10.6.10. Replacing clamp resistor

Service MTTR 4 - 8 h

There are two versions of clamp resistors existing: an older version with 2 big resistors and a newer version with 6 small resistors (see Fig. 10–37). The replacement procedure is similar for both versions.

Figure 10–37 Clamp resistor

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Empty the water circuit of the cooling system according to section 10.5.2, **Emptying the cooling liquid circuit**, page 139 (recommended since access to the hoses is quite difficult).

   It is also possible to release only the over pressure of the cooling system as described in section 10.5.1, **Releasing the over pressure from the cooling liquid circuit**, page 138 and then to close the leaks immediately with Legris plugs.
3. Switch off the auxiliary power supply in the respective unit(s).
4. Disconnect all cables (mark the cables before disconnecting).
5. Unbolt the Allen-key screws.
6. Replace the resistor.

   NOTE – To do this, the lower 6-pack must be taken out completely, it is not possible to remove one single resistor.
7. Reconnect all plugs.

   For instructions to connect the cooling tubes, see section 3.2.3, **Tube cutter**, page 36.

8. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.6.11. Replacing clamp reactor

Service MTTR 2 - 4 h

1. Shut-down the PCS6000 according to the "PCS6000 Lockout/tagout procedure", 3BHS600000 E22.
2. Release the over pressure of the cooling system according to section 10.5.1, **Releasing the over pressure from the cooling liquid circuit**, page 138.
3. Switch off the auxiliary power supply in the respective unit(s).
4. Remove the clamp capacitor including the neutral point busbar (see Fig. 10–38).
5. Disconnect the Legris input and output from clamp reactor and clamp resistor and close the leaks with Legris plugs.

Figure 10–38 Clamp reactor

6. Remove the clamp resistor according to section 10.6.10, **Replacing clamp resistor**, page 172.
7. Disconnect the busbars to the reactor.
8. Remove the reactor by unbolting the two M6 screws in the front and the 4 Torx screws in the back.

   CAUTION! The reactor weights approximately 25 kg. Use lifting aids and proper lifting technique when lifting and moving.
9. Replace the reactor and install all parts again.

10.6.12. Replacing LEM current transducer

Service MTTR 0 - 2 h

Figure 10–39 LEM current transducers

1) Two upper busbar bolts
2) Four LEM mounting screws
3) Two lower busbar bolts

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Disconnect all cables from LEM current transducer.
3. Unbolt the 2 lower M12 busbar bolts.
4. Remove the 4 LEM mounting screws.
5. Unbolt the 2 upper M12 busbar bolts.
6. Replace the LEM current transducer.
7. Bolt the cooper bars again (40 Nm).
8. Reconnect all cables. Make sure no wire was interchanged, compare to the remaining LEM current transducers.
9. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.6.13. Replacing DC capacitor

Service MTTR 2 - 4 h

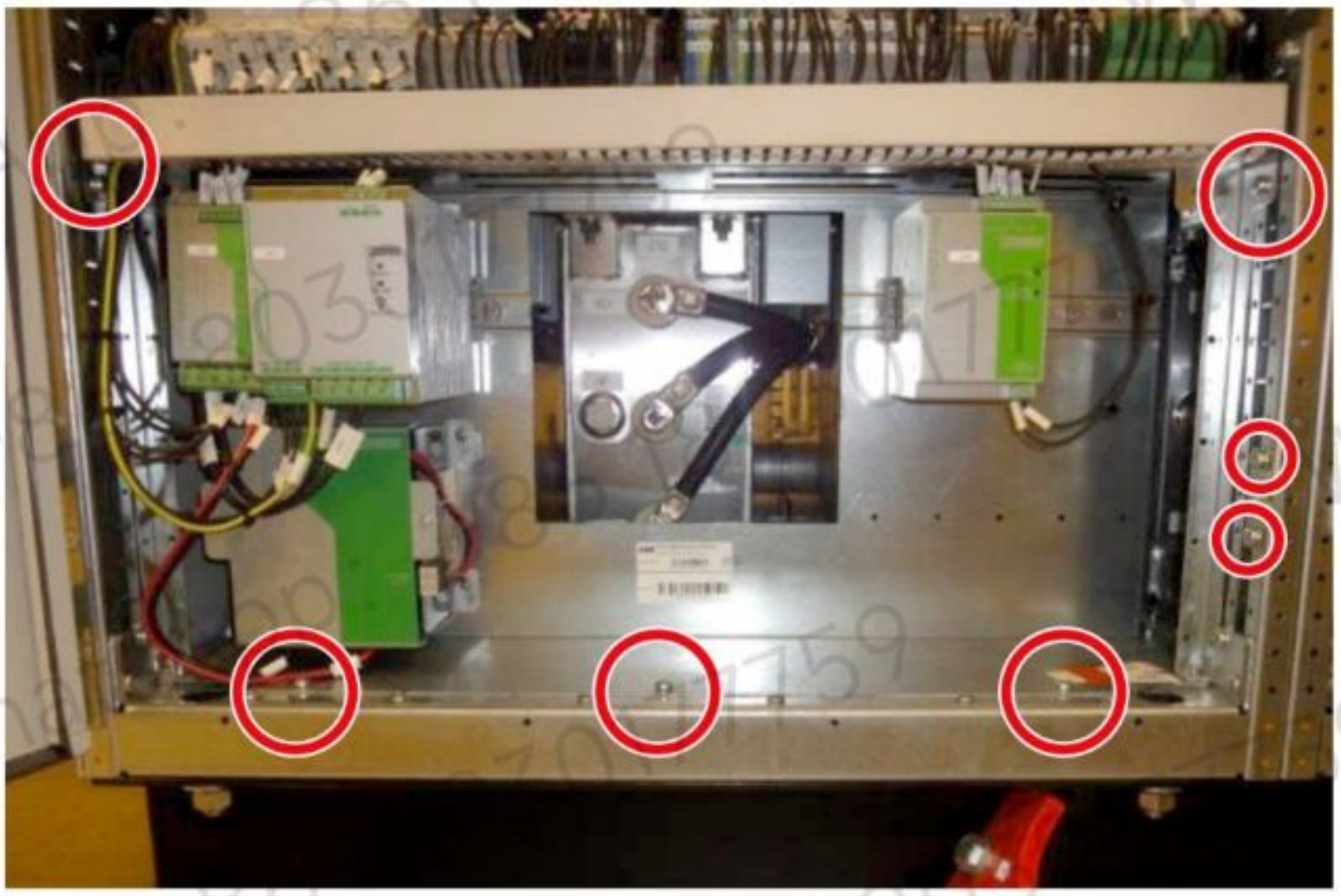


Figure 10–40 Mounting screws of ASM in front of DC capacitor

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Disconnect all system cables from ASM.
3. Remove ASM by unbolting the 5 Torx screws and the door fixation plate screws (see arrows in Fig. 10–40).

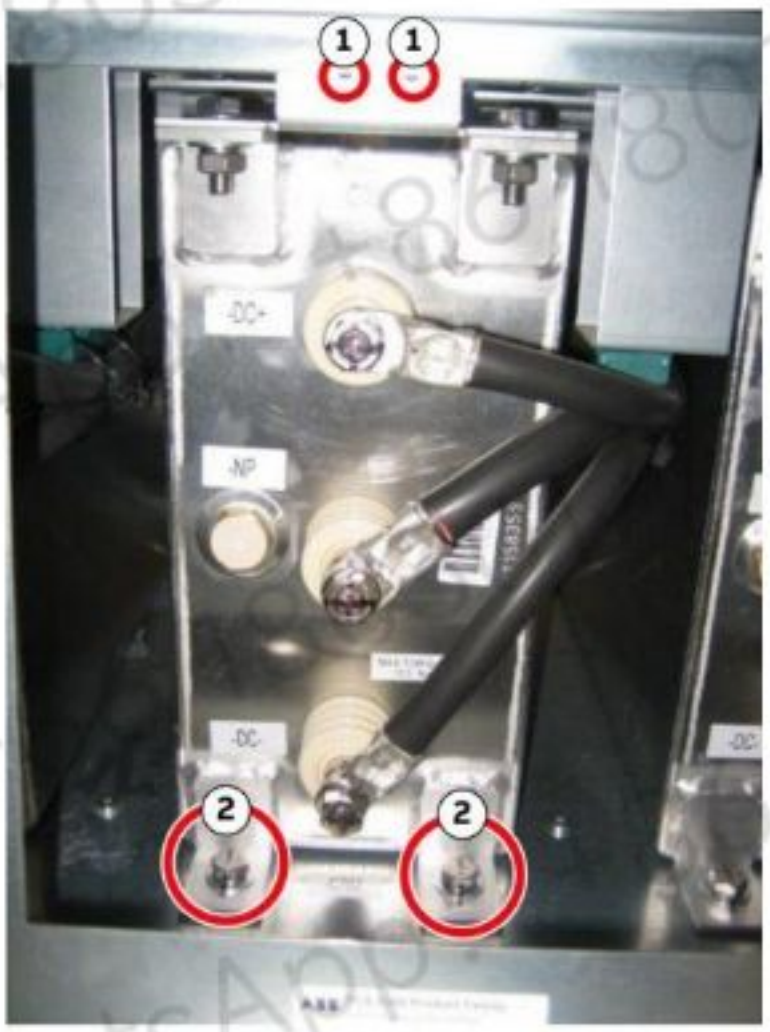


Figure 10–41 DC capacitor

1) Torx screw	2) Hexagonal screw

4. Mark the cables with DC+, NP and DC- and then disconnect them.

   CAUTION! The capacitor weights approximately 50 kg. Single person lift could cause injury. Use assistance when lifting and moving.

5. Remove the capacitor by releasing the hexagonal screws at bottom and the Torx screws on top (see Fig. 10–41).

6. Assembly the metal plate from the old capacitor to the new.

7. Replace the DC capacitor.

   NOTICE During loosening as well as fastening, the capacitor connections need to be held in place with a 19 mm spanner. For maximum tightening torques refer to section 10.4.1, **Correct tightening torques of bolted connections**, page 135.

8. Reconnect the cable.

9. Install the ASM again.

10. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.7. Replacing components in DRU

Converter service tools from the toolbox (3BHB008753R0001) for standard converters are required to carry out these procedures eg, a spreading tool (see chapter 3, **Service tools**, page 31).

A pressure loading spanner is attached to the bottom of the DRU frame.

There are two types of spreader tools available. Type 2 is the preferred tool when working on the diode stack of the LSU (see Fig. 10–42).

10.7.1. General

Service MTTR 2 - 4 h

After faulty semiconductors have been identified, they have to be exchanged according to the procedures below.

⚠CAUTION

- All stacks containing semiconductors must be released before using the spreading tool.

Figure 10–42 Spreader tools

1) Type 1 spreader tool
2) Type 2 spreader tool

To ensure sufficient cooling, each stack is clamped with a specified clamping force. To exchange semiconductors, the clamping force must be released.

10.7.2. Releasing the stacks

IMPORTANT! The clamping pressure of the stack must be released when diodes or thyristors of the rectifier are replaced. Do not release the pressure all at once, as otherwise all semiconductors in the stack will become mis-aligned. They must then be re-centered in a time consuming procedure. The misalignment results from the flexible busbar connectors at the rear of the stack. They are connected to the coolers and push them to the front, resulting in misalignment of the semiconductors. It is therefore essential that the instructions below are followed.

Procedure:

1. Shut down the PCS6000 according to the "PCS6000 Lockout/tagout procedure", 3BHS600000 E22.
2. Insert the clamp pressure loading spanner (see B in Fig. 10–43).
3. Insert the spreader tool (type 2, see Fig. 10–42) into the openings of the coolers above and below the diode or thyristor which is to be replaced (see Fig. 10–43).

   NOTICE DO NOT use the extensions available for type 1 of the spreader tool. The extensions cause the cooler above the faulty semiconductor to be pushed down by the flexible connectors at the rear of the stack, thus clamping the semiconductor. When replacing a semiconductor which is next to a pulse transformer, pay attention to the transformer leads. The wires can be easily caught in the gears of the spreader tool.

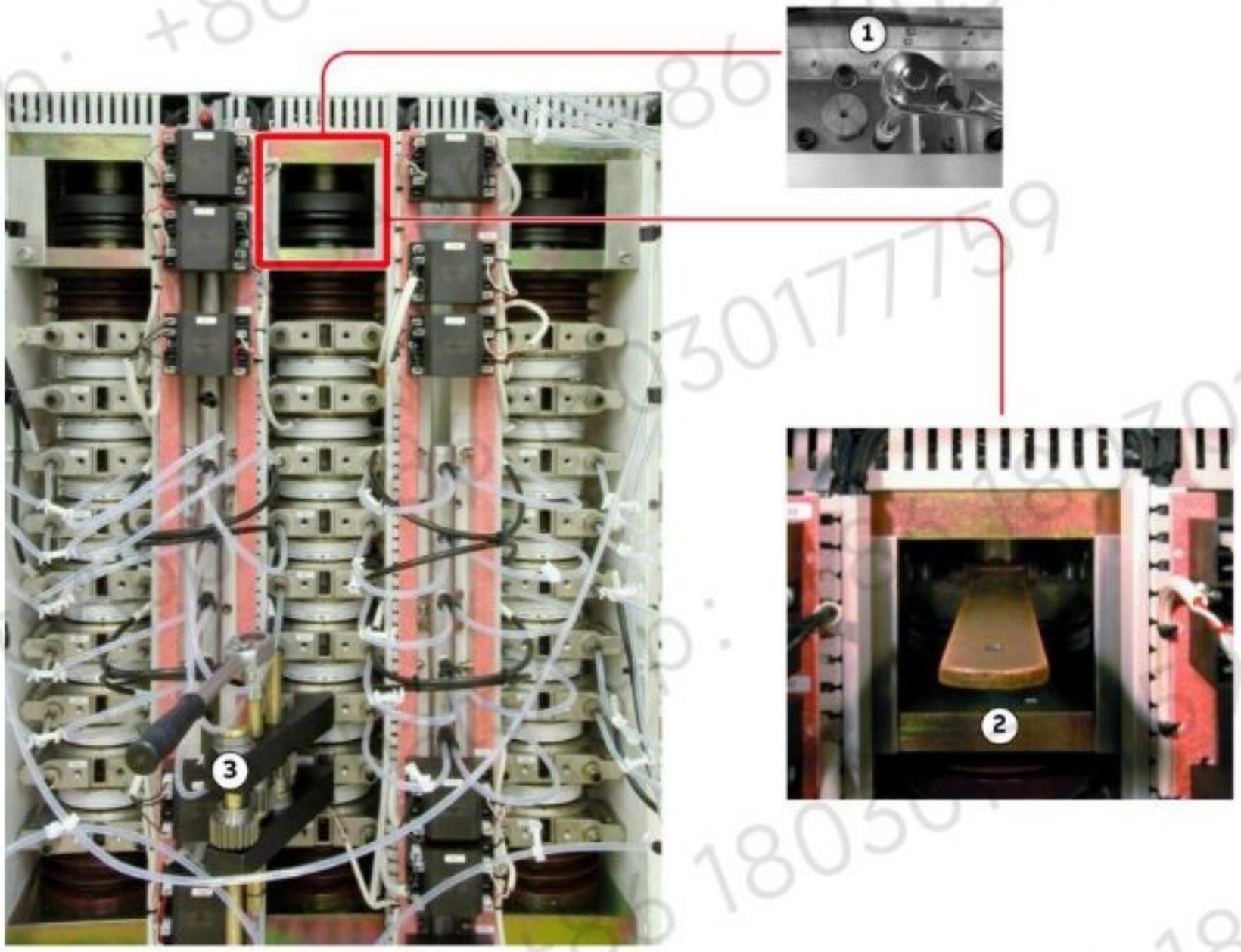


Figure 10–43 Applying spreader tool

1) Pressure loading spanner
2) Pressure adjusting bolts
3) Spreader tool

4. Alternately release the clamping pressure and then spread the spreader tool to maintain the pressure in the stack above the semiconductor to be changed.

   Proceeding in this manner prevents the semiconductors from becoming misaligned.

5. Remove the semiconductor as soon as the clearance above the semiconductor is big enough.

6. Prepare the new semiconductor for reassembly.

   Check the contact surfaces of the new diode for any dirt. If necessary, clean the contact surfaces with an appropriate solvent (eg, alcohol). Using a fluff-free cloth wipe the surfaces paying attention not to scratch the surfaces.

   IMPORTANT! DO NOT use any grease or any electrical joint compound.

7. Insert the new semiconductor into the stack and center it.

   NOTICE Pay attention to the correct polarity. Always verify the polarity with the corresponding wiring diagram.

8. Alternately close the gap between the new semiconductor and the cooler and increase the pressure in the stack until the pressure adjustment spanner can be removed.

9. Reconnect any disconnected wires.

10. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.7.3. Centering misaligned stacks

In case a stack becomes misaligned, the coolers can be pushed back into place and the semiconductors can be centered using a fixture as illustrated in Fig. 10–44 Rearranging misaligned stacks.

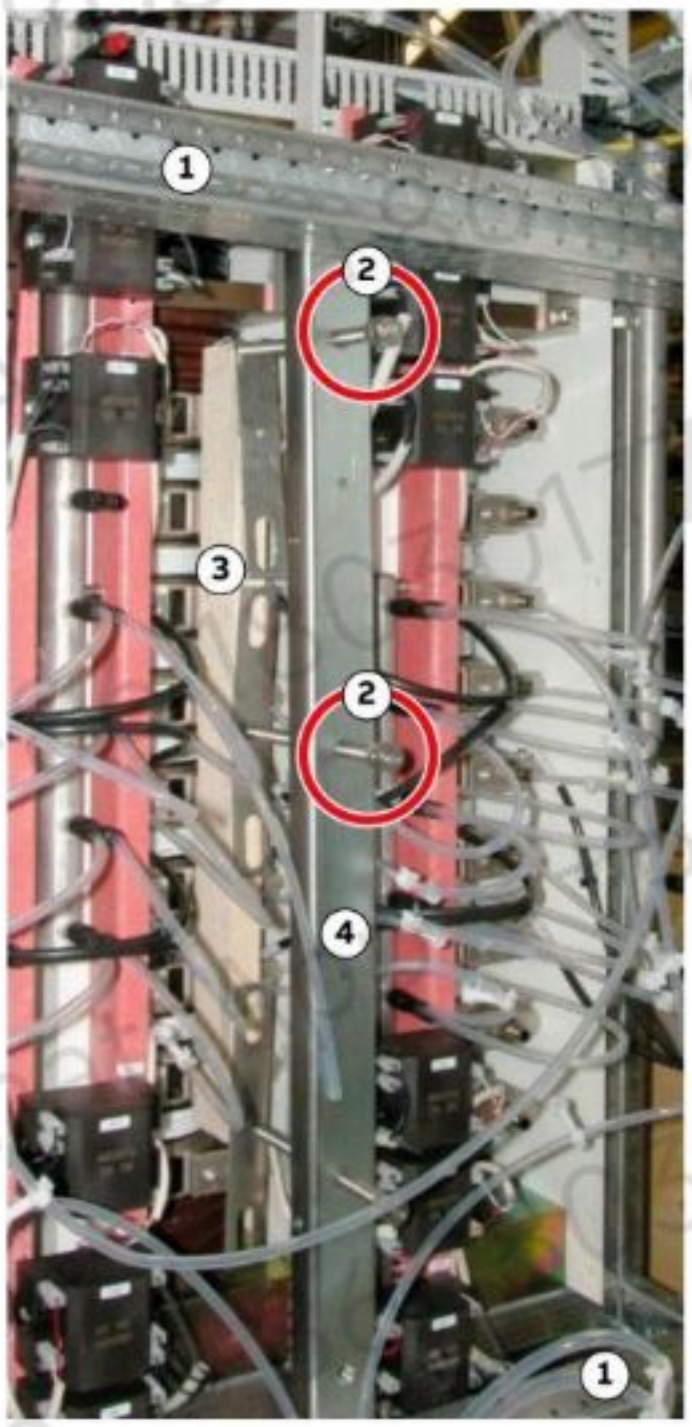


Figure 10–44 Rearranging misaligned stacks

1) Horizontal bar	3) Wooden bar
2) Adjustment bolt	4) Vertical bar

The two horizontal bars are fixed to the frame of the cabinet. By means of the adjustment bolts, the wooden bar is pushed against the coolers thus pushing the coolers back into place and holding them there. The semi-conductors can be centered one by one starting at the bottom of the stack. The spreader tool is used to create the clearance for moving the semiconductors into place. Since the space is very narrow it is recommended to use a piece of wire shaped into a half moon to move the semi-conductors.

10.8. Replacing components in DLU

10.8.1. Replacing grounding isolator

Service MTTR 0 - 2 h

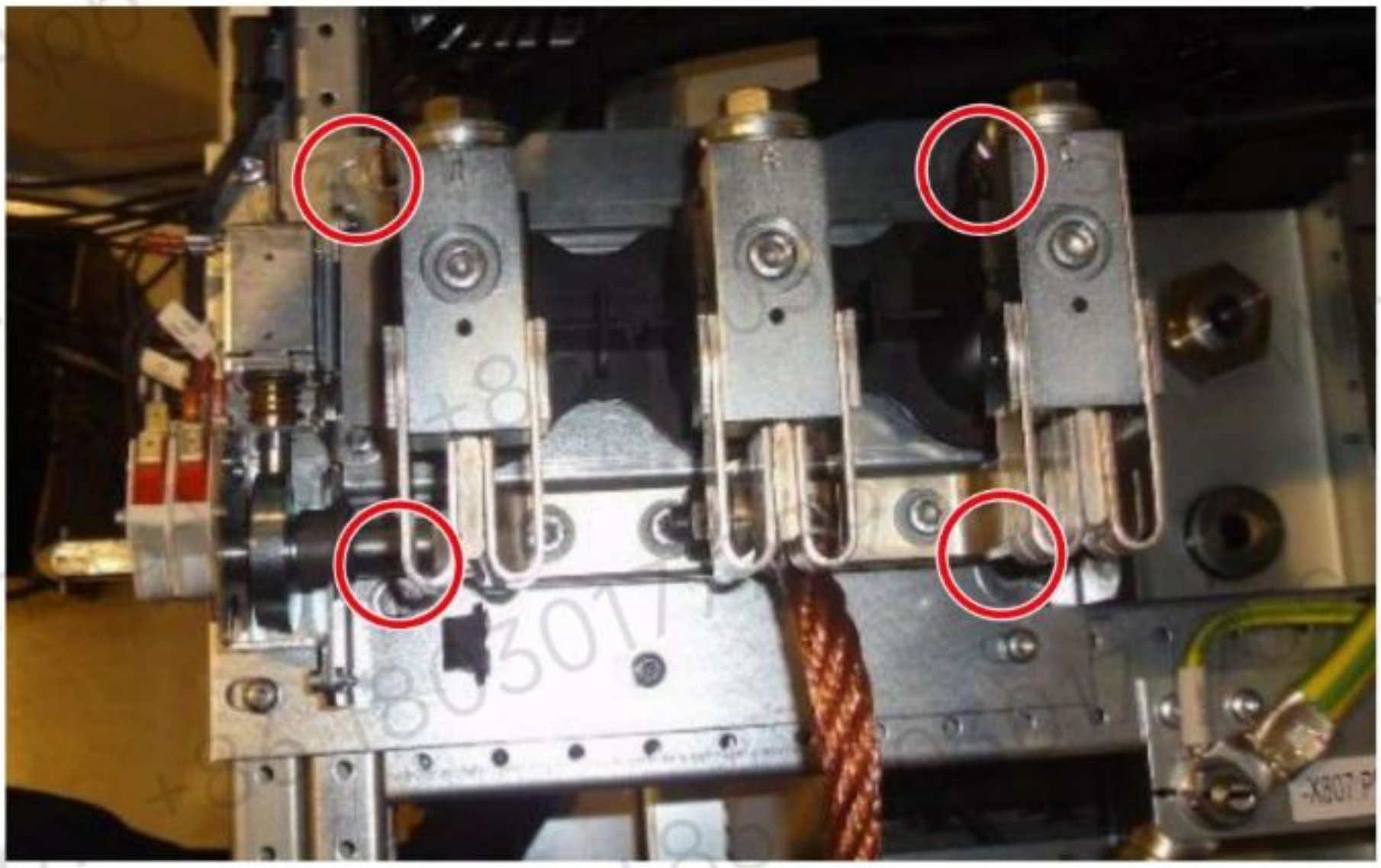


Figure 10–45 Earth isolator mounting screws

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Before remove the grounding isolation install an additional grounding kit to ground the DC-link.
3. Disconnect all electrical cables.
4. Unbolt the 4 screws (see Fig. 10–45).
5. Replace the earth connector (weight approximately 10 kg).
6. Remove the additional grounding kit
7. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.8.2. Replacing resistor -R462_1, -R462_2

Service MTTR 0 - 2 h

Figure 10–46 Resistor -R462_1, -R462_2

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Disconnect all electrical cables.
3. Unbolt the Torx screws for the resistor, which have to be replaced.
4. Replace the faulty resistor.
5. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.8.3. Replacing resistor -R751 to -R754 or capacitor -C751 to -C752

Service MTTR 2 - 4 h

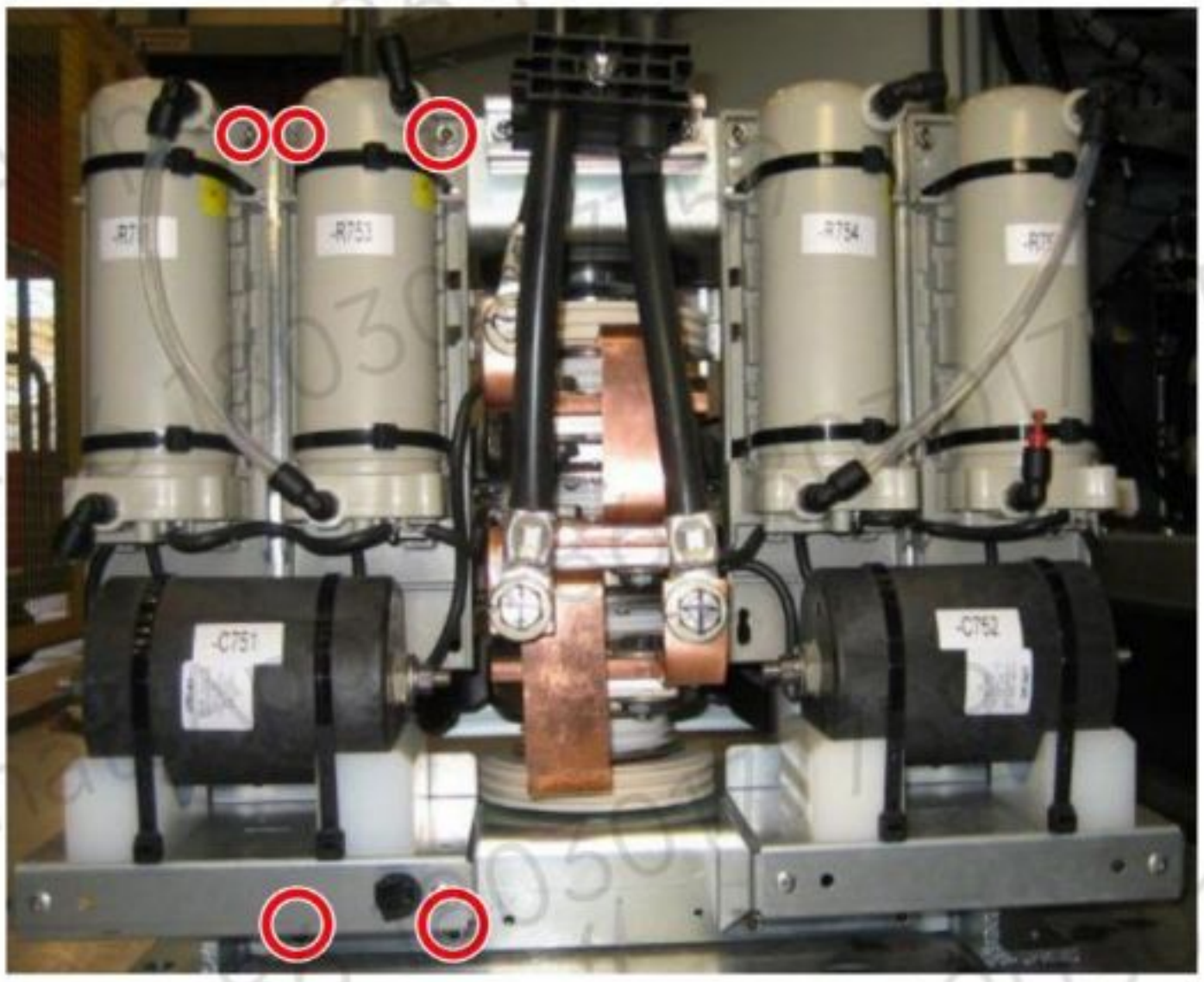


Figure 10–47 Rear view of VLM

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Release the over pressure of the cooling system according to section 10.5.1, **Releasing the over pressure from the cooling liquid circuit**, page 138.
3. Place a catching tray in such a way that leaking cooling liquid from the faulty resistor-assembly does not spill into the converter.

