

SYSTEM DRIVES

# ACS5000 water-cooled

## User manual



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# 1. About this manual

## 1.1. Equipment covered by this manual

This manual covers standard drive and provides generic information on the drive. The manual does not claim to cover all variations and details of the drive, nor to consider all eventualities that may arise during installation, commissioning, operation and maintenance of the drive.

If the drive is adapted to specific customer needs or applications, and handling, installation, and operation of the drive are affected by these modifications, information on these modifications is provided in the appropriate documentation (such as layout drawings, wiring diagrams, project-specific data, engineering notes).

If information is required beyond the instructions in this manual, refer the matter to ABB.

## 1.2. Structure of the user documentation

The documentation for a standard drive consists of this document and the following project-specific appendices.

NOTE – These appendices are NOT included in this document.

- **Appendix A - Additional manuals** provides manuals about additional equipment delivered with the drive (such as project-specific options like pulse encoder or fieldbus interfaces), or information on modifications of the standard drive.
- **Appendix B - Technical data** contains the technical data sheets of the drive.
- **Appendix C - Mechanical drawings** provides the outline drawings of the drive. The drawings are generated according to the customer-specific project.
- **Appendix D - Wiring diagrams** contains the circuit diagrams with information on device identification, cross-reference and device identification conventions. The diagrams are generated according to the customer-specific project. “Setting of protective devices” is generated according to the customer-specific project.
- **Appendix E - Parts list** produced for each project and contains all information to identify a component.
- **Appendix F - Test reports and certificates** provides the test reports of the drive. Quality certificates, and codes and standards the drive complies with are added if necessary for the project.
- **Appendix G - Signal and parameter table** includes descriptions of actual signals, control and status words, and control parameters and their default settings.

| PRODUCT | DOCUMENT KIND | DOCUMENT ID.   | REV. | LANG. | PAGE   |
|---------|---------------|----------------|------|-------|--------|
| ACS500W | User manual   | 3BHS799208 E01 | F    | en    | 15/178 |

### 1.3. Related documents

The following documents are available for supplementary information:

Table 1-1 Maintenance

| Title                                   | Document number |
|---|-----------------|
| ACS5000 preventive maintenance schedule | 3BHS855274 E01  |

Table 1-2 Technical data

| Title   | Document number |
|---|-----------------|
| Technical data from DriveSmart <sup>(1)</sup> |                 |

<sup>(1)</sup> Configuration software for medium voltage drives

Table 1-3 Schematics

| Title          | Document number  |
|----------------|------------------|
| Layout drawing | Project-specific |

Table 1-4 Specifications and guidelines

| Title  | Document number |
|--|-----------------|
| Generic transformer specification            | 3BHS356582 E01  |
| Generic motor specification                  | 3BHS824803 E01  |
| Main circuit breaker engineering guideline   | 3BHS125149 E50  |
| ACS5000 power cable specification            | 3BHS215798 E01  |
| Power cables engineering guideline           | 3BHS542290 E01  |
| Auxiliary power and control cables guideline | 3BHS813742 E01  |
| Customer interface                           | 3BHS347034 E03  |

Table 1-5 Manuals

| Title                                   | Document number |
|---|-----------------|
| ACS5000 Service manual                  | 3BHS264270 E20  |
| Air-cooled excitation units user manual | 3BHS252500 E01  |

Table 1-6 I/O interface

| Title   | Document number |
|---|-----------------|
| S800 I/O Getting started <sup>(1)</sup>               | 3BSE020923      |
| S800 I/O Modules and Termination Units <sup>(1)</sup> | 3BSE020924      |

<sup>(1)</sup> Also available online in the ABB Library (<https://library.abb.com>)

| PRODUCT  | DOCUMENT KIND | DOCUMENT ID.   | REV. | LANG. | PAGE   |
|----------|---------------|----------------|------|-------|--------|
| ACS5000W | User manual   | 3BHS799208 E01 | F    | en    | 16/178 |

Table 1-7 Serial communications interfaces

| Title  | Document number |
|--|-----------------|
| Ethernet - NETA-21 remote monitoring tool user manual <sup>(1)</sup> | 3AUA0000096939  |
| Modbus - NMBA-01 installation and start-up guide <sup>(1)</sup>      | 3AFY58919772    |
| Profibus - NPBA-12 installation and start-up guide <sup>(1)</sup>    | 3BFE64341588    |

<sup>(1)</sup> Also available online in the ABB Library (<https://library.abb.com>)

## 1.4. Terms and abbreviations

The following table lists terms and abbreviations you should be familiar with when using this user manual. Some of the terms and abbreviations used in this user manual are unique to ABB and might differ from the normal usage.

Table 1-8 Terms and abbreviations

| Term/Abbreviation | Definition  |
|-------------------|---|
| AMC               | The application and motor controller (AMC) is a digital signal processor and the heart of the drive control system.   |
| Converter         | Short form for ACS5000 frequency converter  |
| COU               | The control unit (COU) consists of a control section, a customer interface section and a terminal section.<br>The control section incorporates the hardware for control, monitoring and protection functions of the drive and the communication interface to the door-mounted CDP control panel.<br><br>The COU compartment also incorporates the grounding frame for cable screens and the ground cable, the grounding accessories and the motor terminal section. |
| CVMI              | Current voltage measurement interface   |
| Drive             | Synonym for ACS5000 frequency converter   |
| DriveDebug        | DriveDebug is part of ABB's DriveWare® software tools for devices using the DDCS communications protocol. DriveDebug runs on computers with Microsoft Windows® operating systems. DriveDebug is a specialist tool used to diagnose, tune and troubleshoot frequency converters.   |
| DriveWindow       | DriveWindow is a DriveWare® product. DriveWindow is a 32-bit Microsoft Windows® application for commissioning and maintaining ABB drives equipped with optical communication links.   |
| DriveMonitor      | DriveMonitor is a monitoring and diagnostics system that allows secure access to the frequency converter via the Internet from a remote location. DriveMonitor provides long-term monitoring functions that allow to infer equipment status and improve equipment performance.  |
| EAF               | Earth fault monitoring  |
| EMC               | Electromagnetic compatibility   |

Table 1-8 Terms and abbreviations (continued)

| <b>Term/Abbreviation</b> | <b>Definition</b>  |
|--------------------------|--|
| EOI                      | Electrical-optical interface   |
| Equipment                | Frequency converter and related equipment  |
| EXU                      | The excitation unit (EXU) is part of the drive when a synchronous motor has to be supplied with excitation power.  |
| Ground                   | Earth  |
| To ground                | To connect the electrical equipment to the earth, eg, by a grounding set or a grounding switch.  |
| I/O device               | Term of ABB's S800 I/O process system. An I/O device consists of a module termination unit (MTU) and one I/O module.   |
| I/O module               | Term of ABB's S800 I/O process system. The I/O module is an active input or output device for digital or analog signals.   |
| I/O station              | Term of ABB's S800 I/O process system. The I/O station typically consists of a bus modem and several input and output devices.   |
| IGCT                     | Integrated gate-commutated thyristor   |
| IPS                      | Insulated power supply   |
| LED                      | Light emitting diode   |
| LSU                      | Line supply unit (rectifier phase module)  |
| MCB                      | The main circuit breaker (MCB) is a major protection device of the drive system and connects and / or disconnects the main power supply to the drive.  |
| Motor terminal section   | This is the customer terminal for connecting motor cables. It is located behind the swing frame of the COU compartment.  |
| NP                       | Neutral point  |
| OEI                      | Optical-electrical interrupter   |
| PCU                      | A primary phase converter unit (PCU) consists of a transformer terminal section, a rectifier stack, a DC link and an inverter stack. A secondary phase converter unit consists of a DC link and an inverter stack. |
| Phase module             | The phase module is a compact assembly of wired components including power semiconductors and circuit boards that serves as a standardized building block for the inverter and rectifier stack.                    |
| PICW                     | Person in charge of work   |
| PINT                     | Pulse interface  |
| PPE                      | Personal protective equipment  |
| PTW                      | Permit to work   |
| SW                       | Software   |
| S800 I/O                 | The S800 I/O is a distributed process input / output system that can be connected to various process controllers from ABB and other companies.   |

Table 1-8 Terms and abbreviations (continued)

| Term/Abbreviation            | Definition   |
|------------------------------|--|
| Transformer terminal section | This is the customer terminal for connecting transformer cables. It is located in the back of the PCU compartment. |
| WCU                          | The water cooling unit (WCU) dissipates heat losses of the power electronics.                                      |

## 1.5. Target groups and required qualification

The drive presented in this manual is part of an industrial environment where voltages are present that contain a potential hazard of electric shock and / or burn. For this reason, only personnel who have a thorough knowledge of the drive and the industrial environment and have obtained the required qualification should handle, install, operate, or maintain the drive.

The manual addresses personnel who are responsible for unpacking, transportation, installation, operation and maintenance of the drive. The personnel must carry out the below listed tasks in a manner that does not cause physical harm or danger, and ensures the safe and reliable functioning of the drive.

**IMPORTANT!** Commissioning of the drive must only be performed by qualified and certified ABB personnel

### 1.5.1. Handling

Personnel must be skilled and experienced in unpacking and transporting heavy equipment.

### 1.5.2. Mechanical installation

The personnel must be qualified to prepare the installation site according to the site and equipment requirements and to perform the installation accordingly.

### 1.5.3. Electrical installation

Personnel must have a sound knowledge of the relevant electrical codes and specifications covering low and medium voltage equipment, be experienced with electrical wiring principles and know the electrical symbols typically used in wiring diagrams.

### 1.5.4. Operation

The personnel include all persons who operate the drive from the local operator panel of the drive. The personnel must know the functions of the operator panel, be adequately trained for the drive, and know the driven process. Special knowledge of frequency converter technology is not required.

|          |               |                |      |       |        |
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### 1.5.5. Maintenance

The personnel include all persons who

- Are qualified to carry out preventive and corrective maintenance on drive as described in this manual
- Are thoroughly familiar with the drive
- Have a sound knowledge of the relevant electrical codes and specifications covering low and medium voltage equipment
- Are able to assess the hazards associated with the energy sources of the drive and act correspondingly
- Know the safe shutdown and grounding procedures for the drive system

## 1.6. User's responsibilities

It is the responsibility of those in charge of the drive to ensure that each person involved in the installation, operation or maintenance of the drive has received the appropriate training and has thoroughly read and clearly understood the instructions in this manual and the relevant safety instructions.

## 1.7. Intended use of equipment

Those in charge of the drive must ensure that the drive is only used as specified in the contractual documents, operated under the conditions stipulated in the technical specifications and on the rating plate of the drive, and serviced in the intervals specified by ABB.

Use of the drive outside the scope of the specifications is not permitted.

Intended equipment use also implies that only spare parts recommended and approved by ABB must be used.

Unauthorized modifications and constructional changes of the drive are not permitted.

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## 1.8. Quality certificates and applicable standards

The following certificates and conformity declarations are available with ABB:

- ISO 9001 and ISO 14001 certificates stating that ABB Switzerland Ltd has implemented and maintains a management system which fulfills the requirements of the normative standards
- EC declaration of conformity
- List of standards the drive complies with (see “Appendix F - Test reports and certificates”)

Table 1-9 Standards that are referred to in this document

| Standard      | Title   |
|---------------|---|
| ANSI Z535.6   | American national standard for product safety information in product manuals, instructions, and other collateral materials  |
| ISO 3864-2    | 2004 (E) - 'Graphical symbols – Safety colors and safety signs – Part 2: Design principles for product safety labels'   |
| ISO 7010      | 2011 (E) - Graphical symbols - Safety colours and safety signs - Registered safety sign   |
| EN 50110      | European standard code for electrical work safety   |
| ISO 13849-1   | Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design, section 6.2.6 Category 3   |
| IEC 60204-1   | Safety of machinery - Electrical equipment of machines - Part 1: General requirements   |
| IEC 60721-3-2 | Classification of environmental conditions: Classification of groups of environmental parameters and their severities; Transportation                                   |
| IEC 60721-3-1 | Classification of environmental conditions: Classification of groups of environmental parameters and their severities; Storage  |
| IEC 60721-3-3 | Stationary use at weather-protected locations   |
| IEC 62477-2   | Safety requirements for power electronic converter systems and equipment – Part 2: Power electronic converters from 1 000 V AC or 1 500 V DC up to 36 kV AC or 54 kV DC |

## 1.9. Items covered by delivery

The delivery includes the following items, whereas items 3 – 5 are shipped in a separate container.

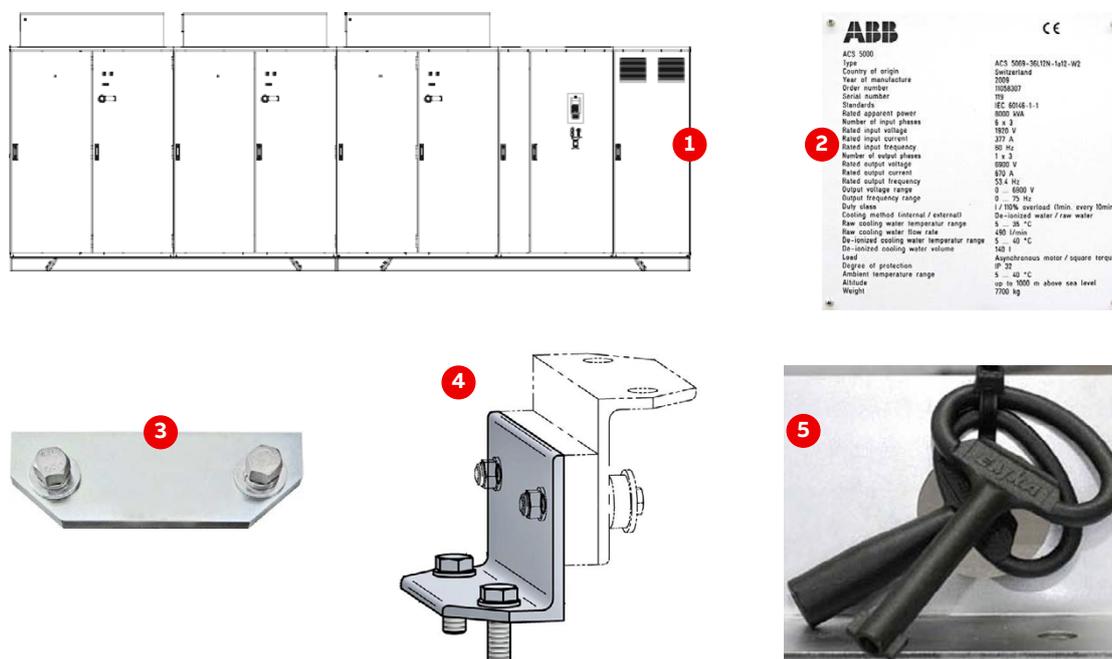


Figure 1-1 Typical delivery

- |  |   |
|--|---|
| <p>1) Drive (either frame size): shipped in transport units.<br/>Shipping splits are defined in the customer-specific layout drawing.</p> <p>2) Rating plate: on the first door from the left.</p> | <p>3) Roof joints</p> <p>4) Roof attachments (only for marine drives)</p> <p>5) Door keys</p> |
|--|---|

### 1.9.1. Identifying the delivery

The drive and accessories are identified by the type code printed on the rating label.

The rating label is located on the back of the control compartment door.

The label provides information on the type of drive, the rated voltage, the frequency and the current of the main and the auxiliary power supply.

## 1.10. Tools

ABB offers various tool sets containing all necessary tools and equipment for installation, commissioning and maintenance of the drive. The content of the tool sets is described in the manual Service equipment.

|                     |                              |                                |           |             |                |
|---------------------|------------------------------|--------------------------------|-----------|-------------|----------------|
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|---------------------|------------------------------|--------------------------------|-----------|-------------|----------------|

## 2. Important safety information



Read this material carefully before working on or around the equipment. Failure to do so can result in serious Injury or DEATH! Keep for future reference.

### 2.1. Safety standards

The following industry standards are observed:

- ANSI Z535.6
- ISO 3864-2
- ISO 7010
- EN 50110

### 2.2. Safety messages

The following safety messages are provided to help prevent personal injury and damage to the equipment. The indicated hazard level is based on the ANSI Z535.6 standard.



This is the safety alert symbol. It is used to alert you to potential physical injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

**⚠️ DANGER** indicates a hazardous situation which, if not avoided, will result in death or serious injury.

**⚠️ WARNING** Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

**⚠️ CAUTION** Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

**NOTICE** is used to address practices not related to physical injury, but which can result in equipment damage.

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## 2.3. Product safety labels

Safety labels are affixed to the drive components to alert personnel of potential hazards when working on the equipment. For more information, see the label placement document for the drive. The instructions on the safety labels must always be followed and the labels must be kept in a perfectly legible condition.

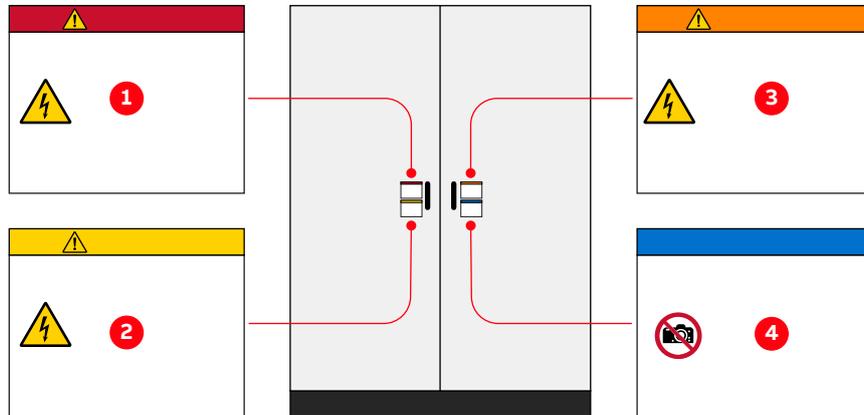


Figure 2-1 Product warning label examples (label placement depends on the drive)

- |                  |                  |
|------------------|------------------|
| 1) Danger label  | 3) Caution label |
| 2) Warning label | 4) Notice label  |

Additional safety labels, including the following, might also be provided:



### Electricity warning

This sign can also have additional text below it, eg, “High voltage”.



### No access for people with active implanted cardiac device

The magnetic field of the drive can influence the functioning of pacemakers. The pacemaker sign should be installed at the entrance to the drive room or at a minimum distance of 6 m from the drive to stop personnel with pacemakers approaching the drive.



### Firefighting sign

Outlines the procedure when fighting fire in electrical equipment. The sign must be installed well visible near the drive.



### High voltage sign

Must be installed clearly visible at the main circuit breaker in the switchgear room. The sign alerts personnel to the high voltage which can be present on the secondary side of the input transformer until the main circuit breaker has been opened and secured and the drive has been de-energized and grounded.

## 2.4. General safety instructions



### 1) Minimize hazards



### 2) Before energizing the drive:

- Remove all foreign objects are from the drive
- Fasten all internal and external covers securely
- Close, lock, and/or bolt all doors
- Move the release dial of the door safety switches into the locked position



### 3) Before working on the drive:

- Turn off, lock out, and tag out the main and auxiliary power supplies to the drive
- De-energize the drive
- Ensure that the safety ground connections are in place
- Ensure that the appropriate personal protective equipment (PPE) is available and used when required
- Inform the involved personnel about the potential safety hazards
- Wear hearing protection when a drive is running.



### 4) Before working simultaneously on the drive and on other drive system equipment:

- Observe the relevant safety codes and standards
- Turn off all energy sources for the equipment
- Ensure that all lockout and tagout devices are in place
- Install barriers around and use appropriate covers on the equipment that is still energized
- Inform the involved personnel about the potential safety hazards



### 5) In case of fire in the drive room:

- Observe the established rules and regulations for fire safety
- Only allow firefighters with the appropriate PPE to enter the drive room

## 2.5. The 7 steps that save lives

ABB's 7 steps that save lives concept is a series of actions that must take place prior to commencing work on or near electrical installations.



### 1) Prepare for the work: do an on-site risk assessment or job hazard analysis that considers the limits of approach for shock and arc-flash.

- Be in possession of a clear work order to execute the work.
- When required, the access or work permit is to be obtained by a person who is authorized for the specific electrical system.
- Engage the person responsible for electrical equipment or system to review single-line diagrams, schematics, switching plans, etc.
- Ensure the competence of workers.
- Check for proper tools for the job.
- Determine and select the proper arc-rated Personal Protective Equipment (PPE).
- Decide of the appropriate work methods and initiate the Permit To Work (PTW) process.



### 2) Clearly identify the work location and equipment.

- Use your senses (sight, hearing and smell) to identify problem areas.
- Define the work area via barriers and barricading and label equipment.
- Avoid distractions such as talking or texting on the phone.



### 3a) Disconnect all sources of supply.

- If ABB is responsible for switching and it cannot be done remotely, then the person performing the switching must be properly trained and wearing the proper PPE identified in step 1.
- The Person in Charge of Work (PICW) must ensure that switching is performed in the proper manner by witnessing it from a safe distance if present on site or by engaging the person responsible for switching to identify all isolation points.



### 3b) Secure against reconnection by applying Lockout/Tagout.

- Apply Lockout/Tagout (LOTO) to the energy isolation device and if multiple energy isolation devices are involved, then Group LOTO must be implemented with the PICW serving as the Group LOTO Leader.

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#### 4) **Verify the absence of operating voltage: always test before you touch!**

Only use properly rated and inspected voltage detection devices and wear proper PPE identified in step 1:

- Test voltage detection device
- Test for voltage
- Test voltage detection device

It is highly important that the voltage detection device is tested on a known voltage source such as a Proving Unit or by performing an internal self-test, according to the manufacturer's instructions, before and after testing for the absence of operating voltage.



#### 5) **Carry out earthing and short-circuiting.**

- Close and lock the earthing switch if the electrical equipment is designed for this purpose or apply portable equipment for earthing and short-circuiting.

If this is carried out by the customer, then the PICW must ensure that this equipment is properly earthed as a part of the integration/verification and during step 7 when the PICW walks the PTW.



#### 6) **Protect against adjacent live parts and take special precautions when close to bare conductors.**

- Determine minimum approach distances, apply screening or shrouding, and when applicable, padlock both cable and busbar shutters.
- If working within the restricted approach boundary or vicinity zone where inadvertent movement could cause contact with live parts, special precautions must be employed, such as the use of the properly rated insulated gloves and tools.



#### 7) **Complete the permit to work and "Walk the Permit".**

- Check isolation points
- Verify that all circuits are isolated and secured
- Ensure all parties are integrated with the Lockout/Tagout
- Check the earths are properly applied
- Answer specific questions from the working group
- Ensure the work can proceed without danger
- Complete and verify the "Permit to Work"

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## 2.6. Possible residual risks

Residual risks must be considered by the drive system integrator and/or plant owner when assessing the hazards of the equipment to personnel. The following risks can pose a hazard to drive system personnel:



- 1) **Electric power equipment generates electro-magnetic fields which can cause a hazard to people with metal implants and / or a pacemaker.**



- 2) **Drive system components can move unintentionally when being commissioned, operated, or serviced due to:**

- Operation of the equipment outside the scope of the specifications
- Incorrectly assembled or installed equipment
- Wrongly connected cables
- External influence on, or damage of the equipment
- Wrong parameter settings
- Software errors
- Faulty hardware



- 3) **Hazardous touch voltages can be present on drive system components, which can be caused by:**

- Operation of the equipment outside the scope of the specifications
- External influence on, or damage of the equipment
- Induced voltages by external equipment
- Condensation on equipment components, or pollution
- Faulty hardware



- 4) **High temperatures, noise, particles, or gases can be emitted from drive system components caused by:**

- Operation of the equipment outside the scope of the specifications
- External influence on or damage of the equipment
- Incorrect parameter settings
- Software errors
- Faulty hardware



- 5) **Hazardous substances can be emitted from drive system components caused by:**

- Incorrect disposal of components

|                     |                              |                                |           |             |                |
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|---------------------|------------------------------|--------------------------------|-----------|-------------|----------------|

## 2.7. Important note - main circuit breaker

The main circuit breaker (MCB) is a major protection device of the drive. If a serious fault occurs in the drive, the MCB must disconnect the main power supply to the drive immediately. The main power supply must be disconnected without delay on an open or trip command from the drive to prevent hazard to the personnel and further damage to the equipment. The MCB is located on the primary side of the converter transformer.

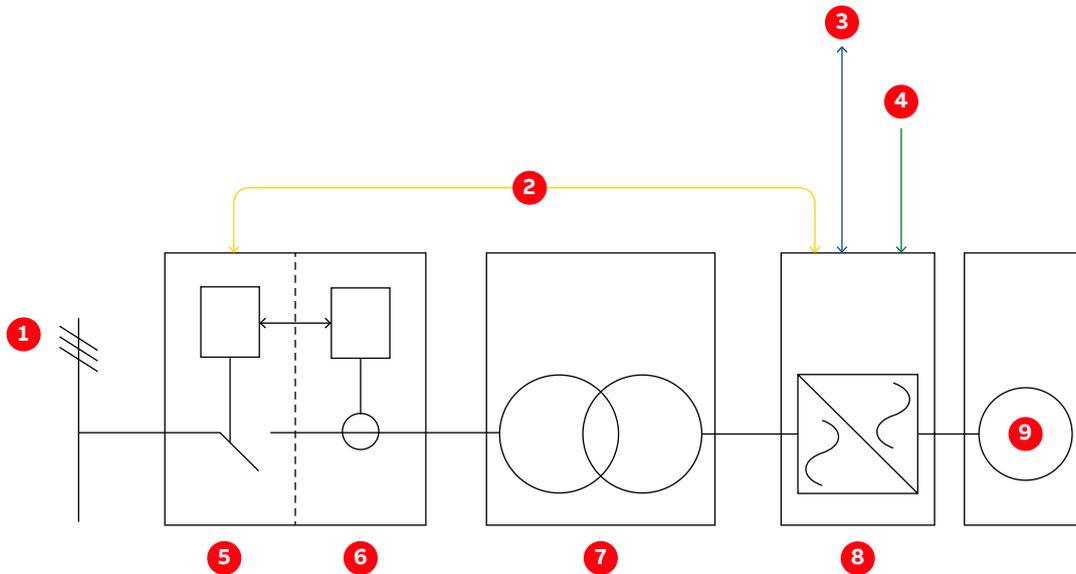


Figure 2-2 Drive system overview

- |                                |                          |
|--------------------------------|--------------------------|
| 1) Main power supply           | 6) Protection relay      |
| 2) MCB control interface       | 7) Converter transformer |
| 3) Higher-level control system | 8) Drive                 |
| 4) Local MCB control           | 9) Motor                 |
| 5) MCB                         |                          |

The MCB is defined as a switching device to disconnect the power supply whenever required by the process or when a fault occurs. Typical devices used as MCBs are:

- Vacuum circuit breakers
- SF6 circuit breakers
- Fused contactors or motor control centers

A dedicated protection relay is used for:

- Transformer primary cable protection
- Transformer protection (if applicable)
- Transformer secondary cable protection (if applicable)
- Backing up the drive protection

In general, these protective measures are not included in the drive as provided by ABB.

### 2.7.1. Safety and protection requirements

For safety and protection reasons, the MCB must meet the stipulated minimum requirements of the specifications of ABB MV Drives. It is the system integrator's responsibility to ensure that the minimum requirements are met. The minimum requirements for the MCB are stated in this note and in the respective MCB engineering guideline, which are available for each medium voltage drive from ABB.

The safety requirements for the drive are based on the following standards:

- ISO 13849-1
- IEC 60204-1

### 2.7.2 Minimum requirements for MCB and MCB control

- The MCB open and / or trip command has to be wired directly from the drive to the MCB.

It is not permitted to wire the trip command through any PLC or DCS system if it is not certified to meet SIL three-level requirements and to fulfill the timing requirements outlined below.

Opening of the MCB by the drive must be possible at any time. It is not permitted to interrupt the open and / or trip command, eg, by a local-remote switch in the MCB.

When the MCB is in service position, the drive must have exclusive control of closing the MCB. Local closing of the MCB is not permitted.

- The maximum opening time of the MCB must never exceed the product- or project-specific maximum time defined in the MCB specifications. Typical maximum values for the drive are defined as follows:

- **Maximum protection trip time:** 75 ms

The maximum protection trip time is the maximum allowed breaking time (open and arcing) of the breaking device after the open command has been initiated to prevent further damage to the drive, such as diode failures.

- **Maximum safety trip time:** 500 ms

The maximum safety trip time is the maximum allowed time to ensure safe disconnection of the main power supply to prevent any hazard to personnel.

For more information on the MCB requirements, control interface and control philosophy, see “Main circuit breaker engineering guideline” (3BHS125149 E50).

### 2.7.3. Maintenance recommendation

The MCB trip circuits should be checked annually once per year.

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## 3. Power electronics and cabinet features

### 3.1. Main features of the drive

The water-cooled ACS5000 is a voltage source frequency converter of the ACS product range. It is available for up to 36 MVA and for standard motors with voltages up to 6.9 kV.

The drive features several proven ABB technologies including:

- Multilevel-fuseless voltage source inverter (VSI-MF) design
- Direct torque control (DTC) platform
- IGCT power semiconductors

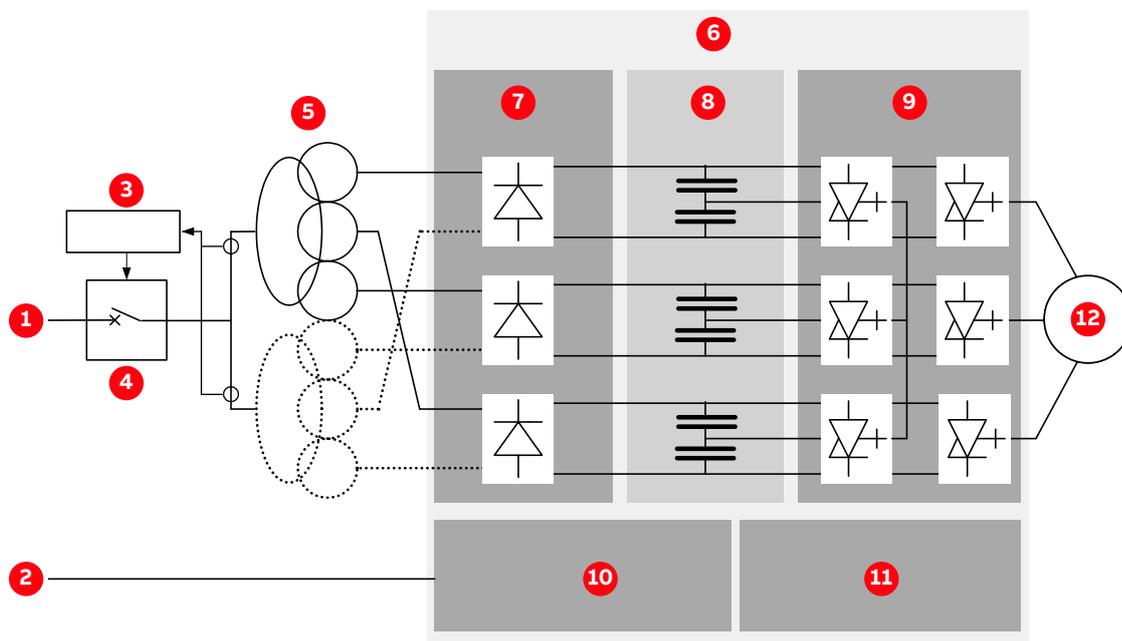


Figure 3-1 Typical block diagram of the drive

- |   |                                   |
|---|-----------------------------------|
| 1) Main power supply                    | 7) 18-pulse or 36-pulse rectifier |
| 2) Auxiliary power supply               | 8) DC link                        |
| 3) $I >> Prot$                          | 9) 9-level inverter               |
| 4) MCB                                  | 10) Control system                |
| 5) Transformers:                        | 11) Cooling system                |
| • 18-pulse (solid line)                 | 12) Motor                         |
| • 36-pulse (solid line and dotted line) |                                   |
| 6) ACS5000                              |                                   |

**VSI-MF**

The VSI design employs DC-link capacitors and provides a switched voltage waveform. As a result of the multilevel topology, the drive produces an optimum number of switching levels - 9 levels, phase to phase. The resulting output waveform permits the application of standard motors without decreasing the reliability and efficiency of the motor.

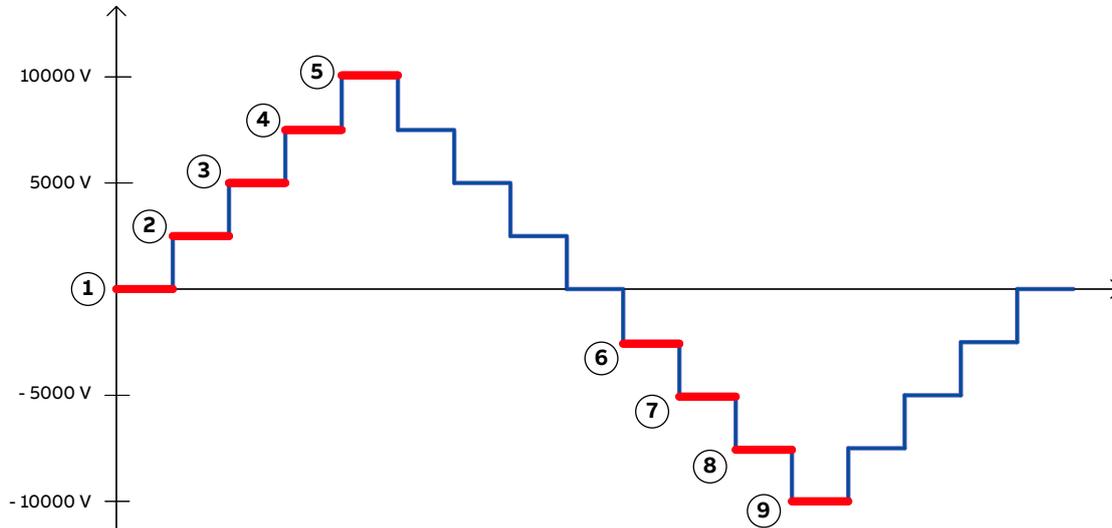


Figure 3-2 Switching levels

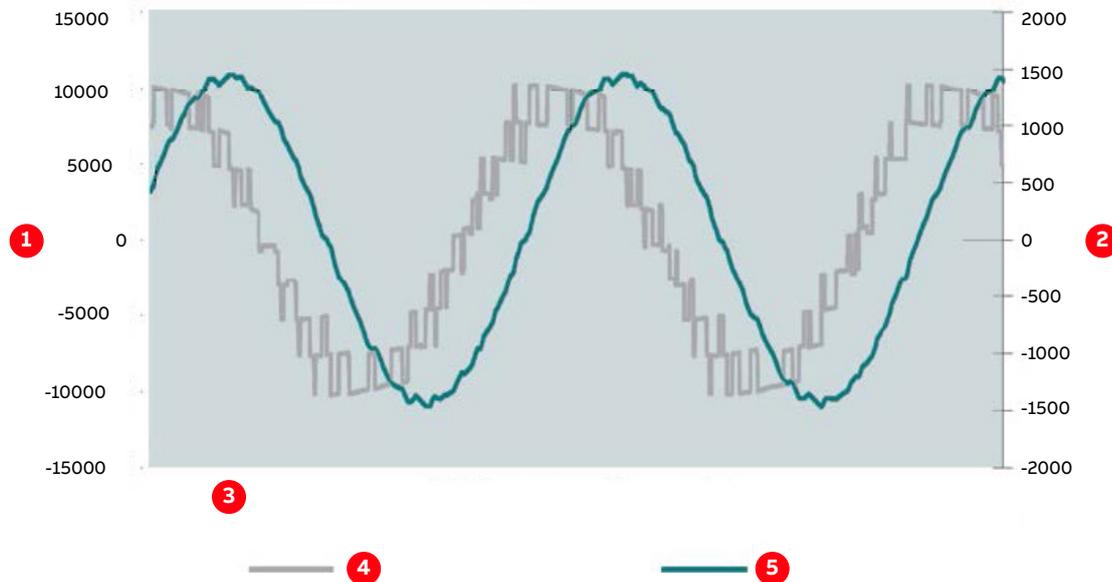


Figure 3-3 Principle of 9-level topology

- 1) Volts
- 2) Amps
- 3) 50 Hz operation point
- 4) Voltage
- 5) Current

## IGCT

Integrated gate-commutated thyristors (IGCT) are used as switching devices in the inverter section of the phase converter units. IGCTs combine fast switching capabilities with low losses and enable a drive design with a low parts count.



Figure 3-4 IGCT

### **Fuseless protection concept**

The drive does not require any power fuses. Instead, the IGCTs of the inverter are used for protection. If an overcurrent occurs, protection firing is triggered and fault clearing is initialized in less than 25  $\mu$ s.

## 3.2. Frame sizes

The drive comes in four frame sizes. Depending on the frame size, the drive has the following line-up specifications.

Table 3-1 Line-up specifications by frame size

| Frame size | Rating | COU | Primary PCU | Secondary PCUs | PCU width (mm) | WCU width (mm) | Total length (mm) |
|------------|--------|-----|-------------|----------------|----------------|----------------|-------------------|
| 1          | 12 MVA | 1   | 3           | 0              | 1700           | 800            | 7130              |
| 2          | 18 MVA | 1   | 3           | 0              | 2100           | 1400           | 8930              |
| 3          | 24 MVA | 1   | 3           | 3              | 1700           | 1400           | 12830             |
| 4          | 36 MVA | 1   | 3           | 3              | 2100           | 1400           | 15230             |

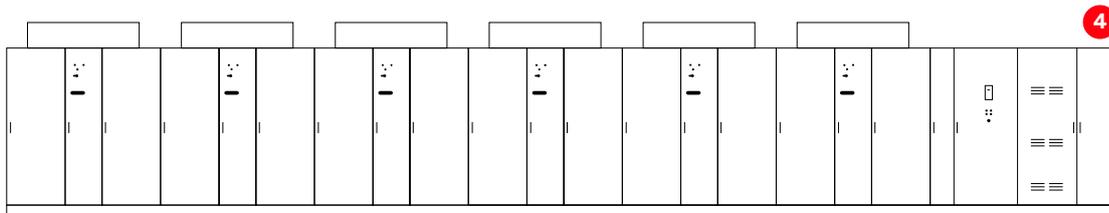
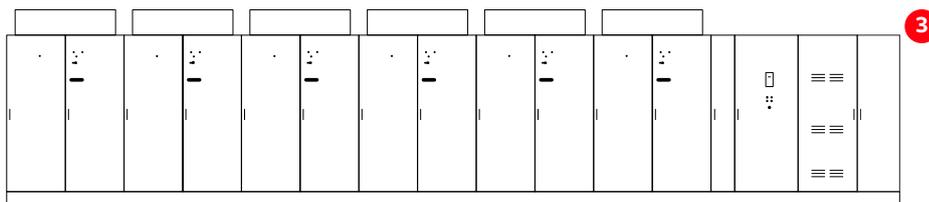
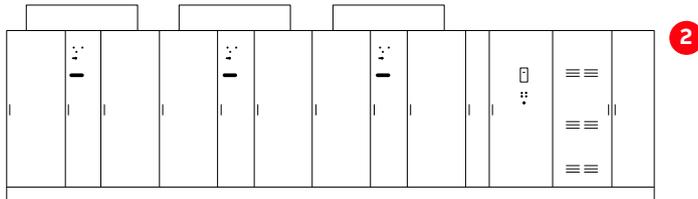
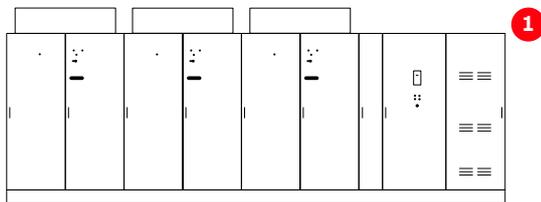


Figure 3-5 Frame sizes 1 – 4

### 3.3. Phase converter unit (PCU)

All frame sizes use three primary phase converter units, each supplying one motor phase.

In frame size 1 and 2, one primary phase converter unit represents a complete functional assembly.

In frame size 3 and 4, one primary and one secondary phase converter unit (connected via DC link) represent a complete functional assembly.

#### Transformer cable connection

The back left part of the primary phase converter unit contains the terminals for the transformer cables (Fig. 3-6:1 and Fig. 3-8:1).

Depending on the cable entry ordered, the unit comes with a top or bottom cable entry.

For information on the dimensions and the busbar arrangement, see “Appendix C - Mechanical drawings”.

| PRODUCT  | DOCUMENT KIND | DOCUMENT ID.   | REV. | LANG. | PAGE   |
|----------|---------------|----------------|------|-------|--------|
| ACS5000W | User manual   | 3BHS799208 E01 | F    | en    | 35/178 |

### 3.3.1. Primary phase converter unit (1700 mm and 2100 mm)

#### Primary PCU (1700)

Primary phase converter units of 1700 mm are used in frame size 1 and 3.

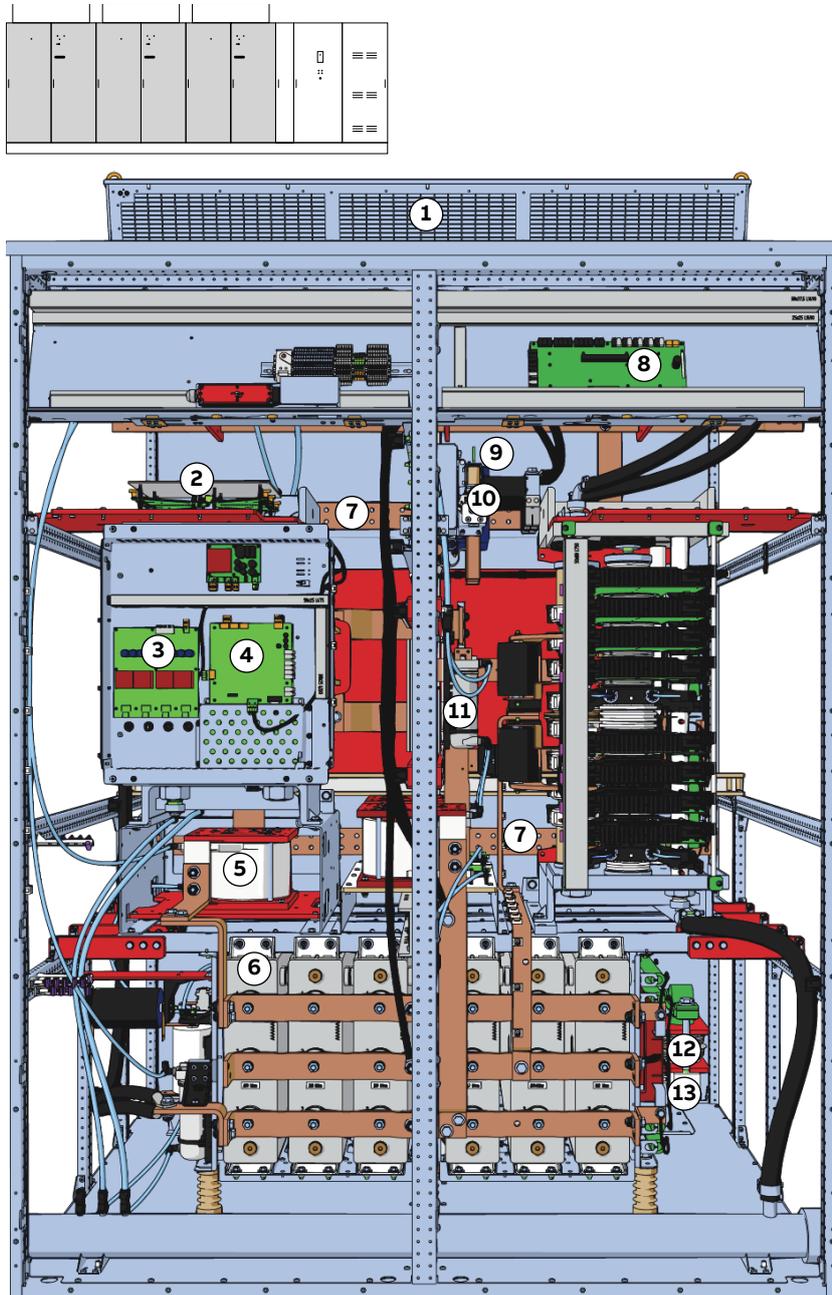


Figure 3-6 Primary PCU, 1700 mm

- |   |                                      |
|---|--------------------------------------|
| 1) Roof-mounted cooling unit                              | 7) PE ground busbar                  |
| 2) HVD circuit board                                      | 8) Main INT circuit board            |
| 3) Crowbar circuit board or PINT circuit board            | 9) IPS (Integrated Power Supply)     |
| 4) CVMI circuit board for voltage and current measurement | 10) Grounding switch                 |
| 5) 2 di/dt chokes and 2 VLSCD circuit boards              | 11) Clamp resistor                   |
| 6) DC-link capacitors                                     | 12) Back oscillation damping circuit |
|   | 13) DC link limiter (18-pulse only)  |

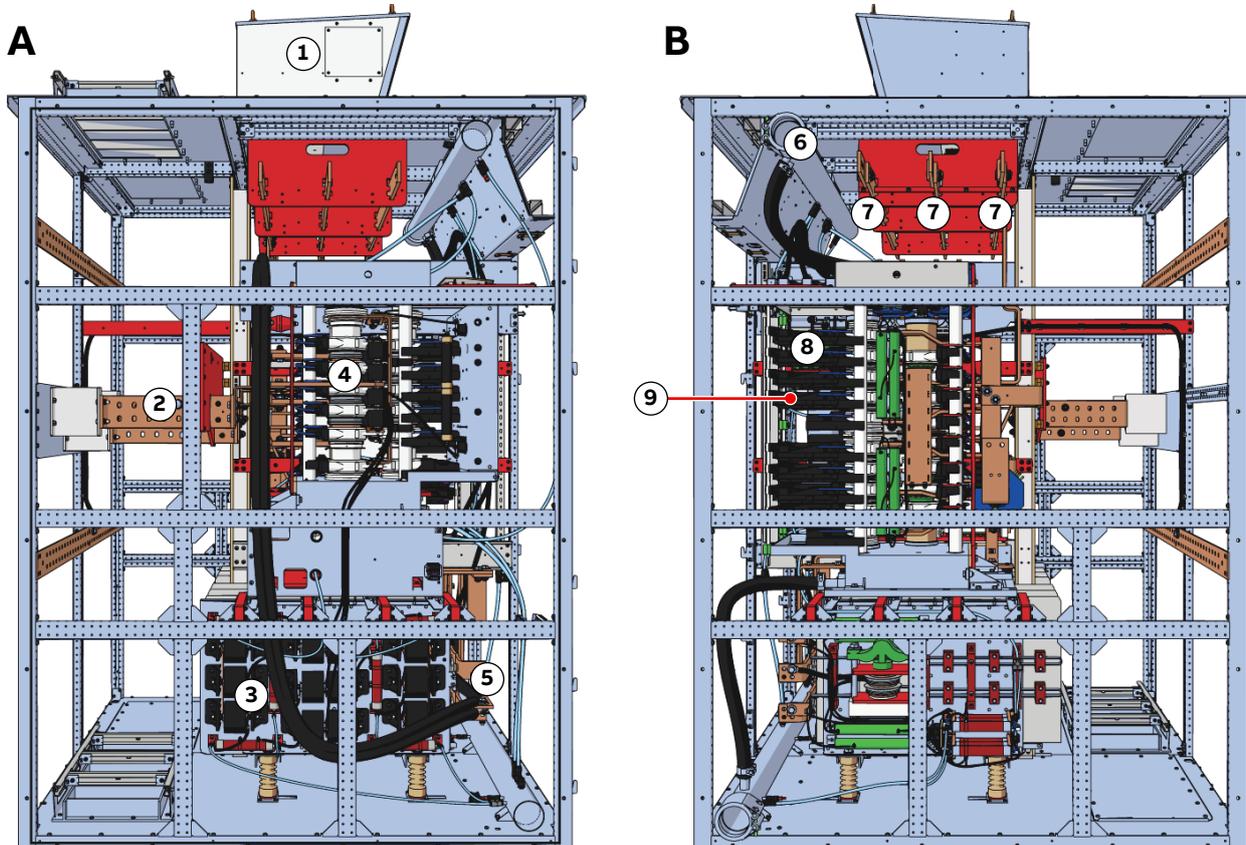
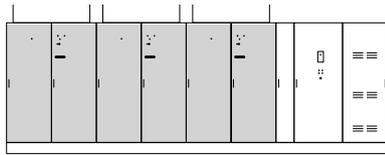


Figure 3-7 Primary PCU, 1700 mm: side view left (A) and side view right (B)

- |   |   |
|---|---|
| 1) Roof-mounted cooling unit                            | 6) Water pipe                                     |
| 2) Terminal compartment for transformer cables          | 7) AC busbars for adjacent PCU and motor phase    |
| 3) LSU snubber plate (18-pulse only)                    | 8) Inverter stacks consisting of diodes and IGCTs |
| 4) Rectifier stacks consisting of diodes and thyristors | 9) Gate unit                                      |
| 5) DC-link connection                                   |   |

## Primary PCU (2100)

Primary phase converter units of 2100 mm are used in frame size 2 and 4.

