FREQCON

# FAT Test Protocol

# Converter & BESS

**(Factory Acceptance Test)**

| Version | Date | Name | Description |
|---|---|---|---|
| 1.0 | 2024-02-29 | S. Laudahn | First version |
| 1.1 | 2024-05-14 | C. Palenzuela<br>J. Nitsch | Updated several sections |
| 2.0 | 2024-07-08 | C. Palenzuela | Updated several sections |
| | | | |
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**Table 1: Version overview**

| | Date | Name |
|---|---|---|
| **Editor** | 29.02.2024 | S. Laudahn |
| **Checked by** | | |
| **Released by** | | |

**Table 2: Release overview**

## Imprint

**Software development**

**Hardware development and production**

Freqcon GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

Phone: +49 (0) 5165 - 291 760 - 0

Email:
info@freqcon.com

**Contact information**

For further information, please call us or send an e-mail to info@freqcon.com.
Visit our website http://www.freqcon.com for more information about our products and solutions.

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# Identification

## Product and type designation

**Device type**
BESS 1 MW / 5MWh

**Circuit diagram version**
10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62

**Document number**
23A2007_240708_FAT_BESS_Converter_EN_v2.0

## Name and address of the manufacturer

**Manufacturer of the product**
FREQCON GmbH
Bürgerwiesenweg 5
D-27336 Rethem, Germany

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## Original document

This document is an original document of FREQCON GmbH.

# 1 About this document

This acceptance report is used to assess compliance with all design and customer requirements of the tested system.

The factory acceptance test (FAT) is carried out by specialised personnel before delivery of the system and the result is checked by the customer.

# 2 Responsibilities

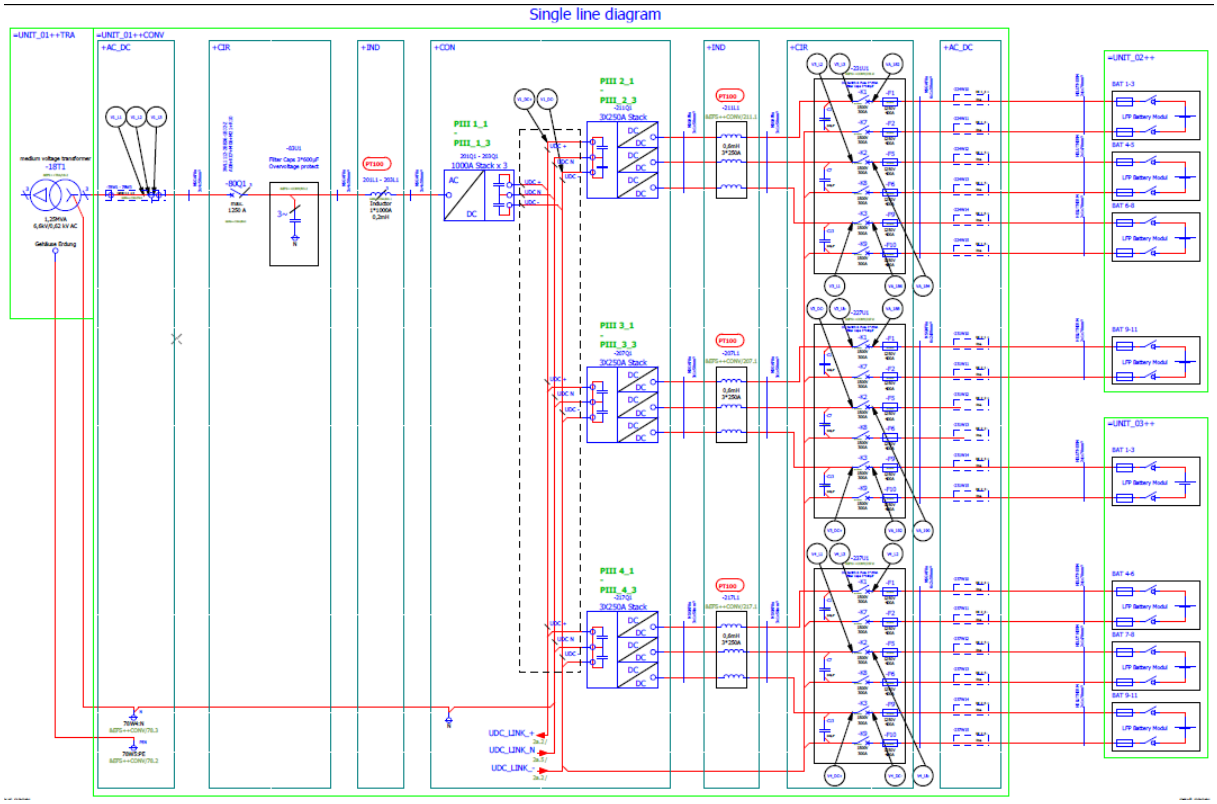
## 2.1 Responsibilities of FREQCON GmbH

- Preparation and review of the acceptance report
- Carrying out the acceptance test (FAT), documentation of the results
- Elimination of identified deviations
- Preparation and review of the acceptance report