   NOTICE Leakage of cooling liquid into the converter needs to be avoided; especially glycol causes severe pollution of the converter.
4. Remove hoses from the resistor, direct the leaking water into the catching tray and close the leaks with Legris plugs.
5. Unbolt the cable to the capacitor.
6. Unbolt the 5 Allen-key screws (3 above and 2 below) from the relevant resistor-assembly (see Fig. 10–47).
7. Unbolt the cable between the resistor and the copper bar.
8. Remove the whole resistor-assembly and replace the faulty component.
9. Install the resistor-assembly again and reconnect all cables and hoses.
10. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.8.4. Replacing resistor -R461

Service MTTR 0 - 2 h

Figure 10–48 Resistor -R461

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Release the over pressure of the cooling system according to section 10.5.1, **Releasing the over pressure from the cooling liquid circuit**, page 138.
3. Place a catching tray in such a way that leaking cooling liquid from the faulty resistor does not spill into the converter.

   NOTICE Leakage of cooling liquid into the converter needs to be avoided; especially glycol causes severe pollution of the converter.
4. Remove hoses from the resistor, direct the leaking water into the catching tray and close the leak with a Legris plug.
5. Disconnect the electrical connection.
6. Replace the resistor.
7. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.8.5. Replacing capacitor -C461

Service MTTR 0 - 2 h

Figure 10–49 Capacitor -C461

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Replace the capacitor.

   NOTICE DO NOT exert any torque onto the capacitor! During loosening as well as fastening, the capacitor connections need to be held in place with a 23 mm flat wrench (contained in converter service toolbox). For maximum tightening torques refer to section 10.4.1, **Correct tightening torques of bolted connections**, page 135.
3. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.8.6. Replacing IGCTs and diodes

Service MTTR 0 - 2 h

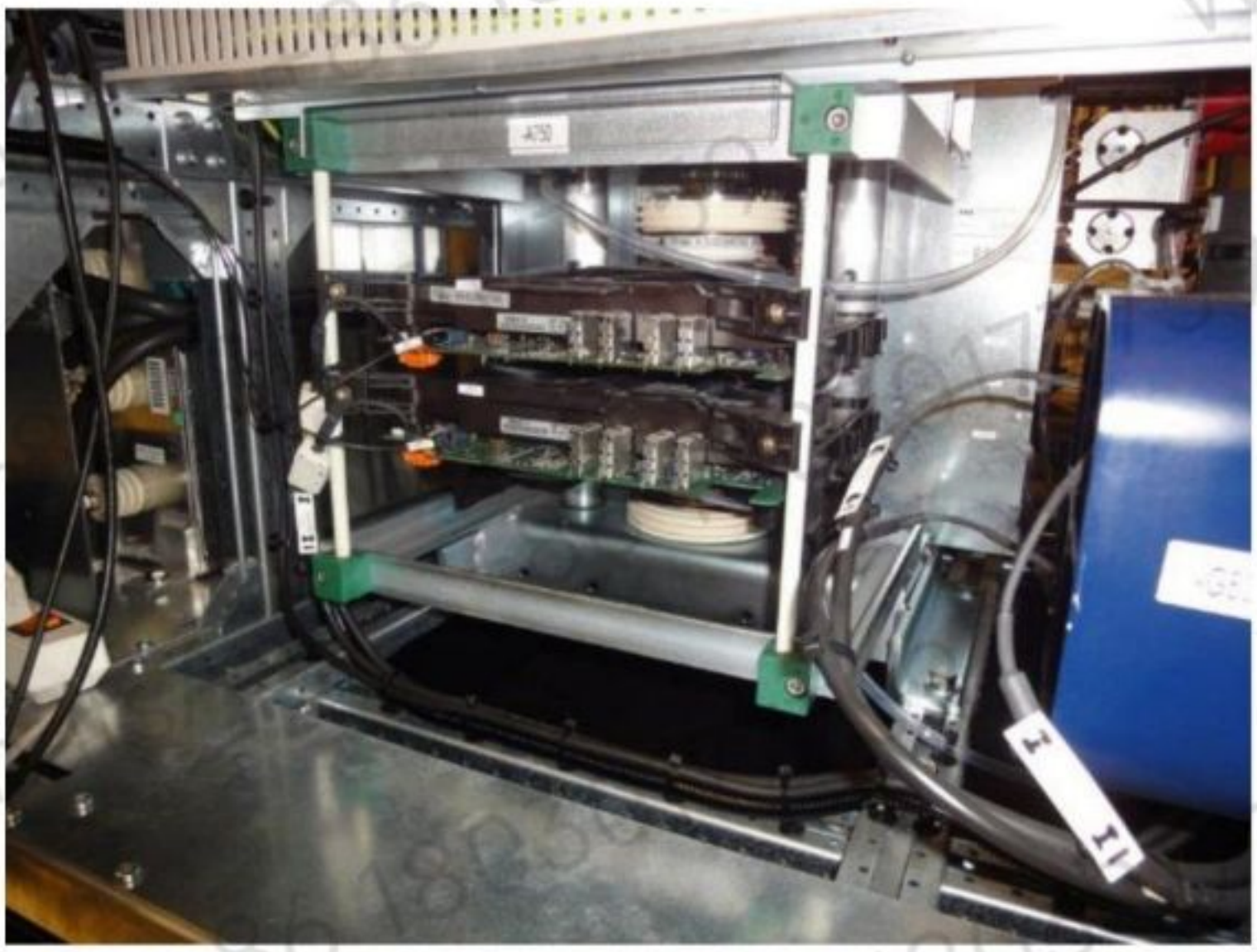


Figure 10–50 VLM

The procedure for replacing the semiconductors in the VLM is similar but not exactly the same as the procedure described in section 10.6, **Replacing components in POU**, page 139. In the VLM there is only one stack instead of three, but the figures shown in section 10.6, **Replacing components in POU**, page 139 apply in principle.

1. Switch off MCB -Q401 to interrupt the 3AC 400 V input voltages of the AC/DC converter (24 V power supply).
2. On the UPS -G402 turn the selector switch “Bat.-Select” to “Service”, then back to “7.2 Ah” (Fig. 8–11 in section 8.8, **Replacing PECINTM**, page 97) to interrupt the 24 V battery supply voltage (the yellow LED “Bat.-Mode” must be dark).
3. Take the pressure loading gauge from its storage place and insert it completely under the tension jack of the stack.

   NOTICE The pressure loading gauge must be inserted completely before the stack can be released. Otherwise the tension jack can break.
4. If an IGCT is to be changed loosen all 4 fixation screws of the gate unit fixations using a 5 mm Allen wrench to make sure that the gate unit fixation can move freely in vertical direction.
5. Release the stack by loosening the clamping screw counter-clockwise using the socket wrench with 12 mm Allen socket.
6. Enter a stabilizer plate in the bottom of the stack.

7. Insert the spreading tool as described in section 10.6.3, **Using the spreading tool**, page 145.

   IMPORTANT! If the lower diode of the VLM has to be replaced the use of the spreading tool is not possible. A second person must lift and hold the upper components while the diode is exchanged

8. Replace an IGCT similar as described in section section 10.6.4, **Replacing IGCTs**, page 149 (steps 2 to 10) or replace a diode similar as described in section section 10.6.5.2, **Replacing clamp diodes**, page 155 (steps 2 to 8).

9. Re-check replaced IGCTs as described in section 9.8, **Checking IGCTs with multimeter (if a FADEC 3 is unavailable)**, page 127 and re-check replaced diodes according to section 9.9.3, **Checking clamp diodes**, page 130.

10. Tighten the stack by tightening the clamping screw.

    Make sure that the clamping screw enters correctly into the pressure plate (special attention has to be payed to this since the insulation plate is not in a fixed position). Otherwise the pressure plate could be damaged.

11. Tighten the clamping screw until the pressure loading gauge is just released and the surfaces are even, then remove the pressure loading gauge.

12. Fasten the pressure loading gauge in its storage place with the M12 fastening screw and washer using a 19 mm wrench.

13. f an IGCT has been changed, tighten all 4 fixation screws of the IGCT gate unit fixations using a 5 mm Allen wrench.

10.8.7. Replacing VLM

Service MTTR 2 - 4 h

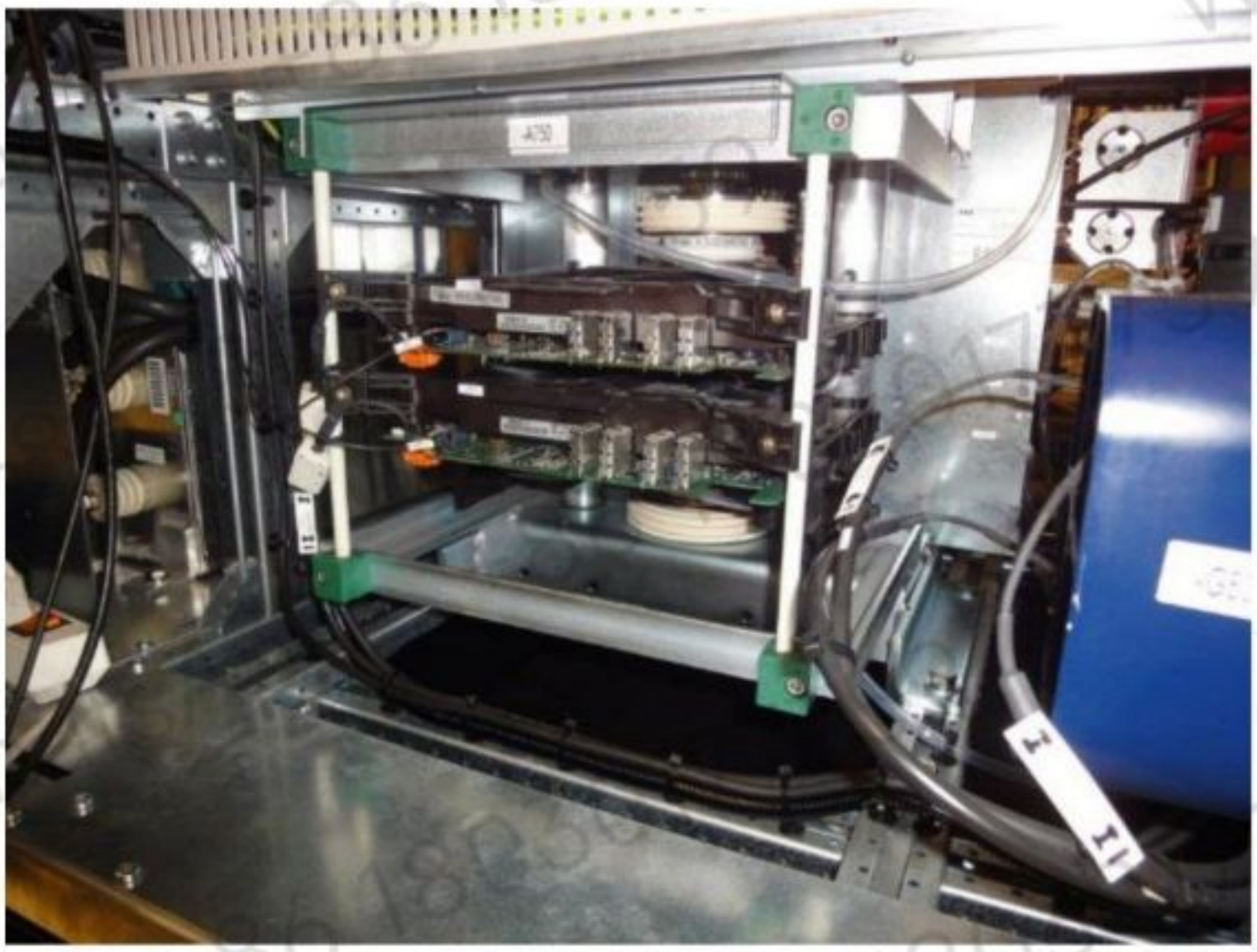


Figure 10–51 VLM

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Release the over pressure of the cooling system according to section 10.5.1, **Releasing the over pressure from the cooling liquid circuit**, page 138.
3. Remove cable trunk across the cabinet.
4. Disconnect power cable -X802, -X803, -X804 at patch panel.
5. Place a catching tray in such a way that leaking cooling liquid from the water hoses does not spill into the converter.
6. Disconnect 6 water hoses, direct the leaking water into the catching tray and close the leak with a Legris plug.
7. Disconnect the electrical connection in front of the VLM between the POU and IPS.

   CAUTION! The VLM weights approximately 60 kg. Single person lift could cause injury. Use assistance when lifting and moving.
8. Unbolt the VLM with the four screws (see Fig. 10–51) from the frame.
9. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.8.8. Replacing pre-charging transformer

Service MTTR 2 - 4 h

Figure 10–52 Precharging transformer (VLM removed)

1) Pre-charging transformer

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Release the over pressure of the cooling system according to section 10.5.1, **Releasing the over pressure from the cooling liquid circuit**, page 138.
3. If access from the back side is possible, remove the back wall of the cabinet.

   If this access is not possible, release the over pressure of the cooling system according to section 10.5.1, **Releasing the over pressure from the cooling liquid circuit**, page 138 and remove VLM according to section 10.8.7, **Replacing VLM**, page 189 to gain access.
4. Disconnect all electrical connections.
5. Open the 4 M10 bolts and remove the transformer. If access from the back side is possible lift the transformer out from behind, otherwise use the chain block to lift the transformer to the front of the cabinet (see Fig. 10–52).
6. Rebuild the DLU in reverse order.
7. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.8.9. Replacing dv/dt filter reactor in DLU

Service MTTR 4 - 8 h

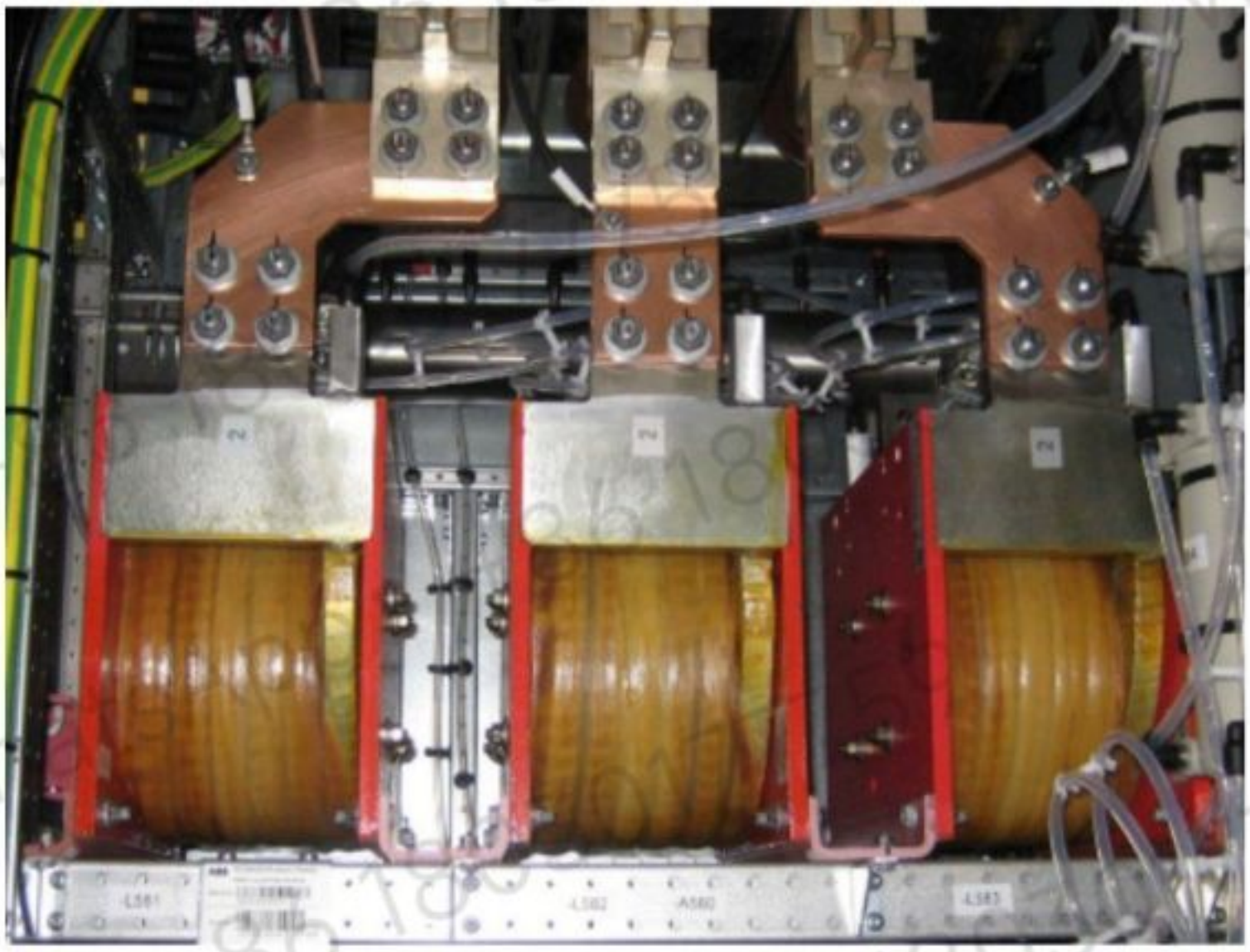


Figure 10–53 dv/dt filter reactor

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Empty water circuit of the cooling system according to section 10.5.2, **Emptying the cooling liquid circuit**, page 139.
3. Disconnect water pipes, busbars and cables.

   CAUTION! The reactor weighs approximately 25 kg. Use lifting aids and proper lifting technique when lifting and moving.

4. Unbolt the 4 mounting bolts from the U-shaped profiles on the faulty reactor (see Fig. 10–54).

Figure 10–54 dv/dt filter reactor mounting bolts (different VFM variants)

NOTE – 2 bolts in front and 2 bolts on back of the reactor.

5. Replace the faulty dv/dt filter reactor.
6. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.8.10. Replacing dv/dt filter resistor in DLU

Service MTTR 4 - 8 h

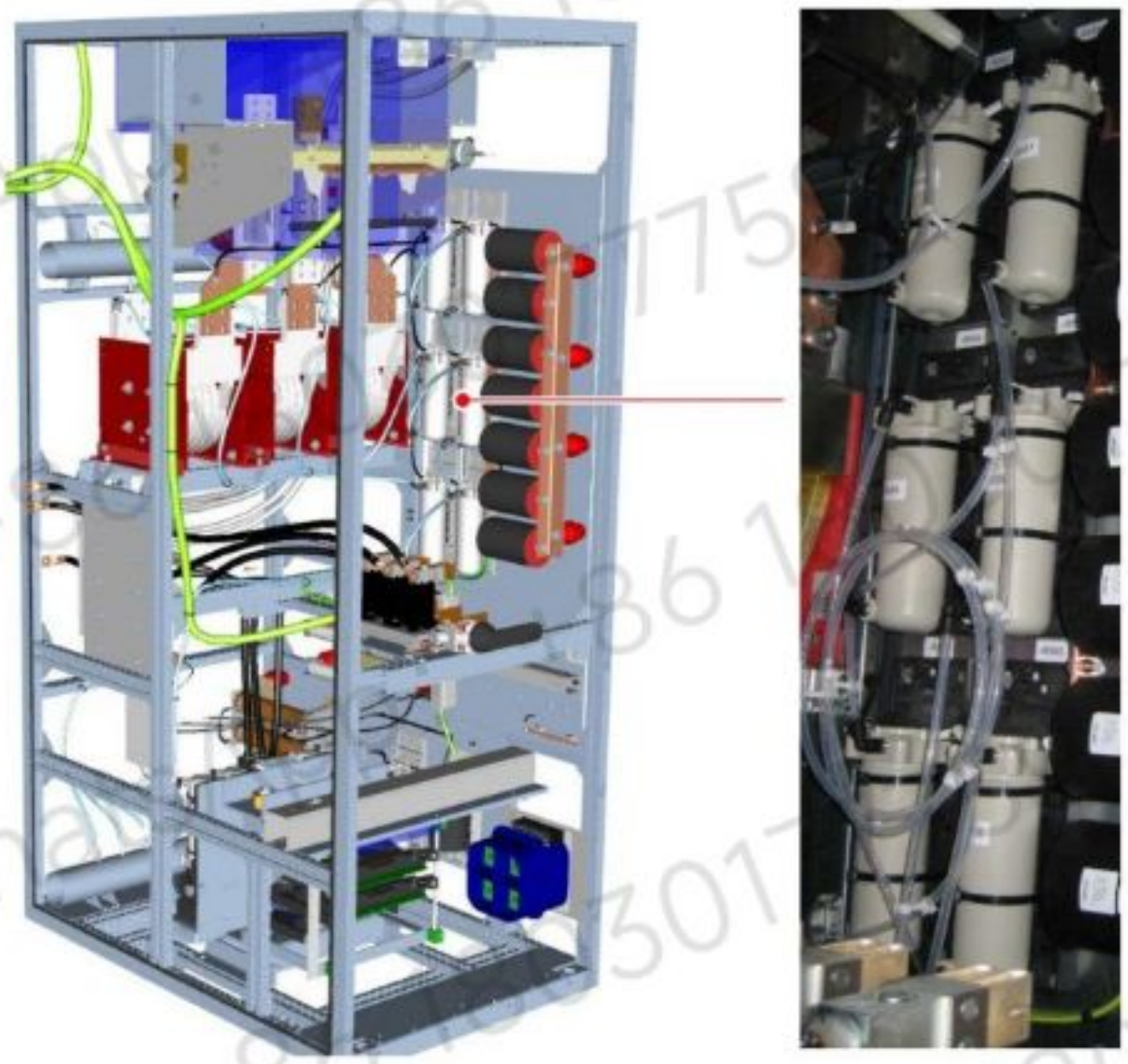


Figure 10–55 dv/dt filter resistors

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Remove the transparent plastic cover in front of the capacitor bank by loosening the mounting screws.
3. Empty water circuit of the cooling system according to section 10.5.2, **Emptying the cooling liquid circuit**, page 139.
4. Disconnect water pipes and cables.
5. Remove the cable ties.
6. Replace the dv/dt filter resistor.
7. Reconnect water pipes and cables.
8. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.8.11. Replacing dv/dt filter capacitor in DLU

Service MTTR 0 - 2 h

Figure 10–56 dv/dt filter capacitors

1. Shutdown the PCS6000 according to “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Remove the transparent plastic cover in front of the capacitor bank by loosening the mounting screws.
3. Disconnect cables.
4. Replace dv/dt filter capacitor.
   Do not exert any torque onto the capacitors. During loosening as well as fastening, the capacitor connections need to be held in place with a 23 mm flat wrench (contained in converter service toolbox).

