

Rexroth 2AD Asynchronous Motors

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Edition 03

Project Planning Manual



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1 Introduction to the Product

The 2AD series consists of squirrel-cage, induction, housed motors using fixed blower units for surface ventilation.

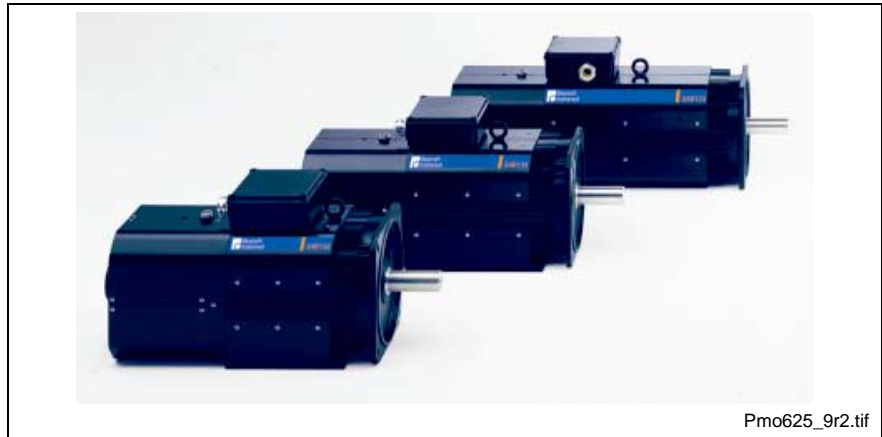


Fig. 1-1: Example: 2AD134

For optimum adaptation of the motor to the machine, different frame sizes with tested options can be selected using the type code. External accessories are also available.

Combined with digital control devices from the INDRADRIVE, DIAx or ECODRIVE series, the 2AD series offers an intelligent drive solution with a high power density and open functions.

1.1 Power Graduation

2AD motors have power ranges up to 93 kW.

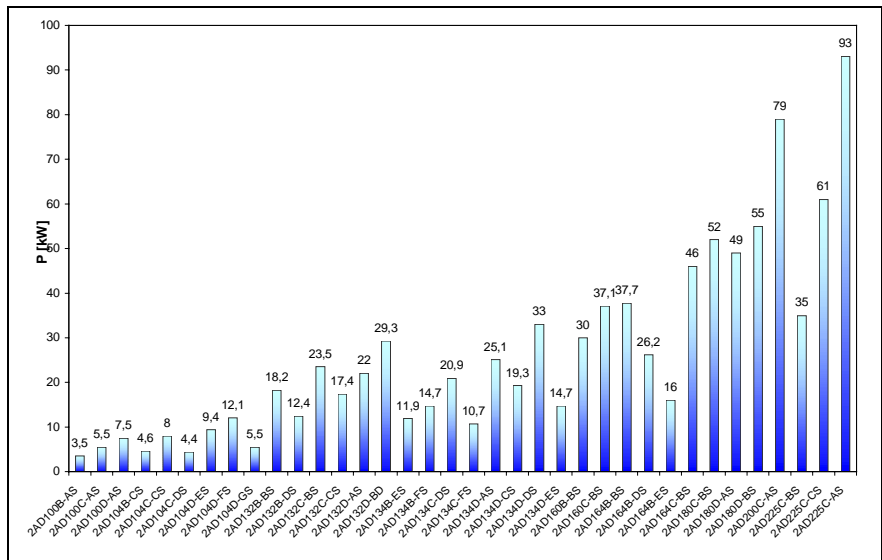


Fig. 1-2: 2AD power graduation

You can find the power data available for certain motor-drive combinations by using the corresponding documentation in Fig. 1-5.

1.2 Notes Regarding the Documentation

The 2AD series has the following documentation:

System component	Documentation	Material number	Note
2AD motor	2AD design DOK-MOTOR*-2AD*****-PR04-EN-P	00260287	
Accessory	Assembly Instructions for Labyrinth Seals	-	included in the scope of delivery for the accessory
Accessory	Assembly Instructions for blower Cowls	-	included in the scope of delivery for the accessory

Fig. 1-3: Scope of documentation

Document Structure

The following setup provides an overview of the contents of this documentation.

Sect.	Title	Reference	Target group		
1	Introduction to the Product	General information	All		
2	Important Instructions on Use	Safety	Required		
3	Safety Instructions on Electric Drives and Controls				
4	Definitions	Product description	Beginners		
5	Technical Data, 2AD104		For project planning personnel		
6	Technical Data, 2AD134				
7	Technical Data, 2AD164				
8	Technical Data, 2AD184				
9	Technical Data, 2AD200				
10	Technical Data, 2AD225				
11	Accessories			Practice	Operating and maintenance personnel
12	Connection System				
13	Application Instructions				
14	Handling, Transport				
15	Installation				
16	Operating	Additional information	All		
17	Service				
18	Glossary				
19	Index				

Fig. 1-4: Document structure



2AD280 is not included in this documentation. This special-purpose motor is described in DOK-MOTOR*-2AD280*****-PR01-AE-P.

Additional Documentation

Note: The entire documentation listed below is not completely necessary for project planning.

The version number for additional documentation (e.g. **06**) may already be higher than the one given here due to updates.

Material no.:	Title / description	System
00292326	DOK-DRIVE*-SERVO*GEN**-AU 01 -MS-P ECODRIVE03, DURADRIVE, Auswahldaten / Selection Data (1,5 ms Beschleunigungszeit) / (1.5 ms Acceleration Time)	DIAX03 DIAX04, ECODRIVE03 DURADRIVE
00292325	DOK-DRIVE*-SERVO*WZM**-AU 02 -MS-P DIAX04, DKR, ECODRIVE03, DURADRIVE, Auswahldaten / Selection Data (400 ms Beschleunigungszeit) / (400 ms Acceleration Time)	
00289233	DOK-DRIVE*-MAIN*WZM***-AU 02 -MS-P DIAX03/04, ECODRIVE03 mit/with 2AD/ADF, Auswahldaten / Selection Data	
00290821	DOK-DRIVE*-MAIN*WZM1MB-AU 01 -MS-P DIAX03/04, ECODRIVE03 mit/with 1MB, Auswahldaten / Selection Data	
00288730	DOK-DRIVE*-PRINT*****-AU 02 -MS-P DIAX03/04, ECODRIVE03 Auswahldaten / Selection Lists (S1)	
00272097	Design - DOK-DIAX04-HDD+HDS****-PR J2 -EN-P "DIAX04 HDD and HDS Drive Control Devices, 1 st Generation"	DIAX04
00280458	Design - DOK-DIAX04-HDD+HDS**G2-PR J3 -EN-P "DIAX04 HDD and HDS Drive Control Devices, 2 nd Generation"	
00273140	Design - DOK-DIAX04-PLUG*IN*MOD-PR 03 -EN-P "DIAX04 Modules for Intelligent Digital Drive Control Devices"	
00272056	Application Description - DOK-POWER*-HVE+HVR****-ANW 3 -EN-P "DIAX04 HVE and HVR Supply Devices"	
00280640	Application Description - DOK-POWER*-HVE+HVR**G2-AW 06 -EN-P "DIAX04 HVE and HVR Supply Devices, 2 nd Generation"	
00282180	Application Description - DOK-POWER*-HZP*****G2-ANW 1 -EN-P "HZP Choke for Connecting Supply Devices of Type HVR, 2 nd Generation"	
00279714	Design - DOK-ECODR3-DKC**.3****-PR 05 -EN-P "ECODRIVE03 Drive Control Devices"	ECO-DRIVE03
00281042	Selection Data - DOK-ECODR3-SERV-GEN***-AUS 1 -MS-P "ECORIVE03 Servo Applications with 1.5s Acceleration Time"	
00281040	Selection Data - DOK-ECODR3-SERV-WZM***-AU 02 -MS-P "ECORIVE03 Servo Applications with 400ms Acceleration Time"	
00259814	Design - DOK-GENEML-EMC*****-PR 02 -EN-P "Electromagnetic Compatibility (EMC) for Drive and Control Systems"	EMC
00286117	Assembly Instructions - DOK-CONNEX-CAB*INSTR02-MA 01 -EN-P "Ready-for-use Cables and Tools for DIAX04 and ECODRIVE03"	CABLES
00280894	Selection List - DOK-CONNEX-CABLE*STAND-AU 04 -EN-P "DIAX04, ECODRIVE03 and POWERDRIVE Connection Cables"	

Fig. 1-5: Additional documentation



Contact your Bosch Rexroth branch to obtain the current documentation for the products that you use (see the address list in Cap. 17.5 at the end of this documentation).

Standards

This documentation refers to German, European and international technical standards. The list can be found in the appendices of this documentation.

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

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e-mail: postmaster@beuth.de

Outside Systems

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 particular manufacturers.

Your Feedback

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

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2 Important directions for use

2.1 Appropriate use

Introduction

Bosch Rexroth products represent state-of-the-art developments and manufacturing. They are tested prior to delivery to ensure operational safety and reliability.

The products may only be used in the manner that is defined as appropriate. If they are used in an inappropriate manner, then situations can develop that may lead to property damage or injury to personnel.

Note: Bosch Rexroth, as manufacturer, is not liable for any damages resulting from inappropriate use. In such cases, the guarantee and the right to payment of damages resulting from inappropriate use are forfeited. The user alone carries all responsibility of the risks.

Before using Bosch Rexroth products, make sure that all the prerequisites for appropriate use of the products are satisfied:

- Personnel that in any way, shape or form use our products must first read and understand the relevant safety instructions and be familiar with appropriate use of the products.
- If the product takes the form of hardware, then it must remain in its original state, in other words, no structural changes are permitted. It is not permitted to decompile software products or alter source codes.
- Do not mount damaged or faulty products or use them in operation.
- Make sure that the products have been installed in the manner described in the relevant documentation.

Areas of use and application

Asynchronous motors of the 2AD line made by Bosch Rexroth are designed to be used as rotary main-spindle and servo-drive motors. Typical applications are in:

- machine tools,
- printing and paper processing machines,
- packaging and foodstuff machines and
- metal-forming machine tools.

Several types of motors with differing drive power and different interfaces are available for application-specific uses.

Control and monitoring of the motors may require additional sensors and actors.

Note: The motors may only be used with the accessories and parts specified in this document. If a component has not been specifically named, then it may neither be mounted nor connected. The same applies to cables and lines.

Operation is only permitted in the specified configurations and combinations of components using the software and firmware as specified in the relevant function descriptions.

Every drive controller has to be programmed before starting it up, making it possible for the motor to execute the specific functions of an application.

The motors may only be operated under the assembly, installation and ambient conditions as described here (temperature, IP Class, humidity, EMC requirements, etc.) and in the position specified.

2.2 Inappropriate use

Inappropriate use is defined as using the motors outside of the above-referenced areas of application or under operating conditions other than described in the document and the technical data specified.

2AD motors may not be used if

- they are subject to operating conditions that do not meet the above specified ambient conditions. This includes, for example, operation under water, in the case of extreme temperature fluctuations or extremely high maximum temperatures or if
- Bosch Rexroth has not specifically released them for that intended purpose. Please note the specifications outlined in the General Safety Instructions!

3 Safety Instructions for Electric Drives and Controls

3.1 Introduction

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.

Do not attempt to install or start up this equipment without first reading all documentation provided with the product. Read and understand these safety instructions and all user documentation of the equipment prior to working with the equipment at any time. If you do not have the user documentation for your equipment, contact your local Bosch Rexroth representative to send this documentation immediately to the person or persons responsible for the safe operation of this equipment.

If the equipment is resold, rented or transferred or passed on to others, then these safety instructions must be delivered with the equipment.



WARNING

Improper use of this equipment, 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!

3.2 Explanations

The safety instructions describe the following degrees of hazard seriousness in compliance with ANSI Z535. 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
 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 Z535)

3.3 Hazards by Improper Use



DANGER

**High voltage and high discharge current!
Danger to life or severe bodily harm by electric shock!**



DANGER

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



WARNING

High electrical voltage due to wrong connections! Danger to life or bodily harm by electric shock!



WARNING

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



CAUTION

Surface of machine housing could be extremely hot! Danger of injury! Danger of burns!



CAUTION

Risk of injury due to improper handling! Bodily harm caused by crushing, shearing, cutting and mechanical shock or incorrect handling of pressurized systems!



CAUTION

Risk of injury due to incorrect handling of batteries!

3.4 General Information

- 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 equipment.
- Only persons who are trained and qualified for the use and operation of the equipment may work on this equipment 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 equipment 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 equipment is designed for installation in industrial machinery.
- The ambient conditions given in the product documentation must be observed.
- Use only safety features and applications that are clearly and explicitly approved in the Project Planning Manual.

For example, the following areas of use are not permitted: construction cranes, elevators used for people or freight, devices and vehicles to transport people, medical applications, refinery plants, transport of hazardous goods, nuclear applications, applications sensitive to high frequency, mining, food processing, control of protection equipment (also in a machine).
- 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.

3.5 Protection Against Contact with Electrical Parts

Note: This section refers to equipment and drive components with voltages above 50 Volts.

Touching live parts with voltages of 50 Volts and more with bare hands or conductive tools or touching ungrounded housings can be dangerous and cause electric shock. In order to operate electrical equipment, certain parts must unavoidably have dangerous voltages applied to them.



DANGER

High electrical voltage! Danger to life, severe bodily harm by electric shock!

- = Only those trained and qualified to work with or on electrical equipment are permitted to operate, maintain or repair this equipment.
 - = Follow general construction and safety regulations when working on high voltage installations.
 - = Before switching on power the ground wire must be permanently connected to all electrical units according to the connection diagram.
 - = Do not operate electrical equipment at any time, even for brief measurements or tests, if the ground wire is not permanently connected to the points of the components provided for this purpose.
 - = Before working with electrical parts with voltage higher than 50 V, the equipment must be disconnected from the mains voltage or power supply. Make sure the equipment cannot be switched on again unintended.
 - = The following should be observed with electrical drive and filter components:
 - = Wait five (5) 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 equipment on. Prevent contact with live parts at any time.
 - = A residual-current-operated protective device (RCD) must not be used on electric drives! Indirect contact must be prevented by other means, for example, by an overcurrent protective device.
 - = Electrical components with exposed live parts and uncovered high voltage terminals must be installed in a protective housing, for example, in a control cabinet.
-

To be observed with electrical drive and filter components:



DANGER

**High electrical voltage on the housing!
High leakage current! Danger to life, danger of
injury by electric shock!**

- = Connect the electrical equipment, the housings of all electrical units and motors permanently with the safety conductor at the ground points before power is switched on. Look at the connection diagram. This is even necessary for brief tests.
- = Connect the safety conductor of the electrical equipment always permanently and firmly to the supply mains. Leakage current exceeds 3.5 mA in normal operation.
- = Use a copper conductor with at least 10 mm² cross section over its entire course for this safety conductor connection!
- = Prior to startups, even for brief tests, always connect the protective conductor or connect with ground wire. Otherwise, high voltages can occur on the housing that lead to electric shock.

3.6 Protection Against Electric Shock by Protective Low Voltage (PELV)

All connections and terminals with voltages between 0 and 50 Volts on Rexroth products are protective low voltages designed in accordance with international standards on electrical safety.



WARNING

**High electrical voltage due to wrong
connections! Danger to life, bodily harm by
electric shock!**

- = Only connect equipment, electrical components and cables of the protective low voltage type (PELV = Protective Extra Low Voltage) to all terminals and clamps with voltages of 0 to 50 Volts.
- = Only electrical circuits may be connected which are safely isolated against high voltage circuits. Safe isolation is achieved, for example, with an isolating transformer, an opto-electronic coupler or when battery-operated.

3.7 Protection Against Dangerous Movements

Dangerous movements can be caused by faulty control of the 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 injury 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!**

- = Ensure personal safety by means of qualified and tested higher-level monitoring devices or measures integrated in the installation. Unintended machine motion is possible if monitoring devices are disabled, bypassed or not activated.
 - = Pay attention to unintended machine motion or other malfunction in any mode of operation.

 - = 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, especially if there is a possibility of loose parts flying off.
 - = Mount the emergency stop switch in the immediate reach of the operator. Verify that the emergency stop works before startup. Don't operate the machine if the emergency stop is not working.
 - = Isolate the drive power connection by means of an emergency stop circuit or use a starting lockout to prevent unintentional start.
 - = Make sure that the drives are brought to a safe standstill before accessing or entering the danger zone. Safe standstill can be achieved by switching off the power supply contactor or by safe mechanical locking of moving parts.
 - = 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
 - 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 equipment 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.
-

3.8 Protection Against Magnetic and Electromagnetic Fields During Operation and Mounting

Magnetic and electromagnetic fields generated near current-carrying conductors and permanent magnets in motors represent a serious health hazard to persons 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, hearing aids and metal implants are not permitted to enter the following areas:
 - Areas in which electrical equipment and parts are mounted, being operated or started up.
 - Areas in which parts of motors with permanent magnets are being stored, operated, repaired or mounted.
 - = If it is necessary for a person with a heart pacemaker to enter such an area, then a doctor must be consulted prior to doing so. Heart pacemakers that are already implanted or will be implanted in the future, have a considerable variation in their electrical noise immunity. Therefore there are no rules with general validity.
 - = Persons with hearing aids, metal implants or metal pieces must consult a doctor before they enter the areas described above. Otherwise, health hazards will occur.
-

3.9 Protection Against Contact with Hot Parts



CAUTION

**Housing surfaces could be extremely hot!
Danger of injury! Danger of burns!**

- = Do not touch housing surfaces near sources of heat!
Danger of burns!
- ⇒ After switching the equipment off, wait at least ten (10) minutes to allow it to cool down before touching it.
- = Do not touch hot parts of the equipment, such as housings with integrated heat sinks and resistors.
Danger of burns!

3.10 Protection During Handling and Mounting

Under certain conditions, incorrect handling and mounting of parts and components may cause injuries.



CAUTION

Risk of injury by incorrect handling! Bodily harm caused by crushing, shearing, cutting and mechanical shock!

- = Observe general installation and safety instructions with regard to handling and mounting.
- ⇒ Use appropriate mounting and transport equipment.
- ⇒ Take precautions to avoid pinching and crushing.
- = Use only appropriate tools. If specified by the product documentation, special tools must be used.
- ⇒ Use lifting devices and tools correctly and safely.
- = For safe protection wear appropriate protective clothing, e.g. safety glasses, safety shoes and safety gloves.
- ⇒ Never stand under suspended loads.
- = Clean up liquids from the floor immediately to prevent slipping.

3.11 Battery Safety

Batteries contain reactive chemicals in a solid housing. Inappropriate handling may result in injuries or material damage.



Risk of injury by incorrect handling!

- = Do not attempt to reactivate discharged batteries by heating or other methods (danger of explosion and cauterization).
- = Never charge non-chargeable batteries (danger of leakage and explosion).
- ⇒ Never throw batteries into a fire.
- ⇒ Do not dismantle batteries.
- = Do not damage electrical components installed in the equipment.

Note: Be aware of environmental protection and disposal! The batteries contained in the product should be considered as hazardous material for land, air and sea transport in the sense of the legal requirements (danger of explosion). Dispose batteries separately from other waste. Observe the legal requirements in the country of installation.

3.12 Protection Against Pressurized Systems

Certain motors and drive controllers, corresponding to the information in the respective Project Planning Manual, must be provided with pressurized media, such as compressed air, hydraulic oil, cooling fluid and cooling lubricant supplied by external systems. Incorrect handling of the supply and connections of pressurized systems can lead to injuries or accidents. In these cases, improper handling of external supply systems, supply lines or connections can cause injuries or material damage.



Danger of injury by incorrect handling of pressurized systems !

- = Do not attempt to disassemble, to open or to cut a pressurized system (danger of explosion).
- = Observe the operation instructions of the respective manufacturer.
- = Before disassembling pressurized systems, release pressure and drain off the fluid or gas.
- = Use suitable protective clothing (for example safety glasses, safety shoes and safety gloves)
- = Remove any fluid that has leaked out onto the floor immediately.

Note: Environmental protection and disposal! The media used in the operation of the pressurized system equipment may not be environmentally compatible. Media that are damaging the environment must be disposed separately from normal waste. Observe the legal requirements in the country of installation.

Notes

4 Definitions

This chapter provides guidance – especially for beginners – for definitions, designations and product characteristics.



You can find practice-based notes regarding options and possible applications in Chapter 13 "Notes Regarding Application" and in Chapter 16 "Operating 2AD Motors".

4.1 Type Code

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 repair.

Each product group and motor frame size receives an individual type code according to the following model:

Blatt/Sheet 1

Blatt/Sheet 2

2ADDefinitions1.EPS

Fig. 4-1: Example of a 2AD type code

The type code for each motor frame size can be found in the corresponding section "2AD... Technical Data". The following descriptions provide an overview of the individual positions ("type code column") of 2AD series type codes.

Note: When selecting a product, always consider the detailed specifications in the corresponding Chapter "Technical Data" and in Chapter 13 "Notes Regarding Application".

1. Product Group

Type code column 1 2 3 **2AD** is the name of the product group of air-cooled induction motors that can be used as main-spindle drives or servo drives.

2. Motor Frame Size

Type code column 4 5 6 The motor frame size is specified according to the shaft height. The shaft height is the distance from the center of the shaft to the base of the foot. In the case of 2AD motors, the size specification is determined from the corresponding measurement and rounding to the closest standard shaft height.

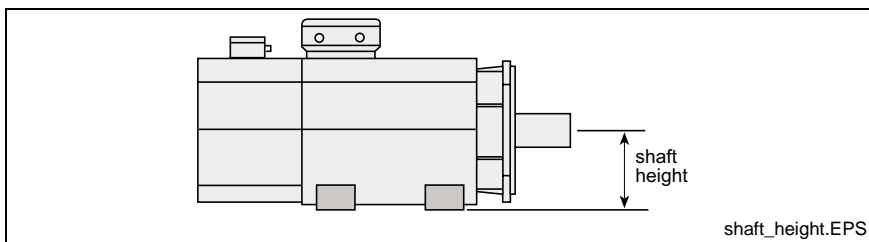


Abb. 4-2: Shaft height

Available motor frame sizes: **2AD104/134/164/184/200/225**.

Motors ending in a "4" are suitable for use with control devices of the INDRADrive, DIAX04 or ECODrive series with bus voltage of up to 750 V_{DC}.

3. Motor Frame Length

Type code 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 continuous torque.

Frame lengths are, for example, **B, C** and **D**.

The performance data of drive combinations with 2AD motors are summarized in the selection documentation (see chapter 1).

4. Frame Shape

Type code column 9 10 11 2AD motors can be supplied according to IEC 34-7 for B05, flange mounting, or B35, flange or foot mounting. The permitted installation positions are described in Chapter 13 "Notes Regarding Application".

5. Position of Power Connector

Type code column 12

The position of the power connector (terminal box or flange socket) is defined as when viewed from the output shaft (side "A"). Selectable options:

Standard design for frame shape B05: above ("O"), as in Figure 4-3.

Designs for frame shape B35: left ("L"), right ("R") or ("O"). In frame shape B35, the position of the assembly feet and that of the terminal box are fixed in relation to one another and can not be changed after the motor has been manufactured.

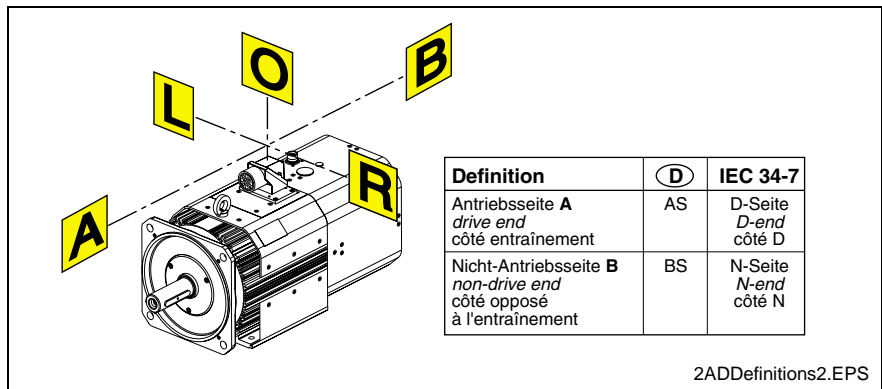


Fig. 4-3: 2AD side definition

6. Output Direction of Power Connector

Type code column 13

The output directions of the power connector are also shown in Fig. 4-3. **Note:** In the case of motors where it is possible to choose between a connector and a terminal box, different ID letters result.

Figure 4-3 shows the output direction of the power connector in position "A".

7. Type of Cooling

Type code column 14

2AD motors must always be operated with a blower whose air flow is guided by the shrouds over the surface of the motor ("surface ventilation"). Axial or radial blowers are available for certain motor types. The air flow is defined as "blowing" or "suctioning" according to the following figures.

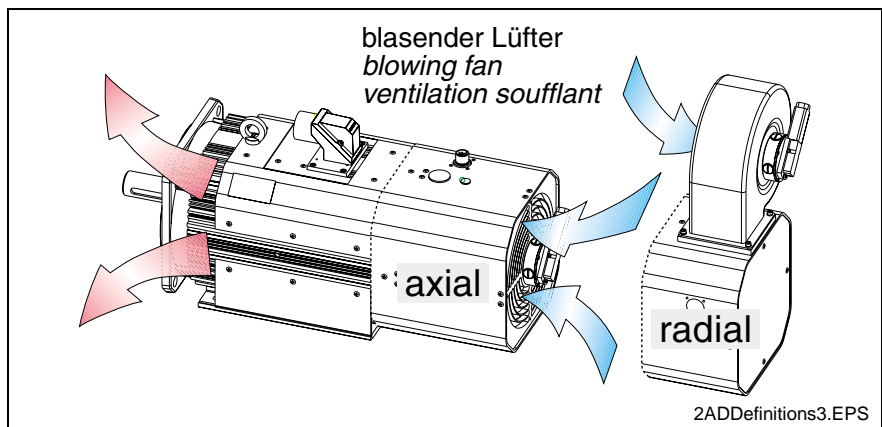


Fig. 4-4: 2AD, blowing fan

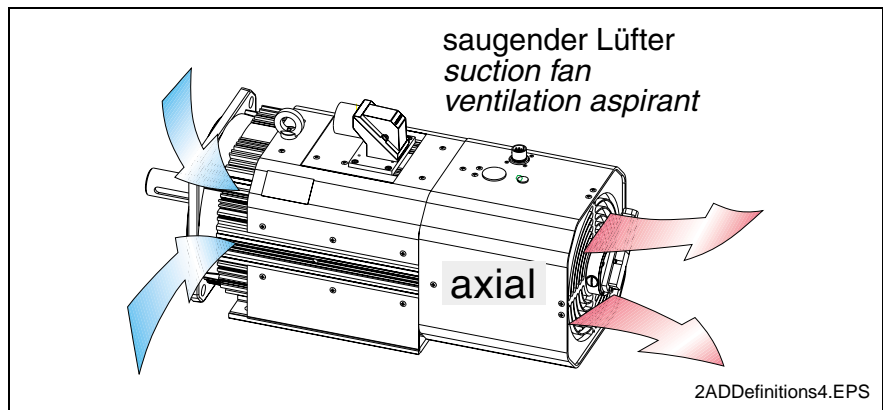


Fig. 4-5: 2AD, suction fan

The recommended design for all blower variants is "blowing". Radial blowers are available only in the "blowing" design; in addition there are limitations for the position of the power connector.

In certain motor blowers, variants of the power supply voltage, noise emission and cooling power are possible.

Please heed the notes in the individual type code of the corresponding Chapter "2AD... Technical Data".

For more information on the different types of cooling, see Chapter 11.1 "Blower Cowls".

8. Winding Code

Type code columns 16 17

Winding codes "A...", "B...", "C...", etc. indicate electrically different windings. "...S" stands for WYE (star) connection, "...D" stands for delta connection. Winding codes do not provide any general information about the performance characteristics of a motor.

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

9. Holding Brake

Type code column 18

2AD motors can be supplied with an integrated holding brake. Several holding torques are available. Depending on the application, an **electrically engaged** or an **electrically released** holding brake can be selected. The motor holding brake is not suitable for the protection of personnel or as a service brake!

Pay special attention to the notes regarding holding brakes in the "Notes regarding Application" and "Operating 2AD Motors" (Chapters 13.5 and 16.1 respectively).

10. Motor Feedback

Type code column 19 2AD motors can be supplied with integrated rotary encoders ("Motor feedback"). The selection of the encoder type required is determined mainly by the demands on the system.

Option	Encoder type	cycles/ revolution	Output signal
0	The motor is supplied without an encoder; the rear is closed off by a cover.		
6	Incremental, single-turn	512	1 V _{pp}
7	Incremental, multi-turn / absolute	512 (keeps track up to 4096 revolutions)	1 V _{pp}
8	Incremental, single-turn, explosion-resistant	512	1 V _{pp}
9	Incremental, multi-turn / absolute, explosion-resistant	512 (keeps track up to 4096 revolutions)	1 V _{pp}
C	Incremental, explosion-resistant	2500	1 V _{pp}
D	Incremental	2500	1 V _{pp}

Fig. 4-6: 2AD motor encoders

All encoder output signals are sinusoidal.

Certain encoder types can be supplied for only certain motor series. See the corresponding motor type code in corresponding Chapter "2AD... Technical Data".

The encoder interface on the control device and the encoder cable must be compatible to the selected motor encoder. See the documentation for control devices and interfaces (documentation list in Chapter 1).

11. Output Shaft

Type code column 21 In order to couple the motor to the machine elements to be driven, the following shaft options are available for all 2AD motors:

Output shaft			
	Smooth shaft	With key	
		Balanced with complete key	Balanced with half key
Without shaft seal	A	B	E
With shaft seal	C	D	H

Fig. 4-7: Output shaft options

Motors with a keyway are always supplied with a key.

Centering holes with a "DS" thread according to DIN 332, Sheet 2 are located on the ends of all motor output shafts. Details can be found in the corresponding motor specifications sheet.

See the sections regarding the shaft seal and the output shaft in Chapter 13 "Notes regarding Application".

12. B-Side Shaft End

Type code column 22 A stub shaft (only on motors with the obsolete, style-3, gear-wheel encoder) permitted the attachment of an additional absolute value encoder.

This option is no longer available.

This option is not required when using control devices of series DIAX03 and DIAX04. Drive controllers of these series can derive absolute actual position values from multi-turn encoders (encoder option "7") and transfer them directly to the control. A separate absolute value encoder is no longer necessary. Select option "2" without a B-side shaft end (preferred design).

13. Bearings

Type code column 23 **Standard** bearings, option "N", consist of deep-groove ball bearings in all 2AD frame sizes.

Heavy-Duty bearings, option "V", can be selected when large radial forces are present. These bearings are not available for the 2AD104.

In motors with heavy-duty bearings, the A-side has an extra cylindrical roller bearing that must be operated with a minimum radial load. In certain motor variants with heavy-duty bearings, the maximum speed is reduced (see "Technical Data"). The grease lifetime of heavy-duty bearings is half of standard bearings.

Select heavy-duty bearings only in exceptional cases.

High-Speed bearings, option "H", permit higher speeds at a reduced axial and radial load-bearing capacity.

14. Vibration Severity Levels (Balance Quality)

Type code column 24 2AD motors are dynamically balanced according to the requirements of DIN ISO 2373; the standard level is "R". In certain frame sizes, options "S" and "S1" can be selected.

For definition of R, S and S1 see Chapter 13-9.

4.2 Designation

The type designation of the complete product results from the selected options. Using the designation and the serial number, every Bosch Rexroth product can be uniquely identified. These designations, along with additional product data, are noted on the name plate.

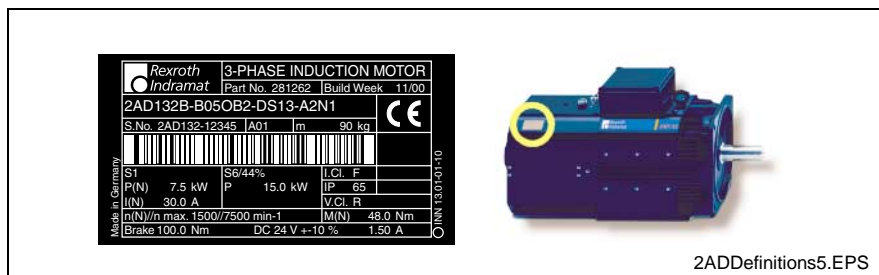


Fig. 4-8: 2AD name plate

2AD motors are supplied with 2 name plates. The second name plate is attached to the original name plate with two-side tape.

The original name plate is permanently attached to the motor housing and must not be removed.

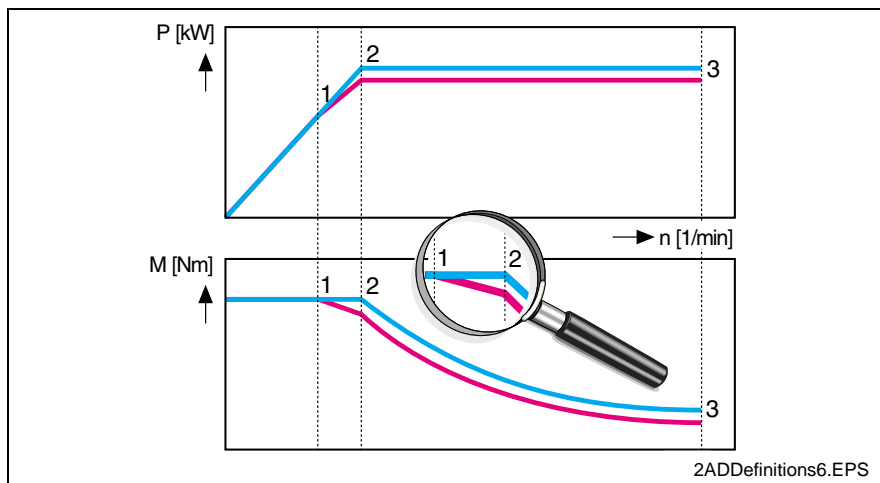
Attach the second name plate to an easily-visible section of the machine. In this way, you can read the motor data at any time without having to work in areas that are difficult to access.



Before sending questions to BOSCH REXROTH, always note all of the data from the name plate.

4.3 Operating Characteristics

The following sample characteristic curves explain the operating behavior of 2AD motors, as does information found in the motor data sheet. The characteristic curve for each selected motor-drive controller combination can be obtained from your Bosch Rexroth sales partner.



P [kW]: mechanical output in kilowatts

M [Nm]: torque available on the output shaft, in Newton meters

n [rpm]: motor speed, in revolutions per minute.

1: derating speed (n_1 in data sheet)

2: rated speed (n_N in data sheet)

3: maximum speed

Fig. 4-9: 2AD sample characteristic curves

Explanation:

1 Derating speed

Derating is present when there is a drop in torque and power before reaching the **rated speed** n_N . This only occurs in some types of motor windings.

The **continuous stand-still current**, I_1 , is applied to the motor until the derating speed is reached.

If there is no derating, $I_1 = I_N$.

The **continuous stand-still torque**, M_1 , is available for S1 operation up to the derating speed.

If there is no derating, $M_1 = M_N$.

Derating is in effect only while operating at speeds between (1) and (2) (see Fig. 4-9). Both the power and the torque are reduced in this range.

- 2 Rated speed** With no derating in effect, induction motors provide a constant torque until the rated speed (rated torque); starting at the rated speed, constant power (**rated power P_N** according to the motor data sheet) is available.
- 3 Maximum speed** The speed up to which a motor can be safely operated. This is usually limited by the mechanical construction (bearings).

