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803-505 Consumer Rd
Toronto, ON M2J 4V8 Tel: 1 416
494 9559
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RECEIVED
JULY 8, 2025
TOWNSHIP OF ARMOUR

Commissioning Plan Peer Review Response

Peer Reviewer Comment 1: The commissioning plan shall include a Responsibility Matrix (RACI table) that defines the roles and responsibilities of stakeholders involved in the commissioning process (developer, contractor(s), OEMs, utility, etc.) to ensure clarity and accountability.

SolarBank Response 1: A RACI matrix is included in Section 6 – Page 9 of the commissioning plan, clearly identifying all relevant parties and their respective responsibilities (Responsible, Accountable, Consulted, Informed) for each commissioning activity.

Peer Reviewer Comment 2: Prior to onsite testing and commissioning, Factory Acceptance Test (FAT) reports, pictures, and videos of the equipment, including but not limited to the DC BESS blocks and inverter-transformer skids, etc., shall be reviewed and any concerns that arise during the review shall be addressed by manufacturer.

SolarBank Response 2: Addressed in Section 3.2 – Page 4, which confirms that FAT documentation (reports, photos, videos) will be reviewed for all major equipment (e.g., battery containers, inverter-transformer skids). All deviations must be resolved by the OEM prior to site delivery and mobilization.

Peer Reviewer Comment 3: The parties in charge of commissioning shall indicate what testing and commissioning standard or procedure they are following. If the Original Equipment Manufacturer (OEM) provides testing and commissioning procedures for equipment, they shall be followed. If not, the responsible party shall follow an industry

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accepted standard such as "ANSI/NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems".

SolarBank Response 3: Covered in Section 3.3 – Page 4, where the plan confirms that testing will follow NETA ATS (2017 or latest version). OEM-specific procedures, for example, EVLO's battery and system commissioning protocols (see Appendix D), will take precedence where available.

Peer Reviewer Comment 4: The detailed commissioning plan shall include Equipment Test Sheet (ETS) for every piece of BOP equipment.

SolarBank Response 4: Covered in Section 3.4 – Page 4, which confirms that individual test sheets will be provided for each Balance of Plant (BOP) component including relays, cables, disconnects, distribution panels, UPS, SCADA, grounding, etc.

Peer Reviewer Comment 5: Energy Management System (EMS, or SPPC) and Energy Management Panels (EMPs) shall be energized and tested prior to BESS hot commissioning.

SolarBank Response 5: This requirement is addressed in Section 4.9 – Page 7, which outlines that EMS and EMPs will be energized, configured, and tested before hot commissioning proceeds.

Peer Reviewer Comment 6: As a part of commissioning, a thorough SCADA point-to-point test shall be conducted to verify the communication and data integrity between site devices and the remote operation and monitoring center. The test shall include alarms, statuses and analogs.

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SolarBank Response 6: Detailed in Section 4.10 – Page 7, which outlines full SCADA point testing with Hydro One.

Peer Reviewer Comment 7: A capacity test shall be conducted to prove that the BESS can meet or exceed Beginning of Life (BOL) energy capacity.

SolarBank Response 7: Addressed in Section 5.5 – Page 8, which describes a charge/discharge cycle that verifies SOC range, nameplate power, round-trip efficiency, and safe operation per OEM (EVLO) specs. Non-compliance will trigger OEM-led corrective action and retesting.

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Commissioning Plan

903 BESS Project

SOLARBANK

Date: July 1st, 2025

Revision: 01

Table of Contents

1. Introduction

1.1. Purpose

This document is the commissioning summary document for the 903 BESS project which is comprised of EVLO's Lithium battery technology. The purpose of this document and the other document in this package is to provide the necessary steps for the commissioning and energization of the field equipment in coordination with utility.

1.2. Project Description

The 903 BESS project is a 4.99 MW BESS generation facility. The project is located in the municipality of Armour, ON. The project will connect to the grid through an existing 44kV distribution line within the project area, which is owned by Hydro One.

2. Health & Safety

The safety of personnel and equipment are the highest priority during testing and commissioning activities.

Energization procedures are planned in advance and communicated to all site personnel. All planned procedures are to be followed and confirmed. Personnel shall complete a safety review prior to any commissioning and energization task. LockOut/Tag-Out procedures shall be implemented as required and the required PPE must be used.

All relevant sections of the Health & Safety Plan must be satisfied and recorded prior to the commencement of any commissioning activity. This includes, but is not limited to:

- Pre Task Planning
- Risk Assessment / Method Statement
- Permit to Work requirements
- Limitations of access / exclusion zones

The designated Commissioning Lead is responsible for ensuring the following safety measures are addressed:

- Ensuring all personnel on work tasks have the proper competencies.
- Ensuring all personnel are fully aware of their duties, responsibilities and the potential hazards associated with the system being tested.
- Restriction of access notices and barriers are posted.
- Access to and from equipment will be provided in a way which allows for a safe workplace and an efficient means of egress in the event of an emergency.
- Firefighting equipment must be available within the concerned areas. This will include equipment suitable for extinguishing electrical fires.
- Permits to work are current and enforced.
- Ensure the equipment to be tested is isolated and marked with commissioning tape/labels.

3. Commissioning Requirements

3.1. Pre-Commissioning Documentation Review

Prior to the start of commissioning, a pre-commissioning documentation review shall be performed.

This review shall include:

- Confirmation of Health & Safety Requirements
- Confirmation that all required permits are obtained and displayed as needed.
- Confirmation that delivery, handling, and storage procedures for all critical equipment (including BESS blocks, transformers, and control panels) are followed as per manufacturer guidelines.
- Collection and review of all equipment manuals, data sheets, and wiring diagrams, which shall be archived and made accessible for reference during commissioning and ongoing O&M.

3.2. Factory Acceptance Testing (FAT) Review

Prior to the commencement of onsite testing and commissioning activities, Factory Acceptance Test (FAT) documentation shall be thoroughly reviewed for all major equipment components, including but not limited to:

- Battery Containers,
- Inverter/Transformer skids,
- UPS,
- Auxiliary transformers
- SCADA equipment.

This documentation shall include FAT reports, photographs, and video evidence to demonstrate conformance to specifications and test protocols. Any issues, deviations, or concerns identified shall be documented and resolved by the respective equipment manufacturer prior to shipment to site.

Completion of this review is a prerequisite for site mobilization and field commissioning.

3.3. Test Procedures

Testing shall follow NETA Standard for Acceptance Testing Specifications (ATS) for Electrical power Equipment & Systems, 2017 or latest standard.

3.4. Test Reports

Test results shall be submitted to the owner in a Test Report(s) as per ATS Section 5.4. The Test Report(s) shall include any deficiencies and recommendations arising from the commissioning.

Test results for individual pieces of equipment shall be recorded on equipment Test Sheets as per ATS Section 5.4.2. Test Sheets shall be provided for all relevant equipment, including but not limited to:

- Protection & Control panels
- Protection relays
- MV and LV transformers
- MV and LV power cables

- Disconnect switches, switchgear, breakers and fuses
- AC and DC distribution panels
- UPS and/or Battery/Charger Systems
- SCADA equipment, telecommunication devices, and fiber optics
- Ground Grid

Test Sheets shall serve as formal documentation of equipment readiness and compliance prior to system energization.

3.5. Hydro One COVER

Hydro One COVER document is a sign-off document recording the completion of project specific testing required for connection to Hydro One's system. The COVER is specific to Hydro One's connection requirements and is not a complete commissioning plan.

The COVER process includes signed-off submissions for the following project Milestones:

- Milestone #1 Connection as a Load Only
- Milestone #2 Connection as a Load with Generator Testing Rights
- Milestone #3 Connection as a Generator

4. Commissioning Tests – Pre-Energization

4.1. Medium Voltage Electrical Equipment

Acceptance testing is required on all MV equipment prior to energization.

Testing scope to include Manufacturers' requirements and ATS requirements.

Equipment to be tested includes:

- MV Motor Operated Disconnect Switch (S&C Alduti-Rupter)
- MV Recloser (G&W HV Viper)
- MV power cables
- MV transformers
- MV switches and Fuses
- MV lightning arresters
- MV Revenue Metering PT/CTs

4.2. Low Voltage Electrical Equipment

Acceptance testing is required on all LV equipment prior to energization.

Equipment to be tested includes:

- LV power cables
- LV switches and fuses
- LV transformers

4.3. Instrument Transformer Tests

All PTs and CTs supplying protective relays shall be tested prior to COVER Milestone #2. Depending on location of the PT/CTs it may be preferable to test them prior to energization (Milestone #1).

Testing shall include:

- Ratio Test
- Polarity Test
- Insulation Test
- CT Saturation Test
- CT secondary circuit continuity test
- Confirmation that PT/CT secondary circuits are grounded, and in one location only.
- Removal of factory installed CT shorting bars/jumpers as required.

4.4. Protective Relay Testing

All protective relays shall be tested prior to COVER Milestone #2.

Equipment to be tested includes:

- SEL-651R Recloser Control Relay
- SEL-2440

Testing shall include:

- Functional I/O tests
- Functional logic tests including breaker failure protection
- Secondary Injection Testing
- Confirm IRIG-B time synchronization
- Test Trips

4.5. Transfer Trip Protection

Transfer Trip Protection shall be tested prior to COVER Milestone #2.

Transfer Trip Protection testing will involve end-to-end testing with Hydro One Protection & Control staff and should be coordinated in advance.

Testing to include:

- Acceptance testing of S4T4 communications circuit
- Functional testing of NSD-570 inputs and outputs
- Confirmation of Guard and Trip signals and levels
- Confirmation of alarm output(s)
- Dead Zone Test Trip
- Live Zone Test Trip

Refer to Hitachi NSD-570 Operating Instructions Section 7 - Commissioning.

Refer to Hydro One NSD570 Telecom Standard Appendix H (attached).

4.6. LV Auxiliary DC Battery System(s)

Auxiliary DC Battery System(s) shall be tested prior to COVER Milestone #2.

Acceptance testing in accordance with ATS is required for the DC battery/charger/distribution system(s).

4.7. BESS Battery Enclosures and Inverters

Pre-energization commissioning to be performed in accordance with Manufacturer’s Instructions.

4.8. Revenue Metering

Complete pre-energization commissioning tests of revenue metering as per Revenue Metering Commissioning Plan.

4.9. Control Systems

Control systems should be checked and verified prior to station energization. Most of the commissioning will require power and will be completed prior to COVER Milestone #2.

Commissioning is required for the various control systems/panels, including but not limited to:

- Site Power Plant Controller (SPPC),
- Energy Management System (EMS),
- Energy Management Panels (EMPs),
- SCADA monitoring and control (SCADA).

Control systems shall be energized, configured, and tested prior to BESS hot commissioning. The following must be verified:

- Availability of internal power supplies
- Proper operation of control logic and functional interfaces
- Interoperability with BESS components and SCADA systems
- communications

This ensures reliable command and control capabilities are in place for safe and coordinated system operation.

4.10. HONI SCADA Point-to-Point Testing

Verification of SCADA communications to Hydro One and completion of point testing is required prior to COVER Milestone #2.

- Confirm SCADA Communications to Hydro One Control Centre
- Confirm DNP3 session
- Complete Point Testing

Point Testing to include:

- Digital Inputs - alarms and status
- Analog Inputs - voltage, current, power, etc.
- Digital Outputs - Remote commands and control functions

Refer to approved SCADA Points List.

5. Commissioning Tests – Post-Energization

5.1. Online Relay Phasor Readings

Confirm phase rotation, angle and magnitude of voltage and current phasors.

Screen capture online phasor readings for test report.

5.2. Online SCADA Values

Confirm online values of voltage, current, power etc. with Hydro One Control Centre.

5.3. Online Revenue Metering Verification

As per Revenue Metering Commissioning Plan.

5.4. BESS Functional Tests

Complete functional tests as per EVLO Commissioning Plan.

5.5. BESS Capacity and Round-Trip Efficiency (RTE) Testing

Following successful functional tests, a full-capacity and efficiency test shall be conducted to verify system performance:

- SOC Compliance: System must charge and discharge fully within OEM-defined SOC limits
- Power Delivery: BESS must sustain nameplate power rating for charge/discharge durations
- Efficiency: Round-trip efficiency (RTE) must meet or exceed manufacturer's nameplate rating
- Stability: Module/cell voltage, current, and temperature shall remain within design operating ranges
- Alarm-Free Operation: System must operate without faults or alarms during test cycle

If any of the above criteria are not met, corrective actions will be taken in consultation with the OEM, and the system shall be retested until compliance is achieved.

5.6. SCADA Controls

Verify operation of SCADA system as per SCADA Commissioning Plan.

6. Commissioning Responsibility Matrix (RACI)

Task / Activity	Solarbank	PRI (Civil Eng)	Raven (Electrical Eng)	Anvil Crawler (LV Contractor)	EVLO (Battery OEM)	Sparkpower (MV Contractor)	N-SCI	HONI	Cachelan (SCADA)	Rodan (IESO)
	Shijiao Xie, P. Eng.	Arash Yazdani, CED, FEC, P.Eng.	Andrew Durwards, P. Eng.	Rob Miller	Alexandrine Joseph, ING. PMP.	Dave MacLean	Sherise McKenzie	Yushun Yang	Tak Chau	Danylo Grod
Pre-Commissioning Safety & Doc Review	A	C	I	C	C	C	I	I	I	I
Civil Engineering Sign-Off	C	R	I	A	I	I	I	I	I	I
EMS / EMP Pre-Commissioning	C	I	I	C	R / A	I	I	I	C	I
SCADA Point-to-Point Testing	C	I	C	C	I	I	I	I	R / A	I
OEM Battery Commissioning	C	I	I	C	R / A	I	I	I	I	I
LV Commissioning	C	I	I	R / A	I	I	I	I	I	I
MV Commissioning	C	I	I	I	I	R / A	I	I	I	I
Monitoring & Control Commissioning	C	I	I	C	I	I	I	I	R / A	I
Utility Commissioning (COVER)	A	I	R	I	I	C	I	R	C	I

IESO Market Registration & Commissioning	C	I	I	C	C	C	A	I	I	R

Notes:

- R = Responsible: Executes the task
- A = Accountable: Ultimately answerable for the result
- C = Consulted: Provides input, must be consulted
- I = Informed: Updated on progress and outcomes
- Additionally: please note that ESA will be called in for all electrical inspections under the ESA license.

