Base Load Power Hub (BLPH)

HSSE Action Tracking Register and Close out report

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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.

1.1.1 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.

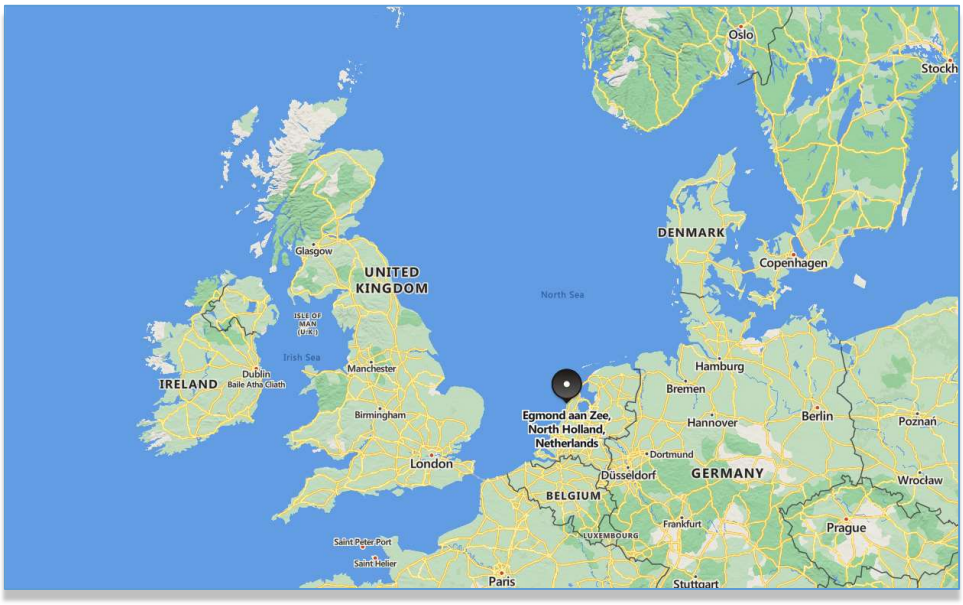


Figure 1 HOLLANDSE KUST NOORD WIND PARK Location Map

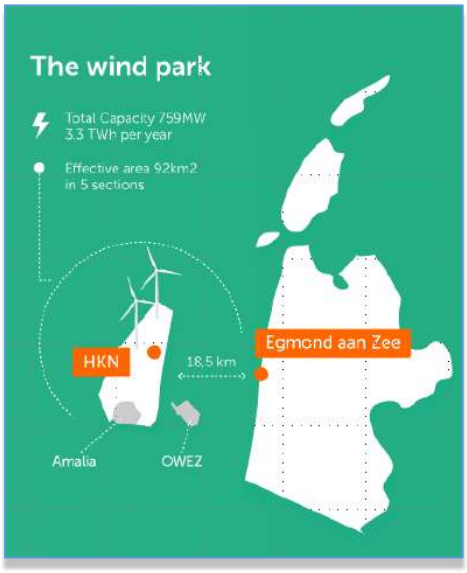


Figure 2 - Wind Park Details

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 located on coordinates E 590719.1, N 5841602.3 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.

1.1.2 Project Concept

All components included in the BLPH will be integrated onshore on a topsides 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.

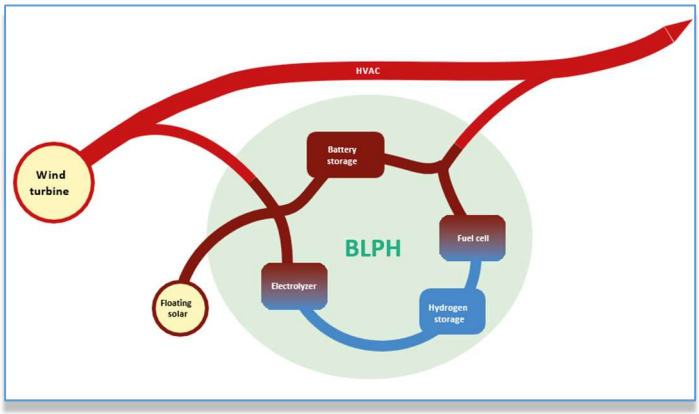


Figure 3 – BLPH Concept

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 s to function as a testbed for the integration of energy storage technologies with renewable generation. It is expected that equipment installed on the BLPH will operate as Normally Unmanned Installation for at least two (2) years with no or minimal maintenance and it will have its own independent control room with the ability to communicate with Crosswind's control room.

2 DOCUMENT SCOPE

The objective of the present document is to provide a formal close out record for all actions that have been responded to and signed-off. This includes both FEED Deferred Actions (i.e., all the actions that cannot be closed out in that Project Phase) and EPC Actions.

The HSSE Action Tracking Register has been implemented on the Project to ensure that all key HSE actions raised from formal workshops such as HAZID, HAZOP and SIMOPS and safety studies are managed and tracked.

Actions raised from other sources are not recorded in this document.

2.1 REFERENCES

Doc. No.	Description
[1] K559-2254-SE-REP-001	HAZID Report, Rev. 1.
[2] K559-2254-SE-REP-015	HAZOP & LOPA Report, Rev. 1
[3] K559-2254-SE-REP-007	Fire and Explosion Risk Analysis Report, Rev. 1
[4] 123A90-DDL-SAF-RE-30006	HAZOP Report
[5] 123A90-DDL-SAF-RE-30009	HAZID Report
[6] 123A90-DDL-SAF-RE-30038	SIMOP/MOPO report

Table 1 - Reference Documents

2.2 DEFINITIONS AND ABBREVIATIONS

COMPANY or Client (CPY):	Crosswind
CONTRACTOR (CTR):	ROSETTI MARINO S.p.A.
PROJECT:	HOLLANDSE KUST NOORD WIND PARK Project

Table 2 – Definitions

AIS	Automatic Identification System
ALARP	As low as reasonably practicable
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
CCS	Central Control System
DCS	Distributed Control System
EPC	Engineering Procurement Construction
ESD	Emergency Shutdown
F&G	Fire and Gas
FEED	Front End Engineering Design
FERA	Fire and Explosion Risk Assessment
HAZID	Hazard Identification Study
HAZOP	Hazard and Operability Study
HKN	Hollandse Kust Noord
HSE	Health, Safety, Environment
ICSS	Integrated Control and Safety System
LOPA	Layers of Protection Analysis
MAH	Major Accident Hazard
MOPO	Matrix Of Permitted Operations
MSDS	Material Safety Datasheets
PCS	Process Control System
PFD	Process Flow Diagram
PFP	Passive Fire Protection
PPE	Personal Protective Equipment
SGSI	Shell Global Solutions International
SHESAMS	Safety, Health, Environment, Security Action Management System
SIMOPS	Simultaneous Operations
SIL	Safety Integrity Level
TSO	Transmission System Operator
UPS	Uninterrupted Power Supply
WTG	Wind Turbine Generator

Table 3 - Abbreviations

3 HSSE ACTION TRACKING REGISTER

3.1 INTRODUCTION

The HSSE Action Tracking Register produced during FEED Project Phase in conformance with FEED Contractor's Safety, Environmental and Health Action Management System (SHEAMS) has been updated adding all the safety actions raised during EPC to the actions that cannot be closed out during FEED (i.e., Deferred Actions).

The HSSE Action Tracking Register is maintained as a "live" repository, allowing actions and responses to be updated at any time.

This document summarises the status of The HSSE Action Tracking Register during EPC.

Actions that were logged within The HSSE Action Tracking Register were taken from the following sources:

- FEED HAZID Report, Ref. [1];
- FEED HAZOP & LOPA Report, Ref. [2];
- FEED Fire and Explosion Risk Analysis Report, Ref. [3];
- EPC HAZOP Report, Ref. [4];
- EPC HAZID Report, Ref. [5];
- EPC SIMOP/MOPO Report, Ref. [6].

The process operating within the HSSE Action Tracking system can be summarised as follows.

- Actions are distributed to the identified responsible parties for completion.
- During the course of works the necessary engineering work as required by the action will be completed and evidence included.
- The responsible party will complete the action response, provide the evidence and sign.
- Once completed, the action is routed through a series of parties to verify the quality and completeness of the action closure, along with confirmation of any required evidence. These parties are:
    - HSE Leader
    - Project Manager
    - Company Approval

The present document will be updated every 2 months, while the HSSE Action Tracking Register will be updated each 2 weeks and presented in the bi-weekly meeting to ensure the actions are follows.

3.2 ACTION STATUS DEFINITION

The action status may be defined as listed below:

- Open – Actions for which any form of response has yet to be submitted.
- For Approval – The proposed response is considered acceptable to Rosetti Marino and the Action is in the approval process with the client.
- Closed – Responses that have been approved as incorporated in the design (or otherwise closed) at EPC. Approval given by the responding discipline, Rosetti Marino Safety, Rosetti Marino Engineering Management and Client. These actions have fully signed response sheets which have been included in Appendix 1.

3.3 ACTION STATUS

The following sections show the status of actions as a total and by Action Source (i.e., study).

3.3.1 Total Action Status

Table 4 - Total Action Status

Status	Totals
Open	**0**
Open Operators	**3**
For Approval	**0**
Actions closed in Feed HSSE rev01	**16**
Closed	**200**
TOTAL	**219**

3.3.2 Action Status by Action Source

Table 5 - FEED HAZID Actions

Status	Totals	%
Open RM.	0	0
Open CW	0	0
For Approval RM scope	0	0
For Approval CW scope	0	0
Actions closed in Feed HSSE rev01	2	8
Closed	24	92
TOTAL	**26**	**100**

Table 6 - FEED HAZOP & LOPA Actions

Status	Totals	%
Open RM.	0	0
OPEN CW	0	0
For Approval RM scope	0	0
For Approval CW scope	0	0
Actions closed in Feed HSSE rev01	14	13
Closed	91	87
TOTAL	**105**	**100**

Table 7 - FEED FERA Actions

Status	Totals	%
Open RM.	0	0
Open CW	0	0
For Approval RM scope	0	0
For Approval CW scope	0	0
Closed	7	0
TOTAL	**7**	**100**

Table 8 - EPC HAZID Actions

Status	Totals	%
Open RM.	0	0
Open RM/CW	0	0
Open RM/CW	0	0
For Approval RM scope	0	0
For Approval RM/CW scope	0	0
For Approval CW scope	0	0
Closed	14	100
TOTAL	**14**	**100**

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Table 9 - EPC HAZOP Actions

Status	Totals	%
Open RM.	0	0
Open RM/CW	0	0
Open CW	0	0
For Approval RM	0	0
For Approval RM/CW	0	0
For Approval CW	0	0
Closed	56	100
TOTAL	**56**	**100**

Table 10 - EPC HFE Actions

Status	Totals	%
Open	0	0
For Approval	0	0
Closed	7	100
TOTAL	**7**	**100**

Table 11 - EPC ALARP Actions

Status	Totals	%
Open CW	0	0
Open Operators	3	100
TOTAL	**3**	**100**

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4 HSSE ACTION REGISTER

Tables below details the status of all actions at the issue date of this document.

4.1 FEED FERA RECOMMENDATIONS

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SHEAM No.Feed HSSE Register_REV 01	SHEAMS Ref.	Source Document Title	Source Document No.	SHEAMS Title	Node/ Source		Action	Response	Status
129	93	BLPH Fire and Explosion Risk Analysis (FERA)	K559- 2254-SE- REP-007	FEED FERA Study Actions	N/A		A hydrogen storage vessel fire failure analysis is to be conducted to determine if a 15 minute depressurising time is sufficient to protect the vessels from an explosive rupture.	According with FERA study doc. no. 123A90-DDL-SAF-RE-30020 , scenarios for jet fires are below 10-4 year. No need for additional mitigation measures	CLOSED
130	94	BLPH Fire and Explosion Risk Analysis (FERA)	K559- 2254-SE- REP-007	FEED FERA Study Actions	N/A		Ensure a robust fire and gas detection design with good coverage and rapid response is provided in the hydrogen storage area.	Robust fire and gas detection design with good coverage and rapid response is provided in the hydrogen storage area. See F&G 123A90-DDL-SAF-RE-30051 / F&G DETECTORS COVERAGE REPORT	CLOSED
131	95	BLPH Fire and Explosion Risk Analysis (FERA)	K559- 2254-SE- REP-007	FEED FERA Study Actions	N/A		Conduct an assessment of oxygen vent design in terms of adequate dispersion and prevention of any interaction with hydrogen vent plume once vendor data is available.	Oxygen vent dispersion has been performed by Electrolyser vendor.This showed no interaction with the hydrogen vent, mainly due to the rising H2 plume and the O2 plume not rising to the height of the H2 vent	CLOSED
132	96	BLPH Fire and Explosion Risk Analysis (FERA)	K559- 2254-SE- REP-007	FEED FERA Study Actions	N/A		Conduct an assessment of internal Electrolyser explosions and determine any possible required additional mitigation measures.	An internal explosion of the electrolyser has been conducted and the result has been added in the main FERA reportdoc. no. 123A90-DDL-SAF-RE-30020 No additional mitigation measures are required based on the FERA.	CLOSED
133	97	BLPH Fire and Explosion Risk Analysis (FERA)	K559- 2254-SE- REP-007	FEED FERA Study Actions	N/A		Company to determine whether PFP protection for main structural elements holding up hydrogen storage area is required for asset protection purposes.	According with latest FERA report 123A90-DDL-SAF-LIS-30020, there is no need for PFP for main structural elements holding up hydrogen storage area.	CLOSED
134	98	BLPH Fire and Explosion Risk Analysis (FERA)	K559- 2254-SE- REP-007	FEED FERA Study Actions	N/A		Further protective measures against BESS thermal runaway events should be considered such as hydrogen storage blowdown on confirmed fire, data analytics tools, explosion hatches and early electrolytic vapour or off-gas detection technologies.	The thermal runaway threat, including all safeguards for the BESS has been analysed and described in technical note "Title Thermal Runaway scenario recommendation for BLPH BESS System" No additional barriers are required	CLOSED
135	99	BLPH Fire and Explosion Risk Analysis (FERA)	K559- 2254-SE- REP-007	FEED FERA Study Actions	N/A		Design of hydrogen vent and/or design of surrounding platform areas is to be revisited in light of hazard criteria exceedance for lit hydrogen vent scenario.	Sorrounding platform areas has been revised and risk assessed during ALARP workshop. Please see Vent Gas Dispersion and Potential Radiation Study 123A90-DDL-SAF-RE-30021 and 123A90-DDL-SAF-RE-30012	CLOSED

BLPH SHEAMS SIGNATURE FORM

Action Title: **Action No:** **Ref. Doc.**	**FERA Study Actions** 1 K559-2254-SE-REP-007
Item No.	1
Cause:	N/A
Consequence:	N/A
Safeguards:	N/A
Actions:	A hydrogen storage vessel fire failure analysis is to be conducted to determine if a 15 minute depressurising time is sufficient to protect the vessels from an explosive rupture.
Assigned Respondent (By)	ROSETTI Technical Safety Engineer
RESPONSE	According with FERA study doc. no. 123A90-DDL-SAF-RE-30020 , scenarios for jet fires are below 10-4 year. No need for additional mitigation measures.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
E.Carminati	
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.24 12:57:55 +02'00'

2 EXECUTIVE SUMMARY

This document has the purpose of detailing the results of the Fire and Explosion Risk Assessment (FERA) study for the new Base Load Power Hub (BLPH) which will be installed in the framework of HOLLANDSE KUST NOORD WIND PARK Project. The scope of this document is limited to the topsides structure and associated facilities up until connection with the monopile, and include the risk related to CPIs packages. The monopile itself is not within the scope of this document.

Following objectives are included in the scope of the study:

- to identify fire and explosion scenarios from the equipment inside the scope of work;
- to calculate damage distances for fire, explosion and flammable release scenarios to determine potential for escalation;
- to evaluate the fire escalation scenarios in detail and suggest suitable risk reduction measures.

To achieve this objective, a thorough analysis has been made on all hazardous substance and streams within the new equipment part of the project.

Parts count approach has been applied to identify all of the possible sources of loss of containment (lines, flanges, valves, equipment) and consequently to calculate the corresponding leakage frequencies for all the section of the plant with hazardous substances.

The system has been segmented into isolatable sections, for the identification of Loss of containment cases (LOC). Each isolatable section is characterized by one or more LOCs, on the basis of characteristics of the handled fluid.

Three leak size categories have been identified for a wider representation of the risk by different LOCs. The consequence assessment has been performed with the software PHAST from DNV-GL. All the identified scenarios have been located in the plot plan. With application of a dedicated software, it has been possible to combine their contribution to determine the impact of new equipment in the scope of the project in order to evaluate the acceptability of fire and explosion scenarios.

The main findings of the FERA study are reported below.

- Jet Fire.

  there are no areas in the platform in which the thermal radiation threshold contours of 37.5 kW/m^2 from jet fire is equal to or above 1.0E-04 per year. The impact of jet fire scenarios on equipment is lower than target frequency and can be classified as tolerable .

- Explosion

  there are no areas in the platform in which the explosion threshold contours of 0.35, 0.27, 0.15 and 0.07 bar are equal to or above 1.0E-04 per year, thus the risk from VCE is considered tolerable .

Following actions are recommended:

- In order to reduce the escalation risk from section 2 (storage section) it is suggest to reduce the total hold up involved in the hazardous scenarios. At the present, all vessels are considered aligned, and

in case of release, about 1200 kg are potentially involved in the release. It is recommended to define the logics of line-up and closure of each vessel automatically during normal operation.

This action will significantly reduce the total amount of H_2 involved in a critical scenario, leading to the decrease of scenario duration and the risk of escalation.

BLPH SHEAMS SIGNATURE FORM

Action Title: **Action No:** **Ref. Doc.**	**FERA Study Actions** 2 K559-2254-SE-REP-007
Item No.	2
Cause:	N/A
Consequence:	N/A
Safeguards:	N/A
Actions:	Ensure a robust fire and gas detection design with good coverage and rapid response is provided in the hydrogen storage area.
Assigned Respondent (By)	ROSETTI Technical Safety Engineer
RESPONSE	Robust fire and gas detection design with good coverage and rapid response is provided in the hydrogen storage area. See F&G 123A90-DDL-SAF-RE-30051 / F&G DETECTORS COVERAGE REPORT
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
E.Carminati	
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
C.Giunchi	
Client	**Sign**
	

3 FIRE AND GAS DETECTION

Fire and Gas Detection System is required to continuously monitor all areas to detect unplanned process releases and fire events so as to prevent escalation of the initiating event and minimize its consequences. The intervention of the system shall be as early as possible to enable raising of an alarm and prompt intervention by the fire protection system. F&G system is installed at BLPH in case of confirmed fire and gas event, a site warning via speakers and beacons will be initiated.

For additional details refer to the Fire Protection philosophy, ref. [1].

3.1 FIRE AND GAS DETECTOR DESIGN APPROACH

Design of the F&G Detector layout was based on the following approach:

1. Identify hazards and characterize their effects using results from the Fire and Explosion Risk Assessment, ref. [2].
2. Identify and divide the platform in Fire Zones. Seven zones where identified in open area, in addition each enclosure represent a separate fire zone. This subdivision is clearly reported also in the F&G Cause and Effect Matrix, ref. [6]
3. Develop the detectors design, by assessing the hazard characteristics at each Fire Zone and determine detector type, number, principle of operation and location.

The Fire and Gas Layouts, ref.[3] and [4], was finally updated, after passing different reviews and location of each detector was determined as per the final 3D model, ref. [5], version.

All fire and gas detectors are connected to the Platform Fire & Gas Detection System (FGS) and are suitable for both the area where they are installed and the detection system to which they are connected.

All field mounted flammable fire and gas detectors (i.e. excluding smoke detectors inside unclassified buildings) are certified for use in a hazardous area Zone 1, even where they are installed in areas that are normally classified as non-hazardous.

3.2 FIRE ZONES

Platform areas are divided into seven fire zones and the enclosures, defined by segregation distance, equipment functions, or fire rated divisions, so as to assist with identification of fire and gas event location and to provide definition for detector voting group as well as control of extinguishing systems.

Automatic actions started in case of fire and gas alarm and fire and gas confirmation are detail in the Fire and Gas Cause and Effect Matrix, ref. [6].

3.3 FLAME DETECTORS

Flame Detectors are positioned toward the areas where a flame is expected. Their exact location, numbers and spacing dependend on the layout of the area and selected position avoid any obstruction such as beams, piping and equipment as much as possible.

To avoid spurious flame detection for any detectors located in open areas, location and voting was carefully assessed. Hydrogen/air mixtures require very little energy to be ignited and hydrogen has a very large range between its Lower Explosive Limits (LEL) and Upper Explosive Limits (UEL). This means a hydrogen leak can easily result in a jet fire. Furthermore, hydrogen burns with an invisible flame, thus UV type flame detectors are necessary for detection of hydrogen fires. However, to avoid spurious detection from any detectors located in open areas, UV-IR flame detectors are preferred since they generate an alarm signal only if a flame is detected on both bands.
The coverage of the flame detectors, as per provider data sheet, reach up to 20m in radius, in normal conditions it can reach 10m radius.

3.4 HYDROGEN GAS

Electro-chemical point gas detectors for hydrogen gas were located at high level, enclosed spaces and air intakes where the risk of hydrogen loss of containment exists and they where mixed with acoustic gas detectors, located in some strategically areas, to increase the robustness of the F&G detection system. A minimum of two detectors was provided at each fire zone to guarantee 2ooN voting logic.

Operations and maintenance personnel, when going to the platform, could be equipped also with personal gas detection equipment.

The correct location of reliable sensors is crucial for timely detection and alarming of hydrogen leaks before an explosive mixture is formed. Hydrogen gas detectors were installed near possible leak sources (valves, hoses, flanges, connections, bellows, etc.), at elevation, below ceilings of enclosed spaces, and in correspondence to forced ventilation system inlets and outlets.

In relation with the gas point detectors, it was deeply study and then also confirmed by the Supplier of these detectors (Draeger), that a coverage level with a radius of 5m is properly assigned to each of these sensors, considering the location in the platform. This indication is also matching with the DEP definition following "flammable gas in open area" as per DEP32.30.20.11 par. 5.3.3.1.

Therefore a sphere with a diameter of 10m was included in the 3D model, to ensure proper coverage of the areas byt these detectors, as shown in the appendix.

