Rexroth
Bosch Group

Rexroth IndraDrive Supply Units and Power Sections

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Project Planning Manual

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Bosch Rexroth AG
Bgm.-Dr.-Nebel-Str. 2 ■ D-97816 Lohr a. Main
Telephone +49 (0)93 52/ 40-0 ■ Fax +49 (0)93 52/ 40-48 85
http://www.boschrexroth.com/
Dept. BRC/EDY1 (RR/US/BB)

Note

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1 Introduction

1.1 About this Documentation

⚠ WARNING

Personal injury and property damage caused by incorrect project planning for applications, machines and installations!

Observe the contents of the reference documentations relevant to your drive system (see chapter 1.2 Reference Documentations , page 1).

In particular, take the Project Planning Manual “Rexroth IndraDrive, Drive System” into account.

Purpose of Documentation

This documentation provides information on

- how to configure Rexroth IndraDrive systems
- considering the components
  - HMV supply units
  - HMS, HMD, HCS02, HCS03 power sections

Changes in Comparison to Previous Edition

Chapter	Changes
Power Sections for Converters	HCS02, HCS03: technical data for order code -L*** added
Power Sections for Inverters	HMS01.1N-W0350: technical data added
IndraDrive M Supply Units	separate connection diagram made available for HMV01.1R-W0120
Functions and Electrical Connection Points	X33, Acknowledge messages mains contactor extended; differences integrated/external mains contactor included
	X40, Acknowledge messages external mains contactor added (HMV01.1R-W0120)
Accessories	accessories HAS01 and HAS02 added

Fig. 1-1: Changes

1.2 Reference Documentations

1.2.1 Overview

☞ The following documentations contain detailed information on the

- allowed applications
- application, ambient and operating conditions
- technical properties of the components

Reference documentations - drive controllers

Title	Kind of documentation	Document typecode1)
Rexroth IndraDrive – Drive System	Project Planning Manual	DOK-INDRV*-SYSTEM*****-PRxx-EN-P
Rexroth IndraDrive Supply Units and Power Sections	Project Planning Manual	DOK-INDRV*-HMV-S-D+HCS-PR01-EN-P

Title	Kind of documentation	Document typecode[1)]
Rexroth IndraDrive - Drive Controllers Control Sections	Project Planning Manual	DOK-INDRV*-CSH********-PRxx-EN-P
Rexroth IndraDrive Additional Components	Project Planning Manual	DOK-INDRV*-ADDCOMP****-PRxx-EN-P

1) In the document typecodes, "xx" is a wild card for the current edition of the documentation (example: "PR01" is the first edition of a Project Planning Manual)

Fig. 1-2: Documentations - overview

☞ The following documentations describe the firmware and contain information on its scope of functions.

Reference documentations - firmware for drive controllers

Title	Kind of documentation	Document typecode[1)]
Rexroth IndraDrive Firmware for Drive Controllers	Functional Description	DOK-INDRV*-MP*-02VRS**-FKxx-EN-P
Rexroth IndraDrive Firmware for Drive Controllers	Functional Description	DOK-INDRV*-MP*-03VRS**-FKxx-EN-P
Rexroth IndraDrive Firmware for Drive Controllers	Functional Description	DOK-INDRV*-MP*-04VRS**-FKxx-EN-P
Rexroth IndraDrive Firmware for Drive Controllers	Parameter Description	DOK-INDRV*-GEN-**VRS**-PAxx-EN-P
Rexroth IndraDrive Firmware for Drive Controllers	Troubleshooting Guide	DOK-INDRV*-GEN-**VRS**-WAxx-EN-P
Rexroth IndraDrive Integrated Safety Technology	Functional and Application Description	DOK-INDRV*-SI*-**VRS**-FKxx-EN-P

1) In the document typecodes, "xx" is a wild card for the current edition of the documentation (example: "PR01" is the first edition of a Project Planning Manual)

Fig. 1-3: Documentations - overview

Supplementary documentations - motors

Title	Kind of documentation	Document typecode[1)]
Rexroth Connection Cables	Selection Data	DOK-CONNEC-CABLE*STAND-AUxx-EN-P
Rexroth IndraDyn A Asynchronous Motors	Project Planning Manual	DOK-MOTOR*-MAD/MAF****-PRxx-EN-P
Rexroth IndraDyn H Frameless Synchronous Spindle Motors	Project Planning Manual	DOK-MOTOR*-MBS-H******-PRxx-EN-P
Rexroth IndraDyn L Synchronous Linear Motors	Project Planning Manual	DOK-MOTOR*-MLF********-PRxx-EN-P
Rexroth IndraDyn S Synchronous Motors	Project Planning Manual	DOK-MOTOR*-MSK********-PRxx-EN-P
Rexroth IndraDyn T Synchronous Torque Motors	Project Planning Manual	DOK-MOTOR*-MBT********-PRxx-EN-P

1) In the document typecodes, "xx" is a wild card for the current edition of the documentation (example: "PR01" is the first edition of a Project Planning Manual)

Fig. 1-4: Documentations - overview

1.3 Your Feedback

Your experience is important for our improvement processes of products and documentations.

Inform us about mistakes you discovered in this documentation and changes you suggest; we would be grateful for your feedback.

Please send your remarks to:

Address for Your Feedback

Bosch Rexroth AG
Dept. BRC/EDY1
Bürgermeister-Dr.-Nebel-Str. 2
D-97816 Lohr
e-mail: brcedy1-dokusupport-drives@boschrexroth.de

2 Important Directions for Use

2.1 Appropriate Use

2.1.1 Introduction

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

⚠ WARNING

Personal injury and property damage caused by incorrect use of the products!

The products have been designed for use in the industrial environment and may only be used in the appropriate way. If they are not used in the appropriate way, situations resulting in property damage and personal injury can occur.

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

Before using Rexroth products, make sure that all the pre-requisites for an appropriate use of the products are satisfied:

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

2.1.2 Areas of Use and Application

Drive controllers made by Rexroth are designed to control electrical motors and monitor their operation.

Control and monitoring of the Drive controllers may require additional sensors and actors.

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

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

Drive controllers have to be programmed before commissioning, making it possible for the motor to execute the specific functions of an application.

Drive controllers of the Rexroth IndraDrive line have been developed for use in single- and multi-axis drive and control tasks.

To ensure application-specific use of Drive controllers, device types of different drive power and different interfaces are available.

Typical applications include:

- handling and mounting systems,
- packaging and food machines,
- printing and paper processing machines and
- machine tools.

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

2.2 Inappropriate Use

Using the Drive controllers outside of the operating conditions described in this documentation and outside of the indicated technical data and specifications is defined as "inappropriate use".

Drive controllers must not be used, if …

- they are subject to operating conditions that do not meet the specified ambient conditions. This includes, for example, operation under water, under extreme temperature fluctuations or extremely high maximum temperatures.
- Furthermore, Drive controllers must not be used in applications which have not been expressly authorized by Rexroth. Please carefully follow the specifications outlined in the general Safety Instructions!

3 Safety Instructions for Electric Drives and Controls

3.1 Safety Instructions - General Information

3.1.1 Using the Safety Instructions and Passing them on to Others

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

If the device is resold, rented and/or passed on to others in any other form, these safety instructions must be delivered with the device in the official language of the user's country.

WARNING

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

Observe the safety instructions!

3.1.2 How to Employ the Safety Instructions

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

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

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

  The machine and installation manufacturer must
  - make sure that the delivered components are suited for his individual application and check the information given in this documentation with regard to the use of the components,
  - make sure that his application complies with the applicable safety regulations and standards and carry out the required measures, modifications and complements.
- Commissioning of the delivered components is only permitted once it is sure that the machine or installation in which they are installed complies with the national regulations, safety specifications and standards of the application.
- Operation is only permitted if the national EMC regulations for the application are met.
- The instructions for installation in accordance with EMC requirements can be found in the section on EMC in the respective documentation (Project Planning Manuals of components and system).

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

National regulations which the user must take into account

- European countries: according to European EN standards
- United States of America (USA):
  - National Electrical Code (NEC)
  - National Electrical Manufacturers Association (NEMA), as well as local engineering regulations
  - regulations of the National Fire Protection Association (NFPA)
- Canada: Canadian Standards Association (CSA)
- Other countries:
  - International Organization for Standardization (ISO)
  - International Electrotechnical Commission (IEC)

3.1.3 Explanation of Warning Symbols and Degrees of Hazard Seriousness

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

Warning symbol	Signal word	Degree of hazard seriousness acc. to ANSI Z 535.4-2002
⚠	Danger	Death or severe bodily harm will occur.
⚠	Warning	Death or severe bodily harm may occur.
⚠	Caution	Minor or moderate bodily harm or material damage may occur.

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

3.1.4 Hazards by Improper Use

⚠ DANGER

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

Observe the safety instructions!

⚠ DANGER

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

Observe the safety instructions!

⚠ WARNING

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

Observe the safety instructions!

⚠ WARNING

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

Observe the safety instructions!

⚠ CAUTION

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

Observe the safety instructions!

⚠ CAUTION

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

Observe the safety instructions!

CAUTION

Risk of injury by improper handling of batteries!

Observe the safety instructions!

3.2 Instructions with Regard to Specific Dangers

3.2.1 Protection Against Contact with Electrical Parts and Housings

☞ This section concerns devices and drive components with voltages of **more than 50 Volt**.

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

DANGER

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

- Only those trained and qualified to work with or on electrical equipment are permitted to operate, maintain and repair this equipment.
- Follow general construction and safety regulations when working on power installations.
- Before switching on the device, the equipment grounding conductor must have been non-detachably connected to all electrical equipment in accordance with the connection diagram.
- Do not operate electrical equipment at any time, even for brief measurements or tests, if the equipment grounding conductor is not permanently connected to the mounting points of the components provided for this purpose.
- Before working with electrical parts with voltage potentials higher than 50 V, the device must be disconnected from the mains voltage or power supply unit. Provide a safeguard to prevent reconnection.
- With electrical drive and filter components, observe the following:

  Wait **30 minutes** after switching off power to allow capacitors to discharge before beginning to work. Measure the electric voltage on the capacitors before beginning to work to make sure that the equipment is safe to touch.
- Never touch the electrical connection points of a component while power is turned on. Do not remove or plug in connectors when the component has been powered.
- Install the covers and guards provided with the equipment properly before switching the device on. Before switching the equipment on, cover and safeguard live parts safely to prevent contact with those parts.
- A residual-current-operated circuit-breaker or r.c.d. cannot be used for electric drives! Indirect contact must be prevented by other means, for example, by an overcurrent protective device according to the relevant standards.
- Secure built-in devices from direct touching of electrical parts by providing an external housing, for example a control cabinet.

☞ For electrical drive and filter components with voltages of **more than 50 volts**, observe the following additional safety instructions.

DANGER

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

- Before switching on, the housings of all electrical equipment and motors must be connected or grounded with the equipment grounding conductor to the grounding points. This is also applicable before short tests.
- The equipment grounding conductor of the electrical equipment and the devices must be non-detachably and permanently connected to the power supply unit at all times. The leakage current is greater than 3.5 mA.
- Over the total length, use copper wire of a cross section of a minimum of 10 mm^2 for this equipment grounding connection!
- Before commissioning, also in trial runs, always attach the equipment grounding conductor or connect to the ground wire. Otherwise, high voltages may occur at the housing causing electric shock.

3.2.2 Protection Against Electric Shock by Protective Extra-Low Voltage

Protective extra-low voltage is used to allow connecting devices with basic insulation to extra-low voltage circuits.

All connections and terminals with voltages between 5 and 50 volts at Rexroth products are PELV systems. 1) It is therefore allowed to connect devices equipped with basic insulation (such as programming devices, PCs, notebooks, display units) to these connections and terminals.

WARNING

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

If extra-low voltage circuits of devices containing voltages and circuits of more than 50 volts (e.g. the mains connection) are connected to Rexroth products, the connected extra-low voltage circuits must comply with the requirements for PELV. 2)

3.2.3 Protection Against Dangerous Movements

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

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

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

---

1) *“Protective Extra-Low Voltage”*

2) *“Protective Extra-Low Voltage”*

The monitoring in the drive components will normally be sufficient to avoid faulty operation in the connected drives. Regarding personal safety, especially the danger of bodily harm and material damage, this alone cannot be relied upon to ensure complete safety. Until the integrated monitoring functions become effective, it must be assumed in any case that faulty drive movements will occur. The extent of faulty drive movements depends upon the type of control and the state of operation.

DANGER

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

- Ensure personal safety by means of qualified and tested higher-level monitoring devices or measures integrated in the installation.

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

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

- Keep free and clear of the machine’s range of motion and moving parts. Possible measures to prevent people from accidentally entering the machine’s range of motion:
  - use safety fences
  - use safety guards
  - use protective coverings
  - install light curtains or light barriers
- Fences and coverings must be strong enough to resist maximum possible momentum.
- Mount the emergency stop switch in the immediate reach of the operator. Verify that the emergency stop works before startup. Don’t operate the device if the emergency stop is not working.
- Isolate the drive power connection by means of an emergency stop circuit or use a safety related starting lockout to prevent unintentional start.
- Make sure that the drives are brought to a safe standstill before accessing or entering the danger zone.
- Additionally secure vertical axes against falling or dropping after switching off the motor power by, for example:
  - mechanically securing the vertical axes,
  - adding an external braking/ arrester/ clamping mechanism or
  - ensuring sufficient equilibration of the vertical axes.
- The standard equipment motor brake or an external brake controlled directly by the drive controller are **not sufficient to guarantee personal safety**!
- Disconnect electrical power to the equipment using a master switch and secure the switch against reconnection for:
  - maintenance and repair work
  - cleaning of equipment
  - long periods of discontinued equipment use
- Prevent the operation of high-frequency, remote control and radio equipment near electronics circuits and supply leads. If the use of such devices cannot be avoided, verify the system and the installation for possible malfunctions in all possible positions of normal use before initial startup. If necessary, perform a special electromagnetic compatibility (EMC) test on the installation.

3.2.4 Protection Against Magnetic and Electromagnetic Fields During Operation and Mounting

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

WARNING

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

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

3.2.5 Protection Against Contact with Hot Parts

CAUTION

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

- Do not touch surfaces of device housings and chokes in the proximity of heat sources! Danger of burns!
- Do not touch housing surfaces of motors! Danger of burns!
- According to the operating conditions, temperatures can be **higher than 60 °C**, 140°F during or after operation.
- Before accessing motors after having switched them off, let them cool down for a sufficiently long time. Cooling down can require **up to 140 minutes**! Roughly estimated, the time required for cooling down is five times the thermal time constant specified in the Technical Data.
- After switching drive controllers or chokes off, wait 15 minutes to allow them to cool down before touching them.
- Wear safety gloves or do not work at hot surfaces.
- For certain applications, the manufacturer of the end product, machine or installation, according to the respective safety regulations, has to take measures to avoid injuries caused by burns in the end application. These measures can be, for example: warnings, guards (shielding or barrier), technical documentation.

3.2.6 Protection During Handling and Mounting

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

CAUTION

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

- Observe the general construction and safety regulations on handling and mounting.
- Use suitable devices for mounting and transport.
- Avoid jamming and bruising by appropriate measures.
- Always use suitable tools. Use special tools if specified.
- Use lifting equipment and tools in the correct manner.
- If necessary, use suitable protective equipment (for example safety goggles, safety shoes, safety gloves).
- Do not stand under hanging loads.
- Immediately clean up any spilled liquids because of the danger of skidding.

3.2.7 Battery Safety

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

CAUTION

Risk of injury by improper handling!

- Do not attempt to reactivate low batteries by heating or other methods (risk of explosion and cauterization).
- Do not recharge the batteries as this may cause leakage or explosion.
- Do not throw batteries into open flames.
- Do not dismantle batteries.
- When replacing the battery/batteries do not damage electrical parts installed in the devices.
- Only use the battery types specified by the manufacturer.

☞ Environmental protection and disposal! The batteries contained in the product are considered dangerous goods during land, air, and sea transport (risk of explosion) in the sense of the legal regulations. Dispose of used batteries separate from other waste. Observe the local regulations in the country of assembly.

3.2.8 Protection Against Pressurized Systems

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

CAUTION

Risk of injury by improper handling of pressurized lines!

- Do not attempt to disconnect, open or cut pressurized lines (risk of explosion).
- Observe the respective manufacturer's operating instructions.
- Before dismounting lines, relieve pressure and empty medium.
- Use suitable protective equipment (for example safety goggles, safety shoes, safety gloves).
- Immediately clean up any spilled liquids from the floor.

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

4 General Specifications of the Devices

4.1 Certifications

Declaration of Conformity

For devices, there are declarations of conformity which confirm that the devices comply with the applicable EN standards and EC Directives. If required, you can ask our sales representative for the declarations of conformity.

Description	Standard
CE conformity regarding Low-Voltage Directive	EN61800-5-1 (IEC 61800-5-1:2003)
CE conformity regarding EMC product standard	EN61800-3 (IEC 61800-3:2004)

Fig.4-1: Applied standards

CE Label

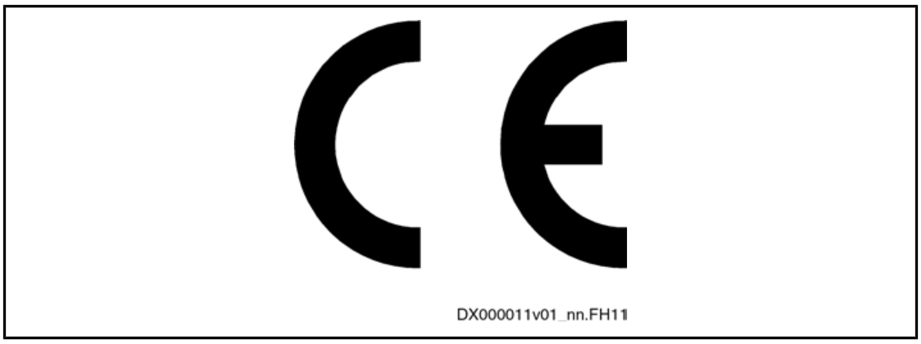


Fig.4-2: CE label

C-UL-US Listing

The devices have been marked with the following label:

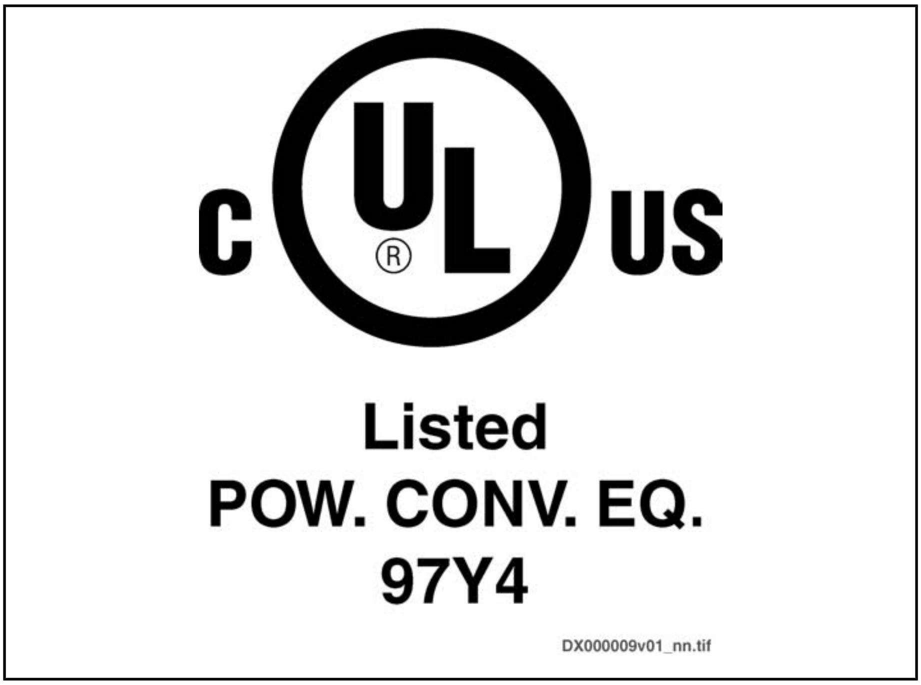


Fig.4-3: C-UL-US label

Description	Standard
listing according to UL standard (UL)	UL 508 C
listing according to CSA standard	see data sheet of the respective device in the section “Information on Standards”

Fig.4-4: Applied standards

☞ **UL ratings**

For using the devices in the scope of UL, take the UL ratings of the individual devices into account. You can find the UL ratings in the corresponding documentation in the section “Technical Data - UL Data”.

In the scope of UL, it is exclusively the supply units HMV01.1R, HMV01.1E, HMV02.1R, HCS02.1E and HCS03.1E which have been approved for supplying IndraDrive devices.

☞ **Wiring material**

For wiring the devices, in the scope of UL exclusively use copper wires of class 1 (or equivalent) with a minimum allowed conductor temperature of 75 °C.

☞ **Allowed pollution degree**

Take the allowed pollution degree of the devices into account. Only use the devices in ambiances with the maximum pollution degree 2 (see Ambient and Operating Conditions).

☞ The devices have been listed by “Underwriters Laboratories Inc.®” (UL). For evidence of certification, see on the Internet under http://www.ul.com under “Certifications” by entering the file number or the “Company name: Rexroth”. You can find the file number of the device in this documentation in the section “Technical Data - Information on Standards” (this example applies to HCS02).

The control sections are part of the listed devices.

CCC (China Compulsory Certification)

The CCC mark of conformity comprises a compulsory certification of safety and quality for certain products which are mentioned in the product catalog “First Catalogue of Products Subject to Compulsory Certification” and the CNCA document “Application Scope for Compulsory Certification of Products acc. first Catalogue” and which are put into circulation in China. The compulsory certification has been existing since 2003.

CNCA is the responsible Chinese authority for certification directives. When a product is imported in China, the certification will be checked at the customs by means of the entries in a database. For compulsory certification, three criteria are normally relevant:

1. Customs tariff number (HS code) according to CNCA document “Application Scope for Compulsory Certification of Products acc. first Catalogue”.
2. Scope of application according to CNCA document “Application Scope for Compulsory Certification of Products acc. first Catalogue”.
3. For the IEC product standard used, there must be a corresponding Chinese GB standard.

For Rexroth drive components described in this documentation, **certification is not yet required**, thus they have not been CCC certified. Negative certifications will not be issued.

4.2 Transport and Storage

4.2.1 Transporting the Devices

Ambient and operating conditions - Transport

Description	Symbol	Unit	Value
temperature range	T_{a_tran}	°C	-25 … 70
relative humidity		%	5 … 95
absolute humidity		g/m^3	1 … 60
climatic category (IEC721)			2K3
moisture condensation			not allowed
icing			not allowed

Fig.4-5: Ambient and operating conditions - Transport

4.2.2 Storing the Devices

CAUTION

Risk of damage to the devices by extended storage!

Some devices contain electrolytic capacitors which may deteriorate during storage.

When storing these devices for a longer period of time, operate them **once a year for at least 1 hour** with power on:

- HCS and HMV devices with mains voltage U_{LN}
- HMS, HMD, HLC devices with DC bus voltage U_{DC}

Ambient and operating conditions - Storage

Description	Symbol	Unit	Value
temperature range	T_{a_store}	°C	-25 … 55
relative humidity		%	5 … 95
absolute humidity		g/m^3	1 … 29
climatic category (IEC721)			1K3
moisture condensation			not allowed
icing			not allowed

Fig.4-6: Ambient and operating conditions - Storage

4.3 Installation Conditions

4.3.1 Ambient and Operating Conditions

The supply units and drive controllers, as well as their additional components, have been designed for control cabinet mounting!

☞ The user must check that the ambient conditions, in particular the control cabinet temperature, are complied with by calculating the heat levels in the control cabinet. Afterwards, make the corresponding measurements to find out whether the ambient conditions have really been complied with.

In the technical data of the individual devices, the power dissipation is indicated as an important input value for calculating the heat levels.

Ambient and operating conditions

Description	Symbol	Unit	Value
degree of protection (IEC529)			IP20
temperature during storage			see chapter “Storing the Devices”
temperature during transport			see chapter “Transporting the Devices”
allowed mounting position, for definition see chapter “Positions of Normal Use and Mounting Positions”			see technical data of the individual devices in chapter “Power Dissipation, Cooling and Distances”
ambient temperature range	T_{a_work}	°C	0 … 40
ambient temperature range during operation with reduced nominal data[1)]	$T_{a\_work\_red}$	°C	0 … 55 see fig. “Capacity utilization at higher ambient temperature” in chapter “Capacity Utilization”
derating at $T_{a\_work} < T_a < T_{a\_work\_red}$ [2)]	f_{Ta}	%/K	see technical data of the individual devices
nominal data up to installation altitude	h_{nenn}	m	1000
maximum installation altitude without additional overvoltage limiter	h_{max_ohne}	m	2000
maximum installation altitude[3)]	h_{max}	m	4000 see fig. “Capacity utilization at higher installation altitude” in chapter “Capacity Utilization”
reduced power data above installation altitude at $T_a < T_{a\_work\_red}$ [4)]	h_{red}	m	1000
relative humidity		%	5 … 95
absolute humidity		g/m^3	1 … 29
climatic category (IEC721)			3K4
allowed pollution degree (EN50178)			2
allowed dust, steam			EN50178 tab. A.2
vibration sine: amplitude (peak-peak) at 10 … 57 Hz[5)]		mm	0,15 ±15 %
vibration sine: acceleration at 57 … 150 Hz[5)]		g	1 ±15 %
vibration noise (random) frequency[5)]		Hz	20 … 150
vibration noise (random) spectral acceleration density, amplitude[5)]		g^2/Hz	0,005 ±3 dB

Description	Symbol	Unit	Value
vibration noise (random) rms value of total acceleration[5)]		g	1
shock test when out of operation (EN60068-2-27), 11 ms		g	10

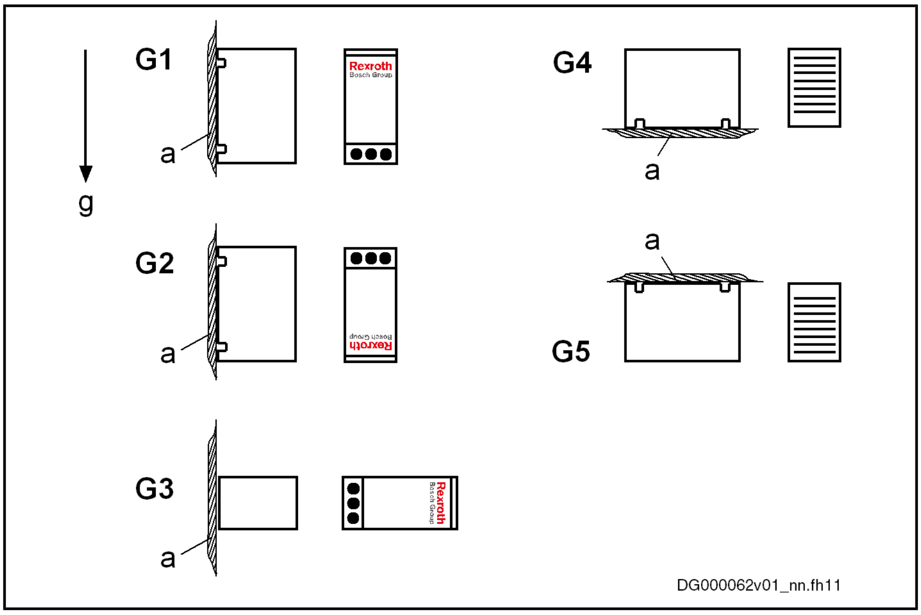
1) observe derating
2) data to be derated: PDC_cont; PBD; Iout_cont
3) In the installation, install overvoltage limiter for transient overvoltages to limit the voltage to 1 kV between the outer conductors and to 2.5 kV between conductor-ground.
4) see following characteristic; observe derating
5) 6) according to EN 60068-2-36

Fig.4-7: Ambient and operating conditions - Operation

4.3.2 Mounting Position

Only operate the devices in allowed mounting positions. **For the allowed mounting positions, see the description of the respective device, table “Data for cooling and power dissipation” .**

Definition of the Mounting Positions



a mounting surface
g direction of gravitational force
G1 Normal mounting position. The natural convection supports the forced cooling air current. This avoids the generation of pockets of heat in the device.
G2 180° to normal mounting position
G3 turned by 90° from vertical to horizontal mounting position
G4 bottom mounting; mounting surface on bottom of control cabinet
G5 top mounting; mounting surface at top of control cabinet

Fig.4-8: Definition of the mounting positions

4.3.3 Compatibility with Foreign Matters

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

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

For this reason, before using the respective material a compatibility test has to be carried out for new lubricants, cleaning agents etc. and our housings/our housing materials.

4.4 Capacity Utilization

Where installation conditions differ, the following performance data are reduced in accordance with the diagrams:

Drive controller:

- allowed DC bus continuous power P_{DC_cont}
- braking resistor continuous power P_{BD}
- continuous current I_{out_cont}

Motor:

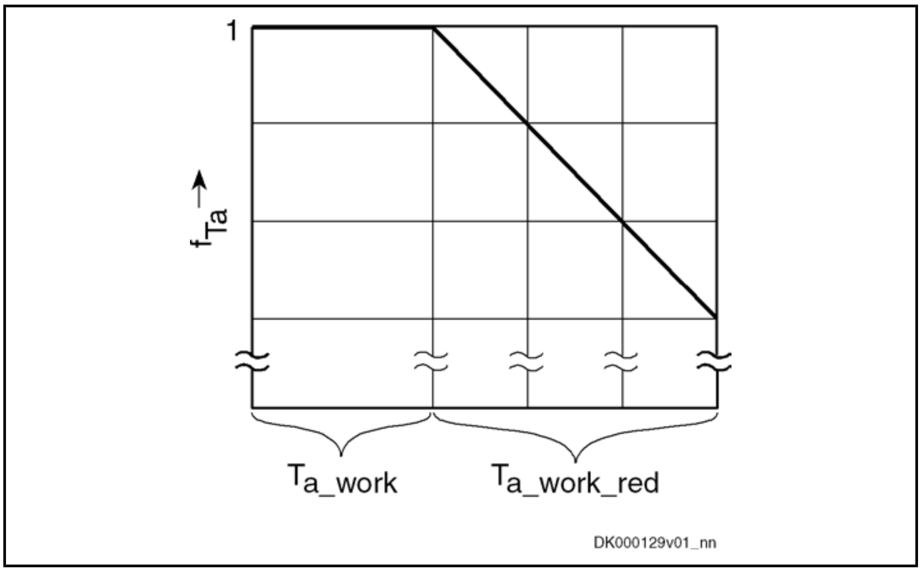
- power
- continuous torque at standstill
- S1 continuous torques
- short-time service torque MKB

If differing ambient temperatures and higher installation altitudes occur simultaneously, both capacity utilization factors must be multiplied. The installation altitude must only be taken into account once, deviating ambient temperatures must be taken into account separately for motor and drive controller.

☞ Use outside of the indicated installation conditions is not allowed, even if the performance data are additionally reduced.

Capacity Utilization vs. Ambient Temperature

As the ambient temperature increases, the capacity utilization of the devices is reduced according to the figure below.

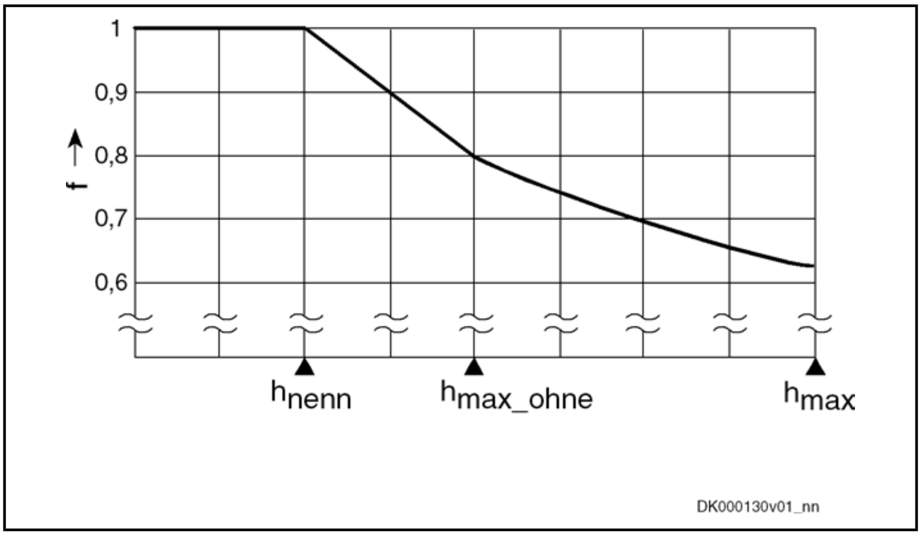


f_{Ta} capacity utilization factor
$T_{a\ work}$ ambient temperature range for operation with nominal data
$T_{a\ work\ red}$ ambient temperature range for operation with reduced nominal data

Fig.4-9: Capacity utilization at higher ambient temperature

Capacity Utilization vs. Installation Altitude

As the installation altitude increases, the capacity utilization of the devices is reduced according to the figure below.



f	capacity utilization factor
h_{nenn}	maximum installation altitude for operation with nominal data
h_{max_ohne}	maximum installation altitude for operation with reduced nominal data without using an overvoltage limiter
h_{max}	maximum installation altitude for operation with reduced nominal data when using an overvoltage limiter

Fig.4-10: Capacity utilization at higher installation altitude

4.5 High-Voltage Test

According to the standard, the devices of the Rexroth IndraDrive range are tested with high voltage.

Test	Test rate
high-voltage test	100% (EN61800-5-1)
high-voltage and insulation test	100% (EN61800-5-1)

Fig.4-11: Applied standards

☞ Before making a high-voltage test for the installation in which the devices are used, disconnect all connections to the devices or disconnect the plug-in connections to protect the electronic components.

4.6 Control Voltage Specification (24V Supply)

The data in the table below generally apply to the 24V supply of the devices of the Rexroth IndraDrive range. For other data, such as power consumption and inrush currents, see the technical data of the respective device.

Description	Symbol	Unit	Value
control voltage for drive systems **without** operation of **motor holding brakes** in Rexroth motors	U_{N3}	V	**19,2 … 28,8** (24 ±20%) When using supply units HMV01.1E, HMV01.1R, HMV02.1R, HLB01.1D: **22,8 … 27,3** (24 -5%, 26 +5%)
control voltage for drive systems **with** operation of **motor holding brakes** in Rexroth motors	U_{N3}	V	Depending on the motor cable length, the control voltage must be within the following voltage ranges: ● motor cable length < 50 m: **22,8 … 25,2** (24 ±5%) ● motor cable length > 50 m: **24,7 … 27,3** (26 ±5%) Take the data of the corresponding motor holding brake into account.
external control voltage at devices of design "NNNV" (see type code HCS02, HCS03; other design: DC 24 V power supply from the DC bus or external)	U_{N3}	V	**26 … 28,8** The output voltage of the internal switching power supply unit is 24 ±10% (see control voltage block diagram "int. SMPS").
max. ripple content	w	-	The amplitudes of the alternating component on U_{N3} must be within the specified voltage range.
maximum allowed overvoltage	U_{N3max}	V	33 (max. 1 ms)

Fig.4-12: Control voltage

☞ **Overvoltage**

Overvoltage greater than 33 V has to be discharged by means of the appropriate electrical equipment of the machine or installation.

This includes:

- 24V power supply units that reduce incoming overvoltage to the allowed value.
- Overvoltage limiters at the control cabinet input that limit existing overvoltage to the allowed value. This, too, applies to long 24V lines that have been run in parallel to power cables and mains cables and can absorb overvoltage by inductive or capacitive coupling.

☞ **Power supply units with buffer (UPS)**

For HMV supply units, use 24 V supplies with buffer times of at least 100 ms (e.g. UPS), if commutation drops and short-time interruptions in the application exceed the specified values.

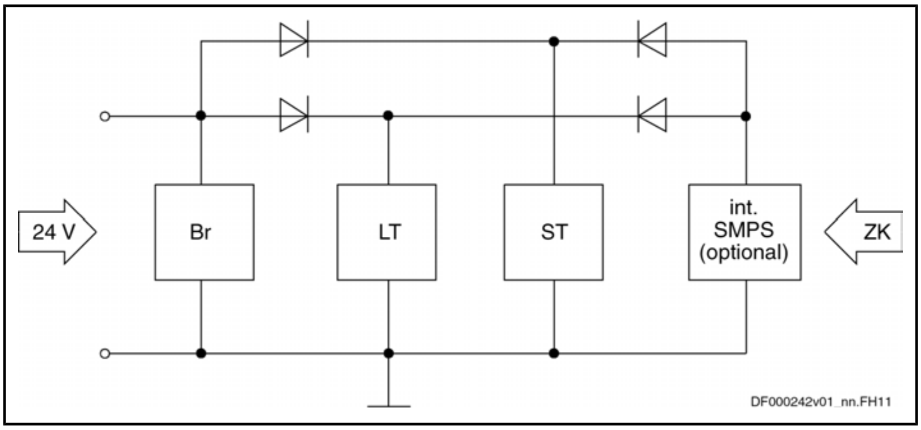
For the 24V supply, also take the following chapter into account: “Dimensioning the Mains Connection” in the Project Planning Manual “Rexroth IndraDrive – Drive System”.

☞ **Insulation monitoring impossible**

The input 0 V is connected in conductive form with the housing potential. Insulation monitoring at +24V and 0V against housing is therefore impossible.

Control Voltage Block Diagram

The control voltage, which is supplied via the connection for 24V supply, takes effect according to the following block diagram.



BR	circuit for brake control
LT	power section, e.g. HCS02
ST	control section, e.g CSB01
ZK	DC bus
int. SMPS	internal switching power supply unit, for types HCS0x.1E-Wxxxx-NxxV

Fig.4-13: *Block diagram of internal control voltage*

5 Power Sections for Converters - IndraDrive C

5.1 Types

Converter	Types	Features
HCS02	W0012 W0028 W0054 W0070	compact modular design 1.5 kW to 11 kW continuous currents up to 28 A
HCS03	W0070 W0100 W0150 W0210	compact modular design 25 kW to 85 kW continuous currents up to 145 A

Fig.5-1: Types

5.2 HCS02 Power Sections

5.2.1 Brief Description, Usage and Structure

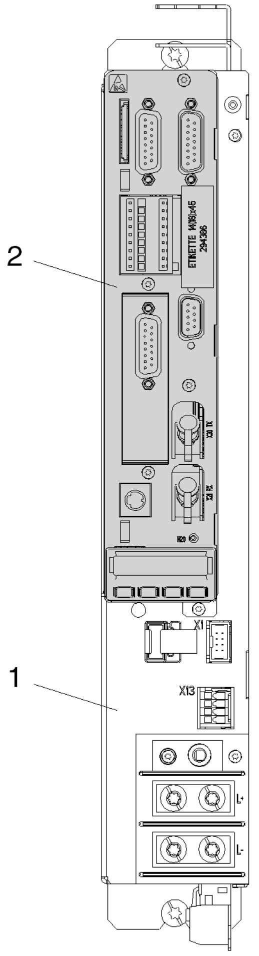
Brief Description The compact converters HCS02 are part of the Rexroth IndraDrive C product range and are used to operate single axes.

Usage The different types are used as follows:

Type	Usage
HCS02.1E-Wxxxx-NNNN HCS02.1E-Wxxxx-NNNV	Operation of a three-phase a.c. motor (asynchronous or synchronous motor) in the power range from 1.5 kW to 11 kW.
HCS02.1E-Wxxxx-LxxN blower control depending on load	Applications with operation at partial load and requirement of a low degree of noise development.

Fig.5-2: Usage of HCS02

Structure, Block Diagrams

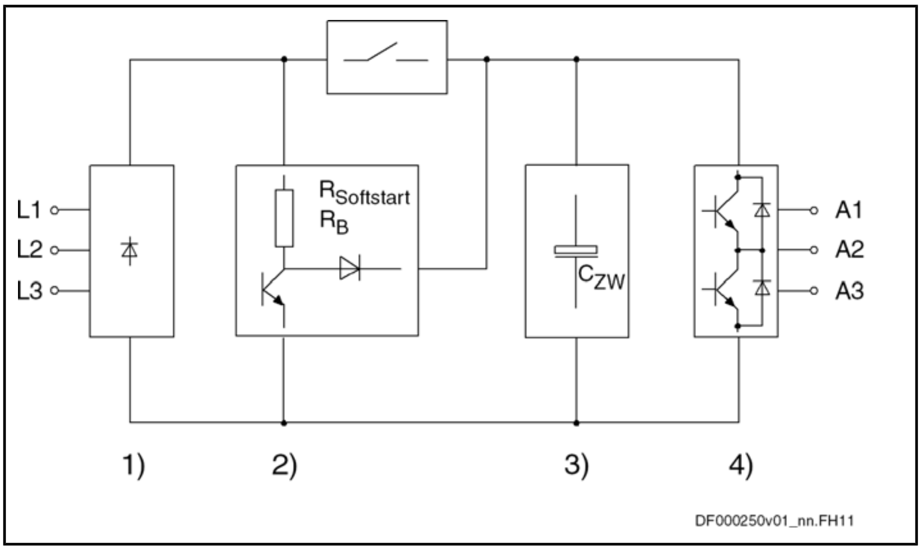


DG000114v01_nn.FH11

1	power section
2	control section

Fig.5-3: Basic structure of the drive controller

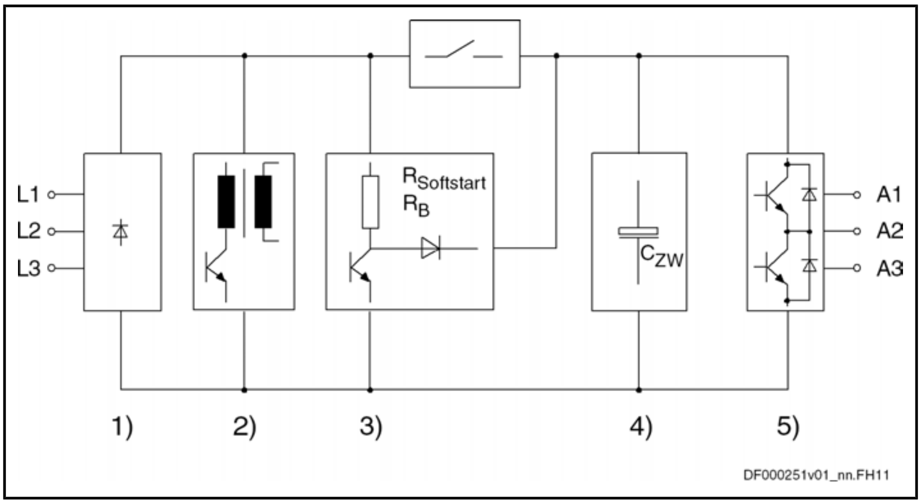
HCS02.1E-W0012-NNNN; -LNNN



1)	mains input with rectifier
2)	braking resistor circuit; charging current limitation
3)	DC bus capacitances
4)	inverter stage with output to motor

Fig.5-4: *HCS02.1E-W0012-NNNN , -LNNN - block diagram*

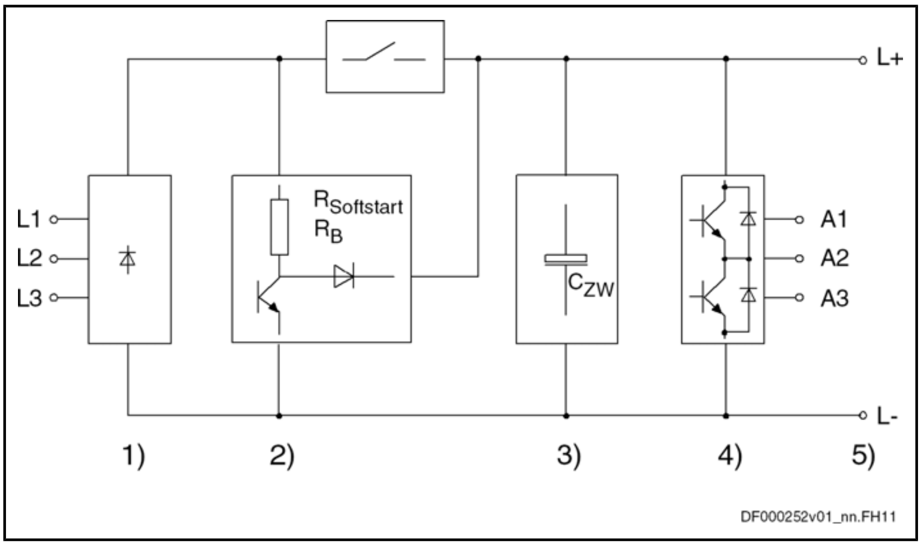
HCS02.1E-W0012-NNNV



1)	mains input with rectifier
2)	optional integrated control voltage supply
3)	braking resistor circuit; charging current limitation
4)	DC bus capacitances
5)	inverter stage with output to motor

Fig.5-5: *HCS02.1E-W0012-NNNV - block diagram*

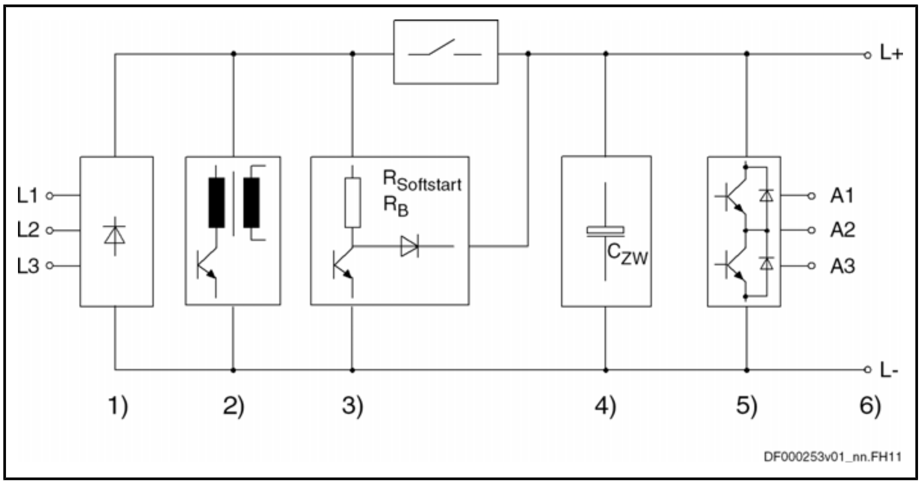
HCS02.1E-W0028-NNNN; -LNNN



1) mains input with rectifier
2) braking resistor circuit; charging current limitation
3) DC bus capacitances
4) inverter stage with output to motor
5) DC bus connection

Fig.5-6: HCS02.1E-W0028-NNNN; -LNNN - block diagram

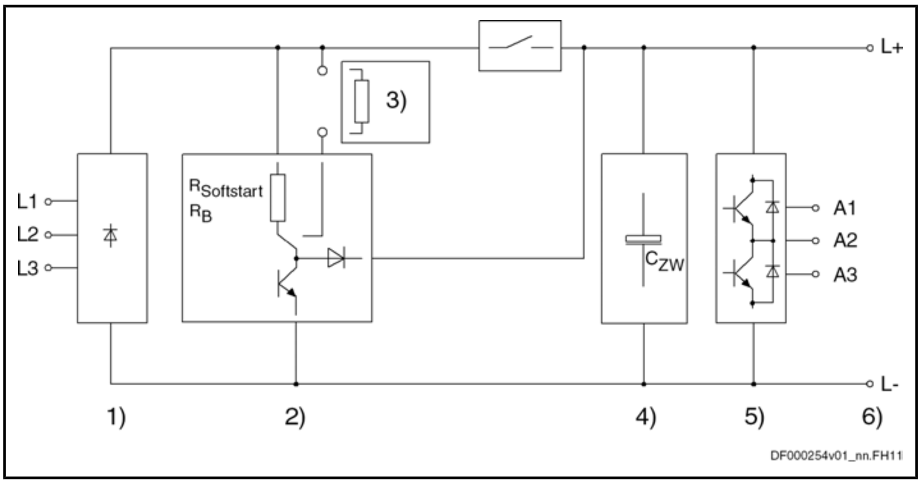
HCS02.1E-W0028-NNNV



1) mains input with rectifier
2) optional integrated control voltage supply
3) braking resistor circuit; charging current limitation
4) DC bus capacitances
5) inverter stage with output to motor
6) DC bus connection

Fig.5-7: HCS02.1E-W0028-NNNV - block diagram

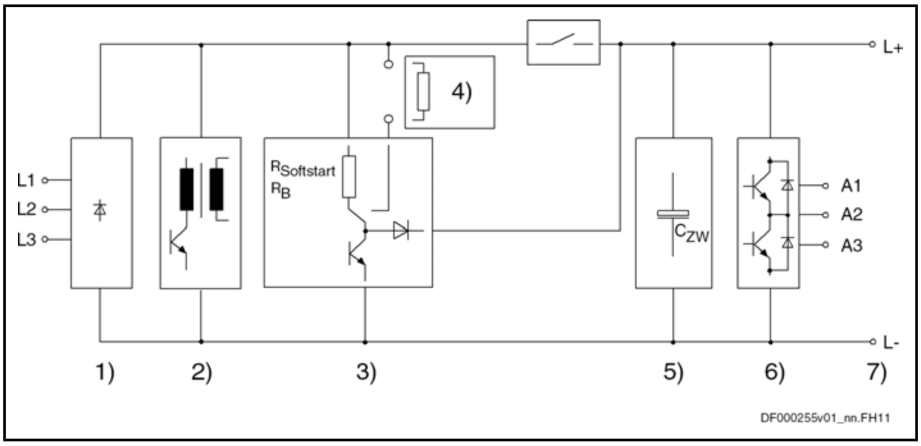
HCS02.1E-W0054/70-NNNN; -LNNN



1)	mains input with rectifier
2)	braking resistor circuit; charging current limitation
3)	optional external braking resistor
4)	DC bus capacitances
5)	inverter stage with output to motor
6)	DC bus connection

Fig.5-8: HCS02.1E-W0054/70-NNNN; -LNNN - block diagram

HCS02.1E-W0054/70-NNNV



1)	mains input with rectifier
2)	optional integrated control voltage supply
3)	braking resistor circuit; charging current limitation
4)	optional external braking resistor
5)	DC bus capacitances
6)	inverter stage with output to motor
7)	DC bus connection

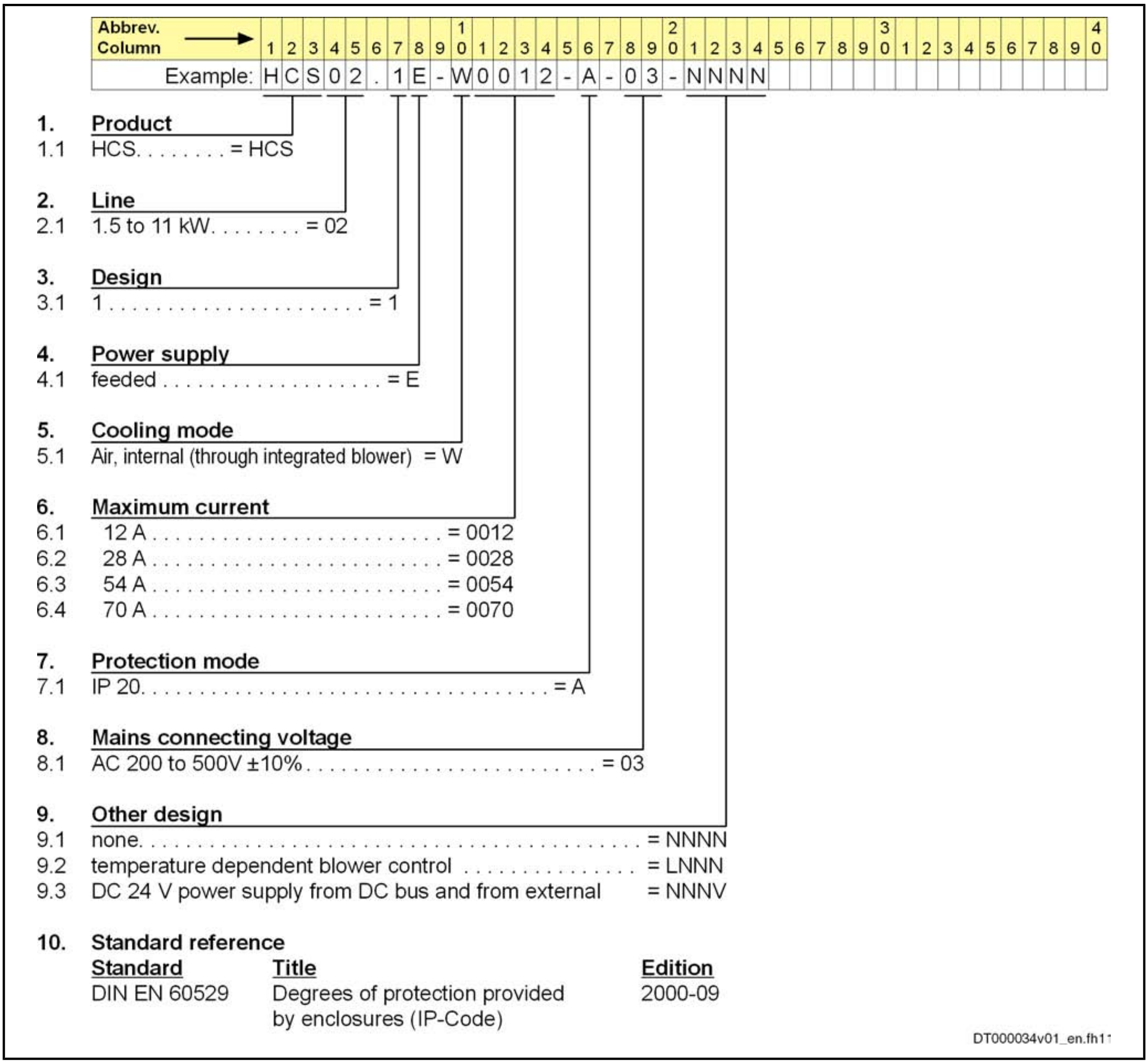
Fig.5-9: HCS02.1E-W0054/70-NNNV - block diagram

5.2.2 Type Code and Identification

Type Code

☞ The following figure illustrates the basic structure of the type code. Our sales representative will help you with the current status of available versions.

Power Sections for Converters - IndraDrive C



Abbrev. Column →	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1	2	3	4	5	6	7	8	9	40
Example:	H	C	S	0	2	.	1	E	-	W	0	0	1	2	-	A	-	0	3	-	N	N	N	N																

1. **Product**
1.1 HCS. . . . . = HCS

2. **Line**
2.1 1.5 to 11 kW. . . . . = 02

3. **Design**
3.1 1 . . . . = 1

4. **Power supply**
4.1 feeded . . . . = E

5. **Cooling mode**
5.1 Air, internal (through integrated blower) = W

6. **Maximum current**
6.1 12 A . . . . = 0012
6.2 28 A . . . . = 0028
6.3 54 A . . . . = 0054
6.4 70 A . . . . = 0070

7. **Protection mode**
7.1 IP 20. . . . . = A

8. **Mains connecting voltage**
8.1 AC 200 to 500V ±10%. . . . . = 03

9. **Other design**
9.1 none. . . . . = NNNN
9.2 temperature dependent blower control . . . . = LNNN
9.3 DC 24 V power supply from DC bus and from external = NNNV

10. **Standard reference**

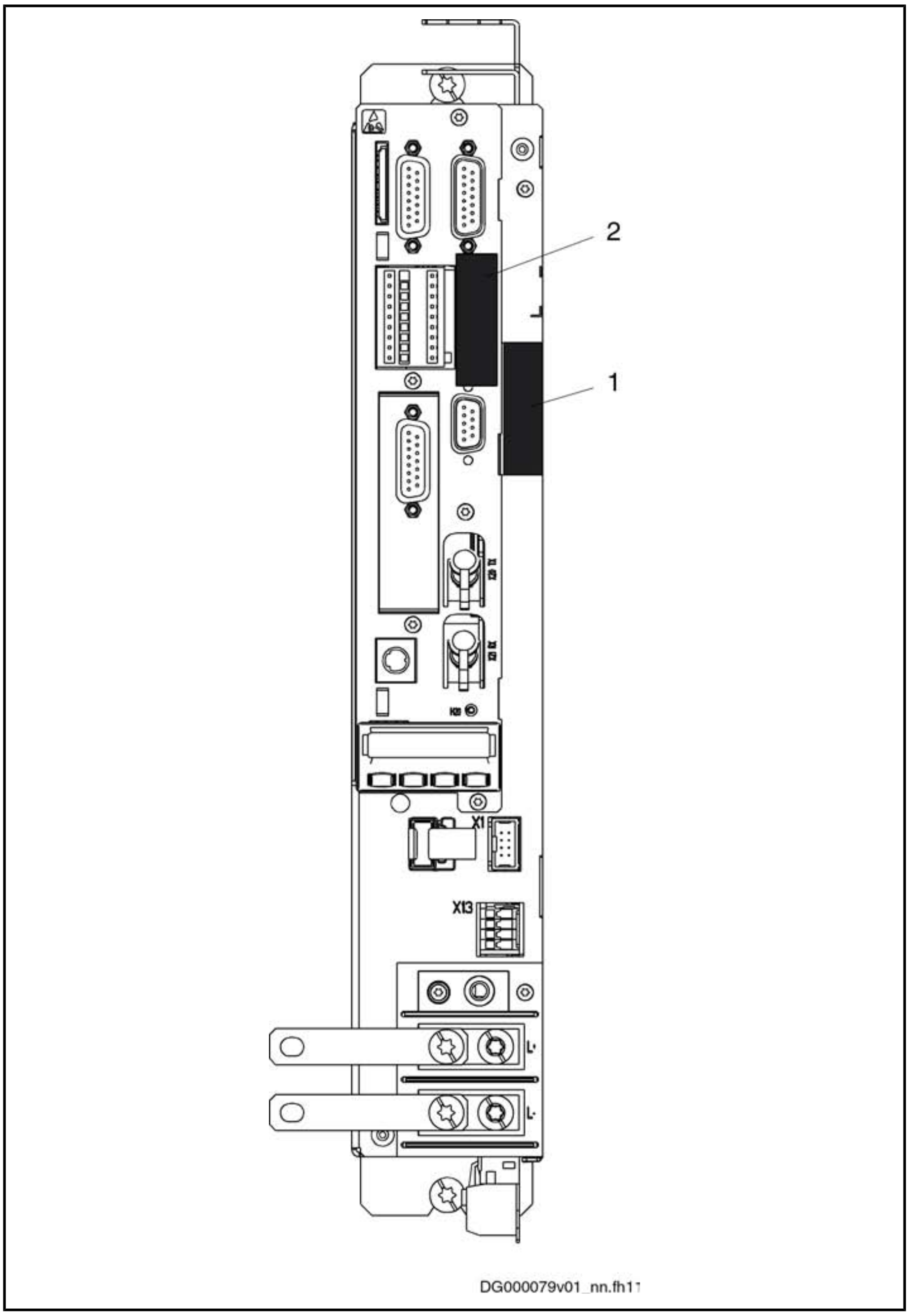
Standard	Title	Edition
DIN EN 60529	Degrees of protection provided by enclosures (IP-Code)	2000-09

DT000034v01_en.fh11

Fig.5-10: Type code HCS02

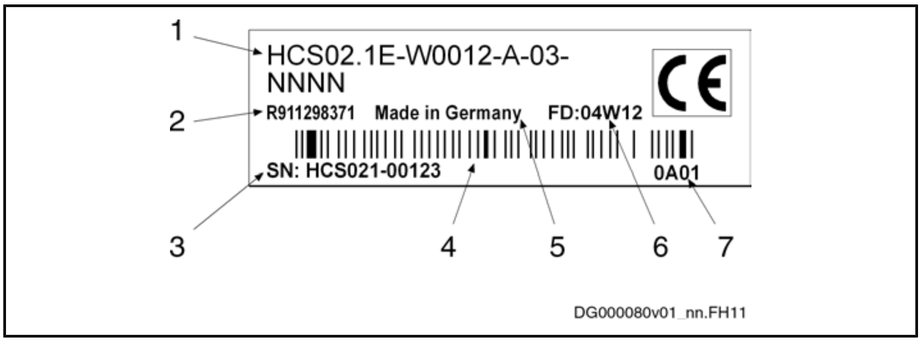
Identification

Type Plate Arrangement



1 power section type plate
2 control section type plate
Fig.5-11: Type plate arrangement

Type Plate



1	device type
2	part number
3	serial number
4	bar code
5	country of manufacture
6	production week, 04W12 meaning year 2004, week 12
7	hardware index

Fig.5-12: *Type plate - power section (example of an HCS02 power section)*

5.2.3 Scope of Supply

The scope of supply includes:

- 1 × touch guard
- 1 × connector X3, X5, X6, X13, X9 each (for designs W0054 and W0070)
- 1 × brochure with safety instructions (in 5 languages)

5.2.4 Technical Data

Ambient and Operating Conditions

General Information

Conditions for transport and storage: see chapter 4.2 Transport and Storage, page 19.

Installation conditions: see chapter 4.3 Installation Conditions , page 19.

This chapter contains:

- limit values for use in the scope of C-UL
- applied standards (CE conformity, UL listing)

UL Data

Ambient and operating conditions - UL ratings

Description	Symbol	Unit	HCS02.1E-W0012-_-03	HCS02.1E-W0028-_-03	HCS02.1E-W0054-_-03	HCS02.1E-W0070-_-03
Suitable for use on a circuit capable of delivering not more than this SCCR, symmetrical amperes (UL) 1)	I_{SCCR}	A rms	42000			
rated input voltage, power (UL)2)	U_{LN_nenn}	V	200...500			
rated input current (UL)3)	I_{L_cont}	A	10,0	16,0	20,0	32,0

Description	Symbol	Unit	HCS02.1E-W0012-_-03	HCS02.1E-W0028-_-03	HCS02.1E-W0054-_-03	HCS02.1E-W0070-_-03
maximum output voltage (UL)	U_{out}	V	530			
maximum output current (UL)	I_{out_max}	A	4,5	11,5	22,0	28,0

1) 600 V AC or less, use listed AC input line fuses or listed circuit breakers

2) HMS, HMD, HLB, HLC, KCU: DC bus L+, L-; HMV, HCS: mains input L1, L2, L3

3) at PDC_cont

Fig.5-13: HCS - Ambient and operating conditions - UL ratings

Information on Standards

Applied standards

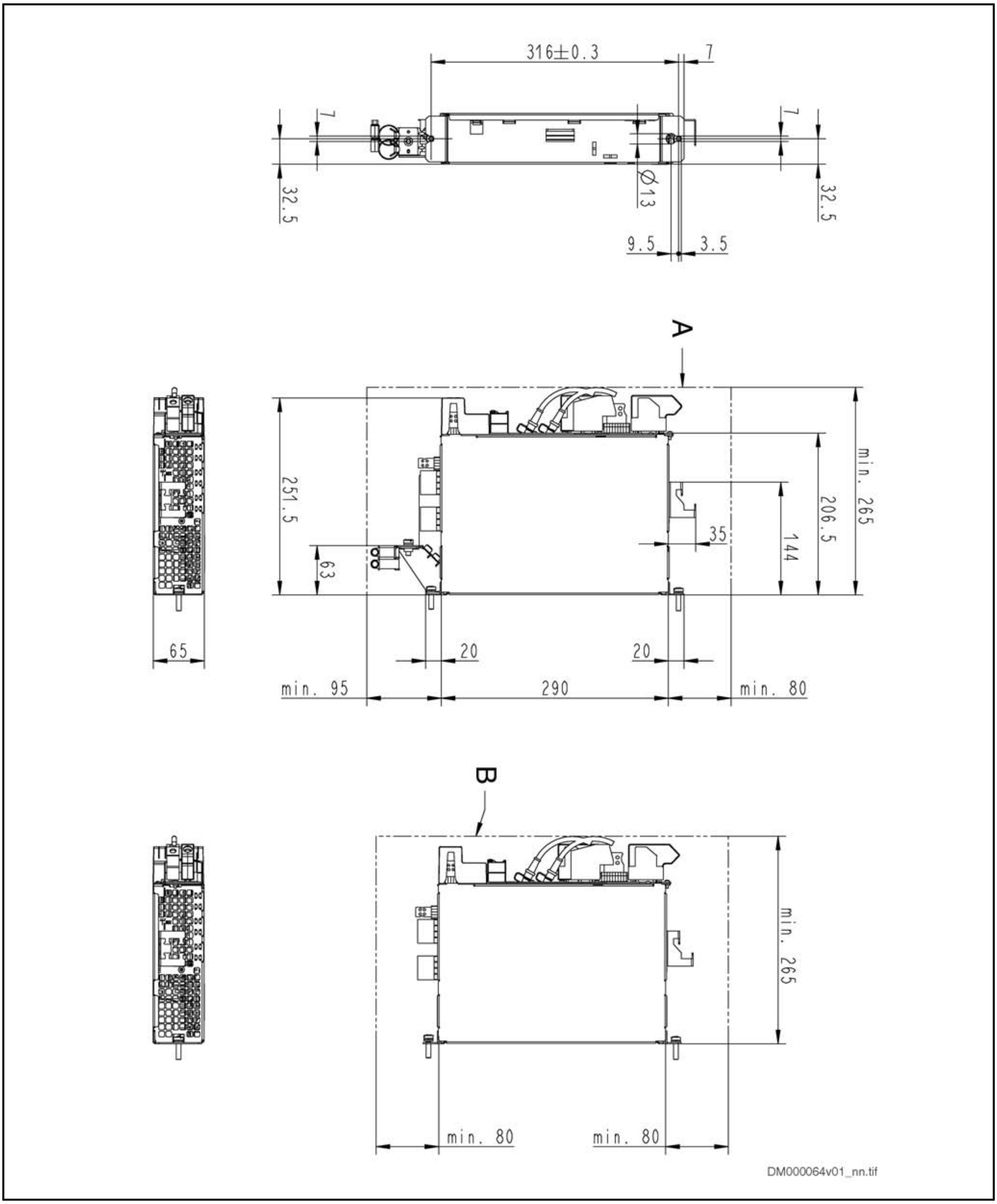
Description	Symbol	Unit	HCS02.1E-W0012-_-03	HCS02.1E-W0028-_-03	HCS02.1E-W0054-_-03	HCS02.1E-W0070-_-03
listing according to UL standard (UL)			UL 508 C			
UL files (UL)			E 134201			
listing according to CSA standard (UL)			Canadian National Standard(s) C22.2 No. 14-05			

Fig.5-14: HCS - Applied standards

Mechanical System and Mounting

Dimensional Drawings

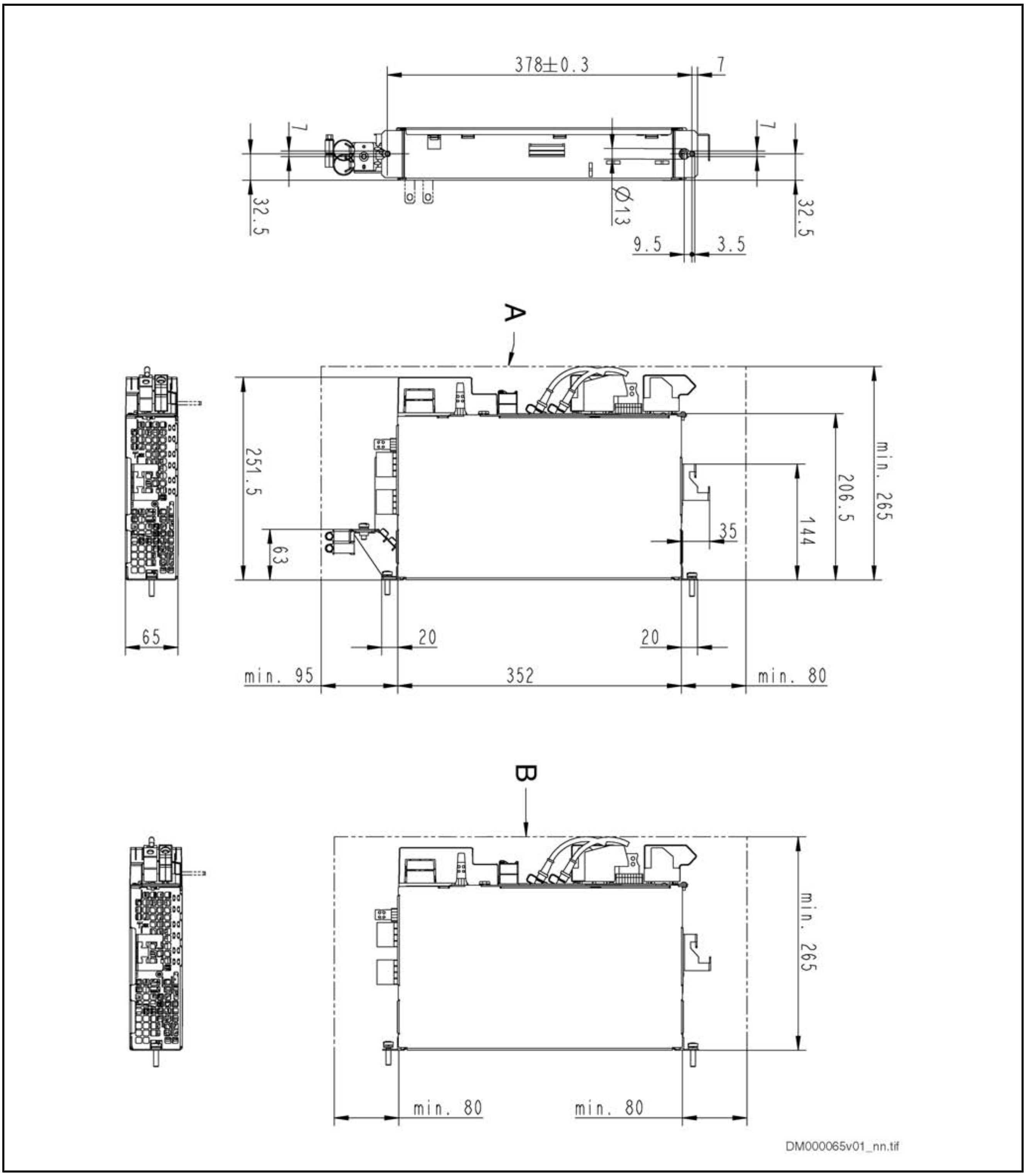
Dimensional drawing HCS02.1E-W0012



A	minimum mounting clearance (when using accessory HAS02.1); plus additional space for cable
B	minimum mounting clearance; plus additional space for cable

Fig.5-15: Dimensional drawing HCS02.1E-W0012

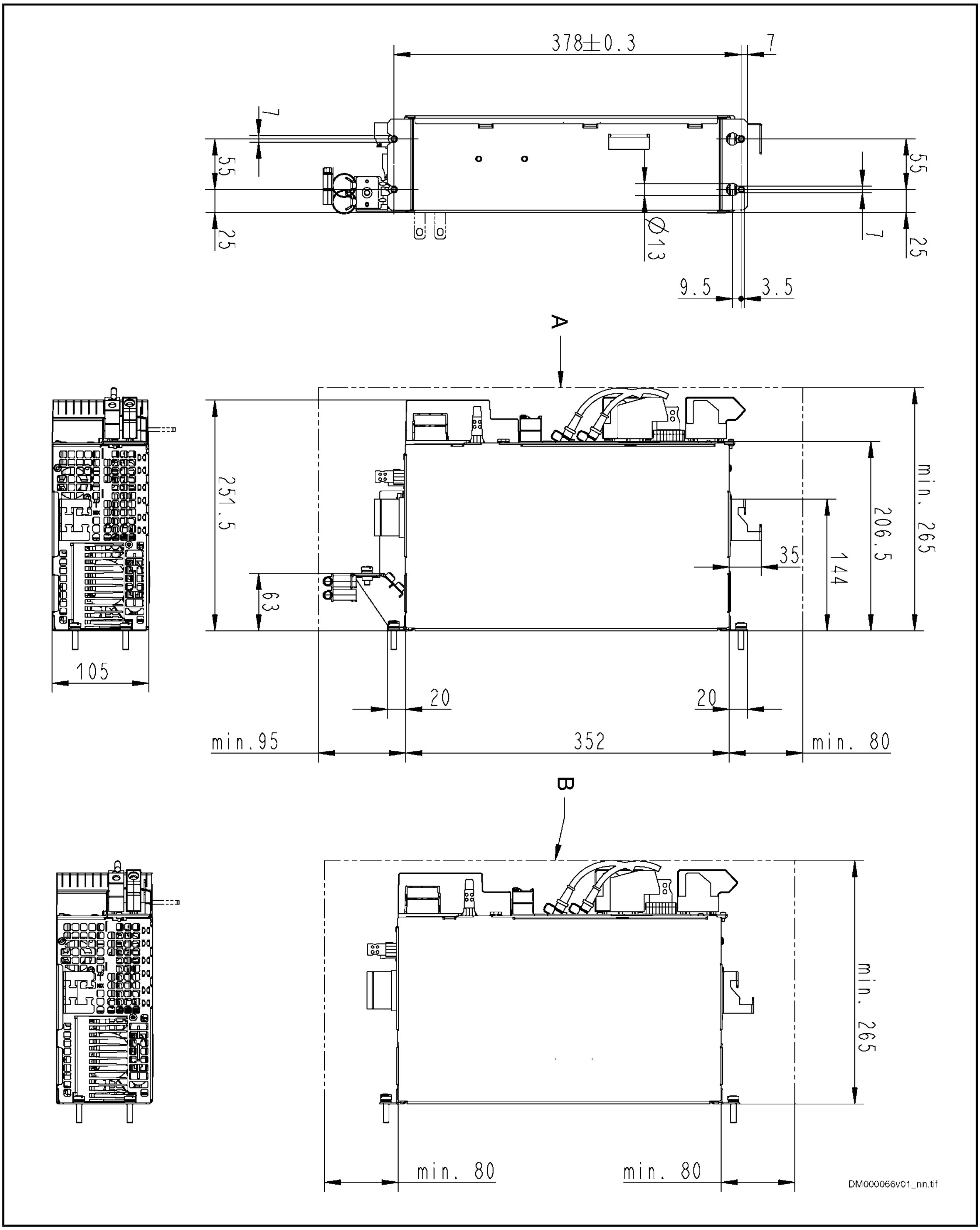
Dimensional drawing HCS02.1E-W0028



A	minimum mounting clearance (when using accessory HAS02.1); plus additional space for cable
B	minimum mounting clearance; plus additional space for cable

Fig.5-16: Dimensional drawing HCS02.1E-W0028

Dimensional drawing HCS02.1E-W0054/70



A	minimum mounting clearance (when using accessory HAS02.1); plus additional space for cable
B	minimum mounting clearance; plus additional space for cable

Fig.5-17: Dimensional drawing HCS02.1E-W0054 and HCS02.1E-W0070

Dimensions, Mass, Insulation, Sound Pressure Level

Data for mass, dimensions, sound pressure level, insulation

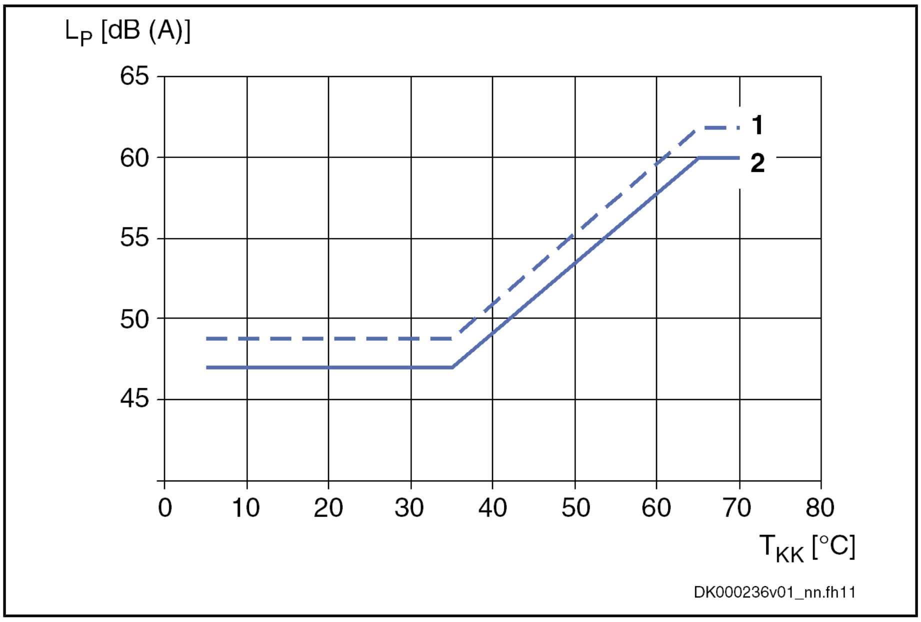
Description	Symbol	Unit	HCS02.1E-W0012-_-03	HCS02.1E-W0028-_-03	HCS02.1E-W0054-_-03	HCS02.1E-W0070-_-03
weight	m	kg	2,90	3,80	6,70	6,80
device height (UL)$^{1)}$	H	mm	290	352		
device depth (UL)$^{2)}$	T	mm	206			
device width (UL)$^{3)}$	B	mm	65		105	
insulation resistance at DC 500 V	R_{is}	MOhm	1,00	8,00		
capacitance against housing	C_Y	nF	2 x 100			
average sound pressure level (accuracy class 2) at P_{DC_cont} $^{4)}$	L_P	dB (A)	60		61	

1) 2) 3)	housing dimension; see also related dimensional drawing
4)	according to DIN EN ISO 11205; comparative value at distance 1 m, out of cabinet; HCS types with order code -L***: load-dependent

Fig.5-18: HCS - Data for mass, dimensions, sound pressure level, insulation

Blower Control Depending on Temperature

In devices of the order code -L***, the internal blower of the cooling system is controlled depending on the temperature of the cooling system. As the load increases, the temperature at the heat sink rises and thereby the sound pressure level according to the characteristic below. The specified “average sound pressure level L_P” applies to operation under rated conditions.



T_{KK}	temperature at heat sink
L_P	average sound pressure level
1	HCS02.1E-W0054/W0070-...-L***
2	HCS02.1E-W0012/W0028-...-L***

*Fig.5-19: Characteristic of sound pressure level for HCS02 with order code "-L***"*

Power Dissipation, Mounting Position, Cooling, Distances

Data for cooling and power dissipation

Description	Symbol	Unit	HCS02.1E-W0012-_-03	HCS02.1E-W0028-_-03	HCS02.1E-W0054-_-03	HCS02.1E-W0070-_-03
ambient temperature range during operation with nominal data	T_{a_work}	°C	0...40			
ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	0...55			
derating of P_{DC_cont}; P_{BD}; I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2,0			
allowed mounting position			G1			
cooling type			forced ventilation			
volumetric capacity of forced cooling	V	m^3/h	approx. 24		approx. 40	
allowed switching frequencies1)	f_s	kHz	4, 8, 12, 16			
power dissipation at I_{out_cont} = 0 A; $f_s = f_s$ (min.)2)	$P_{Diss\_0A\_fsmin}$	W	25	35	85	
power dissipation at I_{out_cont} = 0 A; $f_s = f_s$ (max.)3)	$P_{Diss\_0A\_fsmax}$	W	70	110	195	185
power dissipation at continuous current and continuous DC bus power respectively (UL)4)	P_{Diss_cont}	W	80,00	130,00	270,00	300,00
minimum distance on the top of the device5)	d_{top}	mm	80			
minimum distance on the bottom of the device6)	d_{bot}	mm	80			
temperature rise with minimum distances d_{bot}; d_{top}; P_{BD}	ΔT	K	12	40		50

1) also depending on firmware and control section; see Parameter Description "P-0-0001, Switching frequency of the power output stage"; see "P-0-4058, Amplifier type data"

2) 3) plus dissipation of braking resistor (at HMV, HCS) and control section (at HMx, HCS); find interim values by interpolation to P_Diss_cont

4) HMV, HCS: plus dissipation of braking resistor, control section; KSM: plus rated power consumption control voltage input

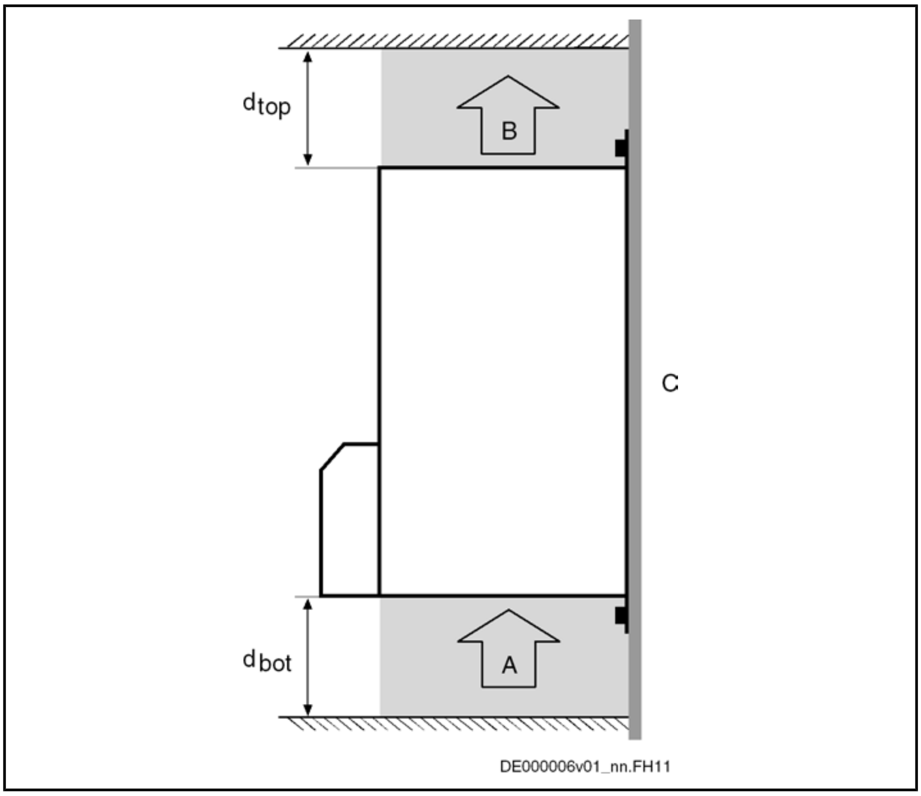
5) 6) see fig. "Air intake and air outlet at drive controller"

Fig.5-20: HCS - Data for cooling and power dissipation

CAUTION

Property damage due to temperatures higher than 105 °C!

Comply with indicated minimum distances!



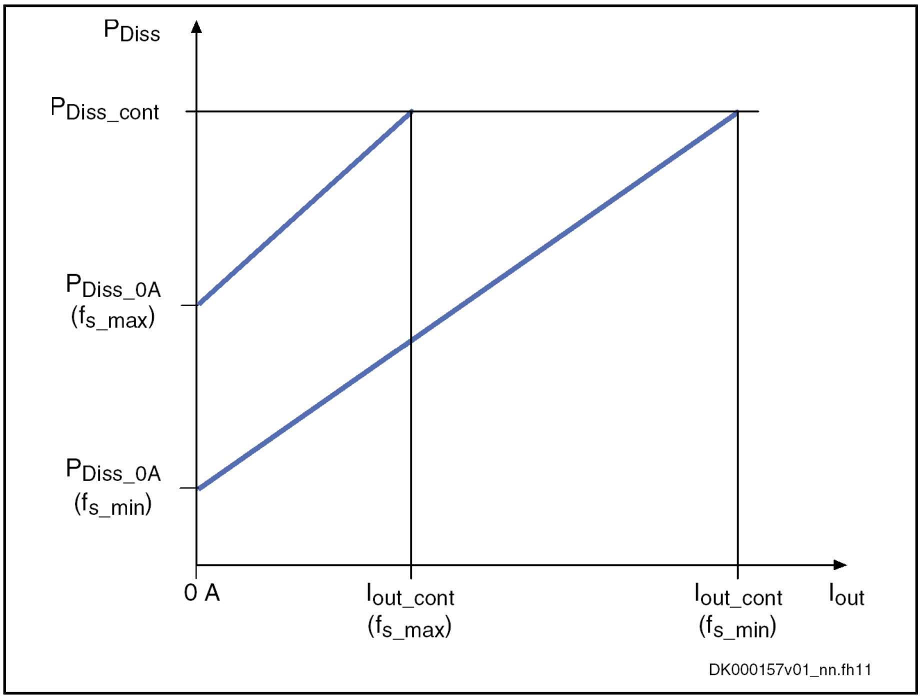
A	air intake
B	air outlet
C	mounting surface in control cabinet
d_{top}	distance top
d_{bot}	distance bottom

Fig.5-21: Air intake and air outlet at drive controller

Power Dissipation vs. Output Current

The figure below illustrates the connection between power dissipation and output current, depending on the switching frequency f_s which was set at the drive controller. See also Parameter Description "P-0-0001, Switching frequency of the power output stage".

☞ In addition, take the power at the braking resistor and the power consumption of the control section into account. Both powers are not contained in the figure.



I_{out}	output current
P_{Diss}	power dissipation
f_s	switching frequency

Fig.5-22: Power dissipation vs. output current

Basic Data Power Section HCS02

General Information

This section contains

- data for control voltage supply
- data for mains voltage supply
- data of DC bus
- data of built-in braking resistor and requirements on an external braking resistor
- data of inverter
- data for cooling and power dissipation

☞ The order of the data tables below follows the energy flow in the drive controller – from mains connection to motor output.

Control Voltage

Data for control voltage supply

Description	Symbol	Unit	HCS02.1E-W0012-_-03	HCS02.1E-W0028-_-03	HCS02.1E-W0054-_-03	HCS02.1E-W0070-_-03
rated control voltage input (UL)[1]	U_{N3}	V	24 ± 20 %			
control voltage when using motor holding brake with motor cable length < 50 m[2]	U_{N3}	V	24 ± 5 %			

Description	Symbol	Unit	HCS02.1E-W0012-_-03	HCS02.1E-W0028-_-03	HCS02.1E-W0054-_-03	HCS02.1E-W0070-_-03
control voltage when using motor holding brake with motor cable length > 50 m[3]	U_{N3}	V	26 ± 5 %			
maximum allowed voltage for 1 m	U_{N3_max}	V	33,00			
maximum inrush current at 24V supply	I_{EIN3_max}	A	2,80			
pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	15			
input capacitance	C_{N3}	mF	0,56			
rated power consumption control voltage input at U_{N3} (UL)[4]	P_{N3}	W	12	14	23	

1) 2) 3) observe supply voltage for motor holding brakes

4) HMS, HMD, HCS: plus holding brake and control section; KCU01: at max. number of axes; KSM01: plus holding brake (UN x IN)

Fig.5-23: HCS - Data for control voltage supply

Mains Voltage

Data for mains voltage supply

Description	Symbol	Unit	HCS02.1E-W0012-_-03	HCS02.1E-W0028-_-03	HCS02.1E-W0054-_-03	HCS02.1E-W0070-_-03
input frequency (UL)	f_{LN}	Hz	50...60			
tolerance input frequency (UL)		Hz	± 2			
maximum allowed mains frequency change	$\Delta f_{LN}/\Delta t$	Hz/s	-			
rotary field condition			none			
Suitable for use on a circuit capable of delivering not more than this SCCR, symmetrical amperes (UL)[1]	I_{SCCR}	A rms	42000			
nominal mains voltage	U_{LN_nenn}	V	3 AC 400			
mains voltage single-phase	U_{LN}	V	200...250			
mains voltage three-phase at TN S, TN C, TT mains	U_{LN}	V	200...500			
mains voltage three-phase at IT mains[2]	U_{LN}	V	200...500			
mains voltage three-phase at Corner-grounded-Delta mains[3]	U_{LN}	V	200...500			
tolerance U_{LN} (UL)		%	± 10			
minimum inductance of the mains supply (inductance of mains phase)[4]	L_{min}	µH	40			
assigned type of mains choke			HNL01.1E-1000-N0012-A-500-NNNN		HNL01.1E-1000-N0020-A-500-NNNN	HNL01.1E-0600-N0032-A-500-NNNN

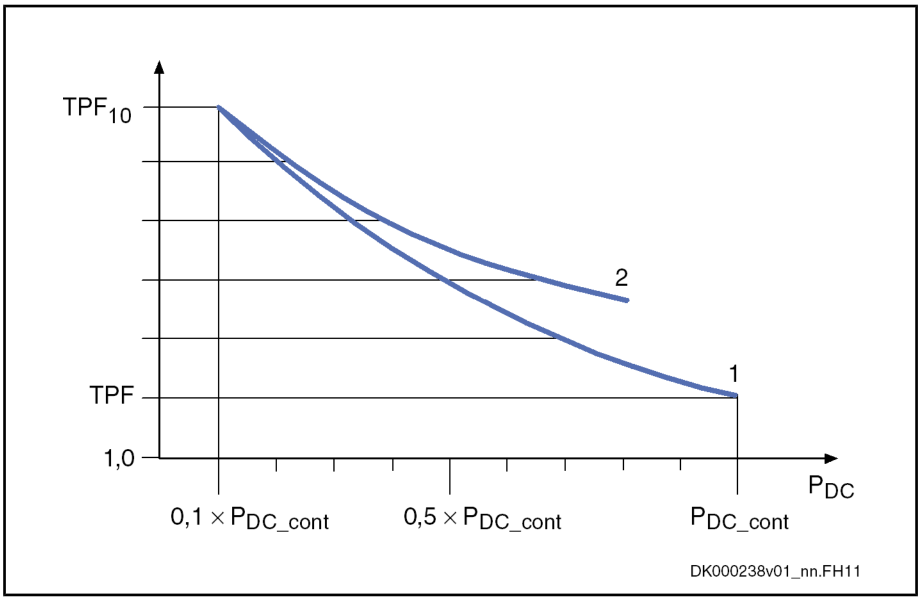
Description	Symbol	Unit	HCS02.1E-W0012-_-03	HCS02.1E-W0028-_-03	HCS02.1E-W0054-_-03	HCS02.1E-W0070-_-03
minimum short circuit power of the mains for failure-free operation⁵⁾	S_{k_min}	MVA	0,2	0,4	0,6	0,8
maximum inrush current⁶⁾	$I_{L\_trans\_max\_on}$	A	1,4...4,3	3,5...10,7	6,3...19,3	9,9...27,5
maximum allowed ON-OFF cycles per minute⁷⁾			1			
power factor TPF (λ_L) at P_{DC_cont} with mains choke; U_{LN_nenn}	TPF		-	0,70	0,75	0,76
power factor TPF (λ_L) at P_{DC_cont} without mains choke; U_{LN_nenn} ⁸⁾	TPF		0,60		0,64	0,56
power factor TPF (λ_L) at 10% P_{DC_cont} without mains choke; U_{LN_nenn} ⁹⁾	TPF_{10}		0,40			
power factor TPF (λ_L) at P_{DC_cont} (single-phase); U_{LN} = 1 AC 230 V	TPF		0,40			
power factor of fundam. component DPF at P_{DC_cont} with mains choke	$\cos\varphi^{h1}$		0,95			
power factor of fundam. component DPF at P_{DC_cont} without mains choke	$\cos\varphi^{h1}$		0,97			
mains connection power at P_{DC_cont}; U_{LN_nenn} with mains choke	S_{LN}	kVA	3,50	7,30	13,30	18,50
mains connection power at P_{DC_cont}; U_{LN_nenn} without mains choke	S_{LN}	kVA	3,50	8,50	11,00	16,00
rated input current (UL)¹⁰⁾	I_{L_cont}	A	10,0	16,0	20,0	32,0
nominal current AC1 for mains contactor at nom. data with mains choke; U_{LN_nenn}			I L_cont			
mains fuse according to IEC 60364-5-52; at nom. data with mains choke; U_{LN_nenn}		A	16; gL	20; gL	25; gL	35; gL

Description	**Symbol**	**Unit**	**HCS02.1E-W0012-_-03**	**HCS02.1E-W0028-_-03**	**HCS02.1E-W0054-_-03**	**HCS02.1E-W0070-_-03**
required wire size according to IEC 60364-5-52; at I_{L_cont} 11)	A_{LN}	mm²	1,5	2,5	4	6
required wire size according to UL 508 A (internal wiring); at I_{L_cont} (UL)12)	A_{LN}	AWG	AWG 14		AWG 12	AWG 10

1)	600 V AC or less, use listed AC input line fuses or listed circuit breakers
2) 3)	mains voltage > ULN: use a transformer with grounded neutral point, don´t use autotransformers!
4)	otherwise use mains choke HNL
5)	HMV0x.xR: Rsc=100; HMV0x.xE, HCS0x.xE: Rsc=50
6)	depending on mains input voltage ULN; HMV01.1R see following note; HMV: constant current charge, HCS: resistance charge; minimum of 250.000 load cycles
7)	without external capacities on DC bus
8) 9)	find interim values by interpolation
10)	at PDC_cont
11)	copper wire; PVC-insulation (conductor temperature 70 °C); installation method B2; Table B52-4; Ta ≤ 40 °C
12)	copper wire; PVC-insulation (conductor temperature 90 °C); Table 13.5.1; Ta ≤ 40 °C

Fig.5-24: HCS - Data for mains voltage supply

Qualitative characteristic TPF vs. DC bus power PDC_cont



1 with mains choke
2 without mains choke

Fig.5-25: Qualitative characteristic TPF vs. DC bus power PDC_cont

DC Bus

Data of power section - DC bus

Description	**Symbol**	**Unit**	**HCS02.1E-W0012-_-03**	**HCS02.1E-W0028-_-03**	**HCS02.1E-W0054-_-03**	**HCS02.1E-W0070-_-03**
DC bus voltage	U_{DC}	V	ULN x 1,41			
capacitance in DC bus	C_{DC}	mF	0,14	0,27	0,54	0,68

Description	Symbol	Unit	HCS02.1E-W0012-_-03	HCS02.1E-W0028-_-03	HCS02.1E-W0054-_-03	HCS02.1E-W0070-_-03
DC resistance in DC bus (L+ to L-) at U_{DC} = 750 V	R_{DC}	kOhm	approx. 300	approx. 150	approx. 75	approx. 60
rated power (t > 10 min) at f_s = 4 kHz; U_{LN_nenn}; control factor a_0 > 0,8; with mains choke	P_{DC_cont}	kW	2,10	5,10	10,00	14,00
rated power (t > 10 min) at f_s = 4 kHz; U_{LN_nenn}; control factor a_0 > 0,8; without mains choke	P_{DC_cont}	kW	2,10	5,10	7,00	9,00
P_{DC_cont} and P_{DC_max} vs. mains input voltage; $U_{LN} \leq U_{LN\_nenn}$		%/V	PDC_cont (ULN) = PDC_cont x [1 - (400-ULN) x 0,0025]			
P_{DC_cont} and P_{DC_max} vs. mains input voltage; $U_{LN} > U_{LN\_nenn}$		%/V	PDC_cont (ULN) = PDC_cont x [1 + (ULN-400) x 0,002]			
maximum allowed DC bus power at U_{LN_nenn}; with mains choke	P_{DC_max}	kW	5,00	10,00	16,00	19,00
maximum allowed DC bus power at U_{LN_nenn}; without mains choke	P_{DC_max}	kW	5,00	8,00	12,00	14,00
balancing factor for P_{DC_cont} (for parallel operation at common DC bus) with mains choke			-	0,80		
balancing factor for P_{DC_cont} (for parallel operation at common DC bus) without mains choke			-	0,50		
monitoring value maximum DC bus voltage, switch-off threshold	$U_{DC\_limit\_max}$	V	900			
monitoring value minimum DC bus voltage, undervoltage threshold	$U_{DC\_limit\_min}$	V	can be parameterized, see "P-0-0114, Undervoltage threshold"			
charging resistor continuous power	P_{DC_Start}	kW	0,05	0,15	0,35	0,50
maximum allowed external DC bus capacitance[1)]	C_{DCext}	mF	-	5,00	7,00	13,00
charging time at maximum allowed C_{DCext} external DC bus capacitance at U_{LN_nenn}	$t_{lade\_DC\_Cext}$	s	2,00			

1) use assigned type of mains choke

Fig.5-26: HCS - Data of power section - DC bus

Single-Phase Mains Connection

☞ **Single-phase mains connection**

Single-phase mains connection is carried out via the connections **L1 and L2.**

The maximum allowed DC bus power P_{DC_max} is limited to the specified continuous power P_{DC_cont}.

Data of power section with single-phase mains connection

Description	Symbol	Unit	HCS02.1E-W0012-_-03	HCS02.1E-W0028-_-03	HCS02.1E-W0054-_-03	HCS02.1E-W0070-_-03
mains voltage single-phase	U_{LN}	V	200...250			
continuous power (t > 10 min)	P_{DC_cont}	W	50...70	100...160	150...250	260...400

Fig.5-27: HCS - Data of power section with single-phase mains connection

Braking Resistor

Data of built-in braking resistor

Description	Symbol	Unit	HCS02.1E-W0012-_-03	HCS02.1E-W0028-_-03	HCS02.1E-W0054-_-03	HCS02.1E-W0070-_-03
braking resistor continuous power	P_{BD}	kW	0,05	0,15	0,35	0,50
braking resistor peak power at U_{DC} = 850 V	P_{BS}	kW	4,00	10,00	18,00	25,00
nominal braking resistance	$R_{DC\_Bleeder}$	ohm	180	72	40	28
braking resistor switch-on threshold - mains voltage independent[1)]	$U_{R\_DC\_On\_f}$	V	820; see also "P-0-0833, Braking resistor threshold" and "P-0-0860, Converter configuration"			
braking resistor switch-on threshold - mains voltage dependent[2)]	$U_{R\_DC\_On\_v}$		see "P-0-0833, Braking resistor threshold" and "P-0-0860, Converter configuration"			
maximum allowed on-time duty	t_{on_max}	s	0,25	0,50		
minimum allowed cycle time	T_{cycl}	s	20,00	33,00	26,00	25,00
maximum regenerative power to be absorbed	W_{R_max}	kWs	1,00	5,00	9,00	13,00
balancing factor for P_{BD} (for parallel operation at common DC bus)	f		-	0,80		
cooling of internal braking resistor			forced			

1) 2) factory setting

Fig.5-28: HCS - Data of built-in braking resistor

Requirements on external braking resistor

Description	Symbol	Unit	HCS02.1E-W0012-_-03	HCS02.1E-W0028-_-03	HCS02.1E-W0054-_-03	HCS02.1E-W0070-_-03
minimum required resistance value of external braking resistor[1)]	$R_{DC\_Bleeder}$	ohm	-		40,0	28,0
assigned braking resistor type HLR01[2)]			-		HLR01.1N-01K8-N40R0; HLR01.1N-03K8-N40R0	HLR01.1N-02K4-N28R0; HLR01.1N-05K5-N28R0

1) see Parameter Description "P-0-0858, Data of external braking resistor"

2) see also Project Planning Manual "Additional Components"; see Parameter Description "P-0-0858, Data of external braking resistor"

Fig.5-29: HCS - Requirements on external braking resistor

Inverter

Data of power section - Inverter

Description	Symbol	Unit	HCS02.1E-W0012-_-03	HCS02.1E-W0028-_-03	HCS02.1E-W0054-_-03	HCS02.1E-W0070-_-03
allowed switching frequencies[1]	f_s	kHz	4, 8, 12, 16			
output voltage, fundamental wave with open-loop operation	U_{out_eff}	V	~ UDC x 0,71			
output voltage, fundamental wave with closed-loop operation	U_{out_eff}	V	~ UDC * 0,71			
rise of voltage at output with U_{LN_nenn} and 15 m motor cable length phase-phase (10-90%)[2]	du/dt	kV/µs	5,00			
rise of voltage at output with U_{LN_nenn} and 15 m motor cable length phase-ground (10-90%)[3]	du/dt	kV/µs	5,00			
output frequency range at f_s = 2 kHz	f_{out_2k}	Hz	-			
output frequency range at f_s = 4 kHz	f_{out_4k}	Hz	0...400			
output frequency range at f_s = 8 kHz	f_{out_8k}	Hz	0..800			
output frequency range at f_s = 12 kHz	f_{out_12k}	Hz	0..1200			
output frequency range at f_s = 16 kHz	f_{out_16k}	Hz	0...1600			
output frequency threshold to detect motor standstill[4]	f_{out_still}	Hz	2...4			
maximum output current at f_s = 2 kHz	I_{out_max2}	A	-			
maximum output current at f_s = 4 kHz	I_{out_max4}	A	11,5	28,3	54,0	70,8
maximum output current at f_s = 8 kHz	I_{out_max8}	A	11,5	28,3	54,0	70,8
maximum output current at f_s = 12 kHz	I_{out_max12}	A	11,5	28,3	54,0	70,8
maximum output current at f_s = 16 kHz	I_{out_max16}	A	11,5	28,3	54,0	70,8
allowed continuous output current at f_s = 2 kHz	I_{out_cont2}	A	-			
allowed continuous output current at f_s = 4 kHz	I_{out_cont4}	A	4,5	12,0	20,6	28,0
allowed continuous output current at f_s = 8 kHz	I_{out_cont8}	A	4,5	9,2	20,6	21,4
allowed continuous output current at f_s = 12 kHz[5]	I_{out_cont12}	A	4,0	5,1	13,8	14,1

Description	Symbol	Unit	HCS02.1E-W0012-_-03	HCS02.1E-W0028-_-03	HCS02.1E-W0054-_-03	HCS02.1E-W0070-_-03
allowed continuous output current at f_s = 16 kHz6)	I_{out_cont16}	A	2,8	4,4	11,1	10,5
allowed continuous output current at f_s = 2 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_2}$	A	-			
allowed continuous output current at f_s = 4 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_4}$	A	4,5	9,7	20,2	
allowed continuous output current at f_s = 8 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_8}$	A	3,3	5,6	13,1	11,9
allowed continuous output current at f_s = 12 kHz; output frequency $f_{out} < f_{out\_still}$ 7)	$I_{out\_cont0Hz\_12}$	A	1,2	2,3	7,5	6,7
allowed continuous output current at f_s = 16 kHz; output frequency $f_{out} < f_{out\_still}$ 8)	$I_{out\_cont0Hz\_16}$	A	0,7	2,1	6,1	4,2
assigned output filters at nom. data; f_s = 4 kHz			tbd			

1) also depending on firmware and control section; see Parameter Description "P-0-0001, Switching frequency of the power output stage"; see "P-0-4058, Amplifier type data"
2) 3) guide value, see following note
4) see following note regarding reduction output current
5) 6) 7) 8) see Parameter Description "P-0-0556, Config word of axis controller", load-depending reduction of PWM frequency fs

Fig.5-30: HCS - Data of power section - Inverter

☞ Observe that the load is almost independent of the power section used.

Especially when using **standard motors** , make sure that they comply with the occurring voltage load.

Observe the information contained in the chapter “Third-Party Motors at IndraDrive Controllers” in the Project Planning Manual of the drive system.

☞ Depending on the electric output frequency, the output current is reduced for thermal protection of the power section.

The output current is reduced, when the electric output frequency has fallen below the threshold to detect motor standstill.

Exemplary Data for Applications

General Information

This section contains

- examples of allowed current profiles
- examples of allowed performance profiles

- data for selecting standard motors

Current Profiles

Examples of allowed current profiles

Description	Symbol	Unit	HCS02.1E-W0012-_-03	HCS02.1E-W0028-_-03	HCS02.1E-W0054-_-03	HCS02.1E-W0070-_-03
maximum output current at $I_{out\_base\_1}$; f_s = 2 kHz; t = 0,4 s; T = 4 s; K = 2,5[1]	$I_{out\_peak1\_2}$	A	-			
base load current at $I_{out\_peak\_1}$; f_s = 2 kHz; t = 0,4 s; T = 4 s; K = 2,5	$I_{out\_base1\_2}$	A	-			
maximum output current at $I_{out\_base\_1}$; f_s = 4 kHz; t = 0,4 s; T = 4 s; K = 2,5[2]	$I_{out\_peak1\_4}$	A	9,07	24,29	41,66	56,56
base load current at $I_{out\_peak\_1}$; f_s = 4 kHz; t = 0,4 s; T = 4 s; K = 2,5	$I_{out\_base1\_4}$	A	3,63	9,72	16,66	22,62
maximum output current at $I_{out\_base\_1}$; f_s = 8 kHz; t = 0,4 s; T = 4 s; K = 2,5[3]	$I_{out\_peak1\_8}$	A	9,07	15,06	33,59	34,77
base load current at $I_{out\_peak\_1}$; f_s = 8 kHz; t = 0,4 s; T = 4 s; K = 2,5	$I_{out\_base1\_8}$	A	3,63	6,02	13,43	13,91
maximum output current at $I_{out\_base\_1}$; f_s = 12 kHz; t = 0,4 s; T = 4 s; K = 2,5[4]	$I_{out\_peak1\_12}$	A	6,03	8,42	21,96	23,12
base load current at $I_{out\_peak\_1}$; f_s = 12 kHz; t = 0,4 s; T = 4 s; K = 2,5	$I_{out\_base1\_12}$	A	2,41	3,37	8,78	9,25
maximum output current at $I_{out\_base\_1}$; f_s = 16 kHz; t = 0,4 s; T = 4 s; K = 2,5[5]	$I_{out\_peak1\_16}$	A	4,25	7,29	17,77	17,16
base load current at $I_{out\_peak\_1}$; f_s = 16 kHz; t = 0,4 s; T = 4 s; K = 2,5	$I_{out\_base1\_16}$	A	1,70	2,92	7,11	6,86
maximum output current at $I_{out\_base\_3}$; f_s = 2 kHz; t = 2 s; T = 20 s; K = 2,0[6]	$I_{out\_peak3\_2}$	A	-			
base load current at $I_{out\_peak\_3}$; f_s = 2 kHz; t = 2 s; T = 20 s; K = 2,0	$I_{out\_base3\_2}$	A	-			
maximum output current at $I_{out\_base\_3}$; f_s = 4 kHz; t = 2 s; T = 20 s; K = 2,0[7]	$I_{out\_peak3\_4}$	A	7,79	20,90	35,86	48,68
base load current at $I_{out\_peak\_3}$; f_s = 4 kHz; t = 2 s; T = 20 s; K = 2,0	$I_{out\_base3\_4}$	A	3,90	10,45	17,93	24,34
maximum output current at $I_{out\_base\_3}$; f_s = 8 kHz; t = 2 s; T = 20 s; K = 2,0[8]	$I_{out\_peak3\_8}$	A	7,79	13,55	30,54	31,36

Description	Symbol	Unit	HCS02.1E-W0012-_-03	HCS02.1E-W0028-_-03	HCS02.1E-W0054-_-03	HCS02.1E-W0070-_-03
base load current at $I_{out\_peak\_3}$; f_s = 8 kHz; t = 2 s; T = 20 s; K = 2,0	$I_{out\_base3\_8}$	A	3,90	6,77	15,27	15,68
maximum output current at $I_{out\_base\_3}$; f_s = 12 kHz; t = 2 s; T = 20 s; K = 2,0[9]	$I_{out\_peak3\_12}$	A	5,57	7,56	19,88	20,81
base load current at $I_{out\_peak\_3}$; f_s = 12 kHz; t = 2 s; T = 20 s; K = 2,0	$I_{out\_base3\_12}$	A	2,78	3,78	9,94	10,40
maximum output current at $I_{out\_base\_3}$; f_s = 16 kHz; t = 2 s; T = 20 s; K = 2,0[10]	$I_{out\_peak3\_16}$	A	3,90	6,55	16,06	15,42
base load current at $I_{out\_peak\_3}$; f_s = 16 kHz; t = 2 s; T = 20 s; K = 2,0	$I_{out\_base3\_16}$	A	1,95	3,27	8,03	7,71
base load current at $I_{out\_peak\_4}$; f_s = 2 kHz; t = 60 s; T = 5 min; K = 1,5	$I_{out\_base4\_2}$	A	-			
maximum output current at $I_{out\_base\_4}$; f_s = 2 kHz; t = 60 s; T = 5 min; K = 1,5[11]	$I_{out\_peak4\_2}$	A	-			
maximum output current at $I_{out\_base\_4}$; f_s = 4 kHz; t = 60 s; T = 5 min; K = 1,5[12]	$I_{out\_peak4\_4}$	A	5,22	14,79	25,13	33,74
base load current at $I_{out\_peak\_4}$; f_s = 4 kHz; t = 60 s; T = 5 min; K = 1,5	$I_{out\_base4\_4}$	A	3,48	9,86	16,76	22,49
maximum output current at $I_{out\_base\_4}$; f_s = 8 kHz; t = 60 s; T = 5 min; K = 1,5[13]	$I_{out\_peak4\_8}$	A	5,22	10,25	22,97	24,33
base load current at $I_{out\_peak\_4}$; f_s = 8 kHz; t = 60 s; T = 5 min; K = 1,5	$I_{out\_base4\_8}$	A	3,48	6,83	15,32	16,22
maximum output current at $I_{out\_base\_4}$; f_s = 12 kHz; t = 60 s; T = 5 min; K = 1,5[14]	$I_{out\_peak4\_12}$	A	4,32	5,71	14,88	16,10
base load current at $I_{out\_peak\_4}$; f_s = 12 kHz; t = 60 s; T = 5 min; K = 1,5	$I_{out\_base4\_12}$	A	2,88	3,81	9,92	10,74
maximum output current at $I_{out\_base\_4}$; f_s = 16 kHz; t = 60 s; T = 5 min; K = 1,5[15]	$I_{out\_peak4\_16}$	A	3,02	4,95	12,00	11,93
base load current at $I_{out\_peak\_4}$; f_s = 16 kHz; t = 60 s; T = 5 min; K = 1,5	$I_{out\_base4\_16}$	A	2,01	3,30	8,00	7,95
maximum output current at $I_{out\_base\_5}$; f_s = 2 kHz; t = 60 s; T = 10 min; K = 1,1[16]	$I_{out\_peak5\_2}$	A	-			

Description	Symbol	Unit	HCS02.1E-W0012-_-03	HCS02.1E-W0028-_-03	HCS02.1E-W0054-_-03	HCS02.1E-W0070-_-03
base load current at $I_{out\_peak\_5}$; f_s = 2 kHz; t = 60 s; T = 10 min; K = 1,1	$I_{out\_base5\_2}$	A	-			
maximum output current at $I_{out\_base\_5}$; f_s = 4 kHz; t = 60 s; T = 10 min; K = 1,1[17)]	$I_{out\_peak5\_4}$	A	4,70	12,75	21,82	29,55
base load current at $I_{out\_peak\_5}$; f_s = 4 kHz; t = 60 s; T = 10 min; K = 1,1	$I_{out\_base5\_4}$	A	4,27	11,59	19,84	26,87
maximum output current at $I_{out\_base\_5}$; f_s = 8 kHz; t = 60 s; T = 10 min; K = 1,1[18)]	$I_{out\_peak5\_8}$	A	4,70	9,46	21,79	22,20
base load current at $I_{out\_peak\_5}$; f_s = 8 kHz; t = 60 s; T = 10 min; K = 1,1	$I_{out\_base5\_8}$	A	4,27	8,60	19,81	20,18
maximum output current at $I_{out\_base\_5}$; f_s = 12 kHz; t = 60 s; T = 10 min; K = 1,1[19)]	$I_{out\_peak5\_12}$	A	4,14	5,27	14,10	14,68
base load current at $I_{out\_peak\_5}$; f_s = 12 kHz; t = 60 s; T = 10 min; K = 1,1	$I_{out\_base5\_12}$	A	3,76	4,79	12,82	13,35
maximum output current at $I_{out\_base\_5}$; f_s = 16 kHz; t = 60 s; T = 10 min; K = 1,1[20)]	$I_{out\_peak5\_16}$	A	2,89	4,57	11,37	10,87
base load current at $I_{out\_peak\_5}$; f_s = 16 kHz; t = 60 s; T = 10 min; K = 1,1	$I_{out\_base5\_16}$	A	2,63	4,15	10,33	9,88

1) 2) 3) 4) 5) 6) 7) 8) 9) 10) 11) 12) 13) 14) 15) 16) 17) 18) 19) 20) see definition profile UEL_I_e

Fig.5-31: HCS - Examples of allowed current profiles

Current Profile “UEL_I_e”

The following current profiles have been defined for converters and inverters.

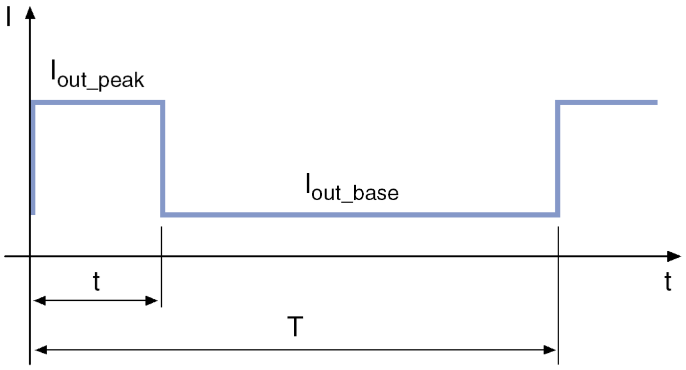
Profile	Explanation
current profile “UEL_I_e”  DK000149v01_nn.fh11	The characteristic data of the profile are used to select converters and inverters for operation with standard motors and servo drives.

Fig.5-32: Definition of current profiles

Performance Profiles

Examples of allowed performance profiles

Description	Symbol	Unit	HCS02.1E-W0012-_-03	HCS02.1E-W0028-_-03	HCS02.1E-W0054-_-03	HCS02.1E-W0070-_-03
maximum DC bus power at U_{LN_nenn}; $T_a \le T_{a\_work}$; t = 0,4 s; T = 4 s; K = 2,5; $P_{DC\_peak} = P_{DC\_max}$; without mains choke[1)]	$P_{DC\_peak\_1}$	kW	4,25	10,33	14,17	18,19
maximum DC bus power at U_{LN_nenn}; $T_a \le T_{a\_work}$; t = 0,4 s; T = 4 s; K = 2,5; $P_{DC\_peak} = P_{DC\_max}$; with mains choke[2)]	$P_{DC\_peak\_1}$	kW	-		20,24	28,30
DC bus power at U_{LN_nenn}; $T_a \le T_{a\_work}$; t =0,4 s; T = 4 s; K = 2,5; $P_{DC\_peak} = P_{DC\_max}$; without mains choke[3)]	$P_{DC\_base\_1}$	kW	1,68	4,12	5,67	7,26
DC bus power at U_{LN_nenn}; $T_a \le T_{a\_work}$; t = 0,4 s; T = 4 s; K = 2,5; $P_{DC\_peak} = P_{DC\_max}$; with mains choke[4)]	$P_{DC\_base\_1}$	kW	-		8,11	11,30
maximum DC bus power at U_{LN_nenn}; $T_a \le T_{a\_work}$; t = 2 s; T = 20 s; K = 2,0; without mains choke[5)]	$P_{DC\_peak\_3}$	kW	3,64	8,88	12,19	15,65
maximum DC bus power at U_{LN_nenn}; $T_a \le T_{a\_work}$; t = 2 s; T = 20 s; K = 2,0; with mains choke[6)]	$P_{DC\_peak\_3}$	kW	-		17,41	24,34

Description	Symbol	Unit	HCS02.1E-W0012-_-03	HCS02.1E-W0028-_-03	HCS02.1E-W0054-_-03	HCS02.1E-W0070-_-03
DC bus power at U_{LN_nenn}; $T_a \le T_{a\_work}$; t = 2 s; T = 20 s; K = 2,0; without mains choke7)	$P_{DC\_base\_3}$	kW	1,82	4,44	6,09	7,82
DC bus power at U_{LN_nenn}; $T_a \le T_{a\_work}$; t = 2 s; T = 20 s; K = 2,0; with mains choke8)	$P_{DC\_base\_3}$	kW	-		8,70	12,17
maximum DC bus power at U_{LN_nenn}; $T_a \le T_{a\_work}$; t = 60 s; T = 5 min; K = 1,5; without mains choke9)	$P_{DC\_peak\_4}$	kW	2,44	6,29	8,54	10,85
maximum DC bus power at U_{LN_nenn}; $T_a \le T_{a\_work}$; t = 60 s; T = 5 min; K = 1,5; with mains choke10)	$P_{DC\_peak\_4}$	kW	-		12,20	16,87
DC bus power at U_{LN_nenn}; $T_a \le T_{a\_work}$; t = 60 s; T = 5 min; K = 1,5; without mains choke11)	$P_{DC\_base\_4}$	kW	1,62	4,19	5,70	7,23
DC bus power at U_{LN_nenn}; $T_a \le T_{a\_work}$; t = 60 s; T = 5 min; K = 1,5; with mains choke12)	$P_{DC\_base\_4}$	kW	-		8,14	11,25
maximum DC bus power at U_{LN_nenn}; $T_a \le T_{a\_work}$; t = 60 s; T = 10 min; K = 1.1; without mains choke13)	$P_{DC\_peak\_5}$	kW	2,19	5,42	7,41	9,50
maximum DC bus power at U_{LN_nenn}; $T_a \le T_{a\_work}$; t = 60 s; T = 10 min; K = 1.1; with mains choke14)	$P_{DC\_peak\_5}$	kW	-		10,59	14,78
DC bus power at U_{LN_nenn}; $T_a \le T_{a\_work}$; t = 60 s; T = 10 min; K = 1.1; without mains choke15)	$P_{DC\_base\_5}$	kW	1,99	4,93	6,74	8,64
DC bus power at U_{LN_nenn}; $T_a \le T_{a\_max}$; t = 60 s; T = 10 min; K = 1,1; with mains choke16)	$P_{DC\_base\_5}$	kW	-		9,63	13,44

1) 2) 3) 4) 5) 6) 7) 8) 9) 10) 11) 12) 13) 14) 15) 16) see definition profile UEL_P_e

Fig.5-33: HCS - Examples of allowed performance profiles

Performance Profile "UEL_P_e"

The following performance profiles have been defined for converters and inverters.

☞ Observe the allowed performance data P_{DC_peak} and P_{DC_base} in the corresponding performance profile of the supply unit or converter.

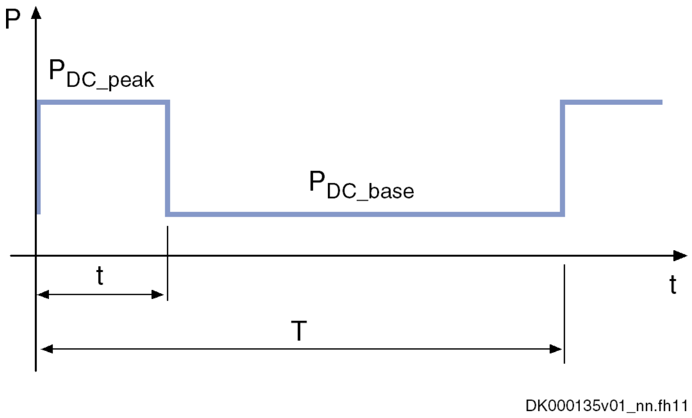
Profile	Explanation
performance profile “UEL_P_e” 	Characteristic of the selection of standard motors and servo drives.

Fig.5-34: Definition of performance profiles, infeeding supply units and converters

Operation With Standard Motors

General Information

Selecting Standard Motors

The tables below show the nominal powers P_{nenn} of standard motors which can be operated at the respective drive controller. The data are subject to the following conditions:

- motor design:

  4-pole standard motor (2 pole pairs) with rated voltage 3 AC 400 V, 50 Hz at mains voltage $U_{LN} \geq$ 3 AC 400 V or

  4-pole standard motor (2 pole pairs) with rated voltage 3 AC 460 V, 60 Hz at mains voltage $U_{LN} \geq$ 3 AC 460 V
- assigned mains choke is used
- operation at minimum switching frequency $f_s = f_s$ (min.)
- rotary field at output with $f_{out} > f_{out\_still}$
- ambient temperature $T_a \leq T_{a\_work}$
- overload ratio K = P_{DC_peak} / P_{DC_base} according to performance profile “UEL_P_e”
- type of mains connection: individual supply

When choosing standard motors for HMS/HMD, select an appropriate HMV supply unit. Observe the performance data P_{DC_peak} and P_{DC_base} in the performance profile “UEL_P_e” of the supply unit.

Operating Standard Motors at 3 AC 400 V

Selection of standard motors 3 AC 400V - Exemplary profiles

Description	Symbol	Unit	HCS02.1E-W0012-_-03	HCS02.1E-W0028-_-03	HCS02.1E-W0054-_-03	HCS02.1E-W0070-_-03
nominal power standard motor 3 AC 400 V; 50 Hz; t > 10 min; K = 1,0; f_s = 4 kHz$^{1)}$	P_{Nenn}	kW	1,50	4,00	7,50	11,00
nominal power standard motor 3 AC 400 V; 50 Hz; t = 60 s; T = 10 min; K = 1,1; f_s = 4 kHz$^{2)}$	P_{Nenn}	kW	1,50	4,00	7,50	11,00
nominal power standard motor 3 AC 400 V; 50 Hz; t = 60 s; T = 5 min; K = 1.5; f_s = 4 kHz$^{3)}$	P_{Nenn}	kW	1,10	4,00	5,50	11,00
nominal power standard motor 3 AC 400 V; 50 Hz; t = 2 s; T = 20 s; K = 2,0; f_s = 4 kHz$^{4)}$	P_{Nenn}	kW	1,10	3,00	5,50	7,50

1) 2) 3) 4) see definition profile UEL_P_e

Fig.5-35: HCS - Selection of standard motors 3 AC 400V - Exemplary profiles

Operating Standard Motors at 3 AC 460 V

Selection of standard motors 3 AC 460V - Exemplary profiles

Description	Symbol	Unit	HCS02.1E-W0012-_-03	HCS02.1E-W0028-_-03	HCS02.1E-W0054-_-03	HCS02.1E-W0070-_-03
nominal power standard motor 3AC460V; 60 Hz; t > 10 min; K = 1,0; f_s = 4 kHz$^{1)}$	P_{Nenn}	kW	1,50	5,50	11,00	15,00
nominal power standard motor 3AC460V; 60 Hz; t = 60 s; T = 10 min; K = 1,1; f_s = 4 kHz$^{2)}$	P_{Nenn}	kW	1,50	5,50	11,00	15,00
nominal power standard motor 3AC460V; 60 Hz; t = 60 s; T = 5 min; K = 1.5; f_s = 4 kHz$^{3)}$	P_{Nenn}	kW	1,10	5,50	7,50	15,00
nominal power standard motor 3AC460V; 60 Hz; t = 2 s; T = 20 s; K = 2,0; f_s = 4 kHz$^{4)}$	P_{Nenn}	kW	1,10	3,70	7,50	11,00

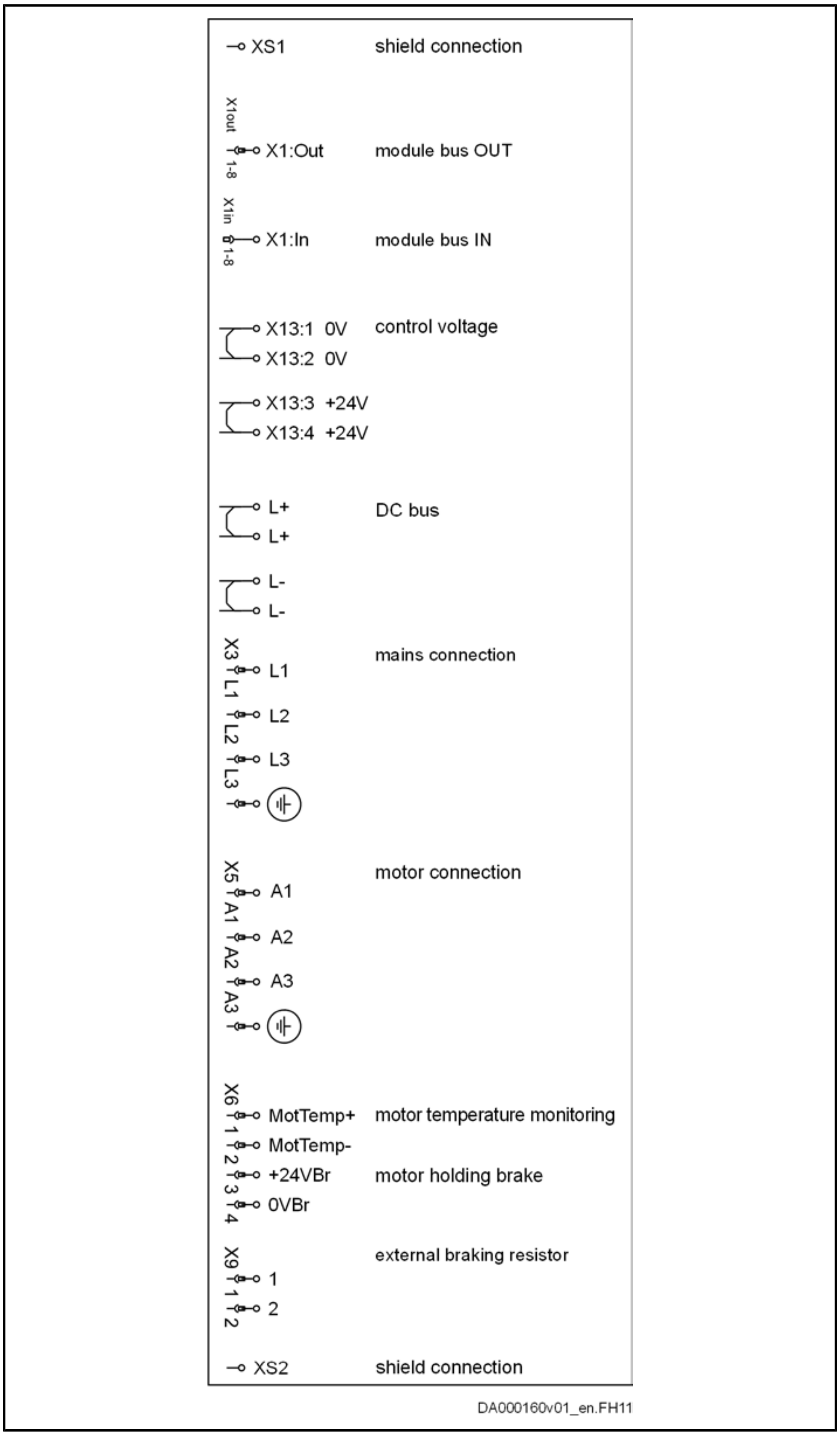
1) 2) 3) 4) see definition profile UEL_P_e; 1 kW ~ 1,36 hp

Fig.5-36: HCS - Selection of standard motors 3 AC 460V - Exemplary profiles

5.2.5 Connections and Interfaces

Overview

Overall Connection Diagram



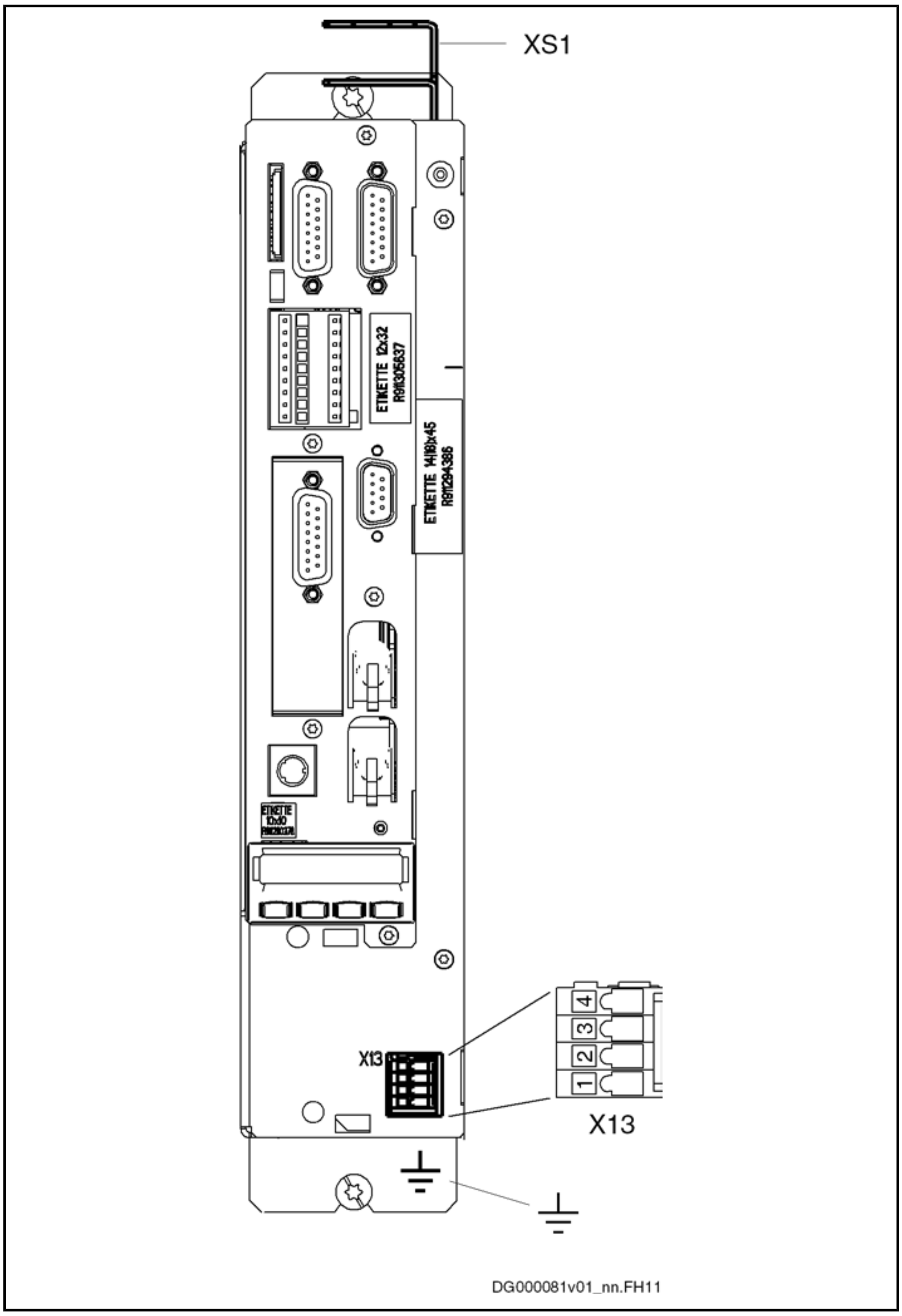
X1, L+/L-	not available for HCS02.1E-W0012
X9	not available for HCS02.1E-W0012 and –W0028

Fig.5-37: Overall connection diagram

☞ Apart from the indicated connections, it is necessary to wire the **Bb contact at the control section** for signaling the readiness for operation of the drive controller (see Project Planning Manual for Control Section).