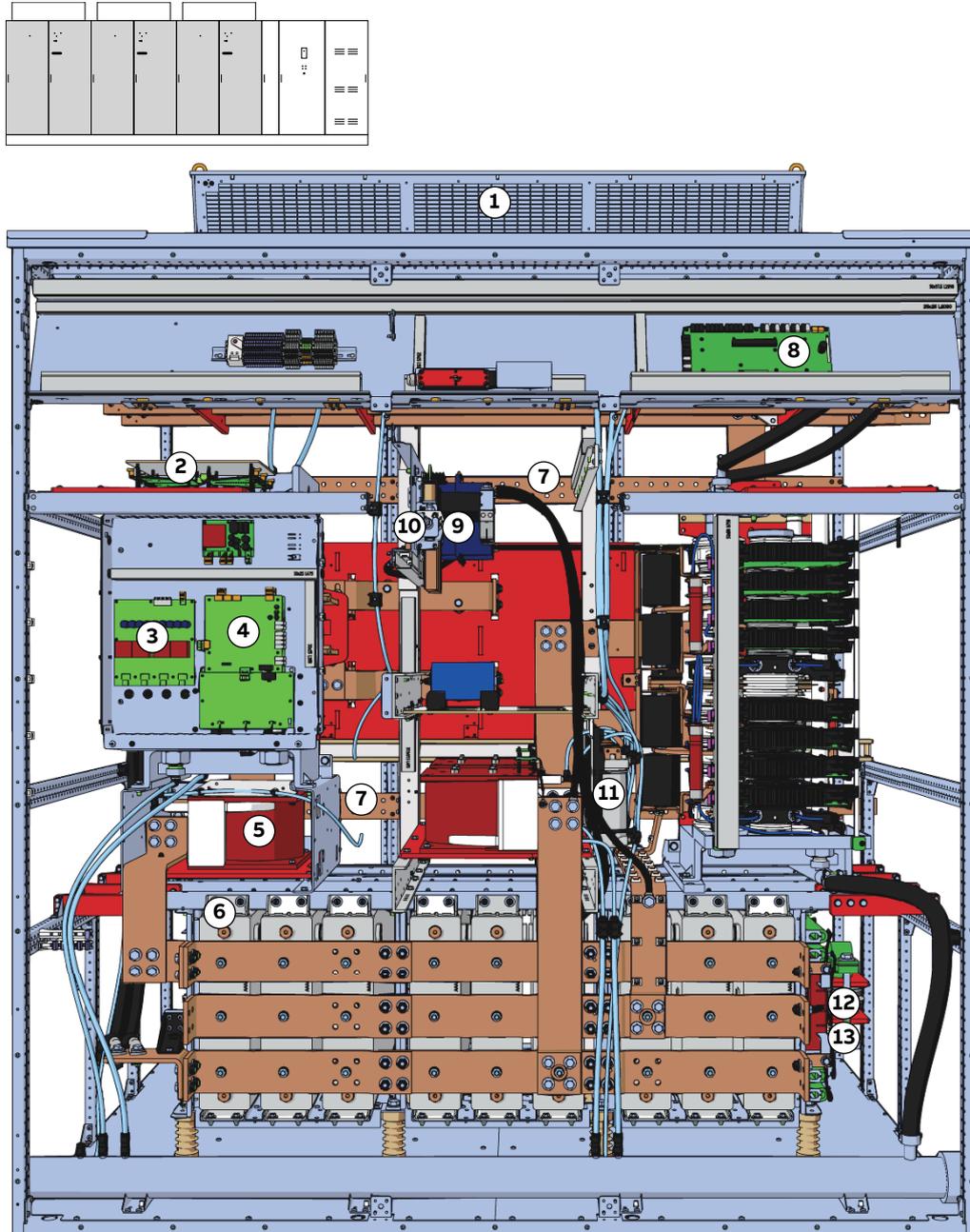


Figure 3-8 Primary PCU, 2100 mm

- |   |                                      |
|---|--------------------------------------|
| 1) Roof-mounted cooling unit                              | 7) PE ground busbar                  |
| 2) HVD circuit board                                      | 8) Main INT circuit board            |
| 3) Crowbar circuit board or PINT circuit board            | 9) IPS (Integrated Power Supply)     |
| 4) CVMI circuit board for voltage and current measurement | 10) Grounding switch                 |
| 5) 2 di/dt chokes and 2 VLSCD circuit boards              | 11) Clamp resistor                   |
| 6) DC-link capacitors                                     | 12) Back oscillation damping circuit |
|   | 13) DC link limiter (18-pulse only)  |

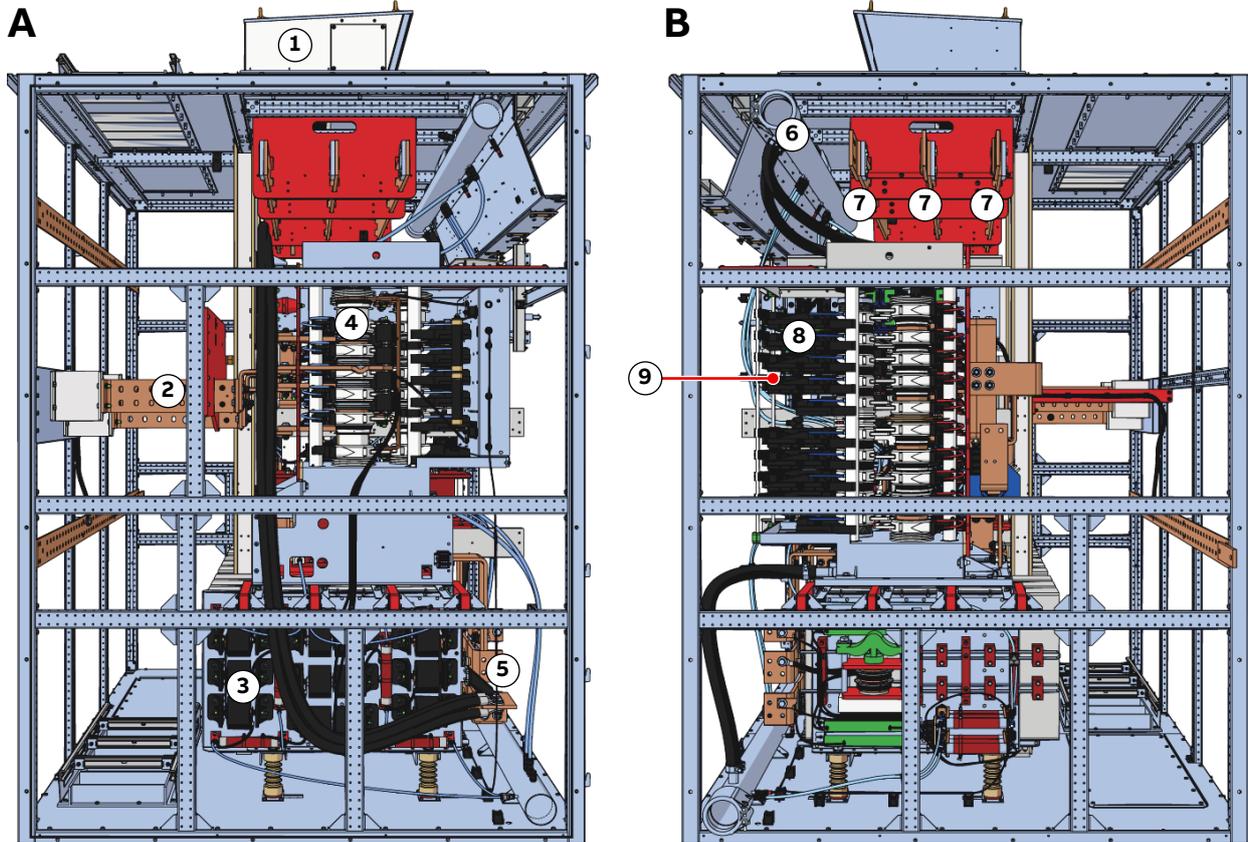
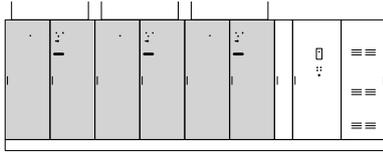


Figure 3-9 Primary PCU, 2100 mm: side view left (A) and side view right (B)

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>1) Roof-mounted cooling unit</li> <li>2) Terminal compartment for transformer cables</li> <li>3) LSU snubber plate (18-pulse only)</li> <li>4) Rectifier stacks consisting of diodes and thyristors</li> <li>5) DC-link connection</li> </ul> | <ul style="list-style-type: none"> <li>6) Water pipe</li> <li>7) AC busbars for adjacent PCU and motor phase</li> <li>8) Inverter stacks consisting of diodes and IGCTs</li> <li>9) Gate unit</li> </ul> |
|--|--|

### 3.3.2. Secondary phase converter unit (1700 mm and 2100 mm)

The secondary phase converter unit has the same design as the primary unit, except that the rectifier stack and the transformer terminal section are missing.

#### Secondary PCU

(1700 and 2100)

Secondary phase converter units of 1700 mm are used in frame size 3.

Secondary phase converter units of 2100 mm are used in frame size 4.

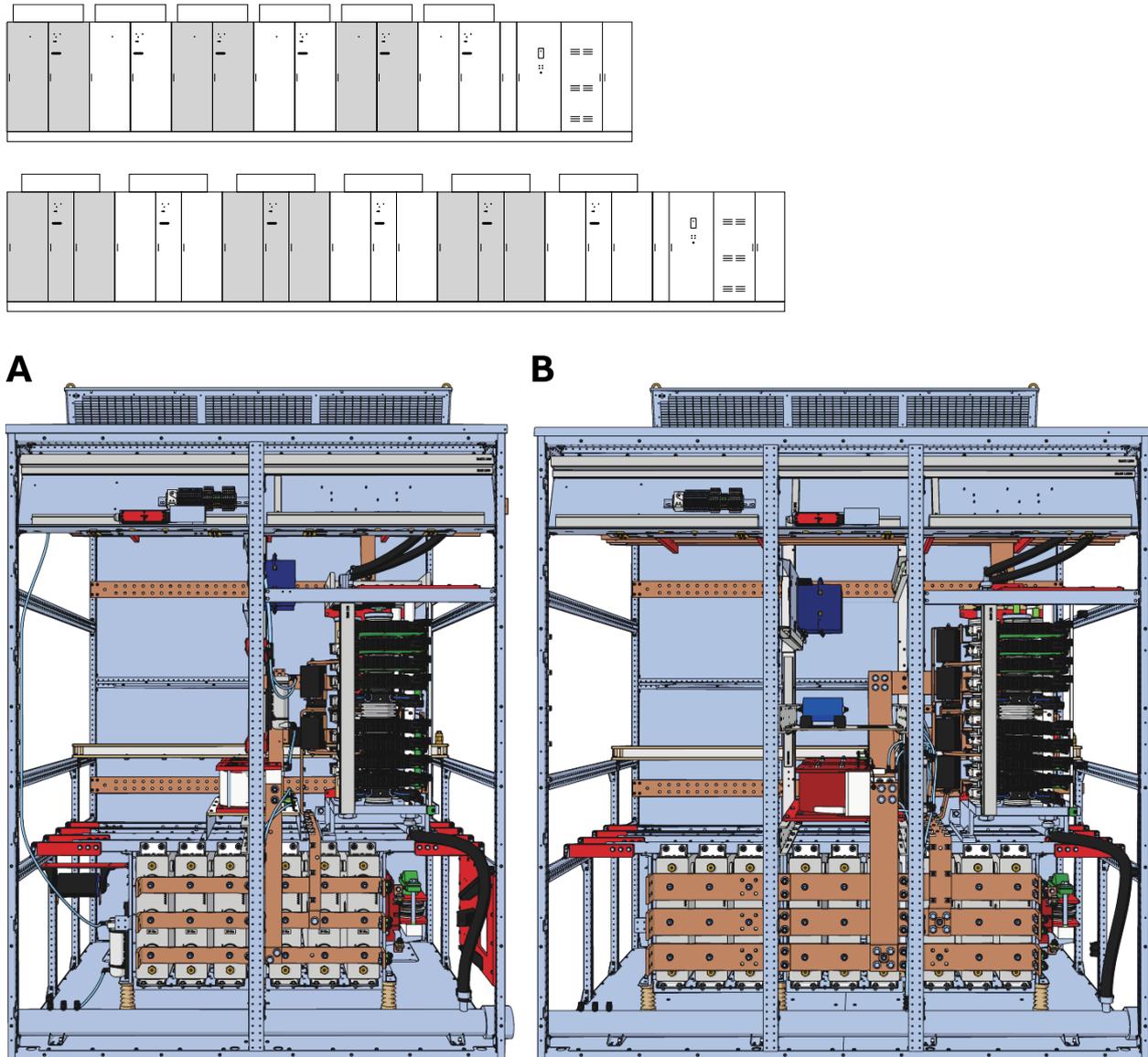


Figure 3-10 Secondary PCU, 1700 mm (A) and 2100 mm (B)

### 3.4. Control unit (COU)

The control unit incorporates the hardware for the control, monitoring and protection functions of the drive, and the communication interfaces to the local control panel and to the remote control devices. Depending on the control concept of the drive system, the remote control devices include a higher-level control system and / or remote operator stations.

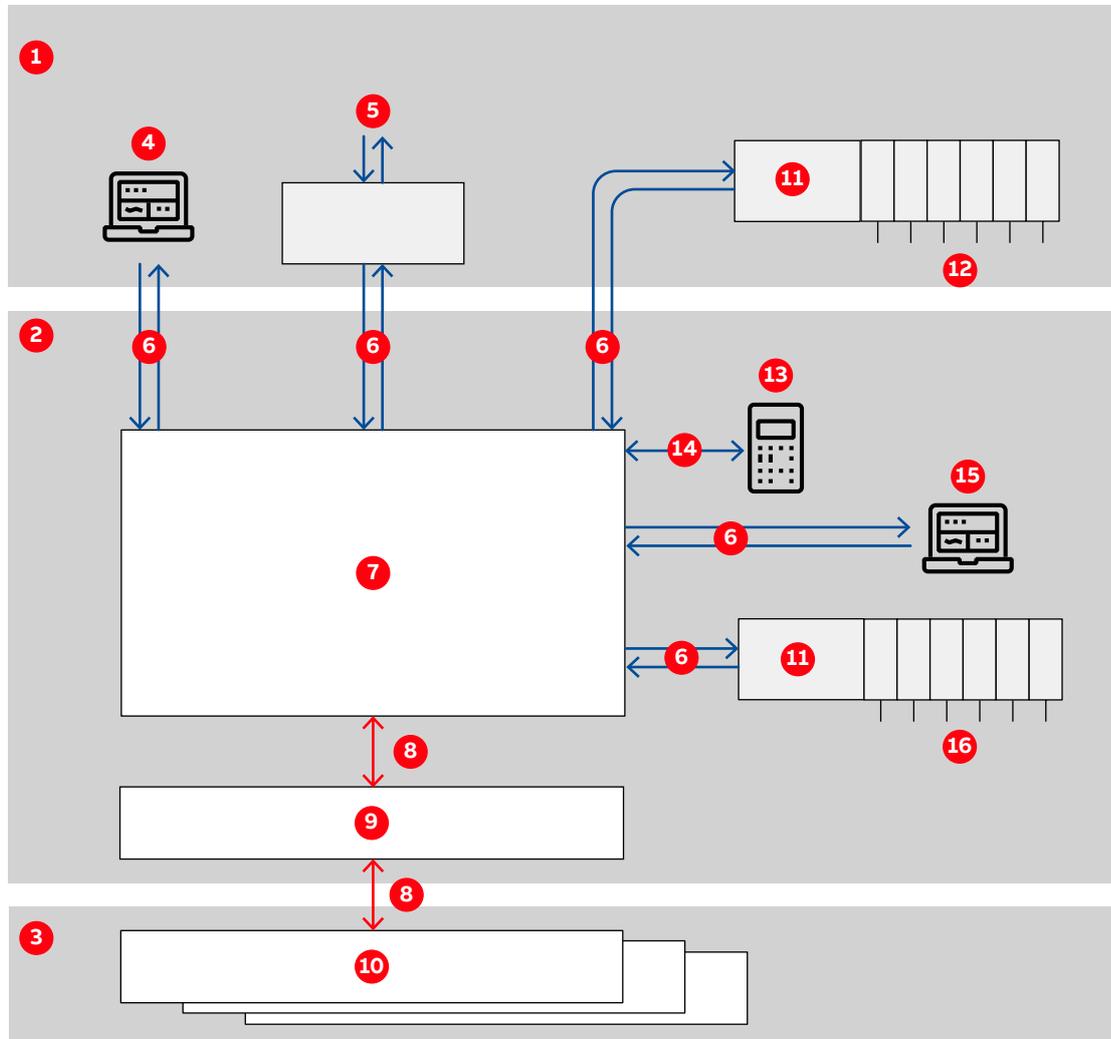


Figure 3-11 Block diagram of control system

- |                                |                             |
|--------------------------------|-----------------------------|
| 1) Customer interface          | 9) Main INT interface       |
| 2) Control unit                | 10) Phase INT interface     |
| 3) Inverter                    | 11) s800 I/O process system |
| 4) ABB Ability™                | 12) Process I/O             |
| 5) Higher-level control system | 13) CDP control panel       |
| 6) DDCS                        | 14) RS485                   |
| 7) AMC circuit board           | 15) PC tools                |
| 8) Fiber-optic                 | 16) Internal I/Os           |

### 3.4.1. Main components

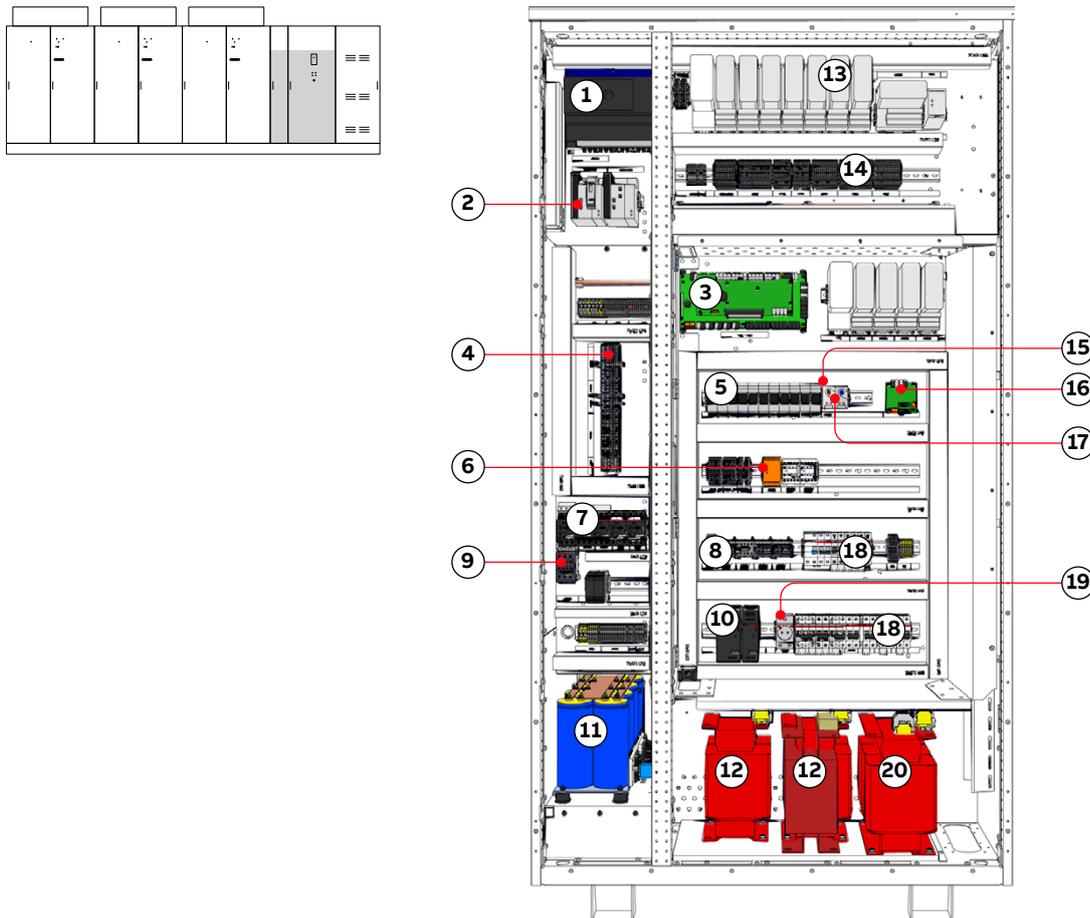


Figure 3-12 COU control section

- |  |  |
|--|--|
| 1) Arc Guard System™   | 12) Isolating transformers for customer UPS – T1011, T1012, and step-down transformer for internal buffer T1021 (optional) |
| 2) NETA-21   | 13) S800 I/O process system  |
| 3) AMC and main INT circuit board  | 14) Customer terminals   |
| 4) Terminals for customer UPS and PCU auxiliary power supply – X200, X100, X101, X120, X3 (from top to bottom) | 15) Thermostat for internal temperature  |
| 5) Auxiliary relay   | 16) EOI circuit board  |
| 6) Safety relay  | 17) Thermostat for door-mounted cooling fan  |
| 7) Motor circuit-breakers  | 18) Miniature circuit breakers   |
| 8) Auxiliary contactors  | 19) 230 V socket   |
| 9) Charging contactor  | 20) Transformer for unbuffered auxiliary power supply (T1111)  |
| 10) Switched-mode power supplies   |  |
| 11) Electrolytic capacitors (optional)   |  |

### 3.4.1.1. AMC circuit board

The AMC circuit board is the major component of the drive's control system and performs general drive, motor control, and closed loop functions. The main internal control devices and the peripheral input and output interfaces to the customer communicate with the AMC circuit board via optical fibers.

The circuit board is fitted with a Motorola DSP processor and features two PPCS and eight DDCS communication channels. The communication channels are used for high speed data transfer via the INT circuit boards to the Phase-INT circuit boards inside the phase modules.

#### Control tasks

The AMC circuit board has specific control and closed-loop tasks assigned to it. It processes drive and status information, performs the speed and torque control tasks, and monitors the operation of the drive.

All relevant drive variables (eg, speed, torque, current, voltage) are continuously monitored by the control system. Pre-programmed protection functions ensure that these variables remain within certain limits in order to maintain safe operation of the drive. These internal functions are not programmable by the user.

Optionally, the drive can monitor signals from external equipment. These can be activated and adjusted with "Parameters".

Other general control, protection and monitoring tasks regarding the whole drive include control and monitoring of:

- Main circuit breaker (MCB)
- Grounding switches
- Door interlocking
- Cooling system

## Direct torque control

The speed and torque of the motor is controlled by DTC (Direct Torque Control). The DTC motor control platform is unique to ABB and has been proven in all variable speed drives of the ACS product range. DTC provides accurate speed and torque control, and high dynamic speed response. DTC is implemented on the AMC circuit board of the INU.

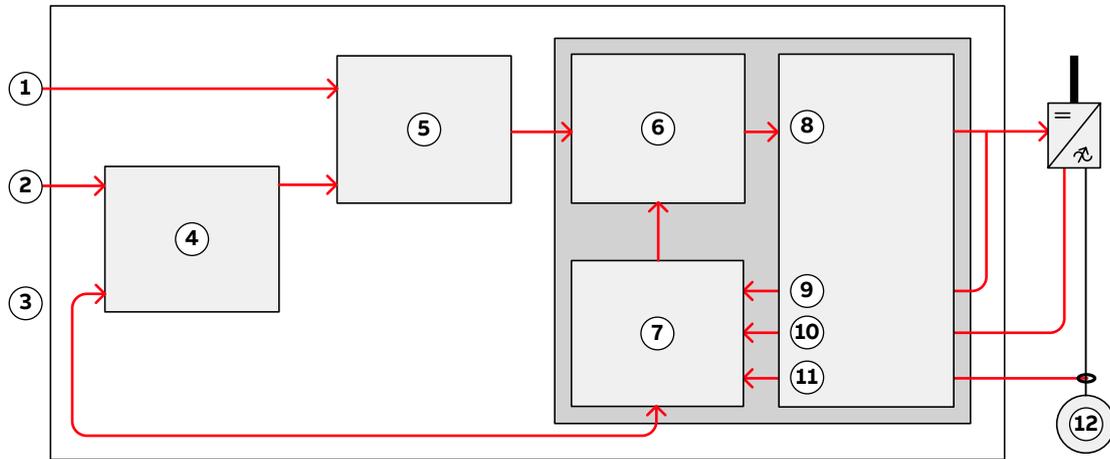


Figure 3-13 DTC torque control

|                                |                     |
|--------------------------------|---------------------|
| 1) Torque reference            | 7) Motor model      |
| 2) Speed reference             | 8) Switching logic  |
| 3) Actual reference            | 9) Switch positions |
| 4) Speed controller            | 10) Voltage         |
| 5) Torque reference controller | 11) Current         |
| 6) Torque-flux comparator      | 12) Motor           |

Switching of the semiconductors is directly controlled in accordance with the motor core variables flux and torque.

The measured motor currents and DC link voltages are inputs to an adaptive motor model. The model produces exact values of torque and flux every 25 microseconds. Motor torque and flux comparators compare the actual values to reference values which are produced by the torque and flux reference controllers.

Depending on the outputs from the hysteresis controllers, the switching logic directly determines the optimum switch positions every 50 ms and initiates switching whenever required.

## Parameters

The control system is configured, customized, and tuned with a set of application parameters. The application parameters are organized in functional groups and have factory-set default values.

The default parameter values are adjusted during commissioning to the specific application of the drive in order to activate the specific control, monitoring and protection functions for the driven process, and to define the signals and data transferred between drive and external equipment.

For more information on the parameters for signal allocation, signal type selection, signal inversion, scaling, and filtering, see “Appendix G - Signal and parameter table”.

## Main circuit breaker

The main circuit breaker (MCB) is an important switching and protection device of the drive system. Therefore it must only be controlled and monitored by the drive.

For more information, see:

- “Main circuit breaker engineering guideline” (3BHS125149 E50)
- “2.7 Important note - main circuit breaker”

## Peripheral I/O devices

The peripheral input and output devices connected to the AMC circuit board include:

- “Local control panel” on page 45
- “Customer interface” on page 46
- “S800 I/O system” for parallel signal transfer to external devices
- Fieldbus adapters for serial data transfer to a higher-level control system
- PC-based service tools comprising:
  - **DriveWare® software tools:** includes software tools such as the commissioning and maintenance tools DriveWindow and DriveDebug, and DriveOPC for data transfer between ABB drives and Windows®-based applications.
  - **DriveMonitor (option):** a monitoring and diagnostics tool that allows access to the drive from any location in the world via a secure Internet connection.

## Local control panel

The control panel serves as the basic user interface for monitoring, control and operation of the drive and setting of parameters.

For more information on local operation and the CDP control panel, see “8 Operation” on page 117 and “9 CDP control panel” on page 133.

| PRODUCT  | DOCUMENT KIND | DOCUMENT ID.   | REV. | LANG. | PAGE   |
|----------|---------------|----------------|------|-------|--------|
| ACS5000W | User manual   | 3BHS799208 E01 | F    | en    | 45/178 |

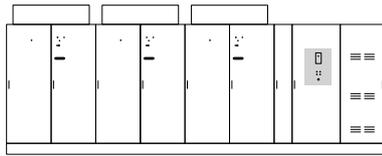


Figure 3-14 Local control panel

1) Local control panel

2) Local control pushbuttons

### Customer interface

The devices present in the customer interface depend on the options ordered, such as:

- Serial communications interface to a higher-level control system
- The modules of the S800 I/O system for monitoring of external equipment, such as transformer and motor
- DriveMonitor



Figure 3-15 COU customer interface section

- |   |                                     |
|---|-------------------------------------|
| 1) Arc Guard System™  | 5) Grey encoder (optional)          |
| 2) Remote condition monitoring NETA-21 and fieldbus interface | 6) NTAC-02 pulse encoder (optional) |
| 3) Customer terminals   | 7) Customer terminals               |
| 4) S800 I/O process system (customer-specific configuration)  |                                     |

### S800 I/O system

The S800 I/O station with digital and analog I/O interfaces transfers drive-related hardwired signals to the AMC circuit board.

Standard ABB Advant S800 I/O modules interconnect internal and external digital and analog I/O signals with the control system of the drive. The I/O station consists of a bus modem serving as an interface to the AMC circuit board and the I/O modules. Each I/O module is plugged into a termination unit that is wired to separate terminals to which the external signals are connected.

## 3.5. Transformer and motor cable terminals

### 3.5.1. Transformer cable terminals

For information on the location of the terminals, see Fig. 3-7.

### 3.5.2. Motor cable terminals

The motor terminals are in the back of the COU compartment. To access them, open the swing frame of the control unit.

Besides of the busbars for motor cable terminations, this unit also includes the charging transformer for the DC link, the EMC filter and the EAF filter.

The layout of the motor terminal section depends on the following:

- Frame size (single or double busbars)
- Cable entry (from top or from bottom of the cabinet)

For information on the dimensions and the busbar arrangement, see “Appendix C - Mechanical drawings”.

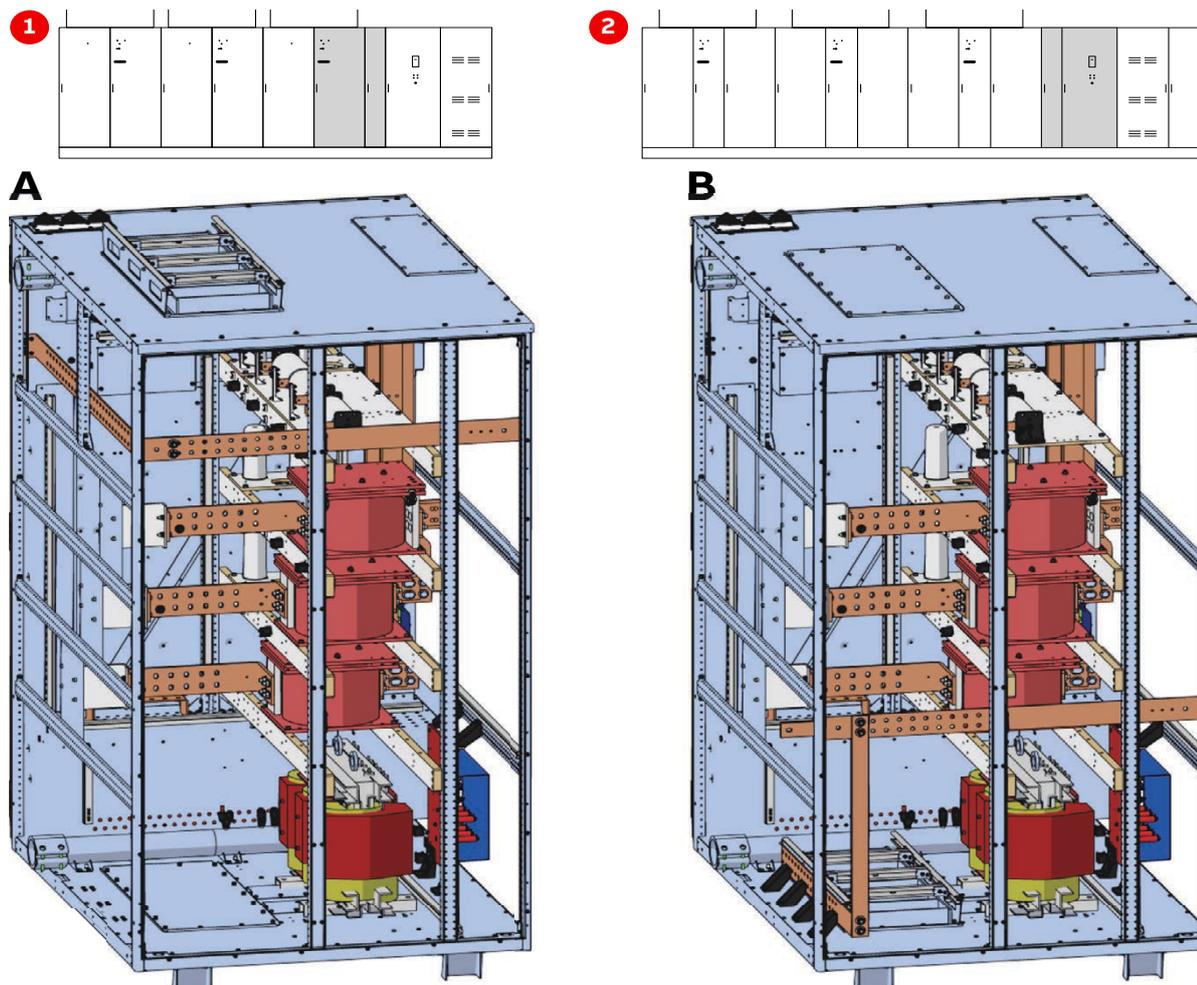


Figure 3-16 Motor terminal section of frame size 1 and 2: top entry (A) and bottom entry (B)

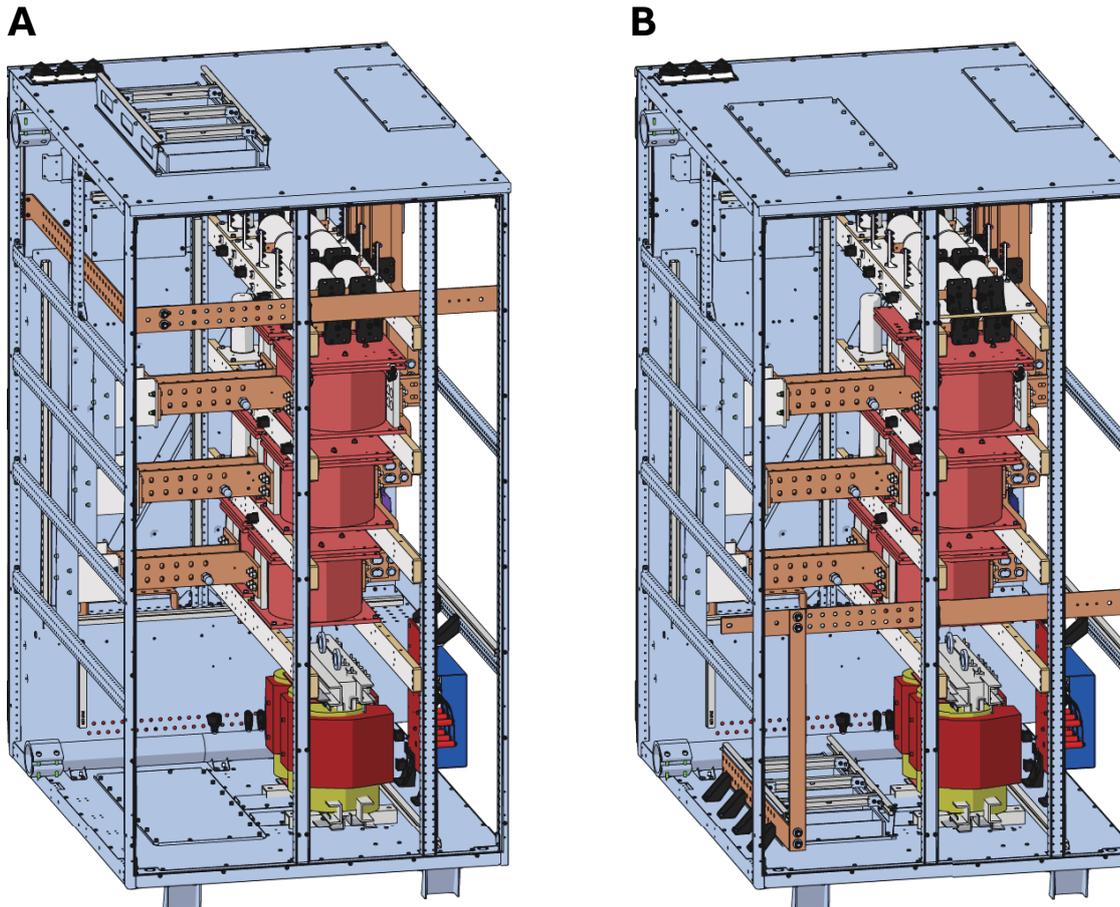
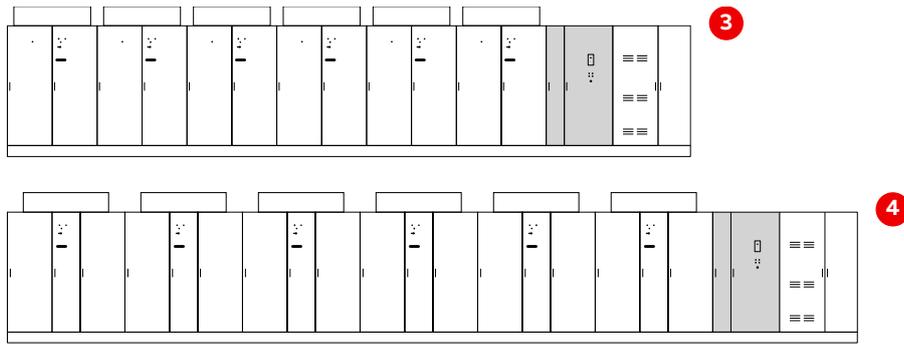


Figure 3-17 Motor terminal section of frame size 3 and 4: top entry (A) and bottom entry (B)

### 3.6. Water cooling unit (WCU)

Depending on the frame size, the water cooling unit comes as one of the following two models:

- 800 mm (frame size 1 and 2)
- 1400 mm (frame size 3 and 4)

Fig. 3-18 shows the water cooling unit of frame size 3 (type WCU1400). It allows you to identify the components of other models as well.

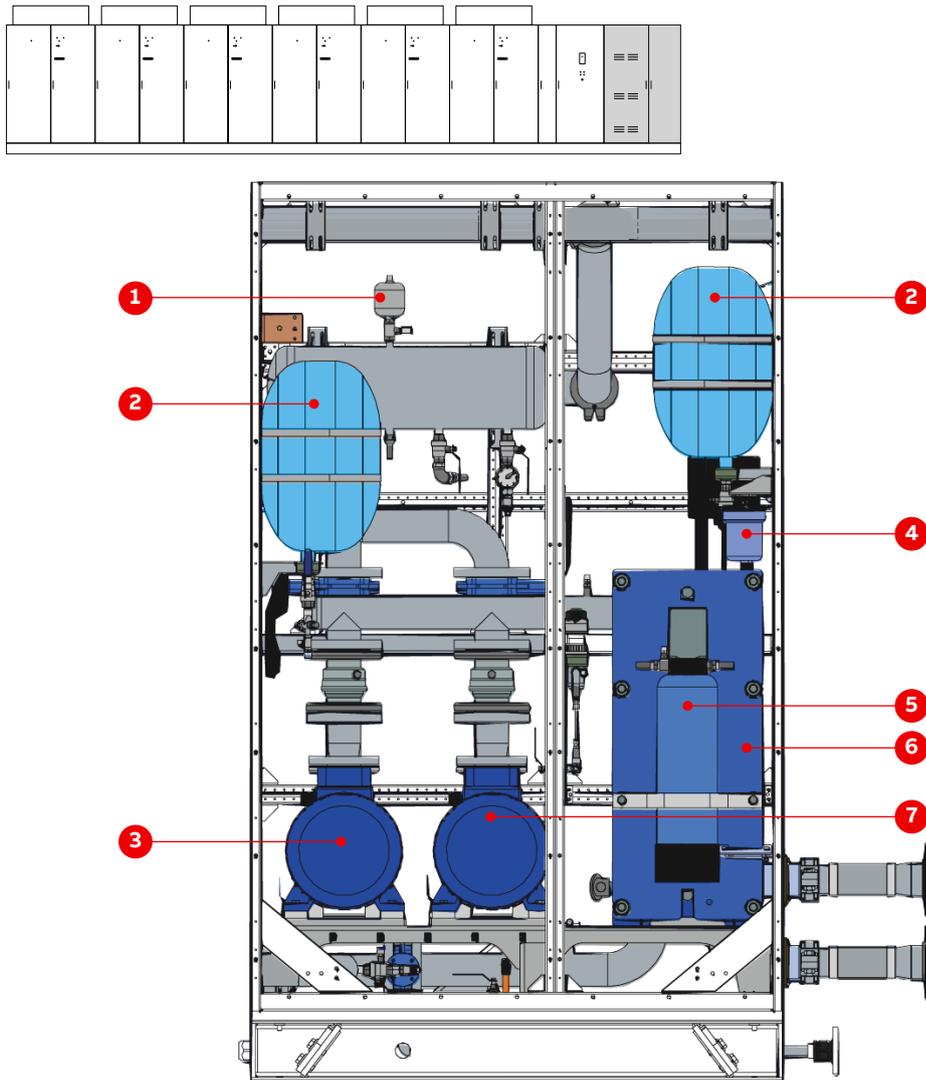


Figure 3-18 WCU (1400 mm), frame size 3

- |                      |                                  |
|----------------------|----------------------------------|
| 1) Deaeration valve  | 5) Ion exchange vessel           |
| 2) Expansion vessels | 6) Water-to-water heat exchanger |
| 3) Water pump 1      | 7) Water pump 2                  |
| 4) Filter            |                                  |

For more information on the water cooling unit, see “Appendix A - Additional manuals”.

### 3.7. EXU – Excitation unit (optional)

The EXU supplies a synchronous motor with excitation power. The EXU is available for the following excitation methods:

- **Brush excitation (DC excitation):** Brush excitation uses a DCS800 AC-to-DC converter (see figure below) which is supplied by the mains. The converter controls the direct current for generating the magnetic field. Brushes and slip-rings feed the DC current to the rotor.
- **Brushless excitation (AC excitation):** Brushless excitation uses a three-phase DCS800 AC-power controller (see figure below). The power controller feeds an exciter which is mounted on the shaft of the main motor. The rotating armature of the exciter supplies a rectifier which generates the DC current for producing the magnetic field in the synchronous motor.

