Base Load Power Hub (BLPH)

BLPH START-UP PROCEDURE

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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.

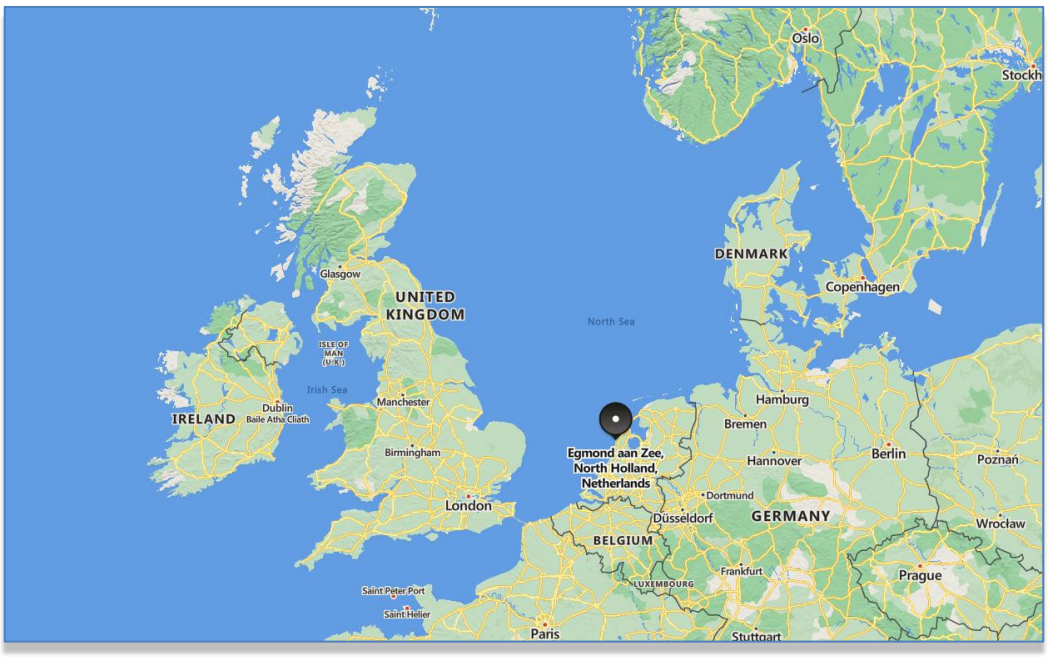


Figure 1 - HOLLANDSE KUST NOORD WIND PARK Location Map

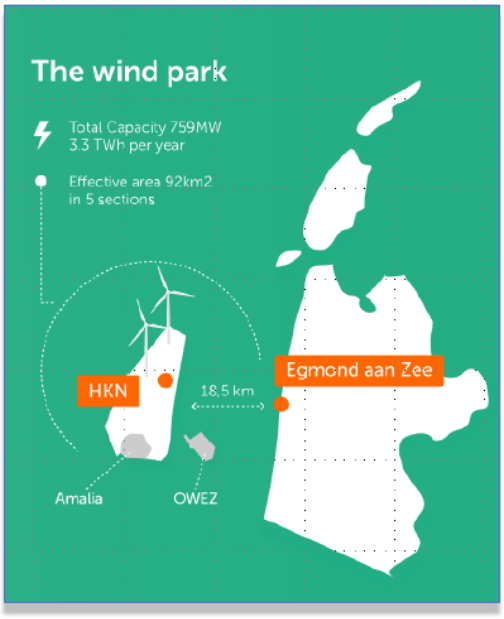


Figure 2 - Wind Park Details

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.

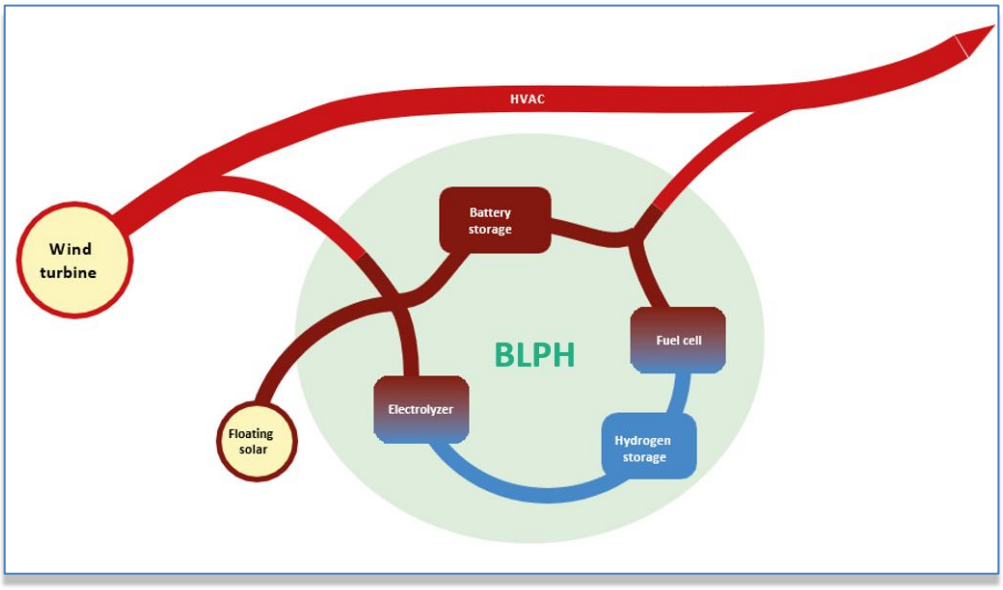


Figure 3 – BLPH Concept

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.

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2 DOCUMENT SCOPE

The purpose of this document is to provide the sequence of actions required to ensure a safe and controlled start-up of the Base Load Power Hub platform.

The document will assume that the platform has reached final completion status "As Constructed" and "As Commissioned" at the end of the worksite phase at Rosetti Marino's fabrication yard in Italy.

The final yard completion status of all Operation Test Procedures is summarised in table 01.

OTP FINAL COMPLETION STATUS		
Rosett Marino Doc. Number	**Document Title**	**FINAL COMPLETION STATUS**
123A90-PML-COM-PRO-03019	OTP - ONSHORE INTEGRATED TEST	COMPLETED
123A90-PML-COM-PRO-03036	OTP - BLACK START	COMPLETED
123A90-PML-COM-PRO-03038	Leak test procedure	COMPLETED
123A90-PML-COM-PRO-03041	OTP - Hydrogen Storage & Venting Systems	COMPLETED
123A90-PML-COM-PRO-03042	OTP - Sea Water Intake & Fresh Water Treatment Systems	COMPLETED
123A90-PML-COM-PRO-03043	OTP - Instrument Air Systems	COMPLETED
123A90-PML-COM-PRO-03055	OTP - Nitrogen generation system	COMPLETED
123A90-PML-COM-PRO-03045	OTP - HV Switchgear & 66 kV Transformer Systems	*PARTIAL*
123A90-PML-COM-PRO-03046	OTP - MV Switchgear & 6.6 kV Transformer Systems	COMPLETED
123A90-PML-COM-PRO-03047	OTP - LV Switch Boards & LV Distribution Board Systems	COMPLETED
123A90-PML-COM-PRO-03050	OTP - DC UPS System 10kVA UP-200F1	COMPLETED
123A90-PML-COM-PRO-03059	OTP - AC UPS System 35kVA UP-200F3	COMPLETED
123A90-PML-COM-PRO-03060	OTP - AC UPS System 15kVA UP-200F4	COMPLETED
123A90-PML-COM-PRO-03051	OTP - Data Network Systems	COMPLETED
123A90-PML-COM-PRO-03053	OTP - Navaid System	COMPLETED
123A90-PML-COM-PRO-03054	OTP - F&G and ESD C&E Logics	COMPLETED
123A90-PML-COM-PRO-03063	OTP - BESS	COMPLETED
123A90-PML-COM-PRO-03061	OTP - Electrolyser	COMPLETED
123A90-PML-COM-PRO-03062	OTP – Fuel Cell	COMPLETED

Table 1: OTP Final Yard Completion Status

3 SUMMARY

3.1 Test Objective

The BLPH Start Up Procedure will provide the elementary operations required to ensure readiness for operation of the main equipment Utilities and CPI packages according to the following sequence:

- SS 77-30 HVAC UPS Equipment Room B-300
- SS 77-40 HVAC I&T Equipment Room B-400
- SS 77-10 HVAC HV/MV Switchgear Room B-100
- SS 77-20 HVAC LV Switchgear Room B-200
- SS 63-00 Instrument Air Package (A-63000)
- SS 63-30 Instrument Air Distribution Network
- SS 64-00 Nitrogen Generator Package (A-64000)
- SS 64-10 Nitrogen Distribution Network
- SS 50-10 Water Desalination Package & Distribution
- SS 55-00 Waste Water Disposal (a temporary tank will be required at an onshore location)
- SS 55-01 Waste Water Brine Discharge System (a temporary tank will be required at an onshore location)
- SS 56-11 Non-Hazardous Open Drain Collection (a suitable drain will be required at an onshore location)
- SS 25-01 Hydrogen Storage Vessel A (V-25001A)
- SS 25-02 Hydrogen Storage Vessel B (V-25001B)
- SS 25-03 Hydrogen Storage Vessel C (V-25001C)
- SS 25-04 Hydrogen Storage Vessel D (V-25001D)
- SS 25-05 Hydrogen Storage Vessel E (V-25001E)
- SS 25-06 Hydrogen Storage Vessel F (V-25001F)
- SS 25-07 Hydrogen Storage Vessels Header (Inlet)
- SS 25-08 Hydrogen Storage Vessels Header (Outlet)
- SS 43-00 Hydrogen Vent Header & Drum System
- SS 20-00 Electrolyser Package (A-20000)
- SS 80-00 Hydrogen Fuel Cell Package (A-80000)
- SS 85-00 BESS Package (A-85000)
- SS 72-00 NAVAID

It should be noted that energisation and operational readiness the electrical, control and safety systems will have been performed in advance in accordance with the Black Start procedure, ref. doc. n. 123A90-PML-COM-PRO-03036.

Consequently, the following subsystems' items of equipment are assumed to be already in service and will not be included within the BLPH Start Up Procedure:

- SS 70-00 F&G Control System
- SS 70-10 F&G Devices: FZ-01 Fuel Cell Area
- SS 70-11 F&G Devices: FZ-02 Hydrogen Vessels Storage Area
- SS 70-12 F&G Devices: FZ-03 Electrolyser Area
- SS 70-13 F&G Devices: FZ-04 B-200 LV Switchgear Room
- SS 70-14 F&G Devices: FZ-04 B-300 UPS & Batteries Switch room
- SS 70-15 F&G Devices: FZ-04 B-400 I&T Equipment Room
- SS 70-16 F&G Devices: FZ-05 BESS & Water Treatment Area
- SS 70-17 F&G Devices: FZ-06 B-100 HV Switch Room Area

- SS 77-10 HVAC HV/MV Switchgear Room B-100 (only technical room internal lighting)
- SS 77-20 HVAC LV Switchgear Room B-200 (only technical room internal lighting)
- SS 77-30 HVAC UPS Equipment Room B-300 (only technical room internal lighting)
- SS 77-40 HVAC I&T Equipment Room B-400 (only technical room internal lighting)
- SS 79-00 Emergency Shutdown Systems (SIS)
- SS 79-10 Emergency Shutdown Systems (SIS): Electrical Systems
- SS 79-11 Emergency Shutdown Systems (SIS): Fuel Cell Area
- SS 79-12 Emergency Shutdown Systems (SIS): Electrolyser Area
- SS 79-13 Emergency Shutdown Systems (SIS): B-400 I&T Equipment Room External
- SS 79-14 Emergency Shutdown Systems (SIS): B-100 HV/MV Switchroom Area External
- SS 82-00 6.6 kV Switchboard (SG-100D1)
- SS 82-10 Power Transformer 1.25 MVA (1BT1 BESS)
- SS 82-20 Power Transformer 3.15 MVA (T4 ELECTROLYSER)
- SS 82-30 Power Transformer 1.25 MVA (TA30 FUEL CELL)
- SS 82-40 Power Transformer 1.6 MVA (TR-200DE1)
- SS 83-00 400 V Switchboard & Connection Box (SG-200N1)
- SS 83-20 400/230 V Switchboard (DP-200N1)
- SS 83-35 Emergency Lighting: Upper Deck
- SS 83-36 Emergency Lighting: Lower Deck
- SS 83-37 Emergency Lighting: Stairs
- SS 83-40 Normal Lighting: Upper Deck
- SS 83-41 Normal Lighting: Lower Deck
- SS 83-42 Normal Lighting: Stairs East
- SS 83-43 Normal Lighting: Stairs West
- SS 83-75 Temporary Diesel Generator
- SS 84-00 DC 10 kVA UPS System (UP-200F1)
- SS 84-10 AC 35 kVA UPS System (UP-200F3)
- SS 84-20 AC 15 kVA UPS System (UP-200F4)
- SS 86-00 Data Networks
- SS 87-00 Electrical Monitoring & Control System (EMCS)
- SS 87-10 Process Control System (PCS)
- SS 87-50 OER & CCR ONSHORE

3.2 System Boundary Limits

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

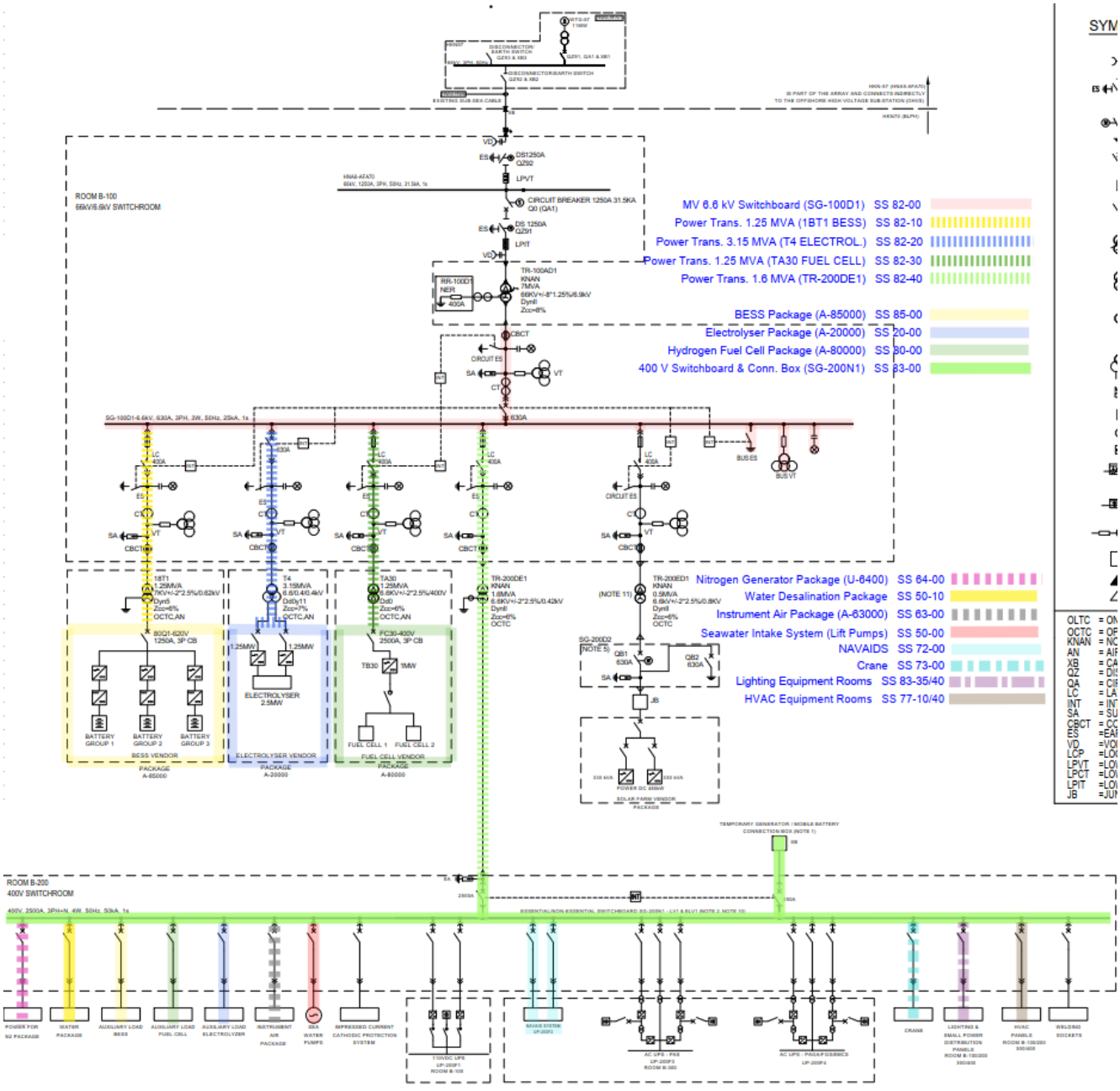


Figure 4 – *BLPH Startup SLD System Boundary Limits*

Reference is also made to the BLPH Flow Diagram detailing the high-level interactions between the main equipment packages, hydrogen storage and platform boundary limits.

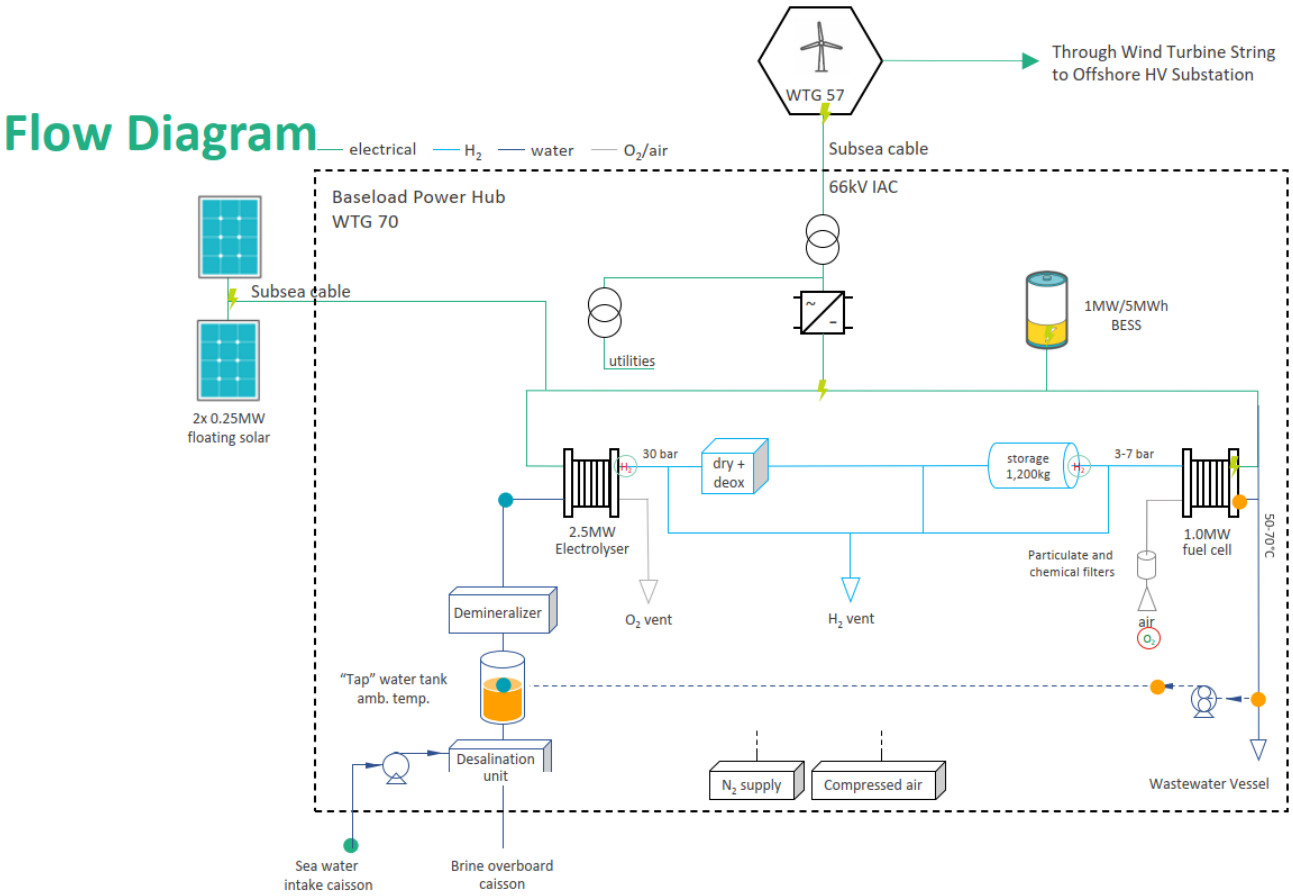


Figure 5 – BLPH Flow Diagram

3.3 Safety Devices

During startup operations, there will be a daily necessity for the operations team to be present on both lower and upper decks to check and maintain all equipment and packages in normal operation.

- Appropriate Personnel Protective Equipment (PPE) and safety equipment e.g., antistatic clothing, safety shoes, hand gloves, helmet, glasses, earplugs etc. are to be available and must be used in line with the site requirements,
- For Arc Flash Risk Category to be considered 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 in accordance with final engineering design,
- All personnel authorised to access the BLPH must be equipped with individual hydrogen gas sensors and ATEX rated radio communication devices (use of cellular mobile phones will not be permitted).

3.4 HSE Management

All necessary safety precautions must be taken to avoid any risk for personnel injury.
During startup operations, safety checks will also be foreseen on a daily basis, e.g. H2 sniffing tests on related flanged joints.

- All personnel involved in this start up procedure 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 with specific PTW,
- Conduct daily "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 approved "Permit to Work" system,
- Electrical and mechanical isolations are to be assured as and when necessary,
- Ensure that the working area is clean, tidy, well illuminated and that access and escape routes are free from obstructions.

Before energising and starting up on any of the BLPH packages 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 all parties involved,
- Review any relevant specific Vendor documentation for the equipment covered by this procedure and observe 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).

4 DOCUMENTS REFERENCES AND ABBREVIATIONS

4.1 Reference Documents

4.1.1 Related Project Engineering Deliverables

Document ID	Document Title
[1] 123A90-PML-PM-LIS-01001	MASTER DOCUMENT REGISTER
[2] 123A90-DDL-PR-PID-80009	BLPH PIPING AND INSTRUMENTATION DIAGRAM GENERAL NOTES
[3] 123A90-DDL-PR-PID-80010	BLPH PIPING AND INSTRUMENTATION DIAGRAM PIPING SYMBOLOGY
[4] 123A90-DDL-PR-PID-80011	BLPH PIPING AND INSTRUMENTATION DIAGRAM ELECTROLYSER PACKAGE
[5] 123A90-DDL-PR-PID-80012	BLPH PIPING AND INSTRUMENTATION DIAGRAM FUEL CELL PACKAGE
[6] 123A90-DDL-PR-PID-80013	BLPH PIPING AND INSTRUMENTATION DIAGRAM HYDROGEN STORAGE VESSELS HEADER (INLET)
[7] 123A90-DDL-PR-PID-80014	BLPH PIPING AND INSTRUMENTATION DIAGRAM HYDROGEN STORAGE VESSELS HEADER (OUTLET)
[8] 123A90-DDL-PR-PID-80015	BLPH PIPING AND INSTRUMENTATION DIAGRAM HYDROGEN STORAGE VESSEL A
[9] 123A90-DDL-PR-PID-80016	BLPH PIPING AND INSTRUMENTATION DIAGRAM HYDROGEN STORAGE VESSEL B
[10]123A90-DDL-PR-PID-80017	BLPH PIPING AND INSTRUMENTATION DIAGRAM HYDROGEN STORAGE VESSEL C
[11]123A90-DDL-PR-PID-80018	BLPH PIPING AND INSTRUMENTATION DIAGRAM HYDROGEN STORAGE VESSEL D
[12]123A90-DDL-PR-PID-80019	BLPH PIPING AND INSTRUMENTATION DIAGRAM HYDROGEN STORAGE VESSEL E
[13]123A90-DDL-PR-PID-80020	BLPH PIPING AND INSTRUMENTATION DIAGRAM HYDROGEN STORAGE VESSEL F
[14]123A90-DDL-PR-PID-80021	BLPH PIPING AND INSTRUMENTATION DIAGRAM SEA-WATER INTAKE SYSTEM SHEET 1
[15]123A90-DDL-PR-PID-80022	BLPH PIPING AND INSTRUMENTATION DIAGRAM SEA-WATER INTAKE SYSTEM SHEET 2
[16]123A90-DDL-PR-PID-80023	BLPH PIPING AND INSTRUMENTATION DIAGRAM WATER TREATMENT PLANT SHEET 1
[17]123A90-DDL-PR-PID-80024	BLPH PIPING AND INSTRUMENTATION DIAGRAM WATER TREATMENT PLANT SHEET 2
[18]123A90-DDL-PR-PID-80025	BLPH PIPING AND INSTRUMENTATION DIAGRAM WATER DISPOSAL SHEET 1
[19]123A90-DDL-PR-PID-80026	BLPH PIPING AND INSTRUMENTATION DIAGRAM WATER DISPOSAL SHEET 2
[20]123A90-DDL-PR-PID-80027	BLPH PIPING AND INSTRUMENTATION DIAGRAM INSTRUMENT AIR PACKAGE
[21]123A90-DDL-PR-PID-80028	BLPH PIPING AND INSTRUMENTATION DIAGRAM HYDROGEN VENT HEADER
[22]123A90-DDL-PR-PID-80029	BLPH PIPING AND INSTRUMENTATION DIAGRAM HYDROGEN VENT DRUM

