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

Rexroth
Bosch Group

Rexroth MBW Asynchronous Roller Kit Motor

R911314804
Edition 02

Project Planning Manual

Title

Rexroth MBW
Asynchronous Roller Kit Motors

Type of Documentation

Project Planning Manual

Document Typecode

DOK-MOTOR*-MBW********-PR02-EN-P

Internal File Reference

- 31480402_Book.doc

Document Number 120-1500-B331-02/EN

Purpose of Documentation?

This documentation....

- explains product features and applications, technical data as well as conditions and limits for operation.
- provides guidlines for product selection, application, handling and operation.

Record of Revisions

Description	Release Date	Notes
DOK-MOTOR*-MBW*******-PR02-EN-P	11.05	1st edition

Validity

The specified data is for product description purposes only and may not be deemed to be guaranteed unless expressly confirmed in the contract. All rights are reserved with respect to the content of this documentation and the availability of the product.

Published by

Bosch Rexroth AG
Bgm.-Dr.-Nebel-Str. 2 • 97816 Lohr a. Main, Deutschland
Telefon +49 (0)93 52 / 40-0 • Fax +49 (0)93 52 / 40-48 85
http://www.boschrexroth.com/
Abt. BRC/EDM1 (fs)

Note

This document has been printed on chlorine-free bleached paper.

Table of Contents

1 Introduction to the Product

1.1 Technical Explanations

Motor Construction

REXROTH MBW roller motor kits are externally ventilated squirrel-cage asynchronous alternating-current motors. They consist of

- a stator with housing (MSW) and
- a rotor with clamp collar (MRW).

Each stator type has a suitable rotor type. There is no way to combine the rotors and stators of different MBW motor sizes.

A motor feedback system is required to operate the roller motor kit. Together with the drive controller, this permits the speed and the position of the drive to be controlled.

Note: The motor feedback system is not a component of the roller motor kit.

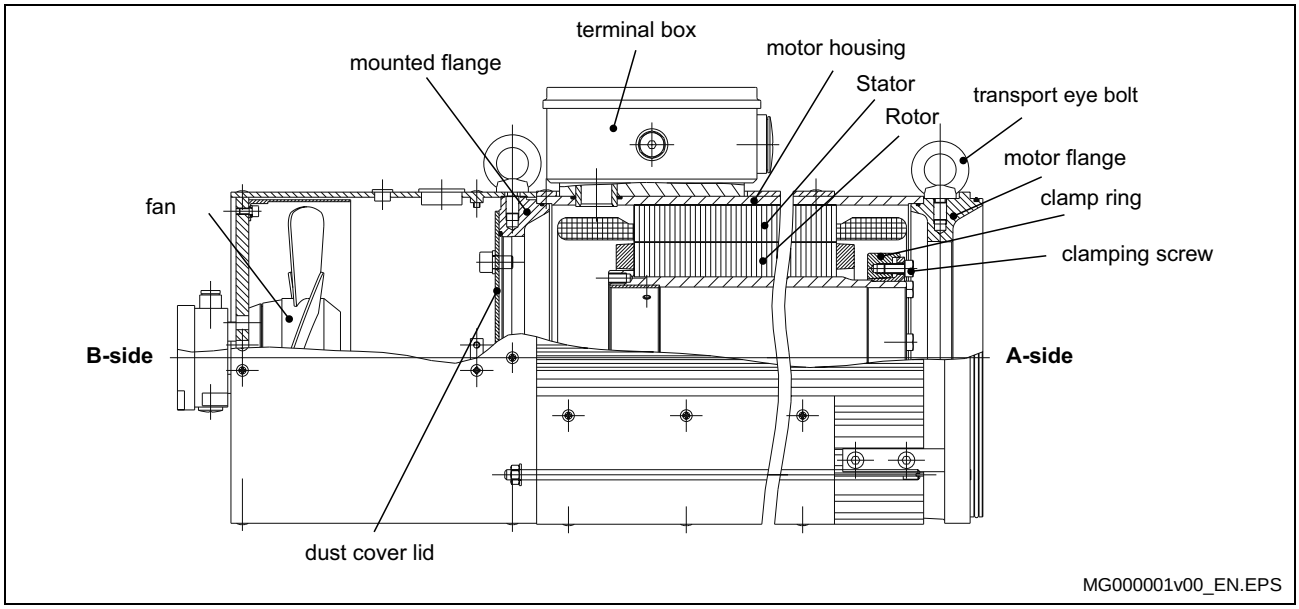


Abb. 1-1: Components of the roller motor kit

Stator The stator (MSW) is made up of the motor housing and a laminated core with end windings located on the front. A motor flange, a mounting flange, a terminal box and (if necessary) transport rings are screwed onto the motor housing (see Fig.1-1).

The stator is screwed onto the frame of the machine using the motor flange on the A-side.

The mounting flange on the B-side is used to attach the fan, the dust protection cover or the end plate.

Depending on the length of the MBW motor and the construction of the roller, a third roller bearing may have to be attached to the B-side of the motor. To do this, an end plate can be attached to the B-side of the MBW motor in place of the dust protection cover. You can find more information in this chapter, "Third Roller Bearing" section.

Rotor The rotor (MRW) consists of a steel sleeve to which a laminated core is attached. On one side of the steel sleeve is an extension onto which a clamp collar is pushed. This side of the rotor is fastened in the direction of the roller bearing onto the neck of the roller to be driven.

The clamp collar transfers the torque from the rotor to the roller neck. The clamp collar can be tightened and relaxed as often as desired because it is strained only in the elastic area. This non-positive type of connection does not cause any undesired tension in the components to be connected.

Sample Structure of Directly Driven (Printing) Rollers

Directly driven rollers (see Fig. 1-2) generally have the functional units

- roller with roller neck
- roller bearing
- MBW roller motor kit
- motor fan (optional)
- motor feedback system and
- drive controller.

The roller bearing type, the lubrication and the degree of bearing priming of the rollers depend on the application and must be specified by the machine constructor.

The motor feedback system determines the rotor position – and thus also the roller position – and reports this to the drive controller. As a result, the speed and the position of the roller can be controlled.

The motor feedback system is not included in the scope of delivery of the roller motor kit.

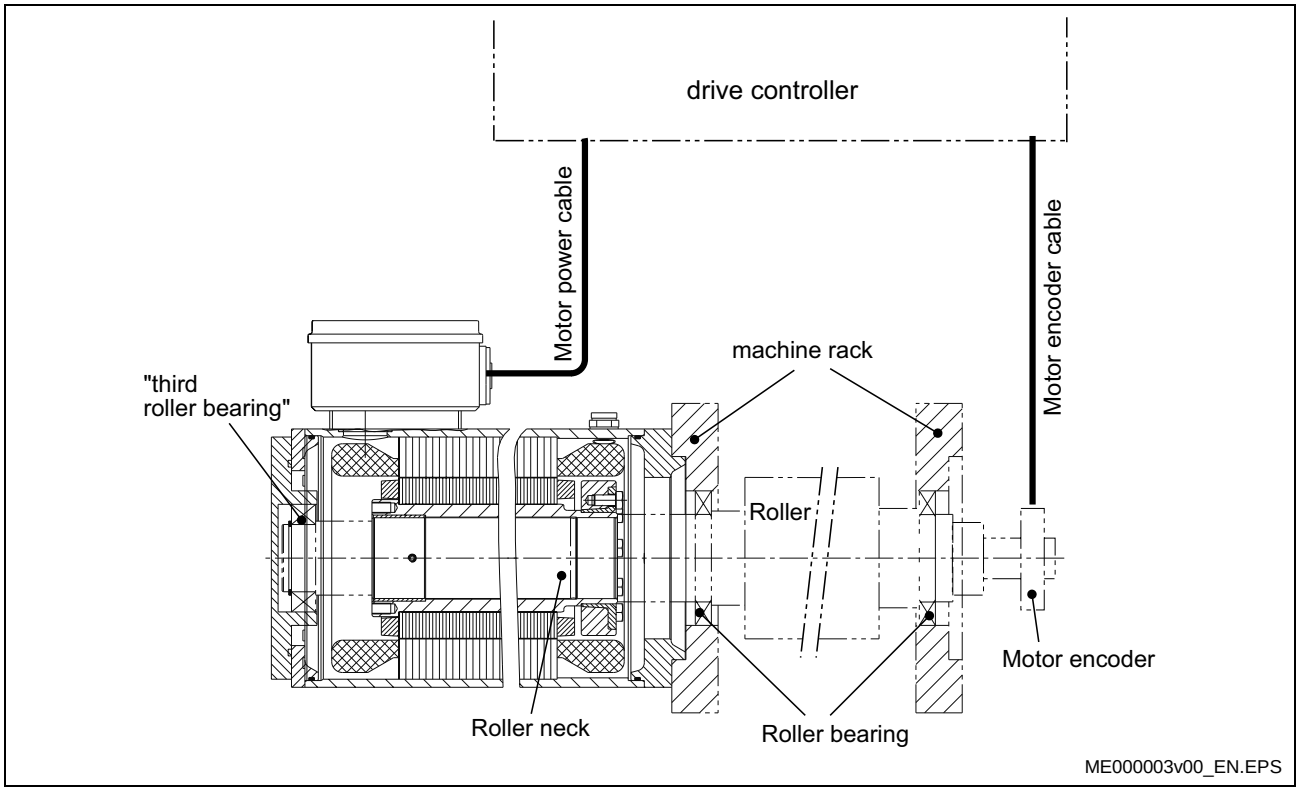


Abb. 1-2: Sample structure of a directly driven printing roller with a MBW roller motor kit

1.2 General Features

Together with our intelligent digital drive controllers, REXROTH MBW roller motor kits form powerful and inexpensive direct drives for rollers and cylinders in printing and paper processing machines as well as for similar applications.

Advantages

Compared to machines with a single driven main shaft (bevel shaft), direct drives have the following advantages:

- the (main) shaft is not needed; therefore, torsion elasticity does not occur
- torque disturbances are not transferred from roller to roller
- gears are not needed, thus reducing imprecision due to the gear play
- decreased length compared to motor-gear combinations.

Direct drives with roller motor kits have excellent control dynamics for quick command value modifications and to quickly react to load disturbances, i.e.:

- short starting and braking times
- extremely low tendency towards vibration due to high mechanical natural harmonics
- very high compensation of local load disturbance torques on every roller.

1.3 Power Graduation

In combination with REXROTH drive controllers, the continuous torques shown in Fig. 1-3 are available. You can find the precise performance data for the various controller-motor combinations in the corresponding controller documentation.

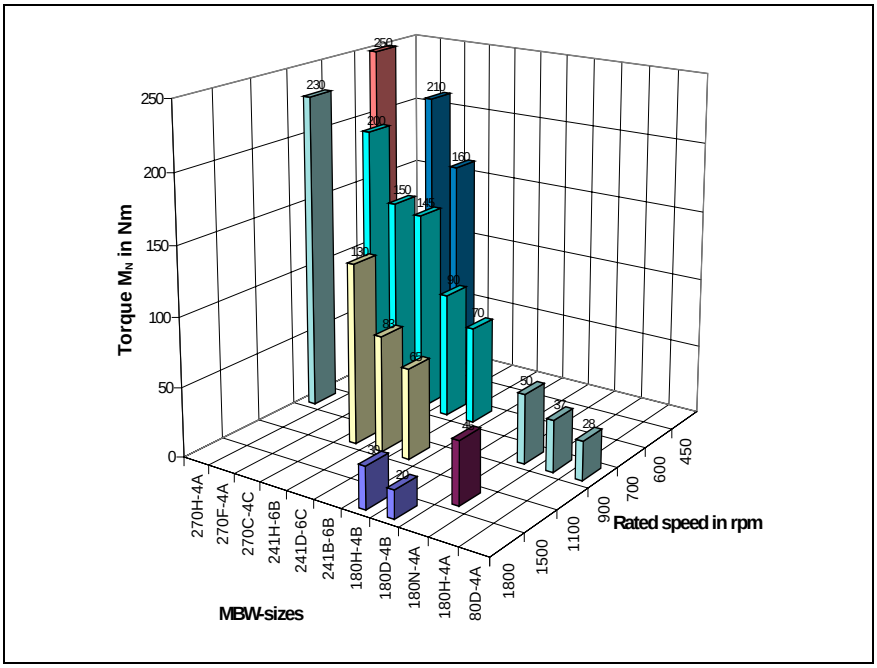


Abb. 1-3: Overview of MBW power graduations

1.4 About this Documentation

Document Structure

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

Sect.	Title	Contents
1	Introduction	Introduction to the product and notes
2	Important Notes on Utilization	**Important safety notes**
3	Notes Regarding Safety	
4	MBW Technical Data	**Product description** for planners and designers
5	Dimensional Data	
6	Type Key	
7	Accessories	
8	Connection Techniques	
9	Operating Conditions and Application Notes	
10	Handling, Transport and Storage	**Practice** for operating and maintenance personnel
11	Installation	
12	Commissioning, Operation and Maintenance	
13	Service & Support	
14	Index	Additional information

Fig. 1-4: Chapter structure

Additional documentation

It is possible that you need additional documentation corresponding to the used devices to design drive systems of the Rexroth MBW motor series. Rexroth has made the entire product documentation available on DVD in PDF format or in the Internet under www.boschrexroth.com/BrcDoku/ (one-time registration required). You will not need all the documentation included on the DVD to project a system.

Note: All documentation is also available as printed versions which you can order from your Rexroth sales office.

Material No.	Title / description
R911281882	-Product Documentation Electric Drives and Controls Version **xx** [1)] DOK-GENRL-CONTR*DRIVE-GN**xx**-DE-D650 (German)
R911281883	-Product Documentation Electric Drives and Controls Version **xx** [1)] DOK-GENRL-CONTR*DRIVE-GN**xx**-EN-D650 (English)
1) The index (e.g. ...**02**-...) identifies the version.	

Fig. 1-5: Additional documentation

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 information on the manufacturers, see chapter 9 ”Application Notes”.

Feedback

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

Please do not hesitate to inform us of any mistakes you detect in this documentation or of any modifications you might desire. We would appreciate your feedback.

Please send your remarks to:

BOSCH Rexroth
Electric Drives and Controls GMBH
Abt. BRC/EDM1
Bürgermeister-Dr.-Nebel-Straße 2
D-97816 Lohr, Germany

Fax +49 (0) 93 52 / 40-43 80

Standards

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

BEUTH Verlag GmbH
Burggrafenstrasse 6
10787 Berlin

Phone +49-(0)30-26 01-22 60, Fax +49-(0)30-26 01-12 60
Internet: http://www.din.de/beuth postmaster@beuth.de

2 Important Instructions on Use

2.1 Appropriate Use

Introduction

Bosch Rexroth products are designed and manufactured using the latest state-of-the-art-technology. Before they are delivered, they are checked for safety of operation.

The products may only be used as intended. If they are used inappropriately, situations may arise resulting in injuries to property and persons.

Note: For damage caused by products not being used as intended, Bosch Rexroth gives no warranty, assumes no liability, and will not pay for any damages. Any risks resulting from the products not being used as intended are the sole responsibility of the user.

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

- Everyone who in any way deals with one of our products must read and understand the corresponding notes regarding safety and regarding appropriate use.
- Regarding hardware components, the products concerned must be left in their original state, i.e. it is not permitted to modify it structurally. Software products may not be decompiled; their source codes may not be altered.
- Damaged or improperly working products must not be installed or put into operation.
- It must be ensured that the products are installed according to the regulations mentioned in the documentation.

Areas of Use and Application

Rexroth MBW roller motor kits are intended to be operated as direct drives in printing machines (printing machine rollers).

Controlling and monitoring of MBW roller motor kits may require connection of additional sensors and actuators.

Note: The roller motor kits may only be used with the accessories specified in this documentation. Components that are not explicitly mentioned may be neither attached nor connected. The same is true for cables and lines.

Operation may be carried out only in the explicitly mentioned configurations and combinations of the component and with the software and firmware specified in the corresponding description of functions.

For the motor to execute the specific functions for the respective application, each drive controller must be programmed before commissioning.

To allow for application-specific requirements in the roller motor kits, our product range comprises various device types with different drive performances and interfaces.

MBW roller motor kits may only be operated under the assembly, mounting and installation conditions, in the normal position, and under the environmental conditions (temperature, degree of protection, humidity, EMC, and the like) specified in this documentation.

2.2 Inappropriate Use

Any use of the MBW roller motor kits beyond the above named applications, or in different operating conditions than those described in the documentation, or with other technical data than those listed, is considered as "inappropriate".

Roller motor kits may not be used if...

- they are subjected to operating conditions which do not comply with the ambient conditions described above. For example, they must not be operated under water, under extreme temperature fluctuations or in extreme maximum temperatures.
- the intended application is not explicitly approved by Bosch Rexroth. In this regard, it is required that you refer to the statements in the general notes regarding safety!

3 Safety Instructions for Electric Drives and Controls

3.1 General Information

Using the Safety Instructions and Passing them on to Others

Do not attempt to install or commission this device without first reading all documentation provided with the product. Read and understand these safety instructions and all user documentation prior to working with the device. If you do not have the user documentation for the device, contact your responsible Bosch Rexroth sales representative. Ask for these documents to be sent immediately to the person or persons responsible for the safe operation of the device.

If the device is resold, rented and/or passed on to others in any other form, then these safety instructions must be delivered with the device.

WARNING

Improper use of these devices, failure to follow the safety instructions in this document or tampering with the product, including disabling of safety devices, may result in material damage, bodily harm, electric shock or even death!

Instructions for Use

Read these instructions before the initial startup of the equipment in order to eliminate the risk of bodily harm or material damage. Follow these safety instructions at all times.

- Bosch Rexroth AG is not liable for damages resulting from failure to observe the warnings provided in this documentation.
- Read the operating, maintenance and safety instructions in your language before starting up the machine. If you find that you cannot completely understand the documentation for your product, please ask your supplier to clarify.
- Proper and correct transport, storage, assembly and installation as well as care in operation and maintenance are prerequisites for optimal and safe operation of this device.
- Only assign trained and qualified persons to work with electrical installations:
  - Only persons who are trained and qualified for the use and operation of the device may work on this device or within its proximity. The persons are qualified if they have sufficient knowledge of the assembly, installation and operation of the equipment as well as an understanding of all warnings and precautionary measures noted in these instructions.
  - Furthermore, they must be trained, instructed and qualified to switch electrical circuits and devices on and off in accordance with technical safety regulations, to ground them and to mark them according to the requirements of safe work practices. They must have adequate safety equipment and be trained in first aid.
- Only use spare parts and accessories approved by the manufacturer.
- Follow all safety regulations and requirements for the specific application as practiced in the country of use.

- The devices have been designed for installation in industrial machinery.
- The ambient conditions given in the product documentation must be observed.
- Only use safety-relevant applications that are clearly and explicitly approved in the Project Planning Manual. If this is not the case, they are excluded.
  Safety-relevant are all such applications which can cause danger to persons and material damage.
- The information given in the documentation of the product with regard to the use of the delivered components contains only examples of applications and suggestions.

  The machine and installation manufacturer must

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

  The machine or installation manufacturer is responsible for compliance with the limiting values as prescribed in the national regulations.
- Technical data, connections and operational conditions are specified in the product documentation and must be followed at all times.

Explanation of Warning Symbols and Degrees of Hazard Seriousness

The safety instructions describe the following degrees of hazard seriousness. The degree of hazard seriousness informs about the consequences resulting from non-compliance with the safety instructions:

Warning symbol with signal word	Degree of hazard seriousness according to ANSI Z 535
 **DANGER**	Death or severe bodily harm will occur.
 **WARNING**	Death or severe bodily harm may occur.
 **CAUTION**	Bodily harm or material damage may occur.

Fig. 3-1: Hazard classification (according to ANSI Z 535)

Hazards by Improper Use

DANGER

High electric voltage and high working current! Risk of death or severe bodily injury by electric shock!

DANGER

Dangerous movements! Danger to life, severe bodily harm or material damage by unintentional motor movements!

WARNING

High electric voltage because of incorrect connection! Risk of death or bodily injury by electric shock!

WARNING

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

CAUTION

Hot surfaces on device housing! Danger of injury! Danger of burns!

CAUTION

Risk of injury by improper handling! Risk of bodily injury by bruising, shearing, cutting, hitting, or improper handling of pressurized lines!

CAUTION

Risk of injury by improper handling of batteries!

3.2 Instructions with Regard to Specific Dangers

Protection Against Contact with Electrical Parts

Note: This section only concerns devices and drive components with voltages of more than 50 Volt.

Contact with parts conducting voltages above 50 Volts can cause personal danger and electric shock. When operating electrical equipment, it is unavoidable that some parts of the devices conduct dangerous voltage.

DANGER

High electrical voltage! Danger to life, electric shock and severe bodily injury!

⇒ Only those trained and qualified to work with or on electrical equipment are permitted to operate, maintain and repair this equipment.

⇒ Follow general construction and safety regulations when working on electrical power installations.

⇒ Before switching on the device, the equipment grounding conductor must have been non-detachably connected to all electrical equipment in accordance with the connection diagram.

⇒ Do not operate electrical equipment at any time, even for brief measurements or tests, if the equipment grounding conductor is not permanently connected to the mounting points of the components provided for this purpose.

⇒ Before working with electrical parts with voltage potentials higher than 50 V, the device must be disconnected from the mains voltage or power supply unit. Provide a safeguard to prevent reconnection.

⇒ With electrical drive and filter components, observe the following:

Wait 30 minutes after switching off power to allow capacitors to discharge before beginning to work. Measure the voltage on the capacitors before beginning to work to make sure that the equipment is safe to touch.

⇒ Never touch the electrical connection points of a component while power is turned on.

⇒ Install the covers and guards provided with the equipment properly before switching the device on. Before switching the equipment on, cover and safeguard live parts safely to prevent contact with those parts.

⇒ A residual-current-operated circuit-breaker or r.c.d. cannot be used for electric drives! Indirect contact must be prevented by other means, for example, by an overcurrent protective device according to the relevant standards.

⇒ Secure built-in devices from direct touching of electrical parts by providing an external housing, for example a control cabinet.

European countries: according to EN 50178/ 1998, section 5.3.2.3.

USA: See National Electrical Code (NEC), National Electrical Manufacturers' Association (NEMA), as well as local engineering regulations. The operator must observe all the above regulations at any time.

With electrical drive and filter components, observe the following:

DANGER

High housing voltage and large leakage current! Risk of death or bodily injury by electric shock!

⇒ Before switching on, the housings of all electrical equipment and motors must be connected or grounded with the equipment grounding conductor to the grounding points. This is also applicable before short tests.

⇒ The equipment grounding conductor of the electrical equipment and the units must be non-detachably and permanently connected to the power supply unit at all times. The leakage current is greater than 3.5 mA.

⇒ Over the total length, use copper wire of a cross section of a minimum of 10 mm^2 for this equipment grounding connection!

⇒ Before start-up, also in trial runs, always attach the equipment grounding conductor or connect with the ground wire. Otherwise, high voltages may occur at the housing causing electric shock.

Protection Against Electric Shock by Protective Low Voltage (PELV)

All connections and terminals with voltages between 5 and 50 Volt at Rexroth products are protective extra-low voltage systems which are provided with touch guard according to the product standards.

WARNING

High electric voltage by incorrect connection! Risk of death or bodily injury by electric shock!

⇒ To all connections and terminals with voltages between 0 and 50 Volt, only devices, electrical components, and conductors may be connected which are equipped with a PELV (Protective Extra-Low Voltage) system.

⇒ Connect only voltages and circuits which are safely isolated from dangerous voltages. Safe isolation is achieved for example by isolating transformers, safe optocouplers or battery operation without mains connection.

Protection Against Dangerous Movements

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

- improper or wrong wiring of cable connections
- incorrect operation of the equipment components
- wrong input of parameters before operation
- malfunction of sensors, encoders and monitoring devices
- defective components
- software or firmware errors

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

The monitoring in the drive components will normally be sufficient to avoid faulty operation in the connected drives. Regarding personal safety, especially the danger of bodily harm and material 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.

DANGER

Dangerous movements! Danger to life, risk of injury, severe bodily harm or material damage!

⇒ For the above reasons, ensure personal safety by means of qualified and tested higher-level monitoring devices or measures integrated in the installation.

They have to be provided for by the user according to the specific conditions within the installation and a hazard and fault analysis. The safety regulations applicable for the installation have to be taken into consideration. Unintended machine motion or other malfunction is possible if safety devices are disabled, bypassed or not activated.

To avoid accidents, bodily harm and/or material damage:

⇒ Keep free and clear of the machine's range of motion and moving parts. Possible measures to prevent people from accidentally entering the machine's range of motion:

- use safety fences
- use safety guards
- use protective coverings
- install light curtains or light barriers

⇒ Fences and coverings must be strong enough to resist maximum possible momentum.

⇒ Mount the emergency stop switch in the immediate reach of the operator. Verify that the emergency stop works before startup. Don't operate the device if the emergency stop is not working.

⇒ Isolate the drive power connection by means of an emergency stop circuit or use a safety related starting lockout to prevent unintentional start.

⇒ Make sure that the drives are brought to a 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 equilibration of the vertical axes.

The standard equipment motor brake or an external brake controlled directly by the drive controller are not sufficient to guarantee personal safety!

⇒ Disconnect electrical power to the equipment using a master switch and secure the switch against reconnection 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 electronics circuits and supply leads. If the use of such devices cannot be avoided, verify the system and the installation for possible malfunctions in all possible positions of normal use before initial startup. If necessary, perform a special electromagnetic compatibility (EMC) test on the installation.

Protection Against Magnetic and Electromagnetic Fields During Operation and Mounting

Magnetic and electromagnetic fields generated by current-carrying conductors and permanent magnets in motors represent a serious personal danger to those with heart pacemakers, metal implants and hearing aids.