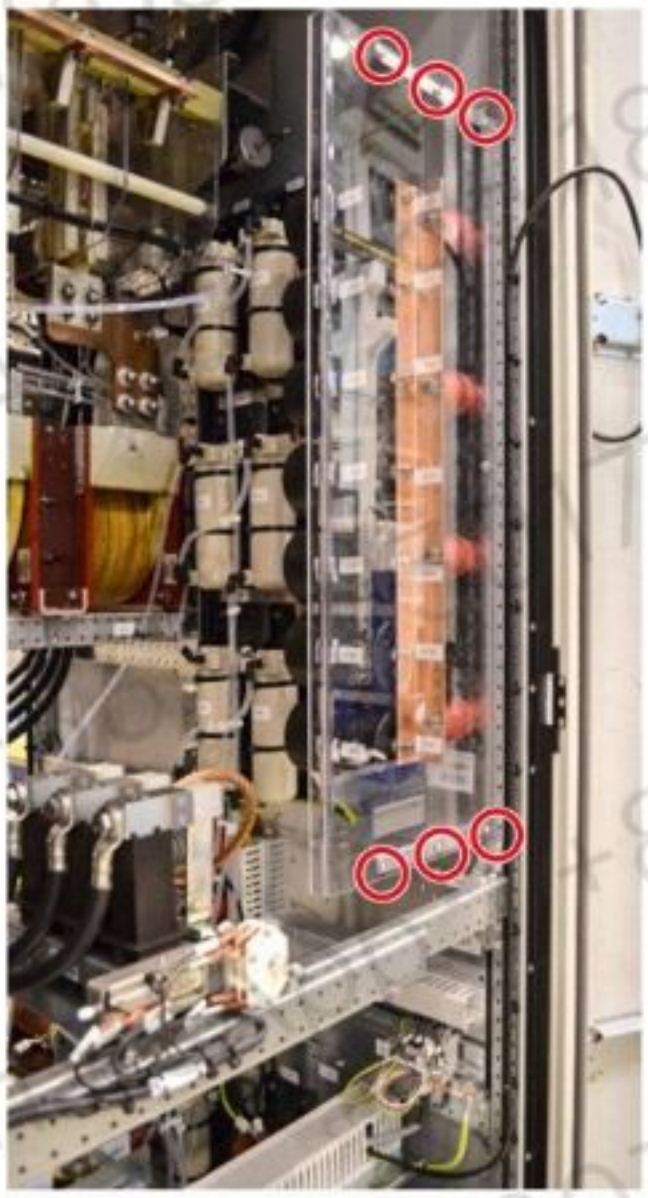
   NOTE – For maximum tightening torques refer to section 10.4.1, **Correct tightening torques of bolted connections**, page 135.
5. Reconnect cables.
6. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.8.12. Replacing grid/generator disconnector module in DLU

Service MTTR 4 - 8 h

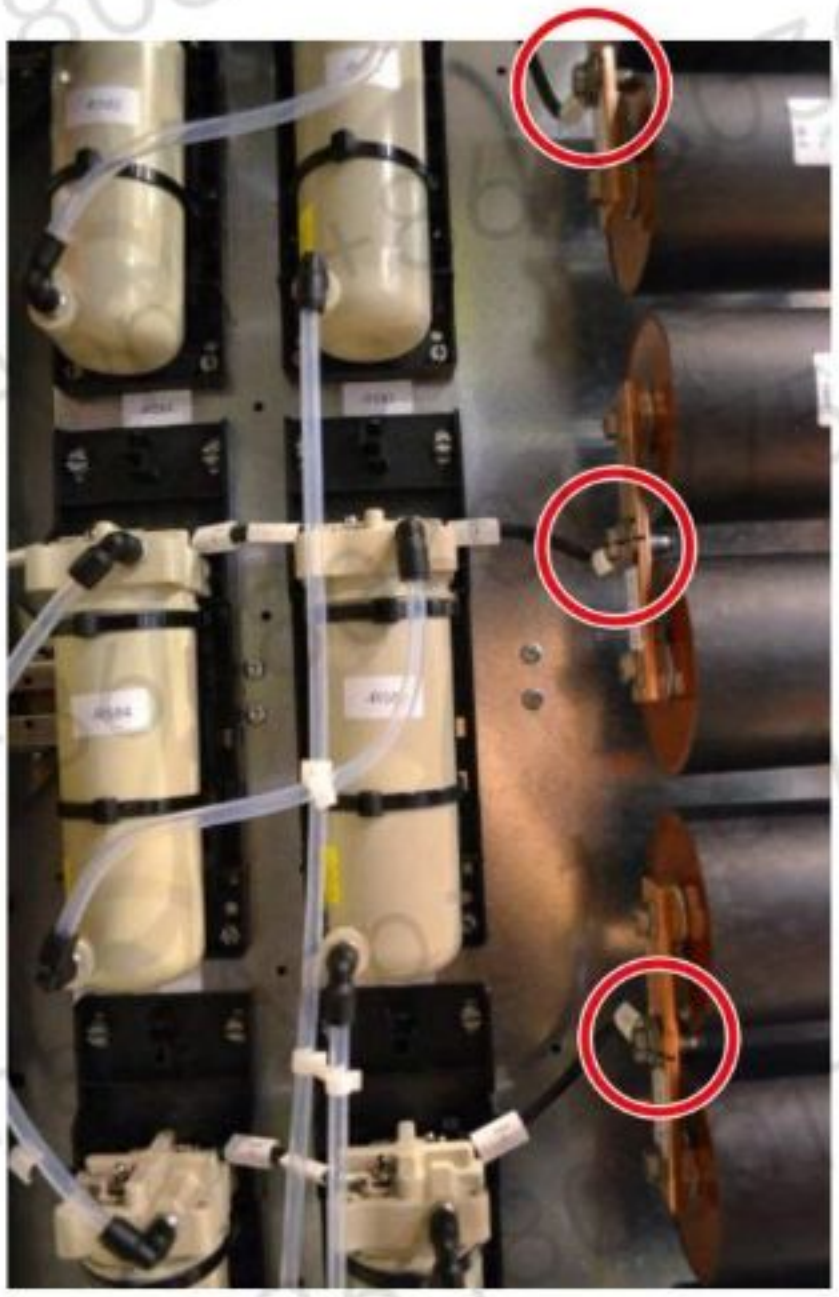
IMPORTANT! For replacing of the GDM a suitable ladder and two persons are required. A fixing point for the chain-block above the GDM is also needed to lift out the GDM. If a fixing point in the surrounding infrastructure is not available, a framework that is similar to the one in the following image is required.

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Disconnect all electrical cables.
3. Remove the transparent plastic cover in front of the capacitor bank by loosening the mounting screws.



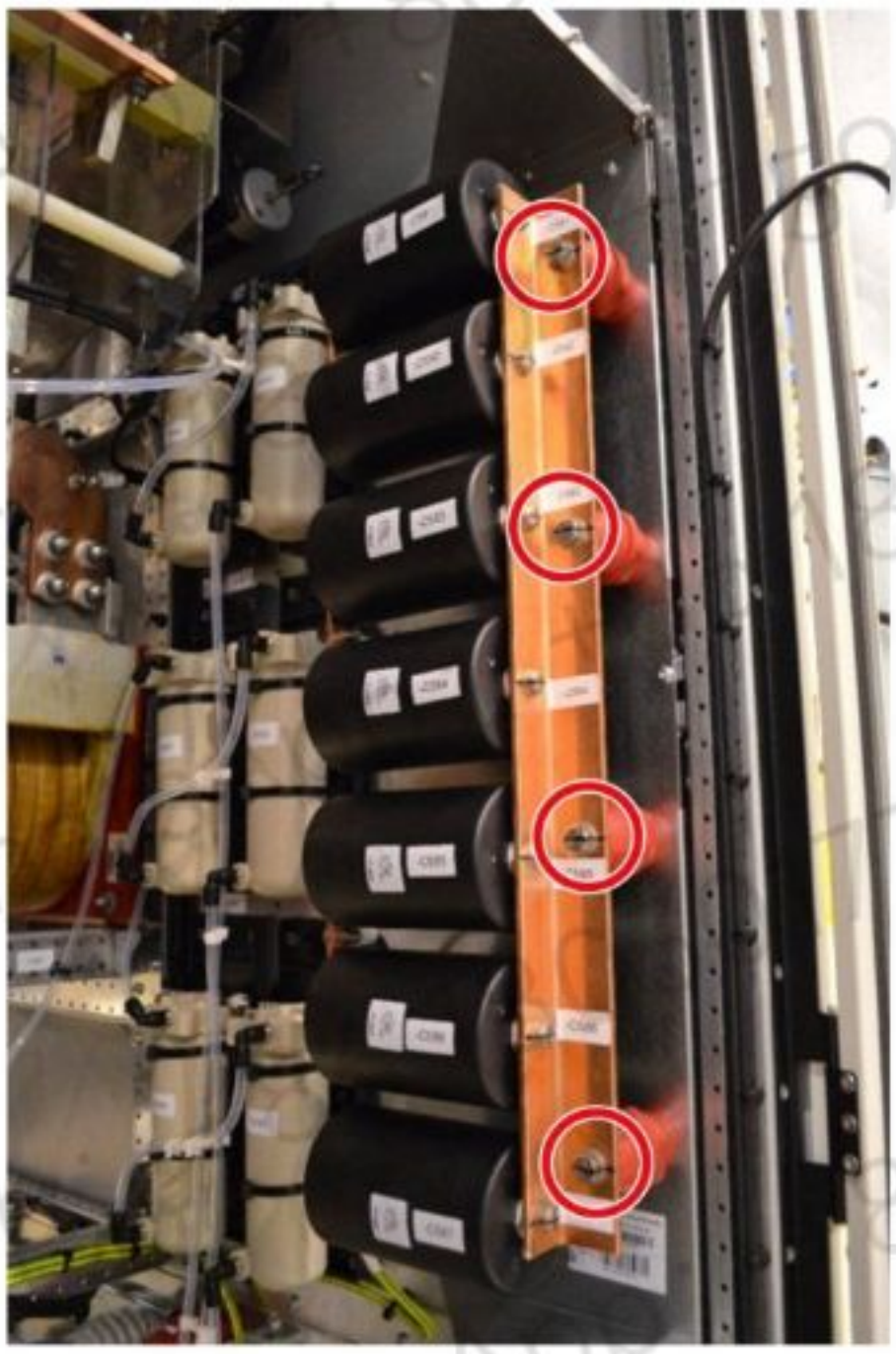
4. Remove the upper aluminum bracket above the capacitors.

5. Loosen the electrical connection between the resistors and capacitor.



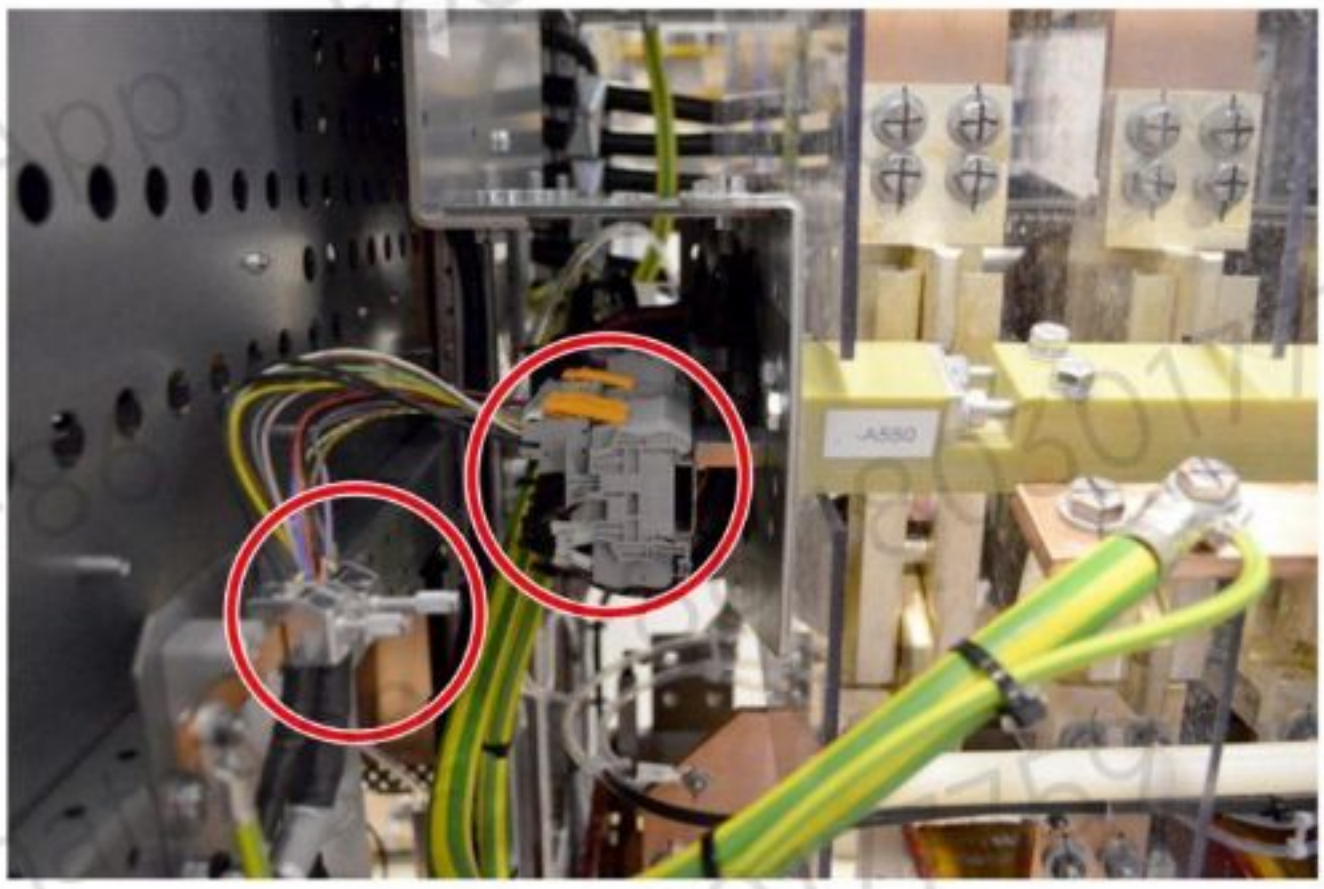
6. Disassemble the capacitor bank by loosening the screws on the right side of the capacitor bank.

   CAUTION! The capacitor bank weighs approximately **30 kg**.



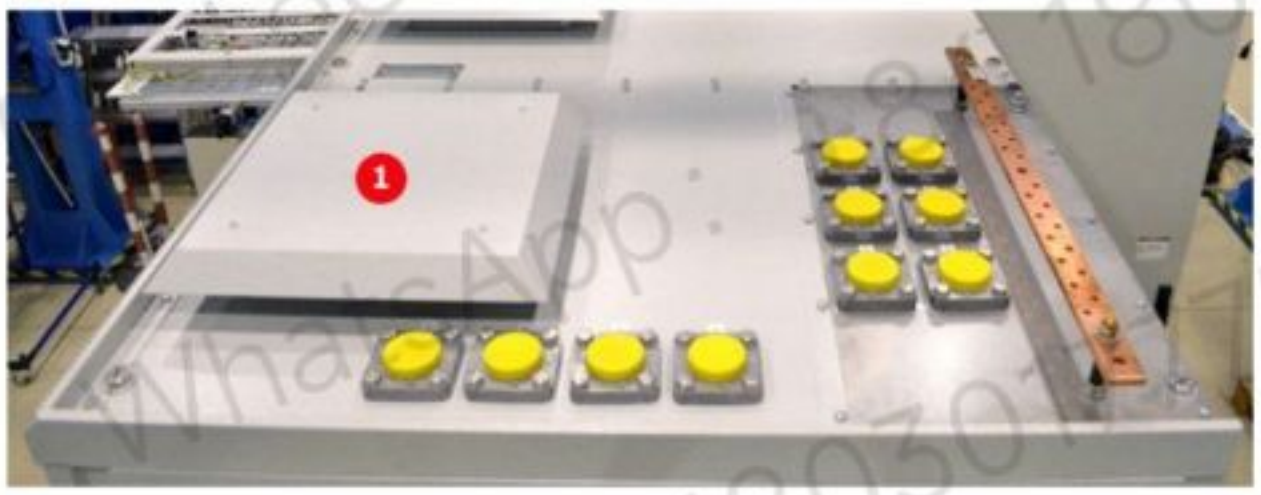
7. Remove the HV cables on the right side of the converter which are connected to the Pfisterer plugs.

8. Disconnect the power supply of the roof fan.
9. Remove the LV power supply of the GDM and unscrew the earth connection on the left side.

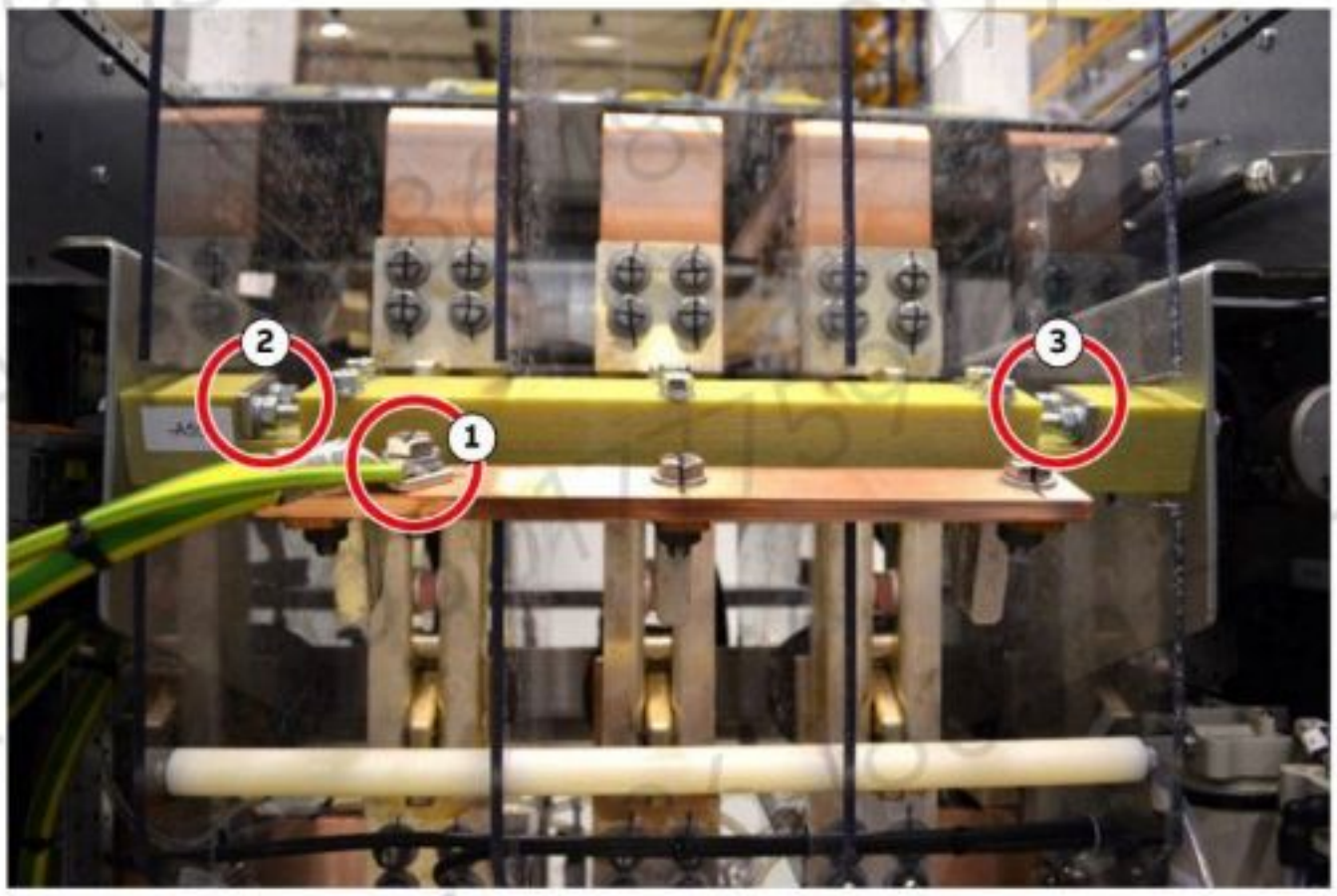


10. Unscrew the roof above the roof fan (1).

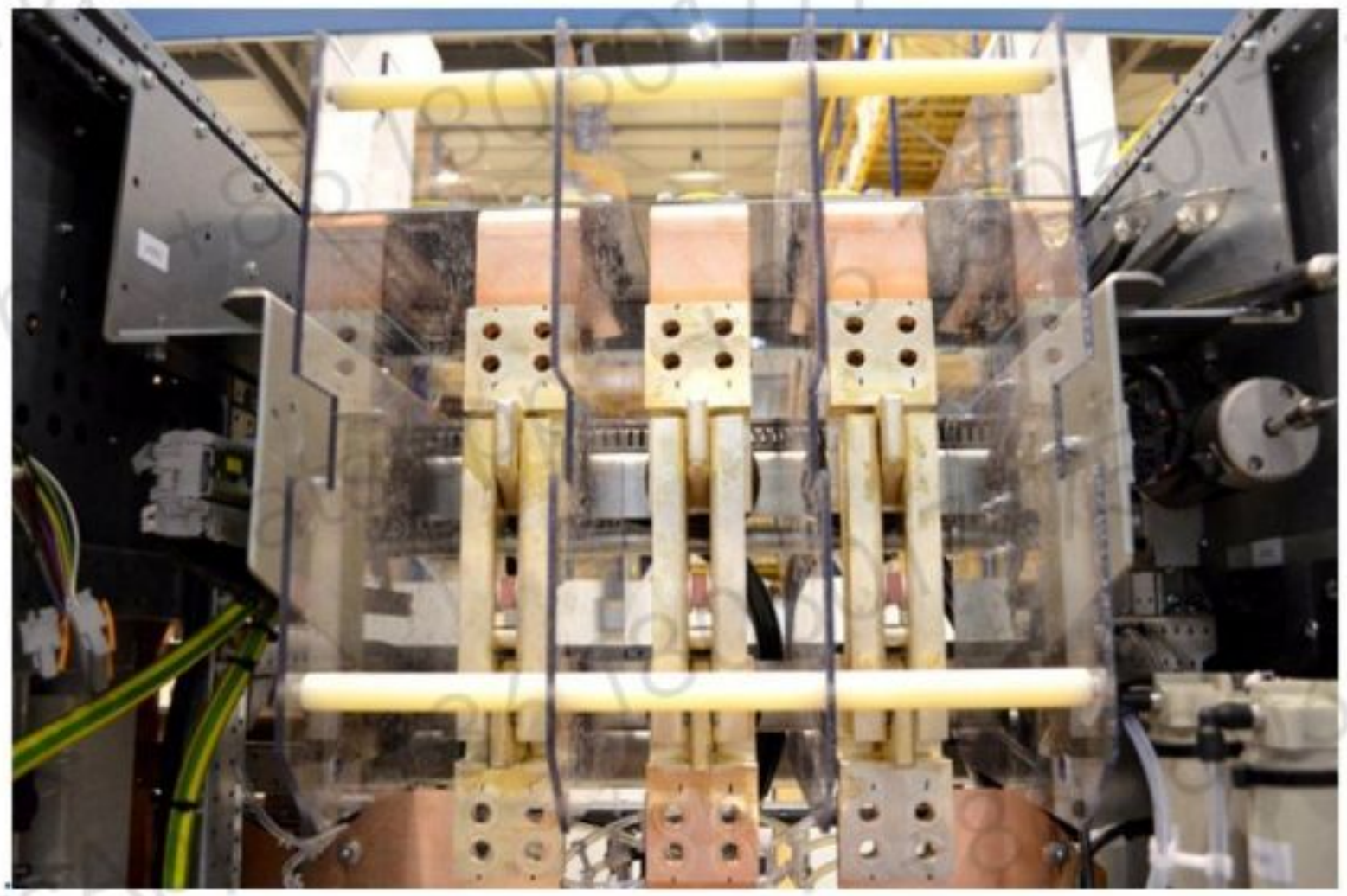
NOTICE Be careful while lifting the roof with the fan.



11. Disconnect the ground (1) in front of the GDM and remove the insulated bar by loosening the mounting screws on the left (2) and the right (3) side of the GDM.



12. Disconnect the copper bars below (to the filter reactor) and above (to Pfisterer plugs) the GDM

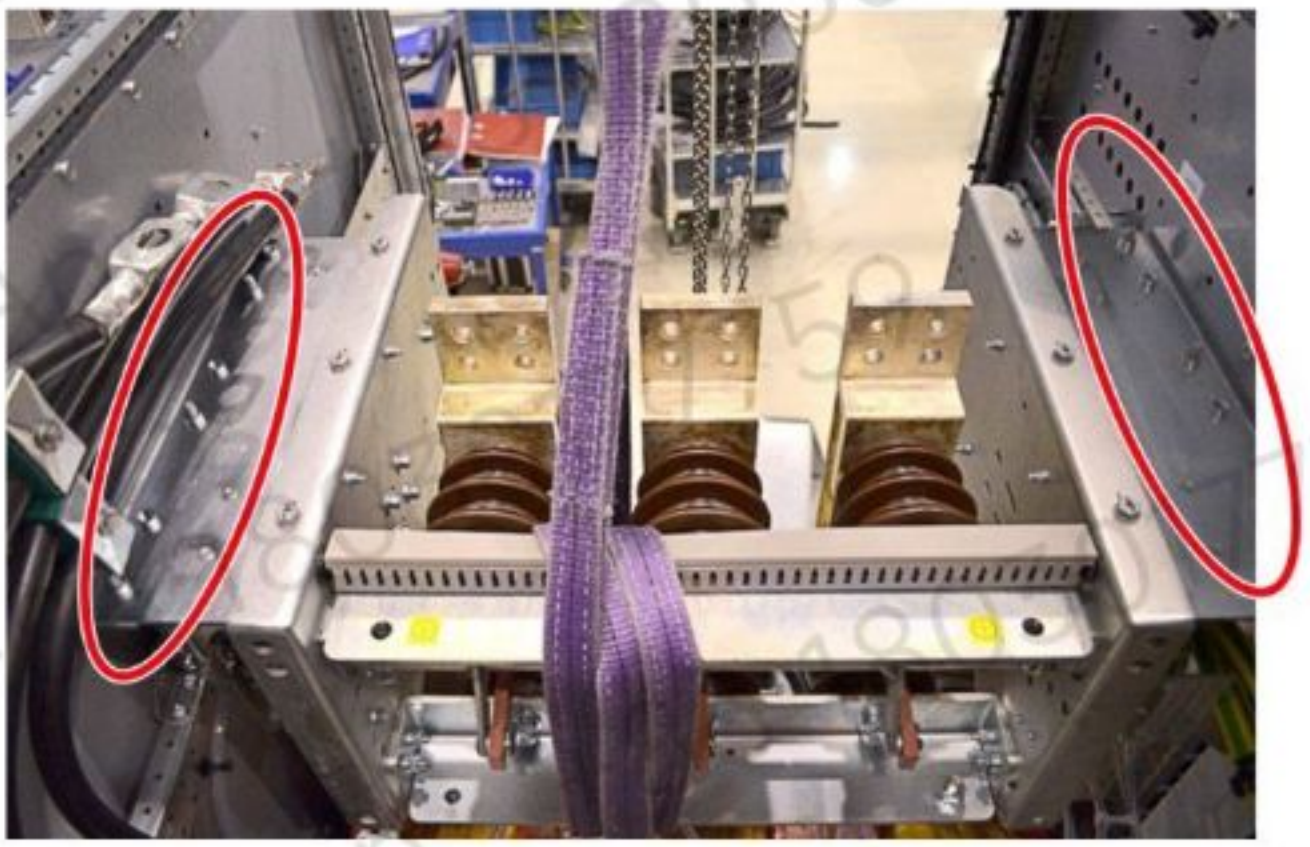


13. Disconnect the cables between the dv/dt filter and the main copper bars (on busbar side).
14. Disconnect the ground cable positioned in the left corner at the back of the DLU.
15. Unscrew the roof part above the GDM.