Document ID	Document Title
[23]123A90-DDL-EL-DL-20100	BASE LOAD POWER HUB - ELECTRICAL EQUIPMENT LAYOUT - TOP DECK
[24]123A90-DDL-EL-DL-20101	BASE LOAD POWER HUB (BLPH) - ELECTRICAL EQUIPMENT LAYOUT - LOWER DECK
[25]123A90-DDL-EL-DL-20102	BASE LOAD POWER HUB (BLPH) - ELECTRICAL EQUIPMENT LAYOUT - BELOW LOWER DECK
[26]123A90-DDL-EL-DL-20104	BASE LOAD POWER HUB (BLPH) - ELECTRICAL EQUIPMENT LAYOUT - HV SWITCHROOM
[27]123A90-DDL-EL-DL-20105	BASE LOAD POWER HUB (BLPH) - ELECTRICAL EQUIPMENT LAYOUT - LV SWITCHROOM
[28]123A90-DDL-EL-DL-20106	BASE LOAD POWER HUB (BLPH) - ELECTRICAL EQUIPMENT LAYOUT - UPS & BATTERIES SWITCHROOM
[29] 1723002197-EL-DA-00006	SG-100D1 HV SWBD 6,6kV - GENERAL ARRANGEMENTS DWG
[30] 1723002197-EL-DA-00007	SG-200N1 LV SWBD 400-230V - GENERAL ARRANGEMENTS DWG
[31] 1723002197-EL-DA-00008	SG-200D2 LV SWBD 800V - GENERAL ARRANGEMENTS DWG
[32] 1723002197-EL-DA-00009	DP-200N1 - LV SWBD 400-230V - GENERAL ARRANGEMENTS DWG
[33] 1723002197-EL-DG-00010	SG-100D1 HV SWBD 6,6kV - ELECTRICAL SINGLE LINE DIAGRAM
[34] 1723002197-EL-DG-00011	SG-200N1 LV SWBD 400-230V ELECTRICAL SINGLE LINE DIAGRAM
[35] 1723002197-EL-DG-00012	SG-200D2-LV SWBD 800V-ELECTRICAL SINGLE LINE DIAGRAM
[36] 1723002197-EL-DG-00013	DP-200N1 LV SWBD 400-230V-ELECTRICAL SINGLE LINE DIAGRAM
[37] 1724000372-EL-DA-00003	DC UPS - GENERAL ARRANGEMENT AND DIMENSIONAL DRAWINGS
[38] 1724000372-EL-DA-00004	AC UPS - GENERAL ARRANGEMENT AND DIMENSIONAL DRAWINGS
[39] 1724000372-EL-DG-00006	DC UPS - SINGLE LINE DIAGRAM and INTERCONNECTING DIAGRAM
[40] 1724000372-EL-DG-00007	AC UPS - SINGLE LINE DIAGRAM and INTERCONNECTING DIAGRAM
[41] 123A90-DDL-EL-DG-20158	OVERALL/KEY SINGLE LINE DIAGRAM
[42] 123A90-DDL-IN-DL-40012	BASE LOAD POWER HUB - OFFSHORE ITER - EQUIPMENT LAYOUT
[43] 123A90-DDL-PR-MAN-80001	OPERATIONS AND MAINTENANCE MANUALS

Table 2: Reference Project Engineering Deliverables

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4.1.2 Vendor Operating and Maintenance Manuals

Document ID	Document Title
[1] 1724000428-MAC-MAN-00030	INSTRUMENT AIR PACKAGE A-63000 INSTALLATION, OPERATING AND MAINTENANCE MANUAL (COES)
[2] 1724000437-MAC-MAN-00029	NITROGEN GENERATION PACKAGE A-64000 INSTALLATION, OPERATING AND MAINTENANCE MANUAL (COES)
[3] 1724000594-IN-MAN-00037	INSTALLATION, OPERATION AND MAINTENANCE MANUAL (YOKOGAWA)
[4] 1724000448-MAC-MAN-00032	WATER TREATMENT PACKAGE A-50000 INSTALLATION, OPERATING AND MAINTENANCE MANUAL (PSC)
[5] 1723002197-EL-MAN-00054	HV INSTALLATION OPERATING AND MAINTENANCE MANUAL
[6] 1723002197-EL-MAN-00057	LV SWG INSTALLATION OPERATING AND MAINTENANCE MANUAL
[7] 1724000372-EL-MAN-00024	DC UPS - INSTALLATION, OPERATING AND MAINTENANCE MANUAL
[8] 1724000372-EL-MAN-00025	AC UPS - INSTALLATION, OPERATING AND MAINTENANCE MANUAL
[9] 1724000594-IN-DA-00009	PCS CABINETS GENERAL ARRANGEMENT DRAWINGS AND INTERNAL LAYOUT
[10] 1724000594-IN-DA-00010	SAFETY SYSTEMS CABINETS (SIS AND FGS) GENERAL ARRANGEMENT DRAWINGS AND INTERNAL LAYOUT
[11] 1724000594-IN-DA-00011	NETWORK AND SERVER CABINETS IN ITER ROOM GENERAL ARRANGEMENT DRAWINGS AND INTERNAL LAYOUT
[12] 1724000594-IN-DA-00012	NETWORK AND SERVER CABINETS IN OER ROOM GENERAL ARRANGEMENT DRAWINGS AND INTERNAL LAYOUT
[13] 1724000594-IN-DA-00013	EMCS CABINETS GENERAL ARRANGEMENT DRAWINGS AND INTERNAL LAYOUT
[14] 1724000049-MD-MAN-00061	INSTALLATION, OPERATION AND MAINTENANCE MANUAL (ALEX SISTEMI)
[15] 1724000775-EL-MAN-00019	NAVIGATION AID SYSTEM INSTALLATION, OPERATION AND MAINTENANCE MANUAL (SICE)
[16] 10354_23A2007_250205	BESS PRO OPERATING AND MAINTENANCE MANUAL
[17] K559-2254-CWIWP4202202-N01-002	OPERATING MANUAL (BALLARD)
[18] K559-2254-CWIWP4202202-N01-003	SERVICE AND MAINTENANCE MANUAL (BALLARD)
[19] C63-PMO-001	USER MANUAL (ELOGEN)
[20] C63-NID-ELO-REP00	OPERATING HANDBOOK FOR THE USE AND MAINTENANCE OF TRANSFORMERS (ELOGEN)
[21] C63-NID-ELO-REP01	USER AND MAINTENANCE MANUAL RECTIFIER (ELOGEN)

Table 3: Vendor Operating and Maintenance Manuals

4.2 Acronyms and Abbreviations

Acronyms / Abbreviations	Description
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
C&E	Cause & Effects
CCS	Central Control 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
F&G	Fire & Gas
HMI	Human Machine Interface
HV	High Voltage
HVAC	Heating, Ventilation and Air Conditioning
HSE	Health, Safety, & Environment
LC	Locked Closed
LO	Locked Open
LOTO	Lock-Out / Tag-Out
LV	Low Voltage
OEM	Original Equipment Manufacturer
PAS	Process Automation System
PCS	Process Control System
PID (P&ID)	Piping and Instrumentation Diagram
PSV	Pressure Safety Valve
PTW	Permit to Work
SIF	Safety Instrumentation Function
SIL	Safety Integrity Level
SIMOPS	Simultaneous Operations
SIS	Safety Instrumented System
SLD	Single Line Diagram
UPS	Uninterruptible Power Supply
WTG	Wind Turbine Generator

Table 4: Acronyms and Abbreviations

5 START-UP PREPARATION ACTIVITIES AT SITE

This chapter refers to the preparation activities at the Client final site (Eemshaven yard).

5.1 Planning and Manpower

5.1.1 Planned tasks with estimated manpower

The unique scope of the BLPH project imposes numerous obligations on the Client Operations Team to achieve and maintain a safety-first approach to energising and starting up the main package items of equipment on the platform.

It is mandatory to consult the relevant detailed documentation supplied by each vendor before any of the main equipment packages can be energised, particularly adherence to safety requirements and recommendations:

- Understand and observe all installed hazard warning symbols and labels,
- Understand and observe all warning levels (i.e. Danger, Warning, Caution),
- Define personnel roles and responsibilities,
- Authorised Personnel training and competency levels,
    - Equipment Operator (basic operational knowledge of the installed equipment package)
    - Trained Equipment Operator (detailed operational knowledge of the installed equipment package)
    - Service and Maintenance Technician (advanced operational knowledge of the installed equipment package)
- Adherence to Site Permit to Work system,
- Trained and experienced to operate on specialised electrical equipment at low voltage and high voltage levels,
- Trained and experienced to operate on specialised mechanical equipment,
- Trained and experienced to operate specialised equipment producing chemicals and / or explosive gasses,
- Required types of personal protective equipment,
- Knowledge of mandatory safety measures,
    - Personnel to observe safety measures related to ATEX rated areas
    - During equipment operation personnel to keep a safe distance
    - During equipment operation all container doors to be kept closed
    - Personnel to utilise personal gas detection devices
    - Personnel to utilise only ATEX rated tools and communication radios
    - Maintenance works to be conducted when equipment is deenergised then locked out and tagged out
- Knowledge and understanding of the approved firefighting measures relevant to each specialised equipment package
- Immediately eliminate faults that impact safety
- Operate the specialised equipment packages only when in perfect working order

Consequently, it can be expected that the initial startups of BLPH will require the presence of more personnel from the owners Operations Team in conjunction with all specialist equipment packages field service personnel.

Over time, as the Operations Team acquires knowledge and experience, the total number of personnel will diminish accordingly.

Estimated minimum manpower for the entire duration of BLPH first start-up:

1 Operations Team lead
1 Operations Team Automation Lead
1 Operations Team Instrumentation Lead
1 Operations Team Mechanical/Process Lead
2 Operations Team Electrical Field Engineers
2 Operations Team Instrumentation Field Engineers
2 Operations Team Mechanical Field Technicians
1 Operations Team Field Engineer (PCS/SIS/F&G)
1 Operations Team Field Engineer (EMCS)

In addition to the above, support from vendor field service personnel will be requested required:

2 Vendor Field Engineer (BESS)
2 Vendor Field Engineer (Electrolyser)
2 Vendor Field Engineer (Fuel Cell)
1 Vendor Field Engineer (WTP)
1 Vendor Field Engineer (Instrument Air and N2 packages)
2 Vendor Field Engineers (Yokogawa)

5.1.2 Start Up duration estimate

The start-up duration is planned as follows:

- 10 days.

It should be noted that the estimated time will be subject to the BLPH Owners operations plan for the platform, i.e. to perform a number of staggered 'partial' equipment energizations before reaching full platform operational status, or schedule a single start-up campaign that will require the full availability of a suitable high voltage power supply connection together with temporary storage tanks for clean sea-water.

5.1.3 Vendor Assistance

As previously mentioned, it is recommended that the initial start-up should foresee the presence of all main equipment package vendors.

5.1.4 Items Postponed

Not applicable

5.1.5 HOLDS

Not applicable

5.1.6 Special Tools & Test Equipment

The following items of Test Equipment are required:

Portable Hydrogen Gas wearing protection device as requirement for PPE
Hand help Hydrogen Gas measuring device (rated to 1000ppm for process flanged joints sniffing)
Portable ATEX radios
Temporary Yard Control Room equipped with PCS and EMCS Operator Workstations
Voltage, frequency, continuity tester (Multimeter), HART Communicator

5.1.7 Commissioning & 2 Years Spare Parts

Reference is made to all related equipment and packages vendors deliverables.

5.1.8 Temporary Facilities

- Electrical 400V reserve Site Power Supply (P approx. 250 kVA) to feed main switchboard SG-200N1 via drawer A2/+08 "Temporary Diesel Generator / Mobile Battery Pack" JB-200E2.
- Electrical 6,6 kV main Site Power Supply (P approx. 6 MVA), incorporating a resistive load bank with rating 2,00 MW. The temporary power supply cable will be connected to HV SWBD SG-100D1, Incomer compartment A6.
- Sea water storage and pumping facilities, required by the sea water treatment package for the preparation of softened water utilised by the Electrolyser package. The tie in point (ref. TP-028) will be the flanged sea water feed boundary interface outside the WTP container installed on the lower deck.
- Site Control Room required with Engineering / Operator Workstations

5.2 BLPH Start-Up Preparation Activities – Onshore SITE

5.2.1 Start-Up Preparation

Step	Description	Result	Verified by	Date
1	Associated Systems Ready for Operation Certificates (RFC) are issued and approved.			
2	No Mechanical Completion or Pre-commissioning punch list 'A' items are outstanding against the systems to be tested.			
3	All personnel involved with the execution of this procedure are familiar with its content as well as with associated safety requirements (Toolbox Talk to be conducted before initiation of activities).			
4	A final walkdown of the systems and packages has been completed, to ensure that all equipment and areas are ready for the energisation and start-up.			
5	Check that areas are free for work and escape routes are clear of any obstructions.			
6	All safety barriers and warning signs have been installed.			

Step	Description	Result	Verified by	Date
	Access to BLPH will be severely restricted to authorised personnel only.			
7	Ensure that proper communications have been established between parties involved in the implementation of the procedure.			
8	Verify availability of test and safety equipment as per sections 3.3 and 3.4			
9	System(s) electrical isolations as per LOTO procedure defined within HSSE Permits to Work duly prepared and approved			
10	System(s) process isolations as per LO-LC procedure defined within HSSE Permits to Work duly prepared and approved			

5.2.2 Electrical Preparation

Step	**Description**	**Result**	**Verified by**	**Date**
11	Check related punch list 'B' items and confirm acceptability for start of energisation and start-up.			
12	Verify that all relevant associated systems / subsystems are completed.			
13	Check that any equipment not required for energisation and start-up has been duly isolated.			

5.2.3 Mechanical Preparation

Step	**Description**	**Result**	**Verified by**	**Date**
14	Check related punch list 'B' items and confirm acceptability for start of energisation and start-up.			
15	Verify that all relevant associated systems / subsystems are completed.			
16	Check that any equipment not required for energisation and start-up has been duly isolated.			

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5.2.4 Instrument Preparation

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

5.2.5 Piping Preparation

Step	Description	Result	Verified by	Date
20	Check related punch list 'B' items and confirm acceptability for start of Integrated Testing activities.			
21	Verify that all relevant associated systems / subsystems are completed.			
22	Check and confirm that all vessels and valves isolations have been completed. Particular reference is made to Hydrogen storage vessels P&ID's and valves according to LO-LC register.			

5.2.6 Additional Discipline Preparation

Not applicable.

5.3 BLPH START-UP SEQUENCE – Onshore SITE

The following sections will describe the test steps to be followed for execution of BLPH start-up, in conjunction with the vendor documentation for the specialised equipment packages.

5.3.1 Equipment Start-Up Sequence

The sequence foresees the start-up of BLPH utilities, hydrogen storage, vent then CPI's;

- SS 77-30 HVAC UPS Equipment Room B-300
- SS 77-40 HVAC I&T Equipment Room B-400
- SS 77-10 HVAC HV/MV Switchgear Room B-100
- SS 77-20 HVAC LV Switchgear Room B-200
- SS 63-00 Instrument Air Package (A-63000)
- SS 63-30 Instrument Air Distribution Network
- SS 64-00 Nitrogen Generator Package (A-64000)
- SS 64-10 Nitrogen Distribution Network
- SS 50-10 Water Desalination Package & Distribution
- SS 55-00 Waste Water Disposal (a temporary tank will be required at an onshore location)
- SS 55-01 Waste Water Brine Discharge System (a temporary tank will be required at an onshore location)
- SS 56-11 Non-Hazardous Open Drain Collection (a suitable drain will be required at an onshore location)
- SS 25-01 Hydrogen Storage Vessel A (V-25001A)
- SS 25-02 Hydrogen Storage Vessel B (V-25001B)
- SS 25-03 Hydrogen Storage Vessel C (V-25001C)
- SS 25-04 Hydrogen Storage Vessel D (V-25001D)
- SS 25-05 Hydrogen Storage Vessel E (V-25001E)
- SS 25-06 Hydrogen Storage Vessel F (V-25001F)
- SS 25-07 Hydrogen Storage Vessels Header (Inlet)
- SS 25-08 Hydrogen Storage Vessels Header (Outlet)
- SS 43-00 Hydrogen Vent Header & Drum System
- SS 20-00 Electrolyser Package (A-20000)
- SS 80-00 Hydrogen Fuel Cell Package (A-80000)
- SS 85-00 BESS Package (A-85000)
- SS 72-00 NAVAID

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5.3.1.1.1 SS 77-30 HVAC UPS Equipment Room B-300

Step	*Description*	*Notes/Remarks*
1	Confirm that HVAC control panel B300-HSB-001 is energized from LV Switchboard SG-200N1 drawer A5/+03 (following on from execution of Black Start Procedure).	
2	With reference to UPS unit 200-UP-200F3, locate and close QF41 which is required for the energization of HVAC control panel PLC.	
3	Inside the HVAC control panel B300-HSB-001, the user is required to locate and close the following circuit breakers: QF2: MODULE INTERNAL SOCKET QF6: HEATING CABLE HHC-77-002 QM1: ELECTRICAL HEATER HSS-77-007/8/9 QM1A: PRESSURING FAN 1 - HFM-77-301 QM2A: SUPPLY FAN HFM-77-302 QM3A: COMPRESSOR 1A HCO-77-301 QM4A: ELECTRICAL HEATER HSS-77-301 QF1A: INTERNAL AUX 230V QM5A: CONDENSER FAN 1/2 HFM-77-305/6 QM1B: PRESSURING FAN HFM-77-303 QM2B: SUPPLY FAN HFM-77-304 QM3B: COMPRESSOR 1A HCO-77-302 QM4B: ELECTRICAL HEATER HHS-77-305 QF1B: INTERNAL AUX 230V QM5B: CONDENSER FAN 1/2 HFM-77-307/8 QF4: POWER ON FOR AC/DC CONVERTER 230V/24Vdc QF5: INTERNAL AUX 24Vdc	
4	Proceed to close the main control panel doors and close the main switches to energize the system: QS1: HVAC CONTROL PANEL (MAIN SWITCH) QFA: HHU-77005 UNIT (MAIN SWITCH) QFB: HHU-77006 UNIT (MAIN SWITCH)	

Step	*Description*	*Notes/Remarks*
5	On the main control panel of HHU-77005 put the external selector switch AUTO/0/MANUAL in AUTO position. On the main control panel of HHU-77006 put the external selector switch AUTO/0/MANUAL in AUTO position.	
6	On HVAC control panel B300-HSB-001, acknowledge and reset the alarms in the HMI located in the main control panel.	
7	In Yokogawa Engineering Workstation (EWS0164), open Prosafe Maintenance, then SCS0110 (SIS) and force the following signal: - 77-XS-003 = TRUE (SHUT-DOWN B-300 UPS room HVAC) N.B. Operator is instructed to record the action of signal forcing in the dedicated Override/Inhibit Register.	
8	Verify on Yokogawa FGS C&E graphic pages that no alarms are active on FIRE ZONE 04. In Yokogawa HVAC graphic pages, select from menu Subsystem→HVAC→B-300 and give the start command.	
9	In Yokogawa Engineering Workstation (EWS0164), open Prosafe Maintenance, then SCS0110 (SIS) and restore normal operating condition on signal 77-XS-003. Confirm that the system is running with no alarms present.	

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5.3.1.1.2 SS 77-40 HVAC I&T Equipment Room B-400

Step	*Description*	*Notes/Remarks*
1	Confirm that HVAC control panel B400-HSB-001 is energized from LV Switchboard SG-200N1 drawer A5/+04 (following on from execution of Black Start Procedure).	
2	With reference to UPS unit 200-UP-200F3, locate and close QF42 which is required for the energization of HVAC control panel PLC.	
3	Inside the HVAC control panel B400-HSB-001, the user is required to locate and close the following circuit breakers: QF2: MODULE INTERNAL SOCKET QF6: HEATING CABLE HHC-77-004 QM1: ELECTRICAL HEATER HSS-77-010/11/12 QM1A: PRESSURING FAN 1 - HFM-77-401 QM2A: SUPPLY FAN HFM-77-402 QM3A: COMPRESSOR 1A HCO-77-401 QM4A: ELECTRICAL HEATER HSS-77-401 QF1A: INTERNAL AUX 230V QM5A: CONDENSER FAN 1/2 HFM-77-405/6 QM1B: PRESSURING FAN HFM-77-403 QM2B: SUPPLY FAN HFM-77-404 QM3B: COMPRESSOR 1A HCO-77-402 QM4B: ELECTRICAL HEATER HHS-77-405 QF1B: INTERNAL AUX 230V QM5B: CONDENSER FAN 1/2 HFM-77-707/8 QF4: POWER ON FOR AC/DC CONVERTER 230V/24Vdc QF5: INTERNAL AUX 24Vdc	
4	Proceed to close the main control panel doors and close the main switches to energize the system: QS1: HVAC CONTROL PANEL (MAIN SWITCH) QSA: HHU-77007 UNIT (MAIN SWITCH) QSB: HHU-77008 UNIT (MAIN SWITCH)	

Step	*Description*	*Notes/Remarks*
5	On the main control panel of HHU-77007 put the external selector switch AUTO/0/MANUAL in AUTO position. On the main control panel of HHU-77008 put the external selector switch AUTO/0/MANUAL in AUTO position.	
6	On HVAC control panel B400-HSB-001, acknowledge and reset the alarms in the HMI located in the main control panel.	
7	In Yokogawa Engineering Workstation (EWS0164), open Prosafe Maintenance, then SCS0110 (SIS) and force the following signal: - 77-XS-004 = TRUE (SHUT-DOWN B-400 I&T Equip. Room HVAC) N.B. Operator is instructed to record the action of signal forcing in the dedicated Override/Inhibit Register.	
8	Verify on Yokogawa FGS C&E graphic pages that no alarms are active on FIRE ZONE 04. In Yokogawa HVAC graphic pages, select from menu Subsystem→HVAC→B-400 and give the start command.	
9	In Yokogawa Engineering Workstation (EWS0164), open Prosafe Maintenance, then SCS0110 (SIS) and restore normal operating condition on signal 77-XS-004. Confirm that the system is running with no alarms present.	

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5.3.1.1.3 SS 77-10 HVAC HV/MV Switchgear Room B-100

Step	*Description*	*Notes/Remarks*
1	Confirm that HVAC control panel B100-HSB-001 is energized from LV Switchboard SG-200N1 drawer A4/+02 (following on from execution of Black Start Procedure).	
2	In Yokogawa Engineering Workstation (EWS0164), open Prosafe Maintenance, then SCS0110 (SIS) and force the following signals: - 77-XS-001 = TRUE (SHUT-DOWN B-100 HV/MV SWGR room HVAC) - 84-XS-004 = TRUE (ELECT. ISOLATION UPS POWER UCP HVAC B-100) N.B. Operator is instructed to record the action of signal forcing in the dedicated Override/Inhibit Register.	
3	With reference to UPS unit 200-UP-200F3, confirm that the safety relay K13 is energized. Proceed to locate and close QF39 which is required for the energization of HVAC control panel PLC.	
4	Inside the HVAC control panel B100-HSB-001, the user is required to locate and close the following circuit breakers: QF2: MODULE INTERNAL SOCKET QF4: HEATING CABLE HHC-77-001 QM1: ELECTRICAL HEATER HSS-77-001/2/3 QM1A: PRESSURING FAN 1 - HFM-77-001 QM2A: ELECTRICAL HEATER HSS-77-103 QF1A: INTERNAL AUX 230V QM1B: PRESSURING FAN 2 - HFM-77-102 QM2B: ELECTRICAL HEATER - HHS-77-104 QF1B: INTERNAL AUX 230V QF5: POWER ON FOR AC/DC CONVERTER 230V/24Vdc QF6: INTERNAL AUX 24Vdc	

Step	*Description*	*Notes/Remarks*
5	Proceed to close the main control panel doors and close the main switches to energize the system: QS1: HVAC CONTROL PANEL (MAIN SWITCH) QSA: HHU-77001 UNIT (MAIN SWITCH) QSB: HHU-77002 UNIT (MAIN SWITCH)	
6	On the main control panel of HHU-77001 put the external selector switch AUTO/0/MANUAL in AUTO position. On the main control panel of HHU-77002 put the external selector switch AUTO/0/MANUAL in AUTO position.	
7	On HVAC control panel B100-HSB-001, acknowledge and reset the alarms in the HMI located in the main control panel.	
8	Verify on Yokogawa FGS C&E graphic pages that no alarms are active on FIRE ZONE 06. In Yokogawa HVAC graphic pages, select from menu Subsystem→HVAC→B-100 and give the start command.	
9	In Yokogawa Engineering Workstation (EWS0164), open Prosafe Maintenance, then SCS0110 (SIS) and restore normal operating condition on signals 77-XS-001 and 84-XS-004. Confirm that the system is running with no alarms present.	

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5.3.1.1.4 SS 77-20 HVAC LV Switchgear Room B-200

Step	*Description*	*Notes/Remarks*
1	Confirm that HVAC control panel B200-HSB-001 is energized from LV Switchboard SG-200N1 drawer A5/+02 (following on from execution of Black Start Procedure).	
2	In Yokogawa Engineering Workstation (EWS0164), open Prosafe Maintenance, then SCS0110 (SIS) and force the following signals: - 77-XS-002 = TRUE (SHUT-DOWN B-200 LV SWGR room HVAC) - 84-XS-005 = TRUE (ELECT. ISOLATION UPS POWER UCP HVAC B-200) N.B. Operator is instructed to record the action of signal forcing in the dedicated Override/Inhibit Register.	
3	With reference to UPS unit 200-UP-200F3, confirm that the safety relay K14 is energized. Proceed to locate and close QF40 which is required for the energization of HVAC control panel PLC.	
4	Inside the HVAC control panel B100-HSB-001, the user is required to locate and close the following circuit breakers: QF2: MODULE INTERNAL SOCKET QF4: HEATING CABLE HHC-77-002 QM1: ELECTRICAL HEATER HSS-77-004/5/6 QM1A: PRESSURING FAN 1 - HFM-77-201 QM2A: ELECTRICAL HEATER HSS-77-201 QF1A: INTERNAL AUX 230V QM1B: PRESSURING FAN 2 - HFM-77-202 QM2B: ELECTRICAL HEATER - HHS-77-202 QF1B: INTERNAL AUX 230V QF5: POWER ON FOR AC/DC CONVERTER 230V/24Vdc QF6: INTERNAL AUX 24Vdc	

Step	*Description*	*Notes/Remarks*
5	Proceed to close the main control panel doors and close the main switches to energize the system: QS1: HVAC CONTROL PANEL (MAIN SWITCH) QSA: HHU-77003 UNIT (MAIN SWITCH) QSB: HHU-77004 UNIT (MAIN SWITCH)	
6	On the main control panel of HHU-77003 put the external selector switch AUTO/0/MANUAL in AUTO position. On the main control panel of HHU-77004 put the external selector switch AUTO/0/MANUAL in AUTO position.	
7	On HVAC control panel B200-HSB-001, acknowledge and reset the alarms in the HMI located in the main control panel.	
8	Verify on Yokogawa FGS C&E graphic pages that no alarms are active on FIRE ZONE 04. In Yokogawa HVAC graphic pages, select from menu Subsystem→HVAC→B-200 and give the start command.	
9	In Yokogawa Engineering Workstation (EWS0164), open Prosafe Maintenance, then SCS0110 (SIS) and restore normal operating condition on signals 77-XS-002 and 84-XS-005. Confirm that the system is running with no alarms present.	

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5.3.1.1.5 SS 63-00 Instrument Air Package (A-63000)

Step	*Description*	*Notes/Remarks*
1	N.B. the Air Compressors have been preserved prior to sail away and mechanical bracings installed as per recommended transportation procedure by Manufacturer Atlas Copco. Please ensure that all preservation and internal bracing materials have been duly removed prior to first energization.	
2	In LV Switchboard SG-200N1, close the auxiliary power miniature circuit breakers QA1 located inside in the drawers: A4/+08 (Instrument Air Compressor K63001-A) A5/+08 (Instrument Air Compressor K63001-B)	
3	Put the drawers in service position and manually close the main power circuit breakers QF1. In the drawers put the selector SA1 (LOCAL/REMOTE) in REMOTE position.	
4	In Yokogawa Electrical graphic pages, select from menu Electrical→LV Switchboard and give the close command to the relevant drawer contactors: A4/+08 (Instrument Air Compressor K63001-A), A5/+08 (Instrument Air Compressor K63001-B).	
5	In Low Voltage Distribution Panel DP-200N1 close the breaker Q29 (UCP - INSTRUMENT AIR PACKAGE A-63000 – AUXILIARY).	

