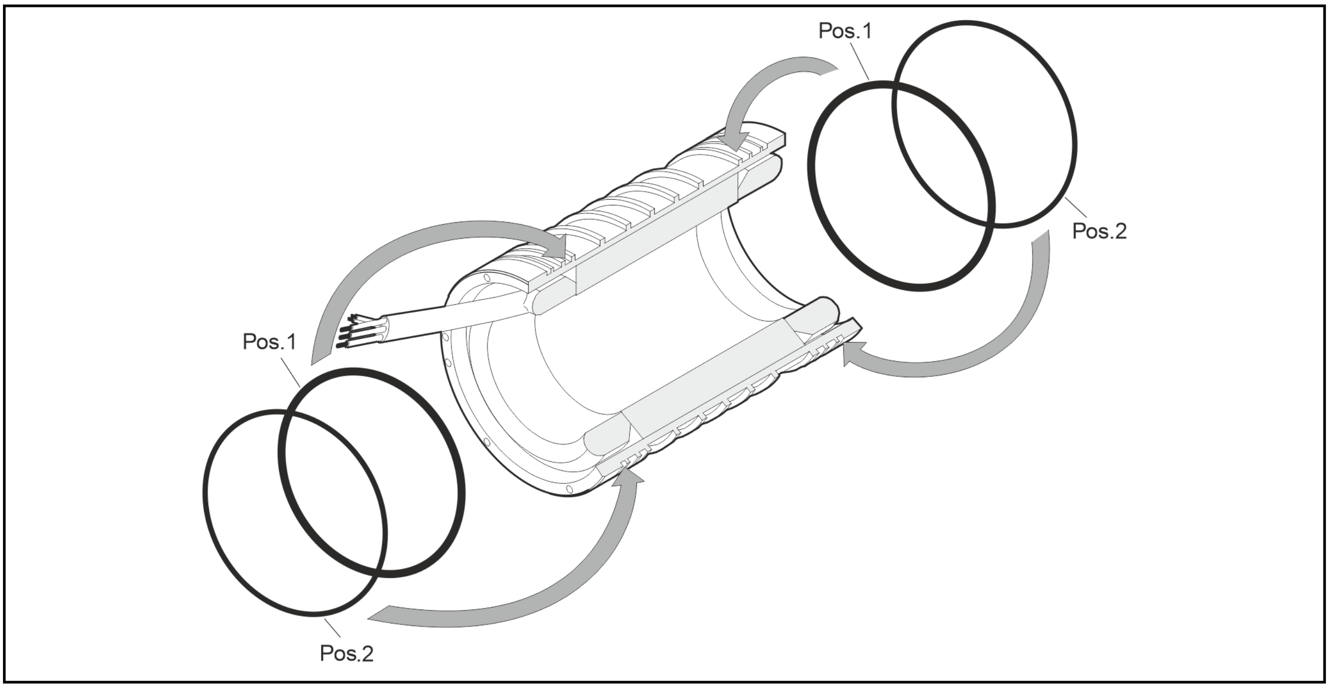


Fig. 11-18: Installing the O-rings

☞ On some motor types, the O-rings for sealing the leakage groove and for coolant sealing have the same dimensions!

4. Centrally slide the stator into the spindle housing. For lifting of the stator, parallel chain or rope hoists are to be used.

☞ For disassembly, do not use the cable loom to pull or push the unit!

Always observe any applicable regulations on transport and handling!