7. Stakeholder Commissioning Responsibilities Summary

The following table outlines the major commissioning responsibilities for each stakeholder in the Battery Energy Storage System (BESS) project. Each party maintains its own detailed commissioning documentation, which is referenced below. These documents collectively support the overall commissioning effort by defining test protocols, responsibilities, verification procedures, and interface requirements. Responsibility designations follow the RACI model to ensure transparency and accountability.

Brief Task Description	Primary Party	Detailed Document Reference
Final inspection and sign-off. Commitment-to-review letter	**Civil Engineer (PRI)**	Appendix A – Civil Engineering Sign Offs
Commissioning of low-voltage AC and DC panels, UPS, disconnects, internal wiring within the E-House	**LV Contractor (Anvil Crawler)**	Appendix B – Anvil Crawler – LV Commissioning Documentation
Installation and commissioning of MV transformer, switchgear, and cable connections to utility interconnection	**MV Contractor (Sparkpower)**	Appendix C – Sparkpower – MV Commissioning Documentation
Factory acceptance, site installation, and commissioning of BESS modules, BMS, and safety validation	**Battery OEM (EVLO)**	Appendix D – EVLO – Battery Commissioning Documentation
SCADA system integration, point-to-point I/O validation, control logic, remote access setup, and revenue metering.	**SCADA Integrator and Metering Installation (N-SCI)**	Appendix E – N-SCI Commissioning Documentation
Remote monitoring interface configuration and visibility testing	**Monitoring Vendor (Cachelan)**	Appendix F – Cachelan Commissioning Scope
Telemetry testing, commissioning test form validation	**IESO Commissioning (Rodan)**	Appendix G – Rodan – IESO Commissioning and Market Integration Guide
Protection witness testing, interconnection energization approval, and system sign-off	**Utility (Hydro One – HONI)**	Appendix H – HONI – Interconnection Commissioning Documentation

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Appendix A – Civil Engineering Sign Off

Project 903

OWNER COMMITMENT TO HAVE GENERAL REVIEW UNDERTAKEN BY ARCHITECTS AND/OR PROFESSIONAL ENGINEERS

PART A – TO BE COMPLETED BY OWNER

Project Description:

Permit Application No.

Address of Project:

Municipality:

WHEREAS the Building Code Act prohibits the construction or demolition of a building if a permit authorizing the construction or demolition has not been issued, and
WHEREAS the Building Code requires that the construction or demolition of the project indicated have general review undertaken by architects and/or professional engineers that are licensed to practice in Ontario, and
WHEREAS general review shall not commence until a permit is issued.
NOW THEREFORE the Owner, who intends to construct or demolish or have the project indicated constructed or demolished, hereby confirms that:

1. The undersigned architect(s) and/or professional engineer(s) have been retained to undertake general review of the construction or demolition of the project indicated to determine whether construction or demolition of the project indicated is in general conformity with the plans and other documents that form the basis for the issuance of a permit, with general review undertaken in accordance with the performance standards of the Ontario Association of Architects (OAA) and/or Professional Engineers Ontario (PEO);
2. All general review reports by the architect(s) and/or professional engineer(s) will be forwarded promptly to the Chief Building Official;
3. Should any retained architect or professional engineer cease to provide general review for any reason during construction or demolition, the Chief Building Official will be notified in writing immediately, and another architect or professional engineer will be retained so that general review continues without interruption;
4. Construction or demolition of the project indicated will only be undertaken if architect(s) and/or professional engineer(s) are retained to undertake general review and a permit authorizing the construction or demolition has been issued; and
5. The architect(s) and/or professional engineer(s) listed below will be notified in writing of the start date of the construction or demolition of the project indicated and that no construction or demolition will commence before the start date given in the notification.

The undersigned hereby certifies that he or she has read and agrees to the above.

Owner's Company Name:	First and Last Name:	Signature:	Date:
Owner's Address:	Telephone:	Fax:	Email:

Company name of the coordinator of the work of all architects and professional engineers:			First and Last Name:
Address:	Telephone:	Fax:	Email:

PART B – TO BE COMPLETED BY ARCHITECTS AND PROFESSIONAL ENGINEERS

The undersigned architect(s) and/or professional engineer(s) hereby declare that they are licensed to practice in Ontario and have been retained to undertake general review of the parts of construction or demolition of the project indicated to determine whether the construction or demolition is in general conformity with the plans and other documents that form the basis for the issuance of a permit, with general review completed in accordance with the performance standards of the OAA and/or PEO.

☐ ARCHITECTURAL ☐ STRUCTURAL ☐ MECHANICAL ☐ ELECTRICAL ☐ SITE SERVICES ☐ OTHER: ______________

Company Name:	First and Last Name:	Signature:	Date:
Address:	Telephone:	Fax:	Email:

☐ ARCHITECTURAL ☐ STRUCTURAL ☐ MECHANICAL ☐ ELECTRICAL ☐ SITE SERVICES ☐ OTHER: ______________

Company Name:	First and Last Name:	Signature:	Date:
Address:	Telephone:	Fax:	Email:

☐ ARCHITECTURAL ☐ STRUCTURAL ☐ MECHANICAL ☐ ELECTRICAL ☐ SITE SERVICES ☐ OTHER: ______________

Company Name:	First and Last Name:	Signature:	Date:
Address:	Telephone:	Fax:	Email:

☐ ARCHITECTURAL ☐ STRUCTURAL ☐ MECHANICAL ☐ ELECTRICAL ☐ SITE SERVICES ☐ OTHER: ______________

Company Name:	First and Last Name:	Signature:	Date:
Address:	Telephone:	Fax:	Email:

Civil Engineering – Commissioning Checklist & Sign-off Memo

Project: 903
Location: 219 Peggs Mountain Rd, Burk's Falls, ON P0A 1C0
Prepared by: Solarbank Corporation
Date: 01/07/2025

Scope of Review

Final civil inspection of the installed E-House structure, including foundation interface, alignment, and structural integrity, as per design drawings and manufacturer specifications.

Commissioning Checklist

Item	Status	Comments
Foundation dimensions and leveling	☐ Yes ☐ No	
Anchor bolt placement and torque check	☐ Yes ☐ No	
Structure plumb, square, and aligned	☐ Yes ☐ No	
E-House securely mounted to foundation	☐ Yes ☐ No	
Door function and weather seal inspection	☐ Yes ☐ No	
Roof installation checked (no leaks/gaps)	☐ Yes ☐ No	
Wall panels and joints properly sealed	☐ Yes ☐ No	

Civil Sign-Off

I certify that the E-House structure has been inspected and found to be installed in accordance with the approved design and structural specifications.

Name: _____
Company: _____
Signature: _____
Date: _____

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Appendix B – Anvil Crawler – LV Commissioning Documentation

Project 903

AC Test Report - Auxiliary Service Equipment Installation

Installation Verification Checklist

Project Name: 903 – Solarbank BESS Project

Completed By:

Name: _____

Company: _____

Date: _____

Notes to Inspector:

1. Place a "Y" for requirements that are met, "N/A" for requirements that are not applicable, and "N" for requirements that have not been met

Equipment Name	Equipment is securely fastened to the supporting structure.	Voltage, current and NEMA ratings match those specified on the drawings.	Enclosure is free from damage, all weather seals (if applicable) are intact, doors and latches operate properly.	Equipment is free of water and signs of moisture entry. Cable entries and other penetrations are water tight.	Equipment is clean and free of dirt and debris.	Conductors sizes and types match the drawings.	All conductors and insulating jackets are free from mechanical damage.	All field connections are torqued to the appropriate tightness and are torque marked.	Fuse/breaker models and sizes match the drawings	Disconnect(s)/Breaker(s) have been tested and operate properly	Equipment is bonded (and grounded, as applicable) per design and OESC.
Metering Cabinet									N/A		
Main Disconnect											
89-G Generator Disconnect											
600V Splitter									N/A		
SST1 - X 400A Disconnect											
SST1 – 225 KVA Transformer									N/A		
460V Splitter									N/A		
DP1-X – 200A Disconnect											

Equipment Name	Equipment is securely fastened to the supporting structure.	Voltage, current and NEMA ratings match those specified on the drawings.	Enclosure is free from damage, all weather seals (if applicable) are intact, doors and latches operate properly.	Equipment is free of water and signs of moisture entry. Cable entries and other penetrations are water tight.	Equipment is clean and free of dirt and debris.	Conductors sizes and types match the drawings.	All conductors and insulating jackets are free from mechanical damage.	All field connections are torqued to the appropriate tightness and are torque marked.	Fuse/breaker models and sizes match the drawings	Disconnect(s)/Breaker(s) have been tested and operate properly	Equipment is bonded (and grounded, as applicable) per design and OESC.
DP2-X – 200A Disconnect											
DP3-X – 200A Disconnect											
SST2-X – 100A Disconnect											
SST2 – 30 KVA Transformer									N/A		
LP1 – 100A E-House Panel											

AC Test Report – Cable Insulation Resistance Auxiliary AC

Installation Verification Checklist

Project Name: 903 – Solarbank BESS Project

Completed By:

Name: _____

Company: _____

Date: _____

Notes to Tester:

1. The purpose of this form is to record the initial insulation resistance values measured for the AC cables as they are installed onsite, prior to termination.
2. Prior to starting tests, record the required information for the meter that is being used to complete the work in the table below and test conditions.
3. Prior to starting tests, test the operation of the meter by measuring the insulation resistance with the test leads together, and again with them apart.
4. Conductors/cables should only be tested once the associated circuit is fully isolated, with conductors unseated, prior to final terminations.
5. **Associated equipment is not to be energized prior to full completion of the below insulation resistance checks.**

Standard: IEA-PVPS T5-06: 2002, Section 5.4.7

Criteria: "Insulation resistance readings on all wires, cables, and bus bars should typically exceed 10 MΩ."

Meter Used to Test Insulation Resistance:

Model #:		Calibration Date:	
Serial #:		Certificate #:	

Test Conditions:

AVG Temp (ºC):	

Equipment Name (Point A)	Equipment Name (Point B)	Test Voltage	Line 1 (Red) to Line 2 (Black)	Line 1 (Red) to Line 3 (Blue)	Line 1 (Red) to Neutral (White)	Line 1 (Red) to Ground / Bond	Line 2 (Black) to Line 3 (Blue)	Line 2 (Black) to Neutral (White)	Line 2 (Black) to Ground / Bond	Line 3 (Blue) to Neutral (White)	Line 3 (Blue) to Ground / Bond
		(V)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)
HT1 (Auxiliary Transformer)	Metering Cabinet										
Metering Cabinet	Main 400A Disconnect										
Main 400A Disconnect	Manual Transfer Switch										
89-G	Manual Transfer Switch										

Equipment Name (Point A)	**Equipment Name (Point B)**	Test Voltage	Line 1 (Red) *to* Line 2 (Black)	Line 1 (Red) *to* Line 3 (Blue)	Line 1 (Red) *to* Neutral (White)	Line 1 (Red) *to* Ground / Bond	Line 2 (Black) *to* Line 3 (Blue)	Line 2 (Black) *to* Neutral (White)	Line 2 (Black) *to* Ground / Bond	Line 3 (Blue) *to* Neutral (White)	Line 3 (Blue) *to* Ground / Bond
		(V)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)
Manual Transfer Switch	600V Splitter										
Splitter	SST1-X										
SST1-X	SST1										
SST1	480V Splitter										
480V Splitter	DP1-X										
480V Splitter	DP2-X										
480V Splitter	DP3-X										
DP1-X	DP1										
DP2-X	DP2										
DP3-X	DP3										
600V Splitter	SST2-X										
SST2-X	SST2										
SST2	LP1										

AC Test Report - Startup Voltage

AC Startup Voltage Check

Project Name: 903 - Solarbank BESS Project

Completed By:

Name: _____

Company: _____

Date: _____

Notes to Tester:

1. The purpose of this form is to record the initial AC Voltage values measured for AC cables as they are energized onsite, in the below order.
2. Prior to starting tests, record the required information for the meter that is being used to complete the work in the table below and testing conditions.
3. Prior to starting tests, ensure all equipment is isolated (open circuit). Equipment is to be energized in order (starting at grid), following successful voltage results at each device.

Meter Used to Test AC Voltage:

Model #:	
Serial #:	
Calibration Date:	

Testing Conditions:

Time:	
Temp (ºC):	

Equipment Name		Line 1 (Red)	Line 1 (Red)	Line 1 (Red)	Line 1 (Red)	Line 2 (Black)	Line 2 (Black)	Line 2 (Black)	Line 3 (Blue)	Line 3 (Blue)
		to	*to*	*to*	*to*	*to*	*to*	*to*	*to*	*to*
		Line 2 (Black)	Line 3 (Blue)	Neutral (White)	Ground / Bond	Line 3 (Blue)	Neutral (White)	Ground / Bond	Neutral (White)	Ground / Bond
	-	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)
Metering Cabinet	Line Side									
	Load Side									
Main 400A Disconnect	Line Side									
	Load Side									
89-G Generator Docking Station	Line Side									
	Load Side									
600V Splitter	Line Side									
	Load Side									
SST-1 – 400A Disconnect	Line Side									
	Load Side									

Equipment Name		Line 1 (Red)	Line 1 (Red)	Line 1 (Red)	Line 1 (Red)	Line 2 (Black)	Line 2 (Black)	Line 2 (Black)	Line 3 (Blue)	Line 3 (Blue)
		to	*to*	*to*	*to*	*to*	*to*	*to*	*to*	*to*
		Line 2 (Black)	Line 3 (Blue)	Neutral (White)	Ground / Bond	Line 3 (Blue)	Neutral (White)	Ground / Bond	Neutral (White)	Ground / Bond
	-	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)
SST1 – 225 KVA Transformer	Line Side									
	Load Side									
460V Splitter	Line Side									
	Load Side									
DP1-X – 200A Disconnect	Line Side									
	Load Side									
DP2-X – 200A Disconnect	Line Side									
	Load Side									
DP3-X – 200A Disconnect	Line Side									
	Load Side									
SST2-X – 100A Disconnect	Line Side									
	Load Side									
SST2 – 30 KVA Transformer	Line Side									
	Load Side									
LP1 – 100A E-House Panel	Line Side									
	Load Side									

DC Test Report – Cable Insulation Resistance DC Feeders

Installation Verification Checklist

Project Name: 903 – Solarbank BESS Project

Completed By:

Name: _____

Company: _____

Date: _____

Notes to Tester:

1. The purpose of this form is to record the initial insulation resistance values measured for the AC cables as they are installed onsite, prior to termination.
2. Prior to starting tests, record the required information for the meter that is being used to complete the work in the table below and test conditions.
3. Prior to starting tests, test the operation of the meter by measuring the insulation resistance with the test leads together, and again with them apart.
4. Conductors/cables should only be tested once the associated circuit is fully isolated, with conductors unseated, prior to final terminations.
5. **Associated equipment is not to be energized prior to full completion of the below insulation resistance checks.**

Standard: IEA-PVPS T5-06: 2002, Section 5.4.7

Criteria: "Insulation resistance readings on all wires, cables, and bus bars should typically exceed 10 MΩ."

