

Rexroth RD 500 SFT Drive Control Devices Sinus Frontend Technology

R911201407
Edition 01

Project Planning Manual



Title	Rexroth RD500 SFT Drive Control Devices Sinus frontend technology
Type of Documentation	Project Planning Manual
Document Typecode	DOK-RD500*-SFT*****-PR01-EN-P
Internal File Reference	Document number: 120-1950-B337-01/EN
Purpose of Documentation	This documentation describes the components RD 500 SFT. It provides information: <ul style="list-style-type: none"> • For accessories • For mechanical assembly • For electrical installation • For liquid cooling

Record of Revisions

Description	Release Date	Notes
DOK-RD500*-SFT*****-PR01-EN-P	09.2004	First edition

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Published by Bosch Rexroth AG
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<http://www.boschrexroth.de/>
Dpt.: ENG (im/rk)

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

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1 Safety Instructions for Electric Servo Drives and Controls

1.1 Introduction

Read these instructions before the equipment is used and eliminate the risk of personal injury or property damage. Follow these safety instructions at all times.

Do not attempt to install, use or service this equipment without first reading all of the 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 product is resold, rented, transferred or passed on to others, then these safety instructions must be delivered with the product.



WARNING

Inappropriate 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 product damage, personal injury, severe electrical shock or death!

1.2 Explanations

The safety warnings in this documentation describe individual degrees of hazard seriousness in compliance with ANSI:

Warning symbol with text	Degree of hazard seriousness
 DANGER	The degree of hazard seriousness describes the consequences resulting from non-compliance with the safety guidelines: Bodily harm or product damage will occur.
 WARNING	Death or severe bodily harm may occur.
 CAUTION	Death or severe bodily harm may occur.

Fig. 1-1:Classes of danger according to ANSI

1.3 Hazards due to inappropriate use



DANGER

High voltage and high discharge current! Danger to life, risk of severe electrical shock and risk of injury!



DANGER

Dangerous movements! Danger to life and risk of injury or equipment damage by unintentional motor movements!



WARNING

High electrical voltage due to wrong connections! Danger to life, severe electrical shock and severe bodily injury!



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 inappropriate handling! Bodily injury caused by crushing, shearing, cutting and mechanical shock or improper handling of pressurized systems!



CAUTION

Risk of injury due to inappropriate handling of batteries!

1.4 General information

- Bosch Rexroth is not liable for damages resulting from failure to observe the warnings given in these documentation.
- Read all of the operating, maintenance and safety instructions in your language before starting up the machine. If you find that due to a translation error you can not 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.
- Trained and qualified personnel in electrical equipment:
Only trained and qualified personnel may work on this equipment or in its proximity. Personnel are qualified if they have sufficient knowledge of the assembly, installation and operation of the product as well as an understanding of all warnings and precautionary measures noted in these instructions.
Furthermore, they should be trained, instructed and qualified to switch electrical circuits and equipment on and off, to ground them and to mark them according to the requirements of safe work practices and common sense. 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 on commercial machinery.
European countries: see directive 89/392/EC (Machinery Directive)
- The ambient conditions specified in the product documentation must be observed.
- Use only safety features that are clearly and explicitly approved in the Project Planning manual.
For example, the following areas of use are not allowed: Cranes and hoisting equipment, elevators used for people or freight, devices and vehicles to transport people, medical applications, refinery plants, the transport of hazardous goods, radioactive or nuclear applications, applications sensitive to high frequency, mining, control of protection equipment (also in a machine).
- Start-up is only permitted once it is ensured that the machine, in which the product is installed, complies with the requirements of national safety regulations and safety specifications of the application.
- Operation is only permitted if the national EMC regulations for the application are met.
The machine builder is responsible for compliance with the limiting values as prescribed in the national regulations and specific EMC regulations for the application.

European countries: see Directive 89/336/EC (EMC Directive).

US.: Refer to the National Electrical Code (NEC), National Electrical Manufacturers Association (NEMA), and local building codes. The user of this equipment must observe the above noted items at all times.

- Technical data, connections and operational conditions are specified in the product documentation and must be followed at all times.

1.5 Protection against contact with electrical parts

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

Making contact with parts at voltages above 50 Volts could be dangerous to personnel and cause an electrical shock. When operating electrical equipment, it is unavoidable that some parts of the unit conduct dangerous voltages.



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

- ⇒ 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 electrical installations.
- ⇒ Before powering-up, the productive conductor must be permanently connected to all electrical units according to the connection diagram.
- ⇒ Do not operate electrical equipment at any time if the protective conductor is not permanently connected, even for brief measurements or tests.
- ⇒ Before working with electrical parts with voltage potentials higher than 50 V, the equipment must be disconnected from the line supply or power supply.
- ⇒ The following should be observed with electrical drives, power supplies, and filter components:
Wait five (30) minutes after switching off power to allow capacitors to discharge before beginning work. Measure the voltage at the capacitors before beginning 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 (r.c.d.) must not be used on an electric drive! Indirect contact may be prevented by other means, for example, by an overcurrent protective device.
- ⇒ Equipment that is built into machines must be se-

cured against direct contact. Use appropriate housings, for example a control cabinet.

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

US: Refer to the National Electrical Code (NEC), National Electrical Manufacturers Association (NEMA) and local building codes. The user of this equipment must observe the above noted instructions at all times.

To be observed for electric drives and filter components:



DANGER

High voltage! High leakage current! Danger to life, danger of injury and bodily harm from electrical shock!

- ⇒ Before powering-up all housings and motors must be permanently grounded according to the connection diagram. This applies even for brief tests.
- ⇒ The protective conductor of the electrical equipment must be permanently connected to the line supply. The leakage current is greater than 3.5 mA.
- ⇒ Use a copper conductor with at least 10 mm² cross section over its entire course for this protective connection!
- ⇒ Prior to startups, even for brief tests, always connect the protective conductor or connect with ground wire. High voltage levels can occur on the housing that could lead to severe electrical shock and personal injury.

European countries: EN 50178 / 1998, Section 5.3.2.1.

US: Refer to the National Electrical Code (NEC), National Electrical Manufacturers Association (NEMA), and local building codes. The user of this equipment must observe the above noted instructions at all times.

1.6 Protection against electrical shock by protective low voltage (PELV)

All connections and terminals with voltages between 5 and 50 Volts on Bosch Rexroth products are protective low voltages designed in accordance with the following Standards:

- International: IEC 60364-4-41
- EU countries: Refer to EN 50178/1998, Section 5.2.8.1.



WARNING

High voltage due to wrong connections! Danger to life, severe electrical shock and severe bodily injury!

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

1.7 Protection against dangerous movements

Dangerous movements can be caused by faulty control or the connected motors. There are various causes:

- unclean or wrong wiring of cable connections
- inappropriate or wrong operation of equipment
- malfunction of sensors, encoders and monitoring circuits
- defective components
- software errors

Dangerous movements can occur immediately after equipment has been powered-up or even after an unspecified time of trouble-free operation.

The monitors in the drive components make faulty operation almost impossible. Regarding personnel safety, especially the danger of bodily harm and property damage, this alone should not be relied upon to ensure complete safety. Until the built-in monitors become active and effective, it must be assumed in any case that some faulty drive movements will occur. The extent of these faulty drive movements depends on the type of control and the state of operation.

**DANGER**

Dangerous movements! Danger to life and risk of injury or equipment damage!

- ⇒ Personnel protection must be secured for the above listed reason by means of superordinate monitors or measures.

These are implemented in accordance with the specific situation of the plant/system and a danger and fault analysis conducted by the manufacturer of the plant/system. All the safety regulations that apply to this plant/system are included. By switching off, circumventing or if safety devices have simply not been activated, then random machine movements or other types of faults can occur.

Avoiding accidents, injury or property damage:

- ⇒ Keep free and clear of the machine's range of motion and moving parts. Prevent people from accidentally entering the machine's range of movement:
 - use protective fences
 - use protective railings
 - install protective coverings
 - install light curtains or light barriers
- ⇒ Fences must be strong enough to withstand maximum possible momentum.
- ⇒ Mount the emergency stop switch (E-stop) 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 start-inhibit system to prevent unintentional start-up.
- ⇒ Make sure that the drives are brought to standstill before accessing or entering the danger zone.
- ⇒ Secure vertical axes against falling or slipping after switching off the motor power by, for example:
 - Mechanically securing the vertical axes
 - Adding an external brake / clamping mechanism
 - Balancing and thus compensating for the vertical axes weight and the gravitational force

The standard equipment motor brake or an external brake controlled directly by the servo drive are not sufficient to guarantee the safety of personnel!
- ⇒ Disconnect electrical power to the equipment using a master switch and lock-out the switch against reclosure:
 - for maintenance and repair work
 - for cleaning of equipment
 - if the equipment is not used for long periods of time

- ⇒ Avoid operating high-frequency, remote control and radio equipment near electronic circuits and feeder cables. If use of such equipment cannot be avoided, verify the system and the plant for possible malfunctions at all possible positions of normal use before the first start-up. If necessary, perform a special electromagnetic compatibility (EMC) test on the plant.
-

1.8 Protection against magnetic and electromagnetic fields during operations and mounting

Magnetic and electromagnetic fields generated by 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 pacemakers, metal implants and hearing aids are not permitted to enter 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 pacemaker to enter such an area, then a physician must be consulted prior to doing so. Pacemakers, that are already implanted or will be implanted in the future, have a considerable deviation in their immunity to interference. Due to the unpredictable behavior there are no generally valid rules.
 - ⇒ 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.
-

1.9 Protection against contact with hot parts



CAUTION

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

- ⇒ Do not touch surfaces near the source of heat! Danger of burns!
- ⇒ Wait ten (10) minutes before you access any hot unit. Allow the unit to cool down.
- ⇒ Do not touch hot parts of the equipment, such as housings, heatsinks or resistors. Danger of burns!

1.10 Protection during handling and installation

Under certain conditions inappropriate handling and installation of parts and components may cause injuries.



CAUTION

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

- ⇒ Observe general instructions and safety regulations during handling installation.
- ⇒ Use only appropriate lifting or moving 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.
- ⇒ Wear appropriate protective clothing, e.g. safety glasses, safety shoes and safety gloves.
- ⇒ Never stay under suspended loads.
- ⇒ Clean up liquids from the floor immediately to prevent personnel from slipping.

1.11 Battery safety

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



CAUTION

Risk of injury through incorrect handling!

- ⇒ Do not attempt to re-activate discharged batteries by heating or other methods (danger of explosion and corrosion).
- ⇒ Never charge batteries (danger from leakage and explosion).
- ⇒ Never throw batteries into a fire.
- ⇒ Do not dismantle batteries.
- ⇒ Handle with care. Incorrect withdrawal or installation of a battery can damage equipment.

Note: 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 of batteries separately from other refuse. Observe the legal requirements given in the country of installation.

1.12 Protection against pressurized systems

Certain Motors (ADS, ADM, 1MB etc.) and drives, corresponding to the information in the Project Planning manual, must be provided with various media at a high pressure such as compressed air, hydraulic oil, cooling fluid or coolant. In these cases, improper handling of the supply of the pressurized systems or connections of the fluid or air under pressure can lead to injuries or accidents.



CAUTION

Danger of injury when pressurized systems are handled by untrained personnel!

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

Note: Environmental protection and disposal! The fluids used in the operation of the pressurized system equipment is not environmentally compatible. Fluid that is damaging to the environment must be disposed of separately from normal waste. Observe the national specifications of the country of installation.

1.13 Precautionary measures when handling components which can be destroyed by electrostatic discharge (ESDS)

The drive units contain components and parts which can be destroyed by electrostatic discharge. Please observe the following when working with electronic modules and boards:

- Electronic modules and boards should only be touched if absolutely necessary.
- Before touching an electronic module/board, the human body must first be electrically discharged.
- Electronic modules/boards may not come into contact with highly-insulating materials (e.g. plastic foils, insulating work surfaces, articles of clothing manufactured from man-made fiber).
- Electronic modules/boards may only be placed on conductive surfaces.
- The soldering iron tip must be grounded when carrying-out soldering work on electronic modules/boards.

- Electronic modules/boards and components may only be stored and shipped in conductive packaging (e.g. metalized plastic or metal containers).
- If the packaging is not conductive, electronic modules/boards must be wrapped in a conductive material. In this case, e.g. conductive foam rubber or household aluminum foil can be used.

The necessary ESDS protective measures are clearly shown in the following diagram:

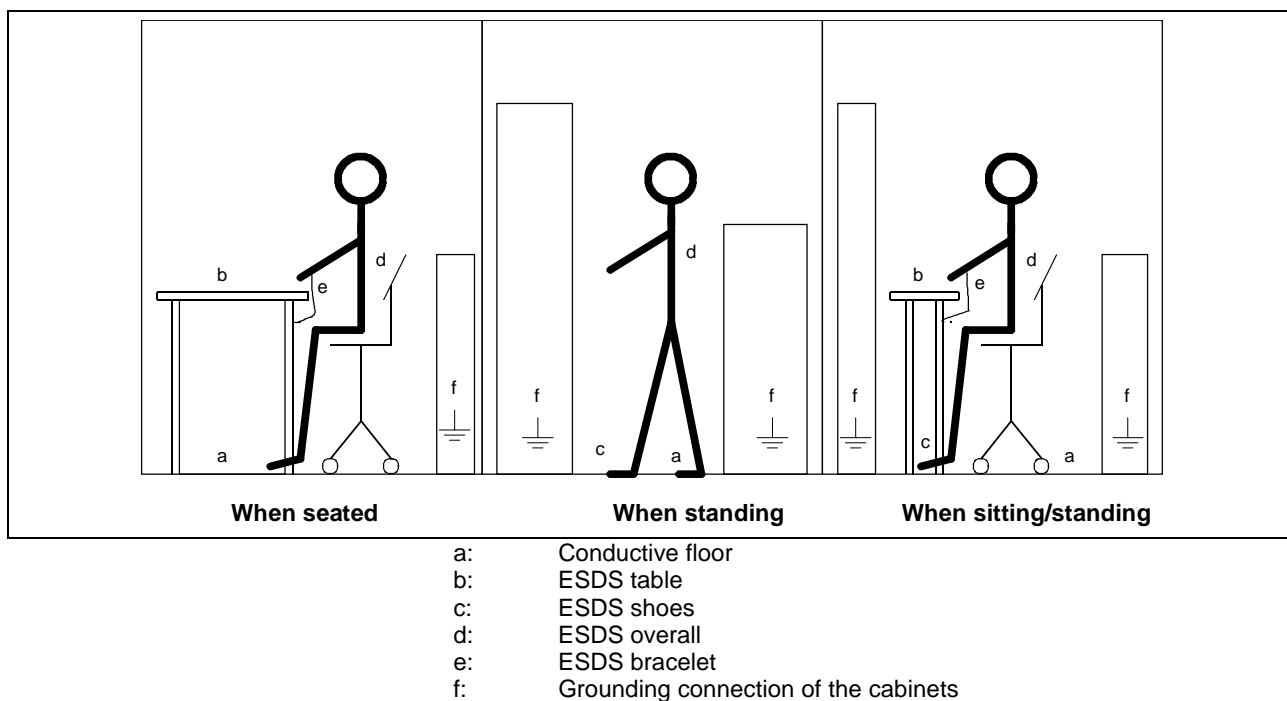


Fig. 1-2: ESDS protective measures

1.14 General information liquid cooling



CAREFUL

Antifreeze agent is hazardous!

⇒ If you swallow it, immediately seek medical attention and show the doctor the packaging or the label.



CAREFUL

Mixing with other antifreeze agents!

⇒ Do not mix the cooling agent with other antifreeze agents.

⇒ If assembled units have to be re-filled with cooling agent then only the specified antifreeze agent may be used.



WARNING

Burning caused by hot parts with temperatures over 30 °C!

⇒ Wear protective gloves

⇒ Only replace units after the liquid cooling has cooled down

**WARNING****Damage to property caused by moisture!**

⇒ The inlet temperature of the cooling agent may only be max. 5 K under the air temperature inside the control cabinet in temperate zones (up to 40 °C and air humidity of 70 %)!

Note: The surest protection against moisture is:
inlet temperature of the cooling agent = ambient temperature

Liquid-cooled drive components are perfused by a cooling agent that usually has a different temperature than that of the ambient air.

If warm air comes into contact with an object that is less warm than itself then precipitation is formed on the surface of the object if the temperature of the object is under the dew point. The object becomes moist.

**WARNING****Damage to property caused by corrosion!**

⇒ Make sure there is enough corrosion and frost protection

**WARNING****Damage to property due to a fault in the coolant circulation system!**

⇒ Trouble-free operation within the coolant circulation system must be ensured

Note: Try to ensure there are no deposits in the cooling pipe.

Note: Due to temperature differences, you should be aware of the change in volume of the cooling agent.

Recommendation Separate the cooling circuit by using a suitable recoler (e.g. plate heat exchanger).

**WARNING****Damage to property due to a failure in the pump!**

⇒ When the following occur at the same time!

- operated at overload
- electrical short-circuit at the output
- failure of the coolant pump

⇒ The unit can age prematurely in case of:

- a failure of the coolant pump without overload or short-circuit at the output

Note: To ensure the cooling function, the pump **must** be monitored



DANGER

Destruction of unit due to short-circuit!

⇒ Install drip protection

2 Important Usage Instructions

2.1 Usage for the Intended Purpose

Introduction

Bosch Rexroth products are developed and manufactured according to the appropriate state of technology of each product. Their operational reliability is checked before delivery.

The products may only be used for their intended purpose. If they are not used for their intended purpose then situations may arise that result in the damage to goods and/or to persons.

Note: In cases where the products are not used for their intended purposes, Bosch Rexroth, as manufacturer of the products, does not provide any guarantee, liability or indemnification; any risks arising from incorrect use of the products that is not for their intended purposes lies solely with the user.

Before using Bosch Rexroth products, you must meet the following requirements in order to ensure that the products are used for their intended purposes:

- Anyone working with any of our products in any way must read and understand the relevant safety regulations and the regulations regarding the intended purpose of the product.
- If the product in question is hardware, then the product must be left in its original condition, i.e. no physical changes to the hardware must be made. Software products must not be de-compiled and their source code must not be changed.
- Damaged or faulty products must not be installed or put into operation.
- You must ensure that the products are installed according to the regulations stipulated in the documentation.

Range of use and application

Individual components from Bosch Rexroth may only be operated together with inverters from the RD 500 SFT series.

Note: The components and their attachments may only be used and combined with the drive control units specified. Components not expressly named must neither be installed nor connected. This also applies to cables and lines. The equipment may only be operated in the configuration and combination of components expressly indicated and only using the software and firmware that has been indicated and specified in the respective functional description.

The components may only be operated under the assembly and installation requirements stipulated in this manual and only in the positions indicated and fully observing the stipulated environmental conditions (temperature, type of enclosure, humidity, EMC etc.).

2.2 Usage not in Accordance with the Intended Purpose

Using components outside of the stipulated range of application or under other operating conditions than those described in this manual, or using other technical specifications, is determined to be "not in accordance with the intended purpose".

The components may not be used when they are ...

- ... subjected to operating conditions that do not accord to the stipulated environmental conditions. This means that, e.g. operation under water, under extreme variations in temperature or under extreme maximum temperatures is forbidden.
- Furthermore, the components may not be used for applications for which they have not been expressly released by Bosch Rexroth. In this regard, please always observe the statements made in the general safety instructions!

2.3 Tests and Certifications

CE Mark



Figure 2-1: CE Mark (Type Label)

The UR mark has been received according to UL – recognition under the file number E227957.

UL Mark



Figure 2-2: UL Mark (Type Label)

The following components have UL recognition:

- HPS01.1
- NAM04.2
- HNF01.1
- HNP01.1
- HNL01.1
- RZR01.1
- RZU-E

The requirements for an operation complying with the UL mark of conformity have to be observed:

- **Wiring within the power circuit:** All components have to be wired by Cu-cords which resist temperatures of at least 90 °C (194 °F). For the wiring, please use merely class 1 cords (NEC).
- **Wiring within the control circuit:** All components have to be wired by Cu-cables which resist temperatures of at least 75 °C.
- SFT-components are suitable for the application in an environment corresponding to soiling class 2.
- SFT components are appropriate for the operation at mains which conduct a short circuit current of maximum 12,6 A at 3AC 480 maximum (UL test conditions).
- Maximum operating pressure of the coolant: 2 bar.
- discharge time: Note see in documentation

3 Transport and Storage

3.1 Transport of the Devices

Conditions

Temperature	-25 ... 70 °C
Relative humidity	5 ... 95 %; Climatic category 2K3
Absolute humidity	1 ... 60 g / m ³ ; Climatic category 2K3
Moisture condensation	not permissible
Icing	not permissible
Shock test when not in operation acc. to EN60068-2-27	Half-sinus in 3 axes: 10 g / 11 ms

Fig. 3-1: Transport conditions

Note: Notice for a sufficient frost protection at liquid cooled components.

3.2 Storage of the Devices

Conditions

Temperature	-25 ... 55 °C
Relative humidity	5 ... 95 %; Climatic category 1K3
Absolute humidity	1 ... 29 g / m ³ ; Climatic category 1K3
Moisture condensation	not permissible
Icing	not permissible

Fig. 3-2: Storage conditions

Extended Storage

The drive controllers contain electrolytic capacitors which may deteriorate during extended storage. Accordingly, when storing the drive controllers for a longer period of time, please operate each controller once per year for at least one hour with the power ON (and the DC bus voltage applied).

4 HPS01.1 Power-Stack

4.1 Description of the Power-Stack

Water-cooled power sections. The powers of 450 kW and 650 kW result from the parallel connection of 250 kW or 350 kW modules each.

Physical Characteristics

- 3 IGBT half bridge modules on liquid coolers on mounting plates
- quick-lock coupling for liquid coolers
- connection for DC link terminal bars C and D
- DC fuses for outgoing DC link for power supply unit and automatic controller box
- borings in the lid of the unit for test prods (checking of DC link voltage)
- The parts inserted as inverter for both line and motor are of the same type.
- Power data are indicated for the operation as both line- and motor-inverter.

Type Label

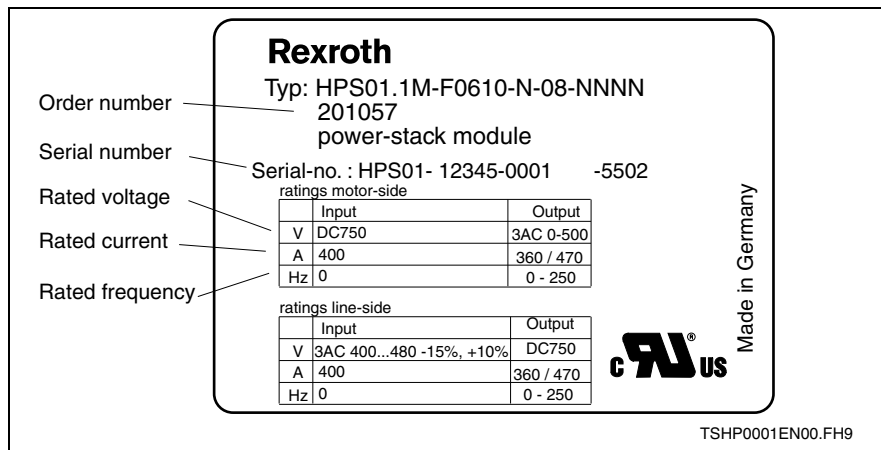


Figure 4-2: Type Label of the HPS01.1 at mains end / motor side

General Technical Specifications of the Power Inverter and Motor Inverter HPS01.1

HPS01.1	HPS01.1M-F0610-N-08-NNNN	HPS01.1M-F0610-N-08-NNNN	2x HPS01.1M-F0610-N-08-NNNN	2x HPS01.1M-F0880-N-08-NNNN
Environmental conditions, level of noise suppression and immunity to interference in operation				
Environmental class	3K3 acc. to DIN IEC 721-3-3			
Ambient temperature	0 – 40 °C			
Level of noise suppression	Acc. to EN 55011 / EN 61800-3, A2 only together with all required components for SFT			
Immunity to interference	EN 61800-3			
Type of enclosure	IP20 acc. to EN 60529 (without connection terminals)			
Weight	kg 92	95	184	190

Figure 4-3: General technical specifications of the power inverter and motor inverter

Technical Specifications of Power Inverter HPS01.1 with a Pulse Frequency of 4.2 kHz

HPS01.1		HPS01.1M-F0610-N-08-NNNN	HPS01.1M-F0610-N-08-NNNN	2x HPS01.1M-F0610-N-08-NNNN	2x HPS01.1M-F0880-N-08-NNNN
DC link power	kW	300	420	530	770
Max. DC link power for t = 60 s	kW	390	564	689	1001
Supply voltage 3 AC 380 - 480 V ($\pm 10\%$)					
Mains frequency $\pm 2\%$	Hz	50 / 60			
Rated current ¹⁾	A	440	630	800	1170
Peak current for t = 60 s	A	572	819	1040	1521
Nominal power SN	kVA	305	436	554	811
Peak power for t = 60 s	kVA	396	567	721	1054
Power loss	kW	5.4	7.9	10.2	14.2

1): at a mains voltage of > 400 V : The maximum current must be reduced by 1 % for every 4 V.
 at a mains voltage of < 360 V : The DC link power reduced by 1 % for every 4 V.

Tab.: 4-1 Technical specifications of the HPS01.1 power inverter with a pulse frequency of 4.2 kHz

Technical Specifications of Motor Inverter HPS01.1 with a Pulse Frequency of 4 kHz

HPS01.1		HPS01.1M-F0610-N-08-NNNN	HPS01.1M-F0610-N-08-NNNN	2x HPS01.1M-F0610-N-08-NNNN	2x HPS01.1M-F0880-N-08-NNNN
Rated power of motor ¹⁾	kW	250	350	450	650
Supply voltage DC 750 V (-15 % +5 %)					
Output frequency	Hz	0 - 250			
Rated current	A	360	520	690	950
Peak current for t = 60 s	A	470	680	895	1235
Peak current for t = 1 s ²⁾	A	612	884	1173	1591
Nominal power SN	kVA	312	450	598	823
Peak power for t = 60 s	kVA	407	589	775	1070
Power loss	kW	4.1	5.8	7.8	10.5

1): Max. perm. rated power of motor related to a 4-pole standard motor
 2): At a peak current for t = 1 s, the max. DC link power of the corresponding power inverter must not be exceeded.

Tab.: 4-2 Technical specifications of the motor inverter with a pulse frequency of 4 kHz

Technical Specifications of Motor Inverter HPS01.1 with a Pulse Frequency of 8 kHz

HPS01.1		HPS01.1M-F0610-N-08-NNNN	HPS01.1M-F0610-N-08-NNNN	2x HPS01.1M-F0610-N-08-NNNN	2x HPS01.1M-F0880-N-08-NNNN
Rated power of motor ¹⁾	kW	250	350	450	650
Supply voltage DC 750 V (-15 % +5 %)					
Output frequency	Hz	0 - 250			
Rated current	A	257	360	492	658
Peak current for t = 60 s	A	334	468	640	855
Peak current for t = 1 s ²⁾	A	437	612	836	1119
Nominal power for SN	kVA	230	331	439	605
Peak power for t = 60 s	kVA	298	430	571	786
Power loss	kW	4.1	5.8	7.8	10.5

- 1): Max. perm. rated power of motor related to a 4-pole standard motor
 2): At a peak current for t = 1 s, the max. DC link power of the corresponding power inverter must not be exceeded.

Tab.: 4-3 Technical specifications of the motor inverter with a pulse frequency of 8 kHz

Technical Specifications of Motor Inverter HPS01.1 with a Pulse Frequency of 12 kHz

HPS01.1		HPS01.1M-F0610-N-08-NNNN	HPS01.1M-F0610-N-08-NNNN	2x HPS01.1M-F0610-N-08-NNNN	2x HPS01.1M-F0880-N-08-NNNN
Rated power of motor ¹⁾	kW	250	350	450	650
Supply voltage DC 750 V (-15 % +5 %)					
Output frequency	Hz	0 - 250			
Rated current	A	195	275	374	502
Peak current for t = 60 s	A	253	357	486	653
Peak current for t = 1 s ²⁾	A	332	467	636	853
Nominal power SN	kVA	186	269	357	491
Peak power for t = 60 s	kVA	243	349	464	638
Power loss	kW	4.1	5.8	7.8	10.5

- 1): Max. perm. rated power of motor related to a 4-pole standard motor
 2): At a peak current for t = 1 s, the max. DC link power of the corresponding power inverter must not be exceeded.

Tab.: 4-4 Technical specifications of the motor inverter with a pulse frequency of 12 kHz

Control Principle

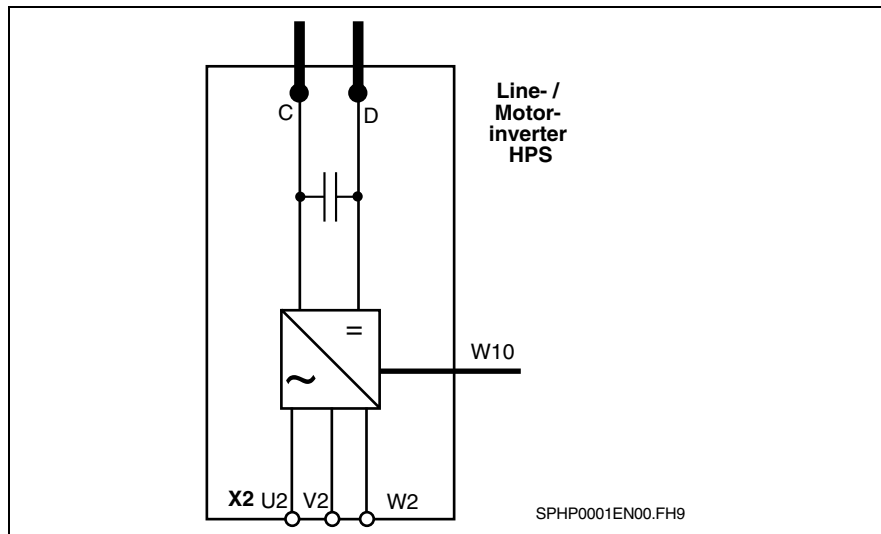


Figure 4-4: Control principle of the HPS01.1

4.2 Mechanical Assembly

Minimum requirements related to the place of installation

- The service room must be dust free. Dusty air must be filtered.
- The environmental temperature must be between 0° and 40 °C.
- Relative humidity must not exceed 90 % and there must be no moisture in the storage area.
- The air fed-in must not contain any gases which could endanger the function of the units or which are aggressive or electrically conductive.
- The minimum distances to other components must be observed.
- The unit dissipates heat and warms up the surroundings. Suitable distance from units and devices that are sensitive to heat should therefore be observed.

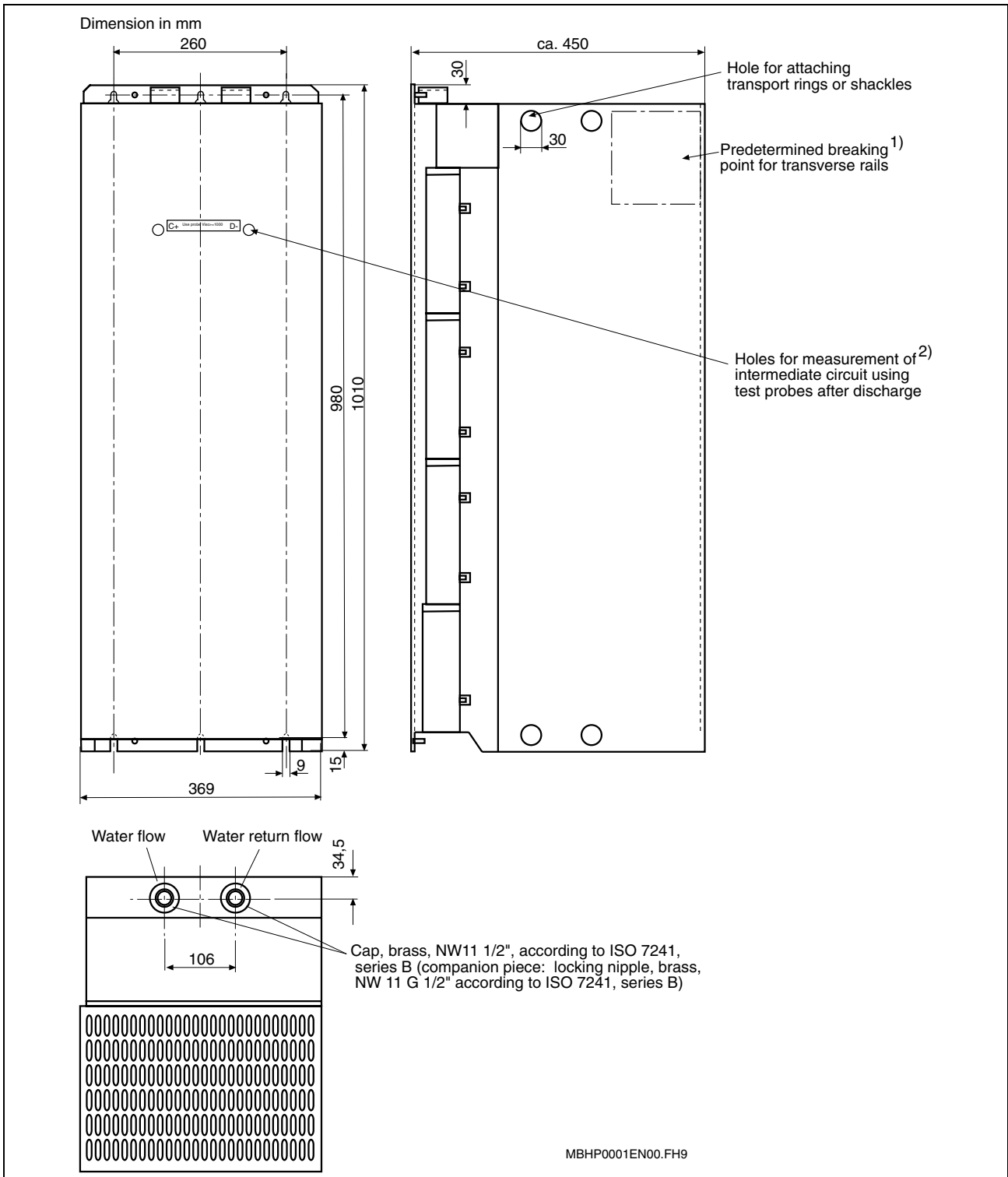
Assembly

The following points should be observed when assembling the device:

- Assembly must be made in the vertical position on an even surface.
- When assembling the cabinet, the amount of cooling air required by each unit must be calculated and the cabinet should be cooled accordingly.
- The metal housing of the Power-Stack module should be level and connected securely and electroconductive to the control cabinet or the fitting panel. If necessary, use contact discs or scratching discs.
- The required fixing screws are indicated in the drilling template of the dimension drawing.
- There are notches on the side walls to erect the units using hoisting equipment. Transport eyes and transport shackles can be hooked on at these points.
- Connect the cooling-water circuit of the Power-Stacks using the radiator hoses. Additional information is contained in Chapter Liquid Cooling.