WARNING

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

⇒ Persons with heart pacemakers and metal implants are not permitted to enter following areas:
- Areas in which electrical equipment and parts are mounted, being operated or commissioned.
- Areas in which parts of motors with permanent magnets are being stored, repaired or mounted.

⇒ If it is necessary for somebody with a pacemaker to enter such an area, a doctor must be consulted prior to doing so. The interference immunity of present or future implanted heart pacemakers differs greatly, so that no general rules can be given.

⇒ Those with metal implants or metal pieces, as well as with hearing aids must consult a doctor before they enter the areas described above. Otherwise health hazards may occur.

Protection Against Contact with Hot Parts

CAUTION

Hot surfaces at motor housings, on drive controllers or chokes! Danger of injury! Danger of burns!

⇒ Do not touch surfaces of device housings and chokes in the proximity of heat sources! Danger of burns!

⇒ Do not touch housing surfaces of motors! Danger of burns!

⇒ According to operating conditions, temperatures can be **higher than 60 °C, 140 °F** during or after operation.

⇒ Before accessing motors after having switched them off, let them cool down for a sufficiently long time. Cooling down can require **up to 140 minutes**! Roughly estimated, the time required for cooling down is five times the thermal time constant specified in the Technical Data.

⇒ After switching drive controllers or chokes 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, the manufacturer of the end product, machine or installation, according to the respective safety regulations, has to take measures to avoid injuries caused by burns in the end application. These measures can be, for example: warnings, guards (shielding or barrier), technical documentation.

Protection During Handling and Mounting

In unfavorable conditions, handling and assembling certain parts and components in an improper way can cause injuries.

CAUTION

Risk of injury by improper handling! Bodily injury by bruising, shearing, cutting, hitting!

⇒ Observe the general construction and safety regulations on handling and assembly.

⇒ Use suitable devices for assembly and transport.

⇒ Avoid jamming and bruising by appropriate measures.

⇒ Always use suitable tools. Use special tools if specified.

⇒ Use lifting equipment and tools in the correct manner.

⇒ If necessary, use suitable protective equipment (for example safety goggles, safety shoes, safety gloves).

⇒ Do not stand under hanging loads.

⇒ Immediately clean up any spilled liquids because of the danger of skidding.

Battery Safety

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

CAUTION

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 recharge the batteries as this may cause leakage or explosion.

⇒ Do not throw batteries into open flames.

⇒ Do not dismantle batteries.

⇒ Do not damage electrical parts installed in the devices.

Note: Environmental protection and disposal! The batteries installed 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 separate from other waste. Observe the local regulations in the country of assembly.

Protection Against Pressurized Systems

According to the information given in the Project Planning Manuals, motors cooled with liquid and compressed air, as well as drive controllers, can be partially supplied with externally fed, pressurized media, such as compressed air, hydraulics oil, cooling liquids, and cooling lubricating agents. In these cases, improper handling of external supply systems, supply lines, or connections can cause injuries or damages.

CAUTION

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 (for example safety goggles, safety shoes, safety gloves).

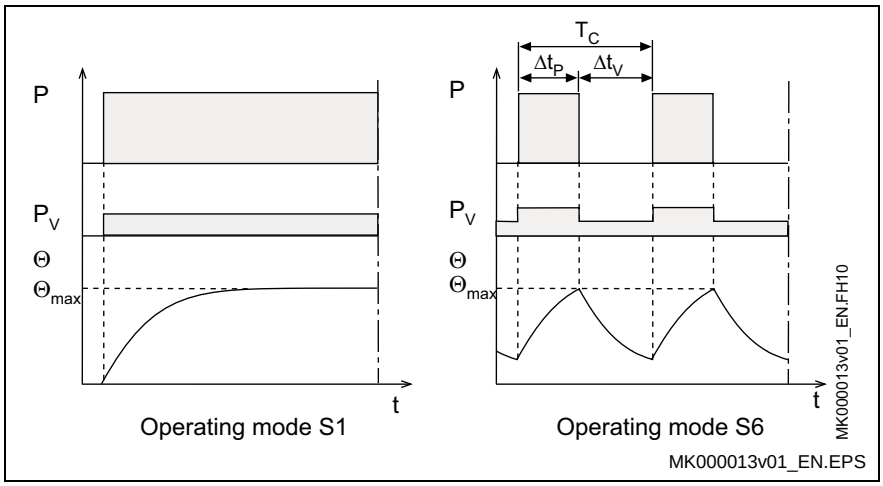
⇒ Immediately clean up any spilled liquids from the floor.

Note: Environmental protection and disposal! The agents used to operate the product might not be economically friendly. Dispose of ecologically harmful agents separate from other waste. Observe the local regulations in the country of assembly.

4 Technical Data

4.1 Operating Modes

Bosch Rexroth motors are documented according to the test criteria and measuring methods of EN 60034-1. Stated technical data refer to operating modes S1 (continuous operation) and S6 (periodic operation), each with surface cooling through direct-connected fan units or liquid cooling.



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
$Δt_V$: Idling time

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

ON Time

Operating mode S6 is supplemented by specification of the ON time (ED) in %. The operating time is calculated as follows:

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

ED: Cyclic duration factor in %
T_C: Cycle duration
$Δt_P$: Operating time with constant load

Fig. 4-2: Cyclic duration factor

4.2 Operating Behavior

Parameters and characteristic curves of the Rexroth MBW motor series and specifications of the motor data sheet are explained in the following.

Parameters

Rated torque M_N Available torque that can be output at the rated speed in operating mode S1 (continuous operation). Unit = Newton meters (Nm).

Rated performance P_N Mechanical power output of the motor while running at the rated speed and rated torque. Unit = kilowatts (kW).

Rated current I_N Phase current of the motor while running at the rated speed and rated torque, specified as a root-mean-squared value in amps (A).

Rated speed n_N Typical working speed defined by the manufacturer. Depending on the particular application, other working speeds are possible (see speed-torque curve).

Maximum speed M_{max} Maximum torque that can be output at peak current I_{max} , given in Newton-meters (Nm).

⇒ The maximum torque that can be attained depends on the drive control device used. Only the specified maximum torque M_{max} in the selection lists is binding.

Maximum output P_{max} Maximum power output of the motor at $540V_{DC}$, given in kilowatts (kW).

⇒ The maximum output that can be attained depends on the drive controller that is used and on the power supply. Only the maximum output specified in the selection data is binding.

Maximum current I_{max} Maximum short-term branch current of the motor permitted without damaging the winding, given as a root-mean-square value in amperes (A).

⇒ To avoid a thermal overload when operating the motor with external controllers, note that the current is to be reduced after 400 ms to 2.2x the rated current and that I_{max} may be reapplied only if the winding temperature is in the permitted range if the degree of relief of the motor permits this.

Maximum speed n_{max} Maximum permitted speed of the motor in rpm depending on the selected bearing type according to the type code. Normally, the maximum speed is restricted by mechanical factors such as centrifugal forces, bearing stress or the use of a holding brake.

Torque constant in nominal point K_{M_N} at 20° C Ratio of torque increase to motor torque-forming current. Unit = Nm/A. Valid up to rated current I_N.

Discharge capacity C_{ab} Capacity of short-circuited power connections U, V, W against the motor housing. Unit = nF.

Power wire cross-section A

The power wire cross-section specified in the data sheets (in mm²) is based on the current rating for installation type B2 of the cable and can vary depending on the selected connection type (plug or terminal box). Therefore, when selecting the appropriate power cable, pay attention to the information in Chapter 8 “Connection Techniques” and to the documentation “Rexroth Connection Cable” (MNR R911282688).

Rotor moment of inertia J_{rot}

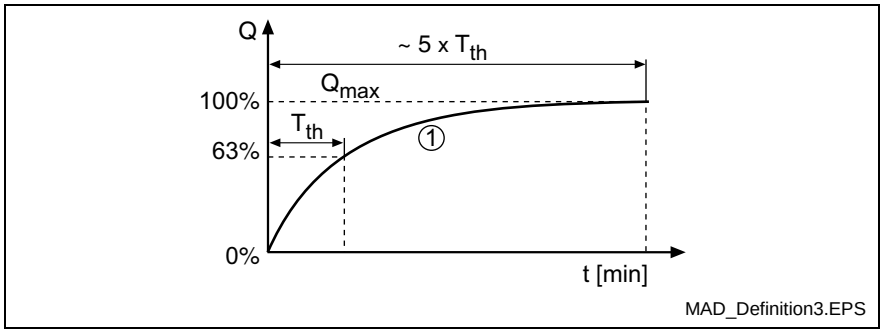
The moment of inertia of the rotor without bearing, brake and encoder. Unit = kgm².

Motor mass m

Mass of the motor in standard version, without holding brake, specified in kilograms (kg).

Thermal time constant T_{th}

Duration of the temperature rise to 63% of the final temperature of the motor under load with rated torque in S1 operation and surface ventilation by direct-connected fan units.



(1): Curve of the motor temperature over time
T_{th}: Thermal time constant

Fig. 4-3: Thermal time constant

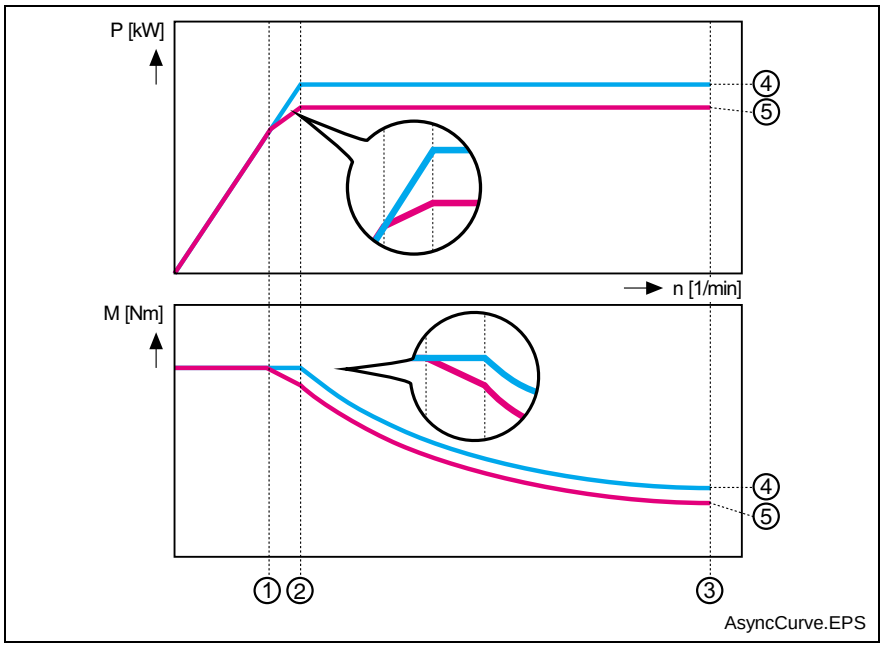
Cycle time T_C

Duration of the cycle in the S6 operating mode until the thermal steady-state condition is reached when the maximum temperature equals the end temperature in S1 operation (see Fig. 4-1).

Number of pole pairs p

Number of pole pairs of the motor.

Characteristic Curve



P [kW]: mechanical output in kilowatts
M [Nm]: torque available on the output shaft, in Newton meters
n [rpm]: motor speed, in rotations per minute
(1): key speed (n_1 in data sheet)
(2): rated speed (n_N)
(3): max. torque (n_{max})
(4): characteristic curve without de-rating
(5): characteristic curve with de-rating

Fig. 4-4: IndraDyn A sample characteristic curves

Note: The achievable torque depends on the drive controller used. The reference value for the characteristic curves of the motor is an unregulated intermediate circuit voltage of $540V_{DC}$.

Explanation:

(1) Key speed

Start of a drop in speed and power before reaching the rated speed n_N. This behavior is called **de-rating** and occurs only with some versions of motor windings. **With no de-rating, the key speed equals the rated speed.**

Until the key speed is reached, continuous current at standstill I_1 applies (root-mean-square value). **With no de-rating, the continuous current at standstill equals the rated current I_N.**

Until the key speed is reached, continuous torque at standstill M_1 is available for S1 operation. **With no de-rating, the continuous torque at standstill equals rated torque M_N.**

With an effective de-rating, torque is reduced when the key speed is reached.1-4 shows two characteristic curves starting at the key speed.

(2) Rated speed

With no de-rating effect, induction motors provide a constant torque up to the rated speed (rated torque); starting at the rated speed, constant **rated power P_N** is available.

(3) Maximum speed

The speed limit up to which a motor can be safely operated. This is usually limited by the mechanical construction (bearing) or by using a holding brake.

4.3 MBW Technical Data

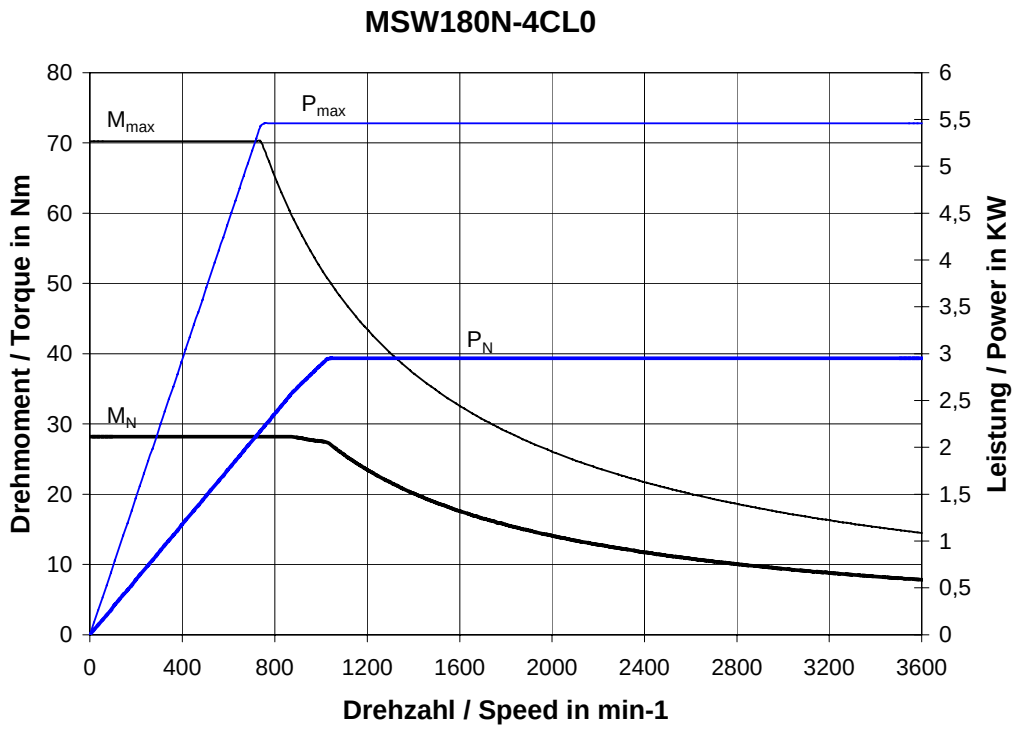
Data Sheet

Identification	Symbol	Unit	MBW					
Motor data [1])								
Frame size			180		241		270	
Frame length			N		H		H	
Winding code			4C		6F		4A	
Design [6)]			L0	L1	L0	L1	L0	L1
Rated torque	M_N	Nm	28	55	57	125	85	185
Rated current	I_N	A	8.2	12.6	10.9	16.5	27.1	47.8
Rated power	P_N	kW	2.6	5.2	3.6	7.9	8.9	19.4
Rated speed	n_N	rpm	900		600		1000	
Key speed	n_1	rpm	900		600		700	
Maximum speed [5)]	n_{max}	rpm	3600		2400		4000	
Continuous torque at standstill	M_{n1}	Nm	28	55	57	125	95	200
Continuous current at standstill	I_{n1}	A	8.2	12.6	10.9	16.5	29.5	50.7
Torque constant at 20° C	K_{M_N}	Nm/A	4.53	4.81	6.12	9.48	3.68	4.53
Discharge capacity	C_{ab}	nF	14.6		12.5		3.4	
Moment of inertia [3)]	J_{rot}	kgm²	0.035		0.227		0.5	
Power wire cross-section [2)]	A	mm²	1		1	2.5	4	10
Number of pole pairs	p		2		3		2	
Mass of stator [4)]	m_{stat}	kg	37		63		135	
Mass of rotor	m_{rot}	kg	18		39		77	
Max. magnetic force [7)]	F_{Mg_max}	N	1400		2350		4350	
Nominal air gap	s_n	mm	0.5		0.65		0.6	
Minimum air gap	s_{min}	mm	0.3		0.35		0.3	
Max. axial offset path	x_{axial}	mm	±10					
Thermal time constant	t_{th}	min	in preparation					
Permissible ambient temperature	t_{um}	°C	0...45					
Insulation class acc. to DIN VDE 0530-1			F					
Motor protection class			IP00					
Degree of protection, axial fan			IP44					
Fan			**Axial fan**					
Air current			with out fan	B → A blowing	without fan	B → A blowing	without fan	B → A blowing
Power consumption	S_N	VA		see Chap. 8.3		see Chap. 8.3		see Chap. 8.3
Connection voltage	U_N	V						
Fan flow	I_{max}	A						
Medium air voltage	V	m³/h						

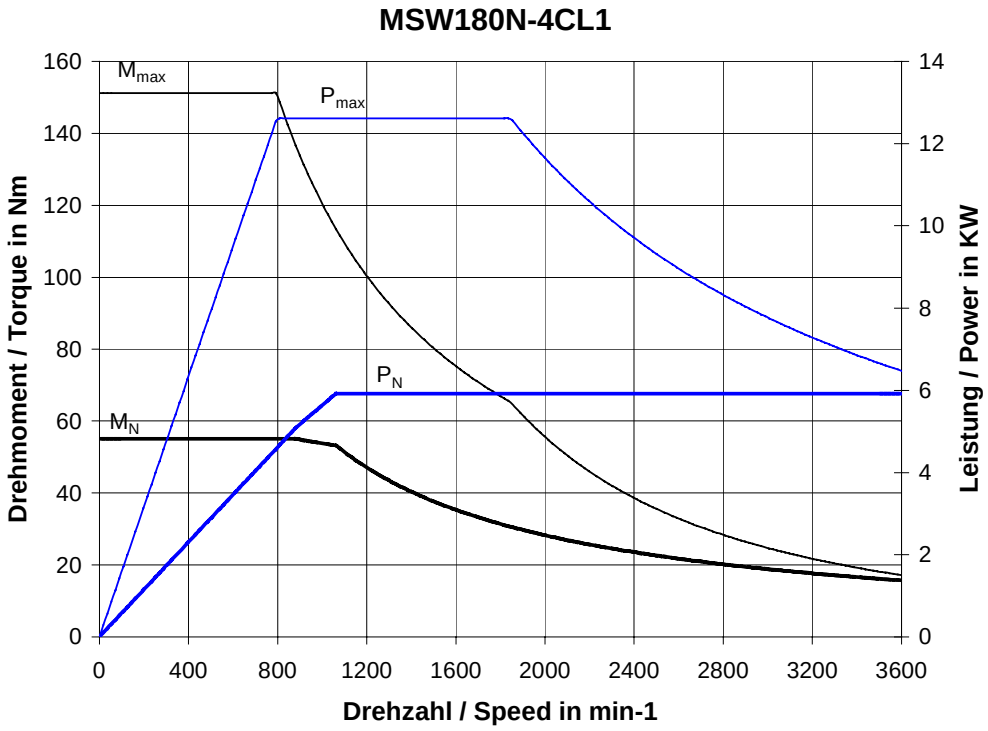
[1]) The determined values are root-mean-square values according to IEC 60034-1. Reference value = 540 V_{DC} intermediate circuit.
[2]) Rated for cable assemblies with current carrying capacity according to VDE0298-4 (1992) and installation type B2 according to EN 60204-1 (1993) at 40°C ambient temperature. When using other cables, larger cross-sections may be necessary.
[3]) Rotor without a shaft or encoder (shaft and encoder are provided and attached by the customer).
[4]) Mass specification incl. surrounding housing, end plate, mounting flange and dust protection lid.
[5]) Specification applies to rotor without shaft; other maximum speeds may result after the shaft and encoder have been installed by the customer.
[6]) L0=without fan; L1=with fan
[7]) for minimum air gap.

Fig. 4-5: Rexroth MBW data sheet

MBW180 Motor Characteristic Curves



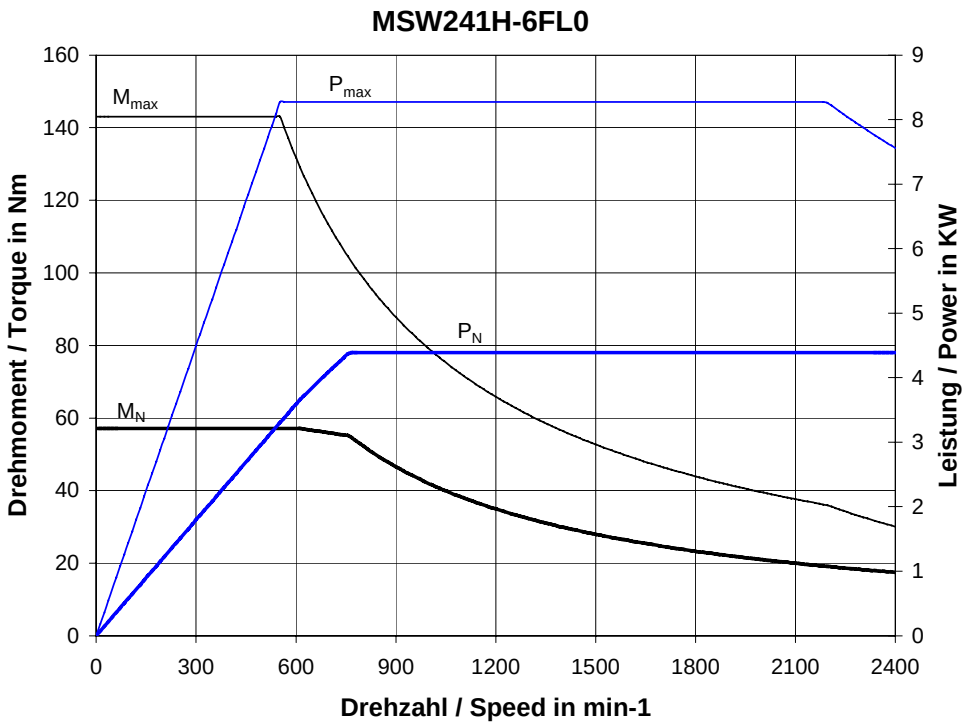
Mit Regelgerät HMS01.1N-W0020 an Versorger HMV01.1E-W0120 an 3x AC400V (-5%)
With Drive Controller HMS01.1N-W0020 at HMV01.1E-W0120 with main connection 3xAC400V (-5%)



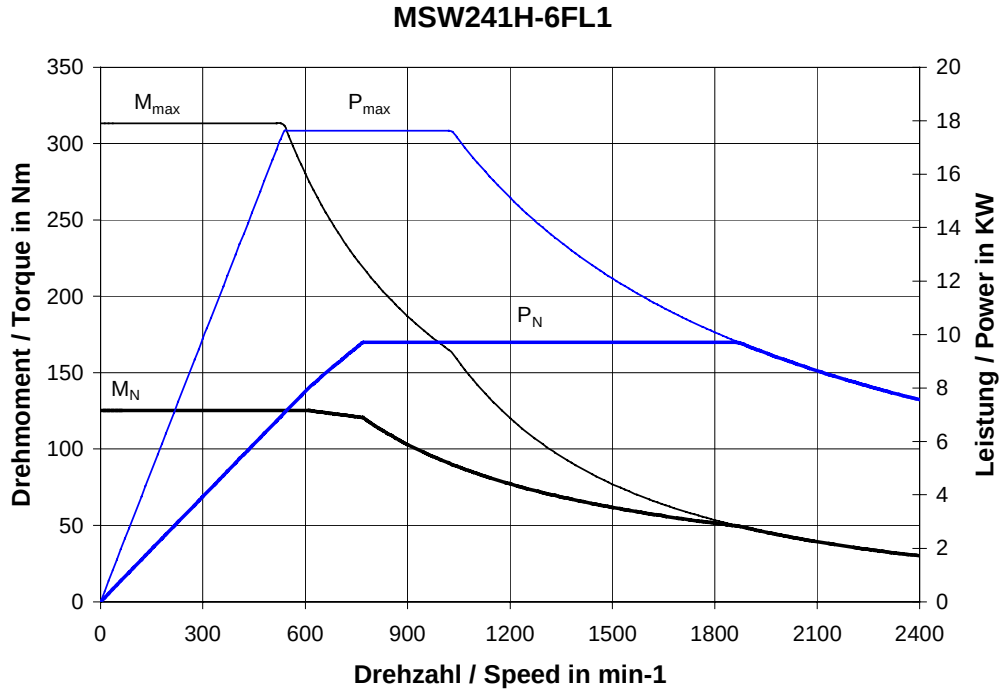
Mit Regelgerät HMS01.1N-W0036 an Versorger HMV01.1E-W0120 an 3x AC400V (-5%)
With Drive Controller HMS01.1N-W0036 at HMV01.1E-W0120 with main connection 3xAC400V (-5%)