Step	*Description*	*Notes/Remarks*
6	In Yokogawa Engineering Workstation (EWS0164), open Prosafe Maintenance, then SCS0110 (SIS) and force the following signals: - 63-XS-001 = TRUE (SHUT-DOWN A-63000 Instrument air PKG) - 84-XS-003 = TRUE (ELECT. ISOLATION UPS POWER UCP (INSTRUMENT AIR A-63000) N.B. Operator is instructed to record the action of signal forcing in the dedicated Override/Inhibit Register.	
7	With reference to UPS unit 200-UP-200F3, confirm that the safety relay K10 is energized. Proceed to locate and close QF34 which is required for the energization of IA control panel PLC.	
8	In Yokogawa SIS graphic pages, select from menu SIS C/E→ESD1-1D and proceed to enable the start-up override (OOS) on the LL pressure alarm for 63PI-004 As an alternative, in case the timer will not be sufficient to allow a proper start-up of the package, the operator can proceed with the following: In Yokogawa Engineering Workstation (EWS0164), open Prosafe Maintenance, then SCS0110 (SIS) and force the following signal: - 63PI-004 = 50%	
9	In Package Local Control Panel, set external selector switch to REMOTE position and push the RESET button. N.B. The package reset command simultaneously on the Local Control Panel and SIS must be completed within 30 seconds.	

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Step	*Description*	*Notes/Remarks*
10	In Yokogawa SIS graphic pages, select from menu SIS C/E→PSD and proceed to give the INTERLOCK RESET command. In Yokogawa Process graphic pages, select from menu Process→Instrument Air and give the start command. In Yokogawa Engineering Workstation (EWS0164), open Prosafe Maintenance, then SCS0110 (SIS) and restore normal operating condition on signals 63-XS-001 and 84-XS-003.	
11	On the Instrument Air package, proceed with the following start up steps:	
12	Open the following manual valves to pressurize the pre-filter group. • BLPH-MV-700, • BLPH-MV-701, • BLPH-MV-702 • BLPH-MV-703	
13	Slowly open manual valves BLPH-MV-704, BLPH-MV-705, BLPH-MV-712 and BLPH-MV-720 to pressurize the dryer.	
14	Keep outlet manual valves BLPH-MV-719 and BLPH-MV-727 closed.	
15	On local control panel press Start push button 63-HS-001: Running light 63-XL-003 is on.	
16	After a few minutes check the pressure shown by one or both pressure gauges. One pressure gauge (pos 63-PI-053 or 63-PI-055 and 63-PI-057 or 63-PI-059) will show the operating pressure, while the other the atmospheric pressure. If the dryer is repressurizing, both pressure gauges will show pressure inside the tower.	

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Step	*Description*	*Notes/Remarks*
17	Make sure the cycle is carried out properly. If not, go back to the start-up procedure and to the "Troubleshooting" section as detailed within vendors Installation, Operating and Maintenance Manual.	
18	Now the dryer is ready for its operation, however it is recommended to let it operate for a few cycles with the outlet flow off. This procedure must be observed for example when the dryer has been off stream for a long period of time (> 1 month).	
19	Slowly open outlet valves BLPH-MV-719 and BLPH-MV-727, so that to pressurise the service up to the after-filter group. Never go beyond the maximum design flow of 350 Sm3/h.	
20	Slowly open manual valves BLPH-MV-728 and BLPH-MV-729 to pressurize the after-filter group (maximum design flow 350 Sm3/h).	
21	Slowly open manual valves BLPH-MV-730 and BLPH-MV-731 to pressurize the service up to the line (maximum design flow 350 Sm3/h).	
NOTE	General note: valves provided with locking device shall be kept open or closed as shown in the package P&ID.	

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22	Description of the normal operating cycle to be observed: Tower (pos. D-63001A or D-63002A) is in the absorption phase, while tower (pos. D-63001B or D-63002B) is regenerating. • ABSORPTION PHASE Solenoid valve (pos. 63-XY-052 or 63-XY-054) is de-energized. Therefore valve (pos. 63-XV-052 or 63-XV-054) is in the position shown on the package P&ID. The gas to be dried enters tower (pos. D-63001A or D-63002A), flows on the desiccant bed in an upward direction and comes out from outlet valve, dried and ready for utilization. • REGENERATION PHASE Solenoid valve (pos. 63-XY-052 or 63-XY-054) is energized. Therefore valve (pos. 63-XV-052 or 63-XV-054) is open. A small percentage of the dry gas is drawn by calibrated orifice (pos. 63-FO-001 or 63-FO-002) from tower (pos. D-63001A or D-63002A) and will be expanded inside tower (pos. D-63001B or D-63002B). The gas runs through the tower in a counter-current direction and regenerates it. Afterwards it is vented to the atmosphere through valve (pos. 63-XV-052 or 63-XV-054). • PRESSURIZATION Solenoid valve (pos. 63-XY-052 or 63-XY-054) is de-energized, and it controls the closing of valve (pos. 63-XV-052 or 63-XV-054). Therefore, regeneration gas, coming from calibrated orifice (pos. 63-FO-001 or 63-FO-002) will pressurize tower (pos. D-63001B or D-63002B), since it is not vented to the atmosphere. • CHANGE-OVER Solenoid valves (pos. 63-XY-051 or 63-XY-053 and 63-XY-052 or 63-XY-054) are energized therefore valve (pos. 63-XV-051 or 63-XV-053) shifts and the gas to be dried enters tower (pos. D-63001B or D-63002B).	

Step	*Description*	*Notes/Remarks*
	Valve (pos. 63-XV-052 or 63-XV-054) opens causing the decompression of tower (pos. D-63001A or D-63002A) which starts its regeneration.	
NOTE	In order to stop the package, proceed with the following shut down steps.	
23	Close outlet and inlet manual valves (pos. BLPH-MV-712, BLPH-MV-719, BLPH-MV-720 and BLPH-MV-727), to isolate the dryer.	
24	Press button 63-HS-002: DRYER ON light (Pos. H2) is now off.	
25	Cut the power supply to the Local Control Panel; POWER ON lights (Pos. 63-XL-001 and 63-XL-002) are off.	

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5.3.1.1.6 SS 63-30 Instrument Air Distribution Network

Step	*Description*	*Notes/Remarks*
1	Proceed to verify the condition of Instrument Air Distribution pots, status of actuated valves, connection to Nitrogen Generator and Electrolyser Packages	
2	Proceed to verify status of signals (process variables) received from the following pressure transmitters: 63-PI-003 (Instrument Air to Distribution Header) 63-PI-004 (Instrument Air to Distribution Header Low Pressure) As the network pressurizes and the process value reading from 63PI-003 reaches at least 4 barg, the forcing on the 63-PI-004 signal (process variable) can be removed. N.B. Low Low pressure on instrument air manifold (63-PT-004) with value less than 4 barg will result in ESD-1D scenario	
3	Functioning of the actuated valves will be checked successively according to their related subsystems.	

5.3.1.1.7 SS 64-00 Nitrogen Generator Package (A-64000)

Step	*Description*	*Notes/Remarks*
1	N.B. the Nitrogen Generator Local Control Panel has been preserved prior to sail away as recommended by Manufacturer COES. Please ensure that all preservation materials have been duly removed prior to first energization.	
2	In Low Voltage Distribution Panel DP-200N1, close the breaker Q30 (UCP – N2 PACKAGE – AUXILIARY)	
3	In Yokogawa Engineering Workstation (EWS0164), open Prosafe Maintenance, then SCS0110 (SIS) and force the following signal: - 64-XS-001 = TRUE (SHUT-DOWN U-64000 Nitrogen PKG) - 84-XS-002 = TRUE (ELECT. ISOLATION UPS POWER UCP (NITROGEN A-64000) N.B. Operator is instructed to record the action of signal forcing in the dedicated Override/Inhibit Register.	
4	With reference to UPS unit 200-UP-200F3, confirm that the safety relay K11 is energized. Proceed to locate and close QF35 which is required for the energization of HVAC control panel PLC.	
5	In Yokogawa SIS graphic pages, select from menu SIS C/E→ESD1-1D and proceed to enable the start-up override (OOS) on the LL pressure alarm for 64PI-002 As an alternative, in case the timer will not be sufficient to allow a proper start-up of the package, the operator can proceed with the following: In Yokogawa Engineering Workstation (EWS0164), open Prosafe Maintenance, then SCS0110 (SIS) and force the following signal: - 64PI-002=50%	

Step	*Description*	*Notes/Remarks*
6	In Package Local Control Panel, set external selector switch to REMOTE position and push the RESET button N.B. The package reset command simultaneously on the Local Control Panel and SIS must be completed within 30 seconds.	
7	In Yokogawa SIS graphic pages, select from menu SIS C/E→PSD and proceed to give the INTERLOCK RESET command. In Yokogawa Process graphic pages, select from menu Process→Nitrogen and give the start command. In Yokogawa Engineering Workstation (EWS0164), open Prosafe Maintenance, then SCS0110 (SIS) and restore normal operating condition on signals 64-XS-001 and 84-XS-002.	
NOTE	WARNING: THE INSTRUMENT AIR PACKAGE AND DISTRIBUTION NETWORK MUST BE FULLY PRESSURIZED BEFORE STARTING UP THE NITROGEN GENERATOR.	
8	On the Nitrogen Generator package, proceed with the following start up steps: • Start up in LOCAL control mode Place the switch on nitrogen generation package local control panel in "Local" position and verify that lamps 64-XL-001 and 64-XL-002 are switched on	
9	Verify that instrument air is available for pneumatic actuated valves, according to project procedure.	
10	Press the START push-button 64-HS-001 on local control panel to start the nitrogen generator: the PLC will start its operation, and the different electric components will get enabled as described in the functional description. Verify that PSA RUNNING lamp 64-XL-003 is switched on.	

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Step	*Description*	*Notes/Remarks*
11	Make sure the generator operating cycle is properly carried out and that no alarm condition is highlighted.	
12	After the correct start-up, until the measured oxygen level is greater than design value, the nitrogen flow is automatically vented to atmosphere, i.e. N2 < 97% purity.	
13	When the measured oxygen level is lower than set value, the nitrogen flow is automatically provided to the users, i.e. N2 > 97% purity.	
14	• Start up in REMOTE control mode Place the switch on local control panel on ''REMOTE' position and verify the LOCAL/REMOTE STATUS PROFIBUS signal.	
15	Give the REMOTE START impulsive command to start the generator: the PLC will start its operation, and the different electric components will become enabled. Verify that PSA RUNNING lamp is switched on.	
16	Make sure the generator operating cycle is properly carried out and that no alarm condition is highlighted.	
17	After the correct start-up, until the measured oxygen level is greater than design value, the nitrogen flow is automatically vented to atmosphere, i.e. N2 < 97% purity.	
18	When the measured oxygen level is lower than set value, the nitrogen flow is automatically provided to the users. i.e. N2 > 97% purity.	
NOTE	WARNING: WHEN THE NITROGEN GENERATOR IS STOPPED, THERE IS NO FLOW OF NITROGEN TO THE DISTRIBUTION NETWORK.	

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Step	*Description*	*Notes/Remarks*
19	• Package STOP in LOCAL control mode Press the STOP push-button 64-HS-002 on local control panel to stop the generator. Verify that PSA RUNNING lamp 64-XL-003 is switched off. Cut power supply to the local control panel and verify that lamps 64-XL-001 and 64-XL-002 are switched off.	
20	• Package STOP in REMOTE control mode Valid only if the switch on local control panel is on "REMOTE" position. Give the REMOTE STOP impulsive command to stop the PSA operating cycle. Verify that PSA RUNNING lamp 64-XL-003 is switched off. Cut power supply to the local control panel and verify that lamps 64-XL-001 and 64-XL-002 are switched off.	

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5.3.1.1.8 SS 64-10 Nitrogen Distribution Network

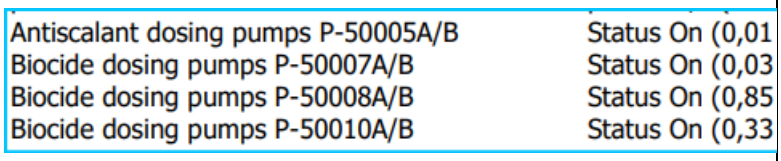
Step	*Description*	*Notes/Remarks*
1	Proceed to verify the condition and status of the connection to the Electrolyser Package, Hydrogen Vessels and the following actuated valves: 64PV-031A 64PV-031B 25SDV-001	
2	Proceed to verify status of signals (process variables) received from the following pressure transmitters: 64PI-057 64PI-002 As the network pressurizes and the process value reading from 64PI-057 reaches at least 3.5 barg, the forcing on the 64PI-002 signal can be removed. N.B. Low Low pressure on nitrogen manifold (64-PT-002) with value less than 3.5 barg will result in ESD-1D scenario.	
3	Functioning of the actuated valves will be checked successively according to their related subsystems.	

5.3.1.1.9 SS 50-10 Water Desalination Package & Distribution

Step	*Description*	*Notes/Remarks*
1	N.B. the Water Treatment Package, including Local Control Panels, has been preserved prior to sail away as recommended by Manufacturer PSC. Please ensure that all preservation materials have been duly removed prior to first energization.	
2	In LV Switchboard SG-200N1, close the auxiliary power miniature circuit breakers QA1 located inside in the drawers: - A3/+08 (WATER PACKAGE)	
3	Put the drawers in service position and manually close the main power circuit breakers QF1. In the drawers put the selector SA1 (LOCAL/REMOTE) in REMOTE position.	
4	In Yokogawa Electrical graphic pages, select from menu Electrical→LV Switchboard and give the close command to the relevant switch	
5	In Yokogawa Engineering Workstation (EWS0164), open Prosafe Maintenance, then SCS0110 (SIS) and force the following signal: - 50-XS-001 = TRUE (SHUT-DOWN A-500003 Sea water treatment PKG) - 84-XS-001 = TRUE (ELECT. ISOLATION UPS POWER UCP (WATER TREAT. A-50000) N.B. Operator is instructed to record the action of signal forcing in the dedicated Override/Inhibit Register.	
6	With reference to UPS unit 200-UP-200F3, confirm that the safety relay K12 is energized. Proceed to locate and close QF36 which is required for the energization of HVAC control panel PLC.	

Step	*Description*	*Notes/Remarks*
7	In Package Local Control Panel, set external selector switch to REMOTE position and push the RESET button	
8	In Yokogawa SIS graphic pages, select from menu SIS C/E→PSD and proceed to give the INTERLOCK RESET command. In Yokogawa Engineering Workstation (EWS0164), open Prosafe Maintenance, then SCS0110 (SIS) and restore normal operating condition on signals 50-XS-001 and 84-XS-01.	
9	With reference to Package Vendor doc n. 1724000448-MAC-MAN-00032 title WATER TREATMENT PACKAGE A-50000 INSTALLATION, OPERATING AND MAINTENANCE MANUAL, proceed to follow with dedicated Vendor procedure for Package start-up.	
10	Additional steps required for start-up of Sea Water Lift Pumps P-50001A/B In LV Switchboard SG-200N1, close the auxiliary power miniature circuit breakers QA1 located inside in the drawers: A7/+01 (SEA WATER LIFT PUMP PM-50001A) A6/+01 (SEA WATER LIFT PUMP PM-50001B) N.B. In case of onshore testing, the Sea Water Lift Pump drawers should NOT be utilised. As an exceptional case, the forced signals can be maintained if pumps are not in use.	
11	In Yokogawa Engineering Workstation (EWS0164), open Prosafe Maintenance, then SCS0110 (SIS) and force the following signal: - 83-XS-001A = TRUE (SHUTDOWN SEAWATER LIFT PUMP P-50001A) - 83-XS-001B = TRUE (SHUTDOWN SEAWATER LIFT PUMP P-50001B) N.B. Operator is instructed to record the action of signal forcing in the dedicated Override/Inhibit Register.	

Step	*Description*	*Notes/Remarks*
12	Put the drawers in service position and manually close the main power circuit breakers QF1. In the drawers put the selector SA1 (LOCAL/REMOTE) in REMOTE position.	
13	Pre-startup package internal visual check: • With reference to package P&D, all bypass manual valves of each on-line analyzer shall be closed. • All manual isolation valves for each chemical injection line shall be opened. • At least one of the motorized valves 50-XV-021 and 50-XV-022 at SW Booster Pumps suction is opened. • All motorized valves 50-XV-023, 50-XV-024, 50-XV-025, 50-XV-027, 50-XV-030, dedicated to SWRO automatic flushing are closed. • Off-spec automatic motorized valves 50 XV-026 and 50-XV-032 shall be opened. • Manual control valve MV-550 and MV-558 of each SWRO brine stream is fully opened. Furthermore, check and confirm that following reverse osmosis membranes, filters, chemicals, etc. have been duly installed and fluids topped up: • Sea water coarse filter A-50003 • Sand filter S-50001 • Antiscalant fluid in storage tank T-50003 • Cartridge filters S-50002A/B, S-50003A/B • Biocide fluid in storage tank T-50004 • RO membranes in RO units A-50007A/B • Softening filter S-50004 • UV steriliser S-50010 N.B. Caustic Soda fluid in storage tank T-50002 is not required (no pH correction dosing will be operational).	
14	Startup of Container Electrical Heaters and Air Fans: • Start/stop N° 3 Container Air Fans HFA-50001A/B/C from local control panel (only nr.2 fans at one time). • Start Container Electric Heater HHS-50001A/B, one at a time, from local control panel to check correct operation.	

Step	*Description*	*Notes/Remarks*
15	• Initial startup in LOCAL control operation ➢ Chemical dosing pumps filling and venting ➢ Softener filter start up ➢ Sea water filling and venting of overall hydraulic circuit ➢ Fresh water filling and venting of overall hydraulic circuit	
16	➢ Chemical dosing pumps filling and venting • Turn the manual multifunctional valve in recycle position to vent air from the dosing pumps. • Start each dosing pump from local control panel and wait for priming. • Adjust manually the dosage flow rate of each dosing pump (should not be required unless a dosing pump will be replaced)  Antiscalant dosing pumps P-50005A/B Status On (0,01 Biocide dosing pumps P-50007A/B Status On (0,03 Biocide dosing pumps P-50008A/B Status On (0,85 Biocide dosing pumps P-50010A/B Status On (0,33 • When liquid only exits from the valve, then close it • Check the pump calibration as per Sub-Vendor Manual (should not be required unless a dosing pump will be replaced) • Stop the dosing pumps.	

Step	*Description*	*Notes/Remarks*
17	➢ Softener filter start up The start-up of the unit consists of running a first regeneration cycle during which the column of resins and brine tanks will be filled with water, all automatic features will be checked, and the unit will be prepared to start the service. During the start-up it is not required that salt is available inside the brine tank. At the end of the first regeneration, fill the brine tank with salt. To start up the unit, proceed as follows: • Close both inlet and outlet valve • Switch on electrical power • Start a manual regeneration: press button "man/set" for 5 consecutive seconds, choose IMM using "↑" or "↓" keys and confirm with "man/set" button • Wait until the programmer reaches the backwash position, indicated on the display by 1C followed by a fixed number • Disconnect electric power • Open slowly and not completely the inlet valve. Water will enter from the bottom of the column as air will be expelled from the top to the drain • When only water comes out, open completely the inlet valve and allow the water to flush until the water looks clear • Using a suitable container, add water in the brine tank, until the water mark is approx. 30 cm from the bottom • Switch on electrical power • Wait until the regeneration is completed, checking that the suction of water from brine tank features correctly • Open the outlet valve Put the salt into the brine tank (it can also be completely filled, 50kg quantity required for 6 months operation). Take care not to put salt inside the protection pipe.	

18	➢ Sea water filling and venting of overall hydraulic circuit "A" • Check that no alarm is displayed to HMI, otherwise, recheck and resolve the relevant issue. • Throttle the inlet manual valve MV-500 to approximately 50% to reduce the inlet flow rate. • Start Rosetti's seawater pump and flush the inlet line with seawater feeding, for approx. 10 min, draining it by sample point manual valve MV-501 and temporary connection with flexible hose to drain outside the container. • Check feed seawater quality (visual low Turbidity, No significant TSS presence, Conductivity, No visible colour, NO visible free oil, NO odor). • Check the operation of air vent valves MV-635. • Close the previous sample point valve MV-501. • Open automatic inlet valve 50-XV-020 to fill slowly the following items: Coarse Filter A-50003 Process Electric Heater H-50001 Filtered Water Tank T-50006 • After 10 min open totally the inlet manual valve MV-500. • Start biocide pump P-50007A to feed container, from local control panel. • Before sending the filtered liquid to further steps, ensure through appropriate analysis (TSS -Total suspended solids, turbidity, particle count, Silt Density Index), that the quality of the filtered liquid is suitable to feed SWRO. • When Filtered Water Tank level is high and the filtered water quality is within acceptable values, start SW Booster Pump P-50003A from local panel. • Throttle the cartridge filters outlet manual valve MV-531. • Check the operation of air vent valves MV-640. • Fill the line and Cartridge Filters S-50002A, S-50003A and close the vent valve after only liquid overflowing. • Open totally the manual outlet valve MV-531 and when the pressure is approx. > 2 barg at HP Pump suction, start the HP Pump P-50004A at low-speed rotation value from VFD panel. On VFD panel select manual control and set rotation speed to 65%. • Proceed with the same steps described above to fill and vent SWRO line B.	

Step	*Description*	*Notes/Remarks*
	➢ Sea water filling and venting of overall hydraulic circuit "B" • Check that no alarm is displayed to HMI, otherwise, recheck and resolve the relevant issue. • Throttle the inlet manual valve MV-500 to approximately 50% to reduce the inlet flow rate. • Start Rosetti's seawater pump and flush the inlet line with seawater feeding, for approx. 10 min, draining it by sample point manual valve MV-501 and temporary connection with flexible hose to drain outside the container. • Check feed seawater quality (visual low Turbidity, No significant TSS presence, Conductivity, No visible colour, NO visible free oil, NO odor). • Check the operation of air vent valves MV-635. • Close the previous sample point valve MV-501. • Open automatic inlet valve 50-XV-020 to fill slowly the following items: Coarse Filter A-50003 Process Electric Heater H-50001 Filtered Water Tank T-50006 • After 10 min open totally the inlet manual valve MV-500. • Start biocide pump P-50007B to feed container, from local control panel. • Before sending the filtered liquid to further steps, ensure through appropriate analysis (TSS -Total suspended solids, turbidity, particle count, Silt Density Index), that the quality of the filtered liquid is suitable to feed SWRO. • When Filtered Water Tank level is high and the filtered water quality is within acceptable values, start SW Booster Pump P-50003B from local panel. • Throttle the cartridge filters outlet manual valve MV-539. • Check the operation of air vent valves MV-641. • Fill the line and Cartridge Filters S-50002B, S-50003B and close the vent valve after only liquid overflowing. • Open totally the manual outlet valve MV-539 and when the pressure is approx. > 2 barg at HP Pump suction, start the HP Pump P-50004B at low-speed rotation value from VFD panel. On VFD panel select manual control and set rotation speed to 65%.	

Step	*Description*	*Notes/Remarks*
19	➢ Fresh water filling and venting of overall hydraulic circuit • Fill the Fresh water tank T-50008 with service water. • Throttle Fresh water pump delivery valves MV-563 and MV-566. • Close 50-XV-031 valve and open 50-XV-032 valve. • Start Fresh water pumps P-50009A/B, vent and prime the pump for 10 minutes. • Put the common pretreatment section and one SWRO line in automatic mode for plant start up from control panel.	
20	PACKAGE ACTIVITIES AFTER START UP Alter Water Treatment Package Plant started, the minimum activities required are the following: • On local control panel, select REMOTE operation mode. • Remote monitoring of all process parameters (pressure, flowrate, conductivity, etc.). • Increase High Pressure Pumps pressure in case of lower freshwater flowrate. • Switch the SWRO line from stand-by to service and stop the previous operating SWRO line every week by remote, in order to use line A and line B for similar period. • In case of any alarm signal or interlock activation, it is recommended a technical evaluation of the situation to identify the problem and plan the best solution procedure.	

5.3.1.1.10 SS 55-00 Waste Water Disposal

Step	*Description*	*Notes/Remarks*
1	Prepare a temporary flexible hose from the transition piece tie-in point below the lower deck to the SITE designated drainage point. Ref. doc. n. 123A90-DDL-PR-PID-80026, flanged connection "DECK/HOOK-UP 001"	
2	In case the BLPH wastewater is not classified as suitable for the SITE drainage system, a temporary storage holding tank should be provided, to be successively drained and disposed of according to local regulations.	

5.3.1.1.11 SS 55-01 Waste Water Brine Discharge System

Step	*Description*	*Notes/Remarks*
1	Prepare a temporary flexible hose from the transition piece tie-in point below the lower deck to the SITE designated drainage point. Ref. doc. n. 123A90-DDL-PR-PID-80025, flanged connection "DECK/HOOK-UP 004" & "DECK/HOOK-UP 005"	
2	In case the BLPH waste brine water is not classified as suitable for the SITE drainage system, a temporary storage holding tank should be provided, to be successively drained and disposed of according to local regulations.	

5.3.1.1.12 SS 56-11 Non-Hazardous Open Drain Collection

Step	*Description*	*Notes/Remarks*
1	Prepare a temporary flexible hose from the transition piece tie-in point below the lower deck to the SITE designated drainage point. Ref. doc. n. 123A90-DDL-PR-PID-80043, flanged connection "DECK/HOOK-UP 007"	

Step	Description	Notes/Remarks
2	The non-hazardous open drain collects only rainwater from the upper and lower decks; there should not be any issue with SITE disposal.	

5.3.1.1.13 SS 25-01 Hydrogen Storage Vessel A (V-25001A)

Step	Description	Notes/Remarks
1	N.B: Prior to subsystem pressurization with hydrogen gas, it will be required to check the LO-LC Register jointly with the respective marked-up P&IDs to identify all the flanged witness joints to be carefully monitored during the first pressurization.	
2	Confirm that no trip conditions are present in Yokogawa SIS C&E graphic page ESD1-1D.	
3	In Yokogawa Process graphic page for Hydrogen Vessel V-25001A, proceed to open the faceplate for valve 25BDV-005 and give the close command. Confirm that the corresponding limit switch 25ZSL-005 is received in Yokogawa Process graphic page highlighting the valve closed position.	
4	It is required to perform a manual open-and-close action on the following valves to verify the correct functioning and status of the feedback signals: 25XV-004 25XV-006 25PV-035 25FV-031 Proceed to restore the automatic mode of operation for each valve.	
5	Verify the alignment of the manual process valves according to the LO-LC Register jointly with the respective marked-up P&IDs.	