Dimension Drawing

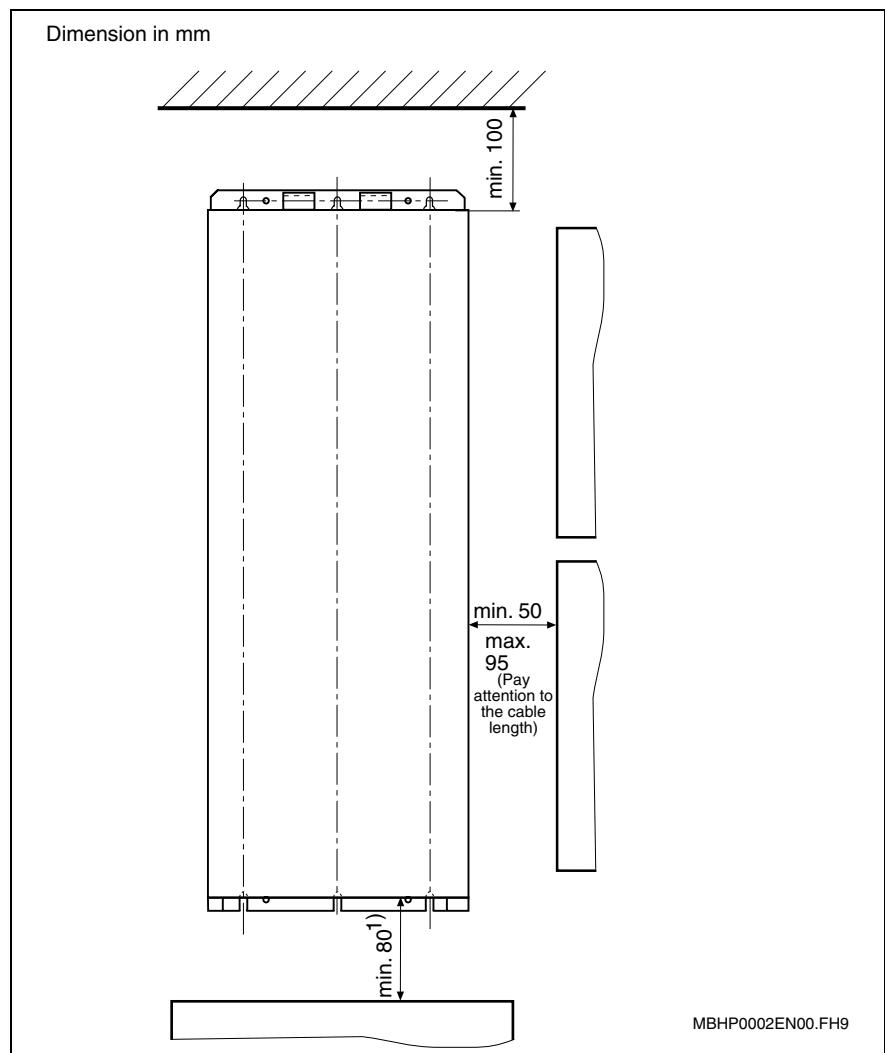
A Power-Stack module is shown in the drawings below.



- 1): In case of transverse power connections (bars or cable) the areas delimited by rated break points must be removed at the side panels.
- 2): We recommend „Hirschmann Prüf 2610 FT“ test prods. (test voltage 1000 V)

Figure 4-5 Dimension drawing of the HPS01.1 Power-Stack module

Minimum Clearance Distance



- 1): When installing the RZU aggregate current transformer, the minimum distance does not need to be observed.

Figure 4-6: Minimum clearance distances to adjacent components

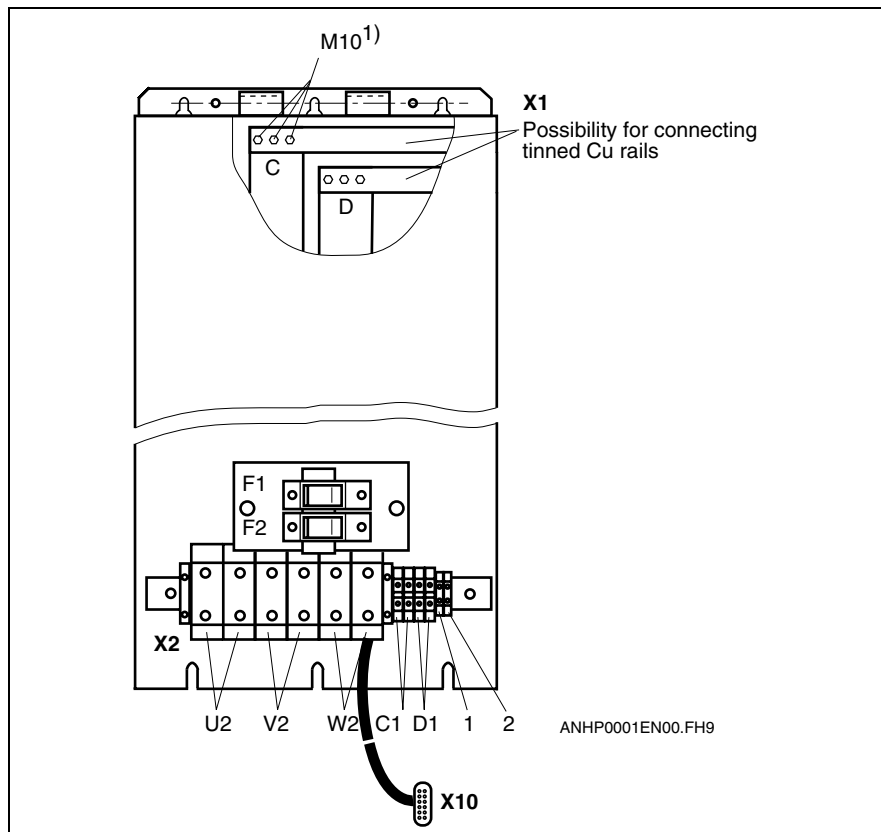
Technical Specifications of the HPS01.1 Coolant Circulation System

Information regarding liquid cooling is contained in Chapter Liquid Cooling.

4.3 Electrical Installation

Power Terminals

Layout plan of terminals on the HPS01.1



1): Max. tightening torque of the screws: 35 Nm.

Figure 4-7: Layout plan of terminals

Fuses F1 and F2

- The lid of the housing must be removed to make a visual check.
- Before removing the lid of the housing, the DC link voltage must be checked to make sure it is at zero potential .
- The trip display is used to check the function of the fuses. (lateral pin).
- If the fuse is working correctly then the pin does not protrude out of the fuse housing.
- Fuse type F1 and F2: 4 A / 690 V Ferraz Shawmut 6,921 Cp gRC, Ref.nummer F081517.

Conductor Cross Sections

The conductor cross sections refer here to the rated current of the inverter. The corresponding cross section of the ground conductor must be at least as large as that of the power lines.

The following requirements are assumed for the power lines:

- The cross sections are each for one phase in case of multi-wire lines and have been determined according to the regulations of VDE0298.
- From 50 mm² (AWG 1/0) they are laid free and non-contacting in the cabinet.

The following requirements are assumed for the motor lines:

- The cross sections are for screened 4-wire cable and have been determined according to the regulations of VDE0298.
- From 50 mm² (AWG 1/0), they are laid free and non-contacting in the cabinet.

Note: The conductor cross sections stipulated in mm² assume the use of PVC 70 °C lines.
The conductor cross sections stipulated in AWG assume the use of THHN or THHW 194 °F (90 °C) lines.

Description of the Power Terminals of the HPS01.1 Power Inverter

X2, power terminals

Type

HPS01.1xx	Type	Number	Type of Construction
250	high current terminal	6	terminal for bar assembly
350	high current terminal	6	terminal for bar assembly
450	high current terminal	6	terminal for bar assembly
650	high current terminal	6	terminal for bar assembly

Figure 4-8: Type

IDs of the individual connections

ID	Meaning
U2	connected to power-on module U1
V2	connected to power-on module V1
W2	connected to power-on module W1

Figure 4-9: IDs of the individual connections

Cross section for connection

HPS01.1xx	Conductor cross sections that can be connected 1) in mm ²	AWG	Recommended minimum cross section 2) in mm ²	
250	2 x 70 - 240	2 x 2/0 – 500MCM	2 x 120	2 x 250MCM
350	2 x 70 - 240	2 x 2/0 – 500MCM	2 x 240	2 x 500MCM
450	2 x 2 x 70 - 240	2 x 2 x 2/0 – 500MCM	2 x 2 x 120	2 x 2 x 250MCM
650	2 x 2 x 70 - 240	2 x 2 x 2/0 – 500MCM	2 x 2 x 240	2 x 2 x 500MCM

- 1): for copper terminal bars
 2): - **Both** terminals of a phase must be connected.
 - When using terminal bars, the enclosed contact profiles (screwless spring-cage type) must be used (Figure 4-18)

Figure 4-10: Cross sections for connection

Tightening torque 25 - 30 Nm.

Recommended fuses

Fuse

HPS01.1xx	Maximum series fuse, type gL in A
250	500
350	750
450	1000
650	1400

Figure 4-11: Series fuses

Note: Please respect the specific ambient conditions as well as the maximum short circuit current of the feeding mains.

X2, power terminals of DC link auxiliary connection

Type

HPS01.1xx	Type	Number	Type of Construction
250	universal terminal	4	with screw connection
350	universal terminal	4	with screw connection
450	universal terminal	4	with screw connection
650	universal terminal	4	with screw connection

Figure 4-12: Type

IDs of the individual connections

ID	Meaning
2 x C1	DC link auxiliary connection (ZK) L+ only for connecting the power module and the automatic controller box, 2-pin fused (4A) in HPS
2 x C1	DC link auxiliary connection (ZK) L- only for connecting the power module and the automatic controller box, 2-pin fused (4A) in HPS

Figure 4-13: IDs of the individual connections

Cross section for connection

HPS01.1xx	Conductor cross sections that can be connected in mm ²	AWG	Recommended minimum cross section in mm ²	AWG
250	0.2 – 6	26 - 8	1.5	16
350	0.2 – 6	26 - 8	1.5	16
450	0.2 – 6	26 - 8	1.5	16
650	0.2 – 6	26 - 8	1.5	16

Figure 4-14: Cross sections for connection

Tightening torque 1.5 - 1.8 Nm.

X2, supply to the fan

Type

HPS01.1xx	Type	Number	Type of Construction
250	universal terminal	2	with screw connection
350	universal terminal	2	with screw connection
450	universal terminal	2	with screw connection
650	universal terminal	2	with screw connection

Figure 4-15: Type

IDs of the individual connections

ID	Meaning
1	connection terminal for the 24 V supply to the fan; only for connecting at the power module current input max. 0,5 A
2	connection terminal for the 0 V supply to the fan; only for connecting at the power module

Figure 4-16: IDs of the individual connections

Cross section for connection

HPS01.1xx	Conductor cross sections that can be connected in mm ²	AWG	Recommended minimum cross section in mm ²	AWG
250	0.2 – 2.5	24 - 12	1.5	16
350	0.2 – 2.5	24 - 12	1.5	16
450	0.2 – 2.5	24 - 12	1.5	16
650	0.2 – 2.5	24 - 12	1.5	16

Figure 4-17: Cross sections for connection

Tightening torque 0.6 - 1.8 Nm.

Note: To achieve an extensive seating for the terminal bars, the enclosed prismatic, self-sealing contact profiles must be used.

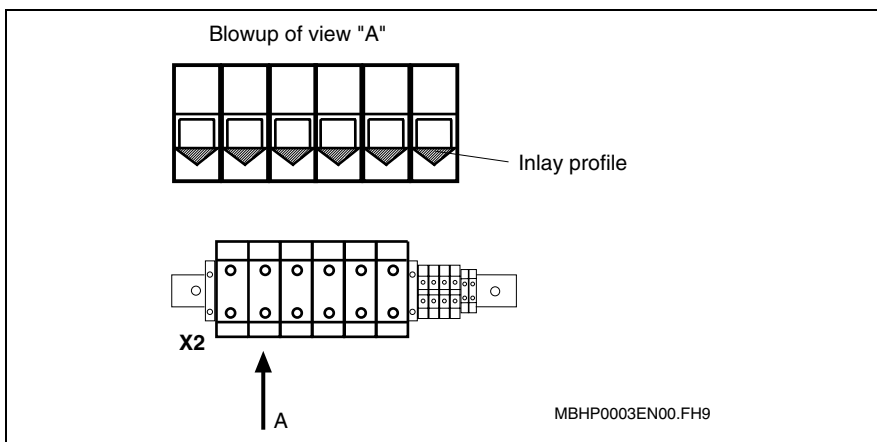


Figure 4-18: Contact profiles (screwless spring-cage type) when using terminal bars

X1, DC link

Type

HPS01.1xx	Type	Number	Type of Construction
250	Terminal bar	2	Connection with screw M10
350	Terminal bar	2	Connection with screw M10
450	Terminal bar	2	Connection with screw M10
650	Terminal bar	2	Connection with screw M10

Figure 4-19: Type

IDs of the individual connections

ID	Meaning
C	DC link connection (ZK) L+
D	DC link connection (ZK) L-

Figure 4-20: IDs of the individual connections

Cross section for connection

HPS01.1xx	Conductor cross sections that can be connected 1)	Recommended minimum cross section 1) in mm ² (when using cable)	
250	Connection terminal bar with 3 x M10 x 30	2 x 120	2 x 250MCM
350	Connection terminal bar with 3 x M10 x 30	2 x 185	2 x 350MCM
450	Connection terminal bar with 3 x M10 x 30	2 x 300	2 x 600MCM
650	Connection terminal bar with 3 x M10 x 30	2 x 400	2 x 800MCM

1): for tin-coated copper terminal bars
Figure 4-21: Cross sections for connection

Tightening torque 35 Nm

Recommended DC fuses

Recommended DC fuses dedicated to the utilisation of power units comprised in motor inverters which are mounted remotely. This kind of fuses is required in case of extended intermediate circuit distribution and a lack of auxiliary measures against short circuits.

fuses

SFT DC link power in kW	HPS01.1	Maximum current by the DC fuse in A
300	1 x HPS01.1M-F0610-N-08-NNNN	500
420	1 x HPS01.1M-F0880-N-08-NNNN	630
530	2 x HPS01.1M-F0610-N-08-NNNN	800
770	2 x HPS01.1M-F0880-N-08-NNNN	1200

Abb. 4-22: Recommended DC fuses

Note: These fuses play a role as protective gear if a short circuit occurs. You are meant to fit one of them at each pole. You are allowed to apply fusible cut-outs which are part of the function and service classes gL, gR and aR, but which must be suitable for a service voltage of 750 V direct current. Please consider that the lifetime period of fuses depends on the ambient conditions. In this context as in general, respect the manufacturer's indications.

X10

Terminal	Comment
X10	cable with 37-pin D-Sub plug for connecting to the RZR automatic controller box X10.1 res. X10.2

Figure 4-23 Connection terminals to controller box RZR01.1

Description of the Power Terminals of the HPS01.1 Motor Inverter

X2, power terminals

Type

HPS01.1xx	Type	Number	Type of Construction
250	high current terminal	6	terminal for bar assembly
350	high current terminal	6	terminal for bar assembly
450	high current terminal	6	terminal for bar assembly
650	high current terminal	6	terminal for bar assembly

Figure 4-24: Type

IDs of the individual connections

ID	Meaning
U2	connection to the motor or motor filter U
V2	connection to the motor or motor filter V
W2	connection to the motor or motor filter W

Figure 4-25: IDs of the individual connections

Cross section for connection

HPS01.1xx	Conductor cross sections that can be connected 1) in mm ²	AWG	Recommended minimum cross section 1) in mm ²	AWG
250	2 x 70 - 240	2 x 2/0 – 500MCM	2 x 95	2 x 4/0
350	2 x 70 - 240	2 x 2/0 – 500MCM	2 x 150	2 x 300MCM
450	2 x 2 x 70 - 240	2 x 2 x 2/0 – 500MCM	2 x 2 x 70	2 x 2 x 2/0
650	2 x 2 x 70 - 240	2 x 2 x 2/0 – 500MCM	2 x 2 x 120	2 x 2 x 250MCM

1): - **Both** terminals of a phase must be connected.

Figure 4-26: Cross sections for connection

Tightening torque 25 - 30 Nm.

X2, power terminals of DC link auxiliary connection

Type

HPS01.1xx	Type	Number	Type of Construction
250	universal terminal	4	with screw connection
350	universal terminal	4	with screw connection
450	universal terminal	4	with screw connection
650	universal terminal	4	with screw connection

Figure 4-27: Type

IDs of the individual connections

ID	Meaning
2 x C1	DC link auxiliary connection (ZK) L+, only for connecting the power module and the automatic controller box, 2-pin fused (4 A) in HPS
2 x C1	DC link auxiliary connection (ZK) L-, only for connecting the power module and the automatic controller box, 2-pin fused (4 A) in HPS

Figure 4-28: IDs of the individual connections

Cross section for connection

HPS01.1xx	Conductor cross sections that can be connected in mm ²	AWG	Recommended minimum cross section in mm ²	AWG
250	0.2 – 6	26 - 8	1.5	16
350	0.2 – 6	26 - 8	1.5	16
450	0.2 – 6	26 - 8	1.5	16
650	0.2 – 6	26 - 8	1.5	16

Figure 4-29: Cross sections for connection

Tightening torque 1.5 - 1.8 Nm.

X2, supply to the fan

Type

HPS01.1xx	Type	Number	Type of Construction
250	universal terminal	2	Screw connection
350	universal terminal	2	Screw connection
450	universal terminal	2	Screw connection
650	universal terminal	2	Screw connection

Figure 4-30: Type

IDs of the individual connections

ID	Meaning
1	connection terminal for the 24 V supply to the fan; only for connecting at the power module current input max. 0,5 A
2	connection terminal for the 0 V supply to the fan; only for connecting at the power module

Figure 4-31: IDs of the individual connections

Cross section for connection

HPS01.1xx	Conductor cross sections that can be connected in mm ²	AWG	Recommended minimum cross section in mm ²	AWG
250	0.2 – 2.5	24 - 12	1.5	16
350	0.2 – 2.5	24 - 12	1.5	16
450	0.2 – 2.5	24 - 12	1.5	16
650	0.2 – 2.5	24 - 12	1.5	16

Figure 4-32: Cross sections for connection

Tightening torque 0.6 - 1.8 Nm.

X1, DC link

Type

HPS01.1xx	Type	Number	Type of Construction
250	Terminal bar	2	Connection with screw M10
350	Terminal bar	2	Connection with screw M10
450	Terminal bar	2	Connection with screw M10
650	Terminal bar	2	Connection with screw M10

Figure 4-33: Type

IDs of the individual connections

ID	Meaning
C	DC link connection (ZK) L+
D	DC link connection (ZK) L-

Figure 4-34: IDs of the individual connections

Cross section for connection

HPS01.1xx	Conductor cross sections that can be connected 1)	Recommended minimum cross section 1) in mm ² (when using cable)	
250	Connection terminal bar with 3 x M10 x 30	2 x 120	2 x 250MCM
350	Connection terminal bar with 3 x M10 x 30	2 x 185	2 x 350MCM
450	Connection terminal bar with 3 x M10 x 30	2 x 300	2 x 600MCM
650	Connection terminal bar with 3 x M10 x 30	2 x 400	2 x 800MCM

1): for tin-coated copper terminal bars

Figure 4-35: Cross sections for connection

Tightening torque 35 Nm.

X10

Terminal	Comment
X10	cable with 37 pin D-Sub plug for connecting to the RZR automatic controller box X10.1 res. X10.2

Figure 4-36: Connection terminals to controller box RZR01.1

4.4 Commissioning

- Before putting the Power-Stack into operation, the inside fan must be checked to make sure it is functioning correctly (cool air must be blown into the interior of the unit).

4.5 Maintenance

Lifetime

Lifetime of various components at an ambient temperature of 60 °C

Component	Lifetime in h
DC link - electrolytic capacitor	35.000
Fan	40.000

Figure 4-37: Lifetime in hours

Measuring the DC link

Before removing the front cover, the DC link voltage must be measured.

To do this, there are two boreholes in the front cover. The DC link voltage can be measured by inserting test prods at these locations.

Note: The discharge time of the DC link to 50 V is approx. 30 minutes.



DANGER

Danger of lethal electric shock from live parts with more than 50 V!

⇒ The front cover may only be removed after the DC link has completely discharged!

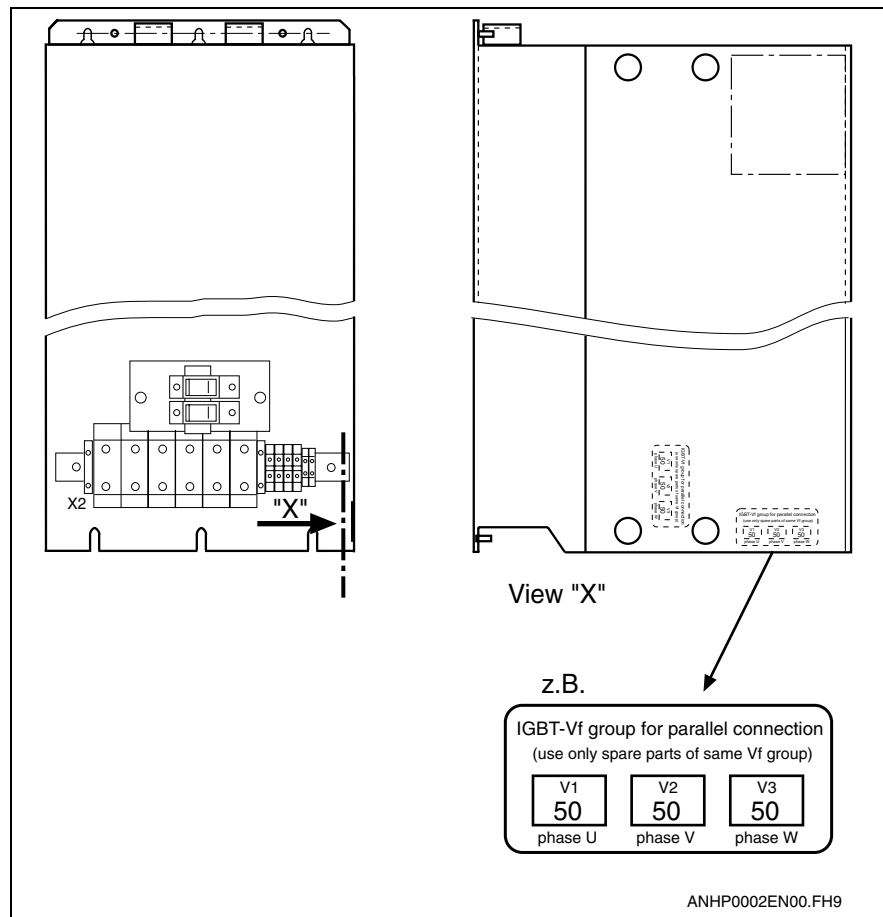
Fuses F1 and F2

Fuse type F1 and F2: 4 A / 690 V Ferraz Shawmut 6,921 Cp gRC, Ref.nummer F081517.

4.6 Repairs / Replacing the Unit

- The HPS01.1 can not be repaired on location.
- To be able to put the HPS01.1 Power-Stack module back into operation, the inverter must be replaced.
- When ordering spare parts, and when making an error report, you must mention the voltage class of the IGBT module.

Details regarding the various classes of voltage are listed on the inside of the unit.



Type Label

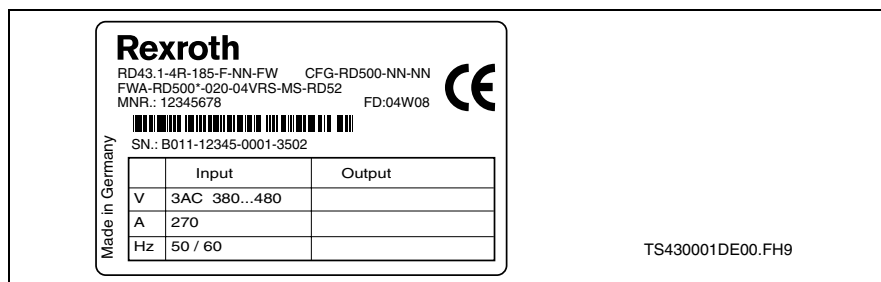


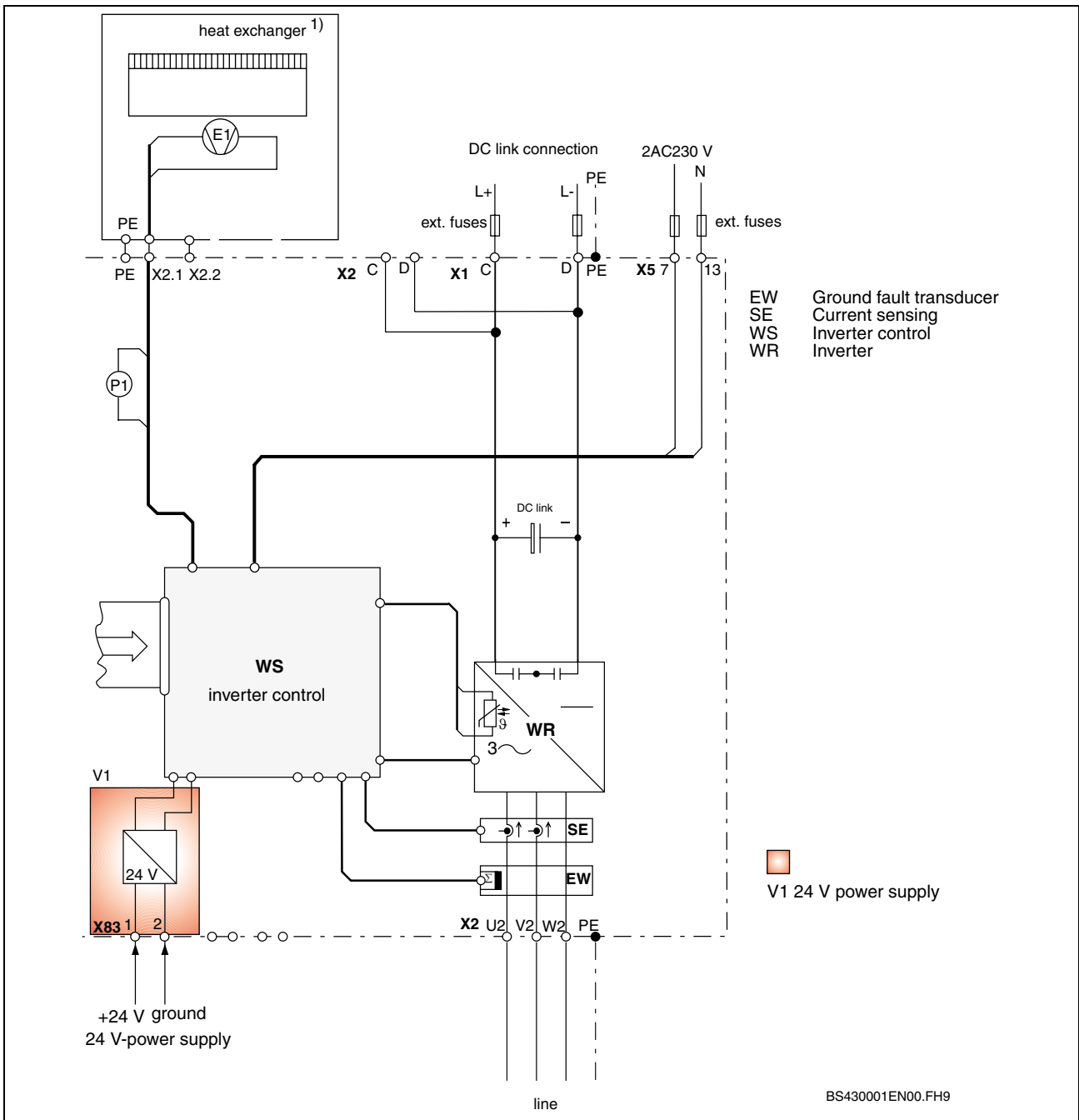
Figure 5-2: Type Label of RD43

Technical Specifications of the RD43 with a Pulse Frequency of $f_p = 4.2$ kHz

		4.2 kHz
RD43		185
Rated power of DC-link	kW	185
Supply voltage 3 AC 380 – 480 V (± 10 %) 50 / 60 Hz		
DC link voltage, regulated	V	750
Rated current (line)	A	270
Peak current (line) for $t = 60$ s	A	353
$t = 1$ s	A	461
Nominal power (line) S_N	kVA	187
Peak power for $t = 60$ s	kVA	244
Environmental conditions, level of noise suppression and immunity to interference in operation		
Environmental class		3K3 acc. to DIN IEC 721-3-3 (ambient temperature 0 – 40 °C)
Cooling air requirements	m ³ / s	0.6
Level of noise suppression / immunity to interference		Acc. to EN 55011 / EN 61800-3, A2 only together with all required components for SFT
Mechanics		
Type of enclosure		IP 20 acc. to EN 60529 (without connection terminals)
Weight of the inverter for cooling types:		
F forced air cooling with internal liquid circulation	kg	180
R liquid cooling with internal pump	kg	157
W liquid cooling without internal pump	kg	155

Tab.: 5-1 Technical Specifications

Control Principle (185kW)



P1: Pump is not used in cooling type W
 1): Heat exchanger is not used in cooling types R and W
 Figure 5-3: Control principle of RD43

5.2 Mechanical Assembly

Minimum requirements related to the place of installation

- The service room must be dust free. Dusty air must be filtered.
- The environmental temperature must be between 0° and 40 °C.
- Relative humidity must not exceed 90 % and there must be no moisture in the storage area.
- The air fed-in must not contain any gases which could endanger the function of the units or which are aggressive or electrically conductive.
- The minimum distances to other components must be observed.
- The unit dissipates heat and warms up the surroundings. Suitable distance from units and devices that are sensitive to heat should therefore be observed.