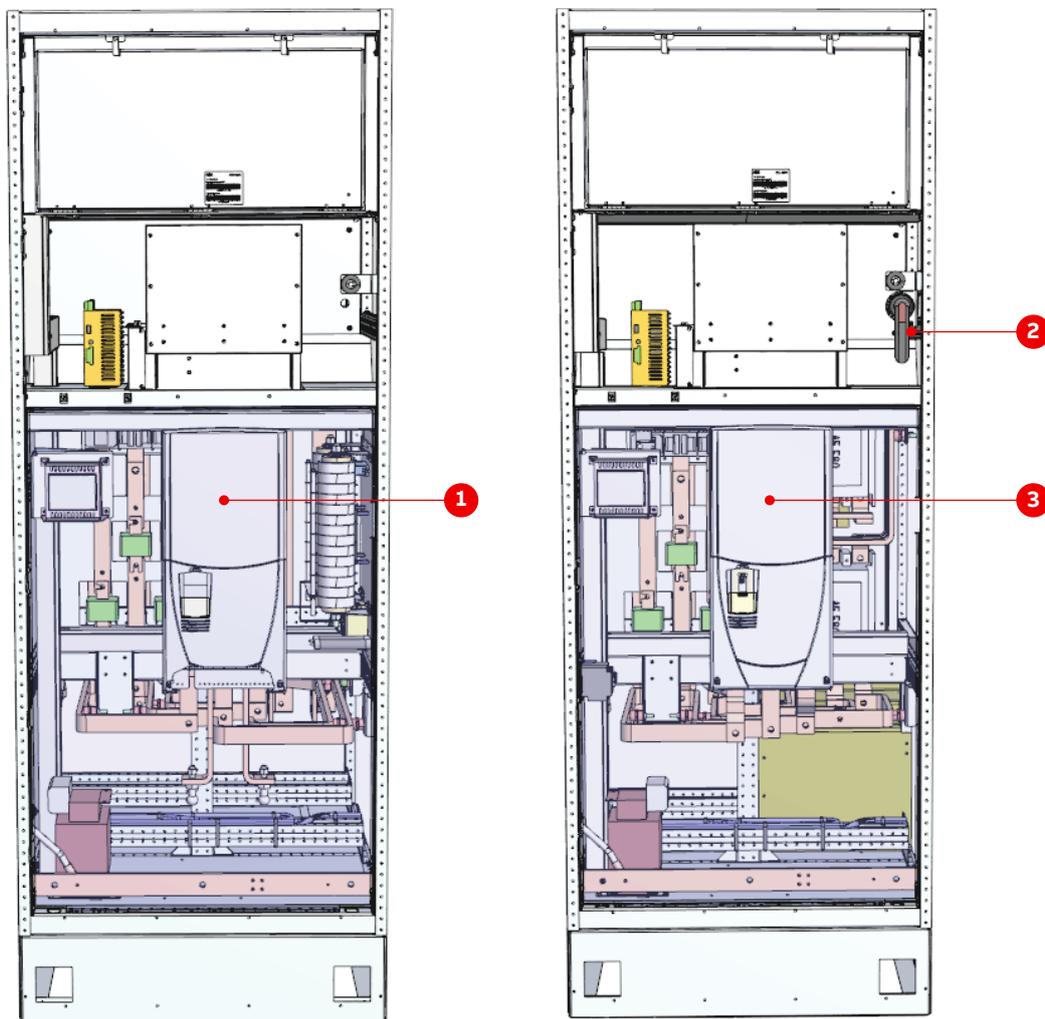


Figure 3-19 EXU

- |                               |                        |
|-------------------------------|------------------------|
| 1) AC-to-DC converter         | 3) AC power controller |
| 2) Output disconnect (option) |                        |

## DCS800 control panel

The control panel of the DCS800 unit enables the user to control, read the status messages and set the parameters of the DCS800 unit. The panel can also be used to copy parameters from one DCS800 unit to another DCS800.



Figure 3-20 EXU control panel

For more information, see “8 Operation” on page 117.

### Reversing switch

The EXU for brushless excitation is equipped with a reversing switch for changing the sense of rotation. The switch is actuated by the drive.

The switch changes the sense of rotation via the optical communication link. When the drive is in state ReadyOn or NotReadyOn, the switch is opened.

### Output disconnecter

The optional output disconnecter (Fig. 3-19: 3) is used to disconnect the EXU from the motor for maintenance purposes.

### 3.8. Door interlocking system

The doors of each PCU compartment are secured with an electromechanical interlocking mechanism to prevent them from being opened during operation.

The main protection features of the interlocking system are:

- Grounding switches (Fig. 3-22)
- Locking bars (Fig. 3-23)

The interlocking system ensures that you cannot connect the main power supply to the drive until all doors of PCU compartments are closed and locked and the grounding switches are in ungrounded position.

The interlocking system also ensures that you cannot open the doors of PCU compartments until the main power supply is disconnected, the DC-link capacitors are discharged and the grounding switches are in grounded position.

The doors of the COU compartment (control unit and motor terminal section) and the WCU compartment are not integrated into the interlocking system and can be opened at all time. However, do not open the swing frame of the control unit while the drive is in operation.

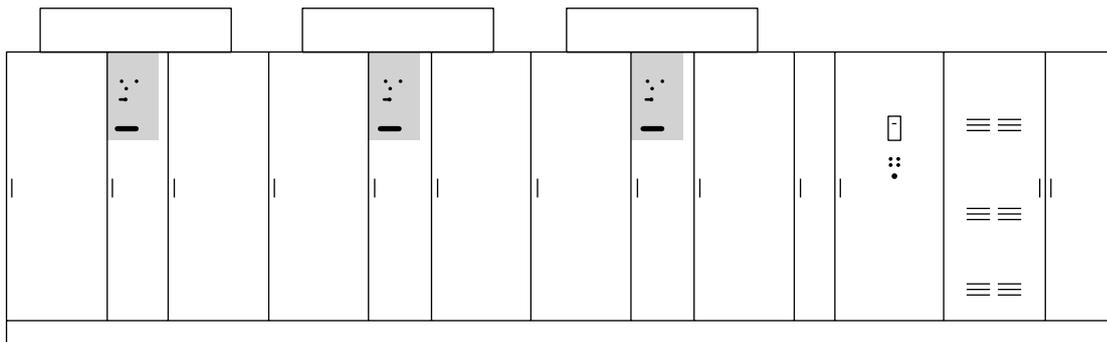


Figure 3-21 Location of protection features and lights

For instructions on how to open and close doors, see “10.6.3 Opening and closing the doors” on page 167.

### 3.9. Grounding switches

There is one grounding switch (Fig. 3-22: 1) on each primary PCU.

Turning a grounding switch to the grounded position (horizontal) is only possible once the yellow lamp (Fig. 3-22: 2) lights up. The yellow lamp indicates that the main power supply is disconnected and the DC link has discharged.

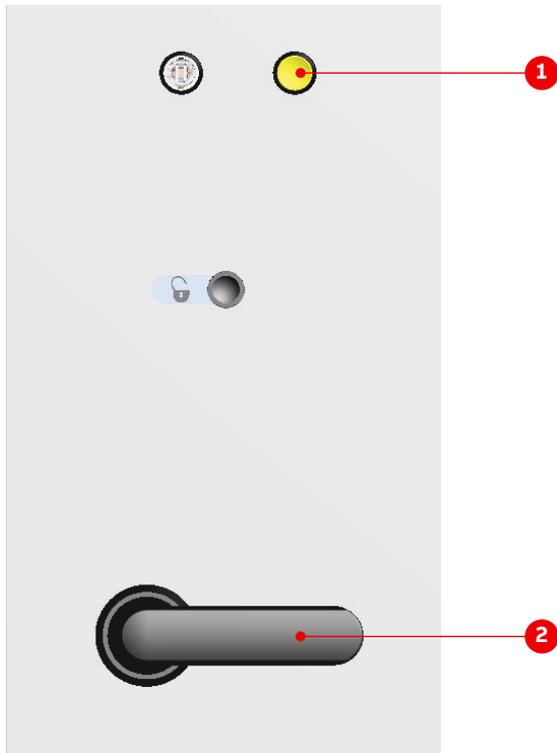


Figure 3-22 Grounding switch

- 1) Grounding switch:  
Horizontal position - drive is grounded  
Vertical position - drive is not grounded.
- 2) Yellow lamp (grounding switch released): Lights up to indicate that you can turn the grounding switch to the grounded or ungrounded position.

For a detailed grounding diagram, see “Appendix D - Wiring diagrams”.

#### 3.9.1. Locking bars

There is one locking bar (Fig. 3-23: 3) on each primary and each secondary PCU.

Sliding a locking bar to the unlocked or locked position is only possible, once the white lamp (Fig. 3-23: 2) lights up. The white lamp indicates that the drive is grounded.

In addition, sliding a locking bar to the locked position is only possible, once all doors of a PCU (2 doors in 1700 mm PCUs, 3 doors in 2100 mm PCUs) are closed.

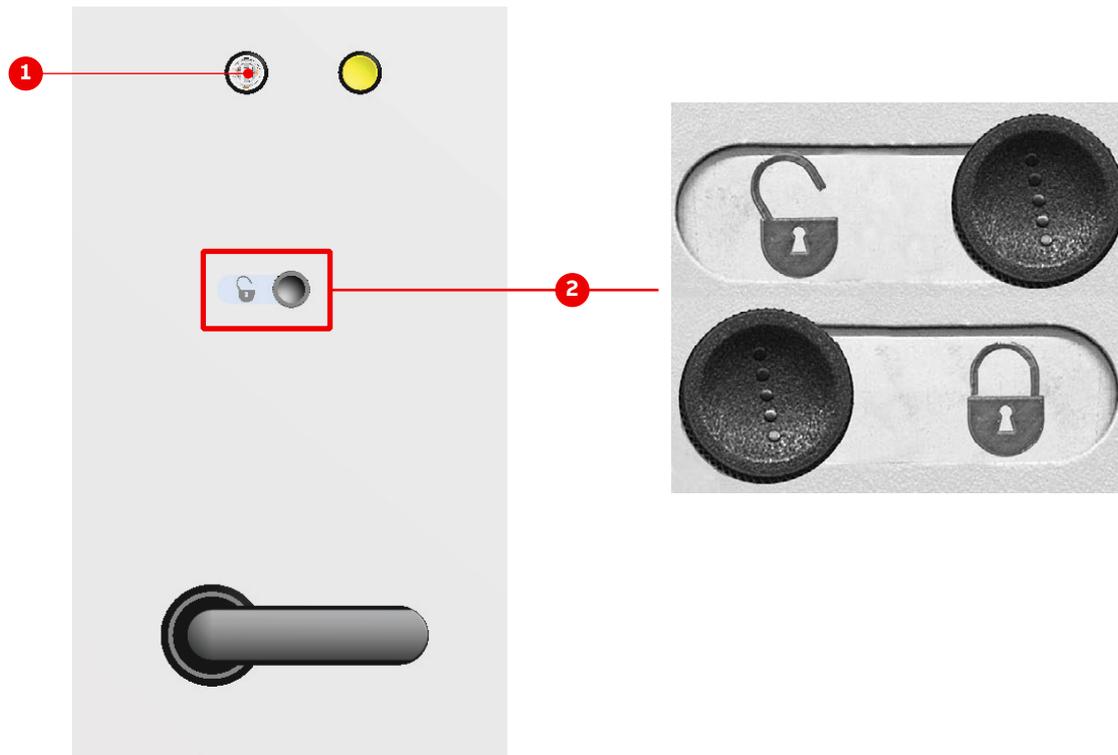


Figure 3-23 Locking bar and white lamp

- 1) White lamp: Lights up to indicate that the drive is grounded and you can slide the locking bar to the unlocked or locked position.
- 2) Locking bar: Unlocks or locks the door handles of a PCU compartment.

## 3.10. Grounding studs

The COU and each PCU has grounding studs that are designed for use with the 4-way grounding set (Fig. 3-25).

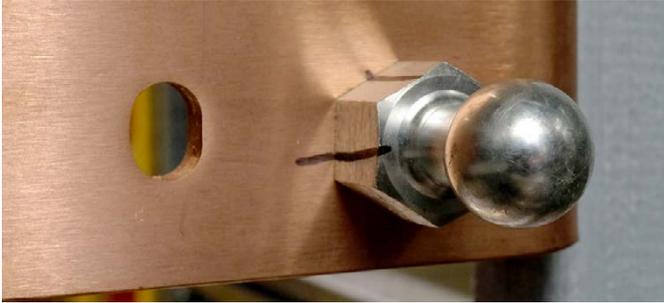


Figure 3-24 Grounding stud

### 3.10.1. Grounding set



**⚠ DANGER** Hazardous voltages!

The steps in the “2.5 The 7 steps that save lives” on page 26 must be completed before you access the grounding studs in the PCU.

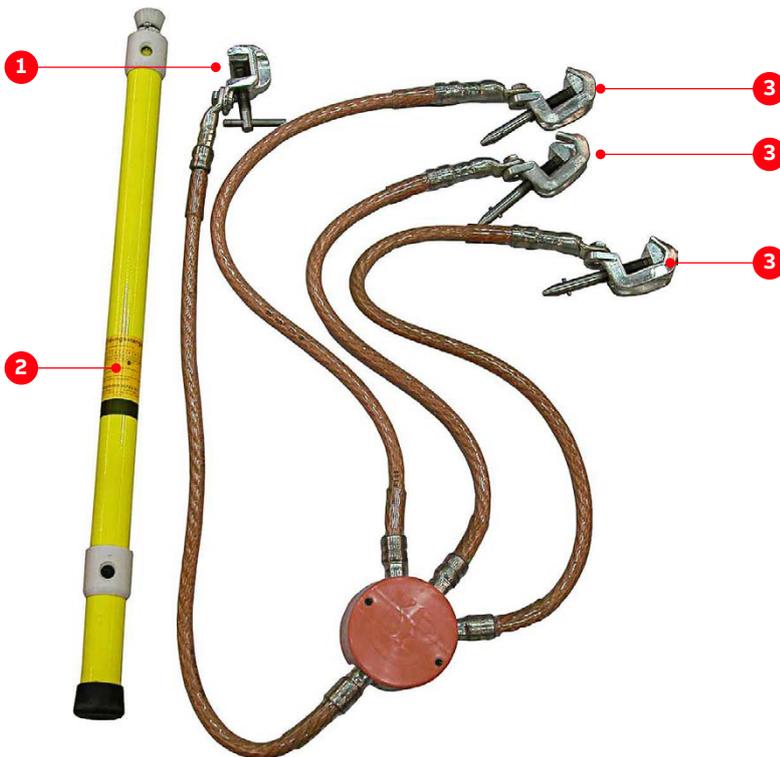


Figure 3-25 4-way grounding set

- |                               |                        |
|-------------------------------|------------------------|
| 1) Enclosure ground clamp     | 3) Busbar ground clamp |
| 2) Telescopic insulating pole |                        |

### 3.10.2. Output grounding studs in COU

The converter output grounding studs (Fig. 3-26: 1L1, 1L2, 1L3, and PE) are behind the swing frame in the COU.

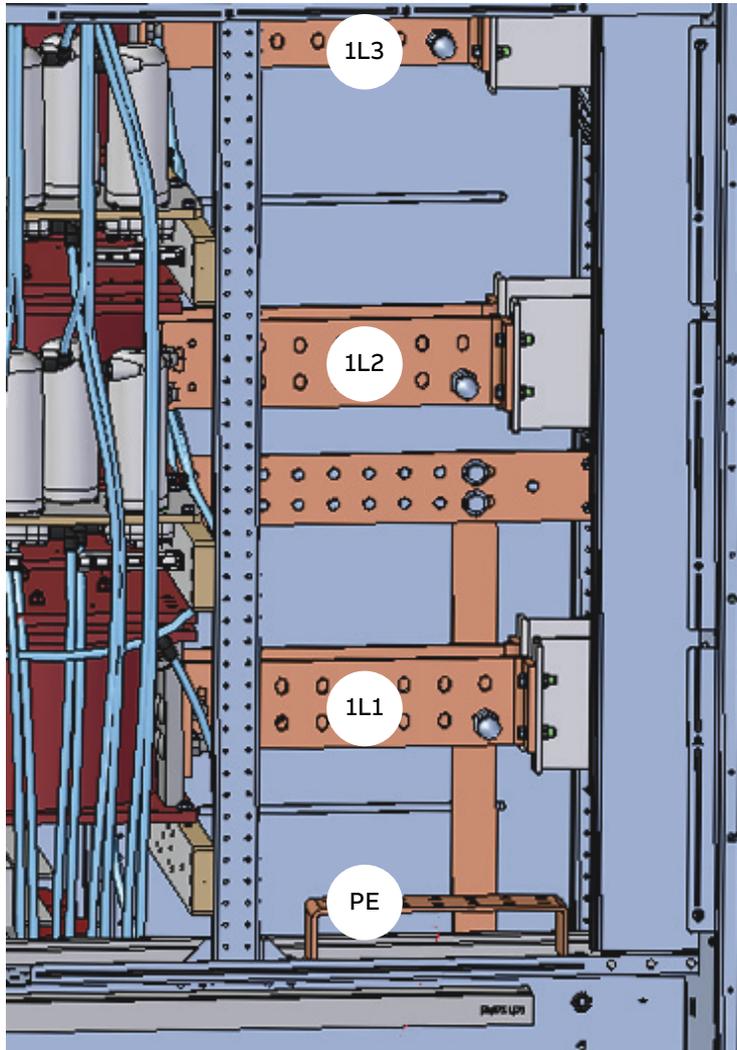


Figure 3-26 Connection studs for the 4-way grounding set in the COU

### 3.10.3. Input grounding studs in a PCU



**DANGER** Hazardous voltages!

The steps in the “2.5 The 7 steps that save lives” on page 26 must be completed before you remove the side and back walls from the drive to access the grounding studs in a PCU.

The converter input grounding studs (Fig. 3-27: 1L1, 1L2, and 1L3; Frame sizes 3 and 4 also have 2L1, 2L2, and 2L3) and the protective earth grounding studs (Fig. 3-27: PE) are at the back of each PCU.

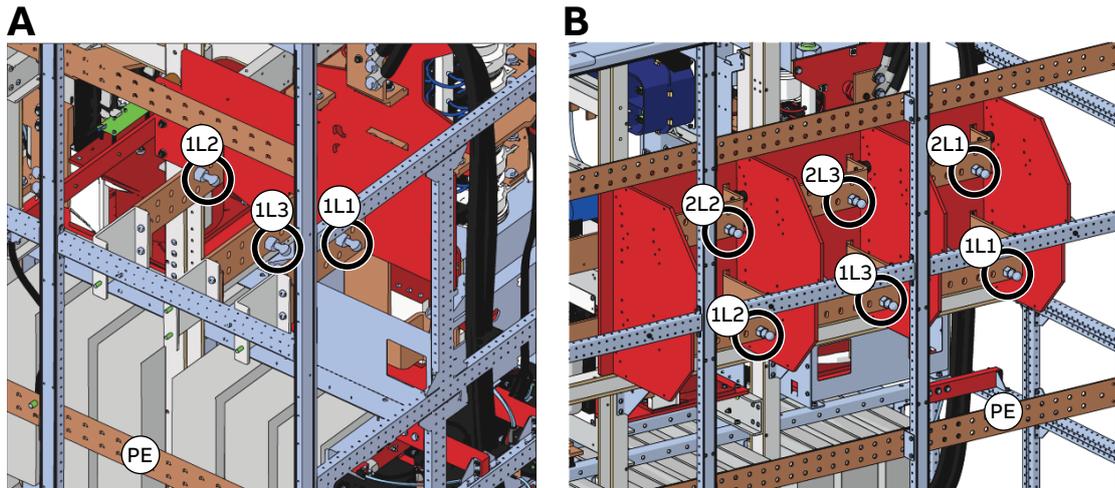


Figure 3-27 Connection studs for the 4-way grounding set in an 18-pulse ACS5000WPCU (A) and a 36-pulse ACS5000W PCU (B)

| PRODUCT  | DOCUMENT KIND | DOCUMENT ID.   | REV. | LANG. | PAGE   |
|----------|---------------|----------------|------|-------|--------|
| ACS5000W | User manual   | 3BHS799208 E01 | F    | en    | 58/178 |

## 4. Transportation, storage and disposal

### 4.1. Safety



The drive must only be handled by personnel who are skilled and experienced in unpacking and transporting heavy equipment

### 4.2. Transport conditions

The transport conditions for the drive are based on IEC 60721-3-2.

- **Classification:** 2K12 / 2B1 / 2C2 / 2S5 / 2M4

### 4.3. Unpacking and inspection

1. Remove all packaging material carefully.
2. Check the drive and accompanying equipment for damages.
3. Compare the complete delivery with the purchase order and the packing list.
4. If parts are missing or damaged, immediately inform the shipping company and the ABB service organization.

It is recommended to photograph the damages and send the photographs to ABB.

### 4.4. Identifying drive units

A delivery can consist of transport units for several drives. To identify the transport units and assign them to a particular drive, see the following accompanying papers for information:

- Packing list, attached to the packaging of each transport unit
- Packing label on the back wall of each drive unit (PCU, COU, WCU). The packing label is only visible after the packaging has been removed.

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|----------|---------------|----------------|------|-------|--------|
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### 4.4.1. Packing list

The “Commodity description” column of the packing list states the number of the drive that the transport unit belongs to.

| ABB item<br>Customer item                     | Qty.                       | Unit.                   | Identnumber                    | Commodity description                                |
|---|----------------------------|-------------------------|--------------------------------|--|
| 001201  | 1                          | PC                      |                                | Converter <b>1</b> <sup>(1)</sup> : Transport Unit 1 |
| <b>ABB Switzerland Ltd</b>                    |                            |                         |                                |  |
| Drives  |                            |                         |                                |  |
| Mailing address:<br>CH-5401 Baden/Switzerland | Phone:<br>+41 58 589 27 95 | Telex:<br>755749 abb ch | Facsimile:<br>+41 58 580 20 84 | Bank Credit Suisse CH-8070 Zurich/Switzerland        |

- (1) All of the transport units for a drive have the same converter number, in this case, “Converter **1**”.

The item number in the “ABB Item / Customer item” column of the packing list provides information about separately delivered crates with accessories such as tools and installation material .

| ABB item<br>Customer item                     | Qty.                       | Unit.                   | Identnumber                    | Commodity description                         |
|---|----------------------------|-------------------------|--------------------------------|---|
| 00 <b>1</b> 221 <sup>(1)</sup>                | 1                          | PC                      |                                | cross wiring                                  |
| 00 <b>1</b> 222                               | 1                          | PC                      |                                | WCU accessory                                 |
| 00 <b>1</b> 223                               | 1                          | PC                      |                                | crank for isolator                            |
| 00 <b>1</b> 500                               | 1                          | PC                      | 3BHB013202R0001                | ACS6080 Max-SL LOOSE PARTS config.            |
| <b>ABB Switzerland Ltd</b>                    |                            |                         |                                |   |
| Drives  |                            |                         |                                |   |
| Mailing address:<br>CH-5401 Baden/Switzerland | Phone:<br>+41 58 589 27 95 | Telex:<br>755749 abb ch | Facsimile:<br>+41 58 580 20 84 | Bank Credit Suisse CH-8070 Zurich/Switzerland |

- (1) The third digit from the right identifies the drive that the accessories belong to, ie, drive **1**.

### 4.4.2. Packing label

The packing labels on the back wall of transport units can also be used for identification.

|                    |   |  |
|--------------------|---|--|
| ABB                | Packing Label   | 0000                                       |
| Material no        | 3BHB009964R1500   | 1 ST                                       |
| Material           | Cabinet ARU/INU LSU config.   |  |
| Order no/positions | 11027727  | 00 <b>1</b> 241 <sup>(1)</sup> Project CBA |
| Material Document  | <br>004902892300012004 |  |

- (1) The fourth digit from the right identifies the drive that the transport unit belongs to, ie, drive **1**.

## 4.5. Lifting and transportation



### **NOTICE** Risk of component damage!

Refer to “Appendix C - Mechanical drawings” before transporting the drive. This appendix provides details on dimensions, weight, and center of gravity of the drive.

- To prevent distortions, DO NOT lift and move the drive or a transport unit with a forklift.
- If the transport units are joined but not yet on the base frame, DO NOT lift and move them with a crane.

Instead, use appropriate transport means, such as heavy load hydraulics rollers or air cushions. If in doubt, contact ABB for instructions.

- To prevent damage to drive components, transport and move the drive or a transport unit only in upright position.
- To prevent dirt from entering the drive, keep the doors of the drive or a transport unit closed.

Metallic dust in particular can cause damage and failure when the drive is energized.

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### 4.5.1. Using a crane to lift a transport unit or the drive by the base frame



#### **CAUTION** Tipping hazard!

- To prevent the drive or transport unit from tipping when following these instructions, use an extra sling around the cabinet for stabilization (Fig. 4-2).



#### **NOTICE** Risk of component damage.

To prevent deformation of the cabinet:

- Only use a crane to lift single transport units or the drive by the base frame.
- Always observe the center of gravity!

Refer to Fig. 4-1 and Fig. 4-2 when following these ABB recommendations:

- Use a lift frame or a lift spreader with the crane.
- If a lift frame or lift spreader is not available, make sure that the slope angle is a maximum of 15° (see Fig. 4-2).
- Use lifting equipment (eg, web slings, chain slings, round slings, safety hooks, shackles) that corresponds to the weight that is to be lifted.
- Attach the slings to the lifting brackets at the base frame.
- To prevent the drive or transport unit from crashing if one sling tears, fasten an extra sling around the cabinet for stabilization.
- Use appropriate safety hooks or shackles to attach a sling.
- DO NOT pass a sling through the hole of the bracket.
- If the slings are too close to the cabinet, protect the edges and the door handles or levers.
- Lift the drive or a transport unit slowly and steadily to the required clearance height, maintaining it in upright position.
- Check the horizontal position and reposition the slings if necessary.



Figure 4-1 Lifting bracket on base frame of a drive and safety hook secured to lifting bracket

1) Lifting bracket (hole  $\varnothing$ 42 mm)

2) Safety hook

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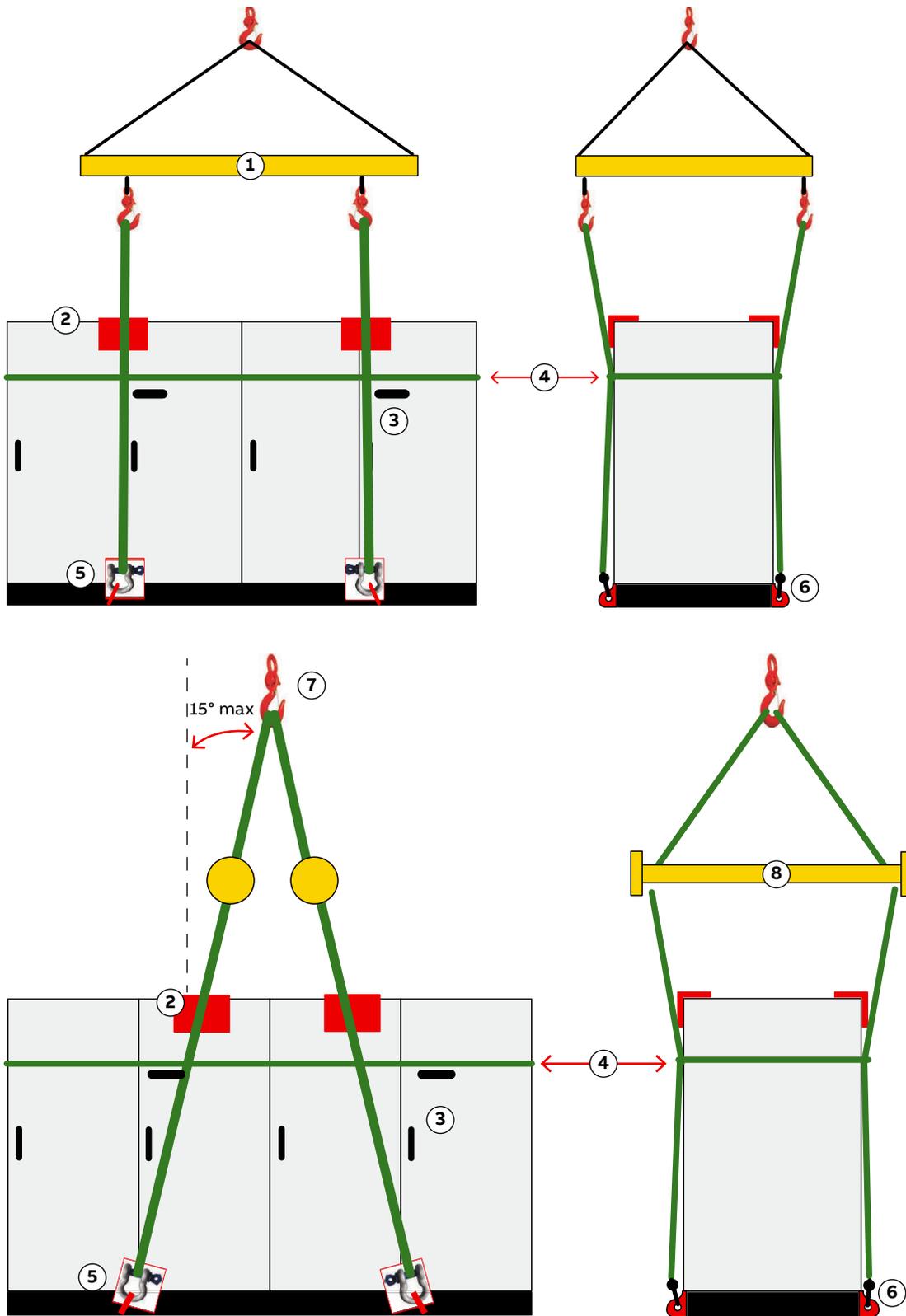


Figure 4-2 Lift frame and lift spreader

- |                                    |                           |
|------------------------------------|---------------------------|
| 3) Lift frame                      | 7) Safety hook or shackle |
| 4) Protect the edges               | 8) Lifting bracket        |
| 5) Protect door handles and levers | 9) Slope angle            |
| 6) Extra sling                     | 10) Lift spreader         |

## 4.6. Storage

### 4.6.1. Storage conditions

The minimum requirements for storage are based on IEC 60721-3-1.

– **Classification:** 1K22 / 1B1 / 1C2 / 1S11 / 1M11

The drive can be stored for up to one year in the original packaging as long as it is not damaged or opened. For information on longer storage periods, contact the ABB service organization.

### 4.6.2. Storage

If the drive is taken out of service for a longer time proceed as follows:

1. Drain the cooling circuit completely or add the appropriate amount of glycol for frost proofing if the drive is to be stored in ambient temperatures below 0 °C.

For information about draining and frost proofing, see the manual of the water cooling unit in “Appendix A - Additional manuals”.

2. Cover all cable inlets and ventilation slots with an impermeable plastic or aluminum foil and a wooden panel.
3. Add a desiccant of the appropriate quality:
  - One unit desiccant (30 g) absorbs 6 g water vapor
  - When using a polyethylene foil: 10 units/m<sup>2</sup> foil
4. Close and lock the doors of the drive.
5. Use polyethylene or equivalent for packaging:
  - 0.3 g/m<sup>2</sup>/24 h water vapor diffusion
6. Attach humidity indicators to the packaging.

**NOTICE** The storage conditions and the packaging should be checked regularly. Any damages which occur during the storage period must be repaired immediately.

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## 4.7. Storage and handling of spare parts



### **NOTICE** Risk of component damage.

Static electricity can damage printed circuit boards.

- Apply static-sensitive precautions when handling spare parts.

### 4.7.1. Warranty information

**IMPORTANT!** Check the spare parts immediately after receipt for damages. Report any damage to the shipping company and the ABB service organization.

Observe the following to maintain spare parts in good condition and to keep the warranty valid during the warranty period:

- Keep spare parts in their original packaging.
- Store printed circuit boards in antistatic bags or boxes.
- Storage temperature range: -5 °C – + 55 °C
- Storage place requirements:
  - Free of vibration and shock.
  - Protected against dust, sand, vermin and insects.
  - Free of corrosive gases, salt or other impurities that could damage electronic equipment.
  - Dry, no condensation: relative air humidity: 5 – 95%  
If in doubt whether the maximum allowed humidity is exceeded, protect spare parts by an external heater.
- Do not touch a component without wearing a wrist grounding strap.
- Put the component on a grounded working surface protected against electrostatic discharges.
- Hold the component only at the edge.

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## 4.8. Disposal of packaging materials and components

Dispose of the packaging materials and components at the end of the life time of the drive according to local regulations.

|          |               |                |      |       |        |
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## 5. Mechanical installation

### 5.1. Safety



All installation work must be carried out by qualified personnel according to the site and equipment requirements and in compliance with local regulations.

### 5.2. Overview of installation work

The drive is delivered in transport units that must be joined and fixed to the floor at the installation site.

The installation includes the following work:

- “5.5 Preparing the installation site” on page 69
- “5.6 Aligning transport units” on page 70
- “5.7 Joining transport units” on page 71
- “5.8 Applying silicone” on page 72
- “5.9 Installing roof joints” on page 72
- “5.10 Installing roof-mounted cooling units” on page 73 (option)
- “5.11 Installing roof attachments” on page 78 (option)
- “5.12 Joining water pipes” on page 80
- “5.13 Joining busbars” on page 81
- “5.14 Connecting the heating cable” on page 83 (option)
- “5.15 Connecting raw water pipes” on page 84
- “5.16 Fixing the drive to the floor” on page 84

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## 5.3. General notes on installation

### **NOTICE** Risk of component damage,

Observe the following during installation:

- Ensure that no dirt enters the drive.  
Always close the doors when work is discontinued and completely cover openings. Metallic dust in particular may cause failures when the drive is powered up and cause damage.
- When joining two transport units, DO NOT damage or dislocate the EMC sealing strip that is glued onto the outer joining surfaces of the cabinet frame.
- If the transport units are joined but not yet on the base frame, DO NOT lift and move them with a crane.  
Instead, use appropriate transport means, such as heavy load hydraulics rollers or air cushions.

## 5.4. Dimensions and clearances

For information on dimensions, location and size of fixing holes and clearances, see “Appendix C - Mechanical drawings”.

### 5.4.1. Rear and top access to the cabinet

Joining the transport units and DC busbars requires rear and top access.

### 5.4.2. Cabinet roof

The cabinet roof is not designed as a base for foreign devices or cable ducts. Therefore, do not install any foreign objects on the roof.

### 5.4.3. Fire protection

To prevent fire from spreading into the drive, apply suitable fire protection measures.

### 5.4.4. Cable duct material

Use cable ducts of non-flammable material with non-abrasive surface.

To prevent dust, humidity and animals from entering the drive, protect all cable entries and exits of cable ducts.

### 5.4.5. Installation material

Installation material is supplied with the drive in a separate box.

### 5.4.6. Tools

See “1.10 Tools” on page 22.

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## 5.5. Preparing the installation site

To ensure proper alignment and installation of the drive, prepare the floor as follows:

- The floor must be able to support the weight of the drive (min. 1500 kg/m<sup>2</sup>).
- The overall incline of the floor across 5 m must not exceed 5 mm.

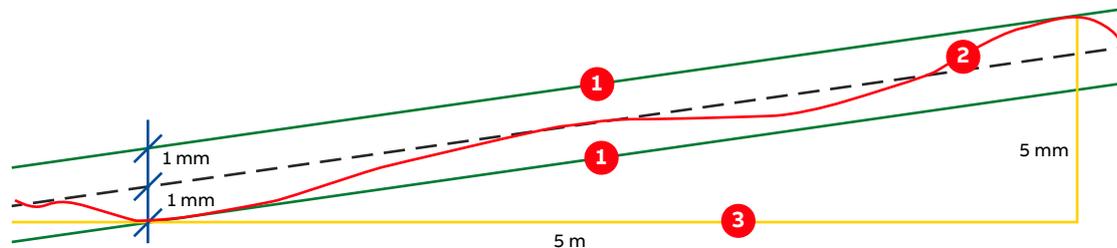


Figure 5-1 Floor inclination

- |  |  |
|--|--|
| 1) Tolerance from mean ground $\pm 1$ mm | 3) Tolerance for incline: 5 mm incline on 5 m length |
| 2) Surface or floor                      |  |

The floor must be even.

- Check the evenness and incline of the floor well in advance so that work for improving the surface is completed before the installation of the drive.
- Use a spirit level or flooring rule with a vial for checking.  
Recommended length: 1 – 2 m.
- If the surface cannot be improved, place shims or leveling plates under the base frame at appropriate distances (every 1 m) for adjustment.
- Leveling plates of the following size are recommended: 10 mm x 10 mm
- Drill the fixing holes before moving the drive to the final location.

## 5.6. Aligning transport units

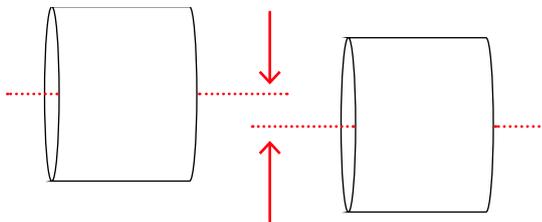
1. Remove the protective covers from the water pipe ends on both sides.



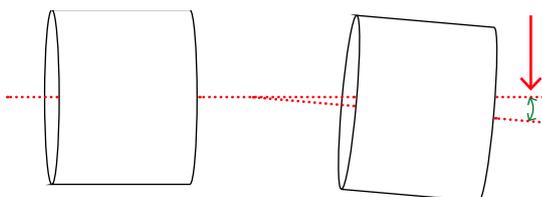
2. Check that a pipe joint has been slid on one pipe end of two adjoining water pipes.



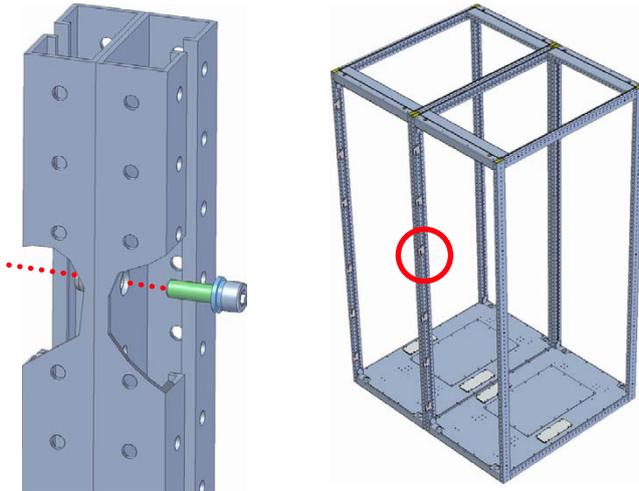
3. Line up the transport units as shown in “Appendix C - Mechanical drawings”.  
The units can be lined up either beginning from the left or the right.
4. Align the transport units.
5. Verify the following alignment parameters:
6. Maximum values for the axial misalignment and the angular deflection of two adjoining water pipes are not exceeded
  - Axial misalignment:  $\pm 3$  mm



- Axial deflection:  $5^\circ$



7. Screw holes are exactly aligned.



8. Cabinet doors are not misaligned and that there are no gaps between cabinet walls and cabinet frame
9. Adjoining surfaces of transport units meet perfectly all around

## 5.7. Joining transport units

Join the transport units with the supplied installation material. The installation material is mounted at one of the transport units.

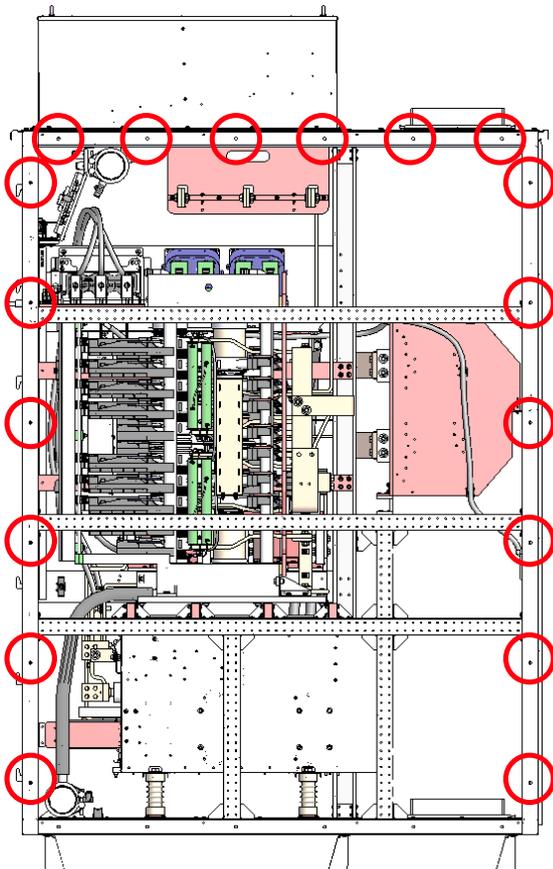


Figure 5-2 Connection points on side of transport units (PCU example)

| PRODUCT  | DOCUMENT KIND | DOCUMENT ID.   | REV. | LANG. | PAGE   |
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## 5.8. Applying silicone

Silicone prevents water from entering the gap between two joining roof plates. Apply silicone where two transport units have been joined (Fig. 5-3). Gaps within a transport unit are factory-sealed.



Figure 5-3 Applying silicone

## 5.9. Installing roof joints

Install the roof joints across shipping splits at the following locations:

- Marine drives: at the front of the roof (the back is reserved for roof attachments, see “5.11 Installing roof attachments” on page 78.)
- Standard drives: at the front and the back of the roof

For the exact number and fitting location of roof joints, see “Appendix C - Mechanical drawings”.

Table 5-1 Installation material per roof joint

| Items            | Details         | ID Number       |
|------------------|-----------------|-----------------|
| Connecting piece | 8 x 80 x 220 mm | 3BHB011552R0001 |
| Hex-head bolt    | M16 x 40        | NB 312350P0464  |
| Washer           | 17x30x3         | 9ABA450078P0008 |



Figure 5-4 Roof joint

## 5.10. Installing roof-mounted cooling units

This section applies only if the units are not preinstalled.

### 5.10.1. Lifting a unit with a crane



#### **CAUTION** Heavy objects!

- An IP42 cooling unit weighs **40 kg**.
- An IP54 cooling unit weighs **98 kg**.

#### Procedure:

1. Attach appropriate slings and shackles to the lifting brackets of a cooling unit.
2. Using a crane, lift the cooling units above the cabinet.

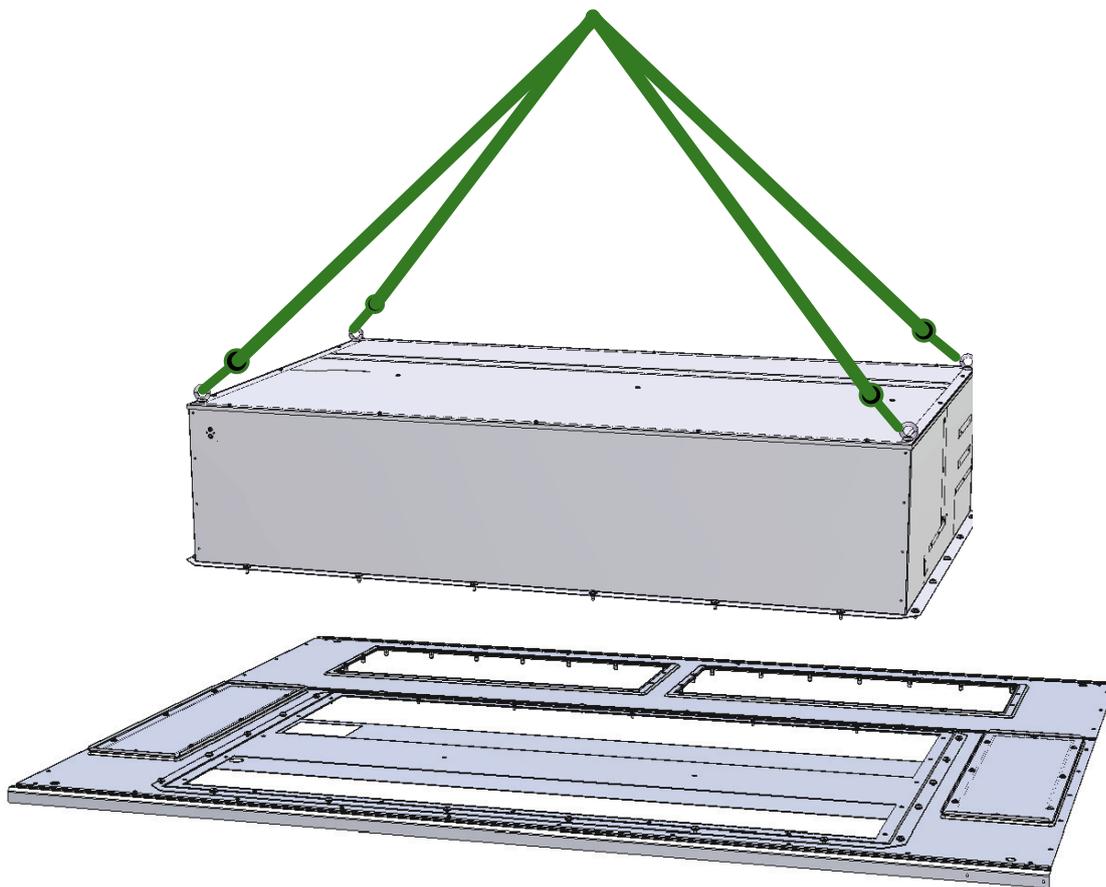


Figure 5-5 Lifting a cooling unit (example with IP54 unit)

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|----------|---------------|----------------|------|-------|--------|
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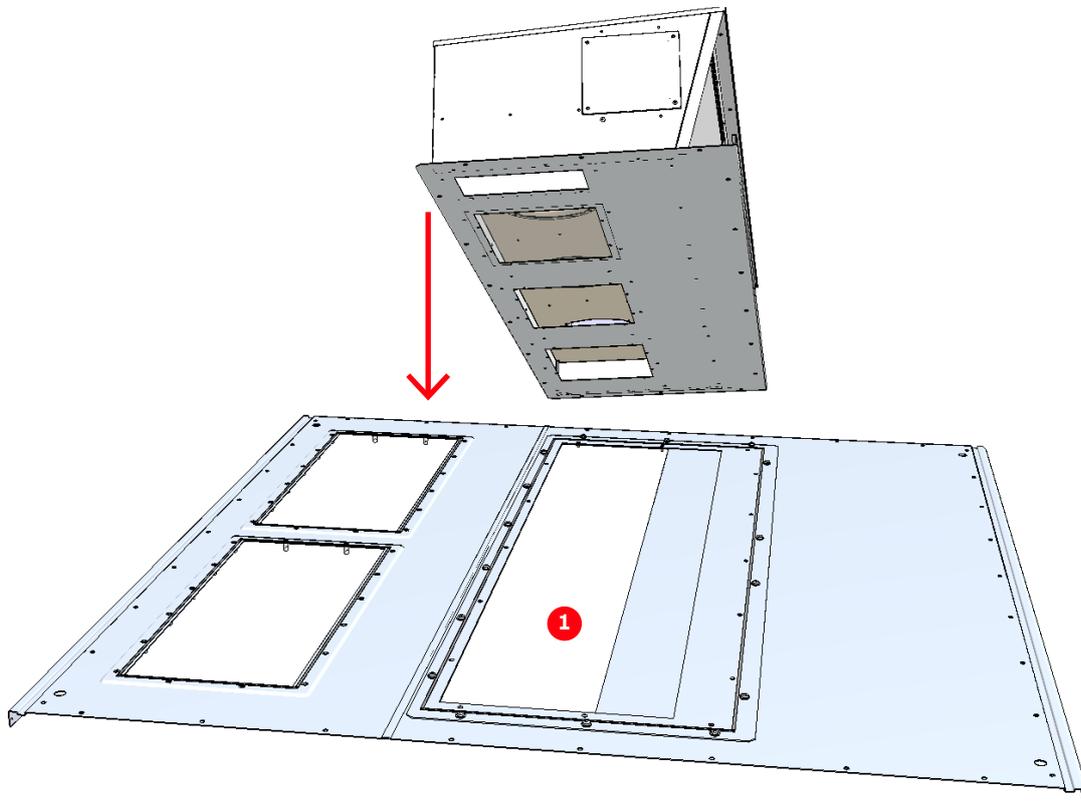
### 5.10.2. Installing IP42 roof-mounted cooling units

One by one, install the IP42 roof-mounted cooling units on top of the PCU compartments that have the designated openings.