5.3.1.1.14 SS 25-02 Hydrogen Storage Vessel B (V-25001B)

Step	*Description*	*Notes/Remarks*
1	N.B: Prior to subsystem pressurization with hydrogen gas, it will be required to check the LO-LC Register jointly with the respective marked-up P&IDs to identify all the flanged witness joints to be carefully monitored during the first pressurization.	
2	Confirm that no trip conditions are present in Yokogawa SIS C&E graphic page ESD1-1D.	
3	In Yokogawa Process graphic page for Hydrogen Vessel V-25001B, proceed to open the faceplate for valve 25BDV-007 and give the close command. Confirm that the corresponding limit switch 25ZSL-007 is received in Yokogawa Process graphic page highlighting the valve closed position.	
4	It is required to perform a manual open-and-close action on the following valves to verify the correct functioning and status of the feedback signals: 25XV-008 25XV-009 25PV-037 25FV-032 Proceed to restore the automatic mode of operation for each valve.	
5	Verify the alignment of the manual process valves according to the LO-LC Register jointly with the respective marked-up P&IDs.	

5.3.1.1.15 SS 25-03 Hydrogen Storage Vessel C (V-25001C)

Step	*Description*	*Notes/Remarks*
1	N.B: Prior to subsystem pressurization with hydrogen gas, it will be required to check the LO-LC Register jointly with the respective marked-up P&IDs to identify all the flanged witness joints to be carefully monitored during the first pressurization.	
2	Confirm that no trip conditions are present in Yokogawa SIS C&E graphic page ESD1-1D.	
3	In Yokogawa Process graphic page for Hydrogen Vessel V-25001C, proceed to open the faceplate for valve 25BDV-010 and give the close command. Confirm that the corresponding limit switch 25ZSL-010 is received in Yokogawa Process graphic page highlighting the valve closed position.	
4	It is required to perform a manual open-and-close action on the following valves to verify the correct functioning and status of the feedback signals: 25XV-011 25XV-012 25PV-040 25FV-033 Proceed to restore the automatic mode of operation for each valve.	
5	Verify the alignment of the manual process valves according to the LO-LC Register jointly with the respective marked-up P&IDs.	

5.3.1.1.16 SS 25-04 Hydrogen Storage Vessel D (V-25001D)

Step	*Description*	*Notes/Remarks*
1	N.B: Prior to subsystem pressurization with hydrogen gas, it will be required to check the LO-LC Register jointly with the respective marked-up P&IDs to identify all the flanged witness joints to be carefully monitored during the first pressurization.	
2	Confirm that no trip conditions are present in Yokogawa SIS C&E graphic page ESD1-1D.	
3	In Yokogawa Process graphic page for Hydrogen Vessel V-25001D, proceed to open the faceplate for valve 25BDV-013 and give the close command. Confirm that the corresponding limit switch 25ZSL-013 is received in Yokogawa Process graphic page highlighting the valve closed position.	
4	It is required to perform a manual open-and-close action on the following valves to verify the correct functioning and status of the feedback signals: 25XV-014 25XV-015 25PV-043 25FV-034 Proceed to restore the automatic mode of operation for each valve.	
5	Verify the alignment of the manual process valves according to the LO-LC Register jointly with the respective marked-up P&IDs.	

5.3.1.1.17 SS 25-05 Hydrogen Storage Vessel E (V-25001E)

Step	*Description*	*Notes/Remarks*
1	N.B: Prior to subsystem pressurization with hydrogen gas, it will be required to check the LO-LC Register jointly with the respective marked-up P&IDs to identify all the flanged witness joints to be carefully monitored during the first pressurization.	
2	Confirm that no trip conditions are present in Yokogawa SIS C&E graphic page ESD1-1D.	
3	In Yokogawa Process graphic page for Hydrogen Vessel V-25001E, proceed to open the faceplate for valve 25BDV-016 and give the close command. Confirm that the corresponding limit switch 25ZSL-016 is received in Yokogawa Process graphic page highlighting the valve closed position.	
4	It is required to perform a manual open-and-close action on the following valves to verify the correct functioning and status of the feedback signals: 25XV-017 25XV-018 25PV-046 25FV-038 Proceed to restore the automatic mode of operation for each valve.	
5	Verify the alignment of the manual process valves according to the LO-LC Register jointly with the respective marked-up P&IDs.	

5.3.1.1.18 SS 25-06 Hydrogen Storage Vessel F (V-25001F)

Step	*Description*	*Notes/Remarks*
1	N.B: Prior to subsystem pressurization with hydrogen gas, it will be required to check the LO-LC Register jointly with the respective marked-up P&IDs to identify all the flanged witness joints to be carefully monitored during the first pressurization.	
2	Confirm that no trip conditions are present in Yokogawa SIS C&E graphic page ESD1-1D.	
3	In Yokogawa Process graphic page for Hydrogen Vessel V-25001F, proceed to open the faceplate for valve 25BDV-019 and give the close command. Confirm that the corresponding limit switch 25ZSL-019 is received in Yokogawa Process graphic page highlighting the valve closed position.	
4	It is required to perform a manual open-and-close action on the following valves to verify the correct functioning and status of the feedback signals: 25XV-020 25XV-021 25PV-049 25FV-036 Proceed to restore the automatic mode of operation for each valve.	
5	Verify the alignment of the manual process valves according to the LO-LC Register jointly with the respective marked-up P&IDs.	

5.3.1.1.19 SS 25-07 Hydrogen Storage Vessels Header (Inlet)

Step	*Description*	*Notes/Remarks*
1	N.B: Prior to subsystem pressurization with hydrogen gas, it will be required to check the LO-LC Register jointly with the respective marked-up P&IDs to identify all the flanged witness joints to be carefully monitored during the first pressurization.	
2	Confirm that no trip conditions are present in Yokogawa SIS C&E graphic page PSD.	
3	In Yokogawa Process graphic page for Hydrogen Storage Vessel Header (Inlet), proceed to open the faceplate for valve 25SDV-001 and give the open command. Confirm that the corresponding limit switch 25ZSH-001 is received in Yokogawa Process graphic page highlighting the valve open position.	
4	It is required to perform a manual open-and-close action on the following valve to verify the correct functioning and status of the feedback signals: 25XV-024 Proceed to restore the automatic mode of operation for the valve and confirm valve closed position.	
5	Verify the alignment of the manual process valves according to the LO-LC Register jointly with the respective marked-up P&IDs.	

5.3.1.1.20 SS 25-08 Hydrogen Storage Vessels Header (Outlet)

Step	*Description*	*Notes/Remarks*
1	N.B: Prior to subsystem pressurization with hydrogen gas, it will be required to check the LO-LC Register jointly with the respective marked-up P&IDs to identify all the flanged witness joints to be carefully monitored during the first pressurization.	
2	In Yokogawa SIS graphic pages, select from menu SIS C/E→PSD and proceed to enable the start-up override (OOS) on the LL pressure alarm for 80PI-002 As an alternative, in case the timer will not be sufficient to allow a proper start-up of the package, the operator can proceed with the following: In Yokogawa Engineering Workstation (EWS0164), open Prosafe Maintenance, then SCS0110 (SIS) and force the following signal: - 80PI-002=50% (Hydrogen storage to A-80000 Package) N.B. Operator is instructed to record the action of signal forcing in the dedicated Override/Inhibit Register.	
3	Confirm that no trip conditions are present in Yokogawa SIS C&E graphic pages PSD and ESD1-1D.	
4	In Yokogawa Process graphic page for Hydrogen Storage Vessel Header (Outlet), proceed to open the faceplate for valve 25BDV-022 and give the close command. Confirm that the corresponding limit switch 25ZSL-022 is received in Yokogawa Process graphic page highlighting the valve closed position and confirm valve closed position.	
5	In Yokogawa Process graphic page for Hydrogen Storage Vessel Header (Outlet), proceed to open the faceplate for valve 25SDV-023 and give the open command. Confirm that the corresponding limit switch 25ZSH-023 is received in Yokogawa Process graphic page highlighting the valve open position.	

Step	*Description*	*Notes/Remarks*
6	It is required to perform a manual open-and-close action on the following valves to verify the correct functioning and status of the feedback signals: 25PV-055A 25PV-055B 80XV-001 Proceed to restore the automatic mode of operation for each valve and confirm the correct default open/closed position.	
7	Verify the alignment of the manual process valves according to the LO-LC Register jointly with the respective marked-up P&IDs.	

5.3.1.1.21 SS 43-00 Hydrogen Vent Header & Drum System

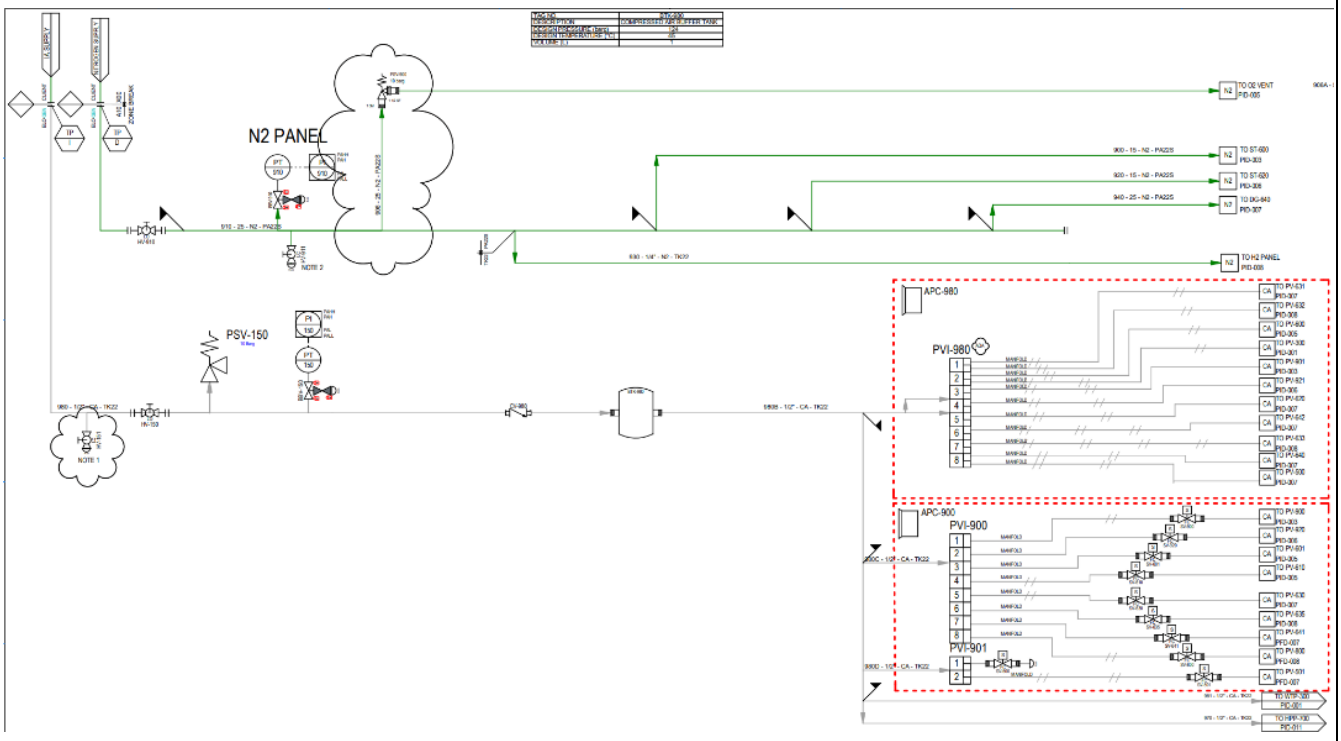
Step	*Description*	*Notes/Remarks*
1	In BLPH Upper Deck, locate the flow gauge 64FG-001 and proceed to regulate the manual needle valve BLPH-MV-171. The 64FG-001 should indicate a flow of 10 Nm^3/hr. In Yokogawa Process graphic page for Hydrogen Vent Drum, verify the flow reading on 43FI-001 of approx. 3 kg/hr.	
2	In Yokogawa Process graphic page for Hydrogen Vent Drum, verify the HIGH HIGH level reading on 43LI-001 of less than 650 mm. N.B. The LOW level alarm is set for +200 mm.	
3	Verify the alignment of the manual process valves according to the LO-LC Register jointly with the respective marked-up P&IDs.	

5.3.1.1.22 SS 20-00 Electrolyser Package (A-20000)

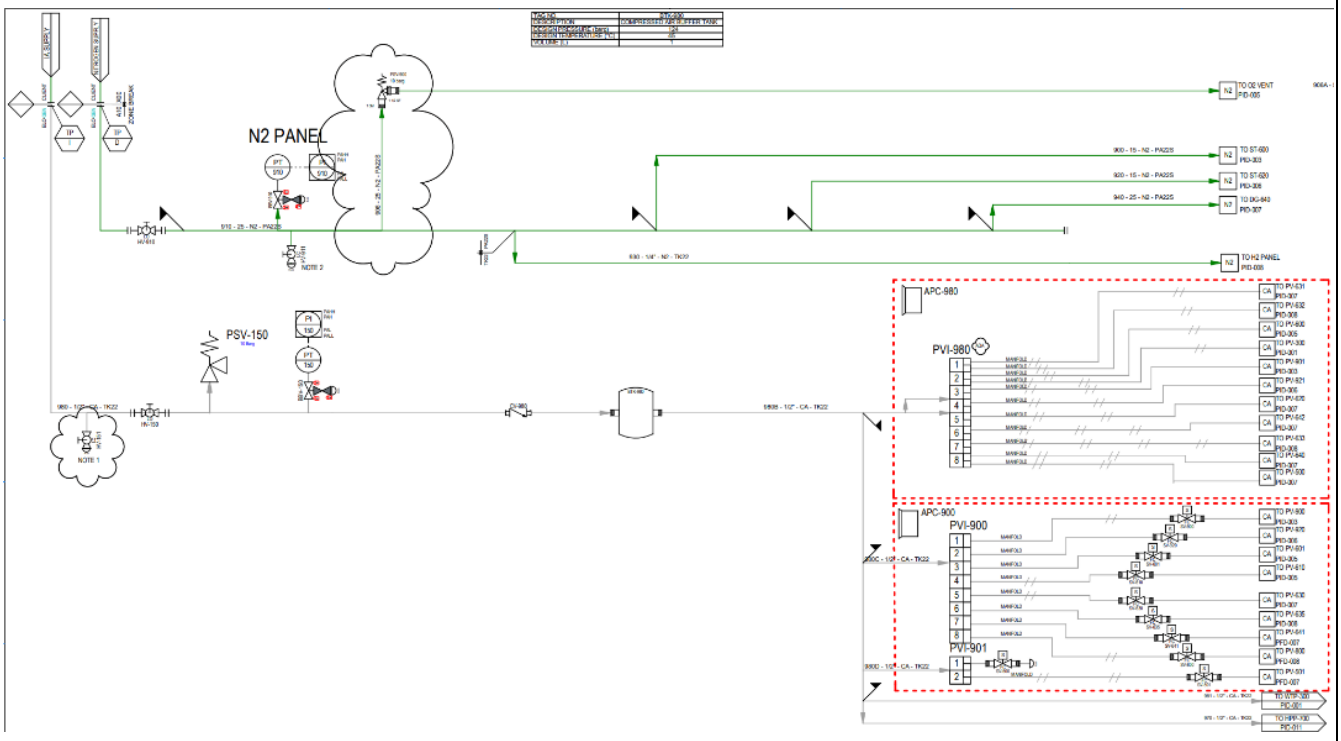
Step	*Description*	*Notes/Remarks*
1	N.B. the Electrolyser Package, including Local Control Panels, has been preserved prior to sail away as recommended by Manufacturer Elogen. Please ensure that all preservation materials have been duly removed prior to first energization. In case of BPLH first startup after preservation period or following any period of process plant maintenance, it is extremely important to ensure correct execution of purging sequences via dedicated PCS commands; - PURGING AIR → NITROGEN → HYDROGEN.	
2	In LV Switchboard SG-200N1, close the auxiliary power miniature circuit breakers in the cubicle A1/+08: QA1 (Motor Spring Charger C.B.) QA2 (Command Circuit)	
3	Put the drawers in service position and check that the spring is charged. In the drawer put the selector SA1 (LOCAL/REMOTE) in REMOTE position.	
4	In Yokogawa Electrical graphic pages, select from menu Electrical→LV Switchboard and give the close command to the relevant switch	

Step	*Description*	*Notes/Remarks*
5	In 6.6kV Switchgear SG-100D1 column A1, check that the breaker is in racked-in position and the earth switch is in open position. Proceed to locate and close the following circuit breakers: QD1 (protection device) QD2 (command circuits) QD3 (Spring Charging Motor) QV1, QV2, QV3, QV4, QV5 (measurement) QD4 (thermal monitoring) QA2 (internal lighting heaters and socket) Proceed to put the selector SA1 (LOCAL/REMOTE) in REMOTE position.	
6	In Yokogawa Electrical graphic pages, select from menu Electrical→Overall Single Line Diagram and give the close command to the feeder located in 6.6kV Switchgear SG-100D1 panel A1	
7	In Yokogawa Engineering Workstation (EWS0164), open Prosafe Maintenance, then SCS0110 (SIS) and force the following signal to the Electrolyser: - 20-XS-001=TRUE (SHUT-DOWN A-20000 Electrolyser PKG) N.B. Operator is instructed to record the action of signal forcing in the dedicated Override/Inhibit Register.	
8	In Package Local Control Panel, set external selector switch to REMOTE position and push the RESET button	
9	In Yokogawa SIS graphic pages, select from menu SIS C/E→PSD and proceed to give the INTERLOCK RESET command. In Yokogawa Engineering Workstation (EWS0164), open Prosafe Maintenance, then SCS0110 (SIS) and restore normal operating condition on signal 20-XS-001.	

Step	*Description*	*Notes/Remarks*
10	➢ Electrolyser Package Internal 400V Aux Supply 1. Confirm ON 400Vac on customer switchgear (SG-200N1). 2. Switch ON 400Vac on the control cabinet (1QF3). 3. Phases presence indicator is lit (1FU1). 4. Switch ON the UPS with the CB (100QF5) and the 24VDC power supply by (130QF1 & 130QF3). Note. If the UPS has been completely depleted, please engage the UPS bypass switch on the front of the panel, this takes a supply direct from SG-200N1(before incomer switch 1QF3) once the UPS has charged return bypass switch to off position 5. Wait for PLC to start up. 6. Log into Maintenance mode on HMI. 7. On the "Production Control" page, select Local and Manual mode. 7. Wait 3min and acknowledge all HMI alarms by pressing the HMI acknowledge button. 8. Press the yellow Reset button on the front of the control panel. 9. Acknowledge all HMI alarms again. 10. Any other standing alarms to be investigated and made healthy	
11	➢ Electrolyser Package Internal 6.6KV Main Supply 1. Confirm 6600 VAC on the customer MV switchgear SG-100D1 and transformer T4 is energized. 2. Confirm voltages are present on NIDEC HMI. 3. Confirm no Alarms are present if there are then, Press the yellow Reset button on the front of the Elogen control panel. 4. Acknowledge all HMI alarms again. 5. Confirm System is healthy.	
12	➢ Electrolyser Package Internal Instrument Air Supply 1. Confirm valve BLPH-MV-210 from IA Network is open. 2. Confirm Instrument Air is at 7 barg. 3. Confirm IA line up as per attached PID C63-PID-001-009. 4. Open the HV-150 valve and all the other Instrument Air network valves in accordance with the attached following PID.	

Step	Description	Notes/Remarks
		
13	➢ Electrolyser Package Internal Nitrogen Supply 1. Confirm valve BLPH-NRV-019 from Nitrogen Network is open. 2. Confirm the nitrogen supply is at 7 barg. 3.Confirm Nitrogen line up as per attached PID C63-PID-001-009. 4. Open the HV-910 valve and all the other nitrogen network valves in accordance with the following PID.	

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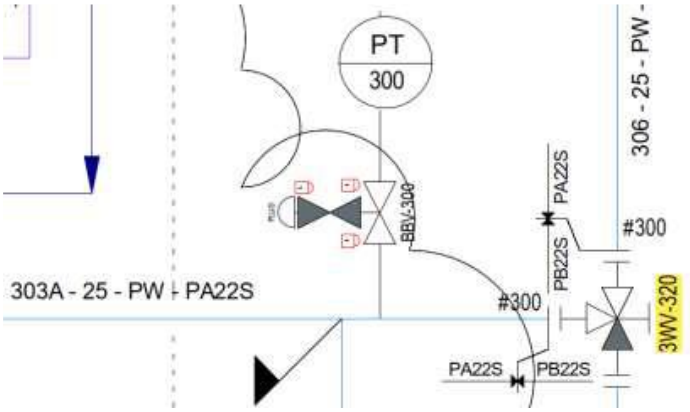
Step	Description	Notes/Remarks
		
14	➢ Electrolyser Package HVAC 1.At the Paumier HVAC panel ensure that power is on. 2. Confirm no Alarms are present, and system is healthy. 3. In normal operation, the AHU fans, heater, and dampers are in "AUTOMATIC" mode: the start/running/stop is automatic, controlled by the HVAC HMI. 4.Confirm operation of HVAC by checking flow is present at outlet ducts.	
15	➢ Electrolyser Package Internal WTP (OVIVO) 1. Ensure that power is on. 2. Confirm no Alarms are present, and the system is healthy, if required press the acknowledgement button to reset all alarms/faults. 3. Confirm the system is in automatic mode. 4. Confirm valve BLPH-MV-001 from PSC WTP is open. 5. Confirm a water supply of 4 barg from the PSC WTP on Ovivo HMI.	

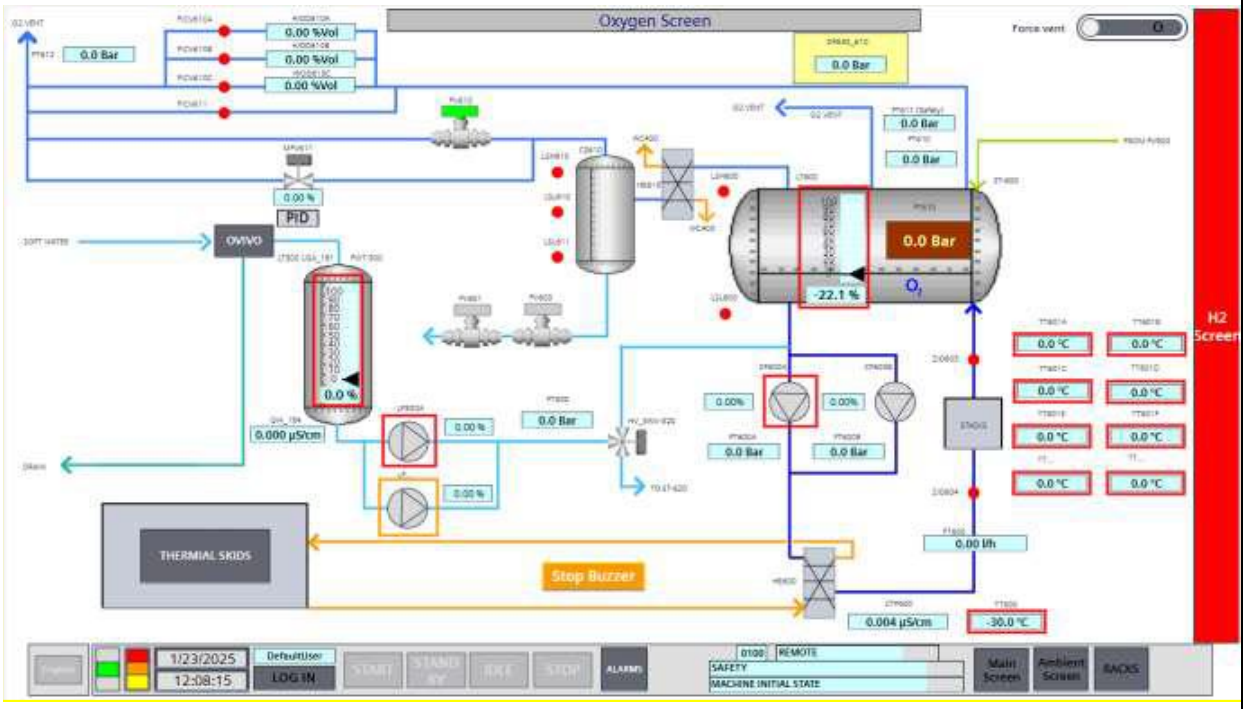
Step	Description	Notes/Remarks
16	**Line Walk of 02 Loop** Line-up the valves as per following tables with PID C63-PID-001-001 to PID C63-PID-01-007	

Valve Open	Confirmed/Signed
HV-300	
HV-301A	
HV-302A	
PV-300	
HV-600	
HV-600A	
HV-600B	
HV-601A	
HV-6018	
HV-602A	
HV-603A	
HV-604	
HV-605	
For Venting: HV-615	
For Venting: MPV-611	

Valve Closed	Confirmed/Signed
HV-600D	
HV-600DA	
HV-6000B	
HV-6010	
HV-602DA	
HV-603D	
PV-640	
For Venting: PV-610	

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Step	Description	Notes/Remarks
17	➢ WATER TOP-UP FOR THE ELECTROLYSIS (OXYGEN SIDE-600 LOOP) This step can be Skipped if the level is sufficient. 1. At the Elogen HMI. 2. Make sure the electrolyser is stopped, depressurized and cold (Stacks temperature under 40 °C –TT-601X). 3. The status displayed on the HMI should be "STOP" 4. Log in to "Maintenance" mode via the HMI. 5. Check that the Water Treatment Package is available to start in automatic operation. 5. Check that the 3WV-320 is open towards oxygen loop.  6. Check that all the hand valves are in the locked position on oxygen loop are as indicated on the P&ID (cf. C63-PID-001). 7. Check that the level on the pure water buffer tank (depicted as DEMIN TANK on the following P&ID) is high enough to perform the operation (the LALL-301 is not active)	

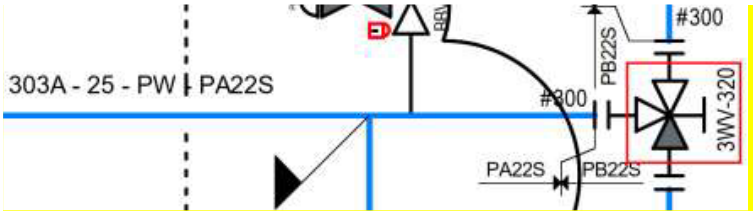
Step	Description	Notes/Remarks
		
	8. Set the LP-300A/B to **55%** of its speed in case the oxygen separator tank (ST-600) is depressurized to prevent overflows. 5. Follow the increase on the level of ST-600 displayed on the HMI 6. Stop the LP-300 once the LT-600 displays **43%**. 7. Start the CP-600. The water level should decrease. 8. Stop the CP-600. 9. Repeat the sequence from steps #5 to #9, until the water level of ST-600 is stable at **43%**. **Note:** Ensure that the CP-600 does not exceed the maximum number of starts per hour.	

