



Maintenance and repair instructions

for trained personnel, certified by ConverterTec



(Exemplary illustration)

con|cycle[®] - MP1 • Frequency converter system

Original operation manual

This document is updated regularly.

- Always use the current version of the document.

Document history

ConverterTec document revisions

- The first released version of a document has the revision acronym **A**.
- All further revisions are identified alphabetically from **B** to **Z**.

Revisions

Date	Version	Modification
15.10.2015	B	Document updated
31.08.2018	C	Document updated
21.12.2018	D	Document updated
05.03.2019	E	Document updated
19.08.2019	F	Document updated
12.10.2020	G	ConverterTec Update

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1 Safety

1.1 Classification of the warning notices with relation to actions



DANGER

Imminent danger to life or danger of severe injuries



WARNING

Danger of minor injuries



CAUTION

Danger of material or environmental damages

NOTICE

Information and tips for easy handling of the product or the documentation

1.2 Intended use

Improper use may cause danger for life and limb and damage to the product and other material assets.

The frequency converters of the series **CONCYCLE® CW 1xx1LD** are intended for operation with doubly fed asynchronous machines in wind turbines.

The intended use includes:

- observing all instructions for the product and all components of the system
- operation of the product without modifications to the product
- operation of the product within the relevant operating limits
- complying with all inspection and maintenance conditions

Any other use than the one described in these instructions or a use beyond the one described herein is regarded as improper use and is prohibited.

The manufacturer is not liable for damage resulting from improper use. Improper use invalidates the warranty of the manufacturer. The risk lies solely with the operator.

1.3 General safety instructions

- ▶ Follow the safety instructions of the operator.
- ▶ Observe national regulations, standards, guidelines and laws.
- ▶ Only use measuring tools which are calibrated and approved for the corresponding voltage levels.
- ⊗ Never stay alone in the wind turbine.
- ⊗ Never operate the product with open cabinets.
- ⊗ Do not remove, modify or disable any safety devices. Only remove the protective coverings if required for professional maintenance and repair.
- ⊗ Do not reconstruct or modify the product.

1.3.1 Danger to life due to electric shock

Touching live components causes danger to life due to electric shock.

Before working on the product, observe the **five safety rules**:

- ▶ Isolate from power supply
- ▶ Protect against reclosing
- ▶ Verify the safe isolation from supply
- ▶ Connect to earth and short circuit
- ▶ Provide neighbouring parts under voltage with barriers

1.3.2 Risk of burning from hot components

During operation, components such as big chokes may heat up.

Before working on the product:

- ▶ Wait until hot components have cooled down.
- ▶ If required, measure the temperature of the components e.g. with an infrared measuring device.

1.3.3 Damage to property by electrostatic discharge

Electronic components can be destroyed by electrostatic discharge.

- ⊗ Do not touch electronic components.
- ▶ If you work at open electronic components, wear an antistatic wrist strap for potential equalisation for electrostatic discharge.

1.4 Foreseeable misuse

- ▶ Do **not** commission the product if there is water condensation in the cabinet.
- ▶ Do **not** operate the product with coolant leakages present.
- ▶ Do **not** operate the product with larger dust deposits.

1.5 Safety signs on the product



This symbol identifies danger to life due to high voltages in one area of the product. Only qualified personnel may work in that area of the product (→ **Chap. 1.9**).



This symbol identifies areas of the product with sensitive electronic components. Electronic components can be damaged by electrostatic discharge.

- ⊙ Do not touch electronic components.
- ▶ If you work at open electronic components, wear an antistatic wrist strap for potential equalisation for electrostatic discharge.

1.6 Behaviour in case of fire

1. Report the fire:
 - Call the local emergency number (→ **Information sign emergency number in the WPP**)
2. Bring yourself to safety:
 - Take along persons at risk
 - Close doors
 - Follow marked escape route
 - Do not use elevators
 - Observe instructions (→ **Escape and rescue plan in the WPP**)
3. Try to extinguish the fire.
 - Use the fire extinguisher

1.7 Behaviour in case of accidents

4. Report the accident:
 - Call the local emergency number (→ **Information sign emergency number in the WPP**)
5. Administer first aid:
 - Secure the accident location
 - Care for the injured
 - Observe the operating instructions
6. Take further measures:
 - Instruct ambulance or fire brigade
 - Remove curious bystanders

1.8 Obligations of the operator

The system operator has the following supervisory duties:

- Complementing the general safety information with local requirements
- Provisioning first-aid kit, fire extinguisher and rescue device for height rescue
- Make sure that only qualified personnel works on the product (→ **Chap. 1.9**)
- Make sure that the personnel is trained in height rescue and first aid
- Make sure that all safety devices are always present and in operation
- Regular trainings for the personnel about the following:
 - Observing and using all instructions
 - Intended use of the product
 - Knowledge of all safety devices
 - Complying with legal provisions
 - Observing operating instructions

1.9 Qualification of personnel

Expertise is required for all work on the product. In order to guarantee safety, only a certified experienced professional may work on the product.

All works on the product must be carried out under supervision of a certified experienced professional.

The operator has to make sure that the personnel is qualified.

1.9.1 Experienced professional certified by ConverterTec

Experienced professionals are persons who can assess the tasks assigned to them, identify potential hazards, and take appropriate protective measures due to their technical training, knowledge and experience as well as their knowledge of the applicable regulations.

A certified experienced professional must also be trained by ConverterTec and certified for the work at the product.

1.10 Personal protective equipment

The personnel must wear appropriate personal protective equipment adapted to the dangers and working conditions. The protective equipment must protect but not restrain.

The following legal requirements apply for the personal protective equipment.

The personal protective equipment must be worn for all work on the product.

If special work requires additional protective equipment, this protective equipment is listed together with the corresponding work.

2 Information about the documentation

2.1 Display conventions

Describing text

- ▶ Single instruction
 1. First of several instructions with defined order
 2. Second of several instructions with defined order
 - ↳ Reaction of the product
- ⊖ Prohibited action
 - Bullet point, 1st category
 - Bullet point, 2nd category

2.2 Applicable Documents

- ▶ Observe all documents supplied with the system or components of the system, and
 - documents which are supplied on request
 - Long term storage of CONCYCLE® frequency converters – RPS-Wind **(4930-1374)**
 - Documents which are supplied after training and successful certification specifically for the individual person
 - Technical Documentation CONCYCLE® System Tool - GB **(KP-38971gb)**

2.3 Keeping the documents

- ▶ Keep these instructions and all documents supplied with the product for further use.

2.4 Validity of the instructions

These instructions are only applicable for:

- CW12x1LD-C0x
- CW13x1LD-C0x
- CW14x1LD-C0x
- CW14x1ML-C0x

2.5 Target groups

These instructions are intended for

- Park operators
- Experienced professionals

In order to guarantee safety, only a certified experienced professional may work on the product.

3 Maintenance work

3.1 Preparation

3.1.1 Save data

1. Use the CONCYCLE® System Tool (CST) for data backup.
2. Save the last three trigger files.
3. Format the Disturbancerecorder.
4. Create and save a data trigger in mains parallel operation and under load.

NOTICE

In absence of wind, the last data trigger with mains parallel operation is sufficient. Disturbance records are also permitted.

5. Save the Event Counter and the Working Time in a single file:
 - CONCYCLE® System Tool → Counter → Show counter → Save As Text...
 - It does not matter, whether “Event Counter” or “Working Time” is selected.
 - CSC_BZ_EZ_1.txt (text file before maintenance)
6. Make a note of the switching cycles of the circuit breaker in the Maintenance protocol circuit breaker.
7. Save the Eventrecorder data:
 - Event_1.evt (event list before maintenance)
8. Use the CST to synchronize time to the local time or to the wind turbine controller (WTC) time.
 - CONCYCLE® System Tool → Display → Commissioning Wizard → Set system clock...
 - ↳ If time differs more than 1h, make a note in the maintenance protocol (time lag).
9. Check the parameter 202 (Installation).
 - CONCYCLE® System Tool → Display → Commissioning Wizard → Administration
 - ↳ If the parameter 202 does not match the name of the wind turbine, add the correct name (no blanks allowed in the name).

3.1.2 Check documentation

- ▶ At the system, check the documentation for completeness:
 - Cover page (document no. on cover page and name plate must match)
 - Project overview
 - Site overview
 - Part list
 - Electrical circuit diagram (incl. setting list)
 - Terminal plan
 - Installation and operating instructions
 - Maintenance instructions circuit breaker
 - Mechanical set-up and construction drawings

3.1.3 Disconnect system from mains



DANGER

Danger to life due to electric shock

Touching live components causes danger to life due to electric shock.

Before working on the product, observe the **five safety rules**:

- ▶ Isolate from power supply
 - ▶ Protect against reclosing
 - ▶ Verify the safe isolation from supply
 - ▶ Connect to earth and short circuit
 - ▶ Provide neighbouring parts under voltage with barriers
-
- ▶ Before working on the converter:
 - Stop the wind turbine.
 - Switch off the main circuit breaker (-Q10).
 - Switch off the breaker for precharge the DC-link (-Q45).

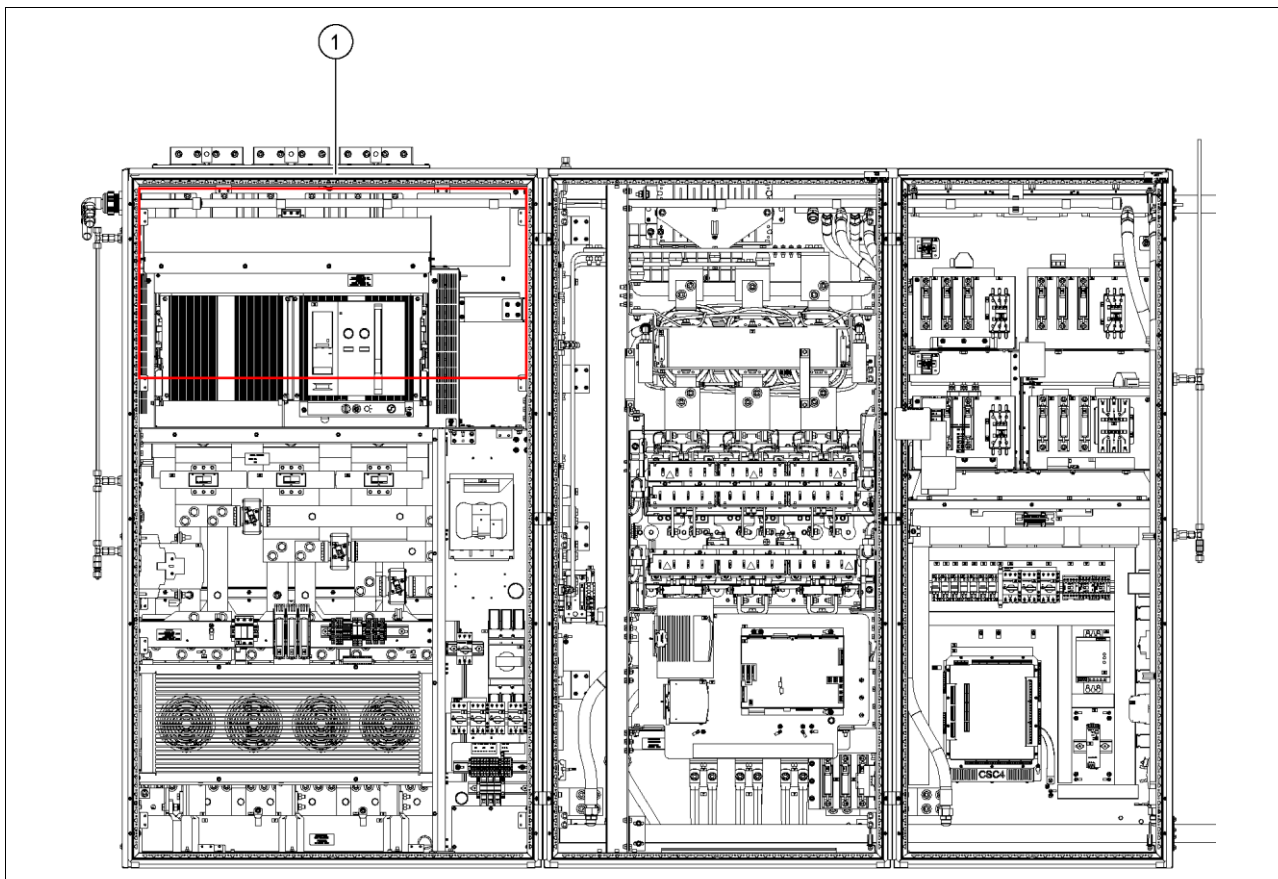


Fig. 3-1 Arc-free area (Exemplary illustration)

1 Arc-free area



DANGER

Danger to life due to electric shock

The arc-free area (1) above the main circuit breaker is covered by a protective covering.
As long as the medium voltage is switched on, the arc-free area is under electrical power.

- ⊘ Never remove the protective covering for maintenance or repair.

NOTICE

Work below the main circuit breaker can be carried out without switching off the medium voltage.

3.1.4 Remove finger protection

- If required, remove finger protection (Shock proof protection).

3.2 Maintenance work

NOTICE

- ▶ Only perform those of the following maintenance tasks that are listed in the appropriate maintenance protocol.

- ▶ Carry out the following maintenance work **once per year**:
 - For the **steps 2 and 3** of the maintenance, the auxiliary power supply (AUX) and the uninterrupted power supply (UPS) must remain ON.

Step	Components to be tested	AUX / UPS	
1	Visual check	OFF / OFF	→ Chap. 3.2.1
2	Batteries (if installed)	ON / ON	→ Chap. 3.2.2
3	Heat exchanger	ON / ON	→ Chap. 3.2.4
4	Switching and safety elements	OFF / OFF	→ Chap. 3.2.5
5	Ringline	OFF / OFF	→ Chap. 3.2.6
6	Mechanical connections and vibration damages	OFF / OFF	→ Chap. 3.2.7
7	Assemblies	OFF / OFF	→ Chap. 3.2.8
8	Electrical plug-in, clamping, and screw connections	OFF / OFF	→ Chap. 3.2.9
9	Surge protection	OFF / OFF	→ Chap. 3.2.10
10	Circuit breaker	OFF / OFF	→ Chap. 3.2.11
11	IGBT modules	OFF / OFF	→ Chap. 3.2.12
12	Mains filter	OFF / OFF	→ Chap. 3.2.13
13	Insulation resistance	OFF / OFF	→ Chap. 3.2.14

- ▶ Carry out the following maintenance work **every second year**:

Components to be replaced	AUX / UPS	
Batteries (if installed)	OFF / OFF	→ Chap. 3.2.3

- ▶ Carry out the following maintenance work **every four years**:

Components to be replaced	AUX / UPS	
LSC contactor fan (if installed)	OFF / OFF	→ Chap. 3.2.15

3.2.1 Visual check

1. Check the following points visually:
 - Correct positions of the plug-in fuses
 - Excessive or local discoloration
 - Missing or loose screw connections
 - Correct positions of the connectors
 - Missing screws or nuts
 - Discoloration of cables or connector housings
 - Discoloration of copper fittings
 - Loose screws, washers or nuts
 - Leakages of the heat exchangers
 - Damage to the heat exchanger fins
 - Contamination of the airways
 - Damage to or bending of load-bearing parts
 - Damage to or cracks in plastic housings
 - Contamination on circuit boards or Prime-Pack modules
 - Discoloration of connections
 - Deformations in capacitors, high pressure beads or signs of overheating
 - Escaped oil, dirt or deposits
 - Foreign objects or animal carcasses
 - Conspicuous limescale deposits on pipes or hose couplings
2. To detect changes during the next inspection, capture all condition changes with photos.

3.2.2 Check batteries (if installed)



Fig. 3-2 Batteries (Exemplary illustration)

1. Check the external state of the batteries:

- damaged housing
- tight fitting of plug connections
- charred contacts



CAUTION

Damage to property due to inappropriate battery chargers

Only battery chargers specified by ConverterTec can charge batteries in a functionally safe manner.

- Only use the battery chargers specified by ConverterTec (see circuit diagram / part list).

2. Check the charging voltage at the battery charger.

↳ approx. 27.5 V $\pm$ 1 % (refer to setting list for exact value!)

3. Switch off the power supply (24 V) on the automatic circuit breaker (CB) F8/1.

4. Measure the battery voltage:

- directly at the battery terminals
 - with a converter ready for operation in standstill
- ↳ Target battery voltage > 22 V at 10 ... 40 °C ambient temperature for 3 min

5. If the measured battery voltage is below the target battery voltage, replace the battery (→ **Chap. 3.2.3**).

3.2.3 Replace batteries (if installed)



DANGER

Danger to life due to electric shock

Some circuits inside the converter may be energized by the auxiliary power supply or the uninterrupted power supply (400/230 V).

Touching live components causes danger to life due to electric shock.

- ▶ Pay attention during the replacement of the batteries.
- ⊘ Do not touch any component.



DANGER

Danger of corrosive injury due to open batteries

Batteries may contain corrosive substances.

- ⊘ Do not open batteries.

1. Remove the old batteries.
 - Always replace both batteries
 - Properly dispose of old batteries observing local requirements
2. Unpack the new batteries and clean them if required.
 - Only use batteries from ConverterTec's part list
3. Install the new batteries.
4. Connect the new batteries with the correct pins and without current flow to the DC power supply (battery charger and consumers switched off).
5. Switch on the battery charger and charge the batteries.

3.2.4 Clean heat exchanger



DANGER

Danger to life due to electric shock

Some circuits inside the converter may be energized by the auxiliary power supply or the uninterrupted power supply (400/230 V).

Touching live components causes danger to life due to electric shock.

- ▶ Pay attention during the heat exchanger check.
- ⊘ Do not touch any component.

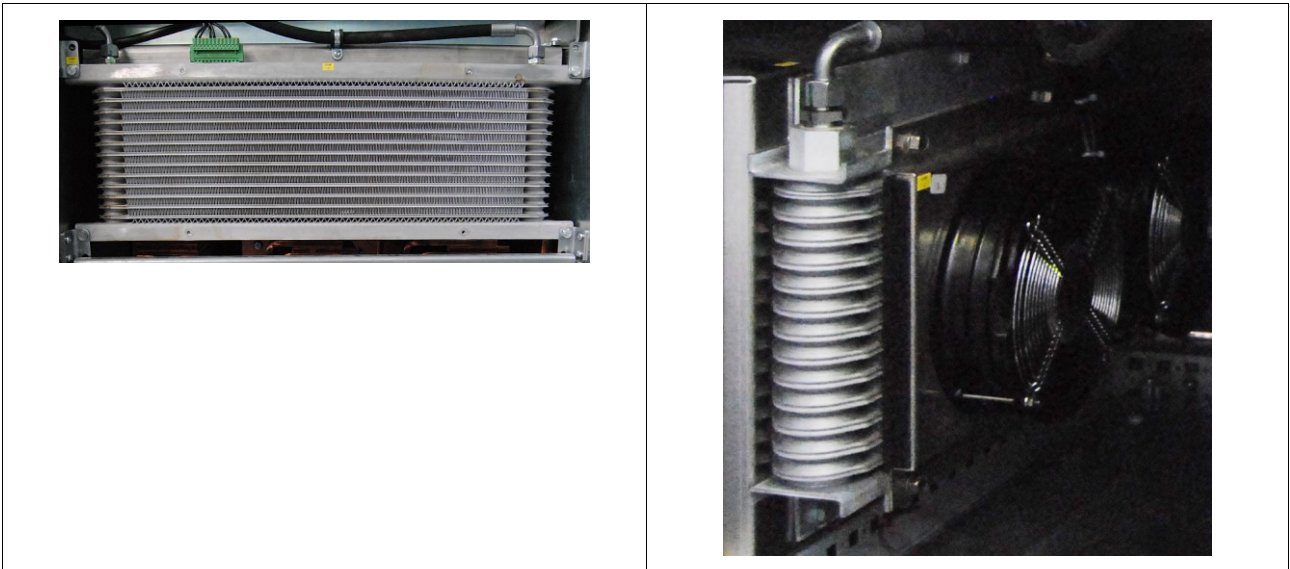


Fig. 3-3 Heat exchanger (Exemplary illustration)

1. Remove dirt immediately:
 - Use a vacuum cleaner or compressed air.
 - Make sure the dirt is finally removed and cannot settle again afterwards.
2. Activate the fans of all heat exchangers:
 - CONCYCLE® System Tool → Commissioning Wizard → Cooling system control test function
 - or
 - by pressing the push button -S8

3.2.5 Check switching and safety elements



DANGER

Danger to life due to electric shock

Touching live components causes danger to life due to electric shock.