Meter Used to Test Insulation Resistance:

Model #:		Calibration Date:	
Serial #:		Certificate #:	

Test Conditions:

AVG Temp (ºC):	

Equipment Test Point A	Equipment Test Point B	Test Voltage	Pos 1 (Red)	Pos 1 (Red)	Pos 1 (Red)	Pos 1 (Red)	Pos 1 (Red)	Pos 2 (Red)	Pos 2 (Red)	Pos 2 (Red)	Pos 2 (Red)	Neg 1 (Bla)	Neg 1 (Bla)	Neg 1 (Bla)	Neg 2 (Bla)	Neg 2 (Bla)	G 1 (Grn)
			to	to	to	to	to	to	to	to	to	to	to	to	to	to	to
			Pos 2 (Red)	Neg1 (Bla)	Neg 2 (Bla)	G 1 (Grn)	G 2 (Grn)	Neg 1 (Bla)	Neg 2 (Bla)	G 1 (Grn)	G 2 (Grn)	Neg2 (Bla)	G 1 (Grn)	G 2 (Grn)	G 1 (Grn)	G 2 (Grn)	G 2 (Grn)
		(V)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)
PCS 1	BESS 1																
PCS 1	BESS 2																
PCS 2	BESS 3																
PCS 2	BESS 4																

Equipment Test Point A	Equipment Test Point B	Test Voltage	Pos 1 (Red)	Pos 1 (Red)	Pos 1 (Red)	Pos 1 (Red)	Pos 1 (Red)	Pos 2 (Red)	Pos 2 (Red)	Pos 2 (Red)	Pos 2 (Red)	Neg 1 (Bla)	Neg 1 (Bla)	Neg 1 (Bla)	Neg 2 (Bla)	Neg 2 (Bla)	G 1 (Grn)
			to	to	to	to	to	to	to	to	to	to	to	to	to	to	to
			Pos 2 (Red)	Neg1 (Bla)	Neg 2 (Bla)	G 1 (Grn)	G 2 (Grn)	Neg 1 (Bla)	Neg 2 (Bla)	G 1 (Grn)	G 2 (Grn)	Neg2 (Bla)	G 1 (Grn)	G 2 (Grn)	G 1 (Grn)	G 2 (Grn)	G 2 (Grn)
		(V)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)	(MΩ)
PCS 3	BESS 5																
PCS 3	BESS 6																
PCS 4	BESS 7																
PCS 5	BESS 8																
PCS 5	BESS 0																

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Appendix C – Sparkpower – MV Commissioning Documentation

Project 903

SPARKPOWER®

<CUSTOMER NAME>
<SITE NAME>

MV Switch and Manual Operator
Test Procedure XXXXX – P2

Air Break MV Switches will be tested as listed in the manufacturer's instructions, Spark Test Sheets and NETA Section 7.5.1.3.

Switch		
Equipment ID	*Serial No.*	
Manufacturer	*Voltage*	***kV Max.***
Type	*B.I.L.*	***kV***
Style / Cat.	*Current*	***Amps***

Operator	
Manufacturer	*Serial No.*
Style / Cat.	*Type*

Mechanical Inspection

Spark Test Sheet

1. Inspect operating mechanism.

   Tested By: **Date Completed:**

2. Verify manual operation, alignment and penetration.

   Tested By: **Date Completed:**

   Inspect and record the condition of each insulator.

   Tested By: **Date Completed:**

3. Inspect and record the condition of the stationary and moving contact surfaces.

   Tested By: **Date Completed:**

4. Inspect and record ground gradient mat for position and ground connections.

   Tested By: **Date Completed:**

<CUSTOMER NAME>
<SITE NAME>

MV Switch and Manual Operator
Test Procedure XXXXX – P2

5. Inspect and record ground connection to the manual-operating handle.
   Tested By: **Date Completed:**

6. Inspect and record tower condition.
   Tested By: **Date Completed:**

7. Inspect and record tower grounding.
   Tested By: **Date Completed**

8. Set and test pallet switches.
   Tested By: **Date Completed:**

Electrical Testing

1. Measure the contact resistance of the main contacts. Resistance measurement based on 100A DC current test.
   Spark Test Sheet High Voltage Air Break Switch
   Tested By: **Date Completed:**

2. Photograph the nameplate of the High Voltage Air Break Switch.
   Photographed By: **Date Completed:**

3. Measure the insulation resistance of the switch. Insulation resistance @ 10kV DC.
   Spark Test Sheet High Voltage Air Break Switch
   Tested By: **Date Completed:**

(*) Tests that need to be completed in the order listed above.

SPARKPOWER®

<CUSTOMER NAME>
<SITE NAME>

MV Switch and Manual Operator
Test Procedure XXXXX – P2

AC / DC Control Wire Check

Yellow line applicable schematic drawings

1. Verify wire connections to pallet SW.
   Tested By: **Date Completed:**

Testing Completed

Technical Lead – Signature Spark	Date
Project Manager – Signature Spark	Date

SPARKPOWER®

<CUSTOMER NAME>
<SITE NAME>

IED Protective Relay
Test Procedure XXXXX - P5 - IED

IED PROTECTIVE RELAY			
Location			
Substation ID	**Main 230 kV**	*Equipment ID*	
Room Location		*Serial No.*	
Manufacturer		*Part No.*	
Type		*Firm Ware Rev.*	
Style / Cat.		*Power Supply*	***VDC***

IED Protective Relay will be tested as listed in the manufacturer's instructions, Spark Test Sheets, Omicron Test Results and NETA Section 7.9.2

Initial Inspection

1. Record Serial No., Part No. and Firmware Revision No. record on Procedure Sheet.

   Tested By: Date Completed:

2. Confirm correct power supply voltage and polarity.

   Tested By: Date Completed:

3. Power relay up and install setting file.

   Tested By: Date Completed:

4. Confirm Correct Communication Settings.

   Tested By: Date Completed:

SPARKPOWER®

<CUSTOMER NAME>
<SITE NAME>

IED Protective Relay
Test Procedure XXXXX - P5 - IED

Electrical Testing

1. Confirm operation of required protection elements and metering record as Omicron test report or Spark test sheet.
   Tested By: Date Completed:

2. Confirm correct logic operation record as "yellow line" on logic diagram provided. Tested By: Date Completed:

3. Confirm field AC current and voltage inputs from field devices. Record as "yellow line" on the AC 3 line Diagrams and CT Loop Test Sheet TS-1
   Tested By: Date Completed:

4. Confirm Correct Trip and I/O function to field and other devices. Record as "yellow line" on DC schematic drawings.
   Tested By: Date Completed:

5. If required Confirm End to End communication and correct function to other IED devices. For example mirror bits or line differential function.
   Tested By: Date Completed:

6. If required Confirm correct communication and network function to other IED devices. For example communications to a MMI or SCADA device.
   Tested By: Date Completed:

7. If required Confirm correct Analog and Digital values to remote SCADA.

Tested By: Date Completed:

(*) Tests that need to be completed in the order listed above.

SPARKPOWER®

<CUSTOMER NAME>
<SITE NAME>

IED Protective Relay
Test Procedure XXXXX - P5 - IED

Testing Completed

Technical Lead – Signature	Date
Project Manager – Signature	Date

SPARKPOWER®

<CUSTOMER NAME>
<SITE NAME>

28kV SF6 Circuit Breaker
And Isolation Switches
Test Procedure XXXXXXX - P7A

Circuit Breaker will be tested as listed in the manufacturer's instructions, Spark Test Sheets and NETA Section 7.6.4.

Substation ID	**Port Colborne TS**		
Equipment ID		*Serial No.*	

Manufacturer		*Voltage*	***kV***
Type		*B.I.L.*	***kV***
Style / Cat.		*Current*	***Amps***
Control Voltage	**125 *VDC***		***kA***
Operations Counter	*(as left)*		

Mechanical Inspection

Spark Test Sheet

1. Inspect operating mechanism.
   Tested By: **Date Completed:**

2. Remove mechanical operation blocking device.
   Tested By: **Date Completed:**

3. Verify manual operation.
   Tested By: **Date Completed:**

4. Verify operation of the close/open indicator.
   Tested By: **Date Completed:**

5. Verify operation of the charged/discharged spring position indicator.
   Tested By: **Date Completed:**

<CUSTOMER NAME>
<SITE NAME>

28kV SF6 Circuit Breaker
And Isolation Switches
Test Procedure XXXXXXX - P7A

6. Inspect/record the condition of each bushing.
   Tested By: **Date Completed:**

7. Inspect/record the condition of each dead tank assembly.
   Tested By: **Date Completed:**

8. Inspect/record tower condition.
   Tested By: **Date Completed:**

9. Inspect/record tower grounding.
   Tested By: **Date Completed:**

Electrical Testing

1. Measure the contact resistance of the main contacts. Resistance measurement based on 100A DC input. (*)
   Spark Test Sheet
   Tested By: **Date Completed:**

2. Measure the contact resistance of the Isolation switches contacts. Resistance measurement based on 100A DC input. (*)
   Spark Test Sheet
   Tested By: **Date Completed:**

3. Measure the insulation resistance of the SF6 circuit breaker. Resistance measured at 10 kV DC(*)
   Spark Test Sheet
   Tested By: **Date Completed:**

4. Photograph the SF6 circuit breaker nameplate.
   Photographed By: **Date Completed:**

<CUSTOMER NAME>
<SITE NAME>

28kV SF6 Circuit Breaker
And Isolation Switches
Test Procedure XXXXXXX - P7A

5. Measure the insulation resistance of the Isolation switches. Resistance measured at 10 kV DC(*)
Spark Test Sheet
Tested By: **Date Completed:**

6. Photograph the Isolation switch nameplates.
Photographed By: **Date Completed:**

7. Test current transformers for winding resistance, saturation, polarity and ratio. (*)
See NDB Test Report
Tested By: **Date Completed:**

8. Photograph the nameplate of the current transformer.
Photographed By: **Date Completed:**

9. Breaker timing test.
See GE Programa Test Report
Tested By: **Date Completed:**

(*) Tests that need to be completed in the order listed above.

AC / DC Control Wire Check

Yellow line applicable schematic drawings

1. Verify wire connections.
Tested By: **Date Completed:**

2. Verify current transformer (CT) connections.
Check 3 line and protection drawings for final CT ratio
Tested By: **Date Completed:**

<CUSTOMER NAME>
<SITE NAME>

28kV SF6 Circuit Breaker
And Isolation Switches
Test Procedure XXXXXXX - P7A

3. Verify current transformers' shorting pins are removed
   Tested By: **Date Completed:**

4. Measure insulation resistance of the CT wiring. Confirm single point of grounding. Spark Test Sheet
   Tested By: **Date Completed:**

5. Secondary current injection. Apply current in the breaker's control cabinet and measure in the associated control panel. Confirm polarity, wire location and device connections. Spark Test Sheet
   Tested By: **Date Completed:**

6. Verify ground connections.
   Tested By: **Date Completed:**

Testing Completed

_____ _____
Technical Lead – Signature Date
Spark

_____ _____
Project Manager – Signature Date
Spark

SPARKPOWER®

<CUSTOMER NAME>
<SITE NAME>

MV Potential Transformer
Test Procedure - P8A

The Potential Transformer will be tested as per manufacturer's instructions, Spark Test Sheets and NETA Section 7.10

Substation ID			
Equipment ID			
Manufacturer		*Type*	
Style / Cat.		*Accuracy*	
High Voltage		*Low Voltage*	
Burden		*B.I.L.*	**kV**
Phase	**A**	**B**	**C**
Position			
Serial No.			

Mechanical Inspection

Spark Test Sheet

1. Inspect and record mounting.
   Tested By: Date Completed:

2. Inspect and record ground connection.
   Tested By: Date Completed:

3. Inspect and record the condition of transformer case.
   Tested By: Date Completed:

<CUSTOMER NAME>
<SITE NAME>

MV Potential Transformer
Test Procedure - P8A

Electrical Testing

1. Measure insulation resistance at 5kV potential.

   Spark Test Sheet

   Tested By: Date Completed:

2. Measure winding resistance (*)

   Spark Test Sheet

   Tested By: Date Completed:

3. Measure the turns ratio.

   Spark Test Sheet.

   Tested By: Date Completed:

4. Test for voltage injection for all potential transformer secondary circuits from field control box to protection control panel.

   Record on Drawing.

   Tested By: Date Completed:

5. Functional check of potential transformer secondary wiring.

   Yellow line record on appropriate schematic drawings.

   Tested By: Date Completed:

<CUSTOMER NAME>
<SITE NAME>

MV Potential Transformer
Test Procedure - P8A

Testing Completed

Technical Lead – Signature Spark	Date
Project Manager – Signature Spark	Date

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Appendix D – EVLO – Battery Commissioning Documentation

Project 903

Commissioning Plan

Armour BESS Project

Revision #2

CONFIDENTIAL

Cold commissioning / Auxiliary Power test

The auxiliary power test validates the auxiliary power supply, control systems, temperature regulation, HVAC, internal communication, fire detection, and safety mechanisms to ensure they are properly configured and integrated with the main power grid.