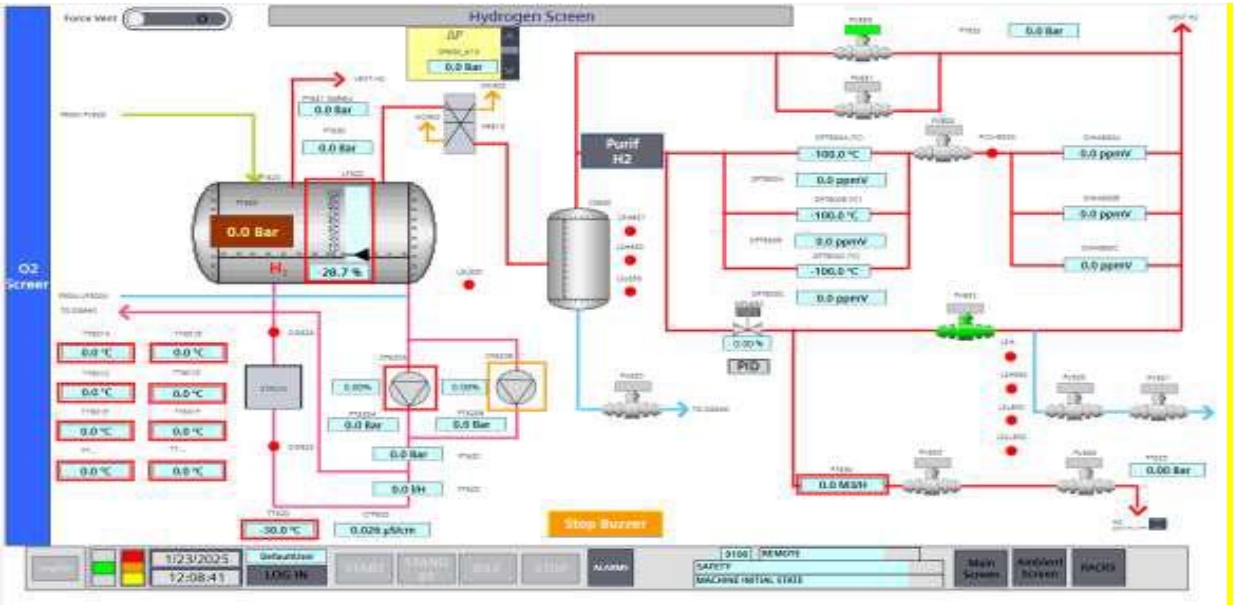
Step	Description	Notes/Remarks
18	Line Walk of H2 loop Line-up the valves as per below tables with PID C63-PID-001-001 to PID C63-PID-001-007	

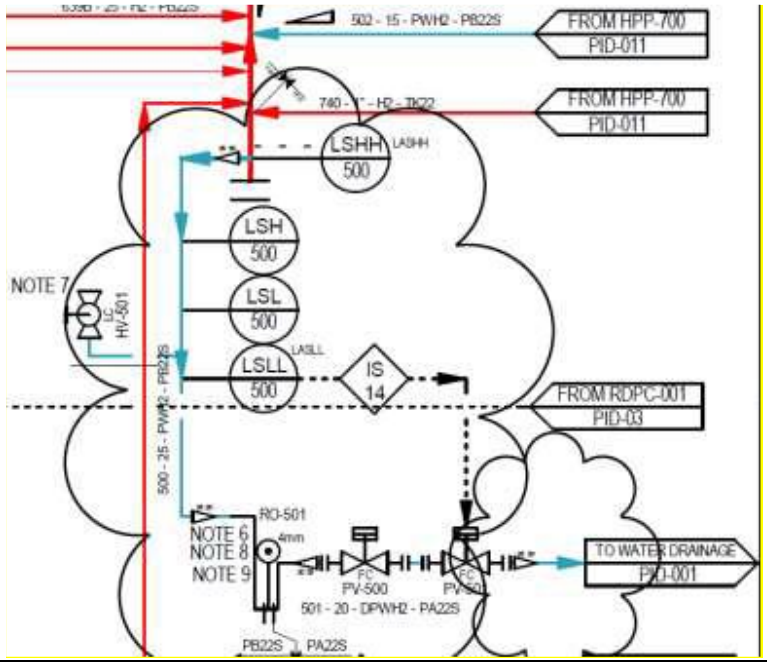
Valve Open	Confirmed/Signed
HV-300	
HV-301B	
HV-302B	
HV-620	
HV-620A	
HV-620B	
HV-621A	
HV-621B	
HV-622	
HV-623	
HV-624	
MV-640	
For Venting: PV-631	
For Venting PV-642	

Valve Closed	Confirmed/Signed
HV-620D	
HV-620DA	
HV-620D8	
HV-621D	
HV-622D	
PV-600	
PV-620	
PV-640	
PV-641	

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Step	Description	Notes/Remarks
19	➢ WATER TOP-UP FOR THE ELECTROLYSIS HYDROGEN SIDE-620 LOOP) This step can be Skipped if the level is sufficient. 1. At the Elogen HMI make sure the electrolyser is depressurized, and its status indicates STOP. 2.Log in to "Maintenance" mode via the HMI. 3. Check that the Water Treatment Package is available to start in automatic operation. 4.Move valve 3WV-320 the open position from the LP-300 pump to the ST-620 hydrogen separator tank.  6. Start the LP-300 pump via the HMI at 55% of its capacity. 7. When the water level in the ST-620 separator tank reaches 45%:	



Step	Description	Notes/Remarks
	8.Stop the LP-300 pump. 9. Start CP-620 pump. The water level should decrease. 8. Stop CP-620 pump. 9. Repeat the sequence from step 5 to step 8 until the water level in the ST-620 separator tank has stabilized at 45%. 10. Once the water level in the ST-620 separator tank has stabilized at 45%: 11. Return valve 3WV-320 to its normal position, i.e., from the LP-300 pump to the ST-600 oxygen separator tank and lock it.	
20	➢ FILL DRAIN SIPHON 1. Make sure the electrolyser is stopped, depressurized and wait until the pipes have cooled down. 2. Make sure the H2 vent is nitrogen flushed. 3. Make sure there is no backpressure from general H2 vent. 4. Open all the access doors to the electrolyser. 5. Unlock HV-501, Remove the plug. 6. Open HV-501. 7. Fill the siphon until the LSL-500 is triggered (generally 2L are required. 8. Close HV-501 and lock it. 9. Reinstall the plug using Teflon tape 	

Step	*Description*	*Notes/Remarks*
21	➢ Clean Air bubble in DG-640 1. Open HV-642 2. Set MV-941 3. Reverse SP-940 4. Open HV-940 5. Flush with N2 the DG-640 for 30s 6. Close HV-940 7. Reverse SP-940 8. Close HV-642	

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22

- Final Line-up of system

Confirm line-up the valves as per below tables with
PID C63-PID-001-001 to
PID C63-PID-001-0016.

Valve Open	Confirmed/Signed
HV-300	
HV-301	
HV-301D	
HV-301A	
HV-301B	
HV-302A	
HV-302B	
MV-420	
MV-406	
MV-408	
HV-615	
HV-600A	
HV-600B	
HV-601A	
HV-601B	
HV-600	
HV-624	
HV-620	
HV-620A	
HV-620B	
HV-621A	
HV-621B	
MV-640	
MV-631	
HV-642	
MV-642	
BLPH-MV-002	
MV-632	
HV-633	

Step	Description	Notes/Remarks

Valve Closed	Confirmed/Signed
HV-300D	
HV-300DA	
HV-300DB	
HV-303DA	
HV-303DB	
PV-300	
HV-307V	
HV-410D	
HV-4610	
HV-610D	
HV-600D	
HV-600DA	
HV-600DB	
HV-601D	
MV-600D	
HV-619D	
HV-606D	
HV-620D	
HV-620DA	
HV-620DB	
HV-626D	
HV-640D	
HV-401D	

23	➢ Electrolyser Operational MODE 1. Leave maintenance mode and return to operator screen. 2. Switch the Electrolyser to Automatic on the HMI and remote operating mode via the selector switch located on the control panel. 3. Confirm communication/Available with PCS. 4. The Electrolyser Package now is operative and ready to start via PCS.	

5.3.1.1.23 SS 80-00 Hydrogen Fuel Cell Package (A-80000)

Step	*Description*	*Notes/Remarks*
1	N.B. the Hydrogen Fuel Cell Package, including Local Control Panels, has been preserved prior to sail away as recommended by Manufacturer Ballard. Please ensure that all preservation materials have been duly removed prior to first energization.	
2	In LV Switchboard SG-200N1, close the auxiliary power miniature circuit breaker QA1 located inside in the drawer: A4/+03 FUEL CELL AUXILIARY LOAD	
3	Put the drawers in service position and manually close the main power circuit breaker QF1. In the drawers put the selector SA1 (LOCAL/REMOTE) in REMOTE position.	
4	In Yokogawa Electrical graphic pages, select from menu Electrical→LV Switchboard and give the close command to the relevant switch	
5	In 6.6kV Switchgear SG-100D1 column A7, check that the breaker is in racked-in position and the earth switch is in open position. Proceed to locate and close the following circuit breakers: QD1 (protection device) QD2 (command circuits) QV1, QV2, QV3, QV4, QV5 (measurement) QD4 (thermal monitoring) QA2 (internal lighting heaters and socket) Proceed to put the selector SA1 (LOCAL/REMOTE) in REMOTE position.	

Step	*Description*	*Notes/Remarks*
6	In Yokogawa Engineering Workstation (EWS0164), open Prosafe Maintenance, then SCS0110 (SIS) and force the following signal to 6.6kV Switchgear SG-100D1 column A7: 82-XS-003=TRUE (OPEN FUEL CELL A-80000 INC. CIRCUIT BREAKERS) N.B. Operator is instructed to record the action of signal forcing in the dedicated Override/Inhibit Register.	
7	In Yokogawa Electrical graphic pages, select from menu Electrical→Overall Single Line Diagram and give the close command to the feeder located in 6.6kV Switchgear SG-100D1 panel A7	
8	In Yokogawa Engineering Workstation (EWS0164), open Prosafe Maintenance, then SCS0110 (SIS) and force the following signal to the Fuel Cell: - 80-XS-001=TRUE (SHUT-DOWN A-80000 Fuel Cell PKG) N.B. Operator is instructed to record the action of signal forcing in the dedicated Override/Inhibit Register.	
9	In Package Local Control Panel, set external selector switch to REMOTE position and push the RESET button	
10	In Yokogawa SIS graphic pages, select from menu SIS C/E→PSD and proceed to give the INTERLOCK RESET command. In Yokogawa Engineering Workstation (EWS0164), open Prosafe Maintenance, then SCS0110 (SIS) and restore normal operating condition on signals 82-XS-003 and 80-XS-001.	
11	The Hydrogen Fuel Cell Package now is ready for startup.	

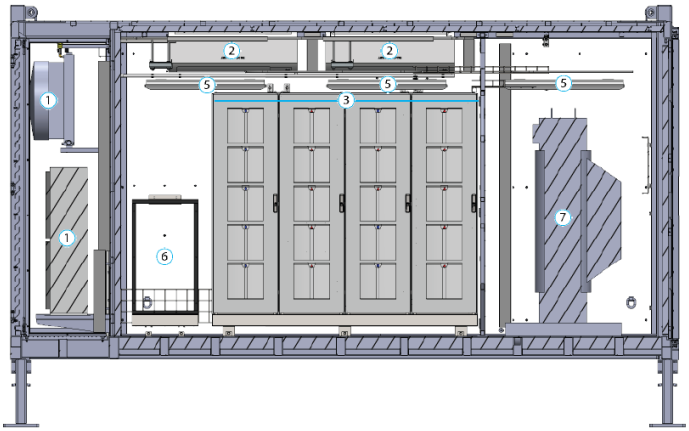
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Step	*Description*	*Notes/Remarks*
12	Enter the FC package and locate panel +UC50 (across from 40ft entry door). Inside panel +UC50: • close Switch Disconnector –SG01 • close MCCB –FC02 Control System is now initializing.	
13	Locate panel +UC20 (Middle of 40ft container, inside). • Outside panel +UC20, observe HMI booting. Within 1 min, user interface will appear. Allow 2 mins to pass for initialization. • Safety system is awaiting the warm-up of the hydrogen sensors. Observe countdown timer on overhead hydrogen sensors (from 10 minutes). • When 10min sensor warm-up completes, the safety system reset button on panel +UC20 will flash blue. Press button to enable safety system.	
NOTE	**At this point, the FC package is in "Sleep", mode and can be left unmanned to manage internal temperature. If operation of the package is desired, continue with the startup sequence.**	
14	Ensure external 6,6kV supply is active (as per step 5)	
15	Locate hydrogen manifold, outside of the 40ft container. On the hydrogen manifold, ensure the 7 isolation handles are in the open position: • QM00 Main Feed Line • QM01 Supply Line 1 • QM02 Supply Line 2 • QM03 Supply Line 3 • QM04 Supply Line 4 • QM05 Supply Line 5 • QM06 Supply Line 6	
16	From this point, the fuel cell package can be operated from the BLPH control system.	

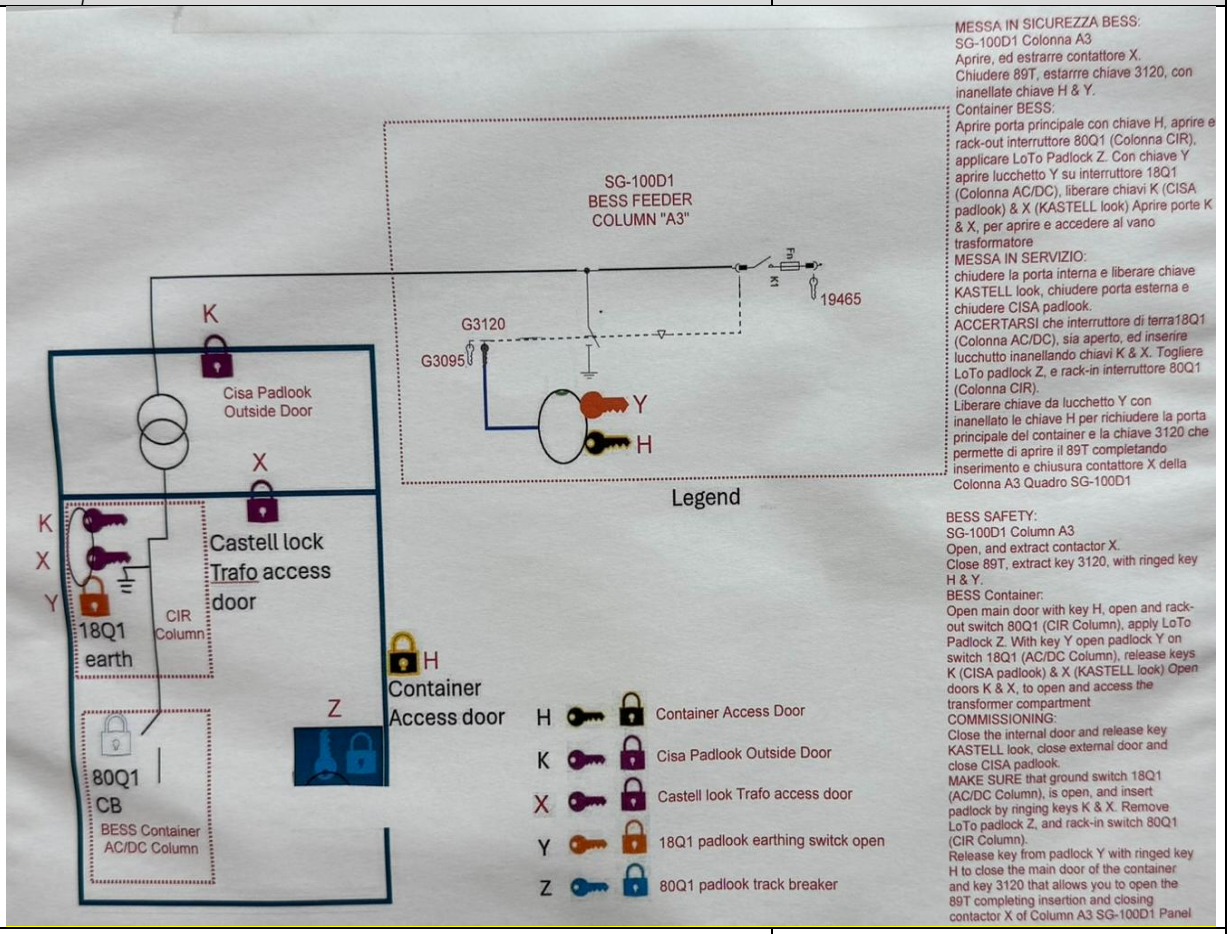
5.3.1.1.24 SS 85-00 BESS Package (A-85000)

Step	*Description*	*Notes/Remarks*
1	N.B. the BESS Package, including Local Control Panels, has been preserved prior to sail away as recommended by Manufacturer Freqcon. Please ensure that all preservation materials have been duly removed prior to first energization.	
2	In LV Switchboard SG-200N1, close the auxiliary power miniature circuit breakers QA1 located inside in the drawers: A6/+02 BESS LV2 CABINET A6/+03 BESS LV1 CABINET A4/+04 BESS PCS CABINET	
3	Put the drawers in service position and manually close the main power circuit breakers QF1 in the drawers: A6/+02 BESS LV2 CABINET A6/+03 BESS LV1 CABINET A4/+04 BESS PCS CABINET In the drawers put the selectors SA1 (LOCAL/REMOTE) in REMOTE position.	
4	In Yokogawa Electrical graphic pages, select from menu Electrical→LV Switchboard and give the close command to the relevant switches	
5	Proceed to follow with dedicated Vendor procedure for Package start-up as listed below. In the event of any issues encountered while following these steps please refer to Package Vendor doc n. 10354-23A2007250205 title OPERATING AND MAINTENANCE MANUAL BESS PRO.	

Step	*Description*	*Notes/Remarks*
6	Inside BESS 1 and BESS 2 container, in the main control and distribution panel, ensure the following MCBs are turned on: 684F1, 690F1, 690F2, 690F3, 690F4, 690F5, 101Q1, 691F4, 684F3, 691F1, 691F2, 691F3, 684F4, 687F1, 687F2, 687F3, 687F4, 687F5, 687F6, 688F1, 688F2, 688F3, 688F4, 688F5.	

Step	Description	Notes/Remarks
7	Enter PCS container and perform a visual check on the CoSy (cooling system). 4.4.1 Container Overview Side view cosy  Figure 6: Container overview – side view Position / Component ① External cooling system components (*for details see section 4.8 "Cooling System"*) ② Internal cooling system components (*for details see section 4.8 "Cooling System"*) ③ Converter cabinets (CONV) ④ Control cabinets (CTRL_1 & CTRL_2) ⑤ Container lights ⑥ Cooling system cabinet (COSY) ⑦ MV Transformer Table 7: Container overview – components Visually check that there is no loss on containment of coolant liquid at the cooling system hose connections or on the floor underneath the cabinets.	

Step	*Description*	*Notes/Remarks*
8	Open the main control cabinet behind the HMI screen and ensure the follow MCBs are energized: 190F3, 191F1, 191F2, 101Q1. At this point, the control unit starts up. (Simotion turns on, HMI turns on and WebVisualization (WebVisu) access is active, Access to Simotion WebVisu is established and "Run" state of Simotion can be confirmed) Check that the following MCBs are on: 84F2, 183F1, 183F2, 185F1, 185F2, 187F1, 181Q1, 181Q2, 182Q1.	
9	- A healthy system has no communication issues – all BESS cabinets have communication and show active measurement - No active alarms – such as gas, fire, voltage, temperature etc. Confirm healthy communications with Yokogawa before leaving control room.	
10	- Release key from padlock Y with ringed key H to close the main door of the container and key 3120 that allows you to open 89T Earth - Re-insert contactor and close SG-10001 Column A3	

Step	Description	Notes/Remarks
		
11	In 6.6kV Switchgear SG-100D1 column A3, check that the breaker is in racked-in position and the earth switch is in open position. Proceed to locate and close the following circuit breakers: QD1 (protection device) QD2 (command circuits) QV1, QV2, QV3, QV4, QV5 (measurement) QD4 (thermal monitoring) QA2 (internal lighting heaters and socket) Proceed to put the selector SA1 (LOCAL/REMOTE) in REMOTE position.	

Step	*Description*	*Notes/Remarks*
12	In Yokogawa Engineering Workstation (EWS0164), open Prosafe Maintenance, then SCS0110 (SIS) and confirm the following signal to 6.6kV Switchgear SG-100D1 column A3 – - 82-XS-002 = TRUE is healthy. (OPEN BESS A-85000 INCOMING CIRCUIT BREAKERS)	
13	In Yokogawa Electrical graphic pages, select from menu Electrical→Overall Single Line Diagram and give the close command to the feeder located in 6.6kV Switchgear SG100D1 panel A3	
14	In Yokogawa Engineering Workstation (EWS0164), open Prosafe Maintenance, then SCS0110 (SIS) and confirm following signal to the BESS - 85-XS-001=TRUE is healthy (SHUT-DOWN A-85000 BESS PKG)	
15	In Package Local Control Panel, set external selector switch to REMOTE position and push the RESET button In Yokogawa Engineering Workstation (EWS0164), open Prosafe Maintenance, then SCS0110 (SIS) and restore normal operating condition on signals 82-XS-002 and 85-XS-001.	
16	In Yokogawa SIS graphic pages, select from menu SIS C/E→PSD and proceed to give the INTERLOCK RESET command.	
17	Confirm the BESS Package is healthy and available at the PCS. The BESS Package now is operative and ready to start via the PCS	

5.3.1.1.25 SS 72-00 NAVAID

Step	*Description*	*Notes/Remarks*
1	N.B. the NAVAID System, including Local Control Panels, has been preserved prior to sail away as recommended by Manufacturer SICE. Please ensure that all preservation materials have been duly removed prior to first energization.	
2	With reference to Package Vendor doc n. 1724000775-EL-MAN-00019 title INSTALLATION, OPERATING AND MAINTENANCE MANUAL, proceed to follow with dedicated Vendor procedure for Package start-up.	
3	In LV Switchboard SG-200N1, close the auxiliary power miniature circuit breakers QA1 located inside in the drawers: A7/+05 (NAVAID SYSTEM FEEDER A) A7/+06 (NAVAID SYSTEM FEEDER B)	
4	Put the drawers in service position and manually close the main power circuit breakers QF1 in the drawers: A7/+05 (NAVAID SYSTEM FEEDER A) A7/+06 (NAVAID SYSTEM FEEDER B)	
5	In NAVAID Control Panel NC-200F2 close the following circuit breakers: Q2 for Normal Power Supply (LINE A) Q3 for Essential Power Supply (LINE B) Q4 for Battery Charger BC-200F2A Q5 for Battery Charger BC-200F2B	
6	In Battery Charger CB-200F2 close the circuit breaker Q1 for connect the BATTERY BANK BA-200F2 to the NAVAIDS CENTRAL CONTROL PANEL (NC-200F2)	

Step	*Description*	*Notes/Remarks*
7	In NAVAID Control Panel NC-200F2 close the following circuit breakers: Q1 for 24Vdc Battery Bus Bar Q6 for Medium Intensity AOL 1/2 (EOL-200-01/02) Q7 for Medium Intensity AOL 3/4 (EOL-200-03/04) Q8 for Marine Yellow Light 1 (EML-200-01) Q9 for Marine Yellow Light 2 (EML-200-02) Q10 for Boat Landing Status Light (ESL-200-01) Q11 for Visibility Meter (EVM-200-01), Control System, Astro Time KA1 and Earth Insulation Relay KE1	
8	The local display panel installed on the cover of the enclosure B of the NCCP has its own ON/OFF switch (LCD1). Verify that the above-mentioned switch (accessible from the internal side of the enclosure) is switched ON (bottom left on the board)	
9	The Inverter INV1/INV2 installed inside the NCCP has their own ON/OFF/ECO switch. The user has to verify that the above-mentioned switch is in ON position (I)	
10	Put the selector S1, located on the cover of the enclosure B of the NCCP, in AUTO position. In this position the Marine lights are switched on/off accordingly to the photocell detection, the visibility meter detection and the astronomical time switch detection. The Obstruction lights are always activated regardless of the above.	
11	In Yokogawa SIS graphic pages, select from menu SIS C/E→PSD and confirm that there are no alarms.	
12	The NAVAID System now is in AUTO operation.	