Before working on the product, observe the **five safety rules**:

- ▶ Isolate from power supply
 - ▶ Protect against reclosing
 - ▶ Verify the safe isolation from supply
 - ▶ Connect to earth and short circuit
 - ▶ Provide neighbouring parts under voltage with barriers
-
- ▶ Switch off
 - the auxiliary power supply
 - the uninterrupted power supply (UPS)
 - all circuit breakers
 - all motor protection relays and fuses in the low voltage cabinet
 - all motor protection relays and fuses in the control cabinet

Relays, contactors



Fig. 3-4 Relays, contactors (Exemplary illustrations)

1. Check all relays and contactors for tight fitting.
2. Check the connections on the relays and contactors.
3. Replace faulty relays and contactors.

Motor protection relays, time relays and fuses

4. Check all motor protection relays and time relays for tight fitting.
5. Check the connections on the relays.
6. Compare the settings of the motor protection relay and the time relay to the settings in the circuit diagram.
7. Replace faulty relays.
8. Check all fuses for tight fitting.
9. Replace faulty fuses.
 - Observe correct voltage class for the LV high power fuses (500 V, 660 V, 690 V, 950 V)!
 - Always replace fuses of all phases at the same time!

Auxiliary contacts

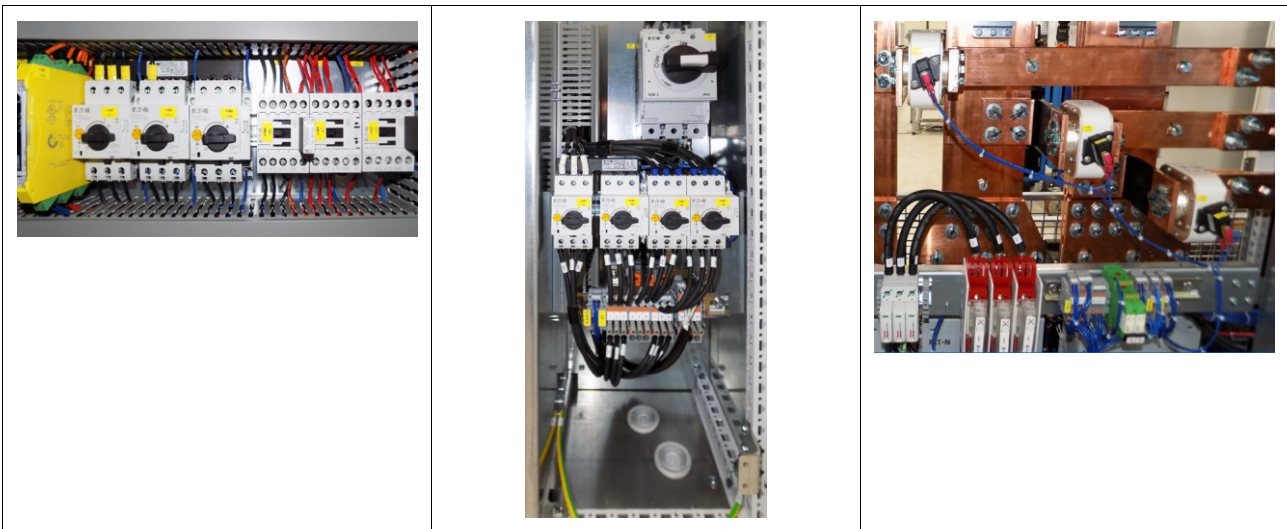


Fig. 3-5 Auxiliary contacts (Exemplary illustrations)

3.2.6 Check ringline

The ringline consists of

- Shut Down Signal 1
 - Battery OFF-Delay
 - External Hardware
 - Cooling System Failure
- Check the ringline signal:
- Use a multimeter.
 - Refer to the current electrical drawing.

3.2.7 Check mechanical connections and vibration damages

Mechanical connections



Fig. 3-6 Mechanical connections (Exemplary illustration)

1. Check mechanical connection points, especially door hinges and locks.
2. Check if doors, roof plates, and side walls close correctly.
3. Replace faulty or missing screws.

Vibration damages



Fig. 3-7 Vibration damages (Exemplary illustrations)

Under adverse operating conditions, cabinets can be damaged by vibrations.

4. Check the following points:

- Outer area
 - Cabinet fixing on the machine support/support construction
 - Stability
 - Attachment of the side walls/roofs (IP Code must be met)
 - Loose screws, missing screws
 - Fastening of the components
- Inner area
 - Fastening of the components
 - Strain relief of the cables
 - Clamping and screw connections
 - Seals of the cabinet doors
 - Door hinges
 - Cable/core insulations (observe abrasion wear spot!)

5. To inform the ConverterTec Service, document all vibration damages in the Maintenance protocol.

3.2.8 Check screw connections of the assemblies

In general, all screw connections within the CONCYCLE® converter are maintenance-free. The tightening torques do not have to be checked regularly. But the tightening torques must be checked if:

- There is a strong suspicion that a screw connection is no longer tight (e.g. if thermal effects are visible).
 - The colour marks on the screw connections are no longer in line.
1. Check the screw connections of all assemblies visually for abnormal conditions.
 2. If you see an abnormal condition:
 - Unscrew the screw connection.
 - Tighten the screw connection again with the nominal torque (see component documentation).
 3. When loosening and retightening screw connections:
 - Replace removed spring washers.
 - For connections of the copper rail system, clean residues of grease and pollutions from the copper bus bar system before making a screw connection.
 - Observe the tightening torques for screw connections of the electrical devices (see component documentation).
 - Observe the following tightening torques for cable lug connections and copper bus bars:

Thread	Tightening torque [Nm]
M4	2.3
M5	4.6
M6	7.9
M8	19
M10	38
M12	66
M16	162

NOTICE

Manufacturer's torque settings may vary from the current setting list.

4. To prevent repeated checks and thus minimise the work load, mark checked screw connections with a felt-tip pen.

3.2.9 Check electrical plug-in, clamping, and electrical screw connections

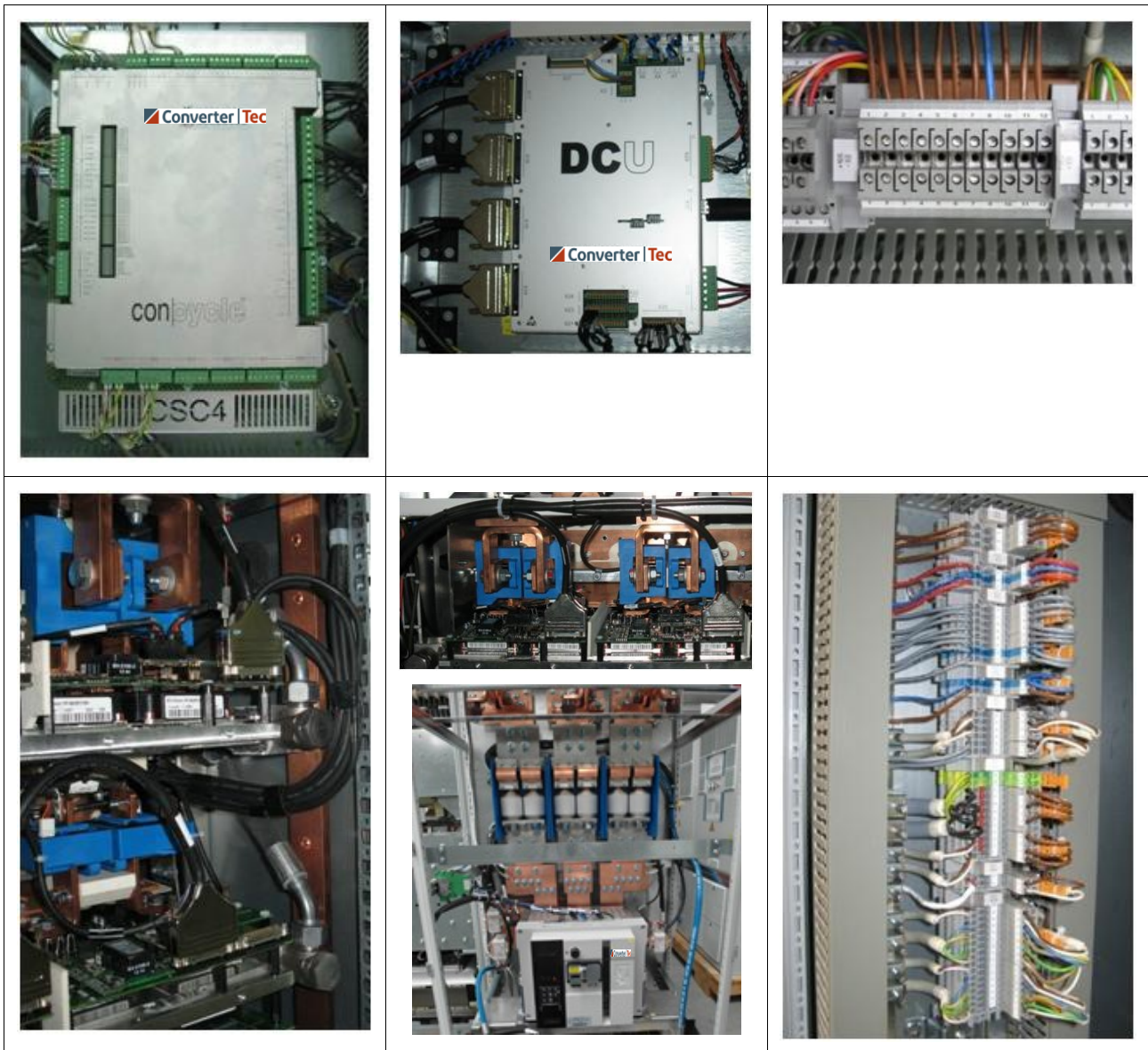


Fig. 3-8 Electrical plug-in, clamping, and electrical screw connections (Exemplary illustrations)

1. Check all plug connections and plug of the fibre optic cables for tight fitting.
Fibre optic cables may only be replaced completely.
2. Replace faulty fibre optic cables completely.
3. Randomly check the clamped connections:
 - on the components
 - on the terminal block
4. Check all clamping connections if the clamped connections are in bad state (e.g. thermal changes in colour).

3.2.10 Check surge protection

Surge protection: SPD device (type 2)



Fig. 3-9 Surge protection: SPD device (type 2) (Exemplary illustrations)

1. Check if the surge protection device (SPD) was overloaded:
 - ↳ The colour indicator indicates an overload by colour change (red sign, or, when supplied, red LED).
2. Replace overloaded surge protection devices (SPD) immediately.
3. In case of a breakdown, replace the fuse of the surge protection device.

Surge protection: Surge arrester (type 1)



Fig. 3-10 Surge arrester (type 1) - optional (Exemplary illustration)

The surge arrester type 1 is electrically monitored and is maintenance-free.

3.2.11 Check circuit breaker

- Observe the maintenance instructions 9943-1799
Maintenance instructions CONCYCLE® - Circuit breaker

3.2.12 Check IGBT modules

1. Check the IGBT modules visually for abnormal conditions:
 - Dust, dirt
 - Moisture
 - Foreign objects
 - Deposition of cooling agent
 - Loose connections
2. Check the electronic components of the driver boards at random visually for traces of overheating and deposits (at least one LSC, one MSC, and one DC-link limiter driver board).
3. Check the plug connections of the electric lines for tight fitting:
 - Controller cable between DCU and driver board
 - Current sensor
 - DC-link measuring
4. Check the copper bus bars at random for tight fitting.

3.2.13 Check mains filter



DANGER

Danger to life due to electric shock

Touching live components causes danger to life due to electric shock.

If the discharge choke is faulty, the discharging time of the capacitors can exceed 10 minutes.

- ▶ Observe the five safety rules for the operation of electric systems.
- ▶ Make sure that the capacitors are discharged.
- ▶ When working on capacitors, observe national regulations.

Filter capacitors

Validity: If filter capacitors are part of the scope of delivery of the converter

1. Make sure that the filter capacitors are de-energised.
 - Discharging time > 3 min
2. Check the capacitor cans for mechanical deformation and damages.
3. Exchange damaged capacitors.

NOTICE

A mixed assembly with capacitors from different manufacturers is prohibited.

Exception: The mixed assembly is planned, checked and released by ConverterTec.

4. Check the overpressure valve / opening in the area of the connection terminals.
5. Replace capacitors with damaged overpressure valve / opening.
6. Check the capacities of the capacitors:
 - check all phases against each other
 - record the measured values in the maintenance protocol

NOTICE

Capacitors in delta connection: $C_{\text{total}} = 1.5 \cdot C_{\text{individual}}$

Capacitors in star connection: $C_{\text{total}} = 0.5 \cdot C_{\text{individual}}$

7. Replace capacitors if their measured capacity deviates more than the labelled tolerance (usually 5%) from the nominal capacity.

Discharge choke**Fig. 3-11 Discharge choke (Exemplary illustrations)**

8. Make sure that the capacitor connected to the discharge choke is discharged.
9. Check the resistance of the discharge choke with a multimeter.
 - ↳ Typical resistance phase to phase of the discharge choke: $4\text{ k}\Omega (\pm 2\text{ k}\Omega)$
10. If the resistance of the discharge choke deviates from the determined value, replace the discharge choke.

NOTICE

- If a measurement is not possible (no access to the capacitors), make a note in the maintenance protocol.

Capacitor contactors (inrush current limitation)

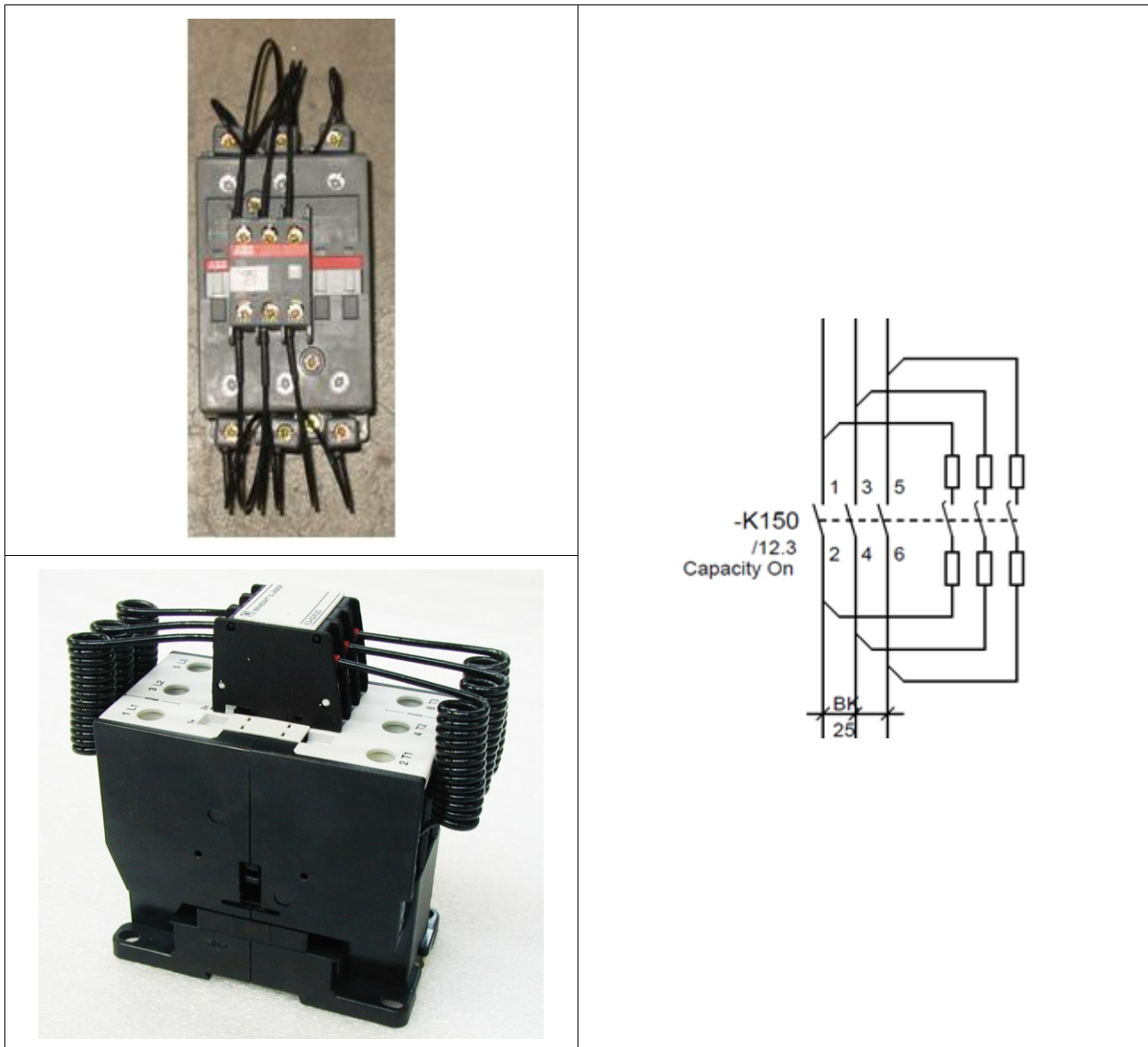


Fig. 3-12 Capacitor contactors (Exemplary illustrations)

NOTICE

A faulty capacitor can be a sign of a faulty capacitor contactor.

11. Check the capacitor contactors for
 - burned contacts
 - faulty or kinked cables
12. Check the resistances of the damping resistors with a multimeter.
 - ↳ Resistance approx. 1-2 Ω
13. Replace faulty capacitor contactors.

3.2.14 Check insulation resistance



DANGER

Danger to life due to electric shock

During measurement of the insulation resistance, the cabinet can be energised with up to 1000 V. Danger to life due to electric shock present.

- ⊘ Do not touch the cabinet during measurement of the insulation resistance.

1. Observe the following conditions:
 - Insulation resistance measuring device according to IEC 61557-1
 - Measurement of the insulation resistance only with DC voltage
 - Test voltage $U = 1000 \text{ V DC}$
2. If applicable, remove the fuses of the surge protection device (SPD) of the stator, the stator voltage measurement, and the stator filter.
3. Measure the insulation resistances of the stator paths (= stator cable + stator) with an insulation resistance measuring device (setting $U = 1000 \text{ V DC}$).
 - ↳ Insulation resistance $< 10 \text{ M}\Omega$: Measure stator cable and stator separately
 - ↳ Measure the insulation resistances of the stator cable and the stator separately with an insulation resistance measuring device (setting $U = 1000 \text{ V DC}$).
 - ↳ Insulation resistance $< 10 \text{ M}\Omega$: Contact the generator manufacturer
4. Disconnect all phases of the rotor paths (= rotor cable + rotor) in the cabinet.
5. Measure the insulation resistances of the rotor paths with an insulation resistance measuring device (setting $U = 1000 \text{ V DC}$).
 - ↳ Insulation resistance $< 10 \text{ M}\Omega$: Measure rotor cable and rotor separately
 - ↳ Measure the insulation resistances of the rotor cable and the rotor separately with an insulation resistance measuring device (setting $U = 1000 \text{ V DC}$).
 - ↳ Insulation resistance of rotor $< 10 \text{ M}\Omega$: Check brush room and clean if required
 - ↳ Insulation resistance $< 10 \text{ M}\Omega$: Contact the generator manufacturer
6. Refit the fuses of the surge protection devices (SPD).