	Test	Description	Acceptance Criteria
1	SPPC Panel Energization	The purpose of this test is to ensure the proper energization and functionality of the SPPC (EMS) panel.	– The UPS units are properly powered – Battery connections of the UPS are closed and secure. – Power supply is stable and meets the specifications. – Proper functioning of the power meter with the provided supply (if applicable).
2	Auxiliary Equipment Startup	The purpose of this test is to ensure the proper energization and functionality of the auxiliary platform panels, including the UPS Panel, 460 VAC Panel, 208 VAC Panel, Transformer (Xmer.) Panel, and PS Panel.	– The UPS Panel must be properly powered with the input voltage meeting the specified requirements. – The 460 VAC Panel must receive the correct voltage within the specified limits. – The 208 VAC Panel must receive the correct voltage within the specified limits (if applicable). – The Transformer Panel must be properly powered with the input voltage meeting the specified requirements (if applicable). – The PS Panel must receive the correct voltage within the specified limits.
3	EMP panel energization	This test aims to verify the proper energization and functionality of the EMP panel.	– The 24 VDC power supply must be verified for each group. – The power supply for the EMP panel heater must be verified (if applicable).
4	PCS Cold Commissioning	This test outlines the auxiliary power test and configuration of the PCS, until the point where it is "Ready to Run”.	– The Bender, Remote I/O, and Switch must be configured with the correct IP addresses. – PCS firmware must be verified. – No faults should be present in the PCS. – The fluid level of the coolant must be verified. – The pump must be running without leaks on the connection in the coolant tray and on either side of the power stage. – The fan must operate correctly. – If applicable, the soft parallel must be well connected.
5	EVLOFLEX Auxiliaries Energization	The purpose of this test is to ensure the proper energization and functionality of auxiliary systems of container.	– Auxiliary power must be activated and distributed to the BESS. – All components of the control panel must be powered. – The IP addresses must be correctly configured for all containers.

6	HVAC Configuration & Startup	This test aims to configure the HVAC system, including the economizer configuration parameters and the fan.	– The economizer must be configured according to the specified parameters. – The fan must be correctly configured. – The voltages and currents of the fans must be measured and recorded. – The voltages and currents of the compressor must be measured and recorded. – The pressures must be accurately measured and recorded.
7	HVAC Test	This test aims to verify the proper functioning of the HVAC system commands.	– The fan should activate and operate correctly when the command is engaged. – The heating system should activate and operate correctly when the command is engaged. – The cooling system should activate and operate correctly when the command is engaged. – The dehumidification system should activate and operate correctly when the command is engaged.
8	BMS Validation	This test aims to ensure that the BMS is functioning correctly and that no faults are present.	– No fault codes or error messages should be present in the BMS. – The BMS should maintain stable communication – All monitored parameters (e.g., voltage, temperature) should remain within the specified limits.
9	Internal Network configuration and verification	This test aims to ensure that the internal network is correctly configured and functioning as expected.	– All network devices should be able to communicate with each other without any connectivity issues.
10	Fire detection test	This test aims to ensure that the fire detection system is functioning correctly and can accurately detect and respond to fire incidents	– The system should accurately detect fire events and trigger alarms. – All sensors and detectors present proper functionality and coverage

HOT COMMISSIONING / MAIN POWER TEST

The hot commissioning test involves connecting the Battery Energy Storage System (BESS) to the main power source to perform a series of functional tests. These tests include verifying the system's emergency shutdown capabilities, reactive power controls, and resilience responses under both normal and abnormal operating conditions. The objective is to ensure that the BESS operates reliably and safely when integrated with the main power source and can effectively handle various scenarios that may arise during its operation.

	Test	Description	Acceptance Criteria
1	Emergency Shutdown Safety Test (F-Stop)	This test will ensure that the BESS stops immediately when any F-Stop condition is triggered, enters a fault state, and does not restart automatically until manually reset.	– The BESS must stop immediately when any of the specified F-Stop conditions are triggered, ensuring the system enters a fault state. – Upon entering a fault state, the BESS must not restart automatically and must maintain the latched fault condition until manually reset.
2	System Startup and Shutdown Test	The test aims to validate the start-up and shutdown processes for the entire Battery Energy Storage System (BESS), ensuring smooth transitions through different operating states (idle, charge, and discharge) and confirming the ability to reverse the power flow direction.	– The BESS must start up with no errors or alarms, as appropriately demonstrated on the user interface (UI). – The BESS must perform the shutdown process with no errors, as confirmed on the UI. – The system should transition smoothly through different operating states (idle, charge, and discharge) without any interruptions or issues. – The BESS must be able to reverse the power flow direction as required.
3	Calibration of PCS	The objective of this test is to calibrate the offset of the active and reactive AC currents of the Power Conversion System (PCS).	The calibration is considered successful if the offset values for both active and reactive AC currents meet the following criteria: – The offset value for active AC current must be within the range of 0 kW ± 1%. – The offset value for reactive AC current must be within the range of 0 kVAR ± 1%.
4	BESS Assessment and Balancing	The objective of this test is to perform a complete balancing of the Battery Energy Storage System (BESS) to ensure that the system maintains stability and operates within the acceptable parameters of voltage and frequency	– The balancing process must be completed without triggering any alarms for under-voltage or over-voltage conditions. – The BESS must maintain voltage levels within the specified range during normal operation. – The BESS must demonstrate stable operation without oscillations or erratic behavior during and after the balancing test.

5	Energy Capacity and Round-Trip Efficiency Test	The Energy Capacity and Round-Trip Efficiency Test aims to verify that the Battery Energy Storage System (BESS) meets the specified energy capacity and efficiency requirements.	– The Measured Energy Capacity is to be greater than or equal to nameplate AC energy capacity. – The round-trip efficiency must be greater than the required round-trip efficiency of the project
6	Calibration of BESS at POI	This test involves calibrating the Energy Management System (EMS) and activating a power loss compensator to account for any discrepancies between the output of the Power Conversion System (PCS) and the power meter readings.	– The initial calibration conditions must be set over the range of usable power. – The loss compensator must be activated. – The active power setpoint command sent in the EMS must match the value of the active power reading at the power meter within the specified tolerance
7	Charge/Discharge Active (and Reactive) Power Capacity Test	The objective of this test is to validate the Energy Management System (EMS) regulation at both the active and reactive power levels at the point of interconnection (POI).	– The EMS must regulate the active power at the POI within the specified tolerance range of no more than 3%. – The hold period for the active power value must be no less than 10 minutes. – The EMS must regulate the reactive power at the POI within the specified tolerance range of no more than 3%. – The hold period for the reactive power value must be no less than 10 minutes.
8	Voltage and frequency anomalies tests	These tests ensure that the system can detect and respond appropriately to voltage and frequency anomalies, maintaining safe and reliable operation	– An undervoltage alarm must be generated when the voltage drops below the specified minimum threshold. – An overvoltage alarm must be generated when the voltage exceeds the specified maximum threshold. – An underfrequency alarm must be generated when the frequency drops below the specified minimum threshold. – An over frequency alarm must be generated when the frequency exceeds the specified maximum threshold.
9	Services EMS Test	These tests are designed to evaluate the performance and stability of the Energy Management System (EMS) while operating various services included in the project. These tests ensure that the EMS can effectively manage the Battery Energy Storage System (BESS) and respond appropriately to different scenarios. Service test selected for this project • Static Peak Shaving	

evloenergy.com

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Appendix E – N-SCI Commissioning Documentation

Project 903

TRS-0145.01-015

Date Issued: 6 May 2025

To: Ina Lila, Solar Bank Corp	From: N-Sci Technologies Inc.
A: 505 Consumers Road, Suite 803, Toronto, Ontario, Canada M2J 4V8 T: (647) 544 5734 E: ina.lila@solarbankcorp.com	A: 6 – 875 Queen St. E., Sault Ste. Marie, ON P6A 2B3 T: 705-949-1033 E: info@nsci.ca
Copy To: (indicate email or courier):	
1. dennis.stainton@solarbankcorp.com 2. gfinlayson@nsci.ca 3. rreid@nsci.ca 4. smckenzie@nsci.ca 5. pvelaga@nsci.ca	Total # of Pages: 3

Customer Ref #	Qty	N-Sci Ref. #	Description	Comment
145.01	1	FRM-145.01-200	Commissioning Plan Template	

Acknowledgement Required By Receiver (Yes/No): No

Acknowledgement

Please sign this acknowledgement and fax back to the FAX number above upon receipt of this transit document.

Received by (print name) **Signature** **Date**

Declaration

The work presented in this package represents N-Sci Technologies Inc.'s ("N-Sci's") best efforts and judgments based on the information available at the time this package was prepared.

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N-Sci Technologies Inc.
2A – 875 Queen Street East | Sault Ste. Marie, Ontario P6A 2B3
T: (705) 949-1033 | E: info@nsci.ca | W: www.nsci.ca

1. Objective

To outline the commissioning activities for the metering installation at the PORT HOPE BESS 1 site, ensuring the system is compliant with applicable metering standards, Market Rules, and approved procedures.

2. Scope of Work

The commissioning plan covers the following tasks:

- Site assessment and pre-installation review
- Verify installation of metering equipment
- Verification of CT/VT wiring and ratios
- Functional testing of metering system
- Communication testing (SCADA, remote access)
- Data validation and accuracy checks
- Submission of commissioning results and relevant documentation

3. Key Activities

Activity	Testing requirements	By	Deliverables	Done
Before Site Visits	Insulation resistance and continuity testing of the wiring back to the CTs and PTs.	Site Contractors	Test results	
	Test execution: One electrical technician will be positioned at the instrument transformer (IT) cluster at the top of the pole, and another will be at the cabinet at the bottom of the pole. N-Sci will provide the necessary forms and witness the testing.	Site Contractors/ Technicians	Completed forms	
Site Visit 1 (De-energized, Following Equipment Installation)	Verification of primary wiring connections, including documentation through photographs of both the connections and equipment nameplates. The secondary cables should either be color-coded or labeled with cable identifiers.	N-Sci Personnel	Photographs of equipment connections and nameplates	
Site Visit 2 (De-energized, Approximately Two (2) Weeks Prior to Energization)	Verify communication with the Independent Electricity System Operator (IESO)	N-Sci Personnel	Communication with head-end system is stable.	
	Conduct current injection test to confirm meter operation	N-Sci Personnel	All compliance records and certifications are complete	
	Ensure meters are fully functional and ready for IESO validation	N-Sci Personnel	Meter operates within defined accuracy limits	
Site Visit 3 (Post-Energization, Within 90 Days (Depending on Load Conditions))	Identify and prepare independent metering device (alternative source) for on-site testing	N-Sci Personnel		
	Use independent metering device to verify ratio and polarity of instrument transformers (CTs/VTs)	N-Sci Personnel		
	Connect power quality analyzer in parallel with installed meters	N-Sci Personnel		
	Conduct cross-phase analysis to confirm meter accuracy	N-Sci Personnel		
	Document verification results for inclusion in commissioning report	N-Sci Personnel		

N-Sci Technologies Inc.
2A – 875 Queen Street East | Sault Ste. Marie, Ontario P6A 2B3
T: (705) 949-1033 | E: info@nsci.ca | W: www.nsci.ca

4. Equipment Details

Tag No.	Associated Meter	Description	MC NofA No.(*)
A		SADTEM, OCF52-3, 100:5 A	AE-1648
B		SADTEM, OCF52-3, 100:5 A	AE-1648
A		SADTEM, VE9, 46000:115 V	AE-1275
B		SADTEM, VE9, 46000:115 V	AE-1275

5. Commissioning Procedure

1. **Site Visit & Safety**
   - Confirm isolation procedures and site access.
   - Verify installation environment is compliant.
2. **Meter Installation**
   - Install meter in pre-designated enclosure.
   - Ensure CTs/VTs are connected per single-line diagram.
3. **Testing & Verification**
   - Confirm phase rotation, polarity, burden, and ratios.
   - Perform load checks and compare readings with handheld/reference meter.
   - Verify register mapping, pulse outputs, and communications.
4. **Communications**
   - Establish remote access or SCADA connection.
   - Perform end-to-end test (e.g., FTP, DNP, or Modbus).
5. **Documentation**
   - Provide test results, as-built drawings, and CT/VT calibration certs.
   - Submit commissioning report to Market Participant and relevant authorities.

6. Sign-Off

Commissioning will be considered complete upon:

- Submission of final report and test results

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Appendix F – Cachelan Commissioning Scope

Project 903

Cachelan Commissioning Scope of Work

Project: 903
Location: 219 Peggs Mountain Rd, Burk's Falls, ON P0A 1C0
Date: 01/07/2025

1. HONI SCADA Commissioning
    a. HONI SCADA Link Test – Test the cellular signal strength
    b. HONI SCADA Data Points Test
2. IESO Telemetry Commissioning
    a. CheckPoint VPN gateway connection test
    b. Telemetry point test
    c. Production telemetry test

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Appendix G – Rodan – IESO Commissioning and Market Integration Guide

Project 903

Project Team							

System Commissioning Checkout							
Preliminary Commissioning Pre-Requisites							
Short Description	**Long Description**	**Notes**	**Start Date**	**Responsible Person(s)**	**Responsible Witness**	**Integrator Initials**	**Witness Initials**
Software FAT completed	SCADA Hub and RTAC software FAT completed						
Software FAT deficiencies addressed	SCADA Hub and RTAC software FAT deficiencies addressed						
System SAT plan created and approved	System SAT plan created and approved						
As-programmed SCADA points list	As-programmed SCADA points list						
As-programmed PCN	As-programmed PCN						
Production RTAC program	Production RTAC program	Eramosa to provide to Rodan. To be integrated with the Belrey configuration and loaded to the RTAC					
Rodan D/C VMs updated with any patches etc	Rodan D/C VMs updated with any patches etc						
Ignition SCADA Hub updated with any patches	Ignition SCADA Hub updated with any patches						
SCADA Hub historian data purged of records	SCADA Hub historian data purged of records						
SCADA Hub production Ignition project loaded	SCADA Hub production Ignition project loaded	Project loadout completed to Ignition SCADA Hub					
Custom database tables loaded	Custom database tables loaded	Tables for all sites to be pre-populated					
Site WAN communication hardware installed & commissioned. Rodan D/C communication system commissioned	Site WAN communication hardware installed & commissioned. Ready for connection to Ignition IO server						
RTAC pre-configured.	RTAC pre-configured including comm settings and Eramosa users. Ready for remote access.						
PMC panel / system commissioned	PMC panel / system commissioned. Ready for points testing with the RTAC.						
Enersys EMS system commissioned	Enersys EMS system commissioned. Ready for points testing with the RTAC.						
Site LAN / comms system commissioned	Site LAN / comms system commissioned. Ready to support local comms for connecting RTAC with PMC and Enersys.						
Rodan supplied AOS commissioned							
Site ready for preliminary commissioning							
Preliminary Commissioning Checklist - Recommended Onsite For Site 1							
RTAC verification	RTAC verification	Connect to RTAC locally. Confirm comms settings Confirm Eramosa advanced programming is in place					
RTAC comms testing	RTAC comms testing	Check comms with EMS Check comms with PMC Verify PMC points are being read as programmed Verify Modbus comms with Enersys					
PMC points testing	PMC points testing	Ideally for site #1 the system statuses, alarms and commands to the PMC system are functionally tested. This is not just a test that forces the points. This is a test to confirm that the statuses, the alarms, and the commands all function as anticipated. This is typically completed with the P&C integrator, the engineer responsible for the p&c design and the SCADA integrator and often requires consideration for how the tests are to be performed in combination with be able to create the conditions via injection testing.					
Enersys EMS points testing	Enersys EMS points testing	Test selected points with the EMS system. Not anticipating a full test since it was completed previously during prototype testing					
Confirm remote access to site RTAC	Confirm remote access to site RTAC						
Rodan D/C Ignition IO server connected to site RTAC via DNP3	Rodan D/C Ignition IO server connected to site RTAC via DNP3						
Site RTAC to Ignition IO sever DNP3 points testing	Site RTAC to Ignition IO sever DNP3 points testing						
Confirm AOS connects to site RTAC via Modbus	Confirm AOS connects to site RTAC via Modbus						
Site RTAC to AOS points testing	Site RTAC to AOS points testing						
Site ready for software commissioning and software SAT (Market Mechanism Testing)							