Regarding ultrasonic detectors, the sensor range depends on the Mass Flow leak to be detected, that is related with the hole size that is assumed to happen. Draeger provided the curve for the Mass Flow of 40g/sec for Signal [dB] vs Source Distance for the Ultrasonic detectors purchased. In our case, considering the case of H2 leaks we can follow the following table shared by Draeger:

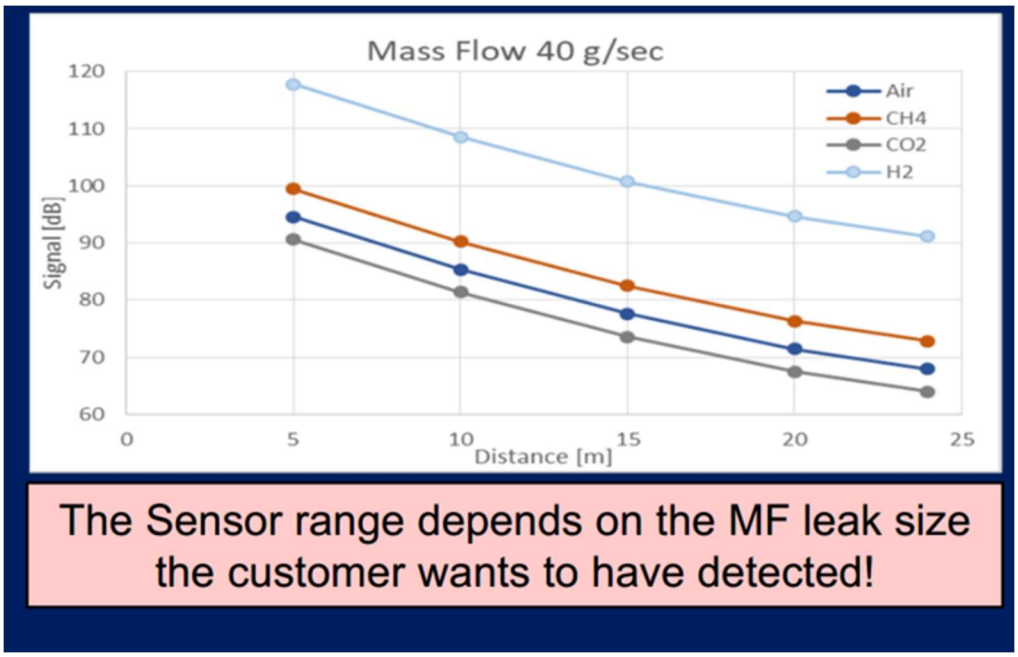


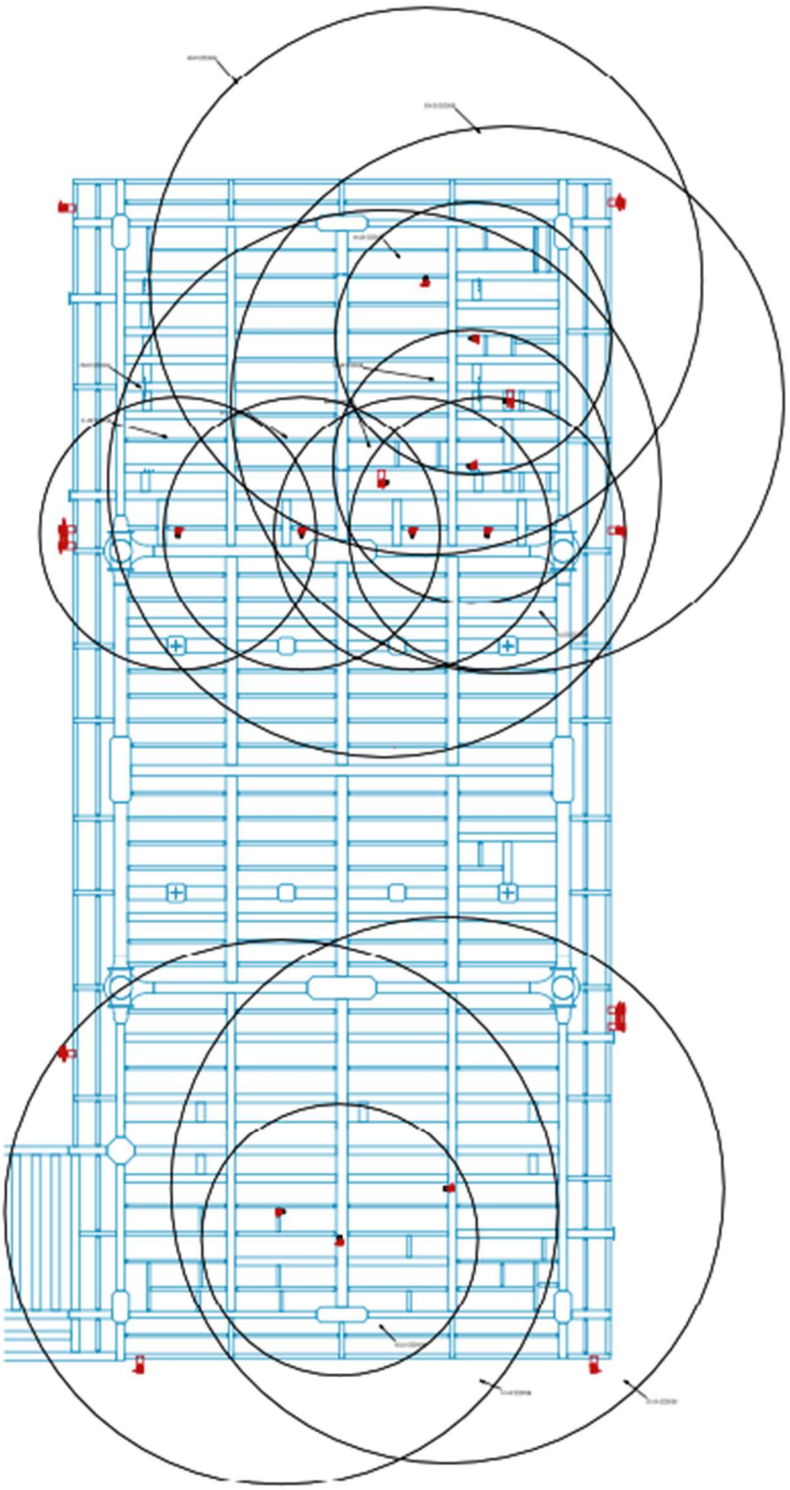
Figure 4 – Noise level versus Coverage

In our case, the minimum mass flow considered in the Fire and Explosion Risk Assessment, ref. [2], is 30g/s as per minimum hole size (5mm) and for 25mm, it is 760 g/s. Considering a background noise for normal operation, as per the noise study, ref. [7], lower than 80dB(A), we can confirm, that in a conservative approach the 10m of radius was properly assumed.

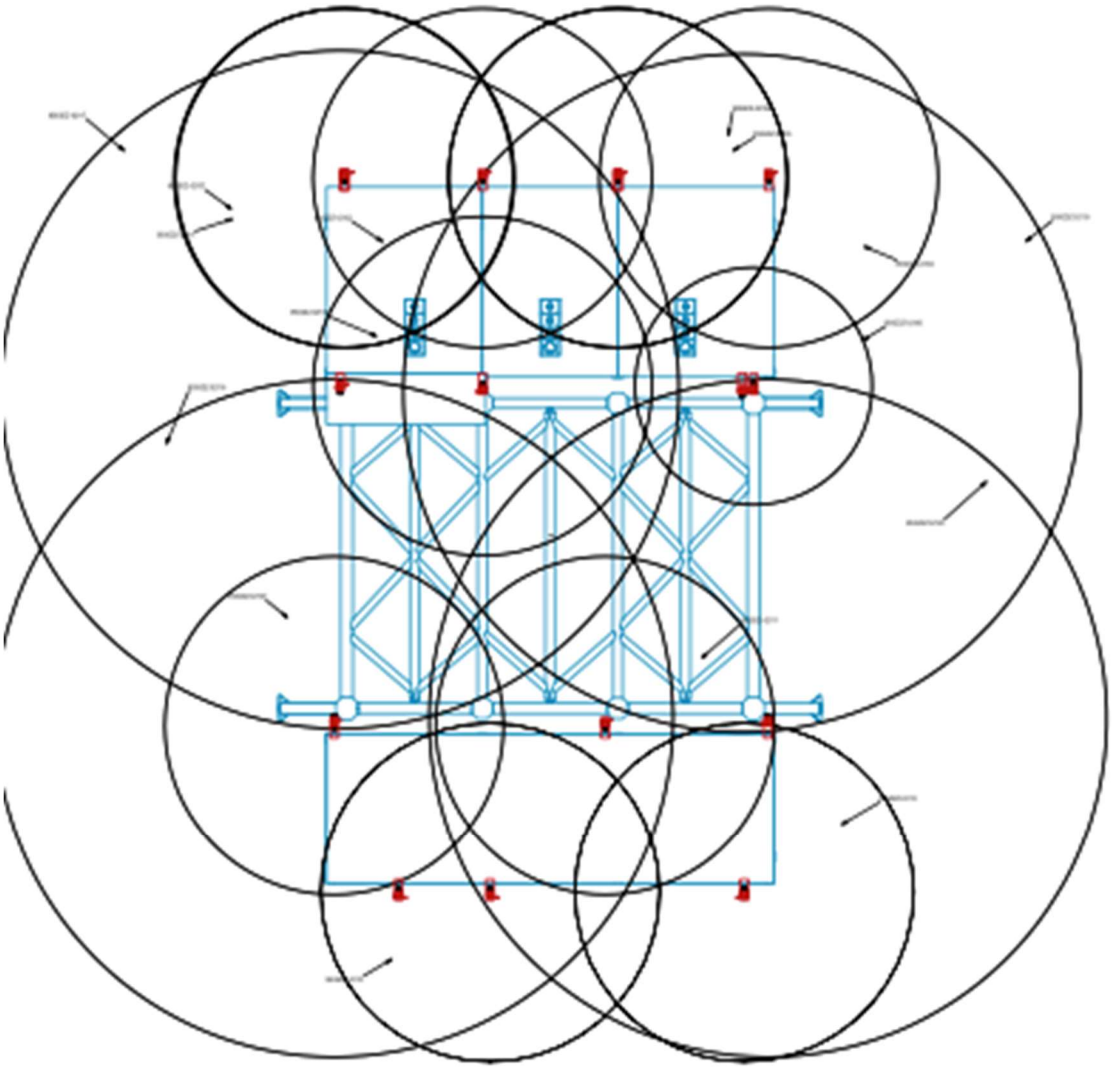
This leads to the conclusion that the whole platform is sufficiently covered with the actual position of ultrasonic and point detectors.

ANNEX 1 – GAS AND FLAME DETECTORS 3D DRAWINGS

The below picture shows the coverage at lower deck of gas detectors.



The below picture shows the coverage at upper deck of gas detectors.



ANNEX 2 – GAS AND FLAME DETECTORS DATASHEETS

HYDROGEN POINT DETECTORS

POS.	TAG NUMBER	SERVICE
1	950-GDZ-02101	H2 GD FZ-02 H2 STORAGE VESSELS AREA
2	950-GDZ-02102	H2 GD FZ-02 H2 STORAGE VESSELS AREA
3	950-GDZ-02103	H2 GD FZ-02 H2 STORAGE VESSELS AREA
4	950-GDZ-02104	H2 GD FZ-02 H2 STORAGE VESSELS AREA
5	950-GDZ-02105	H2 GD FZ-02 H2 STORAGE VESSELS AREA
6	950-GDZ-02106	H2 GD FZ-02 H2 STORAGE VESSELS AREA
7	950-GDZ-02107	H2 GD FZ-02 H2 STORAGE VESSELS AREA
8	950-GDZ-02108	H2 GD FZ-02 H2 STORAGE VESSELS AREA
9	950-GDZ-02109	H2 GD FZ-02 H2 STORAGE VESSELS AREA
10	950-GDZ-02110	H2 GD FZ-02 H2 STORAGE VESSELS AREA
11	950-GDZ-02111	H2 GD FZ-02 H2 STORAGE VESSELS AREA
12	950-GDZ-02112	H2 GD FZ-02 H2 STORAGE VESSELS AREA
13	950-GDZ-02113	H2 GD FZ-02 H2 STORAGE VESSELS AREA
14	950-GDZ-02114	H2 GD FZ-02 H2 STORAGE VESSELS AREA
15	950-GDZ-02115	H2 GD FZ-02 H2 STORAGE VESSELS AREA
16	950-GDZ-02116	H2 GD FZ-02 H2 STORAGE VESSELS AREA
17	950-GDZ-04201	H2 GD FZ-04 B-400 HVAC AIR INTAKE
18	950-GDZ-04202	H2 GD FZ-04 B-400 HVAC AIR INTAKE
19	950-GDZ-04203	H2 GD FZ-04 B-400 HVAC AIR INTAKE
20	950-GDZ-04204	H2 GD FZ-04 B-400 AMBIENT
21	950-GDZ-04205	H2 GD FZ-04 B-400 AMBIENT
22	950-GDZ-04206	H2 GD FZ-04 B-400 AMBIENT
23	950-GDZ-04207	H2 GD FZ-04 B-300 HVAC AIR INTAKE
24	950-GDZ-04208	H2 GD FZ-04 B-300 HVAC AIR INTAKE
25	950-GDZ-04209	H2 GD FZ-04 B-300 HVAC AIR INTAKE
26	950-GDZ-04210	H2 GD FZ-04 B-300 AMBIENT
27	950-GDZ-04211	H2 GD FZ-04 B-300 AMBIENT
28	950-GDZ-04212	H2 GD FZ-04 B-300 AMBIENT
29	950-GDZ-04213	H2 GD FZ-04 B-200 HVAC AIR INTAKE
30	950-GDZ-04214	H2 GD FZ-04 B-200 HVAC AIR INTAKE
31	950-GDZ-04215	H2 GD FZ-04 B-200 HVAC AIR INTAKE
32	950-GDZ-04216	H2 GD FZ-04 B-200 AMBIENT
33	950-GDZ-04217	H2 GD FZ-04 B-200 AMBIENT
34	950-GDZ-04218	H2 GD FZ-04 B-200 AMBIENT
35	950-GDZ-05101	H2 GD FZ-05 BESS AREA
36	950-GDZ-05102	H2 GD FZ-05 BESS AREA
37	950-GDZ-05103	H2 GD FZ-05 BESS AREA
38	950-GDZ-05104	
39	950-GDZ-05105	
40	950-GDZ-05106	
41	950-GDZ-06201	H2 GD FZ-06 B-100 HVAC AIR INTAKE
42	950-GDZ-06202	H2 GD FZ-06 B-100 HVAC AIR INTAKE
43	950-GDZ-06203	H2 GD FZ-06 B-100 HVAC AIR INTAKE
44	950-GDZ-06204	H2 GD FZ-06 B-100 AMBIENT
45	950-GDZ-06205	H2 GD FZ-06 B-100 AMBIENT
46	950-GDZ-06206	H2 GD FZ-06 B-100 AMBIENT
47	950-GDZ-03104	H2 GD FZ-03 ELECTROLYZER PK AREA
48	950-GDZ-03105	H2 GD FZ-03 ELECTROLYZER PK AREA
49	950-GDZ-01103	H2 GD FZ-03 ELECTROLYZER PK AREA

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Dräger Polytron® 8200 CAT
Detection of flammable gases and vapors

The Dräger Polytron® 8200 CAT is an advanced explosion-proof transmitter for the detection of combustible gases in the lower explosion limit (LEL). It uses a catalytic bead DrägerSensor® Ex that will detect most flammable gases and vapors. In addition to a 3-wire 4 to 20-mA analog output with relays it also offers HART®, Modbus and Fieldbus protocols, making it compatible with most control systems.



Dräger. Technology for Life®

Benefits

Fast and stable – the DrägerSensor® Ex

The built-in DrägerSensor® Ex is based on the proven catalytic bead measuring principle. It has excellent long-term stability with outstanding poison resistance. And this is the reason for its durability. Due to the novel gas inlet opening, the sensor responds to gas in only a few seconds. This allows you to react immediately with countermeasures and prevent the development of a flammable atmosphere.

Easy device management via digital communication

The Dräger Polytron 8200 is equipped with digital interfaces allowing for quick and easy remote interrogation of the transmitter's state. Integration with existing asset management systems such as PACTware™ is possible via DTM. In addition to the common HART® communication system, the fieldbus interfaces PROFIBUS® PA, FOUNDATION fieldbus™ H1, and Modbus RTU are also available.

Same design, same operating principle

The Dräger Polytron 8200 belongs to the Polytron 8000 series. All transmitters in this series have the same design and user interface. This allows for uniform operation with reduced training and maintenance requirements. The large graphic backlit display shows status information clearly and in an easy to use format. The measured gas concentration, selected gas type, and measuring unit are displayed during normal operation. Colored LEDs (green, yellow and red) provide additional alarm and status information.

The Polytron 8200 is operated by means of a magnetic wand over contact surfaces.

Three relays for controlling external equipment

Upon request, the Dräger Polytron 8200 can also be supplied with three integrated relays. This enables you to use it as an independent gas detection system with two arbitrarily adjustable concentration alarms and one fault alarm. Audible alarms, signal lights or similar devices can thus be controlled locally without an additional cable between the transmitter and central controller.

Safe, robust housing for every application

Polytron 8200 features a Class I, Div. 1 rated explosion proof enclosure made from aluminium or stainless steel, making it suitable for a wide range of environmental conditions.

Make the impossible possible with the remote sensor

A remote explosion proof junction allows installation of the sensor up to 350' away from the transmitter in difficult to access areas. A permanently attached remote calibration adapter allows for remote bump testing or calibration from the Polytron display by using permanently attached tubing that takes the calibration gas to the sensor.

Technical Data

Dräger Polytron® 8200 CAT

Type	Explosion proof / flameproof enclosed transmitter (“d”)		
Gases	Flammable gases and vapors		
Measuring ranges	DQ	0 to 100 % LEL	
	LC	0 to 10 % LEL	
Display	Backlit graphic LCD; 3 Status LEDs (green/yellow/red)		
Performance Characteristics	Accuracy/repeatability	Zero	≤ 1 % LEL
		Span	≤ 1 % LEL
		Long-term drift	≤ 3 % LEL after 6 months
	Response time	T50	< 7 seconds (methane)
		T90	< 13 seconds (methane)
Electrical data	Signal output analog	Normal operation	4 to 20 mA, 3- or 4-wire, sink or source
		Maintenance	Constant 3.4 mA (adjustable)
		Fault	< 1.2 mA
	Signal output digital	HART® w/ 3- or 4-wire, PROFIBUS® PA, FOUNDATION fieldbus™ H1 and Modbus RTU w/ 5-wires	
	Power supply	10 to 30 V DC	
	Power consumption (max.)	DQ w/o relay, non-remote	105 mA at 24 V
		DQ w/ relay, remote	145 mA at 24 V
	Relay specification (option)	2 alarm relays and 1 fault relay, SPDT 5 A @ 230 VAC, 5 A @ 30 VDC	
Environmental conditions (see sensor data sheet)	Temperature	-40 to 80 °C (-40 to 176 °F) without relay -40 to 70 °C (-40 to 158 °F) with relay- -50 to 85 °C (-122 to 185 °F) remote sensor	
	Pressure	23.6 to 38.4 inch Hg / 800 to 1,200 mbar	
	Humidity	5 to 95% r. h., non-condensing	
Housing	Transmitter housing	Epoxy coated copper-free aluminium or stainless steel SS316 L	
	Sensor housing	Stainless steel 303	
	Enclosure protection type	NEMA 4X & 7, IP65/66/67	
	Cable entry point	3/4" NPT threaded holes or M20 cable gland	
	Dimensions (H x W x D)	11.0" x 5.9" x 5.1" / 280 x 150 x 130 mm	
	Weight, approx.	Aluminium	4.9 lbs / 2.2 kg
		SS316 L	8.8 lbs / 4.0 kg
Approvals*	UL & CSA	Class I, Div 1, Groups A, B, C, D;	
		Class II, Div 1, Groups E, F, G;	
		Class I, Zone 1, Group IIC;	
		T-Code T6/T4	
	IECEx	Ex db IIC T6/T4 Gb, -40 ≤ Ta ≤ +40/+70 °C;	
	ATEX	II 2G Ex db IIC T6/T4 Gb, -40 ≤ Ta ≤ +40/+70 °C;	
	CE markings	ATEX (Directive 2014/34/EU)	
		Electromagnetic Compatibility (Directive 2014/30/EU)	
		Low Voltage (Directive 2014/35/EU)	
	Shipping approvals (for DQ sensor only)	DNV GL, ABS, LR, CCS, RMRS	
	MED approval (for DQ sensor only)	Certificate No. MEDB0000411	

Technical Data

	DEKRA Performance approval (for DQ sensor only)	Certificate No. BVS 13 ATEX G 001 X
	SIL 2 certified by TUEV Sued	Certificate No. Z10 053474 0023

* All docking station versions are only ATEX/IECEx approved

Ordering Information

Dräger Polytron® 8200 CAT	Approval Code	Order Number
Dräger Polytron® 8200 CAT DQ d A 4-20/HART®	XTR 0410	83 44 439
Dräger Polytron® 8200 CAT DQ d A 4-20/HART® relay	XTR 0411	83 44 440
Dräger Polytron® 8200 CAT DQ d S 4-20/HART®	XTR 0510	83 44 448
Dräger Polytron® 8200 CAT DQ d S 4-20/HART® relay	XTR 0511	83 44 449
Dräger Polytron® 8xx0 Kit (Custom configuration e. g. LC sensor or bus communication)		83 44 800

Accessories		Order Number
Magnetic wand		45 44 101
Pipe mount bracket		45 44 198
Aluminum junction box for remote sensor ‘d’		45 44 099
Stainless steel junction box for remote sensor ‘d’		45 44 098
Duct mount kit		68 12 725
IR Connection Kit Polytron® 5000/8000		45 44 197
PolySoft licence (1 year)		83 28 600
PolySoft licence (subscription)		83 28 601
Splash guard		68 12 510
Weather protection kit Dräger Polytron® 5/6/8xxx		37 02 198
Gassing adapter	PE, w/o tubing	68 06 978
	PE incl. tubing	46 09 314
Calibration adapter Viton®		68 10 536
Process adapter (Stainless steel) for DQ		68 12 470
Process adapter (Stainless steel) for LC		68 12 465

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FOUNDATION fieldbus™ is a registered trademark of the Fieldbus Foundation™.
PROFIBUS® is a registered trademark of PROFIBUS and PROFINET International (PI).
PACTware™ is a registered trademark of Pepperl+Fuchs GmbH.
Viton® is a registered trademark of the DuPont company.
Windows® is a registered trademark of Microsoft Corporation.

HYDROGEN ULTRASONIC LEAK DETECTORS

POS.	TAG NUMBER	SERVICE
1	950-GDZ-01101	H2 GD FZ-01 FUEL CELL PK AREA
2	950-GDZ-01102	H2 GD FZ-01 FUEL CELL PK AREA
3	950-GDZ-02117	H2 GD FZ-02 H2 STORAGE VESSELS AREA
4	950-GDZ-02118	H2 GD FZ-02 H2 STORAGE VESSELS AREA
5	950-GKDZ-02119	H2 GD FZ-02 H2 STORAGE VESSELS AREA
6	950-GDZ-02120	H2 GD FZ-02 H2 STORAGE VESSELS AREA
7	950-GDZ-03101	H2 GD FZ-03 ELECTROLYZER PK AREA
8	950-GDZ-03102	H2 GD FZ-03 ELECTROLYZER PK AREA
9	950-GDZ-03103	H2 GD FZ-03 ELECTROLYZER PK AREA

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Dräger Polytron® 8900 UGLD
Ultrasonic Gas Leak Detector

The Dräger Polytron® 8900 UGLD transmitter is an early warning area monitor for detecting high-pressure gas leaks in outdoor industrial process environments. Thanks to an ultrasonic acoustic sensor, it responds earlier than conventional gas detectors because it registers the sound of leaking gas instead of measuring the concentration of accumulated gas clouds. As gas escapes, leaks are immediately detected in the surrounding area, regardless of the wind direction.