Fig. 4-6: MBW180 motor characteristic curves

MBW241 Motor Characteristic Curves



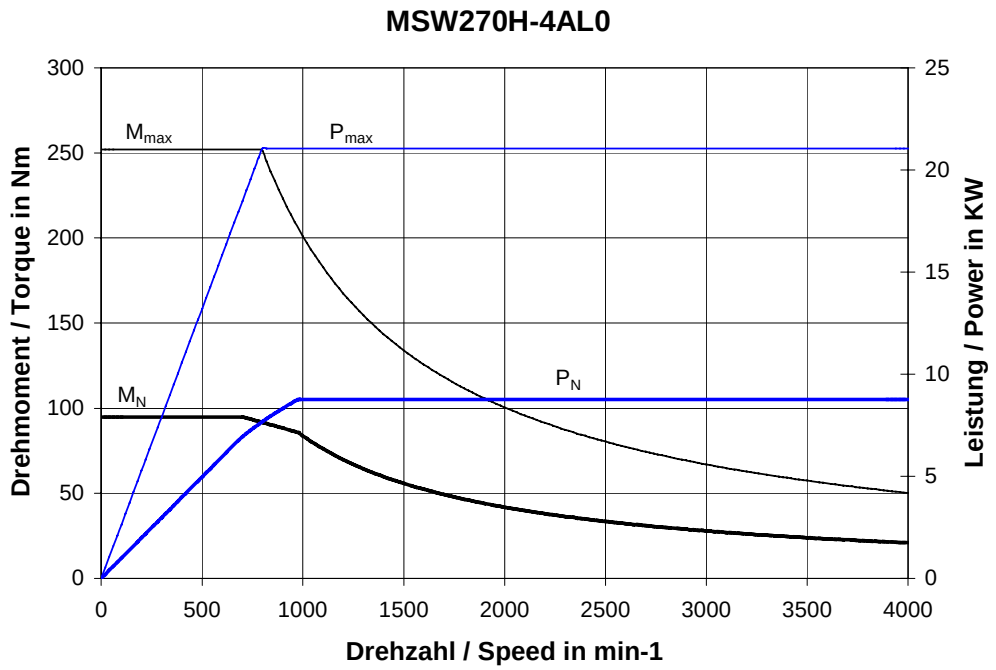
Mit Regelgerät HMS01.1N-W0036 an Versorger HMV01.1E-W0120 an 3x AC400V (-5%)
With Drive Controller HMS01.1N-W0036 at HMV01.1E-W0120 with main connection 3xAC400V (-5%)



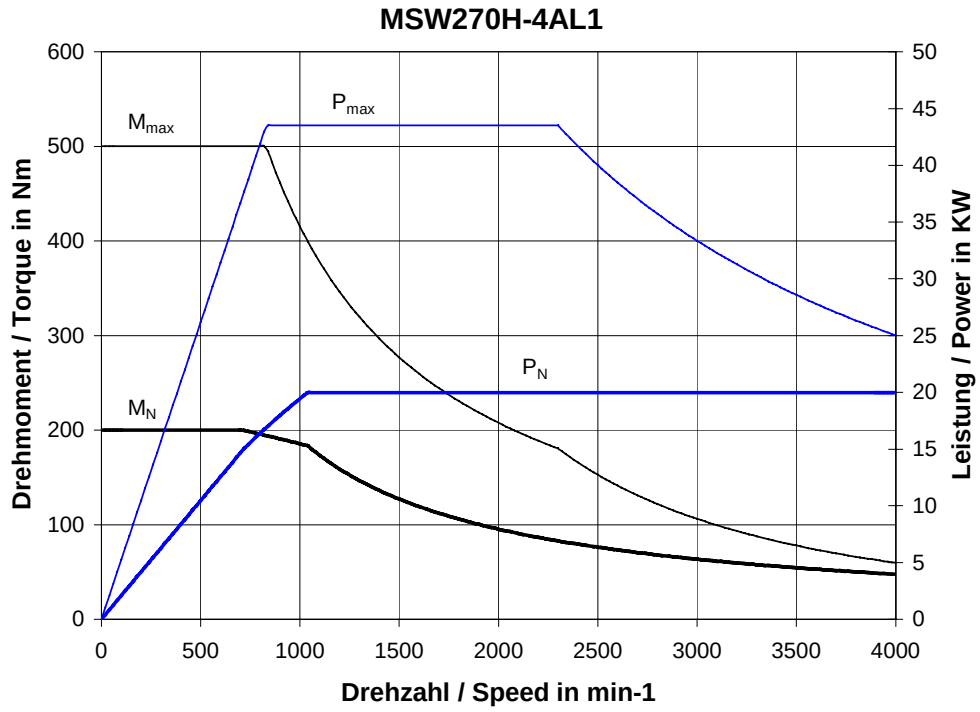
Mit Regelgerät HMS01.1N-W0054 an Versorger HMV01.1E-W0120 an 3x AC400V (-5%)
With Drive Controller HMS01.1N-W0054 at HMV01.1E-W0120 with main connection 3xAC400V (-5%)

Fig. 4-7: MBW241 motor characteristic curves

MBW270 Motor Characteristic Curves



Mit Regelgerät HMS01.1N-W0070 an Versorger HMV01.1E-W0120 an 3x AC400V (-5%)
With Drive Controller HMS01.1N-W0070 at HMV01.1E-W0120 with main connection 3xAC400V (-5%)

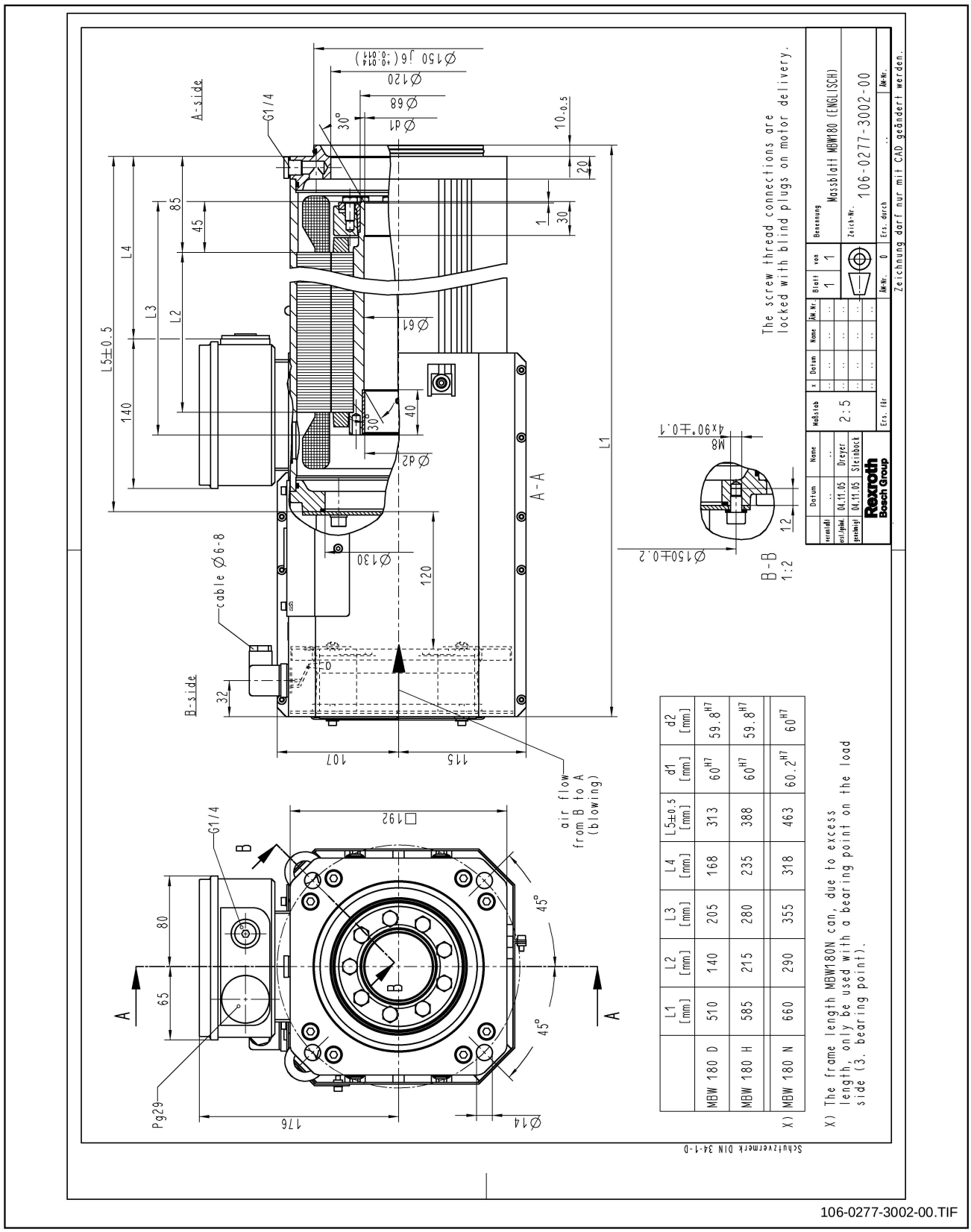


Mit Regelgerät HMS01.1N-W0150 an Versorger HMV01.1E-W0120 an 3x AC400V (-5%)
With Drive Controller HMS01.1N-W0150 at HMV01.1E-W0120 with main connection 3xAC400V (-5%)

Fig. 4-8: MBW270 motor characteristic curves

5 Dimensional Data

5.1 MBW180 Dimension Sheet



	L1 [mm]	L2 [mm]	L3 [mm]	L4 [mm]	L5±0.5 [mm]	d1 [mm]	d2 [mm]
MBW 180 D	510	140	205	168	313	60^{H7}	59.8^{H7}
MBW 180 H	585	215	280	235	388	60^{H7}	59.8^{H7}
X) MBW 180 N	660	290	355	318	463	60.2^{H7}	60^{H7}

Fig. 5-1: MBW180 dimension sheet

5.2 MBW180 / S002 Dimension Sheet

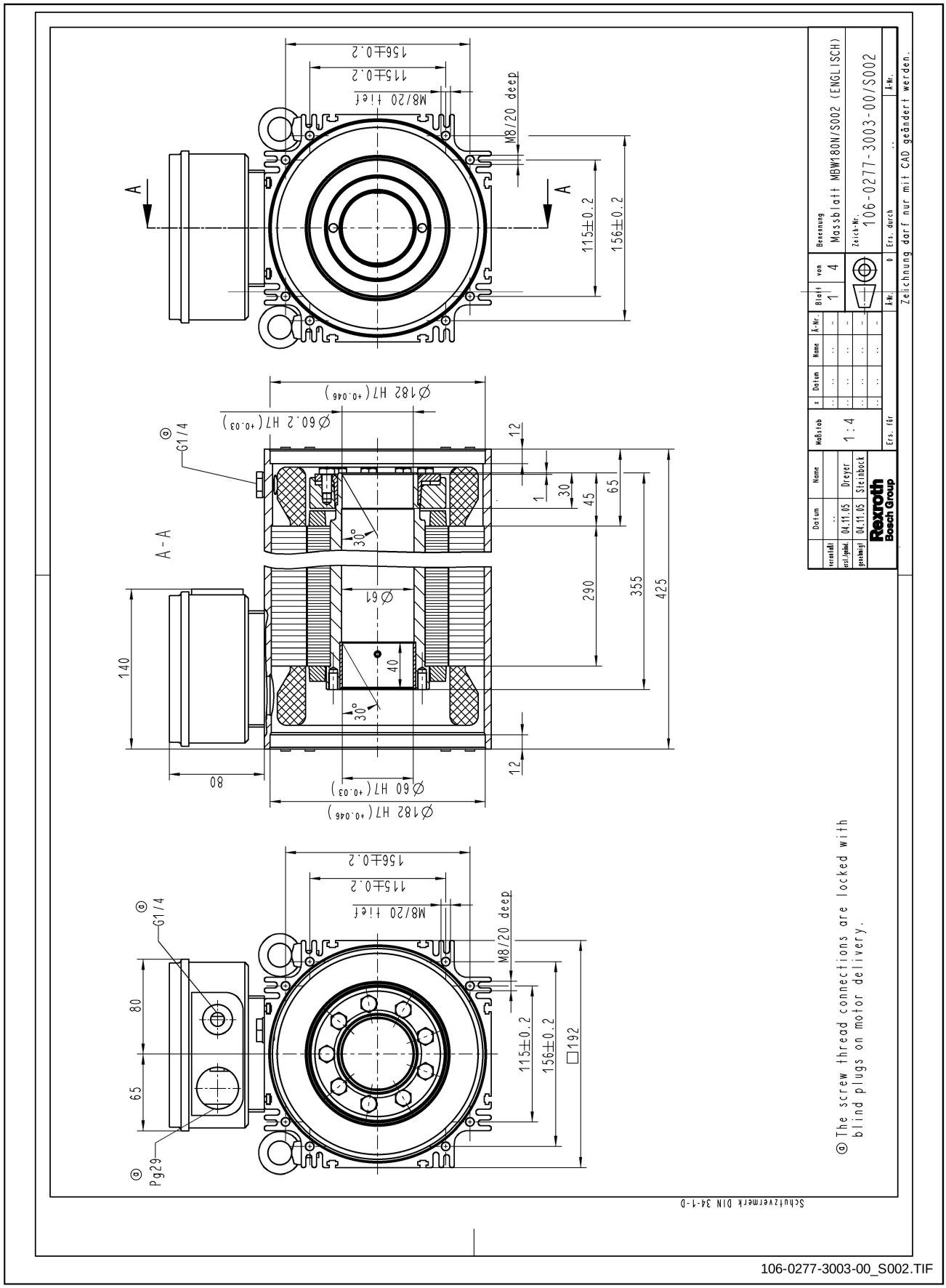


Fig. 5-2: MBW180 / S002 dimension sheet (1/4)

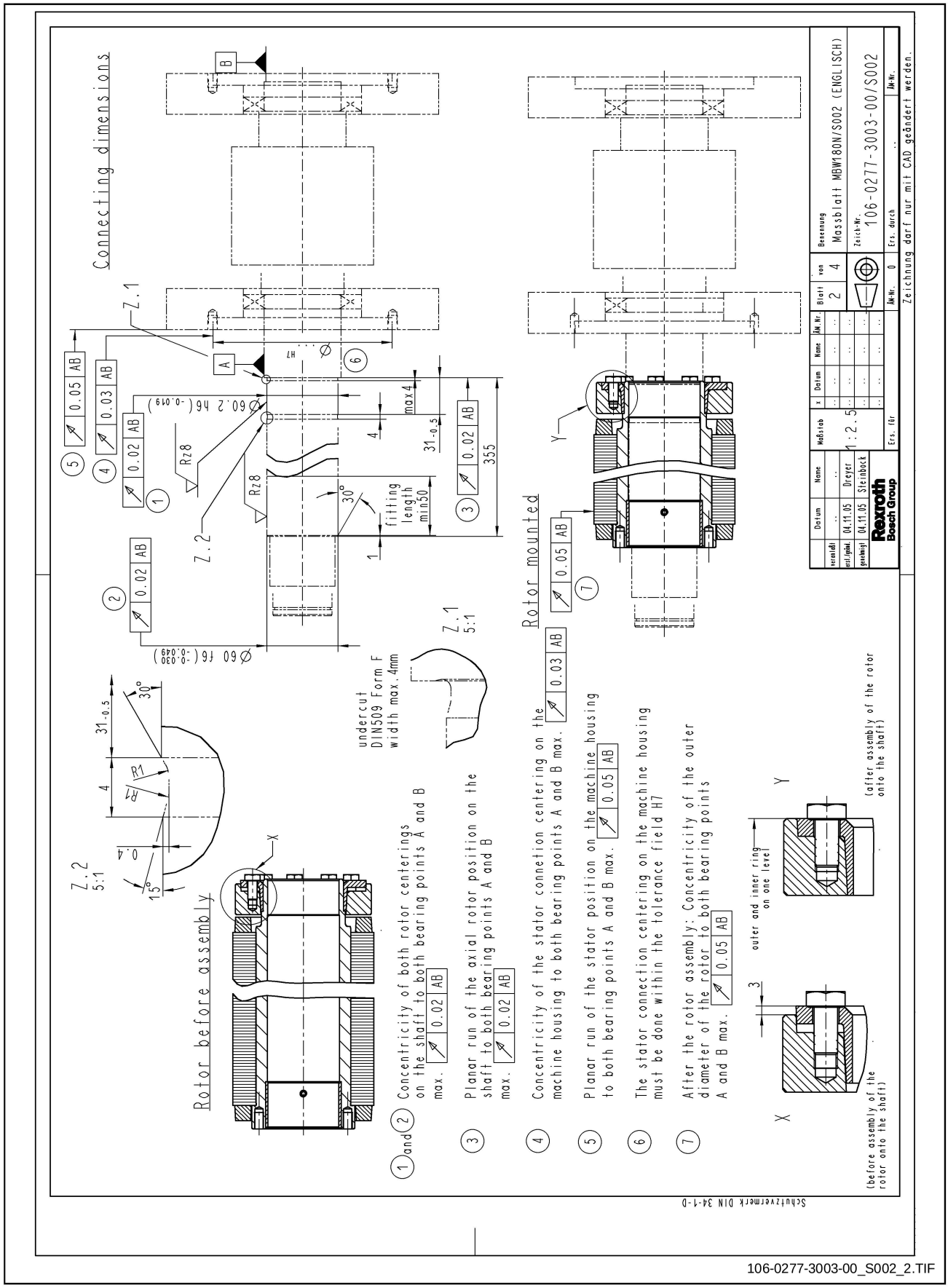
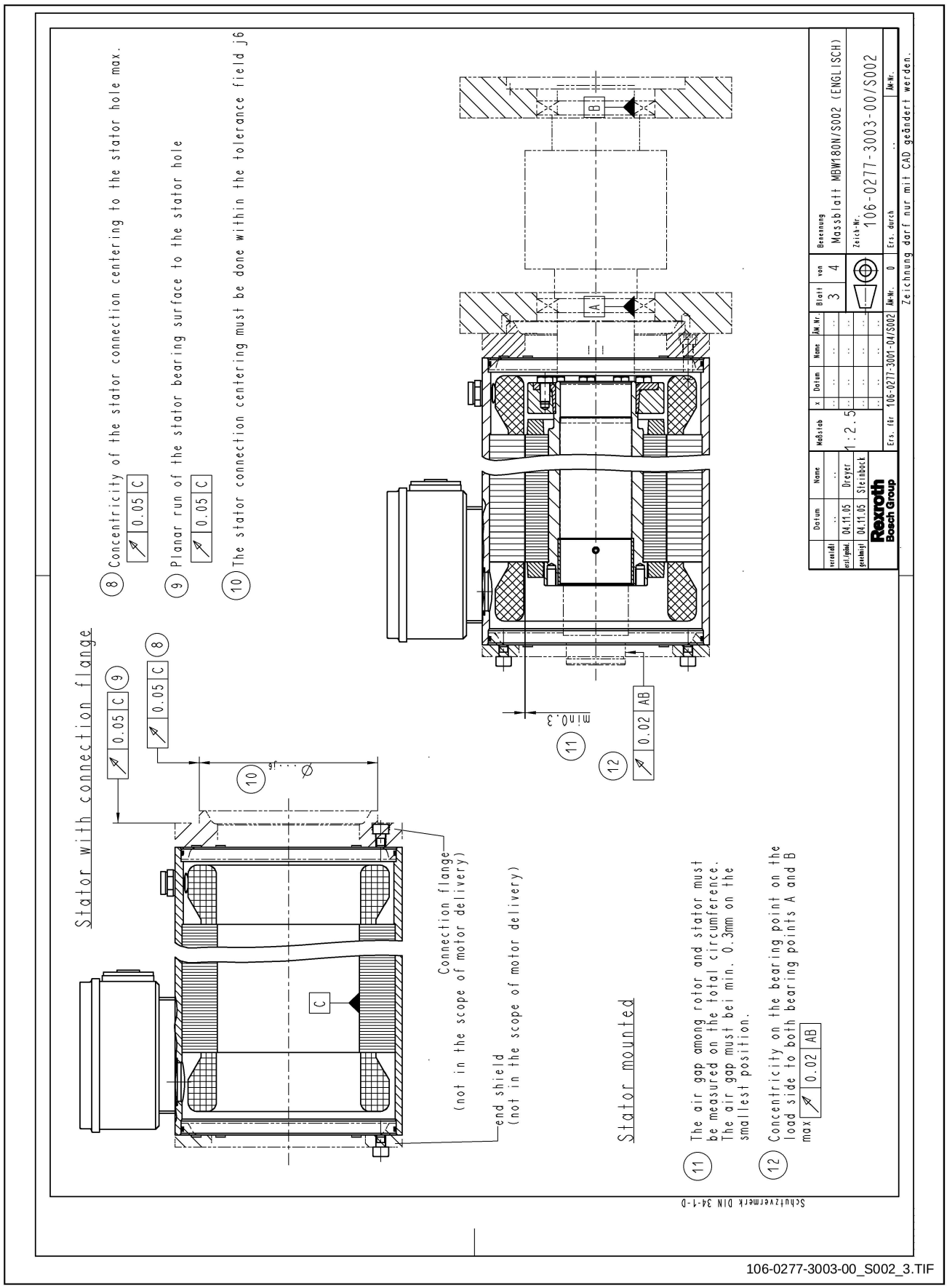


Fig. 5-3: MBW180 / S002 dimension sheet (2/4)



106-0277-3003-00_S002_3.TIF

Fig. 5-4: MBW180 / S002 dimension sheet (3/4)

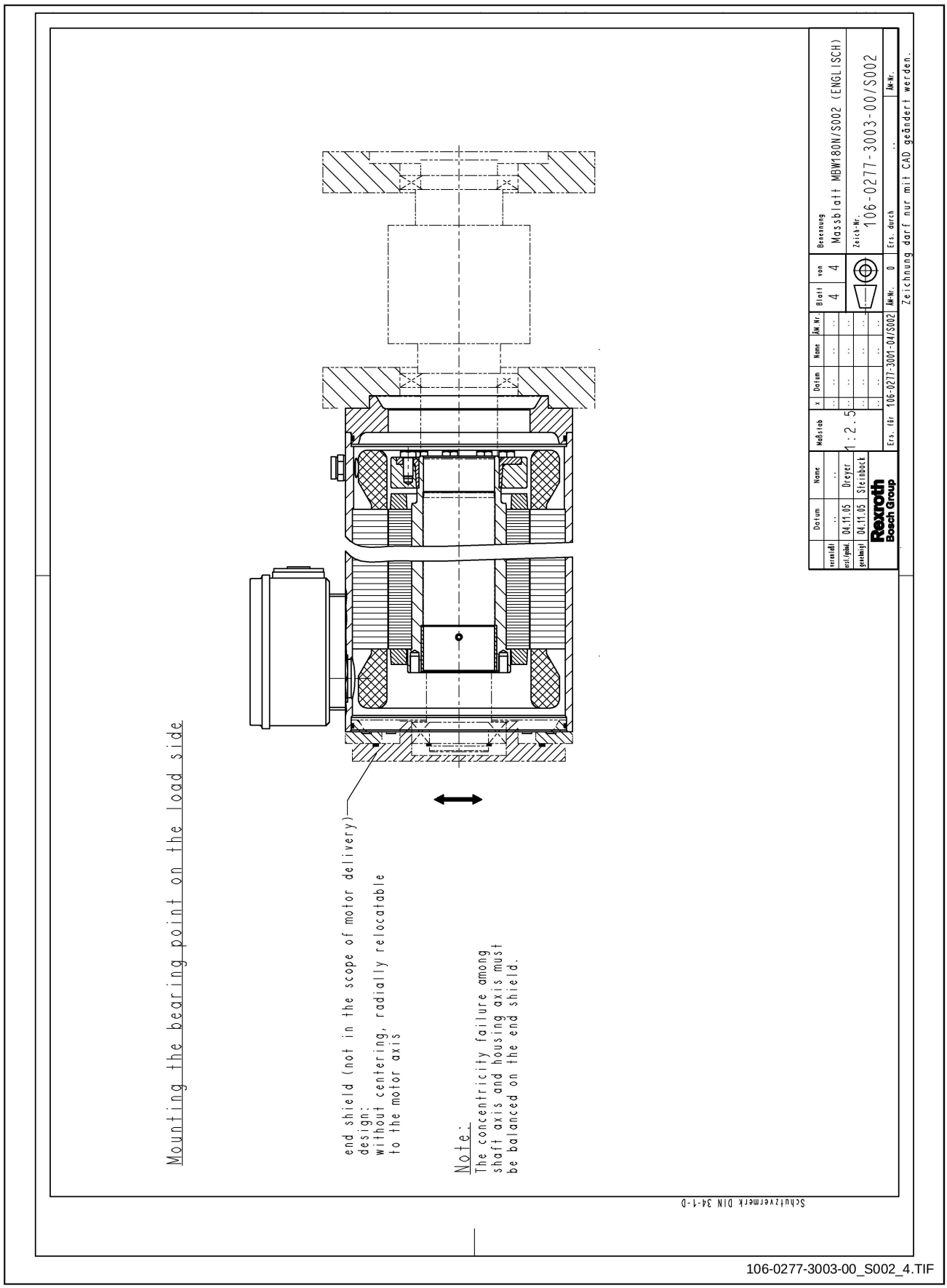


Fig. 5-5: MBW180 / S002 dimension sheet (4/4)