5.3.1.2 INTEGRATED START-UP OF BLPH

Step	*Description*	*Notes/Remarks*
Note	All Operations Modes were tested and proven as part of Onshore Integrated Testing (OIT) during the campaign at Onshore WORKSITE (as per OTP Integrated Test Procedure - document number 123A90-PML-COM-PRO-03019). There has been no change to the Control Philosophy since so there is no requirement to repeat OIT.	
1	BLPH Start-Up will be demonstrated by BLPH entering IMPORT Mode (Mode 1) BLPH will enter IMPORT Mode under the following conditions: • Grid Tied. • Supply guarantee is Active. • HNA5 Produces ≥ 1 MW for one minute. • Check the BESS is NOT fully charged or NOT PCS.ProcessFullyCharge (H2 storage vessels not full) If the above conditions are satisfied, EMCS requests the PCS to enter IMPOORT Mode 1. After receiving the permissive "PCS.PermToEnterImport", BLPH enters in IMPORT MODE 1. BLPH is considered "able to operate in import" if it can charge the BESS or produce H2 with the electrolyser (at least one of the two) and neither the BESS nor the Fuel Cell are committed to continue producing power (according to their transition policy and any prevailing control logic). BLPH will remain in this Mode of Operation until the condition to transition to either MODE 1A or 1B are satisfied. Refer to Operations & Maintenance Manuals – document number 123A90-DDL-PR-MAN-80001	

5.3.2 BLPH Mode Change Check & Confirmation

Step	*Description*	*Notes/Remarks*
Note	This section is to be used during 1st Start-Up of BLPH in new location only. It is meant to ensure sign off of each of the different Operating Modes as the prevailing conditions change.	
1	Mode 0 Operation entered, and confirmed BLPH acts as described in Operations & Maintenance Manuals – document number 123A90-DDL-PR-MAN-80001	
2	Mode 1A Operation entered, and confirmed BLPH acts as described in Operations & Maintenance Manuals – document number 123A90-DDL-PR-MAN-80001	
3	Mode 1B Operation entered, and confirmed BLPH acts as described in Operations & Maintenance Manuals – document number 123A90-DDL-PR-MAN-80001	
4	Mode 2 Operation entered, and confirmed BLPH acts as described in Operations & Maintenance Manuals – document number 123A90-DDL-PR-MAN-80001	
5	Mode 3 Operation entered, and confirmed BLPH acts as described in Operations & Maintenance Manuals – document number 123A90-DDL-PR-MAN-80001	
6	Mode 4 Operation entered, and confirmed BLPH acts as described in Operations & Maintenance Manuals – document number 123A90-DDL-PR-MAN-80001	
7	Mode 4A Operation entered, and confirmed BLPH acts as described in Operations & Maintenance Manuals – document number 123A90-DDL-PR-MAN-80001	
8	Mode 5 Operation entered, and confirmed BLPH acts as described in Operations & Maintenance Manuals – document number 123A90-DDL-PR-MAN-80001	

Step	*Description*	*Notes/Remarks*
9	Mode 6 Operation entered, and confirmed BLPH acts as described in Operations & Maintenance Manuals – document number 123A90-DDL-PR-MAN-80001	
10	Mode 7 Operation entered, and confirmed BLPH acts as described in Operations & Maintenance Manuals – document number 123A90-DDL-PR-MAN-80001	
11	Mode 8 Operation entered, and confirmed BLPH acts as described in Operations & Maintenance Manuals – document number 123A90-DDL-PR-MAN-80001	

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5.3.2.1 BLPH START-UP PROCEDURE - Tests Certifying Authority Table of Attendances

Name and Surname	Certifying Authority	Position	Signature

5.3.2.2 BLPH START-UP PROCEDURE - Tests Final Signatures and Company Acceptance

Name and Surname	Company Representative	Position	Signature

6 APPENDICES

6.1 MARKED-UP P&IDs "AS PRESERVED"

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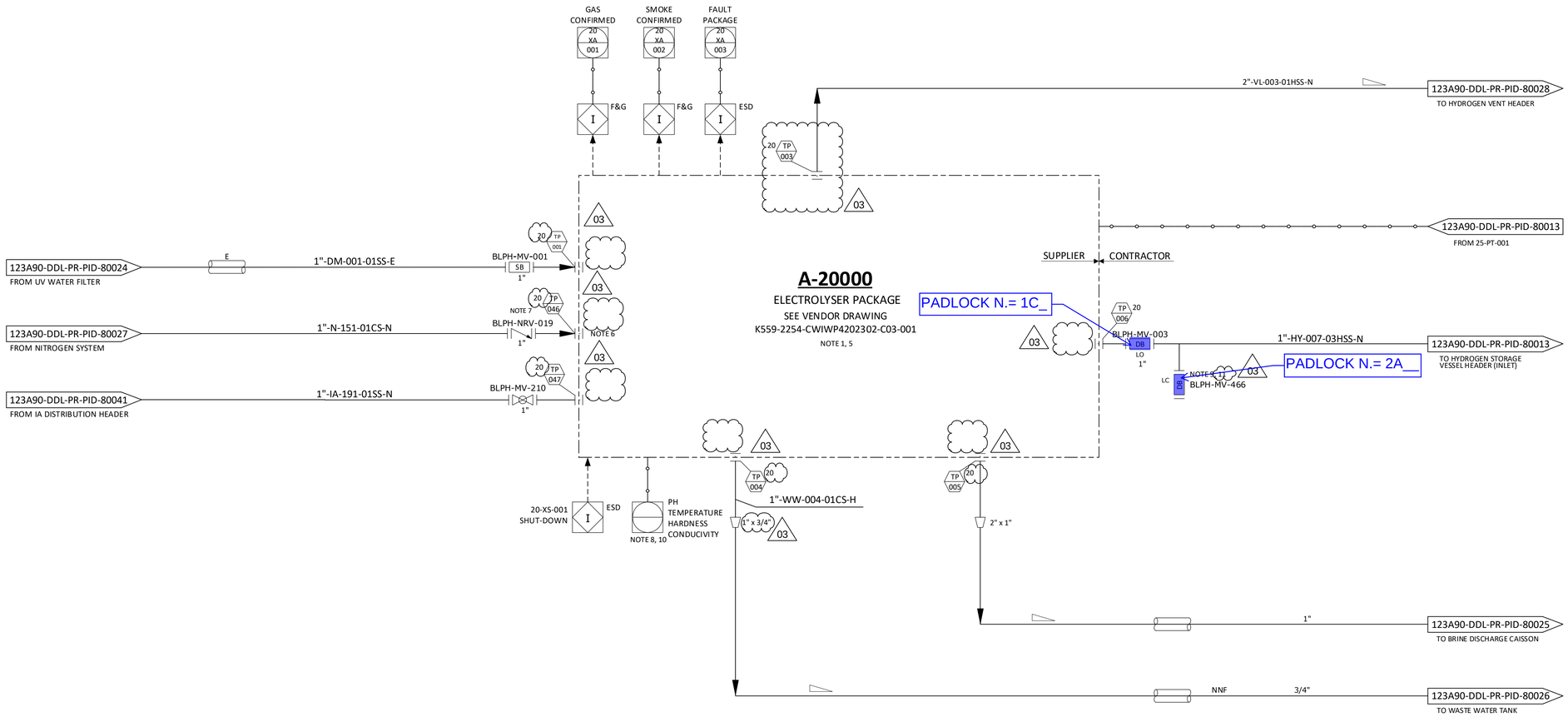
DRAWING NO. DRAWING_NO.

REV. REV

A-20000
ELECTROLYSER PACKAGE

DUTY: 2.5MW
DESIGN PRESSURE: 40 barg
DESIGN TEMPERATURE: 80 °C
H2 GENERATING CAPACITY: 500 Nm³/h

only for
LOTO / LO-LC
AS PRESERVED AT SAIL AWAY
Rev. 01 del
26/07/2025



NOTES

1. PACKAGE SUPPLIED WITH POWER FROM THE BLPH ELECTRICAL SYSTEM.
2. DELETED.
3. DELETED.
4. DELETED.
5. ELECTROLYSER PACKAGE INCLUDES AN OXYGEN VENT LINE WHICH IS IN THE SCOPE OF SUPPLY OF THE ELECTROLYSER PACKAGE UP TO THE ATMOSPHERE. NO PHYSICAL INTERFACE IS PRESENT BETWEEN ELECTROLYSER PACKAGE AND CONTRACTOR ON THIS LINE.
6. AN ISOLATION VALVE DOWNSTREAM THE CHECK VALVE NRV-019 IS PROVIDED WITHIN THE PACKAGE A-20000.
7. CHECK VALVE NRV-019 TO BE INSTALLED AS CLOSE AS POSSIBLE TO THE ELECTROLYSER PACKAGE A-20000.
8. SERIAL COMMUNICATION WITH CONTROL SYSTEM.
9. NITROGEN PURGING CONNECTION TO BE LOCATED AS CLOSE AS POSSIBLE TO MANUAL VALVE BLPH-MV-003.
10. PH, TEMPERATURE, HARDNESS AND CONDUCTIVITY SHALL BE SENT FROM CONTROL SYSTEM TO ELECTROLISER UCP IN ADDITION TO THE OTHER SOFTWARE SIGNALS. 03
11. MANUAL VALVE BLPH-MV-466 TO BE CONNECTED WITH MANUAL VALVE BLPH-MV-275 (INSTALLED ON NITROGEN GENERATION PACKAGE EXIT LINE) BY MEAN ON A FLEXIBLE HOSE DURING COMMISSIONING PHASE FOR PURGING OPERATION.

HOLDS

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FOR SAIL AWAY
G. Laurentiu 25/07/25

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
03	09/09/2024	CIM	RZI	DLO	ACCEPTED FOR CONSTRUCTION (AFC)
02	12/06/2024	CIM	RZI	DLO	ACCEPTED FOR CONSTRUCTION (AFC)
01	15/02/2024	CIM	RZI	DLO	ISSUE FOR ACCEPTANCE (IFA)
00	20/10/2023	CIM	RZI	DLO	ISSUE FOR ACCEPTANCE (IFA)

CROSSWIND

ROSETTI MARINO

TITLE :
BLPH PIPING AND INSTRUMENTATION DIAGRAM
ELECTROLYSER PACKAGE

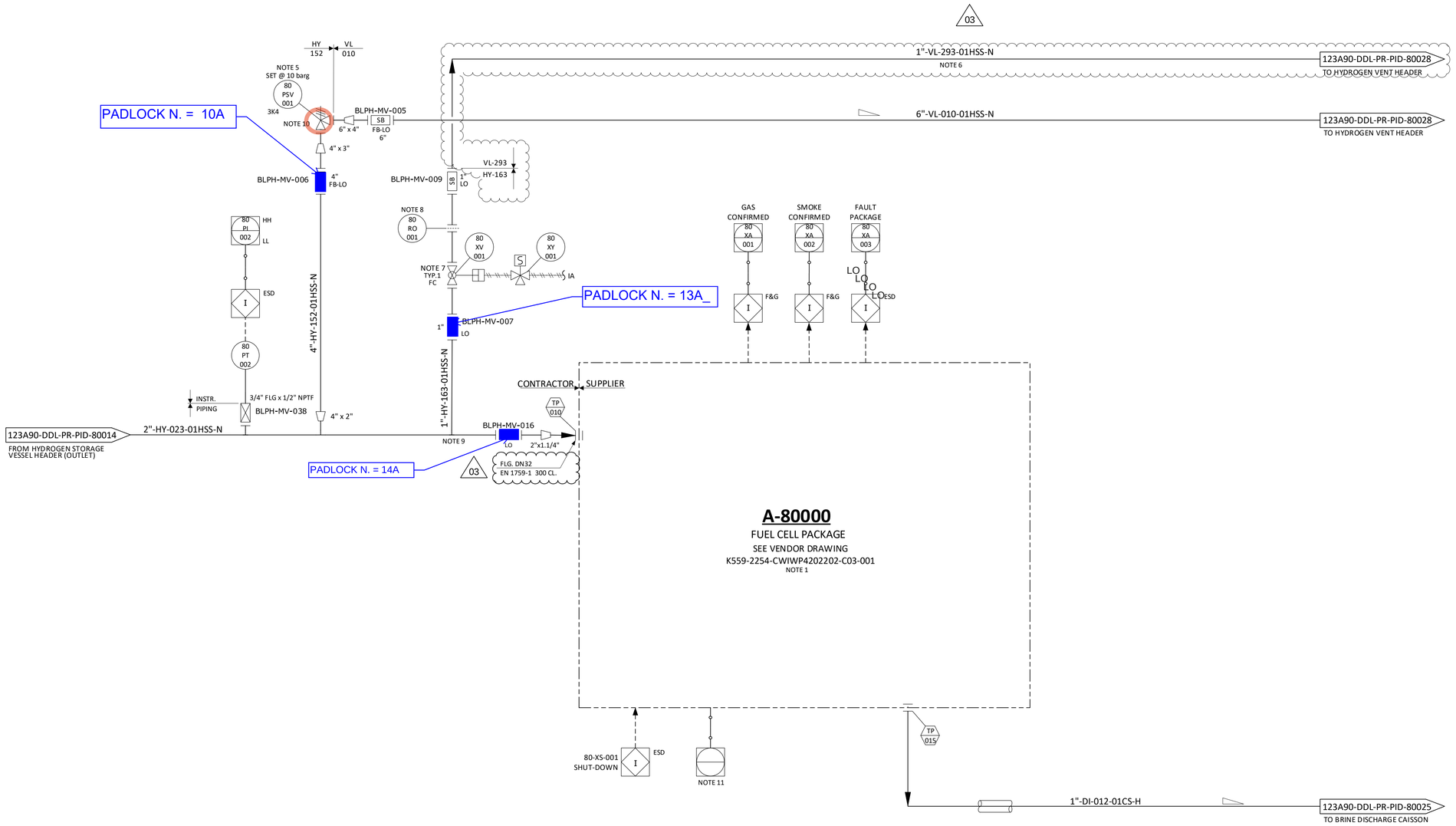
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A1	DRAWING NO. 123A90-DDL-PR-PID-80011	SHEET 001	REV. 03

File Name : FILE_NAME

DRAWING NO. DRAWING_NO.

REV. REV



NOTES

1. THE VENDOR PACKAGE WILL CONTAIN AIR INTAKE AND EXHAUST, SUITABLY SAFEGUARDED AND SEPARATED.
2. DELETED.
3. DELETED.
4. DELETED
5. ONE UNINSTALLED SPARE PSV SHALL BE AVAILABLE.
6. LINE REQUIRED FOR PURGING OF PIPING WORK.
7. TIGHT SHUT-OFF VALVE.
8. FOR ORIFICE DIAMETER REFERENCE SHALL BE MADE TO "RELIEF, VENT AND BLOWDOWN REPORT" DOC. N. "123A90-DDL-PR-RE-80030".
9. LINE 1"-HY-163-01HSS-N WILL BE LOCATED AS CLOSE TO THE PACKAGE AS POSSIBLE TO ENSURE COMPLETE PURGING OF THE LINE.
10. 80-PSV-001 SIZED FOR CV FAILURE OF UPSTREAM CONTROL VALVE 25-PV-055A/B.
11. SERIAL COMMUNICATION WITH CONTROL SYSTEM.

HOLDS

1. DELETED.
2. DELETED.

WITNESS JOINT

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FOR SAIL AWAY
G. Laurentiu 25/07/25

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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02	12/06/2024	CIM	RZI	DLO	ACCEPTED FOR CONSTRUCTION (AFC)
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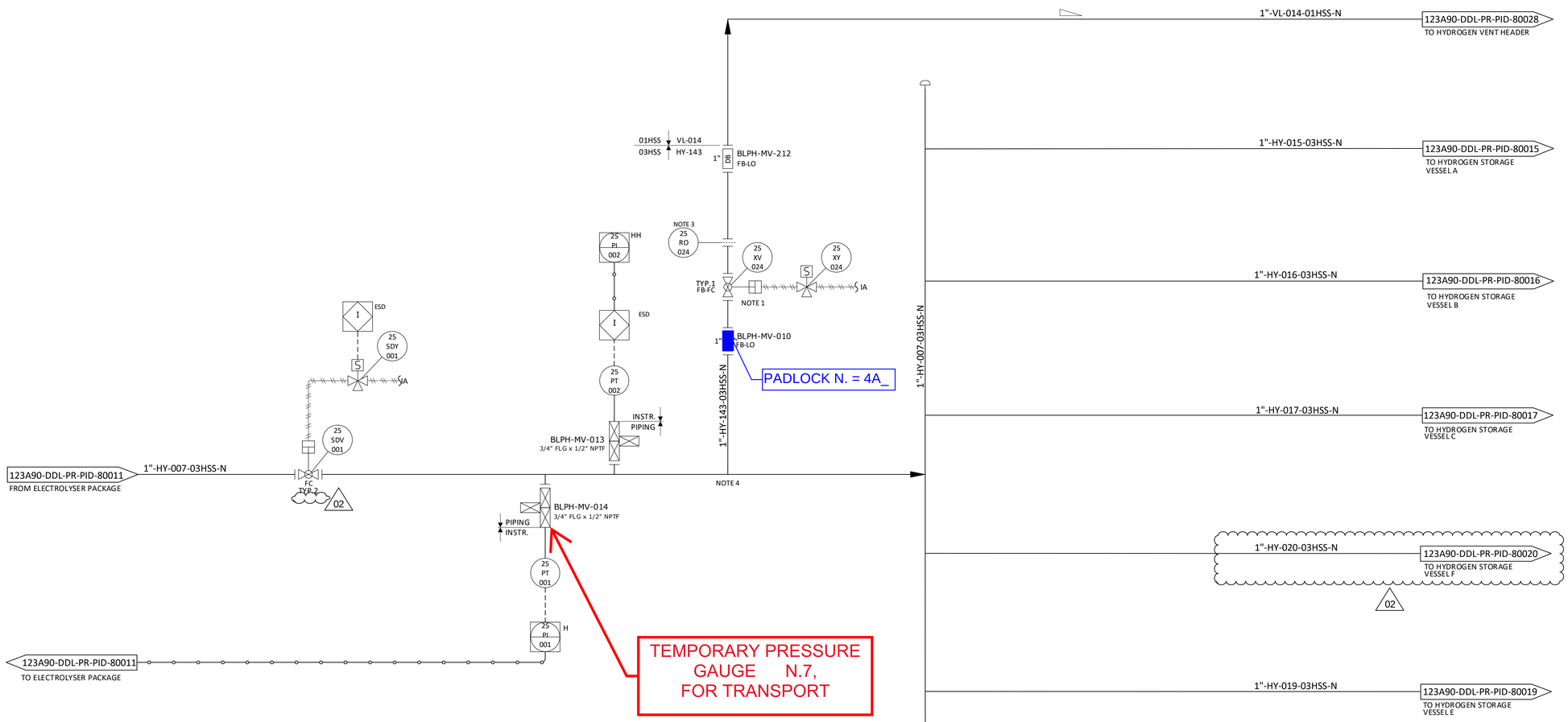
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FUEL CELL PACKAGE

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REV. REV



TEMPORARY PRESSURE GAUGE N.7, FOR TRANSPORT

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FOR SAIL AWAY
G. Laurentiu 25/07/25

NOTES

1. TIGHT SHUT OFF XV.
2. DELETED. 02
3. FOR ORIFICE DIAMETER REFERENCE SHALL BE MADE TO "RELIEF, VENT AND BLOWDOWN REPORT" DOC. N. "123A90-DDL-PR-RE-80030".
4. PIPING CONNECTION TO 25-XV-003 SHALL BE AS CLOSE TO THE MANIFOLD AS POSSIBLE, TO ENSURE COMPLETE PURGING OF FEED LINE.

HOLDS

1. DELETED.

LO

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02	12/06/2024	CIM	RZI	DLO	ACCEPTED FOR CONSTRUCTION (AFC)
01	15/02/2024	CIM	RZI	DLO	ISSUE FOR ACCEPTANCE (IFA)
00	20/10/2023	CIM	RZI	DLO	ISSUE FOR ACCEPTANCE (IFA)

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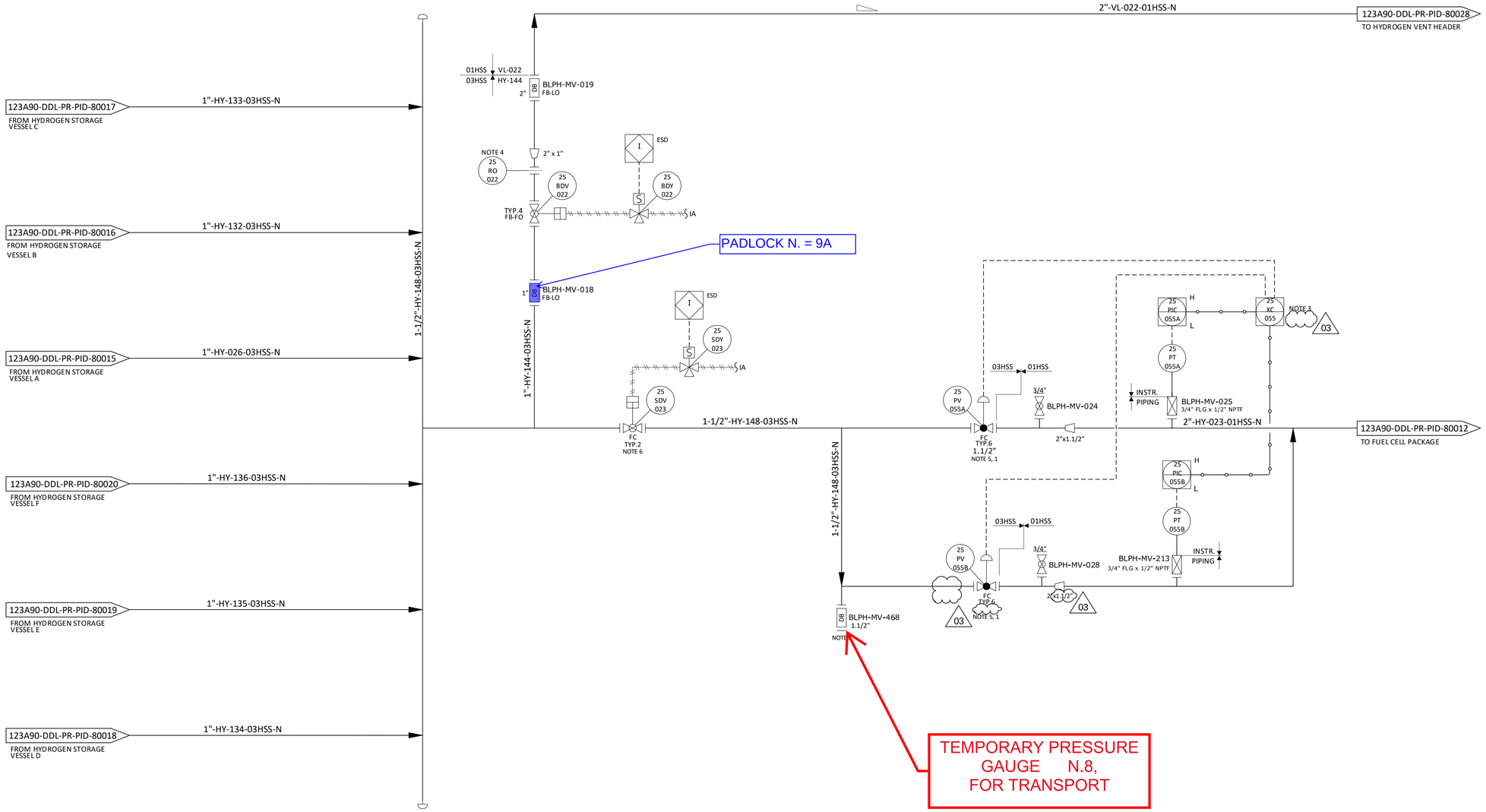
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BLPH PIPING AND INSTRUMENTATION DIAGRAM
HYDROGEN STORAGE VESSELS HEADER (INLET)

CONTRACT NO./TITLE	CW-I-WP4-2023-05/HOLLANDSE KUST NOORD WIND PARK	SCALE	NTS
DRAWN	CHECKED	APPROVED	DATE
A1	DRAWING NO. 123A90-DDL-PR-PID-80013	SHEET 001	REV. 02

File Name : FILE_NAME

DRAWING NO. DRAWING_NO.

REV. REV



NOTES

1. TIGHT SHUT-OFF VALVE.
2. DELETED.
3. CONTROL VALVES 25-PV-055A/B WORK IN SPLIT RANGE:
   - FOR LOW OPERATING CV (UP TO 0.31) VALVE "B" IS USED
   - FOR HIGH OPERATING CV (FROM 0.31) VALVE "A" IS USED
4. FOR ORIFICE DIAMETER REFERENCE SHALL BE MADE TO "RELIEF, VENT AND BLOWDOWN REPORT" DOC. N. "123A90-DDL-PR-RE-80030".
5. SOFTWARE INTERLOCK PREVENTS OPENING OF THE CONTROL VALVES 25-PV-055A/B IN CASE FUEL CELL PACKAGE (A-80000) IS NOT READY TO START. 03
6. SDV VALVE 25-SDV-023 TO BE INSTALLED AS CLOSE AS POSSIBLE TO THE CONTROL VALVES 25-PV-055A/B. 03
7. DELETED. 03
8. TO BE USED DURING COMMISSIONING PHASE.

HOLDS

1. DELETED.
2. DELETED. 03

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BLPH PIPING AND INSTRUMENTATION DIAGRAM
HYDROGEN STORAGE VESSELS HEADER (OUTLET)

CONTRACT NO./TITLE	CW-I-WP4-2023-05/HOLLANDSE KUST NOORD WIND PARK		SCALE	NTS
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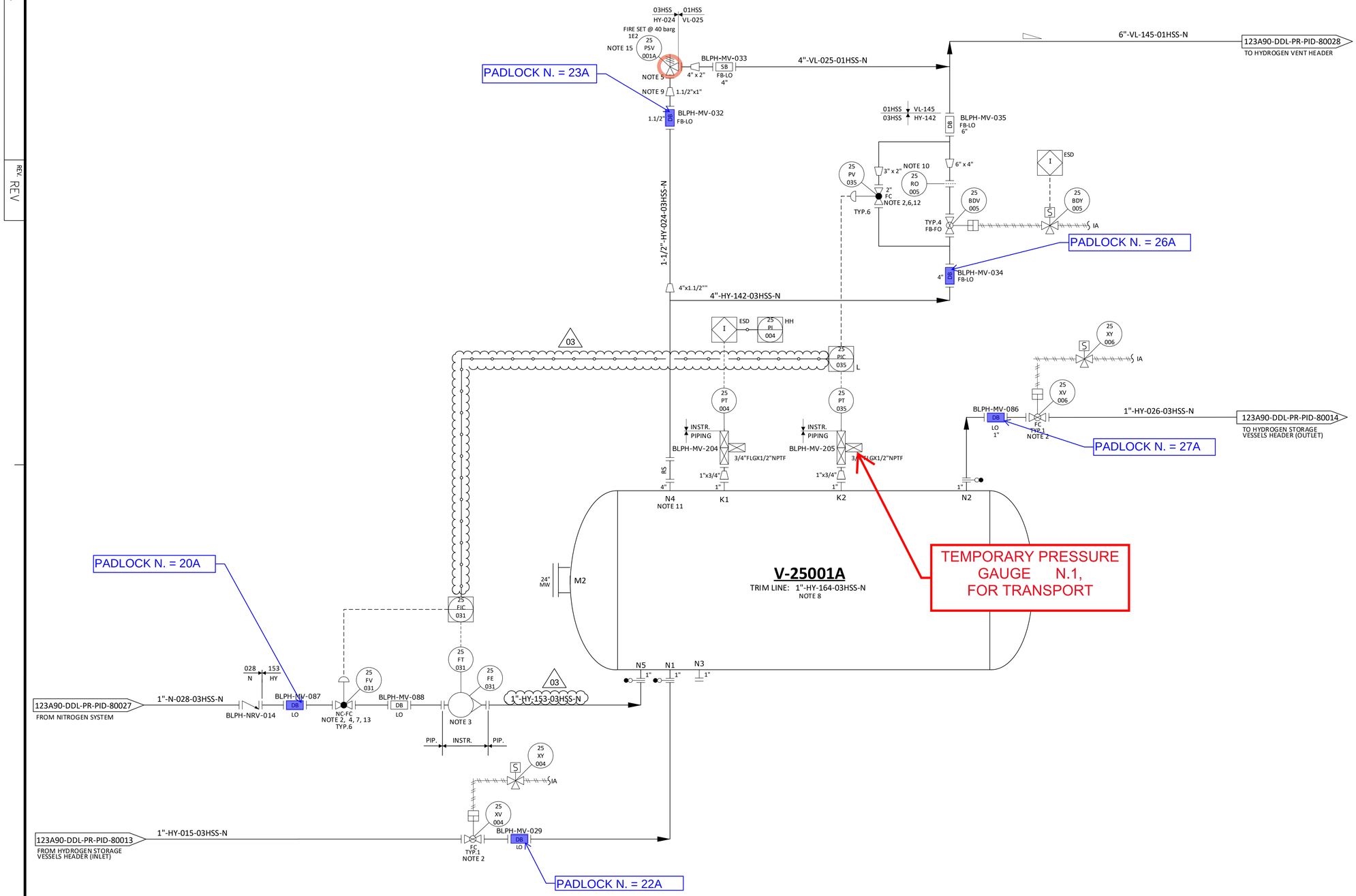
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REV. REV

V-25001 A

HYDROGEN STORAGE VESSEL

SIZE : 2800 mm (ID) X 15500 mm (L T/T)
DESIGN P/T : 40 barg / -10 / 80 °C
MATERIAL : CARBON STEEL
OPERATING P/T : 30 barg /AMB



NOTES

1. DELETED.
2. TIGHT SHUT OFF VALVE.
3. VARIABLE AREA FLOWMETER TO BE INSTALLED VERTICALLY WITH DIRECTION OF FLOW UPWARDS.
4. NITROGEN CONTROL VALVE (25-FV-031) CAN NOT OPEN UNTIL THE PRESSURE WITHIN THE VESSEL IS BELOW THE NITROGEN SUPPLY PRESSURE. 03
5. ONE COMMON UNINSTALLED SPARE PSV FOR ALL VESSELS.
6. FOR PULSE PRESSURE PURGING OF VESSEL WITH HYDROGEN.
7. FOR FLOW PURGING OF VESSEL WITH NITROGEN.
8. FOR DESCRIPTION AND SPECIFICATION OF VESSEL NOZZLE, REFERENCE SHALL BE MADE TO THE TECHNICAL DATA SHEET FOR H2 STORAGE, DOC. N. "123A90-DDL-MAC-DS-50027".
9. REDUCERS TO BE INSTALLED AS CLOSE TO PSV AS POSSIBLE.
10. FOR ORIFICE DIAMETER REFERENCE SHALL BE MADE TO "RELIEF, VENT AND BLOWDOWN REPORT "DOC. N. "123A90-DDL-PR-RE-80030".
11. NOZZLE N4 TO BE INSTALLED AT MINIMUM DISTANCE FROM TANGENT LINE OF THE VESSEL (ON THE OPPOSITE SIDE OF N5 NOZZLE).
12. SOFTWARE INTERLOCK TO PREVENT 25-PV-035 BEING OPENED OUTSIDE OF A PURGE CYCLE OPERATION AND PROCESS START-UP CHARGING MODE (SEE DOC. "PROCESS CONTROL LOGICS DESCRIPTION" N. 123A90-DDL-IN-RE-40095). CONTROL VALVE 25-PV-035 IS USED ONLY IN CASE OF VESSEL PURGING OR PROCESS START-UP CHARGING MODES. 03
13. SOFTWARE INTERLOCK TO PREVENT 25-FV-031 BEING OPENED OUTSIDE OF A PURGE CYCLE OPERATION.
14. A TIMER ALARM ON THE H2 PRESSURIZATION SECTION OF THE PURGE CYCLE IN THE CONTROL LOGIC IS PROVIDED TO DETERMINE IF THE PURGE VALVE 25-PV-035 HAS FAILED TO CLOSE.
15. 25-PSV-001A SIZED FOR FIRE.