Dräger. Technology for Life®

Benefits

Ultrasonic sensor technology – the early warning system for gas leaks

Typical gas detection systems used to monitor pressurised gas pipes or containers in industrial environments only detect a gas leak if the gas is in the immediate vicinity of the gas sensor. Environmental influences such as wind can delay or prevent a gas cloud from being detected by gas sensors. On the contrary, the Dräger Polytron 8900 UGLD is not affected by environmental factors and detects a high-pressure gas leak as soon as gas escapes. Effective early gas leak warnings can prevent unnecessary shutdowns, saving time and money.

A perfect complement to your gas detection system

The Dräger Polytron 8900 extends the Polytron 8000 series family with acoustic gas leak detection. All transmitters in this series have the same design and an identical user interface. A common user interface ensures that little training or maintenance is required for existing users. The Polytron 8900 UGLD perfectly complements existing flame and gas detection systems with reliable early gas leak warnings.

Delivers results that are easy to understand

For easy interpretation of results, the measured values on the display of the Polytron 8900 UGLD are shown from 0 to 100 percent of the full scale decibel sensitivity range. The ultrasound level is immediately displayed and transmitted without the use of difficult to interpret artificial intelligence. Alarms are configured at a specific level above a predetermined background noise level. Additionally, a time delay of up to 30 seconds can be set in the control system.

Can even detect gas leaks in loud industrial environments

Loud process areas generate noise which is mostly in the audible spectrum. Gas leaks from pressurized vessels above 10 bar generate both audible sound and inaudible ultrasound. Since Polytron 8900 is tuned to measure in the ultrasound spectrum, it can easily identify gas leaks with a leak rate of 100 g/sec in a 65 ft radius circle.

Robust design and fully-sealed sensor

The Polytron 8900 UGLD is an explosion-proof transmitter with a sensor housed in a galvanically-isolated, intrinsically-safe enclosure. The sensor is an ultrasonic microphone that is completely sealed in PVCC, making it impervious to water and dirt. It provides reliable readings without the need for an additional environmental protection baffle. Regular calibration is not necessary, but unlike some other UGLDs on the market, calibration is possible and easy. The expected lifespan of the ultrasonic sensor is more than 10 years.

Technical Data

Dräger Polytron® 8900 UGLD

Type	Explosion proof / flameproof enclosed transmitter (“d”) or combined with increased safety (“d/e”)		
Gases	Flammable and toxic gases such as hydrogen, methane, ethylene, propane, CO_2, nitrogen and hydrogen sulphide		
Measurement ranges	0-100% equivalent to 55-110 dB; typical alarm setting 10% UGLD signal above background		
Display	Back-lit graphic LCD display; 3 status LEDs (green/yellow/red)		
Sensor Type	PVCC coated piezoelectric microphone with built-in automatic self-test sound generator		
Sensor Performance	Response Time	< 3 sec.	
	Minimum Pressure	> 2 bar (29 psi) Methane	
	Coverage Radius	6.5ft -65 ft depending on gas type, leak rate and background noise	
	Frequency Range	18 kHz - 80 kHz	
Electrical data	Analogue signal output	Normal operation	4 to 20 mA
		Maintenance	Constant 3.4 mA or
			4 mA ±1 mA
			1 Hz modulation; (adjustable)
		Fault	< 1,2 mA
	Digital signal output	HART®	
	Power supply	10 to 30 V DC, 3-wire	
	Power consumption	w/ relay, remote	100 mA at 24 V
	Relay specification	Two alarm relays and one error relay, SPDT 5 A @ 230 VAC, 5 A @ 30 VDC	

Environmental conditions (See sensor data sheet)	Temperature	-40 to 70°C (-40 to 158°F) with relays
	Pressure	700 to 1,300 mbar
	Humidity	0 to 100 % relative humidity
Housing	Transmitter housing	Stainless steel SS316L
	Sensor housing	Polyamide 6
	Housing protection type	NEMA 4X & 7, IP65/66/67
	Cable entry	Three ¾" NPT thread openings or M20 cable gland
	Dimensions (H × W × D)	11.02" x 5.90" x 5.12" inches
	Weight, approx.	11 lbs
Approvals	UL	Class I, Div 1, Groups A, B, C, D; Class I, Zone 1, Group IIC; T-Code T4
	CSA*	Class I, Div 1, Groups A, B, C, D; Class I, Zone 1, Group IIC; T-Code T4
	IECEx	Ex db [ia] IIC T4 Gb, -40 ≤ Ta ≤ +40 / +70 °C Ex db eb [ia] IIC T4 Gb, -40 ≤ Ta ≤ +40/ +70°C; “e” version;
	ATEX	II 2G Ex db [ia] IIC T4 Gb, -40 ≤ Ta ≤ +40 / +70 °C II 2G Ex db eb [ia] IIC T4 Gb, -40 ≤ Ta ≤ +40/+70°C; “e” version
	CE Markings	ATEX (Directive 2014/34/EU) Electromagnetic compatibility (Directive 2014/30/EU) Low voltage (Directive 2014/35/EU)
	Marine approval*	DNV-GL

Technical Data

	SIL 2	Certificate TÜV Süd

* Pending

Ordering Information

Dräger Polytron® 8900 UGLD	Approval code	Part number
Polytron® 8900 UGLD d S 4-20/HART® Relay Stainless Steel Ex d Housing with 4-20mA HART® output and 3 Relays	ETR 0521	83 28 030

Accessories		Part number
Magnetic Wand		45 44 101
Remote Sensing Head with wall mount kit		83 28 021
Connecting cable with plug for the Remote Sensing Head	5 m	83 23 305
	15 m	83 23 315
	30 m	83 23 330
UGLD Calibration and Bump Test Kit w/o Air Cylinder		83 28 042
Zero Air Gas Cylinder 103L for Calibration and Bump Test Kit		45 10 058
Pole Mount Kit		45 44 198
Polysoft Basic (one year license)		83 28 600
Polysoft Basic (Subscription – yearly fee)		83 28 601
IR Connection Kit (requires PolySoft)		45 44 197

HART® is a registered trademark of the HART Communication Foundation.

FLAME DETECTOR

POS.	TAG NUMBER	SERVICE
1	950-FDZ-01101	FZ-01 FUEL CELL PK AREA
2	950-FDZ-01102	FZ-01 FUEL CELL PK AREA
3	950-FDZ-01103	FZ-01 FUEL CELL PK AREA
4	950-FDZ-01104	FZ-01 FUEL CELL PK AREA
5	950-FDZ-02101	FZ-02 H2 STORAGE VESSELS AREA
6	950-FDZ-02102	FZ-02 H2 STORAGE VESSELS AREA
7	950-FDZ-02103	FZ-02 H2 STORAGE VESSELS AREA
8	950-FDZ-02104	FZ-02 H2 STORAGE VESSELS AREA
9	950-FDZ-03101	FZ-03 ELECTROLYZER PK AREA
10	950-FDZ-03102	FZ-03 ELECTROLYZER PK AREA
11	950-FDZ-03103	FZ-03 ELECTROLYZER PK AREA
12	950-FDZ-03104	FZ-03 ELECTROLYZER PK AREA
13	950-FDZ-04101	FZ-04 B-400/B-300/B-200 AREA
14	950-FDZ-04102	FZ-04 B-400/B-300/B-200 AREA
15	950-FDZ-04103	FZ-04 B-400/B-300/B-200 AREA
16	950-FDZ-04104	FZ-04 B-400/B-300/B-200 AREA
17	950-FDZ-05101	FZ-05 BESS AREA
18	950-FDZ-05102	FZ-05 BESS AREA
19	950-FDZ-05103	FZ-05 BESS AREA
20	950-FDZ-05104	FZ-05 BESS AREA
21	950-FDZ-06101	FZ-06 B-100 AREA
22	950-FDZ-06103	FZ-06 B-100 AREA

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FlameSpec
UV-IR
UV-IR Flame Detector



The FlameSpec UV-IR will detect fires and explosions extremely quickly, thereby allowing mitigation steps to be initiated more rapidly to limit event escalation.

Introduction

The FlameSpec-UV-IR flame detector provides ultra-fast response, high performance and reliable detection of a large variety of fires including hydrocarbon fires (visible and non-visible), as well as hydrogen and methane/hydrogen mixed fires. The detector addresses slow growing fires as well as fast eruptions of fire using improved UV-IR technology. The detector operates in all weather and light conditions.

Key Benefits

- High immunity to false alarm
- High sensitivity – up to 100 ft. (30m) for a 1 ft^2 (0.1m^2) n-heptane pan fire.
- Hydrocarbon and non-hydrocarbon flame detection.
- Ultra-fast detection mode detection within 5 milliseconds for fireballs or explosions
- High speed (<0.5s) model [X5] available for compliance with NFPA 33.
- Four sensitivity levels.
- Universal outputs, 3 and 4 wire, 4-20 mA sink / source, Fire, Auxiliary and Fault Relays. RS485 port using Modbus RTU.
- Event logger – alarms, faults and other relevant events are logged to non-volatile memory
- Built-in-Test (BIT) – Automatic and manual self-test of window cleanliness and overall detector operation.
- Dirty optics warning for preventive maintenance needs.
- HART® 7, for configuration & maintenance - option available.
- Window heater to avoid condensation and icing.
- Stainless steel tilt mount with horizontal and vertical adjustment.
- Functional safety - SIL 2 capable - option available.
- Detect high UV (sparks and arcs) or IR levels via auxiliary relay and 4-20mA.

Fire and Gas Detection Technologies Inc. | 4222 E. La Palma Ave. Anaheim, CA 92807 USA
Tel: (+1) 714-671-8500 | support@fg-detection.com
Version: F110V0010.08 • May 2023

FlameSpec UV-IR

UV-IR Flame Detector

Model: FLS-UV-IR

Response Characteristics

Fuel	Size	Sensitivity	Distance ft. (m)	Avrg Resp.Time (s)
N-Heptane	1 x 1 ft.	Extreme	98 (30)	2.0
N-Heptane	1 x 1 ft.	High	75 (23)	1.7
N-Heptane	1 x 1 ft.	Medium	49 (15)	1.0
N-Heptane	1 x 1 ft.	Low	16 (5)	1.0
Gasoline	2 x 2 ft.	Extreme	197 (60)	3.3
Gasoline	1 x 1 ft.	Extreme	98 (30)	1.8
Gasoline	1 x 1 ft.	Medium	49 (15)	1.3
Methane	32-in Plume	Extreme	59 (18)	1.4
Methane	32-in Plume	Medium	30 (9)	0.9
LPG	32-in Plume	Extreme	75 (23)	1.2
LPG	32-in Plume	High	56 (17)	1.6
LPG	32-in Plume	Medium	33 (10)	1.2
LPG	32-in Plume	Low	13 (4)	1.2
Diesel	1 x 1 ft.	Extreme	75 (23)	2.6
Diesel	1 x 1 ft.	Medium	36 (11)	1.2
JP5	1 x 1 ft.	Extreme	75 (23)	3.3
JP5	1 x 1 ft.	High	56 (17)	1.8
JP5	1 x 1 ft.	Medium	36 (11)	1.2
JP5	1 x 1 ft.	Low	16 (5)	1.2
Kerosene	1 x 1 ft.	Extreme	75 (23)	1.8
Kerosene	1 x 1 ft.	Medium	36 (11)	0.9
Methanol	1 x 1 ft.	Extreme	52 (16)	0.8
Methanol	1 x 1 ft.	High	43 (13)	3.2
Methanol	1 x 1 ft.	Medium	30 (9)	1.3
Methanol	1 x 1 ft.	Low	10 (3)	2.7
Ethanol	1 x 1 ft.	Extreme	62 (19)	4.1
Ethanol	1 x 1 ft.	Medium	31 (9.5)	2.9
Isopropanol	1 x 1 ft.	Extreme	75 (23)	2.2
Isopropanol	1 x 1 ft.	Medium	36 (11)	0.8
Polypropylene	1 x 1 ft.	Extreme	49 (15)	1.4
Polypropylene	1 x 1 ft.	Medium	23 (7)	0.9
Hydrogen	32-in Plume	Extreme	66 (20)	6.4
Hydrogen	32-in Plume	Medium	33 (10)	1.0
Syngas (30%CH_4:70%H_2)	32-in Plume	Extreme	59 (18)	3.2
Syngas (30%CH_4:70%H_2)	32-in Plume	Medium	33 (10)	1.2

FlameSpec UV-IR

UV-IR Flame Detector

Model: FLS-UV-IR

Immunity to False Alarm

False Alarm Source	Modulated		Unmodulated	
	Distance ft. (m)	Response	Distance ft. (m)	Response
Sunlight, Direct, Reflected		No Alarm		No Alarm
Incandescent frosted glass light, 300W	2.0 (0.5)	No Alarm	2.0 (0.5)	No Alarm
Fluorescent, 70W (3x23.3W)	2.0 (0.5)	No Alarm	2.0 (0.5)	No Alarm
Electric arc	2.0 (0.5)	No Alarm	2.0 (0.5)	No Alarm
Arc welding	10.0 (3.0)	No Alarm	10.0 (3.0)	No Alarm
Radiation heater, 2000W	2.0 (0.5)	No Alarm	2.0 (0.5)	No Alarm
Halogen lamp (500W) non-shielded	7.0 (2.0)	No Alarm	7.0 (2.0)	No Alarm
Halogen lamp (1000W)	2.0 (0.5)	No Alarm	2.0 (0.5)	No Alarm
Mercury vapor lamp 160Wx3	2.0 (0.5)	No Alarm	2.0 (0.5)	No Alarm
Exhausts	2.0 (0.5)	No Alarm	2.0 (0.5)	No Alarm
Projector led	2.0 (0.5)	No Alarm	2.0 (0.5)	No Alarm
Solenoid bell	2.0 (0.5)	No Alarm	2.0 (0.5)	No Alarm
soldering iron	2.0 (0.5)	No Alarm	2.0 (0.5)	No Alarm
Electric Drill	2.0 (0.5)	No Alarm	2.0 (0.5)	No Alarm

FlameSpec UV-IR

UV-IR Flame Detector

Model: FLS-UV-IR

FIRE DETECTION	**Detection time and distance**	5ms for fast burst of explosion 1s for 1 ft² (0.1m²) n-heptane pan fire at 0–50 ft. (0–15m) < 2s for 1 ft² (0.1m²) n-heptane pan fire at 50–100 ft. (15–30m)
	Sensitivity Range	4 sensitivity ranges: Extreme, High, Medium, Low
	Field of view (IR detection)	90° Horizontal, 80° Vertical
	Time Delay	0-30 seconds
	Built in Test	Automatic and Manual
ELECTRICAL SPECIFICATIONS	**Operating Voltage**	24 VDC nominal (18-32 VDC)
	Current Consumption	Standby: 120mA 180mA all systems in operation (including window heater)
	Electrical Entries	2x cable and conduit entries 3/4" NPT(F) or M25x1.5
	Wiring	14-17 AWG (2.5–1.0 mm²)
OUTPUTS	**Relays**	SPST volt-free contacts rated 2A at 30 VDC 3 relays: Alarm & Auxiliary – normally open; Fault – normally closed
	0-20mA (stepped) current output	3 wire and 4 wire (isolated) configurations (sink and source) HART® rev 7.0 (option available)
	Indication	Tri-color LED (Green, Yellow, Red)
	Modbus	RTU compatible on RS-485
MECHANICAL SPECIFICATIONS	**Size**	5.51 x 3.54 × 3.54" (140×90×90mm)
	Weight	Detector (Stainless Steel 316): 6.6 lbs. (3.0 kg) Tilt mount (Stainless Steel 316): 3.3 lbs. (1.5 kg)
ENVIRONMENTAL SPECIFICATIONS	**Temperature Range**	Operating: -67°F to +185°F (-55°C to +85°C) Storage: -67°F to +185°F (-55°C to +85°C)
	Humidity	Up to 99% (RH), non-condensing
	Ingress Protection	IP66 & 68 (2m, 24hr); NEMA 4X & 6P
APPROVALS	**ATEX**	ATEX: II 2 G D Ex db IIC T5 Gb or Ex db eb IIC T5 Gb and Ex tb IIIC T95°C Db -55°C<Ta<75°C Ex db IIC T4 Gb or Ex db eb IIC T4 Gb and Ex tb IIIC T105°C Db -55°C<Ta<85°C
	IECEx, INMETRO & PESO	Ex db IIC T5 Gb -50°C≤Ta≤75°C Ex db IIC T4 Gb -50°C≤Ta≤85°C
	FMus & FMc	Class I, Div. 1, Groups B, C & D; T4 Class I, Zone 1, AEx/Ex db IIC T4 Gb T4 -50°C≤Ta≤85°C T5 -50°C≤Ta≤75°C
	EAC CU TR	1Ex d IIC T5 Gb or 1Ex de IIC T5 Gb and Ex tb IIIC T95°C Db -55°C≤Ta≤75°C 1Ex d IIC T4 Gb or 1Ex de IIC T4 Gb and Ex tb IIIC T105°C Db -55°C≤Ta≤85°C
	Performance	ANSI FM 3260 EN 54-10
	Functional safety	Certified SIL2 capable per IEC 61508:2010 High & Low demand (option available)
ACCESSORIES	**Tilt mount, model FLS-TMO-S01**	**High vibration mounting bracket, model FLS-MIL-S01**
	Weather cover, model FLS-WCO-S01	**Flame simulator, model FLS-FSIM-UV-IR-KIT**
	2" & 3" pole mount adapter, model FLS-PMA-S23	**Airshield, model FLS-ASD-S01**
	Duct mount with window, model FLS-DMW-S01	**Duct mount for airshield, model FLS-DMX-S01**
WARRANTY	**5 years**	

BLPH SHEAMS SIGNATURE FORM

Action Title: **Action No:** **Ref. Doc.**	**FERA Study Actions** 3 K559-2254-SE-REP-007
Item No.	3
Cause:	N/A
Consequence:	N/A
Safeguards:	N/A
Actions:	Conduct an assessment of oxygen vent design in terms of adequate dispersion and prevention of any interaction with hydrogen vent plume once vendor data is available.
Assigned Respondent (By)	CROSSWIND Technical Safety Engineer
RESPONSE	Oxygen vent dispersion has been performed by Electrolyser vendor. This showed no interaction with the hydrogen vent, mainly due to the rising H2 plume and the O2 plume not rising to the height of the H2 vent.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements

Company Discipline Lead	**Sign**
	Hamant Patel Digitally signed by Hamant Patel Date: 2024.10.08 11:03:40 +01'00'
Company HSE Lead	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.08 10:04:04 +02'00'
Company Project Manager	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.09 09:16:22 +02'00'
Contractor received for information. Not independently verified. Information implemented	**Sign**

BLPH SHEAMS SIGNATURE FORM

Action Title: **Action No:** **Ref. Doc.**	**FERA Study Actions** 4 K559-2254-SE-REP-007
Item No.	4
Cause:	N/A
Consequence:	N/A
Safeguards:	N/A
Actions:	Conduct an assessment of internal Electrolyser explosions and determine any possible required additional mitigation measures.
Assigned Respondent (By)	CROSSWIND Technical Safety Engineer
RESPONSE	An internal explosion of the electrolyser has been conducted and the result has been added in the main FERA report doc. no. 123A90-DDL-SAF-RE-30020 No additional mitigation measures are required based on the FERA.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements

Company Discipline Lead	**Sign**
	Hamant Patel Digitally signed by Hamant Patel Date: 2024.10.08 11:02:42 +01'00'
Company HSE Lead	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.08 10:04:49 +02'00'
Company Project Manager	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.09 09:16:55 +02'00'
Contractor received for information. Not independently verified. Information implemented	**Sign**

BLPH SHEAMS SIGNATURE FORM

Action Title: **Action No:** **Ref. Doc.**	**FERA Study Actions** 5 K559-2254-SE-REP-007
Item No.	5
Cause:	N/A
Consequence:	N/A
Safeguards:	N/A
Actions:	Company to determine whether PFP protection for main structural elements holding up hydrogen storage area is required for asset protection purposes.
Assigned Respondent (By)	ROSETTI Technical Safety Engineer
RESPONSE	According with latest FERA report 123A90-DDL-SAF-LIS-30020, there is no need for PFP for main structural elements holding up hydrogen storage area.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
E.Carminati	
EPC HSE Lead	**Sign**
C.Caracciolo	CC
EPC Project Manager	**Sign**
D. Lo Sterzo	
Client	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.24 13:01:45 +02'00'

2 EXECUTIVE SUMMARY

This document has the purpose of detailing the results of the Fire and Explosion Risk Assessment (FERA) study for the new Base Load Power Hub (BLPH) which will be installed in the framework of HOLLANDSE KUST NOORD WIND PARK Project. The scope of this document is limited to the topsides structure and associated facilities up until connection with the monopile, and include the risk related to CPIs packages. The monopile itself is not within the scope of this document.

Following objectives are included in the scope of the study:

- to identify fire and explosion scenarios from the equipment inside the scope of work;
- to calculate damage distances for fire, explosion and flammable release scenarios to determine potential for escalation;
- to evaluate the fire escalation scenarios in detail and suggest suitable risk reduction measures.

To achieve this objective, a thorough analysis has been made on all hazardous substance and streams within the new equipment part of the project.

Parts count approach has been applied to identify all of the possible sources of loss of containment (lines, flanges, valves, equipment) and consequently to calculate the corresponding leakage frequencies for all the section of the plant with hazardous substances.

The system has been segmented into isolatable sections, for the identification of Loss of containment cases (LOC). Each isolatable section is characterized by one or more LOCs, on the basis of characteristics of the handled fluid.

Three leak size categories have been identified for a wider representation of the risk by different LOCs. The consequence assessment has been performed with the software PHAST from DNV-GL. All the identified scenarios have been located in the plot plan. With application of a dedicated software, it has been possible to combine their contribution to determine the impact of new equipment in the scope of the project in order to evaluate the acceptability of fire and explosion scenarios.

The main findings of the FERA study are reported below.

- Jet Fire.

  there are no areas in the platform in which the thermal radiation threshold contours of 37.5 kW/m^2 from jet fire is equal to or above 1.0E-04 per year. The impact of jet fire scenarios on equipment is lower than target frequency and can be classified as tolerable .

- Explosion

  there are no areas in the platform in which the explosion threshold contours of 0.35, 0.27, 0.15 and 0.07 bar are equal to or above 1.0E-04 per year, thus the risk from VCE is considered tolerable .