Table 5-2 Installation material per IP42 unit

| Item                     | Quantity | Details         |
|--------------------------|----------|-----------------|
| Self-tapping Torx screws | 18       | M6x16           |
| Washers with sealing     | 18       | 6.8x1 (4.8x2.8) |
| Cable binders            |          |                 |

1. Align the unit with the opening (1) in the cabinet roof.



2. Slowly lower the cooling unit onto the cabinet roof.  
**IMPORTANT!** Make sure that the screw holes fit.
3. Screw the cooling unit to the cabinet roof.
4. To get to the cable inside the cabinet, remove the back wall if necessary to reach them from the back.

5. Route the cables along the pre-installed white cable brackets and through the designated openings (1) into the front of the cable duct.

Use cable binders to fix the cables to the cable brackets.

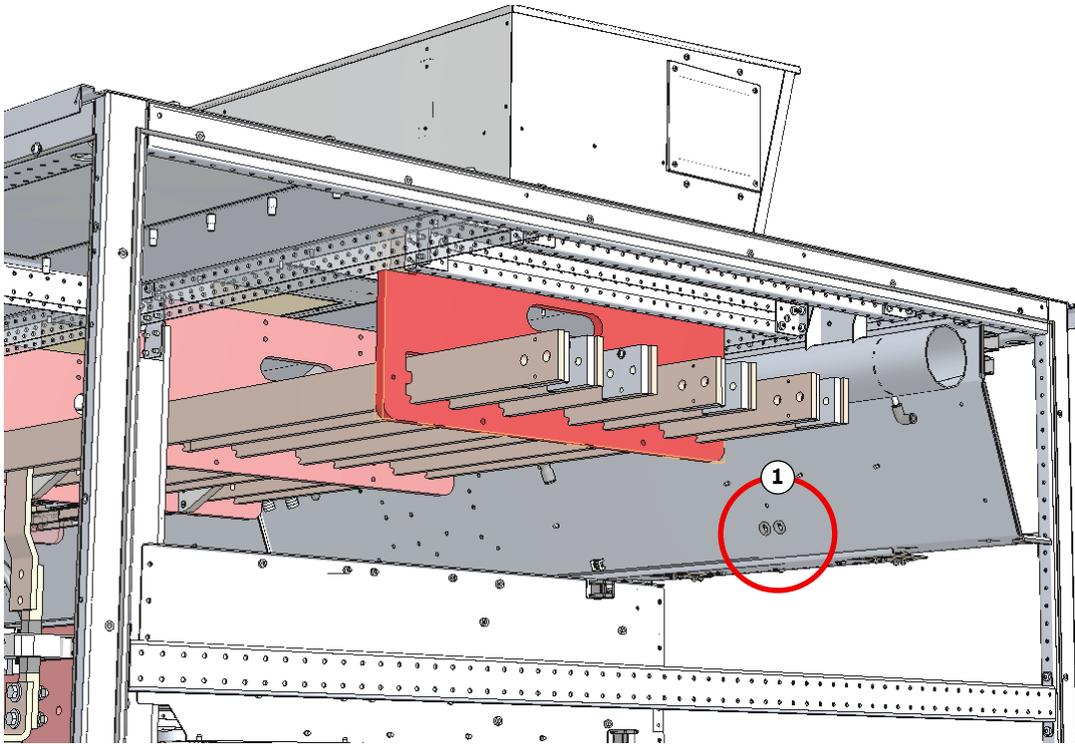


Figure 5-6 Cable duct openings (example with 1700 mm PCU)

6. In the cable duct at the front, connect the cables according to “Appendix D - Wiring diagrams”.

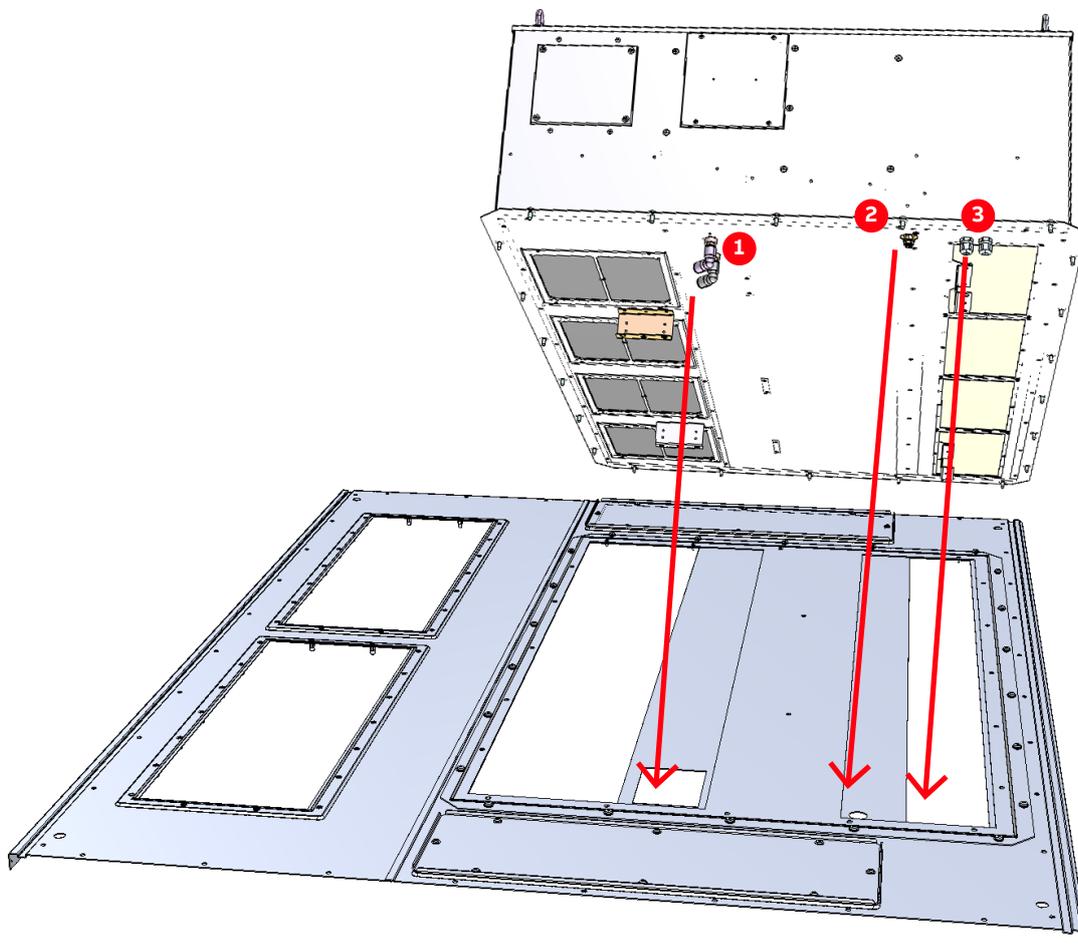
### 5.10.3. Installing IP54 roof-mounted cooling units

One by one, install the IP54 roof-mounted cooling units on top of the PCU compartments that have the designated openings.

Table 5-3 Installation material per IP54 unit

| Item                     | Quantity | Details         |
|--------------------------|----------|-----------------|
| Self-tapping Torx screws | 22       | M6x16           |
| Washers with sealing     | 22       | 6.8x1 (4.8x2.8) |
| Tube spacers             | 2        |                 |

1. Align the water inlet / outlet (1), drain outlet (2), and cables (3) of the unit with the designated openings in the cabinet roof.



2. Slowly lower the cooling unit onto the cabinet.  
Make sure that the water inlet / outlet, the drain outlet, the cables and the screw holes fit.
3. Screw the cooling unit to the cabinet roof.
4. To get to the water inlet / outlet and the drain outlet from inside the cabinet.
  - Try to reach them from underneath the cable duct at the front
  - Remove the back wall if necessary to reach them from the back.

5. Connect the tube from the return pipe (Fig. 5-7: 5) to the water outlet (Fig. 5-7: 1).  
The tubes are transparent. The colors used in Fig. 5-7 are for illustration only.
6. Seen from the back, the water outlet is on the left. Seen from the front, the water outlet is on the right.
7. Connect the tube from the feed pipe (at bottom of cabinet) to the water inlet (Fig. 5-7: 2).
8. Seen from the back, the water inlet is on the right. Seen from the front, the water inlet is on the left.
9. Connect the drain tube to the drain outlet (Fig. 5-7: 3).  
The drain tube guides condensation water to the cabinet floor.

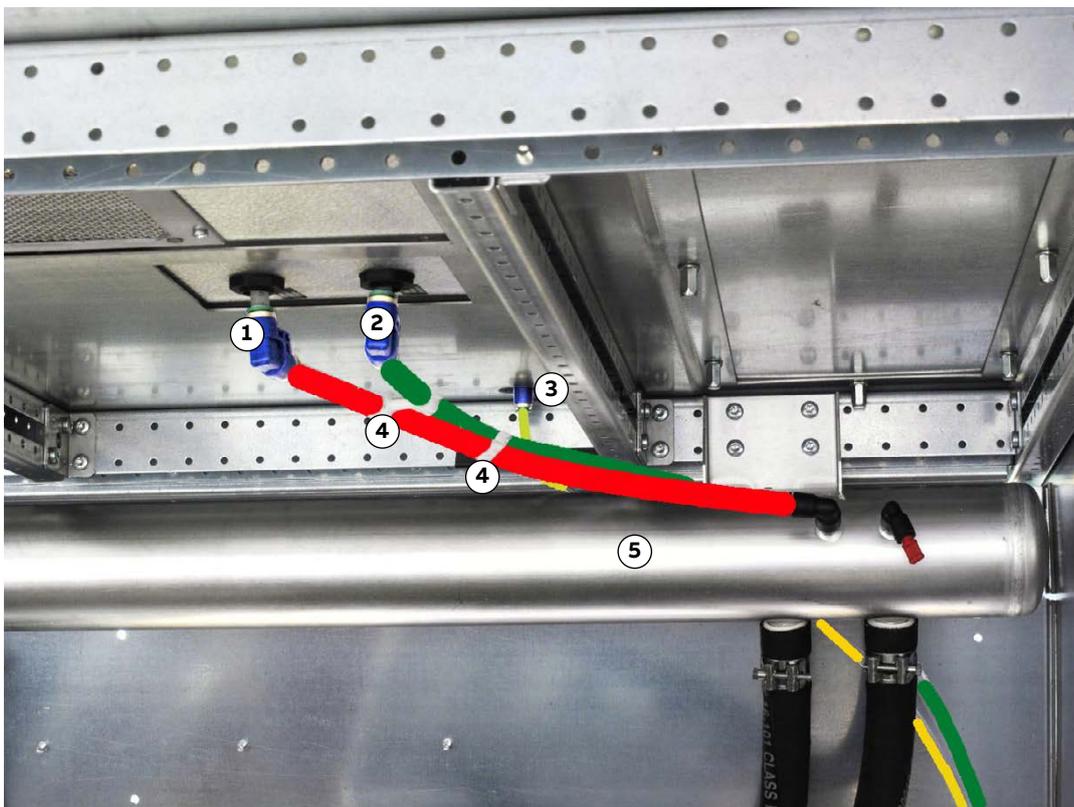


Figure 5-7 Water inlet / outlet and drain outlet (back view)

10. Install the two white spacers (Fig. 5-7: 4) between the inlet and outlet tube.
11. In the cable duct at the front, connect the cables according to the Wiring Diagram in “Appendix D - Wiring diagrams”.

## 5.11. Installing roof attachments

This section applies to marine drives.

To prevent tilting and dampen vibrations, attach the drive to the ceiling or the back wall of the drive room according to the instructions. For information on the fitting location, see “Appendix D - Wiring diagrams”.

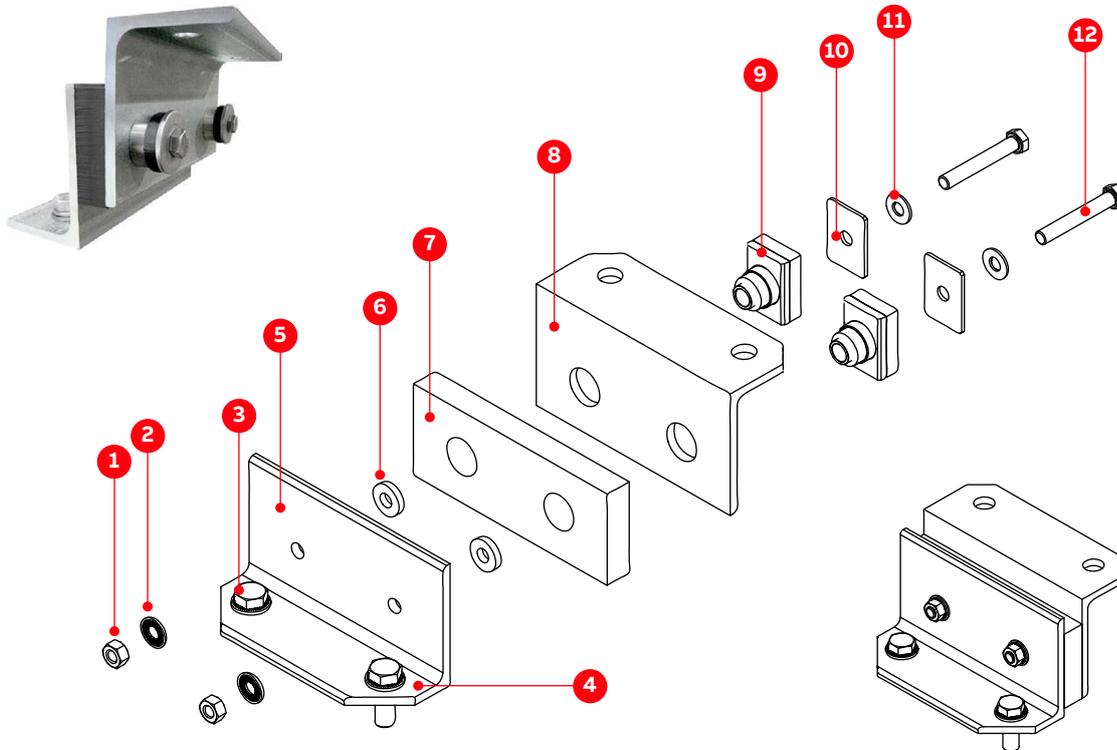


Figure 5-8 Roof attachment

| Item | Details                | ID number       |                 |
|------|------------------------|-----------------|-----------------|
| 1)   | 2 x nuts               | M12             | HZN 452198P1022 |
| 2)   | 2 x washers            | 13 / 29 ST / ZN | 9ABA450078P0007 |
| 3)   | 2 x washers            | 17x30x3         | 9ABA450078P0008 |
| 4)   | 2 x hex-head bolts     | M16x40          | NB 312350P0464  |
| 5)   | 1 x bracket            |                 | 3BHB035997R0002 |
| 6)   | 2 x spacers            |                 | 3BHB032466R0001 |
| 7)   | 1 x damping pad        |                 | 3BHB035998R0001 |
| 8)   | 1 x bracket            |                 | 3BHB035997R0001 |
| 9)   | 2 x damping connectors |                 | 3BHB033405R0001 |
| 10)  | 2 x plates             |                 | 3BHB035999R0001 |
| 11)  | 2 x washers            | 13 / 29 ST / ZN | 9ABA450078P0007 |
| 12)  | 2 x hex-head bolts     | M12x80          | NB 312450P8127  |

1. Assemble the roof attachment.
2. Tighten the bolts firmly.
3. To fix the drive to the ceiling or the back wall, use two suitable struts per roof attachment (the struts are not part of the scope of delivery).

**WARNING!** DO NOT install the struts at a 90° angle to the cabinet roof (Fig. 5-9).

4. If you fix the drive to the ceiling, use two struts per roof attachment (1 in Fig. 5-9).
5. If you fix the drive to the back wall, install one strut in a 90° angle to the drive (2 in Fig. 5-9).

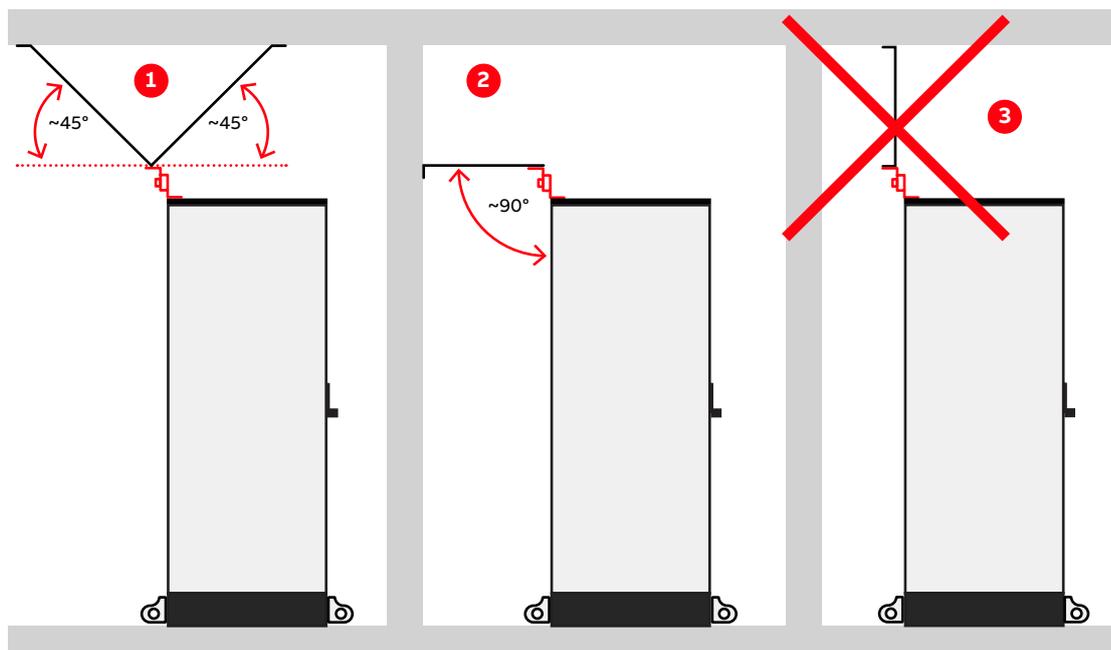
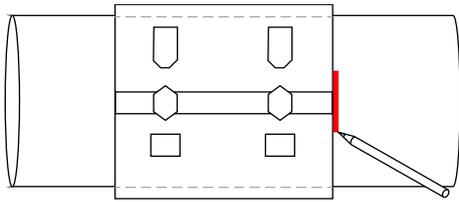


Figure 5-9 Recommended ceiling and wall fixings

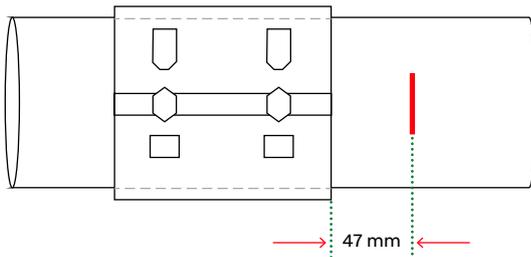
- |  |   |
|--|---|
| <ol style="list-style-type: none"> <li>1) Two struts at 45° to ceiling</li> <li>2) One strut at 90° to wall</li> </ol> | <ol style="list-style-type: none"> <li>3) Do not install the struts at a 90° angle to the cabinet roof</li> </ol> |
|--|---|

## 5.12. Joining water pipes

1. Mark the length of a pipe joint on one end of a water pipe as a fitting guide.



2. Slide the pipe joint over the two adjoining pipe ends.
3. Center the pipe joint.



4. After adjusting a pipe joint, alternately tighten the bolts lightly.
5. Tighten the bolts to the torque indicated on the pipe joint.

### 5.12.1. Removing a pipe joint

If you need to remove a pipe joint, proceed as follows:

1. Loosen the bolts alternately but do not remove them completely.
2. Slide the pipe joint to the side.
3. The sealing lip may touch the pipe end.
4. Turn and move the pipe joint smoothly.
5. Clean the pipe joint and treat the bolts with an appropriate lubricant before refitting.

## 5.13. Joining busbars

There are three types of busbars that need to be joined:

- AC busbars (Fig. 5-10: 1)
- PE ground busbar (Fig. 5-10: 2)
- DC busbars (Fig. 5-10: 3)

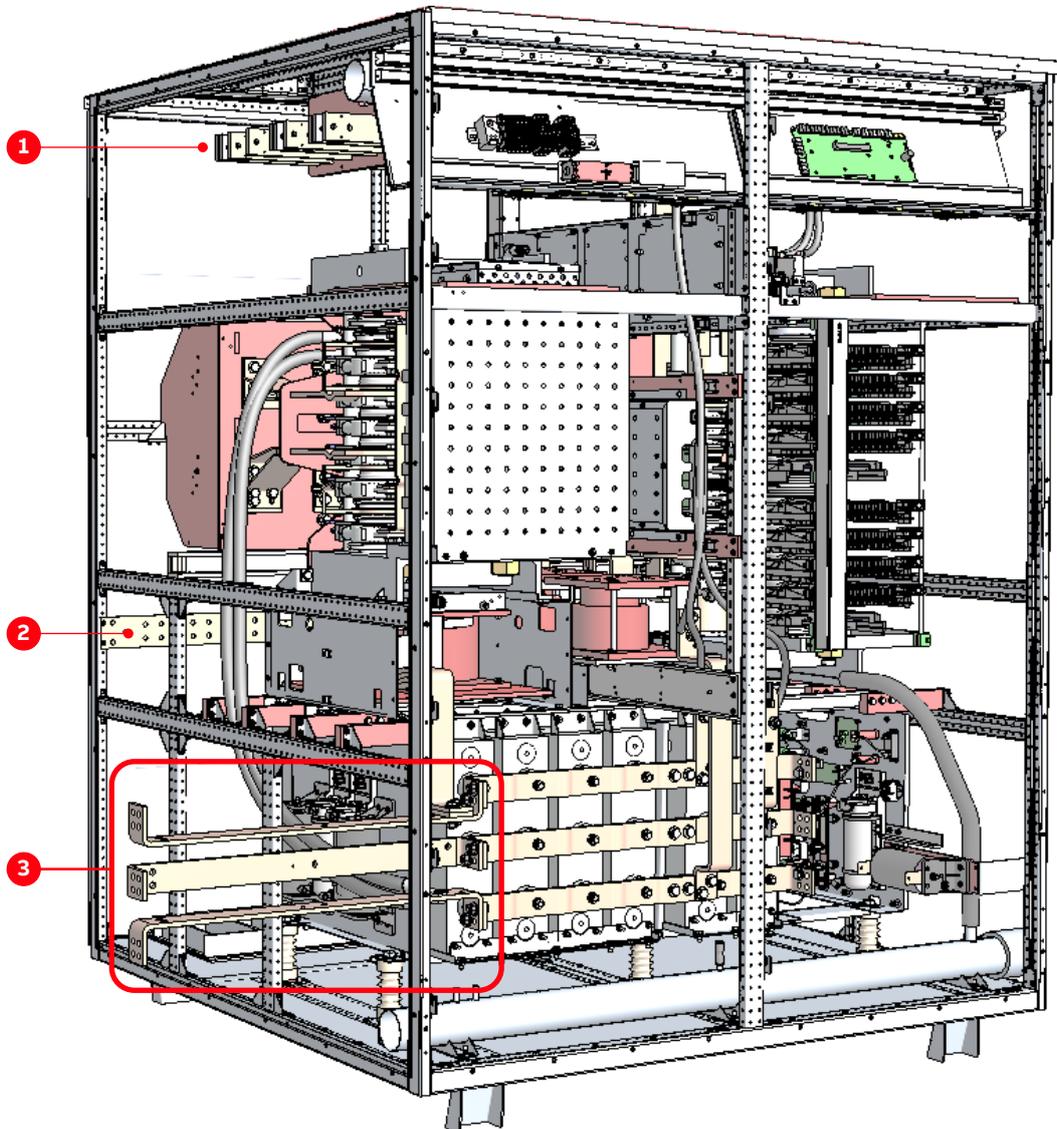


Figure 5-10 Busbar connections

1. Before installing the joining pieces, grease the bolts to maintain the required contact pressure.
2. Join the busbars.
3. Tighten the bolts to the torque of 40 Nm.

| PRODUCT | DOCUMENT KIND | DOCUMENT ID.   | REV. | LANG. | PAGE   |
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### AC busbars

The joining pieces of the AC busbars and related installation material are mounted at one of the busbar ends in the transport units.

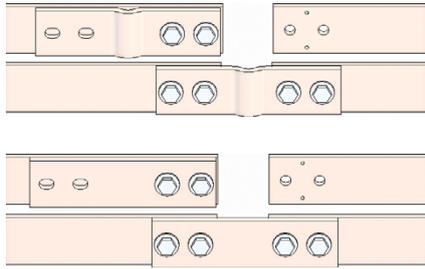


Figure 5-11 AC busbar connection

### PE ground busbar

The joining pieces of the PE ground busbar and related installation material are mounted at one of the busbar ends in the transport units.

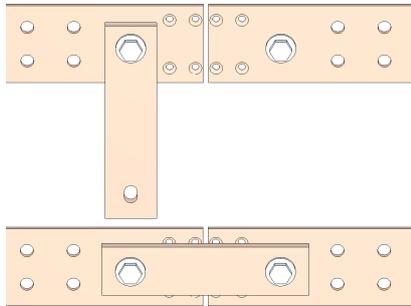


Figure 5-12 PE ground busbar connection

### DC busbars

The joining pieces of the DC busbars are deposited inside the transport units. Related installation material is mounted at one of the busbar ends in the transport units.

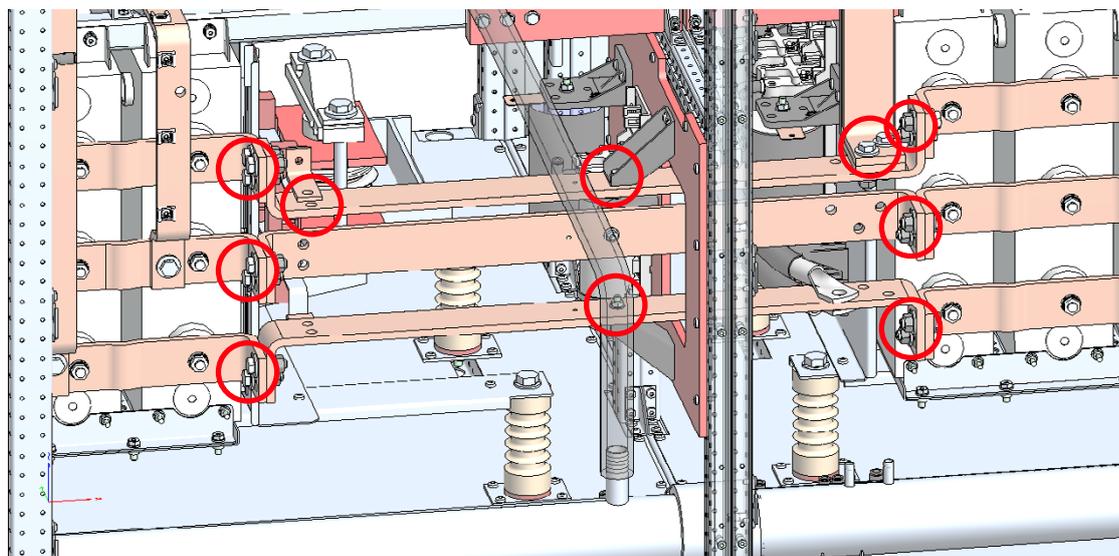


Figure 5-13 DC busbar connection

| PRODUCT  | DOCUMENT KIND | DOCUMENT ID.   | REV. | LANG. | PAGE   |
|----------|---------------|----------------|------|-------|--------|
| ACS5000W | User manual   | 3BHS799208 E01 | F    | en    | 82/178 |

## 5.14. Connecting the heating cable

This section applies to drives that are delivered in several transport units and are equipped with a heating cable.

- Connect the heating cables of two adjoining transport units with each other.
- Fasten the connectors with cable ties.

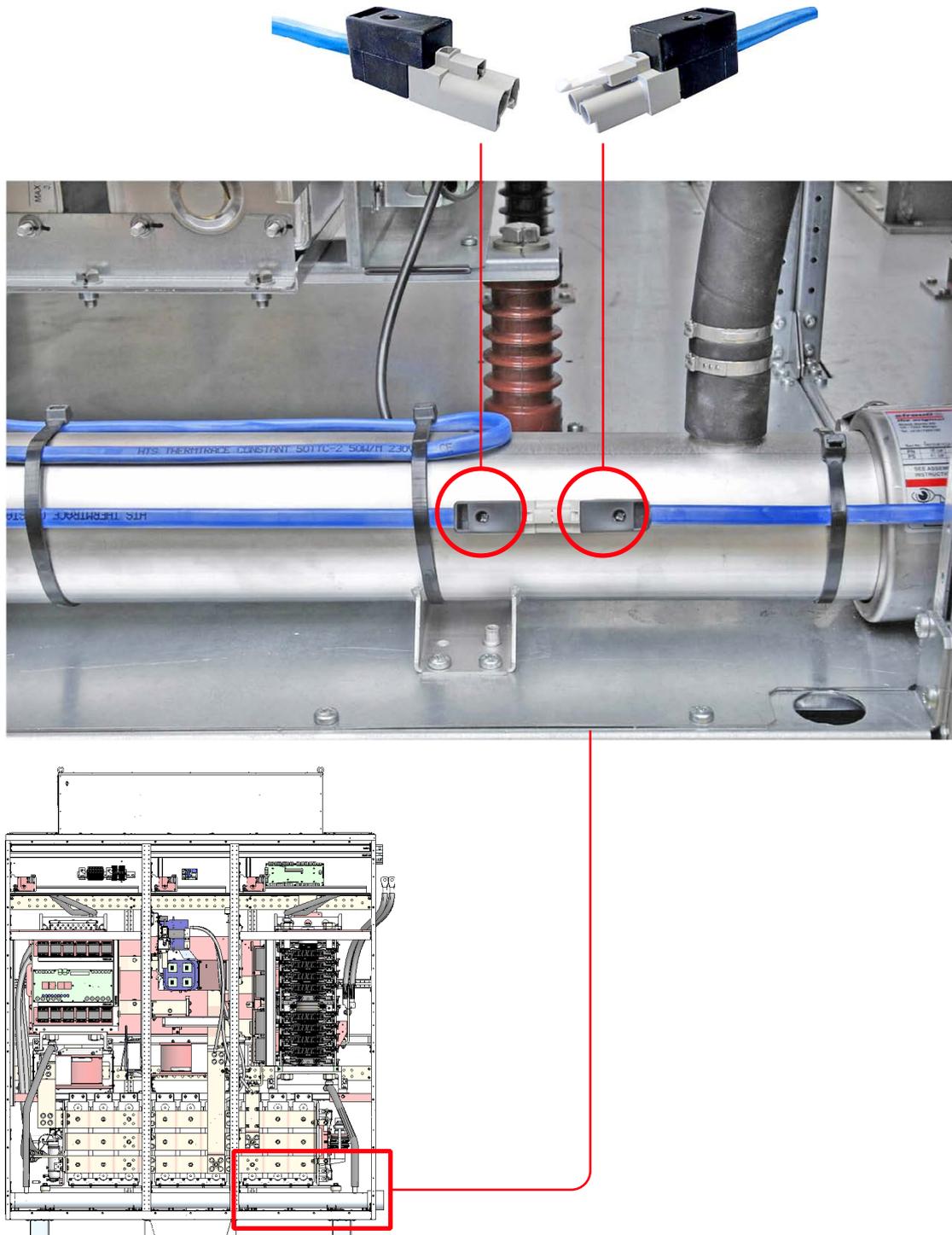


Figure 5-14 Heating cable connection

| PRODUCT  | DOCUMENT KIND | DOCUMENT ID.   | REV. | LANG. | PAGE   |
|----------|---------------|----------------|------|-------|--------|
| ACS5000W | User manual   | 3BHS799208 E01 | F    | en    | 83/178 |

## 5.15. Connecting raw water pipes

Connect the incoming and outgoing raw water pipes to the flanges of the water cooling unit.

Installation material such as counter flanges, bolts, nuts and seals are supplied.

For dimensions of the raw water entry and the flanges, see “Appendix C - Mechanical drawings”.

## 5.16. Fixing the drive to the floor

The base frame provides holes for fixing the drive to the floor. Floor fixings are not supplied. Bolts and nuts of size M16 are recommended.



| PRODUCT  | DOCUMENT KIND | DOCUMENT ID.   | REV. | LANG. | PAGE   |
|----------|---------------|----------------|------|-------|--------|
| ACS5000W | User manual   | 3BHS799208 E01 | F    | en    | 84/178 |

## 6. Electrical installation

### 6.1. Safety



#### **DANGER** Hazardous voltage!

Improper work can lead to life-threatening injury or DEATH!

- The electrical installation must be carried out by qualified personnel according to the site and equipment requirements, and the relevant electrical codes.
- When the electrical installation is completed, the main and auxiliary power supply to the drive must not be switched on without the consent of the ABB commissioning personnel.
- Take appropriate measures to prevent the main and auxiliary power supply from being switched on during installation.

### 6.2. Overview

The installation includes the following items:

- “6.4 Grounding” on page 86
- “6.5 Internal wiring” on page 91
- “6.6 Cable entries” on page 95
- “6.7 Power cables, ground cables, equipotential bonding conductor” on page 99
- “6.8 Auxiliary power cables and control cables” on page 106

### 6.3. Cable requirements

#### 6.3.1. Power cables

For information on the requirements for power cables, ground cable and equipotential bonding conductor, see:

- ACS5000 power cable specification
- Power cables engineering guideline

#### 6.3.2. Auxiliary and control cables

##### **NOTICE** Risk of false signals!

- DO NOT lay control cables in parallel to the power supply cables.  
If this cannot be avoided, a minimum distance of 30 cm must be maintained between control and power supply cables.
- Cross control and power supply cables at an angle of 90°

For information on the requirements for the auxiliary power cable and the control cables, see “Auxiliary power and control cables guideline”

| PRODUCT  | DOCUMENT KIND | DOCUMENT ID.   | REV. | LANG. | PAGE   |
|----------|---------------|----------------|------|-------|--------|
| ACS5000W | User manual   | 3BHS799208 E01 | F    | en    | 85/178 |

## 6.4. Grounding

The cabinet is equipped with ground buses (marked PE, Protective Earth) for grounding the armor and shields of the cables, and for the connection of the ground cable.

To identify the ground buses, see “Appendix C - Mechanical drawings”.

### 6.4.1. Grounding the transformer and an 18-pulse drive

Fig. 6-1 shows the grounding connections of an 18-pulse drive and an input transformer in the PCU compartments.

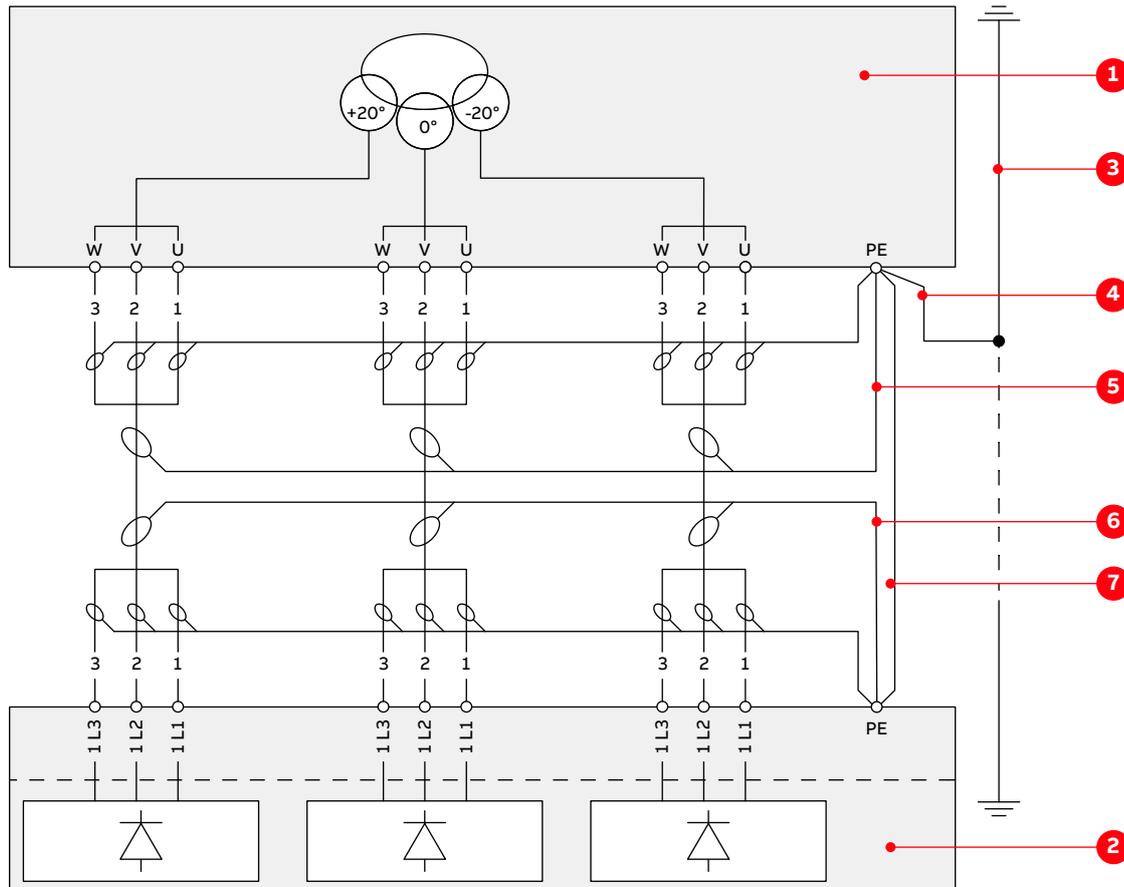


Figure 6-1 Grounding the transformer and an 18-pulse drive (in PCU)

- |   |                                    |
|---|------------------------------------|
| 1) Input transformer                      | 5) Cable screen                    |
| 2) Drive                                  | 6) Cable shield                    |
| 3) Grounding network of installation site | 7) Equipotential bonding conductor |
| 4) Ground cable                           |                                    |

## 6.4.2. Grounding the transformer and a 36-pulse drive

Fig. 6-2 shows the grounding connections of a drive and an input transformer in the PCU compartments.

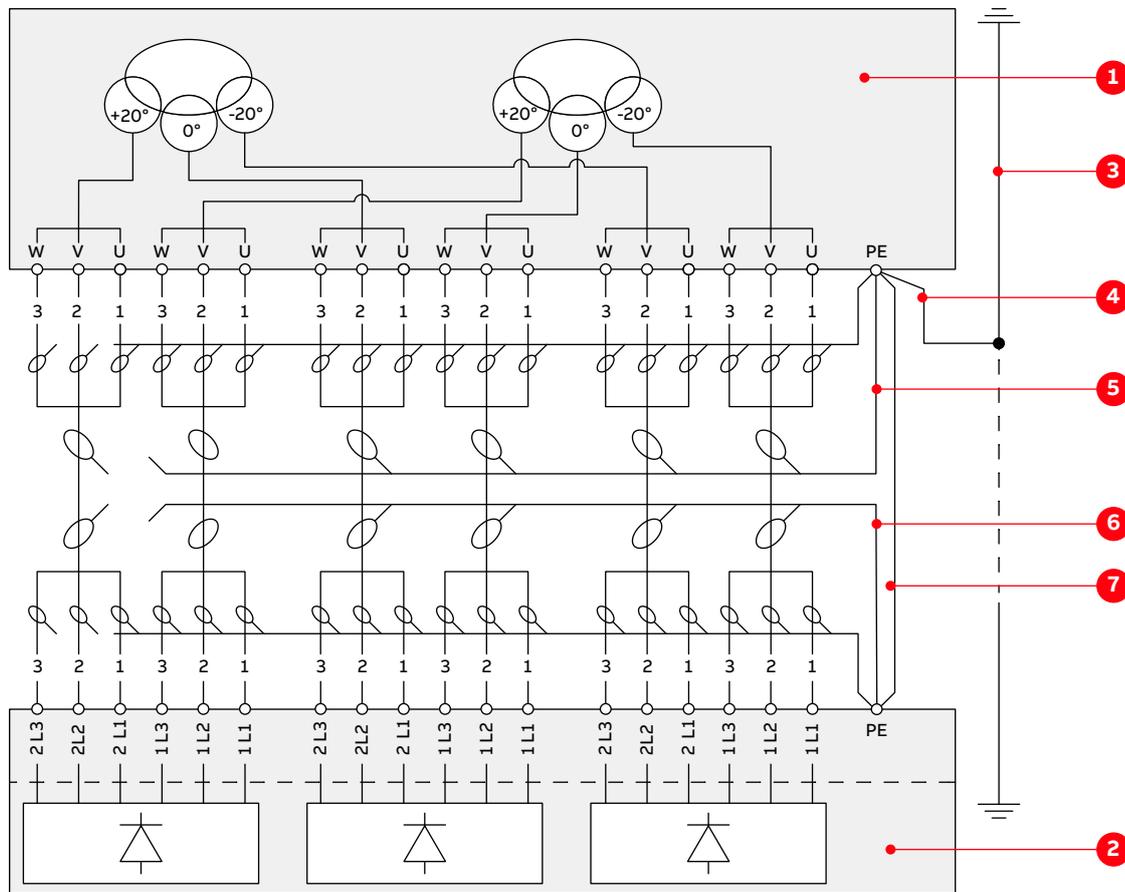


Figure 6-2 Grounding the transformer and a 36-pulse drive (in PCU)

- |   |                                    |
|---|------------------------------------|
| 1) Input transformer                      | 5) Cable screen                    |
| 2) Drive                                  | 6) Cable shield                    |
| 3) Grounding network of installation site | 7) Equipotential bonding conductor |
| 4) Ground cable                           |                                    |

### 6.4.3. Grounding the drive and the motor (multi-point bonding)

Fig. 6-3 shows the multi-point connections to ground a drive and a motor in the COU compartment.

For more information see the “Power cables engineering guideline” (3BHS542290 E01).