5 Technical data 2AD104

5.1 Data sheet

Designation	Symbol	Unit	2AD104							
Motor data ¹⁾										
Length			B		C		D			
Winding			CS	ES	CS	DS	ES	FS	GS	HS
Rated torque	M_N	Nm	29	30	48	52	64	64	70	70
Rated speed	n_N	rpm	1500	1100	1600	800	1400	1800	750	480
Rated power	P_N	kW	4.6	3.5	8.0	4.4	9.4	12.1	5.5	3.5
Rated current	I_N	A	11.9	9.8	20.5	10.0	22.4	29.0	13.1	8.7
Standstill continuous current	I_1	A	= I_N	= I_N	= I_N	= I_N	= I_N	= I_N	= I_N	= I_N
Standstill continuous torque	M_1	Nm	= M_N	= M_N	= M_N	= M_N	= M_N	= M_N	= M_N	= M_N
Derating speed	n_1	rpm	= n_N	= n_N	= n_N	= n_N	= n_N	= n_N	= n_N	= n_N
Min. cross-section of power connection ²⁾	A	mm ²	2.5	2.5	2.5	2.5	2.5	4.0	2.5	2.5
Moment of inertia of rotor ³⁾	J_m	kgm ²	0.014		0.021		0.027			
Mass ⁴⁾	m	kg	37		55		60			
Maximum speed ⁵⁾	n_{max}	rpm	9,000							
Thermal time constant	t_{th}	min								
Noise level ⁶⁾	L_p	dB(A)	70							
Permissible ambient temperature	T	°C	0...40							
Insulation class acc. to DIN VDE 0530-1			F							
Class of motor protection			IP65							
Class of blower protection			IP24							
Holding brake (optional)			Electr. lock				electr. released			
Transferable torque	M_4	Nm	30				24			
Connection voltage	U_N	V	DC 24 ± 10 %							
Rated current	I_N	A	0.9				1.1			
Moment of inertia	J_m	kgm ²	0.0007							
Maximum permissible brake energy	W_{max}	Ws	20,000							
Release delay	t_i	ms	50				100			
Lock delay	t_k	ms	50				60			
Mass	m	kg	1.5							
Motor blower			Axialblower				Radialblower			
Air current			B →A blowing		A →B suction		B →A blowing			
Power consumption	S_N	VA	60		70		60			
Nominal voltage	U_N	V	230 or 115 V, 50/60 Hz, ± 10%							
Medium air volume	V	m ³ /h	230		195		200			
¹⁾ Values determined according to IEC 60034-1. Current and voltage values are indicated as root-mean-square values. Selection data and operating curves are contained in a separate documentation "DOK-DRIVE*-MAIN*WZM****-AU01-MS-P". ²⁾ Rated current-carrying capacity acc. to VDE0298-4 (1992) and installation option B2 acc. to EN60204-1 (1993) at a 40 °C ambient temperature. ³⁾ Value without holding brake. ⁴⁾ Value without holding brake, but with blower. ⁵⁾ When using an ECODRIVE03 drive controller with feedback option "C" or "D", $n_{max} = 3500$ rpm ⁶⁾ At 1m distance, with PWM = 4 kHz										

Fig. 5-1: Data sheet 2AD104

5.2 Type code 2AD104

Abbrev.	Column	→	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0
---------	--------	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Example: 2 A D 1 0 4 B - B 0 5 O B 1 - C S 0 6 - A 2 N 1

1. Product
 - 1.1 2AD = 2AD
2. Motor size
 - 2.1 104 = 104
3. Motor length ①
 - 3.1 Lengths = B, C, D
4. Mounting style ②
 - 4.1 Flange mounting. = B05
 - 4.2 Flange and foot mounting. = B35
5. Position of power connection ③
 - 5.1 left = L
 - 5.2 top = O
 - 5.3 right = R
6. Output direction of power connection ③

	Power plug (Blower with plug)	Junction box (Blower with junction box)
6.1 to side A	A	C
6.2 to side B	B	D
6.3 to the left	L	F
6.4 to the right	R	E
7. Cooling mode ④

Axial blower				Radial blower					
Air flow		Blower arrangement							
blowing	in-take	left	right	below					
115V/230V	115V/230V	115V/230V	115V/230V	115V/230V	115V/230V	115V/230V	115V/230V		
4	1	5	2	C	8	A	6	B	7

 - 7.1 Fan cover with connection piece = E⑤
8. Windings code
 - 8.1 2AD104B = CS, ES
 - 8.2 2AD104C = CS, DS
 - 8.3 2AD104D = ES, FS, GS, HS
9. Holding brake
 - 9.1 without holding brake = 0
 - 9.2 with holding brake 30 Nm, electrical clamp = 1
 - 9.3 with holding brake 24 Nm, electrical release. = 2

INN-41-01-T10-04-M11-2AD3.EPS

Fig. 5-2: 2AD104 Type code (1)

5.3 Dimensions sheet 2AD104

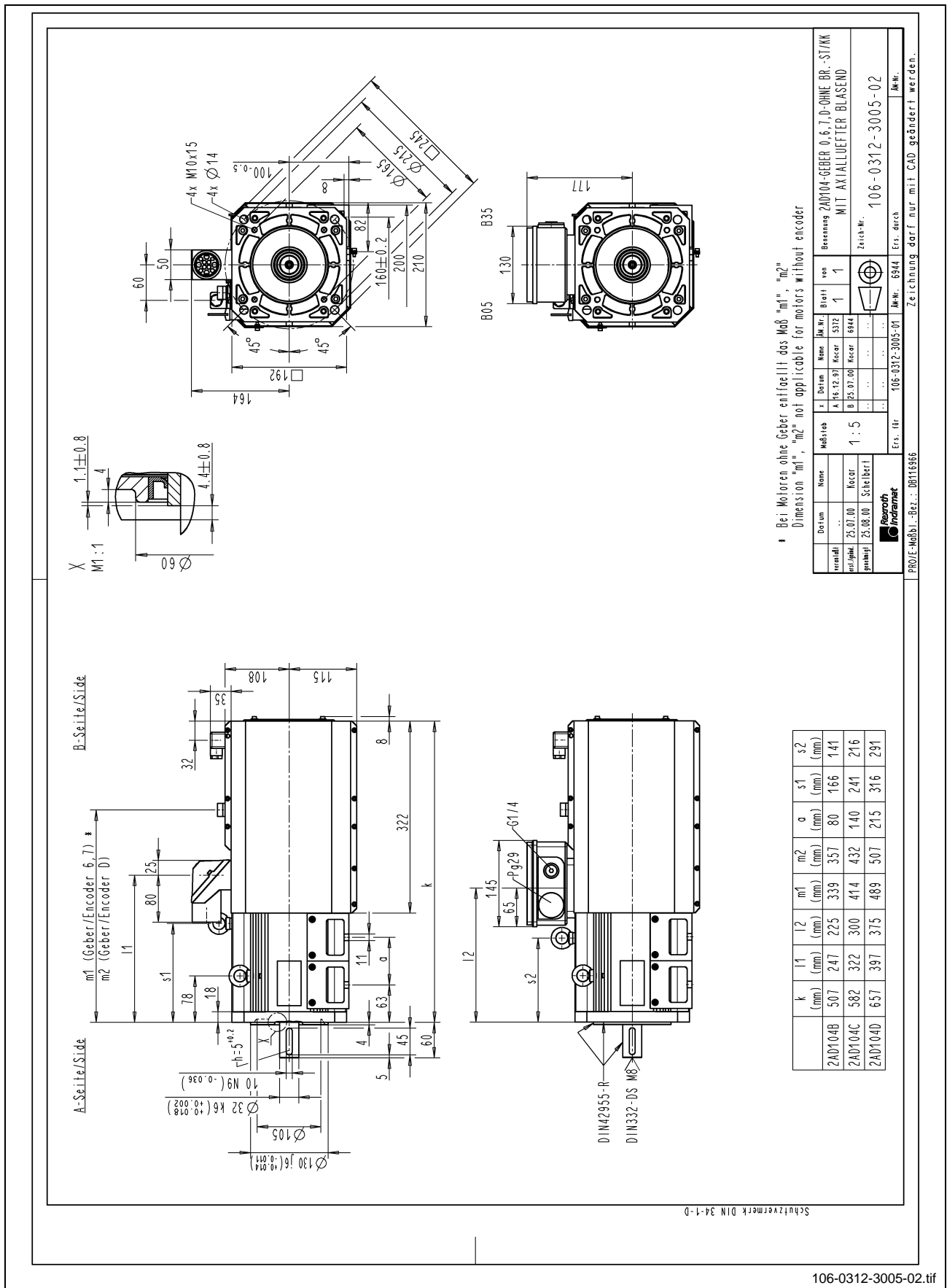
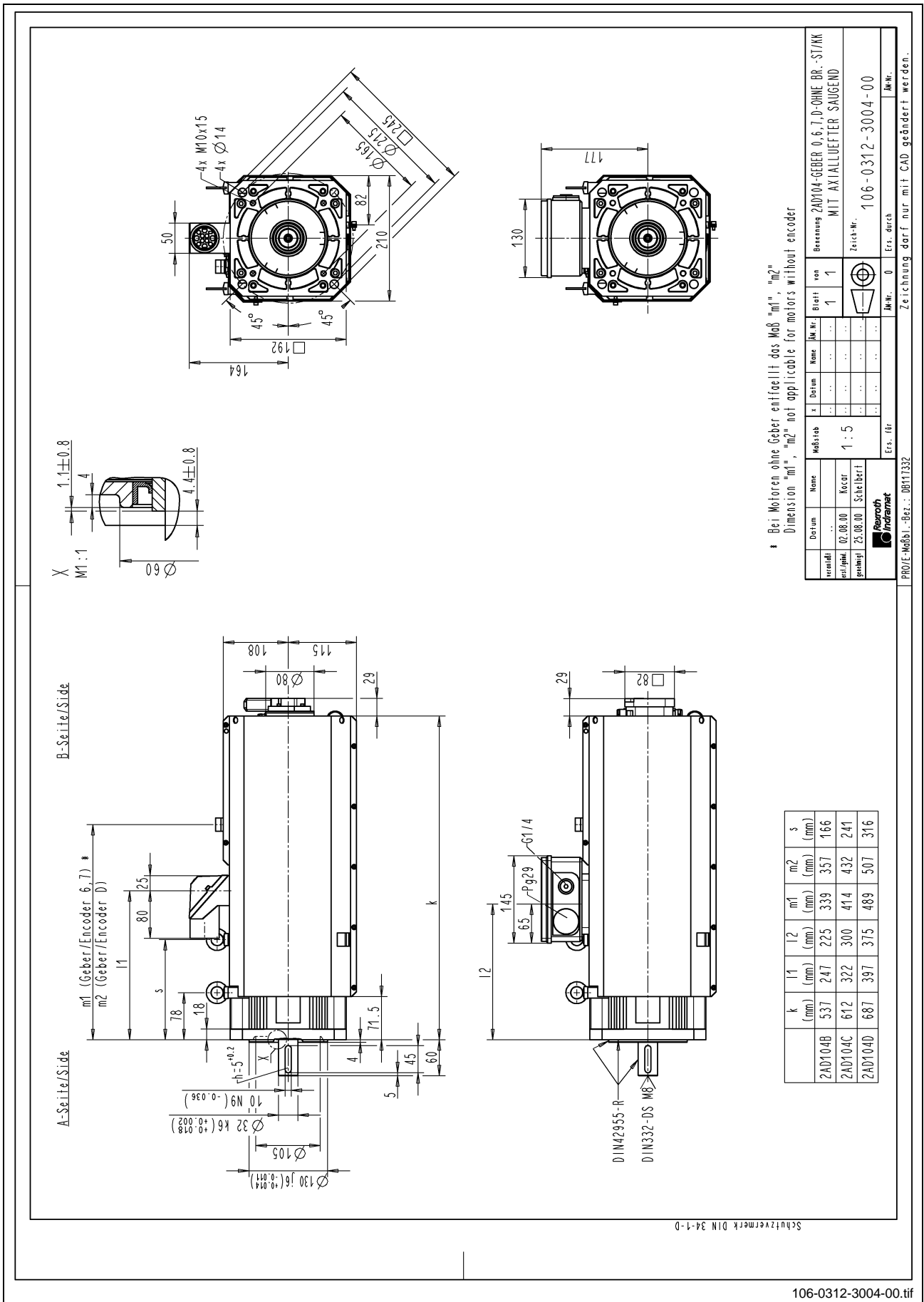


Fig. 5-4: Dimensions sheet 2AD104, Axial blower "blowing", without brake



106-0312-3004-00.tif

Fig. 5-5: Dimensions sheet 2AD104, Axial blower "suction", without brake

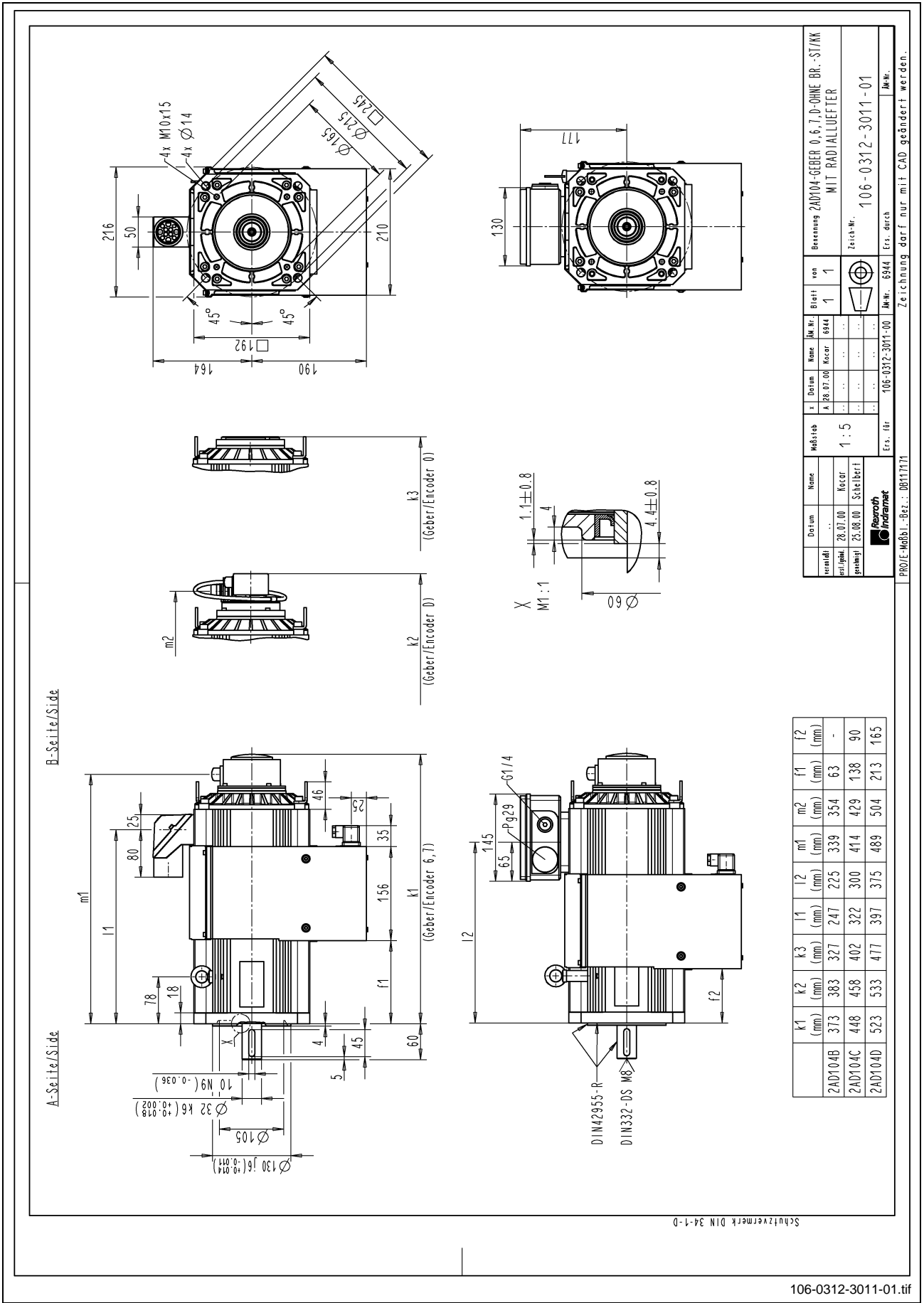


Fig. 5-6: Dimensions sheet 2AD104, Radial blower, without brake

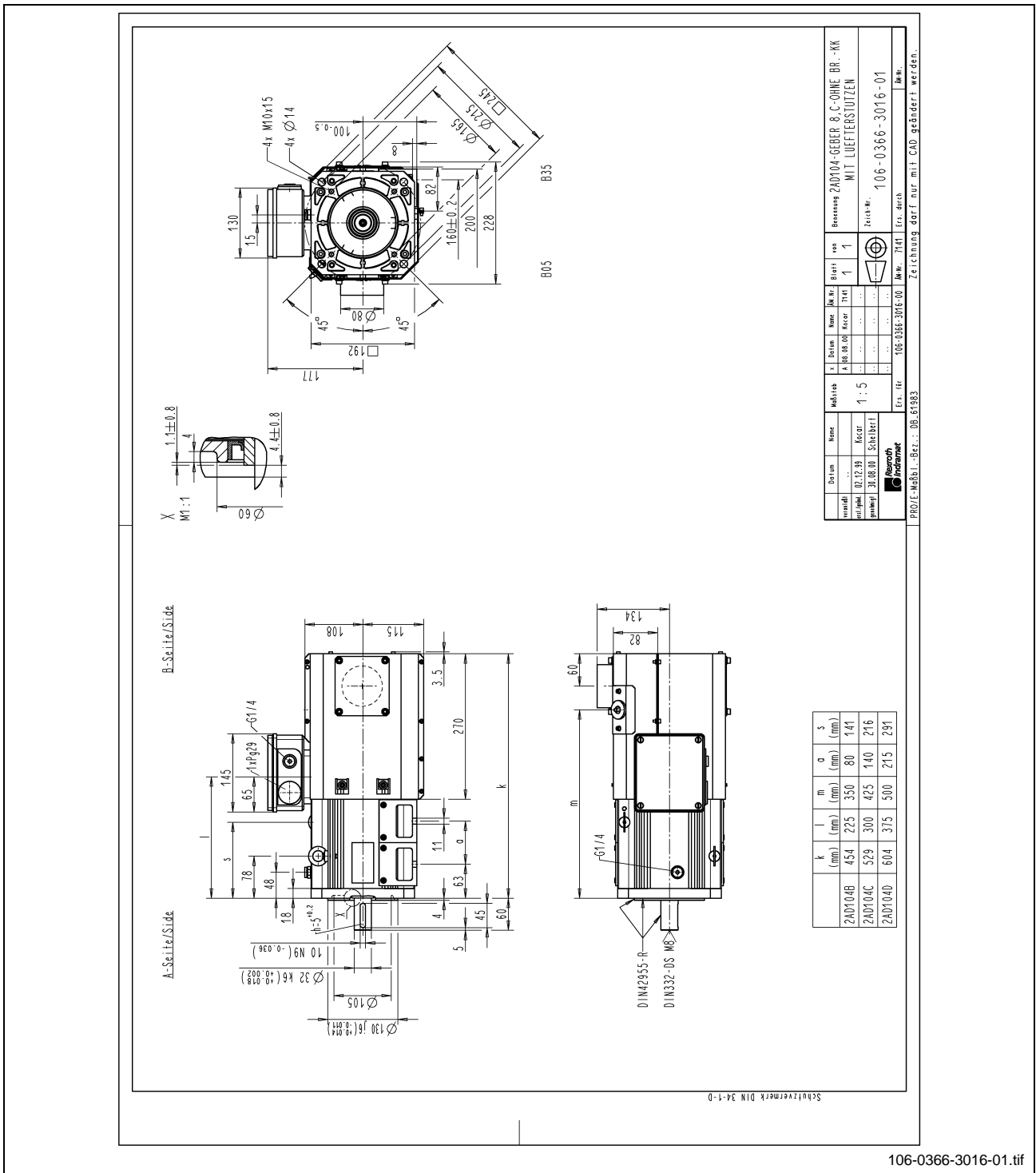
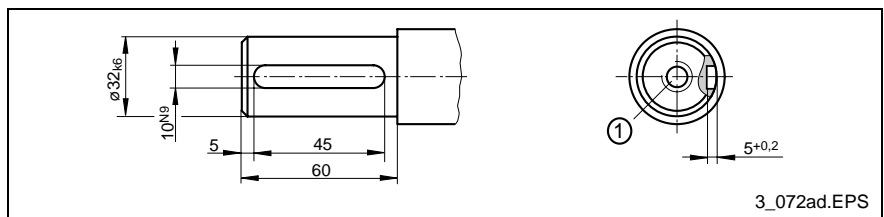


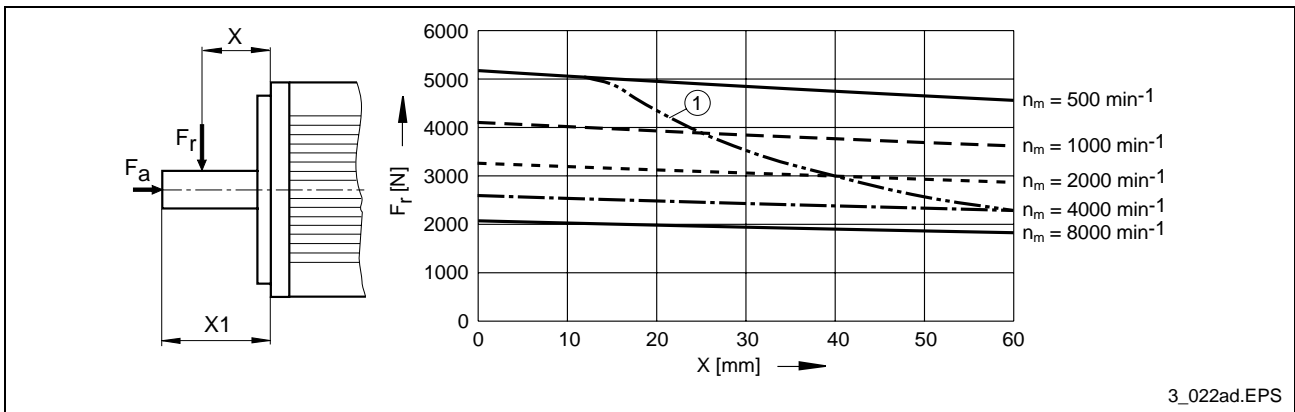
Fig. 5-7: Dimensions sheet 2AD104, EX



(1): Centering bore hole M8 x 19 acc. to DIN 332. Balancing tolerance R acc. to DIN 42955. Corresponding keys A10 x 8 x 45 acc. to DIN 6885 (included in delivery).

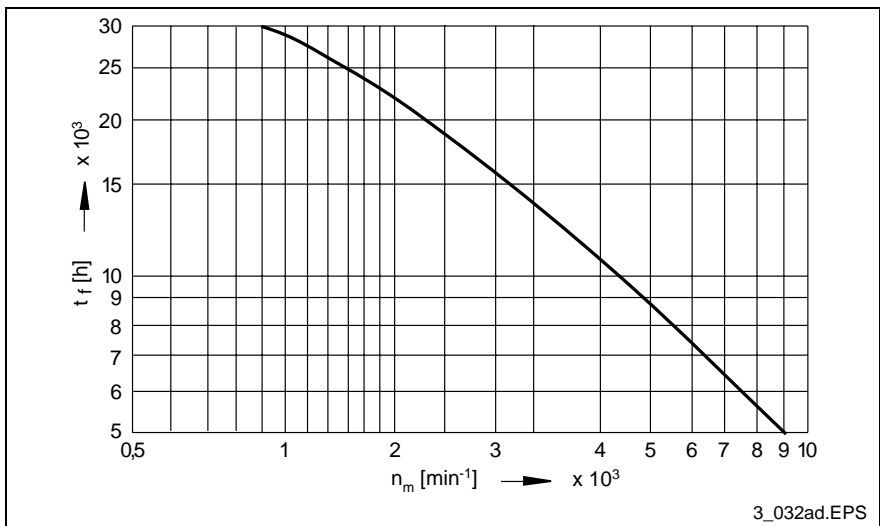
Fig. 5-8: 2AD104, Output shaft with keyway

5.4 Shaft load 2AD104



- F_r : Permissible radial force allowed for a mechanical lifetime of $L_h = 20,000$ operating hours
 - F_a : Permissible axial force. Max. 30N in all installation positions
 - X : Distance between the location of the resultant radial force F_r and the motor flange
 - $X1$: Permissible effective range of radial force F_r
 - n_m : Mean speed
 - (1): Load limit for output shaft with key
- Fig. 5-9: 2AD104, Shaft load

5.5 Grease life 2AD104



- t_f : grease life
 - n_m : mean speed
- Fig. 5-10: 2AD104 Grease life

Note: The grease life shown was determined under optimal operating conditions. Deviations to these conditions may influence the grease life in a negative manner.

6 Technical data 2AD134

6.1 Data sheet

Designation	Symbol	Unit	2AD134									
Motor data ¹⁾												
Length			B			C			D			
Winding			ES	FS	GS	DS	FS	HS	AS	CS	DS	ES
Rated torque	M _N	Nm	76	70	85	100	120	115	160	160	155	175
Rated speed	n _N	rpm	1500	2000	1000	2000	850	1100	1500	1150	2000	800
Rated power	P _N	kW	11.9	14.7	8.9	20.9	10.7	13.2	25.1	19.3	32.5	14.7
Rated current	I _N	A	28.0	39.5	21.6	49.0	24.2	31.5	68.0	50.0	71.5	30.3
Standstill continuous current	I ₁	A	= I _N	42.0	= I _N	55.0	= I _N	= I _N	= I _N	= I _N	73.5	= I _N
Standstill continuous torque	M ₁	Nm	= M _N	76	= M _N	115	= M _N	= M _N	= M _N	= M _N	160	= M _N
Derating speed	n ₁	rpm	= n _N	1500	= n _N	1500	= n _N	= n _N	= n _N	= n _N	1500	= n _N
Min. cross-section of power connection ²⁾	A	mm ²	4	10	2.5	16	6	6	16	10	25	6
Moment of inertia of rotor ³⁾	J _m	kgm ²	0.054			0.076			0.118			
Mass ⁴⁾	m	kg	90			115			135			
Maximum speed ⁵⁾	n _{max}	rpm	7500									
Thermal time constant	t _{th}	min	45			50			55			
Noise level ⁶⁾	L _p	dB(A)	75									
Permissible ambient temperature	T	°C	0...40									
Insulation class acc. to DIN VDE 0530-1			F									
Class of motor protection			IP65									
Class of blower protection			IP24									

			electr. lock	electr. released	electr. released reinforced
Holding brake (optional)					
Transferable torque	M ₄	Nm	100	80	100
Connection voltage	U _N	V	DC 24 ± 10 %		
Rated current	I _N	A	1.6		2.0
Moment of inertia	J _m	kgm ²	0.002		0.002
Maximum permissible brake energy	W _{max}	Ws	30,000		30,000
Release delay	t _i	ms	140		110
Lock delay	t _k	ms	110		70
Mass	m	kg	4		4

Motor blower			Axialblower		Radialblower
Air current			B →A blowing	A →B suction	B →A blowing
Power consumption	S _N	VA	170 145		330
Nominal voltage	U _N	V	3 x 400 V, 50 Hz, ± 15 % 3 x 460 V, 60 Hz, ± 10 %		
Medium air volume	V	m ³ /h	1,000	850	600

¹⁾ Values determined according to IEC 60034-1. Current and voltage values are indicated as root-mean-square values. Selection data and operating curves are contained in a separate documentation "DOK-DRIVE*-MAIN*WZM****-AU01-MS-P"

²⁾ Rated current-carrying capacity acc. to VDE0298-4 (1992) and installation option B2 acc. to EN60204-1 (1993) at a 40 °C ambient temperature

³⁾ Value without holding brake

⁴⁾ Value without holding brake, but with blower

⁵⁾ When using an ECODRIVE03 drive controller with feedbackoption "C" or "D", n_{max} = 3500 rpm

⁶⁾ At 1m distance, with PWM = 4 kHz

Fig. 6-1: Data sheet 2AD134

6.2 Type code 2AD134

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:	2	A	D	1	3	4	B	-	B	0	5	O	B	1	-	E	S	0	6	-	A	2	N	1																			

1. Product

1.1 2AD..... = 2AD

2. Motor size

2.1 134..... = 134

3. Motor length

3.1 Lengths..... = B, C, D

4. Mounting style

4.1 Flange mounting..... = B05^①

4.2 Flange and foot mounting..... = B35

5. Position of power connection ^②

5.1 left..... = L

5.2 top..... = O

5.3 right..... = R

6. Output direction of power connection ^②

	Power plug (Blower with plug)	Junction box connection (Blower with junction box)
6.1 to side A	A	C
6.2 to side B	B	D
6.3 to the left	L	F
6.4 to the right	R	E

7. Cooling mode ^③

Axial blower Air flow		Radial blower Blower arrangement			
blowing	in-take	top	right	below	left
1	2	3	6	7	8

7.1

7.2 Fan cover with connection piece..... = E^④

8. Windings code

8.1 2AD134B..... = ES, FS, GS

8.2 2AD134C..... = DS, FS, HS

8.3 2AD134D..... = AS, CS, DS, ES

9. Holding brake

9.1 without holding brake..... = 0

9.2 with holding brake 100 Nm, electrical clamp..... = 1

9.3 with holding brake 80 Nm, electrical release..... = 2

9.4 with holding brake 100 Nm, electrical release, heavy-duty... = 3

INN-41-01-T13-04-M13-2AD3.EPS

Fig. 6-2: 2AD134 Type code (1)

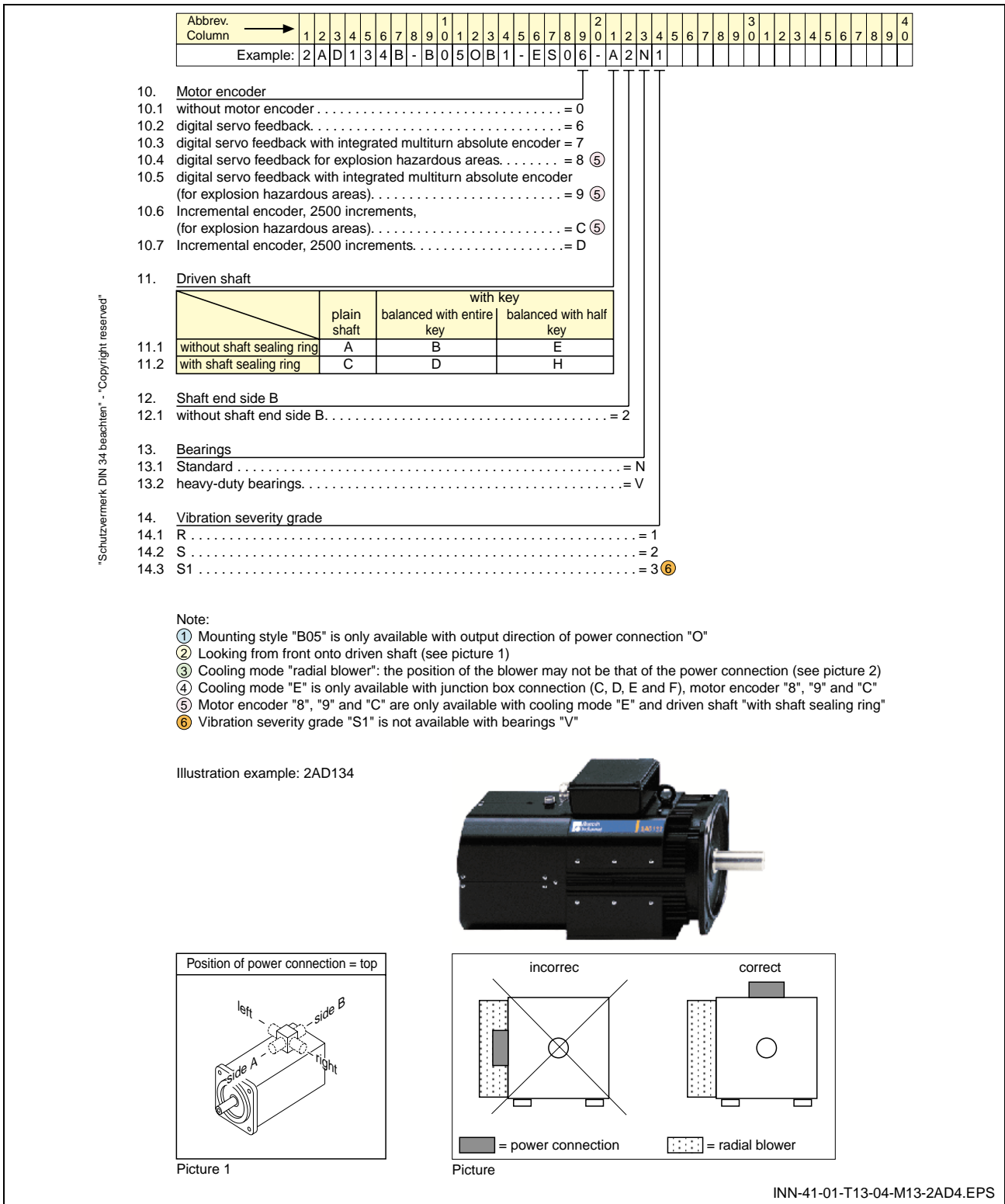


Fig. 6-3: 2AD134 Typen code (2)

Note:

- Detailed explanations of individual options are contained in Chapter 4 "Definitions".
- Check that the individual options are available before ordering from your BOSCH REXROTH sales representative.

