Base Load Power Hub (BLPH)

OTP: UPS System UP-200F4 15kVA

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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.

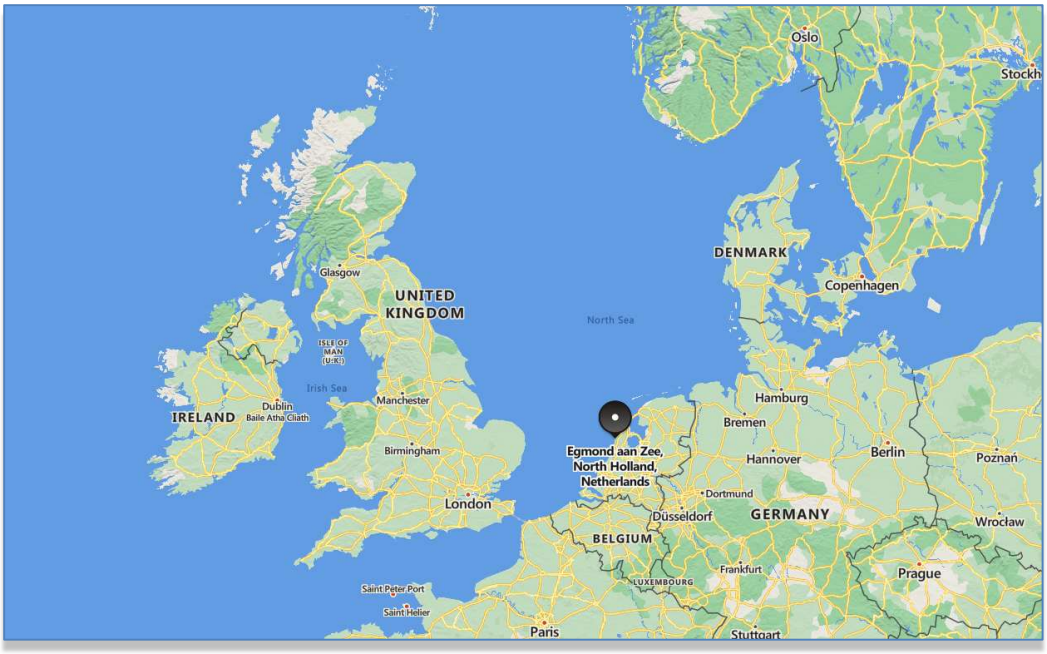


Figure 1 - HOLLANDSE KUST NOORD WIND PARK Location Map

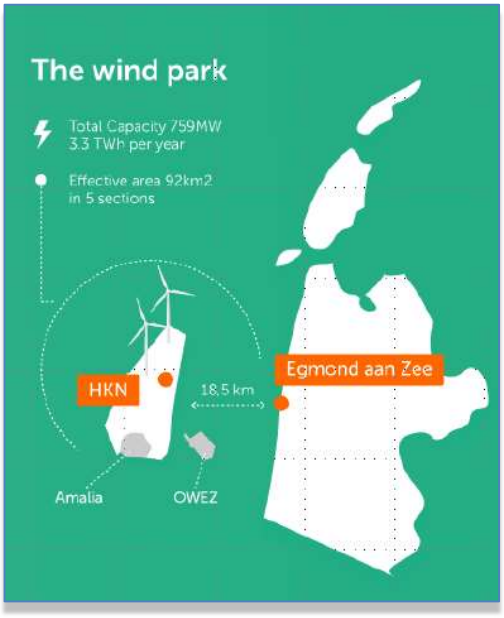


Figure 2 - Wind Park Details

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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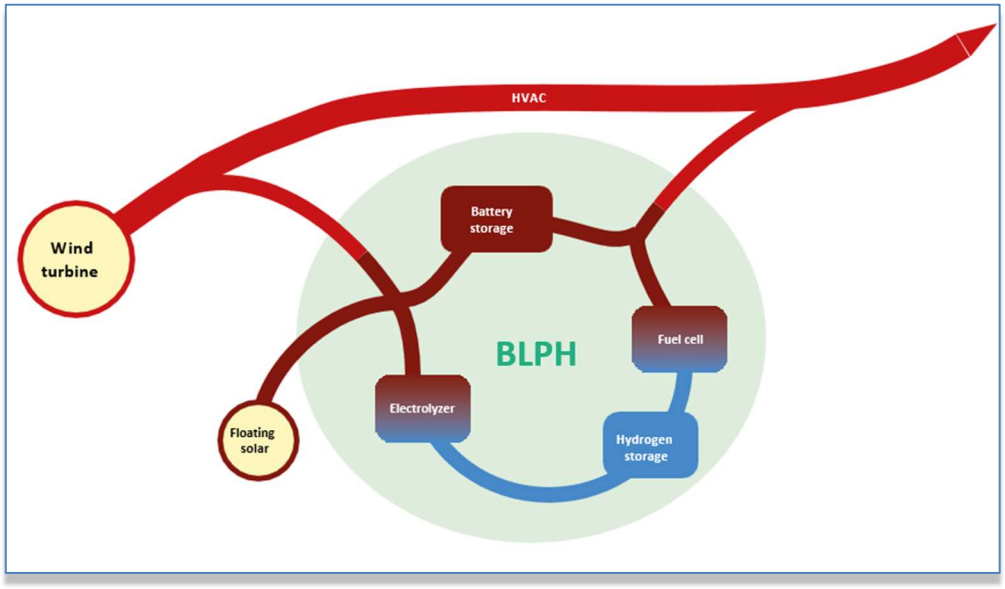


Figure 3 – BLPH Concept

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 methodology and the planned actions to be implemented for the preparation and execution of Mechanical Completion, Pre-commissioning, Commissioning & Start-Up activities to be performed on the PLANT, including COMPANY PROVIDED ITEMS, at the onshore premises of CONTRACTOR located in Milan (Italy) offices and Piomboni yard - Marina di Ravenna (Italy).

CONTRACTOR, pursuant to CONTRACT and PROJECT requirements, shall implement an exacting methodology, complete with a distinct set of tools and documentation to meet the following key objectives:
Perform the Mechanical Completion, Pre-commissioning and Commissioning on the WORKSITE to the maximum extent possible so as to minimise the commissioning operations on SITE;

- Ensure safety for the people, environment and facilities during the execution of the Commissioning activities at WORKSITE,
- Ensure integrity and operation of the equipment for their lifetime in accordance with PROJECT design and specifications,
- Plan a smooth and flawless execution of the Commissioning activities avoiding unforeseen downtimes and delays.

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Achievement of the above objectives shall be obtained by:

- Defining and prioritizing a predetermined sequence of the Mechanical Completion checks, Pre-commissioning and Commissioning tests and tasks,
- Checking, testing systematically and exhaustively all the components of PLANT in compliance with PROJECT approved procedures and CONTRACT terms, managed by a dedicated team of inspectors, technicians and field engineers who will perform the Mechanical Completion, Pre-commissioning, Commissioning and Start-Up tasks and subsequently record the results via discipline specific check, inspection and test sheets (ITR's) & where applicable via discrete Operational Test Procedures (OTP's).
- Ensuring full traceability of the performed checks and tests, through implementation of a dedicated Project Completions Management System (CMS) containing individual references to all tagged items.

3 OTP SUMMARY

3.1 Test Objective

The operating test of UPS AC 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.

Activities shall be developed as follows:

- Onshore pre-commissioning and commissioning activities at Contractor site (WORKSITE)
    - PHASE 1: UPS START UP with battery banks first charging and discharging tests
    - PHASE 2: UPS OPERATIONAL AND FUNCTIONAL TESTS
    - PHASE 3: COMMUNICATION TESTS with PCS and ESD systems.
- Offshore commissioning (SITE)
    - Visual inspection of all components, UPS start up with Black Start.