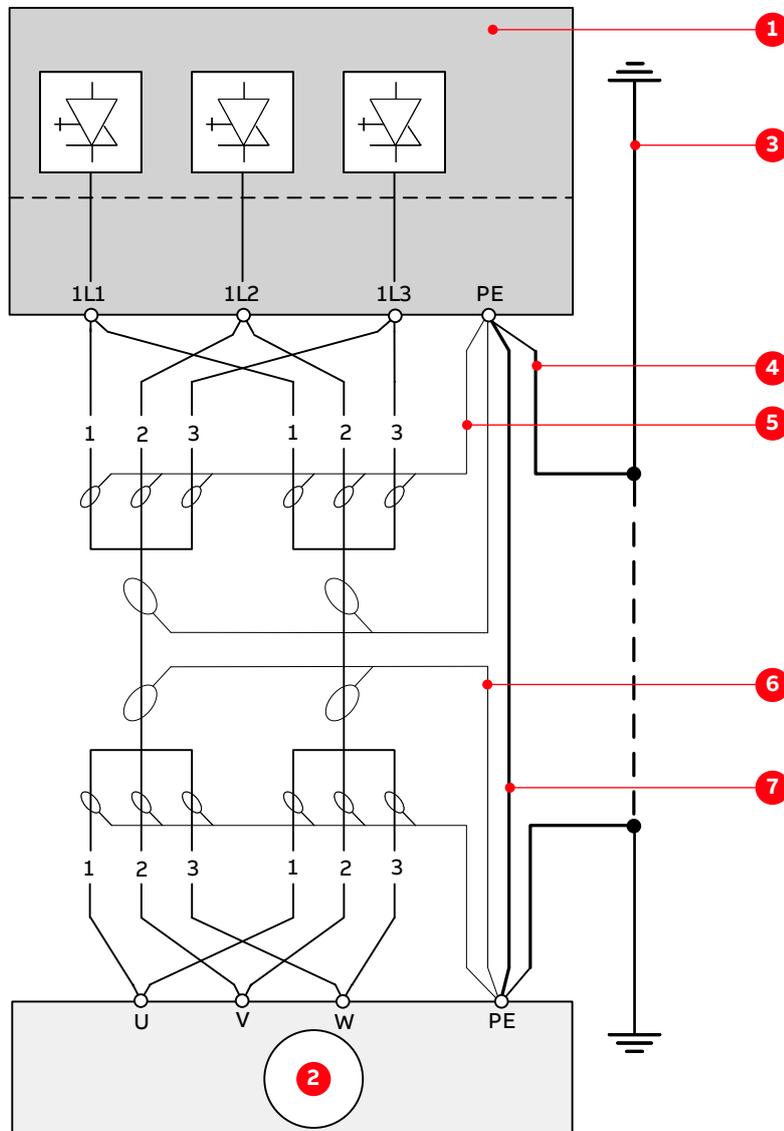


Figure 6-3 Grounding the drive and the motor (multi-point bonding)

- |   |                                    |
|---|------------------------------------|
| 1) Drive                                  | 5) Cable screen                    |
| 2) Motor                                  | 6) Cable shield                    |
| 3) Grounding network of installation site | 7) Equipotential bonding conductor |
| 4) Ground cable                           |                                    |

### 6.4.4. Grounding the drive and the motor (single-point bonding)

Fig. 6-4 shows the single-point bonding connections to ground a drive and a motor in the COU compartment.

For more information see the “Power cables engineering guideline” document.

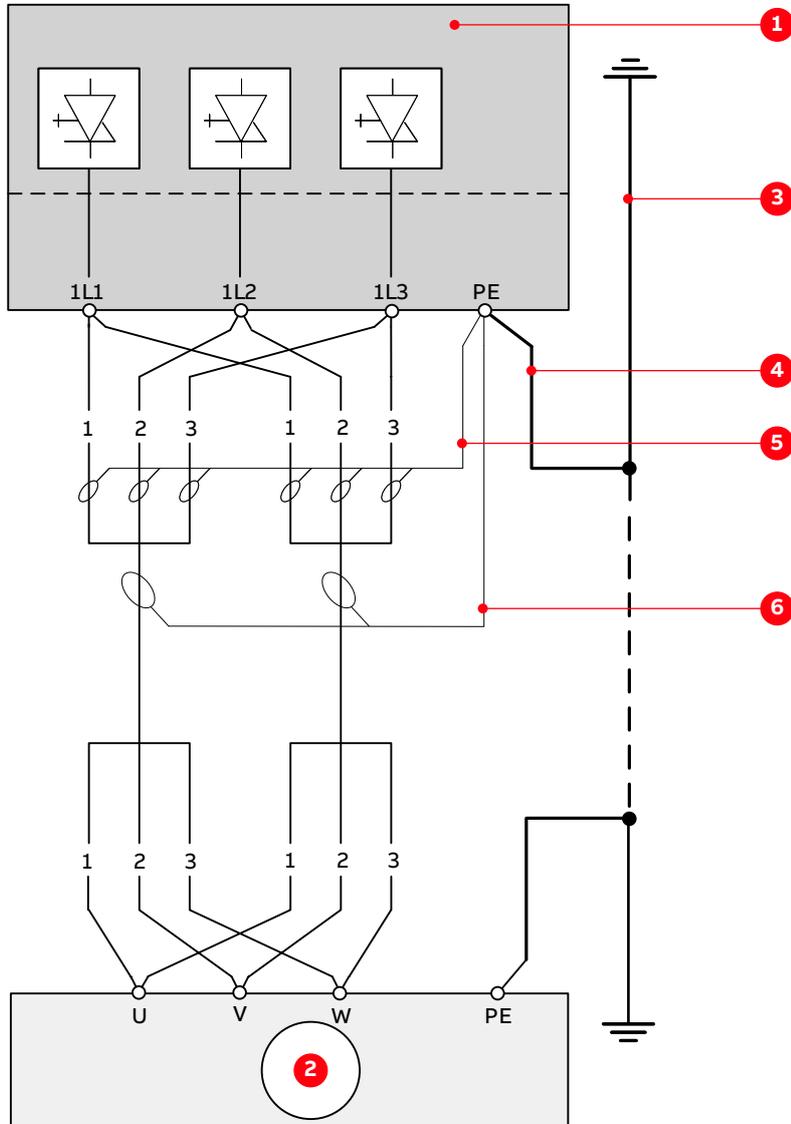


Figure 6-4 Grounding the drive and the motor (single-point bonding)

- |   |                 |
|---|-----------------|
| 1) Drive                                  | 4) Ground cable |
| 2) Motor                                  | 5) Cable screen |
| 3) Grounding network of installation site | 6) Cable shield |

### 6.4.5. Ground cable connection

The ground cable enters the COU compartment from the top or from the bottom. It connects to the PE ground busbar of the adjoining PCU compartment. The ground busbar spans across the entire length of the drive (Fig. 6-5, Fig. 6-6). The connection must be in compliance with local regulations. For project-specific illustrations, see “Appendix D - Wiring diagrams”.

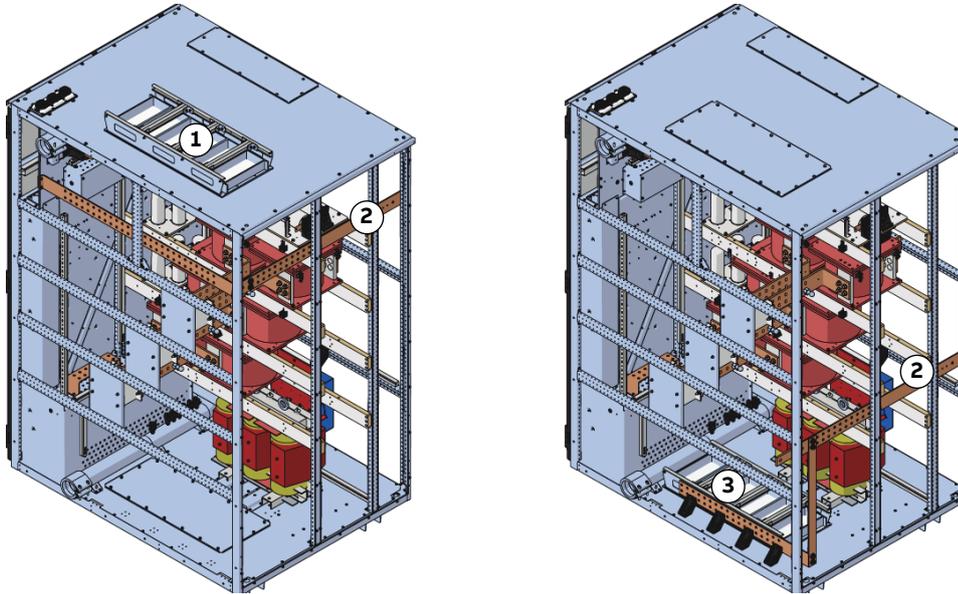


Figure 6-5 PE ground busbar in a COU

- 1) Top entry
- 2) PE ground busbar

- 3) Bottom entry

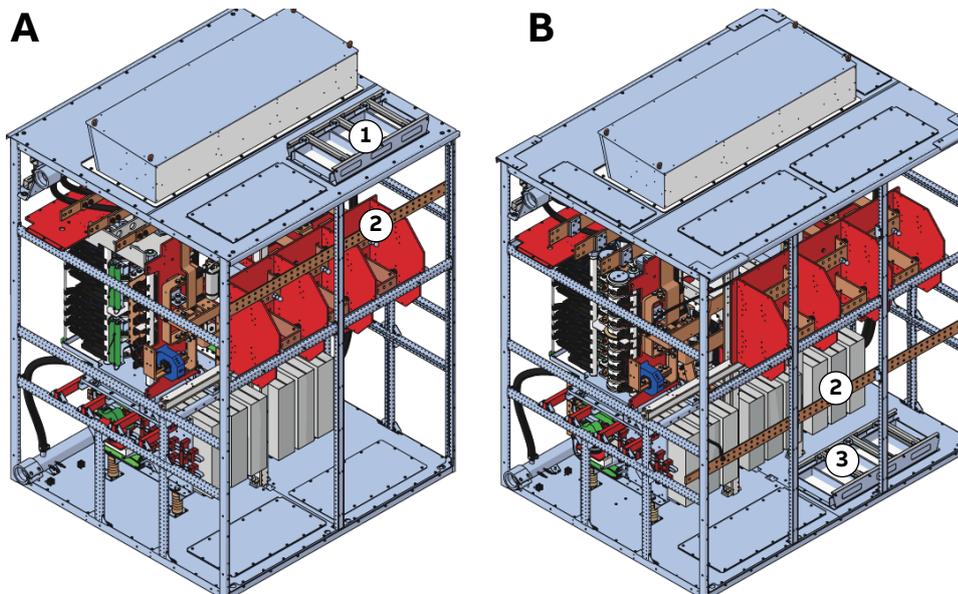


Figure 6-6 PE ground busbar in a PCU frame size 1 (A) and frame size 2 (B)

- 1) Top entry
- 2) PE ground busbar

- 3) Bottom entry

## 6.5. Internal wiring

For information on each individual connection, see the Converter hardware diagram in “Appendix D - Wiring diagrams”.

Internal wiring comprises all cabling and wiring across shipping splits, and includes:

- Signal cable connection
- Auxiliary power supply cable connection
- Optical fiber connections
- Arc Guard sensor cabling

Make the above mentioned connections through the cable duct in the upper part of the drive cabinet (Fig. 6-7 and Fig. 6-8).

Additionally there is one charging cable to be connected. The charging cable is located at the bottom of the drive cabinet behind the water pipe.

The cables and wires can be identified by their specific designation. All cables are prepared for connection and are also marked with the corresponding terminal designation.

| PRODUCT  | DOCUMENT KIND | DOCUMENT ID.   | REV. | LANG. | PAGE   |
|----------|---------------|----------------|------|-------|--------|
| ACS5000W | User manual   | 3BHS799208 E01 | F    | en    | 91/178 |

### 6.5.1. Optical fibers



#### **NOTICE** Risk of equipment failure!

Handle optical fibers with care. A damaged or incorrectly installed optical fiber cable can degrade data transmission and cause equipment failure.

- Only use the designated encoder cable conduit that passes through the drive to the EXU.

The conduit extends 10 – 20 mm from the entry plate of the drive.

- Cover the cable end with a cap BEFORE you pull the cable through the conduit.
- DO NOT exceed the maximum tensile load of 1.0 N and the minimum bend radius of 25 mm.
- When you tighten the cable ties DO NOT deform the optical fibers and DO NOT use a cable tie gun.
- Hold the connector when you connect or disconnect an optical fiber.

#### Optical fibers for internal arc protection

#### **NOTICE** Risk of cable damage.

Optical fiber cables are only available in standard lengths.

- DO NOT cut or extend the cables
- Wind up excess cable in coils with a minimum diameter of 100 mm.

Each unit with power cable entries and terminals is monitored for arc faults by the Arc Guard System™ with up to 4 detectors. See the project-specific “Converter hardware diagram” on page 392 for the exact number of detectors in each cubicle.

The Arc Guard unit and the HMI panel are in the COU (Fig. 3-15) and the detectors are pre-installed in the relevant cabinets. The optical fibers, which are coiled up beside the detectors, must be routed from the detectors to the Arc Guard unit in the COU.

| PRODUCT  | DOCUMENT KIND | DOCUMENT ID.   | REV. | LANG. | PAGE   |
|----------|---------------|----------------|------|-------|--------|
| ACS5000W | User manual   | 3BHS799208 E01 | F    | en    | 92/178 |

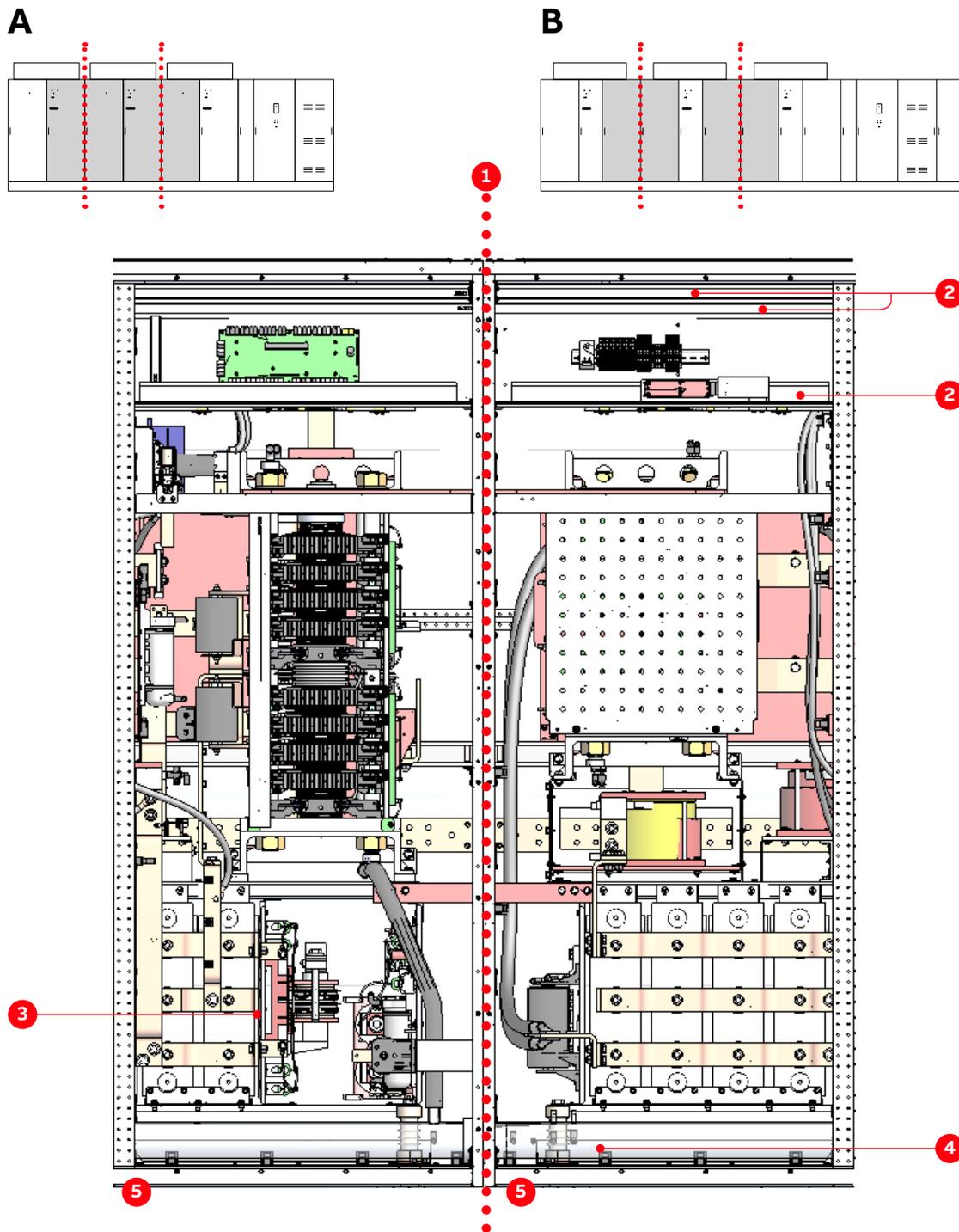


Figure 6-7 Wiring across shipping splits, frame size 1 (A) and 2 (B)

- 1) Shipping split PCUx1 – PCUx1
- 2) Cable ducts on each side of the shipping split for:
  - Auxiliary power supply cables
  - Optical fibers
  - Signal cables
- 3) Connection point for charging cable
- 4) Charging cable behind water pipe (not illustrated), laid on the brackets and connected to the busbar
- 5) PCUx1

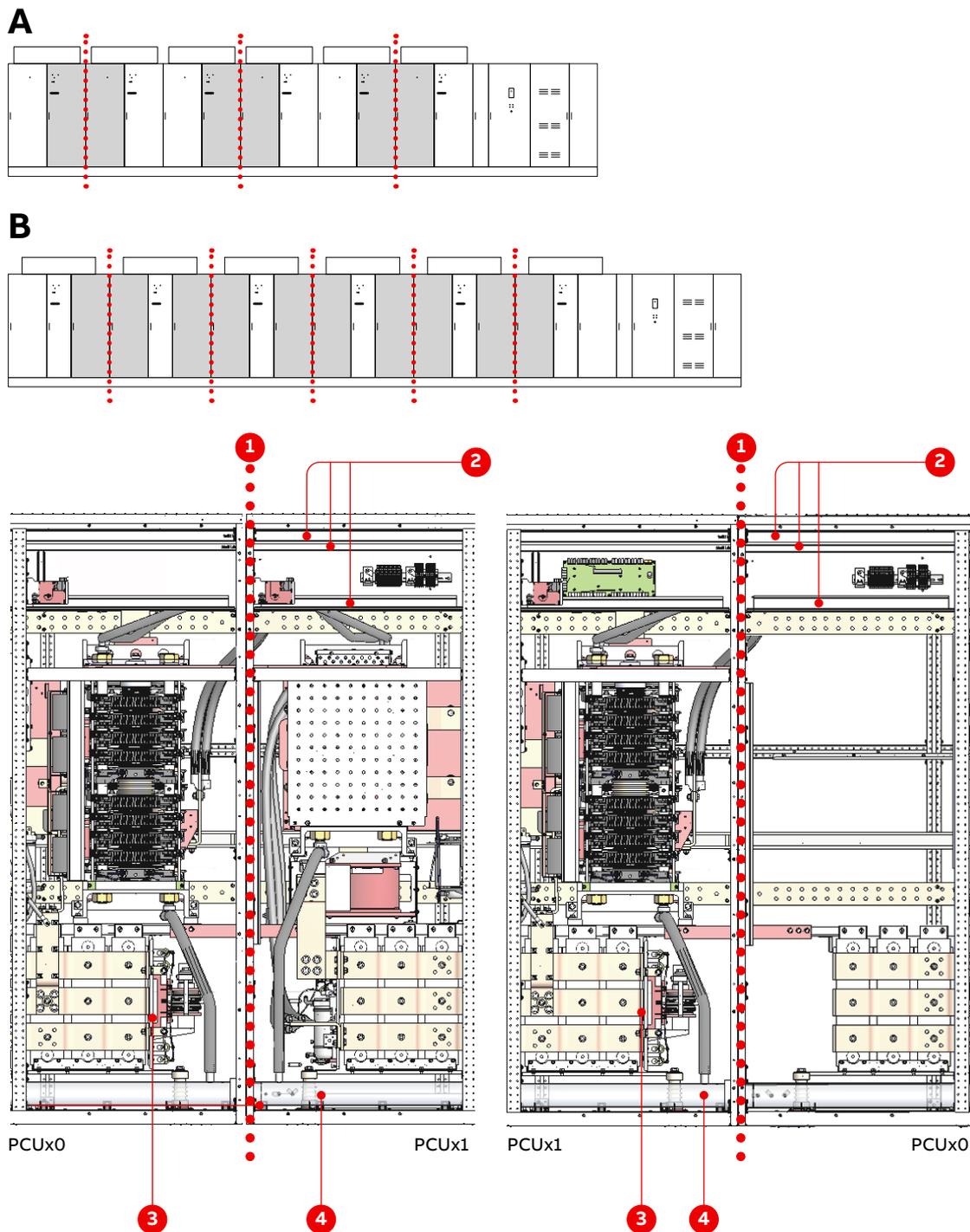


Figure 6-8 Wiring across shipping splits, frame size 3 and 4

- |  |   |
|--|---|
| 1) Shipping split                                      | 4) Charging cable behind water pipe (not illustrated), laid on the brackets and connected to the busbar |
| 2) Cable ducts on each side of the shipping split for: | 5) PCUx0  |
| • Auxiliary power supply cables                        | 6) PCUx1  |
| • Optical fibers                                       |   |
| • Signal cables  |   |
| 3) Connection point for charging cable                 |   |

## 6.6. Cable entries

The drive is prepared for top or bottom cable entry with one or a combination of the following cable entries:

- Cable entry with sealing modules, type 1
- Cable entry with cable glands

For information on the location and the dimensions of the cable entry, see “Appendix C - Mechanical drawings”.

### 6.6.1. Cable entry with sealing modules, type 1

- **Usage:** power cables, ground cables, bonding conductors
- **Included in delivery:** cable entry frame (Fig. 6-9: 1)
- **Not included in delivery:** sealing modules (Fig. 6-9: 2), accessories, tools

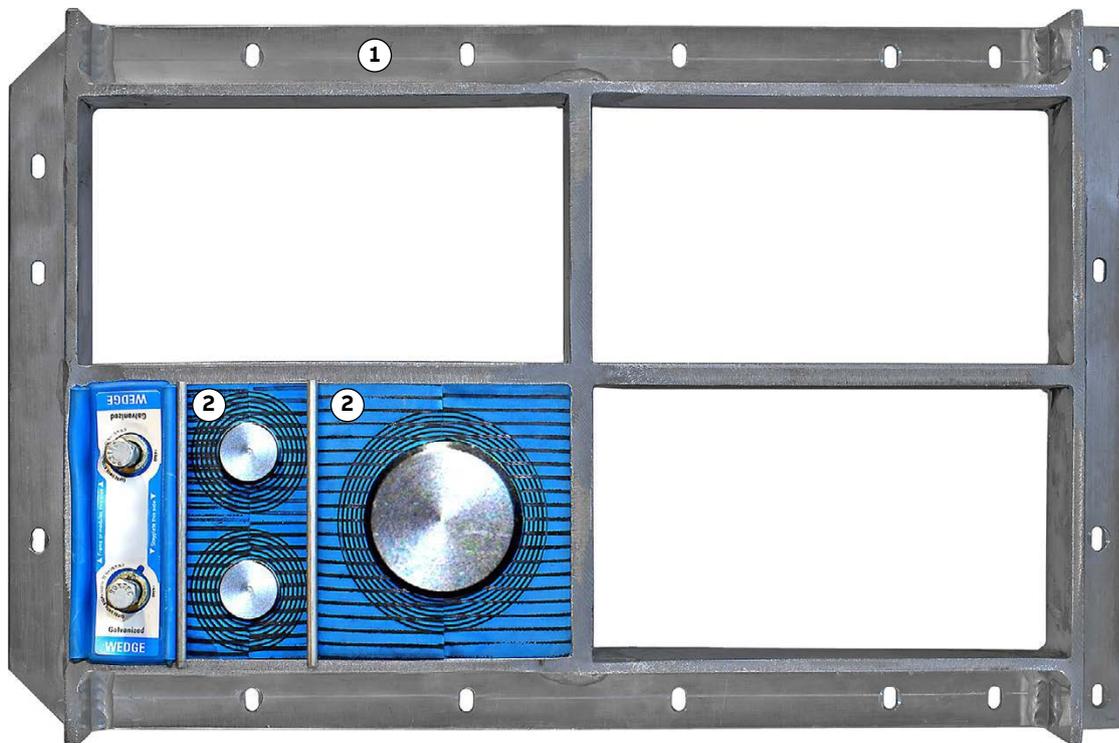
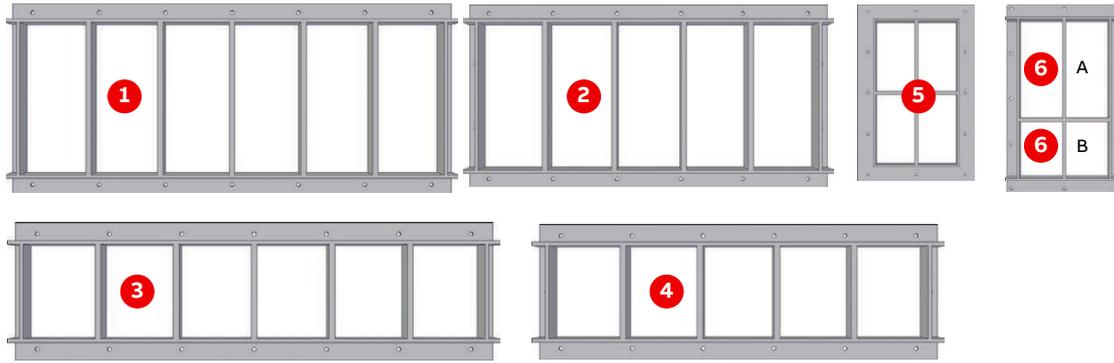


Figure 6-9 Cable entry with sealing modules – type 1

- |                           |                      |
|---------------------------|----------------------|
| 1) Compression wedge      | 1) Cable entry frame |
| 2) Sealing module (RM120) |                      |

Frame sizes (FS)



RM120



RM69



RM60

Figure 6-10 Cable entry frame sizes (top) for type 1 sealing modules (bottom)

Table 6-1 Type 1 sealing modules and cables per frame opening

| Frame              | 1        | 1        | 2        | 3    | 4    | 5   | 6A  | 6B  |
|--------------------|----------|----------|----------|------|------|-----|-----|-----|
| Location           | COU      | PCU      | PCU      | PCU  | PCU  | EXU | SBU | SBU |
| Cable entry top    | FS 2/4/6 | FS 2/4/6 | FS 1/3/5 | -    | -    | √   | √   | √   |
| Cable entry bottom | FS 2/4/6 | FS 2/4   | FS 1/3   | FS 6 | FS 5 | √   | √   | √   |

Table 6-2 Maximum number of type 1 sealing modules per frame opening

| Frame | 1 | 1 | 2 | 3 | 4 | 5 | 6A | 6B |
|-------|---|---|---|---|---|---|----|----|
| RM120 | 2 | 2 | 2 | 1 | 1 | 1 | 2  | 1  |
| RM90  | - | - | - | - | - | 2 | 2  | 1  |
| RM60  | 8 | 8 | 8 | 4 | 4 | 6 | 8  | 4  |

Table 6-3 Maximum number of cables per frame opening - 3 core

| Frame      | 1 | 1 | 2 | 3 | 4 | 5 | 6A | 6B |
|------------|---|---|---|---|---|---|----|----|
| ∅ 68-99 mm | 2 | 2 | 2 | 1 | 1 | 1 | 2  | 1  |
| ∅ 48-71 mm | - | - | - | - | - | 2 | 2  | 1  |

Table 6-4 Maximum number of cables per frame opening - single core

| Frame      | 1 | 1 | 2 | 3 | 4 | 5 | 6A | 6B |
|------------|---|---|---|---|---|---|----|----|
| ∅ 28-50 mm | 8 | 8 | 8 | 4 | 4 | 6 | 8  | 4  |

### 6.6.2. Cable entry with sealing modules, type 2

- **Usage:** auxiliary power cables and control cables
- **Included in delivery:** frame (Fig. 6-11: 1)



Figure 6-11 Cable entry with sealing modules – type 1

- **Supplier:** Roxtec AB (roxtec.com)
- **Not included in delivery:** EMC sealing inserts (Fig. 6-9: 2), installation tools, accessories

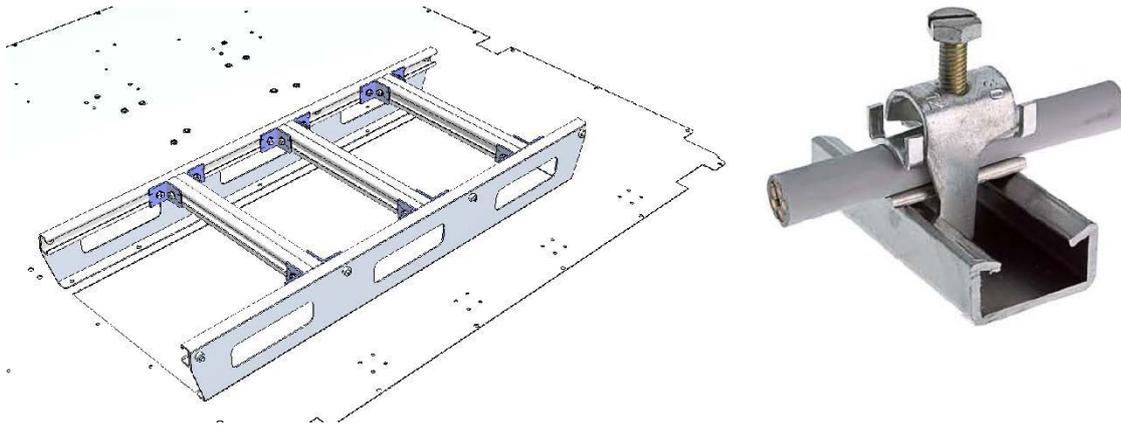
### 6.6.3. Cable entry with cable glands

- **Usage:** power cables, ground cables, bonding conductors, auxiliary power cables, control cables
- **Included in delivery:** undrilled plate for cable glands



Figure 6-12 Cable entry with cable gland

- **Cable strain reliefs:** (C-rails).



- **Not included in delivery:** cable glands, tools, cable clamps, accessories

#### 6.6.4. Cable entry with EMC plates

- **Usage:** power cables, ground cables, bonding conductors, auxiliary power cables, control cables
- **Included in delivery:** galvanized plate with EMC mesh (Fig. 6-13: 1) and sealing grommets (Fig. 6-13: 1)

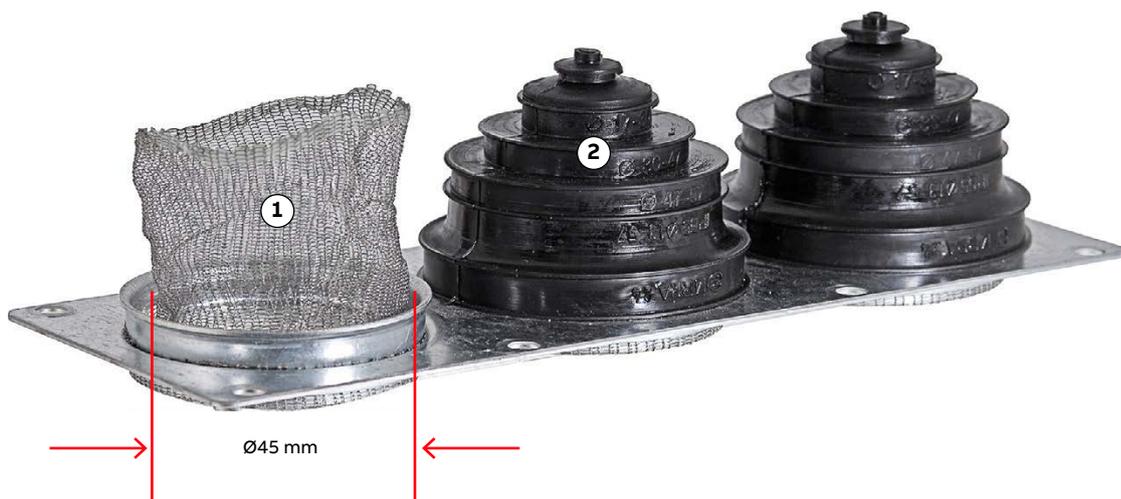


Figure 6-13 Cable entry with EMC plates

## 6.7. Power cables, ground cables, equipotential bonding conductor

See “Appendix A - Additional manuals” for information on:

- Project-specific cable entry
- Distance between point of cable entry and terminals
- Busbar and fastening hole dimensions
- Installation instructions for sealing modules

See “Appendix D - Wiring diagrams” for information on:

- Designation, cross-reference and device identification conventions
- Transformer cables and motor cables and their corresponding connections

### 6.7.1. Preparing the cable entry and the cables



#### **NOTICE** Risk of damage or malfunction!

Waste inside the cabinet can cause damage or malfunction.

- If possible, do not cut cables inside the terminal compartment.
- Retrieve any waste which accidentally dropped into the cabinet.

#### 6.7.1.1. Determining the cable length

1. Determine the required length of a cable between the point of entry and the connection point inside the cabinet.
2. Cut the cable to the required length before connection.

### 6.7.1.2. Preparing cables for cable entries with cable glands

Prepare cables with an outer cable screen or shield for EMC bonding with the metal enclosure of the cabinet as illustrated.

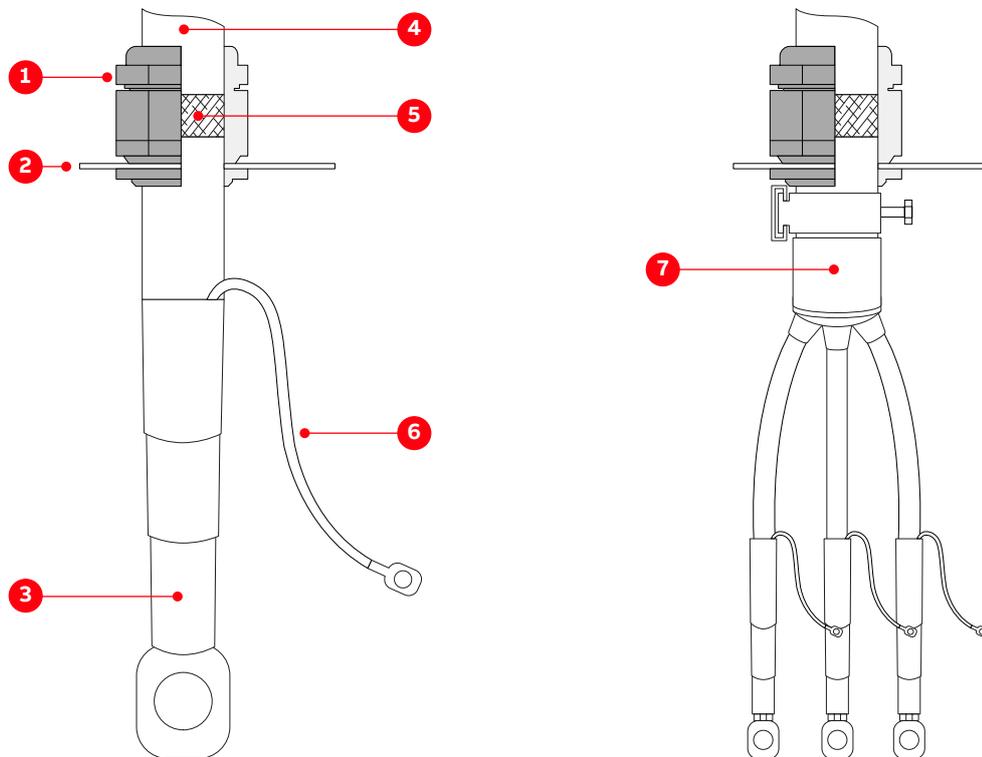


Figure 6-14 Preparing power cables for cable glands

- |                                |   |
|--------------------------------|---|
| 1) Cable gland                 | 5) Conductor insulation removed to expose cable shield        |
| 2) Plate                       | 6) Cable screen extension to be connected to PE ground busbar |
| 3) Heat-shrinkable termination | 7) Sheath seal  |
| 4) Outer cable sheath          |   |

### 6.7.1.3. Preparing cables for cable entries with sealing modules

Prepare cables with an outer cable screen or shield for EMC bonding with the metal enclosure of the cabinet as illustrated.

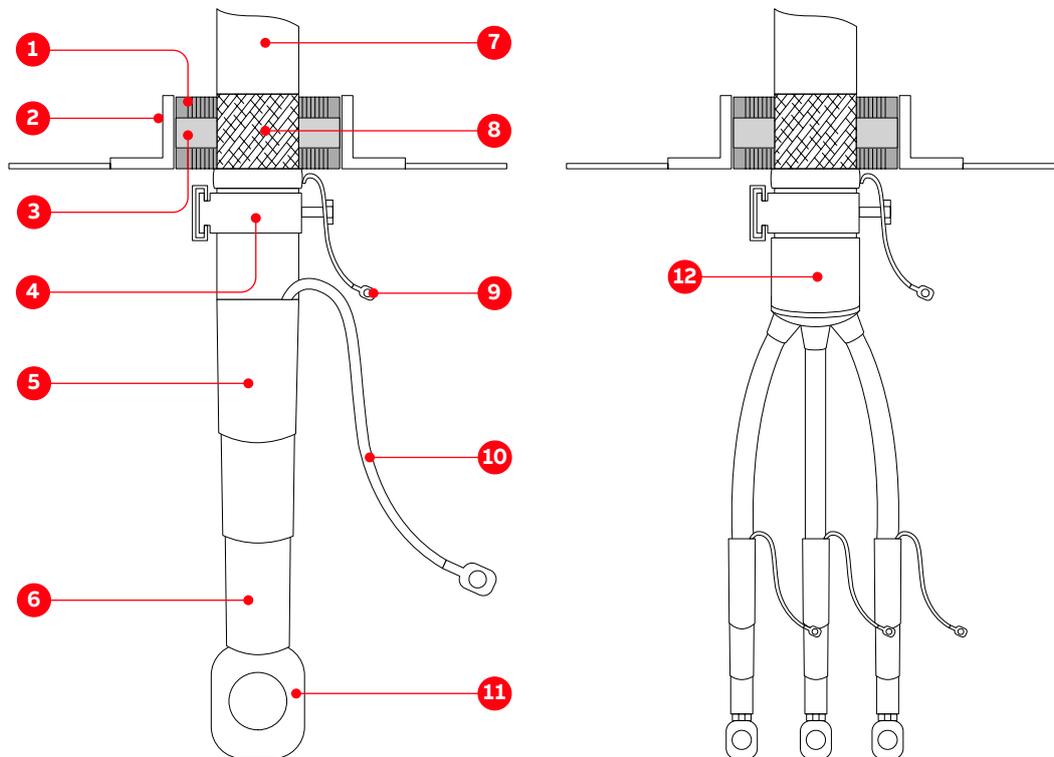


Figure 6-15 Preparing power cables for sealing modules

- |                                      |  |
|--------------------------------------|--|
| 1) Sealing module                    | 8) Cable sheath removed to expose cable shield                             |
| 2) Frame                             | 9) Shield extension to be connected to PG busbar                           |
| 3) Conductive foil of sealing module | 10) Cable screen extension to be connected to the PG busbar                |
| 4) Cable clamp                       | 11) Cable lug as specified by the cable supplier and suitable for M12 bolt |
| 5) Shrinkable sheath seal            | 12) Sheath seal  |
| 6) Heat-shrinkable termination       |  |
| 7) Outer cable sheath                |  |

Install the sealing modules according to the instructions of the sealing module supplier.

## 6.7.2. Connecting the cables



### **CAUTION** Risk of flashover!

High voltages in the terminal unit can cause flashover between the electric potential of different conductors and the electric potential of a conductor and earth.

When you route and connect the cables, maintain the following minimum clearances:

- 70 mm between cable lugs of conductors with a different potential
- 70 mm between the cable lug of a conductor and the parts with earth potential
- 30 mm between cables with a different potential

### 6.7.2.1. Checking the cable insulation

- Measure the insulation of each cable before connection and verify that the results are within the specification of the cable manufacturer.
- Leave the conductors unconnected at both ends until the commissioning personnel has given permission to connect them.

### 6.7.2.2. Connecting the cables

Connect the cables to their corresponding busbars:

- Transformer cables to the busbars inside the primary PCU (Fig. 6-16)
- Motor cables to the busbars inside the COU (Fig. 6-18)
- Ground cable to the PE ground busbar

| PRODUCT  | DOCUMENT KIND | DOCUMENT ID.   | REV. | LANG. | PAGE    |
|----------|---------------|----------------|------|-------|---------|
| ACS5000W | User manual   | 3BHS799208 E01 | F    | en    | 102/178 |

## Transformer cables ACS5000W 36-pulse

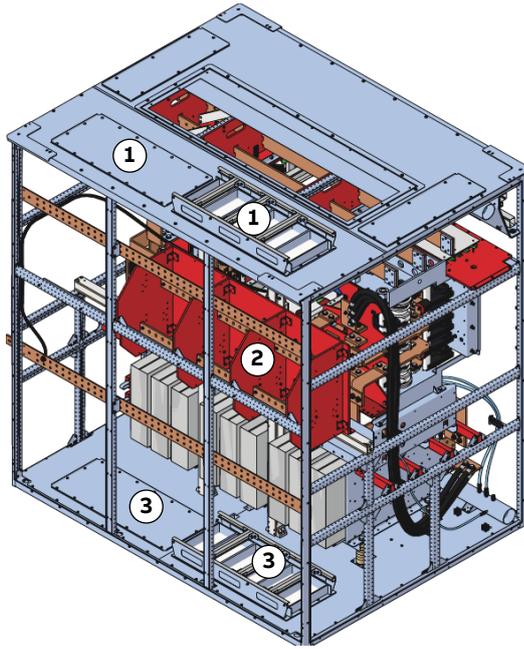


Figure 6-16 PCU 36-pulse top and bottom entry (back view)

- |                                   |                       |
|-----------------------------------|-----------------------|
| 1) Top cable entry                | 3) Bottom cable entry |
| 2) Busbars for transformer cables |                       |

## Transformer cables ACS5000W 18-pulse

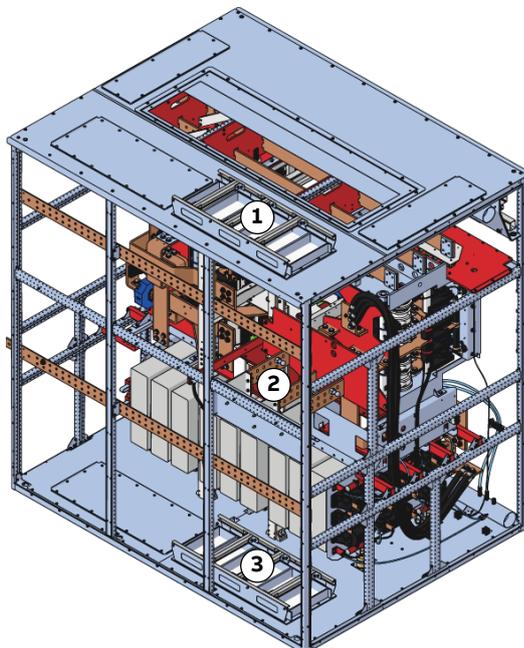


Figure 6-17 PCU 18-pulse top and bottom entry (back view)

- |                                   |                       |
|-----------------------------------|-----------------------|
| 1) Top cable entry                | 3) Bottom cable entry |
| 2) Busbars for transformer cables |                       |

## Motor cables

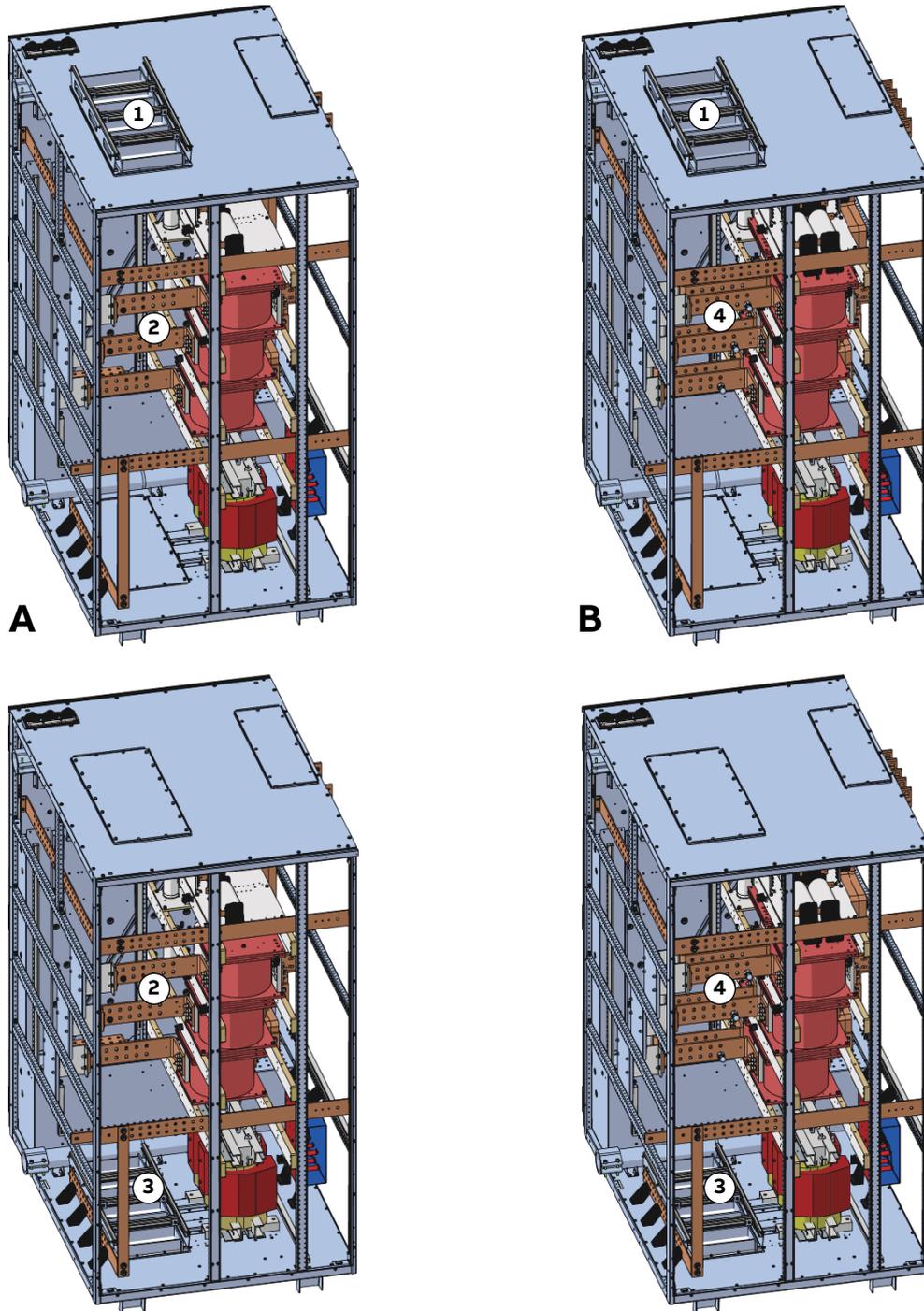


Figure 6-18 COU cable terminals, top and bottom entry (back view) - frame sizes 1 and 2 (A) and 3 and 4 (B)

- |  |  |
|--|--|
| 1) Top cable entry                                   | 3) Bottom cable entry                                |
| 2) Busbars for motor cables<br>(frame sizes 1 and 2) | 4) Busbars for motor cables<br>(frame sizes 3 and 4) |

### 6.7.2.3. Bolted connections

#### Material requirements

Use stainless steel bolts and nuts with the appropriate steel grade and property class for the connection (recommended: A2-70 [designation according to ISO 3506]).