Assembly

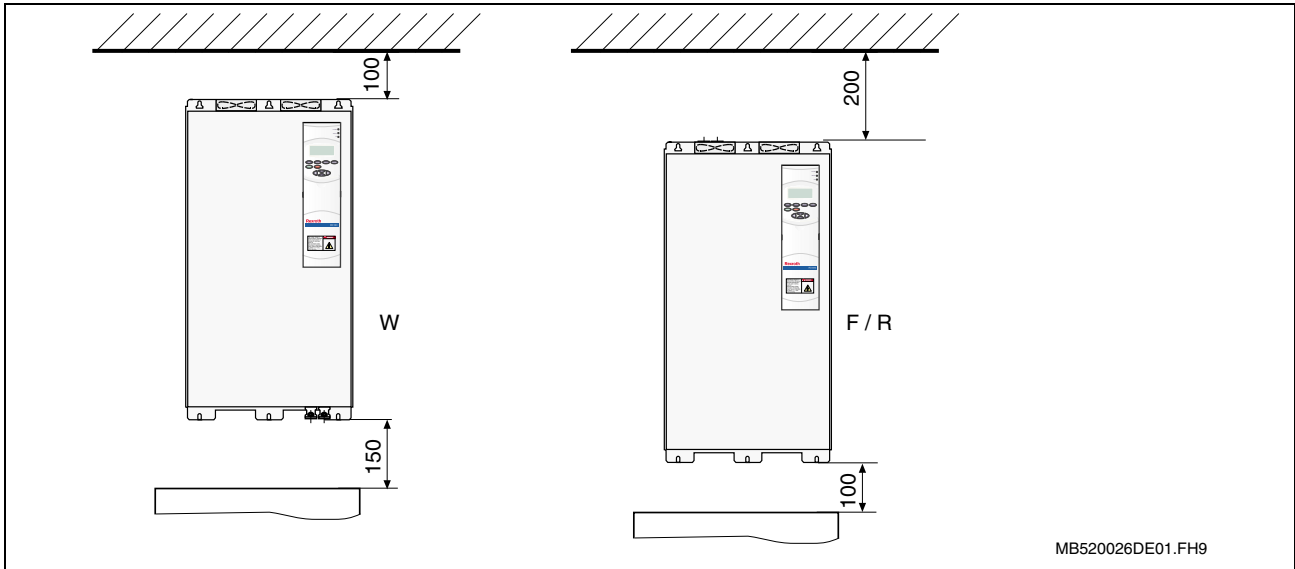
The following points should be observed when assembling the device:

- Assembly must be made in the vertical position on an even surface.
- When assembling the cabinet, the amount of cooling air required by each unit must be calculated and the cabinet should be cooled accordingly.
- The metal housing of the RD43 should be level and connected securely and electroconductive to the control cabinet or the fitting panel. If necessary, use contact discs or scratching discs.
- The required fixing screws are indicated in the drilling template of the dimension drawing.
- There are notches on the side walls to erect the units using hoisting equipment. Transport eyes and transport shackles can be hooked on at these points.
- Connect the cooling-water circuit of the Power-Stacks using the radiator hoses. Additional information is contained in Chapter Liquid Cooling.

Dimension Drawing of RD43

The dimension drawings of the inverter with its various types of cooling are contained in the chapter on the liquid cooling.

Minimum Clearance Distance



Dimension in mm

W: Minimum clearance distances to adjacent components at cooling type W

F / R: Minimum clearance distances to adjacent components at cooling type F and R

Figure 5-4: Minimum clearance distances to adjacent components

Conductor Cross Sections

The conductor cross sections refer here to the rated current of the inverter.

The corresponding cross section of the ground conductor must be at least as large as that of the power lines.

The following requirements are assumed for the power lines:

- The cross sections are each for one phase in case of multi-wire lines and have been determined according to the regulations of VDE0298.
- From 50 mm² they are laid free and non-contacting in the cabinet.

5.3 Power Terminals

After mechanical assembly, the electrical connections must be made.

Layout Plan of Terminals on the Power Inverter

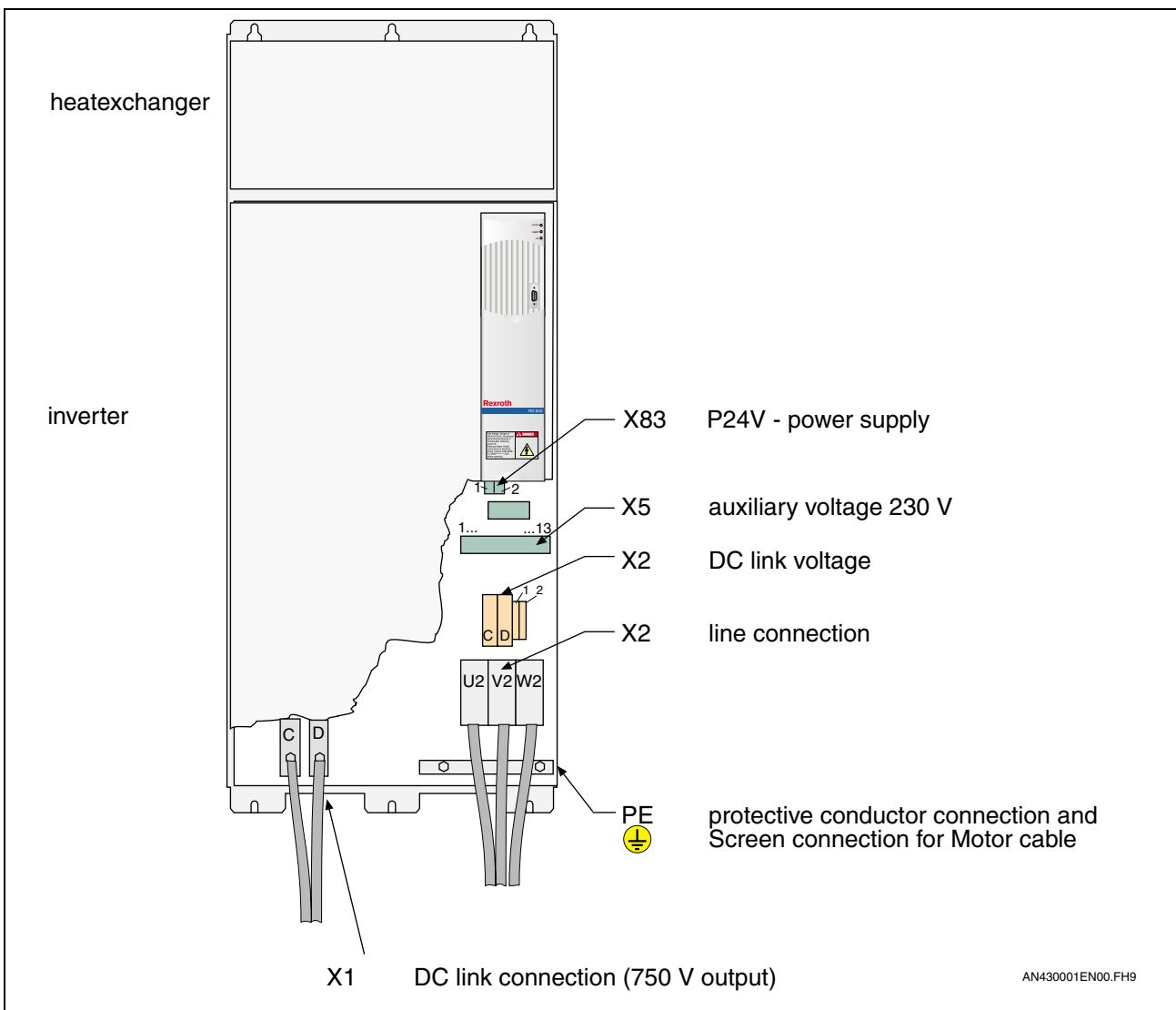


Figure 5-5: Layout plan of terminals on the RD43

Description of the Power Terminals

X2, power connection (on the AC side)

Type

RD43.1-xx-	Type	Number	Type of Construction
185	high current terminal	3	terminal for bar assembly

Figure 5-6: Type

IDs of the individual connections

ID	Meaning
U2	power connection U
V2	power connection V
W2	power connection W

Figure 5-7: IDs of the individual connections

Protective Wire Connection • Bolts, M8 (tightening torque 12.0 Nm).

Cross section for connection

RD43.1-xx-	Conductor cross sections that can be connected 1) in mm ²	AWG	Recommended cross section in mm ²	AWG
185	70 - 240	2/0 – 500MCM	2 x 95	2 x 4/0

1): Due to the size of the terminals

Figure 5-8: Cross sections for connection

Tightening torque 25 - 30 Nm.

Power inverter fuses

Fuse

RD43.1-xx-	Maximum series fuse, type gL in A 1)
185	400

1): at a power connection of 3AC 400 V and rated power of unit

Figure 5-9: Series fuses

X2, DC link, control terminals

Type

RD43.1-xx-	Type	Number	Type of Construction
185	through terminal	2	line-up terminal

Figure 5-10: Type

IDs of the individual connections

ID	Meaning
C	DC link terminal L+
D	DC link terminal L-

Figure 5-11: IDs of the individual connections

Cross section for connection

RD43.1-xx-	Conductor cross sections that can be connected in mm ²	AWG
185	10 – 35	8 - 2

Figure 5-12: Cross sections for connection

Tightening torque 4.0 – 5.0 Nm.

X2, connection of fan

Type

RD43.1-xx-	Type	Number	Type of Construction
185	through terminal	2	line-up terminal

Figure 5-13: Type

IDs of the individual connections

ID	Meaning
1 (L / P)	connection for the fan of the heat exchanger
2 (0 V AC)	

Figure 5-14: IDs of the individual connections

Cross section for connection

RD52.1-xx-	Conductor cross sections that can be connected ¹⁾ in mm ²	AWG
185	0.5 - 6	20 - 10

1): Due to the size of the terminals

Figure 5-15: Cross sections for connection

Tightening torque 0.5 - 1.0 Nm.

X1, DC link – output voltage

Type

RD43.1-xx-	Type	Number	Type of Construction
185	bolt connection, M12	2	bar

Figure 5-16: Type

IDs of the individual connections

ID	Meaning
C	DC link connection (ZK) L+
D	DC link connection (ZK) L-
=> to the motor inverter	

Figure 5-17: IDs of the individual connections

Protective Wire Connection • Bolts, M8 (tightening torque 12.0 Nm).

Cross section for connection

RD43.1-xx-	Recommended conductor cross section in mm ²	AWG
185	2 x 95	2 x 4/0

Figure 5-18: Cross sections for connection

Tightening torque 50 Nm

Recommended DC - fuses

Recommended fuses for the DC output at extended DC link distribution and a lack of auxiliary measures against short circuits.

fuses

RD43	Max. current by DC – fuses in A
RD43.1-4R-185	315

Figure 5-19: Recommended DC - fuses

Note: These fuses play a role as protective gear if a short circuit occurs. You are meant to fit one of them at each pole. You are allowed to apply fusible cut-outs which are part of the function and service classes gL, gR and aR and which furthermore must be suitable for a service voltage of 750 V direct current. Please consider that the lifetime period of fuses depends on the ambient conditions. In this context as in general, respect the manufacturer's indications.

X5, control voltage

Type

RD43.1-xx-	Type	Pole number	Type of Construction
185	plug connector	13	plug at unit

Figure 5-20: Type

IDs of the individual connections

ID	Meaning	Power Consumption
7	AC 230 V \pm 10 %, 50 / 60 Hz	cooling type F: 350 VA cooling type R: 150 VA cooling type W: 60 VA
13	N	

Figure 5-21: IDs of the individual connections

Cross section for connection

RD43.1-xx-	Conductor cross sections that can be connected ¹⁾ in mm ²	AWG
185	0.2 – 2.5	24 - 12

1): Due to the size of the terminals

Figure 5-22: Cross sections for connection

Tightening torque 0.5 – 0.6 Nm.

X83, 24 V stand-by supply for the electronics

Type

RD52.1-xx-	Type	Pole number	Type of Construction
185	plug connector	2	plug at unit

Figure 5-23: Type

IDs of the individual connections

ID	Meaning
1	P24 V 24 VDC -15 / +20 %, ripple max. 5 % (VDE0411 / 500), power consumption ~40 W, inrush current 5 A
2	ground

Figure 5-24: IDs of the individual connections

Cross section for connection

RD43.1-xx-	Recommended minimum cross section in mm ²	AWG	Conductor cross sections that can be connected in mm ²	AWG
185	1.5	16	0.2 – 2.5	24 - 14

Figure 5-25: Cross sections for connection

Tightening torque 0.22 – 0.25 Nm.

Connection Cable

To connect to the appropriate RNA power connection module, the RZU-E05-RNA01/NAM01-160-350kW cable must be ordered separately.

5.4 Commissioning

Commissioning of RD43 see Dok-RD500*-SFT*****IB0x-EN-P.

6 HNF01.1 3-Input Filter

6.1 Description of the Input Filter

The HNF01.1 input filter is used in order to reduce the interference level to within permissible limits for connections within industrial environments or within public networks that do not supply private households. The limit values of the „2nd environment“ are thereby observed.

The limit values of the “2nd environment” EN61800-3 correspond to the limit values of the EN55011 standard, class A, group 2.

Type key

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	
Example:	H	N	F	0	1	.	1	A	-	P	2	K	0	-	R	1	2	0	0	-	A	-	4	8	0	-	N	N	N	N				3

1. **Product**
 - 1.1 HNF..... = HNF
2. **line**
 - 2.1 1..... = 01
3. **Design**
 - 3.1 1..... = 1
4. **EMC area per DIN EN 61800-3**
 - 4.1 industrial area = A
5. **Applications**
 - 5.1 axes, cable length..... = P2K0
6. **Supply system**
 - 6.1 only for feeding units = E
 - 6.2 only for regenerative units..... = R
7. **Nominal current**
 - 7.1 z.B. 70 A..... = 0070
8. **Degree of protection**
 - 8.1 IP20..... = A
9. **Mains connecting voltage**
 - 9.1 3 AC 400...480V -15+10%, 50/60 Hz..... = 480
 - 9.2 3 AC 400...500V -15+10%, 50/60 Hz..... = 500
10. **Other design**
 - 10.1 none..... = NNNN
11. **Standard reference**

Standard	Title	Edition
DIN EN 60529	Degrees of protection provided by enclosures (IP-Code)	2000-09
DIN EN 61800-3	Adjustable speed electrical power drive system, - Part 3: EMC-Product standard including specific test methodes (IEC 61800-3:1996); German version EN 61800-3:1996 + A11:2000	2001-02

TLZU0009EN00.FH9

Figure 6-1: Type key HNF01.1

Technical Specifications

Input filter for connection voltages of 380 V ... 480 V:

Input filter HNF01.1...						
		...300	...0450	...0650	...0800	...1200
Input voltage	V	3 AC 380 ... 480 V ($\pm 10\%$) 50 / 60 Hz				
max. current	A	300	450	650	800	1200
Environmental conditions, level of noise suppression and immunity to interference in operation						
Environmental class		3K3 acc. to DIN IEC 721-3-3 (ambient temperature 0 – 40 °C)				
Level of noise suppression / immunity to interference		A 2 acc. to EN 55011 / EN 61800-3				
Type of enclosure		IP00 acc. to EN 60529				
Weight	kg	21	22	28	28	34

Tab.: 6-1 Technical Specifications

Note: Derating via operating frequency as with the frequency inverter

Connection Requirements (only when together with the HNP01.1 Sine Power Filter)

Lengths of motor cable that can be connected

Pulse Frequency f_p 4.2 kHz		
Rated current in A	Max. length of motor cable in m	Number of center lines
300	750	15
450	1000	22
650	1000	22
800	2000	45
1000	2000	45

Tab.: 6-2 Connection requirements

Note: Screened motor lines must be used in order to observe the limit value.

Type Label

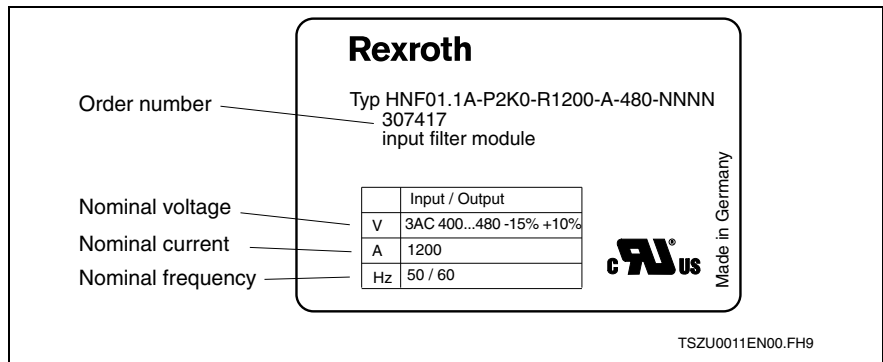
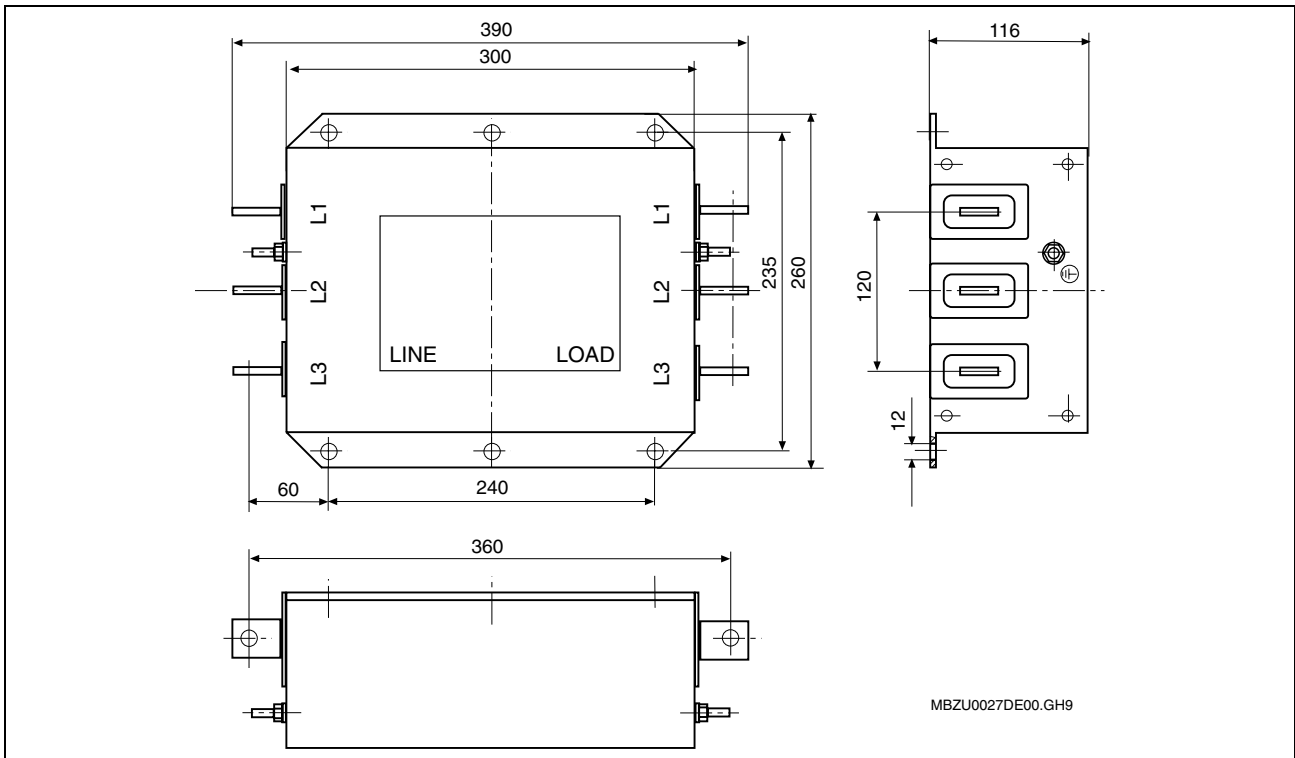


Figure 6-2: Type Label of HNF01.1

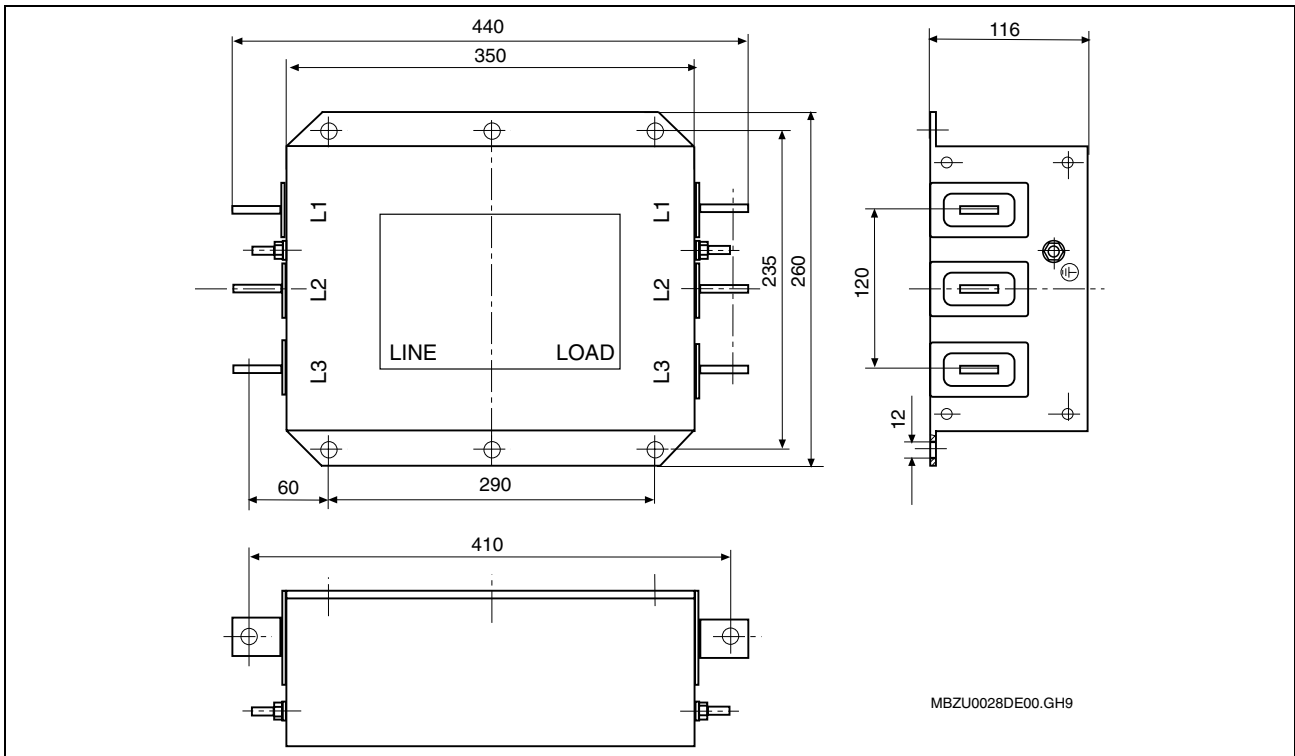
6.2 Mechanical Assembly

Dimension Drawing



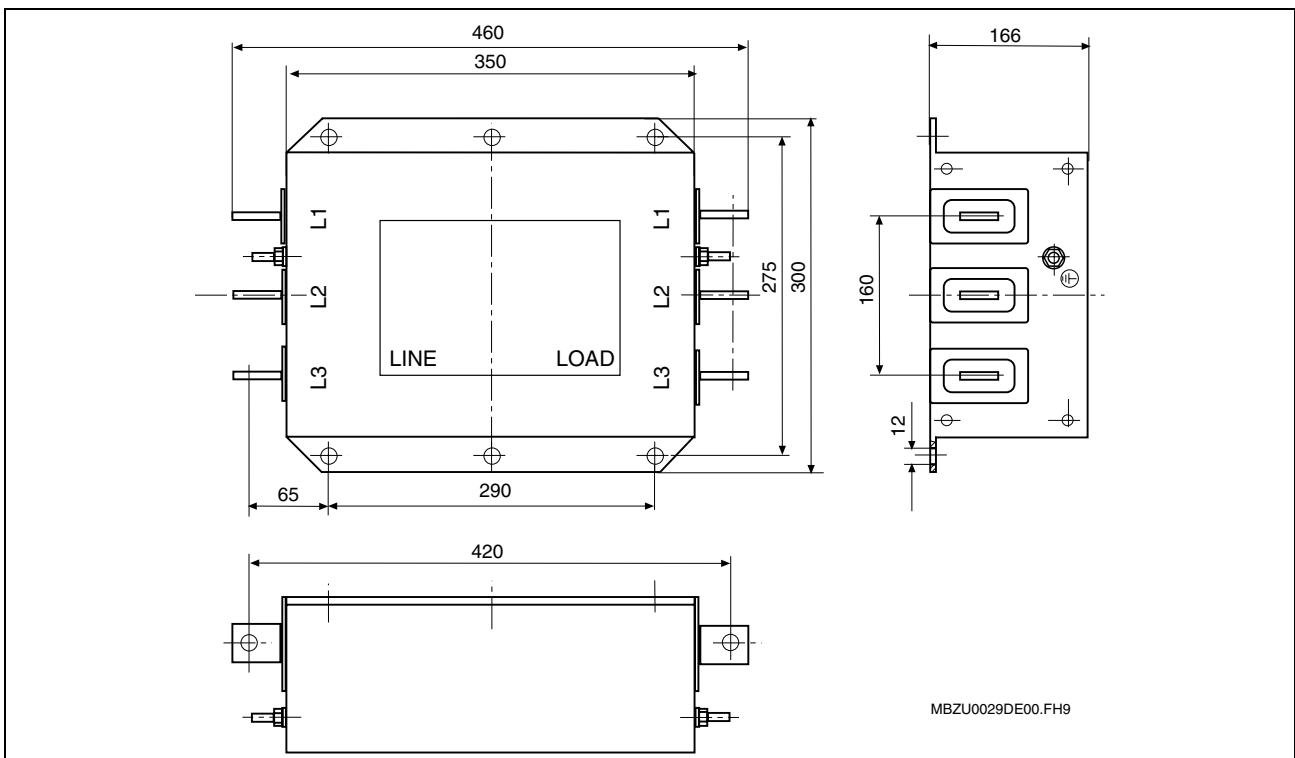
Dimensions in mm

Figure 6-3: Dimension sheet of input filter HNF01.1A-M750-R0300-A-480-NNNN



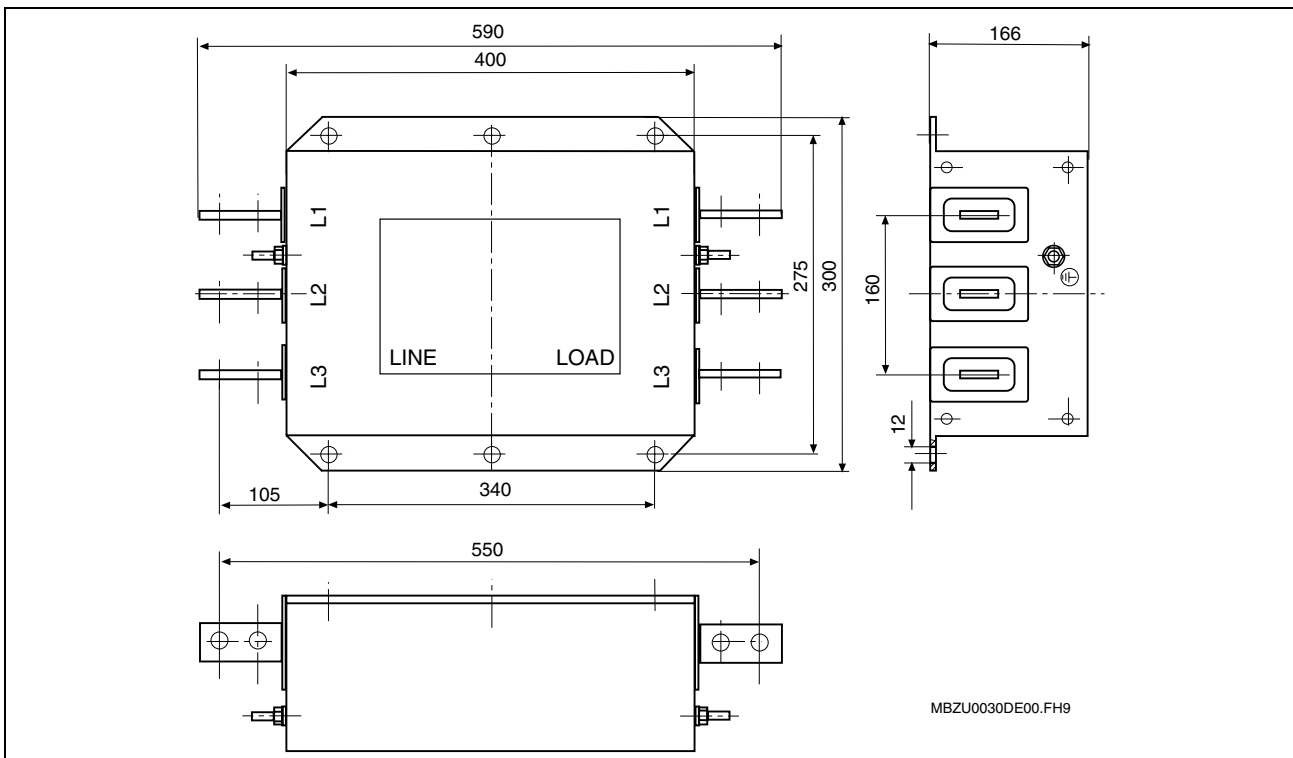
Dimensions in mm

Figure 6-4: Dimension sheet of input filter HNF01.1A-N1K0-R0450-A-480-NNNN



Dimensions in mm

Figure 6-5: Dimension sheet of input filter HNF01.1A-N1K0-R0650-A-480-NNNN and HNF01.1A-P2K0-R0800-A-480-NNNN



Dimensions in mm

Figure 6-6: Dimension sheet of line filter HNF01.1A-P2K0-R1200-A-480-NNNN

Assembly

The input filter is fixed to the base plate by six screws. Zinc-plated or tin-coated screws should be used (do not use paint-finished or anodized fasteners and screws).

If the mounting plates are paint-finished, the following should also be observed:

- Remove any existing paint on the mounting surface at the connection points in order to create a secure and extensive contact area.

The filter function of the line filter is only ensured if it is suitably grounded.

Note: The filter must be installed in the control cabinet in accordance with generally valid assembly instructions for EMC-compliant installation. See also chapter 6.3.

Additional instructions regarding assembly are contained in the SFT operating instructions Dok-RD500*-SFT*****IB0x-EN-P.

6.3 Connection

L1, L2, L3: Line: line filter input

L1', L2', L3': Load: line filter output

The lines are connected to the terminal bars on the power and load side or to the PE pins in accordance with the marking.

For reasons of EMC, the filter has to be mounted to one of the isolating wall by its line side. Therefore please use the existing tapped bores. In addition to this, the separating wall is in charge of the filter's low-inductive ground connection.

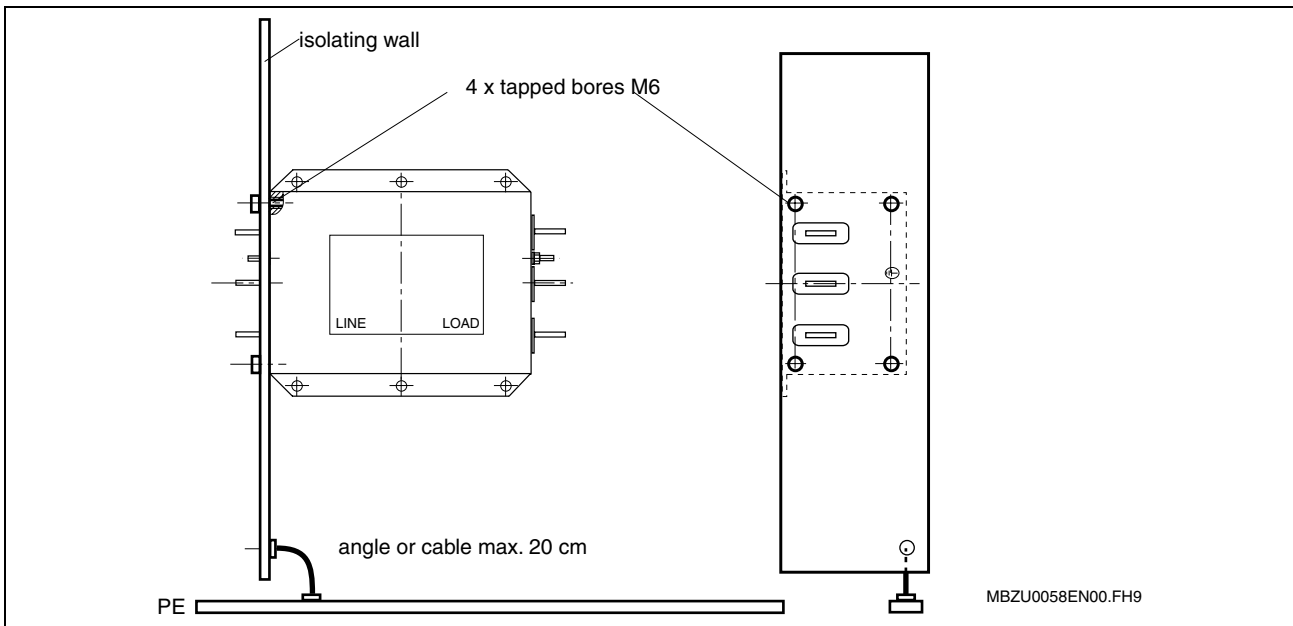


Figure 6-7: Mounting isolation wall

For safety reasons, the protective wire between the isolating wall and the PE bar must have

- at least half of the cross-section of the outer conductor.
- **It must be permanently fixed.** (It may only be loosened using tools).
- be kept within a length of 20 cm

The reason for this is the high leakage current of the input filter in the ground conductor that can arise due to an imbalance in the three-phase AC system or during a phase failure. Input filters must therefore always be grounded before switching them on for the first time. There are suitable connections for this in the machine, in the system and in the control cabinet.

Note: For reasons of EMC, the notes given in the preceding paragraphs must be observed in any case. A ground connection via a line tap to the PE terminal bar is not sufficient.

7 RND01.1 Mains Choke three-phase

7.1 Description of the Mains choke three-phase

The RND01.1 Power choke is required for the correct functioning of the RD43.1-4R-185 power inverter.

