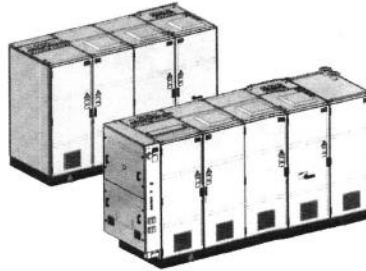


# ROUTINE TEST REPORT

GE Hal-X ITC  
PCS6000 Wind  
3BHS868401E27



## Tests Carried Out

|    |                                                  |                                     |
|----|--------------------------------------------------|-------------------------------------|
| 1  | Visual Inspection                                | <input checked="" type="checkbox"/> |
| 2  | Electrical tests                                 | <input checked="" type="checkbox"/> |
| 3  | Install PCS Service Suite on IPC                 | <input checked="" type="checkbox"/> |
| 4  | Checking Control Devices                         | <input checked="" type="checkbox"/> |
| 5  | Water circuit & pressure test                    | <input checked="" type="checkbox"/> |
| 6  | Install System in Test Bay                       | <input checked="" type="checkbox"/> |
| 7  | Checking the protective devices                  | <input checked="" type="checkbox"/> |
| 8  | Heat run test                                    | <input checked="" type="checkbox"/> |
| 9  | Checking the properties of the control equipment | <input checked="" type="checkbox"/> |
| 10 | Used Instruments for Routine Test                | <input checked="" type="checkbox"/> |
| 11 | Final Work                                       | <input checked="" type="checkbox"/> |
| 12 | Final Inspection                                 | <input checked="" type="checkbox"/> |
| 13 | Reference Documents                              | <input checked="" type="checkbox"/> |

### ABB PCS6000 Product Family

CCA1 FR-G-HX-UL

Material No.



3BHE057276R0001

Serial No.



2UFA900A96607

Checked 2020  
5384

### ABB PCS6000 Product Family

CCA2 FR-G-HX-UL

Material No.



3BHE057277R0001

Serial No.



2UFA900A96608

Checked 2020  
5384

## Confirmation

All tests described have been carried out successfully

Examiner 1 Eukasz Karpik

Examiner 2 Adam Strzypke

Place / Date Aleksandra Górecka 12020-03-12



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# 1 VISUAL INSPECTION

## 1.1 Converter Cabinet CCA1

- 1.1.1 Mechanical installation..... ☒
- 1.1.2 Electrical installation ..... ☐
- 1.1.3 Water piping..... ☐

Addition dimension check:

General tolerances for linear measures according to ISO 2768-m

General tolerances for welded constructions according to EN ISO 13920-B

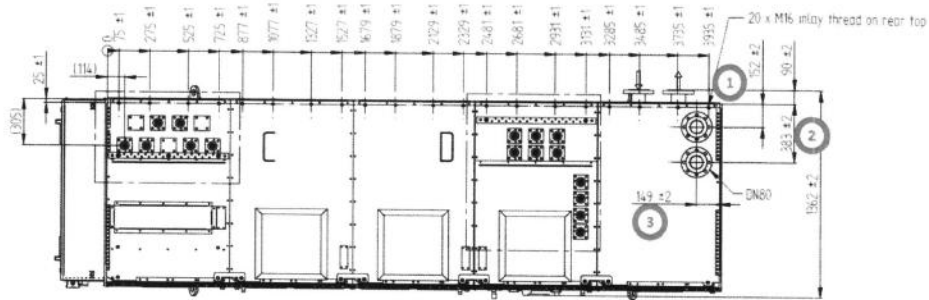


Figure 1-1: Converter Cabinet Top View

| Position | Nominal Dimension | Tolerance | Measured Dimension | OK?                                 |
|----------|-------------------|-----------|--------------------|-------------------------------------|
| 1        | 152 mm            | ±5 mm     | 151                | <input checked="" type="checkbox"/> |
| 2        | 383 mm            | ±5 mm     | 382                | <input checked="" type="checkbox"/> |
| 3        | 149 mm            | ±5 mm     | 149                | <input checked="" type="checkbox"/> |

Table 1-1 Converter Cabinet Top View

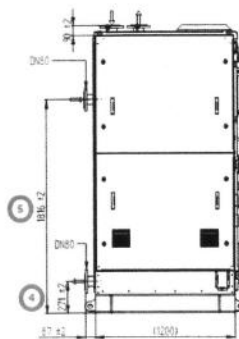


Figure 1-2: Converter Cabinet Side View

| Position | Nominal Dimension | Tolerance | Measured Dimension | OK?                                 |
|----------|-------------------|-----------|--------------------|-------------------------------------|
| 4        | 271 mm            | ±5 mm     | 273                | <input checked="" type="checkbox"/> |
| 5        | 1816 mm           | ±5 mm     | 1821               | <input checked="" type="checkbox"/> |

Table 1-2 Converter Cabinet Side View

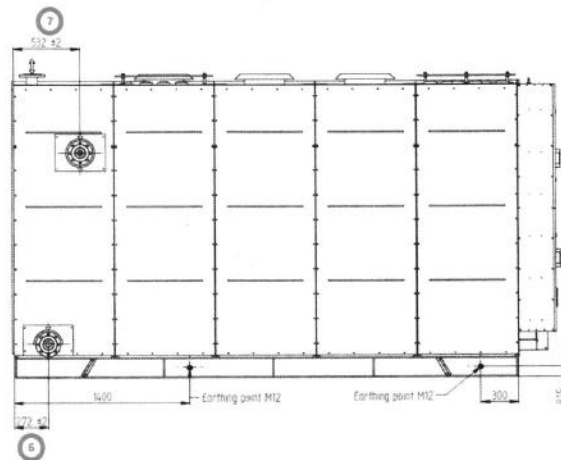


Figure 1-3: Converter Cabinet Rear View

| Position | Nominal Dimension | Tolerance | Measured Dimension | OK?                                 |
|----------|-------------------|-----------|--------------------|-------------------------------------|
| 6        | 272 mm            | ±5 mm     | 274                | <input checked="" type="checkbox"/> |
| 7        | 532 mm            | ±5 mm     | 529                | <input checked="" type="checkbox"/> |

Table 1-3 Converter Cabinet Rear View

|            |                     |               |       |           |         |
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## 1.2 Converter Cabinet CCA2

- 1.2.1 Mechanical installation..... ☒
- 1.2.2 Electrical installation ..... ☒
- 1.2.3 Water piping..... ☒

Addition dimension check:

General tolerances for linear measures according to ISO 2768-m

General tolerances for welded constructions according to EN ISO 13920-B



Figure 1-4: Converter Cabinet Side View

| Position | Nominal Dimension | Tolerance | Measured Dimension | OK?                                 |
|----------|-------------------|-----------|--------------------|-------------------------------------|
| 8        | 271 mm            | ±5 mm     | 274                | <input checked="" type="checkbox"/> |
| 9        | 1816 mm           | ±5 mm     | 1819               | <input checked="" type="checkbox"/> |

Table 1-4 Converter Cabinet Side View

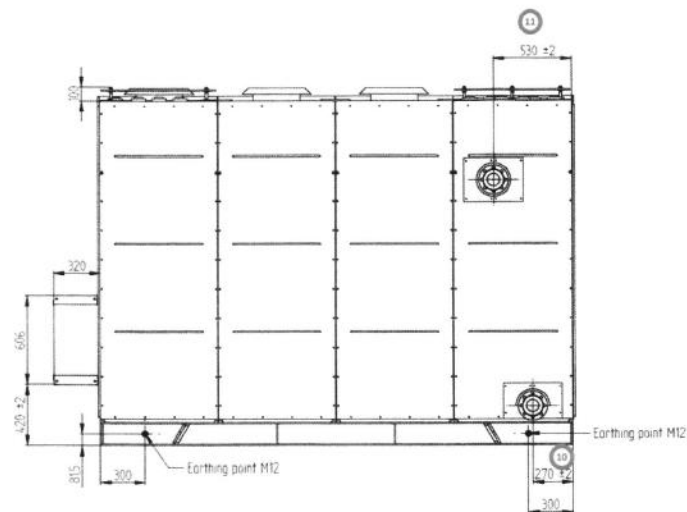


Figure 1-5: Converter Cabinet Rear View

| Position | Nominal Dimension | Tolerance | Measured Dimension | OK?                                 |
|----------|-------------------|-----------|--------------------|-------------------------------------|
| 10       | 270 mm            | ±5 mm     | 272                | <input checked="" type="checkbox"/> |
| 11       | 530 mm            | ±5 mm     | 526                | <input checked="" type="checkbox"/> |

Table 1-5 Converter Cabinet Rear View

## 2 ELECTRICAL TESTS

### 2.1 a.c. or d.c. voltage test

| Device | Circuit               | $U_{Test}$ | Range                    | Result                    | OK                                  |
|--------|-----------------------|------------|--------------------------|---------------------------|-------------------------------------|
| CCA1   | Insulation Resistance | 1.8 kV     | $R_{mes} \geq 10M\Omega$ | $R_{Test}: 31.30 M\Omega$ | <input checked="" type="checkbox"/> |
| CCA1   | Main Circuit          | 10.0 kV DC | $I_{leak} \leq 1mA$      | $I_{Test}: 0.0 mA$        | <input checked="" type="checkbox"/> |

Table 2-1 High Voltage Circuit Cabinets CCA1

| Device | Circuit               | $U_{Test}$ | Range                    | Result                    | OK                                  |
|--------|-----------------------|------------|--------------------------|---------------------------|-------------------------------------|
| CCA2   | Insulation Resistance | 1.8 kV     | $R_{mes} \geq 10M\Omega$ | $R_{Test}: 34.10 M\Omega$ | <input checked="" type="checkbox"/> |
| CCA2   | Main Circuit          | 10.0 kV DC | $I_{leak} \leq 1mA$      | $I_{Test}: 0.0 mA$        | <input checked="" type="checkbox"/> |