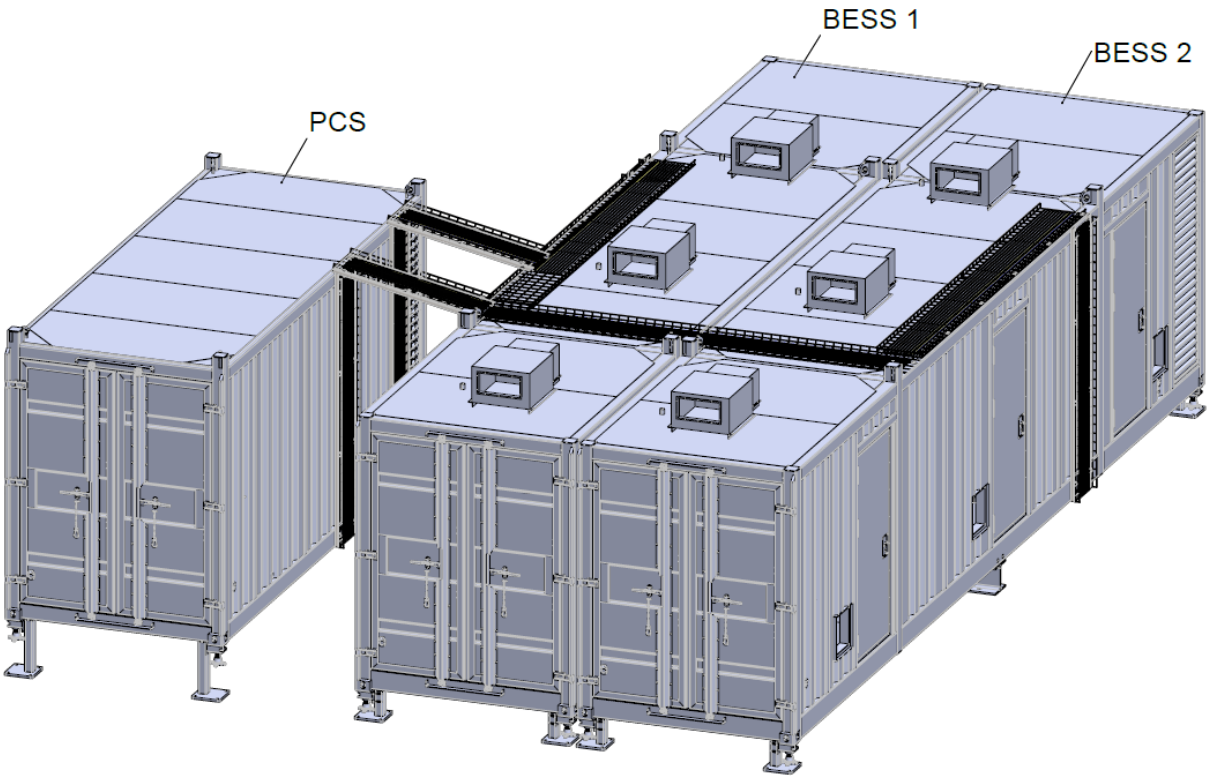
## 2.2 Responsibilities of the customer

- Dispatch of specialised personnel to FREQCON GmbH, inspection of the acceptance results and documented data by the specialised personnel
- Confirmation of the factory acceptance report by specialised personnel

## 2.3 Single Line Diagram



## 2.4 General Arrangement



# 3 Converter (PCS)

## 3.1 Reference Documents Converter (PCS)

| Document Title | Document Name |
|---|---|
| Overall Schematics | 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62 |
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## 3.2 PCS Tests

### 3.2.1 Prerequisites

The following documents must be available in electronic form or as a printout for the FAT:

1. Circuit diagram of the system
2. Manual in the current version
3. General arrangement overview
4. Interface documentation (if available)

| Remarks: |
| --- |
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### 3.2.2 Visual Inspection of Control Cabinet 1

Check all system components, including external ones, to ensure that they are in perfect condition.
Document the qualification results in the following table.