Arrangement of the Connection Points

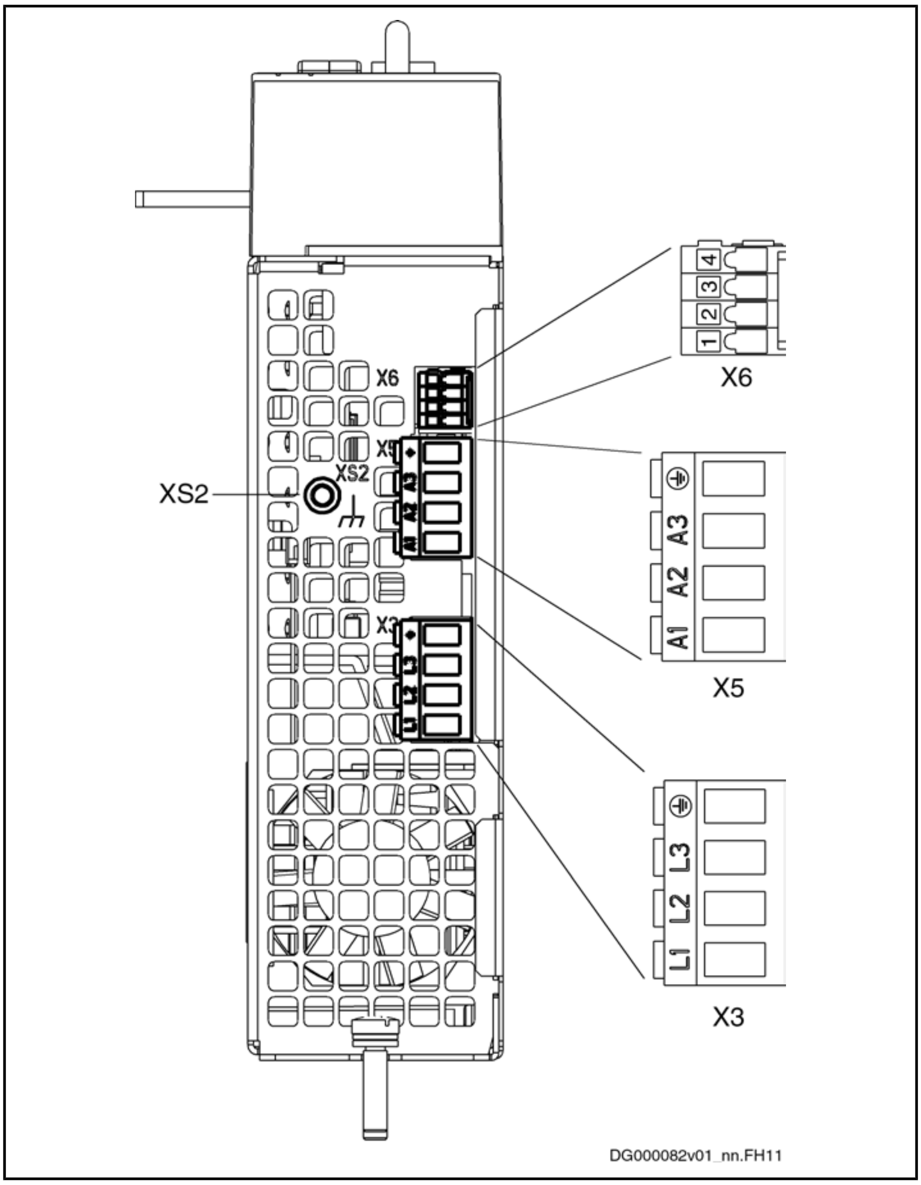
Connection points power section HCS02.1E-W0012 (front)



X13 control voltage
XS1 shield connection control lines

Fig.5-38: Connection points power section HCS02.1E-W0012 (front)

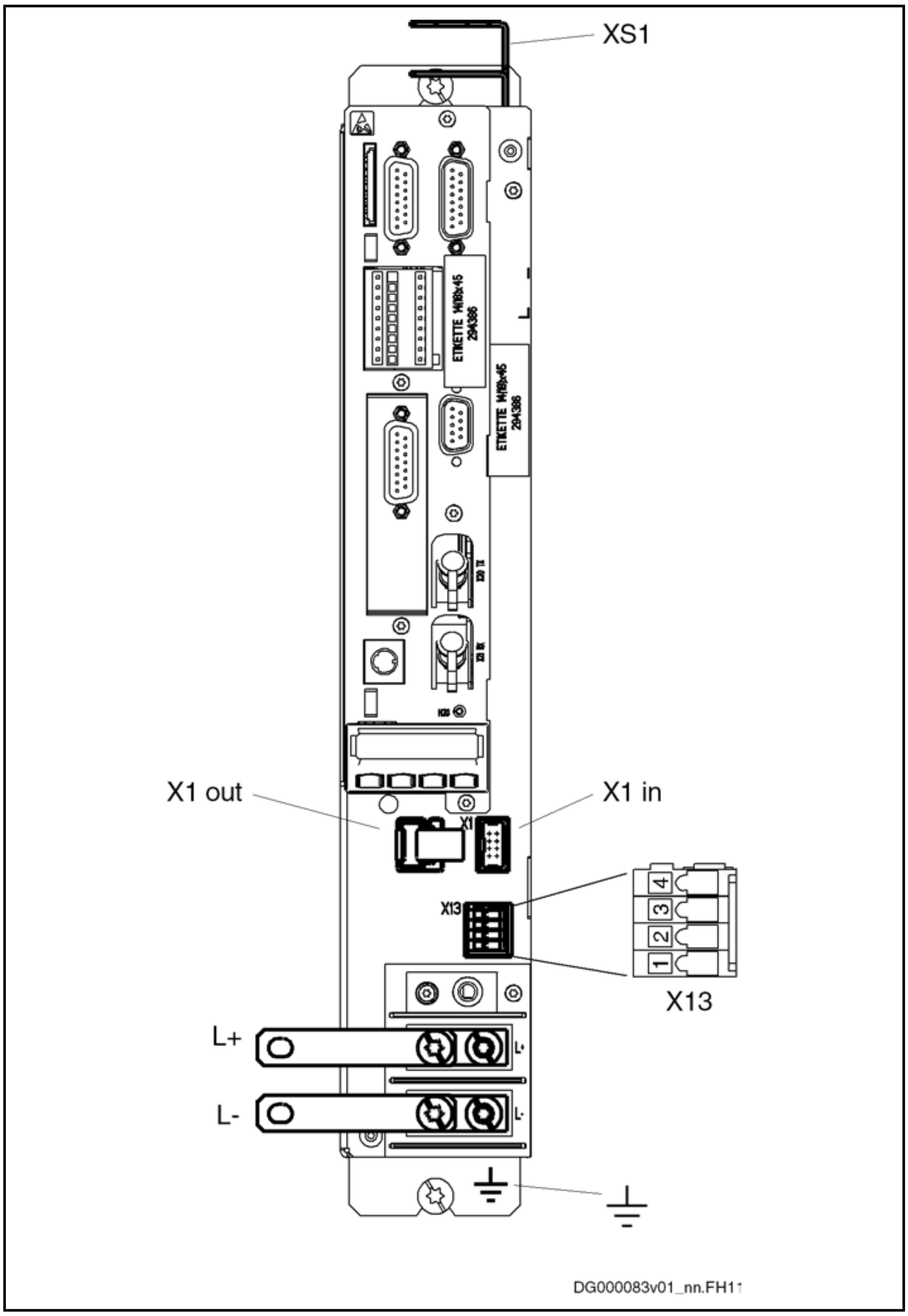
Connection points power section HCS02.1E-W0012 (bottom)



X3	mains connection
X5	motor connection
X6	motor temperature monitoring, motor holding brake
XS2	shield connection motor cable

Fig.5-39: *Connection points power section HCS02.1E-W0012 (bottom)*

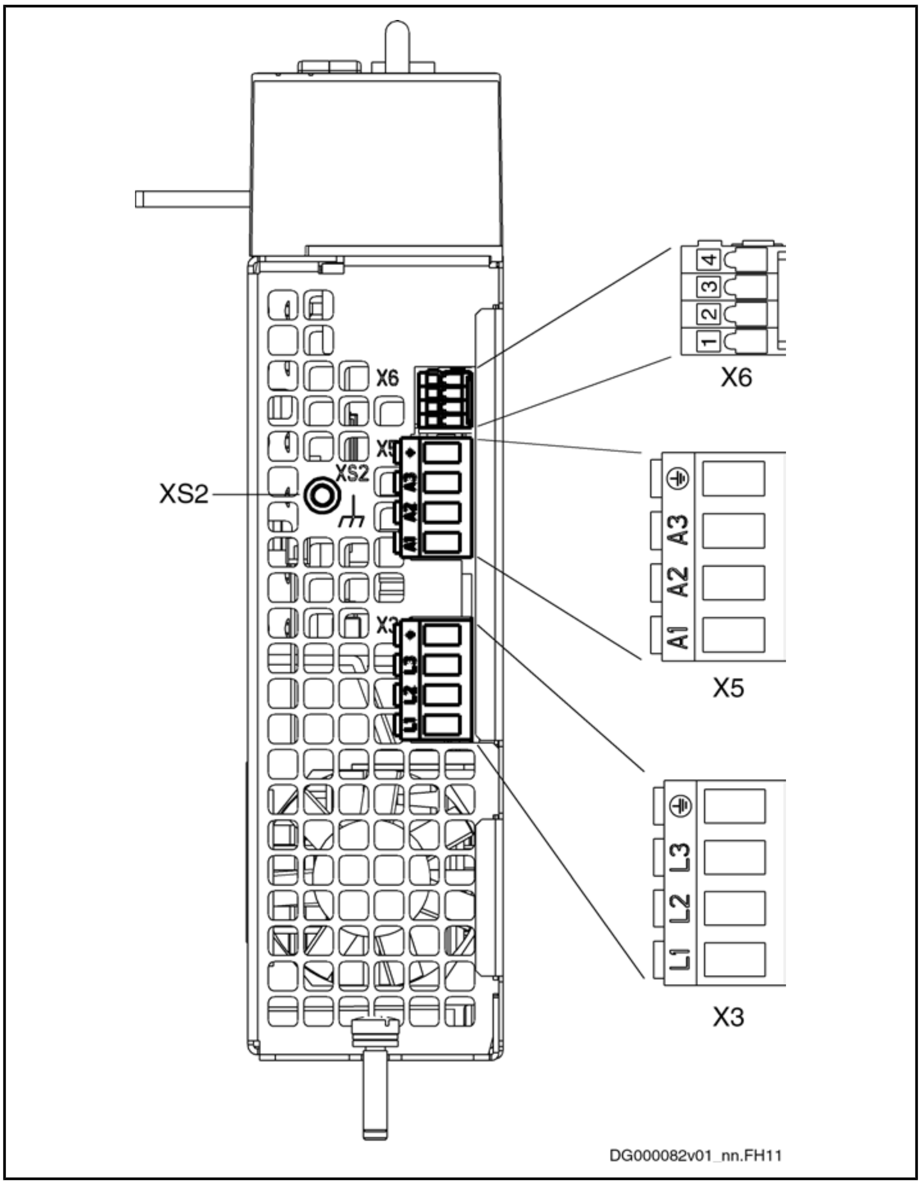
Connection points power sections HCS02.1E-W0028, -W0054, -W0070 (front)



X1	module bus
X13	control voltage
XS1	shield connection control lines
L+, L-	DC bus

Fig.5-40: Connection points power sections HCS02.1E-W0028, -W0054, -W0070 (front)

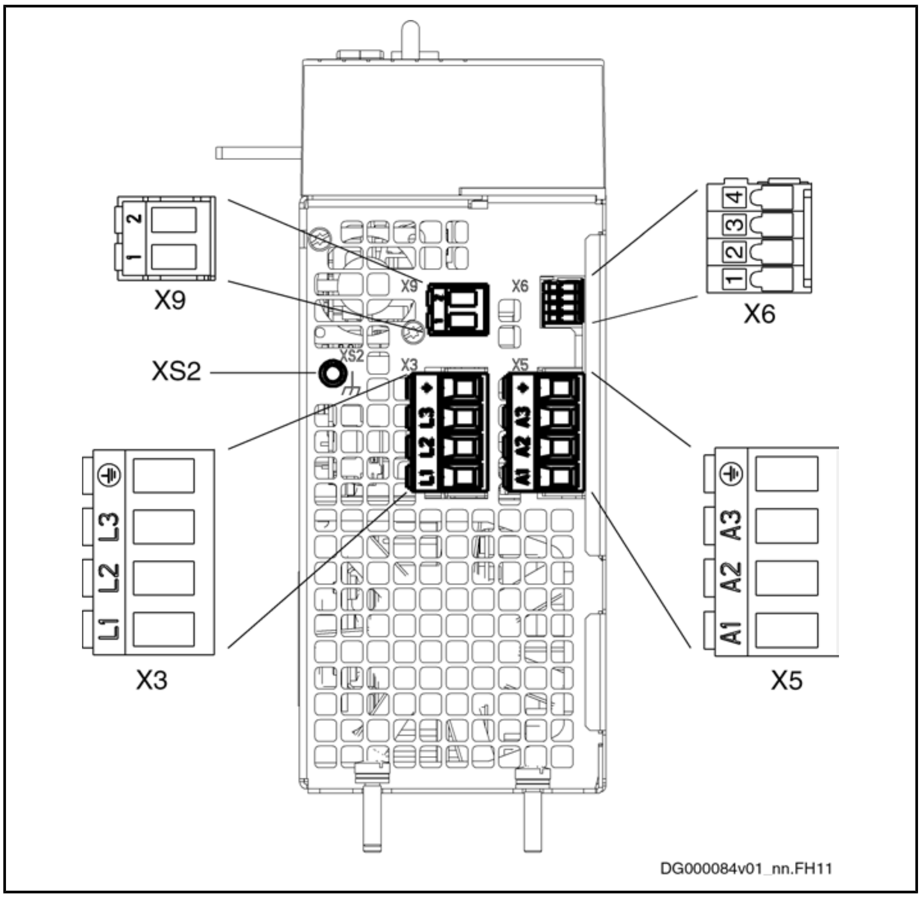
Connection points power section HCS02.1E-W0028 (bottom)



X3	mains connection
X5	motor connection
X6	motor temperature monitoring, motor holding brake
XS2	shield connection motor cable

Fig.5-41: *Connection points power section HCS02.1E-W0028 (bottom)*

Connection points power sections HCS02.1E-W0054, -W0070 (bottom)



X3	mains connection
X5	motor connection
X6	motor temperature monitoring, motor holding brake
X9	external braking resistor
XS2	shield connection motor cable

Fig.5-42: Connection points power sections HCS02.1E-W0054, -W0070 (bottom)

DANGER

Lethal electric shock caused by live parts with more than 50 V!

Via the connection X3 (mains connection), connect the drive controller to the equipment grounding conductor system.

Description of the Connection Points

The connection points are described in detail in chapter 8 Functions and Electrical Connection Points , page 241.

Touch Guard

The touch guard is described in detail in chapter 9 Touch Guard at Devices , page 291.

5.3 HCS03 Power Sections

5.3.1 Brief Description, Usage and Structure

Brief Description

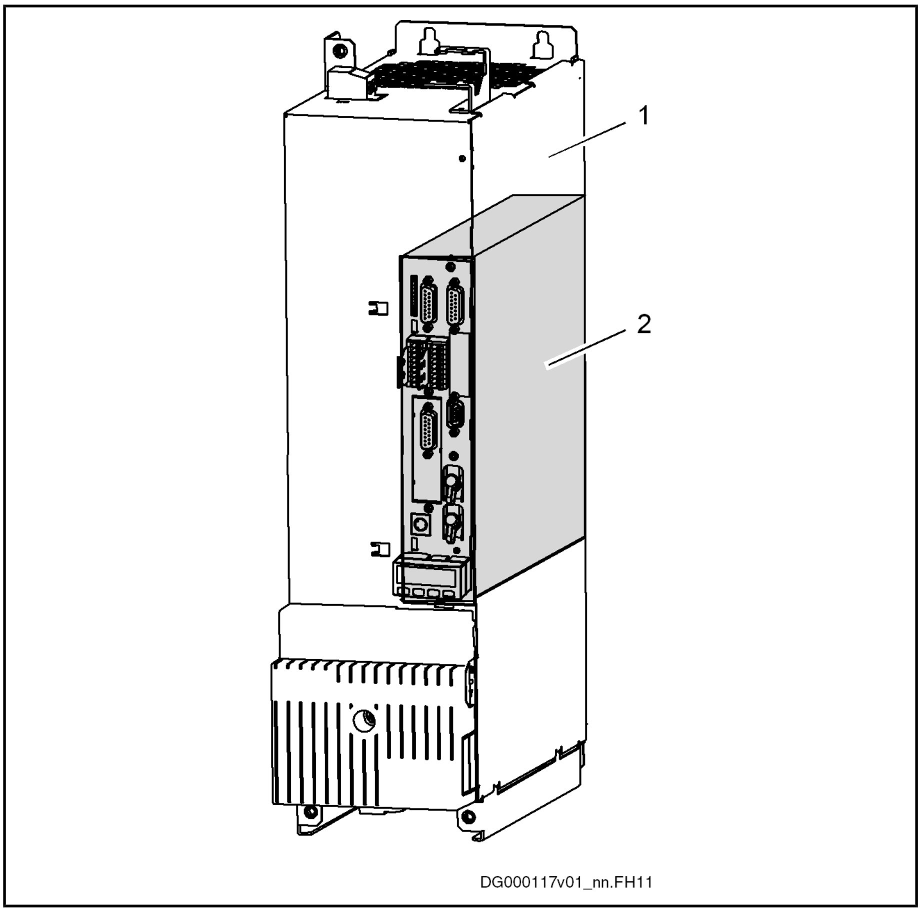
The compact converters HCS03 are part of the Rexroth IndraDrive C product range and are used to operate single axes.

Usage

Type	Usage
HCS03.1E-Wxxxx-NNNV HCS03.1E-Wxxxx-NNBV	Operation of a three-phase a.c. motor (asynchronous or synchronous motor).
HCS03.1E-Wxxxx-LNNV HCS03.1E-Wxxxx-LNBV blower control depending on load	Applications with operation at partial load and requirement of a low degree of noise development.

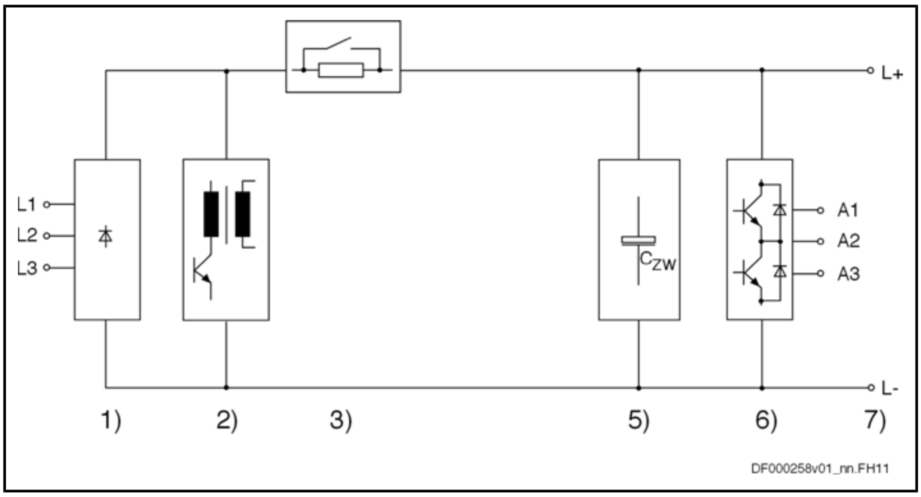
Fig.5-43: *Usage of HCS03*

Structure, Block Diagrams



1 power section
2 control section
Fig.5-44: *Basic structure of the drive controller*

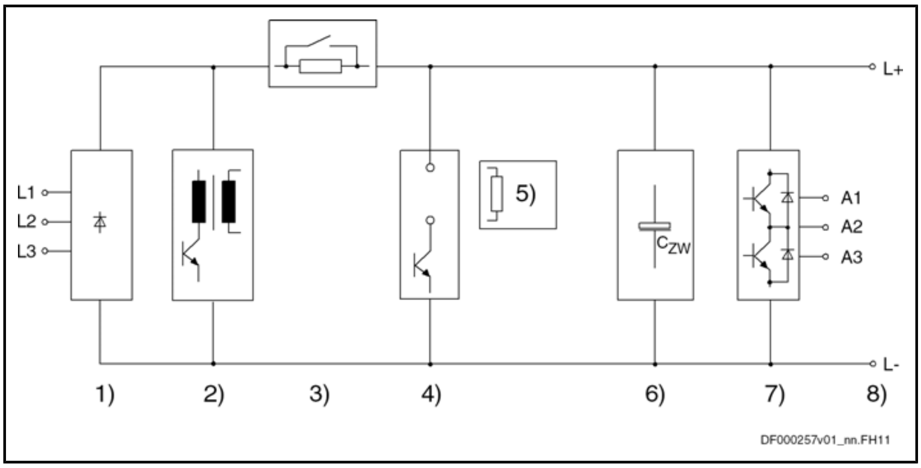
HCS03.1E-…-NNNV; -LNxV



1)	mains input with rectifier
2)	integrated control voltage supply
3)	charging current limitation, for -W0210 with thyristors
5)	DC bus capacitances
6)	inverter stage with output to motor
7)	DC bus connection

Fig.5-45: *HCS03.1E-…-NNNV - block diagram*

HCS03.1E-…-NNBV; -LNBV



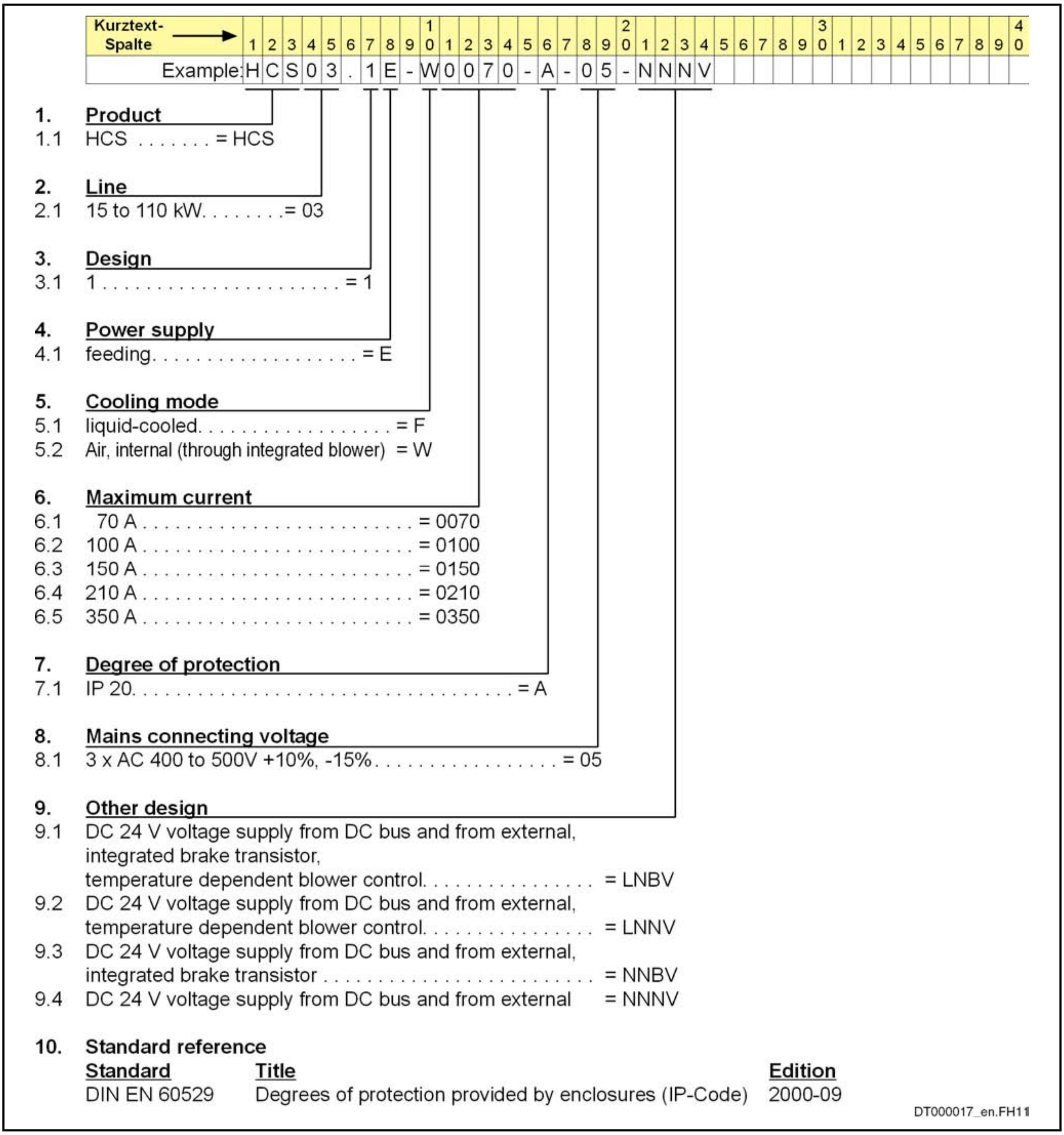
1)	mains input with rectifier
2)	integrated control voltage supply
3)	charging current limitation, for -W0210 with thyristors
4)	optional braking transistor
5)	optional external braking resistor
6)	DC bus capacitances
7)	inverter stage with output to motor
8)	DC bus connection

Fig.5-46: *HCS03.1E-…-NNBV - block diagram*

5.3.2 Type Code and Identification

Type Code

☞ The following figure illustrates the basic structure of the type code. Our sales representative will help you with the current status of available versions.



Kurztext-Spalte	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1	2	3	4	5	6	7	8	9	40
Example:	H	C	S	0	3	.	1	E	-	W	0	0	7	0	-	A	-	0	5	-	N	N	N	V																

1. **Product**
1.1 HCS .... = HCS

2. **Line**
2.1 15 to 110 kW........= 03

3. **Design**
3.1 1 .... = 1

4. **Power supply**
4.1 feeding.................. = E

5. **Cooling mode**
5.1 liquid-cooled.................. = F
5.2 Air, internal (through integrated blower) = W

6. **Maximum current**
6.1 70 A .... = 0070
6.2 100 A .... = 0100
6.3 150 A .... = 0150
6.4 210 A .... = 0210
6.5 350 A .... = 0350

7. **Degree of protection**
7.1 IP 20.................................. = A

8. **Mains connecting voltage**
8.1 3 x AC 400 to 500V +10%, -15%................. = 05

9. **Other design**
9.1 DC 24 V voltage supply from DC bus and from external, integrated brake transistor, temperature dependent blower control................ = LNBV
9.2 DC 24 V voltage supply from DC bus and from external, temperature dependent blower control................ = LNNV
9.3 DC 24 V voltage supply from DC bus and from external, integrated brake transistor .... = NNBV
9.4 DC 24 V voltage supply from DC bus and from external = NNNV

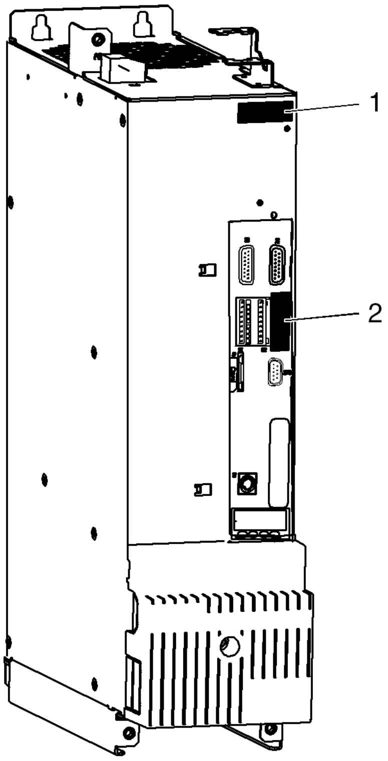
10. **Standard reference**

Standard	Title	Edition
DIN EN 60529	Degrees of protection provided by enclosures (IP-Code)	2000-09

Fig.5-47: Type code HCS03.1

Identification

Type Plate Arrangement



DG000100v01_nn.FH11

1	power section type plate
2	control section type plate

Fig.5-48: Type plate arrangement

Type Plate

DG000080v01_nn.FH11

1	device type
2	part number
3	serial number
4	bar code
5	country of manufacture
6	production week, 04W12 meaning year 2004, week 12
7	hardware index

Fig.5-49: Type plate - power section (example of an HCS02 power section)

5.3.3 Scope of Supply

The scope of supply of the HCS03 power section includes:

- 1 × touch guard
- 1 × connector X3 (only for design W0070)

- 1 × connector X5 (only for design W0070)
- 1 × connector X6
- 1 × connector X9 (for order codes -xxBx)
- 1 × brochure with safety instructions (in 5 languages)

5.3.4 Technical Data

Ambient and Operating Conditions

General Information

Conditions for transport and storage: see chapter 4.2 Transport and Storage, page 19.

Installation conditions: see chapter 4.3 Installation Conditions , page 19.

This chapter contains:

- limit values for use in the scope of C-UL
- applied standards (CE conformity, UL listing)

UL Data

Ambient and operating conditions - UL ratings

Description	Symbol	Unit	HCS03.1E-W0070-_-05	HCS03.1E-W0100-_-05	HCS03.1E-W0150-_-05	HCS03.1E-W0210-_-05
Suitable for use on a circuit capable of delivering not more than this SCCR, symmetrical amperes (UL) 1)	I_{SCCR}	A rms	42000			
rated input voltage, power (UL)2)	U_{LN_nenn}	V	400...500			
rated input current (UL)3)	I_{L_cont}	A	50,0	80,0	106,0	146,0
maximum output voltage (UL)	U_{out}	V	480			
maximum output current (UL)	I_{out_max}	A	45,0	75,0	95,0	145,0

1) 600 V AC or less, use listed AC input line fuses or listed circuit breakers
2) HMS, HMD, HLB, HLC, KCU: DC bus L+, L-; HMV, HCS: mains input L1, L2, L3
3) at PDC_cont

Fig.5-50: HCS - Ambient and operating conditions - UL ratings

Information on Standards

Applied standards

Description	Symbol	Unit	HCS03.1E-W0070-_-05	HCS03.1E-W0100-_-05	HCS03.1E-W0150-_-05	HCS03.1E-W0210-_-05
listing according to UL standard (UL)			UL 508 C			
UL files (UL)			E 227957			
listing according to CSA standard (UL)			Canadian National Standard(s) C22.2 No. 14-05			

Fig.5-51: HCS - Applied standards

Mechanical System and Mounting

Dimensional Drawings

Dimensional drawing HCS03.1E-W0070

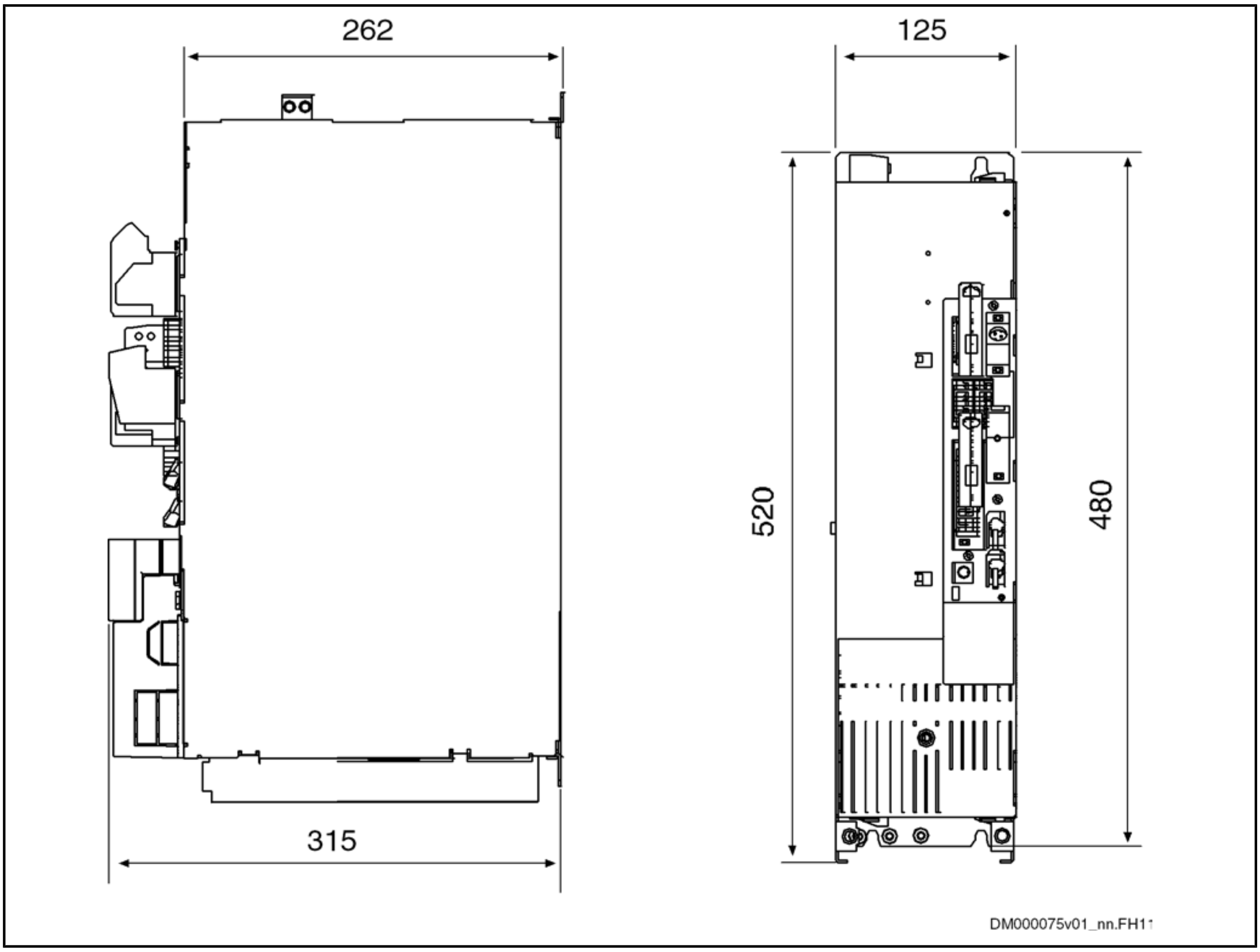


Fig.5-52: Dimensional drawing HCS03.1E-W0070

Dimensional drawing HCS03.1E-W0070 with HAS02

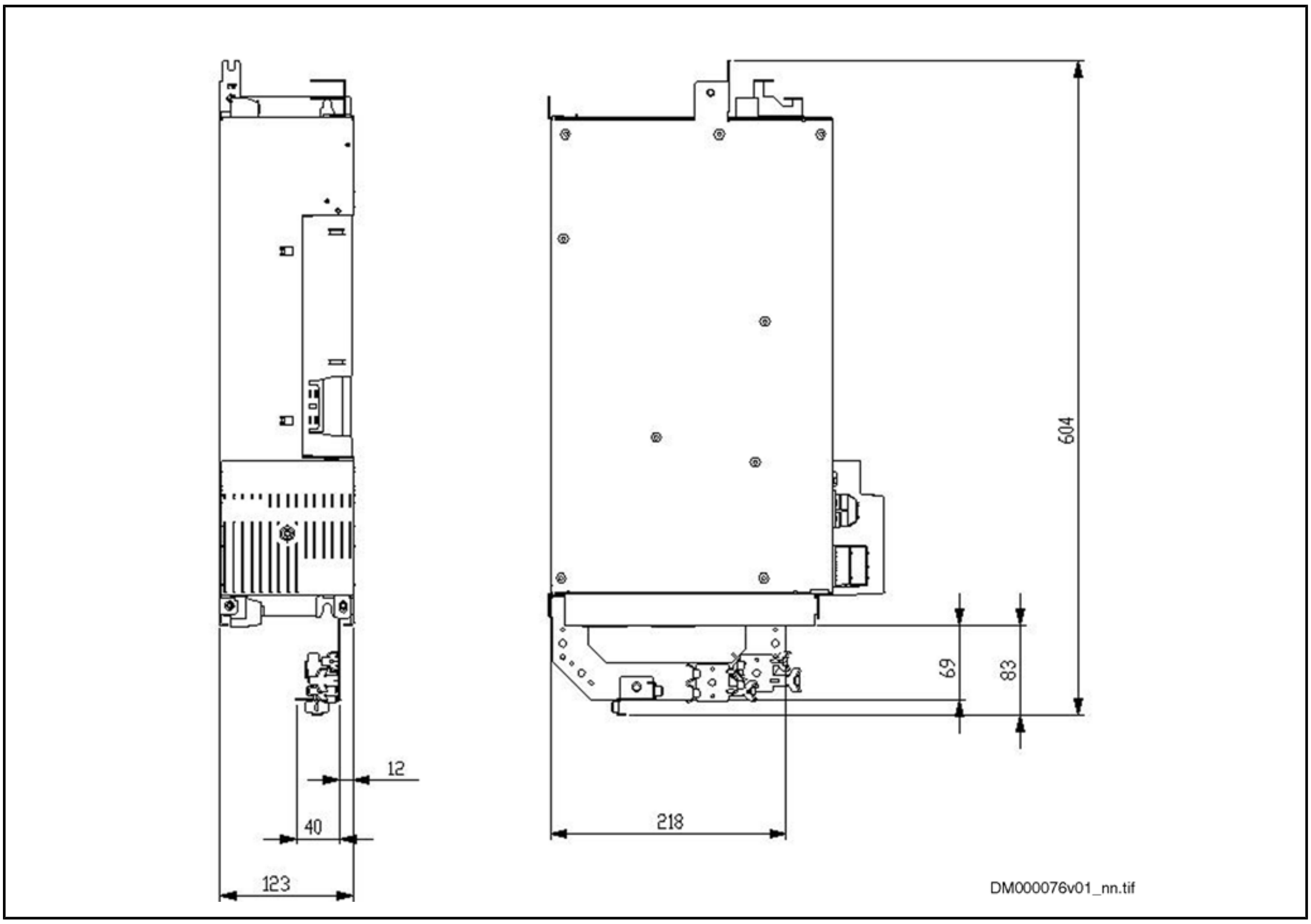


Fig.5-53: Dimensional drawing HCS03.1E-W0070 with HAS02

Dimensional drawing HCS03.1E-W0100 and HCS03.1E-W150

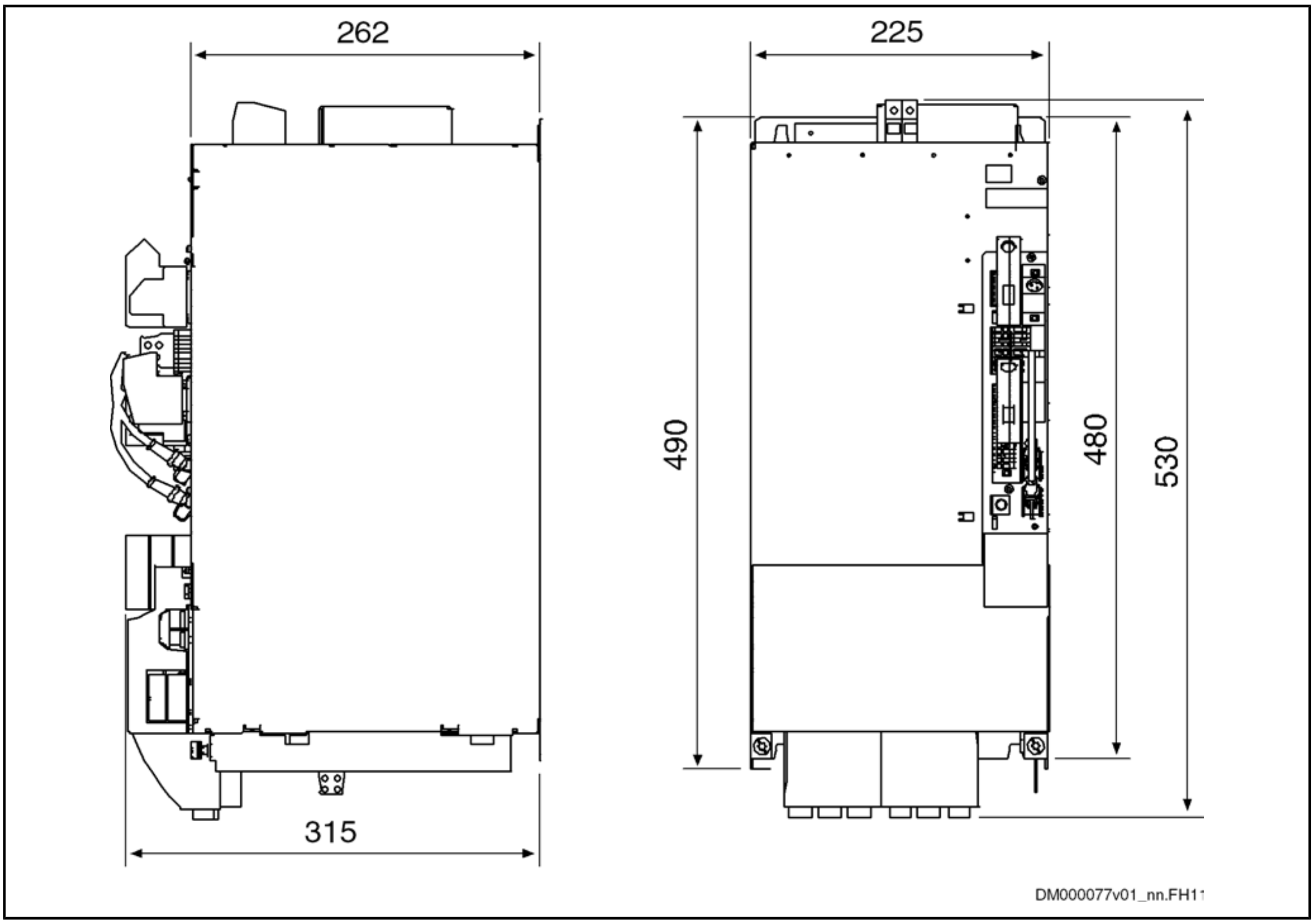


Fig.5-54: Dimensional drawing HCS03.1E-W0100 and HCS03.1E-W150

Dimensional drawing HCS03.1E-W0100 and HCS03.1E-W150 with HAS02

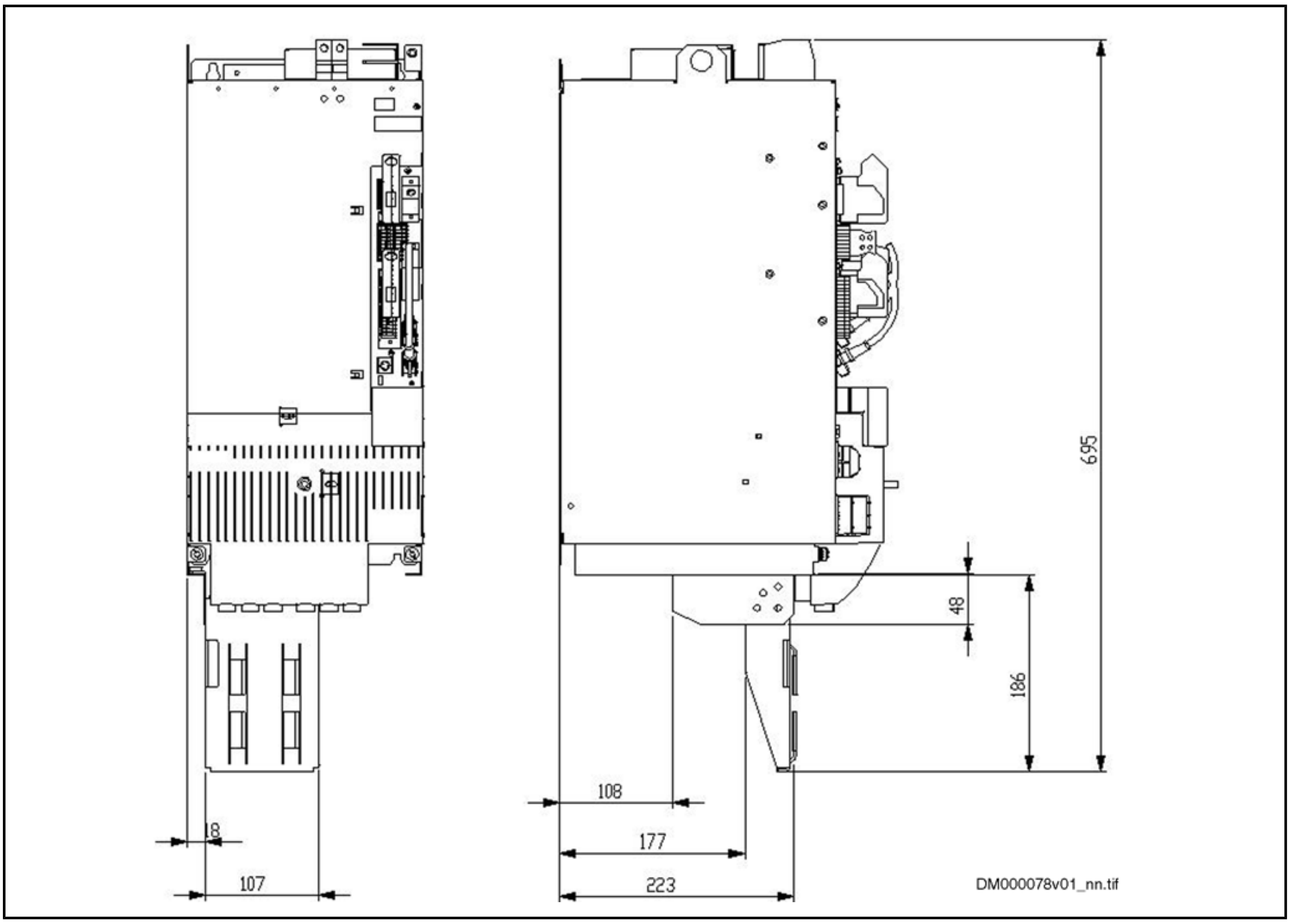


Fig.5-55: Dimensional drawing HCS03.1E-W0100 and HCS03.1E-W150 with HAS02

Dimensional drawing HCS03.1E-W0210

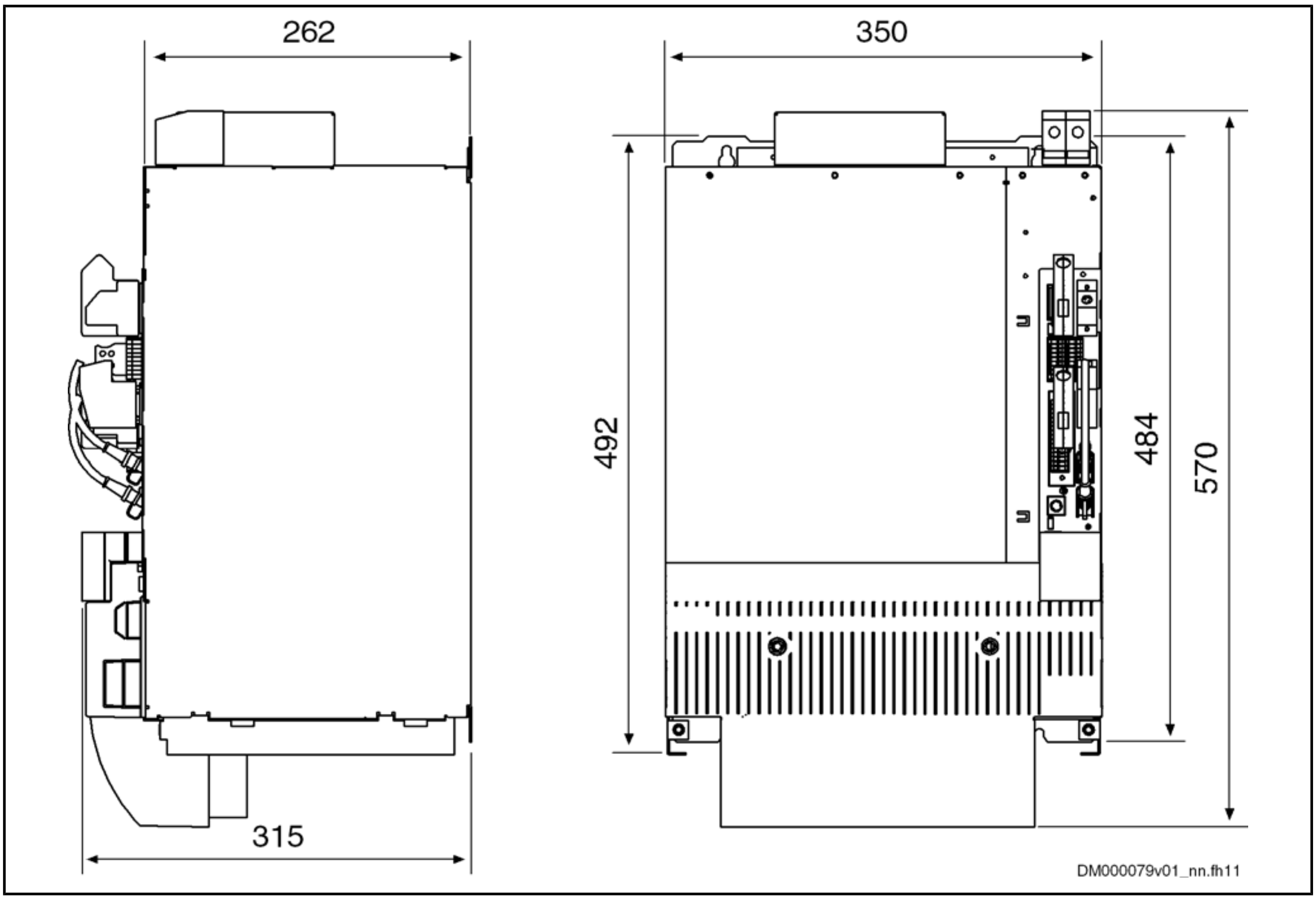


Fig.5-56: Dimensional drawing HCS03.1E-W0210

Dimensional drawing HCS03.1E-W0210 with HAS02

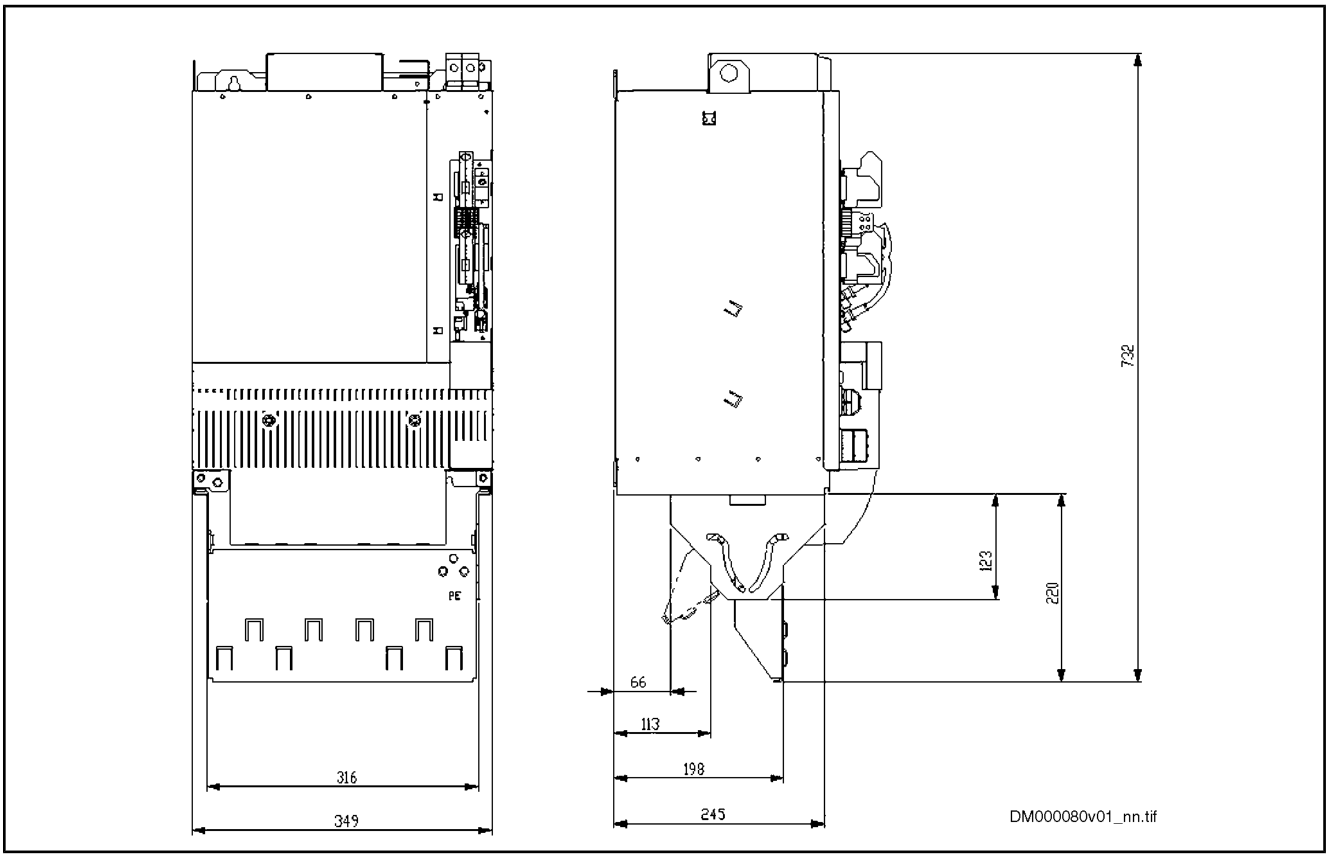


Fig.5-57: Dimensional drawing HCS03.1E-W0210 with HAS02

Boring dimensions HCS03.1E-W0070

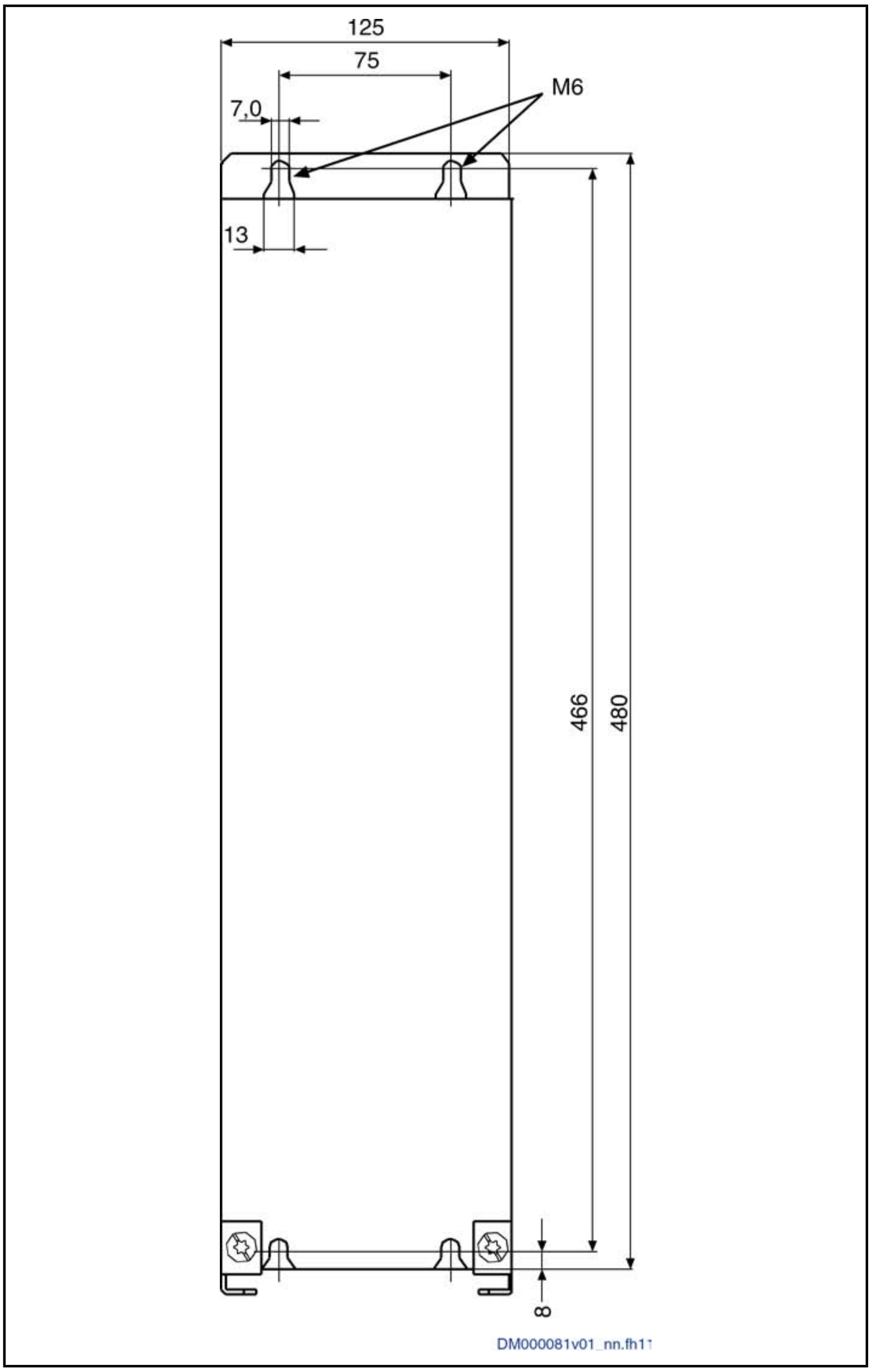


Fig.5-58: Boring dimensions HCS03.1E-W0070

Boring dimensions HCS03.1E-W0100 and HCS03.1-W0150

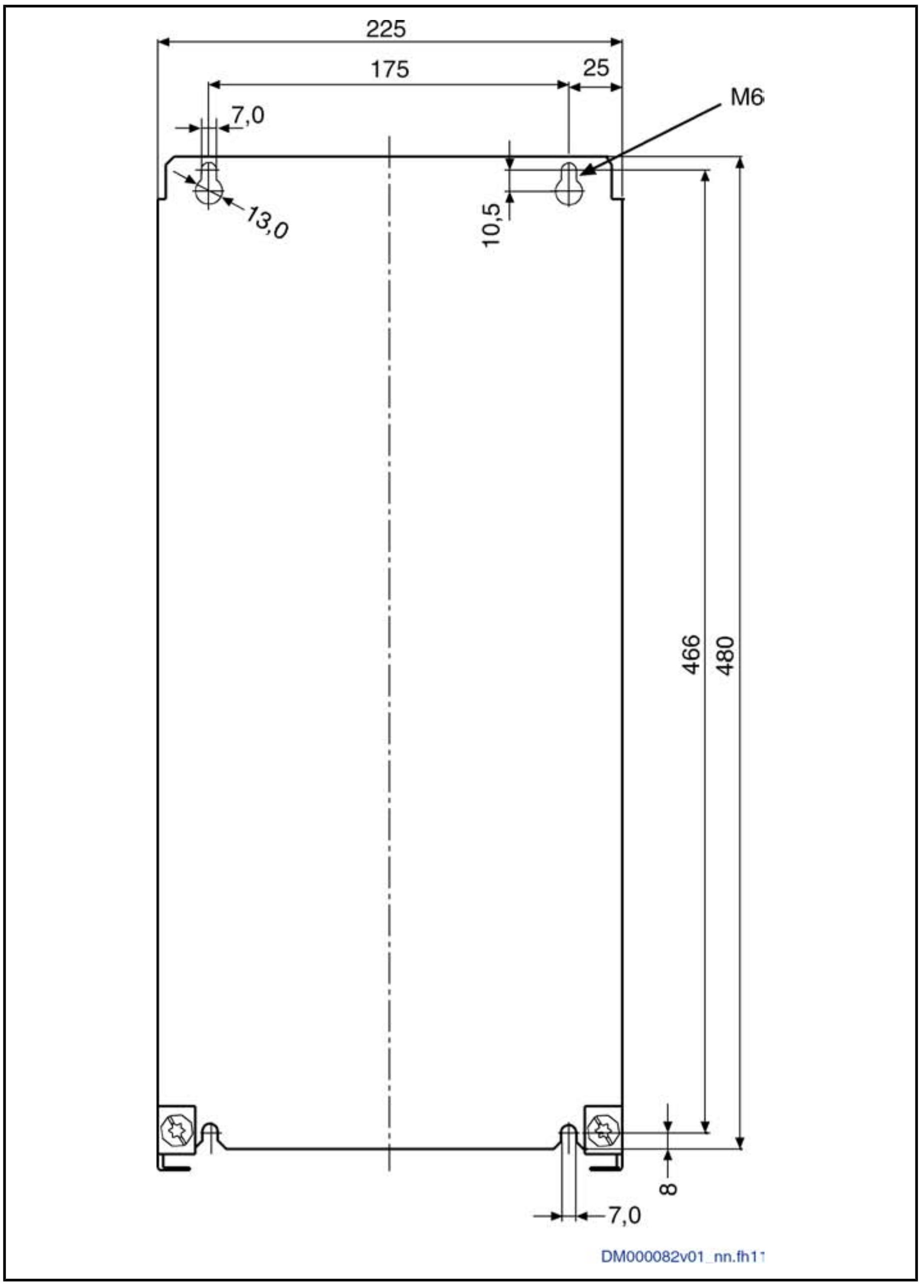


Fig.5-59: Boring dimensions HCS03.1E-W0100 and HCS03.1-W0150

Boring dimensions HCS03.1E-W0210

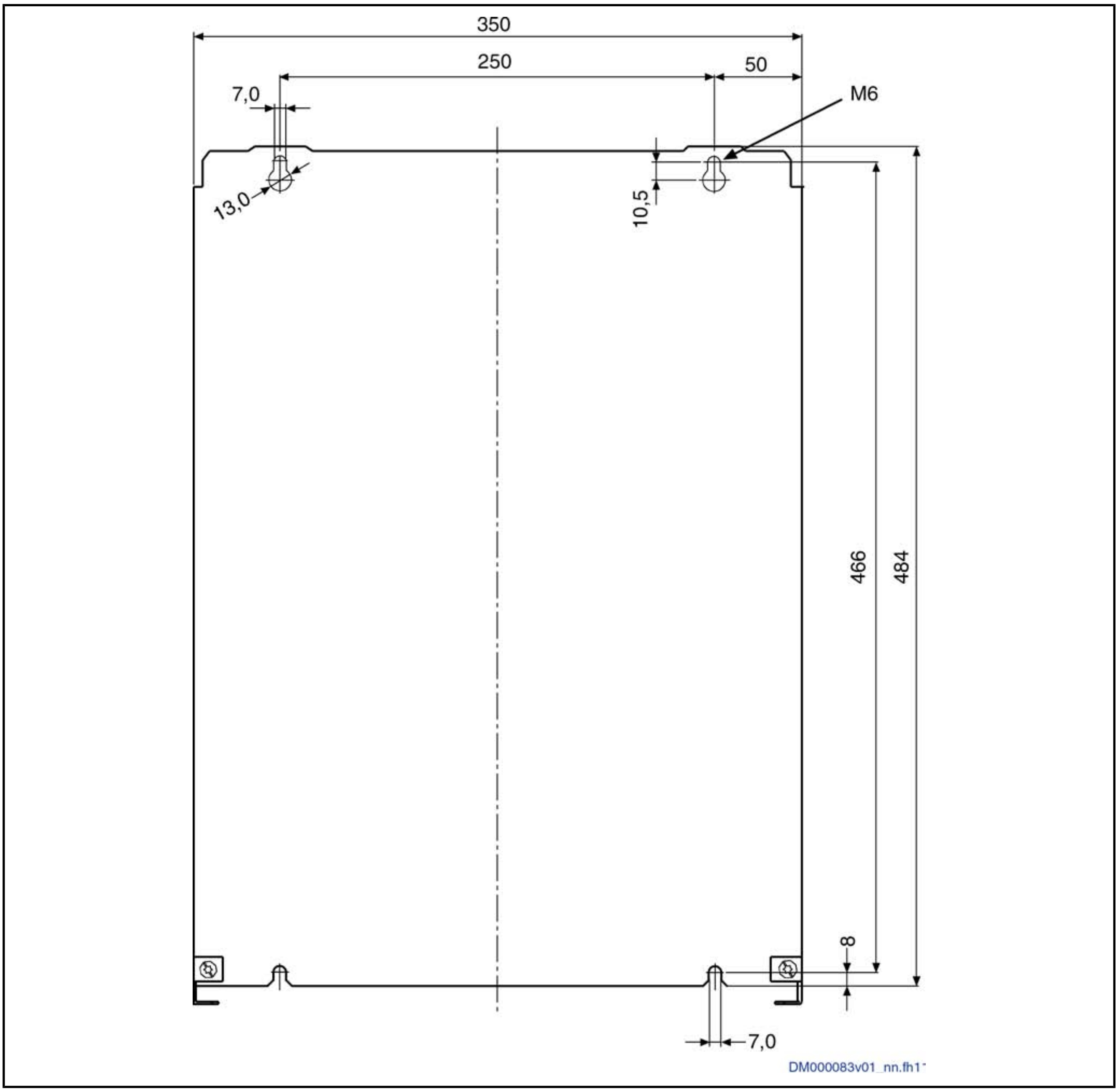


Fig.5-60: Boring dimensions HCS03.1E-W0210

Dimensions, Mass, Insulation, Sound Pressure Level

Data for mass, dimensions, sound pressure level, insulation

Description	Symbol	Unit	HCS03.1E-W0070-_-05	HCS03.1E-W0100-_-05	HCS03.1E-W0150-_-05	HCS03.1E-W0210-_-05
weight	m	kg	13,00	20,00		38,00
device height (UL)$^{1)}$	H	mm	490			
device depth (UL)$^{2)}$	T	mm	262			
device width (UL)$^{3)}$	B	mm	125	225		350

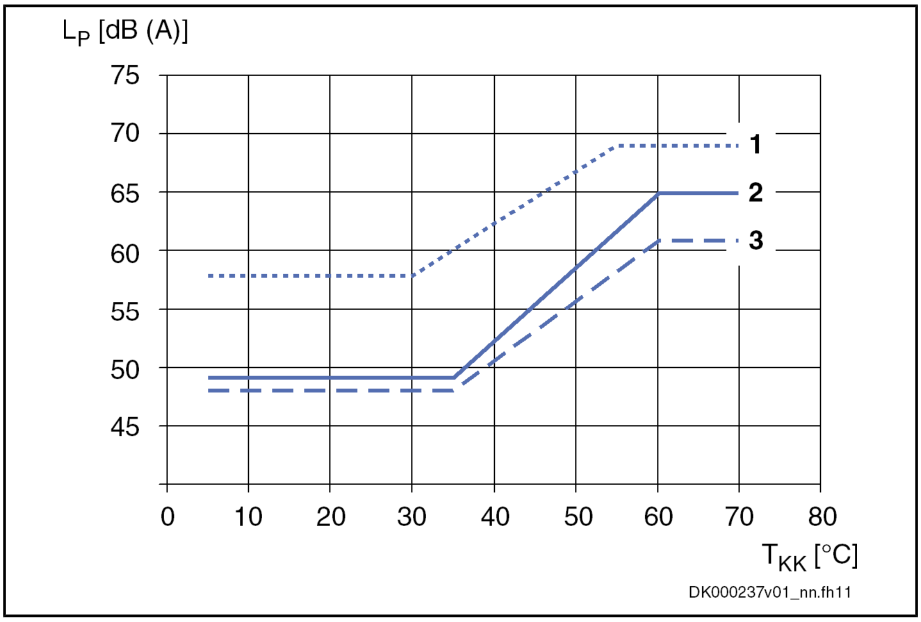
Description	Symbol	Unit	HCS03.1E-W0070-_-05	HCS03.1E-W0100-_-05	HCS03.1E-W0150-_-05	HCS03.1E-W0210-_-05
insulation resistance at DC 500 V	R_{is}	MOhm	11,00			
capacitance against housing	C_Y	nF	2 x 100			
average sound pressure level (accuracy class 2) at P_{DC_cont} 4)	L_P	dB (A)	65	61		69

1) 2) 3)	housing dimension; see also related dimensional drawing
4)	according to DIN EN ISO 11205; comparative value at distance 1 m, out of cabinet; HCS types with order code -L***: load-dependent

Fig.5-61: *HCS - Data for mass, dimensions, sound pressure level, insulation*

Blower Control Depending on Temperature, Sound Pressure Level

Devices of the order code -L*** control the internal blower of the cooling system depending on the temperature of the cooling system. As the load increases, the temperature at the heat sink rises and thereby the sound pressure level (see characteristic below). The specified “average sound pressure level L_P” applies to operation under rated conditions.



T_{KK}	temperature at heat sink
L_p	average sound pressure level
1	HCS03.1E-W0210-…-L***
2	HCS03.1E-W0070-…-L***
3	HCS03.1E-W0100/W0150-…-L***

Fig.5-62: *Sound pressure level of HCS03.1E-…-L*** devices*

Power Dissipation, Mounting Position, Cooling, Distances

Data for cooling and power dissipation

Description	Symbol	Unit	HCS03.1E-W0070-_-05	HCS03.1E-W0100-_-05	HCS03.1E-W0150-_-05	HCS03.1E-W0210-_-05
ambient temperature range during operation with nominal data	T_{a_work}	°C	0...40			
ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	0...55			

Description	Symbol	Unit	HCS03.1E-W0070-_-05	HCS03.1E-W0100-_-05	HCS03.1E-W0150-_-05	HCS03.1E-W0210-_-05
derating of P_{DC_cont}; P_{BD}; I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2,0			
allowed mounting position			G1			
cooling type			forced ventilation			
volumetric capacity of forced cooling	V	m^3/h	265,00	367,00		780,00
allowed switching frequencies[1]	f_s	kHz	4, 8, 12, 16			
power dissipation at I_{out_cont} = 0 A; $f_s = f_s$ (min.)[2]	$P_{Diss\_0A\_fsmin}$	W	240	290	350	600
power dissipation at I_{out_cont} = 0 A; $f_s = f_s$ (max.)[3]	$P_{Diss\_0A\_fsmax}$	W	630	750	900	1600
power dissipation at continuous current and continuous DC bus power respectively (UL)[4]	P_{Diss_cont}	W	800,00	950,00	1150,00	2000,00
minimum distance on the top of the device[5]	d_{top}	mm	80			
minimum distance on the bottom of the device[6]	d_{bot}	mm	100			
temperature rise with minimum distances d_{bot}; d_{top}; P_{BD}	ΔT	K	30			

1) also depending on firmware and control section; see Parameter Description "P-0-0001, Switching frequency of the power output stage"; see "P-0-4058, Amplifier type data"

2) 3) plus dissipation of braking resistor (at HMV, HCS) and control section (at HMx, HCS); find interim values by interpolation to P_Diss_cont

4) HMV, HCS: plus dissipation of braking resistor, control section; KSM: plus rated power consumption control voltage input

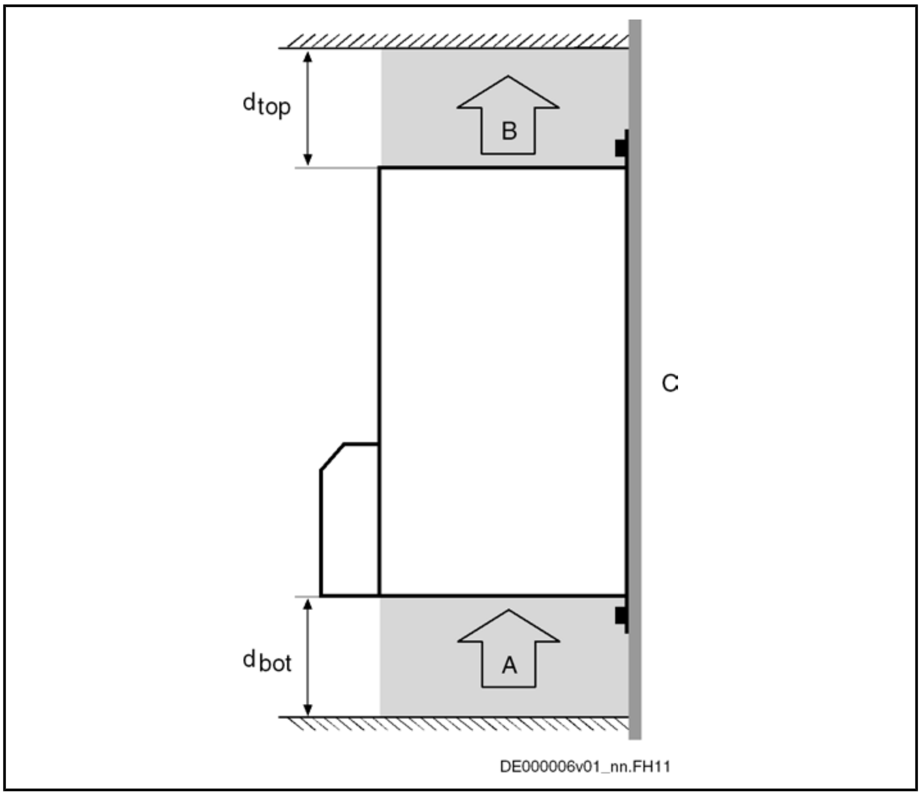
5) 6) see fig. "Air intake and air outlet at drive controller"

Fig.5-63: HCS - Data for cooling and power dissipation

⚠ CAUTION

Property damage due to temperatures higher than 105 °C!

Comply with indicated minimum distances!



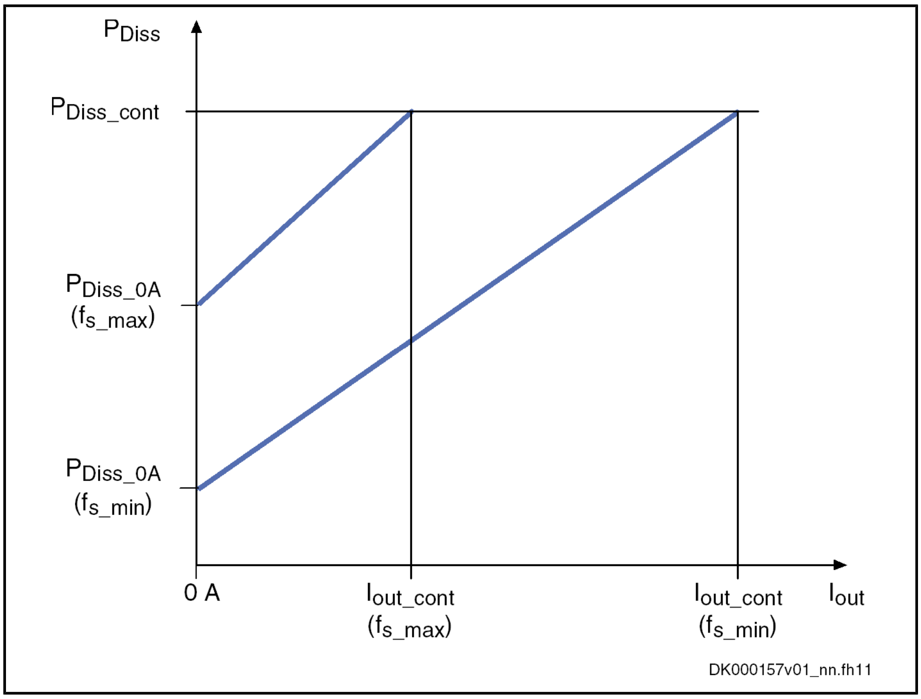
A	air intake
B	air outlet
C	mounting surface in control cabinet
d_{top}	distance top
d_{bot}	distance bottom

Fig.5-64: *Air intake and air outlet at drive controller*

Power Dissipation vs. Output Current

The figure below illustrates the connection between power dissipation and output current, depending on the switching frequency f_s which was set at the drive controller. See also Parameter Description "P-0-0001, Switching frequency of the power output stage".

☞ In addition, take the power at the braking resistor and the power consumption of the control section into account. Both powers are not contained in the figure.



I_{out}	output current
P_{Diss}	power dissipation
f_s	switching frequency

Fig.5-65: Power dissipation vs. output current

Basic Data Power Section HCS03

General Information

This chapter contains:

- data for control voltage supply
- data for mains voltage supply
- data of DC bus
- data of built-in braking resistor and requirements on an external braking resistor
- data of inverter
- data for cooling and power dissipation

☞ The order of the data tables below follows the energy flow in the drive controller – from mains connection to motor output.

Control Voltage

Data for control voltage supply

Description	Symbol	Unit	HCS03.1E-W0070-_-05	HCS03.1E-W0100-_-05	HCS03.1E-W0150-_-05	HCS03.1E-W0210-_-05
rated control voltage input (UL)[1]	U_{N3}	V	24 ± 20 %			
control voltage when using motor holding brake with motor cable length < 50 m[2]	U_{N3}	V	24 ± 5 %			

Description	**Symbol**	**Unit**	**HCS03.1E-W0070-_-05**	**HCS03.1E-W0100-_-05**	**HCS03.1E-W0150-_-05**	**HCS03.1E-W0210-_-05**
control voltage when using motor holding brake with motor cable length > 50 m[3)	U_{N3}	V	26 ± 5 %			
maximum allowed voltage for 1 m	U_{N3_max}	V	33,00			
maximum inrush current at 24V supply	I_{EIN3_max}	A	2,80			
pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	5			
input capacitance	C_{N3}	mF	0,56			
rated power consumption control voltage input at U_{N3} (UL)[4)	P_{N3}	W	22	25		30

1) 2) 3) observe supply voltage for motor holding brakes

4) HMS, HMD, HCS: plus holding brake and control section; KCU01: at max. number of axes; KSM01: plus holding brake (UN x IN)

Fig.5-66: HCS - Data for control voltage supply

Mains Voltage

Data for mains voltage supply

Description	**Symbol**	**Unit**	**HCS03.1E-W0070-_-05**	**HCS03.1E-W0100-_-05**	**HCS03.1E-W0150-_-05**	**HCS03.1E-W0210-_-05**
input frequency (UL)	f_{LN}	Hz	50...60			
tolerance input frequency (UL)		Hz	± 2			
maximum allowed mains frequency change	$\Delta f_{LN}/\Delta t$	Hz/s	-			
rotary field condition			none			
Suitable for use on a circuit capable of delivering not more than this SCCR, symmetrical amperes (UL) [1)	I_{SCCR}	A rms	42000			
nominal mains voltage	U_{LN_nenn}	V	3 AC 400			
mains voltage single-phase	U_{LN}	V	-			
mains voltage three-phase at TN S, TN C, TT mains	U_{LN}	V	400...500			
mains voltage three-phase at IT mains[2)	U_{LN}	V	400...500			
mains voltage three-phase at Corner-grounded-Delta mains[3)	U_{LN}	V	400...500			
tolerance U_{LN} (UL)		%	± 10			
minimum inductance of the mains supply (inductance of mains phase)[4)	L_{min}	µH	40			

Power Sections for Converters - IndraDrive C

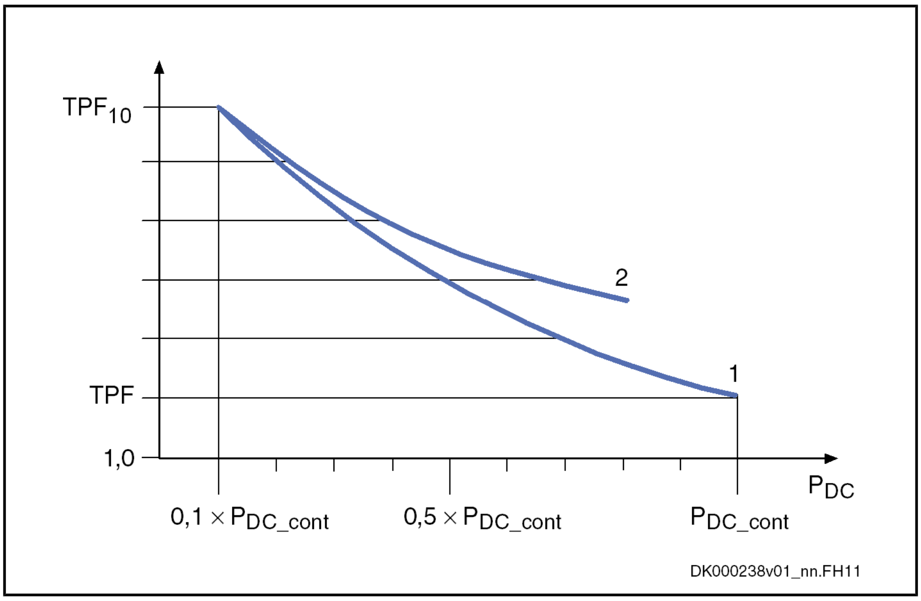
Description	Symbol	Unit	HCS03.1E-W0070-_-05	HCS03.1E-W0100-_-05	HCS03.1E-W0150-_-05	HCS03.1E-W0210-_-05
assigned type of mains choke			HNL01.1E-0571-N0050-A-500-NNNN; HNK01.1A-A075-E0050-A-500-NNNN	HNL01.1E-0362-N0080-A-500-NNNN; HNK01.1A-A075-E0080-A-500-NNNN	HNL01.1E-0240-N0106-A-500-NNNN; HNK01.1A-A075-E0106-A-500-NNNN	HNL01.1E-0170-N0146-A-500-NNNN; HNK01.1A-A075-E0146-A-500-NNNN
minimum short circuit power of the mains for failure-free operation5)	S_{k_min}	MVA	1,1	2,0	2,7	3,8
maximum inrush current6)	$I_{L\_trans\_max\_on}$	A	2,80	5,70		17,00
maximum allowed ON-OFF cycles per minute7)			1			3
power factor TPF (λ_L) at P_{DC_cont} with mains choke; U_{LN_nenn}	TPF		0,85	0,83	0,81	0,78
power factor TPF (λ_L) at P_{DC_cont} without mains choke; U_{LN_nenn} 8)	TPF		0,57	0,59	0,61	0,62
power factor TPF (λ_L) at 10% P_{DC_cont} without mains choke; U_{LN_nenn} 9)	TPF_{10}		0,40			
power factor TPF (λ_L) at P_{DC_cont} (single-phase); U_{LN} = 1 AC 230 V	TPF		-			
power factor of fundam. component DPF at P_{DC_cont} with mains choke	$\cos\varphi^{h1}$		0,95		0,94	0,93
power factor of fundam. component DPF at P_{DC_cont} without mains choke	$\cos\varphi^{h1}$		0,64	0,67	0,70	0,73
mains connection power at P_{DC_cont}; U_{LN_nenn} with mains choke	S_{LN}	kVA	35,00	55,20	72,90	99,30
mains connection power at P_{DC_cont}; U_{LN_nenn} without mains choke	S_{LN}	kVA	22,60	40,30	54,00	76,00
rated input current (UL)10)	I_{L_cont}	A	50,0	80,0	106,0	146,0
nominal current AC1 for mains contactor at nom. data with mains choke; U_{LN_nenn}			I L_cont			
mains fuse according to IEC 60364-5-52; at nom. data with mains choke; U_{LN_nenn}		A	63; gR	100; aR	125; gR	200; gR

Description	Symbol	Unit	HCS03.1E-W0070-_-05	HCS03.1E-W0100-_-05	HCS03.1E-W0150-_-05	HCS03.1E-W0210-_-05
required wire size according to IEC 60364-5-52; at I_{L_cont} 11)	A_{LN}	mm^2	16	35	50	95
required wire size according to UL 508 A (internal wiring); at I_{L_cont} (UL)12)	A_{LN}	AWG	AWG 8	AWG 4	AWG 2	AWG 1/0

1)	600 V AC or less, use listed AC input line fuses or listed circuit breakers
2) 3)	mains voltage > ULN: use a transformer with grounded neutral point, don't use autotransformers!
4)	otherwise use mains choke HNL
5)	HMV0x.xR: Rsc=100; HMV0x.xE, HCS0x.xE: Rsc=50
6)	depending on mains input voltage ULN; HMV01.1R see following note; HMV: constant current charge, HCS: resistance charge; minimum of 250.000 load cycles
7)	without external capacities on DC bus
8) 9)	find interim values by interpolation
10)	at PDC_cont
11)	copper wire; PVC-insulation (conductor temperature 70 °C); installation method B2; Table B52-4; Ta ≤ 40 °C
12)	copper wire; PVC-insulation (conductor temperature 90 °C); Table 13.5.1; Ta ≤ 40 °C

Fig.5-67: *HCS - Data for mains voltage supply*

Qualitative characteristic TPF vs. DC bus power PDC_cont



1 with mains choke
2 without mains choke

Fig.5-68: *Qualitative characteristic TPF vs. DC bus power PDC_cont*

DC Bus

Data of power section - DC bus

Description	Symbol	Unit	HCS03.1E-W0070-_-05	HCS03.1E-W0100-_-05	HCS03.1E-W0150-_-05	HCS03.1E-W0210-_-05
DC bus voltage	U_{DC}	V	ULN x 1,41			
capacitance in DC bus	C_{DC}	mF	0,94	1,44	1,88	4,70

Description	Symbol	Unit	HCS03.1E-W0070-_-05	HCS03.1E-W0100-_-05	HCS03.1E-W0150-_-05	HCS03.1E-W0210-_-05
DC resistance in DC bus (L+ to L-) at U_{DC} = 750 V	R_{DC}	kOhm	approx. 95	approx. 47		approx. 16
rated power (t > 10 min) at f_s = 4 kHz; U_{LN_nenn}; control factor a_0 > 0,8; with mains choke	P_{DC_cont}	kW	25,00	43,00	56,00	85,00
rated power (t > 10 min) at f_s = 4 kHz; U_{LN_nenn}; control factor a_0 > 0,8; without mains choke	P_{DC_cont}	kW	13,00	24,00	34,00	47,00
P_{DC_cont} and P_{DC_max} vs. mains input voltage; $U_{LN} \leq U_{LN\_nenn}$		%/V	PDC_cont (ULN) = PDC_cont x [1 - (400-ULN) x 0,0025]			
P_{DC_cont} and P_{DC_max} vs. mains input voltage; $U_{LN} > U_{LN\_nenn}$		%/V	PDC_cont (ULN) = PDC_cont x [1 + (ULN-400) x 0,002]			
maximum allowed DC bus power at U_{LN_nenn}; with mains choke	P_{DC_max}	kW	40,00	59,00	89,00	124,00
maximum allowed DC bus power at U_{LN_nenn}; without mains choke	P_{DC_max}	kW	20,00	33,00	54,00	68,00
balancing factor for P_{DC_cont} (for parallel operation at common DC bus) with mains choke			1,00			
balancing factor for P_{DC_cont} (for parallel operation at common DC bus) without mains choke			0,80			
monitoring value maximum DC bus voltage, switch-off threshold	$U_{DC\_limit\_max}$	V	900			
monitoring value minimum DC bus voltage, undervoltage threshold	$U_{DC\_limit\_min}$	V	can be parameterized, see "P-0-0114, Undervoltage threshold"			
charging resistor continuous power	P_{DC_Start}	kW	-			
maximum allowed external DC bus capacitance$^{1)}$	C_{DCext}	mF	-			50 (HWI >01)
charging time at maximum allowed C_{DCext} external DC bus capacitance at U_{LN_nenn}	$t_{lade\_DC\_Cext}$	s	tbd			

1) use assigned type of mains choke

Fig.5-69: HCS - Data of power section - DC bus

External Braking Resistor

Requirements on external braking resistor

Description	Symbol	Unit	HCS03.1E-W0070-_-05	HCS03.1E-W0100-_-05	HCS03.1E-W0150-_-05	HCS03.1E-W0210-_-05
minimum required resistance value of external braking resistor[1]	$R_{DC\_Bleeder}$	ohm	17,5	11,7	7,0	5,0
assigned braking resistor type HLR01[2]			HLR01.1N-0300-N17R5	HLR01.1N-0470-N11R7	HLR01.1N-0780-N07R0	HLR01.1N-1K08-N05R0

1) see Parameter Description "P-0-0858, Data of external braking resistor"
2) see also Project Planning Manual "Additional Components"; see Parameter Description "P-0-0858, Data of external braking resistor"

Fig.5-70: HCS - Requirements on external braking resistor

Inverter

Data of power section - Inverter

Description	Symbol	Unit	HCS03.1E-W0070-_-05	HCS03.1E-W0100-_-05	HCS03.1E-W0150-_-05	HCS03.1E-W0210-_-05
allowed switching frequencies[1]	f_s	kHz	4, 8, 12, 16			
output voltage, fundamental wave with open-loop operation	U_{out_eff}	V	~ UDC x 0,71			
output voltage, fundamental wave with closed-loop operation	U_{out_eff}	V	~ UDC * 0,71			
rise of voltage at output with U_{LN_nenn} and 15 m motor cable length phase-phase (10-90%)[2]	du/dt	kV/µs	5,00			
rise of voltage at output with U_{LN_nenn} and 15 m motor cable length phase-ground (10-90%)[3]	du/dt	kV/µs	5,00			
output frequency range at f_s = 2 kHz	f_{out_2k}	Hz	-			
output frequency range at f_s = 4 kHz	f_{out_4k}	Hz	0...400			
output frequency range at f_s = 8 kHz	f_{out_8k}	Hz	0..800			
output frequency range at f_s = 12 kHz	f_{out_12k}	Hz	0..1200			
output frequency range at f_s = 16 kHz	f_{out_16k}	Hz	0...1600			
output frequency threshold to detect motor standstill[4]	f_{out_still}	Hz	2...4			
maximum output current at f_s = 2 kHz	I_{out_max2}	A	-			
maximum output current at f_s = 4 kHz	I_{out_max4}	A	70,0	100,0	150,0	210,0
maximum output current at f_s = 8 kHz	I_{out_max8}	A	62,0	86,0	137,0	190,0

Description	**Symbol**	**Unit**	HCS03.1E-W0070-_-05	HCS03.1E-W0100-_-05	HCS03.1E-W0150-_-05	HCS03.1E-W0210-_-05
maximum output current at f_s = 12 kHz	I_{out_max12}	A	47,0	60,0	105,0	135,0
maximum output current at f_s = 16 kHz	I_{out_max16}	A	34,0	50,0	86,0	105,0
allowed continuous output current at f_s = 2 kHz	I_{out_cont2}	A	-			
allowed continuous output current at f_s = 4 kHz	I_{out_cont4}	A	45,0	73,0	95,0	145,0
allowed continuous output current at f_s = 8 kHz	I_{out_cont8}	A	33,0	50,0	66,0	100,0
allowed continuous output current at f_s = 12 kHz5)	I_{out_cont12}	A	24,0	37,0	48,0	72,0
allowed continuous output current at f_s = 16 kHz6)	I_{out_cont16}	A	18,0	27,0	37,0	54,0
allowed continuous output current at f_s = 2 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_2}$	A	-			
allowed continuous output current at f_s = 4 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_4}$	A	29,2	46,9	60,9	92,5
allowed continuous output current at f_s = 8 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_8}$	A	18,3	30,4	39,6	57,8
allowed continuous output current at f_s = 12 kHz; output frequency $f_{out} < f_{out\_still}$ 7)	$I_{out\_cont0Hz\_12}$	A	12,0	20,8	27,4	38,3
allowed continuous output current at f_s = 16 kHz; output frequency $f_{out} < f_{out\_still}$ 8)	$I_{out\_cont0Hz\_16}$	A	8,6	15,0	20,0	27,9
assigned output filters at nom. data; f_s = 4 kHz			tbd			

1) also depending on firmware and control section; see Parameter Description "P-0-0001, Switching frequency of the power output stage"; see "P-0-4058, Amplifier type data"

2) 3) guide value, see following note

4) see following note regarding reduction output current

5) 6) 7) 8) see Parameter Description "P-0-0556, Config word of axis controller", load-depending reduction of PWM frequency fs

Fig.5-71: HCS - Data of power section - Inverter

☞ Observe that the load is almost independent of the power section used.

Especially when using **standard motors** , make sure that they comply with the occurring voltage load.

Observe the information contained in the chapter “Third-Party Motors at IndraDrive Controllers” in the Project Planning Manual of the drive system.

☞ Depending on the electric output frequency, the output current is reduced for thermal protection of the power section.

The output current is reduced, when the electric output frequency has fallen below the threshold to detect motor standstill.

Exemplary Data for Applications

General Information

This chapter contains:

- examples of allowed current profiles
- examples of allowed performance profiles
- data for selecting standard motors

Current Profiles

Examples of allowed current profiles

Description	Symbol	Unit	HCS03.1E-W0070-_-05	HCS03.1E-W0100-_-05	HCS03.1E-W0150-_-05	HCS03.1E-W0210-_-05
maximum output current at $I_{out\_base\_1}$; f_s = 2 kHz; t = 0,4 s; T = 4 s; K = 2,5 1)	$I_{out\_peak1\_2}$	A	-			
base load current at $I_{out\_peak\_1}$; f_s = 2 kHz; t = 0,4 s; T = 4 s; K = 2,5	$I_{out\_base1\_2}$	A	-			
maximum output current at $I_{out\_base\_1}$; f_s = 4 kHz; t = 0,4 s; T = 4 s; K = 2,5 2)	$I_{out\_peak1\_4}$	A	70,00	100,00	150,00	210,00
base load current at $I_{out\_peak\_1}$; f_s = 4 kHz; t = 0,4 s; T = 4 s; K = 2,5	$I_{out\_base1\_4}$	A	28,00	40,00	60,00	84,00
maximum output current at $I_{out\_base\_1}$; f_s = 8 kHz; t = 0,4 s; T = 4 s; K = 2,5 3)	$I_{out\_peak1\_8}$	A	56,29	78,09	116,46	169,54
base load current at $I_{out\_peak\_1}$; f_s = 8 kHz; t = 0,4 s; T = 4 s; K = 2,5	$I_{out\_base1\_8}$	A	22,52	31,24	46,58	67,81
maximum output current at $I_{out\_base\_1}$; f_s = 12 kHz; t = 0,4 s; T = 4 s; K = 2,5 4)	$I_{out\_peak1\_12}$	A	41,49	57,08	85,83	122,51
base load current at $I_{out\_peak\_1}$; f_s = 12 kHz; t = 0,4 s; T = 4 s; K = 2,5	$I_{out\_base1\_12}$	A	16,60	22,83	34,33	49,00

Description	Symbol	Unit	HCS03.1E-W0070-_-05	HCS03.1E-W0100-_-05	HCS03.1E-W0150-_-05	HCS03.1E-W0210-_-05
maximum output current at $I_{out\_base\_1}$; f_s = 16 kHz; t = 0,4 s; T = 4 s; K = 2,5[5]	$I_{out\_peak1\_16}$	A	31,31	42,79	65,24	92,58
base load current at $I_{out\_peak\_1}$; f_s = 16 kHz; t = 0,4 s; T = 4 s; K = 2,5	$I_{out\_base1\_16}$	A	12,52	17,12	26,10	37,03
maximum output current at $I_{out\_base\_3}$; f_s = 2 kHz; t = 2 s; T = 20 s; K = 2,0[6]	$I_{out\_peak3\_2}$	A	-			
base load current at $I_{out\_peak\_3}$; f_s = 2 kHz; t = 2 s; T = 20 s; K = 2,0	$I_{out\_base3\_2}$	A	-			
maximum output current at $I_{out\_base\_3}$; f_s = 4 kHz; t = 2 s; T = 20 s; K = 2,0[7]	$I_{out\_peak3\_4}$	A	66,15	91,81	135,86	210,00
base load current at $I_{out\_peak\_3}$; f_s = 4 kHz; t = 2 s; T = 20 s; K = 2,0	$I_{out\_base3\_4}$	A	33,07	45,91	67,93	105,00
maximum output current at $I_{out\_base\_3}$; f_s = 8 kHz; t = 2 s; T = 20 s; K = 2,0[8]	$I_{out\_peak3\_8}$	A	47,56	63,92	95,46	148,43
base load current at $I_{out\_peak\_3}$; f_s = 8 kHz; t = 2 s; T = 20 s; K = 2,0	$I_{out\_base3\_8}$	A	23,78	31,96	47,73	74,22
maximum output current at $I_{out\_base\_3}$; f_s = 12 kHz; t = 2 s; T = 20 s; K = 2,0[9]	$I_{out\_peak3\_12}$	A	34,94	46,52	70,06	106,87
base load current at $I_{out\_peak\_3}$; f_s = 12 kHz; t = 2 s; T = 20 s; K = 2,0	$I_{out\_base3\_12}$	A	17,47	23,26	35,03	53,44
maximum output current at $I_{out\_base\_3}$; f_s = 16 kHz; t = 2 s; T = 20 s; K = 2,0[10]	$I_{out\_peak3\_16}$	A	26,33	34,78	53,13	80,58
base load current at $I_{out\_peak\_3}$; f_s = 16 kHz; t = 2 s; T = 20 s; K = 2,0	$I_{out\_base3\_16}$	A	13,17	17,39	26,57	40,29
base load current at $I_{out\_peak\_4}$; f_s = 2 kHz; t = 60 s; T = 5 min; K = 1,5	$I_{out\_base4\_2}$	A	-			
maximum output current at $I_{out\_base\_4}$; f_s = 2 kHz; t = 60 s; T = 5 min; K = 1,5[11]	$I_{out\_peak4\_2}$	A	-			
maximum output current at $I_{out\_base\_4}$; f_s = 4 kHz; t = 60 s; T = 5 min; K = 1,5[12]	$I_{out\_peak4\_4}$	A	47,66	75,04	108,03	162,72
base load current at $I_{out\_peak\_4}$; f_s = 4 kHz; t = 60 s; T = 5 min; K = 1,5	$I_{out\_base4\_4}$	A	31,77	50,02	72,02	108,48

Description	Symbol	Unit	HCS03.1E-W0070-_-05	HCS03.1E-W0100-_-05	HCS03.1E-W0150-_-05	HCS03.1E-W0210-_-05
maximum output current at $I_{out\_base\_4}$; f_s = 8 kHz; t = 60 s; T = 5 min; K = 1,5[13]	$I_{out\_peak4\_8}$	A	34,02	51,94	75,38	112,29
base load current at $I_{out\_peak\_4}$; f_s = 8 kHz; t = 60 s; T = 5 min; K = 1,5	$I_{out\_base4\_8}$	A	22,68	34,62	50,26	74,86
maximum output current at $I_{out\_base\_4}$; f_s = 12 kHz; t = 60 s; T = 5 min; K = 1,5[14]	$I_{out\_peak4\_12}$	A	24,90	37,66	55,12	80,57
base load current at $I_{out\_peak\_4}$; f_s = 12 kHz; t = 60 s; T = 5 min; K = 1,5	$I_{out\_base4\_12}$	A	16,60	25,10	36,75	53,71
maximum output current at $I_{out\_base\_4}$; f_s = 16 kHz; t = 60 s; T = 5 min; K = 1,5[15]	$I_{out\_peak4\_16}$	A	18,73	28,08	41,70	60,61
base load current at $I_{out\_peak\_4}$; f_s = 16 kHz; t = 60 s; T = 5 min; K = 1,5	$I_{out\_base4\_16}$	A	12,49	18,72	27,80	40,41
maximum output current at $I_{out\_base\_5}$; f_s = 2 kHz; t = 60 s; T = 10 min; K = 1,1[16]	$I_{out\_peak5\_2}$	A	-			
base load current at $I_{out\_peak\_5}$; f_s = 2 kHz; t = 60 s; T = 10 min; K = 1,1	$I_{out\_base5\_2}$	A	-			
maximum output current at $I_{out\_base\_5}$; f_s = 4 kHz; t = 60 s; T = 10 min; K = 1,1[17]	$I_{out\_peak5\_4}$	A	46,36	73,69	98,64	150,11
base load current at $I_{out\_peak\_5}$; f_s = 4 kHz; t = 60 s; T = 10 min; K = 1,1	$I_{out\_base5\_4}$	A	42,14	66,99	89,67	136,47
maximum output current at $I_{out\_base\_5}$; f_s = 8 kHz; t = 60 s; T = 10 min; K = 1,1[18]	$I_{out\_peak5\_8}$	A	33,06	50,97	68,66	103,39
base load current at $I_{out\_peak\_5}$; f_s = 8 kHz; t = 60 s; T = 10 min; K = 1,1	$I_{out\_base5\_8}$	A	30,05	46,34	62,42	93,99
maximum output current at $I_{out\_base\_5}$; f_s = 12 kHz; t = 60 s; T = 10 min; K = 1,1[19]	$I_{out\_peak5\_12}$	A	24,20	36,95	50,13	74,09
base load current at $I_{out\_peak\_5}$; f_s = 12 kHz; t = 60 s; T = 10 min; K = 1,1	$I_{out\_base5\_12}$	A	22,00	33,59	45,57	67,36

Description	Symbol	Unit	HCS03.1E-W0070-_-05	HCS03.1E-W0100-_-05	HCS03.1E-W0150-_-05	HCS03.1E-W0210-_-05
maximum output current at $I_{out\_base\_5}$; f_s = 16 kHz; t = 60 s; T = 10 min; K = 1,1[20]	$I_{out\_peak5\_16}$	A	18,20	27,55	37,90	55,70
base load current at $I_{out\_peak\_5}$; f_s = 16 kHz; t = 60 s; T = 10 min; K = 1,1	$I_{out\_base5\_16}$	A	16,54	25,05	34,45	50,64

[1] [2] [3] [4] [5] [6] [7] [8] [9] [10] [11] [12] [13] [14] [15] [16] [17] [18] [19] [20] see definition profile UEL_I_e

Fig.5-72: HCS - Examples of allowed current profiles

Current Profile “UEL_I_e”

The following current profiles have been defined for converters and inverters.

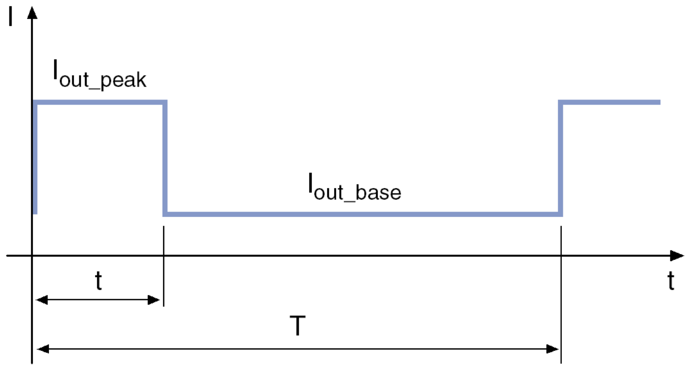
<table>
<tr><th>Profile</th><th>Explanation</th></tr>
<tr><td>current profile “UEL_I_e”

DK000149v01_nn.fh11</td><td>The characteristic data of the profile are used to select converters and inverters for operation with standard motors and servo drives.</td></tr>
</table>

Fig.5-73: Definition of current profiles

Performance Profiles

Examples of allowed performance profiles

Description	Symbol	Unit	HCS03.1E-W0070-_-05	HCS03.1E-W0100-_-05	HCS03.1E-W0150-_-05	HCS03.1E-W0210-_-05
maximum DC bus power at U_{LN_nenn}; $T_a \leq T_{a\_work}$; t = 0,4 s; T = 4 s; K = 2,5; $P_{DC\_peak} = P_{DC\_max}$; without mains choke[1]	$P_{DC\_peak\_1}$	kW	20,22	32,88	53,68	68,07
maximum DC bus power at U_{LN_nenn}; $T_a \leq T_{a\_work}$; t = 0,4 s; T = 4 s; K = 2,5; $P_{DC\_peak} = P_{DC\_max}$; with mains choke[2]	$P_{DC\_peak\_1}$	kW	38,89	58,90	88,42	123,10

Description	Symbol	Unit	HCS03.1E-W0070-_-05	HCS03.1E-W0100-_-05	HCS03.1E-W0150-_-05	HCS03.1E-W0210-_-05
DC bus power at U_{LN_nenn}; $T_a \leq T_{a\_work}$; t =0,4 s; T = 4 s; K = 2,5; $P_{DC\_peak} = P_{DC\_max}$; without mains choke[3)]	$P_{DC\_base\_1}$	kW	8,09	13,15	21,47	27,23
DC bus power at U_{LN_nenn}; $T_a \leq T_{a\_work}$; t = 0,4 s; T = 4 s; K = 2,5; $P_{DC\_peak} = P_{DC\_max}$; with mains choke[4)]	$P_{DC\_base\_1}$	kW	15,56	23,56	35,37	49,24
maximum DC bus power at U_{LN_nenn}; $T_a \leq T_{a\_work}$; t = 2 s; T = 20 s; K = 2,0; without mains choke[5)]	$P_{DC\_peak\_3}$	kW	19,12	30,18	48,64	68,07
maximum DC bus power at U_{LN_nenn}; $T_a \leq T_{a\_work}$; t = 2 s; T = 20 s; K = 2,0; with mains choke[6)]	$P_{DC\_peak\_3}$	kW	36,75	54,08	80,09	123,10
DC bus power at U_{LN_nenn}; $T_a \leq T_{a\_work}$; t = 2 s; T = 20 s; K = 2,0; without mains choke[7)]	$P_{DC\_base\_3}$	kW	9,56	15,09	24,30	34,03
DC bus power at U_{LN_nenn}; $T_a \leq T_{a\_work}$; t = 2 s; T = 20 s; K = 2,0; with mains choke[8)]	$P_{DC\_base\_3}$	kW	18,37	27,04	40,04	61,55
maximum DC bus power at U_{LN_nenn}; $T_a \leq T_{a\_work}$; t = 60 s; T = 5 min; K = 1,5; without mains choke[9)]	$P_{DC\_peak\_4}$	kW	13,78	24,66	38,65	52,74
maximum DC bus power at U_{LN_nenn}; $T_a \leq T_{a\_work}$; t = 60 s; T = 5 min; K = 1,5; with mains choke[10)]	$P_{DC\_peak\_4}$	kW	26,48	44,20	63,68	95,39
DC bus power at U_{LN_nenn}; $T_a \leq T_{a\_work}$; t = 60 s; T = 5 min; K = 1,5; without mains choke[11)]	$P_{DC\_base\_4}$	kW	9,19	16,44	25,77	35,17
DC bus power at U_{LN_nenn}; $T_a \leq T_{a\_work}$; t = 60 s; T = 5 min; K = 1,5; with mains choke[12)]	$P_{DC\_base\_4}$	kW	17,65	29,46	42,45	63,59
maximum DC bus power at U_{LN_nenn}; $T_a \leq T_{a\_work}$; t = 60 s; T = 10 min; K = 1.1; without mains choke[13)]	$P_{DC\_peak\_5}$	kW	13,40	23,23	35,29	48,65
maximum DC bus power at U_{LN_nenn}; $T_a \leq T_{a\_work}$; t = 60 s; T = 10 min; K = 1.1; with mains choke[14)]	$P_{DC\_peak\_5}$	kW	25,76	43,41	58,15	88,00

Description	Symbol	Unit	HCS03.1E-W0070-_-05	HCS03.1E-W0100-_-05	HCS03.1E-W0150-_-05	HCS03.1E-W0210-_-05
DC bus power at U_{LN_nenn}; $T_a \le T_{a\_work}$; t = 60 s; T = 10 min; K = 1.1; without mains choke[15)]	$P_{DC\_base\_5}$	kW	12,16	22,03	32,10	44,24
DC bus power at U_{LN_nenn}; $T_a \le T_{a\_max}$; t = 60 s; T = 10 min; K = 1,1; with mains choke[16)]	$P_{DC\_base\_5}$	kW	23,41	39,46	52,86	80,00

1) 2) 3) 4) 5) 6) 7) 8) 9) 10) 11) 12) 13) 14) 15) 16) see definition profile UEL_P_e

Fig.5-74: HCS - Examples of allowed performance profiles

Performance Profile “UEL_P_e”

The following performance profiles have been defined for converters and inverters.

☞ Observe the allowed performance data P_{DC_peak} and P_{DC_base} in the corresponding performance profile of the supply unit or converter.

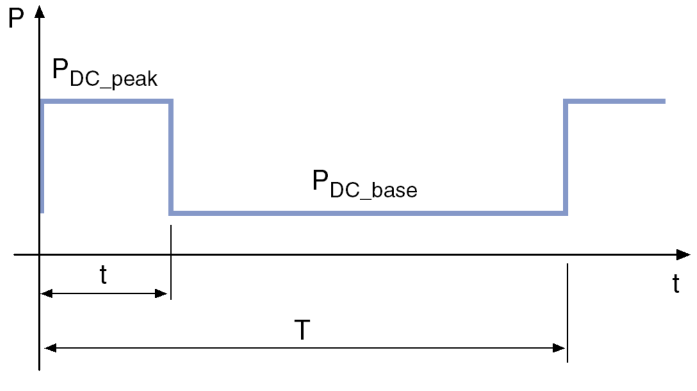
Profile	Explanation
performance profile “UEL_P_e”  DK000135v01_nn.fh11	Characteristic of the selection of standard motors and servo drives.

Fig.5-75: Definition of performance profiles, infeeding supply units and converters

Operation With Standard Motors

General Information

Selecting Standard Motors

The tables below show the nominal powers P_{nenn} of standard motors which can be operated at the respective drive controller. The data are subject to the following conditions:

- motor design:

  4-pole standard motor (2 pole pairs) with rated voltage 3 AC 400 V, 50 Hz at mains voltage $U_{LN} \ge$ 3 AC 400 V or

  4-pole standard motor (2 pole pairs) with rated voltage 3 AC 460 V, 60 Hz at mains voltage $U_{LN} \ge$ 3 AC 460 V
- assigned mains choke is used
- operation at minimum switching frequency $f_s = f_s$ (min.)
- rotary field at output with $f_{out} > f_{out\_still}$

- ambient temperature $T_a \leq T_{a\_work}$
- overload ratio K = P_{DC_peak} / P_{DC_base} according to performance profile “UEL_P_e”
- type of mains connection: individual supply

When choosing standard motors for HMS/HMD, select an appropriate HMV supply unit. Observe the performance data P_{DC_peak} and P_{DC_base} in the performance profile “UEL_P_e” of the supply unit.

Operating Standard Motors at 3 AC 400 V

Selection of standard motors 3 AC 400V - Exemplary profiles

Description	Symbol	Unit	HCS03.1E-W0070-_-05	HCS03.1E-W0100-_-05	HCS03.1E-W0150-_-05	HCS03.1E-W0210-_-05
nominal power standard motor 3 AC 400 V; 50 Hz; t > 10 min; K = 1,0; f_s = 4 kHz$^{1)}$	P_{Nenn}	kW	22,00	37,00	45,00	75,00
nominal power standard motor 3 AC 400 V; 50 Hz; t = 60 s; T = 10 min; K = 1,1; f_s = 4 kHz$^{2)}$	P_{Nenn}	kW	18,50	30,00	45,00	75,00
nominal power standard motor 3 AC 400 V; 50 Hz; t = 60 s; T = 5 min; K = 1.5; f_s = 4 kHz$^{3)}$	P_{Nenn}	kW	15,00	22,00	37,00	55,00
nominal power standard motor 3 AC 400 V; 50 Hz; t = 2 s; T = 20 s; K = 2,0; f_s = 4 kHz$^{4)}$	P_{Nenn}	kW	15,00	22,00	37,00	55,00

1) 2) 3) 4) see definition profile UEL_P_e

Fig.5-76: HCS - Selection of standard motors 3 AC 400V - Exemplary profiles

Operating Standard Motors at 3 AC 460 V

Selection of standard motors 3 AC 460V - Exemplary profiles

Description	Symbol	Unit	HCS03.1E-W0070-_-05	HCS03.1E-W0100-_-05	HCS03.1E-W0150-_-05	HCS03.1E-W0210-_-05
nominal power standard motor 3AC460V; 60 Hz; t > 10 min; K = 1,0; f_s = 4 kHz$^{1)}$	P_{Nenn}	kW	30,00	45,00	55,00	92,00
nominal power standard motor 3AC460V; 60 Hz; t = 60 s; T = 10 min; K = 1,1; f_s = 4 kHz$^{2)}$	P_{Nenn}	kW	22,00	37,00	55,00	92,00
nominal power standard motor 3AC460V; 60 Hz; t = 60 s; T = 5 min; K = 1.5; f_s = 4 kHz$^{3)}$	P_{Nenn}	kW	18,50	30,00	45,00	75,00
nominal power standard motor 3AC460V; 60 Hz; t = 2 s; T = 20 s; K = 2,0; f_s = 4 kHz$^{4)}$	P_{Nenn}	kW	18,50	30,00	45,00	75,00

1) 2) 3) 4) see definition profile UEL_P_e; 1 kW ~ 1,36 hp

Fig.5-77: HCS - Selection of standard motors 3 AC 460V - Exemplary profiles

5.3.5 Connections and Interfaces

Overview

Overall Connection Diagram

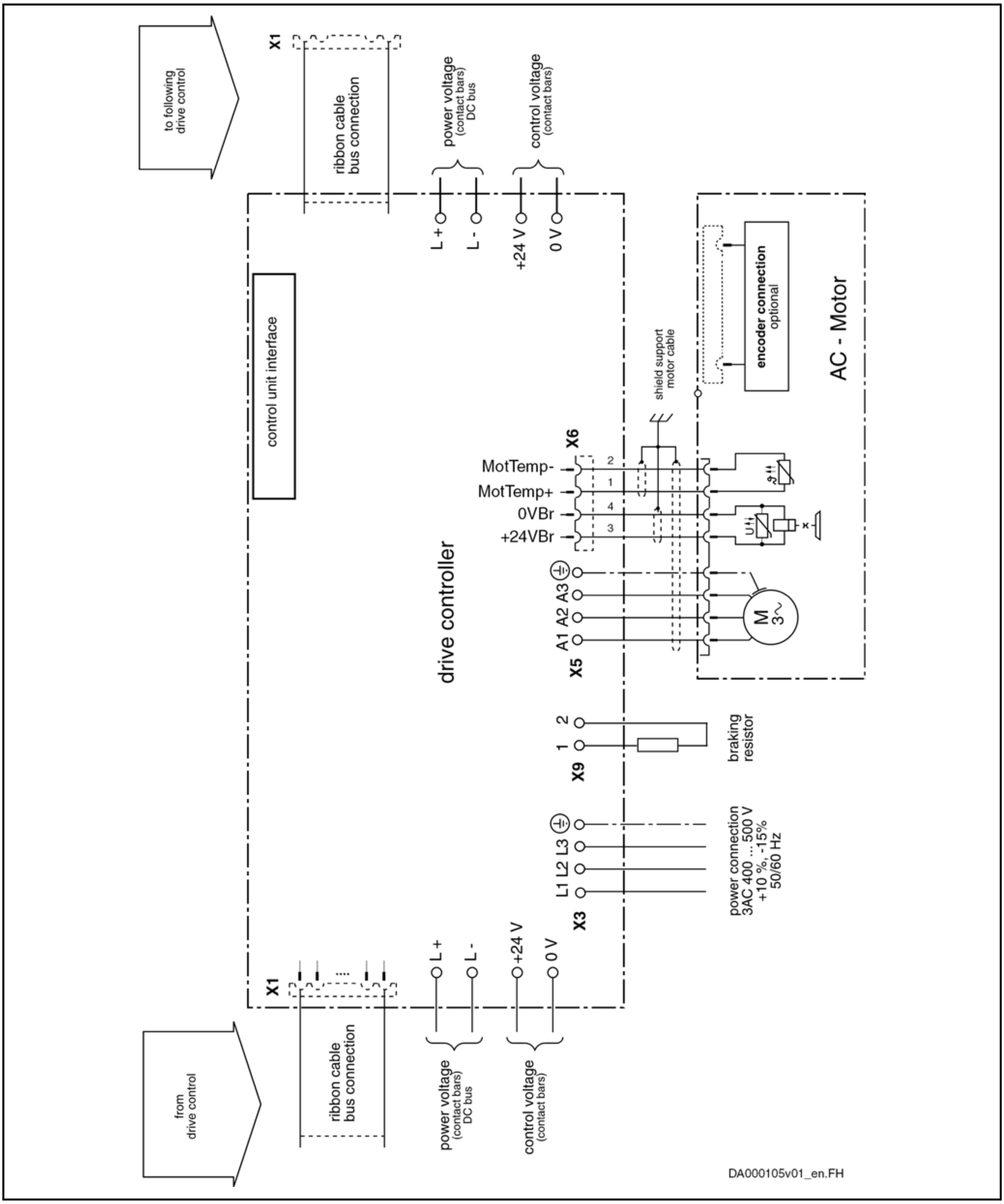


Fig.5-78: Overall connection diagram

Arrangement of the Connection Points

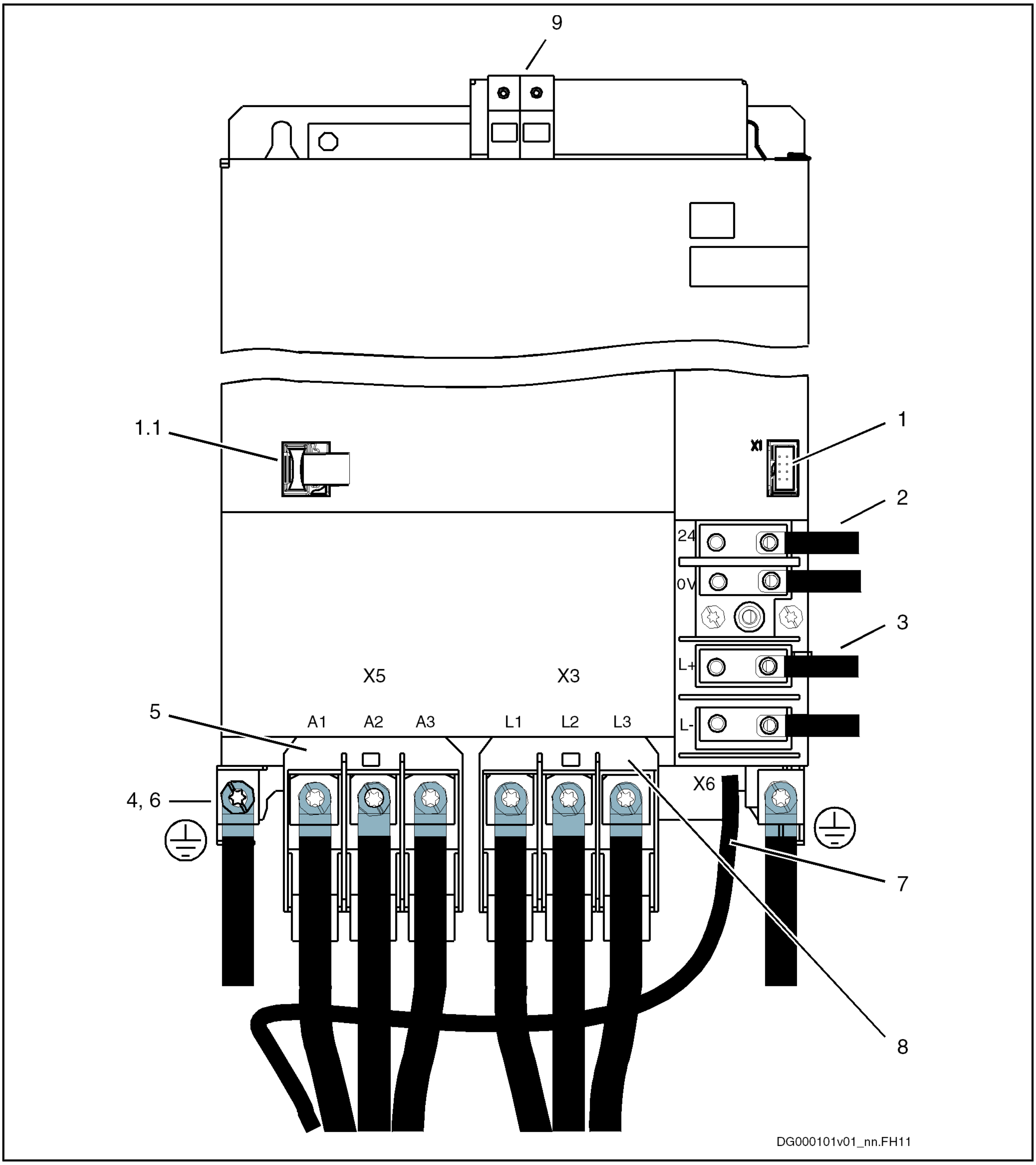
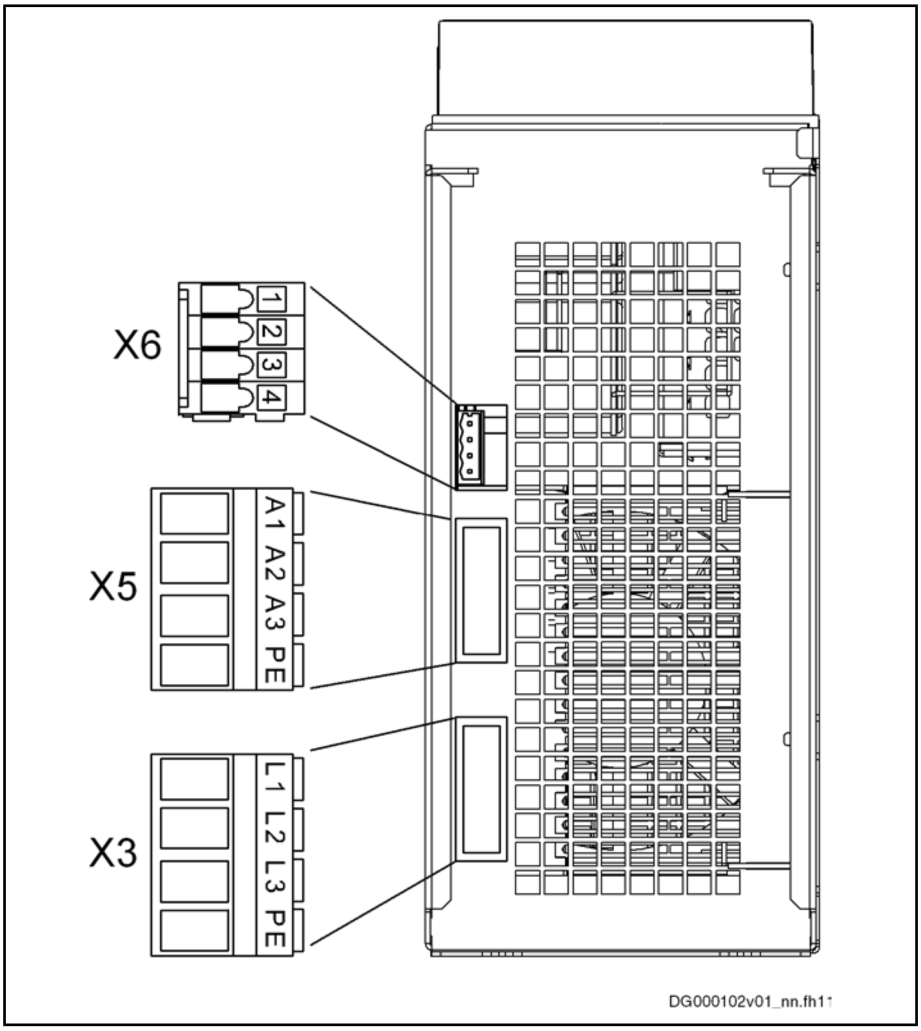


Fig.5-79: Connections at power section HCS03.1

No.	**Description**	**Design**	**Connection obligatory?**	**Note on terminal description**
1	module bus X1	ribbon cable	no	The module bus connection is only necessary, if a converter of identical performance or an inverter is connected to L+ and L-.
1.1	parking position X1			
2	control voltage; +24V and 0 V	bars	yes (for compliance with UL terms and utilization of integrated safety technology)	Connection of an external 24 V supply is only necessary, if an external mains contactor or a holding brake is used. If connection with bars is not possible, short twisted wires may be used as an alternative.
3	DC bus; L+ and L-	bars	no	Connection is only necessary, if two converters of identical performance are to be linked via the DC bus or if an inverter is connected. If connection with bars is impossible, lines may be used as an alternative.
4	equipment grounding conductor	joint bar	yes	If connection with joint bar is impossible, lines may be used as an alternative.
5	motor (X5)	shielded motor cable	yes	4 connections: A1, A2, A3, equipment grounding conductor
6	motor cable shield		yes	Connect the shield of the motor cable to the housing over the largest possible surface area. Use the optionally available accessory HAS02.
7	motor temperature monitoring and motor holding brake (X6)	shielded cable or shielded motor cable with integrated connection cable for X6	no	This connection is only required, if the motor is equipped with temperature monitoring function and/or holding brake and if these functions are to be used.
8	mains	single cores or 4-core non-metallic-sheathed cable	yes	
9	braking resistor	single cores	no	

Fig.5-80: Connections at power section HCS03.1



X3	mains
X5	motor
X6	motor temperature, motor holding brake

Fig.5-81: *Connections at power section HCS03.1E-W0070 (bottom)*

Description of the Connection Points

The connection points are described in detail in chapter 8 Functions and Electrical Connection Points , page 241.

Touch Guard The touch guard is described in detail in chapter 9 Touch Guard at Devices , page 291.

6 Power Sections for Inverters - IndraDrive M

6.1 Overview of Types

Inverter	Types	Features
HMS01.1N	W0012 W0028 W0054 W0070 W0110 W0150 W0210 W0350	compact modular design continuous currents up to 250 A
HMD01.1N	W0012 W0020 W0036	compact modular design continuous currents up to 20 A
HMS02.1N	W0028 W0054	compact modular design continuous currents up to 25 A minor mounting dimensions than HMS01

Fig.6-1: Overview of inverter types

6.2 HMS01 Power Sections

6.2.1 Brief Description, Usage and Structure

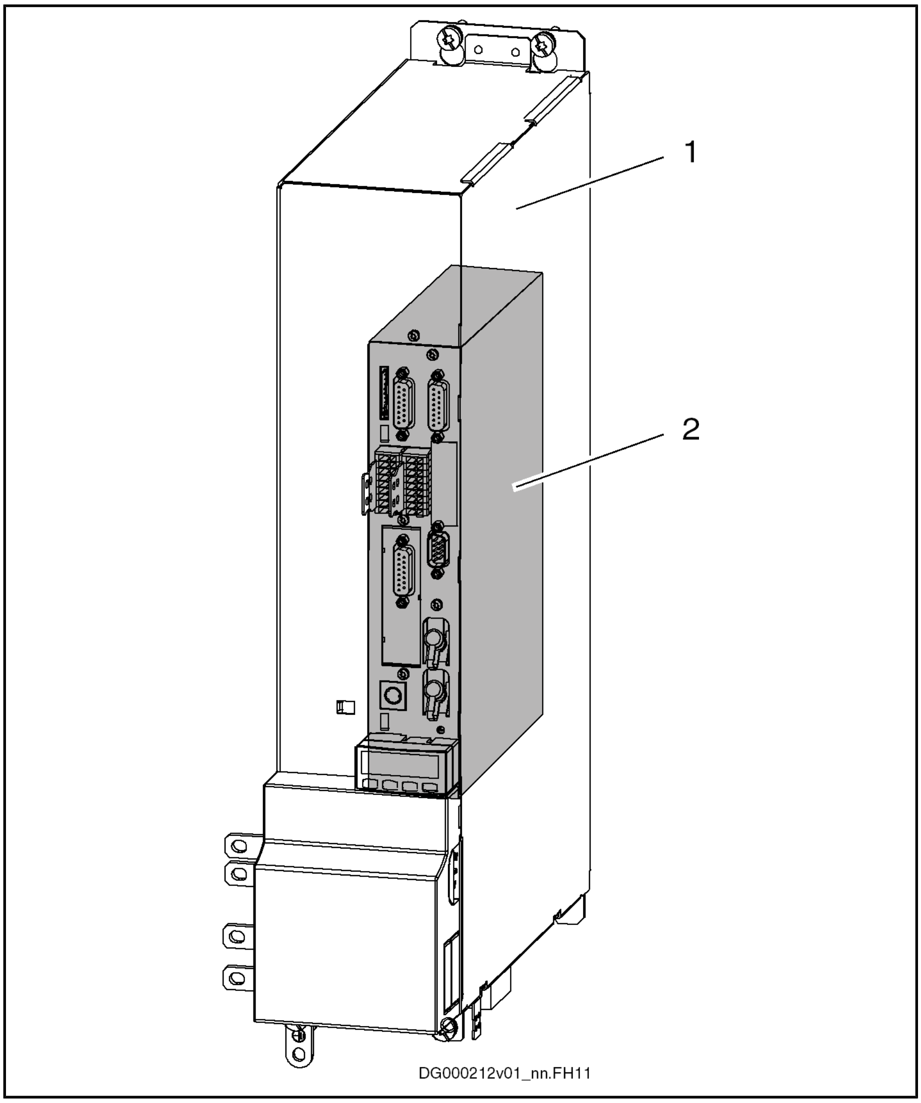
Brief Description The HMS01 inverters are part of the Rexroth IndraDrive M product range and are used to operate single axes.

Usage The different types are used as follows:

Type	Usage
HMS01.1N-Wxxxx-NNNN	• single-axis device • Operation of a three-phase a.c. motor (asynchronous or synchronous motor).