Table 2-2 High Voltage Circuit Cabinets CCA2

### 2.2 Protective equipotential bonding test

Fill in the highest measured resistances

| Measurement                            | Range                     | Result                        | OK                                  |
|----------------------------------------|---------------------------|-------------------------------|-------------------------------------|
| against CCU PE terminal                | $R_{mes} \leq 0.02\Omega$ | $R_{Test\_max}: 0.009 \Omega$ | <input checked="" type="checkbox"/> |
| against CCA1 base frame grounding bolt | $R_{mes} \leq 0.02\Omega$ | $R_{Test\_max}: 0.009 \Omega$ | <input checked="" type="checkbox"/> |
| against CCI PE terminal                | $R_{mes} \leq 0.02\Omega$ | $R_{Test\_max}: 0.002 \Omega$ | <input checked="" type="checkbox"/> |
| against CCA2 base frame grounding bolt | $R_{mes} \leq 0.02\Omega$ | $R_{Test\_max}: 0.006 \Omega$ | <input checked="" type="checkbox"/> |
| against BRU1 (+A50) PE terminal        | $R_{mes} \leq 0.02\Omega$ | $R_{Test\_max}: 0.006 \Omega$ | <input checked="" type="checkbox"/> |
| against BRU2 (+A51) PE terminal        | $R_{mes} \leq 0.02\Omega$ | $R_{Test\_max}: 0.006 \Omega$ | <input checked="" type="checkbox"/> |

Table 2-3 Protective Bonding Cabinets

## 2.3 Checking of Auxiliary Devices

### 2.3.1 Power Supply

Converter Control Unit (2 x 3AC400V in CCU)

| Auxiliary Voltage | Nominal Voltage   | OK                                  |
|-------------------|-------------------|-------------------------------------|
| $U_{L1} - N$      | 230VAC $\pm 10\%$ | <input checked="" type="checkbox"/> |
| $U_{L2} - N$      | 230VAC $\pm 10\%$ | <input checked="" type="checkbox"/> |
| $U_{L3} - N$      | 230VAC $\pm 10\%$ | <input checked="" type="checkbox"/> |

Table 2-4 CCU Power Supply 1

- o Clockwise phase sequence



| Auxiliary Voltage | Nominal Voltage   | OK                                  |
|-------------------|-------------------|-------------------------------------|
| $U_{L1} - N$      | 230VAC $\pm 10\%$ | <input checked="" type="checkbox"/> |
| $U_{L2} - N$      | 230VAC $\pm 10\%$ | <input checked="" type="checkbox"/> |
| $U_{L3} - N$      | 230VAC $\pm 10\%$ | <input checked="" type="checkbox"/> |

Table 2-5 CCU Power Supply 2

- o Clockwise phase sequence



- -Q301 and -Q304 closed

- o GBM springs charged



- -Q305 closed

- o Check FI at terminal -X314 (FI -Q305)  $t_{off, max} \leq 300 \text{ ms}$ ,  $t_{test}$  <sup>30</sup>..... ms



- -Q303 closed, -P301 to maximum and -P302 to minimum

- o K301 closes properly



- -Q306 closed

- o CCU S800 Cluster red LED is on



- o PEC and COMBI I/O red LED are on



- o Voltage in auxiliary supply socket -X992 is ok



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### 3 INSTALL PCS SERVICE SUITE ON IPC

#### 3.1 Install Procedure

3.1.1 Check BIOS version ..... ☒

| Project Version |
|-----------------|
| ABBV1x64        |

Table 3-1 PCS Service Suite Image

3.1.2 Transfer PCS Service Suite image to IPC ..... ☒

| Version  | Location                                    |
|----------|---------------------------------------------|
| v 8.43.9 | \\IP_ADDRESS_OR_HOSTNAME\IPC-DPL\FROM_STICK |

Table 3-2 PCS Service Suite Image

#### 3.2 Test & Configure PCS Service Suite Installation

3.2.1 Check if connection to AC 800PEC exists ..... ☐

3.2.2 Check Power Fail functionality ..... ☒

## 4 CHECKING CONTROL DEVICES

### 4.1 Control SW Download

- Software Download to PEC completed ☒

| Test Station SW | Software Version |
|-----------------|------------------|
| SL              | v 4.6.0.0        |
| CB              | v 4.6.0.3        |

Table 4-1 Software Version

### 4.2 Power Supply

- Close -Q307
- Measure 400VAC in each ASM

| Auxiliary Voltage | Nominal Voltage   | OK                                  |
|-------------------|-------------------|-------------------------------------|
| $U_{L1} - N$      | 230VAC $\pm 10\%$ | <input checked="" type="checkbox"/> |
| $U_{L2} - N$      | 230VAC $\pm 10\%$ | <input checked="" type="checkbox"/> |
| $U_{L3} - N$      | 230VAC $\pm 10\%$ | <input checked="" type="checkbox"/> |

Table 4-2 ASM Power Supply

- Clockwise phase sequence ☒
- Close -Q401
- Measure 24VDC in each ASM ☒

| Auxiliary Voltage | Nominal Voltage  | Measured Voltage | OK                                  |
|-------------------|------------------|------------------|-------------------------------------|
| ASM +A22          | 24VDC $\pm 0.2V$ | U: 24.0... V     | <input checked="" type="checkbox"/> |
| ASM +A23          | 24VDC $\pm 0.2V$ | U: 24.0... V     | <input checked="" type="checkbox"/> |
| ASM +A26          | 24VDC $\pm 0.2V$ | U: 24.0... V     | <input checked="" type="checkbox"/> |
| ASM +A27          | 24VDC $\pm 0.2V$ | U: 24.0... V     | <input checked="" type="checkbox"/> |

Table 4-3 ASM Power Supply 1

- All stacks are up (green & yellow LED are on) ☒
- PECINTMs no red LED is on ☒

- Force fans and heaters

- +A40 Converter Control Unit

+A40 Rotation direction fan ok ☒

+A40 Current consumption fan & heater:  $I_{max} \leq 3.5 A$   $I_{test}: 3.20 A$  ☒

- +A22 Power Unit

+A22 Rotation direction roof fan ok ☒

+A22 Consumption roof fan:  $I_{max} \leq 0.80 A$   $I_{test}: 0.60 A$  ☒

|            |                     |               |       |           |         |
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- +A23 Power Unit
  - +A23 Rotation direction roof fan ok ☒
  - +A23 Consumption roof fan:  $I_{max} \leq 0,80A$   $I_{test}: 0,60 A$  ☒
- +A24 DC Link Unit
  - +A24 Rotation direction roof fan ok ☒
  - +A24 Consumption roof fan:  $I_{max} \leq 0,80A$   $I_{test}: 0,60 A$  ☒
- +A26 Power Unit
  - +A26 Rotation direction roof fan ok ☒
  - +A26 Consumption roof fan:  $I_{max} \leq 0,80A$   $I_{test}: 0,60 A$  ☒
- +A27 Power Unit
  - +A27 Rotation direction roof fan ok ☒
  - +A27 Consumption roof fan:  $I_{max} \leq 0,80A$   $I_{test}: 0,60 A$  ☒
- +A28 DC Link Unit
  - +A28 Rotation direction roof fan ok ☒
  - +A28 Consumption roof fan:  $I_{max} \leq 0,80A$   $I_{test}: 0,60 A$  ☒

- LEM power supply  $\pm 24VDC$

| Field | Device | Nominal Voltage      | Meas pos Voltage | Meas neg Voltage | OK                                  |
|-------|--------|----------------------|------------------|------------------|-------------------------------------|
| +A22  | -U703  | $\pm 24VDC \pm 0.2V$ | U: 24,0... V     | U: -24,1... V    | <input checked="" type="checkbox"/> |
| +A22  | -U704  | $\pm 24VDC \pm 0.2V$ | U: 24,0... V     | U: -24,1... V    | <input checked="" type="checkbox"/> |
| +A22  | -U705  | $\pm 24VDC \pm 0.2V$ | U: 24,0... V     | U: -24,1... V    | <input checked="" type="checkbox"/> |
| +A23  | -U703  | $\pm 24VDC \pm 0.2V$ | U: 24,0... V     | U: -24,0... V    | <input checked="" type="checkbox"/> |
| +A23  | -U704  | $\pm 24VDC \pm 0.2V$ | U: 24,0... V     | U: -24,0... V    | <input checked="" type="checkbox"/> |
| +A23  | -U705  | $\pm 24VDC \pm 0.2V$ | U: 24,0... V     | U: -24,0... V    | <input checked="" type="checkbox"/> |
| +A26  | -U703  | $\pm 24VDC \pm 0.2V$ | U: 24,0... V     | U: -24,1... V    | <input checked="" type="checkbox"/> |
| +A26  | -U704  | $\pm 24VDC \pm 0.2V$ | U: 24,0... V     | U: -24,1... V    | <input checked="" type="checkbox"/> |
| +A26  | -U705  | $\pm 24VDC \pm 0.2V$ | U: 24,0... V     | U: -24,1... V    | <input checked="" type="checkbox"/> |
| +A27  | -U703  | $\pm 24VDC \pm 0.2V$ | U: 24,0... V     | U: -24,1... V    | <input checked="" type="checkbox"/> |
| +A27  | -U704  | $\pm 24VDC \pm 0.2V$ | U: 24,0... V     | U: -24,1... V    | <input checked="" type="checkbox"/> |
| +A27  | -U705  | $\pm 24VDC \pm 0.2V$ | U: 24,0... V     | U: -24,1... V    | <input checked="" type="checkbox"/> |