| TR01 | Test | | Result |
|---|---|---|---|
| 1.1 | **Cleanliness** | **Test Layout:**<br>Check covers and cabinet interior for cleanliness and rust.<br>**Pass Fail Criteria:**<br>Covers and interior are clean, without dirt or rust. | ☐ OK<br>☐ Defects<br>☐ N/A |
| 1.2 | **Metal sheets** | **Test Layout:**<br>Check metal sheets for sharp edges and damages.<br>**Pass Fail Criteria:**<br>No sharp edges or recognisable damage present. | ☐ OK<br>☐ Defects<br>☐ N/A |
| 1.3 | **Wires and cables** | **Test Layout:**<br>Visually inspect cable connections and wires inside the control cabinet for perfect condition and loose parts.<br>**Pass Fail Criteria:**<br>Cable connections in perfect condition, no loose parts present. | ☐ OK<br>☐ Defects<br>☐ N/A |
| 1.4 | **Compliance with circuit diagram** | **Test Layout:**<br>• Check if main components of the control cabinet are installed in accordance with the circuit diagram.<br>• Check if labelling of the components in the control cabinet corresponds to the circuit diagram (exemplary test of some components).<br>**Pass Fail Criteria:**<br>• Essential parts of the control cabinet are available in accordance with the circuit diagram.<br>• Labelling of the components in the control cabinet corresponds to the circuit diagram.<br>**Reference document:**<br>10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62 | ☐ OK<br>☐ Defects<br>☐ N/A |
| 1.5 | **Control elements labelling** | **Test Layout:**<br>Check if the operating elements on the control cabinet door are labelled according to the circuit diagram.<br>**Pass Fail Criteria:**<br>The operating elements are labelled according to the circuit diagram.<br>**Reference document:**<br>10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62 | ☐ OK<br>☐ Defects<br>☐ N/A |

| | | | |
|---|---|---|---|
| 1.6 | **Control elements description** | **Test Layout:**<br>Check if the operating elements are explained in the operating manual.<br>**Pass Fail Criteria:**<br>The operating elements are explained in the operating manual.<br><br>**Reference document:**<br>10354_23A2007_YYMMDD_Operating_Manual_ Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_EN_vx.x | ☐ OK<br>☐ Defects<br>☐ N/A |
| 1.7 | **Data interface** | **Test Layout:**<br>Check if data interface complies with the schematic.<br>**Pass Fail Criteria:**<br>The data interface corresponds to the circuit diagram.<br><br>**Reference document:**<br>10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62 | ☐ OK<br>☐ Defects<br>☐ N/A |
| 1.8 | **Earthing** | **Test Layout:**<br>Check if the control cabinet is properly earthed in accordance with the circuit diagram.<br>**Pass Fail Criteria:**<br>The control cabinet is properly earthed. | ☐ OK<br>☐ Defects<br>☐ N/A |
| 1.9 | **Power supply** | **Test Layout:**<br>Check the AC connection terminals of the control cabinet. Check if all three phases provide 230 V AC by using a Multimeter.<br>**Pass Fail Criteria:**<br>All three phases of the AC supply provide 230 V AC. | ☐ OK<br>☐ Defects<br>☐ N/A |
| 1.10 | **UPS** | **Test Layout:**<br>Check if the control cabinet is properly earthed in accordance with the circuit diagram.<br>**Pass Fail Criteria:**<br>The UPS complies with the specification.<br><br>**Reference document:**<br>10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62 | ☐ OK<br>☐ Defects<br>☐ N/A |

| | | | |
|---|---|---|---|
| 1.11 | **Warnings** | **Test Layout:**<br>Check if the required warning signs are located on the cabinet doors.<br>**Pass Fail Criteria:**<br>The required warning signs are located on the cabinet doors.<br>**Reference document:**<br>FORM_QS002_Warnhinweise_20231013_Rev3-0 | ☐ OK<br>☐ Defects<br>☐ N/A |

| Remarks: |
|---|
| |

### 3.2.3 Visual Inspection of Control Cabinet 2

Check all system components, including external ones, to ensure that they are in perfect condition.
Document the qualification results in the following table.

| TR01 | Test | | Result |
|---|---|---|---|
| 1.1 | **Cleanliness** | **Test Layout:**<br>Check covers and cabinet interior for cleanliness and rust.<br>**Pass Fail Criteria:**<br>Covers and interior are clean, without dirt or rust. | ☐ OK<br>☐ Defects<br>☐ N/A |
| 1.2 | **Metal sheets** | **Test Layout:**<br>Check metal sheets for sharp edges and damages.<br>**Pass Fail Criteria:**<br>No sharp edges or recognisable damage present. | ☐ OK<br>☐ Defects<br>☐ N/A |
| 1.3 | **Wires and cables** | **Test Layout:**<br>Visually inspect cable connections and wires inside the control cabinet for perfect condition and loose parts.<br>**Pass Fail Criteria:**<br>Cable connections in perfect condition, no loose parts present. | ☐ OK<br>☐ Defects<br>☐ N/A |
| 1.4 | **Compliance with circuit diagram** | **Test Layout:**<br>• Check if main components of the control cabinet are installed in accordance with the circuit diagram.<br>• Check if labelling of the components in the control cabinet corresponds to the circuit diagram (exemplary test of some components).<br>**Pass Fail Criteria:**<br>• Essential parts of the control cabinet are available in accordance with the circuit diagram.<br>• Labelling of the components in the control cabinet corresponds to the circuit diagram.<br>**Reference document:**<br>10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62 | ☐ OK<br>☐ Defects<br>☐ N/A |
| 1.5 | **Earthing** | **Test Layout:**<br>Check if the control cabinet is properly earthed in accordance with the circuit diagram.<br>**Pass Fail Criteria:**<br>The control cabinet is properly earthed.<br>**Reference document:**<br>10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62 | ☐ OK<br>☐ Defects<br>☐ N/A |
| 1.6 | **Power supply** | **Test Layout:**<br>Check the AC connection terminals of the control cabinet. Check if all three phases provide 230 V AC by using a Multimeter. | ☐ OK<br>☐ Defects<br>☐ N/A |