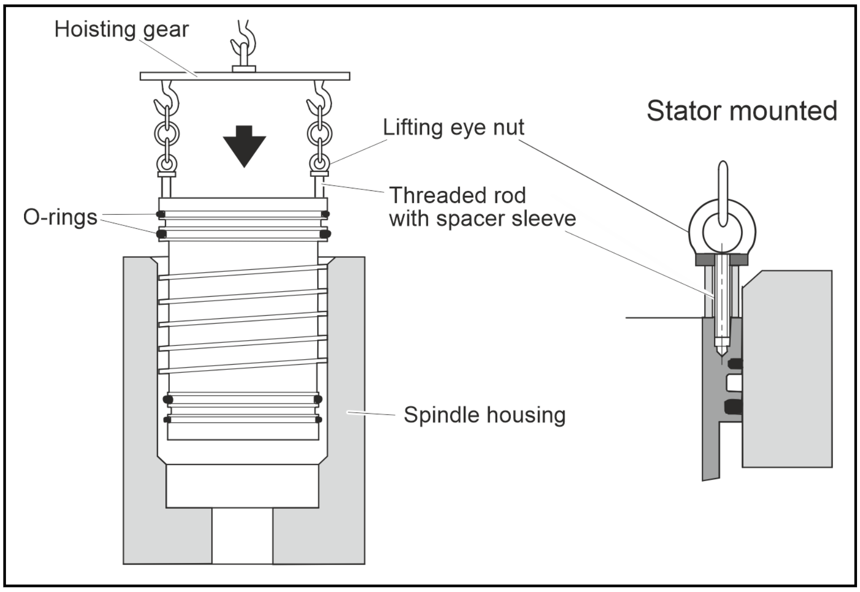


Fig. 11-19: Stator installation into spindle housing

5. Push the stator in its end position. In case of difficult assembly, use suitable tools.
6. Screw the stator to the end shield at the front. Evenly tighten the screws with a torque wrench. The tightening torques can be found in the corresponding design drawings.
7. Secure screws with liquid screw lock.
8. Pin the stator to the end shield (not for 1MS140).

   The holes in the cooling jacket of the stator for the dowel pins are predrilled. They must be drilled out with a drill to the dimension specified in the design documents.

11.11.4 Check O-rings for tightness

After installing the stator, the O-rings should be checked for tightness.

Procedure:

1. Fill coolant groove between cooling jacket and spindle housing with coolant.
2. Close any cooling connection in the spindle housing with a suitable screw plug.
3. Connect pump for cooling liquid with pressure pointer and pressure regulator to the second connection.
4. Position the spindle housing so that the leakage holes are at the lowest point (bottom).
5. Pump in coolant and slowly increase pressure from 0 to 6 bar.

   When 6 bar is reached, observe leakage hole for 10 min to see if coolant escapes.

☞ If the coolant leaks at the leakage holes, the O-rings must be replaced. Determine and eliminate the cause of the O-ring defect.

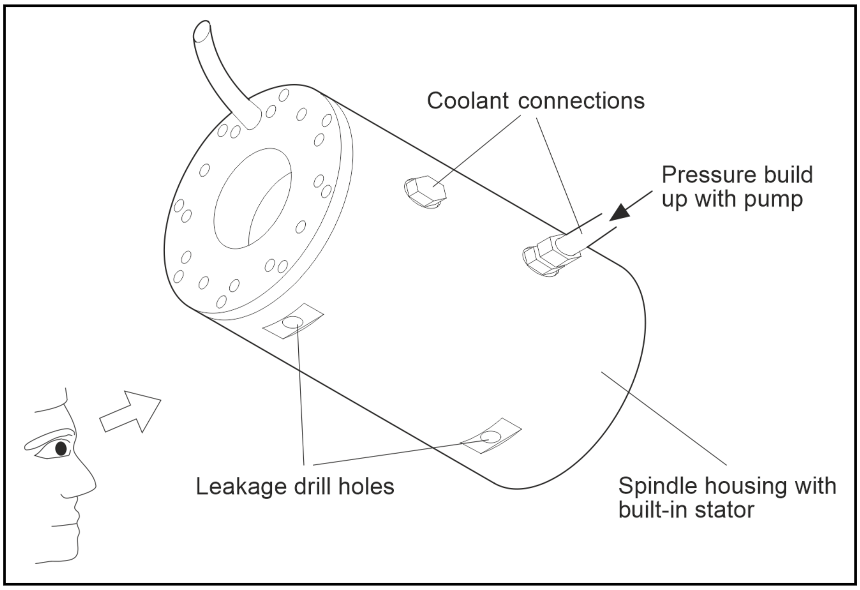


Fig. 11-20: Checking the O-rings for tightness

11.11.5 Electrical connection of the stator

A 1.5 m long connecting lead is attached to the stator on delivery. The stator is wrapped with a protective tube and consists of

- three power wires (marked U, V and W),
- and two pairs of conductors for the two thermistors in the winding head.