Table 4-4 LEM Voltage

### 4.3 Analog Interface

#### 4.3.1 HVD Boards

- HVD Board +A22 Power Unit (2500VDC)

| Signal              | Nominal Voltage | Measured Voltage               | OK                                  |
|---------------------|-----------------|--------------------------------|-------------------------------------|
| U <sub>DC+/NP</sub> | 2500VDC ±50V    | U <sub>DC+/NP</sub> : 2505 VDC | <input checked="" type="checkbox"/> |
| U <sub>NP/DC-</sub> | 2500VDC ±50V    | U <sub>NP/DC-</sub> : 2530 VDC | <input checked="" type="checkbox"/> |

Table 4-5 HVD Board DC Voltage

- HVD Board +A23 Power Unit (3300VAC)

| Signal            | Nominal Voltage | Meas 1 (R-S)                | Meas 1 (S-T)                | Meas 1 (T-R)                | OK                                  |
|-------------------|-----------------|-----------------------------|-----------------------------|-----------------------------|-------------------------------------|
| U <sub>R/PE</sub> | 3300VAC ±50V    | U <sub>RS</sub> : 3.32 kVAC | U <sub>ST</sub> : 0.00 kVAC | U <sub>TR</sub> : 3.32 kVAC | <input checked="" type="checkbox"/> |
| U <sub>S/PE</sub> | 3300VAC ±50V    | U <sub>RS</sub> : 3.31 kVAC | U <sub>ST</sub> : 3.31 kVAC | U <sub>TR</sub> : 0.00 kVAC | <input checked="" type="checkbox"/> |
| U <sub>T/PE</sub> | 3300VAC ±50V    | U <sub>RS</sub> : 0.00 kVAC | U <sub>ST</sub> : 3.33 kVAC | U <sub>TR</sub> : 3.33 kVAC | <input checked="" type="checkbox"/> |

Table 4-6 HVD Board AC Voltage

- HVD Board +A26 Power Unit (2500VDC)

| Signal              | Nominal Voltage | Measured Voltage               | OK                                  |
|---------------------|-----------------|--------------------------------|-------------------------------------|
| U <sub>DC+/NP</sub> | 2500VDC ±50V    | U <sub>DC+/NP</sub> : 2540 VDC | <input checked="" type="checkbox"/> |
| U <sub>NP/DC-</sub> | 2500VDC ±50V    | U <sub>NP/DC-</sub> : 2531 VDC | <input checked="" type="checkbox"/> |

Table 4-7 HVD Board DC Voltage

- HVD Board +A27 Power Unit (3300VAC)

| Signal            | Nominal Voltage | Meas 1 (R-S)                | Meas 1 (S-T)                | Meas 1 (T-R)                | OK                                  |
|-------------------|-----------------|-----------------------------|-----------------------------|-----------------------------|-------------------------------------|
| U <sub>R/PE</sub> | 3300VAC ±50V    | U <sub>RS</sub> : 3.32 kVAC | U <sub>ST</sub> : 0.00 kVAC | U <sub>TR</sub> : 3.32 kVAC | <input checked="" type="checkbox"/> |
| U <sub>S/PE</sub> | 3300VAC ±50V    | U <sub>RS</sub> : 3.33 kVAC | U <sub>ST</sub> : 3.33 kVAC | U <sub>TR</sub> : 0.00 kVAC | <input checked="" type="checkbox"/> |
| U <sub>T/PE</sub> | 3300VAC ±50V    | U <sub>RS</sub> : 0.00 kVAC | U <sub>ST</sub> : 3.33 kVAC | U <sub>TR</sub> : 3.33 kVAC | <input checked="" type="checkbox"/> |

Table 4-8 HVD Board AC Voltage

#### 4.3.2 LEM

- Feed 40A

| Field | Device | Nominal Current | Allowed Value | Meas Voltage | OK                                  |
|-------|--------|-----------------|---------------|--------------|-------------------------------------|
| +A22  | -U703  | 40A             | ±3%           | I: 40 A      | <input checked="" type="checkbox"/> |
| +A22  | -U704  | 40A             | ±3%           | I: 38 A      | <input checked="" type="checkbox"/> |
| +A22  | -U705  | 40A             | ±3%           | I: 39 A      | <input checked="" type="checkbox"/> |
| +A23  | -U703  | 40A             | ±3%           | I: 39 A      | <input checked="" type="checkbox"/> |
| +A23  | -U704  | 40A             | ±3%           | I: 41 A      | <input checked="" type="checkbox"/> |
| +A23  | -U705  | 40A             | ±3%           | I: 40 A      | <input checked="" type="checkbox"/> |
| +A26  | -U703  | 40A             | ±3%           | I: 41 A      | <input checked="" type="checkbox"/> |
| +A26  | -U704  | 40A             | ±3%           | I: 41 A      | <input checked="" type="checkbox"/> |
| +A26  | -U705  | 40A             | ±3%           | I: 39 A      | <input checked="" type="checkbox"/> |
| +A27  | -U703  | 40A             | ±3%           | I: 41 A      | <input checked="" type="checkbox"/> |
| +A27  | -U704  | 40A             | ±3%           | I: 39 A      | <input checked="" type="checkbox"/> |
| +A27  | -U705  | 40A             | ±3%           | I: 40 A      | <input checked="" type="checkbox"/> |

Table 4-9 LEM Current

#### 4.4 Control Signals

##### 4.4.1 Key Switch

- S301 ON/OFF Designation & signal ok



##### 4.4.2 Emergency OFF

- Internal -S302 Designation & signal ok
- Internal -S302 unlocked: measure contact at  
-X950: 27/28, 31/32 & 33/34  
contacts are short circuit
- Internal -S302 locked (pushed): measure contact at  
-X950: 27/28, 31/32 & 33/34  
contacts are open



##### 4.4.3 Signal lamp

- -H301 Color red & signal ok
- -H302 Color red & signal ok
- -H303 Color yellow & signal ok
- -H304 Color yellow & signal ok
- -S305 Color green & signal ok
- -S306 Color white & signal ok



##### 4.4.4 Door Interlock

- Release doors in Software
  - o Function & feedback
- Lock doors in Software
  - o Function & feedback



##### 4.4.5 Primary Grid Breaker

- o Function & feedback



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#### 4.4.6 Secondary Grid Breaker

The entire test must be executed for both grid breakers (CCA1 & CCA2)

| Condition                                                                                                                               | Yes                                 | No                       | Remark: |
|-----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|--------------------------|---------|
| Converter not in LoTo state, CCU key in ON position.<br>All Unit doors are closed and the converter grounding Isolator is open.         | <input checked="" type="checkbox"/> | <input type="checkbox"/> |         |
| The configuration plug -X911 / -X921 are set correctly, according to "Electrical circuit diagram"                                       | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 48VDC   |
| No trips                                                                                                                                | <input checked="" type="checkbox"/> | <input type="checkbox"/> |         |
| GRB is ready                                                                                                                            | <input checked="" type="checkbox"/> | <input type="checkbox"/> |         |
| Operate disconnector by output command in force mode and check the position indication in the HMI.                                      |                                     |                          |         |
| Disconnector is in close position                                                                                                       | <input checked="" type="checkbox"/> | <input type="checkbox"/> |         |
| Disconnector is in GND position                                                                                                         | <input checked="" type="checkbox"/> | <input type="checkbox"/> |         |
| Disconnector is in open position                                                                                                        | <input checked="" type="checkbox"/> | <input type="checkbox"/> |         |
| Operate GRB by output command in force mode and check corresponding position displayed in HMI.<br>Disconnector is open (test position). |                                     |                          |         |
| GRB is in open position                                                                                                                 | <input checked="" type="checkbox"/> | <input type="checkbox"/> |         |
| Activate "Force interlock"                                                                                                              |                                     |                          |         |
| Close GRB                                                                                                                               |                                     |                          |         |
| GRB is closed and display in HMI is correct.                                                                                            | <input checked="" type="checkbox"/> | <input type="checkbox"/> |         |
| Open GRB                                                                                                                                |                                     |                          |         |
| GRB is open and display in HMI is correct.                                                                                              | <input checked="" type="checkbox"/> | <input type="checkbox"/> |         |
| GRB Disconnector is in grounded position                                                                                                | <input checked="" type="checkbox"/> | <input type="checkbox"/> |         |
| GRB is closed                                                                                                                           | <input checked="" type="checkbox"/> | <input type="checkbox"/> |         |
| It must <b>not</b> be possible to open the GRB via the HMI                                                                              | <input checked="" type="checkbox"/> | <input type="checkbox"/> |         |
| Open GRB and set GRB Disconnector back to test position                                                                                 | <input checked="" type="checkbox"/> | <input type="checkbox"/> |         |