5.3 MBW241 Dimension Sheet

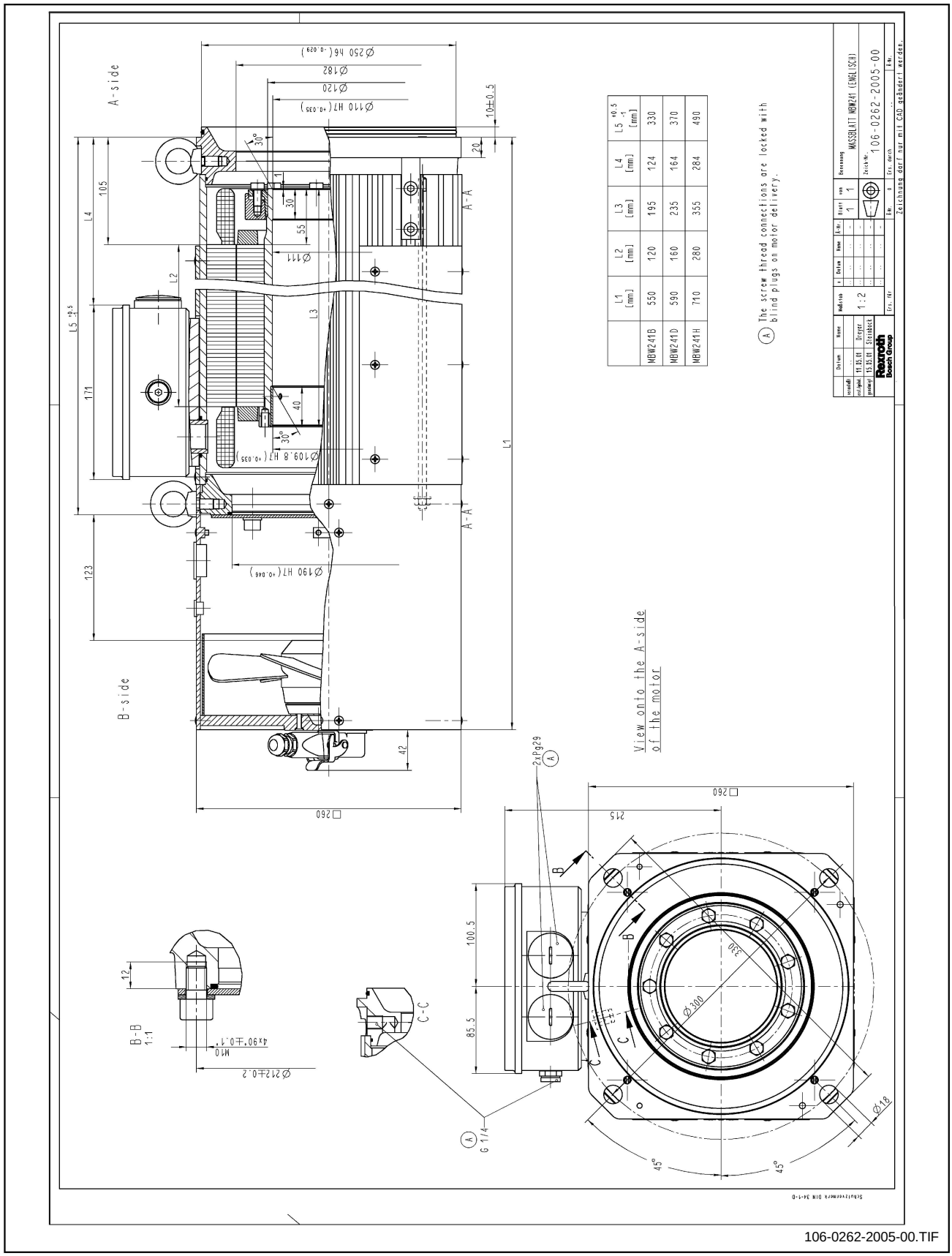


Fig. 5-6: MBW241 dimension sheet

5.4 MBW241H / S002 Dimension Sheet

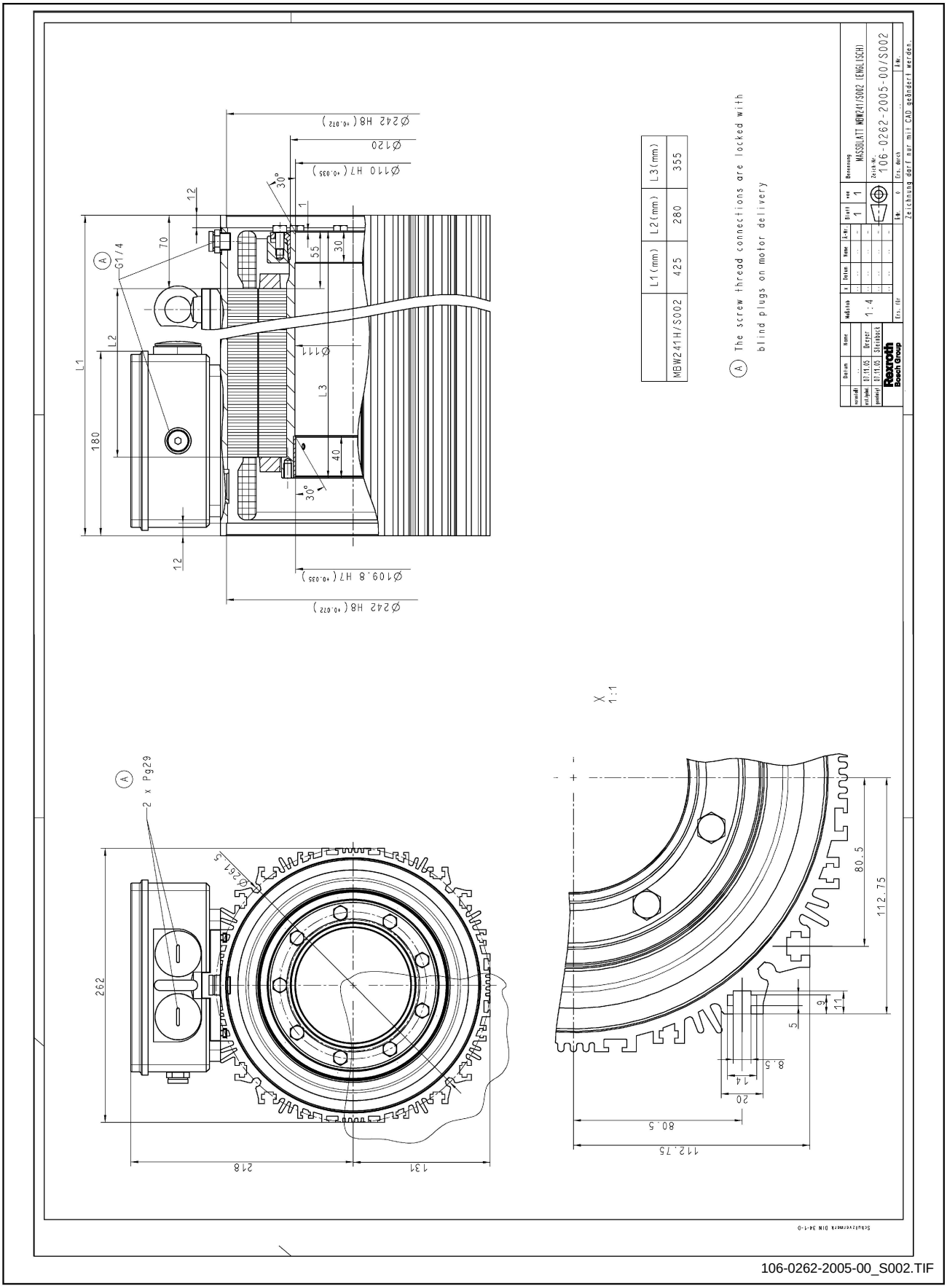


Fig. 5-7: MBW241H / S002 dimension sheet

MBW241H / S002 Connection Dimensions

in preparation

Fig. 5-8: MBW241H / S002 connection dimensions

5.5 MBW270 Dimension Sheet

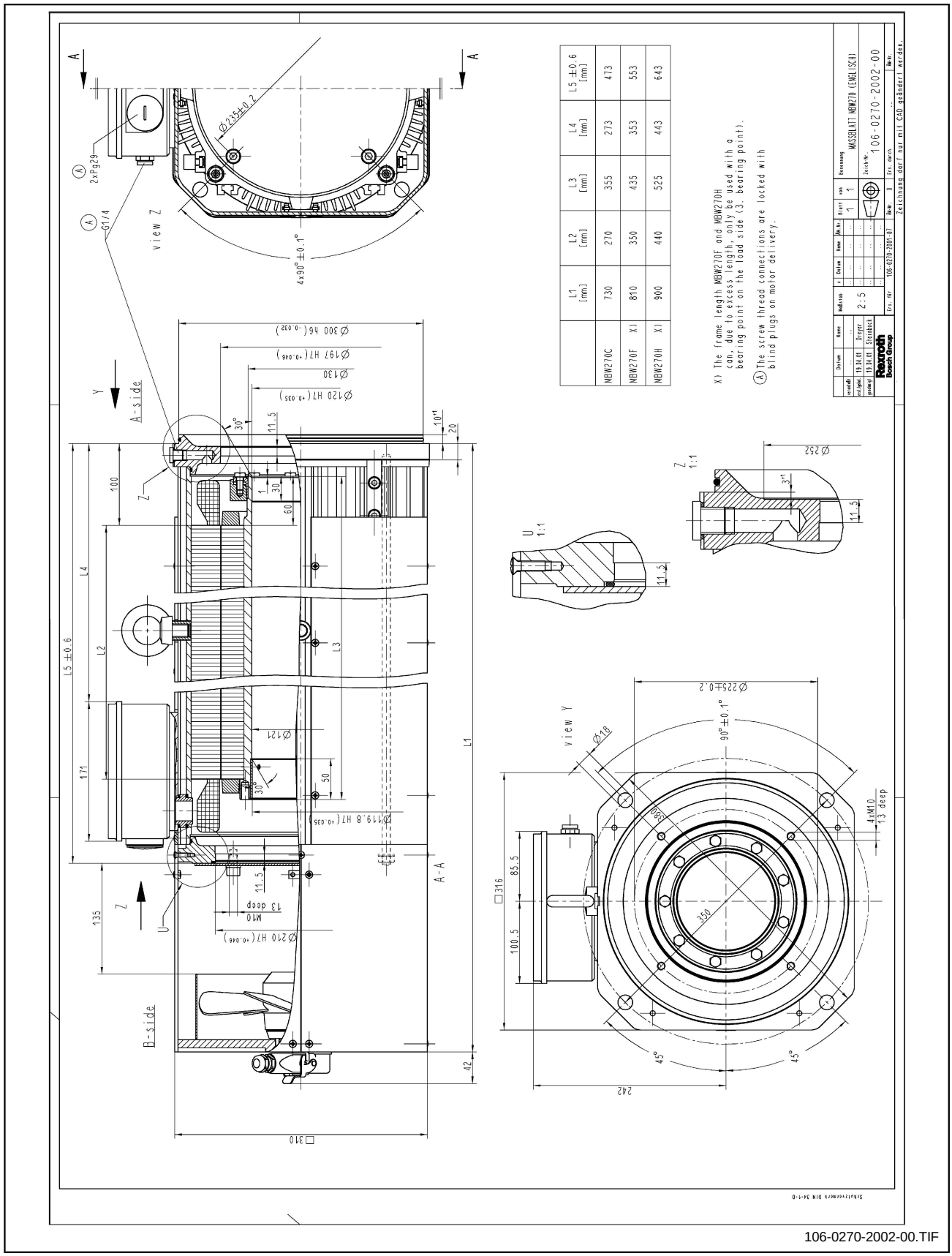


Fig. 5-9: MBW270 dimension sheet

MBW270 Connection Dimensions

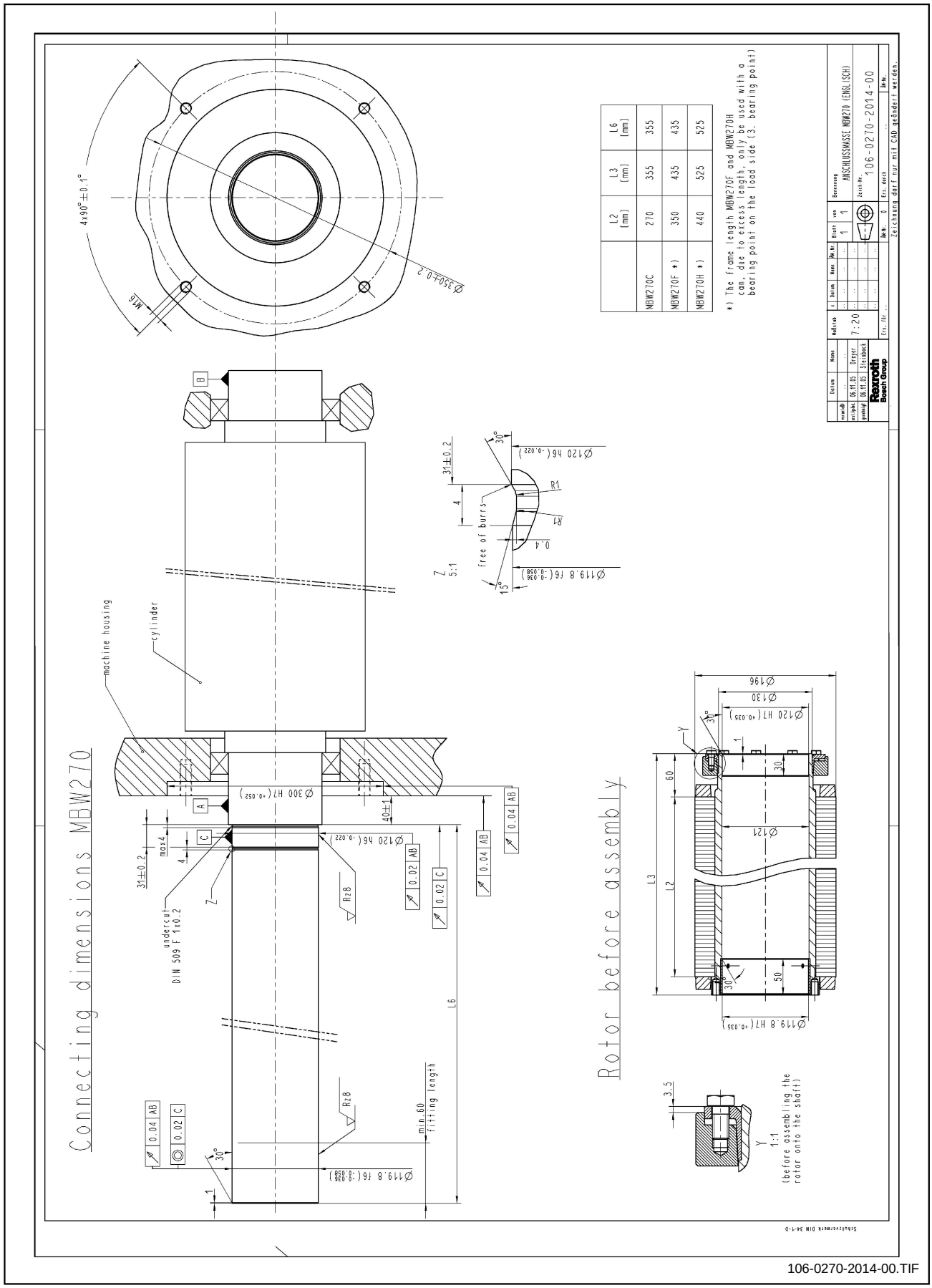


Fig. 5-10: MBW270 connection dimensions (1/4)

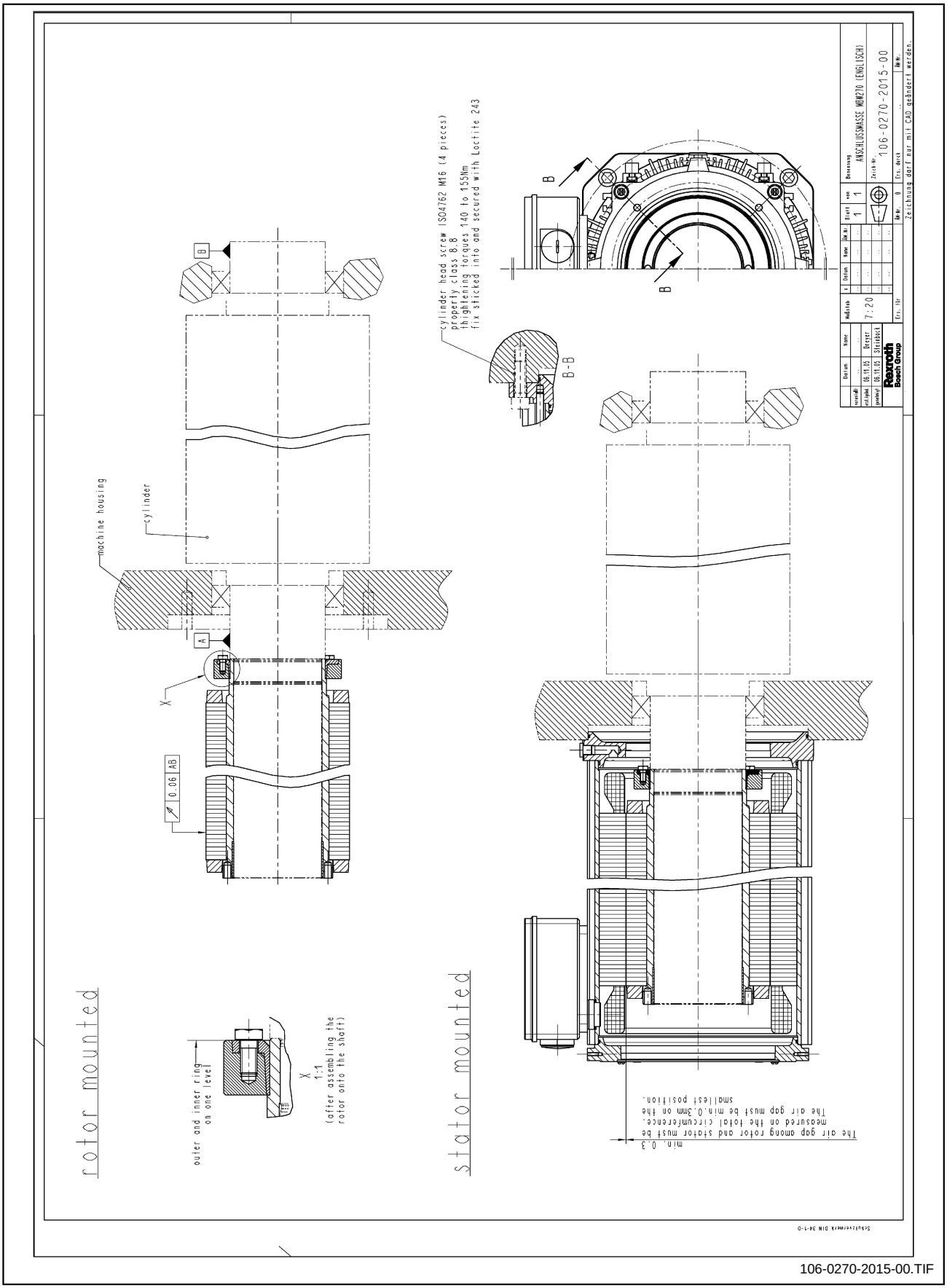


Fig. 5-11: MBW270 connection dimensions (2/4)

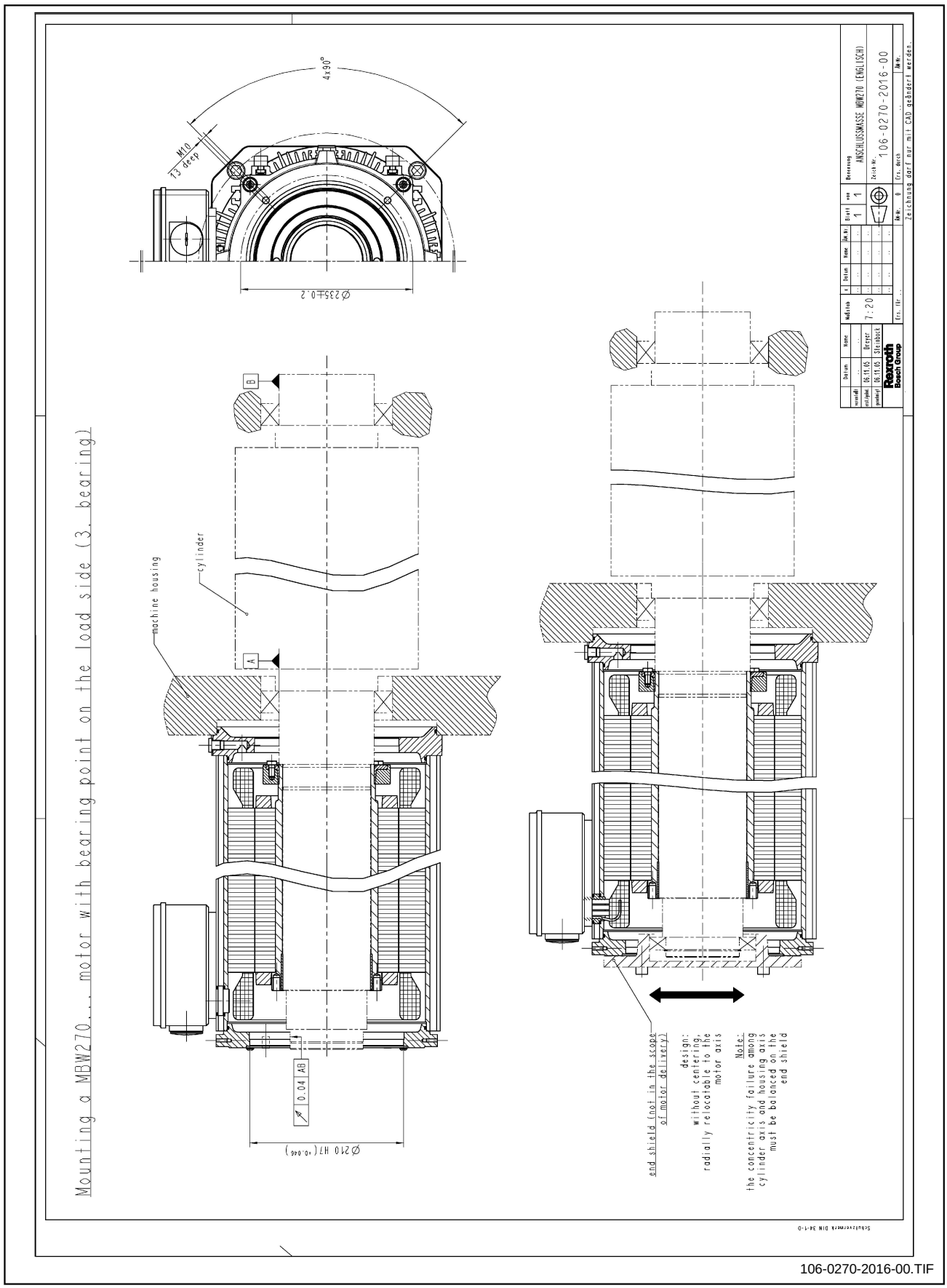


Fig. 5-12: MBW270 connection dimensions (3/4)

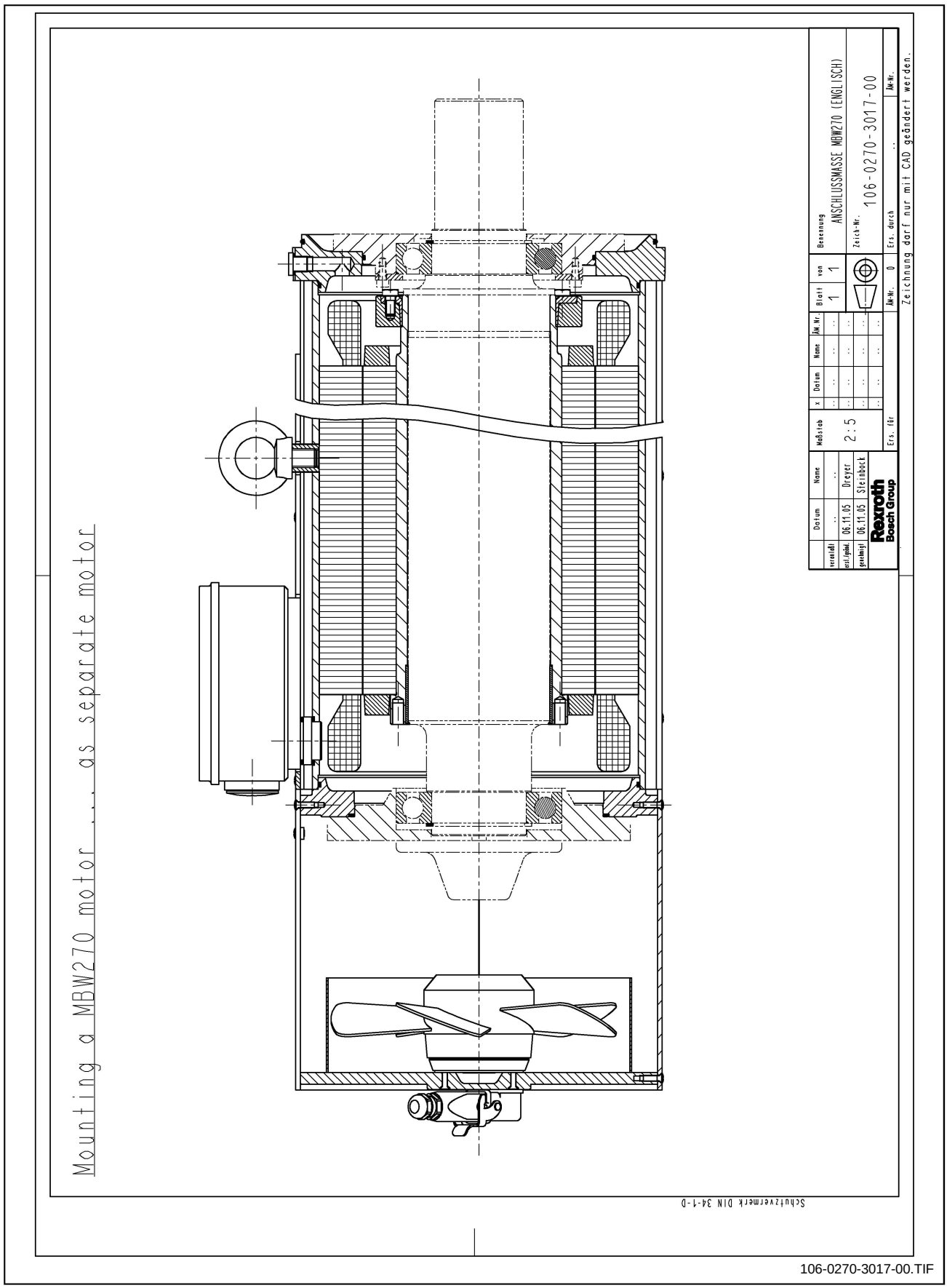


Fig. 5-13: MBW270 connection dimensions (4/4)

6 Type Codes

The type code describes the motor variants that are supplied; it is the basis for selecting and ordering products from Bosch Rexroth. This applies to both new products as well as spare parts and repairs.

