Base Load Power Hub (BLPH)

# OTP – LV Switch Boards & LV Distribution Board Systems

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# 1 INTRODUCTION

## 1.1 Project Overview

Crosswind, a Shell and Eneco joint venture, was awarded the tender to develop the offshore Hollandse Kust Noord (HKN) wind farm, located 18.5km off the coast of Netherlands near the town of Egmond aan Zee. The consortium plans to have HKN operational in 2023 with an installed capacity of 759MW generating at least 3.3TWh per year. This is sufficient renewable power to supply more than 1 million Dutch households with green electricity.

Offshore wind farms produce intermittent electricity and balancing these dips and peaks and integrating this electricity into the national energy system requires new technologies. For this reason, the offshore wind farm will include several new technologies that could be implemented at full-scale in the future. The new technologies being explored include a floating solar park, a short-duration battery storage as well as long-term storage via green hydrogen produced by water electrolysis and subsequently consumed in a fuel cell. The combination of these individual measures, herein referred to as the Base Load Power Hub (BLPH) will ensure a continuous power supply regardless of the wind situation.

## 1.2 Project Location

The Hollandse Kust Noord (HKN) wind farm is located 18.5km off the coast of the Netherlands near the town of Egmond aan Zee.

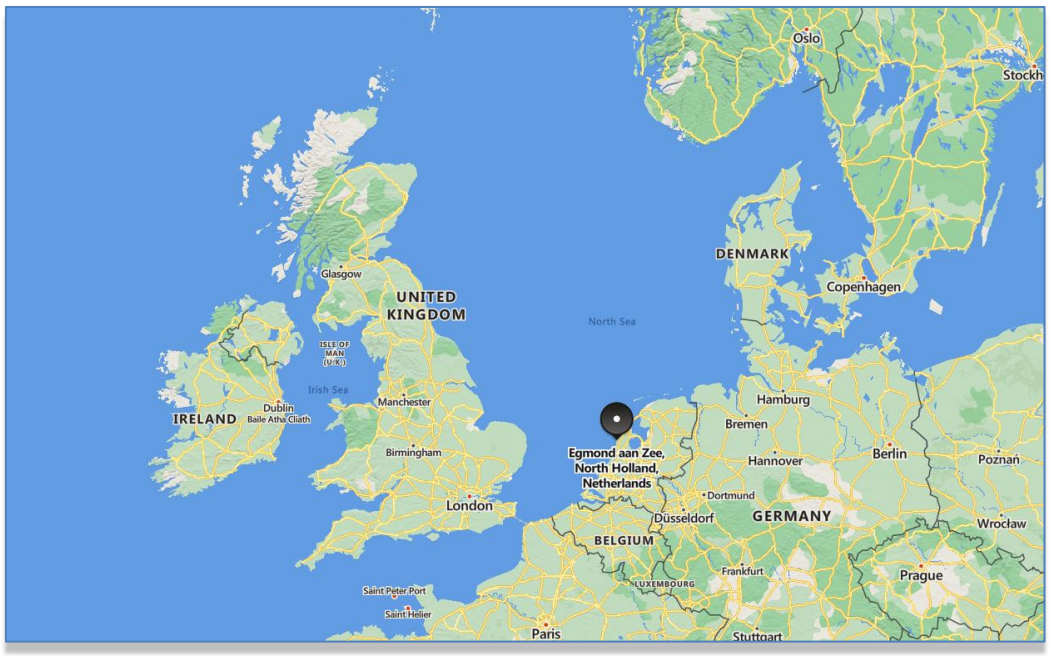



*Figure 1 - HOLLANDSE KUST NOORD WIND PARK Location Map*

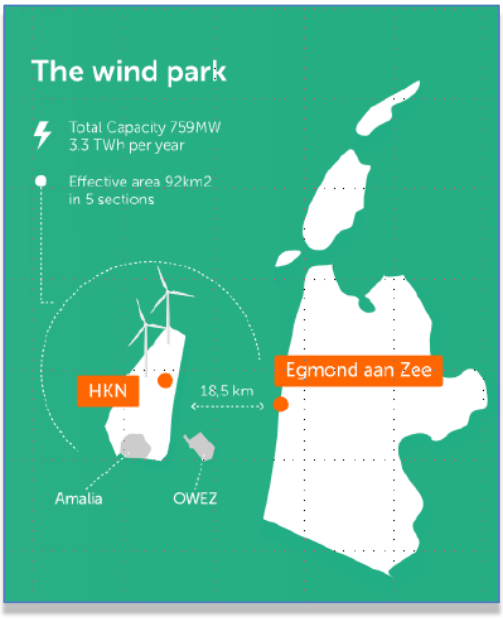



*Figure 2 - Wind Park Details*

The wind farm will consist of No. 69 x 11.5MW wind turbine generators each to be installed on a dedicated monopile structure. A 70th monopile is located on coordinates E 590719.1, N 5841602.3 and is reserved for installing the platform accommodating the BLPH. The monopile structure was designed and installed by Van Oord Offshore Wind (VooW) and therefore not part of the BLPH scope.

## 1.3 Project Concept

All components included in the BLPH will be integrated onshore on a topside and installed in an offshore location within the boundaries of the HKN wind farm. At its simplest, the BLPH will store energy during periods of high electricity generation from renewable sources (a wind turbine generator and the floating solar PV farm) and release it during periods of low generation. In practice. It is expected that the energy stored will supplement generation from renewable sources to ensure that at least 1.0MW of power is exported to the electrical grid regardless of wind/solar availability.

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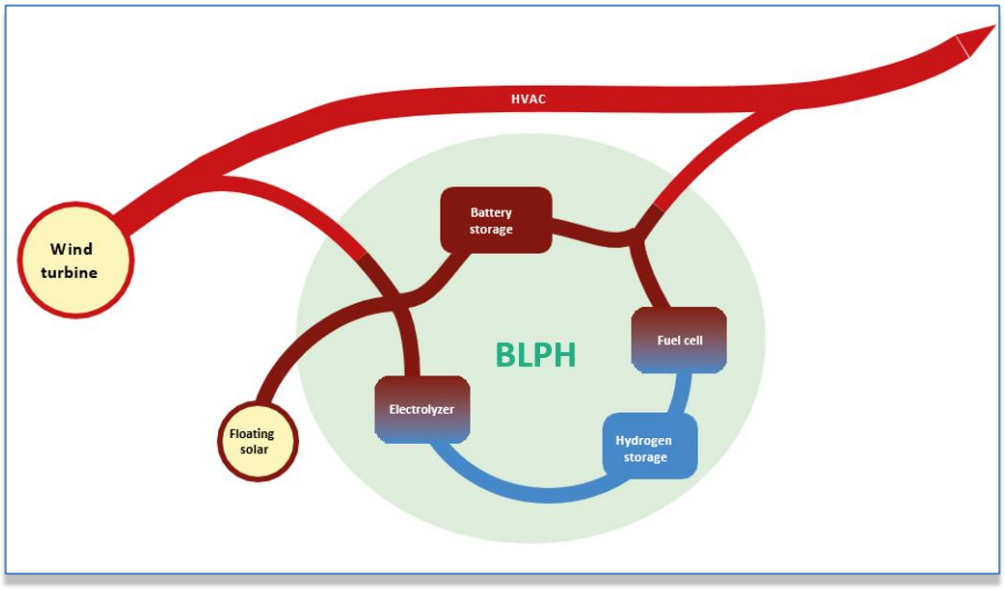



*Figure 3 – BLPH Concept*

Electricity in the BLPH will be stored in the form of electrons in a battery energy storage system (BESS) as well as converted into green hydrogen via water electrolysis. When the power output from the connecting wind turbine drops to below 1 MWe, the BLPH will return its stored energy to supplement the remaining power output. This will be by discharging the BESS, while stored hydrogen will be converted back into electricity using a fuel cell to extend the discharge duration.
The purpose of the BLPH is to function as a testbed for the integration of energy storage technologies with renewable generation. It is expected that equipment installed on the BLPH will operate as Normally Unmanned Installation for at least two (2) years with no or minimal maintenance and it will have its own independent control room with the ability to communicate with Crosswind's control room.

# 2 DOCUMENT SCOPE

The purpose of this document is to describe the dedicated Commissioning procedure together with the detailed test steps to be implemented for the preparation and execution of the operation testing of the Low Voltage Switchboard and Low Voltage Distribution Board.

The document will cover all related test steps to be performed at both the onshore Worksite construction yard and the offshore SITE.

# 3 OTP SUMMARY

## 3.1 Test Objective

The operating test of the LV Power Distribution Switchboard system is executed to ensure that the system is started up in a safe and controlled manner and to verify the correct operation according to the project requirements.

Aim of this document is to provide the sequence and appropriate actions to test the LV Power Distribution Switchboard SG-200N1 and LV Distribution Board DP-200N1.

Activities shall be developed as follows:

- Onshore pre-commissioning and commissioning activities at Contractor site (WORKSITE)
  - PHASE 1: SWBD SG-200N1 and DB DP-200N1 with power supply from temporary 400V Diesel Generator (from yard 400V supply).
  - PHASE 2: SWBD SG-200N1 and DB DP-200N1 Energized from TR-200DE1 and 6.6kV Switchboard SG-100D1 via 6,6 kV temporary yard facilities.
  - PHASE 3: SWBD SG-200N1 and DB DP-200N1 will be tested with EMCS system.

- Offshore commissioning (SITE)
  - SWBD SG-200N1 with power supply from permanent 6,6kV Switchboard SG-100D1 and 66kV GIS HNA6-AFA70.

## 3.2 System Boundary Limits

See below the interested systems and subsystems on the Overall Single Line Diagram (extract from Doc. N. 123A90-PML-COM-DG-03012)

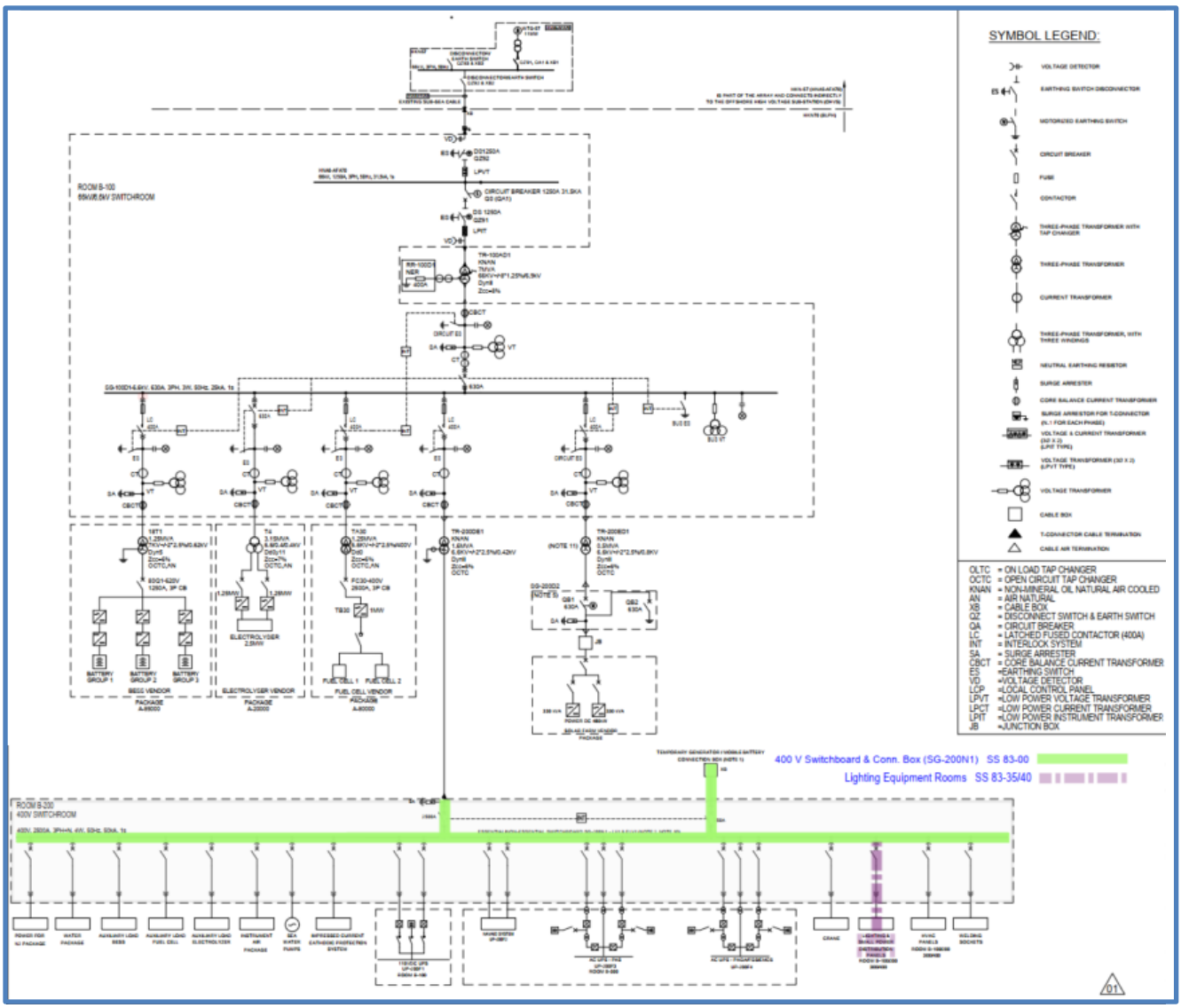



*Figure 4 – OTP System Boundary Limits*

## 3.3 Test and System Description

This document is related to the following systems/ subsystems:

- 83-00: 400 V Switchboard & Connection Box (SG-200N1)
- 83-20: 400/230V Distribution Board (DP-200N1)

All equipment is installed inside Technical Room B-200.
System boundary limits are defined in OVERALL SINGLE LINE DIAGRAM Doc. 123A90-PML-COM-DG-03012.

These items of the system shall be tested on worksite and on site.

The LV switchboards are metal enclosed prefabricated self-supporting type, for floor installation in compliance to the requirements of IEC 61439 1&2.