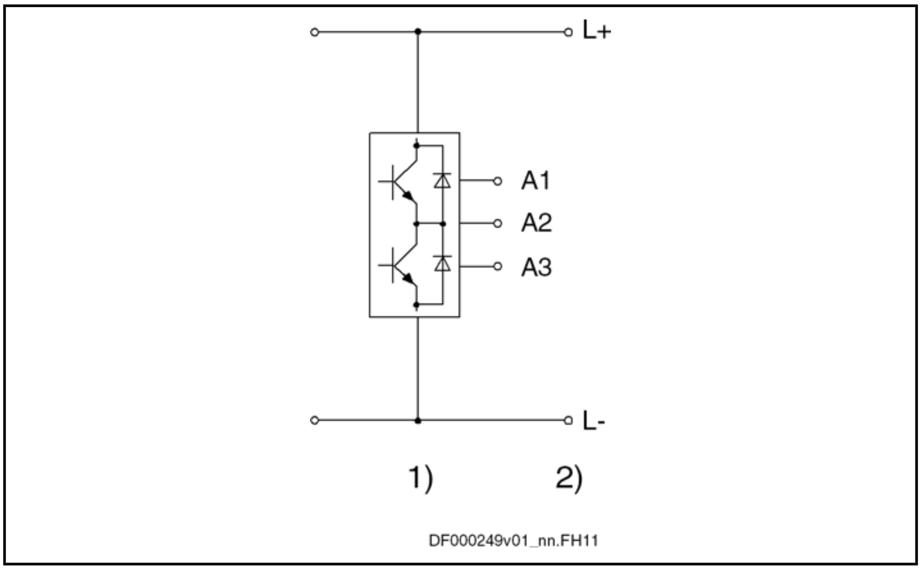
Fig.6-2: Usage of HMS01

Structure, Block Diagrams



1	power section
2	control section

Fig.6-3: Basic structure of the drive controller



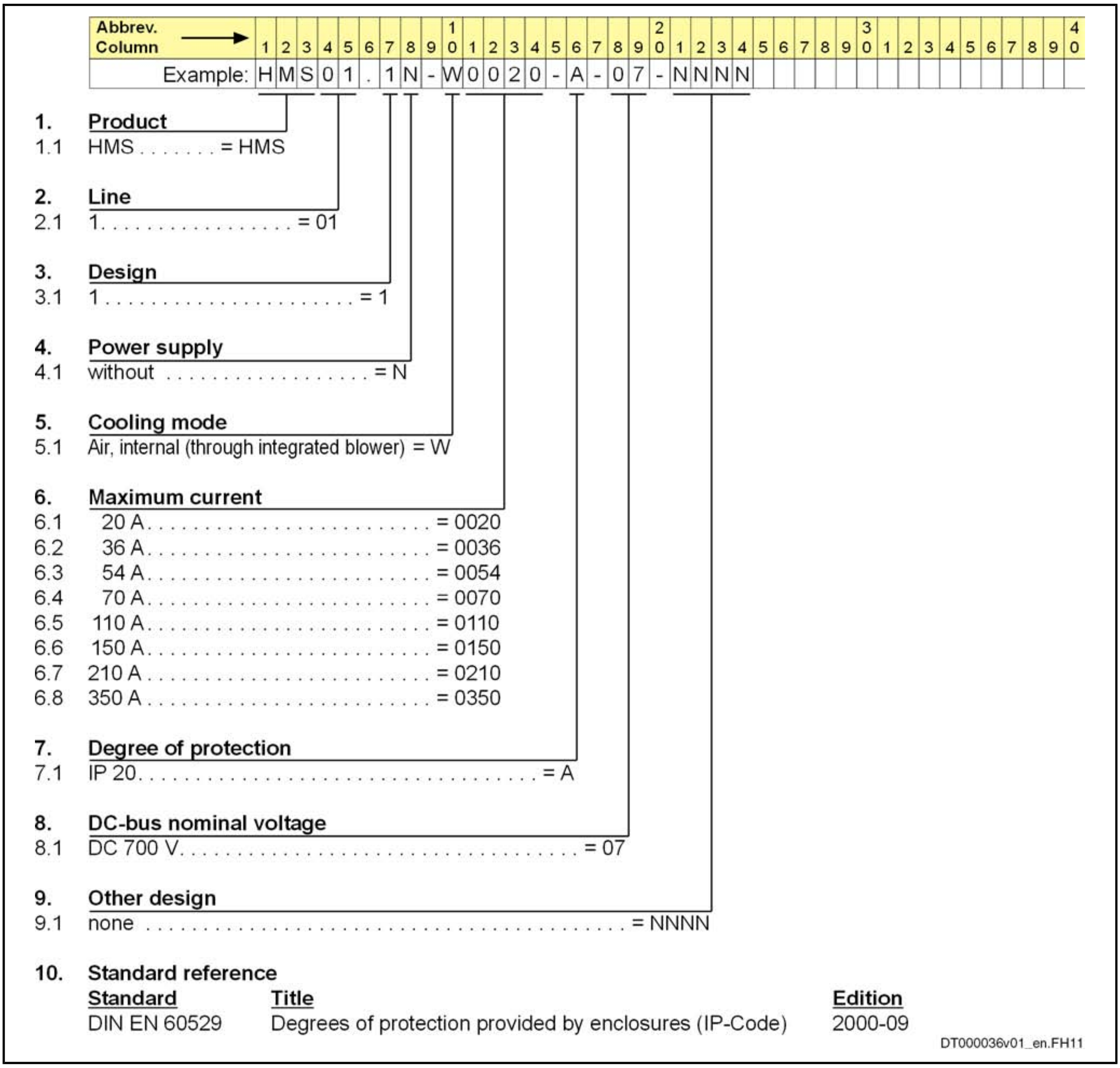
1)	inverter stage with output to motor
2)	DC bus connection
Fig.6-4:	*HMS01 - block diagram*

6.2.2 Type Code and Identification

Type Code

☞ The following figure illustrates the basic structure of the type code. Our sales representative will help you with the current status of available versions.

Power Sections for Inverters - IndraDrive M



Example: HMS01.1N-W0020-A-07-NNNN

1. Product
1.1 HMS . . . . = HMS

2. Line
2.1 1. . . . . = 01

3. Design
3.1 1 . . . . = 1

4. Power supply
4.1 without . . . . = N

5. Cooling mode
5.1 Air, internal (through integrated blower) = W

6. Maximum current
6.1 20 A. . . . . = 0020
6.2 36 A. . . . . = 0036
6.3 54 A. . . . . = 0054
6.4 70 A. . . . . = 0070
6.5 110 A. . . . . = 0110
6.6 150 A. . . . . = 0150
6.7 210 A . . . . = 0210
6.8 350 A . . . . = 0350

7. Degree of protection
7.1 IP 20. . . . . = A

8. DC-bus nominal voltage
8.1 DC 700 V. . . . . = 07

9. Other design
9.1 none . . . . = NNNN

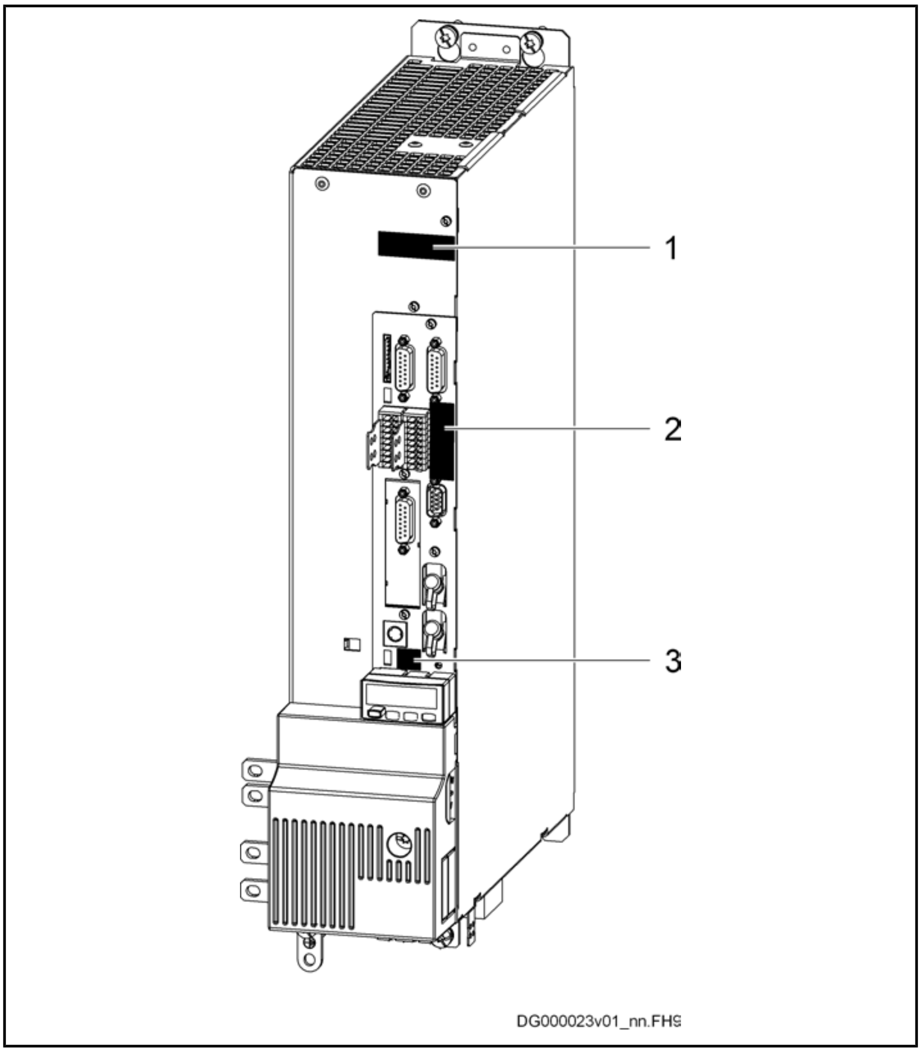
10. Standard reference

Standard	**Title**	**Edition**
DIN EN 60529	Degrees of protection provided by enclosures (IP-Code)	2000-09

Fig.6-5: Type code HMS01

Identification

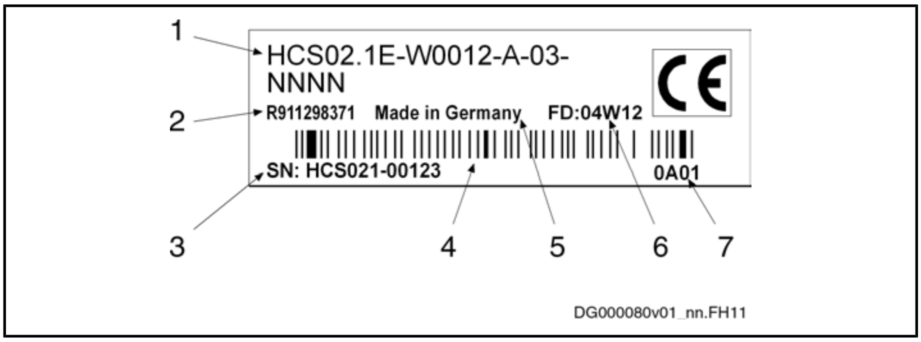
Type Plate Arrangement



1	power section type plate
2	control section type plate
3	firmware type plate

Fig.6-6: *Type plates at the drive controller*

Type Plate



1	device type
2	part number
3	serial number
4	bar code
5	country of manufacture
6	production week, 04W12 meaning year 2004, week 12
7	hardware index

Fig.6-7: *Type plate - power section (example of an HCS02 power section)*

6.2.3 Scope of Supply

The scope of supply includes:

- 1 × touch guard
- 1 × connector X5 and X6 each

6.2.4 Technical Data

Ambient and Operating Conditions

General Information

Conditions for transport and storage: see chapter 4.2 Transport and Storage, page 19.

Installation conditions: see chapter 4.3 Installation Conditions , page 19.

This chapter contains:

- limit values for use in the scope of C-UL
- applied standards (CE conformity, UL listing)

UL Data

Ambient and operating conditions - UL ratings

Description	Symbol	Unit	HMS01.1N-W0020	HMS01.1N-W0036	HMS01.1N-W0054	HMS01.1N-W0070
Suitable for use on a circuit capable of delivering not more than this SCCR, symmetrical amperes (UL) 1)	I_{SCCR}	A rms	42000			
rated input voltage, power (UL)2)	U_{LN_nenn}	V	254...750			
rated input current (UL)3)	I_{L_cont}	A	14,0	24,5	40,0	49,0

Description	Symbol	Unit	HMS01.1N-W0020	HMS01.1N-W0036	HMS01.1N-W0054	HMS01.1N-W0070
maximum output voltage (UL)	U_{out}	V	500			
maximum output current (UL)	I_{out_max}	A	12,1	21,3	35,0	42,4

1) 600 V AC or less, use listed AC input line fuses or listed circuit breakers
2) HMS, HMD, HLB, HLC, KCU: DC bus L+, L-; HMV, HCS: mains input L1, L2, L3
3) at PDC_cont

Fig.6-8: HMS - Ambient and operating conditions - UL ratings

Ambient and operating conditions - UL ratings

Description	Symbol	Unit	HMS01.1N-W0110	HMS01.1N-W0150	HMS01.1N-W0210	HMS01.1N-W0350
Suitable for use on a circuit capable of delivering not more than this SCCR, symmetrical amperes (UL) 1)	I_{SCCR}	A rms	42000			
rated input voltage, power (UL)2)	U_{LN_nenn}	V	254...750			
rated input current (UL)3)	I_{L_cont}	A	80,0	115,0	167,0	290,0
maximum output voltage (UL)	U_{out}	V	500			
maximum output current (UL)	I_{out_max}	A	68,5	100,0	145,0	250,0

1) 600 V AC or less, use listed AC input line fuses or listed circuit breakers
2) HMS, HMD, HLB, HLC, KCU: DC bus L+, L-; HMV, HCS: mains input L1, L2, L3
3) at PDC_cont

Fig.6-9: HMS - Ambient and operating conditions - UL ratings

Information on Standards

Applied standards

Description	Symbol	Unit	HMS01.1N-W0020	HMS01.1N-W0036	HMS01.1N-W0054	HMS01.1N-W0070
listing according to UL standard (UL)			UL 508 C			
UL files (UL)			E 134201			
listing according to CSA standard (UL)			Canadian National Standard(s) C22.2 No. 14-05			

Fig.6-10: HMS - Applied standards

Applied standards

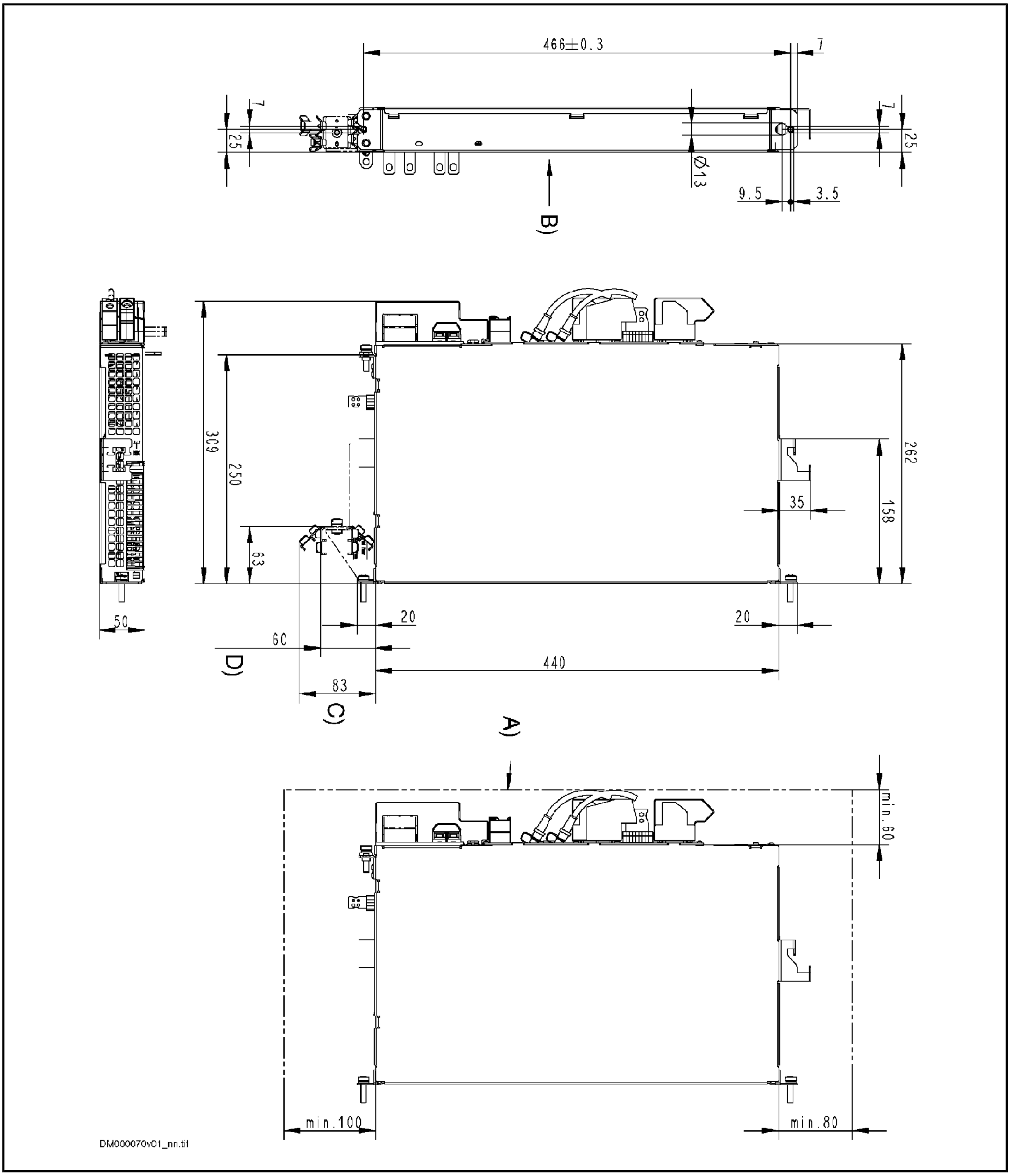
Description	Symbol	Unit	HMS01.1N-W0110	HMS01.1N-W0150	HMS01.1N-W0210	HMS01.1N-W0350
listing according to UL standard (UL)			UL 508 C			
UL files (UL)			E 134201			
listing according to CSA standard (UL)			Canadian National Standard(s) C22.2 No. 14-05			

Fig.6-11: HMS - Applied standards

Mechanical System and Mounting

Dimensional Drawings

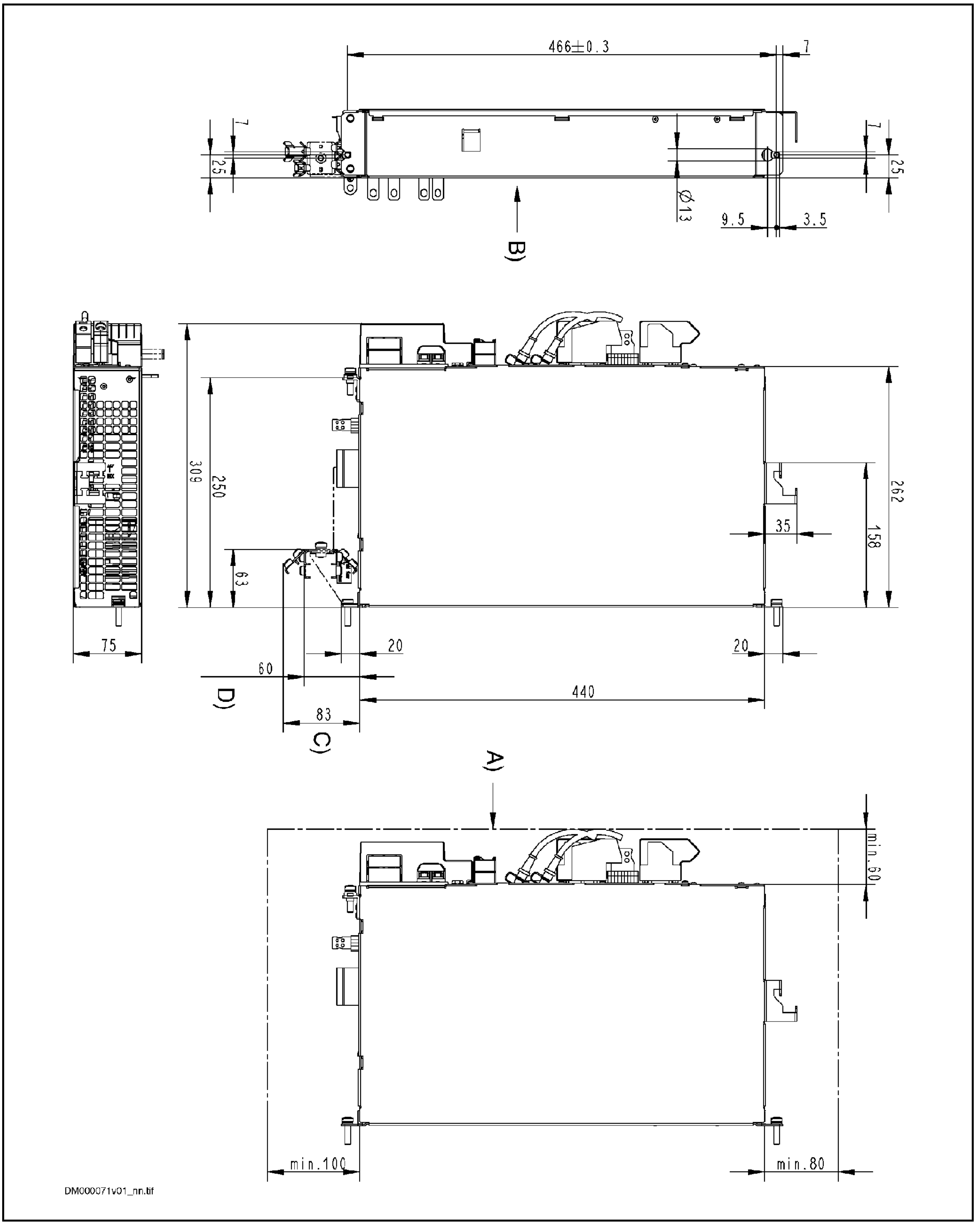
HMS01.1N-W0020 and HMS01.1N-W0036



A)	minimum mounting clearance (plus additional space for motor cable) Note: Rexroth IndraDrive supply units require greater mounting clearance!
B)	rear view!
C)	dimensions for accessory HAS02.1 when motor cable run with 45°
D)	dimensions for accessory HAS02.1 when motor cable run horizontally

Fig.6-12: Dimensions HMS01.1N-W0020 and HMS01.1N-W0036

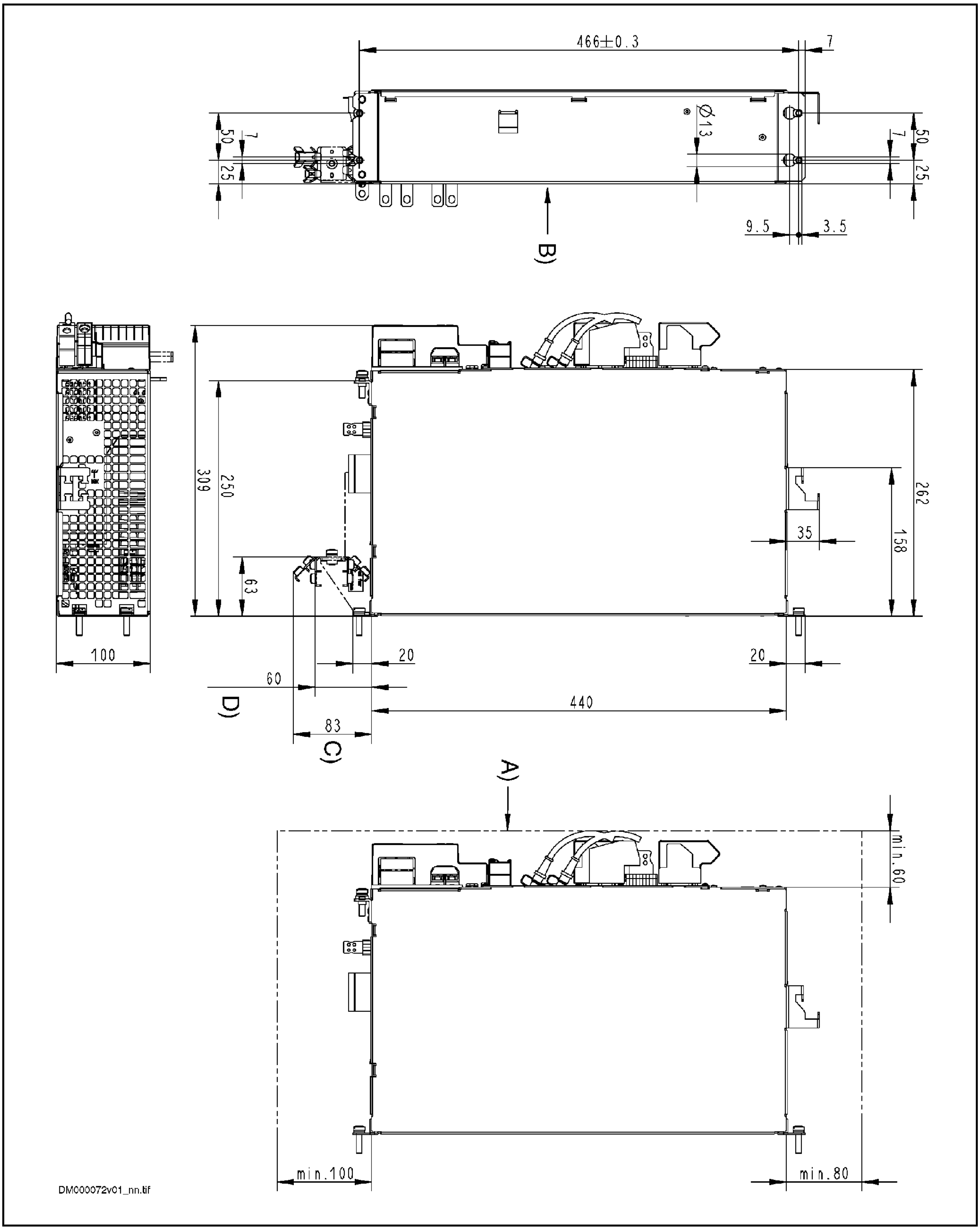
HMS01.1N-W0054



A)	minimum mounting clearance (plus additional space for motor cable) Note: Rexroth IndraDrive supply units require greater mounting clearance!
B)	rear view!
C)	dimensions for accessory HAS02.1 when motor cable run with 45°
D)	dimensions for accessory HAS02.1 when motor cable run horizontally

Fig.6-13: Dimensions HMS01.1N-W0054

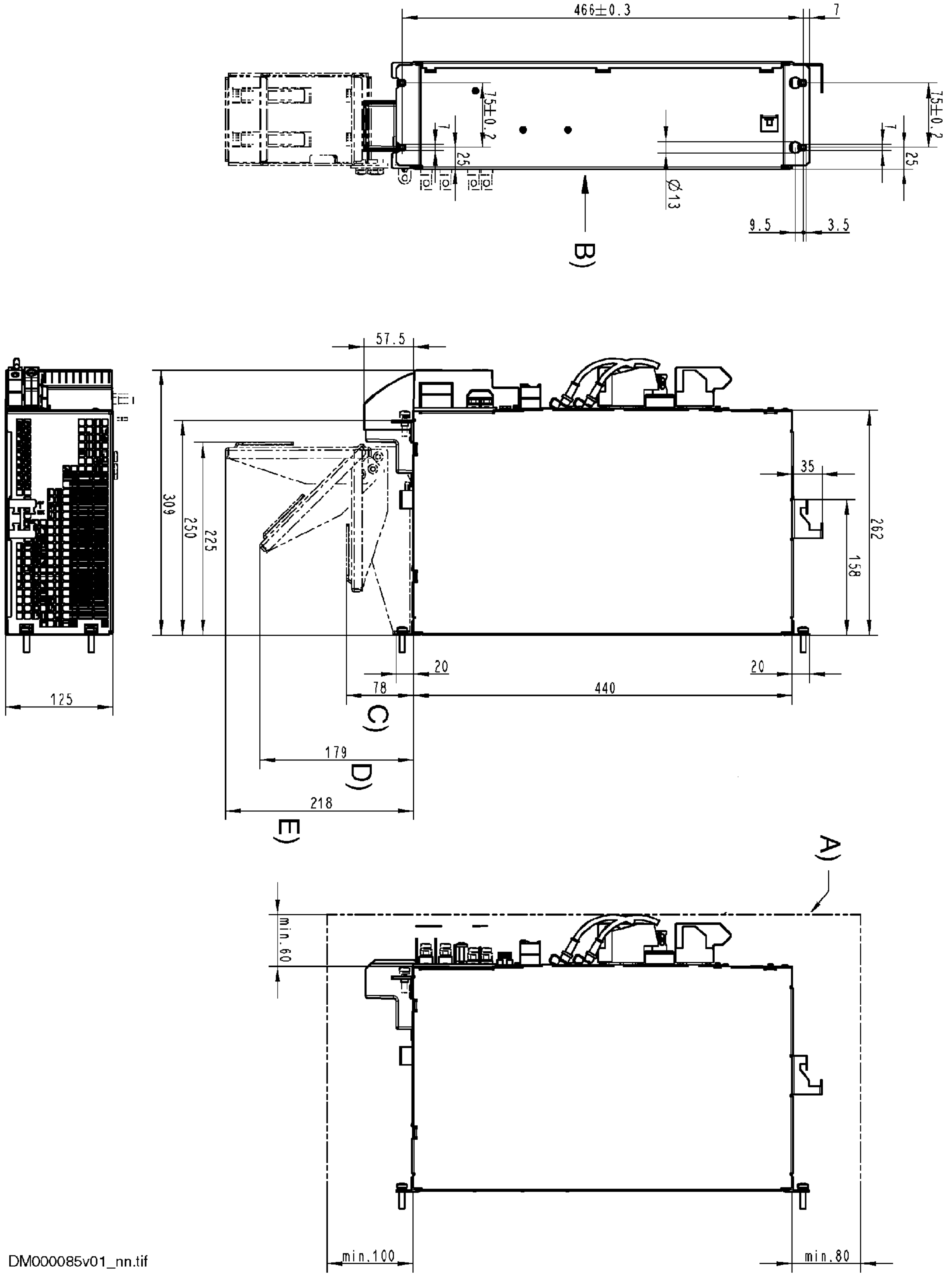
HMS01.1N-W0070



A)	minimum mounting clearance (plus additional space for motor cable) Note: Rexroth IndraDrive supply units require greater mounting clearance!
B)	rear view!
C)	dimensions for accessory HAS02.1 when motor cable run with 45°
D)	dimensions for accessory HAS02.1 when motor cable run horizontally

Fig.6-14: Dimensions HMS01.1N-W0070

HMS01.1N-W0110



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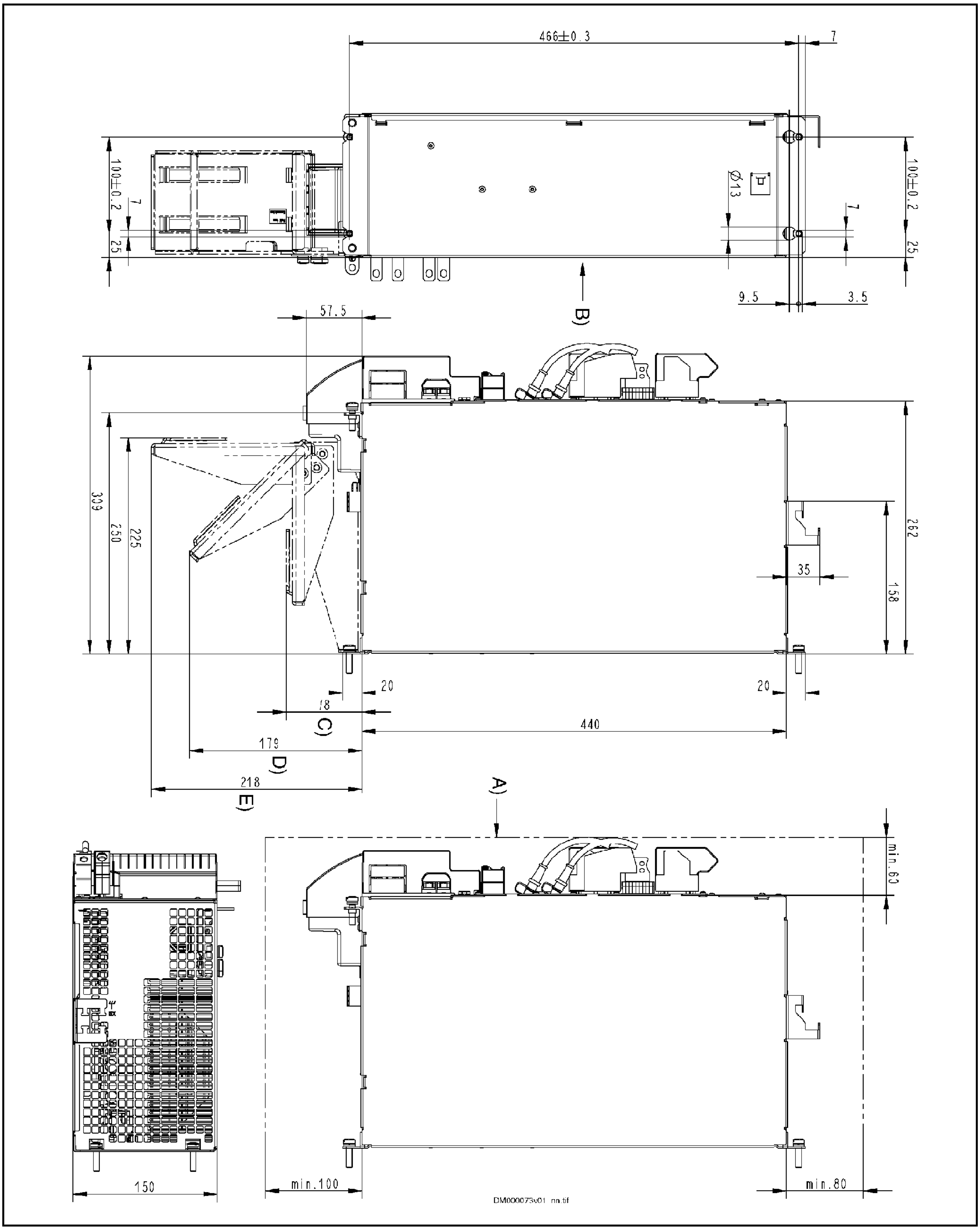
A)	minimum mounting clearance (plus additional space for motor cable) Note: Rexroth IndraDrive supply units require greater mounting clearance!
B)	rear view!
C)	dimensions for accessory HAS02.1 when motor cable run horizontally
D)	dimensions for accessory HAS02.1 when motor cable run with 45°
E)	dimensions for accessory HAS02.1 when motor cable run vertically

Fig.6-15: Dimensions HMS01.1N-W0110

Power Sections for Inverters - IndraDrive M

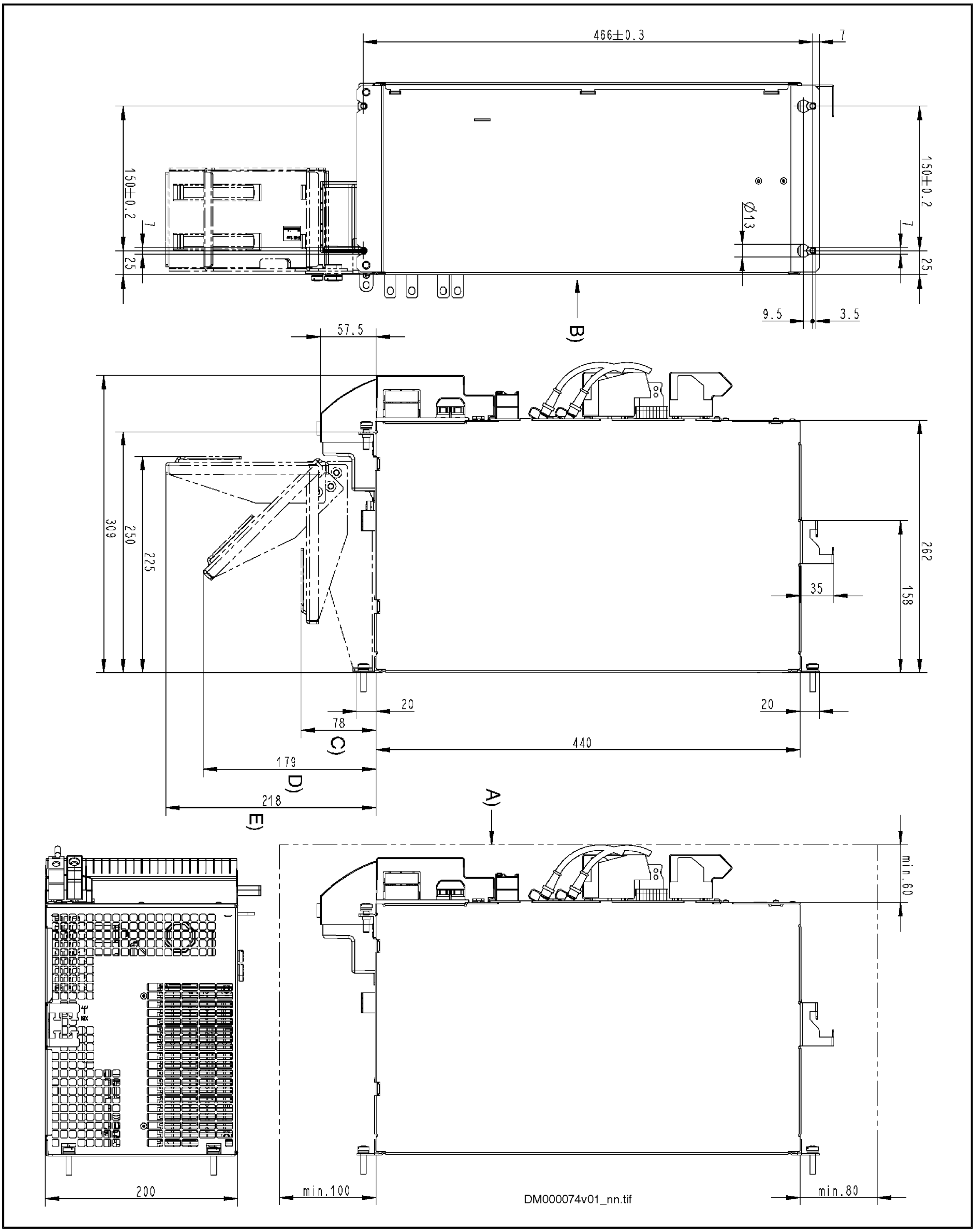
HMS01.1N-W0150



A)	minimum mounting clearance (plus additional space for motor cable) Note: Rexroth IndraDrive supply units require greater mounting clearance!
B)	rear view!
C)	dimensions for accessory HAS02.1 when motor cable run horizontally
D)	dimensions for accessory HAS02.1 when motor cable run with 45°
E)	dimensions for accessory HAS02.1 when motor cable run vertically

Fig.6-16: Dimensions HMS01.1N-W0150

HMS01.1N-W0210

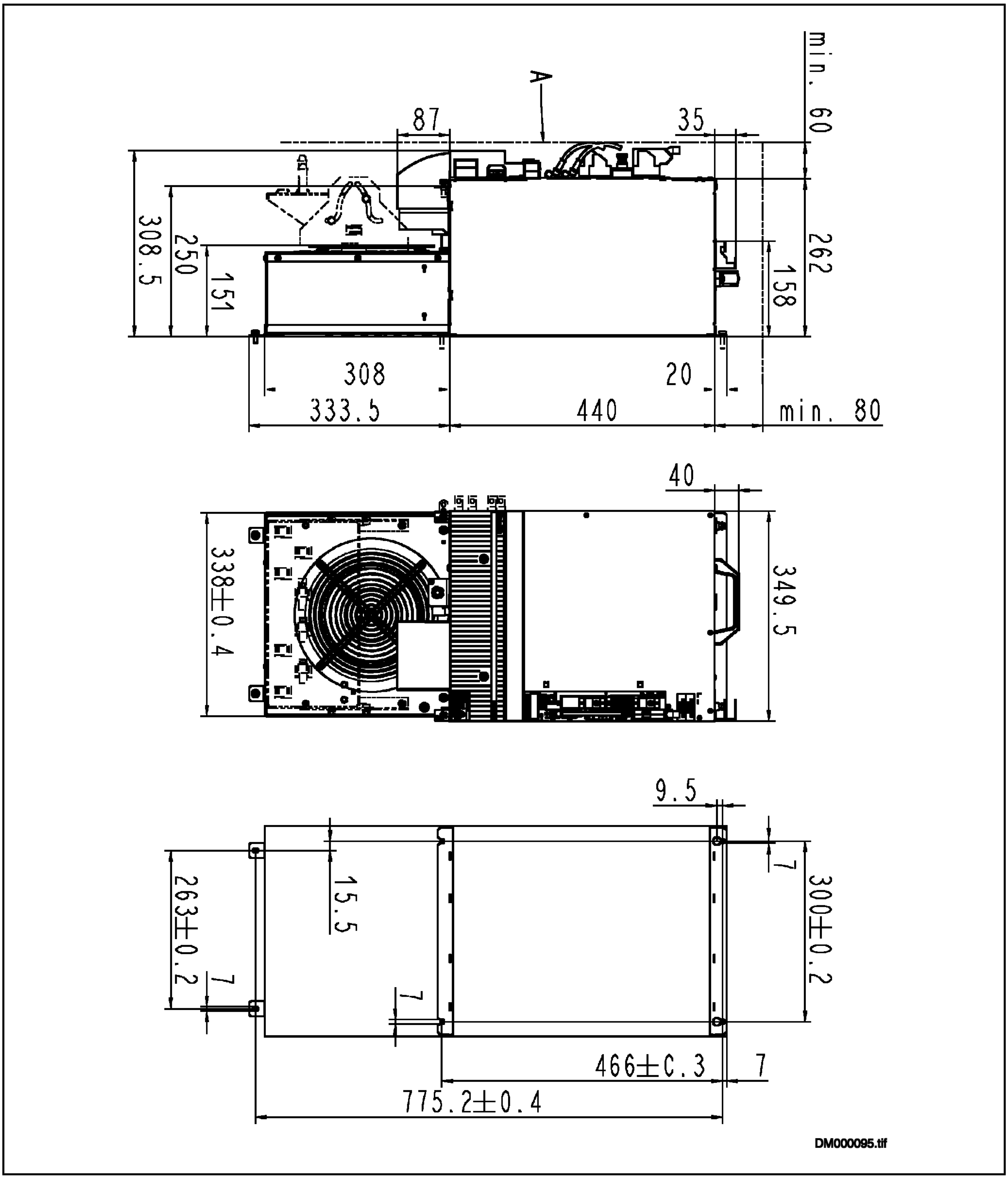


DM000074v01_nn.tif

A)	minimum mounting clearance (plus additional space for motor cable) Note: Rexroth IndraDrive supply units require greater mounting clearance!
B)	rear view!
C)	dimensions for accessory HAS02.1 when motor cable run horizontally
D)	dimensions for accessory HAS02.1 when motor cable run with 45°
E)	dimensions for accessory HAS02.1 when motor cable run vertically

Fig.6-17: *Dimensions HMS01.1N-W0210*

HMS01.1N-W0350



A	minimum mounting clearance (plus additional space for motor cable) Note: Rexroth IndraDrive supply units require greater mounting clearance!

Fig.6-18: *Dimensions HMS01.1N-W350*

Dimensions, Mass, Insulation, Sound Pressure Level

Data for mass, dimensions, sound pressure level, insulation

Description	Symbol	Unit	HMS01.1N-W0020	HMS01.1N-W0036	HMS01.1N-W0054	HMS01.1N-W0070
weight	m	kg	5,27		6,68	7,94
device height (UL)$^{1)}$	H	mm	440			
device depth (UL)$^{2)}$	T	mm	262			
device width (UL)$^{3)}$	B	mm	50		75	100
insulation resistance at DC 500 V	R_{is}	MOhm	>50			
capacitance against housing	C_Y	nF	2 x 68			
average sound pressure level (accuracy class 2) at P_{DC_cont} $^{4)}$	L_P	dB (A)	tbd			

1) 2) 3) housing dimension; see also related dimensional drawing

4) according to DIN EN ISO 11205; comparative value at distance 1 m, out of cabinet; HCS types with order code -L***: load-dependent

Fig.6-19: HMS - Data for mass, dimensions, sound pressure level, insulation

Data for mass, dimensions, sound pressure level, insulation

Description	Symbol	Unit	HMS01.1N-W0110	HMS01.1N-W0150	HMS01.1N-W0210	HMS01.1N-W0350
weight	m	kg	11,06	12,74	16,44	31,70
device height (UL)$^{1)}$	H	mm	440			
device depth (UL)$^{2)}$	T	mm	262			
device width (UL)$^{3)}$	B	mm	125	150	200	350
insulation resistance at DC 500 V	R_{is}	MOhm	>50			
capacitance against housing	C_Y	nF	2 x 100			
average sound pressure level (accuracy class 2) at P_{DC_cont} $^{4)}$	L_P	dB (A)	76	tbd		80

1) 2) 3) housing dimension; see also related dimensional drawing

4) according to DIN EN ISO 11205; comparative value at distance 1 m, out of cabinet; HCS types with order code -L***: load-dependent

Fig.6-20: HMS - Data for mass, dimensions, sound pressure level, insulation

Power Dissipation, Mounting Position, Cooling, Distances

Data for cooling and power dissipation

Description	Symbol	Unit	HMS01.1N-W0020	HMS01.1N-W0036	HMS01.1N-W0054	HMS01.1N-W0070
ambient temperature range during operation with nominal data	T_{a_work}	°C	0...40			
ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	0...55			
derating of P_{DC_cont}; P_{BD}; I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2,0			

Description	**Symbol**	**Unit**	**HMS01.1N-W0020**	**HMS01.1N-W0036**	**HMS01.1N-W0054**	**HMS01.1N-W0070**
allowed mounting position			G1			
cooling type			forced ventilation			
volumetric capacity of forced cooling	V	m^3/h	tbd			
allowed switching frequencies[1)]	f_s	kHz	4, 8, 12, 16			
power dissipation at I_{out_cont} = 0 A; $f_s = f_s$ (min.)[2)]	$P_{Diss\_0A\_fsmin}$	W	60	40	90	110
power dissipation at I_{out_cont} = 0 A; $f_s = f_s$ (max.)[3)]	$P_{Diss\_0A\_fsmax}$	W	120	130	260	330
power dissipation at continuous current and continuous DC bus power respectively (UL)[4)]	P_{Diss_cont}	W	165,00	210,00	420,00	485,00
minimum distance on the top of the device[5)]	d_{top}	mm	80			
minimum distance on the bottom of the device[6)]	d_{bot}	mm	100			
temperature rise with minimum distances d_{bot}; d_{top}; P_{BD}	ΔT	K	40	50	40	50

1) also depending on firmware and control section; see Parameter Description "P-0-0001, Switching frequency of the power output stage"; see "P-0-4058, Amplifier type data"

2) 3) plus dissipation of braking resistor (at HMV, HCS) and control section (at HMx, HCS); find interim values by interpolation to P_Diss_cont

4) HMV, HCS: plus dissipation of braking resistor, control section; KSM: plus rated power consumption control voltage input

5) 6) see fig. "Air intake and air outlet at drive controller"

Fig.6-21: HMS - Data for cooling and power dissipation

Data for cooling and power dissipation

Description	**Symbol**	**Unit**	**HMS01.1N-W0110**	**HMS01.1N-W0150**	**HMS01.1N-W0210**	**HMS01.1N-W0350**
ambient temperature range during operation with nominal data	T_{a_work}	°C	0...40			
ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	0...55			
derating of P_{DC_cont}; P_{BD}; I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2,0			
allowed mounting position			G1			
cooling type			forced ventilation			
volumetric capacity of forced cooling	V	m^3/h	165,00	tbd		1400,00
allowed switching frequencies[1)]	f_s	kHz	4, 8, 12, 16			4, 8, 12

Description	**Symbol**	**Unit**	**HMS01.1N-W0110**	**HMS01.1N-W0150**	**HMS01.1N-W0210**	**HMS01.1N-W0350**
power dissipation at I_{out_cont} = 0 A; $f_s = f_s$ (min.)$^{2)}$	$P_{Diss\_0A\_fsmin}$	W	60	70	160	280
power dissipation at I_{out_cont} = 0 A; $f_s = f_s$ (max.)$^{3)}$	$P_{Diss\_0A\_fsmax}$	W	160	130	400	520
power dissipation at continuous current and continuous DC bus power respectively (UL)$^{4)}$	P_{Diss_cont}	W	640,00	965,00	1570,00	2750,00
minimum distance on the top of the device$^{5)}$	d_{top}	mm	80			
minimum distance on the bottom of the device$^{6)}$	d_{bot}	mm	100			
temperature rise with minimum distances d_{bot}; d_{top}; P_{BD}	ΔT	K	35	45		50

1) also depending on firmware and control section; see Parameter Description "P-0-0001, Switching frequency of the power output stage"; see "P-0-4058, Amplifier type data"

2) 3) plus dissipation of braking resistor (at HMV, HCS) and control section (at HMx, HCS); find interim values by interpolation to P_Diss_cont

4) HMV, HCS: plus dissipation of braking resistor, control section; KSM: plus rated power consumption control voltage input

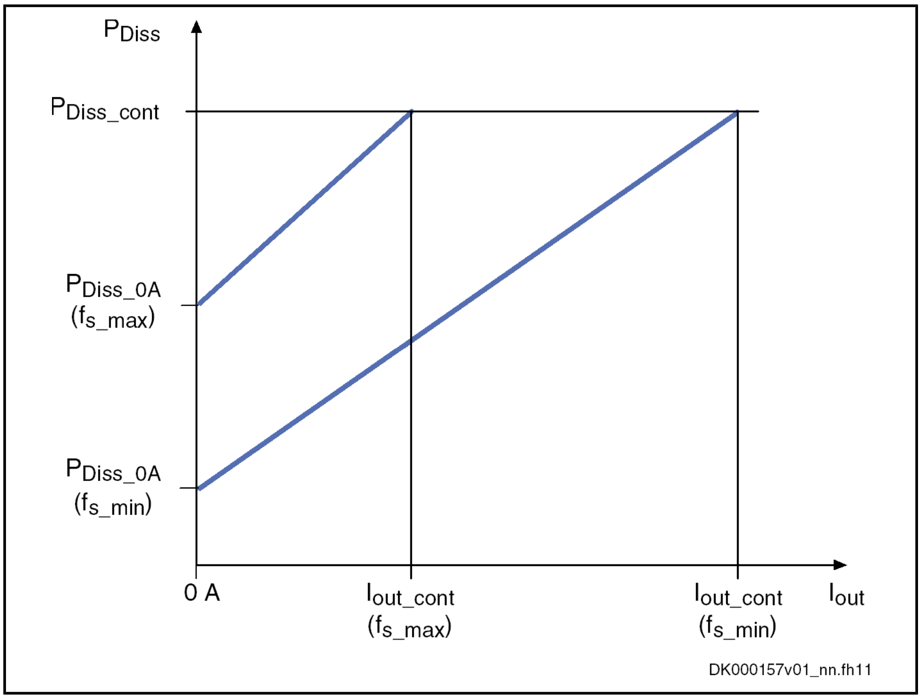
5) 6) see fig. "Air intake and air outlet at drive controller"

Fig.6-22: HMS - Data for cooling and power dissipation

Power Dissipation vs. Output Current

The figure below illustrates the connection between power dissipation and output current, depending on the switching frequency f_s which was set at the drive controller. See also Parameter Description "P-0-0001, Switching frequency of the power output stage".

☞ In addition, take the power at the braking resistor and the power consumption of the control section into account. Both powers are not contained in the figure.



I_{out} output current

P_{Diss} power dissipation

f_s switching frequency

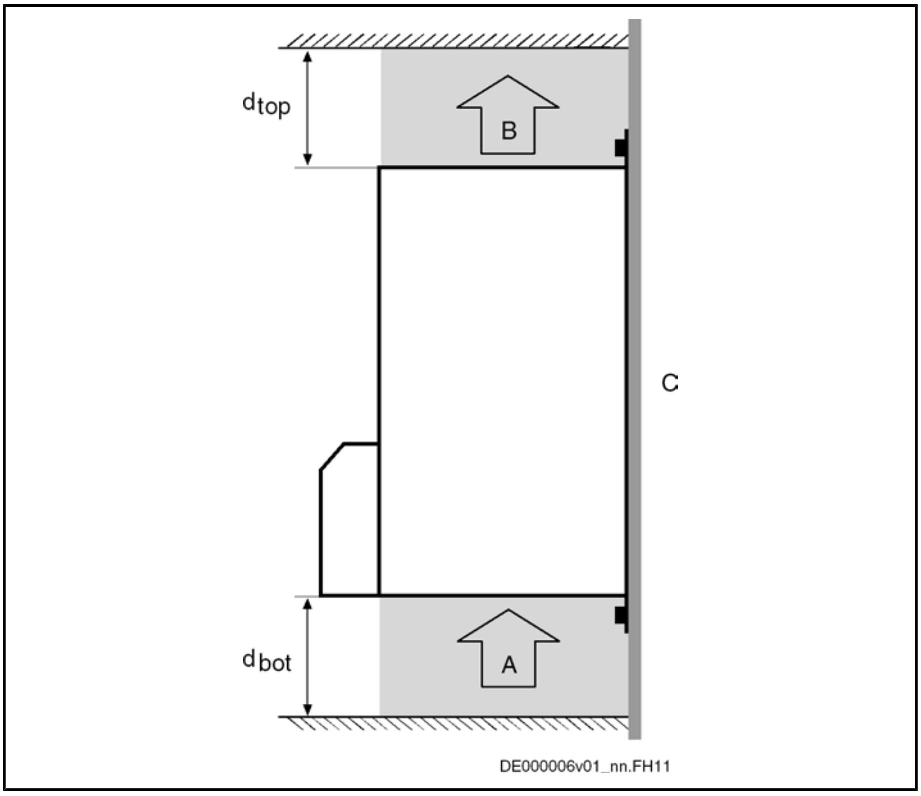
Fig.6-23: Power dissipation vs. output current

Distances

CAUTION

Property damage due to temperatures higher than 105 °C!

Comply with indicated minimum distances!



A	air intake
B	air outlet
C	mounting surface in control cabinet
d_{top}	distance top
d_{bot}	distance bottom

Fig.6-24: Air intake and air outlet at drive controller

Basic Data Power Section HMS01

General Information

This chapter contains:

- data for control voltage supply
- data of DC bus
- data of inverter

☞ The order of the data tables below follows the energy flow in the drive controller – from mains connection to motor output.

Control Voltage

Data for control voltage supply

Description	Symbol	Unit	HMS01.1N-W0020	HMS01.1N-W0036	HMS01.1N-W0054	HMS01.1N-W0070
rated control voltage input (UL)[1)]	U_{N3}	V	24 ± 20 %			
control voltage when using motor holding brake with motor cable length < 50 m[2)]	U_{N3}	V	24 ± 5 %			

Description	Symbol	Unit	HMS01.1N-W0020	HMS01.1N-W0036	HMS01.1N-W0054	HMS01.1N-W0070
control voltage when using motor holding brake with motor cable length > 50 m[3]	U_{N3}	V	26 ± 5 %			
maximum allowed voltage for 1 m	U_{N3_max}	V	33 (1ms)			
maximum inrush current at 24V supply	I_{EIN3_max}	A	4,20			
pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	5			
input capacitance	C_{N3}	mF	0,47			
rated power consumption control voltage input at U_{N3} (UL)[4]	P_{N3}	W	10	15	10	16

1) 2) 3) observe supply voltage for motor holding brakes

4) HMS, HMD, HCS: plus holding brake and control section; KCU01: at max. number of axes; KSM01: plus holding brake (UN x IN)

Fig.6-25: HMS - Data for control voltage supply

Data for control voltage supply

Description	Symbol	Unit	HMS01.1N-W0110	HMS01.1N-W0150	HMS01.1N-W0210	HMS01.1N-W0350
rated control voltage input (UL)[1]	U_{N3}	V	24 ± 20 %			
control voltage when using motor holding brake with motor cable length < 50 m[2]	U_{N3}	V	24 ± 5 %			
control voltage when using motor holding brake with motor cable length > 50 m[3]	U_{N3}	V	26 ± 5 %			
maximum allowed voltage for 1 m	U_{N3_max}	V	33 (1ms)			
maximum inrush current at 24V supply	I_{EIN3_max}	A	8,50	4,20		<10
pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	6			-
input capacitance	C_{N3}	mF	1,00			1,05
rated power consumption control voltage input at U_{N3} (UL)[4]	P_{N3}	W	34	23	75	218

1) 2) 3) observe supply voltage for motor holding brakes

4) HMS, HMD, HCS: plus holding brake and control section; KCU01: at max. number of axes; KSM01: plus holding brake (UN x IN)

Fig.6-26: HMS - Data for control voltage supply

Power Section - DC Bus

Data of power section - DC bus

Description	Symbol	Unit	HMS01.1N-W0020	HMS01.1N-W0036	HMS01.1N-W0054	HMS01.1N-W0070
DC bus voltage	U_{DC}	V	254...750			
capacitance in DC bus	C_{DC}	mF	-			

Description	Symbol	Unit	HMS01.1N-W0020	HMS01.1N-W0036	HMS01.1N-W0054	HMS01.1N-W0070
DC resistance in DC bus (L+ to L-) at U_{DC} = 750 V	R_{DC}	kOhm	approx. 1000			
monitoring value maximum DC bus voltage, switch-off threshold	$U_{DC\_limit\_max}$	V	900			
monitoring value minimum DC bus voltage, undervoltage threshold	$U_{DC\_limit\_min}$	V	254			

Fig.6-27: HMS - Data of power section - DC bus

Data of power section - DC bus

Description	Symbol	Unit	HMS01.1N-W0110	HMS01.1N-W0150	HMS01.1N-W0210	HMS01.1N-W0350
DC bus voltage	U_{DC}	V	254...750			
capacitance in DC bus	C_{DC}	mF	-			4,90
DC resistance in DC bus (L+ to L-) at U_{DC} = 750 V	R_{DC}	kOhm	approx. 1000			approx. 50
monitoring value maximum DC bus voltage, switch-off threshold	$U_{DC\_limit\_max}$	V	900			
monitoring value minimum DC bus voltage, undervoltage threshold	$U_{DC\_limit\_min}$	V	254			

Fig.6-28: HMS - Data of power section - DC bus

Power Section - Inverter

Data of power section - Inverter

Description	Symbol	Unit	HMS01.1N-W0020	HMS01.1N-W0036	HMS01.1N-W0054	HMS01.1N-W0070
allowed switching frequencies[1)]	f_s	kHz	4, 8, 12, 16			
output voltage, fundamental wave with open-loop operation	U_{out_eff}	V	~ UDC x 0,71			
output voltage, fundamental wave with closed-loop operation	U_{out_eff}	V	~ UDC x 0,71			
rise of voltage at output with U_{LN_nenn} and 15 m motor cable length phase-phase (10-90%)[2)]	du/dt	kV/µs	5,00			
rise of voltage at output with U_{LN_nenn} and 15 m motor cable length phase-ground (10-90%)[3)]	du/dt	kV/µs	5,00			
output frequency range at f_s = 2 kHz	f_{out_2k}	Hz	-			
output frequency range at f_s = 4 kHz	f_{out_4k}	Hz	0...400			
output frequency range at f_s = 8 kHz	f_{out_8k}	Hz	0...800			
output frequency range at f_s = 12 kHz	f_{out_12k}	Hz	0...1200			

Power Sections for Inverters - IndraDrive M

Description	Symbol	Unit	HMS01.1N-W0020	HMS01.1N-W0036	HMS01.1N-W0054	HMS01.1N-W0070
output frequency range at f_s = 16 kHz	f_{out_16k}	Hz	0...1600			
output frequency threshold to detect motor standstill[4)]	f_{out_still}	Hz	2...4			
maximum output current at f_s = 2 kHz	I_{out_max2}	A	-			
maximum output current at f_s = 4 kHz	I_{out_max4}	A	20,0	36,0	54,0	70,7
maximum output current at f_s = 8 kHz	I_{out_max8}	A	20,0	36,0	54,0	70,7
maximum output current at f_s = 12 kHz	I_{out_max12}	A	16,0	31,0	45,0	65,0
maximum output current at f_s = 16 kHz	I_{out_max16}	A	11,0	24,0	35,0	51,0
allowed continuous output current at f_s = 2 kHz	I_{out_cont2}	A	-			
allowed continuous output current at f_s = 4 kHz	I_{out_cont4}	A	12,1	21,3	35,0	42,4
allowed continuous output current at f_s = 8 kHz	I_{out_cont8}	A	8,3	15,0	20,0	24,1
allowed continuous output current at f_s = 12 kHz[5)]	I_{out_cont12}	A	5,0	9,5	12,0	14,4
allowed continuous output current at f_s = 16 kHz[6)]	I_{out_cont16}	A	2,7	6,0	7,5	9,3
allowed continuous output current at f_s = 2 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_2}$	A	-			
allowed continuous output current at f_s = 4 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_4}$	A	8,1	14,2	23,4	28,3
allowed continuous output current at f_s = 8 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_8}$	A	5,5	10,0	13,4	16,1
allowed continuous output current at f_s = 12 kHz; output frequency $f_{out} < f_{out\_still}$ [7)]	$I_{out\_cont0Hz\_12}$	A	3,3	6,4	8,2	9,6

Description	Symbol	Unit	HMS01.1N-W0020	HMS01.1N-W0036	HMS01.1N-W0054	HMS01.1N-W0070
allowed continuous output current at f_s = 16 kHz; output frequency $f_{out} < f_{out\_still}$ 8)	$I_{out\_cont0Hz\_16}$	A	1,8	4,0	5,1	6,2
assigned output filters at nom. data; f_s = 4 kHz			-			

1) also depending on firmware and control section; see Parameter Description "P-0-0001, Switching frequency of the power output stage"; see "P-0-4058, Amplifier type data"
2) 3) guide value, see following note
4) see following note regarding reduction output current
5) 6) 7) 8) see Parameter Description "P-0-0556, Config word of axis controller", load-depending reduction of PWM frequency fs

Fig.6-29: HMS - Data of power section - Inverter

Data of power section - Inverter

Description	Symbol	Unit	HMS01.1N-W0110	HMS01.1N-W0150	HMS01.1N-W0210	HMS01.1N-W0350
allowed switching frequencies$^{1)}$	f_s	kHz	4, 8, 12, 16			4, 8, 12
output voltage, fundamental wave with open-loop operation	U_{out_eff}	V	~ UDC x 0,71			
output voltage, fundamental wave with closed-loop operation	U_{out_eff}	V	~ UDC x 0,71			
rise of voltage at output with U_{LN_nenn} and 15 m motor cable length phase-phase (10-90%)$^{2)}$	du/dt	kV/µs	5,00			
rise of voltage at output with U_{LN_nenn} and 15 m motor cable length phase-ground (10-90%)$^{3)}$	du/dt	kV/µs	5,00			
output frequency range at f_s = 2 kHz	f_{out_2k}	Hz	-			
output frequency range at f_s = 4 kHz	f_{out_4k}	Hz	0...400			
output frequency range at f_s = 8 kHz	f_{out_8k}	Hz	0...800			
output frequency range at f_s = 12 kHz	f_{out_12k}	Hz	0...1200			
output frequency range at f_s = 16 kHz	f_{out_16k}	Hz	0...1600			-
output frequency threshold to detect motor standstill$^{4)}$	f_{out_still}	Hz	2...4			
maximum output current at f_s = 2 kHz	I_{out_max2}	A	-			
maximum output current at f_s = 4 kHz	I_{out_max4}	A	110,0	150,0	210,0	350,0
maximum output current at f_s = 8 kHz	I_{out_max8}	A	110,0	150,0	210,0	250,0

Description	Symbol	Unit	HMS01.1N-W0110	HMS01.1N-W0150	HMS01.1N-W0210	HMS01.1N-W0350
maximum output current at f_s = 12 kHz	I_{out_max12}	A	75,0	136,0	190,0	170,0
maximum output current at f_s = 16 kHz	I_{out_max16}	A	60,0	106,0	155,0	-
allowed continuous output current at f_s = 2 kHz	I_{out_cont2}	A	-			
allowed continuous output current at f_s = 4 kHz	I_{out_cont4}	A	68,5	99,7	150,7	250,0
allowed continuous output current at f_s = 8 kHz	I_{out_cont8}	A	43,5	67,5	101,7	170,0
allowed continuous output current at f_s = 12 kHz$^{5)}$	I_{out_cont12}	A	32,0	48,4	72,6	126,0
allowed continuous output current at f_s = 16 kHz$^{6)}$	I_{out_cont16}	A	25,5	36,8	54,2	-
allowed continuous output current at f_s = 2 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_2}$	A	-			
allowed continuous output current at f_s = 4 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_4}$	A	42,2	57,0	86,1	150,0
allowed continuous output current at f_s = 8 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_8}$	A	24,9	38,6	58,2	92,0
allowed continuous output current at f_s = 12 kHz; output frequency $f_{out} < f_{out\_still}$ $^{7)}$	$I_{out\_cont0Hz\_12}$	A	18,3	27,7	41,5	68,0
allowed continuous output current at f_s = 16 kHz; output frequency $f_{out} < f_{out\_still}$ $^{8)}$	$I_{out\_cont0Hz\_16}$	A	14,7	21,1	31,0	-
assigned output filters at nom. data; f_s = 4 kHz			-			

1) also depending on firmware and control section; see Parameter Description "P-0-0001, Switching frequency of the power output stage"; see "P-0-4058, Amplifier type data"

2) 3) guide value, see following note

4) see following note regarding reduction output current

5) 6) 7) 8) see Parameter Description "P-0-0556, Config word of axis controller", load-depending reduction of PWM frequency fs

Fig.6-30: HMS - Data of power section - Inverter

☞ Observe that the load is almost independent of the power section used.

Especially when using **standard motors** , make sure that they comply with the occurring voltage load.

Observe the information contained in the chapter “Third-Party Motors at IndraDrive Controllers” in the Project Planning Manual of the drive system.

☞ Depending on the electric output frequency, the output current is reduced for thermal protection of the power section.

The output current is reduced, when the electric output frequency has fallen below the threshold to detect motor standstill.

Exemplary Data for Applications

General Information

This chapter contains:

- examples of allowed current profiles
- examples of allowed performance profiles
- data for selecting standard motors

Current Profiles

Examples of allowed current profiles

Description	Symbol	Unit	HMS01.1N-W0020	HMS01.1N-W0036	HMS01.1N-W0054	HMS01.1N-W0070
maximum output current at $I_{out\_base\_1}$; f_s = 2 kHz; t = 0,4 s; T = 4 s; K = 2,5[1)]	$I_{out\_peak1\_2}$	A	-			
base load current at $I_{out\_peak\_1}$; f_s = 2 kHz; t = 0,4 s; T = 4 s; K = 2,5	$I_{out\_base1\_2}$	A	-			
maximum output current at $I_{out\_base\_1}$; f_s = 4 kHz; t = 0,4 s; T = 4 s; K = 2,5[2)]	$I_{out\_peak1\_4}$	A	19,05	34,71	54,00	66,87
base load current at $I_{out\_peak\_1}$; f_s = 4 kHz; t = 0,4 s; T = 4 s; K = 2,5	$I_{out\_base1\_4}$	A	7,62	13,88	21,60	26,75
maximum output current at $I_{out\_base\_1}$; f_s = 8 kHz; t = 0,4 s; T = 4 s; K = 2,5[3)]	$I_{out\_peak1\_8}$	A	13,22	24,83	34,39	38,76
base load current at $I_{out\_peak\_1}$; f_s = 8 kHz; t = 0,4 s; T = 4 s; K = 2,5	$I_{out\_base1\_8}$	A	5,29	9,93	13,76	15,50
maximum output current at $I_{out\_base\_1}$; f_s = 12 kHz; t = 0,4 s; T = 4 s; K = 2,5[4)]	$I_{out\_peak1\_12}$	A	8,06	15,90	21,07	23,40
base load current at $I_{out\_peak\_1}$; f_s = 12 kHz; t = 0,4 s; T = 4 s; K = 2,5	$I_{out\_base1\_12}$	A	3,22	6,36	8,43	9,36

Power Sections for Inverters - IndraDrive M

Description	Symbol	Unit	HMS01.1N-W0020	HMS01.1N-W0036	HMS01.1N-W0054	HMS01.1N-W0070
maximum output current at $I_{out\_base\_1}$; f_s = 16 kHz; t = 0,4 s; T = 4 s; K = 2,5[5)]	$I_{out\_peak1\_16}$	A	4,40	10,10	13,21	15,18
base load current at $I_{out\_peak\_1}$; f_s = 16 kHz; t = 0,4 s; T = 4 s; K = 2,5	$I_{out\_base1\_16}$	A	1,76	4,04	5,28	6,07
maximum output current at $I_{out\_base\_3}$; f_s = 2 kHz; t = 2 s; T = 20 s; K = 2,0[6)]	$I_{out\_peak3\_2}$	A	-			
base load current at $I_{out\_peak\_3}$; f_s = 2 kHz; t = 2 s; T = 20 s; K = 2,0	$I_{out\_base3\_2}$	A	-			
maximum output current at $I_{out\_base\_3}$; f_s = 4 kHz; t = 2 s; T = 20 s; K = 2,0[7)]	$I_{out\_peak3\_4}$	A	17,28	31,32	52,93	60,94
base load current at $I_{out\_peak\_3}$; f_s = 4 kHz; t = 2 s; T = 20 s; K = 2,0	$I_{out\_base3\_4}$	A	8,64	15,66	26,46	30,47
maximum output current at $I_{out\_base\_3}$; f_s = 8 kHz; t = 2 s; T = 20 s; K = 2,0[8)]	$I_{out\_peak3\_8}$	A	11,93	22,27	30,67	35,04
base load current at $I_{out\_peak\_3}$; f_s = 8 kHz; t = 2 s; T = 20 s; K = 2,0	$I_{out\_base3\_8}$	A	5,96	11,14	15,33	17,52
maximum output current at $I_{out\_base\_3}$; f_s = 12 kHz; t = 2 s; T = 20 s; K = 2,0[9)]	$I_{out\_peak3\_12}$	A	7,24	14,19	18,73	21,06
base load current at $I_{out\_peak\_3}$; f_s = 12 kHz; t = 2 s; T = 20 s; K = 2,0	$I_{out\_base3\_12}$	A	3,62	7,09	9,36	10,53
maximum output current at $I_{out\_base\_3}$; f_s = 16 kHz; t = 2 s; T = 20 s; K = 2,0[10)]	$I_{out\_peak3\_16}$	A	3,94	8,98	11,72	13,63
base load current at $I_{out\_peak\_3}$; f_s = 16 kHz; t = 2 s; T = 20 s; K = 2,0	$I_{out\_base3\_16}$	A	1,97	4,49	5,86	6,81
base load current at $I_{out\_peak\_4}$; f_s = 2 kHz; t = 60 s; T = 5 min; K = 1,5	$I_{out\_base4\_2}$	A	-			
maximum output current at $I_{out\_base\_4}$; f_s = 2 kHz; t = 60 s; T = 5 min; K = 1,5[11)]	$I_{out\_peak4\_2}$	A	-			
maximum output current at $I_{out\_base\_4}$; f_s = 4 kHz; t = 60 s; T = 5 min; K = 1,5[12)]	$I_{out\_peak4\_4}$	A	12,60	22,45	40,45	45,67
base load current at $I_{out\_peak\_4}$; f_s = 4 kHz; t = 60 s; T = 5 min; K = 1,5	$I_{out\_base4\_4}$	A	8,40	14,97	26,97	30,45

Description	Symbol	Unit	HMS01.1N-W0020	HMS01.1N-W0036	HMS01.1N-W0054	HMS01.1N-W0070
maximum output current at $I_{out\_base\_4}$; f_s = 8 kHz; t = 60 s; T = 5 min; K = 1,5[13]	$I_{out\_peak4\_8}$	A	8,64	15,85	23,26	26,02
base load current at $I_{out\_peak\_4}$; f_s = 8 kHz; t = 60 s; T = 5 min; K = 1,5	$I_{out\_base4\_8}$	A	5,76	10,57	15,51	17,35
maximum output current at $I_{out\_base\_4}$; f_s = 12 kHz; t = 60 s; T = 5 min; K = 1,5[14]	$I_{out\_peak4\_12}$	A	5,22	10,04	14,16	15,56
base load current at $I_{out\_peak\_4}$; f_s = 12 kHz; t = 60 s; T = 5 min; K = 1,5	$I_{out\_base4\_12}$	A	3,48	6,69	9,44	10,37
maximum output current at $I_{out\_base\_4}$; f_s = 16 kHz; t = 60 s; T = 5 min; K = 1,5[15]	$I_{out\_peak4\_16}$	A	2,83	6,33	8,85	10,05
base load current at $I_{out\_peak\_4}$; f_s = 16 kHz; t = 60 s; T = 5 min; K = 1,5	$I_{out\_base4\_16}$	A	1,89	4,22	5,90	6,70
maximum output current at $I_{out\_base\_5}$; f_s = 2 kHz; t = 60 s; T = 10 min; K = 1,1[16]	$I_{out\_peak5\_2}$	A	-			
base load current at $I_{out\_peak\_5}$; f_s = 2 kHz; t = 60 s; T = 10 min; K = 1,1	$I_{out\_base5\_2}$	A	-			
maximum output current at $I_{out\_base\_5}$; f_s = 4 kHz; t = 60 s; T = 10 min; K = 1,1[17]	$I_{out\_peak5\_4}$	A	12,26	21,67	36,47	43,32
base load current at $I_{out\_peak\_5}$; f_s = 4 kHz; t = 60 s; T = 10 min; K = 1,1	$I_{out\_base5\_4}$	A	11,15	19,70	33,16	39,38
maximum output current at $I_{out\_base\_5}$; f_s = 8 kHz; t = 60 s; T = 10 min; K = 1,1[18]	$I_{out\_peak5\_8}$	A	8,39	15,28	20,91	24,63
base load current at $I_{out\_peak\_5}$; f_s = 8 kHz; t = 60 s; T = 10 min; K = 1,1	$I_{out\_base5\_8}$	A	7,63	13,89	19,01	22,39
maximum output current at $I_{out\_base\_5}$; f_s = 12 kHz; t = 60 s; T = 10 min; K = 1,1[19]	$I_{out\_peak5\_12}$	A	5,07	9,67	12,71	14,71
base load current at $I_{out\_peak\_5}$; f_s = 12 kHz; t = 60 s; T = 10 min; K = 1,1	$I_{out\_base5\_12}$	A	4,61	8,79	11,56	13,37

Description	Symbol	Unit	HMS01.1N-W0020	HMS01.1N-W0036	HMS01.1N-W0054	HMS01.1N-W0070
maximum output current at $I_{out\_base\_5}$; f_s = 16 kHz; t = 60 s; T = 10 min; K = 1,1^20)	$I_{out\_peak5\_16}$	A	2,75	6,09	7,94	9,50
base load current at $I_{out\_peak\_5}$; f_s = 16 kHz; t = 60 s; T = 10 min; K = 1,1	$I_{out\_base5\_16}$	A	2,50	5,54	7,22	8,63

1) 2) 3) 4) 5) 6) 7) 8) 9) 10) 11) 12) 13) 14) 15) 16) 17) 18) 19) 20) see definition profile UEL_I_e

Fig.6-31: HMS - Examples of allowed current profiles

Examples of allowed current profiles

Description	Symbol	Unit	HMS01.1N-W0110	HMS01.1N-W0150	HMS01.1N-W0210	HMS01.1N-W0350
maximum output current at $I_{out\_base\_1}$; f_s = 2 kHz; t = 0,4 s; T = 4 s; K = 2,5^1)	$I_{out\_peak1\_2}$	A	-			
base load current at $I_{out\_peak\_1}$; f_s = 2 kHz; t = 0,4 s; T = 4 s; K = 2,5	$I_{out\_base1\_2}$	A	-			
maximum output current at $I_{out\_base\_1}$; f_s = 4 kHz; t = 0,4 s; T = 4 s; K = 2,5^2)	$I_{out\_peak1\_4}$	A	106,40	150,00	210,00	350,00
base load current at $I_{out\_peak\_1}$; f_s = 4 kHz; t = 0,4 s; T = 4 s; K = 2,5	$I_{out\_base1\_4}$	A	42,56	60,00	84,00	140,00
maximum output current at $I_{out\_base\_1}$; f_s = 8 kHz; t = 0,4 s; T = 4 s; K = 2,5^3)	$I_{out\_peak1\_8}$	A	67,91	107,09	156,29	250,00
base load current at $I_{out\_peak\_1}$; f_s = 8 kHz; t = 0,4 s; T = 4 s; K = 2,5	$I_{out\_base1\_8}$	A	27,16	42,84	62,52	100,00
maximum output current at $I_{out\_base\_1}$; f_s = 12 kHz; t = 0,4 s; T = 4 s; K = 2,5^4)	$I_{out\_peak1\_12}$	A	50,36	77,35	112,47	170,00
base load current at $I_{out\_peak\_1}$; f_s = 12 kHz; t = 0,4 s; T = 4 s; K = 2,5	$I_{out\_base1\_12}$	A	20,14	30,94	44,99	68,00
maximum output current at $I_{out\_base\_1}$; f_s = 16 kHz; t = 0,4 s; T = 4 s; K = 2,5^5)	$I_{out\_peak1\_16}$	A	40,62	58,83	84,38	-
base load current at $I_{out\_peak\_1}$; f_s = 16 kHz; t = 0,4 s; T = 4 s; K = 2,5	$I_{out\_base1\_16}$	A	16,25	23,53	33,75	-
maximum output current at $I_{out\_base\_3}$; f_s = 2 kHz; t = 2 s; T = 20 s; K = 2,0^6)	$I_{out\_peak3\_2}$	A	-			

Description	Symbol	Unit	HMS01.1N-W0110	HMS01.1N-W0150	HMS01.1N-W0210	HMS01.1N-W0350
base load current at $I_{out\_peak\_3}$; f_s = 2 kHz; t = 2 s; T = 20 s; K = 2,0	$I_{out\_base3\_2}$	A	-			
maximum output current at $I_{out\_base\_3}$; f_s = 4 kHz; t = 2 s; T = 20 s; K = 2,0[7]	$I_{out\_peak3\_4}$	A	95,87	140,83	208,94	350,00
base load current at $I_{out\_peak\_3}$; f_s = 4 kHz; t = 2 s; T = 20 s; K = 2,0	$I_{out\_base3\_4}$	A	47,93	70,41	104,47	175,00
maximum output current at $I_{out\_base\_3}$; f_s = 8 kHz; t = 2 s; T = 20 s; K = 2,0[8]	$I_{out\_peak3\_8}$	A	60,73	96,70	142,91	240,00
base load current at $I_{out\_peak\_3}$; f_s = 8 kHz; t = 2 s; T = 20 s; K = 2,0	$I_{out\_base3\_8}$	A	30,36	48,35	71,45	120,00
maximum output current at $I_{out\_base\_3}$; f_s = 12 kHz; t = 2 s; T = 20 s; K = 2,0[9]	$I_{out\_peak3\_12}$	A	44,90	69,65	102,46	170,00
base load current at $I_{out\_peak\_3}$; f_s = 12 kHz; t = 2 s; T = 20 s; K = 2,0	$I_{out\_base3\_12}$	A	22,45	34,83	51,23	85,00
maximum output current at $I_{out\_base\_3}$; f_s = 16 kHz; t = 2 s; T = 20 s; K = 2,0[10]	$I_{out\_peak3\_16}$	A	36,17	52,97	76,75	-
base load current at $I_{out\_peak\_3}$; f_s = 16 kHz; t = 2 s; T = 20 s; K = 2,0	$I_{out\_base3\_16}$	A	18,09	26,49	38,37	-
base load current at $I_{out\_peak\_4}$; f_s = 2 kHz; t = 60 s; T = 5 min; K = 1,5	$I_{out\_base4\_2}$	A	-			
maximum output current at $I_{out\_base\_4}$; f_s = 2 kHz; t = 60 s; T = 5 min; K = 1,5[11]	$I_{out\_peak4\_2}$	A	-			
maximum output current at $I_{out\_base\_4}$; f_s = 4 kHz; t = 60 s; T = 5 min; K = 1,5[12]	$I_{out\_peak4\_4}$	A	70,02	106,73	162,71	273,00
base load current at $I_{out\_peak\_4}$; f_s = 4 kHz; t = 60 s; T = 5 min; K = 1,5	$I_{out\_base4\_4}$	A	46,68	71,16	108,47	182,00
maximum output current at $I_{out\_base\_4}$; f_s = 8 kHz; t = 60 s; T = 5 min; K = 1,5[13]	$I_{out\_peak4\_8}$	A	43,90	72,42	110,19	178,00
base load current at $I_{out\_peak\_4}$; f_s = 8 kHz; t = 60 s; T = 5 min; K = 1,5	$I_{out\_base4\_8}$	A	29,27	48,28	73,46	119,00
maximum output current at $I_{out\_base\_4}$; f_s = 12 kHz; t = 60 s; T = 5 min; K = 1,5[14]	$I_{out\_peak4\_12}$	A	32,34	52,00	78,67	133,00

Power Sections for Inverters - IndraDrive M

Description	Symbol	Unit	HMS01.1N-W0110	HMS01.1N-W0150	HMS01.1N-W0210	HMS01.1N-W0350
base load current at $I_{out\_peak\_4}$; f_s = 12 kHz; t = 60 s; T = 5 min; K = 1,5	$I_{out\_base4\_12}$	A	21,56	34,67	52,45	89,00
maximum output current at $I_{out\_base\_4}$; f_s = 16 kHz; t = 60 s; T = 5 min; K = 1,5[15)]	$I_{out\_peak4\_16}$	A	26,01	39,54	58,83	-
base load current at $I_{out\_peak\_4}$; f_s = 16 kHz; t = 60 s; T = 5 min; K = 1,5	$I_{out\_base4\_16}$	A	17,34	26,36	39,22	-
maximum output current at $I_{out\_base\_5}$; f_s = 2 kHz; t = 60 s; T = 10 min; K = 1,1[16)]	$I_{out\_peak5\_2}$	A	-			
base load current at $I_{out\_peak\_5}$; f_s = 2 kHz; t = 60 s; T = 10 min; K = 1,1	$I_{out\_base5\_2}$	A	-			
maximum output current at $I_{out\_base\_5}$; f_s = 4 kHz; t = 60 s; T = 10 min; K = 1,1[17)]	$I_{out\_peak5\_4}$	A	69,32	101,61	153,95	264,00
base load current at $I_{out\_peak\_5}$; f_s = 4 kHz; t = 60 s; T = 10 min; K = 1,1	$I_{out\_base5\_4}$	A	63,02	92,38	139,95	240,00
maximum output current at $I_{out\_base\_5}$; f_s = 8 kHz; t = 60 s; T = 10 min; K = 1,1[18)]	$I_{out\_peak5\_8}$	A	43,73	68,78	104,01	172,00
base load current at $I_{out\_peak\_5}$; f_s = 8 kHz; t = 60 s; T = 10 min; K = 1,1	$I_{out\_base5\_8}$	A	39,75	62,53	94,56	156,00
maximum output current at $I_{out\_base\_5}$; f_s = 12 kHz; t = 60 s; T = 10 min; K = 1,1[19)]	$I_{out\_peak5\_12}$	A	32,21	49,37	74,19	128,00
base load current at $I_{out\_peak\_5}$; f_s = 12 kHz; t = 60 s; T = 10 min; K = 1,1	$I_{out\_base5\_12}$	A	29,28	44,88	67,45	117,00
maximum output current at $I_{out\_base\_5}$; f_s = 16 kHz; t = 60 s; T = 10 min; K = 1,1[20)]	$I_{out\_peak5\_16}$	A	25,90	37,54	55,46	-
base load current at $I_{out\_peak\_5}$; f_s = 16 kHz; t = 60 s; T = 10 min; K = 1,1	$I_{out\_base5\_16}$	A	23,55	34,13	50,42	-

1) 2) 3) 4) 5) 6) 7) 8) 9) 10) 11) 12) 13) 14) 15) 16) 17) 18) 19) 20) see definition profile UEL_I_e

Fig.6-32: HMS - Examples of allowed current profiles

Current Profile “UEL_I_e”

The following current profiles have been defined for converters and inverters.

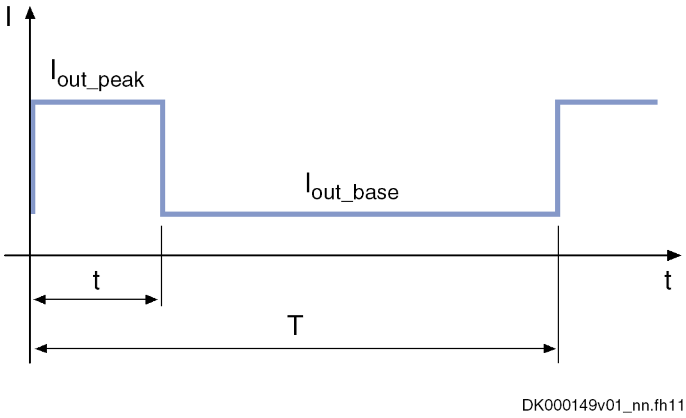
Profile	Explanation
current profile “UEL_I_e” 	The characteristic data of the profile are used to select converters and inverters for operation with standard motors and servo drives.

Fig.6-33: Definition of current profiles

Operation With Standard Motors

General Information

Selecting Standard Motors

The tables below show the nominal powers P_{nenn} of standard motors which can be operated at the respective drive controller. The data are subject to the following conditions:

- motor design:

  4-pole standard motor (2 pole pairs) with rated voltage 3 AC 400 V, 50 Hz at mains voltage $U_{LN} \geq$ 3 AC 400 V or

  4-pole standard motor (2 pole pairs) with rated voltage 3 AC 460 V, 60 Hz at mains voltage $U_{LN} \geq$ 3 AC 460 V
- assigned mains choke is used
- operation at minimum switching frequency $f_s = f_s$ (min.)
- rotary field at output with $f_{out} > f_{out\_still}$
- ambient temperature $T_a \leq T_{a\_work}$
- overload ratio $K = P_{DC\_peak} / P_{DC\_base}$ according to performance profile “UEL_P_e”
- type of mains connection: individual supply

☞ When choosing standard motors for HMS/HMD, select an appropriate HMV supply unit. Observe the performance data P_{DC_peak} and P_{DC_base} in the performance profile “UEL_P_e” of the supply unit.

Operating Standard Motors at 3 AC 400 V

Selection of standard motors 3 AC 400V - Exemplary profiles

Description	Symbol	Unit	HMS01.1N-W0020	HMS01.1N-W0036	HMS01.1N-W0054	HMS01.1N-W0070
nominal power standard motor 3 AC 400 V; 50 Hz; t > 10 min; K = 1,0; f_s = 4 kHz1)	P_{Nenn}	kW	5,50	11,00	18,50	22,00
nominal power standard motor 3 AC 400 V; 50 Hz; t = 60 s; T = 10 min; K = 1,1; f_s = 4 kHz2)	P_{Nenn}	kW	4,00	7,50	15,00	18,50
nominal power standard motor 3 AC 400 V; 50 Hz; t = 60 s; T = 5 min; K = 1.5; f_s = 4 kHz3)	P_{Nenn}	kW	3,00	7,50	11,00	15,00
nominal power standard motor 3 AC 400 V; 50 Hz; t = 2 s; T = 20 s; K = 2,0; f_s = 4 kHz4)	P_{Nenn}	kW	3,00	7,50	11,00	15,00

1) 2) 3) 4) see definition profile UEL_P_e

Fig.6-34: HMS - Selection of standard motors 3 AC 400V - Exemplary profiles

Selection of standard motors 3 AC 400V - Exemplary profiles

Description	Symbol	Unit	HMS01.1N-W0110	HMS01.1N-W0150	HMS01.1N-W0210	HMS01.1N-W0350
nominal power standard motor 3 AC 400 V; 50 Hz; t > 10 min; K = 1,0; f_s = 4 kHz1)	P_{Nenn}	kW	tbd	55,00	75,00	tbd
nominal power standard motor 3 AC 400 V; 50 Hz; t = 60 s; T = 10 min; K = 1,1; f_s = 4 kHz2)	P_{Nenn}	kW	tbd	45,00	75,00	tbd
nominal power standard motor 3 AC 400 V; 50 Hz; t = 60 s; T = 5 min; K = 1.5; f_s = 4 kHz3)	P_{Nenn}	kW	tbd	37,00	55,00	tbd
nominal power standard motor 3 AC 400 V; 50 Hz; t = 2 s; T = 20 s; K = 2,0; f_s = 4 kHz4)	P_{Nenn}	kW	tbd	37,00	55,00	tbd

1) 2) 3) 4) see definition profile UEL_P_e

Fig.6-35: HMS - Selection of standard motors 3 AC 400V - Exemplary profiles

Operating Standard Motors at 3 AC 460 V

Selection of standard motors 3 AC 460V - Exemplary profiles

Description	Symbol	Unit	HMS01.1N-W0020	HMS01.1N-W0036	HMS01.1N-W0054	HMS01.1N-W0070
nominal power standard motor 3AC460V; 60 Hz; t > 10 min; K = 1,0; f_s = 4 kHz1)	P_{Nenn}	kW	5,50	11,00	18,40	22,10
nominal power standard motor 3AC460V; 60 Hz; t = 60 s; T = 10 min; K = 1,1; f_s = 4 kHz2)	P_{Nenn}	kW	5,50	11,00	18,40	22,10

Description	Symbol	Unit	HMS01.1N-W0020	HMS01.1N-W0036	HMS01.1N-W0054	HMS01.1N-W0070
nominal power standard motor 3AC460V; 60 Hz; t = 60 s; T = 5 min; K = 1.5; f_s = 4 kHz3)	P_{Nenn}	kW	3,70	7,40	14,70	
nominal power standard motor 3AC460V; 60 Hz; t = 2 s; T = 20 s; K = 2,0; f_s = 4 kHz4)	P_{Nenn}	kW	3,70	7,40	14,70	

1) 2) 3) 4) see definition profile UEL_P_e; 1 kW ~ 1,36 hp

Fig.6-36: HMS - Selection of standard motors 3 AC 460V - Exemplary profiles

Selection of standard motors 3 AC 460V - Exemplary profiles

Description	Symbol	Unit	HMS01.1N-W0110	HMS01.1N-W0150	HMS01.1N-W0210	HMS01.1N-W0350
nominal power standard motor 3AC460V; 60 Hz; t > 10 min; K = 1,0; f_s = 4 kHz1)	P_{Nenn}	kW	36,80	55,20	91,90	tbd
nominal power standard motor 3AC460V; 60 Hz; t = 60 s; T = 10 min; K = 1,1; f_s = 4 kHz2)	P_{Nenn}	kW	36,80	55,20	73,60	tbd
nominal power standard motor 3AC460V; 60 Hz; t = 60 s; T = 5 min; K = 1.5; f_s = 4 kHz3)	P_{Nenn}	kW	22,10	36,80	55,20	tbd
nominal power standard motor 3AC460V; 60 Hz; t = 2 s; T = 20 s; K = 2,0; f_s = 4 kHz4)	P_{Nenn}	kW	22,10	36,80	55,20	tbd

1) 2) 3) 4) see definition profile UEL_P_e; 1 kW ~ 1,36 hp

Fig.6-37: HMS - Selection of standard motors 3 AC 460V - Exemplary profiles

Performance Profile “UEL_P_e”

The following performance profiles have been defined for converters and inverters.

☞ Observe the allowed performance data P_{DC_peak} and P_{DC_base} in the corresponding performance profile of the supply unit or converter.

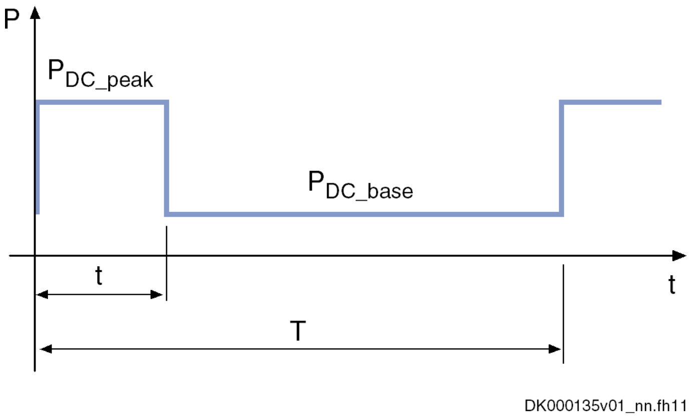
Profile	Explanation
performance profile “UEL_P_e”  	Characteristic of the selection of standard motors and servo drives.

Fig.6-38: Definition of performance profiles, infeeding supply units and converters

6.2.5 Connections and Interfaces

Overview

Overall Connection Diagram

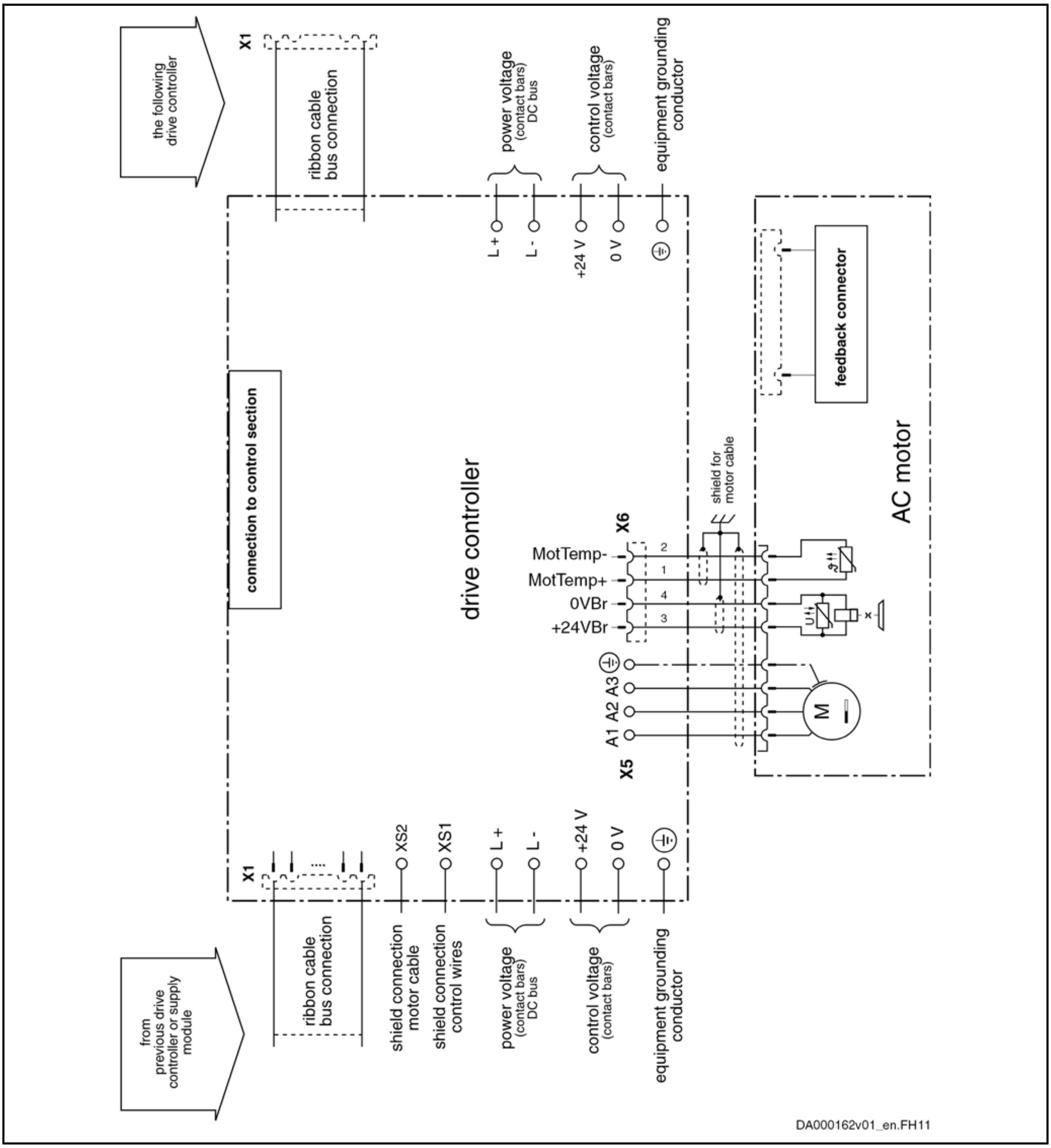
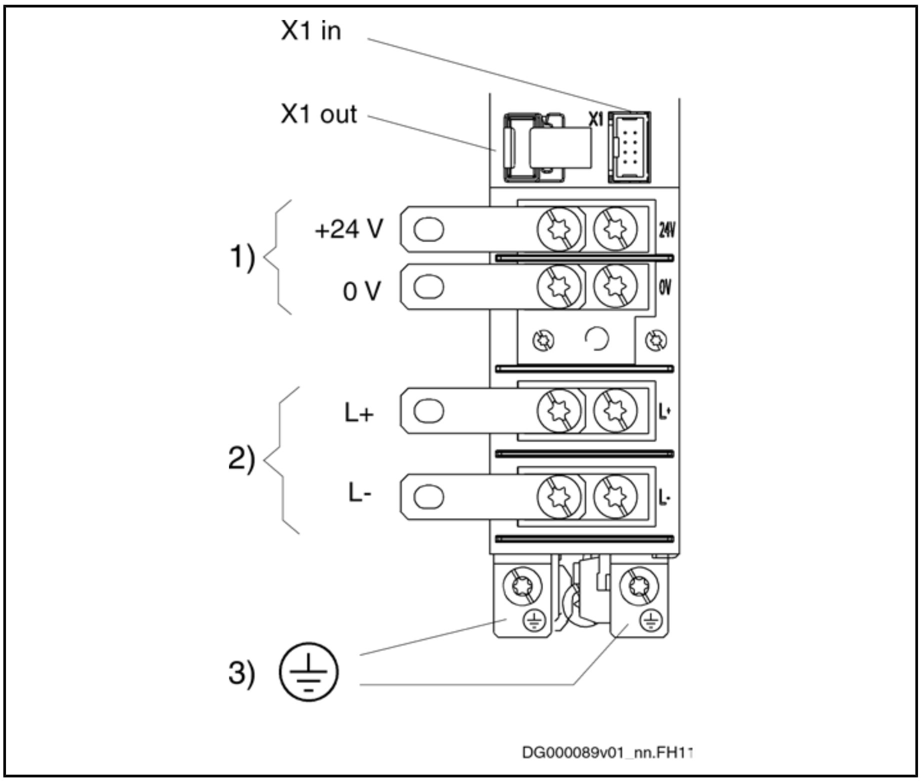


Fig.6-39: Connection diagram HMS01.1-Wxxxx

Arrangement of the Connection Points

Connection Points at HMS01.1N-W0020 and HMS01.1N-W0036

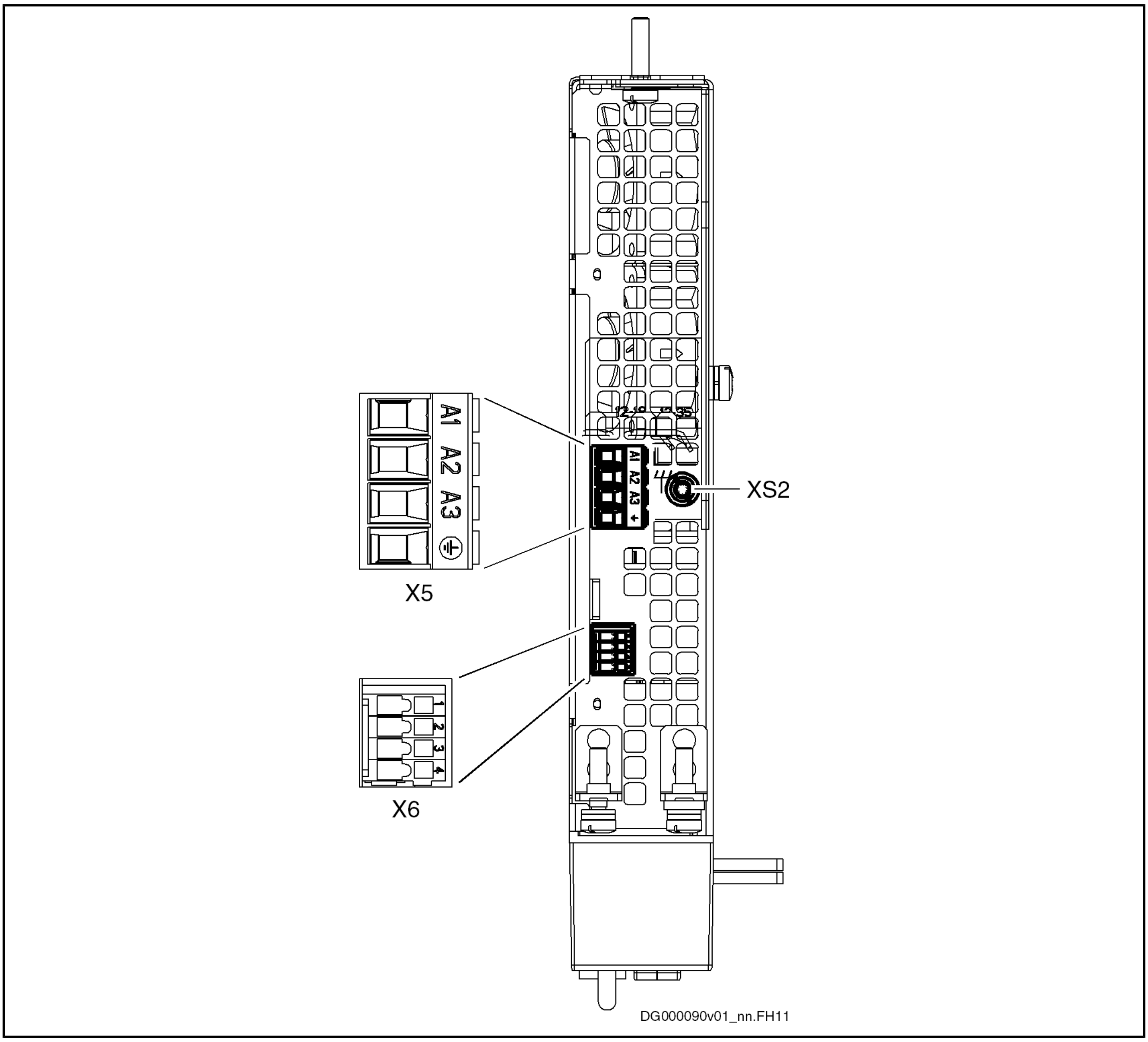
Connections at power section (front)



1)	control voltage
2)	DC bus
3)	equipment grounding conductor
X1 in, X1 out	module bus

Fig.6-40: *Connections at power section (front) HMS01.1N-W0020 and HMS01.1N-W0036*

Connections at power section (bottom)

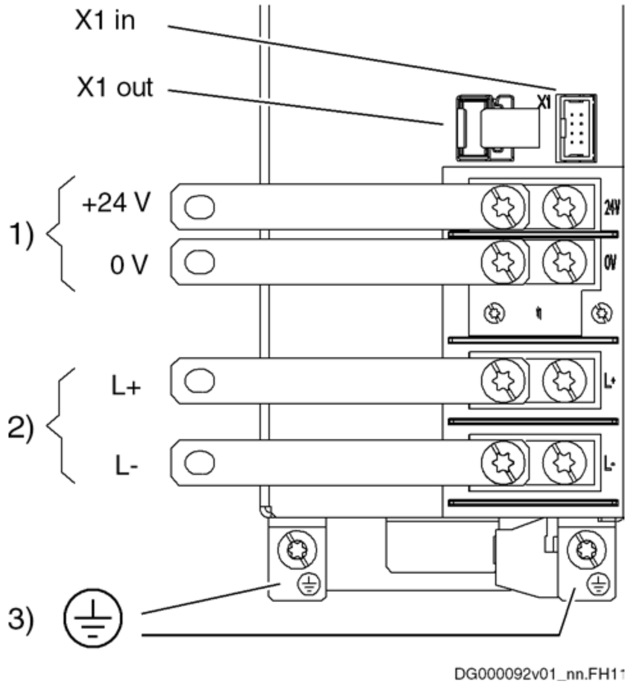


X5	motor connection
X6	motor temperature monitoring and motor holding brake
XS2	shield connection (motor power cable)

Fig.6-41: Connections at power section (bottom) HMS01.1N-W0020, -W0036

Connection Points at HMS01.1N-W0054 and HMS01.1N-W0070

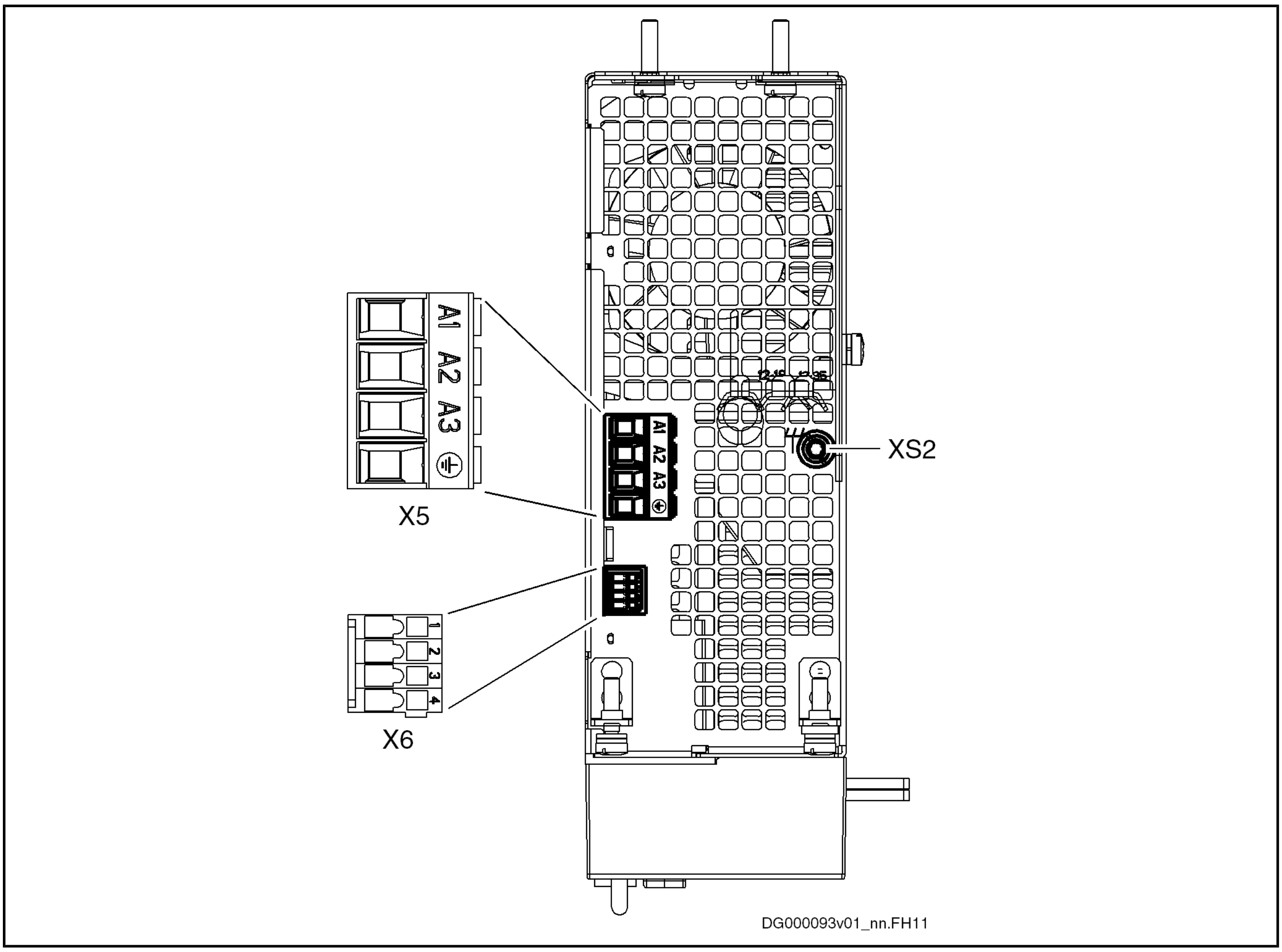
Connections at power section (front)



1)	control voltage
2)	DC bus
3)	equipment grounding conductor
X1 in, X1 out	module bus

Fig.6-42: Connections at power section (front) HMS01.1N-W0054 and -W0070

Connections at power section (bottom)

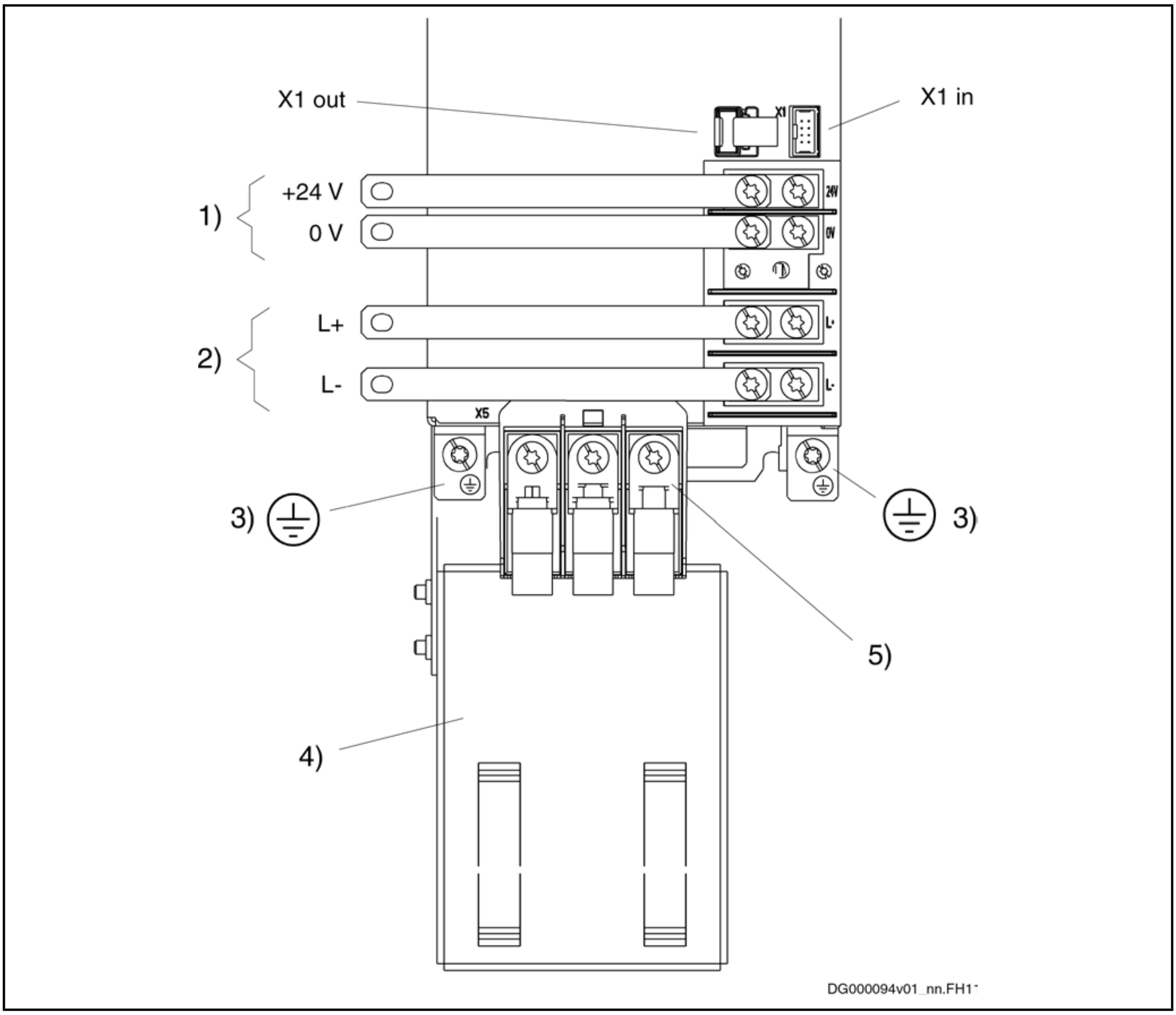


X5	motor connection
X6	motor temperature monitoring and motor holding brake
XS2	shield connection (motor power cable)

Fig.6-43: Connections at power section (bottom) HMS01.1N-W0054 and -W0070

Connection Points at HMS01.1N-W0110, HMS01.1N-W0150 and HMS01.1N-W0210

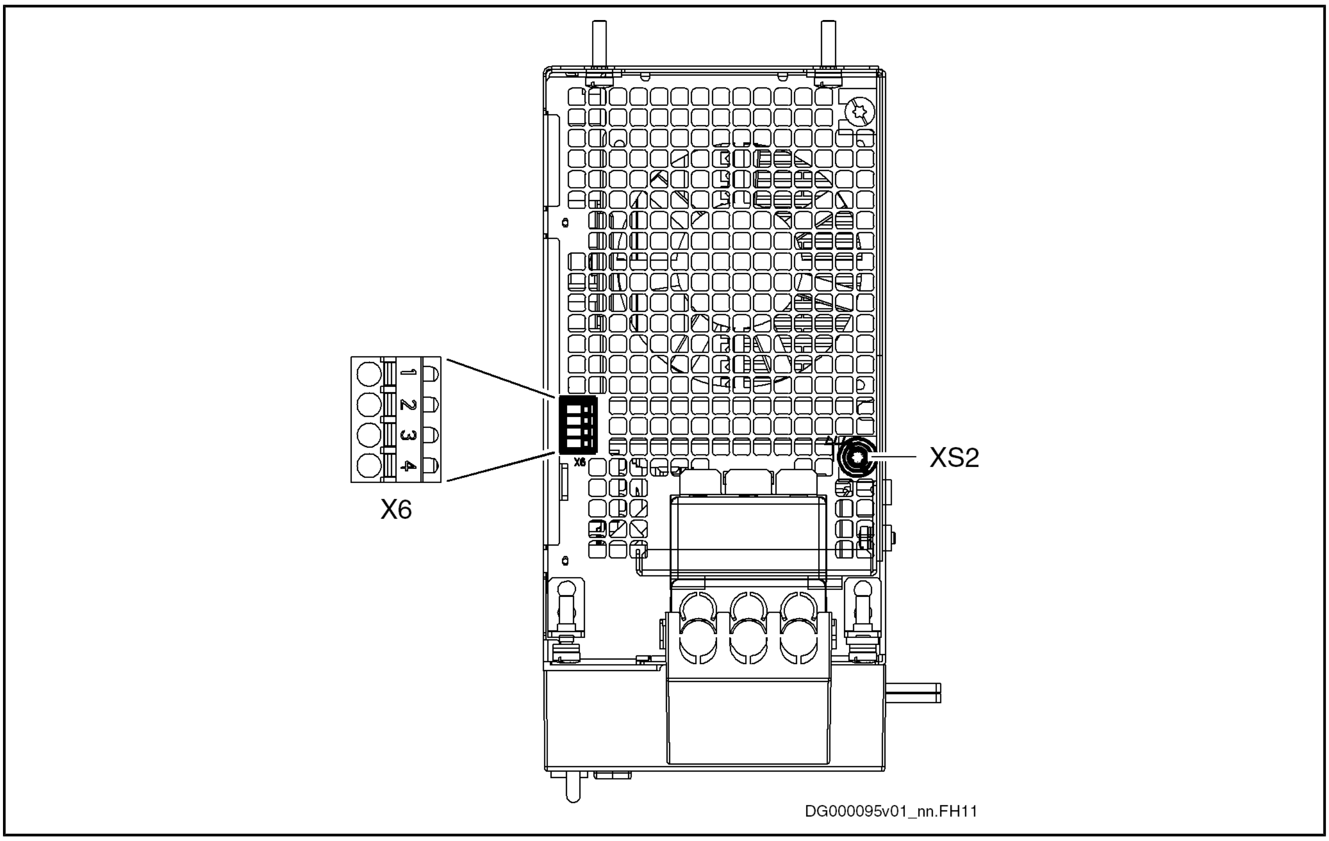
Connections at power section (front)



1)	control voltage
2)	DC bus
3)	equipment grounding conductor
4)	plate for shield connection of motor cable (optional)
5)	motor connection
X1 in, X1 out	module bus

Fig.6-44: *Connections at power section (front) HMS01.1N-W0110, HMS01.1N-W0150 and HMS01.1N-W0210*

Connections at power section (bottom)

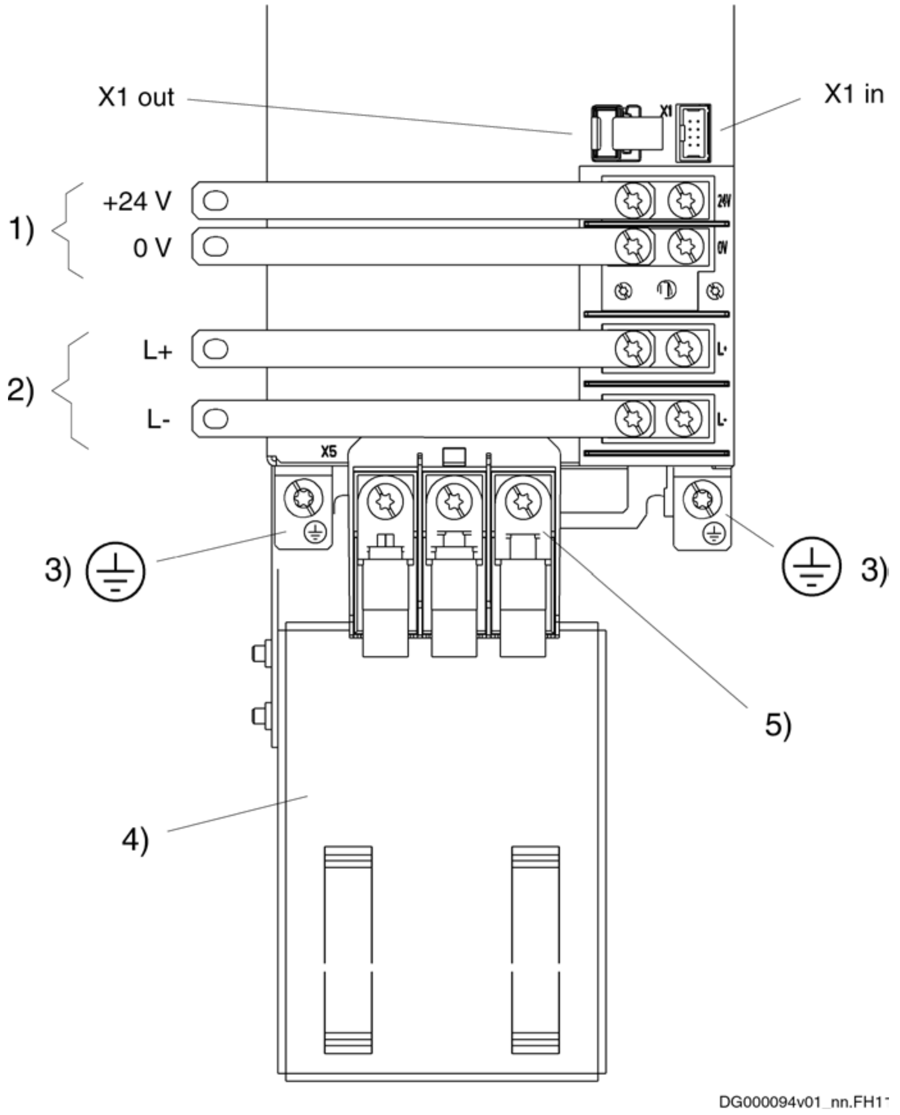


X6	motor temperature monitoring and motor holding brake
XS2	shield connection (motor power cable)

Fig.6-45: Connections at power section (bottom) HMS01.1N-W0110, HMS01.1N-W0150 and HMS01.1N-W0210

Connection Points at HMS01.1N-W0350

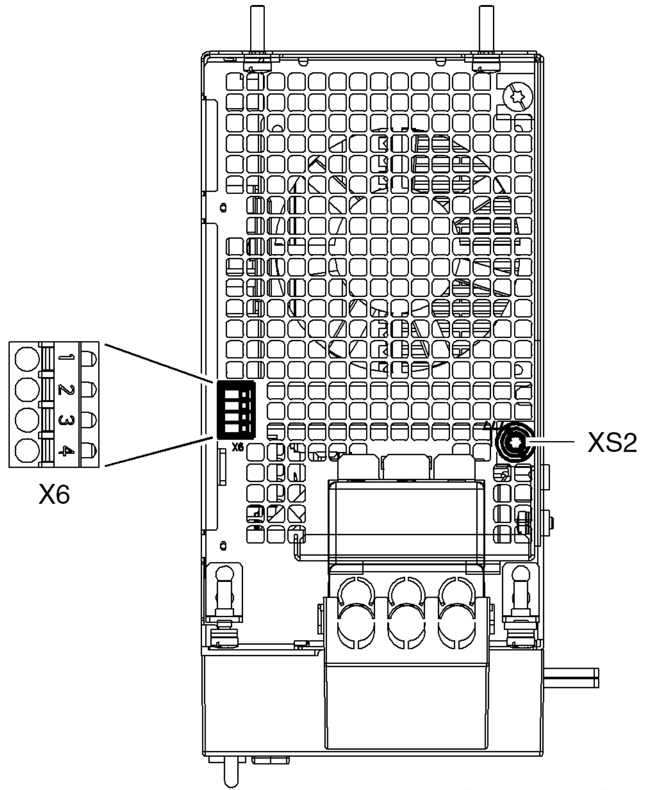
Connections at power section (front)



1)	control voltage
2)	DC bus
3)	equipment grounding conductor
4)	plate for shield connection of motor cable (optional)
5)	motor connection
X1 in, X1 out	module bus

Fig.6-46: Connections at power section (front) HMS01.1N-W0350

Connections at power section (bottom)



X6	motor temperature monitoring and motor holding brake
XS2	shield connection (motor power cable)

Fig.6-47: Connections at power section (bottom) HMS01.1N-W0350

Description of the Connection Points

The connection points are described in detail in chapter 8 Functions and Electrical Connection Points , page 241.

Touch Guard The touch guard is described in detail in chapter 9 Touch Guard at Devices , page 291.

6.3 HMS02 Power Sections

6.3.1 Brief Description, Usage and Structure

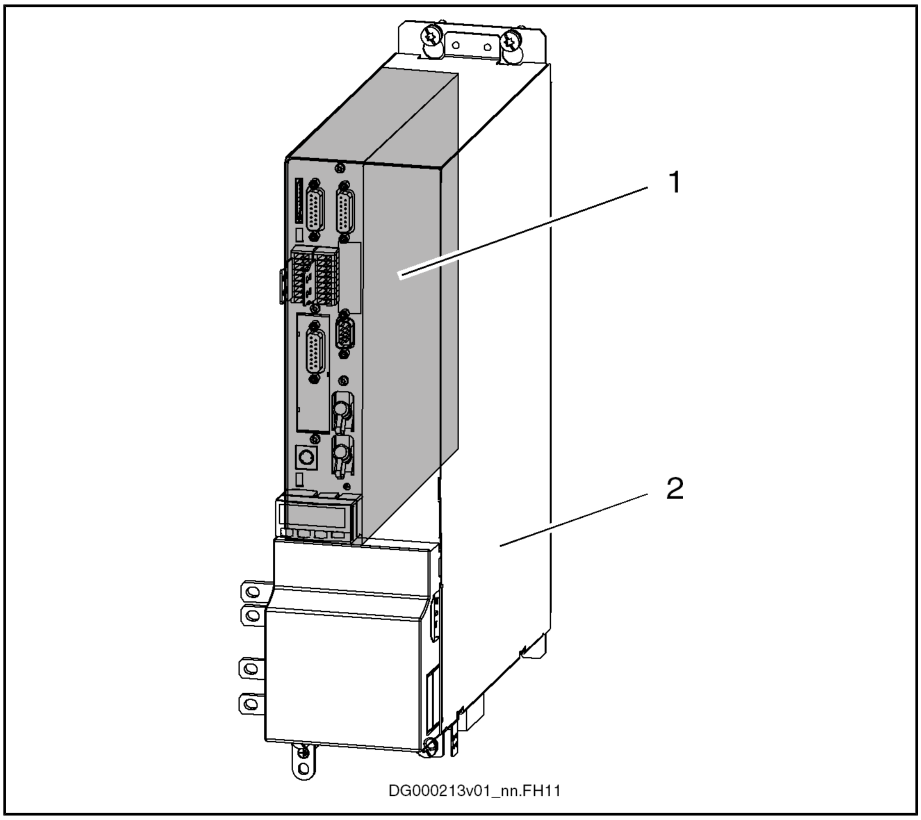
Brief Description The HMS02 inverters are part of the Rexroth IndraDrive M product range and are used to operate single axes.

Usage The different types are used as follows:

Type	Usage
HMS02.1E-Wxxxx-NNNN	- single-axis device - Operation of a three-phase a.c. motor (asynchronous or synchronous motor).

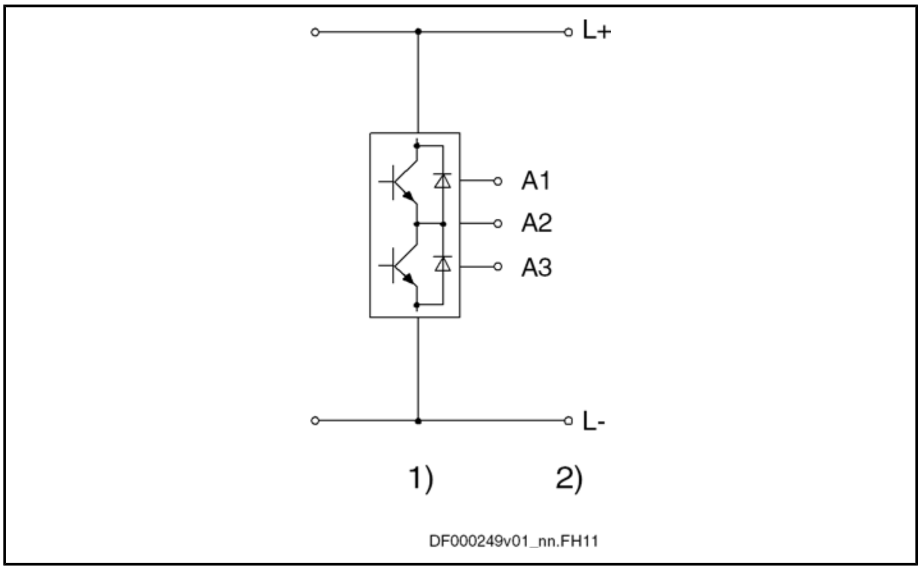
Fig.6-48: Usage

Structure, Block Diagrams



1	power section
2	control section

Fig.6-49: *Basic structure of the drive controller*



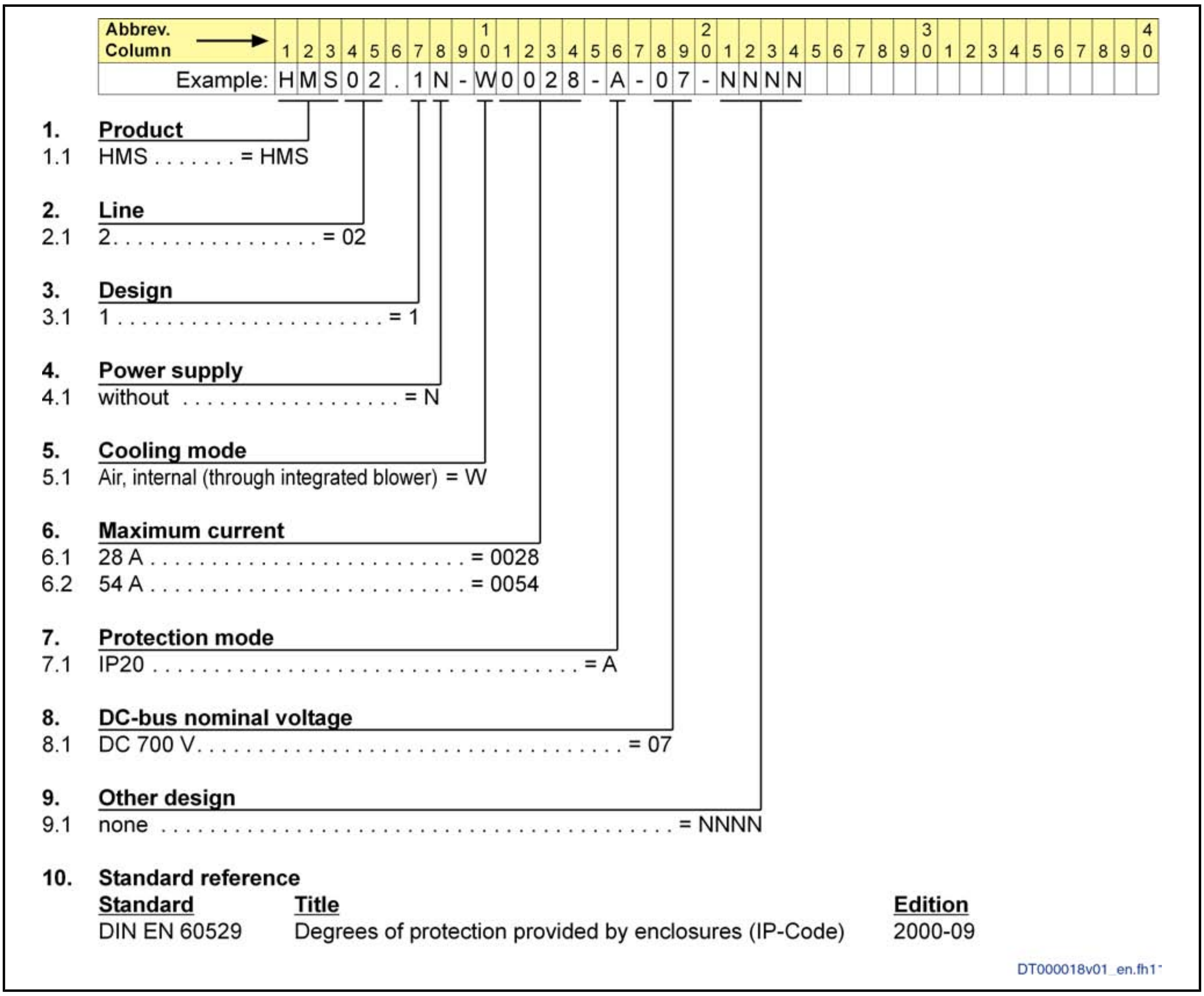
1)	inverter stage with output to motor
2)	DC bus connection

Fig.6-50: *Block diagram*

6.3.2 Type Code and Identification

Type Code

☞ The following figure illustrates the basic structure of the type code. Our sales representative will help you with the current status of available versions.



1. Product
1.1 HMS . . . . = HMS

2. Line
2.1 2. . . . . = 02

3. Design
3.1 1 . . . . = 1

4. Power supply
4.1 without . . . . = N

5. Cooling mode
5.1 Air, internal (through integrated blower) = W

6. Maximum current
6.1 28 A . . . . = 0028
6.2 54 A . . . . = 0054

7. Protection mode
7.1 IP20 . . . . = A

8. DC-bus nominal voltage
8.1 DC 700 V. . . . . = 07

9. Other design
9.1 none . . . . = NNNN

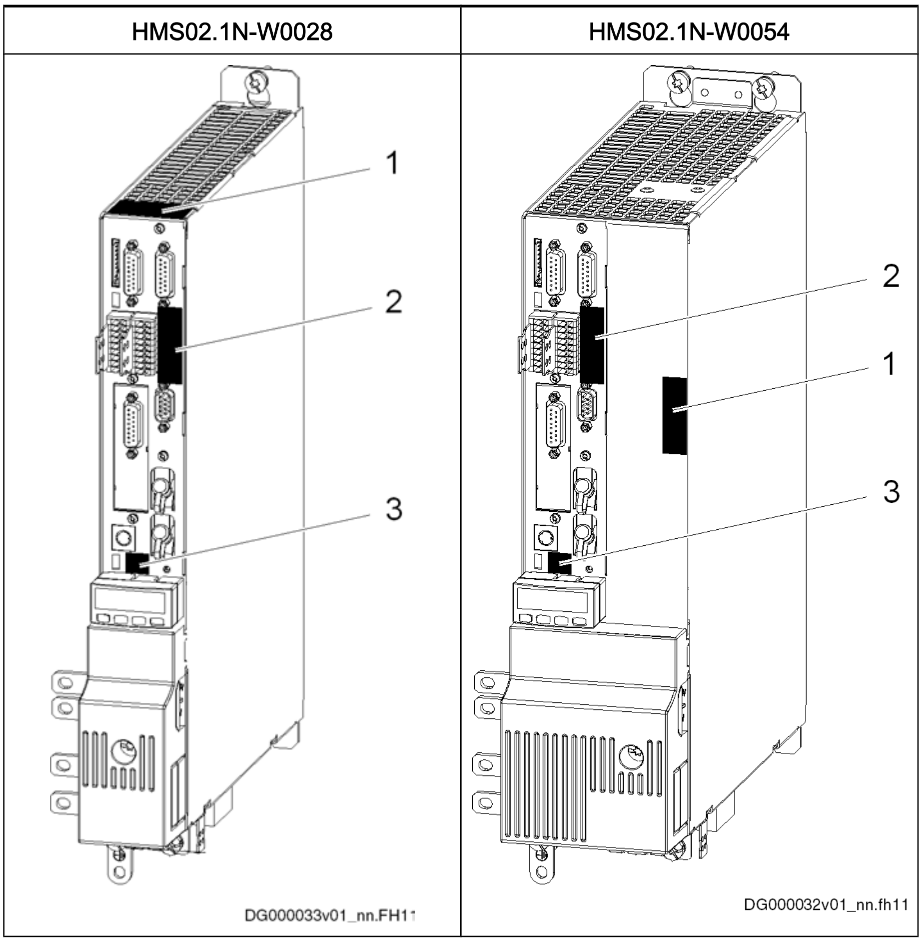
10. Standard reference

Standard	Title	Edition
DIN EN 60529	Degrees of protection provided by enclosures (IP-Code)	2000-09

Fig.6-51: Type code HMS02

Identification

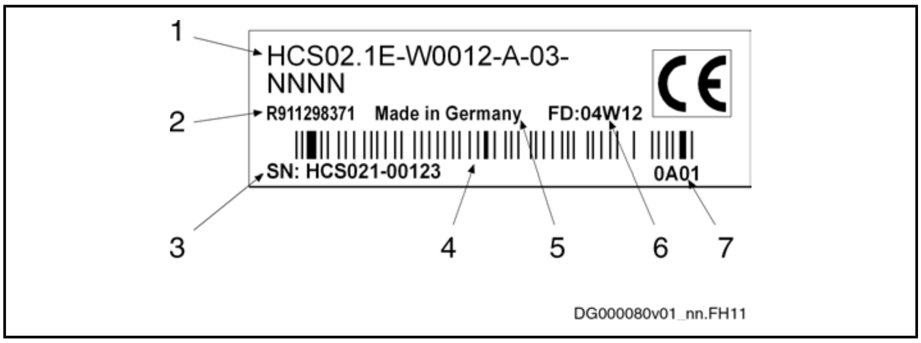
Type Plate Arrangement



1	power section type plate
2	control section type plate
3	firmware type plate

Fig.6-52: Type plates at the drive controller

Type Plate



1	device type
2	part number
3	serial number
4	bar code
5	country of manufacture
6	production week, 04W12 meaning year 2004, week 12
7	hardware index

Fig.6-53: Type plate - power section (example of an HCS02 power section)

6.3.3 Scope of Supply

The scope of supply includes:

- 1 × touch guard
- 1 × connector X5 and X6 each

6.3.4 Technical Data

Ambient and Operating Conditions

General Information

Conditions for transport and storage: see chapter 4.2 Transport and Storage, page 19.