6.3 Dimensions sheet 2AD134

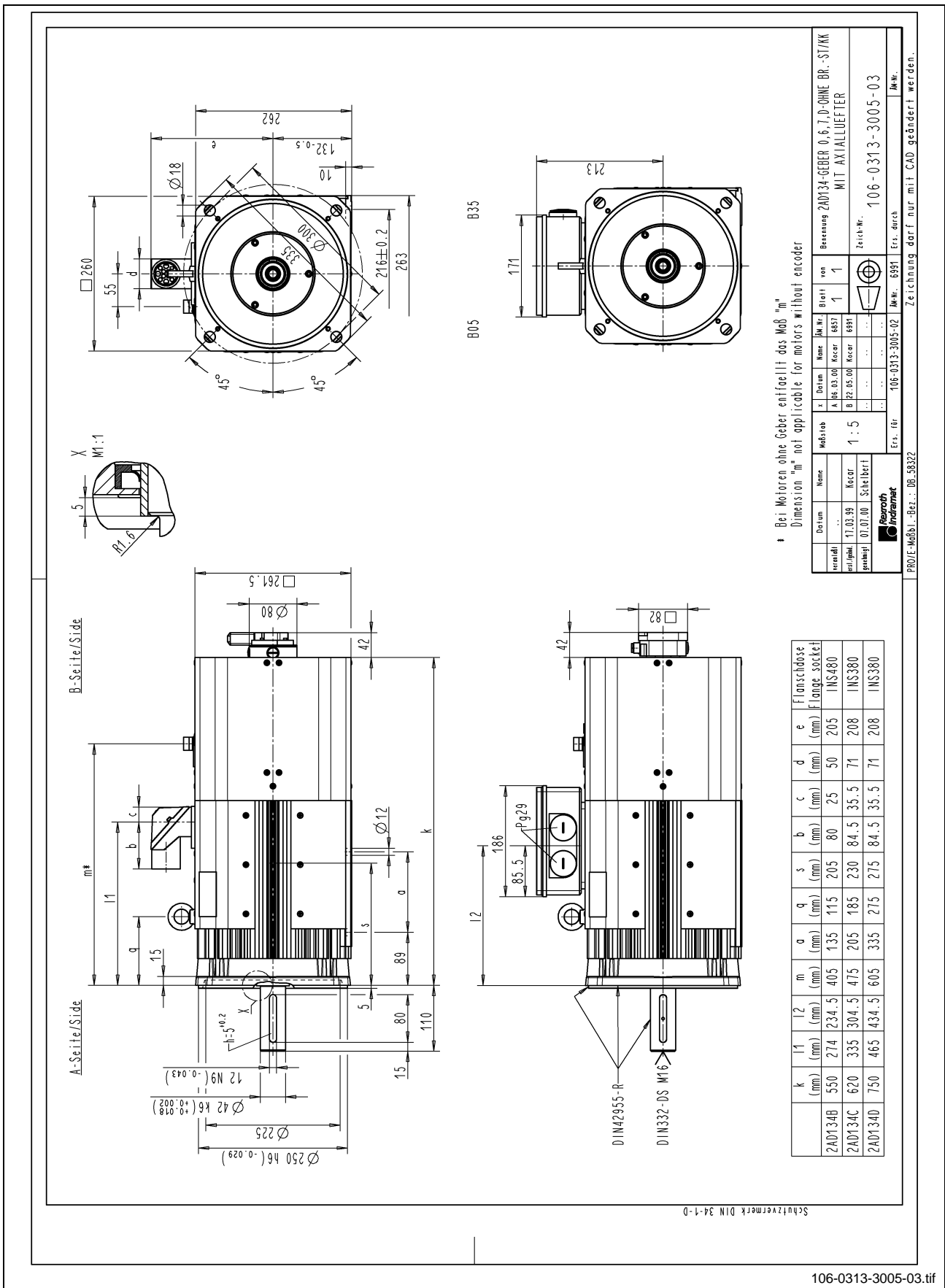


Fig. 6-4: Dimensions sheet 2AD134, Axial blower without brake

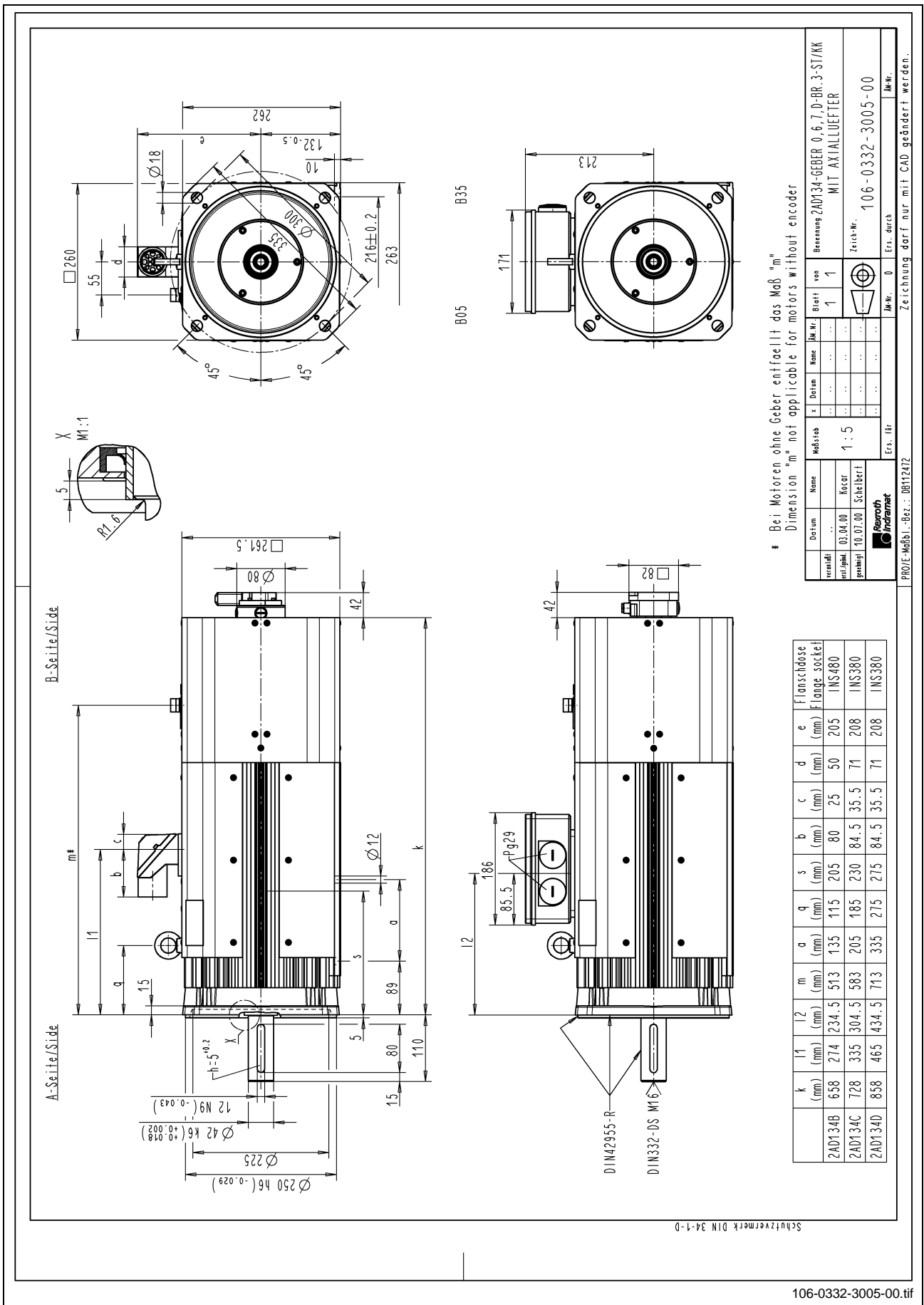


Fig. 6-5: Dimensions sheet 2AD134, Axial blower with brake 3

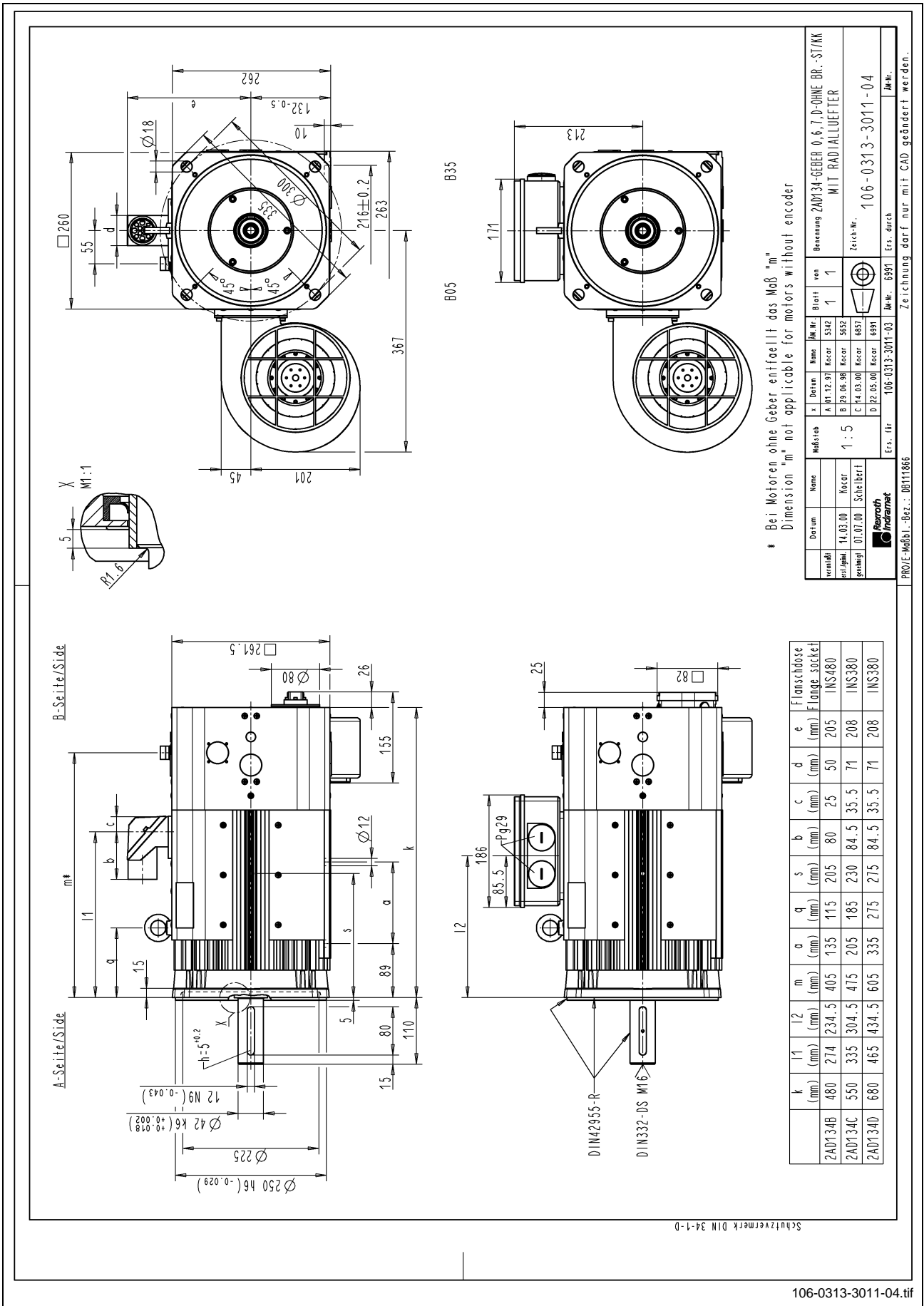


Fig. 6-6: Dimensions sheet 2AD134, Radial blower without brake

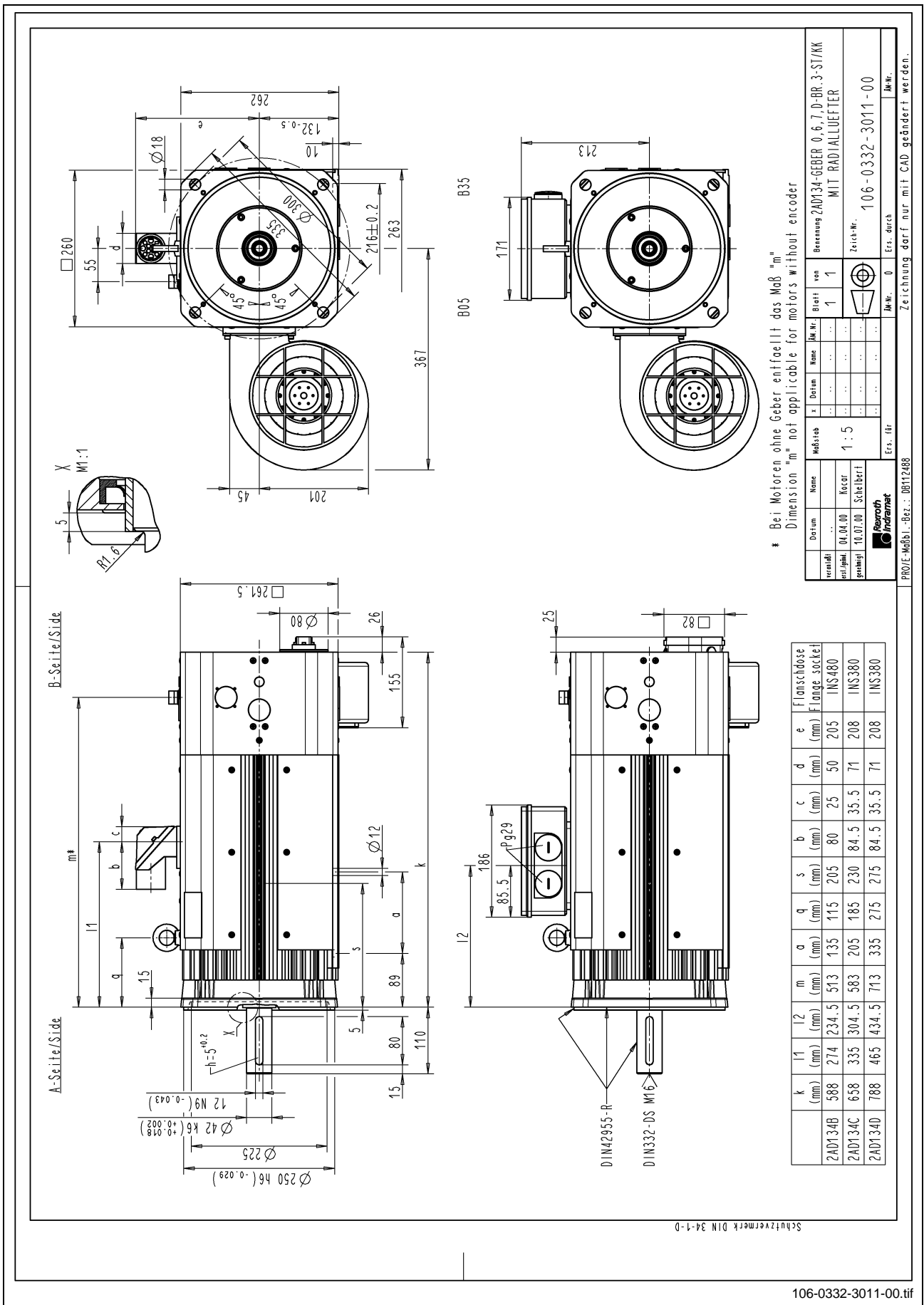


Fig. 6-7: Dimensions sheet 2AD134, Radial blower with brake 3

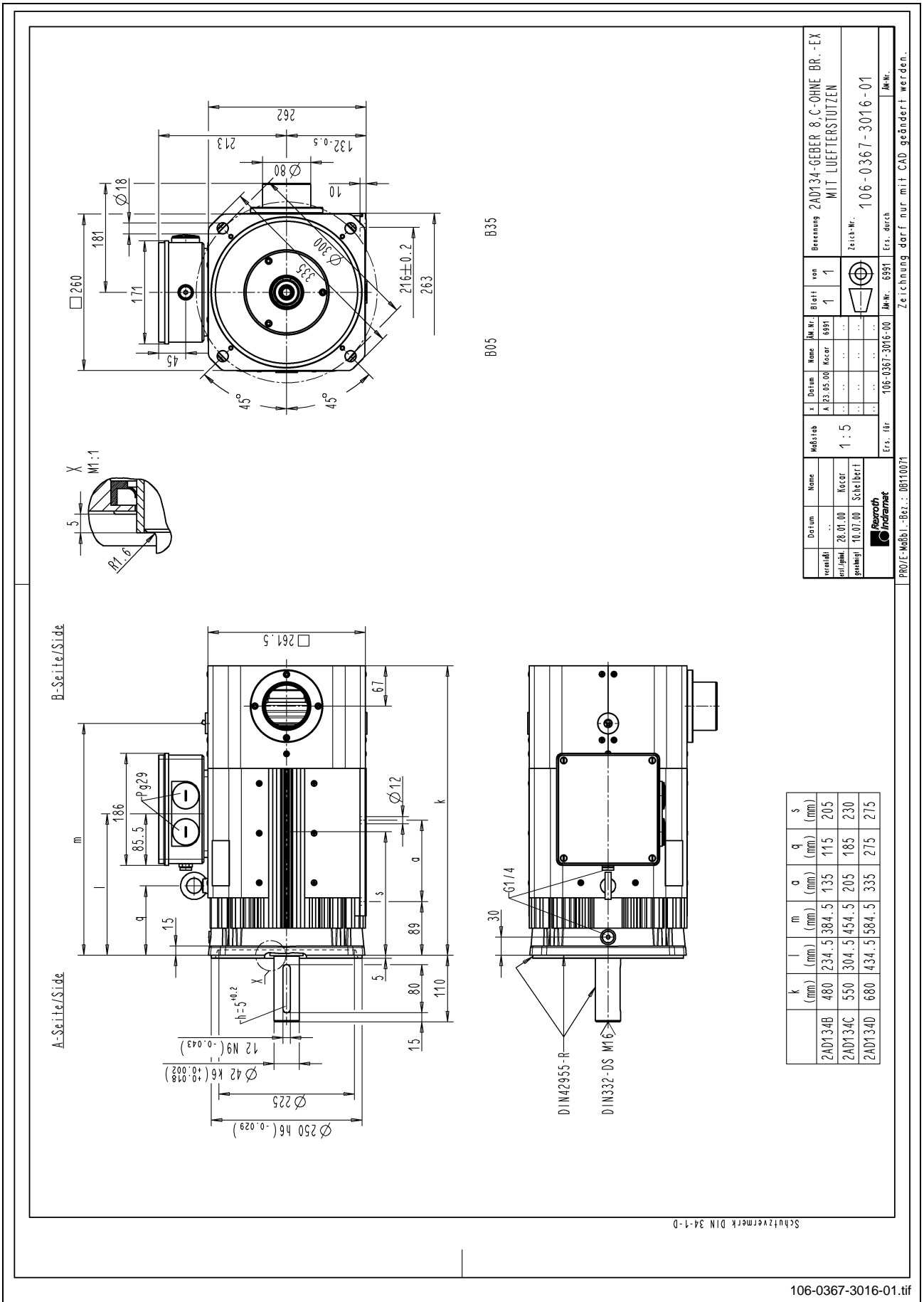
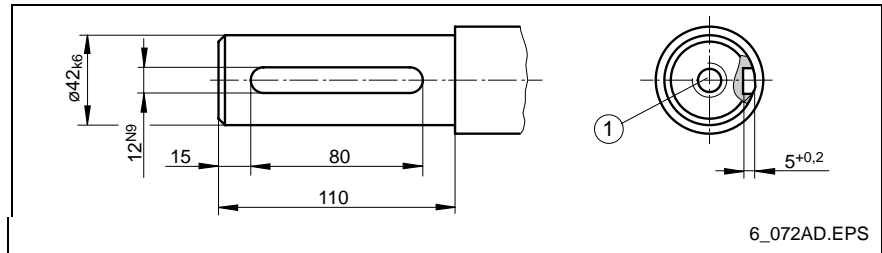


Fig. 6-8: Dimensions sheet 2AD134, Ex without brake



- (1): Centering bore hole M16 x 36 DS acc. to DIN 332. Balancing tolerance R acc. to DIN 42955. Corresponding keys A12 x 8 x 80 acc. to DIN 6885 (included in delivery).

Fig. 6-9: 2AD134, Output shaft with keyway

Blower support base

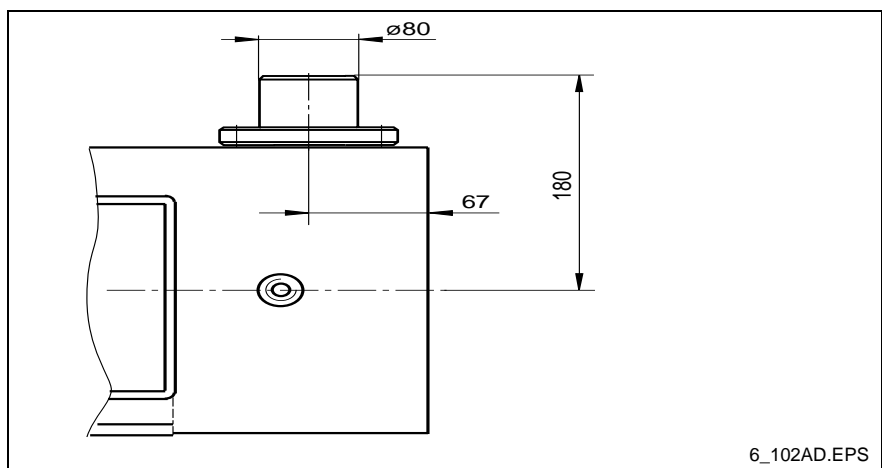
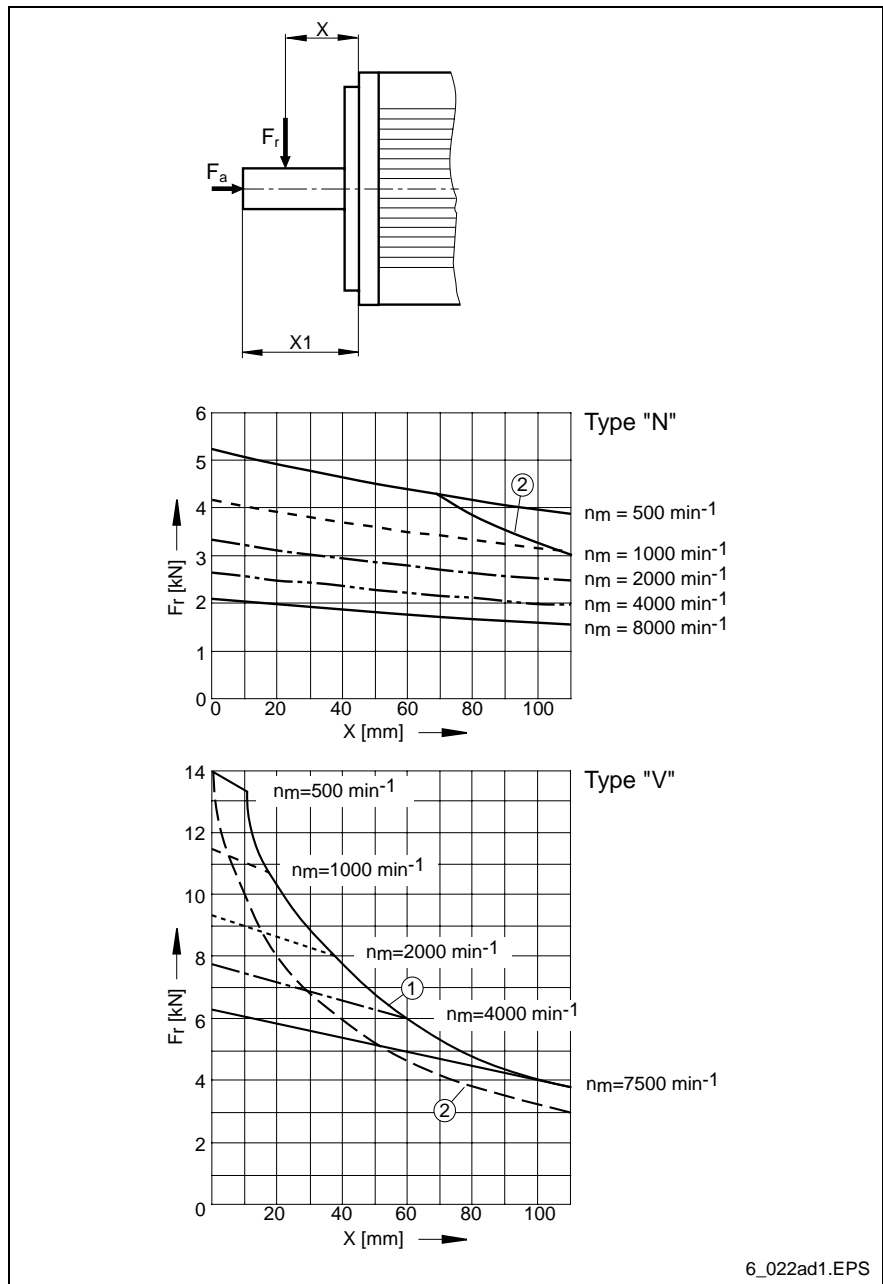


Fig. 6-10: 2AD134 with optional M01-2AD132/134 accessory mounted

6.4 Shaft load 2AD134

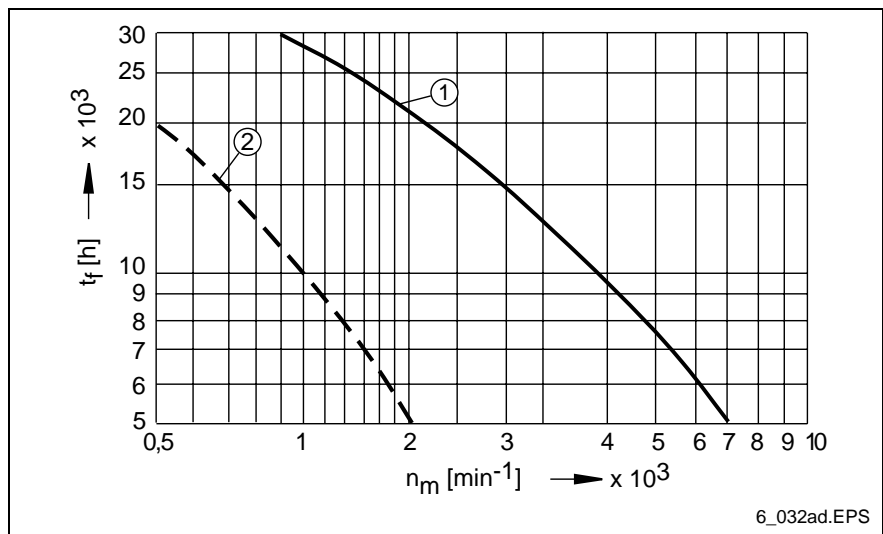


- F_r : Permissible radial force allowed for a mechanical lifetime of $L_h = 20,000$ operating hours
- F_a : Permissible axial force. Max. 50N in all installation positions
- X : Distance between the location of the resultant radial force F_r and the motor flange
- $X1$: Permissible effective range of radial force F_r
- n_m : Mean speed
- (1): Load limit for output shaft without key
- (2): Load limit for output shaft with key
- "N": Standard bearing
- "V": Heavy-duty bearing

Fig. 6-11: 2AD134, Shaft load

Note: 2AD134 motors with heavy-duty bearings must be operated with a minimum radial force of $F_r \geq 1$ kN.

6.5 Grease life 2AD134



t_f : grease life
 n_m : mean speed
 (1): Standard bearing
 (2): Heavy-duty bearing

Fig. 6-12: 2AD134 Grease life

Note: The grease life shown was determined under optimal operating conditions. Deviations to these conditions may influence the grease life in a negative manner.

7 Technical data 2AD164

7.1 Data sheet

Designation	Symbol	Unit	2AD164					
Motor data ¹⁾								
Length			B			C		
Winding			BS	DS	ES	BS	ES	FS
Rated torque	M_N	Nm	180	200	210	240	240	265
Rated speed	n_N	rpm	2,000	1,250	725	1,830	1,250	540
Rated power	P_N	kW	37.7	26.2	16.0	46.0	31.4	15.0
Rated current	I_N	A	75.5	53.0	34.0	93.5	65.5	34.0
Standstill continuous current	I_1	A	81.7	= I_N	= I_N	= I_N	= I_N	= I_N
Standstill continuous torque	M_1	Nm	200	= M_N	= M_N	= M_N	= M_N	= M_N
Derating speed	n_1	rpm	1500	= n_N	= n_N	= n_N	= n_N	= n_N
Min. cross-section of power connection ²⁾	A	mm ²	25	16	6	25	16	6
Moment of inertia of rotor ³⁾	J_m	kgm ²	0.174			0.229		
Mass ⁴⁾	m	kg	206			240		
Maximum speed ⁵⁾	n_{max}	rpm	6000					
Thermal time constant	t_{th}	min		60				
Noise level ⁶⁾	L_p	dB(A)	75					
Permissible ambient temperature	T	°C	0...40					
Insulation class acc. to DIN VDE 0530-1			F					
Class of motor protection			IP65					
Class of blower protection			IP24					

Holding brake (optional)			electr. lock	electr. released	Electr. released reinforced
Transferable torque	M_4	Nm	100		240
Connection voltage	U_N	V	DC 24 ± 10 %		
Rated current	I_N	A	1.8	2.0	
Moment of inertia	J_m	kgm ²	0.0065		0.0097
Maximum permissible brake energy	W_{max}	Ws	40,000		70,000
Release delay	t_l	ms	120	130	110
Lock delay	t_k	ms	90	85	60
Mass	m	kg	5		11

Motor blower			Axialblower		Radialblower
Air current			B →A blowing	A →B suction	B →A blowing
Power consumption	S_N	VA	220		330
Nominal voltage	U_N	V	3 x 400 V, 50/60 Hz, ± 15 % 3 x 460 V, 60 Hz, ± 10 %		
Medium air volume	V	m ³ /h	1,120	950	630

- ¹⁾ Values determined according to IEC 60034-1. Current and voltage values are indicated as root-mean-square value. Selection data and operating curves are contained in a separate documentation "DOK-DRIVE*-MAIN*WZM****-AU01-MS-P"
- ²⁾ Rated current-carrying capacity acc. to VDE0298-4 (1992) and installation option B2 acc. to EN60204-1 (1993) at a 40 °C ambient temperature
- ³⁾ Value without holding brake
- ⁴⁾ Value without holding brake, with blower
- ⁵⁾ When using an ECODRIVE03 drive controller with feedback option "C" or "D", n_{max} = 3500 rpm
- ⁶⁾ At 1 m distance, with PWM = 4 kHz

Fig. 7-1: Data sheet 2AD164

Abbrev.	Column	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	
Example:	→	2	A	D	1	6	4	B	-	B	0	5	O	B	1	-	D	S	4	7	-	A	2	N	1											

- 10. Motor encoder
- 10.1 without motor encoder = 0
- 10.2 digital servo feedback = 6
- 10.3 digital servo feedback with integrated multiturn absolute encoder = 7
- 10.4 digital servo feedback for explosion hazardous areas. = 8 ⑤
- 10.5 digital servo feedback with integrated multiturn absolute encoder for explosion hazardous areas. = 9 ⑤
- 10.6 Incremental encoder, 2500 increments, (for explosion hazardous areas)=⑤
- 10.7 Incremental encoder, 2500 increments. = D
- 11. Driven shaft

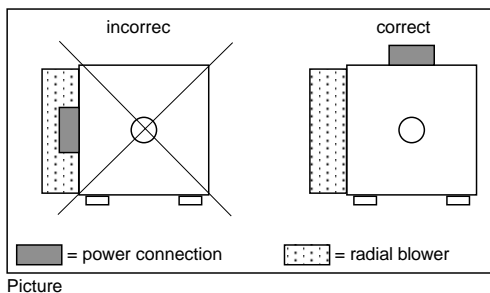
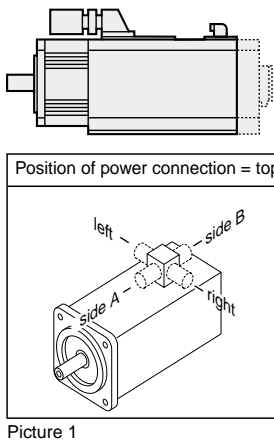
	plain shaft	with key	
		balanced with entire key	balanced with half key
11.1 without shaft sealing ring	A	B	E
11.2 with shaft sealing ring	C	D	H

- 12. Shaft end side B
- 12.1 without shaft end side B. = 2
- 13. Bearings
- 13.1 Standard = N
- 13.2 heavy-duty bearings. = V
- 14. Vibration severity grade
- 14.1 R = 1
- 14.2 S = 2
- 14.3 S1 = 3 ⑥

Note:

- ① Mounting style "B05" is only available with position of power connection "O"
- ② Looking from front onto driven shaft (see picture 1)
- ③ Cooling mode "radial blower": the position of the blower may not be that of the power connection (see picture 2)
with cooling mode 1 to 8: Connecting voltage 3 x AC 400 V, 50 to 60 Hz
with cooling mode 9: Connecting voltage 3 x AC 460 V, 60 Hz (Low-noise)
Connecting voltage 3 x AC 400 V, 50 Hz -10 % rated output (Low-noise)
- ④ Cooling mode "E" is only available with junction box connection (C, D, E and F), motor feedback "8", "9" and "C"
- ⑤ Motor feedback "8", "9" and "C" are only available with cooling mode "E" and driven shaft "with shaft sealing ring"
- ⑥ Vibration severity grade "3" is not available with bearings "V"

Illustration example: 2AD164



INN-41-01-T16-04-M14-2AD4.EPS

Fig. 7-3: 2AD164 Type code (2)

Note:

- Detailed explanations of individual options are contained in Chapter 4 "Definitions".
- Check that the individual options are available before ordering from your BOSCH REXROTH sales representative.

7.3 Dimensions sheet 2AD164

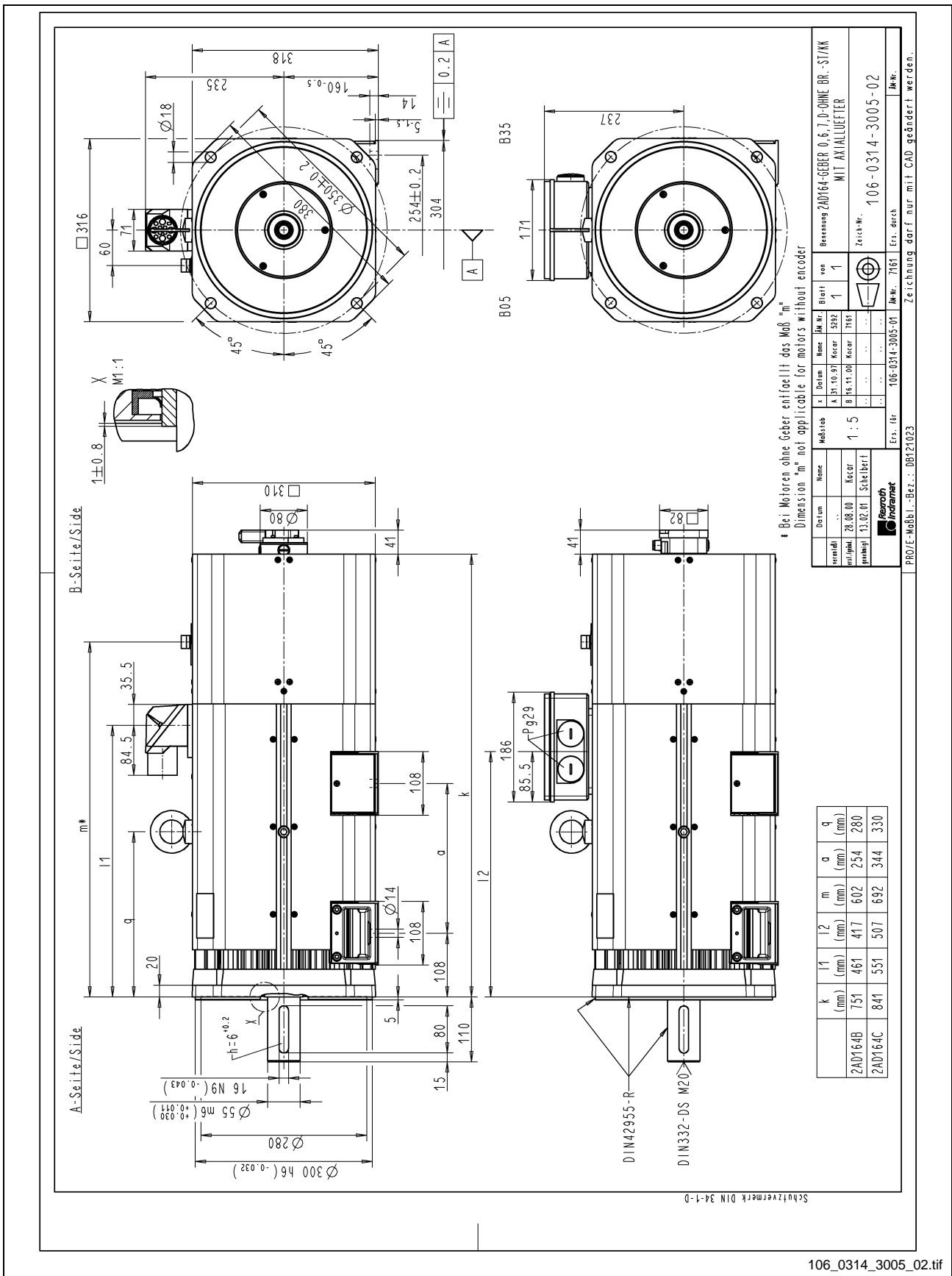


Fig. 7-4: Dimensions sheet 2AD164, Axial blower without brake

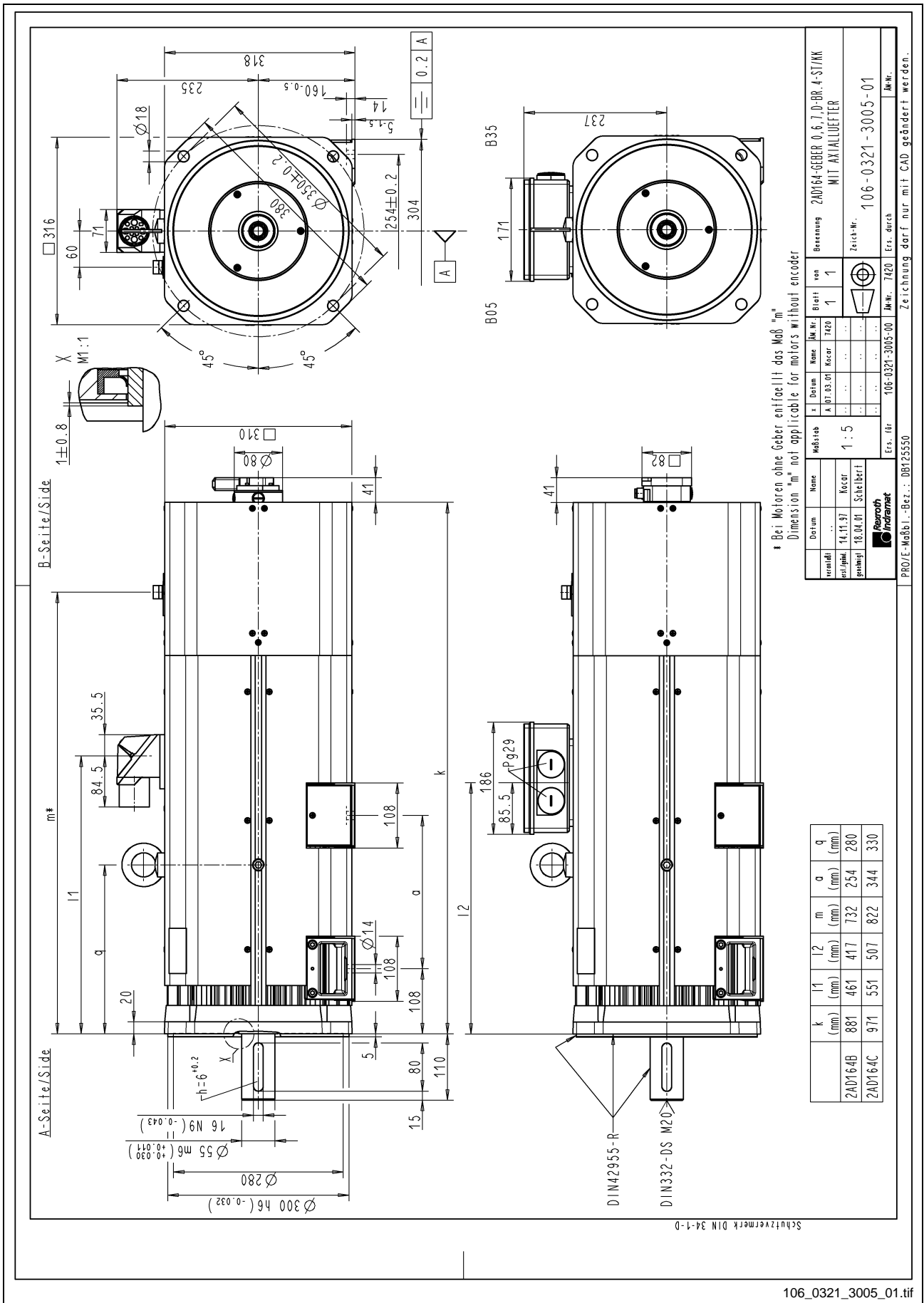
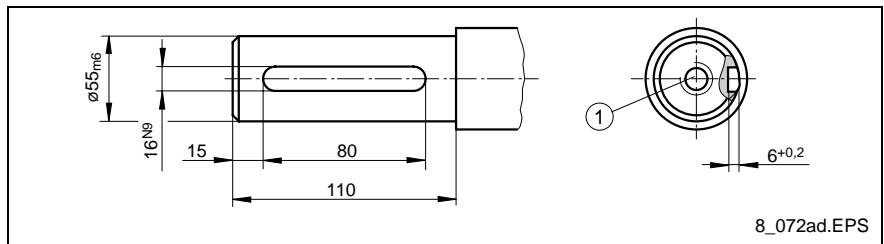


Fig. 7-5: Dimensions sheet 2AD164, Axial blower with brake 4



(1): Centering bore hole M20 x 42 DS acc. to DIN 332. Balancing tolerance R acc. to DIN 42955. Corresponding keys A16 x 10 x 80 acc. to DIN 6885 (included in delivery).