| | | | |
|---|---|---|---|
| | | **Pass Fail Criteria:**<br>All three phases of the AC supply provide 230 V AC. | |
| 1.8 | **Warnings** | **Test Layout:**<br>Check if the required warning signs are located on the cabinet doors. | ☐ OK<br>☐ Defects<br>☐ N/A |
| | | **Pass Fail Criteria:**<br>The required warning signs are located on the cabinet doors.<br>**Reference document:**<br>FORM_QS002_Warnhinweise_20231013_Rev3-0 | |

| Remarks and description of defects: |
|---|
| |

### 3.2.4 Visual inspection of Converter Cabinets

Check all system components, including external ones, to ensure that they are in perfect condition.
Document the qualification results in the following table.

| TR02 | Test | | Result |
|---|---|---|---|
| 2.1 | **Cleanliness** | **Test Layout:**<br>Check covers and cabinet interior for cleanliness and rust.<br>**Pass Fail Criteria:**<br>Covers and interior are clean, without dirt or rust. | ☐ OK<br>☐ Defects<br>☐ N/A |
| 2.2 | **Metal sheets** | **Test Layout:**<br>Check metal sheets for sharp edges and damages<br>**Pass Fail Criteria:**<br>No sharp edges or recognisable damage present. | ☐ OK<br>☐ Defects<br>☐ N/A |
| 2.3 | **Wires and cables** | **Test Layout:**<br>Visually inspect cable connections and wires inside the converter cabinets for perfect condition and loose parts.<br>**Pass Fail Criteria:**<br>Cable connections are in perfect condition, no loose parts present. | ☐ OK<br>☐ Defects<br>☐ N/A |
| 2.4 | **Compliance with circuit diagram** | **Test Layout:**<br>Visually inspect the following power components for compliance with the circuit diagram:<br>• AC IGBTs<br>• DC IGBTs<br>• AC inductors<br>• DC inductors<br>• AC Filter<br>**Pass Fail Criteria:**<br>The power components (IGBT, choke, filter) correspond to the circuit diagram.<br>**Reference document:**<br>10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62 | ☐ OK<br>☐ Defects<br>☐ N/A |
| 2.5 | **Protective elements** | **Test Layout:**<br>Check correct installation of protective elements according to the circuit diagram.<br>**Pass Fail Criteria:**<br>The protective elements are installed according to the circuit diagram.<br>**Reference document:**<br>10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62 | ☐ OK<br>☐ Defects<br>☐ N/A |

| | | | |
|---|---|---|---|
| 2.6 | **Connection busbars** | Check if connection busbars are installed according to the circuit diagram.<br>**Pass Fail Criteria:**<br>The connection busbars are installed according to the circuit diagram.<br>**Reference document:**<br>10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62 | ☐ OK<br>☐ Defects<br>☐ N/A |
| 2.7 | **Earthing** | **Test Layout:**<br>Check control cabinet for proper earthing. Refer to circuit diagram.<br>**Pass Fail Criteria:**<br>The control cabinet is properly earthed according to the circuit diagram.<br>**Reference document:**<br>10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62 | ☐ OK<br>☐ Defects<br>☐ N/A |
| 2.8 | **Smoke detectors** | **Test Layout:**<br>Check if smoke detectors are installed in the IGBT cabinet according to the circuit diagram.<br>**Pass Fail Criteria:**<br>Smoke detectors are installed in the IGBT cabinet according to the circuit diagram.<br>**Reference document:**<br>10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62 | ☐ OK<br>☐ Defects<br>☐ N/A |
| 2.9 | **Smoke detector test** | **Test Layout:**<br>Use test spray to trigger the sensor.<br>**Pass Fail Criteria:**<br>Alarm signal triggers “301024: Supply: Smoke detector feedback tripped” alarm and is displayed on HMI/WebVisu.<br><br>Hardware Trigger: Smoke FG1 | ☐ OK<br>☐ Defects<br>☐ N/A |

| Remarks and description of defects: |
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## 3.3 Visual inspection of Converter Cooling System

Check the correct installation and connection of the cooling system. Document the qualification results in the following table.