16. Remove the Plexiglas cover of the GDM.
17. Install a framework and the chain-block above the cabinet next to the door and connect the chain-block to the GDM.

NOTICE Ensure that the position of the tension belt matches with the center of gravity so that the GDM can be craned straight up and down.

18. Remove the mounting screws on both sides of the GDM.



19. Lift the GDM some millimeters and remove the left aluminum plate.

20. Crane the GDM carefully through the door.

NOTICE ABB recommends that two people lift the GDM. Be careful that it doesn't hit the water cooled resistors. Also be careful with the relays on the left side of the GDM.

21. Replace the GDM.

22. Rebuild the DLU in reverse orders

23. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.9. Replacing components in VFU

10.9.1. Replacing grid/generator disconnector module (GDM1) at the front of the VFU

Service MTTR 4 - 8 h

Requirements

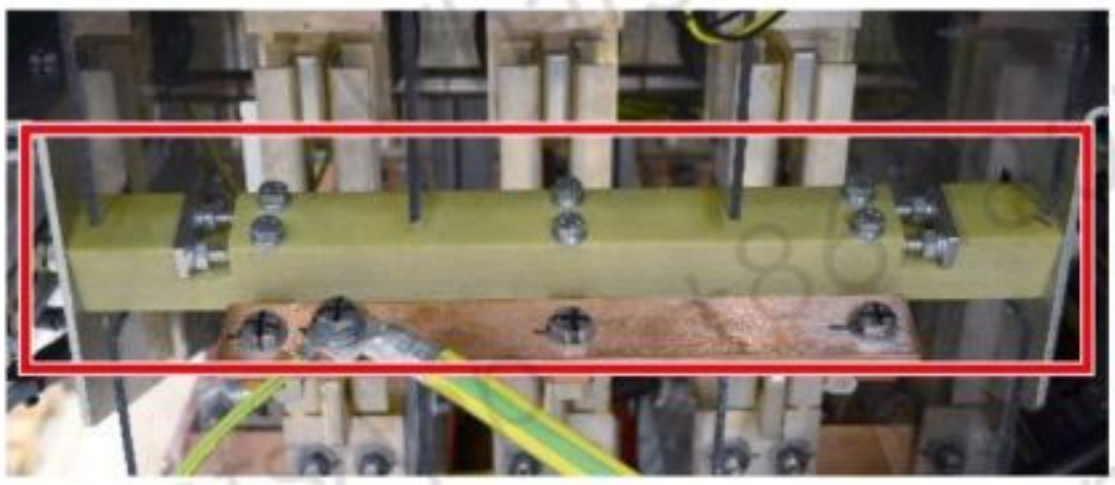
- 2 people
- Ladder
- Fixing point for the chain block above the GDM

  If the surrounding infrastructure does not have a fixing point, use a framework that is similar to Fig. 10–57.

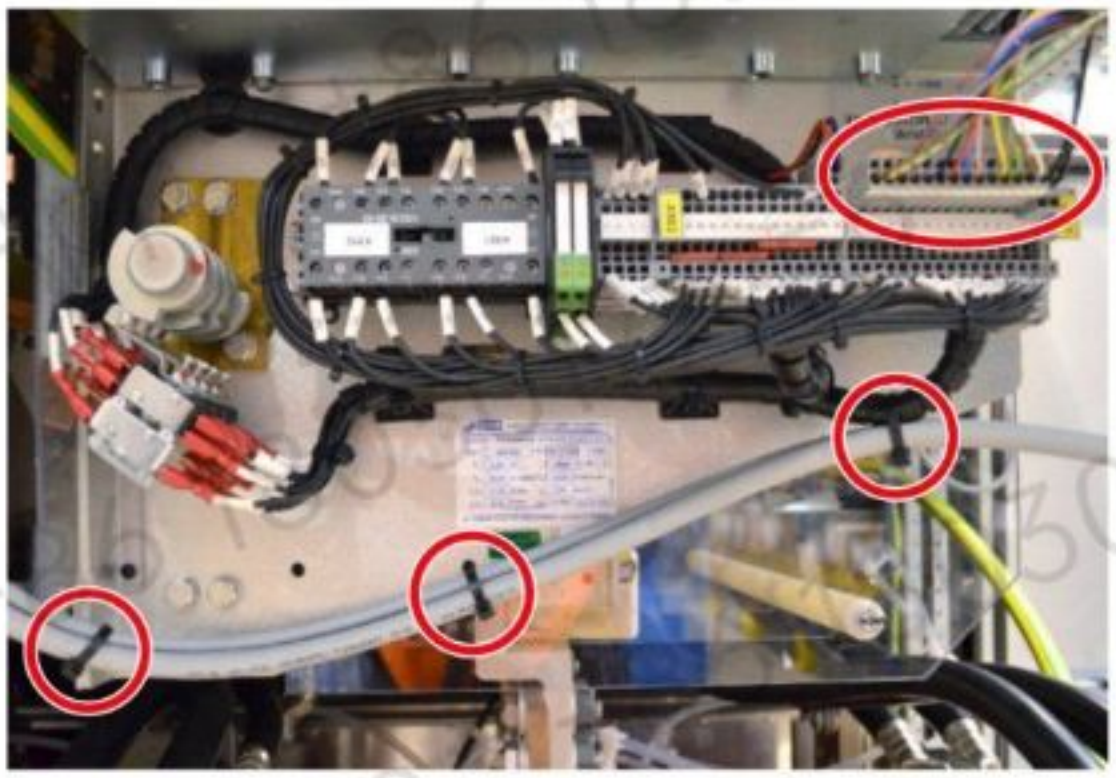
Figure 10–57 Framework for chain-block

1) Chain block	4) GDM1
2) Framework for chain block	5) Front door location
3) GDM2	

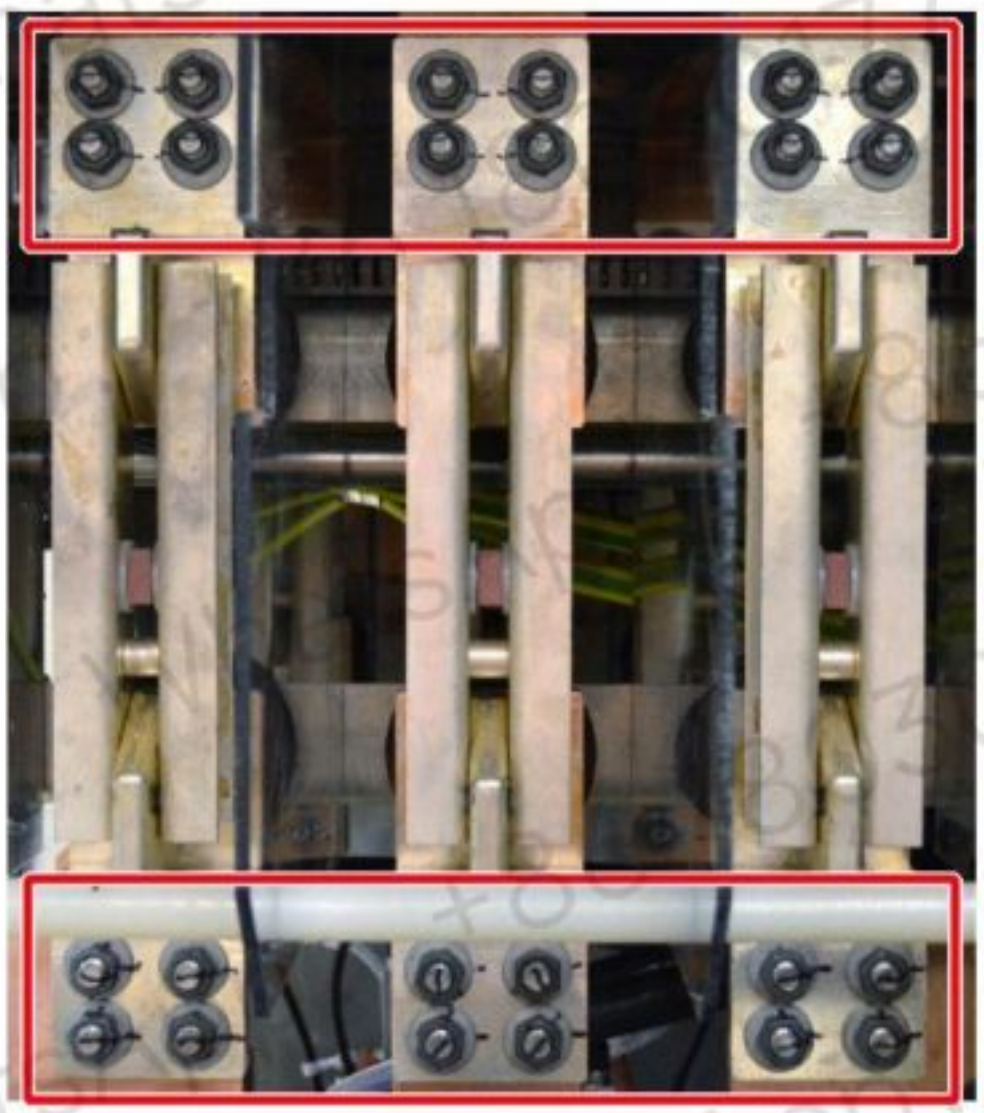
1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Remove grounding cables shown in the figure below.
3. Remove the insulated bar in front of the GDM1 by loosening the four mounting bolts positioned on the left and right side of the GDM1 aluminum frame.



4. Remove the three cable ties and the system and LV system cable positioned at the side of the GDM1.

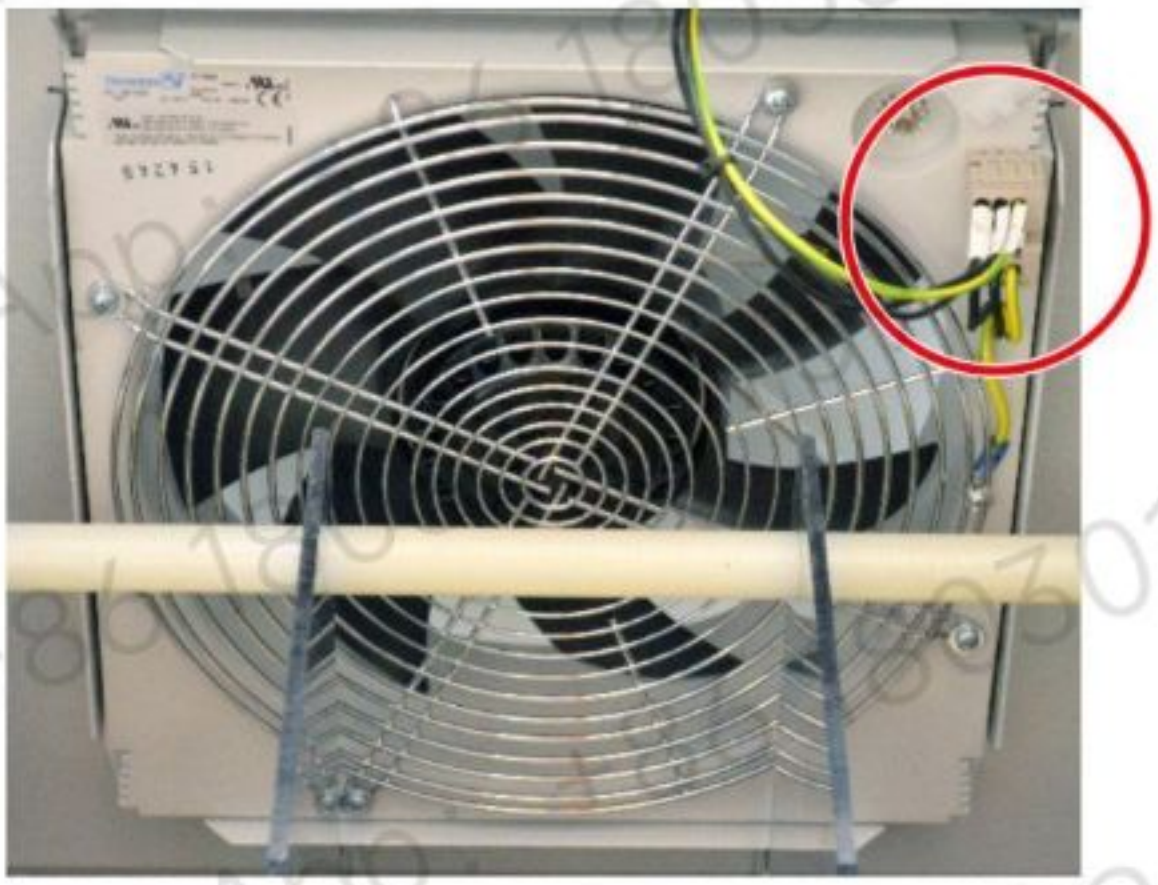


5. Remove the screws which connect the GDM1 to the copper bars.



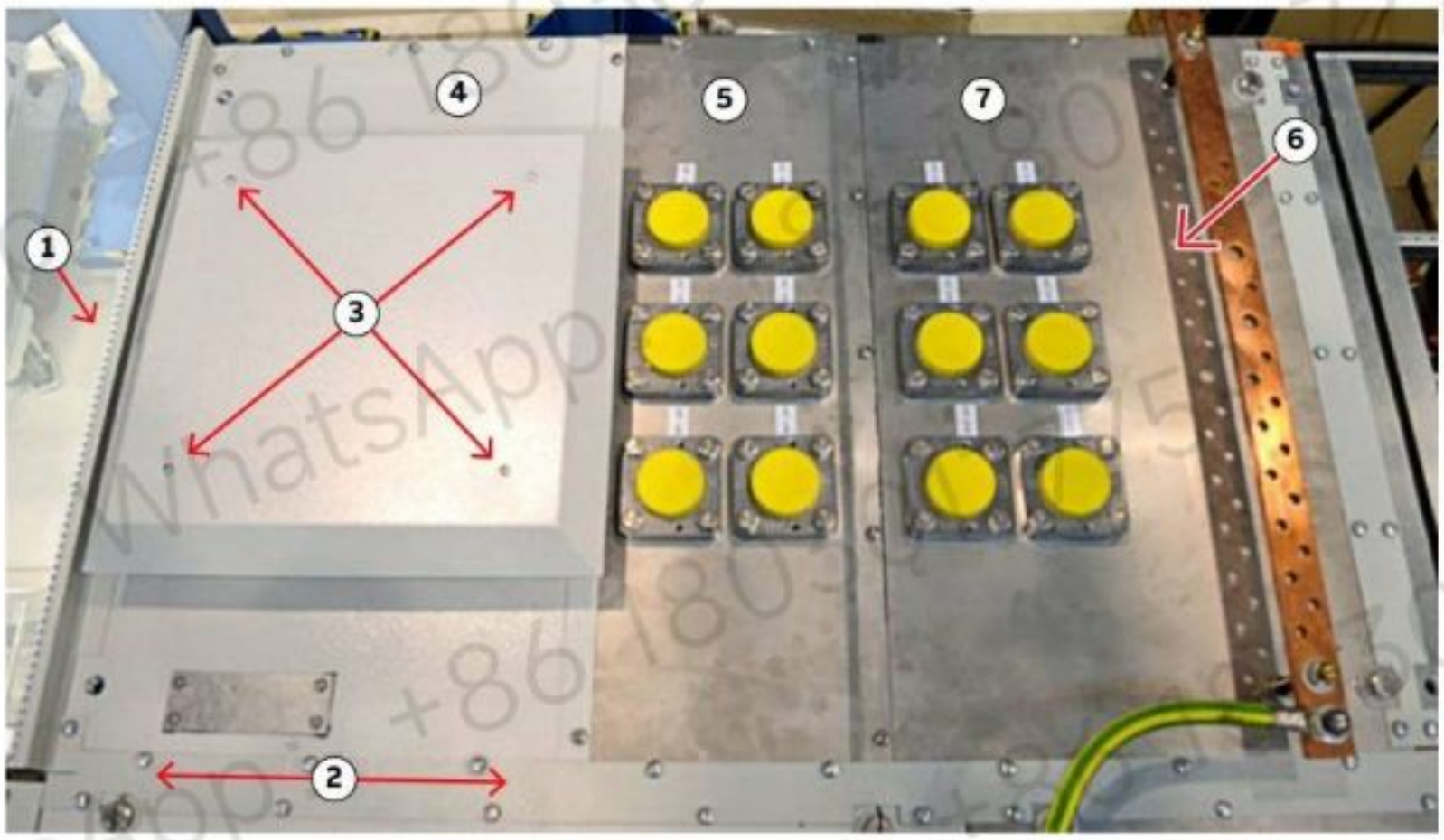
6. Remove the HV-cables on the dv/dt reactors and position them in a way that the GDM1 can be pulled out easily.

7. Remove the voltage supply cable from the roof fan.



8. Loosen the roof cover of the converter.

The numbers in the following picture shows the working sequence.



9. Remove the front frame cover.

10. Loosen the screws of the overlapping cover (between VFU and DLU/POU).

11. Remove the screws of the roof fan and remove the cover plate.

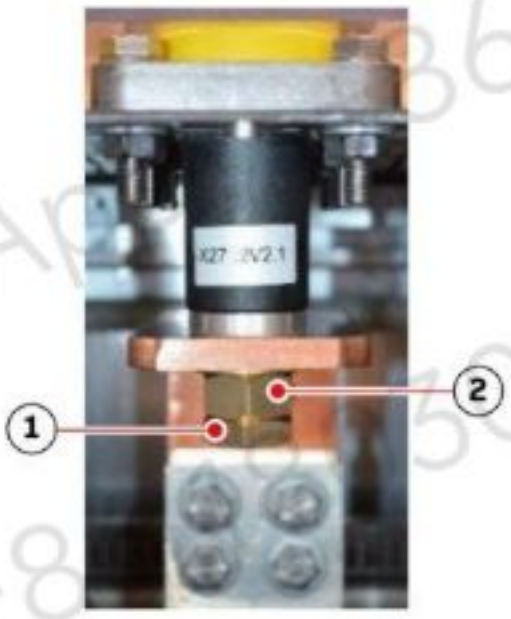
12. Remove the screws of the cover under the roof fan before lifting the roof segment.

NOTICE While removing this roof segment, do not pull on the roof fan itself.

13. Remove the screws and afterwards the cover plate above GDM1

14. Unscrew the overlapping plate between VFU and WCU.

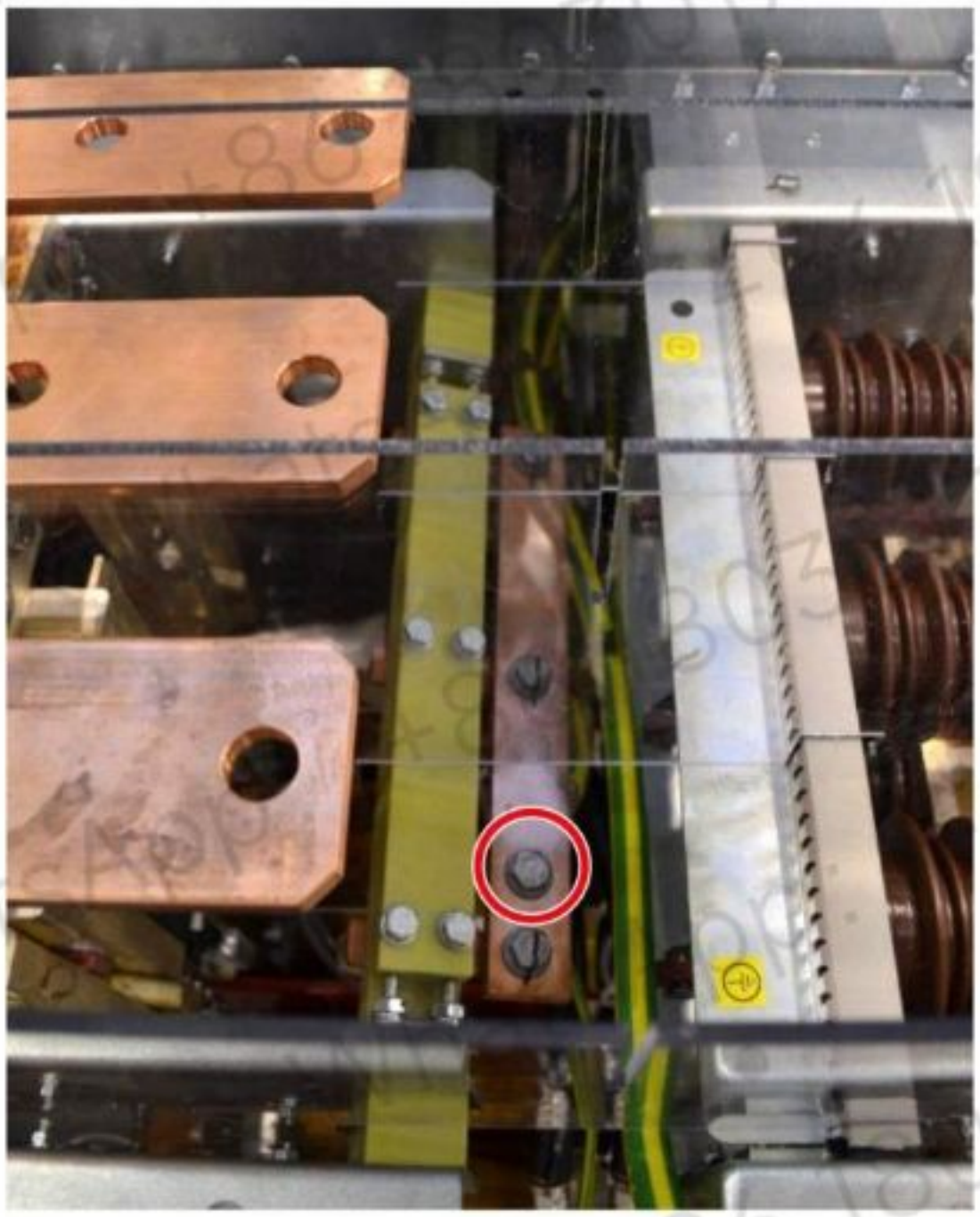
15. Before removing the cover above GDM2, unscrew nuts 1 and 2 of the six Pfisterer plugs between GDM2 and remove the plugs.



16. Remove the two grounding cable mounted under and above the roof cover of GMD2.

17. Remove the roof cover above GDM2.

18. Remove grounding cables on the copper bar between GDM1 and GDM2 as well as the insulated bar by loosening the mounting bolts.



19. Remove the side wall of VFU and loosen the mounting screws of GDM1 and remove the aluminum plate on the left side of the GMD1 mounted on the frame.

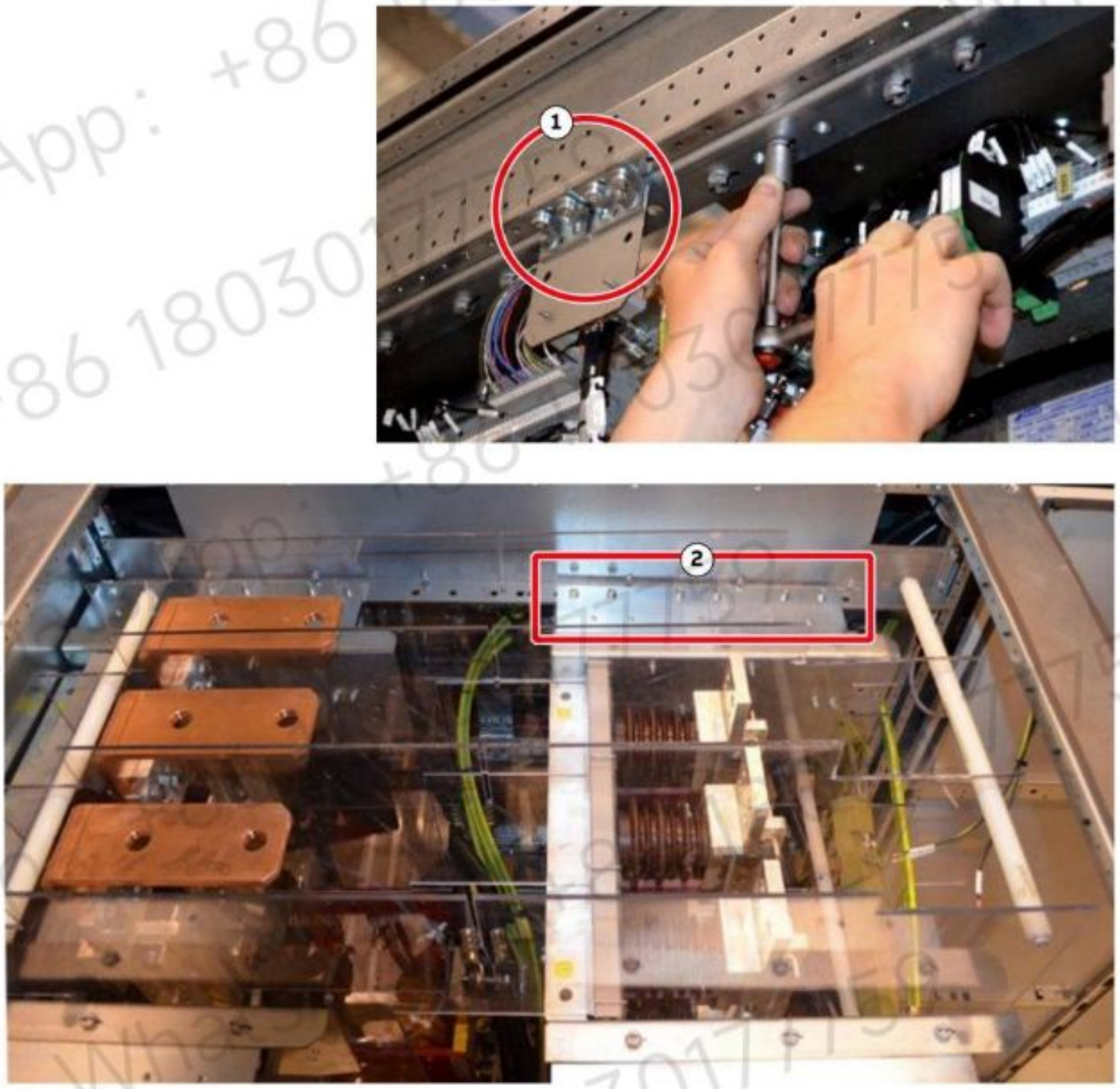


Figure 10–58 GDM1 mounting screws and aluminum plate

1) Mounting screws	2) Aluminum plate

20. Remove the grounding cable from the Insulated bar which is located between GDM1 and GDM2.

21. Pull the GMD1 with the Plexiglas housing to the front.

22. Remove the Plexiglas housing.

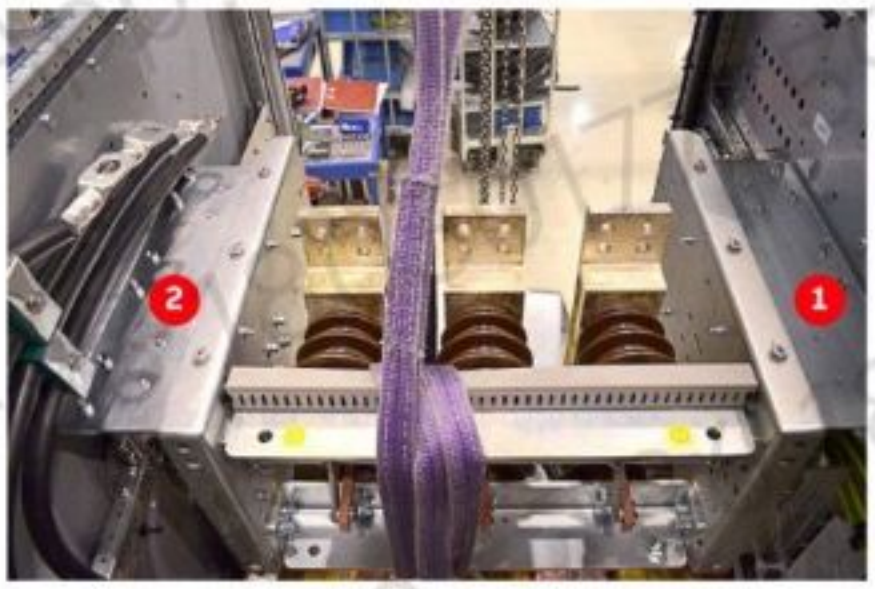
23. Install the framework and the chain block above the GMD1.