Fig. 7-8: 2AD164 Output shaft with keyway

Blower support base

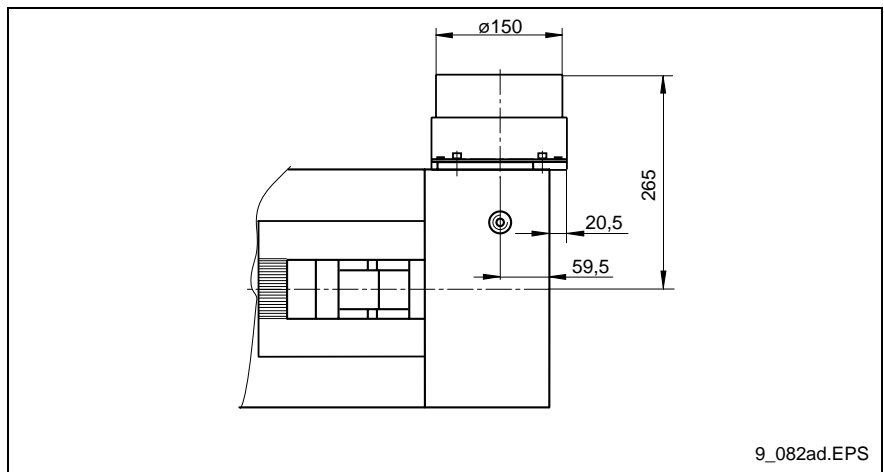


Fig. 7-9: 2AD164 with optional M01-2AD160/164 accessory mounted

Labyrinth seal

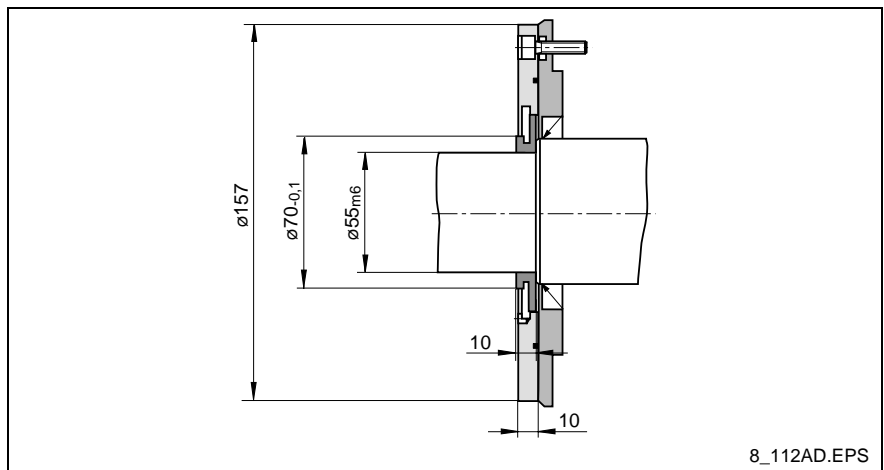
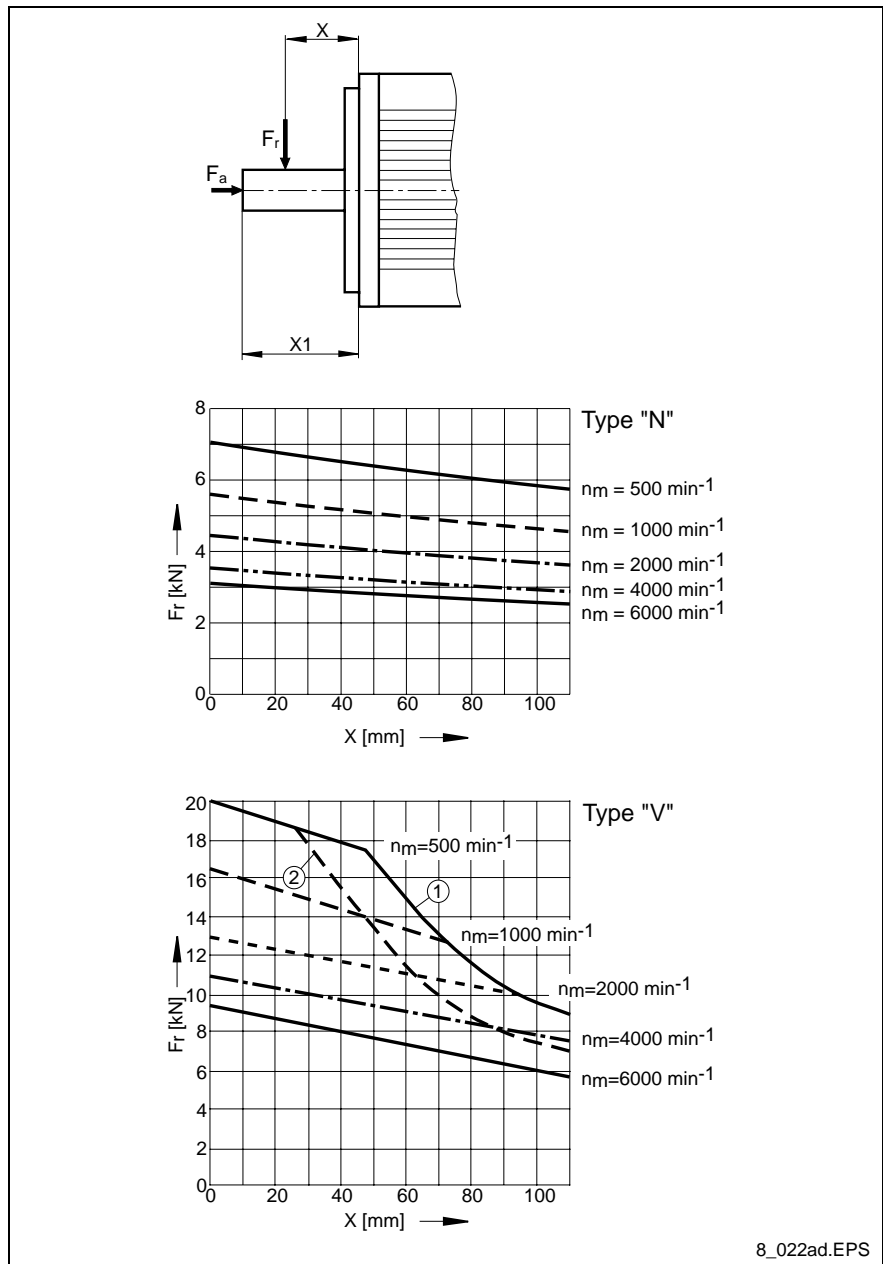


Fig. 7-10: 2AD164 with optional M02-2AD160/164 accessory mounted

7.4 Shaft load 2AD164

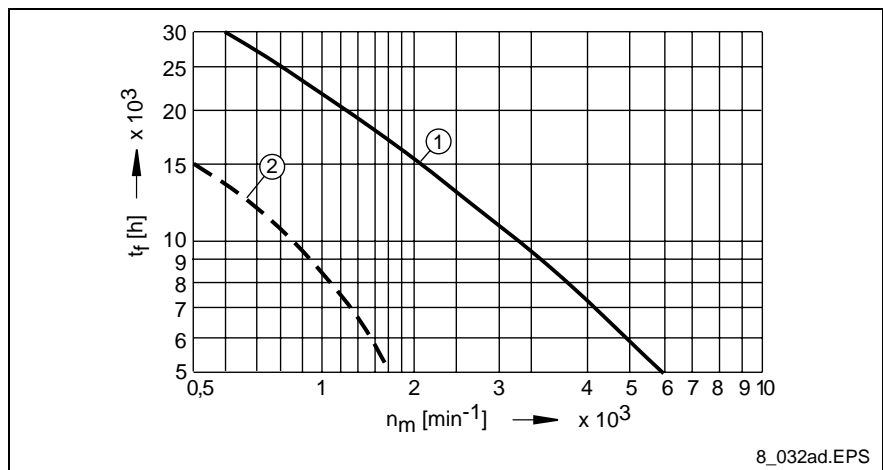


- F_r : Permissible radial force allowed for a mechanical lifetime of $L_h = 20,000$ operating hours
- F_a : Permissible axial force. Max. 50N in all installation positions
- X : Distance between the location of the resultant radial force F_r and the motor flange
- $X1$: Permissible effective range of radial force F_r
- n_m : Mean speed
- (1): Load limit for output shaft without key
- (2): Load limit for output shaft with key
- "N": Standard bearing
- "V": Heavy-duty bearing

Fig. 7-11: 2AD164, Shaft load

Note: 2AD164 motors with heavy-duty bearings must be operated with a minimum radial force of $F_r \geq 1,5 \text{ kN}$.

7.5 Grease life 2AD164



t_f : grease life
 n_m : mean speed
 (1): Standard bearing
 (2): Heavy-duty bearing

Fig. 7-12: 2AD164 Grease life

Note: The grease life shown was determined under optimal operating conditions. Deviations to these conditions may influence the grease life in a negative manner.

8 Technical data 2AD184

8.1 Data sheet

Designation	Symbol	Unit	2AD184		
Motor data ¹⁾					
Length			C	D	D
Winding			CS	CS	DS
Rated torque	M_N	Nm	318	350	320
Rated speed	n_N	rpm	1,500	1,500	2,000
Rated power	P_N	kW	50	55	67
Rated current	I_N	A	113	125	151
Standstill continuous current	I_1	A	= I_N	135.7	157
Standstill continuous torque	M_1	Nm	= M_N	390	340
Derating speed	n_1	rpm	= n_N	1,000	1,500
Min. cross-section of power connection ²⁾	A	mm ²	2 x 16	2 x 25	2 x 25
Moment of inertia of rotor ³⁾	J_m	kgm ²	0.46	0.58	0.58
Mass ⁴⁾	m	kg	366	420	420
Maximum speed	n_{max}	rpm	6,000		
Thermal time constant	t_{th}	min	70	75	75
Noise level ⁵⁾	L_p	dB(A)	80		
Permissible ambient temperature	T	°C	0...40		
Insulation class acc. to DIN VDE 0530-1			F		
Class of motor protection			IP65		
Class of blower protection			IP24		

Holding brake (optional)			electr. lock	electr. released reinforced
Transferable torque	M_4	Nm	300	240
Connection voltage	U_N	V	DC 24 ± 10 %	
Rated current	I_N	A	2	
Moment of inertia	J_m	kgm ²	0.0188	
Maximum permissible brake energy	W_{max}	Ws	70,000	
Release delay	t_i	ms	160	110
Lock delay	t_k	ms	120	60
Mass	m	kg	11	

Motor blower			Axialblower	Radialblower
Air current			B →A blowing	B →A blowing
Power consumption	S_N	VA	220	300
Blower current	I_{max}	A	0,51	-
Nominal voltage	U_N	V	3 x 400 V, 50/60 Hz, ± 15 % 3 x 460 V, 60 Hz, ± 10 %	
Medium air volume	V	m ³ /h	1,950	660

¹⁾ Values determined according to IEC 60034-1. Current and voltage values are indicated as root-mean-square values. Selection data and operating curves are contained in a separate documentation "DOK-DRIVE*-MAIN*WZM****-AU01-MS-P"

²⁾ Rated current-carrying capacity acc. to VDE0298-4 (1992) and installation option B2 acc. to EN60204-1 (1993) at a 40°C ambient temperature

³⁾ Value without holding brake

⁴⁾ Value without holding brake, but with motor blower

⁵⁾ At 1m distance, with PWM = 4 kHz

Fig. 8-1: Data sheet 2AD184

8.2 Type code 2AD184

Abbrev. Column →		1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4								
Example:		2	A	D	1	8	4	C	-	B	3	5	O	C	1	-	C	S	0	6	-	A	2	V	1																												

1. Product
 1.1 2AD..... = 2AD

2. Motor size
 2.1 184..... = 184

3. Motor length
 3.1 Lengths = C, D

4. Mounting style
 4.1 Flange and foot mounting = B35

5. Position of power connection ①
 5.1 left = L
 5.2 top = O
 5.3 right = R

6. Output direction of power connection ①
 6.1 Junction box connected to side A = C
 6.2 Junction box connected to side B = D
 6.3 Junction box connected on the right = E
 6.4 Junction box connected on the left = F

7. Cooling mode ②
 7.1 axial blower, blowing (400 V) = 1
 7.2 radial blower, top (400 V) = 3
 7.3 radial blower, right (400 V) = 6
 7.4 radial blower, left (400 V) = 8

8. Windings code
 8.1 2AD184C..... = CS
 8.2 2AD184D..... = CS, DS

9. Holding brake
 9.1 without holding brake = 0
 9.2 with holding brake 300 Nm, electrical clamp = 1
 9.3 with holding brake 240 Nm, electrical release, heavy-duty... = 3

10. Motor encoder
 10.1 without motor encoder = 0
 10.2 digital servo feedback = 6
 10.3 digital servo feedback with integrated multiturn absolute encoder = 7
 10.4 incremental encoder, 2500 increments. = D

11. Driven shaft

		plain shaft	with key	
			balanced with entire key	balanced with half key
11.1	without shaft sealing ring	A	B	E
11.2	with shaft sealing ring	C	D	H

INN-41-01-T18-04-M06-2AD3.EPS

Fig. 8-2: 2AD184 Type code (1)

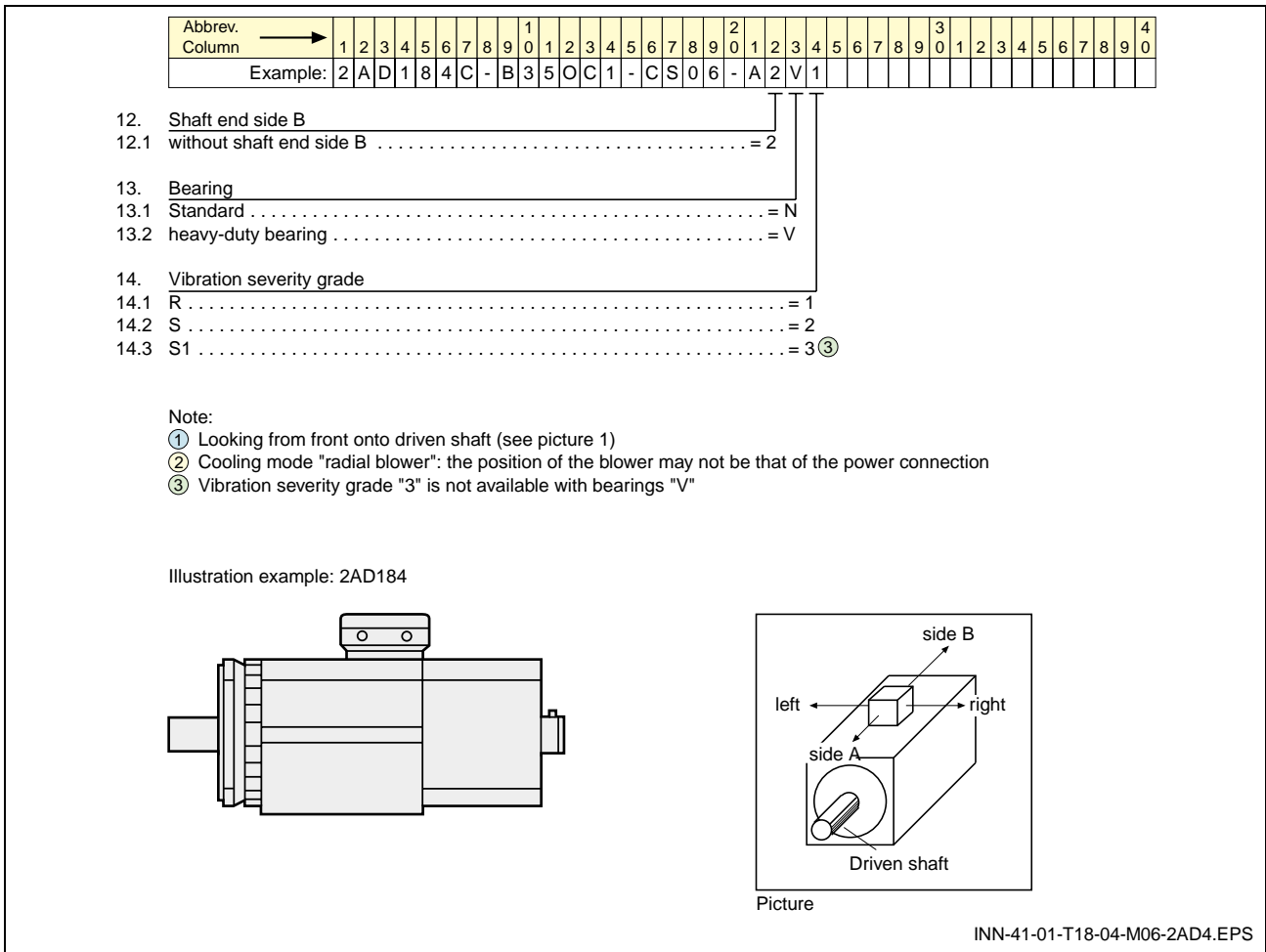


Fig. 8-3: 2AD184 Type code (2)

Note:

- Detailed explanations of individual options are contained in Chapter 4 "Definitions".
- Check that the individual options are available before ordering from your BOSCH REXROTH sales representative.

8.3 Dimensions sheet 2AD184

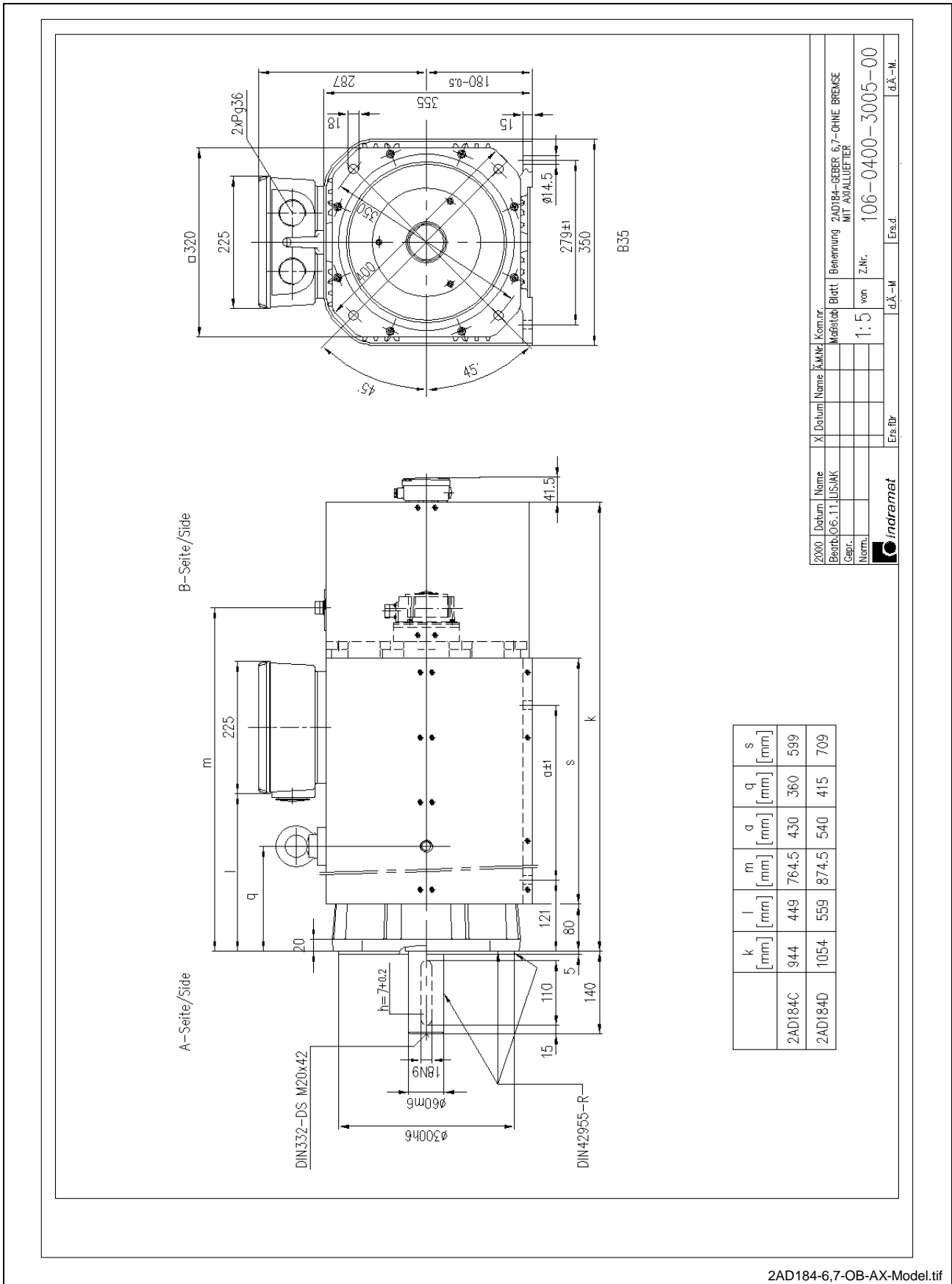
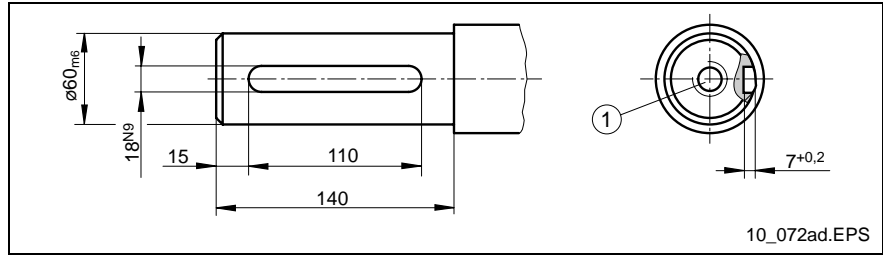


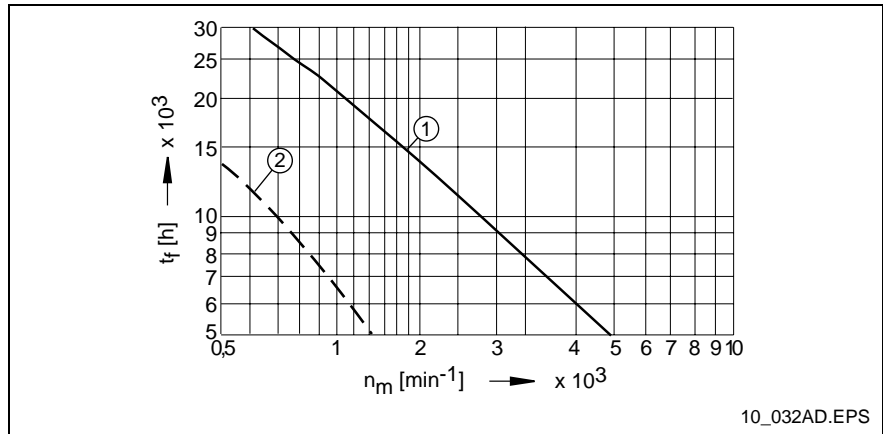
Fig. 8-4: 2AD184 Dimensions sheet, Axial blower without brake



(1): Centering bore hole M20 x 42 DS acc. to DIN 332. Balancing tolerance R acc. to DIN 42955. Corresponding keys A18 x 11 x 110 acc. to DIN 6885 (included in delivery).

Fig. 8-5: 2AD184, Output shaft with keyway

8.4 Grease life 2AD184

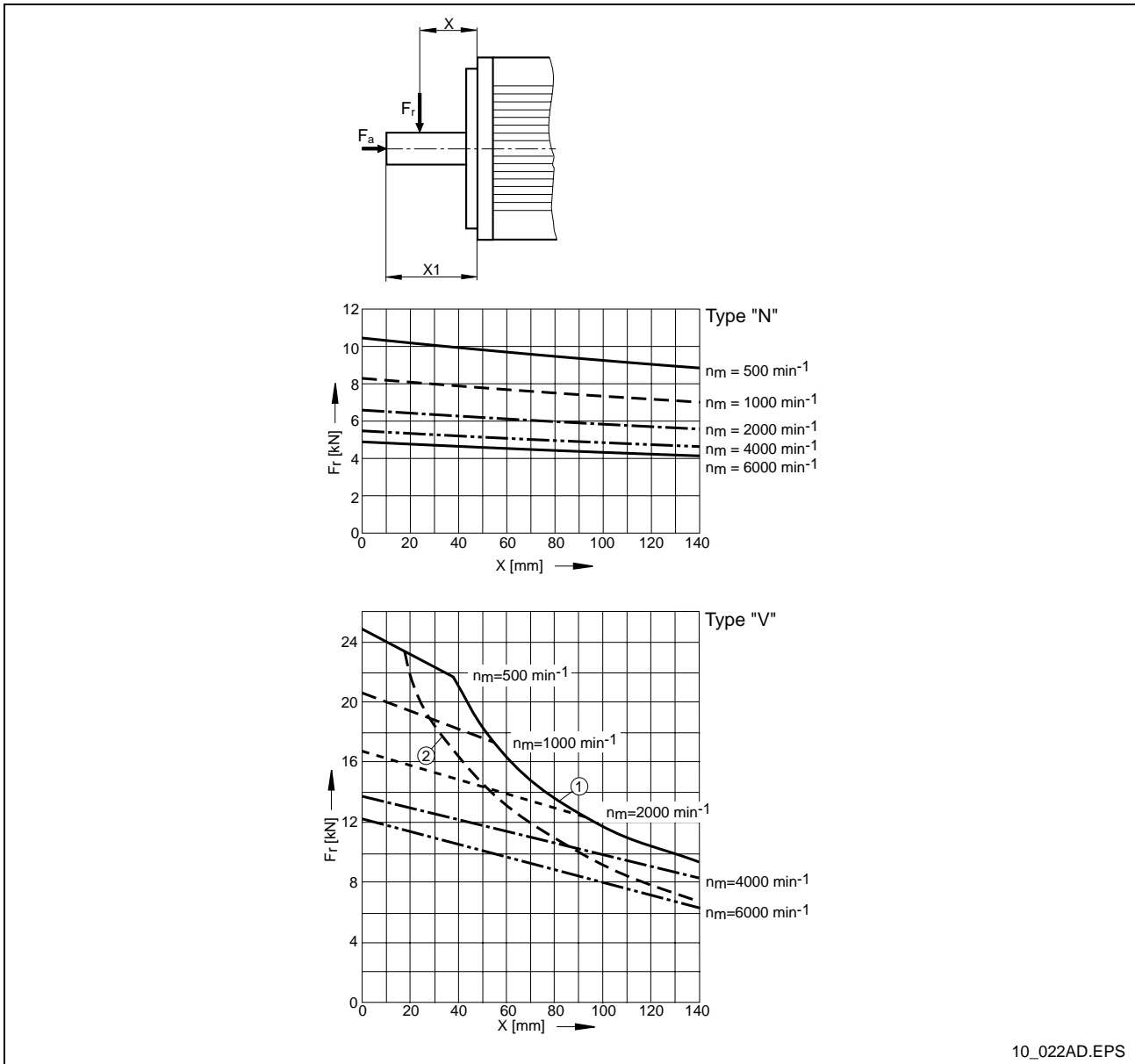


tf: grease life
 nm: mean speed
 (1): Standard bearing
 (2): Heavy-duty bearing

Fig. 8-6: 2AD184 Grease life

Note: The grease life shown was determined under optimal operating conditions. Deviations to these conditions may influence the grease life in a negative manner.

8.5 Shaft load 2AD184



- F_r : Permissible radial force allowed for a mechanical lifetime of $L_h = 20,000$ operating hours
 - F_a : Permissible axial force. Max. 50N in all installation positions
 - X : Distance between the location of the resultant radial force F_r and the motor flange
 - X_1 : Permissible effective range of radial force F_r
 - n_m : Mean speed
 - (1): Load limit for output shaft without key
 - (2): Load limit for output shaft with key
 - "N": Standard bearing
 - "V": Heavy-duty bearing
- Fig. 8-7: 2AD184, Shaft load

Note: 2AD184 motors with heavy-duty bearings must be operated with a minimum radial force of $F_r \geq 2$ kN.

9 Technical data 2AD200

9.1 Data sheet

Designation	Symbol	Unit	2AD200		
Motor data ¹⁾					
Length			C		
Winding			AS		
Rated torque	M_N	Nm	500		
Rated speed	n_N	rpm	1,500		
Rated power	P_N	kW	78.5		
Rated current	I_N	A	184.6		
Standstill continuous current	I_1	A	= I_N		
Standstill continuous torque	M_1	Nm	= M_N		
Derating speed	n_1	rpm	= n_N		
Min. cross-section of power connection ²⁾	A	mm ²	2 x 25		
Moment of inertia of rotor ³⁾	J_m	kgm ²	0.85		
Mass ⁴⁾	m	kg	450		
Maximum speed	n_{max}	rpm	5,000		
Thermal time constant	t_{th}	min			
Noise level ⁵⁾	L_p	dB(A)	77		
Permissible ambient temperature	T	°C	0...40		
Insulation class acc. to DIN VDE 0530-1			F		
Class of motor protection			IP65		
Class of blower protection			IP24		
Holding brake (optional)			electr. lock	electr. released	
Transferable torque	M_4	Nm	not available		
Connection voltage	U_N	V			
Rated current	I_N	A			
Moment of inertia	J_m	kgm ²			
Maximum permissible brake energy	W_{max}	Ws			
Release delay	t_i	ms			
Lock delay	t_k	ms			
Mass	m	kg			
Motor blower			Axialblower		Radialblower
Air current			B →A blowing	A →B suction	B →A blowing
Power consumption	S_N	VA	600		340
Nominal voltage	U_N	V	3 x 400 V, 50/60 Hz, ± 15 % 3 x 460 V, 60 Hz, ± 10 %		
Medium air volume	V	m ³ /h	2,500	2,125	1,200
¹⁾ Values determined according to IEC 60034-1. Current and voltage values are indicated as root-mean-square values. Selection data and operating curves are contained in a separate documentation "DOK-DRIVE*-MAIN*WZM****-AU01-MS-P" ²⁾ Rated current-carrying capacity acc. to VDE0298-4 (1992) and installation option B2 acc. to EN60204-1 (1993) at a 40 °C ambient temperature ³⁾ Value without holding brake ⁴⁾ Value without holding brake, but with motor blower ⁵⁾ At 1m distance, with PWM = 4 kHz					

Fig. 9-1: Data sheet 2AD200

9.2 Type code 2AD200

Abbrev.	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0								
Column →																																																
Example:	2	A	D	2	0	0	C	-	B	3	5	O	B	1	-	A	S	0	3	-	A	2	N	1																								

1. Product

1.1 2AD = 2AD

2. Motor size

2.1 200 = 200

3. Motor length

3.1 Length = C

4. Mounting style

4.1 Flange- and foot mounting = B35

5. Position of power connection ①

5.1 top = O

5.2 left = L

5.3 right = R

6. Output direction of power connection ①

6.1 Junction box connected to side A = A

6.2 Junction box connected to side B = B

6.3 Junction box connected on the left = L

6.4 Junction box connected on the right = R

7. Cooling mode ②

	Axial blower		Radial blower			
	Air flow		Blower arrangement			
	blowing	in-take	top	right	below	left
7.1	1	2	3	6	7	8

8. Windings code

8.1 2AD200C = AS

9. Holding brake

9.1 without holding brake = 0

10. Motor encoder

10.1 High-resolution motor encoder = 3

10.2 digital servo feedback = 6

10.3 digital servo feedback with integr. multiturn absolute encoder = 7

11. Driven shaft

		with key	
		balanced with entire key	balanced with half key
11.1	without shaft sealing ring	A	E
11.2	with shaft sealing ring	C	H

INN-41-01-T20-00-M04-2AD3.EPS

Fig. 9-2: 2AD200 Type code (1)

9.3 Dimensions sheet 2AD200

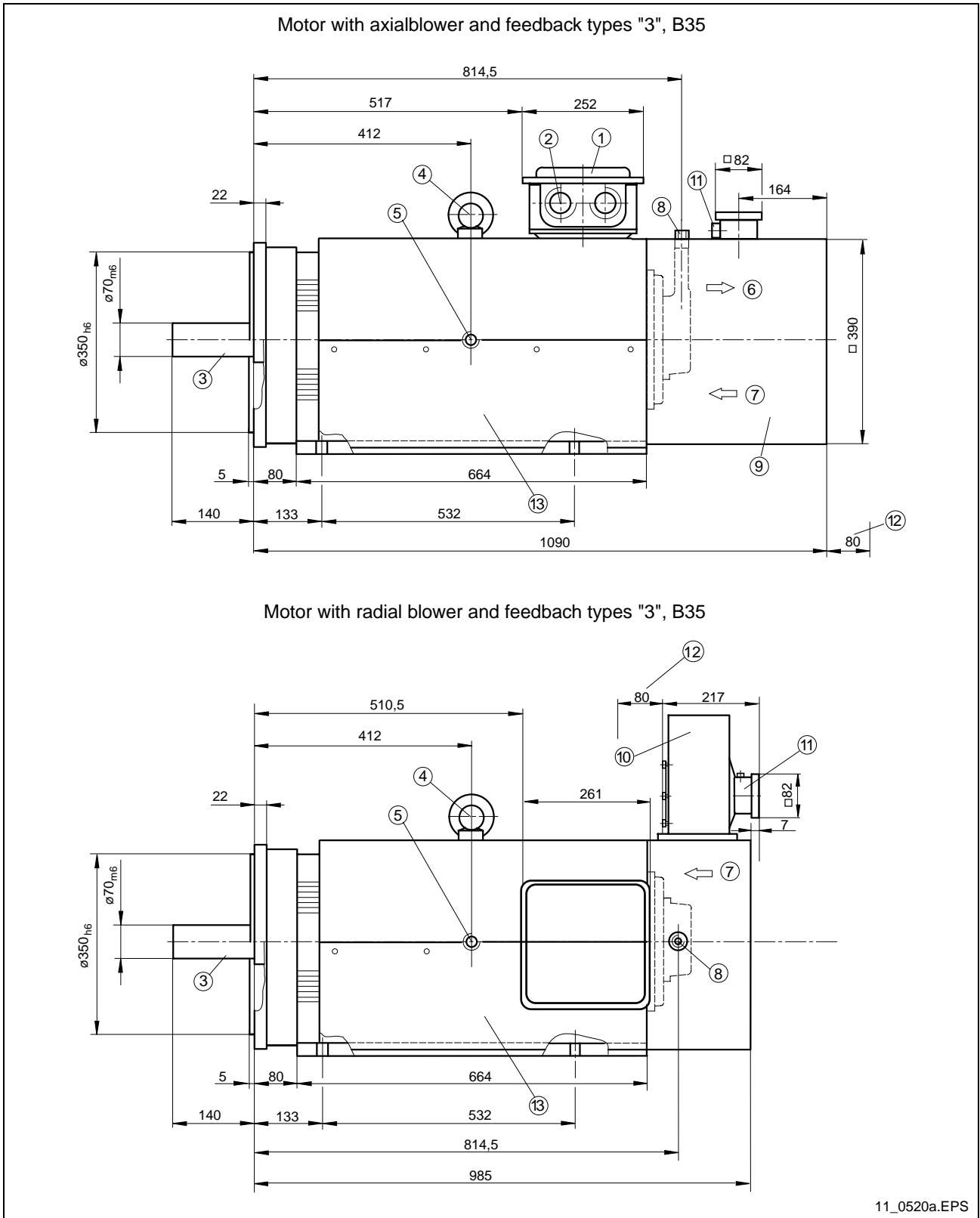


Fig. 9-4: Dimensions sheet 2AD200 (1)

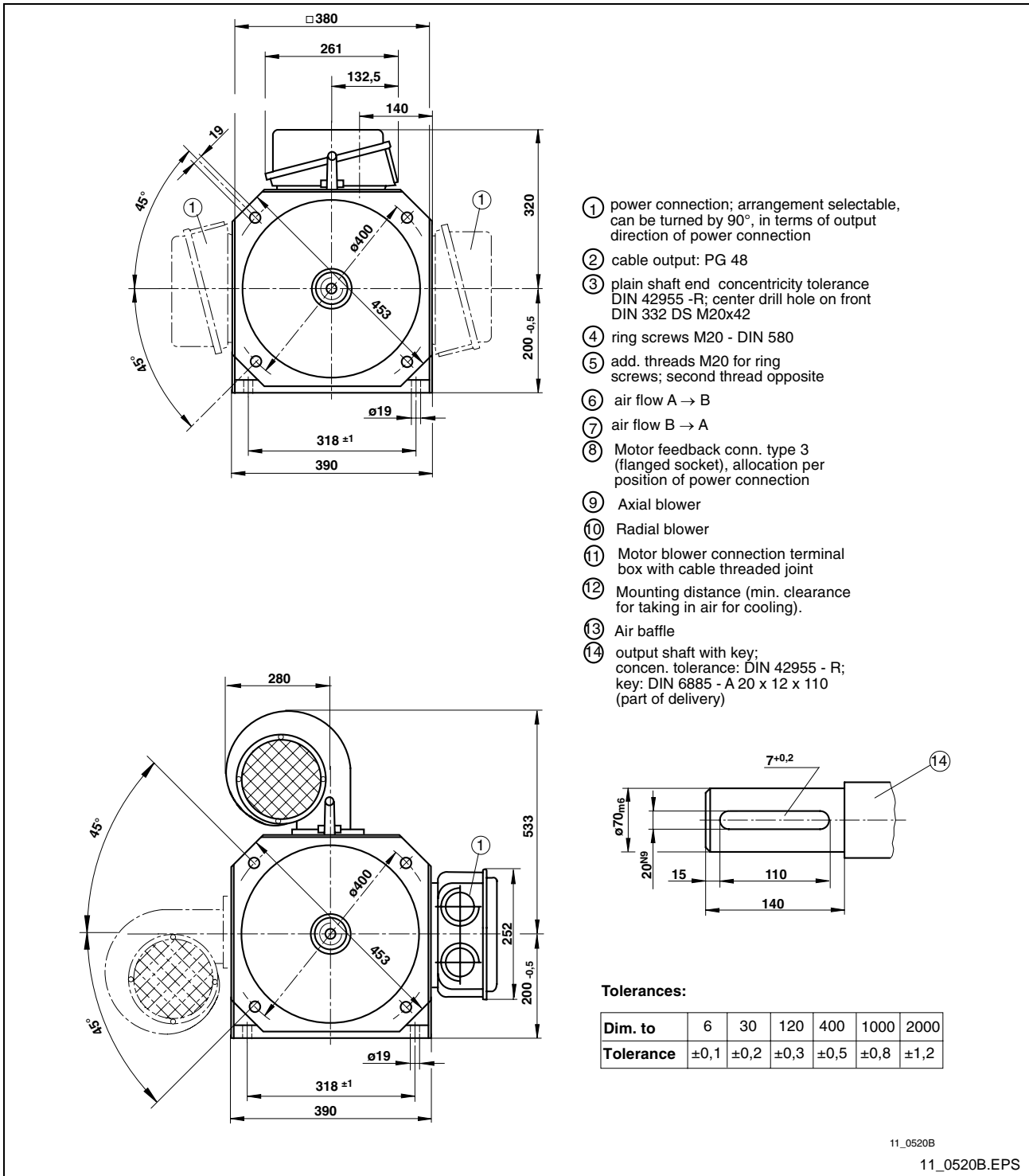


Fig. 9-5: Dimensions sheet 2AD200 (2)

Feedback type "6", "7"

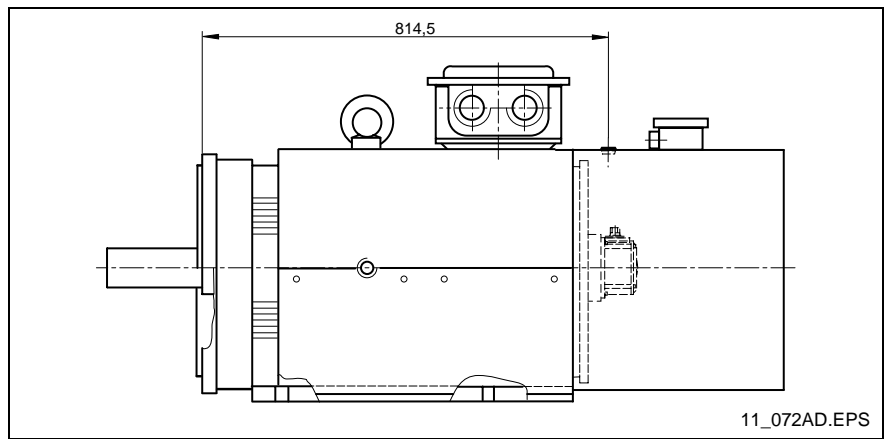
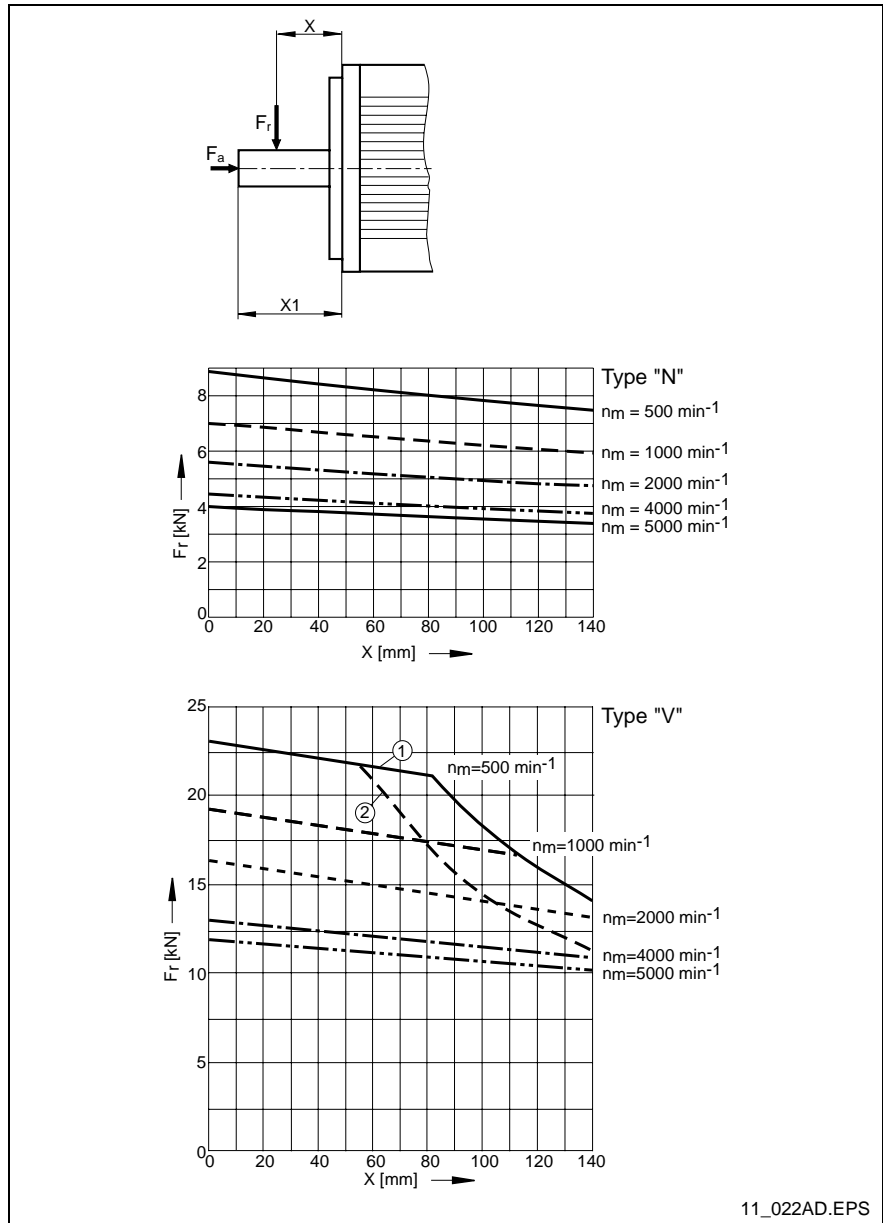


Fig. 9-6: 2AD200 with feedback type "6", "7"

9.4 Shaft load 2AD200

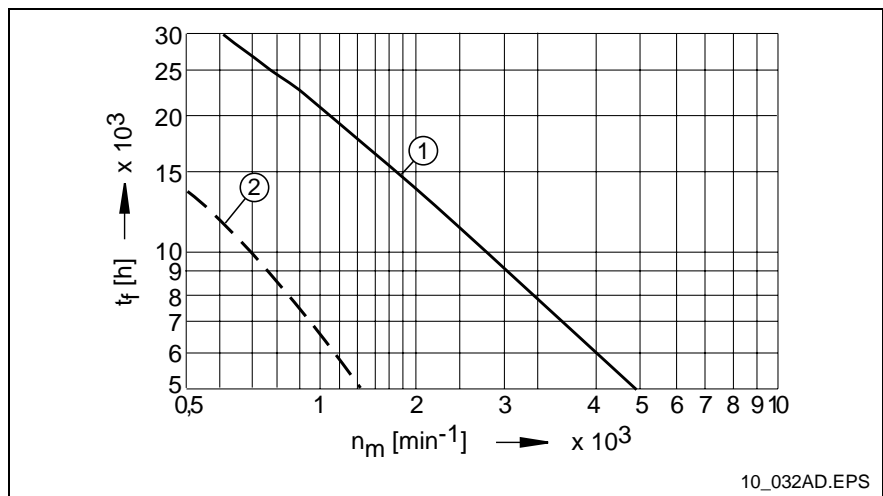


F_r : Permissible radial force allowed for a mechanical lifetime of $L_h = 20,000$ operating hours
 F_a : Permissible axial force. Max. 50N in all installation positions
 X : Distance between the location of the resultant radial force F_r and the motor flange
 $X1$: Permissible effective range of radial force F_r
 n_m : Mean speed
 (1): Load limit for output shaft without key
 (2): Load limit for output shaft with key
 "N": Standard bearing
 "V": Heavy-duty bearing

Fig. 9-7: 2AD200, Shaft load

Note: 2AD200 motors with heavy-duty bearings must be operated with a minimum radial force of $F_r \geq 2$ kN.