Only one of two thermistors is connected to the controller. The other thermistor serves only as a reserve. Its functionality is not guaranteed.

Before connecting the thermistor, its functionality must be checked. For this purpose, the resistance of the thermistor is measured at room temperature using an ohmmeter. If the measured value is between 30-50 kΩ, the checked thermistor is functional and can be used.

All lines are optionally connected either in a device connector (INS038x/048x) or in a terminal box. The device connector or terminal box must be attached directly to the spindle housing.

☞ When routing the connection cable to the terminal box or to the device connector make sure that the permissible bending radius of the connection cable is not undershot!

The edges of the feed-through holes must not be sharp!

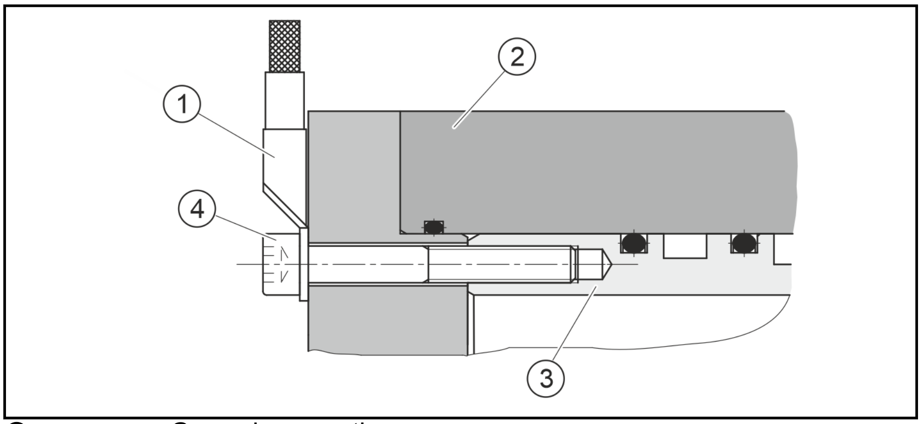
Attaching the grounding cable to the spindle housing

The permissible bending radius depends on the diameter of the connecting lead of the respective motor type. Please also observe the information provided under tab. 8-2 "Connection wires at the stator" on page 138.

The ground connection must be made on the spindle housing as described in Fig. 11-21. To this end, the stator is grounded with the end shield via a screw connection.

The minimum cross-section depends on the type of motor. The corresponding data are listed in the chapter "Technical data".

☞ The specified minimum cross-section of the power wires also applies to the ground connection line and must be observed.



① Ground connection
② Spindle housing
③ Stator
④ Brass screw M6 or M8

Fig. 11-21: Grounding of stator and spindle housing

Procedure:

1. Clean the contact surface for the screw head. The surface must be bare metal so that both the spindle housing and the stator are grounded.
2. Screw the grounding cable with cable lug to the end shield using a brass screw (M6 or M8, depending on the model).
3. Grease the connection with petroleum jelly to protect it from corrosion.

Connecting the cable loom to the device connector

The wires of the cable loom are soldered to the back of the device connector. The wires must be soldered according to fig. 8-3 "Example of connecting INS38x/48x device connectors of Rexroth " on page 142. Then screw the device connector to the machine housing. Make sure that there is a seal between the device connector and the machine housing.

Connecting the cable loom in the terminal box

Before connecting the wires of the cable loom in the terminal box, check the seals of the terminal box:

- There must be a terminal box seal and a cover seal.
- The sealings and the sealing surfaces must be in perfect condition.