Installation conditions: see chapter 4.3 Installation Conditions , page 19.

This chapter contains:

- limit values for use in the scope of C-UL
- applied standards (CE conformity, UL listing)

UL Data

Ambient and operating conditions - UL ratings

Description	Symbol	Unit	HMS02.1N-W0028	HMS02.1N-W0054
Suitable for use on a circuit capable of delivering not more than this SCCR, symmetrical amperes (UL) 1)	I_{SCCR}	A rms	42000	
rated input voltage, power (UL)$^{2)}$	U_{LN_nenn}	V	254...750	
rated input current (UL)$^{3)}$	I_{L_cont}	A	18,4	30,7
maximum output voltage (UL)	U_{out}	V	500	
maximum output current (UL)	I_{out_max}	A	15,0	25,0

1) 600 V AC or less, use listed AC input line fuses or listed circuit breakers

2) HMS, HMD, HLB, HLC, KCU: DC bus L+, L-; HMV, HCS: mains input L1, L2, L3

3) at PDC_cont

Fig.6-54: HMS - Ambient and operating conditions - UL ratings

Information on Standards

Applied standards

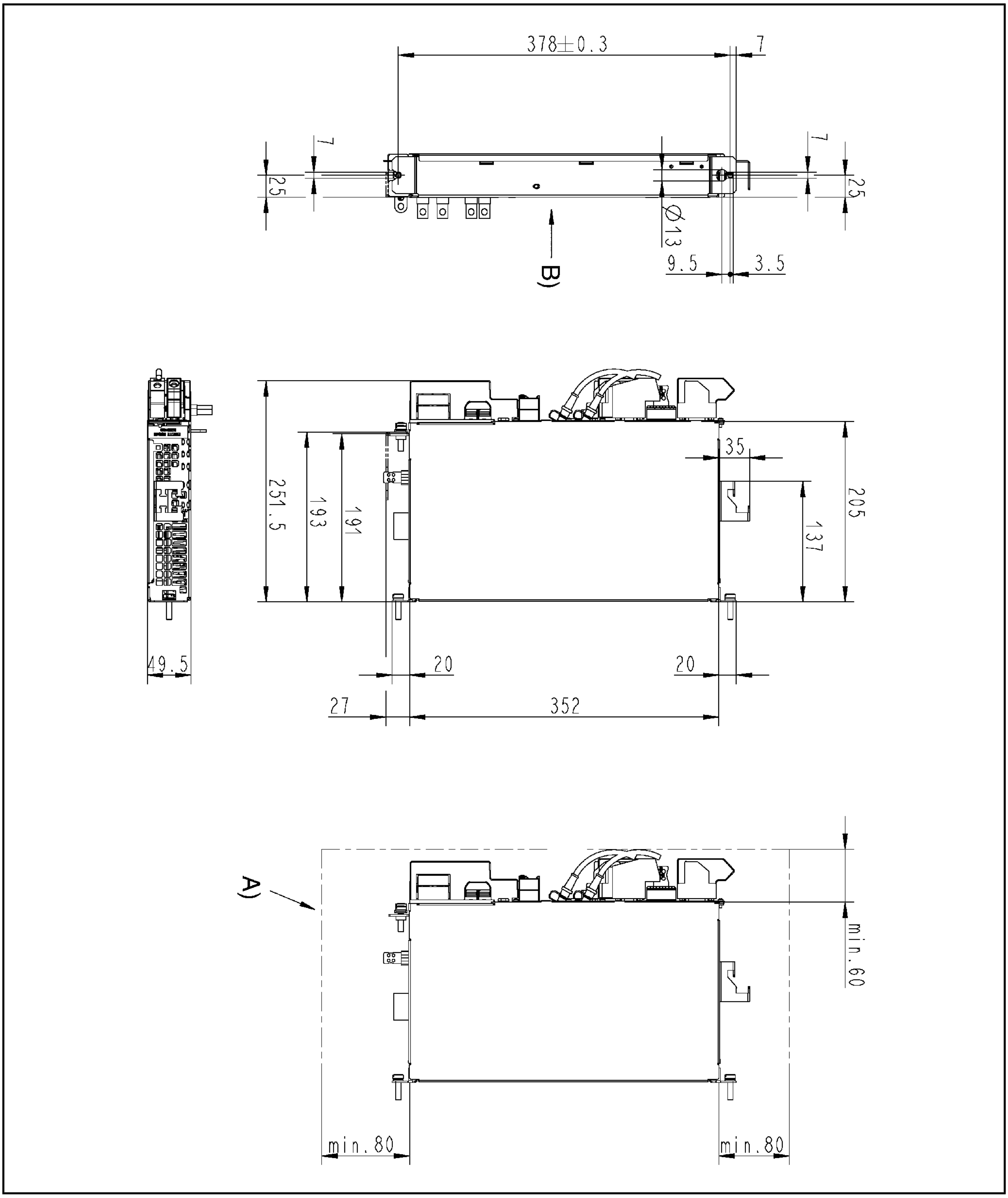
Description	Symbol	Unit	HMS02.1N-W0028	HMS02.1N-W0054
listing according to UL standard (UL)			UL 508 C	
UL files (UL)			E 134201	
listing according to CSA standard (UL)			Canadian National Standard(s) C22.2 No. 14-05	

Fig.6-55: HMS - Applied standards

Mechanical System and Mounting

Dimensional Drawings

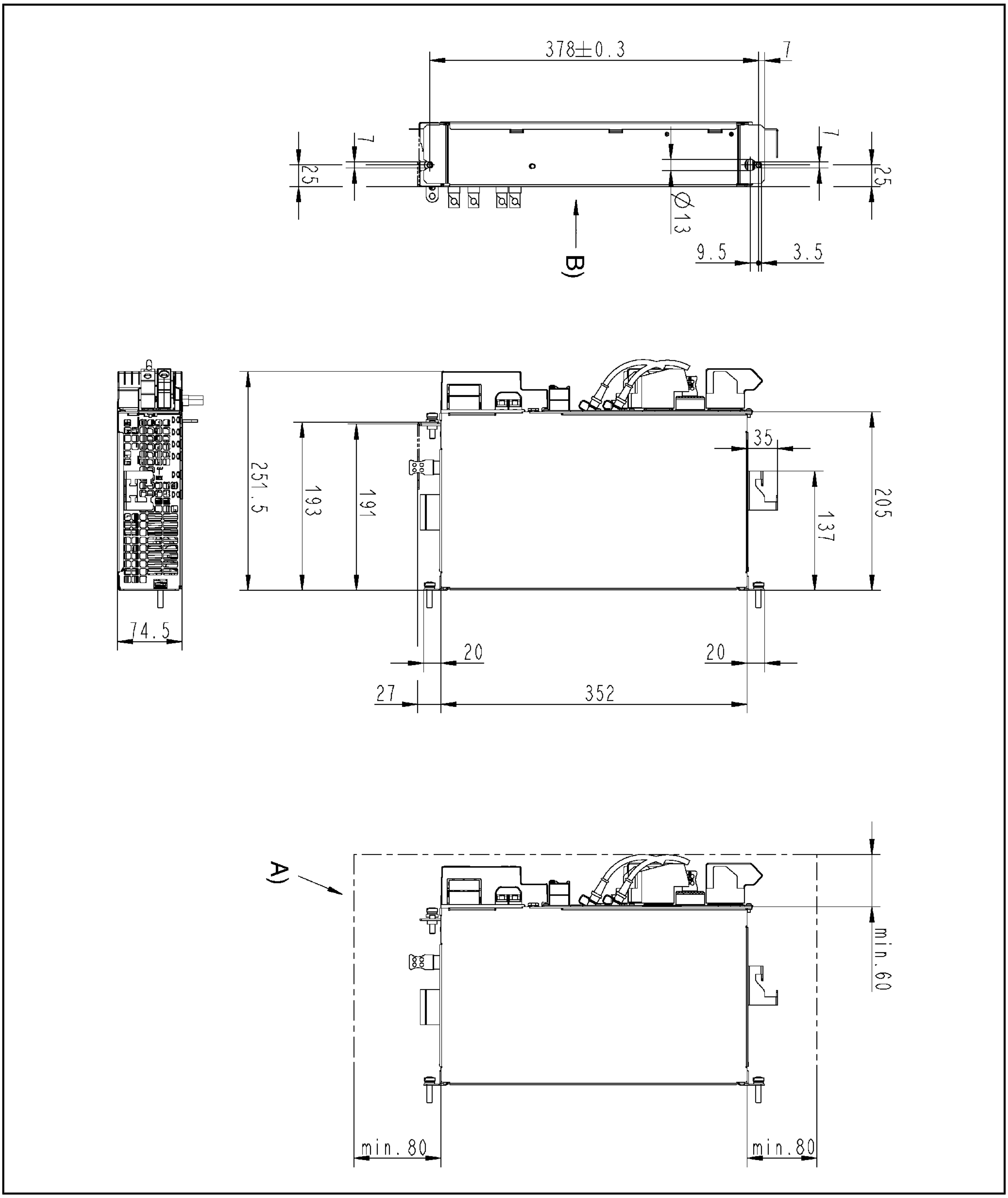
Dimensions HMS02.1N-W0028



A)	minimum mounting clearance (plus additional space for motor cable) Note: Rexroth IndraDrive supply units require greater mounting clearance!
B)	rear view!

Fig.6-56: *Dimensions HMS02.1N-W0028*

Dimensions HMS02.1N-W0054



A)	minimum mounting clearance (plus additional space for motor cable) Note: Rexroth IndraDrive supply units require greater mounting clearance!
B)	rear view!
Fig.6-57:	*Dimensions HMS02.1N-W0054*

Dimensions, Mass, Insulation, Sound Pressure Level

Data for mass, dimensions, sound pressure level, insulation

Description	Symbol	Unit	HMS02.1N-W0028	HMS02.1N-W0054
weight	m	kg	3,50	5,00
device height (UL)$^{1)}$	H	mm	352	
device depth (UL)$^{2)}$	T	mm	205	
device width (UL)$^{3)}$	B	mm	50	75
insulation resistance at DC 500 V	R_{is}	MOhm	>8	
capacitance against housing	C_Y	nF	2 x 68	
average sound pressure level (accuracy class 2) at P_{DC_cont} $^{4)}$	L_P	dB (A)	tbd	

1) 2) 3) housing dimension; see also related dimensional drawing
4) according to DIN EN ISO 11205; comparative value at distance 1 m, out of cabinet; HCS types with order code -L***: load-dependent

Fig.6-58: HMS - Data for mass, dimensions, sound pressure level, insulation

Power Dissipation, Mounting Position, Cooling, Distances

Data for cooling and power dissipation

Description	Symbol	Unit	HMS02.1N-W0028	HMS02.1N-W0054
ambient temperature range during operation with nominal data	T_{a_work}	°C	0...40	
ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	0...55	
derating of P_{DC_cont}; P_{BD}; I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2	
allowed mounting position			G1	
cooling type			forced ventilation	
volumetric capacity of forced cooling	V	m^3/h	17,20	tbd
allowed switching frequencies$^{1)}$	f_s	kHz	4, 8	4, 8, 12, 16
power dissipation at I_{out_cont} = 0 A; $f_s = f_s$ (min.)$^{2)}$	$P_{Diss\_0A\_fsmin}$	W	35	40
power dissipation at I_{out_cont} = 0 A; $f_s = f_s$ (max.)$^{3)}$	$P_{Diss\_0A\_fsmax}$	W	70	150
power dissipation at continuous current and continuous DC bus power respectively (UL)$^{4)}$	P_{Diss_cont}	W	150,00	350,00
minimum distance on the top of the device$^{5)}$	d_{top}	mm	80	

Description	Symbol	Unit	HMS02.1N-W0028	HMS02.1N-W0054
minimum distance on the bottom of the device[6]	d_{bot}	mm	80	
temperature rise with minimum distances d_{bot}; d_{top}; P_{BD}	ΔT	K	65	

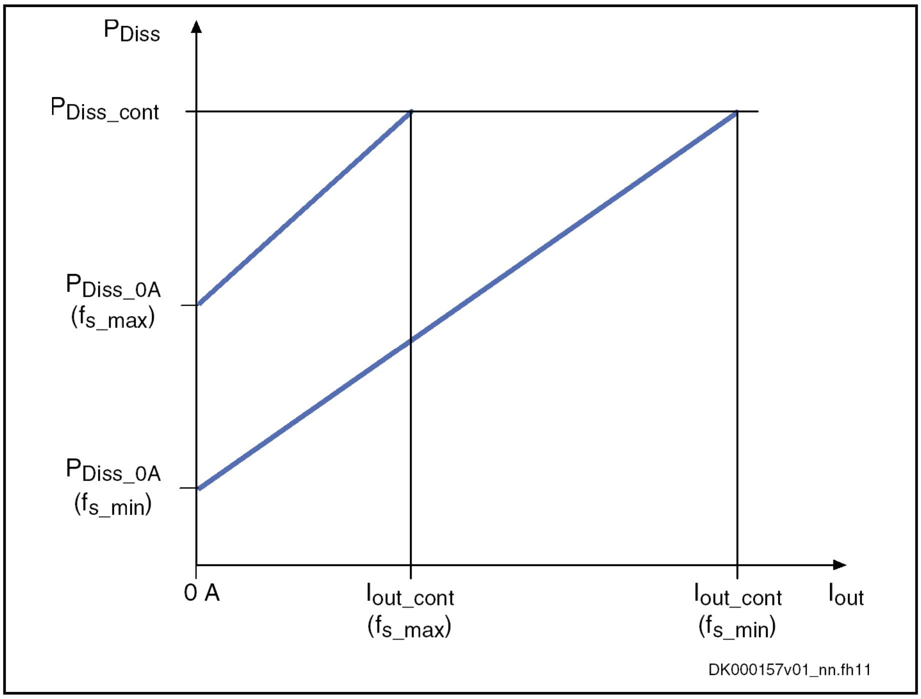
1)	also depending on firmware and control section; see Parameter Description "P-0-0001, Switching frequency of the power output stage"; see "P-0-4058, Amplifier type data"
2) 3)	plus dissipation of braking resistor (at HMV, HCS) and control section (at HMx, HCS); find interim values by interpolation to P_Diss_cont
4)	HMV, HCS: plus dissipation of braking resistor, control section; KSM: plus rated power consumption control voltage input
5) 6)	see fig. "Air intake and air outlet at drive controller"

Fig.6-59: HMS - Data for cooling and power dissipation

Power Dissipation vs. Output Current

The figure below illustrates the connection between power dissipation and output current, depending on the switching frequency f_s which was set at the drive controller. See also Parameter Description "P-0-0001, Switching frequency of the power output stage".

☞ In addition, take the power at the braking resistor and the power consumption of the control section into account. Both powers are not contained in the figure.



I_{out}	output current
P_{Diss}	power dissipation
f_s	switching frequency

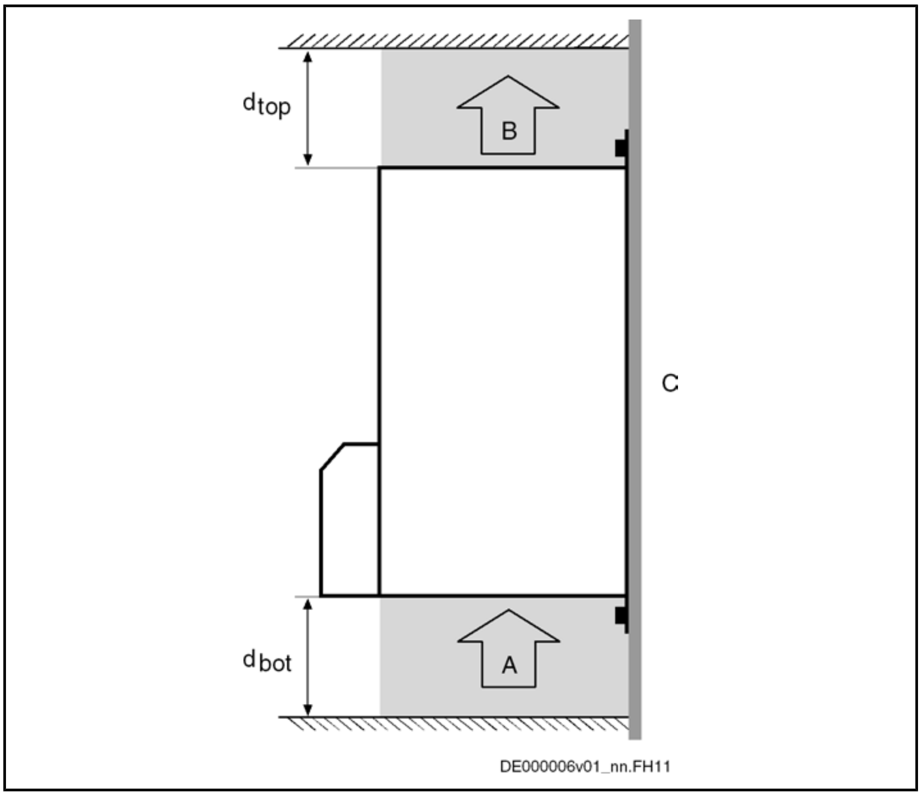
Fig.6-60: Power dissipation vs. output current

Distances

CAUTION

Property damage due to temperatures higher than 105 °C!

Comply with indicated minimum distances!



A	air intake
B	air outlet
C	mounting surface in control cabinet
d_{top}	distance top
d_{bot}	distance bottom

Fig.6-61: Air intake and air outlet at drive controller

Basic Data Power Section HMS02

General Information

This section contains

- data for control voltage supply
- data of DC bus
- data of inverter

☞ The order of the data tables below follows the energy flow in the drive controller – from mains connection to motor output.

Control Voltage

Data for control voltage supply

Description	Symbol	Unit	HMS02.1N-W0028	HMS02.1N-W0054
rated control voltage input (UL)[1]	U_{N3}	V	24 ± 20 %	
control voltage when using motor holding brake with motor cable length < 50 m[2]	U_{N3}	V	24 ± 5 %	
control voltage when using motor holding brake with motor cable length > 50 m[3]	U_{N3}	V	26 ± 5 %	
maximum allowed voltage for 1 m	U_{N3_max}	V	33 (1ms)	
maximum inrush current at 24V supply	I_{EIN3_max}	A	4,80	
pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	10	
input capacitance	C_{N3}	mF	1,20	
rated power consumption control voltage input at U_{N3} (UL)[4]	P_{N3}	W	13	17

1) 2) 3) observe supply voltage for motor holding brakes
4) HMS, HMD, HCS: plus holding brake and control section; KCU01: at max. number of axes; KSM01: plus holding brake (UN x IN)

Fig.6-62: HMS - Data for control voltage supply

Power Section - DC Bus

Data of power section - DC bus

Description	Symbol	Unit	HMS02.1N-W0028	HMS02.1N-W0054
DC bus voltage	U_{DC}	V	254...750	
capacitance in DC bus	C_{DC}	mF	0,14	0,27
DC resistance in DC bus (L+ to L-) at U_{DC} = 750 V	R_{DC}	kOhm	approx. 300	approx. 150
monitoring value maximum DC bus voltage, switch-off threshold	$U_{DC\_limit\_max}$	V	900	
monitoring value minimum DC bus voltage, undervoltage threshold	$U_{DC\_limit\_min}$	V	254	

Fig.6-63: HMS - Data of power section - DC bus

Power Section - Inverter

Data of power section - Inverter

Description	Symbol	Unit	HMS02.1N-W0028	HMS02.1N-W0054
allowed switching frequencies[1]	f_s	kHz	4, 8	4, 8, 12, 16
output voltage, fundamental wave with open-loop operation	U_{out_eff}	V	~ UDC x 0,71	
output voltage, fundamental wave with closed-loop operation	U_{out_eff}	V	~ UDC x 0,71	

Description	Symbol	Unit	HMS02.1N-W0028	HMS02.1N-W0054
rise of voltage at output with U_{LN_nenn} and 15 m motor cable length phase-phase (10-90%)[2]	du/dt	kV/µs	5,00	
rise of voltage at output with U_{LN_nenn} and 15 m motor cable length phase-ground (10-90%)[3]	du/dt	kV/µs	5,00	
output frequency range at f_s = 2 kHz	f_{out_2k}	Hz	-	
output frequency range at f_s = 4 kHz	f_{out_4k}	Hz	0...400	
output frequency range at f_s = 8 kHz	f_{out_8k}	Hz	0...800	
output frequency range at f_s = 12 kHz	f_{out_12k}	Hz	-	0...1200
output frequency range at f_s = 16 kHz	f_{out_16k}	Hz	-	0...1600
output frequency threshold to detect motor standstill[4]	f_{out_still}	Hz	2...4	
maximum output current at f_s = 2 kHz	I_{out_max2}	A	-	
maximum output current at f_s = 4 kHz	I_{out_max4}	A	28,3	54,0
maximum output current at f_s = 8 kHz	I_{out_max8}	A	28,3	54,0
maximum output current at f_s = 12 kHz	I_{out_max12}	A	-	54,0
maximum output current at f_s = 16 kHz	I_{out_max16}	A	-	40,0
allowed continuous output current at f_s = 2 kHz	I_{out_cont2}	A	-	
allowed continuous output current at f_s = 4 kHz	I_{out_cont4}	A	13,8	25,0
allowed continuous output current at f_s = 8 kHz	I_{out_cont8}	A	8,5	20,0
allowed continuous output current at f_s = 12 kHz[5]	I_{out_cont12}	A	-	12,7
allowed continuous output current at f_s = 16 kHz[6]	I_{out_cont16}	A	-	10,2
allowed continuous output current at f_s = 2 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_2}$	A	-	
allowed continuous output current at f_s = 4 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_4}$	A	9,2	19,2

Description	Symbol	Unit	HMS02.1N-W0028	HMS02.1N-W0054
allowed continuous output current at f_s = 8 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_8}$	A	5,1	12,5
allowed continuous output current at f_s = 12 kHz; output frequency $f_{out} < f_{out\_still}$ 7)	$I_{out\_cont0Hz\_12}$	A	-	7,0
allowed continuous output current at f_s = 16 kHz; output frequency $f_{out} < f_{out\_still}$ 8)	$I_{out\_cont0Hz\_16}$	A	-	5,6
assigned output filters at nom. data; f_s = 4 kHz			-	

1)	also depending on firmware and control section; see Parameter Description "P-0-0001, Switching frequency of the power output stage"; see "P-0-4058, Amplifier type data"
2) 3)	guide value, see following note
4)	see following note regarding reduction output current
5) 6) 7) 8)	see Parameter Description "P-0-0556, Config word of axis controller", load-depending reduction of PWM frequency fs

Fig.6-64: *HMS - Data of power section - Inverter*

☞ Observe that the load is almost independent of the power section used.

Especially when using **standard motors** , make sure that they comply with the occurring voltage load.

Observe the information contained in the chapter “Third-Party Motors at IndraDrive Controllers” in the Project Planning Manual of the drive system.

☞ Depending on the electric output frequency, the output current is reduced for thermal protection of the power section.

The output current is reduced, when the electric output frequency has fallen below the threshold to detect motor standstill.

Exemplary Data for Applications

General Information

This chapter contains:

- examples of allowed current profiles
- examples of allowed performance profiles
- data for selecting standard motors

Current Profiles

Current Profile “UEL_I_e”

The following current profiles have been defined for converters and inverters.

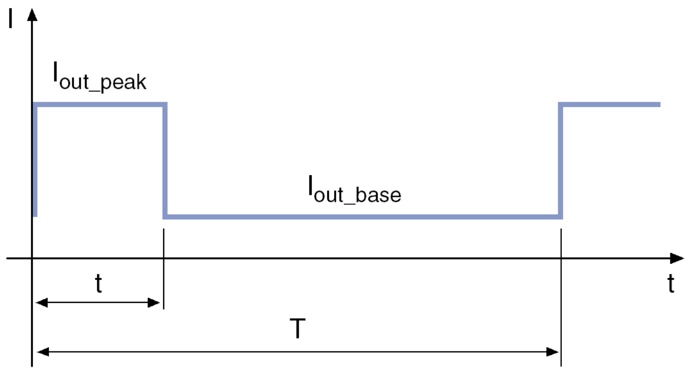
Profile	Explanation
current profile “UEL_I_e”  DK000149v01_nn.fh11	The characteristic data of the profile are used to select converters and inverters for operation with standard motors and servo drives.

Fig.6-65: Definition of current profiles

Examples of allowed current profiles

Description	Symbol	Unit	HMS02.1N-W0028	HMS02.1N-W0054
maximum output current at $I_{out\_base\_1}$; f_s = 2 kHz; t = 0,4 s; T = 4 s; K = 2,5 1)	$I_{out\_peak1\_2}$	A	-	
base load current at $I_{out\_peak\_1}$; f_s = 2 kHz; t = 0,4 s; T = 4 s; K = 2,5	$I_{out\_base1\_2}$	A	-	
maximum output current at $I_{out\_base\_1}$; f_s = 4 kHz; t = 0,4 s; T = 4 s; K = 2,5 2)	$I_{out\_peak1\_4}$	A	23,11	48,74
base load current at $I_{out\_peak\_1}$; f_s = 4 kHz; t = 0,4 s; T = 4 s; K = 2,5	$I_{out\_base1\_4}$	A	9,25	19,50
maximum output current at $I_{out\_base\_1}$; f_s = 8 kHz; t = 0,4 s; T = 4 s; K = 2,5 3)	$I_{out\_peak1\_8}$	A	14,13	31,93
base load current at $I_{out\_peak\_1}$; f_s = 8 kHz; t = 0,4 s; T = 4 s; K = 2,5	$I_{out\_base1\_8}$	A	5,65	12,77
maximum output current at $I_{out\_base\_1}$; f_s = 12 kHz; t = 0,4 s; T = 4 s; K = 2,5 4)	$I_{out\_peak1\_12}$	A	-	20,49
base load current at $I_{out\_peak\_1}$; f_s = 12 kHz; t = 0,4 s; T = 4 s; K = 2,5	$I_{out\_base1\_12}$	A	-	8,20
maximum output current at $I_{out\_base\_1}$; f_s = 16 kHz; t = 0,4 s; T = 4 s; K = 2,5 5)	$I_{out\_peak1\_16}$	A	-	16,56
base load current at $I_{out\_peak\_1}$; f_s = 16 kHz; t = 0,4 s; T = 4 s; K = 2,5	$I_{out\_base1\_16}$	A	-	6,62

Description	Symbol	Unit	HMS02.1N-W0028	HMS02.1N-W0054
maximum output current at $I_{out\_base\_3}$; f_s = 2 kHz; t = 2 s; T = 20 s; K = 2,0$^{6)}$	$I_{out\_peak3\_2}$	A	-	
base load current at $I_{out\_peak\_3}$; f_s = 2 kHz; t = 2 s; T = 20 s; K = 2,0	$I_{out\_base3\_2}$	A	-	
maximum output current at $I_{out\_base\_3}$; f_s = 4 kHz; t = 2 s; T = 20 s; K = 2,0$^{7)}$	$I_{out\_peak3\_4}$	A	21,88	43,44
base load current at $I_{out\_peak\_3}$; f_s = 4 kHz; t = 2 s; T = 20 s; K = 2,0	$I_{out\_base3\_4}$	A	10,94	21,72
maximum output current at $I_{out\_base\_3}$; f_s = 8 kHz; t = 2 s; T = 20 s; K = 2,0$^{8)}$	$I_{out\_peak3\_8}$	A	13,35	29,04
base load current at $I_{out\_peak\_3}$; f_s = 8 kHz; t = 2 s; T = 20 s; K = 2,0	$I_{out\_base3\_8}$	A	6,67	14,52
maximum output current at $I_{out\_base\_3}$; f_s = 12 kHz; t = 2 s; T = 20 s; K = 2,0$^{9)}$	$I_{out\_peak3\_12}$	A	-	18,56
base load current at $I_{out\_peak\_3}$; f_s = 12 kHz; t = 2 s; T = 20 s; K = 2,0	$I_{out\_base3\_12}$	A	-	9,28
maximum output current at $I_{out\_base\_3}$; f_s = 16 kHz; t = 2 s; T = 20 s; K = 2,0$^{10)}$	$I_{out\_peak3\_16}$	A	-	14,97
base load current at $I_{out\_peak\_3}$; f_s = 16 kHz; t = 2 s; T = 20 s; K = 2,0	$I_{out\_base3\_16}$	A	-	7,49
base load current at $I_{out\_peak\_4}$; f_s = 2 kHz; t = 60 s; T = 5 min; K = 1,5	$I_{out\_base4\_2}$	A	-	
maximum output current at $I_{out\_base\_4}$; f_s = 2 kHz; t = 60 s; T = 5 min; K = 1,5$^{11)}$	$I_{out\_peak4\_2}$	A	-	
maximum output current at $I_{out\_base\_4}$; f_s = 4 kHz; t = 60 s; T = 5 min; K = 1,5$^{12)}$	$I_{out\_peak4\_4}$	A	14,84	33,90
base load current at $I_{out\_peak\_4}$; f_s = 4 kHz; t = 60 s; T = 5 min; K = 1,5	$I_{out\_base4\_4}$	A	9,89	22,60
maximum output current at $I_{out\_base\_4}$; f_s = 8 kHz; t = 60 s; T = 5 min; K = 1,5$^{13)}$	$I_{out\_peak4\_8}$	A	9,03	24,84
base load current at $I_{out\_peak\_4}$; f_s = 8 kHz; t = 60 s; T = 5 min; K = 1,5	$I_{out\_base4\_8}$	A	6,02	16,56
maximum output current at $I_{out\_base\_4}$; f_s = 12 kHz; t = 60 s; T = 5 min; K = 1,5$^{14)}$	$I_{out\_peak4\_12}$	A	-	15,81

Description	Symbol	Unit	HMS02.1N-W0028	HMS02.1N-W0054
base load current at $I_{out\_peak\_4}$; f_s = 12 kHz; t = 60 s; T = 5 min; K = 1,5	$I_{out\_base4\_12}$	A	-	10,54
maximum output current at $I_{out\_base\_4}$; f_s = 16 kHz; t = 60 s; T = 5 min; K = 1,5[15]	$I_{out\_peak4\_16}$	A	-	12,74
base load current at $I_{out\_peak\_4}$; f_s = 16 kHz; t = 60 s; T = 5 min; K = 1,5	$I_{out\_base4\_16}$	A	-	8,49
maximum output current at $I_{out\_base\_5}$; f_s = 2 kHz; t = 60 s; T = 10 min; K = 1,1[16]	$I_{out\_peak5\_2}$	A	-	
base load current at $I_{out\_peak\_5}$; f_s = 2 kHz; t = 60 s; T = 10 min; K = 1,1	$I_{out\_base5\_2}$	A	-	
maximum output current at $I_{out\_base\_5}$; f_s = 4 kHz; t = 60 s; T = 10 min; K = 1,1[17]	$I_{out\_peak5\_4}$	A	14,23	26,35
base load current at $I_{out\_peak\_5}$; f_s = 4 kHz; t = 60 s; T = 10 min; K = 1,1	$I_{out\_base5\_4}$	A	12,93	23,95
maximum output current at $I_{out\_base\_5}$; f_s = 8 kHz; t = 60 s; T = 10 min; K = 1,1[18]	$I_{out\_peak5\_8}$	A	8,65	20,79
base load current at $I_{out\_peak\_5}$; f_s = 8 kHz; t = 60 s; T = 10 min; K = 1,1	$I_{out\_base5\_8}$	A	7,87	18,90
maximum output current at $I_{out\_base\_5}$; f_s = 12 kHz; t = 60 s; T = 10 min; K = 1,1[19]	$I_{out\_peak5\_12}$	A	-	13,21
base load current at $I_{out\_peak\_5}$; f_s = 12 kHz; t = 60 s; T = 10 min; K = 1,1	$I_{out\_base5\_12}$	A	-	12,00
maximum output current at $I_{out\_base\_5}$; f_s = 16 kHz; t = 60 s; T = 10 min; K = 1,1[20]	$I_{out\_peak5\_16}$	A	-	10,63
base load current at $I_{out\_peak\_5}$; f_s = 16 kHz; t = 60 s; T = 10 min; K = 1,1	$I_{out\_base5\_16}$	A	-	9,66

1) 2) 3) 4) 5) 6) 7) 8) 9) 10) 11) 12) 13) 14) 15) 16) 17) 18) 19) 20) see definition profile UEL_I_e

Fig.6-66: HMS - Examples of allowed current profiles

Operation With Standard Motors

General Information

Selecting Standard Motors

The tables below show the nominal powers P_{nenn} of standard motors which can be operated at the respective drive controller. The data are subject to the following conditions:

- motor design:

  4-pole standard motor (2 pole pairs) with rated voltage 3 AC 400 V, 50 Hz at mains voltage $U_{LN} \geq$ 3 AC 400 V or

  4-pole standard motor (2 pole pairs) with rated voltage 3 AC 460 V, 60 Hz at mains voltage $U_{LN} \geq$ 3 AC 460 V
- assigned mains choke is used
- operation at minimum switching frequency $f_s = f_s$ (min.)
- rotary field at output with $f_{out} > f_{out\_still}$
- ambient temperature $T_a \leq T_{a\_work}$
- overload ratio $K = P_{DC\_peak} / P_{DC\_base}$ according to performance profile “UEL_P_e”
- type of mains connection: individual supply

☞ When choosing standard motors for HMS/HMD, select an appropriate HMV supply unit. Observe the performance data P_{DC_peak} and P_{DC_base} in the performance profile “UEL_P_e” of the supply unit.

Operation With Standard Motors

Operating Standard Motors at 3 AC 400 V

in preparation

Operating Standard Motors at 3 AC 460 V

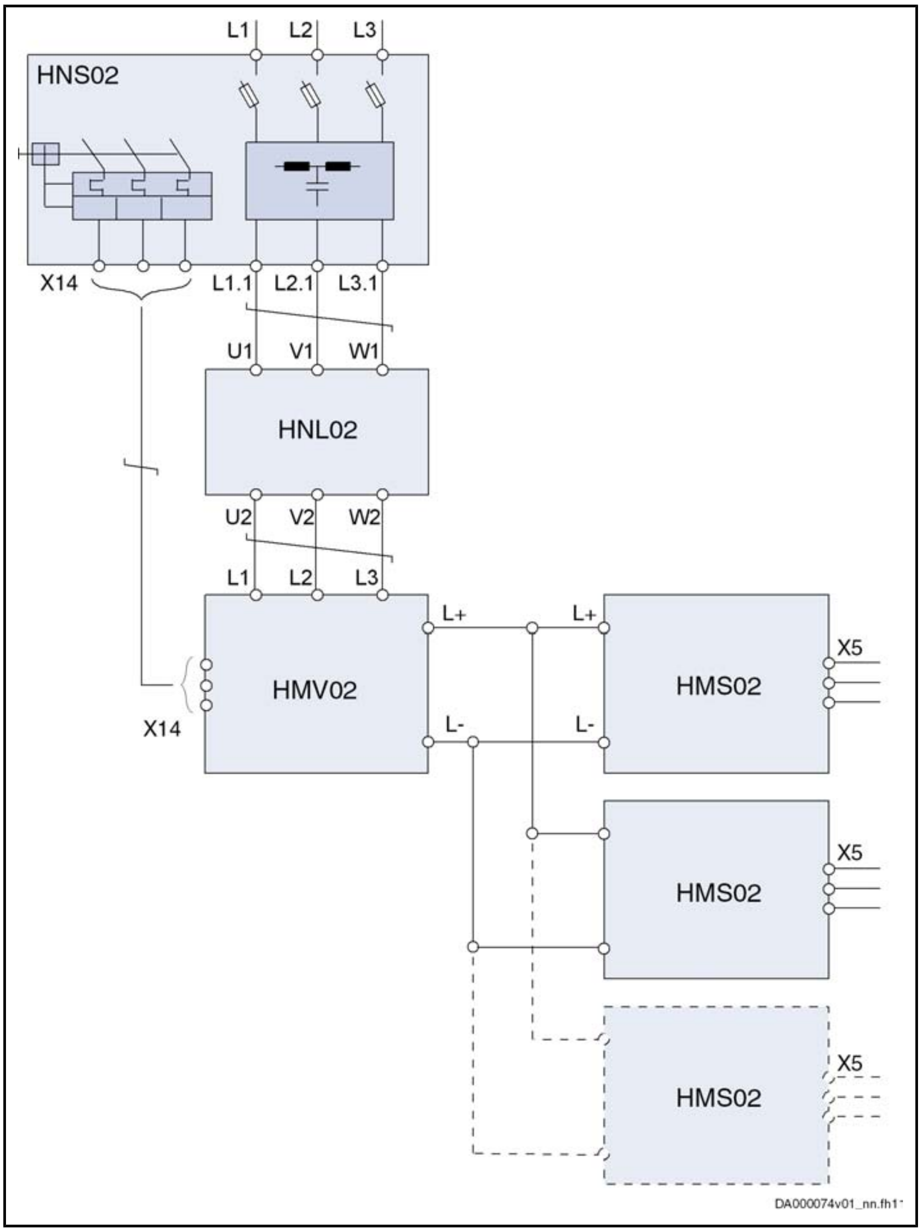
in preparation

6.3.5 Connections and Interfaces

Overview

Overall Connection Diagram

Overall connection diagram with mains filter, mains choke, supply unit, power section



HNS02	mains filter
HNL02	mains choke
HMV02	supply unit
HMS02	power section

Fig.6-67: *Overall connection diagram (mains filter, mains choke, supply unit, power section)*

Connection diagram of power section

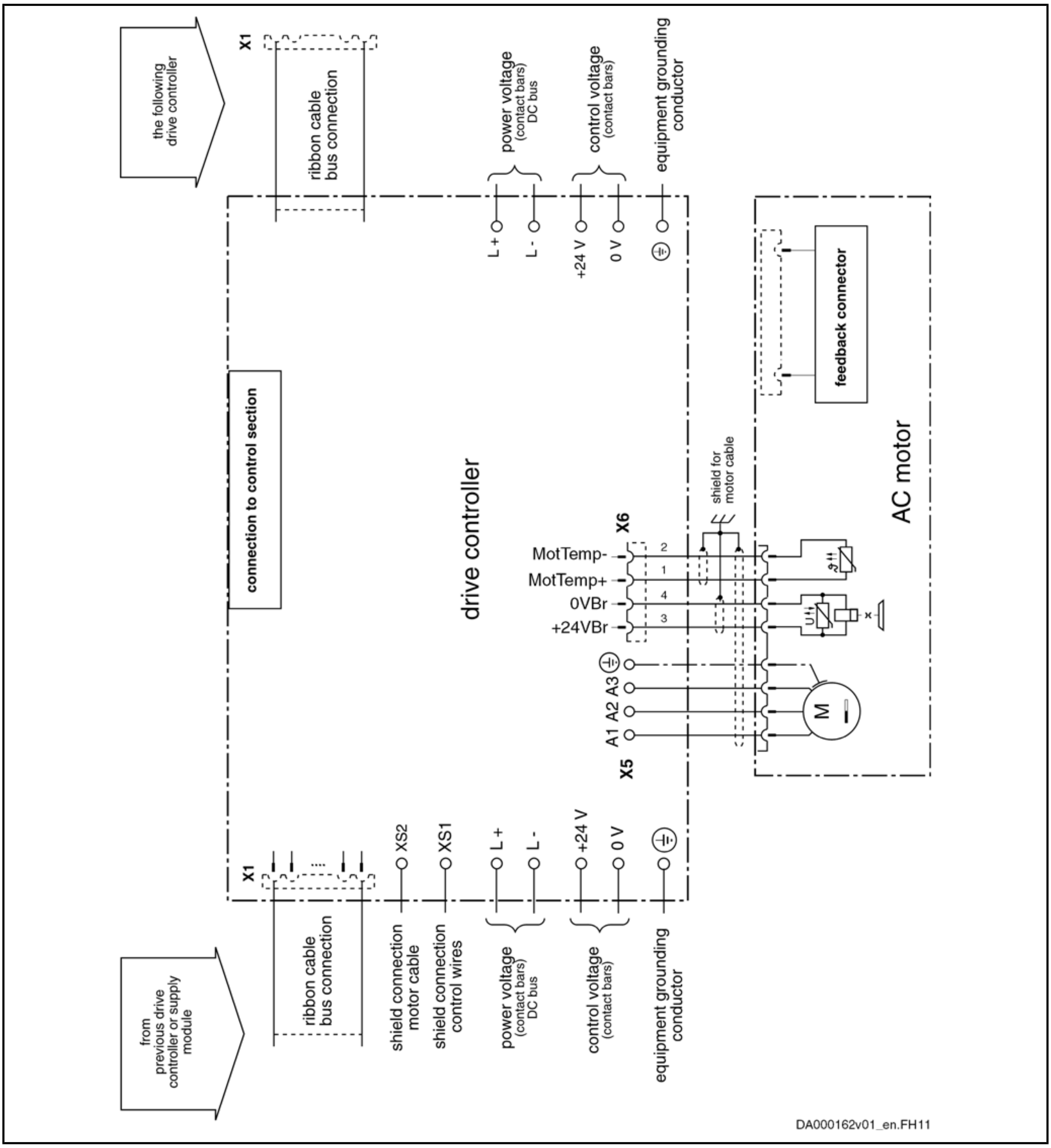
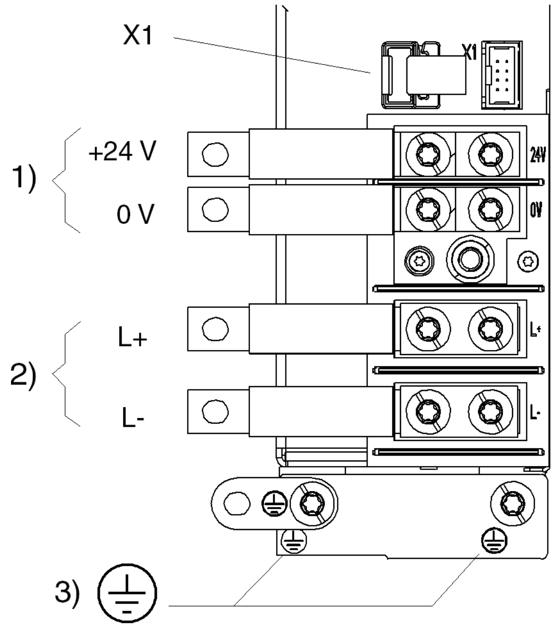


Fig.6-68: Connection diagram HMS02.1-Wxxxx

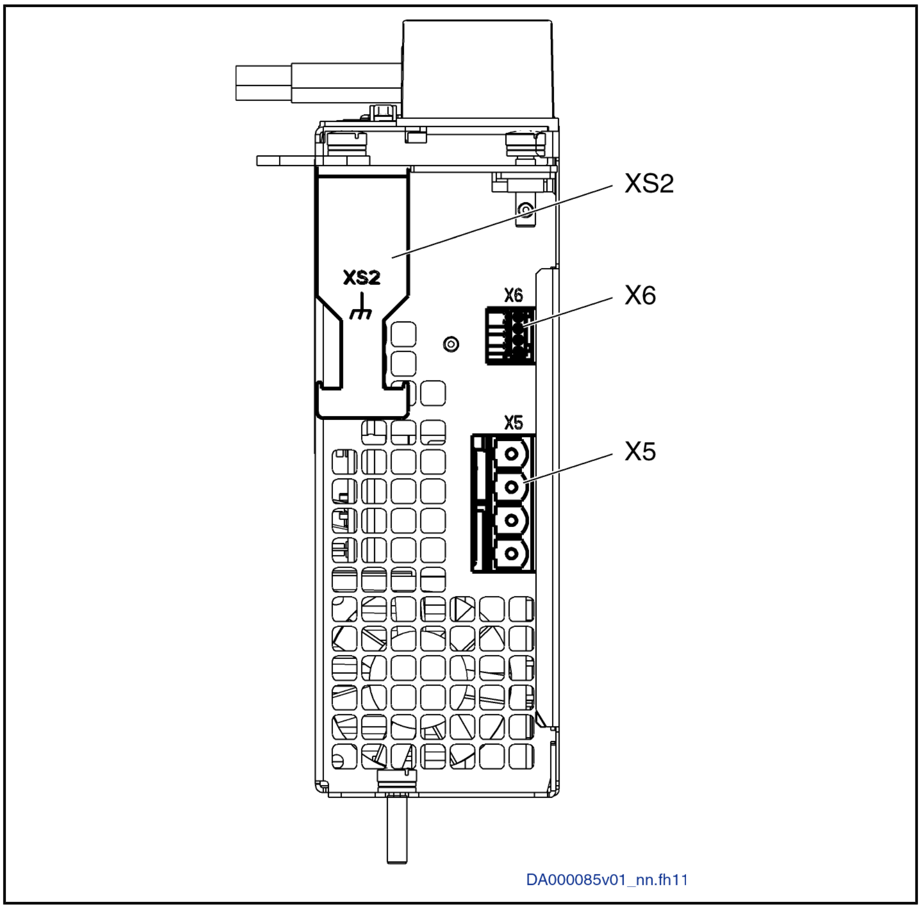
Arrangement of the Connection Points



DA000084v01_nn.fh11

1)	control voltage
2)	DC bus
3)	equipment grounding conductor
X1 in, X1 out	module bus

Fig.6-69: *Connections at power section (front)*



X5	motor connection
X6	motor temperature monitoring and motor holding brake
XS2	shield connection (motor power cable)

Fig.6-70: Connections at power section (bottom)

Description of the Connection Points

The connection points are described in detail in chapter 8 Functions and Electrical Connection Points , page 241.

Touch Guard The touch guard is described in detail in chapter 9 Touch Guard at Devices , page 291.

6.4 HMD01 Power Sections

6.4.1 Brief Description, Usage and Structure

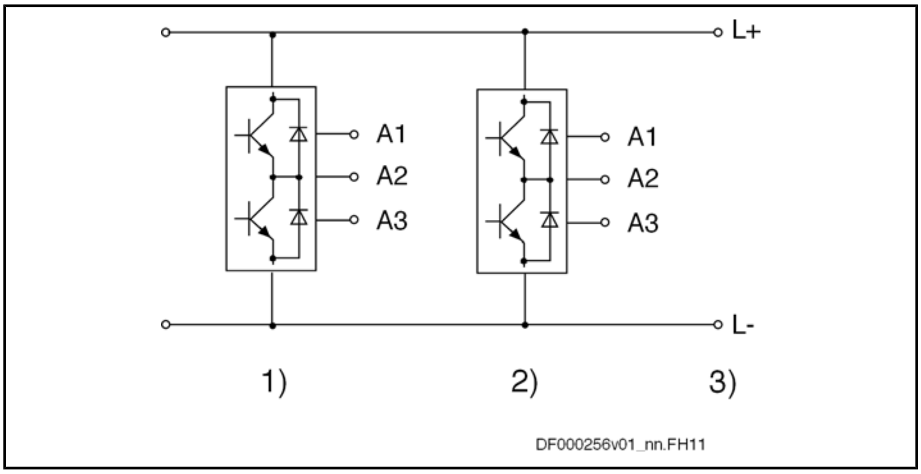
Brief Description The HMD01 inverters are part of the Rexroth IndraDrive M product range and are used to operate 2 single axes.

Usage The different types are used as follows:

Type	Usage
HMD01.1E-Wxxxx-NNNN	• double-axis device • Operation of two three-phase a.c. motors (asynchronous or synchronous motors).

Fig.6-71: Usage of HMD01

Structure, Block Diagrams



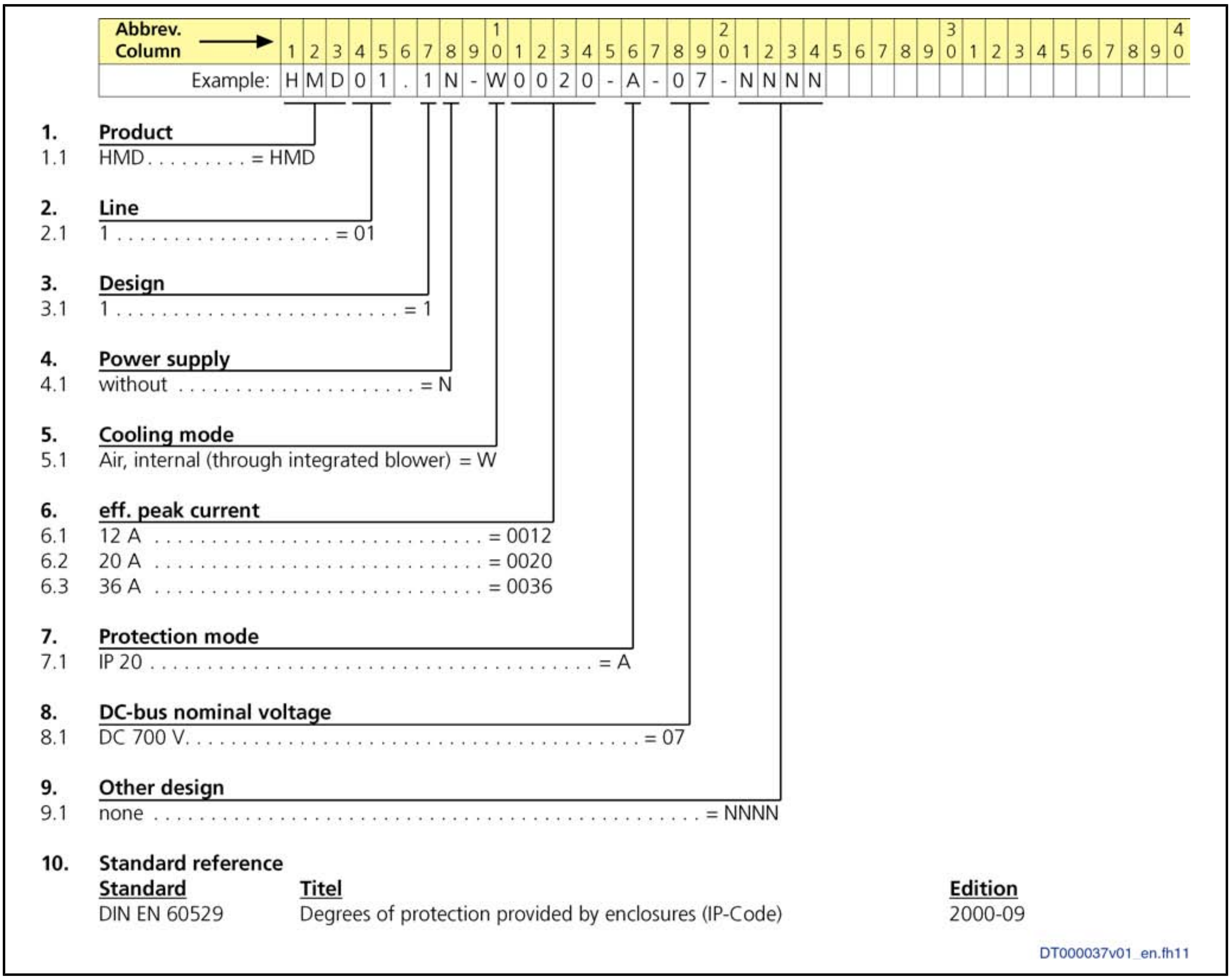
1)	inverter stage axis 1 with output to motor
2)	inverter stage axis 2 with output to motor
3)	DC bus connection

Fig.6-72: *HMD - block diagram*

6.4.2 Type Code and Identification

Type Code

☞ The following figure illustrates the basic structure of the type code. Our sales representative will help you with the current status of available versions.



Abbrev. Column →	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1	2	3	4	5	6	7	8	9	40
Example:	H	M	D	0	1	.	1	N	-	W	0	0	2	0	-	A	-	0	7	-	N	N	N	N																

1. Product
1.1 HMD. . . . . = HMD

2. Line
2.1 1 . . . . = 01

3. Design
3.1 1 . . . . = 1

4. Power supply
4.1 without . . . . = N

5. Cooling mode
5.1 Air, internal (through integrated blower) = W

6. eff. peak current
6.1 12 A . . . . = 0012
6.2 20 A . . . . = 0020
6.3 36 A . . . . = 0036

7. Protection mode
7.1 IP 20 . . . . = A

8. DC-bus nominal voltage
8.1 DC 700 V. . . . . = 07

9. Other design
9.1 none . . . . = NNNN

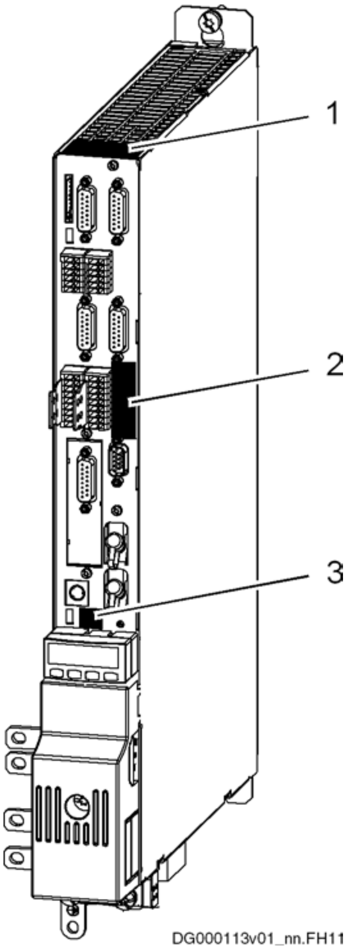
10. Standard reference

Standard	Titel	Edition
DIN EN 60529	Degrees of protection provided by enclosures (IP-Code)	2000-09

Fig.6-73: Type code HMD01

Identification

Type Plate Arrangement



1	power section type plate
2	control section type plate
3	firmware type plate

Fig.6-74: Type plates at the drive controller

Type Plate

1	device type
2	part number
3	serial number
4	bar code
5	country of manufacture
6	production week, 04W12 meaning year 2004, week 12
7	hardware index

Fig.6-75: Type plate - power section (example of an HCS02 power section)

6.4.3 Scope of Supply

- 1 × touch guard
- 1 × connector X5.1, X5.2, X6.1 and X6.2 each

6.4.4 Technical Data

Ambient and Operating Conditions

General Information

Conditions for transport and storage: see chapter 4.2 Transport and Storage, page 19.

Installation conditions: see chapter 4.3 Installation Conditions , page 19.

This chapter contains:

- limit values for use in the scope of C-UL
- applied standards (CE conformity, UL listing)

UL Data

Ambient and operating conditions - UL ratings

Description	Symbol	Unit	HMD01.1N-W0012	HMD01.1N-W0020	HMD01.1N-W0036
Suitable for use on a circuit capable of delivering not more than this SCCR, symmetrical amperes (UL) 1)	I_{SCCR}	A rms	42000		
rated input voltage, power (UL)2)	U_{LN_nenn}	V	254..750VDC		
rated input current (UL)3)	I_{L_cont}	A	17,0	24,5	49,0
maximum output voltage (UL)	U_{out}	V	530		
maximum output current (UL)	I_{out_max}	A	6,9	10,0	20,0

1) 600 V AC or less, use listed AC input line fuses or listed circuit breakers
2) HMS, HMD, HLB, HLC, KCU: DC bus L+, L-; HMV, HCS: mains input L1, L2, L3
3) at PDC_cont

Fig.6-76: HMD - Ambient and operating conditions - UL ratings

Information on Standards

Applied standards

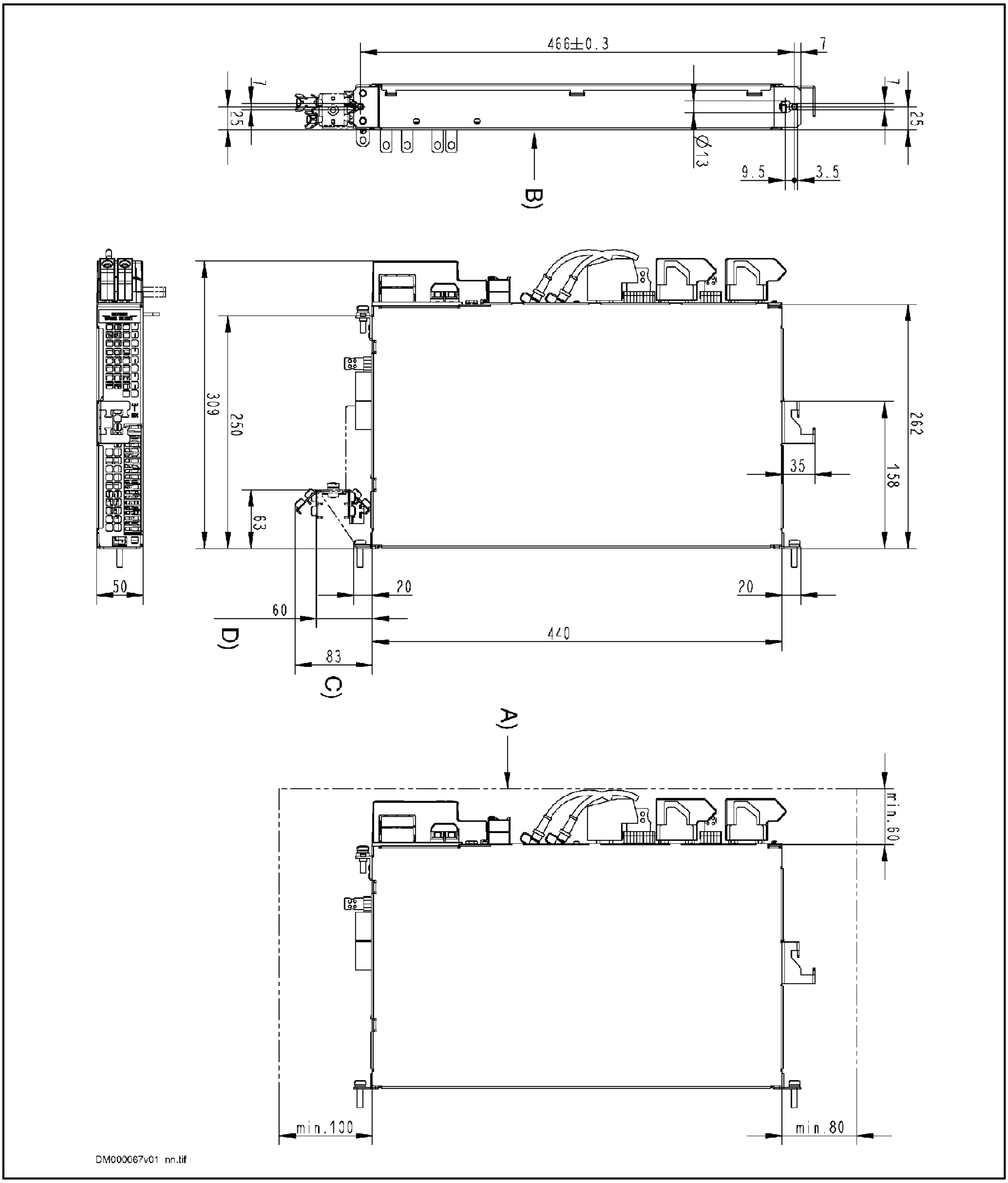
Description	Symbol	Unit	HMD01.1N-W0012	HMD01.1N-W0020	HMD01.1N-W0036
listing according to UL standard (UL)			UL 508 C		
UL files (UL)			E 134201		
listing according to CSA standard (UL)			Canadian National Standard(s) C22.2 No. 14-05		

Fig.6-77: HMD - Applied standards

Mechanical System and Mounting

Dimensional Drawings

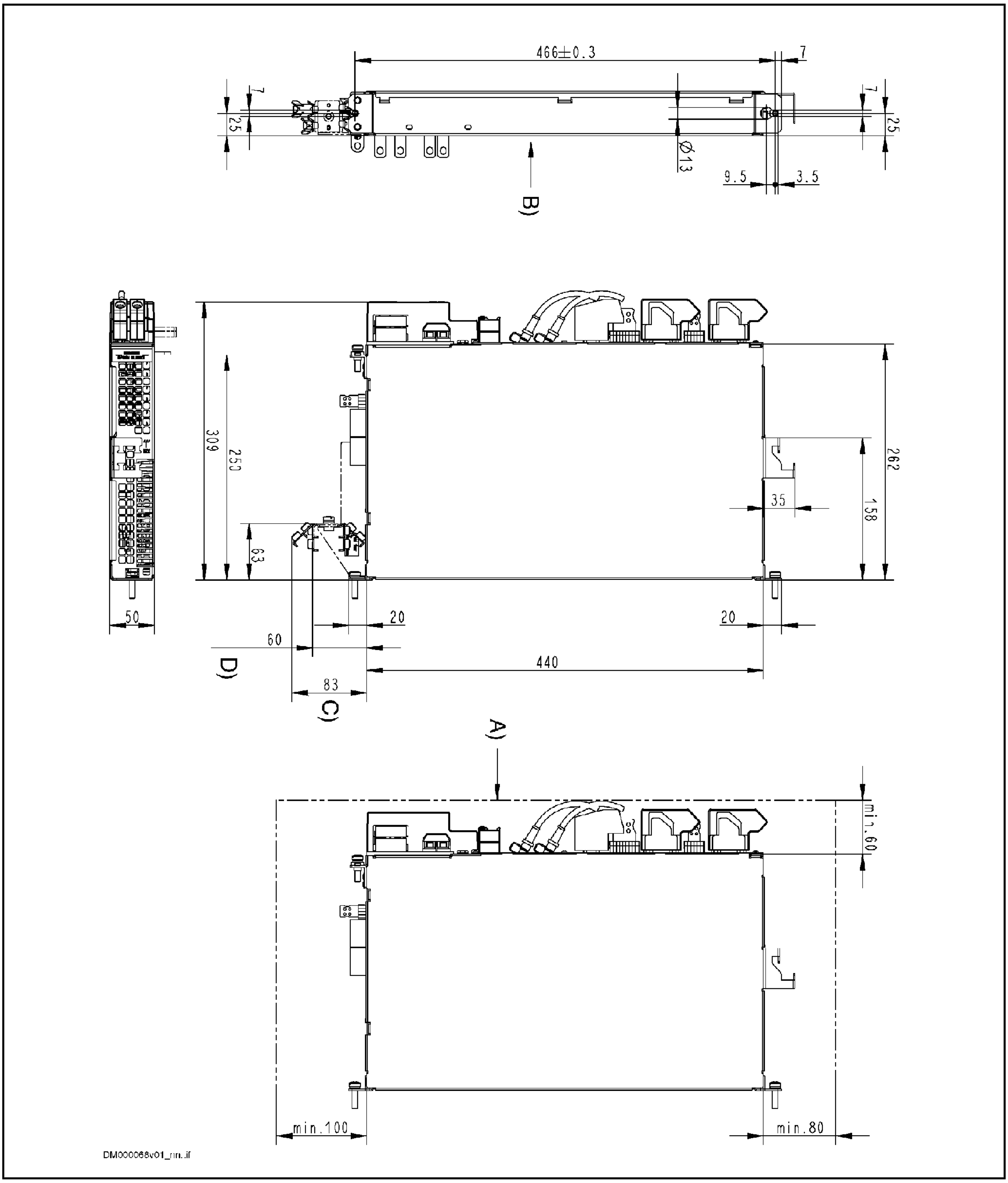
HMD01.1N-W0012



A)	minimum mounting clearance (plus additional space for motor cable) Note: Rexroth IndraDrive supply units require greater mounting clearance!
B)	rear view!
C)	dimensions for accessory HAS02.1 when motor cable run with 45°
D)	dimensions for accessory HAS02.1 when motor cable run horizontally

Fig.6-78: *Dimensions HMD01.1N-W0012*

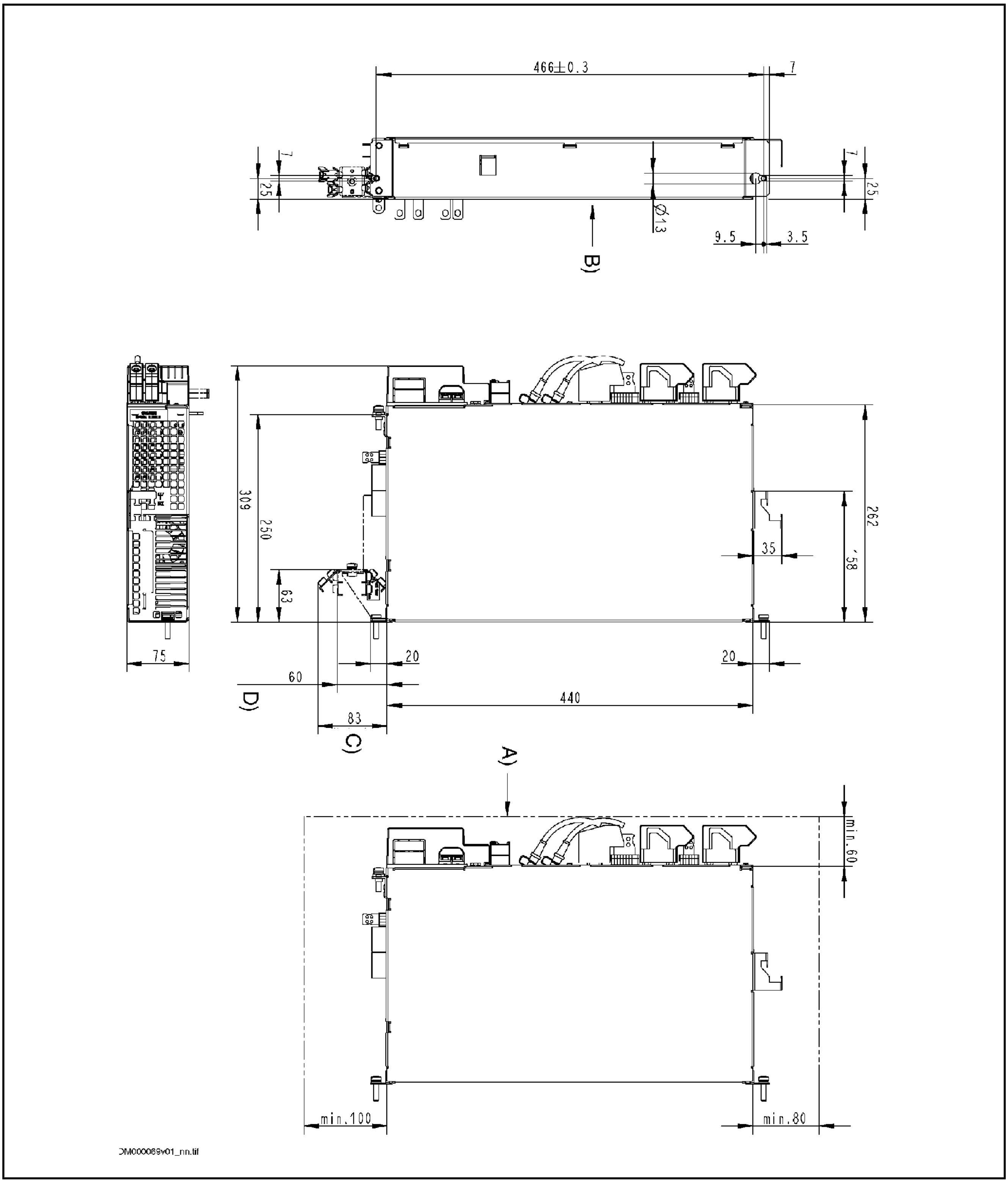
HMD01.1N-W0020



A)	minimum mounting clearance (plus additional space for motor cable) Note: Rexroth IndraDrive supply units require greater mounting clearance!
B)	rear view!
C)	dimensions for accessory HAS02.1 when motor cable run with 45°
D)	dimensions for accessory HAS02.1 when motor cable run horizontally

Fig.6-79: Dimensions HMD01.1N-W0020

HMD01.1N-W0036



A)	minimum mounting clearance (plus additional space for motor cable) Note: Rexroth IndraDrive supply units require greater mounting clearance!
B)	rear view!
C)	dimensions for accessory HAS02.1 when motor cable run with 45°
D)	dimensions for accessory HAS02.1 when motor cable run horizontally

Fig.6-80: Dimensions HMD01.1N-W0036

Dimensions, Mass, Insulation, Sound Pressure Level

Data for mass, dimensions, sound pressure level, insulation

Description	Symbol	Unit	HMD01.1N-W0012	HMD01.1N-W0020	HMD01.1N-W0036
weight	m	kg	5,50	5,60	7,50
device height (UL)[1]	H	mm	440		
device depth (UL)[2]	T	mm	262		
device width (UL)[3]	B	mm	50		75
insulation resistance at DC 500 V	R_{is}	MOhm	>50		
capacitance against housing	C_Y	nF	136,00		
average sound pressure level (accuracy class 2) at P_{DC_cont} [4]	L_P	dB (A)	tbd		

1) 2) 3) housing dimension; see also related dimensional drawing
4) according to DIN EN ISO 11205; comparative value at distance 1 m, out of cabinet; HCS types with order code -L***: load-dependent

Fig.6-81: HMD - Data for mass, dimensions, sound pressure level, insulation

Power Dissipation, Mounting Position, Cooling, Distances

Data for cooling and power dissipation

Description	Symbol	Unit	HMD01.1N-W0012	HMD01.1N-W0020	HMD01.1N-W0036
ambient temperature range during operation with nominal data	T_{a_work}	°C	0...40		
ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	0...+55		
derating of P_{DC_cont}; P_{BD}; I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2,0		
allowed mounting position			G1		
cooling type			forced ventilation		
volumetric capacity of forced cooling	V	m^3/h	tbd		
allowed switching frequencies[1]	f_s	kHz	4, 8		
power dissipation at I_{out_cont} = 0 A; $f_s = f_s$ (min.)[2]	$P_{Diss\_0A\_fsmin}$	W	2 x 35	2 x 10	2 x 15
power dissipation at I_{out_cont} = 0 A; $f_s = f_s$ (max.)[3]	$P_{Diss\_0A\_fsmax}$	W	2 x 50	2 x 10	2 x 25
power dissipation at continuous current and continuous DC bus power respectively (UL)[4]	P_{Diss_cont}	W	2 x 95	2 x 135	2 x 205
minimum distance on the top of the device[5]	d_{top}	mm	80		

Description	Symbol	Unit	HMD01.1N-W0012	HMD01.1N-W0020	HMD01.1N-W0036
minimum distance on the bottom of the device[6)]	d_{bot}	mm	100		
temperature rise with minimum distances d_{bot}; d_{top}; P_{BD}	ΔT	K	40		45

1) also depending on firmware and control section; see Parameter Description "P-0-0001, Switching frequency of the power output stage"; see "P-0-4058, Amplifier type data"

2) 3) plus dissipation of braking resistor (at HMV, HCS) and control section (at HMx, HCS); find interim values by interpolation to P_Diss_cont

4) HMV, HCS: plus dissipation of braking resistor, control section; KSM: plus rated power consumption control voltage input

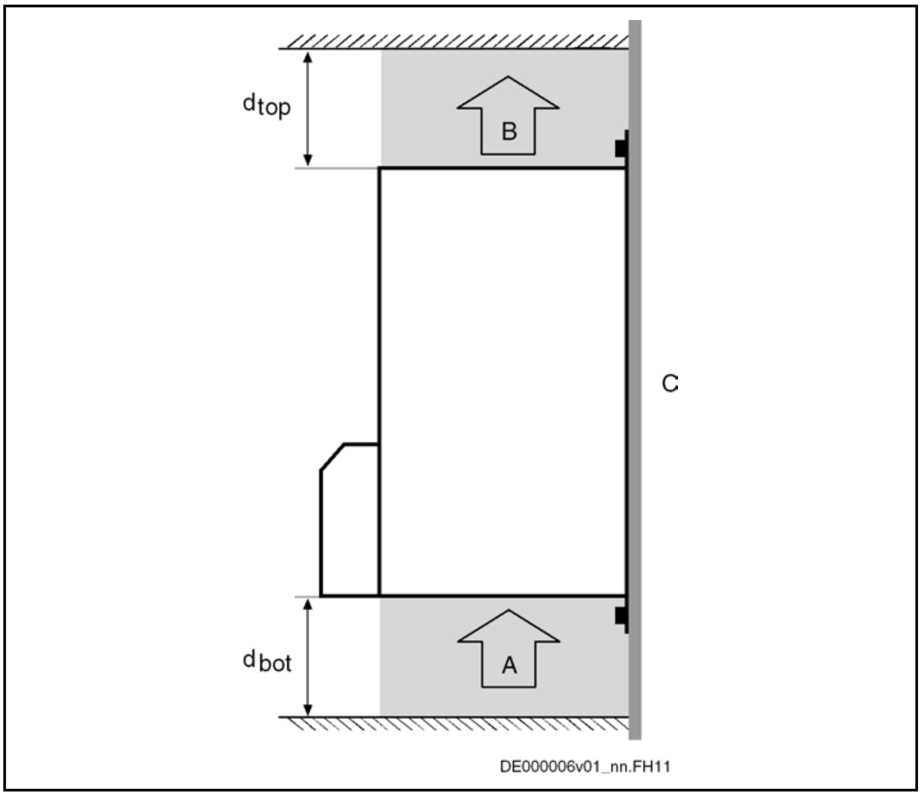
5) 6) see fig. "Air intake and air outlet at drive controller"

Fig.6-82: HMD - Data for cooling and power dissipation

CAUTION

Property damage due to temperatures higher than 105 °C!

Comply with indicated minimum distances!



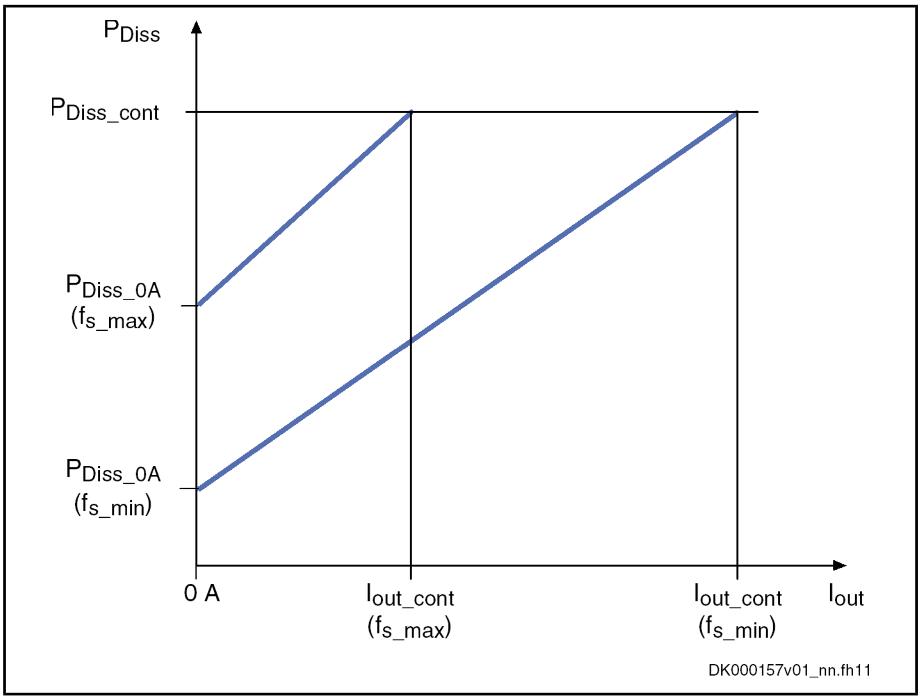
A	air intake
B	air outlet
C	mounting surface in control cabinet
d_{top}	distance top
d_{bot}	distance bottom

Fig.6-83: Air intake and air outlet at drive controller

Power Dissipation vs. Output Current

The figure below illustrates the connection between power dissipation and output current, depending on the switching frequency f_s which was set at the drive controller. See also Parameter Description "P-0-0001, Switching frequency of the power output stage".

☞ In addition, take the power at the braking resistor and the power consumption of the control section into account. Both powers are not contained in the figure.



I_{out}	output current
P_{Diss}	power dissipation
f_s	switching frequency

Fig.6-84: *Power dissipation vs. output current*

Basic Data Power Section HMD01

General Information

This chapter contains:

- data for control voltage supply
- data of DC bus
- data of inverter

☞ The order of the data tables below follows the energy flow in the drive controller – from mains connection to motor output.

Control Voltage

Data for control voltage supply

Description	Symbol	Unit	HMD01.1N-W0012	HMD01.1N-W0020	HMD01.1N-W0036
rated control voltage input (UL)$^{1)}$	U_{N3}	V	24 ± 20 %		
control voltage when using motor holding brake with motor cable length < 50 m$^{2)}$	U_{N3}	V	24 ± 5 %		
control voltage when using motor holding brake with motor cable length > 50 m$^{3)}$	U_{N3}	V	26 ± 5 %		

Description	Symbol	Unit	HMD01.1N-W0012	HMD01.1N-W0020	HMD01.1N-W0036
maximum allowed voltage for 1 m	U_{N3_max}	V	33 (1ms)		
maximum inrush current at 24V supply	I_{EIN3_max}	A	6,30		
pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	5		
input capacitance	C_{N3}	mF	0,47		
rated power consumption control voltage input at U_{N3} (UL)[4]	P_{N3}	W	17		11

1) 2) 3) observe supply voltage for motor holding brakes

4) HMS, HMD, HCS: plus holding brake and control section; KCU01: at max. number of axes; KSM01: plus holding brake (UN x IN)

Fig.6-85: HMD - Data for control voltage supply

DC Bus

Data of power section - DC bus

Description	Symbol	Unit	HMD01.1N-W0012	HMD01.1N-W0020	HMD01.1N-W0036
DC bus voltage	U_{DC}	V	254..750		
capacitance in DC bus	C_{DC}	mF	-		
DC resistance in DC bus (L+ to L-) at U_{DC} = 750 V	R_{DC}	kOhm	approx. 1000		
monitoring value maximum DC bus voltage, switch-off threshold	$U_{DC\_limit\_max}$	V	900		
monitoring value minimum DC bus voltage, undervoltage threshold	$U_{DC\_limit\_min}$	V	254		

Fig.6-86: HMD - Data of power section - DC bus

Inverter

Data of power section - Inverter

Description	Symbol	Unit	HMD01.1N-W0012	HMD01.1N-W0020	HMD01.1N-W0036
allowed switching frequencies[1]	f_s	kHz	4, 8		
output voltage, fundamental wave with open-loop operation	U_{out_eff}	V	~ UDC x 0,71		
output voltage, fundamental wave with closed-loop operation	U_{out_eff}	V	~ UDC x 0,71		
rise of voltage at output with U_{LN_nenn} and 15 m motor cable length phase-phase (10-90%)[2]	du/dt	kV/µs	5,00		
rise of voltage at output with U_{LN_nenn} and 15 m motor cable length phase-ground (10-90%)[3]	du/dt	kV/µs	5,00		
output frequency range at f_s = 2 kHz	f_{out_2k}	Hz	-		
output frequency range at f_s = 4 kHz	f_{out_4k}	Hz	0..400		
output frequency range at f_s = 8 kHz	f_{out_8k}	Hz	0...800		

Description	Symbol	Unit	HMD01.1N-W0012	HMD01.1N-W0020	HMD01.1N-W0036
output frequency range at f_s = 12 kHz	f_{out_12k}	Hz	-		
output frequency range at f_s = 16 kHz	f_{out_16k}	Hz	-		
output frequency threshold to detect motor standstill[4)]	f_{out_still}	Hz	2..4		
maximum output current at f_s = 2 kHz	I_{out_max2}	A	-		
maximum output current at f_s = 4 kHz	I_{out_max4}	A	12,0	20,0	36,0
maximum output current at f_s = 8 kHz	I_{out_max8}	A	12,0	20,0	36,0
maximum output current at f_s = 12 kHz	I_{out_max12}	A	-		
maximum output current at f_s = 16 kHz	I_{out_max16}	A	-		
allowed continuous output current at f_s = 2 kHz	I_{out_cont2}	A	-		
allowed continuous output current at f_s = 4 kHz	I_{out_cont4}	A	6,9	10,0	20,0
allowed continuous output current at f_s = 8 kHz	I_{out_cont8}	A	3,7	6,1	13,0
allowed continuous output current at f_s = 12 kHz[5)]	I_{out_cont12}	A	-		--
allowed continuous output current at f_s = 16 kHz[6)]	I_{out_cont16}	A	-		
allowed continuous output current at f_s = 2 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_2}$	A	-		
allowed continuous output current at f_s = 4 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_4}$	A	4,4	7,0	13,7
allowed continuous output current at f_s = 8 kHz; output frequency $f_{out} < f_{out\_still}$	$I_{out\_cont0Hz\_8}$	A	1,7	4,1	8,9
allowed continuous output current at f_s = 12 kHz; output frequency $f_{out} < f_{out\_still}$[7)]	$I_{out\_cont0Hz\_12}$	A	-		

Description	Symbol	Unit	HMD01.1N-W0012	HMD01.1N-W0020	HMD01.1N-W0036
allowed continuous output current at f_s = 16 kHz; output frequency $f_{out} < f_{out\_still}$ 8)	$I_{out\_cont0Hz\_16}$	A	-		
assigned output filters at nom. data; f_s = 4 kHz			-		

1) also depending on firmware and control section; see Parameter Description "P-0-0001, Switching frequency of the power output stage"; see "P-0-4058, Amplifier type data"
2) 3) guide value, see following note
4) see following note regarding reduction output current
5) 6) 7) 8) see Parameter Description "P-0-0556, Config word of axis controller", load-depending reduction of PWM frequency fs

Fig.6-87: HMD - Data of power section - Inverter

☞ Observe that the load is almost independent of the power section used.

Especially when using **standard motors** , make sure that they comply with the occurring voltage load.

Observe the information contained in the chapter “Third-Party Motors at IndraDrive Controllers” in the Project Planning Manual of the drive system.

☞ Depending on the electric output frequency, the output current is reduced for thermal protection of the power section.

The output current is reduced, when the electric output frequency has fallen below the threshold to detect motor standstill.

Exemplary Data for Applications

General Information

This chapter contains:

- examples of allowed current profiles
- examples of allowed performance profiles
- data for selecting standard motors

Current Profiles

Examples of allowed current profiles

Description	Symbol	Unit	HMD01.1N-W0012	HMD01.1N-W0020	HMD01.1N-W0036
maximum output current at $I_{out\_base\_1}$; f_s = 2 kHz; t = 0,4 s; T = 4 s; K = 2,5 1)	$I_{out\_peak1\_2}$	A	-		
base load current at $I_{out\_peak\_1}$; f_s = 2 kHz; t = 0,4 s; T = 4 s; K = 2,5	$I_{out\_base1\_2}$	A	-		
maximum output current at $I_{out\_base\_1}$; f_s = 4 kHz; t = 0,4 s; T = 4 s; K = 2,5 2)	$I_{out\_peak1\_4}$	A	11,66	17,38	33,44
base load current at $I_{out\_peak\_1}$; f_s = 4 kHz; t = 0,4 s; T = 4 s; K = 2,5	$I_{out\_base1\_4}$	A	4,67	6,95	13,38

Description	Symbol	Unit	HMD01.1N-W0012	HMD01.1N-W0020	HMD01.1N-W0036
maximum output current at $I_{out\_base\_1}$; f_s = 8 kHz; t = 0,4 s; T = 4 s; K = 2,5[3)]	$I_{out\_peak1\_8}$	A	6,35	10,76	22,14
base load current at $I_{out\_peak\_1}$; f_s = 8 kHz; t = 0,4 s; T = 4 s; K = 2,5	$I_{out\_base1\_8}$	A	2,54	4,31	8,86
maximum output current at $I_{out\_base\_1}$; f_s = 12 kHz; t = 0,4 s; T = 4 s; K = 2,5[4)]	I out_peak1_12	A	-		
base load current at $I_{out\_peak\_1}$; f_s = 12 kHz; t = 0,4 s; T = 4 s; K = 2,5	I out_base1_12	A	-		
maximum output current at $I_{out\_base\_1}$; f_s = 16 kHz; t = 0,4 s; T = 4 s; K = 2,5[5)]	I out_peak1_16	A	-		
base load current at $I_{out\_peak\_1}$; f_s = 16 kHz; t = 0,4 s; T = 4 s; K = 2,5	I out_base1_16	A	-		
maximum output current at $I_{out\_base\_3}$; f_s = 2 kHz; t = 2 s; T = 20 s; K = 2,0[6)]	$I_{out\_peak3\_2}$	A	-		
base load current at $I_{out\_peak\_3}$; f_s = 2 kHz; t = 2 s; T = 20 s; K = 2,0	$I_{out\_base3\_2}$	A	-		
maximum output current at $I_{out\_base\_3}$; f_s = 4 kHz; t = 2 s; T = 20 s; K = 2,0[7)]	$I_{out\_peak3\_4}$	A	10,50	15,44	30,13
base load current at $I_{out\_peak\_3}$; f_s = 4 kHz; t = 2 s; T = 20 s; K = 2,0	$I_{out\_base3\_4}$	A	5,25	7,72	15,07
maximum output current at $I_{out\_base\_3}$; f_s = 8 kHz; t = 2 s; T = 20 s; K = 2,0[8)]	$I_{out\_peak3\_8}$	A	5,67	9,52	19,79
base load current at $I_{out\_peak\_3}$; f_s = 8 kHz; t = 2 s; T = 20 s; K = 2,0	$I_{out\_base3\_8}$	A	2,84	4,76	9,89
maximum output current at $I_{out\_base\_3}$; f_s = 12 kHz; t = 2 s; T = 20 s; K = 2,0[9)]	I out_peak3_12	A	-		
base load current at $I_{out\_peak\_3}$; f_s = 12 kHz; t = 2 s; T = 20 s; K = 2,0	I out_base3_12	A	-		
maximum output current at $I_{out\_base\_3}$; f_s = 16 kHz; t = 2 s; T = 20 s; K = 2,0[10)]	I out_peak3_16	A	-		
base load current at $I_{out\_peak\_3}$; f_s = 16 kHz; t = 2 s; T = 20 s; K = 2,0	I out_base3_16	A	-		
base load current at $I_{out\_peak\_4}$; f_s = 2 kHz; t = 60 s; T = 5 min; K = 1,5	$I_{out\_base4\_2}$	A	-		

Power Sections for Inverters - IndraDrive M

Description	Symbol	Unit	HMD01.1N-W0012	HMD01.1N-W0020	HMD01.1N-W0036
maximum output current at $I_{out\_base\_4}$; f_s = 2 kHz; t = 60 s; T = 5 min; K = 1,5[11]	$I_{out\_peak4\_2}$	A	-		
maximum output current at $I_{out\_base\_4}$; f_s = 4 kHz; t = 60 s; T = 5 min; K = 1,5[12]	$I_{out\_peak4\_4}$	A	8,01	11,72	23,37
base load current at $I_{out\_peak\_4}$; f_s = 4 kHz; t = 60 s; T = 5 min; K = 1,5	$I_{out\_base4\_4}$	A	5,34	7,81	15,58
maximum output current at $I_{out\_base\_4}$; f_s = 8 kHz; t = 60 s; T = 5 min; K = 1,5[13]	$I_{out\_peak4\_8}$	A	4,29	7,19	15,23
base load current at $I_{out\_peak\_4}$; f_s = 8 kHz; t = 60 s; T = 5 min; K = 1,5	$I_{out\_base4\_8}$	A	2,86	4,79	10,16
maximum output current at $I_{out\_base\_4}$; f_s = 12 kHz; t = 60 s; T = 5 min; K = 1,5[14]	$I_{out\_peak4\_12}$	A	-		
base load current at $I_{out\_peak\_4}$; f_s = 12 kHz; t = 60 s; T = 5 min; K = 1,5	$I_{out\_base4\_12}$	A	-		
maximum output current at $I_{out\_base\_4}$; f_s = 16 kHz; t = 60 s; T = 5 min; K = 1,5[15]	$I_{out\_peak4\_16}$	A	-		
base load current at $I_{out\_peak\_4}$; f_s = 16 kHz; t = 60 s; T = 5 min; K = 1,5	$I_{out\_base4\_16}$	A	-		
maximum output current at $I_{out\_base\_5}$; f_s = 2 kHz; t = 60 s; T = 10 min; K = 1,1[16]	$I_{out\_peak5\_2}$	A	-		
base load current at $I_{out\_peak\_5}$; f_s = 2 kHz; t = 60 s; T = 10 min; K = 1,1	$I_{out\_base5\_2}$	A	-		
maximum output current at $I_{out\_base\_5}$; f_s = 4 kHz; t = 60 s; T = 10 min; K = 1,1[17]	$I_{out\_peak5\_4}$	A	7,25	10,49	20,93
base load current at $I_{out\_peak\_5}$; f_s = 4 kHz; t = 60 s; T = 10 min; K = 1,1	$I_{out\_base5\_4}$	A	6,59	9,54	19,02
maximum output current at $I_{out\_base\_5}$; f_s = 8 kHz; t = 60 s; T = 10 min; K = 1,1[18]	$I_{out\_peak5\_8}$	A	3,87	6,43	13,60
base load current at $I_{out\_peak\_5}$; f_s = 8 kHz; t = 60 s; T = 10 min; K = 1,1	$I_{out\_base5\_8}$	A	3,52	5,84	12,36

Description	Symbol	Unit	HMD01.1N-W0012	HMD01.1N-W0020	HMD01.1N-W0036
maximum output current at $I_{out\_base\_5}$; f_s = 12 kHz; t = 60 s; T = 10 min; K = 1,1[19]	$I_{out\_peak5\_12}$	A	-		
base load current at $I_{out\_peak\_5}$; f_s = 12 kHz; t = 60 s; T = 10 min; K = 1,1	$I_{out\_base5\_12}$	A	-		
maximum output current at $I_{out\_base\_5}$; f_s = 16 kHz; t = 60 s; T = 10 min; K = 1,1[20]	$I_{out\_peak5\_16}$	A	-		
base load current at $I_{out\_peak\_5}$; f_s = 16 kHz; t = 60 s; T = 10 min; K = 1,1	$I_{out\_base5\_16}$	A	-		

1) 2) 3) 4) 5) 6) 7) 8) 9) 10) 11) 12) 13) 14) 15) 16) 17) 18) 19) 20) see definition profile UEL_I_e

Fig.6-88: HMD - Examples of allowed current profiles

Current Profile "UEL_I_e"

The following current profiles have been defined for converters and inverters.

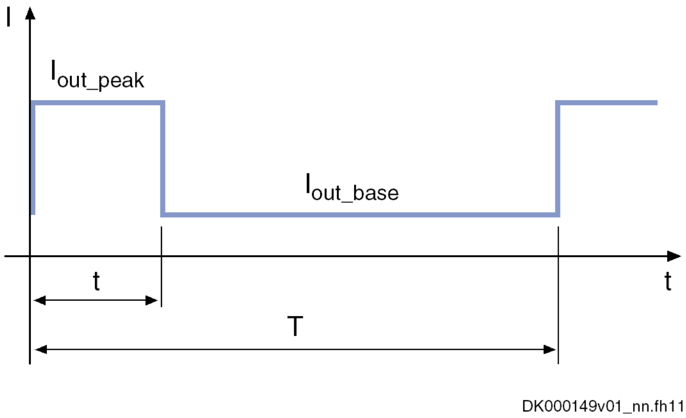
Profile	Explanation
current profile "UEL_I_e" 	The characteristic data of the profile are used to select converters and inverters for operation with standard motors and servo drives.

Fig.6-89: Definition of current profiles

Operation With Standard Motors

General Information

Selecting Standard Motors

The tables below show the nominal powers P_{nenn} of standard motors which can be operated at the respective drive controller. The data are subject to the following conditions:

- motor design:

  4-pole standard motor (2 pole pairs) with rated voltage 3 AC 400 V, 50 Hz at mains voltage U_{LN} ≥ 3 AC 400 V or

  4-pole standard motor (2 pole pairs) with rated voltage 3 AC 460 V, 60 Hz at mains voltage U_{LN} ≥ 3 AC 460 V

- assigned mains choke is used
- operation at minimum switching frequency f_s= f_s (min.)
- rotary field at output with f_{out}>f_{out_still}
- ambient temperature T_a≤T_{a_work}
- overload ratio K = P_{DC_peak} / P_{DC_base} according to performance profile "UEL_P_e"
- type of mains connection: individual supply

☞ When choosing standard motors for HMS/HMD, select an appropriate HMV supply unit. Observe the performance data P_{DC_peak} and P_{DC_base} in the performance profile "UEL_P_e" of the supply unit.

Operating Standard Motors at 3 AC 400 V

Selection of standard motors 3 AC 400V - Exemplary profiles

Description	Symbol	Unit	HMD01.1N-W0012	HMD01.1N-W0020	HMD01.1N-W0036
nominal power standard motor 3 AC 400 V; 50 Hz; t > 10 min; K = 1,0; f_s = 4 kHz$^{1)}$	P_{Nenn}	kW	3,00	4,00	7,50
nominal power standard motor 3 AC 400 V; 50 Hz; t = 60 s; T = 10 min; K = 1,1; f_s = 4 kHz$^{2)}$	P_{Nenn}	kW	2,20	4,00	7,50
nominal power standard motor 3 AC 400 V; 50 Hz; t = 60 s; T = 5 min; K = 1.5; f_s = 4 kHz$^{3)}$	P_{Nenn}	kW	2,20	3,00	7,50
nominal power standard motor 3 AC 400 V; 50 Hz; t = 2 s; T = 20 s; K = 2,0; f_s = 4 kHz$^{4)}$	P_{Nenn}	kW	2,20	3,00	7,50

1) 2) 3) 4) see definition profile UEL_P_e

Fig.6-90: HMD - Selection of standard motors 3 AC 400V - Exemplary profiles

Operating Standard Motors at 3 AC 460 V

Selection of standard motors 3 AC 460V - Exemplary profiles

Description	Symbol	Unit	HMD01.1N-W0012	HMD01.1N-W0020	HMD01.1N-W0036
nominal power standard motor 3AC460V; 60 Hz; t > 10 min; K = 1,0; f_s = 4 kHz$^{1)}$	P_{Nenn}	kW	3,70	5,50	11,00
nominal power standard motor 3AC460V; 60 Hz; t = 60 s; T = 10 min; K = 1,1; f_s = 4 kHz$^{2)}$	P_{Nenn}	kW	2,20	3,70	11,00

Description	Symbol	Unit	HMD01.1N-W0012	HMD01.1N-W0020	HMD01.1N-W0036
nominal power standard motor 3AC460V; 60 Hz; t = 60 s; T = 5 min; K = 1.5; f_s = 4 kHz$^{3)}$	P_{Nenn}	kW	2,20	3,70	7,40
nominal power standard motor 3AC460V; 60 Hz; t = 2 s; T = 20 s; K = 2,0; f_s = 4 kHz$^{4)}$	P_{Nenn}	kW	2,20	3,70	7,40

1) 2) 3) 4) see definition profile UEL_P_e; 1 kW ~ 1,36 hp

Fig.6-91: HMD - Selection of standard motors 3 AC 460V - Exemplary profiles

Performance Profile "UEL_P_e"

The following performance profiles have been defined for converters and inverters.

☞ Observe the allowed performance data P_{DC_peak} and P_{DC_base} in the corresponding performance profile of the supply unit or converter.

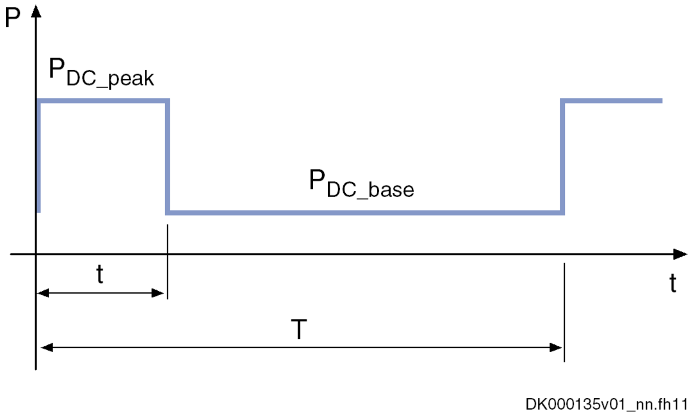
Profile	Explanation
performance profile "UEL_P_e" 	Characteristic of the selection of standard motors and servo drives.

Fig.6-92: Definition of performance profiles, infeeding supply units and converters

6.4.5 Connections and Interfaces

Overview

Overall Connection Diagram

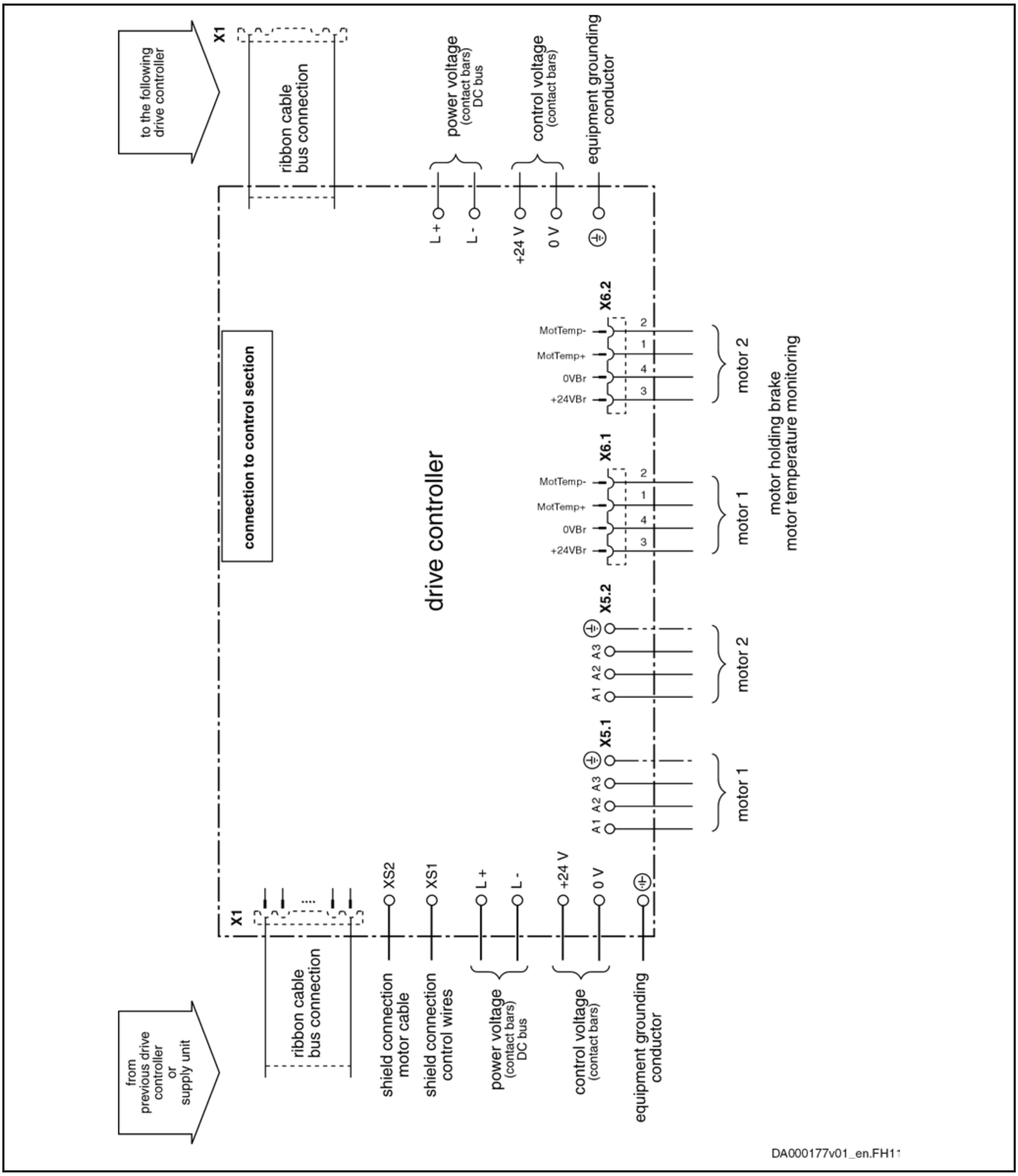
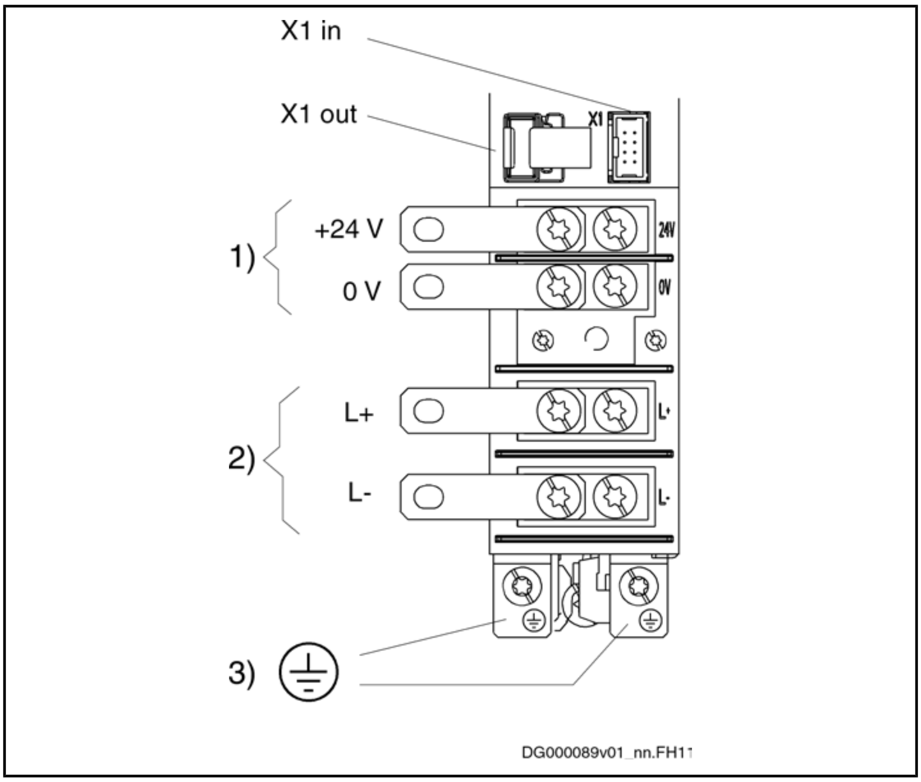


Fig.6-93: Connection diagram HMD01

Arrangement of the Connection Points

Connection Points at HMD01.1N-W0012, HMD01.1N-W0020 and HMD01.1N-W0036

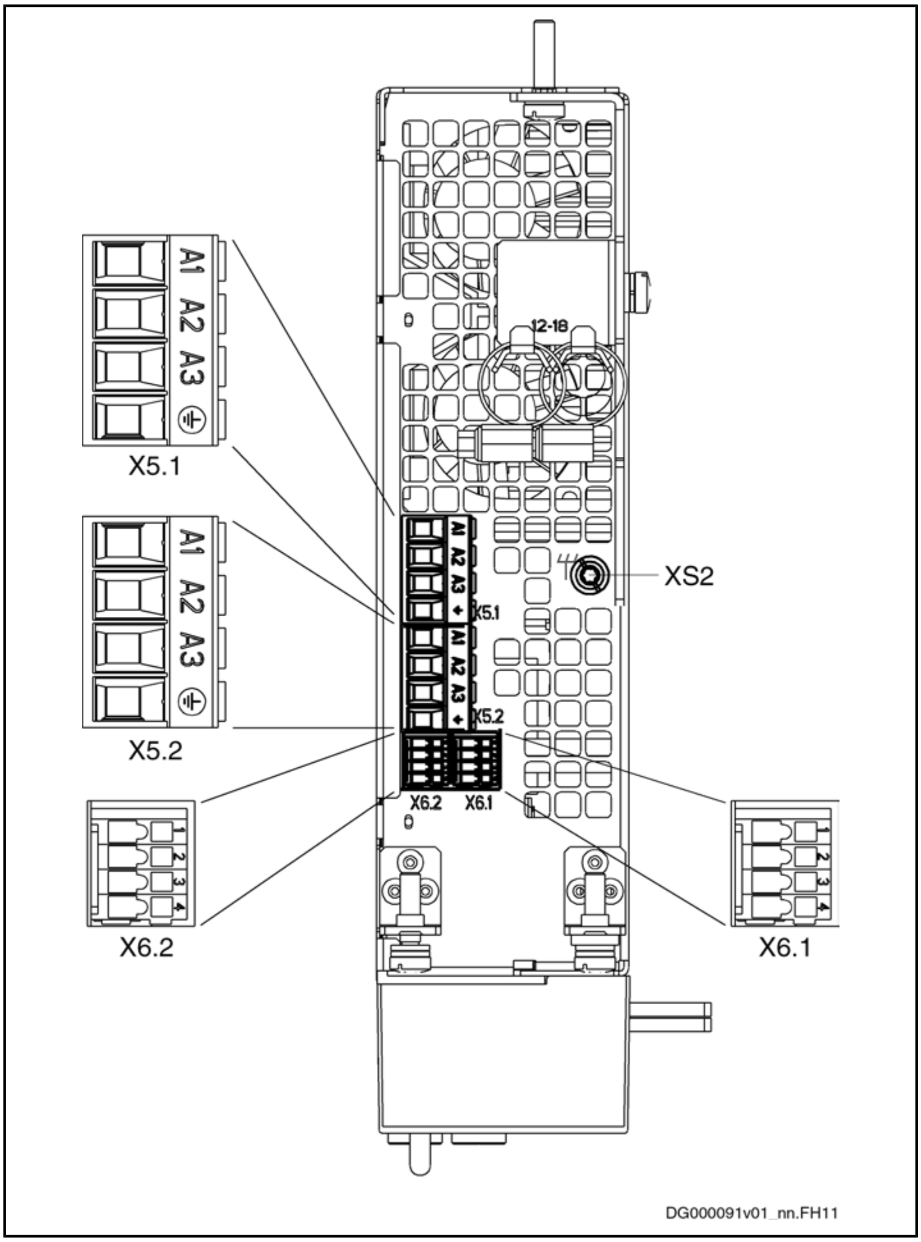
Connections at power section (front)



1)	control voltage
2)	DC bus
3)	equipment grounding conductor
X1 in, X1 out	module bus

Fig.6-94: *Connections at power section (front)*

Connections at power section (bottom) HMD01.1N-W0012, HMD01.1N-W0020, -W0036



X5.1, X5.2	motor connection
X6.1, X6.2	motor temperature monitoring and motor holding brake
XS2	shield connection (motor power cable)

Fig.6-95: *Connections at power section (bottom)*

Description of the Connection Points

The connection points are described in detail in chapter 8 Functions and Electrical Connection Points , page 241.

Touch Guard The touch guard is described in detail in chapter 9 Touch Guard at Devices , page 291.

7 IndraDrive M Supply Units

7.1 Types

Supply unit	Characteristic	Type	Features
HMV01.1E	infeeding	W0030 W0075 W0120	to supply HMS01 and HMD01 drive controllers
HMV01.1R	regenerative	W0018 W0045 W0065 W0120	to supply HMS01 and HMD01 drive controllers
HMV02.1R	regenerative	W0015	to supply HMS02 drive controllers

Fig.7-1: Overview

7.2 HMV01.1E Supply Units, Infeeding

7.2.1 Brief Description, Usage and Structure

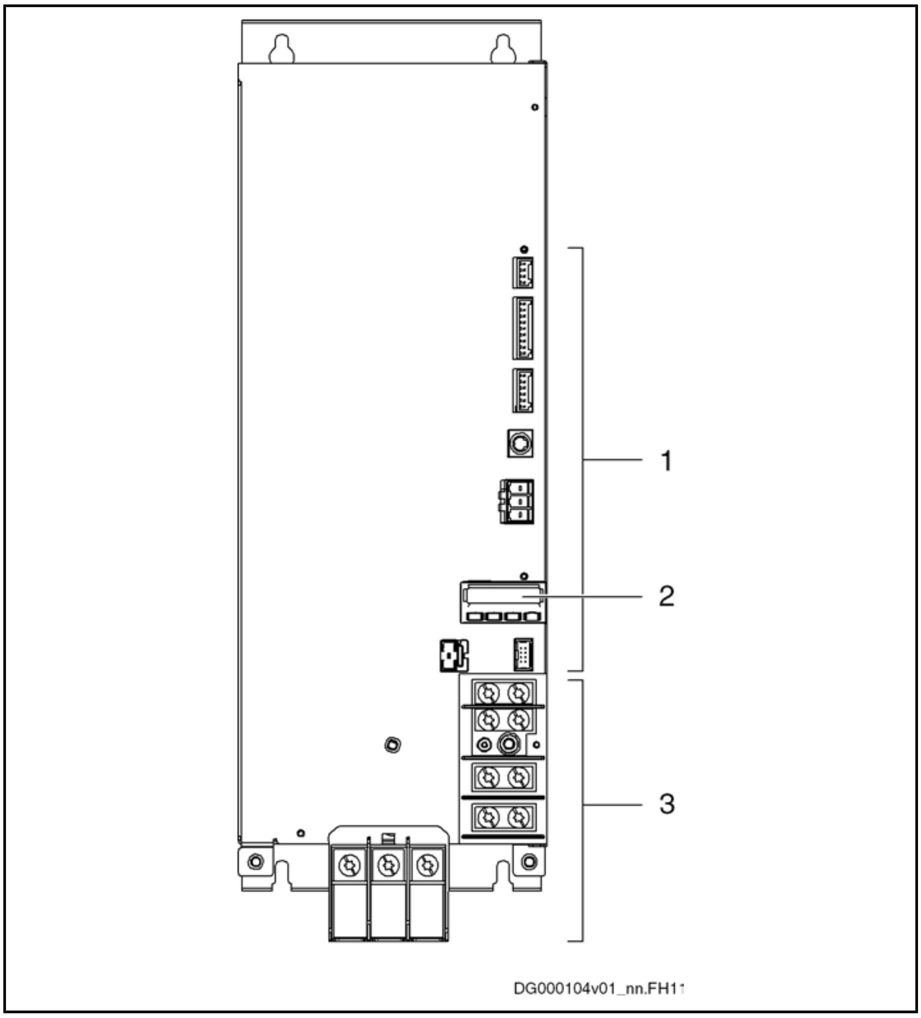
Brief Description HMV supply units are used to supply modular HMS and HMD devices.

Usage The different types can be used as follows:

Type	Usage
HMV01.1E	**infeeding** to supply HMS01 and HMD01 drive controllers

Fig.7-2: Usage of supply units

Design



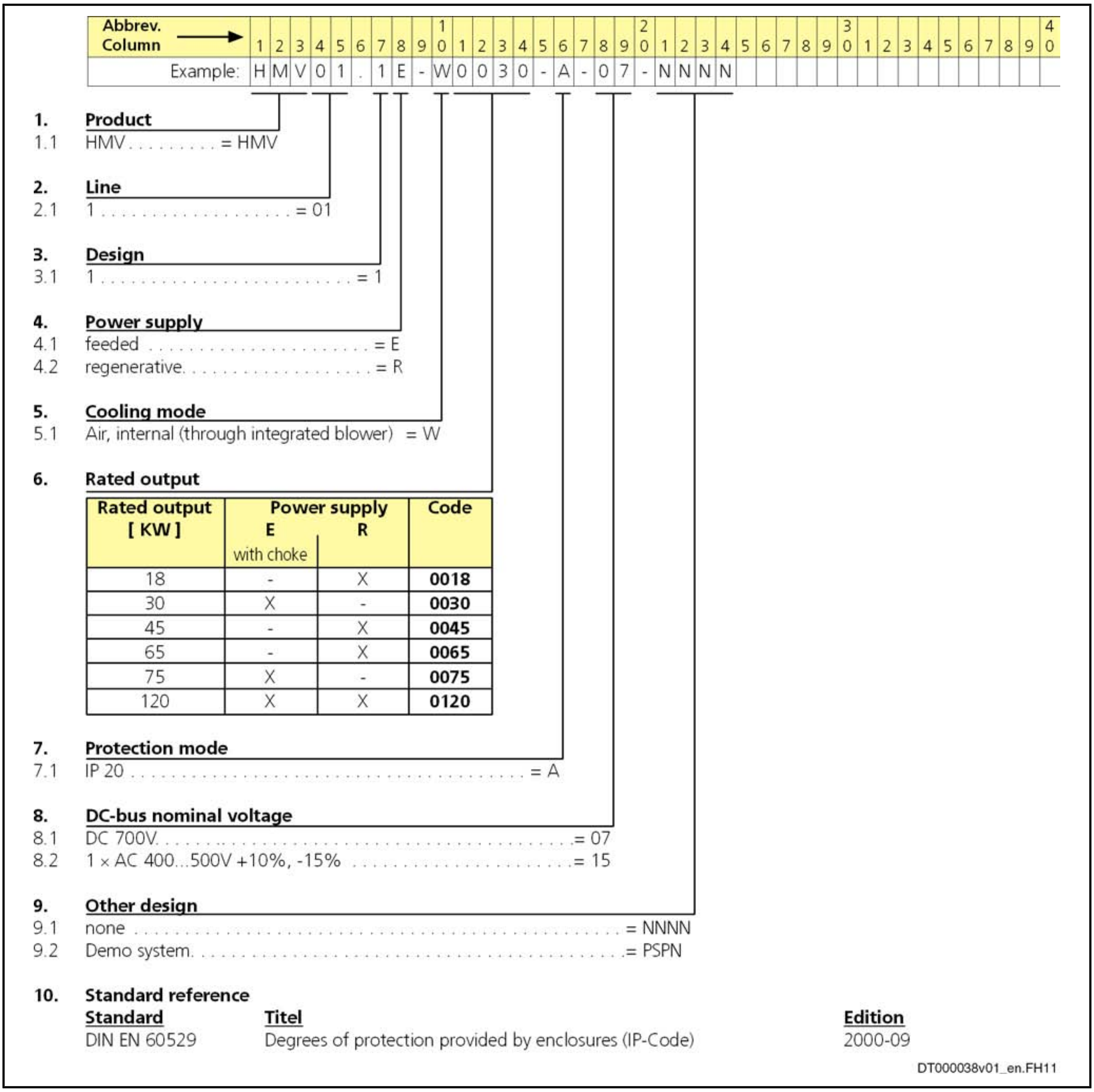
1	interfaces for signal processing
2	control panel
3	power connections incl. control voltage

Fig.7-3: Basic design

7.2.2 Type Code and Identification

Type Code

☞ The following figure illustrates the basic structure of the type code. Our sales representative will help you with the current status of available versions.



Abbrev. Column →	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1	2	3	4	5	6	7	8	9	40
Example:	H	M	V	0	1	.	1	E	-	W	0	0	3	0	-	A	-	0	7	-	N	N	N	N																

1. Product
1.1 HMV . . . . = HMV

2. Line
2.1 1 . . . . = 01

3. Design
3.1 1 . . . . = 1

4. Power supply
4.1 feeded . . . . = E
4.2 regenerative. . . . . = R

5. Cooling mode
5.1 Air, internal (through integrated blower) = W

6. Rated output

Rated output [KW]	Power supply E with choke	Power supply R	Code
18	-	X	**0018**
30	X	-	**0030**
45	-	X	**0045**
65	-	X	**0065**
75	X	-	**0075**
120	X	X	**0120**

7. Protection mode
7.1 IP 20 . . . . = A

8. DC-bus nominal voltage
8.1 DC 700V. . . . .= 07
8.2 1 × AC 400...500V +10%, -15% . . . .= 15

9. Other design
9.1 none . . . . = NNNN
9.2 Demo system. . . . .= PSPN

10. Standard reference

Standard	**Titel**	**Edition**
DIN EN 60529	Degrees of protection provided by enclosures (IP-Code)	2000-09

DT000038v01_en.FH11

Fig.7-4: Type Code

Identification

Type Plate Arrangement

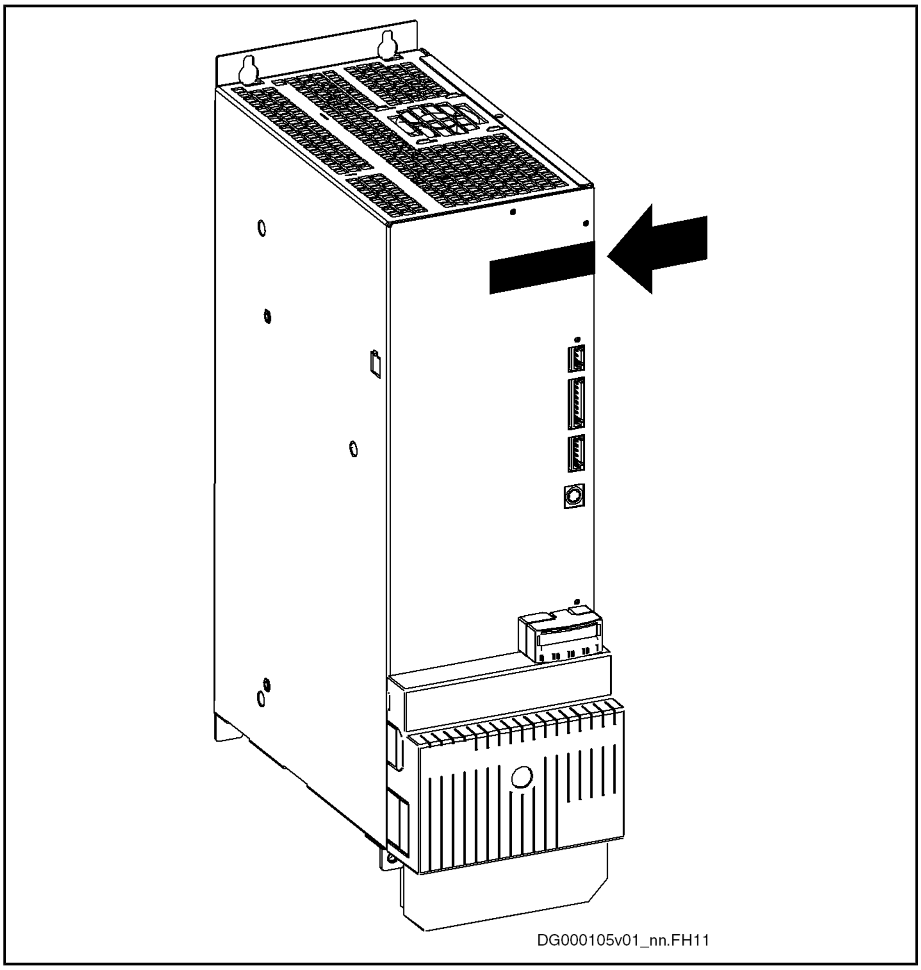
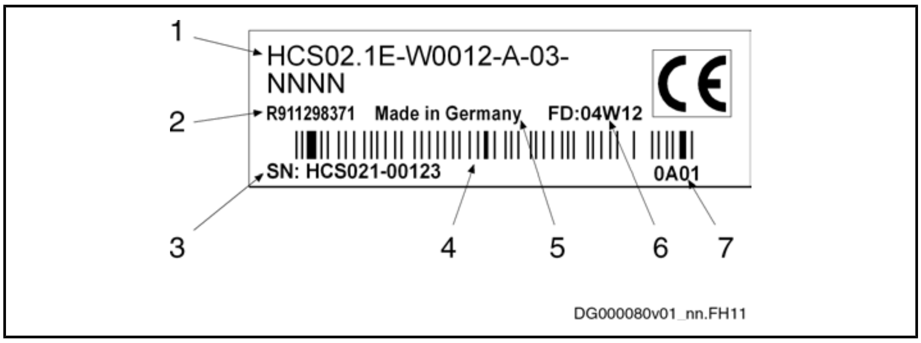


Fig.7-5: Type plate at device

Type Plate



1	device type
2	part number
3	serial number
4	bar code
5	country of manufacture
6	production week, 04W12 meaning year 2004, week 12
7	hardware index

Fig.7-6: Type plate - power section (example of an HCS02 power section)

7.2.3 Scope of Supply

The scope of supply includes:

- 1 × touch guard

- 1 × connector X31, X32 and X33 each
- 1 × joint bar to connect the equipment grounding conductor to a neighboring device
- 1 × standard control panel each
- 1 × brochure with safety instructions (in 5 languages)

7.2.4 Technical Data HMV01.1E

Ambient and Operating Conditions

General Information

Conditions for transport and storage: see chapter 4.2 Transport and Storage, page 19.

Installation conditions: see chapter 4.3 Installation Conditions , page 19.

This chapter contains:

- limit values for use in the scope of C-UL
- applied standards (CE conformity, UL listing)

UL Data

Ambient and operating conditions - UL ratings

Description	Symbol	Unit	HMV01.1E-W0030	HMV01.1E-W0075	HMV01.1E-W0120
Suitable for use on a circuit capable of delivering not more than this SCCR, symmetrical amperes (UL) 1)	I_{SCCR}	A rms	42000		
rated input voltage, power (UL)2)	U_{LN_nenn}	V	380...480		
rated input current (UL)3)	I_{L_cont}	A	51,0	128,0	204,0
maximum output voltage (UL)	U_{out}	V	435...710 dc		
maximum output current (UL)	I_{out_max}	A	69,0	173,0	276,0

1) 600 V AC or less, use listed AC input line fuses or listed circuit breakers
2) HMS, HMD, HLB, HLC, KCU: DC bus L+, L-; HMV, HCS: mains input L1, L2, L3
3) at PDC_cont

Fig. 7-7: HMV - Ambient and operating conditions - UL ratings

Information on Standards

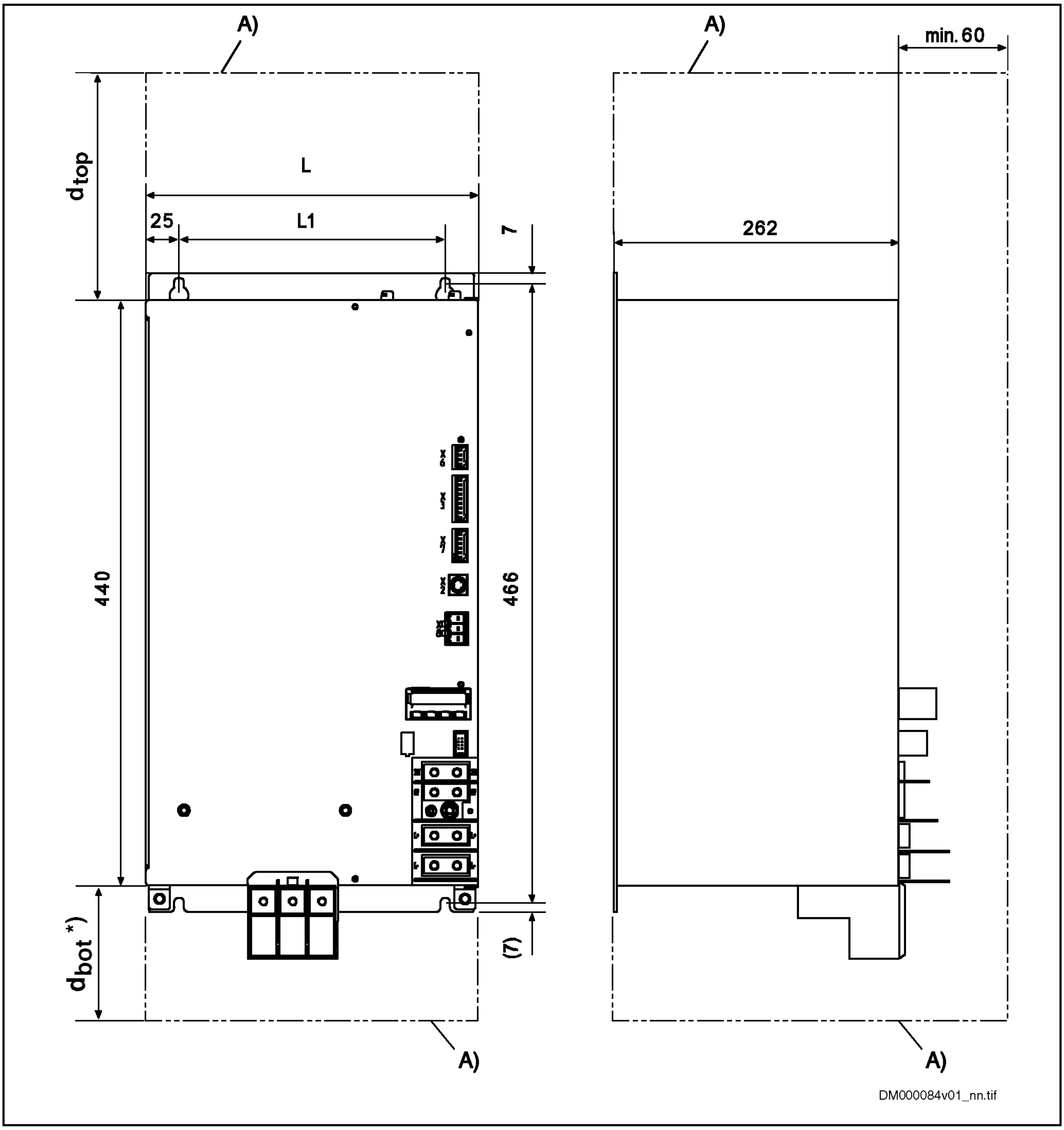
Applied standards

Description	Symbol	Unit	HMV01.1E-W0030	HMV01.1E-W0075	HMV01.1E-W0120
listing according to UL standard (UL)			UL 508 C		
UL files (UL)			E 134201		
listing according to CSA standard (UL)			Canadian National Standard(s) C22.2 No. 14-05		

Fig. 7-8: HMV - Applied standards

Mechanical System and Mounting

Dimensions



A)	minimum mounting clearance
*)	plus additional space for mains connection cable (the required space depends on the minimum bending radius of the connected mains connection cable)

Fig. 7-9: *Dimensions*

Device	L [mm]	L1 [mm]
HMV01.1E-W0030	150	100
HMV01.1E-W0075	250	200
HMV01.1E-W0120	350	300

Fig.7-10: Dimensions

Dimensions, Mass, Insulation, Sound Pressure Level

Data for mass, dimensions, sound pressure level, insulation

Description	Symbol	Unit	HMV01.1E-W0030	HMV01.1E-W0075	HMV01.1E-W0120
weight	m	kg	13,50	22,00	32,00
device height (UL)$^{1)}$	H	mm	440		
device depth (UL)$^{2)}$	T	mm	262		
device width (UL)$^{3)}$	B	mm	150	250	350
insulation resistance at DC 500 V	R_{is}	MOhm	tbd		
capacitance against housing	C_Y	nF	2 x 470		
average sound pressure level (accuracy class 2) at P_{DC_cont} $^{4)}$	L_P	dB (A)	tbd		

1) 2) 3) housing dimension; see also related dimensional drawing

4) according to DIN EN ISO 11205; comparative value at distance 1 m, out of cabinet; HCS types with order code -L***: load-dependent

Fig.7-11: HMV - Data for mass, dimensions, sound pressure level, insulation

Power Dissipation, Mounting Position, Cooling, Distances

Data for cooling and power dissipation

Description	Symbol	Unit	HMV01.1E-W0030	HMV01.1E-W0075	HMV01.1E-W0120
ambient temperature range during operation with nominal data	T_{a_work}	°C	0...+40		
ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	0...55		
derating of P_{DC_cont}; P_{BD}; I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2,0		
allowed mounting position			G1		
cooling type			forced ventilation		
volumetric capacity of forced cooling	V				
power dissipation at continuous current and continuous DC bus power respectively (UL)$^{1)}$	P_{Diss_cont}	W	150,00	340,00	500,00
minimum distance on the top of the device$^{2)}$	d_{top}	mm	300		

Description	Symbol	Unit	HMV01.1E-W0030	HMV01.1E-W0075	HMV01.1E-W0120
minimum distance on the bottom of the device[3)]	d_{bot}	mm	130		
temperature rise with minimum distances d_{bot}; d_{top}; P_{BD}	ΔT	K	65		

1) HMV, HCS: plus dissipation of braking resistor, control section; KSM: plus rated power consumption control voltage input

2) 3) see fig. "Air intake and air outlet at drive controller"

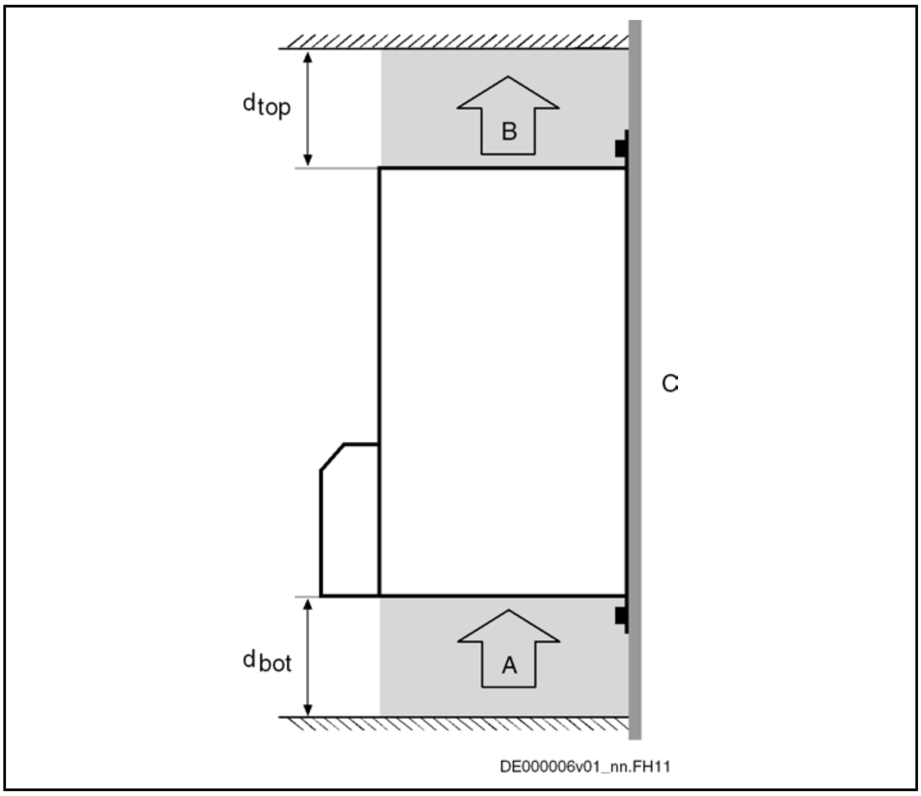
Fig.7-12: HMV - Data for cooling and power dissipation

Distances

CAUTION

Property damage due to temperatures higher than 105 °C!