Following actions are recommended:

- In order to reduce the escalation risk from section 2 (storage section) it is suggest to reduce the total hold up involved in the hazardous scenarios. At the present, all vessels are considered aligned, and

BLPH SHEAMS SIGNATURE FORM

Action Title: **Action No:** **Ref. Doc.**	**FERA Study Actions** 6 K559-2254-SE-REP-007
Item No.	6
Cause:	N/A
Consequence:	N/A
Safeguards:	N/A
Actions:	Further protective measures against BESS thermal runaway events should be considered such as hydrogen storage blowdown on confirmed fire, data analytics tools, explosion hatches and early electrolytic vapour or off-gas detection technologies. Supplier to determine whether PFP protection around BESS area are required for asset protection purposes.
Assigned Respondent (By)	CROSSWIND Technical Safety Engineer
RESPONSE	The thermal runaway threat, including all safeguards for the BESS has been analysed and described in technical note "Title Thermal Runaway scenario recommendation for BLPH BESS System" No additional barriers are required.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements

Company Discipline Lead	**Sign**
	Alessandro Sutto
Company HSE Lead	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.07 16:05:51 +02'00'
Company Project Manager	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.07 17:17:01 +02'00'
Contractor received for information. Not independently verified. Information implemented.	**Sign**

BLPH SHEAMS SIGNATURE FORM

Action Title: **Action No:** **Ref. Doc.**	**FERA Study Actions** 7 K559-2254-SE-REP-007
Item No.	7
Cause:	N/A
Consequence:	N/A
Safeguards:	N/A
Actions:	Design of hydrogen vent and/or design of surrounding platform areas is to be revisited in light of hazard criteria exceedance for lit hydrogen vent scenario.
Assigned Respondent (By)	ROSETTI Technical Safety Engineer
RESPONSE	Sorrounding platform areas has been revised and risk assessed during ALARP workshop. Please see Vent Gas Dispersion and Potential Radiation Study 123A90-DDL-SAF-RE-30021 and 123A90-DDL-SAF-RE-30012
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
E.Carminati	
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.12.17 18:21:50 +01'00'

7 RECOMMENDATION

Considering that some areas in the platform should be involved, for some meteo -climatic condition, in thermal radiation higher than 6.31 kW/m^2, is recommended to:

- Ensure that the access to the second level of the platform above storage vessel on upper deck (elevation +38.6 meters) will be limited to the maintenance activity (e.g BDV/PSV valves) after total depressurization of storage vessels, in order to avoid excessive thermal radiation on operator in case of accidental ignition of gas released during an emergency depressurization.

  The platform above storage vessels with limited access is highlighted in the below figure (yellow).

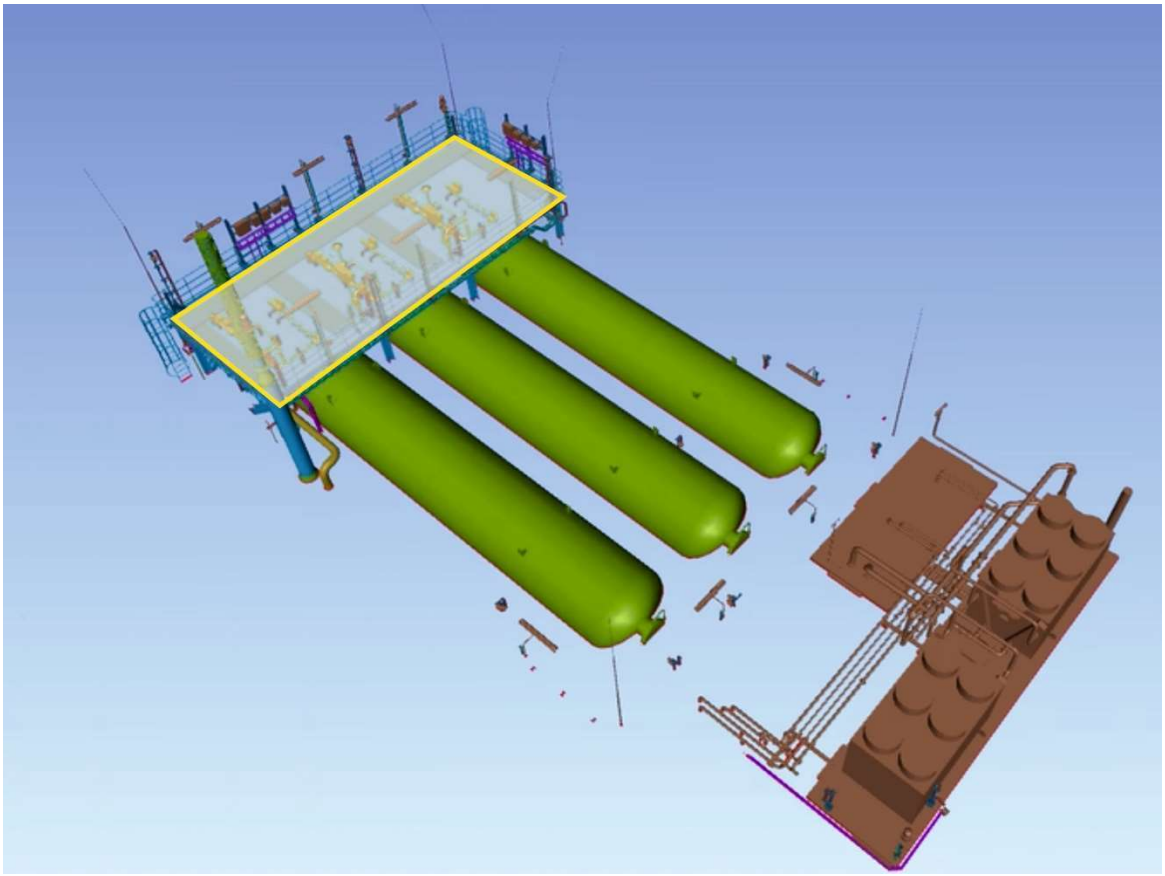


Figure 31 – Platform above storage vessels with limited access

- Ensure that the access to the roof of electrolyser package on upper deck (elevation +36.8 meters) will be limited to the maintenance activity after total depressurization of storage vessels, in order to avoid excessive thermal radiation on operator in case of accidental ignition of gas released during an emergency depressurization.

  The roof area of electrolyser package with limited access is highlighted in the below figure (green).

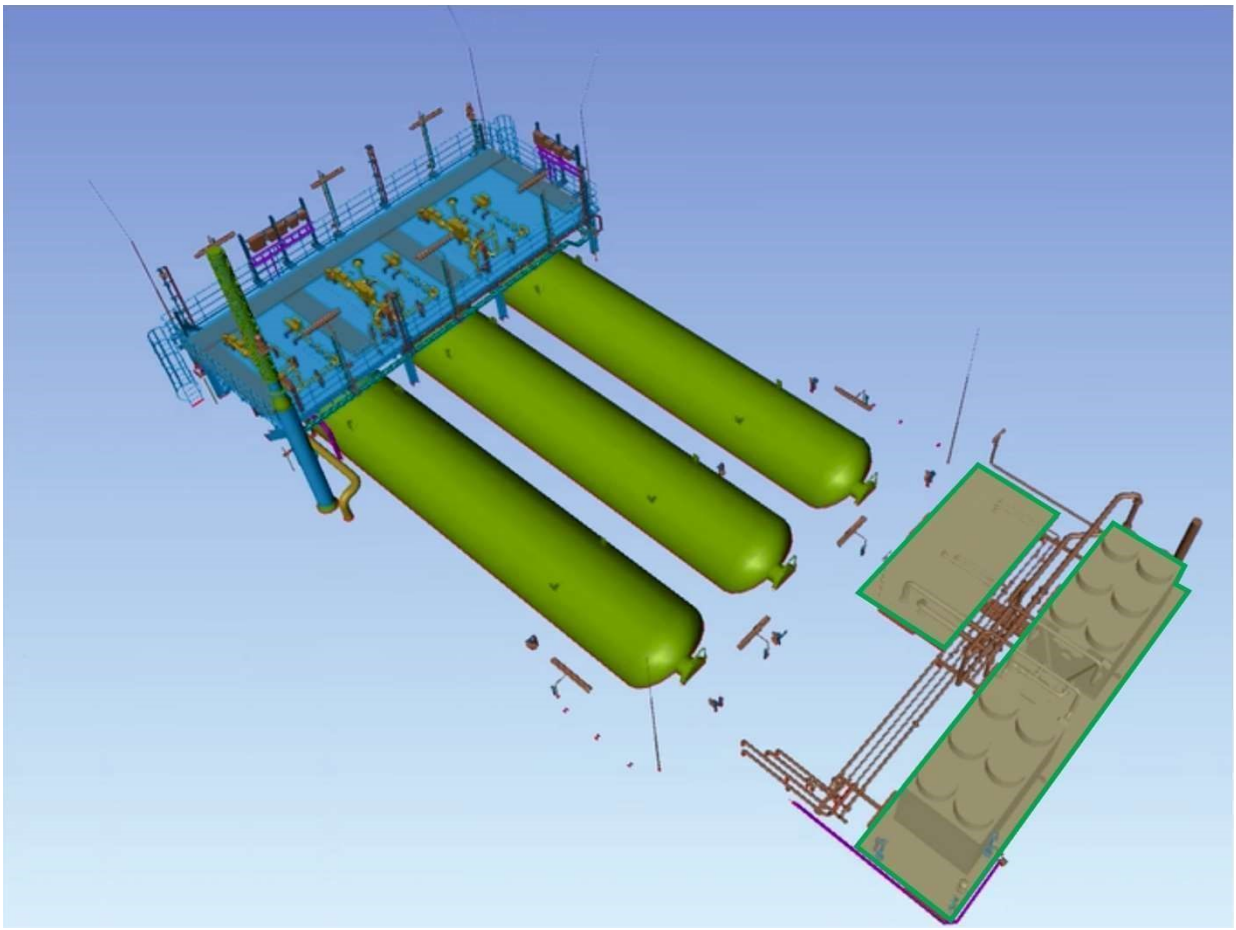


Figure 32 – Roof area of electrolyser package with limited access

9 Vent height – operator injuries

IDENTIFY	Problem Definition	
	Vent height – operator injuries	
	HSSE Issues and Potential Risk	
	During maintenance activities, the worst scenario for operators is an emergency which requires the depressurization of storage vessels, with the simultaneous discharge of all 7 blowdown valves, resulting alternatively in the following scenarios: • Ignition of H_2 after the release, leading to the formation of a flame in the top of the stack. • H_2 flammable gas dispersion from the stack.	
	HSSE Standard and Tolerability Criteria	
	The radiation of 6.31 kW/m^2 (including solar radiation) shall not be reached in location where people presence can be possible. According to API 521, 6.31 kW/m^2 is "the maximum radiant heat intensity in areas where emergency action lasting up to 30 s can be required by personnel without shielding but with appropriate clothing".	
ASSESS	Options Considered	
	a) As per design b) Increase vent height c) Staggered depressurization of the storage vessels d) Reduce hydrogen storage vessels pressure	
	Basis for Selection & Uncertainties	
	Option Discussion: the team agrees that the risk associated with the current design solution is ALARP	
	Justification for Chosen Option	
	Change in the project philosophy, after the vent was already ordered, regarding the possibility to board personnel without depressurizing the hydrogen circuit. Definition of a restricted area on top of the hydrogen vessels that can be accessed only after total depressurization of storage vessels.	
	Justification for Rejected Options (e.g. Options not incorporated as considered beyond ALARP)	
	Option B is considered grossly disproportionate due to the complexity and cost for building the support structure of the new higher vent, since the initial vent has already been ordered. Option C is not feasible due to the time constraint of the emergency depressurization, according to API 521. Option D is considered grossly disproportionate as the required pressure to remove the restricted area is 4.5 barg, which, being below the operating pressure of the fuel cell, entails the venting of hydrogen.	
CONTROL & EVALUATION	Residual HSSE Risk	
	Possibility of operator exposure to a maximum heat radiation of 8.5 kW/m^2 in case of ignition of hydrogen vented during emergency scenario.	
	Recommendations for Next Project Phase (operational phase)	By
	Apply controls to restrict access to the impacted area.	Operators
	Requirements for the Operations HSSE-Plan (operational phase)	By
	Ensure that the access to the second level of the platform above storage vessel on upper deck (elevation +38.6 meters) will be limited to the	Operators

	maintenance activity (e.g., BDV/PSV valves) after total depressurization of storage vessels, in order to avoid excessive thermal radiation on operator in case of accidental ignition of gas released during an emergency depressurization.	

4.2 FEED/EPC HAZID RECOMMENDATIONS

SHEAM No.Feed HSSE Register_REV 01	SHEAMS Ref.	SHEAMS Title	Action	Due by	Response	Status
1	-	FEED HAZID Study Actions	Action closed in Feed HSSE rev01	CROSSWIND	Bow-tie provided showing thermal runaway	CLOSED IN HSSE REV.01
2	1	FEED HAZID Study Actions	Update layout to show vent from BESS.	ROSETTI	According with the mail attached, no vent from BESS will be provided. The Potential emergency exhaust of H2 shall be released on the lower deck with the following mitigation to manage the risk of accumulation. 1.Exhaust openings have been provided above BESS containers (see extract from 3D model attached) 2.Areas idenfied for accumulation shall be fited with a H2 detector (1 per accumulation area. See 123A90-DDL-SAF-DL-30027 attached). These shall be voted in alignment with the platform FGS philosophy i.e. 2ooN	CLOSED
3	2	FEED HAZID Study Actions	Consider requirement for ATEX certification for BESS.	CROSSWIND	There is no hazardous zoning for BESS containers. Ref doc K559-2254-CWIWP4202201-E99-099	CLOSED
4	3	FEED HAZID Study Actions	Review PEM electrolyser data to determine frequency of membrane failure & potential for internal explosion with Identification of mitigation measures.	CROSSWIND	Failure data have been reviewed and added into the FERA. Refer to 123A90-DDL-SAF-LIS-30020	CLOSED
5	4	FEED HAZID Study Actions	Clarify measures in place to prevent damage to HV cable during maintenance activities & transfer of equipment between asset & boats. Dropped object study to be undertaken.	ROSETTI	According with dropped object and swinging loads study (doc. no. 123A90-DDL-SAF-RE-30018) the calculated risk linked with the demage of underwater power cable between the platform and the seaside falls in tolerable risk region (see attached). However, for offshore wind projects in the Dutch part of the North Sea a burial depth requirement of 2.0 m. applies. A depth of 2.0 m is considered sufficient for large dropped objects (say, vessel anchors) not to reach the cable.	CLOSED
6	-	FEED HAZID Study Actions	Crosswind to provide earlier windfarm dropped object study.	CROSSWIND	Crosswind has not carried out a comphrensive dropped object study for the HV cables to the seabed. In genera, for offshore wind project in the Dutch part of the north sea a buriad depth requirement of 2.o applies (in the UK it is less, 0.5-1.0 m or so). A dept of 2.0 m is considered suficient for large dropped object (say, vessel anchors) not to reach the cable. However, for the cables right next to the MP, additional cable protection system (CPS) are typically applied. This is because the inter-array cabling (IAC) into the wind turbine foundation typically enters the monopile at mudline as not to require excavation of the monopile for IAC cable pull-in. Atypical example of such a COS is provided in the picture to the right: it fully sorrounds the cable and provides a mechanical barrier for dropped objects in the vicinity of foundations. The CPS reduces the risk of dropped object impacts to electrical cables to ALARP.	CLOSED
136	5	FEED HAZID Study Actions	Review PEM electrolyser data to determine intermittent operation & impact to electrolyser design.	CROSSWIND	The electrolyser is capable of intermittent operation. Refer to the notes on Operational Limitation of Electrolyser and Rev 2.0 of the Chronogram and Control and Operational Philosophy for detailed information. The stacks are designed to withstand 5,000 pressure cycles, which corresponds to approximately 10 years of operation. The electrolyser can operate within a power range of 250 kW to 2500 kW, equivalent to 10-100% of its load capacity. The ramping rate of the electrolyser is 15 kW/second, allowing for flexible and responsive operation	CLOSED
7	6	FEED HAZID Study Actions	Confirm compliance with permitted discharges from facility & water decree from RWS.	ROSETTI	Sampling point sent.Waiting Dom feedback on this topic	CLOSED
8	-	FEED HAZID Study Actions	CW to provide permitted discharge & water decree	action closed in Feed HSSE rev01	Max discharge od 2000 kg/h of brine..	CLOSED IN HSSE REV.01
9	7	FEED HAZID Study Actions	Vendor to confirm PEM electrolyser stack design is developed to take into account expected movement associated with monopile design.	CROSSWIND	Elogen confirmed that the electrolyser package design can withstand the acceleration as per CWD requirements, ref to CWHKN-INN-BPH-TQ-00031	CLOSED
10	8	FEED HAZID Study Actions	Develop philosophy for operation of electrolysers during periods of maintenance.	CROSSWIND	The operating philosophy of the BLPH is that the electrolyser is completely shutdown when any person will come to the platform.	CLOSED
11	9	FEED HAZID Study Actions	Crosswind to provide results from boat collision studies from Shell Marine. Crosswind to provide lighting plan for facility.	CROSSWIND	1) Boat Collision ("Ship Impact") with BLPH foundation was part of the project Deliverable from the wind farm foundation package. Van Oord Offshore Wind has provided the following report which has been accepted by the Crosswind wind farm team and which available on CW ACONEX VOWP-DEN-FND-RPT-00037, document reference 144671-VOOW-TF-ENG-REP-1056 Ship impact for BLPH. 2) Crosswind has already produced and issued to the Dutch Authorities the following document "CWHKN-PMG-PJA-PLN-00005, Identification marks and lighting plan" BLPH has been included into the document : "A temporary nautical light is foreseen on the BLPH foundation such that is marked like other installed foundations. The temporary light will be removed once the permanent nautical lighting contour has been commissioned. "	CLOSED
12	10	FEED HAZID Study Actions	Crosswind to share procedures for personnel transfer.	CROSSWIND	See attached document	CLOSED
13	11	FEED HAZID Study Actions	Earthing design to be developed, taking in account fuel cell & electrolyser designs.	ROSETTI	CPI will be connected to earth at two (2) battery limit points provided by each CPI.	CLOSED
137	12	FEED HAZID Study Actions	Clarify need for containment of glycol system in event of leakage from fuel cell (or consider biodegradable alternative).	CROSSWIND	If accidental leak occurs we will not have many cubic of it which could end up to the sea, the product will have a relatively low impact for the environment and will get degraded quickly into the sea as per data sheet.No additional containment required. Below, an extract from the Datasheet “Environmental exposure controls" of the Manufacturer	CLOSED
14	13	FEED HAZID Study Actions	Clarify regulatory requirements for disposal of dead birds/ biodiversity of existing area. Environmental impact assessment to cover impact to birds.	CROSSWIND	If dead birds are found the the BLPH , they will be disposed as per Dutch Industry stadnard Nogepa N.64	CLOSED
15	14	FEED HAZID Study Actions	Develop philosophy for preventing birds from forming habitats on asset.	ROSETTI	Within BLPH scope the only critical asset where birds can try to create issues is the Hydrogen Vent outlet which has been equipped with bird screen. See detail of bird screen in the drawing 1724000887-MAC-DA-00003 below attached. Therefore, Rosetti will not develop a dedicated philosophy for preventing birds from forming habitats on asset	CLOSED
16	15	FEED HAZID Study Actions	Determine material selection philosophy used by vendors.	CROSSWIND	Refer to Material Selection Report K559-2254-MT-REP-001, from FEED phase, and 123A90-DDL-MAT-RE-60011 rev 01. Also, refer to document Basic Design Engineering Packages, K559-2254-PM-PLN-003.	CLOSED
17	16	FEED HAZID Study Actions	Clarify measures taken to prevent unauthorised access. Procedures to be developed to ascertain facility condition on arrival.	ROSETTI	Warning signs will be placed on the side of the access gate of the platform to prevent unauthorised access. The safety sign will be placed at the entrance of the staircase from the MAP access with followind text both in Dutch and English	CLOSED
18	17	FEED HAZID Study Actions	Consider use of seal less pumps to minimise lube/seal oil leakages & maintenance activities.	ROSETTI	P-50001 A/B - This pump handle sea water which is a not a hazardous liquid,single seal will be used. Shaft line bearings are lubricated by pumped fluid (sea water). Lubrication of thust bearing is made by a constant level oiler, not under pressure. P-50009 A/B - This pump handle fresh water, which is not a hazardous fluid,single seal will be used. Radial sleeve bearing will be lubricated by pumped fluid, thrust bearing lubrication, due to very small dimension of the pump will be done by greased bearings, usually sealed berings grease for life.	CLOSED
19	18	FEED HAZID Study Actions	Within electrolyser package clarify mitigations in place to prevent leakage of seal oil into oxygen rich streams.	CROSSWIND	There is no lube/seal oil on the BLPH electrolyser package. hence this recommendations is superceded.	CLOSED
138	19	FEED HAZID Study Actions	Ensure hydrogen produced from chlorination plant is routed to safe location (away from oxygen vent).	CROSSWIND	During WTP HAZOP has been decided to use biocide instead of chloride; action no longer applicable	CLOSED
20	20	FEED HAZID Study Actions	Fuel cell vendor to confirm quality of by-product water to determine potential for re-use / disposal.	CROSSWIND	The process water drain goes to the Brine Discharge Caisson.The water is not reused. The water is categorised as DI water “similar to tap water”	CLOSED
21	21	FEED HAZID Study Actions	Develop strategy for chemical handling (storage basis) & potential use of safety showers on platform.	ROSETTI	Due to typology and number of site visit, it has been agreed that personnel will bring the portable eye wash prior each visit to the platform. No fixed safety shower neither eye was are deemed necessary.	CLOSED
22	22	FEED HAZID Study Actions	Study work to be conducted to determine potential for legionella on platform & mitigation measures to be adopted.	ROSETTI	Study work shall not be conducted as the hazard will not be present in case there are no fixed eye wash nor safety shower	CLOSED
23	23	FEED HAZID Study Actions	Crosswind Health risk assessment to be conducted.	CROSSWIND	Crosswind Innovations project register include the health element. CTV will be the main welfare facilities whilst personnel being offshore, similar to the current situation for the wind farm BoP contractors. Subcontractors could define additional measures as part of their own task risk assessments	CLOSED