During the sinusoidal forward and reverse power feed, the power choke not only smoothes the current but also acts as a choke coil for the boost converter.

Type Code

Abbrev. Column	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0			
example:	R	N	D	0	1	.	1	-	4	-	1	8	5								2		
1. Product																							
1.1	RND			.....			=			RND												
2. line																							
2.1	1			.....			=			01												
3. Design																							
3.1	1			.....			=			1												
4. max. mains connecting voltage																							
4.1	3 x AC 380...480 V, ±10 %			.....			=			4												
5. rated power FUR in kW																							
5.1	185			.....			=			185												
note:																							
①	FUR = converter frequency																						
																					TLZU0011EN00.FH9		

Figure 7-1: Type code of RND01.1 mains choke three-phase

Technical Specifications of the Power Inverter Choke

Mains choke three-phase RND01.1-4-185		
Input voltage	V	3 AC 380 - 480 V (±10 %) 50 / 60 Hz
Rated current	A	300
Environmental conditions, level of noise suppression and immunity to interference in operation		
Environmental class		3K3 acc. to DIN IEC 721-3-3 (ambient temperature 0 – 40 °C)
Cooling air requirements	m ³ / h	1000
Power loss	kW	2,5
Type of enclosure		IP00 acc. to EN 60529
Weight	kg	125

Figure 7-2: Technical specifications of power choke RND01.1

Note: The protective wire connection must have a cross-section of at least 50 % of the outer conductor if there is no additional connection to the PE.

Type Label

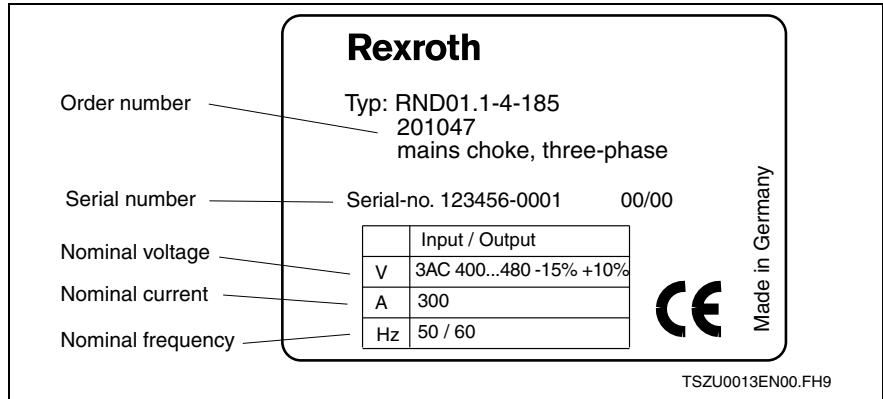
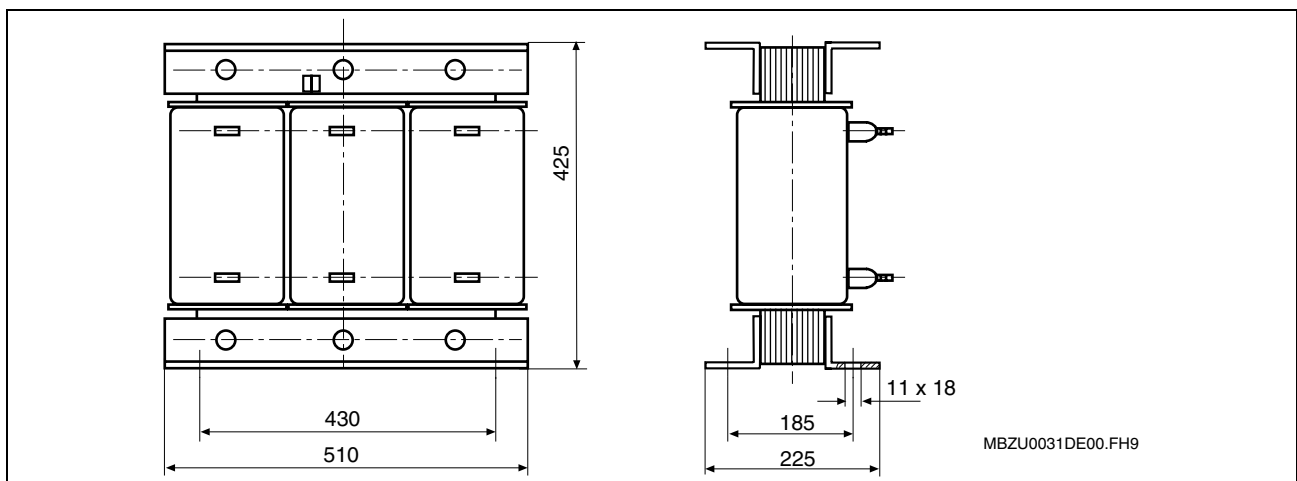


Figure 7-3: Type Label of RND01.1 mains choke three-phase

7.2 Mechanical Assembly of the Mains choke three-phase

Dimension Drawing



Dimensions in mm

Figure 7-4: Mains choke three-phase RND01.1-4-185

7.3 Connection

L1, L2, L3: Connection is made at Cu-clips with cable lug M10 / 95 mm² (AWG 4/0) with a tightening torque of 35 Nm.

Thermal switch: Break contact with a maximum contact load of 30 V / 1.
Recommended conductor cross section: 1.5 mm² (AWG 16).

7.4 Ventilation

The choke requires forced ventilation. There are two possibilities of doing this. (see Figure).

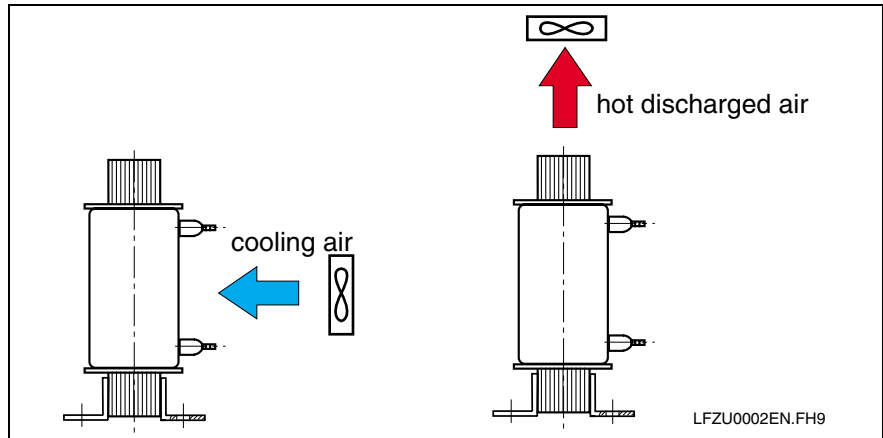


Figure 7-5: Cooling possibilities of the RND01.1-4-185 mains choke three-phase

Note: The stipulated amount of cooling air must be ensured.
=> A cooling duct may have to be attached.

Technical Specifications of the Input Inverter Choke

Input inverter choke HNL01.1R-0xxx-Nxxxx-A-480-NNNF			
xxx		...0450	...0650
Input voltage	V	3 AC 380 - 480 V ($\pm 10\%$) 50 / 60 Hz	
Rated current	A	450	650
Inductance	μH	260	180
Environmental conditions, level of noise suppression and immunity to interference in operation			
Environmental class		3K3 acc. to DIN IEC 721-3-3 (ambient temperature 0 – 40 °C)	
Cooling air requirements	m^3 / h	400	450
Power loss environment	kW	0.69	0.96
Liquid cooling ¹⁾			
Power loss liquid	kW	1,5	1,7
Counter-pressure	bar	0.7	0.7
Flow rate during differential pressure	l / min	8.5	8.5
Max input temperature	°C	52	48
Type of enclosure		IP00 acc. to EN 60529	
Weight	kg	230	250

1): The chokes are delivered unfilled.

Figure 8-2: Technical specifications of the input inverter choke HNL01.1

Note: The protective wire connection must have a cross-section of at least 50 % of the outer conductor if there is no additional connection to the PE.

Technical Specifications of the Input Filter Choke

Input filter choke HNL01.1R-0xxx-Nxxxx-A-480-NNNN						
xxx		...0300	...0450	...0650	...0800	...1200
Input voltage	V	3 AC 380 - 480 V ($\pm 10\%$) 50 / 60 Hz				
Rated current	A	270	440	630	800	1170
Inductance	μH	190	130	90	65	45
Environmental conditions, level of noise suppression and immunity to interference in operation						
Environmental class		3K3 acc. to DIN IEC 721-3-3 (ambient temperature 0 – 40 °C)				
Cooling air requirements	m^3 / h	200	300	400	400	500
Power loss	kW	0.2	0.35	0.4	0.45	0.6
Type of enclosure		IP00 acc. to EN 60529				
Weight	kg	100	120	150	195	230

Figure 8-3: Technical specifications of the filter choke HNL01.1

Type Label

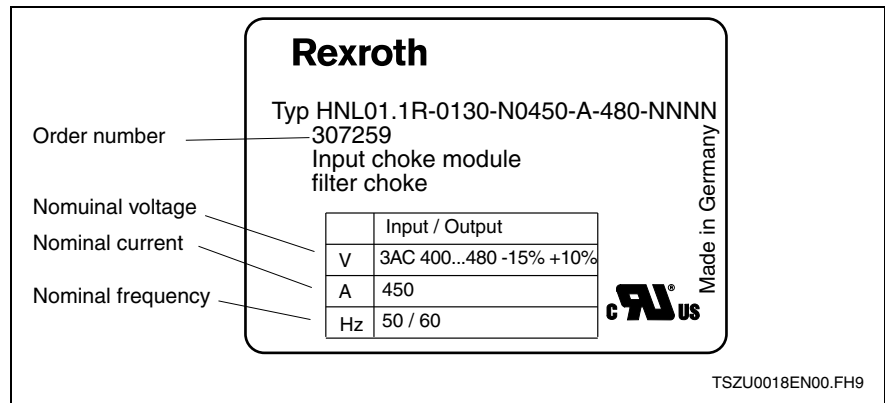
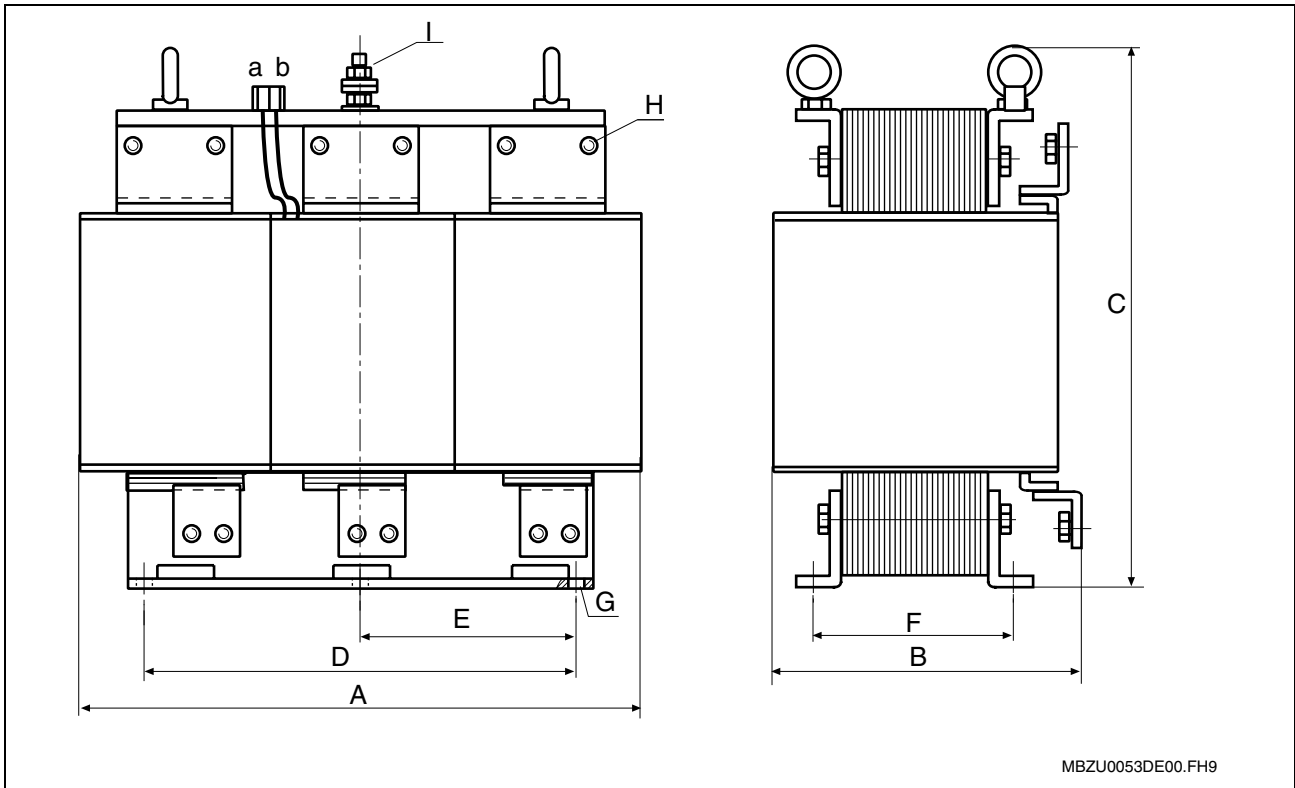


Figure 8-4: Type Label of input inverter choke / input filter choke HNL01.1

8.2 Mechanical Assembly

Dimension Drawings of the Power Filter Choke

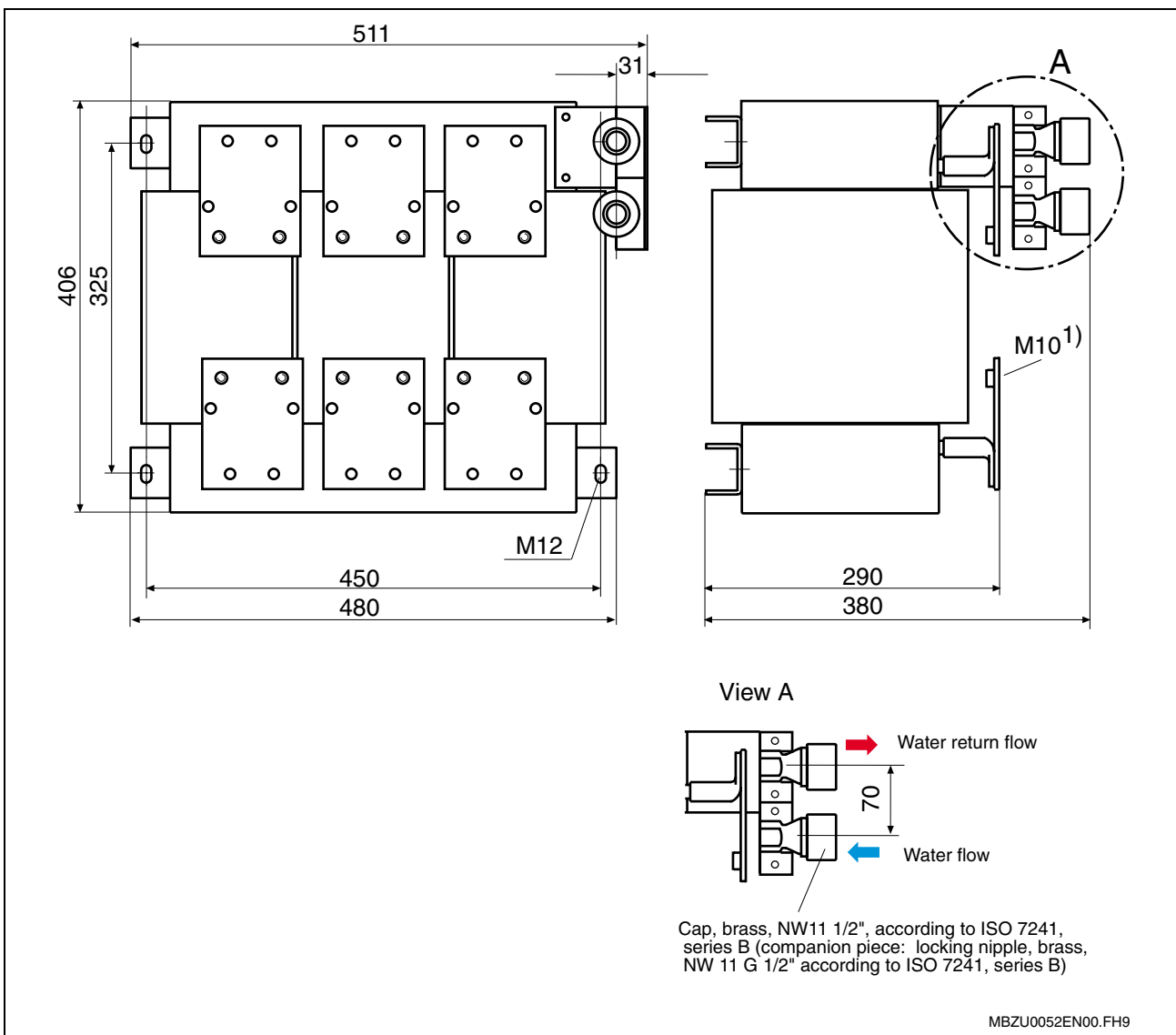


a / b: Thermal switch connection
 Figure 8-5: Power filter choke HNL01.1R-0xxx-Nxxxx-A-480-NNNN

Type HNL01.1-1R-0xxx-Nxxxx-A-480-NNNN									
Nxxxx									
	A	B	C	D	E	F	G	H 1)	I (PE)
N0300	420	213	405	316	157	143	6 x M10	M10	M8
N0450	420	243	410	316	157	173	6 x M10	M10	M8
N0650	480	270	475	356	157	185	6 x M12	M10	M10
N0800	480	270	475	356	157	185	6 x M12	M12	M10
N1200	480	270	545	356	157	215	6 x M12	M12	M10

Dimensions in mm
 1) Connection for L1, L2 and L3
 Figure 8-6: Table of dimensions of power filter choke HNL01.1

Dimension Drawing of Power Inverter Chokes



Dimensions in mm

1): Connection for L1, L2 and L3

Figure 8-7: Power inverter chokes HNL01.1R-0xxx-N0450-A-480-NNNF
HNL01.1R-0xxx-N0650-A-480-NNNF

- Air cooling** During air cooling, make sure that the air current, e.g. is fed to the choke via air baffles.
- Liquid cooling** Primarily, the liquid cooling of the HNL01.1R-0180-N0650-A-480-NNNF and HNL01.1R-0260-N0450-A-480-NNNF power inverter chokes results in the avoidance of waste heat caused by iron loss in the inside of the cabinet. The copper losses are only dissipated to a small degree via the cooling agent so additional ventilation is required. This can be achieved by door-mounted fans or by air conditioning in the control cabinet.
- When the power filter chokes are included as components of the Sine Power Filter, then these are ventilated by the HNP01.1 filter capacitor unit underneath it. Additional fans are not required.
- Additional information regarding liquid cooling is contained in Chapter Liquid cooling.

8.3 Connection

L1, L2, L3: The connection is made by means of screw threads on copper plates.

The tightening torque for the connections:

- M10 = 35 Nm
- M12 = 50 Nm

Thermal switch: Break contact with a maximum contact load of 30 V / 1 A.

Recommended conductor cross section: 1.5 mm² (AWG 16).

Note: Over-temperature protection:

The HNL01.1 are equipped with a thermal switch in order to avoid secondary damages in case of over-temperature or due to a lack of cooling. The chokes do not switch off automatically. We recommend that the floating connectors of all thermal switches (break contacts) be connected in series.

For additional information see DOK-RD500*-SFT*****-IBxx-EN-P (operating instructions).

9 HNP01.1 Filter capacitor

9.1 Description

During the sinusoidal forward and reverse power feed, noise voltages develop at the pulse frequency of the power inverter and at a multiple thereof. These noise voltages interfere with the mains voltage and can be an interference to other consumers – especially in cases where the network is weak.

Sinus Frontend Technology frequency inverters are therefore equipped with a sine power filter in order to comply with the interference level fed by wire acc. to DIN EN 61000-2-4, even within the range of pulse-frequency noise voltages. The HNP01.1 filter capacitor unit and the corresponding power filter chokes from the HNL01.1 series are components of the sine power filter.

Note: The HNP01.1 Filter capacitor may only be operated together with the HNL01.1 line filter chokes and line inverter chokes.

Note: The Sine Power Filter (HNL01.1+HNP01.1) can only be run in combination with the 4.2 kHz mains inverter pulse frequency adjusted at works. If it becomes necessary to modify the pulse frequency, you are expected to have this operation executed by our service staff.

Detailed instructions are contained in the operating instructions DOK-RD500*-SFT*****-IBxx-EN-P.

Type Key

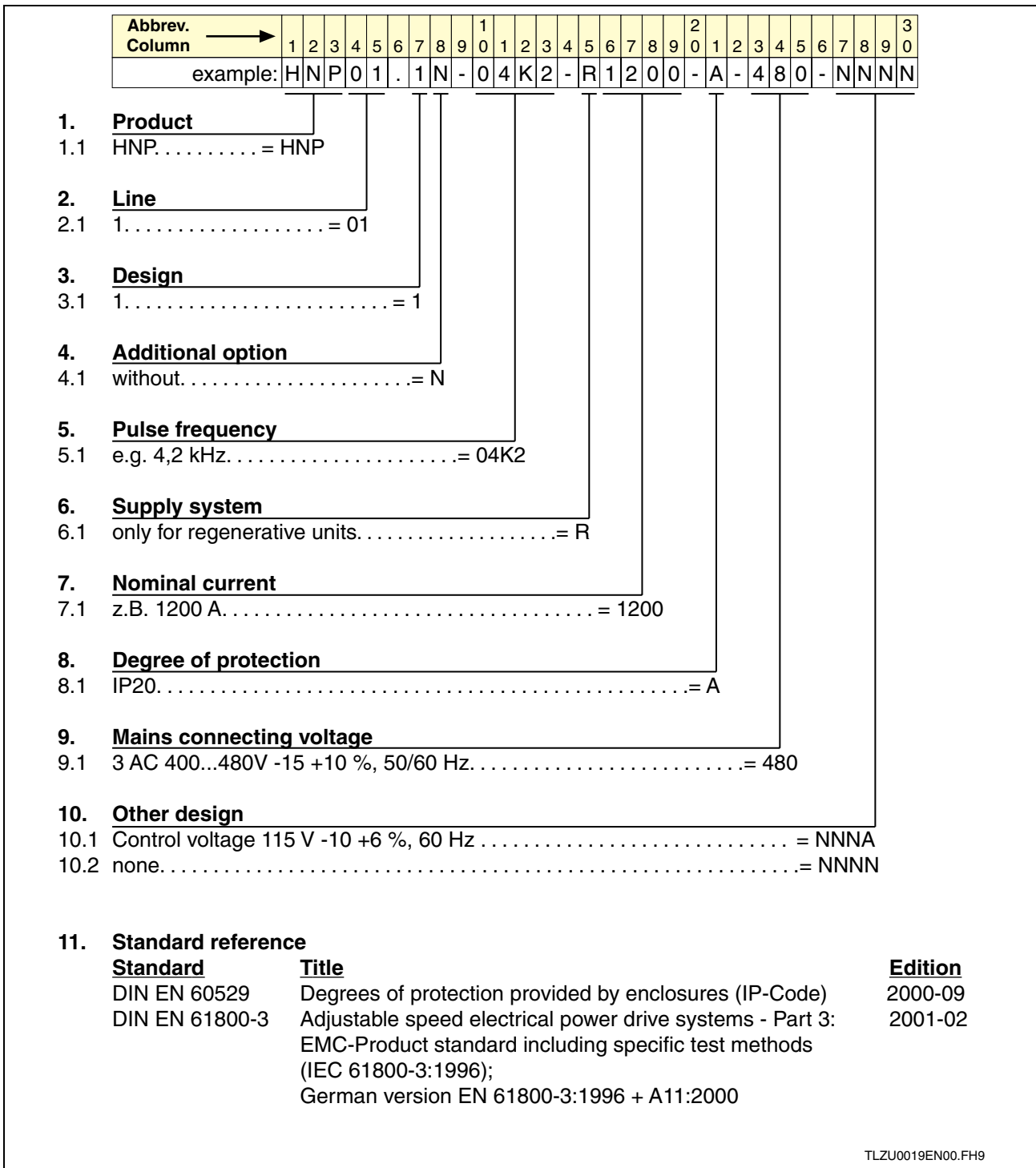


Figure 9-1: Type key of HNP01.1

Technical Specifications of the filter capacitor

Filter capacitor HNP01.1N-04K0-Rxxxx-A-480-NNNx						
xxxx		...0300	...0450	...0650	...0800	...1200
Input voltage	V	3 AC 380 - 480 V (± 10 %) 50 / 60 Hz				
Rated current at 400 V ¹⁾	A	300	440	630	800	1170
Max. leakage current via X1	A	110	110	110	220	220
Rated pulse frequency	Hz	4200				
For the HNP01.1N-04K0-Rxxxx-A-480-NNNN						
Auxiliary supply for fans (X2.1, .2)		AC 230 V (± 10 %) 50 / 60 Hz				
Power consumption for fans	VA	115				
For the HNP01.1N-04K0-Rxxxx-A-480-NNNA						
Auxiliary supply for fans (X2.1, .2)		AC 115 V (-10 % +6 %) 60 Hz				
Power consumption for fans	VA	165				
Noise level of ventilation	dB (A)	77 at open control cabinet door 63 at closed control cabinet door with filter cartridge				
Environmental conditions, level of noise suppression and immunity to interference in operation						
Environmental class		3K3 acc. to DIN IEC 721-3-3 (ambient temperature 0 – 40 °C)				
Level of noise suppression / immunity to interference		A 2 acc. to EN 55011 / EN 61800-3 only together with all required components for SFT				
Type of enclosure		IP00 acc. to EN 60529				
Weight	kg	50	55	60	75	80

1): At a mains voltage > 400 V: The maximum current must be reduced by 1 % for every 4 V.

Figure 9-2: Technical specifications of the HNP01.1 filter capacitor

Note: Connection X1 for leakage current:

There is a high level of leakage current. The cable connection from the PE bar to the terminal(s) X1 is mandatory. Operation without this ground connection is not allowed. The indicated cable cross-sections are also recommended for leakage currents that are expected to be too low. For types HNP01.1N-04K2-R0800-A-480-NNNx and HNP01.1N-04K2-R1200-A-480-NNNx, make sure that both X1 terminals are connected to the PE bar with the specified cable cross-section.

Note: Protective Wire Connection:

The housing must be grounded via a protective wire using the connector bolts intended for this purpose. If there is no other connection from the housing to the PE, then the protective wire connection must be at least 50 % of the cross section of the outer conductor.

Detailed information on connecting the HNP01.1 is contained in DOK-RD500*-SFT*****-IBxx-EN-P.

Type Label

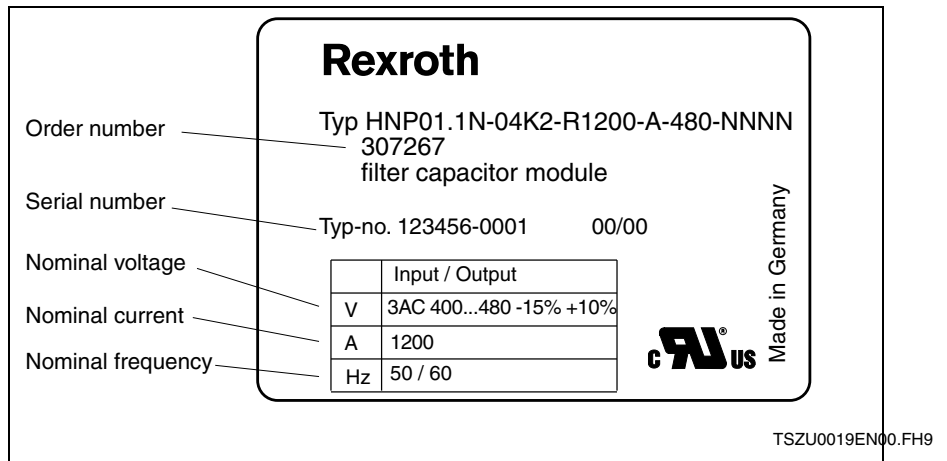
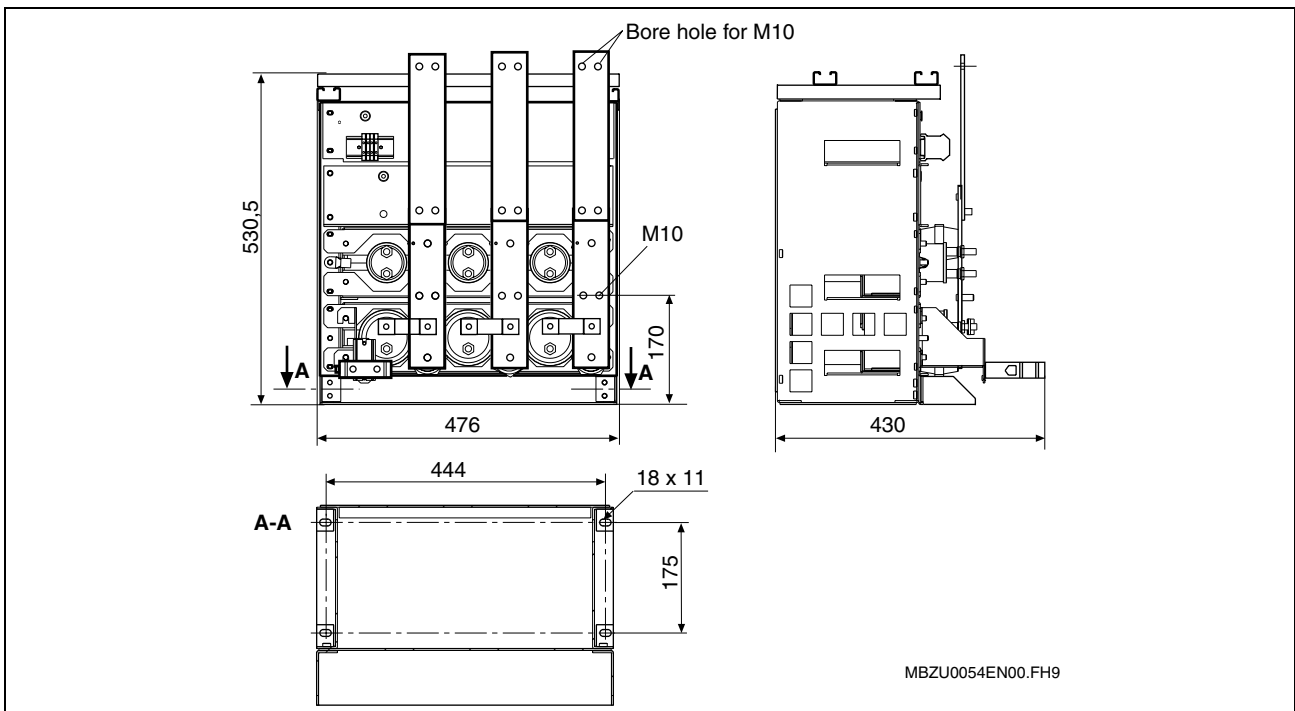