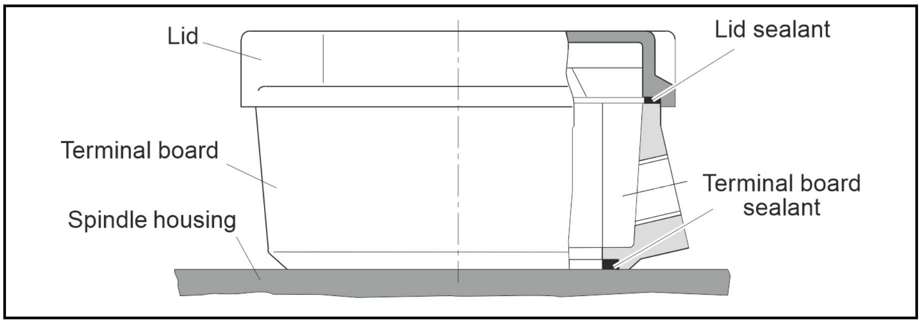


Fig. 11-22: Sealings on the terminal box

If the cables are connected in a terminal box, the power connections and the ground connection must be fitted with cable lugs. The size of the cable lugs must be selected according to the conductor cross-section and the diameter of the stud bolts in the terminal box.

☞ The individual wires of the cable loom must be clearly marked in the terminal box so that any confusion of the wires can be ruled out.

Fig. 11-23 shows an example of the arrangement of the individual connection points in a terminal box.

Attach the individual lines as follows:

1. Screw the crimped cable lug of the ground connection tightly at the point provided for this purpose.
2. Screw the power connections onto the connection bolts using a nut (observe tightening torques!). They must be connected in accordance with their marking:
   - Wire U on bolt U1
   - Wire V on bolt V1
   - Wire W on bolt W1

Thread	M3.5	M4	M5	M6	M8	M10	M12
Tightening torque in Nm	0.8	1.2	2	3	6	10	15.5

Tab. 11-5: Tightening torques for terminal plate nuts according to DIN46200

3. Clamp the thermistor connections to the terminal block.

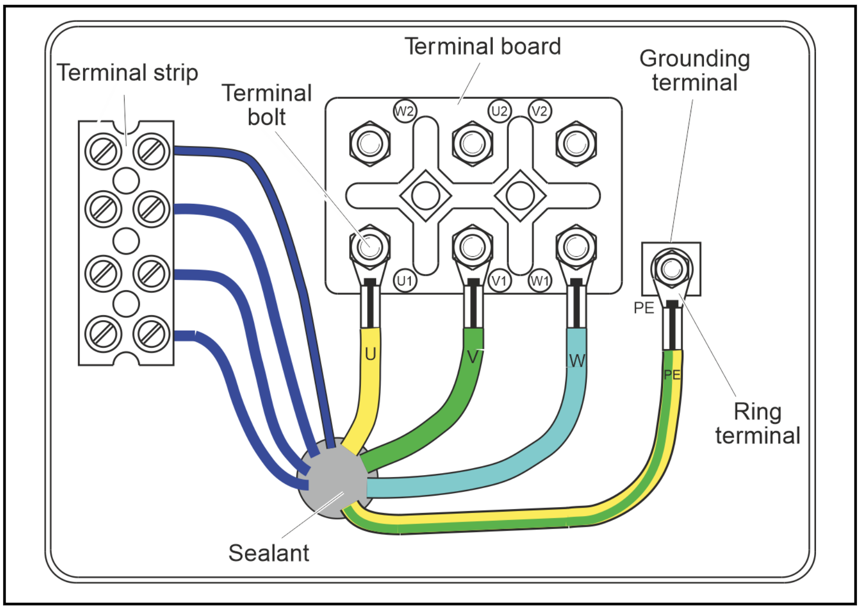


Fig. 11-23: Terminal box with terminal plate and terminal strip

☞ For other terminal box designs, connections shall be made in accordance with the appropriate design documents.

4. After connecting the conductors in the terminal box, seal the through hole between the terminal box and the spindle housing with a plastic sealing compound.

Checking stator electrically

Following the installation of the stator and the connection of the wires in the terminal box or in the device connector, a winding test must be carried out.

For more information, please refer to the instructions in chapter 12.5.3 "Carry out the winding test" on page 207.

11.12 Removing stator from spindle housing

Removal of the stator is necessary, for example, when,

- a winding is blown out,
- both thermistors are defective,
- O-rings are leaking.