3.2 System Boundary Limits

See below the affected systems and subsystems on the Overall Single Line Diagram

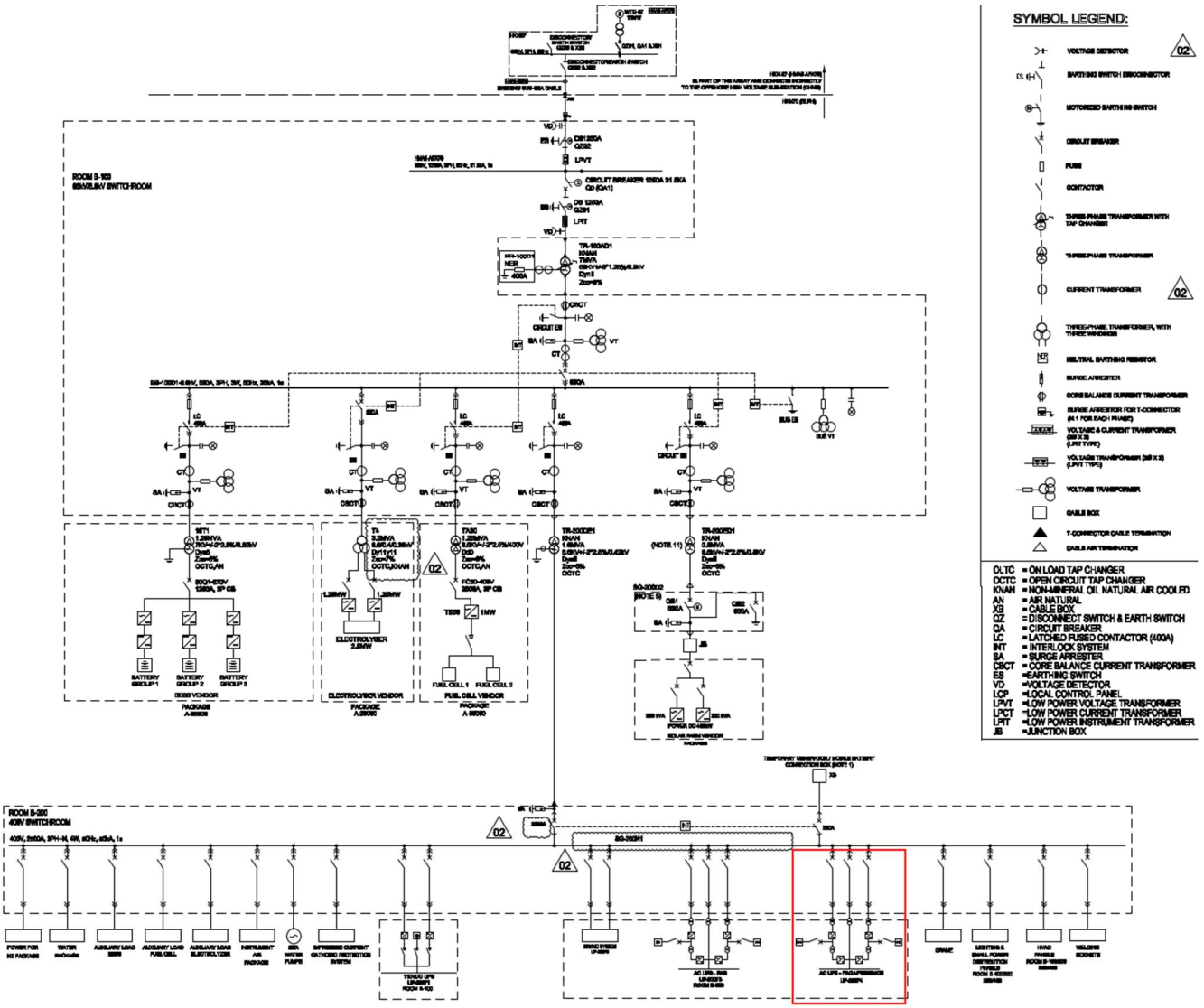


Figure 4 – OTP System Boundary Limits

3.3 Test and System Description

This document is related to the following systems/ subsystems:

- 83-00: 400/230V Switchboard SG-200N1
- 83-20: 400/230V Distribution Board DP-200N1
- 84-20: 230V AC UPS - 15KVA (UP-200F4)
- 84-20: 230V UPS DISTRIBUTION BOARD (UP-200F4)
- 84-20: UPS BATTERY RACK BANK (BA-200F4A & BA-200F4B)

- 84-20: UPS CUT OFF BREAKER (CB-200F4A/CB-200F4B)
- 79-00: EMERGENCY SHUTDOWN SYSTEMS (SIS)
- 87-10: PROCESS CONTROL SYSTEM (PCS)

All equipment is installed inside Technical Room B-300.

These parts of the system shall be tested at worksite and at site.

The UPS are metal enclosed prefabricated self-supporting type, for floor installation in compliance to the requirements of IEC 61439 1&2.
The UPS 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
- Finish Colour: RAL 7035

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

POWER SUPPLY:
- Rated Service Voltage: 400V
- Rated Frequency: 50 Hz
- Cabinet Rated Current: A

BUSBARS:
- Busbars: 3P+PE
- Maximum Operating Temperature: 70°C
- Protection: External IP 31

BATTERY:
- Configuration 2x50%
- Autonomy :240 MIN/BANK
- Temp. Design: -8,4 – 40 °C
- Humidity :95%
- Lead ACID VLRA GEL
- Capacity 120 Ah
- Recharge: 10h
- Float Charge: 2,28 V
- Boost Charge: 2,28 V

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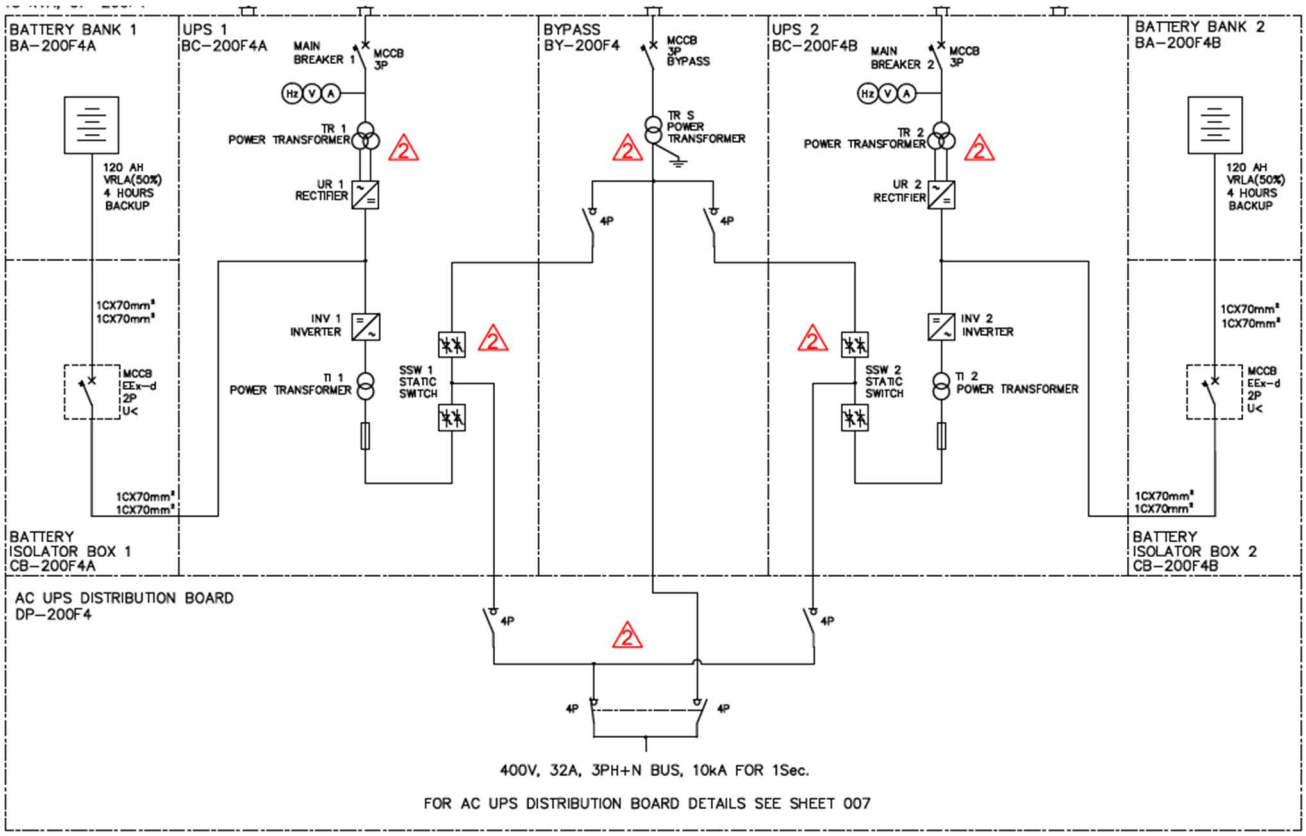


Figure 5 – UPS Single Line Diagram Block

The basic Single Line Diagram of the UPS 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, safety glasses hand gloves, helmet, earplugs etc. are available and must be used in line with the site requirements.
- Warning safety signs are to be posted with restricted access to essential personnel only.
- Adequate firefighting equipment.
- Specific details will be provided as part of the individual activity risk assessment prepared for each Permit to Work, which is a mandatory requirement for energizing items of equipment. Arc flash protection is not foreseen during execution of this OTP.
- PPE Will be Arc Flash Cat. 1.
-

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, 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
- 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.

Applicable panels:

- SS84-20 UPS-200F4

Refer Overall SLD with Marked-up Sub-systems.