Figure 9-3: Type Label of filter capacitor HNP01.1

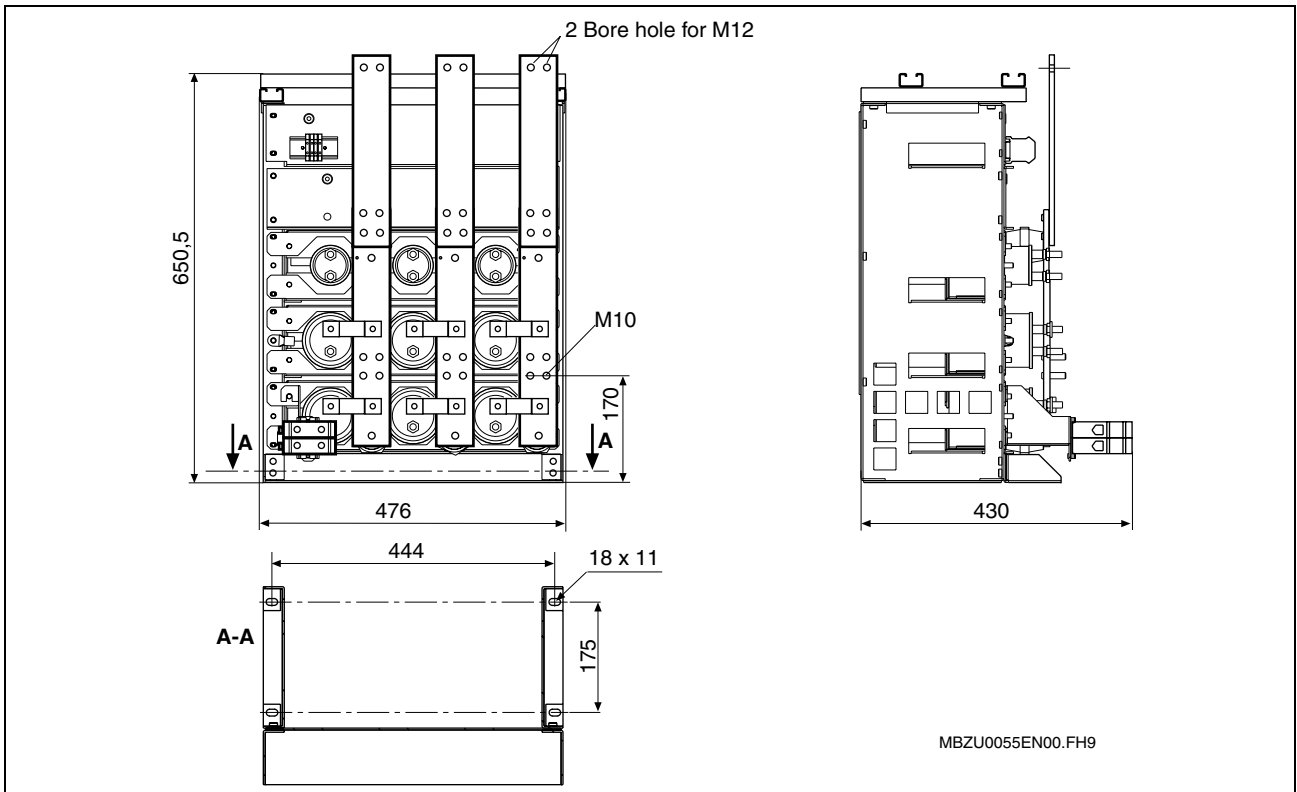
9.2 Mechanical Assembly

Dimension Drawings of the Filter capacitor



Dimensions in mm

Figure 9-4: Filter capacitor HNP01.1N-04K2-R0300 / 0450 / 0650-NNNx



Dimensions in mm
Figure 9-5: Filter capacitor HNP01.1N-04K2-R0800 / 1200-NNNx

9.3 Electrical Installation

Layout plan of terminals

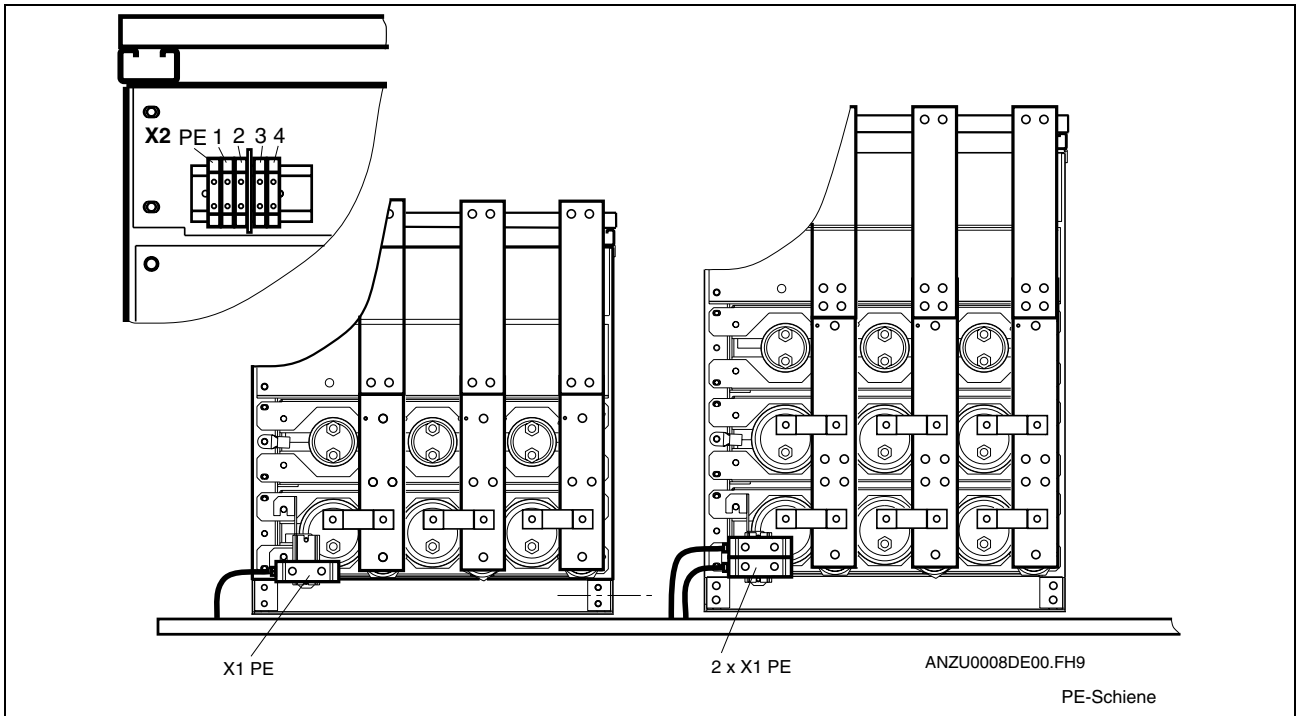
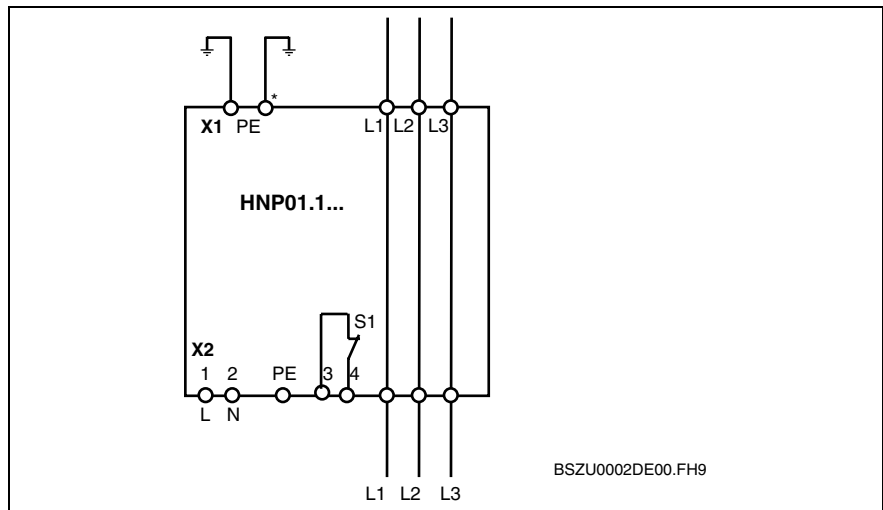


Figure 9-6: Terminals of filter capacitor HNP01.1

Control Principle



*): only for HNP 800 / 1200

Figure 9-7: Control principle of filter capacitor HNP01.1

Description of Terminals of the Filter capacitor

**L1, L2, L3 Power Connections on input filter choke (above) and
L1, L2, L3 on input inverter choke (HNL / RND)**

Cross section for connection

HNP01.1N-04K0-Rxxxx-A-480-NNNx	Type	Number	Cross section
0300	end-to-end terminal bars	3	60 x 6 mm
0450	end-to-end terminal bars	3	60 x 6 mm
0650	end-to-end terminal bars	3	60 x 6 mm
0800	end-to-end terminal bars	3	60 x 10 mm
1200	end-to-end terminal bars	3	60 x 10 mm

Figure 9-8: Cross section for connection

IDs of the individual connections

ID	Meaning
L1	power connection
L2	
L3	

Figure 9-9: IDs of the individual connections

Type on connection for input choke filter

HNP01.1N-04K0-Rxxxx-A-480-NNNx		Tightening torque
0300 / 0450 / 0650	2 x bore hole for M10 connection to the terminal bar	35 Nm
0800 / 1200	2 x bore hole for M12 connection to the terminal bar	50 Nm

Figure 9-10: Connections

Type on connection for input inverter choke

HNP01.1N-04K0-Rxxxx-A-480-NNNx		Tightening torque
0300 / 0450 / 0650	each 2 x stud bolt M10	35 Nm
0800 / 1200	each 4 x stud bolt M10	35 Nm

Figure 9-11: Connections

X1, connection to the PE

Type

HNP01.1...	Type	Number	Type of Construction
0300	high current terminal	1	terminal for bar assembly
0450	high current terminal	1	terminal for bar assembly
0650	high current terminal	1	terminal for bar assembly
0800	high current terminal	2	terminal for bar assembly
1200	high current terminal	2	terminal for bar assembly

Figure 9-12: Type

IDs of the individual connections

ID	Meaning
PE	connection to PE terminal bar (2 each for 0800 and 1200) ¹⁾

1): for 0800 and 1200: both terminals must be connected.

Figure 9-13: IDs of the individual connections

Cross section for connection

HNP01.1N-04K0-Rxxxx-A-480-NNNx	Conductor cross sections that can be connected in mm ²	AWG	Recommended minimum cross section in mm ²	AWG
0300 - 0650	35 - 95	2 – 4/0	95	4/0
0800 - 1200	2 x 35 - 95	2 x 2 – 4/0	2 x 95	2 x 4/0

Figure 9-14: Connections

Tightening torque 25 - 30 Nm.

X2 terminal

Type

HNP01.1...	Type	Number	Type of Construction
0300	tension spring through terminal	5	terminal for bar assembly
0450	tension spring through terminal	5	terminal for bar assembly
0650	tension spring through terminal	5	terminal for bar assembly
0800	tension spring through terminal	5	terminal for bar assembly
1200	tension spring through terminal	5	terminal for bar assembly

Figure 9-15: Type

IDs of the individual connections

ID	Meaning
1	supply voltage L for fan
2	supply voltage N for fan
3	thermal switch break contact DC 30 V / 1 A
4	thermal switch break contact DC 30 V / 1 A
PE	PE fan

Figure 9-16:IDs of the individual connections

Cross section for connection

HNP01.1N-04K0-Rxxxx-A-480-NNNx	Conductor cross sections that can be connected in mm ²	AWG	Recommended minimum cross section in mm ²	AWG
0300 - 1200	0.2 – 2.5	24 - 12	1.5	14

Figure 9-17:Connections

Note: Over-temperature protection:

The HNP01.1 is equipped with a thermal switch in order to avoid possible secondary damages if the fan fails. The HNP01 does not switch off automatically. We recommend that the floating connectors of the thermal switch (break contact, 150 °C) X2.3-4 be connected in series with the thermal switches of the HNL01.1 line choke as well as with X15.1-2 belonging to the control device of the line side.

Detailed information on connecting the HNP01.1 is contained in DOK-RD500*-SFT*****-IBxx-EN-P.

9.4 Operation

The filter capacitor can only be run if the clock rate of the mains inverter is adjusted at 4.2 kHz (trimmed at works). Only our service staff is allowed to alter this setting.

9.5 Maintenance

Operating Period

The operating period of the MKV capacitors is 100.000 hours

The lifetime of the fan is 40.000 hours

10 RNA01.2 Line Power Supply Module

10.1 Description of the Line Power Supply Module

Physical Characteristics

- Terminal bar connections
- interface for control signals to the RD43 power inverter
- interface for customized supply voltage and check-back (response) signal (safe-OFF, Q1 ON, K1 ON)
- contains precharging circuit for the DC-link capacitors in the HPS01.1
- contains the main contactor for separating the HPS01.1 power from the mains voltage
- contains mains voltage detection for synchronization of the forward feed and reverse feed

Type Key

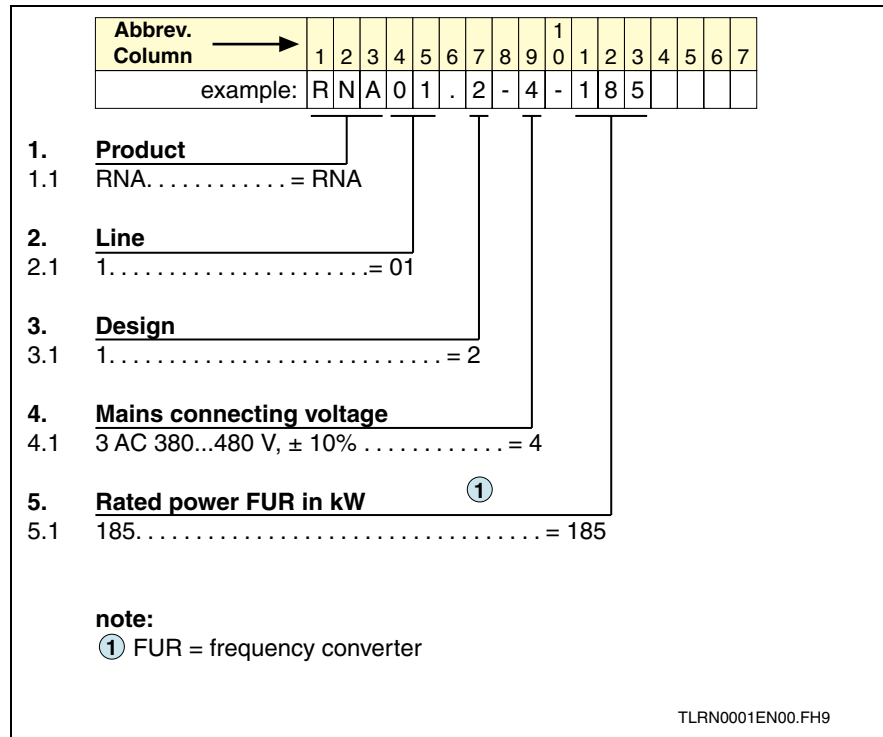


Figure 10-1: Type key of RNA01.2 Line Power Supply Module

Technical Specifications of Line Power Supply Module

Line Power Supply Module RNA01.2-4-185		
Input voltage	V	3 AC 380 ... 480 V (±10 %) 50 / 60 Hz
max. current	A	300
Power consumption 230V duration / 150 ms	VA	15 / 650
max. capacity of intermediate circuit that can be connected	mF	150
Environmental conditions, level of noise suppression and immunity to interference in operation		
Environmental class		3K3 acc. to DIN IEC 721-3-3 (ambient temperature 0 – 40 °C)
Level of noise suppression / immunity to interference		A 2 acc. to EN 55011 / EN 61800-3 only together with all required components for SFT
Type of enclosure		IP00 acc. to EN 60529
Weight	kg	18

Tab.: 10-1 Technical Specifications

Type Label of Line Power Supply Module

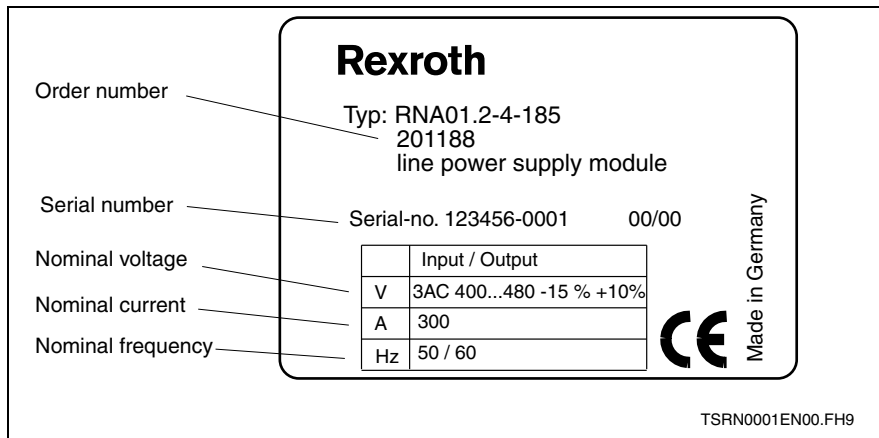


Figure 10-2: Type Label of RNA01.2

Control Principle of Line Power Supply Module

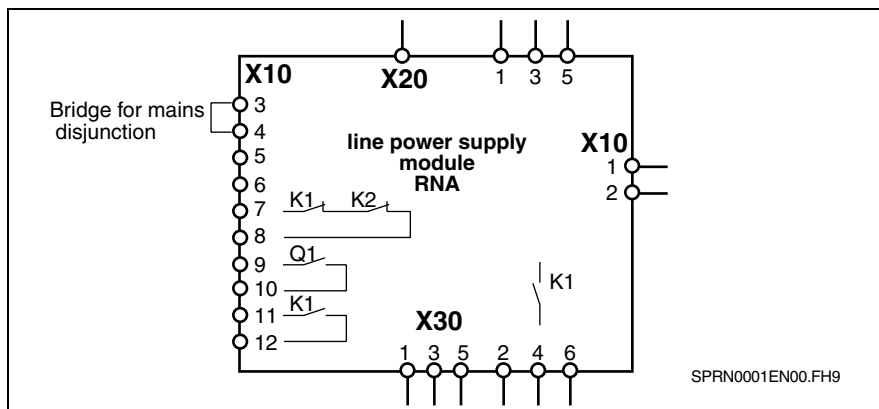


Figure 10-3: Control principle of RNA01.2

Bridge for mains disjunction: Removing the bridge prevents K1 and K2 from being switched on. Thus the power section of the inverter remains disconnected from the mains.

10.2 Mechanical Assembly

Minimum requirements related to the place of installation

- The service room must be dust free. Dusty air must be filtered.
- The environmental temperature must be between 0 and 40 °C.
- Relative humidity must not exceed 90 % and there must be no moisture in the storage area.
- The air fed-in must not contain any gases which could endanger the function of the units or which are aggressive or electrically conductive.
- Air circulation must not be hindered. The minimum clearance distances for inlet air and outgoing air of the respective class must not be narrowed by additional constructions.
- The unit dissipates heat and warms up the surroundings. Sufficient clearance to heat-sensitive units should therefore be observed.

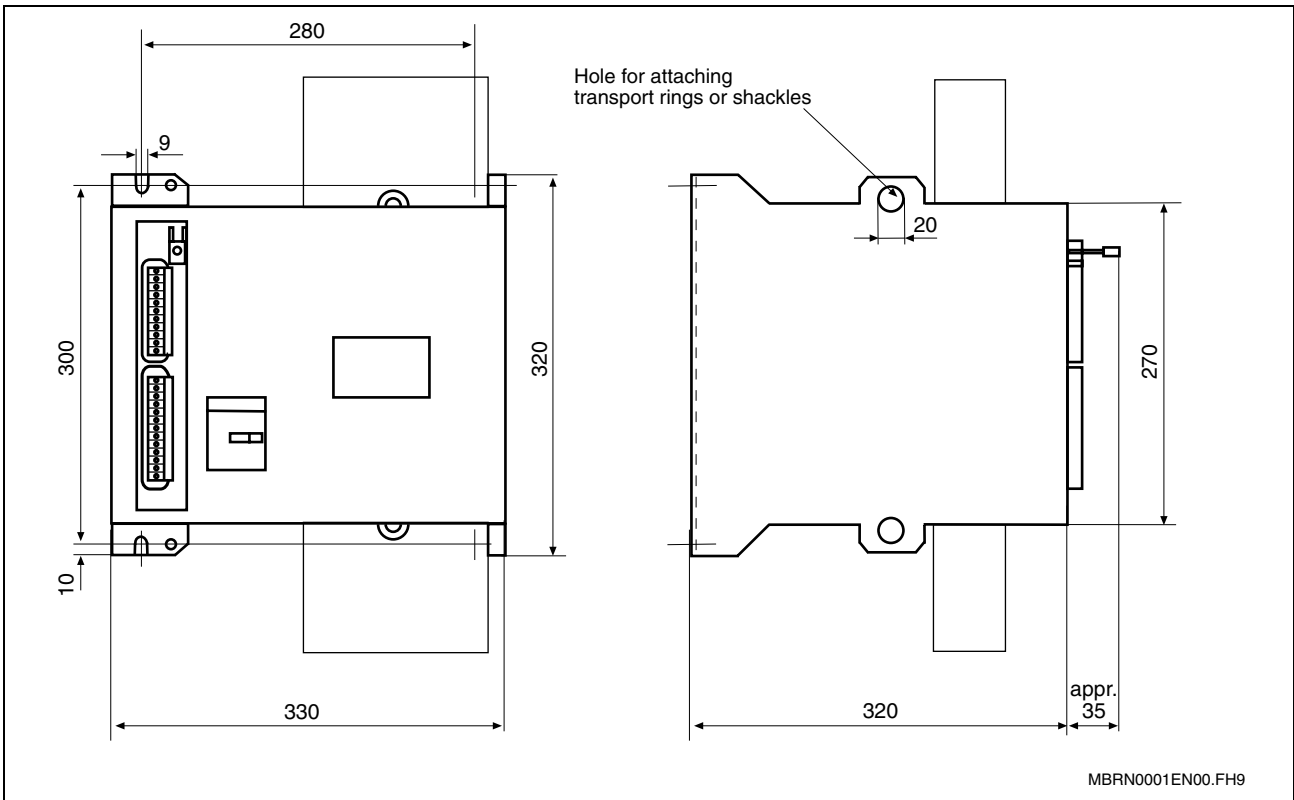
Assembly

The following points should be observed when assembling the device:

- Assembly must be made in the vertical position on an even surface.
- When assembling the cabinet, the amount of cooling air required by each unit must be calculated and the cabinet should be cooled accordingly.
- The metal housing of the line power supply module should be level and connected securely to the control cabinet or the fitting panel. If necessary, use contact discs or scratching discs.
- The required fixing screws are indicated in the drilling template of the dimension drawing.

Dimension Drawing of Line Power Supply Module

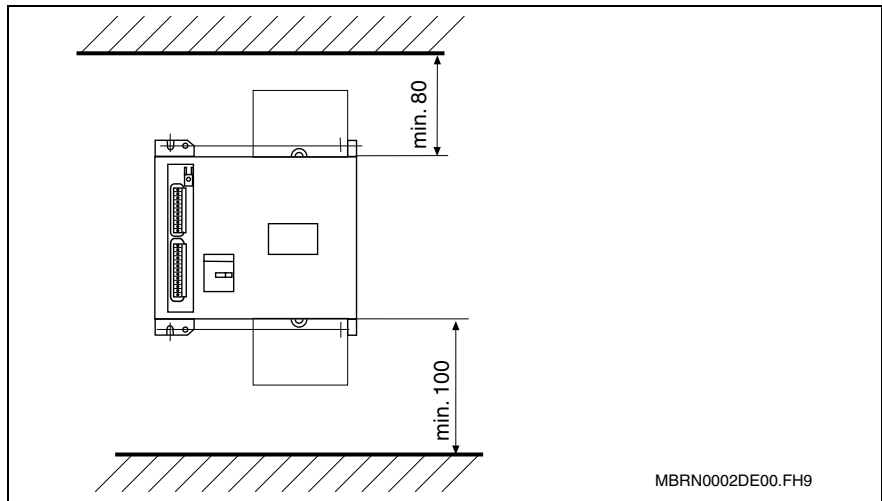
A power connection module is shown in the drawings below.



Dimensions in mm

Figure 10-4: Dimension drawing of Line Power Supply Module RNA01.2

Minimum Clearance Distance



Dimensions in mm

Figure 10-5: Minimum clearance distances to adjacent components

10.3 Electrical Installation of Line Power Supply Module

Power Terminals

Layout plan of terminals of Line Power Supply Module RNA01.2

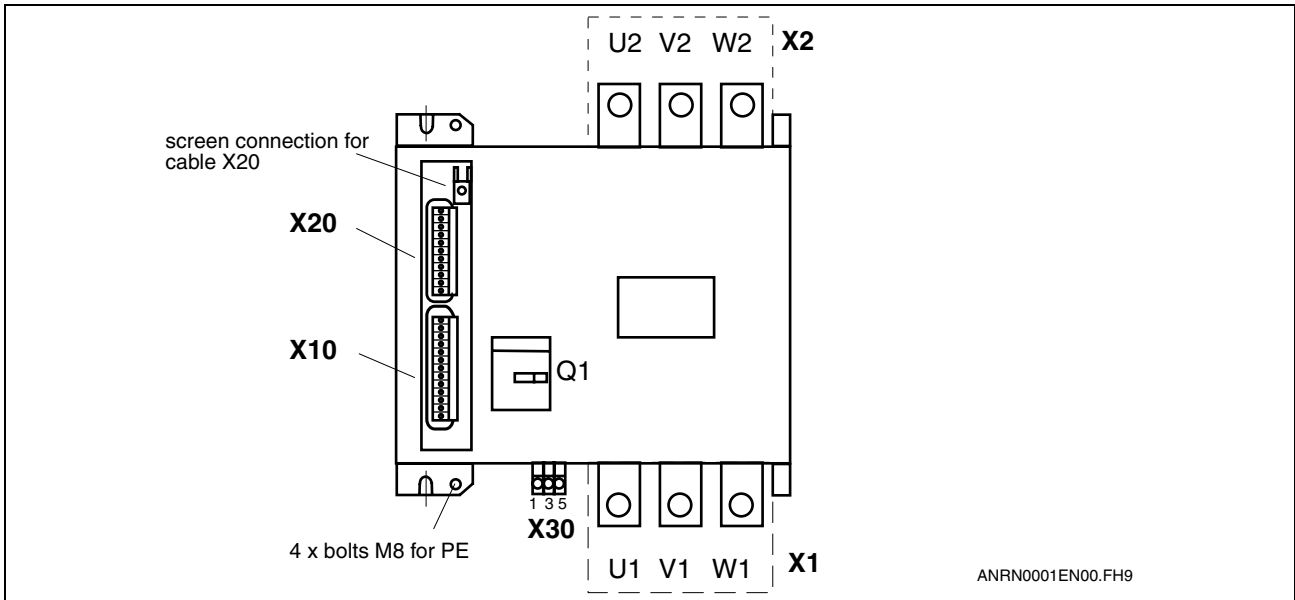


Figure 10-6: Layout plan of terminals

Conductor Cross Sections

The conductor cross sections refer here to the rated current of the inverter. The corresponding cross section of the ground conductor must be at least 50 % of that of the outer conductor if the unit has no permanent electrically conductive connection to the earthed mounting plate.

Description of the Terminals of the Line Power Supply Module

X10

Type

RNA01.2..	Type	Pole number	Type of Construction
185	spring force connector	13	plug connector

Figure 10-7: Type

IDs of the individual connections

ID	Meaning	
1	control voltage AC 230 V ¹⁾	
5	control voltage AC 230 V, neutral conductor	
3	function „safe power termination“ when removing the X10.3-4 bridge. Main contactor and precharging contactor have no supply voltage.	
4		
5	control voltage output for preload amplification (X10.5: AC 230 V, X10.6: neutral conductor connected during the precharging phase); can be loaded with max. 1 A	
6		
7	response from main contactor and precharging contactor OFF (break contact from K1 and K2 in series)	max. DC 24 V / 1 A AC 230 V / 1 A
8		
9	response circuit breaker Q1 ON (NOC from Q1)	max. DC 24 V / 1 A AC 230 V / 1 A
10		
11	response from main contactor Q1 ON (NOC of K1)	max. DC 24 V / 1 A AC 230 V / 1 A
12		
13	reserve	

- 1): **Required control voltage:** AC 230 V $\pm 10\%$ 50 / 60 Hz.
To ensure the „safe termination from power“ function, the control voltage must be separated from the feeding network in networks that do not include a neutral conductor. The secondary voltage must be grounded. (If the network has a neutral conductor then the phase voltage can have potential.
Power consumption at 230 V: 15 VA; transient pulse 650 VA for 150 ms. Recommended circuit breaker: 1.0 A (characteristic C acc. to EN60898)

Figure 10-8: IDs of the individual connections

Cross section for connection

RNA01.2..	Conductor cross sections that can be connected in mm ²	AWG	Recommended minimum cross section in mm ²	AWG
0185	0.2 – 2.5	24 - 12	1.5	14

Figure 10-9: Connections

X20, prefabricated control cable RZU05-RNA / NAM01-160-350kW

Type

RNA01.2..	Type	Pole number	Type of Construction
185	plug connector	11	plug connector

Figure 10-10: Type

IDs of the individual connections

ID	Meaning
1	P24 V
2	Response K1 ON
3	K1 ON
4	K2 ON
5	reference ground
6	sin + (phase angle detection)
7	sin - (phase angle detection)
8	cos + (phase angle detection)
9	cos - (phase angle detection)
10	reserve
11	reserve

Figure 10-11: IDs of the individual connections

Cross section for connection

RNA01.2..	Conductor cross sections that can be connected in mm ²	AWG	Recommended minimum cross section in mm ²	AWG
0185	0.2 – 2.5	24 - 12	1.5	14

Figure 10-12: Connections

Tightening torque 0.5 – 0.6 Nm.

X30, connection to line filter HNF01.1 (load side) for synchronization

Type

RNA01.2..	Type	Number	Type of Construction
185	high current through terminal	3	with screw connection

Figure 10-13: Type

IDs of the individual connections

ID	Meaning
1	L1
3	L2
5	L3

Figure 10-14: IDs of the individual connections

Cross section for connection

RNA01.2..	Conductor cross sections that can be connected in mm ²	AWG	Recommended minimum cross section in mm ²	AWG
0185	0.5 - 10	20 – 8	4 short-circuit protected ¹⁾	12

1): The planning instructions for this cable connection must be observed. See operating instructions DOK-RD500*-SFT*****-IBxx-EN-P.

Figure 10-15: Connections

Tightening torque 1.5 – 1.8 Nm.

K1 connection

Connection	Comment	
K1 1, 3, 5, 2, 4, 6	conductor cross section that can be connected, terminal bar with M10 insert nut ¹⁾	recommended minimum cross section in mm ² 1x 185 (1 x 400MCM)

1) Tightening torque 35Nm

Mains voltage detection

Short-circuit protected by circuit breaker

Q1	Circuit Breaker 1.6 A
Reference input	1.1 A
Short-circuit separating power	100 kA

Figure 10-16: Switch Q1

Control Cable RZU- E05

Connection to the control and regulation circuit of the power inverter:

Control cable RZU-E05-RNA01 / NAM01-160-350 kW, order number R911201390.

11 NAM04.2 Line Power Supply Module

11.1 Description of the Line Power Supply Module

Physical Characteristics

- Terminal bar connection
- interface for control signals from the RZR01 controller box
- interface for customized supply voltage and check-back (response) signals (safe-OFF, Q1 ON, K1 ON)
- contains precharging circuit for the DC-link capacitors in the HPS01.1
- contains the main contactor for separating the HPS01.1 power from the mains voltage
- contains mains voltage detection (only NAM...NE) for synchronization of the forward feed and reverse feed.