Item No	Study	Action	Date Raised	Due by	Response	Status
1	EPC HAZID	FERA to be updated in detail design to include scenarios and protections from the electrolyzer and fuel cell package	05-ott-23	ROSETTI	FERA has been updated including scenarios and protections from the electrolyzer and fuel cell package. See doc. 123A90-DDL-SAF-RE-30020_rev03	CLOSED
2	EPC HAZID	Verify with the BESS supplier the type of fire suppression system and update HER if required	05-ott-23	CROSSWIND	The only active (chemical) suppression in the BESS system are the Stat-x cartridges. They are located inside the battery cabinets inside the 2 BESS containers. In the HAZID this scenario is considered a 4C with potential to harm personnel in the container during activation of the fire suppression system leading to asphyxiation. Due to local release of the fire suppression in the BESS cabinets, it will not remove oxygen from the container causing asphyxiation. According to MSDS the release of Stat-x may cause temporary, mild irritation of mucous membranes if inhaled (H335). Additionally, it may cause skin and eye irritation (H315/319). It is not highly toxic and therefore, Ranking can be reduced to a 3C in HAZID	CLOSED
3	EPC HAZID	Check the risk ranking based on Company Health SME and update the HER if required	05-ott-23	CROSSWIND	Internal HSE Risk register has been checked , CW comfirm the exposure risk to UPS battery counpond is to beconsidered not applicable	CLOSED
4	EPC HAZID	Evaluate the possibility to use portable eye wash and shower	05-ott-23	ROSETTI	Due to typology and number of site visit (scheduled inly twice a year), it has been decided that personnel will bring the portable eye wash prior each visit to the platform.	CLOSED
5	EPC HAZID	Develop a bow-tie for hydrogen hazard	05-ott-23	CROSSWIND / ROSETTI	Bow-tie has been developed for hydrogen hazard. See 123A90-DDL-SAF-RE-30011 – ALARP Term of Reference attached	CLOSED
6	EPC HAZID	Ensure a no-fly zone is established around the facilities if required	05-ott-23	CROSSWIND	Reference attached	CLOSED
7	EPC HAZID	Verify that electrolyzer container is not considered a confined space	05-ott-23	CROSSWIND	Crosswind has received written confirmation from Elogen that the electrolyser process container will be classified as confined space area	CLOSED
8	EPC HAZID	Establish requirements for nitrogen bottle on the platform. Update HER if required	05-ott-23	ROSETTI	No nitrogen bottle is present on the platform, thus the cause is eliminated	CLOSED
9	EPC HAZID	Vendor to confirm that UV radiation is safe	05-ott-23	ROSETTI	PSC confirm that the UV lamp is installed inside a close stainless-steel cylindrical chamber. For this reason, sincethe lamp is isolated from the ambient (not visible and reachable), there is no risk associated to the field operator Please see GENERAL ARRANGEMENT - UV PACKAGE AND DATA SHEET / Document Number: 1724000448-MAC-DA-00011	CLOSED
10	EPC HAZID	Verify with Vendor the amount of hydrogen produced by electroclorination package. Update the risk ranking and HER based on the outcome of this verification	05-ott-23	ROSETTI	The current configuration of the package features a biocide injection, instead of electroclorination package.Biocide injection does not produce hydrogen. Hence the risk ranking and HER necessity no update. This solution has been shared with Crosswind as describe in vendor offers and TBE reviewed by Crosswind	CLOSED

Item No	Study	Action	Date Raised	Due by	Response	Status
11	EPC HAZID	Clarify type of chemical used as scale inhibitor and update HER afterwards, if required	05-ott-23	ROSETTI	The chemicals used in the WTP A-50000 are the following: Biocide: EB-Biocide Plus (Everblue SRL). The product is classified as hazardous pursuant to the provisions set forth in (EC) Regulation 1272/2008 (CLP). For safety operation please refer to applicable Safety datasheet in order to manage safety and correctly the chemical. The tank material is compatible with the chemical used to avoid leakage problem due to tank corrosion. This substance has to be considered as 4B risk ranking categorization on people (see below extract from MSDS) - Antiscalant: EVERBLUE 600 (Everblue SRL).. The product does not contain substances classified as being hazardous to human health or the environment pursuant to the provisions Regulation (EC) 1272/2008 (CLP) (and subsequent amendments and supplements) in such quantities as to require the statement.No need to update the HER (see below extract from MSDS)For safety operation please refer to applicable Safety datasheet. The tank material is compatible with the chemical used to avoid leakage problem due to tank corrosion.Caustic Soda (2% solution): the product is classified as hazardous. For the water treatment package, Caustic soda 20% shall be diluted with demineralisedwater on shore to obtain a Caustic soda solution 2%, then will be transported off-shore. 1B risk ranking categorization on people is considered, according withMSDS, for this substance (see below extract from MSDS)On shore the operator shall follow the safety product datasheet during the dilution operation	CLOSED
12	EPC HAZID	Clarify type of chemical used for cleaning RO membrane and update the HER	05-ott-23	ROSETTI	CIP vessel has been replaced with the complete supply of the membranes needed by the process for the 2 years operation. Membranes will be replaced every 6 months. No chemical will be used for the cleaning of RO membrane. No need to update the HER.	CLOSED
13	EPC HAZID	Verify with Sea Water Tratment System Vendor if it is possible to have fish trapped and decomposing in the package	05-ott-23	ROSETTI	The feed water is delivered by P-50001 A/B out of WTP vendor scope.The pump has been purchased by RM. Pump feature a suction screen 7 mm mesh size, to avoid entry of foreign objects that could clog the pump.Pump internals, and caisson are injected with biocide to avoid presence of microorganisms, muscles spores,algae's, and very small fishes. According with Vendor, tighter mesh is not possible, because affect suction of the pump.	CLOSED
14	EPC HAZID	Consider to provide physical barrier on the stair	05-ott-23	ROSETTI	An anti-intrusion security gate will be provided at the beginning of the platform access staircase. It will be represented in a Plot Plan Below Lower Deck drawing doc. N. 123A90-DDL-PP-DL-70071.	CLOSED

APPENDIX A CLOSED HSE ACTION SHEETS

BLPH
SHEAMS SIGNATURE FORM

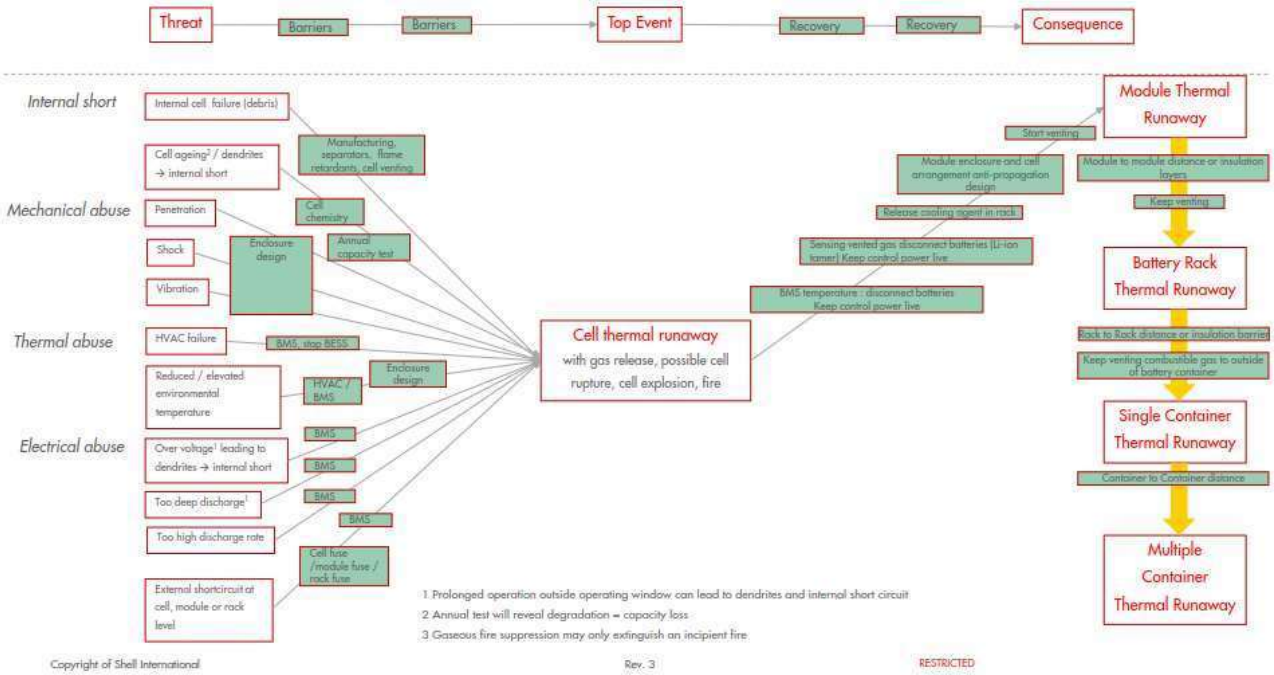
Action No:	**0001**	**Rev:**	1
Action Title:	**HAZID Study Actions**	**Date:**	25/03/2023
Ref. Doc:	K559-2254-SE-REP-001		
Title:	BLPH HAZID Study		
Node:	1: Electrical System		
Reference Drawings:	N/A		
Parameter	H-03.05b	**Deviation**	Hydrogen
Cause:	Thermal runaway within BESS.		
Consequence:	Potential explosive atmosphere. Asset damage. Potential fatalities.		
Safeguards:	Fire & gas detection philosophy will be developed during FEED phase.		
Action:	1 Shell to consider providing thermal runaway bow-tie information to KBR.		
RESPONSE:	**Responsible Discipline: Shell** Bow-Tie provided showing cell thermal runaway		
Attachments:	None		

Name:	Signature:	Raise PCN:	Yes/No	PCN No:

RESPONSE ACCEPTANCE:

Discipline Lead:	Nick Menegazzo	Signature:	Date: 2023-05-09 | 13:25 BST
HSE Lead:	Samer Bachir	Signature:	Date: 2023-05-15 | 03:34 CDT
Proj. Manager:	John Schofield	Signature:	Date: 2023-05-15 | 09:57 BST
Client:	Paul Sampossum	Signature:	Date: 2023-05-15 | 13:02 BST

FUTURE ACTION/CROSS REFERENCE:


Threat
Barriers
Barriers
Top Event
Recovery
Recovery
Consequence
Internal short
Internal cell failure (debris)
Cell ageing[2] / dendrites → internal short
Manufacturing, separators, flame retardants, cell venting
Mechanical abuse
Penetration
Cell chemistry
Shock
Enclosure design
Annual capacity test
Vibration
Thermal abuse
HVAC failure
BMS, stop BESS
Reduced / elevated environmental temperature
HVAC / BMS
Enclosure design
Electrical abuse
Over voltage[1] leading to dendrites → internal short
BMS
Too deep discharge[1]
BMS
Too high discharge rate
BMS
Cell fuse / module fuse / rack fuse
External shortcircuit at cell, module or rack level
Cell thermal runaway
with gas release, possible cell rupture, cell explosion, fire
BMS temperature : disconnect batteries Keep control power live
Sensing vented gas disconnect batteries (Li-ion tamer) Keep control power live
Release cooling agent in rack
Module enclosure and cell arrangement anti-propagation design
Start venting
Module Thermal Runaway
Module to module distance or insulation layers
Keep venting
Battery Rack Thermal Runaway
Rack to Rack distance or insulation barrier
Keep venting combustible gas to outside of battery container
Single Container Thermal Runaway
Container to Container distance
Multiple Container Thermal Runaway
1 Prolonged operation outside operating window can lead to dendrites and internal short circuit
2 Annual test will reveal degradation = capacity loss
3 Gaseous fire suppression may only extinguish an incipient fire
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Rev. 3
RESTRICTED

BLPH
SHEAMS SIGNATURE FORM

Action No:	**0008**	**Rev:**	1
Action Title:	**HAZID Study Actions**	**Date:**	
Ref. Doc:	K559-2254-SE-REP-001		
Title:	BLPH HAZID Study		
Node:	1: Electrical System		
Reference Drawings:	N/A		
Parameter	H-21.05	**Deviation**	Brines
Cause:	Discharge brine from process.		
Consequence:	Impact marine life.		
Safeguards:			
Action:	5 Crosswind to provide permitted discharge & water decree		
RESPONSE:	**Responsible Discipline: Shell** In the permits we have formally applied for a maximum discharge of 2000 kg/hour (around 2 m3/hour) of brine, which is a little higher than the around 1575 kg/hour that the earlier DGSI calculations for the electrolyser showed to be needed. This amount of brine is not expected to impact the marine life at all and no additional tests or calculations will be required by the permit authority.		
Attachments:	None		

Name: Signature: Raise PCN: Yes/No PCN No:

RESPONSE ACCEPTANCE:

Discipline Lead:	Janet Leung	Signature:	Date: 2023-05-09 | 14:11 CEST
HSE Lead:	Samer Bachir	Signature:	Date: 2023-05-09 | 07:14 CDT
Proj. Manager:	John Schofield	Signature:	Date: 2023-05-09 | 13:26 BST
Client:	Paul Van Rossum	Signature:	Date: 2023-05-15 | 13:02 BST

FUTURE ACTION/CROSS REFERENCE:

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZID Study Actions** K559-2254-SE-REP-001
Item No.	1
Cause:	Hydrogen released from BESS.
Consequence:	Potential explosive atmosphere. Asset damage.
Safeguards:	
Actions:	Update layout to show vent from BESS.
Assigned Respondent (By)	ROSETTI Piping & Layouts Engineer
RESPONSE	According with the mail attached, no vent from BESS will be provided. The Potential emergency exhaust of H2 shall be released on the lower deck with the following mitigation to manage the risk of accumulation. 1.Exhaust openings have been provided above BESS containers (see extract from 3D model attached) 2.Areas identified for accumulation shall be fitted with a H2 detector (1 per accumulation area. See 123A90-DDL-SAF-DL-30027 attached). These shall be voted in alignment with the platform FGS philosophy i.e. 2ooN
Attachments:	
Issue Date	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
Carla Bortolin	Carla Bortolin
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo.Sterzo	
Client	**Sign**

Da: Stephen Bremner <stephen.bremner@crosswindhkn.nl>
Inviato: giovedì 18 aprile 2024 12:10
A: Giunchi Claudia (Rosetti) <Claudia.Giunchi@rosetti.it>; Lo Sterzo Davide (Rosetti) <Davide.LoSterzo@rosetti.it>
Cc: Dominik Sznajder <dominik.sznajder@crosswindhkn.nl>; Sutto, Alessandro GSNL-PTX/P/S <Alessandro.Sutto@shell.com>; Brunelli Massimiliano (Rosetti) <Massimiliano.Brunelli@rosetti.it>; Philip Robinson <Philip.Robinson@kbr.com>
Oggetto: RE: BLPH BESS ventilation - sensors on platform and communication

Hi Claudia/Davide,

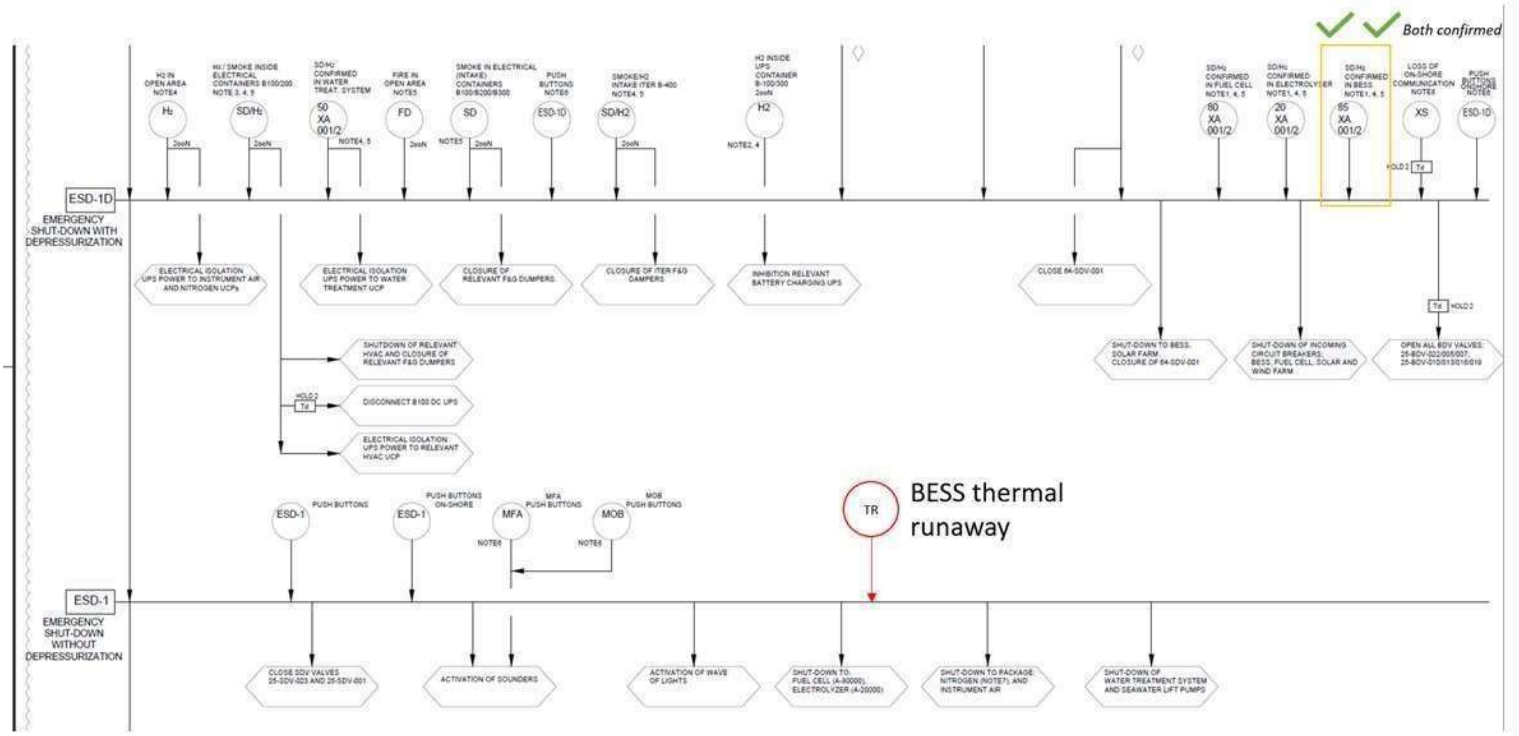
Thanks for the collaborative discussion last week on the way forward regarding the BESS vent.

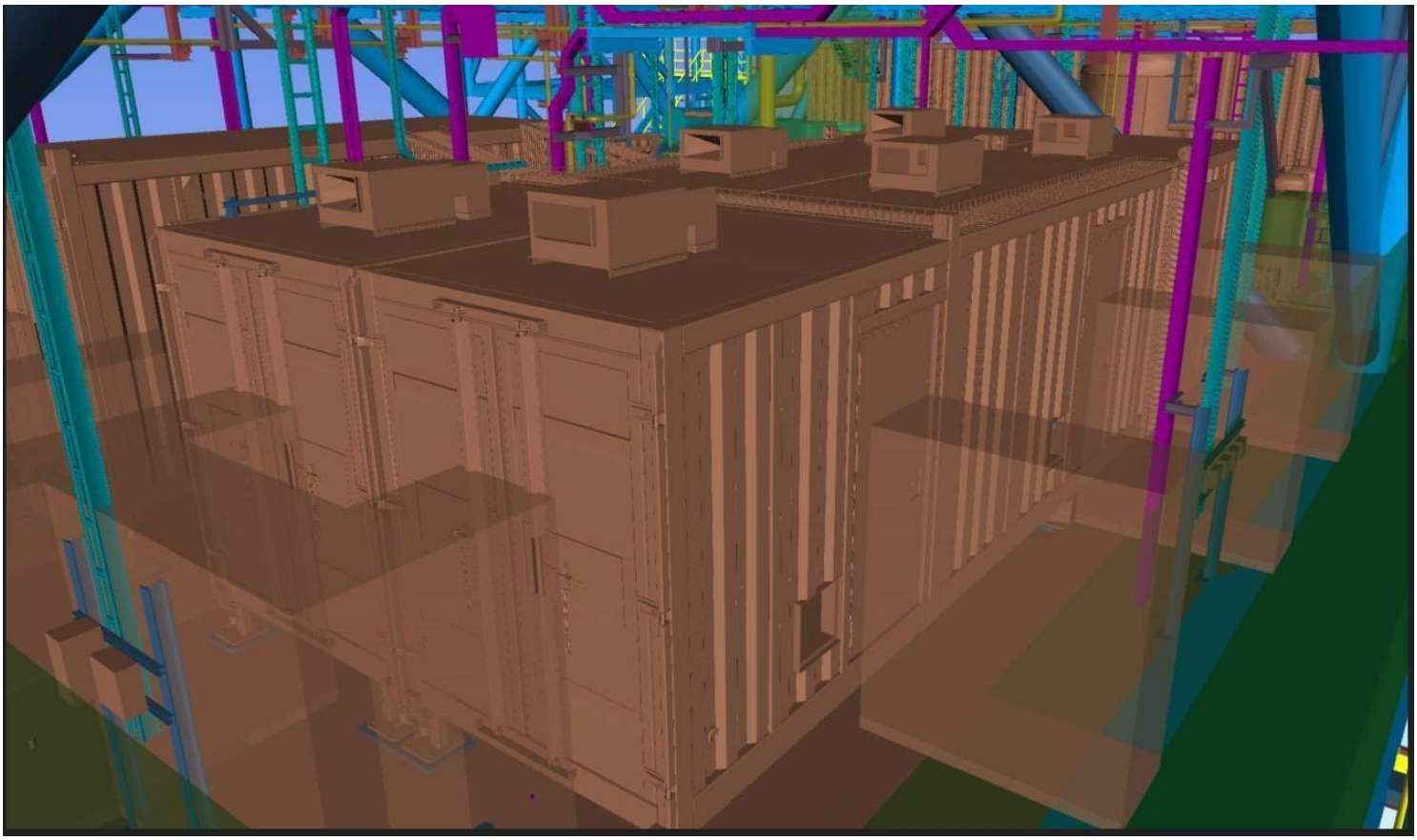
Summary and agreed way forward:

The emergency exhaust shall be released on the lower deck with the following mitigation to manage the risk of accumulation.

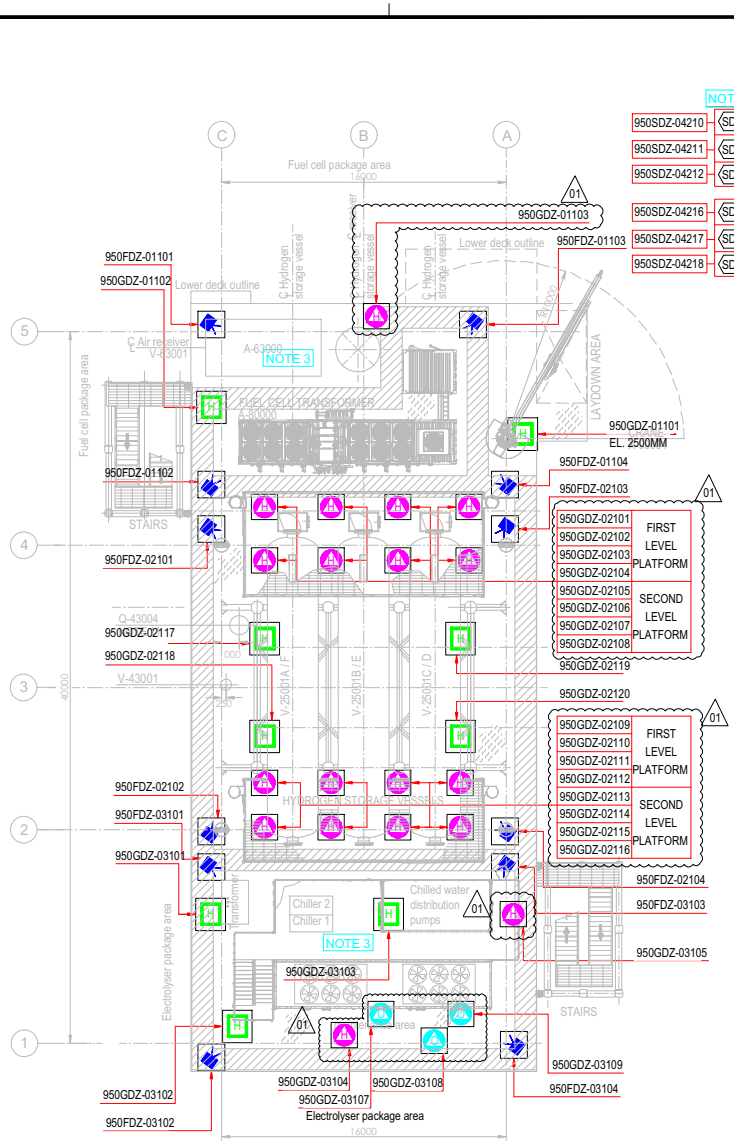
1. Areas for potential accumulation above BESS containers to be reviewed and identified
2. Areas identified for accumulation shall be fitted with a H2 detector (1 per accumulation area). These shall be voted in alignment with the platform FGS philosophy i.e. 2ooN and shall take the execute action as currently outlined in the process safety block diagram.