9.5 Grease life 2AD200



t_r : grease life
 n_m : mean speed
 (1): Standard bearing
 (2): Heavy-duty bearing
 Fig. 9-8: 2AD200 Grease life

Note: The grease life shown was determined under optimal operating conditions. Deviations to these conditions may influence the grease life in a negative manner.

10 Technical data 2AD225

10.1 Data sheet

Designation	Symbol	Unit	2AD225
Motor data ¹⁾			
Length			C
Winding			AS
Rated torque	M_N	Nm	592
Rated speed	n_N	rpm	1,500
Rated power	P_N	kW	93
Rated current	I_N	A	210
Standstill continuous current	I_1	A	= I_N
Standstill continuous torque	M_1	Nm	520
Derating speed	n_1	rpm	= n_N
Min. cross-section of power connection ²⁾	A	mm ²	2 x 35
Moment of inertia of rotor ³⁾	J_m	kgm ²	1.05
Mass ⁴⁾	m	kg	705
Maximum speed with standard bearings	n_{max}	rpm	5,000
Maximum speed with heavy duty bearings	n_{max}	rpm	4,500
Thermal time constant	t_{th}	min	130
Noise level ⁵⁾	L_p	dB(A)	78
Permissible ambient temperature	T	°C	0...40
Insulation class acc. to DIN VDE 0530-1			F
Class of motor protection			IP65
Class of blower protection			IP24

Holding brake (optional)			electr. lock	electr. released
Transferable torque	M_4	Nm	not available	
Connection voltage	U_N	V		
Rated current	I_N	A		
Moment of inertia	J_m	kgm ²		
Maximum permissible brake energy	W_{max}	Ws		
Release delay	t_i	ms		
Lock delay	t_k	ms		
Mass	m	kg		

Motor blower			Axialblower	
Air current			B →A blowing	A →B suction
Power consumption	S_N	VA	460	
Nominal voltage	U_N	V	3 x 400 V, 50/60 Hz, ± 15 % 3 x 460 V, 60 Hz, ± 10 %	
Medium air volume	V	m ³ /h	3,500	2,975

¹⁾ Values determined according to IEC 60034-1. Current and voltage values are indicated as root-mean-square values. Selection data and operating curves are contained in a separate documentation "DOK-DRIVE*-MAIN*WZM****-AU01-MS-P"

²⁾ Rated current-carrying capacity acc. to VDE0298-4 (1992) and installation option B2 acc. to EN60204-1 (1993) at a 40°C ambient temperature

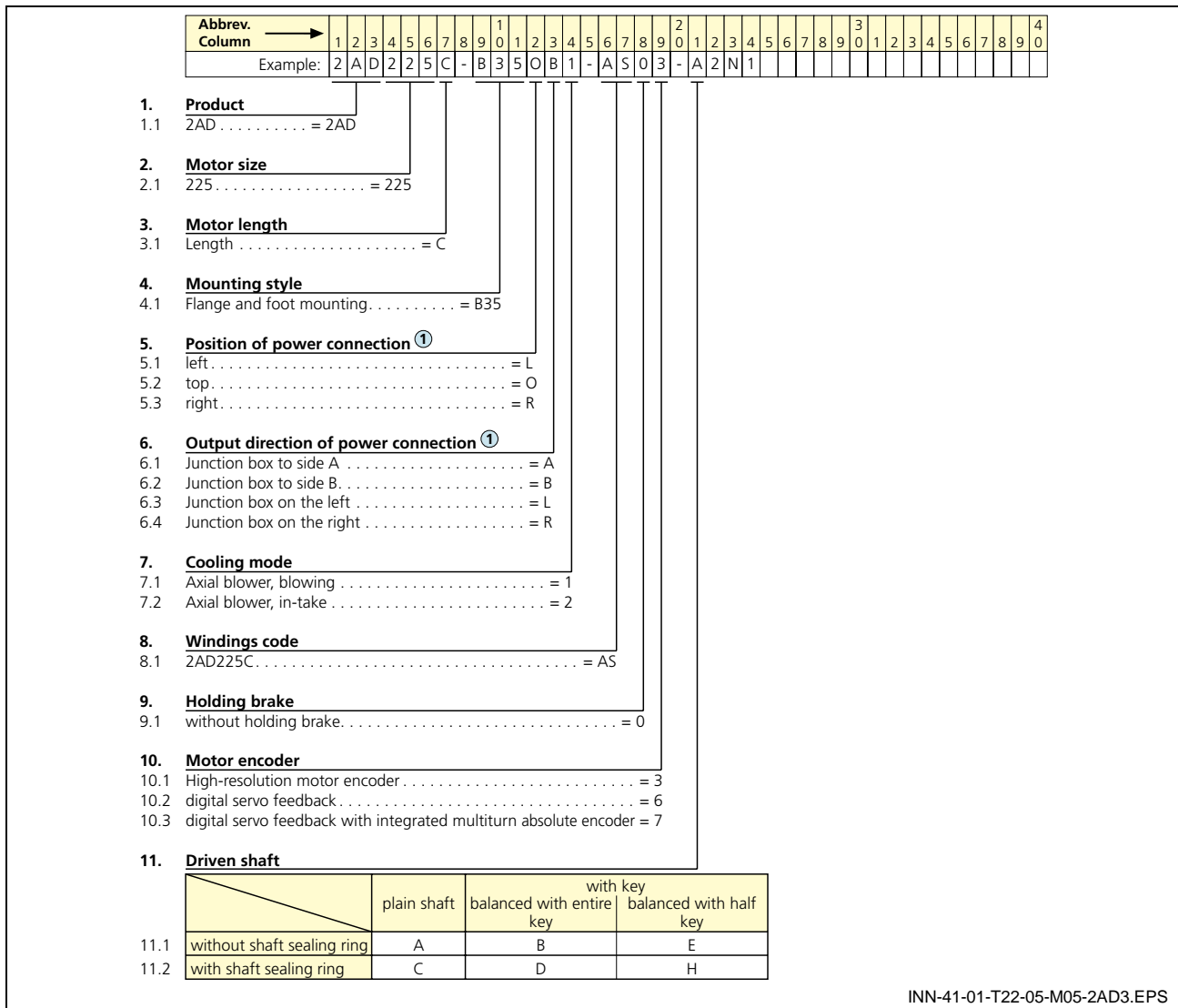
³⁾ Value without holding brake

⁴⁾ Value without holding brake, but with motor blower

⁵⁾ At 1m distance, with PWM = 4 kHz

Fig. 10-1: Data sheet 2AD225

10.2 Type code 2AD225



INN-41-01-T22-05-M05-2AD3.EPS

Fig. 10-2: 2AD225 Type code (1)

Abbrev.	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
Column	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0

Example: 2AD225C-B3O5B1-A S03-A2N1

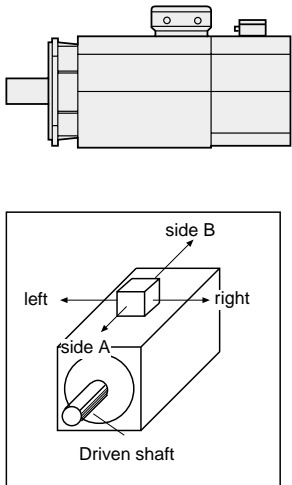
12. Shaft end side B
 12.1 without shaft end side B..... = 2

13. Bearings
 13.1 Standard..... = N
 13.2 heavy-duty bearings..... = V

14. Vibration severity grade
 14.1 R..... = 1
 14.2 S..... = 2
 14.3 S1..... = 3 ②

Note:
 ① Looking from front onto driven shaft (see picture 1)
 ② Vibration severity grade "3" is not available with bearings "V"

Illustration example: 2AD225



INN-41-01-T22-05-M05-2AD4.EPS

Fig. 10-3: 2AD225 Type code (2)

Note:

- Detailed explanations of individual options are contained in Chapter 4 "Definitions".
- Check that the individual options are available before ordering from your BOSCH REXROTH sales representative.

10.3 Dimensions sheet 2AD225

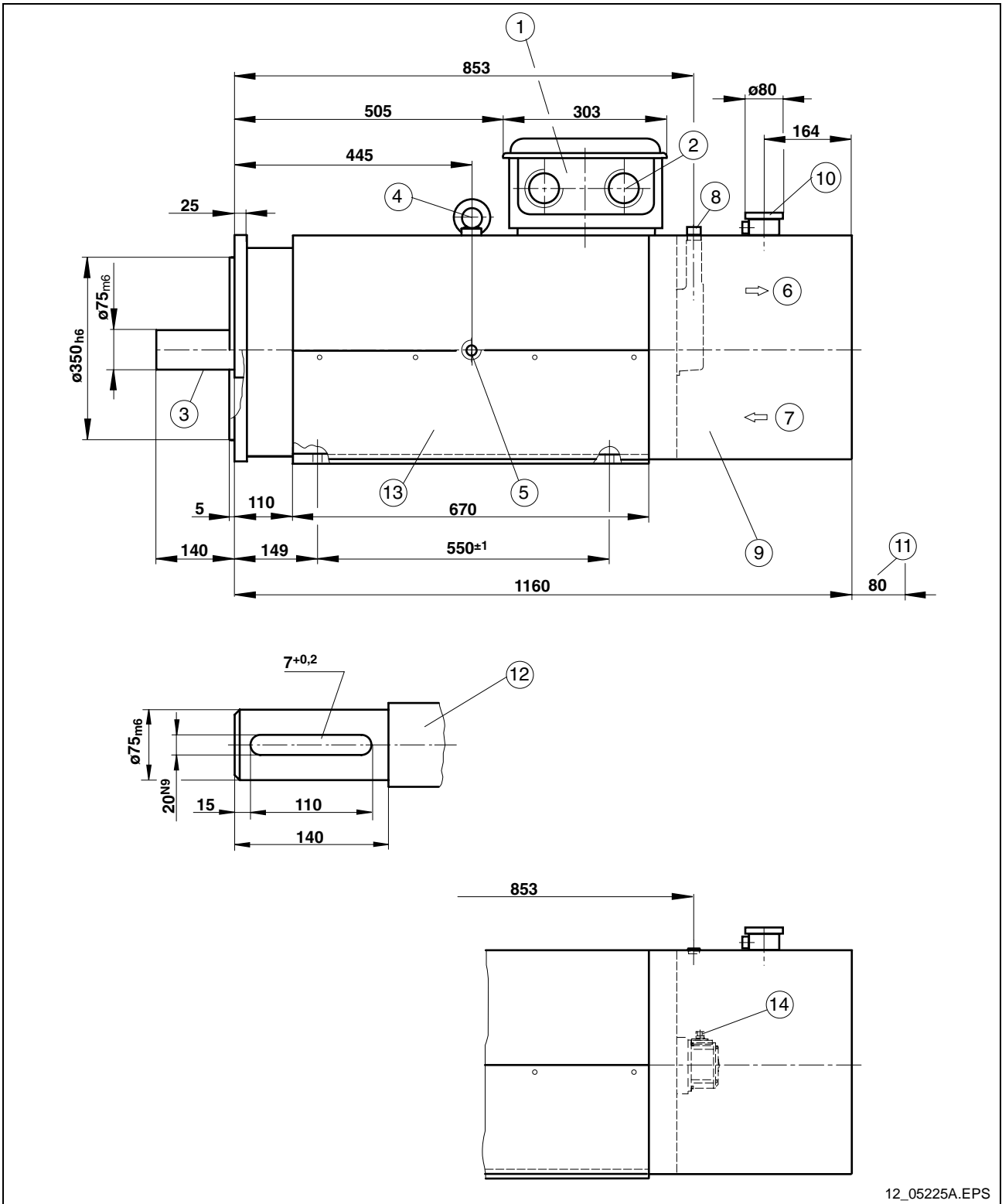
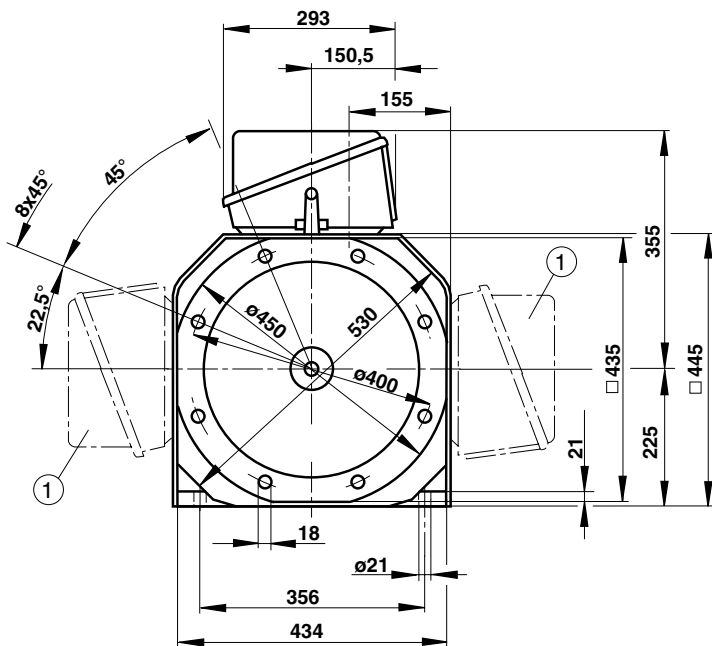


Fig. 10-4: Dimensions sheet 2AD225 (1)



- ① Power connection
- ② cable output: PG 48
- ③ plain shaft end concentricity tolerance DIN 42955 -R; center drill hole on front DIN 332 DS M20x42
- ④ ring screws M20 - DIN 580
- ⑤ add. threads M10 for ring screws; second thread opposite
- ⑥ air flow A → B
- ⑦ air flow B → A
- ⑧ Motor feedback conn. type 3 (flanged socket), allocation per position of power connection
- ⑨ Axial blower
- ⑩ Motor blower connection terminal box with cable threaded joint
- ⑪ Mounting distance (min. clearance for taking in air for cooling).
- ⑫ output shaft with key; concen. tolerance: DIN 42955 - R; key: DIN 6885 - A 20 x 12 x 110 (part of delivery)
- ⑬ Air baffle
- ⑭ Motor feedback conn. types 6, 7 (flange socket), arranged in terms of the position of the power connection

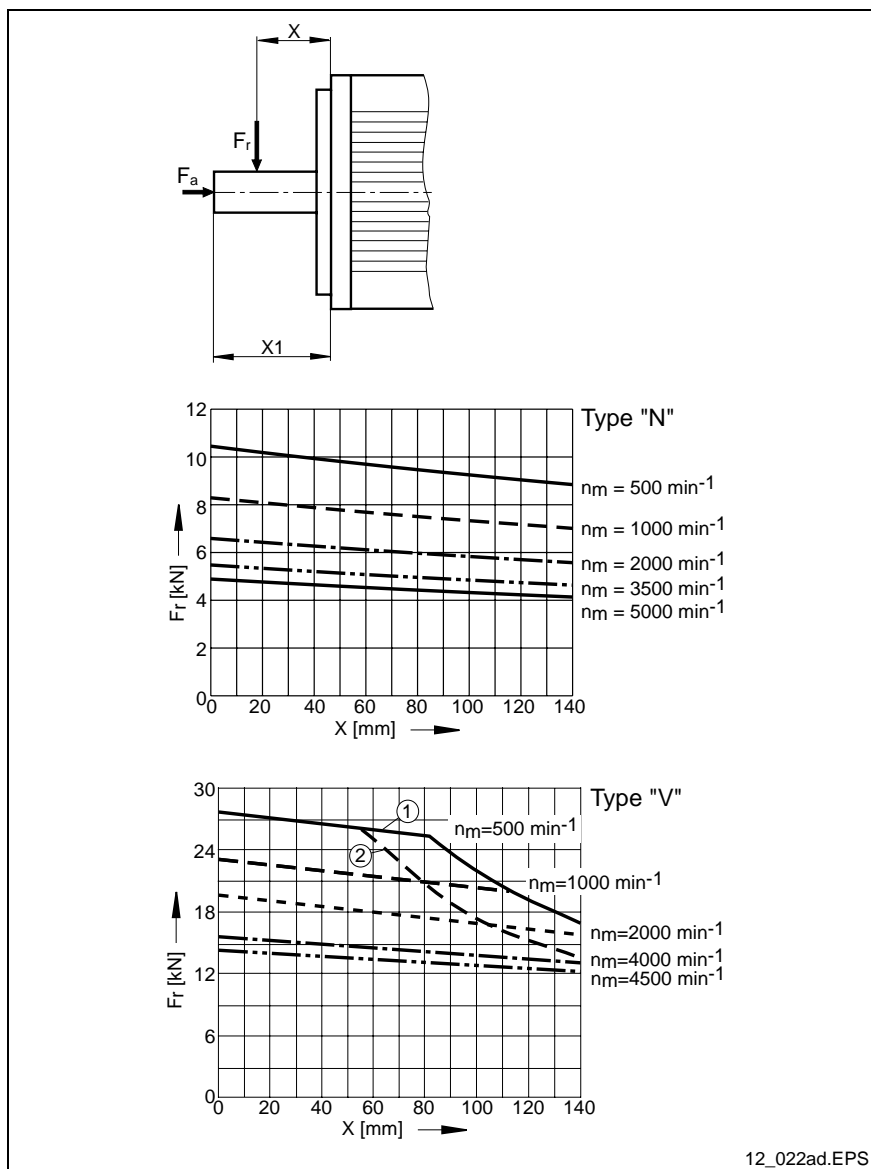
Tolerances:

Dim.	6	30	120	400	1000	2000
Tolerance	±0,1	±0,2	±0,3	±0,5	±0,8	±1,2

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Fig. 10-5: Dimensions sheet 2AD225 (2)

10.4 Shaft load 2AD225

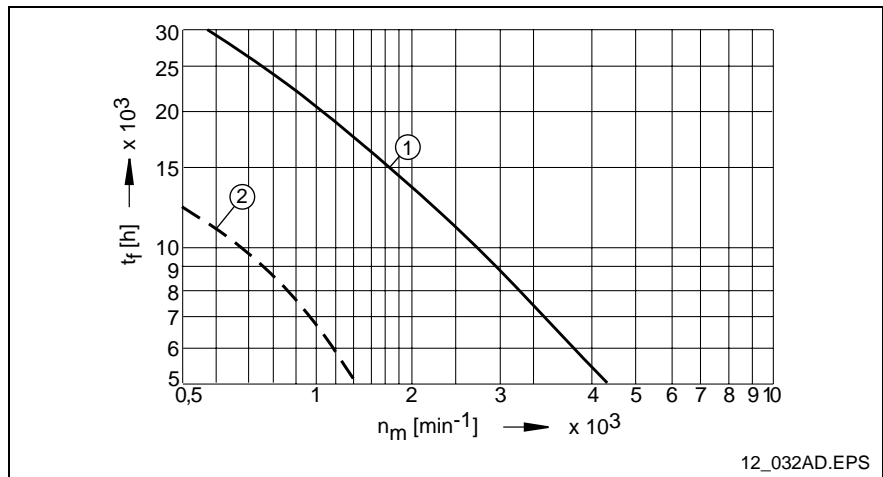


- F_r : Permissible radial force allowed for a mechanical lifetime of $L_h = 20,000$ operating hours
- F_a : Permissible axial force. Max. 50N in all installation positions
- X : Distance between the location of the resultant radial force F_r and the motor flange
- X_1 : Permissible effective range of radial force F_r
- n_m : Mean speed
- (1): Load limit for output shaft without key
- (2): Load limit for output shaft with key
- "N": Standard bearing
- "V": Heavy-duty bearing

Fig. 10-6: 2AD225, Shaft load

Note: 2AD225 motors with heavy-duty bearings must be operated with a minimum radial force of $F_r \geq 2 \text{ kN}$.

10.5 Grease life 2AD225



t_f : grease life
 n_m : mean speed
 (1): standard bearings
 (2): heavy-duty bearings

Fig. 10-7: 2AD225 Grease life

Note: The grease life shown was determined under optimal operating conditions. Deviations to these conditions may influence the grease life in a negative manner.

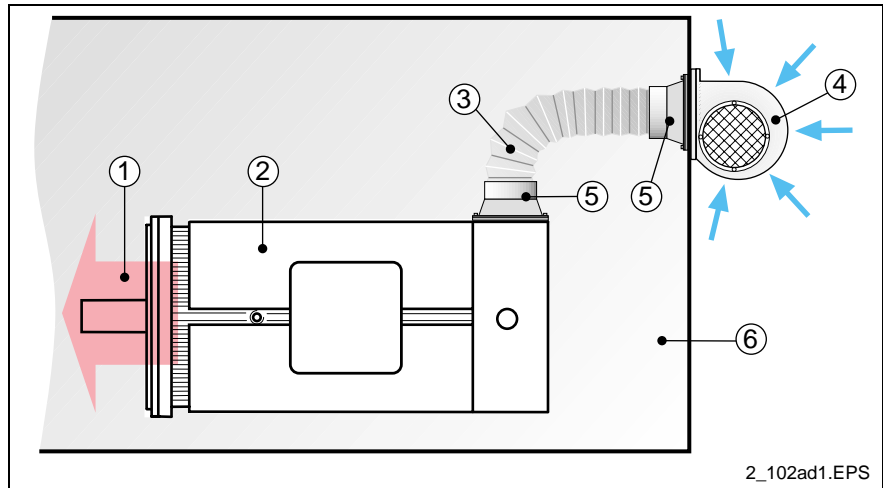
11 Accessories

11.1 Blower Cowl

When motors are used in a strongly polluted environment (e.g. dusts, oils, cutting materials and lubricants), clean air for motor cooling should be supplied externally via a hose or an air duct.

⇒ In this case, select motors with a radial blower.

Sample application



- (1): Air Exhaust
- (2): 2AD motor
- (3): Air duct (not included in scope of delivery)
- (4): 2AD radial blower, air entry
- (5): SUP-M01-2AD... (2 shown)
- (6): Working area

Fig. 11-1: 2AD blower cowl (example)

Note:

- For use according to the above example, the factory-attached radial blower must be removed from the motor and mounted separately.
- Two SUP-M01-2AD... blower cowl accessories are required for assembly according to the above example. Assembly instructions are supplied with the accessories.
- Retrofitting blower cowls is possible (Only certain motor variants allow radial blowers). Pay attention to the limitations of the corresponding type code.
- If Bosch Rexroth radial blowers are used, the air duct or hose may not be longer than 1 m; its path must not change direction by more than 90°.
- An air duct or hose does not belong to the supply program.

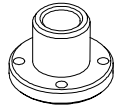
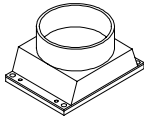
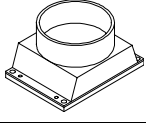
Blower cowl for	Type	Material number	Design
2AD104	SUP-M01-2AD100	in preparation	
2AD134	SUP-M01-2AD132	00268753	
2AD164	SUP-M01-2AD160	00275660	
2AD184	SUP-M01-2AD180	00268606	
2AD200	SUP-M01-2AD200	in preparation	
2AD225	SUP-M01-2AD225	in preparation	

Fig. 11-2: Accessory SUP-M01-2Adxxx

Radial blowers Radial blowers for 2AD motors are also available individually for special applications in hazardous locations.

⇒ See the additional notes in Chapter 13-10 "Notes Regarding Application and Explosion Protection".

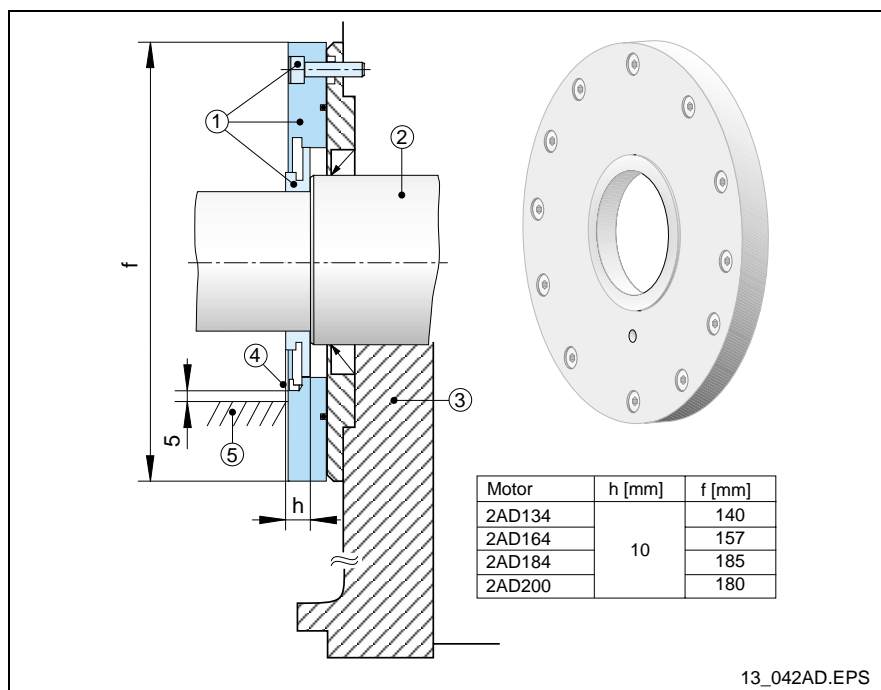
11.2 Labyrinth Seal

To protect the motor output shaft against spraying fluids, 2AD motors that are already equipped with the "shaft seal" option can be retrofitted with labyrinth seals (accessory SUP-M02-2AD...).

Labyrinth seal for	Type	Material number
2AD134	SUP-M02-2AD132	00273268
2AD164	SUP-M02-2AD160	00272843
2AD184	SUP-M02-2AD180	00273209
2AD200	SUP-M02-2AD200	00272846

Fig. 11-3: Accessory SUP-M02-2ADxxx

Accessory SUP-M02-2AD... is supplied complete with fastening screws and assembly instructions.



- (1): Labyrinth seal with fastening screws (scope of delivery)
 (2): Motor drive shaft end
 (3): Motor flange drive end
 (4): Drain hole
 (5): Max. permitted level of a fluid
 (h): Thickness of labyrinth seal
 (f): Diameter

Fig. 11-4: 2AD labyrinth seal

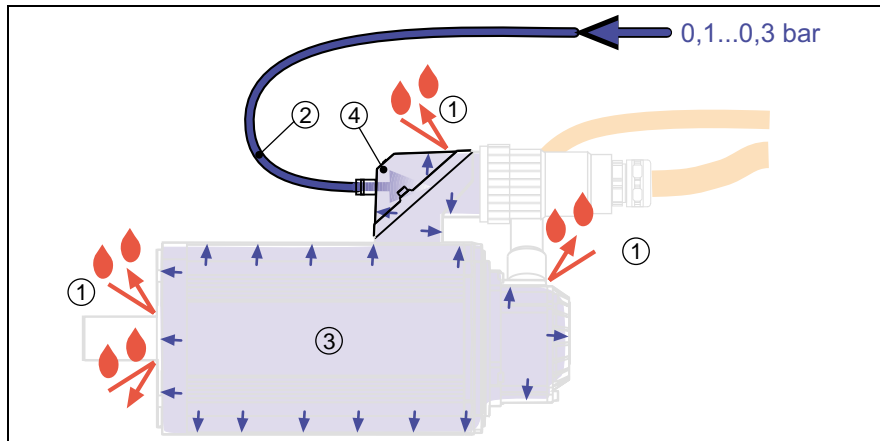
Note:

- Pay attention to the assembly instructions for accessory SUP-M02-2AD... (in the scope of delivery).
- The labyrinth seal is effective only above approx. 200 rpm and may be attached only to motors with factory-mounted shaft seals.
- Seeping fluids can lead to damage to the motor. The integrity of the motor seal is ensured only according to the guidelines of the corresponding motor protection class.

11.3 Air-Pressure Connector Kits

The standard international protection (IP) rating may not be sufficient for use under some adverse conditions. High demands may be made on the integrity of motor seals when the motors are used in areas where oily lubricating coolants are used. In these cases, we recommend using air-pressure kits for our motors.

The air-pressure kit supplies a positive pressure to the motor interior via the special connector; this prevents the penetration of, for example, creep oil and coolant lubricants.



- (1): Splashing water, coolant lubricant
- (2): Compressed-air line (plastic pipe, type PA 4 x 0.75, or equivalent)
- (3): Positive pressure inside the motor
- (4): Air-pressure connector accessory

Fig. 11-5: Example: motor with air-pressure connector

Special air-pressure connectors are available as accessories for 2AD motors with frame sizes of 104 to 164; the motors must be equipped with a motor flange socket. The special connectors are installed by simply replacing the motor flange socket cover.

Ordering name of accessory sets

Motor flange socket (type)	Description	Motor
INS0480	SUP-M01-MHD order number 283006	see Fig.12.2 Overview of power connection
INS0380	SUP-M02-MHD order number 283007	

Fig. 11-6: Air-Pressure Connector Kit Accessories

Note: Pay attention to the documentation “Sealing Air Accessory for Synchronous Servomotors”, Mat. No. 283689, as well as the assembly instructions for the accessory kit (in the scope of delivery).

11.4 Gearboxes

In certain conditions, fixed-ratio or two-speed gearboxes can be attached to 2AD motors.

Type	Type of Gearbox	2AD requirements	Supplier
GTS.. GTM..	Fixed-ratio planetary gearbox	Smooth motor shaft	Bosch Rexroth 1)
2K...	2-speed planetary gearbox 2)	Motor shaft with keyway and shaft seal	ZF Maschinenbetriebe GmbH Postfach 2549 88015 Friedrichshafen, Germany Tel. +49-(0)7541-77-0
58...	Worm gear 2)	Smooth motor shaft 2)	ATLANTA Zahnrad- und Werkzeugfabrik Seidenspinner GmbH & Co. Karl-Benz-Str. 16 74321 Bietigheim- Bissingen, Germany Tel. +49-(0)7142-7001-0
1) Gearboxes must be ordered as a separate sub-item of the motor. 2) Rexroth is not the manufacturer of these gearboxes. Clarify compatibility and technical details with the manufacturer.			

Fig. 11-7: 2AD motors with gearbox

Note: Only low axial shaft loads are permitted for 2AD motors (see the corresponding Chapter "2AD.. Technical Data" and Chapter 13 "Notes Regarding Application"). Therefore, 2AD motors are **not** suitable for machine elements that generate axial loading of the 2AD motor (e.g. helical driving pinion).

12 Connection System

12.1 Notes

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 plugged connections that are optimally adapted to the products and to a wide range of demands.

Decisive advantages of Bosch 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, resistant against hydrolysis, silicon- and halogen-free, low adhesion
- Recognized by 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 manufactures may not fulfill these criteria.

Bosch Rexroth shall not be held responsible for resulting failures or damage.



You can find additional information ...

- for selecting power and encoder cables for motor frame sizes **2AD1x4 and 2AD200/225** in the following descriptions of this section as well as in the documentation "Selecting DIAX04 and ECODRIVE... Connection Cables", Mat. No. 00280894.
- for assembling **cables and plugs**, as well as technical data, in the documentation "Indramat Connection Techniques, Assembling and Tools...", Mat. No. 00280895.

12.2 Diagram

The connections shown below are required to operate a 2AD motor.

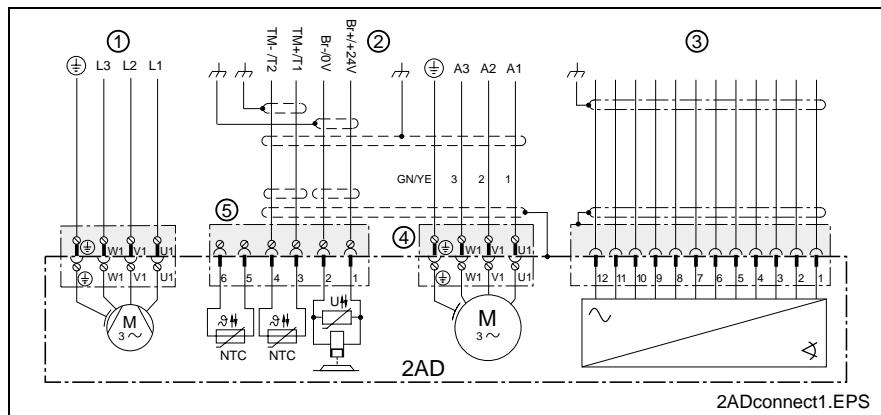


Fig. 12-1: 2AD connection diagram (sample plugged connection)

- (1) Blower** Depending on the motor type, a motor blower is connected either with 2 or with 3 phases to the power supply via blower cables and a motor protection switch (example: 3 phases). Blower units work independently of the control device. Blower cables and protective circuit breakers are not in the scope of delivery of Bosch Rexroth. The model whether the blower is supplied with a terminal box or a plug connection depends on the selected design of the power connector.
- (2) Brake** The optional brake can be triggered by an external control (PLC) or with appropriate control devices. The wires for connecting the brake are led out with the power connector to the terminal box or the flange socket.
- (3) Encoder** The encoder connection has a flange socket or plug connection design. The pin assignments depend on the encoder model. The position of the encoder connection on the motor depends to the selected position of the power connector.
- (4) Power** The power connector can be designed as a flange socket or a terminal box with various exit directions (example: terminal box). Only in the case of terminal boxes can the exit direction be changed after delivery.
- (5) Temperature sensor** The temperature sensors (NTC thermistors) 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 sensor are led out with the power connector to the terminal box or the flange socket. If a sensor fails, the remaining sensor can continue to be used after checking if it functions. Pay attention to the notes at the end of this Chapter as well as to Chapter 16 "Operating 2AD Motors".

12.3 Power Connector

Overview

For most 2AD motors, you can choose between a plug connection and a terminal box. Please observe the individual type code columns. Plugs and cables are not included in the scope of delivery of the motor and must be ordered as separate items.

