NetSure™ 7100 Energy

DC Power System – Hybrid

Test Instructions

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Technical Support Site

If you encounter any installation or operational issues with your product, check the pertinent section of this manual to see if the issue can be resolved by following outlined procedures.

Visit https://www.vertiv.com/support/ for additional assistance.

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Admonishments Used in this Document

DANGER! Warns of a hazard the reader ***will*** be exposed to that will ***likely*** result in death or serious injury if not avoided. (ANSI, OSHA)

WARNING! Warns of a potential hazard the reader ***may*** be exposed to that ***could*** result in death or serious injury if not avoided. This admonition is not used for situations that pose a risk only to equipment, software, data, or service. (ANSI)

CAUTION! Warns of a potential hazard the reader ***may*** be exposed to that ***could*** result in minor or moderate injury if not avoided. (ANSI, OSHA) This admonition is not used for situations that pose a risk only to equipment, data, or service, even if such use appears to be permitted in some of the applicable standards. (OSHA)

ALERT! Alerts the reader to an action that ***must be avoided*** in order to protect equipment, software, data, or service. (ISO)

ALERT! Alerts the reader to an action that ***must be performed*** in order to prevent equipment damage, software corruption, data loss, or service interruption. (ISO)

FIRE SAFETY! Informs the reader of fire safety information, reminders, precautions, or policies, or of the locations of fire-fighting and fire-safety equipment. (ISO)

SAFETY! Informs the reader of general safety information, reminders, precautions, or policies not related to a particular source of hazard or to fire safety. (ISO, ANSI, OSHA)

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Important Safety Instructions

Safety Admonishments Definitions

Definitions of the safety admonishments used in this document are listed under “Admonishments Used in this Document” on page iv.

General Safety

DANGER! YOU MUST FOLLOW APPROVED SAFETY PROCEDURES.

Performing the following procedures may expose you to hazards. These procedures should be performed by qualified technicians familiar with the hazards associated with this type of equipment. These hazards may include shock, energy, and/or burns. To avoid these hazards.

a) The tasks should be performed in the order indicated.

b) Remove watches, rings, and other metal objects.

c) Prior to contacting any uninsulated surface or termination, use a voltmeter to verify that no voltage or the expected voltage is present. Check for voltage with both AC and DC voltmeters prior to making contact.

NOTE! *Always verify that your voltmeter is in good condition by testing it against a recognized supply.*

d) Wear eye protection.

e) Use certified and well-maintained insulated tools. Use double-insulated tools appropriately rated for the work to be performed.

f) This equipment is not suitable for use in locations where children are likely to be present.

g) This product is intended only for installation in a Restricted Access Location.

h) Only authorized and properly trained personnel (Skilled person) should be allowed to install, inspect, operate, or maintain the equipment.

i) Do not work on LIVE parts. If required to work or operate live parts, obtain appropriate Energized Work Permits as required by the local authority or by other national building codes and local regulations.

Voltages

Hazardous Voltage

DANGER! HAZARD OF ELECTRICAL SHOCK.
More than one disconnect may be required to de-energize the system before servicing.

AC Input Voltages

DANGER! This system operates from an AC input voltage capable of producing fatal electrical shock. AC input power must be completely disconnected from the branch circuits' wiring used to provide power to the system before any AC electrical connections are made. Follow local lockout/tagout procedures to ensure upstream branch circuit breakers remain de-energized during installation. DO NOT apply AC input power to the system until all electrical connections have been completed and checked.

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DC Output

DANGER! This system produces DC power. Although the DC voltage is not hazardously high, the converters can deliver large amounts of current. Exercise extreme caution not to inadvertently contact or have any tool contact an output terminal or exposed wire connected to an output terminal. NEVER allow a metal object, such as a tool, to contact more than one termination at a time, or to simultaneously contact a termination and a grounded object. Even a momentary short circuit can cause sparking, explosion, and injury.

DANGER! Follow local lockout/tagout procedures to ensure DC branch circuit protection devices remain de-energized during installation at loads, as required.

Battery

WARNING! Correct polarity must be observed when connecting battery leads.

WARNING! Special safety precautions are required for procedures involving handling, installing, and servicing batteries. Observe all battery safety precautions in this manual and in the battery instruction manual. These precautions should be followed implicitly at all times.

WARNING! A battery can present a risk of electrical shock and high short-circuit current. Servicing of batteries should be performed or supervised only by properly trained and qualified personnel knowledgeable about batteries and the required precautions.