After 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 prove:

- Voltage, frequency and phase sequence to the terminals of Incoming 1&2 (Rectifier) and Bypass are according to specification
- UPS startup

Charging/Discharging of battery banks

Phase 2 will prove:

- Unit Synchronization
- Powering of one unit at the time will show A in normal operation and B in stand-by and vice versa.
- Installation and functionality of Battery breakers
- Inverter output voltage within tolerance

- Unit changes to Battery operation
- Unit changes to By-pass operation
- Functionality of Manual By-pass Switch
- Output / Distribution as per specification
- Black Start Operation

Phase 3 will prove:
- Test functionality of UPS and Test communication Modbus TCP-IP with PCS

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

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-PRO-03007	Commissioning Strategy
[7] 123A90-PML-COM-LIS-03011	System/Sub-Systems List
[8] 123A90-PML-COM-LIS-03012	System/Sub-System Boundary Limit Diagrams
[9] 123A90-PML-COM-PRO-03038	Leak Test Procedure

Document ID	Document Title
[10]123A90-PML-COM-SP-03032	Pre-Commissioning Functional Test Sheet Template Collection (ITR-B)
[11]123A90-PML-COM-SP-03014	Commissioning TDS - Temporary Equipment & Facilities
[12]123A90-PML-COM-PRO-03019	OTP – Onshore Performance & Integrated Test Procedure
[13]123A90-PML-COM-LIS-03034	Inhibit-Override Register
[14]123A90-PML-COM-LIS-03035	PSV Calibration Register
[15]123A90-PML-COM-PRO-03036	OTP - Black Start Procedure
[16]123A90-PML-COM-LIS-03024	Commissioning Spare Parts and Consumables List
[17]123A90-PML-COM-PRO-03022	Initial offshore START-UP procedures
[18]123A90-PML-COM-SP-03057	Worksite WEF (Work Execution Flow Scheme)
[19]123A90-PML-COM-SP-03058	Site WEF (Work Execution Flow Scheme)
[20]123A90-PML-COM-RE-03001	Commissioning Final Dossier (ITR-B)
[21]123A90-PML-QHSE-PRO-00116	Flushing and Cleaning Procedures
[22]123A90-PML-QHSE-SP-00118	Mechanical Completion Check Sheet Template Collection (ITR-A)
[23]123A90-PML-QHSE-RE-00115	Mechanical Completion Final Dossier (ITR-A)
[24]123A90-PML-QHSE-PRO-00117	Punch list Management Procedure
[25]123A90- 123A90-PML-COM-PRO-03041	OTP - Hydrogen Storage & Venting Systems
[26]123A90- 123A90-PML-COM-PRO-03042	OTP - Sea Water Intake & Fresh Water Treatment Syst.
[27]123A90- 123A90-PML-COM-PRO-03043	OTP - Instrument Air System
[28]123A90- 123A90-PML-COM-PRO-03055	OTP - Nitrogen Generation System
[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 Syst.
[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-03053	OTP - Navaid System
[37]123A90- 123A90-PML-COM-PRO-03054	OTP - F&G and ESD C&E Logics
[38]123A90-PML-QHSE-PRO-00120	Proverlis Management Procedure

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Document ID	Document Title
[39]123A90-PML-COM-PRO-03056	OTP – Document Template
[40]123A90-PML-COM-PRO-03059	OTP - AC UPS System 35kVA UP-200F3
[41]123A90-PML-COM-PRO-03060	OTP - AC UPS System 15kVA UP-200F4

Table 2: Reference Project Deliverables

4.1.3 Vendor Documents

Document ID	Document Title
[1] 1723002197-COM-LIS-00001	SPARE PART INDEX REGISTER (COMMISSIONING AND OPERATION)
[2] 172400372-QC-ITP-00002	INSPECTION AND TEST PLAN
[3] 1724000372-EL-DA-00004	GENERAL ARRANGEMENT AND DIMENSIONAL DRAWINGS
[4] 1724000372-EL-DS-00005	UPS & BATTERIES TECHNICAL DATA SHEET
[5] 1724000372-EL-DG-00007	AC UPS SINGLE LINE DIAGRAM AND INTERCONNECTING DIAGRAM
[6] 1724000372-EL-DG-00009	AC UPS-WIRING DIAGRAM & TERMINAL SCHEDULE INCLUDING EQUIPMENTS LIST &BILL OF MATERIAL
[7] 1724000372-EL-DG-00011	AC UPS-BATTERY LAYOUT AND INTERCONNECTING DIAGRAM
[8] 1724000372-EL-CAL-00012	BATTERY SIZING CALCULATION
[9] 1724000372-EL-CAL-00013	HEAT DISSIPATION
[10] 1724000372-EL-LIS-000014	I/O LIST
[11] 1724000372-EL-PRO-00015	PAINTING PROCEDURE
[12] 1724000372-EL-PRO-00017	UPS-FACTORY ACCEPTANCE TEST PROCEDURE
[13] 1724000372-EL-PRO-00019	UPS-SITE ACCEPTANCE TEST PROCEDURE/PRE - COMMISSIONING/COMMISSIONING PROCEDURE
[14] 1724000372-QC-LIS-00020	EQUIPMENT MANUFACTURE RECORD BOOK (FINAL DOSSIER)-INDEX
[15] 1723002197-QC-LIS-00021	EX CERTIFICATION LIST
[16] 1723002197-EL-LIS-00022	ATEX DOCUMENTATION
[17] 1723002197-QC-PRO-00055	PACKING, SHIPPING, HANDLING AND STORAGE PROCEDURES
[18] 1724000372-EL-MAN-00025	INSTALLATION, OPERATING AND MAINTENANCE MANUAL (INCLUDING SITE ERECTION INSTRUCTIONS AND 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

Acronyms / Abbreviations	Description
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
OEM	Original Equipment Manufacturer
OMAR	Operating Modes Assurance Review
OTP	Operational Test Procedure (Commissioning)
OR	Operations Readiness
ORR	Operations Readiness Review

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Acronyms / Abbreviations	Description
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

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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
- 1 E&I commissioning technicians from Contractor
- 1 Vendor technician
- 1 PCS/ESD Workstation Operators (phase 3)

5.1.2 Test duration estimate

The test duration should be as follows:

- 5 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

Equipment vendor 3W Power S.p.A. will provide a qualified specialist to assist with all aspects of commissioning of the UPS-200F3 system.

5.1.4 Items Postponed to C&E OTP

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 UPS, installed and put in operation during the WORKSITE phase:

- 83-00: 400V Switchboard SG-200N1
- 83-20: 400V Distribution Board DP-200N1
- 84-20:230V UPS AC UP-200F4

5.2.3 Status of Required Associated Subsystems

PHASE 1 UPS START UP with battery banks first charging and discharging tests
Subsystems required RFC for Commissioning of UPS

- 83-00 400V Switchboard SG200N1
- 83-20 Distribution board DP-200N1
- 88-00: Earthing System
- 83-99: Temporary Yard 400/230V Main and auxiliary power supplies
- 84-20: UPS AC UP-200F4

PHASE 2 UPS OPERATIONAL AND FUNCTIONAL TESTS
Subsystems required RFC for Commissioning of LV Power Distribution:

- 83-00 400V Switchboard SG200N1
- 83-20 Distribution board DP-200N1
- 88-00: Earthing System
- 83-99: Temporary Yard 400/230V Main and auxiliary power supplies
- 84-20: UPS AC UP-200F4

PHASE 3 COMMUNICATION TESTS with PCS and ESD systems
Subsystems required RFC for Commissioning of UPS:

- 83-00 400V Switchboard SG200N1
- 83-20 Distribution board DP-200N1
- 88-00: Earthing System
- 83-99: Temporary Yard 400/230V Main and auxiliary power supplies
- 84-20: UPS AC UP-200F4
- 79-00: SIS (ESD)
- 87-10: Process Control System (PCS)

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
- Infrared temperature instrument
- Temporary Load Bank (Rated 15kVA)
- Portable radios
- 230VAC/24VDC temporary stabilized power supply

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 3W document 1723002197-COM-LIS-00052 "Commissioning and operation Spare Parts Index Register" regarding the UPS spare parts.

5.2.7 Temporary Facilities

Phase 1 and Phase2: Temporary Load Bank for battery discharge tests and UPS functional test with rating 15kVA.

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. All specific safety requirements will be detailed within HSE risk assessment mandatory for every Permit to Work (PTW).			
8	Ensure that proper communications have been established between parties involved in the implementation of the procedure.			
9	Verify availability of test equipment and consumables as per section 3.2.4.			
10	System(s) isolations as per LOTO procedure defined within HSSE Permits to Work and Commissioning procedures duly prepared and approved. Particular attention will be given to LOTO isolation of UPS outgoing MCB feeders.			

Step	Description	Result	Verified by	Date
11	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
12	Check related punch list 'B' items and confirm acceptability for start of commissioning activities.			
13	Verify that all relevant associated systems / subsystems are completed.			
14	Check that grounding and bonding are in accordance with applicable documents.			
15	Review and confirmation of protection settings on up-stream LV Switchboards feeder power supply circuit breakers.			
16	Verify finalization of UPS '1', '2' and 'By-Pass' Units internal power and auxiliary circuit connections in accordance with manufacturers documentation.			
17	Verify finalization of the auxiliary contact connection between UP-200F4 UPS Unit '1' (Inverter) and UPS MAIN DISTRIBUTION SWITCHBOARD SG-200N1 related to acquisition of the simultaneous CLOSED status of three circuit breakers INCOMER UPS '1', IN-COMER UPS '2'			

5.3.3 Mechanical Preparation

Not applicable.

5.3.4 Instrument Preparation

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

Step	Description	Result	Verified by	Date
21	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

During the PHASE 1 will be tested:

- Startup UPS '1' and '2' and bypass
- First charge of battery racks 'A' and 'B' (12 hours each)
- Discharge of battery racks 'A' and 'B' (10 hours each)
- Second recharge racks 'A' and 'B' (battery banks in normal operation)

5.4.1 Test Preparation

Need to Verify:

- 400V Power supply is available
- All systems and subsystems involved in this procedure must be ready for commissioning and available.