| TR03 | Test | | Result |
|---|---|---|---|
| 3.1 | **Leakage and connections check** | **Test Layout:**<br>Check the converter water cooling system for proper connection and leaks.<br>Run cooling system and perform visual check of connections and check for leaks | ☐ OK<br>☐ Defects<br>☐ N/A |
| | | **Pass Fail Criteria:**<br>All connections are properly connected and no leakage present. | |
| 3.2 | **Pressure check** | **Test Layout:**<br>Check whether the pressure of the cooling system is above 3 bar.<br>Check on the manometer of the converter cooling system cabinet (COSY) and verify value on HMI/WebVisu. | ☐ OK<br>☐ Defects<br>☐ N/A |
| | | **Pass Fail Criteria:**<br>Manometer and HMI/WebVisu indicate a pressure of 3 bar. | |
| 3.3 | **Water drop check** | **Test Layout:**<br>Check that no drops of water can be seen at the connection points of the coolant hoses. | ☐ OK<br>☐ Defects<br>☐ N/A |
| | | **Pass Fail Criteria:**<br>No water on the connection points of coolant hoses. | |

| Remarks: |
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## 3.4 Function test

Check whether the electrical power and signal transmission meets the agreed requirements. Document the qualification results in the following table.

| TR04 | Test | | Result |
|---|---|---|---|
| 4.1 | **Supply voltage control cabinet** | **Test Layout:**<br>Switch on the control cabinet by applying the supply voltage or turning on the main switch. The control unit starts up properly. | ☐ OK<br>☐ Defects<br>☐ N/A |
| | | **Pass Fail Criteria:**<br>Pass:<br>- Simotion turns on<br>- HMI turns on properly and WebVisualization (WebVisu) access is active<br>- Access to Simotion WebVisu is established and "Run" state of Simotion can be confirmed | |
| 4.2 | **Feedback signals** | **Test Layout:**<br>Exemplary control of system feedback and error evaluation, for example by manually triggering fuses. Errors are output correctly. | ☐ OK<br>☐ Defects<br>☐ N/A |
| | | **Pass Fail Criteria:**<br>Random sampling:<br>The status is correctly indicated by the red Error LED on the control cabinet 1 door.<br>The error message can be reset by pressing the reset button on the control cabinet. | |
| 4.3 | **Smoke detectors** | **Test Layout:**<br>Test the smoke detector in PCS CON-cabinet with test spray. | ☐ OK<br>☐ Defects<br>☐ N/A |
| | | **Pass Fail Criteria:**<br>The smoke detectors trigger accordingly and an error (Error level 4) is generated. | |

| | | | |
|---|---|---|---|
| 4.4 | **Cabinet Fans** | **Test Layout:**<br>Testing the cabinet fans by simulating increased temperature values of the cabinets or direct control of the fans by the control system.<br>**Pass Fail Criteria:**<br>Cabinet fans activate according to temperature threshold set in the control system. | ☐ OK<br>☐ Defects<br>☐ N/A |
| 4.5 | **Converter liquid cooling system** | **Test Layout:**<br>Converter liquid cooling system test:<br>Switch on the cooling system. The cooling system heats the cooling water as required. Check the heat exchangers by simulating the cooling water temperature.<br>**Pass Fail Criteria:**<br>- Heat exchanger switches on and off correctly (Visual check)<br>- "Preheating" status is correctly indicated by the yellow "Preheating LED" on the control cabinet.<br>- Pump is running (visual check)<br>- Heater is heating up the coolant (check coolant temperature on HMI/WebVisu) | ☐ OK<br>☐ Defects<br>☐ N/A |
| 4.6 | **AC connection** | **Test Layout:**<br>Apply the operating voltage (if not already applied). Check the measured voltages for plausibility with Multimeter at AC connection point.<br>The HMI/WebVisu displays the mains voltage correctly.<br>The measured Multimeter values correspond to the values displayed on the HMI/WebVisu. | ☐ OK<br>☐ Defects<br>☐ N/A |
| 4.7 | **Converter pre-charging** | **Test Layout:**<br>Pre-charging of converter.<br>**Pass Fail Criteria:**<br>- Converter is pre-charged from the mains and the 3WL main circuit breaker (80Q1) switches-on.<br>- "Ready for Operation" status is indicated by the green "Ready for Operation" LED on the control cabinet door. | ☐ OK<br>☐ Defects<br>☐ N/A |
| 4.8 | **IGBTs** | **Test Layout:**<br>IGBT activation<br>**Pass Fail Criteria:**<br>- IGBTs can be switched on without any problems.<br>- DC link is regulated to the set voltage.<br>- "Operating" status is indicated by the green "Operating" LED on the control cabinet door. | ☐ OK<br>☐ Defects<br>☐ N/A |
| 4.9 | **Emergency stop** | **Test Layout:**<br>Test of the emergency stop. Switching on the emergency stop or switching off the main switch when the inverter is in operation (DC-link control). | ☐ OK<br>☐ Defects<br>☐ N/A |