Personal Protective Equipment (PPE)

DANGER! ARC FLASH AND SHOCK HAZARD.
Appropriate PPE and tools are required when working on this equipment. An appropriate flash protection boundary analysis should be done to determine the “hazard/risk” category, and to select proper PPE.

Handling Equipment Containing Static Sensitive Components

ALERT! Installation or removal of equipment containing static-sensitive components requires careful handling. Before handling any equipment containing static-sensitive components, read and follow the instructions contained on the Static Warning Page.

Maintenance and Replacement Procedures

CAUTION! When performing any step in procedures that require the removal or installation of hardware, use caution to ensure no hardware is dropped and left inside the unit; otherwise, service interruption or equipment damage may occur.

NOTE! *When performing any step in procedures that require the removal of existing hardware, retain all hardware for use in subsequent steps, unless otherwise directed.*

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Static Warning

This equipment contains static-sensitive components. The warnings listed below must be observed to prevent damage to these components. Disregarding any of these warnings may result in personal injury or damage to the equipment.

1. Strictly adhere to the procedures provided in this document.
2. Before touching any equipment containing static-sensitive components, discharge all static electricity from yourself by wearing a wrist strap grounded through a one-megaohm resistor. Some wrist straps have a built-in one-megaohm resistor; no external resistor is necessary. Read and follow the wrist strap manufacturer's instructions outlining the use of a specific wrist strap.
3. Do not touch traces or components on equipment containing static-sensitive components. Handle equipment containing static-sensitive components only by the edges that do not have connector pads.
4. After removing equipment containing static-sensitive components, place the equipment only on conductive or anti-static material such as conductive foam, conductive plastic, or aluminum foil. Do not use ordinary Styrofoam™ or ordinary plastic.
5. Store and ship equipment containing static-sensitive components only in static shielding containers.
6. If necessary to repair equipment containing static-sensitive components, wear an appropriately grounded wrist strap, work on a conductive surface, use a grounded soldering iron, and use grounded test equipment.

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1 Introduction

1.1 Abbreviations used in this document:

AC Alternating Current

NCU NetSure™ Control Unit

CB Circuit Breaker

DC Direct Current

FV Freely Ventilated

LED Light Emitting Diode

LVD Low Voltage Disconnect

1.2 General

These test instructions apply to NetSure™ 7100 Energy DC Power Systems equipped with NCU Control Unit BMP903100/-, MPPT Solar Converters, and Rectifiers.

This performance test is to be made in the following cases:

- As a final test or an acceptance test of a new plant.
- As a final test or an acceptance test when a plant has been extended.
- As a scheduled performance test (Test of Signals and Supervision).

Read through the whole of these test instructions before starting the test.

2 Preliminaries

The person responsible for the power supply system shall have been informed that tests are to be made and that an alarm will be sent out to the central alarm unit.

2.1.1 Documents

The following documents are necessary for the test:

- The power manual, which includes this document.
- Battery documents from the battery supplier.

2.1.2 Test Equipment

The following equipment is necessary for the test:

- Test load from 2 – 10 A.
- Multimeter

2.2 Safety Rules

SAFETY! Tests may be undertaken only by adequately trained personnel with satisfactory knowledge about the power supply system. The most recent revision of the safety rules (10183324) and the safety rules in force locally shall be adhered to during the test.

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3 Installation Check

These checks refer to the separate power system INSTALLATION AND USER INSTRUCTIONS document.

3.1 Procedure

Item	Action	Comments (√ means OK)
Inspection of Cabinets		
1.	Inspect the equipment and accessories for compliance with the offer, delivery note, and installation instructions.	
2.	Check the anchoring of the cabinet(s).	
3.	Check the bar interconnection of cabinets, if applicable.	
4.	Check the connections between the power supply system and the system earth.	
5.	Check that the earthing of the cabinet(s) conforms to the installation instructions and local regulations.	
Inspection of Mains Connections		
6.	Check the electrical connections on the AC and DC mains power side for compliance with the installation instructions, drawings, and local regulations.	
7.	Check that AC and DC power protective measures conform to the installation instructions and local regulations.	
Inspection of Cabling		
8.	Check that the battery fuses/circuit breakers and cables are correctly dimensioned (cable area in relation to fuse/circuit breaker size).	
9.	Check the cable connections to the battery connection units (tightening, short-circuit protection, marking)	
10.	Check that the distribution fuses/circuit breakers and cables are correctly dimensioned (cable area in relation to fuse/circuit breaker size)	
11.	Check the cable connections to the distribution units (tightening, short-circuit protection, marking).	
12.	Check that communication and alarm cables are connected according to the document INSTALLATION AND USER INSTRUCTIONS.	
13.	Check the fixing of all cables connected to the cabinet(s) and that cable ties are correctly cut (no sharp edges).	
14.	Check the marking of all cables connected to the cabinet(s). It must be possible to trace the connections of all cables.	
Batteries		
15.	Check that the correct number of cells is installed.	
16.	Check that the battery cells face the right way by measuring their polarity with a voltmeter.	
17.	Install the inter-cell connectors of the batteries, leaving a middle connector open (not connected).	
18.	Check that the inter-cell connectors are correctly installed and tightened by the correct torque.	
19.	Check that the cell voltage equalizers, if any, are correctly connected across the cells.	
Initial Charging ***NOTE!*** *For freely ventilated (FV)* ***dry charged*** *batteries only.*		
20.	If freely ventilated (FV) dry charged batteries are used, they shall be charged initially according to the battery supplier's instructions.	