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**Check of all different GRB1 opening command paths**

| Test of E-STOP from External                                                                             | Yes                                 | No                       | Remark: |
|----------------------------------------------------------------------------------------------------------|-------------------------------------|--------------------------|---------|
| Test of E-Stop from Ext. only applies if customer open command -X910:29:30 is connected.                 |                                     |                          |         |
| X910:29:30 is connected                                                                                  | <input checked="" type="checkbox"/> | <input type="checkbox"/> |         |
| Disconnect -X910:21 converter side (Off1 cmd)                                                            |                                     |                          |         |
| Remove relay -K317 from the base (Off2 cmd)                                                              |                                     |                          |         |
| close GRB via the HMI                                                                                    |                                     |                          |         |
| If the External contact gets closed, the GRB opens immediately                                           | <input checked="" type="checkbox"/> | <input type="checkbox"/> |         |
| Test of OFF 1                                                                                            | Yes                                 | No                       | Remark: |
| Connect -X910:21 converter side (Off1 cmd)                                                               |                                     |                          |         |
| Remove relay -K317 from the base (Off2 cmd)                                                              |                                     |                          |         |
| Disconnect -X910:29 converter side (Ext. Off)                                                            |                                     |                          |         |
| close GRB via the HMI                                                                                    |                                     |                          |         |
| If the Local Emergency Button on the cabinet +A40 is pushed, the GRB opens immediately                   | <input checked="" type="checkbox"/> | <input type="checkbox"/> |         |
| Test of OFF 2                                                                                            | Yes                                 | No                       | Remark: |
| Disconnect-X910:21 converter side (Off1 cmd)                                                             |                                     |                          |         |
| Insert relay -K317 from the base (Off2 cmd)                                                              |                                     |                          |         |
| Disconnect -X910:29 converter side (Ext. Off)                                                            |                                     |                          |         |
| close GRB via the HMI                                                                                    |                                     |                          |         |
| If the Local Emergency Button on the cabinet +A40 is pushed, the GRB opens immediately                   | <input checked="" type="checkbox"/> | <input type="checkbox"/> |         |
| Test of Undervoltage                                                                                     | Yes                                 | No                       | Remark: |
| Close the GRB, then disconnect -X910:27 internal.(supervision relay +48 VDC) → GRB must open immediately | <input checked="" type="checkbox"/> | <input type="checkbox"/> |         |
| After successful test, all wires are connected again properly and relay inserted                         | <input checked="" type="checkbox"/> | <input type="checkbox"/> |         |
| Contact blocks of emergency button                                                                       | Yes                                 | No                       | Remark: |
| The contact blocks of the Local Emergency Button +A40 are properly fixed                                 | <input checked="" type="checkbox"/> | <input type="checkbox"/> |         |



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Check of all different GRB2 opening command paths

| Test of E-STOP from External                                                                             | Yes                                 | No                       | Remark:        |
|----------------------------------------------------------------------------------------------------------|-------------------------------------|--------------------------|----------------|
| Test of E-Stop from Ext. only applies if customer open command -X920:29:30 is connected.                 |                                     |                          |                |
| X920:29:30 is connected                                                                                  | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                |
| Disconnect -X920:21 converter side (Off1 cmd)                                                            |                                     |                          |                |
| Remove relay -K318 from the base (Off2 cmd)                                                              |                                     |                          |                |
| close GRB via the HMI                                                                                    |                                     |                          |                |
| If the External contact gets closed, the GRB opens immediately                                           | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                |
| <b>Test of OFF 1</b>                                                                                     | <b>Yes</b>                          | <b>No</b>                | <b>Remark:</b> |
| Connect -X920:21 converter side (Off1 cmd)                                                               |                                     |                          |                |
| Remove relay -K318 from the base (Off2 cmd)                                                              |                                     |                          |                |
| Disconnect -X920:29 converter side (Ext. Off)                                                            |                                     |                          |                |
| close GRB via the HMI                                                                                    |                                     |                          |                |
| If the Local Emergency Button on the cabinet +A40 is pushed, the GRB opens immediately                   | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                |
| <b>Test of OFF 2</b>                                                                                     | <b>Yes</b>                          | <b>No</b>                | <b>Remark:</b> |
| Disconnect-X920:21 converter side (Off1 cmd)                                                             |                                     |                          |                |
| Insert relay -K318 from the base (Off2 cmd)                                                              |                                     |                          |                |
| Disconnect -X920:29 converter side (Ext. Off)                                                            |                                     |                          |                |
| close GRB via the HMI                                                                                    |                                     |                          |                |
| If the Local Emergency Button on the cabinet +A40 is pushed, the GRB opens immediately                   | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                |
| <b>Test of Undervoltage</b>                                                                              | <b>Yes</b>                          | <b>No</b>                | <b>Remark:</b> |
| Close the GRB, then disconnect -X920:27 internal.(supervision relay +48 VDC) → GRB must open immediately | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                |
| After successful test, all wires are connected again properly and relay inserted                         | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                |
| <b>Contact blocks of emergency button</b>                                                                | <b>Yes</b>                          | <b>No</b>                | <b>Remark:</b> |
| The contact blocks of the Local Emergency Button +A40 are properly fixed                                 | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                |

#### 4.4.7 Generator Disconnecter

- Check Generator Disconnecter -A550 function OPEN / CLOSE / EARTHED with Software
- Check Disconnecter Switch -A550 feedbacks

| Location         | Position | Feedback | OK                                  |
|------------------|----------|----------|-------------------------------------|
| +A24 DLU74 GDM81 | CLOSED   | CLOSED   | <input checked="" type="checkbox"/> |
| +A24 DLU74 GDM81 | OPEN     | OPEN     | <input checked="" type="checkbox"/> |
| +A24 DLU74 GDM81 | EARTHED  | EARTHED  | <input checked="" type="checkbox"/> |

Table 4-10 Disconnecter Signals CCA1

When GDM is GROUNDED, Force door lock OPEN and open DLU +A24 door.

- o Confirm 24 V<sub>DC</sub> between -XS551:3 and :4 ☒

Lock LG1. Confirm that key G1 is removeable

- o Confirm no voltage between -XS551:3 and :4 ☒
- o Confirm software signal that GDM is deenergised ☒

Unlock LG1. Close DLU +A24 door.

| Location         | Position | Feedback | OK                                  |
|------------------|----------|----------|-------------------------------------|
| +A28 DLU75 GDM81 | CLOSED   | CLOSED   | <input checked="" type="checkbox"/> |
| +A28 DLU75 GDM81 | OPEN     | OPEN     | <input checked="" type="checkbox"/> |
| +A28 DLU75 GDM81 | EARTHED  | EARTHED  | <input checked="" type="checkbox"/> |

Table 4-11 Disconnecter Signals CCA2

When GDM is GROUNDED, Force door lock OPEN and open DLU +A28 door.

- o Confirm 24 V<sub>DC</sub> between -XS551:3 and :4 ☒

Lock LG2. Confirm that key G2 is removeable

- o Confirm no voltage between -XS551:3 and :4 ☒
- o Confirm software signal that GDM is deenergised ☒

Unlock LG2. Close DLU +A28 door.

#### 4.4.8 Lockout/Tagout functionality

Establish start conditions:

- GDMs in CLOSED position
- GBM breakers OPEN, disconnectors CLOSED
- Key switch on CCU ON
- Set key exchanger X1 so that key T is removeable
- All converter doors closed
- Release all forced signals

|            |                     |                                      |       |           |         |
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| Lockout/Tagout functionality test                                                                                                                                                  | Yes                                 | No                       | Remark:           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|--------------------------|-------------------|
| Set key switch on CCU to OFF. Force "Rotor locked" signal. LED "Generator side voltage free" turns ON.                                                                             | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                   |
| Push button "Generator side voltage free". Both GDMs move to GROUNDED position.                                                                                                    | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                   |
| LED "Generator grounded" turns ON when both GDMs are in GROUNDED position.                                                                                                         | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                   |
| Lock GDMs with locks LG1 and LG2. Confirm that keys G1 and G2 are removeable.                                                                                                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                   |
| Unlock GDMs with locks LG1 and LG2. Confirm that keys R1 and R2 are removeable.                                                                                                    | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                   |
| Push button "Generator grounded". LED "Generator grounded" turns OFF. Both GDMs move to CLOSED position.                                                                           | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                   |
| Release "Rotor locked" signal. LED "Generator side voltage free" turns OFF.                                                                                                        | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                   |
| Remove keys 10 and 20 from key exchanger X1 in CCU. Both GBM disconnectors move to GROUNDED positions and both breakers close.                                                     | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                   |
| Force "Rotor braked" signal. Both GDMs move to OPEN position.                                                                                                                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                   |
| Release "Rotor braked" signal. Both GBU doors are released when both GDMs are OPEN.                                                                                                | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                   |
| Force both GBM breakers to OPEN. Force both GBM breakers to CLOSED. Confirm that both breakers are operational.                                                                    | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                   |
| Open GBU doors. Insert key 10 into key exchanger X10 inside GBU +A21. Remove key 11. Insert key 20 into key exchanger X20 inside GBU +A24. Remove key 21.                          | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                   |
| Force both GBM breakers to OPEN. Confirm that both breakers are not operational.                                                                                                   | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                   |
| Insert key 11 into key exchanger X11 on DLU +A24. Release key 12. Insert key 21 into key exchanger X21 on DLU +A28. Release key 22. Confirm that LED "Isolator released" turns ON. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                   |
| Confirm software signals that GDMs are deenergised.                                                                                                                                | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                   |
| Confirm both DC-Link grounding isolators are locked in OPEN position                                                                                                               | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                   |
| Insert key 12 into lock L10. Unlock and close DC-Link grounding isolator. Check signalization OPEN / CLOSE -Q801 in Software.                                                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                   |
| Insert key 22 into lock L20. Unlock and close DC-Link grounding isolator. Check signalization OPEN / CLOSE -Q802 in Software.                                                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                   |
| Lock L11. Confirm that key C1 is removeable and grounding isolator is locked in GROUNDED position.                                                                                 | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                   |
| Lock L21. Confirm that key C2 is removeable and grounding isolator is locked in GROUNDED position.                                                                                 | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                   |
| All POU and DLU doors are released.                                                                                                                                                | <input checked="" type="checkbox"/> | <input type="checkbox"/> | JITH TEST MODE ON |
| Open DLU doors and confirm no voltage between -XS551:3 and :4                                                                                                                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                   |
| Disconnect the locking coil -Q801, A2 in +A24. Confirm that the locking bolt moves freely through the hole without touching the housing. Reconnect the locking coil                | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                   |
| Disconnect the locking coil -Q802, A2 in +A28. Confirm that the locking bolt moves freely through the hole without touching the housing. Reconnect the locking coil                | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                   |
| Close DLU doors. Unlock DC-Link grounding isolator on DLU +A24, open and lock it with L10. Remove key 12 and insert it into key exchanger X11 Release key 11.                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> |                   |