The LV switchboard (SWBD) main data are the following:
GENERAL CHARACTERISTICS CLIMATIC CONDITION:
- Installation: Marine Offshore-Indoor
- Design Ambient Temperature: -8,4+40°C
- Rel. Humidity average 95%

ENCLOSURES:
- Type: Floor Standing
- Cell Type: MCC/F
- Finish Colour: RAL 7035

CONNECTIONS:
- Cable Compartment Access: Front (Incoming & Outgoing)
- Cable Entry From: Top
- Switchboard Access: Front

POWER SUPPLY:
- Rated Service Voltage: 400/230V
- Rated insulation Voltage: 690V
- Rated Frequency: 50 Hz
- Switchboard Rated Current: 2500A
- Rated Short Time Withstand Current (Isc): 50kA/1s
- Internal Arc Classification: 50kA
- Arcing Class: 0,3 sec
- Neutral operation: TN-S

BUSBARS:
- Busbars: 3P+N+PE
- Material: Electrolytic Copper
- Coating: Sheathed (Insulation)
- Maximum Operating Temperature: 70°C
- Protection: Internal IP20/External IP 30
- Segregation: FORM 4b

There are three Aux power supply (230VAC, 24VDC).
- 230V From main bus bar (upstream)
  - Supply motor spring charger
  - command circuits (feeders)
- 230V from DP200N1(Q39)
  - Internal space heater/lighting
- 230V from DP-200F3
  - Protections device and protection ethernet switch (incoming CB)
  - Command circuits (incoming CB)
  - Supply 230V/24Vdc converter

The LV distribution board (DB) main data are the following:
GENERAL CHARACTERISTICS:
- Number Of Phases: 3 + N Wire System
- Service Voltage: 400/230V
- 1000V Rated Ins. Voltage for Main Busbars: 690V
- Rated Frequency: 50Hz

- Insulation Level: 2.5kV-1min (For Power Circuit)
- Insulation Level: 2kV - 1min (For Control Circuit If Existing)
- Rated Impulse Withstand Voltage: 4kV

CLIMATIC CONDITION:

- Installation: Marine Offshore-Indoor
- Design Ambient Temperature: -8,4+40°C
- Rel. Humidity average 95%

ENCLOSURES:

- Type: MCC/F
- Cell Type: MCC/F
- Finish Colour Semi-Matt-Textured: RAL 7035

CONNECTIONS:

- Cable Compartment Access: Front (Incoming & Outgoing)
- Cable Entry From: Top (Outgoing)
- Switchboard Access: Front

POWER SUPPLY:

- Rated Service Voltage: 400V
- Switchboard Rated Current: 63A
- Rated Short Time Withstand Current (Isc): 6kA/1S
- Neutral operation: TNS

BUSBARS:

- Busbars: 3P+N+PE
- Maximum Operating Temperature: 70°C
- Protection: External IP 30/Internal IP20
- Segregation: FORM 2b

The basic Single Line Diagram of the switchboards and relevant connections is shown in the document 123A90-DDL-EL-DG-20158 "Overall/Key Single Line Electrical Diagram".

## 3.4 Safety Devices

- Appropriate Personnel Protective Equipment (PPE) and safety equipment e.g., safety shoes, hand gloves, helmet, earplugs etc. are available and must be used in line with the site requirements.
- For Arc Flash Risk Category to be consider without maintenance switch ON, for SG-200N1 and DP-200N1 PPE Level 1 online Side Fault and for SG-200N1 PPE Level 2 and DP-200N1 PPE Level 1 on Bus Side Fault, as per Arc Flash Energy Calculation 123A90-DDL-EL-RE-20172, section 3.7 and attachment 2
- Warning safety signs are to be posted with restricted access to essential personnel only.
- Adequate firefighting equipment.

## 3.5 HSE Management

All necessary safety precautions must be taken to avoid any risk for personnel injury.

- All personnel involved in this operational test shall be competent for the tasks they will be required to undertake
- Place safety / warning signs and segregate the entire area with barrier tapes (safety barriers) of a colour distinguished (blue and white) from those used for construction activities
- Restrict access into area only to authorized personnel
- Conduct "Toolbox Talk" with all personnel prior to starting test work
- Appropriate Personnel Protective Equipment (PPE) and safety equipment e.g. safety shoes, safety glasses, hand gloves, helmet, earplugs etc. are available and must be used in line with the site requirements

- All activities carried out on the project shall be performed in accordance with the "Permit to Work" system Doc. PRO-HSE-23
- Additional reference corporate safety documentation to be observed and adhered to; PRO-HSE-30 Working with Electricity, PRO-HSE-25 Simultaneous Operations (SIMOPS) and PRO-HSE-07 HAZID.
- Electrical and mechanical isolations are to be assured as per Doc. PRO-HSE-08 and "Commissioning and start-up operation" procedure.
- Observe and enforce all international codes and regulations to safeguard personnel, plant and environment.
- Ensure that the working area is clean, tidy, well illuminated and that access and escape routes are free from obstructions.

Before starting work on any of the activities in this OTP it is the responsibility of the persons performing the work to:

- Familiarize themselves with the plant/equipment to be worked on
- Ensure they are aware of all other work activities that are taking place, or due to take place
- If necessary, re-plan any situation/activity
- Ensure proper communications between parties involved in the execution of the OTP
- Read the relevant Vendor documentation for the equipment covered by this OTP and observe any special requirements and limitations recommended or imposed by Vendor
- Verify that all personnel involved in the implementation of this procedure are familiar with its content as well as the associated safety requirements (Toolbox Talk)

## 3.6 Acceptance Criteria

- Before Power ON:

Visual inspection and verification are a crucial step to identify any obvious issues with the installation, such as loose connections, missing components, or damage to the equipment.

Crosschecking the installation with engineering documentation ensures that the installation is done correctly and according to the manufacturer's guidelines. These steps can help identify any missing or incorrect components, and wrong connections.
All protection relays should be set according to the "Report on Selectivity Study of Electrical Protection Relays 123A90-DDL-EL-RE-20168".
Check the protection setting on related check sheet type B (HOLD) for each protection.
Apply the padlocks on the all feeder Breakers, in the incomer breakers and on auxiliary MCB as per LoTo Procedure.

Applicable panels:

- SS83-00: 400 V Switchboard & Connection Box (SG-200N1)
- SS83-20 :400V/230V Distribution Board "DP-200N1"

Refer Overall SLD with Marked Sub-systems.

- Power ON:

Powering ON the unit is an essential step to verify that the equipment is functioning correctly. Observing if everything is OK and any alarm will help detect possible errors or malfunctions.

Phase 1 will be powered through temporary feed and without limited connected systems/devices that will be available at this stage.
Phase 1 will prove correct:

- Voltage, frequency and phase sequence to the main terminals are according to specification.
- SWBD SG-200N1 energization
- DB-200N1 energization

- Output / Distribution as per specification
-

Phase 2 will be powered through 6.6kV/LV transformer TR-200DE1 as per design and with other systems connected to distribution board.
Phase 2 will prove correct:

- Test and validation of safety interlock between 6.6kV and low voltage SWBDs
- Verify phase sequence, frequency, voltage and current
- SWBD SG-200N1 Output Supply to consumers (UPSs, DB, Motors, lights, etc.)
- DB-200N1 energization
- DB-200N1 Output Supply to consumers (Lights, Heaters, Sockets)

Phase 3 Repeat Phase 2 to test sequence and will prove correct functionality of the following signals:

- Modbus communication to EMCS
- IEC61850 communication between EMCS and the protections
- Functionality interlock and commands between circuit breakers
- I/O hardwired connections

Performing the steps in this OTP as per engineering documents is crucial to ensure that the equipment is operating correctly and that it meets the desired design specifications. Observing the results will help identify any issues that may arise during the operation.

Overall, following these steps shall provide a comprehensive and effective way to verify the equipment installation and functionality. Furthermore, additional test steps will be provided within dedicated Black-Start Procedure.

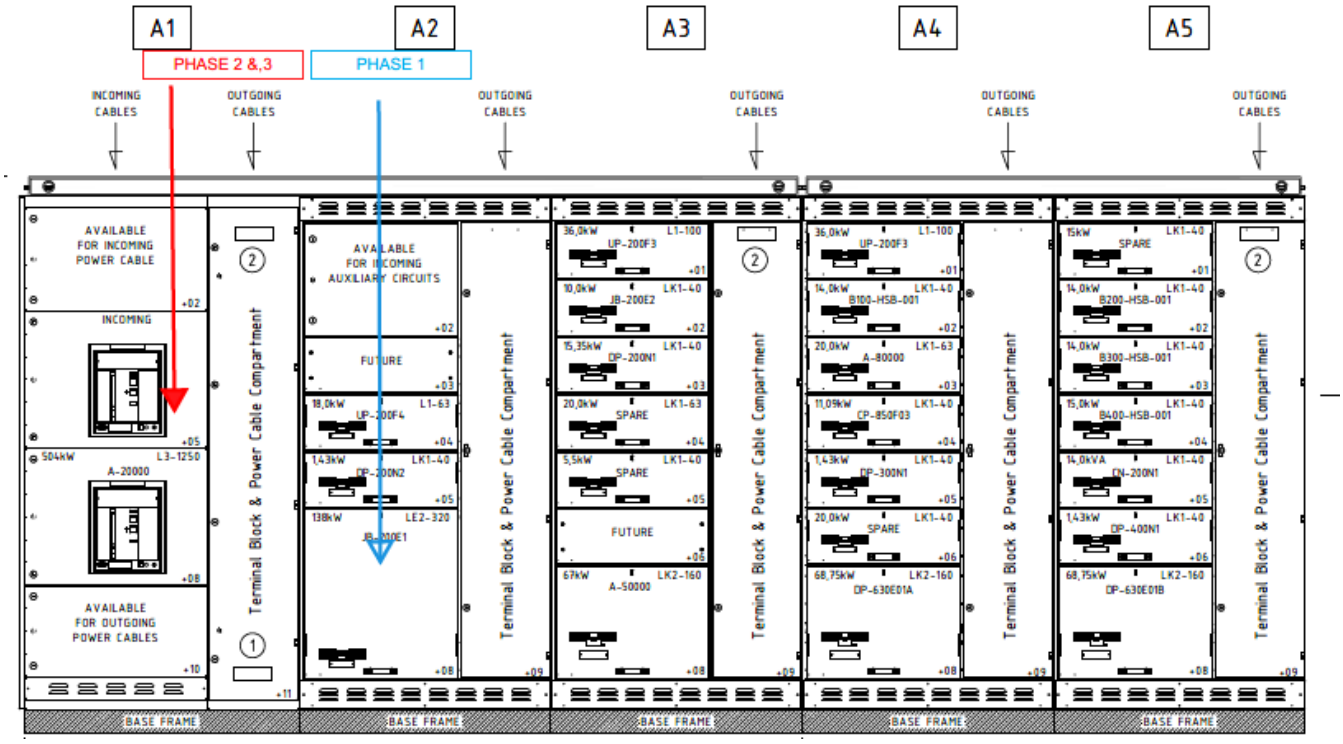



*Figure 5 – Power supply in OTP Phases*

# 4 DOCUMENTS REFERENCES AND ABBREVIATIONS

## 4.1 Reference Documents

### 4.1.1 Company Documents and Standards

| Document ID | Document Title |
|---|---|
| [1] K559-2254-CG-PHI-001 | Commissioning Philosophy |
| [2] K559-2254-EL-ELL-002 | BLPH Electrical Load List (CCS MODE 2(A) 'HOT STANDBY') |
| [3] K559-2254-EL-ELL-003 | BLPH Electrical Load List (CCS MODE 3(C) 'DISCHARGING') |
| [4] K559-2254-EL-ELL-004 | BLPH Electrical Load List (CCS MODE 4(A) 'COLD STANDBY') |
| [5] K559-2254-EL-ELL-005 | BLPH Electrical Load List (CCS MODE 4A(D) 'EMERGENCY MODE (Island)) |
| [6] K559-2254-EL-ELL-006 | BLPH Electrical Load List (CCS MODE 5(D) 'POWER OUT (Blackout)) |
| [7] K559-2254-PR-PHI-001 | Main process control philosophy |

**Table 1:** Company Key Reference Documentation

These documents were produced in FEED and made available to RM for info. They have subsequently been superseded by Detailed Design, similar or same deliverables.

### 4.1.2 Project Documents

| Document ID | Document Title |
|---|---|
| [1] 123A90-PML-PM-LIS-01001 | Master Document Register |
| [2] 123A90-PML-PM-PL-00001 | Project Execution Plan |
| [3] 123A90-PML-QHSE-PL-00001 | Project HSE Plan |
| [4] 123A90-PRO-HSE-23 | RM Yard Permit To Work Procedure |
| [5] 123A90-PML-COM-PL-03002 | Mechanical Completion & Commissioning Execution Plan |
| [6] 123A90-PML-COM-LIS-03011 | System/Sub-Systems List |
| [7] 123A90-PML-COM-LIS-03012 | System/Sub-System Boundary Limit Diagrams |
| [8] 123A90-PML-COM-PRO-03038 | Leak Test Procedure |
| [9] 123A90-PML-COM-SP-03032 | Pre-Commissioning Functional Test Sheet Template Collection (ITR-B) |
| [10]123A90-PML-COM-SP-03014 | Commissioning TDS - Temporary Equipment & Facilities |
| [11]123A90-PML-COM-PRO-03019 | OTP – Onshore Performance & Integrated Test Procedure |
| [12]123A90-PML-COM-LIS-03034 | Inhibit-Override Register |
| [13]123A90-PML-COM-LIS-03035 | PSV Calibration Register |

| Document ID | Document Title |
|---|---|
| [14]123A90-PML-COM-PRO-03036 | OTP - Black Start Procedure |
| [15]123A90-PML-COM-LIS-03024 | Commissioning Spare Parts and Consumables List |
| [16]123A90-PML-COM-PRO-03022 | Initial offshore START-UP procedures |
| [17]123A90-PML-COM-SP-03057 | Worksite WEF (Work Execution Flow Scheme) |
| [18]123A90-PML-COM-SP-03058 | Site WEF (Work Execution Flow Scheme) |
| [19]123A90-PML-COM-RE-03001 | Commissioning Final Dossier (ITR-B) |
| [20]123A90-PML-QHSE-PRO-00116 | Flushing and Cleaning Procedures |
| [21]123A90-PML-QHSE-SP-00118 | Mechanical Completion Check Sheet Template Collection (ITR-A) |
| [22]123A90-PML-QHSE-RE-00115 | Mechanical Completion Final Dossier (ITR-A) |
| [23]123A90-PML-QHSE-PRO-00117 | Punch list Management Procedure |
| [24]123A90- 123A90-PML-COM-PRO-03041 | OTP - Hydrogen Storage & Venting Systems |
| [25]123A90- 123A90-PML-COM-PRO-03042 | OTP - Sea Water Intake & Fresh Water Treatment Systems |
| [26]123A90- 123A90-PML-COM-PRO-03043 | OTP - Instrument Air System |
| [27]123A90- 123A90-PML-COM-PRO-03055 | OTP - Nitrogen Generation System |
| [28]123A90- 123A90-PML-COM-PRO-03044 | OTP - HVAC Systems |
| [29]123A90- 123A90-PML-COM-PRO-03045 | OTP - HV Switchgear & 66 kV Transformer Systems |
| [30]123A90- 123A90-PML-COM-PRO-03046 | OTP - 6.6 kV Switchgear & Transformer Systems |
| [31]123A90- 123A90-PML-COM-PRO-03047 | OTP - LV Switch Boards & LV Distribution Board Systems |
| [32]123A90- 123A90-PML-COM-PRO-03048 | OTP - Lighting & Small Power Systems |
| [33]123A90- 123A90-PML-COM-PRO-03049 | OTP - Electrical Heat Tracing Systems |
| [34]123A90- 123A90-PML-COM-PRO-03050 | OTP - DC UPS System 10kVA UP-200F1 |
| [35]123A90- 123A90-PML-COM-PRO-03051 | OTP - Data Network Systems |
| [36]123A90- 123A90-PML-COM-PRO-03052 | OTP - Telecom & Surveillance Systems |
| [37]123A90- 123A90-PML-COM-PRO-03053 | OTP - Navaid System |
| [38]123A90- 123A90-PML-COM-PRO-03054 | OTP - F&G and ESD C&E Logics |
| [39]123A90-PML-QHSE-PRO-00120 | Proverlis Management Procedure |
| [40]123A90-PML-COM-PRO-03056 | OTP – Document Template |
| [41]123A90-PML-COM-PRO-03059 | OTP - AC UPS System 35kVA UP-200F3 |
| [42]123A90-PML-COM-PRO-03060 | OTP - AC UPS System 15kVA UP-200F4 |