3.2.15 Replace LSC contactor fan (if installed)

NOTICE

ConverterTec recommends the exchange of the fan –E2 in the power cabinet +1S2 every four years.

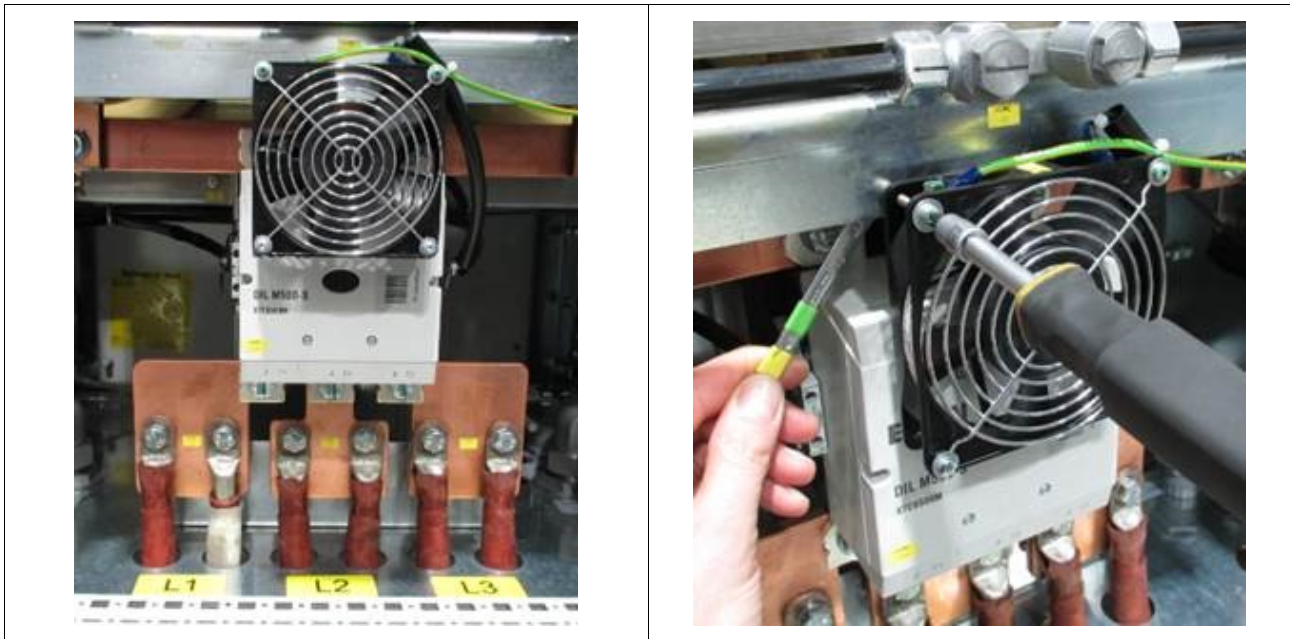


Fig. 3-13 LSC contactor fan (Item no.: 4930-1341) (Exemplary illustration)

1. Unplug the 230 V power supply cable.
2. Loosen the two upper mounting screws with
 - Wrench (7 mm)
 - Screwdriver
3. Loosen the PE connection.
4. Dismount the old fan.
5. Mount the new fan with
 - Air flow direction to the contactor
 - Screws: M4
 - Torque wrenches: 2,3 Nm

3.3 Follow-up

3.3.1 Clean system



This symbol identifies areas of the product with sensitive electronic components. Electronic components can be damaged by electrostatic discharge.

- ⊘ Do not touch electronic components.
- ▶ If you work at open electronic components, wear an antistatic wrist strap for potential equalisation for electrostatic discharge.

- ⊘ Do not use compressed air for cleaning.
- ▶ Clean the system with suitable tools (vacuum cleaner, cloth, etc.).

3.3.2 Reinstall finger protection

- ▶ Reinstall finger protection if removed.

3.3.3 Check safety devices

- ▶ Make sure that all safety devices are in perfect state and fully functional.
 - Emergency switches
 - Safety locks
 - Overcurrent protection relays
 - Finger protection
 - etc.

3.3.4 Close cabinets

- ▶ Close all cabinets prior to commissioning.

3.3.5 Connect mains voltage

1. Observe the national accident prevention regulations.
2. Reconnect the mains voltage.
3. Follow the 5 safety rules (→ **Chap. 1.3.1**).

3.3.6 Check heating system

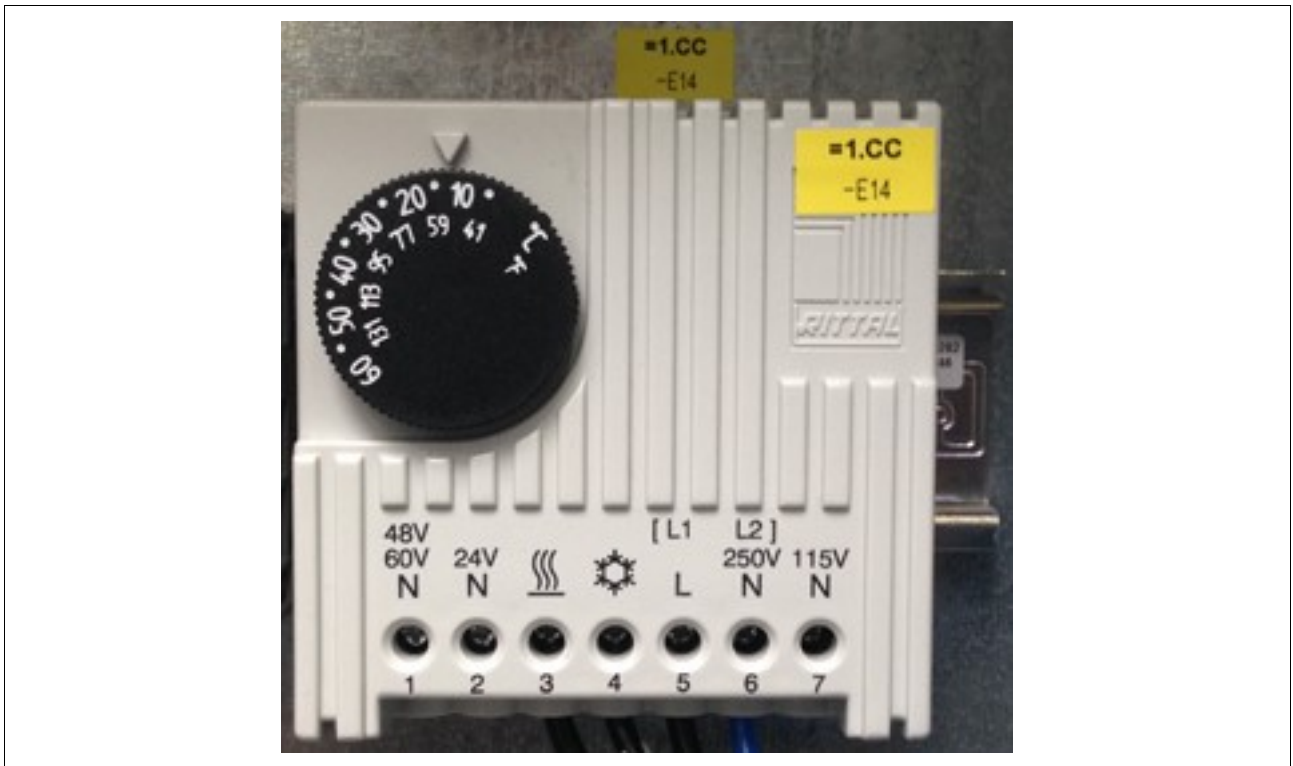


Fig. 3-14 Thermostat (Exemplary illustration)

1. Check the function of the heating system with the setting list in the circuit diagram by adjusting the thermostats.

NOTICE

The thermostats are usually mechanically locked.

- Refer to the product documentation in order to release and relock this interlockings.

2. If the value of the thermostat deviates from the setting list, make a note in the maintenance protocol and contact the ConverterTec Service and the customer service.

3.3.7 Check cooling system

Fan of the recooling system

1. Check if the fans of the heat exchangers turn freely and quietly.
2. If the fans don't turn quietly, make a note in the maintenance protocol and contact the ConverterTec Service.

Cooling system

3. Check the cooling pipes, cooling elements, cooling hoses and connection points of the cooling circuit for tightness and corrosion.
4. If connection points leak or are corroded, repair them immediately:
 - Drain cooling agent.
 - If possible repair connection points, otherwise replace faulty components.
 - Refill cooling circuit with new cooling agent.
5. If traces of humidity or moisture appear in the area of the IGBT module, then
 - switch off the power supply (24 V) on the automatic circuit breaker (CB) F8.
 - switch the cooling system into heating operation for at least 8 hours.

↳ The IGBT modules will be dried.

NOTICE

According to DIN 20066, part 5, for HANSA-FLEX hoses ConverterTec strongly recommends to exchange all cooling hoses after 6 years of operation.

Optional cooling devices

6. Follow the manufacturer's documentation for the optional cooling devices.

3.3.8 Check and save data

1. Use the CONCYCLE® System Tool.
2. Check if the data trigger created before maintenance is still in the Eventrecorder.
 - ↳ If the data trigger is not anymore in the Event recorder, contact ConverterTec Service.
3. Create and save a data trigger in mains parallel operation and under load:
 - DR_xxx.dsb.

NOTICE

If no wind is present, the data trigger can also be carried out at a later stage.

4. Check the data trigger DR_xxx.dsb:
 - All measurements must be present in all phases.
 - No oscillations may occur in the DC-link voltage and in the rotation speed signal.
 - ↳ If any disturbances occur, contact the ConverterTec Service.
5. Save the Event Counter and the Working Time in a single file:
 - CONCYCLE® System Tool → Counter → Show counter → Save As Text...
 - It does not matter, whether “Event Counter” or “Working Time” is selected.
 - CSC_BZ_EZ_2.txt (text file after maintenance)
6. Download the Eventrecorder.

3.3.9 Maintain maintenance protocol

Warranty is only granted if a maintenance protocol which is filled in correctly and signed, and the data saved before and after maintenance is sent to ConverterTec.

1. Fill in the maintenance protocol.
2. Send the maintenance protocol within two weeks after maintenance to ConverterTec Service:
 - Completed and signed maintenance protocol
 - Data saved before maintenance
 - Data saved after maintenance

4 Replacement of components with lifting device 1

Validity: CW1211LD, CW1251LD, CW1331LD, CW1361LD, and CW1391LD



DANGER

Danger to life due to electric shock

Touching live components causes danger to life due to electric shock.

Before working on the product, observe the **five safety rules**:

- ▶ Isolate from power supply
- ▶ Protect against reclosing
- ▶ Verify the safe isolation from supply
- ▶ Connect to earth and short circuit
- ▶ Provide neighbouring parts under voltage with barriers



DANGER

Risk of injury below suspended loads

Staying below suspended loads can cause serious injuries.

- ▶ Always work under supervision of a second person.
- ▶ Never stay below a suspended load.



DANGER

Risk of injury by suspended components

Heavy components sliding from the hands may cause serious injuries.

- ▶ Always use a lifting device for maintenance and replacement of heavy components.

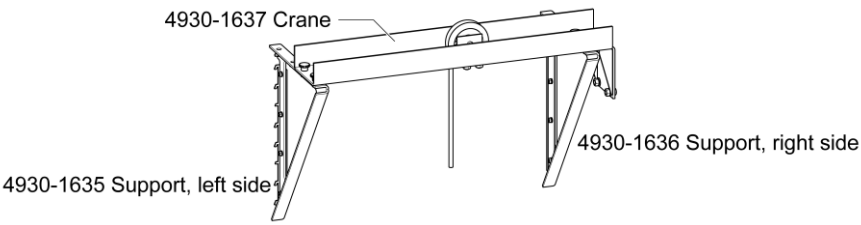
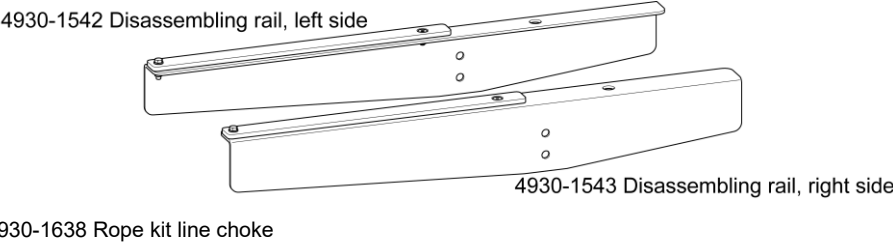
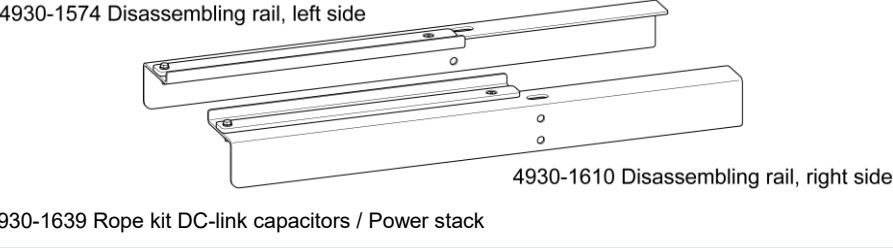
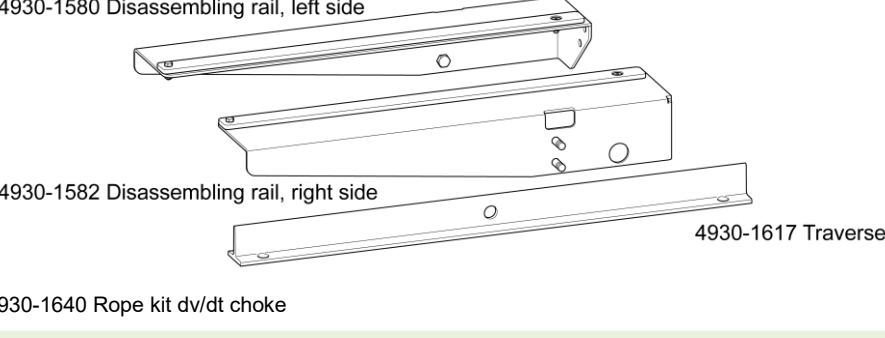
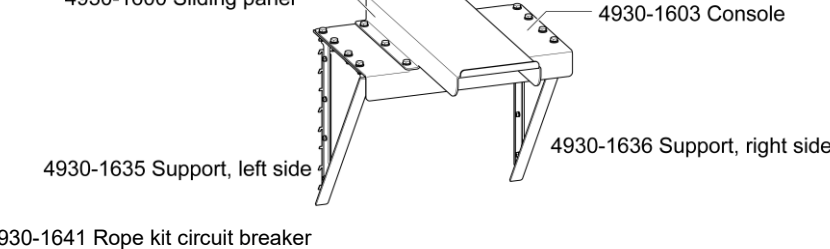
4.1 Scope of application

1. Always use a lifting device to replace the following components:

- Line choke
- dv/dt choke
- Circuit breaker
- Power stack
- DC-link capacitors

2. Refer to **Chap. 4.2** for the kits of the lifting device and their respective article numbers.

4.2 Kits of the lifting device 1

4930-1529	Total kit	
4930-1642	Standard kit	 4930-1637 Crane 4930-1635 Support, left side 4930-1636 Support, right side
4930-1644	Kit line choke	 4930-1542 Disassembling rail, left side 4930-1543 Disassembling rail, right side 4930-1638 Rope kit line choke
4930-1645	Kit DC-link capacitors / Power stack	 4930-1574 Disassembling rail, left side 4930-1610 Disassembling rail, right side 4930-1639 Rope kit DC-link capacitors / Power stack
4930-1646	Kit dv/dt choke	 4930-1580 Disassembling rail, left side 4930-1582 Disassembling rail, right side 4930-1617 Traverse 4930-1640 Rope kit dv/dt choke
4930-1643	Kit circuit breaker	 4930-1600 Sliding panel 4930-1603 Console 4930-1635 Support, left side 4930-1636 Support, right side 4930-1641 Rope kit circuit breaker

4.3 Drain cooling circuit

- Before removing liquid cooled components, drain the cooling circuit.

4.4 Install lifting device



CAUTION

Damage to property due to interfering edges in the cabinet

For removal and installation of components, interfering edges in the cabinet can cause damage to components.

- Make sure that the components can be removed and installed freely.

4.4.1 Place supports

NOTICE

For removing the Power stack, the disassembling rails are sufficient. There is no need to use the supports and the crane.

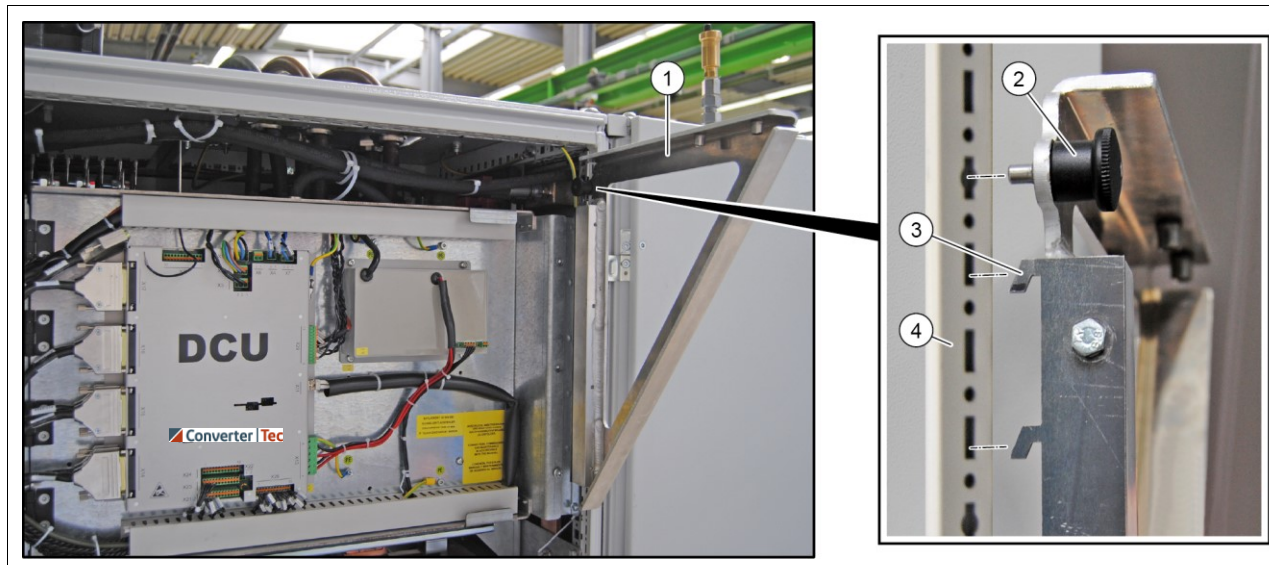


Fig. 4-1 Support (Exemplary illustration)

- | | |
|---------------------------|-----------------|
| 1 Right-hand side support | 3 Hook |
| 2 Safety bolt | 4 Cabinet frame |

- Place the right-hand side support (1) into the cabinet frame (4) in the cabinet:
 - Hook the hook (3) of the support (1) into the cabinet frame (4)
 - Lock the original safety bolt (2) into a hole of the cabinet frame (4)
- Assemble the left-hand side support on the left side of the cabinet.