Figure 10–59 GDM1 with framework for chain block

1) Chain block	2) Framework

24. Remove the aluminum plate (1) on the right side of the GDM1.

25. Remove the aluminum plate (2) on the left side of the GDM1.



26. Lower the GDM1 out of position.

CAUTION! Two people are required, one to operate the chain block and one to move the GDM1.

27. Replace the GDM1.

28. Rebuild the DLU in reverse order.

29. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.9.2. Replacing grid/generator disconnector module (GDM2) at the back of the VFU

Service MTTR 4 - 8 h

Requirements

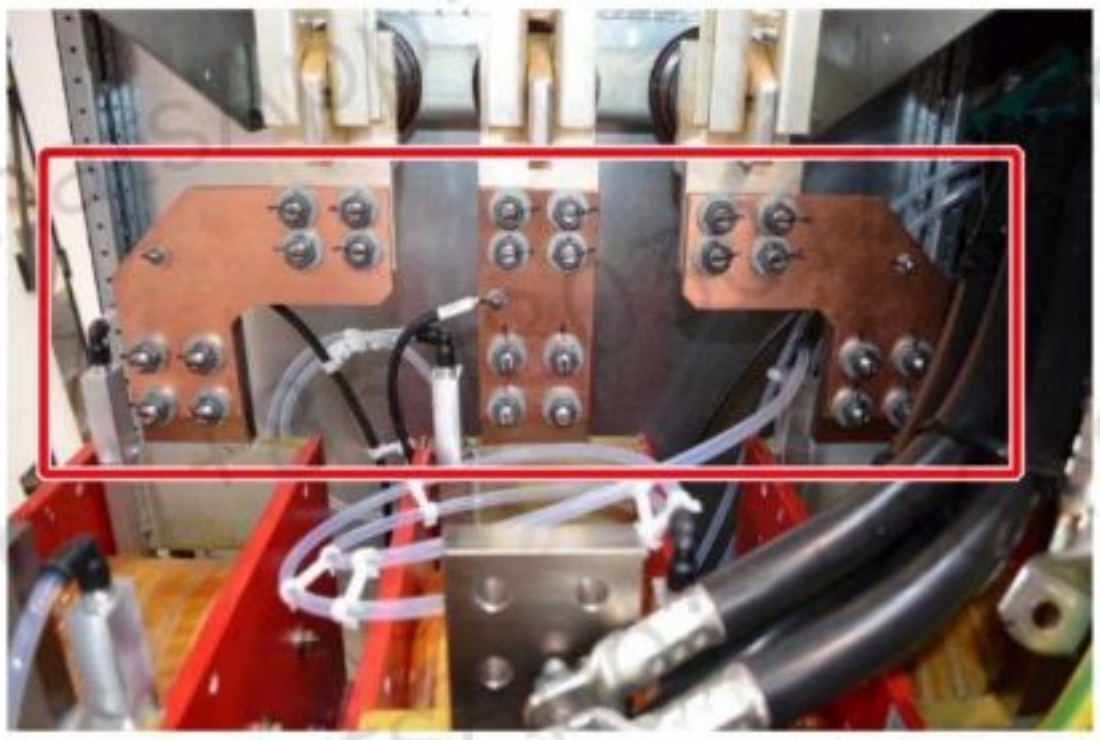
- Before replacing the GDM2 (at the back) the GDM1 at the front must be removed.
  See section 10.9.1, **Replacing grid/generator disconnector module (GDM1) at the front of the VFU**, page 203.
- 2 people
- Ladder
- Fixing point for the chain block above the GDM
  If the surrounding infrastructure does not have a fixing point, use a framework that is similar to Fig. 10–60.

Figure 10–60 Framework for chain-block

1) Chain block
2) Framework for chain block
3) GDM2
4) GDM1
5) Front door location

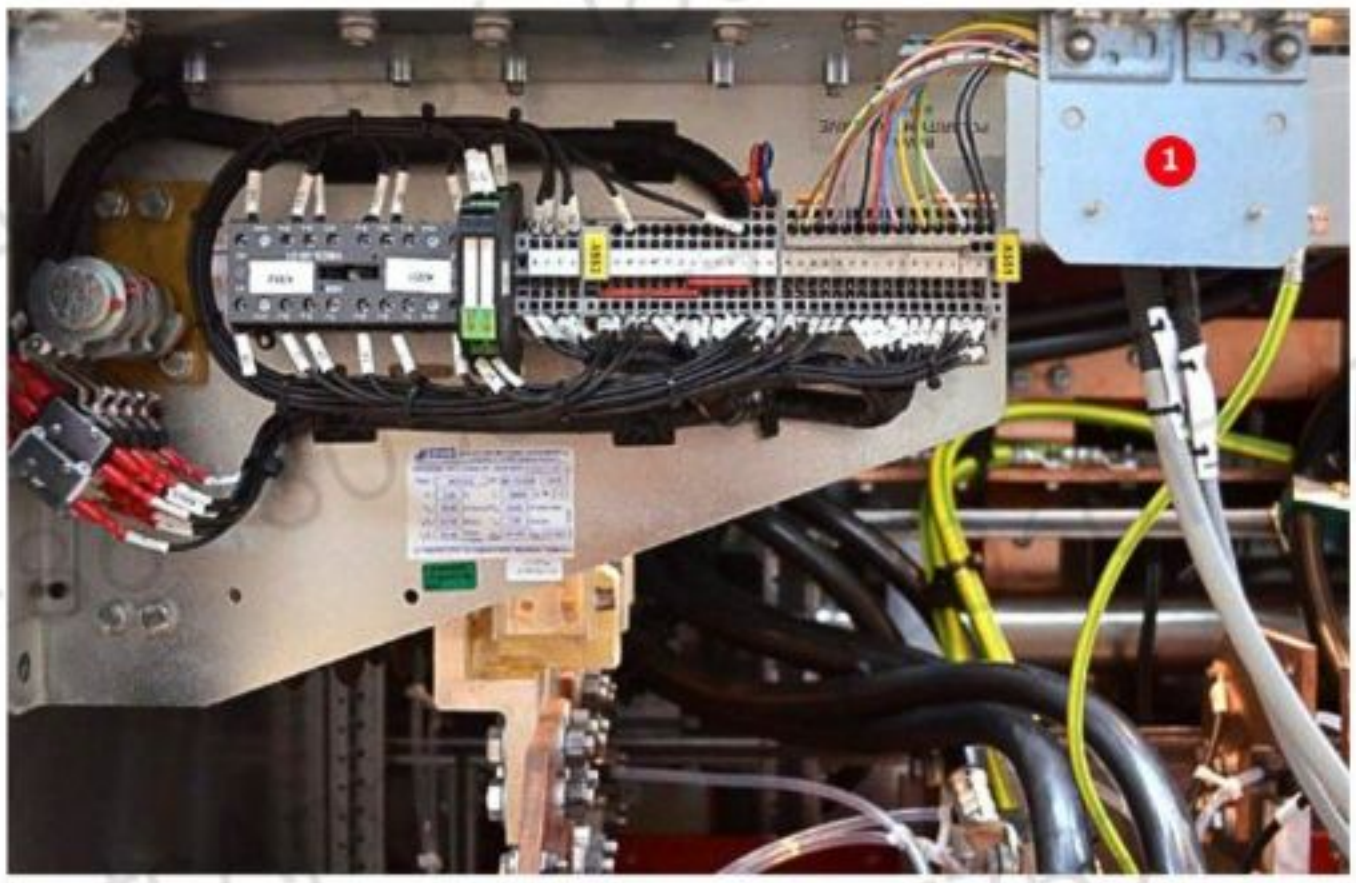
1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Follow the procedure of section 10.9.1, **Replacing grid/generator disconnector module (GDM1) at the front of the VFU**, page 203.

3. Remove the copper plates above (Pfisterer connector) and below (dv/dt reactor) of GMD1.

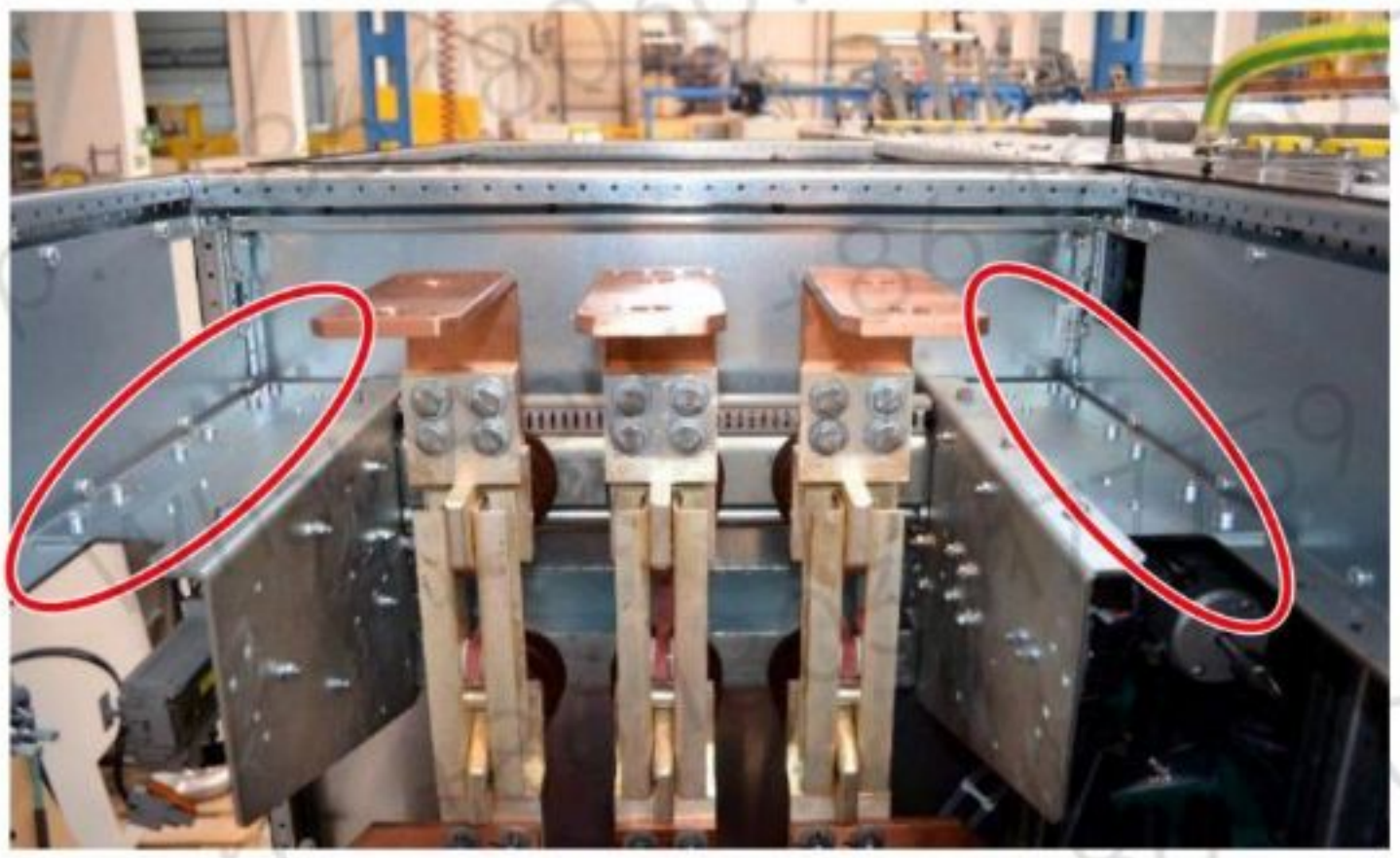


4. Remove the HV cables and position them in a way that the GDM can easily be pulled out and open the green cable holder on the left side.

5. Remove the LV and system cable on the left side of the GDM2 as well as the aluminum plate.



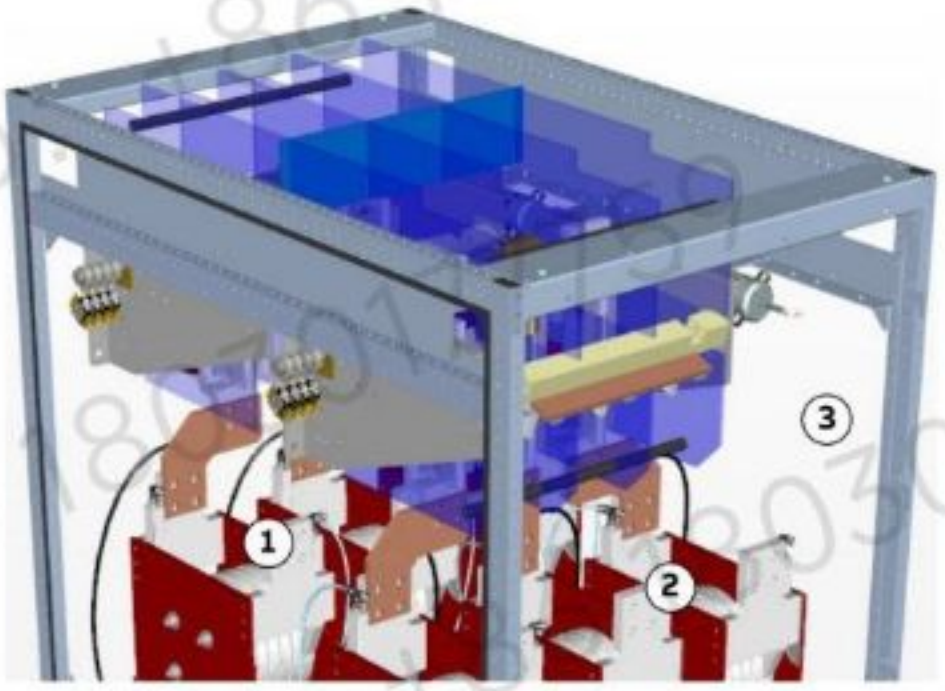
6. Remove the mounting screws of GDM2 and pull the GDM2 to the front of the cabinet.



7. Lift the GDM2 down as described in section 10.9.1, **Replacing grid/generator disconnector module (GDM1) at the front of the VFU**, page 203.
8. Replace the GDM2.
9. Rebuild the VFU in reverse order.
10. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.9.3. Replacing dv/dt filter reactor at the front of the VFU (VFM1)

Service MTTR 4 - 8 h



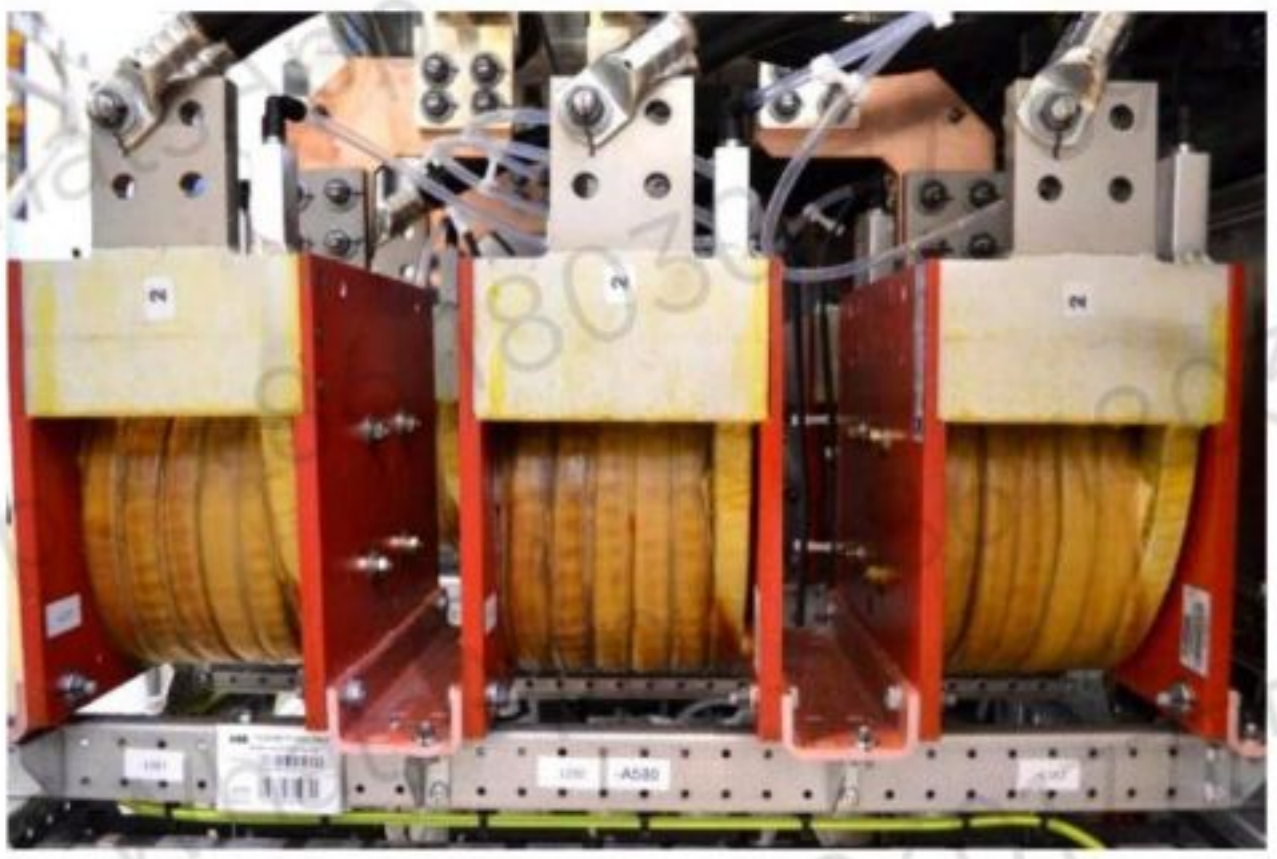


Figure 10–61 dv/dt filter reactor

1) VFM2	3) Front (door location)
2) VFM1	

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Empty water circuit of the cooling system according to section 10.5.2, **Emptying the cooling liquid circuit**, page 139.
3. Disconnect water pipes, copper busbars and power cables.

   CAUTION! The reactor weights approximately 25 kg. Use lifting aids and proper lifting technique when lifting and moving.

4. Unbolt the 4 mounting screws from the U-shaped profiles on the faulty reactor (see Fig. 10–62).

   2 screws in front and 2 screws on back of the reactor. When the screws are loosen, the reactor can be replaced.

Figure 10–62 dv/dt filter reactor mounting screws (different VFM variants)

5. Replace the faulty dv/dt filter reactor.

6. Fasten the mounting screws.
7. Reconnect the water pipes, copper busbar and the power cable.

   DANGER! Be aware of the correct mounting torque, when reconnecting the copper bars and power cables (See section 10.4.1, **Correct tightening torques of bolted connections**, page 135). It also has to be ensured that the washer rest flat on the copper busbars.

8. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70

10.9.4. Replacing dv/dt filter reactor at the back of the VFU (VFM2)

Service MTTR 4 - 8 h

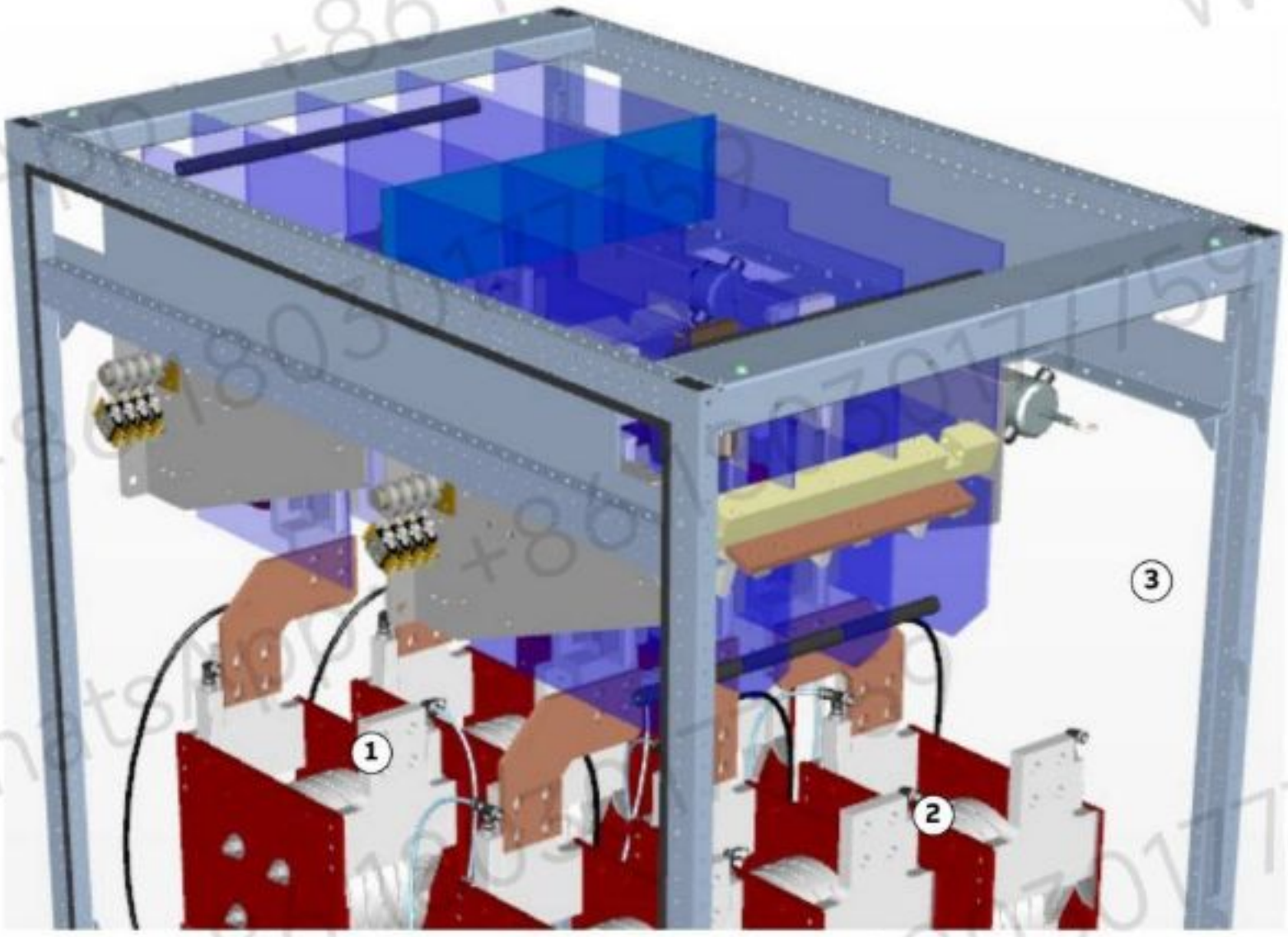


Figure 10–63 Position of VFM

1) VFM2	3) Front (door location)
2) VFM1	

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Empty water circuit of the cooling system according to section 10.5.2, **Emptying the cooling liquid circuit**, page 139.
3. Remove the filter reactor in front of the faulty reactor (see section 10.9.3, **Replacing dv/dt filter reactor at the front of the VFU (VFM1)**, page 213).

CAUTION! The reactor weights approximately 25 kg. Use lifting aids and proper lifting technique when lifting and moving.

4. Remove the copper plate of the front reactor.

5. Disconnect water pipes, busbar and power cable.

6. Unbolt the 4 mounting screws from the U-shaped profiles on the faulty reactor (see Fig. 10–54).

Note: 2 screws in front and 2 screws on back of the reactor.