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| Document ID | Document Title |
|---|---|
| [43] 123A90-PML-COM-PRO-03007 | Commissioning Strategy |

**Table 2**: Reference Project Deliverables

### 4.1.3 Vendor Documents

| Document ID | | Document Title |
|---|---|---|
| [1] | 1723002197-COM-LIS-00052 | SPARE PART INDEX REGISTER (COMMISSIONING AND OPERATION) |
| [2] | 1723002197-EL-CAL-00049 | HEAT DISSIPATION CALCULATIONS |
| [1] | 1723002197-EL-DA-00007 | SG-200N1 LV SWBD 400-230V - GENERAL ARRANGEMENTS DWG, FOUNDATION LOAD CALCULATION INCLUDING COG |
| [2] | 1723002197-EL-DA-00009 | DP-200N1 - LV SWBD 400-230V - GENERAL ARRANGEMENTS DWG, FOUNDATION LOAD CALCULATION INCLUDING COG |
| [3] | 1723002197-EL-DG-00011 | SG-200N1 LV SWBD 400-230V ELECTRICAL SLD |
| [4] | 1723002197-EL-DG-00013 | DP-200N1 LV SWBD 400-230V-ELECTRICAL SLD |
| [5] | 1723002197-EL-DG-00030 | SG-200N1 LV SWBD 400-230V FUNCTIONAL DIAGRAMS - INCOMINGS AND INTERCONNECTING AND AUX DISTRIBUTION |
| [6] | 1723002197-EL-DG-00031 | SG-200N1 LV SWBD 400-230V - FUNCTIONAL DIAGRAMS - TYPICAL FEEDERS |
| [7] | 1723002197-EL-DG-00033 | DP-200N1 LV SWBD 400-230V FUNCTIONAL DIAGRAM |
| [8] | 1723002197-EL-DS-00035 | SG-200N1 EQUIPMENT DATA SHEETS INCLUDING MSDS and WEIGHT DATA SHEET |
| [9] | 1723002197-EL-DS-00037 | DP-200N1 EQUIPMENT DATA SHEETS INCLUDING MSDS and WEIGHT DATA SHEET |
| [10] | 1723002197-EL-LIS-00042 | SG-200N1 IO LIST (HARDWARE - SOFTWARE) |
| [11] | 1723002197-EL-LIS-00050 | CONSUMPTION LIST |
| [12] | 1723002197-EL-LIS-00051 | DATA TABLE |
| [13] | 1723002197-EL-LIS-00053 | SPECIAL TOOLS LIST |
| [14] | 1723002197-EL-MAN-00054 | INSTALLATION OPERATING AND MAINTENANCE MANUAL |
| [15] | 1723002197-EL-REP-00038 | PROTECTION SETTING REPORT |
| [16] | 1723002197-EL-SO-00040 | SG-200N1 PROTECTION CONFIGURATION (INCLUDING IO CONFIGURATION) (CID File and PCM600) |
| [17] | 1723002197-MAT-PRO-00004 | MV-LV SWG PAINTING PROCEDURE |
| [18] | 1723002197-MD-LIS-00001 | SUPPLIER MASTER INDEX REGISTER (SMIR) |
| [19] | 1723002197-QC-DB-00048 | EQUIPMENT MANUFACTURERS RECORD BOOK â€“ COMPLETE |
| [20] | 1723002197-QC-ITP-00003 | INSPECTION AND TEST PLAN - LV Switchgear |
| [21] | 1723002197-QC-LIS-00005 | EQUIPMENT MANUFACTURER RECORD BOOK (FINAL DOSSIER) - INDEX |
| [22] | 1723002197-QC-PRO-00045 | FACTORY ACCEPTANCE TEST PROCEDURE - LV Switchgear |
| [23] | 1723002197-QC-PRO-00047 | SITE ACCEPTANCE TEST PROCEDURE - LV Switchgear |
| [24] | 1723002197-QC-PRO-00055 | PACKING, SHIPPING, HANDLING AND STORAGE PROCEDURES |

**Table 3:** Vendor Reference Documentation

## 4.2 Acronyms and Abbreviations

| Acronyms / Abbreviations | Description |
|---|---|
| AIS | Automatic Identification System |
| AHU | Air Handling Unit |
| AOC | Achievement of Commissioning |
| C&E | Cause & Effects |
| CCS | Central Control System |
| CCTV | Closed Circuit Television |
| CMS | Completions Management System |
| CPI | Company Provided Item |
| CRS | Comments Response Sheet |
| CSU | Commissioning & Start-Up |
| E&I | Electrical & Instrumentation |
| EMCS | Electrical Monitoring & Control System |
| ESD | Emergency Shut Down |
| FAT | Factory Acceptance Test |
| FT | Functional Test |
| F&G | Fire & Gas |
| GALT | Gross Air Leak Test |
| HAZID | Hazard Identification Studies |
| HAZOP | Hazard and Operability Studies |
| HKN | Hollandse Kust Noord |
| HV | High Voltage |
| HVAC | Heating, Ventilation and Air Conditioning |
| HSE | Health, Safety, & Environment |
| ICSS | Integrated Control and Safety System |
| ITR | Inspection & Test Record |
| LC | Locked Closed |
| LO | Locked Open |
| LoSH | Limits of System Handover |
| LOTO | Lock-Out / Tag-Out |
| LV | Low Voltage |
| MC | Mechanical Completion |
| MDR | Master Document Register |
| MOC | Management of Change |
| NUI | Normally Unmanned Installation |

| Acronyms / Abbreviations | Description |
|---|---|
| OEM | Original Equipment Manufacturer |
| OMAR | Operating Modes Assurance Review |
| OTP | Operation Test Procedure (Commissioning) |
| OR | Operations Readiness |
| ORR | Operations Readiness Review |
| PACO | Process Automation, Control and Optimisation |
| PCS | Process Control System |
| PID (P&ID) | Piping and Instrumentation Diagram |
| PSV | Pressure Safety Valve |
| PTW | Permit to Work |
| PVP | Piping and Vessels Preparation |
| PC&C | Pre-Commissioning & Commissioning |
| PSUA | Pre Start-Up Audit |
| PSSR | Pre Start-up Safety Review |
| RFC | Ready for Commissioning |
| RFO | Ready for Operation |
| RFSA | Ready For Sail Away |
| RFSU | Ready For Start-Up |
| SAT | Site Acceptance test |
| SECE | Safety Environmental Critical Element |
| SIF | Safety Instrumentation Function |
| SIL | Safety Integrity Level |
| SIMOPS | Simultaneous Operations & Maintenance |
| SIS | Safety Instrumented System |
| SLD | Single Line Diagram |
| SoF | Statement of Fitness |
| TA | Technical Authority |
| TQ | Technical Query |
| TIV | Technical Integrity verification |
| UPS | Uninterruptible Power Supply |
| VHF | Very High Frequency |
| VSAT | Very Small Aperture Terminal |

Table 4: Acronyms and Abbreviations

# 5 OTP AT ONSHORE WORKSITE

This chapter refer to the activities on the Contractor worksite (construction yard).

## 5.1 Planning and Manpower

### 5.1.1 Planned tasks with estimated manpower

Estimated manpower for the entire duration of the Test:

- 1 E&I commissioning superintendent
- 1 E&I commissioning supervisor from Contractor
- 2 E&I commissioning technicians from Contractor
- 1 Vendor technician
- 1 Workstation Operators (required for phase 3)

### 5.1.2 Test duration estimate

The test duration should be as follows:

- 12 days approx.

If necessary, the estimated time can be extended in order to complete all required pre-commissioning and commissioning activities.

### 5.1.3 Vendor Assistance

Vendor IMESA S.p.A. will provide a qualified specialist to assist with the first energization of the LV SWBD and DB.

### 5.1.4 Items Postponed to C&E OTP (IEC61850 ETHERNET)

Not applicable

### 5.1.5 HOLDS

Not applicable

## 5.2 OTP Test Requirements – Onshore WORKSITE

### 5.2.1 Pre-Commissioning Achievement

Prior the commissioning operation starts, the relevant pre-commissioning ITRs should be fully signed.

### 5.2.2 Commissioning Achievement

The commissioning achievement will be the successful operation, functionality and safeguarding test of LV Power distribution System, installed and put in operation during the WORKSITE phase:

- 83-00: 400 V Switchboard & Connection Box (SG-200N1)
- 83-20: 400V Distribution Board DP-200N1

### 5.2.3 Status of Required Associated Subsystems

- PHASE 1

Subsystems required RFC for Commissioning of LV Power Distribution

- 83-00 400 V Switchboard & Connection Box (SG-200N1)
- 83-00 400 V Switchboard & Connection Box (SG-200N1) - Auxiliary power supply
- 83-20 400/230 V Switchboard (DP-200N1)
- 88-00: Earthing System
- 83-99: Temporary Yard 400/230V Main and auxiliary power supplies

- PHASE 2

Subsystems required RFC for Commissioning of LV Power Distribution:

- 88-00: Earthing and Lightning Protection
- 82-00 SG-100D1 6.6 kV SWBD compartment A6 & A4 6,6 kV
- 82-40 Transformer 1,6 MVA TR-200DE1
- 84-10 AC 35 kVA UPS System (UP-200F3)
- 83-99 6.6 kV power supply from temporary 6,6 kV Diesel Generator Yard facilities
- 83-00: 400 V Switchboard & Connection Box (SG-200N1)
- 83-20: 400/230 V Switchboard (DP-200N1)
- 79-00: Emergency Shutdown Systems (SIS) (ESD)

- PHASE 3

Subsystems required RRFCC for Commissioning of LV Power Distribution:

- 88-00: Earthing and Lightning Protection
- 82-00: SG-100D1 6.6 kV SWBD compartment A6 & A4 6,6 kV
- 82-40: Transformer 1,6 MVA TR-200DE1
- 84-10: AC 35 kVA UPS System (UP-200F3) 83-00: 400 V Switchboard & Connection Box (SG-200N1)
- 83-20: 400/230 V Switchboard (DP-200N1)
- 79-00: Emergency Shutdown Systems (SIS) (ESD)
- 87-00: Electrical Monitoring & Control System (EMCS)
- 87-10: Process Control System (PCS)
- 86-00: Data Network - IEC61850 Ethernet Communication network High and Low Voltage
- 86-00: Data Network - MODBU RTU Network Switchboard 6.6 kV and Low Voltage

### 5.2.4 Special Tools & Test Equipment

The following special tool and Test Equipment are required (see vendor document 1723002197-EL-LIS-00053):

- Voltage, frequency, continuity tester (Multimeter)
- Phases sequence tester
- Extracting tool & transportation trolley
- Portable radios (3 pcs + 1 per Technical Room)
- 230V/24Vdc temporary stabilized power supply converter

| **TESTING & MEASUREMENT INSTRUMENT USED** | | | |
|---|---|---|---|
| Type | Serial N. | Calibration certificate | Validity |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

### 5.2.5 Consumable List

Not applicable

### 5.2.6 Commissioning Spare Parts

Reference is made to IMESA document 1723002197-COM-LIS-00052 "Commissioning and operation Spare Parts Index Register" regarding the LV SWBD e DB spare parts.

### 5.2.7 Temporary Facilities

Phase 1: Temporary Electrical 400V Yard Power Supply to feed main switchboard SG-200N1 via drawer A2/+08 "Temporary Diesel Generator / Mobile Battery Pack" JB-200E2.
A dedicated subsystem SS 83-99 will be created and populated with relevant ITR-A and ITR-B for 400V temporary yard power supply facilities.

Phase 2: 6.6 kV temporary Yard Power Supply from Diesel Generator Yard facilities (see also doc. n. 123A90-PML-COM-SP-03014).
A dedicated subsystem SS 82-99 will be created and populated with relevant ITR-A and ITR-B for 6,6kV temporary yard power supply facilities.

## 5.3 OTP Description – Onshore WORKSITE

### 5.3.1 OTP Test Preparation

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| 1 | System Ready for Commissioning Certificate (RFC) is issued and approved. | | | |
| 2 | No Mechanical Completion or Pre-commissioning punch list 'A' items are outstanding against the system to be commissioned. | | | |
| 3 | Factory Acceptance Test Procedure has been carried out successfully (refer to Doc. 1723002197-QC-PRO-00045) | | | |
| 4 | All personnel involved in the implementation of this procedure are familiar with its content as well as with associated safety requirements (Toolbox Talk to be conducted before initiation of activities). | | | |
| 5 | A final walkdown of the system has been completed, to ensure that the system and the area are ready for commissioning. | | | |
| 6 | Check that areas are free for work and escape routes are clear of any obstructions. | | | |
| 7 | All safety barriers and warning signs have been installed. | | | |
| 8 | Ensure that proper communications have been established between parties involved in the implementation of the procedure. | | | |

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| 9 | Verify availability of test equipment and consumables as per section 3.2.4. | | | |
| 10 | With reference to Commissioning Temporary equipment & Facilities (refer on Doc. 123A90-PML-COM-SP-03014), check that power is available to any temporary equipment or test equipment (if any). | | | |
| 11 | System(s) isolations as per LOTO procedure defined within HSSE Permits to Work and Commissioning procedures duly prepared and approved | | | |
| 12 | All yard personnel have been duly notified by dedicated LUN (Livening Up Notification) that the system(s) is ready for commissioning. | | | |

### 5.3.2 Electrical Preparation

| **Step** | **Description** | **Result** | **Verified by** | **Date** |
|---|---|---|---|---|
| 13 | Check related punch list 'B' items and confirm acceptability for start of commissioning activities. | | | |
| 14 | Verify that all relevant associated systems / subsystems are completed. | | | |
| 15 | Check that grounding and bonding are in accordance with applicable documents. | | | |
| 16 | Review and confirm protection settings on up-stream LV Switchboards feeder power supply circuit breakers. | | | |
| 17 | Verify finalization of SG-200N1 LV Switchboard Units internal power and auxiliary circuit connections in accordance with manufacturers documentation. | | | |
| 18 | Verify and confirm completion of final connections between the 6.6 kV SWBD SG-100D1 compartment A4, Power transformer TR-200-DE1 6,6/0,4 kV and LV Switchboard SG-200-N1 (PHASE 2 and 3) | | | |

### 5.3.3 Mechanical Preparation

Not applicable.

### 5.3.4 Instrument Preparation

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| 19 | Check related punch list 'B' items and confirm acceptability for start of commissioning activities. | | | |
| 20 | Verify that all relevant associated systems / subsystems are ready. | | | |
| 21 | Check Inhibit and Override register has been prepared and validated. | | | |
| 22 | Verify that relevant equipment/ components are available and in operation for start of commissioning activities. | | | |

### 5.3.5 Piping Preparation

Not applicable

### 5.3.6 Additional Discipline Preparation

Not applicable.

## 5.4 OTP Test Steps – Onshore WORKSITE - PHASE 1

The previous chapters must be successfully performed prior to commissioning of the LV Power Distribution Switchboard with temporary low voltage 400V yard power supply.

The PHASE 1 Temporary Yard Power supply will be connected and energized on SG-200N1 to Incomer "JB-200E2" position A02/+08 "Temporary Generator Mobile Battery Pack".

In the following steps the functionality of the LV Power Distribution Switchboards shall be tested:

- SS 83-00: 400 V Switchboard & Connection Box (SG-200N1)
- SS 83-20: 400V Distribution Board "DP-200N1"

### 5.4.1 Test Preparation

Need to Verify:

- Auxiliary power supplies are available 230V
- Phase1 400V Temporary Yard power supply is available
- All systems and subsystems involved in this procedure must be ready for commissioning and available.