4.4.2 Assemble the crane

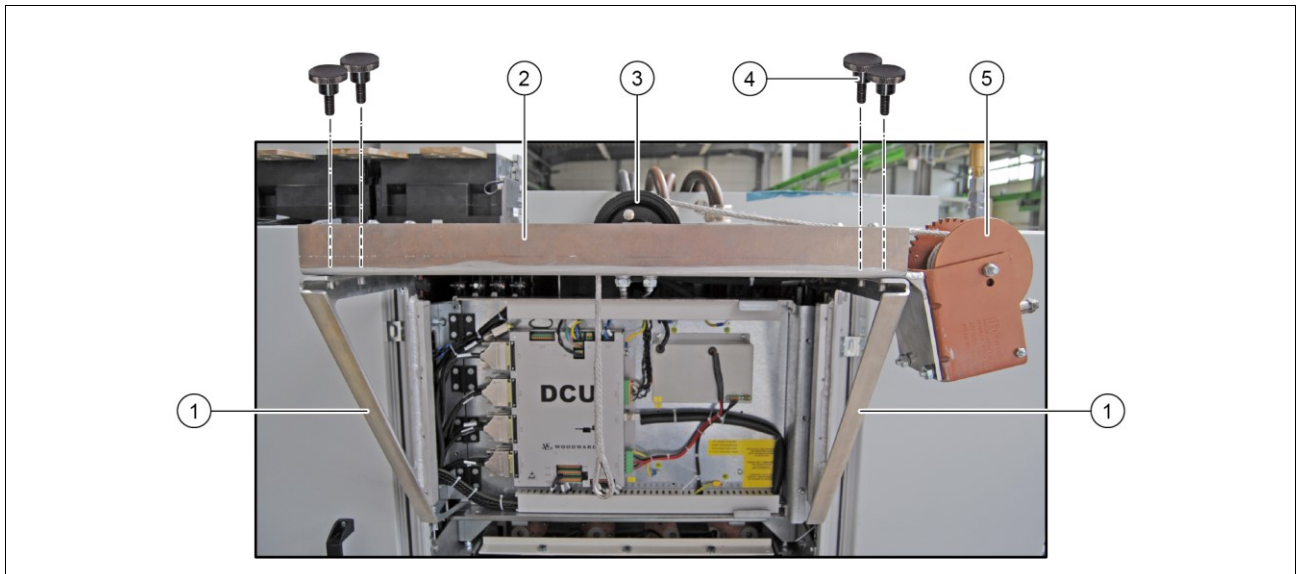


Fig. 4-2 Crane (Exemplary illustration)

- | | |
|-----------------|-----------------|
| 1 Supports | 4 Knurled screw |
| 2 U metal sheet | 5 Rope winch |
| 3 Idler pulley | |

3. Place the crane, consisting of U metal sheet (2), idler pulley (3), rope winch (5) and crane rope onto the supports (1).
 - The rope winch (5) can be positioned on the right or left-hand side on the supports (1).
4. Make sure that the holes of the U metal sheet (2) and the supports (1) are aligned.
 - The U metal sheet (2) has holes for different cabinet widths.
5. Assemble the crane with the four knurled screws (4).

4.4.3 Insert supporting ropes

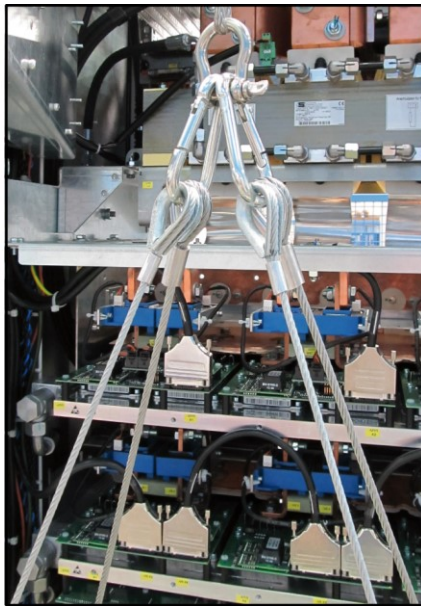


Fig. 4-3 Supporting ropes of the rope kit (Exemplary illustration)

6. Use the pre-assembled rope kit.
- Or, if the rope kit is not pre-assembled,
6. Insert the supporting ropes into the shackles.

Component	Shackle		Supporting ropes		Other resources
	large	small	short	long	
Line choke	3x	4x	2x 900 mm (front)	2x 1000 mm (rear)	—
dv/dt choke	3x	8x	2x 140 mm (front)	2x 260 mm (rear)	1x traverse
Circuit breaker	3x	—	1x 430 mm (left)	1x 480 mm (right)	2x fixing angle
Power stack	3x	—	1x 500 mm (left)	1x 500 mm (right)	—
DC-link capacitors	3x	—	1x 500 mm (left)	1x 500 mm (right)	—

4.5 Disassemble component

4.5.1 Line choke

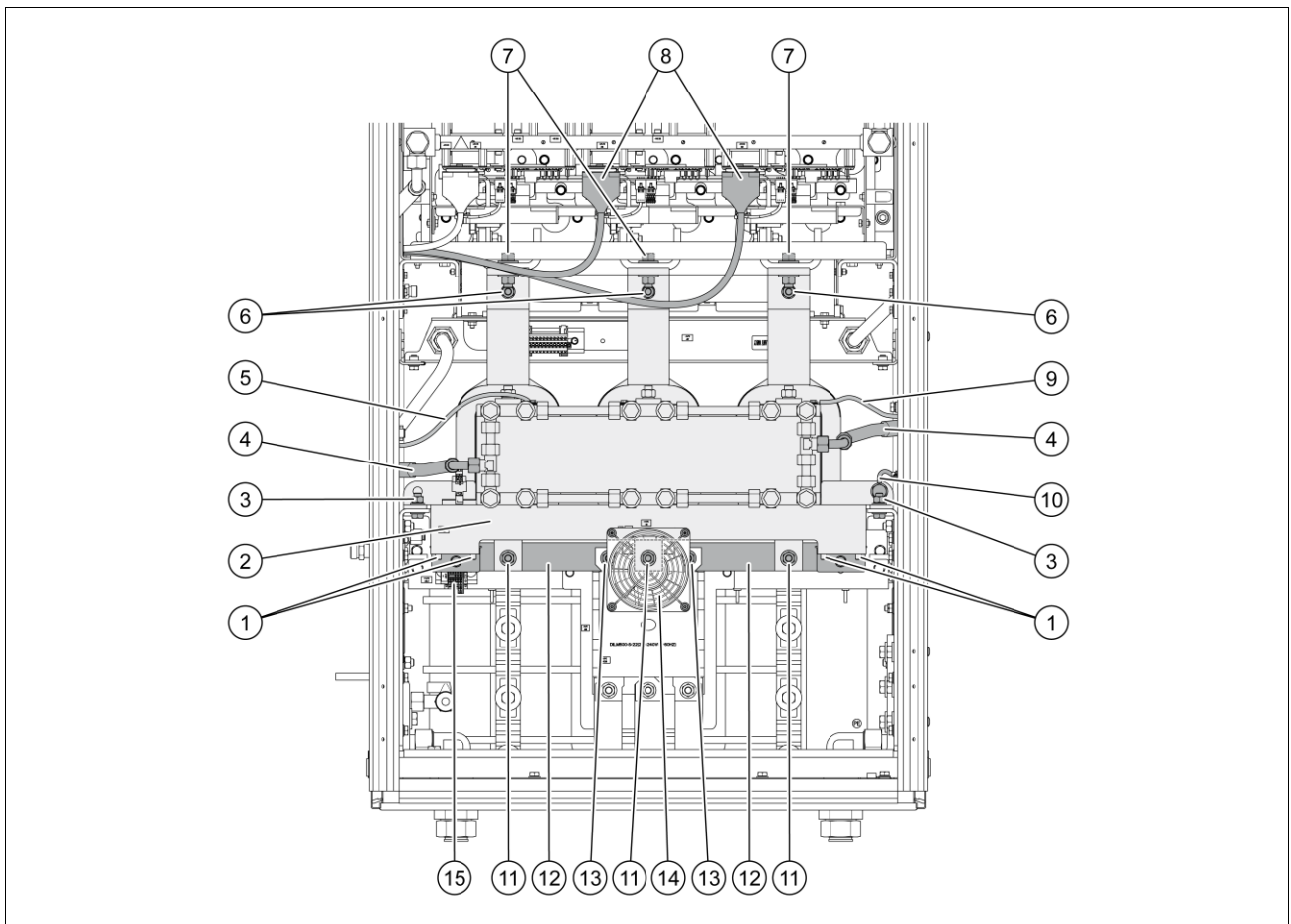


Fig. 4-4 Line choke (Exemplary illustration)

- | | |
|-------------------------------------|-----------------------------------|
| 1 Lower screws of choke holder | 9 Earth cable |
| 2 Line choke | 10 Earth cable |
| 3 Upper screws on choke holder (4x) | 11 Lower screws of copper bracket |
| 4 Hydraulic connections | 12 Copper bus bars (2x) |
| 5 Screw for cable holder | 13 Screws on copper bus bars |
| 6 Electrical connections | 14 Fans |
| 7 Electrical connections | 15 PE Terminals |
| 8 Plug | |

7. In order to disassemble the line choke **(2)**, remove items **1** and **3** through **14**.

8. If required, loosen the three PE terminals **(15)**.

4.5.2 dv/dt choke

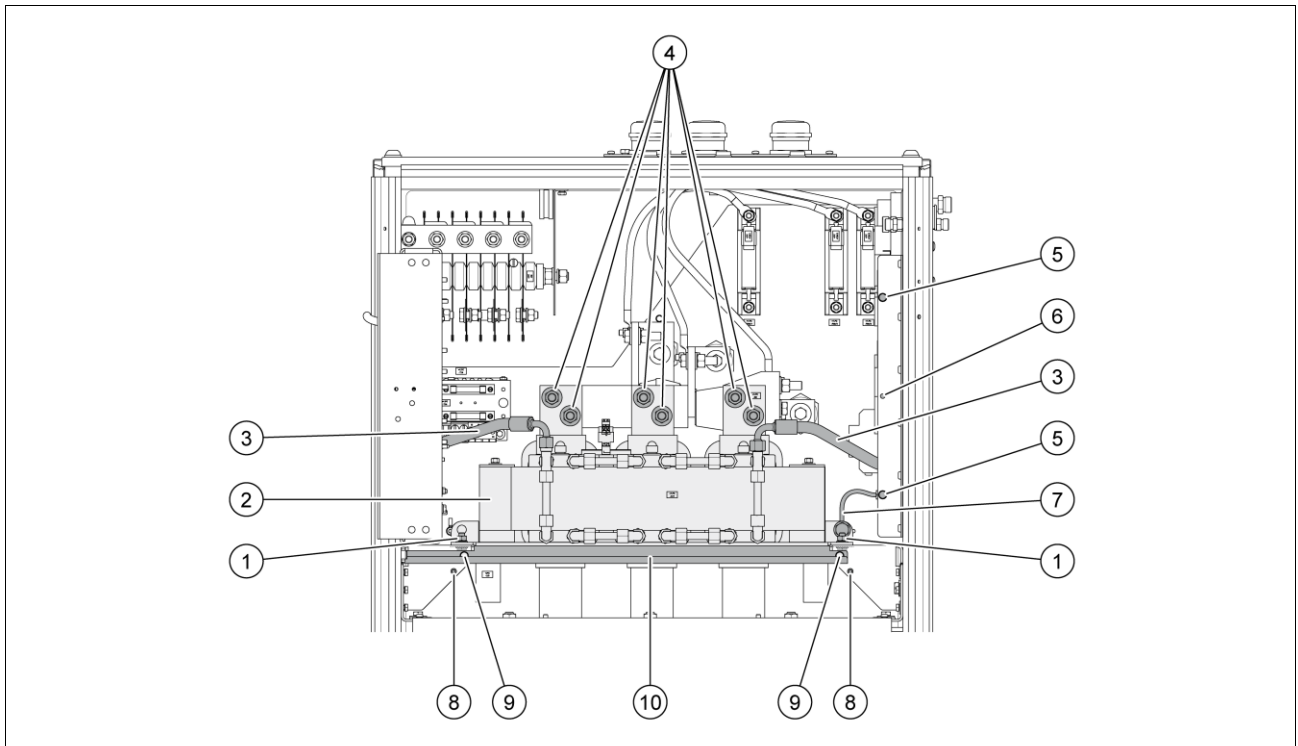


Fig. 4-5 dv/dt choke (Exemplary illustration)

- | | |
|--|------------------------------|
| 1 Upper screws on choke holder (4x) | 6 Centring pin |
| 2 dv/dt choke | 7 Earth cable |
| 3 Hydraulic connections | 8 Screws for rail adapter |
| 4 Electrical connections | 9 Screws on condensate drain |
| 5 Mounting screws of the DCU support panel | 10 Condensate drain |

- ▶ Loosen the two mounting screws **(5)** of the DCU support panel.
- ▶ Turn the DCU support panel by 90° to the left.

**DANGER****Risk of injuries due to sharp edges**

The DCU support panel has sharp edges.

- ▶ Prevent inadvertent closing of the DCU support plate by e.g. fixing the DCU support panel on the cabinet frame with plastic ribbon.
- ▶ Cushion the sharp edges of the DCU support panel with e.g. foam material.

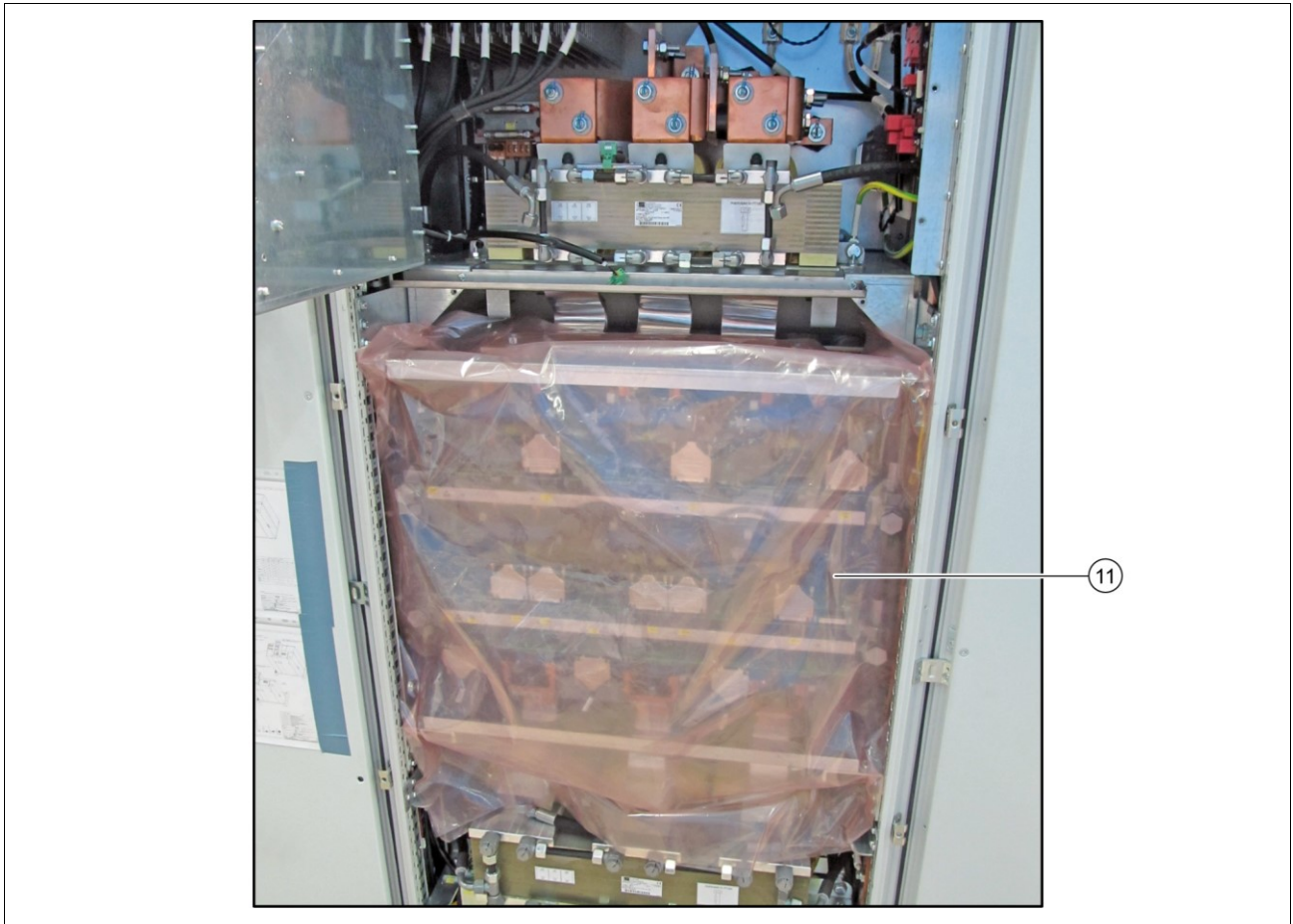


Fig. 4-6 Antistatic foil (Exemplary illustration)

11 Antistatic foil

1. Protect the area below the dv/dt choke with antistatic foil **(11)** from pollutions and liquids.
2. Remove the condensate drain **(10)**.
3. Remove the four screws on top of the choke holder **(1)**.
4. Remove the earth cable **(7)** from the dv/dt choke.
5. Disassemble the hydraulic connections **(3)**.
6. Disassemble the electrical connections **(4)**.

4.5.3 Circuit breaker



Fig. 4-7 Air baffle (Exemplary illustration)

1 Air baffle

2 Circuit breaker

1. Disassemble the air baffle **(1)**.

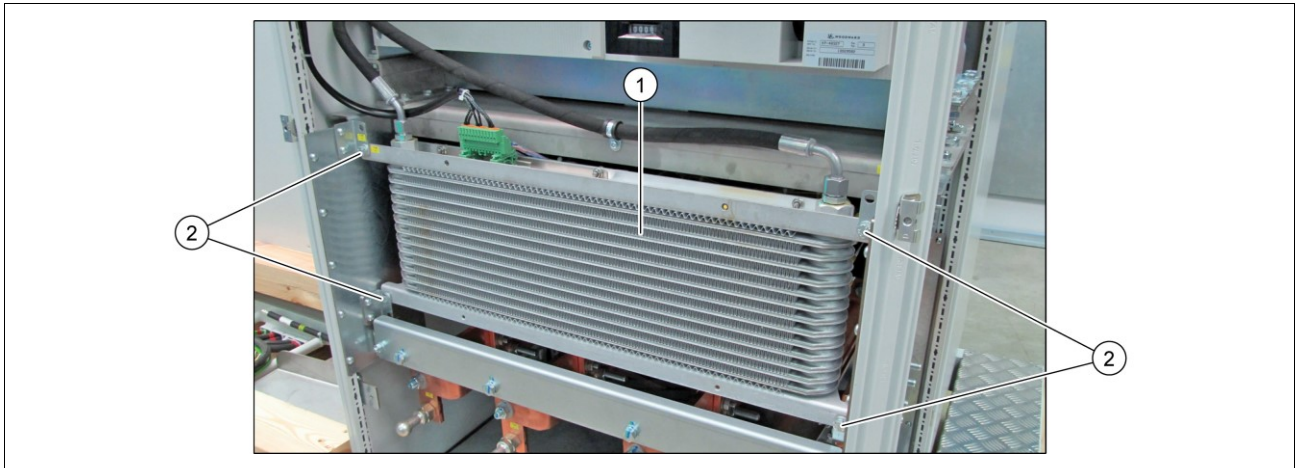


Fig. 4-8 Heat exchanger (Exemplary illustration)

1 Heat exchanger

2 Screws

2. Loosen the four screws (2) at the heat exchanger (1).

3. Turn the heat exchanger by 90° to the left.

NOTICE

The cooling circuit of the heat exchanger does not need to be drained.