⚠ DANGER **Risk of shock at live parts!**

⇒ Before disassembly of the stator, always de-energize the electrical system and secure it against reactivation!

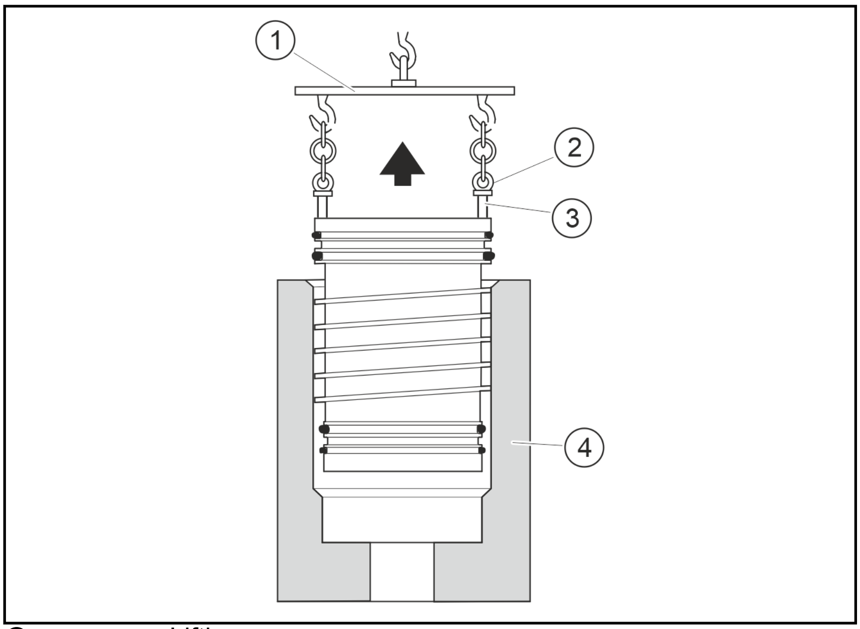
Procedure:

1. Loosening of electrical connections:
   - Power connection
   - Thermistor connection
   - Grounding cable
2. Loosen the cap screws on the end shield and unscrew them.
3. Slowly remove the end shield with a suitable tool.
4. Screw ring eyelets into suitable holes.

☞ During disassembly, do not pull or push at the cable loom to prevent damage at the stator.

Always observe any applicable regulations on transport and handling.

5. Slowly pull out the stator with a suitable lifting tool (observe stator weight!).



① Lifting gear
② Ring eyelet
③ Threaded bar with distance sleeve
④ Spindle housing

Fig. 11-24: Disassembly of the stator from the spindle housing

12 Commissioning, operation and maintenance

12.1 General

⚠ CAUTION	**Do not touch housing surfaces of motors! Risk of burns!**

⇒ According to the operating conditions, temperatures can be higher than 60 °C during or after operation.

⇒ Before accessing motors after having switched them off, allow them to cool down for a sufficient period of time. A cooling time up to 140 minutes can be necessary! Roughly estimated, the time required for cooling down is five times the thermal time constant specified in the Technical Data.

⇒ Wear safety gloves or do not work at hot surfaces.

⇒ For certain applications, measures to prevent burns in the end use must be taken by the manufacturer on the end product, in the machine or in the plant in accordance with the safety regulations. These measures can be, for example: Warnings, guards (shieldings or barriers), technical documentation.

12.2 Commissioning

12.2.1 General

⚠ CAUTION	**Property damage caused by errors when controlling motors and moving parts! Unclear operating states and product data!**

⇒ Do not commission the motors if connections, operating states or product data are unclear or faulty.

⇒ Do not commission the motors if safety devices and monitoring units of the plant are damaged or not in operation.

⇒ Damaged products must not be operated.

⇒ Request missing information or support during commissioning from Bosch Rexroth.

The following commissioning notes refer to 1MB motors as part of a drive system with drive controller and control unit.

12.2.2 Preparation

1. Make sure you have the documentations of all used products ready.
2. Record all measures taken in the commissioning log.
3. Check the products for damage.
4. Check all mechanical and electrical connections.
5. Activate the safety and monitoring equipment of the system.