Nuts with bonded coating can be used as an alternative to uncoated stainless steel nuts.

#### Connection type

The following connection type is recommended when a cable lug (Fig. 6-19: 4) is connected to a busbar:

- Spring washer (Fig. 6-19: 1) and flat washer (Fig. 6-19: 2) on each side of the busbar (Fig. 6-19: 3).

Other washers can be used, provided they maintain the required contact pressure.

- Use cable lugs suitable for M12 bolts.

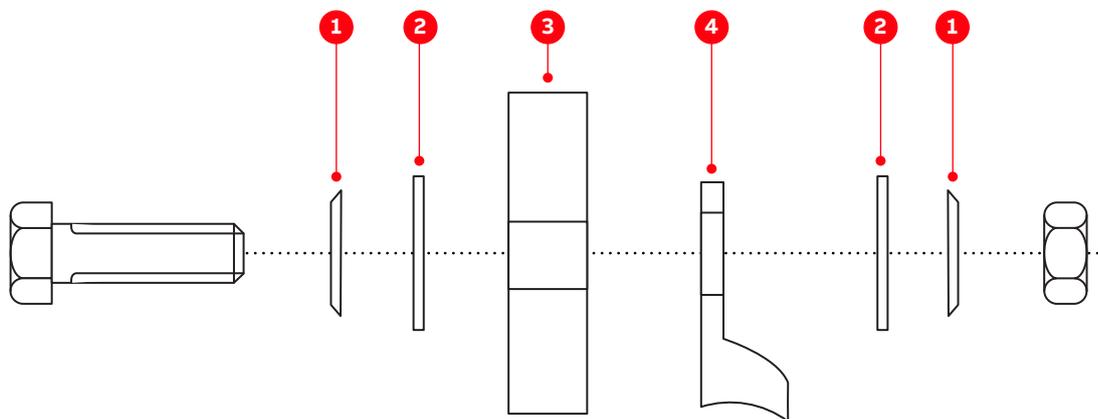


Figure 6-19 Bolted busbar connection

#### Lubrication

- If stainless steel bolts and nuts are used, lubricate the thread and head contact surface of the bolt using recommended pasts, eg, Molykote D paste.

If a coated nut (eg, with bonded molybdenum-disulfide [ $\text{MoS}_2$ ] coating) is used, the connection does not have to be lubricated.

#### Tightening torque

- Tighten bolted connections with bolts of sizes M10 and greater with the recommended nominal torque for the bolt size used.

## 6.8. Auxiliary power cables and control cables

See “Appendix C - Mechanical drawings” for information on:

- Project-specific cable entry
- Dimensions between point of cable entry and terminals

See “Appendix D - Wiring diagrams” for information on:

- Conventions for cross-references and device identification
- Terminal designations

### 6.8.1. Preparing the cable entry and the cables

#### Determining the cable length

1. Determine the required length of a cable between the point of entry and the connection point inside the cabinet.
2. Cut the cable to the required length before connection.

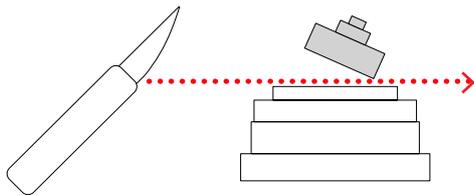
#### Routing the cables

- The auxiliary power supply cables enter the WCU compartment.
- The control cables enter the COU compartment.

#### Preparing cables for EMC plates - only top cable entry

1. Remove the grommets.
2. To ensure proper sealing, cut along the marking that corresponds to the cable diameter.
3. Slide the grommet onto the cable.

The grommet must fit tightly to prevent water entering the cabinet.



If cables are entered through the cabinet floor, the grommets can be discarded.

4. If necessary, remove the entry plate and pull the cable through the entry holes.

**5. Remove the cable insulation at the point of entry (Fig. 6-20: 1).**

If the outer cable screen is non-conductive, cut open the cable screen in the middle of the stripped area (Fig. 6-20: 1). To turn the conductive side inside out, pull the cable screen ends over the cable insulation (Fig. 6-20: 2). Connect the screens ends with a continuous conducting foil (Fig. 6-20: 3).

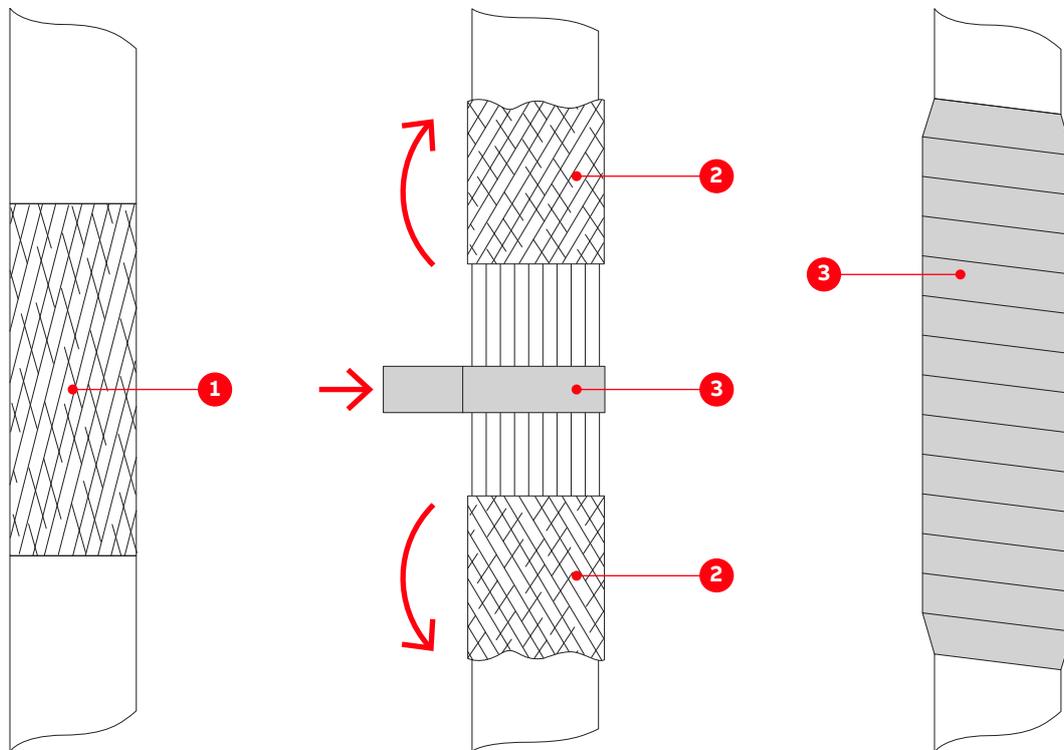
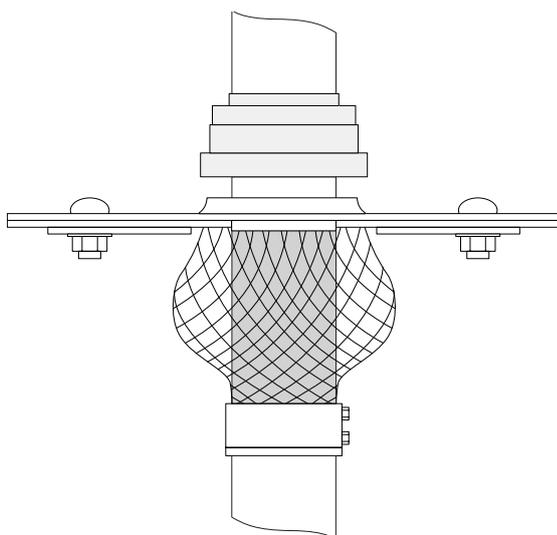


Figure 6-20 Preparing control cables for EMC plates

**6. Pull the cable through the entry plate.**



**7. To prevent water from entering the cabinet, fit the grommet tightly and seal any gaps with silicone.**

**8. If you had removed the entry plate, remount it and fasten it properly.**

| PRODUCT  | DOCUMENT KIND | DOCUMENT ID.   | REV. | LANG. | PAGE    |
|----------|---------------|----------------|------|-------|---------|
| ACS5000W | User manual   | 3BHS799208 E01 | F    | en    | 107/178 |

### 6.8.1.1. Preparing cables for cable entries with sealing modules

1. Unscrew the frame and remove the sealing modules.

For information on removing and installing the sealing modules and using the compression wedge, see “Appendix A - Additional manuals”.

2. Prepare the cables with an outer cable screen for EMC bonding with the metal enclosure of the cabinet as illustrated.

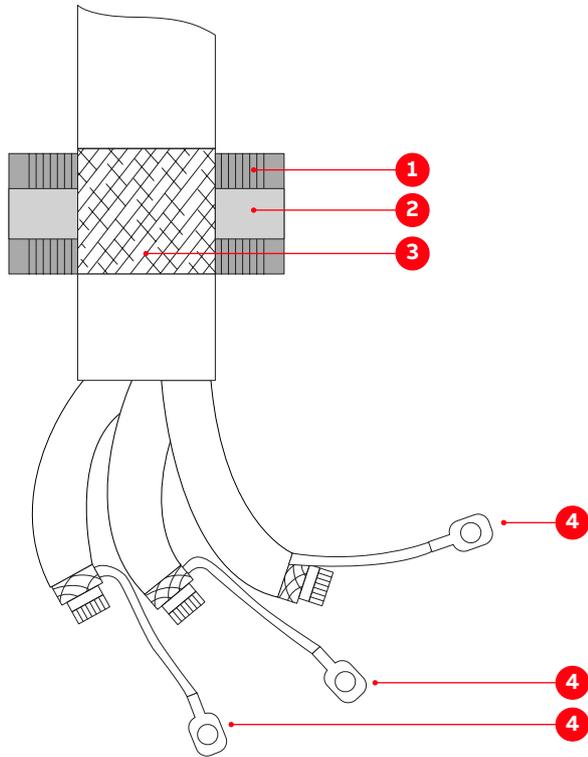


Figure 6-21 Preparing control cables for sealing modules

- |  |  |
|--|--|
| 1) Sealing module                              | 4) Conductor screen extension to be connected to PE terminal |
| 2) Conductive foil                             |  |
| 3) Cable sheath removed to expose cable shield |  |

### 6.8.1.2. Preparing cables for cable entries with cable glands

Prepare the cables with an outer cable screen for EMC bonding with the metal enclosure of the cabinet as illustrated.

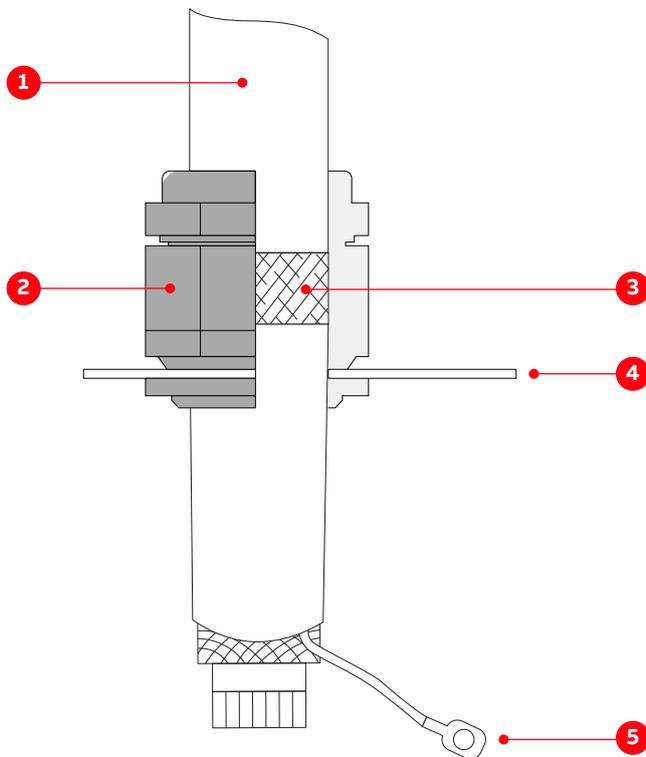


Figure 6-22 Preparing control cables for cable glands

- |  |  |
|--|--|
| 1) Outer cable sheath                                  | 4) Plate   |
| 2) Cable gland   | 5) Conductor screen extension to be connected to PE terminal |
| 3) Conductor insulation removed to expose cable shield |  |

### 6.8.2. Connecting the cables

- For information on project-specific connections, see “Appendix D - Wiring diagrams”.
- For information on terminal sizes, see document “Customer interface”.

### 6.8.2.1. Connecting auxiliary power cables and space heater cables in WCU

#### Top cable entry

1. Route the cables through the cable transit into the terminal compartment (Fig. 6-23: 1) of the WCU.
2. Connect the cables to the relevant terminals.

#### Bottom entry

1. Route the cables through the floor or the top of the WCU, up the cable duct (4 in Fig. 6-23) on the right side wall and then into the terminal compartment (3 in Fig. 6-23) of the WCU.
2. Connect the cable to the bottom of the relevant terminals, according to the converter wiring diagram.

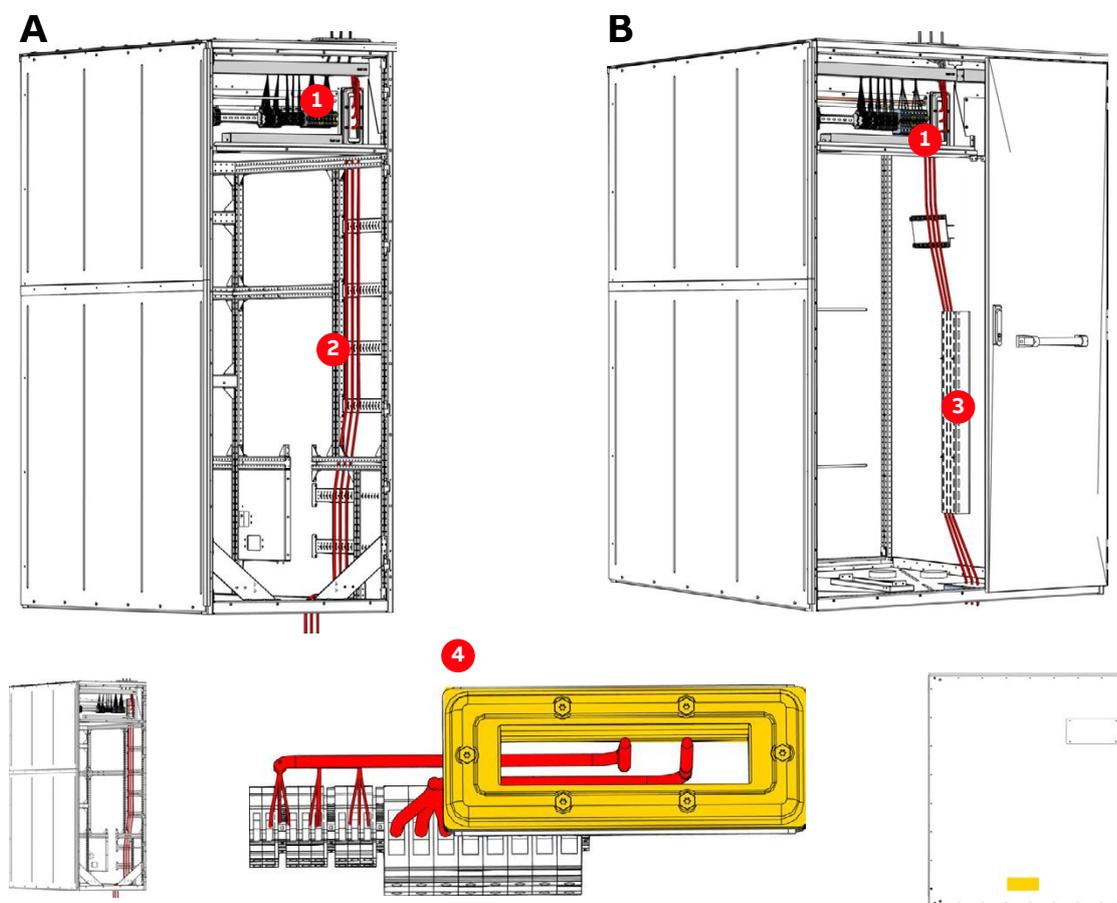


Figure 6-23 Cable routing in WCU800 (A) and WCU1400 (B) cabinets

- |                              |   |
|------------------------------|---|
| 1) Terminal compartment      | 3) WCU1400 cable entry bottom           |
| 2) WCU800 cable entry bottom | 4) Cable entry top (WCU800 and WCU1400) |

## 6.8.2.2. Connecting cables in COU

### Shielded cables

- If you use twisted pair cables, leave the unshielded cable ends twisted until they reach the terminals.
- Leave unshielded conductor ends as short as possible.
- Use a shield grounding clamp (Fig. 6-24) to fasten the overall shield and the individual shields to the ground busbar (Fig. 6-24: 8).



Figure 6-24 Shield grounding clamp

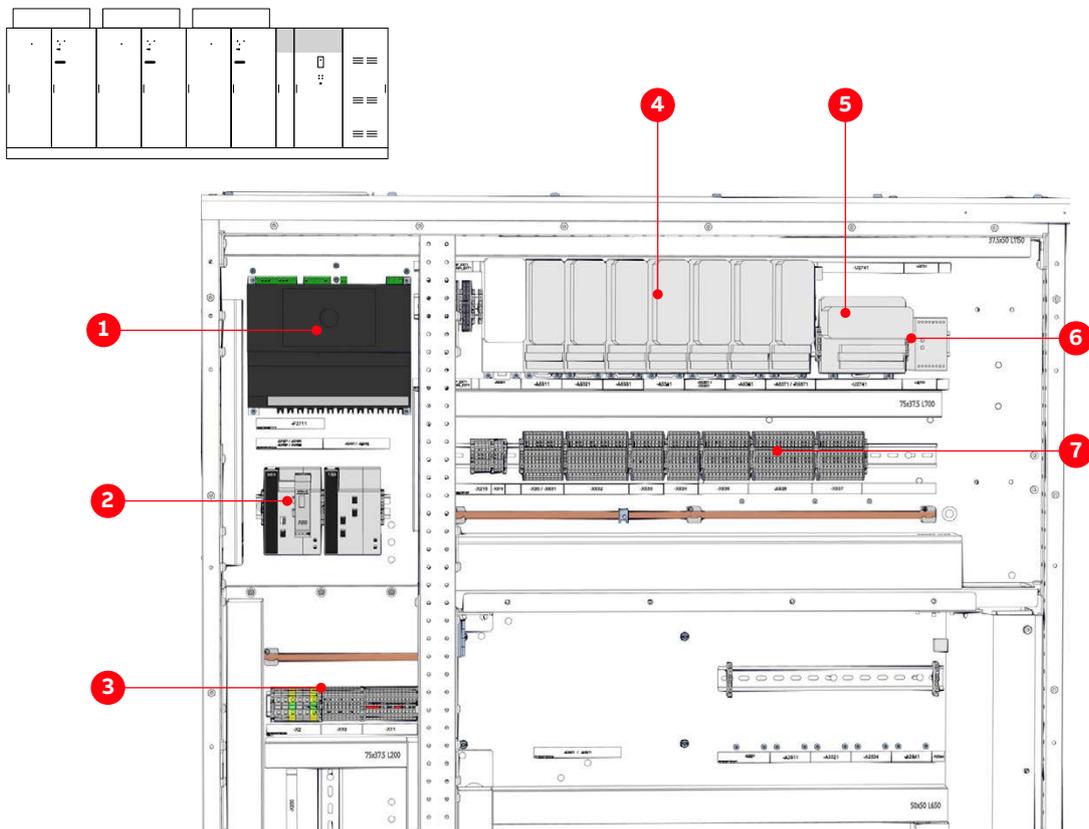


Figure 6-25 COU customer interface section

- |   |                                     |
|---|-------------------------------------|
| 1) Arc Guard™   | 5) Grey encoder (optional)          |
| 2) Remote condition monitoring NETA-21 and fieldbus interface | 6) NTAC-02 pulse encoder (optional) |
| 3) Customer terminals   | 7) Customer terminals               |
| 4) S800 I/O process system (customer-specific configuration)  |                                     |

**Control power supply**

- Connect the cable for the control power to terminal X2 (Fig. 6-25: 11).

**Control signals**

- Connect the cables to the following terminals:
  - X10, X11 (Fig. 6-25: 10) Main circuit breaker signals and emergency off signals
  - X20 – X27 (Fig. 6-25: 7) Control signals of monitored equipment

**Fieldbus interface**

- Connect the cable directly to the fieldbus adapter.

**Encoder interface**

1. Connect the cable directly to the encoder adapter.
2. Connect the overall shield and the individual shields of the encoder cable to the copper busbar.

**IMPORTANT!** DO NOT connect the shields directly to the encoder adapter.

## 7. Commissioning

### 7.1. Required qualification



Commissioning, parameter adjustments and functional tests must be carried out only by qualified commissioning personnel that have been certified by ABB.

### 7.2. Commissioning procedure



Information on the commissioning procedure and the start conditions for commissioning can be obtained from ABB.

### 7.3. Commissioning checklist



In order to ensure uncomplicated and speedy commissioning, it is important that drive and associated equipment are ready for commissioning. Reviewing and completing the items in the commissioning checklist before the commissioning personnel arrive on site will help to achieve this.

### 7.4. Customer assistance



During the commissioning period, the customer is requested to provide qualified personnel for assistance, who are:

- Experienced with medium and low voltage equipment and with the local safety regulations,
- Familiar with the driven process
- Authorized to operate associated medium and low voltage equipment (eg, input circuit breaker, other low and medium voltage switchgear)
- Authorized to operate the driven process for functional tests

### 7.5. Customer acceptance



When commissioning has been completed, the commissioning report is signed by the responsible commissioning personnel and by the customer as a sign of acceptance. A copy of the report and a copy of the actual parameter settings are handed out to the customer.

| PRODUCT  | DOCUMENT KIND | DOCUMENT ID.   | REV. | LANG. | PAGE    |
|----------|---------------|----------------|------|-------|---------|
| ACS5000W | User manual   | 3BHS799208 E01 | F    | en    | 113/178 |

## 7.6. Commissioning checklists

This checklist is designed to help you prepare the drive and associated equipment for commissioning.

### 7.6.1. Mechanical installation checklist

- |   |                          |
|---|--------------------------|
| 1) Drive is aligned according to drive layout drawing (if delivered in several transport units) and installed according to the instructions in this user manual (3BHS799208 E01 F). | <input type="checkbox"/> |
| 2) Silicon sealant is applied across roof plate gaps.   | <input type="checkbox"/> |
| 3) Roof joints are installed.   | <input type="checkbox"/> |
| 4) Pipe joints are orientated and torqued correctly.  | <input type="checkbox"/> |
| 5) Roof attachments are installed (if applicable).  | <input type="checkbox"/> |
| 6) Busbars are installed and torqued correctly.   | <input type="checkbox"/> |
| 7) Raw water piping is completed and pipes are flanged to the drive (if applicable).  | <input type="checkbox"/> |
| 8) Raw water supply is ready.   | <input type="checkbox"/> |
| 9) Visual inspection:   | <input type="checkbox"/> |
| – No badly affixed or damaged components  |                          |
| – No foreign objects left in the cabinet  |                          |
| – No dirt, dust or moisture in the cabinet  |                          |

### 7.6.2. Electrical installation checklist

- |  |                          |
|--|--------------------------|
| 1) Types and cross sections of control cables suitable for the signal type and signal level.   | <input type="checkbox"/> |
| 2) Types and cross sections of power cables selected according to the ABB power cable specification.   | <input type="checkbox"/> |
| 3) Pulse encoder cable shields are connected to the shield earthing point and not connected directly to the pulse encoder interface (applies only to drives with pulse encoder interface). | <input type="checkbox"/> |
| 4) Cable entries prepared according to the instructions in the user manual (3BHS799208 E01 F).   | <input type="checkbox"/> |
| 5) Control cable screens and conductors are connected as instructed in the user manual, labeled appropriately, and the customer side connections are completed.                            | <input type="checkbox"/> |
| 6) Heating cables (if supplied) connected  | <input type="checkbox"/> |

### 7.6.2. Electrical installation checklist (continued)

- 
- 7) Wiring across shipping splits is completed according to the instructions in the user manual (3BHS799208 E01 F).
- 
- 8) Ground cable of the drive is securely connected at both ends.
- 
- 9) Cable armor and screens of power supply cables are connected to PE ground busbar.
- 
- 10) The transformer and motor cables are installed but the conductors not connected at both ends (cables and drive must be insulation resistance tested (Megger test) before connection).
- 

### 7.6.3. Door interlocking checklist

- 
- 1) The release dial of the safety switches in the locked position.
- 

### 7.6.4. Main circuit breaker (MCB)

- 
- 1) MCB selected as per “Main circuit breaker specification”<sup>(1)</sup>
- 
- 2) High-voltage power connections completed
- 
- 3) MCB is ready to be tested with drive
- 
- 4) MCB protection relay settings are tested
- 
- 5) Protection devices (eg, door locks) are tested and in operation.
- 
- 6) Local operation of MCB is disabled.
- 
- 7) Emergency-off loop is tested.
- 

<sup>(1)</sup> Pay attention to MCB opening time and installation of undervoltage coil or second opening coil

### 7.6.5. Input transformer checklist

- 
- 1) Grounding is completed
- 
- 2) Transformer auxiliaries (eg, dehydrating breathers, cooling, protection devices) are ready.
- 
- 3) Protection devices are tested and in operation.
-

### 7.6.6. Motor checklist

- |  |                          |
|--|--------------------------|
| 1) Motor is installed, aligned and alignment protocol available. | <input type="checkbox"/> |
| 2) Motor is not coupled to driven load.                          | <input type="checkbox"/> |
| 3) Grounding is completed  | <input type="checkbox"/> |
| 4) Motor auxiliaries (eg, bearing lubrication) are ready         | <input type="checkbox"/> |
| 5) Control and monitoring signals are connected.                 | <input type="checkbox"/> |

### 7.6.7. Insulation tests checklist

- |   |                          |
|---|--------------------------|
| 1) Insulation of the cables to input transformer, from input transformer to drive and from drive to motor is tested, and measured values within required limits.  | <input type="checkbox"/> |
| 2) Test report is available   | <input type="checkbox"/> |
| If the commissioning personnel carry out the test, an additional day per drive-motor combination must be reserved. After the test, the mains cables can be connected, except at the drive end. Test must comply with the specification. |                          |

### 7.6.8. Power checklist

- |   |                          |
|---|--------------------------|
| 1) Medium voltage available for startup of drive. | <input type="checkbox"/> |
| 2) Low voltage is available for startup of drive. | <input type="checkbox"/> |

### 7.6.9. Miscellaneous checklist

- |   |                          |
|---|--------------------------|
| 1) Sufficient number and correct type of spare parts available  | <input type="checkbox"/> |
| 2) Sufficient quantity of deionized water according is available. (see "Appendix C - Mechanical drawings"). | <input type="checkbox"/> |
| 3) Air conditioning of drive room ready for load run of drive   | <input type="checkbox"/> |
| 4) Optional equipment (eg, chiller) ready   | <input type="checkbox"/> |

## 8. Operation

### 8.1. Operating conditions

The operating conditions for the drive are according to IEC 60721-3-3.

- **Classification:** 3K22 / 3B1 / 3S6 / 3M11

### 8.2. Safety



The drive system must only be operated by qualified and authorized personnel, ie, personnel who are familiar with the operation of the drive system and the hazards involved.

### 8.3. Overview

This chapter outlines the local operation of the drive.

Control of the drive via a PLC or higher-level control system is not described in this chapter. If the drive is controlled from remote, see the applicable manuals for information.

The status messages and parameter settings used in this chapter are typical examples to illustrate the related instructions and display functions and may therefore differ from the actual status messages and parameter settings in the drive.

|          |               |                |      |       |         |
|----------|---------------|----------------|------|-------|---------|
| PRODUCT  | DOCUMENT KIND | DOCUMENT ID.   | REV. | LANG. | PAGE    |
| ACS5000W | User manual   | 3BHS799208 E01 | F    | en    | 117/178 |

## 8.4. Local operator panel

The operator panel on the control compartment enables the operator to control the drive without restrictions, provided that all requirements for normal operation are met. The functions of the local operator panel include:

- Connecting and disconnecting the main power supply
- Setting the reference value
- Starting and stopping the drive system
- Displaying: Actual values, status messages and alarm and fault messages
- Viewing and setting parameters
- Resetting alarm and fault messages
- Activating the emergency-off
- Testing lights and illuminated push buttons



Figure 8-1 Local operator panel

## 8.5. Lamp-test function

The lights and illuminated push buttons on the control compartment can be tested with the lamp-test function.

The lamp test is activated via the CDP control panel by setting control parameter 16.7 to LAMP TEST. The lamp-test function resets itself after a set time.

## 8.6. Status messages

The following section lists the status messages of the main operating states that the drive passes through when:

- Drive is put into operation (see “8.6.1 Start sequence of the drive” on page 121)
- Drive is stopped (see “8.6.2 Stop sequence of the drive” on page 122)
- Fault condition has occurred

The status messages are sent to the higher-level control system and are displayed on the CDP control panel of the drive.

For information on other status messages (eg, fault status messages), see the status words in “Appendix G - Signal and parameter table”.

| PRODUCT  | DOCUMENT KIND | DOCUMENT ID.   | REV. | LANG. | PAGE    |
|----------|---------------|----------------|------|-------|---------|
| ACS5000W | User manual   | 3BHS799208 E01 | F    | en    | 119/178 |

## NotReadyOn



The DC link cannot be charged and the drive cannot be connected to the main power supply, ie, the main circuit breaker cannot be closed. The status message is displayed, eg, when the doors of medium voltage compartments are still open, the grounding switch of the drive is in the grounded position, or the motor starter of the fan unit is switched off.

## ReadyOn



The drive is healthy and ready for the ON command. The ON command initiates charging of the DC link capacitors and the closing of the main circuit breaker of the drive. Depending on the control location, the command can either be sent from the higher-level control system to the drive or be initiated by pressing the SUPPLY ON push button on the control compartment door.

## Charging



The status message ReadyOn changes to Charging when the DC link capacitors of the drive are being charged.

## ReadyRun



The drive is energized and ready for operation. As soon as the start command is initiated, the motor is magnetized and the drive starts to modulate.

## ReadyRef



The drive is running and operating according to the set speed or torque reference value. When in remote control mode, the reference value is set at the higher-level control system. When in local control mode, the value is entered into the CDP control panel.

## Stopping



The drive has received a stop command and that a ramp or coast stop has been initiated. The stopping mode depends on the parameter setting. The status message changes to ReadyRun when the zero speed threshold is reached.

When a start command is given while the drive is stopping, the drive resumes operation and the status message changes to ReadyRef again.

## Tripped



A fault condition has occurred that requires a shutdown of the drive. The status message always alternates with the specific fault message. The type of shutdown depends on the fault class the fault condition is assigned to in the drive software.

| PRODUCT  | DOCUMENT KIND | DOCUMENT ID.   | REV. | LANG. | PAGE    |
|----------|---------------|----------------|------|-------|---------|
| ACS5000W | User manual   | 3BHS799208 E01 | F    | en    | 120/178 |

### 8.6.1. Start sequence of the drive



1) **NotReadyOn**



2) **ReadyOn**

- Auxiliary power supply on
- PCU doors closed and locked
- Drive not grounded
- No emergency-off
- No fault
- WCU ready



3) **On command**



4) **Charging**

- DC link charges
- MCB closes
- Cooling system switches on



5) **ReadyRun**



6) **Start Command**

- Inverter starts to modulate



7) **ReadyRef**



8) **Operation**

### 8.6.2. Stop sequence of the drive



1) **Operation**



2) **ReadyRef**



3) **Stop command**



4) **Stopping**

- Speed ramps down
- Inverter stops modulating



5) **ReadyRun**



6) **Off command**

- MCB opens
- DC link discharges
- Cooling system switches off after a delay



7) **ReadyOn**

- Ground drive
- PCU doors are released for opening
- Switch off auxiliary power supply



8) **NotReadyOn**

### 8.6.3. Emergency-off sequence



1) **Operation**



2) **ReadyRef**



3) **Emergency-off command**

- MCB opens
- Inverter stop modulating
- Speed coasts down



4) **NotReadyOn**

## 8.7. Starting the drive



### **DANGER** Hazardous voltages!

- To prevent unintentional contact with energized components, all covers must be screwed in place.
- The release dial of the door safety switches must be in the locked position to prevent the doors of the medium voltage compartments from being opened unintentionally during operation.



### **CAUTION** Cooling system starts automatically!

The cooling system can start automatically after the auxiliary voltage has been switched on.

### **NOTICE**

When you start the drive system locally for the first time after commissioning, have the following documents at hand:

- “Appendix D - Wiring diagrams” to identify the circuit breakers to be switched on
- “Appendix A - Additional manuals”, manual of the water cooling unit to check that the water cooling unit is ready for operation
- “9 CDP control panel” on page 133” for information on functions and features of the CDP control panel

| PRODUCT  | DOCUMENT KIND | DOCUMENT ID.   | REV. | LANG. | PAGE    |
|----------|---------------|----------------|------|-------|---------|
| ACS5000W | User manual   | 3BHS799208 E01 | F    | en    | 123/178 |

### 8.7.1. Checks before starting the drive

When the drive is put into service after it has been commissioned, or after it has been taken out of service for a longer period, check the drive according to the following list:

- Check that tools and foreign objects are not left inside the cabinet.
- Check that all auxiliary power supplies from external sources are switched on.
- Check that all internal circuit breakers of the drive are closed.
- Check that all covers are fitted.
- Check that all locking screws are removed from the locking bars on the inside of the doors of medium voltage compartments.
- Check that the doors are closed and locked or bolted.
- Check that the grounding switch is in position not grounded.
- Check that the MCB is in operating position.
- Check that there is no run interlock active.

### 8.7.2. Starting the drive from remote

When the drive system is operated from a higher-level control system or an operator control desk, follow the instructions in the applicable manuals.

### 8.7.3. Starting the drive locally

1. Set the CDP control panel to local control mode.



2. If the EMERGENCY-OFF RESET push button is flashing, press the push button to cancel flashing.

Each time the auxiliary voltage is switched off and on again, the emergency-off safety relay of the drive is actuated and lets the EMERGENCY-OFF RESET push button flash.

The push button also flashes if the EMERGENCY-OFF push button on the control compartment door, or any other emergency-off switch linked to the drive, is pressed. If the push button continuous flashing, verify that there is no emergency-off command active.

For more information, see “8.9 Emergency-off” on page 128.

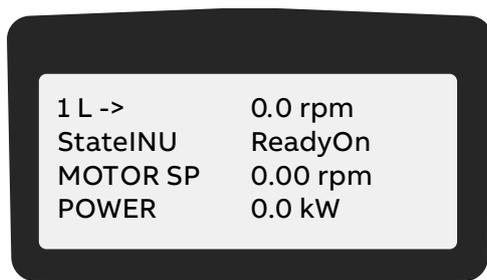
3. Check that no alarm or fault messages are displayed on the CDP control panel.

When a fault message is displayed on the CDP control panel, reset the fault.



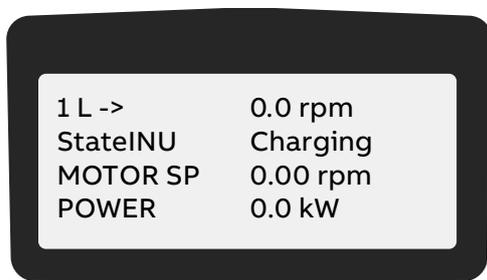
If a fault cannot be reset, it must be rectified by the responsible personnel.

When no alarms and faults are present and the drive is ready, the CDP control panel displays ReadyOn.



- Press the SUPPLY ON push button on the control compartment door to charge the DC link. The push button flashes during charging.

The status line of the CDP control panel alternates between Charging and AuxiliaryOn.

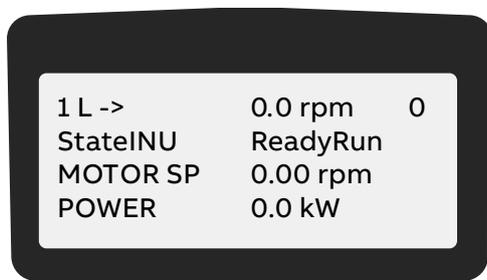


#### Alternating display message:

- Charging
- AuxiliaryOn

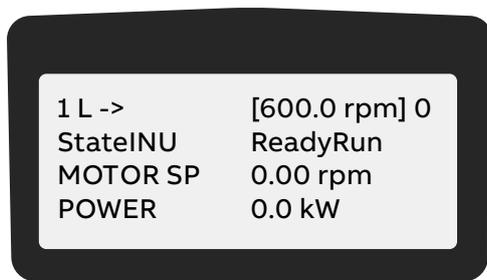
After charging has been finished, the following takes place:

- The main circuit breaker closes automatically.
- The SUPPLY ON push button lights up permanently.



- Enter the reference value.

For more information, see “9.3.2 Entering a reference value” on page 153.



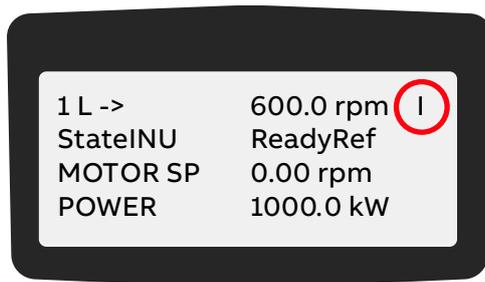
6. To start the motor, press the START key.



After the motor has been magnetized, the motor speed ramps up to the reference value.

While the motor is accelerating, the run status message in the display blinks. When the motor speed has reached the reference value, the run status message lights up permanently.

The display shows ReadyRef to indicate that the drive system is operating.

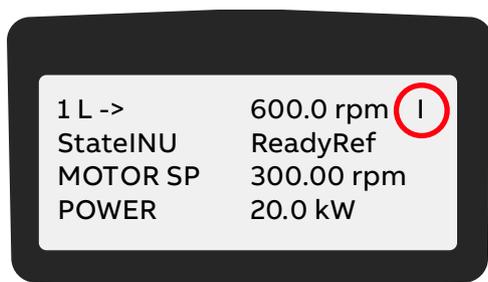


## 8.8. Stopping the drive

- To stop the motor, press the STOP key.



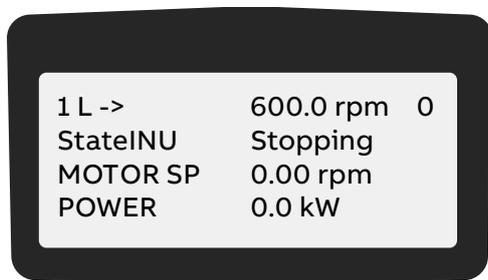
The motor stops according to the preset stop function. While the motor stops, the status line of the display shows ReadyRef and the run status message blinks.



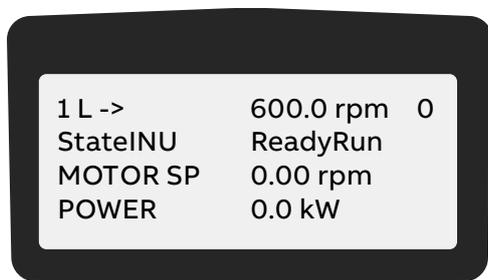
As long as the stop sequence is in progress, you can always restart the drive by pressing the START key.



Just before the motor comes to a standstill, the status line shortly displays Stopping.



When the motor has reached zero speed, the status line displays ReadyRun.



As long as the MCB has not been opened, you can restart the motor at any time.

## 8.9. Emergency-off



### **CAUTION** Hazardous voltage!

Pressing the EMERGENCY-OFF push button DOES NOT disconnect the auxiliary power supply from the drive.

The drive is equipped with a hardwired emergency-off circuit. When an emergency situation occurs during operation, this safety feature ensures that the drive system can be disconnected without delay from the main power supply. When the EMERGENCY-OFF push button has been pressed while the drive is at standstill, the main power supply cannot be connected to the drive, hence the drive cannot be started up.

The EMERGENCY-OFF push button of the drive is part of the local operator panel (Fig. 8-1) and features a latching switch action.

### 8.9.1. Initiating an emergency off



To initiate an emergency stop, press the EMERGENCY-OFF push button on the door of the control compartment, or, if present, an external EMERGENCY-OFF push button that is linked to the emergency-off circuit.

When an emergency-off is initiated during operation, the following takes place:

- Main circuit breaker opens
- Drive coasts down
- DC link of the drive discharges
- Status line indication of the CDP control panel alternates between EmergencyOff and NotReadyOn.

|          |           |
|----------|-----------|
| 1 L ->   | 600.0 rpm |
| StateINU | EmergeOff |
| MOTOR SP | 0.00 rpm  |
| POWER    | 0.0 kW    |

#### Alternating display message:

- EmergeOff
- NotReadyOn

- EMERGENCY-OFF RESET push button flashes.
- SUPPLY OFF push button flashes.

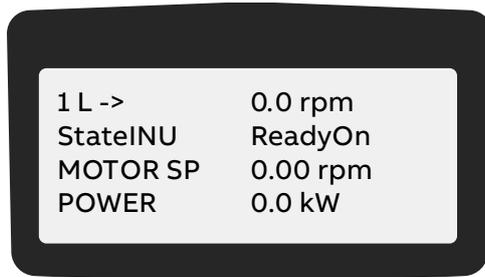
## 8.9.2. Starting the drive system after an emergency-off

1. To start up the drive system after an emergency-off, unlatch the EMERGENCY-OFF push button.

The EMERGENCY-OFF push button returns to its initial position when turned into the direction indicated by the arrows on the push button.

2. To reset the emergency-off safety relay of the drive, press EMERGENCY-OFF RESET button.

After resetting, the drive status message changes to ReadyOn.



The main power supply can be connected to the drive, and the drive can be started again.

## 8.10. Arc resistant design

The arc resistant design provides the drive with ABB class IV arc fault protection (see Table 8-1) in accordance with IEC 62477-2.

Table 8-1 ABB arc resistant classes

| ABB class | Description  |
|-----------|--|
| Class I   | Protection based on arc prevention (NOT certified according to IEC 62477-2)  |
| Class II  | Protection based on arc resistant cabinet structure <sup>(1)</sup>   |
| Class III | Protection based on external arc fault limitation and elimination. HV fuses are applied externally to limit the arc fault current <sup>(1)</sup> |
| Class IV  | Fast arc detection and elimination <sup>(1)</sup>  |

<sup>(1)</sup> IAC certified by 3rd body according to IEC 62477-2

### 8.10.1. Internal arc classification (IAC)

The arc fault rating, which is based on arc fault tests, is on the label underneath the drive rating plate.

| Internal Arc Classification (IAC) |     |     |     |   |   |                |                |     |    |
|-----------------------------------|-----|-----|-----|---|---|----------------|----------------|-----|----|
| ABB Class IV                      |     |     |     |   |   |                |                |     |    |
| IAC                               | F   | L   | R   | T | B | I <sub>A</sub> | t <sub>A</sub> | APR | SC |
| IEC 62477-2                       | 2b  | 2b  | 2b  | 1 | 1 | 9.5 kA         | 0.5 s          | Yes | No |
| Distance [m]                      | 0.3 | 0.3 | 0.3 | - | - |                |                |     |    |

3BHB049908R5409

Figure 8-2 IAC label example

**IMPORTANT!** The Main Circuit Breaker (MCB) for the drive fulfills the APR (Associated Protection Requirement) without the need for additional devices. The MCB requirements are described in “2.7 Important note - main circuit breaker” on page 29.

Based on the ACS5000W IAC rating, the minimum approach distance is 0.3 m. Local rules may require additional distance. The user is responsible to determine the correct approach distance considering local rules.

### 8.10.2. Arc detection with the Arc Guard System™

The Arc Guard System™ detects fast arc faults in the terminal sections of the drive. When the Arc Guard System detects an arc fault the drive performs protection firing and immediately opens the main circuit breaker. The Arc Guard monitor and HMI panel are located in the COU (Fig. 3-12).