7. Replace the faulty dv/dt filter reactor.

8. Reconnect pipes, busbars and power cables.

9. Reassemble the dv/dt filter in the front.

10.9.5. Replacing dv/dt filter resistor in VFU

Service MTTR 0 - 2 h

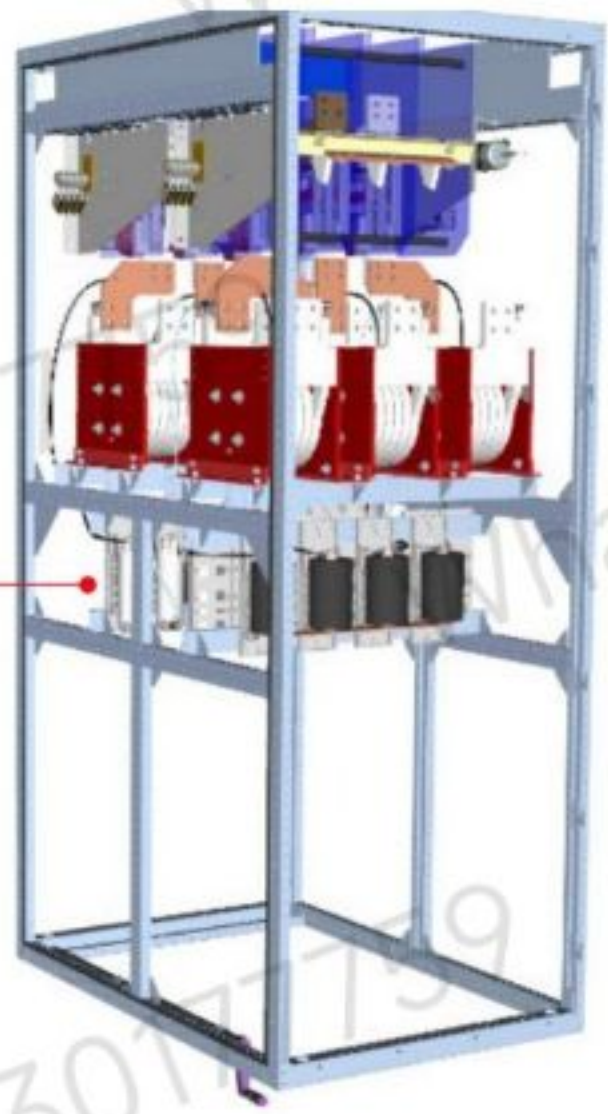


Figure 10–64 dv/dt filter resistors

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Empty water circuit of the cooling system according to section 10.5.2, **Emptying the cooling liquid circuit**, page 139.
3. Remove the Plexiglas cover in front of the capacitor bank by loosening the mounting screws.
4. Disconnect water pipes and cables.

5. Remove the mounting screws of the backplane.

Figure 10–65 Position of mounting screws dv/dt filter resistors

6. Remove the cable ties.

7. Replace the dv/dt filter resistor.

8. Add new cable ties.

9. Mount the resistor together with its backplane.

10. Reconnect water pipes and cables.

11. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.9.6. Replacing dv/dt filter capacitor in VFU

Service MTTR 0 - 2 h

Figure 10–66 dv/dt filter capacitors

1. Shut-down the PCS6000 according to “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Remove the Plexiglas in front of the capacitor bank by loosening the mounting screws.
3. Disconnect cables.
4. Replace dv/dt filter capacitor.

   NOTICE DO NOT exert any torque onto the capacitors. During loosening as well as fastening, the capacitor connections need to be held in place with a 23 mm flat wrench (contained in converter service toolbox). For maximum tightening torques refer to section 10.4.1, **Correct tightening torques of bolted connections**, page 135.
5. Reconnect cables.
6. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.10. Replacing components in WCU (Swedewater)

10.10.1. Replacing or cleaning conductivity meter

Service MTTR 4 - 8 h

Figure 10–67 Conductivity meter

1) Coupling ring

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Empty water circuit of the cooling system according to section 10.5.2, **Emptying the cooling liquid circuit**, page 139.
3. Disconnect the electrical connection.

4. Turn coupling ring below the meter clockwise (looking from top) to open.

Figure 10–68 Conductivity meter

5. Replace the conductivity meter.
6. Tighten coupling ring below the meter in anti-clockwise direction.
7. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.10.2. Replacing inlet water temperature meter

Service MTTR 0 - 2 h

Figure 10–69 Temperature meter

1. Shut-down the PCS6000 according to “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.

   IMPORTANT! Pocket type sensor, water circuit has not been touched.

2. Remove 2 radial screws.

3. Replace measuring head and check that the sensor wires are covered with heat conducting paste.

4. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.10.3. Replacing pressure gauge and pressure transmitter

Service MTTR 0 - 2 h

Figure 10–70 Pressure gauge and transmitter

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Close valve V91 for B5501 or V92 for B5502 and B5530.
3. Replace the faulty component.

   Use a sealing paste (Loctite 278 or similar product) and apply according to the manufacturer's technical information.
4. Open the valve again.
5. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.10.4. Replacing deionizer flow meter

Service MTTR 0 - 2 h

Figure 10–71 Deionizer flow meter

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Release the over pressure of the cooling system as described in section 10.5.1, **Releasing the over pressure from the cooling liquid circuit**, page 138 or, if necessary, empty water circuit of the cooling system according to section 10.5.2, **Emptying the cooling liquid circuit**, page 139.
3. Close valve V59.
4. Replace the deionizer flow meter.
5. Open valve V59 again.
6. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.
7. Adjust the flow valve to a flow indication of approximately 8 l/min

10.10.5. Replacing the ion exchange vessel

Service MTTR 0 - 2 h

⚠CAUTION Corrosive substance!

Contact may result in irritation. For more information, see Safety Data Sheet 8-1000-193.

- Avoid skin and eye contact with the deionizer resin!
- Wear protective clothing, including rubber gloves and safety goggles

Figure 10–72 Ion exchange vessel (right side: old version)

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Close flow meter FI10 before and valve V59 after the ion exchange vessel.
3. Open first valve V55 and then V71 to release pressure.

   CAUTION! Pay attention to the direction of the vent hole and make sure that escaping water does not cause injury to persons or damage to the motor or other components. Water temperature can be up to **50°C**.

4. Close valve V55 and V71 again.

Figure 10–73 Ion exchange vessel

5. Remove the two clamps to dismount the vessel.

   CAUTION! The ion exchanger vessel weights approximately 20 kg.

6. Hold the vessel distributor head in place and turn the vessel to unbolt it from the distribution head.
7. Switch over the vessel distributor head with the hose couplings to the new vessel.
8. Check the correct length (minimum bending force at the Legris fitting) of plastic tubes (in old versions). If they are not long enough replace tubes and Legris.
9. Remount the vessel and re-position the clamps.
10. Open carefully flow meter FI10 before the ion exchange vessel.
11. De-aerate through valve V71 and close when water starts to trickle out.
12. Open valve V59.
13. Run pump for approximately 30 minutes to flush loosen resin into the (old) water filter.
14. Replace the water filter according section 10.10.6, **Replacing the water filter**, page 227.

10.10.6. Replacing the water filter

Service MTTR 0 - 2 h

Figure 10–74 Water filter

The water filter has a limited life length. It is recommended to replace the water filter when the deionizer vessel is serviced or changed. Should the flow indicated on flow meter FI10 go down, a change of the water filter is due.

If you have replaced the resin vessel it is possible to flush any new resin out of the vessel. Therefore, first run the pump for 30 minutes with the new vessel before replacing the old filter.

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Close flow meter FI10 and valve V59.
3. Release the over pressure of the cooling system as described in section 10.5.1, **Releasing the over pressure from the cooling liquid circuit**, page 138.
4. Unbolt bottom of housing. Remove large O-ring and set aside.

   NOTE – Although it should be possible to unbolt the filter housing by hand, oil filter pliers can be helpful.
5. Discard used water filter. Rinse out bottom of housing.
6. Wipe clean O-ring of old lubricant.
7. Lubricate O-ring with clean petroleum jelly (Vaseline) or silicone lubricant.
8. Place O-ring back into groove and smooth into place with finger.

9. Insert new water filter over standpipe in bottom of housing.

   NOTICE Water filters with tapered ends need to be specifically installed with the tapered end towards the threads of the housing.

10. Screw bottom of housing onto cap and hand tighten.

    NOTICE DO NOT over-tighten. Make sure cap standpipe slips into water filter.

11. Turn on water supply (flow meter FI10) slowly to fill the cooling system with water.

12. Open valve V59.

13. Check for leaks before leaving installation.

14. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.10.7. Replacing pump

Service MTTR 2 - 4 h

Converter service tools are required to carry out this work:

- Pump maintenance table kit WCU (3BHE039649R0001)
- Base beam lifting jack (3BHE039648R0001)
- Chain-block minimum 150 kg (3BHB032083R0001)

See also chapter 3, **Service tools**, page 31.

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Open MCB -Q601 or -Q602 on the WCU electrical control box.
3. Release the over pressure of the cooling system as described in section 10.5.1, **Releasing the over pressure from the cooling liquid circuit**, page 138.
4. Close valve V1 or V2 to isolate pump from the water circuit (the other pump side is isolated by the non return valve V3 or V4).
5. Place a catching tray under the draining bolt of the pump in such a way that escaping cooling liquid when opening the draining bolt does not spill into the converter.

   IMPORTANT! The catching tray should be capable to catch approximately 5 liters.

6. Open draining bolt and deaeration valve V73/72 to drain the pump.

7. Disconnect pump electrically.

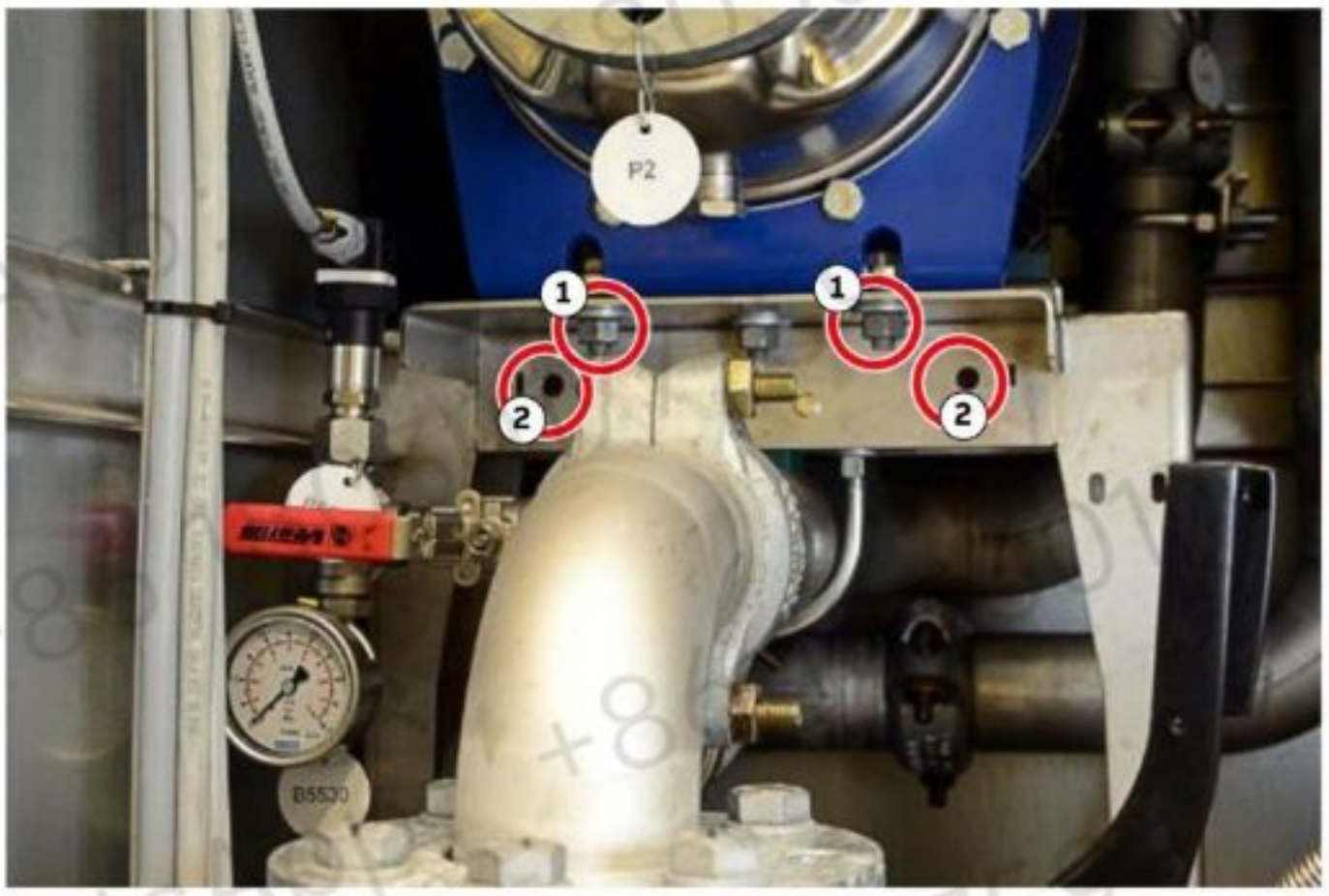


Figure 10–75 Pump support

1) Support bolt	2) Mounting hole for maintenance table

8. Remove the 3 support bolts (see Fig. 10–75).

9. Loosen both flanges of the pump and remove bolts.

Figure 10–76 Pump flange

1) Pump flange bolt

10. Use the bolts from the pump flange to fix valve V1 before removing the connecting pipe (see Fig. 10–76).

The connecting pipe can be turned out of the way using the turn flanges (see Fig. 10–77).

Figure 10–77 Connecting pipes turned aside

11. Use the bolts from the pump flange to fix valve V1 before removing the connecting pipe (see Fig. 10–76).

12. If no 10 mm mounting holes (see Fig. 10–75) are available (converters delivered before January 1, 2013), the pump maintenance table can only be used after drilling these holes according to the drilling plan shown in Fig. 10–78.

Figure 10–78 Drilling plan

13. Install pump maintenance table (see Fig. 10–79) with long legs (for upper pump) or with short legs (for lower pump).

Figure 10–79 Pump maintenance table with long legs (for upper pump)

14. Pull pump to front into suitable working or lifting position.

CAUTION! The pump with motor weights approximately 125 kg. Single person lift could cause injury. Use lifting aids and assistance when lifting and moving.

15. For work on the pump maintenance table fix motor with M12 bolt to the table.

16. For removing the pump install base beam lifting jack into MNS profile.

17. Lift pump out of the cabinet.

Figure 10–80 Use of chain-block to lift out pump

18. Replace pump and fit all back in opposite order.

19. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.10.8. Replacing pump slip ring sealing

Service MTTR 0 - 2 h

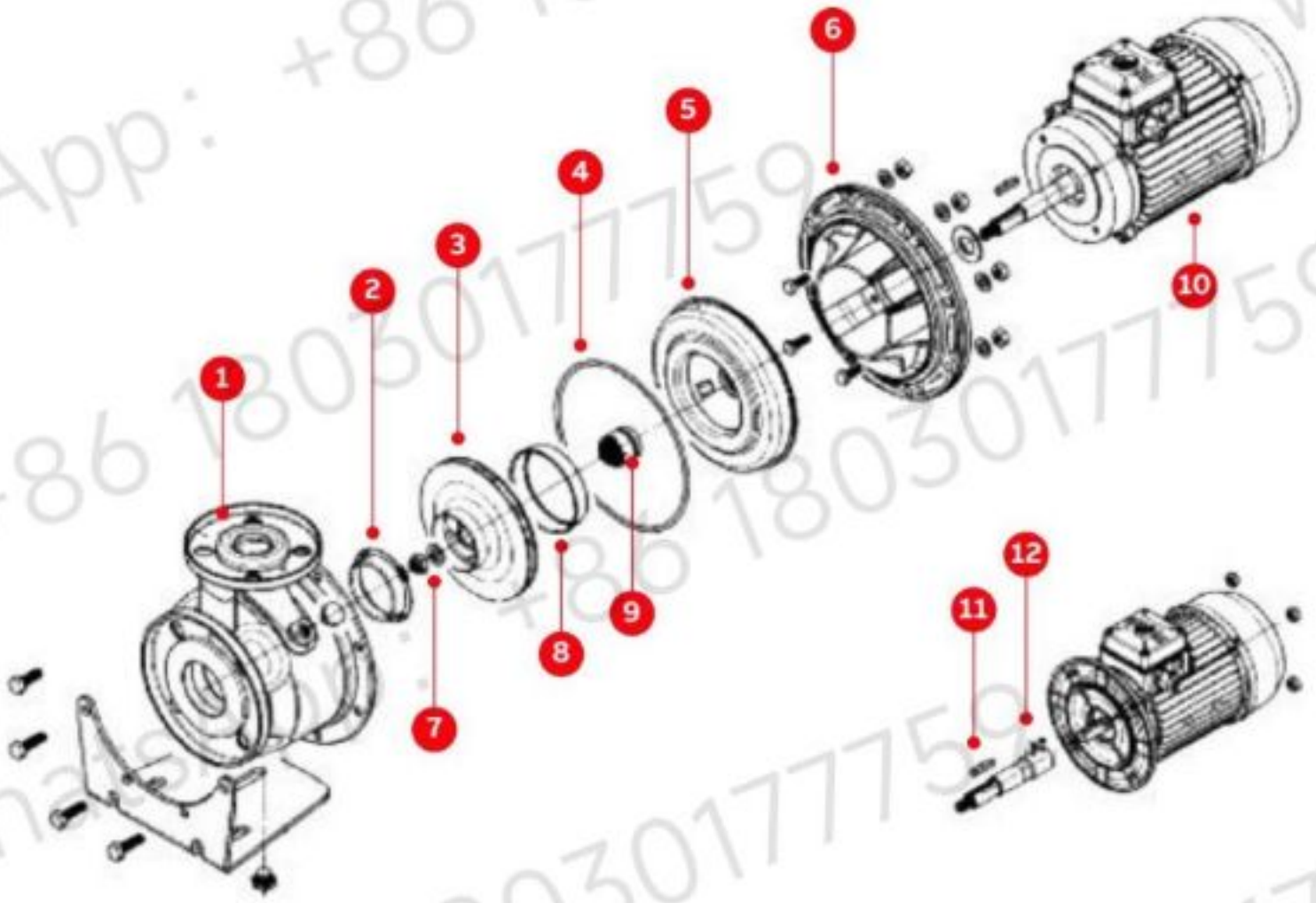


Figure 10–81 Pump components (Swedewater)

1) Pump body	7) Impeller fastening nut and washer
2) Wear ring	8) Counter-wear ring
3) Impeller	9) Mechanical seal
4) O-ring	10) Complete motor
5) Seal-holding disk	11) Tab
6) Adapter	12) Coupling

1. Follow instruction in section 10.10.7, **Replacing pump**, page 228 (steps 1 to 10).

2. Open pump case (see Fig. 10–82).

Figure 10–82 Opening pump case

3. Remove pump wheel with impact wrenches.

4. Remove key out of keyway.

Figure 10–83 Pump shaft

5. Remove spring and sealing.

6. Replace sealing.

Figure 10–84 Pump sealing

7. Rotate pump by hand to ensure correct centering.

8. Fit all back in opposite order.

9. Pump wheel torque is 45 Nm.

10. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.10.9. Replacing the 3-way valve

Service MTTR 4 - 8 h

Figure 10–85 3-way valve

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Empty water circuit of the cooling system according to section 10.5.2, **Emptying the cooling liquid circuit**, page 139.
3. Remove side wall of the WCU cabinet.
4. Remove pulling clutch.
5. Loosen the actuator and move it out of the way.
6. Open all 3 “Grinnell” flanges.
7. Replace valve and fit all back in opposite order.
8. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.10.10. Replacing expansion vessel

Service MTTR 0 - 2 h

Figure 10–86 Expansion vessel

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Switch off 24 V DC auxiliary power.
3. Release the over pressure of the cooling system as described in section 10.5.1, **Releasing the over pressure from the cooling liquid circuit**, page 138.
4. Close valve V56 (the key for the padlock is inside the electrical control box).
5. Unbolt the 4 mounting screws of the electrical control box and temporarily strap the electrical control box to the WCU frame without removing the cables (see Fig. 10–86).

   CAUTION! The expansion vessel weights approximately 24 kg. Use lifting aids and proper lifting technique when lifting and moving.
6. Disconnect the coolant hose.

7. Unbolt the 2 mounting screws on the lower side of the expansion vessel.

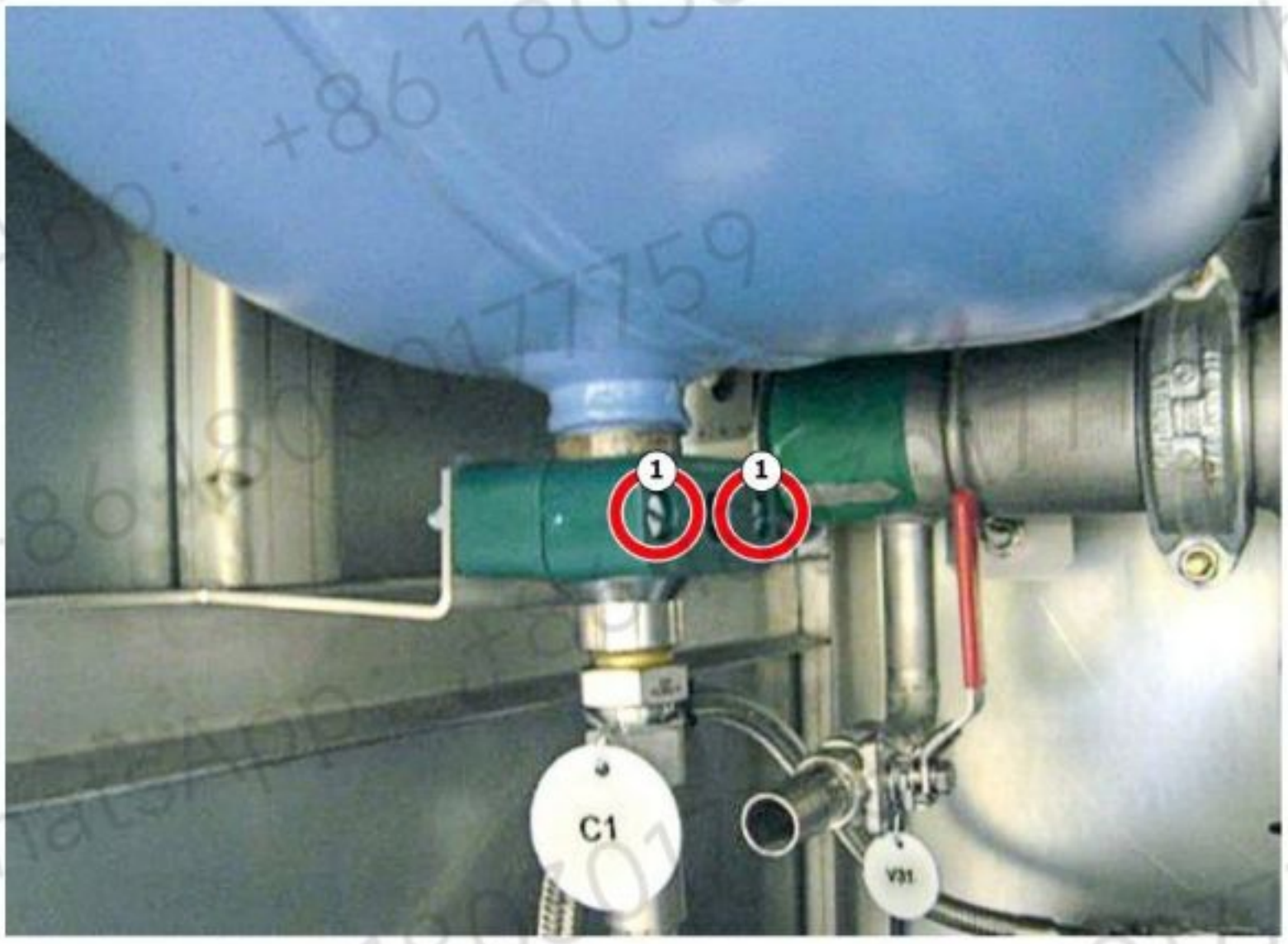


Figure 10–87 Expansion vessel

1) Mounting screw

8. Unhook the expansion vessel from the upper mounting, remove it and then install the new expansion vessel and connect the coolant hose.

Use a sealing paste (Loctite 278 or similar product) and apply according to the manufacturer's technical information.

9. Equalize the air pressure to zero by pressing the car tube valve on the vessel.

10. Open valve V56 and secure against closing with padlock.

11. Switch on 24 V DC auxiliary power.

12. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.10.11. Replacing automatic deaeration valve

Service MTTR 0 - 2 h

Figure 10–88 Automatic deaeration valve

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Close valve V51.
3. Replace the automatic deaeration valve.

   NOTE – If required, remove the WCU back wall or unbolt the 4 mounting screws of the electrical control box and temporarily strap the electrical control box to the WCU frame without removing the cables (see Fig. 10–86).
4. Open valve V51.
5. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.10.12. Replacing (checking) ball valve ¾”

Service MTTR 0 - 2 h

> **NOTICE** **Risk of component damage.**
>
> A leaking valve might be fixed by following the steps below. However, if it's still dripping after tightening, then the whole valve should be replaced.

1. Remove the crank with a 14 size spanner.

Figure 10–89 Ball valve ¾”

1) Mounting nut

2. Tight the gland with a 14 size spanner with approximately 20 Nm.

Figure 10–90 Gland from the Ball valve ¾”

1) Gland

10.10.13. Replacing (checking) ball valve ½”

Service MTTR 0 - 2 h

> **NOTICE** **Risk of component damage.**
>
> A leaking valve might be fixed by following the steps below. However, if it's still dripping after tightening, then the whole valve should be replaced.

1. Turn the crank approximately 10 times ON and OFF.

Figure 10–91 Ball valve ½”

10.11. Replacing components in WCU (ARMATEC)

⚠WARNING High voltage!

- Before the internals of the PCS6000 are accessed for service purposes, the relevant components of the converter must be de-energized safely.

Service MTTR

MTTR (hours)	Service
4 - 8	Replacing a pump
0 - 2	Replacing the vessel
0 - 2	Replacing the cartridge
0 - 2	Replacing valve K5541
0 - 2	Replacing the expansion vessel C1
0 - 2	Replacing conductivity sensor B5503
0 - 2	Replacing pressure sensor B5501
0 - 2	Replacing pressure sensor B5502
0 - 2	Replacing flow indicator FI10

IMPORTANT! For all work on the WCU, whether maintenance or troubleshooting, see the relevant documents of the manufacturer. For ARMATEC Water Cooling Units use please the ARMATEC WCU Service Instruction (appendix B06).

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22
2. If necessary, empty water circuit of the cooling system according to section 10.5.2, **Emptying the cooling liquid circuit**, page 139.
3. The replacement of WCU components is described in WCU service documentation (appendix B06).
4. Filling and draining of the cooling system according to “PCS6000 user manual”, 3BHS600000 E40.
5. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.12. Replacing components in FIU

The FIU with FCM is the previous generation. From 2015 onward, the FIU is assembled with the FIM.