12.2.3 Procedure

Once all requirements are met, proceed as follows:

1. Commission the drive system according to the instructions of the corresponding product documentation. The respective information can be found in the functional description of the drive controllers.

2. Record all measures taken in the commissioning log.
3. Sometimes, additional steps may be required for commissioning controllers and control units. Commissioning of the motor does not include checks for proper functioning and performance of the plant. These checks must be carried out while the machine is commissioned as a whole. Comply with the information and instructions of the machine manufacturer.

12.3 Shutdown

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

1. Comply with the instructions in the machine documentation.
2. Use the machine-side control commands to decelerate the drive to a controlled standstill.
3. Switch off the power and control voltage of the controller.
4. Switch off the motor protection switch for the motor fan (if existing).
5. Switch off the main switch of the machine.

   Secure the machine against accidental movements and against unauthorized operation.
6. Wait until the discharging time of the electrical systems has elapsed and then disconnect all electrical connections.
7. Before disassembling the motor and, if applicable, the fan unit, secure them against dropping or moving and afterwards, disconnect the mechanical connections.
8. Record all measures taken in the commissioning log.

12.4 Dismounting

⚠ DANGER **Fatal injury due to errors during the activation of motors or work on moving elements!**

⇒ Work on machines is only allowed if they are secured and while they are not running.

⇒ Before starting disassembly, secure the machine against unforeseeable movements and against unauthorized operation.

⇒ Before dismounting the motor and the supply lines, secure them against dropping or moving and disconnect the mechanical connections only thereafter.

General procedure during disassembly:

1. Comply with the instructions in the machine documentation.
2. Comply with the safety instructions and carry out all steps as described above in section "Deactivation".
3. Before disassembling the motor and the supply lines, secure them against dropping or moving and disconnect the mechanical connections only thereafter.
4. Dismount the motor from the machine. Store the motor properly!
5. Document all executed measures in the commissioning report and the machine maintenance plan.

12.5 Maintenance

12.5.1 General

Aynchronous motors of the 1MB series are maintenance-free as long as they are operated under the specified operating conditions and during their service life. Operation under unfavorable conditions can, however, lead to restrictions in availability.

- Increase availability with regular preventive maintenance measures. Comply with the machine manufacturer's instructions in the machine maintenance plan and the maintenance measures described below.
- Record all maintenance measures in the machine maintenance plan.

12.5.2 Measures

⚠ DANGER **Risk of injury due to moving elements! Risk of injury due to hot surfaces!**

⇒ Do not carry out any maintenance work while the machine is running

⇒ Secure the machine against start-up and unauthorized operation during maintenance work

⇒ Do not work on hot surfaces

Bosch Rexroth recommends the following maintenance measures, based on the maintenance plan of the machine manufacturer:

Measure	Interval
Check the cooling system for proper functioning.	According to the specifications in the machine maintenance plan, but at least every 1,000 operating hours.
Check the mechanical and electrical connections.	According to the specifications in the machine maintenance plan, but at least every 1,000 operating hours.
Check the machine for smooth running, vibrations and bearing noise.	According to the specifications in the machine maintenance plan, but at least every 1,000 operating hours.
Remove dust, chips and other dirt from the motor housing, cooling fins and the connections.	Depending on the degree of soiling, but after one operating year at the latest.

Tab. 12-1: Maintenance measures

12.5.3 Carry out the winding test

The winding test is carried out between the windings, the housing and the hot conductors and is used to check the insulation capacity.

The test voltage must be a sinusoidal AC voltage U_{eff} = 1,500 V.

Proceed the test according to DIN EN 60034-17.

☞ The winding must be carried out by a qualified electrician or under the direction and supervision of a qualified electrician!

Test recommendation:

Do the following measures and write them down in the test report (tab. 12-2 "Test report motor spindle" on page 210):

- Windings - housing
- Windings - thermistor 1
- Windings - thermistor 2

Procedure:

1. The windings not intended for testing must be connected to each other and to the housing.
2. Voltage U_{eff} = 1,500 V for a period of time of 5 sec. Apply to the corresponding winding ends or parts of the test specimen.
3. Measure leakage current.