#### *5.4.1.1 Auxiliary SG-200N1 Low voltage switchboard*

The power from 400V Temporary Yard Supply will be connected to the "JB-200E2" breaker QF1 on the Column A2, Drawer +08.

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| **Energization of Low Voltage SWBD SG-200N1** | | | | |
| **PHASE1**: 400V Power supply via "Temporary generator mobile battery pack" circuit JB-200E2 | | | | |
| Verify related ITR-Bs for the DRAWER INCOMER A2/+08 is completed. | | | | |
| 23 | Verify and confirm the INCOMING QF1 breaker of JB-200E2 is open and the drawer +08 is in extract position. | | | |
| 24 | Verify the correct phase sequence L1, L2, L3, on the input power of the drawer A2/+08. | | | |
| 25 | The selector QU1 Auxiliary Voltage Switch located on drawer A2/+02 must be closed on POS.1 | | | |
| 26 | Close protection QU3 located on drawer A2/+02 for the auxiliary voltage from temporary generator | | | |
| 27 | Energized temporary yard power supply and measure presence of 230V on Incoming protection QU3 located on drawer A2/+02 for the auxiliary voltage from temporary generator | | | |
| 28 | Check that MCBs QA1 and QA2 of drawer A2/+08 are closed | | | |
| 29 | Verify on the terminal strip X1 11-12 of the drawer A2/+08 permissive to close command to main breaker QF1. | | | |
| 30 | Verification of Interlock between:<br>- Main Incomer QF1 (A1/+05)<br>and<br>- " *Temporary Generator Mobile Battery Pack*" JB-200E1 Incomer QF1 (A2/+08)<br><br>With reference to Vendor Documents:<br>- 1723002197-EL-DG-00031 sheet 051<br>- 1723002197-EL-DG-00030 sheet 22<br><br>**Inhibit to close Main Incomer (A1/+05)**<br><br>- On drawer A2/+08 remove jumper between terminal strip Y1:44-43<br>- Confirm breaker QF1 (A2/+08) is closed | | | |

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| | - On drawer A1/+05 verify open circuit between terminals X2:3-4 (Breaker closing circuit)<br>- Press push button SC1 closing command and confirm that main breaker QF1 (A1/+05) does NOT closed<br><br>**<u>Inhibit to close JB-200E1 Incomer (A2/+08)</u>**<br><br>- On drawer A1/+05 the Breaker QF1 (A1/+05) is closed<br>- On drawer A2/+08 confirm open circuit between terminals X1: 11-12 (QF1 undervoltage coil circuit)<br>- Close manually Incomer breaker QF1 (A2/+08) and confirm that Breaker does NOT closed | | | |
| 31 | VERIFICATION OF DRAWER FUNCTION IN TEST POSITION | | | |
| 32 | With reference Vendor Doc.1723002197-EL-DG-00031 sheet 51 Place the drawer in test position and verified<br>- Green Lamp L1 open circuit breaker should be on<br>- Red Lamp L2 circuit breaker closed must be off<br>- Amber Lamp L3 tripped circuit breaker must be off | | | |
| 33 | With reference Vendor Doc. 1723002197-EL-DG-00031 sheet 51 Close manually QF1<br>- Green Lamp L1 open circuit breaker should be off<br>- Red Lamp L2 closed circuit breaker must be on<br>- Amber Lamp L3 tripped circuit breaker must be off | | | |
| 34 | With reference Vendor Doc. 1723002197-EL-DG-00031 sheet 51<br>- Extract drawer "Temporary Generator Battery Pack" in and located test button on main circuit breaker Q1, then press test button to simulate fault condition<br>- Reinsert the drawer | | | |

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| | - Green Lamp L1 open circuit breaker should be on<br>- Red Lamp L2 closed circuit breaker must be off<br>- Amber Lamp L3 tripped circuit breaker must be on<br>Extract the drawer and reset main circuit breaker Q1 | | | |
| 35 | Insert the drawer to service position. | | | |
| 36 | The INCOMING "JB-200E1" QF1 "Temporary Generator Battery Pack" must now be closed manually.<br>It should be noted that manual closure of the circuit breaker QF1 can only be possible when the following two criteria have been achieved:<br>- Main circuit breaker QF1 in open position<br>- The incoming power supply must be already energized | | | |
| 37 | With reference Vendor Doc. 1723002197-EL-DG-00031 sheet 51, the signalling of closed Circuit Breaker Q1 Red lamp L2 is on | | | |
| 38 | With reference Vendor Doc. 1723002197-EL-DG-00031 sheet 51 Check the functioning of undervoltage coil "YU" QF1: manually open the MCB QA1<br>- Main Circuit breaker QF1 will trip and open immediately<br>- Green Lamp L1 open circuit breaker should be on<br>- Red Lamp L2 closed circuit breaker must be off<br>- Amber Lamp L3 tripped circuit breaker must be on | | | |
| 39 | With reference Vendor Doc. 1723002197-EL-DG-00031 sheet 51, manually close the MCB QA1.<br>Proceed to close main circuit breaker QF1 and energized low voltage distribution SWBD. | | | |
| 40 | The SWBD is now available to energize the respective platform consumers. | | | |

*5.4.1.2 DB Distribution Board DP-200N1*

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| **Energization of Distribution Board DP-200N1** | | | | |
| Verify the system 83-20 related DP-200N1 is ready for commissioning with signed RFC certificate. | | | | |
| Verify related ITR-B for the DRAWER FEEDER A3/+03 on SG-200N1 is completed | | | | |
| 41 | With reference to Vendor Doc. 1723002197-EL-DG-00031 sheet 38 Closing the breaker QA1 the aux power supply | | | |
| 42 | Insert the drawer in test position<br>- | | | |
| 43 | With reference to Vendor Doc. 1723002197-EL-DG-00031 sheet 39 Place the selector SA1 in Local position | | | |
| 44 | With reference the Vendor Doc. 1723002197EL-DG-00031 sheet 40 Close the Main Breaker QF1 manually<br>- Green Lamp L1 open circuit breaker should be off<br>- Red Lamp L2 closed circuit breaker must be on<br>- Red Lamp L3 Contactor energized must be off<br>- Amber Lamp L3 tripped circuit breaker must be off | | | |
| 45 | With reference Vendor Doc. 1723002197-EL-DG-00031 sheet 39 Close the contactor K1 using the local Push Button PM1<br>- Red Lamp L3 Contactor energized must be on | | | |
| 46 | With reference Vendor Doc. 1723002197-EL-DG-00031 sheet 39 Open the contactor K1 using the local Push Button PA1<br>- Red Lamp L3 Contactor energized must be off | | | |
| 47 | Insert the drawer to service position. | | | |
| 48 | With reference Vendor Doc. 1723002197-EL-DG-00031 sheet 38 | | | |

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| | Manually close the circuit breaker QF1 and press the Push Button PM1 to close the contactor K1 and consequently energize the power supply to DP-200N1 | | | |
| 49 | Verify the correct phase sequence L1, L2, L3 on the input power of the INCOMER on the terminal X1: 1-2-3. | | | |
| 50 | With reference Vendor Doc. 1723002197-EL-DG-00033 sheet 5<br>Closing the general incoming Q1 of DP-200N1 manually | | | |
| 51 | All the functionality Automatic (Unmanned) and Manual (Manned) of lighting circuits will be tested in the related OTP of light. | | | |
| 52 | All the functionality of Heat tracing circuits will be tested on the document "OTP-Electrical Heat Tracing Systems". | | | |
| 53 | **Cumulative Trip Signal Test**<br>With reference Vendor Doc. 1723002197-EL-DG-00033 sheet 19<br>The cumulative signal is a series of **closed trip** contact of all MCB excluding:<br>- Surge arrestor switch trip signal<br>- MCBs of Lighting Utilities trip signals<br>- MCBs of Trace Heating trip signals<br><br>The cumulative MCBs trip signals is connected on terminals X2:82-83 verify and confirm the following trip close contacts:<br>- Q1 .....☐<br>- Q5.....☐<br>- Q6.....☐<br>- Q7 .....☐<br>- Q11..... ☐<br>- Q12 .....☐<br>- Q23.....☐<br>- Q24.....☐<br>- Q25.....☐<br>- Q26.....☐<br>- Q27.....☐<br>- Q28.....☐<br>- Q29.....☐<br>- Q30.....☐<br>- Q31.....☐ | | | |

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| | - Q32..... ☐<br>- Q33..... ☐<br>- Q34..... ☐<br>- Q35..... ☐<br>- Q36..... ☐<br>- Q37..... ☐<br>- Q38..... ☐<br>- Q39..... ☐<br>- Q40..... ☐<br>- Q41..... ☐<br>- Q42..... ☐<br>- Q43..... ☐<br>- Q46..... ☐<br>- Q47..... ☐<br>- Q48..... ☐<br>- Q49..... ☐<br>- Q50..... ☐<br>- Q51..... ☐<br><br>The cumulative trip signal test will be possible when above breakers will be ready for commissioning. (PHASE 3) | | | |

*5.4.1.3 OTP Worksite Phase 1 - Tests Notes and Remarks*

*5.4.1.4 OTP Worksite Phase 1 - Tests Certifying Authority Table of Attendances*

| Name and Surname | Certifying Authority | Position | Signature |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

*5.4.1.5 OTP WORKSITE Phase 1 - Tests Final Signatures and Company Acceptance*

| Name and Surname | Company Representative | Position | Signature |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

### 5.4.2 OTP Steps WORKSITE - PHASE 2

It is foreseen that previous sections are successfully performed.

To energize Switchboard SG-200N1 from 6.6kV SG-100D1 Switchboard has been energized:
- Temporary Yard 6.6kV power supply
- 6.6kV SG-100D1 SWBD Compartment A6 and A5 (Incomer and Measuring compartment)
- 6.6kV SG-100D1 SWBD Compartment A4 – (Feeder TR-200DE1 Transformer)

The compartment A4 of 6.6 kV SG-100D1 SWBD is available, and all necessary tests are performed and accepted for that system. See OTP 123A90-PML-COM-PRO-03046 6.6 kV Switchgear & Transformer Systems PHASES 1/2/3
All Cables are pulled up, tested and yard temporary power supply is completed and available.
LV Power Distribution Switchboards and Distribution Boards is working in normal operation and no alarm pending.

In the following steps the functionality of the LV Power Distribution Switchboards and Distribution Boards shall be tested for:

- SS 83-00: 400 V Switchboard & Connection Box (SG-200N1)
- SS 83-20: 400V Distribution Board DP-200N1
- SS 82-00: 6,6 kV 6.6 kV SG-100D1 HV SWBD UNIT A4

#### *5.4.2.1 Energization SG-200N1 From 6.6 KV SG-100D1*

Verification of system and subsystem LV Power Distribution Switchboards and Distribution Boards are completed without punch lists or pending point that limit the power up.
Verify that FEEDER A4 of 6.6 kV is available.

Auxiliary power supplies in SG-100D1 and in SG-200N1 are available:
- UPS AC/DC 110V UP-200F1
- UPS AC 230V UP-200F3
- Normal power supplies from DP-200N1
- Temporary Yard 6,6kV power supply

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| **Energization of LV SWBD SG-200N1 from 6.6 kV Switchboard SG-100D1 comp. A4** | | | | |
| 54 | See and refer to related steps of 6.6 kV OTP of SG-100D1 6,6 kV to supply the Low Voltage SG-200N1, Doc n. 123A90-PML-COM-PRO-03046, PHASES 1/2/3. | | | |
| 55 | Reference is made to Logic diagram 1723002197-EL-DG-00030 sheet 22<br><br>Interlock to main breaker QF1 (A1/+05) from drawer A2/+08 | | | |

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| | Permissive to closing incomer QF1 (A1+05) from JB-200E1 QF1 breaker (A2/+08)<br><br>Located on A2/+02 cubicle<br>Confirm close circuit between terminals X2:3-4<br>(it means QF1 (A2/+08) is open or racked out) | | | |
| 56 | With reference Vendor Doc. 1723002197-EL-DG-00030 sheet 17<br>Verify the correct phase sequence L1, L2, L3 of the INCOMER power supply cables. Column A2/+02 SG-200N1 | | | |
| 57 | The selector QU1 Auxiliary Voltage Switch located on drawer A2/+02 must be closed on POS.2 | | | |
| 58 | Close protection QU2 located on drawer A2/+02 for the auxiliary voltage from main bus bar in upstream. | | | |
| 59 | With reference Vendor Doc. 1723002197-EL-DG-00030 sheet 16<br>Check and confirm that auxiliary circuit is available<br>- QU2 is closed and verify the voltage on selector QU1 terminals 5-1<br>- Place the selector QU1 in position 2 and circuit will be supplied (see the K30A should be on) | | | |
| 60 | With reference Vendor Doc. 1723002197-EL-DG-00030 sheet 17.<br>Verify and confirm the voltage references are available Column A02/+02:<br>- Close protection QV1<br>- Close protection QV2<br>- Verify the voltage presence on terminals XV:1-2-3 | | | |
| 61 | Verify the voltage reading on REF615 display<br><br>Voltage = ..... V | | | |

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| 62 | With reference the Vendor Doc 173002197-EL-DG-00030 sheet 19-20<br>Close auxiliary breakers 230V located on drawer A2/+02<br>QA1 Motor Spring charger incoming CB ..... ☐<br>QA2 protection device incoming CB ☐<br>QA3 command circuits incoming CB ☐<br>QA4 converter 230/24 VDC..... ☐<br>QA5 command circuits (feeders)..... ☐<br>QA6 internal space heaters /lighting ☐<br>The protections are working, and auxiliary circuits are powered, and the permissive signals are closed ..... ☐ | | | |
| 63 | Mechanical Interlock between 6.6 KV SWBD SG-100D1 (Column A4) and LV SWBD SG-200N1 Incomer<br><br>With reference Vendor 6.6 KV *SLD 1723002197 EL-DG-00010*, *LV SLD 1723002197 EL-DG-00030*<br><br>**Interlock On SG-200N1 main incomer**<br><br>Earthing switch BGE Column A4 is open, its KEY-3 **G3398** is free and its KEY-4) **G3135** is blocked on earthing switch<br>- Key **G3398** is ringed with main incomer QF1 (A1/+05) Rack-In/Out system Key **151733** (2) of DG-200N1 SWBD<br>- Insert the key **151733** on Rack-In/Out system of Main Incomer QF1 place the breaker in test or service position and the key **151733** will be blocked on n Rack-In/Out system<br><br>**Interlock On SG-100D1 main incomer**<br><br>SG-200N1 Incomer is extract position the Key **151733** is free. | | | |

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| | - Insert KEY-3 **G3398** on the earth switch of column A4 (BGE), if possible close it and the **G3398** key will remain blocked on the BGE until the BGE is opened and the key is free again. | | | |
| 64 | Rack in the Main incoming breaker QG1 in test position | | | |
| 65 | With reference the Vendor Doc. 1723002197-EL-DG-00030 sheet 26 and located in column A2/+02<br>- Place the selector SA1 in local position.<br>- Verify and confirm the SA2 Selector is in normal position (not in maintenance position)<br>- Reference is made to sheets 13 and 14 Logic Diagram | | | |
| 66 | Reference is made to Logic diagram 1723002197-EL-DG-00030 sheet 13 regarding the closing of the circuit breaker.<br>Locate the Push Button SC1 on compartment A2/+02<br>- Push SC1 to close main breaker<br>- Led-3 on the REF615 must be ON<br>- On the REF615 display the circuit breaker symbol will change to closed | | | |
| 67 | Locate the Push Button SO1 on compartment A2/+02<br>- Push SO1 to open main breaker<br>- Led-3 on the REF615 must be OFF<br>- On the REF615 display the circuit breaker symbol will change to opened | | | |
| 68 | Rack in the Main incoming breaker QG1 in service position | | | |
| 69 | Reference is made to Logic diagram 1723002197-EL-DG-00030 sheet 13 regarding the closing of the circuit breaker.<br>Locate the Push Button SC1 on compartment A2/+02 | | | |

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| | - Push SC1 to close main breaker<br>- Led 3 on the REF615 must be ON<br>- On the REF615 display the circuit breaker symbol will change to closed | | | |
| 70 | Locate the Push Button SO1 on compartment A2/+02<br>- Push SO1 to open main breaker<br>- Led 3 on the REF615 must be OFF<br>- On the REF615 display the circuit breaker symbol will change to opened | | | |
| 71 | Rotate selector switch SA1 to remote position.<br>Repeat previous test to close main breaker and confirm that it's not possible with selector switched to remote. | | | |

Note: All Test in remote condition (selector SA1 in logic diagram IEC61850) will be tested on PHASE 3 with EMCS.