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|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|--------------------------|--|
| Unlock DC-Link grounding isolator on DLU +A28, open and lock it with L20. Remove key 22 and insert it into key exchanger X21<br>Release key 21.                           | <input checked="" type="checkbox"/> | <input type="checkbox"/> |  |
| All POU and DLU doors are locked.                                                                                                                                         | <input checked="" type="checkbox"/> | <input type="checkbox"/> |  |
| Insert key 11 into key exchanger X10 and release key 10. Close GBU door.                                                                                                  | <input checked="" type="checkbox"/> | <input type="checkbox"/> |  |
| Insert key 21 into key exchanger X20 and release key 20. Close GBU door.                                                                                                  | <input checked="" type="checkbox"/> | <input type="checkbox"/> |  |
| Insert keys 10 and 20 into key exchanger X1. Set key exchanger X1 so that key T is removeable. Both GBM breakers open and both GBM disconnectors move to CLOSED position. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |  |
| Both GBU doors are locked.                                                                                                                                                | <input checked="" type="checkbox"/> | <input type="checkbox"/> |  |
| Force "Rotor braked" signal. Both GDMs move to CLOSED position.                                                                                                           | <input checked="" type="checkbox"/> | <input type="checkbox"/> |  |
| Release "Rotor braked" signal. Set key switch on CCU to ON.<br>Confirm software signal that LoTo sequence is finished                                                     | <input checked="" type="checkbox"/> | <input type="checkbox"/> |  |

#### 4.4.9 Temperature sensors

- Check PT100 temperature measurements

| Location               | SW Meas    | Ref Meas   | Allowed Difference | OK                                  |
|------------------------|------------|------------|--------------------|-------------------------------------|
| CCU temperature        | 28.4... °C | 27.1... °C | ±8°C               | <input checked="" type="checkbox"/> |
| CCU ambient            | 23.0... °C | 24.1... °C | ±8°C               | <input checked="" type="checkbox"/> |
| DLU temperature (CCA1) | 26.2... °C | 24.9... °C | ±8°C               | <input checked="" type="checkbox"/> |
| DLU temperature (CCA2) | 26.9... °C | 25.4... °C | ±8°C               | <input checked="" type="checkbox"/> |

Table 4-12 Temperature Values

<sup>1</sup>when using a Fluke 87V with 80 BK thermocouple

#### 4.5 Pulse Pattern

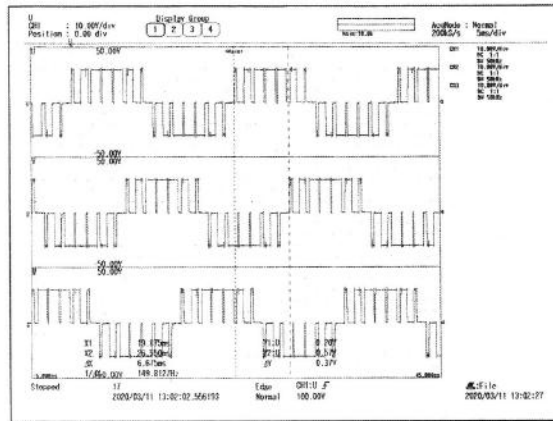


Figure 4-1: Pulse pattern grid side converter (GRI) in CCA1

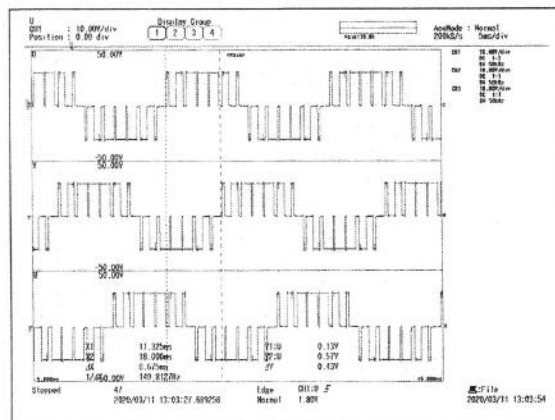


Figure 4-2: Pulse pattern generator side converter (GEC) in CCA1

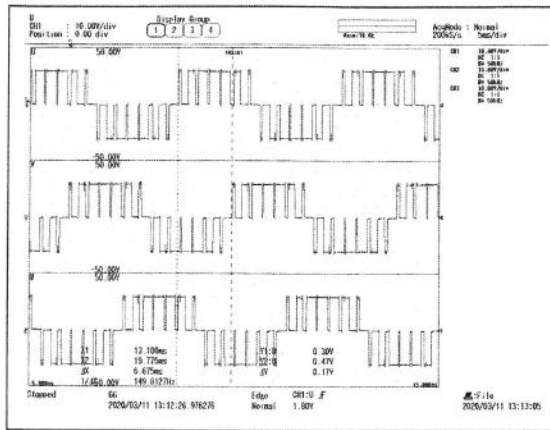


Figure 4-3: Pulse pattern grid side converter (GRI) in CCA2

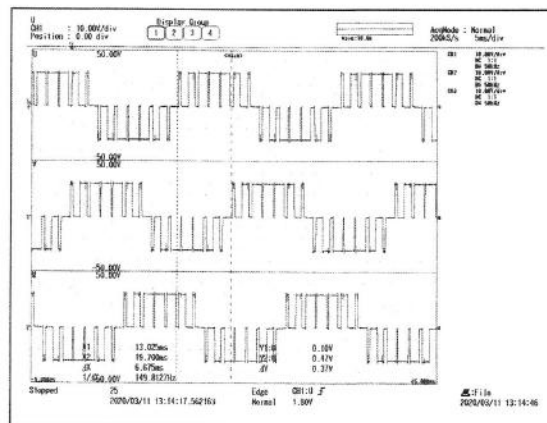


Figure 4-4: Pulse pattern generator side converter (GEC) in CCA2

- Pulse pattern grid side converter (GRI) in CCA1
- Pulse pattern generator side converter (GEC) in CCA1
- Pulse pattern grid side converter (GRI) in CCA2
- Pulse pattern generator side converter (GEC) in CCA2

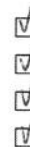


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#### 4.6 DC Link discharging with VLM

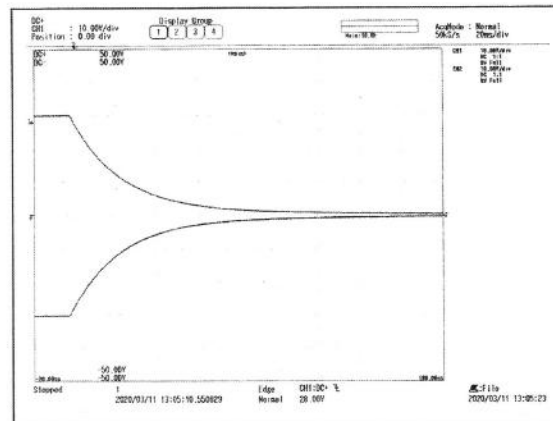


Figure 4-5: Discharging curve DC Link (CCA1)

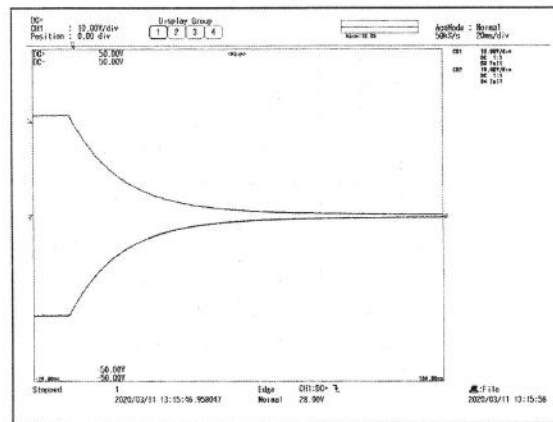


Figure 4-6: Discharging curve DC Link (CCA2)

- Discharging DC Link with VLM of CCA1
- Discharging DC Link with VLM of CCA2



4.7 ASE Board  
4.7.1 CCA1

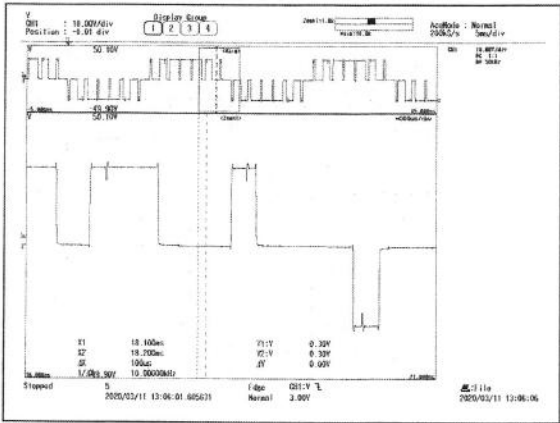


Figure 4-7: Pulse pattern without movement

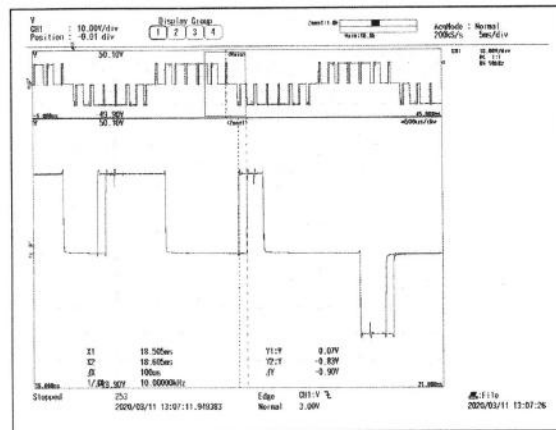


Figure 4-8: Positive movement phase V (+100mV)