Preliminary Commissioning Checklist - Remote For Sites 2-15							
Confirm remote access to site RTAC	Confirm remote access to site RTAC						
RTAC verification	RTAC verification	Connect to RTAC remotely. Confirm comms settings Confirm Eramosa advanced programming is in place					
RTAC comms testing	RTAC comms testing	Check comms with EMS Check comms with PMC Verify PMC points are being read as programmed Verify Modbus comms with Enersys					
PMC points testing	PMC points testing	Basic check / audit of points. Confirm statuses and commands of any breakers.					
Enersys EMS points testing	Enersys EMS points testing	Test selected points with the EMS system. Not anticipating a full test since it was completed previously during prototype testing					
Rodan D/C Ignition IO server connected to site RTAC via DNP3	Rodan D/C Ignition IO server connected to site RTAC via DNP3						
Site RTAC to Ignition IO sever DNP3 points testing	Site RTAC to Ignition IO sever DNP3 points testing	Confirm alarms and notifications are working					
Confirm AOS connects to site RTAC via Modbus	Confirm AOS connects to site RTAC via Modbus						
Site RTAC to AOS points testing	Site RTAC to AOS points testing	Basic check / audit of points.					
Site ready for software commissioning and software SAT (Market Mechanism Testing)							
Software Commissioning Pre-Requisites							
PMC system fully commissioned	PMC system fully commissioned	Able to transfer power					
Enersys system fully commissioned	Enersys system fully commissioned	Able to transfer power					
Any comms and points testing deficiencies resolved	Any comms and points testing deficiencies resolved						
ECO-System in a state to support software commissioning	ECO-System in a state to support software commissioning	Battery SOC, required loads available					
Rodan OP's has set the site parameters & setpoints within the Ignition SCADA	Rodan OP's has set the site parameters & setpoints within the Ignition SCADA						
Alarm and notifications enabled	Alarm and notifications enabled						
Software Commissioning Checklist - Remote							
Functional checks in SCADA manual	Functional checks in SCADA manual	Execute software SAT plan					
Functional checks in SCADA auto - scheduled dispatch	Functional checks in SCADA auto - scheduled dispatch	Execute software SAT plan					
Functional checks in SCADA auto - AOS	Functional checks in SCADA auto - AOS	Execute software SAT plan					
Verification of historian logging	Verification of historian logging						
Site ready for handoff to Rodan Operations							
Remote Support & Final Commissioning							
Remote support for deficiencies	Remote support for deficiencies						
As commissioned PCN	As commissioned PCN	First site only					
As commissioned design manual	As commissioned design manual	First site only					
As commissioned runbook	As commissioned runbook	First site only					
Commissioning checkout completed	Commissioning checkout completed						
As commissioned RTAC program backed up	As commissioned RTAC program backed up						

Project Name

Site Name

Site Code

SAT Date(s)

Client Project Number

Integrator Project Number

Attendees	Name	Company	Initals

Prerequisites

Item	Party Responsible	Test Preparation	Initials	Client Initials

Ignition Architecture

Item #	Item	Description	Complete	Action Item
1.1	**Front End Gateway Configuration**			
1.1.1	Gateway License	all required modules active and licensed		
1.1.2	Gateway Network Configuration	active gateway network connection to IO server		

1.1.3	Gateway Access	gateway access set to rodan idp. Fall back configured to default		
1.1.4	Audit Profile Configuration	audit profile created and active		
1.1.5	Database Connections	all database connections active		
1.1.6	Realtime Tag Providers	remote tag provider from IO server		
1.1.7	Historical Tag Providers	query only remote history provider to IO server		
1.1.8	Alarm Journals Configuration	no alarm journals created		
1.1.9	Notification Pipeline Configuration	no notificaiton pipelines		
1.1.10	DNP3 Connection to site	no device connections		
1.1.11	Gateway backups configured	daily backups configured		
1.2	**IO Gateway Configuration**			
1.2.1	Gateway License	all required modules active and licensed		
1.2.2	Gateway Network Configuration	active gateway network connection to Front End server		
1.2.3	Gateway Access	gateway access set to rodan idp. Fall back configured to default		
1.2.4	Audit Profile Configuration	audit profile created and active		
1.2.5	Database Connections	all database connections active		
1.2.6	Realtime Tag Providers	Tag provider for site created using site code. Populated with tags		
1.2.7	Historical Tag Providers	Datasource history provider configured for both production and datawarehouse		

1.2.8	Alarm Journals Configuration	alarm journal		
1.2.9	Notification Pipeline Configuration	email and twilio pipelines created		
1.2.10	DNP3 Connection to site	device connection to site		
1.2.11	Gateway backups configured	daily backups configured		

Ignition HMI

Item #	Item	Description	Complete	Action Item
2.1	Project Access			
2.1.1	viewer access			
2.1.2	analyst access			
2.1.3	operator access			
2.1.4	supervisor access			
2.1.5	admin access			
2.1.6	https access on network			
2.1.7	https access on vpn			
2.2	Project navigation			
2.2.1	Navigation by menus			
2.2.2	Navigation by overview graphic			
2.2.3	Navigation to sub menus			
2.2.4	Meta data shown correctly from portfolio database			
2.3	Project Telemetry			
2.3.1	real time data	real time data active and changing		
2.3.2	alarm indications	new alarms generated correctly		
2.3.3	alarm summary	alarm summary active and accurate		

2.3.4	tag history	tag history can be queried		
2.3.5	alarm notifications	new alarms generate notifications		
2.3.6	alarm coalescing	alarms summarized on overview screen		

Communications

Item #	Item	Description	Complete	Action Item
3.1	RTAC Settings			
3.1.1	ETH_01 IP settings	Left as default		
3.1.2	ETH_02 IP settings	IP: 192.168.200.2/24 Gateway: 192.168.200.1		
3.1.3	ETH_03 IP settings	Left as default		
3.1.4	ETH_04 IP settings	Left as default		
3.1.5	ETH_F IP settings	Left as default		
3.1.6	Time sync	IRIG_B connection to satellite clock		
3.1.7	Time zone	UTC offset: -300 minutes Enable DST: false		
3.2	EMS Communication Settings			
3.2.1	Communication Protocol	Modbus Client		
3.2.2	IP address	192.168.2.5		
3.2.3	Port	502		
3.2.4	Slave ID	1		
3.3	AOS Communication Settings			
3.3.1	Communication protocol	Modbus Server		
3.3.2	Server IP port	1024		
3.3.3	Modbus clients	Restricted to:		
3.4	Ignition Communication Settings			

3.4.1	Communication protocol	DNP3 Server		
3.4.2	Server IP port	20001		
3.4.3	Server DNP3 address	1		
3.4.4	Client DNP3 address	0		
3.4.5	DNP3 clients	Restricted to:		

BESS Control

Item #	Item	Description	Complete	Action Item
2.1	First Trigger and Second Trigger Setpoint			
2.1.1	First trigger setpoint	In BESS auto and AOS enabled, the RTAC forwards the AOS first trigger setpoint.		
2.1.2	First trigger setpoint	While not in BESS auto, or AOS is disabled, the RTAC forwards the Ignition HMI first trigger setpoint.		
2.1.3	Second trigger setpoint	In BESS auto and AOS enabled, the RTAC forwards the AOS second trigger setpoint.		
2.1.4	Second trigger setpoint	While not in BESS auto, or AOS is disabled, the RTAC forwards the Ignition HMI second trigger setpoint.		
2.2	BESS Manual			
2.2.1	Bumpless transfer	When transitioning from BESS auto to BESS manual the automatic setpoint will be maintined with		

		a duration of 5 minutes.		
2.2.2	Charging	Charge kW setpoint must be between the upper and lower input setpoints to be committed.		
2.2.3	Charging	Operators enter a KW setpoint and duration for manual charging.		
2.2.4	Charging	Charging is allowed when the BESS SOC is below the global upper SOC limit.		
2.2.5	Charging	Charging is maintained for the operator entered duration unless a stop condition is reached.		
2.2.6	Charging	Manual charging is stopped when the BESS SOC equals the global upper SOC limit or the charging time has expired.		
2.2.7	Charging	The system is set to idle with a kw and duration setpoint of 0 when manual charging is stopped.		
2.2.8	Discharging	Discharge kW setpoint must be between the upper and lower input setpoints to be committed.		
2.2.9	Discharging	Operators enter a KW setpoint and duration for manual discharging.		
2.2.10	Discharging	Discharging is allowed when the BESS SOC is		

		above the global lower SOC limit.		
2.2.11	Discharging	Discharging is maintained for the operator entered duration unless a stop condition is reached.		
2.2.12	Discharging	Manual discharging is stopped when the BESS SOC equals the global lower SOC limit or the discharging time has expired.		
2.2.13	Discharging	The system is set to idle with a kw and duration setpoint of 0 when manual discharging is stopped.		
2.3	BESS Auto			
2.3.1	Priority	A scheduled dispatch has the highest priority for automatic contol. An AOS dispatch will not override a scheduled dispatch.		
2.3.2	Priority	AOS dispatch has the second highest priority. A scheduled dispatch will override an AOS dispatch.		
2.3.3	Priority	The RTAC executes the first active schedule. Schedule 1 has priority over Schedule 2, Schedule 2 has priority over schedule 3 and so on. If two schedules have overlapping dispatch times, the first active one will execute.		

2.3.4	Dispatch	The RTAC can hold 6 unique schedules for charging or discharging.		
2.3.5	Dispatch	A scheduled charge/discharge uses a kw setpoint, start time, and duration.		
2.3.6	Scheduled charging	When the RTAC time falls between the start and end time of a schedule and there is a scheduled charge and the BESS SOC is lower than the global upper SOC limit, then a scheduled charge begins.		
2.3.7	Scheduled charging	A scheduled charge stops when the rtac time is greater than the schedule start time plus the schedule duration or the BESS SOC reaches the global upper SOC limit.		
2.3.8	Scheduled charging	When a scheduled charge stops, the system is set to idle with a kW setpoint of 0.		
2.3.9	Scheduled discharging	When the RTAC time falls between the start and end time of a schedule and there is a scheduled discharge and the BESS SOC is greater than the global lower SOC limit, then a scheduled discharge begins.		

2.3.10	Scheduled discharging	A scheduled discharge stops when the rtac time is greater than the schedule start time plus the schedule duration or the BESS SOC reaches the global lower SOC limit.		
2.3.11	Scheduled discharging	When a scheduled discharge stops, the system is set to idle with a kW setpoint of 0.		
2.3.12	AOS dispatch	AOS values are ignored while the BESS AOS is disabled.		
2.3.13	AOS charging	The system will charge using AOS values only if the BESS SOC is lower than the global upper SOC limit.		
2.3.14	AOS charging	The system will stop charging using AOS values if the BESS SOC equals the global upper SOC limit.		
2.3.15	AOS discharging	The system will discharge only if the BESS SOC is greater than the global lower SOC limit.		
2.3.16	AOS discharging	The system will stop discharging using AOS values if the BESS SOC equals the global lower SOC limit.		
2.4	Reverse Power Protection			

2.4.1	Controller discharge request	The RTAC implements reverse power protection to maintain a difference of 22 kW at MFR-02. MFR-02 minus the discharge request sent to the EMS system is always greater than or equal to 22 kW.		
2.4.2	Controller discharge request	If 22 kW cannot be maintained with a positive dispach setpoint i.e. a discharge request, the RTAC will set the system to idle.		
2.4.2	SCADA Indication	While the RTAC is filtering the dispatch setpoint to maintain reverse power protection, an status banner will be displayed on SCADA.		

[KR] Pass condition for both Auto and Manual modes should record a kW reading on the bess meter

[KR] Can a reverse power scenario be also simulated based on actual meter readings?

Breaker Control & Statuses

Item #	Item	Description	Complete	Action Item
6.1	ECO-52-1			
	Auto-Restore Latch	Command is correctly sent to MFR-01 relay.		
	Open Breaker	Command is correctly sent to MFR-01 relay.		
	Close Breaker	Command is correctly sent to MFR-01 relay.		
6.2	ECO-DG-1			

	Auto-Restore Latch	Command is correctly sent to MFR-01 relay.		
	Open Breaker	Command is correctly sent to MFR-01 relay.		
	Close Breaker	Command is correctly sent to MFR-01 relay.		
	Remote Target Reset	Command is correctly sent to MFR-01 relay.		
	LDC Lockout Reset	Command is correctly sent to MFR-01 relay.		
	Utility Trip	Status is correctly read from MFR-01 relay.		
	Utility Close Block	Status is correctly read from MFR-01 relay.		
	Main Bus at 120%:	Status is correctly read from MFR-01 relay.		
	MCB Exposed to Pickup	Status is correctly read from MFR-01 relay.		

[KR] Pass condition would be actual opening/closing of breakers and a condition for reset after a simulated fault condition

Fault Response

Item #	Item	Description	Complete	Action Item
6.1	SCADA to RTAC Comm Fail			
6.1.1	Communication Failure	Any communication failure that exceeds 5 minutes will generate an alarm on SCADA		
6.1.2	BESS Response	All BESS dispatches from SCADA will be set to 0.		
6.1.3	EV Response	All EV dispatches from SCADA will be set to their operator defined defaults.		
6.2	AOS to RTAC Comm Fail			
6.2.1	BESS Response	All BESS dispatches from AOS will be set to 0.		