Figure 8-3 Arc Guard™ system with HMI panel

The Arc Guard System™ consists of the following:

- Arc Guard unit TVOC-2 with HMI panel
- Optical fiber detector

### 8.10.3. Action after the Arc Guard System™ has been triggered

1. De-energize and ground the drive according to “10.6.2 De-energizing the drive” on page 165.
2. Search for the location where the arc has been detected.
3. Check the Arc Guard HMI panel messages and use the circuit diagrams.



Figure 8-4 HMI panel

4. Open the power units and localize the defect.
5. Repair the defect or contact support line if needed.
6. Reset the fault on Arc Guard HMI panel.
7. Acknowledge the firing through with parameter 16.26 on the CDP control panel (only when fault was understood and corrected).
8. Restart the drive.

## 8.11. De-energizing and grounding the drive

See “10.6.2 De-energizing the drive” on page 165.

## 8.12. Opening the doors

See “10.6.3 Opening and closing the doors” on page 167.

| PRODUCT  | DOCUMENT KIND | DOCUMENT ID.   | REV. | LANG. | PAGE    |
|----------|---------------|----------------|------|-------|---------|
| ACS5000W | User manual   | 3BHS799208 E01 | F    | en    | 132/178 |

## 9. CDP control panel

### 9.1. Overview

The panel messages and parameter settings in the following sections are typical examples and might differ from the actual ones.

#### 9.1.1. Display and keypad

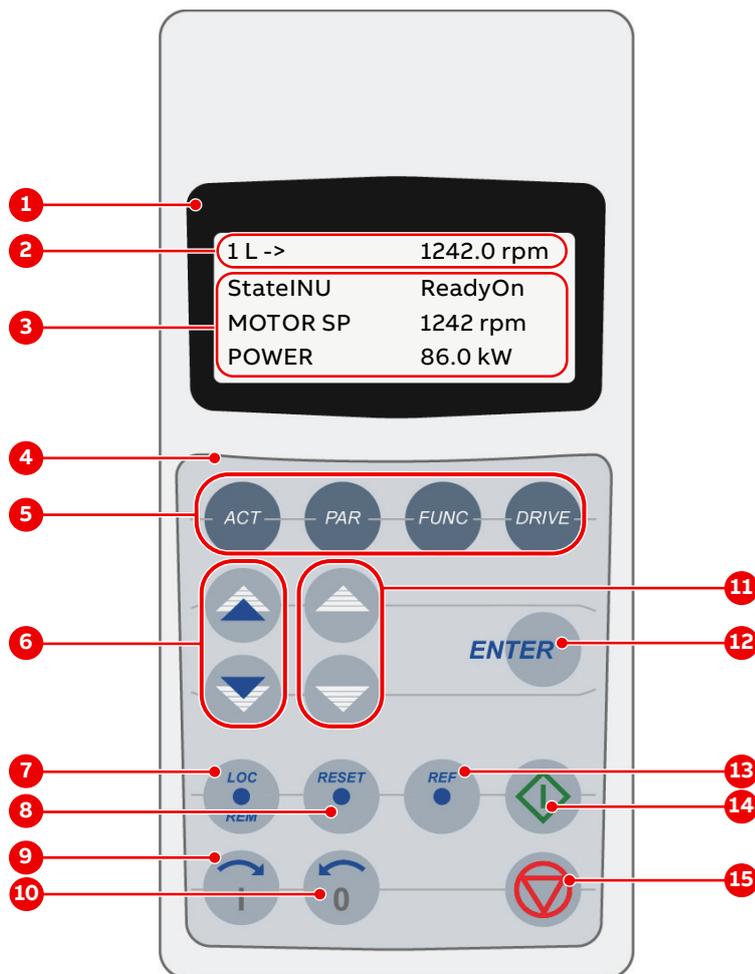


Figure 9-1 CDP control panel

- |   |   |
|---|---|
| 1) Display  | 8) Reset key  |
| 2) Status line  | 9) Forward key  |
| 3) Actual signal names and values   | 10) Backward key  |
| 4) Keypad   | 11) Slow navigation key for selecting signals or fault messages |
| 5) Mode selection keys  | 12) Enter key, terminates a procedure                           |
| 6) Fast navigation key for selecting the actual signals display or the fault memory display | 13) Reference key   |
| 7) Local / remote selection key   | 14) Start key   |
|   | 15) Stop key  |

## 9.1.2. Functions

The CDP control panel serves as the basic user interface for operating and monitoring the drive when the local operating mode has been selected.

The CDP control panel can be attached to or detached from the drive without having to switch off the auxiliary power supply first.

Using the CDP control panel, it is possible to:

- Enter startup data
- Enter reference values
- Enter start, stop and direction commands
- Display actual values (three values can be read simultaneously)
- Display and adjust parameters
- Display information on the most recent 64 fault events

## 9.2. Modes

The CDP control panel provides the following modes:

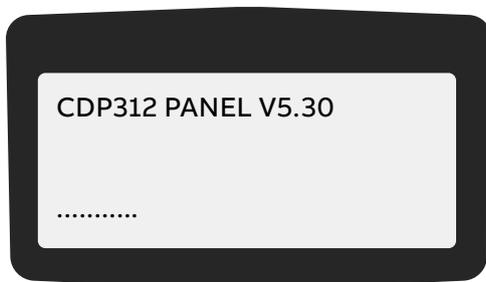
- “9.2.1 Identification mode” on page 134
- “9.2.2 Actual signals mode” on page 136
- “9.2.3 Parameters mode” on page 143
- “9.2.4 Functions mode” on page 148
- Drive mode (not used)

### 9.2.1. Identification mode

The identification mode informs the user about the CDP control panel version and the ID number of the drive. The information appears on the display

- when the power supply is switched on, or
- when the CDP control panel is connected to the drive and the auxiliary voltage has been switched on already.

When the CDP control panel is initialized, the display changes as follows:



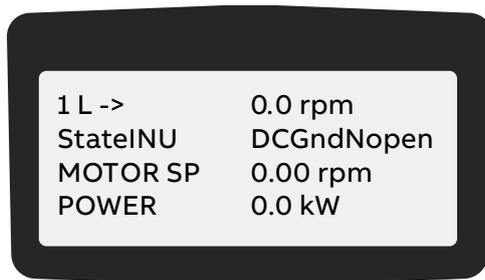
After 2-3 seconds the display shows the drive name (1, 2), the application software in use (3), and the drive identification (4) is displayed.



After another few seconds.



After another few seconds, the display changes to the actual signals display. The status line of the display alternates between DCGndNopen and NotReadyOn.



#### Alternating display message:

- DCGndNopen
- NotReadyOn

## 9.2.2. Actual signals mode

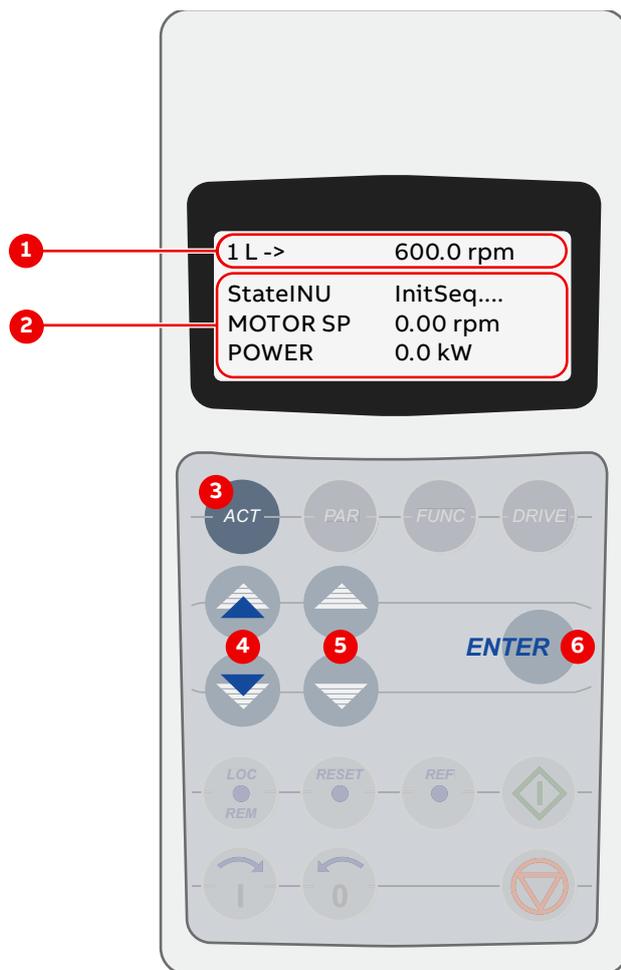


Figure 9-2 Control panel functions for Actual signals mode

- |   |  |
|---|--|
| 1) Display  | 5) Slow navigation key for selecting signals or fault messages |
| 2) Actual signal names and values   | 6) Enter key for confirming the selection                      |
| 3) Selection key for actual signals mode  |  |
| 4) Fast navigation key for selecting the actual signals display or the fault memory display |  |

### 9.2.2.1. Overview

Two displays can be selected in the actual signals mode:

- Actual signals display
- Fault memory display

The actual signals display appears first when entering the actual signals mode. However, when the drive is in a fault condition, the fault memory display appears instead.

The actual signals display is used to monitor the drive without interfering with its operation. It continuously displays three selectable actual values.

If no key is actuated within one minute (an exception from this is the fault memory display), the CDP control panel automatically returns to the actual signals display from other modes.

### Actual values

For the complete list of selectable actual signals, see “Appendix G - Signal and parameter table”.

The actual values are organized in groups.

| Group    | Description                                      |
|----------|--|
| Group 01 | Measured or calculated motor values              |
| Group 02 | Measured or calculated drive values              |
| Group 03 | Reference values                                 |
| Group 04 | Status signals of S800 I/O system                |
| Group 05 | Communication link and MCB status signals        |
| Group 06 | Software version, drive and motor nominal values |
| Group 07 | Control words                                    |
| Group 08 | Status words                                     |
| Group 09 | Fault and alarm words                            |

### Fault memory

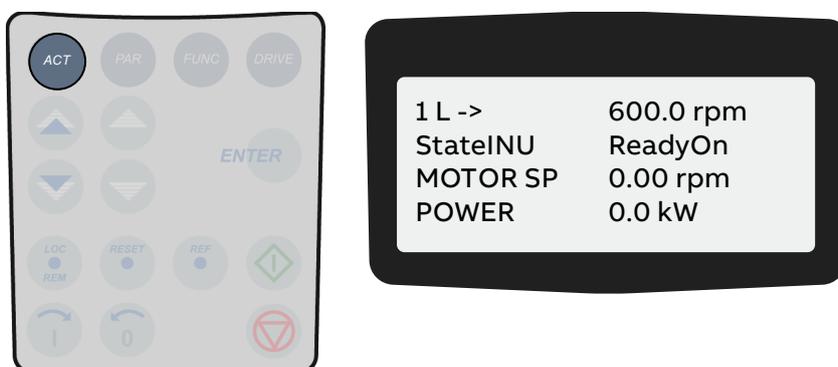
The fault memory display provides information on the 64 most recent fault events that occurred in the drive. It displays the name of the fault and the time it occurred. For instructions on how to display and reset the fault memory, see “9.2.2.7 Displaying and resetting an active fault” on page 142.

When the drive generates a fault or alarm, the corresponding message displays immediately.

Changing from the fault memory display to other modes is possible without resetting the fault first. If no key is actuated, the fault or alarm message displays as long as the fault is active.

#### 9.2.2.2. Selecting the actual signals display

To select the actual signals display, press the ACT key.



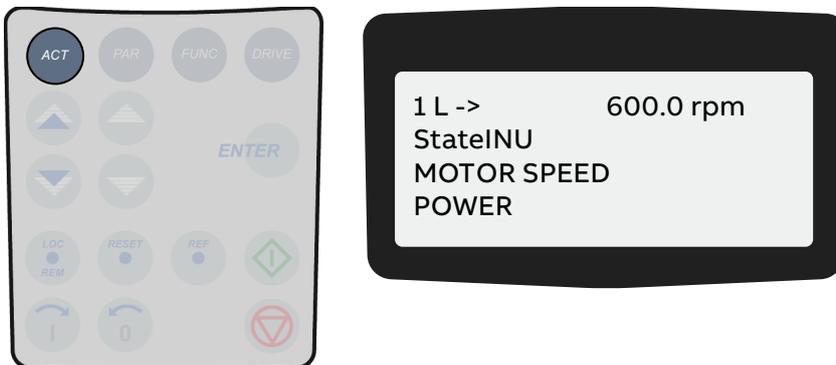
### 9.2.2.3. Toggling between actual signals display and fault memory

To toggle between actual signals display and fault history display, press a fast navigation key.



### 9.2.2.4. Displaying three actual signals

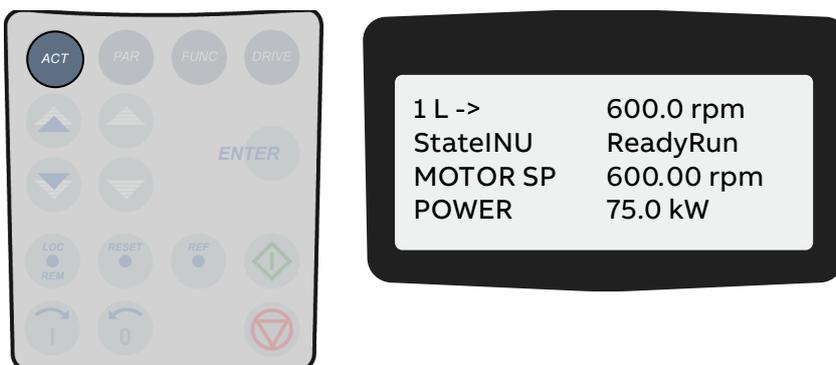
1. To display the full name of three actual signals, press and hold the ACT key.



2. To return to the actual signals display, release the ACT key.

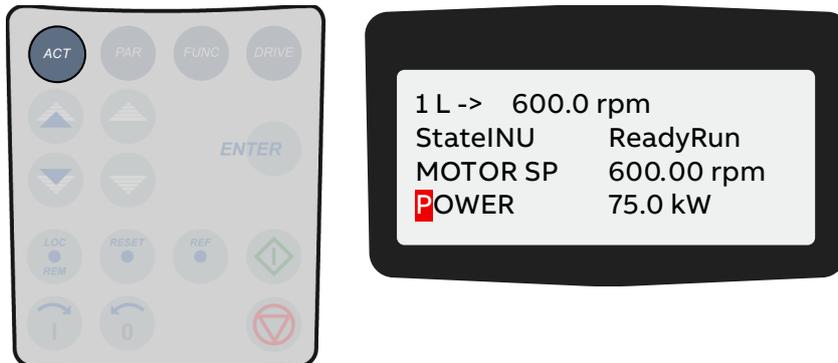
### 9.2.2.5. Selecting actual signals

1. To select the actual signals display, press the ACT key.



2. To select a line where the actual signal is to be displayed, press the slow navigation keys.

A **blinking** cursor indicates the selected line.



3. To enter the actual signals selection function, press the ENTER key.



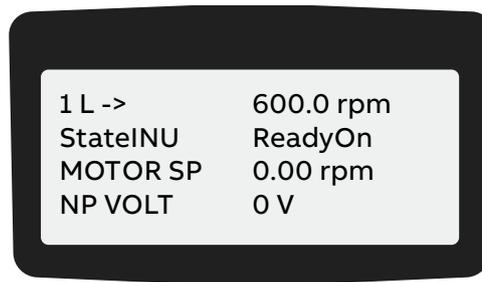
4. To select a parameter group, press a fast navigation keys.



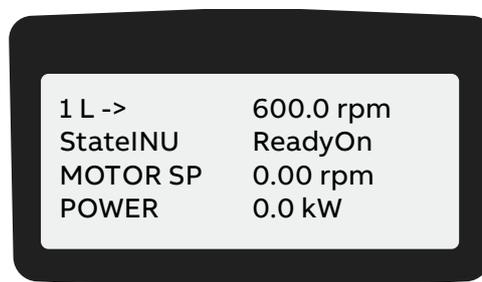
5. To select an actual signal, press a slow navigation keys.



6. To confirm the selection and to return to the actual signals display, press the ENTER key.

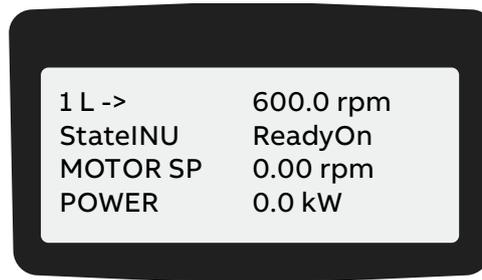


7. To cancel the selection and keep the original selection, press any of the mode selection keys. The selected keypad mode is entered.

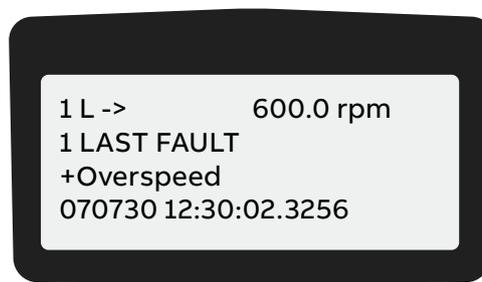


### 9.2.2.6. Displaying a fault and resetting the fault memory

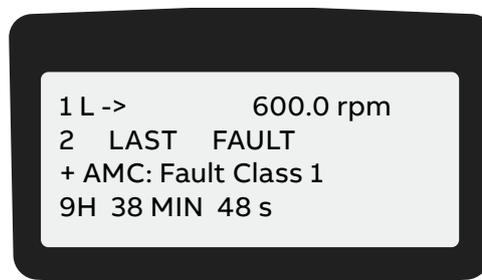
1. To open the actual signals display, press the ACT key.



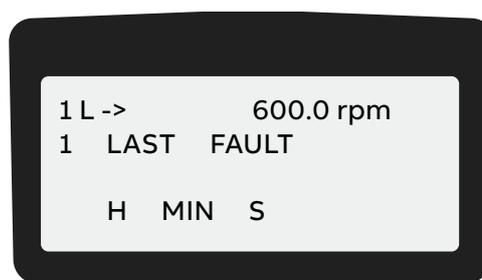
2. To change to the fault memory display, press a fast navigation key.



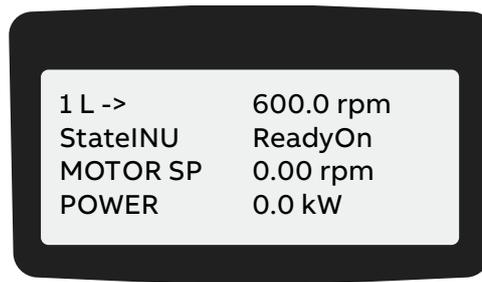
3. To display a specific fault, press the slow navigation keys. The up key selects the previous, the down key the next fault.



4. To clear the fault memory, press the RESET key.

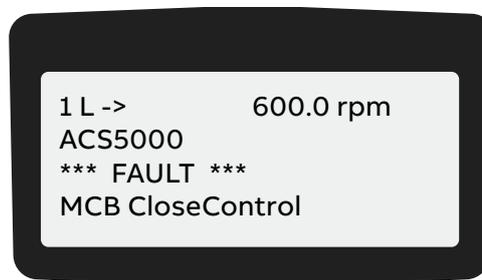


5. To return to the actual signals display, press a fast navigation key.

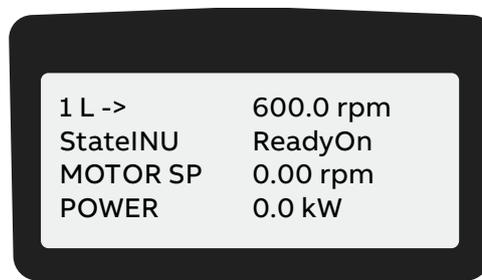


### 9.2.2.7. Displaying and resetting an active fault

1. To display an active fault, press the ACT key.



2. To reset the fault, press the RESET key.



### 9.2.3. Parameters mode

**NOTICE** Risk of component damage.

Running the drive system with incorrect data can result in improper operation, reduction of control accuracy and damage of equipment.

- Parameters must only be set by qualified personnel.
- DO NOT change any parameter, if the meaning of the parameter and the effects of the change are not fully understood.

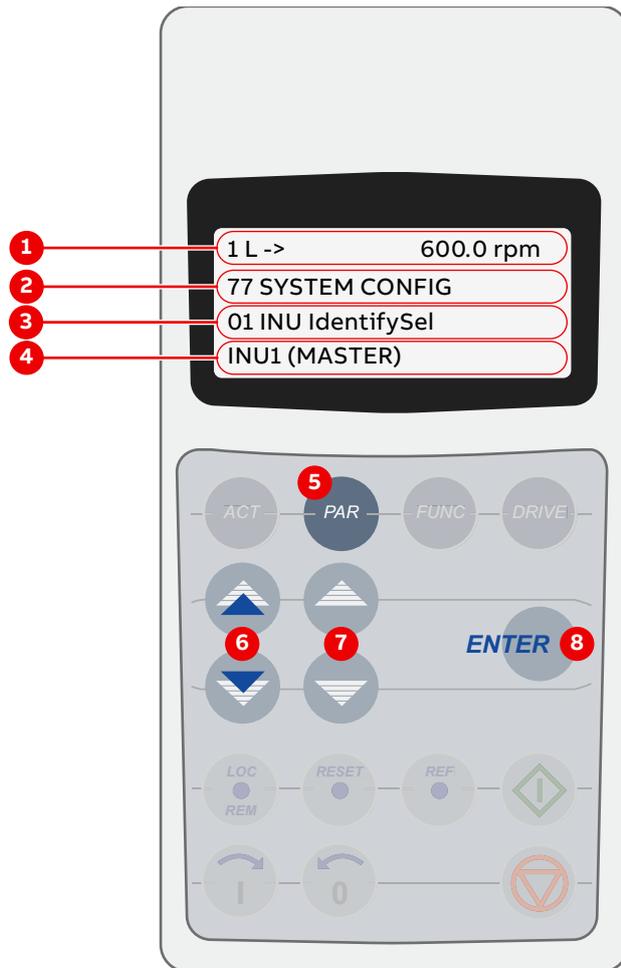


Figure 9-3 Control panel functions for Parameters mode

- |                                      |  |
|--------------------------------------|--|
| 1) Status line                       | 6) Fast navigation key for selecting a parameter group (and a parameter value) |
| 2) Group number and name             | 7) Slow navigation key for selecting a parameter (and a parameter value)       |
| 3) Parameter number and name         | 8) Enter key for confirming the selection                                      |
| 4) Parameter value                   |  |
| 5) Selection key for parameters mode |  |

### 9.2.3.1. Overview

If the parameter lock is disabled or unlocked (see “ Enabling / unlocking a parameter lock” on page 147) the parameters mode allows entering the parameter settings for the required drive configuration depending on the application.

The parameters are organized in functional groups, so called parameter groups.

| Group    | Description                           | Parameter | Description              |
|----------|---------------------------------------|-----------|--------------------------|
| Group 07 | Control words                         | 21.01     | Start function           |
| Group 08 | Status words                          | 21.02     | Start function           |
| Group 09 | Fault and alarm words                 | 21.03     | Off1 stop mode           |
| Group 11 | Start, stop, direction or MCB control | 21.04     | Process stop selection   |
| Group 12 | Reference selection                   | 21.05     | Process stop signal      |
| Group 16 | System control inputs                 | 21.06     | Process stop MCB control |
| Group 17 | DC link control                       | 21.07     | Process stop mode        |
| Group 18 | Utility                               | .         |                          |
| Group 19 | Data storage                          | .         |                          |
| Group 20 | Limits                                | .         |                          |
| Group 21 | Start / stop / process stop           | 21.17     | MCB closing time limit   |
| Group 22 | Ramp functions                        | .         |                          |
| Group 23 | Speed reference                       | 21.19     | MCB available signal     |

For details about the parameters, their settings and functions, see “Appendix G - Signal and parameter table”.

When entering the parameters mode for the first time after the auxiliary supply voltage of the drive has been switched on, the CDP control panel displays the first parameter of parameter group 11. The next time the parameters mode is entered, the previously selected parameter displays.

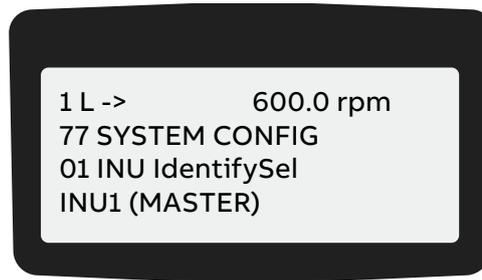
Some parameter settings cannot be changed while the drive is running. If tried, the following warning displays.



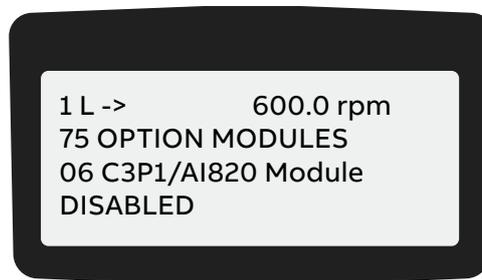
**\*\* WARNING \*\***  
WRITE ACCESS DENIED  
PARAMETER SETTING  
NOT POSSIBLE

### 9.2.3.2. Changing a parameter setting

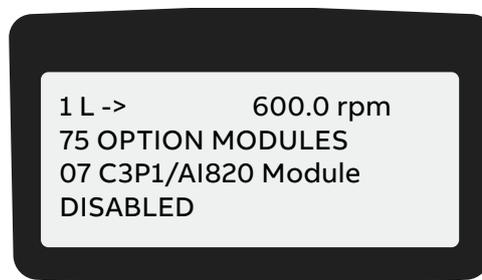
1. To enter the parameters mode, press the PAR key.



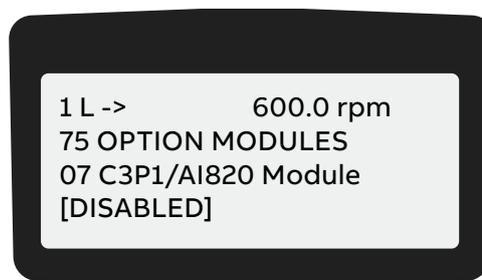
2. To select a different group, press a fast navigation key.



3. To select a parameter, press a slow navigation key.

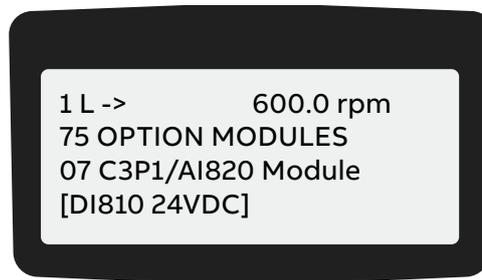


4. To enter the parameter setting function, press the ENTER key.

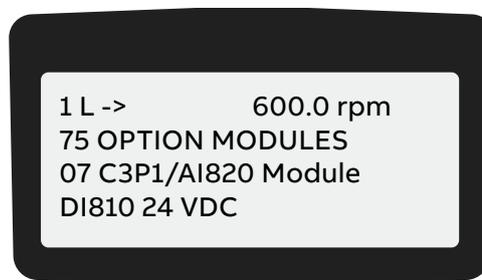


5. To change the parameter value, press:

- Slow navigation keys for numbers and text
- Fast navigation keys for numbers only

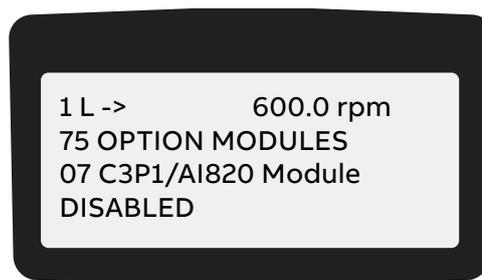


6. To confirm the setting and to return to the actual signals display, press the ENTER key.



7. To cancel the setting and keep the original setting, press any of the mode selection keys.

The selected keypad mode is entered.



## Enabling / unlocking a parameter lock

Unwanted parameter settings can be prevented by activating the parameter lock function.

The corresponding parameters are 16.02 PARAMETER LOCK and 16.03 PASSCODE and belong to parameter group 16 SYSTEM CTRL INPUTS.

### Enabling the parameter lock

1. Select parameter 16.02.
2. Set parameter 16.02 to 1 (LOCKED).
3. Confirm the setting and exit the parameters mode.

### Unlocking the parameter lock

1. Select parameter 16.03.
2. Set the correct pass code.
3. Confirm the setting and exit the parameters mode.

For more information, see “Appendix G - Signal and parameter table”.

#### 9.2.3.3. User lock

#### **NOTICE** Risk of component damage.

ABB is not be liable for damages or losses caused by the failure to activate the user lock with a new pass code.

- See the “Legal disclaimer” on page 2.

### Setting the master pass code

ABB recommends that you set a master pass code to lock the control panel to protect the parameter values.

1. To activate the user lock for the first time, enter the default pass code, ie, 358, in 16.02 Passcode.

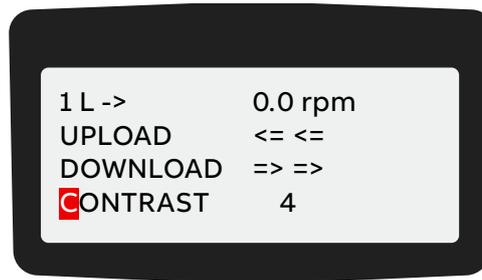
You can now edit parameters 16.24...16.25.

2. Enter the old pass code in 16.24 OldUserPasscode.
3. Enter the new pass code in 16.25 NewUserPasscode.
4. In 16.02 Parameter Lock, enable the user lock functionality.

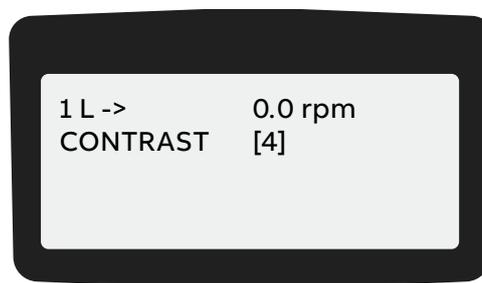
NOTE – To reopen the user lock, ie, to edit parameters 16.24 and 16.25 , enter the new pass code in 16.03 Passcode.



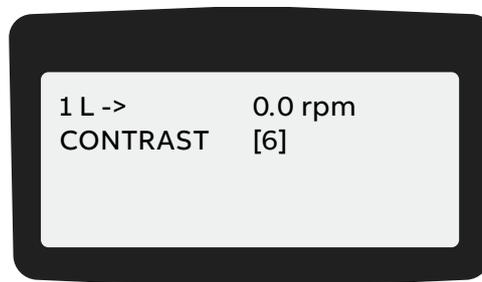
2. To select the contrast adjustment function, press the slow navigation keys until the **blinking** cursor reaches the CONTRAST line.



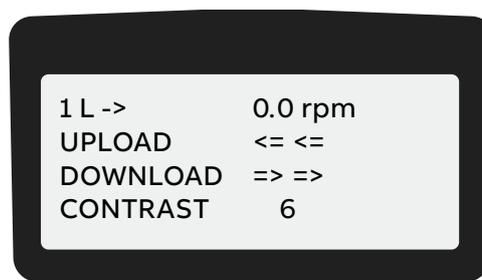
3. Press the ENTER key.



4. To change the contrast, press the slow navigation keys.



5. To confirm the setting and to return to the actual signals display, press the ENTER key.



6. To cancel the setting and keep the original setting, press any of the mode selection keys. The selected keypad mode is entered.



### 9.2.5. Local and remote control mode

The local-remote feature of the CDP control panel allows selecting the control location of the drive. Possible are:

- Local control (L)
- Remote control (R)

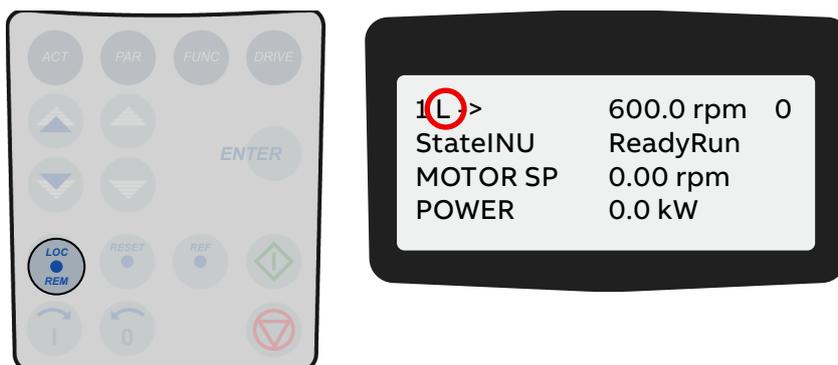
NOTE – In this context, remote control is not necessarily equivalent to higher-level control. For more information, see “9.2.5.4 Remote control” on page 151.

#### 9.2.5.1. Local control

In local control mode, full operational control of the drive is enabled from the local operator panel. Commands from remote have no effect.

- To enter the local control mode, press the LOC-REM key.

Local control is indicated by the letter **L**.



#### 9.2.5.2. Disabling / enabling local lock function

Accidental switching from remote control to local control can be prevented with the local lock function.

The corresponding parameter is 16.04 LOCAL LOCK and belongs to the parameter group 16 SYSTEM CTRL INPUTS.

### 9.2.5.3. Enabling the local lock

- To enable the local lock, set parameter 16.04 to 2 (LOCKED).

With this parameter setting, local control (including the LOC-REM key) is disabled.

If the CDP control panel or a DriveWindow PC is in local control mode at the time that the local lock is enabled, they remain in local control mode until they are switched to remote control mode. This means that the CDP control panel displays the letter L until you press the LOC-REM key.

### Disabling the local lock

- To disable the local lock, set parameter 16.04 to 1 (OPEN).

With this parameter setting, switching between remote and local control is enabled.

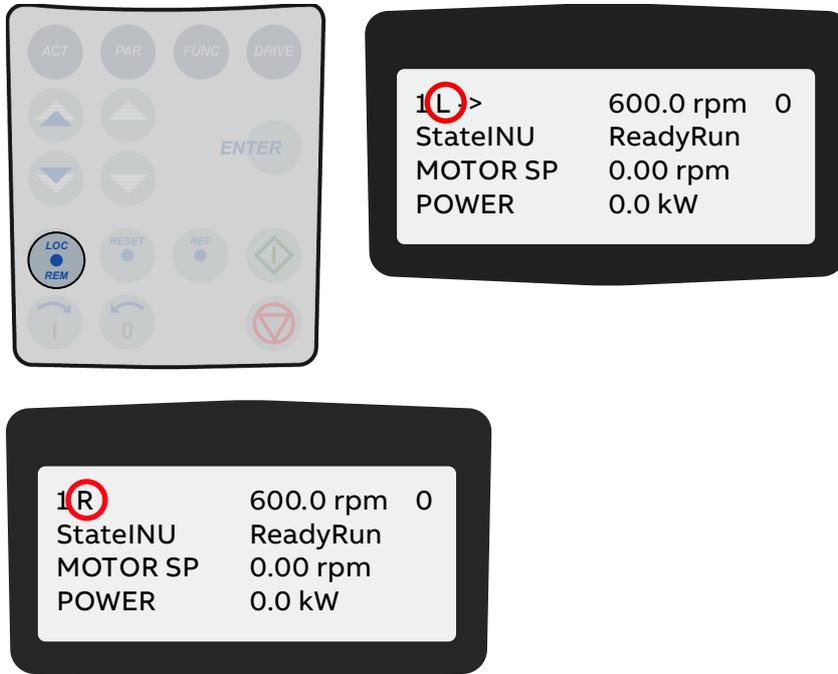
### 9.2.5.4. Remote control

In remote control mode, operational commands or reference values usually come from a higher-level control system via fieldbus or remote I/O.

However, with the following parameter settings it is possible to start and stop the drive, to set the direction of rotation, and to enter reference values from the CDP control panel.

- 11.01 EXT1 START/STOP/DIR = 10 (KEYPAD) or  
12.03 EXT REF1 SELECT = 1 (KEYPAD) and  
12.02 EXT1/EXT2 SELECT = 1 (EXT1)
- 11.02 EXT2 START/STOP/DIR 10 (KEYPAD) or  
12.06 EXT REF2 SELECT = 1 (KEYPAD) and  
12.02 EXT1/EXT2 SELECT = 2 (EXT2)

- To enter the remote control mode, press the LOC-REM key.
  - A blank space indicates full remote control from a higher-level control system.
  - The letter **R** indicates partial remote control (some commands are enabled locally).



NOTE – To prevent accidental switching from remote control to local control, see “9.2.5.2 Disabling / enabling local lock function” on page 150.

## 9.3. Operational commands

For instructions on how to start and stop the drive system from the CDP control panel, see “8.7 Starting the drive” on page 123 and “8.8 Stopping the drive” on page 127.

### 9.3.1. Setting the direction of rotation

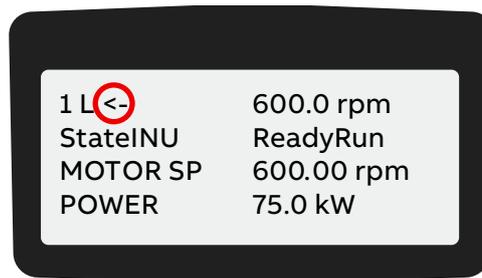
Setting the direction of rotation from the CDP control panel is possible in:

- Local control mode (L)
- Remote control mode (R)

The arrow on the display indicates the direction of rotation:

- When the motor is running, the arrow indicates the actual direction.
- When the motor is not running, the arrow indicates the preselected direction.

To set the direction of rotation, press the forward or backward key.



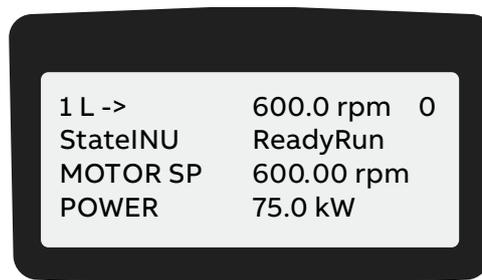
If you change the direction while the motor is running, the motor automatically ramps down to zero speed and reaccelerates in the opposite direction to the preset speed. The arrow changes at zero speed.

### 9.3.2. Entering a reference value

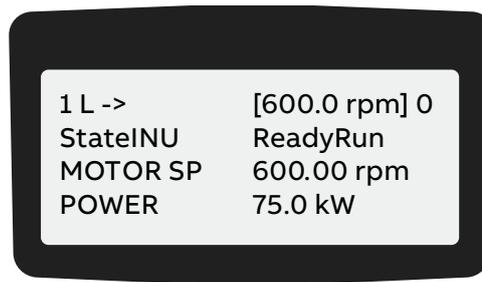
Entering a reference value from the CDP control panel is possible in:

- Local control mode (**L**)
- Remote control mode (**R**)

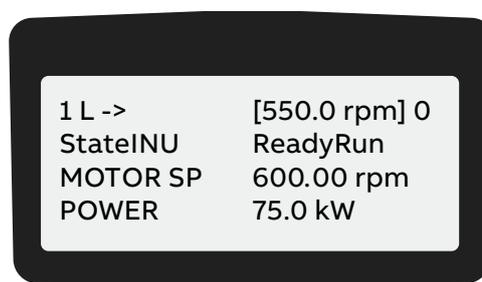
1. Press a mode selection key.



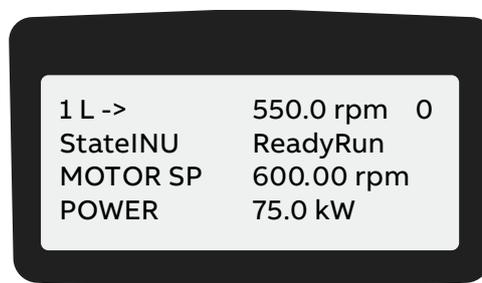
2. To enter the reference value input mode, press the REF key.



3. To enter / change the reference value, press the corresponding fast or slow navigation key.



4. To exit the mode, press a mode selection key.



## 10. Preventive and corrective maintenance

### 10.1. General information

During the warranty period of the drive, any maintenance must be carried out exclusively by ABB service personnel. After the warranty period, repair work may only be carried out by certified personnel.

#### 10.1.1. Required qualification

To maintain safe and reliable operation of the drive, ABB recommends taking out a service contract with the ABB service organization.

#### 10.1.2. Maintenance schedule

Carry out all maintenance tasks according to the maintenance schedule, on time and at the stated intervals in the “ACS5000 preventive maintenance schedule” (3BHS855274 E01).

#### 10.1.3. Logbook

It is recommended to record all troubleshooting and maintenance work in a logbook including:

- Date and time
- Detailed description

#### 10.1.4. Spare parts

To ensure safe and reliable operation, use only spare parts recommended and approved by ABB.

For information on types and identification codes, see “Appendix E - Parts list”.

| PRODUCT  | DOCUMENT KIND | DOCUMENT ID.   | REV. | LANG. | PAGE    |
|----------|---------------|----------------|------|-------|---------|
| ACS5000W | User manual   | 3BHS799208 E01 | F    | en    | 155/178 |

## 10.2. Identifying electrical equipment

### 10.2.1. Device designation

To facilitate the identification in wiring diagrams and parts lists, all devices are labeled in accordance with IEC 81346-1.

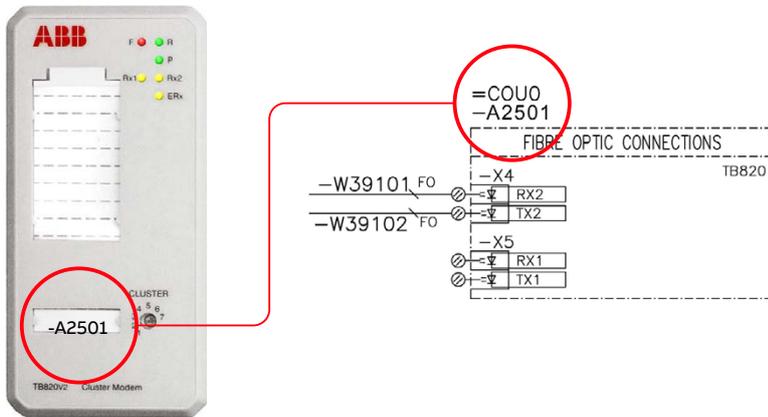


Figure 10-1 Device identification

### 10.2.2. Cables and wires

Cables and wires in the drive are equipped with marker sleeves that carry the same identifying number as on the wiring diagrams.

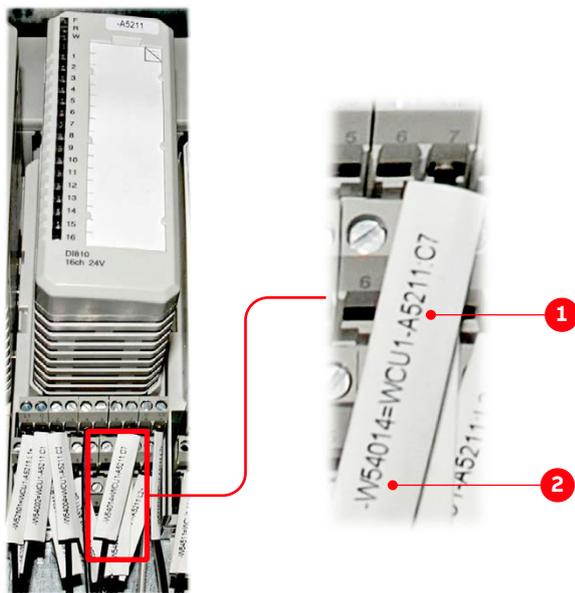


Figure 10-2 Cable and wire designation

1) Terminal number

2) Wire number

### 10.2.3. Understanding wiring diagrams

For information on item designation and cross-reference conventions, see “Appendix D - Wiring diagrams”.

|                     |                              |                                |           |             |                 |
|---------------------|------------------------------|--------------------------------|-----------|-------------|-----------------|
| PRODUCT<br>ACS5000W | DOCUMENT KIND<br>User manual | DOCUMENT ID.<br>3BHS799208 E01 | REV.<br>F | LANG.<br>en | PAGE<br>156/178 |
|---------------------|------------------------------|--------------------------------|-----------|-------------|-----------------|

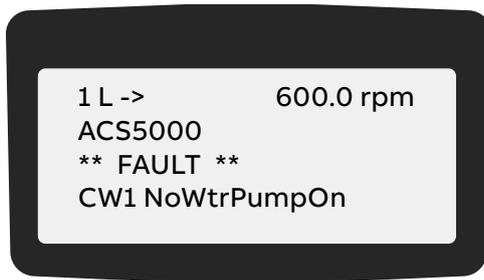
## 10.3. Alarm / fault indications

When a failure occurs in the drive or in the equipment monitored by the drive (eg, main circuit breaker, transformer, cooling system), the CDP control panel displays a corresponding alarm or fault message.

### 10.3.1. Messages

The type of light emitted by the alarm / fault lamp on the control compartment door depends on the type of message:

- Flashing light: alarm
- Light remains on: fault



The message can be saved and viewed in the fault history of the drive when a PC with DriveWindow, DriveDebug or DriveMonitor is connected to the drive. The fault history can also be called up on the CDP control panel.

### 10.3.2. Error message levels

- Two error message levels are used in the drive:
- Alarm: does not shut down the drive
- Fault: shuts down the drive

#### 10.3.2.1. Alarm

An alarm does not shut down the drive. If the condition causing the alarm is not corrected, a persisting alarm can often lead to a fault. An alarm cannot be reset manually. The alarm message is deleted from the display as soon as the alarm condition has been corrected.

### 10.3.2.2. Fault

A fault shuts down the drive. The type of shutdown depends on the origin of the fault.