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*5.4.2.2 OTP Worksite Phase 2 Tests Notes and Remarks*

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*5.4.2.3 OTP Worksite Phase 2 - Tests Certifying Authority Table of Attendances*

| Name and Surname | Certifying Authority | Position | Signature |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

*5.4.2.4 OTP WORKSITE Phase 2 - Tests Final Signatures and Company Acceptance*

| Name and Surname | Company Representative | Position | Signature |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

### 5.4.3 OTP Steps WORKSITE - PHASE 3

It is foreseen that previous chapters are successfully performed.

All systems fed from SWBD SG-200N1 and from DB DP-200N1 are available and ready to work, all necessary tests are performed and accepted for those systems.
All Cables are pulled up, tested and temporary power supply is completed and available.
LV Power Distribution Switchboards and Distribution Boards is working in normal operation and no alarm pending.

In the following steps will be defined the tests of all signals from/to SG-200N1 and DP-200N1 hardwired or via Modbus TCP-IP or by network IEC61850. The functionalities provided on I/O lists vendor document 1723002197-EL-LIS-00042 of the LV Switchboards and Distribution Boards will be tested for:

- 123A90: 400V Switchboard SG-200N1 Incoming
- 123A90: 400V Distribution Board DP-200N1
-

All I/O list will be individually loop checked and recorded on dedicated ITR-Bs precommissioning check sheets. Verify and confirm that all check sheets have been performed successfully.

### 5.4.4 Test Preparation

Verification of systems and subsystems LV Switchboards and Distribution board.
All systems and subsystems involved in this procedure must be ready for commissioning and available.

To perform the signals test is mandatory that the EMCS cabinet and Network cabinet – IEC 61850 network system – and PCS Cabinet – Modbus TCP-IP network system - are already energized, available and ready to work.

To test all signals, refer to specific electrical pre-commissioning check sheets, they will be used for the specific validation of all I/O signals.

#### *5.4.4.1 SG-200N1 - I/O list FP1 Protection Main Incomer QF1 (A1/+05) – Network IEC61850*

To test all signals, refer to specific electrical pre-commissioning check sheets, they will used the specific functioning of all I/O.

Following I/O signals groups List to be verify

Protection FP1 Signals from/to SG-200N1 Main Incomer QF1 located on cubicle A2/+02
Network IEC61850 to EMCS Cabinet
This I/O list concern the protection warning and alarm, breaker feedback and command in local and in remote, measures reading on the upstream main busbar.
To test I/O list has been used type B pre-commissioning check sheet where it is possible find a complete information about I/O. For specific signal tags and all information see I/O list 1723002197-EL-LIS-00042

| DEVICE LOCATION | DEVICE | SIGNAL_DESCRIPTION | TYPE ANALOG/ DIGITAL | RELAY/ DEVICE MODEL | UNIT | SCALE FACTOR | IEC61850 Technical Key | Note |
|---|---|---|---|---|---|---|---|---|
| A2/+02 | FP1 | CIRCUIT-BREAKER - PROTECTION TRIPPED "50" | SW-DI | REF615 | | | SG200N1 FP1 | 1=tripped |
| A2/+02 | FP1 | CIRCUIT-BREAKER - PROTECTION TRIPPED "51" | SW-DI | REF615 | | | SG200N1 FP1 | 1=tripped |
| A2/+02 | FP1 | CIRCUIT-BREAKER - FUNCTION TRIPPED "74TCS" | SW-DI | REF615 | | | SG200N1 FP1 | 1=tripped |
| A2/+02 | FP1 | CIRCUIT-BREAKER - FUNCTION TRIPPED "86" | SW-DI | REF615 | | | SG200N1 FP1 | 1=tripped |
| A2/+02 | FP1 | CIRCUIT-BREAKER - READY TO CLOSE | SW-DI | REF615 | | | SG200N1 FP1 | 1=ready |
| A2/+02 | FP1 | CIRCUIT-BREAKER - OPEN OR TEST POSITION | SW-DI | REF615 | | | SG200N1 FP1 | 1=open |
| A2/+02 | FP1 | CIRCUIT-BREAKER - CLOSED AND INSERTED | SW-DI | REF615 | | | SG200N1 FP1 | 1=closed |
| A2/+02 | FP1 | CIRCUIT-BREAKER - WATCHDOG | SW-DI | REF615 | | | SG200N1 FP1 | 0=Failure |
| A2/+02 | FP1 | MCBs ALARM | SW-DI | REF615 | | | SG200N1 FP1 | 0=alarm |
| A2/+02 | FP1 | SA1 ON "LOCAL" POSITION | SW-DI | REF615 | | | SG200N1 FP1 | 1=local |
| A2/+02 | FP1 | SA1 ON "REMOTE" POSITION | SW-DI | REF615 | | | SG200N1 FP1 | 1=remote |
| A2/+02 | FP1 | SA2 ON "MAINTENANCE" POSITION | SW-DI | REF615 | | | SG200N1 FP1 | 1=maintenance |
| A2/+02 | FP1 | INTERTRIP TO 6.6 KV SWBD | SW-DI | REF615 | | | SG200N1 FP1 | 1=tripped |
| A2/+02 | FP1 | CIRCUIT-BREAKER - CLOSE COMMAND | SW-DO | REF615 | | | SG200N1 FP1 | 1=close command |
| A2/+02 | FP1 | CIRCUIT-BREAKER - OPEN COMMAND | SW-DO | REF615 | | | SG200N1 FP1 | 1=open command |
| A2/+02 | FP1 | MEASURE - CURRENT "L1" | SW-AI | REF615 | A | 1 | SG200N1 FP1 | |
| A2/+02 | FP1 | MEASURE - CURRENT "L2" | SW-AI | REF615 | A | 1 | SG200N1 FP1 | |
| A2/+02 | FP1 | MEASURE - CURRENT "L3" | SW-AI | REF615 | A | 1 | SG200N1 FP1 | |
| A2/+02 | FP1 | MEASURE - VOLTAGE "L1-L2" | SW-AI | REF615 | V | 1 | SG200N1 FP1 | |

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| DEVICE LOCATION | DEVICE | SIGNAL_DESCRIPTION | TYPE ANALOG/ DIGITAL | RELAY/ DEVICE MODEL | UNIT | SCALE FACTOR | IEC61850 Technical Key | Note |
|---|---|---|---|---|---|---|---|---|
| A2/+02 | FP1 | MEASURE - VOLTAGE "L2-L3" | SW-AI | REF615 | V | 1 | SG200N1 FP1 | |
| A2/+02 | FP1 | MEASURE - VOLTAGE "L3-L1" | SW-AI | REF615 | V | 1 | SG200N1 FP1 | |
| A2/+02 | FP1 | MEASURE - FREQUENCY | SW-AI | REF615 | Hz | 1 | SG200N1 FP1 | |
| A2/+02 | FP1 | MEASURE - APPARENT POWER | SW-AI | REF615 | kVA | 1 | SG200N1 FP1 | |

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| 72 | Confirm correct and positive result of precommissioning Check Sheet for above signals I/O list | Correct and positive results .....☐ | | |

*5.4.4.2 SG-200N1 - I/O list Common signals from Switchboard – Network Modbus TCP-IP*

Internal Common Signals from/to SG-200N1 located on cubicle A2/+02
Network Modbus TCP-IP to PCS Cabinets
This I/O list concern the common warning, alarm & feedback.
For specific signal tags and all information see I/O list 1723002197-EL-LIS-00042

| DEVICE LOCATION | DEVICE | SIGNAL_DESCRIPTION | TYPE ANALOG / DIGITAL | RELAY / DEVICE MODEL | UNIT | SCALE FACTOR | Note |
|---|---|---|---|---|---|---|---|
| A2/+02 | A4 | SG-200N1 - SURGE ARRESTER FAULT | SW-DI | Module I/O | | | 0=failure |
| A2/+02 | A4 | SG-200N1 - LOSS 230VAC AUXILIARY VOLTAGE | SW-DI | Module I/O | | | 1=alarm |
| A2/+02 | A4 | SG-200N1 - "FP1" WATCHDOG PROTECTION | SW-DI | Module I/O | | | 0=failure |
| A2/+02 | A4 | SG-200N1 - MOTOR FEEDER FAULT LOOP [BUS-3] | SW-DI | Module I/O | | | 0=failure |
| A2/+02 | A4 | available | SW-DI | Module I/O | | | |
| A2/+02 | A4 | available | SW-DI | Module I/O | | | |

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| 73 | Confirm correct and positive result of precommissioning Check Sheet for above signals I/O list | Correct and positive results.....☐ | | |

*5.4.4.3 SG-200N1 - I/O list Common signal from DB DP-200N1– Network Modbus TCP-IP*

Distribution Board DP-200N1 Common Signals from/to SG-200N1 located on cubicle A2/+02
Network Modbus TCP-IP to PCS Cabinets.

This I/O list concern the common warning and alarm & feedback from DP-200N1.

For specific signal tags and all information see I/O list 1723002197-EL-LIS-00042.

Modbus I/O Table

| DEVICE LOCATION | DEVICE | SIGNAL_DESCRIPTION | TYPE ANALOG/ DIGITAL | RELAY/ DEVICE MODEL | UNIT | SCALE FACTOR | Note |
|---|---|---|---|---|---|---|---|
| A2/+02 | A5 | DP-200N1 - SURGE ARRESTER FAULT | SW-DI | Module I/O | | | 0=failure |
| A2/+02 | A5 | DP-200N1 - NORMAL AND EMERGENCY LIGHTING ON AUTOMATIC | SW-DI | Module I/O | | | 1=automatic |
| A2/+02 | A5 | DP-200N1 - NORMAL AND EMERGENCY LIGHTING ACTIVATED | SW-DI | Module I/O | | | 1=activated |
| A2/+02 | A5 | DP-200N1 - NORMAL AND EMERGENCY CIRCUIT-BREAKER CLOSED | SW-DI | Module I/O | | | 1=close |
| A2/+02 | A5 | DP-200N1 - TRACE HEATINGS ACTIVATED | SW-DI | Module I/O | | | 1=activated |
| A2/+02 | A5 | DP-200N1 - TRACE HEATINGS CIRCUIT-BREAKER CLOSED | SW-DI | Module I/O | | | 1=close |
| A2/+02 | A5 | DP-200N1 - MAIN AND UTILITIES CIRCUIT-BREAKERS CLOSED | SW-DI | Module I/O | | | 1=close |
| A2/+02 | A5 | available | SW-DI | Module I/O | | | |

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| 74 | Confirm correct and positive result of precommissioning Check Sheet for above signals I/O list | Correct and positive results.....☐ | | |

Hardwired signals from DP-200N1 to Module I/O A5 of SG-200N1 located on cubicle A2/+02.
Refer to vendor document 172300219-EL-DG-00030 SG-200N1 wiring diagram.
The hardwired signals will be individually loop checked and recorded on dedicated ITR-Bs precommissioning check sheets
Hardwired I/O table

| Signal Description | From | | To | | I/O reference |
|---|---|---|---|---|---|
| | Cubicle | terminals | Cubicle | Terminals | |
| DP-200N1 - SURGE ARRESTER FAULT | DP-200N1 Cable riser | XS-1<br>XS-2 | SG-200N1 A2/+02 | X2-70<br>X2-71 | E1.0 |
| DP-200N1 - NORMAL AND EMERGENCY LIGHTING ON AUTOMATIC | DP-200N1 Cable riser | XT-3<br>XT-4 | SG-200N1 A2/+02 | X2-72<br>X2-73 | E1.1 |
| DP-200N1 - NORMAL AND EMERGENCY LIGHTING ACTIVATED | DP-200N1 Cable riser | XT-5<br>XT-6 | SG-200N1 A2/+02 | X2-74<br>X2-75 | E1.2 |
| DP-200N1 - NORMAL AND EMERGENCY CIRCUIT-BREAKER CLOSED | DP-200N1 Cable riser | XT-5<br>XT-6 | SG-200N1 A2/+02 | X2-76<br>X2-77 | E1.3 |

| Signal Description | From | | To | | I/O reference |
|---|---|---|---|---|---|
| | Cubicle | terminals | Cubicle | Terminals | |
| DP-200N1 - TRACE HEATINGS ACTIVATED | DP-200N1 Cable riser | XT-7<br>XT-8 | SG-200N1 A2/+02 | X2-78<br>X2-79 | E1.4 |
| DP-200N1 - TRACE HEATINGS CIRCUIT-BREAKER CLOSED | DP-200N1 Cable riser | XH-5<br>XH-6 | SG-200N1 A2/+02 | X2-80<br>X2-81 | E1.5 |
| DP-200N1 - MAIN AND UTILITIES CIRCUIT-BREAKERS CLOSED | DP-200N1 Cable riser | XP-1<br>XP-2 | SG-200N1 A2/+02 | X2-82<br>X2-83 | E1.6 |
| available | | | SG-200N1 A2/+02 | X2-84<br>X2-85 | E1.7 |

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| 75 | Confirm correct and positive result of precommissioning Check Sheet for above signals I/O list | Correct and positive results.....☐ | | |

*5.4.4.4 SG-200N1 - I/O list Hardwired Signal from 6.6 KV SWBD SG-100D1 Unit A4 to Incomer Protection Relay FP1 - network IEC61850*

Hardwired signals from/to 6.6 KV SWBD SG-100D1 to ABB REF615 FP1 protection relay Input Module X120 located on cubicle SG-200N1 A2/+02.

Refer to vendor document 172300219-EL-DG-00030 SG-200N1 wiring diagram, sheets 010, 013 and 014 (logic diagram), 022, 026, 031.
All I/O list will be individually loop checked and recorded on dedicated ITR-Bs precommissioning check sheets.