HOLDS

1. DELETED.
2. DELETED.
3. DELETED.
4. DELETED.

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00	20/10/2023	CIM	RZI	DLO	ISSUE FOR ACCEPTANCE (IFA)

CROSSWIND

ROSETTI MARINO

TITLE :
BLPH PIPING AND INSTRUMENTATION DIAGRAM
HYDROGEN STORAGE VESSEL A

CONTRACT NO./TITLE	CW-I-WP4-2023-05/HOLLANDSE KUST NOORD WIND PARK		SCALE	NTS
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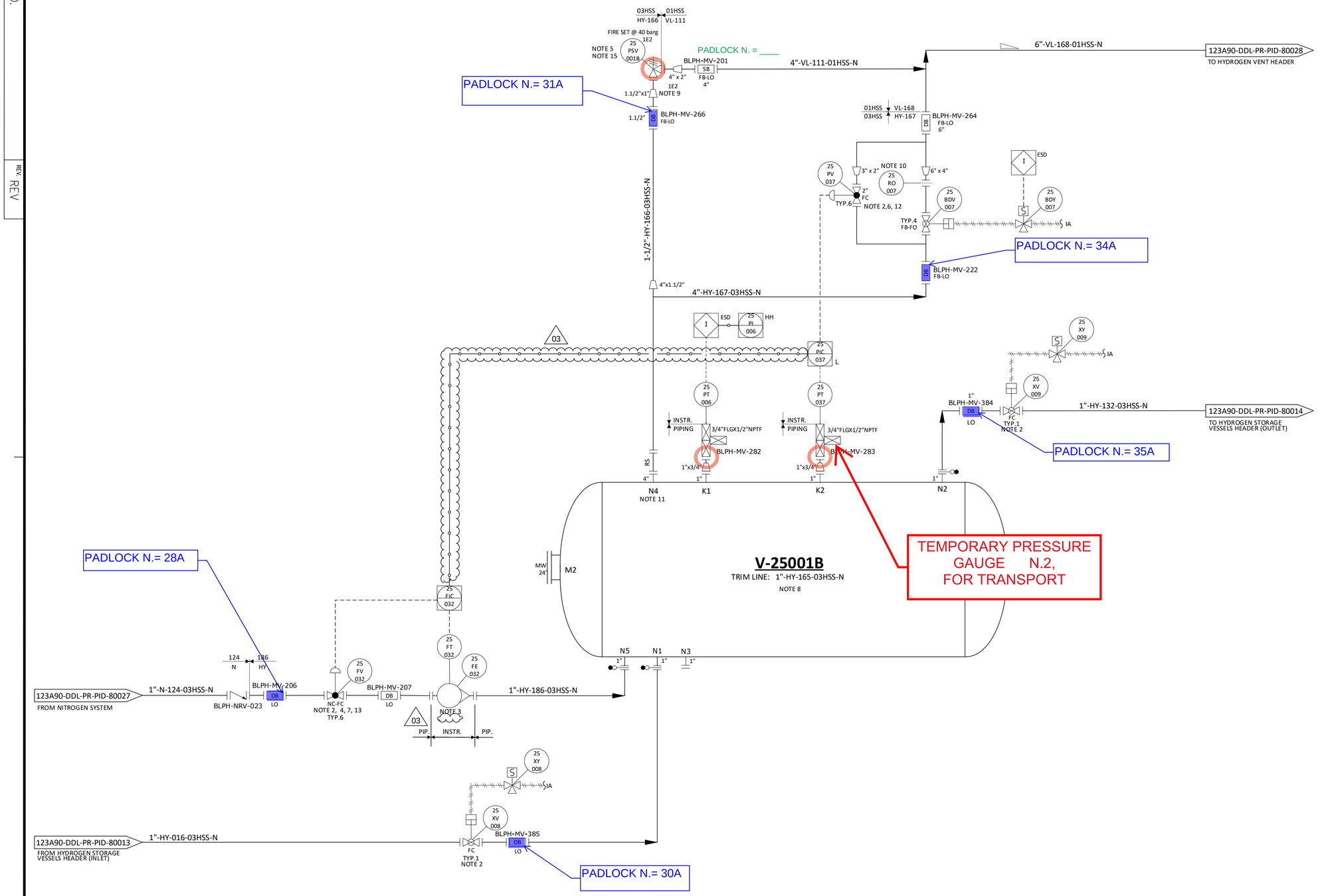
DRAWING NO. DRAWING_NO.

REV. REV

V-25001 B

HYDROGEN STORAGE VESSEL

SIZE : 2800 mm (ID) X 15500 mm (L T/T)
DESIGN P/T : 40 barg / -10 / 80 °C
MATERIAL : CARBON STEEL
OPERATING P/T : 30 barg / AMB



NOTES

1. DELETED.
2. TIGHT SHUT OFF VALVE.
3. VARIABLE AREA FLOWMETER TO BE INSTALLED VERTICALLY WITH DIRECTION OF FLOW UPWARDS. 03
4. NITROGEN CONTROL VALVE (25-FV-032) CAN NOT OPEN UNTIL THE PRESSURE WITHIN THE VESSEL IS BELOW THE NITROGEN SUPPLY PRESSURE.
5. ONE COMMON UNINSTALLED SPARE PSV FOR ALL VESSELS.
6. FOR PULSE PRESSURE PURGING OF VESSEL WITH HYDROGEN.
7. FOR FLOW PURGING OF VESSEL WITH NITROGEN.
8. FOR DESCRIPTION AND SPECIFICATION OF VESSEL NOZZLE, REFERENCE SHALL BE MADE TO THE TECHNICAL DATA SHEET FOR H2 STORAGE, DOC. N. "123A90-DDL-MAC-DS-50027".
9. REDUCERS TO BE INSTALLED AS CLOSE TO PSV AS POSSIBLE.
10. FOR ORIFICE DIAMETER REFERENCE SHALL BE MADE TO "RELIEF, VENT AND BLOWDOWN REPORT "DOC. N. "123A90-DDL-PR-RE-80030".
11. NOZZLE N4 TO BE INSTALLED AT MINIMUM DISTANCE FROM TANGENT LINE OF THE VESSEL (ON THE OPPOSITE SIDE OF N5 NOZZLE).
12. SOFTWARE INTERLOCK TO PREVENT 25-PV-037 BEING OPENED OUTSIDE OF A PURGE CYCLE OPERATION AND PROCESS START-UP CHARGING MODE (SEE DOC."PROCESS CONTROL LOGICS DESCRIPTION" N. 123A90-DDL-IN-RE-40095). CONTROL VALVE 25-PV-037 IS USED ONLY IN CASE OF VESSEL PURGING OR PROCESS START-UP CHARGING MODES. 03
13. SOFTWARE INTERLOCK TO PREVENT 25-FV-032 BEING OPENED OUTSIDE OF A PURGE CYCLE OPERATION.
14. A TIMER ALARM ON THE H2 PRESSURIZATION SECTION OF THE PURGE CYCLE IN THE CONTROL LOGIC IS PROVIDED TO DETERMINE IF THE PURGE VALVE 25-PV-037 HAS FAILED TO CLOSE.
15. 25-PSV-001B SIZED FOR FIRE.

HOLDS

1. DELETED.
2. DELETED.
3. DELETED.
4. DELETED.

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REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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02	12/06/2024	CIM	RZI	DLO	ACCEPTED FOR CONSTRUCTION (AFC)
01	15/02/2024	CIM	RZI	DLO	ISSUE FOR ACCEPTANCE (IFA)
00	20/10/2023	CIM	RZI	DLO	ISSUE FOR ACCEPTANCE (IFA)

CROSSWIND

ROSETTI MARINO

TITLE :
BLPH PIPING AND INSTRUMENTATION DIAGRAM
HYDROGEN STORAGE VESSEL B

CONTRACT NO./TITLE	CW-I-WP4-2023-05/HOLLANDSE KUST NOORD WIND PARK		SCALE NTS
DRAWN	CHECKED	APPROVED	DATE
A1	DRAWING NO. 123A90-DDL-PR-PID-80016		SHEET 001 / REV. 03

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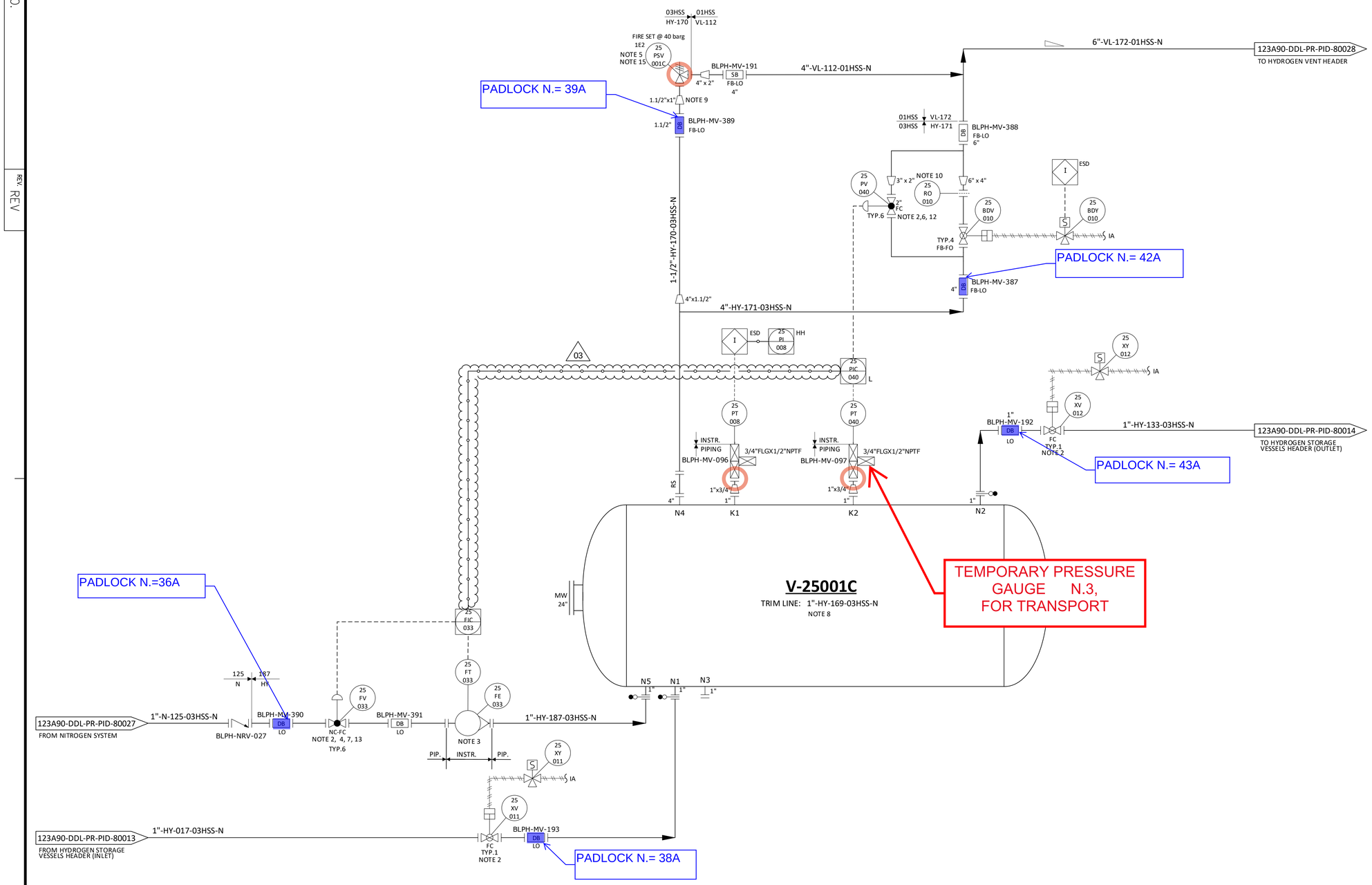
DRAWING NO. DRAWING_NO.

REV. REV

V-25001_C

HYDROGEN STORAGE VESSEL

SIZE : 2800 mm (ID) X 15500 mm (L T/T)
DESIGN P/T : 40 barg / -10 / 80 °C
MATERIAL : CARBON STEEL
OPERATING P/T : 30 barg / AMB



NOTES

1. DELETED.
2. TIGHT SHUT OFF VALVE.
3. VARIABLE AREA FLOWMETER TO BE INSTALLED VERTICALLY WITH DIRECTION OF FLOW UPWARDS.
4. NITROGEN CONTROL VALVE (25-FV-033) CAN NOT OPEN UNTIL THE PRESSURE WITHIN THE VESSEL IS BELOW THE NITROGEN SUPPLY PRESSURE. 03
5. ONE COMMON UNINSTALLED SPARE PSV FOR ALL VESSELS.
6. FOR PULSE PRESSURE PURGING OF VESSEL WITH HYDROGEN.
7. FOR FLOW PURGING OF VESSEL WITH NITROGEN.
8. FOR DESCRIPTION AND SPECIFICATION OF VESSEL NOZZLE, REFERENCE SHALL BE MADE TO THE TECHNICAL DATA SHEET FOR H2 STORAGE, DOC. N. "123A90-DDL-MAC-DS-50027".
9. REDUCERS TO BE INSTALLED AS CLOSE TO PSV AS POSSIBLE.
10. FOR ORIFICE DIAMETER REFERENCE SHALL BE MADE TO "RELIEF, VENT AND BLOWDOWN REPORT" DOC. N. "123A90-DDL-PR-RE-80030".
11. NOZZLE N4 TO BE INSTALLED AT MINIMUM DISTANCE FROM TANGENT LINE OF THE VESSEL (ON THE OPPOSITE SIDE OF N5 NOZZLE).
12. SOFTWARE INTERLOCK TO PREVENT 25-PV-040 BEING OPENED OUTSIDE OF A PURGE CYCLE OPERATION AND PROCESS START-UP CHARGING MODE (SEE DOC. "PROCESS CONTROL LOGICS DESCRIPTION" N. 123A90-DDL-IN-RE-40095). CONTROL VALVE 25-PV-040 IS USED ONLY IN CASE OF VESSEL PURGING OR PROCESS START-UP CHARGING MODES. 03
13. SOFTWARE INTERLOCK TO PREVENT 25-FV-033 BEING OPENED OUTSIDE OF A PURGE CYCLE OPERATION.
14. A TIMER ALARM ON THE H2 PRESSURIZATION SECTION OF THE PURGE CYCLE IN THE CONTROL LOGIC IS PROVIDED TO DETERMINE IF THE PURGE VALVE 25-PV-040 HAS FAILED TO CLOSE.
15. 25-PS-V001C SIZED FOR FIRE.

HOLDS

1. DELETED.
2. DELETED.
3. DELETED.
4. DELETED.

WITNESS JOINT

LO

LC

LO-LC PROCESS ISOLATIONS
FOR SAIL AWAY
G. Laurentiu 25/07/25

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
03	09/09/2024	CIM	RZI	DLO	ACCEPTED FOR CONSTRUCTION (AFC)
02	12/06/2024	CIM	RZI	DLO	ACCEPTED FOR CONSTRUCTION (AFC)
01	15/02/2024	CIM	RZI	DLO	ISSUE FOR ACCEPTANCE (IFA)
00	20/10/2023	CIM	RZI	DLO	ISSUE FOR ACCEPTANCE (IFA)

CROSSWIND

ROSETTI MARINO

TITLE :
BLPH PIPING AND INSTRUMENTATION DIAGRAM
HYDROGEN STORAGE VESSEL C

CONTRACT NO./TITLE	CW-I-WP4-2023-05/HOLLANDSE KUST NOORD WIND PARK			SCALE	NTS
DRAWN	CHECKED	APPROVED	DATE		
A1	DRAWING NO. 123A90-DDL-PR-PID-80017			SHEET 001	REV. 03

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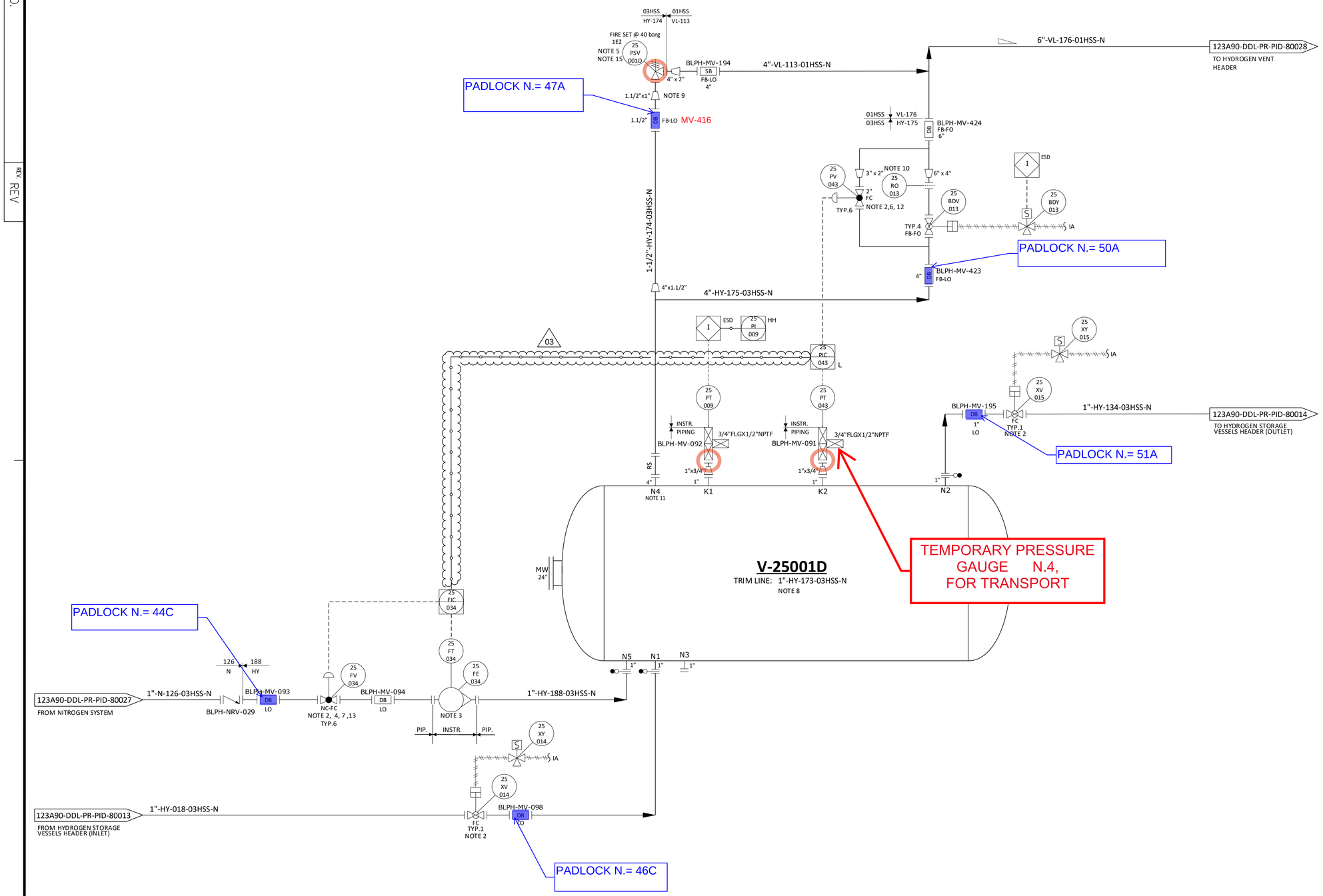
DRAWING NO. DRAWING_NO.

REV. REV

V-25001_D

HYDROGEN STORAGE VESSEL

SIZE : 2800 mm (ID) X 15500 mm (L T/T)
DESIGN P/T : 40 barg / -10 / 80 °C
MATERIAL : CARBON STEEL
OPERATING P/T : 30 barg / AMB



NOTES

1. DELETED.
2. TIGHT SHUT OFF VALVE.
3. VARIABLE AREA FLOWMETER TO BE INSTALLED VERTICALLY WITH DIRECTION OF FLOW UPWARDS. 03
4. NITROGEN CONTROL VALVE (25-FV-034) CAN NOT OPEN UNTIL THE PRESSURE WITHIN THE VESSEL IS BELOW THE NITROGEN SUPPLY PRESSURE.
5. ONE COMMON UNINSTALLED SPARE PSV FOR ALL VESSELS.
6. FOR PULSE PRESSURE PURGING OF VESSEL WITH HYDROGEN.
7. FOR FLOW PURGING OF VESSEL WITH NITROGEN.
8. FOR DESCRIPTION AND SPECIFICATION OF VESSEL NOZZLE, REFERENCE SHALL BE MADE TO THE TECHNICAL DATA SHEET FOR H2 STORAGE, DOC. N. "123A90-DDL-MAC-DS-50027".
9. REDUCERS TO BE INSTALLED AS CLOSE TO PSV AS POSSIBLE.
10. FOR ORIFICE DIAMETER REFERENCE SHALL BE MADE TO "RELIEF, VENT AND BLOWDOWN REPORT" DOC. N. "123A90-DDL-PR-RE-80030".
11. NOZZLE N4 TO BE INSTALLED AT MINIMUM DISTANCE FROM TANGENT LINE OF THE VESSEL (ON THE OPPOSITE SIDE OF N5 NOZZLE).
12. SOFTWARE INTERLOCK TO PREVENT 25-PV-043 BEING OPENED OUTSIDE OF A PURGE CYCLE OPERATION AND PROCESS START-UP CHARGING MODE (SEE DOC. "PROCESS CONTROL LOGICS DESCRIPTION" N. 123A90-DDL-IN-RE-40095). CONTROL VALVE 25-PV-043 IS USED ONLY IN CASE OF VESSEL PURGING OR PROCESS START-UP CHARGING MODES. 03
13. SOFTWARE INTERLOCK TO PREVENT 25-FV-034 BEING OPENED OUTSIDE OF A PURGE CYCLE OPERATION.
14. A TIMER ALARM ON THE H2 PRESSURIZATION SECTION OF THE PURGE CYCLE IN THE CONTROL LOGIC IS PROVIDED TO DETERMINE IF THE PURGE VALVE 25-PV-043 HAS FAILED TO CLOSE.
15. 25-PSV-001D SIZED FOR FIRE.