Comply with indicated minimum distances!



A	air intake
B	air outlet
C	mounting surface in control cabinet
d_{top}	distance top
d_{bot}	distance bottom

Fig.7-13: Air intake and air outlet at drive controller

Basic Data Supply Unit HMV01, Infeeding

General Information

This chapter contains:

- data for control voltage supply
- data for mains voltage supply

- data of DC bus
- data of built-in braking resistor and requirements on an external braking resistor
- data for cooling and power dissipation

☞ The order of the data tables below follows the energy flow in the supply unit - from mains connection to DC bus output.

Control Voltage

Data for control voltage supply

Description	Symbol	Unit	HMV01.1E-W0030	HMV01.1E-W0075	HMV01.1E-W0120
rated control voltage input (UL)1)	U_{N3}	V	24 ± 5 %		
control voltage when using motor holding brake with motor cable length < 50 m2)	U_{N3}	V	24 ± 5 %		
control voltage when using motor holding brake with motor cable length > 50 m3)	U_{N3}	V	26 ± 5 %		
maximum allowed voltage for 1 m	U_{N3_max}	V	28,80		
maximum inrush current at 24V supply	I_{EIN3_max}	A	5,00	5,50	10,00
pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	15		50
input capacitance	C_{N3}	mF	tbd		
rated power consumption control voltage input at U_{N3} (UL)4)	P_{N3}	W	25	30	55

1) 2) 3) observe supply voltage for motor holding brakes

4) HMS, HMD, HCS: plus holding brake and control section; KCU01: at max. number of axes; KSM01: plus holding brake (UN x IN)

Fig.7-14: HMV - Data for control voltage supply

Mains Voltage

Data for mains voltage supply

Description	Symbol	Unit	HMV01.1E-W0030	HMV01.1E-W0075	HMV01.1E-W0120
input frequency (UL)	f_{LN}	Hz	50...60		
tolerance input frequency (UL)		Hz	± 2		
maximum allowed mains frequency change	$\Delta f_{LN}/\Delta t$	Hz/s	1		
rotary field condition			none		
Suitable for use on a circuit capable of delivering not more than this SCCR, symmetrical amperes (UL) 1)	I_{SCCR}	A rms	42000		
nominal mains voltage	U_{LN_nenn}	V	3 AC 400		
mains voltage single-phase	U_{LN}	V	--		

IndraDrive M Supply Units

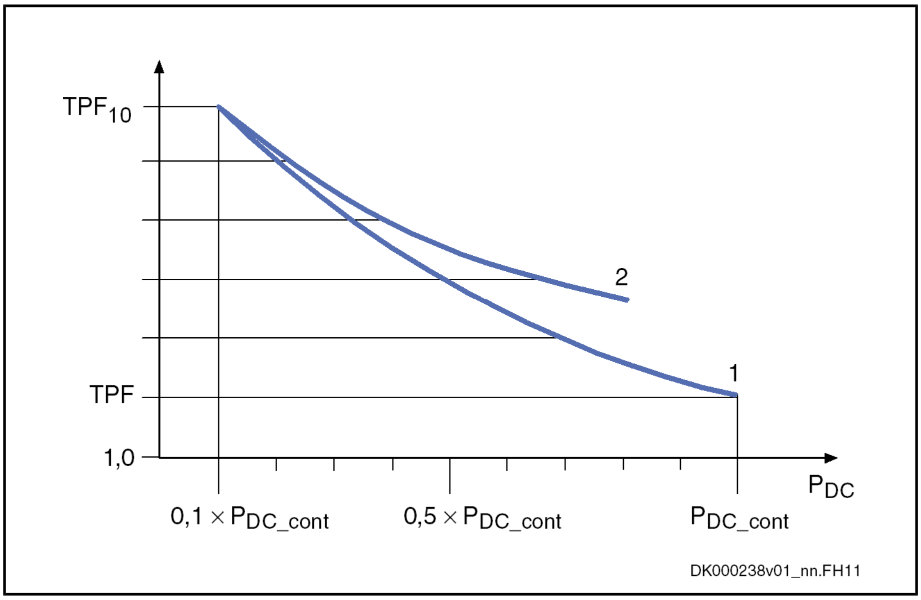
Description	Symbol	Unit	HMV01.1E-W0030	HMV01.1E-W0075	HMV01.1E-W0120
mains voltage three-phase at TN S, TN C, TT mains	U_{LN}	V	380...480		
mains voltage three-phase at IT mains2)	U_{LN}	V	200...230		
mains voltage three-phase at Corner-grounded-Delta mains3)	U_{LN}	V	200...230		
tolerance U_{LN} (UL)		%	±10		
minimum inductance of the mains supply (inductance of mains phase)4)	L_{min}	µH	40		
assigned type of mains choke			HNL01.1E-0400-N0051-A-480	HNL01.1E-0200-N0125-A-480	HNL01.1E-0100-N0202-A-480
minimum short circuit power of the mains for failure-free operation5)	S_{k_min}	MVA	1,6	3,4	5,4
maximum inrush current6)	$I_{L\_trans\_max\_on}$	A	I L_cont		
maximum allowed ON-OFF cycles per minute7)			1		
power factor TPF (λ_L) at P_{DC_cont} with mains choke; U_{LN_nenn}	TPF		0,88		
power factor TPF (λ_L) at P_{DC_cont} without mains choke; U_{LN_nenn} 8)	TPF		0,64		
power factor TPF (λ_L) at 10% P_{DC_cont} without mains choke; U_{LN_nenn} 9)	TPF_{10}		0,40		
power factor TPF (λ_L) at P_{DC_cont} (single-phase); U_{LN} = 1 AC 230 V	TPF		-		
power factor of fundam. component DPF at P_{DC_cont} with mains choke	$\cos\varphi^{h1}$		0,97		
power factor of fundam. component DPF at P_{DC_cont} without mains choke	$\cos\varphi^{h1}$		0,97		
mains connection power at P_{DC_cont}; U_{LN_nenn} with mains choke	S_{LN}	kVA	35,00	86,00	tbd
mains connection power at P_{DC_cont}; U_{LN_nenn} without mains choke	S_{LN}	kVA	31,00	68,00	108,00
rated input current (UL)10)	I_{L_cont}	A	51,0	128,0	204,0
nominal current AC1 for mains contactor at nom. data with mains choke; U_{LN_nenn}			mains contactor integrated		

Description	Symbol	Unit	HMV01.1E-W0030	HMV01.1E-W0075	HMV01.1E-W0120
mains fuse according to IEC 60364-5-52; at nom. data with mains choke; U_{LN_nenn}		A	63	160	250
required wire size according to IEC 60364-5-52; at I_{L_cont} 11)	A_{LN}	mm^2	10	50	95
required wire size according to UL 508 A (internal wiring); at I_{L_cont} (UL)12)	A_{LN}	AWG	AWG 6	AWG 1	AWG 4/0

1) 600 V AC or less, use listed AC input line fuses or listed circuit breakers
2) 3) mains voltage > ULN: use a transformer with grounded neutral point, don't use autotransformers!
4) otherwise use mains choke HNL
5) HMV0x.xR: Rsc=100; HMV0x.xE, HCS0x.xE: Rsc=50
6) depending on mains input voltage ULN; HMV01.1R see following note; HMV: constant current charge, HCS: resistance charge; minimum of 250.000 load cycles
7) without external capacities on DC bus
8) 9) find interim values by interpolation
10) at PDC_cont
11) copper wire; PVC-insulation (conductor temperature 70 °C); installation method B2; Table B52-4; Ta ≤ 40 °C
12) copper wire; PVC-insulation (conductor temperature 90 °C); Table 13.5.1; Ta ≤ 40 °C

Fig.7-15: HMV - Data for mains voltage supply

Qualitative characteristic TPF vs. DC bus power PDC_cont



1 with mains choke
2 without mains choke

Fig.7-16: Qualitative characteristic TPF vs. DC bus power PDC_cont

Supply Unit - DC Bus

Data of supply unit - DC bus

Description	Symbol	Unit	HMV01.1E-W0030	HMV01.1E-W0075	HMV01.1E-W0120
DC bus voltage	U_{DC}	V	ULN x 1,41		
capacitance in DC bus	C_{DC}	mF	1,41	3,76	5,64
DC resistance in DC bus (L+ to L-) at U_{DC} = 750 V	R_{DC}	kOhm	approx. 27	approx. 14	approx. 10
rated power (t > 10 min) at f_s = 4 kHz; U_{LN_nenn}; control factor a_0 > 0,8; with mains choke	P_{DC_cont}	kW	30,00	75,00	120,00
rated power (t > 10 min) at f_s = 4 kHz; U_{LN_nenn}; control factor a_0 > 0,8; without mains choke	P_{DC_cont}	kW	18,00	45,00	72,00
P_{DC_cont} and P_{DC_max} vs. mains input voltage; $U_{LN} \leq U_{LN\_nenn}$		%/V	PDC_cont (ULN) = PDC_cont x [1 - (400-ULN) x 0,0025]		
P_{DC_cont} and P_{DC_max} vs. mains input voltage; $U_{LN} > U_{LN\_nenn}$		%/V	PDC_cont (ULN) = PDC_cont x [1 + (ULN-400) x 0,002]		
maximum allowed DC bus power at U_{LN_nenn}; with mains choke	P_{DC_max}	kW	45,00	112,50	180,00
maximum allowed DC bus power at U_{LN_nenn}; without mains choke	P_{DC_max}	kW	45,00	112,50	180,00
balancing factor for P_{DC_cont} (for parallel operation at common DC bus) with mains choke			0,80		
balancing factor for P_{DC_cont} (for parallel operation at common DC bus) without mains choke			not allowed		
monitoring value maximum DC bus voltage, switch-off threshold	$U_{DC\_limit\_max}$	V	900, see also Troubleshooting Guide for E8025, F2817		
monitoring value minimum DC bus voltage, undervoltage threshold	$U_{DC\_limit\_min}$	V	1,06 x ULN; see also Troubleshooting Guide for E2026, F2026		
charging resistor continuous power	P_{DC_Start}	kW	charging via current source		
maximum allowed external DC bus capacitance$^{1)}$	C_{DCext}	mF	150,00		
charging time at maximum allowed C_{DCext} external DC bus capacitance at U_{LN_nenn}	$t_{lade\_DC\_Cext}$				

1) use assigned type of mains choke

Fig.7-17: HMV - Data of supply unit - DC bus

Integrated Braking Resistor

Data of built-in braking resistor

Description	Symbol	Unit	HMV01.1E-W0030	HMV01.1E-W0075	HMV01.1E-W0120
braking resistor continuous power	P_{BD}	kW	1,50	2,00	2,50
braking resistor peak power at U_{DC} = 850 V	P_{BS}	kW	36,00	90,00	130,00
nominal braking resistance	$R_{DC\_Bleeder}$	ohm	14	6	4
braking resistor switch-on threshold - mains voltage independent$^{1)}$	$U_{R\_DC\_On\_f}$	V	820; see also X32		
braking resistor switch-on threshold - mains voltage dependent$^{2)}$	$U_{R\_DC\_On\_v}$		ULN * 1,41 + 80V; see also X32		
maximum allowed duty cycle at T_{cycl}	ED_{rel}	s	tbd		
minimum allowed cycle time	T_{cycl}	s	tbd		
maximum regenerative power to be absorbed	W_{R_max}	kWs	100,00	250,00	500,00
balancing factor for P_{BD} (for parallel operation at common DC bus)	f		tbd		
cooling of internal braking resistor			forced ventilation		

1) 2) factory setting

Fig.7-18: *HMV - Data of built-in braking resistor*

Exemplary Data for Applications

General Information

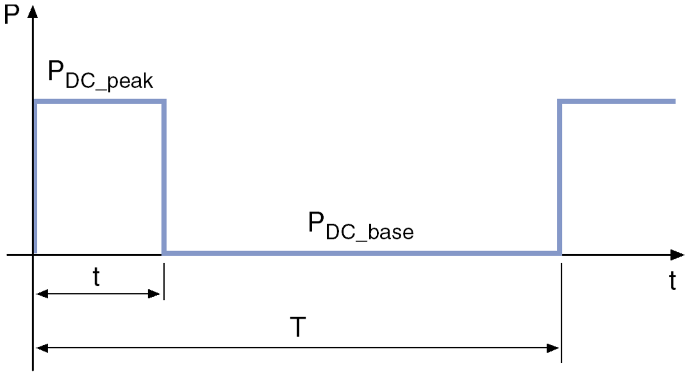
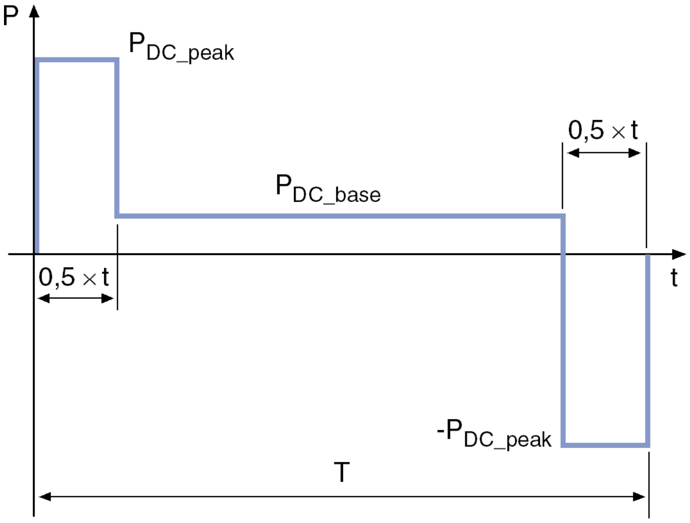
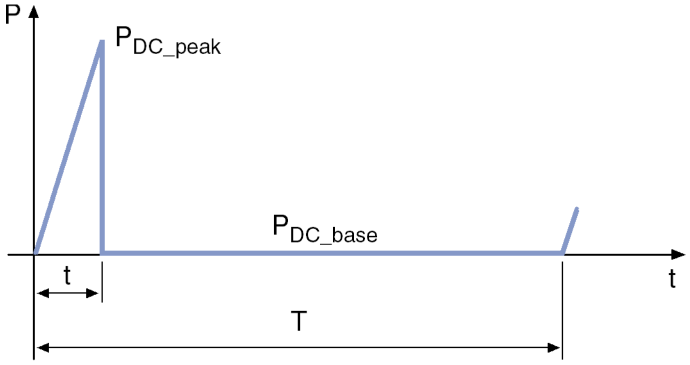
This chapter contains:

- examples of allowed performance profiles

Performance Profiles

Performance Profiles of Infeeding Supply Units

The following performance profiles have been defined for infeeding supply units.

Profile	Explanation
performance profile “WZM_HS_KB_e”  DK000155v01_nn.fh11	The characteristic data of the profile are used to select infeeding and regenerative supply units. Characteristic of applications in machine tools, short-time operation of the main spindle.
performance profile “WZM_HS_Fr_e”  DK000150v01_nn.fh11	The characteristic data of the profile are used to select infeeding supply units. Characteristic of main spindles in milling machines.
performance profile “WZM_SA_acc_e”  DK000154v01_nn.fh11	The characteristic data of the profile are used to select infeeding supply units. Characteristic of servo drives at machine tools.

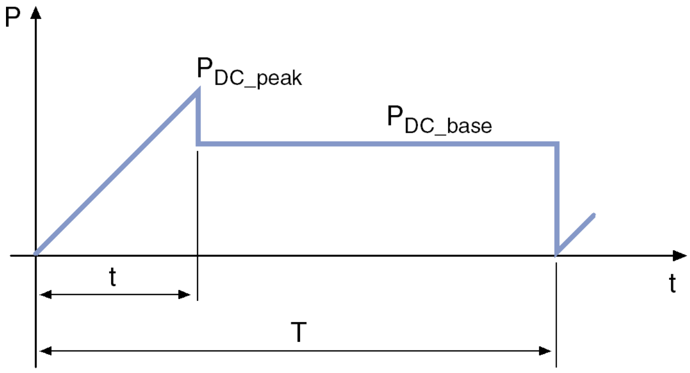
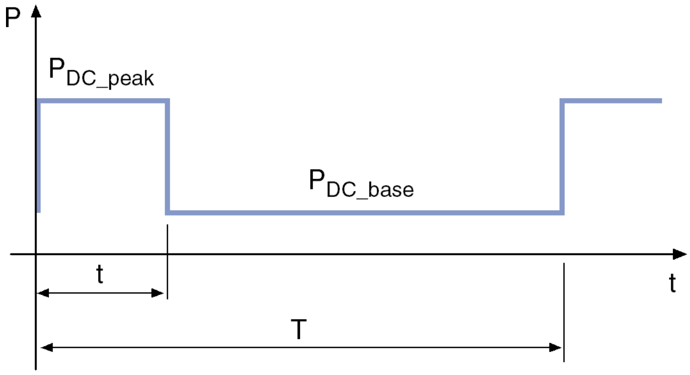
Profile	Explanation
performance profile “DRM_S1_acc_e”  DK000152v01_nn.fh11	The characteristic data of the profile are used to select infeeding and regenerative supply units. Characteristic of starting and operation at printing machines.
performance profile “UEL_P_e”  DK000135v01_nn.fh11	The characteristic data of the profile are used to select infeeding and regenerative supply units. Characteristic of applications using standard motors in overload operation.

Fig. 7-19: Definitions of performance profiles, infeeding supply units

Examples of allowed performance profiles, supply units HMV....E

Description	Symbol	Unit	HMV01.1E-W0030	HMV01.1E-W0075	HMV01.1E-W0120
DC bus power at U_{LN_nenn}; t = 132 s; T = 300 s; without mains choke[1]	$P_{DC\_base\_10}$	kW	0,0		
maximum DC bus power at U_{LN_nenn}; t = 132 s; T = 300 s; without mains choke[2]	$P_{DC\_peak\_10}$	kW	24,30	60,70	97,20
DC bus power at U_{LN_nenn}; t = 132 s; T = 300 s; with mains choke[3]	$P_{DC\_base\_10}$	kW	0,0		
maximum DC bus power at U_{LN_nenn}; t = 132 s; T = 300 s; with mains choke[4]	$P_{DC\_peak\_10}$	kW	40,50	97,50	162,00
DC bus power at U_{LN_nenn}; t = 3 s; t = 60 s; without mains choke[5]	$P_{DC\_base\_11}$	kW	9,00	22,50	36,00
maximum DC bus power at U_{LN_nenn}; t = 3 s; t = 60 s; without mains choke[6]	$P_{DC\_peak\_11}$	kW	39,60	94,50	180,00

Description	Symbol	Unit	HMV01.1E-W0030	HMV01.1E-W0075	HMV01.1E-W0120
DC bus power at U_{LN_nenn}; t = 3 s; t = 60 s; with mains choke7)	$P_{DC\_base\_11}$	kW	16,50	41,20	66,00
maximum DC bus power at U_{LN_nenn}; t = 3 s; t = 60 s; with mains choke8)	$P_{DC\_peak\_11}$	kW	45,00	112,50	180,00
DC bus power at U_{LN_nenn}; t = 0.2 s; T = 4 s; without mains choke9)	$P_{DC\_base\_12}$	kW	0,0		
maximum DC bus power at U_{LN_nenn}; t = 0.2 s; T = 4 s; without mains choke10)	$P_{DC\_peak\_12}$	kW	45,00	112,50	180,00
DC bus power at U_{LN_nenn}; t = 0.2 s; T = 4 s; with mains choke11)	$P_{DC\_base\_12}$	kW	0,0		
maximum DC bus power at U_{LN_nenn}; t = 0.2 s; T = 4 s; with mains choke12)	$P_{DC\_peak\_12}$	kW	45,00	112,50	180,00
DC bus power at U_{LN_nenn}; t = 60 s; T = 900 s; without mains choke13)	$P_{DC\_base\_13}$	kW	16,20	40,50	64,80
maximum DC bus power at U_{LN_nenn}; t = 60 s; T = 900 s; without mains choke14)	$P_{DC\_peak\_13}$	kW	36,00	72,00	180,00
DC bus power at U_{LN_nenn}; t = 60 s; T = 900 s; with mains choke15)	$P_{DC\_base\_13}$	kW	27,00	67,50	108,00
maximum DC bus power at U_{LN_nenn}; t = 60 s; T = 900 s; with mains choke16)	$P_{DC\_peak\_13}$	kW	45,00	101,20	180,00

1) 2) 3) 4) see definition profile WZM_HS_KB_e
5) 6) 7) 8) see definition profile WZM_HS_Fr_e
9) 10) 11) 12) see definition profile WZM_SA_acc_e
13) 14) 15) 16) see definition profile DRM_S1_acc_e

Fig.7-20: HMV....E - Examples of allowed performance profiles

7.2.5 Connections and Interfaces

Overview

Overall Connection Diagram

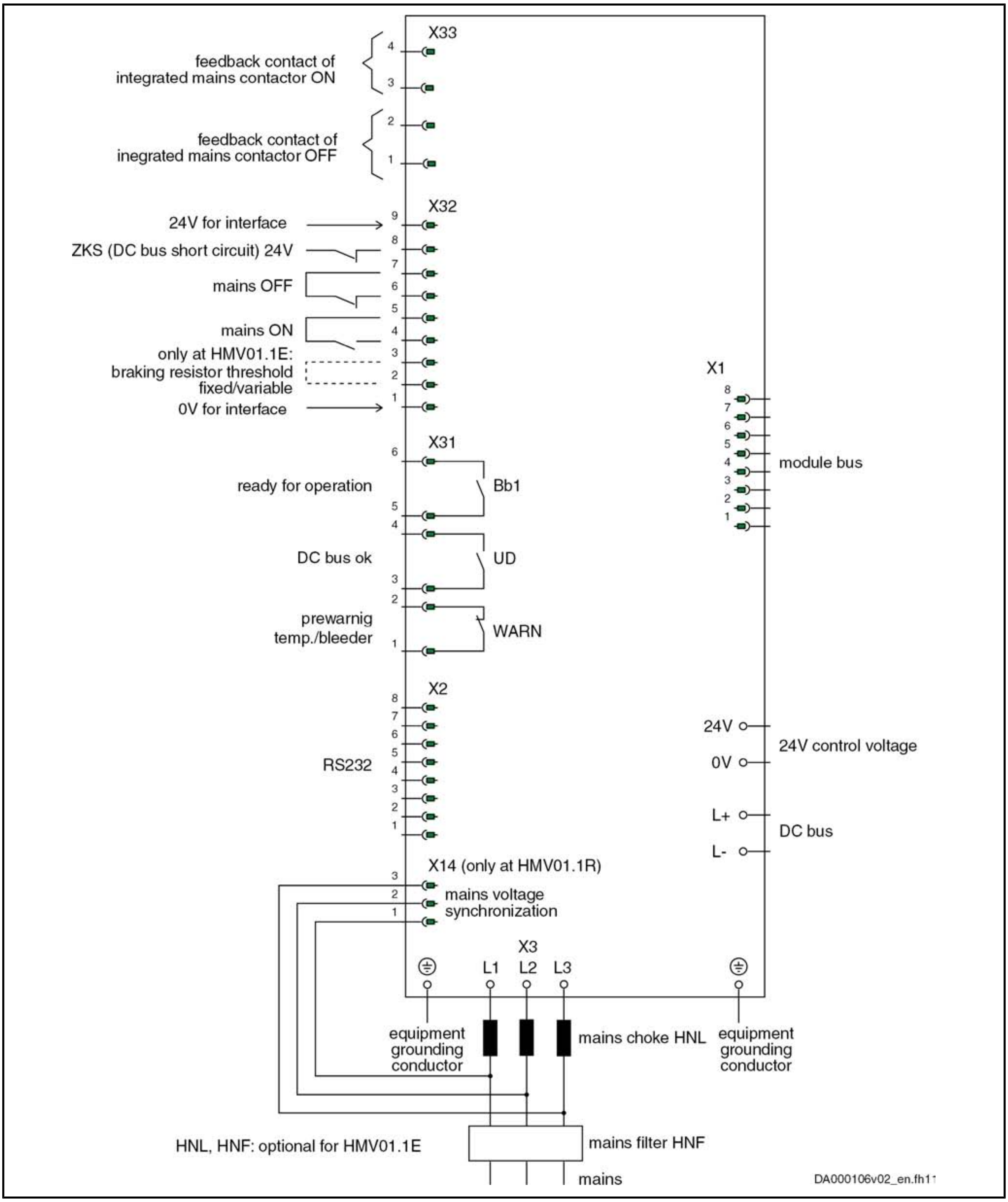
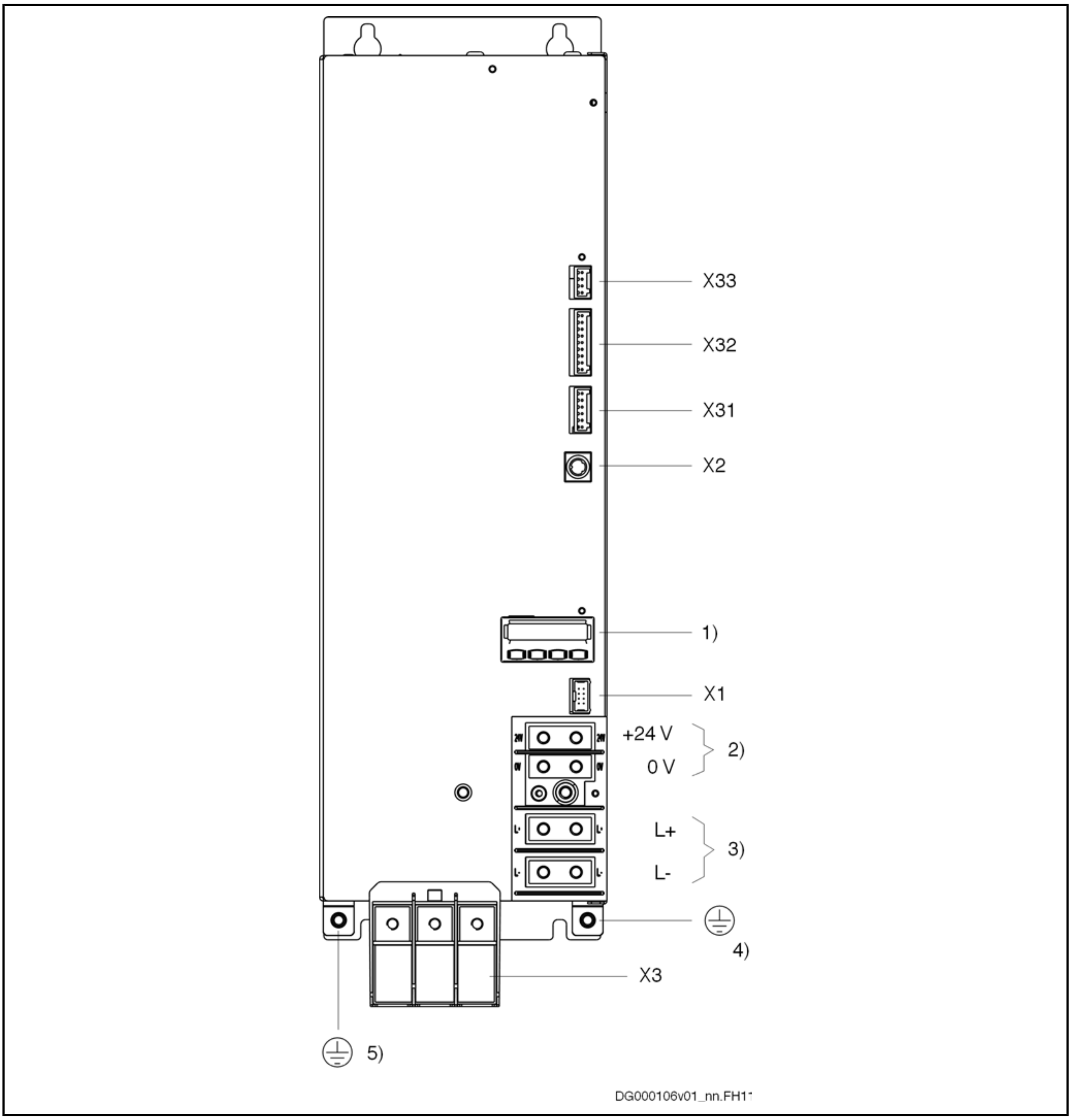


Fig.7-21: Connection diagram HMV01.1R-W018; -W0043; -W0065

Arrangement of the Connection Points

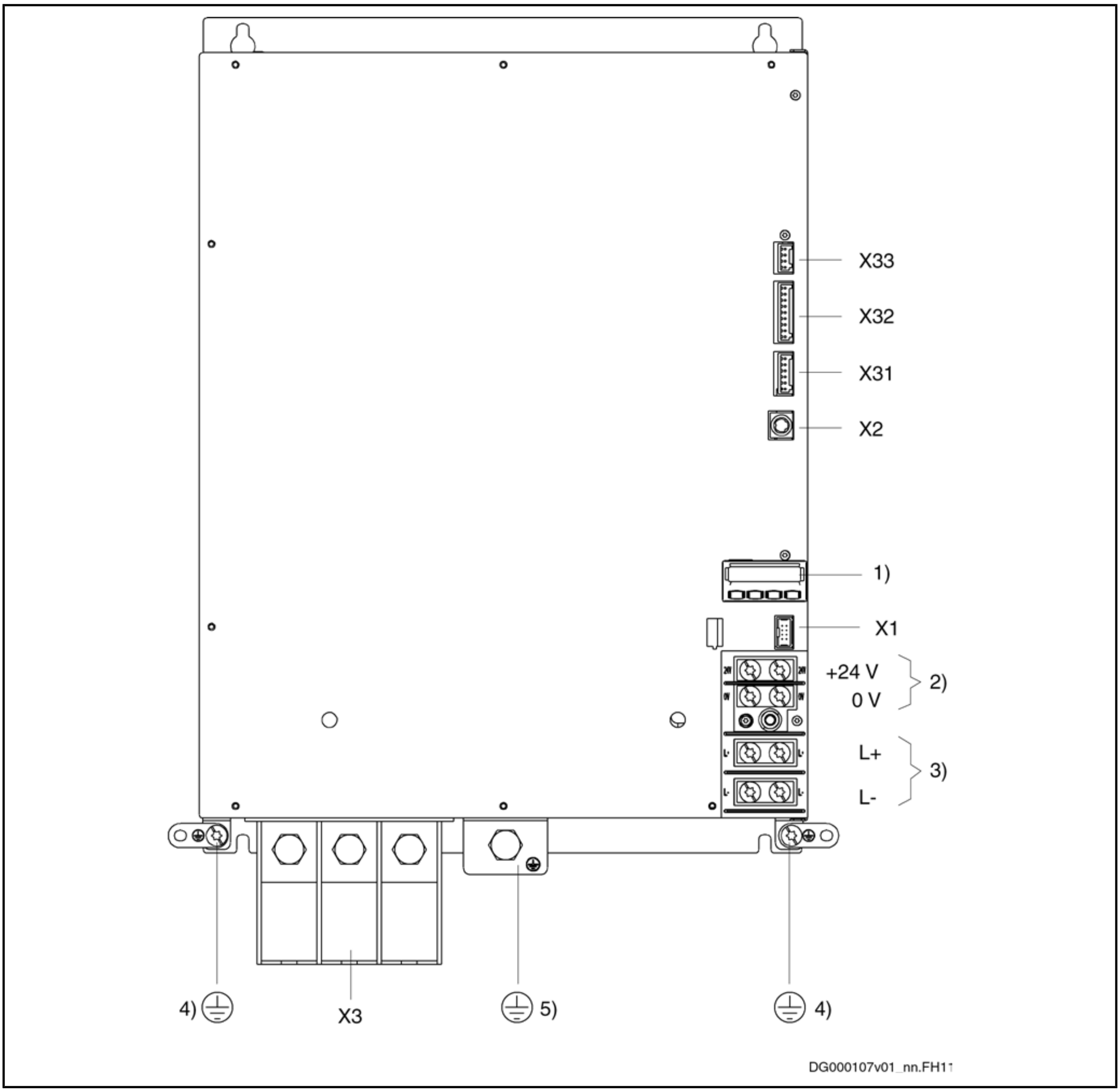
Connections HMV01.1E-W0030 and HMV01.1E-W0075



X33	acknowledge messages of mains contactor
X32	mains contactor control and DC bus short circuit (ZKS)
X31	connection for messages
X2	RS232
X1	module bus
X3	mains connection
	connection of equipment grounding conductor
1)	control panel
2)	control voltage
3)	DC bus
4)	connection point of equipment grounding conductor (with joint bar to neighboring device)
5)	connection point of equipment grounding conductor (mains)

Fig.7-22: Connections HMV01.1E-W0030 and HMV01.1E-W0075

Connections HMV01.1E-W0120



X33	acknowledge messages of mains contactor
X32	mains contactor control and DC bus short circuit (ZKS)
X31	connection for messages
X2	RS232
X1	module bus
X3	mains connection
1)	control panel
2)	control voltage
3)	DC bus
4)	connection point of equipment grounding conductor (with joint bar to neighboring device)
5)	connection point of equipment grounding conductor (mains)

Fig.7-23: Connections HMV01.1E-W0120

Description of the Connection Points

The connection points are described in detail in chapter 8 Functions and Electrical Connection Points , page 241.

Touch Guard The touch guard is described in detail in chapter 9 Touch Guard at Devices , page 291.

7.3 HMV01.1R Supply Units, Regenerative

7.3.1 Brief Description, Usage and Structure

Brief Description HMV01 supply units

- supply modular HMS and HMD devices
- have an integrated mains contactor (exception: HMV01.1R-W0120)

☞ Observe the **functional differences** between the connection points **X33** and **X40**, depending on the supply unit!

- Supply units **with** integrated mains contactor:

  X33 provides message signals on the status of the integrated mains contactor
- Supply units **without** integrated mains contactor:

  X40 receives message signals on the status of the external mains contactor

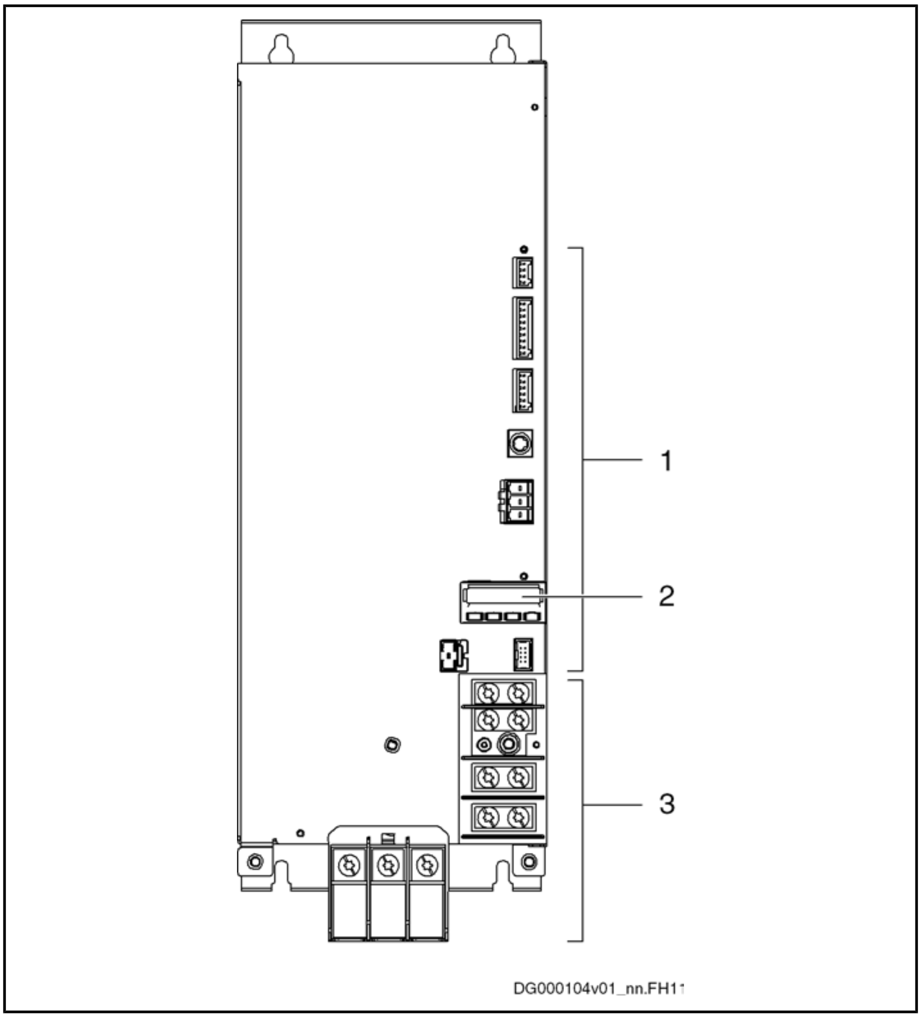
---

Usage

Type	Usage
HMV01.1R	**regenerative** to supply HMS01 and HMD01 drive controllers

Fig.7-24: Usage of supply units

Design



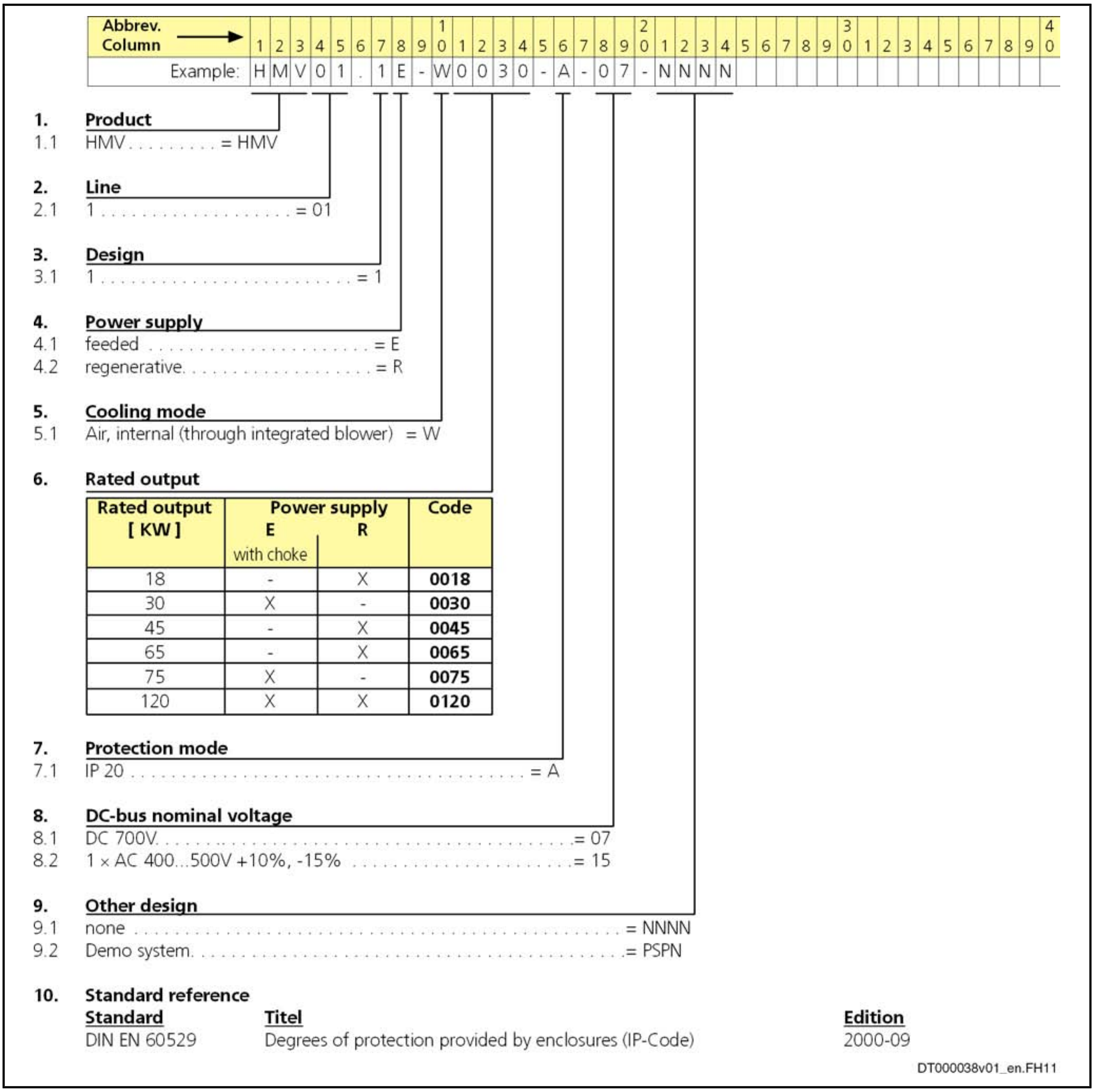
1	interfaces for signal processing
2	control panel
3	power connections incl. control voltage

Fig.7-25: Basic design

7.3.2 Type Code and Identification

☞ The following figure illustrates the basic structure of the type code. Our sales representative will help you with the current status of available versions.

IndraDrive M Supply Units



Abbrev. Column →	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1	2	3	4	5	6	7	8	9	40
Example:	H	M	V	0	1	.	1	E	-	W	0	0	3	0	-	A	-	0	7	-	N	N	N	N																

1. Product
1.1 HMV . . . . = HMV

2. Line
2.1 1 . . . . = 01

3. Design
3.1 1 . . . . = 1

4. Power supply
4.1 feeded . . . . = E
4.2 regenerative. . . . . = R

5. Cooling mode
5.1 Air, internal (through integrated blower) = W

6. Rated output

Rated output [KW]	Power supply E with choke	R	Code
18	-	X	**0018**
30	X	-	**0030**
45	-	X	**0045**
65	-	X	**0065**
75	X	-	**0075**
120	X	X	**0120**

7. Protection mode
7.1 IP 20 . . . . = A

8. DC-bus nominal voltage
8.1 DC 700V. . . . .= 07
8.2 1 × AC 400...500V +10%, -15% . . . .= 15

9. Other design
9.1 none . . . . = NNNN
9.2 Demo system. . . . .= PSPN

10. Standard reference

Standard	**Titel**	**Edition**
DIN EN 60529	Degrees of protection provided by enclosures (IP-Code)	2000-09

DT000038v01_en.FH11

Fig.7-26: Type code

Identification

Type Plate Arrangement

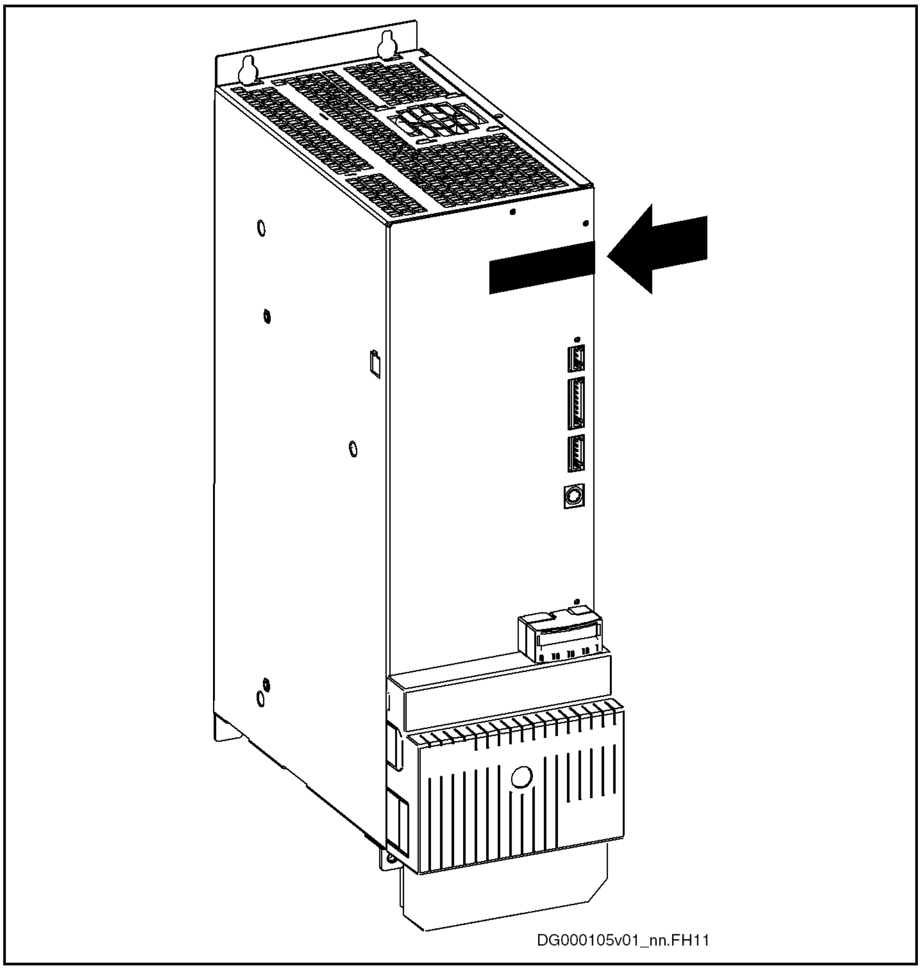
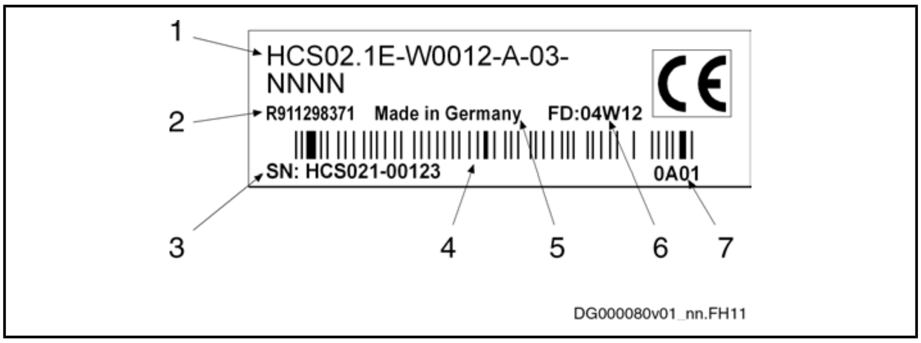


Fig. 7-27: Type plate at device

Type Plate



1	device type
2	part number
3	serial number
4	bar code
5	country of manufacture
6	production week, 04W12 meaning year 2004, week 12
7	hardware index

Fig. 7-28: Type plate - power section (example of an HCS02 power section)

7.3.3 Scope of Supply

- 1 × touch guard
- 1 × connector X14, X31, X32 and X33 each

- 1 × joint bar to connect the equipment grounding conductor to a neighboring device
- 1 × standard control panel each
- 1 × brochure with safety instructions (in 5 languages)

7.3.4 Technical Data HMV01.1R

Ambient and Operating Conditions

General Information

Conditions for transport and storage: see chapter 4.2 Transport and Storage, page 19.

Installation conditions: see chapter 4.3 Installation Conditions , page 19.

This chapter contains:

- limit values for use in the scope of C-UL
- applied standards (CE conformity, UL listing)

UL Data

Ambient and operating conditions - UL ratings

Description	Symbol	Unit	HMV01.1R-W0018	HMV01.1R-W0045	HMV01.1R-W0065	HMV01.1R-W0120
Suitable for use on a circuit capable of delivering not more than this SCCR, symmetrical amperes (UL) 1)	I_{SCCR}	A rms	42000			
rated input voltage, power (UL)2)	U_{LN_nenn}	V	380...480			
rated input current (UL)3)	I_{L_cont}	A	26,0	65,0	94,0	181,0
maximum output voltage (UL)	U_{out}	V	750 dc			
maximum output current (UL)	I_{out_max}	A	24,0	60,0	87,0	160,0

1) 600 V AC or less, use listed AC input line fuses or listed circuit breakers
2) HMS, HMD, HLB, HLC, KCU: DC bus L+, L-; HMV, HCS: mains input L1, L2, L3
3) at PDC_cont

Fig.7-29: HMV - Ambient and operating conditions - UL ratings

Information on Standards

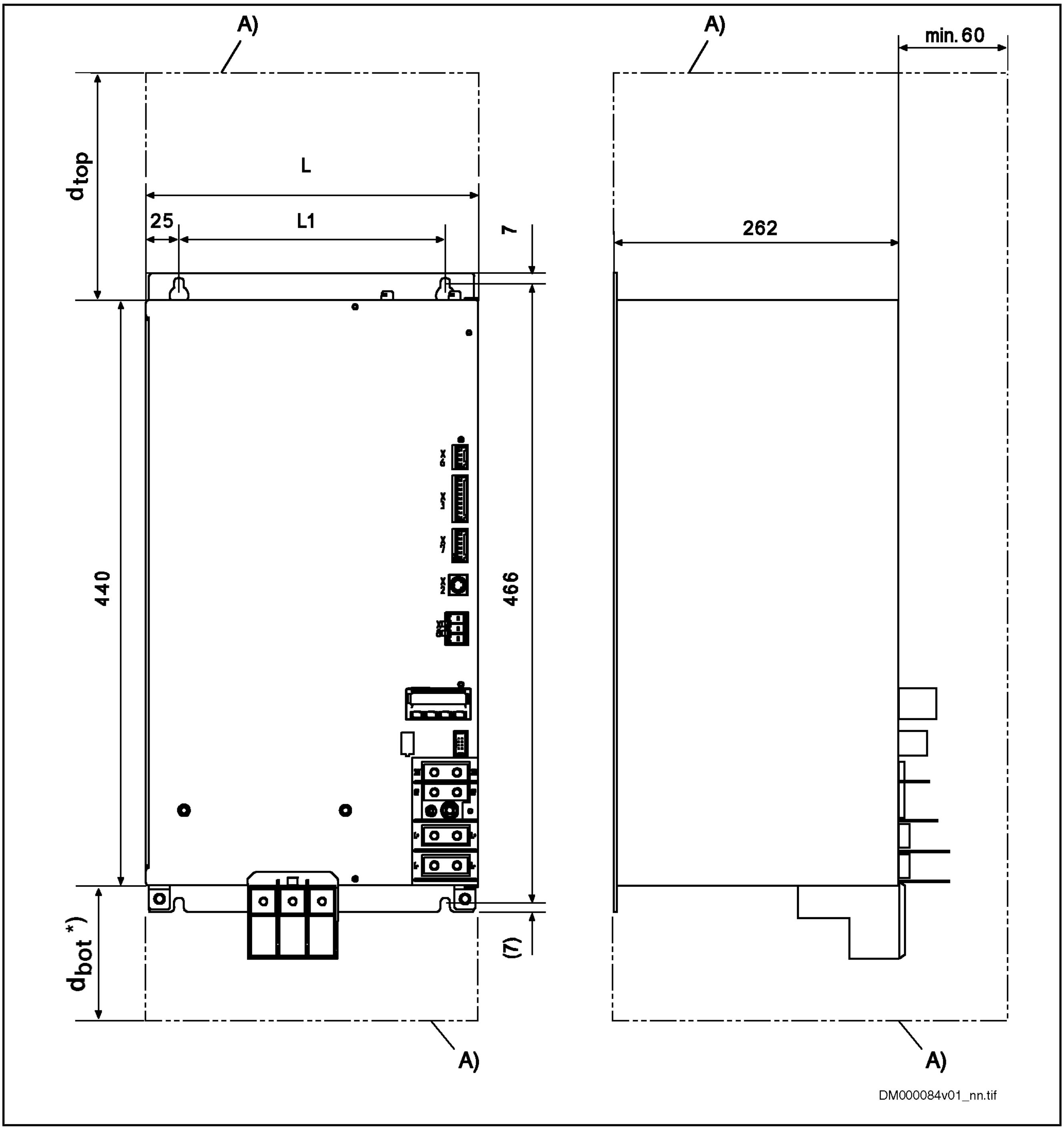
Applied standards

Description	Symbol	Unit	HMV01.1R-W0018	HMV01.1R-W0045	HMV01.1R-W0065	HMV01.1R-W0120
listing according to UL standard (UL)			UL 508 C			
UL files (UL)			E 134201			
listing according to CSA standard (UL)			Canadian National Standard(s) C22.2 No. 14-05			

Fig.7-30: HMV - Applied standards

Mechanical System and Mounting

Dimensions



A)	minimum mounting clearance
d_{top}, d_{bot}	see chapter "Power Dissipation, Cooling, Distances"
*)	plus additional space for mains connection cable (the required space depends on the minimum bending radius of the connected mains connection cable)

Fig. 7-31: Dimensions

Device	L [mm]	L1 [mm]
HMV01.1R-W0018	175	125
HMV01.1R-W0045	250	200
HMV01.1R-W0065	350	300
HMV01.1R-W0120	350	300

Fig.7-32: Dimensions

Dimensions, Mass, Insulation, Sound Pressure Level

Data for mass, dimensions, sound pressure level, insulation

Description	Symbol	Unit	HMV01.1R-W0018	HMV01.1R-W0045	HMV01.1R-W0065	HMV01.1R-W0120
weight	m	kg	13,50	20,00	31,00	34,50
device height (UL)$^{1)}$	H	mm	440			
device depth (UL)$^{2)}$	T	mm	262			
device width (UL)$^{3)}$	B	mm	175	250	350	
insulation resistance at DC 500 V	R_{is}	MOhm	tbd			
capacitance against housing	C_Y	nF	tbd			
average sound pressure level (accuracy class 2) at P_{DC_cont} $^{4)}$	L_P	dB (A)	tbd			80

1) 2) 3) housing dimension; see also related dimensional drawing

4) according to DIN EN ISO 11205; comparative value at distance 1 m, out of cabinet; HCS types with order code -L***: load-dependent

Fig.7-33: HMV - Data for mass, dimensions, sound pressure level, insulation

Power Dissipation, Mounting Position, Cooling, Distances

Data for cooling and power dissipation

Description	Symbol	Unit	HMV01.1R-W0018	HMV01.1R-W0045	HMV01.1R-W0065	HMV01.1R-W0120
ambient temperature range during operation with nominal data	T_{a_work}	°C	0...+40			
ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	0...55			
derating of P_{DC_cont}; P_{BD}; I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2,0			
allowed mounting position			G1			
cooling type			forced ventilation			
volumetric capacity of forced cooling	V	m^3/h	tbd			1400,00
power dissipation at continuous current and continuous DC bus power respectively (UL)$^{1)}$	P_{Diss_cont}	W	290,00	680,00	800,00	2000,00

Description	Symbol	Unit	HMV01.1R-W0018	HMV01.1R-W0045	HMV01.1R-W0065	HMV01.1R-W0120
minimum distance on the top of the device[2)]	d_{top}	mm	300			
minimum distance on the bottom of the device[3)]	d_{bot}	mm	130			334
temperature rise with minimum distances d_{bot}; d_{top}; P_{BD}	ΔT	K	65			

1)	HMV, HCS: plus dissipation of braking resistor, control section; KSM: plus rated power consumption control voltage input
2) 3)	see fig. "Air intake and air outlet at drive controller"

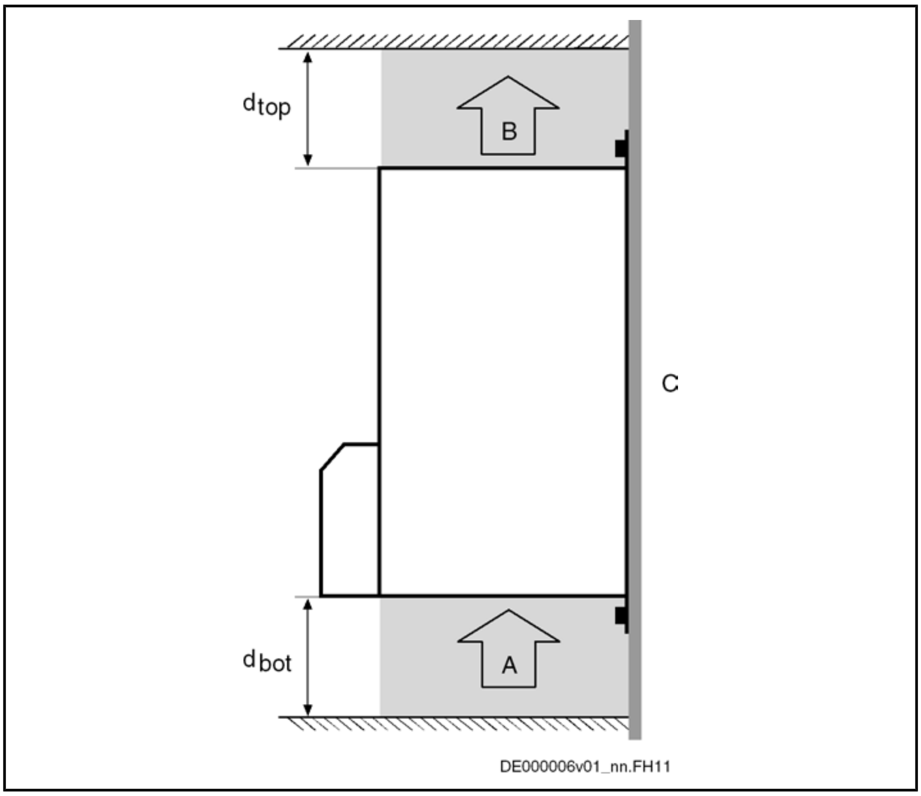
Fig.7-34: HMV - Data for cooling and power dissipation

Distances

CAUTION

Property damage due to temperatures higher than 105 °C!

Comply with indicated minimum distances!



A	air intake
B	air outlet
C	mounting surface in control cabinet
d_{top}	distance top
d_{bot}	distance bottom

Fig.7-35: Air intake and air outlet at drive controller

Basic Data Supply Unit HMV01, Regenerative

General Information

This chapter contains data with regard to:

- control voltage supply
- mains voltage supply
- DC bus
- built-in braking resistor or requirements on an external braking resistor
- cooling and power dissipation

☞ The order of the data tables below follows the energy flow in the device – from mains connection to DC bus output.

Control Voltage

Data for control voltage supply

Description	Symbol	Unit	HMV01.1R-W0018	HMV01.1R-W0045	HMV01.1R-W0065	HMV01.1R-W0120
rated control voltage input (UL)$^{1)}$	U_{N3}	V	24 ± 5 %			
control voltage when using motor holding brake with motor cable length < 50 m$^{2)}$	U_{N3}	V	24 ± 5 %			
control voltage when using motor holding brake with motor cable length > 50 m$^{3)}$	U_{N3}	V	26 ± 5 %			
maximum allowed voltage for 1 m	U_{N3_max}	V	28,80			
maximum inrush current at 24V supply	I_{EIN3_max}	A	5,50	7,00	7,50	13,00
pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	15			2000
input capacitance	C_{N3}	mF	10,00			1,00
rated power consumption control voltage input at U_{N3} (UL)$^{4)}$	P_{N3}	W	31	41	108	224

1) 2) 3) observe supply voltage for motor holding brakes
4) HMS, HMD, HCS: plus holding brake and control section; KCU01: at max. number of axes; KSM01: plus holding brake (UN x IN)

Fig.7-36: HMV - Data for control voltage supply

Mains Voltage

Data for mains voltage supply

Description	Symbol	Unit	HMV01.1R-W0018	HMV01.1R-W0045	HMV01.1R-W0065	HMV01.1R-W0120
input frequency (UL)	f_{LN}	Hz	50...60			
tolerance input frequency (UL)		Hz	± 2			
maximum allowed mains frequency change	$\Delta f_{LN}/\Delta t$	Hz/s	1			
rotary field condition			none			

Description	Symbol	Unit	HMV01.1R-W0018	HMV01.1R-W0045	HMV01.1R-W0065	HMV01.1R-W0120
Suitable for use on a circuit capable of delivering not more than this SCCR, symmetrical amperes (UL) [1)	I_{SCCR}	A rms	42000			
nominal mains voltage	U_{LN_nenn}	V	3 AC 400			
mains voltage three-phase at TN S, TN C, TT mains	U_{LN}	V	380...480			
mains voltage three-phase at IT mains[2)	U_{LN}	V	200...230			
mains voltage three-phase at Corner-grounded-Delta mains[3)	U_{LN}	V	200...230			
tolerance U_{LN} (UL)		%	±10			
minimum inductance of the mains supply (inductance of mains phase)[4)	L_{min}	µH	40			
assigned type of mains choke			HNL01.1R-0980-C0026-A-480; HNL01.1R-4200-S0026-A-480	HNL01.1R-0590-C0065-A-480; HNL01.1R-6300-S0065-A-480	HNL01.1R-0540-C0094-A-480; HNL01.1R-3000-S0094-A-480	HNL01.1R-0300-C0180-A-480
minimum short circuit power of the mains for failure-free operation[5)	S_{k_min}	MVA	1,9	4,7	6,8	13,2
maximum inrush current[6)	$I_{L\_trans\_max\_on}$	A	40,00	94,00	150,00	I L_cont
maximum allowed ON-OFF cycles per minute[7)			1			
power factor TPF (λ_L) at P_{DC_cont} with mains choke; U_{LN_nenn}	TPF		0,99			
power factor of fundam. component DPF at P_{DC_cont} with mains choke	$\cos\varphi^{h1}$		0,97			
mains connection power at P_{DC_cont}; U_{LN_nenn} with mains choke	S_{LN}	kVA	19,00	47,00	68,00	132,00
rated input current (UL)[8)	I_{L_cont}	A	26,0	65,0	94,0	181,0
nominal current AC1 for mains contactor at nom. data with mains choke; U_{LN_nenn}			mains contactor integrated			I L_cont
mains fuse according to IEC 60364-5-52; at nom. data with mains choke; U_{LN_nenn}		A	35	80	125	224

Description	Symbol	Unit	HMV01.1R-W0018	HMV01.1R-W0045	HMV01.1R-W0065	HMV01.1R-W0120
required wire size according to IEC 60364-5-52; at I_{L_cont} 9)	A_{LN}	mm^2	4	16	35	95
required wire size according to UL 508 A (internal wiring); at I_{L_cont} (UL)10)	A_{LN}	AWG	AWG 10	AWG 6	AWG 3	AWG 3/0

1)	600 V AC or less, use listed AC input line fuses or listed circuit breakers
2) 3)	mains voltage > ULN: use a transformer with grounded neutral point, don't use autotransformers!
4)	otherwise use mains choke HNL
5)	HMV0x.xR: Rsc=100; HMV0x.xE, HCS0x.xE: Rsc=50
6)	depending on mains input voltage ULN; HMV01.1R see following note; HMV: constant current charge, HCS: resistance charge; minimum of 250.000 load cycles
7)	without external capacities on DC bus
8)	at PDC_cont
9)	copper wire; PVC-insulation (conductor temperature 70 °C); installation method B2; Table B52-4; Ta ≤ 40 °C
10)	copper wire; PVC-insulation (conductor temperature 90 °C); Table 13.5.1; Ta ≤ 40 °C

Fig.7-37: HMV - Data for mains voltage supply

Supply Unit - DC Bus

Data of supply unit - DC bus

Description	Symbol	Unit	HMV01.1R-W0018	HMV01.1R-W0045	HMV01.1R-W0065	HMV01.1R-W0120
DC bus voltage	U_{DC}	V	750, closed-loop-controlled			
capacitance in DC bus	C_{DC}	mF	0,70	1,88	2,82	4,95
DC resistance in DC bus (L+ to L-) at U_{DC} = 750 V	R_{DC}	kOhm	approx. 67	approx. 28	approx. 14	approx. 46
rated power (t > 10 min) at f_s = 4 kHz; U_{LN_nenn}; control factor a_0 > 0,8; with mains choke	P_{DC_cont}	kW	18,00	45,00	65,00	120,00
P_{DC_cont} and P_{DC_max} vs. mains input voltage; $U_{LN} \leq U_{LN\_nenn}$		%/V	PDC_cont (ULN) = PDC_cont x [1 - (400-ULN) x 0,0025]			
P_{DC_cont} and P_{DC_max} vs. mains input voltage; $U_{LN} > U_{LN\_nenn}$		%/V	PDC_cont			
maximum allowed DC bus power at U_{LN_nenn}; with mains choke	P_{DC_max}	kW	45,00	112,00	162,00	180,00
monitoring value maximum DC bus voltage, switch-off threshold	$U_{DC\_limit\_max}$	V	900, see also Troubleshooting Guide for E8025, F2817			
monitoring value minimum DC bus voltage, undervoltage threshold	$U_{DC\_limit\_min}$	V	1,06 x ULN; see also Troubleshooting Guide for E2026, F2026			

Description	Symbol	Unit	HMV01.1R-W0018	HMV01.1R-W0045	HMV01.1R-W0065	HMV01.1R-W0120
maximum allowed external DC bus capacitance[1]	C_{DCext}	mF	150,00			
charging time at maximum allowed C_{DCext} external DC bus capacitance at U_{LN_nenn}	$t_{lade\_DC\_Cext}$	s	90,00			

[1] use assigned type of mains choke

Fig. 7-38: HMV - Data of supply unit - DC bus

Integrated Braking Resistor

Data of built-in braking resistor

Description	Symbol	Unit	HMV01.1R-W0018	HMV01.1R-W0045	HMV01.1R-W0065
braking resistor continuous power	P_{BD}	kW	0,40		
braking resistor peak power at U_{DC} = 850 V	P_{BS}	kW	36,00	90,00	130,00
nominal braking resistance	$R_{DC\_Bleeder}$	ohm	19	8	5
braking resistor switch-on threshold - mains voltage independent[1]	$U_{R\_DC\_On\_f}$	V	820; see also X32		
maximum regenerative power to be absorbed	W_{R_max}	kWs	80,00	100,00	150,00
cooling of internal braking resistor			forced		

[1] factory setting

Fig. 7-39: HMV - Data of built-in braking resistor

☞ HMV01.1R-W0120 supply units do not have an integrated braking resistor.

Exemplary Data for Applications

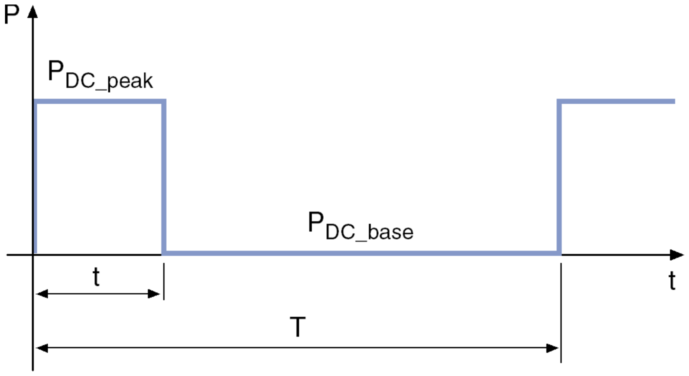
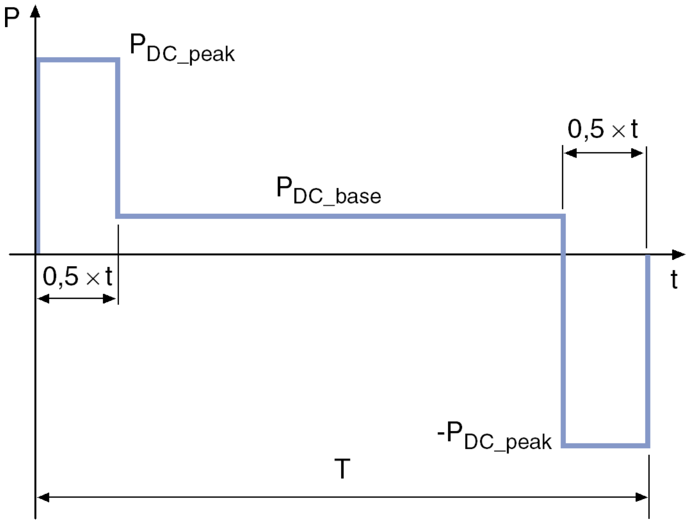
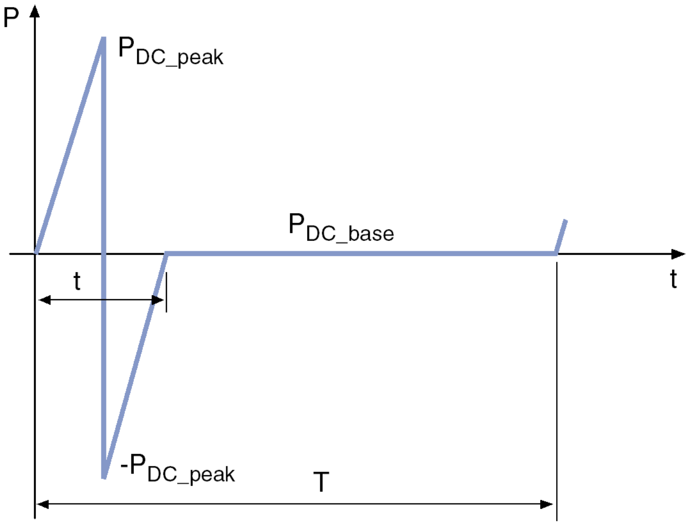
General Information

This chapter contains examples of allowed performance profiles.

Performance Profiles

Performance Profiles of Regenerative Supply Units

The following profiles have been defined for regenerative supply units.

Profile	Explanation
performance profile “WZM_HS_KB_e”  DK000155v01_nn.fh11	The characteristic data of the profile are used to select infeeding and regenerative supply units. Characteristic of applications in machine tools, short-time operation of the main spindle.
performance profile “WZM_HS_Fr_r”  DK000150v01_nn.fh11	The characteristic data of the profile are used to select regenerative supply units. Characteristic of main spindles in milling machines.
performance profile “WZM_SA_acc_r”  DK000151v01_nn.fh11	The characteristic data of the profile are used to select regenerative supply units. Characteristic of servo drives at machine tools.

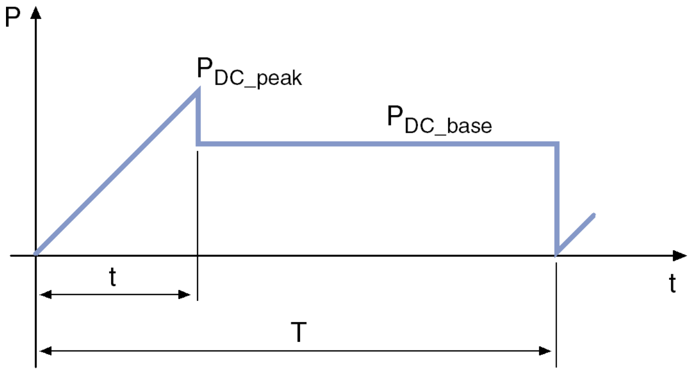
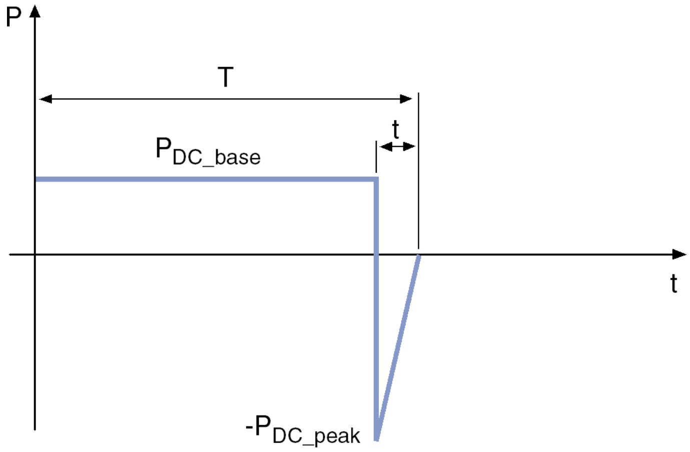
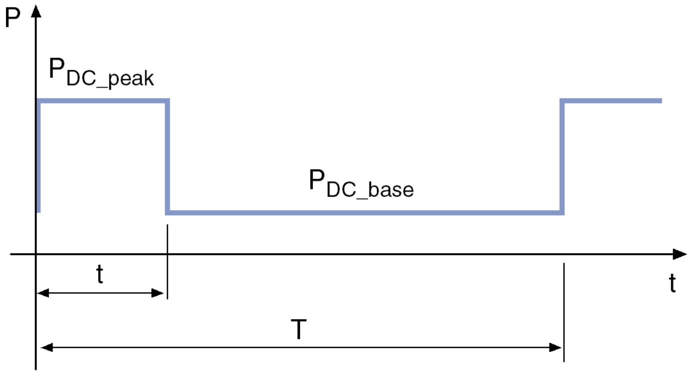
Profile	Explanation
performance profile “DRM_S1_acc_e”  DK000152v01_nn.fh11	The characteristic data of the profile are used to select infeeding and regenerative supply units. Characteristic of starting and operation at printing machines.
performance profile “DRM_S1_acc_r”  DK000153v01_nn.fh11	The characteristic data of the profile are used to select regenerative supply units. Characteristic of deceleration at printing machines.
performance profile “UEL_P_e”  DK000135v01_nn.fh11	The characteristic data of the profile are used to select infeeding and regenerative supply units. Characteristic of applications using standard motors in overload operation.

Fig. 7-40: Definitions of performance profiles, regenerative supply units

Examples of allowed performance profiles, supply units HMV....R

Description	**Symbol**	**Unit**	**HMV01.1R-W0018**	**HMV01.1R-W0045**	**HMV01.1R-W0065**	**HMV01.1R-W0120**
DC bus power at U_{LN_nenn}; t = 132 s; T = 300 s; with mains choke$^{1)}$	$P_{DC\_base\_14}$	kW	0			
maximum DC bus power at U_{LN_nenn}; t = 132 s; T = 300 s; with mains choke$^{2)}$	$P_{DC\_peak\_14}$	kW	21,60	45,00	68,20	tbd
DC bus power at U_{LN_nenn}; t = 6 s; t = 60 s; with mains choke$^{3)}$	$P_{DC\_base\_15}$	kW	3,60	9,00	13,00	24,00
maximum DC bus power at U_{LN_nenn}; t = 6 s; t = 60 s; with mains choke$^{4)}$	$P_{DC\_peak\_15}$	kW	45,00	103,50	133,20	tbd
DC bus power at U_{LN_nenn}; t = 0.4 s; T = 4 s; with mains choke$^{5)}$	$P_{DC\_base\_16}$	kW	0			
maximum DC bus power at U_{LN_nenn}; t = 0.4 s; T = 4 s; with mains choke$^{6)}$	$P_{DC\_peak\_16}$	kW	45,00	112,50	162,50	tbd
DC bus power at U_{LN_nenn}; t = 60 s; T = 900 s; with mains choke$^{7)}$	$P_{DC\_base\_17}$	kW	16,20	40,50	58,50	108,00
maximum DC bus power at U_{LN_nenn}; t = 60 s; T = 900 s; with mains choke$^{8)}$	$P_{DC\_peak\_17}$	kW	32,40	63,00	97,50	tbd

1) 2) 4)	see definition profile WZM_HS_KB_e
3)	see definition profile WZM_HS_Fr_r
5) 6) 8)	see definition profile WZM_SA_acc_r
7)	see definition profile DRM_S1_acc_r

Fig.7-41: HMV....R - Examples of allowed performance profiles

7.3.5 Connections and Interfaces

Overall Connection Diagram HMV01.1R-W0018, -W0045, -W0065

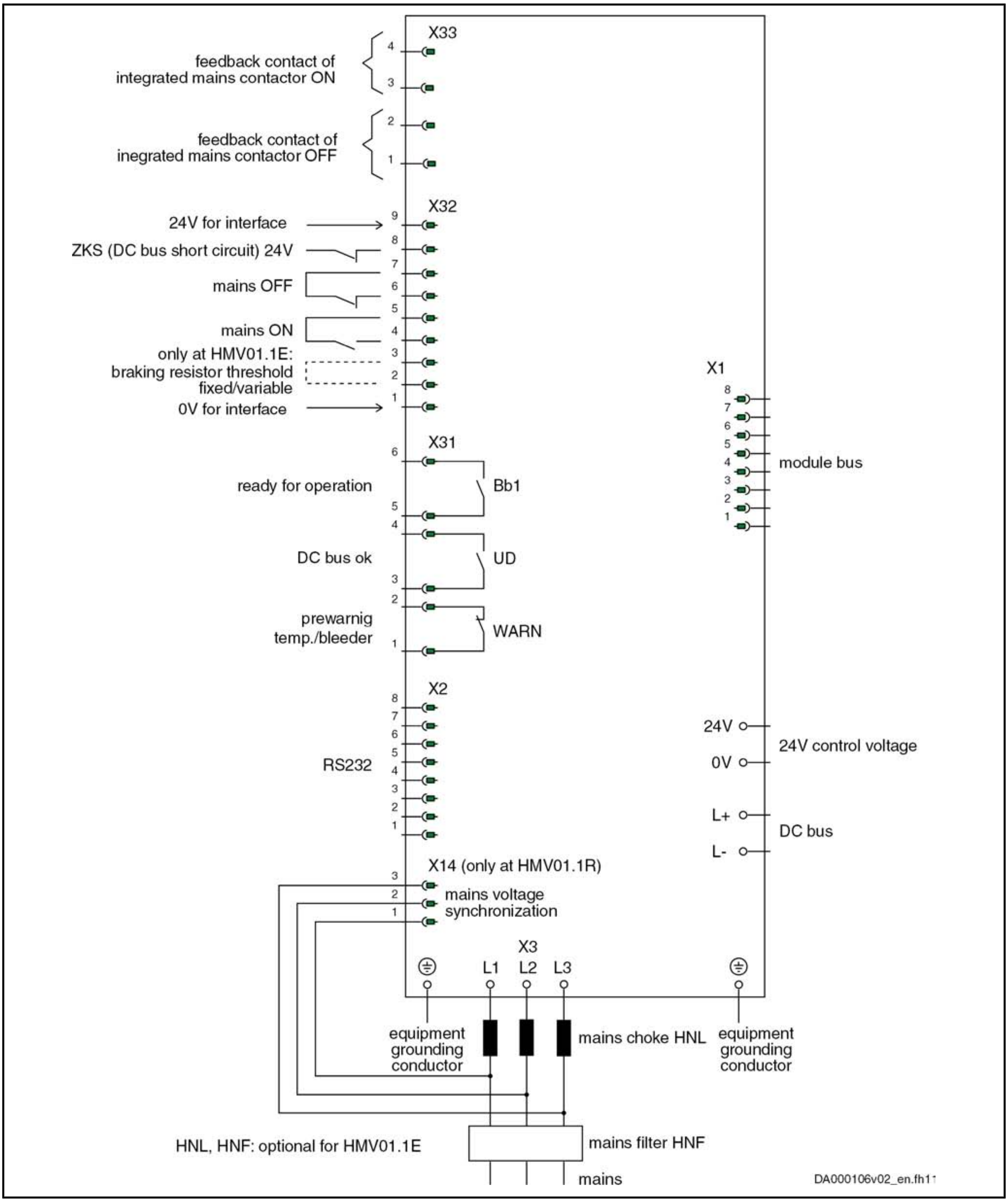


Fig.7-42: Connection diagram HMV01.1R-W018; -W0043; -W0065

Overall Connection Diagram HMV01.1R-W0120

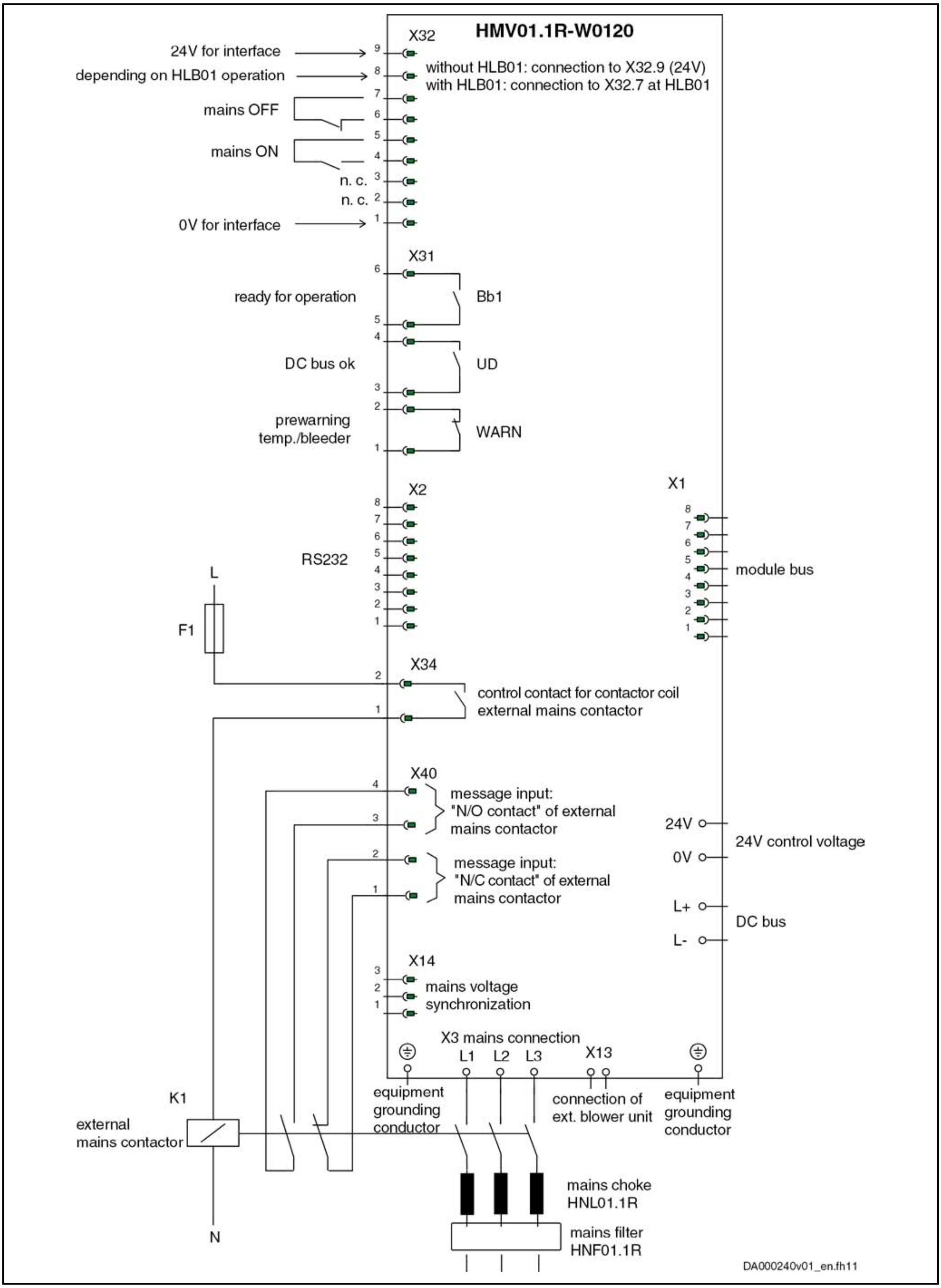


Fig.7-43: Connection diagram HMV01.1R-W0120

Connection Diagram with HLB01.1D

CAUTION

Risk of damage to the device!

Establish connection from **HMV_X32/8** to **HLB_X32/7**.

This avoids energy from the mains connection being supplied and the ZKS stage of the DC bus resistor unit HLB being simultaneously active.

Also applies to HMV01 without integrated ZKS stage and external mains contactor HMV01.1R-W0120.

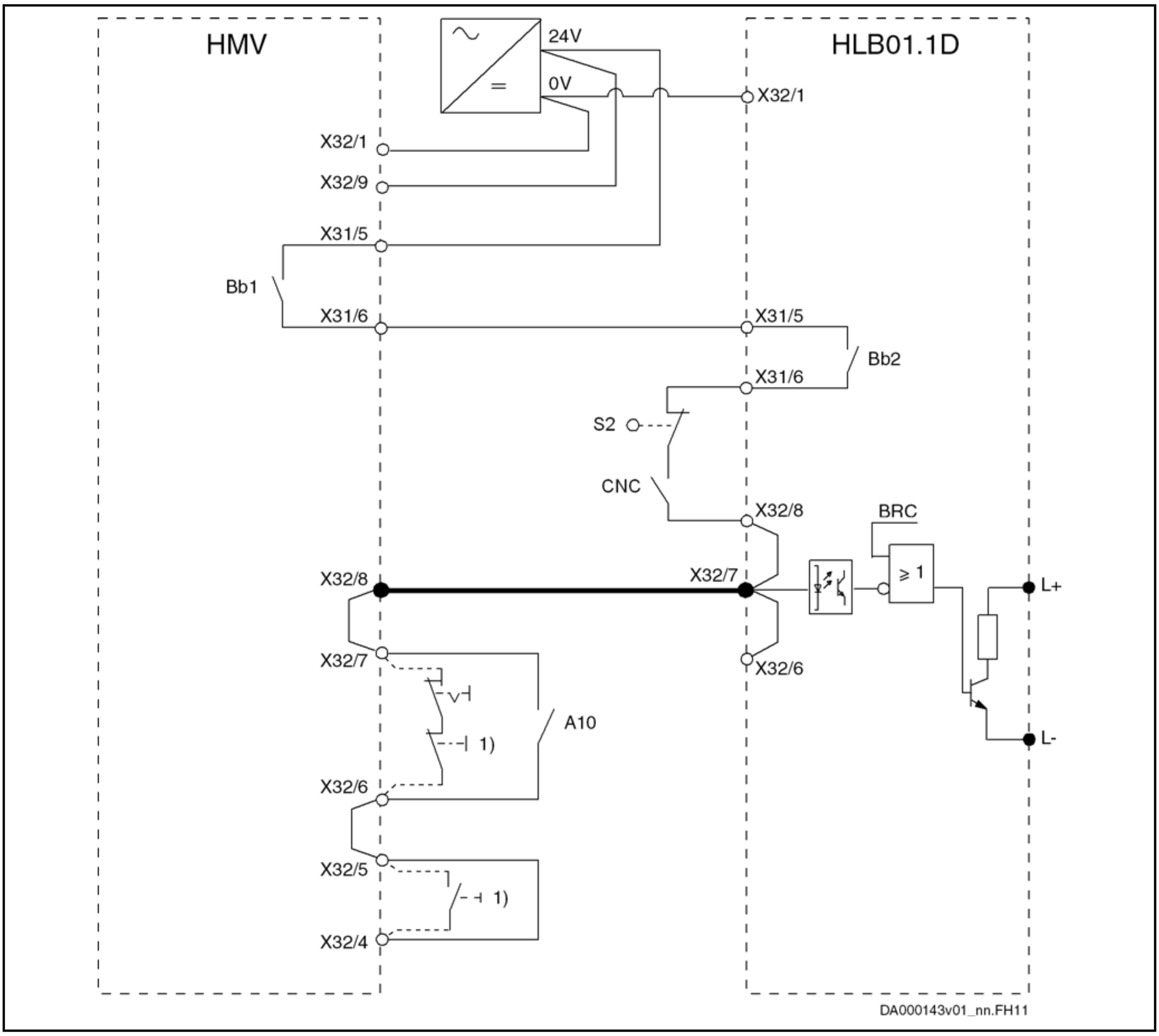
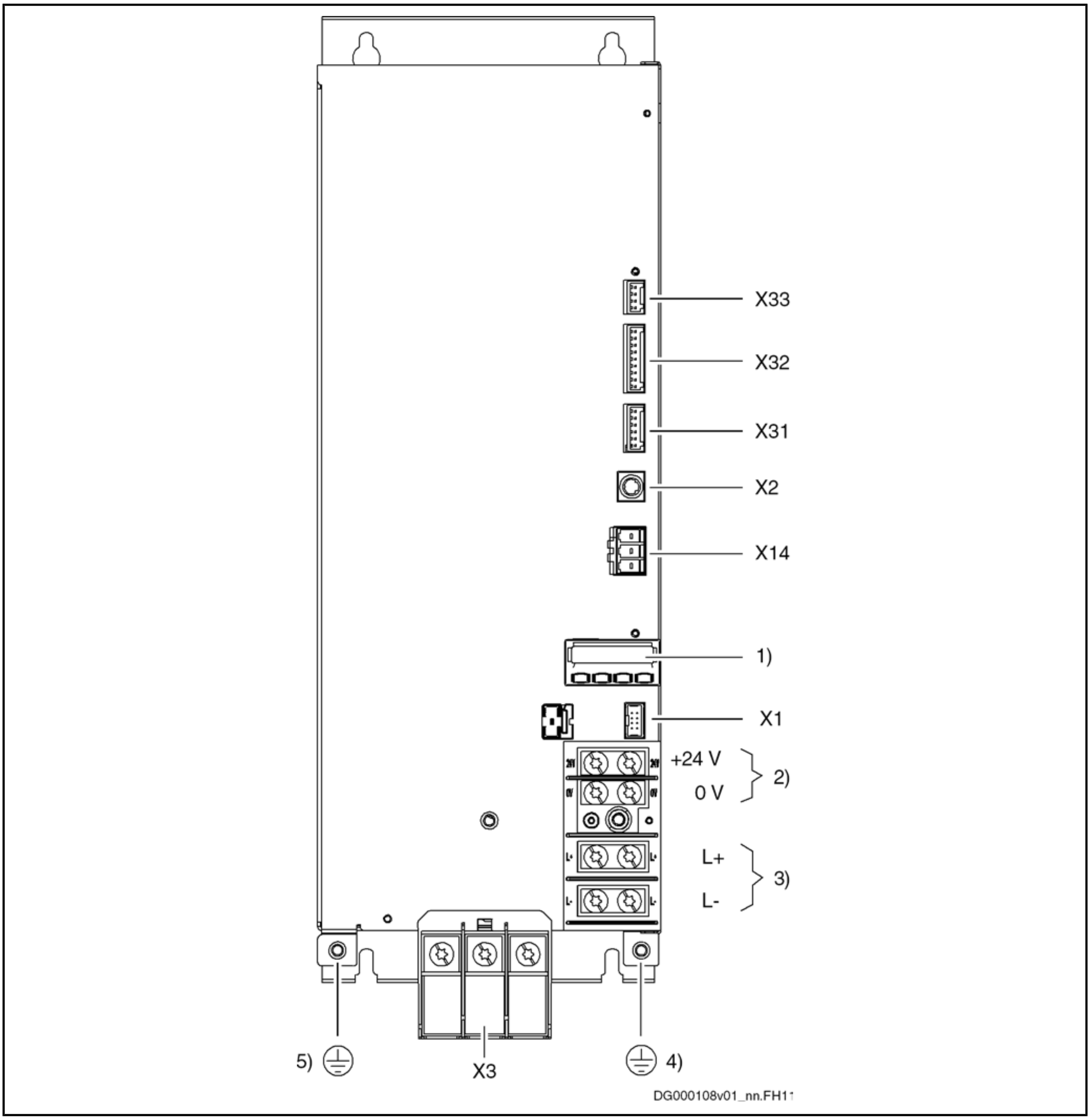


Fig.7-44: Connection diagram HMV01 with HLB01.1D

☞ For other connection diagrams and control circuits for the mains connection, see the documentation “Rexroth IndraDrive - Drive System, Project Planning Manual” in the section “Control Circuits for the Mains Connection”

Arrangement of the Connection Points

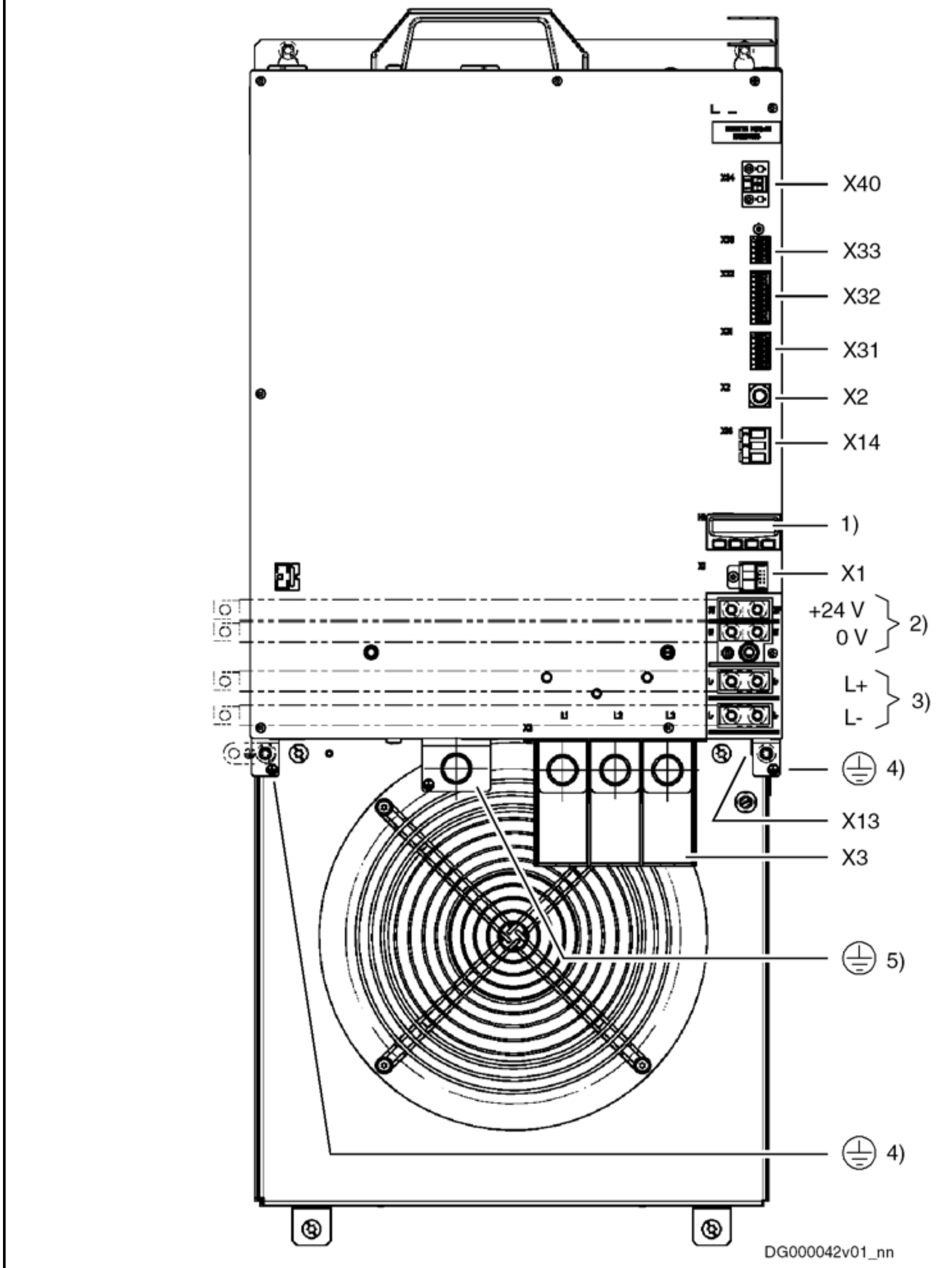
Connections HMV01.1R-W0018, -W0045, -W0065



X33	acknowledge messages of mains contactor
X32	mains contactor control and DC bus short circuit (ZKS)
X31	connection for messages
X2	RS232
X14	mains voltage synchronization
X3	mains connection
X1	module bus
1)	control panel
2)	control voltage
3)	DC bus
4)	connection point of equipment grounding conductor (with joint bar to neighboring device)
5)	connection point of equipment grounding conductor (mains)

Fig.7-45: Connections HMV01.1R-W0018, -W0045, -W0065

Connections HMV01.1R-W0120



X34	contact for external mains contactor
X40	acknowledge messages of mains contactor
X32	mains contactor control and DC bus short circuit (ZKS)
X31	connection for messages
X2	RS232
X14	mains voltage synchronization
X13	voltage connection for blower unit
X3	mains connection
X1	module bus
1)	control panel
2)	control voltage
3)	DC bus
4)	connection point of equipment grounding conductor (with joint bar to neighboring device)
5)	connection point of equipment grounding conductor (mains)

Fig.7-46: Connections HMV01.1R-W0120

☞ Connect **HMV01.1R-W0120** supply units to the mains via an **external mains contactor**. The connection **X40** receives the message signals on the status of the external mains contactor (see also chapter “X40, Acknowledge Messages of External Mains Contactor”).

Description of the Connection Points

The connection points are described in detail in chapter 8 Functions and Electrical Connection Points , page 241.

Touch Guard

The touch guard is described in detail in chapter 9 Touch Guard at Devices , page 291.

7.4 HMV02.1R Supply Units, Regenerative

7.4.1 Brief Description, Usage and Structure

Brief Description

HMV supply units supply modular HMS and HMD devices.

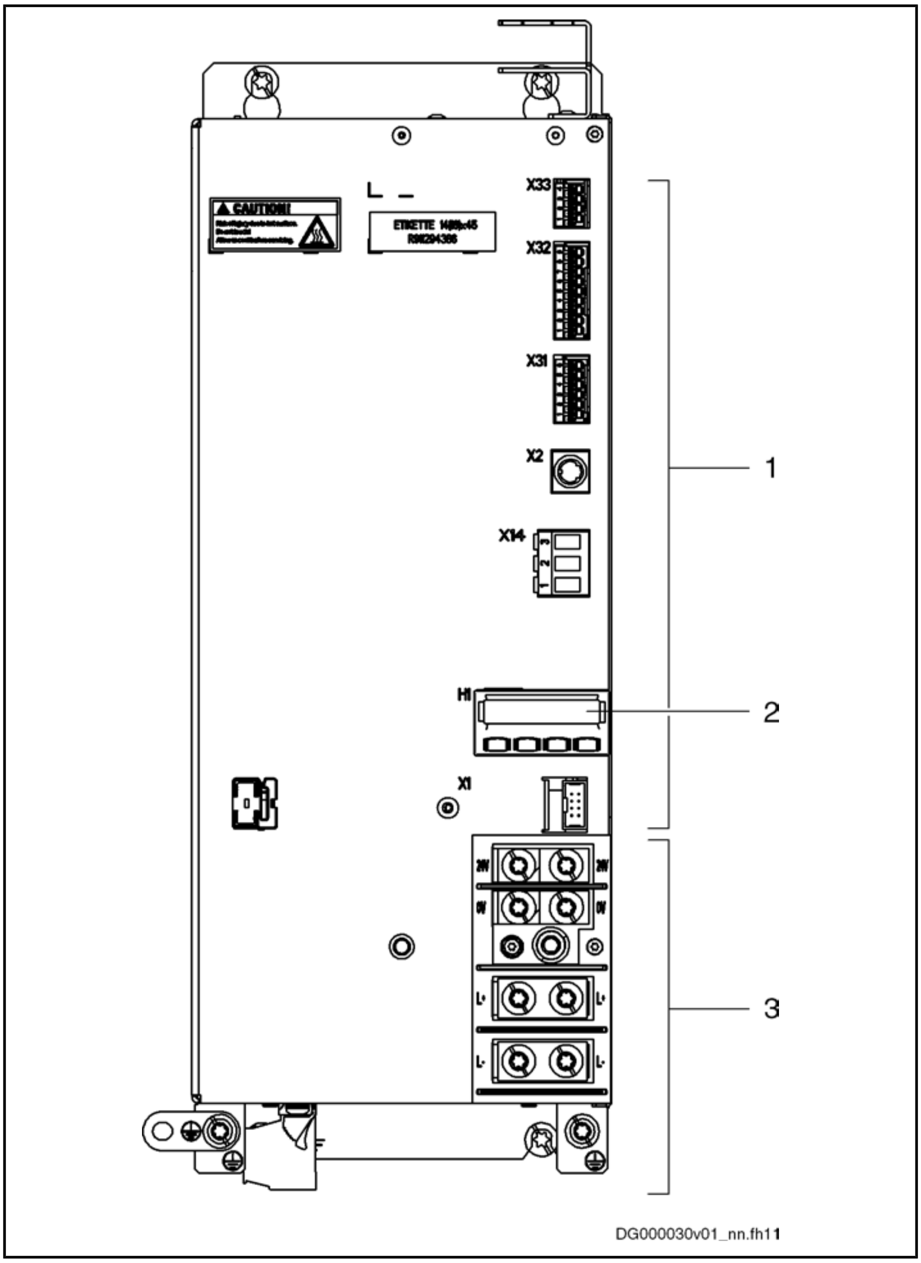
Usage

The different types can be used as follows:

Type	Usage
HMV02.1R	**regenerative** to supply HMS02 drive controllers

Fig.7-47: Usage of supply units

Design



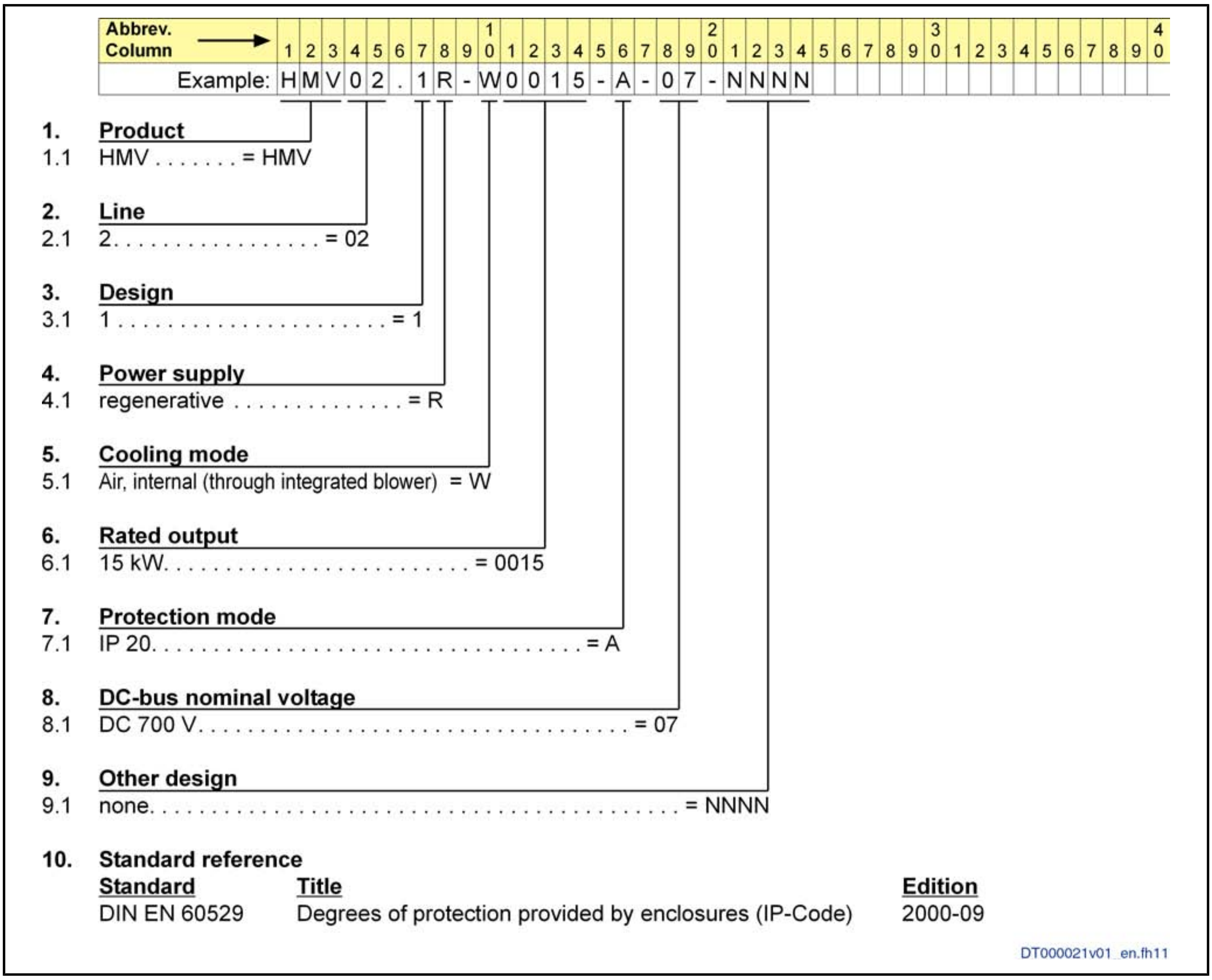
1	interfaces for signal processing
2	control panel
3	power connections incl. control voltage

Fig.7-48: Basic design

7.4.2 Type Code and Identification

Type Code

☞ The following figure illustrates the basic structure of the type code. Our sales representative will help you with the current status of available versions.



1. Product
1.1 HMV . . . . = HMV

2. Line
2.1 2. . . . . = 02

3. Design
3.1 1 . . . . = 1

4. Power supply
4.1 regenerative . . . . = R

5. Cooling mode
5.1 Air, internal (through integrated blower) = W

6. Rated output
6.1 15 kW. . . . . = 0015

7. Protection mode
7.1 IP 20. . . . . = A

8. DC-bus nominal voltage
8.1 DC 700 V. . . . . = 07

9. Other design
9.1 none. . . . . = NNNN

10. Standard reference

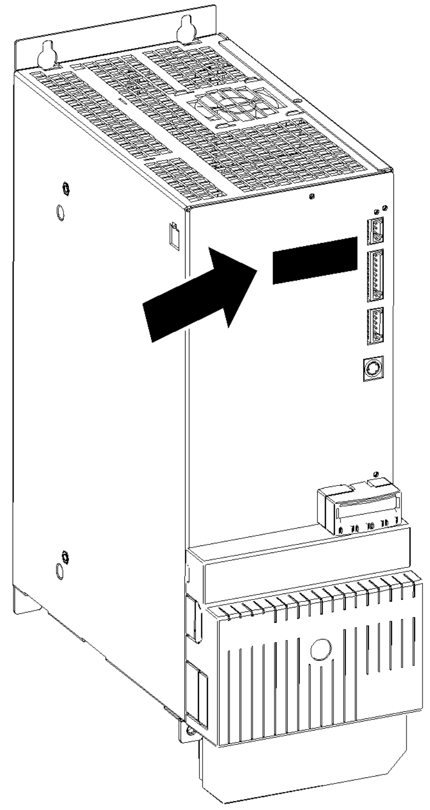
Standard	Title	Edition
DIN EN 60529	Degrees of protection provided by enclosures (IP-Code)	2000-09

DT000021v01_en.fh11

Fig.7-49: Type code

Identification

Type Plate Arrangement



DR000005v01_nn.FH11

Fig.7-50: *Type plate at device*

Type Plate

DG000080v01_nn.FH11

1	device type
2	part number
3	serial number
4	bar code
5	country of manufacture
6	production week, 04W12 meaning year 2004, week 12
7	hardware index

Fig.7-51: *Type plate - power section (example of an HCS02 power section)*

7.4.3 Scope of Supply

The scope of supply includes:

- 1 × touch guard
- 1 × connector X14, X31, X32 and X33 each

- 1 × joint bar to connect the equipment grounding conductor to a neighboring device
- 1 × standard control panel each
- 1 × brochure with safety instructions (in 5 languages)

7.4.4 Technical Data HMV02.1R

Ambient and Operating Conditions

General Information

Conditions for transport and storage: see chapter 4.2 Transport and Storage, page 19.

Installation conditions: see chapter 4.3 Installation Conditions , page 19.

This chapter contains:

- limit values for use in the scope of C-UL
- applied standards (CE conformity, UL listing)

UL Data

Ambient and operating conditions - UL ratings

Description	Symbol	Unit	HMV02.1R-W0015
Suitable for use on a circuit capable of delivering not more than this SCCR, symmetrical amperes (UL) 1)	I_{SCCR}	A rms	42000
rated input voltage, power (UL)2)	U_{LN_nenn}	V	380...480
rated input current (UL)3)	I_{L_cont}	A	23,0
maximum output voltage (UL)	U_{out}	V	750 dc
maximum output current (UL)	I_{out_max}	A	20,0

1) 600 V AC or less, use listed AC input line fuses or listed circuit breakers

2) HMS, HMD, HLB, HLC, KCU: DC bus L+, L-; HMV, HCS: mains input L1, L2, L3

3) at PDC_cont

Fig.7-52: HMV - Ambient and operating conditions - UL ratings

Information on Standards

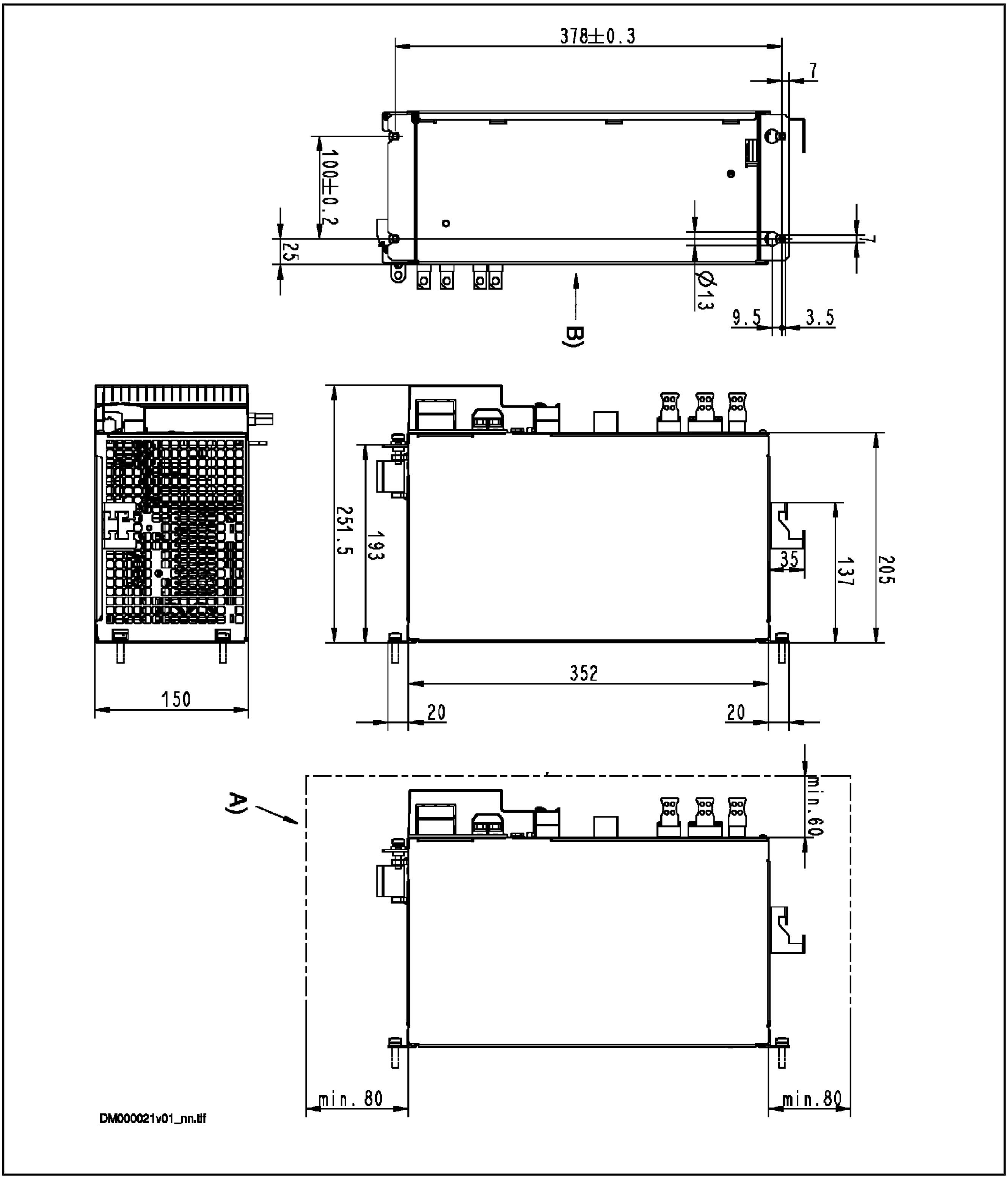
Applied standards

Description	Symbol	Unit	HMV02.1R-W0015
listing according to UL standard (UL)			UL 508 C
UL files (UL)			E 134201
listing according to CSA standard (UL)			Canadian National Standard(s) C22.2 No. 14-05

Fig.7-53: HMV - Applied standards

Mechanical System and Mounting

Dimensions



A	minimum mounting clearance (plus additional space for mains connection cable [the required space depends on the minimum bending radius of the connected mains connection cable])
B	rear view!

Fig.7-54: *Dimensional drawing*

Dimensions, Mass, Insulation, Sound Pressure Level

Data for mass, dimensions, sound pressure level, insulation

Description	Symbol	Unit	HMV02.1R-W0015
weight	m	kg	9,50
device height (UL)$^{1)}$	H	mm	352
device depth (UL)$^{2)}$	T	mm	205
device width (UL)$^{3)}$	B	mm	150
insulation resistance at DC 500 V	R_{is}	MOhm	5,00
capacitance against housing	C_Y	nF	2x 470
average sound pressure level (accuracy class 2) at P_{DC_cont} $^{4)}$	L_P	dB (A)	75

1) 2) 3) housing dimension; see also related dimensional drawing

4) according to DIN EN ISO 11205; comparative value at distance 1 m, out of cabinet; HCS types with order code -L***: load-dependent

Fig.7-55: HMV - Data for mass, dimensions, sound pressure level, insulation

Power Dissipation, Mounting Position, Cooling, Distances

Data for cooling and power dissipation

Description	Symbol	Unit	HMV02.1R-W0015
ambient temperature range during operation with nominal data	T_{a_work}	°C	0..+40
ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	0...55
derating of P_{DC_cont}; P_{BD}; I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2,7
allowed mounting position			G1
cooling type			forced ventilation
volumetric capacity of forced cooling	V	m^3/h	115,00
power dissipation at continuous current and continuous DC bus power respectively (UL)$^{1)}$	P_{Diss_cont}	W	500,00
minimum distance on the top of the device$^{2)}$	d_{top}	mm	80
minimum distance on the bottom of the device$^{3)}$	d_{bot}	mm	80
temperature rise with minimum distances d_{bot}; d_{top}; P_{BD}	ΔT	K	65

1) HMV, HCS: plus dissipation of braking resistor, control section; KSM: plus rated power consumption control voltage input

2) 3) see fig. "Air intake and air outlet at drive controller"

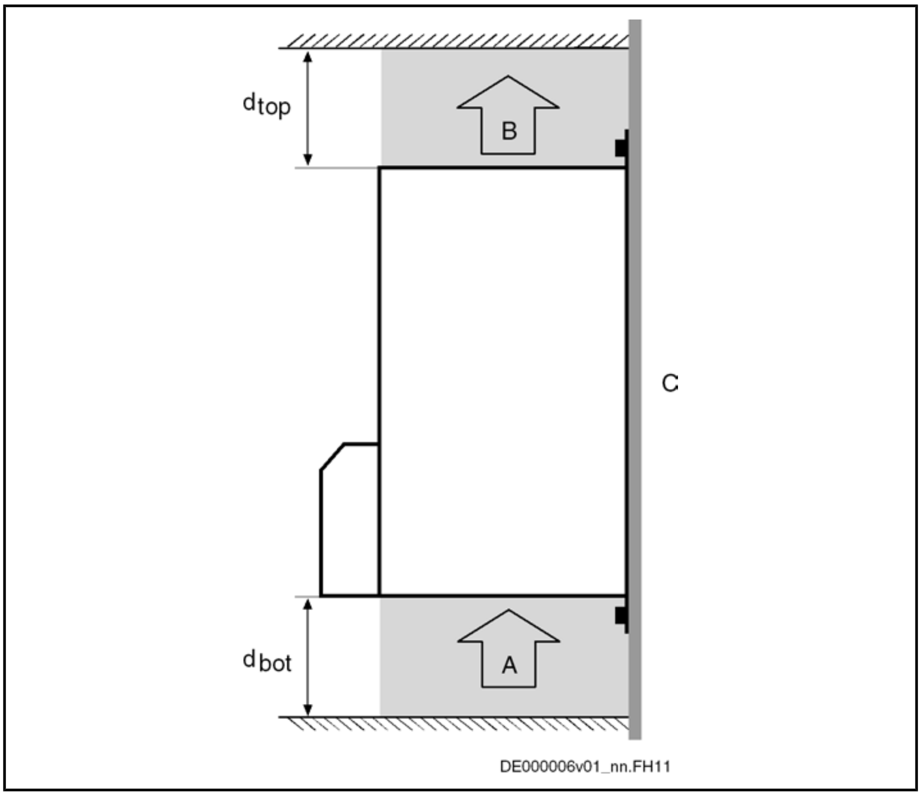
Fig.7-56: HMV - Data for cooling and power dissipation

Distances

CAUTION

Property damage due to temperatures higher than 105 °C!

Comply with indicated minimum distances!



A	air intake
B	air outlet
C	mounting surface in control cabinet
d_{top}	distance top
d_{bot}	distance bottom

Fig.7-57: *Air intake and air outlet at drive controller*

Basic Data Supply Unit HMV02, Regenerative

General Information

This chapter contains data with regard to:

- control voltage supply
- mains voltage supply
- DC bus
- built-in braking resistor or requirements on an external braking resistor
- cooling and power dissipation

☞ The order of the data tables below follows the energy flow in the supply unit - from mains connection to DC bus output.

Control Voltage

Data for control voltage supply

Description	Symbol	Unit	HMV02.1R-W0015
rated control voltage input (UL)$^{1)}$	U_{N3}	V	24 ± 5 %
control voltage when using motor holding brake with motor cable length < 50 m$^{2)}$	U_{N3}	V	24 ± 5 %
control voltage when using motor holding brake with motor cable length > 50 m$^{3)}$	U_{N3}	V	26 ± 5 %
maximum allowed voltage for 1 m	U_{N3_max}	V	33,00
maximum inrush current at 24V supply	I_{EIN3_max}	A	5,50
pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	15
input capacitance	C_{N3}	mF	10,00
rated power consumption control voltage input at U_{N3} (UL)$^{4)}$	P_{N3}	W	27

1) 2) 3) observe supply voltage for motor holding brakes

4) HMS, HMD, HCS: plus holding brake and control section; KCU01: at max. number of axes; KSM01: plus holding brake (UN x IN)

Fig.7-58: HMV - Data for control voltage supply

Mains Voltage

Data for mains voltage supply

Description	Symbol	Unit	HMV02.1R-W0015
input frequency (UL)	f_{LN}	Hz	50...60
tolerance input frequency (UL)		Hz	± 2
maximum allowed mains frequency change	$\Delta f_{LN}/\Delta t$	Hz/s	1
rotary field condition			none
Suitable for use on a circuit capable of delivering not more than this SCCR, symmetrical amperes (UL) $^{1)}$	I_{SCCR}	A rms	42000
nominal mains voltage	U_{LN_nenn}	V	3 AC 400
mains voltage three-phase at TN S, TN C, TT mains	U_{LN}	V	380...480
mains voltage three-phase at IT mains$^{2)}$	U_{LN}	V	200...230
mains voltage three-phase at Corner-grounded-Delta mains$^{3)}$	U_{LN}	V	200...230
tolerance U_{LN} (UL)		%	±10

Description	Symbol	Unit	HMV02.1R-W0015
minimum inductance of the mains supply (inductance of mains phase)4)	L_{min}	µH	50
assigned type of mains choke			HNL02.1R-0980-C0023-A-480
minimum short circuit power of the mains for failure-free operation5)	S_{k_min}	MVA	1,6
maximum inrush current6)	I L_trans_max_ on	A	I L_cont
maximum allowed ON-OFF cycles per minute7)			1
power factor TPF (λ_L) at P_{DC_cont} with mains choke; U_{LN_nenn}	TPF		0,99
power factor of fundam. component DPF at P_{DC_cont} with mains choke	$\cos\varphi^{h1}$		0,97
mains connection power at P_{DC_cont}; U_{LN_nenn} with mains choke	S_{LN}	kVA	15,75
rated input current (UL)8)	I_{L_cont}	A	23,0
nominal current AC1 for mains contactor at nom. data with mains choke; U_{LN_nenn}			mains contactor integrated
mains fuse according to IEC 60364-5-52; at nom. data with mains choke; U_{LN_nenn}		A	35
required wire size according to IEC 60364-5-52; at I_{L_cont} 9)	A_{LN}	mm^2	4
required wire size according to UL 508 A (internal wiring); at I_{L_cont} (UL)10)	A_{LN}	AWG	AWG 10

1) 600 V AC or less, use listed AC input line fuses or listed circuit breakers
2) 3) mains voltage > ULN: use a transformer with grounded neutral point, don't use autotransformers!
4) otherwise use mains choke HNL
5) HMV0x.xR: Rsc=100; HMV0x.xE, HCS0x.xE: Rsc=50
6) depending on mains input voltage ULN; HMV01.1R see following note; HMV: constant current charge, HCS: resistance charge; minimum of 250.000 load cycles
7) without external capacities on DC bus
8) at PDC_cont
9) copper wire; PVC-insulation (conductor temperature 70 °C); installation method B2; Table B52-4; Ta ≤ 40 °C
10) copper wire; PVC-insulation (conductor temperature 90 °C); Table 13.5.1; Ta ≤ 40 °C

Fig.7-59: HMV - Data for mains voltage supply

Supply Unit - DC Bus

Data of supply unit - DC bus

Description	Symbol	Unit	HMV02.1R-W0015
DC bus voltage	U_{DC}	V	750, closed-loop-controlled
capacitance in DC bus	C_{DC}	mF	0,70
DC resistance in DC bus (L+ to L-) at U_{DC} = 750 V	R_{DC}	kOhm	approx. 67
rated power (t > 10 min) at f_s = 4 kHz; U_{LN_nenn}; control factor a_0 > 0,8; with mains choke	P_{DC_cont}	kW	15,00
P_{DC_cont} and P_{DC_max} vs. mains input voltage; $U_{LN} \leq U_{LN\_nenn}$		%/V	PDC_cont (ULN) = PDC_cont x [1 - (400-ULN) x 0,0025]
P_{DC_cont} and P_{DC_max} vs. mains input voltage; $U_{LN} > U_{LN\_nenn}$		%/V	PDC_cont
maximum allowed DC bus power at U_{LN_nenn}; with mains choke	P_{DC_max}	kW	30,00
monitoring value maximum DC bus voltage, switch-off threshold	$U_{DC\_limit\_max}$	V	900, see also Troubleshooting Guide for E8025, F2817
monitoring value minimum DC bus voltage, undervoltage threshold	$U_{DC\_limit\_min}$	V	600
maximum allowed external DC bus capacitance[1)]	C_{DCext}	mF	50,00
charging time at maximum allowed C_{DCext} external DC bus capacitance at U_{LN_nenn}	$t_{lade\_DC\_Cext}$		

1) use assigned type of mains choke

Fig.7-60: HMV - Data of supply unit - DC bus

Integrated Braking Resistor

Data of built-in braking resistor

Description	Symbol	Unit	HMV02.1R-W0015
braking resistor continuous power	P_{BD}	kW	0,30
braking resistor peak power at U_{DC} = 850 V	P_{BS}	kW	33,00
nominal braking resistance	$R_{DC\_Bleeder}$	ohm	16
braking resistor switch-on threshold - mains voltage independent[1)]	$U_{R\_DC\_On\_f}$	V	820; see also X32
maximum regenerative power to be absorbed	W_{R_max}	kWs	40,00
cooling of internal braking resistor			forced

1) factory setting

Fig.7-61: HMV - Data of built-in braking resistor

Exemplary Data for Applications

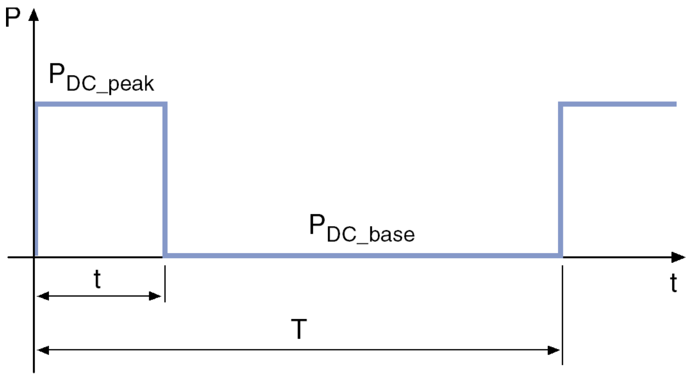
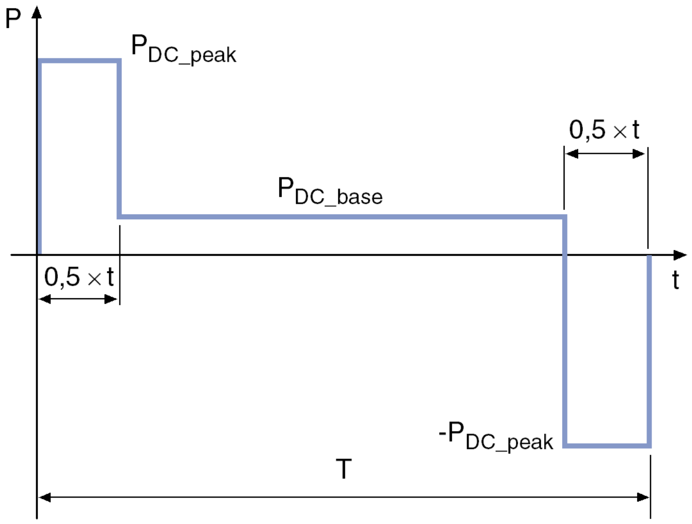
General Information

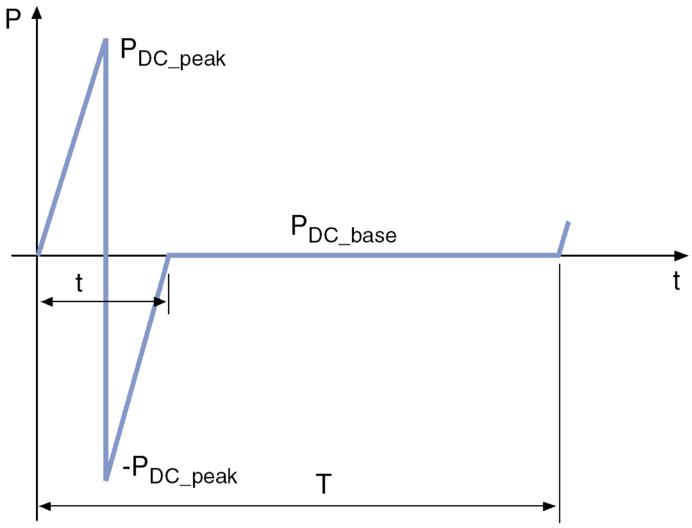
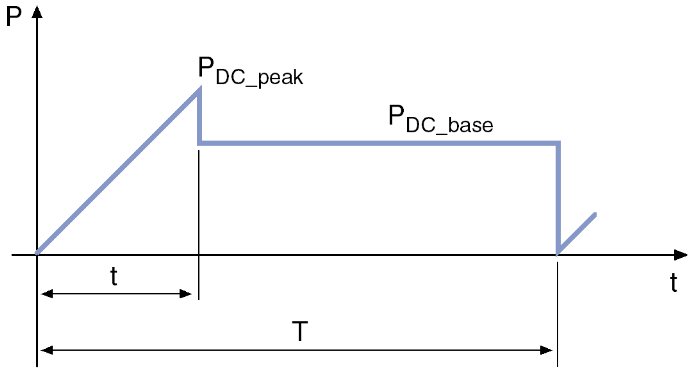
This chapter contains examples of allowed performance profiles.

Performance Profiles

Performance Profiles of Regenerative Supply Units

The following profiles have been defined for regenerative supply units.

Profile	Explanation
performance profile “WZM_HS_KB_e”  DK000155v01_nn.fh11	The characteristic data of the profile are used to select infeeding and regenerative supply units. Characteristic of applications in machine tools, short-time operation of the main spindle.
performance profile “WZM_HS_Fr_r”  DK000150v01_nn.fh11	The characteristic data of the profile are used to select regenerative supply units. Characteristic of main spindles in milling machines.

Profile	Explanation
performance profile “WZM_SA_acc_r”  DK000151v01_nn.fh11	The characteristic data of the profile are used to select regenerative supply units. Characteristic of servo drives at machine tools.
performance profile “DRM_S1_acc_e”  DK000152v01_nn.fh11	The characteristic data of the profile are used to select infeeding and regenerative supply units. Characteristic of starting and operation at printing machines.

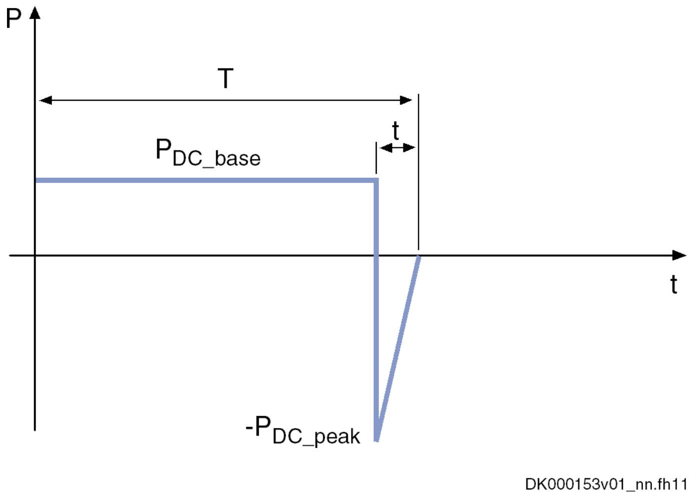
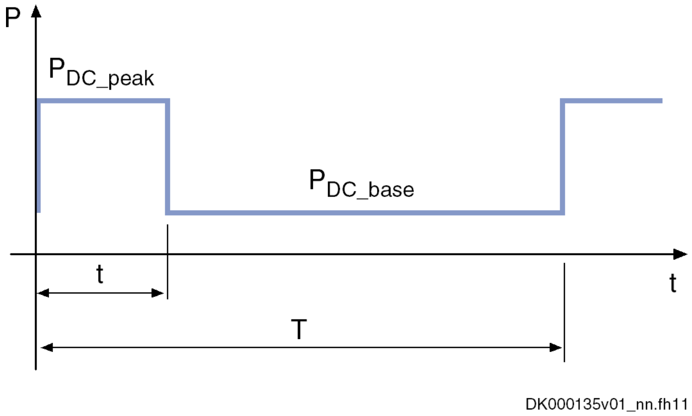
Profile	Explanation
performance profile "DRM_S1_acc_r"  	The characteristic data of the profile are used to select regenerative supply units. Characteristic of deceleration at printing machines.
performance profile "UEL_P_e"  	The characteristic data of the profile are used to select infeeding and regenerative supply units. Characteristic of applications using standard motors in overload operation.