4. Fix the heat exchanger with e.g. plastic ribbon at the cabinet frame.



Fig. 4-9 Plug connections at the circuit breaker (Exemplary illustration)

1 Plug connections

5. Remove the electric plug connections on the upper right part of the circuit breaker (1).

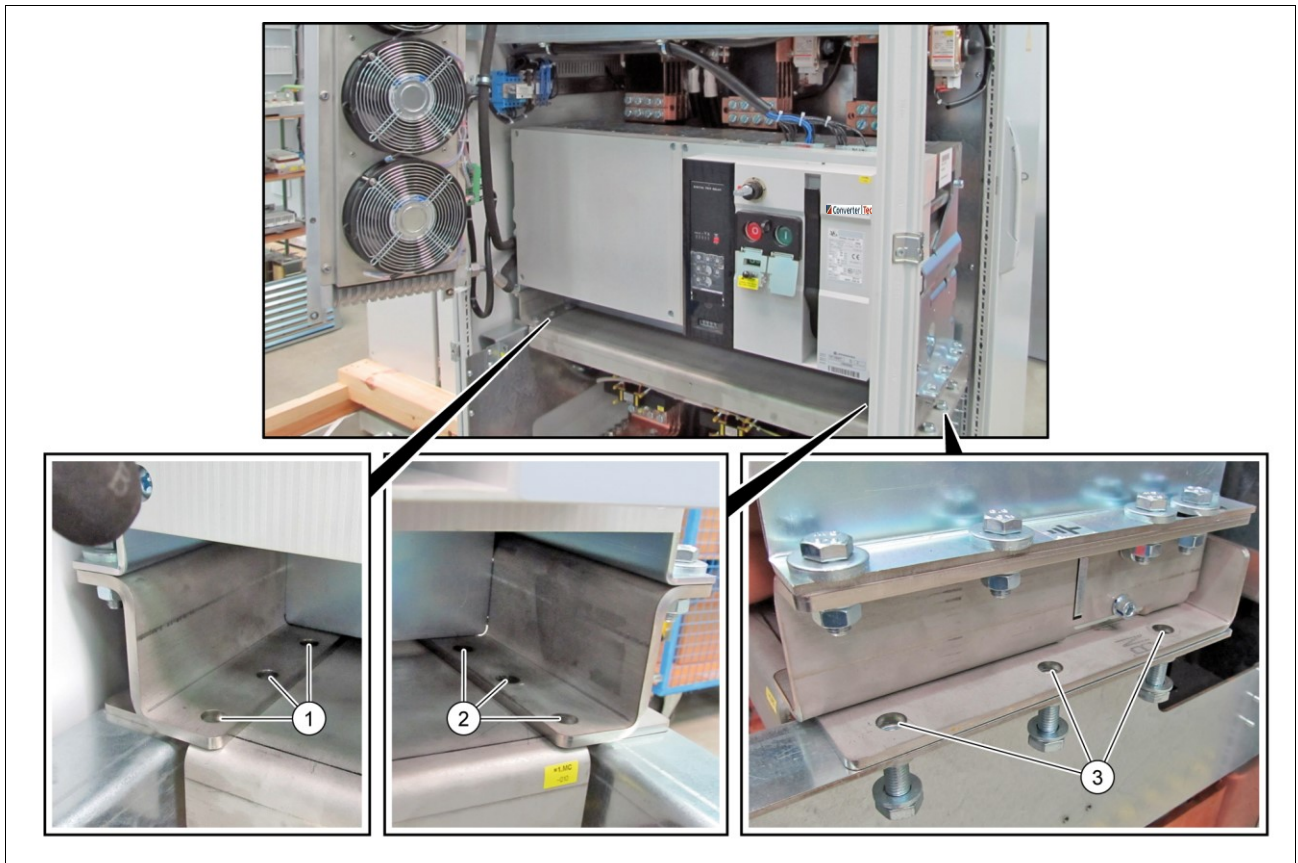


Fig. 4-10 Screws at the circuit breaker (Exemplary illustration)

- 1 Screws on the left
- 2 Screws on the right

- 3 Screws on the right

6. Loosen the screws at the feet of the circuit breaker:

- Left foot: 3 screws (1)
- Right foot: 6 screws (2, 3)

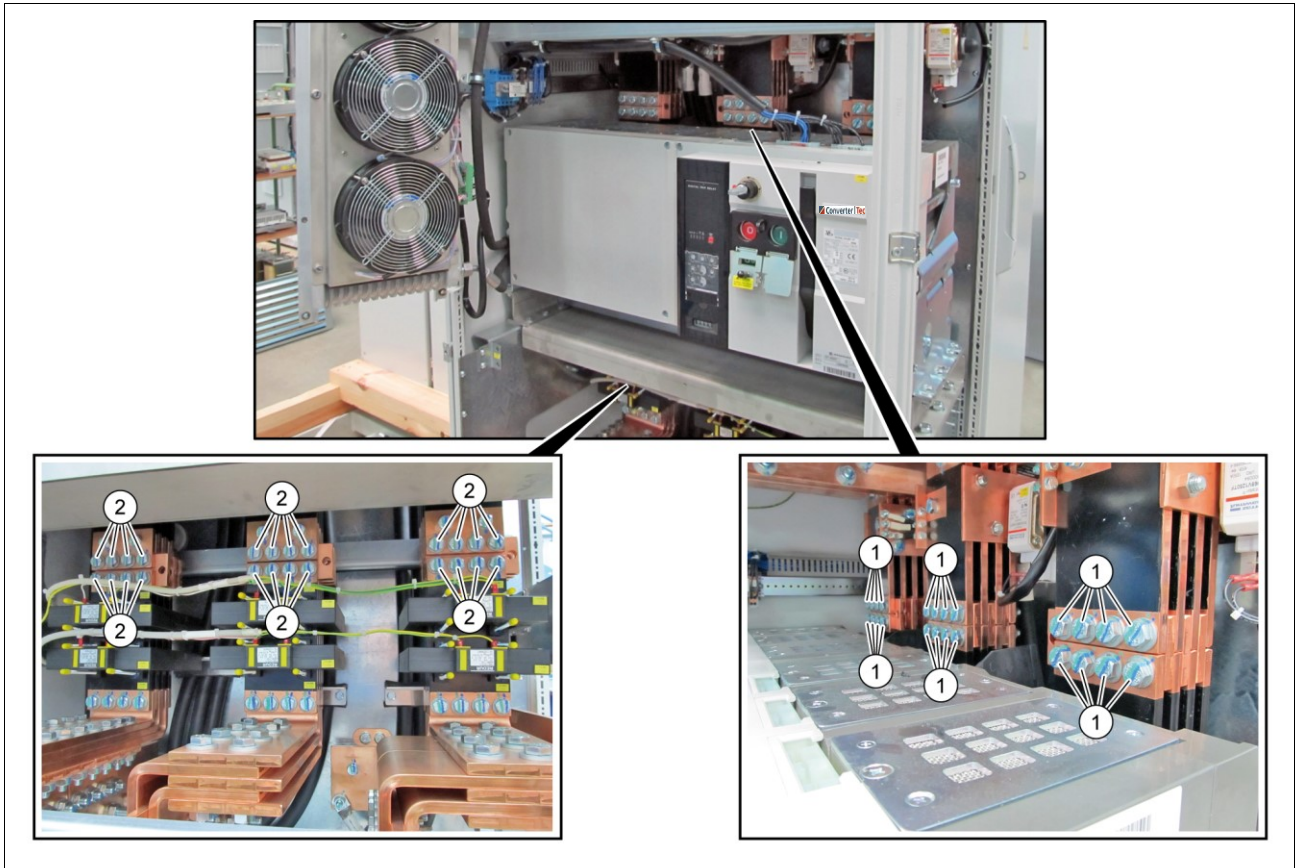


Fig. 4-11 Electric connections (Exemplary illustration)

1 Upper screws

2 Lower screws

7. Loosen the screws of the electric connections:

- Upper copper packages: 3x 8 screws **(1)**
- Lower copper packages: 3x 8 screws **(2)**

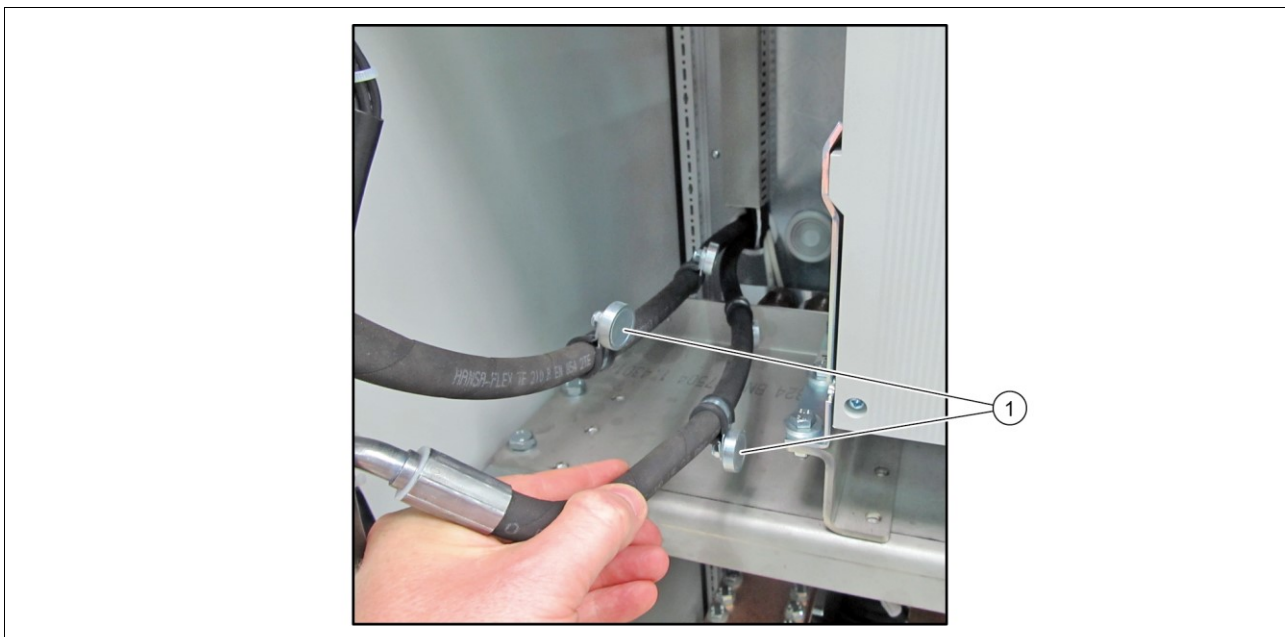


Fig. 4-12 Magnetic holder (Exemplary illustration)

1 Magnetic holder

8. Remove the magnetic holders **(1)** of the hydraulic lines of the heat exchanger from the circuit breaker.

4.5.4 Power stack

- ▶ In order to disassemble the Power stack, remove all mechanical hydraulic and electrical connections on the Power stack.

4.5.5 DC-link capacitors

1. In order to disassemble the DC-link capacitors, first disassemble
 - machine side converter
 - line side converter
 - DC-link limiter



DANGER

Danger to life due to electric shock

Touching live components causes danger to life due to electric shock.

If the discharge choke is faulty, the discharging time of the capacitors can exceed 10 minutes.

- ▶ Observe the five safety rules for the operation of electric systems.
- ▶ Make sure that the capacitors are discharged.
- ▶ When working on capacitors, observe national regulations.

2. Remove all mechanical, hydraulic and electrical connections on the DC-link capacitors.
3. For faulty capacities, always replace all DC-link capacitors after consulting with the ConverterTec Service.

4.6 Replace component

4.6.1 Preparing rail adapter

Validity: **All components to be removed, except circuit breaker**

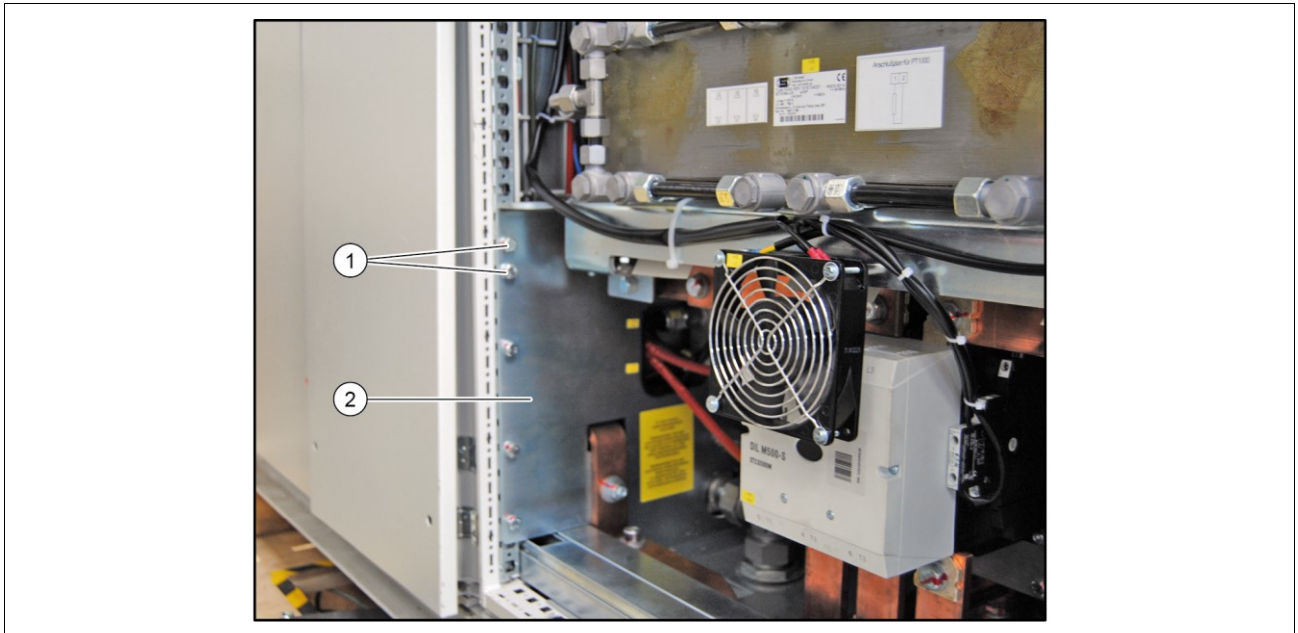


Fig. 4-13 Screws for fixing the disassembling rails (here as an example for the line choke)

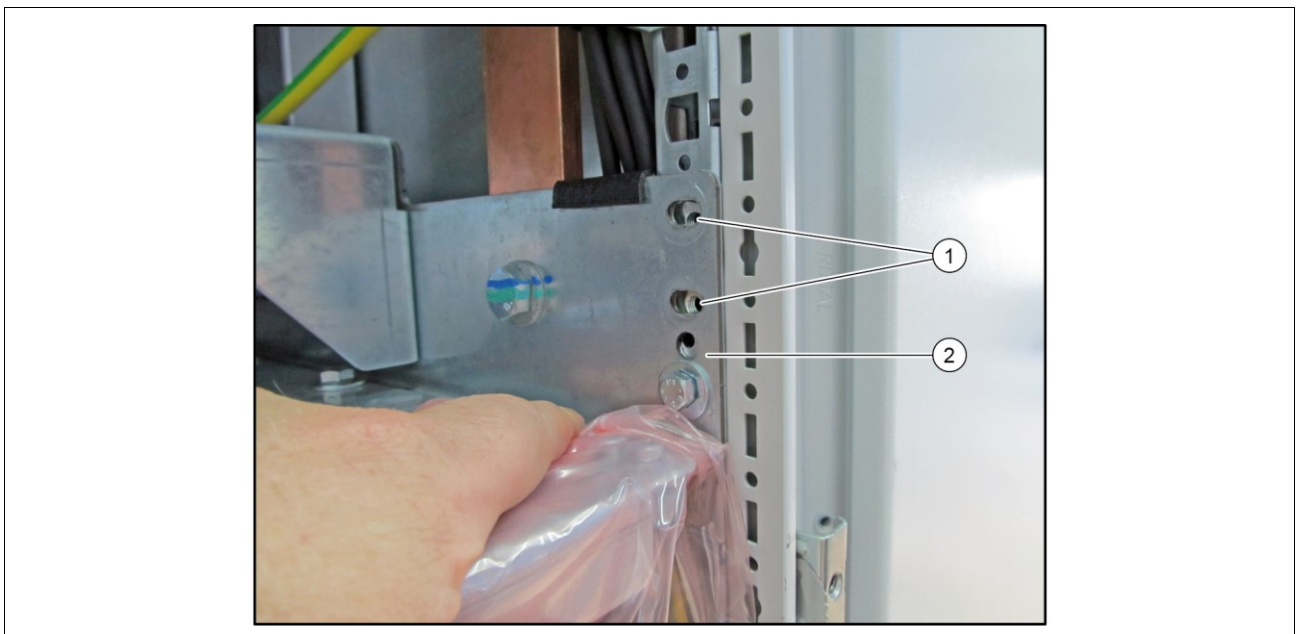


Fig. 4-14 Screws for fixing the disassembling rails (here as an example for the dv/dt choke)

1 Screws

2 Support plate

1. Remove the two upper screws **(1)** at the right and the left support plates **(2)** each.

4.6.2 Insert disassembling rails

Validity: **All components to be removed, except circuit breaker**

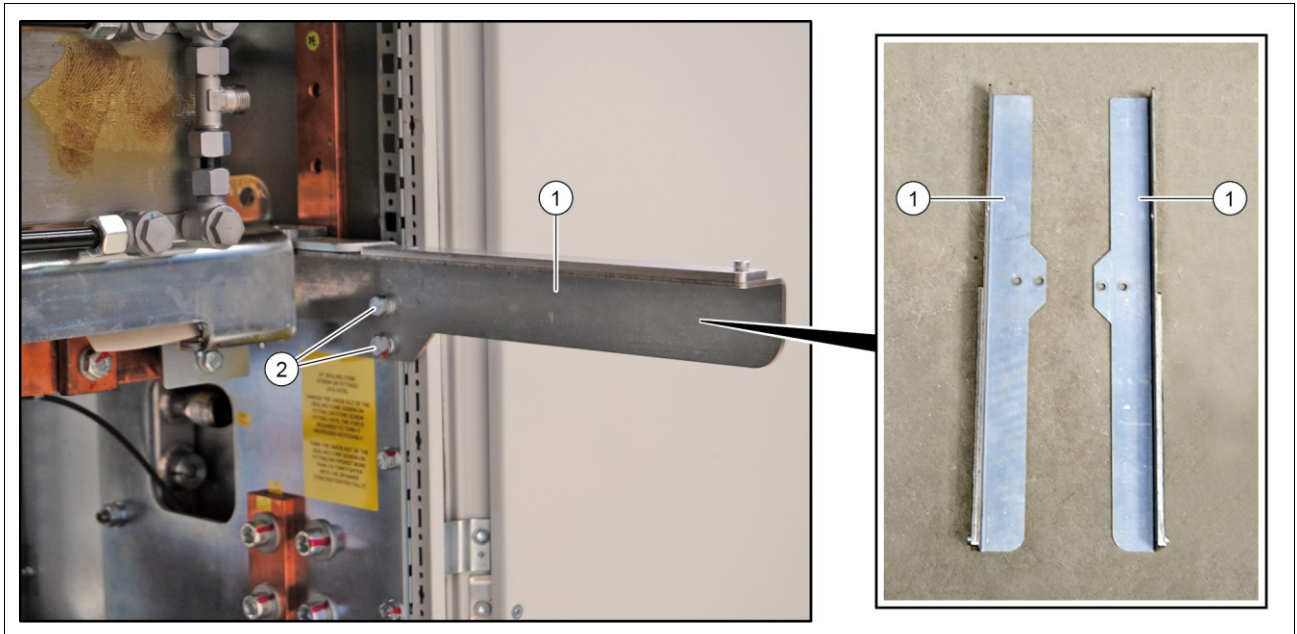


Fig. 4-15 Disassembling rails (here as an example for the line choke)

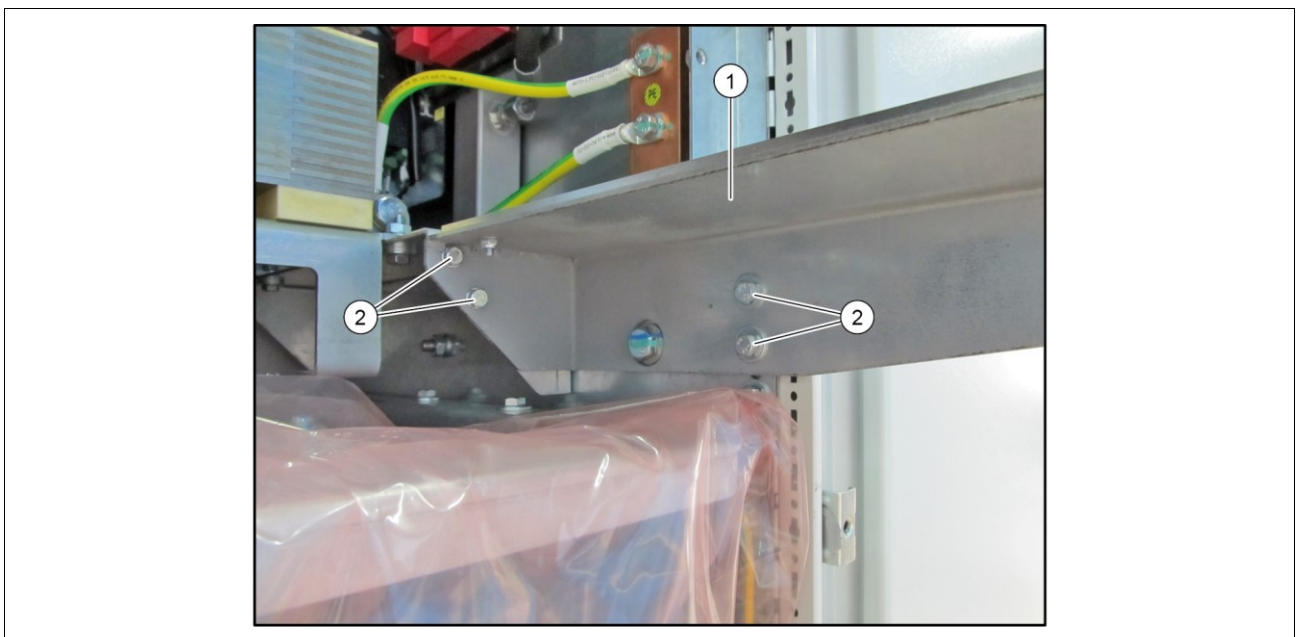


Fig. 4-16 Disassembling rails (here as an example for the dv/dt choke)

1 Disassembling rails

2 Screws

2. Insert the first disassembling rail **(1)** up to the stop into the support plate.
3. Screw in the disassembling rail **(1)** with the original screws **(2)**.
4. Assemble the second disassembling rail **(1)** on the other side of the cabinet.