Rexroth MBW roller motor kits consist of the components "stator" and "rotor". The type code is divided in "type code for stator MRW..." and "type code for rotor MSW...".

The following description gives an overview of the separate columns of the type code (”abbrev. column”) and their meanings. You can find the type code for a particular unit in the following chapter.

Type Code, Rotor MRW

1. Product Group

Abbrev. columns 1 2 3

MRW is the rotor designation of a roller motor kit of the MBW series.

2. Motor Frame Size

Abbrev. columns 4 5 6

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

3. Motor Frame Length

Abbrev. column 7

Within a series, the graduation of increasing motor frame length is indicated by ID letters in alphabetic order.

Frame lengths are, for example, **D**, **H** and **N**.

4. Design/Mechanical Construction

Abbrev. column 9

S indicates the fastening of the rotor by a clamp collar.

5. Rotor Internal Diameter

Abbrev. columns 10 11 12

Indicates the internal diameter of the rotor in millimeters (mm).

Type Codes, Stator MSW

1. Product

Abbrev. columns 1 2 3

MSW is the stator designation of a roller motor kit of the MBW series.

2. Motor Frame Size

Abbrev. columns 4 5 6

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

Available sizes: **180/241/270**.

3. Motor Frame Length

Abbrev. column 7

Within a series, the graduation of increasing motor frame length is indicated by ID letters in alphabetic order. The longer the motor frame, the higher the torque.

Frame lengths are, for example, **D**, **H** and **N**.

4. Winding Code

Abbrev. columns 9 10

Winding codes "**4A**", "**4B**", etc. are used to differentiate winding variants; they indicate the rated speed.

A drive combination is selected based on the corresponding selection data and operating characteristics.

An intermediate circuit voltage of 540 V_{DC} is used as a fixed reference value.

5. Coolant

Abbrev. column 11

MBW motors are available **only with air cooling**.

6. Type of Cooling

Abbrev. column 12

MBW motors are designed to be operated with **axial fans**. Cooling occurs using air currents that are guided by air plates over the surface of the motor. The main direction is “blowing“.

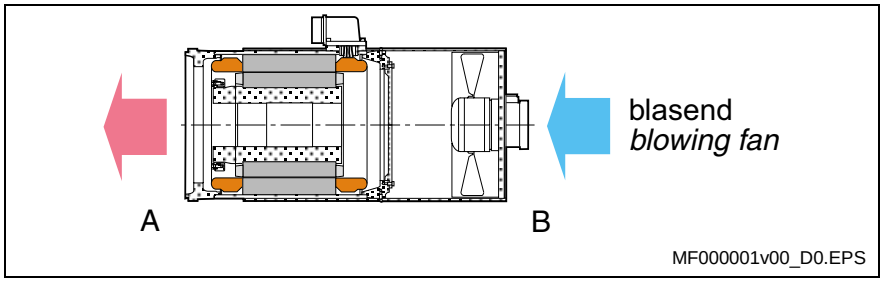


Fig. 6-1: Axial fan air current

7. Power Connection Design

Abbrev. column 14

MBW motors are connected to power via a **terminal box**.

8. Position of the Power Connection

Abbrev. column 15

The terminal box is located on the top ("**T**") of the motor housing (see Fig. 6-2).

9. Output Direction of Power Connector

Abbrev. column 16

Cable output directions on the terminal box are on the "**A**" or the "**B**" side.

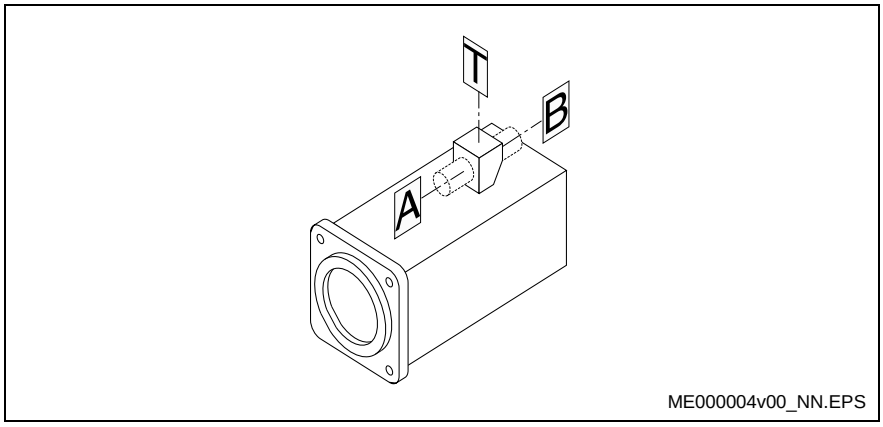


Fig. 6-2: Position of cable connection

The position of the terminal box cannot be changed after the motor has been manufactured.

8. Motor Encoder

Abbrev. column 17

The motor feedback system required to determine the position of the roller is not a component of the roller motor kit.

9. Special Models

Abbrev. columns 19 20 21 22

Reserved for optional types. You can find a short description in the appropriate type code; mechanical details are in the corresponding dimension sheet.

6.1 MBW180 Type Code

Rotor MRW180

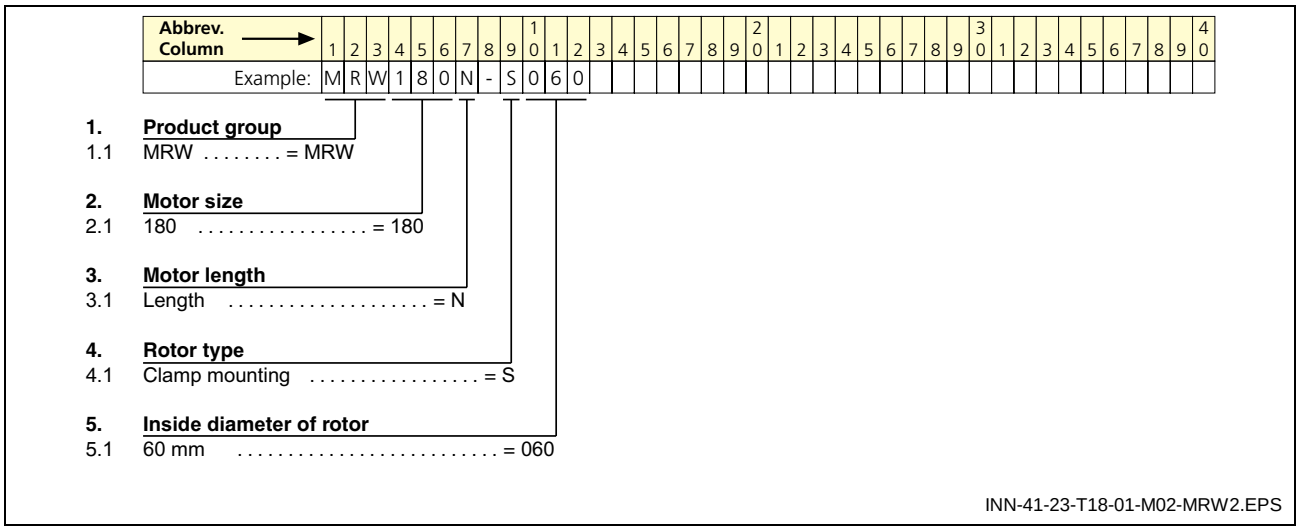


Fig. 6-3: MRW180 type code

Stator MSW180

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

1. Product
1.1 MSW . . . . . = MSW

2. Motor size
2.1 180 . . . . . = 180

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

4. Windings code
4.1 MSW180N . . . . . = 4C

5. Cooling medium
5.1 Air . . . . . = L

6. Cooling mode
6.1 without blower . . . . . = 0
6.1 Axial blower 230 V, blowing . . . . . = 1
6.2 Axial blower 115 V, blowing . . . . . = 2

7. Type of power connection
7.1 Junction box . . . . . = 4

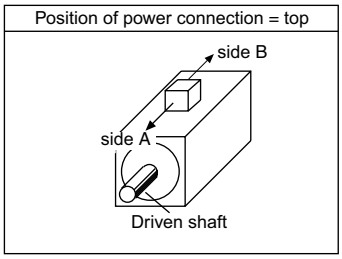
8. Position of power connection
8.1 top . . . . . = T

9. Output direction of power connection ①
9.1 to side A . . . . . = A
9.2 to side B . . . . . = B

10. Motor encoder
10.1 without motor encoder, standard . . . . . = N

11. Special design
11.1 without end shield to side A and side B . . . . . = S002 ②

Note:
① Looking from front onto driven shaft (see picture 1)
② Special design "S002" is only available without blower



Picture 1

RNC-41231-802_NOR_E_D0_2003-06-052.EPS

Fig. 6-4: MSW180 type code

6.2 MBW241 Type Code

Rotor MRW241

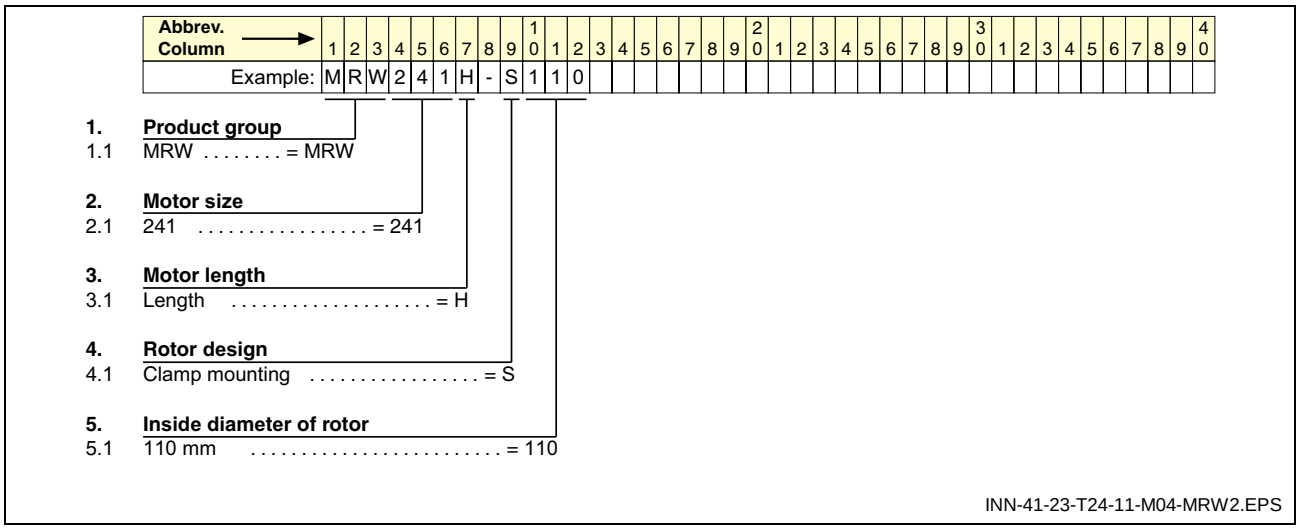


Fig. 6-5: MRW241 type code

Stator MSW241

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

1. Product
1.1 MSW . . . . . = MSW

2. Size
2.1 241 . . . . . = 241

3. Length
3.1 Lengths . . . . . = H

4. Windings code
4.1 MSW241H . . . . . = 6F

5. Cooling medium
5.1 Air . . . . . = L

6. Cooling mode
6.1 without blower . . . . . = 0
6.2 Axial blower, AC 400 V, blowing . . . . . = 1

7. Type of power connection
7.1 Terminal box . . . . . = 4

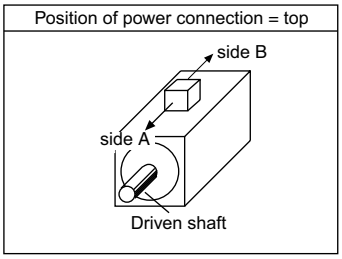
8. Position of power connection ①
8.1 top . . . . . = T

9. Output direction of power connection ①
9.1 to side A . . . . . = A
9.2 to side B . . . . . = B

10. Encoder
10.1 without encoder, standard . . . . . = N

11. Special design
11.1 without end shield to side A and side B . . . . . = S002 ②

Note:
① Looking from front onto driven shaft (see picture 1)
② Special design "S002" is only available with cooling mode "0" and with type of power connection "4"



Picture 1

RNC-41232-412_NOR_N_D0_2005-01-272.EPS

Fig. 6-6: MSW241 type code

6.3 MBW270 Type Code

Rotor MRW270

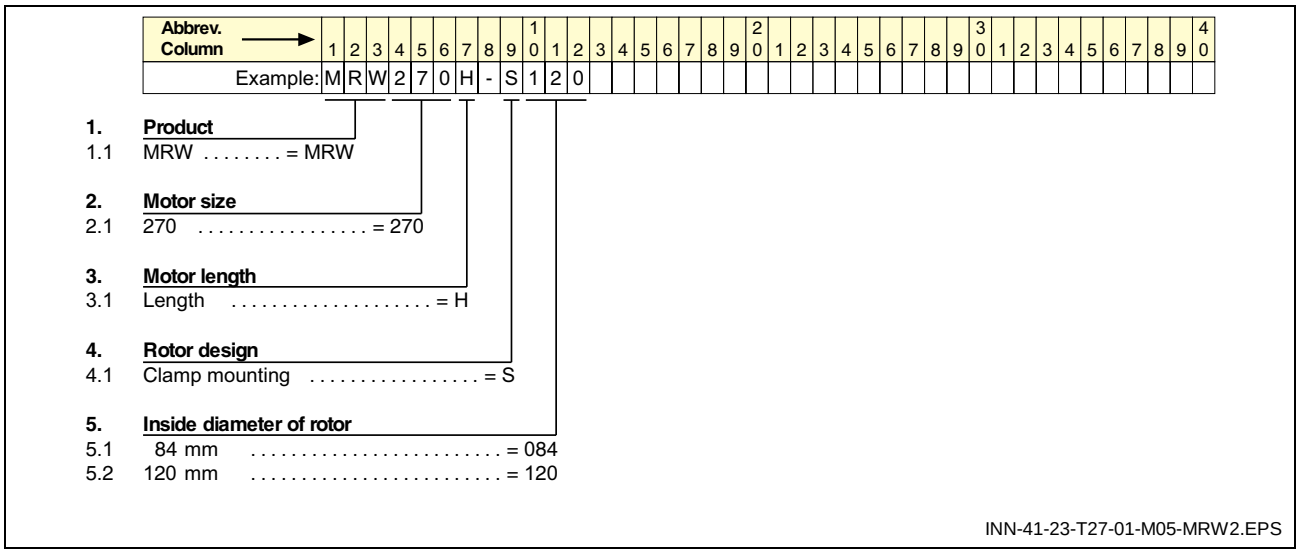


Fig. 6-7: MRW270 type code

Stator MSW270

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

1. Product
1.1 MSW . . . . . = MSW

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

3. Motor length
3.1 Length . . . . . = H

4. Windings code
4.1 MSW270H . . . . . = 4A

5. Cooling medium
5.1 Air . . . . . = L

6. Cooling mode
6.1 without blower . . . . . = 0
6.2 Axial blower, AC 400 V, blowing . . . . . = 1

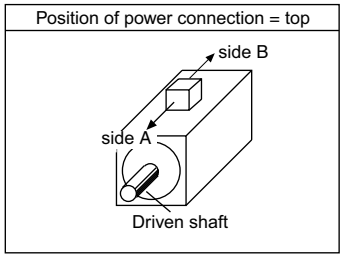
7. Type of power connection
7.1 Terminal box . . . . . = 4

8. Position of power connection ①
8.1 top . . . . . = T

9. Output direction of power connection ①
9.1 to side A . . . . . = A
9.2 to side B . . . . . = B

10. Motor encoder
10.1 without motor encoder, standard . . . . . = N

Note:
① Looking from front onto driven shaft (see picture 1)



Picture 1

RNC-41232-702_NOR_E_D0_2003-06-102.EPS

Fig. 6-8: MSW270 type code

7 Accessories

No accessories for Rexroth MBW motors are currently available.

8 Connection Techniques

8.1 Notes

CAUTION

Destruction of the motors by direct connection to the 50/60Hz mains network (three-wire or single-phase mains)!

⇒ The motors described here may be operated only with suitable drive control devices, with variable output voltage and frequency (converter mode) as specified by Rexroth.

The user can either use ready-made Bosch Rexroth cables or assemble the required cables himself.

Bosch Rexroth offers an extensive program of ready-made cables and plug-in connectors that are optimally adapted to the products and to a wide range of demands.

Decisive advantages of Rexroth ready-made cables are:

- Pre-wired without additional finishing
- Laid out for continuous alternate bending use
- Resistant against mineral oils, grease and biologic oils, silicon- and halogen-free, low adhesion
- Use of licensed cables acc. to UL and CSA
- Burning characteristics fulfill VDE0472-804 requirements
- Maintain EMC guidelines
- Protection class up to IP67

Note: **Note that self-assembled cables or cable systems of other manufacturers may not fulfill these criteria.**

Bosch Rexroth shall not be held responsible for resulting malfunction states or damages.

You can find additional information...

- about the electrical connection of MBW motors in the following descriptions in this chapter.
- about making **cables and connectors** ready-to-use, as well as technical data, in the Rexroth documentation “Connection Cables, Selection Data”, MNR R911280894.

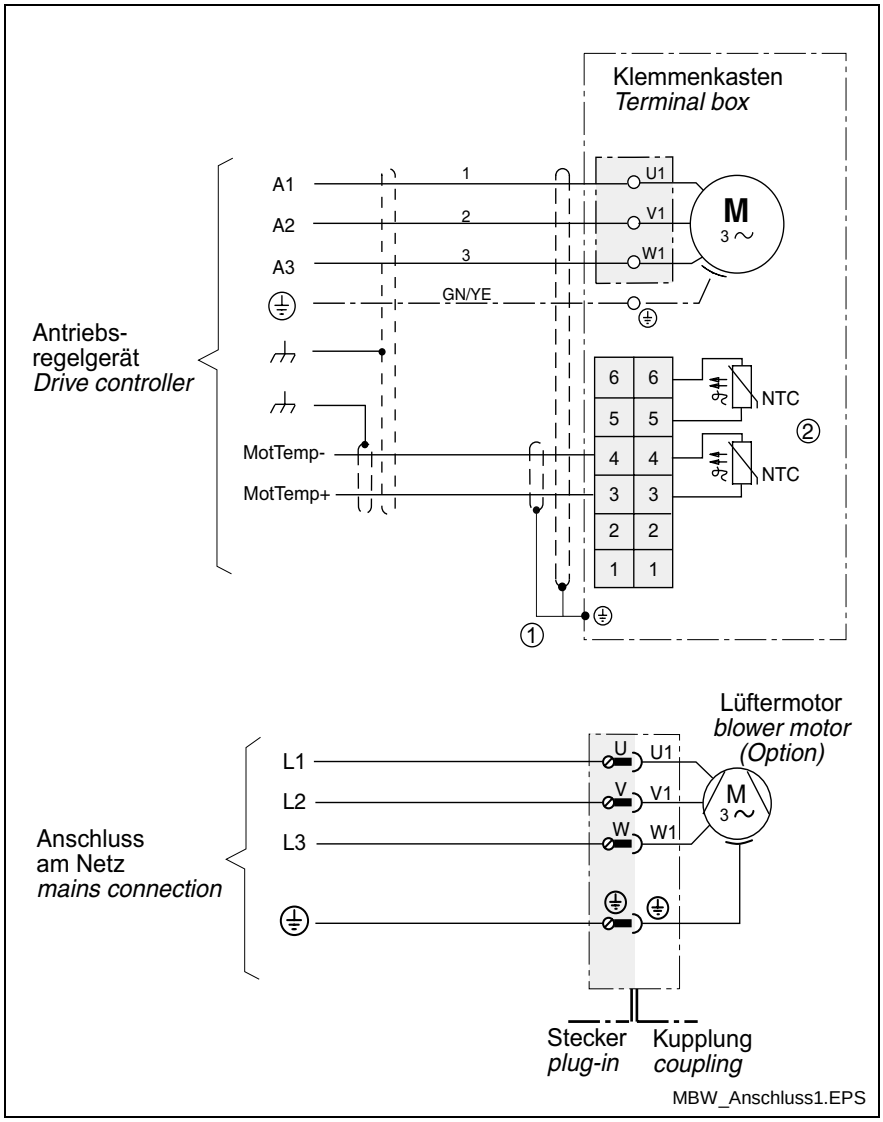
8.2 Power Connection

In addition to the motor feedback system (which is not a component of the MBW motor), the connections described in the following are required to operate an MBW motor.

(1) Motor fan Depending on the motor type, a motor fan is connected either with 2 or with 3 phases to the power supply via fan cables and a motor protection switch (example: 3 phases). Fan units work independently of the drive controller. The power connection uses a plug. The plug for connecting the fan is included in the scope of delivery and is located on the fan.

(2) Power For all MBW motors, the power connection uses a terminal box.

(3) Temperature sensor The temperature sensors (NTC) are permanently installed in the motor winding; they are always present in pairs, but only one sensor may be connected. The wires for connecting the sensors are led out with the power connector in the terminal box. If a sensor fails, the remaining sensor can continue to be used. The function of the spare sensor cannot be guaranteed.



(1): Shield connection via cable clamp of strain relief in the screwed connection.

(2): Only one NTC sensor is connected and evaluated. Connect the spare sensor only if necessary.

Fig. 8-1: MBW connection plan (terminal box)

Overview of connections

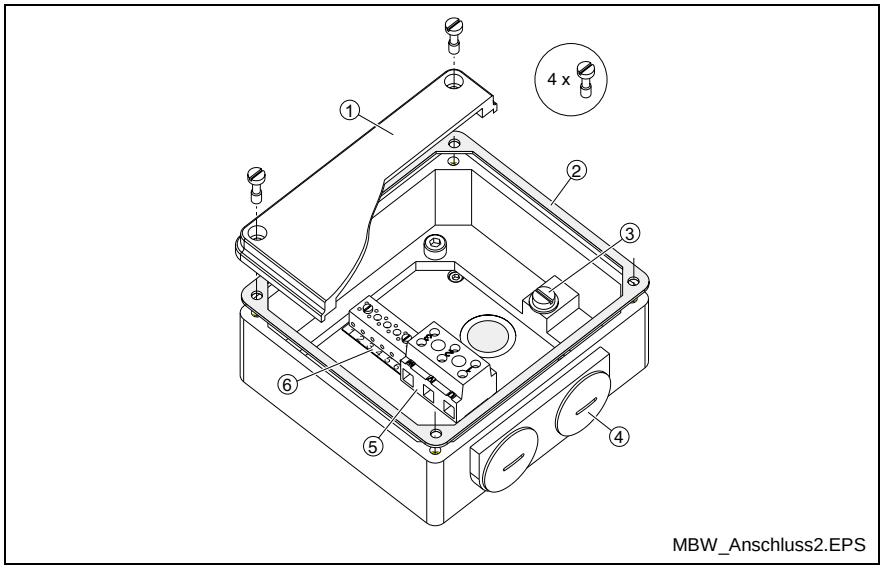
Motor		Terminal box 1)		
Frame size	Winding	U-V-W	PE	PG 2)
MSW180N	4C	WES	M6	29
MSW241H	6F	WES	M8	29
MSW270H	4A	WES	M8	29

1) WES = wire end sleeve.
M6 / M8 = diameter of terminal stud.
Connected using ring terminals. For the connection cross-section, see the motor data sheet.
2) PG screw is integrated in the ready-made IKG power cable.

Fig. 8-2: Overview of MBW power connectors

Terminal box

MBW motors for drive combinations that have drive controllers with a high intermediate circuit voltage (INDRADRIVE, DIAX04 and ECODRIVE series) are equipped with a terminal strip for cables with wire end sleeves (in the terminal box) or with a terminal board for cables with ring terminals.



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

Fig. 8-3: MBW terminal box

A schematic diagram of the connection is located in the lid of the terminal box.