HOLDS

1. DELETED.
2. DELETED.
3. DELETED.
4. DELETED.

WITNESS JOINT

LO

LC

LO-LC PROCESS ISOLATIONS
FOR SAIL AWAY
G. Laurentiu 25/07/25

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
03	09/09/2024	CIM	RZI	DLO	ACCEPTED FOR CONSTRUCTION (AFC)
02	12/06/2024	CIM	RZI	DLO	ACCEPTED FOR CONSTRUCTION (AFC)
01	15/02/2024	CIM	RZI	DLO	ISSUE FOR ACCEPTANCE (IFA)
00	20/10/2023	CIM	RZI	DLO	ISSUE FOR ACCEPTANCE (IFA)

CROSSWIND

ROSETTI MARINO

TITLE :
BLPH PIPING AND INSTRUMENTATION DIAGRAM
HYDROGEN STORAGE VESSEL D

CONTRACT NO./TITLE	CW-I-WP4-2023-05/HOLLANDSE KUST NOORD WIND PARK		SCALE	NTS
DRAWN	CHECKED	APPROVED	DATE	
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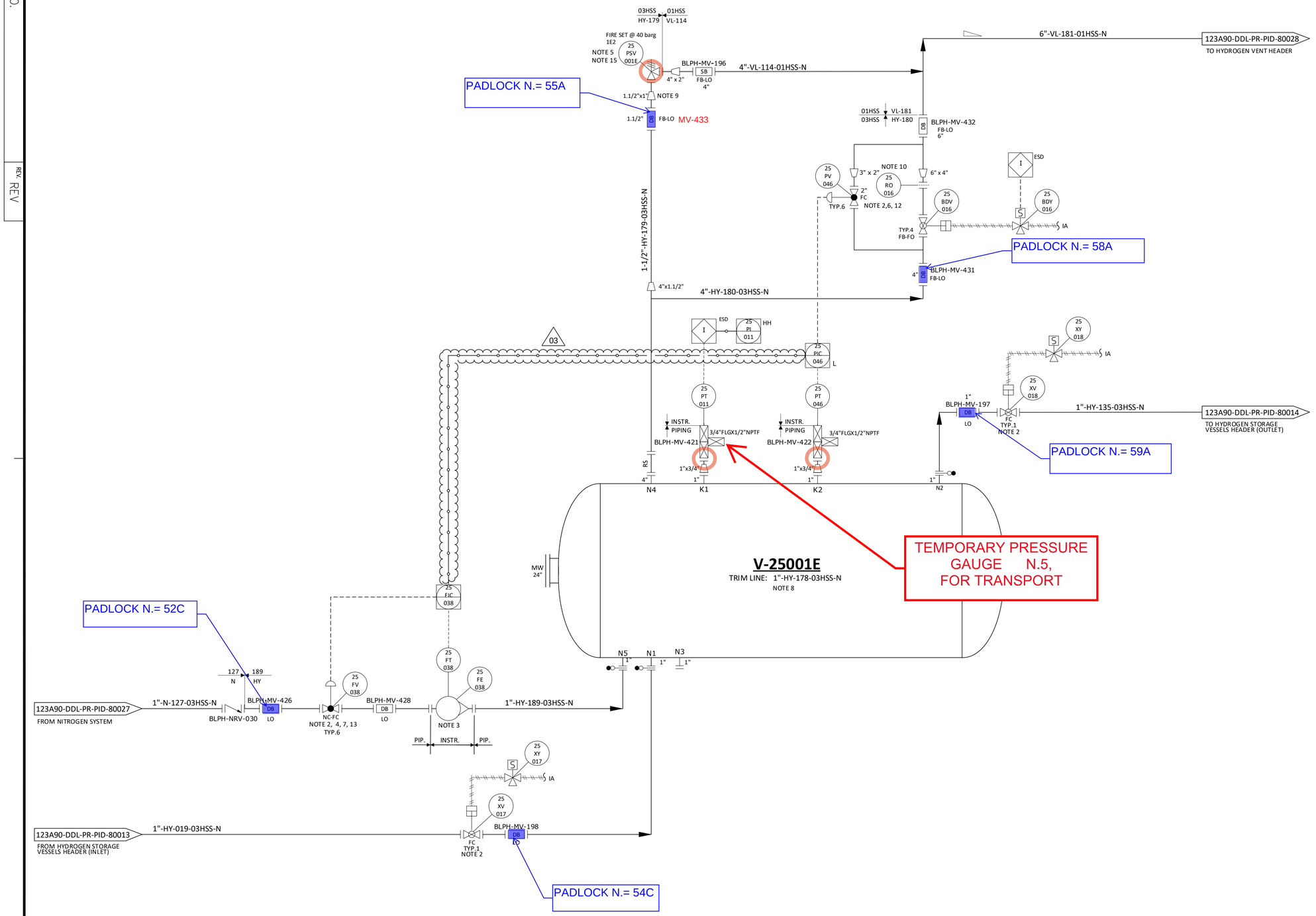
DRAWING NO. DRAWING_NO.

REV. REV

V-25001 E

HYDROGEN STORAGE VESSEL

SIZE : 2800 mm (ID) X 15500 mm (L T/T)
DESIGN P/T : 40 barg / -10 / 80 °C
MATERIAL : CARBON STEEL
OPERATING P/T : 30 barg / AMB



NOTES

1. DELETED.
2. TIGHT SHUT OFF VALVE.
3. VARIABLE AREA FLOWMETER TO BE INSTALLED VERTICALLY WITH DIRECTION OF FLOW UPWARDS.
4. NITROGEN CONTROL VALVE (25-FV-038) CAN NOT OPEN UNTIL THE PRESSURE WITHIN THE VESSEL IS BELOW THE NITROGEN SUPPLY PRESSURE. 03
5. ONE COMMON UNINSTALLED SPARE PSV FOR ALL VESSELS.
6. FOR PULSE PRESSURE PURGING OF VESSEL WITH HYDROGEN.
7. FOR FLOW PURGING OF VESSEL WITH NITROGEN.
8. FOR DESCRIPTION AND SPECIFICATION OF VESSEL NOZZLE, REFERENCE SHALL BE MADE TO THE TECHNICAL DATA SHEET FOR H2 STORAGE, DOC. N. "123A90-DDL-MAC-DS-50027".
9. REDUCERS TO BE INSTALLED AS CLOSE TO PSV AS POSSIBLE.
10. FOR ORIFICE DIAMETER REFERENCE SHALL BE MADE TO "RELIEF, VENT AND BLOWDOWN REPORT" DOC. N. "123A90-DDL-PR-RE-80030".
11. NOZZLE N4 TO BE INSTALLED AT MINIMUM DISTANCE FROM TANGENT LINE OF THE VESSEL (ON THE OPPOSITE SIDE OF N5 NOZZLE).
12. SOFTWARE INTERLOCK TO PREVENT 25-PV-046 BEING OPENED OUTSIDE OF A PURGE CYCLE OPERATION AND PROCESS START-UP CHARGING MODE (SEE DOC. "PROCESS CONTROL LOGICS DESCRIPTION" N. 123A90-DDL-IN-RE-40095). CONTROL VALVE 25-PV-046 IS USED ONLY IN CASE OF VESSEL PURGING OR PROCESS START-UP CHARGING MODES. 03
13. SOFTWARE INTERLOCK TO PREVENT 25-FV-038 BEING OPENED OUTSIDE OF A PURGE CYCLE OPERATION.
14. A TIMER ALARM ON THE H2 PRESSURIZATION SECTION OF THE PURGE CYCLE IN THE CONTROL LOGIC IS PROVIDED TO DETERMINE IF THE PURGE VALVE 25-PV-046 HAS FAILED TO CLOSE.
15. 25-PSV-001E SIZED FOR FIRE.

HOLDS

1. DELETED.
2. DELETED.
3. DELETED.
4. DELETED.

WITNESS JOINT

LO

LC

LO-LC PROCESS ISOLATIONS
FOR SAIL AWAY
G. Laurentiu 25/07/25

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
03	09/09/2024	CIM	RZI	DLO	ACCEPTED FOR CONSTRUCTION (AFC)
02	12/06/2024	CIM	RZI	DLO	ACCEPTED FOR CONSTRUCTION (AFC)
01	15/02/2024	CIM	RZI	DLO	ISSUE FOR ACCEPTANCE (IFA)
00	20/10/2023	CIM	RZI	DLO	ISSUE FOR ACCEPTANCE (IFA)

CROSSWIND

ROSETTI MARINO

TITLE :
BLPH PIPING AND INSTRUMENTATION DIAGRAM
HYDROGEN STORAGE VESSEL E

CONTRACT NO./TITLE	CW-I-WP4-2023-05/HOLLANDSE KUST NOORD WIND PARK		SCALE	NTS
DRAWN	CHECKED	APPROVED	DATE	
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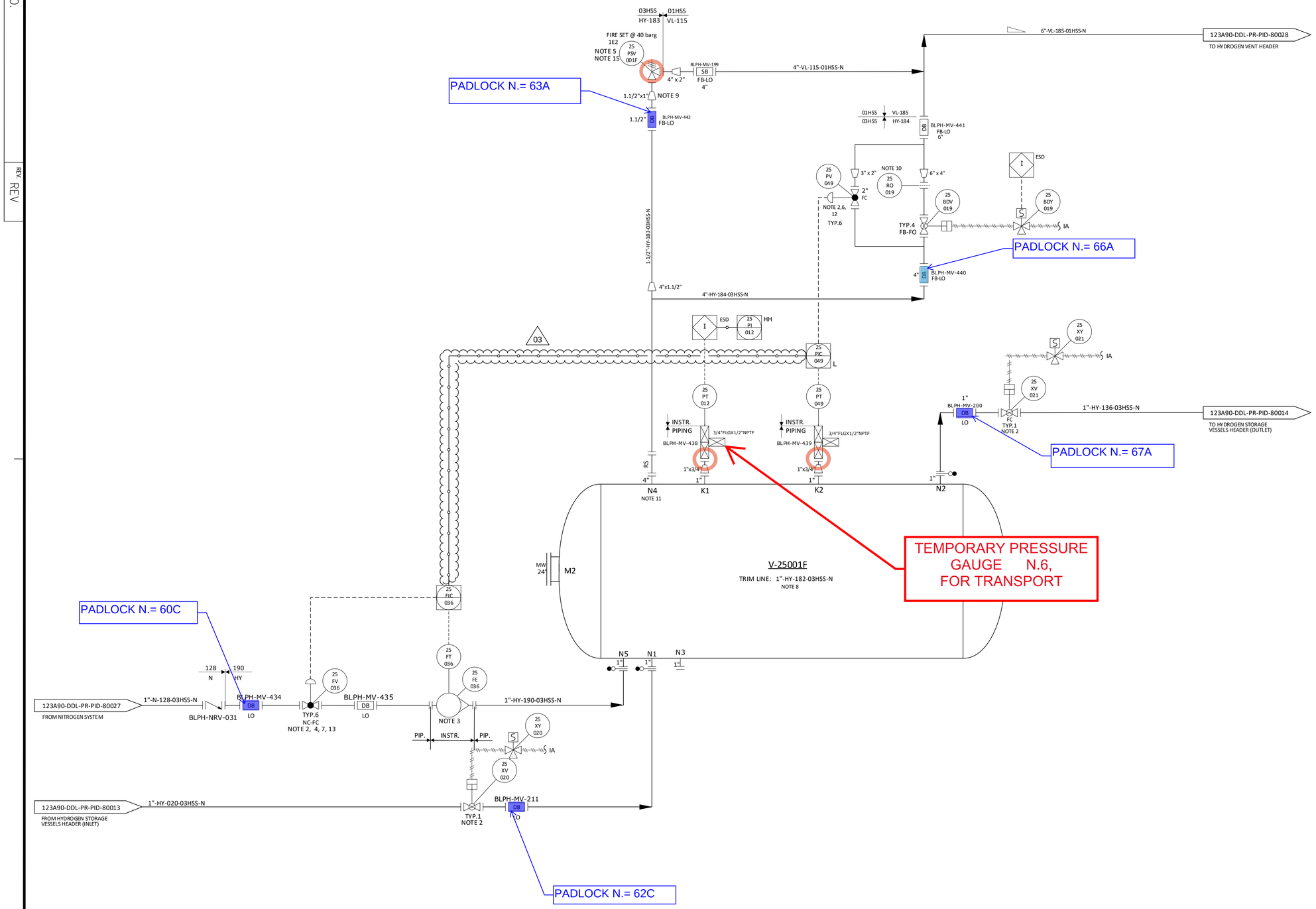
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REV. REV

V-25001_F

HYDROGEN STORAGE VESSEL

SIZE : 2800 mm (ID) X 15500 mm (L T/T)
DESIGN P/T : 40 barg / -10 / 80 °C
MATERIAL : CARBON STEEL
OPERATING P/T : 30 barg / AMB



NOTES

1. DELETED.
2. TIGHT SHUT OFF VALVE.
3. VARIABLE AREA FLOWMETER TO BE INSTALLED VERTICALLY WITH DIRECTION OF FLOW UPWARDS. 03
4. NITROGEN CONTROL VALVE (25-FV-036) CAN NOT OPEN UNTIL THE PRESSURE WITHIN THE VESSEL IS BELOW THE NITROGEN SUPPLY PRESSURE.
5. ONE COMMON UNINSTALLED SPARE PSV FOR ALL VESSELS.
6. FOR PULSE PRESSURE PURGING OF VESSEL WITH HYDROGEN.
7. FOR FLOW PURGING OF VESSEL WITH NITROGEN.
8. FOR DESCRIPTION AND SPECIFICATION OF VESSEL NOZZLE, REFERENCE SHALL BE MADE TO THE TECHNICAL DATA SHEET FOR H2 STORAGE, DOC. N. "123A90-DDL-MAC-DS-50027".
9. REDUCERS TO BE INSTALLED AS CLOSE TO PSV AS POSSIBLE.
10. FOR ORIFICE DIAMETER REFERENCE SHALL BE MADE TO "RELIEF, VENT AND BLOWDOWN REPORT" DOC. N. "123A90-DDL-PR-RE-80030".
11. NOZZLE N4 TO BE INSTALLED AT MINIMUM DISTANCE FROM TANGENT LINE OF THE VESSEL (ON THE OPPOSITE SIDE OF N5 NOZZLE).
12. SOFTWARE INTERLOCK TO PREVENT 25-PV-049 BEING OPENED OUTSIDE OF A PURGE CYCLE OPERATION AND PROCESS START-UP CHARGING MODE (SEE DOC. "PROCESS CONTROL LOGICS DESCRIPTION" N. 123A90-DDL-IN-RE-40095). CONTROL VALVE 25-PV-049 IS USED ONLY IN CASE OF VESSEL PURGING OR PROCESS START-UP CHARGING MODES. 03
13. SOFTWARE INTERLOCK TO PREVENT 25FV036 BEING OPENED OUTSIDE OF A PURGE CYCLE OPERATION.
14. A TIMER ALARM ON THE H2 PRESSURIZATION SECTION OF THE PURGE CYCLE IN THE CONTROL LOGIC IS PROVIDED TO DETERMINE IF THE PURGE VALVE 25-PV-049 HAS FAILED TO CLOSE.
15. 25-PSV-001F SIZED FOR FIRE.

HOLDS

1. DELETED.
2. DELETED.
3. DELETED.
4. DELETED.

WITNESS JOINT

LO

LC

LO-LC PROCESS ISOLATIONS
FOR SAIL AWAY
G. Laurentiu 25/07/25

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
03	09/09/2024	CIM	RZI	DLO	ACCEPTED FOR CONSTRUCTION (AFC)
02	12/06/2024	CIM	RZI	DLO	ACCEPTED FOR CONSTRUCTION (AFC)
01	15/02/2024	CIM	RZI	DLO	ISSUE FOR HAZOP (IFA)
00	20/10/2023	CIM	RZI	DLO	ISSUE FOR ACCEPTANCE (IFA)

CROSSWIND

ROSETTI MARINO

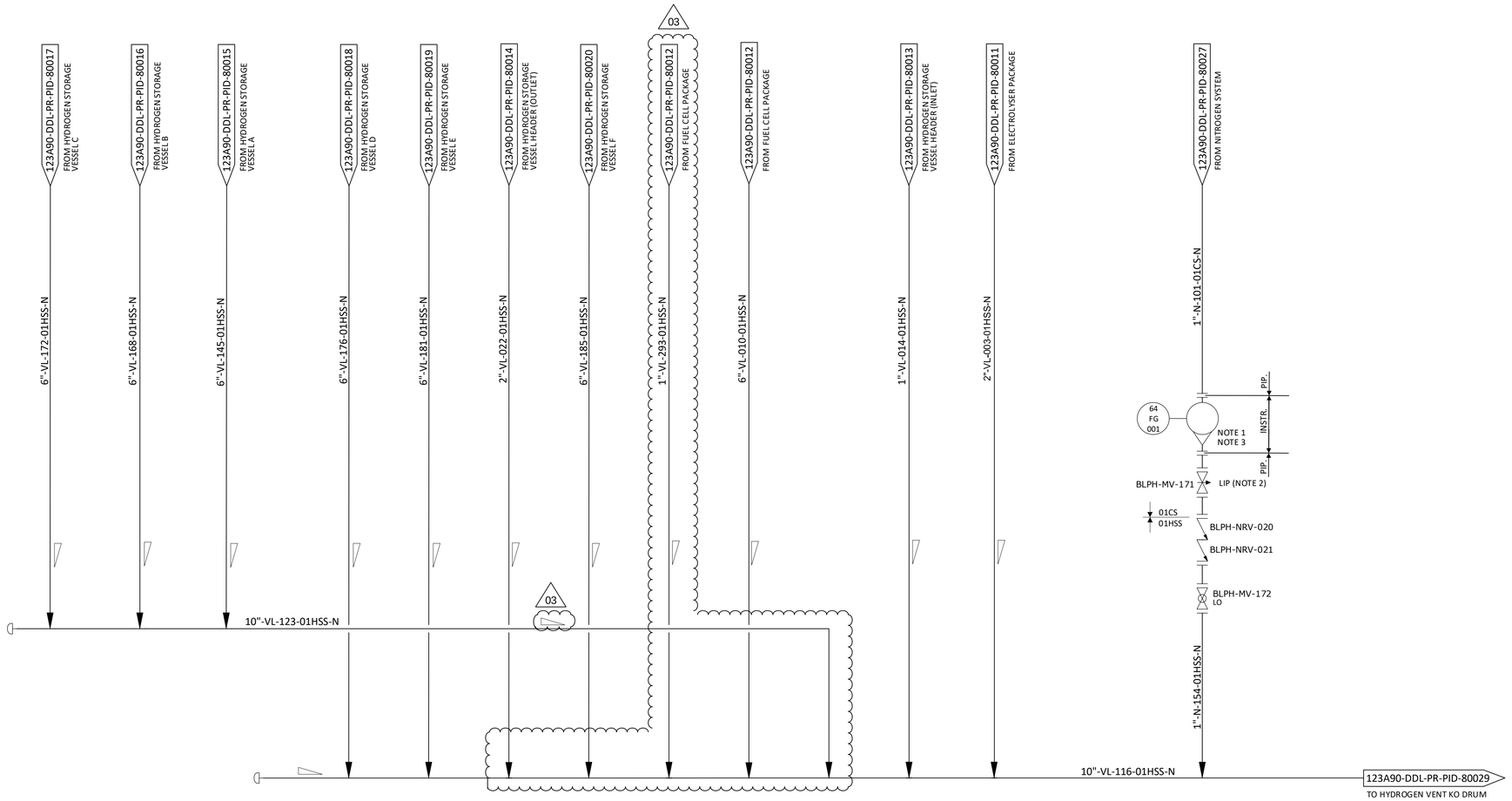
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BLPH PIPING AND INSTRUMENTATION DIAGRAM
HYDROGEN STORAGE VESSEL F

CONTRACT NO./TITLE	CW-I-WP4-2023-05/HOLLANDSE KUST NOORD WIND PARK		SCALE	NTS
DRAWN	CHECKED	APPROVED	DATE	
A1	DRAWING NO. 123A90-DDL-PR-PID-80020		SHEET 001	REV. 03

File Name = FILE_NAME

DRAWING NO. DRAWING_NO.

REV. REV



NOTES

1. FLOW METER 64-FG-001 SHALL BE READABLE FROM MANUAL VALVE MV-171.
2. VALVE BLPH-MV-171 TO BE LOCKED IN PLACE.
3. VERTICAL INSTALLATION.

HOLDS

1. DELETED.
2. DELETED.

LO

LC

LO-LC PROCESS ISOLATIONS
FOR SAIL AWAY
G. Laurentiu 25/07/25

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
03	09/09/2024	CIM	RZI	DLO	ACCEPTED FOR CONSTRUCTION (AFC)
02	12/06/2024	CIM	RZI	DLO	ACCEPTED FOR CONSTRUCTION (AFC)
01	15/02/2024	CIM	RZI	DLO	ISSUE FOR ACCEPTANCE (IFA)
00	20/10/2023	CIM	RZI	DLO	ISSUE FOR ACCEPTANCE (IFA)

CROSSWIND

ROSETTI MARINO

TITLE :
BLPH PIPING AND INSTRUMENTATION DIAGRAM
HYDROGEN VENT HEADER

CONTRACT NO./TITLE	CW-I-WP4-2023-05/HOLLANDSE KUST NOORD WIND PARK	SCALE	NTS
DRAWN	CHECKED	APPROVED	DATE

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	123A90-DDL-PR-PID-80028	001	03

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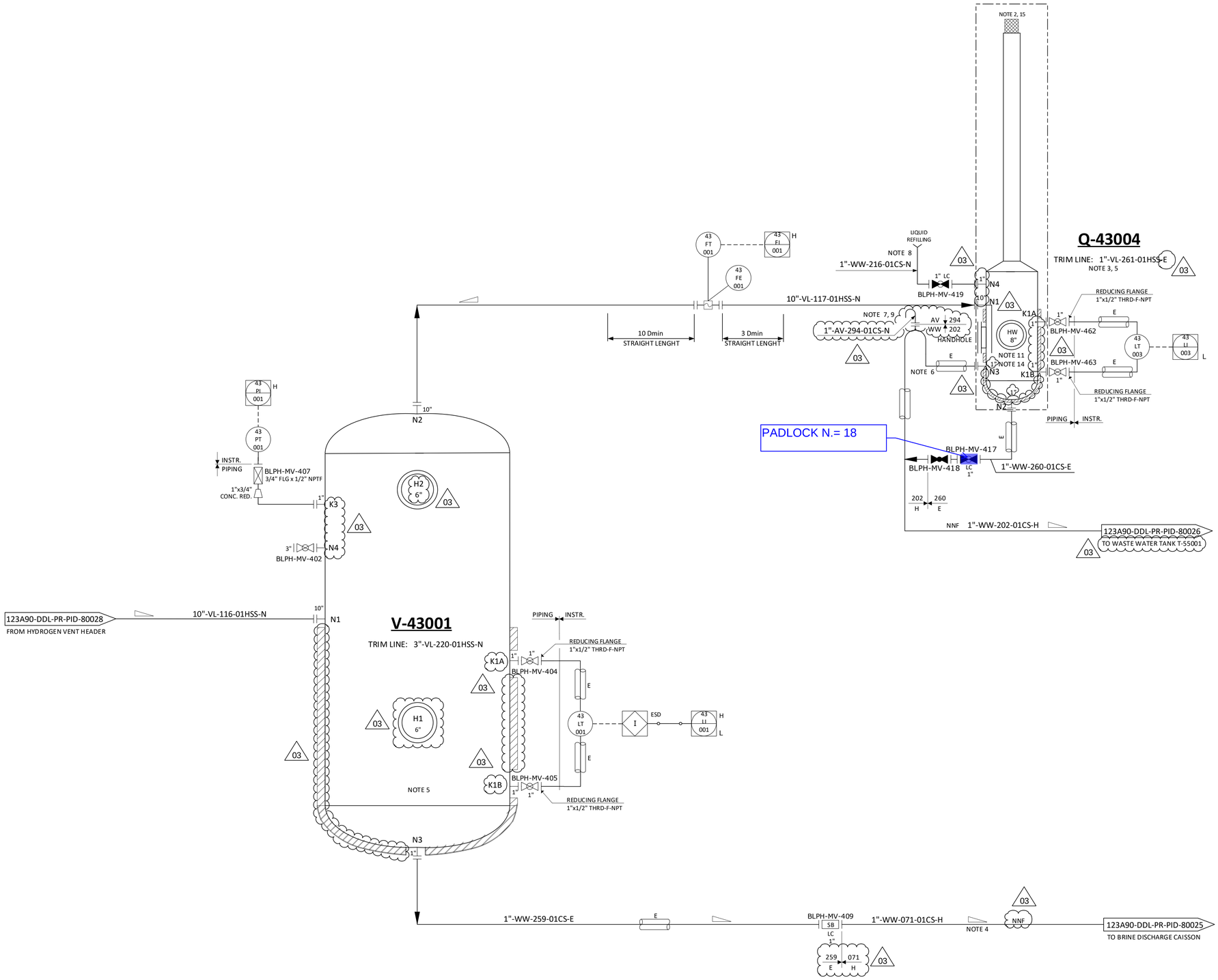
REV. REV

V-43001

HYDROGEN VENT KO DRUM
SIZE : 600 mm (ID) x 2350 mm (H)
DESIGN P/T : 3.5 barg / -10 / 80°C
MATERIAL : LTCS + 1 mm CA

Q-43004

HYDROGEN VENT NOTE 1
SIZE : 254 mm (ID)
DESIGN P/T : 3.5 barg / -10 / 80°C
MATERIAL : LTCS + 3 mm CA



NOTES

1. VENT TO SAFE LOCATION SEGREGATED FROM OTHER VENTS.
2. VENT TO BE EQUIPPED WITH BIRD SCREEN.
3. LIQUID SEAL DRUM IS PART OF THE VENT SYSTEM.
4. LIQUID DRAIN LINES TO BE ROUTED TO ENSURE GRAVITY DRAIN.
5. HYDROGEN VENT KO DRUM AND LIQUID SEAL DRUM TO BE HEAT TRACING.
   - V-43001 HEAT TRACED FROM B.T.L. UP TO 600 mm, BOTTOM HEAD ALSO TO BE HEAT TRACED.
6. SEAL LEG WILL BE DETERMINATED ON THE MAXIMUM BACK PRESSURE IN THE VENT.
7. SEAL VENT TO BE PLACED INTO A SAFE POSITION.
8. FILLING LINE TO BE PLACED IN AN ACCESSIBLE POSITION.
9. TRACED FROM NOZZLE N3 UP TO SWAN NECK.
10. DELETED.
11. INLET DIP LEG SUBMERSION HEIGHT OF 0.6 m.
12. DELETED.
13. FOR DESCRIPTION AND SPECIFICATION OF VESSEL NOZZLE, REFERENCE SHALL BE MADE TO THE TECHNICAL DATA SHEET FOR H2 VENT KOD.
14. LIQUID INSIDE SEAL DRUM IS A WATER - GLYCOL MIXTURE WITH 50% VOLUME OF GLYCOL. (03)
15. TOP OF TIP OF H2 VENT SHALL BE AT AS MINIMUM 6.2 m FROM HIGHEST REACHABLE PLATFORM.

HOLDS

1. DELETED.
2. DELETED.
3. DELETED.

LO

LC

LO-LC PROCESS ISOLATIONS
FOR SAIL AWAY
G. Laurentiu 25/07/25

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
03	09/09/2024	CIM	RZI	DLO	ACCEPTED FOR CONSTRUCTION (AFC)
02	12/06/2024	CIM	RZI	DLO	ACCEPTED FOR CONSTRUCTION (AFC)
01	15/02/2024	CIM	RZI	DLO	ISSUE FOR ACCEPTANCE (IFA)
00	20/10/2023	CIM	RZI	DLO	ISSUE FOR ACCEPTANCE (IFA)

CROSSWIND

ROSETTI MARINO

TITLE :
BLPH PIPING AND INSTRUMENTATION DIAGRAM
HYDROGEN VENT DRUM

CONTRACT NO./TITLE	CW-I-WP4-2023-05/HOLLANDSE KUST NOORD WIND PARK		SCALE	NTS
DRAWN	CHECKED	APPROVED	DATE	
A1	DRAWING NO. 123A90-DDL-PR-PID-80029		SHEET 001	REV. 03

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