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4 Start-up Preparations

4.1 Procedure

Item	Action	Result	Comments (√ means OK)
1.	Check all batteries and distribution fuses/circuit breakers in the system.	They should be removed/ switched off.	
2.	Check the AC MAINS IN supply fuses/circuit breakers for the rectifiers.	They should be removed/ switched off.	
3.	Check the DC MAINS IN supply fuses/circuit breakers for the converters.	They should be removed/ switched off.	
4.	If installed, please disconnect the rectifiers from the subrack(s). See the document INSTALLATION AND USER INSTRUCTIONS of the system.		
5.	If installed, please disconnect the converters from the subrack(s). See the document INSTALLATION AND USER INSTRUCTIONS of the system.		
6.	Disconnect the control unit from the subrack. See the document INSTALLATION AND USER INSTRUCTIONS of the system.		
7.	Check with an ohmmeter between the positive and negative system terminals.	There must be no short-circuit (>10 kohms)	
8.	Check with an ohmmeter between the negative system terminal and the cabinet chassis.	There must be no short-circuit (>10 Mohms)	
9.	Check the battery block voltages and the total battery voltages.	The voltages shall correspond to values given by the battery supplier.	
10.	Check the AC mains phase voltage.	The rectifiers are designed for the nominal mains voltage range 200 to 250 VAC, 50/60 Hz. Voltage range 85 to 300 VAC.	
11.	Check the Solar DC input voltage.	The MPPT converters are designed for the nominal voltage of 200 to 420 VDC. Voltage range 70 to 420 VDC.	
12.	Install the rectifiers, converters, and the control unit in the subrack(s).		

5 Start-up and Installation Test

5.1 Procedure

Item	Action	Result	Comments (√ means OK)
1.	Connect/switch on the AC mains supply fuses/circuit breakers to the cabinet. If there is an AC distribution unit in the cabinet, switch on the mains circuit-breakers to the rectifiers. Connect/switch on the DC mains supply fuses/circuit breakers to the cabinet. If there is a DC distribution unit in the cabinet, switch on the mains circuit-breakers to the converters.	The green LEDs on the rectifiers, converters, and the NCU will emit light.	
		The rectifier and converter fans will start.	
		If the LVD contactors were off, they would operate.	
		An alarm, "Battery Fuse Alarm," will be issued, and the alarm LED of the NCU will emit light. The audible alarm will sound. (Press any button on the NCU to silence it.)	
2.	Check the DC voltage on the display of the NCU.	The voltage should be close to what has been set in the NCU. If temperature-compensated charging is activated, the difference may be ±2 V from the set value.	
3.	Using the NCU, select and set up battery temperature compensation in accordance with the battery manufacturer's instructions.		
4.	Locate and verify that the temperature compensation probe is active. Warm the sensor with your hand and verify the system voltage.		
5.	If temperature-compensated charging is activated, warm the sensor on the battery with your hand and observe the system voltage.	The voltage should start to drop.	

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Item	Action	Result	Comments (√ means OK)
6.	Install the last inter-cell connector on one of the battery banks.	The battery voltage should read 2.0 to 2.1 V/cell or 48 to 51 V/battery for a lead-acid battery that consists of 24 cells. If a cell reads below 2.0 V, it needs recharging or might be faulty.	
7.	Connect/switch on the battery fuse/CB for the same battery.	The battery voltage will increase and reach the system voltage. (This might take hours, depending on the charging state of the battery.)	
8.	Connect the other batteries in the same way.	The alarm "Battery Fuse Alarm" ceases.	
		The corresponding battery will increase its voltage and reach the system voltage.	
9.	Connect/switch on the distribution fuses/CBs.	The loads will get a DC supply.	
		The alarms on the NCU cease.	
10.	Check all the LEDs of the system.	Only the green LEDs "On" should emit light. No LED must flash.	