In addition, there will be a FGS hardwire signal from the BESS, "confirmed thermal runaway in BESS" as outline below. Critically, AUX power to the BESS shall remain active in this case.





DRAWING NO. 123A90-DDL-PP-DL-30027 REV. 00



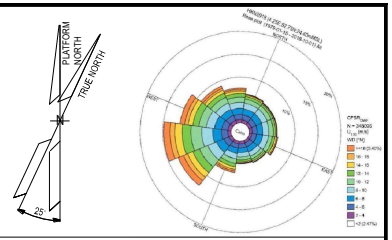
PLAN ON UPPER DECK
EL+30.310 T.O.S.

PLAN ON LOWER DECK
EL+23.310 T.O.S.

EQUIPMENT LIST

TAG NUMBER	DESCRIPTION	TAG NUMBER	DESCRIPTION
A-20000	ELECTROLYSER	TR-200DE1	TRANSFORMER AUX. 6.6kV/0.4kV
A-63000	INSTRUMENT AIR PACKAGE	TR-200ED1	SOLAR TRANSFORMER PV FARM EQUIPMENT
A-80000	FUEL CELL	RR-100AD1-NER	NEUTRAL EARTHING RESISTOR
A-85000	BESS	V-63001	AIR RECEIVER
A-50000	WATER TREATMENT PACKAGE	V-64001	NITROGEN RECEIVER
P-50001A/B	SEAWATER LIFT PUMPS	X-99001	CRANE
Q-43004	HYDROGEN VENT		
A-64000	NITROGEN SYSTEM		
V-25001A-F	HYDROGEN STORAGE VESSELS		
V-43001	HYDROGEN VENT KO DRUM		
YLB-079001/2	LIFE RAFTS		
B-100	HV/MV SWITCHROOM 66kV/6.6kV		
B-200	LV SWITCHROOM 400V		
B-300	AC UPS EQUIPMENT ROOM		
B-400	I&T EQUIPMENT ROOM		
TR-100AD1	TRANSFORMER MAIN 66kV/6.6kV		

SYMBOL	DESCRIPTION	QTY.
	UV-IR FLAME DETECTOR (FDZ)	22
	POINT SOURCE HYDROGEN DETECTOR (GDZ)	46
SD	SMOKE DETECTOR (SDZ)	24
	POINT SOURCE OXYGEN DETECTOR (GDZ)	3
H	ULTRA SONIC HYDROGEN DETECTOR (GDZ)	9



NOTES

1. ALL DIMENSIONS IN mm U.N.O
2. ALL ELEVATIONS IN METERS.
3. VENDOR TO DEFINE AND SUPPLY ALL FIRE & GAS DETECTORS TO BE USED IN FUEL CELL, ELECTROLYSER AND BESS. TO BE IN COMPLIANCE WITH PROJECT REQUIREMENTS. THESE WILL BE SHOWN IN THE NEXT REVISON OF THE DOCUMENT.
4. PERSONNEL EXPECTED TO USE HANDHELD HYDROGEN AND LOW OXYGEN DETECTORS WHEN WORKING IN CONFINED SPACES ENTRY.
5. F&G LAYOUTS FOR I&T EQUIPMENT ROOM, AC UPS, LV SWITCH ROOM AND HV/MV SWITCHROOM CONTAINERS LOCATED AT DOOR ENTRANCE OF EACH ROOM (2003) AND START ABANDON. (01)
6. SMOKE DETECTORS (2003) AND POINT SOURCE HYDROGEN DETECTORS (2003) TO BE PROVIDED AROUND HVAC INLET AREAS AND UPON CONFIRMED DETECTION CLOSE DAMPERS TO ROOMS.
7. ULTRASONIC H2 DETECTORS TO BE LOCATED ON VALVE ACCESS PLATFORMS FOR H2 STORAGE VESSELS.
8. POINT SOURCE H2 DETECTORS TO BE LOCATED ON VALVE ACCESS PLATFORM FOR H2 STORAGE VESSELS.
9. EXACT LOCATION OF F&G DETECTORS AND DEVICES IS SHOWN IN THE 3D MODEL. (01)
10. LOCATION OF THE 6 SENSOR (950GDZ-05101/102/103/104/105/106) AT CEALING ABOVE BESS ROOF, TO AVOID GAS ACCUMULATION AT POCKETS

ELEVATION
FDZ = 2.0m El.
GDZ = 2.5m El. INSIDE THE COTAINER
SDZ = 2.0m El.

HOLDS

REFERENCE DOCUMENTS

123A90-DDL-PP-DS-70070	PLOT PLAN - LOWER & UPPER DECK
123A90-DDL-PP-DS-70071	PLOT PLAN - BELOW LOWER DECK
123A90-DDL-SAF-RE-30020	FERA REPORT (01)

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
01	10/07/24	MMA	CCA	DLO	ACCEPTED FOR CONSTRUCTION (AFC)
00	12/02/24	MMA	CCA	DLO	ISSUE FOR APPROVAL (IFA)

CROSSWIND

ROSETTI MARINO

TITLE :
F & G DETECTORS LAYOUT - LOWER & UPPER DECK

CONTRACT NO./TITLE CW-I-WP4-2023-05/HOLLANDSE KUST NOORD WIND PARK | SCALE 1:150

DRAWN | CHECKED C. CARACCIOLO | APPROVED D. LO STERZO | DATE 10/07/24

A1 | DRAWING NO. 123A90-DDL-SAF-DL-30027 | SHEET 001 | REV. 01

File Name : 123A90-DDL-SAF-DL-30027 Rev.01

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZID Study Actions** K559-2254-SE-REP-001
Item No.	2
Cause:	Hydrogen released from BESS.
Consequence:	Potential explosive atmosphere. Asset damage.
Safeguards:	
Actions:	Consider requirement for ATEX certification for BESS.
Assigned Respondent (By)	CROSSWIND
RESPONSE	There is no hazardous zoning for BESS containers. Ref doc K559-2254-CWIWP4202201-E99-099
Attachments:	
Issue Date	

Approvals / Endorsements

Company Discipline Lead	**Sign**
	Alessandro Sutto
Company **HSE Lead**	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.01 12:56:01 +02'00'
Company **Project Manager**	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.02 08:30:41 +02'00'
Contractor received for information. Not independently verified. Information implemented	**Sign**

BLPH SHEAMS SIGNATURE FORM

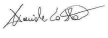
Action Title: **Ref. Doc.**	**HAZID Study Actions** K559-2254-SE-REP-001
Item No.	3
Cause:	Hydrogen leaking into oxygen system leading to fire.
Consequence:	Potential for internal explosion.
Safeguards:	
Actions:	Review PEM electrolyser data to determine frequency of membrane failure & potential for internal explosion with Identification of mitigation measures.
Assigned Respondent (By)	CROSSWIND
RESPONSE	Failure data have been reviewed and added into the FERA. Refer to 123A90-DDL-SAF-LIS-30020
Attachments:	
Issue Date	

Approvals / Endorsements

Company **Discipline Lead**	**Sign** Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.01 10:11:38 +02'00'
Company **HSE Lead**	**Sign** Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.01 10:11:38 +02'00'
Company **Project Manager**	**Sign** Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.02 08:31:12 +02'00'
Contractor received for information. Not independently verified. Information implemented	**Sign**

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZID Study Actions** K559-2254-SE-REP-001
Item No.	4
Cause:	Maintenance activity (transfer of equipment between boat & platform)
Consequence:	Potential damage to high voltage cable on seabed. Refer to Node 2
Safeguards:	
Actions:	Clarify measures in place to prevent damage to HV cable during maintenance activities & transfer of equipment between asset & boats. Dropped object study to be undertaken.
Assigned Respondent (By)	ROSETTI Technical Safety Engineer
RESPONSE	According with dropped object and swinging loads study (doc. no. 123A90-DDL-SAF-RE-30018) the calculated risk linked with the demage of underwater power cable between the platform and the seaside falls in tolerable risk region (see attached). However, for offshore wind projects in the Dutch part of the North Sea a burial depth requirement of 2.0 m. applies. A depth of 2.0 m is considered sufficient for large dropped objects (say, vessel anchors) not to reach the cable.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
E. Carminati	
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo.Sterzo	
Client	**Sign**
	

Digitaal ondertekend door Paul van Rossum
Datum: 2024.08.21 08:22:54 +02'00'

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZID Study Actions** K559-2254-SE-REP-001
Item No.	5
Cause:	Intermittent operation of electrolyser
Consequence:	Potential cyclic operations, potential leakage due to fatigue. Refer to hydrogen leak for risk ranking.
Safeguards:	
Actions:	Review PEM electrolyser data to determine intermittent operation & impact to electrolyser design.
Assigned Respondent (By)	CROSSWIND
RESPONSE	The electrolyser is capable of intermittent operation. Refer to the notes on Operational Limitation of Electrolyser and Rev 2.0 of the Chronogram and Control and Operational Philosophy for detailed information. The stacks are designed to withstand 5,000 pressure cycles, which corresponds to approximately 10 years of operation. The electrolyser can operate within a power range of 250 kW to 2500 kW, equivalent to 10-100% of its load capacity. The ramping rate of the electrolyser is 15 kW/second, allowing for flexible and responsive operation
Attachments:	
Issue Date	

Approvals / Endorsements	
Company Discipline Lead	**Sign**
	Hamant Patel
Company HSE Lead	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.01 17:16:19 +02'00'
Company Project Manager	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.02 08:31:58 +02'00'
Contractor received for information. Not independently verified. Information implemented	**Sign**

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZID Study Actions** K559-2254-SE-REP-001
Item No.	6
Cause:	Discharge brine from process.
Consequence:	Impact marine life.
Safeguards:	
Actions:	Confirm compliance with permitted discharges from facility & water decree from RWS.
Assigned Respondent (By)	ROSETTI Technical Safety Engineer
RESPONSE	In compliance with water decree the wastewater flow discharged into the surface water of the North Sea are the ones as per following table:

From	To	Type of Discharge	P&ID
INSTRUMENT AIR PACKAGE	Brine discharge caisson	Demineralized Water	123A90-DDL-PR-PID-80025
FUEL CELL PACKAGE	Brine discharge caisson	Demineralized Water	123A90-DDL-PR-PID-80025
ELECTROLYSER PACKAGE	Brine discharge caisson	Waste Water	123A90-DDL-PR-PID-80025
WATER TREATMENT PACKAGE	Brine discharge caisson	Fresh Water	123A90-DDL-PR-PID-80025
HYDROGEN KO DRUM	Brine discharge caisson	Waste Water with no contaminants	123A90-DDL-PR-PID-80025
ELECTROLYSER PACKAGE	Waste Water Tank	Pure Water + Hydrogen + Catalyst + Zeolite	123A90-DDL-PR-PID-80026
Biocide Dosing	Waste Water Tank	Biocide dosing	123A90-DDL-PR-PID-80026
WATER TREATMENT PACKAGE	Waste Water Tank	Waste Water	123A90-DDL-PR-PID-80026
Liquid seal drum	Waste Water Tank	Water/Glycol (50%)	123A90-DDL-PR-PID-80026

Sampling point is present in line WW-073-01CS-H to sample the brine wastewater flow as per 123A90-DDL-PR-PID-80025.

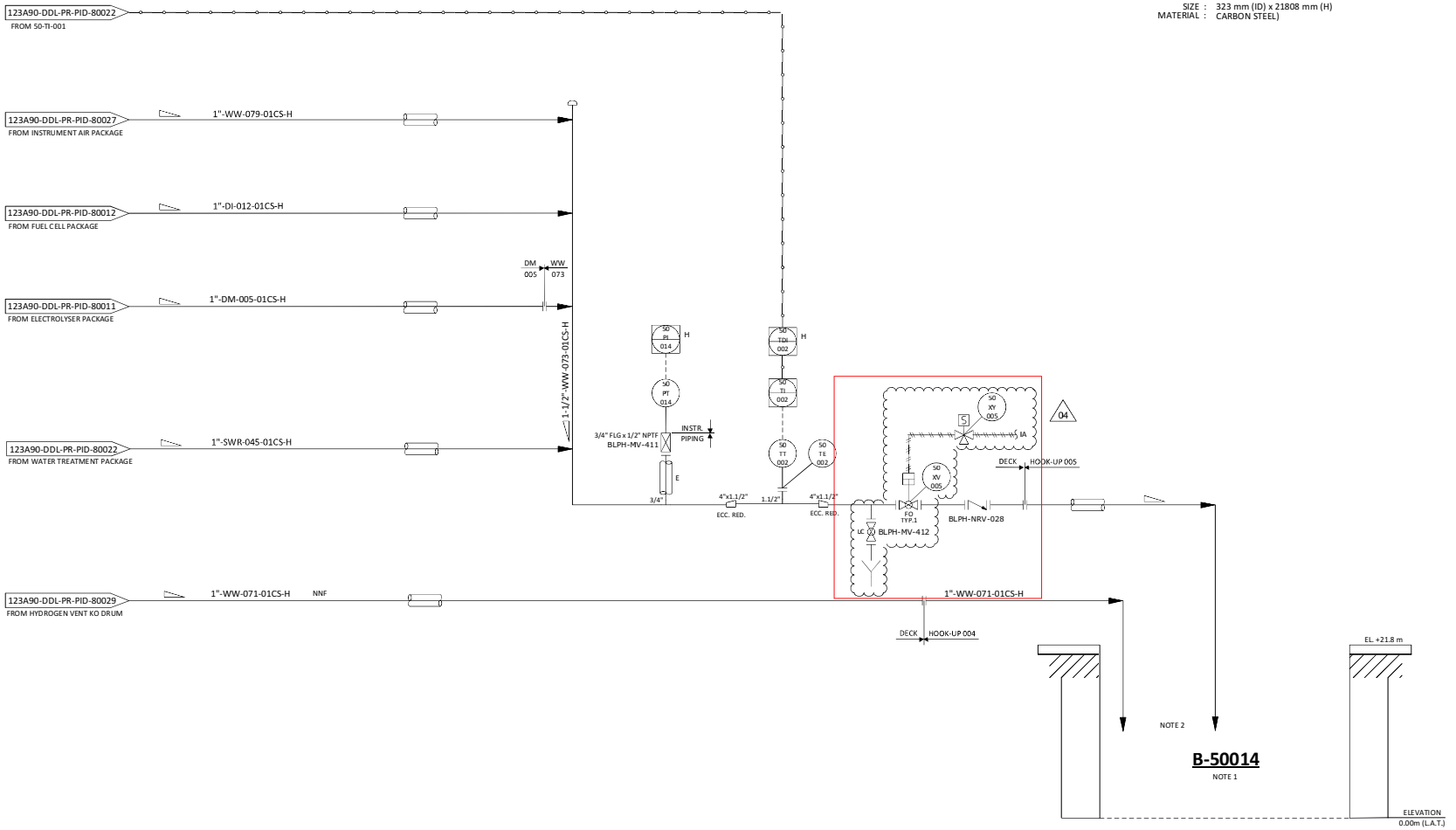
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements

EPC Discipline Lead	**Sign**
C. Giunchi	
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo.Sterzo	
Client	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.12.20 11:56:32 +01'00'

DRAWING_NO.

REV.



NOTES

1. CAISSON IS OPEN TOPPED.
2. ALL LINES TO TERMINATE APPROXIMATLEY 21000 mm ABOVE SEAWATER LEVEL (LAT).

HOLDS

1. DELETED.

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
04	11/10/2024	CIM	RZI	DLO	ACCEPTED FOR CONSTRUCTION (AFC)
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
WATER DISPOSAL SHEET 1

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-80025		SHEET 001	REV. 04

File Name : FILE_NAME

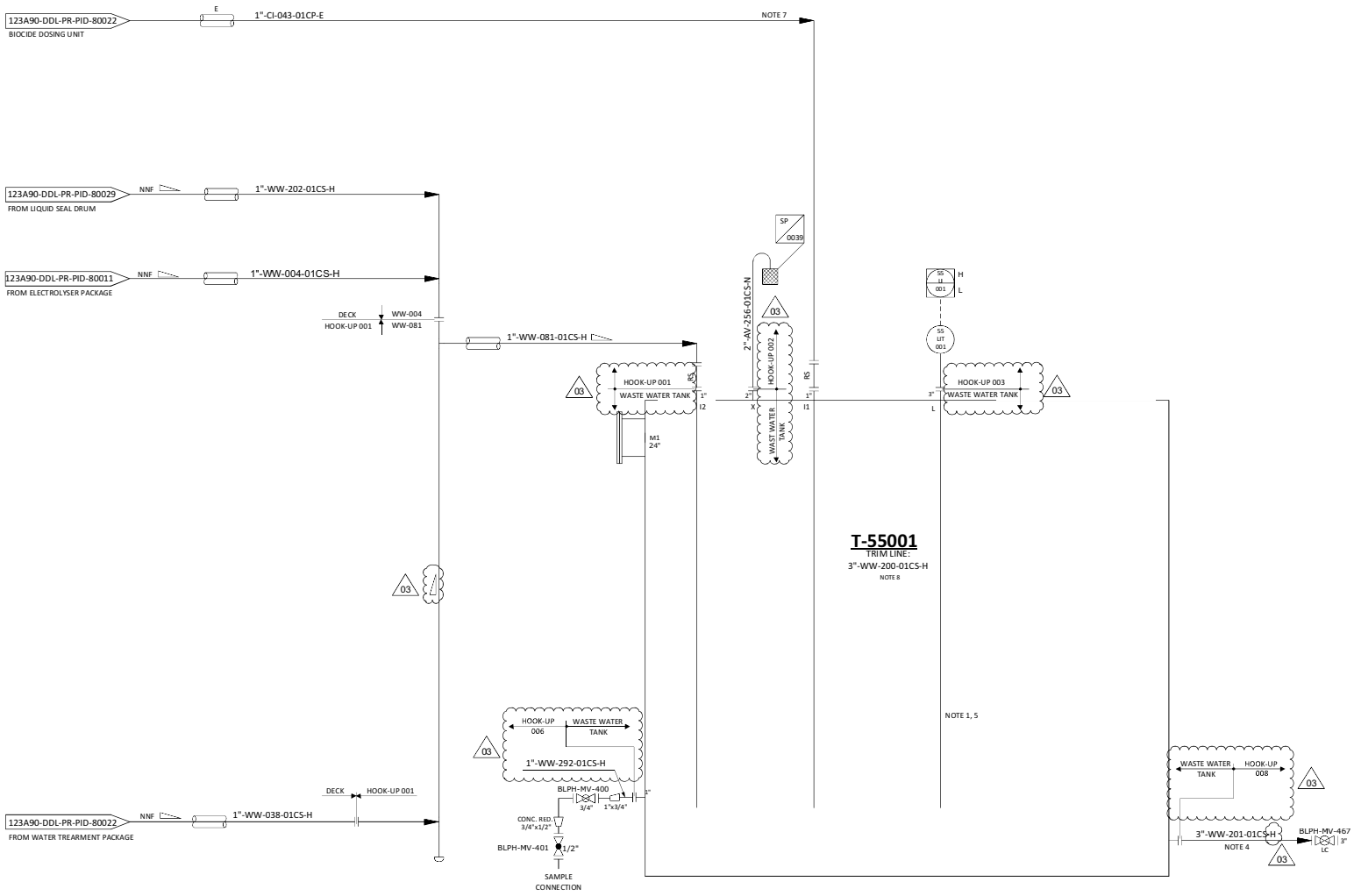
DRAWING NO. DRAWING_NO.

REV. REV.

T-55001

WASTE WATER TANK

CAPACITY : 16 m³
DESIGN P/T : 0.005 barg / 80°C
MATERIAL : CARBON STEEL



NOTES

1. DELETED. 03
2. DELETED.
3. DELETED.
4. DRAIN LINE TO SHIP DISPOSAL.
5. PERFORATED STILLING TUBE.
6. DELETED.
7. FOR PERIODIC DOSING OF THE WASTE WATER TANK.
8. FOR DESCRIPTION AND SPECIFICATION OF VESSEL NOZZLE, REFERENCE SHALL BE MADE TO THE TECHNICAL DATA SHEET FOR WASTE WATER TANK - T-55001, DOC. N. "123A90-DDL-MAC-DS-50008"

HOLDS

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

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
WATER DISPOSAL SHEET 2

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-80026		SHEET 001	REV. 03

File Name : FILE_NAME

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZID Study Actions** K559-2254-SE-REP-001
Item No.	7
Cause:	PVC/ metallic piping within packages.
Consequence:	Potential fragmentation, leading to loss of containment.
Safeguards:	Vibration analysis conducted for process systems. Post- Meeting Note: (refer to hydrogen)
Actions:	Vendor to confirm PEM electrolyser stack design is developed to take into account expected movement associated with monopile design.
Assigned Respondent (By)	CROSSWIND
RESPONSE	Elogen confirmed that the electrolyser package design can withstand the acceleration as per CWD requirements, ref to CWHKN-INN-BPH-TQ-00031.
Attachments:	
Issue Date	

Approvals / Endorsements

Company **Discipline Lead**	**Sign**
	Hamant Patel
Company **HSE Lead**	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.01 17:16:32 +02'00'
Company **Project Manager**	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.02 08:32:34 +02'00'
Contractor received for information. Not independently verified. Information implemented	**Sign**

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZID Study Actions** K559-2254-SE-REP-001
Item No.	8
Cause:	Gas blowby to supporting systems.
Consequence:	Refer to connecting nodes.
Safeguards:	
Actions:	Develop philosophy for operation of electrolysers during periods of maintenance.
Assigned Respondent (By)	CROSSWIND
RESPONSE	The operating philosophy of the BLPH is that the electrolyser is completely shutdown when any person will come to the platform.
Attachments:	
Issue Date	

Approvals / Endorsements

Company **Discipline Lead**	**Sign**
	Hamant Patel Digitally signed by Hamant Patel Date: 2024.10.02 08:31:18 +01'00'
Company **HSE Lead**	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.01 10:13:33 +02'00'
Company **Project Manager**	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.02 08:32:59 +02'00'
Contractor received for information. Not independently verified. Information implemented	**Sign**

BLPH SHEAMS SIGNATURE FORM

Action Title:	**HAZID Study Actions**
Ref. Doc.	K559-2254-SE-REP-001
Item No.	9
Cause:	Boats in vicinity
Consequence:	Collision with asset. Loss of stability. Potential Fatalities.
Safeguards:	Navigation aids. Procedures developed by crosswind.
Actions:	Crosswind to provide results from boat collision studies from Shell Marine. Crosswind to provide lighting plan for facility.
Assigned Respondent (By)	CROSSWIND
RESPONSE	1) Boat Collision ("Ship Impact") with BLPH foundation was part of the project Deliverable from the wind farm foundation package. Van Oord Offshore Wind has provided the following report which has been accepted by the Crosswind wind farm team and which available on CW ACONEX VOWP-DEN-FND-RPT-00037, document reference 144671-VOOW-TF-ENG-REP-1056 Ship impact for BLPH. 2) Crosswind has already produced and issued to the Dutch Authorities the following document "CWHKN-PMG-PJA-PLN-00005, Identification marks and lighting plan" BLPH has been included into the document : "A temporary nautical light is foreseen on the BLPH foundation such that is marked like other installed foundations. The temporary light will be removed once the permanent nautical lighting contour has been commissioned. "
Attachments:	
Issue Date	

Approvals / Endorsements

Company **Discipline Lead**	**Sign**
N LE BRUN	26-09-2024 LE BRUN
Company **HSE Lead**	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.01 10:29:27 +02'00'
Company **Project Manager**	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.02 08:33:40 +02'00'
Contractor received for information. Not independently verified. Information implemented	**Sign**

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZID Study Actions** K559-2254-SE-REP-001
Item No.	10
Cause:	Transfer from boat, Flotel to offshore platform. Transfer of personnel from boat to asset. (made worse by fog)
Consequence:	Personnel injury / fatality.
Safeguards:	Procedures in place for transfer of personnel onto asset.
Actions:	Crosswind to share procedures for personnel transfer.
Assigned Respondent (By)	CROSSWIND
RESPONSE	See attached document CW Innovations BLPH Offshore transfe
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
Discipline Lead	**Sign**
Nicolas LE BRUN	04/09/2024 LE BRUN
HSE Lead	**Sign**
Paul van Rossum	Digitaal ondertekend door Paul van Rossum Datum: 2024.09.05 12:02:15 +02'00'
Project Manager	**Sign**
Dominik Sznaider	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.09.06 08:23:55 +02'00'
Contractor received for information. Not independently verified. Information implemented	**Sign**



CrossWind Innovations HSSE

-

Offshore Personnel Transfer

- Internal -

CROSSWIND

Our MOTO :

HKN ONE TEAM

Everyone returns home safely

CROSSWIND

- Crew Transfer Vessels (CTV's) are used for transportation of offshore personnel and small cargo.