Fig. 7-62: Definitions of performance profiles, regenerative supply units

Examples of allowed performance profiles, supply units HMV....R

Description	Symbol	Unit	HMV02.1R-W0015
DC bus power at U_{LN_nenn}; t = 132 s; T = 300 s; with mains choke[1)]	$P_{DC\_base\_14}$	kW	0
maximum DC bus power at U_{LN_nenn}; t = 132 s; T = 300 s; with mains choke[2)]	$P_{DC\_peak\_14}$	kW	15,00
DC bus power at U_{LN_nenn}; t = 6 s; t = 60 s; with mains choke[3)]	$P_{DC\_base\_15}$	kW	3,00
maximum DC bus power at U_{LN_nenn}; t = 6 s; t = 60 s; with mains choke[4)]	$P_{DC\_peak\_15}$	kW	30,00
DC bus power at U_{LN_nenn}; t = 0.4 s; T = 4 s; with mains choke[5)]	$P_{DC\_base\_16}$	kW	0

IndraDrive M Supply Units

Description	Symbol	Unit	HMV02.1R-W0015
maximum DC bus power at U_{LN_nenn}; t = 0.4 s; T = 4 s; with mains choke6)	$P_{DC\_peak\_16}$	kW	30,00
DC bus power at U_{LN_nenn}; t = 60 s; T = 900 s; with mains choke7)	$P_{DC\_base\_17}$	kW	9,00
maximum DC bus power at U_{LN_nenn}; t = 60 s; T = 900 s; with mains choke8)	$P_{DC\_peak\_17}$	kW	15,00
maximum DC bus power at U_{LN_nenn}; $T_a \le T_{a\_work}$; t = 0,4 s; T = 4 s; K = 2,5; $P_{DC\_peak} = P_{DC\_max}$; with mains choke9)	$P_{DC\_peak\_1}$	kW	25,00
DC bus power at U_{LN_nenn}; $T_a \le T_{a\_work}$; t = 0,4 s; T = 4 s; K = 2,5; $P_{DC\_peak} = P_{DC\_max}$; with mains choke10)	$P_{DC\_base\_1}$	kW	10,00
maximum DC bus power at U_{LN_nenn}; $T_a \le T_{a\_work}$; t = 2 s; T = 20 s; K = 2,0; with mains choke11)	$P_{DC\_peak\_3}$	kW	22,00
DC bus power at U_{LN_nenn}; $T_a \le T_{a\_work}$; t = 2 s; T = 20 s; K = 2,0; with mains choke12)	$P_{DC\_base\_3}$	kW	11,00
maximum DC bus power at U_{LN_nenn}; $T_a \le T_{a\_work}$; t = 60 s; T = 5 min; K = 1,5; with mains choke13)	$P_{DC\_peak\_4}$	kW	16,00
DC bus power at U_{LN_nenn}; $T_a \le T_{a\_work}$; t = 60 s; T = 5 min; K = 1,5; with mains choke14)	$P_{DC\_base\_4}$	kW	10,60
maximum DC bus power at U_{LN_nenn}; $T_a \le T_{a\_work}$; t = 60 s; T = 10 min; K = 1.1; with mains choke15)	$P_{DC\_peak\_5}$	kW	15,00
DC bus power at U_{LN_nenn}; $T_a \le T_{a\_max}$; t = 60 s; T = 10 min; K = 1,1; with mains choke16)	$P_{DC\_base\_5}$	kW	13,60

1) 2) 4)	see definition profile WZM_HS_KB_e
3)	see definition profile WZM_HS_Fr_r
5) 6) 8)	see definition profile WZM_SA_acc_r
7)	see definition profile DRM_S1_acc_r
9) 10) 11) 12) 13) 14) 15) 16)	see definition profile UEL_P_e

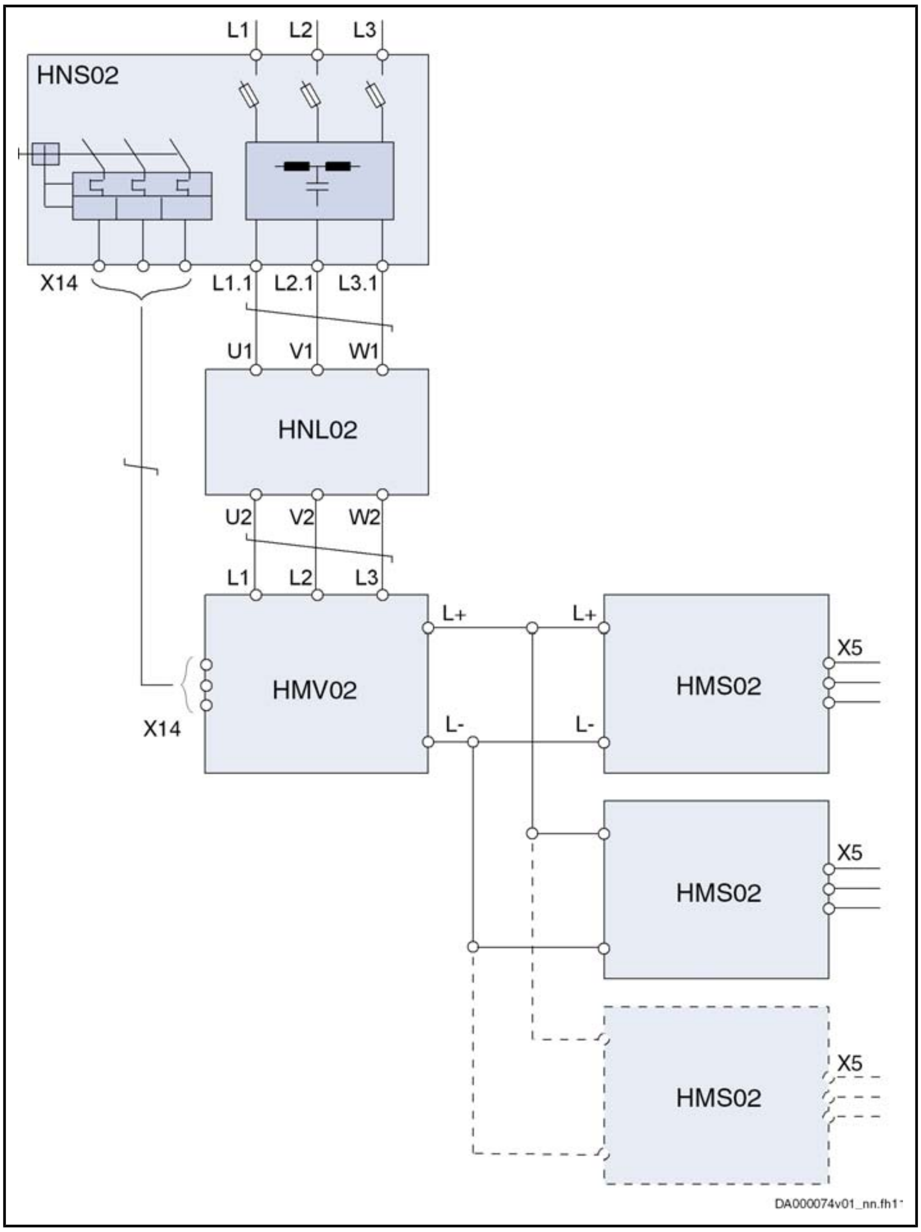
Fig.7-63: *HMV....R - Examples of allowed performance profiles*

7.4.5 Connections and Interfaces

Overview

Overall Connection Diagram

Overall connection diagram with mains filter, mains choke, supply unit, power section



HNS02	mains filter
HNL02	mains choke
HMV02	supply unit
HMS02	power section

Fig. 7-64: Overall connection diagram (mains filter, mains choke, supply unit, power section)

Overall connection diagram of supply unit

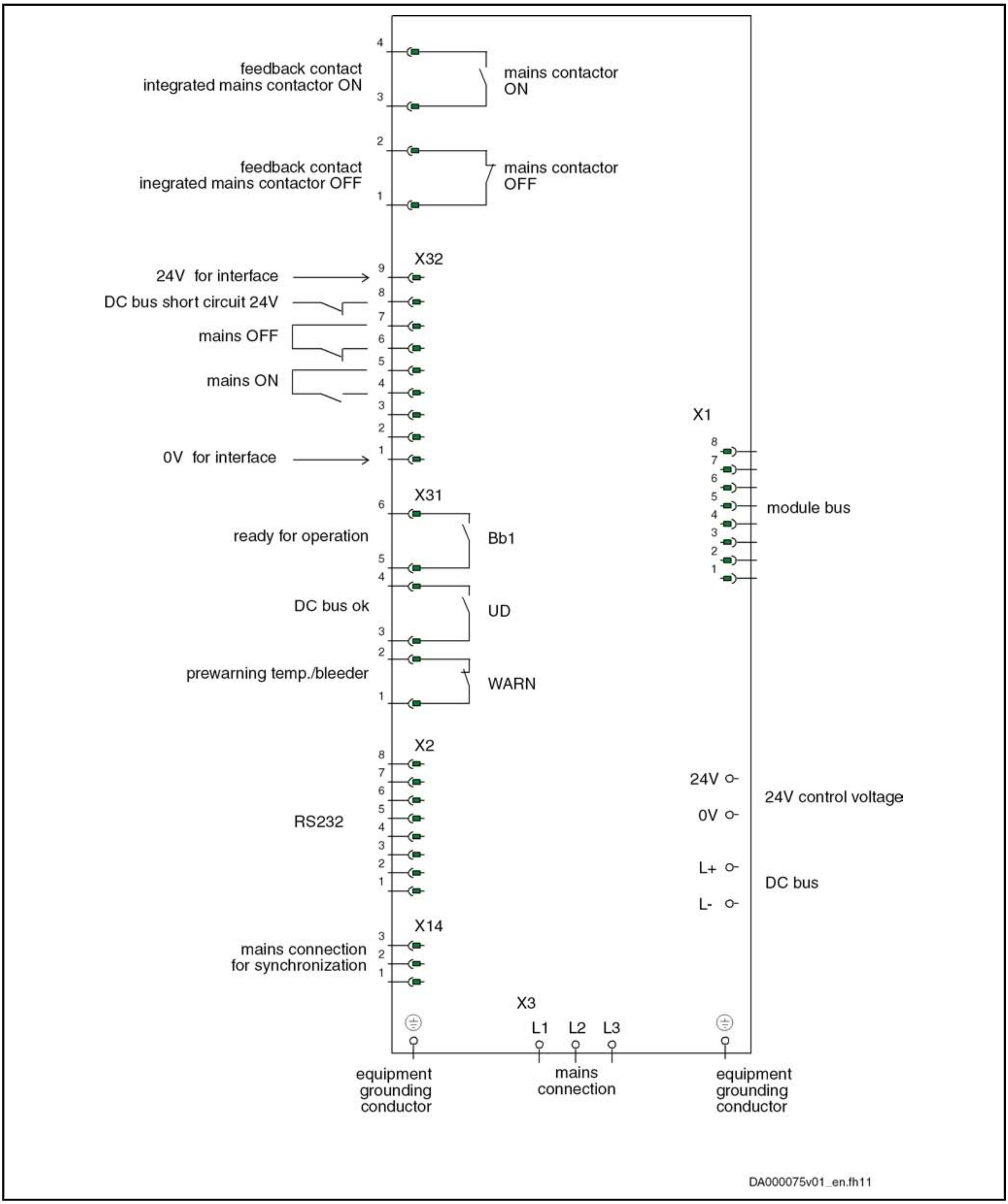
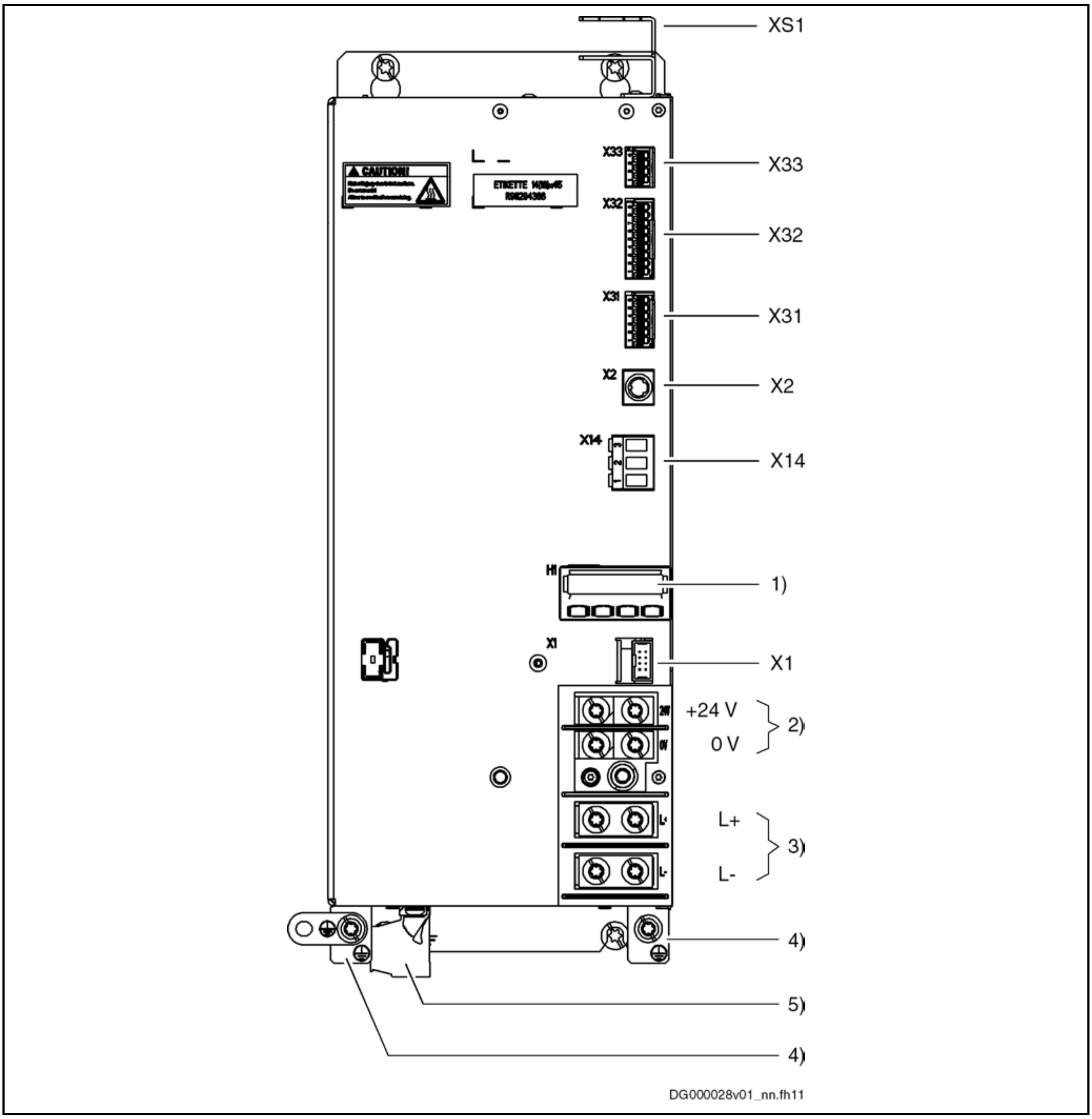


Fig.7-65: Connection diagram

Arrangement of the Connection Points



XS1	shield connection for control lines
X33	acknowledge messages of mains contactor
X32	mains contactor control and DC bus short circuit (ZKS)
X31	connection for messages
X2	RS232
X14	mains voltage synchronization
X1	module bus
1)	control panel
2)	control voltage
3)	DC bus
4)	connection of equipment grounding conductor
5)	mains connection

Fig.7-66: Connections HMV02.1R

Description of the Connection Points

The connection points are described in detail in chapter 8 Functions and Electrical Connection Points , page 241.

Touch Guard The touch guard is described in detail in chapter 9 Touch Guard at Devices , page 291.

8 Functions and Electrical Connection Points

8.1 Overview of Functions, Power Sections and Supply Units

The table below shows the most important hardware functions which the devices provide.

Functions	Device	Connection point	Description / properties
General			
data exchange via module bus	HCS02[1] HCS03 HMS01 HMS02 HMV01 HMV02	X1	Information on the status of the drive controllers is exchanged via the module bus.
commissioning and service interface	HMV01 HMV02 control sections	X2	serial interface RS232
24V supply			
integrated control voltage supply	HCS02.1E-…-NxxV (optional equipment)	-	24V supply is generated from the DC bus via a switching power supply unit. U_{DC} > 200 V
	HCS03.1E-…-xxxV	-	24V supply is generated from the DC bus via a switching power supply unit. U_{DC} > 300 V
plug with screw flange	HCS02	X13	
screw connection	HCS03 HMS01 HMS02 HMV01 HMV02	+24V; 0V	Provides the option to “loop through” the supply via contact bars.
Message contacts			
message ready for operation (Bb)	HMV01 HMV02	X31	Floating contact which shows the status of the drive controller.
message DC bus (UD)	HMV01 HMV02	X31	Floating contact which shows the status of the DC bus of the supply unit.
message warning (WARN)	HMV01 HMV02	X31	Floating contact which shows the status of the drive controller.
Mains input			

---

[1] *not available for HCS02.1E-W0012*

Functions	**Device**	**Connection point**	**Description / properties**
for supply with mains voltage, infeeding and regenerative	HMV01.1R HMV02.1R	X3	
for supply with mains voltage, infeeding	HMV01.1E HCS02.1E HCS03.1E	X3	
input mains voltage synchronization	HMV01.1R HMV02.1R	X14	used for synchronizing regeneration stage with supply mains at X3
plug with screw flange	HCS02.1E-W0012…0070 HCS03.1E-W0070	X3	
screw connection	HCS03.1E-W0100…0210	X3	
Mains contactor and mains control			
integrated mains contactor	HMV01[2] HMV02.1R	-	
external mains contactor	HCS02 HCS03 HMV01.1R-W0120	-	
contact for controlling the external mains contactor	HMV01.1R-W0120	X34	
input for N/O contact (EIN)	HMV01[3]	X32	connection for ON switch of mains connection
input for N/C contact (AUS)	HMV01[4]	X32	connection for OFF switch of mains connection
integrated feedback contacts	HMV **with** integrated mains contactor	X33	1 N/O contact and 1 N/C contact
inputs for feedback contacts	HMV **without** integrated mains contactor	X40	for 1 N/O contact and 1 N/C contact
DC bus functions			
connection for DC bus	HMV HMS HMD HCS[5]	terminal block L+; L-	Provides the option to “loop through” the supply via contact bars.

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[2] *not available for HMV01.1R-W0120*

[3] *not available for HMV01.1R-W0120*

[4] *not available for HMV01.1R-W0120*

Functions	Device	Connection point	Description / properties
controlled DC bus voltage	HMV01.1R HMV02.1R		
input DC bus short circuit (ZKS)	HMV01.1E HLB01.1C, D	X32	Input via which the ZKS stage can be controlled.
Braking resistor			
built-in braking resistor	HCS02 HMV01[6)] HMV02	-	
connection external braking resistor	HCS02.1E-W0054…0070 HCS03.1E-W0070…0210	X9	connection for HLR braking resistors
braking resistor switch-on threshold	HMV01.1E	X32	This input determines how the switch-on threshold of the built-in braking resistor is generated.
braking resistor switch-on threshold active, in spite of failure of external 24V supply	HCS02.1E-Wxxxx-A-03-NxxV HCS03.1E-Wxxxx-A-05-xxBV	-	supply from DC bus via integrated switching power supply unit
Motor output			
input motor temperature monitoring	HCS HMS HMD	X6	input (per axis) used to connect sensor of motor temperature evaluation
output for controlling motor holding brake via **electronic** contact	HMS01 HMD01 HCS03	X6	output (per axis) via which motor holding brake can be controlled
output for controlling motor holding brake via **electromechanic** contact	HCS02 HMS02	X6	output (per axis) via which motor holding brake can be controlled
plug with screw flange	HCS02.1E-W0012…0070 HCS03.1E-W0070	X5	
screw connection	HCS03.1E-W0100…W0210 HMV01	X5	
Others			

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5) not available for HCS02.1E-W0012

6) not available for HMV01.1R-W0120

Functions	Device	Connection point	Description / properties
cable shield - control lines	HMS HMD	XS1	shield connection control lines
cable shield - motor lines	HMS HMD	XS2	for accessory HAS02 shield connection motor cable
supply external blower unit HAB01	HMV01.1R-W0120	X13	system-internal connection
blower control depending on cooling system load	HCS02.1E-Wxxxx-A-03-LxxN HCS03.1E-Wxxxx-A-05-LxxV	-	reduces noise development in operation under partial load
mechanical receptacle for braking resistor HLR01 at the top	HCS03.1E-W0070…210	-	allows ventilating braking resistor HLR in “outlet air” of converter
mechanical receptacle for mains filter HNK01 and motor filter HMF01 at the bottom	HCS03.1E-W0070…210	-	allows ventilating mains filter HNK01 and motor filter HMF01 in “supply air” of converter

Fig.8-1: Functions

8.2 Electrical Connection Points – Overview

Connection point	Device	Brief description
X1	HCS02[7)] HCS03 HMS01 HMS02 HMD01 HMV01 HMV02 HLB01	module bus connection in drive system
X2	HMV01 HMV02	commissioning and service interface
X3	HCS02 HCS03 HMV01 HMV02	mains connection
X5	HCS02 HCS03 HMS01 HMS02	inverter output connection to motor

7) *not available at HCS02.1E-W0012*

Connection point	Device	Brief description
X5.1 X5.2	HMD01	inverter output connection to motor
X6	HCS02 HCS03 HMS01 HMS02	connection for temperature monitoring and holding brake connection to motor
X6.1 X6.2	HMD01	connection for temperature monitoring and holding brake connection to motor
X9	HCS02.1E-W0054 HCS02.1E-W0070 HCS03.1E-Wxxxx-xxBx	connection external braking resistor
X13	HCS02.1E	control voltage (24V, 0V)
X13	HMV01.1R-W0120	system-internal connection supply of external blower unit HAB01
X14	HMV01.1R HMV02.1R HNS02	mains voltage synchronization
X31	HMV01 HMV02 HLB01	messages Bb1, UD, WARN UD not available for HLB01
X32	HMV01 HMV02	mains contactor control and DC bus short circuit (ZKS)
X32	HLB01	DC bus short circuit control, clear errors, braking resistor switch-on threshold
X33	HMV01 HMV02	provides message signals of the integrated mains contactor
X34	HMV01.1R-W0120	contact for controlling the external mains contactor
X40[8)]	HMV01.1R-W0120	receives message signals of the external mains contactor
X41.1; X41.2	HNS02	converter from D-Sub to terminal blocks for connections “optional safety technology modules L1, S1” at control sections
+24V; 0V	HCS03 HMS01 HMS02 HMD01 HMV01 HMV02	control voltage supply connections integrated in terminal block

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[8)] *HWI ≥ A11; HWI < A11: X33*

Connection point	Device	Brief description
L+; L-	HCS02[9] HCS03 HMS01 HMS02 HMD01 HMV01 HMV02	DC bus connection connections integrated in terminal block
XS1	HCS02 HMS HMD	shield connection, control lines cable shields
XS2	HCS02 HMS HMD	shield connection, motor cable connection for accessory HAS02
ground connection	all	connection of housing to ground potential
⏚	all	equipment grounding conductor connection of the component

Fig.8-2: Electrical connection points – overview

8.3 X1, Module Bus

Function, Pin Assignment

The module bus is an **internal system connection** used for data exchange between the drive controllers.

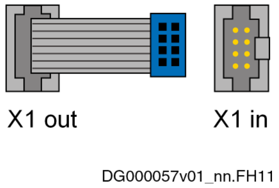
View	Identification	Function
	X1 in	to plug in module bus connector
	X1 out	passes module bus connection to neighboring drive controller

Fig.8-3: X1, module bus

Notes on Installation

Keep ribbon cable in parking position, when neighboring device is not connected.

8.4 X2, Serial Interface (RS232)

8.4.1 General Information

The serial interface (RS232) is required for programming, parameterization and diagnosis during commissioning and servicing.

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[9] not available at HCS02.1E-W0012

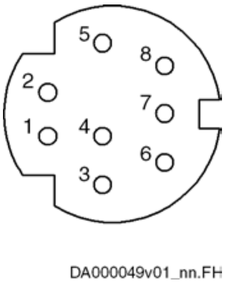
Connection point	Type	No. of poles	Stranded wire [mm²]	Description	Figure
X2	MiniDin, female (device)	8	0,25–0,5	serial interface	

Fig.8-4: Connections

Pin Assignment

Pin	Signal	Function
1	RTS	request to send
2	CTS	clear to send
3	TxD	transmit data
4	GND	reference potential
5	RxD	receive data
6	V_{cc}	supply voltage
7	n. c.	n. c.
8	n. c.	n. c.

n. c. not connected

Fig.8-5: Pin assignment of serial interface

Features

Feature	Unit	Min.	Typ.	Max.
number of nodes				1
allowed cable length	m			15
transmission rates	kBaud	9,6		115
connection		galvanically connected to control section supply		
allowed voltage difference between reference potentials of control section and data end device	V			1

Fig.8-6: Features

☞ The accessory **HAS05.1-005** makes available a converter from RS232 to RS485 (see Project Planning Manual "Rexroth IndraDrive - Drive System", chapter "Accessories").

8.4.2 Connection Diagrams Serial Interface to PC

Serial Interface to PC With 9-Pin D-Sub

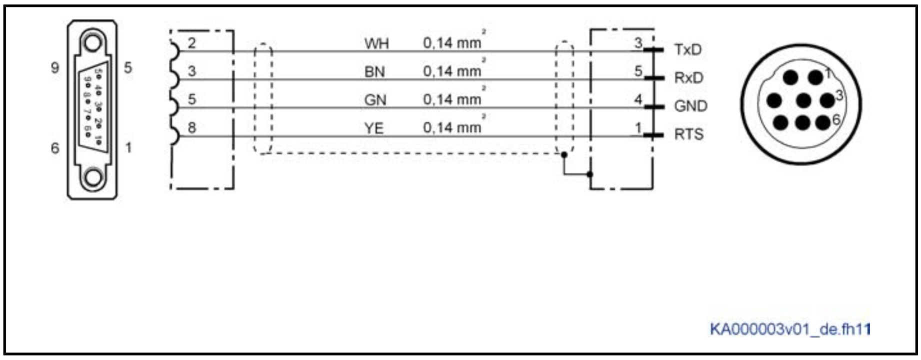


Fig.8-7: Connection of serial interface to PC with 9-pin D-Sub

☞ For **direct** connection to the serial interface, use our cable **IKB0041** .

Serial Interface to PC With 25-Pin D-Sub

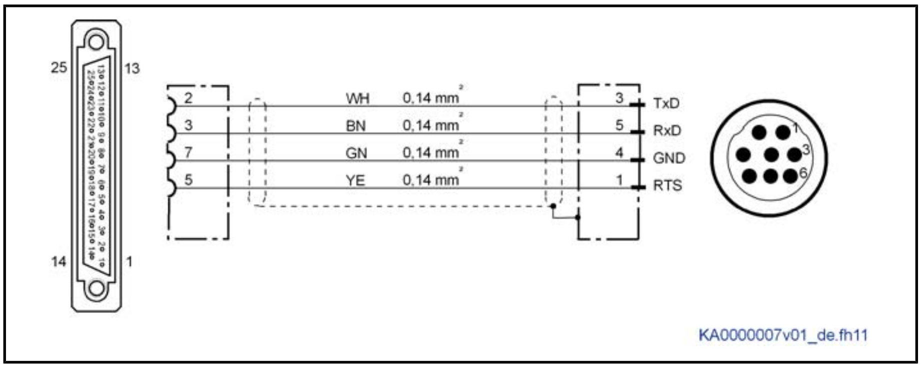


Fig.8-8: Connection of serial interface to PC with 25-pin D-Sub

8.5 X3, Mains Connection

8.5.1 Important Notes

DANGER

Lethal electric shock caused by live parts with more than 50 V!

Exclusively operate the device with plugged on connector and connected equipment grounding conductor!

Notes on Installation

Dimension the **required cross section** of the connection cables according to the determined phase current I_{LN} and the mains fuse.

☞

Equipment grounding conductor: material and cross section

For the equipment grounding conductor, use the same metal (e.g. copper) as for the outer conductors.

For the connections from the equipment grounding conductor connection of the device to the equipment grounding conductor system in the control cabinet, make sure the cross sections of the lines are sufficient.

Cross sections of the equipment grounding connections:

- for **HCS03.1E** drive controllers and **HMV01** supply units, **at least 10 mm^2** , but not smaller than the cross sections of the outer conductors of the mains supply feeder
- for **HCS02.1E** drive controllers, **at least 4 mm^2** , but not smaller than the cross sections of the outer conductors of the mains supply feeder

  Additionally, mount the housing of HCS02.1E to a bare metal mounting plate. Connect the mounting plate, too, with at least the same cross section to the equipment grounding conductor system in the control cabinet.

For outer conductors with a cross section greater than 16 mm^2, you can reduce the cross section of the equipment grounding connection according to the table "Cross section of equipment grounding conductor, excerpt from EN 61800-5-1:2003".

Cross-sectional area A of outer conductors	Minimum cross-sectional area A_{PE} of equipment grounding connection
$A \le 16\ \text{mm}^2$	A
$16\ \text{mm}^2 < A \le 35\ \text{mm}^2$	16
$35\ \text{mm}^2 < A$	A / 2

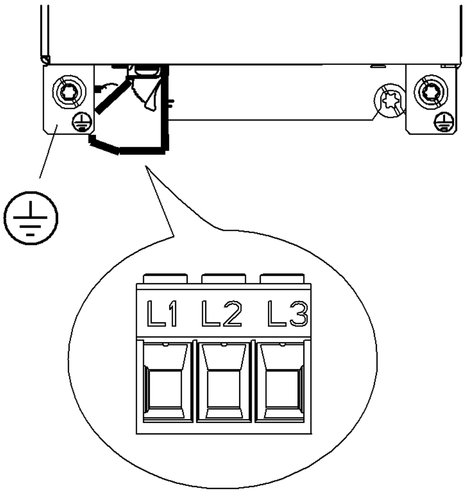
Fig.8-9: Cross section of equipment grounding conductor, excerpt from EN 61800-5-1:2003, table 2

CAUTION

Damage to the device!

Provide strain relief for the terminal connectors of the device in the control cabinet or use the optionally available connection accessory HAS02.

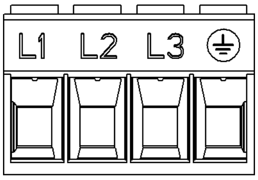
8.5.2 X3, Mains Connection HMV02.1R-W0015

View	Identification	Function 3-phase operation
 DA000181v01_nn.FH11	L1	connection to supply mains (L1)
	L2	connection to supply mains (L2)
	L3	connection to supply mains (L3)
	⏚	connection of equipment grounding conductor of drive controller

Screw connection at connector	Unit	Min.	Max.
tightening torque	Nm	1,5	1,7
connection cable stranded wire	mm^2	1,5	6
	AWG	16	10
occurring current load and minimum required connection cross section	A	see Technical Data of device used (I_{L_cont}, I_{L_max} and A_{LN})	
occurring current load	V	see Technical Data of device used (U_{LN})	

Fig.8-10: Function, pin assignment, properties

8.5.3 X3, Mains Connection HCS02.1E-W0012, -W0028

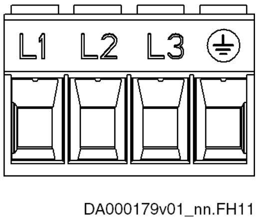
View	Identification	Function 3-phase operation	Function 1-phase operation
 DA000179v01_nn.FH11	L1	connection to supply mains (L1)	
	L2	connection to supply mains (L2)	connection to neutral conductor supply mains
	L3	connection to supply mains (L3)	n.c.
	⏚	connection of equipment grounding conductor of drive controller	

Screw connection at connector	Unit	Min.	Max.
tightening torque	Nm	0,5	0,6
connection cross section stranded wire	mm^2 / AWG	1,5 / 16	4 / 10

occurring current load and minimum required connection cross section	A	see technical data of device used (I_{L_cont}, I_{L_max} and A_{LN})
occurring voltage load	V	see technical data of device used (U_{LN})

Fig.8-11: Function, pin assignment, properties

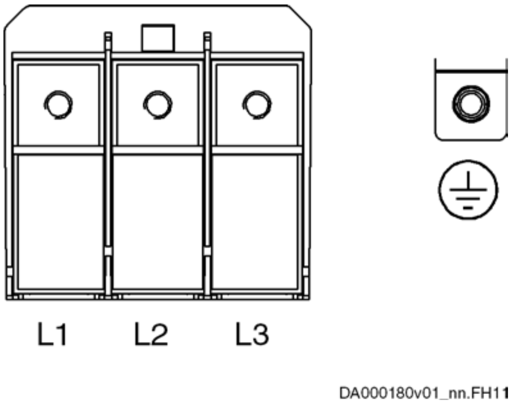
8.5.4 X3, Mains Connection HCS02.1E-W0054, -W0070 and HCS03.1E-W0070

View	Identification	Function 3-phase operation	Function 1-phase operation[1]
	L1	connection to supply mains (L1)	
	L2	connection to supply mains (L2)	connection to neutral conductor supply mains
	L3	connection to supply mains (L3)	n.c.
	⏚	connection of equipment grounding conductor of drive controller	
Screw connection at connector	**Unit**	**Min.**	**Max.**
tightening torque	Nm	1,5	1,7
connection cross section stranded wire	mm² / AWG	1,5 / 16	16 / 6
occurring current load and minimum required connection cross section	A	see technical data of device used (I_{L_cont}, I_{L_max} and A_{LN})	
occurring voltage load	V	see technical data of device used (U_{LN})	

1) only allowed for HCS02.1E drive controllers

Fig.8-12: Function, pin assignment, properties

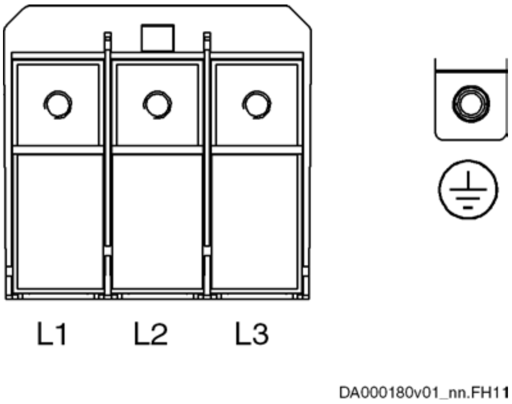
8.5.5 X3, Mains Connection HCS03.1E-W0100…0150 and HMV01.1R-W0018…0065; HMV01.1E-W0030…0075

View	Identification	Function
	L1	connection to supply mains (L1)
	L2	connection to supply mains (L2)
	L3	connection to supply mains (L3)
	⏚	connection of equipment grounding conductor of drive controller
Terminal block	**Unit**	**Min.**	**Max.**

screw thread		M6	
tightening torque	Nm	5,5	6,5
connection cables stranded wire with ring cable lug	mm^2	1×16; 1×25; 1×35; 1×50 2×25; 2×35; 2×50 2×16 with accessories	
	AWG	1×6; 1×4; 1×2; 1×1 2×4; 2×2; 2×1 2×6 with accessories	
occurring current load and minimum required connection cross section	A	see technical data of device used (I_{L_cont}, I_{L_max} and A_{LN})	
occurring voltage load	V	see technical data of device used (U_{LN})	

Fig.8-13: Function, pin assignment, properties

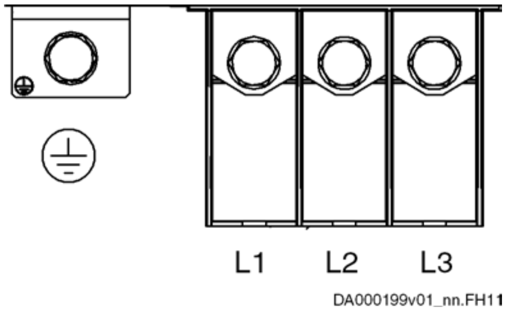
8.5.6 X3, Mains Connection HCS03.1E-W0210

View	Identification	Function
	L1	connection to supply mains (L1)
	L2	connection to supply mains (L2)
	L3	connection to supply mains (L3)
	⏚	connection of equipment grounding conductor of drive controller

Terminal block	Unit	Min.	Max.
screw thread		M10	
tightening torque	Nm	16	20
connection cables stranded wire with ring cable lug	mm^2	1×16; 1×25; 1×35; 1×50 2×25; 2×35; 2×50 2×16 with accessories	
	AWG	1×6; 1×4; 1×2; 1×1 2×4; 2×2; 2×1 2×6 with accessories	
occurring current load and minimum required connection cross section	A	see technical data of device used (I_{L_cont}, I_{L_max} and A_{LN})	
occurring voltage load	V	see technical data of device used (U_{LN})	

Fig.8-14: Function, pin assignment, properties

8.5.7 X3, Mains Connection HMV01.1E-W0120 and HMV01.1R-W0120

View	Identification	Function 3-phase operation
	L1	connection to supply mains (L1)
	L2	connection to supply mains (L2)
	L3	connection to supply mains (L3)
	⏚	connection of equipment grounding conductor of drive controller

Terminal block	Unit	Min.	Max.
screw thread		M10	
tightening torque	Nm	16	20
connection cables stranded wire with ring cable lug	mm^2	1×16; 1×25; 1×35; 1×50; 1×70; 1×120 2×16 (with different angles) 2×25; 2×35; 2×50; 2×70; 2×120	
	AWG	1×6; 1×4; 1×2; 1×1; 1×1/0; 1×2/0; 1×4/0 2×6 (with different angles) 2×4; 2×2; 2×1; 2×1/0; 2×2/0; 2×4/0	
occurring current load and minimum required connection cross section	A	see technical data of device used (I_{L_cont}, I_{L_max} and A_{LN})	
occurring voltage load	V	see technical data of device used (U_{LN})	

Fig.8-15: X3, mains connection

8.6 X5, Motor Connection

8.6.1 Important Notes

DANGER

Lethal electric shock caused by live parts with more than 50 V!

Exclusively operate the device with plugged on connector and connected equipment grounding conductor!

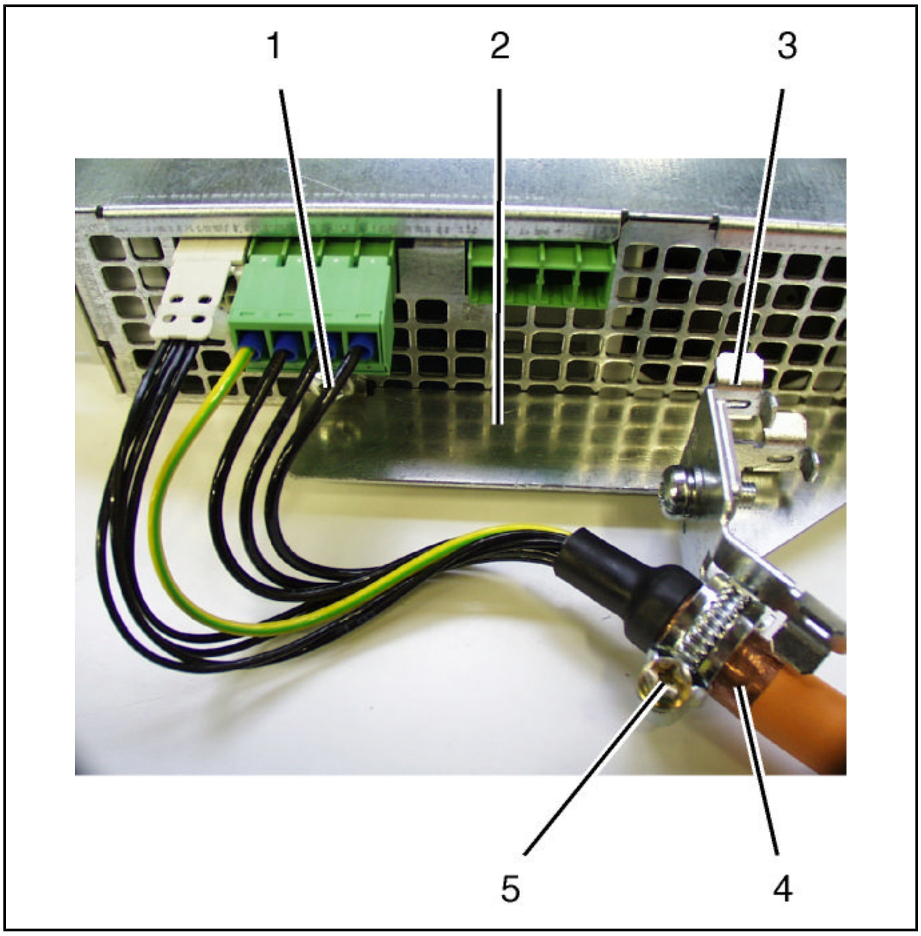
Notes on Installation

The connection cross section data refer to the line cross sections which can be connected. Dimension the **required cross section** of the connecting lines according to the occurring current load by the motor which is used.

CAUTION

Damage to the device!

Provide strain relief for the terminal connectors of the device in the control cabinet or use the optionally available connection accessory HAS02.



1	screw in thread XS2
2	sheet metal of accessories
3	fixing device
4	shield of motor cable
5	clip

Fig.8-16: *Strain relief, shield connection of motor cable with accessory HAS02 - example HCS02*

☞

- For optimum shield contact of the motor power cable, use our accessory HAS02, where possible.
- For the connection between drive controller and motor use our ready-made motor power cables, where possible (see documentation “Rexroth Connection Cables - Selection Data”).
- When using NFD03.1 mains filters, the maximum allowed conductor cross section is limited to 4 mm^2.
- For selecting the motor cables, observe the information contained in the section “Connection Cables to Motor” in the documentation “Rexroth IndraDrive Drive System - Project Planning Manual”.

Coding of the Connectors

☞ At the **HMD** power sections with two inverter outputs, the outputs have been coded, i.e. provided with a coding section. This avoids accidentally interchanging the two cables.

Coding

- X5.1: coding section at pin 2
- X5.2: coding section at pin 1

For ready-made Rexroth motor power cables, you therefore have to change the coding of the **male connector at the motor power cable** for **X5.2**, i.e. put the coding section at the male connector (not at the female connector at the drive controller) from pin 1 to pin 2. For X5.1, you do not need to change the coding of the male connector at the motor power cable.

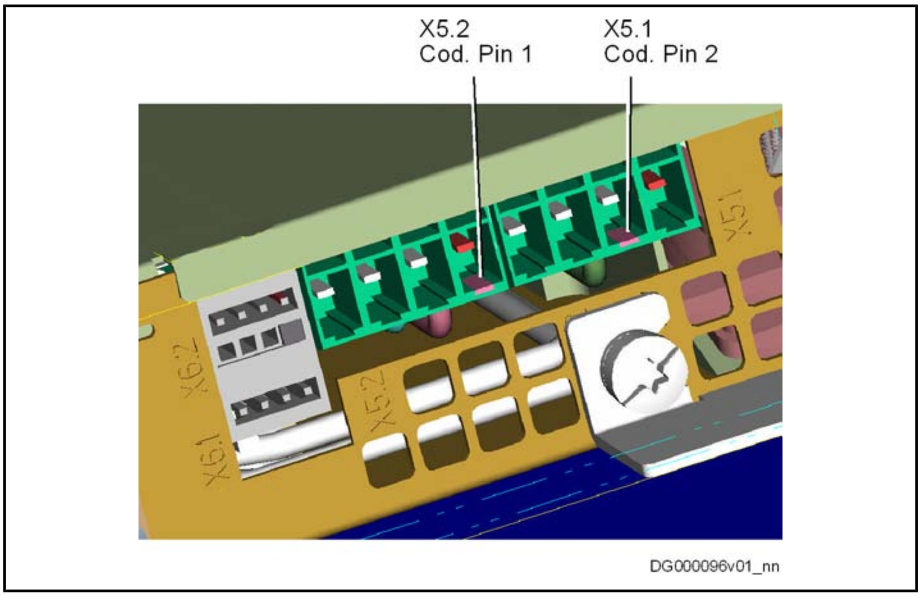
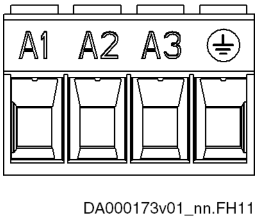


Fig.8-17: Coding of X5.1 and X5.2

8.6.2 X5, Motor Connection HCS02.1E-W0012, -W0028 and HMS01.1N-W0020, -W0036 and HMD01.1N-W0012…0036 and HMS02.1N-W0028

<table>
<tr><th>View</th><th>Identification</th><th colspan="2">Function</th></tr>
<tr><td rowspan="4">
</td><td>A1</td><td colspan="2">for power connection U1 at motor</td></tr>
<tr><td>A2</td><td colspan="2">for power connection V1 at motor</td></tr>
<tr><td>A3</td><td colspan="2">for power connection W1 at motor</td></tr>
<tr><td>⏚</td><td colspan="2">for equipment grounding conductor of motor</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td>Screw connection at connector</td><td>Unit</td><td>Min.</td><td>Max.</td></tr>
<tr><td>tightening torque</td><td>Nm</td><td>0,5</td><td>0,6</td></tr>
</table>

connection cable stranded wire	mm^2	1,5	4
	AWG	16	10
occurring current load and minimum required connection cross section	A	see Technical Data of device used (I_{out})	
occurring voltage load	V	see Technical Data of device used (U_{out})	
short circuit protection		A1, A2, A3 against each other and each of them against ground	

Fig.8-18: Function, pin assignment, properties

8.6.3 X5, Motor Connection HCS02.1E-W0054, -W0070 and HCS03.1E-W0070 and HMS01.1N-W0054, -W0070 and HMS02.1N-W0054

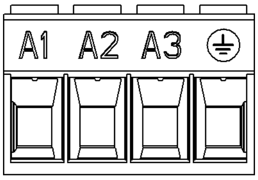
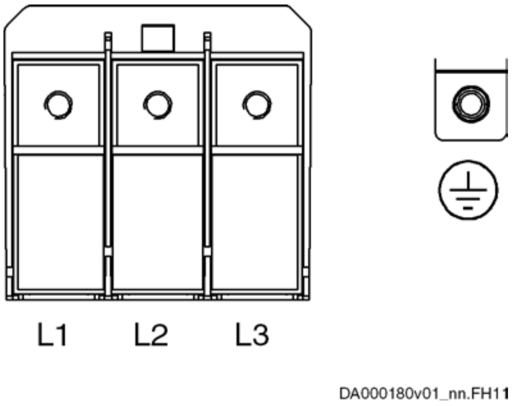
View	Identifica-tion	Function	
	A1	for power connection U1 at motor	
	A2	for power connection V1 at motor	
	A3	for power connection W1 at motor	
	⏚	for equipment grounding conductor of motor	
Screw connection at connector	**Unit**	**Min.**	**Max.**
tightening torque	Nm	1,5	1,7
connection cable stranded wire	mm^2	1,5	16
	AWG	16	6
occurring current load and minimum required connection cross section	A	see Technical Data of device used (I_{out})	
occurring voltage load	V	see Technical Data of device used (U_{out})	
short circuit protection		A1, A2, A3 against each other and each of them against ground	

Fig.8-19: Function, pin assignment, properties

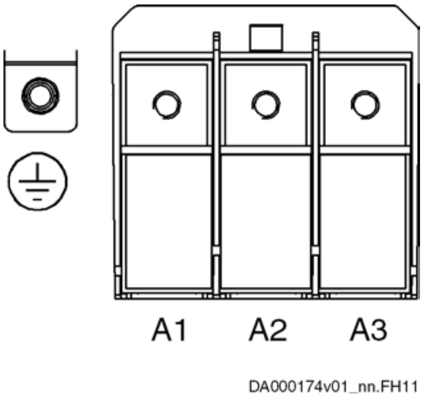
8.6.4 X5, Motor Connection HMS01.1N-W0110

View	Identification	Function
	A1	for power connection U1 at motor
	A2	for power connection V1 at motor
	A3	for power connection W1 at motor
	⏚	for equipment grounding conductor of motor

Terminal block	Unit	Min.	Max.
screw thread		M6	
tightening torque	Nm	5,5	6,5
connection cables stranded wire with ring cable lug	mm^2	1×16; 1×25; 1×35 2×16; 2×25; 2×35	
	AWG	1×6; 1×4; 1×2; 1×1 2×6; 2×4; 2×2; 2×1	
occurring current load and minimum required connection cross section	A	see technical data of device used (I_{out})	
occurring voltage load	V	see technical data of device used (U_{out})	
short circuit protection		A1, A2, A3 against each other and each of them against ground	

Fig.8-20: Function, pin assignment, properties

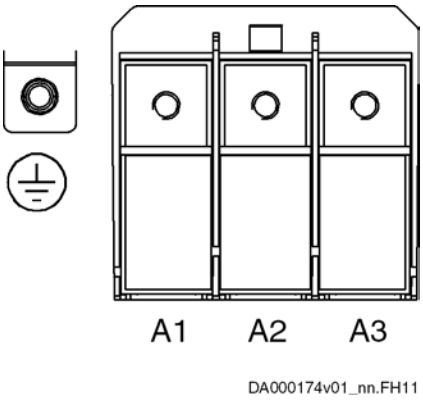
8.6.5 X5, Motor Connection HCS03.1E-W0100…0150 and HMS01.1N-W0150…0210

View	Identification	Function
	A1	for power connection U1 at motor
	A2	for power connection V1 at motor
	A3	for power connection W1 at motor
	⏚	for equipment grounding conductor of motor

Terminal block	Unit	Min.	Max.
screw thread		M6	
tightening torque	Nm	5,5	6,5
connection cables stranded wire with ring cable lug	mm^2	1×16; 1×25; 1×35; 1×50 2×25; 2×35; 2×50 2×16 with accessories	
	AWG	1×6; 1×4; 1×2; 1×1 2×4; 2×2; 2×1 2×6 with accessories	
occurring current load and minimum required connection cross section	A	see technical data of device used (I_{L_cont}, I_{L_max} and A_{LN})	
occurring voltage load	V	see technical data of device used (U_{LN})	
short circuit protection		A1, A2, A3 against each other and each of them against ground	

Fig.8-21: Function, pin assignment, properties

8.6.6 X5, Motor Connection HCS03.1E-W0210

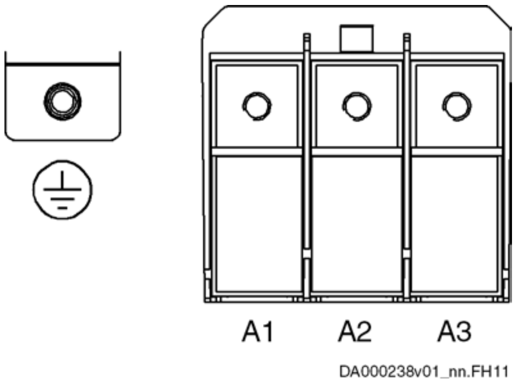
View	Identification	Function
	A1	for power connection U1 at motor
	A2	for power connection V1 at motor
	A3	for power connection W1 at motor
	⏚	for equipment grounding conductor of motor

Terminal block	Unit	Min.	Max.
screw thread		M10, ⏚ M8	
tightening torque	Nm	16	20
connection cables stranded wire with ring cable lug	mm^2	1×16; 1×25; 1×35; 1×50 2×25; 2×35; 2×50 2×16 with accessories	
	AWG	1×6; 1×4; 1×2; 1×1 2×4; 2×2; 2×1 2×6 with accessories	

occurring current load and minimum required connection cross section	A	see technical data of device used (I_{L_cont}, I_{L_max} and A_{LN})
occurring voltage load	V	see technical data of device used (U_{LN})
short circuit protection		A1, A2, A3 against each other and each of them against ground

Fig.8-22: Function, pin assignment, properties

8.6.7 X5, Motor Connection HMS01.1N-W0350

View	Identification	Function
	A1	for power connection U1 at motor
	A2	for power connection V1 at motor
	A3	for power connection W1 at motor
	⏚	for equipment grounding conductor of motor

Terminal block	Unit	Min.	Max.
screw thread		M10	
tightening torque	Nm	16	20
connection cables stranded wire with ring cable lug	mm^2	1×16; 1×25; 1×35; 1×50; 1×70; 1×120 2×16, 2×25; 2×35; 2×50; 2×70; 2×120	
	AWG	1×6; 1×4; 1×2; 1×1; 1×1/0; 1×2/0; 1×4/0 2×6; 2×4; 2×2; 2×1; 2×1/0; 2×2/0; 2×4/0	
occurring current load and minimum required connection cross section	A	see technical data of device used (I_{L_cont}, I_{L_max} and A_{LN})	
occurring voltage load	V	see technical data of device used (U_{LN})	
short circuit protection		A1, A2, A3 against each other and each of them against ground	

Fig.8-23: X5, motor connection

8.7 X6, Motor Temperature Monitoring and Motor Holding Brake

8.7.1 Important Notes

DANGER

Lethal electric shock caused by live parts with more than 50 V!

Exclusively operate the device with plugged on connector and connected equipment grounding conductor!

DANGER

Dangerous movements! Danger to personnel from falling or dropping axes!

The standard motor holding brake provided or an external motor holding brake controlled directly by the drive controller are not sufficient on their own to guarantee the safety of personnel!

Personnel safety must be achieved using higher-ranking, fail-safe procedures:

- Dangerous areas should be blocked off with protective fences or grids
- Additionally secure vertical axes against falling or dropping after switching off the motor power by, for example:
  - mechanically securing the vertical axes
  - providing external braking/catching/clamping mechanisms
  - ensuring sufficient equilibration of the vertical axes

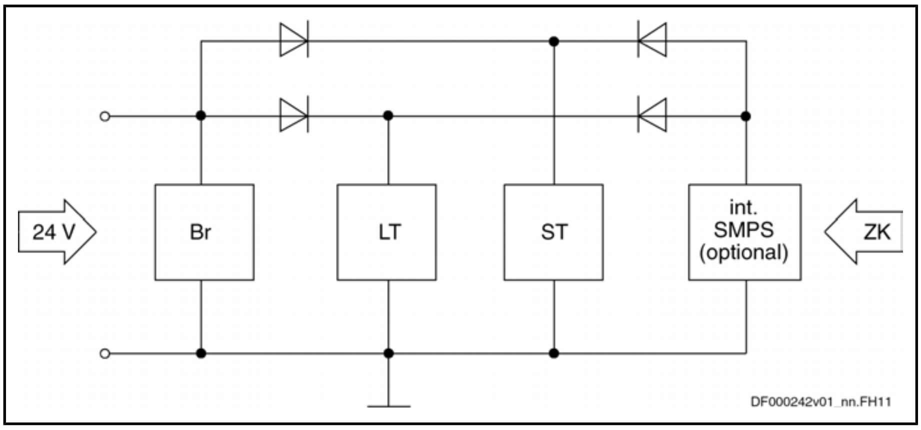
Function

The connection point X6 contains the connections for

- monitoring the motor temperature
- controlling the motor holding brake

☞ Via an integrated contact element (BR), the power section switches the voltage of the **external** 24V supply (connection X13 at HCS02 power sections) to the output for controlling the motor holding brake.

The integrated 24V control voltage supply of power sections of the order code **-NxxV** is not available at the connection point X6 (see figure below “Block diagram of internal control voltage”). Therefore, an **external** 24V supply is required for controlling the motor holding brake.



BR	circuit for brake control
LT	power section, e.g. HCS02
ST	control section, e.g CSB01
ZK	DC bus
int. SMPS	internal switching power supply unit, for types HCS0x.1E-Wxxxx-NxxV

Fig.8-24: Block diagram of internal control voltage

Notes on Installation

☞ Make sure the voltage supply for the motor holding at the motor brake is sufficient. You have to take into account that voltage drops on the supply line. Use connecting lines with the highest possible cross section of the single strands.

☞ An external contact element is required, if motor holding brakes with higher currents than the allowed current load are to be supplied at X6.

Coding of the Connectors

☞ At the **HMD** power sections with two inverter outputs, the outputs have been coded, i.e. provided with a coding section. This avoids accidentally interchanging the two cables.

Coding

- X6.1: coding section at pin 4
- X6.2: coding section at pin 1

For ready-made Rexroth motor power cables, you therefore have to code the **male connector at the motor power cable** accordingly for X6.1 and X6.2:

- for connector X6.1: cut off plastic pin 4 at connector
- for connector X6.2: cut off plastic pin 1 at connector

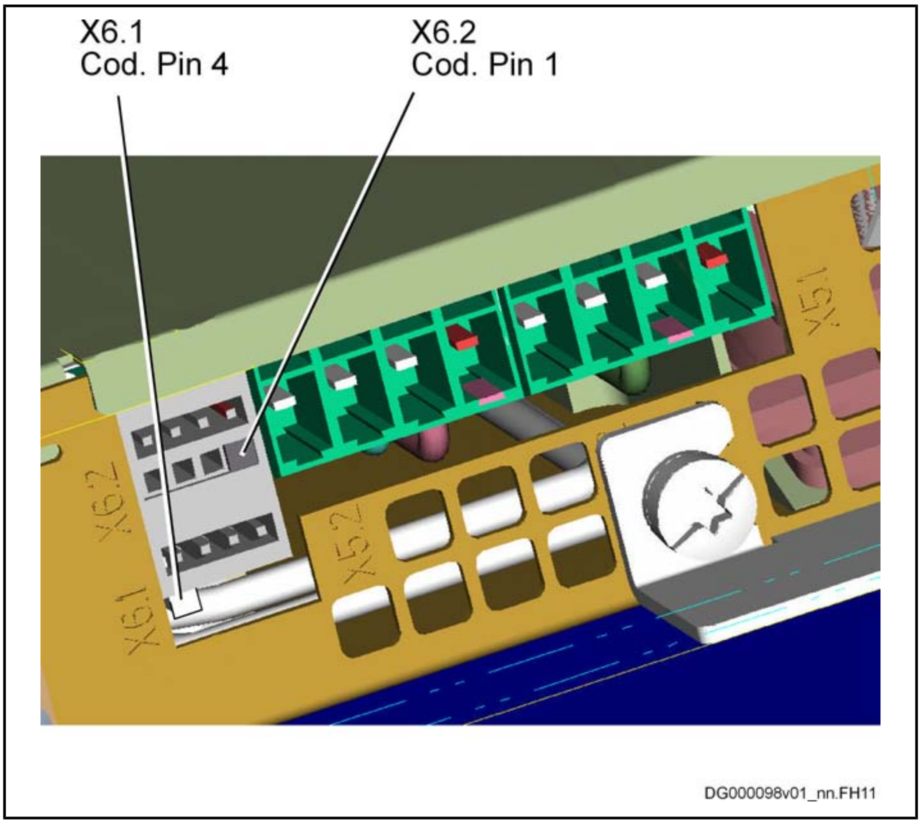
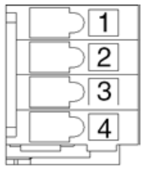


Fig.8-25: Coding of X6.1 and X6.2

8.7.2 Connection Point

View	Connection	Signal name	Function
 DG000097v01_nn.FH11	1	MotTemp+	input motor temperature evaluation
	2	MotTemp-	
	3	+24V	output for controlling the motor holding brake
	4	0V	

Spring terminal (connector)	Unit	Min.	Max.
connection cable solid wire	mm^2	0,5	1,5
connection cable stranded wire	mm^2	0,5	1,5
	AWG	20	16
current load capacity X6.3, X6.4:			
HCS02.1E-W0012; -W0028; -W0054; -W0070	A	-	2
HCS03.1E-W0070; -W0100; -W0150; -W0210	A	-	2
HCS04.1E	A	-	tbd
HMS01.1N-W0020; -W0036	A	-	1,6
HMS01.1N-W0054; -W0070	A	-	2
HMS01.1N-W0110; -W0150; -W0210	A	-	2,5
HMS02.1N-W0028; -W0054	A	-	2
HMD01.1N-W0012; -W0020; -W0036	A	-	1.5 per axis
time constant of load	ms	-	50
number of switching actions at max. time constant of load		250.000	
switching frequency	Hz	-	0,5
short circuit protection		X6.3 against X6.4 (output for controlling the motor holding brake)	
overload protection		X6.3 against X6.4 (output for controlling the motor holding brake)	
integrated contact element for controlling the motor holding brake:			
HCS02.1E HMS02.1N		electromechanical contact	
HCS03.1E HCS04.1E HMS01.1N HMD01.1N		electronic contact	

Fig.8-26: Function, pin assignment

Connection Diagram

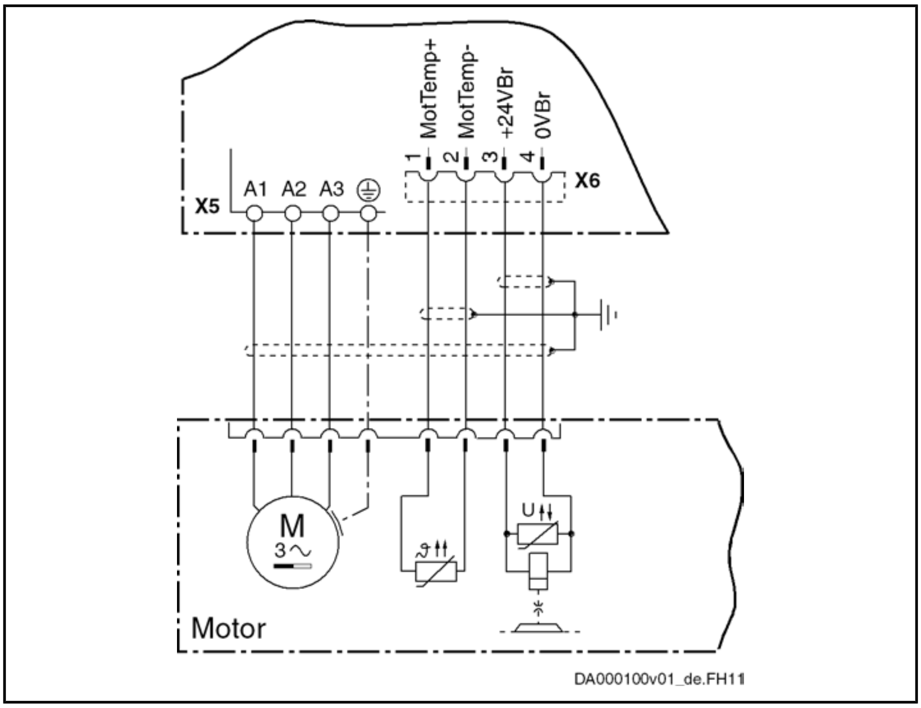


Fig.8-27: Connection of motor temperature monitoring and motor holding brake

8.8 X9, External Braking Resistor

8.8.1 Important Notes

DANGER

Lethal electric shock caused by live parts with more than 50 V!

Exclusively operate the device with plugged on connector and connected equipment grounding conductor!

☞ Keep in mind that you have to parameterize the external braking resistor in the drive controller to protect the drive controller and the braking resistor against overload.

See also Parameter Description of the firmware used

“P-0-0860, Converter configuration”and

“P-0-0858, Data of external braking resistor”

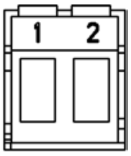
8.8.2 X9, External Braking Resistor HCS02.1E-W0054, -W0070

Function, Pin Assignment

X9 is used to connect an external braking resistor which is controlled via the internal switch.

☞ For HCS02 devices, the connection X9 is contained in all designs, except for -W0012 and -W0028.

For HCS03 devices, the connection X9 is contained in the order code -xxBV.

View	Connection	Signal name	Function
 DA000178v01_nn.FH11	1	n.s.	connection braking resistor
	2	n.s.	connection braking resistor
Screw terminal (connector)	**Unit**	**Min.**	**Max.**
connecting line	mm²	2,5	4
stranded wire	AWG	14	10
tightening torque	Nm	1,5	1,7
current load	A	peak value: 30 r.m.s. value: 15	
voltage load	V	n.s.	
short circuit protection		to be ensured by means of appropriate fusing elements in the mains connection at X3	

n.s. not specified

Fig.8-28: Function, pin assignment

Notes on Installation

Maximum allowed line length to external braking resistor: **5 m**

Twist unshielded lines.

CAUTION

Danger by insufficient installation!

Protect the lines with the appropriate fusing elements in the supply feeder.

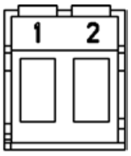
For the connecting lines at X9, use at least the cross section of the lines for mains connection at X3.

8.8.3 X9, External Braking Resistor HCS03.1E-W0070…0210

Function, Pin Assignment

X9 is used to connect an external braking resistor which is controlled via the internal switch.

☞ For HCS03 devices, the connection X9 is contained in the order code -xxBV.

View	Connection	Signal name	Function
 DA000178v01_nn.FH11	1	n.s.	connection braking resistor
	2	n.s.	connection braking resistor
Screw terminal (connector)	**Unit**	**Min.**	**Max.**
HCS03.1E-W0070			

connecting line stranded wire	mm^2	16	
	AWG	6	
tightening torque	Nm	1,5	1,7
HCS03.1E-W0100, -W0150			
connecting line stranded wire	mm^2	25	
	AWG	4	
tightening torque	Nm	2,0	2,5
HCS03.1E-W0210			
connecting line stranded wire	mm^2	50	
	AWG	0	
tightening torque	Nm	8,0	9,0
HCS03.1E			
voltage load	V	n.s.	
short circuit protection		to be ensured by means of appropriate fusing elements in the mains connection at X3	

n.s. not specified

Fig.8-29: Function, pin assignment

Notes on Installation

Maximum allowed line length to external braking resistor: **5 m**

Twist unshielded lines.

CAUTION

Danger by insufficient installation!

Protect the lines with the appropriate fusing elements in the supply feeder.

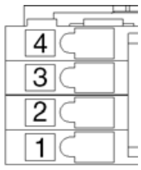
For the connecting lines at X9, use at least the cross section of the lines for mains connection at X3.

8.9 X13, Control Voltage (24V, 0V)

Function, Pin Assignment

The external 24V supply is applied via connection point X13 for

- the power section of the drive controller
- brake control via X6
- the control section of the drive controller with the optional modules, except for such optional modules (e.g. safety technology S1) which require their own power supply

Assignment	Connection	Signal name	Function
 DG000115v01_nn.FH11	4	+24V	power supply and “looping through”
	3	+24V	
	2	0V	reference potential for power supply and “looping through”
	1	0V	
Spring terminal (connector)	**Unit**	**Min.**	**Max.**

connection cross section solid wire	mm^2	1,0	1,5
connection cross section stranded wire	mm^2	1,0	1,5
connection cross section	AWG	18	16
power consumption	W	see P_{N3} (see index entry with reference to the corresponding page)	
voltage load capacity	V	see U_{N3} (see index entry with reference to the corresponding page)	
current carrying capacity “looping through” from +24V to +24V, 0V to 0V continuous current P_{N3}/U_{N3}	A		6
current carrying capacity “looping through” from +24V to +24V, 0V to 0V inrush current I_{EIN3}	A		12
polarity reversal protection		within the allowed voltage range by internal protective diode	

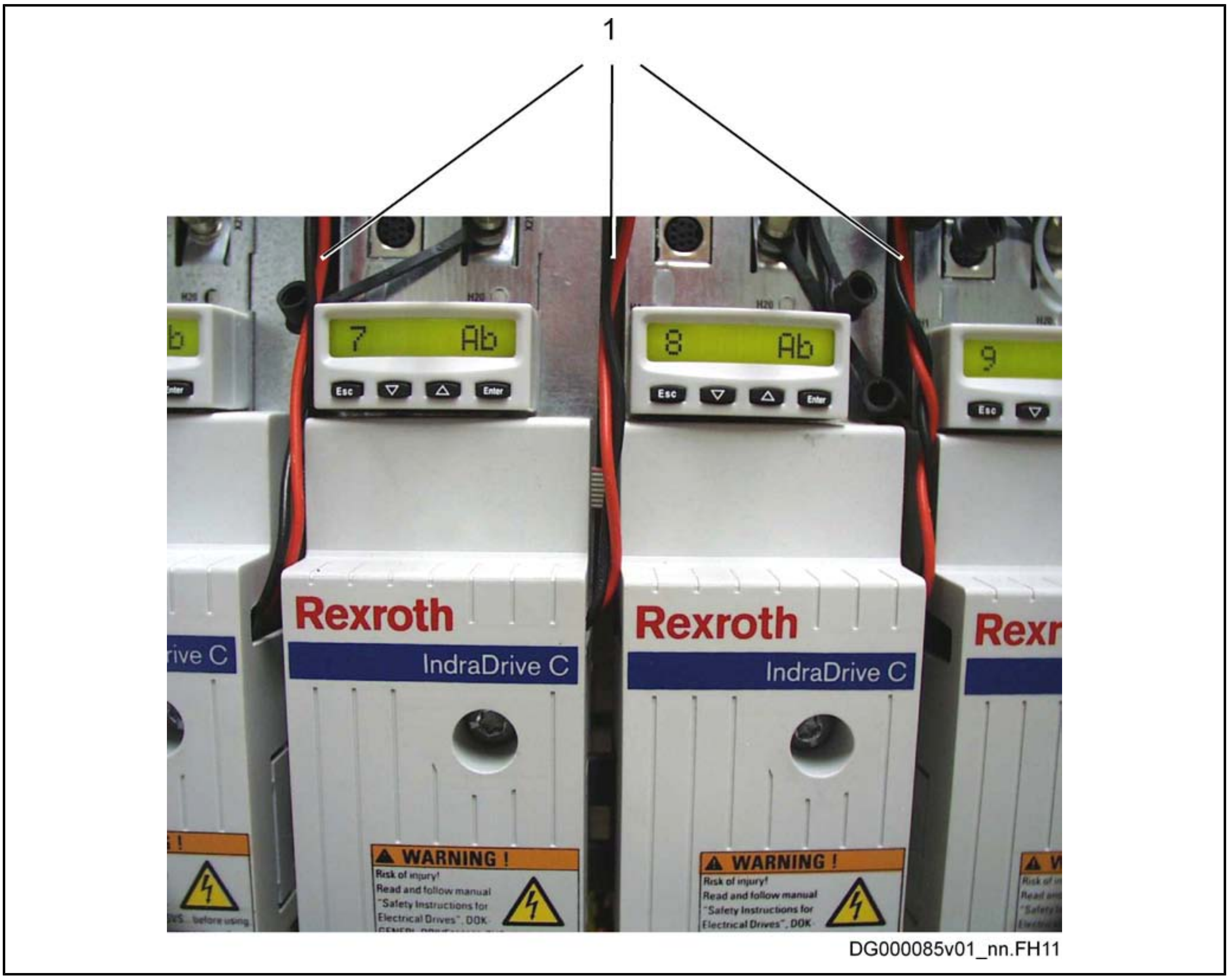
Fig.8-30: Function, pin assignment, properties

Notes on Installation

Requirements on the connection to the 24V supply:

- minimum cross section: 1 mm^2
- maximum allowed inductance: 100 μH (2 twisted single strands, 75 m long)
- parallel line routing where possible

The control voltage supply is routed to the connection X13 from **above**:



1	lines to control voltage supply
Fig.8-31:	*Control voltage supply at X13*

☞ The input 0V is connected in conductive form with the housing potential. It is therefore impossible to use an insulation monitor at +24V and 0V against housing.

8.10 X13, Supply Blower Unit HAB01

Description Via this connection, the blower unit HAB01 of HMV01.1R-W0120 and HMS01.1N-W0350 devices is supplied with voltage (24V, 0V). The connection is situated at the bottom of the device (see figure below).

CAUTION

Risk of damage by overheating!

Always operate HMV01.1R-W0120 and HMS01.1N-W0350 with the blower unit HAB01.

☞ Do not operate any other loads at connection X13.

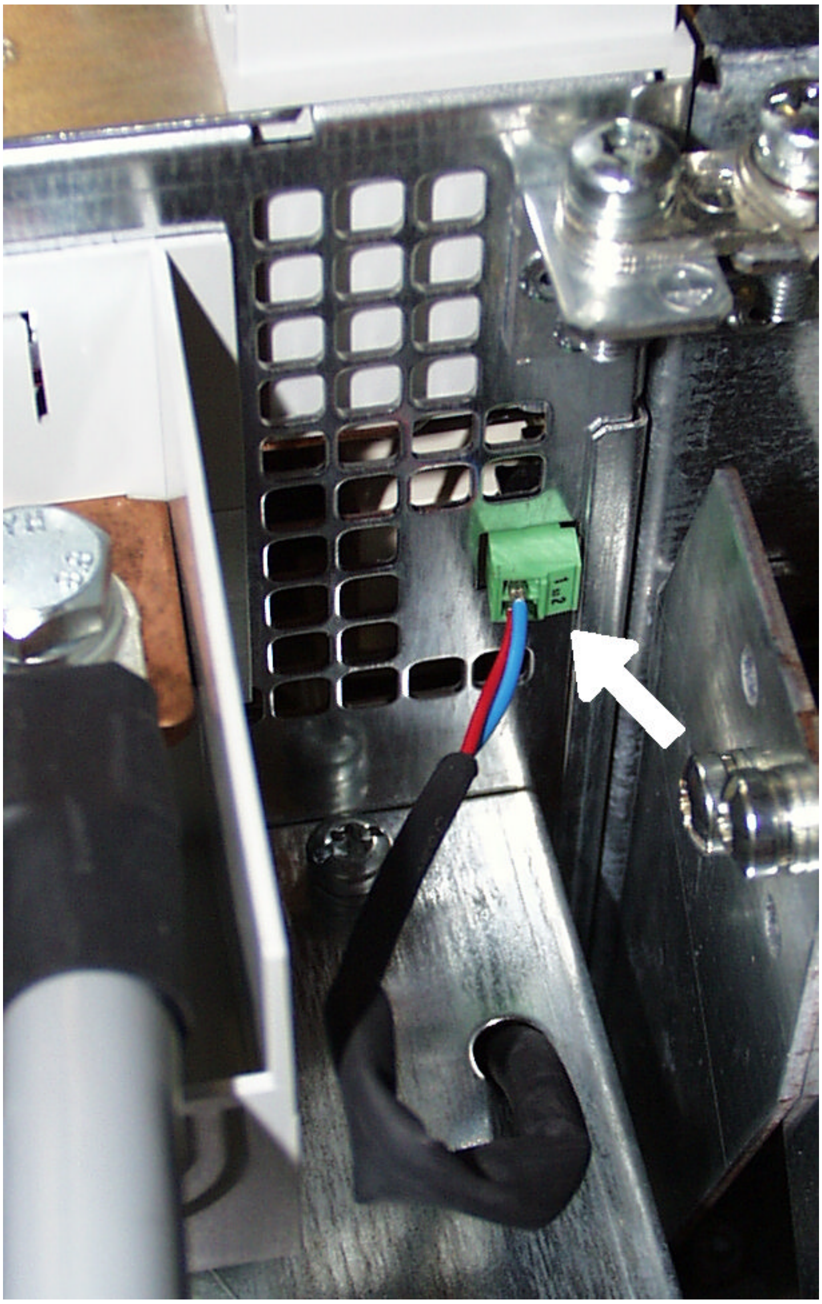


Fig.8-32: Connection at the bottom of the device

Function, Pin Assignment

Connection	Signal name	Function
1	24V	Power supply for external blower unit HAB01. Power consumption contained in P_{N3} of HMV or HMS.
2	0V	

Fig.8-33: Function, pin assignment

8.11 X14, Mains Voltage Synchronization

8.11.1 Connection Point

Description

This connection point only exists for regenerative supply units. The connection point is used to connect the mains voltage for mains voltage synchronization and for preloading the DC bus.

Function, Pin Assignment

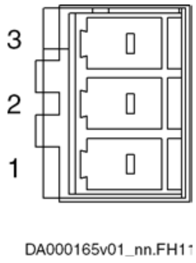
View	Connection	Function	Level	Note
	3	mains connection phase L3 before choke	max. 530 V	current load max. 5 A
	2	mains connection phase L2 before choke	max. 530 V	current load max. 5 A
	1	mains connection phase L1 before choke	max. 530 V	current load max. 5 A

Fig.8-34: Function, pin assignment

Technical Properties

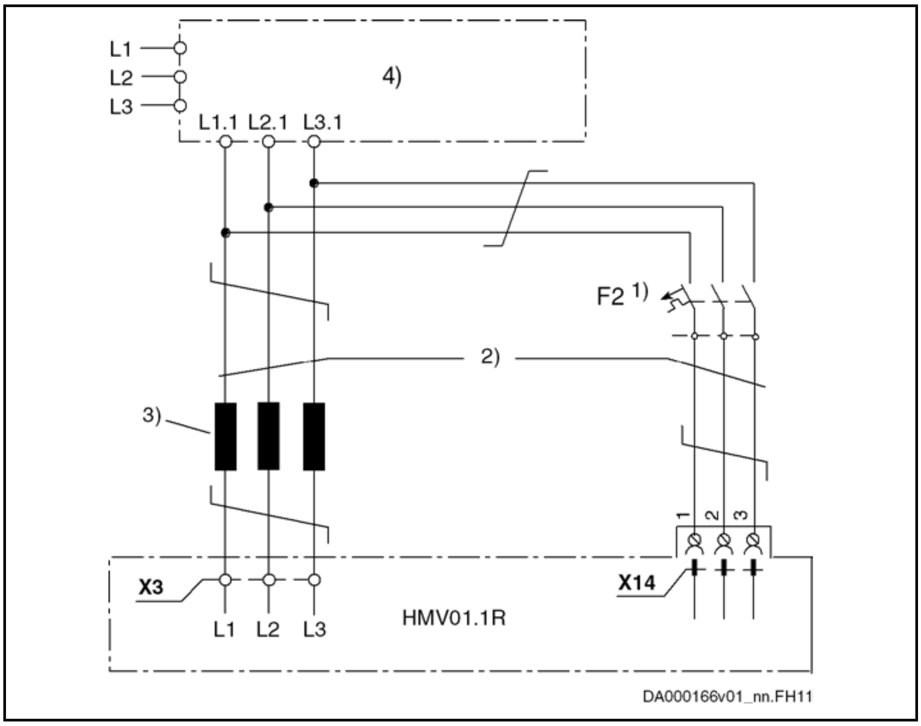
Data	Unit	Min. required	Typ.	Max. allowed
number of poles		3		
type		STECK - LE 7,62 M PC 4,0 / 3G		
design		male connector at device		
connection cable solid wire	mm^2	1,5		4
connection cable stranded wire	mm^2	1,5		2,5
	AWG	14		12
tightening torque	Nm	0,5		0,6

Fig.8-35: Technical properties

8.11.2 Mains Synchronization HMV01

The synchronizing voltage has to be picked off before the mains choke and after the mains filter. Power voltage and synchronizing voltage connection have to be in phase (see figure).

The synchronizing voltage has to be connected to the input for mains voltage synchronization (X14) of the supply unit.



1) fusing of connection X14
2) in-phase connection required
3) mains choke
4) mains filter

Fig.8-36: Synchronizing voltage HMV01.1R

☞ Install slow 5 A fuses in the supply line to connection X14.

☞ Connect the connections X3 and X14 in phase:

- X3.L1 in phase with X14.1
- X3.L2 in phase with X14.2
- X3.L3 in phase with X14.3

8.11.3 Mains Synchronization HMV02

For mains synchronization, connect the output X14 of the HNS02 mains filter to the input for mains voltage synchronization X14 of HMV02.1R.

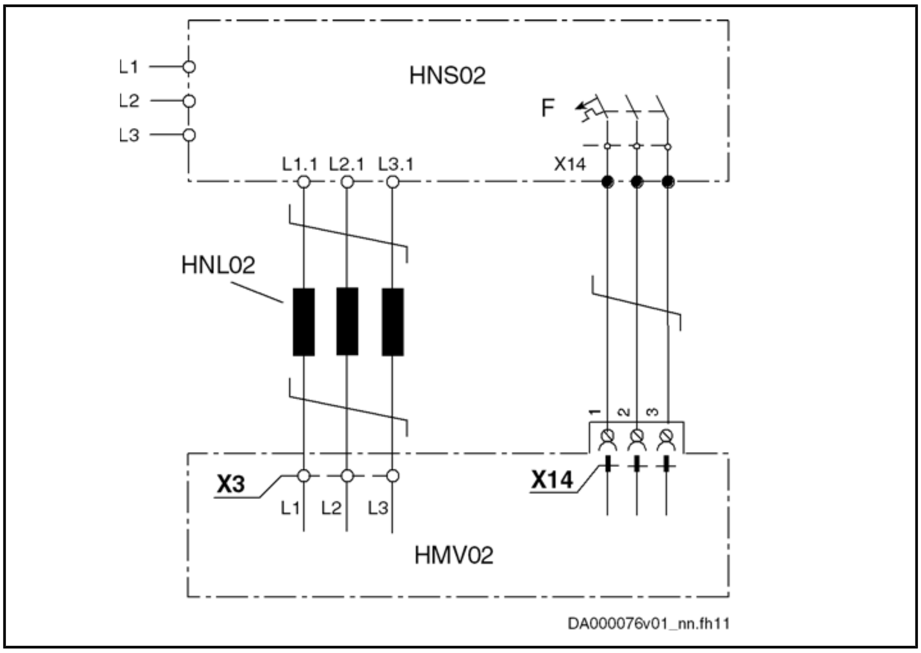


Fig.8-37: Synchronizing voltage HMV02.1R

8.12 X31, Messages Bb1, UD, WARN

View

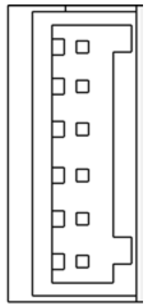


Fig.8-38: View

Function, Pin Assignment

The connection point X31 provides message signals on the status of the supply unit. The messages have been designed as floating contacts.

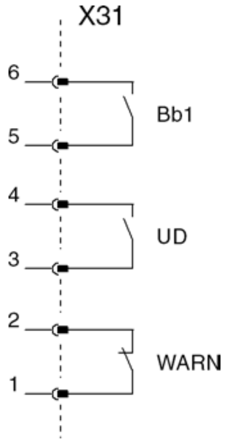
Assignment	Connection	Signal name	Function
 DA000168v01_nn.FH11	6	Bb1_2	N/O contact signals readiness for connecting the external mains contactor **Closed with:** readiness for operation of supply unit **Open with:** • error messages F2800 to F2899 • error messages F8069 and F8070 • warnings E2800 to E2899
	5	Bb1_1	
	4	UD_2	N/O contact signals status of DC bus voltage U_{DC} **Closed with:** DC bus voltage in specified range
	3	UD_1	
	2	WARN_2	N/C contact signals warning states **Open with:** • overload at integrated braking resistor • overtemperature at supply unit
	1	WARN_1	

Fig.8-39: Function, pin assignment

☞ Include the Bb1 contact in the control circuit for mains connection.

When Bb1 contact opens, the mains contactor must interrupt the power supply.

See also chapter “Control Circuits for the Mains Connection” in the documentation Rexroth IndraDrive - Drive System, Project Planning Manual.

Technical Properties

Data	Unit	Min.	Typ.	Max.
number of poles		6		
type		spring terminal		
design		pins at device		
connection cable solid wire	mm²	0,5		1,5
connection cable stranded wire	mm²	0,5		1,5
	AWG	20		16
current load capacity	A			1
voltage load capacity	V			DC30
minimum load of contacts	mA	10		

Data	Unit	Min.	Typ.	Max.
contact resistance at minimum load	mOhm			
number of mechanical switching cycles			10^6	

Fig.8-40: Technical properties

Notes on Installation

☞ For the application prototypes of the supply units, the "WARN" contact had been realized as N/O contact. As of the following hardware indices (HWIs), the "WARN" contact is realized as N/C contact:

- HMV01.1E-W0030: as of HWI -14
- HMV01.1E-W0075: as of HWI -14
- HMV01.1E-W0120: as of HWI -15
- HMV01.1R-W0018: as of HWI -17
- HMV01.1R-W0045: as of HWI -17
- HMV01.1R-W0065: as of HWI -18

8.13 X32, Mains Contactor Control and DC Bus Short Circuit

View

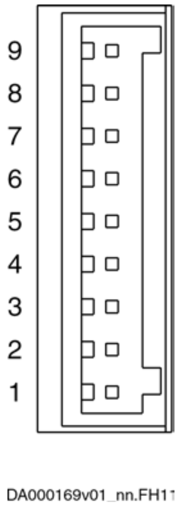


Fig.8-41: View

Function, Pin Assignment

Is used to connect the signals for controlling

- the mains contactor
- the ZKS stage (ZKS = DC bus short circuit)
- the braking resistor switch-on threshold

CAUTION

Risk of fire caused by the “sacrificing behavior” of the ZKS stage!

The “ZKS” input activates the function “DC bus short circuit”, when there hasn't any voltage been applied and when there isn't any current flowing to the input. This status occurs both in the case of wire break and when the 24V supply fails.

When the 24V supply fails in applications in which energy does not only get to the DC bus via the mains connection, but also via regeneratively operated motors (e.g. following-on rollers), the ZKS stage converts this energy into heat until it is destroyed (“sacrificing behavior”).

Counter measures with such applications:

- Do not use drive controllers with integrated ZKS stage or
- buffer the 24V supply (e.g. by means of a UPS) to evaluate the monitor and switch off the energy flow in the case of error.

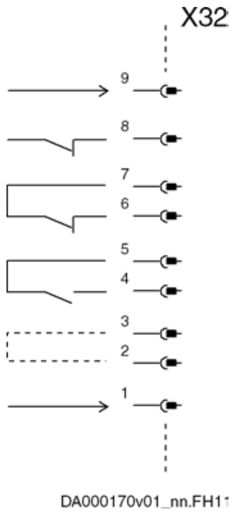
Assignment	Connection	Signal name	Function
	9	24V_IF	supply of circuits for control of DC bus short circuit and mains contactor
	1	0V	
	2	24V	output (24 V) Connected to connection X32.3, it is used to switch the braking resistor switch-on threshold.
	3	braking resistor switch-on threshold	Input at HMV01.1E: ● connected to 24 V (X32.2): activates **fixed** threshold (independent of mains voltage) ● not connected: activates **variable** threshold (independent of mains voltage) Switch-on thresholds: see technical data, table “Data of built-in braking resistor” ● HMV01.1E ● HMV01.1R ● HMV02.1R
	4	EIN2	connection for N/O contact to control the mains contactor (switch-on) input is edge-controlled
	5	EIN1	
	6	AUS2	connection for N/C contact to control the mains contactor (switch-off)
	7	AUS1	
	8	ZKS	Controls the ZKS stage: ● not connected: ZKS active ● connected to 24 V: ZKS not active

Fig.8-42: Connection point X32

☞ Include the Bb1 contact in the control circuit for mains connection.

When Bb1 contact opens, the mains contactor must interrupt the power supply.

See also chapter “Control Circuits for the Mains Connection” in the documentation “Rexroth IndraDrive - Drive System, Project Planning Manual”.

Technical Properties

Data	Unit	Min.	Typ.	Max.
number of poles			9	
type			spring terminal	
design			pins at device	
connection cable solid wire	mm^2	0,5		1,5
connection cable stranded wire	mm^2	0,5		1,5
	AWG	20		16
current consumption (X32.9, X32.1)	A		0,1	
voltage load capacity	V			DC30

Fig.8-43: Technical properties

8.14 X33, Acknowledge Messages of Integrated Mains Contactor

View

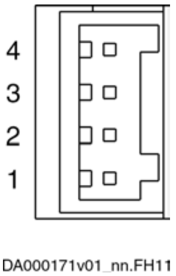


Fig.8-44: View

Function, Pin Assignment

☞ Observe the **functional differences** between the connection points **X33** and **X40**, depending on the supply unit!

- Supply units **with** integrated mains contactor:

  X33 provides message signals on the status of the integrated mains contactor
- Supply units **without** integrated mains contactor:

  X40 receives message signals on the status of the external mains contactor

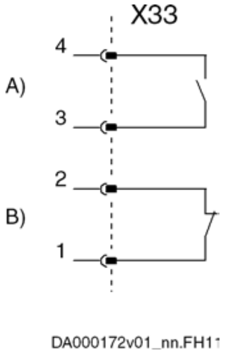
Assignment	Connection	Signal name	Function
Supply units **with** integrated mains contactor			**Provides** message signals for evaluation on the status of the integrated mains contactor of supply units. The floating contacts are mechanically connected to the integrated mains contactor.
	4	-	A) N/O contact of integrated mains contactor closed with mains contactor picked up
	3	-	
	2	-	B) N/C contact of integrated mains contactor open with mains contactor picked up
	1	-	

Fig.8-45: Function, pin assignment

Properties

Data	Unit	Min.	Typ.	Max.
number of poles		4		
type		spring terminal		
design		pins at device		
connection cable solid wire	mm^2	0,5		1,5
connection cable stranded wire	mm^2	0,5		1,5
	AWG	20		16
Data of integrated N/O and N/C contacts (A and B) of HMV02.1, HMV01.1 except for HMV01.1R-W0120				
current load capacity	A			1
peak current when switching on	A			5
voltage load capacity	V			DC30
minimum load of contacts	mA	10		
contact resistance at minimum load	mOhm			1000
number of mechanical switching cycles			10^6	
number of switching actions at max. time constant of load		100.000		
time constant of load	ms			50
pick up delay	ms			10
drop out delay	ms			10

Fig.8-46: Properties

8.15 X34, Contact for Controlling the External Mains Contactor

View

Fig.8-47: View

Function, Pin Assignment

The contact at X34 is used to control the external mains contactor of supply units without integrated mains contactor (e.g. HMV01.1R-W0120). The contact is included in the Control Circuits for the Mains Connection .

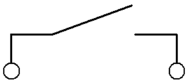
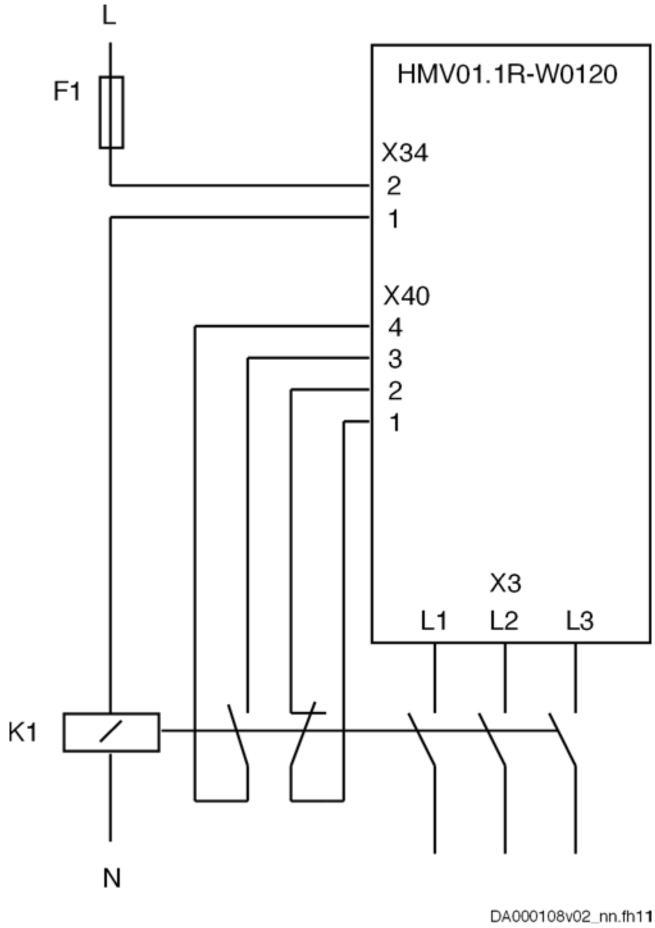
Assignment	Connec-tion	Signal name	Function
 DA000017v01_nn.fh11	1	–	N/O contact
	2	–	

Fig.8-48: Function, pin assignment

Connection Diagram



K1	external mains contactor
L, N	supply voltage of control circuit for mains connection

Fig.8-49: X34, X40 connection diagram - block diagram

Properties

Data	Unit	Min.	Typ.	Max.
number of poles		2		
type		spring terminal		
design		pins at device		
connection cable solid wire	mm^2	0,5		1,5
connection cable stranded wire	mm^2	0,5		1,5
	AWG	20		16
current load capacity	A			DC1 AC2
fuse F1	A			2
peak current when switching on	A			5
voltage load capacity	V			DC30 AC250
minimum load of contacts	mA	10		
contact resistance at minimum load	mOhm			1000
number of mechanical switching cycles			10^6	
number of switching actions at max. time constant of load		100.000		
time constant of load	ms			50
pick up delay	ms			10
drop out delay	ms			10

Fig.8-50: Properties

Notes on Installation Only use mains contactors with overvoltage limiter at the contactor coil (e.g. mains contactor 3RT1456-6AP36 with overvoltage limiter 3RT1956-1CD00 by Siemens).

8.16 X40, Acknowledge Messages of External Mains Contactor

☞ The connection point X40 is available at HMV01.1R-W0120 with hardware index ≥ A11; X33 does not exist at HMV01.1R-W0120.

View

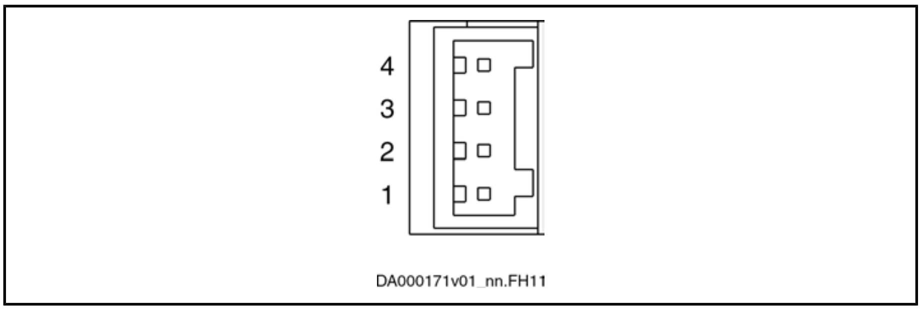


Fig.8-51: View

Function, Pin Assignment

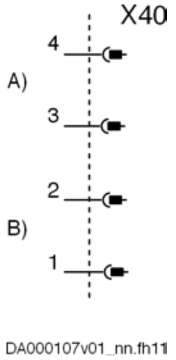
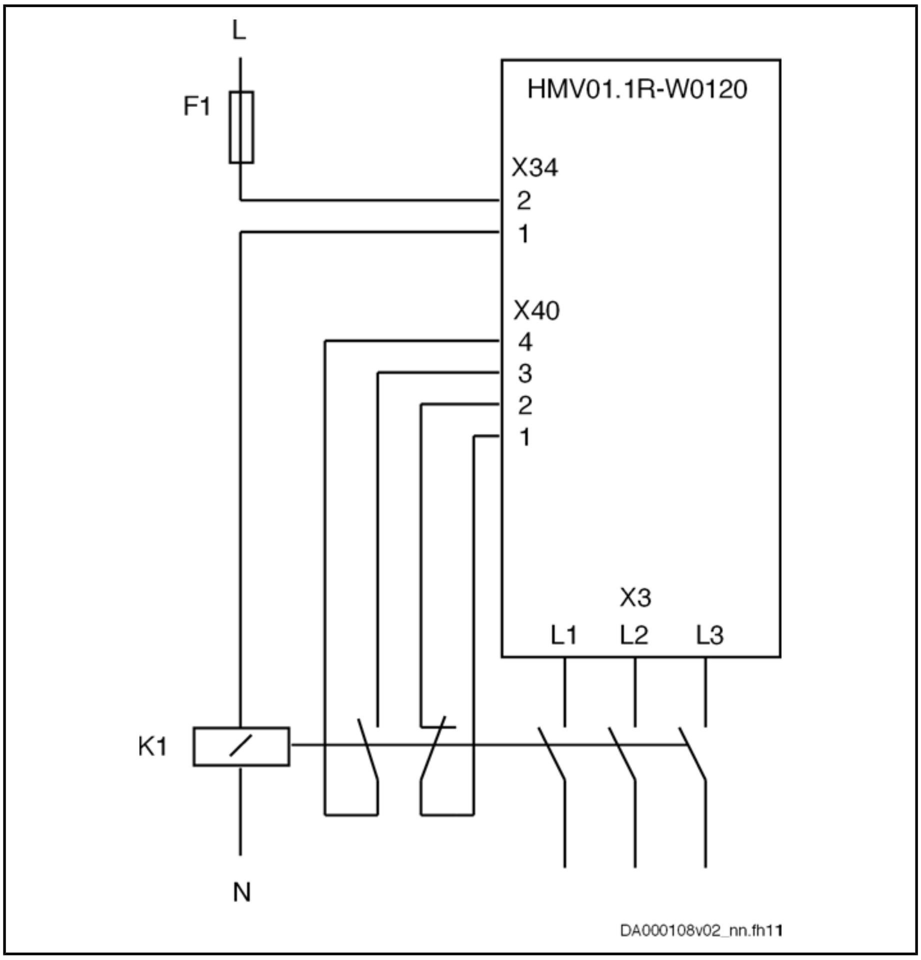
Assignment	Connection	Signal name	Function
Supply units **with** external mains contactor HMV01.1R-W0120			**Receives** message signals on the status of the external mains contactor.
	4	-	A) connect N/O contact of **external** mains contactor
	3	-	
	2	-	B) connect N/C contact of **external** mains contactor
	1	-	

Fig.8-52: Function, pin assignment

Connection Diagram

Supply units **without** integrated mains contactor



K1	external mains contactor
L, N	supply voltage of control circuit for mains connection

Fig.8-53: X34, X40 connection diagram - block diagram

Properties

Data	Unit	Min.	Typ.	Max.
number of poles		4		
type		spring terminal		
design		pins at device		
connection cable solid wire	mm^2	0,5		1,5
connection cable stranded wire	mm^2	0,5		1,5
	AWG	20		16

Fig.8-54: Properties

8.17 Terminal Block, 24V - 0V (24V Supply)

Function, Pin Assignment

Connection of external 24V supply:

24V supply of HMS, HMD, HCS power sections (not at HCS02)

- for the power section of the drive controller
- for brake control via X6
- for the control section of the drive controller with the optional modules, except for such optional modules (e.g. safety technology S1) which require their own power supply

24V supply of HMV supply units

- for the integrated electronics
- for the 24V interface of the mains connection for ON/OFF control

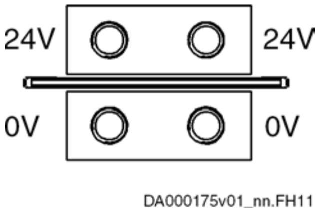
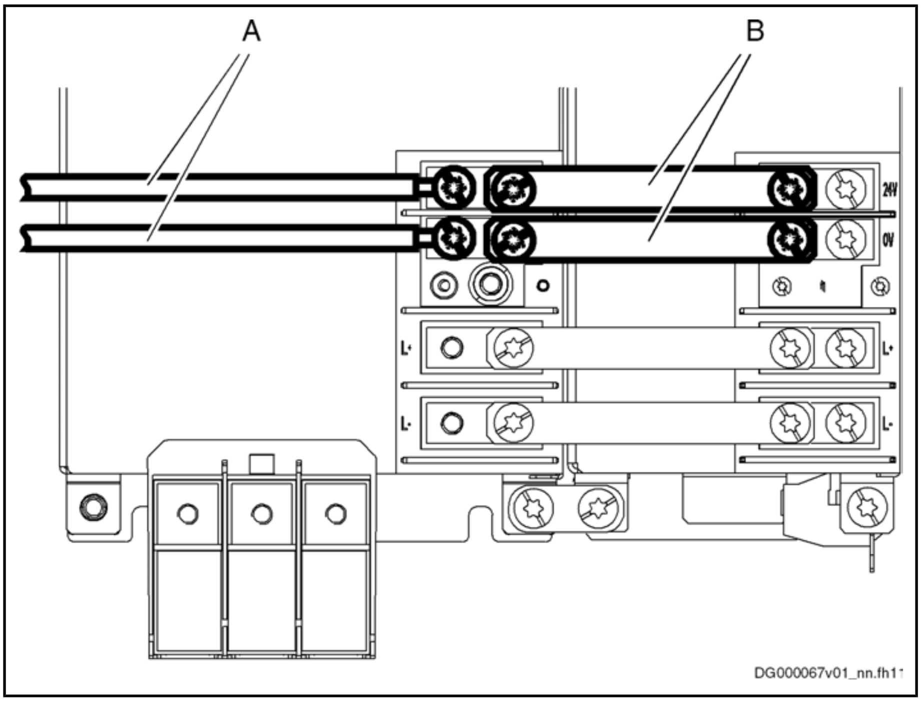
<table>
<tr><th>View</th><th>Identification</th><th colspan="2">Function</th></tr>
<tr><td rowspan="2">
</td><td>+24V</td><td colspan="2">power supply
connection to neighboring devices with contact bars from the HAS01.1 accessory</td></tr>
<tr><td>0V</td><td colspan="2">reference potential for power supply
connection to neighboring devices with contact bars from the HAS01.1 accessory</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td>Screw connection
M6 thread at device (terminal block)</td><td>Unit</td><td>Min.</td><td>Max.</td></tr>
<tr><td>tightening torque</td><td>Nm</td><td>5,5</td><td>6,5</td></tr>
<tr><td>power consumption</td><td>W</td><td colspan="2">see P_{N3} (see index entry with reference to the corresponding page)</td></tr>
<tr><td>voltage load capacity</td><td>V</td><td colspan="2">see U_{N3} (see index entry with reference to the corresponding page)</td></tr>
<tr><td>polarity reversal protection</td><td></td><td colspan="2">within the allowed voltage range by internal protective diode</td></tr>
<tr><td colspan="4">current carrying capacity “looping through” from 24V to 24V, 0V to 0V
(contact bars in scope of supply of accessory HAS01)</td></tr>
<tr><td>with contact bars -072-</td><td>A</td><td colspan="2">220</td></tr>
</table>

Fig.8-55: Function, pin assignment, properties

Connection Diagram



A	cable (to source of control voltage supply)
B	contact bars

Fig.8-56: Connection points and connections of control voltage

Notes on Installation

Requirements on the connection to the 24V supply:

- maximum allowed inductance of 100 µH (2 twisted single strands, 75 m long)
- parallel line routing where possible

☞ The input 0V is connected in conductive form with the housing potential. It is therefore impossible to use an insulation monitor at +24V and 0V against housing.

8.18 Terminal Block L+, L- (DC Bus Connection)

WARNING

Lethal electric shock caused by live parts with more than 50 V!

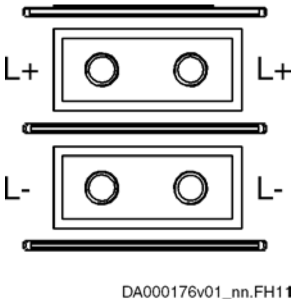
- Wait at least 30 minutes after switching off power to allow discharging. To shorten the waiting time until voltage has fallen below 50 V, you can use a discharging device (see documentation “Rexroth IndraDrive - Drive System” or, if existing, chapter “Appendix” in this documentation).
- Check whether voltage has fallen below 50 V before touching live parts!

Function, Pin Assignment

The DC bus connection connects

- several drive controllers to one another
- a drive controller to additional components

☞ HCS02.1E-W0012 drive controllers do not have a DC bus connection.

View	Identification	Function
	L+	connections to connect the DC bus connections
	L-	

Screw connection M6 thread at device (terminal block)	Unit	Min.	Max.
tightening torque	Nm	5,5	6,5
short circuit protection		via fusing elements connected in the incoming circuit to the mains connection	
overload protection		via fusing elements connected in the incoming circuit to the mains connection	
current carrying capacity “looping through” from L+ to L+, L- to L- (contact bars in scope of supply of accessory HAS01)			
with contact bars -072	A		220
additionally with contact bars -042 and end piece	A		245

Fig.8-57: Function, pin assignment, properties

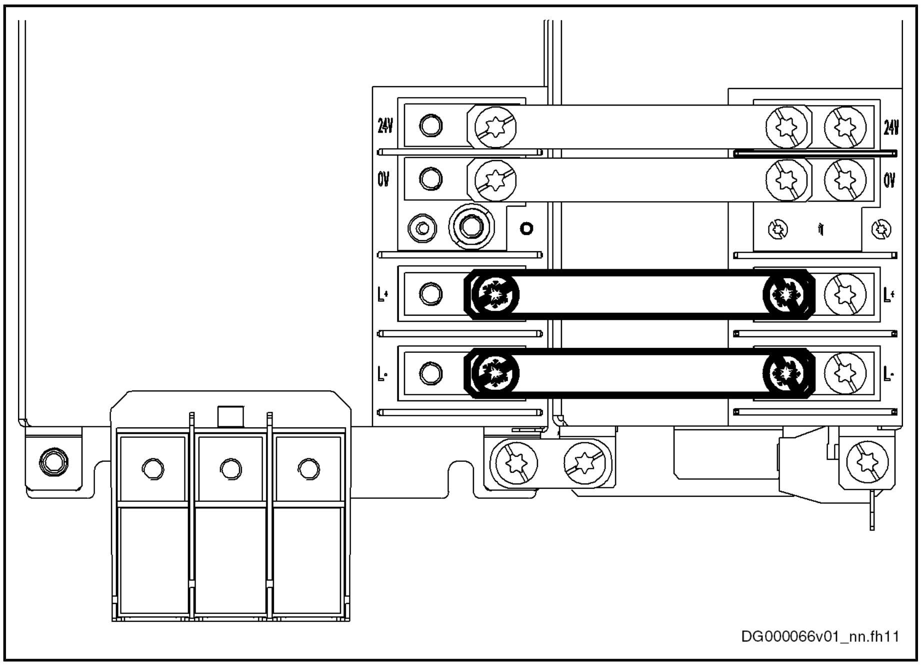


Fig.8-58: Contact bars

Notes on Installation

If in special cases it is not possible to use the contact bars provided to establish the connection, the connection must be established using the shortest possible (2 × 2 m, as a maximum) and twisted wires.

CAUTION

Damage caused by voltage arcing!

Insulate ring terminals and connecting lines with a heat-shrinkable sleeve. Afterwards only strip the insulation of the contact surface of the ring terminal.

The cross section of the lines must be at least 10 mm^2, but mustn't be smaller than the cross section of the supply feeder at mains connection X3.

The dielectric strength of the single strand must be at least 750 V (e.g. strand type H07).

8.19 XS1, Shield Connection Control Lines

CAUTION

Risk of damage caused by high temperature of the outgoing air!

Observe outlet temperatures at the top of the devices.

☞ Always connect the shields with the largest possible metal-to-metal contact surface.

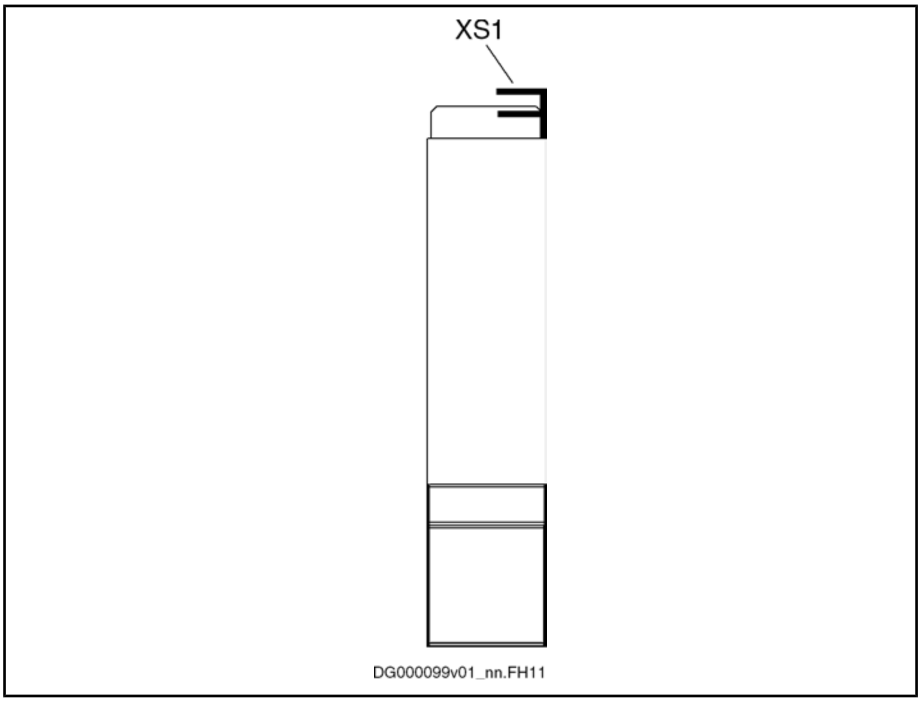


Fig.8-59: Shield connection XS1 (control lines)

Function Connection point for the shields of lines connected to the control section and of which the connectors do not have their own shield connection.

8.20 XS2, Shield Connection Motor Cable

CAUTION

Risk of damage to the drive controller caused by too long screws!

Exclusively use screws of a **maximum length of 12 mm** for the thread of shield connection XS2.

The connection consists of an M6 thread and is used for mounting the shielding plate for shield connection of the motor power cable (accessory HAS02.1).

8.21 Ground Connection

The ground connection of the housing is used to provide functional safety of the drive controllers and protection against contact in conjunction with the equipment grounding conductor.

Ground the housings of the drive controllers:

1. Connect the bare metal back panel of the drive controller in conductive form to the mounting surface in the control cabinet. To do this, use the supplied mounting screws.
2. Connect the mounting surface of the control cabinet in conductive form to the equipment grounding system.
3. For the ground connection, observe the maximum allowed ground resistance.

   See Project Planning Manual “Rexroth IndraDrive – Drive System” chapter “Dimensioning the Mains Connection”

8.22 Connection Point of Equipment Grounding Conductor, HMV

DANGER

Lethal electric shock caused by live parts with more than 50 V!

Via the joint bar on the front connect the drive controller **to the supply unit**.

Via the joint bar on the front connect the drive controller **to the neighboring drive controller**.

Connect the equipment grounding conductor connection of the supply unit to the equipment grounding conductor system of the control cabinet.

Check the continuity of the equipment grounding conductors from the mains connection to the connected motors.

☞ **Equipment grounding conductor: material and cross section**

For the equipment grounding conductor, use the same metal (e.g. copper) as for the outer conductors.

For the connections from the equipment grounding conductor connection of the device to the equipment grounding conductor system in the control cabinet, make sure the cross sections of the lines are sufficient.

Cross sections of the equipment grounding connections:

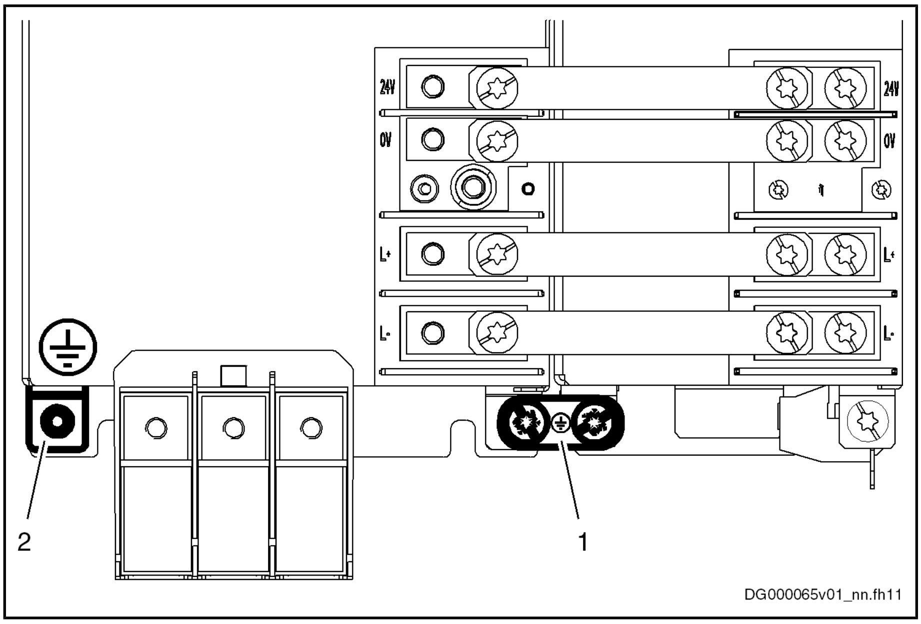
- for **HCS03.1E** drive controllers and **HMV01** supply units, **at least 10 mm^2** , but not smaller than the cross sections of the outer conductors of the mains supply feeder
- for **HCS02.1E** drive controllers, **at least 4 mm^2** , but not smaller than the cross sections of the outer conductors of the mains supply feeder

  Additionally, mount the housing of HCS02.1E to a bare metal mounting plate. Connect the mounting plate, too, with at least the same cross section to the equipment grounding conductor system in the control cabinet.

For outer conductors with a cross section greater than 16 mm², you can reduce the cross section of the equipment grounding connection according to the table "Cross section of equipment grounding conductor, excerpt from EN 61800-5-1:2003".

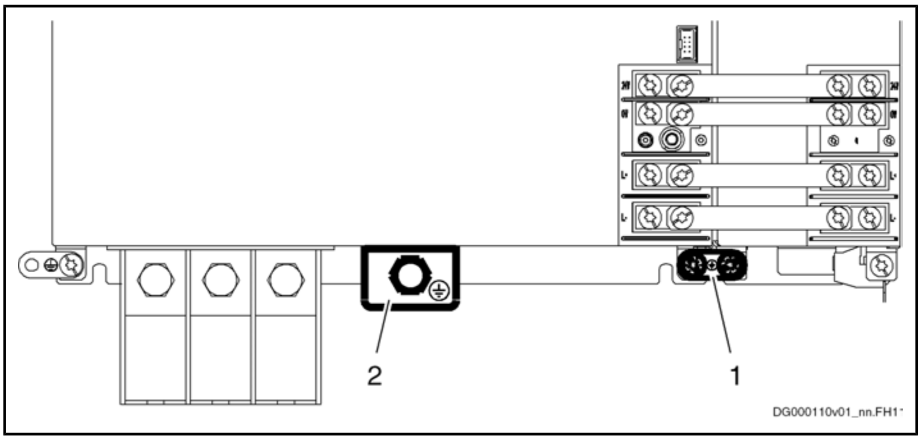
Cross-sectional area A of outer conductors	Minimum cross-sectional area A_{PE} of equipment grounding connection
A ≤ 16 mm²	A
16 mm² < A ≤ 35 mm²	16
35 mm² < A	A / 2

Fig.8-60: Cross section of equipment grounding conductor, excerpt from EN 61800-5-1:2003, table 2



1 joint bar
2 equipment grounding conductor connection at supply unit

Fig.8-61: Equipment grounding conductor connection at the supply unit or neighboring device



1 joint bar
2 equipment grounding conductor connection at supply unit

Fig.8-62: Equipment grounding conductor connection at the HMV01.1-W0120 supply unit or neighboring device

Design The equipment grounding conductor is connected with screws:

HMV01.1E-W0030, -W0075 HMV01.1R-W0018, -W0045, -W0065 HMV02.1R-W0015	HMV01.1E-W0120 HMV01.1R-W0120
M6 × 25	M10

Fig.8-63: Design

Tightening Torque

HMV01.1E-W0030, -W0075 HMV01.1R-W0018, -W0045, -W0065 HMV02.1R-W0015	HMV01.1E-W0120 HMV01.1R-W0120
6 Nm	18 Nm

Fig.8-64: Tightening torque

8.23 Connection Point of Equipment Grounding Conductor, HMS, HMD

DANGER

Lethal electric shock caused by live parts with more than 50 V!

Connect the drive controller to the equipment grounding system of the control cabinet.

Supplying device **with** connection for joint bar:

- Via the joint bar on the front connect the drive controller to the supplying device.

Supplying device **without** connection for joint bar:

- Via a separate connection line, connect the drive controller to the equipment grounding system of the control cabinet.

Via the joint bar on the front connect the drive controller to the neighboring drive controller.

Connect the equipment grounding conductor connection of the supplying device to the equipment grounding conductor system of the control cabinet.

Check the continuity of the equipment grounding conductors from the mains connection to the connected motors.

☞ **Equipment grounding conductor: material and cross section**

For the equipment grounding conductor, use the same metal (e.g. copper) as for the outer conductors.

For the connections from the equipment grounding conductor connection of the device to the equipment grounding conductor system in the control cabinet, make sure the cross sections of the lines are sufficient.

Cross sections of the equipment grounding connections:

- for **HCS03.1E** drive controllers and **HMV01** supply units, **at least 10 mm^2** , but not smaller than the cross sections of the outer conductors of the mains supply feeder
- for **HCS02.1E** drive controllers, **at least 4 mm^2** , but not smaller than the cross sections of the outer conductors of the mains supply feeder

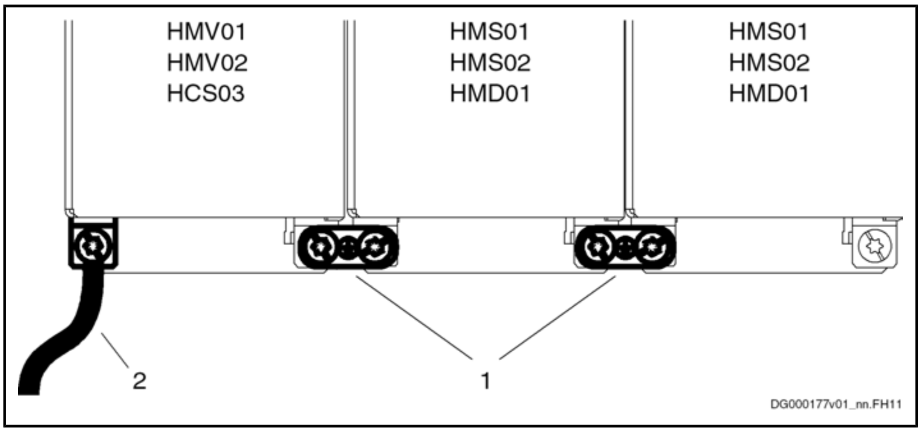
  Additionally, mount the housing of HCS02.1E to a bare metal mounting plate. Connect the mounting plate, too, with at least the same cross section to the equipment grounding conductor system in the control cabinet.

For outer conductors with a cross section greater than 16 mm^2, you can reduce the cross section of the equipment grounding connection according to the table "Cross section of equipment grounding conductor, excerpt from EN 61800-5-1:2003".

Cross-sectional area A of outer conductors	Minimum cross-sectional area A_{PE} of equipment grounding connection
A ≤ 16 mm²	A
16 mm² < A ≤ 35 mm²	16
35 mm² < A	A / 2

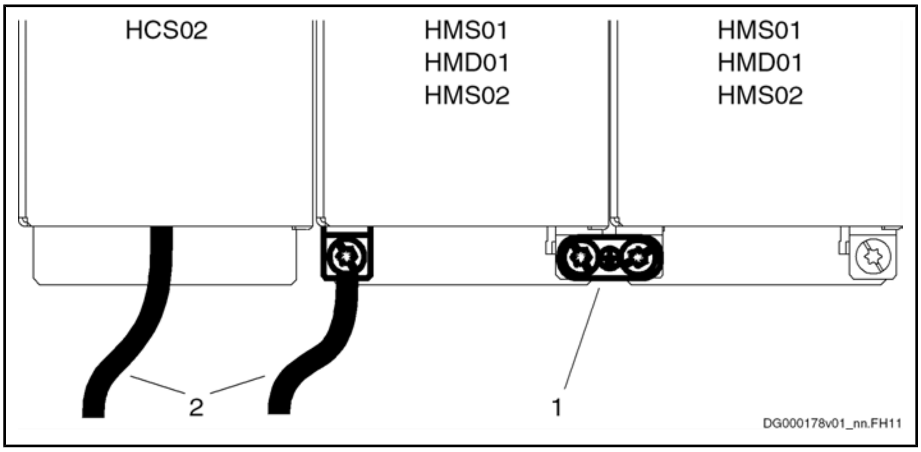
Fig.8-65: *Cross section of equipment grounding conductor, excerpt from EN 61800-5-1:2003, table 2*

☞ The line for connecting the equipment grounding conductor must have at least the cross section (wire size) of the mains supply feeder. If the cross sections (wire sizes) of the mains supply feeder are smaller than 10 mm^2 (AWG 8), the equipment grounding conductor must be at least 10 mm^2 (AWG 8).



1	joint bar
2	connection to equipment grounding system

Fig.8-66: *Equipment grounding conductor connection for supply via HMV01, HMV02, HCS03*



1	joint bar
2	connection to equipment grounding system

Fig.8-67: *Equipment grounding conductor connection for supply via HCS02*

Design, Tightening Torque

The joint bars are connected with screws:

Device	Design	Tightening torque
HMS01.1N HMS02.1N HMD01.1N	M6 × 25	6 Nm

Fig.8-68: Data of connection point

9 Touch Guard at Devices

9.1 Cutouts

WARNING

Lethal electric shock caused by live parts with more than 50 V!

- The appropriate touch guard must be mounted for each device following connection work.
- Never mount a damaged touch guard.
- Immediately replace a damaged touch guard by an undamaged touch guard.
- Keep the cutouts at the touch guard as small as possible. Only remove the cutouts if necessary.

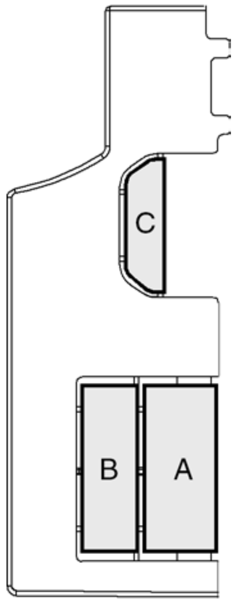
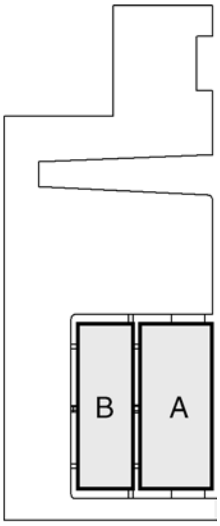
Type 1	Type 2
 DG000050v01_nn.FH11	 DG000049v01_nn.FH11

Fig.9-1: Cutouts at the touch guard

- If the DC bus and the control voltage are connected by means of **contact bars**, only **cutout A** may be removed from the touch guard.
- If the DC bus and the control voltage are connected by means of **cables** (e.g. in the case of multiple-line arrangement), the **cutouts A, B and C** may be removed from the touch guard.
- At the first and last device in a line of interconnected devices, you must **not** remove any cutout at the outer side of the touch guard.

9.2 Mounting

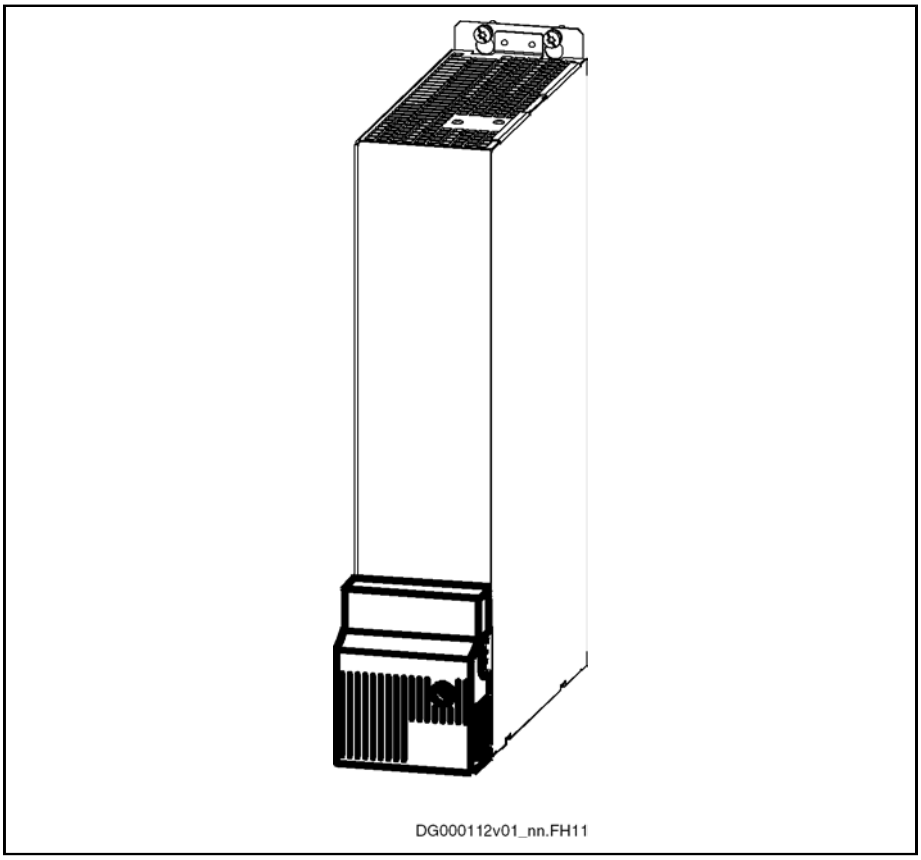


Fig.9-2: Touch guard at device

The touch guard is fixed to the device with screws.

Tightening Torque max. 2.8 Nm

10 Operation and Diagnosis

10.1 Supply Units

10.1.1 Control Panel

Brief Description

Rexroth IndraDrive supply units have a standard control panel with an 8-digit display and four keys.

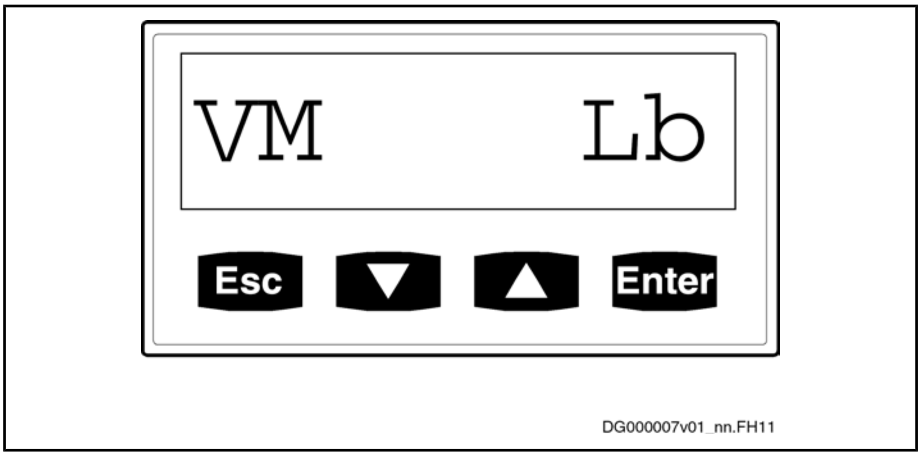


Fig. 10-1: Standard control panel with display and keys

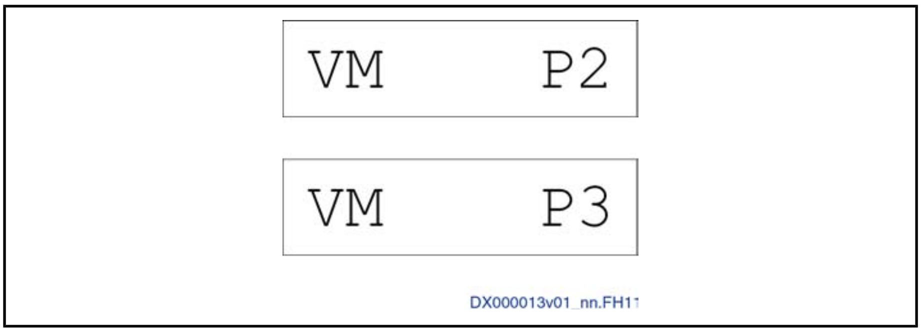
Functional Description

Displays

The display automatically shows:

- phases during device initialization
- operating states
- activated commands
- diagnostic command messages
- warnings
- diagnostic error messages

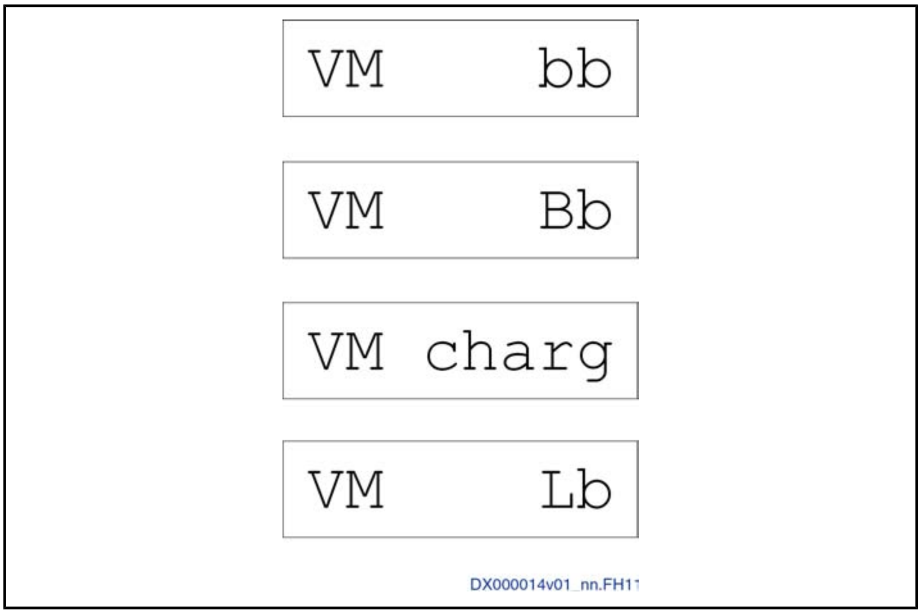
Display During Device Initialization



P2 phase 2
P3 phase 3

Fig. 10-2: Display during device initialization

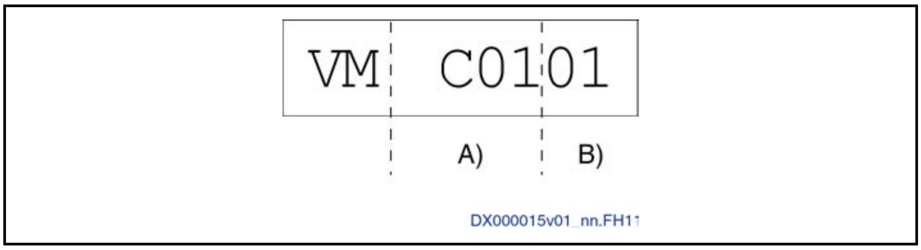
Display of Operating States



bb	ready for operation
Bb	ready for operation, mains voltage applied
charg	DC bus charging
Lb	ready for power output

Fig. 10-3: Display of operating states

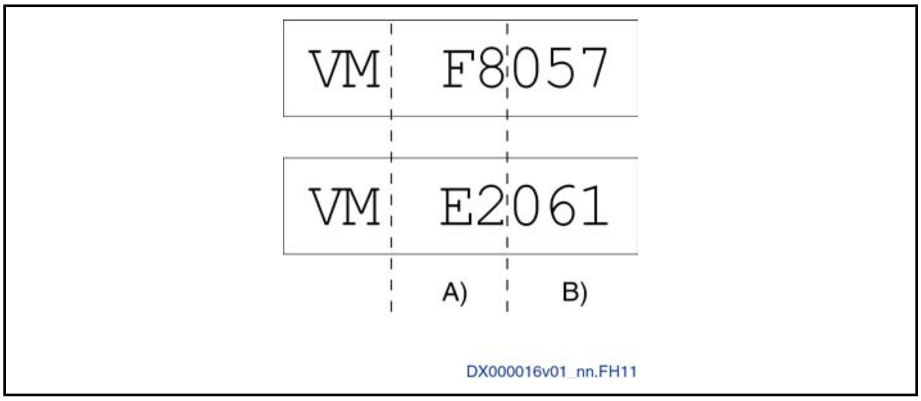
Diagnostic Command Messages



A)	displays currently active command
B)	displays number of diagnostic command message

Fig. 10-4: Diagnostic command messages

Warnings and Diagnostic Error Messages



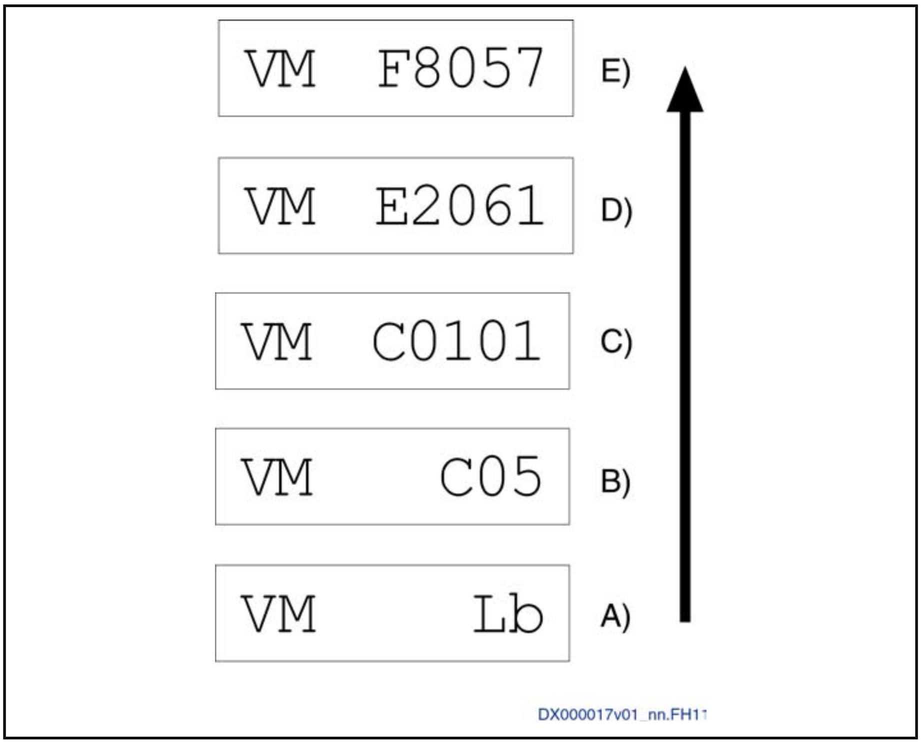
A)	displays error class and warning class
B)	displays error number and warning number

Fig. 10-5: Warnings and diagnostic error messages

Priorities of Display

The displays have different priorities because it is impossible to have various displays at the same time.