5.4.1.1 UPS Start-Up Procedure

Step	Description	Result	Verified by	Date
START-UP UPS				
	Preparation before start-up:			
1	*Before start-up, check that the default equipment data tallies with the battery data*			
2	*Before start-up, check that the equipment is earthed in accordance with regulations*			
3	*Make sure that the ventilation grids are never covered during operation*			

Step	Description	Result	Verified by	Date
4	Check the battery cut off breaker is open.			
5	Set the load interrupter switch Q1 to the "OFF" position.			
6	Set the manual bypass switch Q29 to position "3 - Manual bypass".			
7	Remove the protective cover from the connection panel			
8	Check connection of the mains voltage for the rectifier.			
9	Measure the mains voltage at connection terminal X1 (outer conductor/outer conductor): the mains voltage is U~ = 400 V			
10	Measure the mains voltage at connection terminal X4 (outer conductor/neutral conductor): the mains voltage is U~ = 230 V			
11	Check the Phase rotation at connection terminal X1: L1, L2 and L3 clockwise rotation			
12	Disconnect the mains voltage for the rectifier			
13	Resolve any problems identified			
14	Replace the protective cover on the connection panel.			
15	Confirm absence of anomalies preventing UPS start-up.			
Starting UP the UPS				
16	Set the load interrupter switch Q1 to the "OFF" position			
17	**-** Set the manual bypass switch Q29 to position "2 - Service operation".			
18	Connect the mains voltage for the rectifier.			
19	Connect the mains voltage for the bypass circuit			
20	Check status: The bypass is starting up, *the green and yellow LEDs are flashing. LCD: "Main menu" is displayed*			

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Step	Description	Result	Verified by	Date
21	Wait for status: The bypass is ready, *the green LED is flashing. LCD: "Bypass symbol OK" is displayed*			
22	Set the manual bypass switch Q29 to position "1 - Inverter operation". *The green and yellow LEDs flash.*			
23	Set the load interrupter switch Q1 to the "ON" position.			
24	Wait for status: The REC is ready, *the green LED is flashing. LCD: "INV symbol OK" is displayed*			
25	Check the battery cut off breaker voltage and polarity			
26	Close the battery cut off breaker			
27	Press the "~I" key on the HMI. *LCD: "INV symbol" flashes*			
28	Wait for status: Bypass switches to normal operation, *green LED lights up. LCD: "Energy flow display via INV" is displayed*			
29	The first UPS unit is now in operation, repeat the above STEPS to start the second UPS unit.			

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5.4.1.2 Charge And Discharge Battery

Here follows the installed battery type datasheet:

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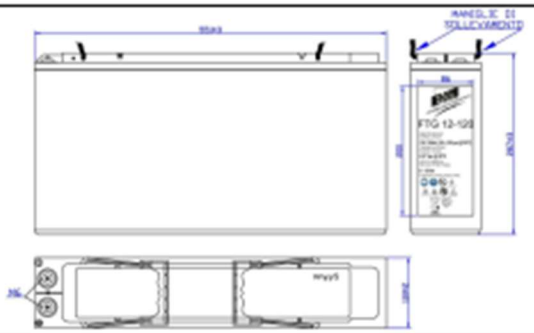
FAAM

FTG 12-120

CARATTERISTICHE DIMENSIONALI

Tensione nominale Capacità nominale (10 ore)		12V 120Ah (1,80Vpc) a 20°C
Dimensioni	Lunghezza Larghezza Altezza totale	551 ±3mm 110 ±2mm 287 ±3mm
Disegno tecnico n°4 00412-0		Peso 42,5 Kg ± 5%
Terminali a vite: M6 femmina Materiale: ottone		

Batteria stazionaria ermetica regolata con valvola
Materiale box: ABS di colore nero
Materiale coperchio: ABS termosaldato di colore nero
Piastre positive tubolari e negative piane a griglia fusa impastata Pb/Ca/Sn
Separatori microporosi ad alta capacità di assorbimento
Tecnologia GEL VRLA attacchi frontali
Vita di progetto: 15 anni (a 20°C)
Norma di riferimento: CEI EN 60896 Parti 21 e 22



Tensione di mantenimento a 20°C 2,27±0,02V/el
Tensione di carica rapida 2,40±0,02V/el
Temperatura di esercizio: 20°C±3°C (raccomandata)
Max temperatura di lavoro: -40°C / 50°C
Coppia di serraggio: 8-10 Nm
Massima corrente di carica permessa: 24A
Massima corrente di scarica: 960A

CARATTERISTICHE ELETTRICHE

Caratteristiche

Capacità	10ore(1,80Vpc fin a 20°C) 8ore(1,75Vpc fin a 20°C) 3ore(1,70Vpc fin a 20°C) 1ora(1,60Vpc fin a 20°C)	120,0 Ah 116,8 Ah 94,2 Ah 73,3 Ah
Influenza della temperatura sulla capacità (10h)	40°C 20°C 0° C	102% 100% 85%
Resistenza interna Ri: 8,8 mΩ ±10%	SCC Icc: 1300 A ±10%	

Tensione di carica	Uso ciclico	Corrente iniziale minore di 24A Tensione 14,4~15,0 V a 20°C Coefficiente di temperatura -30 mV/°C
	Uso standby	Nessun limite sulla corrente di carica iniz. Tensione 13,5~13,8 V a 20°C Coefficiente di temperatura -18mV/°C

Curve di scarica @ 20°C (77 °F)

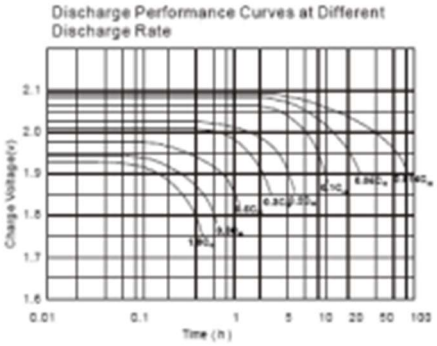


Tabella di scarica a Corrente costante (Amp) e Potenza costante (Watt/elem.) a 20°C

Tempo		30min	60min	120min	180min	300min	600min	1200min
9,6V	A	107,0	73,3	44,5	33,2	22,6	12,8	6,78
	W	197,0	139,0	85,1	64,0	43,9	25,3	13,5
10,2V	A	98,6	68,9	41,6	31,4	21,6	12,4	6,63
	W	185,0	132,0	80,4	61,0	42,3	24,6	13,2
10,8V	A	85,7	61,2	38,3	28,9	20,3	12,0	6,42
	W	164,0	119,0	74,5	56,4	39,9	23,9	12,8

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Step	Description	Result	Verified by	Date
Battery bank FIRST Charging operation (commissioning charge)				
In charger only mode the rectifier is on and charging the battery. There is no output voltage and the load is not supplied.				
This mode can be used to fully charge the battery before operation. This activity will be performed with Vendor Technician.				
Verification of system status for CHARGING:				
30	Perform first full commissioning charge of Battery Bank A with duration 12 hours. N.B. The UPS unit must be recalibrated by vendor filed engineer for the purpose of the test. Commissioning charge voltage seting equal to: .....V With reference to Annex 001 '12h Capacity charge test record' start recording measurements at beginning of charging cycle every 30 minutes. ANNEX 001 12H CAPACITY CHARGE TEST RECORD			
31	Perform first full commissioning charge of Battery Bank B with duration 12 hours. N.B. The UPS unit must be recalibrated by vendor field engineer for the purpose of the test. Commissioning charge voltage seting equal to: .....V With reference to Annex 002 '12h Capacity charge test record' start recording measurements at beginning of charging cycle every 30 minutes. ANNEX 002 12H CAPACITY CHARGE TEST RECORD			
After successful completion of above steps record Battery Bank A and B terminal voltages.				

Step	Description	Result	Verified by	Date
32	Record Battery Bank A Terminal voltage. Record results in: "ANNEX 003 - BEFORE DISCHARGE BANK A"			
33	Record Battery Bank B Terminal voltage. Record results in: "ANNEX 004 - BEFORE DISCHARGE BANK B"			
After successful completion of above steps prepare for Battery Banks Discharge tests.				
Verification for system status for DISCHARGING:				
34	Verify that Batteries are disconnected from UPS, cut off breakers Q0 and Q2 are open.			
35	With vendor field service engineer connect temporary load bank to AC output of UPS.			
36	The Discharge tests will be performed with a constant discharge current of 12,0 A for the duration of the 10h test**.**			
37	Verify that all connections between UPS and temporary Load Bank are correct			
38	Verify and confirm that auxiliary power supply for Load Bank is OK.			
After completion of above verification steps continue with following steps and record results in relevant attached ANNEX documents. Perform each Battery Bank discharge test separately, First Battery Bank A and then Battery Bank B. Records measurements in intervals of 30 minutes. During each measurement record ambient temperature.				
39	Perform discharge of Battery Bank A for 10h. Record results in: "ANNEX 05 - DISCHARGE BANK A"			
40	Perform discharge of Battery Bank B for 10h. Record results in:			

Step	Description	Result	Verified by	Date
	"ANNEX 06 - DISCHARGE BANK B"			
	Battery Re-Charge			
	Verification for system status for CHARGING:			
41	N.B. The UPS unit must now be recalibrated by vendor field engineer to the normal volatge value for the UPS normal operation. UPS'1' Normal Voltage battery charging calibration equal to: .....V UPS'2' Normal Voltage battery charging calibration equal to: V			
42	Proceed with recharging of battery bank A under normal operation UPS '1' charging conditions and monitor periodically battery voltages for a period of 10 h. Confirm normal operation of UPS '1' with no alarms and battery bank A voltages after 10 hours period.			
43	Proceed with recharging of battery bank B under normal operation UPS '2' charging conditions and monitor periodically battery voltages for a period of 10 h. Confirm normal operation of UPS '2' with no alarms and battery bank B voltages after 10 hours period.			