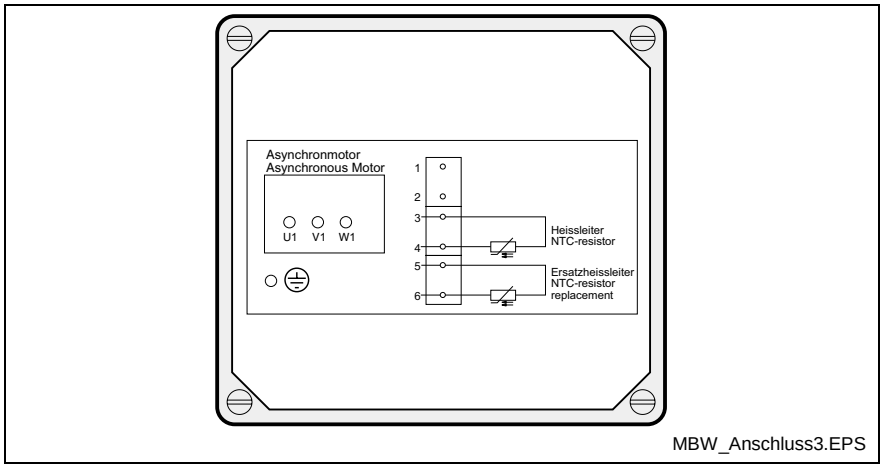


Fig. 8-4: MBW terminal box connection

Note:

- Only one contact pair of NTC resistor connectors 3-4 and 5-6 is connected. The polarity within a pair of wires is not relevant.
- Do not remove or damage the seal glued into the cover.
- Observe the size of the PG screwed connection and connection thread for the cable inlet into the terminal box.
- The connections of the internal winding interconnection in the terminal box must not be removed.

8.3 Motor Fan Connection

Motor size, MBW....	Fan type	Airflow direction	Type of connection		Connection voltage [V]	Power consumption [VA]	Fan current [A]	Mean air volume [m³/h]
180	axial	B > A (blowing)	Flange socket + plug	(1)	AC 115V ± 10 %, 60 Hz	60	0.5	230
					AC 230V ± 10 %, 50 Hz	60	0.3	230
241				(2)	3 x 400V ± 15 %, 50/60 Hz	170	0.17	1000
270					3 x 400V ± 15 %, 50/60 Hz	220	0.11	1120
Indices (1) and (2) are used in this chapter only to explain the type of connection. Please observe the examples below.								

Fig. 8-4: MBW fan connections

Note: To establish the motor fan connection, the fan plug must be opened and fastened.

- The electric connection may be established by skilled personnel only. Please observe the safety notes.
- The plug for connecting the fan is included in the scope of delivery and is located on the fan.
- Fan cables and protective circuit breakers do not belong to the Bosch Rexroth scope of delivery.

Design (1)

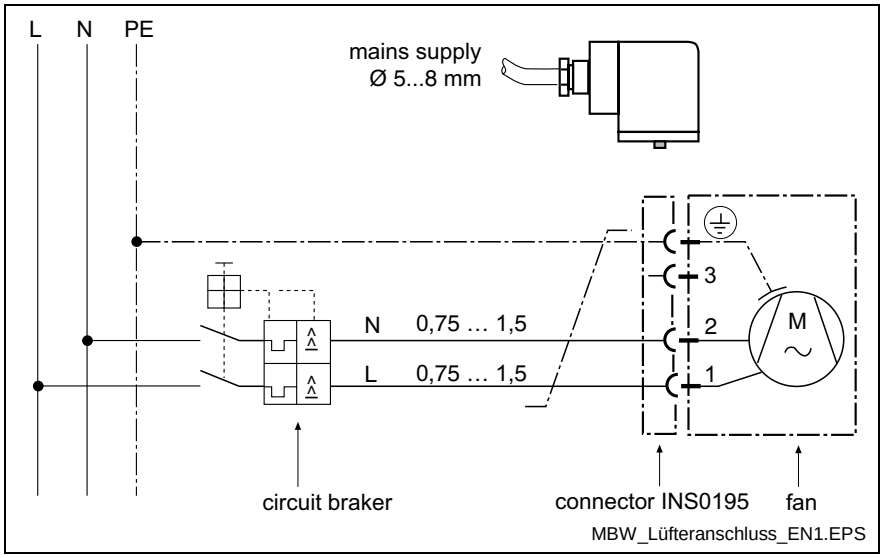


Fig. 8-5: Fan connection design (1)

Design (2)

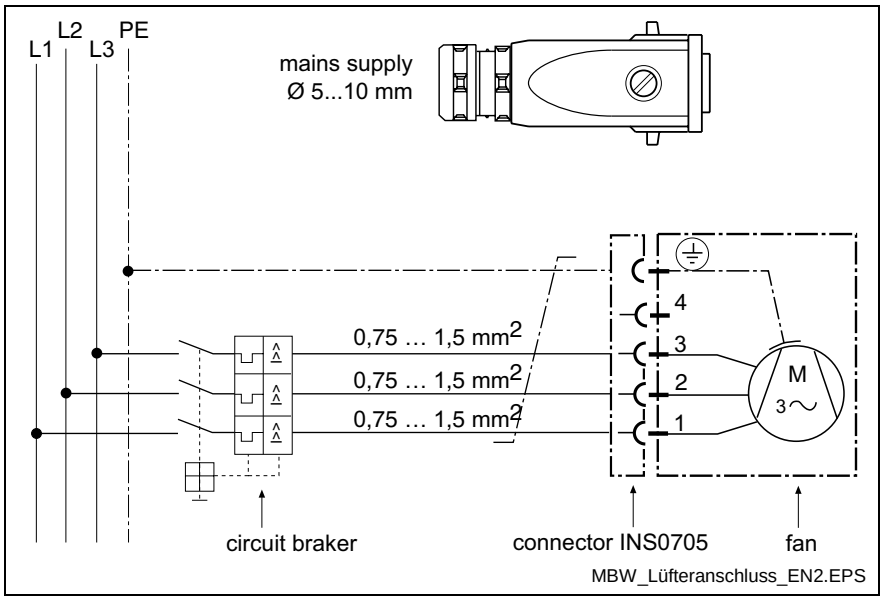


Fig. 8-6: Fan connection design (2)

8.4 Temperature Sensor Connection

In MBW motors, two temperature sensors (NTC) are permanently installed in the motor winding – only one sensor is connected (see Fig. 8-1). The wires for connecting the sensors are led out with the power connector in the terminal box.

If a sensor fails, the spare sensor can continue to be used.

Note: The polarity within a pair of wires is not relevant for the functioning of the NTC resistor. The function of the spare sensor cannot be guaranteed.

9 Notes Regarding Application and Construction

9.1 Conditions for Use

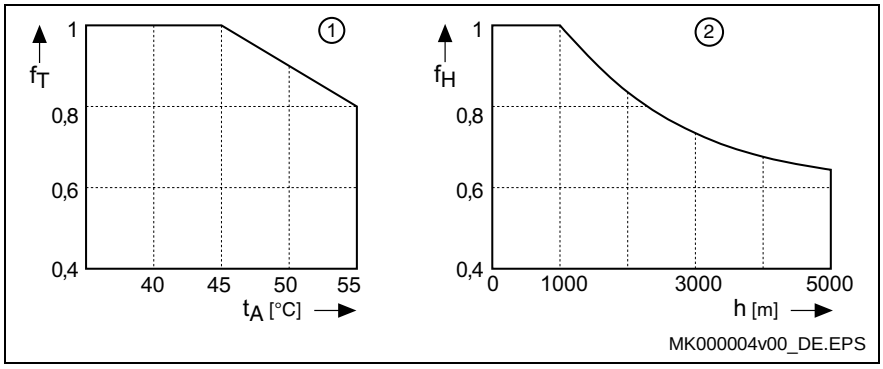
Setup Elevation and Ambient Temperature

The performance data specified for the motors apply in the following conditions:

Ambient temperature: 0 to +45°C,

Set-up elevation: up to 1,000m above sea level.

If you want to use the motors in areas with values beyond these ranges, the performance data are reduced according to the following figure.



(1): Utilization depending on the ambient temperature
(2): Utilization depending on the setup elevation
f_T: Temperature utilization factor
t_A: Ambient temperature in degrees Celsius
f_H: Height utilization factor
h: Setup elevation in meters

Fig. 9-1: Utilization factors

If **either** the ambient temperature **or** the setup height exceeds the nominal data:

1. Multiply the motor data provided in the selection data with the calculated utilization factor.
2. Ensure that the reduced motor data are not exceeded by your application.

If **both** the ambient temperature **and** the site altitude exceed the nominal data:

1. Multiply the determined utilization factors f_T and f_H by each other.
2. Multiply the value obtained by the motor data specified in the selection data.

Ensure that the reduced motor data are not exceeded by your application.

9.2 Air humidity

Ambient climatic conditions are defined into different classes according to DIN EN 60721-3-3 (1995), Table 1. They are based on observations made over long periods of time throughout the world and take into account all influencing quantities that could have an effect, such as the air temperature and humidity.

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

This class is excerpted in the following table.

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
Speed of temperature change	°C/min	0.5
[1]) Rexroth permits 0°C as the lowest air temperature.		

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

9.3 Protection class

The protective classes according to IEC 60529 apply to Rexroth MBW motors. In each and every installation position of the motors, it must be ensured that they are not subjected to ambient conditions outside of the particularly applicable degree of protection.

The degree of protection is defined by the abbreviation IP (International Protection) and two reference numbers specifying the degree of protection. The first code number describes the protection class against contact and penetration of foreign substances; the second code number describes the protection class against water penetration.

1st code number	Degree of protection
0	Not protected
2	Protection against complete penetration of solid foreign bodies with a diameter of 12.5 mm and larger
4	Protection against penetration of solid foreign bodies with a diameter of 1.0 mm and larger
6	Dust-proof; contact protection against parts under power
2nd code number	**Degree of protection**
0	Not protected
4	Protection against spraying water from any direction
5	Protection against water jets from any direction

Fig. 9-3: Degrees of protection according to IEC 60529

Motor area		Protection class
Motor		IP00
Power and feedback connection (only if properly assembled)		IP65
Fan	Fan motor	IP44
	Fan screen	IP24

Fig. 9-4: Protection class ranges of MBW motors

It must be ensured that, in each and every installation position, the motors are not subjected to ambient conditions outside of the particularly applicable degree of protection according to IEC 60529.

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

9.4 Protection from Touching Hot Surfaces

CAUTION

Surfaces of the motor housing may be hot!
Risk of injury! Risk of burning!

⇒ Do not touch the housing surface of motors that are in operation! Risk of burning!

⇒ Depending on the operating conditions, the temperature may be above 60° C (140° F).

⇒ Before touching the motor, let it cool sufficiently after switching it off.

⇒ For certain applications, measures for preventing burns according to the notes regarding safety of the manufacturer are to be carried out on the end product, in the machine or in the system. These measures can be, for example: warnings, separating protective equipment (shield or barrier), technical documentation.

9.5 Compatibility

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

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

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

9.6 Motor Feedback

The drive controller requires the current value of the roller position to regulate the roller speed/position. To achieve this, the motor feedback system provides an appropriate signal to the drive controller.

Note: The motor feedback system required to determine the position of the roller is not a component of the roller motor kit.

Type recommendation

We recommend using high-resolution position encoders such as Heidenhain types ROD 481, ERN 180, ERN 680 and RON 285. They have a separate bearing and a stator coupling. This eliminates eccentricity errors and minimizes reversal errors. In addition, we recommend INDRAMAT encoders GDS1.1 and GDM1.1 (see INDRAMAT documentation 209-0069-4360-00 EN /08.94) with a suitable coupling, such as a Schmidt-Kupplung Control-Flex CPQ 15-xx-xx.

Advantages of stator couplings compared to separate couplings:

- axial movements of the roller neck of up to ±10 mm can be compensated, depending on the coupling of the measuring system that is used,
- more rigid coupling of the rotary encoder to the printing roller,
- good dynamic behavior of the drive, even at high roller accelerations.

Recommended assembly

Install on the side of the roller opposite of the motor, directly on the roller. Advantage: high precision of the generated actual position value.

If assembly is possible only on the motor side of the roller, the motor feedback system must be attached to the B-side of the roller motor kit. In this case, a third roller bearing on the mounting flange of the stator (MSW) is required. This is necessary due to the high concentricity tolerance required by the motor feedback system.

For more information about attaching a third roller bearing, see section 9.5 “Assembling the Rotor" and Chapter 5 "Dimensional Details" of the corresponding motor.

9.7 Operating with compressed air

The roller motor kits have been prepared for a compressed air connection. This permits excess pressure immersion "p" according to DIN EN 50016 (VDE 0170/0171, part 3), edition 05.96.

An air entry hole in the terminal box and an air exit hole on the top side of the motor housing are provided for the connection (see Fig. 9-1). The threaded ports are closed by plugs when the motor is delivered.

⇒ If you want to use the motors in explosion-endangered areas, integrate the compressed air connections in your explosion protection concept. However, note that the roller motor kit itself is not certified.

⇒ Make sure that the interior of the motor is as pressure-tight as possible against the surroundings and the driven roller. In this way, you reduce large pressure losses within your compressed air guidance system.

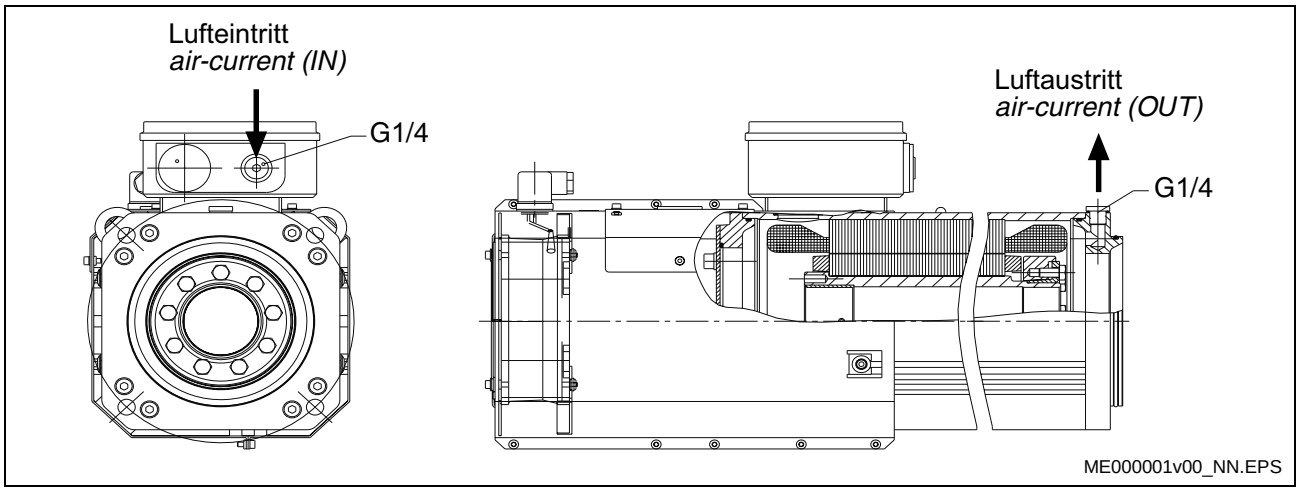


Fig. 9-5: MBW compressed air connection

9.8 Planning the Mechanical Construction

The precision of the synchronization of the driven roller depends on

- the electrical control technique and
- the mechanical structure of the roller frame-roller-motor system.

Control technique

The control quality of the motor / motor feedback / controller system affects the precision of the roller position. This is especially important for the synchronization of several rollers.

The following are prerequisites for a high control quality:

- a high precision of the actual position value generated by the motor feedback system. The precision depends on
  - the number and precision of the generated signal periods per rotation,
  - the exact encoder assembly

  and
- a high-resolution position encoder signal provided by the drive controller or the control.

See also section 9.2 "Motor Feedback System".

Rexroth drive controllers resolve every encoder signal period with 8192x sine-shaped output signals.

The highest precision in transferring speed and actual and command position values over the entire speed range of the motors, as well as an extremely high degree of control, can be attained by using, among other things, the SERCOS interface, which is a component of the Rexroth family of drive controllers. SERCOS interface is a serial real-time communication system in which the data are transferred with a high degree of noise immunity, between drive controllers and the control via fiber-optics cables.

Mechanical system

The roller framework / roller bearing / roller system affects both the rigidity and the operating precision of the roller drive.

The rigidity and the tolerance of the roller bearing play a large role in the operating precision in the axial and radial directions.

Please see section 9.5 and Chapter 5 "Dimensional Data" of the roller motor kit that is used to see what the requirements are for the dimensions and tolerances of the roller, as well as for the installation environment of the roller motor kit on the roller frame.

9.9 Rotor and Stator

Magnetic forces

There are strong magnetic forces between the rotor and the stator during operation. Among other things, these forces depend on the size of the air gap between the rotor and the stator. After assembly, the air gap between the rotor and the stator should be equally large at every position.

An irregularly large air gap leads to a magnetic force working on one side; this both negatively influences the concentricity and causes continuous flexing of the shaft.

The one-sided magnetic force works from the stator to the rotor. Its point of entry lies in the middle of the rotor-plate package (see Fig. 9-6):

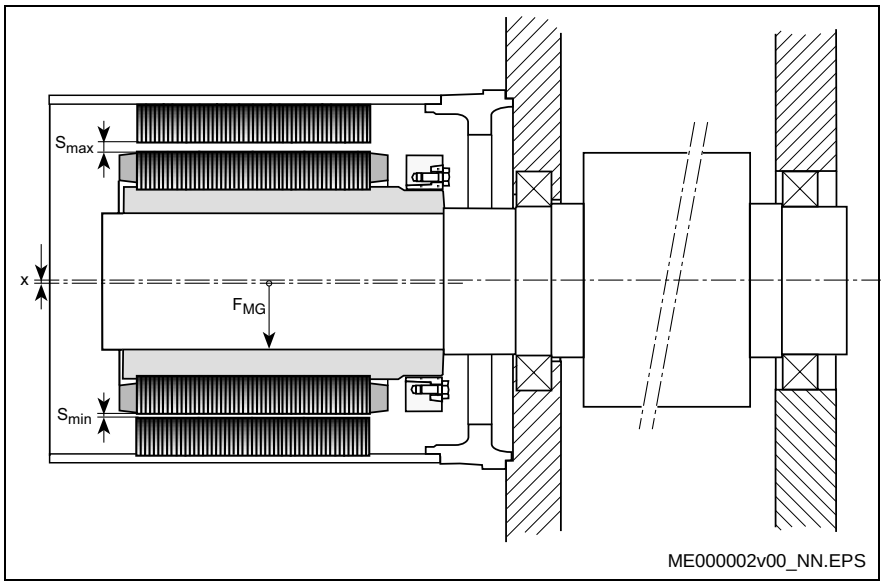


Fig. 9-6: One-sided magnetic force on the shaft due to irregular air gap

WARNING

System damage possible!

⇒ If the roller neck or the roller bearing are dimensioned incorrectly or if the roller motor kit is assembled imprecisely, the system can be damaged or, at the least, its functioning and operational safety can be limited.

⇒ Observe the following instructions.

The "minimum air gap s_{min}" and the "max. magnetic force $F_{Mg\ max}$" of the individual motors are listed in Chapter 4 "Technical Data".

⇒ Take the "max. magnetic force $F_{Mg\ max}$" into account as an additional flexure when laying out the roller neck and the roller bearing!

⇒ Ensure that the air gap is never smaller than the "minimum air gap s_{min}" at any location!

Note: The roller neck must be designed as a solid shaft.

Axial movement

The rotor and the stator may be moved axially to one another within the limits listed in the Technical Data. This is important especially for the page register adjustment of printing rollers.

In the permitted movement range, no additional restoring forces that are relevant for the mechanical construction occur between the rotor and the stator.

⇒ For the values for the maximum permitted axial movement path X_{axial}, see Chapter 4 “Technical Data” of the individual motors.

⇒ Take into account that the X_{axial} value listed there can be limited by the couplings of the measuring system that is used!

Note: Axial movement always leads to a reduction of the torque. This effect increases linearly with the movement. For example, if the movement path is 10 mm, the torque is reduced by approx. 10% if the rotor is 100 mm long.

Third roller bearing

Very high demands are made of the alignment of the stator and the roller. Therefore, it may be necessary to install an end plate – to incorporate a third roller bearing – onto the mounting flange on the B-side of the motor. A third roller bearing must be installed if

- the motor feedback system can be attached only to the B-side of the motor for space reasons,

- or -

- 3 roller bearings are stipulated in the Technical Data of the individual motors (e.g. due to the motor frame length),

- or -

- this manual requires tolerances for the installation of a MBW that can not be maintained with certainty using 2 bearings.

Following is an example:

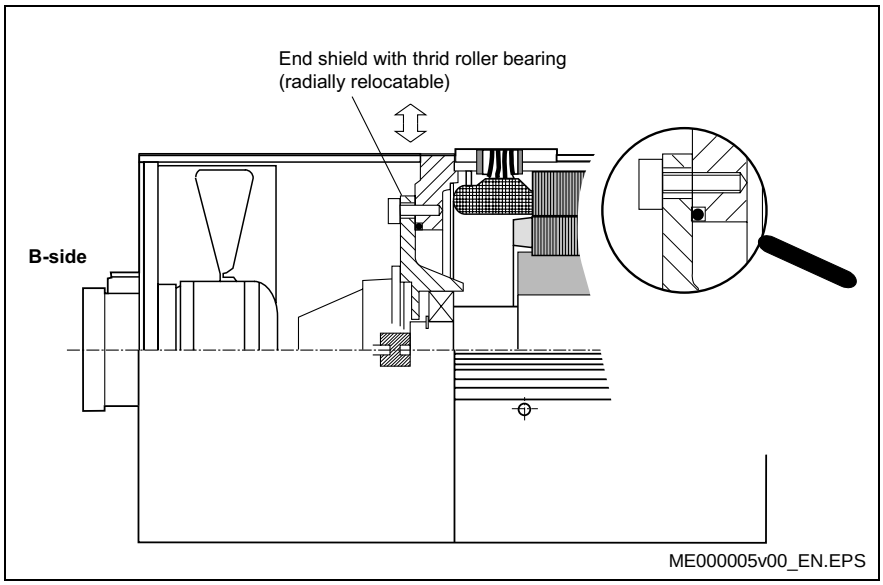


Fig. 9-7: Installing an end plate with a third roller bearing to which the motor feedback system is also attached to the B-side of the motor

Note:

- To compensate for alignment errors between the stator and the roller axis, it must be possible to move the end plate radially compared to the stator!
- The end plate does not belong to the Bosch Rexroth scope of delivery.

10 Handling, Transport and Storage

General Information

CAUTION

Damages or injuries and invalidation of the warranty due to improper handling!
Heavy!

⇒ Protect the products from dampness and corrosion

⇒ Avoid mechanical stresses such as throwing, tipping or dropping the products.

⇒ Use only suitable lifting equipment on the transport eyes of the motor.

⇒ Never pick up a motor by the fan or by connectors, cables or connection threads.

⇒ Use suitable protective equipment and wear protective clothing during transport.

⇒ **Transport** the motors horizontally in a dry, low-vibration, dust-free and corrosion-protected state. Permitted temperature range: **-20° C to +80° C**.

⇒ **Store** the motors horizontally in a dry, vibration-free, dust-free and corrosion-protected location. Permitted temperature range: **0° C to +45° C**.

10.1 Supplied Condition

Depending on what is ordered, either an entire MBW roller motor kit is delivered or only individual components, such as

- the stator or
- the rotor with clamp collar (preinstalled on the rotor).

The goods are delivered on a pallet or in a box. The rotor and the stator are packed separately in Styrofoam to prevent mechanical damage due to parts knocking together during transport. Also use the Styrofoam to store the parts.

If several motors or components are ordered, they are packed together into one package, if possible.

For protection against inclement weather, a carton is placed over the palette and affixed to it with retaining straps.

An envelope containing the delivery documents is attached to the carton.

10.2 Identifying the Goods

Delivery Note

An envelope with two copies of the delivery note is attached to the transport packaging. Further accompanying documents do not exist, if not specially requested.

In the case of large orders, the goods may be divided over several transport containers. However, this is then noted on the delivery note or the waybill.

The delivery note lists the entire delivery according to names and order designations.

Bar Code Label

For identification purposes, a bar code label is attached to the packaging for both the stator and the rotor.

Type Labels

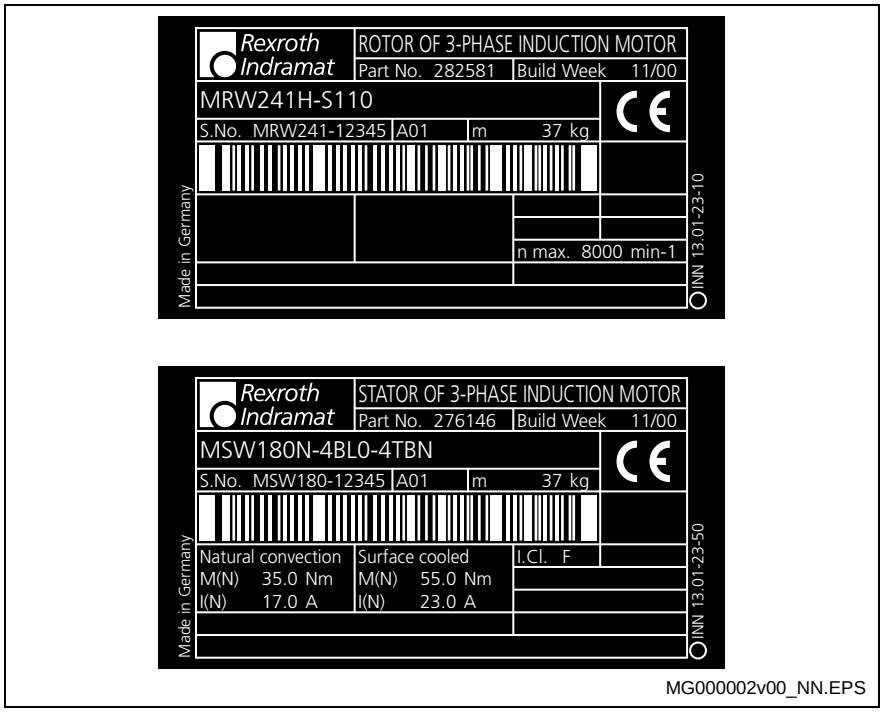


Fig. 10-1: Type label for rotor and stator

- Compare the information on the type labels with that on the delivery note.
- You can find the type codes of the individual motors in Chapter 6.