Figure 10–92 FIU with FCM (left) and with FIM (right)

1) FIU with FCM	2) FIU with FIM

10.12.1. Replacing HFM filter reactor

Service MTTR 0 - 2 h

Figure 10–93 HFM filter reactor

1) Middle beam	2) Mounting screw

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Disconnect all necessary electrical connections.
3. Remove middle beam.

   CAUTION! The reactor weights approximately **44 kg**. Use lifting aids and proper lifting technique when lifting and moving.
4. Mark the reactor's position and unbolt the 4 mounting screws on the lower supports of the reactor and remove it.
5. Replace the new reactor in the same position (marks), fix the mounting screws and connect all cables.
6. Install the middle beam as it was before.
7. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.12.2. Replacing HFM filter capacitor

Service MTTR 2 - 4 h

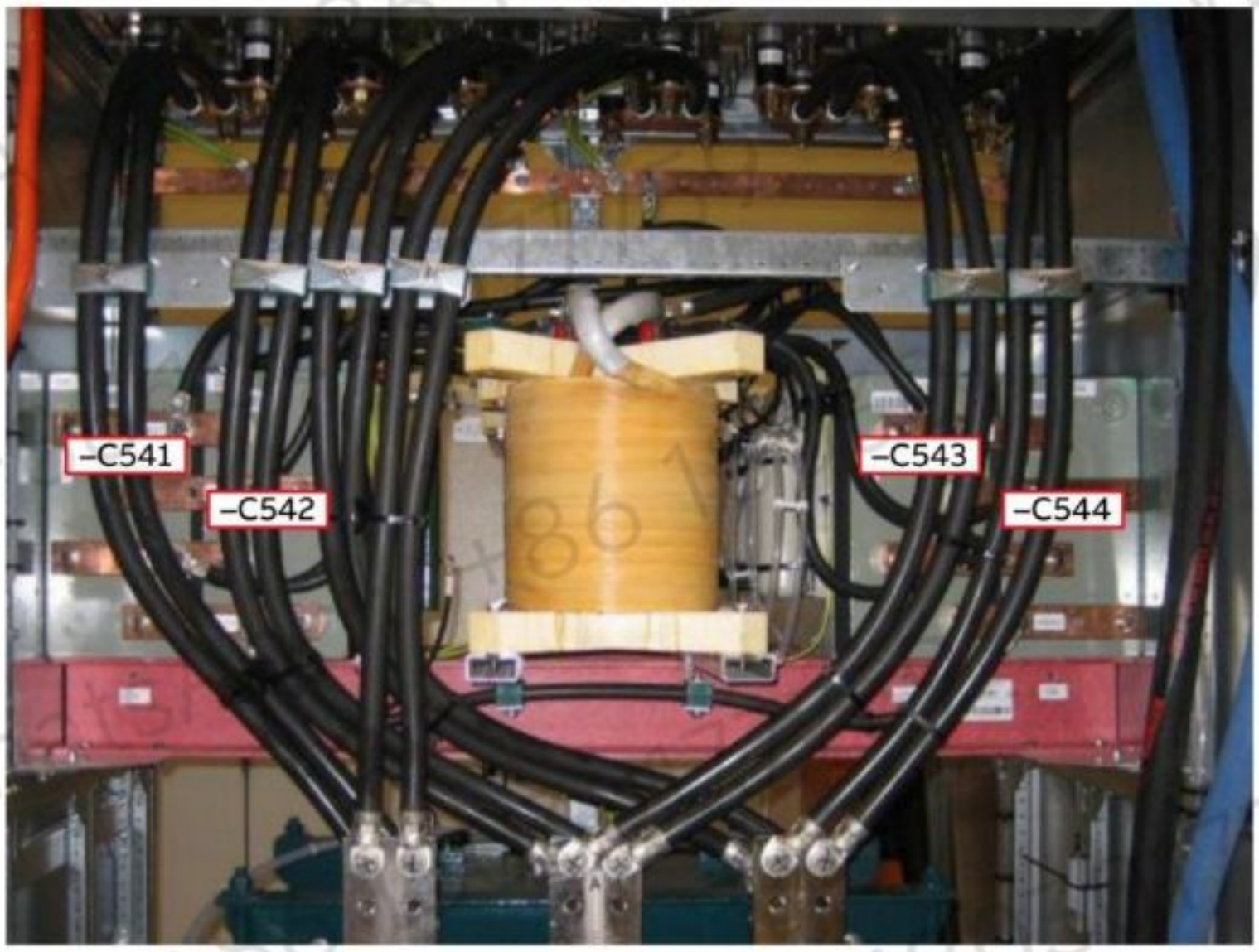


Figure 10–94 HFM filter capacitor

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. For -C541, first remove -C542. Likewise, for -C544 first remove -C543.
3. For -C541 and -C542. If applicable, remove the FCM.

4. Open first the cable duct from the FCM (the cables stay connected) and remove the FCM with part of the frame (see Fig. 10–95).

   The FIM in converters without an FCM do not need to be removed.

Figure 10–95 FCM removal (circles show bolt locations)

5. Disconnect all necessary electrical connections.

   CAUTION! The capacitor weights approximately 41 kg. Single person lift could cause injury. Use assistance when lifting and moving.

6. Remove the plate top of the capacitors.

Figure 10–96 Top and bottom views of capacitor

7. Unbolt the capacitor (bottom long bolts and top short bolts).

8. Remove power cables and beam in front of the capacitor.
9. Pull the capacitor out, until the bottom flange is on top of the front beam and then put a wooden beam (circa 50 × 25 × 400mm) under the capacitor and fix it with a cable tie to the two rear beams (see Fig. 10–96) to support the capacitor while taking out or putting back in.
10. To lift the capacitor out, install the ring bolt from the top plate to the capacitor and use the base beam lifting jack.

Figure 10–97 Lifting out capacitor

11. Lift the new capacitor with the chain block and shift it back into its destined position.

    For maximum tightening torques refer to section 10.4.1, **Correct tightening torques of bolted connections**, page 135.
12. Rebuild the filter unit by reconnecting all electrical connections and assembly all components at original position.
13. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.12.3. Replacing HFM filter resistor

Service MTTR 4 - 8 h

Figure 10–98 HFM filter resistor

1. Shutdown the PCS6000 according to “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Empty water circuit of the cooling system according to section 10.5.2, **Emptying the cooling liquid circuit**, page 139.
3. Disconnect cooling hoses and cables from the resistor.
4. Remove the 4 mounting screws of the base plate and remove the resistor with base plate.
5. Install new resistor with base plate and reconnect cooling hoses and cables.
6. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.12.4. Replacing filter reactor

Service MTTR 4 - 8 h

> **⚠CAUTION Heavy object!**
>
> The reactor weights approximately **760 kg**.
>
> – Use lifting aids and assistance when lifting and moving.

Converter service tools are required to carry out this work:

– Reactor replacement kit FIU (3BHE039651R0001)

– Chain-block minimum 150 kg (3BHB032083R0001)

See chapter 3, **Service tools**, page 31.

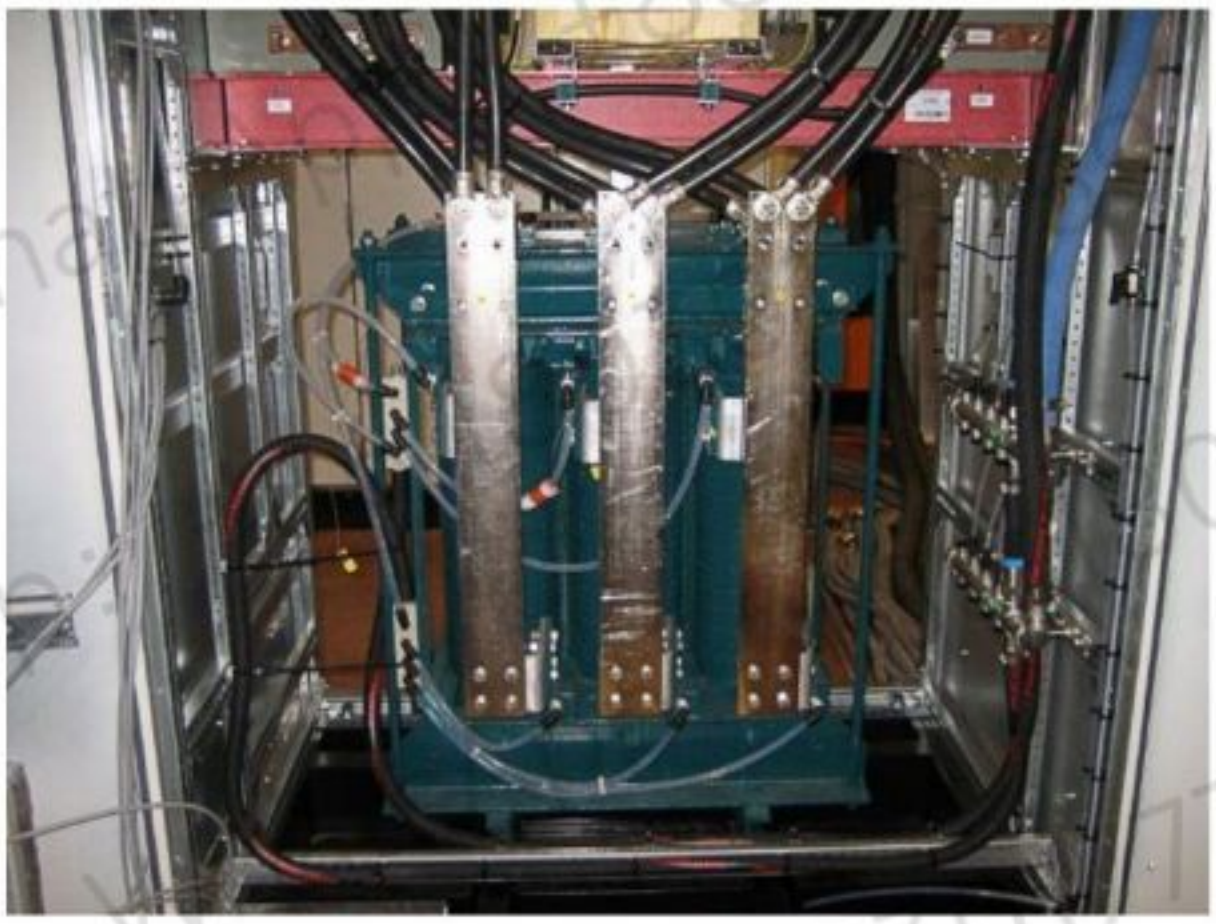


Figure 10–99 Filter reactor

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Empty water circuit of the cooling system according to section 10.5.2, **Emptying the cooling liquid circuit**, page 139circuit.
3. Remove middle beam of the cabinet.
4. If applicable, remove the FCM (see section 10.12.2, **Replacing HFM filter capacitor**, page 243, Fig. 10–81), unbolt all cables (including ground connection in the back of the reactor), hoses and screws.

   NOTE – In converters with FIM instead of FCM the FIM can remain installed.
5. Remove bottom front beam of the cabinet.
6. Remove the water connection to the filter reactor including the beam.
7. Install reactor replacement kit for replacement of the reactor.

8. Hook on back lower beam and on connection bar.

   If eye bolts are provided: mount eye bolts into the threaded holes on front beam and use eye bolts for fixing.

9. Loosen reactor bolts, grease slides, pull out of the cabinet with chain block.

10. The filter reactor is now outside the cabinet, use a crane to move it.

Figure 10–100 Removed filter reactor

11. When the new reactor is on the slides, use the chain block to pull it back into the cabinet.

12. Reinstall all mechanical and electrical components in reverse order.

    IMPORTANT! DO NOT forget the ground connection in the back.

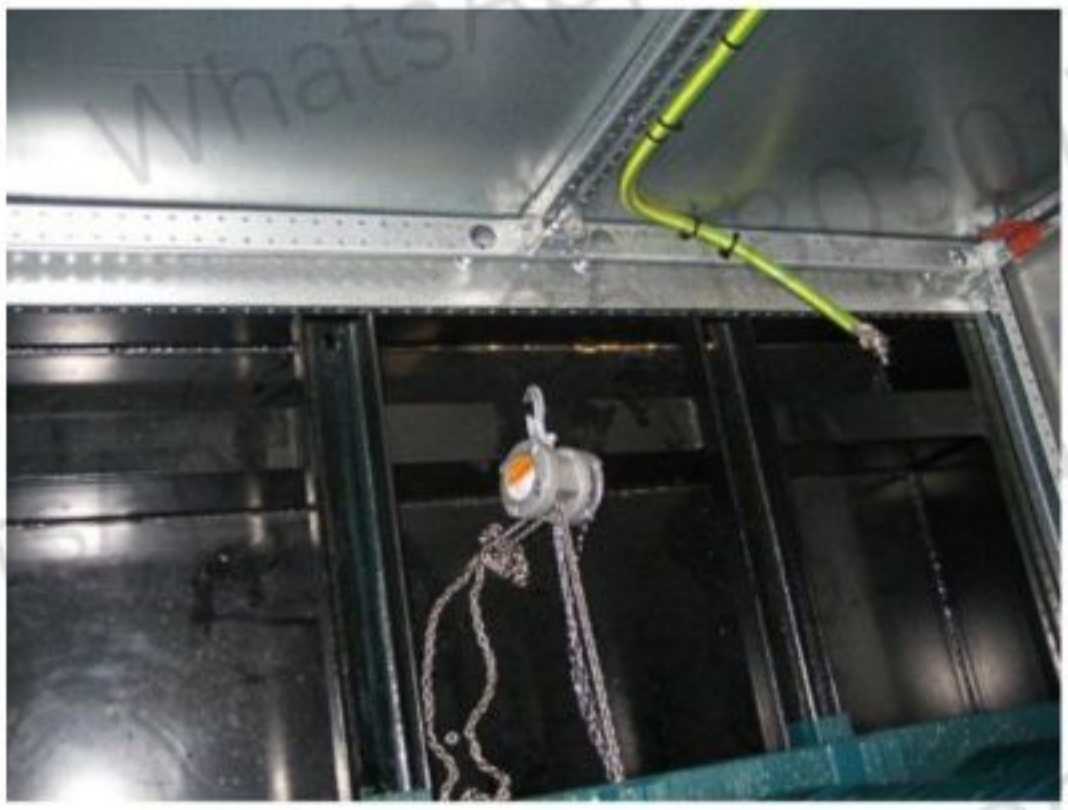


Figure 10–101 Ground connection

13. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.12.5. Replacing pressure transmitter

Service MTTR 4 - 8 h

Figure 10–102 Pressure transmitter

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Empty water circuit of the cooling system according to section 10.5.2, **Emptying the cooling liquid circuit**, page 139.
3. Disconnect all Legris adapters and hoses from the stainless steel water distribution (use a catching tray to catch the remaining cooling liquid).
4. Heat up the connection thread (below the transmitter) up to approximately 250 °C with a hand-held hot air blower until the Loctite 620 sealing mellows and unbolt the pressure transmitter from the stainless steel water distribution.
5. Clean any remaining Loctite from the thread and let it dry completely.
6. Install new pressure transmitter. The new part must be sealed again with “Loctite 620” or a similar product.
7. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.13. Replacing components in GBU

10.13.1. Replacing generator breaker (GEB) / grid breaker (GRI)

Service MTTR 4 - 8 h

> **⚠CAUTION Heavy object!**
>
> The generator breaker weights approximately **160 kg**.
>
> ▸ Use lifting aids and assistance when lifting and moving.

Tools

Converter service tools are required to carry out this work:

– GEB replacement trolley GBU50/70 (3BHE040630R0001) (see chapter 3, **Service tools**, page 31).

Procedure:

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Isolate and earth the power cable connection to the GEB/GRI.
3. Discharge GEB/GRI spring.
4. Remove the arc protection cover on the GEB/GRI cabinet.

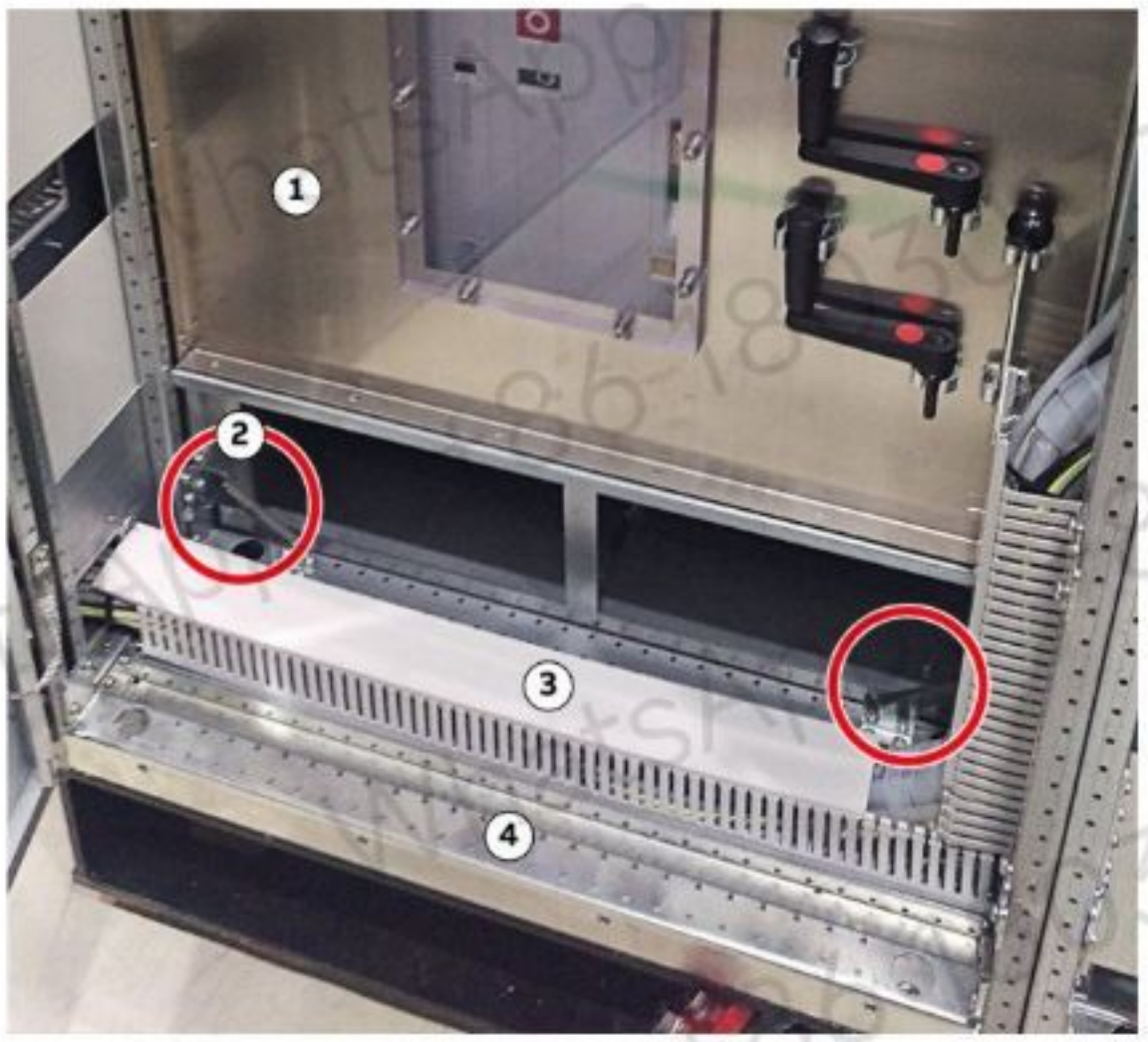


Figure 10–103 GBU

1) Arc protection cover	3) Cable duct
2) Corner brace	4) Lower front beam

5. Unplug the 230 V supply (-X561 L2, N2, PE).
6. Discharge the breaker spring by opening and closing the GEB/GRI.
7. Disconnect all control plugs from the GEB/GRI.

   IMPORTANT! Access to the breaker connections is either possible from the back side after removing the back wall (if accessible) or from below after removing the drawer (only on new design).

Figure 10–104 Generator breaker (GEB)

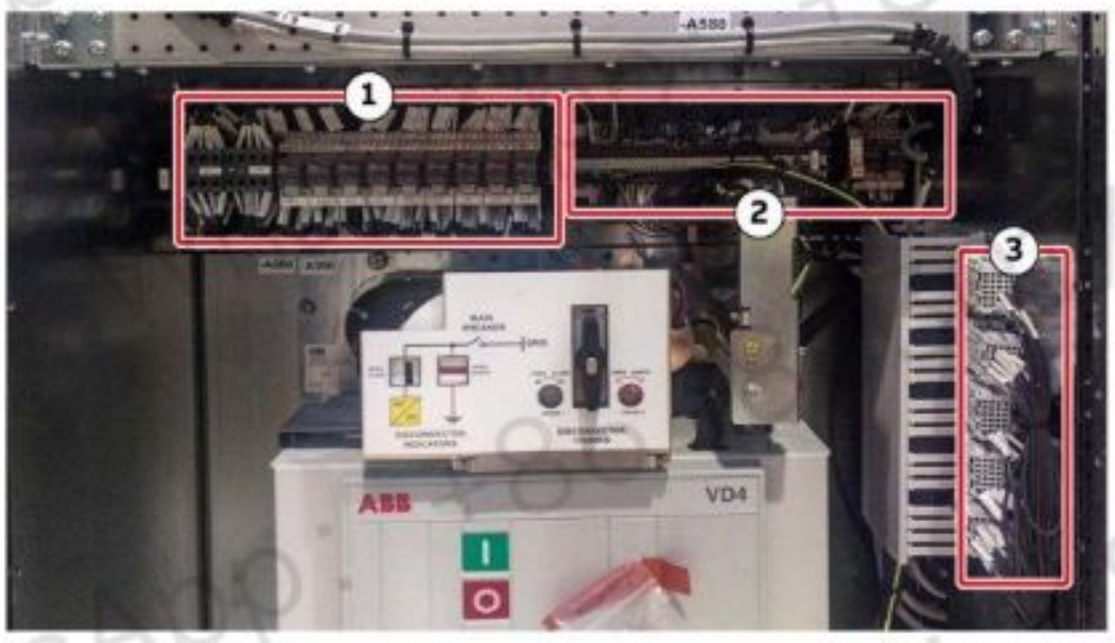


Figure 10–105 Grid breaker (GRI)

1) DMC3
2) -X561 rail
3) GRI plug breaker
4) External rail -X561, fan MCB and temperature monitoring

8. Unbolt the 4 drawer mounting screws, 2 on each side (there is only one fan drawer on new design).

Figure 10–106 Drawer mounting screws

9. Remove the corner braces.

Figure 10–107 Corner braces

10. If present, remove the push button locking device.

Figure 10–108 GBM push button locking device

11. Unbolt the lower front beam mounting screws (one on each side) to allow the fan drawer to be pulled out.

Figure 10–109 Lower front beam mounting screws

12. Disconnect the signal cables from the differential pressure measurement device, which is on top of the fan drawer.

Figure 10–110 Differential pressure measurement device

13. Pull out and remove the fan drawer below the GEB.

Figure 10–111 Fan drawer below the GEB

14. If access from the back side is possible, remove the back wall of the cabinet, if not, access to the GEB main power cable is possible underneath the GEB.

If available, use a cushion to protect your head from the edges.

Figure 10–112 Protection cushion

15. Disconnect the power cables on the 3 lower bus bar connections at the breaker.

Figure 10–113 Breaker's lower power cable connections

16. Disconnect the copper angle with the power cables at the upper connection at the breaker.

Figure 10–114 Breaker's upper power cable connection

17. Disconnect the protection earth cable on the back of the GEB base plate.

NOTE – For better accessibility, you might need to remove the DMC3 / -X561 rail plate.

Figure 10–115 Breaker's protecting earth connection

18. Remove the fiber optic cable from the copper bar.

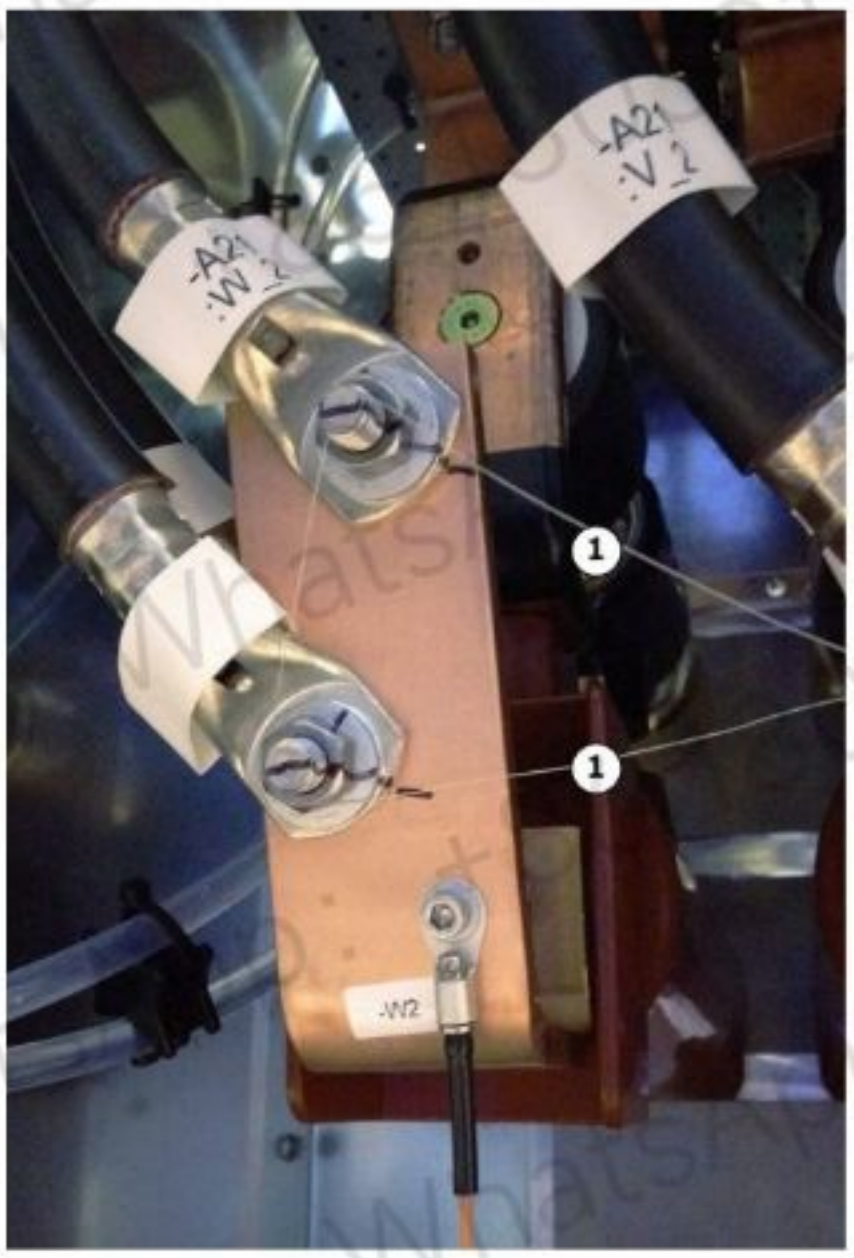


Figure 10–116 Fiber optic cable

19. Remove the front cover of the breaker by loosening two M8 bolts on the bottom.

Figure 10–117 Breaker's protecting earth connection

20. Install the two trolley track beam on the cabinet bottom and support the track beam outside of the cabinet securely (height ~210 mm).