⚠ DANGER **Risk of shock at live parts!**

⇒ If the leakage current is higher than the specified limit value, the components are not sufficiently insulated from each other!

⇒ During commissioning, there is both danger to life when touching the spindle housing and danger of machine damage!

⇒ The kit spindle motor must not be put into operation under any circumstances! Search for and eliminate possible errors.

The test is successful, if the leakage current is ≤ 20 mA for the respective measurements (at 1MS375 ≤ 50 mA).

Do inductivity test

After mounting the complete motor spindle - including terminal box installation or installation of the flange socket - the inductance value of the spindle motor must be checked. The inductivity values are listed in chapter “Technical data” of the respective 1MB motor.

- **Conditions:**
- Temperature of motor spindle: approx. +20 °C
- Spindle is in standstill
- Test equipment:
- Inductance meter with 1kHz measuring frequency

Test procedure:

The measurement is made between the three power terminals or power contacts.

- Measurement of winding U - V
- Measurement of winding V – W
- Measurement of winding W - U

The measured values may deviate max. ±10 % from the inductance values specified in the technical data!

Reasons for deviating measured values:

- Diameter of the rotor after turning is not correct
- Rotor is defective

☞ If the determined inductance value is outside the permissible value range, the operating characteristic of the drive is no longer guaranteed! However, there is no risk of the electric drive components being damaged during operation!

Test report of 1MB motor

Type designation of the motor spindle					
Motor type: 1MB _ _ _ _ - _ _ - A _ _ _ A _					
Serial no. 1MB _ _ _ - _ _ _ _ _ _					
Manufacturing date: ____ - ____ (see also chapter “Identification of the goods”)					
• **Winding test**					
			Yes	No	
Test procedure acc. to chapter 12.5.3 "Carry out the winding test" on page 207					
Test voltage: __________ V					
Test duration: _____________ V					
			Criteria: i < __________ ?		
			passed	not passed	
Measurement:	U housing				
	V housing				
	W housing				Connect the power wires of the cable harness conductively!
	Thermistor 1 - windings				
	Thermistor 2 - windings				
• **Inductivity test** (acc. to "Do inductivity test" on page 208)					
Temperature of motor spindle:		__________ °C			
Measuring frequency:		__________ kHz			
Inductivity value; acc. to techn. Data:		L_{TD} = __________ mH			
Measurement				**Test** $0.9 \times L_{TD} < L_{mess} < 1.1 \times L_{TD}$ _____mH < L_{mess}<_____mH	
Inductivity	Symbol	Unit	Measured value	passed	not passed
... Winding U-V	L_{mess1}	mH			
... Winding U-V	L_{mess1}	mH			
... Winding U-V	L_{mess1}	mH			
• **Thermistor test and connection specification**					
For connection to the control unit, select a thermistor and connect it to the appropriate terminals (according to the motor spindle connection diagram).					
Criteria:	$30\ k\Omega < R_{20\,°C} < 50\ k\Omega$				
Notes	____				
Place, date:	______________	Name / Company:	________________________________		

Tab. 12-2: Test report motor spindle

12.6 Troubleshooting

12.6.1 General information

⚠ DANGER **Risk of injury due to moving elements! Risk of injury due to hot surfaces!**

⇒ Do not carry out any maintenance work while the machine is running

⇒ Switch off the controller and the machine and wait until the discharging time of the electrical systems has elapsed before starting troubleshooting

⇒ Secure the machine against start-up and unauthorized operation during maintenance work

⇒ Do not work on hot surfaces

Possible causes for failures of 1MB motors can be restricted to the following areas:

- Cooling and temperature behavior
- Internal temperature sensor
- Motor encoder or encoder connection
- Mechanical damage of the motor
- Mechanical connection to machine

The encoder connection and the temperature sensor are monitored by the controller or the control unit; corresponding diagnostic messages are displayed. Comply with the instructions in the corresponding documentation.

The sections below describe examples of some fault states along with possible causes. This list is not exhaustive.