- Positive movement phase V (+100mV)

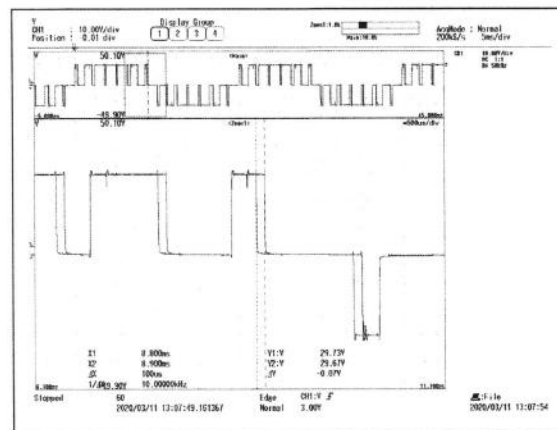


Figure 4-9: Negative movement phase V (-100mV)

- Negative movement phase V (-100mV)



|            |                     |                                      |                    |                       |                         |
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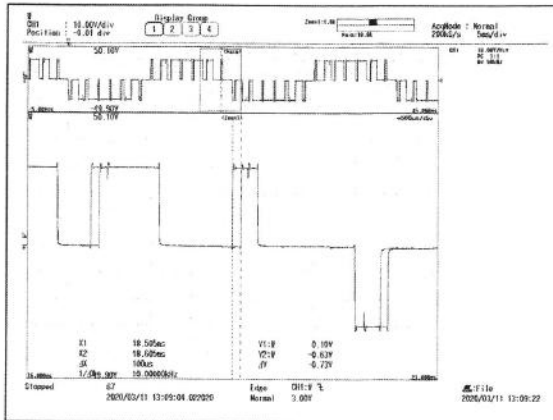


Figure 4-10: Positive movement phase W (+100mV)

- Positive movement phase W (+100mV)

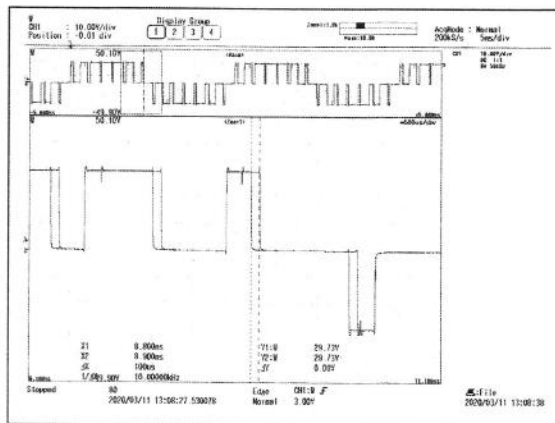


Figure 4-11: Negative movement phase W (-100mV)

- Negative movement phase W (-100mV)



|            |                     |                               |             |                |                  |
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#### 4.7.2 CCA2

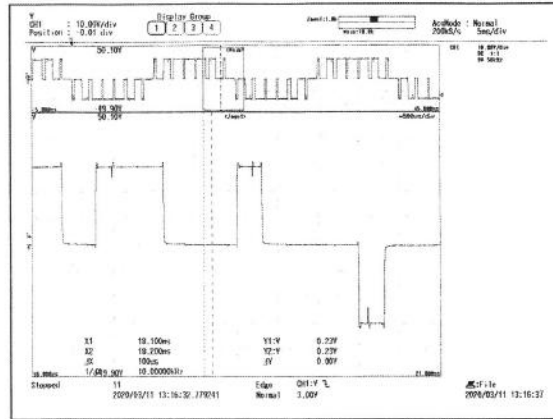
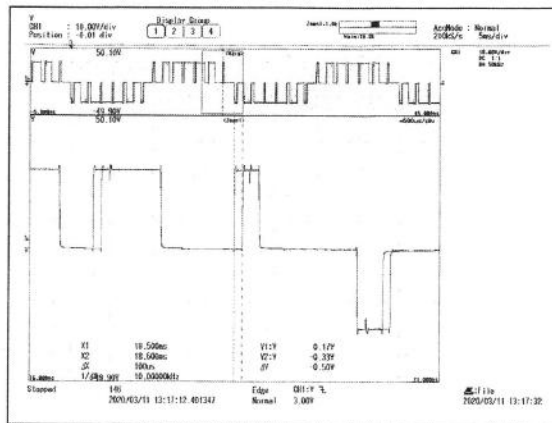


Figure 4-12: Pulse pattern without movement



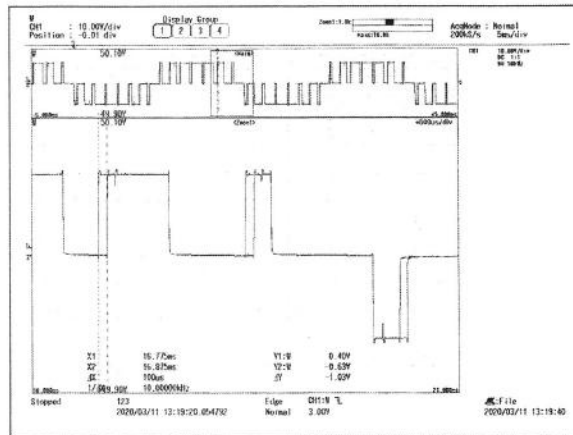


Figure 4-15: Positive movement phase W (+100mV)

- Positive movement phase W (+100mV)

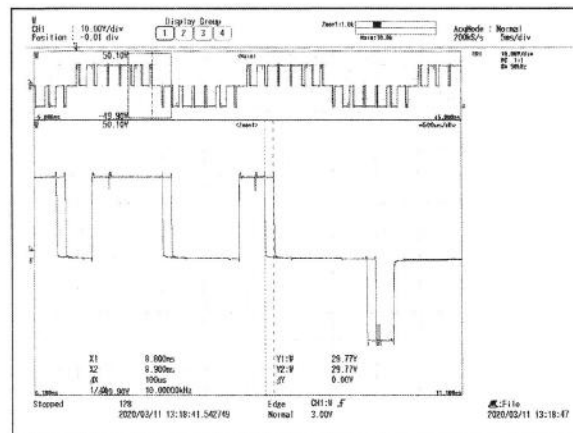


Figure 4-16: Negative movement phase W (-100mV)

- Negative movement phase W (-100mV)



## 5 WATER CIRCUIT & PRESSURE TEST

### 5.1 Fill Cabinets

- Cabinets are filled and deaerated well ☒

### 5.2 Leak tightness

- Pressure Test: Test time:  $t \geq 30$  min  
Initial test pressure:  $p_{in} = 8 \text{ bar} \pm 0.2 \text{ bar}$   
pressure drop shall be  $\Delta p \leq 0.3 \text{ bar}$

| State                                    | Value |                                 |                                     |
|------------------------------------------|-------|---------------------------------|-------------------------------------|
| Initial pressure<br>[ $p_{in}$ ]         | 8,08  |                                 |                                     |
| Final pressure<br>after 30 min           | 7,80  | Passed criteria                 | OK                                  |
| Pressure drop $\Delta p$<br>after 30 min | 0,28  | $\Delta p \leq 0.3 \text{ bar}$ | <input checked="" type="checkbox"/> |

### 5.3 Pumps

- Motor starter value according to schematic [2]
  - o Pump 1: Correct Rotation direction ok  
(check the rotation direction of the motor fans) ☒

| Pump | Allowed Current                          | Max Inrush Current          | Meas current               | Inrush Current                | OK                                  |
|------|------------------------------------------|-----------------------------|----------------------------|-------------------------------|-------------------------------------|
| 1    | $I_{Ph,R}: 20 \text{ A} \pm 2 \text{ A}$ | $I_{IR} \leq 110 \text{ A}$ | $I_{Ph,R}: 20,1 \text{ A}$ | $I_{Ph,R,IR}: 58,1 \text{ A}$ | <input checked="" type="checkbox"/> |
| 1    | $I_{Ph,S}: 20 \text{ A} \pm 2 \text{ A}$ | $I_{IR} \leq 110 \text{ A}$ | $I_{Ph,S}: 20,7 \text{ A}$ | $I_{Ph,S,IR}: 49,6 \text{ A}$ | <input checked="" type="checkbox"/> |
| 1    | $I_{Ph,T}: 20 \text{ A} \pm 2 \text{ A}$ | $I_{IR} \leq 110 \text{ A}$ | $I_{Ph,T}: 19,6 \text{ A}$ | $I_{Ph,T,IR}: 61,7 \text{ A}$ | <input checked="" type="checkbox"/> |

Table 5-1 Pump 1 currents

| Pump | Minimum Pressure    | Actual Pressure | OK                                  |
|------|---------------------|-----------------|-------------------------------------|
| 1    | dpint_CCA1: 3.4 bar | 3,73            | <input checked="" type="checkbox"/> |
| 1    | dpint_CCA2: 3.4 bar | 3,57            | <input checked="" type="checkbox"/> |