| | | | |
|---|---|---|---|
| | | **Pass Fail Criteria:**<br>- Inverter immediately switches to OFF mode.<br>- Red “Fault” LED starts glowing on control cabinet door.<br>- AC main switch (80Q1) opens. | |
| 4.10 | **Back-to-Back Test** | **Duration: After reaching 1000 A duration test of 10 min.**<br>**Test Layout:**<br><u>Back-to-Back Test: At 400 V AC connection</u><br>Increase the AC current setpoint value slowly to 1000 A output and keep this value for 10 minutes.<br><br>- 10 A<br>- 100 A<br>- 200 A<br>- …<br>- 1000 A<br><br><u>Heat run:</u><br>Check if temperatures of<br>- IGBTs<br>- Inductors<br>- Coolant of converter cooling system<br>are within the permissible ranges by verifying the temperature values displayed on the HMI/WebVisu. | ☐ OK<br>☐ Defects<br>☐ N/A |
| | | **Pass Fail Criteria:**<br><u>Back-to-Back Test:</u><br>AC current output of 1000 A is displayed correctly on the HMI/WebVisu according to setpoint.<br><u>Heat run:</u><br>IGBT, inductor and converter cooling system coolant temperatures are below the temperature thresholds set in the control system. | |
| 4.10 | **DC ports** | **Duration: After reaching 250 A test duration is 10 min.**<br>**Test Layout:**<br>DC-ports connection<br>Increase the DC current setpoint slowly to 250 A and keep this value for 10 minutes.<br><u>Heat run:</u><br>Check if temperatures of<br>- IGBTs<br>- Inductors<br>- Coolant of converter cooling system<br>are within the permissible ranges by verifying the temperature values displayed on the HMI/WebVisu. | |

| | | | |
|---|---|---|---|
| | | **Pass Fail Criteria:**<br>Back-to-Back Test:<br>DC current output of 250 A is displayed on the HMI/WebVisu according to setpoint.<br>Heat run:<br>IGBT, inductor and converter cooling system coolant temperatures are below the temperature thresholds set in the control system. | |
| 4.11 | **Measurements** | **Test Layout:**<br>Check if the measured values (temperatures, voltages and currents) are properly collected by the Simotion (PCS main controller) and verify by using a multimeter or current clamp at DC and AC side.<br>**Pass Fail Criteria:**<br>Values measured with multimeter are +/- 5% correspond to the values displayed on the HMI/WebVisu. | ☐ OK<br>☐ Defects<br>☐ N/A |
| 4.12 | **Switching-off** | **Test Layout:**<br>Switching off the inverter. The inverter is properly switched off by removing the control bits.<br>**Pass Fail Criteria:**<br>“OFF” state is indicated by the HMI/WebVisu. | ☐ OK<br>☐ Defects<br>☐ N/A |
| 4.13 | **UPS** | **Test Layout:**<br>Checking the UPS functionality. If the auxiliary supply fails (e.g. by activating the fuse of the AC power supply unit), the control cabinet continues to be supplied by the UPS.<br>**Pass Fail Criteria:**<br>After the defined time, the control cabinet is switched off completely. When the voltage returns, the control unit starts up again and the UPS battery is charged. | ☐ OK<br>☐ Defects<br>☐ N/A |
| 4.14 | **WebVisu/HMI** | **Test Layout:**<br>Check the Web Visualisation (WebVisu) running on the control cabinet HMI for proper functionality<br>**Pass Fail Criteria:**<br>Select each individual HMI (WebVisu) pages and check behaviour (lag during selection or scrolling, correct display of values and system components). The visualisation is functional. | ☐ OK<br>☐ Defects<br>☐ N/A |

| Remarks: |
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# 4 BESS 1

## 4.1 Reference Documents BESS 1

| Document Title | Document name |
|---|---|
| Schematic | 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62 |
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## 4.2 Battery Cabinets Tests

### 4.2.1 Prerequisites

The following documents must be available in electronic form or as a printout for the FAT:

1. Circuit diagram of battery cabinets
2. General arrangement overview
3. Interface documentation (if available)

| Remarks: |
|---|
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### 4.2.2 Visual inspection of Battery Cabinets

Check system components of 3 battery cabinets (one cabinet in each container section) inside BESS 1 container, including external ones, to ensure that they are in perfect condition. Document the qualification results in the following table.

| TR05 | Test | | Result |
|---|---|---|---|
| 5.1 | **Cleanliness** | **Test Layout:**<br>Check covers and cabinet interior for cleanliness and rust.<br>**Pass Fail Criteria:**<br>Covers and interior are clean, without dirt or rust. | ☐ OK<br>☐ Defects<br>☐ N/A |
| 5.2 | **Metal sheets** | **Test Layout:**<br>Check metal sheets for sharp edges and damages<br>**Pass Fail Criteria:**<br>No sharp edges or recognisable damage present. | ☐ OK<br>☐ Defects<br>☐ N/A |
| 5.3 | **Wires and cables** | **Test Layout:**<br>Visually inspect cable connections and wires inside the battery cabinets for perfect condition and no loose parts.<br>**Pass Fail Criteria:**<br>Cable connections are in perfect condition, no loose parts present. | ☐ OK<br>☐ Defects<br>☐ N/A |
| 5.4 | **Protective elements** | **Test Layout:**<br>Check correct installation of protective elements according to circuit diagram.<br>**Pass Fail Criteria:**<br>Protective elements are installed according to the circuit diagram.<br>**Reference document:**<br>10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62 | ☐ OK<br>☐ Defects<br>☐ N/A |
| 5.5 | **Earthing** | **Test Layout:**<br>Check battery cabinet for proper earthing. Refer to circuit diagram.<br>**Pass Fail Criteria:**<br>Battery cabinet is properly earthed according to circuit diagram.<br>**Reference document:**<br>10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62 | ☐ OK<br>☐ Defects<br>☐ N/A |
| 5.6 | **Smoke detectors** | **Test Layout:**<br>Check if smoke detectors are installed in battery cabinet according to circuit diagram. | |