4.6.3 Install supports and console with sliding panel (from the kit circuit breaker)

Validity: **Circuit breaker**

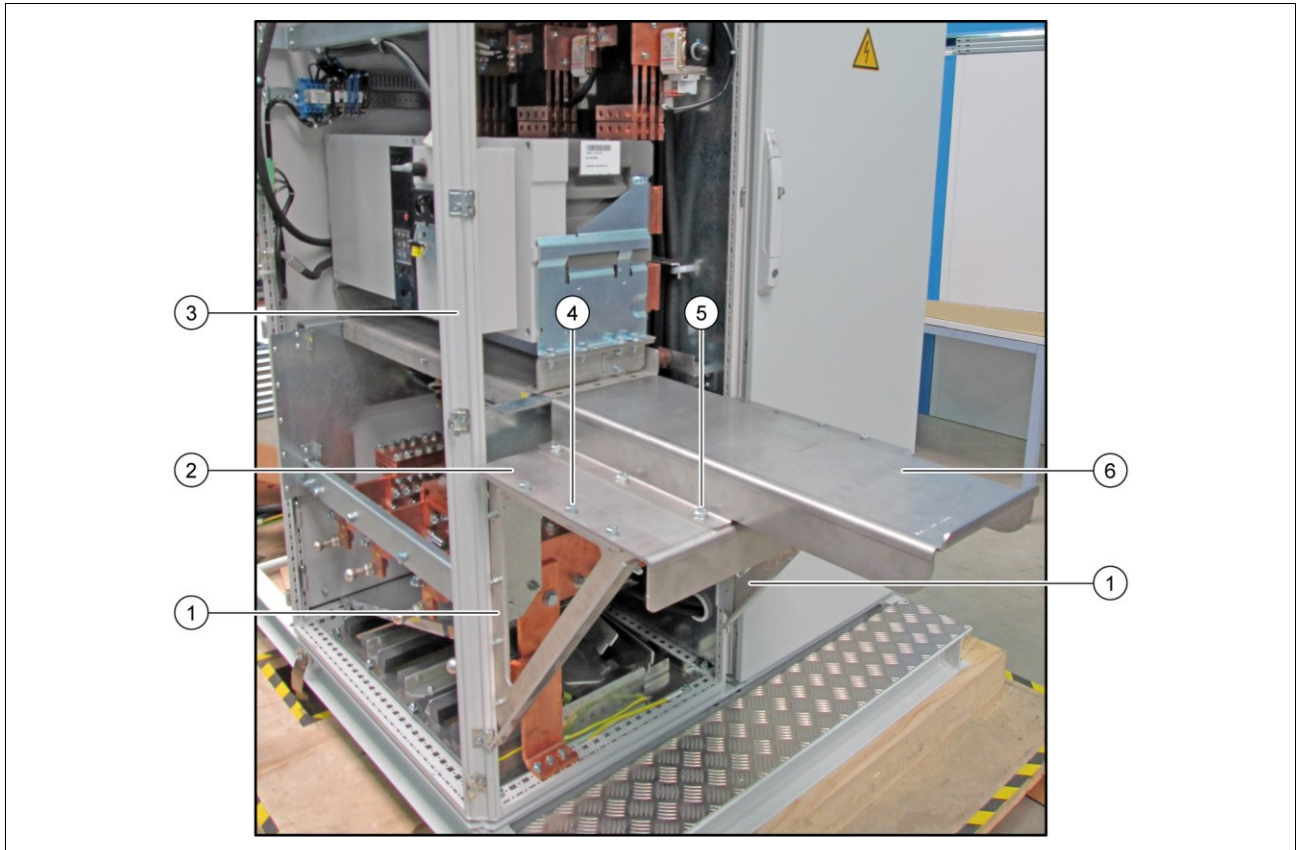


Fig. 4-17 Supports and console with sliding panel (Exemplary illustration)

- | | |
|-----------------|--|
| 1 Supports | 4 Screws on console/supports (6x) |
| 2 Console | 5 Screws on console/sliding panel (6x) |
| 3 Cabinet frame | 6 Sliding panel |

1. Place the right-hand side support **(1)** into the cabinet frame **(3)** in the cabinet:
 - Hook the hook of the support **(1)** into the cabinet frame **(3)**
 - Place the support as low that the lower edge of the circuit breaker is aligned with the sliding panel.
 - Lock the original safety bolt of the support **(1)** into a hole of the cabinet frame **(3)**
2. Assemble the left-hand side support on the left side of the cabinet.
3. Screw the console **(2)** with the sliding panel **(6)** onto the supports **(1)**.
4. Check if the sliding panel **(6)** is screwed tightly onto the console **(2)**.

4.6.4 Pull out component



CAUTION

Damage of the circuit breaker when pulling out

The circuit breaker can be damaged when pulling out.

- When pulling out the circuit breaker, take care that the components on the front are not damaged, especially the Profalux locking device and the mechanical interlocking.

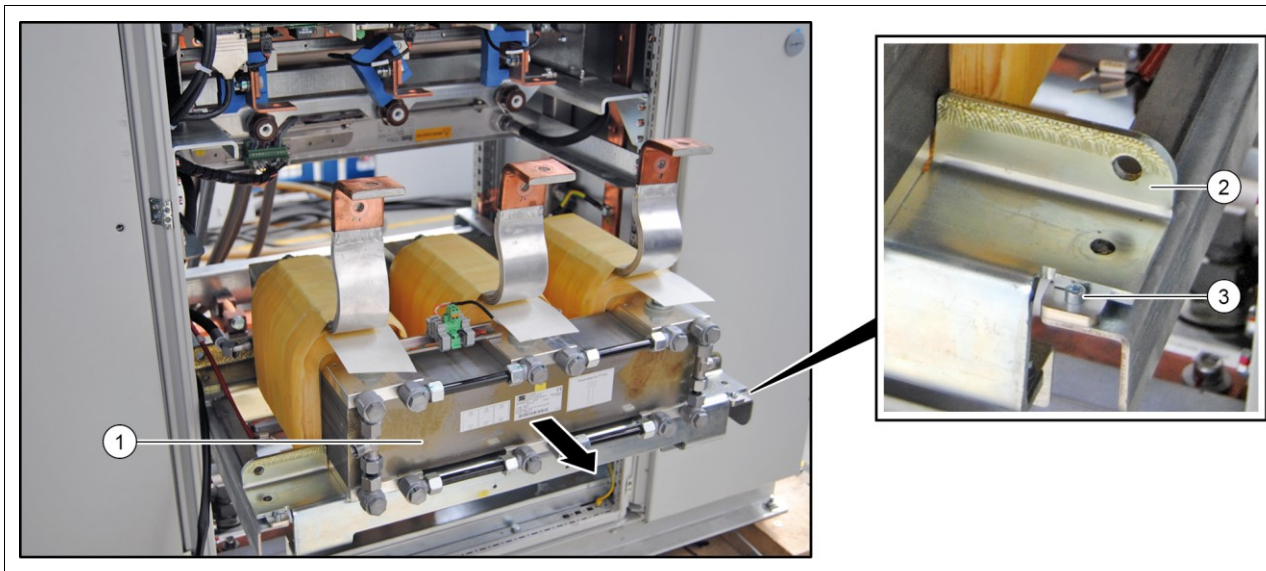


Fig. 4-18 Stop screws of the disassembling rails (here as an example for the line choke)

- | | | | |
|---|---------------|---|-------------|
| 1 | Component | 3 | Stop screws |
| 2 | Anchor points | | |

5. Pull the component (1) to the front until the anchor points (2) on the component holder contact the stop screws (3) of the disassembling rails.

NOTICE

The circuit breaker is pulled out on the side of the cabinet to the sliding panel.

4.6.5 Insert component

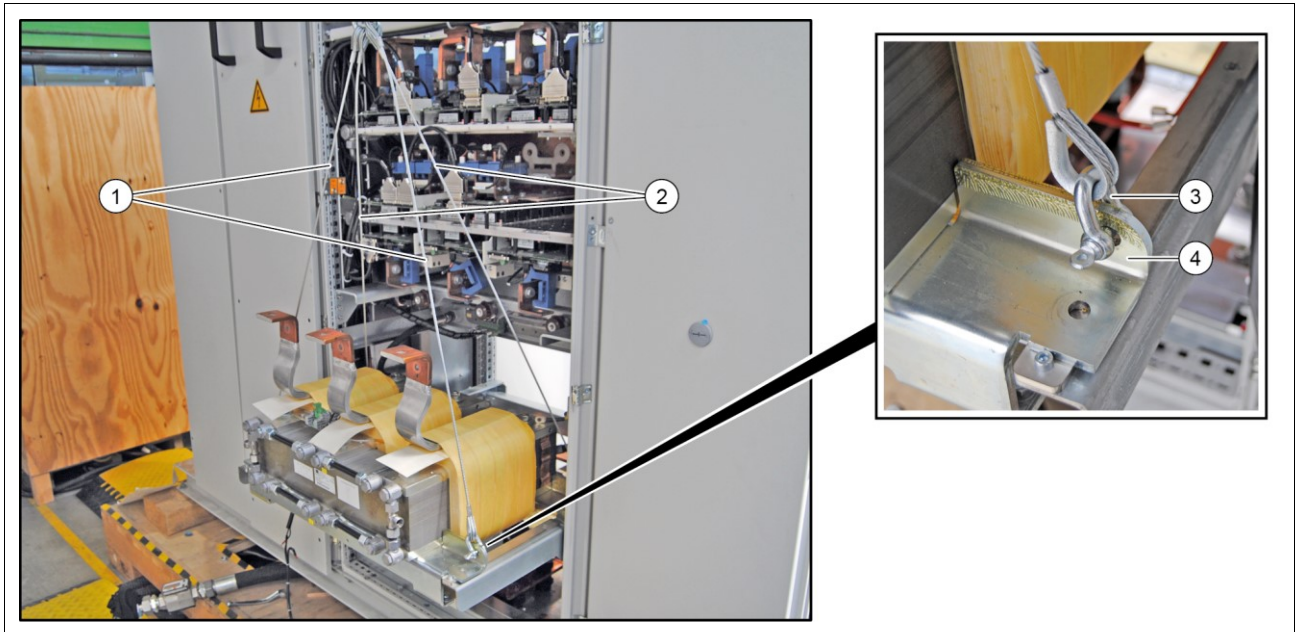


Fig. 4-19 Anchor points for fixing the component (here as an example for the line choke)

- | | |
|--------------------------|-----------------|
| 1 Short supporting ropes | 3 Small shackle |
| 2 Long supporting ropes | 4 Anchor points |

6. Fix the small shackle **(3)** with the anchor points **(4)** onto the component holder. Pay attention to the lengths and the anchor points of the supporting ropes:

Component	Shackle		Supporting ropes		Other resources
	large	small	short	long	
Line choke	3x	4x	2x 900 mm (front)	2x 1000 mm (rear)	—
dv/dt choke	3x	8x	2x 140 mm (front)	2x 260 mm (rear)	1x traverse
Circuit breaker	3x	—	1x 430 mm (left)	1x 480 mm (right)	2x fixing angle
Power stack	3x	—	1x 500 mm (left)	1x 500 mm (right)	—
DC-link capacitors	3x	—	1x 500 mm (left)	1x 500 mm (right)	—

7. Pay attention to the remaining cable windings on the rope winch (min. 3 windings).
8. When removing the dv/dt choke, also use the traverse from the kit dv/dt choke.

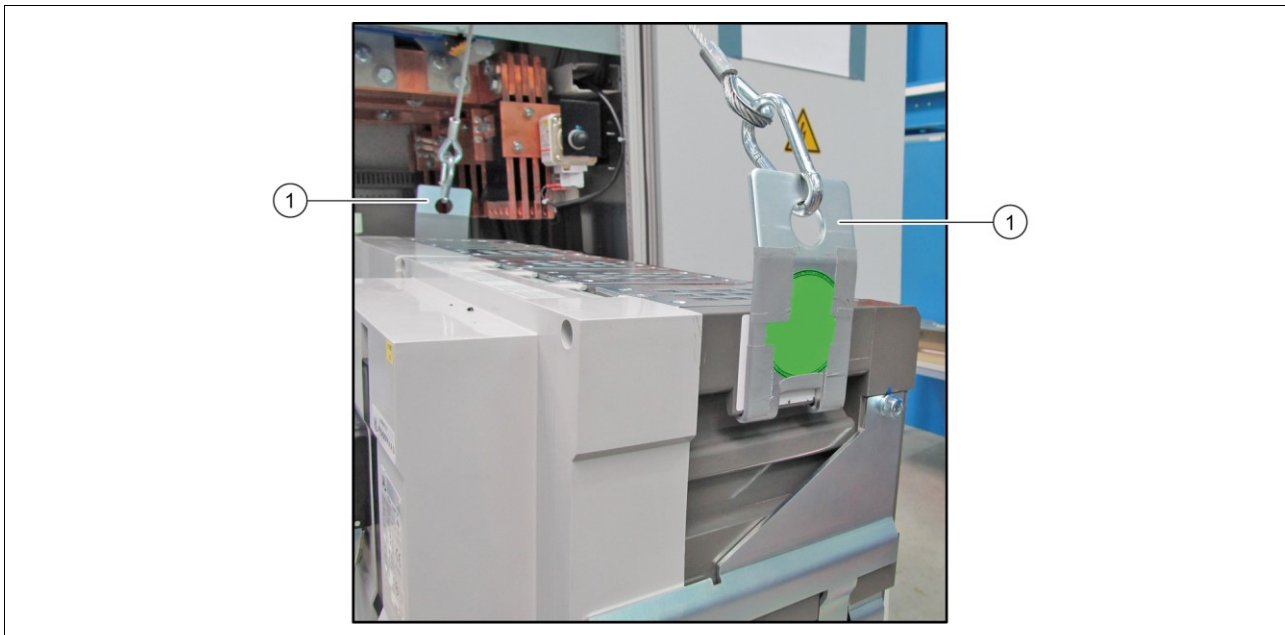


Fig. 4-20 Fixing angle at the circuit breaker (Exemplary illustration)

1 Fixing angle

9. When removing the circuit breaker, use also the two fixing angles **(1)** from the kit circuit breaker.

4.6.6 Lift component

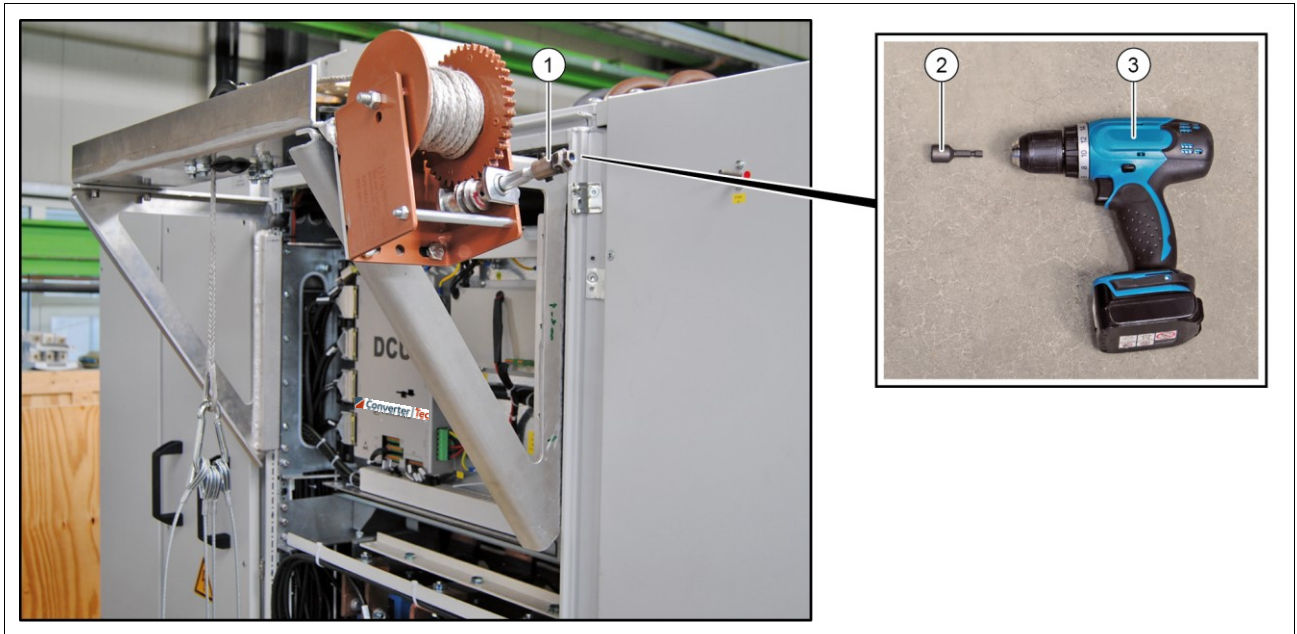


Fig. 4-21 Lifting device (Exemplary illustration)

- | | | | |
|---|---------------|---|------------------|
| 1 | Rope winch | 3 | Drilling machine |
| 2 | Screw adapter | | |

10. Attach a crank or a drilling machine **(3)** to the rope winch **(1)**.

- Screw adapter **(2)** for the drilling machine: Spanner size 13
- Rotation speed of the drilling machine: max. 600 rpm

11. Lift the component.

- No diagonal pulling of the component.

4.6.7 Turn component

Validity: **dv/dt choke and circuit breaker**

12. Turn the component by 90°.

4.6.8 Disassemble copper packages

Validity: **Circuit breaker**



DANGER

Risk of injury below suspended loads

Staying below suspended loads can cause serious injuries.