Figure 10–118 Trolley track beams

21. If available on site, the Reactor Replacement Kit can be used for this purpose.

Figure 10–119 Support by reactor replacement kit

22. Pull the beams only as far, as they are still supported by the base beam of the cabinet.

Figure 10–120 Trolley track beams (top view)

23. Loosen the two wing nuts under the trolley and leave at least 25 mm space for adjusting the lever.

Figure 10–121 Trolley with loose wing nuts

24. Insert the trolley into the cabinet and adjust the lever to fit GEB.

First use the two M8 bolts to fix the GEB to the lever.

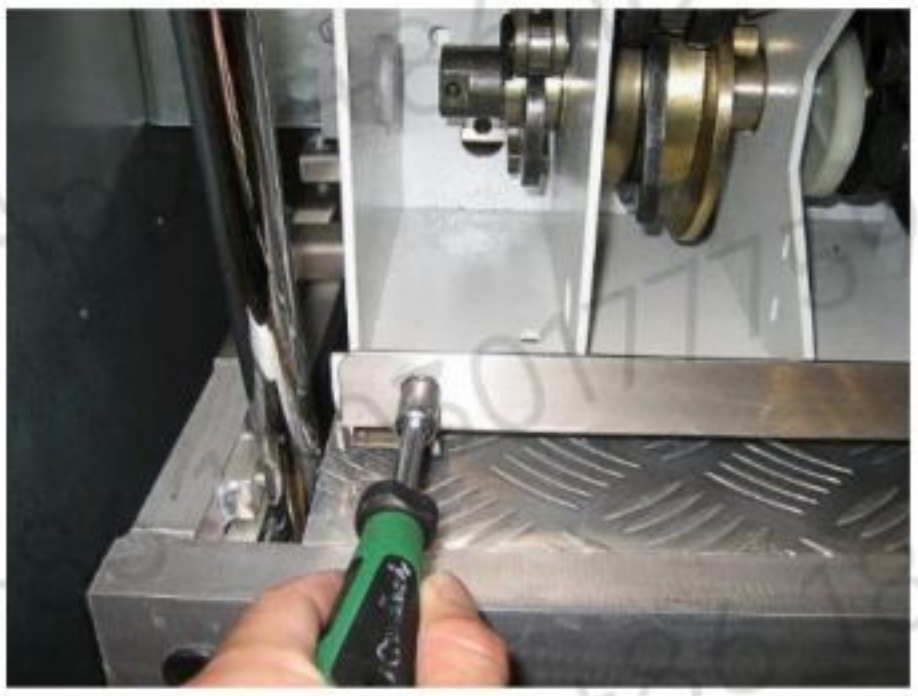


Figure 10–122 Fixing the GEB to the lever

25. Raise the lever by tightening the four M12 lifting bolts smoothly.

Figure 10–123 Rising the lever

26. Loosen the eight M8 mounting screws and adjust the lever, until all screws can easily be turned out by hand.

Figure 10–124 Unbolting the GEB

27. Pull the GEB out of the cabinet (take special care for the cooling hoses above the GEB!).

The GEB can then be lifted by crane (with or without the trolley).

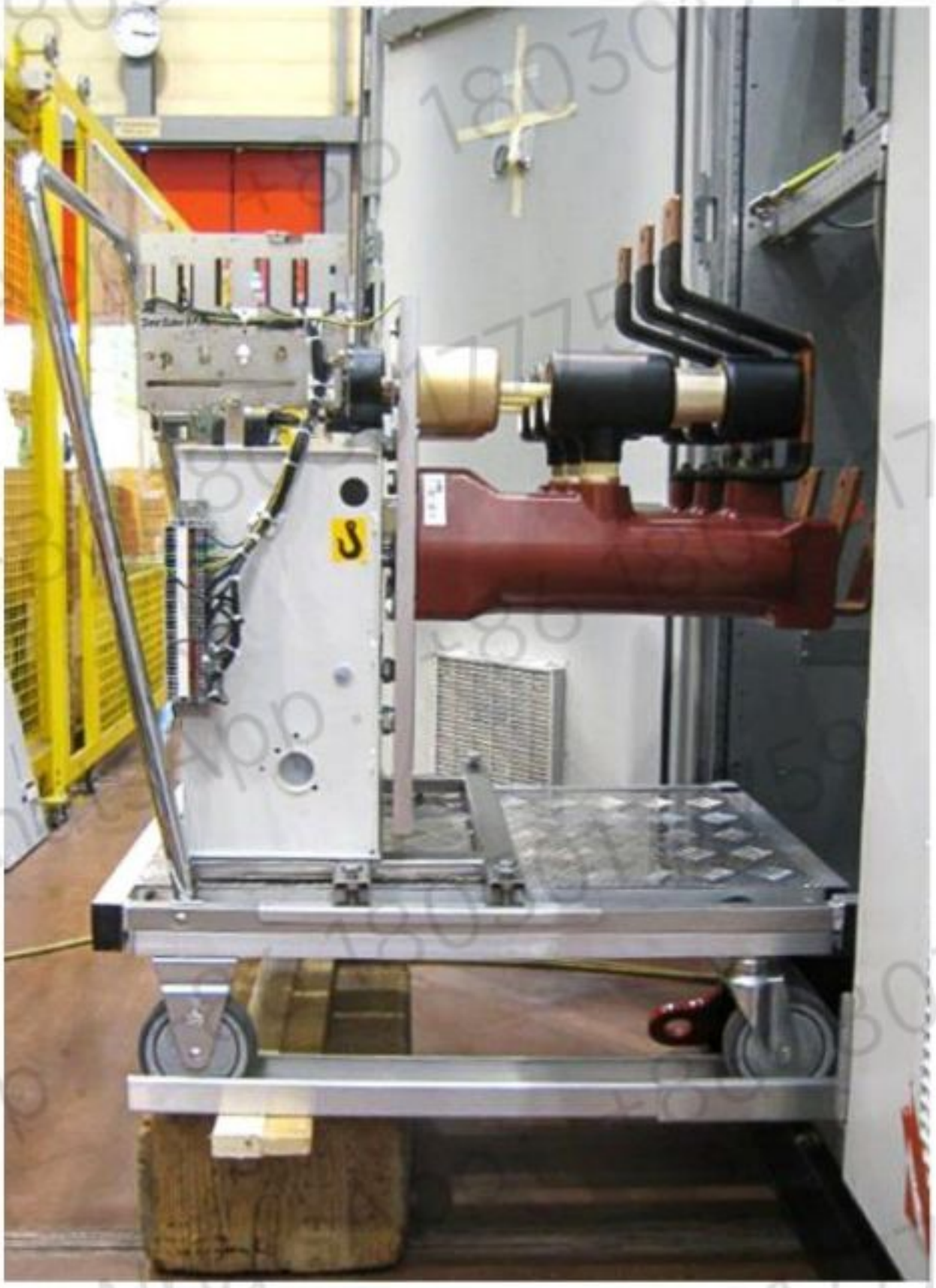


Figure 10–125 GEB pulled out of the cabinet

28. Mount the new breaker in reverse order.

IMPORTANT! The explosion protection flap of the fan drawer must be open and held by the retention spring after the drawer has been reinserted.

If the explosion protection flap is closed, open it as follows:

– Insert a small item, eg, an Allen key into the hole at the bottom of the drawer (see Fig. 10–126) and push the retaining spring down (see Fig. 10–127) so that the flap can be pushed back until it engages at the back end of the retaining spring (see Fig. 10–128).

Figure 10–126 Releasing the retaining spring (flap closed)

Figure 10–127 Releasing the retaining spring (flap open)

Figure 10–128 Flap open and engaged

29. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.13.2. Replacing dv/dt filter reactor in GBU

Service MTTR 4 - 8 h

⚠CAUTION Heavy object!

The reactor weights approximately **25 kg**.

- Use lifting aids and proper lifting technique when lifting and moving.

Figure 10–129 dv/dt filter reactor

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Empty water circuit of the cooling system according to section 10.5.2, **Emptying the cooling liquid circuit**, page 139.
3. Disconnect water pipes, busbars and cables.

4. Put two wooden support beams of approximately 60 mm height under the dv/dt filter reactor

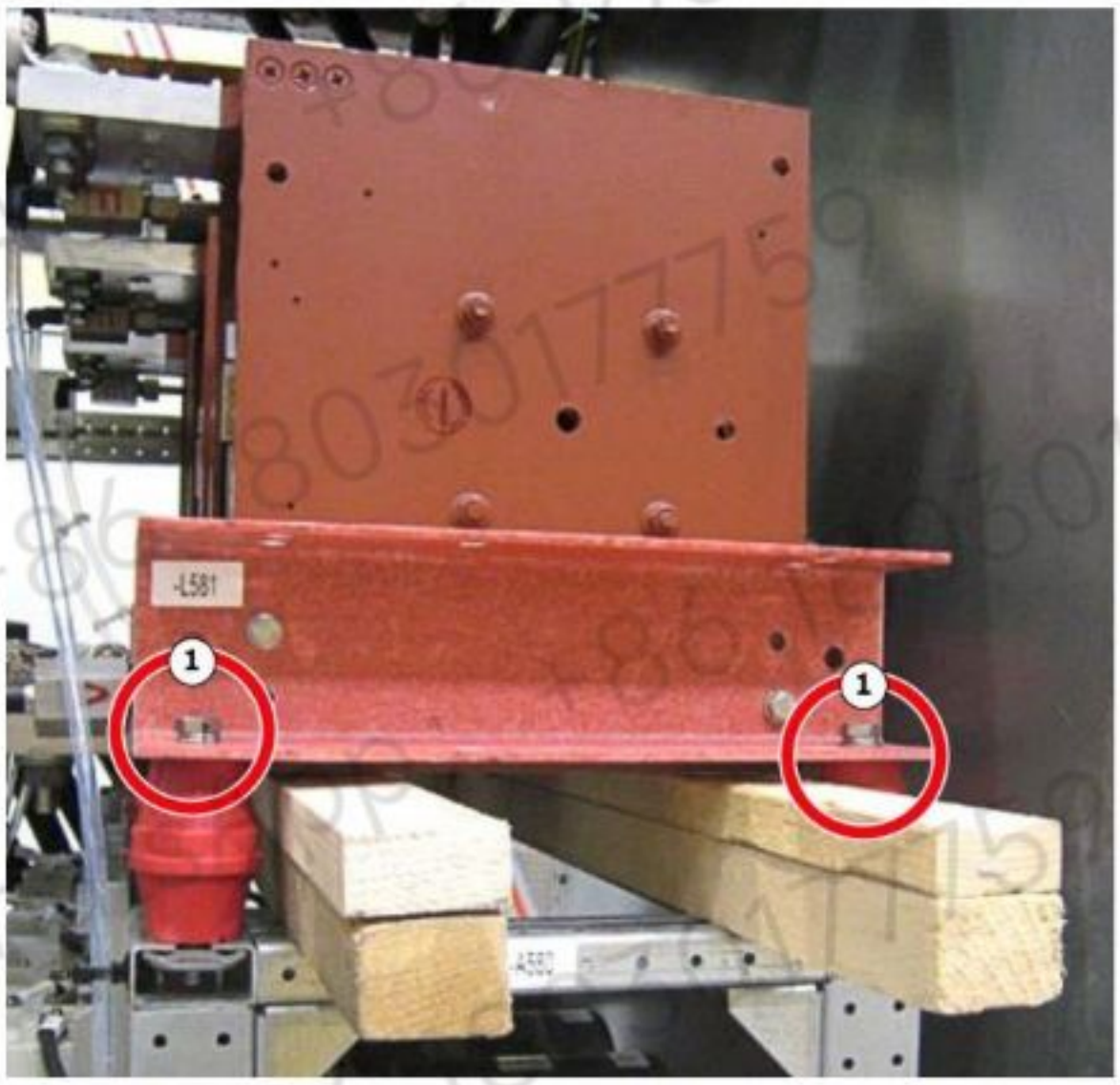


Figure 10–130 dv/dt filter reactor mounting bolts

1) Mounting bolt

5. Unbolt the 4 mounting bolts from the U-shaped profiles on the faulty reactor (see Fig. 10–130).

   NOTE – 2 screws in front and 2 screws on back of the reactor.

6. Replace the faulty dv/dt filter reactor.

7. Remove the wooden beams.

8. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.13.3. Replacing dv/dt filter resistor in GBU

Service MTTR 4 - 8 h

Figure 10–131 dv/dt filter resistors

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Empty water circuit of the cooling system according to section 10.5.2, **Emptying the cooling liquid circuit**, page 139.
3. Disconnect water pipes and cables.
4. Remove the cable ties.
5. Replace the dv/dt filter resistor.
6. Reconnect water pipes and cables.
7. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.13.4. Replacing dv/dt filter capacitor in GBU

Service MTTR 0 - 2 h

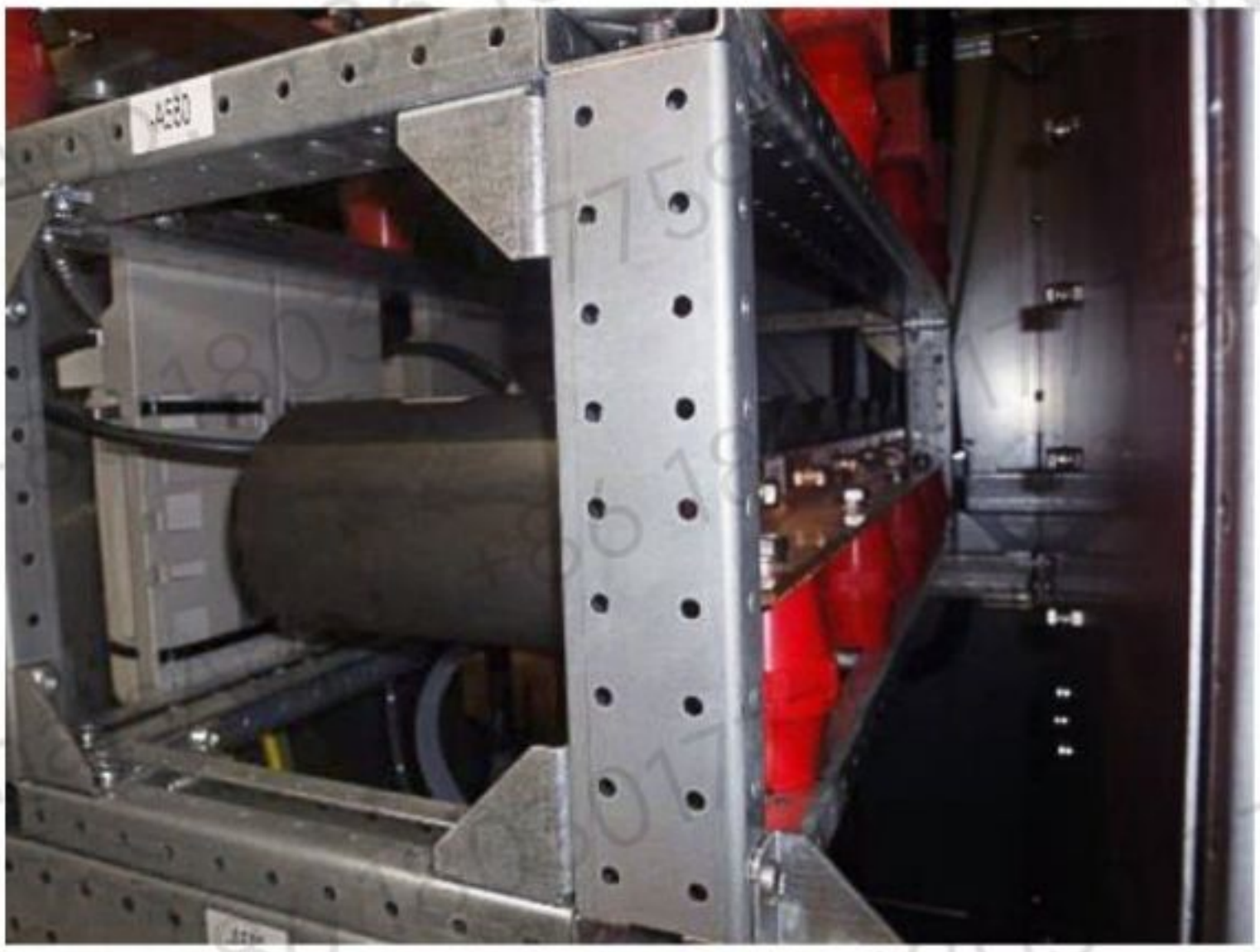


Figure 10–132 dv/dt filter capacitors

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Disconnect cables.
3. Replace dv/dt filter capacitor.

   NOTICE DO NOT exert any torque onto the capacitors! During loosening as well as fastening, the capacitor connections need to be held in place with a 23 mm flat wrench (contained in converter service toolbox). For maximum tightening torques refer to section 10.4.1, **Correct tightening torques of bolted connections**, page 135.
4. Reconnect cables.
5. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.13.5. Replacing fan of GBU fan drawer

Service MTTR 0 - 2 h

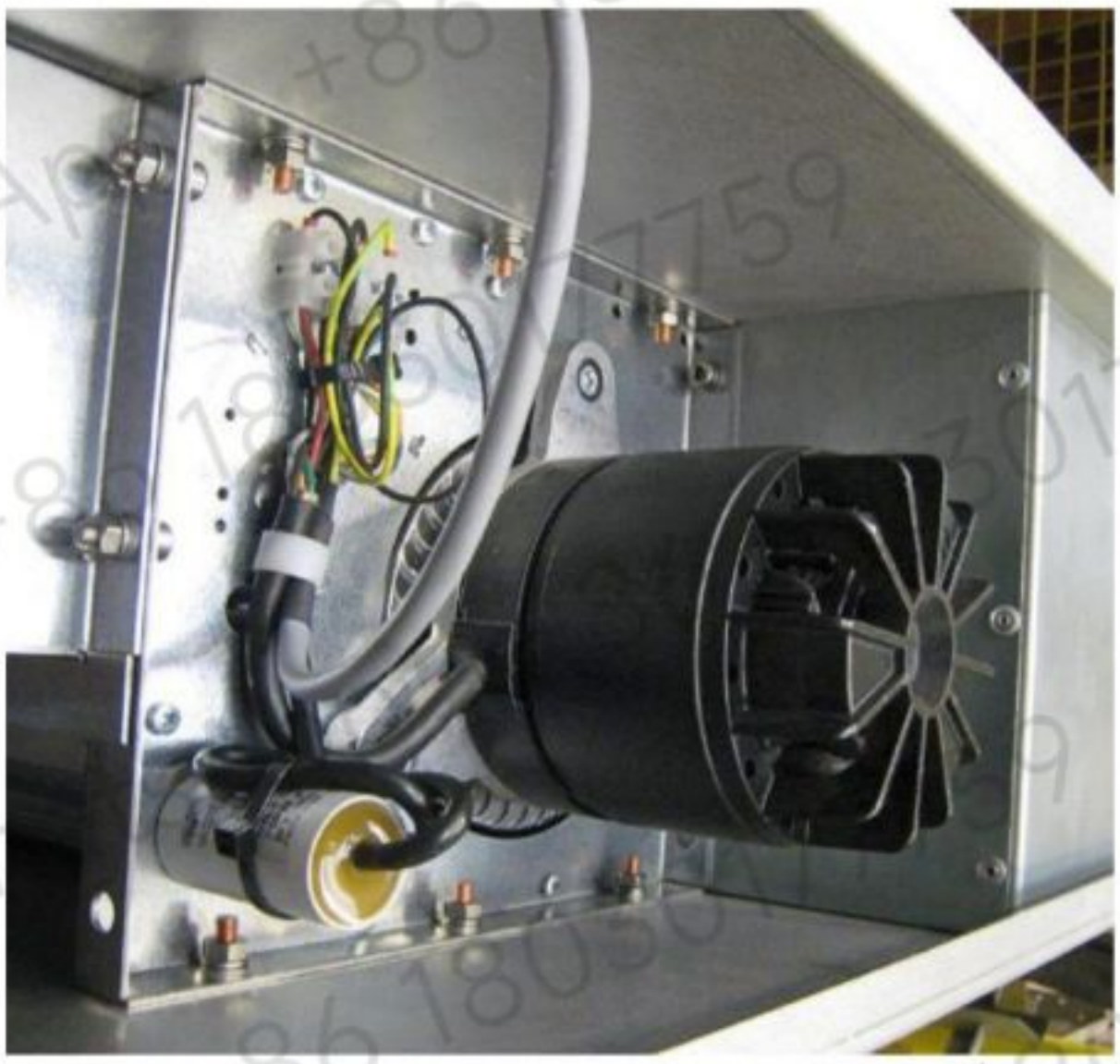


Figure 10–133 Fan of GBU fan drawer

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Disconnect the fan power supply plugs from the generator breaker (GEB).
3. Unbolt the 4 drawer mounting screws, 2 on each side (there is only a fan drawer on new design).

Figure 10–134 Drawer mounting screws

4. Unbolt the lower front beam mounting screws (one on each side) to allow the fan drawer to be pulled out.

Figure 10–135 Lower front beam mounting screws

5. Pull out and remove the fan drawer below the GEB.

Figure 10–136 Fan drawer below the GEB

Figure 10–137 Fan drawer removed.

6. Unbolt all drawer metal plates until the fan can be removed.

7. Replace fan.

8. Reassemble in reverse order.

   IMPORTANT! The explosion protection flap of the fan drawer must be open and held by the retention spring after the drawer has been reinserted.

9. If the explosion protection flap is closed:

- Insert a small item, eg, an Allen key into the hole at the bottom of the drawer.

Figure 10–138 Releasing the retaining spring (flap closed)

- Push the retaining spring down (see Fig. 10–127) so that the flap can be pushed back until it engages at the back end of the retaining spring (see Fig. 10–128).

Figure 10–139 Releasing the retaining spring (flap open)

Figure 10–140 Flap open and engaged

10. Restart the PCS6000 according to section 5.4, **Start-up after maintenance or troubleshooting**, page 70.

10.14.2. Replacing roof fan and air filter mats

Service MTTR 0 - 2 h

Figure 10–142 Roof fan

Replacing the roof fan

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Switch off corresponding MCB (see electrical circuit diagram) to interrupt the 3AC 400 V fan supply voltages.
3. Disconnect the cables from the fan.
4. Press in the plastic clip on the corner of the fan and move it out of the top of the cabinet.
5. Replace the fan unit by a new one.
6. Reconnect the cables to the fan.

Replacing the roof fan filter

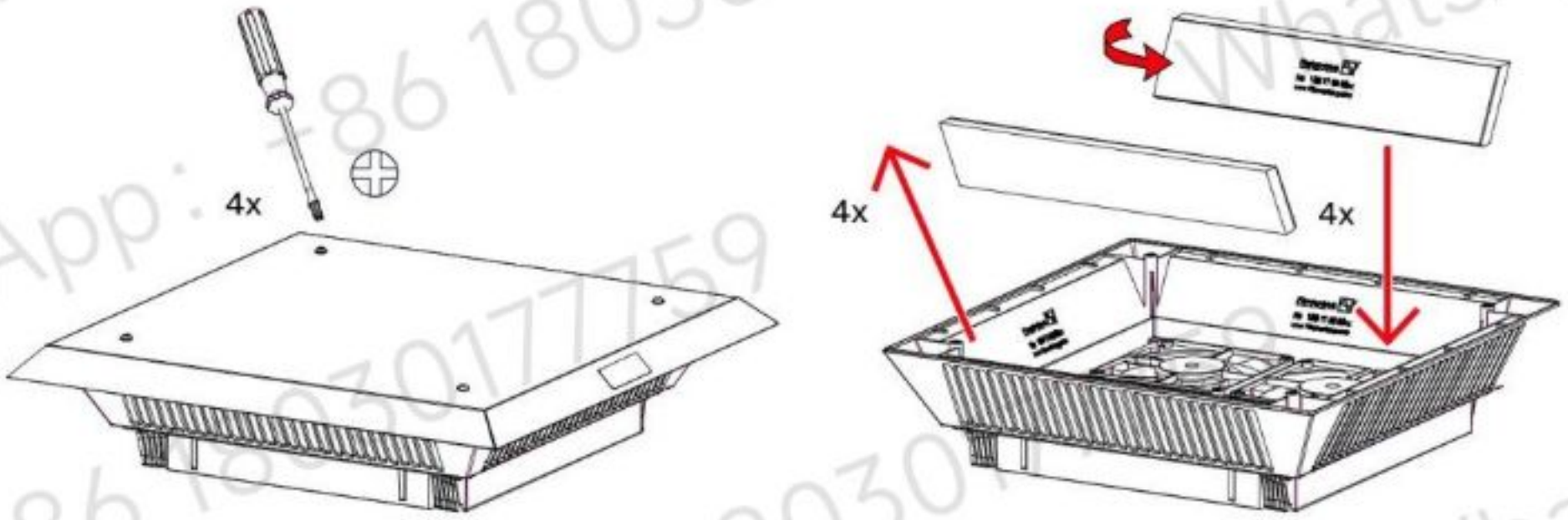


Figure 10–143 Filter fan replacement

1. Shut down the PCS6000 according to the “PCS6000 Lockout/tagout procedure”, 3BHS600000 E22.
2. Switch off corresponding MCB (see electrical circuit diagram) to interrupt the 3AC 400 V fan supply voltages.
3. Unscrew top cover.
4. Replace the 4 filter mats.

   NOTICE Make sure that the filter is installed in the correct position.
5. Reassemble the top cover.