Depending on the type of fault, the drive opens the main circuit breaker (MCB) or keeps it closed:

- Class 1 faults (FC 1) open the MCB.
- Class 2 faults (FC 2) do not open the MCB.

Since the MCB is controlled and monitored entirely by the drive, no external opening command must be given to the MCB when a fault condition occurs.

A fault condition must be corrected and the fault be manually reset before the drive can be started again.

### 10.3.2.3. Alarm / fault messages

When an alarm or a fault occurs, a specific message is saved in the fault history of the drive. Information on the 64 most recent fault and alarm events are saved.

### 10.3.3. Fault handling

The faults are entered into the fault buffer as they occur and are numbered:

- The last fault entered has number 1.
- The first fault entered has the highest number.

Information of the fault classification (eg, FC 1 or FC 2) is also saved when the first fault of the fault class is active. Date and time stamps facilitate fault tracing, especially when a fault leads to several subsequent faults.

#### Example:

|    |                                  |                          |
|----|----------------------------------|--------------------------|
| 1) | <b>+Fault AMC: Fault Class 2</b> | 2008-01-08 16:58:24.3770 |
| 2) | <b>+Fault PPCS Communication</b> | 2008-01-08 16:58:24.3760 |
| 3) | <b>+Fault AMC: Fault Class 1</b> | 2008-01-08 16:56:02.1170 |
| 4) | <b>+Fault DC Undervoltage</b>    | 2008-01-08 16:56:02.1170 |

In the above example:

|    |                                  |  |
|----|----------------------------------|--|
| 1) | <b>+Fault AMC: Fault Class 2</b> | Classifies the fault   |
| 2) | <b>+Fault PPCS Communication</b> | Represents a subsequent fault that occurred 2 min. 22 s than the first fault |
| 3) | <b>+Fault AMC: Fault Class 1</b> | Classifies the fault   |
| 4) | <b>+Fault DC Undervoltage</b>    | Reason for the failure of the drive system as it occurred first              |

For more information on alarms and faults, see “Appendix G - Signal and parameter table”.

### 10.3.4. Standard troubleshooting procedure

If a fault shuts down the drive, proceed as follows:



- 1) **DO NOT switch off the auxiliary supply voltage or try to reset a fault message before all information at the time of the occurrence of the fault condition has been saved.**



- 2) **Select the fault history display on the CDP control panel, but do not clear the buffer now!**

For more information, see “9 CDP control panel” on page 133.



- 3) **Identify the fault and make a logbook entry.**



- 4) **Save the content of the data logger when a PC is available that has the DriveWindow or DriveDebug tool installed.**

The data logger provides information (eg, waveforms of voltage, current, torque) for efficient troubleshooting.



- 5) **Contact ABB service if a fault cannot be rectified.**

When calling ABB service, it is recommended to have the following data available at the time when the fault occurred:

- Operating, ambient and load conditions
- Unusual events



- 6) **After the fault has been rectified, start the drive as described in “8 Operation” on page 117.**

## 10.4. Removing the CDP control panel

When the CDP control panel must be removed from its mounting cradle, follow the instructions below.

1. When the panel is removed while the drive is in operation, check the setting of parameter 31.01 PANEL LOSS SUPERVISION first.

If the parameter is set to NOT USED, the panel can be removed without interrupting drive operation.

For more information on parameter settings, see “Appendix G - Signal and parameter table”.

2. To remove the panel, proceed as illustrated.

**IMPORTANT!** When the CDP control panel has been removed during operation, the drive can only be stopped by pressing the emergency-off pushbutton.

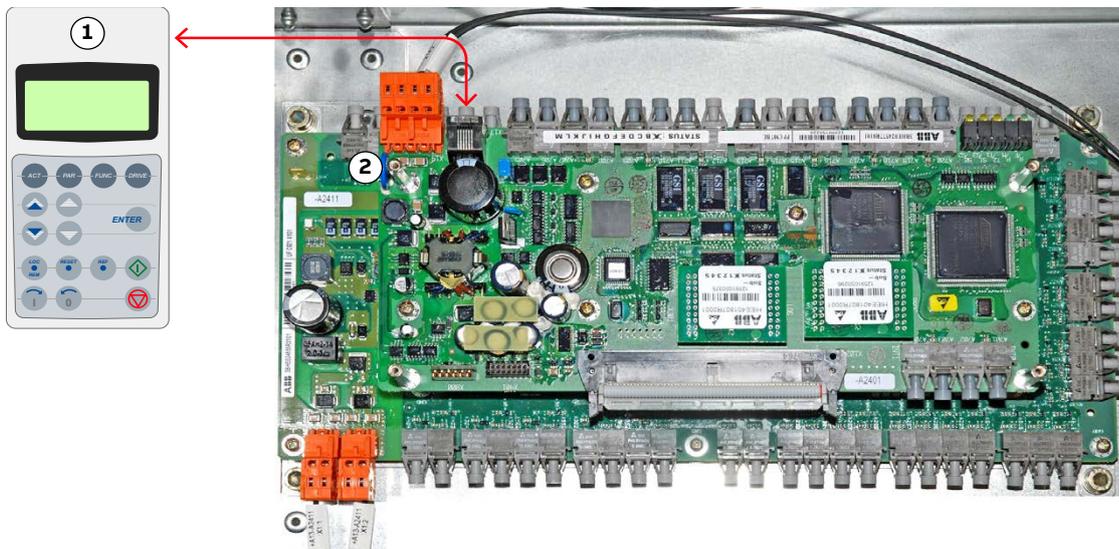


### LEDs

The green LED (4) signals that the control voltage has been switched on.

### Communication with AMC circuit board

The CDP control panel (1) is connected to the AMC circuit board (2) via an RS485 interface.



## 10.5. LEDs and switches on circuit boards and I/O devices

The following section provides an overview of the meaning of LEDs and switches of the main circuit boards and I/O modules. The LEDs presented in the following section can be checked easily while the auxiliary voltage is switched on without having to remove covers first. The LEDs provide information on the status of the devices and can be used for diagnostic purposes.

### 10.5.1. AMC circuit board

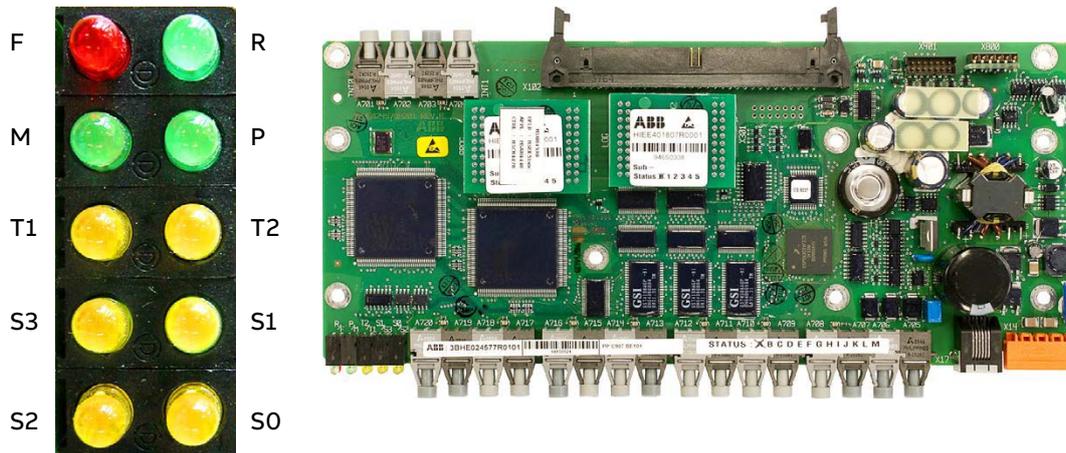


Figure 10-3 LEDs of AMC circuit board

| LED | Color  | Description                      | Status when software has loaded |          | Status when software has not loaded |          |
|-----|--------|----------------------------------|---------------------------------|----------|-------------------------------------|----------|
|     |        |                                  | Booting                         | ON       | Booting                             | ON       |
| F   | Red    | Fault                            | ON                              | OFF      | ON                                  | ON       |
| R   | Green  | Run                              | OFF                             | OFF      | OFF                                 | OFF      |
| M   | Green  |                                  | ON                              | OFF      | ON                                  | ON       |
| P   | Green  | Supply OK                        | ON                              | ON       | ON                                  | ON       |
| T1  | Yellow | Receiving data on DDCS channel 0 | Flashing                        | ON / OFF | Flashing                            | ON / OFF |
| T2  | Yellow | Receiving data on DDCS channel 3 | Flashing                        | ON / OFF | Flashing                            | ON / OFF |
| S3  | Yellow |                                  | OFF                             | OFF      | OFF                                 | OFF      |
| S1  | Yellow |                                  | Flashing                        | OFF      | Flashing                            | OFF      |
| S2  | Yellow |                                  | Flashing                        | OFF      | Flashing                            | OFF      |
| S0  | Yellow |                                  | Flashing                        | OFF      | Flashing                            | OFF      |

### 10.5.2. S800 I/O bus modem TB820

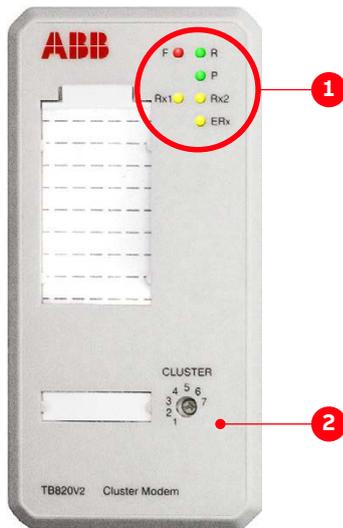


Figure 10-4 TB820 bus modem

| LED | Color  | Indication                       |
|-----|--------|----------------------------------|
| F   | Red    | Fault in module                  |
| R   | Green  | Device in operation              |
| P   | Green  | Power supply is healthy          |
| Rx1 | Yellow | Traffic on optical module bus    |
| Rx2 | Yellow | Traffic on optical module bus    |
| ERx | Yellow | Traffic on electrical module bus |

#### 10.5.2.1. Bus modem address

The TB820 bus modem has a unique cluster address that identifies the module in the software and links it to a parameter.

The address is set with the rotary switch on the module (Fig. 10-4: 1). The factory-set value must not be changed.

### 10.5.3. S800 I/O modules

LEDs on I/O modules having the same meaning on all types of I/O modules are always at the same position. The LEDs are always at the topmost position on each module (Fig. 10-5: 1) and are identified as follows:

- F: fault
- R: run
- W: warning
- O or OSP (only output modules)

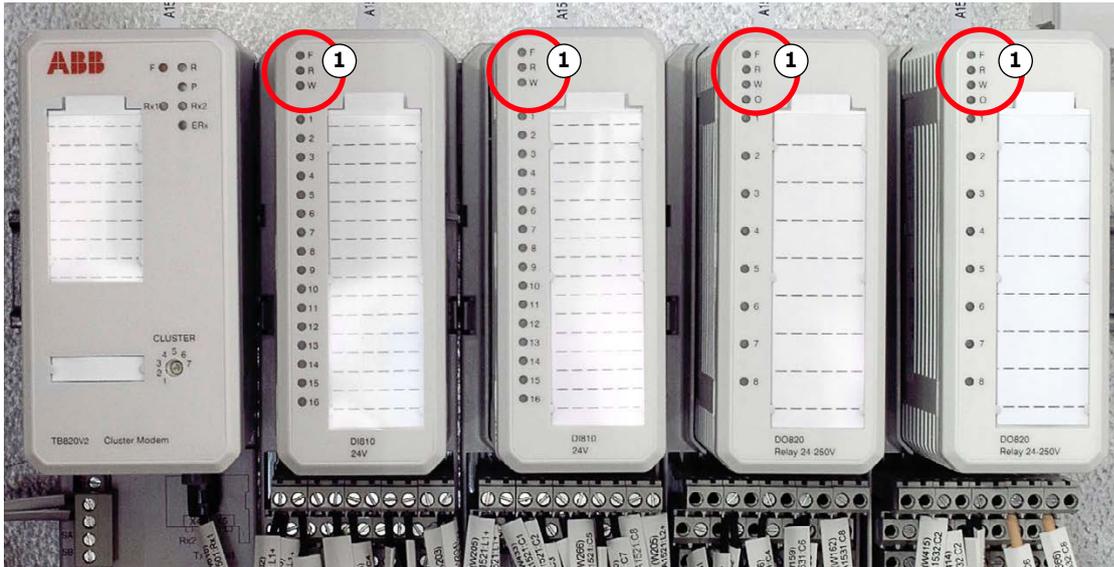


Figure 10-5 Example of S800 I/O station

| LED | Color  | Indication   |
|-----|--------|--|
| F   | Red    | Indicates failure  |
| R   | Green  | Device is operating normally                             |
| W   | Yellow | External fault or minor fault in the module              |
| O   | Yellow | Indicates an active signal                               |
| OSP | Yellow | Indicates an active signal (output set as predetermined) |

For more information, see the following manuals:

- S800 I/O - General information and installation, user’s guide
- S800 I/O - Modules and termination unit, user’s guide

## 10.6. Corrective maintenance

Overview on maintenance tasks:

- “10.6.6 Visual checks on the drive” on page 173
- “10.6.7 Cleaning” on page 173
- “10.6.8 Checking wire and cable connections” on page 174
- “10.6.9 Checking and replacing filter mats” on page 174
- “10.6.10 Replacing a door-mounted fan” on page 175
- “10.6.11 Replacing a fan of an IP42 roof-mounted cooling unit” on page 176 (optional)
- “10.6.12 Replacing a fan of an IP54 roof-mounted cooling unit” on page 177 (optional)

### 10.6.1. Safety



#### **⚠ DANGER** Hazardous voltages!

Before starting to work on the drive, make sure:

- Main and auxiliary power supply to the drive are switched off, locked out, and tagged out,
- Drive is de-energized
- Grounding connections are in place
- Personal protective equipment is provided and used when required
- Everyone involved is informed

Before energizing the drive again, make sure:

- All foreign objects are removed from the drive
- All internal and external covers are securely fastened and all doors are closed, locked and / or secured (locking bar in locked position)
- Release dials of safety switches are in locked position
- When maintenance on the drive is carried out, such as changing of semiconductors, grounding equipment must be connected at the appropriate locations.

The grounding equipment ensures that hazardous voltages cannot be fed into the drive, from the main power supply or the motor.

| PRODUCT  | DOCUMENT KIND | DOCUMENT ID.   | REV. | LANG. | PAGE    |
|----------|---------------|----------------|------|-------|---------|
| ACS5000W | User manual   | 3BHS799208 E01 | F    | en    | 164/178 |



**WARNING** Hazardous DC voltage!

Depending on the type of auxiliary supply, the drive can be equipped with buffer capacitors inside the control unit. During operation, the capacitor voltage is 300 V (DC).

- Wait 5 minutes for the capacitors to discharge.
- Before touching a capacitor, verify that the capacitors are discharged.



**NOTICE** Foreign matter and particularly metallic dust can cause failure and damage when the drive is energized!

Ensure that foreign matter cannot enter the cabinet:

- Close the doors and cover openings completely when work is discontinued.
- Retrieve any foreign matter which accidentally dropped into the cabinet.

### 10.6.2. De-energizing the drive

The following section describes how to de-energize the drive using the local operator panel of the drive. If the drive is controlled from remote, follow the established shutdown procedures.

For instructions on how to use the CDP control panel, see “9 CDP control panel” on page 133.

#### 10.6.2.1. Stopping the motor

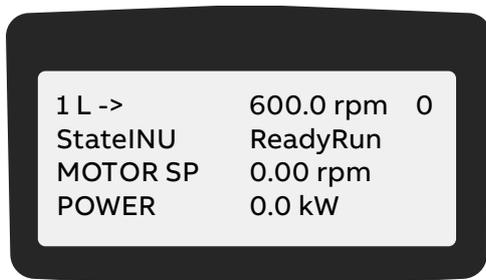
1. Enable the local control mode of the CDP control panel.



2. To stop the motor, press the STOP key.



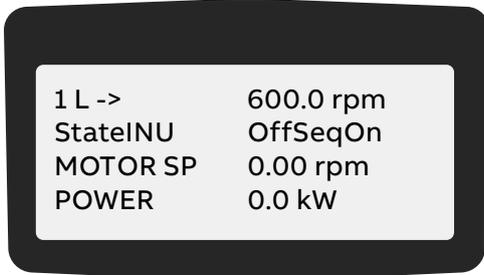
When the motor has reached zero speed, the display shows ReadyRun.



### 10.6.2.2. De-energizing the drive

1. To disconnect the drive from the main power supply, press the SUPPLY OFF pushbutton. The following takes place:
2. Main circuit breaker (MCB) opens
3. DC link discharges

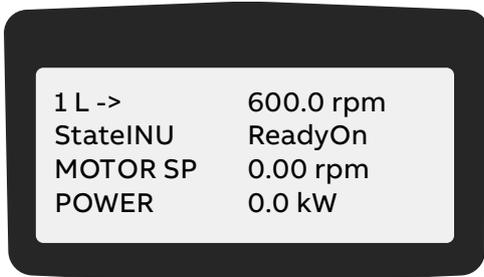
While the DC link discharges, the CDP control panel shows the following:



**Alternating display message:**

- OffSeqOn
- Discharging
- AuxiliaryOn

When the DC link has discharged completely, the status line displays ReadyOn and the SUPPLY OFF pushbutton changes to a permanent light.



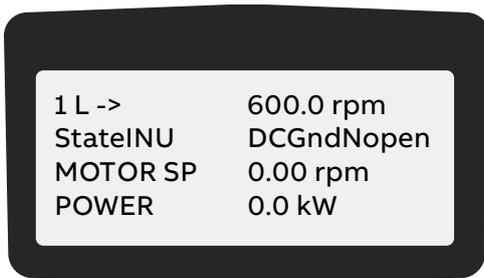
4. Rack-out, lock-out, ground and tag-out the main circuit breaker.
5. Wait until the yellow lamp GROUNDING SWITCH UNLOCKED lights up.

Because cooling of the drive continues for a preset time after switching off the main power supply, the yellow lamp lights up with a delay.

If the lamp does not light up and there is a reason to believe that the grounding circuit is malfunctioning.

For more information, “10.4 Removing the CDP control panel” on page 160.

6. Once the yellow lamp GROUNDING SWITCH UNLOCKED is lit, turn the grounding switch to the grounded position.
7. When the grounding switch is in the grounded position, the status line alternates between DCGnd NOpen, NotReadyOn, StateINU NotRdy.



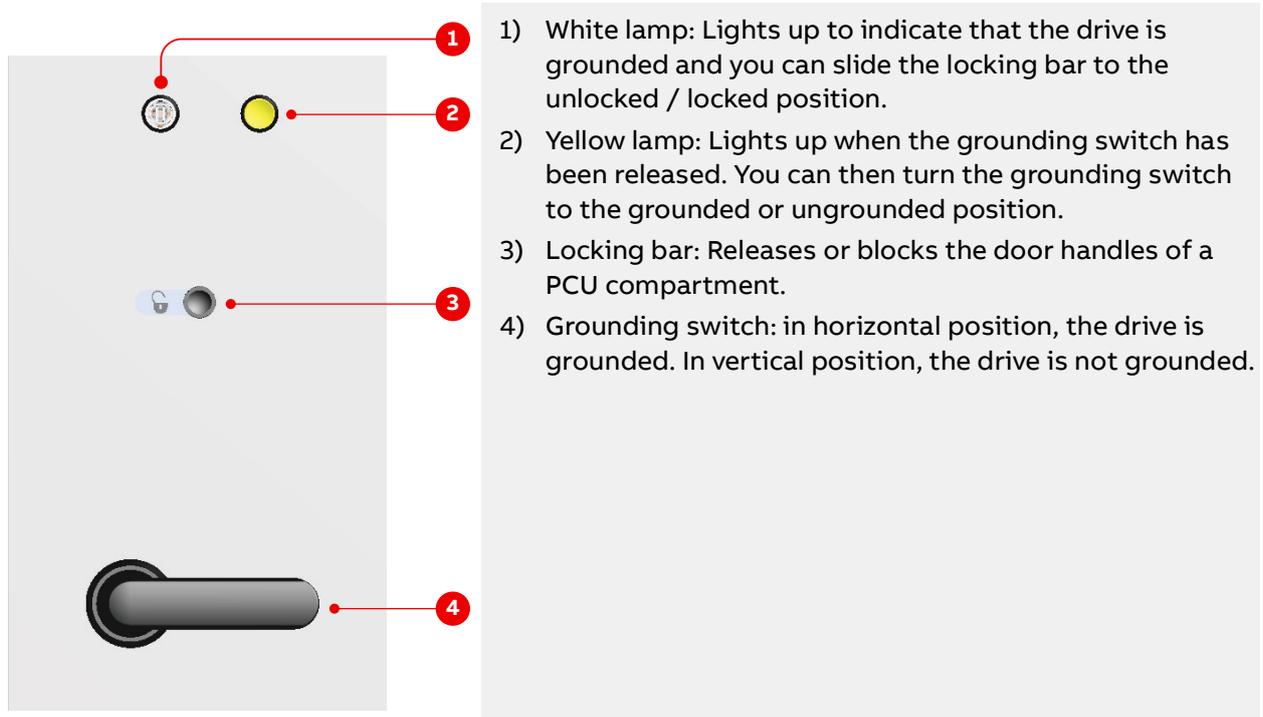
**Alternating display message:**

- DCGnd Nopen
- NotReadyOn

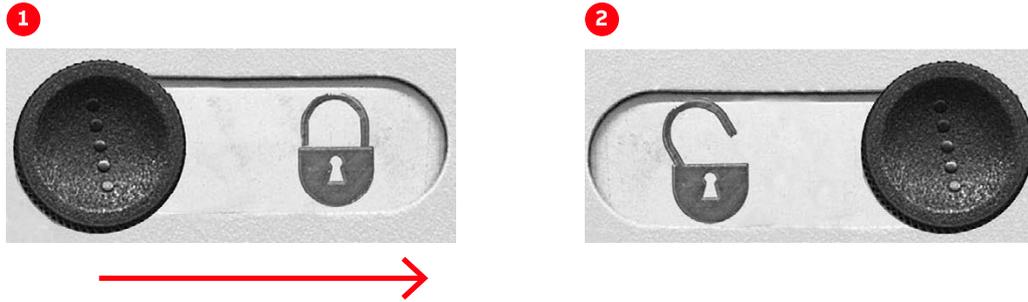
8. If necessary, open the doors of medium voltage compartments according to “10.6.3 Opening and closing the doors” on page 167
9. Switch off and lock-out all auxiliary supply voltages from external sources.  
The drive is now de-energized, and safe access is possible.

### 10.6.3. Opening and closing the doors

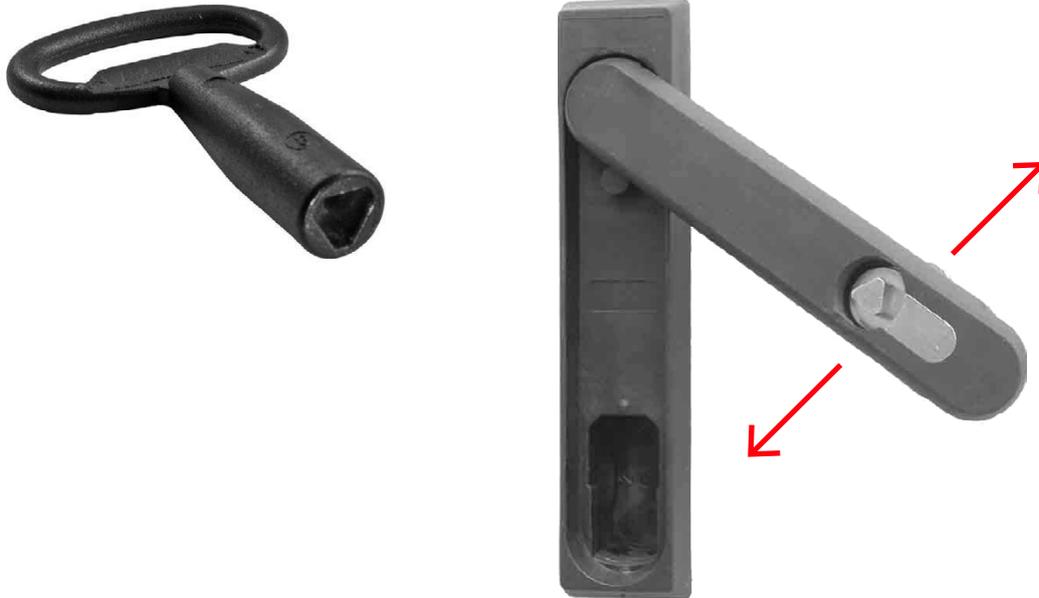
#### Releasing the doors



1. To test the yellow lamp, press its pushbutton.  
If the lamp does not light up, see “10.4 Removing the CDP control panel” on page 160.
2. If the drive is in operation, stop the drive according to “8.8 Stopping the drive” on page 127.
3. To discharge the DC link of the drive, press the SUPPLY OFF pushbutton on the local control panel.  
The yellow lamp lights up when the DC link is discharged.  
If the yellow lamp does not light up, see “10.4 Removing the CDP control panel” on page 160.
4. Once the yellow lamp lights up, turn the grounding switch to the grounded position.  
The white lamp lights up to indicate that the drive is grounded.
5. Once the white lamp lights up, slide the locking bar from the locked (1) to the unlocked (2) position.



### Opening the doors



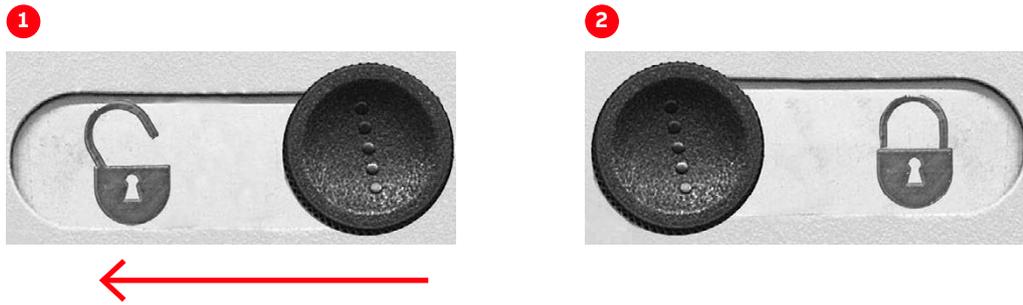
1. To release the door handle, insert and turn the key to the right.  
The door handle pops out.
2. To open the door, turn the door handle:
3. To the right if the door is hinged on the right
4. To the left if the door is hinged on the left.

### Closing and locking the doors

Once maintenance of medium voltage compartments is complete, proceed as follows:

1. To close a door, bring the door handle in line with the door plate and press the handle down until it clicks in.
2. Before actuating the locking bars, make sure that the drive is supplied with auxiliary voltage.

3. To lock a door, slide the locking bar from the unlocked (1) to the locked (2) position.



A limit switch monitors the locked position of the locking bars. If any door of a medium voltage compartment is not locked properly, you cannot start the drive.

#### 10.6.4. Grounding switch is not released

When the DC link of the drive has been discharged, the lamp GROUNDING SWITCH UNLOCKED lights up to indicate that the grounding switch is released and can be turned to the grounded position.

**IMPORTANT!** DO NOT use force for turning the grounding switch in any direction. The handle and / or the switch could get damaged.

If the lamp does not light up, proceed as follows:

- 1) Verify that the main circuit breaker (MCB) is in the open position.
- 2) Check the drive status on the CDP control panel.

The drive status should be ReadyOn, indicating that the DC link has discharged and the MCB has opened.

- 3) Check the actual value of the DC-link voltage on the CDP control panel.

The actual value (parameter 2.30 DC Volt 1-3 MaxVal) must be < 50 V (discharged).

- 4) Check if there are any alarm and fault messages on the display.

If there are alarms / faults, contact the ABB service organization

### 10.6.5. Emergency release of a door safety switch



**DANGER** Hazardous voltages!

Touching energized components can be fatal.

- Before you unlock a safety switch, de-energize and ground the drive according to “10.6.2 De-energizing the drive” on page 165.
- DO NOT unlock the safety switches permanently.

#### 10.6.5.1. Location of safety switches

Each primary and each secondary PCU is equipped with a safety switch. The safety switches block and release the locking bars, depending on whether or not the drive is discharged and grounded. This prevents doors from being opened unintentionally during operation.

In 1700 mm PCUs, the safety switches are on the back of the left door.

In 2100 mm PCUs, the safety switches are on the back of the middle door.

A screw cap on the front of the door marks the exact position.

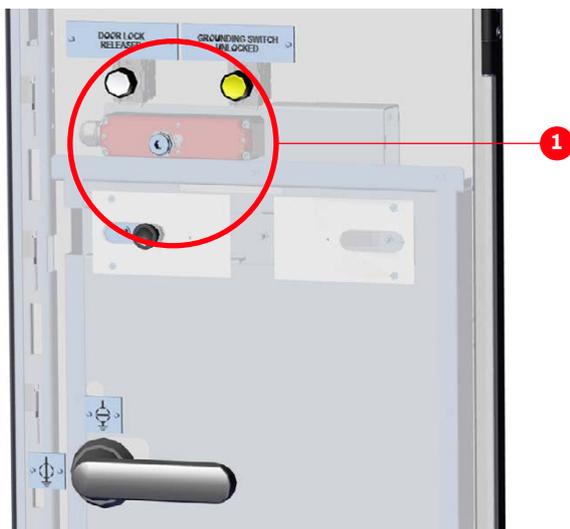
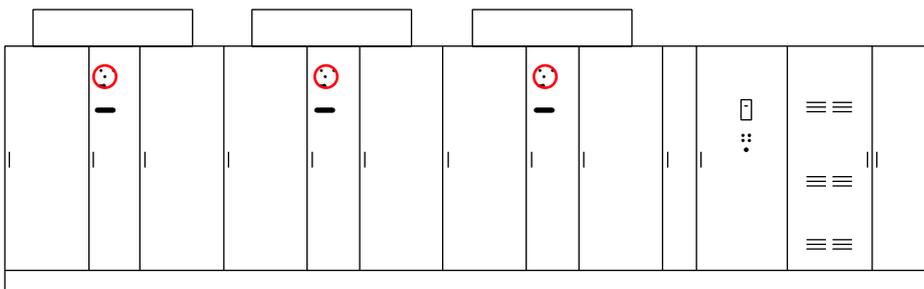


Figure 10-6 Location of safety switches

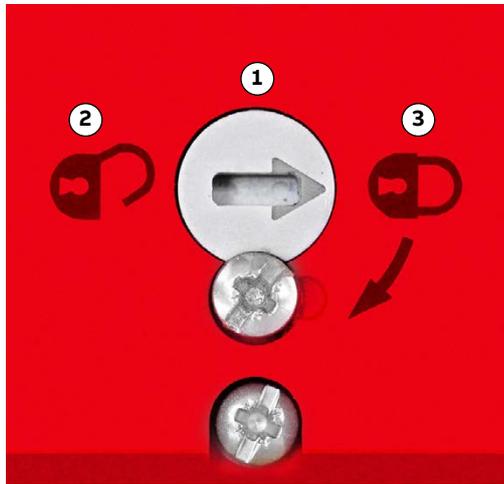
#### 1) Safety switch

For the safety switches to work and to be able to open the doors, auxiliary power supply is required.

|                     |                              |                                |           |             |                 |
|---------------------|------------------------------|--------------------------------|-----------|-------------|-----------------|
| PRODUCT<br>ACS5000W | DOCUMENT KIND<br>User manual | DOCUMENT ID.<br>3BHS799208 E01 | REV.<br>F | LANG.<br>en | PAGE<br>170/178 |
|---------------------|------------------------------|--------------------------------|-----------|-------------|-----------------|

If the auxiliary power supply is unavailable and the doors are closed, you can only open them by unlocking the safety switch manually.

### 10.6.5.2. Safety-switch settings

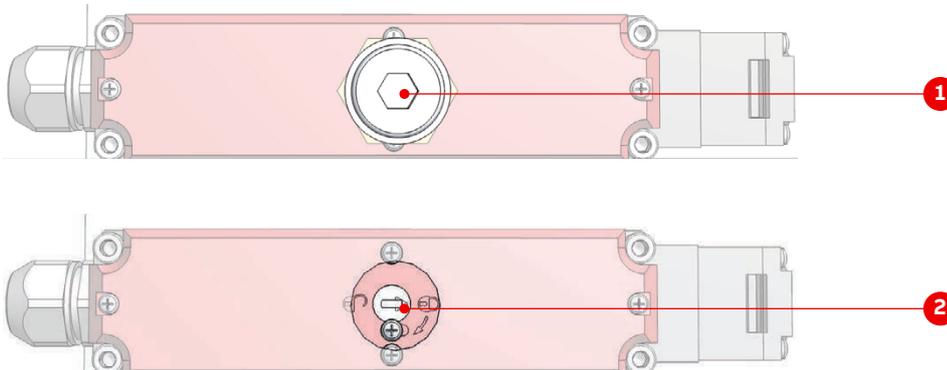


- 1) Release dial
- 2) Unlocked position: enables opening the door of a medium voltage unit whether the auxiliary voltage is switched on or off.
- 3) Locked position: Normal operating setting  
To open the door of a medium voltage unit, the DC link must be discharged and the auxiliary voltage must be switched on.

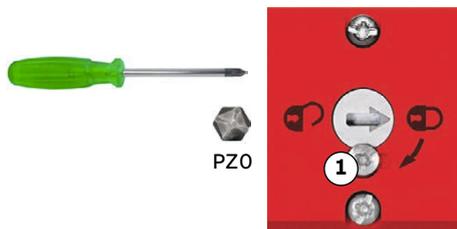
Figure 10-7 Safety switch

#### Unlocking

1. To access the release dial (2), remove the screw cap (1) from the door.

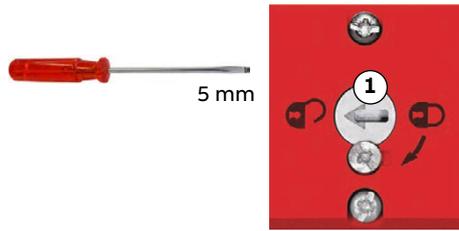


2. Turn out the locking screw (1) until the release dial can be turned.



3. Turn the release dial from the locked to the unlocked position.

You can now actuate the locking bar and open the doors.



4. When the door is open, turn the release dial to the locked position and screw in the locking screw.



5. Screw in the locking screw again.
6. Refit the screw cap.

### 10.6.6. Visual checks on the drive

Check the drive and its immediate vicinity visually at the intervals stated on the maintenance schedule and pay attention to the following items:

- Humidity inside the drive
- Permitted range of ambient air temperature and humidity of the drive
- Dust built-up inside the drive
- Appropriate fastening of cables and wires and connections of cable shields and screens
- Integrity of cable insulation
- Signs for overheated components, wires, cables or busbars
- Corrosion on electronic circuit boards, connectors or busbars
- Correct type of signal and power supply cables

For information, see the applicable cable specifications.

### 10.6.7. Cleaning

#### **NOTICE** Risk of component damage!

Dust and moisture on electrical components and wiring can cause failure and damage the components as well as the loss of low-level signals on loose connections.

- Check the cabinet regularly for signs of dust and humidity and clean if necessary.
- Use appropriate and recommended cleansing agents.
- DO NOT use alcohol and solvents that can damage the components.

#### 10.6.7.1. Cleaning the drive cabinet

When cleaning the drive cabinet, keep the following in mind:

- To prevent dirt falling into equipment, cover the equipment.
- The drive contains components which are sensitive to electrostatic discharge. Therefore, take electrostatic-sensitive precautions and use suitable tools.
- Clean circuit boards with special care. To prevent the components being damaged, use antistatic brushes and a vacuum cleaner with a soft nozzle.
- Remove dust on assemblies and busbars inside the cabinet with a vacuum cleaner and lint-free cleaning cloths.
- Remove water, oily or greasy deposits on assemblies, components and busbars with water- and oil-absorbing microfibers such as "3M Scotch Brite".
- Use a nylon brush or a vacuum cleaner for removing dust or deposits from recesses.
- Clean the outside of the cabinet with a vacuum cleaner and cleaning cloths.

| PRODUCT  | DOCUMENT KIND | DOCUMENT ID.   | REV. | LANG. | PAGE    |
|----------|---------------|----------------|------|-------|---------|
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### 10.6.8. Checking wire and cable connections



**NOTICE** Risk of component damage!

Vibration can loosen electrical connections and cause equipment failure!  
Excessive force damages the capacitor bushings!

- Tighten to the torque value on the label attached to the capacitor.  
**IMPORTANT!** DO NOT exceed 20 Nm if the tightening torque value is not specified.
- Check all power and control cable connections and tighten them if necessary.
- Check that all plugs and connectors are tight.

### 10.6.9. Checking and replacing filter mats

For the filter mat replacement interval, see the “ACS5000 preventive maintenance schedule” (3BHS855274 E01).

#### 10.6.9.1. Location

Drives with IP54 cabinet, have filter mats in the following compartment doors:

- Water cooling unit (WCU)

Drives with IP42 cabinet, have filter mats in the following compartment doors:

- Phase converter unit (PCU)
- Water cooling unit (WCU)

When replacing a filter mat, see “Appendix D - Wiring diagrams” for information on the protection switch of the cooling fan

#### 10.6.9.2. Replacing filter mats

**IMPORTANT!** Use only filter mats of the same filter class and size as the original filter mat for replacement.

Table 10-1 Filter mat specifications

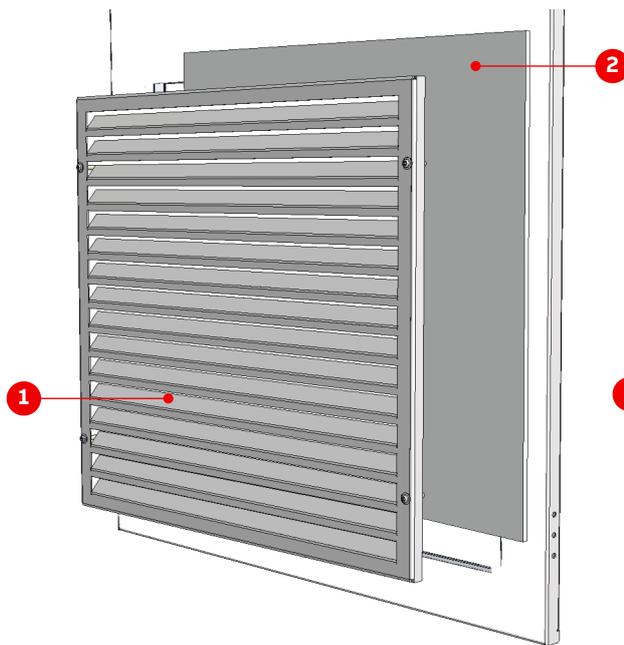
| Item         | Description                            |
|--------------|--|
| Filter class | G3 (EN779)                             |
| Thickness    | ~ 10 mm                                |
| Dimensions   | WCU: 125 x 250 mm<br>PCU: 600 x 652 mm |

Although checking and replacing the filter mats of the WCU compartment is possible during operation of the drive, it is easier to do it when the drive is shut down. The fans behind the air outlet panels may start automatically when the temperature rises to a certain level.

## Replacing both types of WCU filter mats

1. Switch off the protection switch of the cooling fan according to “Appendix D - Wiring diagrams” in order to prevent the cooling fans from starting automatically.
2. Remove the air outlet panel (Fig. 10-8:1).
3. Roll down the filter mat (Fig. 10-82) beginning at the top.
4. Insert a new filter mat.
5. Reattach the air outlet panel.

**A**



**B**

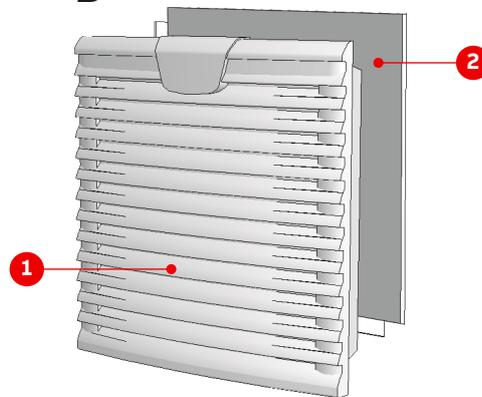


Figure 10-8 Filter mat replacement for PCU (A) and WCU (B)

### 10.6.10. Replacing a door-mounted fan

The WCU compartment has door-mounted fans.

For replacement instructions, see “Assembly instructions for fan and filter units” in “Appendix A - Additional manuals”.

|                     |                              |                                |           |             |                 |
|---------------------|------------------------------|--------------------------------|-----------|-------------|-----------------|
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|---------------------|------------------------------|--------------------------------|-----------|-------------|-----------------|

### 10.6.11. Replacing a fan of an IP42 roof-mounted cooling unit



**WARNING** Hazardous voltage!

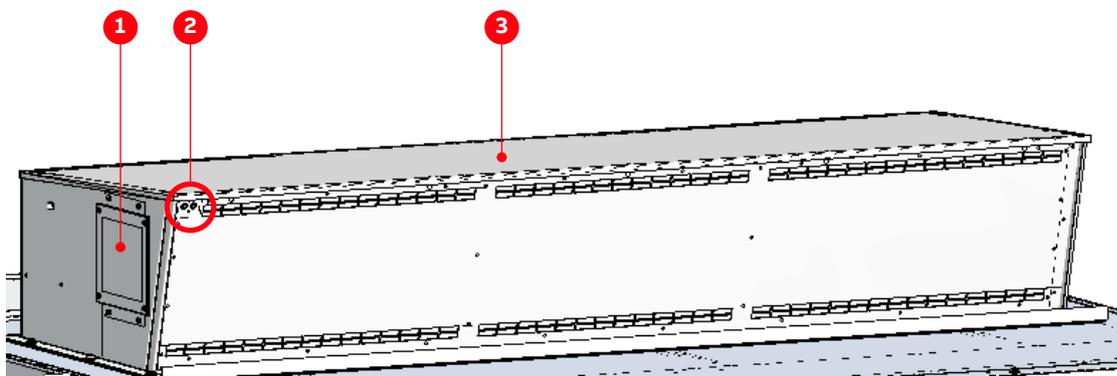
Before starting any work on the fans, de-energize the cooling unit.

The roof-mounted cooling unit as used with IP42 cabinets consists of three fans. One fan is redundant and takes over when one of the other fans fails.

If one fan fails, the red indicator lights up and replacement is required.

#### 10.6.11.1. Replacing a fan

For replacement instructions, see the Instruction manual in “Appendix A - Additional manuals”.



- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>1. Control access panel</li> <li>2. Indicator lights</li> </ul> | <ul style="list-style-type: none"> <li>3. Location of fans (below cover)</li> </ul> |
|--|---|

Figure 10-9 Roof-mounted cooling unit (IP42)

- Dimensions: (L x W x H): 1550 x 550 x 230 mm
- Weight: 40 kg

### 10.6.12. Replacing a fan of an IP54 roof-mounted cooling unit



**WARNING** Hazardous voltage!

Before starting any work on the fans, de-energize the cooling unit.

The roof-mounted cooling unit as used with IP54 cabinets consists of an air-to-water heat exchanger and four fans. One fan is redundant and takes over when one of the other fans fails.

If one fan fails, the red indicator lights up and replacement is required.

#### 10.6.12.1. Replacing a fan

For replacement instructions, see the instruction manual in “Appendix A - Additional manuals”.

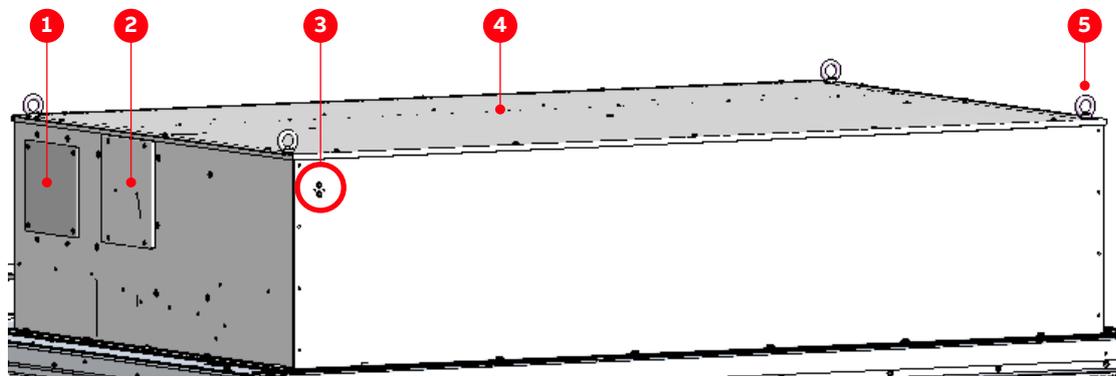


Figure 10-10 Roof-mounted cooling unit (IP54)

- |                           |                                     |
|---------------------------|-------------------------------------|
| 1) Control access panel   | 4) Location of fans (below cover)   |
| 2) Air-bleed access plate | 5) Lifting eye (one in each corner) |
| 3) Indicator lights       |                                     |

- Dimensions: (L x W x H): 1550 x 975 x 386 mm
- Weight: 98 kg

|          |               |                |      |       |         |
|----------|---------------|----------------|------|-------|---------|
| PRODUCT  | DOCUMENT KIND | DOCUMENT ID.   | REV. | LANG. | PAGE    |
| ACS5000W | User manual   | 3BHS799208 E01 | F    | en    | 178/178 |





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**[new.abb.com/drives/medium-voltage-ac-drives](http://new.abb.com/drives/medium-voltage-ac-drives)**