- The fender system at the bow helps the vessel to approach the access ladder of at the foundation boat landing area and facilitates safe boarding of the personnel.

CROSSWIND

Vessel Rules

- If you are boarding the vessel for the first time, ensure that you receive an introduction of the vessel safety from the crew & watch the safety Induction.
- Make yourself aware of all the safety features inside the vessel & sign the entry sheet.
- No people are allowed outside the CTV cabin during transit and transfer without the permission of the Vessel Master/Designated crew member.
- All people must remain seated in the CTV cabin area unless instructed by the vessel crew.
- If the CTV is equipped with seat belts, they must be used and fasten during the transit time.
- Vessel Master has the final decision.



CTV TRANSFER – REQUIRED PPE

1. Safety harness with double lanyard , restrain larnyard and kong frog connection





2. Life jacket (275N) with Personal Locator Beacon (PLB)




3. Helmet with the chin strap





4. Safety Shoes with ankle suport



5. Gloves



NOTE: **It's <u>not allowed</u> to climb the boat landing ladder carrying a backpack**, for small items a small tool bag can be attached with a karabiner to the tool carrier loops on the safety harness



Transfer Immersion Suit

Implementation of G+ Guideline and RA: CTV transfers without immersion suit

TOOLBOX

Eneco

EWOO (Eneco Wind Operations Offshore) is responsible for management of 6 offshore wind farms. Prinses Amalia Windpark, Eneco Luchterduinen, Borssele III, IV and V and Hollandse Kust Noord. Safety of all people working on these sites is of the highest priority, therefore we share this toolbox.

Please spend some time reading the document and keep it in mind when you are working for our projects, either in the office or on site. Please share the Toolbox with relevant parties.

WHAT: CTV transfers and immersion suits

An immersion suit was compulsory during a CTV transfer when the seawater temperature was below 10°C and during hours of darkness. The immersion suit is considered by many as hindering movement during transfers as it adds additional weight and the volume of the suit somewhat immobilizes body parts. Incidents have occurred when persons tripped while donning an immersion suit.

EWOO follows the G+ OFFSHORE WIND GOOD PRACTICE GUIDELINES WIND FARM TRANSFER. The likelihood of unplanned water entry, whilst undertaking a standard CTV transfer, is extremely low with the existing mitigating measures. If a person does fall in the water, the time it takes to recover a person is short.

During a CTV transfer it is no longer required to wear an immersion suit when the seawater temperature is below 10°C or during hours of darkness when following the correct mitigating measures.



HOW: Mitigating measures required when not wearing an immersion suit:

1. The transferee must hook on to and off from the SRL at the CTV to be protected from falling into the sea during the transfer.
2. The CTV vessel crew must be trained and competent to quickly recover a person from the sea. The time taken to remove a casualty from the sea should ideally be less than 15 minutes.
3. The transferee will follow the detailed transfer procedure as described in EWOO online induction (G+ guideline).
4. The transfer time will be reduced as much as possible using a quick release device such as the frog.
5. The transferee must wear a personal floatation device (life vest) with a AIS-PLB.
6. The weather forecast and monitoring will be done 24/7 by the MCC.
7. During the hours of darkness the CTV will provide:
   a. Sufficient (flood) lighting to illuminate the boat landing
   b. A (search) light to illuminate possible incoming waves.
   c. During hours of darkness the transferee will use a headlight to illuminate the ladder rungs.
8. The transferee must bring an immersion suit or abandonment suit to the work location at the turbine or OHVS to be prepared for an external emergency abandonment of the location into the sea.

It is allowed to continue to use the immersion suit in case of personal preference or if the mitigating measures can not be adhered to.

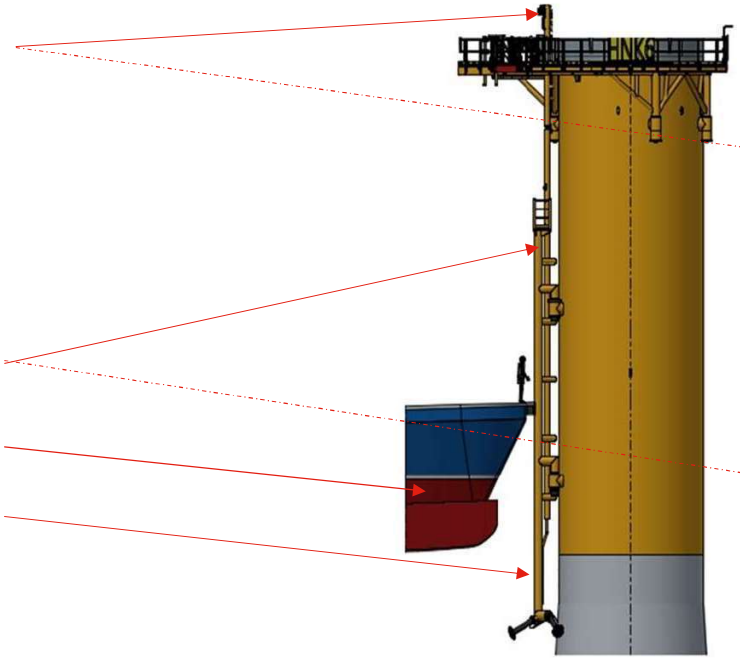
CROSSWIND

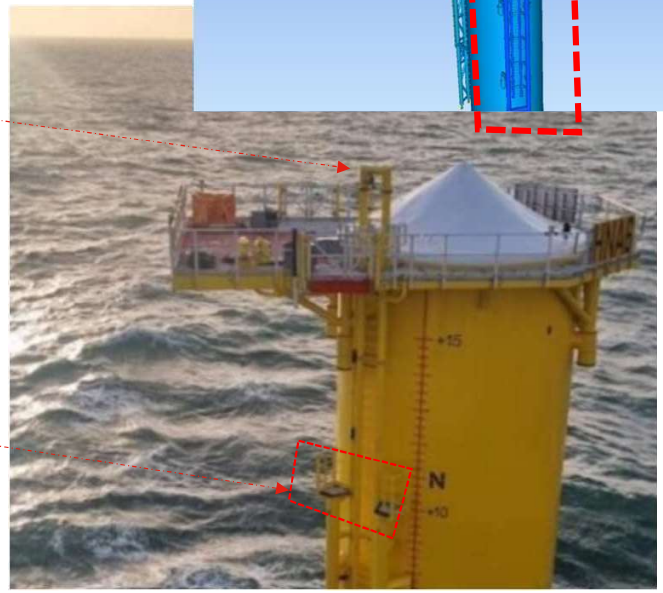
Boat landing access BLPH

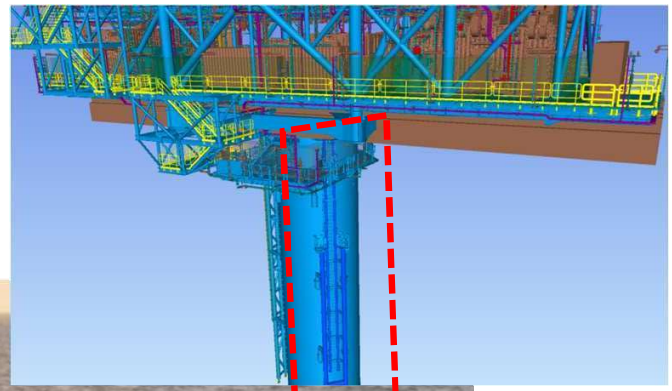
- Safe Retracting Landyard (SRL)

on the ladder

- Rest Platform
- CTV Bow
- Boat Landing







CROSSWIND

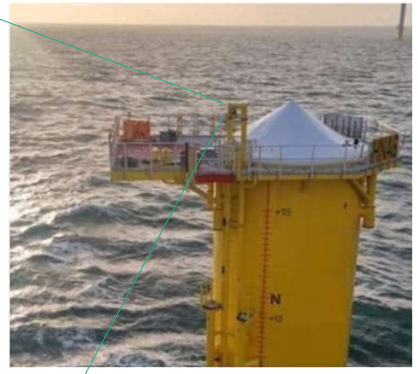
SRL block

Safety line (seel cable)
& connection point



Pull down tetherline

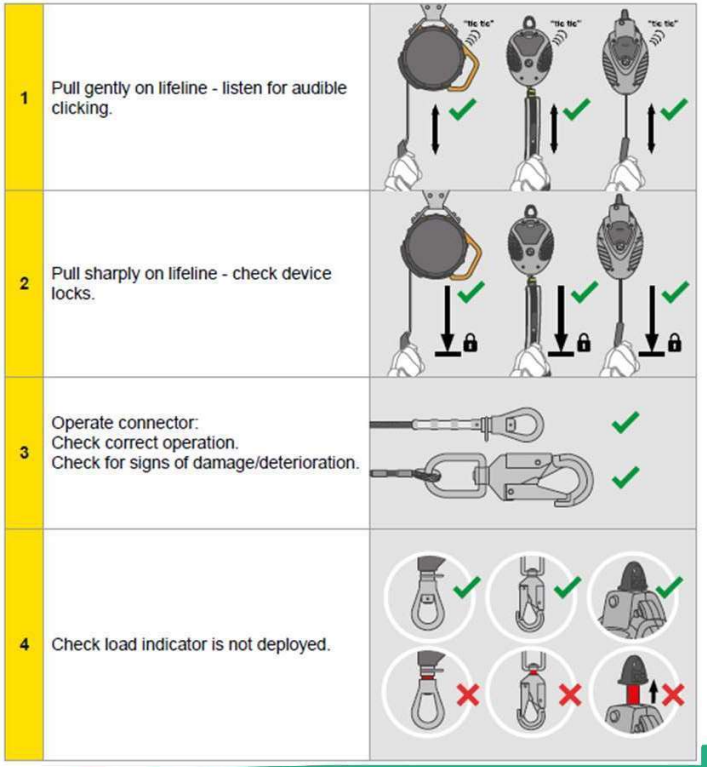




CROSSWIND

Self Retractile Lanyard - PRE-USE CHECKS

- Before the transfer CTV Deckhand will perform the SRL pre-use checks and ensure all are connected prior to leaving the vessel.
- If a problem is identified, the SRL shall be immediately withdrawn from use and replace by the spare one



CROSSWIND

Rules to be followed during the transfer from CTV to BLPH

- During transfer to/from BLPH, transferee shall remain seated and using of the seatbelt is mandatory.
- CTV transfer (Boat Transfer) is a part of Sea Survival GWO training.





Stand up and prepare yourself with PPEs only on instructions of the deckhand

Buddy check : do binomials and check each other that you have all required PPE

Walk in single file and follow the safety line

CROSSWIND

Rules to be followed during the CTV transfer:



- Always follow the instruction given by the deckhand in charge of the transfer.
- Carrying equipment, bagpacks while climbing up and down the ladder are strictly forbidden.
- Bags or other equipment will be transferred independently using a crane and certified lifting bags.
- Deckhand performs SRL pre-use check and creates length in the cable allow connection while on vessel.
- Deckhand give signal to Transferee to approval transfer area
- Transferee Connect Frog to the SRL
- Put SRL pull line over left shoulder to prevent trip hazard.
- One person at a time, must use SRL when climbing up/down ladder.
- Maintain 3-points of contact with ladder





CROSSWIND

Rules to be followed during the transfer from CTV to BLPH



Climb on the CTV anti slippering platform.

Prepare quick connector or carabiner.



The Deckhand will pull down the SRL rope with extra slack and connect yourself.

Let make sure the **CTV is facing the boat landing** and the **transfer is made at the high position**



Once the vessel is on top of the swell, the deckhand will give you the signal to go, don't hesitate. If needed, there is space enough for your body between the ladder and the vertical pipes

CROSSWIND

Rules to be followed during the transfer from BLPH to CTV



Step down the ladder and before climbing on CTV, wait for Deckhand's instructions. Be careful to not block the SRL while stepping down the ladder.

As soon as you access on the anti slippering plateform, disconnect immediately the SRL line. You must then follow **the marking way** on deck and reach the boat cabin.

CROSSWIND

Do you feel comfortable?

- You can stop transfers at any time if you believe that safe transfers are no longer possible due to the sea state.

CROSSWIND



Thank You

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZID Study Actions** K559-2254-SE-REP-001
Item No.	11
Cause:	Salty conditions. Stray currents.
Consequence:	Potential electrocutions.
Safeguards:	Electrically earthed.
Actions:	Earthing design to be developed, taking in account fuel cell & electrolyser designs.
Assigned Respondent (By)	ROSETTI Electrical Engineer
RESPONSE	CPI will be connected to earth at two (2) battery limit points provided by each CPI.
Attachments:	
Issue Date (dd/mm/yy)	12/04/2024

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
Andrea Madaschi	
EPC HSE Lead	**Sign**
Carolina Caracciolo	
EPC Project Manager	**Sign**
Davide Lo Sterzo	
Client	**Sign**
	Digitaal ondertekend door Paulwan Bossum Datum: 2024.08.21 08:23:12 +02'00'

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZID Study Actions** K559-2254-SE-REP-001
Item No.	12
Cause:	Leakage into sea
Consequence:	Impact marine life. Post-meeting note: (monoethylenglycol is classified under soluble organic substances (e.g. salts, acids, glycols and alcohols) (Part 2 of HOCNF:) and is readily biogradable - literature data for marine toxicity are - LC50 or EC50> 100 mg/l, and - log Pow 700.)
Safeguards:	NA
Actions:	Clarify need for containment of glycol system in event of leakage from fuel cell (or consider biodegradable alternative).
Assigned Respondent (By)	CROSSWIND
RESPONSE	if accidental leak occurs we will not have many cubic of it which could end up to the sea, the product will have a relatively low impact for the environment and will get degraded quickly into the sea as per data sheet.No additional containment required. Below, an extract from the Datasheet "Environmental exposure controls" of the Manufacturer
Attachments:	
Issue Date	

SECTION 12: Ecological information

12.1. Toxicity

Hazardous to the aquatic environment, short-term (acute) : Not classified

Hazardous to the aquatic environment, long-term (chronic) : Not classified

Monoethylene glycol (107-21-1)	
LC50 - Fish [1]	72860 mg/l (Pimephales promelas)

12.2. Persistence and degradability

Proviflow Neo	
Persistence and degradability	Rapidly degradable

Monoethylene glycol (107-21-1)	
Persistence and degradability	Readily biodegradable.

12.3. Bioaccumulative potential

Monoethylene glycol (107-21-1)	
Bioaccumulative potential	Low bioaccumulation potential.

Approvals / Endorsements

Company Discipline Lead	**Sign**
	P Kyle
Company HSE Lead	**Sign**
	Paul van Rossum — Digitaal ondertekend door Paul van Rossum, Datum: 2024.10.18 13:03:32 +02'00'
Company Project Manager	**Sign**
	Dominik Sznajder — Digitally signed by Dominik Sznajder, Date: 2024.10.24 14:08:49 +02'00'
Contractor received for information. Not independently verified. Information implemented	**Sign**

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZID Study Actions** K559-2254-SE-REP-001
Item No.	13
Cause:	Potential oxygen rich atmosphere around vents
Consequence:	Potential impact on passing birds
Safeguards:	
Actions:	Clarify regulatory requirements for disposal of dead birds/ biodiversity of existing area. Environmental impact assessment to cover impact to birds.
Assigned Respondent (By)	CROSSWIND
RESPONSE	If dead birds are found the the BLPH , they will be disposed as per Dutch Industry stadnard Nogepa N.64
Attachments:	
Issue Date	

Approvals / Endorsements

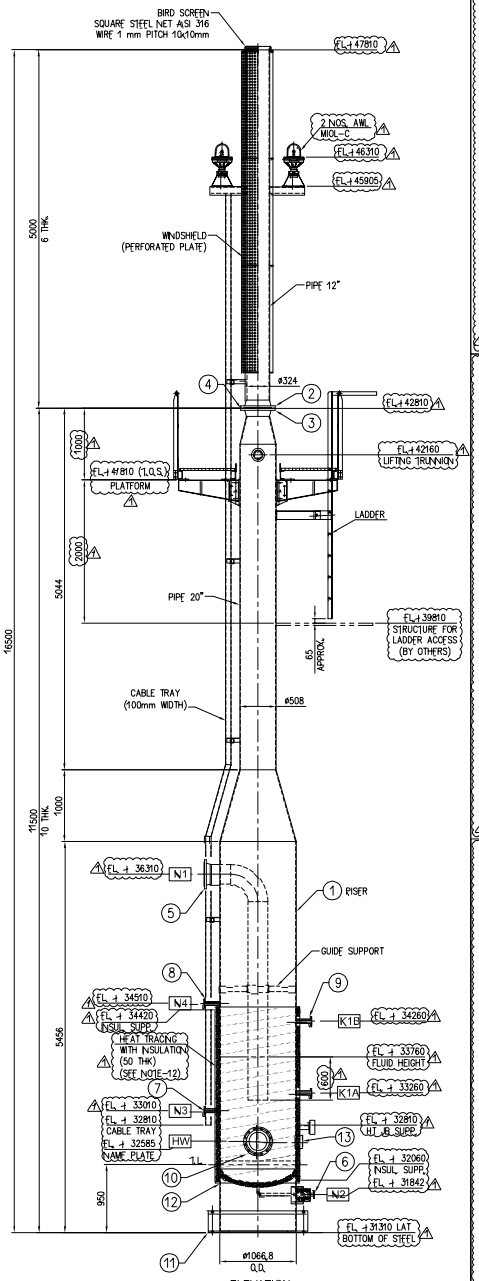
Company **Discipline Lead**	**Sign**
N LE BRUN	25/09/2024 LE BRUN
Company **HSE Lead**	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.01 10:30:17 +02'00'
Company **Project Manager**	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.02 08:34:08 +02'00'
Contractor received for information. Not independently verified. Information implemented	**Sign**

BLPH SHEAMS SIGNATURE FORM

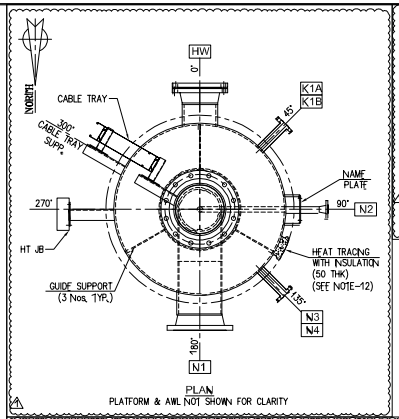
Action Title: **Ref. Doc.**	**HAZID Study Actions** K559-2254-SE-REP-001
Item No.	14
Cause:	Bird droppings
Consequence:	Slippery surfaces
Safeguards:	
Actions:	Develop philosophy for preventing birds from forming habitats on asset.
Assigned Respondent (By)	ROSETTI Project Management
RESPONSE	Within BLPH scope the only critical asset where birds can try to create issues is the Hydrogen Vent outlet which has been equipped with bird screen. See detail of bird screen in the drawing 1724000887-MAC-DA-00003 below attached. Therefore, Rosetti will not develop a dedicated philosophy for preventing birds from forming habitats on asset
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
F.Mura	
EPC HSE Lead	**Sign**
C.Caracciolo	
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.12.20 11:55:21 +01'00'

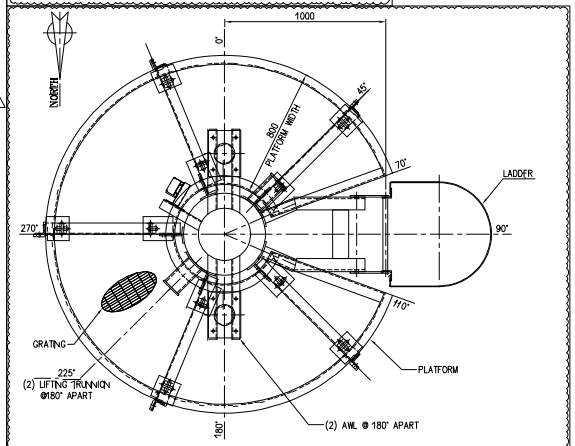
DRAWING NO. 1724000887-MAC-DA-00003_00 | REV. REV



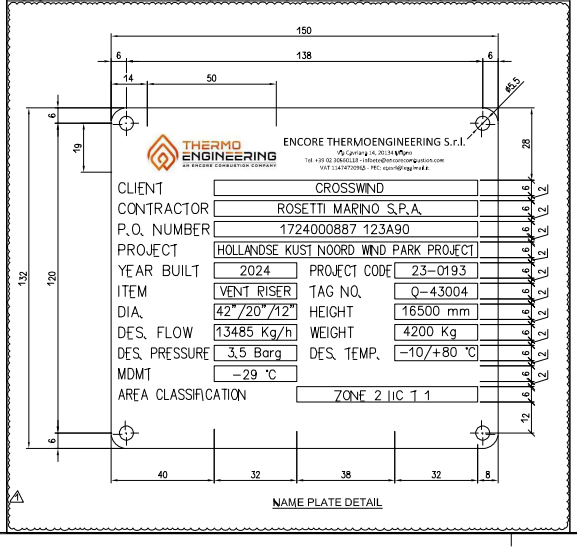
ELEVATION
SCALE 1:36
(FOR TRUE ORIENTATION REFER PLAN VIEWS)