6 Test of Signals and Supervision

This item can be used as a scheduled performance test.

The alarms are checked on the display and on the alarm relay outputs.

NOTE! *The LED indications and alarm category may differ depending on the NCU settings. The indications in the tables below are the default settings.*

For configuration of the NCU, refer to the USER'S GUIDE (11KO7503JL) and TABLES OF SET VALUES (11QF2335LA).

The equipment shall be in normal operation, all the rectifiers shall be in operation, and the batteries shall be connected.

6.1 Procedure for Rectifiers/S48-4300e3, e4 Converters

Item	Action	Result	Comments (√ means OK)
1.	Check that all rectifiers / S48-4300e3, e4 converters connected to the system are recognized on the Status Rectifier/Converter pages of the NCU.	When the data is displayed, the green LED on the corresponding rectifier/converter will flash.	
2.	Pull out one Rectifier/ S48-4300e3, e4 converter.	Verify that the system logs the removal of a rectifier/converter.	
3.	Insert the Rectifier/ S48-4300e3, e4 converter.	The rectifier/converter starts, and the log recognizes its return.	
4.	Repeat items 2 and 3 for all Rectifiers/ S48-4300e3, e4 converters in the system.		
5.	Restore the incoming AC mains to the Rectifiers/ S48-4300e3, e4 converters.	The alarm ceases.	
6.	If possible, disconnect the AC mains supply for one Rectifier/ S48-4300e3, e4 converters.	Alarms "AC Input Fail", "Current Limit", and "Rectifier/Converter Protected" appear in the Active Alarm page of the NCU display.	
		The green and the yellow LEDs on the NCU and the rectifier emit light.	
7.	Restore the AC mains supply to the Rectifier/ S48-4300e3, e4 converter.	The alarms cease.	
8.	Repeat items 6 and 7 for all Rectifiers/ S48-4300e3, e4 converters in the system.		

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Item	Action	Result	Comments (√ means OK)
9.	If possible, disconnect the incoming DC mains to the S48-4300e3, e4 converters.	Alarm "DC Input Fail" appears in the Active Alarm page of the NCU display.	
		The green and an alarm LED on the NCU emit light. The green and the yellow LEDs on the rectifiers emit light.	
10.	Restore the incoming DC mains to the S48-4300e3, e4 converters.	The alarm ceases.	
11.	If possible, disconnect the DC mains supply for one S48-4300e3, e4 converter.	Alarm "Converter Communication Fail" appears in the Active Alarm page of the NCU display.	
		The green and an alarm LED on the NCU emit light. The green and the yellow LEDs on the converter emit light.	
12.	Restore the DC supply to the S48-4300e3, e4 converters.	The alarm ceases.	
13.	Repeat items 11 and 12 for all S48-4300e3, e4 converters in the system.		
14.	Remove/switch off one battery fuse/circuit-breaker.	Alarm "Battery Fuse Alarm" appears in the Active Alarm page of the NCU display.	
		An alarm LED on the NCU and a red LED on the battery CB alarm board emit light.	
15.	Connect/switch on the battery fuse/CB.	The alarms cease.	
16.	Repeat items 14 and 15 for all battery fuses/CBs of the system.		
17.	Remove/switch off one free (not used) distribution fuse/CB and connect a small load to it.	"DC Fuse Alarm" appears in the Active Alarm page of the NCU display.	
		An alarm LED on the NCU emits light.	
18.	Remove the load from the distribution fuse/CB.	The alarm ceases.	
19.	Check that all the values are correctly set. See document TABLES OF SET VALUES for the NCU.		

6.2 Independent DC Port (if applicable)

This port is/ may be provided to enable the integration of well–behaved third–party 48 VDC Energy Source, such as the fuel cells, DC Generators, or the Wind turbines. This port does not regulate or control the incoming energy source; it only monitors itself. Thus, it is the responsibility of the integrator to define the setup of this source and the corresponding test procedure.

7 Final Steps

7.1 Procedure

Item	Action	Comments (√ means OK)
1.	Disconnect any test equipment that has been connected to the system and make sure that materials not belonging to the equipment have been removed.	
2.	Restore the equipment to its original condition.	
3.	Check and hand over the customer documents to the client.	
4.	Check and hand over contracted spare parts, if any.	
5.	Make sure that all the actions taken have been noted in the logbook, stating at what time and the name of the person who took the actions.	

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