6.2.2	EV Response	All EV dispatches from AOS will be set to their operator defined defaults.		
6.3	RTAC and LDC Comm fail			
6.3.1	Communication Failure	TBD		

[KR] Pass condition would be evident from meter readings

Action Items

Section	Description	Assigned	Date	Notes

Signoff

_____	_____	_____	_____
Client Representative	Date	Client Representative	Date
_____	_____	_____	_____
Consultant	Date	Consultant	Date
_____	_____	_____	_____
Integrator	Date	Integrator	Date

SOLARBANK

Appendix H – HONI – Interconnection Commissioning Documentation

Project 903

Customer Instructions for Completing the COVER form (DCG)

As per Hydro One's Technical Interconnection Requirements (TIR), the COVER process shall apply to all distribution connected/connecting generator facilities that exceed 10 kW and impact the Hydro One Networks Inc. ("Hydro One") distribution and/or transmission systems. The requirements of the COVER may vary depending on generation capacity and the connection requirements associated with upstream impacts dictated by the Connection Impact Assessment (CIA).

PRE-REQUISITE

Submit design documentation (i.e. single line diagram, intertie protection settings, etc.) required by Hydro One for a design compatibility review at least four (4) months prior to the earliest proposed energization date.

STAGE 1: COVER PLAN

1.1. Complete Facility and Customer Contact Information of the COVER Form by completing the highlighted portions of Sections 1. Identify the tests that will be conducted by completing the highlighted portions (Legend columns) of Sections 2 & 3, where applicable. Submit the draft COVER to the Project Manager at least three (3) months prior to the earliest proposed energization date.

1.2. COVER coordinator will review the proposed documents and respond to the acceptability of the proposed COVER/commissioning plan within ten (10) business days of receiving the draft COVER and prior to pre-energization testing. Hydro One COVER Coordinator approves the proposed COVER/commissioning plan by initialing Section 2E.

STAGE 2: PRE-ENERGIZATION

Applicable to Generator Connection Completeness Requirements for Milestones 1 and 2 (for new connections) and modification projects (for existing connections).

2.1. Complete all applicable testing in Section 2.

2.2. Sign off the COVER, in Section 2, by a Customer P.Eng Representative, and submit it to the Project Manager, ten (10) business days in advance of energization date.

2.3. The COVER coordinator will review the certified COVER and recommend to the Controlling Authority (CA) for connection to the grid by signing Section 2 (for OGCC controlled distributed generators, the OGCC is the controlling authority. For other feeders the controlling authority will be Provincial Lines.)

2.4. Section 3 testing can only proceed when all salient comments have been resolved and tests completed for Sections 2.

2.5. The customer will contact the Controlling Authority to request authorization to connect to the grid (for OGCC controlled distributed generators, the OGCC is the controlling authority. For other feeders the controlling authority will be Provincial Lines).

2.6. The Controlling Authority will sign off Section 2 upon acceptance of connection.

STAGE 3: POST-ENERGIZATION

Applicable to Generator Connection Completeness Requirements for Milestones 3 (for new connections) and modification projects (for existing connections).

3.1. Complete and sign Section 3 when all parts of the COVER form are complete and submit it to the Project Manager.
Note: online load readings and power factor performance test to be performed within ten (10) business days of placing station in service as generator. Customer contacts Account Executive if constant power factor requirements cannot be met.

3.2. The COVER Coordinator will review the completed COVER and respond to the acceptability of COVER within five (5) business days. Upon acceptance, the COVER Coordinator will sign off the appropriate COVER Section 3 Signoff section and will distribute the completed COVER to distribution list found in Section 3.

3.3. Summary of testing results and certificates must be kept on file for a minimum period of 7 years by the Customer (as indicated by IESO Market Rules, Chp.4, 5.1.3). Hydro One may require this information, on an exception basis.

CLASSIFICATIONS:

CAE (Capacity Allocation Exempt) – A generation facility which is not a micro generation facility and which has a name-plate rated capacity:

(1) Less than or equal to 250 kW and connected to a less than 15 kV line

(2) Less than or equal to 500 kW and connected to a 15 kV or greater line

CAR (Capacity Allocation Required) – A generation facility which is not a micro generation facility and which has a name-plate rated capacity:

(1) Greater than 250 kW and connected to a less than 15 kV line

(2) Greater than 500 kW and connected to a 15 kV or greater line

Hydro One Networks Inc.
483 Bay Street
Toronto, Ontario, Canada
M5G 2P5

CONFIRMATION OF VERIFICATION EVIDENCE REPORT (COVER)

[Distribution Connected Generation]

(Refer to Instructions Page)

Section 1 *(Step 1.1)*	FACILITIES and CONTACT INFORMATION	
NAME OF CUSTOMER	Solarbank	
HYDRO ONE PROJECT ID#	48,500	
NAME OF GENERATOR FACILITY	903	
TYPE OF GENERATOR	BESS	
NAMEPLATE CAPACITY	4.99 MW	
PROPOSED ENERGIZATION DATES	For Load Connection (Milestone #1) – if applicable:	March 2026
	For Generation Connection (Milestone #2 or Modification)	May 2026
HYDRO ONE OPERATING DESIGNATION (NCXXXX)		
OEB GENERATOR LICENSE NUMBER		
SUPPLY FEEDER DESIGNATIONS AND HYDRO ONE STATION	44 kV M2 Hydro One distribution feeder of Muskoka Transformer Station	
SINGLE PHASE OR THREE PHASE	Three Phase	

CUSTOMER CONTACT	HYDRO ONE COVER COORDINATOR CONTACT
Print Name: Andrew Durward	**Print Name: Milo Van Dyke**
Title: Engineering Consultant	**Title: Senior P&C Engineer/Officer**
Date: 2025-06-24	**Date:**
Tel. #: 905-327-6838	**Tel. #:**
Email: adurward@raveneng.ca	**Email:**

Section 2A *(Step 1.1) (Step 2.1)*	**VERIFICATION-PROTECTION & CONTROL**

Legend: • New Connection: M1 = Test Required for Milestone 1 ; M2 = Test Required for Milestone 2 • Existing Connection: M = Test Required for Modification Results: P = Pass, F = Fail All Parts: N/A = Not Applicable	Legend	Results	Initials	Date mm/dd/yyyy	Note #
Is commissioning in compliance with the submitted Commissioning plans?	M2				
Are reviewed relay settings applied and tested?	M2				
Confirm that the following protection systems, as applicable, have been verified to function as per the design: NOTE: Tests marked with an asterisks (*) require Hydro One staff coordination					
Feeder Protection – All elements used to protect feeder	N/A				
HV Breaker Failure Protection **(52U)**	M2				
LV Breaker Failure Protection	N/A				
Transformer Differential Protection	N/A				
Transformer Backup Protection	N/A				
Under and Over Frequency	M2				
Under and Over Voltage	M2				
Other Anti-islanding Protection (in lieu of transfer trip)	N/A				
Certified to CSA standard / Bears certification mark (applicable to Inverter based DG)	M2				
Transfer Trip / Remote Trip *	M2				
Dead Zone Test Trip *	M2				
DGEO (Generator End Open) *	M2				
LSBS (Low Set Block Signal)	M2				
Reclosers (include configuration and testing details in notes) *	N/A				
Line Differential Protection *	N/A				
Blocking Scheme Circuits *	N/A				
Generation Rejection & Load Rejection Circuits *	N/A				
Reverse Power	N/A				
Gen. Protection that trip HV Sync Breakers	N/A				
Instrument Transformer (eg. CTs + VTs, etc.)	M2				
Monitoring Equipment (eg. DFR, SER, etc.)	N/A				
Other (Specify)	N/A				

Section 2B *(Step 1.1) (Step 2.1)*	**TELEMETRY TESTS BEFORE ENERGIZATION AT DISTRIBUTION CONNECTED GENERATOR**

Confirm the following SCADA telemetry quantities, where applicable Legend: • New Connection: M1 = Test Required for Milestone 1 ; M2 = Test Required for Milestone 2 • Existing Connection: M = Test Required for Modification Results: P = Pass, F = Fail All Parts: N/A = Not Applicable NOTE: Tests marked with an asterisks (*) require Hydro One staff coordination	Legend	Results	Initials	Date mm/dd/yyyy	Note #
MW Flows and Directions *	M2				
MVAR Flow and Directions *	M2				
Phase to Phase or Phase to Neutral Voltages *	M2				
Three Phase Currents *	M2				
HV switchers/HV breakers/Bus Tie Breakers Open/Close Status * **(52U)**	M2				
HV Line Disconnect Switches Open/Close Status * **(89-L)**	M2				
Synchronizing Breakers Open/Close Status *					
Automatic Voltage Regulators, Power System Stabilizers status *					
Generation Rejection Selection Status *					
LV Breakers/Interrupters/Switchers, Open/Close Status *					
LV Synchronizing Breakers, Open/Close Status *					
Protection Alarms (such as failure of interface protection, breaker failure, connection status) *	M2				
Other (specify)					

Section 2C *(Step 1.1) (Step 2.1)*	CONFIRMATION OF VERIFICATION-POWER EQUIPMENT

Legend: • New Connection: M1 = Test Required for Milestone 1; M2 = Test Required for Milestone 2 ; W = Witness • Existing Connection: M = Test Required for Modification; W = Witness Result: P = Pass, F = Fail All Parts: N/A = Not Applicable	Legend	Result	Initial	Date mm/dd/yyyy	Note #
• **Verify the HV disconnect switches/circuit switchers are suitable as an isolation point per Utility Work Protection Code? * Attach document (see Appendix A – witnessing form)** *Note that witnessing is required by Hydro One staff when the test is performed.* NOTE: Any future modifications to the isolation device(s) used to provide supporting guarantees to Hydro One staff under the Utility Work Protection Code must be re-witnessed by Hydro One personnel.	W				
• **Name of Hydro One Staff Witnessing HV Disconnect**	Name:				
• Confirm correct operation of the HV disconnect switches/circuit switchers/breakers	M2				
• Is closing time within manufacturer's specification?					
• Is opening time within manufacturer's specification?	M2				
• Are the specified HV surge arrestors installed?	M2				
• Confirm the power transformer Doble test results are within specification	M2				
• Confirm power transformers connected correctly as per the design.	M2				
• Confirm the DC system installed (ie battery, charger, dc panel, dc monitoring)? Verified	M2				
• Does the HV equipment (ie, disconnect switches, circuit switchers, breakers, CVTs, CTs) have the appropriate voltage class and current ratings as per the submitted Single Line Diagram?	M2				
• Confirm Station Service transformers installed and verified.	M2				
• Directional fault indicators installed at PCC as per TIR requirements.	M2				
• Other (specify)					

Section 2D *(Step 1.1) (Step 2.1)*	PRE-ENERGIZATION CONNECTION AUTHORIZATION

Legend: SD = Supporting Document, N/A = Not Applicable	Legend	Date mm/dd/yyyy
New Connection (Milestone 1) - If applicable • Prior to energizing any new or modified load or portions of generator facilities (Milestone #1), the Customer must provide the following: 1. Temporary Connection Authorization issued by Electrical Safety Authority (ESA) (Ontario Electrical Safety Code Article 2-014). 2. *Confirmation Letter of Generator Isolation* signed and stamped by a Professional Engineer registered in the province of Ontario stating that their equipment to be energized has passed ESA inspection **(see Appendix B – Confirmation Letter of Generator Isolation)** 3. A single line diagram identifying portions of generator facilities to be energized and the isolation point(s).	SD	
New Connection (Milestone 2) or Existing Connection (Modification Project) • Prior to final in-service of new or modified load or all generator facilities (Milestone #2), the Customer must provide the following: 1. Grid Connection Authorization issued by Electrical Safety Authority (ESA) (Code Article 2-012).	SD	

NOTES: (For Sections 2)

#:	Comments:	Date Action Resolved: (mm/dd/yyyy)	Customer Initials	COVER Coordinator Concurrence

Section 2E *(Step 1.2)*	**COVER REVIEW SIGN OFF**
The COVER Coordinator approves the proposed checks, verifications, tests and notes in Section 2 and Section 3 submitted by the customer for the scheduled COVER.	____ Initials of Hydro One COVER Coordinator Print Name: Date:

Section 2F	SIGN OFF TO CONNECT AS A LOAD (IF APPLICABLE) (New Connection – Milestone #1) Please check ☐ Applicable ☐ Not Applicable

By signing* this form, the customer acknowledges the following: ▪ **All required verifications in Section 2 specified under this COVER document have been completed.** ▪ **The generator facility design and operation meets the minimum standards for generator facilities connected to a distribution system, as per the Distribution System Code.** ▪ **The equipment and installation meet CSA and/or other applicable electrical safety standards.** ▪ **The generator holds an OEB Electricity Generation License.** *(Step 2.2)*	Signature of Customer Representative (Note: Must be P. Eng licensed in Ontario) Print Name: Title: Date: Must affix P.Eng seal (stamp here):

*After signing the COVER, the customer shall submit it to Hydro One's Project Manager with a copy to the Account Executive.

Hydro One's COVER Coordinator has reviewed the customer's Certified COVER document and the customer's facility may be connected to the grid, subject to Controlling Authority's final review. *(Step 2.3)*	Signature of Hydro One COVER Coordinator Print Name: Title: Date:

The Project Manager shall forward (scan/fax) the completed document to the Controlling Authority to initiate the connection (for OGCC controlled distributed generators, the OGCC is the controlling authority. For other feeders the controlling authority will be Provincial Lines). The Project Manager shall contact (phone) the Controlling Authority, to notify him/her of the completed COVER. The Project Manager will ensure this document is placed within the Distribution Connection Agreement (DCA).

CONTROLLING AUTHORITY COVER ACCEPTANCE OF CONNECTION

_____ _____

Signature of Controlling Authority **Dated**

(Step 2.6)

Section 2G	SIGN OFF TO CONNECT AS A LOAD WITH GENERATOR TESTING RIGHTS (New Connection – Milestone #2 OR Existing Connection – Modification)

By signing* this form, the customer acknowledges the following: ▪ **All required verifications specified in Section 2 under this COVER document have been completed.** ▪ **The generator facility design and operation meets the minimum standards for generator facilities connected to a distribution system, as per the Distribution System Code.** ▪ **The equipment and installation meet CSA and/or other applicable electrical safety standards.** ▪ **The generator holds an OEB Electricity Generation License.** *(Step 2.2)*	Signature of Customer Representative (Note: Must be P. Eng licensed in Ontario) Print Name: Title: Date: Must affix P.Eng seal (stamp here):

*After signing the COVER, the customer shall submit it to Hydro One's Project Manager with a copy to the Account Executive.