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5.4.2 OT WORKSITE Phase 1 – Tests Notes and Remarks

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5.4.2.1 OTP Worksite Phase 1 - Tests Certifying Authority Table of Attendances

Name and Surname	Certifying Authority	Position	Signature

5.4.2.2 OTP WORKSITE Phase 1 - Tests Final Signatures and Company Acceptance

Name and Surname	Company Representative	Position	Signature

5.4.3 OTP Steps WORKSITE - PHASE 2

It is foreseen that previous sections are successfully performed.

The cabinet UPS is available, and all necessary tests are performed and accepted for that system.
All Cables are pulled up, tested and yard temporary power supply is completed and available.
UPS AC is working in normal operation and no alarm pending.

In the following steps the functionality of UPS shall be tested for:
- SS 83-00: 400V Switchboard SG-200N1 Main power supply feeders
- SS 83-20: 400V Distribution Board DP-200N1 Aux. power supply feeder
- SS 84-20: 230V UPS UP-200F4

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 2 will be performed through permanent power supply feeder arrangements.
PHASE 2 will prove correct:
- Voltage, frequency and phase sequence to the terminals of Incoming 1&2 (Rectifier) and Bypass are according to specification.
- Unit Synchronization
- Powering of one unit at the time will show UPS'1' in normal operation and UPS'2' in stand-by and vice versa.
- Installation and functionality of Battery breakers
- Charging of batteries and battery current
- Inverter output voltage within tolerance
- Functionality of Manual By-pass Switch
- Black start operation
- Output / Distribution as per specification

5.4.3.1 Verify UPS Unit'1'

These steps are required for initial verification of the UPS Unit '1'.

The following power supplies are available:
- Auxiliaries power supply from DP-200N1
- Main power supplies from SG-200N1

Step	Description	Result	Verified by	Date
SS 84-20 UPS SYSTEM INITIAL VERIFICATION				
1	Verify all metallic parts are correctly earthed as per engineering documentation			
2	Verify that all UPS internal circuit breakers and fuses are in the close / on position and UPS healthy with no alarms			

Step	Description	Result	Verified by	Date
3	Verify that the battery cut-off breaker related to Battery Bank 'A' Q2 is in the close / on position			
4	Verify and confirm availability of temporary power supply on main input terminals			

5.4.3.2 Verify UPS UNIT 'BYPASS'

These steps are required for initial verification of the UPS Unit 'By-Pass'.

The following power supplies are available:
- Auxiliaries power supply from DP-200N1
- Main power supplies from SG-200N1

Step	Description	Result	Verified by	Date
SS 84-20 UPS SYSTEM INITIAL VERIFICATION				
5	Verify all metallic parts are correctly earthed as per engineering documentation			
6	Verify that all UPS internal circuit breakers and fuses are in the close / on position			
7	Verify all metallic parts are correctly earthed as per engineering documentation			

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5.4.3.3 Verify UPS UNIT'2'

These steps are required for initial verification of the UPS Unit '2'.

The following power supplies are available:
- Auxiliaries power supply from DP-200N1
- Main power supplies from SG-200N1

Step	Description	Result	Verified by	Date
SS 84-20 UPS SYSTEM INITIAL VERIFICATION				
8	Verify all metallic parts are correctly earthed as per engineering documentation			
9	Verify that all UPS internal circuit breakers and fuses are in the close / on position			
10	Verify and confirm availability of temporary power supply on main input terminals			

5.4.3.4 UPS Functional Tests

Step	Description	Result	Verified by	Date
UPS '1' & '2' and Bypass Functional test				
1.	Confirm that main breaker QF1 on both Incoming 1 & 2 are CLOSED (A6/+05 SG200N1) & (A6/+06 SG200N1)			
2.	Confirm that main breaker QF1 on Bypass is CLOSED (A2/+04 SG200N1)			
3.	Confirm that Battery banks are powered ON, and Battery MCCB box 1&2 are overridden from ESD (selector switch S2 in position Override) and both breakers Q2 are CLOSED			
4.	Confirm there is no alarms present on HMI UPS UP-200F4.			
5.	Breaker status: Q29 – Manual Bypass CLOSED UPS '1' Q1 – CLOSED UPS '2' Q1 – CLOSED UPS '1' Q2 – CLOSED (Battery) UPS '2' Q2 – CLOSED (Battery)			
RECTIFIER A1 OF UPS '1' MAINS FAILURE.				
This check is performed for one unit at a time, starting with unit 1. Afterwards unit 1 is in standby and unit 2 is in normal operation, with load connected of 35kVA.				
6.	Open the MCCB in A6/+05 of SG-200N1 SWBD			
7.	Check the incoming AC voltage on terminals X1: 1U,1V,1W. (Expected Value 0 V) Vin =……V Check the incoming AC current through UPS '1' control panel HMI -A18 (Expected value 0 A): Ain = ……A Check the AC voltage in output on terminals X3: U,V,W (Expected Value 400V) Vout= …….. V Check the output AC current through UPS '1' control panel HMI -A18 (Expect Value Equal to 50 % of Nominal Current): Aout=……A			

Step	Description	Result	Verified by	Date
	Verify the Normal operation of INVERTER A2 of UPS'1' via Battery Bank BAT1.			
RECTIFIER A1 OF UPS '1' MAINS RETURN				
8.	Close the MCCB in A6/+05 of SG-200N1 SWBD			
9.	Check the incoming AC voltage on terminals X1: 1U,1V,1W. (Expected Value 400 V) Vin =……V Check the incoming AC current through UPS '1' control panel HMI -A18 (Expected value Equal to 50% of Nominal Current): Ain = ……A Check the AC voltage in output on terminals X3: U,V,W (Expected Value 400V) Vout= …….. V Check the output AC current through UPS '1' control panel HMI -A18 (Expect Value Equal to 50% of Nominal Current): Aout=……A Verify the Normal operation of INVERTER A2 of UPS'1' via Battery Bank BAT1.			
INVERTER A2 OF UPS '1' FAILURE – Transfer from Inverter UPS'2' PARALLEL OPERATION				
10.	Switch off Inverter A2 via HMI -A18			
11.	Record AC Load Voltage and AC Load current at terminals X3 and UPS'2' terminals X4. Check the AC voltage on terminals X3: U, V, W (Expected Value 400 V) Vout= …… V Check the output AC current through Inverter A2 in UPS '1' control panel HMI -A18 (Expected Value 0 A): Aout=……A Check the AC voltage on terminals X4: U, V, W (Expected Value 400 V) Vout= …… V Check the UPS'2' AC current on control panel HMI -A18 (Expected Value 100% of Nominal Current) Aout=……A			

Step	Description	Result	Verified by	Date
INVERTER A2 OF UPS 1 RESTORATION - Transfer of load from UPS'2' to Inverter				
12.	Switch ON the Inverter A2 via HMI -A18			
13.	Recording of AC Load Voltage and AC Load current at terminals X3 and UPS'2' terminals X4. Check the AC voltage on terminals X3: U,V,W (Expected Value 400 V) Vout= …… V Check the output AC current through Inverter A2 in UPS '1' control panel HMI -A18 (Expected Value 50% of Nominal Current): Aout=……A Check the AC voltage on terminals X4: U, V, W (Expected Value 400 V) Vout= …… V Check the bypass AC current on control panel HMI -A18 (Expected Value 0 A). Aout=……A			

PARALLEL OPERATION UPS1 and UPS2 Switching OFF UPS2 via MCCB of SG200N1				
14.	Open MCB of A6/+05 of the UPS '2' in SG-200N1			
15.	Switch off Inverter A2 of UPS '2' with MCB Q2			
16.	Verify UPS1 takes over 100% Load via HMI -A18: AC Load voltage and AC load current and SBS current by screen shot.			
RECTIFIER A1 OF UPS '2' MAINS FAILURE				
17.	This check is performed for one unit at a time, starting with unit 1. Afterwards unit 2 is in standby and unit 1 is in normal operation, with load connected of 15kVA.			
18.	Open the MCCB in A6/+06 of SG-200N1 SWBD			

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19.	Check the incoming AC voltage on terminals X1: 2U,2V,2W.(Expected Value 0 V) Vin =……V Check the incoming AC current through UPS '2' control panel HMI -A18 (Expected value 0 A) : Ain = ……A Check the AC voltage in output on terminals X3: U,V,W (Expected Value 400V) Vout= …….. V Check the output AC current through UPS '2' control panel HMI -A18 (Expect Value Equal to 50% of Nominal Current): Aout=……A Verify the Normal operation of INVERTER A2 of UPS'1' via Battery Bank BAT2.			
RECTIFIER A1 OF UPS '2' MAINS RETURN				
20.	Close the MCB in A6/+06 of SG-200N1 SWBD			
21.	Check the incoming AC voltage on terminals X1: 2U,2V,2W. (Expected Value 400 V) Vin =……V Check the incoming AC current through UPS '2' control panel HMI -A18 (Expected value 50% of nominal current A) : Ain = ……A Check the AC voltage in output on terminals X3: U,V,W (Expected Value 400V) Vout= …….. V Check the output AC current through UPS '1' control panel HMI -A18 (Expect Value Equal to 50% of Nominal Current): Aout=……A Verify the Normal operation of INVERTER A2 of UPS'2' via Battery Bank BAT2.			
INVERTER A2 OF UPS '2' FAILURE – Transfer from Inverter to UPS'1' PARALLEL OPERATION				
22.	Switch off Inverter A2 via HMI			