Type Key

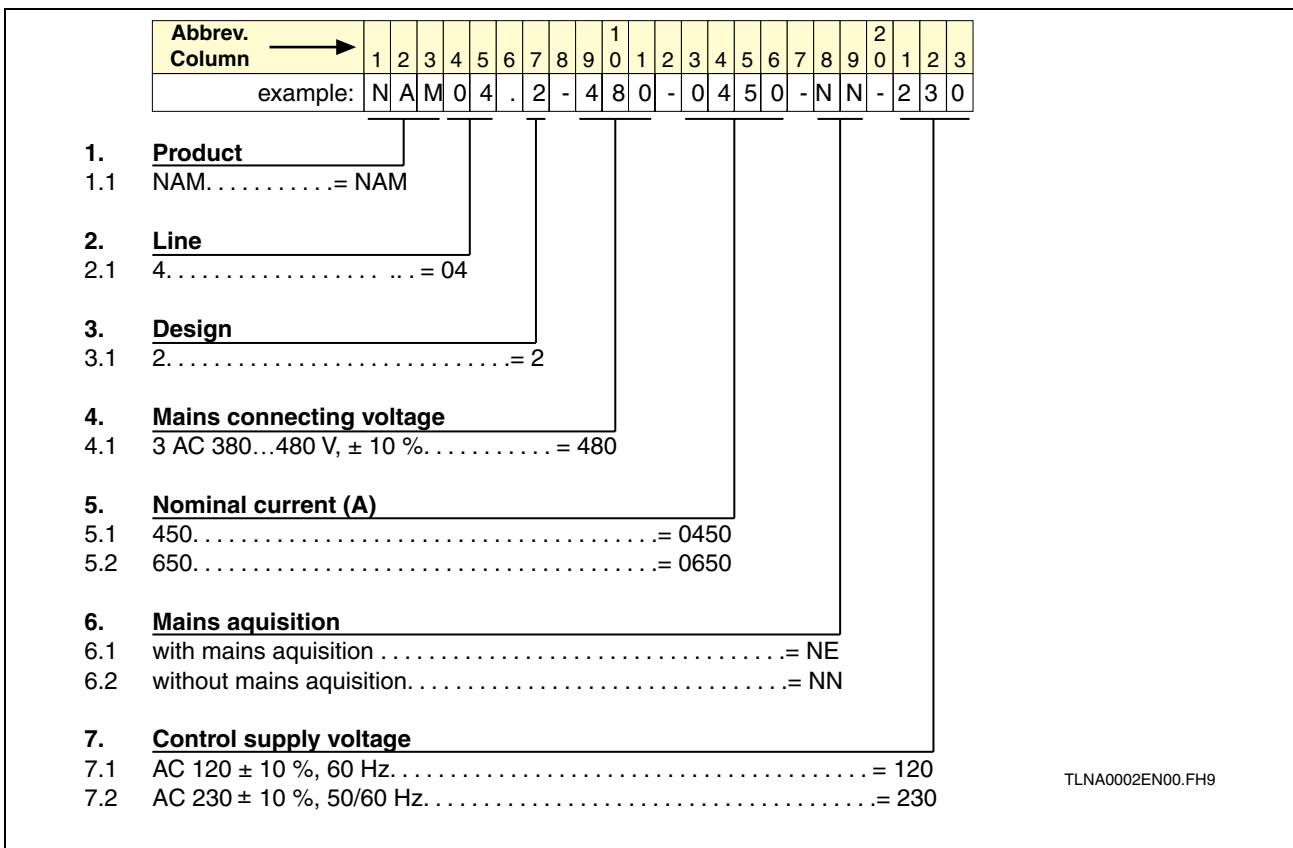


Figure 11-1: Type key of NAM04.2 power-on module

Technical Specifications

Power-on module NAM04.2-480-...		...0450-Nx-230	...0650-Nx-230
Input voltage	V	3 AC 380 - 480 V (±10 %) 50 / 60 Hz	
max. current	A	450	650
Power consumption 230V duration / 150 ms	VA	15 / 1000	

Power-on module NAM04.2-480-...		
max. capacity of intermediate circuit that can be connected	mF	150
Environmental conditions, level of noise suppression and immunity to interference in operation		
Environmental class	3K3 acc. to DIN IEC 721-3-3 (ambient temperature 0 – 40 °C)	
Level of noise suppression / immunity to interference	A 2 acc. to EN 55011 / EN 61800-3 only together with all required components for SFT	
Type of enclosure	IP00 acc. to EN 60529	
Weight	kg	20
		20

Tab.: 11-1 Technical Specifications of NAM04.2

Type Label

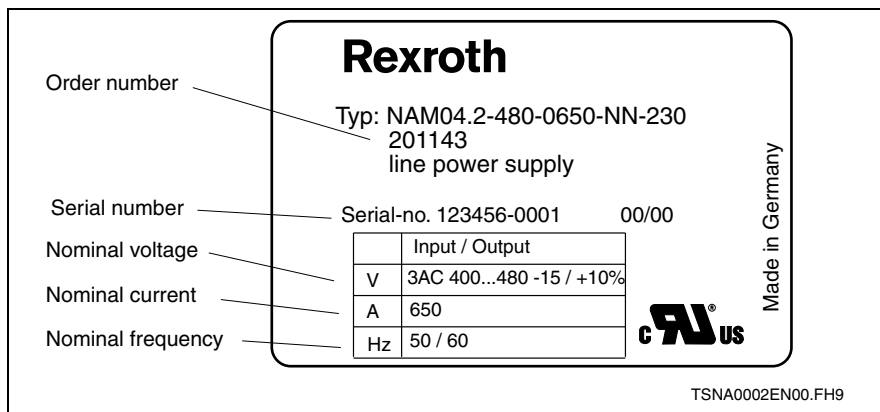


Figure 11-2: Type Label of NAM04.2

Control Principle

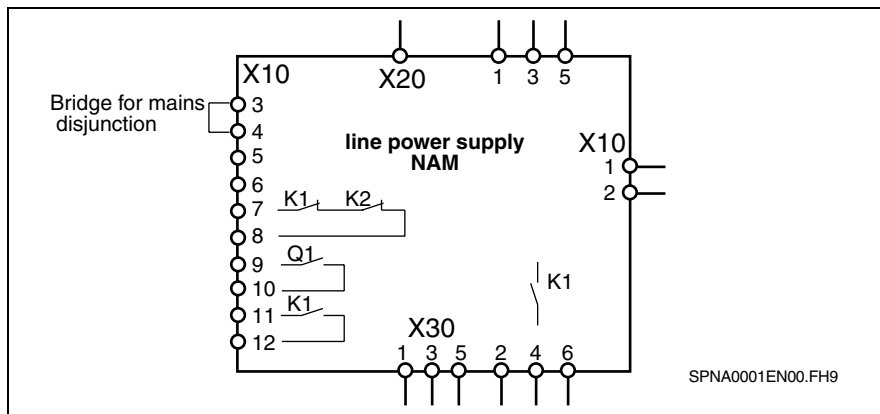


Figure 11-3: Control principle of NAM04.2

Bridge for mains disjunction: Removing the bridge prevents K1 and K2 from being switched on. Thus the power section of the inverter remains disconnected from the mains.

11.2 Mechanical Assembly

Minimum requirements related to the place of installation

- The service room must be dust free. Dusty air must be filtered.
- The environmental temperature must be between 0 and 40 °C.
- Relative humidity must not exceed 90 % and there must be no moisture in the storage area.
- The air fed-in must not contain any gases which could endanger the function of the units or which are aggressive or electrically conductive.
- Air circulation must not be hindered. The minimum clearance distances for inlet air and outgoing air of the respective class must not be narrowed by additional constructions.
- The unit dissipates heat and warms up the surroundings. Sufficient clearance to heat-sensitive units should therefore be observed.

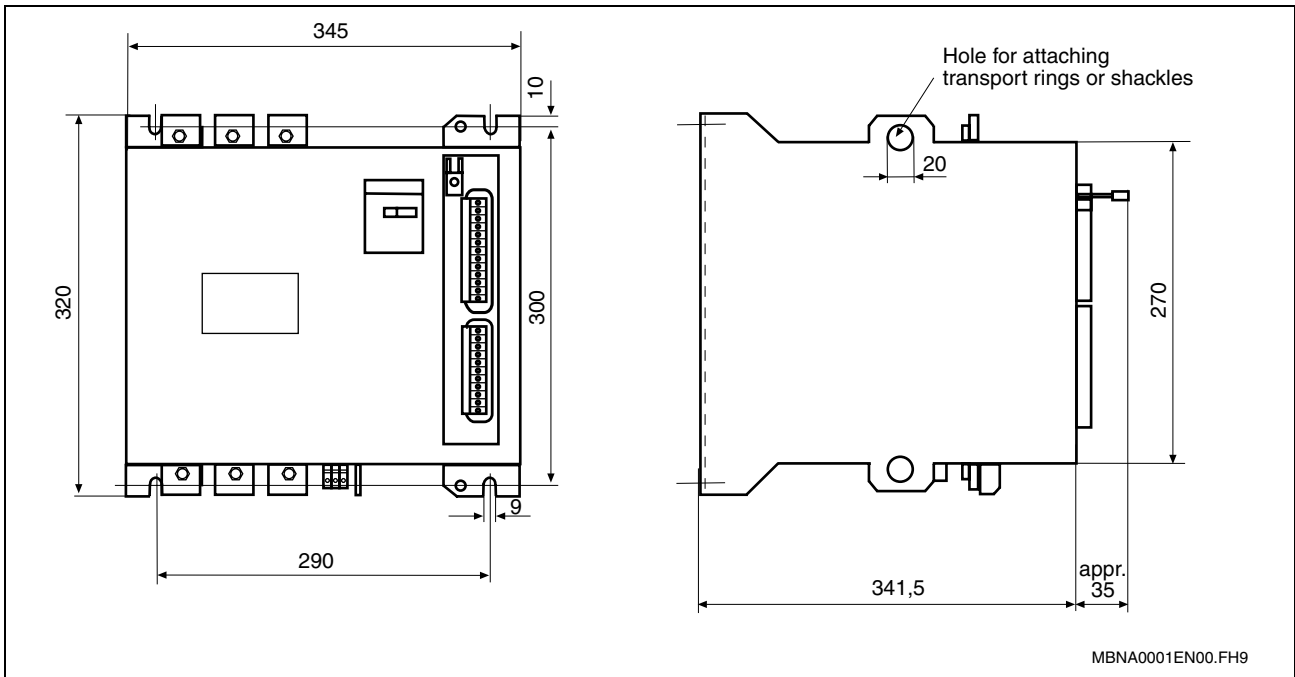
Assembly

The following points should be observed when assembling the device:

- Assembly must be made in the vertical position on an even surface.
- When assembling the cabinet, the amount of cooling air required by each unit must be calculated and the cabinet should be cooled accordingly.
- The metal housing of the line power supply module should be level and connected securely to the control cabinet or the fitting panel. If necessary, use contact discs or scratching discs.
- The required fixing screws are indicated in the drilling template of the dimension drawing.

Dimension Drawing

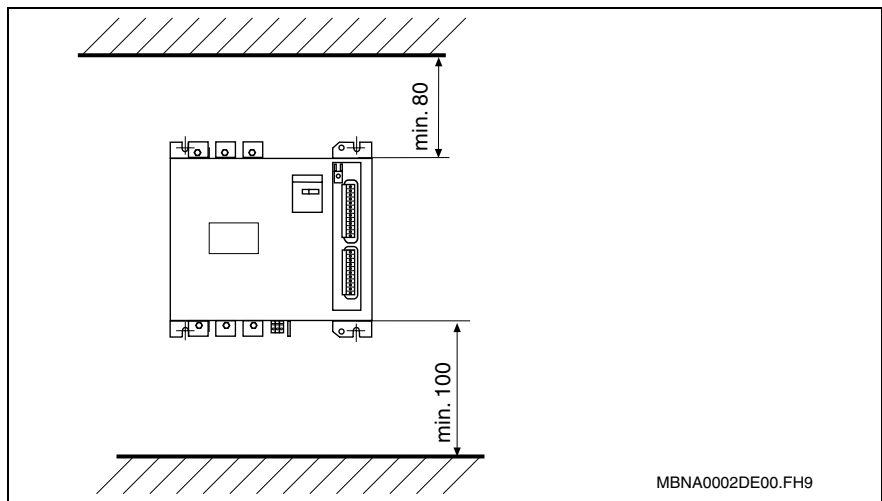
A power-on module is shown in the drawings below.



Dimensions in mm

Figure 11-4: Dimension drawing of power-on module NAM04.2-480-0650-xx-xxx / NAM04.2-480-0450-xx-xxx

Minimum Clearance Distance



Dimensions in mm

Figure 11-5: Minimum clearance distances to adjacent components

11.3 Electrical Installation

Layout plan of terminals

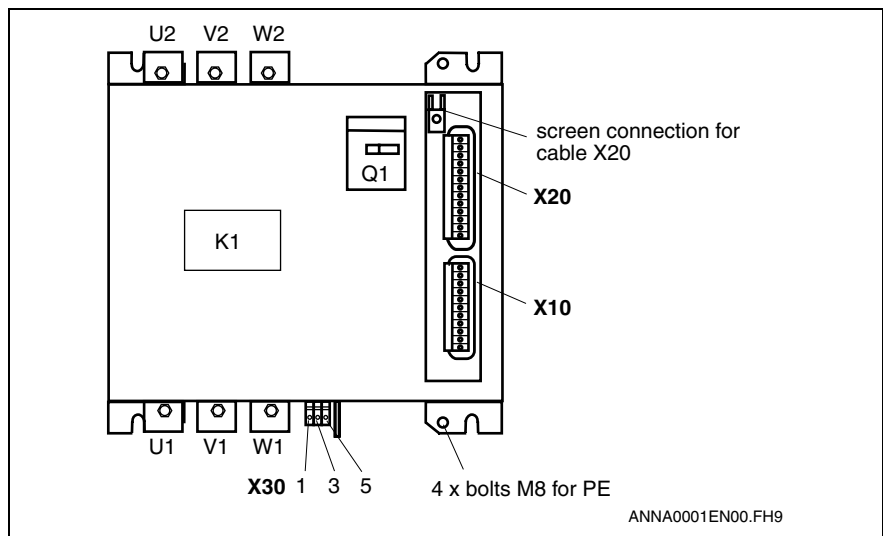


Figure 11-6: Layout plan of terminals

Conductor Cross Sections

The conductor cross sections refer here to the rated current of the inverter.

The corresponding cross section of the ground conductor must be at least 50 % of that of the outer conductor if the unit has no permanent electrically conductive connection to the earthed mounting plate.

Description of the Terminals of the Line Power Supply Module

X10

Type

NAM04.2-...	Type	Pole number	Type of Construction
0250	spring force connector	13	plug connector
0350	spring force connector	13	plug connector
0450	spring force connector	13	plug connector
0650	spring force connector	13	plug connector

Figure 11-7: Type

IDs and meanings of the individual connections of the line power supply module with auxiliary voltage 120 V NAM 04.2-xxx-0xxx-xx-**120**

ID	Meaning	
1	control voltage AC 120 V ¹⁾	
2	control voltage AC 120 V, neutral conductor	
3	function „safe power termination“ when removing the X10.3-4 bridge.	
4	Main contactor and pre-charging protection have no supply voltage.	
5	control voltage output for preload amplification (X10.5: AC 120 V, X10.6: neutral conductor connected during the pre-charging phase); can be loaded with max. 1 A	
6		
7	response from main contactor and pre-charging protection OFF (break contact from K1 and K2 in series)	max. DC 24 V / 1 A AC 120 V / 1 A
8		
9	response, circuit breaker Q1 EIN (NOC of Q1) only for NAM04.2-480-0XXX-NE-xxx	max. DC 24 V / 1 A AC 120 V / 1 A
10		
11	response from main contactor Q1 ON (NOC of K1)	max. DC 24 V / 1 A AC 120 V / 1 A
12		
13	reserve	

1) **Required control voltage:** AC 120 V $\pm 10\%$, 60 Hz.

To ensure the „safe termination from power“ function, the control voltage must be separated from the feeding network in networks that do not include a neutral conductor. The secondary voltage must be grounded. (If the network has a neutral conductor then the phase voltage can have potential).

Power consumption at 120 V: 15 VA; transient pulse 1000 VA for 150 ms. Recommended circuit breaker: 3.0 A (characteristic C acc. to EN60898)

Please remember that in case of parallel connections the power consumption is doubled!

Figure 11-8: IDs of the individual connections

IDs and meanings of the individual connections of the line power supply module with auxiliary voltage 230 V NAM 04.2-xxx-0xxx-xx-230

ID	Meaning	
1	control voltage AC 230 V ¹⁾	
2	control voltage AC 230 V, neutral conductor	
3	function „safe power termination“ when removing the X10.3-4 bridge.	
4	Main contactor and pre-charging protection have no supply voltage.	
5	control voltage output for preload amplification (X10.5: AC 230 V, X10.6: neutral conductor connected during the pre-charging phase); can be loaded with max. 1 A	
6		
7	response from main contactor and pre-charging protection OFF (break contact from K1 and K2 in series)	max. DC 24 V / 1 A AC 230 V / 1 A
8		
9	response from circuit breaker Q1 EIN (NOC of Q1) only for NAM04.2-480-0XXX-NE-xxx	max. DC 24 V / 1 A AC 230 V / 1 A
10		
11	response from main contactor Q1 ON (NOC of K1)	max. DC 24 V / 1 A AC 230 V / 1 A
12		
13	reserve	

- 1): **Required control voltage:** AC 230 V $\pm 10\%$, 50 / 60 Hz.
 To ensure the „safe termination from power“ function, the control voltage must be separated from the feeding network in networks that do not include a neutral conductor. The secondary voltage must be grounded. (If the network has a neutral conductor then the phase voltage can have potential).
Power consumption at 230 V: 15 VA; transient pulse 1000 VA for 150 ms. Recommended circuit breaker: 1.6 A (characteristic C acc. to EN60898)
 Please remember that in case of parallel connections the power consumption is doubled!

Figure 11-9: IDs of the individual connections

Cross section for connection

NAM04.2..	Conductor cross sections that can be connected in mm ²	AWG	Recommended minimum cross section in mm ²	AWG
0250	0.2 – 2.5	24 - 12	1.5	14
0350	0.2 – 2.5	24 - 12	1.5	14
0450	0.2 – 2.5	24 - 12	1.5	14
0650	0.2 – 2.5	24 - 12	1.5	14

A minimum cross-section of 1 mm² is recommended for connections 7 – 12.

Figure 11-10: Connections

X20, prefabricated control cable RZU05-RNA / NAM01-160-350kW RZU06- RNA / NAM01-450-650kW

Type

NAM04.2..	Type	Pole number	Type of Construction
0250 ¹⁾	plug connector	11	plug connector
0350 ¹⁾	plug connector	11	plug connector
0450 ²⁾	plug connector	11	plug connector
0650 ²⁾	plug connector	11	plug connector

1): RZU05-RNA / NAM01-160-350kW

2): RZU06-RNA / NAM01-450-650kW

Figure 11-11: Type

IDs of connections of RZU05-RNA / NAM01-160-350kW

ID	Meaning
1	P24 V
2	response K1 ON
3	K1 ON
4	K2 ON
5	reference ground
6	sin + (phase angle detection)
7	sin - (phase angle detection)
8	cos + (phase angle detection)
9	cos - (phase angle detection)
10	reserve
11	reserve

Figure 11-12: IDs of the individual connections

IDs of connections of RZU06- RNA / NAM01-450-650kW

ID	Meaning
1	P24 V
2	response K1 ON
3	K1 ON
4	K2 ON
5	absolute dimensions
6	-
7	-
8	-
9	-
10	reserve
11	reserve

Figure 11-13: IDs of the individual connections

Cross section for connection

NAM04.2..	Conductor cross sections that can be connected in mm ²	AWG	Recommended minimum cross section in mm ²	AWG
0250	0.2 – 2.5	24 - 12	1.5	14
0350	0.2 – 2.5	24 - 12	1.5	14
0450	0.2 – 2.5	24 - 12	1.5	14
0650	0.2 – 2.5	24 - 12	1.5	14

Figure 11-14: Connections

Tightening torque 0.5 – 0.6 Nm.

X30, connection to line filter HNF01.1 (load side) for synchronization

Type

NAM04.2	Type	Number	Type of Construction
0250	high current through terminal	3	with screw connection
0350	high current through terminal	3	with screw connection
0450	high current through terminal	3	with screw connection
0650	high current through terminal	3	with screw connection

Figure 11-15: Type

IDs of the individual connections

ID	Meaning
1	L1
3	L2
5	L3

Figure 11-16: IDs of the individual connections

Cross section for connection

NAM04.2 NAM04.2..NE	Conductor cross sections that can be connected in mm ²	AWG	Recommended minimum cross section in mm ²	AWG
0250	0.5 - 10	20 – 8	4 short-circuit protected ¹⁾	12
0350	0.5 - 10	20 – 8	4 short-circuit protected ¹⁾	12
0450	0.5 - 10	20 – 8	4 short-circuit protected ¹⁾	12
0650	0.5 - 10	20 – 8	4 short-circuit protected ¹⁾	12

1): The planning instructions for this cable connection must be observed. See operating instructions DOK-RD500*-SFT*****-IBxx-EN-P.

Figure 11-17: Connections

Tightening torque 1.5 – 1.8 Nm.

Power Contactor Connection K1	Comment	
	NAM04.2-480-0450-NE or NN (250 kW / 450 kW)	
1, 3, 5, 2, 4, 6	conductor cross section that can be connected, terminal bar with M10 insert nut ¹⁾	recommended minimum cross section in mm ² 2 x 120 (2 x 250MCM)
	NAM04.2-480-0650-NE or NN (350 kW / 650)	
1, 3, 5, 2, 4, 6	conductor cross section that can be connected, terminal bar with M10 insert nut ¹⁾	recommended minimum cross section in mm ² 2 x 2 x 240 (2 x 2 x 500MCM)

1): Tightening torque 35 Nm.

Mains voltage detection

Short-circuit protected by circuit breaker

Q1	Circuit Breaker 1.6 A
Reference input	1.1 A
Short-circuit separating power	100 kA

Figure 11-18: Switch Q1

Control Cable RZU

Connection to RZR01 controller box (on the mains side):

Control cable RZU-E05-RNA01 / NAM01-160-350 kW with order number R911201390.

Control cable RZU-E06-RNA01 / NAM01-160-350 kW with order number R911201391.

For additional information, see chapter 15 and operating instructions DOK-RD500*-SFT*****-IBxx-EN-P.

12 NTM02.1 Power Module

12.1 Description of the Power Module

The NTM02.1 power module provides the DC 24 V regulated control supply voltage for the RZR01.1 and HPS01.1 components.

Physical Characteristics

The power supply is short-circuit and open-circuit proof.

Type Key

Abbrev. Column	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	
Example:	N	T	M	0	2	.	1	-	2	3	0	-	0	2	4	-	1	5			
1. Product																					
1.1	NTM..... = NTM																				
2. Line																					
2.1	2..... = 02																				
3. Design																					
3.1	1..... = 1																				
4. Nominal input voltage																					
4.1	AC 230V ± 10%..... = 230																				
5. Nominal output voltage																					
5.1	DC 24V..... = 024																				
6. Nominal output current																					
6.1	15 A at AC 230V = 15																				

TLNT0001EN00.FH9

Figure 12-1: Type code of power module NTM02.1

Technical Specifications

NTM02.1-230-024-15		
Input voltage AC ¹⁾	V	AC 230 50 / 60 Hz, ±10 %
Max. power consumption AC	A	1.5
Input voltage DC ¹⁾	V	DC 750 -40 % +20 %
Max. power consumption AC	A	1
Max. output current at 24 V	A	15
Max. output current when only supplied by AC	A	5
Max. power loss	W	100
Environmental conditions, level of noise suppression and immunity to interference in operation		
Environmental class	3K3 acc. to DIN IEC 721-3-3 (ambient temperature 0 – 40 °C)	
Level of noise suppression / immunity to interference	A 2 acc. to EN 55011 / EN 61800-33 only together with all required components for SFT	

	NTM02.1-230-024-15	
Type of enclosure	IP20 acc. to EN 60529 (without connection terminals)	
Weight	kg	7.5

1): Unit **must** be connected to intermediate circuit for DC supply.
 Operation at 230 V is only permitted for stand-by operation at a reduced output current.
 internal circuit breaker for control transformer: 1 A
 external circuit breaker recommended: 2 A
 external DC fuses recommended: 4 A (contained in the HPS)

Tab.: 12-1 Technical Specifications

Type Label

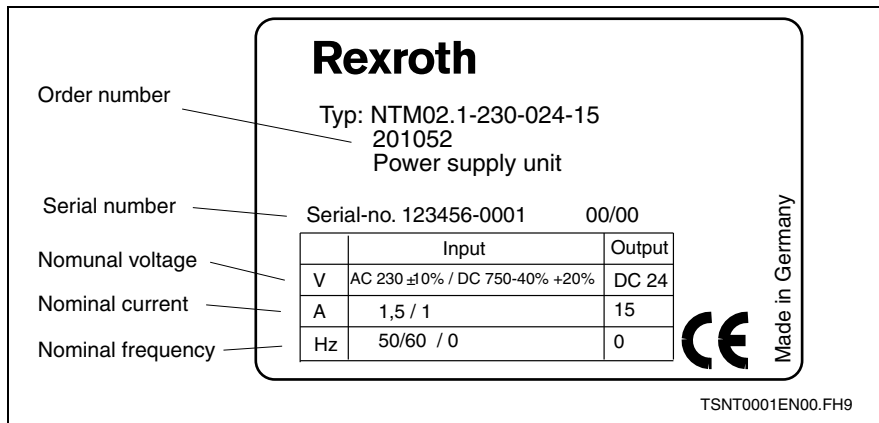


Figure 12-2: Type Label of NTM02.1

Control Principle

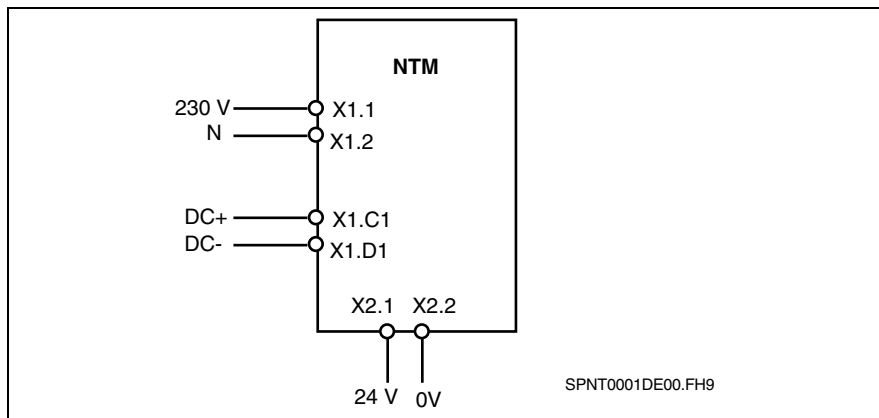


Figure 12-3: Control principle of NTM02.1

12.2 Mechanical Assembly

Minimum requirements related to the place of installation

- The service room must be dust free. Dusty air must be filtered.
- The environmental temperature must be between 0 and 40 °C.
- Relative humidity must not exceed 90 % and there must be no moisture in the storage area.

- The air fed-in must not contain any gases which could endanger the function of the units or which are aggressive or electrically conductive.
- Air circulation must not be hindered. The minimum clearance distances for inlet air and outgoing air of the respective class must not be narrowed by additional constructions.
- The unit dissipates heat and warms up the surroundings. Sufficient clearance to heat-sensitive units should therefore be observed.

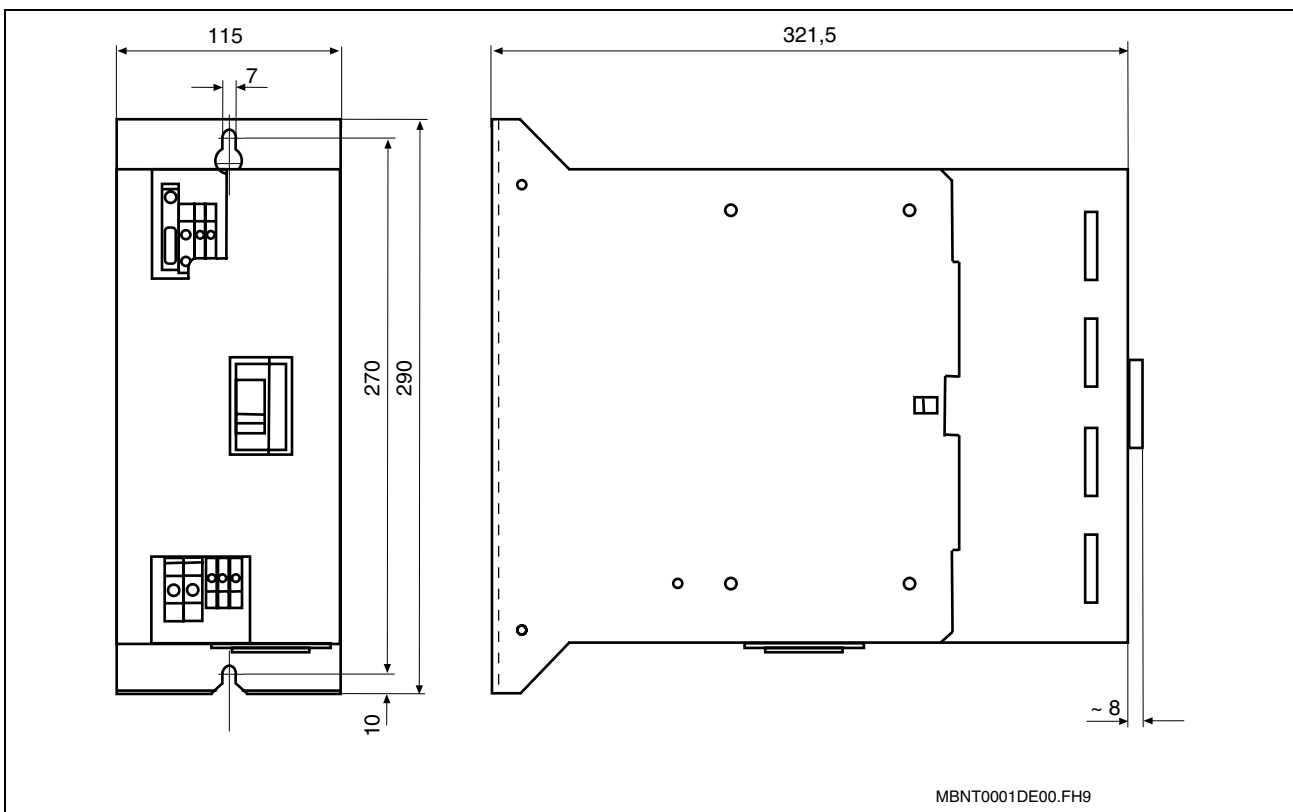
Assembly

The following points should be observed when assembling the device:

- Assembly must be made in the vertical position on an even surface.
- When assembling the cabinet, the amount of cooling air required by each unit must be calculated and the cabinet should be cooled accordingly.
- The metal housing of the power module should be level and connected securely to the control cabinet or the fitting panel. If necessary, use contact discs or scratching discs.
- The required fixing screws are indicated in the drilling template of the dimension drawing.

Dimension Drawing

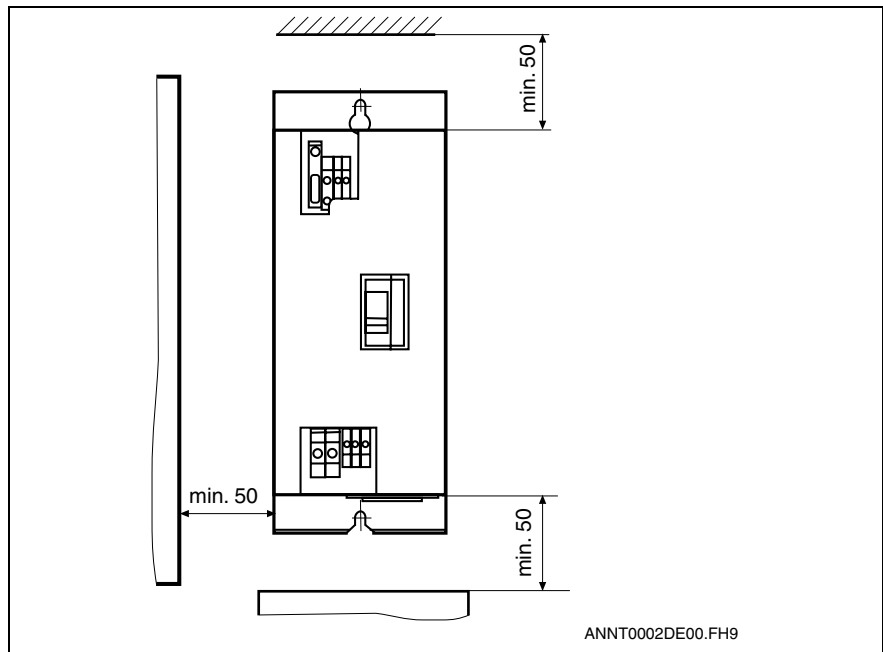
A power module is shown in the drawings below.



Dimensions in mm

Figure 12-4: Dimension drawing of power module NTM 02.1

Minimum Clearance Distances



Dimensions in mm
 Figure 12-5: Minimum clearance distances to adjacent components

12.3 Electrical Installation

Layout Plan of Terminals

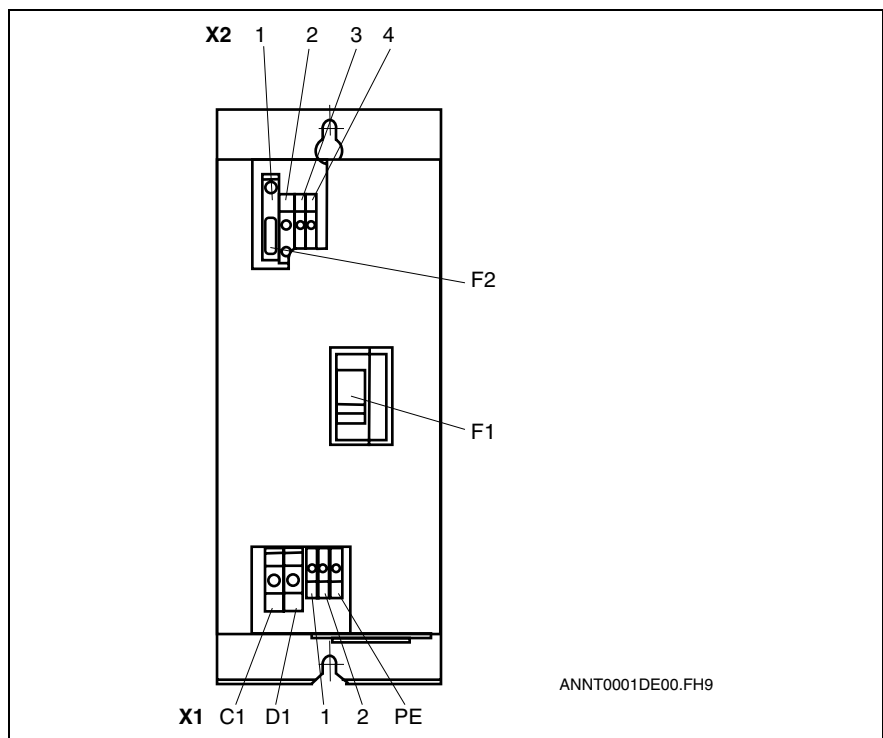


Figure 12-6: Layout plan of terminals

Description of the NTM02.1-230-024-15 Terminals

X1, DC link voltage

Type

NTM02.1	Type	Number	Type of Construction
230	universal terminal	2	with screw connection

Figure 12-7: Type

IDs of the individual connections

ID	Meaning
C1	DC link voltage 750 V DC+
D1	DC link voltage DC-

Figure 12-8: IDs of the individual connections

Cross section for connection

NTM02.1	Conductor cross sections that can be connected in mm ²	AWG	Recommended minimum cross section in mm ²	AWG
230	0.2 – 6	26 - 8	1.5	16

Figure 12-9: Cross sections for connection

Tightening torque 0.6 – 1.8 Nm.