Hydro One's COVER Coordinator has reviewed the customer's Certified COVER document and the customer's facility may be connected to the grid, subject to Controlling Authority's final review. *(Step 2.3)*	Signature of Hydro One COVER Coordinator Print Name: Title: Date:

The Project Manager shall forward (scan/fax) the completed document to the Controlling Authority to initiate the connection (for OGCC controlled distributed generators, the OGCC is the controlling authority. For other feeders the controlling authority will be Provincial Lines). The Project Manager shall contact (phone) the Controlling Authority, to notify him/her of the completed COVER. The Project Manager will ensure this document is placed within the Distribution Connection Agreement (DCA).

CONTROLLING AUTHORITY COVER ACCEPTANCE OF CONNECTION

_____ _____

Signature of Controlling Authority **Dated**

(Step 2.6)

Section 3A *(Step 1.1) (Step 3.1)*	**POST ENERGIZATION CHECKS AT RATED SYSTEM VOLTAGE**				
Legend: • New Connection: M3 = Test Required for Milestone 3 • Existing Connection: M = Test Required for Modification Result: P = Pass, F = Fail All Parts: N/A = Not Applicable **NOTE 1:** Tests marked with an asterisks (*) require Hydro One staff coordination **NOTE 2:** Tests must be performed with the generator operating at a minimum of ten percent (10%) of its rated capacity.	Legend	Result	Initial	Date mm/dd/yyyy	Note #
Are phasor readings completed and analyzed by the customer for Protection listed in **Section 2A**?	M3				
Are phasor readings completed and analyzed by the customer for SCADA quantities listed in **Section 2B**?	M3				
On Load SCADA Values for Hydro One NMS confirmed consistent with test(s) performed in **Section 2B**? *	M3				
Post Energization Live Zone Test Trip of the distribution connected generator performed (applicable for DG with Transfer Trip / Remote Trip). *	M3				
Post Energization Anti-Islanding Test (applicable for projects without Transfer Trip).					
Confirm compliance to TIR Section 2.3.6. iii (applicable for three-phase DG Facilities, including those using multiple three-phase inverters or multiple single-phase inverters).	M3				

NOTES: (For Section 3)

#:	Comments:	Date Action Resolved: (mm/dd/yyyy)	Customer Initials	COVER Coordinator Concurrence

Section 3B *(Step 3.1)*	SIGN OFF TO CONNECT AS A GENERATOR (New Connection – Milestone #3 OR Existing Connection – Modification)

I/we acknowledge the completion of all sections of the COVER and the deficiencies identified in the "NOTES" section have been resolved.

I/we acknowledge, in accordance with the Distribution System Code, Appendix F, for a Generation facility of Small size, Mid size, and Large size, the Customer shall, at Hydro One's request, provide Hydro One with a summary of testing results, including any certificates of inspection or other applicable authorizations or approvals certifying that any of the Customer's new, modified or replacement facilities have passed the relevant tests and comply with all applicable instruments and standards referred to in the code. This information will be kept on file for a period of seven (7) years by the Customer.

Signature of Customer Representative (Note: Must be P. Eng licensed in Ontario)
Print Name:
Title:
Date:
Affix P.Eng. seal (stamp here):

Hydro One's COVER Coordinator has reviewed the customer's potential/on load checks at the rated system voltage *(Step 3.2)*	Signature of Hydro One COVER Coordinator Print Name: Title: Date:

DISTRIBUTION LIST (WHEN ALL SECTIONS ARE COMPLETED):

☐ Customer Care – Account Executive ☐ Controlling Authority ☐ Customer ☐ Project Manager
☐ Hydro One COVER Coordinator ☐ Records Management

(Step 3.2)

Distribution Generation Disconnect Switch Confirmation

Project ID Number: _____ 48,520

Project Name: _____ SFF-06

Disconnect Switches: _____ 89-1

This is to confirm that disconnect-switches installed on this project are suitable as an isolation point per Hydro One Utility Work Protection Code (UWPC).

Hydro One Witness Name: _____

Signature: _____

Date: _____

Company letterhead

***Instructions**: The letter is to be provided on Distributed Generation company letterhead by an employee or agent acting on behalf of the company. The letter needs to be signed by a Professional Engineer registered in the Province of Ontario or an accountable company representative.*

Attention **Date: _____**
Hydro One Inc.
Networks Operating Division
System Controller

Confirmation Letter of Generation Isolation
For [Insert Project name: _____ and Proj#_____]

[Insert Company name] is applying for connection as a load (Milestone #1) for the purposes of commissioning and testing all the Distributed Generation facilities.

In addition to the submitted partial COVER and ESA Temporary Connection Authorization, [Insert Company name] hereby declares that all the equipment to be energized has passed ESA inspection and the attached single line diagram identifies the portions of generator facilities to be energized. The generation will be isolated by opening the following device(s) which is/are shown in the submitted single line diagram (attached SLD):

The above devices will also be tagged and locked, where available, to prevent inadvertent operation. The locks and tags will not be removed unless authorized by Hydro One.

[Insert Company name] will apply for Milestone #2 by submitting the completed COVER up to Section 2 of the COVER and ESA final Connection Authorization at a later date.

Please reference the project data below for your operational schedules.

Name of Facility (Generator)	
Hydro One Operating Designation (NCxxxx) – shown in the COVER	
Supply TS/DS name	
Supply Feeder(s) Designation	
Generator Site Legal Address	
Generator 24 hours contact name	
Generator 24 hours phone number	

Regards,

_____
Signature

_____
Name

_____
Title/Position

_____
PEO ID (if applicable)

Attachment: Single Line Diagram

KEYWORD: TELEPROTECTION, DESN, NSD570 FRAME ASSEMBLY

SUBJECT: NSD570 ANALOG WITH FRAME ASSEMBLY; TELEPROTECTION DESIGN, INSTALLATION, AND COMMISSIONING AT DESN

APPENDIX A – Field Commissioning Procedure

A.1 General

The commissioning technician/engineer will review the test procedures and equipment manual before beginning. Site equipment installation and circuit drawings should be reviewed and referred to as required.

Document test results on the form provided in Appendix D. Electronic documentation in MS Word format is recommended, and electronic versions of the test form may be obtained from HONI Telecom Engineering at \\vortex-ho1\telecom\Tel_Ref_Info\Teleprotection\NSD570.

For any question regarding commissioning of the NSD570 contact HONI Telecom Engineering.

A.2 Test Result Record Keeping Requirements

Upon completion of the commissioning/acceptance tests the distribution of the test results shall be as follows:

1) One hard copy for each station (to be filed on site)

2) One hard copy of each station's results to the Telecom Engineering Department

3) One electronic copy to be archived with WinZip (or Windows XP Explorer) into the Telecom folder under the corresponding station-specific subdirectory of \\Vortex-HO1\P&C_Archives\.. Please read through HODS SP0178R0 [4] carefully.

A.3 End-to-End Interconnection

End-to-end circuit paths between the NSD570 equipment will generally be provided by VF leased circuits (occasionally installations may use Power Line Carrier (PLC) on one or both routes). These circuits must be commissioned following the procedures in HONI Standard 6446-60220-01 [5], and the results available; before beginning end-to-end testing per Paragraph A.10.

A.4 Equipment & Documentation Required

The following is required for the factory acceptance test:

- VF Frequency Selective Meter or VF Flat Meter
  Note: The Consultronics Auto-TIMS is preferred because this is the instrument used to commission the circuit. Use of a frequency selective meter may require disabling the EOC in the NSD570 Common Settings menu in order to ensure accuracy. Ensure that this is re-enabled once the measurements are completed.
- Test leads
- 2 of Bantam TRS to 310 TRS test leads
- 2 of Bantam TRS to alligator clip test leads
- 2 of 600-Ohm terminated 310 TRS Plug
- 2 of 310 Plastic Plug
- HONI Approved Digital Multimeter
- PC to COM1 cable (1:1 serial RS-232)
- Laptop PC w/Windows NT, 2000 or XP operating system & MS Word (or compatible program)
- HMI570 User Interface Program (Version 1.13 or later)
- HONI Standard DESN NSD570 Settings Files (.xml files)
- Blank Standard Test Forms in MS Word format
- NSD570 Operating Instructions Manual [6]
- Drawing set (drawing templates or application specific drawings)

A.5 Precautions

The NSD570 contains modules that can be damaged by ESD; therefore use the correct anti-static wrist strap when handling the modules.

Use extra care when working with relay interface modules (G3LR), which may be connected to high battery voltages.

Always remove power to the NSD570 shelf before removing or plugging in the NSD570 modules.

Ensure that the corresponding receive blocking switches are open before sending commands when there is any chance that these commands could affect in-service line protection.

A.6 Modules of the NSD570

1) Check and ensure that NSD570 required modules are equipped and plugged in to the proper module slots according to the site drawings. Generally, only the first G3LR module in each TPE is required (unless more than two commands per line are required). Remove any extra G3LR modules as follows:

a. Remove the screws holding the Phoenix connector block to the module.

b. Unplug the connector.

c. Remove the module.

d. Tie-wrap the module connector (complete with wiring) to the cable rail on the rear of the NSD570 shelf.

2) Refer to Appendix B.14 for jumper settings, and check the Hardware jumper settings to ensure that they match the required configuration for Analog applications (G3LA and G3LR modules). If these settings cannot be determined from the factory test documents, loosen the screws holding the Phoenix plug connectors and remove the connector with wires attached before attempting to remove the module.

A.7 Check power supply, connections, and grounding

1) Verify the primary power wiring and input source voltage, and open sliding links ARP1, ARN1, ARP2, & ARN2 (or BRP1, BRN1, BRP2, & BRN2) before connecting power.

2) If power wiring is provided to sliding links ARP2 & ARN2 or BRP2 & BRN2, make sure that the straps connecting these links with ARP1 & ARN1 or BRP1 & BRN1 are removed.

3) Check that the power and ground return connections have been wired correctly.

4) Check that rack ground bars are grounded properly by a #4 ground wire.

5) Confirm cable shields for communication circuits are grounded, and that bare drain wires have been insulated with plastic sleeving.

6) Confirm that all connections are secure at terminal block, jackfield, blocking switches, and the VF circuit interface (e.g. Bell/Hydro Interface).

7) Before continuing with the procedure, ensure that the NSD570's at both ends of the circuits are isolated from the associated protection relays as in Paragraph A.5.

8) After connecting power, check the supply voltage at the sliding links on terminal strip TB(1). It must be in the range from 48 Vdc to 250 Vdc (± 20 %) for nominal battery voltage and from 100 Vac to 240 Vac (-15%, +10%) for nominal Mains voltage 50/60 Hz.
   Note: Most installations will be powered from station battery (usually 125 Vdc at the DESN and 250 Vdc at the Terminal end).

9) Switch on power to the NSD570 units under test by closing sliding links ARP1 & ARN1 (or BRP1 & BRN1) and confirm that the associated NSD570 power supply LED(s) is/are illuminated Green.

10) Make sure that DC wetting is available at the applicable positive and negative Tx Keying terminal blocks, and that the DC Wetting blocking switches operate correctly.
   Note: If DC wetting for the second line is provided via sliding links ARP2 & ARN2, close these links before proceeding.

11) Make sure that DC potential is available at the BATT. DC test jacks when TB(1) TP1 & TP2 are closed, and is removed when TP1 & TP2 are open.

12) In case of dual (redundant) power supply, the supply voltage for both modules must be checked. Two LEDs on the front panel indicate the status of the power supply modules (Green = Ok, Red = fail, Dark = not assembled). Note that the standard calls for a single supply.

13) Check that the VF wiring is routed through the hybrid located in the Fabricon jackfield (see Appendix C on page 20). This is accomplished by ensuring that the removable connector on the back of the jackfield which is wired to the NSD570 shelf is plugged into the TB4 position, and that the connector which is wired to the blocking switches is plugged into the TB3 position.

A.8 Configure NSD570 Software Settings

The HMI software is the interface between the user and the NSD570 device, allowing the user to Commission, Configure and Monitor the NSD570.

Installation and usage of the HMI570 software is described in Section 4 of the ABB Operating Instructions Manual [(6)].

A.8.1 Connect to the NSD570 Equipment

1) Connect the NSD570 RS-232 serial port to the Laptop computer with the RS-232 cable.

2) Start the HMI570 and login with username *Administrator* and password *welcome*.

3) Click on the TPE1 or TPE2 button to connect to TPE1 on default address 241 or TPE2 on default address 246 respectively.

4) In cases where TPE1 & TPE2 have been programmed with the same device address, obtain access by the following procedure:

   a. Power down the shelf and remove the G3LA card from TPE1.

   b. Power up the shelf, log into TPE2 and change it's Device Address.

   c. Power down the shelf and restore the G3LA card to TPE1.

   d. Power up the shelf and continue with step 3).

A.8.2 Prepare NSD570 Software Settings

1) Obtain the Standard settings (configuration) files for the NSD570 universal frame assembly DESN commissioning from the Protection and Control Information Management System (PCMIS).

2) Click on *Configuration* to bring up the Configuration menu and then click *Load from Disk*.

3) Click on *Browse* to locate and open the factory test settings file provided by HONI Telecom Engineering for that TPE, then click on *load*.

4) Click on *Edit Configuration* under the Configuration menu, and then click on *edit* under the device identification field.

5) Change the station name to correspond to the Site drawings.

6) Change the device address according to whether the equipment is TPE1 or TPE2. Click on *update* to make the change.

7) Check that the other fields in the loaded configuration agree with those shown in Appendix A, and that the *Jumper Settings* agree with the actual jumper settings checked in Paragraph A.6.

A.8.3 Edit Analog Configuration

Check that the Tx and Rx level settings in the *Analog Interface* field agree with those shown on the associated Telecom Circuit Schematic Drawing (the standard value is +1 dBm Tx and -23 dBm Rx). If not, edit these settings in the configuration file, using a procedure similar to that in Paragraph A.8.2.