The current drive status is displayed with highest priority.



E)	error messages (highest priority)
D)	warnings
C)	diagnostic command messages
B)	commands
A)	operating status (lowest priority)

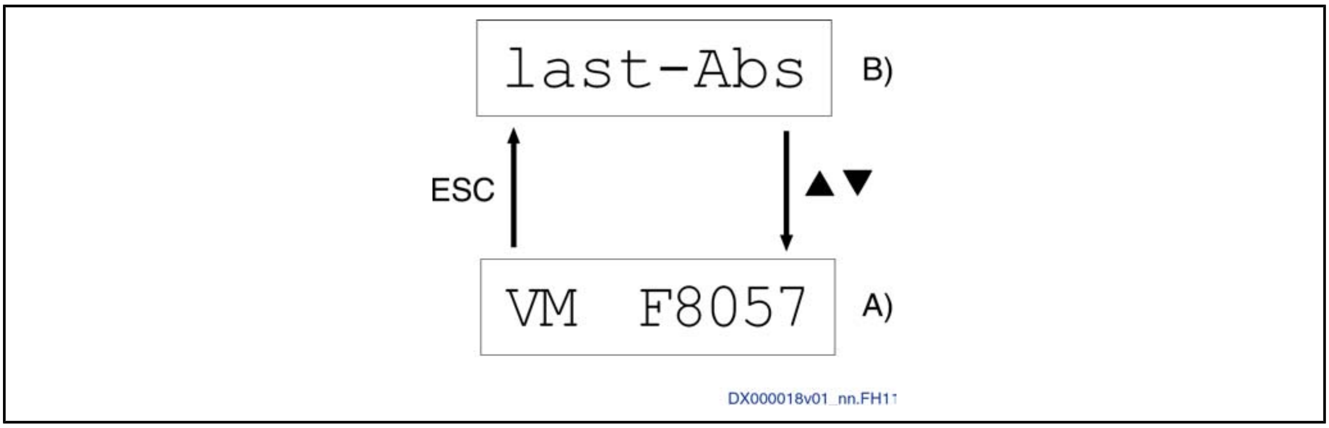
Fig. 10-6: *Priority of displays with examples*

Complete Diagnostic Message Text

Call complete diagnostic message text for diagnostic message currently displayed:

- initial state: standard display (e.g. "VM F8057")
- press key "v" or "^"

The diagnostic message text is displayed in the form of a marquee text. After the marquee text was completely displayed, the standard display appears again.



B)	current diagnostic message (marquee text)
A)	standard display

Fig. 10-7: *Calling complete diagnostic message text*

Extended Displays

Call extended displays (see also figure below):

- initial state: standard display (e.g. "VM Lb")
- simultaneously press "Enter" and "Esc" keys for at least 8 seconds
- press "Enter" key
- press "v" or "^" key until desired display appears
- press "Enter" key

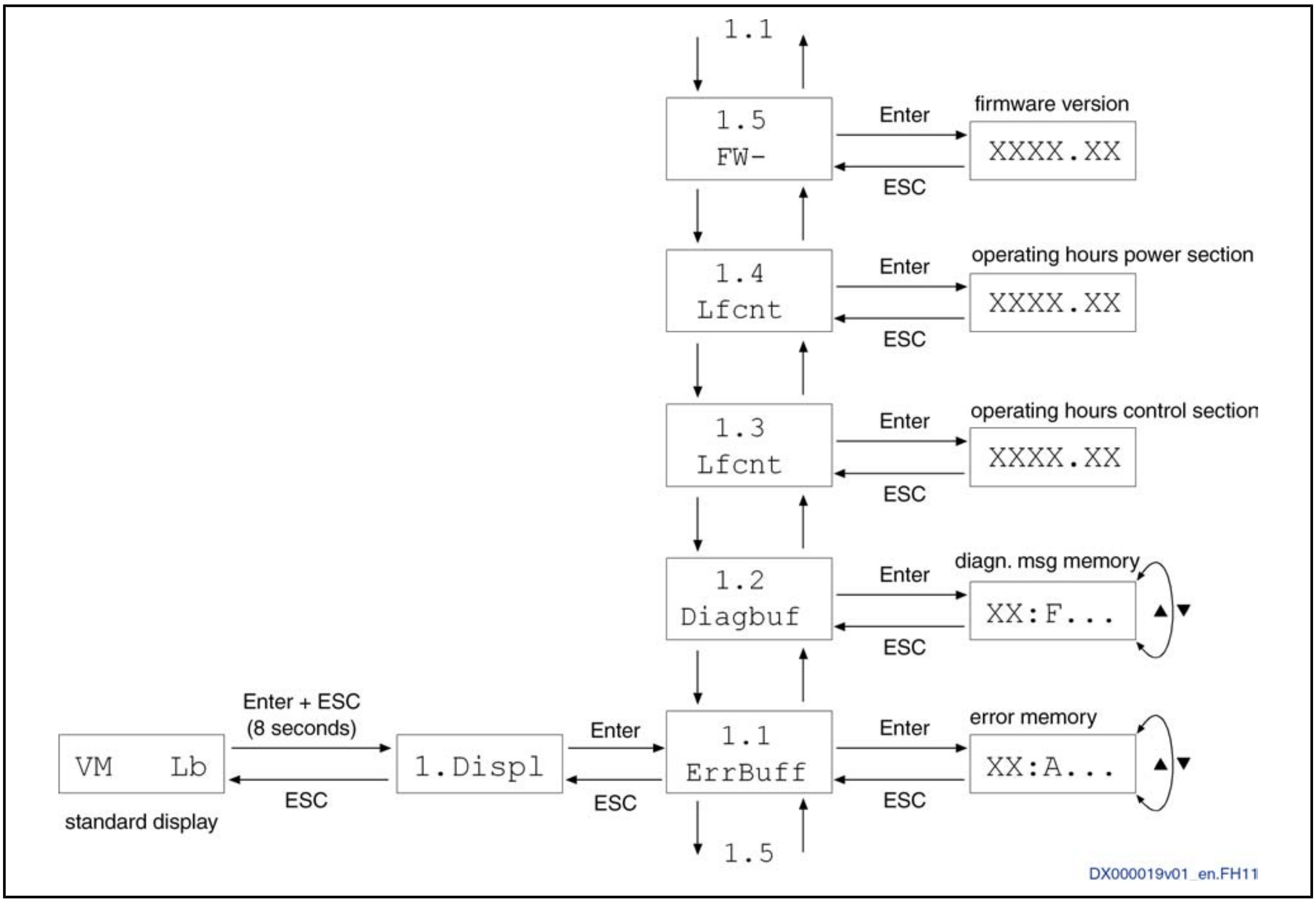


Fig. 10-8: Calling extended displays

There are the following extended displays:

- **1.1 ErrBuff:** error memory; with the "v" or "^" key you can browse the memory
- **1.2 DiagBuf:** diagnostic message memory; with the "v" or "^" key you can browse the memory
- **1.3 Lfcnt:** operating hours counter control section
- **1.4 Lfcnt:** operating hours counter power section (only for HMV01.1R)
- **1.5 FW-***:** type designation of the firmware active in the device

Setting the Language

Set language in which diagnostic message texts are displayed (see also figure below):

- initial state: standard display (e.g. "VM Lb")
- simultaneously press "Enter" and "Esc" keys for at least 8 seconds

- press "^" key
- press "Enter" key
- press "Enter" key
- with "v" or "^" key select the desired language

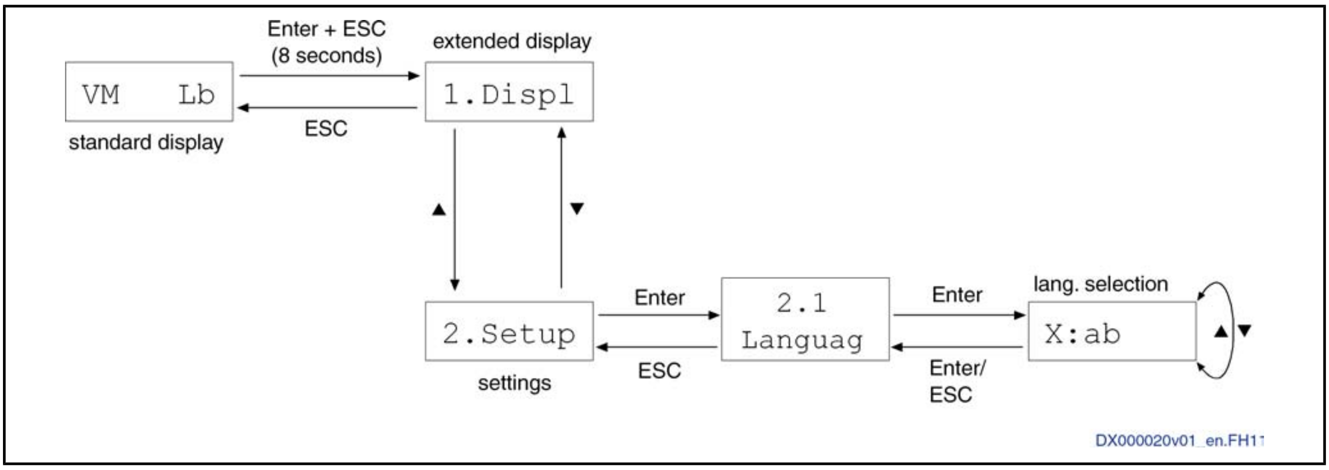


Fig. 10-9: Setting the language

10.1.2 Diagnostic Messages Displayed at IndraDrive M Supply Units

HMV - Diagnostic Messages for Operating States and During the Initialization Phase

☞ For detailed descriptions of the diagnostic messages mentioned in this chapter, see Troubleshooting Guide of the firmware documentation.

Display	Diagnostic message number	Diagnostic message
VM P0	A0000	Communication phase 0
VM P1	A0001	Communication phase 1
VM P2	A0002	Communication phase 2
VM P3	A0003	Communication phase 3
VM Bb	A0012	Control and power sections ready for operation
VM bb	A0013	Ready for power on
VM Lb	A0500	Supply module in voltage control
VM I Lb	A0501	Supply module in current control
VM Lb	A0502	Supply module in operation
VM charg	A0503	DC bus charging active
VM lb	A0510	Test run for voltage control

Display	Diagnostic message number	Diagnostic message
VM ZKS	A0520	DC bus quick discharge active
VM AF	A0800	Unknown operating mode

Fig. 10-10: Initialization and operating states HMV

HMV - Diagnostic Warning Messages

☞ For detailed descriptions of the diagnostic messages mentioned in this chapter, see Troubleshooting Guide of the firmware documentation.

Display	Diagnostic message number	Diagnostic message
VM E2026	E2026	Undervoltage in power section
VM E2050	E2050	Device overtemp. Prewarning
VM E2061	E2061	Device overload prewarning
VM E2810	E2810	Drive system not ready for operation
VM E2816	E2816	Undervoltage in power section
VM E2819	E2819	Mains failure
VM E2820	E2820	Braking resistor overload prewarning
VM E8025	E8025	Overvoltage in power section
VM E8057	E8057	Device overload, current limit active

Fig. 10-11: Diagnostic warning messages HMV

HMV - Diagnostic Error Messages

☞ For detailed descriptions of the diagnostic messages mentioned in this chapter, see Troubleshooting Guide of the firmware documentation.

Display	Diagnostic message number	Diagnostic message
VM PL	F2009	PL Load parameter default values
VM F2018	F2018	Device overtemperature shutdown

Display	Diagnostic message number	Diagnostic message
VM F2022	F2022	Device temperature monitor defective
VM F2026	F2026	Undervoltage in power section
VM F2077	F2077	Current measurement trim wrong
VM F2087	F2087	Module group communication error
VM F2110	F2110	Error in non-cyclical data communic. of power section
VM F2802	F2802	PLL is not synchronized
VM F2814	F2814	Undervoltage in mains
VM F2815	F2815	Overvoltage in mains
VM F2816	F2816	Softstart fault power supply unit
VM F2817	F2817	Overvoltage in power section
VM F2818	F2818	Phase failure
VM F2819	F2819	Mains failure
VM F2820	F2820	Braking resistor overload
VM F2821	F2821	Error in control of braking resistor
VM F2833	F2833	Ground fault in motor line
VM F2834	F2834	Contactor control error
VM F2835	F2835	Mains contactor wiring error
VM F2836	F2836	DC bus balancing monitor error
VM F2837	F2837	Contactor monitoring error
VM F2840	F2840	Error supply shutdown
VM F2860	F2860	Overcurrent in mains-side power section
VM F2890	F2890	Invalid device code
VM F2891	F2891	Incorrect interrupt timing
VM F2892	F2892	Hardware variant not supported
VM F8057	F8057	Device overload shutdown
VM F8069	F8069	+/-15Volt DC error
VM F8070	F8070	+24Volt DC error

Display	**Diagnostic message number**	**Diagnostic message**
VM F8813	F8813	Connection error mains choke
VM F9001	F9001	Error internal function call
VM F9003	F9003	Watchdog
VM F9004	F9004	Hardware trap

Fig. 10-12: Diagnostic error messages HMV

HMV - Diagnostic Command Messages

☞ For detailed descriptions of the diagnostic messages mentioned in this chapter, see Troubleshooting Guide of the firmware documentation.

Diagnostic command messages HMV

Display	**Diagnostic message number**	**Diagnostic message**
VM C01	C0100	Communication phase 3 transition check
VM C0101	C0101	Invalid parameters (-> S-0-0021)
VM C0102	C0102	Limit error in parameter (-> S-0-0021)
VM C02	C0200	Exit parameterization level procedure command
VM C0201	C0201	Invalid parameters (->S-0-0423)
VM C0202	C0202	Parameter limit error (->S-0-0423)
VM C0203	C0203	Parameter calculation error (->S-0-0423)
VM C0212	C0212	Invalid control section data (->S-0-0423)
VM C04	C0400	Activate parameterization level 1 procedure command
VM C0401	C0401	Switching not allowed
VM C05	C0500	Reset class 1 diagnostics, error reset
VM C08	C0800	Load basic parameters command
VM C0851	C0851	Parameter default value incorrect (-> S-0-0021)
VM C0852	C0852	Locked with password

Fig. 10-13: Diagnostic command messages HMV

10.2 Drive Controllers

10.2.1 Control Panel

☞ For the detailed description of the standard control panel, see section “Control Panels” in the Functional Description of the firmware documentation.

10.2.2 Diagnostic Messages Displayed at Drive Controllers

☞ For detailed descriptions of all diagnostic messages displayed at drive controllers, see “Troubleshooting Guide” of the firmware documentation.

11 Accessories

11.1 General Information

This section describes the accessories

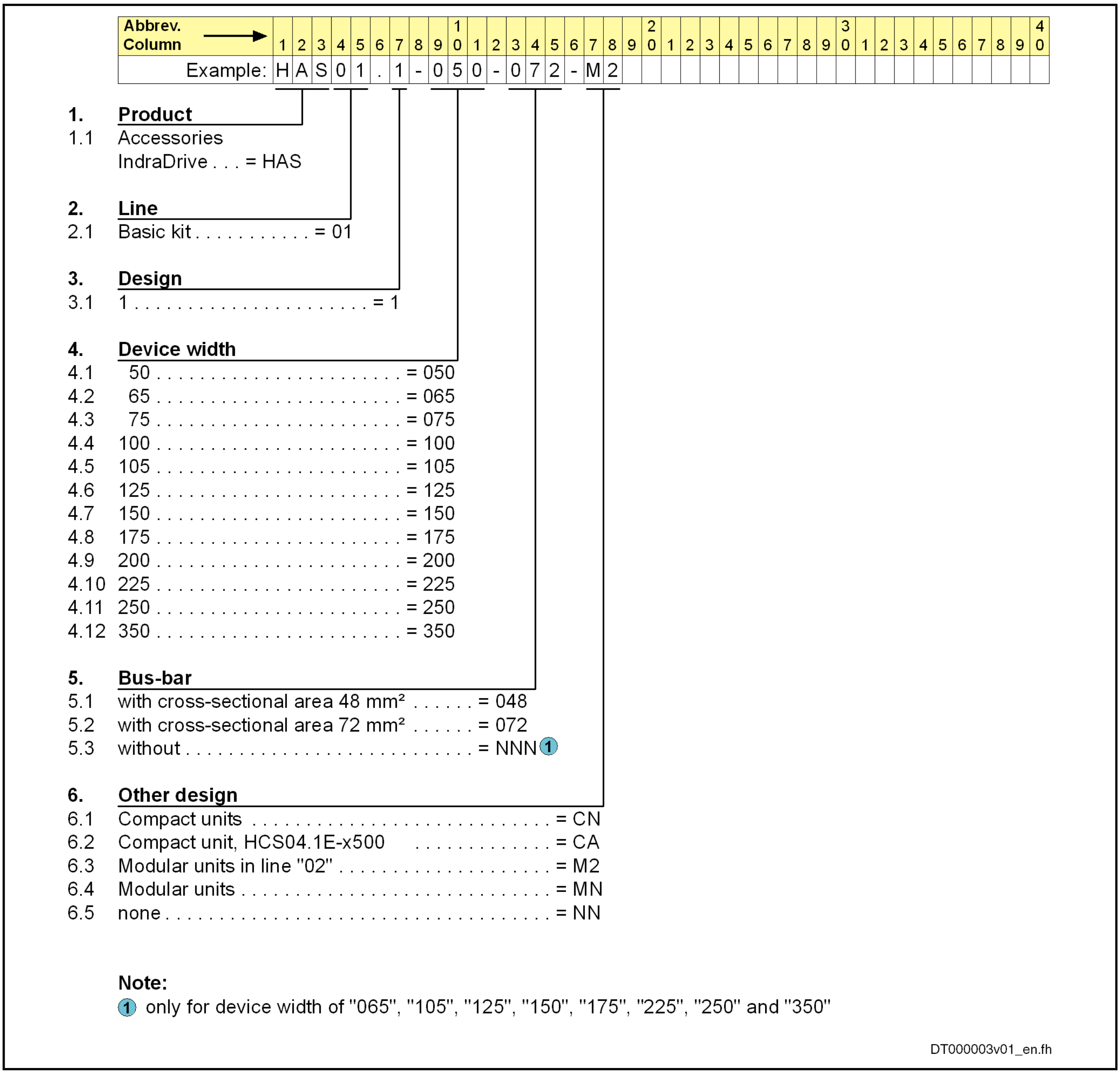
- HAS01, basic accessories
- HAS02, shield connection

For the complete scope of available accessories in the Rexroth IndraDrive system, see documentation “Rexroth IndraDrive - Drive System”.

11.2 HAS01 Basic Accessories

11.2.1 Type Code

☞ The following figure illustrates the basic structure of the type code. Our sales representative will help you with the current status of available versions.



Abbrev. Column →	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1	2	3	4	5	6	7	8	9	40
Example:	H	A	S	0	1	.	1	-	0	5	0	-	0	7	2	-	M	2																						

1. Product
1.1 Accessories IndraDrive . . . = HAS

2. Line
2.1 Basic kit . . . . = 01

3. Design
3.1 1 . . . . = 1

4. Device width
4.1 50 . . . . = 050
4.2 65 . . . . = 065
4.3 75 . . . . = 075
4.4 100 . . . . = 100
4.5 105 . . . . = 105
4.6 125 . . . . = 125
4.7 150 . . . . = 150
4.8 175 . . . . = 175
4.9 200 . . . . = 200
4.10 225 . . . . = 225
4.11 250 . . . . = 250
4.12 350 . . . . = 350

5. Bus-bar
5.1 with cross-sectional area 48 mm² . . . . . . = 048
5.2 with cross-sectional area 72 mm² . . . . . . = 072
5.3 without . . . . = NNN①

6. Other design
6.1 Compact units . . . . = CN
6.2 Compact unit, HCS04.1E-x500 . . . . = CA
6.3 Modular units in line "02" . . . . = M2
6.4 Modular units . . . . = MN
6.5 none . . . . = NN

Note:
① only for device width of "065", "105", "125", "150", "175", "225", "250" and "350"

DT000003v01_en.fh

Fig. 11-1: Type code HAS01.1

11.2.2 Brief Description

Accessories for mounting and installing the drive controllers in a group, i.e. next to each other.

As adjusted to the device widths, we distinguish 3 types:

- HAS01 **without** contact bars (-NNN)
- HAS01 **with** contact bars (-072-) to connect the DC buses
- HAS01 **with** contact bars (-072-) to connect the DC buses and joint bars to connect the equipment grounding conductors of the devices

☞ Observe that the contact bars of the basic accessories HAS01 are used for connection to the drive controller on the **left-hand** side.

11.2.3 Usage

The HAS01 accessories are used to

- fix the drive controllers to a mounting surface
- connect the DC bus connections of drive controllers
- connect the 24V supply of drive controllers of the Rexroth IndraDrive M range
- connect the equipment grounding conductor from drive controller to drive controller or supply unit
- increase the current carrying capacity of the contact bars in the DC bus for high-performance devices (by means of the parts “end piece” and “bar” in HAS01; see chapter “Assignment”)

☞ **Use of the parts “end piece” and “bar”**

For high-performance devices, you have to mount the end pieces and bars contained in the HAS01 accessory (see chapter “Assignment”).

See sections “Terminal Block L+, L- (DC Bus Connection)” and “Terminal Block, 24V - 0V (24V Supply)” in the Project Planning Manual "Rexroth IndraDrive, Supply Units and Power Sections".

11.2.4 Assignment

The accessories are assigned to the individual devices depending on the device width (see section “Type Code”).

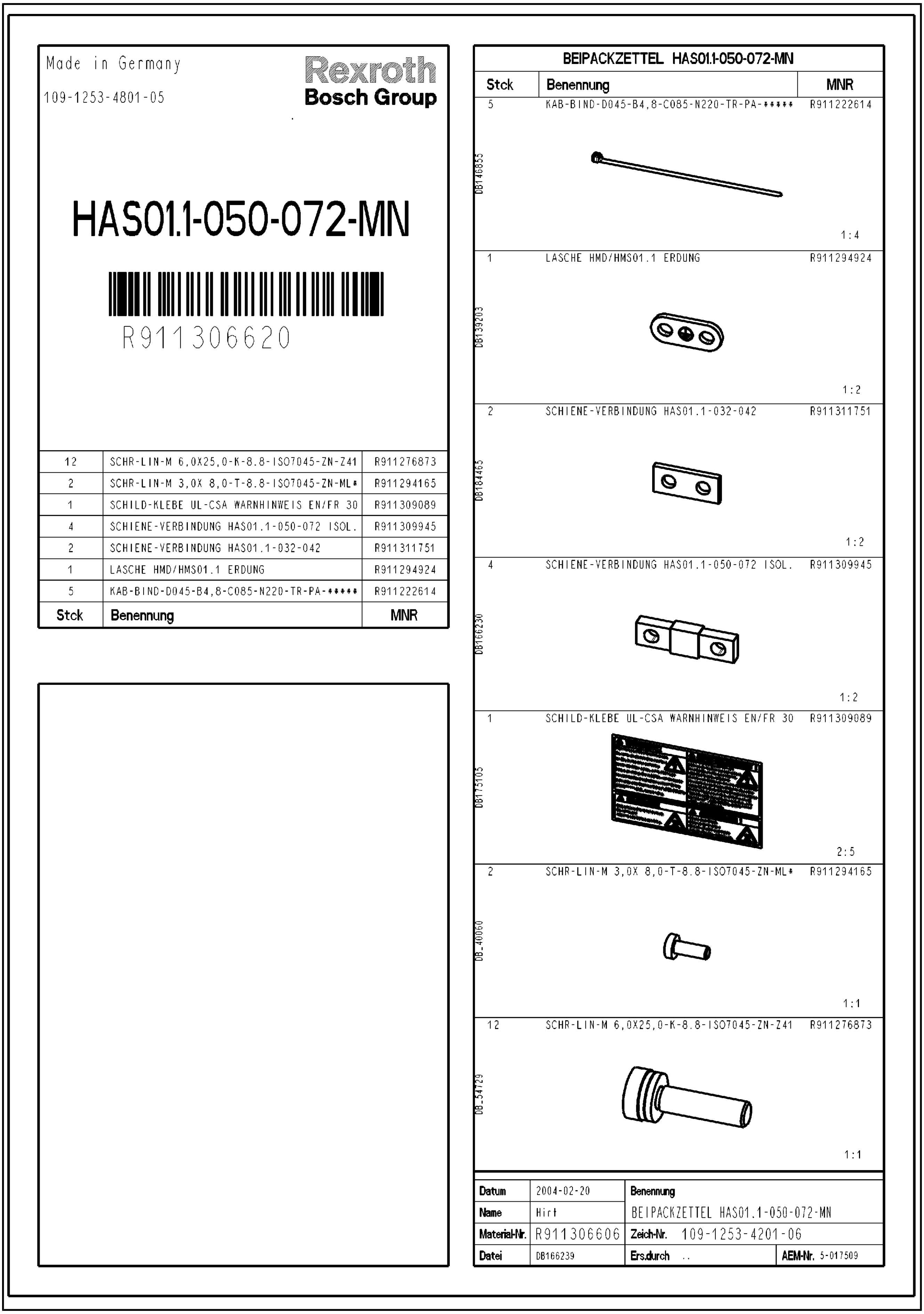
Device type		Width / mm	Accessory HAS01.1-	
				with “end piece”
HMS01.1N-	W0020	50	050	-
	W0036	50	050	-
	W0054	75	075	-
	W0070	100	100	-
	W0110	125	125	-
	W0150	150	150	-
	W0210	200	200	■
	W0350	350	350	■
HMD01.1N-	W0012	50	050	-
	W0020	50	050	-
	W0036	75	075	-
HMS02.1N-	W0028	49.5	050	-
	W0054	74.5	075	-
HLB01.1	D	100	100	-
HLC01.1	D	100	100	-

Device type		Width / mm	Accessory HAS01.1-	
				with "end piece"
HMV01.1E-	W0030	150	150	-
	W0075	250	250	■
	W0120	350	350	■
HMV01.1R-	W0018	175	175	-
	W0045	250	250	■
	W0065	350	350	■
	W0120	350	350	■
HMV02.1R-	W0015	150	150	-
HCS02.1N-	W0012	65	065	-
	W0028	65	065	-
	W0054	105	105	-
	W0070	105	105	-
HLB01.1	C	65	065	-
HLC01.1	C	50	050	-
HCS03.1N-	W0070	125	125	-
	W0100	225	225	-
	W0150	225	225	-
	W0210	350	350	■

Fig.11-2: Device width

11.2.5 Scope of Supply

Components of the accessory: see accompanying notes



Made in Germany
109-1253-4801-05

Rexroth
Bosch Group

HAS01.1-050-072-MN

R911306620

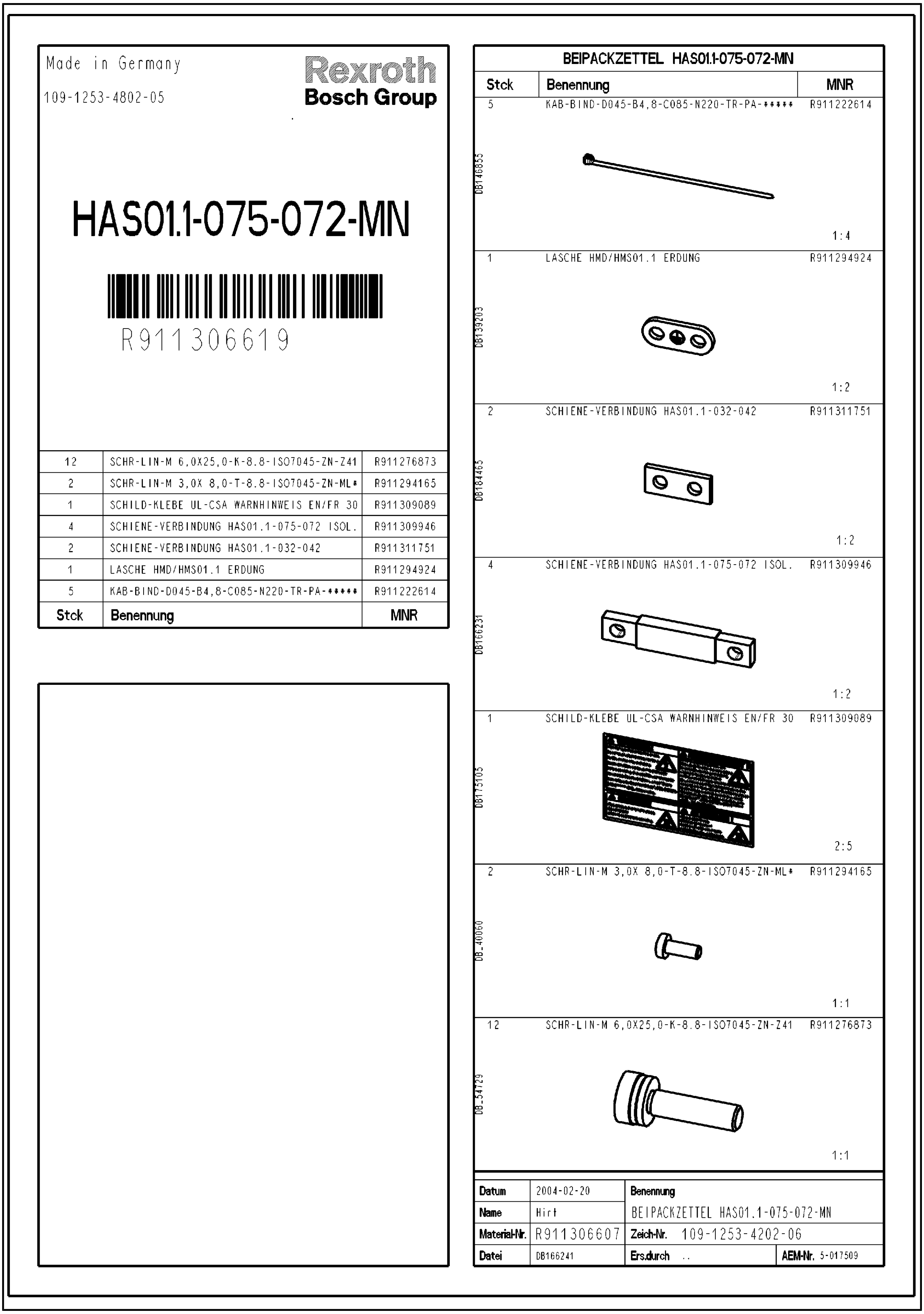
12	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
4	SCHIENE-VERBINDUNG HAS01.1-050-072 ISOL.	R911309945
2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751
1	LASCHE HMD/HMS01.1 ERDUNG	R911294924
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
Stck	**Benennung**	**MNR**

BEIPACKZETTEL HAS01.1-050-072-MN

Stck	Benennung	MNR
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-***** DB146855 1:4	R911222614
1	LASCHE HMD/HMS01.1 ERDUNG DB139203 1:2	R911294924
2	SCHIENE-VERBINDUNG HAS01.1-032-042 DB184465 1:2	R911311751
4	SCHIENE-VERBINDUNG HAS01.1-050-072 ISOL. DB166230 1:2	R911309945
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30 DB175105 2:5	R911309089
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML* DB_40060 1:1	R911294165
12	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41 DB_54729 1:1	R911276873

Datum	2004-02-20	**Benennung**	
Name	Hirt	BEIPACKZETTEL HAS01.1-050-072-MN	
Material-Nr.	R911306606	**Zeich-Nr.** 109-1253-4201-06	
Datei	DB166239	**Ers.durch** ..	**AEM-Nr.** 5-017509

Fig.11-3: Accompanying note



Made in Germany
109-1253-4802-05

Rexroth
Bosch Group

HAS01.1-075-072-MN

R911306619

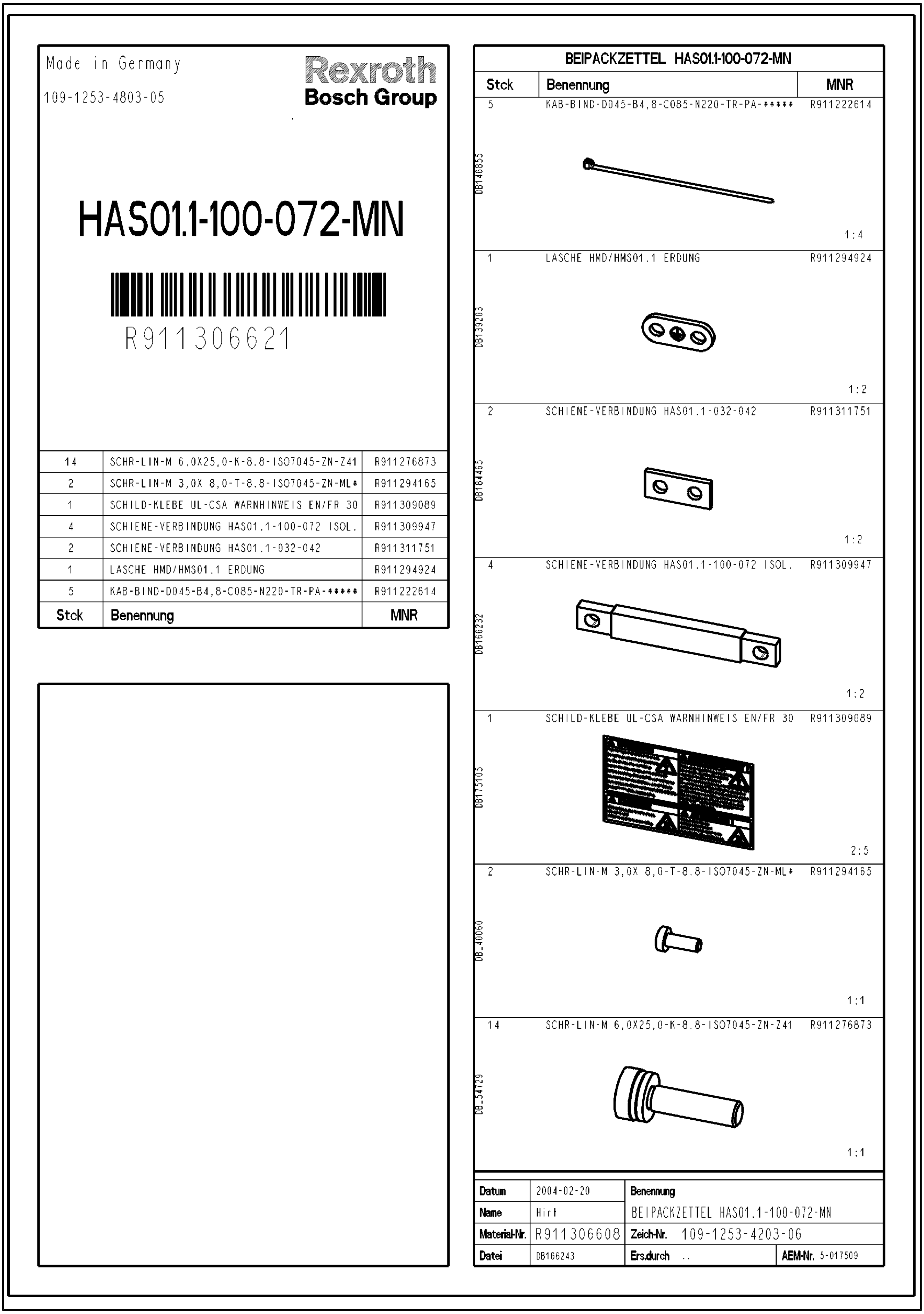
Stck	Benennung	MNR
12	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
4	SCHIENE-VERBINDUNG HAS01.1-075-072 ISOL.	R911309946
2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751
1	LASCHE HMD/HMS01.1 ERDUNG	R911294924
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614

BEIPACKZETTEL HAS01.1-075-072-MN

	Stck	Benennung	MNR	
DB146855	5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614	1:4
DB139203	1	LASCHE HMD/HMS01.1 ERDUNG	R911294924	1:2
DB184465	2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751	1:2
DB166231	4	SCHIENE-VERBINDUNG HAS01.1-075-072 ISOL.	R911309946	1:2
DB175105	1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089	2:5
DB_40060	2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165	1:1
DB_54729	12	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873	1:1

Datum	2004-02-20	**Benennung**	
Name	Hirt	BEIPACKZETTEL HAS01.1-075-072-MN	
Material-Nr.	R911306607	**Zeich-Nr.** 109-1253-4202-06	
Datei	DB166241	**Ers.durch** ..	**AEM-Nr.** 5-017509

Fig.11-4: Accompanying note



Made in Germany
109-1253-4803-05

Rexroth
Bosch Group

HAS01.1-100-072-MN

R911306621

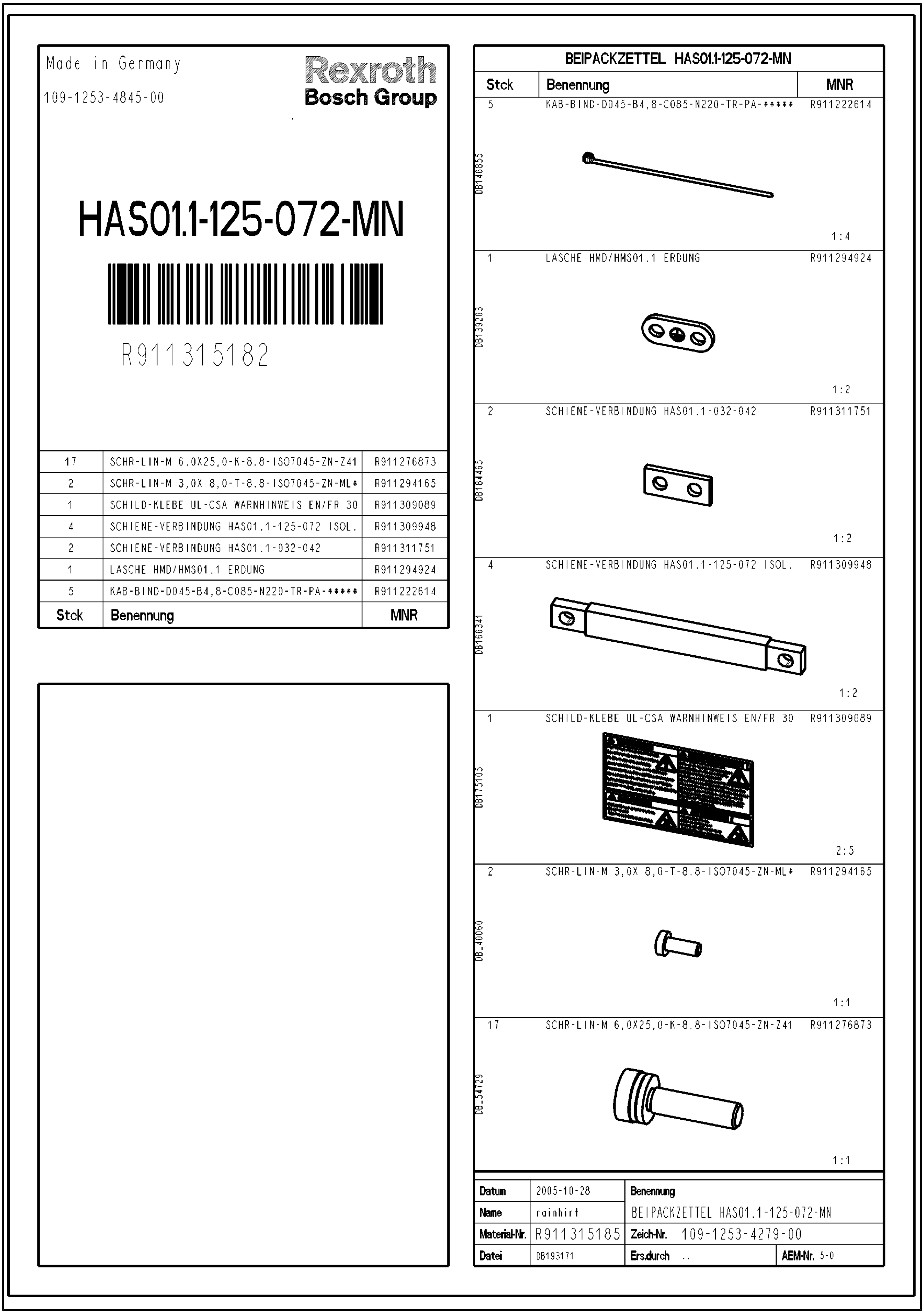
14	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
4	SCHIENE-VERBINDUNG HAS01.1-100-072 ISOL.	R911309947
2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751
1	LASCHE HMD/HMS01.1 ERDUNG	R911294924
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
Stck	**Benennung**	**MNR**

BEIPACKZETTEL HAS01.1-100-072-MN

Stck	Benennung	MNR		
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614	DB146855	1:4
1	LASCHE HMD/HMS01.1 ERDUNG	R911294924	DB139203	1:2
2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751	DB184465	1:2
4	SCHIENE-VERBINDUNG HAS01.1-100-072 ISOL.	R911309947	DB166232	1:2
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089	DB175105	2:5
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165	DB_40060	1:1
14	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873	DB_54729	1:1

Datum	2004-02-20	**Benennung**	
Name	Hirt	BEIPACKZETTEL HAS01.1-100-072-MN	
Material-Nr.	R911306608	**Zeich-Nr.** 109-1253-4203-06	
Datei	DB166243	**Ers.durch** ..	**AEM-Nr.** 5-017509

Fig. 11-5: Accompanying note



Made in Germany

109-1253-4845-00

Rexroth
Bosch Group

HAS01.1-125-072-MN

R911315182

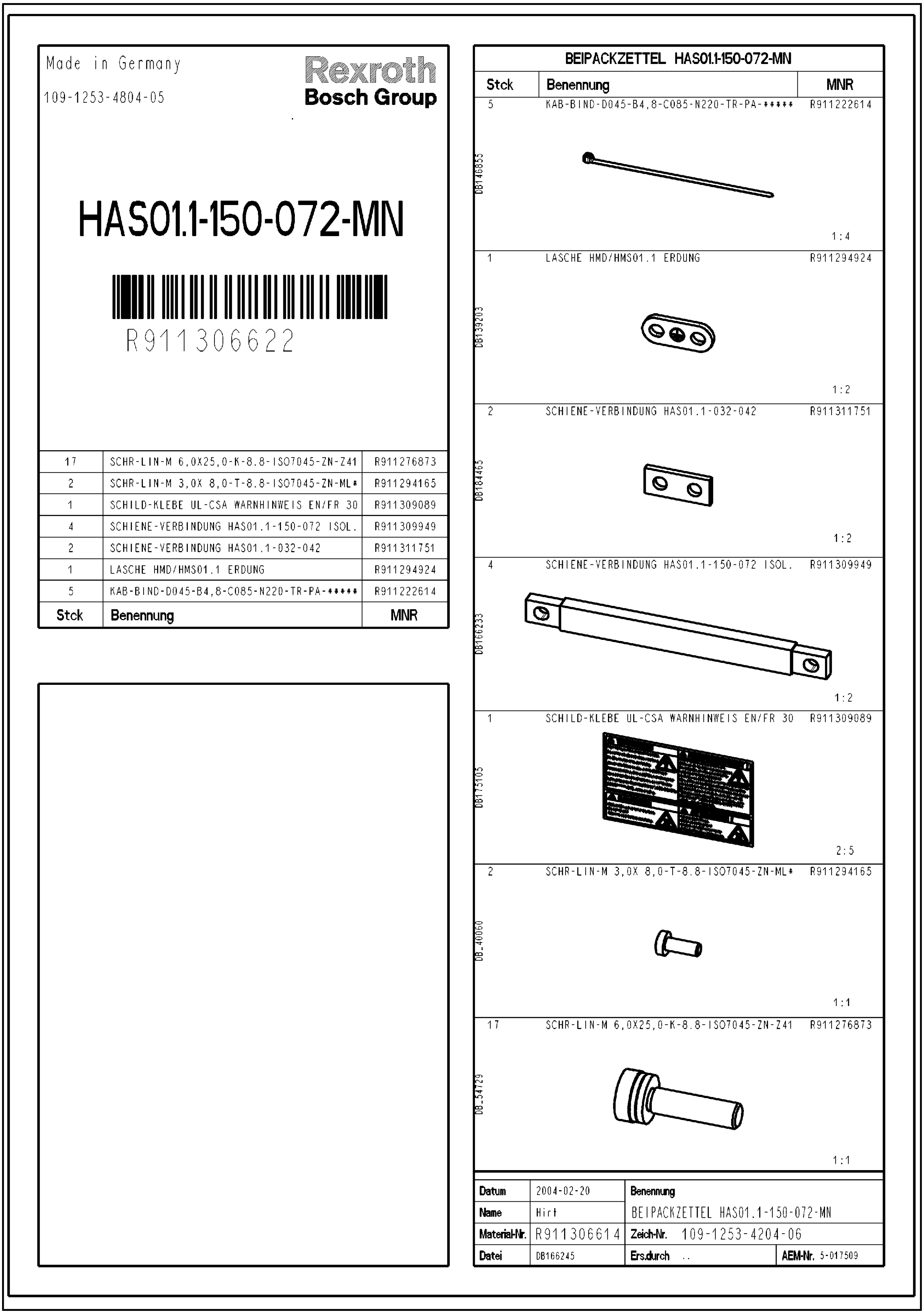
Stck	Benennung	MNR
17	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
4	SCHIENE-VERBINDUNG HAS01.1-125-072 ISOL.	R911309948
2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751
1	LASCHE HMD/HMS01.1 ERDUNG	R911294924
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614

BEIPACKZETTEL HAS01.1-125-072-MN

Stck	Benennung	MNR
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
1	LASCHE HMD/HMS01.1 ERDUNG	R911294924
2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751
4	SCHIENE-VERBINDUNG HAS01.1-125-072 ISOL.	R911309948
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
17	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873

Datum	2005-10-28	**Benennung**	
Name	rainhirt	BEIPACKZETTEL HAS01.1-125-072-MN	
Material-Nr.	R911315185	**Zeich-Nr.** 109-1253-4279-00	
Datei	DB193171	**Ers.durch** ..	**AEM-Nr.** 5-0

Fig.11-6: Accompanying note



Made in Germany

109-1253-4804-05

Rexroth
Bosch Group

HAS01.1-150-072-MN

R911306622

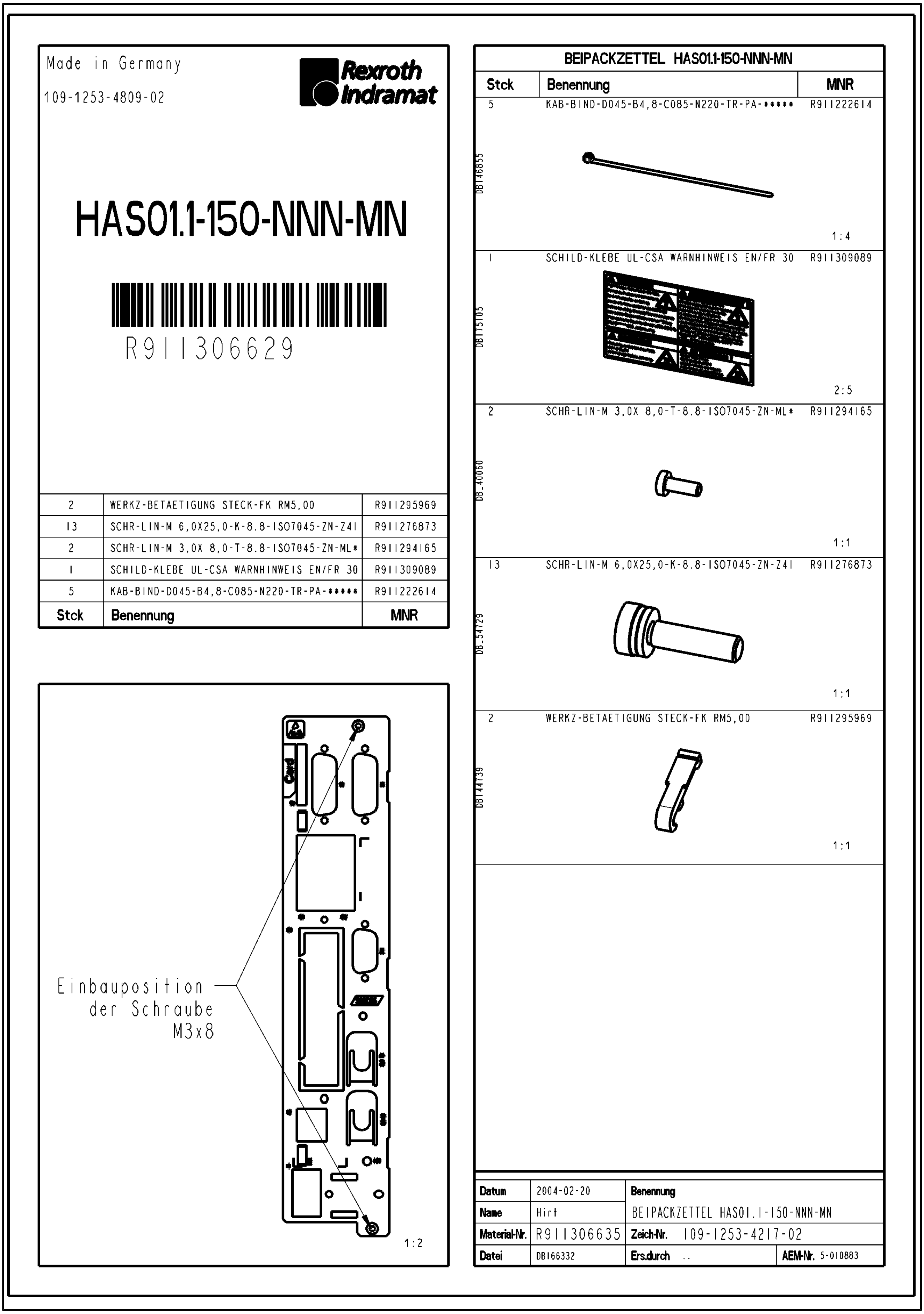
Stck	Benennung	MNR
17	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
4	SCHIENE-VERBINDUNG HAS01.1-150-072 ISOL.	R911309949
2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751
1	LASCHE HMD/HMS01.1 ERDUNG	R911294924
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614

BEIPACKZETTEL HAS01.1-150-072-MN

Stck	Benennung	MNR		
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614	1:4	DB146855
1	LASCHE HMD/HMS01.1 ERDUNG	R911294924	1:2	DB139203
2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751	1:2	DB184465
4	SCHIENE-VERBINDUNG HAS01.1-150-072 ISOL.	R911309949	1:2	DB166233
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089	2:5	DB175105
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165	1:1	DB_40060
17	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873	1:1	DB_54729

Datum	2004-02-20	Benennung	
Name	Hirt	BEIPACKZETTEL HAS01.1-150-072-MN	
Material-Nr.	R911306614	Zeich-Nr. 109-1253-4204-06	
Datei	DB166245	Ers.durch ..	AEM-Nr. 5-017509

Fig. 11-7: Accompanying note



Made in Germany

109-1253-4809-02

Rexroth Indramat

HAS01.1-150-NNN-MN

R911306629

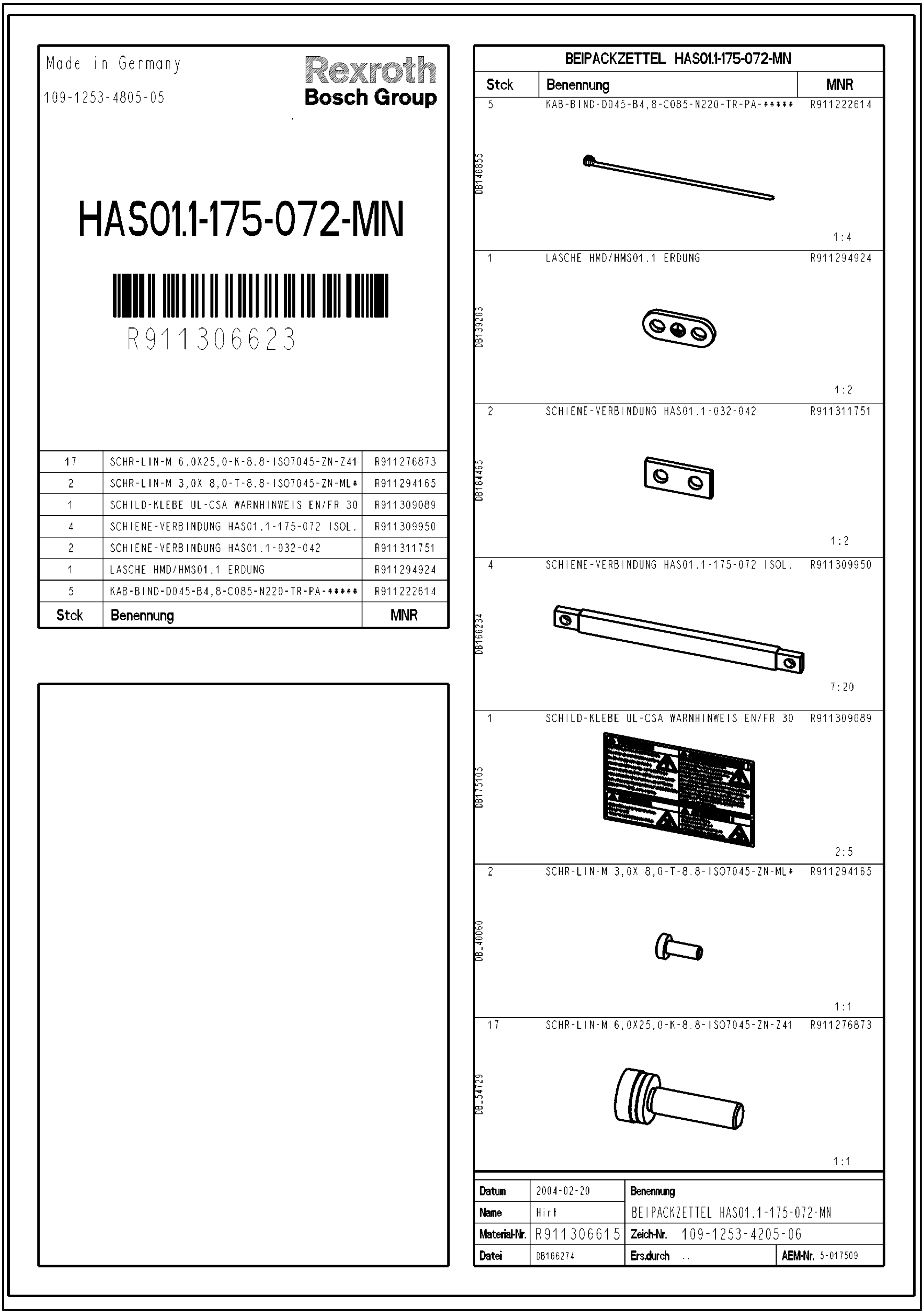
Stck	Benennung	MNR
2	WERKZ-BETAETIGUNG STECK-FK RM5,00	R911295969
13	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614

BEIPACKZETTEL HAS01.1-150-NNN-MN

Stck	Benennung	MNR
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
13	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
2	WERKZ-BETAETIGUNG STECK-FK RM5,00	R911295969

Datum	2004-02-20	Benennung	
Name	Hirt	BEIPACKZETTEL HAS01.1-150-NNN-MN	
Material-Nr.	R911306635	Zeich-Nr.	109-1253-4217-02
Datei	DB166332	Ers.durch . .	AEM-Nr. 5-010883

Fig.11-8: Accompanying note



Made in Germany

109-1253-4805-05

Rexroth
Bosch Group

HAS01.1-175-072-MN

R911306623

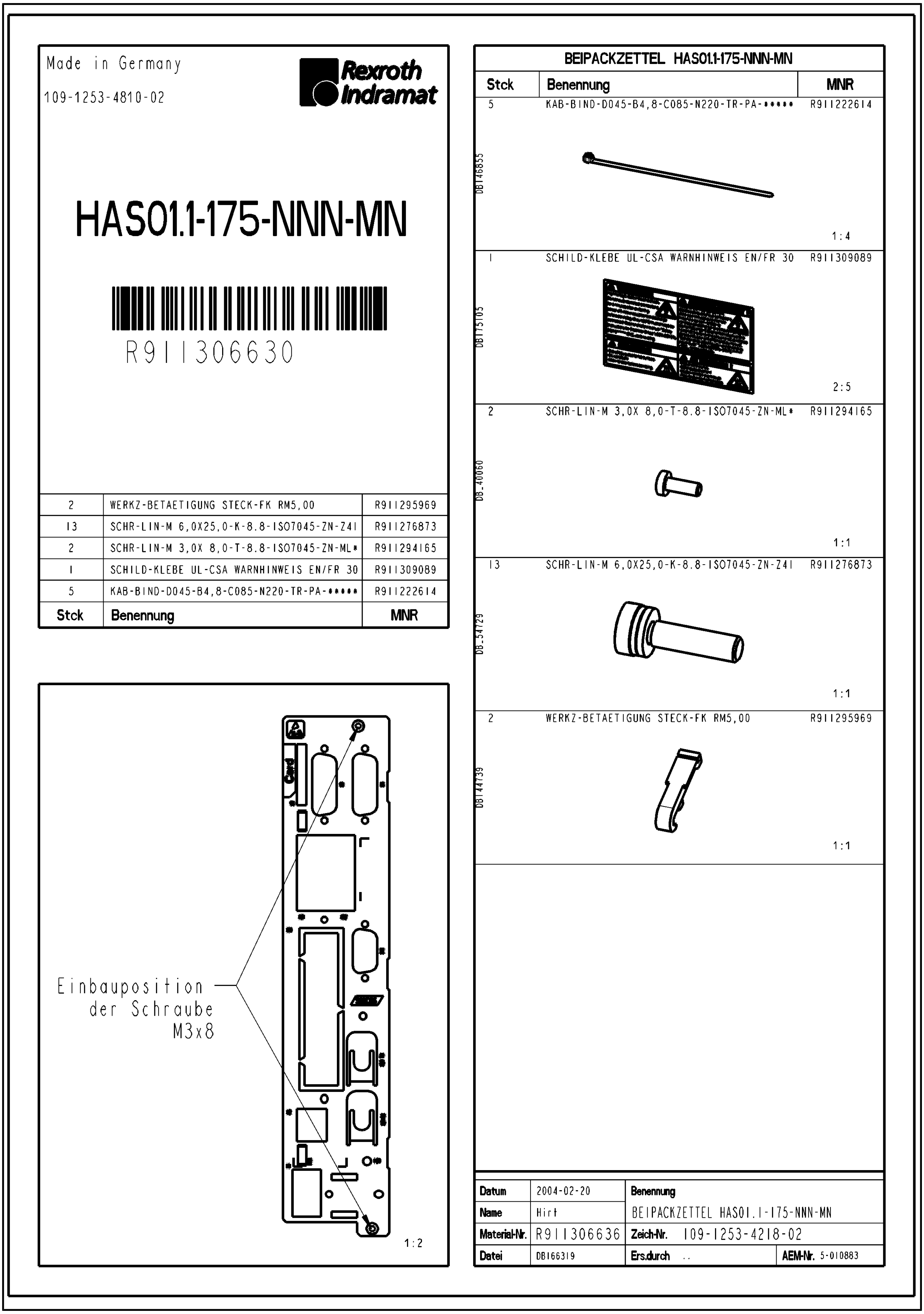
17	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
4	SCHIENE-VERBINDUNG HAS01.1-175-072 ISOL.	R911309950
2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751
1	LASCHE HMD/HMS01.1 ERDUNG	R911294924
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
Stck	**Benennung**	**MNR**

BEIPACKZETTEL HAS01.1-175-072-MN

Stck	Benennung	MNR
5 DB146855	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614 1:4
1 DB139203	LASCHE HMD/HMS01.1 ERDUNG	R911294924 1:2
2 DB184465	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751 1:2
4 DB166234	SCHIENE-VERBINDUNG HAS01.1-175-072 ISOL.	R911309950 7:20
1 DB175105	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089 2:5
2 DB_40060	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165 1:1
17 DB_54729	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873 1:1

Datum	2004-02-20	**Benennung**	
Name	Hirt	BEIPACKZETTEL HAS01.1-175-072-MN	
Material-Nr.	R911306615	**Zeich-Nr.** 109-1253-4205-06	
Datei	DB166274	**Ers.durch** ..	**AEM-Nr.** 5-017509

Fig.11-9: Accompanying note



Made in Germany

109-1253-4810-02

HAS01.1-175-NNN-MN

R911306630

Stck	Benennung	MNR
2	WERKZ-BETAETIGUNG STECK-FK RM5,00	R911295969
13	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614

Einbauposition der Schraube M3x8

1:2

BEIPACKZETTEL HAS01.1-175-NNN-MN

Stck	Benennung	MNR
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
13	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
2	WERKZ-BETAETIGUNG STECK-FK RM5,00	R911295969

DB146855 1:4

DB175105 2:5

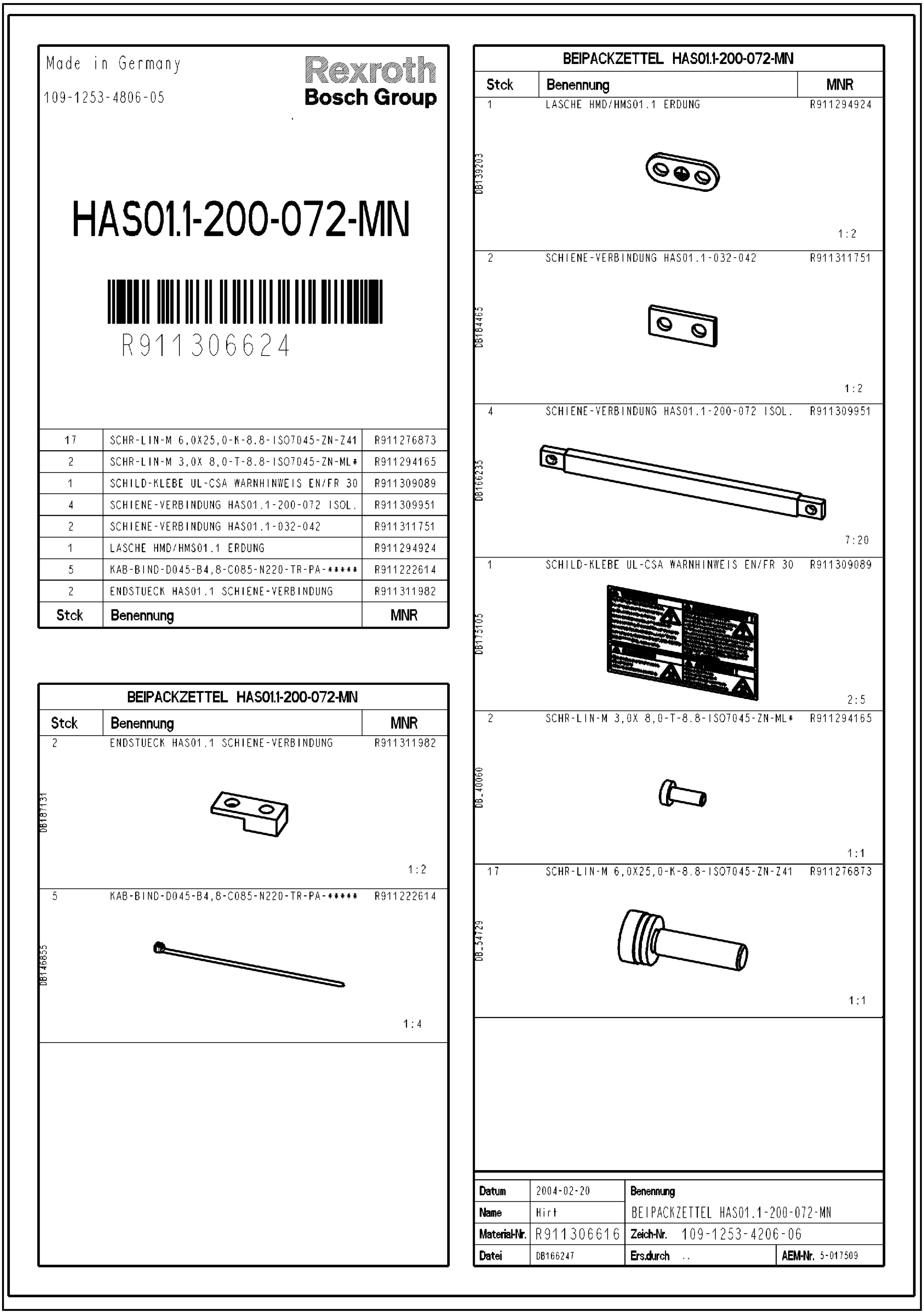
DB_40060 1:1

DB_54729 1:1

DB144739 1:1

Datum	2004-02-20	Benennung	
Name	Hirt	BEIPACKZETTEL HAS01.1-175-NNN-MN	
Material-Nr.	R911306636	Zeich-Nr. 109-1253-4218-02	
Datei	DB166319	Ers.durch ..	AEM-Nr. 5-010883

Fig.11-10: Accompanying note



Made in Germany
109-1253-4806-05
Rexroth
Bosch Group

HAS01.1-200-072-MN

R911306624

Stck	Benennung	MNR
17	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
4	SCHIENE-VERBINDUNG HAS01.1-200-072 ISOL.	R911309951
2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751
1	LASCHE HMD/HMS01.1 ERDUNG	R911294924
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
2	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG	R911311982

BEIPACKZETTEL HAS01.1-200-072-MN

Stck	Benennung	MNR
2	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG DB187131 1:2	R911311982
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-***** DB146855 1:4	R911222614

BEIPACKZETTEL HAS01.1-200-072-MN

Stck	Benennung	MNR
1	LASCHE HMD/HMS01.1 ERDUNG DB139203 1:2	R911294924
2	SCHIENE-VERBINDUNG HAS01.1-032-042 DB184465 1:2	R911311751
4	SCHIENE-VERBINDUNG HAS01.1-200-072 ISOL. DB166235 7:20	R911309951
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30 DB175105 2:5	R911309089
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML* DB.40060 1:1	R911294165
17	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41 DB.54729 1:1	R911276873

Datum	2004-02-20	Benennung	
Name	Hirt	BEIPACKZETTEL HAS01.1-200-072-MN	
Material-Nr.	R911306616	Zeich-Nr. 109-1253-4206-06	
Datei	DB166247	Ers.durch ..	AEM-Nr. 5-017509

Fig. 11-11: Accompanying note

Made in Germany

109-1253-4807-06

Rexroth
Bosch Group

HAS01.1-250-072-MN

R911306625

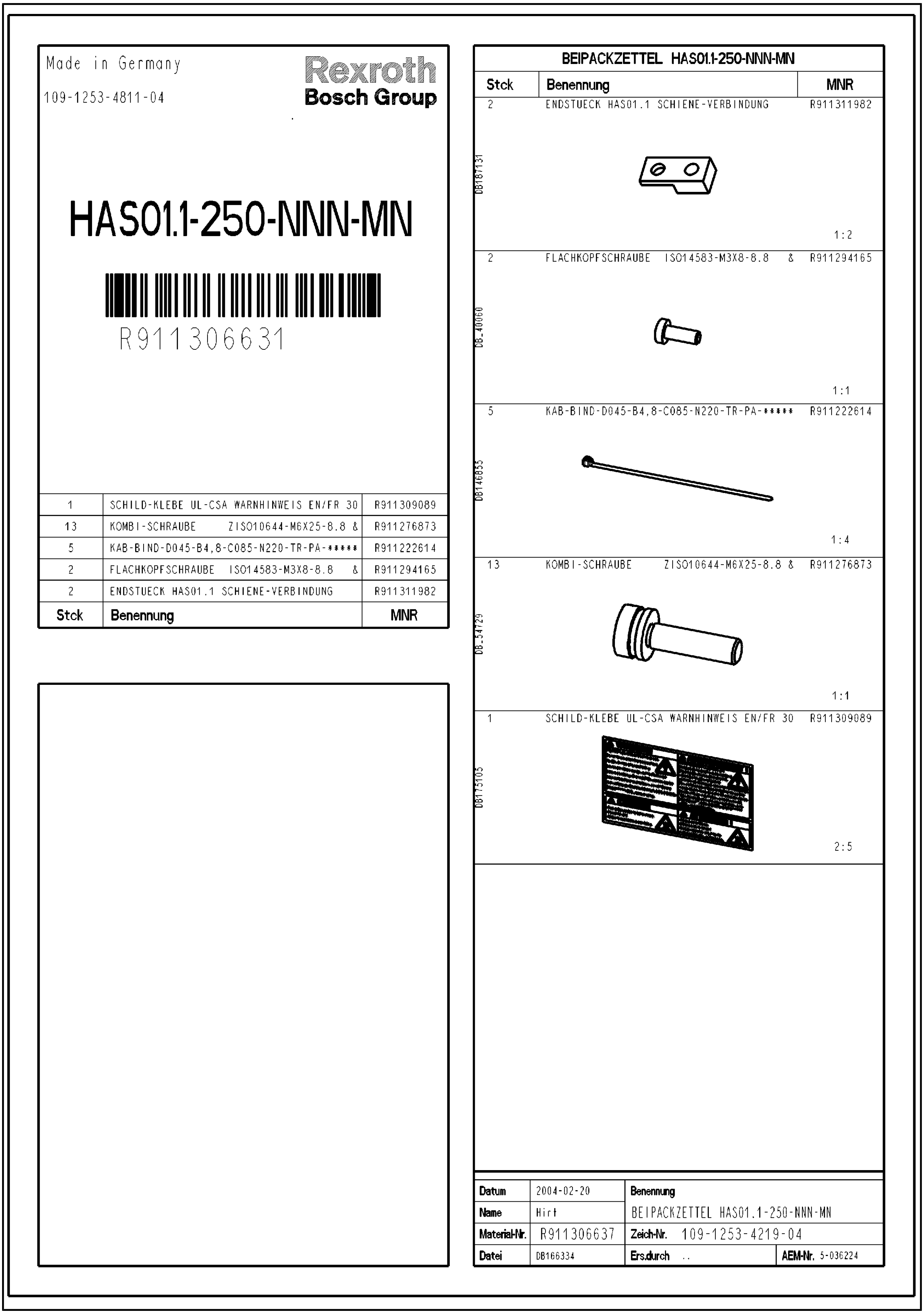
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
4	SCHIENE-VERBINDUNG HAS01.1-250-072 ISOL.	R911309953
2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751
1	LASCHE HMD/HMS01.1 ERDUNG	R911294924
17	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165
2	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG	R911311982
Stck	**Benennung**	**MNR**

BEIPACKZETTEL HAS01.1-250-072-MN

Stck	Benennung	MNR
2 DB187131	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG	R911311982 1:2
2 DB_40060	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165 1:1
5 DB146855	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614 1:4
17 DB_54729	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873 1:1
1 DB139203	LASCHE HMD/HMS01.1 ERDUNG	R911294924 1:2
2 DB184465	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751 1:2
4 DB166236	SCHIENE-VERBINDUNG HAS01.1-250-072 ISOL.	R911309953 1:4
1 DB175105	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089 2:5

Datum	2004-02-20	**Benennung**	
Name	Hirt	BEIPACKZETTEL HAS01.1-250-072-MN	
Material-Nr.	R911306617	**Zeich-Nr.** 109-1253-4207-07	
Datei	DB166276	**Ers.durch** ..	**AEM-Nr.** 5-036224

Fig.11-12: Accompanying note



Made in Germany
109-1253-4811-04

Rexroth
Bosch Group

HAS01.1-250-NNN-MN

R911306631

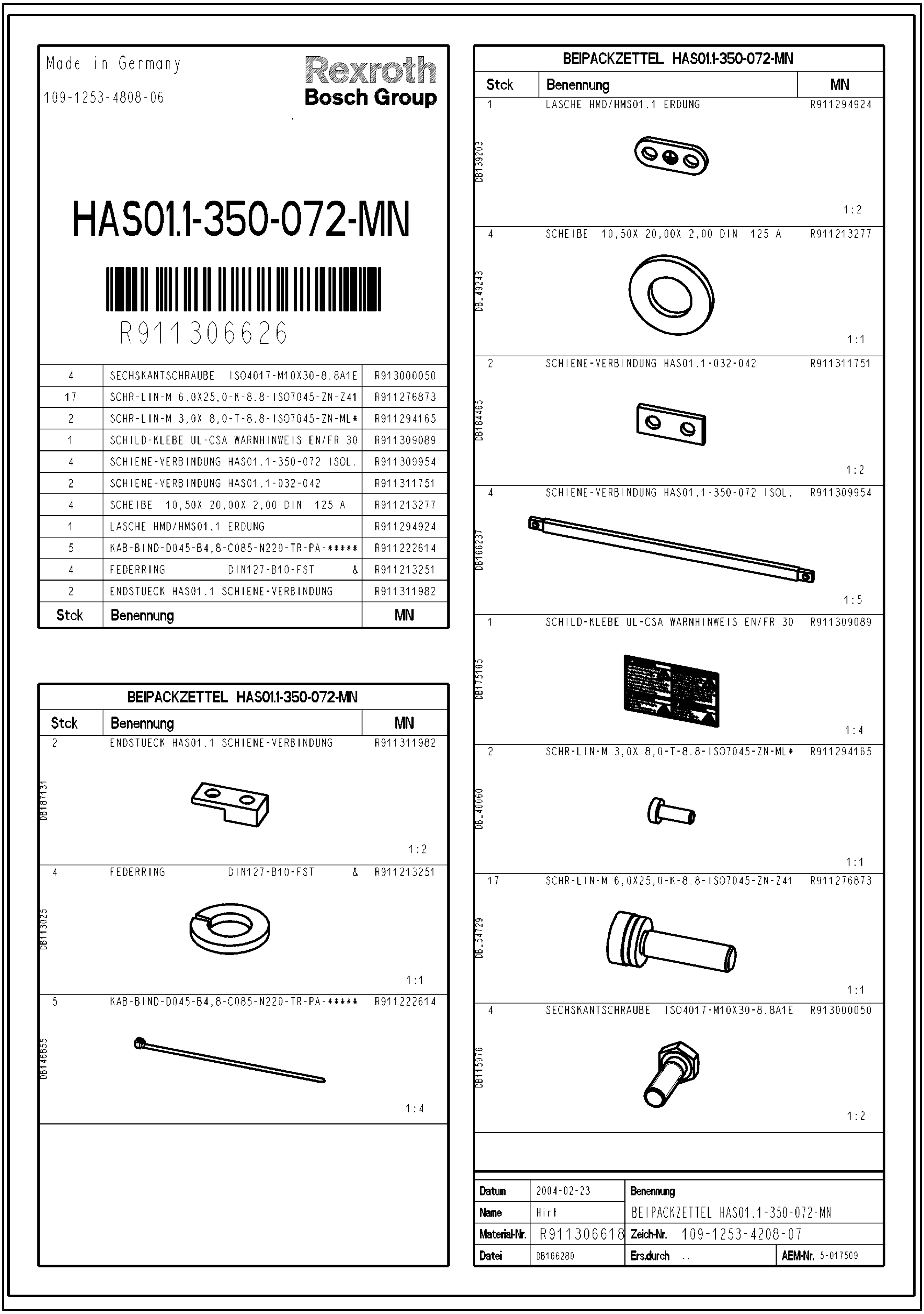
Stck	Benennung	MNR
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
13	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165
2	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG	R911311982

BEIPACKZETTEL HAS01.1-250-NNN-MN

Stck	Benennung	MNR
2	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG	R911311982
2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
13	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089

Datum	2004-02-20	**Benennung**	
Name	Hirt	BEIPACKZETTEL HAS01.1-250-NNN-MN	
Material-Nr.	R911306637	**Zeich-Nr.** 109-1253-4219-04	
Datei	DB166334	**Ers.durch** ..	**AEM-Nr.** 5-036224

Fig. 11-13: Accompanying note



Made in Germany
109-1253-4808-06

Rexroth
Bosch Group

HAS01.1-350-072-MN

R911306626

4	SECHSKANTSCHRAUBE ISO4017-M10X30-8.8A1E	R913000050
17	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
4	SCHIENE-VERBINDUNG HAS01.1-350-072 ISOL.	R911309954
2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751
4	SCHEIBE 10,50X 20,00X 2,00 DIN 125 A	R911213277
1	LASCHE HMD/HMS01.1 ERDUNG	R911294924
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
4	FEDERRING DIN127-B10-FST &	R911213251
2	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG	R911311982
Stck	**Benennung**	**MN**

BEIPACKZETTEL HAS01.1-350-072-MN

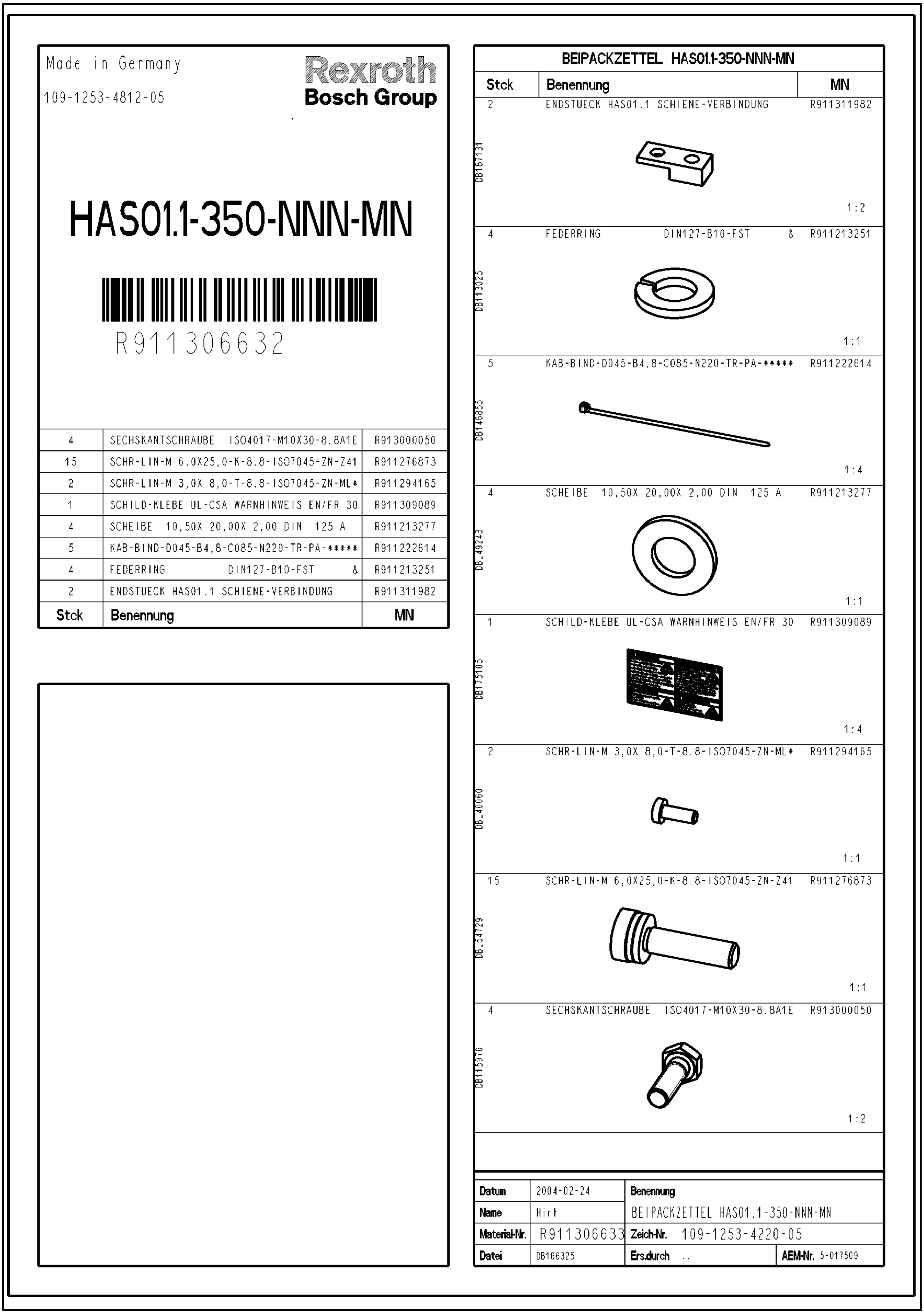
Stck	Benennung	MN
2	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG DB187131 1:2	R911311982
4	FEDERRING DIN127-B10-FST & DB113025 1:1	R911213251
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-***** DB146855 1:4	R911222614

BEIPACKZETTEL HAS01.1-350-072-MN

Stck	Benennung	MN
1	LASCHE HMD/HMS01.1 ERDUNG DB139203 1:2	R911294924
4	SCHEIBE 10,50X 20,00X 2,00 DIN 125 A DB.49243 1:1	R911213277
2	SCHIENE-VERBINDUNG HAS01.1-032-042 DB184465 1:2	R911311751
4	SCHIENE-VERBINDUNG HAS01.1-350-072 ISOL. DB166237 1:5	R911309954
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30 DB175105 1:4	R911309089
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML* DB.40060 1:1	R911294165
17	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41 DB.54129 1:1	R911276873
4	SECHSKANTSCHRAUBE ISO4017-M10X30-8.8A1E DB115976 1:2	R913000050

Datum	2004-02-23	**Benennung**	
Name	Hirt	BEIPACKZETTEL HAS01.1-350-072-MN	
Material-Nr.	R911306618	**Zeich-Nr.** 109-1253-4208-07	
Datei	DB166280	**Ers.durch** ..	**AEM-Nr.** 5-017509

Fig.11-14: Accompanying note



Made in Germany
109-1253-4812-05

Rexroth
Bosch Group

HAS01.1-350-NNN-MN

R911306632

Stck	Benennung	MN
4	SECHSKANTSCHRAUBE ISO4017-M10X30-8.8A1E	R913000050
15	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
4	SCHEIBE 10,50X 20,00X 2,00 DIN 125 A	R911213277
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
4	FEDERRING DIN127-B10-FST &	R911213251
2	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG	R911311982

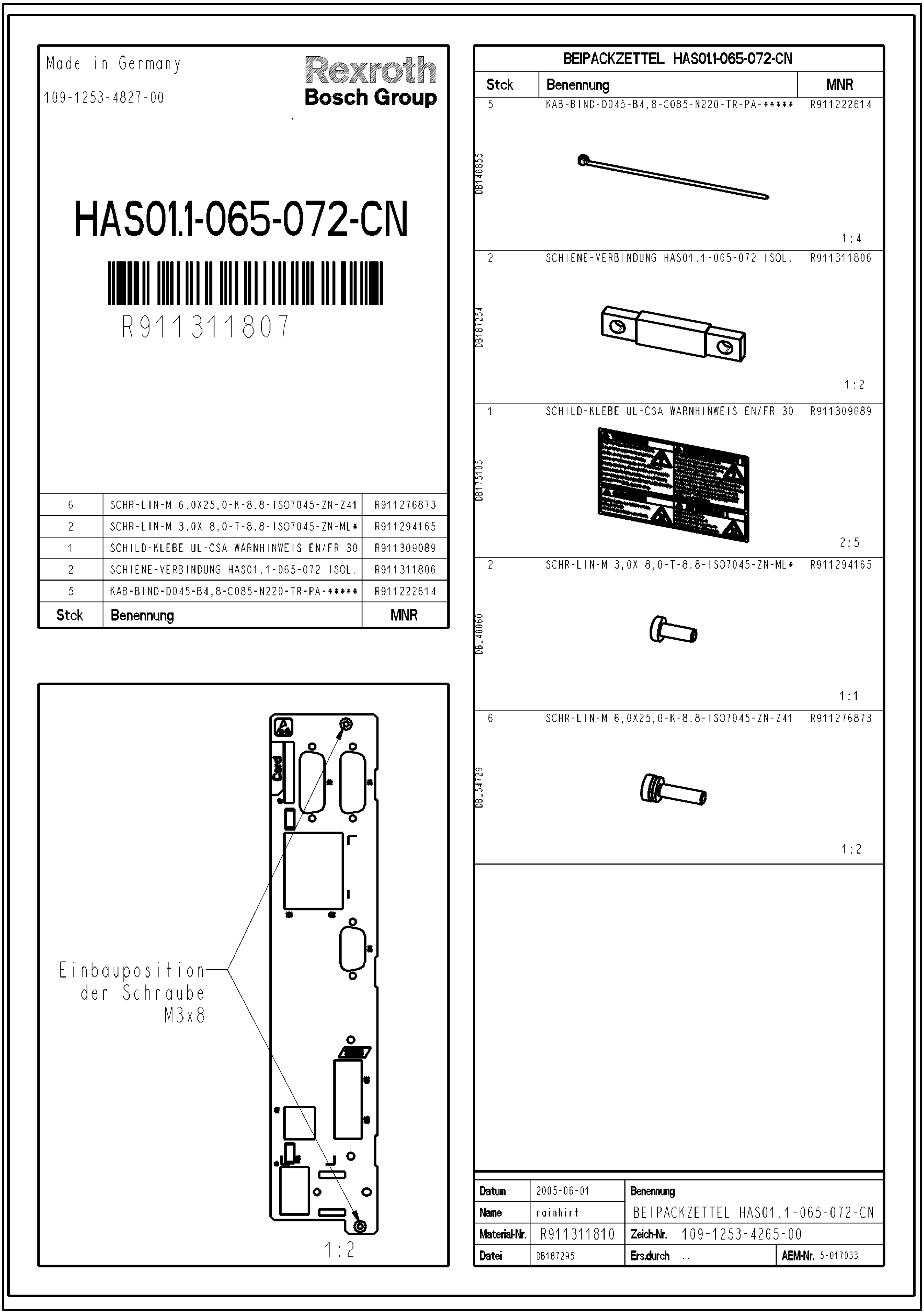
BEIPACKZETTEL HAS01.1-350-NNN-MN

Stck	Benennung	MN
2 DB187131	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG	R911311982 1:2
4 DB113025	FEDERRING DIN127-B10-FST &	R911213251 1:1
5 DB146855	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614 1:4
4 DB_49243	SCHEIBE 10,50X 20,00X 2,00 DIN 125 A	R911213277 1:1
1 DB175105	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089 1:4
2 DB_40060	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165 1:1
15 DB_54729	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873 1:1
4 DB115976	SECHSKANTSCHRAUBE ISO4017-M10X30-8.8A1E	R913000050 1:2

Datum	2004-02-24	**Benennung**	
Name	Hirt	BEIPACKZETTEL HAS01.1-350-NNN-MN	
Material-Nr.	R911306633	**Zeich-Nr.** 109-1253-4220-05	
Datei	DB166325	**Ers.durch** ..	**AEM-Nr.** 5-017509

Fig. 11-15: Accompanying note

Accessories



Made in Germany
109-1253-4827-00

Rexroth
Bosch Group

HAS01.1-065-072-CN

R911311807

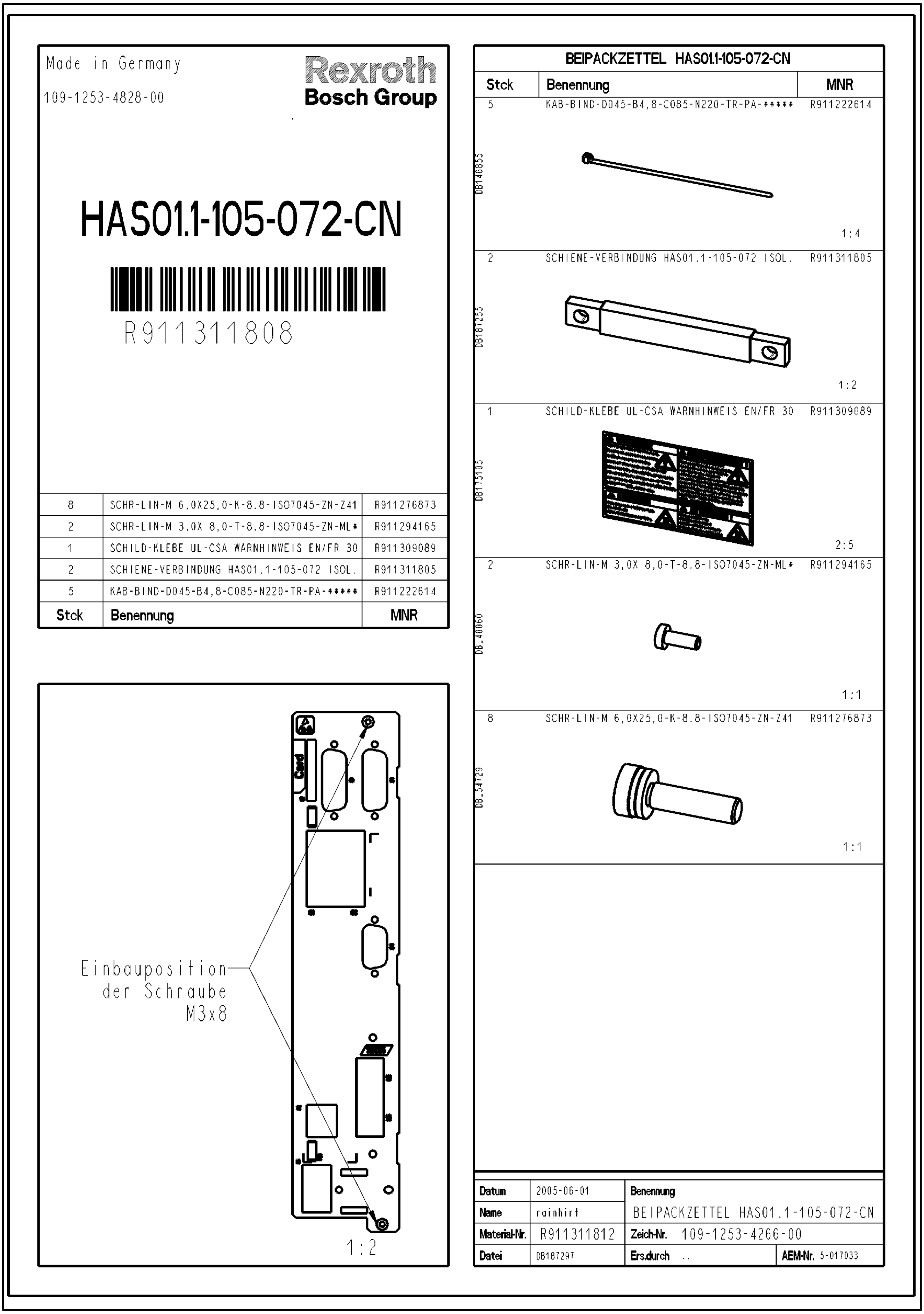
Stck	Benennung	MNR
6	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
2	SCHIENE-VERBINDUNG HAS01.1-065-072 ISOL.	R911311806
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614

BEIPACKZETTEL HAS01.1-065-072-CN

Stck	Benennung	MNR
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
2	SCHIENE-VERBINDUNG HAS01.1-065-072 ISOL.	R911311806
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
6	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873

Datum	2005-06-01	Benennung	
Name	rainhirt	BEIPACKZETTEL HAS01.1-065-072-CN	
Material-Nr.	R911311810	Zeich-Nr. 109-1253-4265-00	
Datei	DB187295	Ers.durch ..	AEM-Nr. 5-017033

Fig.11-16: Accompanying note



Made in Germany
109-1253-4828-00

Rexroth
Bosch Group

HAS01.1-105-072-CN

R911311808

Stck	Benennung	MNR
8	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
2	SCHIENE-VERBINDUNG HAS01.1-105-072 ISOL.	R911311805
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614

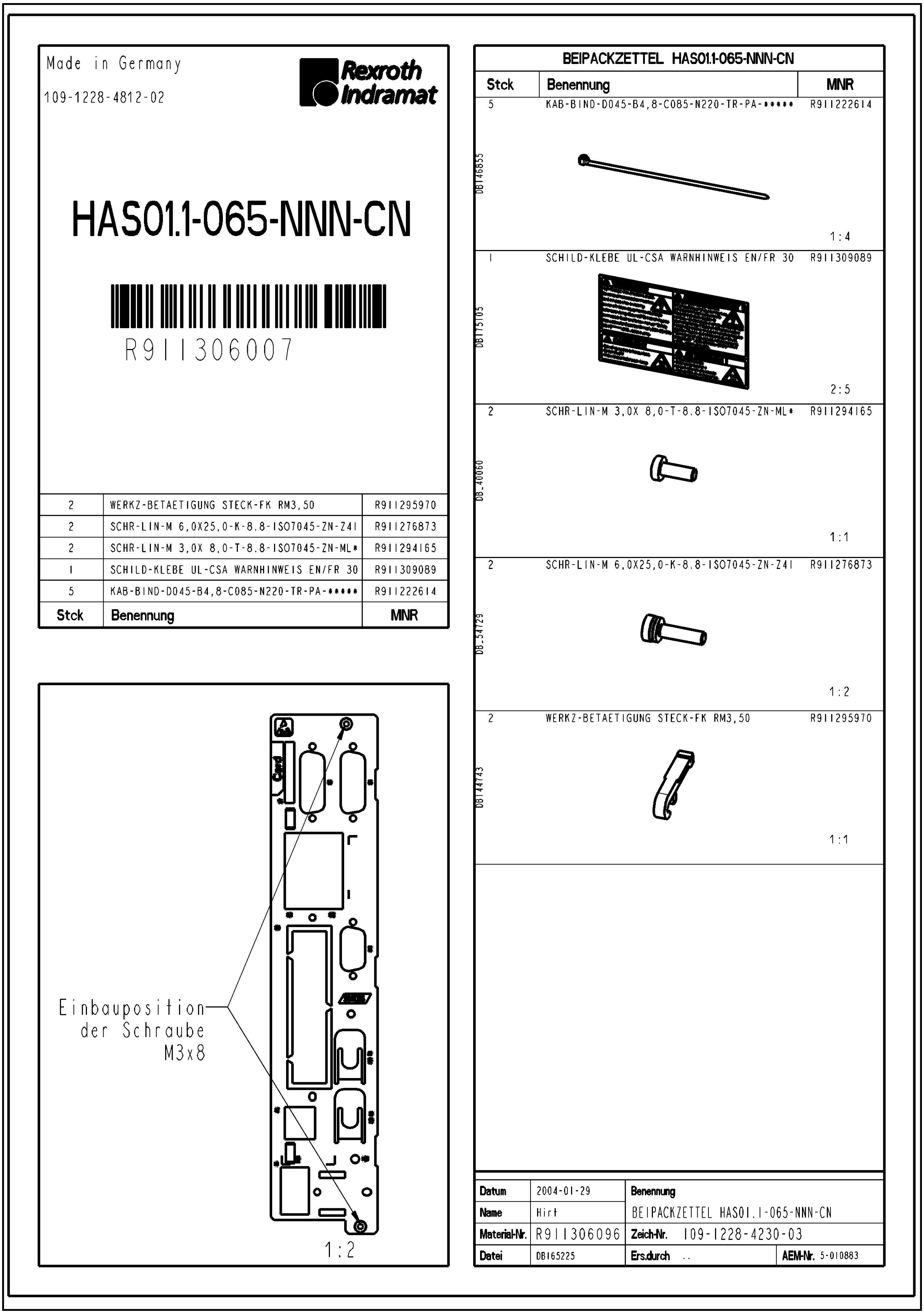
BEIPACKZETTEL HAS01.1-105-072-CN

Stck	Benennung	MNR
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
2	SCHIENE-VERBINDUNG HAS01.1-105-072 ISOL.	R911311805
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
8	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873

Datum	2005-06-01	**Benennung**	
Name	rainhirt	BEIPACKZETTEL HAS01.1-105-072-CN	
Material-Nr.	R911311812	**Zeich-Nr.** 109-1253-4266-00	
Datei	DB187297	**Ers.durch** ..	**AEM-Nr.** 5-017033

Fig. 11-17: Accompanying note

Accessories



Made in Germany

109-1228-4812-02

Rexroth Indramat

HAS01.1-065-NNN-CN

R911306007

Stck	Benennung	MNR
2	WERKZ-BETAETIGUNG STECK-FK RM3,50	R911295970
2	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614

Einbauposition der Schraube M3x8

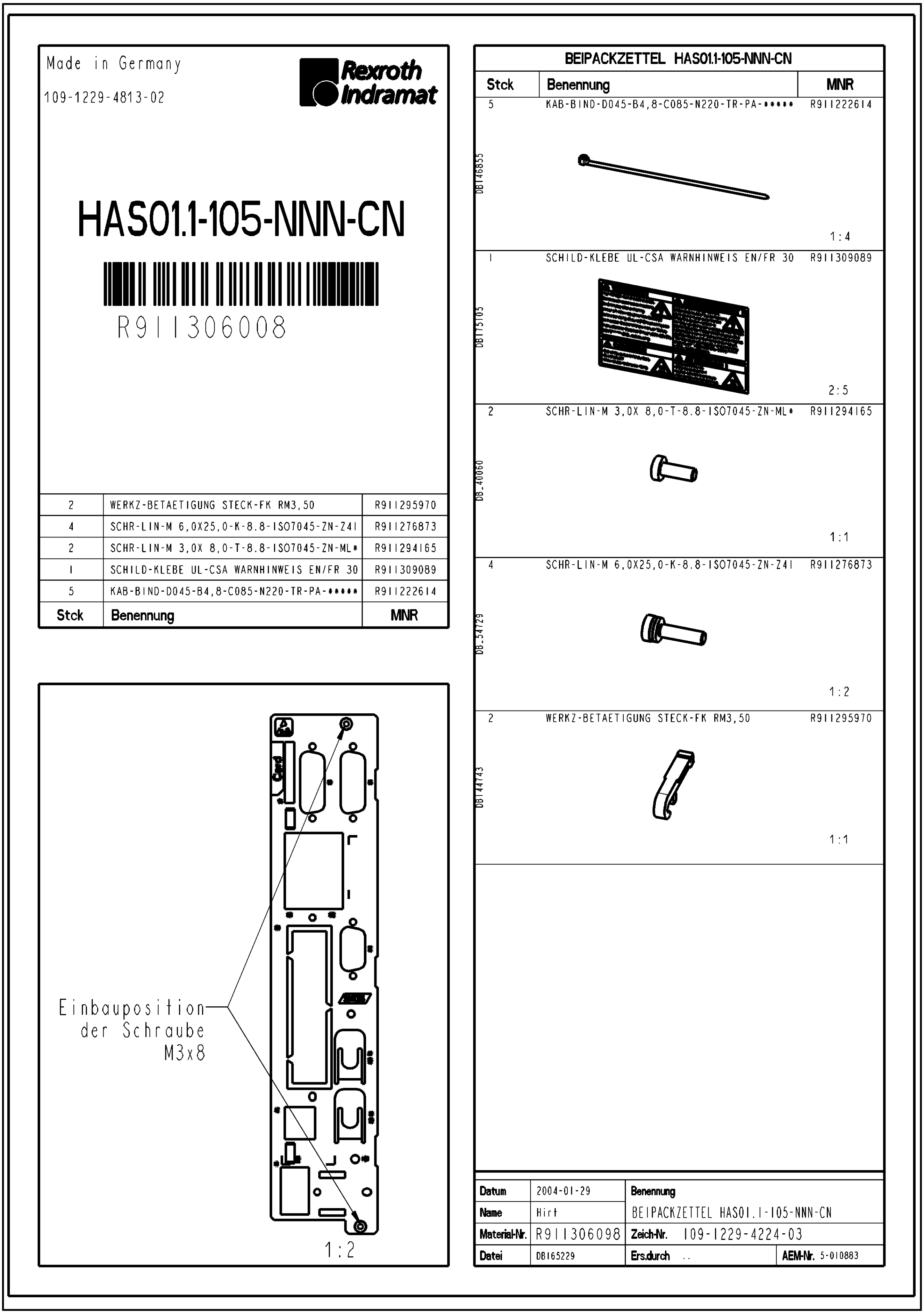
1:2

BEIPACKZETTEL HAS01.1-065-NNN-CN

Stck	Benennung	MNR
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
DB146855	1:4	
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
DB175105	2:5	
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
DB_40060	1:1	
2	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
DB_54729	1:2	
2	WERKZ-BETAETIGUNG STECK-FK RM3,50	R911295970
DB144743	1:1	

Datum	2004-01-29	**Benennung**	
Name	Hirt	BEIPACKZETTEL HAS01.1-065-NNN-CN	
Material-Nr.	R911306096	**Zeich-Nr.** 109-1228-4230-03	
Datei	DB165225	**Ers.durch** ..	**AEM-Nr.** 5-010883

Fig. 11-18: Accompanying note



Made in Germany
109-1229-4813-02

Rexroth Indramat

HAS01.1-105-NNN-CN

R911306008

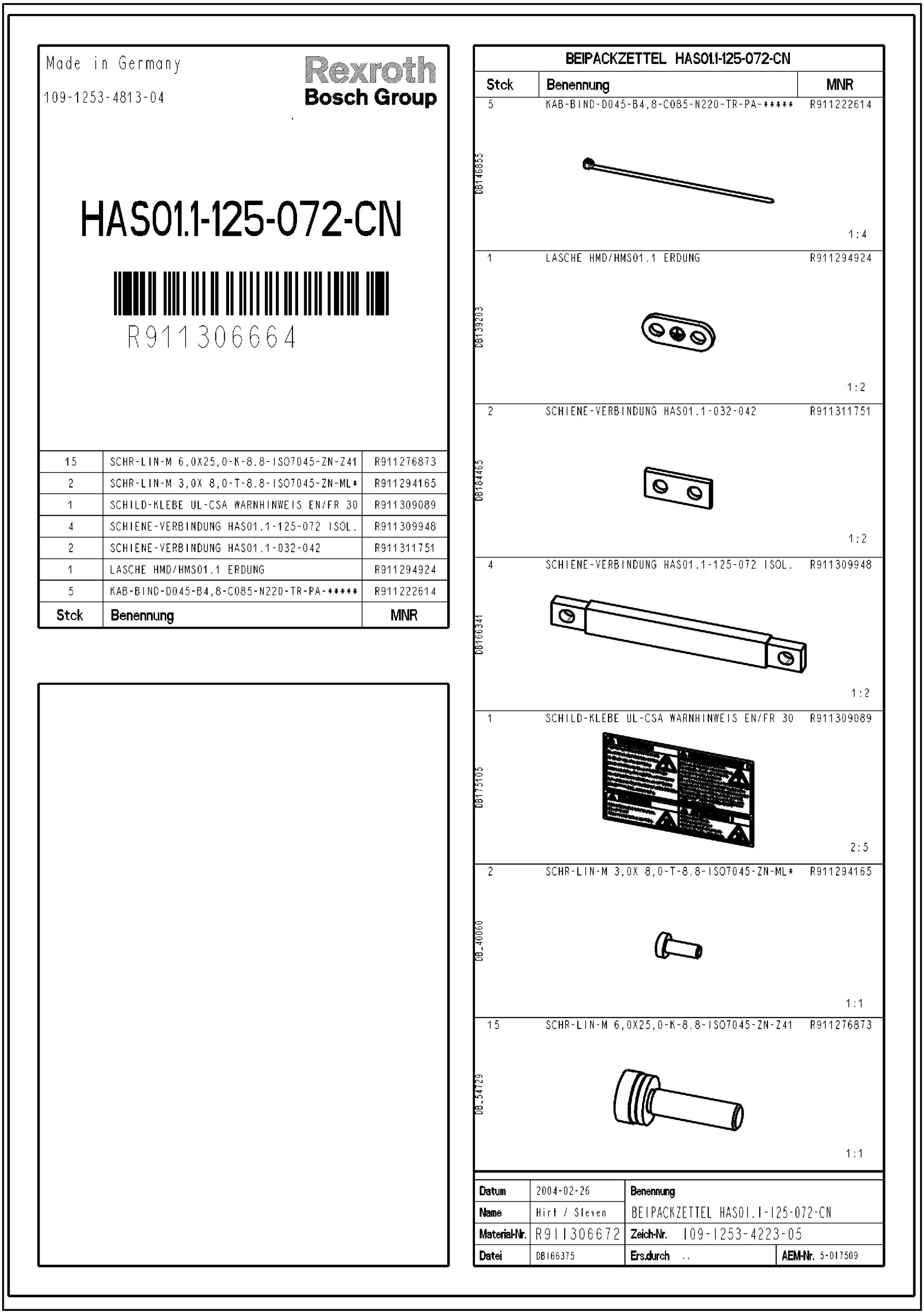
2	WERKZ-BETAETIGUNG STECK-FK RM3,50	R911295970
4	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
Stck	**Benennung**	**MNR**

BEIPACKZETTEL HAS01.1-105-NNN-CN

Stck	Benennung	MNR
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
4	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
2	WERKZ-BETAETIGUNG STECK-FK RM3,50	R911295970

Datum	2004-01-29	**Benennung**	
Name	Hirt	BEIPACKZETTEL HAS01.1-105-NNN-CN	
Material-Nr.	R911306098	**Zeich-Nr.** 109-1229-4224-03	
Datei	DB165229	**Ers.durch** ..	**AEM-Nr.** 5-010883

Fig. 11-19: Accompanying note



Made in Germany

109-1253-4813-04

Rexroth
Bosch Group

HAS01.1-125-072-CN

R911306664

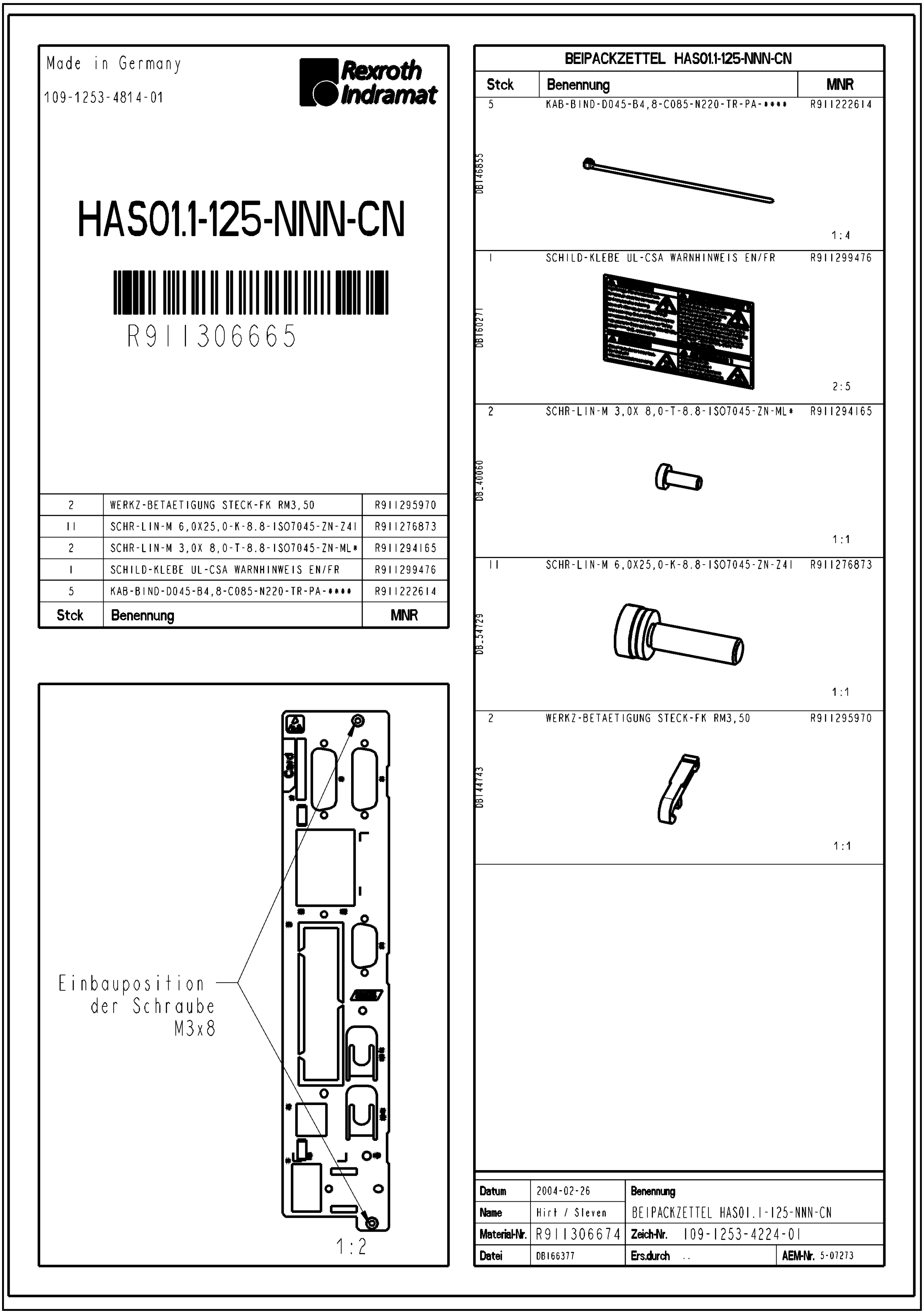
Stck	Benennung	MNR
15	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
4	SCHIENE-VERBINDUNG HAS01.1-125-072 ISOL.	R911309948
2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751
1	LASCHE HMD/HMS01.1 ERDUNG	R911294924
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614

BEIPACKZETTEL HAS01.1-125-072-CN

Stck	Benennung	MNR
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
1	LASCHE HMD/HMS01.1 ERDUNG	R911294924
2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751
4	SCHIENE-VERBINDUNG HAS01.1-125-072 ISOL.	R911309948
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
15	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873

Datum	2004-02-26	**Benennung**	
Name	Hirt / Sleven	BEIPACKZETTEL HAS01.1-125-072-CN	
Material-Nr.	R911306672	**Zeich-Nr.** 109-1253-4223-05	
Datei	DB166375	**Ers.durch** ..	**AEM-Nr.** 5-017509

Fig.11-20: Accompanying note



Made in Germany

109-1253-4814-01

HAS01.1-125-NNN-CN

R911306665

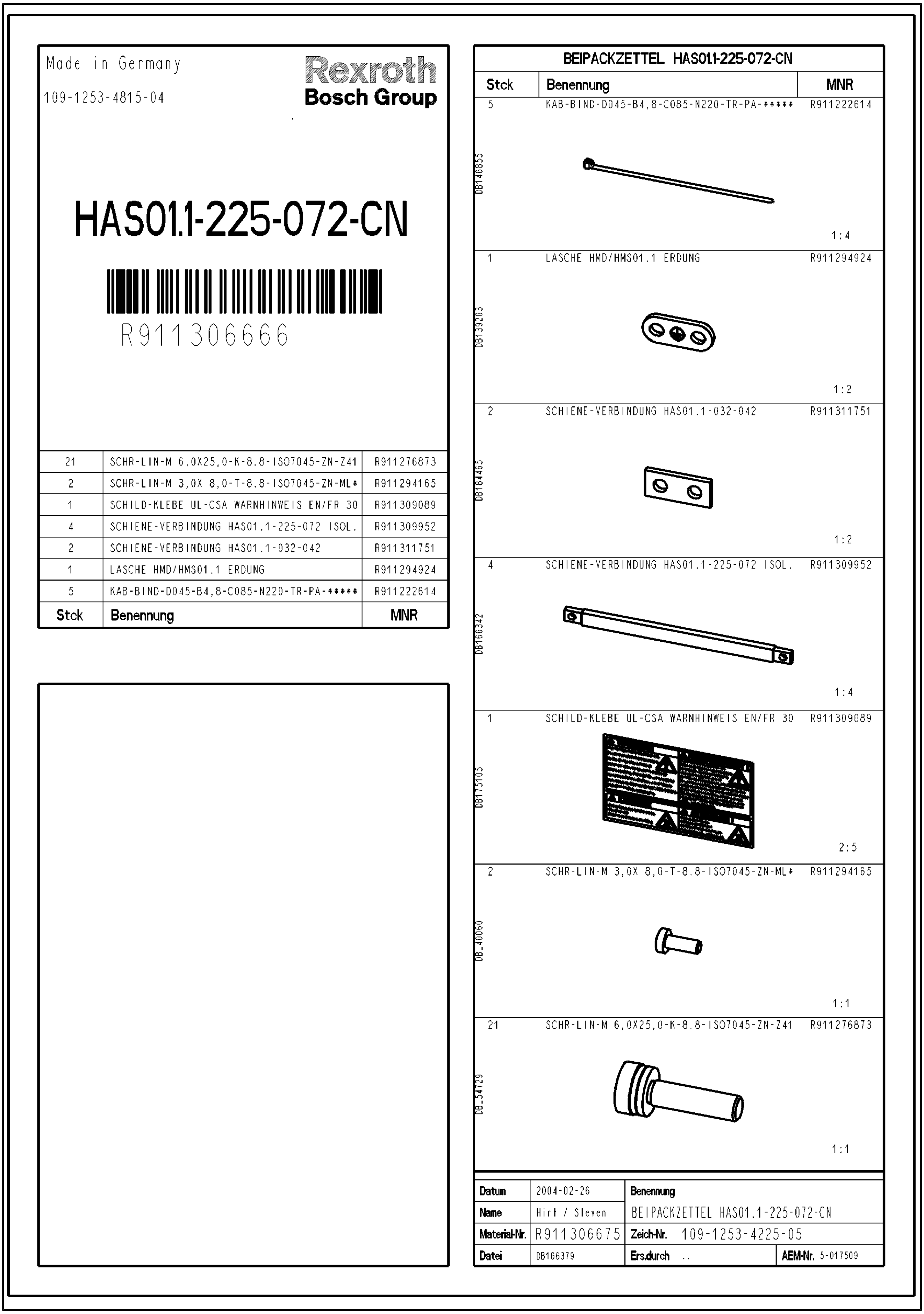
Stck	Benennung	MNR
2	WERKZ-BETAETIGUNG STECK-FK RM3,50	R911295970
11	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR	R911299476
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-****	R911222614

BEIPACKZETTEL HAS01.1-125-NNN-CN

Stck	Benennung	MNR
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-****	R911222614
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR	R911299476
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
11	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
2	WERKZ-BETAETIGUNG STECK-FK RM3,50	R911295970

Datum	2004-02-26	Benennung	
Name	Hirt / Sleven	BEIPACKZETTEL HAS01.1-125-NNN-CN	
Material-Nr.	R911306674	Zeich-Nr. 109-1253-4224-01	
Datei	DB166377	Ers.durch ..	AEM-Nr. 5-07273

Fig.11-21: Accompanying note



Made in Germany

109-1253-4815-04

Rexroth
Bosch Group

HAS01.1-225-072-CN

R911306666

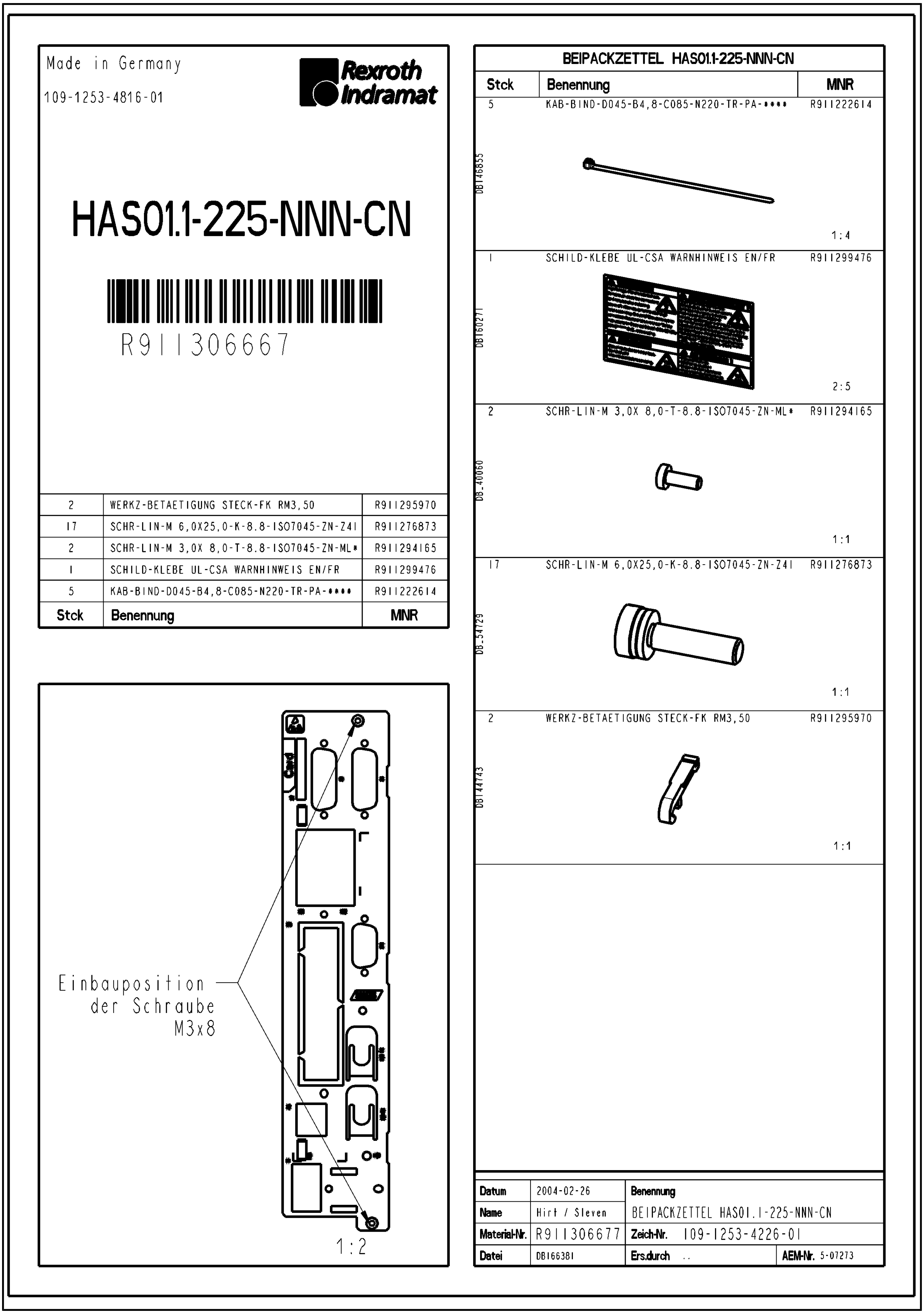
Stck	Benennung	MNR
21	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
4	SCHIENE-VERBINDUNG HAS01.1-225-072 ISOL.	R911309952
2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751
1	LASCHE HMD/HMS01.1 ERDUNG	R911294924
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614

BEIPACKZETTEL HAS01.1-225-072-CN

Stck	Benennung	MNR
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
DB146855		1:4
1	LASCHE HMD/HMS01.1 ERDUNG	R911294924
DB139203		1:2
2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751
DB184465		1:2
4	SCHIENE-VERBINDUNG HAS01.1-225-072 ISOL.	R911309952
DB166342		1:4
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
DB175105		2:5
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
DB_40060		1:1
21	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
DB_54729		1:1

Datum	2004-02-26	**Benennung**	
Name	Hirt / Sleven	BEIPACKZETTEL HAS01.1-225-072-CN	
Material-Nr.	R911306675	**Zeich-Nr.** 109-1253-4225-05	
Datei	DB166379	**Ers.durch** ..	**AEM-Nr.** 5-017509

Fig.11-22: *Accompanying note*



Made in Germany

109-1253-4816-01

Rexroth Indramat

HAS01.1-225-NNN-CN

R911306667

Stck	Benennung	MNR
2	WERKZ-BETAETIGUNG STECK-FK RM3,50	R911295970
17	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR	R911299476
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-****	R911222614

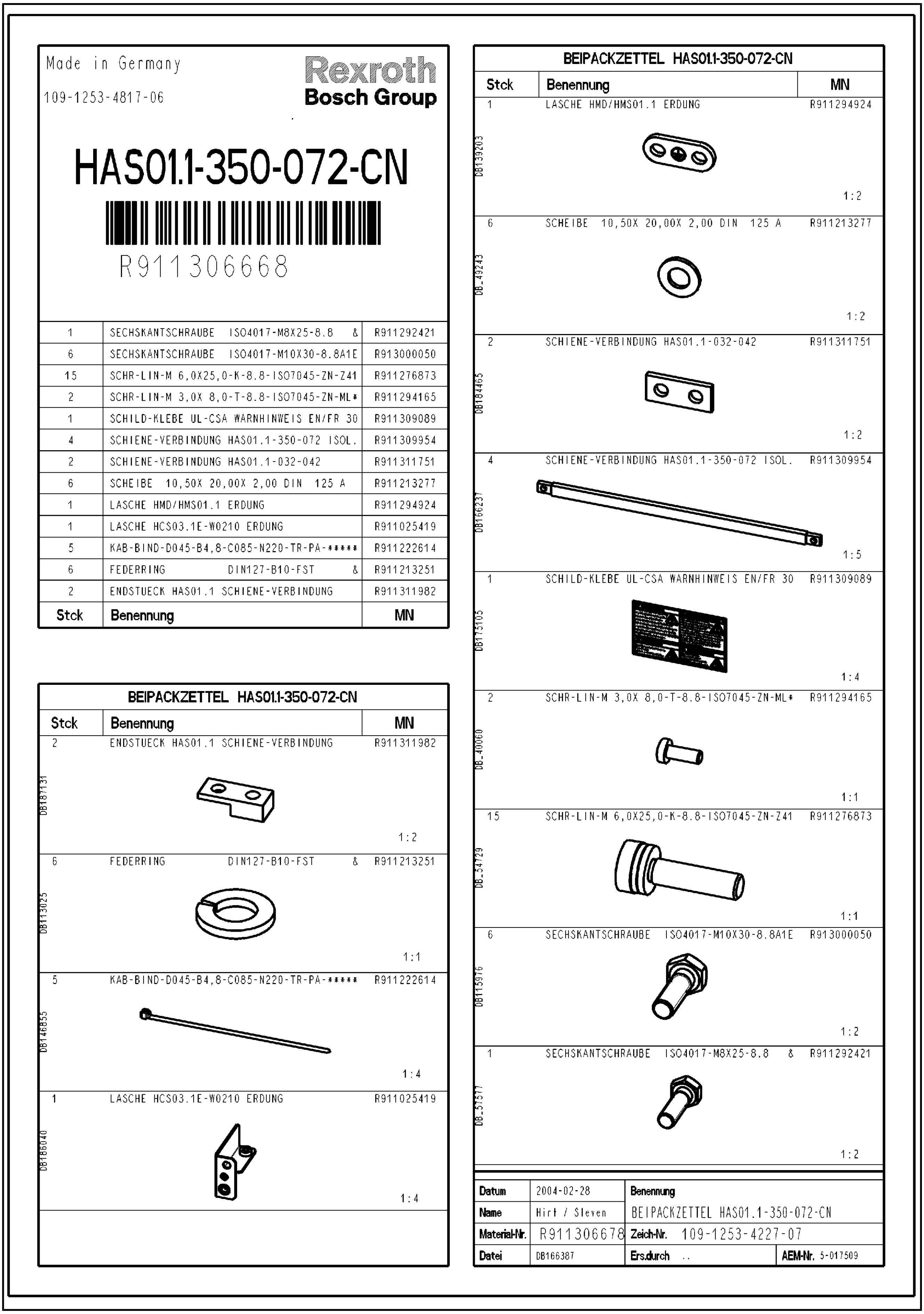
BEIPACKZETTEL HAS01.1-225-NNN-CN

Stck	Benennung	MNR
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-****	R911222614
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR	R911299476
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
17	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
2	WERKZ-BETAETIGUNG STECK-FK RM3,50	R911295970

Datum	2004-02-26	Benennung	
Name	Hirt / Sleven	BEIPACKZETTEL HAS01.1-225-NNN-CN	
Material-Nr.	R911306677	Zeich-Nr. 109-1253-4226-01	
Datei	DB166381	Ers.durch ..	AEM-Nr. 5-07273

Fig. 11-23: Accompanying note

Accessories



Made in Germany

109-1253-4817-06

Rexroth
Bosch Group

HAS01.1-350-072-CN

R911306668

1	SECHSKANTSCHRAUBE ISO4017-M8X25-8.8 &	R911292421
6	SECHSKANTSCHRAUBE ISO4017-M10X30-8.8A1E	R913000050
15	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
4	SCHIENE-VERBINDUNG HAS01.1-350-072 ISOL.	R911309954
2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751
6	SCHEIBE 10,50X 20,00X 2,00 DIN 125 A	R911213277
1	LASCHE HMD/HMS01.1 ERDUNG	R911294924
1	LASCHE HCS03.1E-W0210 ERDUNG	R911025419
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
6	FEDERRING DIN127-B10-FST &	R911213251
2	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG	R911311982
Stck	**Benennung**	**MN**

BEIPACKZETTEL HAS01.1-350-072-CN

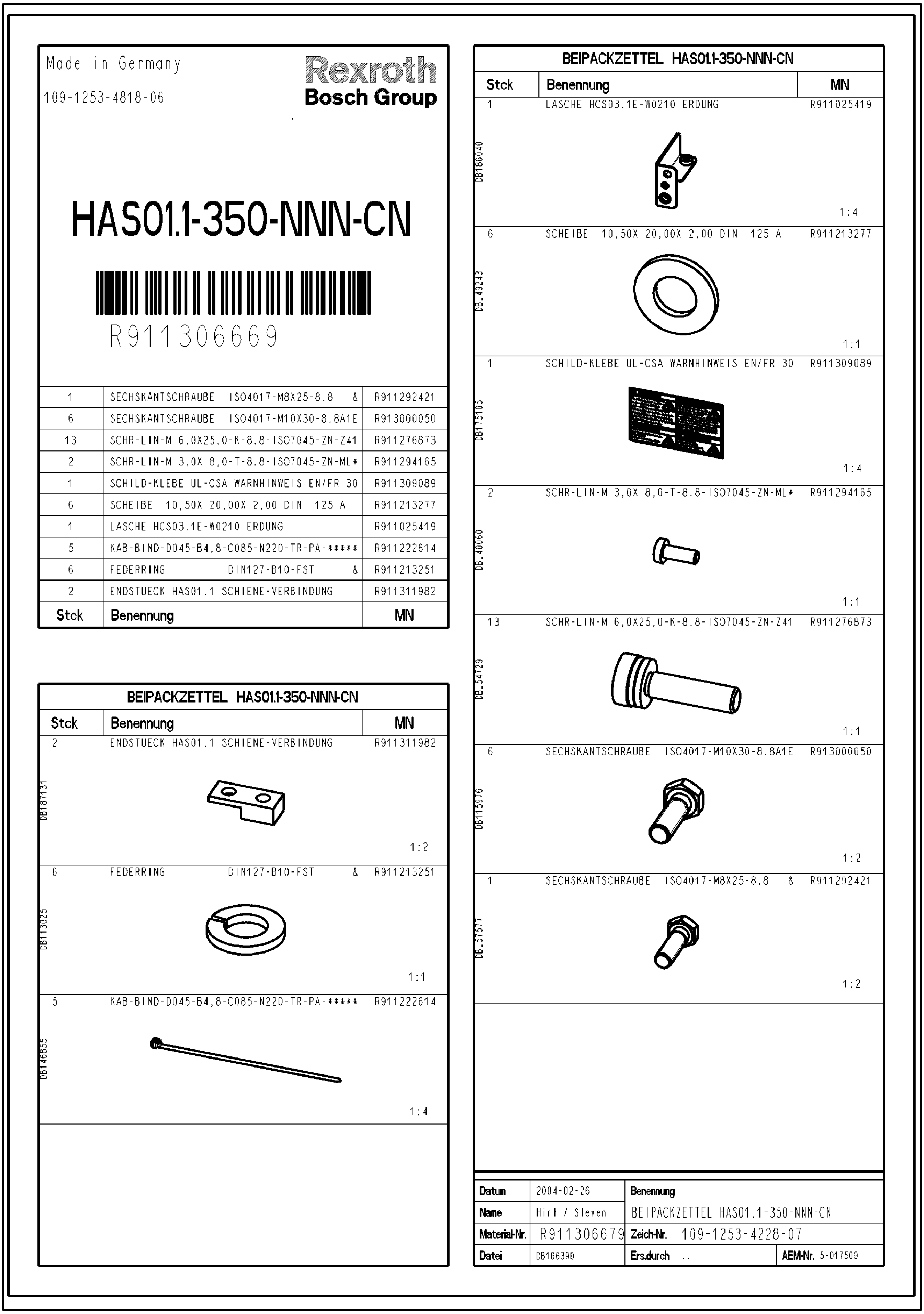
Stck	Benennung	MN
2	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG	R911311982
6	FEDERRING DIN127-B10-FST &	R911213251
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
1	LASCHE HCS03.1E-W0210 ERDUNG	R911025419

BEIPACKZETTEL HAS01.1-350-072-CN

Stck	Benennung	MN
1	LASCHE HMD/HMS01.1 ERDUNG	R911294924
6	SCHEIBE 10,50X 20,00X 2,00 DIN 125 A	R911213277
2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751
4	SCHIENE-VERBINDUNG HAS01.1-350-072 ISOL.	R911309954
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
15	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
6	SECHSKANTSCHRAUBE ISO4017-M10X30-8.8A1E	R913000050
1	SECHSKANTSCHRAUBE ISO4017-M8X25-8.8 &	R911292421

Datum	2004-02-28	**Benennung** BEIPACKZETTEL HAS01.1-350-072-CN	
Name	Hirt / Sleven		
Material-Nr.	R911306678	**Zeich-Nr.** 109-1253-4227-07	
Datei	DB166387	**Ers.durch** ..	**AEM-Nr.** 5-017509

Fig.11-24: Accompanying note



Made in Germany
109-1253-4818-06

Rexroth
Bosch Group

HAS01.1-350-NNN-CN

R911306669

1	SECHSKANTSCHRAUBE ISO4017-M8X25-8.8 &	R911292421
6	SECHSKANTSCHRAUBE ISO4017-M10X30-8.8A1E	R913000050
13	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
6	SCHEIBE 10,50X 20,00X 2,00 DIN 125 A	R911213277
1	LASCHE HCS03.1E-W0210 ERDUNG	R911025419
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
6	FEDERRING DIN127-B10-FST &	R911213251
2	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG	R911311982
Stck	**Benennung**	**MN**

BEIPACKZETTEL HAS01.1-350-NNN-CN

Stck	Benennung	MN
2	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG DB187131 1:2	R911311982
6	FEDERRING DIN127-B10-FST & DB113025 1:1	R911213251
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-***** DB146855 1:4	R911222614

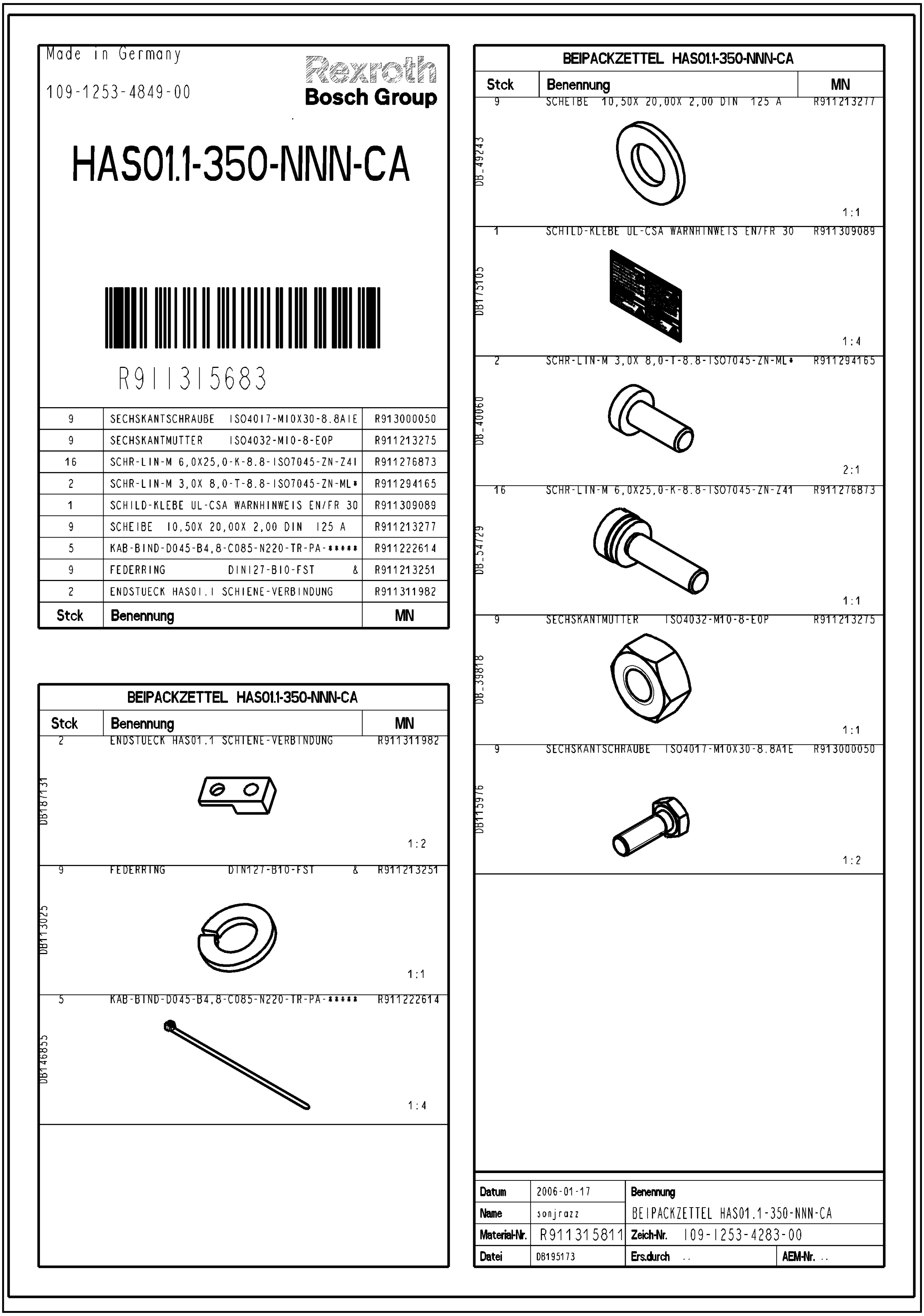
BEIPACKZETTEL HAS01.1-350-NNN-CN

Stck	Benennung	MN
1	LASCHE HCS03.1E-W0210 ERDUNG DB186040 1:4	R911025419
6	SCHEIBE 10,50X 20,00X 2,00 DIN 125 A DB_49243 1:1	R911213277
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30 DB175105 1:4	R911309089
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML* DB_40060 1:1	R911294165
13	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41 DB_54729 1:1	R911276873
6	SECHSKANTSCHRAUBE ISO4017-M10X30-8.8A1E DB115976 1:2	R913000050
1	SECHSKANTSCHRAUBE ISO4017-M8X25-8.8 & DB_57577 1:2	R911292421

Datum	2004-02-26	**Benennung**	
Name	Hirt / Sleven	BEIPACKZETTEL HAS01.1-350-NNN-CN	
Material-Nr.	R911306679	**Zeich-Nr.** 109-1253-4228-07	
Datei	DB166390	**Ers.durch** ..	**AEM-Nr.** 5-017509

Fig. 11-25: Accompanying note

Accessories



Made in Germany

109-1253-4849-00

Rexroth
Bosch Group

HAS01.1-350-NNN-CA

R911315683

Stck	Benennung	MN
9	SECHSKANTSCHRAUBE ISO4017-M10X30-8.8A1E	R913000050
9	SECHSKANTMUTTER ISO4032-M10-8-EOP	R911213275
16	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
9	SCHEIBE 10,50X 20,00X 2,00 DIN 125 A	R911213277
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
9	FEDERRING DIN127-B10-FST &	R911213251
2	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG	R911311982

BEIPACKZETTEL HAS01.1-350-NNN-CA

Stck	Benennung	MN
2	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG	R911311982
9	FEDERRING DIN127-B10-FST &	R911213251
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614

BEIPACKZETTEL HAS01.1-350-NNN-CA

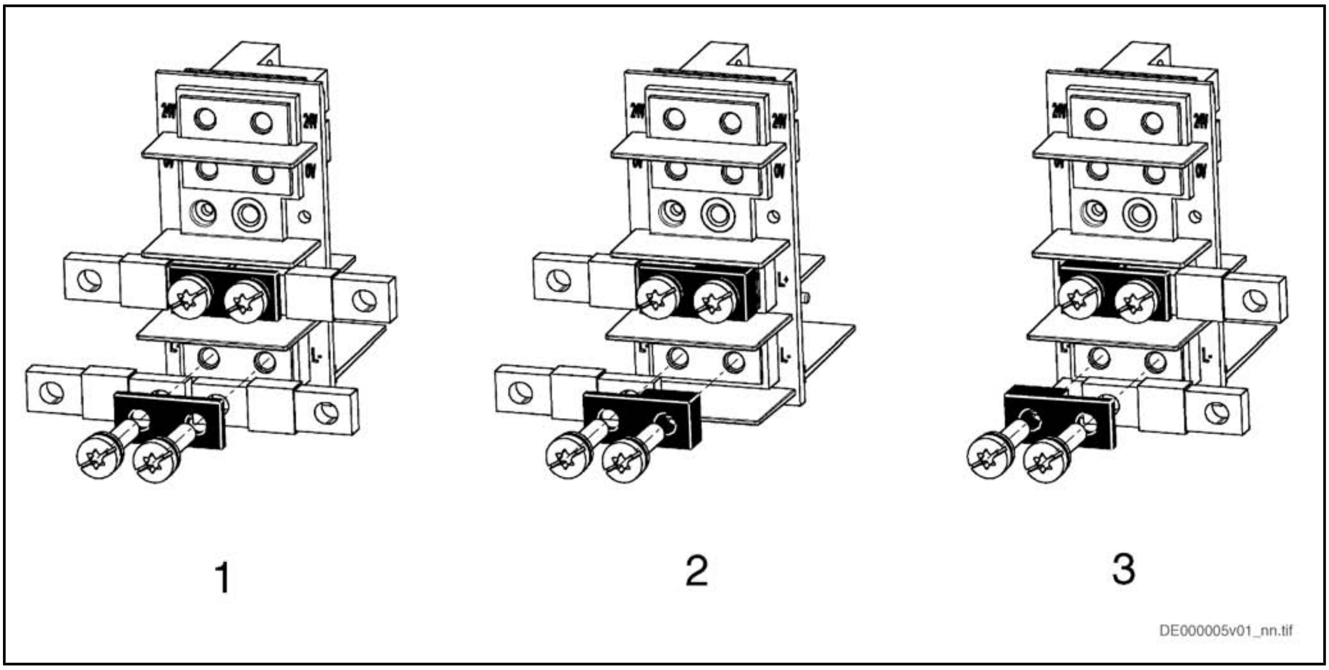
Stck	Benennung	MN
9	SCHEIBE 10,50X 20,00X 2,00 DIN 125 A	R911213277
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911309089
2	SCHR-LIN-M 3,0X 8,0-T-8.8-ISO7045-ZN-ML*	R911294165
16	SCHR-LIN-M 6,0X25,0-K-8.8-ISO7045-ZN-Z41	R911276873
9	SECHSKANTMUTTER ISO4032-M10-8-EOP	R911213275
9	SECHSKANTSCHRAUBE ISO4017-M10X30-8.8A1E	R913000050

Datum	2006-01-17	**Benennung** BEIPACKZETTEL HAS01.1-350-NNN-CA	
Name	sonjrazz		
Material-Nr.	R911315811	**Zeich-Nr.** 109-1253-4283-00	
Datei	DB195173	**Ers.durch** ..	**AEM-Nr.** ..