| | | | |
|---|---|---|---|
| | | **Pass Fail Criteria:**<br>Smoke detectors are installed in battery cabinet according to circuit diagram.<br>**Reference document:**<br>10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62 | ☐ OK<br>☐ Defects<br>☐ N/A |
| 5.7 | **Fire extinguishing system (Stat-X)** | **Test Layout:**<br>Check if Stat-X aerosol cartridges are installed in battery cabinet according to circuit diagram.<br>**Pass Fail Criteria:**<br>Stat-X aerosol cartridges are installed in battery cabinet according to circuit diagram.<br>**Reference document:**<br>10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62 | ☐ OK<br>☐ Defects<br>☐ N/A |
| 5.8 | **Control plate** | **Test Layout:**<br>Check if control plate in the bottom section of the battery cabinet is installed according to circuit diagram.<br>**Pass Fail Criteria:**<br>Control plate is installed according to circuit diagram.<br>**Reference document:**<br>10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62 | ☐ OK<br>☐ Defects<br>☐ N/A |
| 5.9 | **CO Sensor and Alarm Unit** | **Test Layout:**<br>Check if CO Sensor and Alarm Unit are installed according to circuit diagram.<br>**Pass Fail Criteria:**<br>CO Sensor and Alarm Unit are installed according to circuit diagram.<br>**Reference document:**<br>10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62 | ☐ OK<br>☐ Defects<br>☐ N/A |
| 5.10 | **Smoke detector test** | **Test Layout:**<br>Use test spray to trigger the sensor.<br>**Pass Fail Criteria:**<br>Alarm signal will trigger “Thermal runaway” procedure and displayed on HMI. | ☐ OK<br>☐ Defects<br>☐ N/A |
| 5.11 | **CO sensor test** | **Test Layout:**<br>Use test spray to trigger the sensor.<br>**Pass Fail Criteria:**<br>Alarm signal will trigger “Thermal runaway” procedure and displayed on HMI. | ☐ OK<br>☐ Defects<br>☐ N/A |

| | | | |
|---|---|---|---|
| 5.12 | **H2 Sensor Test** | **Test Layout:**<br>H2 Gas Alarm Test:<br>Simulate trigger value in software from gas sensor and check if exhaust units and fire dampers operate properly.<br>Check if gas alarm feedback is properly transmitted via hardwired signals. | ☐ OK<br>☐ Defects<br>☐ N/A |
| | | **Pass Fail Criteria:**<br>After gas alarm the fire dampers open and the exhaust units start venting out the containers. Gas alarm feedback relay has opened. An error message is displayed on the HMI/WebVisu. | |

| Remarks: |
|---|
| |

# 5 BESS 2

## 5.1 Reference Documents BESS 2

| Document Title | Document name |
|---|---|
| Schematic | 10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62 |
| | |
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## 5.2 Battery Cabinets Tests

### 5.2.1 Prerequisites

The following documents must be available in electronic form or as a printout for the FAT:

4. Circuit diagram of battery cabinets
5. General arrangement overview
6. Interface documentation (if available)

| Remarks: |
|---|
| |

### 5.2.2 Visual inspection of Battery Cabinets

Check system components of 3 battery cabinets (one cabinet in each container section) inside BESS 1 container, including external ones, to ensure that they are in perfect condition. Document the qualification results in the following table.

| TR05 | Test | | Result |
|---|---|---|---|
| 6.1 | **Cleanliness** | **Test Layout:**<br>Check covers and cabinet interior for cleanliness and rust.<br>**Pass Fail Criteria:**<br>Covers and interior are clean, without dirt or rust. | ☐ OK<br>☐ Defects<br>☐ N/A |
| 6.2 | **Metal sheets** | **Test Layout:**<br>Check metal sheets for sharp edges and damages<br>**Pass Fail Criteria:**<br>No sharp edges or recognisable damage present. | ☐ OK<br>☐ Defects<br>☐ N/A |
| 6.3 | **Wires and cables** | **Test Layout:**<br>Visually inspect cable connections and wires inside the battery cabinets for perfect condition and no loose parts.<br>**Pass Fail Criteria:**<br>Cable connections are in perfect condition, no loose parts present. | ☐ OK<br>☐ Defects<br>☐ N/A |
| 6.4 | **Protective elements** | **Test Layout:**<br>Check correct installation of protective elements according to circuit diagram.<br>**Pass Fail Criteria:**<br>Protective elements are installed according to the circuit diagram.<br>**Reference document:**<br>10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62 | ☐ OK<br>☐ Defects<br>☐ N/A |
| 6.5 | **Earthing** | **Test Layout:**<br>Check battery cabinet for proper earthing. Refer to circuit diagram.<br>**Pass Fail Criteria:**<br>Battery cabinet is properly earthed according to circuit diagram.<br>**Reference document:**<br>10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62 | ☐ OK<br>☐ Defects<br>☐ N/A |
| 6.6 | **Smoke detectors** | **Test Layout:**<br>Check if smoke detectors are installed in battery cabinet according to circuit diagram. | |