Hardwired I/O table

| DEVICE LOCATION | DEVICE | SIGNAL_DESCRIPTION | TYPE ANALOG / DIGITAL | RELAY/ DEVICE MODEL | UNIT | SCALE FACTOR | Note |
|---|---|---|---|---|---|---|---|
| A2/+02 | REF615 | C.B. Opened or Isolated | SW-DI | X120 Module I/O | | | BI2 |
| A2/+02 | REF615 | Lock out relay (K86) | SW-DI | X120 Module I/O | | | BI3 |
| A2/+02 | REF615 | CB closed, inserted and Earthing switch opened | SW-DI | X120 Module I/O | | | BI4 |

Above I/O are used only in the logic diagram and they will not send any information to EMCS system

| Signal Description | From | | To | | I/O reference |
|---|---|---|---|---|---|
| | Cubicle | terminals | Cubicle | Terminals | |
| C.B. Opened or Isolated | SG-100D1 Unit A4 | XM-49<br>XM-50 | SG-200N1 A2/+02 | X2-15<br>X2-16 | BI2 |
| Lock out relay (K86) | SG-100D1 Unit A4 | XM-51<br>XM-52 | SG-200N1 A2/+02 | X2-17<br>X2-18 | BI3 |

| Signal Description | From | | To | | I/O reference |
|---|---|---|---|---|---|
| | Cubicle | terminals | Cubicle | Terminals | |
| CB closed, inserted and Earthing switch opened | SG-100D1 Unit A4 | XM-53<br>XM-54 | SG-200N1 A2/+02 | X2-19<br>X2-20 | BI4 |
| LOCK OUT RELAY Intertrip to SG-200N1 Incomer | SG-100D1 Unit A4 | XM-69<br>XM-70 | SG-200N1 A2/+02 | X2-7<br>X2-8 | INTERTRIP HARDWIRED ONLY |

Hardwired signals from/to 6.6 KV SWBD SG-100D1 to SG-200N1 located on cubicle A2/+02.

Hardwired I/O table

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| 76 | Confirm correct and positive result of precommissioning Check Sheet for above signals I/O list | Correct and positive results.....☐ | | |

*5.4.4.5 SG-200N1 - I/O list Signal from/to JB-200E2 "TEMPORARY GENERATOR / MOBILE BATTERY PACK" (A2/+08) – Network MODBUS TCP-IP*

Signals from/to the drawer A2/+08 JB-200E2 on SG-200N1 located on cubicle A2/+02.
Network Modbus TCP-IP to PCS Cabinets.

The A2/+08 drawer was made by referring to the typical wiring diagram "LE2-320" see the vendor document 172300219-EL-DG-00030.

This I/O list concern the protection warning and alarm, breaker feedback and measures reading from ABB Ekip Touch Electronic Protection Relay on board of Circuit breaker.

All I/O list will be individually loop checked and recorded on dedicated ITR-Bs precommissioning check sheets.For specific signal tags and all information see I/O list 1723002197-EL-LIS-00042.

Modbus I/O Table

| DEVICE LOCATION | DEVICE | SIGNAL_DESCRIPTION | TYPE ANALOG/ DIGITAL | RELAY/DEVICE MODEL | UNIT | SCALE FACTOR | Note |
|---|---|---|---|---|---|---|---|
| A2/+08 Typ. LE2-320 WD | U1.A | MEASURE - CURRENT "L1" | SW-AI | Ekip Hi-Touch | A | 0,1 | |
| A2/+08 Typ. LE2-320 WD | U1.A | MEASURE - CURRENT "L2" | SW-AI | Ekip Hi-Touch | A | 0,1 | |
| A2/+08 | U1.A | MEASURE - CURRENT "L3" | SW-AI | Ekip Hi-Touch | A | 0,1 | |

| DEVICE LOCATION | DEVICE | SIGNAL_DESCRIPTION | TYPE ANALOG/ DIGITAL | RELAY/DEVICE MODEL | UNIT | SCALE FACTOR | Note |
|---|---|---|---|---|---|---|---|
| Typ. LE2-320 WD | | | | | | | |
| A2/+08 Typ. LE2-320 WD | U1.A | MEASURE - VOLTAGE "L1-L2" | SW-AI | Ekip Hi-Touch | V | 0,1 | |
| A2/+08 Typ. LE2-320 WD | U1.A | MEASURE - VOLTAGE "L2-L3" | SW-AI | Ekip Hi-Touch | V | 0,1 | |
| A2/+08 Typ. LE2-320 WD | U1.A | MEASURE - VOLTAGE "L3-L1" | SW-AI | Ekip Hi-Touch | V | 0,1 | |
| A2/+08 Typ. LE2-320 WD | U1.A | MEASURE - FREQUENCY | SW-AI | Ekip Hi-Touch | Hz | 0,01 | |
| A2/+08 Typ. LE2-320 WD | U1.A | MEASURE - APPARENT POWER | SW-AI | Ekip Hi-Touch | kVA | 0,1 | |
| A2/+08 Typ. LE2-320 WD | U1.A | MEASURE - REAL POWER | SW-AI | Ekip Hi-Touch | kW | 0,1 | |
| A2/+08 Typ. LE2-320 WD | U1.A | MEASURE - REACTIVE POWER | SW-AI | Ekip Hi-Touch | kVAR | 0,1 | |
| A2/+08 Typ. LE2-320 WD | U1.A | MEASURE - POWER FACTOR | SW-AI | Ekip Hi-Touch | COSfi | 0,001 | |
| A2/+08 Typ. LE2-320 WD | U2.B | CIRCUIT-BREAKER - CLOSED AND INSERTED | SW-DI | Module I/O | | | 1=close |
| A2/+08 Typ. LE2-320 WD | U2.B | CIRCUIT-BREAKER - OPEN OR DISCONNECTED | SW-DI | Module I/O | | | 1=open |
| A2/+08 Typ. LE2-320 WD | U2.B | CIRCUIT-BREAKER - TRIPPED | SW-DI | Module I/O | | | 1=tripped |
| A2/+08 Typ. LE2-320 WD | U2.B | FEEDER AVAILABLE | SW-DI | Module I/O | | | 1=available |
| A2/+08 Typ. LE2-320 WD | U2.B | INTERNAL FAULT | SW-DI | Module I/O | | | 0=fault |
| A2/+08 | U2.B | available | SW-DO | Module I/O | | | 1=closing |

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| DEVICE LOCATION | DEVICE | SIGNAL_DESCRIPTION | TYPE ANALOG/ DIGITAL | RELAY/DEVICE MODEL | UNIT | SCALE FACTOR | Note |
|---|---|---|---|---|---|---|---|
| Typ. LE2-320 WD | | | | | | | |
| A2/+08 Typ. LE2-320 WD | U2.B | available | SW-DO | Module I/O | | | 1=opening |

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| 77 | Confirm correct and positive result of precommissioning Check Sheet for above signals I/O list | Correct and positive results ..... ☐ | | |

The internal intertrip hardwired signals have been tested on step 8 of the section "OTP Steps WORKSITE - PHASE 1"

*5.4.4.6 SG-200N1 - I/O list Signal from/to 6.6 KV SWBD SG-200D2 – Network MODBUS TCP-IP*

I/O list from/to SG-200D2 will be tested on the *Solar PV Plant System OTP,* in this LV OTP they are mentioned because there are some I/O that are connected on SG-200N1.

Switchboard SG-200D2 Signals from/to SG-200N1 located on cubicle A2/+02 Network Modbus TCP-IP to PCS Cabinets.

This I/O list concern the common warning and alarm & feedback from SG-200D2.

All I/O list will be individually loop checked and recorded on dedicated ITR-Bs precommissioning check sheets. For specific signal tags and all information see I/O list 1723002197-EL-LIS-00042.

Modbus I/O Table

| DEVICE LOCATION | DEVICE | SIGNAL_DESCRIPTION | TYPE ANALOG/DIGITAL | RELAY/DEVICE MODEL | UNIT | SCALE FACTOR | Note |
|---|---|---|---|---|---|---|---|
| A2/+02 | A4 | SG-200D2 - MCBs HEALTY | SW-DI | Module I/O | | | 0=alarm |
| A2/+02 | A4 | available | SW-DI | Module I/O | | | |

Hardwired I/O table

| Signal Description | From | | To | | I/O reference |
|---|---|---|---|---|---|
| | Cubicle | terminals | Cubicle | Terminals | |
| SG-200D2 - MCBs Healthy | SG-200D2 CL01/+03 | X2-42<br>X2-43 | SG-200N1 A2/+02 | X2-66<br>X2-67 | E0.6 |
| SG-200D2 - Available | | | SG-200N1 A2/+02 | X2-68<br>X2-69 | E0.7 |

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| 78 | Confirm correct and positive result of precommissioning Check Sheet for above signals I/O list | Correct and positive results ..... ☐ | | |

### *5.4.4.7 SG-200N1 - I/O list Signal from/to drawer with Typical WD "L1-n" and "L2-n" – Network MODBUS TCP-IP*

Signals from/to the various drawers (see list below) on SG-200N1 - Network Modbus TCP-IP to PCS Cabinets.

The drawers were made by referring to the Typical Wiring Diagram "L1-n" and L2-n" see the vendor document 172300219-EL-DG-00030.

This I/O list concern the protection warning and alarm, breaker feedback and measures reading from I/O modules installed inside the drawers.

All I/O list will be individually loop checked and recorded on dedicated ITR-Bs precommissioning check sheets. For specific signal tags and all information see I/O list 1723002197-EL-LIS-00042.

Modbus I/O Table

| DEVICE LOCATION[1] | DEVICE | SIGNAL_DESCRIPTION | TYPE ANALOG/ DIGITAL | RELAY/DEVICE MODEL | UNIT | SCALE FACTOR | Note |
|---|---|---|---|---|---|---|---|
| Typical L1-n ÷ L2-n Wiring Diagram | U2.B | CIRCUIT-BREAKER - CLOSED AND INSERTED | SW-DI | Module I/O | | | 1=close |
| Typical L1-n ÷ L2-n Wiring Diagram | U2.B | CIRCUIT-BREAKER - OPEN OR DISCONNECTED | SW-DI | Module I/O | | | 1=open |
| Typical L1-n ÷ L2-n Wiring Diagram | U2.B | CIRCUIT-BREAKER - TRIPPED | SW-DI | Module I/O | | | 1=tripped |
| Typical L1-n ÷ L2-n Wiring Diagram | U2.B | INTERNAL FAULT | SW-DI | Module I/O | | | 0=fault |
| Typical L1-n ÷ L2-n Wiring Diagram | U2.B | available | SW-DI | Module I/O | | | |
| Typical L1-n ÷ L2-n Wiring Diagram | U2.B | available | SW-DO | Module I/O | | | |
| Typical L1-n ÷ L2-n Wiring Diagram | U2.B | available | SW-DO | Module I/O | | | |

[1] See drawer list for device location

This typical WD is applied to following drawers:

| Column | Position | Item TAG | Description TAG |
|---|---|---|---|
| A2 | +04 | UP-200F4 | AC UPS F&G - 8H UP-200F4 - BYPASS |
| A3 | +01 | UP-200F3 | AC UPS PAS - 30 MIN UP-200F3 - LINE A |
| A4 | +01 | UP-200F3 | AC UPS PAS - 30 MIN UP-200F3 - LINE B |
| A6 | +05 | UP-200F4 | AC UPS F&G - 8H UP-200F4 - LINE A |
| A6 | +06 | UP-200F4 | AC UPS F&G - 8H UP-200F4 - LINE B |
| A6 | +08 | ESW-200N1 | WELDING SOCKETS (TOP DECK) |
| A7 | +02 | UP-200F3 | AC UPS PAS - 30 MIN UP-200F3 (BYPASS) |
| A7 | +03 | UP-200F1 | DC BATTERY SYSTEM SWTG CONTROL - FEEDER A |
| A7 | +04 | UP-200F1 | DC BATTERY SYSTEM SWTG CONTROL - FEEDER B |
| A7 | +05 | UP-200F2 | NAVAID SYSTEM FEEDER A |
| A7 | +06 | UP-200F2 | NAVAID SYSTEM FEEDER B |
| A7 | +08 | ESW-200N2 | WELDING SOCKETS (LOWER DECK) |

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| 79 | Confirm correct and positive result of precommissioning Check Sheet for above signals I/O list | Correct and positive results ..... ☐ | | |

*5.4.4.8 SG-200N1 - I/O list Signal from/to drawer with Typical WD "LK1-n" and "LK2-n" – Network MODBUS TCP-IP*

Signals from/to the various drawers (see list below) on SG-200N1 - Network Modbus TCP-IP to PCS Cabinets.

The drawers were made by referring to the Typical Wiring Diagram "LK1-n" and "LK2-n" see the vendor document 172300219-EL-DG-00031.

This I/O list concern the protection warning and alarm, breaker feedback and measures reading from I/O modules and Ekip Touch installed inside the drawers.

All I/O list will be individually loop checked and recorded on dedicated ITR-Bs precommissioning check sheets. For specific signal tags and all information see I/O list 1723002197-EL-LIS-00042.
Modbus I/O Table

| DEVICE LOCATION [1] | DEVICE | SIGNAL_DESCRIPTION | TYPE ANALOG/DIGITAL | RELAY/DEVICE MODEL | UNIT | SCALE FACTOR | Note |
|---|---|---|---|---|---|---|---|
| Typical LK1-n ÷ LK2-n Wiring Diagram | U1.A | CIRCUIT-BREAKER - PROTECTION TRIPPED "L" | SW-DI | Ekip Hi-Touch | | | |
| Typical LK1-n ÷ LK2-n Wiring Diagram | U1.A | CIRCUIT-BREAKER - PROTECTION TRIPPED "S" | SW-DI | Ekip Hi-Touch | | | |
| Typical LK1-n ÷ LK2-n Wiring Diagram | U1.A | CIRCUIT-BREAKER - PROTECTION TRIPPED "I" | SW-DI | Ekip Hi-Touch | | | |
| Typical LK1-n ÷ LK2-n Wiring Diagram | U1.A | CIRCUIT-BREAKER - PROTECTION TRIPPED "G" | SW-DI | Ekip Hi-Touch | | | |
| Typical LK1-n ÷ LK2-n Wiring Diagram | U1.A | CIRCUIT-BREAKER - OPEN | SW-DI | Ekip Hi-Touch | | | |
| Typical LK1-n ÷ LK2-n Wiring Diagram | U1.A | CIRCUIT-BREAKER - CLOSED | SW-DI | Ekip Hi-Touch | | | |
| Typical LK1-n ÷ LK2-n Wiring Diagram | U1.A | CIRCUIT-BREAKER - TRIP UNIT FAILURE | SW-DI | Ekip Hi-Touch | | | |
| Typical LK1-n ÷ LK2-n Wiring Diagram | U1.A | MEASURE - CURRENT "L1" | SW-AI | Ekip Hi-Touch | A | 0,1 | |
| Typical LK1-n ÷ LK2-n Wiring Diagram | U1.A | MEASURE - CURRENT "L2" | SW-AI | Ekip Hi-Touch | A | 0,1 | |
| Typical LK1-n ÷ LK2-n Wiring Diagram | U1.A | MEASURE - CURRENT "L3" | SW-AI | Ekip Hi-Touch | A | 0,1 | |
| Typical LK1-n ÷ LK2-n Wiring Diagram | U1.A | MEASURE - VOLTAGE "L1-L2" | SW-AI | Ekip Hi-Touch | V | 0,1 | |
| Typical LK1-n ÷ LK2-n Wiring Diagram | U1.A | MEASURE - VOLTAGE "L2-L3" | SW-AI | Ekip Hi-Touch | V | 0,1 | |
| Typical LK1-n ÷ LK2-n Wiring Diagram | U1.A | MEASURE - VOLTAGE "L3-L1" | SW-AI | Ekip Hi-Touch | V | 0,1 | |
| Typical LK1-n ÷ LK2-n Wiring Diagram | U1.A | MEASURE - FREQUENCY | SW-AI | Ekip Hi-Touch | Hz | 0,01 | |
| Typical LK1-n ÷ LK2-n Wiring Diagram | U1.A | MEASURE - APPARENT POWER | SW-AI | Ekip Hi-Touch | kVA | 0,1 | |
| Typical LK1-n ÷ LK2-n Wiring Diagram | U1.A | MEASURE - REAL POWER | SW-AI | Ekip Hi-Touch | kW | 0,1 | |