- ▶ Never replace the component alone!
- ▶ Always work under supervision of a second person.
- ▶ Never stay below the suspended component.



Fig. 4-22 Copper packages at the circuit breaker (Exemplary illustration)

1 Copper packages

13. Disassemble the copper packages **(1)** from the circuit breaker.

4.6.9 Disassemble lifting gear

Validity: Line choke and circuit breaker



DANGER

Risk of injury below suspended loads

Staying below suspended loads can cause serious injuries.

- ⊙ Never replace the component alone!
- ▶ Always work under supervision of a second person.
- ▶ Never stay below the suspended component.

14. Line choke: Disassemble the disassembling rails.

15. Circuit breaker: Disassemble the kit circuit breaker.

4.6.10 Replace component

16. Place the component onto a suitable transport trolley with sufficient load capacity.

17. Secure the component on the transport trolley.

18. Unhook the component.

19. Transport the component out of the wind turbine.

20. Transport the new component into the wind turbine.

21. Attach the component to the supporting ropes.

4.6.11 Install component

22. Install component (in reverse order as when removing).

4.7 Document the replacement

- ▶ Document the replacement in the maintenance protocol.

5 Replacement of components with lifting device 2

Validity: **CW14x1LD**



DANGER

Danger to life due to electric shock

Touching live components causes danger to life due to electric shock.

Before working on the product, observe the **five safety rules**:

- ▶ Isolate from power supply
- ▶ Protect against reclosing
- ▶ Verify the safe isolation from supply
- ▶ Connect to earth and short circuit
- ▶ Provide neighbouring parts under voltage with barriers



DANGER

Risk of injury below suspended loads

Staying below suspended loads can cause serious injuries.

- ▶ Always work under supervision of a second person.
- ▶ Never stay below a suspended load.



DANGER

Risk of injury by suspended components

Heavy components sliding from the hands may cause serious injuries.

- ▶ Always use a lifting device for maintenance and replacement of heavy components.

5.1 Scope of application

1. Always use a lifting device to replace the following components:

- Line choke
- dv/dt choke
- Circuit breaker
- LSC Power stack
- MSC Power stack

2. Refer to **Chap. 5.2** for the kits of the lifting device and their respective article numbers.

5.2 Kits of the lifting device 2

10-005-970	Total kit
10-005-971	Kit Circuit breaker (4.5 MW)
	 4930-1653 Fixing angle 10-008-606 Rope kit Circuit breaker
10-005-972	Kit dv/dt choke
	10-005-973 Disassembling rail, left side 4930-1640 Traverse 10-005-974 Disassembling rail, right side 4930-1617 Rope kit dv/dt choke
10-006-483	Kit MSC Power stack
	10-006-481 Disassembling rail, left side 10-006-482 Disassembling rail, right side
10-006-488	Kit LSC Power stack
	10-006-489 Disassembling rail, left side 10-006-490 Disassembling rail, right side 10-006-471 Bracket
10-005-975	Kit Line choke
	10-005-976 Disassembling rail, left side 10-008-505 Bracket 10-006-471 Bracket 10-005-977 Disassembling rail, right side 10-008-607 Rope kit Line choke

5.3 Drain cooling circuit

- Before removing liquid cooled components, drain the cooling circuit.

5.4 Disassemble component



CAUTION

Damage to property due to interfering edges in the cabinet

For removal and installation of components, interfering edges in the cabinet can cause damage to components.

- Make sure that the components can be removed and installed freely.

5.4.1 Line choke

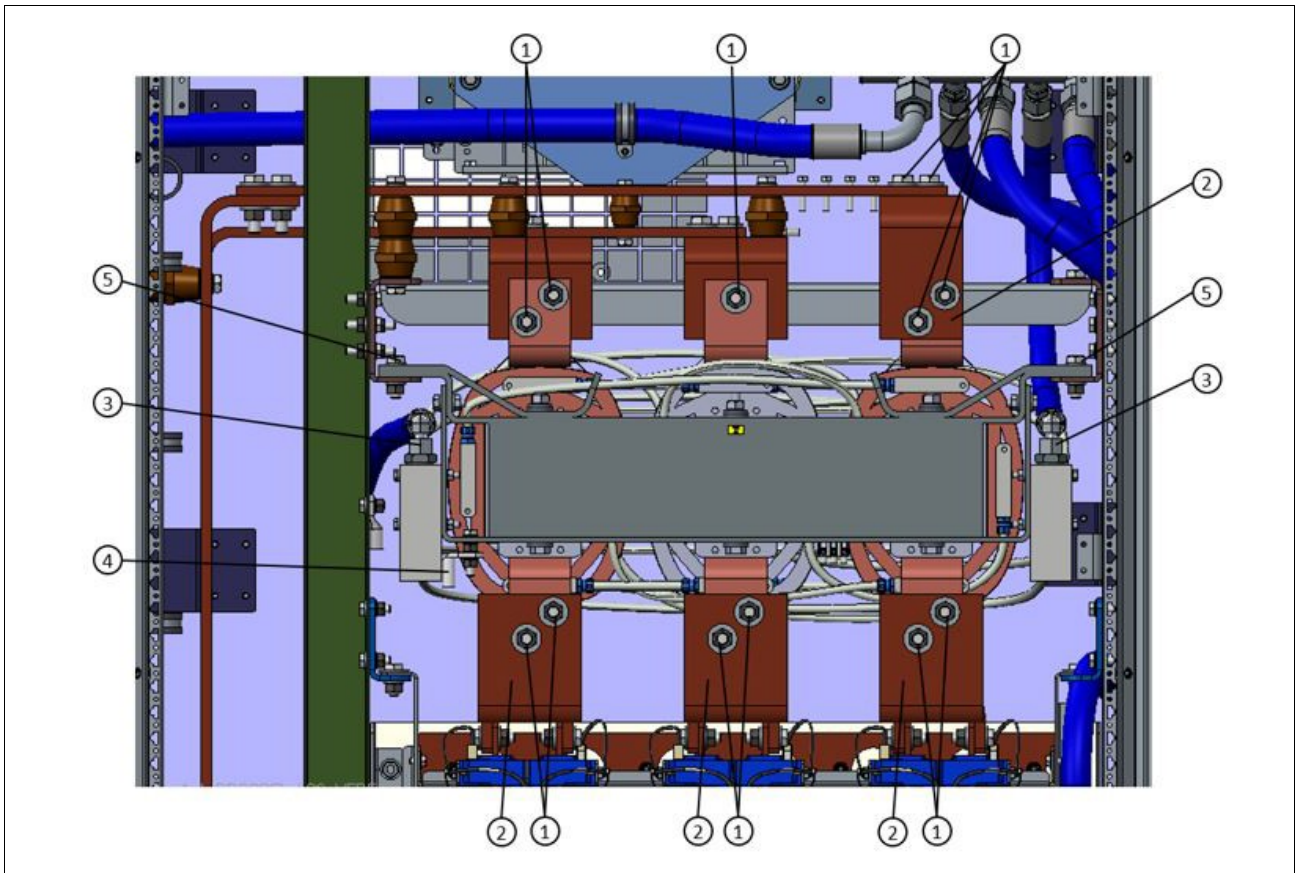


Fig. 5-1 Line choke (Exemplary illustration)

- | | |
|-------------------|-----------------|
| 1 Screws | 3 Cooling pipes |
| 2 Copper packages | 5 Screws |

1. To remove the line choke, loosen the screws **(1)**.
2. Remove all copper packages **(2)**.
3. Remove both cooling pipes **(3)**.
4. Remove the PE cable from the line choke.
5. Loosen the screws **(5)** between the line choke and the cabinet frame.

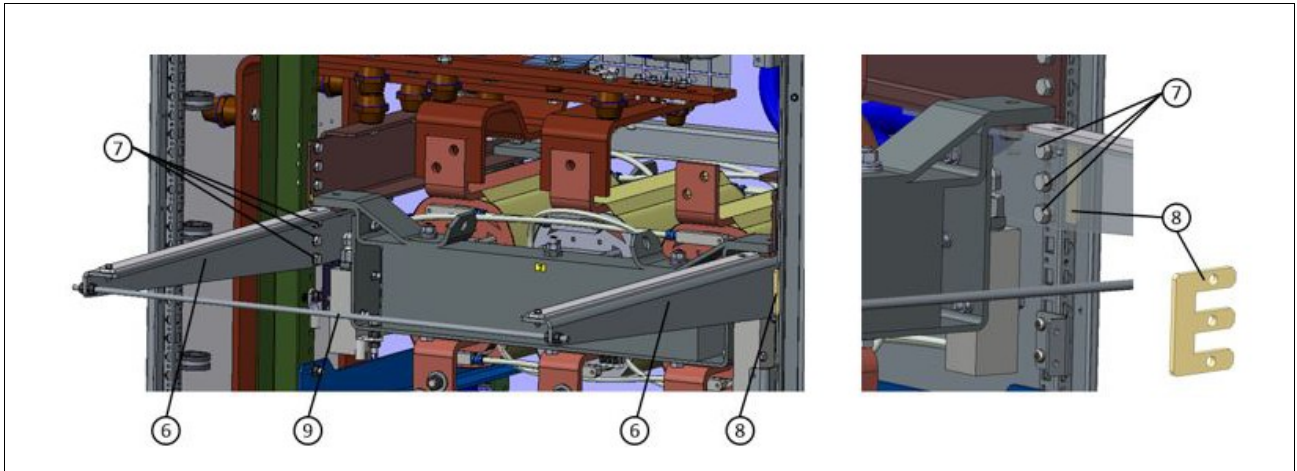


Fig. 5-2 Line choke (Exemplary illustration)

- | | | | |
|---|---------------------|---|----------|
| 6 | Disassembling rails | 8 | Brackets |
| 7 | Screws | 9 | Rod |

6. Assemble both disassembling rails **(6)** on the cabinet frame.
 - Use the screws **(7)** and brackets **(8)** from the kit.
7. Assemble the rod **(9)** between both rails.
 - The rails must be parallel.

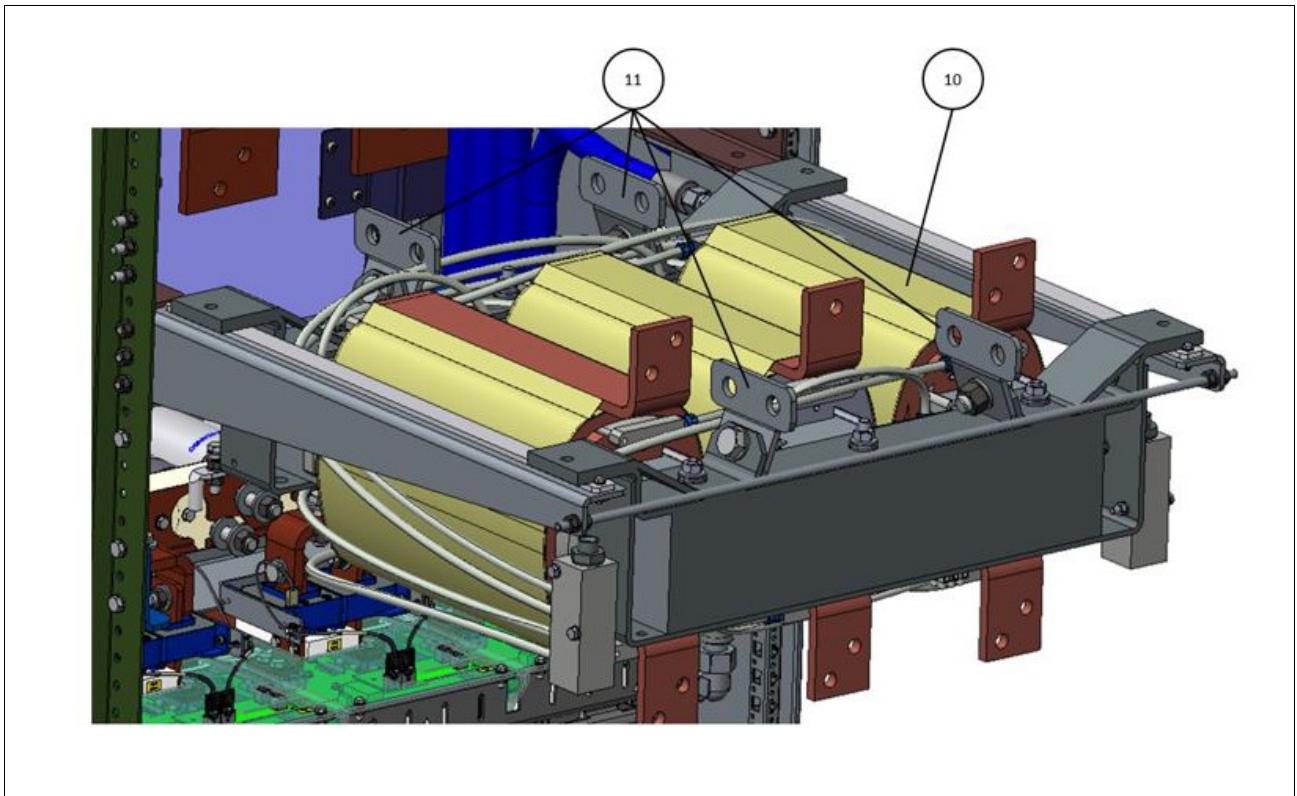


Fig. 5-3 Line choke (Exemplary illustration)

10 Line choke

11 Brackets

8. Pull out the line choke **(10)**.
9. Assemble the 4 brackets **(11)** for lifting the line choke.

5.4.2 dv/dt choke



Fig. 5-4 dv/dt choke (Exemplary illustration)

- | | |
|-----------------|--|
| 1 Support plate | 3 Support plate (incl. mounted components) |
| 2 Screws | |

1. To remove the dv/dt choke, remove all cables from the support plate **(1)**, that obstruct the disassembly.
2. Loosen all screws **(2)**.
3. Remove the support plate (incl. mounted components) **(3)**.

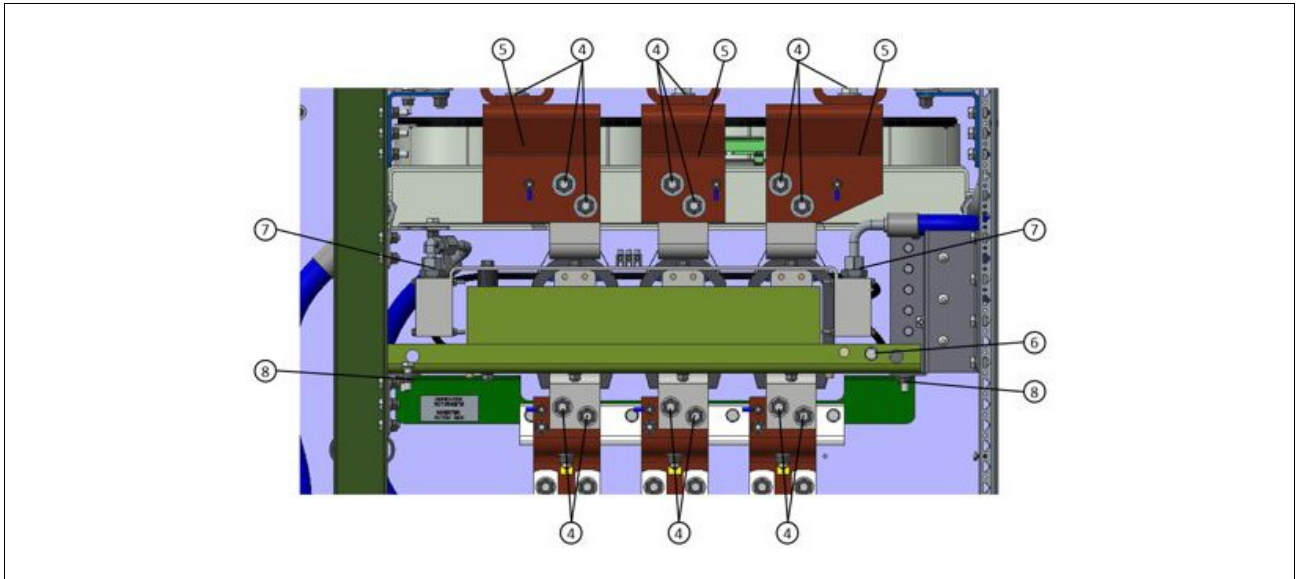


Fig. 5-5 dv/dt choke (Exemplary illustration)

- | | | | |
|---|-----------------|---|---------------|
| 4 | Screws | 7 | Cooling pipes |
| 5 | Copper packages | 8 | Screws |

4. Loosen all screws **(4)**.
5. Remove the copper packages **(5)**.
6. Remove the PE cable from the dv/dt choke.
7. Remove both cooling pipes **(7)**.
8. Loosen the screws **(8)** between the dv/dt choke and the cabinet frame.

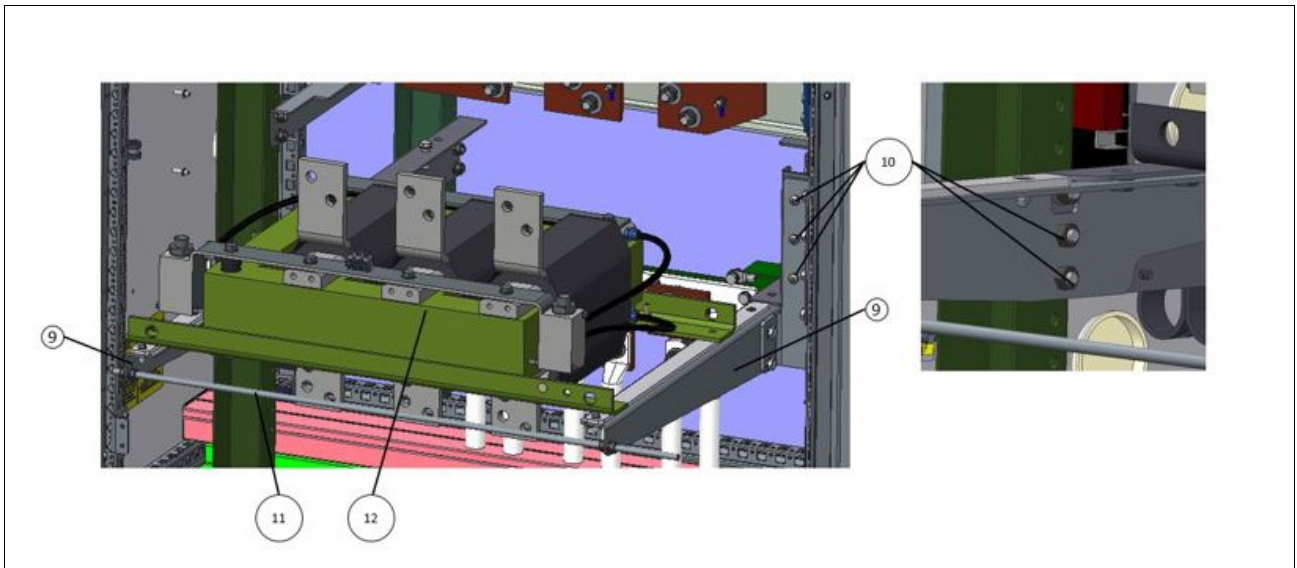


Fig. 5-6 dv/dt choke (Exemplary illustration)

- | | | | |
|----|---------------------|----|-------------|
| 9 | Disassembling rails | 11 | Rod |
| 10 | Screws | 12 | dv/dt choke |

9. Assemble both disassembling rails **(9)** on the cabinet frame.

- Use the original screws **(10)**.

10. Assemble the rod **(11)** between both rails.

- The rails must be parallel.