Stator Attached to the motor housing.

- To help when ordering spare parts
- As service information

Rotor Type data are embossed in the B-side end ring of the rotor (type designation, serial number, month and year of manufacture)

- To help when ordering spare parts
- As service information

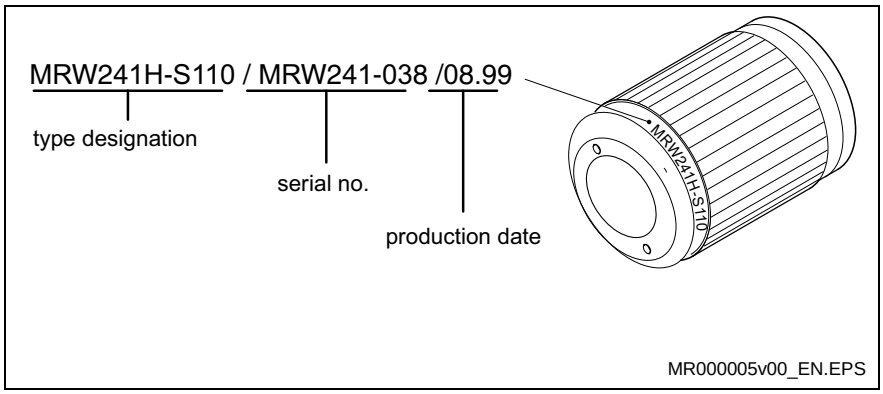


Fig. 10-2: Type data on rotor (example)

Non-ready-made cables Order designation embossed on cable sleeve.

Ready-made cables Label (on cable ties) with order number and length.

10.3 Transport

Use suitable means of transport. Take into account the weight of the components. (You can find weight information in Chapter 4 “Technical Data” or on the type label of the motor).

Rotor Lift and transport only with

- a plastic lifting belt,
- the screwed-in ring screws on the B-side of the steel sleeve for the rotor, or
- with plastic-coated special hooks.

Do not damage the fittings on the inside of the rotor! Damage in this area may make assembly with the required precision impossible.

- Provide for shock absorption if strong vibrations may occur during transport.

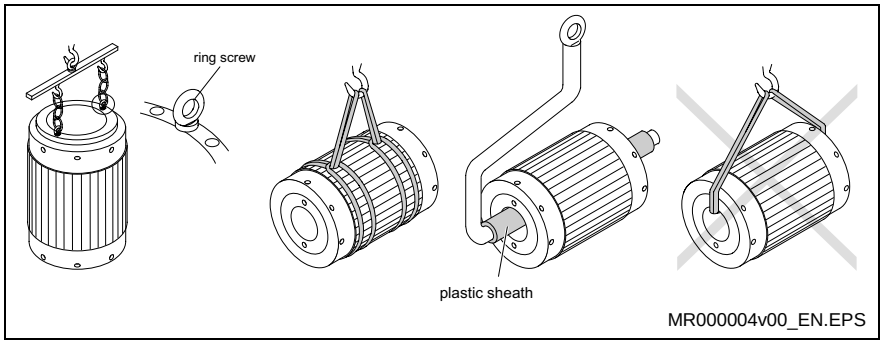


Fig. 10-3: Lifting and transporting the rotor

Stator Lift and transport only with

- a plastic lifting belt or
- screwed-in transport eyes.

Do not damage the surfaces on the inside of the stator! Damage in this area may make assembly impossible.

10.4 Storage

Store the rotor and stator in a dry, vibration-free, dust-free and corrosion-protected location. Permitted storage temperature: 0° C to +45° C.

Use the Styrofoam parts and/or the transport crate to store the motor over a longer time and to protect it against damage and fouling.

If necessary, additionally protect the motor components against moisture and mechanical stress, such as jolts, tipping and falling down.

11 Assembly and Installation

11.1 General Assembly Information

Structure of the assembly instructions

Chapter 11 describes how you...

- mount the rotor on the roller neck,
- remove the rotor from the roller neck,
- attach the stator to the roller frame, and
- remove the stator from the roller frame.

Furthermore, you will find instructions regarding...

- the compressed air connection and
- the electrical connection.

Basic procedure

The basic procedure for assembling the modules is always the same:

- Observe all warnings and safety notes mentioned in Chapter 3. This minimizes the risk of accidents and prevents damage to the system or motor.
- Attach the rotor (MRW) to the roller neck using the clamp collar
- Attach the stator (MSW) to the machine frame
- Check the air gap (= space between the rotor and the stator)
- Attach the dust protection cover or the B-side end plate (and, if necessary, the motor feedback system) to the stator
- Attach the fan to the stator housing

Using the assembly instructions

Depending on the construction of the roller and of the roller frame, assembly may differ from the basic procedure described here:

- Therefore, these assembly instructions are to be understood as a basic guide that must be adapted to the specific requirements.
- Carry out all handling instructions carefully. This ensures correct mounting and dismounting of the components.

11.2 Preparation for Assembly

1. Using the delivery note, check that the delivery is complete.
2. Ensure that the safety regulations are heeded.
3. Check the components for cleanness and for visible damage. Defective parts may not be mounted!
4. Ensure that mounting can be done in a dry and clean environment.
5. Ensure that the rotor seat on the roller and the holder for the motor flange has no burrs.

Procure tools, supplies, measuring and test equipment. The following checklists provide you with an overview of what you need:

Tools and supplies	Done
Crane (depending on weight of component)	
Lifting equipment (depending on weight of component)	
Torque wrench with open-end wrench component	
Ordinary mechanic's tools	
Cleaning material	
Oil for lubrication	
Lubricant	

Fig. 11-1: Checklist for assembly preparation: tools and supplies

Measuring and test material	Done
Slide gauge	
Dial gauge with holder	
Micrometer gauge	
Internal measuring gauge	
Feeler gauge	
Ohmmeter	
High-voltage tester	
Inductance measuring device	

Fig. 11-2: Checklist for assembly preparation: measuring and test materials

Checking Dimensions and Tolerances

Note: Assembly may be started only if **all** dimensions lie within the tolerance limits! This applies to both master dimensions and position tolerances.

These points of reference are also included in the dimension sheets in Chapter 5 "Dimensional Details" for the individual motors. You can find the tolerance information for the points of reference there.

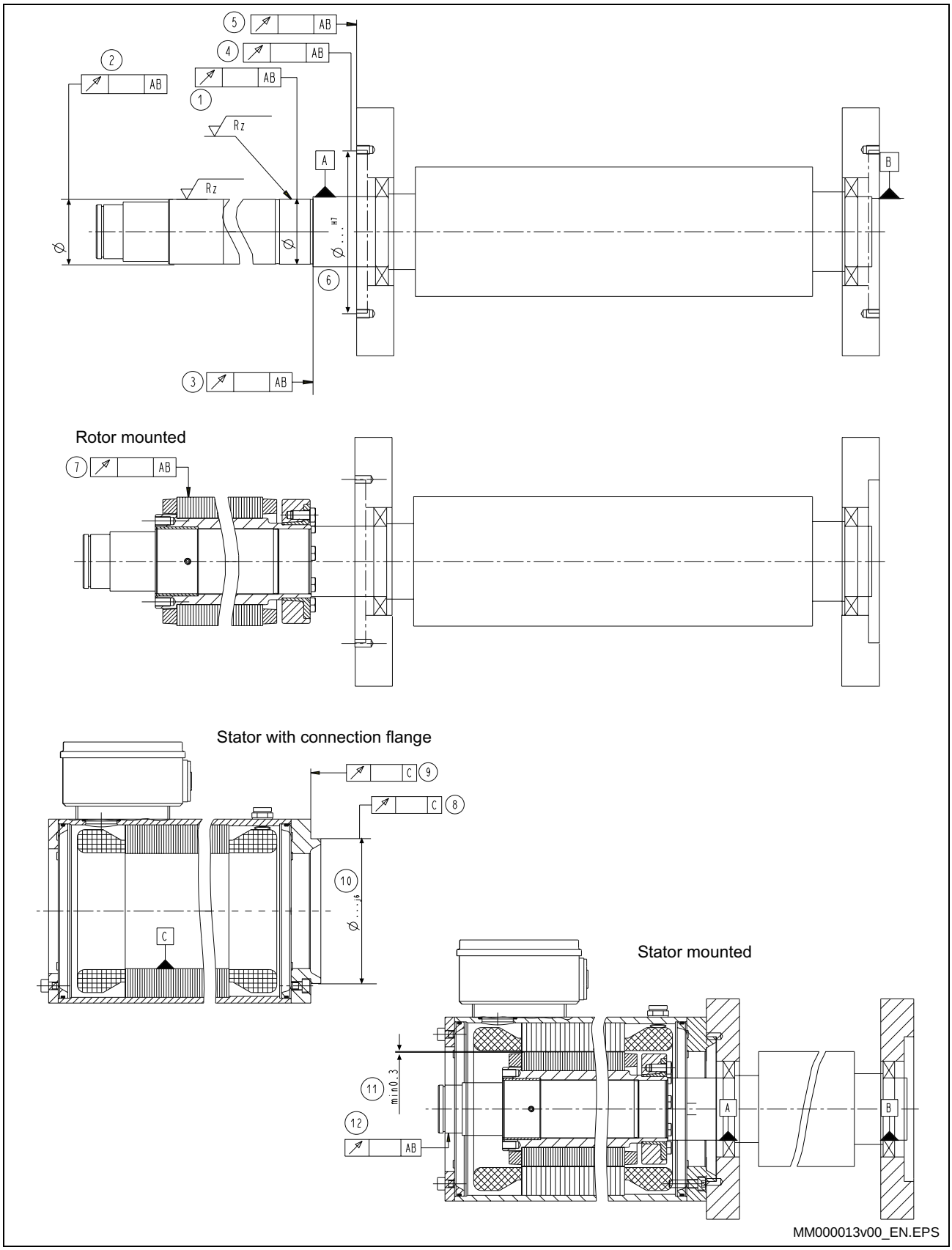


Abb. 11-3: Position tolerances and master dimensions

Position tolerances ⇒ Ensure that the following position tolerances according to DIN ISO1101 are maintained:

Point of ref.	Description
1 and 2	Concentricity of the two rotor centering units on the shaft compared to the two roller bearing positions A and B. The A-side rotor centering unit is under the clamp collar after the rotor has been installed. The B-side rotor centering unit is under the rotor centering bearing after the rotor has been installed.
3	Run-out of the axial rotor stop on the shaft compared to the two roller bearing positions A and B.
4	Concentricity of the stator connection centering unit on the roller frame compared to the two roller bearing positions A and B.
5	Run-out of the stator mounting surface on the roller frame compared to the two bearing positions A and B.
7	After assembly: concentricity of the external rotor diameter compared to the two bearing positions A and B.
8	Concentricity of the stator connection centering unit compared to the stator hole
9	Run-out of the stator mounting surface compared to the stator hole
12	Concentricity of the motor-side bearing position compared to the two bearing positions A and B.

Tab. 11-1: Position tolerances

Master dimensions

⇒ Ensure that the following master dimensions are maintained.

Point of ref.	Description
6	The connection centering unit for the motor flange on the roller frame must be designed according to tolerance class H7.
10	The stator connection centering unit must be designed in tolerance range j6.
11	The air gap between the rotor and the stator must be measured over the entire diameter. The air gap must be at least 0.3 mm at the narrowest point.

Tab. 11-2: Master dimensions

In association with the master dimensions, check the required peak-to-valley heights of the A- and B-side rotor centering units.

11.3 Assembling the Rotor

- Heed Chapters 3 “Notes Regarding Safety” and 10 “Handling, Transport and Storage”.
- Assemble the rotor only after all preliminary work and inspections have been properly carried out according to section 11.3 “Preparation for Assembly”.

Overview and sequence of required assembly steps

1. Clean the clamp collar (only if required; for the description, see the “Cleaning the Clamp Collar” section in this chapter).
2. Mount the clamp collar on the rotor.
3. Mount the rotor on the roller neck.
4. Check the concentricity of the mounted rotor.

Mounting the Clamp Collar

Note: When the motor is delivered, the ready-to-install clamp collar has already been mounted onto the rotor according to the assembly instructions below and is secured against falling down.
The tensioning screws are not tight!

The rotor has an extension on the A-side for the insertion of the clamp collar (see Fig. 11-4).

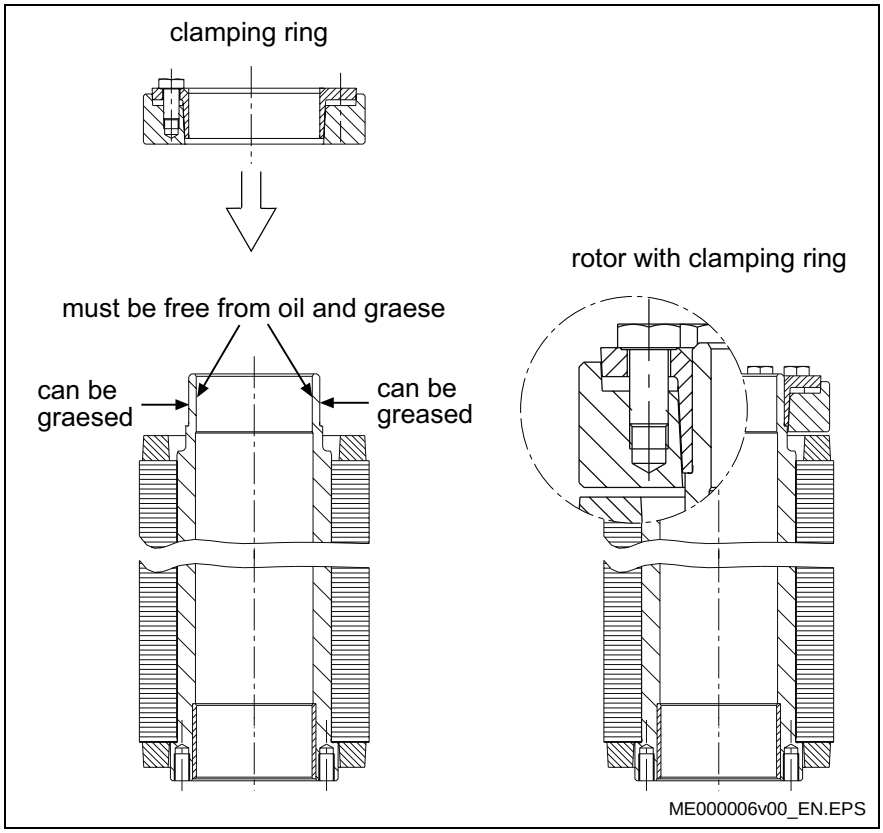


Fig. 11-4: Mounting the clamp collar

We recommend that the rotor be placed on the B-side to mount the clamp collar.

1. If necessary, remove the transport safeguard of the clamp collar.
2. If the clamp collar is heavily soiled, it must be cleaned (for the description, see the “Cleaning the Clamp Collar” section in this chapter).
3. Push the clamp collar onto the rotor. Ensure that the clamp collar is not tilted in its final position and that it is fully flush with the landing stop. Tighten the fastening screws only so much that the clamp collar is secured against slipping or falling down. In no case may the fastening screws be completely tightened; otherwise, the roller neck cannot be mounted.

Mounting the Rotor on the Roller Neck

In the following description, we assume that the roller neck is in the horizontal position.

CAUTION

Malfunctions due to slippage!

The clamp collar ensures that the power is transferred properly between the rotor and the roller neck.

⇒ Therefore, ensure that the roller neck and the rotor are free of dust and grease at the position above which the clamp collar is located after the rotor is installed.

1. Push the rotor smoothly onto the roller neck up to the stop without tilting it.

CAUTION

Malfunctions of the motor and damage to the clamp collar or to the tensioning screws possible!

If tightening is improper, the function of the clamp collar is not guaranteed.

⇒ For this reason, please observe the following instructions.

2. Pay attention to the maximum permitted torque of the tensioning screws.

Screws	Wrench size	Max. torque
M6	SW10	12 Nm
M8	SW13	29 Nm

Fig. 11-5: Maximum torques of tensioning screws

3. Now uniformly tighten each tensioning screws about a quarter turn in a circular order (never crosswise!). Several circuits are required until the desired tension between the rotor and the roller neck has been attained.

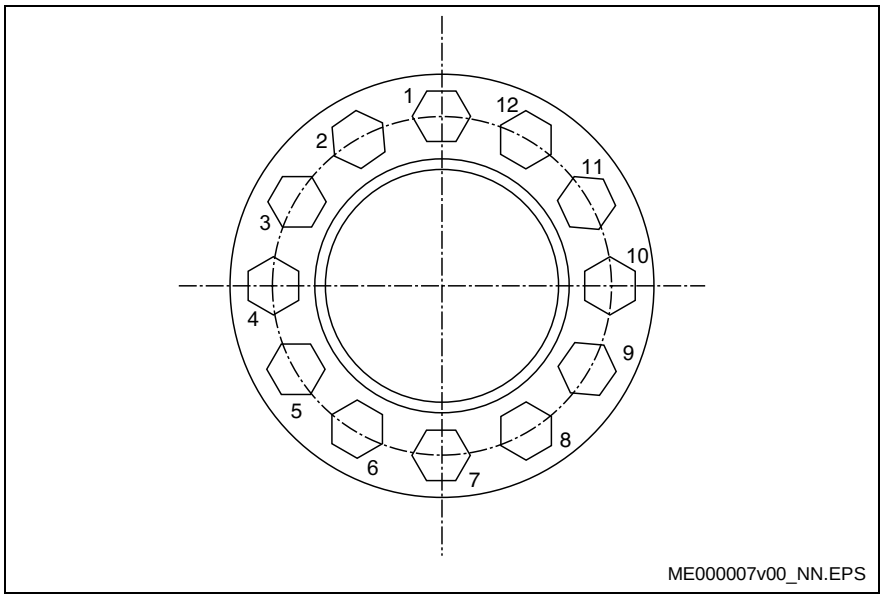
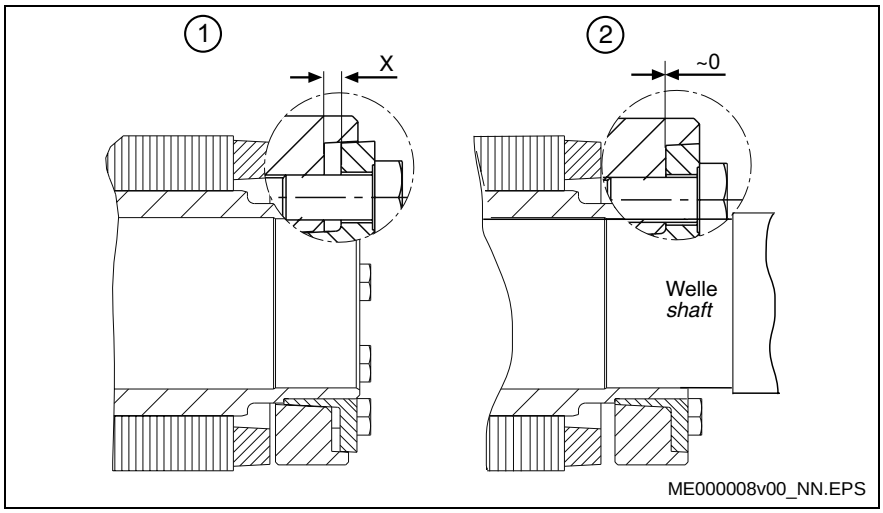


Fig. 11-6: Order for tightening tensioning screws

4. Check the tensioning of the clamp collar. You can recognize that this is proper if the ends of the internal and external rings are level.



(1): Before mounting the rotor onto the shaft
(2): After mounting the rotor onto the shaft

Fig. 11-7: Proper tensioning of clamp collar

Check the Concentricity

Check the concentricity after mounting the rotor onto the shaft.

Note: The stator may be mounted only if the measured concentricity deviation does not exceed the permitted tolerance limits.

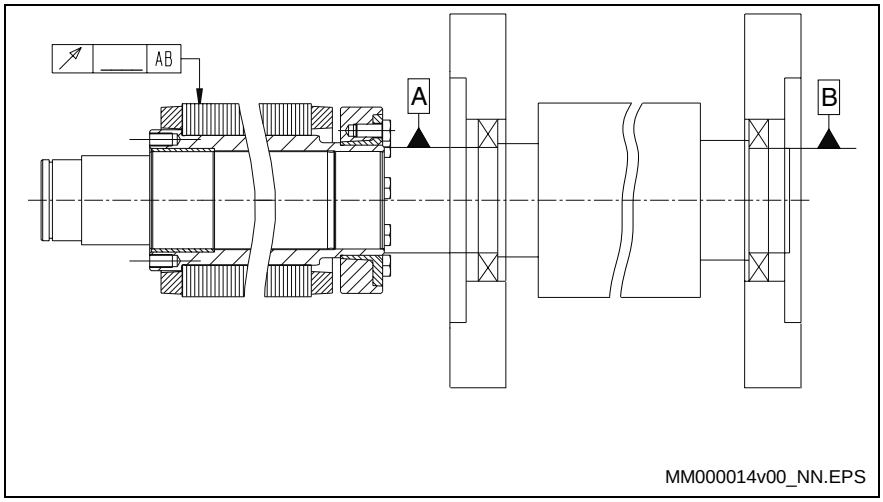


Fig. 11-8: Checking the concentricity tolerance of the mounted rotor

1. You can find the tolerance limits for the individual motors in the figures in the “Dimensional Details” chapter.
2. Measure the concentricity.
3. If the permitted value is exceeded, the stator may not be mounted. You must eliminate the reason why the tolerance is exceeded. To do this, you must first remove the rotor (see the following section 11.4, “Removing the Rotor”).
4. If the concentricity is within the tolerance limits, you may continue with the motor assembly according to section 11.5, “Mounting the stator”.

11.4 Removing the Rotor

The rotor must be removed if

- damage to a roller bearing or
- an assembly failure

exists.

1. Remove any rust or deposits that may have formed on the roller neck in front of the rotor.

CAUTION

Damage to the clamping collar or to the tensioning screws is possible!

In the case of improper loosening, the clamp collar or the tensioning screws may be damaged.

⇒ Heed the following instructions.

2. First uniformly loosen each tensioning screw about a quarter turn in a circular order (never crosswise!). Several circuits are required for complete loosening. Never totally remove the tensioning screws from the clamp collar.

CAUTION

Damage to rotor possible!

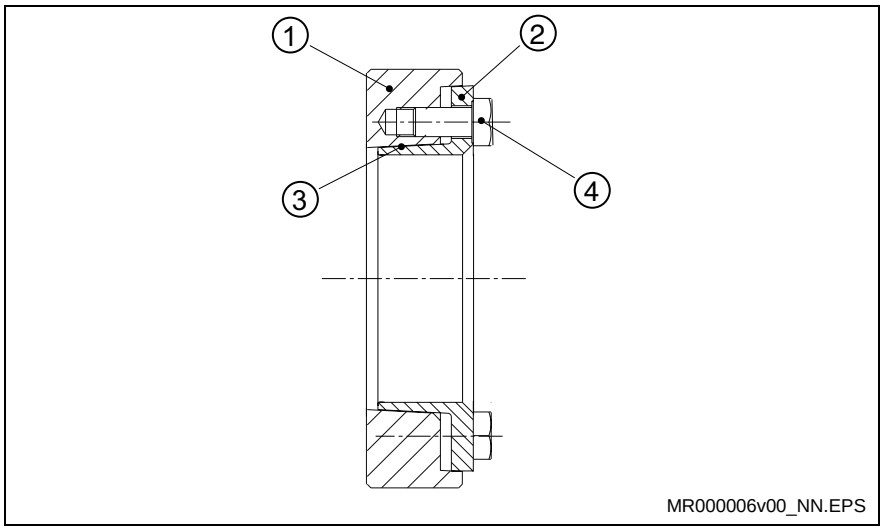
Improper transport or storage can damage the rotor.

⇒ Heed Chapter 3 “Notes Regarding Safety” and the instructions regarding transport and storage in Chapter 10.

3. Pull the rotor smoothly from the roller neck without tilting it.

Cleaning the Clamp Collar

Carry out the following work only if the clamping collar is heavily soiled!



(1): Outer ring (2): Inner ring
(3): Conical surfaces (4): Tensioning screw

Fig. 11-9: Clamp collar

Removal

1. Pull the clamp collar smoothly from the rotor without tilting it.
2. Dismantle the clamp collar. To do this, you must totally remove all the tensioning screws from the inner ring.
3. Carefully clean the clamp collar parts.

Inspection

4. Check whether damage is visible on the conical surfaces of the clamp collar. If this is the case, you may no longer use the clamp collar to mount the rotor. Order a replacement clamp collar from Bosch Rexroth.
5. If no damage is visible, relubricate the conical surfaces between the inner and outer rings of the clamp collar. To do this, use a solid lubricant with a friction coefficient $\mu = 0.04$: see the following product recommendation for lubricating the clamp collar.

Product	Comment	Manufacturer
Molykote 321 R	Bonded coating; spray	Dow Corning
Molykote Spray	Powder spray	Dow Corning
Molykote G Rapid	Spray or paste	Dow Corning
Aemasol MO 19 P	Spray or paste	A.C. Matthes
Molykombin UMF T1	Spray	Klüber Lubrication
Unimoly P5	Powder	Klüber Lubrication

Fig. 11-10: Product recommendation for lubricating the clamp collar

Assembly

1. Reassemble the clamp collar. To do this, push the outer ring onto the inner ring without force and without tilting it. Just use you hand to press the two rings together.
2. Screw the tensioning screws back in and tighten them slightly **by hand** – i.e. without tools.