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| DEVICE LOCATION [1] | DEVICE | SIGNAL_DESCRIPTION | TYPE ANALOG/DIGITAL | RELAY/DEVICE MODEL | UNIT | SCALE FACTOR | Note |
|---|---|---|---|---|---|---|---|
| Typical LK1-n ÷ LK2-n Wiring Diagram | U1.A | MEASURE - REACTIVE POWER | SW-AI | Ekip Hi-Touch | kVAR | 0,1 | |
| Typical LK1-n ÷ LK2-n Wiring Diagram | U1.A | MEASURE - POWER FACTOR | SW-AI | Ekip Hi-Touch | COSfi | 0,001 | |
| Typical LK1-n ÷ LK2-n Wiring Diagram | U2.B | CIRCUIT-BREAKER - CLOSED AND INSERTED | SW-DI | Module I/O | | | 1=close |
| Typical LK1-n ÷ LK2-n Wiring Diagram | U2.B | CIRCUIT-BREAKER - OPEN OR DISCONNECTED | SW-DI | Module I/O | | | 1=open |
| Typical LK1-n ÷ LK2-n Wiring Diagram | U2.B | CIRCUIT-BREAKER - TRIPPED | SW-DI | Module I/O | | | 1=tripped |
| Typical LK1-n ÷ LK2-n Wiring Diagram | U2.B | FEEDER AVAILABLE | SW-DI | Module I/O | | | 1=available |
| Typical LK1-n ÷ LK2-n Wiring Diagram | U2.B | INTERNAL FAULT | SW-DI | Module I/O | | | 0=fault |
| Typical LK1-n ÷ LK2-n Wiring Diagram | U2.B | CONTACTOR CLOSING COMAND | SW-DO | Module I/O | | | 1=closing |
| Typical LK1-n ÷ LK2-n Wiring Diagram | U2.B | CONTACTOR OPENING COMAND | SW-DO | Module I/O | | | 1=opening |
| Typical LK1-n ÷ LK2-n Wiring Diagram | U2.C | available | SW-DI | Module I/O | | | |
| Typical LK1-n ÷ LK2-n Wiring Diagram | U2.C | available | SW-DI | Module I/O | | | |
| Typical LK1-n ÷ LK2-n Wiring Diagram | U2.C | SA1 ON "LOCAL" POSITION | SW-DI | Module I/O | | | 1=local |
| Typical LK1-n ÷ LK2-n Wiring Diagram | U2.C | available | SW-DI | Module I/O | | | |
| Typical LK1-n ÷ LK2-n Wiring Diagram | U2.C | available | SW-DI | Module I/O | | | |
| Typical LK1-n ÷ LK2-n Wiring Diagram | U2.C | available | SW-DO | Module I/O | | | |
| Typical LK1-n ÷ LK2-n Wiring Diagram | U2.C | available | SW-DO | Module I/O | | | |

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[1] See drawer list for device location

This typical WD is applied to following drawers:

| Column | Position | Item TAG | Description TAG |
|---|---|---|---|
| A2 | +05 | SPARE | SPARE |
| A3 | +02 | SPARE | SPARE |
| A3 | +03 | DP-200N1 | DB-LIGHTING & SMALL POWER BoP |
| A3 | +04 | JB-200E3 | CRANE |
| A3 | +05 | SPARE | SPARE |
| A3 | +08 | JB-500E8 | WATER PACKAGE |
| A4 | +02 | B100-HSB-001 | HVAC PANELS HV ROOM |
| A4 | +03 | A-80000 | FUELL CELL AUXIALIRY LOAD |
| A4 | +04 | CP-850F03 | BESS PCS CABINET |
| A4 | +05 | SPARE | SPARE |
| A4 | +06 | SPARE | SPARE |
| A4 | +08 | K-63001-A | INSTRUMENTS AIR PACKAGE 01A |
| A5 | +01 | SPARE | SPARE |
| A5 | +02 | B200-HSB-001 | HVAC PANELS - LV ROOM |
| A5 | +03 | B300-HSB-001 | HVAC PANELS - UPS ROOM |
| A5 | +04 | B400-HSB-001 | HVAC PANELS - ITER |
| A5 | +05 | CN-200N1 | IMPRESSED CURR. CATHODIC PROTECTION (ICCP) SYSTEM |
| A5 | +06 | SPARE | SPARE |
| A5 | +08 | K-63001-B | INSTRUMENTS AIR PACKAGE 01B |
| A6 | +02 | CP-850E1 | BESS LV1 CABINAT (+DISTR 1) |
| A6 | +03 | CP-850E2 | BESS LV2 CABINAT (+DISTR 2) |
| A6 | +04 | SPARE | SPARE |

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| 80 | Confirm correct and positive result of precommissioning Check Sheet for above signals I/O list | Correct and positive results ..... ☐ | | |

*5.4.4.9 SG-200N1 - I/O list Signal from/to drawer with Typical WD "M1-6" – Network MODBUS TCP-IP*

Signals from/to the various drawers (see list below) on SG-200N1 - Network Modbus TCP-IP to PCS Cabinets.

The drawers were made by referring to the Typical Wiring Diagram "M1-6" see the vendor document 172300219-EL-DG-00031.

This I/O list concern the protection warning and alarm, breaker feedback and measures reading from UMC100.3 I/O modules installed inside the drawers.

All I/O list will be individually loop checked and recorded on dedicated ITR-Bs precommissioning check sheets. For specific signal tags and all information see I/O list 1723002197-EL-LIS-00042.

Modbus I/O Table

| DEVICE LOCATION[1] | DEVICE | SIGNAL_DESCRIPTION | TYPE ANALOG/ DIGITAL | RELAY/DEVICE MODEL | UNIT | SCALE FACTOR | Note |
|---|---|---|---|---|---|---|---|
| Typical M1-6 Wiring Diagram | MMU4 | MEASURE - CURRENT (average) | SW-AI | MRP31.0 | A | HOLD - n.1 | |
| Typical M1-6 Wiring Diagram | MMU4 | SA1 ON "LOCAL" POSITION | SW-DI | MRP31.0 | | | 1=local |
| Typical M1-6 Wiring Diagram | MMU4 | MOTOR RUNNING | SW-DI | MRP31.0 | | | 1=running |
| Typical M1-6 Wiring Diagram | MMU4 | MOTOR TRIPPED | SW-DI | MRP31.0 | | | 1=tripped |
| Typical M1-6 Wiring Diagram | MMU4 | USER AVAILABLE | SW-DI | MRP31.0 | | | 1=available |
| Typical M1-6 Wiring Diagram | MMU4 | ESD ACTIVETED | SW-DI | MRP31.0 | | | 0=activeted |

[1] See drawer list for device location

This typical WD is applied to following drawers:

| Column | Position | Item TAG | Description TAG |
|---|---|---|---|
| A6 | +01 | PM-50001A | SEA WATER PUMP A |
| A7 | +01 | PM-50001B | SEA WATER PUMP B |

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| 81 | Confirm correct and positive result of precommissioning Check Sheet for above signals I/O list | Correct and positive results ..... ☐ | | |

### *5.4.4.10 SG-200N1 - I/O list Signal from/to drawer with Typical WD "L3-630" ELECTROLIZER AUXILIARY LOAD – Network MODBUS TCP-IP*

Signals from/to the Electrolizer Auxiliary Load drawer A1/+08 (see list below) on SG-200N1 - Network Modbus TCP-IP to PCS Cabinets.

The drawers were made by referring to the Typical Wiring Diagram "L3-630" see the vendor document 172300219-EL-DG-00031.

This I/O list concern the protection warning and alarm, breaker feedback and measures reading from I/O modules and Ekip Touch installed inside the drawer.

All I/O list will be individually loop checked and recorded on dedicated ITR-Bs precommissioning check sheets. For specific signal tags and all information see I/O list 1723002197-EL-LIS-00042.

Modbus I/O Table

| DEVICE LOCATION[1] | DEVICE | SIGNAL_DESCRIPTION | TYPE ANALOG/ DIGITAL | RELAY/DEVICE MODEL | UNIT | SCALE FACTOR | Note |
|---|---|---|---|---|---|---|---|
| Typical L 3-630 Wiring Diagram | QF1 | CIRCUIT-BREAKER - PROTECTION TRIPPED "L" | SW-DI | Ekip Hi-Touch | | | 1=tripped |
| Typical L3-630 Wiring Diagram | QF1 | CIRCUIT-BREAKER - PROTECTION TRIPPED "S" | SW-DI | Ekip Hi-Touch | | | 1=tripped |
| Typical L3-630 Wiring Diagram | QF1 | CIRCUIT-BREAKER - PROTECTION TRIPPED "I" | SW-DI | Ekip Hi-Touch | | | 1=tripped |
| Typical L3-630 Wiring Diagram | QF1 | CIRCUIT-BREAKER - PROTECTION TRIPPED G" | SW-DI | Ekip Hi-Touch | | | 1=tripped |
| Typical L3-630 Wiring Diagram | QF1 | CIRCUIT-BREAKER - OPEN | SW-DI | Ekip Hi-Touch | | | 1=open |
| Typical L3-630 Wiring Diagram | QF1 | CIRCUIT-BREAKER - CLOSED | SW-DI | Ekip Hi-Touch | | | 1=closed |
| Typical L3-630 Wiring Diagram | QF1 | CIRCUIT-BREAKER - CONNECTED | SW-DI | Ekip Hi-Touch | | | 1=connected |
| Typical L3-630 Wiring Diagram | QF1 | CIRCUIT-BREAKER - ISOLATED | SW-DI | Ekip Hi-Touch | | | 0=isolated |
| Typical L3-630 Wiring Diagram | QF1 | CIRCUIT-BREAKER - TEST | SW-DI | Ekip Hi-Touch | | | 1=test |
| Typical L3-630 Wiring Diagram | QF1 | CIRCUIT-BREAKER - TRIP UNIT FAILURE | SW-DI | Ekip Hi-Touch | | | 1=Failure |
| Typical L3-630 Wiring Diagram | QF1 | CIRCUIT-BREAKER - CLOSE COMMAND | SW-DO | Ekip Hi-Touch | | | 1=close command |
| Typical L3-630 Wiring Diagram | QF1 | CIRCUIT-BREAKER - OPEN COMMAND | SW-DO | Ekip Hi-Touch | | | 1=open command |
| Typical L3-630 Wiring Diagram | QF1 | MEASURE - CURRENT "L1" | SW-AI | Ekip Hi-Touch | A | 0,1 | |
| Typical L3-630 Wiring Diagram | QF1 | MEASURE - CURRENT "L2" | SW-AI | Ekip Hi-Touch | A | 0,1 | |
| Typical L3-630 Wiring Diagram | QF1 | MEASURE - CURRENT "L3" | SW-AI | Ekip Hi-Touch | A | 0,1 | |
| Typical L3-630 Wiring Diagram | QF1 | MEASURE - VOLTAGE "L1-L2" | SW-AI | Ekip Hi-Touch | V | 0,1 | |
| Typical L3-630 Wiring Diagram | QF1 | MEASURE - VOLTAGE "L2-L3" | SW-AI | Ekip Hi-Touch | V | 0,1 | |
| Typical L3-630 Wiring Diagram | QF1 | MEASURE - VOLTAGE "L3-L1" | SW-AI | Ekip Hi-Touch | V | 0,1 | |
| Typical L3-630 Wiring Diagram | QF1 | MEASURE - FREQUENCY | SW-AI | Ekip Hi-Touch | Hz | 0,01 | |
| Typical L3-630 Wiring Diagram | QF1 | MEASURE - APPARENT POWER | SW-AI | Ekip Hi-Touch | kVA | 0,1 | |
| Typical L3-630 Wiring Diagram | QF1 | MEASURE - REAL POWER | SW-AI | Ekip Hi-Touch | kW | 0,1 | |
| Typical L3-630 Wiring Diagram | QF1 | MEASURE - REACTIVE POWER | SW-AI | Ekip Hi-Touch | kVAR | 0,1 | |
| Typical L3-630 Wiring Diagram | QF1 | MEASURE - POWER FACTOR | SW-AI | Ekip Hi-Touch | COSfi | 0,001 | |
| Typical L3-630 Wiring Diagram | U1B | CIRCUIT-BREAKER - CLOSED AND INSERTED | SW-DI | Module I/O | | | 1=close |
| Typical L3-630 Wiring Diagram | U1B | CIRCUIT-BREAKER - OPEN OR DISCONNECTED | SW-DI | Module I/O | | | 1=open |
| Typical L3-630 Wiring Diagram | U1B | CIRCUIT-BREAKER - TRIPPED | SW-DI | Module I/O | | | 1=tripped |

| DEVICE LOCATION[1] | DEVICE | SIGNAL_DESCRIPTION | TYPE ANALOG/ DIGITAL | RELAY/DEVICE MODEL | UNIT | SCALE FACTOR | Note |
|---|---|---|---|---|---|---|---|
| Typical L3-630 Wiring Diagram | U1B | available | SW-DI | Module I/O | | | |
| Typical L3-630 Wiring Diagram | U1B | available | SW-DI | Module I/O | | | |
| Typical L3-630 Wiring Diagram | U1C | available | SW-DI | Module I/O | | | |
| Typical L3-630 Wiring Diagram | U1C | available | SW-DI | Module I/O | | | |
| Typical L3-630 Wiring Diagram | U1C | SA1 ON "LOCAL" POSITION | SW-DI | Module I/O | | | 1=local |
| Typical L3-630 Wiring Diagram | U1C | available | SW-DI | Module I/O | | | |
| Typical L3-630 Wiring Diagram | U1C | available | SW-DI | Module I/O | | | |

[1] See drawer list for device location

This typical WD is applied to following drawers:

| Column | Position | Item TAG | Description TAG |
|---|---|---|---|
| A1 | +08 | A-20000 | ELECTROLYSER AUXILIARY LOAD |

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| 82 | Confirm correct and positive result of precommissioning Check Sheet for above signals I/O list | Correct and positive results ..... ☐ | | |

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*5.4.4.11 OTP WORKSITE Phase 3 - Tests Notes and Remarks*

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*5.4.4.12 OTP WORKSITE Phase 3 - Tests Certifying Authority Table of Attendances*

| Name and Surname | Certifying Authority | Position | Signature |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

*5.4.4.13 OTP WORKSITE Phase 3 - Tests Final Signatures and Company Acceptance*

| Name and Surname | Company Representative | Position | Signature |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

## 5.5 Post-test Conditions

All the electrical contacts which were disconnected for the testing purposes must be reconnected.
After functional tests have been completed, system / sub-systems are left in healthy and safety condition and that they are operational.