X1, Terminals 1 and 2

Type

NTM02.1	Type	Number	Type of Construction
230	universal terminal	2	with all-purpose base

Figure 12-10: Type

IDs of the individual connections

ID	Meaning
1	230 V
2	N

Figure 12-11: IDs of the individual connections

Cross section for connection

NTM02.1	Conductor cross sections that can be connected in mm ²	AWG	Recommended minimum cross section in mm ²	AWG
230	0.2 – 2.5	24 - 14	2.5	14

Figure 12-12: Cross sections for connection

Tightening torque 0.6 - 1.8 Nm.

X1, protective wire connection

Type

NTM02.1	Type	Number	Type of Construction
230	all-purpose protective wire terminal	1	with all-purpose base

Figure 12-13: Type

IDs of the individual connections

ID	Meaning
PE	protective wire connection

Figure 12-14: IDs of the individual connections

Cross section for connection

NTM02.1	Conductor cross sections that can be connected in mm ²	AWG	Recommended minimum cross section in mm ²	AWG
230	0.2 – 2.5	24 - 12	2.5	12

Figure 12-15: Cross sections for connection

Tightening torque 0.6 – 0.8 Nm.

X2, terminal 1

Type

NTM02.1	Type	Number	Type of Construction
230	blade-type fuse terminal	1	with all-purpose base

Figure 12-16: Type

Connection ID

ID	Meaning
1	24 V

Figure 12-17: Connection ID

Cross section for connection

NTM02.1	Conductor cross sections that can be connected in mm ²	AWG	Recommended minimum cross section in mm ²	AWG
230	0.2 – 6	24 - 8	2.5	14

Figure 12-18: Cross section for connection

Tightening torque 1.5 – 1.6 Nm.

X2, terminal 2

Type

NTM02.1	Type	Number	Type of Construction
230	universal terminal	1	with all-purpose base

Figure 12-19: Type

Connection ID

ID	Meaning
2	0 V

Figure 12-20: Connection ID

Cross section for connection

NTM02.1	Conductor cross sections that can be connected in mm ²	AWG	Recommended minimum cross section in mm ²	AWG
230	0.2 – 6	24 - 8	2.5	14

Figure 12-21: Cross section for connection

Tightening torque 1.5 – 1.8 Nm.

X2, terminals 3 and 4

Type

NTM02.1	Type	Number	Type of Construction
230	universal terminal	2	with all-purpose base

Figure 12-22: Type

IDs of the individual connections

ID	Meaning
3	response of F1 ON (NOC) AC 230 V / 5 A; DC24 V / 1 A
4	response of F1 ON (NOC) AC 230 V / 5 A; DC24 V / 1 A

Figure 12-23: IDs of the individual connections

Cross section for connection

NTM02.1	Conductor cross sections that can be connected in mm ²	AWG	Recommended minimum cross section in mm ²	AWG
230	0.2 – 2.5	24 - 14	2.5	14

Figure 12-24: Cross sections for connection

Tightening torque 0.6 – 0.8 Nm.

F1, F2

F1	circuit-breaker 1 A
F2	blade-type electric fuse link SI 15 A

Figure 12-25: Description F1 and F2

For additional information, see operating instructions DOK-RD500*-SFT*****-IBxx-EN-P.

12.4 Commissioning

- wire 24 V to the consumers, observing correct polarity
- permissible consumers: HPS01.1; RZR01.1
- check the fan after switching on (fan sucks up air)
- Switch in circuit breaker F1

12.5 Maintenance

Lifetime

Lifetime of the fan at various ambient temperatures.

Ambient temperature	Lifetime in h
40 °C	80.000
70 °C	40.000

Figure 12-26: Lifetime in hours

13 RZR01.1 controller for the HPS

13.1 Description of the controller for the HPS

Controller with built-in fan.

Physical Characteristics

The inverter controllers contain various different logical device records and various different versions. In addition to this, lines and motor side RZR devices differ in terms of the firmware in use.

Type Key of the controller for the HPS

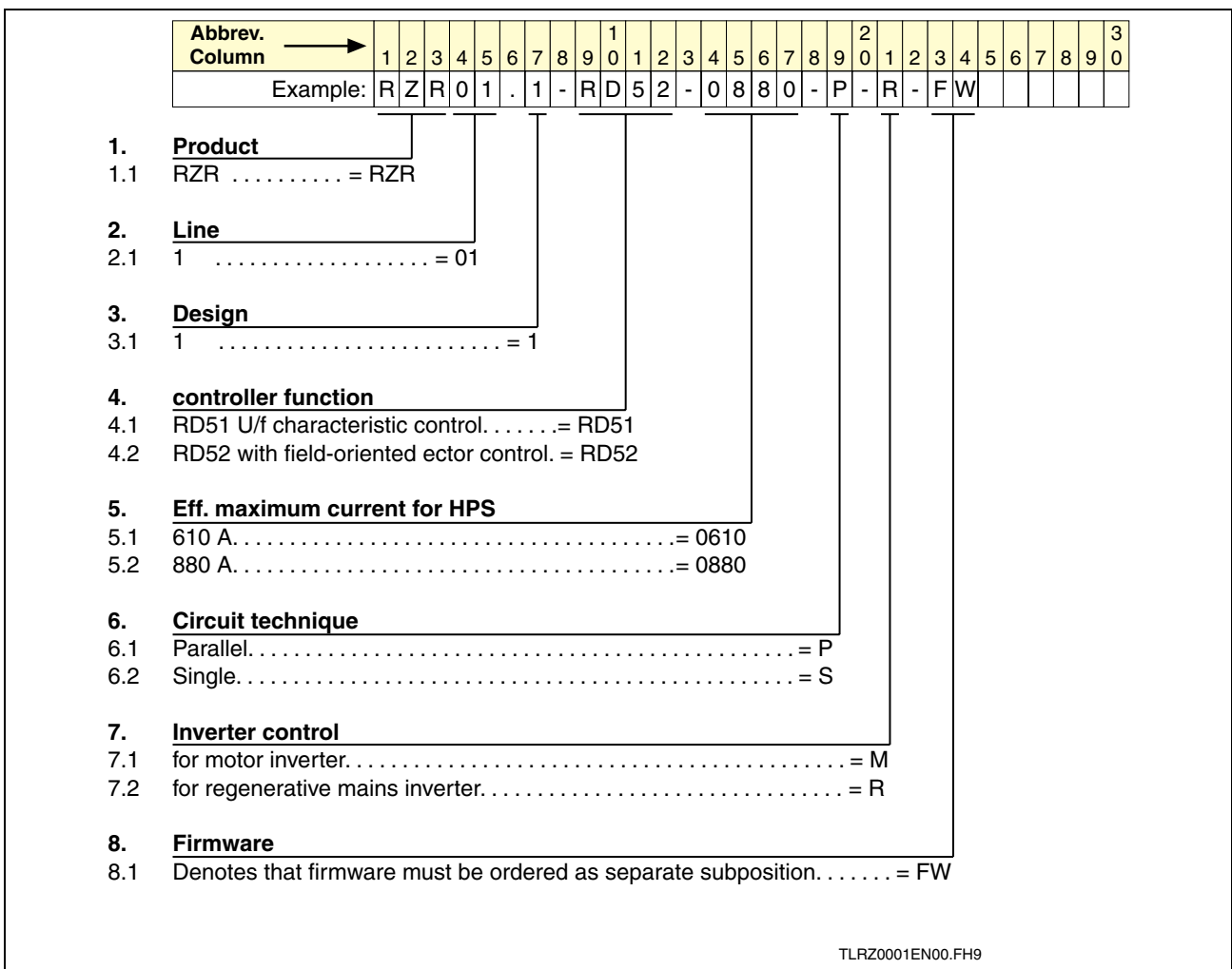


Figure 13-1: Type key of RZR01.1

Technical Specifications

RZR01.1...	
Input voltage	V 24 ± 5 %, ripple max 5 %
max. current consumption	A 12
Environmental conditions, level of noise suppression and immunity to interference in operation	
Environmental class	3K3 acc. to DIN IEC 721-3-3

RZR01.1...	
Ambient temperature	0 – 40 °C
Level of noise suppression / immunity to interference	A 2 acc. to EN 55011 / EN 61800-3 only together with all required components for SFT
Mechanics	
Type of enclosure	IP20 acc. to EN 60529 (without connection terminals)
Weight	kg 6.5

Tab.: 13-1 Technical Specifications

Type Label

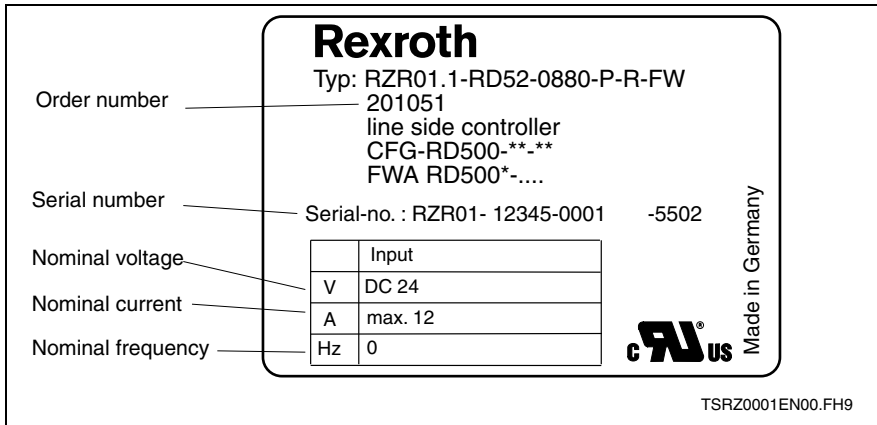


Figure 13-2: Type Label of RZR01.1 (RZR at line side)

Control Principle

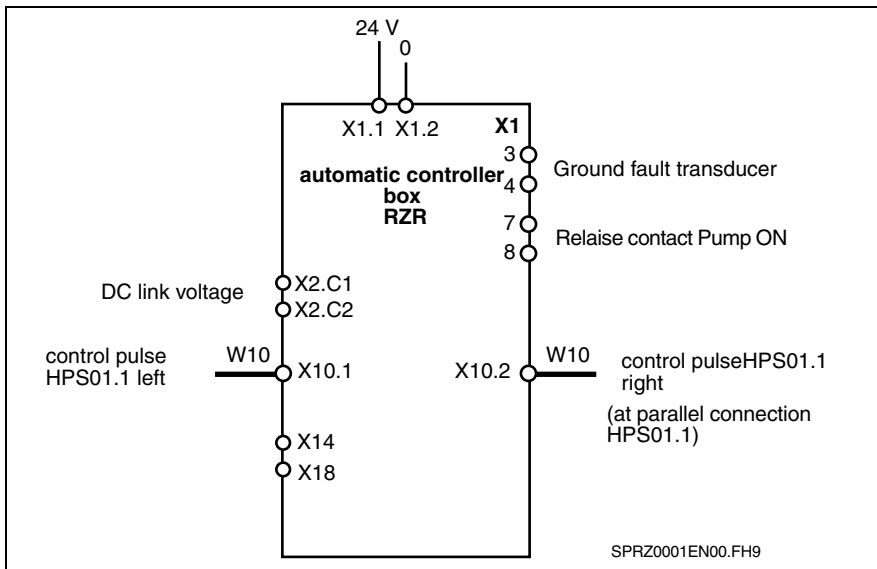


Figure 13-3: Control principle of the RZR01.1

13.2 Mechanical Assembly

Minimum requirements related to the place of installation

- The service room must be dust free. Dusty air must be filtered.
- The environmental temperature must be between 0 and 40 °C.
- Relative humidity must not exceed 90 % and there must be no moisture in the storage area.
- The air fed-in must not contain any gases which could endanger the function of the units or which are aggressive or electrically conductive.
- The minimum distances to other components must be observed. (see Figure 13-5).
- The unit dissipates heat and warms up the surroundings. Sufficient clearance to heat-sensitive units should therefore be observed.

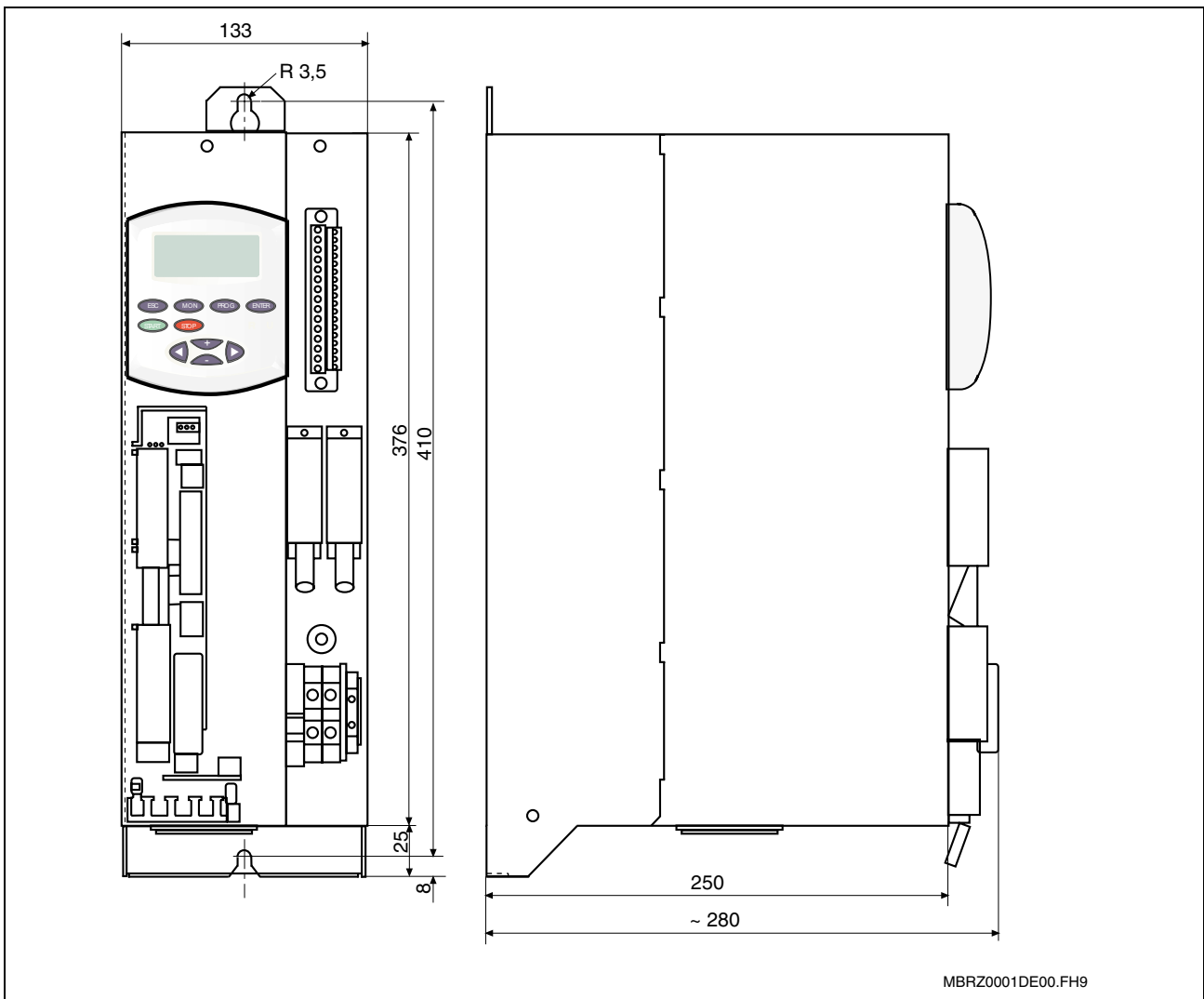
Assembly

The following points should be observed when assembling the device:

- Assembly must be made in the vertical position on an even surface.
- When assembling the cabinet, the amount of cooling air required by each unit must be calculated and the cabinet should be cooled accordingly.
- The metal housing of the controller for the HPS should be level and connected securely to the control cabinet or the fitting panel. If necessary, use contact discs or scratching discs.
- The required fixing screws are indicated in the drilling template of the dimension drawing.

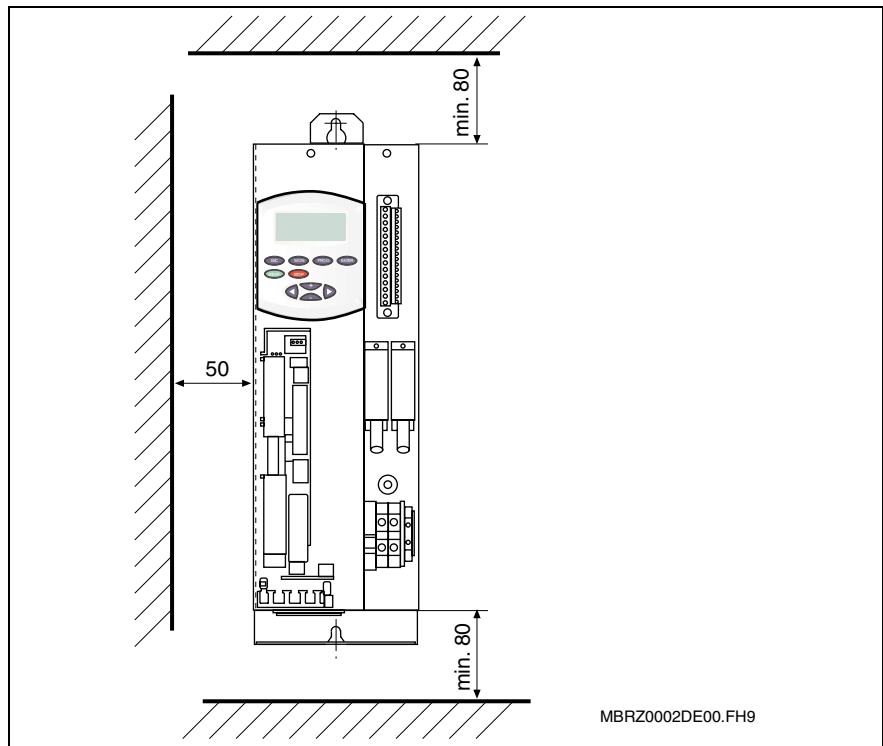
Dimension Drawing

An controller for HPS is shown in the drawings below.



Dimensions in mm
 Figure 13-4: Dimension drawing of controller RZR01.1

Minimum Clearance Distance



Dimensions in mm

Figure 13-5: Minimum clearance distances to adjacent components

13.3 Electrical Installation

Power Terminals

Layout plan of terminals of RZR 01.1 controller box

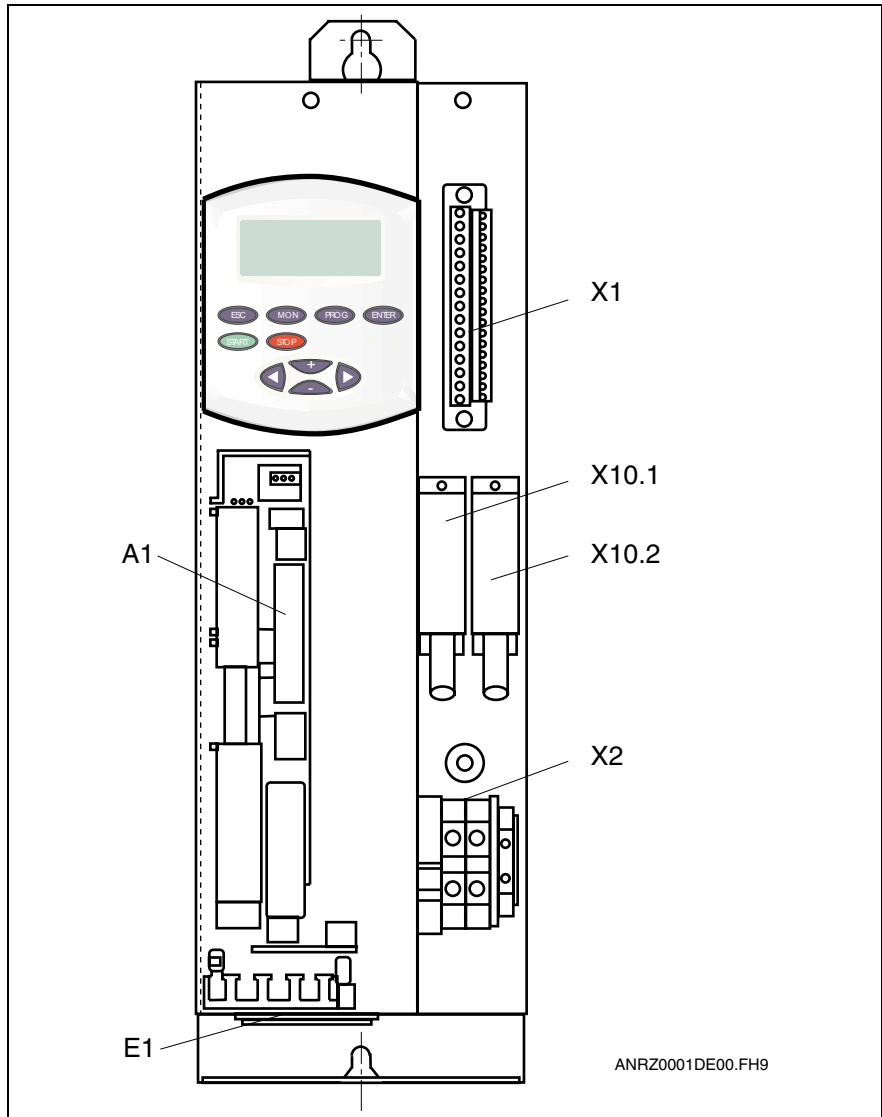


Figure 13-6: Layout plan of terminals

Conductor Cross Sections

The corresponding cross section of the ground conductor must be at least 2.5 mm² (AWG 12).

Description of the Terminals

X1, supply

Type

RZR01.1xx	Type	Pole number	Type of Construction
0610	spring force connector	15	with screw flange
0880	spring force connector	15	with screw flange

Figure 13-7: Type

IDs of the individual connections

ID	Meaning
1	supply voltage 24 V (max. 12 A)
1	supply voltage 24 V (max. 12 A)
2	supply voltage 0 V
2	supply voltage 0 V
3	connection of the aggregate current transformer ¹⁾ RZU-E01 or RZU-E02
4	connection of the aggregate current transformer ¹⁾ RZU-E01 or RZU-E02
5	free
6	free
7	floating contact for control of the pump DC 24 V / 2 A
8	floating contact for control of the pump DC 24 V / 2 A
9 - 13	reserve

1): The planning instructions for this cable connection must be observed

Figure 13-8: IDs of the individual connections

Cross section for connection

RZR01.1xx	Conductor cross sections that can be connected in mm ²	AWG	Recommended minimum cross section in mm ²	AWG
0610	0.2 – 2.5	24 - 12	2.5	14
0880	0.2 – 2.5	24 - 12	2.5	14

Figure 13-9: Cross sections for connection

X2, DC link auxiliary connection

Type

RZR01.1xx	Type	Number	Type of Construction
0610	universal terminal	2	with screw connection
0880	universal terminal	2	with screw connection

Figure 13-10: Type

IDs of the individual connections

ID	Meaning
1	DC link auxiliary connection C1 (L+) for mounting and connecting on the left side to the HPS01.1 X2.C1
2	DC link auxiliary connection D1 (L-) for mounting and connecting on the left side to the HPS01.1 X2.D1

Figure 13-11: IDs of the individual connections

Cross section for connection

RZR01.1xx	Conductor cross sections that can be connected in mm ²	AWG	Recommended minimum cross section in mm ²	AWG
0610	0.2 – 6	26 - 8	1.5	16
0880	0.2 – 6	26 - 8	1.5	16

Figure 13-12: Cross sections for connection

Tightening torque 0.6 – 1.8 Nm.

**DANGER****Danger of lethal electric shock from live parts with more than 750 V DC!****X10, cable W10**

Type

RZR01.1xx	Type	Number
0610	prefabricated cable	1
0880	prefabricated cable	1

Figure 13-13: Type

IDs of the individual connections

ID	Meaning
1	cable W10 (pin D-Sub plug) of HPS01.1
2	cable W10 (pin D-Sub plug) of HPS01.1 right (only for SFT 450 kW and 650 kW)
prefabricated cable of HPS01.1	

Figure 13-14: IDs of the individual connections

Fasteners X14, X18

Terminal	Comment
X14	prefabricated cable with plug X20 for line power supply module ¹⁾
X18	

1): RZR01.1-RDxx-0xxx-S-R-FW: RZU-E05-RNA01 / NAM01-160-350 kW
 RZR01.1-RDxx-0xxx-P-R-FW: RZU-E06-RNA01 / NAM01-450-650 kW

Figure 13-15 Connection to the line power supply module

13.4 Control terminals

Layout plan of terminals SR17002 RZR01.1-RD52-0xxx-x-M-FW SFT motor inverter

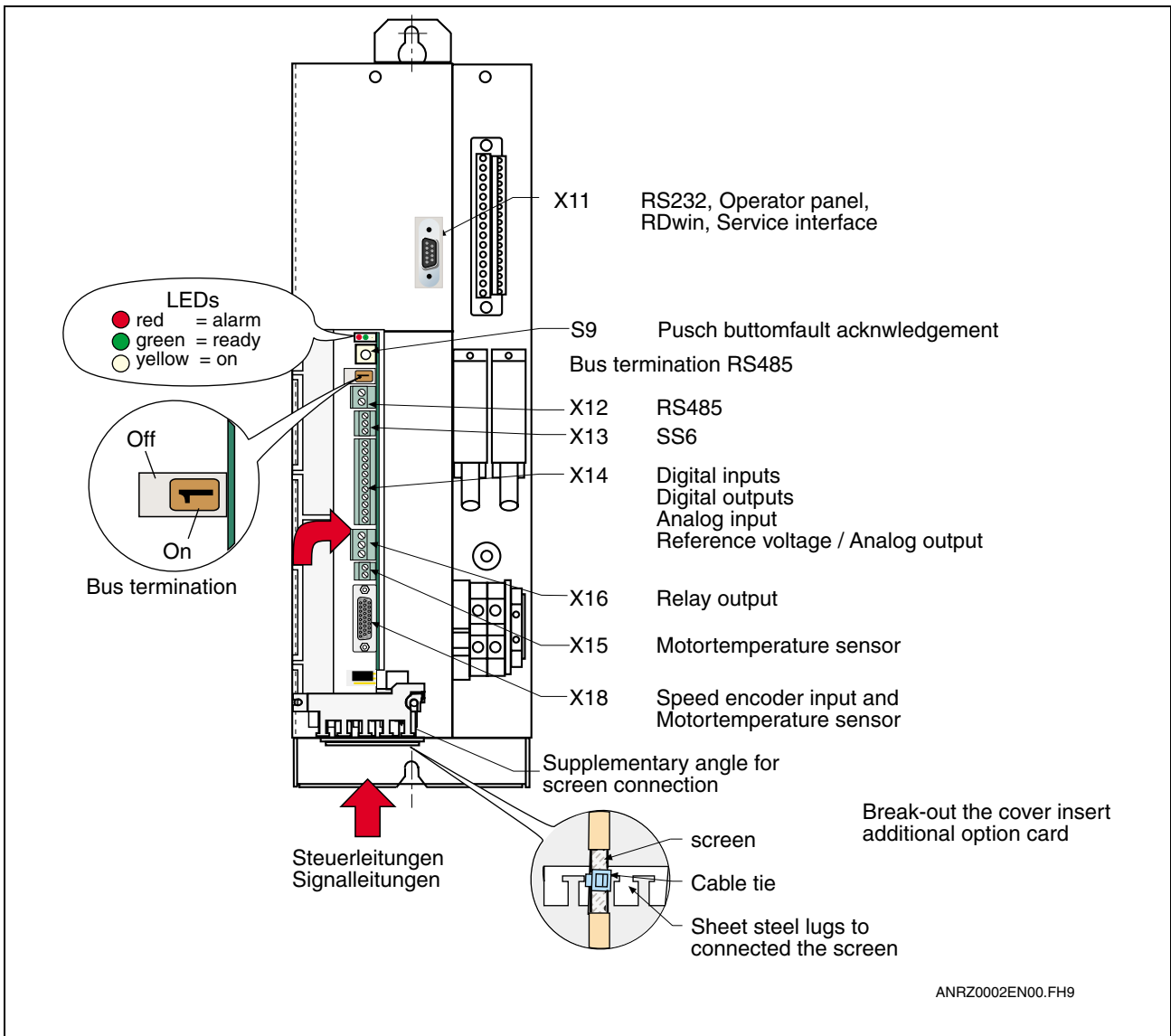


Figure 13-16 Control terminals on control board SR17002

Description of the Control Terminals

Terminal	Designation	Comment	
X11	Service Interface		
3	R x D	RS232 service interface for plugging-in the control panel to connect a PC with the RDwin operating environment	
2	T x D		
5	ground		
X12	RS485 Interface		
1	R x D+ / T x D +	RS485 interface; communication with USS protocol	
2	R x D+ / T x D +		
X13	SS6 Interface		
1	CAN high	point-to-point connection between RD52 and RD52 with internal bus termination. The lines from X13.1 of the first RD52 to X13.1 of the second RD52 and X13.2 of the first and X13.2 of the second RD52 must be twisted. The maximum length of the line is 5 m.	
2	CAN low		
3	ground		
X14	Standard Terminal Strip		
1	P24V output	load capacity max. 50 mA	
2	dig. input 1 dig. output 1	<u>digital inputs</u> without potential separation: input current at 24 V: 8.6 mA H signal: +13 V ... +33 V L signal: -3 V ... +5 V or open terminal	Input / output selectable; function selected with P0471
3	dig. input 2 dig. output 2		
4	dig. input 3 dig. output 3	<u>digital outputs</u> H signal: +21 V, max. 20 mA L signal: 0 V ON / OFF	Input / output selectable; function selected with P0475
5	dig. input 4		
6	dig. input 5	operational release	factory setting operational release
7	digital ground	reference ground of the P24 V (X14.1)	
8	reference ±10 V analog output	selectable function, can be switched-over by P0436 (load capacity: 5 mA, short-circuit proof): reference voltage +10 V reference voltage -10 V analog output 0 ... ±10 V	
9	analog input+	differential input can be selected as follows: (P0201) ±10 V; A / D converter ±11 bit; resolution 20 mV, R _e = 40 kΩ	
10	analog input -	0 ... 20 mA; A / D converter 11 Bit; resolution 0.02 mA, R _e = 150 Ω 4 ... 20 mA; A / D converter 11 Bit; resolution 0.02 mA, R _e = 150 Ω	
11	analog ground	reference ground of the reference voltage or of the analog output (X14.8)	
X15	Motor Temperature Probe		
1	PTC / KTY+	connection of a motor temperature probe (PTC or KTY84). Observe the correct polarity when connecting a KTY84! (can be selected via P0385 ... P0389)	
2	PTC / KTY -		

Terminal	Designation	Comment
X16	Relay Output	
1	NOC	relay output
2	common contact	<u>load capacity:</u> 30 V DC, 7 A
3	break contact (NCC)	
X18	The assignment of the terminal depends on the respective type of transmitter.	

Figure 13-17 Description of the control terminals on the SR17002

13.5 Commissioning

The RZR01.1 may only be connected to the 24 V supply voltage of the NTM02.1-230-024-15, or to a potential-separated supply voltage source that is installed in the control cabinet and that fulfils the following requirements.

Output voltage	$V = 24 \text{ V} \pm 5 \%$
Maximum constant current	$I = 12 \text{ A}$
Transient current	$I = 20 \text{ mA (50 ms)}$
Ripple voltage of the output voltage	max. 250 mV
Ambient temperature	0 – 60 °C

Figure 13-18: Requirements for putting into operation

When putting into operation for the first time, the function of the fan at the base of the unit must be checked. (fan sucks air up)

13.6 Maintenance

Lifetime

Lifetime of the fan at various ambient temperatures.

Ambient temperature	Lifetime in h
40 °C	80.000
70 °C	40.000

Figure 13-19: Lifetime in hours

14 RZU-E03 / 04 Output Choke

14.1 Description of the Output Choke

RZU-E03-HPS01.1M-F0610 and RZU-E04-HPS01.1M-F0880 are each comprised of a pot-type core choke. Basically, the pot-type core choke must be connected to the HPS01.1M power section at the motor end. The power output chokes are used to reduce the edge steepness of the motor voltage. For the powers 450 kW and 650 kW, they also ensure the symmetrical division of the current of the power sections that are connected in parallel. Motor filter RZM can be used (alternatively). In this case, the output choke are not necessary.

Type Key

Abbrev. Column	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	2	
Example:	R	Z	U	-	E	0	3	-	H	P	S	0	1	.	1	M						
1. Product																						
1.1	RZU = RZU																					
2. Accessories																						
2.1	electrical accessories. . . = E																					
2.2	mechanical accessories. . . . = M																					
3. classification figure of function																						
3.1	e. g. 3. = 03																					
4. Product reference																						
4.1	e.g. RD51.1, RD52.2, HPS01.1...																					