The clamp collar can now be used to mount the rotor. If used properly, the clamp collar can be loosened and tightened again as often as desired.

11.5 Mounting the Stator

- Heed Chapters 3 “Notes Regarding Safety” and 10 “Handling, Transport and Storage”.
- Assemble the stator only after all preliminary work and inspections have been properly carried out according to sections 11.2 “Preparation for Assembly” and 11.3 “Mounting the Rotor”. All relevant dimensions must lie within the required tolerance limits.

Sequence of the mounting steps

1. Remove the attachments on the B-side of the stator housing.
2. Mount the stator to the roller frame.
3. Check the air gap between the rotor and the stator.
4. Remount the attachments on the B-side of the motor housing.

Removing the attachments on the B-side of the stator housing

Before mounting the stator housing onto the roller frame, the fan (if is was ordered) and the dust protection cover must be removed.

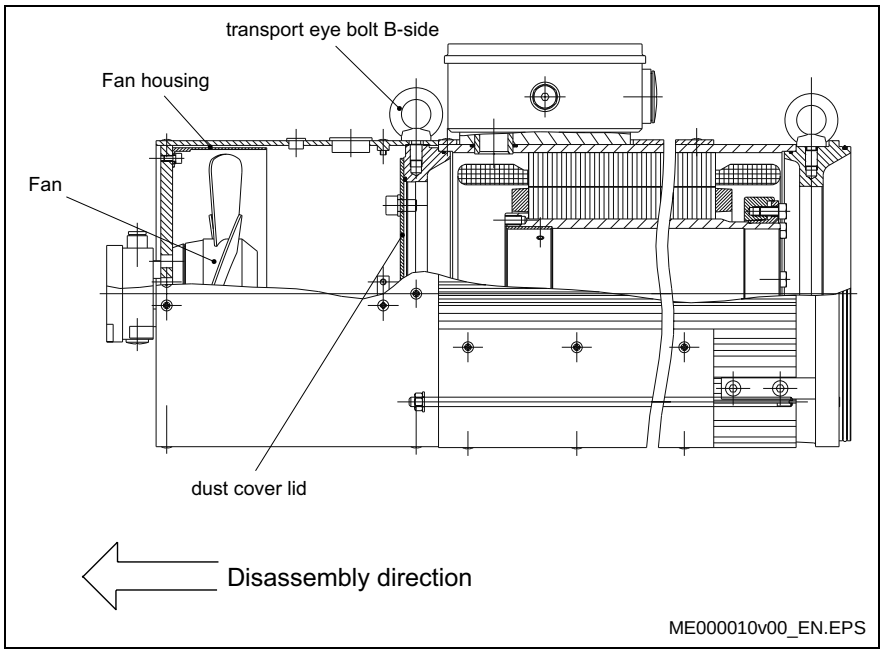


Fig. 11-11: Removal of fan and dust protection cover

1. Secure the fan against falling down. Use suitable lifting equipment.
2. If it exists, completely unscrew the B-side transport eye of the stator housing.
3. Completely unscrew all the fan housing screws on the perimeter of the B-side mounting flange.
4. Remove the fan from the end plate.
5. Remove the dust protection cover.

The stator is now ready for assembly.

Mounting the stator to the roller frame

CAUTION

Malfunctions and damage to the motor are possible!

Metal burrs or other foreign bodies in the stator interior can damage the motor.

⇒ Ensure that no foreign bodies can enter the stator interior during assembly.

⇒ Also heed the instructions regarding transport in Ch. 10.

1. Clean the installation centering unit and the sealing ring on the motor flange and the roller frame.
2. Using suitable lifting equipment, bring the stator housing to the mounting height.
3. Smoothly move the stator into the planned final position without tilting it. The connection centering unit on the motor flange must be pushed into the connection centering unit on the roller frame.
4. Screw the stator onto the roller frame. To do this, guide the fastening screws through the mounting holes on the motor flange. Observe the table below:

Motor frame size	Screw size	Tensile strength	Wrench size	Min./max. torque
MBW 180	M12	10.9	SW 19	88Nm/98Nm
MBW 241	M16	10.9	SW 24	220Nm/240Nm
MBW 270	M16	10.9	SW 24	220Nm/240Nm

Fig. 11-12: Screws and torques for stator assembly

Inspecting the stator / rotor air gap

After the stator has been mounted and after a suitable running-in period of the machine, you must inspect the entire circumference of the air gap between the rotor and the stator.

1. You can find the minimum permitted air gap size s_{min} for the individual motor frame sizes in the “Dimensional Details” chapter.

CAUTION

Damage to the stator winding possible!

The stator winding can be damaged by careless handling of the measuring instrument.

⇒ Therefore, proceed carefully during the measurement and do not use a measuring instrument with sharp edges. We recommend using a feeler gauge as the measuring instrument.

2. Measure the air gap over the entire circumference. The air gap may not be less than s_{min} in any location and in any roller position.

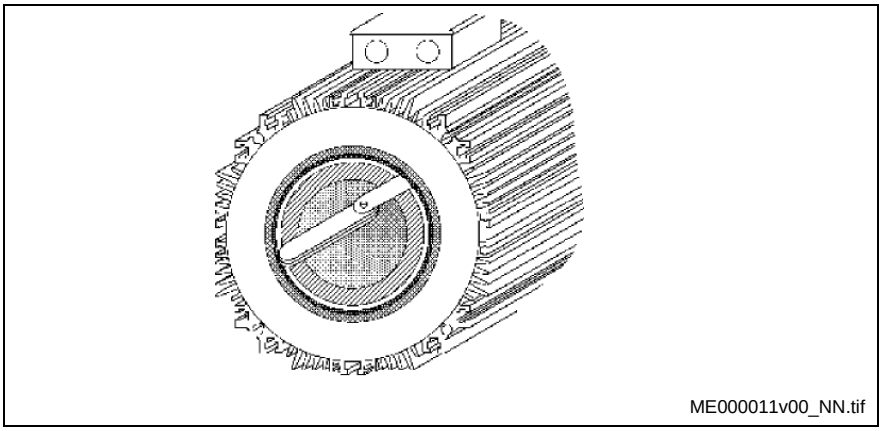


Fig. 11-13: Inspecting the air gap

3. If the value is below the minimum permitted value, the motor may not be put into operation. Situation-dependent measures must be taken to eliminate problems, e.g.:

- First remove the stator and, if necessary, the rotor (see sections 11.4, “Removing the Rotor” and 11.6 “Removing the Stator”). Clean and remeasure all the parts.
- It may also be necessary to rework e.g. the roller neck, the roller bearing or the centering unit.

4. If the air gap value is not below the minimum permitted value, you may continue mounting the motor.

Mounting the attachments on the B-side of the motor

CAUTION

Malfunctions and damage to the motor are possible!

Metal burrs or other foreign bodies between the rotor and the stator can damage the motor.

⇒ Ensure that no foreign bodies can penetrate between the rotor and the stator during assembly of the attachments.

In the final assembly step, you must remount the following attachments on the B-side of the motor:

- dust protection cover or third roller bearing
- motor fan (if ordered).

A third roller bearing (not included in the delivery) must be installed if

the motor feedback system can be attached only to the B-side of the motor,

- or -

3 roller bearings are stipulated in the Technical Data of the individual motors (e.g. due to the motor frame length),

- or -

this manual requires tolerances that can not be maintained with certainty using 2 bearings.

Also see Ch. 4 “Technical Data – Rotor and Stator“.

Assembly without third roller bearing

If a third roller bearing is not required, proceed as follows during assembly:

1. Screw the dust protection cover back onto the mounting flange.
2. Push the motor fan back onto the B-side motor flange and fasten the fan with the supplied screws.
3. If it exists, screw the B-side transport eye of the stator housing back on.

- or -

Assembly with third roller bearing

If a third roller bearing is required, proceed as follows during assembly:

1. Screw the end plate that you have made onto the mounting flange in place of the dust protection cover.
2. Maintain the required concentricity tolerance. Chapter 5 “Dimensional Data” of the individual motors contains a drawing in section “Third Roller Bearing” in which the maximum permitted concentricity error is shown.
3. Compensate for alignment errors between the stator axis and the roller axis on the end plate (Fig. 11-14).

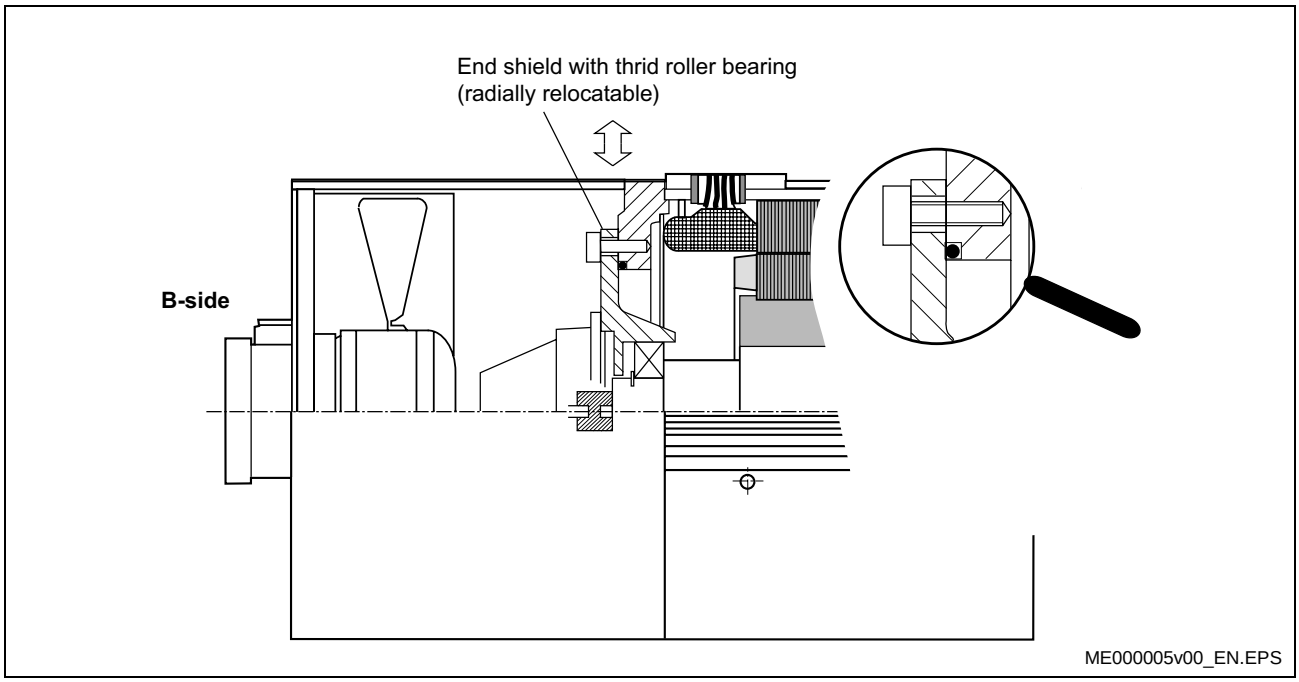


Fig. 11-14: Compensating for alignment errors

1. Correct the orthogonality error between the stator and the roller axis on the motor flange or on the connection centering unit of the motor flange. It may be necessary to rework the connection centering unit on the roller frame.
2. Push the motor fan back onto the B-side motor flange and fasten the fan with the supplied screws.
3. If it exists, screw the B-side transport eye of the stator housing back on.

The assembly of the motor is now complete. For the electrical connection of the motor, please read section 11.9 “Electrically Connecting the Motor”.

11.6 Removing the Stator

The stator must be removed if

- the stator winding is damaged,
- both thermistors are damaged,
- the air gap between the rotor and the stator is less than s_{min}.

DANGER

Danger to life and limb due to electrical power!

Work in the vicinity of parts that are under power is mortally hazardous. Therefore:

⇒ Before removing the stator, the system must be de-energized and the power switch be secured against unintentional or unauthorized restarting.

⇒ Open the terminal box of the motor only if there is no longer residual voltage on the motor connections.

Proceed as follows to remove the stator:

1. Open the terminal box on the stator housing and disconnect the power and termistors.

2. Open the terminal box on the motor fan and disconnect the fan.
3. Insulate all exposed cable ends.
4. Remove all attachments on the B-side mounting flange of the motor. See the “Removing the attachments on the B-side of the stator housing” section in this chapter.
5. If it exists, screw the B-side transport eye of the stator back on.
6. Secure the stator against falling down. Use suitable lifting equipment.
7. Loosen the fastening screws on the motor flange.
8. Smoothly and slowly pull the stator out of the connection centering unit of the roller frame without tilting it.

CAUTION

Damage to stator possible!

Improper transport or storage can damage the stator.

⇒ Therefore, heed the instructions regarding transport and storage in Ch. 10.

11.7 Compressed Air Connection

MBW roller motor kits are designed to be connected to compressed air to attain explosion protection (EEx-p) in explosion-endangered areas.

Connect the motor to the compressed air system according to the specifications of the constructor. The position of the compressed air connections can be seen in Fig. 11-15 and in the dimension sheets for the corresponding motor.

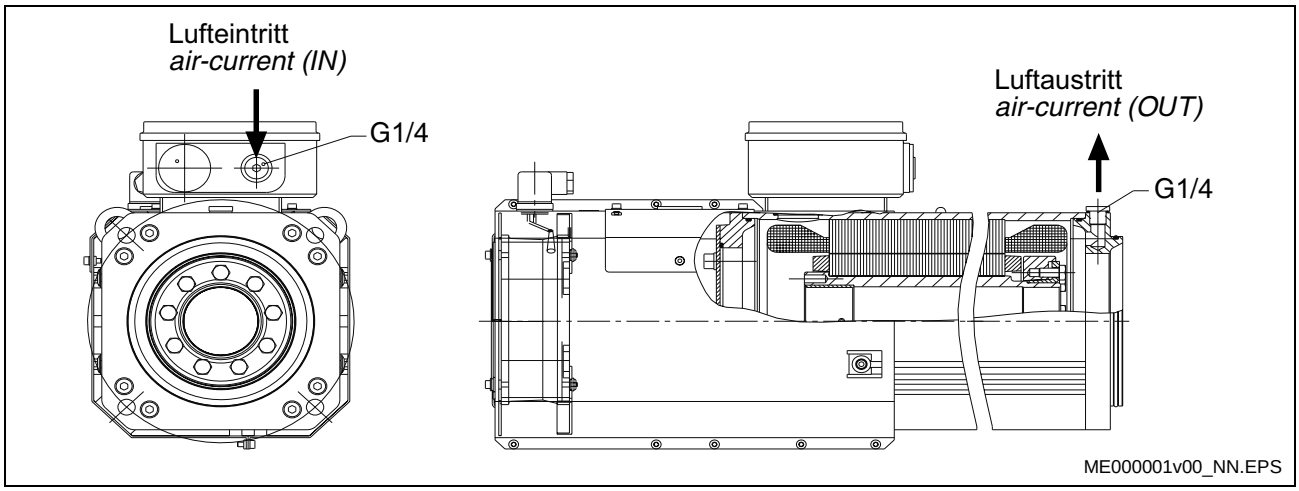


Fig. 11-15: Compressed air connection

11.8 Electrically Connecting the Motor

After proper assembly, the motor must be connected electrically. Bosch Rexroth connection plans (see Ch. 8 “Connection Techniques”) are intended solely to generate system circuit diagrams!

Note: Connect the motor as specified in the machine manufacturer’s system circuit diagram.

12 Operating Roller Motor Kits

12.1 General

CAUTION

Surfaces on motor housings, drive units or throttles may be hot! Risk of injury! Risk of burning!

⇒ Do not touch the surfaces of unit housings and throttles near sources of heat! Risk of burning!

⇒ Do not touch the housing surface of motors! Risk of burning!

⇒ Depending on the operating conditions, the temperature may be above 60° C (140° F) during or after operation.

⇒ Before touching the motor, let it cool sufficiently after switching it off. A cooling time up to 140 minutes can be necessary! A rough estimate of the required cooling time is five times the thermal time constants specified in the Technical Data.

⇒ Before accessing drive units or throttles, let them cool for 15 minutes after switching off.

⇒ Wear safety gloves or do not work on hot surfaces.

⇒ For certain applications, measures for preventing burns in the end application according to the notes regarding safety of the manufacturer are to be carried out on the end product, in the machine or in the system. These measures can be, for example: warnings, separating protective equipment (shield or barrier), technical documentation.

12.2 Commissioning

CAUTION

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

⇒ Do not carry out commissioning if connections, operating states or product data are unclear or faulty!

⇒ Do not carry out commissioning if the safety and monitoring equipment of the system is damaged or not in operation.

⇒ Damaged products may not be operated!

⇒ Contact Bosch Rexroth for missing information or support during commissioning!

The following commission notes refer to the MBW motors as part of a drive-system with a drive and a control unit.

Preparation

1. Keep the documentation of all used products ready.
2. Log 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.

Execution

When all prerequisites have been fulfilled, proceed as follows:

1. Activate the fan (if present) on the MBW and check for proper operation. Heed the notes of the manufacturer.
2. Carry out the commissioning of the drive system according to the instructions of the corresponding product documentation. You can find the respective information in the functional description of the drive-controller.
3. Log all measures taken in the commissioning report.

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

12.3 Deactivation

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

1. Observe the instructions of the machine documentation.
2. Use the machine-side control commands to bring the drive to a controlled standstill.
3. Switch off the power and control voltage of the drive device.
4. Switch off the motor protection switch for the motor fan (if present).
5. Switch off the main switch of the machine.
6. Secure the machine against accidental movements and against unauthorized operation.
7. Wait for the discharge time of the electrical systems to elapse and then disconnect all electrical connections.
8. Before dismantling, secure the motor and fan unit against falling or movement before disconnecting the mechanical connections.
9. Log all measures taken in the commissioning report.

12.4 Dismantling

DANGER

Fatal injury due to errors in activating motors and working on moving elements!

⇒ Do not work on unsecured and operating machines.

⇒ Secure the machine against accidental movements and against unauthorized operation.

⇒ Before dismantling, secure the motor and power supply against falling or movement before disconnecting the mechanical connections.

1. Observe the instructions of the machine documentation.
2. Please heed the safety notes and carry out all steps as described in the above instructions in the "Deactivation" section.
3. Before dismantling, secure the motor and power supply against falling or movement before disconnecting the mechanical connections.
4. Dismantle 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

Asynchronous motors of the MBW series operate maintenance-free within the given operating conditions and service life. However, operation under unfavorable conditions can lead to limitations in availability.

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

⇒ Log all maintenance measures in the machine maintenance plan.

Measures

DANGER

Danger of injury due to moving elements!
Danger of injury due to hot surfaces!

⇒ Do not carry out any maintenance measures when the machine is running.

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

⇒ 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 functioning of the motor fan and the air circulation.	According to the guidelines in the machine maintenance plan, but at least every 1000 operating hours.
Check the mechanical and electrical connections.	According to the guidelines in the machine maintenance plan, but at least every 1000 operating hours.
Check the machine for smooth running, vibrations and bearing noises.	According to the guidelines in the machine maintenance plan, but at least every 1000 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.

Fig. 12-1: Maintenance measures

MBW Motor Fan

It may become necessary to dismantle the fan unit for maintenance measures or troubleshooting.

⇒ This work must be carried out only by skilled personnel.
⇒ Do not carry out any maintenance measures when the machine is running. Please observe the safety notes.
⇒ During dismantling, keep the strips, screws and nuts with which the fan units are fastened.

Parts of the fan unit housings consist of several elements that are screwed together. Remove only the indicated screws.

General procedure for maintaining the fan:

1. Switch off the system and disconnect the electrical fan connection.
2. Secure the fan against falling down. Use suitable lifting equipment.
3. If it exists, completely unscrew the B-side transport eye of the stator housing.
4. Completely unscrew all the fan housing screws on the perimeter of the B-side mounting flange.
5. Remove the fan from the end plate.
6. After completing cleaning or troubleshooting, reattach the fan unit. Secure the fastening screws with "LOCTITE 243 screw fastener" and reestablish the connections.
7. Check the functioning of the motor fan and the air circulation.
8. Log all maintenance measures in the machine maintenance plan.

12.6 Troubleshooting

DANGER

Danger of injury due to moving elements!
Danger of injury due to hot surfaces!

⇒ Do not carry out any maintenance measures when the machine is running.
⇒ Switch off the control device and the machine and wait for the discharging time of the electric systems to elapse.
⇒ During maintenance work, secure the system against restarting and unauthorized use.
⇒ Do not work on hot surfaces.

Possible causes for the malfunctioning of MBW motors can be limited to the following areas:

- fan function and temperature variation
- 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 controlled by the drive controller or control unit; corresponding diagnoses are indicated. Observe the notes in the corresponding documentation.

Some sample faults are shown below, along with potential causes. This list does not lay claim to completeness.

Excess Temperature of Motor Housing

Status The housing temperature of the motor climbs to unusually high values.

CAUTION

Damage of motor or machine by restarting after increased motor temperature!

⇒ Liquid-cooled motors should not be restarted or supplied with cold coolant immediately after failure of the coolant system and an increased motor temperature. Danger of damage!

⇒ Wait until the motor temperature has dropped to approx. 40° C before restarting.

Possible causes

1. Loss or malfunction in the fan or cooling system.
2. Original operating cycle has been changed.
3. Original motor parameters have been changed.
4. Motor bearings worn or defective.

Measures

1. Check the functioning of the fan. Clean if necessary. In the case of a malfunction, contact Bosch Rexroth Service.
2. Check the layout of the drive for changed requirements. If overloading occurs, stop operation. Danger of damage!
3. Reset to the original parameters. Check the layout of the drive in the case of changed requirements.
4. Contact the machine manufacturer.

High motor temperature values, but housing temperature is normal

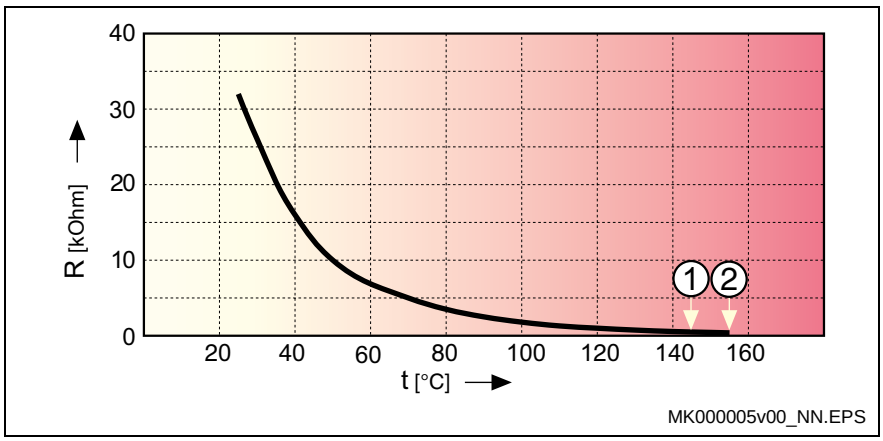
Status The diagnostics system of the drive controller shows unusually high values for the winding temperature via the display or control software. However, the motor housing has a normal temperature.

Possible causes

5. Wiring error or cable break in sensor cable.
6. Diagnostics system defective.
7. Winding temperature sensor malfunction (PTC).

Measures

1. Check the wiring and connection of the temperature sensor according to the terminal diagram.
2. Check the diagnostics system on the drive device or the control unit.
3. Check the resistance value of the temperature sensor using a multimeter.
   - Set the measuring instrument to resistance measurement.
   - Shut down the system and wait for the discharging time to elapse. Separate the temperature sensor connection from the drive device and connect the wire pair with the measuring instrument (this includes the sensor cable in the test). Check the values according to the following characteristic curve:



(1): Temperature alarm at 145°C
(2): Shutdown at 155° C

Fig. 12-2: Winding temperature, NTC sensor characteristic curve

Motor generates vibrations

Status Audible or tactile vibrations occur on the motor.

Possible causes

4. Driven machine elements are insufficiently coupled or damaged.
5. Motor bearings worn or defective. Available bearing lifetime or grease lifetime elapsed.
6. Motor mount loose.
7. Drive system is instable from a control point of view.

Countermeasures

8. Contact the machine manufacturer.
9. Contact the machine manufacturer.
10. Check the mechanical connection. Do not continue to use damaged parts. Contact the machine manufacturer.
11. Check parameters of the drive system (motor and encoder data). Observe the notes in the documentation for the drive controller.

Specified position is not attained

Status

The positioning command of the control unit is not precisely executed, or not at all. No malfunction display on the device controller or the control.

Possible causes

12. Wiring of encoder cable is incorrect or defective. Pin assignment (encoder signals) in cable or plug may be switched.
13. Insufficient shielding of encoder cable against interference.
14. Incorrect encoder parameters set in drive controller.
15. Motor-machine connection loose.
16. Encoder defective.

Countermeasures

17. Check wiring according to terminal diagram and check state of cables for damage.
18. Check shielding; if necessary, increase effective contact surfaces of shielding.
19. Correct the parameters. Observe the commissioning log.
20. Check the mechanical connection. Do not continue to use damaged parts. Contact the machine manufacturer.
21. The encoder must be replaced. Contact the machine manufacturer.

13 Index

N

O

P

R

S

T

U

Rexroth
Bosch Group

Bosch Rexroth AG
Electric Drives and Controls
P.O. Box 13 57
97803 Lohr, Germany
Bgm.-Dr.-Nebel-Str. 2
97816 Lohr, Germany
Phone +49 (0)93 52-40-50 60
Fax +49 (0)93 52-40-49 41
service.svc@boschrexroth.de
www.boschrexroth.com

R911314804

Printed in Germany
DOK-MOTOR*-MBW********-PR02-EN-P