## 5.6 Reinstatement and Preservation Tasks

Generally, the system/ sub-system shall be reinstated at its initial condition; and the following activities must be carried out as minimum:

- all inhibition done for the test shall be removed (as per Inhibit / Override List)
- all equipment/devices shall be returned in healthy functional conditions.
- all preservation routines identified and required will be included in relevant Preservation ITR within the Proverlis Completions System

# 6 OTP AT SITE

## 6.1 Planning and Manpower

### 6.1.1 Offshore Site overview

It is expected that all precommissioning tests, systems energization and commissioning steps will have been successfully performed during the Onshore Phases.
Consequently, during the offshore SITE phase, the respective systems will be inspected prior to re-energization. No additional test steps will be required on these items of equipment, correct operation and functioning will be verified.

### 6.1.2 Planned tasks with estimated manpower

Estimated manpower for the entire duration of the Test:
- 1 E&I commissioning superintendent
- 1 E&I commissioning supervisor from Contractor
- 1 E&I commissioning technicians from Contractor

### 6.1.3 Test duration estimate

The test duration should be as follows:
- 0,5 days approx.

If necessary, the estimated time can be extended to complete all required pre-commissioning and commissioning activities.

### 6.1.4 Vendor Assistance

- Not applicable

### 6.1.5 Items Postponed to C&E OTP

- Not Applicable

### 6.1.6 HOLDS

- Not Applicable

## 6.2 OTP Test Requirements – Offshore SITE

### 6.2.1 Pre-Commissioning Achievement

- Not applicable

### 6.2.2 Commissioning Achievement

The commissioning achievement will be the successful operation, functionality and safeguarding test of Power distribution System LV, installed and put in operation during the WORKSITE phase:

The successful commissioning result, achieved during the WORKSITE commissioning phase for the functionality and safeguard of the LV distribution system, will allow for a smoother commissioning phase of the offshore SITE.
The systems and subsystems involved:
- 88-00: Earthing System
- 82-00: SG-100D1 6.6 kV SWBD compartment A4 6,6 kV

- 82-40: Transformer 1,6 MVA TR-200DE1
- 84-10: UPS System UP-200F3
- 83-00: 400 V Switchboard & Connection Box (SG-200N1)
- 83-20: 400V Distribution board DP-200N1
- 79-00: SIS (ESD)
- 87-00: EMCS cabinet
- 87-10: Process Control System (PCS)
- 86-00: Data Network - IEC61850 Ethernet Communication network High and Low Voltage
- 86-00: Data Network - MODBU RTU Network Switchboard 6.6 kV and Low Voltage

### 6.2.3 Status of Required Associated Subsystems

The systems involved has been already energized and commissioned in WORKSITE Phase

### 6.2.4 Special Tools & Test Equipment

The following special tool and Test Equipment are required (see vendor document 1723002197-EL-LIS-00053):

- Voltage, frequency, continuity tester (Multimeter)
- extracting tool & transportation trolley
- Portable radios (3 pcs + 1 per Technical Room)

| **TESTING & MEASUREMENT INSTRUMENT USED** | | | |
|---|---|---|---|
| Type | Serial N. | Calibration certificate | Validity |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

### 6.2.5 Consumable List

- Not applicable

### 6.2.6 Commissioning Spare Parts

Reference is made to IMESA document 1723002197-COM-LIS-00052 "Commissioning and operation Spare Parts Index Register" regarding the LV SWBD e DB commissioning spare parts are indicated in the document 1723002197-COM-LIS-00052 "Commissioning and operation Spare Parts Index Register".

### 6.2.7 Temporary Facilities

- Temporary Diesel Generator

## 6.3 OTP Description – SITE

On SITE (offshore) phase the first energization of main SWBD SG-200N1 will be done feeding the drawer A2/+08 via Temporary Diesel Generator and will be performed all steps starting with first energization.

N.B.: Kindly note that this procedure does not detail any activities related to BLACK START, consequently reference is made to dedicated document n. 123A90-PML-COM-PRO-03036

### 6.3.1 OTP Test Preparation

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| 83 | System Ready for Operation (RFO) from WORKSITE phases<br>Certificate is issued and approved. | | | |
| 84 | No blocking punch list items are outstanding against the system to be commissioned. | | | |
| 85 | System(s), (de)isolations as per LOTO procedure enclosed within commissioning Work Permits procedures prepared and approved | | | |
| 86 | Verify and confirm that all steps performed at WORKSITE of this procedure are completed without any pending issues that would prevent from proceeding with the offshore SITE PROCEDURE | | | |
| 87 | All personnel involved in the implementation of this procedure are familiar with this procedure as well as with associated safety requirements (Toolbox Talk to be conducted before initiation of activities). | | | |
| 88 | A final walkdown after hook-up of the system has been completed, any preservation items have been removed and to ensure that the system and the area are ready for energization for following items:<br>UP-200F3 230V AC UPS<br>SG-200N1 Main Switchboard<br>DP-200N1 Distribution board | | | |
| 89 | Check that areas are free for work and escape routes are clear of any obstructions. | | | |
| 90 | Ensure that proper communications have been established between parties involved in the implementation of the procedure. | | | |
| 91 | Verify availability of test equipment and consumables as per chapters 6.2.4. | | | |
| 92 | Verify and confirm that the Temporary Diesel Generator is ready to start, that the diesel fuel tank is full. | | | |
| 93 | All personnel have been duly notified during dedicated daily SIMOPS meetings that the system(s) is ready for commissioning. | | | |

### 6.3.2 Electrical Preparation

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| 94 | No blocking punch list items are outstanding against the system to be commissioned. | | | |
| 95 | Review and confirm no changes are required to be performed on existing protection settings. | | | |
| 96 | Verify and confirm that the Temporary Diesel Generator power cables connections have been tested with correct phase rotation before sail away.<br>Perform walk down on Diesel Generator for a final check before energization | | | |

### 6.3.3 Mechanical Preparation

Not applicable.

### 6.3.4 Instrument Preparation

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| 97 | No blocking punch list items are outstanding against the system to be commissioned. | | | |
| 98 | Verify that all relevant associated control and protection systems / subsystems are ready. | | | |
| 99 | Verify as relevant Inhibit and Override list has been prepared and validated (as per JSA). | | | |

### 6.3.5 Piping Preparation

Not applicable

### 6.3.6 Additional Discipline Preparation

Not applicable.

## 6.4 OTP Test Steps – Offshore SITE

The previous chapters must be successfully performed prior to commissioning of the LV Power Distribution Switchboard and Distribution Board.

In the next steps, the functionality of the LV Power Switchboard and the Distribution Board will be tested:

- SS 83-00: 400 V Switchboard & Connection Box (SG-200N1)
- SS 83-20: 400V Distribution Board "DP-200N1"

### 6.4.1 Test Preparation

Verification of system and subsystem LV Power Switchboard and Distribution Board.

### 6.4.2 Energization of Switchboard SG-200N1 and Distribution Board DP-200N1

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| Auxiliary Circuits for 400V Switchboard SG-200N1 | | | | |
| 100 | Verify and confirm (cubicle A2/+02):<br>- the selector QU1 is in position "1"<br>- the fuse switch QU3 is closed | | | |
| 101 | Verify and confirm on drawer A2/+08:<br>- Aux CB QA1 Under voltage coil is closed<br>- Aux CB QA2 command circuits is closed | | | |
| Startup Temporary Diesel Generator and energize power supply to Switchboard SG-200N1 | | | | |
| 102 | Verify and confirm the INCOMING QF1 breaker of JB-200E2 is open and the drawer +08 is in extract position. | | | |
| 103 | Startup the Temporary Diesel Generator, wait for the engine to warm up, check that all parameters are correct and within range.<br>Close the Generator main breaker | | | |
| 104 | Verify the correct phase sequence L1,L2,L3, on the incomer power of the drawer A2/+08. | | | |
| 105 | Manually close Breaker QF1 on drawer A2/+08.<br>The switchboard main Busbar are powered from Temporary Diesel Generator | | | |
| 106 | Verify and confirm on drawer A3/+03 (DP-200N1):<br>- Aux CB QA1 command circuits is closed | | | |
| 107 | On drawer A3/+03 close Breaker QF1 and the distribution board DP-200N1 is powered | | | |
| 108 | Verify and confirm 230VAC from DP-200N1:<br>- From DP-200N1 breaker Q39<br>- To SG-200N1 Breaker QA6 (cubicle A2/+02) | | | |

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| **Energization of LV SWBD SG-200N1 from 6.6 kV Switchboard SG-100D1 comp. A4.<br>Switchboard 6.6kV SG-100D1 is powered from HV 66/6.6kV Transformer TR-100AD1 (see 66kV switchboard "123A90-PML-COM-PRO-03045 OTP - HV Switchgear & 66 kV Transformer Systems") .** | | | | |

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| 109 | See and refer to related steps of 6.6 kV OTP of SG-100D1 6,6 kV to supply the Low Voltage SG-200N1, Doc n. 123A90-PML-COM-PRO-03046, PHASES 1/2/3.<br>The SG-200N1 upstream is powered from 6.6/0.4 kV transformer TR-200DE1, Main incomers QF1 (A1/+05) is open and extract | | | |
| 110 | Reference is made to Logic diagram 1723002197-EL-DG-00030 sheet 22<br><br>Interlock to main breaker QF1 (A1/+05) from drawer A2/+08<br>Permissive to closing incomer QF1 (A1+05) from JB-200E1 QF1 breaker (A2/+08)<br><br>Located on A2/+02 cubicle<br>Confirm close circuit between terminals X2:3-4 (it means QF1 (A2/+08) is open or racked out) | | | |
| 111 | With reference Vendor Doc. 1723002197-EL-DG-00030 sheet 17 Verify the correct phase sequence L1, L2, L3 of the INCOMER power supply cables. Column A2/+02 SG-200N1 | | | |
| 112 | Remove power from temporary generator.<br><br>- Open breaker QF1 (A2/+08) .....☐<br>- Turn OFF temporary Generator .....☐<br>Main Busbars of Switchboard SG-200N1 are OFF | | | |
| 113 | With reference Vendor Doc. 1723002197-EL-DG-00030 sheet 16 Check and confirm that auxiliary circuit is available<br>- Close QU2 MCB ..... ☐<br>- Place the selector QU1 in position 2 and circuit will be supplied (see the K30A should be on)..... ☐ | | | |
| 114 | With reference Vendor Doc. 1723002197-EL-DG-00030 sheet 17. Verify and confirm the voltage references are available on Column A02/+02:<br>- Close protection QV1..... ☐<br>- Close protection QV2..... ☐<br>- Verify the voltage presence on terminals XV:1-2-3 ..... ☐ | | | |
| 115 | Verify the voltage reading on REF615 display | | | |

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| | - Voltage = ..... V | | | |
| 116 | With reference the Vendor Doc 173002197-EL-DG-00030 sheet 19-20 Close auxiliary breakers 230V located on drawer A2/+02<br>QA1 Motor Spring charger incoming CB ..... ☐<br>QA2 protection device incoming CB ..... ☐<br>QA3 command circuits incoming CB ..... ☐<br>QA4 converter 230/24 VDC..... ☐<br>QA5 command circuits (feeders)..... ☐<br>QA6 internal space heaters /lighting ..... ☐<br>The protections are working, and auxiliary circuits are powered, and the permissive signals are closed ..... ☐ | | | |
| 117 | Mechanical Interlock between 6.6 KV SWBD SG-100D1 (Column A4) and LV SWBD SG-200N1 Incomer<br><br>With reference Vendor 6.6 KV *SLD 1723002197 EL-DG-00010*, *LV SLD 1723002197 EL-DG-00030*<br><br>**Interlock On SG-200N1 main incomer**<br><br>Earthing switch BGE Column A4 is open, its KEY-3 **G3398** is free and its KEY-4) **G3135** is blocked on earthing switch<br>- Key **G3398** is ringed with main incomer QF1 (A1/+05) Rack-In/Out system Key **151733** (2) of DG-200N1 SWBD<br>- Insert the key **151733** on Rack-In/Out system of Main Incomer QF1 place the breaker in test or service position and the key **151733** will be blocked on n Rack-In/Out system<br><br>**Interlock On SG-100D1 main incomer**<br><br>SG-200N1 Incomer is extract position the Key **151733** is free.<br>- Insert KEY-3 **G3398** on the earth switch of column A4 (BGE), if possible close it and the **G3398** key will remain blocked on the BGE until the BGE is opened and the key is free again. | | | |

| Step | Description | Result | Verified by | Date |
|---|---|---|---|---|
| 118 | Rack in the Main incoming breaker QF1 in test position | | | |
| 119 | With reference the Vendor Doc. 1723002197-EL-DG-00030 sheet 26 and located in column A2/+02<br>- Place the selector SA1 in local position.<br>- Verify and confirm the SA2 Selector is in normal position (not in maintenance position)<br>- Reference is made to sheets 13 and 14 Logic Diagram | | | |
| 120 | Reference is made to Logic diagram 1723002197-EL-DG-00030 sheet 13 regarding the closing of the circuit breaker.<br>Locate the Push Button SC1 on compartment A2/+02<br>- Push SC1 to close main breaker<br>- Led-3 on the REF615 must be ON<br>- On the REF615 display the circuit breaker symbol will change to closed | | | |
| 121 | Locate the Push Button SO1 on compartment A2/+02<br>- Push SO1 to open main breaker<br>- Led-3 on the REF615 must be OFF<br>- On the REF615 display the circuit breaker symbol will change to opened | | | |
| 122 | Rack in the Main incoming breaker QG1 in service position | | | |
| 123 | Reference is made to Logic diagram 1723002197-EL-DG-00030 sheet 13 regarding the closing of the circuit breaker.<br>Locate the Push Button SC1 on compartment A2/+02<br>- Push SC1 to close main breaker<br>- Led 3 on the REF615 must be ON<br>- On the REF615 display the circuit breaker symbol will change to closed | | | |
| 124 | Locate the Push Button SO1 on compartment A2/+02<br>- Push SO1 to open main breaker<br>- Led 3 on the REF615 must be OFF<br>- On the REF615 display the circuit breaker symbol will change to opened | | | |
| 125 | Rotate selector switch SA1 to remote position.<br>Repeat previous test to close main breaker and confirm that it's not possible with selector switched to remote. | | | |

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OTP SITE Tests Notes and Remarks

### 6.4.3 OTP SITE Tests Certifying Authority Table of Attendances

| Name and Surename | Certifying Authority | Position | Signature |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

### 6.4.4 OTP SITE - Tests Final Signatures and Company Acceptance

| Name and Surname | Company Representative | Position | Signature |
|---|---|---|---|
| **Name and Surename** | **Certifying Authority** | **Position** | **Signature** |
| | | | |
| | | | |
| | | | |
| | | | |

## 6.5 Post-test Conditions

All the electrical contacts which were disconnected for the testing purposes must be reconnected.
After functional tests have been completed, system / sub-systems are left in healthy and safety condition and that they are operational.

## 6.6 Reinstatement tasks

Generally, the system/ sub-system shall be reinstated at its initial condition; and the following activities must be carried out as minimum:

- all inhibition done for the test shall be removed (as per Inhibit / Override List)
- all equipment/devices shall be returned in healthy functional conditions.

# 7 APPENDICES

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## 7.1 Vendor SAT Procedure

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## 7.2 Proverlis Summary System Reports

## 7.3 Equipment Related Technical Queries

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## 7.4 As Built Documentation

## 7.5 Management of Change – Summary Table of Tasks and Details of Affected Related Documentation

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