Motor		Flange socket ¹⁾	Terminal box		
2AD	Winding		U-V-W	Ground ²⁾ (PE)	PG ³⁾
2AD104B	CS	INS480	Ferrules	M6	29
2AD104B	ES	INS480	Ferrules	M6	29
2AD104C	CS	INS480	Ferrules	M6	29
2AD104C	DS	INS480	Ferrules	M6	29
2AD104D	ES	INS480	Ferrules	M6	29
2AD104D	FS	INS480	Ferrules	M6	29
2AD104D	GS	INS480	Ferrules	M6	29
2AD104D	HS	INS480	Ferrules	M6	29
2AD134B	ES	INS480	Ferrules	M8	29
2AD134B	FS	INS480	Ferrules	M8	29
2AD134B	GS	INS480	Ferrules	M8	29
2AD134C	DS	INS380	Ferrules	M8	29
2AD134C	FS	INS380	Ferrules	M8	29
2AD134C	HS	INS380	Ferrules	M8	29
2AD134D	AS	INS380	Ferrules	M8	29
2AD134D	CS	INS380	Ferrules	M8	29
2AD134D	DS	INS380	Ferrules	M8	29
2AD134D	ES	INS380	Ferrules	M8	29
2AD164B	BS	INS380	Ferrules	M8	29
2AD164B	DS	INS380	Ferrules	M8	29
2AD164B	ES	INS380	Ferrules	M8	29
2AD164C	BS	INS380	Ferrules	M8	29
2AD164C	ES	INS380	Ferrules	M8	29
2AD164C	FS	INS380	Ferrules	M8	29
2AD184C	CS	-	Ferrules	M10	36
2AD184D	CS	-	Ferrules	M10	36
2AD184D	DS	-	Ferrules	M10	36
2AD200C	AS	-	M12	M12	48
2AD225C	AS	-	M12	M12	48

1) Flange socket INS480: Mating connector INS481
Flange socket INS380: Mating connector INS381

2) Connection via ring terminals, which have M6, M8, M10 or M12 holes. For the cross-sectional area (gauge) of the ground-wire, see the respective motor data sheets.

3) PG thread is integrated in the ready-made Bosch Rexroth IKG-type power cable.

Fig. 12-2: Overview of 2AD power connectors

Flange Socket

2AD motors for drive combinations with INDRADrive, ECODrive and DIAX04 series and Bus voltage up to 750V equipped with **INS0480** or **INS0380 flange sockets for plugs with a bayonet connection.**

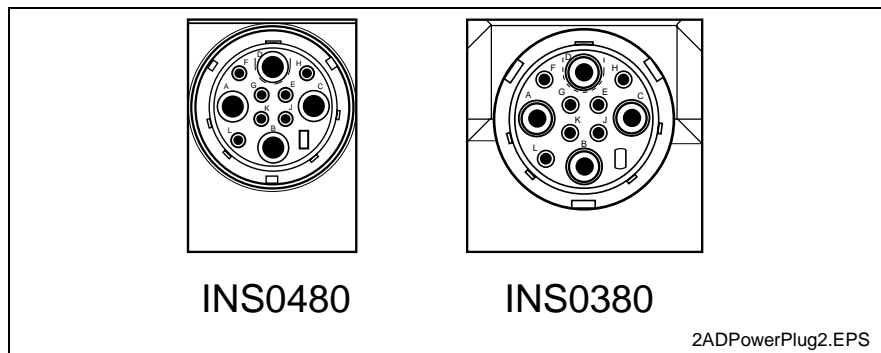


Fig. 12-3: 2AD flange socket power connectors

2AD	104/134	134/164	Description
Flange socket	INS0480	INS0380	
Power supply pins	A,B,C	A,B,C	U1,V1,W1
PE (Ground) pin	D	D	\perp
Temp. sensor pins	E,H	E,H	T1,T2
Brake pins	F,G	F,G	Br+, Br-
Unused pins	J,K,L	J,K,L	
Mating connector	INS0480	INS0381	
Connection with plug	Bayonet connection	Bayonet connection	

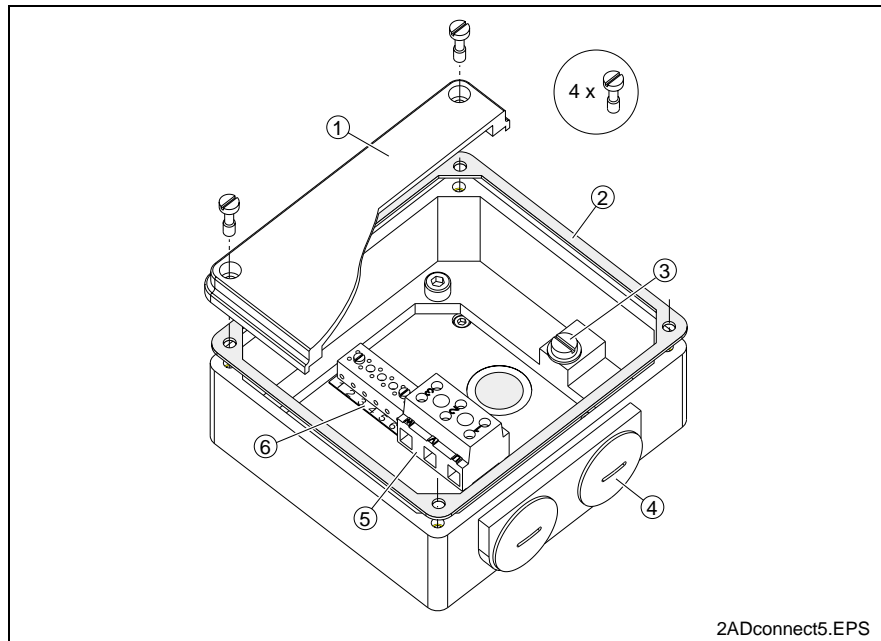
Fig. 12-4: 2AD power connector assignment

Pay attention to the following when selecting cable connections:

- The motor is usually equipped with a **flange socket** with an **external thread**.
- The connection cable is usually equipped with a **plug** with a **bayonet connection**.
- The flange socket on the motor side and the plug on the cable side are connected and screwed on. They are therefore structured as a mirror image, i.e. with different poles.
- The mechanical codings of the flange socket and the plug must be compatible.
- The design of the power cable also depends on the control device used. Please observe the documentation of the control device.

Terminal Box

2AD motors for drive combinations with INDRADRIIVE, ECODRIIVE and DIAx04 series and Bus voltage up to 750V equipped with a **terminal strip** in the terminal box.



- | | | | |
|------|------------------------|------|----------------|
| (1): | Cover | (2): | Gasket |
| (3): | Ground (PE) connection | (4): | Cable entry |
| (5): | Power connection U-V-W | (6): | Terminal strip |

Fig. 12-5: 2AD terminal box with terminal strips

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

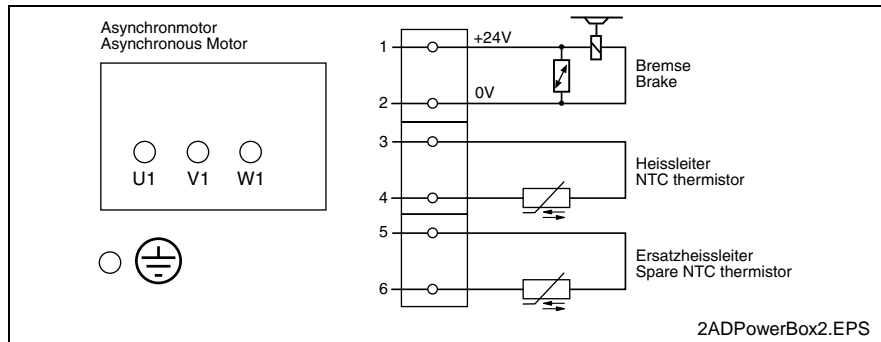


Fig. 12-6: 2AD terminal box connection

Note:

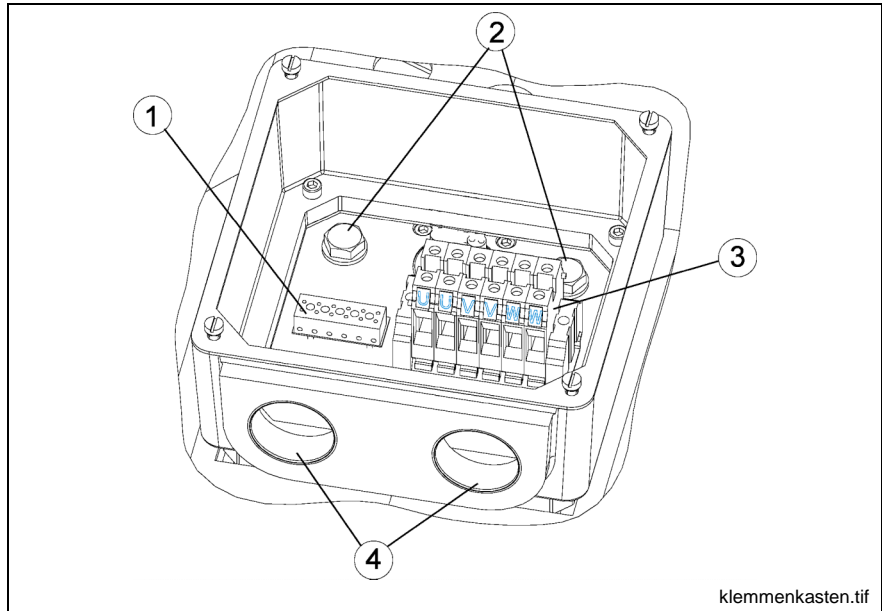
- The brake connections are assigned only if the 2AD motor was manufactured with the "holding brake" option.
- Only **one** contact pair of NTC resistor connectors 3-4 and 5-6 is assigned. The polarity within a pair of wires is not relevant.



The handling of the connections is described in Chapter 15 "Installation".

Double Cabling

A motor connection with two power cables is required if a corresponding single cable cannot be used due to the large bending radius or due to its dimensions. A double connection is only possible with Motors connections with a terminal box.



- 1: Terminals for temperature sensor/brake
- 2: Grounding connections (for ring terminals)
- 3: Terminals for power connection (for ferrules)
- 4: Cable duct for PG screws

Fig. 12-7: Terminal box

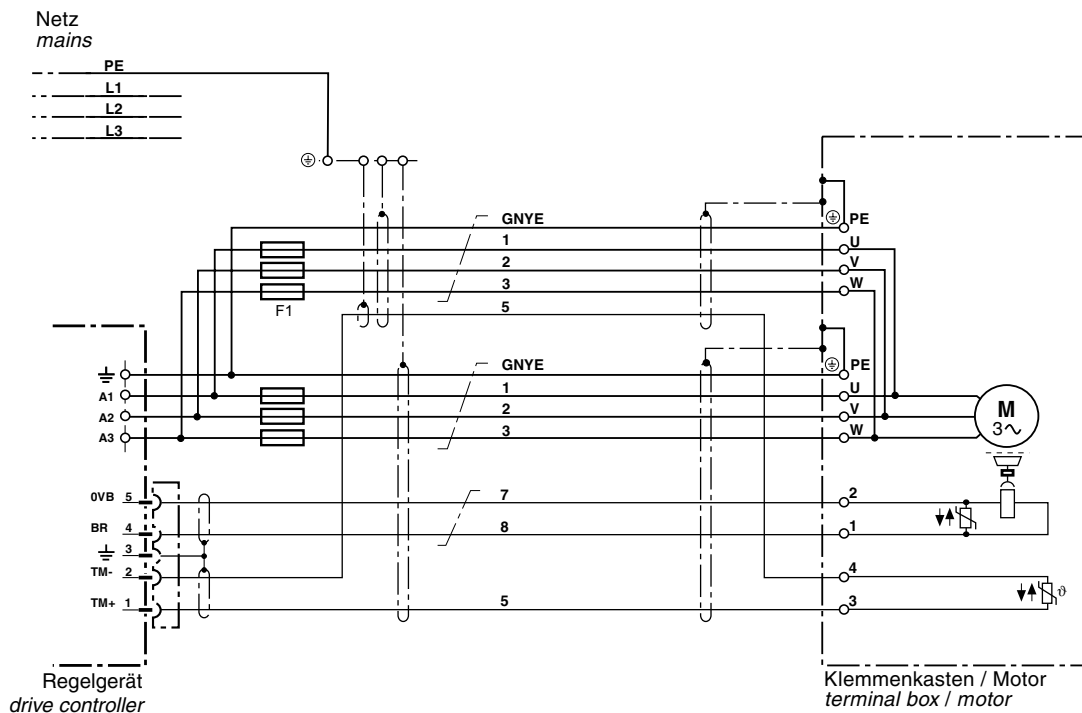


Fig. 12-8: Connection diagram

Notes:

- Wires not shown in the connection diagram are not required and must not be connected.
- F1 fuses (NH...) are sized according to the current rating of the corresponding cable cross-section. See the notes in the cable documentation mentioned below.
- The fuses should be installed in the switch cabinet so that they are as close as possible to the power output of the drive controller.
- The shields of the power cables should be connected to the switch cabinet using the largest possible surface area.
- Cable pairs must be properly connected to series terminal strips or to the terminal studs of the drive controllers; they must also fulfill safety regulations.

Therefore, observe the following documentation:

- “Electromagnetic Compatibility (EMC)...”: material number 259740
- documentation of the motor used
- documentation of the drive controller used

Further information regarding cables:

- “Selecting Connection Cables...”: material number 280894
- “Assembly Instructions for Cables...”: material number 280895

12.4 Encoder Connection

Overview

The encoder connection is designed as a flange socket on the motor housing or as a cable with a coupler. The cables for connecting the motor encoder and the device controller must have a compatible plug on the motor side.

Motor	Motor-side encoder connection for type key option:					
	6	7	8 1)	9 1)	C 1)	D
	Flange socket		10 m cable with coupling			Flange socket
2AD104	INS0638	INS0638	INS0676	INS0676	INS0675	INS0677
2AD134	INS0638	INS0638	INS0676	INS0676	INS0675	INS0677
2AD164	INS0638	INS0638	INS0676	INS0676	INS0675	INS0677
2AD184	INS0638	INS0638	-	-	-	-
2AD200	INS0638	INS0638	-	-	-	-
2AD225	INS0638	INS0638	-	-	-	-
Compatible mating connectors for... INS0224: INS0201, INS0309, INS0400, INS0401, INS0701 INS0638: INS0510, INS0511, INS0512, INS0513, INS0713 INS0515: INS0713 INS0675: INS0639 INS0676: INS0713 INS0677: INS0639 1): For explosion-protected systems						

Fig. 12-9: Overview of 2AD encoder connectors

Design

The flange sockets on the motor side have different designs and codings. The corresponding plugs and cables can therefore not be interchanged.

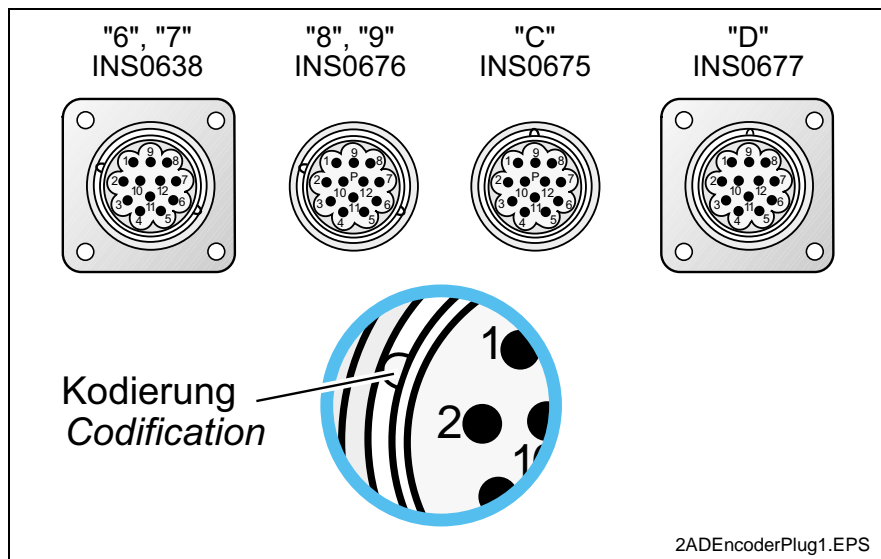
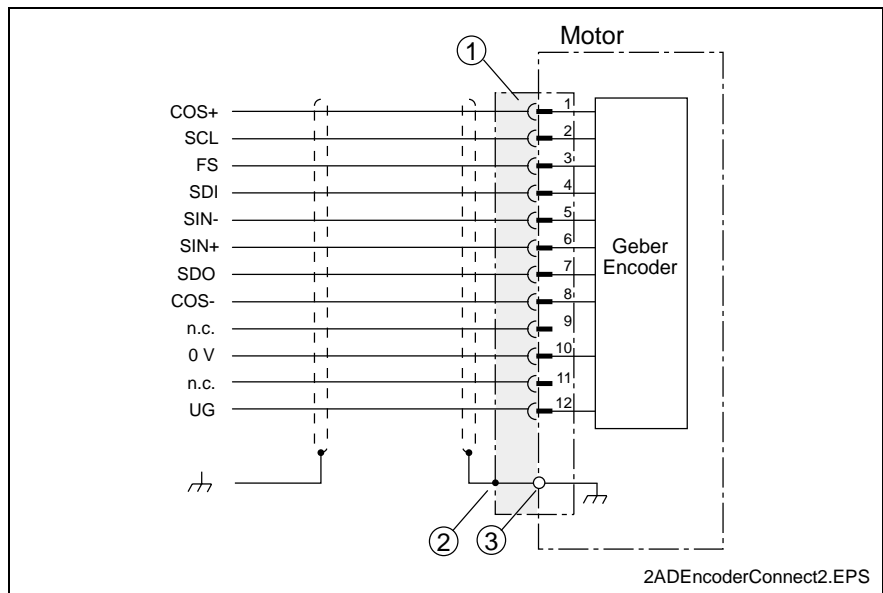


Fig. 12-10: 2AD encoder connection poles and coding

Pay attention to the following when selecting cable connections:

- The motor is usually equipped with a **flange socket** or a **coupling with an external thread**.
- The connection cable is usually equipped with a **plug** with a **union nut**.
- The flange socket on the motor side and the plug on the cable side are connected and screwed together. They are therefore structured as a mirror image, i.e. with different poles.
- The mechanical codings of the flange socket/coupling and the plug must be compatible.
- The design of the encoder cable also depends on the control device used. Please observe the documentation of the drive controller.

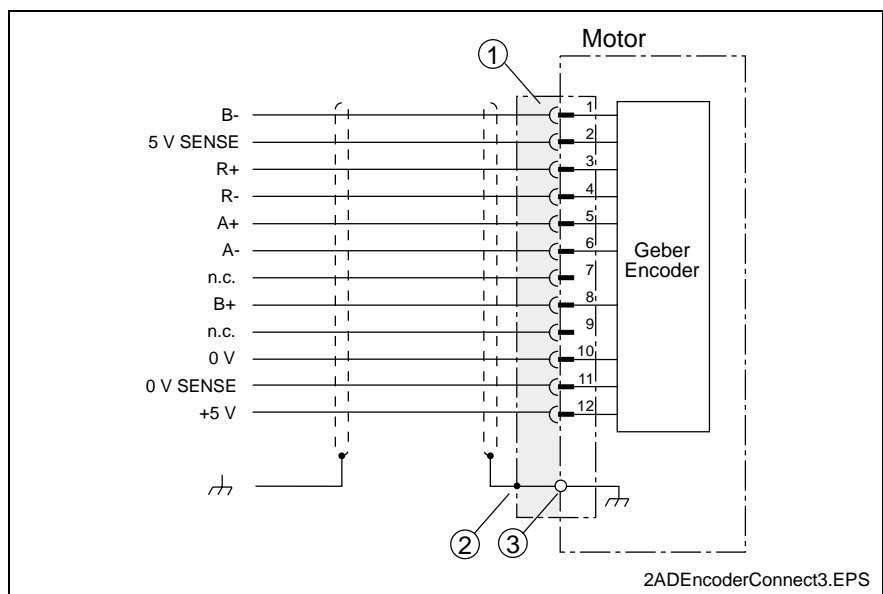
2AD with Encoder Options "6", "7", "8", "9"



- (1): Encoder cable plug
- (2): Shield connection via cable clamp of strain relief in plug
- (3): Electrically conducting connection to motor housing

Fig. 12-11: 2AD encoder connection types "6", "7", "8", "9"

2AD with Encoder Options "C", "D"



- (1): Encoder cable plug
- (2): Shield connection via cable clamp of strain relief in plug
- (3): Electrically conducting connection to motor housing

Fig. 12-12: 2AD encoder connection types "C", "D"

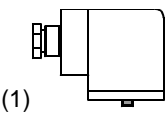


Further information for selecting encoder cables for systems with series DIAX04 and ECODRIVE can be found in the documentation "Selecting DIAX04 and ECODRIVE... Connection Cables", Mat. No. 00280894.

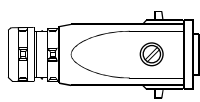
12.5 Blower Connection

2AD motors can be supplied with an axial or a radial blower. Pay attention to the different connections in the following table.

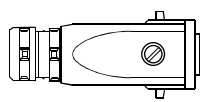
2AD	Power connection	Blower	Direction	Blower connection	Type of connection	Supply voltage
104	Terminal box	axial	A → B (suction)	Flange socket + plug	(2) 3-pin (in preparation)	230 V AC, 115 V AC ±10%, 50-60 Hz
			B → A (blowing)		(1)	
		radial	B → A (blowing)			
	Flange socket	axial	A → B (suction)	Flange socket + plug	(2) 3-pin (in preparation)	
			B → A (blowing)		(1)	
		radial	B → A (blowing)			
134 164	Terminal box	axial	A → B (suction)	Flange socket + plug	(3) 4-pin	3x AC 400 V, ± 15 %, 50-60 Hz 3x AC 460 V, ± 10 %, 60 Hz (6)
			B → A (blowing)			
		radial	B → A (blowing)			
	Flange socket	axial	A → B (suction)	Flange socket + plug		
			B → A (blowing)			
		radial	B → A (blowing)			
184	Flange socket	axial	B → A (blowing)	Flange socket + plug	(3) 4-pin	
200 225	Terminal box (5)	axial	A → B (suction)	Terminal box	(4)	
			B → A (blowing)			
		radial	B → A (blowing)			



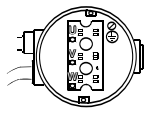
(1)



(2)



(3)



(4)

Indices 1) to 4) are used in this chapter merely to explain the types of connection. Please observe the examples below. The options of the corresponding type code are solely decisive for the product designation of the 2AD motor.

5) 2AD200/225 is not available with a flange socket.
6) only for 2AD164 "blowing"

Fig. 12-13: Table of 2AD blower connections

- Note:** Connecting the motor blower requires opening and the connection of a blower terminal box or a blower plug.
- The electrical connection may be established by qualified technical personnel only. Please observe the safety instructions.
 - The housing tightness may not be reduced.

Design (1)

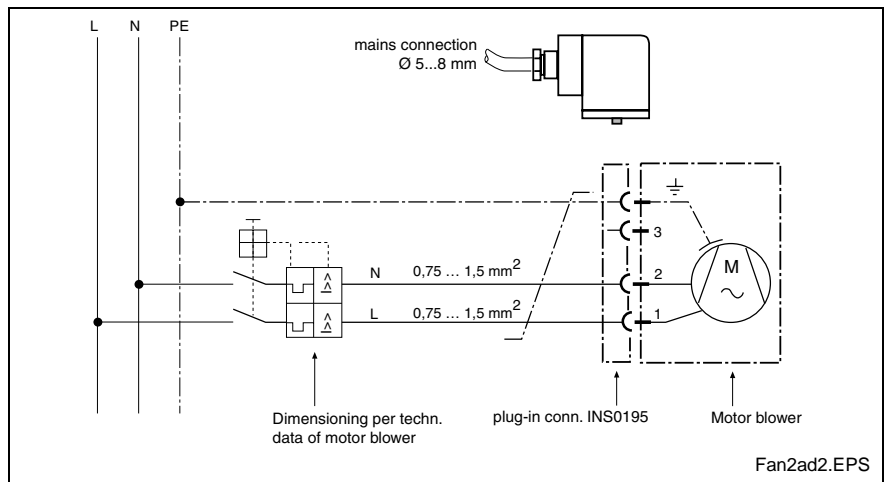


Fig. 12-14: Blower connection design (1) – 3-pin, 2-phase

Design (2) – 3-pin

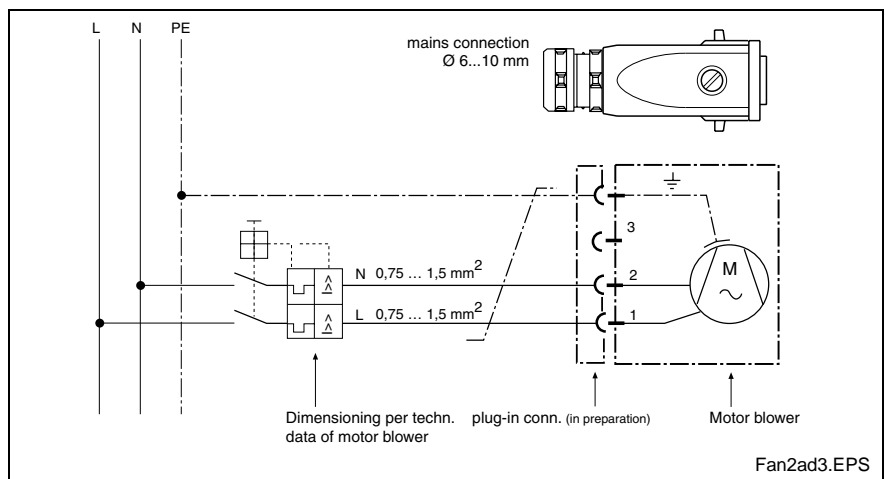


Fig. 12-15: Blower connection design (2) – 3-pin, 2-phase

Design (3) – 4-pin

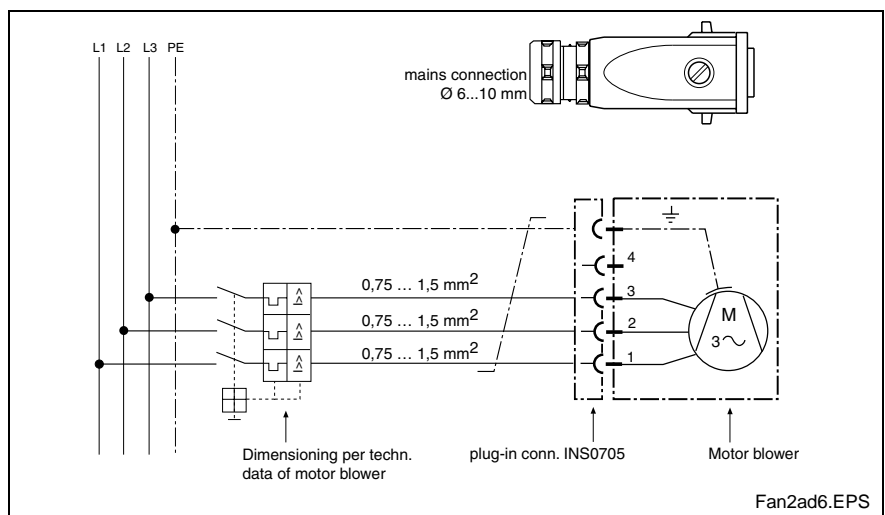


Fig. 12-16: Blower connection design (3) – 4-pin, 3-phase

Design (4)

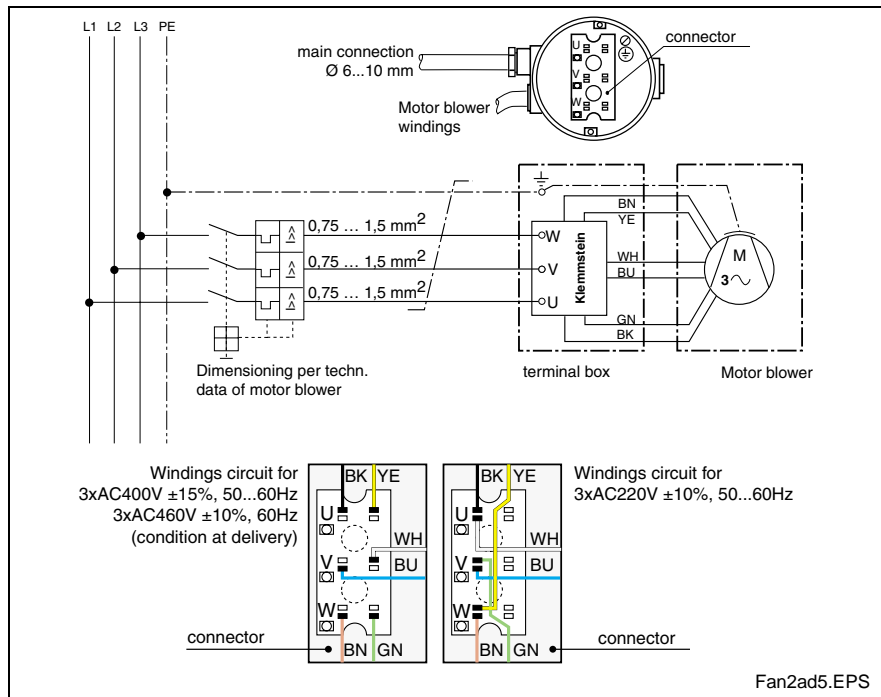


Fig. 12-17: Blower connection design (4), 3-phase

Note: The blower is permanently set to the corresponding supply voltage using the winding interconnection in the terminal box. The set voltage must not be exceeded.

12.6 Temperature Sensors (Thermistors)

In 2AD motors, two temperature sensors (NTC-type thermistors) are permanently installed in the motor winding – only one sensor is connected at a time. The wires for connecting the sensors are led out with the power connector in the terminal box or the flange socket.

If a sensor fails, the spare sensor can be connected. The polarity within a pair of wires is not relevant for the functioning of the NTC resistor.

Motors with terminal boxes The pair of wires of the spare sensor is already laid out on the terminal block in the terminal box.

Motors with power plugs The pair of wires of the spare sensor lies electrically insulated in the flange socket housing. In order to be able to connect the spare sensor, the housing must be opened.

⇒ Observe the additional notes in Chapter 16.4 "Troubleshooting".

13 Notes Regarding Application

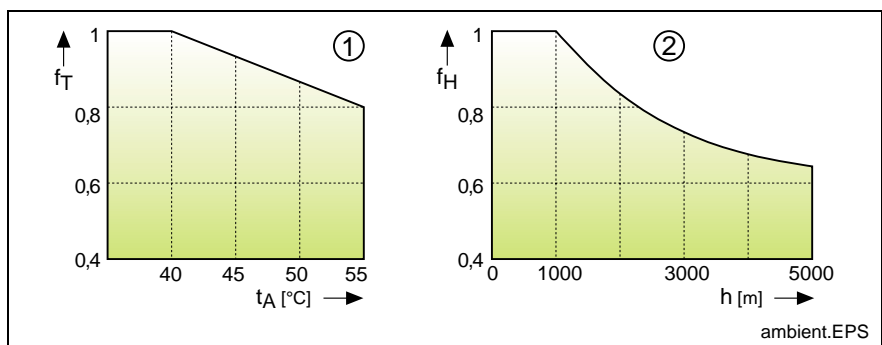
13.1 Conditions for Use

Operation Elevation and Ambient Temperature

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

- ambient temperature of 0°C to +40° C
- setup elevation of 0 to 1000 m 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. 13-1: 2AD 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 torque data are not exceeded by your application.

If **both** the ambient temperature **and** the setup height 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.
3. Ensure that the reduced motor data are not exceeded by your application.

Mechanical Ambient Conditions

According to IEC 721-3-3, Tab. 6, 1994 edition, 2AD motors can be operated in stationary, weather-protected locations under the following conditions:

Sinusoidal vibrations

Influencing quantity	Unit	Max. value of Axial axis:	Max. value of Radial axis:
Amplitude of the displacement at 2 to 9 Hz	mm	in preparation	
Amplitude of the acceleration at 9 to 200 Hz	m/s ²		

Fig. 13-2: 2AD maximum values for sinusoidal vibrations

Shocks

Influencing quantity	Unit	Max. value of Axial axis:	Max. value of Radial axis:
Total shock response range			
Peak acceleration	m/s ²	in preparation	
Duration	ms		

Fig. 13-3: 2AD maximum values for shock stress

- ⇒ For storage, transport and operation of the motors, ensure that the maximum values in Fig. 13-2 and Fig. 13-3 are not exceeded.
- ⇒ Avoid using blower-equipped motors in applications with a high shock stress, such as punching, pressing or reshaping machines.



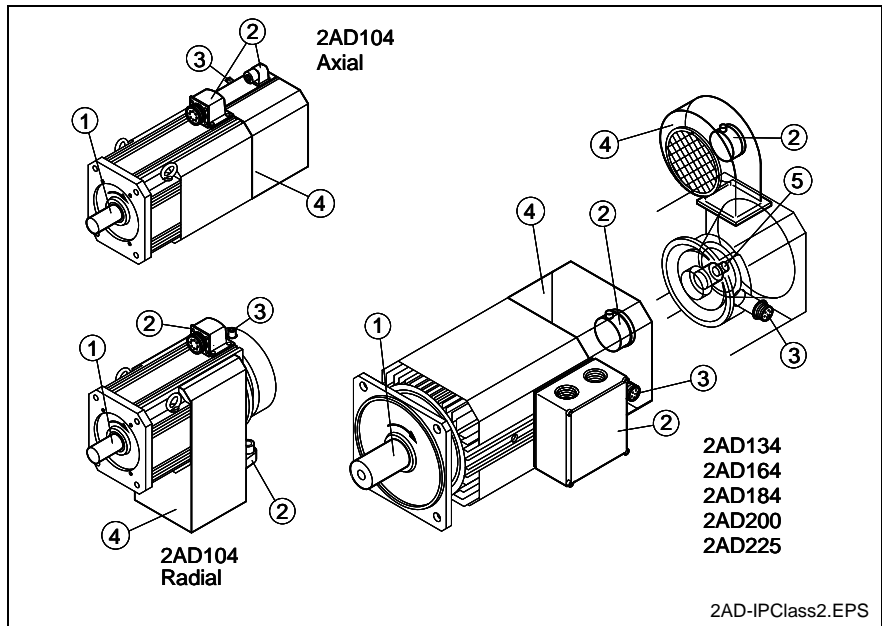
The construction and effectiveness of shock-absorbing or shock-isolating attachments depends on the application and must be tested using measurement equipment. This does not lie within the area of responsibility of the motor manufacturer. Modifications of the motor construction result in nullification of the warranty.

13.2 Ingress Protection Class (IP Class)

The type of protection is defined by the identification symbol IP (International Protection) and two code numbers specifying the degree of protection.

The **first code number** defines the degree of protection against contact and penetration of foreign particles. The **second code number** defines the degree of protection against water.

The protection classes according to IEC 529 (1989, 2nd edition) apply to 2AD motors.



- 1: Output shaft
without shaft seal IP40
with shaft seal IP65
with "labyrinth seal" accessory: IP65 (n>100 rpm)
- 2: Power/blower connection: IP65
- 3: Motor feedback connection: IP65
- 4: Motor blower: IP54
- 5: B-side shaft end (state of delivery): IP65

Fig. 13-4: 2AD protection class ranges

Motor range	Protection class	Note
(1) Output shaft without shaft seal	IP 40	
(1) Output shaft with shaft seal	IP 65	Option
(1) Output shaft with labyrinth seal	IP 65	Accessory; seal effective starting at 200 rpm.
(2) Power and feedback connections	IP 65	Terminal box or plug
(3) Motor encoder connection	IP 65	
(4) Motor blower	IP 24	Blower motor IP 44 Blower screen IP 24

Fig. 13-5: Motor protection class ranges

It must be ensured that, in each and every installation position, the motors are not subjected to ambient conditions outside of the applicable degree of protection according to IEC 34-7.

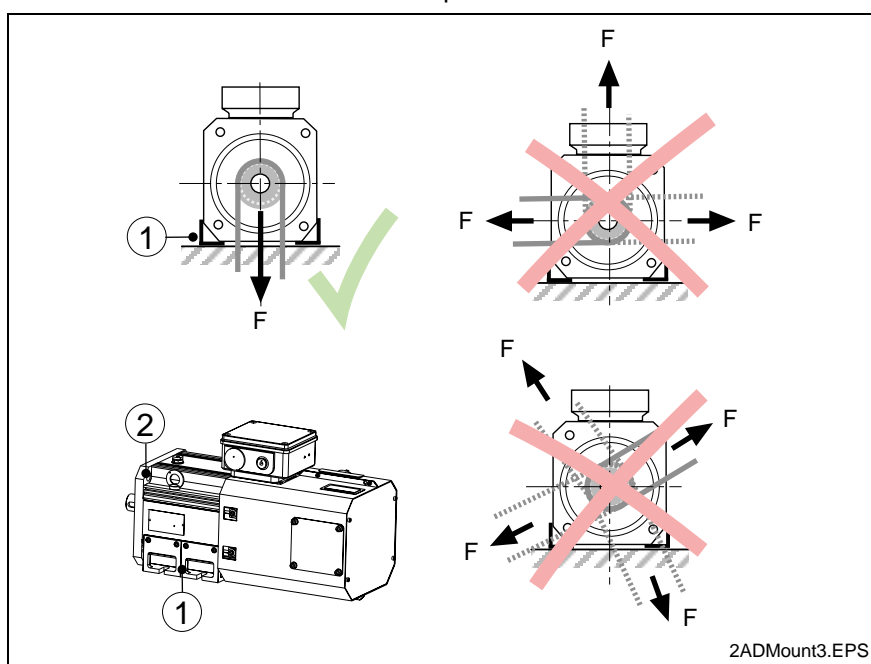


Products and ranges with a low degree of protection are not suited for cleaning procedures with high pressures, vapors or water jets.

13.3 Installation in the Machine

Foot Mounting

The radial forces in the case of foot mounting may only act on the assembly surface only in the vertical direction. The transfer of forces with other effective force directions is not permitted.