TLZU0021EN00.FH9

Figure 14-1: Type key of the RZU-E0X-HPS01.1M-Fxxx

Technical Specifications

Output Choke RZU-E0x-HPS01.1M-Fxxx			
		RZU-E03-HPS01.1M-F0610	RZU-E04-HPS01.1M-F0880
Rated current	A	380	520
Pulse frequency	kHz	4 - 8	
Output frequency	Hz	0 – 250	
Dimensions	mm	120 x 105	120 x 105
Boring	mm	8.5	8.5
Cable	mm ²	4 x parallel 35 (AWG 2)	4 x parallel 50 (AWG 1/0)
Cable connection		fixed (bar connector)	fixed (bar connector)
Cable lengths, input to connection U2, V2, W2	mm	1400	1400
Cable lengths, output to aggregate current transformer	mm	2300	2700
Weight	kg	8.0	9.5

Figure 14-2: Technical specifications of Output Choke RZU-E0X-HPS01.1M-Fxxx

Type Label

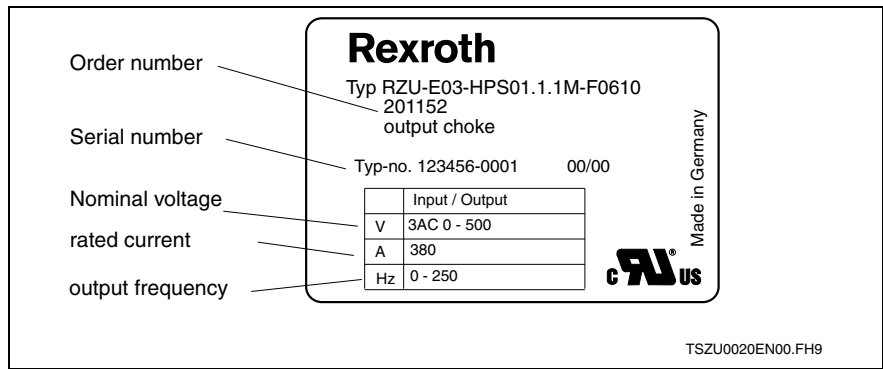


Figure 14-3: Type Label of the RZU-E0X-HPS01.1M-Fxxx

14.2 Mechanical Assembly

No material is contained in the delivery for fixing the chokes.

Assembly example 1

The chokes are fixed by angle joints and a end-to-end threaded rod (M8). The minimum distance to the backward mounting plate is 10 mm for aluminum, and 25 mm for steel. The distance from choke to choke (at least 5 mm) is ensured by using intermediate supports and distance sleeves.

- stud bolts, washers and nuts must be made of brass or magnetic non-conductive steel.
- The holding angles should be made of 3 mm, magnetic non-conductive material (e.g. aluminum).
- The distance sleeves should be made of temperature-stable, non-conductive material.

Note: Additional losses are generated when using other materials; this can result in excessive heat development.

Recommended tightening torque: 15 - 20 Nm

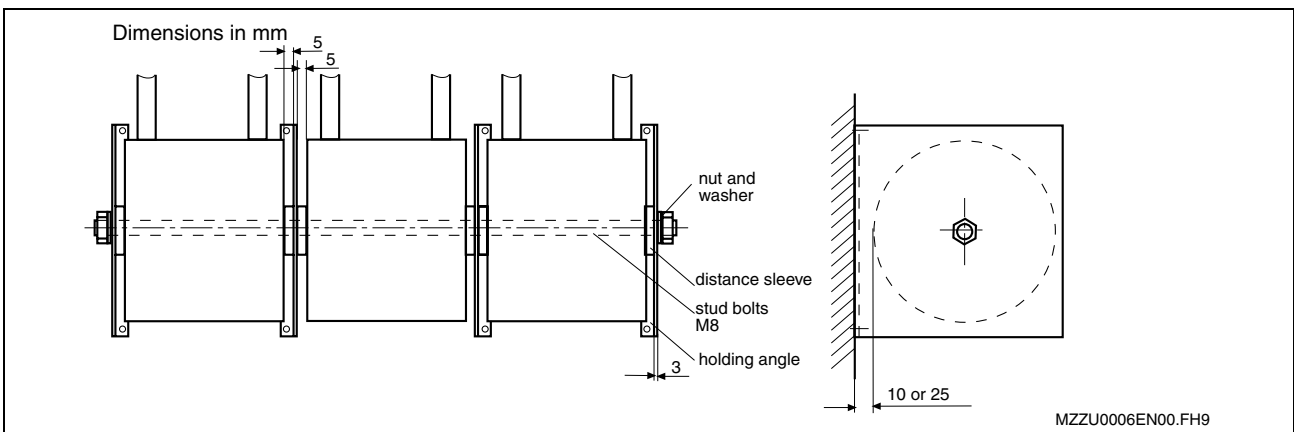


Figure 14-4: Assembly example 1 for balancing chokes

- Assembly example 2** The chokes are fixed individually using stud bolts (M8) that are vertical to the mounting plate. The minimum distance to the backward mounting plate is 10 mm for aluminum, and 25 mm for steel. The distance is ensured using distance sleeves.
- stud bolts, washers and nuts must be made of brass or magnetic non-conductive steel.
 - The distance sleeves should have a minimum diameter of 50 mm and be made of temperature-stable, non-conductive material.

Note: Additional losses are generated when using other materials; this can result in excessive heat development.

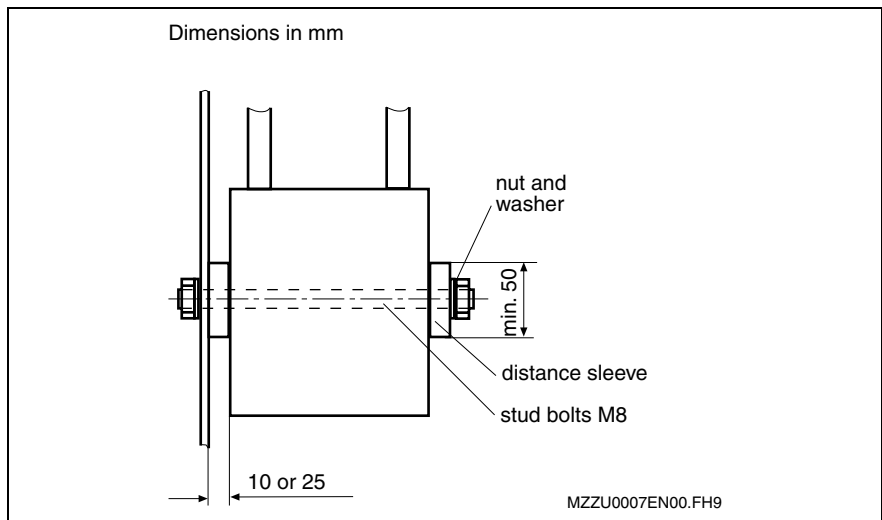


Figure 14-5: Assembly example 2 for balancing chokes

Recommended tightening torque: 15 - 20 Nm

15 RZU-E01 / 02 Current Transformer

15.1 Description of the Current Transformer RZU-E01 / 02 HPS01.1M-Fxxx

RZU-E01-HPS01.1M-F0610 / F0880 and RZU-E02-HPS01.1M-F0610 / F0880 are comprised of an current transformer for the detection of earth leaks (ground faults) from the motor lines and from the motor. The aggregate current transformer is arranged between the output choke and the motor connecting bars. All lines must be led through.

Type Key of the RZU-E01 / 02 Current Transformer

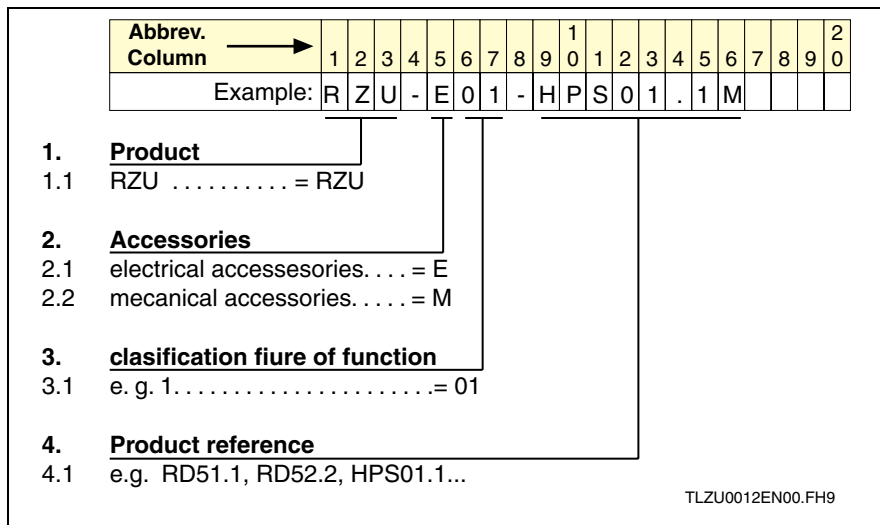


Figure 15-1: Type key of the RZU-E0X-HPS01.1M-Fxxx

Technical Specifications of the RZU-E01 / 02 Current Transformer

Aggregate Current Transformer RZU-E0x-HPS01.1M-Fxxx		
	RZU-E01-HPS01.1M-F0610/F0880 (for SFT 0250 kW / 0350 kW)	RZU-E02-HPS01.1M- F0610/F0880 (for SFT 0450 kW / 0650 kW)
Transfer ratio	1000 A / 1 A	1250 A / 1 A
Cable connection	Recommended cross-section 1.5 mm ²	
Cable length	Max. 1.5 m (twisted with a mesh width of max. 20 mm)	
Boring	85 mm	100 mm

Figure 15-2: Technical specifications of the RZU-E0x... current transformer

Type Label of the RZU-E01 / 02 Current Transformer

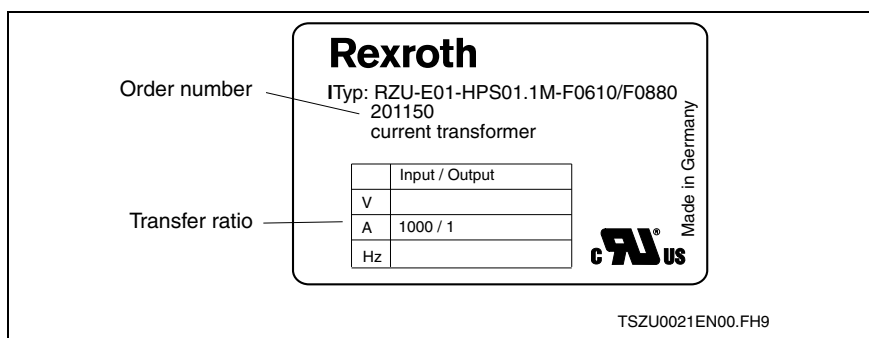


Figure 15-3: Type Label

15.2 Mechanical Assembly of the RZU-E01 / 02 Current Transformer

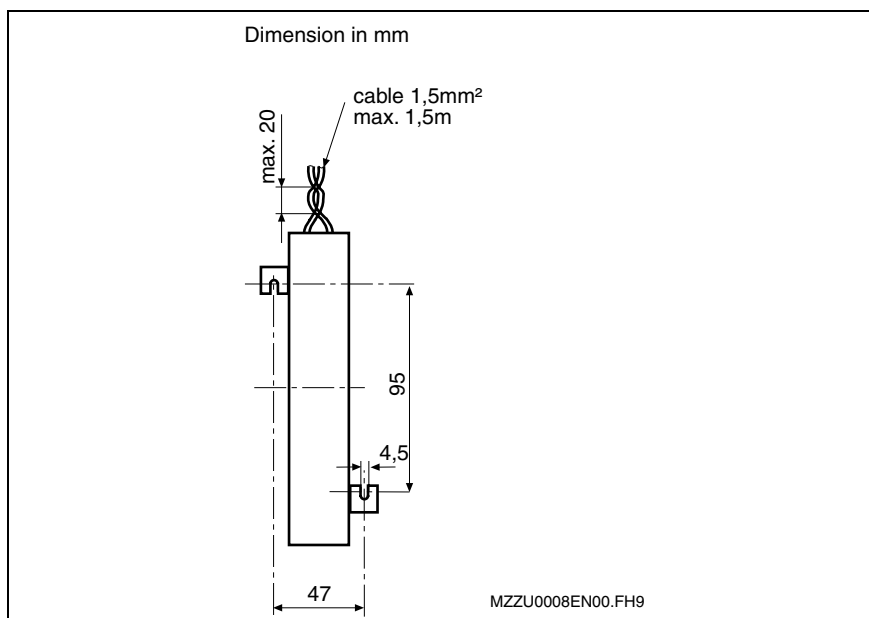


Figure 15-4: Dimension drawing of the aggregate current transformer

Note: Only insulated cable may be led through the current transformer!

Note: The ground-fault transformer signal may only be evaluated by the RZR automatic controller box.

Details of the wiring is contained in operating instructions DOK-RD500*-SFT*****-IB0x-EN-P.

16 RZU-E05 / 06 Control cable

16.1 Description of the control cable

- The control cable RZU-E05-RNA01/NAM01-160-350kW establishes the link between the mains connection module X20 (RNA respectively NAM) and X14 as well as X18, which are both disposed on the control board of the RD 43 inverter, respectively between X20 and the controller box RZR.
- The control cable RZU-E06-RNA01/NAM01-450-650kW joins the mains connection modules NAM X20 to X14 and X18 incorporated in the controller box RZR.

Type key RZU-E05 / 06

Abbrev. Column	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	
Example:	R	Z	U	-	E	0	6	-	H	P	S	0	1	.	1	M					
1. Product																					
1.1	RZU = RZU																				
2. Accessories																					
2.1	electrical accessories. . . = E																				
2.2	mechanical accessories. . . = M																				
3. classification figure of function																					
3.1	e. g. 6. = 06																				
4. Product reference																					
4.1	e.g. RD51.1, RD52.2, HPS01.1...																				

TLZU0020EN00.FH9

Abb.: 16-1 Type key RZU-E0X-RNA01/NAM01xxx

For further information concerning the control cables, please consult the instruction manual DOK-RD500*-SFT*****-IB0x-EN-P.

17 Liquid Cooling

Specified coolant: The coolant comprises tap water and antifreeze, type Antifrogen N (Clariant). It is mixed in the ratio 1 : 1. This guarantees frost protection down to -30 °C.

17.1 Working at the Coolant Circulation System,



CAREFUL

Antifreeze agent is hazardous!

⇒ If you swallow it, immediately seek medical attention and show the doctor the packaging or the label.



CAREFUL

Mixing with other antifreeze agents!

⇒ Do not mix the cooling agent with other antifreeze agents.

⇒ If assembled units have to be re-filled with cooling agent then only the specified antifreeze agent may be used.



WARNING

Burning caused by hot parts with temperatures over 30 °C!

⇒ Wear protective gloves

⇒ Only replace units after the liquid cooling has cooled down



WARNING

Damage to property caused by moisture!

⇒ The inlet temperature of the cooling agent may only be max. 5 K under the air temperature inside the control cabinet in temperate zones (up to 40 °C and air humidity of 70 %)!

Note: The surest protection against moisture is:
inlet temperature of the cooling agent = ambient temperature

Liquid-cooled drive components are perfused by a cooling agent that usually has a different temperature than that of the ambient air.

If warm air comes into contact with an object that is less warm than itself then precipitation is formed on the surface of the object if the temperature of the object is under the dew point. The object becomes moist.



WARNING

Damage to property caused by corrosion!

⇒ Make sure there is enough corrosion and frost protection

**WARNING****Damage to property due to a fault in the coolant circulation system!**

⇒ Trouble-free operation within the coolant circulation system must be ensured

Note: Try to ensure there are no deposits in the cooling pipe.

Note: Due to temperature differences, you should be aware of the change in volume of the cooling agent.

Recommendation Separate the cooling circuit by using a suitable recoler (e.g. plate heat exchanger).

**WARNING****Damage to property due to a failure in the pump!**

⇒ When the following occur at the same time!

- operated at overload
- electrical short-circuit at the output
- failure of the coolant pump

⇒ The unit can age prematurely in case of:

- a failure of the coolant pump without overload or short-circuit at the output

Note: To ensure the cooling function, the pump **must** be monitored

**DANGER****Destruction of unit due to short-circuit!**

⇒ Install drip protection

Technical Specifications of the HPS01.1 Coolant Circulation System

Flow Rate / Filling Amount

Power	Flow Rate	Filling Amount
250 kW, 350 kW	12 l / min	1.25 l
450 kW, 650 kW	2 x 12 l / min	2 x 1.25 l

Figure 17-1: Flow Rate / Filling Amount

Input Temperature

Max input temperature in °C		
Power	Power Inverter	Motor Inverter
250 kW	52	55
350 kW	48	51
450 kW	52	57
650 kW	49	52

Figure 17-2: Max. input temperature

Pressure / Counter-Pressure

Max operating pressure	Counter-Pressure
2.0 bar	0.6 bar at 12 l / min

Figure 17-3: Pressure / Counter-Pressure

Technical Specifications of the Liquid-Cooled Coolant Circulation System Inverter Class D

General Assembly Instructions

The liquid-cooled units are comprised of the unit itself and the copper-plate with soldered copper pipe. This is led to the quick-lock couplings by a tube with a safety against buckling. The lock-couplings are integrated into the unit. The following points should be observed during assembly:

- Assembly must be made in the vertical position on an even surface.
- The required fixing screws are indicated in the drilling template of the dimension drawing.
- The units are delivered with quick-lock couplings (with shut-off) $D_i = 3/8''$. However, the cross section for connection can be changed to $1/2''$, or $3/4''$.

Note: Additional information on radiator hoses, hose nipples, couplings, and angle connections is available from your sales representative.

Dimension Sheet for Motor Inverter RD5x.1-8C-055 / 075 with Cooling Type W

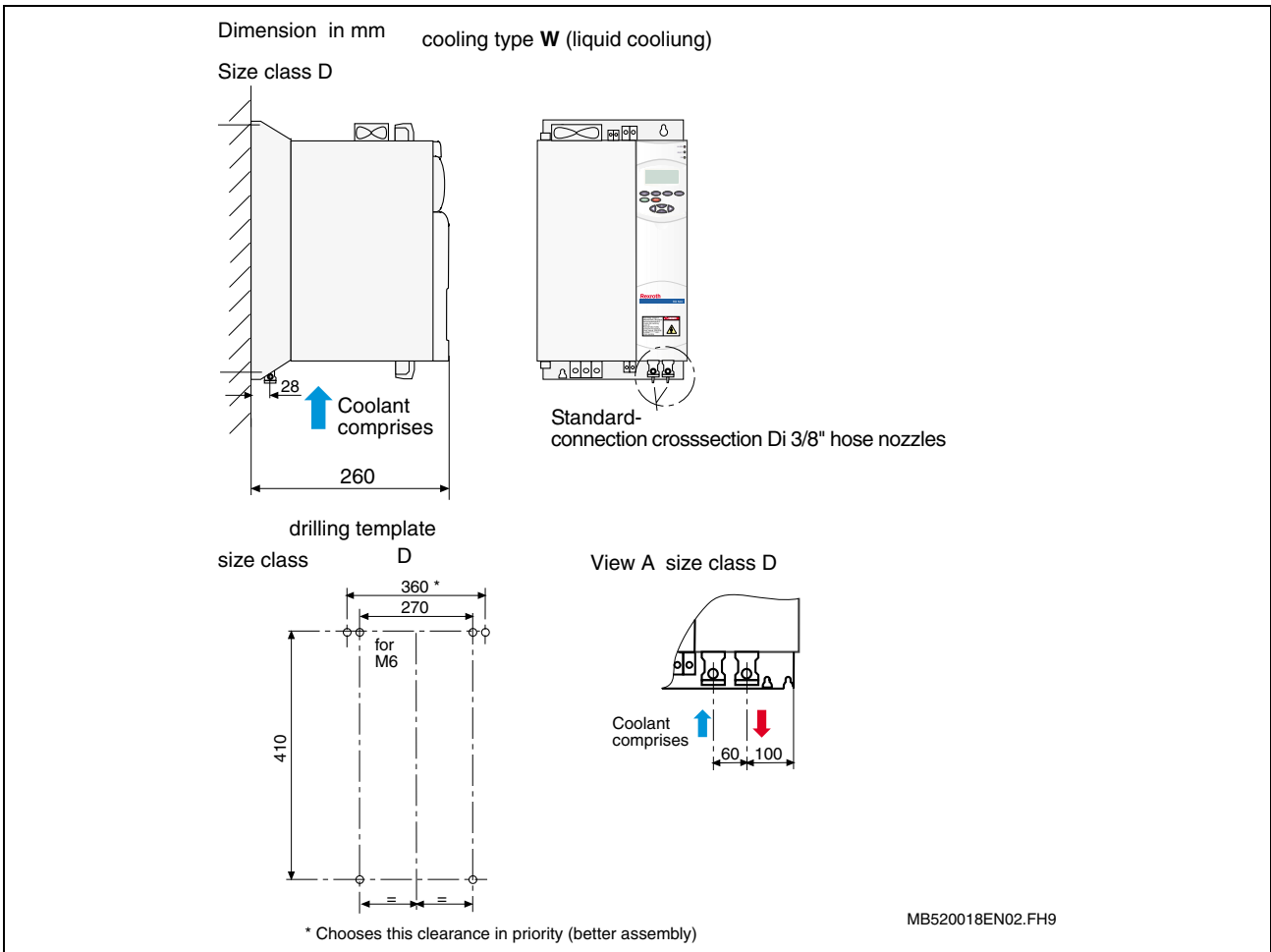


Figure 17-4: Dimension sheet of liquid cooling of motor inverter RD5x.1-8C-055 / 075

The following data must be observed in order to ensure that the maximum permissible temperature in the units is not exceeded.

- The normal diameter of the cooling system is D = 10 mm
- The maximum system pressure is 2 bar
- The inflow temperature of the liquid and the dynamic pressure depend upon the volume flow.
- Volume content = 0,12 l

Flow Rate / Filling Amount

Power	Flow Rate	Filling Amount
55 kW 75 kW	5 l / min	0.12 l

Figure 17-5: Flow Rate / Filling Amount

Input Temperature

Max. input temperature	
55 kW 75 kW	50 °C

Figure 17-6: Max. input temperature

Pressure / Counter-Pressure

Max. operating pressure	Counter-Pressure
2.0 bar	0.3 bar

Figure 17-7: Pressure / Counter-Pressure

Technical Specifications of the Coolant Circulation System of Class G and RD43

General Assembly Instructions

If the heat exchanger is assembled externally then the inverter is no longer cooled through the air current of the heat exchanger. There are therefore extra fans on the inverter

- Assembly must be made in the vertical position on an even surface.
- To ensure that the flow of warm outgoing air is unhampered, a clearance distance of at least 200 mm above the unit must be observed.
- When assembling the cabinet, the amount of cooling air required by each unit must be calculated and the cabinet should be cooled accordingly.
- The required fixing screws are indicated in the drilling template of the dimension drawing.
- Two mounting devices are delivered with the units to erect them using hoisting equipment. These are inserted on both sides on the top at the mounting plate and secured with a screw.
- Assemble the external heat exchanger at the required location. Assembly in the roof of the cabinet or the wall are both possible. Additional technical specifications are contained in the documentation on the accessories (DOK-RD500*-RD500*SUPPL-FKxx-EN-P).

Note: Additional information on radiator hoses, hose nipples, couplings, and angle connections is available from your sales representative.

Dimension Drawing Class G and RD43 with Cooling Type W

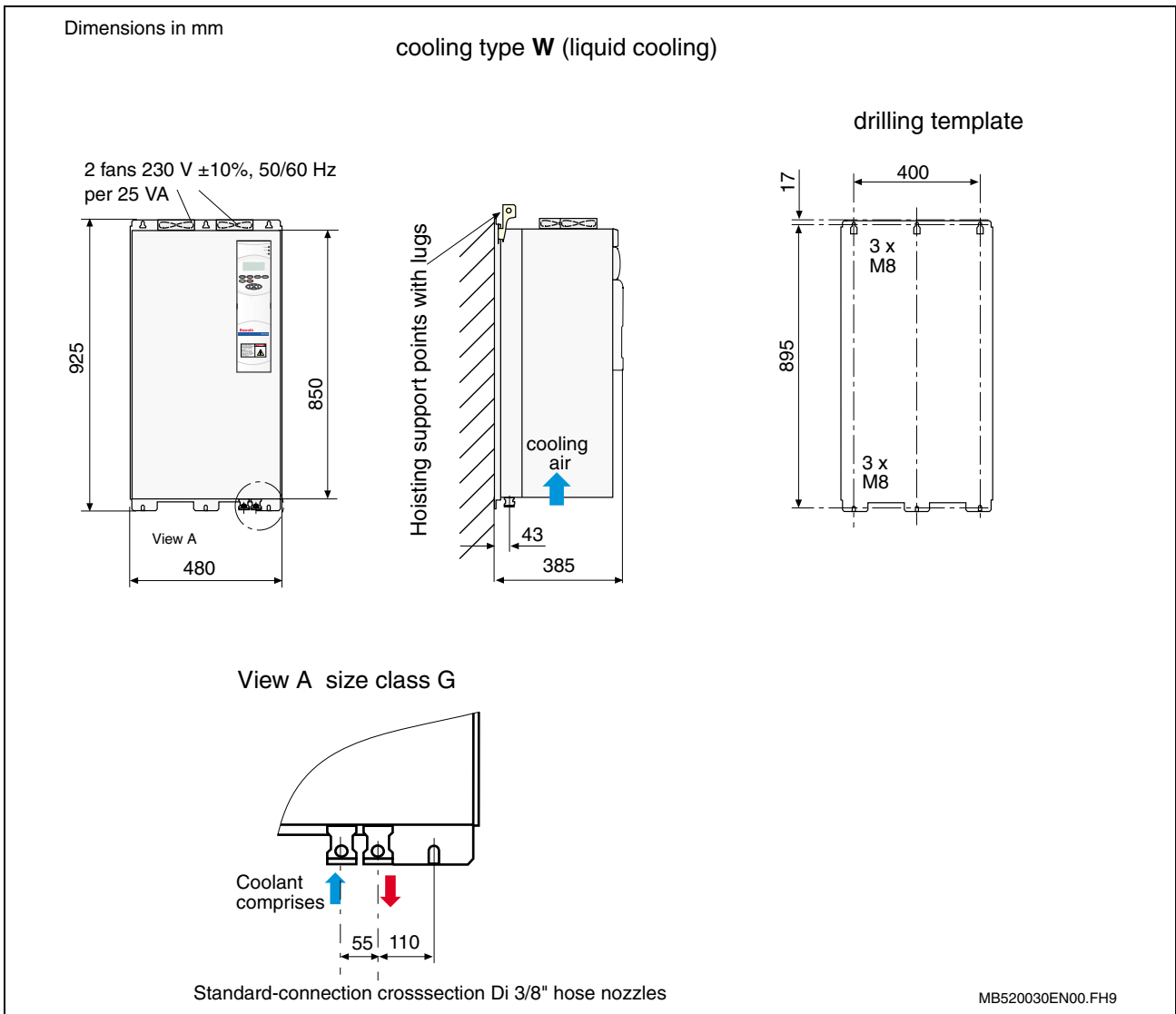


Figure 17-8: Dimension sheet inverter with cooling type W

Dimension Drawing Class G and RD43 with Cooling Type R

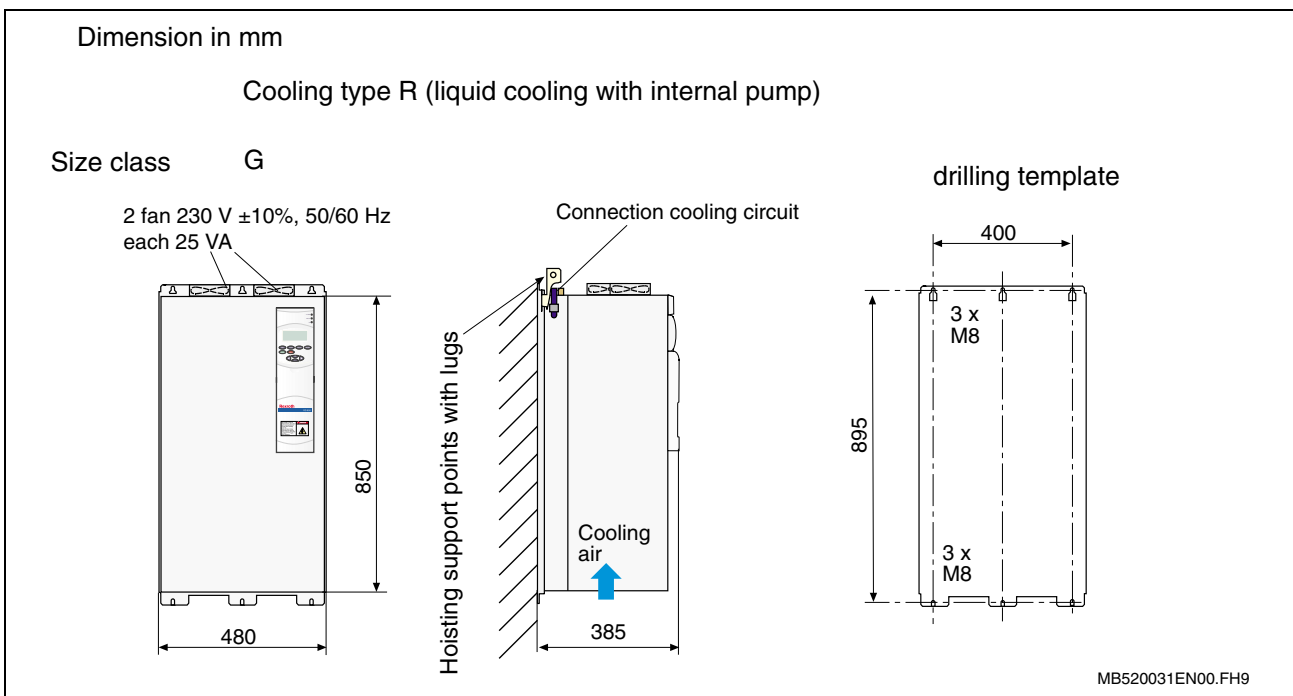


Figure 17-9: Dimension sheet inverter with cooling type R

Flow Rate / Filling Amount

Power	Flow Rate	Filling Amount
160 kW	9 l / min	1.25 l

Figure 17-10: Flow Rate / Filling Amount

Input Temperature

Max. input temperature	
	Motor Inverter
160 kW	51 °C

Figure 17-11: Max. input temperature

Pressure / Counter-Pressure

Max. operating pressure	Counter-Pressure
2.0 bar	0.3 bar

Figure 17-12: Pressure / Counter-Pressure

Technical Specifications of the HNL01.1 Coolant Circulation System

Chokes HNL01.1R-0180-N0650-A-480-NNNF and HNL01.1R-0260-N0450-A-480-NNNF are delivered unfilled.

Flow Rate / Filling Amount

Power	Flow Rate	Filling Amount
0450 / 0650	8.5 l / min	0.2 l

Figure 17-13: Flow Rate / Filling Amount

Input Temperature

Max. input temperature	
0450	52 °C
0650	48 °C

Figure 17-14: Max. input temperature

Pressure / Counter-Pressure

Max. operating pressure	Counter-Pressure
2.0 bar	0.7 bar per 8 l / min

Figure 17-15: Pressure / Counter-Pressure

17.2 Recool of coolant agent

In order to recool the cooling agent, you may choose from 3 basic methods:

1. Water / water heat exchanger for the utilization of process water
2. Air / water heat exchanger
3. Active cooling unit

Before you select and set up the overall cooling liquid cycle, please apply to the responsible distribution facility.

18 Service & Support

18.1 Helpdesk

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

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

- telefonisch - by phone:
über Service Call Entry Center
- via Service Call Entry Center **+49 (0) 9352 40 50 60**
Mo-Fr 07:00-18:00
Mo-Fr 7:00 am - 6:00 pm
- per Fax - by fax: **+49 (0) 9352 40 49 41**
- per e-Mail - by e-mail: service.svc@boschrexroth.de

18.2 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**

18.3 Internet

Unter www.boschrexroth.com 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.com 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 the present documentation may have become obsolete since printing.

18.4 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.

18.5 Kundenbetreuungsstellen - Sales & Service Facilities

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Great Britain - Großbritannien Bosch Rexroth Ltd. Electric Drives & Controls Broadway Lane, South Cerney Cirencester, Glos GL7 5UH Tel.: +44 (0)1285 863000 Fax: +44 (0)1285 863030 sales@boschrexroth.co.uk service@boschrexroth.co.uk	Finland - Finnland Bosch Rexroth Oy Electric Drives & Controls Ansatie 6 017 40 Vantaa Tel.: +358 (0)9 84 91-11 Fax: +358 (0)9 84 91-13 60	France - Frankreich Bosch Rexroth SAS Electric Drives & Controls Avenue de la Trentaine (BP. 74) 77503 Chelles Cedex Tel.: +33 (0)164 72-63 22 Fax: +33 (0)164 72-63 20 Hotline: +33 (0)608 33 43 28	France - Frankreich Bosch Rexroth SAS Electric Drives & Controls ZI de Thibaud, 20 bd. Thibaud (BP. 1751) 31084 Toulouse Tel.: +33 (0)5 61 43 61 87 Fax: +33 (0)5 61 43 94 12
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