12.6.2 Excessive temperature of motor housing

State: The housing temperature of the motor rises to unusually high values.

⚠ CAUTION **Damage to motor or machine by restarting after excessive motor temperature!**

⇒ Liquid-cooled motors may not be restarted or supplied with cold coolant immediately after a failure of the cooling system or an increase in motor temperature Risk of damage!

⇒ Before restarting the motor, wait until the motor temperature has dropped to approx. 40°C.

Possible causes

1. Failure or malfunction in the cooling system.
2. The original machining cycle has been changed.
3. The original motor parameters have been changed.
4. Motor bearings are worn or defective.

Measures for

1. Check the cooling system for proper functioning. Clean as required. In case of failure, contact cooling system manufacturer.
2. Check the sizing of the drive for changed requirements. Stop operation in case of overload. Risk of damage!
3. Restore the original parameters. Check the sizing of the drive if requirements have been changed.

4. Contact the machine manufacturer.

12.6.3 High motor temperature values, but housing temperature is normal

State

The diagnostic system of the controller shows unusually high winding temperature values via display or operator software. However, the temperature of the motor housing is normal.

Possible causes

1. Wiring error or cable break in temperature sensor cable.
2. Diagnostic system defective.
3. Failure temperature sensor.

Measures for

1. Check the wiring and connection of the temperature sensor according to the interconnection diagram.
2. Check the diagnostic system at the controller or the control unit.
3. Check the function or resistance value of the temperature sensor using a multimeter.
   - Set the measuring device to resistance measurement mode.
   - Shut down the system and wait until the discharging time has elapsed. Disconnect the temperature sensor from the controller and connect the wire pair to the measuring device (this also checks the sensor line). Check values according to the characteristic curves in chapter 9.8 "Motor temperature monitoring " on page 160.

12.6.4 Motor generates vibrations

State

Vibrations can be heard or felt at the motor.

Possible causes

1. Driven machine elements are insufficiently coupled or damaged.
2. Motor bearings are worn or defective. Available bearing lifetime or grease lifetime has elapsed.
3. Motor mount has loosened.
4. Drive system is instable from a control point of view.

Countermeasures

1. Contact the machine manufacturer.
2. Contact the machine manufacturer.
3. Check the mechanical connection. Do not continue to use damaged parts. Contact the machine manufacturer.
4. Check the parameterization of the drive system (motor and encoder data). Comply with the instructions in the controller documentations.

12.6.5 Specified position is not reached

State

The positioning command of the control unit is executed either not precisely or not at all. No malfunction displayed by the controller or the control unit.

Possible causes

1. Wiring of encoder cable is incorrect or defective. Pin assignment (encoder signals) in cable or plug may be interchanged.
2. Insufficient shielding of encoder cable against interference signals.
3. Incorrect parameterization of encoder data in controller.
4. Motor-machine element connection has loosened.
5. Encoder defective.

Countermeasures

1. Check wiring according to interconnection diagram of machine and check cables for damage.

2. Check shielding; if necessary, increase effective contact surfaces of shielding.
3. Correct the parameterization. Observe the commissioning log.
4. Check the mechanical connection. Do not continue to use damaged parts. Contact the machine manufacturer.
5. The encoder has to be replaced. Contact the machine manufacturer.

12.6.6 Operation with third-party controllers

Rate of rise of voltage

The insulation system of the motor is subject to a higher dielectric load in converter mode than when it is operated with a merely sinusoidal source voltage. The voltage load of the winding insulation in converter mode is mainly defined by the following factors:

- Crest value of voltage
- Rise time of pulses at the motor terminals
- Switching frequency of final converter stage
- Length of power cable to the motor

Main components are the switching times of the final converter stage and the length of the power cable to the motor. The rates of rise of the voltage occurring at the motor may not exceed the pulse voltage limits specified in **DIN VDE 0530-25 (VDE 0530-25):2009-08 (picture 14, limit curve A)**, measured at the motor terminals of two strands in relation to the rise time.

☞ The final stages of IndraDrive converters keep this limits.

13 Service and support

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

Service Germany

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

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

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

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

Service worldwide

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

Preparing information

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

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

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