11. Pull out the dv/dt choke **(12)**.

5.4.3 Circuit breaker

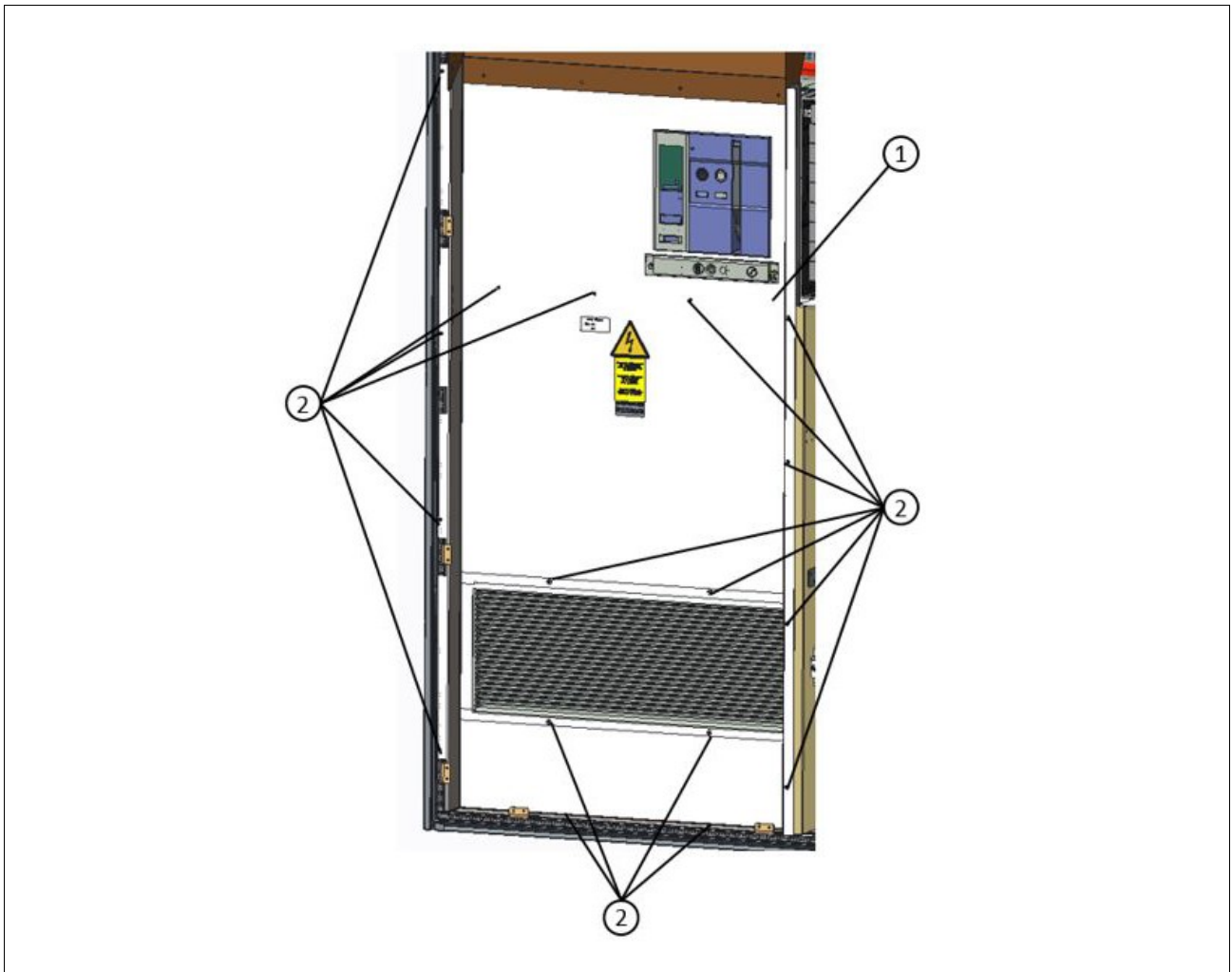


Fig. 5-7 Circuit breaker (Exemplary illustration)

1 Air baffle

2 Screws

1. Loosen the screws **(2)** of the air baffle **(1)**.
2. Remove the air baffle.

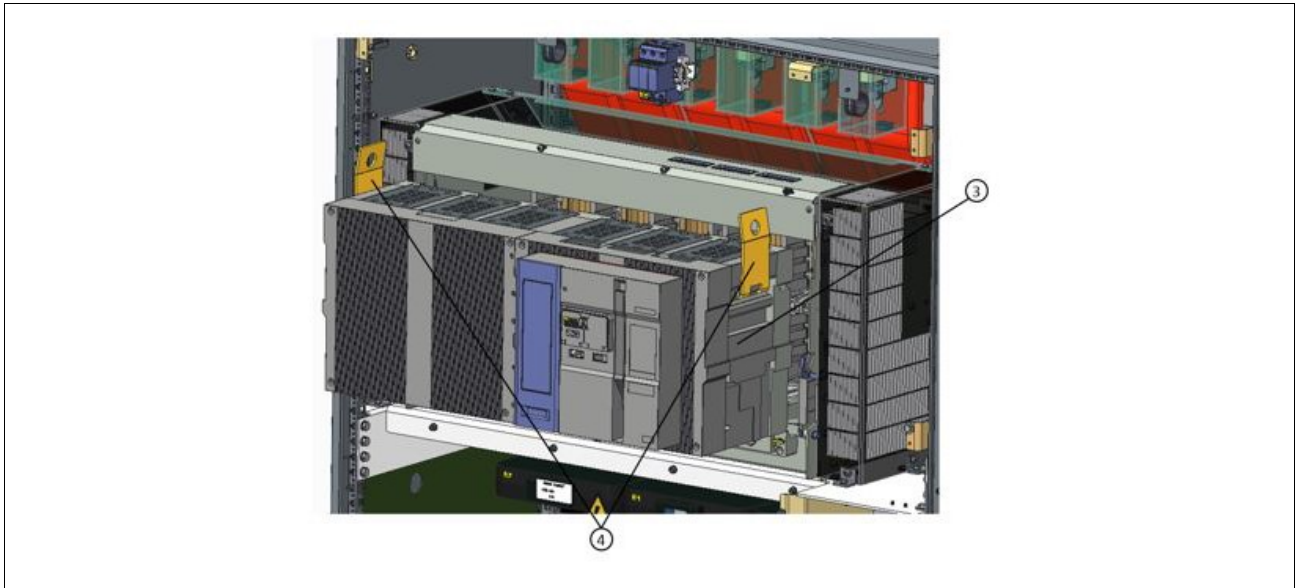


Fig. 5-8 Circuit breaker (Exemplary illustration)

3 Circuit breaker

4 Fixing angles

3. To remove the circuit breaker **(3)**, use the two fixing angles **(4)**.

5.4.4 LSC Power stack

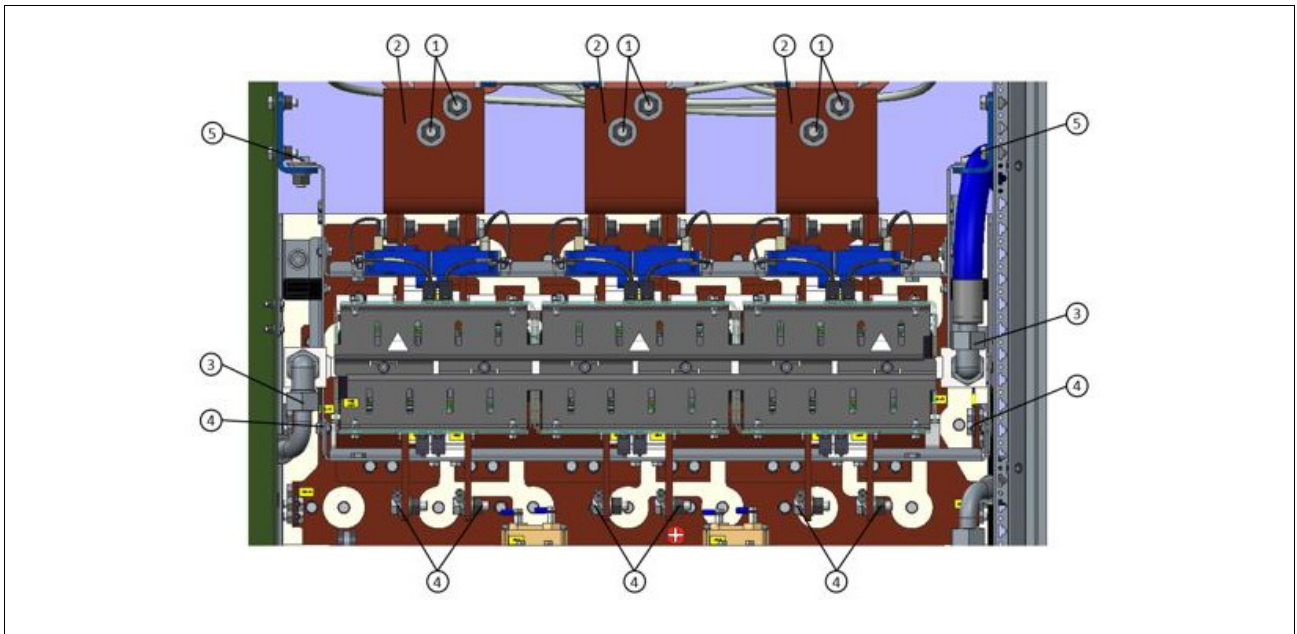


Fig. 5-9 LSC Power stack (Exemplary illustration)

- | | |
|-------------------|----------|
| 1 Screws | 4 Cables |
| 2 Copper packages | 5 Screws |
| 3 Cooling pipes | |

1. To remove the LSC Power stack, loosen the screws **(1)**.
2. Remove all copper packages **(2)**.
3. Remove both cooling pipes **(3)**.
4. Remove all cables **(4)** from the Power stack.
5. Loosen the screws **(5)** between the Power stack and the cabinet frame.

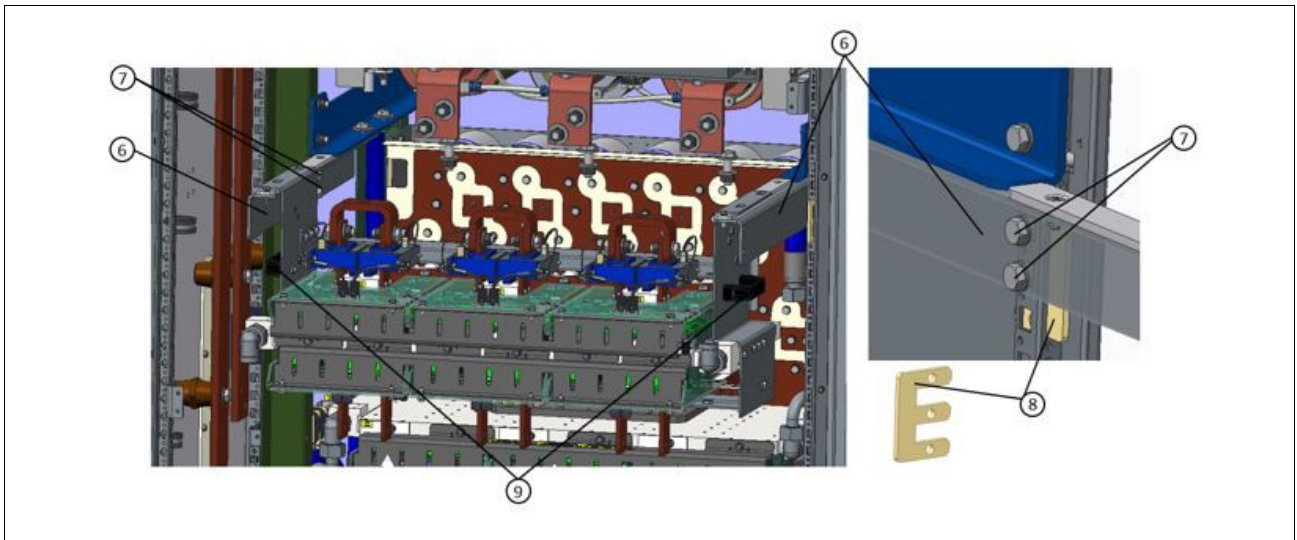


Fig. 5-10 LSC Power stack (Exemplary illustration)

- | | |
|-----------------------|-----------|
| 6 Disassembling rails | 8 Bracket |
| 7 Screws | 9 Handles |

6. Assemble both disassembling rails **(6)** on the cabinet frame.
 - Use the screws **(7)** and the bracket **(8)** from the kit.
7. Pull out the Power stack.
 - Use the handles **(9)**.

5.4.5 MSC Power stack



Fig. 5-11 MSC Power stack (Exemplary illustration)

- 1 Support plate
- 2 Screws

- 3 Support plate (incl. mounted components)

1. To remove the MSC Power stack, remove all cables from the support plate **(1)**, that obstruct the disassembly.
2. Loosen all screws **(2)**.
3. Remove the support plate (incl. mounted components) **(3)**.

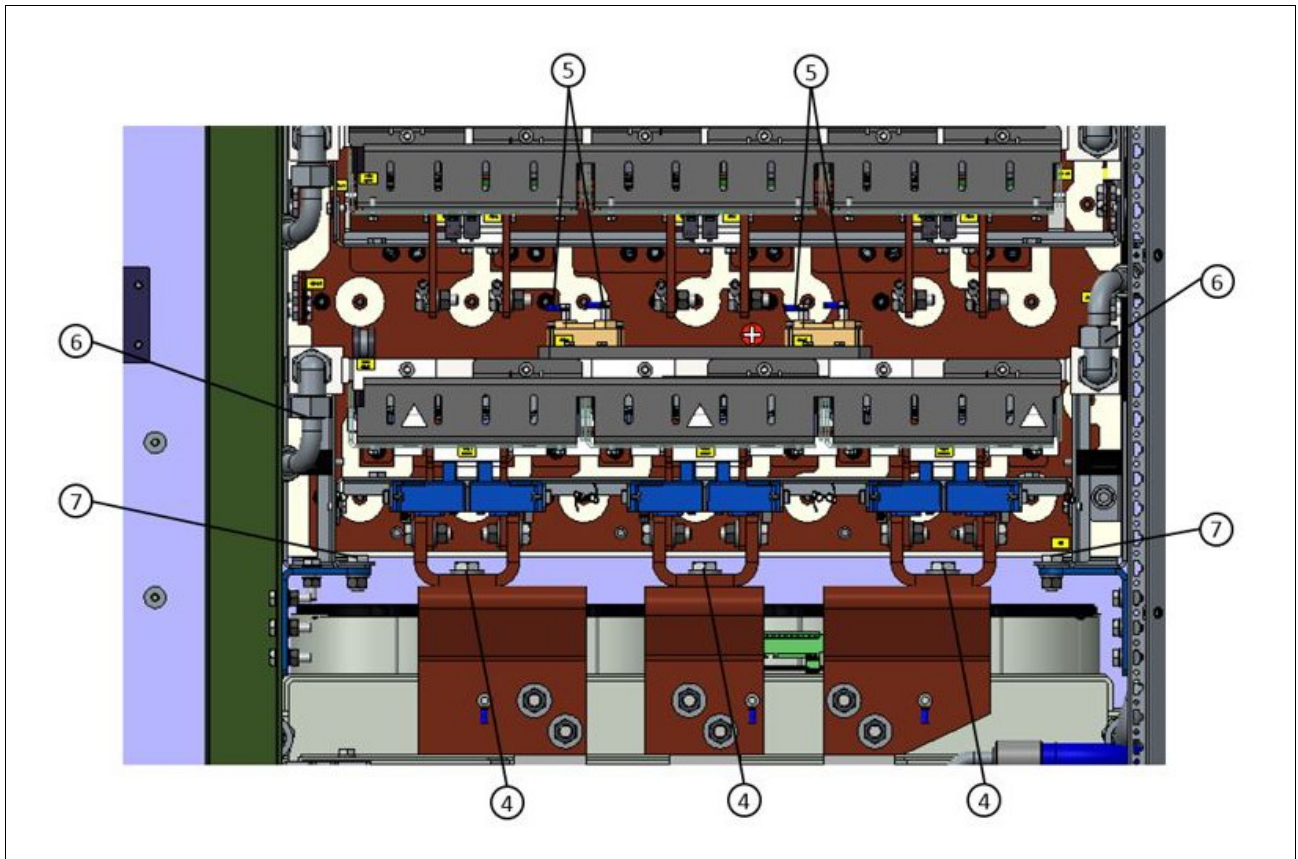


Fig. 5-12 MSC Power stack (Exemplary illustration)

- | | | | |
|---|--------|---|---------------|
| 4 | Screws | 6 | Cooling pipes |
| 5 | Cables | 7 | Screws |

4. Loosen all screws **(4)**.
5. Remove all cables **(5)** from the Power stack.
6. Remove both cooling pipes **(6)**.
7. Loosen the screws **(7)** between the Power stack and the cabinet frame.

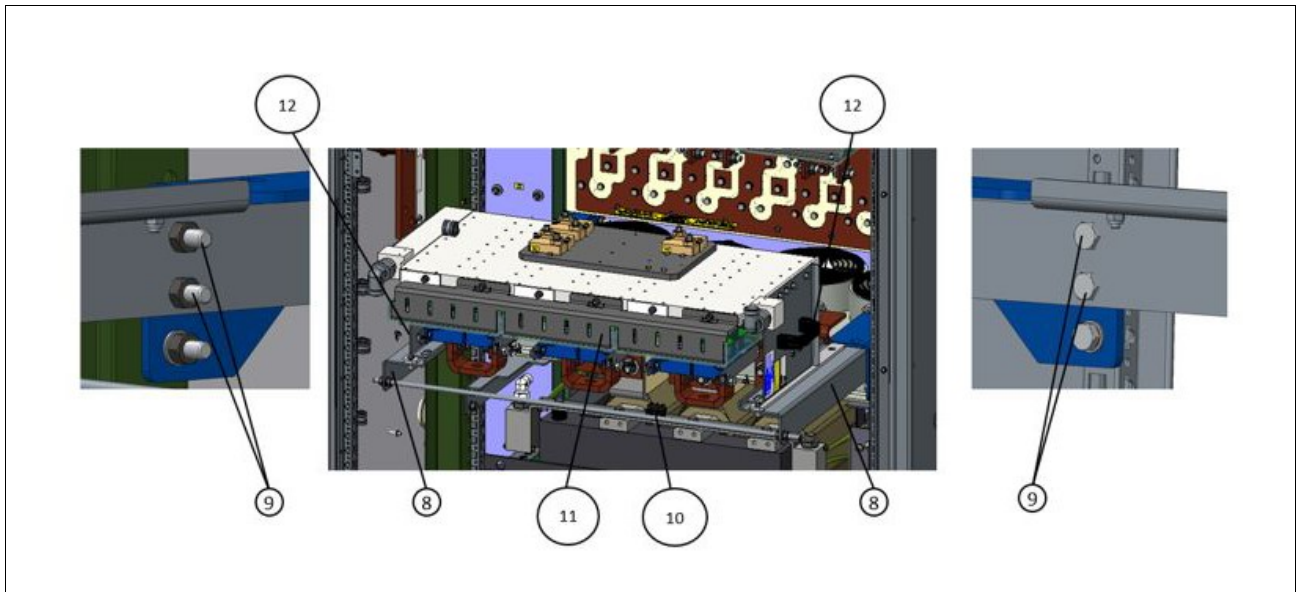


Fig. 5-13 MSC Power stack (Exemplary illustration)

- | | |
|-----------------------|----------------|
| 8 Disassembling rails | 11 Power stack |
| 9 Screws | 12 Handles |
| 10 Rod | |

8. Assemble both disassembling rails **(8)** on the cabinet frame.
 - Use the original screws **(9)**.
9. Assemble the rod **(10)** between both rails.
 - The rails must be parallel.
10. Pull out the Power stack **(11)**.
 - Use the handles **(12)**.

5.4.6 Replace component

- ▶ Place the component onto a suitable transport trolley with sufficient load capacity.
- ▶ Secure the component on the transport trolley.
- ▶ Transport the component out of the wind turbine.
- ▶ Transport the new component into the wind turbine.

5.4.7 Install component

- ▶ Install component (in reverse order as when removing).

5.5 Document the replacement

- ▶ During the maintenance, document the replacement in the maintenance protocol.
- ▶ In case of a service, inform the ConverterTec service.



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