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23.	Record AC Load Voltage and AC Load current at terminals X3 and UPS'1' terminals X4. Check the AC voltage on terminals X3: U, V,W (Expected Value 400 V) Vout= …….. V Check the output AC current through Inverter A2 in UPS '2' control panel HMI -A18 (Expected Value 0 A): Aout=……A Check the AC voltage on terminals X4: U, V,W (Expected Value 400 V) Vout= …….. V Check the UPS'1' AC current on control panel HMI -A18 (Expected Value 100% of Nominal Current) Aout=……A			

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INVERTER A2 OF UPS "2" RESTORATION - Transfer of load from UPS"1" to Inverter				
24.	Switch ON the Inverter A2 via HMI			
25.	Recording of AC Load Voltage and AC Load current at terminals X3 and UPS'1' terminals X4. Check the AC voltage on terminals X3: U,V,W (Expected Value 400 V) Vout= …….. V Check the output AC current through Inverter A2 in UPS '2' control panel HMI -A18 (Expected Value 50% of Nominal Current): Aout=……A Check the AC voltage on terminals X4: U, V,W (Expected Value 400 V) Vout= …….. V Check the bypass AC current on control panel HMI -A18 (Expected Value 0 A). Aout=……A			
PARALLEL OPERATION UPS1 AND UPS2 Switchin OFF UPS1 AND UPS2 via MCCB of SG200N1				
26.	Open MCCB of A6/+05 of the UPS '1' in SG-200N1			
27.	Switch off Inverter A2 of UPS '1' with MCB Q2			
28.	Verify UPS '2' takes over 100% Load via HMI-A18: AC Load voltage and AC load current and SBS current by screen shot			
29.	Open MCCB of A6/+06 of the UPS '2' in SG-200N1			
30.	Switch off Inverter A2 of UPS '2' with MCB Q2			
31.	Verify Bypass takes over 100% Load via HMI_A18.			
UPS1 RESTORATION				
32.	Close MCCB of A6/+05 of the UPS'1' in SG200N1			

33.	Switch ON Inverter A2 of UPS'1' with MCB Q2			
UPS2 RESTORATION				
34.	Close the MCCB in A6/+06 of SG-200N1 SWBD			
35.	Switch ON Inverter A2 of UPS'2' with MCB Q2			

5.4.3.5 Black Start Operation

Step	Description	Result	Verified by	Date
Black Start				
With Black Start it is possible to start the system with only the batteries when the rectifier mains and bypass mains are unavailable. UPS is switched OFF at start of this test.				
Verification for system status				
1.	Verify that Rectifier mains breaker(s) Q1 (UPS 1 and UPS 2) for Incoming 1 and Incoming 2 are in: Open position The rectifier main supplies are not available.			
2.	Measure and record battery banks A & B terminal voltages, confirm suitability to perform Black Start procedure, minimum voltage >178,2V: Bank A: …….....……. V Bank B: …….....……. V			
3.	Verify that Bypass mains input breaker Q10 is in: Open position			

Step	Description	Result	Verified by	Date
	The bypass main supply is not available			
4.	Verify that Output breaker(s) Q31, Q32, Q33,Q34,Q35,Q36,Q37,Q38,Q39,Q40, Q41,Q42,Q43,Q44,Q45,Q46, Q47are in: Open position Consumers must be volt free			
Black Start procedure				
IMPORTANT: The DC capacitors must be charged before connecting the load to the batteries.				
5.	BLACK START UPS'1' With reference to battery cut off breaker enclosures (CB-200F4A/CB-200F4B) locate the following: - Selector switch S1 ON-OFF - Selector switch S2 NORMAL-OVERRIDE			
6.	Rotate selector switch S2 from position NORMAL to position OVERRIDE (ESD healthy signal not available).			
7.	Rotate the selector switch S1 from position OFF to position ON (shunt resistor internally connected to enable precharging of UPS capacitors)			
8.	Confirm power up of UPS'1' controller HMI -A18 within 10 seconds of rotated selector switch S1 to ON position			
9.	When, and only when the controller HMI -A18 will be powered up proceed to close battery cut off breaker Q2.			
10.	The inverter A2 will now be operational and AC output voltage available for essential loads. Proceed to close the followings MCBs: Q31,Q32,Q33,Q34,Q35,Q36,Q37,Q38, Q39,Q40,Q41,Q42,Q43,Q44,Q45,Q46, Q47			
11.	Once essential loads will be operational and platform operational status normal it will be possible to reset the black start scenario.			

Step	Description	Result	Verified by	Date
12.	With reference the battery cut off breaker enclosure CB-200F4A rotate the selector switches as follows: - Selector switch S1 OFF - Selector switch S2 NORMAL			
13.	The battery cut off breaker should remain closed and connected as per normal UPS operation.			
14.	BLACK START UPS'2' With reference to battery cut off breaker enclosures (CB-200F4A/CB-200F4B) locate the following: - Selector switch S1 ON-OFF Selector The inverter A2 will now be operational and AC output voltage available for essential loads switch S2 NORMAL-OVERRIDE			
15.	Rotate selector switch S2 from position NORMAL to position OVERRIDE (ESD healthy signal not available).			
16.	Rotate the selector switch S1 from position OFF to position ON (shunt resistor internally connected to enable precharging of UPS capacitors)			
17.	Confirm power up of UPS'2' controller HMI -A18 within 10 seconds of rotated selector switch S1 to ON position			
18.	When, and only when the controller HMI -A18 will be powered up proceed to close battery cut off breaker Q2.			
19.	The inverter A2 will now be operational and AC output voltage available for essential loads.			
20.	Proceed to close the followings MCBs: Q31,Q32,Q33,Q34,Q35,Q36,Q37,Q38, Q39,Q40,Q41,Q42,Q43,Q44,Q45,Q46, Q47			
21.	Once essential loads will be operational and platform operational status normal it			

Step	Description	Result	Verified by	Date
	will be possible to reset the black start scenario.			
22.	With reference the battery cut off breaker enclosure CB-200F4B rotate the selector switches as follows: - Selector switch S1 OFF - Selector switch S2 NORMAL			
23.	The battery cut off breaker should remain closed and connected as per normal UPS operation.			

5.4.3.6 OTP Worksite Phase 2 Tests Notes and Remarks

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5.4.3.7 OTP Worksite Phase 2 - Tests Certifying Authority Table of Attendances

Name and Surname	Certifying Authority	Position	Signature

5.4.3.8 OTP WORKSITE Phase 2 - Tests Final Signatures and Company Acceptance

Name and Surname	Company Representative	Position	Signature

5.4.4 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 UPS and SIS hardwired and via Modbus TCP-IP between PCS and UPS.

All I/O signals were tested and recorded through dedicated ITR-B precommissioning check sheets.
Verify and confirm that all related check sheets have been performed successfully.

5.4.5 Test Preparation

Verification of systems UPS UP-200F4.
All systems and subsystems involved in this procedure must be ready for commissioning and available.

To perform the signals test is mandatory that 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.

5.4.5.1 UPS UP-200F4 - I/O Instrumental I/O list

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

Following I/O signals groups List to be verified.

This I/O list concern the alarm, feedback and command reading.

Cabinet	FROM	SIGNAL_DESCRIPTION	TYPE ANALOG/DIGITAL	TERMINALS	Note
BOX BATTERY	SIS (ESD)	Disconnect AC UPS UP-200F4 Battery A	DO	XS008A	0 TRIP
BOX BATTERY		Disconnect AC UPS UP-200F4 Battery B	DO	XS008B	0 TRIP
UPSA/B		Battery room fan fault-charge inhibit	DO	X4/1-2	0 INIBIT

Step	Description	Result	Verified by	Date
1	Confirm correct and positive result of pre-commissioning Check Sheet for above signals I/O list, Correct and positive results……☐			

5.4.5.2 UPS UP-200F4 - I/O Modbus TCP-IP list

With reference all register Modbus TCP-IP for PCS system, it attached the Modbus status list

Alarms:
Read: Fct.-Code 3 (Read Holding Register) or Fct.-Code 4 (Read Input Register)