Table 5-2 Pump 1 pressures

### 5.4 2-Way-Valve

- Rotation direction valve OPEN (-X603:1) means minimal cooling ☒
- Feedback signal when valve is in OPEN position  
Valve has reached the end position (failsafe signalization) ☒
- Rotation direction valve CLOSE (-X603:2) means maximal cooling ☒
- Feedback signal when valve is in CLOSE position  
Valve has reached the end position (failsafe signalization) ☒

|            |                     |                               |       |           |         |
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### 5.5 Conductivity sensor

- Current settings correct: 4-20mA → 0.05-2.2uS/cm



| Device      | SW Meas       | Ref Meas      | Allowed Difference | OK                                  |
|-------------|---------------|---------------|--------------------|-------------------------------------|
| +A30 -B5503 | 0.26... μS/cm | 0.26... μS/cm | ±5%                | <input checked="" type="checkbox"/> |

## 6 INSTALL SYSTEM IN TEST BAY

### 6.1 Installation auxiliary cables

- Installation auxiliary cables done
- Safety chain is correct wired
- No alarms or failures in software



### 6.2 Installation test bay power supply

- Installation test bay power supply done



## 7 CHECKING THE PROTECTIVE DEVICES

### 7.1 Test VLSCD Boards

- +A22-U701, Power Unit (GRI) & redundant link in +A23 (GEC)
- +A22-U702, Power Unit (GRI) & redundant link in +A23 (GEC)
- +A23-U701, Power Unit (GEC) & redundant link in +A22 (GRI)
- +A23-U702, Power Unit (GEC) & redundant link in +A22 (GRI)
- +A24-U801, DC Link Unit
- +A24-U802, DC Link Unit
- +A26-U701, Power Unit (GRI) & redundant link in +A27 (GEC)
- +A26-U702, Power Unit (GRI) & redundant link in +A27 (GEC)
- +A27-U701, Power Unit (GEC) & redundant link in +A26 (GRI)
- +A27-U702, Power Unit (GEC) & redundant link in +A26 (GRI)
- +A28-U803, DC Link Unit
- +A28-U804, DC Link Unit



### 7.2 Test Firing through

- Separate firing through CCA1 ok
- Separate firing through CCA2 ok
- Firing through ok (DC Link voltage ±1.5kV) in CCA1 & CCA2
- Firing through ok (DC Link voltage ±2.5kV) in CCA1 & CCA2



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### 7.3 Test Voltage Limiting Module

- Discharge with VLM (DC Link voltage  $\pm 2.5\text{kV}$ ) in CCA1 & CCA2



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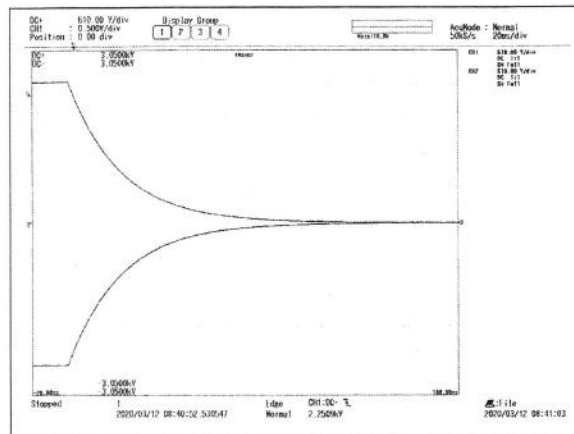
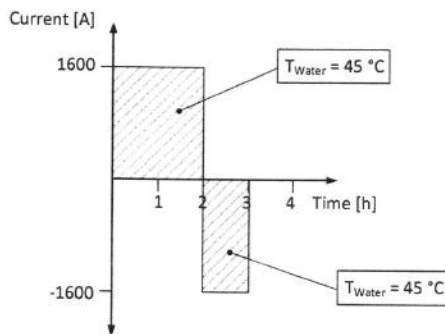


Figure 7-1: Discharging DC Link with VLM  $U_{DC}=\pm 2.5\text{kV}$

## 8 HEAT RUN TEST

### CCA1



Start power test: 17:15 h  
 Change direction: 19:15 h  
 Stop power test: 20:15 h

DC-Link voltage: 2,52 kV  
 Generator voltage: 2,89 kV  
 Load current part 1: 1606 A  
 Load current part 2: 1605 A

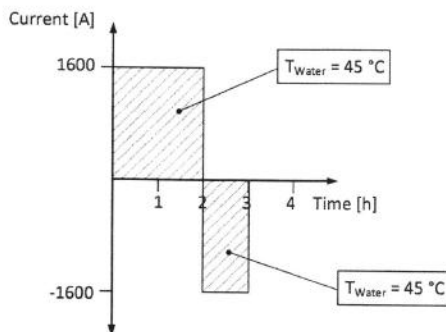
Start water temp: 45,2 °C  
 Change direction: 45,2 °C  
 Stop water temp: 45,3 °C

Figure 8-1: Load sequence

- Water temperature did not exceed  $45 \pm 4$  °C
- No damaged components



### CCA2



Start power test: 8:45 h  
 Change direction: 10:45 h  
 Stop power test: 11:45 h

DC-Link voltage: 2,52 kV  
 Generator voltage: 2,89 kV  
 Load current part 1: 1608 A  
 Load current part 2: 1603 A

Start water temp: 45,1 °C  
 Change direction: 45,6 °C  
 Stop water temp: 45,3 °C

Figure 8-2: Load sequence

- Water temperature did not exceed  $45 \pm 4$  °C
- No damaged components



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## 9 CHECKING THE PROPERTIES OF THE CONTROL EQUIPMENT

CCA1

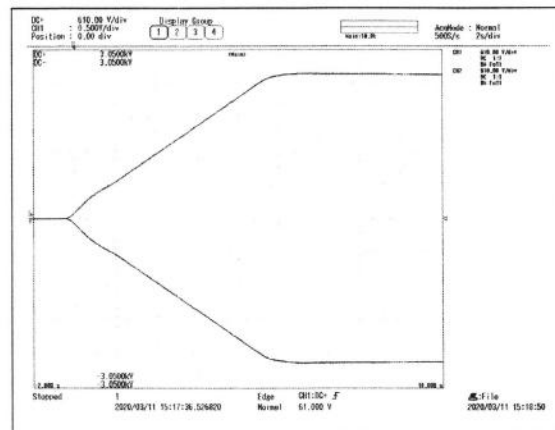


Figure 9-1: Charging Curve DC Link with PCM, CCA1

- No damaged components



CCA2

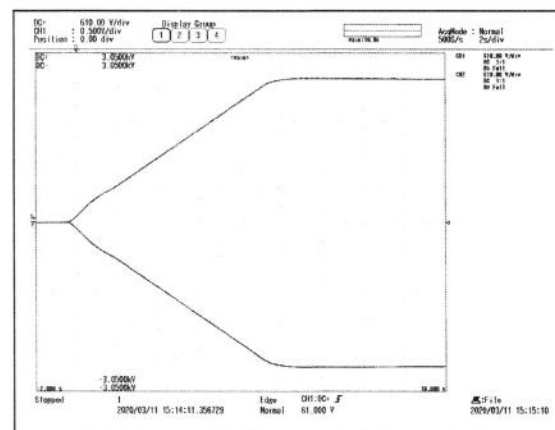


Figure 9-2: Charging Curve DC Link with PCM, CCA2

- No damaged components



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## 10 USED INSTRUMENTS FOR ROUTINE TEST

| No. | Name / Type                        | Identification | Next Calibration |
|-----|------------------------------------|----------------|------------------|
| 1   | Fluke 87V multimeter               | ID 04095       | 2020-11-04       |
| 2   | Fluke 1550C insulation tester      | ID 04117       | 2020-10-24       |
| 3   | KIKUSUI TOS5101 HV tester          | ID 04058       | 2020-10-24       |
| 4   | QPX1200SP DC power supply          | ID 04063       | 2020-12-19       |
| 5   | Fluke 375 clamp multimeter         | ID 04067       | 2020-10-24       |
| 6   | Matrix MPS-3003L-3 DC power supply | ID 04061       | 2020-10-24       |
| 7   | YOKOGAWA DL850 oscilloscope        | ID 04113       | 2020-10-31       |
| 8   | Megger Sverker 650 autotransformer | ID 04062       | 2020-10-24       |
| 9   | Fluke 715 Volt/mA calibrator       | ID 04118       | 2020-10-23       |

Table 10-1 Instrument List

## 11 FINAL WORK

- Water circuit emptied ☒
- Check if there are no glycol marks ☒
- System is clean ☒
- WCU water inlet & outlet DN80 are sealed ☒
- No dust extractions in water pipes ☒
- Check if all plugs are tightened correctly (PEC, COMBI, ASE, CT/VT, S800, IPC) ☒
- IPC WAN interface set to: IP: 10.41.244.90/16 ☒
- ASE housing mounted ☒
- Converter keys in CCU mounted with cable strap ☒
- Check that all circuit breakers and ground isolators are in the grounded position ☒
- Check that generator disconnectors are in CLOSED position ☒
- Dismount Ground Isolator Levers. Put devices in a plastic bag & mount inside door ☒
- Clean water filter in WCU ☒
- Open all MCBs ☒
- Unlock all door interlocks ☒
- GBU bulkhead panel mounted, all bolts tightened ☒
- 2 operating cranks and charging lever placed in clamps ☒
- Crank for manual GDM operation placed in each DLU ☒
- Close all open holes on housing with tape ☒
- Settings and characteristics are done ☒
- Stick IP Address label on PEC ☒
- Stick IP Address label on service interface ☒
- Add trimmings Keys ☒
- Lockout/Tagout key location correct ☒