| | | | |
|---|---|---|---|
| | | **Pass Fail Criteria:**<br>Smoke detectors are installed in battery cabinet according to circuit diagram.<br>**Reference document:**<br>10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62 | ☐ OK<br>☐ Defects<br>☐ N/A |
| 6.7 | **Fire extinguishing system (Stat-X)** | **Test Layout:**<br>Check if Stat-X aerosol cartridges are installed in battery cabinet according to circuit diagram.<br>**Pass Fail Criteria:**<br>Stat-X aerosol cartridges are installed in battery cabinet according to circuit diagram.<br>**Reference document:**<br>10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62 | ☐ OK<br>☐ Defects<br>☐ N/A |
| 6.8 | **Control plate** | **Test Layout:**<br>Check if control plate in the bottom section of the battery cabinet is installed according to circuit diagram.<br>**Pass Fail Criteria:**<br>Control plate is installed according to circuit diagram.<br>**Reference document:**<br>10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62 | ☐ OK<br>☐ Defects<br>☐ N/A |
| 6.9 | **CO Sensor and Alarm Unit** | **Test Layout:**<br>Check if CO Sensor and Alarm Unit are installed according to circuit diagram.<br>**Pass Fail Criteria:**<br>CO Sensor and Alarm Unit are installed according to circuit diagram.<br>**Reference document:**<br>10354_23A2007_CAE_Statron_Shell Crosswind BESS FQ 1MW 5MWh Offshore_20240703_V0.62 | ☐ OK<br>☐ Defects<br>☐ N/A |
| 6.10 | **Smoke detector test** | **Test Layout:**<br>Use test spray to trigger the sensor.<br>**Pass Fail Criteria:**<br>Alarm signal will trigger “Thermal runaway” procedure and displayed on HMI/WebVisu. | ☐ OK<br>☐ Defects<br>☐ N/A |
| 6.11 | **CO sensor test** | **Test Layout:**<br>Use test spray to trigger the sensor.<br>**Pass Fail Criteria:**<br>Alarm signal will trigger “Thermal runaway” procedure and displayed on HMI/WebVisu. | ☐ OK<br>☐ Defects<br>☐ N/A |

| | | | |
|---|---|---|---|
| 6.12 | **H2 Sensor Test** | **Test Layout:**<br>H2 Gas Alarm Test:<br>Simulate trigger value in software from gas sensor and check if exhaust units and fire dampers operate properly.<br>Check if gas alarm feedback is properly transmitted via hardwired signals. | |
| | | **Pass Fail Criteria:**<br>After gas alarm the fire dampers open and the exhaust units start venting out the containers.<br>Gas alarm feedback relay has opened. An error message is displayed in the WebVisu. | |

| Remarks: |
|---|
| |

# 6 Employees Present

Identify each employee involved in the execution of this protocol. Document the person's name, signature, name abbreviation and date in the following table:

| Company Name | Employee Name | Employee Signature | Abbreviation | Date |
|---|---|---|---|---|
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| | Yes/No |
|---|---|
| All persons involved in the factory acceptance test were documented. | ☐ Y<br>☐ N |

| Remarks: |
|---|
| |

# 7 Examination and authorisation

The test report becomes the factory acceptance report as soon as the individual test reports have been completed and labelled with a test date. The factory acceptance report is sent to the customer for confirmation and the results must be documented in the TR8 test report.

| **TR05** | **Examination and authorisation of execution** |
|---|---|
| Check the test results and original data. Final assessment for factory acceptance. | |
| □ PASSED | □ NOT PASSED |
| If there are any deviations, please complete the following section. | |
| Evaluate whether or not the existing deviation has an influence on the final factory acceptance test. | |
| □ YES | □ NO |

| Remarks: |
|---|
| |

| | | | |
|---|---|---|---|
| Carried out by: | | Date: | |
| | FREQCON GmbH | | DD/MM/YYYY |
| Authorised by: | | Date: | |
| | Customer | | DD/MM/YYYY |

# **Appendix A** - Measurement data for the performance test (if performed)

Insert prepared tables for performance values/times/temperatures/etc.