Reg.	Bit no.	Type	Name	Description (1=active)	
2	0	WORD	NonCriticalFault	W: Collective warning	
3	0	WORD	CriticalFault	A: Collective alarm	
4	0	WORD	Userdef_DigIn1Active	W:	"O"
5	0	WORD	Userdef_DigIn2Active	W:	"O"
6	0	WORD	Userdef_DigIn3Active	W:	"O"
7	0	WORD	EmergencySwitchOff	A: UPS output off	"O"
8	0	WORD	DouCanFault	W: DOU CAN fault	
9	0	WORD	MainsFault	W: Rectifier/bypass mains fault	
10	0	WORD	RectifierWarning	W: Rectifier warning	
11	0	WORD	RectifierFault	A: Rectifier fault	
12	0	WORD	BatteryAlarm	A: Battery fault	
13	0	WORD	InverterWarning	W: Inverter warning	
14	0	WORD	InverterFault	A: Inverter fault	
15	0	WORD	SBSWarning	W: Bypass warning	
16	0	WORD	SBSFault	A: Bypass fault	
17	0	WORD	EqualisingCharge	I: Charger status – equalising charging	
18	0	WORD	Charge	I: Charger status – charging	
19	0	WORD	TrickleCharge	I: Charger status – trickle charging	
20	0	WORD	GenSetOperation	I: Charger status: Em. power supply	"O"
21	0	WORD	BattTemp.SensFault	W: Battery temp. sensor	"O"
22	0	WORD	BatteryTemp.ToHigh	W: Battery temp. too high	"O"
23	0	WORD	CircuitBreaker	W: Circuit-breaker tripped	"O"
24	0	WORD	BatteryWarning	W: Battery warning	
25	0	WORD	BatteryLow	W: Battery undervoltage	
26	0	WORD	Overload	W: Inverter overload	
27	0	WORD	FanFault	W: Fan fault	
28	0	WORD	Overload	A: Inverter overload	
29	0	WORD	ShortCircuit	A: Inverter short-circuit	
30	0	WORD	DcUnderVoltage	A: Inverter DC undervoltage	
31	0	WORD	DcOverVoltage	A: Inverter DC overvoltage	
32	0	WORD	PowerStackOverTemp	A: Inverter stack fault	
33	0	WORD	SBSReady	I: Bypass ready	
34	0	WORD	SBSMainsFault	W: Bypass mains fault	
35	0	WORD	SBSBlocked	W: Bypass blocked	
36	0	WORD	RectifierOn	I: Rectifier on	
37	0	WORD	InverterOn	I: Inverter on	
38	0	WORD	SBSOn	I: Bypass on	

Table 5: Modbus TCP-IP PCS

Step	Description	Result	Verified by	Date
2	Confirm correct and positive result of pre-commissioning Check Sheet for above signals I/O list, Correct and positive results. ……..☐			

5.4.5.3 OTP WORKSITE Phase 3 - Tests Notes and Remarks

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5.4.5.4 OTP WORKSITE Phase 3 - Tests Certifying Authority Table of Attendances

Name and Surname	Certifying Authority	Position	Signature

5.4.5.5 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 Completion System.

6 OTP AT OFFSHORE SITE

6.1 Planning and Manpower

6.1.1 Offshore Site overview

It is expected that all pre-commissioning 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 UPS system, will allow for a smoother commissioning phase of the offshore SITE.
The systems and subsystems involved:

- 88-00: Earthing System
- 84-20: UPS System UP-200F4
- 83-00: 400V Switchboard SG-200N1
- 83-20: 400V Distribution board DP-200N1
- 79-00: SIS (ESD)
- 87-10: Process Control System (PCS)
- 86-00: Data Network - MODBUS RTU Network Switchboard Medium Voltage 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)
- Phases sequence tester
- Portable

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 3W document 1723002197-COM-LIS-00052 "Commissioning and operation Spare Parts Index Register" regarding the UPS spare parts.

Item Number	Total number of identical spares installed	Description of recommended spare parts	Parts Project Datasheet no.
	7	8	9
1	36	FUSE 6,3 X 32 F5A 500VAC	1724000372-EL-DS-00005
2	16	G-FUSE 6,3 X 32 F4A 440V KTA/UL	1724000372-EL-DS-00005
3	4	FUSE 6,3 X 32 T8A 500VAC KTA	1724000372-EL-DS-00005
4	4	G-FUSE 6,3 X 32 M2A 500V	1724000372-EL-DS-00005
5	4	619 ADD. REMOTE SIGNAL. OPTION-2 F UPS	1724000372-EL-DS-00005
6	4	261 SBS INTERFACE P8 3-PHASE	1724000372-EL-DS-00005
7	4	261 INVERTER INTERFACE P8 3-PHASE	1724000372-EL-DS-00005
8	4	261 RECTIFIER INTERFACE P8	1724000372-EL-DS-00005
9	32	FUSE CER. 5 X 20 T3,15A 250VAC	1724000372-EL-DS-00005
10	8	CYL. FUSE 5 X 20 2,5A SP 380V S	1724000372-EL-DS-00005
11	2	PCB EQUIP. GCAU V3 VERNISH	1724000372-EL-DS-00005
12	2	PCB RELAY PROTECT RCS VARNISH	1724000372-EL-DS-00005

Table 6: SPARE PART LIST

6.2.7 Temporary Facilities

- Not applicable

6.3 OTP Description – SITE

In 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.
NOTE: When it's confirmed the availability of permanent 66kV high voltage, the temporary power supply from the Temporary Diesel Generator will be removed. A final check on the correct functioning of the UPS system will be performed when BLPH will be energized via the permanent high voltage supply.

N.B.: Kindly note that this procedure this note 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
1	System Ready for Operation Certificate (RFO) from WORKSITE Phase is issued and approved.			
2	No blocking punch list items are outstanding against the system to be commissioned.			
3	System(s), (de)isolations as per LOTO procedure enclosed within commissioning Work Permits procedures prepared and approved			
4	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			
5	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).			
6	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: UP-200F4 230V AC UPS SG-200N1 Main Switchboard DP-200N1 Distribution board			
7	Check that areas are free for work and escape routes are clear of any obstructions.			
8	Ensure that proper communications have been established between parties involved in the implementation of the procedure.			
9	Verify availability of test equipment and consumables as per chapters 6.2.4.			
10	Verify and confirm that the Temporary Diesel Generator is ready to start, that the diesel fuel tank is full.			
11	All personnel have been duly notified during dedicated daily SIMOPS meetings that the system(s) is ready for commissioning.			

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6.3.2 Electrical Preparation

Step	Description	Result	Verified by	Date
12	No blocking punch list items are outstanding against the system to be commissioned.			
13	Review and confirm no changes are required to be performed on existing protection settings.			
14	Verify and confirm that the Temporary Diesel Generator power cables connections have been tested with correct phase rotation before sail away. 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
15	No blocking punch list items are outstanding against the system to be commissioned.			
16	Verify that all relevant associated control and protection systems / subsystems are ready.			
17	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 UPS System.

In the next steps, the functionality of the UPS system will be tested:

- SS 84-20:230V UPS SYSTEM

6.4.1 Test Preparation

Verification of system and subsystem UPS.
Conduct system walkdown and thorough visual inspection of all related components.
Confirm no impediment to proceed with energization.

6.4.2 Energization of UPS UP-200F4.

Step	Description	Result	Verified by	Date
UPS "1" & "2" and Bypass Functional test				
1	Confirm that diesel generator power supply is energized to upstream switchboard SG-200N1.			
2	Set the load interrupter switch Q1 to the "OFF" position			
3	**-** Set the manual bypass switch Q29 to position "2 - Service operation".			
4	Connect the mains voltage for the rectifier.			
5	Connect the mains voltage for the bypass circuit			
6	Check status: The bypass is starting up, *the green and yellow LEDs are flashing. LCD: "Main menu" is displayed*			
7	Wait for status: The bypass is ready, *the green LED is flashing. LCD: "Bypass symbol OK" is displayed*			
8	Set the manual bypass switch Q29 to position "1 - Inverter operation". *The green and yellow LEDs flash.*			
9	Set the load interrupter switch Q1 to the "ON" position.			
10	Wait for status: The REC is ready, *the green LED is flashing. LCD: "INV symbol OK" is displayed*			
11	Check the battery cut off breakersvoltage and polarity			
12	Locate selector switche S2			
13	Rotate selector switch S2 from position NORMAL to position OVERRIDE (ESD healthy signal not available at this time).			
14	Close the battery cut off breaker Q2			
15	Press the "~I" key on the HMI. *LCD: "INV symbol" flashes*			
16	Wait for status: Bypass switches to normal operation, *green LED lights up. LCD: "Energy flow display via INV" is displayed*			

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Step	Description	Result	Verified by	Date
17	The first UPS unit is now in operation, repeat the above STEPS to start the second UPS unit.			
18	Proceed to close on board MCBs to energize BLPH essential loads.			
19	Once ESD protection system will be operational, deactivate battery cut-off breakers override via switch S2, consequently confirm correct UPS start-up with out any alarms.			

6.4.3 OTP SITE Tests Notes and Remarks

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6.4.4 OTP SITE Tests Certifying Authority Table of Attendances

Name and Surname	Certifying Authority	Position	Signature

6.4.5 OTP SITE - Tests Final Signatures and Company Acceptance

Name and Surname	Company Representative	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.