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- UPS batteries removed from CCU and all ASMs



## 12 FINAL INSPECTION

|                                           |                   |
|-------------------------------------------|-------------------|
| PCS6000 Document List Delivered Converter | Converter No.: 20 |
|-------------------------------------------|-------------------|

| CAB  | UNIT              | MOD                            | SAP NUMMER      | BOM | E13 | E14 | E16 | E19 | E26 | E27 |
|------|-------------------|--------------------------------|-----------------|-----|-----|-----|-----|-----|-----|-----|
| CCA1 | Converter Cabinet | Customer Name                  | 3BHE057276R0001 | O   | C   | n/a | A   | n/a | n/a | n/a |
|      | CCU14             | Converter Control Unit (+A40)  | 3BHE056532R0001 | I   | D   | D   | B   | n/a | A   | -   |
|      | GBU72             | Grid Breaker Unit (+A21)       | 3BHE055094R0002 | H   | D   | D   | C   | n/a | A   | A   |
|      | GBM51             | Generator Breaker Module       | 3BHE054801R0011 | n/a | n/a | n/a | E   | -   | n/a | n/a |
|      | VFM70             | du/dt Filter Module            | 3BHE034330R0001 | I   | D   | D   | C   | B   | E   | D   |
|      | POU72             | Power Unit (+A22)              | 3BHE051398R0102 | A   | B   | C   | A   | n/a | A   | A   |
|      | ASM12             | Auxiliary Supply Module        | 3BHE051396R0001 | D   | B   | B   | -   | n/a | B   | -   |
|      | POM72             | Power Module                   | 3BHE051397R0101 | A   | B   | B   | B   | n/a | B   | A   |
|      | DAM10             | DC Acquisition Module          | 3BHE034444R0001 | G   | C   | B   | B   | B   | D   | C   |
|      | POU72             | Power Unit (+A23)              | 3BHE051398R0101 | A   | B   | C   | A   | n/a | A   | A   |
|      | ASM12             | Auxiliary Supply Module        | 3BHE051396R0001 | D   | B   | B   | -   | n/a | B   | -   |
|      | POM72             | Power Module                   | 3BHE051397R0101 | A   | B   | B   | B   | n/a | B   | A   |
|      | DLU74             | DC Link Unit (+A24)            | 3BHE046081R0001 | N   | C   | C   | B   | -   | B   | B   |
|      | GDM81             | Grid/Gen Disconnecter Module   | 3BHE056924R0001 | -   | n/a | n/a | -   | n/a | n/a | n/a |
|      | NCM10             | Neutralpoint Connection Module | 3BHE034443R0001 | D   | D   | C   | A   | B   | C   | C   |
|      | PCM12             | Precharging Module             | 3BHE057852R0001 | C   | -   | A   | -   | n/a | A   | A   |
|      | VLM70             | Voltage Limiting Module        | 3BHE034262R0001 | H   | B   | A   | A   | -   | C   | C   |
|      | VFM74             | du/dt Filter Module            | 3BHE046084R0001 | D   | C   | C   | B   | -   | A   | A   |
|      | WCU81A            | Water Cooling Unit (+A30)      | 3BHE057210R0001 | A   | n/a | n/a | n/a | n/a | n/a | n/a |
|      | BRU52             | Braking Resistor Unit (+A50)   | 3BHE055096R0001 | n/a | A   | n/a | n/a | n/a | n/a | n/a |

|      |                   |                                |                 |     |     |     |     |     |     |     |
|------|-------------------|--------------------------------|-----------------|-----|-----|-----|-----|-----|-----|-----|
| CCA2 | Converter Cabinet | Customer Name                  | 3BHE057277R0001 | M   | n/a | n/a | A   | n/a | n/a | n/a |
|      | GBU72             | Grid Breaker Unit (+A25)       | 3BHE055094R0002 | H   | D   | D   | C   | n/a | A   | A   |
|      | GBM51             | Generator Breaker Module       | 3BHE054801R0011 | n/a | n/a | n/a | E   | -   | n/a | n/a |
|      | VFM70             | du/dt Filter Module            | 3BHE034330R0001 | I   | D   | D   | C   | B   | E   | D   |
|      | POU72             | Power Unit (+A26)              | 3BHE051398R0101 | A   | B   | C   | A   | n/a | A   | A   |
|      | ASM12             | Auxiliary Supply Module        | 3BHE051396R0001 | D   | B   | B   | -   | n/a | B   | -   |
|      | POM72             | Power Module                   | 3BHE051397R0101 | A   | B   | B   | B   | n/a | B   | A   |
|      | DAM10             | DC Acquisition Module          | 3BHE034444R0001 | G   | C   | B   | B   | B   | D   | C   |
|      | POU72             | Power Unit (+A27)              | 3BHE051398R0101 | A   | B   | C   | A   | n/a | A   | A   |
|      | ASM12             | Auxiliary Supply Module        | 3BHE051396R0001 | D   | B   | B   | -   | n/a | B   | -   |
|      | POM72             | Power Module                   | 3BHE051397R0101 | A   | B   | B   | B   | n/a | B   | A   |
|      | DLU75             | DC Link Unit (+A28)            | 3BHE046085R0001 | N   | C   | C   | B   | -   | B   | B   |
|      | GDM81             | Grid/Gen Disconnecter Module   | 3BHE056924R0001 | -   | n/a | n/a | -   | n/a | n/a | n/a |
|      | NCM10             | Neutralpoint Connection Module | 3BHE034443R0001 | D   | D   | C   | A   | B   | C   | C   |
|      | PCM02             | Precharging Module             | 3BHE057853R0001 | B   | -   | A   | -   | n/a | -   | -   |
|      | VLM70             | Voltage Limiting Module        | 3BHE034262R0001 | H   | B   | A   | A   | -   | C   | C   |
|      | VFM74             | du/dt Filter Module            | 3BHE046084R0001 | D   | C   | C   | B   | -   | A   | A   |
|      | BRU52             | Braking Resistor Unit (+A51)   | 3BHE055096R0001 | n/a | A   | n/a | n/a | n/a | n/a | n/a |

\* Document used as basis with modifications

BOM: Bill Of Material  
 E13: Outline Drawing  
 E14: 3D Drawing  
 E16: EI Circuit Diagram  
 E19: Assembly Documentation  
 E26: Routine Test Instruction  
 E27: Routine Test Report

- WCU Type
- All points are fulfilled

Swede Water ☐

Armaterc ☒



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### 13 REFERENCE DOCUMENTS

| Ind. | Doc. No.       | Rev | Title                                   |
|------|----------------|-----|-----------------------------------------|
| 1    | 3BHS868401 E13 | C   | Outline Drawing GE Hal-X ITC            |
| 2    | 3BHS868401 E16 | B   | Electrical Circuit Diagram GE Hal-X ITC |
| 3    | 3BHS868401 E26 | B   | Routine Test Instruction GE Hal-X ITC   |
| 4    |                |     |                                         |
| 5    |                |     |                                         |
| 6    |                |     |                                         |

#### 14 OPEN ISSUES

| No. | Description | Date / Name | Done                     |
|-----|-------------|-------------|--------------------------|
| 1   |             |             | <input type="checkbox"/> |
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#### 15 REVISION

| Rev. ind. | Page (P) Chapter (C)                                                                                       | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Date / Dept. Resp Person           |
|-----------|------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| -         | all                                                                                                        | Document created from 3BHS856856 E27 RevB.<br>Cabinet dimension check CCA1 tbd.<br>Pump motor current tbd after type test.                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 29.11.2019 / MODR-MP1<br>C. Bensch |
| A         | C 1.1<br>C 4.2<br>C 4.3.1<br>C 4.4.3<br>C 4.4.4<br>C 4.4.6<br>C 4.4.7<br>C 4.4.8<br>C 5.3<br>C 7.1<br>C 11 | Dimensional check CCA1 front view and top view added<br>Roof fan current consumption corrected<br>$U_{DC-INP}$ corrected to $U_{NP/DC-}$<br>-H305 removed, -S305 and -S306 added<br>Grounding isolator test shifted to Lockout/Tagout functionality test<br>Interlock tests shifted to Lockout/Tagout functionality test<br>Lockout/Tagout functionality test added<br>Lockout/Tagout functionality test added<br>Pressure value corrected for test with glycol mixture<br>Pump current updated<br>VLSCD CCA2 labels corrected to -U803 and -U804<br>Wording improved, check for GDM cranks added | 16.12.2019 / MODR-MP1<br>C. Bensch |
| B         | C 1.1<br>C 1.2<br>C 4.4.8<br>C 11                                                                          | Rear side flange position check added, new tolerance for flange positions<br>Rear side flange position check added, new tolerance for flange positions<br>Lockout/Tagout test instruction corrected<br>Check of battery removal added                                                                                                                                                                                                                                                                                                                                                             | 20.12.2019 / MODR-MP1<br>C. Bensch |
| C         | C 1<br>C 2.3, C 4.2<br>C 4.2<br>C 4.4.8<br>C 5.2<br>C 5.3<br>C 7.3<br>C 8<br>C 11                          | Overall dimension checks removed<br>Supply voltage check simplified, wording improved<br>Heater current corrected<br>Key switch status corrected<br>Pressure test initial, end pressure table added<br>Pressure adapted for test with pure water<br>Discharge test with 1.5 kV deleted<br>Heatrun duration changed to 1h after direction change<br>Generator disconnect position changed to CLOSED                                                                                                                                                                                                | 20.01.2020 / MODR-MP1<br>C. Bensch |
|           |                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                    |
|           |                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                    |



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