- (1): Mounting feet
 (2): Mounting flange

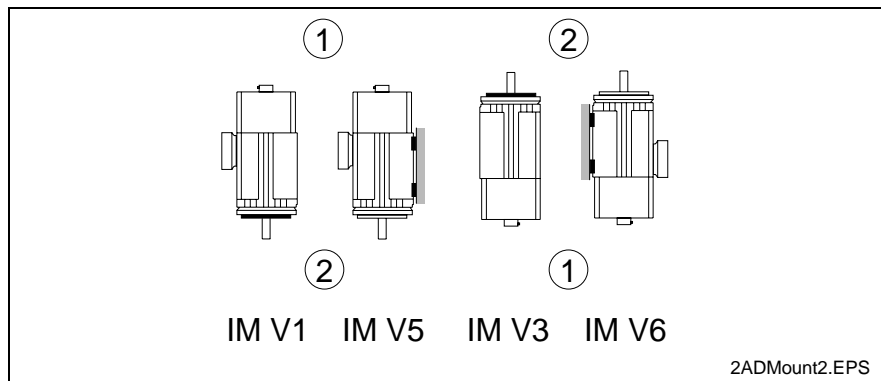
Fig. 13-6: 2AD foot assembly

Note:

- Forces affecting the motor feet that are transferred from a gearbox are not permitted. Forces that are applied to the gearbox shaft must be supported by the gearbox itself.
- An improper installation situation will result in forces that can quickly lead to motor damage.
- Investigate the alternative "flange mounting".

Vertical Installation

In the case of vertical installation positions according to the figure below, dirt and fluids can enter the motor interior more easily, causing malfunctions or failures.



- (1): Blower opening IP 24
 (2): Shaft duct IP 40
 Shaft duct with radial shaft seal IP 65 (option)

Fig. 13-7: 2AD vertical installation position

Notes:

- **Shaft end:** The degree of protection on the flange side of motors with a shaft seal is IP 65. However, sealing is only ensured against splashing fluids. Fluid levels present on the shaft end require a higher degree of protection.
- **B side:** The degree of protection for the blower screens of axial or radial blowers is IP 24. Shavings or large dirt particles can also penetrate the blower screen.
- **Protection class:** The factory-installed protection class of 2AD motors must not be reduced by modifications or by retrofitting accessories.
- In the case of vertical installation, the **grease lifetime** is reduced by 50%.

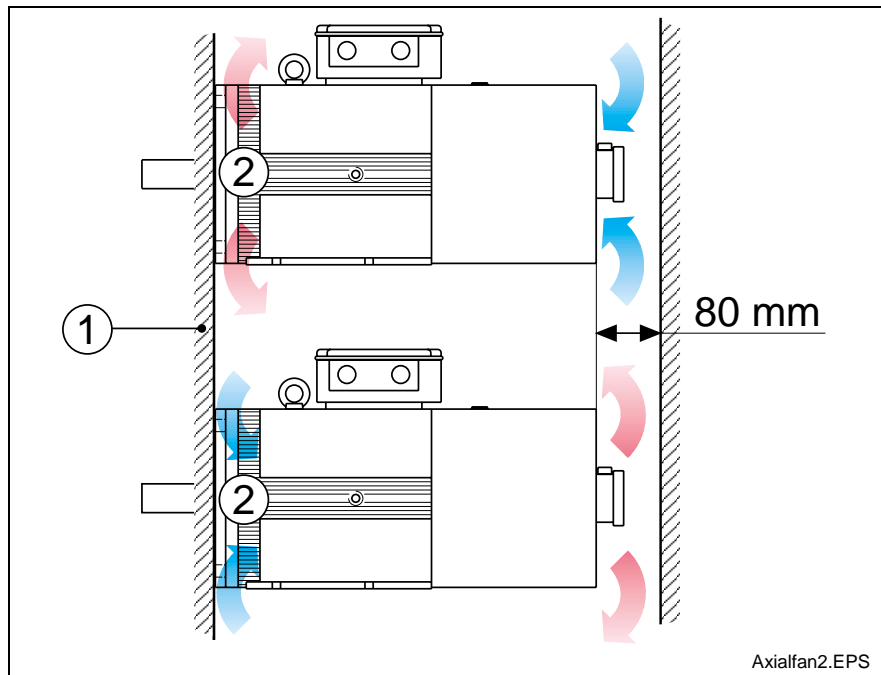
⇒ Already take the installation position and the protection class of the motors into account when planning the system.

13.4 Blowers

2AD motors may only be operated with blowers. Cooling occurs using air currents that are guided through shrouds over the surface of the motor.

When selecting blowers, you must choose between axial and radial blowers as well as between "blowing" (preferred type) and "suction". Observe the information in the type code.

In order to ensure that the required air volume (see the data sheet) can be routed through the blower, a minimum distance between the blower screen and the machine must be taken into account. The distance (2) is determined by the motor construction.



- (1): Machine
(2): Suction/blowing space

Fig. 13-8: 2AD ventilation

- ⇒ Consider the air flow in the machine design. The minimum distance is 80 mm for all 2AD motors.
- ⇒ The recommended design for all blower variants is "blowing".

Dirt can reduce the performance of the blowers and lead to thermal overload of the motors.

When the machine is operated in a dirty environment, increase the system reliability and up-time by regularly cleaning the blower and motor radiator fins.

- ⇒ When designing your machine, provide easy access to the motor and blower to facilitate maintenance work.

13.5 Holding Brake (Option)

Normal Operation The brake in normal operation should only be used at a standstill and when performing the drive-internal brake check. The holding brake is required for holding the axis when the machine is in a de-energized state.



Hazardous movements! Persons endangered by falling or descending axes!

⇒ Observe supplementary DIN and recommendations for European countries:

- DIN EN 954 / 03.97 on security-related parts of controllers.

- Instruction sheet for vertical axes

Issued by:

Süddeutsche Metall-Berufsgenossenschaft

Fachausschuss Eisen und Metall II

Wilhelm-Theodor-Römheld-Str. 15

55130 Mainz, Germany

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

The following is generally valid: The national terms must be observed!

⇒ The serially-delivered motor holding brake does not suffice to ensure protection of persons!

⇒ Ensure protection of persons by superordinate fail-safe measures.

⇒ Cordon off the hazardous area by means of a safety fence or a safety screen.

⇒ Additionally secure vertical axes to prevent them from falling or descending after having switched off the motor, for instance, as follows:

- lock the vertical axis mechanically,

- provide an external braking / collecting / clamping device, or

- ensure proper counter balance of the axis.

- Miscellaneous suitable measures.

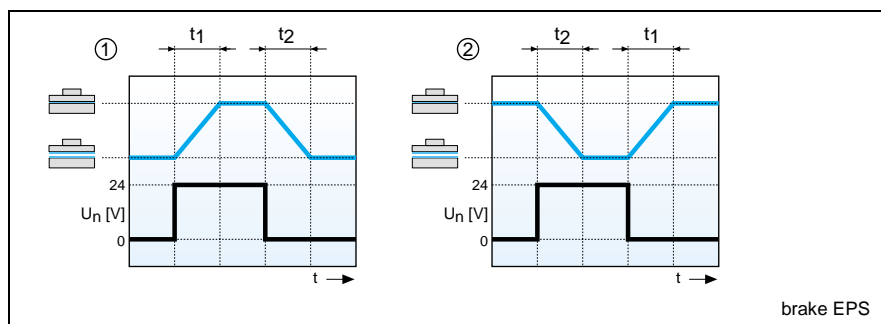
Brake control The brake's control mechanism must ensure this function in normal operation. **Under the worst-case load condition of the power supply, a voltage of 24 V_{DC} +/- 10% must be applied to the motor's brake connection.** To ensure reliable operation, the power supply for the brakes must be monitored by an undervoltage detection system.

Functional test

Before start-up and every 8 hours during operation, the functioning of the brake should be tested with the command "Brake control". By applying a small amount of motor torque, the brake is tested for slippage. Supplementary information and specifications of the availability of this function can be found in the firmware functional description for ECODRIVE.

Selecting Holding Brakes

Brakes are either electrically engaged or electrically released. Due to functional differences, different brakes should be used for main spindle axes and servo-axes. Observe the safety requirements during the plant design.



(1): Electrically-engaged brake
 t_1 : Clamp delay
 (2): Electrically-released brake
 t_2 : Release delay

Fig. 13-9: Holding brake diagram

Main Spindle Applications

Electrically-engaged holding brakes

An **electrically-engaged** holding brakes can be used to lock a main spindle during standstill and when the "controller enable" signal is off, e.g. when a tool change is being performed without a closed position loop.

⇒ Clamp the motor only at standstill, after the controller has signaled the motor is at standstill.

Electrically-released holding brakes should not be used for main spindles. Unintentional clamping of the holding brake at high motor speeds can lead to extreme wear or even destruction of the brake, e.g. in the case of power loss or wire breakage.

Servo Applications

Electrically-released holding brakes

Electrically-released holding brakes are used to hold the axis at a standstill and when the “controller enable” signal is off. When the supply voltage fails, an **electrically-released** brake will automatically close.

- ⇒ Do not use the holding brake as an operational brake to stop moving axes.
- ⇒ For hanging axes, switch off the “controller enable” signal only after the mechanism has stopped completely and the holding brake is engaged.

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

Electrically-engaged holding brakes are inappropriate for servo applications, because clamping in a de-energized state is not possible.

Sizing of Holding Brakes

The physical conditions of holding brakes require consideration of two states. In addition to normal operation, fault conditions must be taken into account. The effective braking torques are physically different.

Normal Operation

In **normal operation** using the holding brake to clamp an axis at a standstill the “static holding torque” (M_4) as indicated in the data sheets applies. Static friction (friction coefficient μ_H)

Fault Condition (EMERGENCY STOP)

In a **fault condition (EMERGENCY STOP)** using the holding brake to stop a moving axle, the “dynamic braking torque” is available. Dynamic friction (friction coefficient μ_G)

The dynamic braking torque is reduced in comparison to the indicated static holding torque M_4 . Therefore, note the following description of dynamic sizing.

Dynamic sizing

The load torque must be less than the minimum available dynamic torque. Otherwise the dynamic brake torque is not sufficient to stop the axis.

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

Further important aspects for sizing:

The holding brake is not a safety brake (see DIN EN 954 / 03.97 and vertical axis data sheet SMBG). As a result of uncontrollable influencing factors such as rust film on the brake surface, the brake holding torque can be reduced. Additionally, excessive voltage and temperature can weaken the permanent magnets and the brake.

Sizing recommendation Bringing these factors together, the following recommendations can be given for sizing the holding brakes to the axes.

The necessary holding torque required for the application must not exceed a maximum of 60% of the static holding torque (M4) of the used holding brake.

Note: **Holding torque reduction and premature wear occur when braking moving axes!**

Do not use the holding brake to stop a moving axis! This is permitted for EMERGENCY STOP situations only. In this situation, the specified rated torque of the holding brake (M4) is reduced to the value of the available dynamic braking torque. Complete deterioration of brake holding capability can be expected after approximately 20,000 revolutions of the brake when engaged.

Maintaining Holding Brakes

In order to ensure proper functioning of the holding brake, it must be checked before the motor is installed.

Before initial startup Measure the holding torque of the brake; grind in the holding brake, if necessary.

Proceed as follows:

1. De-energize the motor and secure it against re-energization.
2. Measure the transmittable holding torque of the holding brake using a torque wrench. The holding torque of the brakes is specified in the data sheets.
3. If the holding torque specified in the data sheets is reached, the holding brake is ready for operation.
If the holding torque specified in the data sheets **is not attained**, the holding brake must be ground in as described in step 4.
4. **Brake burn in procedure:**

Recommendation for burn in	
Interval	1x
Burn-in speed and duration	100 rpm / 30s duration
Procedure	500ms on, 500ms off, 500ms on, etc.
Ambient temperature	-20 °C to +50 °C

Fig. 13-10: Recommended procedure for grinding in motor holding brakes

If the holding torque specified in the data sheets is attained, the holding brake is ready for operation.

If the holding torque specified in the data sheets **is not attained**, repeat steps 4 and 5 of the grinding-in process.

If the specified holding torque is not attained after the second grinding-in process, the holding brake is not operable. Notify Bosch Rexroth Service.

During operation If holding brakes are required only sporadically (braking cycle >48 h) during operation, film rust may develop on the brake friction surface. To prevent the holding torque from dropping below the specified holding torque, we recommend the grinding procedure described below:

Recommendation for burn in	
Interval	Once in 48 h
Grinding-in speed	100 rpm
Number of grinding-in revolutions	1
Ambient temperature	-20 °C to +50 °C

Fig. 13-11: Recommended procedure for grinding in motor holding brakes

Note: The option of automatically implementing the grinding-in routine in the program run is described in the documentation of the particular drive controllers.



During normal operation, it is not necessary to grind in the brake. It is sufficient if the brake is activated twice a day by removing the "controller enable" signal.

13.6 Motor Encoder

Options

"0": The motor is supplied without a factory-installed encoder unit. The rear of the motor is simply covered.

"6": Incremental encoder with I²C interface. 1V_{pp} sine/cosine signals with 512 lines per rotation and absolute period assignment within one shaft rotation ("single-turn").

"7": Incremental encoder with I²C interface. 1V_{pp} sine/cosine signals with 512 lines per rotation and absolute period assignment within 4096 shaft rotations ("multi-turn"). The axis position is stored if the power fails.

"8": Incremental encoder with I²C interface. 1V_{pp} sine/cosine signals with 512 lines per rotation and absolute period assignment within one shaft rotation ("single-turn"). Suitable for explosion-endangered areas according to EN 50014/50018/50019.

"9": Incremental encoder with I²C interface. 1V_{pp} sine/cosine signals with 512 lines per rotation and absolute period assignment within 4096 shaft rotations ("multi-turn"). The axle position is stored if the power fails. Suitable for explosion-endangered areas according to EN 50014/50018/50019.

"C": Incremental encoder with sine/cosine signals (1V_{pp}). 2500 lines per rotation. Suitable for explosion-endangered areas according to EN 50014/50018/50019.

"D": Incremental encoder with sine/cosine signals (1V_{pp}). 2500 lines per rotation.

Compatibility

Due to different encoder technologies, the motor encoders can only be connected to certain drive controllers and interfaces. The compatibility can be seen in the following table:

Encod. option	DIAX01	DIAX03	DIAX04	ECODRIVE
	KDA, TDA, RAC	DKR	HDD, HDS	DKC
6	incompatible	X4	X4	X4
7	incompatible	X4	X4	X4
8	incompatible	X4	X4	X4
9	incompatible	X4	X4	X4
C	incompatible	DLF01-X23	DLF01-X23	X8
D	incompatible	DLF01-X23	DLF01-X23	X8
Encoder data must be set in drive controller				

Fig. 13-12: 2AD encoder compatibility

Accuracy/Repeatability

There are two types of accuracy for rotary encoders: "absolute accuracy" and "relative accuracy".

Absolute Accuracy The absolute accuracy of rotary encoders is determined primarily by the quality and precision of the encoder construction as well as by the mechanical attachment to the motor.

The following values apply to 2AD motors:

Encoder option acc. to type code	Technical data	Absolute Accuracy
6, 7, 8, 9	Incremental, 512 lines	$\pm 0.009^\circ$ ($\pm 0.54'$)
C, D	Incremental, 2500 lines	$\pm 0.007^\circ$ ($\pm \sim 0.43'$)

Fig. 13-13: 2AD absolute accuracy of the encoder

Relative Accuracy "Repeatability" The relative accuracy of encoder systems is also referred to as "repeatability". It is determined primarily by the interpolation variances during further processing of the measured signals in the installed and in the external interpolation and digitization electronics.

For 2AD motors, the following guidelines apply for operation with Bosch Rexroth drive controllers (as of the publishing date of this documentation):

Encoder option acc. to type code	Technical data	Relative Accuracy/ repeatability
6, 7, 8, 9	Incremental, 512 lines	$\pm 0.005'$
C, D	Incremental, 2500 lines	$\pm 0.001'$

Fig. 13-14: 2AD relative encoder accuracy

Continuous further development of the hardware and firmware for drive controllers may result in variances from the above values. Therefore, always observe the information in the current drive controller documentation.

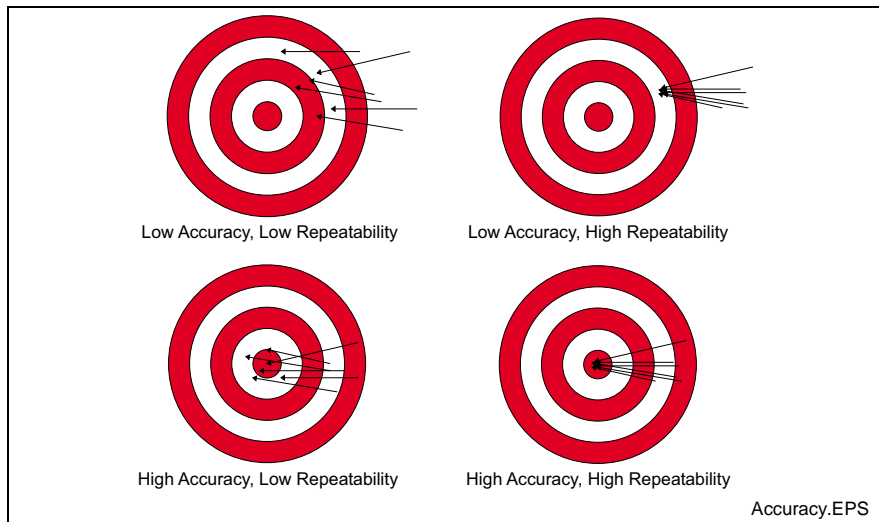


Abb. 13-15: Differentiation between absolut accuracy and repeatability

i The accuracy of encoder systems is only a secondary factor for the accuracy of processing and positioning processes in a system. Determining factors for the accuracy that can be attained include the functions of the system and the quality of the mechanical construction, among other things.

Connection

The encoder connection is always on the same side of the motor as the power connection. The position of the encoder connection cannot be changed after the motor has been delivered. For details, see Chapter 12.4 "Connections".



Detailed information on the encoder connection on the controller side and on setting its parameters can be found in the documentation of the drive controllers.

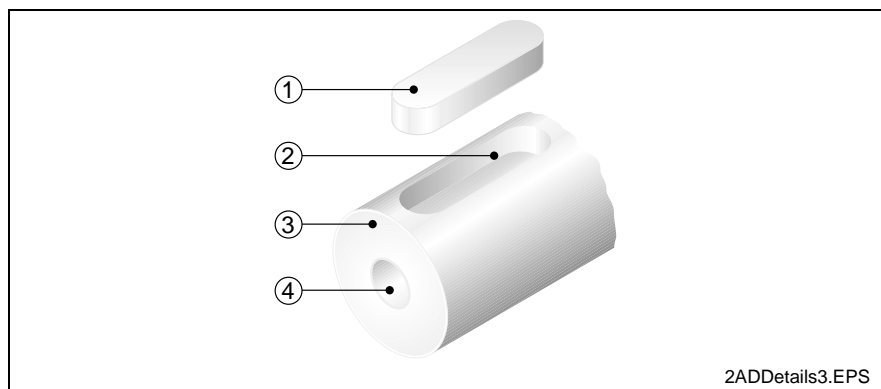
13.7 Output Shaft

Smooth Shaft

The recommended standard model for all 2AD motors provides a force-actuated, zero backlash shaft-hub connection with a high degree of quiet running. Use clamping sets, clamping sleeves or clamping elements to couple the machine elements to be driven.

Output Shaft with Keyway

The optional keyway according to DIN 6885, Sheet 1, version 08-1968, permits keyed transmission of torques with constant direction and low requirements for the shaft-hub connection.



- | | | | |
|------|--------|------|----------------|
| (1): | Key | (3): | Motor shaft |
| (2): | Keyway | (4): | Centering hole |

Fig. 13-16: 2AD output shaft with keyway

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

⇒ Avoid strong reversing operation. Deformations in the area of the keyway can lead to breakage of the shaft.

Balancing with a half key

The motor is balanced with a half key. The mass relationships are similar to those for a smooth shaft. Inserting a complete key results in an imbalance that must be compensated for the machine element that is to be driven.

The hub of a machine element that is to be driven (pinion, pulley, etc.) should correspond to the key length.

⇒ If the hub is shorter, use a graduated key.

Balancing with a full key The motor is balanced using the included key. Hence, the machine element to be driven must be balanced without a key. The keyway length in the hub is independent of the length of the key.



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

Output Shaft With Shaft Seal

With the optional radial shaft seal according to DIN 3760 – Design A, transmissions with oil baths or circulating oil lubrication systems can be attached to 2AD motors, for example.

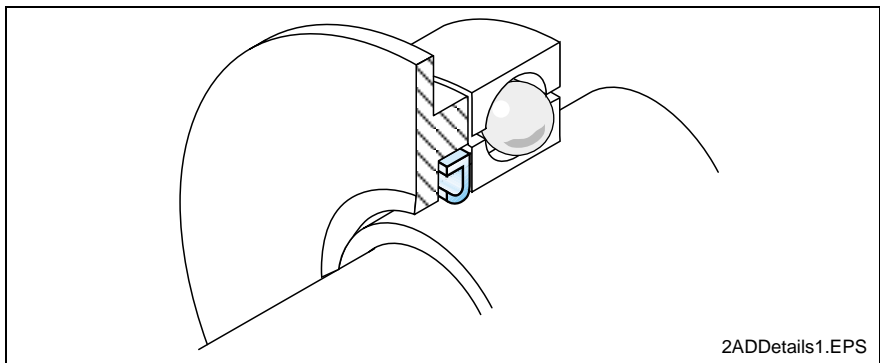


Fig. 13-17: 2AD shaft seal

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

Wear of the seal can be reduced by providing adequate lubrication and keeping mating surface point clean. The lubricant also acts as a coolant, removing the heat generated from the seal.

⇒ Prevent the seal from becoming dry and dirty. Always ensure adequate cleanliness and lubrication.

Resistance The materials used for the radial shaft seals are highly resistant to oils and chemicals. The performance test for the particular operating conditions lies, however, within the machine manufacturer's responsibility. As of the publication date of this document, the following material were used:

Motor	Sealing material	Abbreviztion
2AD104 – 2AD164	Polytetrafluorethylene	PTFE
2AD184-200-225	Fluorocaoutchouc	FPM

Fig. 13-18: 2AD shaft seals



The complex interactions between the seal, the shaft and the fluid to be sealed, as well as the particular operating conditions (frictional heat, soiling, etc.), do not allow accurate calculations of the lifetime of the shaft seal. Experience shows the probability of a failure may already increase as early as after 2000 operating hours under unfavorable conditions.

Vertical installation positions IM V3/IM V6 The degree of protection on the flange side of motors with a shaft seal is IP 65. Hence, tightness is ensured only in case of splashing fluids. Fluid levels present on side A require a higher degree of protection. In the case of the vertical installation of the motor, also heed the notes in Chapter 13.3 "Vertical Installation".

13.8 Bearing and Shaft Loads

During operation, both radial and axial forces act upon the motor shaft and thus upon the bearings. The machine construction and the motor type must be carefully adapted to one another so that the loading limits of the shaft and the bearing are not exceeded.

Note: A radial force that continuously changes the position of its angle, such as one that can occur due to misaligned of couplings, must also be avoided.

Variants

2AD motors can be supplied with standard bearings, heavy-duty bearings or high-speed bearings.

- Standard bearing "N" = deep-groove ball bearing
- Heavy-duty bearing "V" = deep-groove ball bearing + cylindrical roller bearing
- High-speed bearing "H" = deep-groove ball bearing, low-weight design

Standard bearings A standard bearing design (type code "N") for 2AD motors consists of a deep-groove ball bearing that is suitable for taking up low to medium radial and axial forces.

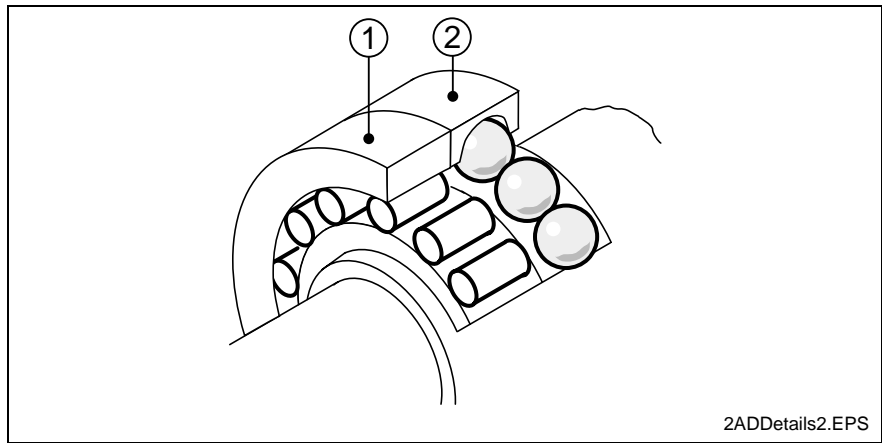
Advantages:

1. Easily available and high lifetime
2. Suitable for high speeds
3. Low-noise running

Disadvantage:

Deep-groove ball bearings cannot with stand high radial or axial loads.

Heavy-duty bearings A 2AD motor equipped with heavy-duty bearings (type code "V") has an additional cylindrical roller bearing on the drive side. See the corresponding information in "2AD... Technical Data".



(1): Cylindrical roller bearing (2): Deep-groove ball bearing
 Fig. 13-19: 2AD heavy-duty bearing arrangements

Advantage:

The heavy-duty bearing can take up larger radial forces.

Disadvantages:

- 4. The grease lifetime is reduced to half of the standard value.
- 5. In certain motors, a reduction of the maximum permitted speed results.
- 6. Motors with a reinforced bearing may only be operated with a permanent radial load (see Fig. 13-20: 2AD radial load). Without a radial load, the bearings could be damaged by resulting sliding friction.

⇒ Select the "reinforced bearing" option only in exceptional cases.

Motors with a heavy-duty bearing must be operated with the following permanent radial loads.

2AD	134	164	184	200	225
Permanent radial load [kN]	1	1.5	2		

Fig. 13-20: 2AD radial load

High-speed bearings

The high-speed bearing design (type code "H") permits very high speeds due to a deep-groove ball bearing with an accordingly low-weight design.

Advantages:

The high-speed bearing permits very high speeds.

Disadvantage:

High-speed bearings can only take up low radial loads.

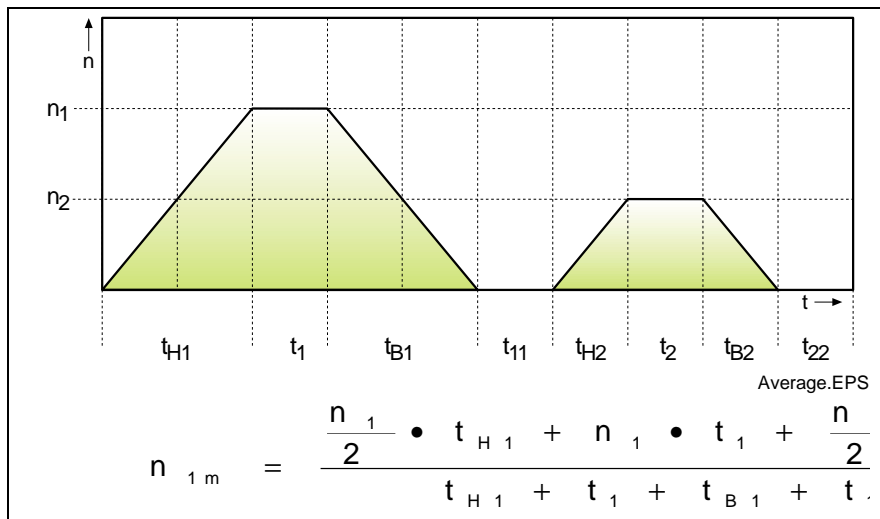
Radial Loads

The permitted radial load on the drive shaft is determined by the bearing type, the shaft design and the average speed n_m .

- ⇒ You can find the permitted load values in the respective diagrams in the "Technical Data" Chapters of this documentation. Avoid exceeding the permitted load values.
- ⇒ In the diagrams, observe the reduced limit values for shafts with keyways.
- ⇒ Calculate the "mean speed" as the average speed over an entire processing cycle.

Mean speed

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



- n_{1m} : mean speed in section 1
- n_1 : processing speed
- t_{H1} : run-up time
- t_1 : processing time
- t_{B1} : braking time
- t_{11} : standstill time
- n_{2m} : mean speed in section 2
- n_2 : processing speed
- t_{H2} : run-up time
- t_2 : processing time
- t_{B2} : braking time
- t_{22} : standstill time

Fig. 13-21: 2AD mean speed

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

Axial Load

Only low axial shaft loads are permitted for 2AD motors (also see "2AD.. Technical Data"). Therefore, 2AD motors are **not** suitable for machine elements that generate axial loading of the 2AD motor (e.g. helical driving pinions).

	104	134	164	180	200	225
Axial load [N]	30	50				

Fig. 13-22: 2AD axial load

The permitted axial load applies for all installation positions.

- ⇒ Avoid unpermitted axial loads or jolting of the motor shaft.

Lifetime

The bearing lifetime is an important criteria for the reliability of 2AD motors. When the lifetime is considered, the "mechanical lifetime" of bearing components and material is differentiated from the "grease lifetime" of the bearing lubricant.

Mechanical lifetime The mechanical lifetime of the bearing is 20,000 hours. This applies to all 2AD motors based on the following:

- The permitted loads from the corresponding "2AD.. Technical Data" section are never exceeded.
- The motor is operated under the permitted conditions for use and in the permitted ambient temperature range of 0° to +40° C.
- The "mean speed" driven over the entire processing cycle conforms with the characteristic curves for the grease lifetime from the corresponding "2AD.. Technical Data" section, whereby:

$$n_m < n_{m(t_f = 20000 \text{ h})}$$

n_m : mean speed

$n_{m(t_f)}$: mean speed for which a grease lifetime of 20,000 h can be expected.

Fig. 13-23: 2AD mean speed

Differing loads can have the following effects:

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

⇒ Avoid exceeding the load limits.

Grease lifetime The deep-groove ball bearings and cylindrical roller bearings in 2AD motors are permanently lubricated. The expected grease lifetime is shown in a diagram in the "2AD.. Technical Data" section; it must be determined individually for every different application.

The diagram contains different characteristic curves for "standard bearings" and "heavy-duty bearings".

The characteristic curves for 2AD motor grease lifetime are valid based on the following:

- The permitted loads from the corresponding "2AD.. Technical Data" section are never exceeded.
- The higher the "mean speed" driven over an entire processing cycle, the lower the grease lifetime.

If the grease lifetime expires, the possibility for failure of the bearing and the motor increases. Especially in the case of motors with reinforced bearings, this can lead to a significantly reduced deployment duration of the motor.

⇒ Also observe the notes regarding the bearings in Chapter 14.3 "Handling, Transport and Storage".

If the heavy-duty-bearing lifetime is being limited by the grease, you can use standard bearings. However, the overloading of the standard bearing

will reduce its mechanical lifetime below the normal 20,000-hour operating lifetime.

⇒ This requires subsequent calculation of the bearing lifetime by Bosch Rexroth. In this case, contact one of our branch offices and explain your application with all relevant application data (load cycle, axial and radial loads, speeds, etc.).



The calculation and sizing of the bearings is based on standard DIN ISO 281.

Help in Selection

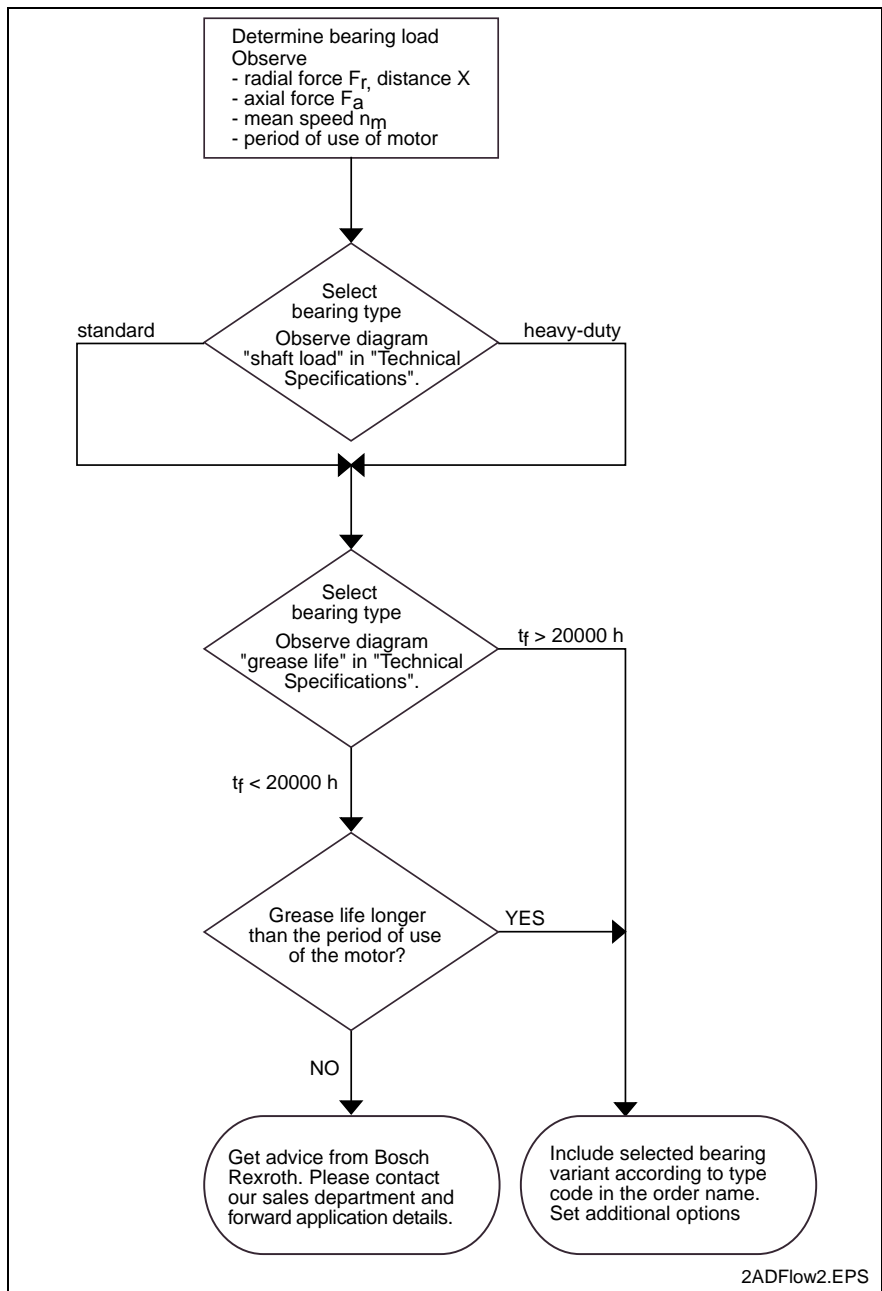


Fig. 13-24: 2AD bearing selection procedure

13.9 Vibration Severity Levels (Balance Quality)

2AD motors are dynamically balanced according to DIN ISO 2373.

Vibration severity level R is standard for all 2AD motors. Levels S and S1 are available for certain motors in case of special demands on the mechanical running smoothness. Pay attention to the limitations in the individual type codes.

Vibr. sev. level	Effective vibrational speed V_{eff} [mm/s]							
	2AD104/134				2AD164 - 225			
	Speed n [rpm]				Speed n [rpm]			
	600-1800	1800-3600	3600-6000	6000-8000	600-1800	1800-3600	3600-6000	6000-8000
R	0.71	1.12	1.8	2.8	1.12	1.8	2.8	4.5
S	0.45	0.71	1.12	1.8	0.71	1.12	1.8	2.8
S1	0.28	0.45	0.71	1.12	0.45	0.71	1.12	1.8

Fig. 13-25: 2AD effective vibration speed

The vibration behavior of attached or driven machine elements can cause repercussions on the 2AD motor; in unfavorable cases, they can cause premature wear or failure.

Due to the system-specific influences on the vibration behavior of the system as a whole, the machine manufacturer must determine the specific circumstances.

In certain cases, the machine elements may need to be balanced in such a manner that no resonance or repercussions occur.

⇒ Take the vibration behavior of the motor and the machine elements into account when designing the system.

13.10 Explosion Protection

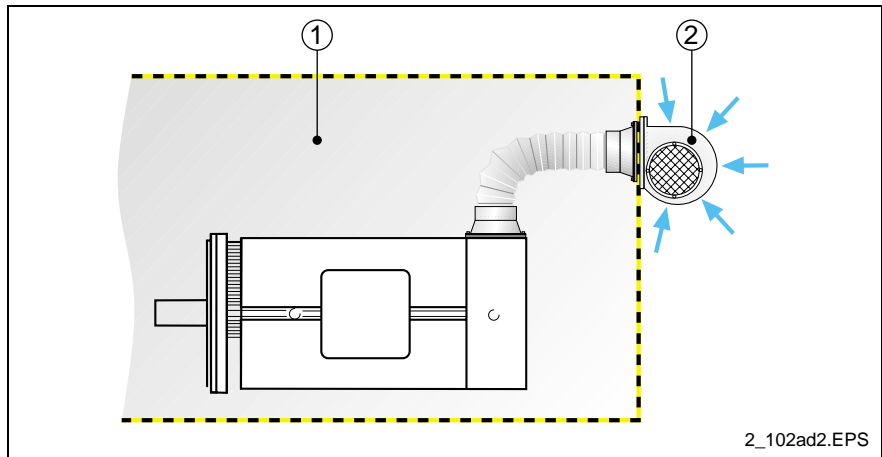


CAUTION

2AD motors themselves are not certified as explosion-protected parts; rather, they are merely suitable for approval according to classification Ex-p as part of a total system!

⇒ Observe standards EN50014, EN50018 and EN50019.

Under certain conditions, 2AD motors with an external blower can be used in explosion-endangered areas according to the following diagram:



- (1): explosion-angered area
- (2): external radial blower

Fig. 13-26: 2AD motor with attached blower supports for explosion-protected area

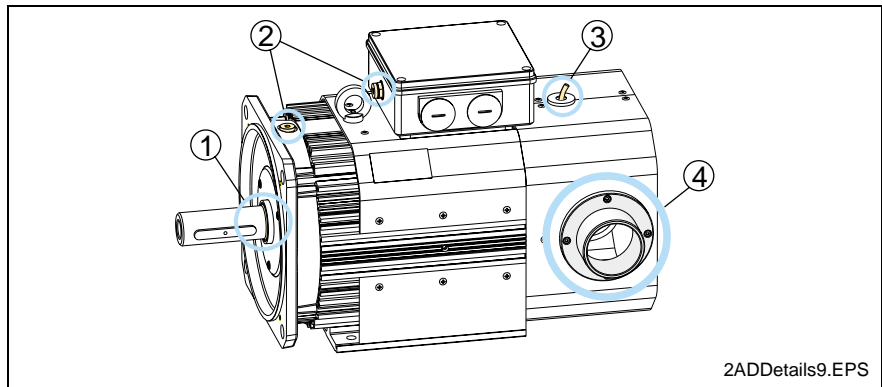
Options for Areas with potentials for Explosion

When 2AD motors are to be used in explosion-angered areas, the motors must be selected with the options described below. These options are not available for all motor frame sizes.