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7 APPENDICES

7.1 Vendor SAT Procedure

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7.2 Proverlis Summary System Reports

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7.3 Equipment Related Technical Queries

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7.4 As Built Documentation

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

7.6 ANNEX CHARGE-DISCHARGE BATTERY RECORDS

7.6.1 ANNEX 001 12h CAPACITY CHARGE TEST RECORD

CROSSWIND BLPH PROJECT - COMMISSIONING PROCEDURE OF UPS SYSTEM UP-200F4 15kVA

UP-200F4 [ANNEX001]
SUBSYSTEM 84-20: BATTERY FIRST CHARGE RECORD SHEET DURATION 12HOURS

BATTERY 'A' RACK' UPS-BAT-1A | 12h CAPACITY CHARGE TEST RECORD

N° Hours	0,30	1,00	1,30	2,00	2,30	3,00	3,30	4,00	4,30	5,00	5,30	6,00	6,30	7,00	7,30	8,00	8,30	9,00	9,30	10,00	10,30	11,00	11,30	12,00	Note:
Time (hh:mm)																									
Charge Voltage (V)																									14,4 V ÷15,0 V at 20°C V
Charge Current (A)																									INITIAL CHARGING CURRENT < 72A .....A
Ambient Temp. (°C)																									
Battery Cell Temp. (°C)																									
Battery N°	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	
11																									FAAM BATTERY,TYPE FTG 12-360 Ah
12																									FAAM BATTERY,TYPE FTG 12-360 Ah
13																									FAAM BATTERY,TYPE FTG 12-360 Ah
14																									FAAM BATTERY,TYPE FTG 12-360 Ah
15																									FAAM BATTERY,TYPE FTG 12-360 Ah
16																									FAAM BATTERY,TYPE FTG 12-360 Ah
17																									FAAM BATTERY,TYPE FTG 12-360 Ah
18																									FAAM BATTERY,TYPE FTG 12-360 Ah
TERMINAL VOLT. n.1°n.18																									

Table 7: DATA RECORD SHEET CHARGE BATTERY BANK A

7.6.2 ANNEX 002 12h CAPACITY CHARGE TEST RECORD

CROSSWIND BLPH PROJECT - COMMISSIONING PROCEDURE OF UPS SYSTEM UP-200F3 35kVA

UP-200F4 [ANNEX002]
SUBSYSTEM 84-20: BATTERY FIRST CHARGE RECORD SHEET DURATION 12HOURS

BATTERY 'B' RACK' UPS-BAT-1B | 12h CAPACITY CHARGE TEST RECORD

N° Hours	0,00	0,30	1,00	1,30	2,00	2,30	3,00	3,30	4,00	4,30	5,00	5,30	6,00	6,30	7,00	7,30	8,00	8,30	9,00	9,30	10,00	10,30	11,00	11,30	12,00	Note:
Time (hh:mm)																										
Charge Voltage (V)																										14,4 V ÷15,0 V at 20°C .....
Charge Current (A)																										INITIAL CHARGING CURRENT < 72A ..
Ambient Temp. (°C)																										
Battery Cell Temp. (°C)																										
Battery N°	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	
11																										FAAM BATTERY,TYPE FTG 12-360
12																										FAAM BATTERY,TYPE FTG 12-360
13																										FAAM BATTERY,TYPE FTG 12-360
14																										FAAM BATTERY,TYPE FTG 12-360
15																										FAAM BATTERY,TYPE FTG 12-360
16																										FAAM BATTERY,TYPE FTG 12-360
17																										FAAM BATTERY,TYPE FTG 12-360
18																										FAAM BATTERY,TYPE FTG 12-360
TERMINAL VOLT. n.1°n.18																										

Table 8: DATA RECORD SHEET CHARGE BATTERY BANK B

7.6.3 ANNEX 003 BEFORE DISCHARGE

CROSSWIND

CROSSWIND BLPH PROJECT - COMMISSIONING PROCEDURE OF UPS SYSTEM UP-200F4 15kVA

ROSETTI MARINO

UP-200F4 [ANNEX 003]
SUBSYSTEM 84-20: BATTERY CHARGE / DISCHARGE RECORD SHEET

EQUIPMENT	BATTERY 'A' RACK UP-200F4	TEST MEASUREMENT:	ANNEX 003: BEFORE DISCHARGE

BATTERY BANK A TERMINAL VOLTAGE
AMBIENT TEMPERATURE .....°C BATTERY TEMPERATURE .....°C

CELL N°	TAG UTILITY / TYPE	MANIFACTURER	MODEL	LOCATION	VOLTAGE (V)	DATE	TIME	REMARKS
1	FAAM,TYPE FTG 12-120 Ah							
2	FAAM,TYPE FTG 12-120 Ah							
3	FAAM,TYPE FTG 12-120 Ah							
4	FAAM,TYPE FTG 12-120 Ah							
5	FAAM,TYPE FTG 12-120 Ah							
6	FAAM,TYPE FTG 12-120 Ah							
7	FAAM,TYPE FTG 12-120 Ah							
8	FAAM,TYPE FTG 12-120 Ah							
9	FAAM,TYPE FTG 12-120 Ah							
10	FAAM,TYPE FTG 12-120 Ah							
11	FAAM,TYPE FTG 12-120 Ah							
12	FAAM,TYPE FTG 12-120 Ah							
13	FAAM,TYPE FTG 12-120 Ah							
14	FAAM,TYPE FTG 12-120 Ah							

BB-000-5-2B

Table 9: DATA RECORD SHEET BEFORE DISCHARGE BATTERY BANK A

7.6.4 ANNEX 004 BEFORE DISCHARGE

CROSSWIND

CROSSWIND BLPH PROJECT - COMMISSIONING PROCEDURE OF UPS SYSTEM UP-200F4 15kVA

ROSETTI MARINO

UP-200F4 [ANNEX 004]

SUBSYSTEM 84-20: BATTERY CHARGE / DISCHARGE RECORD SHEET

EQUIPMENT	BATTERY 'B' RACK UP-200F4	TEST MEASUREMENT:	ANNEX 004: BEFORE DISCHARGE

BATTERY BANK B TERMINAL VOLTAGE

AMBIENT TEMPERATURE .....°C BATTERY TEMPERATURE .....°C

CELL N°	TAG UTILITY / TYPE	MANIFACTURER	MODEL	LOCATION	VOLTAGE (V)	DATE	TIME	REMARKS
44	FAAM,TYPE FTG 12-120 Ah							
45	FAAM,TYPE FTG 12-120 Ah							
46	FAAM,TYPE FTG 12-120 Ah							
47	FAAM,TYPE FTG 12-120 Ah							
48	FAAM,TYPE FTG 12-120 Ah							
49	FAAM,TYPE FTG 12-120 Ah							
50	FAAM,TYPE FTG 12-120 Ah							
51	FAAM,TYPE FTG 12-120 Ah							
52	FAAM,TYPE FTG 12-120 Ah							
53	FAAM,TYPE FTG 12-120 Ah							
54	FAAM,TYPE FTG 12-120 Ah							
55	FAAM,TYPE FTG 12-120 Ah							
56	FAAM,TYPE FTG 12-120 Ah							
57	TERMINAL VOLT. n.37~n.54							

Table 10: *DATA RECORD SHEET BEFORE DISCHARGE BATTERY BANK B*

7.6.5 ANNEX 005 BATTERY DISCHARGE TEST RECORD WITH APPLIED LOAD RESISTIVE BANK

CROSSWIND BLPH PROJECT - COMMISSIONING PROCEDURE OF UPS SYSTEM UP-200F4 15kVA

UPS UP-200F4 [ANNEX 005]
SUBSYSTEM 84-20: BATTERY DISCHARGE RECORD SHEET

BATTERY 'A' RACK' UPS-BAT-1A | 10h CAPACITY DISCHARGE TEST RECORD WITH APPLIED RESISTIVE LOAD BANK

N° Hours	0,00	0,30	1,00	1,30	2,00	2,30	3,00	3,30	4,00	4,30	5,00	5,30	6,00	6,30	7,00	7,30	8,00	8,30	9,00	9,30	10,00	Note:
Time (hh:mm)																						
Discharge Power (W)																						255W ..... W
Discharge Current (A)																						19,120A. ..... A
Ambient Temp. (°C)																						
Battery Cell Temp. (°C)																						
Battery Cell N°	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	
1																						
2																						
3																						
4																						
5																						
6																						
7																						
8																						
9																						

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Table 11: DATA RECORD SHEET DISCHARGE BATTERY BANK A

7.6.6 ANNEX 006 BATTERY DISCHARGE TEST RECORD WITH APPLIED LOAD RESISTIVE BANK

CROSSWIND BLPH PROJECT - COMMISSIONING PROCEDURE OF UPS SYSTEM UP-200F4 15kVA

UPS UP-200F4 [ANNEX 005]
SUBSYSTEM 84-20: BATTERY DISCHARGE RECORD SHEET

BATTERY 'B' RACK' UPS-BAT-1B | 10h CAPACITY DISCHARGE TEST RECORD WITH APPLIED RESISTIVE LOAD BANK

N° Hours	0,00	0,30	1,00	1,30	2,00	2,30	3,00	3,30	4,00	4,30	5,00	5,30	6,00	6,30	7,00	7,30	8,00	8,30	9,00	9,30	10,00	Note:
Time (hh:mm)																						
Discharge Power (W)																						256W ..... W
Discharge Current (A)																						19,20A. ..... A
Ambient Temp. (°C)																						
Battery Cell Temp. (°C)																						
Battery Cell N°	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	
1																						
2																						
3																						
4																						
5																						
6																						
7																						
8																						
9																						

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Table 12: *DATA RECORD SHEET DISCHARGE BATTERY BANK B*