A.8.4 Edit Relay Interfaces and Command Settings

1) In the *Relay Interfaces* field, check that only those commands which are required for the application are programmed to the relay interfaces. If not, edit these settings in the configuration file, using a procedure similar to that in Paragraph A.8.2.

   Note: Generally for the DESN application only command A is required (for direct trip). However, command B is sometimes required for blocking.

2) In the *Command Settings* field ensure that the application setting (direct, blocking, or permissive) matches the requirements for that command. *Direct* is most secure while *blocking* and *permissive* are less secure but more dependable. If in doubt for a particular application, contact Telecom Engineering for clarification.

A.8.5 Apply Configuration File

1) Click on *Configuration* to bring up the configuration menu.

2) Click on *Save To Disk*. Save to a file, with a different name from the template which was initially

loaded, in order to save the changes. Ensure that the original template files are not over-written.

3) Click on *Configuration* to bring up the configuration menu.

4) Click on *Download to Device* to copy the current configuration to the connected NSD570 TPE.

5) Click on *Maintenance* to bring up the Maintenance menu, and then click on *Reset Device* to activate the new configuration downloaded to the device.
   Note: changes to the configuration are not implemented until the configuration has been downloaded to the shelf and the shelf has been reset, as described.

6) Repeat the configuration for the other TPE in the shelf, with the correct template for that TPE.

A.8.6 Configure Real Time Clock

1) Ensure the time and date is correct on the PC.

2) Under the *Maintenance* menu click *Set Time and Date* to set the time and date.

3) To view the new time and date click on *Get Time and Date* in the *Maintenance* menu. Time configuration is applicable to both TPE1 and TPE2.

A.9 Transmitter Tests

A Hybrid/Jackfield panel with full-size TRS jacks is provided to isolate, monitor and test the VF circuit, as shown in the diagrams in Appendix C. The left side two circuits are used in this application.

In each circuit, the first top and bottom jacks are used for transmitting (Tx) and the second top and bottom jacks are used for receiving (Rx). In all circuits, the top jacks are used for equipment side measurements and the bottom jacks are used for line side measurements.

The jackfield panel is wired in safety mode, with the equipment and line jack switches wired in parallel as shown in the insert in Appendix C. This means that any measurements will be "bridging" (insertion of the test plug will not break the circuit) unless a termination or dummy plug is used to open the switch in the second jack.

There is a total of 4 dB insertion loss (mid-band) in the hybrid and isolation transformer. On the equipment side of the jackfield, each jack has a 604 ohm resistor connected internally, to allow the tone equipment to be operated in high impedance mode.

A.9.1 Measure Tx Guard Level at the Jackfield

1) Connect the VF meter input to the jackfield's first top jack (for TPE1 Tx). Insert a 310 dummy plug or termination in the bottom jack to open the circuit Measure the guard level (600 ohm terminated). This value should be ± 2dB from the nominal expected value as documented in the associated Telecom Circuit Schematic Drawing (the standard value is +1 dBm). Record the measured value on the test form.

2) Repeat for the second circuit (TPE2 Tx), by moving the dummy plug and VF meter to the third jack position.

A.9.2 Measure Tx Guard Level at the Line Interface

1) Insert dummy plugs or terminations into both the top and bottom jacks of the third jack position (TPE2 Tx).

2) Open the Transmit Pair VF blocking switch (BS-41).

3) Connect the VF meter input between the blades of BS-41.

4) Measure the guard level (600 ohm terminated) of the TPE1 transmitter. This should be ± 2dB from the nominal expected value (usually -3 dBm). Record the measured value on the test form.

5) Repeat steps 1) to 4) for TPE2 by moving the dummy plugs to the first jack position, so that only the TPE2 transmit signal is present at the Line Interface.

A.9.3 Measure Tx Command Level

1) Connect the VF meter as in paragraph A.9.2 step 3), with dummy plugs in the third jack position to block TPE2 Tx.

2) Key the first command input on TPE1 by applying the fused positive test potential to the jaw of blocking switch BS-2.

3) Observe the illuminated LEDs corresponding to the input being keyed on the chassis front panel.

4) Measure the command level at the Line Interface (600 ohm terminated), which should be equal to the guard level (± 1 dB) recorded in A.9.25) step 4), and record on the test form.
Note: If a selective meter is used, set it to measure flat in order to read the composite level of both command tones.

5) Repeat for any other command inputs which have been configured, and record the level furthest from the guard level.

6) Repeat steps 1) to 5) for TPE2 by moving the dummy plugs to the first jack position (TPE1 Tx), so that only the TPE2 transmit signal is present at the Tx Line Interface, and applying positive test potential initially to the jaw of blocking switch BS-22.

A.9.4 Tx Composite Level

1) With the VF meter connected as in paragraph A.9.2 step 3), remove the dummy plugs so that all tones from both TPEs are present at the Line Interface.

2) Measure the composite level at the Line Interface (600 ohm terminated), which should be 0 dBm ±2 dB. (If a selective meter is used, set it to measure flat in order to read the composite level.)

A.10 End-to-End Tests

Ensure that the commissioning procedures described in A.6 through A.9.4 above have been completed on both the local NSD570 and the remote NSD570 at the other end of the circuit, and that the circuit tests have been completed before continuing with end-to-end testing.

Ensure that the corresponding near-end and far-end receive DC blocking switches are open before sending commands when there is any chance that these commands could affect in-service line protection.

Note that these end-to-end tests generally will require co-ordination with personnel at the other end of the circuit.

A.10.1 Circuit Amplitude Skew

1) The NSD570 in dual tone mode requires that there be no more than 3 dB difference at the receiver between any two tones in the command table (refer to Tables B.7 through B.9 in Appendix B).

2) For normal DESN applications, calculate the maximum difference between circuit attenuations measured between 800 Hz and 1100 Hz for TPE1, and measured between 1800 Hz and 2100 Hz for TPE2 (from the circuit test data). Ensure that these values are less than 2 dB, and record on the test forms.

3) The frequencies listed are for configurations with 960 Hz BW and 2 commands programmed. Consult the appropriate frequency chart if different numbers of commands are used, or if a different bandwidths and/or center frequencies are used (refer to Tables B.7 through B.9 in Appendix B).

4) If the calculated maximum amplitude skew is more than 2 dB, first have the circuit provider try to improve the amplitude/frequency response, as it is probably out of specification.
Note: A possible solution is to introduce loading coils (these could have been removed to improve digital services).

5) Because the frequency spread is greater when all four commands are used in each TPE it may be necessary on some circuits to reconfigure the NSD570s to 480 Hz BW (reducing the maximum skew but increasing end-to–end trip delay by 13 ms). Consult with Telecom Engineering before doing this.

A.10.2 Measure Tx Guard level at the Line Interface

1) Close the local Transmit pair VF blocking switch (BS-41).

2) Measure the composite VF level transmitting on the circuit (600 ohm bridging). This is preferably measured at the Bell-Hydro interface (on the equipment side of the optical isolator, if equipped).

A.10.3 Measure Rx Guard level at the Line Interface

1) Open the local Receive pair blocking switch (BS-43).

2) Close the remote Transmit pair blocking switch at the far end of the circuit.

3) Insert dummy plugs or terminations into the third jack in the remote jackfield at the far end of the circuit in order to block the TPE2 transmit signal.

4) Connect the VF meter input between the jaws of the local Receive pair blocking switch.

5) Measure the TPE1 Rx Guard level (600 ohm terminated) locally and record this reading.

6) Repeat steps 1) to 5) for TPE2, moving the dummy plugs in the remote jackfield at the far end of the circuit to the first jack (TPE1 Tx), so that only the TPE2 transmit signal is present on the circuit.

A.10.4 Measure Rx Guard level at the NSD570

1) Close the local Receive pair blocking switch (BS-43).

2) Close the remote Transmit pair blocking switch (BS-41) at the far end of the circuit.

3) Insert dummy plugs or terminations into the third jack in the remote jackfield at the far end of the circuit in order to block the TPE2 transmit signal.

4) Connect the VF meter input to the second jack on the local jackfield (equipment side).

5) Measure the TPE1 Rx Guard level (600 ohm bridging) locally and record this reading.

6) Repeat steps 1) to 5) for TPE2, moving the dummy plugs in the remote jackfield at the far end of the circuit to the first jack (TPE1 Tx), so that only the TPE2 transmit signal is present on the circuit, and measuring the Rx Guard level on the fourth jack (equipment side).

A.10.5 Adjust the NSD570 Rx Sensitivity

1) Connect the laptop computer to TPE1 of the NSD570 equipment as in Paragraph A.8.1.

2) Click on *Configuration* and *Upload from Device* to load the current NSD570 configuration.

3) Click on *Configuration* and *Edit Configuration*,.

4) Select *Analog Interface*.

5) Click on *edit*.

6) Change *Rx Level [dBm]* to the value for TPE1 measured in Paragraph A.10.4 step 5).

7) Click on *update.*

8) Click on *Configuration.*

9) Click on *Save to Device* to update the setting at the NSD570.

10) Click on *Maintenance* to bring up the *Maintenance* menu, and then click on *Reset Device* to activate the new configuration downloaded to the device.

11) Repeat steps 1) to 10) for TPE2.

A.10.6 NSD570 Loop Test & Status Menu

1) Ensure that the commissioning procedures described in A.6 through A.10.4 above have been completed on both the local NSD570 and the remote NSD570 at the other end of the circuit.

2) Ensure that the circuit tests have been completed before continuing.

3) Ensure that at both ends all plugs have been removed from the Fabricon jacks.

4) Ensure that at both ends the VF blocking switches are closed.

5) Ensure that there are no alarms present on TPE1.

6) Connect to TPE1.

7) Click on the *Maintenance* menu.

8) Click on *Manual Loop Test*. The HMI will show if the NSD570 passed or failed the loop test. It will also show the transmission time if the test passed.

9) Click on the *Status/Alarm* menu.

10) Click on the *Upload Status* submenu.

11) Record the values for *Rx Level [dBm]*, T*x Level [dBm]*, *SNR in 4 kHz noise bandwidth [dB]*, and *Transmission time [ms]* on the test form.
Note: *Transmission time [ms]* will not be available when the equipment is looped-back.

12) Repeat steps 5) to 11) for TPE2.

A.10.7 Teleprotection Functionality Tests

Teleprotection continuity of the NSD570 commands and of the wiring within the frame assembly has been factory tested.

If the cabling from the NSD570 frame assembly terminal block and the associated relay panel blocking switch assemblies has been completed, end-to-end functional continuity checks of the teleprotection must be made from the relay blocking switches in order to ensure that this cabling is complete and correct. If this wiring has not been competed, an interim test may be made using the blocking switches included within the NSD570 frame assembly.

Follow the instructions in the section "Teleprotection Functionality" of HODS document SP0821R0 ([7]).

A.11 Alarm Checks

Alarm connections to the RTU should be made when the system is ready to be put into service. Alarm tests may then be made with the OGCC operator, rather than a local check of the status of the alarm contacts as described below in paragraph A.11.1.

A.11.1 Receive Alarm Indication

1) Ensure that the NSD570 alarms are cleared before continuing.

2) Make sure the TPE1 and TPE2 *Line Interface - OK/Fail* green/red LEDs are lit green.

3) Make sure the TPE1 and TPE2 *Receive*, *Transmit*, *Local*, and *Remote* alarm red LEDs on the front panel are not lit.

4) Make sure the *Relay Interface - OK/Fail* green LED for each equipped G3LR card is lit.

5) Make sure the *Relay Interface - Relay* green LEDs for each equipped G3LR card are not lit.

6) Check that alarm contacts wired between TB(1) terminals 401 & 402, 403 & 404, 405 & 406, 407 & 408, 409 & 410, and 411 & 412 are open.

7) Interrupt the received signal to TPE1 by plugging dummy plugs or terminations into the top and bottom of jack position #2.

8) Make sure the TPE1 *Line Interface - OK/Fail* green/red LED is lit red.

9) Make sure the TPE1 *Receive* and *Local* alarm red LEDs on the front panel are lit.

10) Make sure the left *Relay Interface - Relay* green LED for each equipped TPE1 G3LR card is lit.

11) Ensure that the associated alarm blocking switches are closed.

12) Check that alarm contacts wired between TB(1) terminals 401 & 402, between TB(1) terminals 403 & 404, and between TB(1) terminals 409 & 410 are closed.

13) Restore the received signal to TPE1 and interrupt the received signal to TPE2 by moving the dummy plugs or terminations into the top and bottom of jack position #4.

14) Make sure the TPE2 *Line Interface - OK/Fail* green/red LED is lit red.

15) Make sure the TPE2 *Receive* and *Local* alarm red LEDs on the front panel are lit.

16) Make sure the left *Relay Interface - Relay* green LED for each equipped TPE2 G3LR card is lit.

17) Ensure that the associated alarm blocking switches are closed.

18) Check that alarm contacts wired between terminals TB(1) terminals 405 & 406, between TB(1) terminals 407 & 408, and between TB(1) terminals 411 & 412 are closed.

19) Restore the received signal to both TPE1 and TPE2 by removing the dummy plugs or terminations from the Fabricon jackfield.

A.12 Cleanup

A.12.1 Reset Counters

After all NSD570 tests have passed successfully, the counters need to be reset. Reset the counters as follows:

1) Click on *Trip Counters* in the *Status / Alarm* menu.

2) Activate the checkbox *All*.

3) Click on the *Reset* button.

A.12.2 Clear Event Recorder

To clear all events, go to the *Event Recorder* menu and click on *Clear Event Recorder*.

A.12.3 Reset Device

To ensure that the current configuration is the actual configuration go to the *Maintenance* menu and click on *Reset Device*.

A.12.4 Save the Configuration Data

1) To save the configuration in a disk, go to the *Configuration* menu and click on *Upload From Device*.

2) Click on *Save To Disk*. Save the configuration file on the disk using the Serial Number of the NSD570 rack and the number of the device (TPE1 orTPE2).

3) Click on *View Configuration* in the Configuration menu.

4) Print out the configuration table that is shown.

5) Repeat the steps given in paragraphs A.12.1 through A.12.4 for each commissioned TPE.

6) Archive one electronic copy with WinZip (or Windows XP Explorer) into the "Telecom" folder under the corresponding station-specific subdirectory of \\Vortex-HO1\P&C_Archives\. Also archive the associated NSD570 and circuit commissioning test results (Refer to HODS SP178R0 [4]).

A.13 Restore Covers

After successfully completing the commissioning tests, replace the back cover plate of the NSD570.