Heed the individual motor type codes and the descriptions of the options in Chapter 13 "Notes Regarding Application".

1. **Output shaft** with shaft seal-type code "C", "D" or "H".
2. **Motor encoder** ("motor feedback") for explosion-angered areas. type codes "8", "9" or "C". These encoder types include 10 meters of ready-to-connect encoder cable with a plug connection.
3. **Cooling type** "blower hood with cowl". Type code "E". Motors with this option are supplied without blowers, but with an attached cowl. The blower required for operating the motor must be ordered separately. Option "E" includes 2 air connections for cooling the interior of the motor. The 1/4" connections are equipped at the factory with blank plugs.

Sample delivery:



- (1): Radial shaft seal
- (2): 1/4" connections for housing ventilation
- (3): Encoder cable exit, 10 m, encoder option "8" or "C"
- (4): Blower Cows for "cooling type E"

Fig. 13-27: 2AD sample delivery for explosion-protected areas

Blower Selection

2AD motors may be operated only if a specified minimum volume of air is drawn through the motor. When selecting radial blowers or central ventilation systems, the installed hose or air duct length, as well as the air baffles, must also be taken into account.

The following technical data apply to Bosch Rexroth 2AD radial blowers:

Motor	Radial blower included in accessories	Average required volume V [m ³ /h]	Note
2AD104	SUP-M03-2AD104	200	Max. 1 m hose length, max. 1x 90°
2AD134	SUP-M03-2AD134	600	
2AD164	SUP-M03-2AD164	630	

Fig. 13-28: 2AD radial blowers

Note:

- If the air hose length is longer than 1 meter or if the air duct bends several times, the radial blower or ventilation system requires a higher air transport capability. The machine manufacturer is responsible for the calculation using the system specifications.
- Blower hos air ducts do not belong to the Bosch Rexroth scope of delivery.

The following manufacturers can supply more powerful radial blowers (list with no claim for completeness):

Suppliers of radial blowers (excerpt)	
EBM	EBM Werke GmbH & Co. Bachmühle 2 74673 Muldingen, Germany Tel. +49-(0)7938 / 81-0 Fax +49-(0)7938 / 81-110 http://www.ebm-werke.de/
ZIEHL-ABEGG	Ziehl-Abegg GmbH & Co. KG Zeppelinstraße 28 74653 Künzelsau, Germany Tel. +49-(0)7940 / 16-0 Fax +49-(0)7940 / 16-300 http://www.ziehl-abegg.de/

Fig. 13-29: Manufacturers of radial blowers

Encoder

Select either encoder option "**8**" (DSF explosion protection single-turn), "**9**" (DSF explosion protection multiple-turn) or "**C**" (incremental encoder explosion protection). These encoders, with classification **Eexd**, can be used up to a temperature of 115 °C and are supplied with 10 meters of ready-to-connect encoder cable with a plug connection.

For details on connecting encoders, see the "Connection Techniques" section.

Inspection

The explosion protection approval and classification are carried out for the system as a whole. Separate certification of 2AD motors for use in explosion-endangered area is therefore not required.

13.11 Acceptances, Approvals, Listings

CE Symbol

Declaration of conformity Declarations of conformity certifying the structure of and the compliance with the applicable EN standards and EC guidelines are available for all 2AD motors. If necessary, these declarations of conformity can be requested from the sales office.

The CE symbol is applied to the motor type label of the 2AD motors.

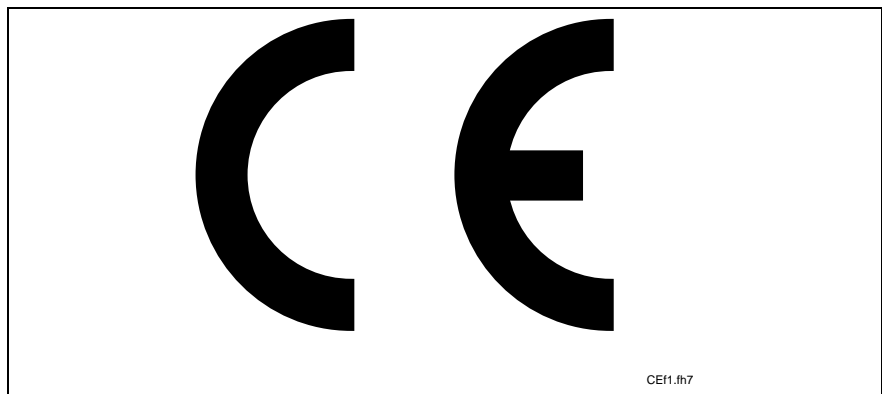


Fig. 13-30: CE symbol

UL, UR, cUR Listing

If you have questions about the certification class of 2AD motors, please consult your local sales partner.

14 Handling, Transport and Storage

14.1 Supplied Condition

2AD motors are delivered in wooden crates, or in boxes. The 2AD104 is packed in a cardboard box.

Packing units on pallets are secured by retaining straps.



CAUTION

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

⇒ Maintain a sufficient distance when carefully cutting the retaining straps.

Factory Inspection

All 2AD motors undergo the following inspections, among others, at the factory:

- | | |
|------------------------------|---|
| Electrical inspection | <ul style="list-style-type: none"> • High-voltage test according to EN 60034-1 (= VDE 0530-1). • Insulation resistance according to EN 60204-1/1.92, Section 20.3. • Protective earth conductor connection according to EN 60204-1/1.92, Section 20.3. |
| Mechanical inspection | <ul style="list-style-type: none"> • Concentricity and position tolerances of shaft end and mounting flange according to DIN 42955. • Vibration measurement according to DIN 2373. |

Customer Inspection

Since all 2AD motors undergo a standardized inspection procedure, high-voltage inspections by the customer are neither required nor recommended. Motors and components could be damaged if they undergo several high-voltage inspections.



CAUTION

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

- ⇒ Avoid repeated inspections.
- ⇒ Observe the regulations of EN 60034-1 (= VDE 0530-1).

14.2 Identification

The total scope of a delivery can be seen in the delivery note or waybill. However, the contents of a delivery can be distributed over several packages.

Each individual package can be identified using the shipment label attached to the outside.

Each device has an individual type label containing the device designation and technical information.

⇒ After receiving the goods, compare the ordered type to the supplied type. Submit claims concerning differences immediately.

14.3 Transportation and Storage



CAUTION

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

- ⇒ Protect the products from dampness and corrosion
- ⇒ Avoid mechanical stressing, throwing, tipping or dropping of the products.
- ⇒ Use only suitable lifting equipment on the eye bolts of the motor.
- ⇒ Never lift the motor using the blower housing.
- ⇒ Use suitable protective equipment and protective clothing during transport.

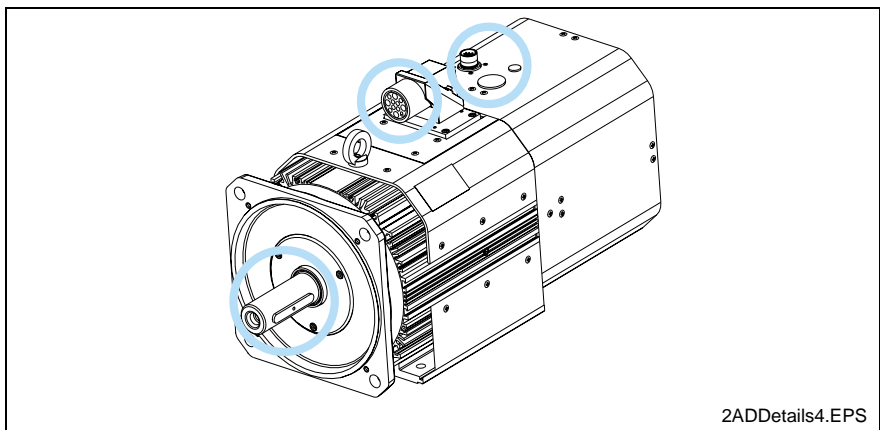
Note:

- Permitted **transport temperature range**: -20°C to +80°C.
- Permitted **storage temperature range**: 0°C to 45°C.
- After storage of one to five years, the motor must warm up for one hour at 1000 rpm before starting normally.
- The max. permitted **storage duration** of the motors is 5 years. After the max. storage duration is exceeded, the bearing grease must be replaced.

Also observe the notes regarding storage and transport on the packages

When delivered, 2AD motors are equipped with protective caps and covers. During transport and storage, the protective sleeves must remain on the motor.

- ⇒ Remove the protective caps just before assembly.
- ⇒ Also use the protective sleeves if you return the goods.



2ADDetails4.EPS

Fig. 14-1: 2AD protective caps

15 Installation

15.1 Safety



WARNING

Injuries due to live parts! Lifting of heavy loads!

- ⇒ Install the motors only when they are not under power and are not connected electrically.
- ⇒ Use suitable lifting equipment, protective equipment and protective clothing during transport.
- ⇒ Do not lift or move the motor using the blower unit.
- ⇒ Observe the notes regarding safety found in previous chapters.

Carry out all working steps especially carefully. In this way, you minimize the risk of accidents and damages.



Some 2AD motors have additional threaded holes along their sides for inserting eye bolts (for details, see the dimension sheet). Additional eye bolts can simplify handling and transport.

15.2 Mechanical Mounting

Accessories

Attach required accessories such as "blower cowls" (SUP-M01-2AD...) or "labyrinth seals" (SUP-M02-2AD...) before assembling the motor. Assembly instructions are supplied with the respective accessory kits.

Fastening Holes

2AD motors are manufactured for either flange mounting (B05) or for foot mounting (B35). Details for the mounting holes can be found in the corresponding dimension sheet.

2AD	B05 (flange mounting)			B35 (foot mounting)		
	Hole	Bolt 1)		Hole	Bolt 1)	
	Ø [mm]	Type	M _{GA} [Nm]	Ø [mm]	Type	M _{GA} [Nm]
104	14	M12	87	11	M10	51
134	18	M16	215	12	M10	51
164	18	M16	215	14	M12	87
184	18	M16	215	14.5	M12	87
200	19	M16	215	19	M16	215
225	18	M16	215	21	M20	430

1) Type and torques as recommendations for bolts of fastening class 8.8.
M_{GA} = Torque in Newton-meters.

Fig. 15-1: 2AD mounting holes

Note: The bolted connections must be able to stand both the force due to the weight of the motor and the forces acting during operation.

Preparation

⇒ Log all measures taken in the commissioning log.

Prepare motor mounting as follows:

1. Check the components for visible damage. Defective components may not be mounted.
2. Ensure that dimensions and tolerances on the system side are suitable for motor attachment (for details, see the dimension sheet).
3. Ensure that mounting can be done in a dry, clean and dust-free environment.
4. Keep tools and aids, as well as measuring and testing equipment, ready.
5. Check whether all components, mounting surfaces and threads are clean.
6. Ensure that the mating surface for the motor flange on the machine side is free of burrs.
7. Remove the protective sleeve of the motor shaft. Retain the sleeve for later use.

Mounting

⇒ Mount the motor to the machine .

Note:

- ⇒ Avoid pinching or jamming the motor's centering (pilot) diameter.
- ⇒ Avoid damaging the centering diameter of the machine as well.
- ⇒ Check the fit and precision of the connection before you proceed.

After proper mechanical mounting, make the electrical connections.

15.3 Electrical Connection

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

Note:

- In the case of self-manufactured cables, pay attention that the design and installation are suitable for EMC.
 - The connection plans of the product documentation are used to generate the system circuit diagrams. The system circuit diagrams of the machine manufacturer are solely decisive for connecting the motor to the machine.
-

Power Connection

Plug connection for
2AD104/134/164

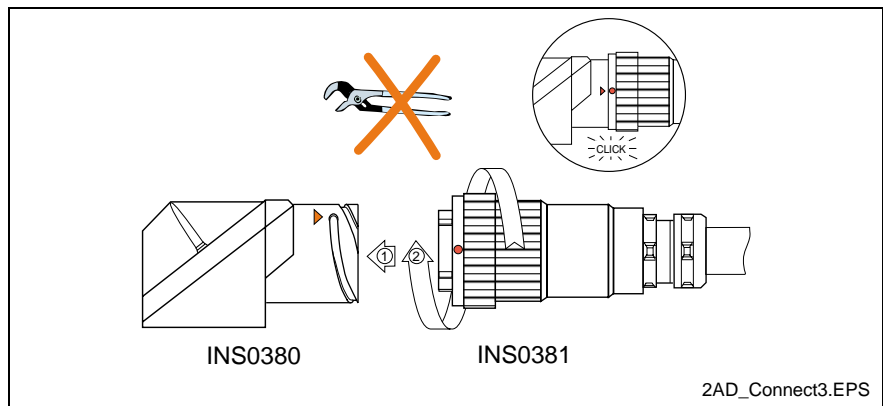
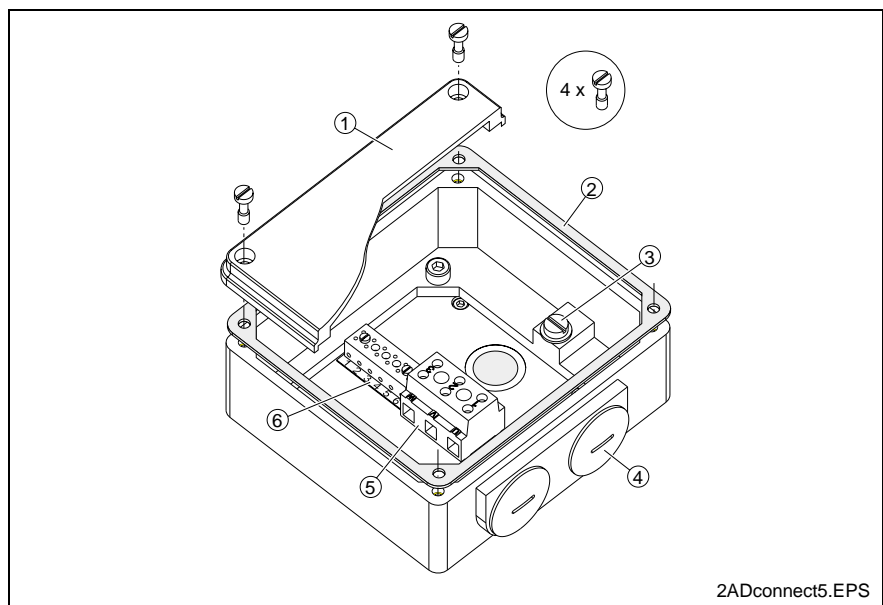


Fig. 15-2: Sample 2AD power plug connection for 2AD1x4

1. Insert the plug into the flange socket; pay attention to the coding.
2. Manually tighten the union nut until it audibly locks in.
3. The red marks on the flange socket and the plug should align when the bayonet connection is locked in.

Terminal box, standard design
for 2AD1x4, 2AD200, 2AD225



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

Fig. 15-3: Sample terminal box

- ⇒ Align the cover and tighten the bolts uniformly. The tightness and IP protective class of the housing provided at the factory may not be reduced.
- ⇒ The gasket (2) is glued into the cover (1) at the factory and must not be removed or damaged.
- ⇒ The connections of the internal winding interconnection in the terminal box must not be removed.



In the case of motors with switchable windings, the connections for the power cable and the internal interconnection are laid out on separate terminal studs.

Encoder Connection

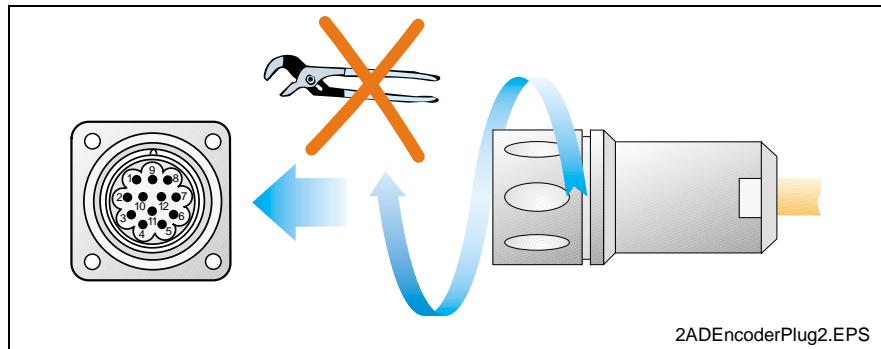


Fig. 15-4: 2AD sample encoder plugged connection

1. Insert the plug into the flange socket; pay attention to the coding.
2. Tighten the union nut by hand.

All the various encoder plugged connections are established according to the same procedure.

Blower Connection

The motor blowers are connected either via the supplied blower plug (3, 4 or 5 pins) or via the blower terminal box. The basic information regarding the connection of the blower is described in detail in Chapter 12.5 "Blower Connections".

Brake and Temperature Sensor Connection

The connections of the motor brake and the temperature sensor are integrated in the power connection. Observe the connection plans of the drive controllers.

⇒ **After proper electrical connection, carry out commissioning according to the instructions in the following chapter.**

15.4 Dismantling

1. Observe the instructions of the machine documentation.
2. Use the machine-side control commands to bring the drive to a controlled standstill.
3. Switch off the power and control voltage of the drive controller.
4. Switch off the motor protection switch for the motor blower.
5. Switch off the main switch of the machine.

6. Secure the machine against accidental movements and against unauthorized operation.
7. Wait for the discharge time of the electrical systems to expire and then remove all electrical connections.
8. Secure the motor and blower unit against falling or movements before removing the mechanical connections.
9. Remove the motor from the machine and store the motor properly.
10. Log all measures taken in the commissioning log.

16 Operating 2AD Motors

16.1 Commissioning

2AD motors are part of a drive system with a drive controller and a control. Commissioning is executed for the drive system.

The proper functioning of the holding brake must be checked before the motor is installed. See Chapter 13.5 "Holding Brake (Option)".

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.



CAUTION

Material damage due to errors in activating 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 must not be put into operation.
- ⇒ Contact Bosch Rexroth for missing information or support during commissioning!

Execution

When all prerequisites have been fulfilled, proceed as follows:

1. Switch on the motor blower of the 2AD motor and check the direction of the blower. Note the arrow mark on the blower screen.
2. Commission the device controllers and power supplies according to the corresponding descriptions. Observe the corresponding "Design..." and "Functional Description..." documentation.
3. Before releasing the setpoint, check whether the set relationship of the maximum motor speed and the preset setpoint corresponds to the specifications for the machine.
4. At a low rotational speed, check whether the rotational direction of the motor and the polarity setpoint correspond to the specifications for the machine.
5. At a low rotational speed, check whether the positioning commands of the control systems are executed correctly.
6. Log all measures taken in the commissioning log.

When all steps have been executed correctly, commissioning of the motor is complete.



Commissioning of drive controllers and the control may require additional steps. Observe the system specifications and the corresponding product documentation.

The inspection of the functioning and performance of the systems is not part of the commissioning of the motor; instead, it is carried out within the framework of the commissioning of the machine as a whole. Observe the information and regulations of the machine manufacturer.

16.2 Deactivation

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

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

16.3 Maintenance

Induction motors of the 2AD series are maintenance free if run within the given operating conditions. However, operation under unfavorable conditions can lead to limitations in availability.

- ⇒ Increase the reliability with regular preventive maintenance measures.
- ⇒ Observe the information of the machine manufacturer in the machine maintenance plan.
- ⇒ Log all maintenance measures taken 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 functionality of the motor blower 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 motor 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, shavings and other dirt from the motor housing, cooling fins and the blower unit.	Depending on the degree of soiling, but after one operating year at the latest.

Fig. 16-1: 2AD maintenance plan

Motor blower

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

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

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

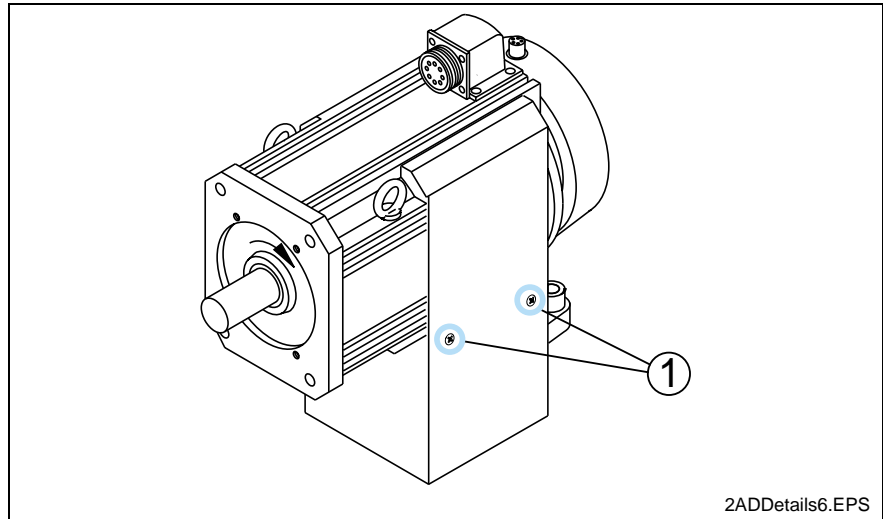
Axial and radial blowers use the same basic housing and are essentially mounted in the same way.

General procedure for maintaining the blower:

1. Switch off the system and disconnect the electrical blower connection.
2. Disconnect the connection between the encoder cable and the motor (exception: 2AD104 with radial blower).
3. Remove the mounting screws of the encoder flange socket only if the available internal cable length is insufficient to remove the blower unit.
4. Secure the blower unit against dropping before you remove the mounting screws.

5. Carefully remove the blower unit from the motor without stressing the internal connection between the motor encoder and the encoder flange socket.
6. After completing cleaning or troubleshooting, reattach the blower unit. Secure the mounting screws with "LOCTITE 243 screw fastener" and reestablish the connections.
7. Check the functioning of the motor blower and the air circulation.
8. Log all maintenance measures in the machine maintenance plan.

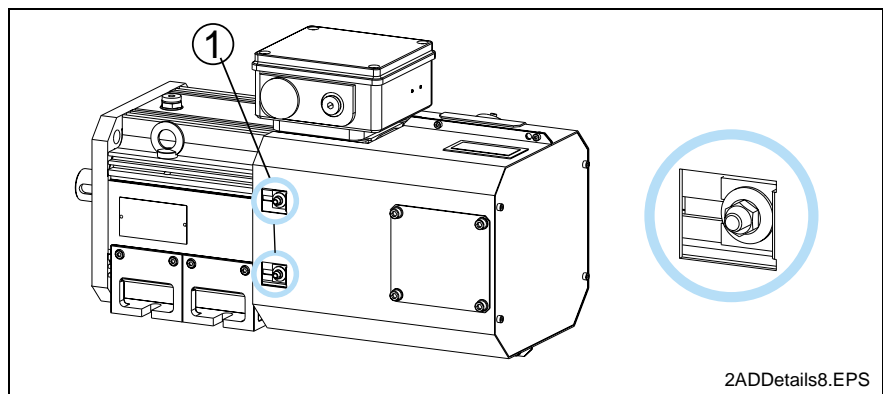
**2AD104
with radial blower**



(1): Mounting screws (also on rear)

Fig. 16-2: 2AD104 radial blower (example)

**2AD104
with axial blower**

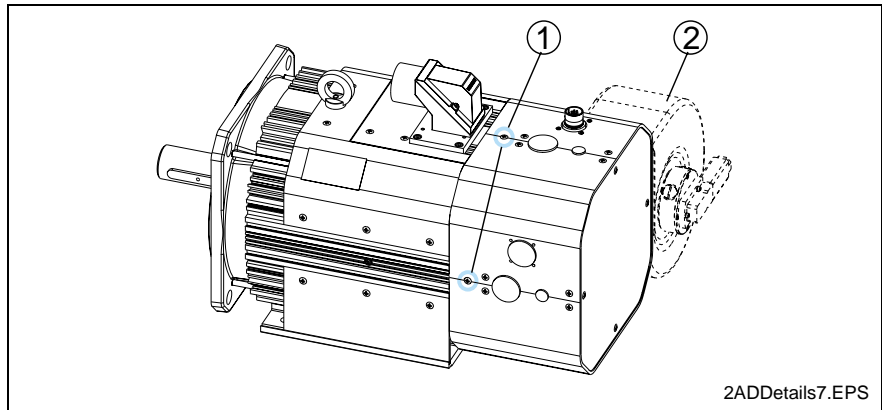


(1): Mounting screws (also on rear)

Fig. 16-3: 2AD104 axial blower (example)

In this variant, the blower unit is attached using strips that are inserted before assembly into the T-grooves of the motor cooling fins. The blower unit is mounted and removed as a whole.

2AD134...
with axial or radial blower



- (1): Mounting screws (also on bottom and rear)
(2): Radial blower (optional)

Fig. 16-4: 2AD... axial/radial blower (example)

In variants "axial blower" and "radial blower" starting with motor frame size 134, the blower units consist of several individual parts.

Holding Brake Maintenance

See section 13.5

16.4 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.
- ⇒ During maintenance work, secure the system against restarting and unauthorized use.
- ⇒ Do not work on hot surfaces.

Possible causes for the malfunctioning of 2AD motors can usually be traced to problems in the following areas:

1. Motor encoder or encoder connection
2. Internal temperature sensor (thermistor)
3. Blower function
4. Mechanical damage of the motor
5. Mechanical connection to machine



For motor encoder and thermistor problems, diagnostics and fault messages will appear on the drive controller on the control. Observe the notes in the corresponding documentation.

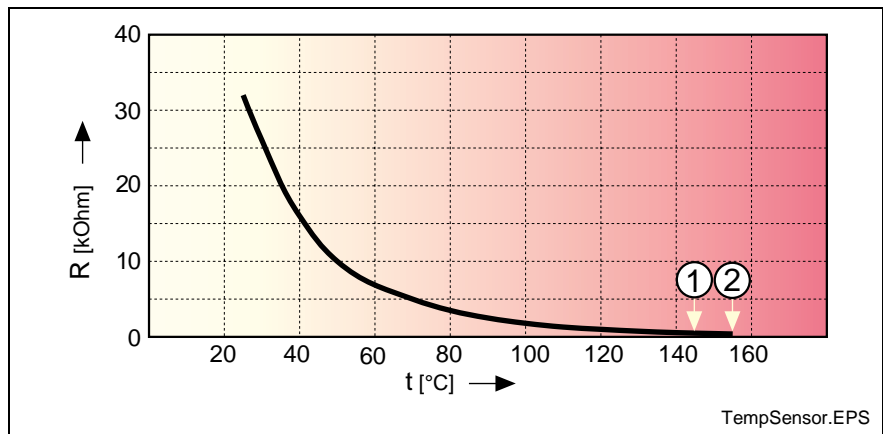
In the following, a few malfunction states are shown as examples with potential causes; no claim is made for completeness of this list.

Excess Temperature of Motor Housing

Status	The housing temperature of the motor climbs to unusually high values.
Possible causes	<ol style="list-style-type: none"> 1. Failure or strong soiling of blower system. 2. Original processing cycle has been changed. 3. Original motor parameters have been changed. 4. Motor bearings are worn or defective.
Countermeasures	<ol style="list-style-type: none"> 1. Check the functioning of the blower. Clean if necessary. In the case of failure, 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. Compare the length of motor operation with the mechanical bearing lifetime and grease consumption lifetime. Slowly turn the motor shaft by hand and pay attention to bearing noises or fault-free movement. In the case of failure, contact Bosch Rexroth Service.

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	<ol style="list-style-type: none"> 1. Wiring error or cable break in sensor cable. 2. Winding temperature sensor failure (NTC). 3. Diagnostics system defective.
Countermeasures	<ol style="list-style-type: none"> 1. Check the wiring and connection of the temperature sensor according to the connection plan. 2. Check the resistance value of the temperature sensor using a multimeter. <ul style="list-style-type: none"> ⇒ Set the measuring instrument to resistance measurement. ⇒ Separate the temperature sensor connection from the device controller 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. ⇒ If the sensor is defective, connect the spare sensor (see the following section). If both sensors are defective, the motor must be replaced. Contact Bosch Rexroth Service.



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

Fig. 16-5: 2AD winding temperature, NTC sensor characteristic curve

3. Check the diagnostics system on the device controller or the control.

Connecting the Spare Sensor

Motor with terminal box

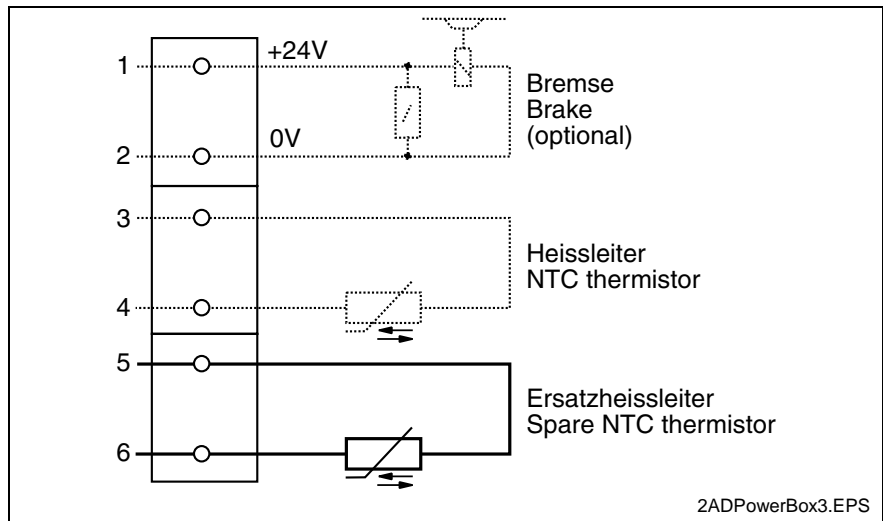
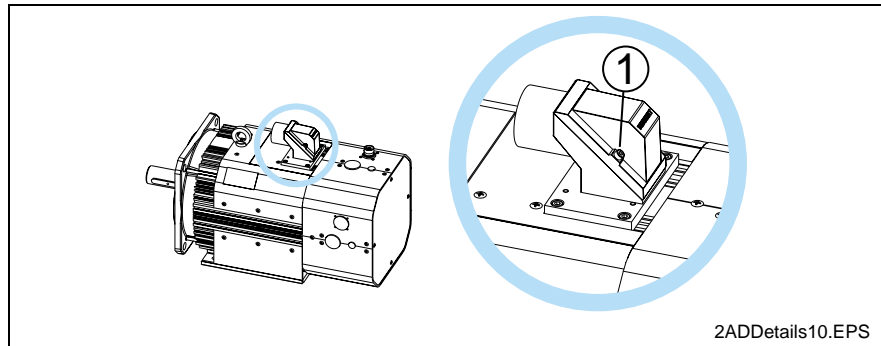


Fig. 16-6: 2AD temperature sensor

1. Switch the drive controller and the machine off and secure the system against unauthorized use.
2. Open the terminal box and remove the connection of the wire pair that leads from the power cable to the defective temperature sensor from the terminal block.
3. Connect this wire pair with the terminal block contacts of the replacement NTC resistor.
4. Check the electrical resistance of the temperature sensor with the system switched off (see the instructions in the previous section).
5. When the test is complete, close the terminal box. Ensure that the cover gasket fits properly. Secure the cover screws with "LOCTITE 243 screw fastener".

Motor with flange socket

Note: Special tools are required to install and remove the contact pins. Information regarding handling and tools can be found in the documentation "Indramat Connection Techniques, Assembling and Tools...", Mat. No. 00280895.



(1): Flange socket housing with mounting screws (2 pieces)

Fig. 16-7: 2AD flange socket

1. Switch the drive controller and the machine off and secure the system against unauthorized use.
2. Remove the mounting screws of the flange socket housing and carefully remove the lid. Avoid damaging the O-ring on the inside.
3. Use the removal tool to remove the contact pins of the defective temperature sensor from the insulator.
4. Use the removal tool to remove two unused contact pins from the insulator; crimp the wires of the spare sensor.
5. Use the installation tool to insert the newly contacted pins into the contact openings – see point (3). The polarity is not relevant. See the "Connection Techniques" section.
6. Use the installation tool to insert the pins of the defective sensor into the remaining contact openings to reestablish the tightness of the insulator.
7. Ensure that the interior O-ring sits perfectly and screw the cover onto the flange socket housing. Secure the mounting screws with "LOCTITE 243 screw fastener".
8. Check the electrical resistance of the temperature sensor with the system switched off (see the instructions in the previous section).

Motor generates vibrations

Status	Audible or tactile vibrations occur on the motor.
Possible causes	<ol style="list-style-type: none"> 1. Machine elements attached to the motor shaft are insufficiently balanced (or not at all). 2. Motor bearings worn or defective. Available bearing life time of grease consumption duration elapsed. 3. Bearings of blower motor worn or defective. 4. Motor mount loose. 5. Drive system is instable from a control point of view.
Countermeasures	<ol style="list-style-type: none"> 1. Check balance of attached machine elements. Check motor for damage. In the case of failure, contact Bosch Rexroth Service. 2. Check motor for damage. In the case of failure, contact Bosch Rexroth Service. 3. Check blower motor for damage. In the case of failure, contact Bosch Rexroth Service. 4. Fasten motor properly and check for damage. In the case of failure, contact Bosch Rexroth Service. 5. Check parameters of 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 is not precisely executed – or not at all. No malfunction display on the device controller or the control.
Possible causes	<ol style="list-style-type: none"> 1. Wiring of encoder cable is incorrect or defective. Pin assignment (encoder signals) in cable or plug may be switched. 2. Insufficient shielding of encoder cable against interference. 3. Incorrect encoder parameters set in drive controller. 4. Motor shaft machine element connection loose. 5. Encoder defective.
Countermeasures	<ol style="list-style-type: none"> 1. Check wiring according to connection plan and check state of cables for damage. 2. Check shielding; if necessary, increase the effective contact surface of the shielding. 3. Correct the parameters. Observe the commissioning log. 4. Check the mechanical connection. Do not continue to use damaged parts. 5. Motor or encoder must be replaced. In the case of failure, contact Bosch Rexroth Service.

17 Service & Support

17.1 Helpdesk

Unser Kundendienst-Helpdesk im Hauptwerk Lohr am Main steht Ihnen mit Rat und Tat zur Seite. Sie erreichen uns

- telefonisch - by phone:
über Service Call Entry Center
- via Service Call Entry Center
- per Fax - by fax:
- per e-Mail - by e-mail:

Our service helpdesk at our headquarters in Lohr am Main, Germany can assist you in all kinds of inquiries. Contact us at:

49 (0) 9352 40 50 60
Mo-Fr 07:00-18:00
Mo-Fr 7:00 am - 6:00 pm

+49 (0) 9352 40 49 41

service@boschrexroth.de

17.2 Service-Hotline

Außerhalb der Helpdesk-Zeiten ist der Service direkt ansprechbar unter

After helpdesk hours, contact our service department directly at

+49 (0) 171 333 88 26

oder - or

+49 (0) 172 660 04 06

17.3 Internet

Unter www.boschrexroth.de finden Sie ergänzende Hinweise zu Service, Reparatur und Training sowie die **aktuellen** Adressen *) unserer auf den folgenden Seiten aufgeführten Vertriebs- und Servicebüros.



Verkaufsniederlassungen



Niederlassungen mit Kundendienst

Außerhalb Deutschlands nehmen Sie bitte zuerst Kontakt mit unserem für Sie nächstgelegenen Ansprechpartner auf.

*) Die Angaben in der vorliegenden Dokumentation können seit Drucklegung überholt sein.

At www.boschrexroth.de you may find additional notes about service, repairs and training in the Internet, as well as the **actual** addresses *) of our sales- and service facilities figuring on the following pages.



sales agencies



offices providing service

Please contact our sales / service office in your area first.

*) Data in this document may have become obsolete since printing.

17.4 Vor der Kontaktaufnahme... - Before contacting us...

Wir können Ihnen schnell und effizient helfen wenn Sie folgende Informationen bereithalten:

1. detaillierte Beschreibung der Störung und der Umstände.
2. Angaben auf dem Typenschild der betreffenden Produkte, insbesondere Typenschlüssel und Seriennummern.
3. Tel./Faxnummern und e-Mail-Adresse, unter denen Sie für Rückfragen zu erreichen sind.

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

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

17.5 Kundenbetreuungsstellen - Sales & Service Facilities

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Vertriebsgebiet Süd Germany South Rexroth Indramat GmbH Landshuter Allee 8-10 80637 München Tel.: +49 (0)89 127 14-0 Fax: +49 (0)89 127 14-490	Vertriebsgebiet West Germany West Bosch Rexroth AG Regionalzentrum West Borsigstrasse 15 40880 Ratingen Tel.: +49 (0)2102 409-0 Fax: +49 (0)2102 409-406	Gebiet Südwest Germany South-West Bosch Rexroth AG Service-Regionalzentrum Süd-West Siemensstr. 1 70736 Fellbach Tel.: +49 (0)711 51046-0 Fax: +49 (0)711 51046-248	Gebiet Südwest Germany South-West Bosch Rexroth AG Regionalzentrum Südwest Ringstrasse 70 / Postfach 1144 70736 Fellbach / 70701 Fellbach Tel.: +49 (0)711 57 61-100 Fax: +49 (0)711 57 61-125
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<p>Sweden - Schweden</p> <p>Rexroth Mecman Svenska AB Indramat Support Ekvåndan 7 254 67 Helsingborg</p> <p>Tel.: +46 (0) 42 38 88 -50 Fax: +46 (0) 42 38 88 -74</p>	<p>Switzerland West - Schweiz West</p> <p>Bosch Rexroth Suisse SA Département Rexroth Indramat Rue du village 1 1020 Renens</p> <p>Tel.: +41 (0)21 632 84 20 Fax: +41 (0)21 632 84 21</p>	<p>Switzerland East - Schweiz Ost</p> <p>Bosch Rexroth Schweiz AG Geschäftsbereich Indramat Hemrietstrasse 2 8863 Buttikon</p> <p>Tel. +41 (0) 55 46 46 111 Fax +41 (0) 55 46 46 222</p>	

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