Fig. 11-26: Accompanying note

11.2.6 Mounting the Parts “Bar” and “End Piece” of the Accessories HAS01

The parts “bar” and “end piece” increase the current carrying capacity of the DC bus connections by reducing the involved contact resistances.



1	bar
2	end piece (right end)
3	end piece (left end)

Fig.11-27: Mounting bar and end piece of HAS01

- **Ad 1:** Use the bars (-042) contained in all HAS01.1-***-072-** as shown in the figure at L+ and L-.
- **Ad 2 and 3:** Use the end pieces contained in all HAS01.1-350-***-** and HAS01.1-200-***-** at the right and left ends of the DC bus connections in the drive system.

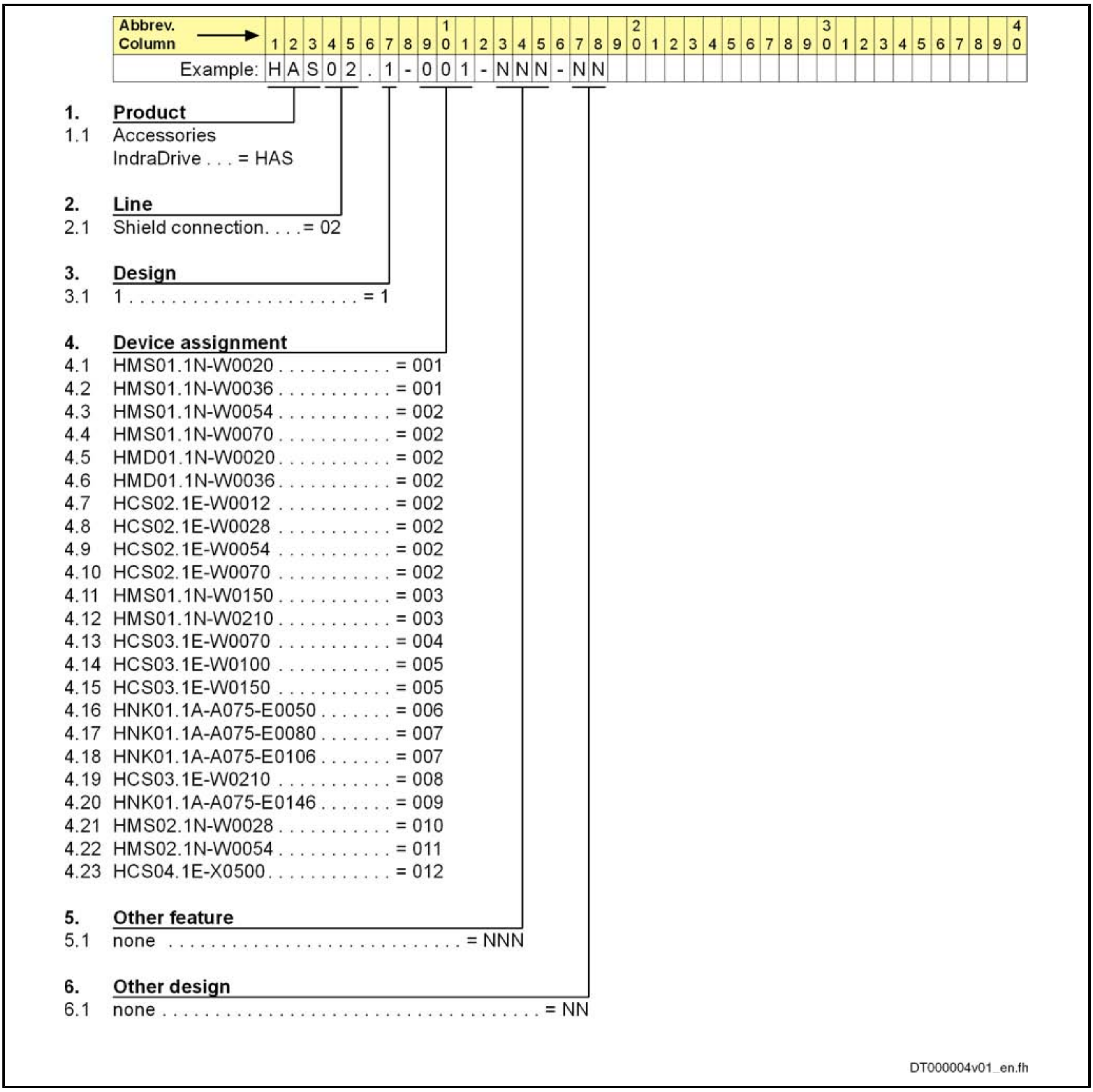
11.3 HAS02 Shield Connection

11.3.1 General Information

Accessories for appropriate connection of the motor cable to the drive controller, especially the shield connection of the motor cable.

There are appropriate HAS02 accessories for the different drive controllers.

11.3.2 Type Code



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

1. **Product**
1.1 Accessories
IndraDrive . . . = HAS

2. **Line**
2.1 Shield connection. . . .= 02

3. **Design**
3.1 1 . . . . = 1

4. **Device assignment**
4.1 HMS01.1N-W0020 . . . . = 001
4.2 HMS01.1N-W0036 . . . . = 001
4.3 HMS01.1N-W0054 . . . . = 002
4.4 HMS01.1N-W0070 . . . . = 002
4.5 HMD01.1N-W0020 . . . . = 002
4.6 HMD01.1N-W0036 . . . . = 002
4.7 HCS02.1E-W0012 . . . . = 002
4.8 HCS02.1E-W0028 . . . . = 002
4.9 HCS02.1E-W0054 . . . . = 002
4.10 HCS02.1E-W0070 . . . . = 002
4.11 HMS01.1N-W0150 . . . . = 003
4.12 HMS01.1N-W0210 . . . . = 003
4.13 HCS03.1E-W0070 . . . . = 004
4.14 HCS03.1E-W0100 . . . . = 005
4.15 HCS03.1E-W0150 . . . . = 005
4.16 HNK01.1A-A075-E0050 . . . . = 006
4.17 HNK01.1A-A075-E0080 . . . . = 007
4.18 HNK01.1A-A075-E0106 . . . . = 007
4.19 HCS03.1E-W0210 . . . . = 008
4.20 HNK01.1A-A075-E0146 . . . . = 009
4.21 HMS02.1N-W0028 . . . . = 010
4.22 HMS02.1N-W0054 . . . . = 011
4.23 HCS04.1E-X0500 . . . . = 012

5. **Other feature**
5.1 none . . . . = NNN

6. **Other design**
6.1 none . . . . = NN

DT000004v01_en.fh

Fig.11-28: Type code HAS02.1

11.3.3 Usage

The HAS02 accessories are used for

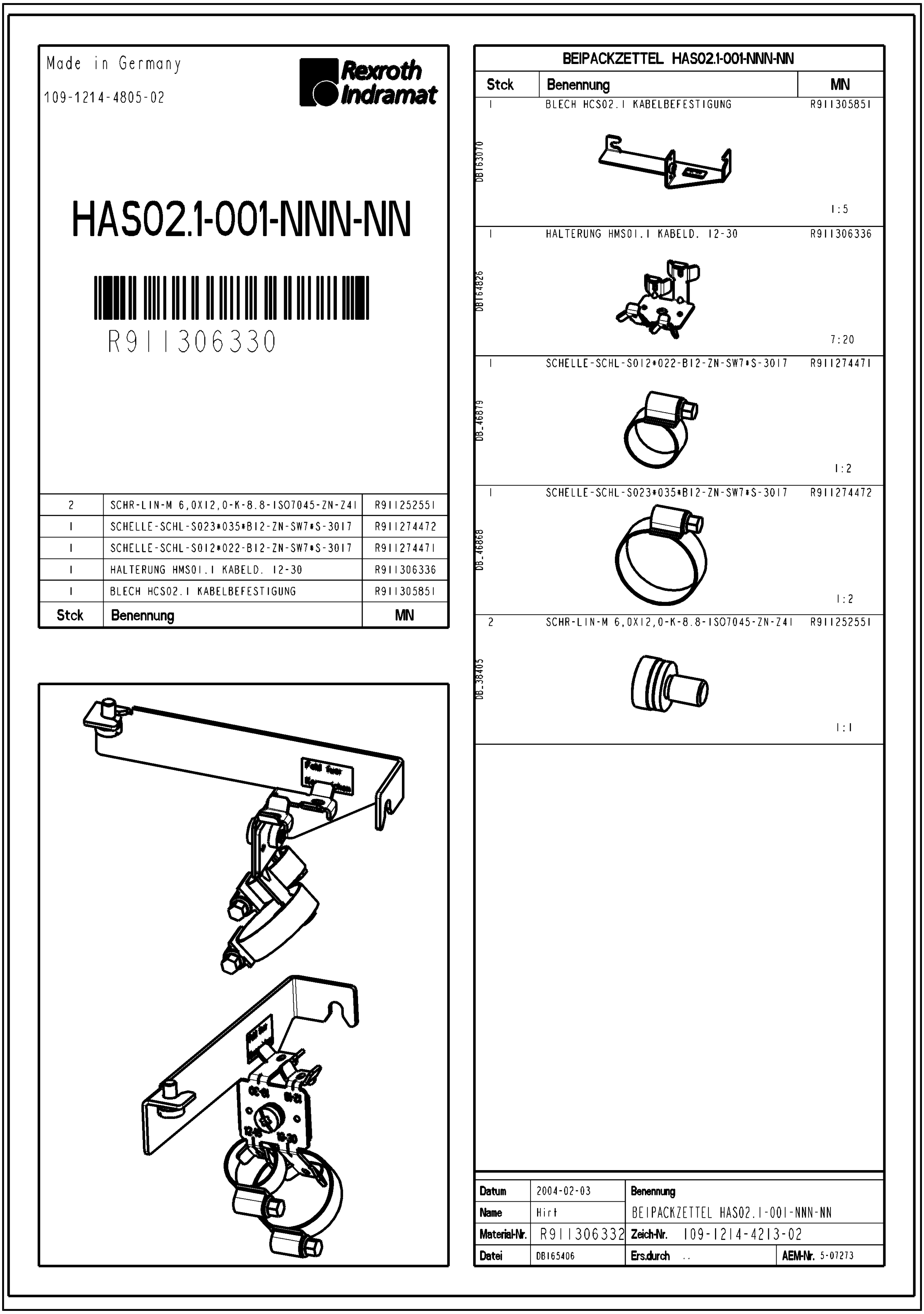
- strain relief of the motor cable
- connecting the shield of the motor cable to the drive controller

11.3.4 Assignment of Accessory HAS02

See section “Type Code (Device assignment)”

11.3.5 Scope of Supply

For the scope of supply and the components of HAS02, see the corresponding accompanying notes.



Made in Germany
109-1214-4805-02

Rexroth Indramat

HAS02.1-001-NNN-NN

R911306330

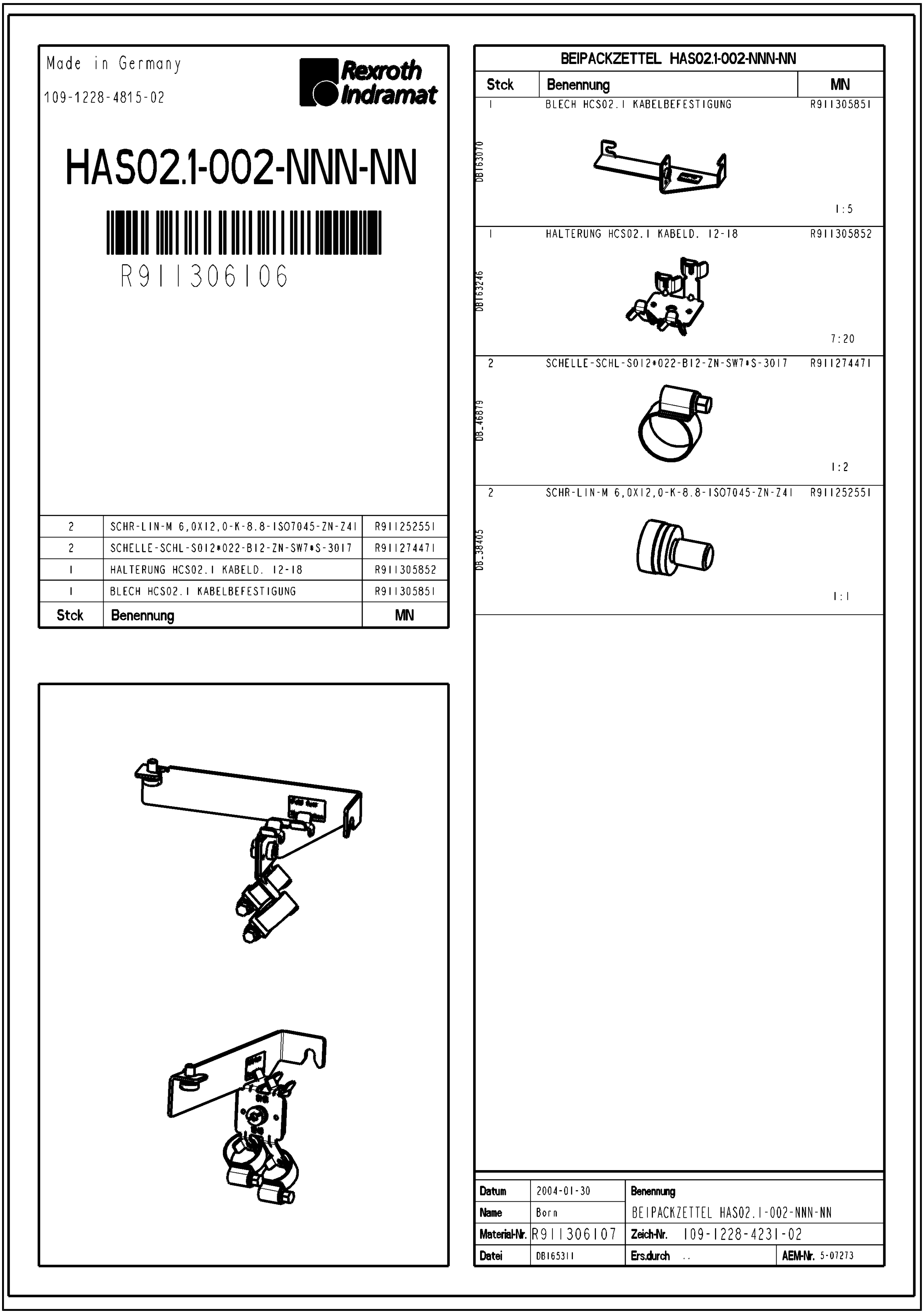
2	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z41	R911252551
1	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472
1	SCHELLE-SCHL-S012*022-B12-ZN-SW7*S-3017	R911274471
1	HALTERUNG HMS01.1 KABELD. 12-30	R911306336
1	BLECH HCS02.1 KABELBEFESTIGUNG	R911305851
Stck	**Benennung**	**MN**

BEIPACKZETTEL HAS02.1-001-NNN-NN

Stck	Benennung	MN
1 DB163070	BLECH HCS02.1 KABELBEFESTIGUNG	R911305851 1:5
1 DB164826	HALTERUNG HMS01.1 KABELD. 12-30	R911306336 7:20
1 DB_46879	SCHELLE-SCHL-S012*022-B12-ZN-SW7*S-3017	R911274471 1:2
1 DB_46868	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472 1:2
2 DB_38405	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z41	R911252551 1:1

Datum	2004-02-03	**Benennung**	
Name	Hirt	BEIPACKZETTEL HAS02.1-001-NNN-NN	
Material-Nr.	R911306332	**Zeich-Nr.** 109-1214-4213-02	
Datei	DB165406	**Ers.durch** ..	**AEM-Nr.** 5-07273

Fig.11-29: Accompanying note



Made in Germany

109-1228-4815-02

Rexroth Indramat

HAS02.1-002-NNN-NN

R911306106

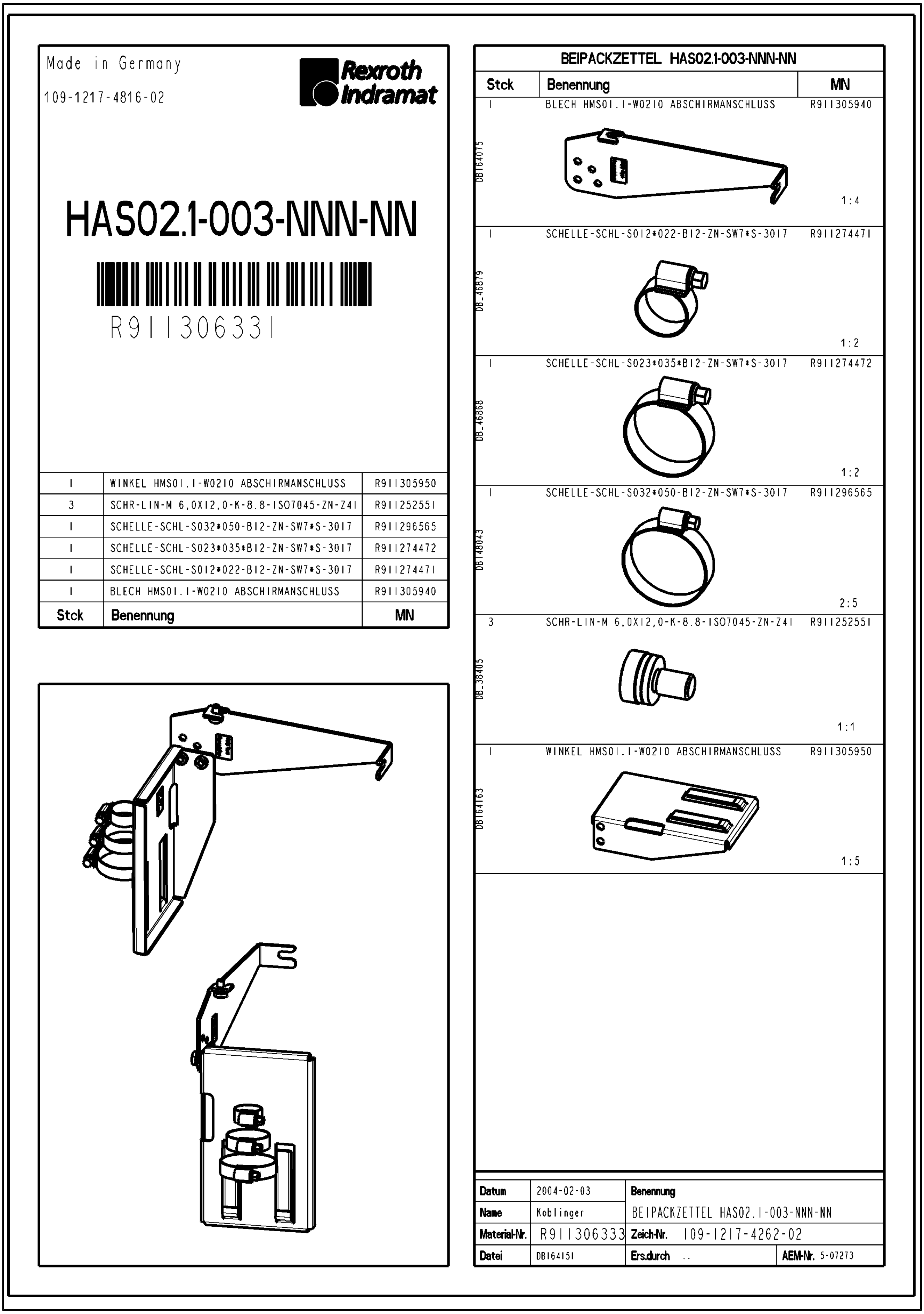
2	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z41	R911252551
2	SCHELLE-SCHL-S012*022-B12-ZN-SW7*S-3017	R911274471
1	HALTERUNG HCS02.1 KABELD. 12-18	R911305852
1	BLECH HCS02.1 KABELBEFESTIGUNG	R911305851
Stck	**Benennung**	**MN**

BEIPACKZETTEL HAS02.1-002-NNN-NN

Stck	Benennung	MN
1	BLECH HCS02.1 KABELBEFESTIGUNG DB163070 1:5	R911305851
1	HALTERUNG HCS02.1 KABELD. 12-18 DB163246 7:20	R911305852
2	SCHELLE-SCHL-S012*022-B12-ZN-SW7*S-3017 DB_46879 1:2	R911274471
2	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z41 DB_38405 1:1	R911252551

Datum	2004-01-30	**Benennung**	
Name	Born	BEIPACKZETTEL HAS02.1-002-NNN-NN	
Material-Nr.	R911306107	**Zeich-Nr.** 109-1228-4231-02	
Datei	DB165311	**Ers.durch** ..	**AEM-Nr.** 5-07273

Fig. 11-30: Accompanying note



Made in Germany

109-1217-4816-02

Rexroth Indramat

HAS02.1-003-NNN-NN

R911306331

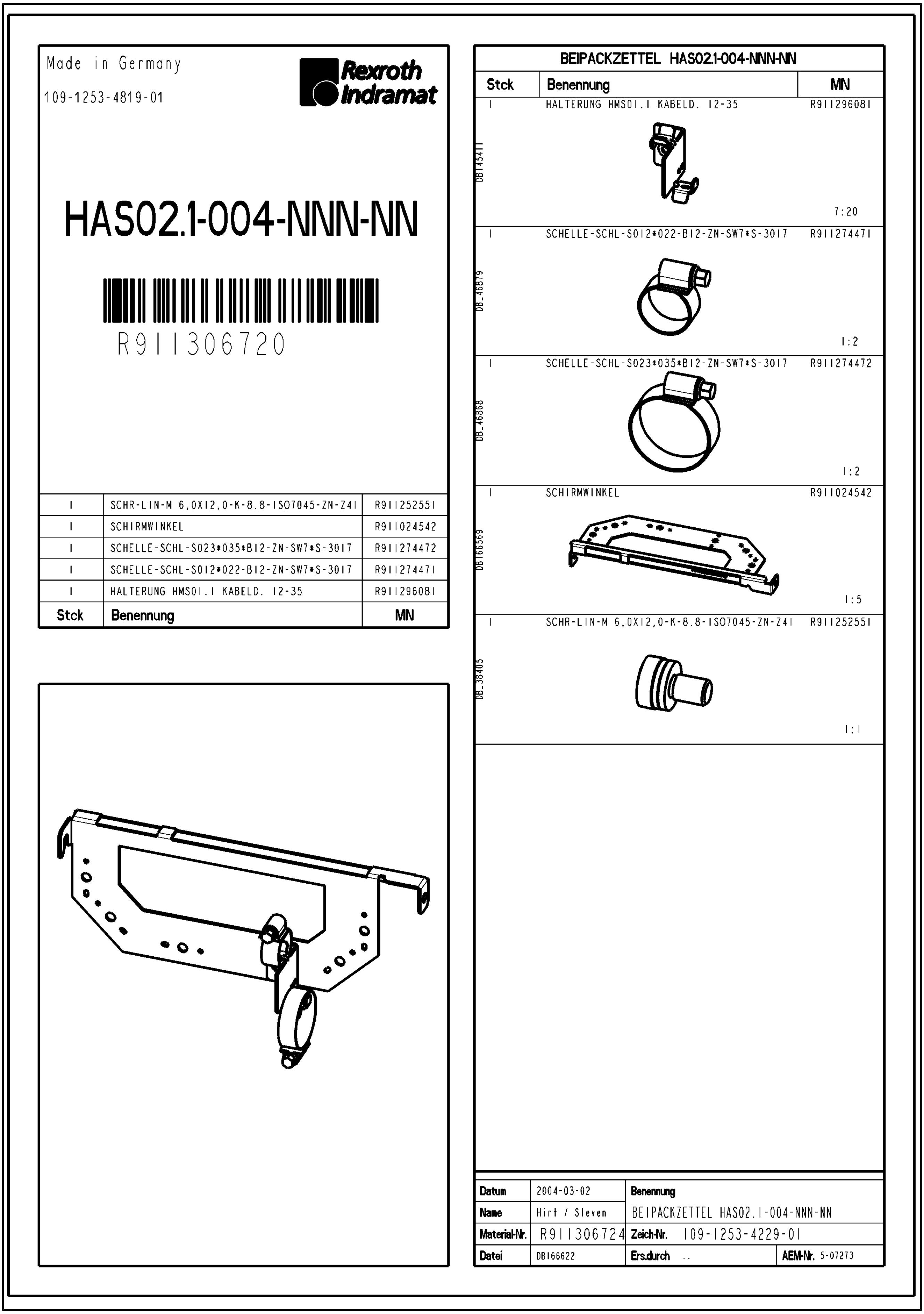
Stck	Benennung	MN
1	WINKEL HMS01.1-W0210 ABSCHIRMANSCHLUSS	R911305950
3	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z41	R911252551
1	SCHELLE-SCHL-S032*050-B12-ZN-SW7*S-3017	R911296565
1	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472
1	SCHELLE-SCHL-S012*022-B12-ZN-SW7*S-3017	R911274471
1	BLECH HMS01.1-W0210 ABSCHIRMANSCHLUSS	R911305940

BEIPACKZETTEL HAS02.1-003-NNN-NN

Stck	Benennung	MN
1	BLECH HMS01.1-W0210 ABSCHIRMANSCHLUSS	R911305940
1	SCHELLE-SCHL-S012*022-B12-ZN-SW7*S-3017	R911274471
1	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472
1	SCHELLE-SCHL-S032*050-B12-ZN-SW7*S-3017	R911296565
3	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z41	R911252551
1	WINKEL HMS01.1-W0210 ABSCHIRMANSCHLUSS	R911305950

Datum	2004-02-03	**Benennung**	
Name	Koblinger	BEIPACKZETTEL HAS02.1-003-NNN-NN	
Material-Nr.	R911306333	**Zeich-Nr.** 109-1217-4262-02	
Datei	DB164151	**Ers.durch** ..	**AEM-Nr.** 5-07273

Fig. 11-31: Accompanying note



Made in Germany
109-1253-4819-01

Rexroth Indramat

HAS02.1-004-NNN-NN

R911306720

1	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z41	R911252551
1	SCHIRMWINKEL	R911024542
1	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472
1	SCHELLE-SCHL-S012*022-B12-ZN-SW7*S-3017	R911274471
1	HALTERUNG HMS01.1 KABELD. 12-35	R911296081
Stck	**Benennung**	**MN**

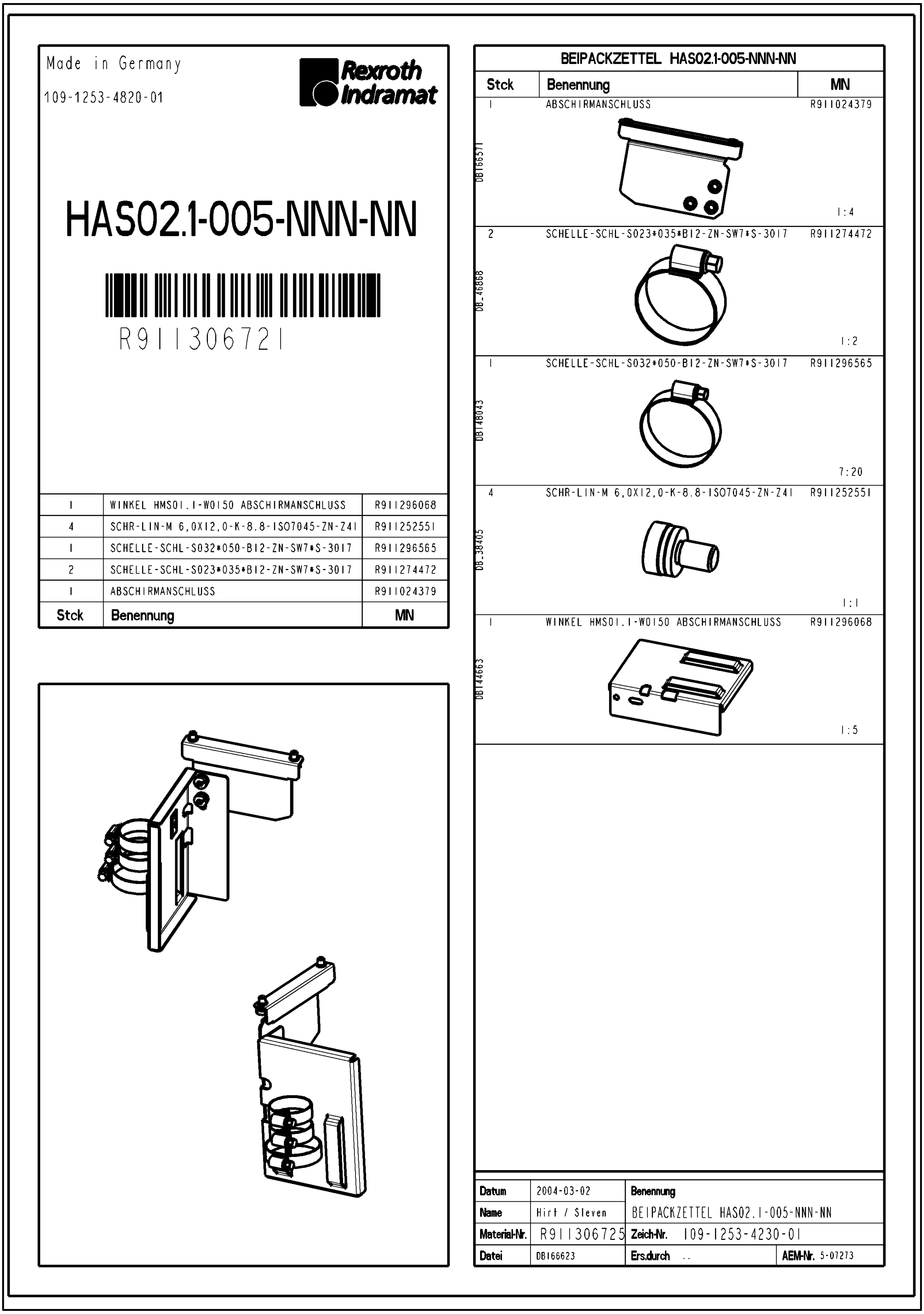
BEIPACKZETTEL HAS02.1-004-NNN-NN

Stck	Benennung	MN
1	HALTERUNG HMS01.1 KABELD. 12-35	R911296081
1	SCHELLE-SCHL-S012*022-B12-ZN-SW7*S-3017	R911274471
1	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472
1	SCHIRMWINKEL	R911024542
1	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z41	R911252551

Datum	2004-03-02	**Benennung**	
Name	Hirt / Sleven	BEIPACKZETTEL HAS02.1-004-NNN-NN	
Material-Nr.	R911306724	**Zeich-Nr.** 109-1253-4229-01	
Datei	DB166622	**Ers.durch** ..	**AEM-Nr.** 5-07273

Fig. 11-32: Accompanying note

Accessories



Made in Germany

109-1253-4820-01

HAS02.1-005-NNN-NN

R911306721

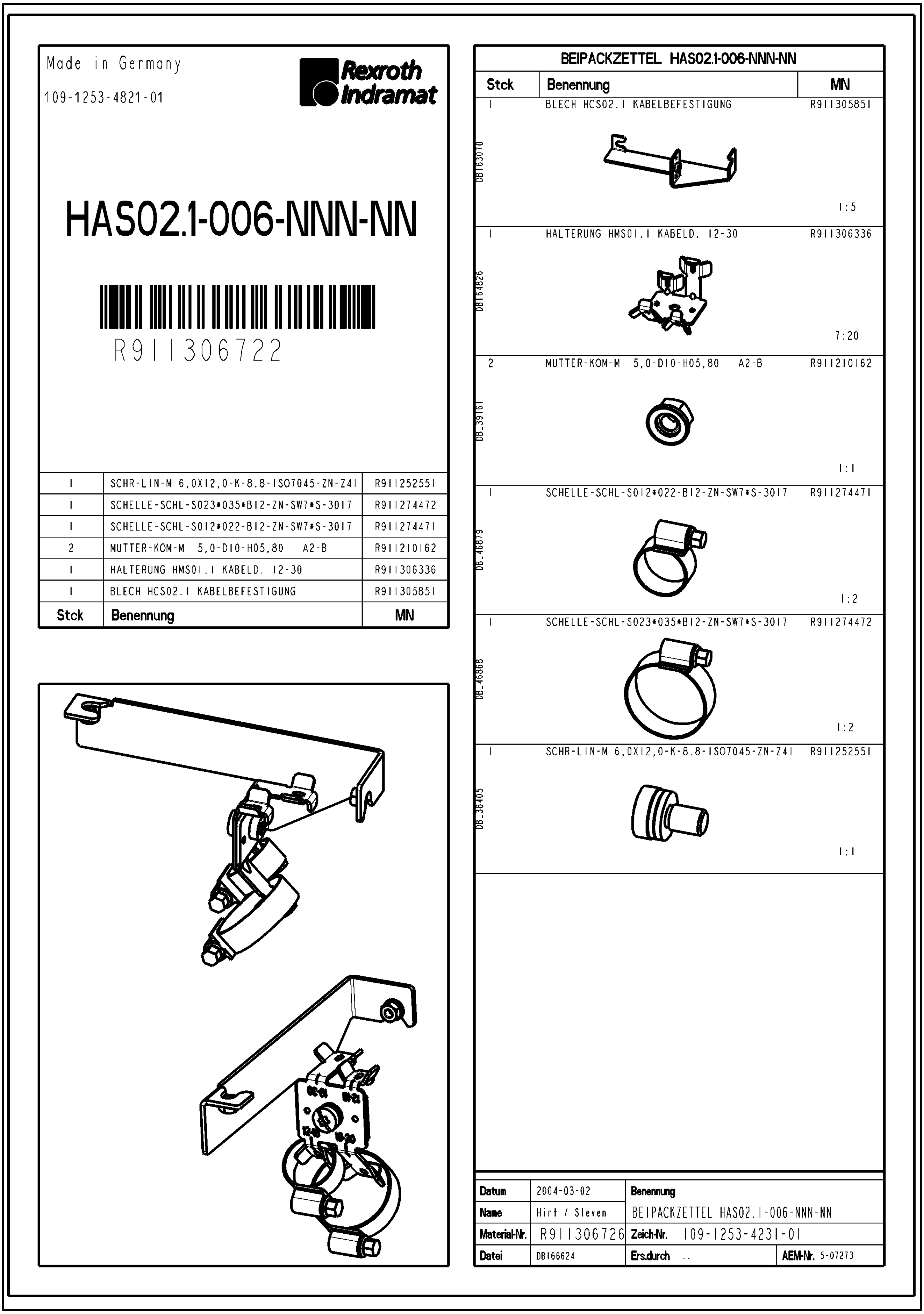
Stck	Benennung	MN
1	WINKEL HMS01.1-W0150 ABSCHIRMANSCHLUSS	R911296068
4	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z41	R911252551
1	SCHELLE-SCHL-S032*050-B12-ZN-SW7*S-3017	R911296565
2	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472
1	ABSCHIRMANSCHLUSS	R911024379

BEIPACKZETTEL HAS02.1-005-NNN-NN

Stck	Benennung	MN		
1	ABSCHIRMANSCHLUSS	R911024379	DB166571	1:4
2	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472	DB_46868	1:2
1	SCHELLE-SCHL-S032*050-B12-ZN-SW7*S-3017	R911296565	DB148043	7:20
4	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z41	R911252551	DB_38405	1:1
1	WINKEL HMS01.1-W0150 ABSCHIRMANSCHLUSS	R911296068	DB144663	1:5

Datum	2004-03-02	Benennung	
Name	Hirt / Sleven	BEIPACKZETTEL HAS02.1-005-NNN-NN	
Material-Nr.	R911306725	Zeich-Nr. 109-1253-4230-01	
Datei	DB166623	Ers.durch ..	AEM-Nr. 5-07273

Fig. 11-33: Accompanying note



Made in Germany
109-1253-4821-01

Rexroth Indramat

HAS02.1-006-NNN-NN

R911306722

1	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z41	R911252551
1	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472
1	SCHELLE-SCHL-S012*022-B12-ZN-SW7*S-3017	R911274471
2	MUTTER-KOM-M 5,0-D10-H05,80 A2-B	R911210162
1	HALTERUNG HMS01.1 KABELD. 12-30	R911306336
1	BLECH HCS02.1 KABELBEFESTIGUNG	R911305851
Stck	**Benennung**	**MN**

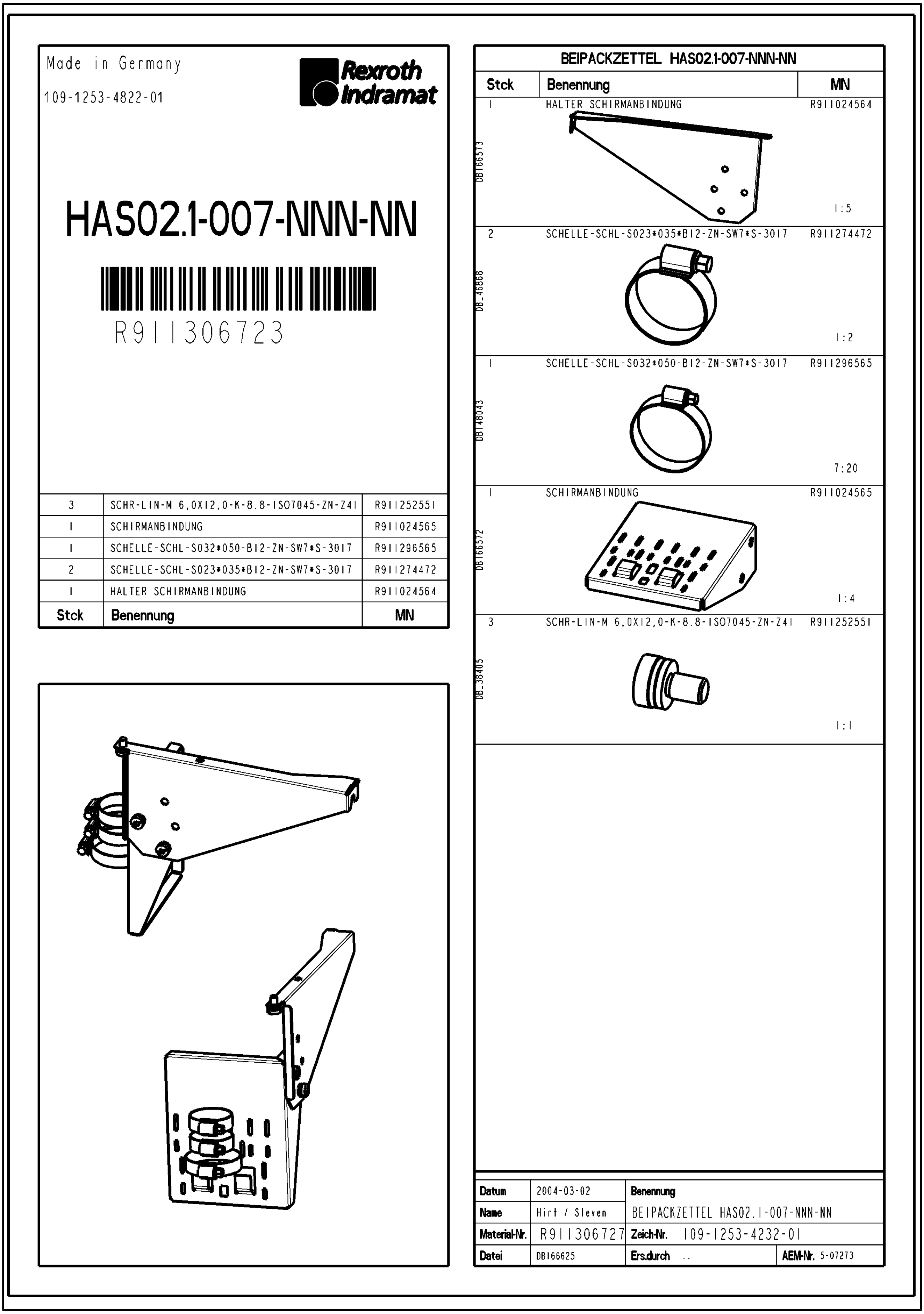
BEIPACKZETTEL HAS02.1-006-NNN-NN

Stck	Benennung	MN	
1	BLECH HCS02.1 KABELBEFESTIGUNG	R911305851	DB163070 1:5
1	HALTERUNG HMS01.1 KABELD. 12-30	R911306336	DB164826 7:20
2	MUTTER-KOM-M 5,0-D10-H05,80 A2-B	R911210162	DB_39161 1:1
1	SCHELLE-SCHL-S012*022-B12-ZN-SW7*S-3017	R911274471	DB_46879 1:2
1	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472	DB_46868 1:2
1	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z41	R911252551	DB_38405 1:1

Datum	2004-03-02	**Benennung**	
Name	Hirt / Sleven	BEIPACKZETTEL HAS02.1-006-NNN-NN	
Material-Nr.	R911306726	**Zeich-Nr.** 109-1253-4231-01	
Datei	DB166624	**Ers.durch** ..	**AEM-Nr.** 5-07273

Fig.11-34: Accompanying note

Accessories



Made in Germany

109-1253-4822-01

Rexroth Indramat

HAS02.1-007-NNN-NN

R911306723

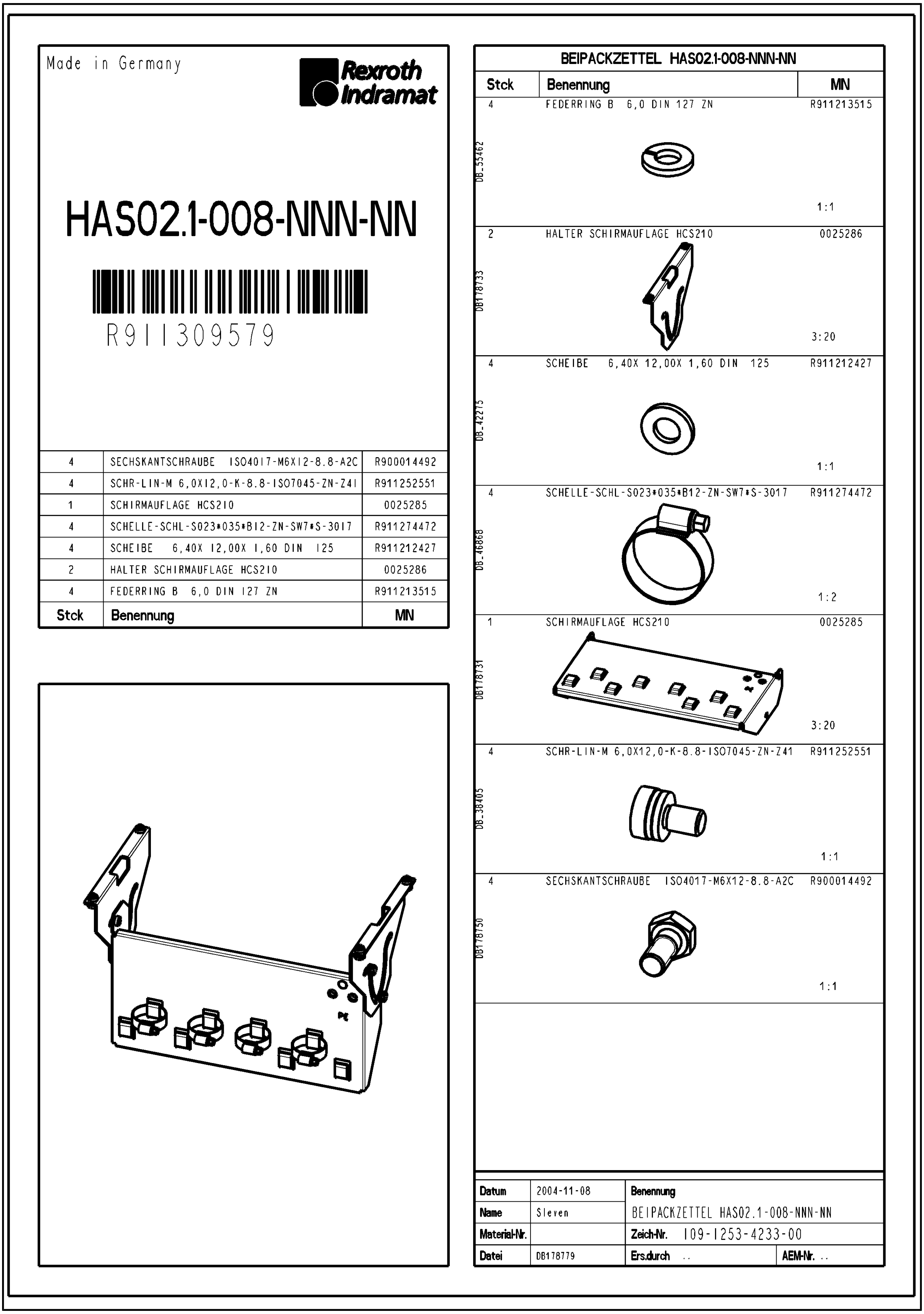
3	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z41	R911252551
1	SCHIRMANBINDUNG	R911024565
1	SCHELLE-SCHL-S032*050-B12-ZN-SW7*S-3017	R911296565
2	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472
1	HALTER SCHIRMANBINDUNG	R911024564
Stck	**Benennung**	**MN**

BEIPACKZETTEL HAS02.1-007-NNN-NN

Stck	Benennung	MN
1	HALTER SCHIRMANBINDUNG	R911024564
2	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472
1	SCHELLE-SCHL-S032*050-B12-ZN-SW7*S-3017	R911296565
1	SCHIRMANBINDUNG	R911024565
3	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z41	R911252551

Datum	2004-03-02	**Benennung**	
Name	Hirt / Sleven	BEIPACKZETTEL HAS02.1-007-NNN-NN	
Material-Nr.	R911306727	**Zeich-Nr.** 109-1253-4232-01	
Datei	DB166625	**Ers.durch** ..	**AEM-Nr.** 5-07273

Fig. 11-35: Accompanying note



Made in Germany

Rexroth Indramat

HAS02.1-008-NNN-NN

R911309579

4	SECHSKANTSCHRAUBE ISO4017-M6X12-8.8-A2C	R900014492
4	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z41	R911252551
1	SCHIRMAUFLAGE HCS210	0025285
4	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472
4	SCHEIBE 6,40X 12,00X 1,60 DIN 125	R911212427
2	HALTER SCHIRMAUFLAGE HCS210	0025286
4	FEDERRING B 6,0 DIN 127 ZN	R911213515
Stck	**Benennung**	**MN**

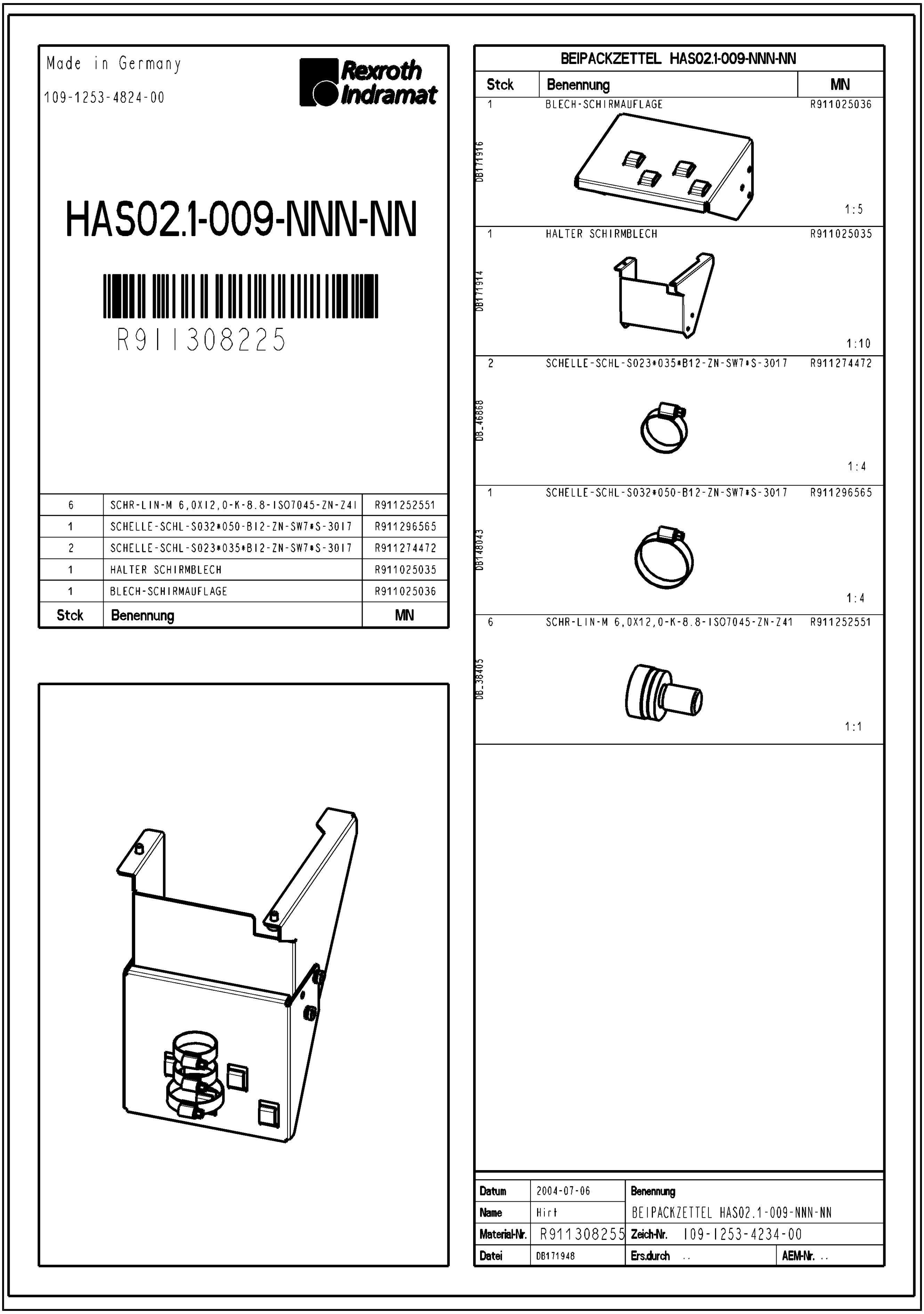
BEIPACKZETTEL HAS02.1-008-NNN-NN

Stck	Benennung	MN		
4	FEDERRING B 6,0 DIN 127 ZN	R911213515	DB_55462	1:1
2	HALTER SCHIRMAUFLAGE HCS210	0025286	DB178733	3:20
4	SCHEIBE 6,40X 12,00X 1,60 DIN 125	R911212427	DB_42275	1:1
4	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472	DB_46868	1:2
1	SCHIRMAUFLAGE HCS210	0025285	DB178731	3:20
4	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z41	R911252551	DB_38405	1:1
4	SECHSKANTSCHRAUBE ISO4017-M6X12-8.8-A2C	R900014492	DB178750	1:1

Datum	2004-11-08	**Benennung**	
Name	Sleven	BEIPACKZETTEL HAS02.1-008-NNN-NN	
Material-Nr.		**Zeich-Nr.** 109-1253-4233-00	
Datei	DB178779	**Ers.durch** ..	**AEM-Nr.** ..

Fig. 11-36: Accompanying note

Accessories



Made in Germany

109-1253-4824-00

Rexroth Indramat

HAS02.1-009-NNN-NN

R911308225

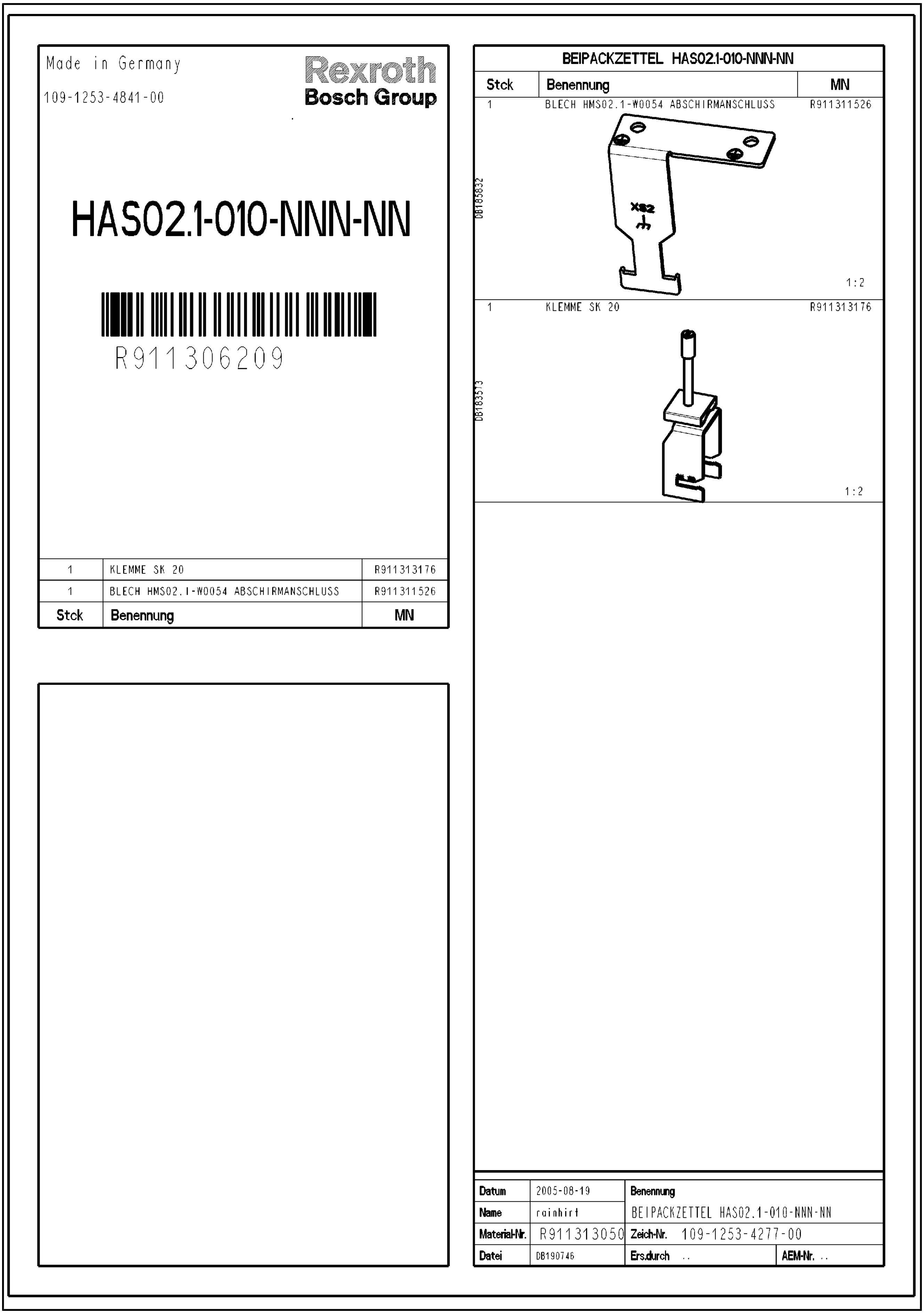
Stck	Benennung	MN
6	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z41	R911252551
1	SCHELLE-SCHL-S032*050-B12-ZN-SW7*S-3017	R911296565
2	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472
1	HALTER SCHIRMBLECH	R911025035
1	BLECH-SCHIRMAUFLAGE	R911025036

BEIPACKZETTEL HAS02.1-009-NNN-NN

Stck	Benennung	MN
1	BLECH-SCHIRMAUFLAGE DB171916 1:5	R911025036
1	HALTER SCHIRMBLECH DB171914 1:10	R911025035
2	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017 DB_46868 1:4	R911274472
1	SCHELLE-SCHL-S032*050-B12-ZN-SW7*S-3017 DB148043 1:4	R911296565
6	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z41 DB_38405 1:1	R911252551

Datum	2004-07-06	Benennung BEIPACKZETTEL HAS02.1-009-NNN-NN	
Name	Hirt		
Material-Nr.	R911308255	Zeich-Nr. 109-1253-4234-00	
Datei	DB171948	Ers.durch ..	AEM-Nr. ..

Fig.11-37: Accompanying note



Made in Germany

109-1253-4841-00

Rexroth
Bosch Group

HAS02.1-010-NNN-NN

R911306209

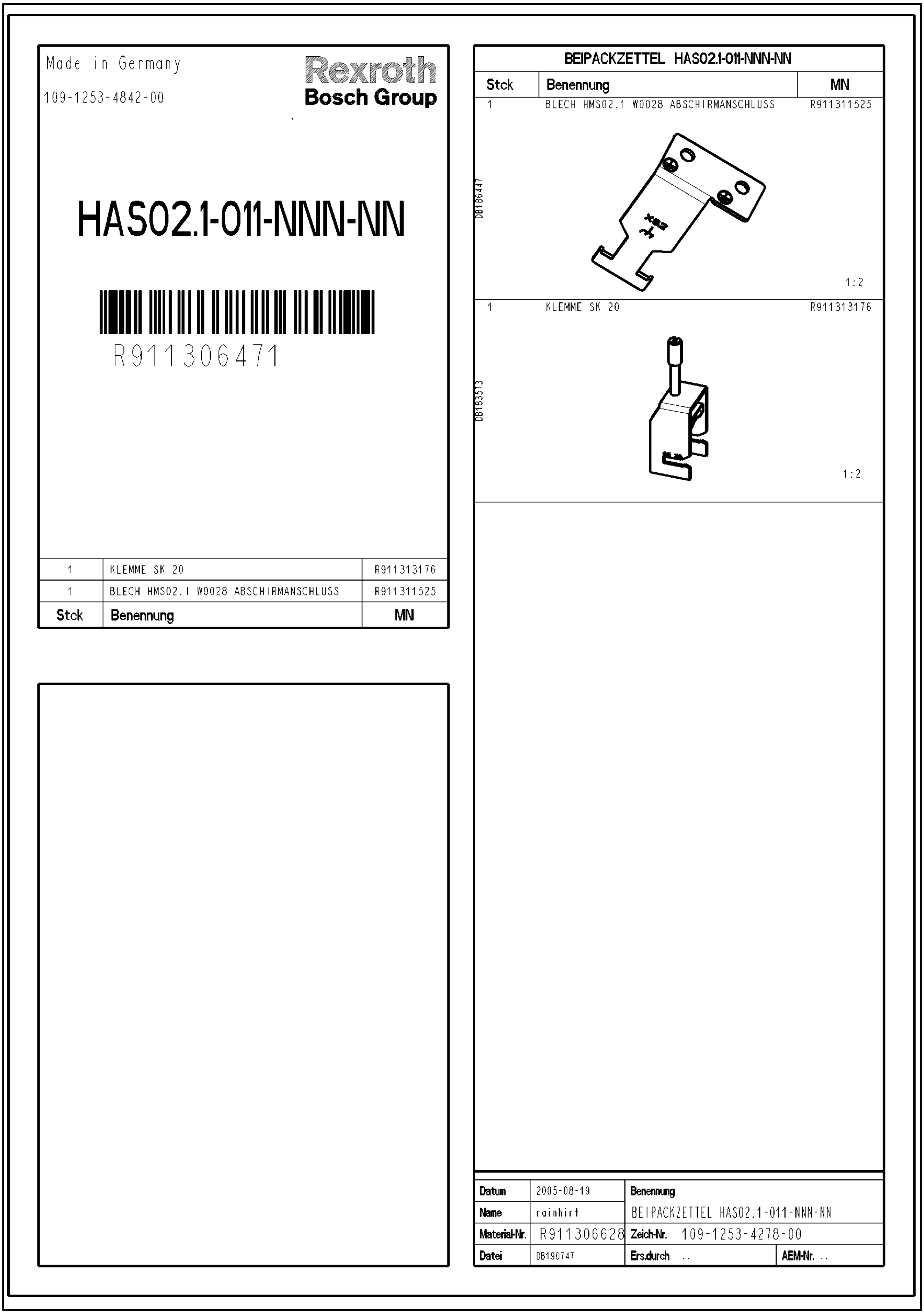
1	KLEMME SK 20	R911313176
1	BLECH HMS02.I-W0054 ABSCHIRMANSCHLUSS	R911311526
Stck	**Benennung**	**MN**

BEIPACKZETTEL HAS02.1-010-NNN-NN

Stck	Benennung	MN
1	BLECH HMS02.1-W0054 ABSCHIRMANSCHLUSS	R911311526
1	KLEMME SK 20	R911313176

Datum	2005-08-19	**Benennung**	
Name	rainhirt	BEIPACKZETTEL HAS02.1-010-NNN-NN	
Material-Nr.	R911313050	**Zeich-Nr.** 109-1253-4277-00	
Datei	DB190746	**Ers.durch** ..	**AEM-Nr.** ..

Fig.11-38: Accompanying note



Made in Germany

109-1253-4842-00

Rexroth
Bosch Group

HAS02.1-011-NNN-NN

R911306471

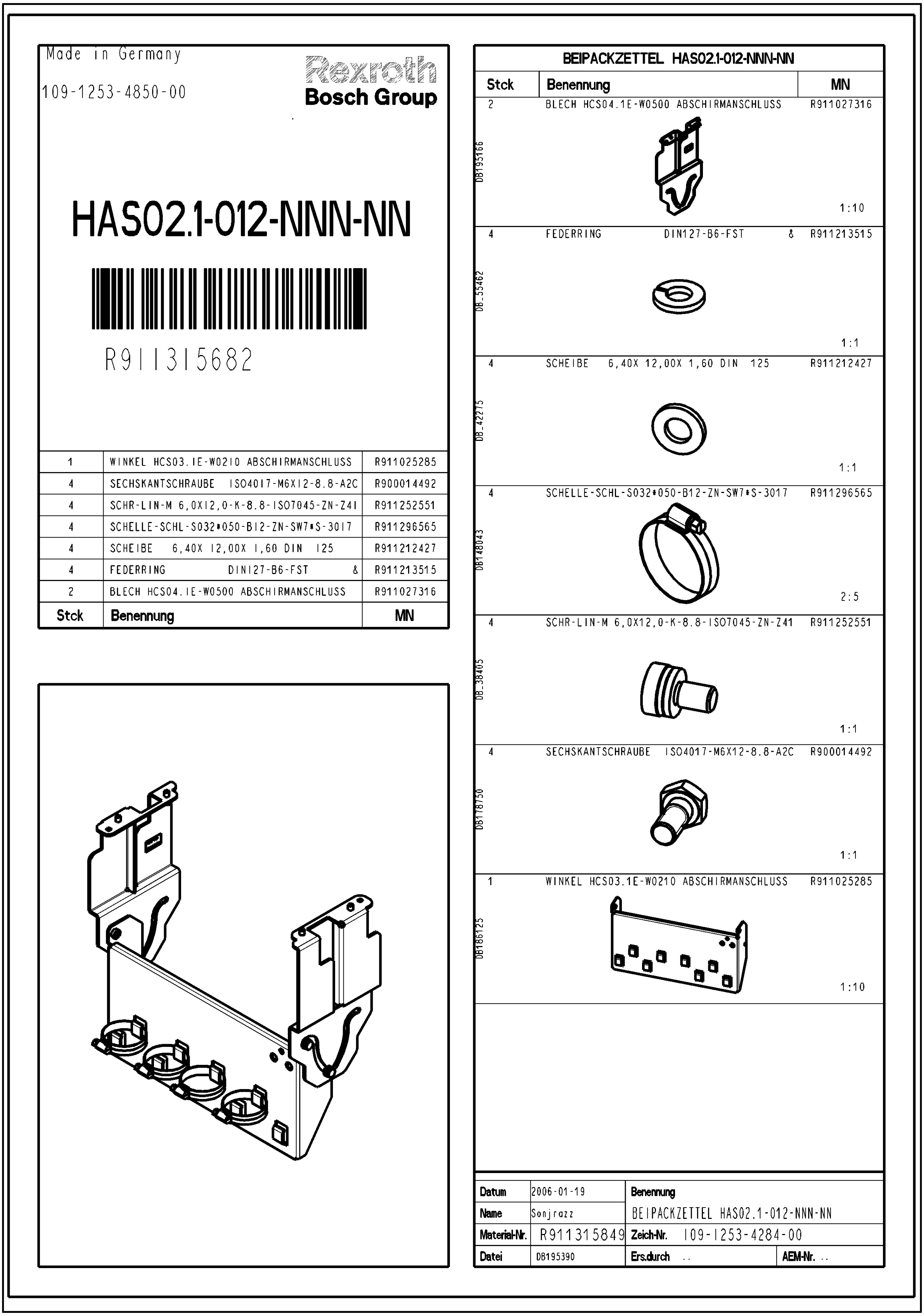
1	KLEMME SK 20	R911313176
1	BLECH HMS02.1 W0028 ABSCHIRMANSCHLUSS	R911311525
Stck	Benennung	MN

BEIPACKZETTEL HAS02.1-011-NNN-NN

Stck	Benennung	MN
1	BLECH HMS02.1 W0028 ABSCHIRMANSCHLUSS	R911311525
1	KLEMME SK 20	R911313176

Datum	2005-08-19	Benennung	
Name	rainhirt	BEIPACKZETTEL HAS02.1-011-NNN-NN	
Material-Nr.	R911306628	Zeich-Nr. 109-1253-4278-00	
Datei	DB190747	Ers.durch ..	AEM-Nr. ..

Fig.11-39: Accompanying note



Made in Germany

109-1253-4850-00

Rexroth
Bosch Group

HAS02.1-012-NNN-NN

R911315682

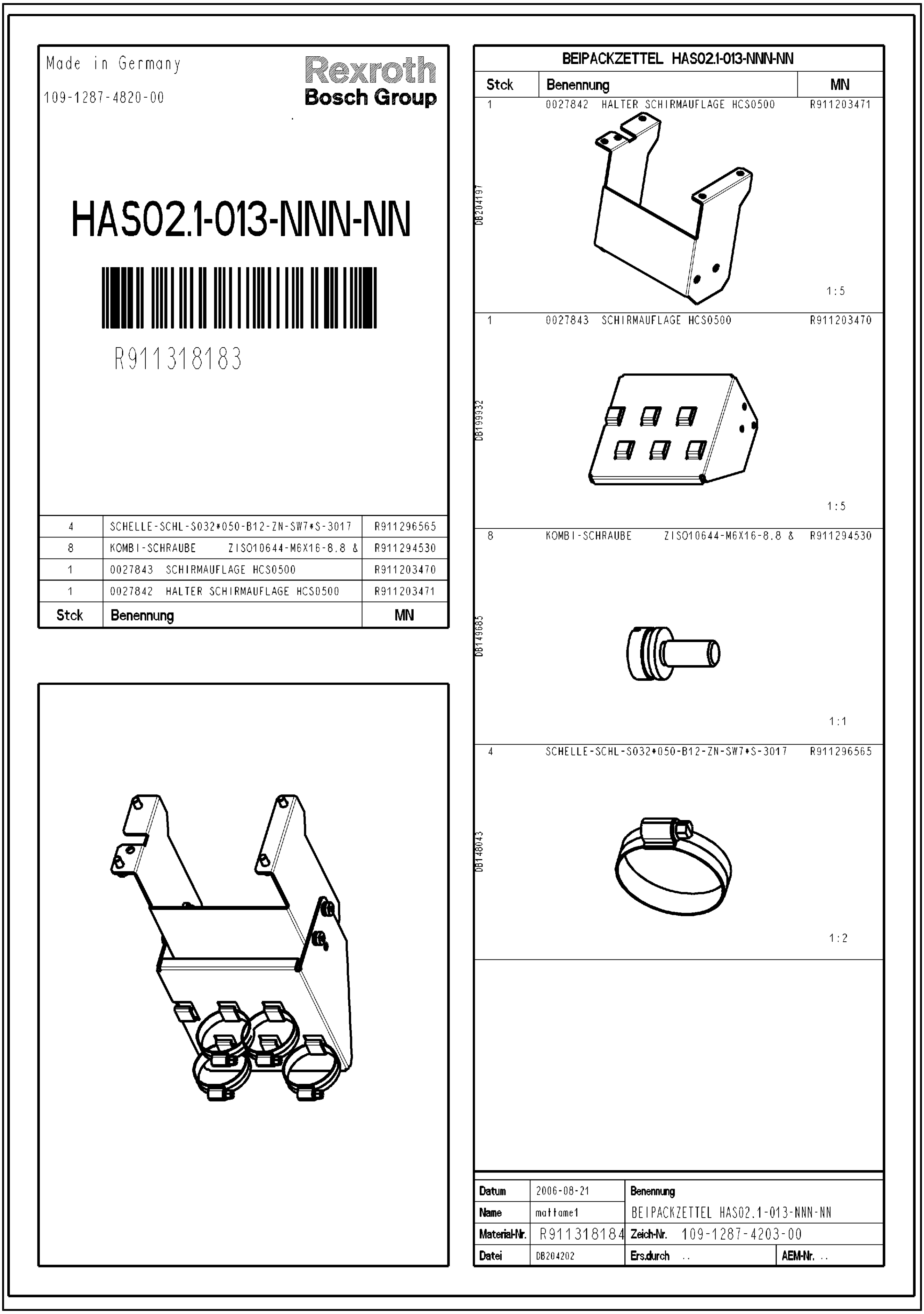
Stck	Benennung	MN
1	WINKEL HCS03.1E-W0210 ABSCHIRMANSCHLUSS	R911025285
4	SECHSKANTSCHRAUBE ISO4017-M6X12-8.8-A2C	R900014492
4	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z41	R911252551
4	SCHELLE-SCHL-S032*050-B12-ZN-SW7*S-3017	R911296565
4	SCHEIBE 6,40X 12,00X 1,60 DIN 125	R911212427
4	FEDERRING DIN127-B6-FST &	R911213515
2	BLECH HCS04.1E-W0500 ABSCHIRMANSCHLUSS	R911027316

BEIPACKZETTEL HAS02.1-012-NNN-NN

	Stck	Benennung	MN	
DB195166	2	BLECH HCS04.1E-W0500 ABSCHIRMANSCHLUSS	R911027316	1:10
DB_55462	4	FEDERRING DIN127-B6-FST &	R911213515	1:1
DB_42275	4	SCHEIBE 6,40X 12,00X 1,60 DIN 125	R911212427	1:1
DB148043	4	SCHELLE-SCHL-S032*050-B12-ZN-SW7*S-3017	R911296565	2:5
DB_38405	4	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z41	R911252551	1:1
DB178750	4	SECHSKANTSCHRAUBE ISO4017-M6X12-8.8-A2C	R900014492	1:1
DB186125	1	WINKEL HCS03.1E-W0210 ABSCHIRMANSCHLUSS	R911025285	1:10

Datum	2006-01-19	**Benennung**	
Name	Sonjrazz	BEIPACKZETTEL HAS02.1-012-NNN-NN	
Material-Nr.	R911315849	**Zeich-Nr.** 109-1253-4284-00	
Datei	DB195390	**Ers.durch** ..	**AEM-Nr.** ..

Fig. 11-40: Accompanying note



Made in Germany

109-1287-4820-00

Rexroth
Bosch Group

HAS02.1-013-NNN-NN

R911318183

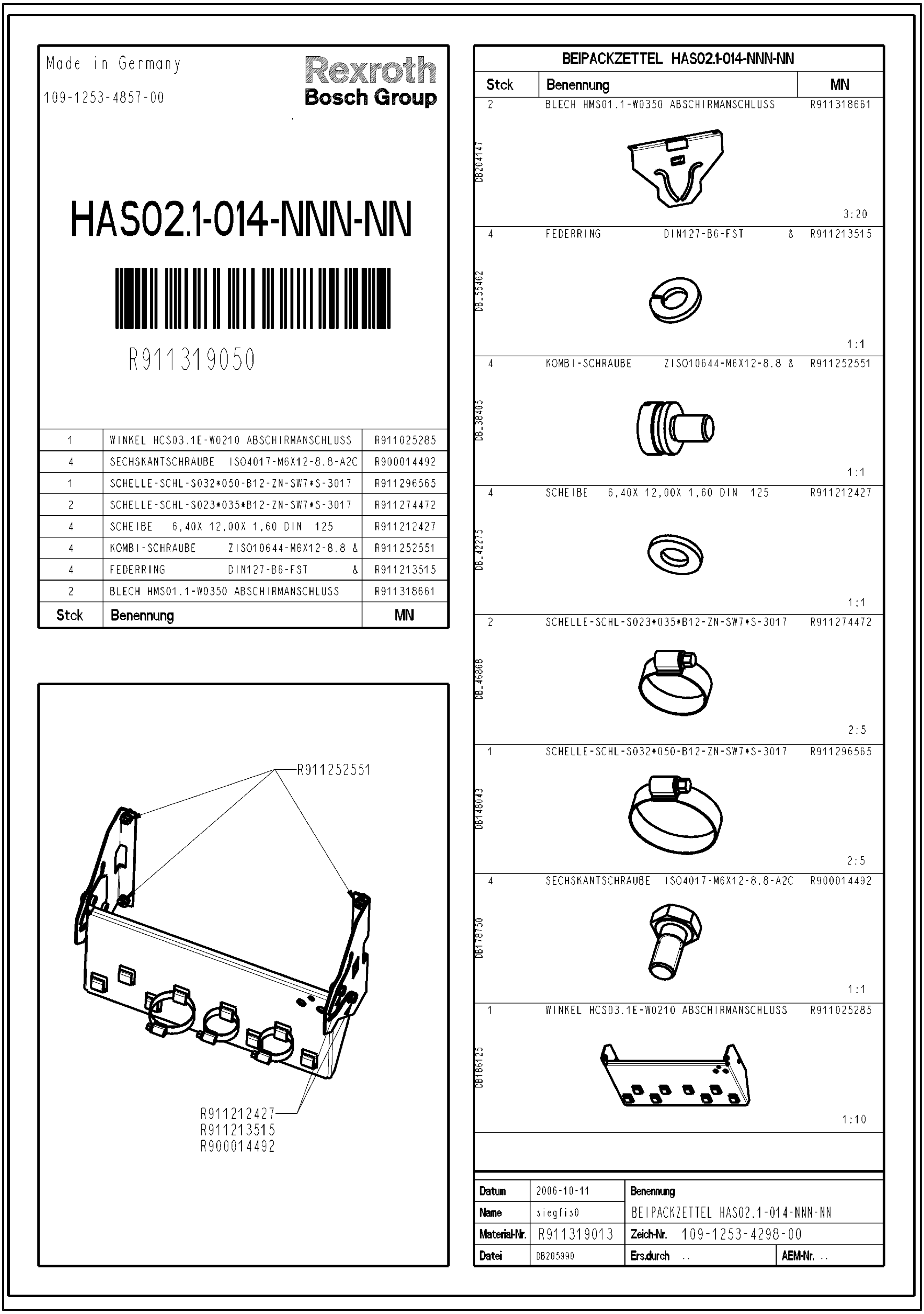
Stck	Benennung	MN
4	SCHELLE-SCHL-S032*050-B12-ZN-SW7*S-3017	R911296565
8	KOMBI-SCHRAUBE ZISO10644-M6X16-8.8 &	R911294530
1	0027843 SCHIRMAUFLAGE HCS0500	R911203470
1	0027842 HALTER SCHIRMAUFLAGE HCS0500	R911203471

BEIPACKZETTEL HAS02.1-013-NNN-NN

Stck	Benennung	MN
1	0027842 HALTER SCHIRMAUFLAGE HCS0500	R911203471
1	0027843 SCHIRMAUFLAGE HCS0500	R911203470
8	KOMBI-SCHRAUBE ZISO10644-M6X16-8.8 &	R911294530
4	SCHELLE-SCHL-S032*050-B12-ZN-SW7*S-3017	R911296565

Datum	2006-08-21	**Benennung** BEIPACKZETTEL HAS02.1-013-NNN-NN	
Name	mattame1		
Material-Nr.	R911318184	**Zeich-Nr.** 109-1287-4203-00	
Datei	DB204202	**Ers.durch** ..	**AEM-Nr.** ..

Fig.11-41: Accompanying note



Made in Germany
109-1253-4857-00

Rexroth
Bosch Group

HAS02.1-014-NNN-NN

R911319050

1	WINKEL HCS03.1E-W0210 ABSCHIRMANSCHLUSS	R911025285
4	SECHSKANTSCHRAUBE ISO4017-M6X12-8.8-A2C	R900014492
1	SCHELLE-SCHL-S032*050-B12-ZN-SW7*S-3017	R911296565
2	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472
4	SCHEIBE 6,40X 12,00X 1,60 DIN 125	R911212427
4	KOMBI-SCHRAUBE ZISO10644-M6X12-8.8 &	R911252551
4	FEDERRING DIN127-B6-FST &	R911213515
2	BLECH HMS01.1-W0350 ABSCHIRMANSCHLUSS	R911318661
Stck	**Benennung**	**MN**

BEIPACKZETTEL HAS02.1-014-NNN-NN

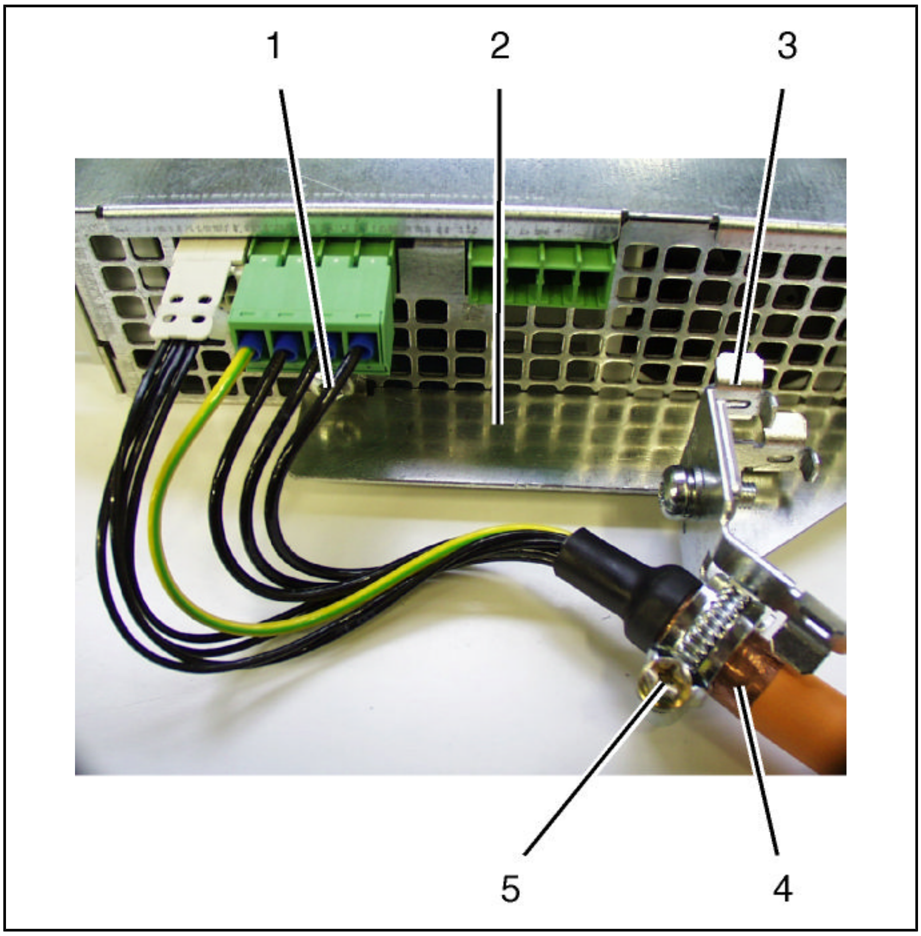
Stck	Benennung	MN		
2	BLECH HMS01.1-W0350 ABSCHIRMANSCHLUSS	R911318661	DB204147	3:20
4	FEDERRING DIN127-B6-FST &	R911213515	DB.55462	1:1
4	KOMBI-SCHRAUBE ZISO10644-M6X12-8.8 &	R911252551	DB.38405	1:1
4	SCHEIBE 6,40X 12,00X 1,60 DIN 125	R911212427	DB.42275	1:1
2	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472	DB.46868	2:5
1	SCHELLE-SCHL-S032*050-B12-ZN-SW7*S-3017	R911296565	DB148043	2:5
4	SECHSKANTSCHRAUBE ISO4017-M6X12-8.8-A2C	R900014492	DB178150	1:1
1	WINKEL HCS03.1E-W0210 ABSCHIRMANSCHLUSS	R911025285	DB186125	1:10

Datum	2006-10-11	**Benennung**	
Name	siegfis0	BEIPACKZETTEL HAS02.1-014-NNN-NN	
Material-Nr.	R911319013	**Zeich-Nr.** 109-1253-4298-00	
Datei	DB205990	**Ers.durch** ..	**AEM-Nr.** ..

Fig.11-42: Accompanying note

11.3.6 Mounting the Accessory HAS02

General Information



1	screw in thread XS2
2	fixing device of shielding plate
3	shielding plate
4	shield of motor cable
5	clip

Fig. 11-43: Shield connection of motor cable

- Unscrew bottom or bottom left fixing screw of drive controller.
- Put fixing device of accessories to bottom of drive controller and screw down fixing screw of drive controller again.

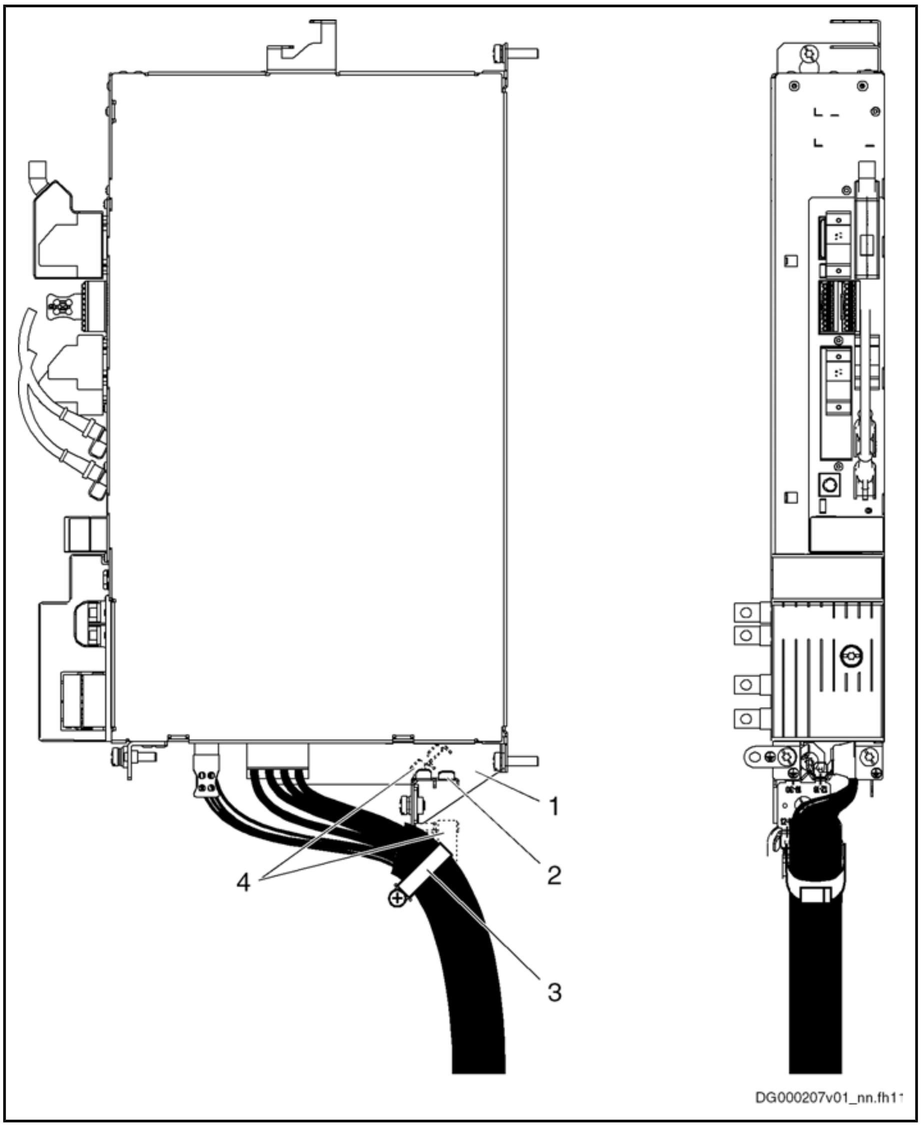
CAUTION

Risk of damage to the drive controller caused by too long screws!

Exclusively use the supplied screws of a length of **12 mm** for the thread of the shield connection XS2.

- Screw second screw (M6 x 12) in thread XS2 at bottom of drive controller.
- Screw shielding plate to sheet metal of accessories according to desired cable routing of motor cable (45° or horizontal). (The figure below illustrates cable routing with 45°.)
- According to diameter of motor cable, fix motor cable at corresponding point of shielding plate (12–18 mm or 19–30 mm) with a clip. Make sure that shield of motor cable has good contact with shielding plate (see figure below).

HAS02.1-001 at HMS01.1N-W0054



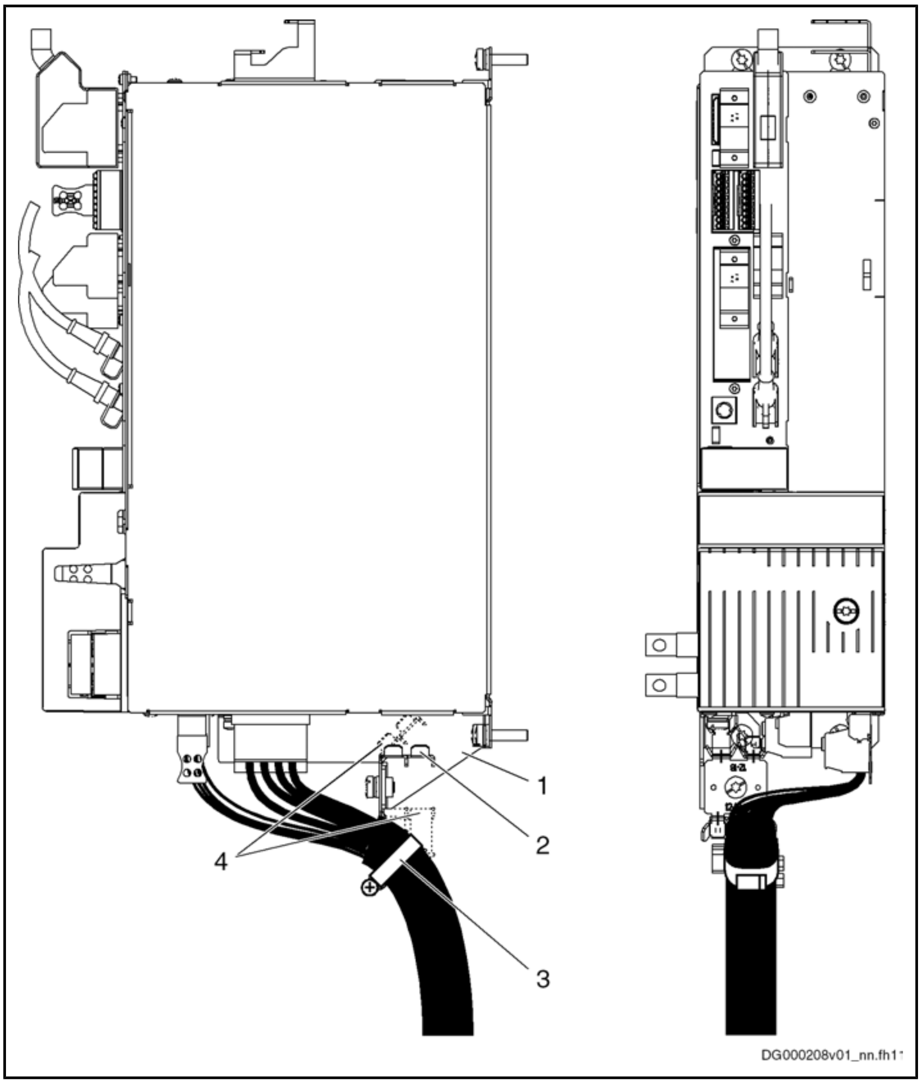
1	fixing device
2	shielding plate
3	clip
4	different possibilities of mounting the shielding plate, according to motor cable routing

Fig. 11-44: HAS02.1-001 at bottom of drive controller HMS01.1N-W0054

Mounting

1. By means of supplied screws, fasten fixing device to bottom of drive controller.
2. Fix shielding plate to fixing device according to desired motor cable routing.
3. Fix shield of cable to shielding plate with appropriate clip.

HAS02.1-002 at HCS02.1E-W0054



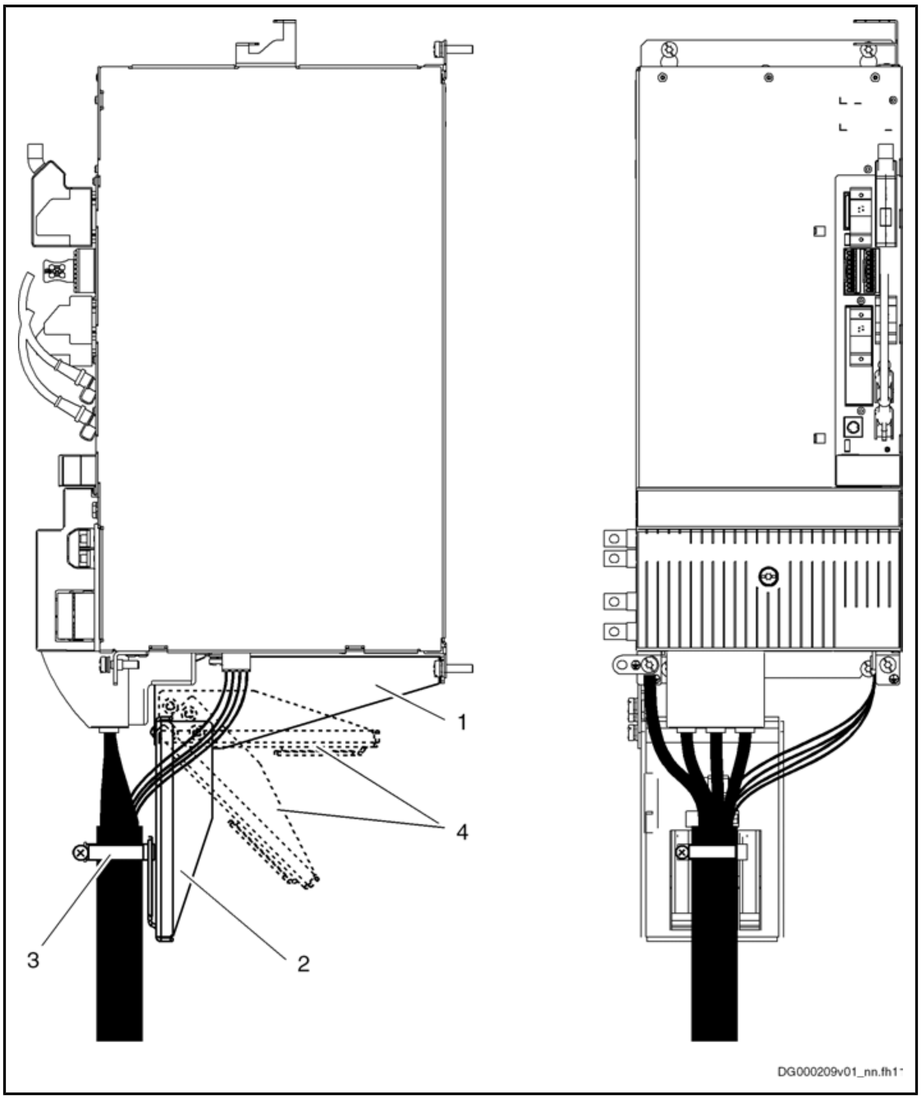
1	fixing device
2	shielding plate
3	clip
4	different possibilities of mounting the shielding plate, according to motor cable routing

Fig. 11-45: HAS02.1-002 at bottom of drive controller HCS02.1E-W0054

Mounting

1. By means of supplied screws, fasten fixing device to bottom of drive controller.
2. Fix shielding plate to fixing device according to desired motor cable routing.
3. Fix shield of cable to shielding plate with appropriate clip.

HAS02.1-003 at HMS01.1N-W0210



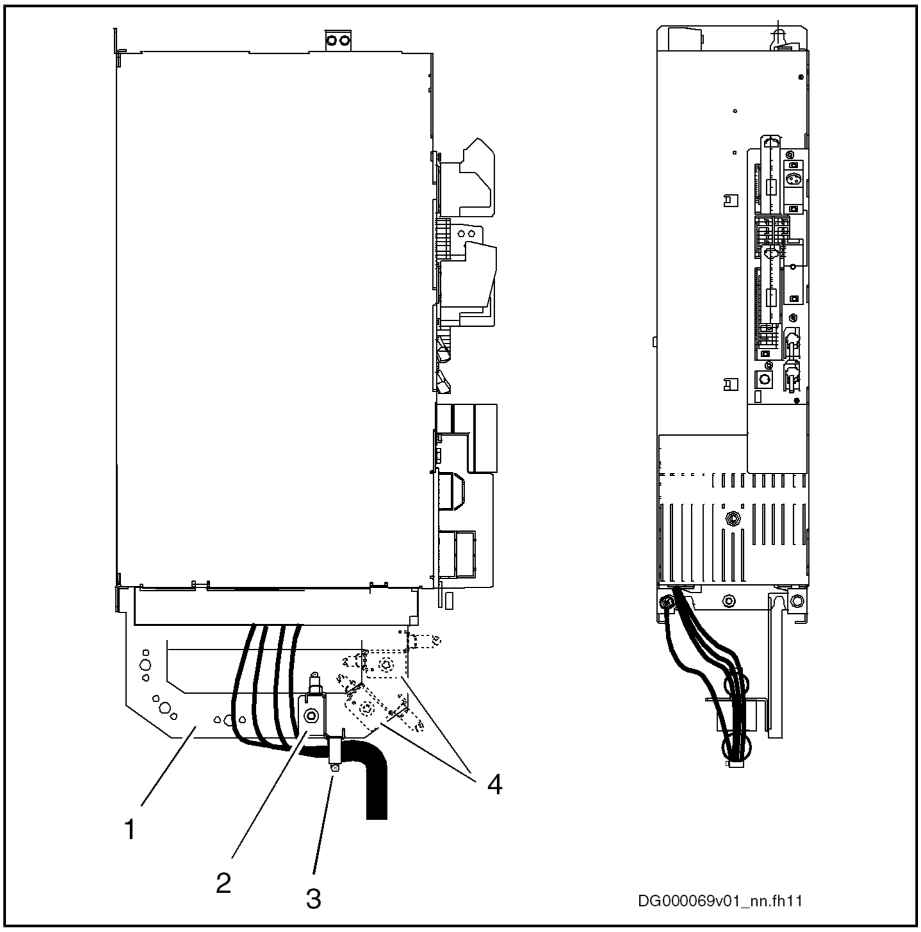
1	fixing device
2	shielding plate
3	clip
4	different possibilities of mounting the shielding plate, according to motor cable routing

Fig. 11-46: HAS02.1-003 at bottom of drive controller HMS01.1N-W0210

Mounting

1. By means of supplied screws, fasten fixing device to bottom of drive controller.
2. Fix shielding plate to fixing device according to desired motor cable routing.
3. Fix shield of cable to shielding plate with appropriate clip.

HAS02.1-004 at HCS03.1E-W0070



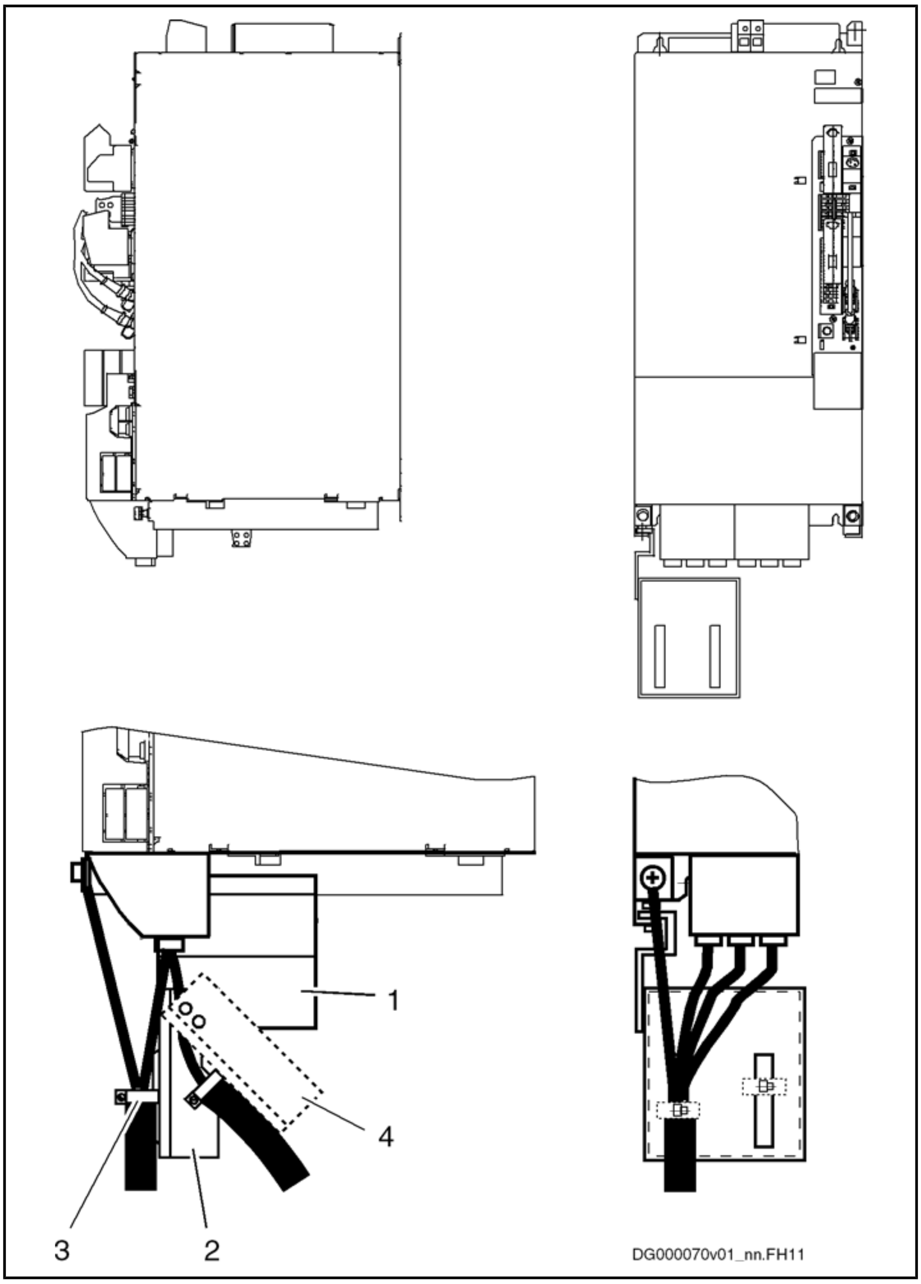
1	fixing device
2	shielding plate
3	clip
4	different possibilities of mounting the shielding plate, according to motor cable routing

Fig.11-47: HAS02.1-004 at bottom of drive controller HCS03.1E-W0070

Mounting

1. By means of supplied screws, fasten fixing device to bottom of drive controller.
2. Fix shielding plate to fixing device according to desired motor cable routing.
3. Fix shield of cable to shielding plate with appropriate clip.

HAS02.1-005 at HCS03.1E-W0100 / 150



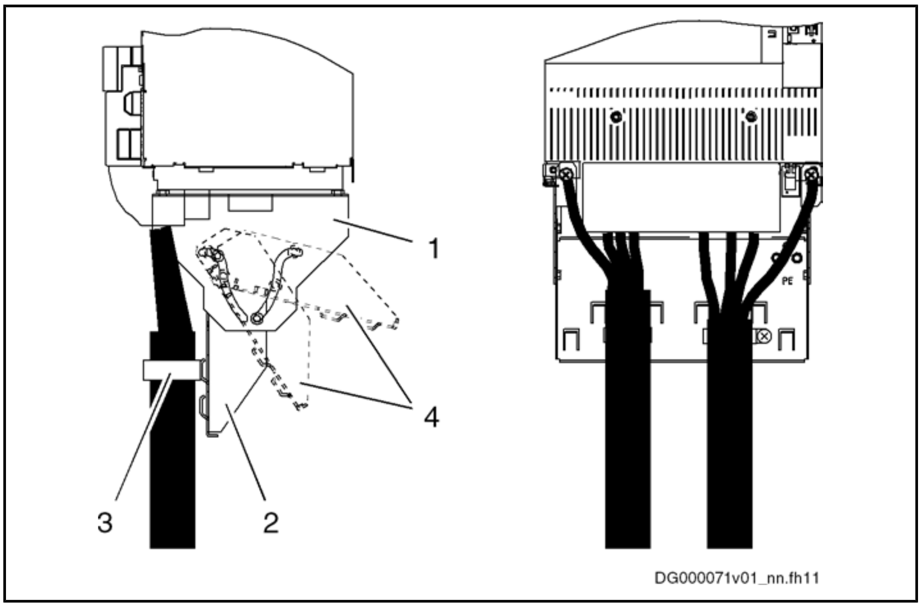
1	fixing device
2	shielding plate
3	clip
4	different possibilities of mounting the shielding plate, according to motor cable routing

Fig. 11-48: HAS02.1-005 at bottom of drive controller HCS03.1E-W0100 / 0150

Mounting

1. By means of supplied screws, fasten fixing device to bottom of drive controller.
2. Fix shielding plate to fixing device according to desired motor cable routing.
3. Fix shield of cable to shielding plate with appropriate clip.

HAS02.1-008 at HCS03.1E-W0210



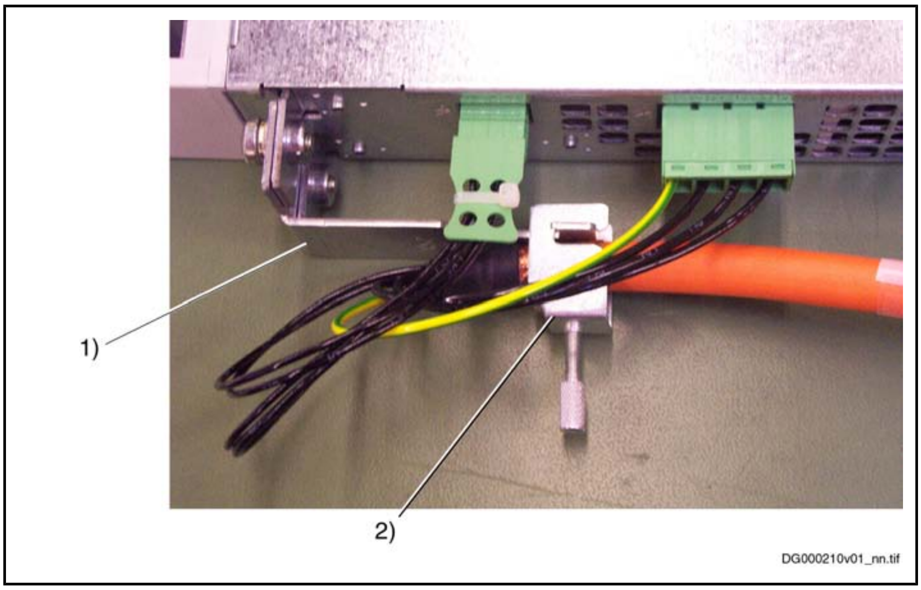
1	fixing device
2	shielding plate
3	clip
4	different possibilities of mounting the shielding plate, according to motor cable routing

Fig. 11-49: *HAS02.1-008 at bottom of drive controller HCS03.1E-W0210*

Mounting

1. By means of supplied screws, fasten fixing device to bottom of drive controller.
2. Fix shielding plate to fixing device according to desired motor cable routing.
3. Fix shield of cable to shielding plate with appropriate clip.

HAS02.1-010 at HMS02.1N-W0028 / 54

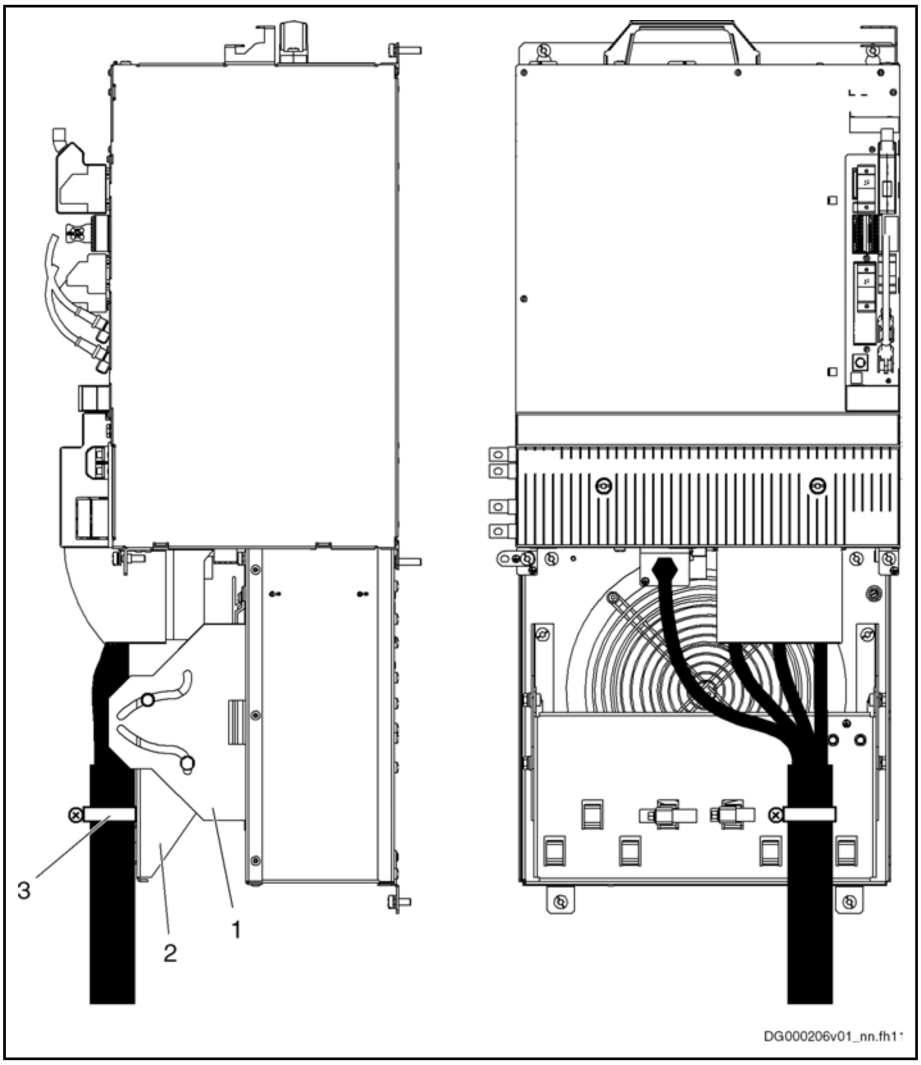


1	fixing device
2	shielding plate

Fig. 11-50: *HAS02.1-010-NNN-NN at bottom of drive controller HMS02.1N-W0028 / 54*

1. Screw fixing device to equipment grounding conductor connection of drive controller.
2. Fix shield of cable with shielding plate to fixing device.

HAS02.1-014 at HMS01.1N-W0350



1	fixing device
2	shielding plate
3	clip

Fig. 11-51: HAS02.1-014 at bottom of drive controller HMS01.1N-W0350

1. By means of supplied screws, fasten fixing device to front of blower unit.

2. Fix shielding plate to fixing device.

3. Fix shield of cable to shielding plate with appropriate clip.

11.3.7 Shield Connection of the Motor Cable via Mains Filter

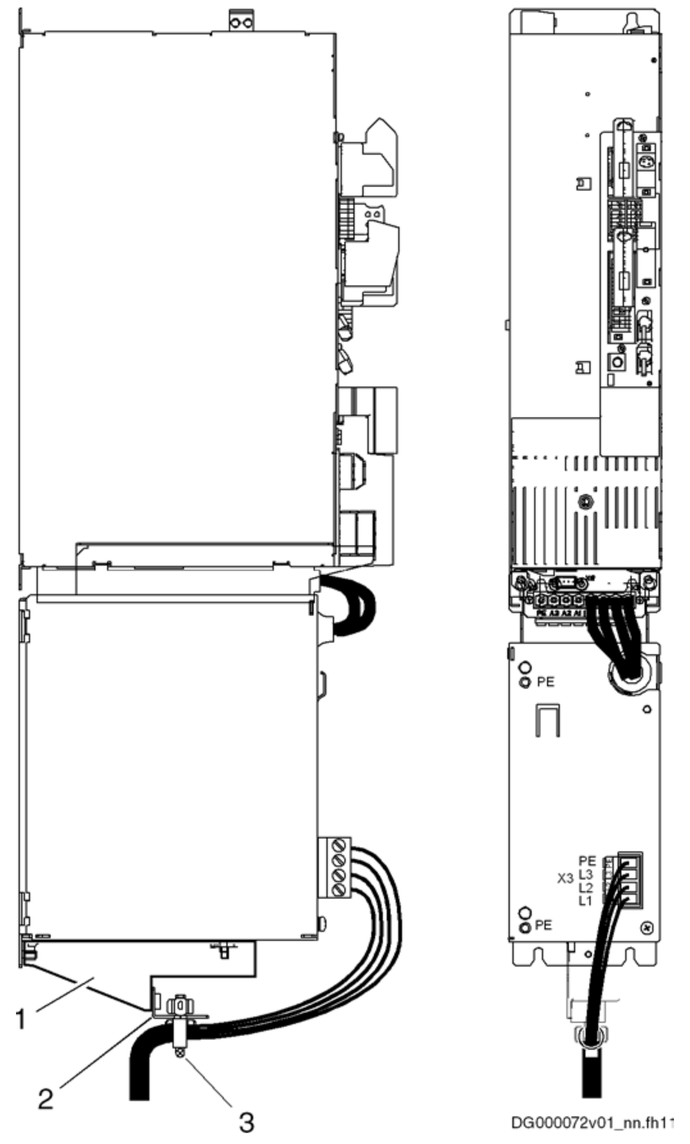
General Information

There is a special shielding plate for shield connection of the motor cable via the mains filter at the drive controller:

Using the shielding plate guarantees optimum shield contact of the motor cable. You should therefore, **where possible, always** use the shielding plate.

The shielding plate is only available as an option.

HAS02.1-006 With Motor Cable and Mains Filter



1	fixing device
2	shielding plate
3	clip

Fig.11-52: HAS02.1-006 at bottom of mains filter (rated current 50 A)

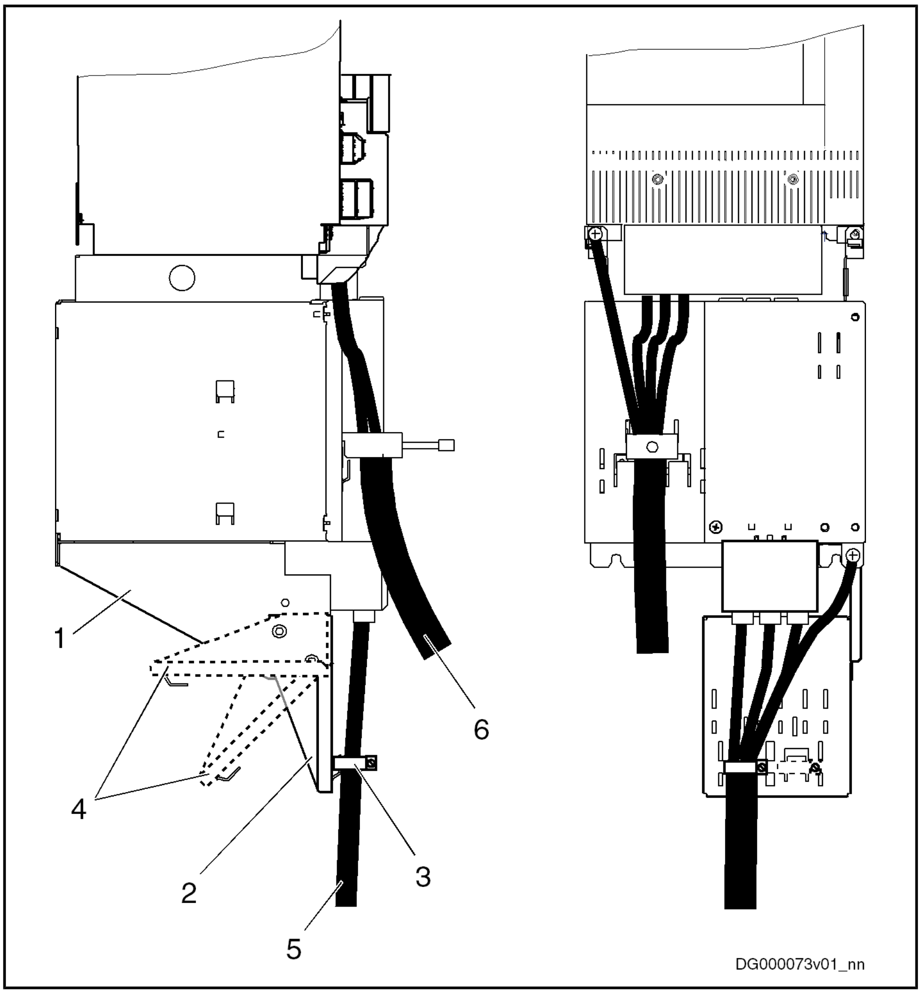
1. Hang up fixing device at bottom of mains filter at threaded bolts and fasten with supplied nuts.

2. Screw shielding plate to fixing device.

3. Fix shield of cable to shielding plate with appropriate clip.

The shield terminals must not be used to provide strain relief.

HAS02.1-007 With Power Supply Cable and Mains Filter



1	fixing device
2	shielding plate
3	clip
4	different possibilities of mounting the shielding plate, according to cable routing
5	power supply cable
6	motor cable

Fig. 11-53: HAS02.1-007 at bottom of mains filter (rated current 80 A / 106 A)

1. Hang up fixing device at bottom of mains filter and fasten with supplied screws.

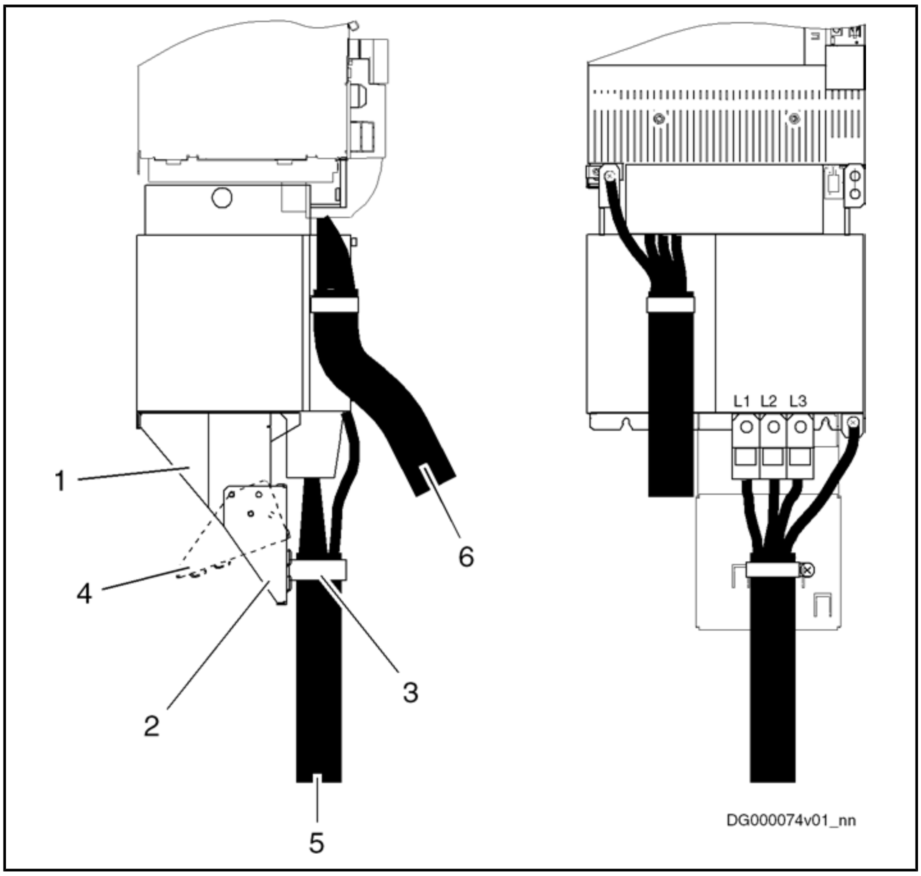
2. Screw shielding plate to fixing device.

According to desired cable routing, the shielding plate can be mounted in different positions

3. Fix shield of cable to shielding plate with clip.

☞ The shield terminals must not be used to provide strain relief.

HAS02.1-009 With Power Supply Cable and Mains Filter



1	fixing device
2	shielding plate
3	clip
4	different possibilities of mounting the shielding plate, according to cable routing
5	power supply cable
6	motor cable

Fig. 11-54: HAS02.1-009 at bottom of mains filter (rated current 146 A)

Mounting

1. By means of supplied screws, fasten fixing device to bottom of drive controller.
2. Fix shielding plate to fixing device according to desired motor cable routing.
3. Fix shield of cable to shielding plate with appropriate clip.

☞ The shield terminals must not be used to provide strain relief.

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12 Environmental Protection and Disposal

12.1 Environmental Protection

12.1.1 Production Processes

The products are made with energy- and resource-optimized production processes which allow re-using and recycling the resulting waste. We regularly try to replace pollutant-loaded raw materials and supplies by more environment-friendly alternatives.

12.1.2 Prohibited Substances

We guarantee that our products do not contain any of the substances specified in the German regulation of prohibited chemicals ("Chemikalien-Verbotsverordnung"). We furthermore declare that our products are free of mercury, asbestos, PCB and chlorinated hydrocarbons.

12.1.3 No Release of Hazardous Substances

Our products do not contain any hazardous substances which may be released in the case of appropriate use. Accordingly, our products will normally not have any negative effect on the environment.

12.1.4 Principal Components

The principal components contained in our products are listed below:

Electronic devices	Motors
• steel • aluminum • copper • synthetic materials • electronic components and modules	• steel • aluminum • copper • brass • magnetic materials • electronic components and modules

Fig. 12-1: Principal components

12.2 Disposal

12.2.1 Return of Products

Our products can be returned to us free of charge for disposal. It is a precondition, however, that the products are free of oil, grease or other dirt.

Furthermore, the products returned for disposal mustn't contain any undue foreign matter or foreign component.

Please send the products free domicile to the following address:

Bosch Rexroth AG
Electric Drives and Controls
Bürgermeister-Dr.-Nebel-Strasse 2
D-97816 Lohr am Main

12.2.2 Packaging Materials

The packaging materials consist of cardboard, wood and polystyrene. These materials can be recycled anywhere without any problem.

For ecological reasons, please refrain from returning the empty packages to us.

12.2.3 Recycling

Due to their high content of metal, most of the product components can be recycled. In order to recycle the metal in the best possible way, the products must be disassembled into individual modules.

Metals contained in electric and electronic modules can also be recycled by means of special separation processes. The synthetic materials remaining after these processes can be thermally recycled.

If the products contain batteries or accumulators, these have to be removed before recycling and disposed of.

13 Service and Support

13.1 Helpdesk

Our service helpdesk at our headquarters in Lohr, Germany, will assist you with all kinds of inquiries.

Contact us:

- By phone through the Service Call Entry Center,
  Monday to Friday 7:00 am - 6:00 pm CET
  +49 (0) 9352 40 50 60
- By fax
  +49 (0) 9352 40 49 41
- By e-mail: service.svc@boschrexroth.de

13.2 Service Hotline

Out of helpdesk hours please contact our German service department directly:

+49 (0) 171 333 88 26

or

+49 (0) 172 660 04 06

Hotline numbers for other countries can be found in the addresses of each region (see below).

13.3 Internet

Additional notes regarding service, maintenance and training, as well as the current addresses of our sales and service offices can be found on

http://www.boschrexroth.com

Outwith Germany please contact our sales/service office in your area first.

13.4 Helpful Information

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

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

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Notes

Rexroth
Bosch Group

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

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