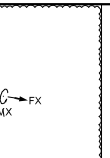
PLAN
PLATFORM & AWL NOT SHOWN FOR CLARITY



PLAN OF PLATFORM & AWL



NAME PLATE DETAIL



NOZZLE LOADS	LOADS [kN]			MOMENTS [kN x m]		
	FX	FY	FZ	MX	MY	MZ
INLET N1 (10")	7,78	14,45	14,45	6,31	4,74	4,74

MATERIAL LIST

ITEM	Q.TY	DESCRIPTION	DIMENSION	MATERIALS
1	1	FLARE RISER SHELL	42" (1066,8) OD x 10 THK	A516 GR.60/EQUIV
	1	FLARE RISER SHELL	20" (508) OD x 10 THK	A516 GR.60/EQUIV
		VENT TIP SHELL	12" (323,9) OD x 6 THK	AISI 316
2	1	VENT TIP FLANGE	ø12" 150# WNRF ASME B16,5	A350 GR LF2
3	1	RISER OUTLET FLANGE	ø12" 150# WNRF ASME B16,5	A350 GR LF2
4	1	GASKET	ø12" 150# SPIRAL WOUND	NOTE-10
5	1	VENT INLET	ø10" 150# WNRF, SCH.40 ASME B16,5	A350 GR LF2
6	1	DRAIN CONNECTION FLANGE	ø1" 150# WNRF, SCH. 80 ASME B16,5	A350 GR LF2
7	1	SWAN NECK CONNECTION FLG	ø1" 150# LWNRF ASME B16,5	A350 GR LF2
8	1	FILLING LINE FLANGE	ø1" 150# LWNRF ASME B16,5	A350 GR LF2
9	2	LEVEL TRANSMITTER CONNECTION	ø1" 150# LWNRF ASME B16,5	A350 GR LF2
10	1	HAND HOLE FLANGE	ø8" 150# WNRF, SCH.40 ASME B16,5	A350 GR LF2
11	1	ANCHOR CHAIR	-	S275J0 or EQUIV.
12	1	SKIRT SHELL	42" (1066,8) OD,	S275J0 or EQUIV.
13	1	NAMEPLATE	-	AISI 316

NOZZLES LIST

POS.	QTY	SIZE	RATING	FLANGE	SERVICE	PROJECTION FROM RISER C/L
N1	1	10"	150#	WNRF	VENT INLET FROM V-43000 W/ DIP PIPE	750
N2	1	1"	150#	WNRF	DRAIN	800
N3	1	1"	150#	LWNRF	SWAN NECK CONNECTION	750
N4	1	1"	150#	LWNRF	FILLING LINE	750
K1A/B	2	1"	150#	LWNRF	LEVEL TRANSMITTER	750
HW	1	8"	150#	WNRF	HAND HOLE W/ BLIND	750

LOADS AT THE BASE

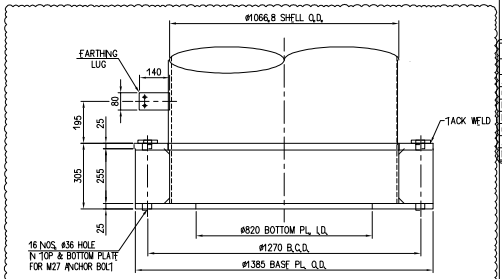
		Vertical [kN]	Shear [kN]	Moment [kN]
DEAD LOAD	DL	-27,66	0,00	0,00
DEAD LOAD CONTENT	DL_0	-17,06	0,00	0,00
LIVE LOAD ON PLATFORM	LL	-13,34	0,00	0,00
NOZZLE LOADS	NL	4,97	24,63	134,99
THERMAL	TL	0,00	0,00	0,00
WIND LOAD	WL	0,00	28,845	235,65
WAVE AND CURRENT LOADS	HL	0,00	-6,99	-55,95

THESE ARE THE RESULTANT FORCES AND THE SHEAR AND MOMENT CAN OCCUR IN ANY DIRECTION.

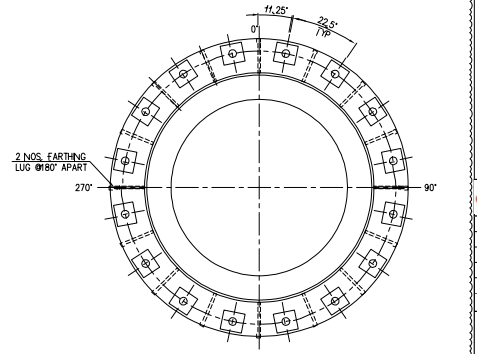
SHEAR = RESULTANT SHEAR: (FX^2 + FZ^2)^0,5

MOMENT = RESULTANT MOM: (MY^2 + MZ^2)^0,5

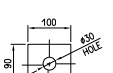
VERTICAL LOAD IS POSITIVE UPWARD



ELEVATION
ANCHOR CHAIR DETAIL
SCALE 1:12

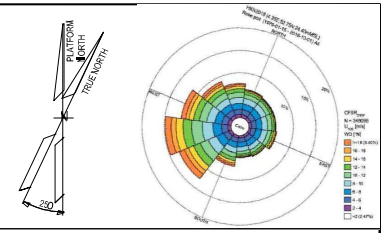


PLAN VIEW



WASHER DETAIL

REFERENCE DOCUMENT	No.
MECHANICAL CALCULATION - HYDROGEN VENT	1724000887-MAC-CA-00004
DETAILED DRAWING WITH PART LIST - HYDROGEN VENT	1724000887-MAC-DD-00005
LIFTING DRAWING - HYDROGEN VENT	1724000887-MAC-DD-00019
.	-



NOTES

GENERAL NOTES:

1. ALL DIMENSION ARE IN mm UNLESS OTHERWISE STATED.
2. ALL ELEVATIONS ARE IN mm UNLESS OTHERWISE STATED.
3. ALL WELDING SHALL BE CONTINUOUS WITH CATHETUS EQUAL TO MINIMUM THK. TO BE WELDED.
4. REFERRING TO MAJOR AXIS FLANGE HOLES SHALL BE SYMMETRICALLY DISPOSED WITH EXCEPTION OF PILOTS FLANGES.
5. ALL FLANGES <= 24" ARE ACCORDING TO ASME B16,5 WITH FINISHING 125 AARH.
6. FOR SURFACE TREATMENT PLEASE REFER TO THE DOCUMENT NO. 1724000887-MAT-PRO-00010 (23-0193-0030).
7. MAIN COMPONENT WEIGHTS (APPROX.):
   RISER WEIGHT (-3800 kg (INCLUDING PLATFORM & LADDER)
   VENT TIP (-400 kg
8. FOR WIRING DIAGRAM (JB AND HT) REFER DOCUMENT NO. 1724000887-MAC-DG-00007 (23-0193-0170)
9. DELETED
10. GASKET SHALL BE STAINLESS STEEL, SPIRAL WOUND, GRAPHITE FILLED, EPOXY-COATED CARBON STEEL CENTERING RING AND STAINLESS STEEL INNER RING.
11. FOR RISER CONSTRUCTION DETAILS REFER DRAWING NO. 1724000887-MAC-DD-00005 (23-0193-131).
12. HEAT TRACING CABLES AND INSULATION SUPPORTS ARE IN ETE SCOPE OF WORK, INSULATION SUPPLY & INSTALLATION BY OTHERS.

NAME PLATE NOTES:

a. ALL DIMENSIONS ARE IN mm, UNLESS OTHERWISE STATED.
b. NAMEPLATE MATERIAL : AISI 316L
   NAMEPLATE THK. : 2 mm
   TEXT COLOR : BLACK
   TEXT ENGRAVED
c. NAMEPLATE WILL BE FIXED ON VENT RISER REFER TO DOC. 1724000887-MAC-DD-00005 (23-0193-0131).

DESIGN DATA

DESCRIPTION	VALUES
AMBIENT TEMPERATURE	-8,4 / +25 °C
OPERATING PRESSURE	ATM barg
DESIGN TEMPERATURE	-10 / +80 °C
DESIGN PRESSURE	3,5 barg
CORROSION ALLOWANCE	3 mm (FOR CARBON STEEL ONLY)
AREA CLASIFICATION	ZONE 2 II T 1
MDMT	-29 °C

THERMO ENGINEERING — AN ENCORE CORPORATION COMPANY

ETE JOB	23-0193
ETE DWG NR.	23-0193-0101

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
01	30-07-2024	SCB	VI	AL	ISSUED FOR REVIEW
00	03-06-2024	RJS	SCB	AL	ISSUED FOR REVIEW

CROSSWIND — ROSETTI MARINO

TITLE :
HYDROGEN VENT
GENERAL ARRANGEMENT
INCLUDING FOUNDATION LOADS

CONTRACT NO./TITLE CW-I-WPE-2023-05/HOLLANDSE KUST NOORD WIND PARK | SCALE 1:36

DRAWN RJS | CHECKED SCB | APPROVED AL | DATE 03/06/24

A1 | DRAWING NO. 1724000887-MAC-DA-00003 | SHEET 001 | REV. 01

File Name : 1724000887-MAC-DA-00003_00

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZID Study Actions** K559-2254-SE-REP-001
Item No.	15
Cause:	PVC piping within packages
Consequence:	Potential fragmentation, leading to loss of containment. Post-Meeting Note: (refer to hydrogen)
Safeguards:	Vibration analysis conducted for process systems.
Actions:	Determine material selection philosophy used by vendors.
Assigned Respondent (By)	CROSSWIND
RESPONSE	Refer to Material Selection Report K559-2254-MT-REP-001, from FEED phase, and 123A90-DDL-MAT-RE-60011 rev 01. Also, refer to document Basic Design Engineering Packages, K559-2254-PM-PLN-003.
Attachments:	
Issue Date	

Approvals / Endorsements

Company **Discipline Lead**	**Sign** DocuSigned by: Hamant Patel 899F2B... 1487...
Company **HSE Lead**	**Sign** Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.01 09:54:41 +02'00'
Company **Project Manager**	**Sign** Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.02 08:34:36 +02'00'
Contractor received for information. Not independently verified. Information implemented	**Sign**

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZID Study Actions** K559-2254-SE-REP-001
Item No.	16
Cause:	Unauthorised access
Consequence:	Damage to facility. Potential danger.
Safeguards:	
Actions:	Clarify measures taken to prevent unauthorised access. Procedures to be developed to ascertain facility condition on arrival.
Assigned Respondent (By)	ROSETTI Project Management
RESPONSE	Warning signs will be placed on the side of the access gate of the platform to prevent unauthorised access. The safety sign will be placed at the entrance of the staircase from the MAP access with followind text both in Dutch and English VERBODEN TOEGANG VOOR ONBEVOEGDEN ACCESS FOR UNAUTHORIZED PERSONS PROHIBITED
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
C.Giunchi	
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo.Sterzo	
Client	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.07 10:49:01 +02'00'

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZID Study Actions** K559-2254-SE-REP-001
Item No.	17
Cause:	Leakages from pumps
Consequence:	Potential injuries for personnel. Environmental hazards. Possible small localised oil mist/spill.
Safeguards:	Spill tray for pumps.
Actions:	Consider use of seal less pumps to minimise lube/seal oil leakages & maintenance activities.
Assigned Respondent (By)	ROSETTI Mechanical Engineer
RESPONSE	P-50001 A/B - This pump handle sea water which is a not a hazardous liquid, single seal will be used. Shaft line bearings are lubricated by pumped fluid (sea water). Lubrication of thust bearing is made by a constant level oiler, not under pressure. P-50009 A/B - This pump handle fresh water, which is not a hazardous fluid, single seal will be used. Radial sleeve bearing will be lubricated by pumped fluid, thrust bearing lubrication, due to very small dimension of the pump will be done by greased bearings, usually sealed berings grease for life.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
F.Mura	
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo.Sterzo	
Client	**Sign**

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZID Study Actions** K559-2254-SE-REP-001
Item No.	18
Cause:	Leakage of lube & seal oil into electrolyser water. (Refer to oxygen leak - Node 2)
Consequence:	Potential hydrocarbon into oxygen rich stream, potential explosion risk.
Safeguards:	
Actions:	Within electrolyser package clarify mitigations in place to prevent leakage of seal oil into oxygen rich streams.
Assigned Respondent (By)	CROSSWIND
RESPONSE	There is no lube/seal oil on the BLPH electrolyser package. hence this recommendations is superceded.
Attachments:	
Issue Date	

Approvals / Endorsements

Company **Discipline Lead**	**Sign**
	Hamant Patel
Company **HSE Lead**	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.01 12:56:25 +02'00'
Company **Project Manager**	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.02 08:34:59 +02'00'
Contractor received for information. Not independently verified. Information implemented	**Sign**

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZID Study Actions** K559-2254-SE-REP-001
Item No.	19
Cause:	Sodium hypochlorite is used as a biocide
Consequence:	Hazardous to health (chlorine). Production of hydrogen leading to fomration of explosive atmosphere
Safeguards:	Post-meeting note: (Dosing to be conducted at low sodium hypochlorite concentrations (less than 1% chlorine) (quantities of hydrogen generated are small) (no stored quantities of sodium hypochlorite)
Actions:	Ensure hydrogen produced from chlorination plant is routed to safe location (away from oxygen vent).
Assigned Respondent (By)	CROSSWIND
RESPONSE	During WTP HAZOP has been decided to use biocide instead of chloride; action no longer applicable.
Attachments:	
Issue Date	

Approvals / Endorsements	
Company Discipline Lead	**Sign** DocuSigned by: Hamant Patel 899F2B5FED91487...
Company HSE Lead	**Sign** Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.01 09:59:21 +02'00'
Company Project Manager	**Sign** Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.02 08:35:36 +02'00'
Contractor received for information. Not independently verified. Information implemented	**Sign**

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZID Study Actions** K559-2254-SE-REP-001
Item No.	20
Cause:	By-product water from fuel cell
Consequence:	Potential Environmental consequence.
Safeguards:	
Actions:	Fuel cell vendor to confirm quality of by-product water to determine potential for re-use / disposal.
Assigned Respondent (By)	CROSSWIND
RESPONSE	The process water drain goes to the Brine Discharge Caisson. The water is not reused. The water is categorised as DI water “similar to tap water”.
Attachments:	
Issue Date	

Approvals / Endorsements

Compnay **Discipline Lead**	**Sign**
	Hamant Patel Digitally signed by Hamant Patel Date: 2024.10.02 08:32:13 +01'00'
Company **HSE Lead**	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.01 [illegible]:52 +02'00'
Company **Project Manager**	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.02 08:36:04 +02'00'
Contractor received for information. Not independently verified. Information implemented	**Sign**

5.0 Water Drainage System

The fuel cell process will produce a max. of 18 L/min of deionized (DI) water at full load. For sizing purposes, it is assumed that all of this DI water condenses and exits through the process water drain. The DI water exiting from the system may be disposed of similar to tap water or reutilized for other purposes if needed by the customer.

The drainage system is internally designed so that it shall not freeze nor block the water flow. The drainage system outlet pipe is guided to the outside of the container, where care must be taken to ensure proper functionality, also during freezing.

Note: This is a bi-directional interface.

Water Drain [19]* (Tag-Nr.: =JB01+DA02-XM01)			
Temperature		**Volume Flow**	
Min.	Max.	Min.	Max.
°C	°C	L/min	L/min
20	70	0	18

Note: Volume flow varies depending on environmental and operating conditions.
Max. value assumes all process water exits through the water drain.

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZID Study Actions** K559-2254-SE-REP-001
Item No.	21
Cause:	Various chemicals (post-meeting note: sodium hydroxide, nitric acid, sodium hypochlorite)
Consequence:	Personnel injury.
Safeguards:	Chemical Selection to reduce impact on personnel. PPE.
Actions:	Develop strategy for chemical handling (storage basis) & potential use of safety showers on platform.
Assigned Respondent (By)	ROSETTI Technical Safety Engineer
RESPONSE	Due to typology and number of site visit, it has been agreed that personnel will bring the portable eye wash prior each visit to the platform. No fixed safety shower neither eye was are deemed necessary.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
E.Carminati	
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo.Sterzo	
Client	**Sign**
	 Digitaal ondertekend door Paul van Rossum Datum: 2024.08.21 08:23:48 +02'00'

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZID Study Actions** K559-2254-SE-REP-001
Item No.	22
Cause:	Growth of legionella, due to decrewed platform philosophy
Consequence:	Adverse impact to operators
Safeguards:	
Actions:	Study work to be conducted to determine potential for legionella on platform & mitigation measures to be adopted.
Assigned Respondent (By)	ROSETTI Technical Safety Engineer
RESPONSE	Study work shall not be conducted as the hazard will not be present in case there are no fixed eye wash nor safety shower.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
C. Caracciolo	
EPC HSE Lead	**Sign**
C. Caracciolo	
EPC Project Manager	**Sign**
D. Lo Sterzo	
Client	**Sign**

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZID Study Actions** K559-2254-SE-REP-001
Item No.	23
Cause:	Lack of welfare facilities for personnel
Consequence:	Adverse health/ mental impact on personnel.
Safeguards:	HRA design developed as part of FEED.
Actions:	Crosswind Health risk assessment to be conducted.
Assigned Respondent (By)	CROSSWIND
RESPONSE	Crosswind Innovations project register include the health element. CTV will be the main welfare facilities whilst personnel being offshore, similar to the current situation for the wind farm BoP contractors. Subcontractors could define additional measures as part of their own task risk assessments
Attachments:	
Issue Date	

Approvals / Endorsements

Company **Discipline Lead**	**Sign**
N LE BRUN	26-09-2024 LE BRUN
Company **HSE Lead**	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.01 10:31:09 +02'00'
Company **Project Manager**	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.02 08:36:38 +02'00'
Contractor received for information. Not independently verified. Information implemented	**Sign**

CROSSWIND ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK Project

Base Load Power Hub (BLPH)

Action N : 01	**Rev.:** 001
Action Title: HAZID Study	**Date:** 05/10/2023
Reference Document n:	
Node: 1-Electrical System	
Hazard/Parameter: Hydrogen	**Deviation**
Cause: Leakage of Hydrogen from PEM	
Consequence: Potential of Explosion. Jet fire & impingement to adjacent equipment. Escalation. Invisible flames. Potential for personal injuries if people are on the platform. Asset damage	
Safeguards: Fire & gas detection & Emergency Shutdown. Material selection report. Minimisation of Leak Sources.	
Recommendation: FERA to be updated in detail design to include scenarios and protections from the electrolyzer and fuel cell package	
Responsible Part: ROSETTI & CROSSWIND Technical Safety	
Response: FERA has been updated including scenarios and protections from the electrolyzer and fuel cell package. See doc. 123A90-DDL-SAF-RE-30020_rev03	
Ref. Docs / Dwgs.:	

RESPONSE ACCEPTANCE

Discipline Leader: Edoardo Carminati	**Signature:** 	**Date:**	11/10/2024
HSE Leader: Carolina Caracciolo	**Signature:** CC	**Date:**	14/10/2024
Project Engineering Manager: Davide Lo Sterzo	**Signature:** 	**Date:**	14/10/2024
Company:	**Signature:** Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.15 08:48:09 +02'00'	**Date:**	

CROSSWIND ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK Project

Base Load Power Hub (BLPH)

Action N : 02	**Rev.:** 001
Action Title: HAZID Study	**Date:** 05/10/2023
Reference Document n:	
Node: 1-Electrical System	
Hazard/Parameter: Hydrogen	**Deviation Low oxygen atmospheres**
Cause: Potential operations of firefighting system within instrument cabinet or BESS	
Consequence: Asphyxiation of personne	
Safeguards: Operation & Maintenance (O&M) Procedure. Manual selector to inhibit release when people are inside. Inergen is not considered asphyxiant based on concentration	
Recommendation: Verify with the BESS supplier the type of fire suppression system and update HER if required	
Responsible Part: CROSSWIND	
Response: The only active (chemical) suppression in the BESS system are the Stat-x cartridges. They are located inside the battery cabinets inside the 2 BESS containers. In the HAZID this scenario is considered a 4C with potential to harm personnel in the container during activation of the fire suppression system leading to asphyxiation. Due to local release of the fire suppression in the BESS cabinets, it will not remove oxygen from the container causing asphyxiation. According to MSDS the release of Stat-x may cause temporary, mild irritation of mucous membranes if inhaled (H335). Additionally, it may cause skin and eye irritation (H315/319). It is not highly toxic and therefore, Ranking can be reduced to a 3C in HAZID.	
Ref. Docs / Dwgs.: 123A90-DDL-EL-DG-20015; 123A90-DDL-PP-DS-70070;123A90-DDL-PR-DG-80003; 123A90-DDL-PR-DG-80004;123A90-DDL-PR-DG-80005;123A90-DDL-PR-DG-80006; 123A90-DDL-PR-DG-80007; 123A90-DDLPR-DG-80008	

RESPONSE ACCEPTANCE

Company Discipline Leader:	**Signature:** *Alessandro Sutto*	**Date:** 01/10/2024
Company HSE Leader:	**Signature:** Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.01 12:55:29 +02'00'	**Date:**
Company Project Manager:	**Signature:** Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.02 08:20:12 +02'00'	**Date:**
Contractor received for information. Not independently verified. Information Implemented :	**Signature:**	**Date:**

CROSSWIND ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK Project

Base Load Power Hub (BLPH)

Action N : 03	**Rev.:** 001
Action Title: HAZID Study	**Date:** 05/10/2023
Reference Document n:	
Node: 1-Electrical System	
Hazard/Parameter: Hydrogen	**Deviation Cadmium compounds and other**
Cause: Leakage from UPS	
Consequence: Potential for personnel injury if exposed	
Safeguards: Operation & Maintenance (O&M) Procedure. Manual selector to inhibit release when people are inside. Inergen is not considered asphyxiant based on concentration	
Recommendation: Check the risk ranking based on Company Health SME and update the HER if required	
Responsible Part: CROSSWIND	
Response: Internal HSE Risk register has been checked , CW comfirm the exposure risk to UPS battery counpond is to be considered not applicable.	
Ref. Docs / Dwgs.: 123A90-DDL-EL-DG-20015; 123A90-DDL-PP-DS-70070;123A90-DDL-PR-DG-80003; 123A90-DDL-PR-DG-80004;123A90-DDL-PR-DG-80005;123A90-DDL-PR-DG-80006; 123A90-DDL-PR-DG-80007; 123A90-DDLPR-DG-80008	

RESPONSE ACCEPTANCE

Company Discipline Leader: Le Brun N. **Signature:** LE BRUN **Date:** 25-09-2024

Company HSE Leader: **Signature:** Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.01 10:24:53 +02'00' **Date:**

Company Project Manager: **Signature:** Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.02 08:22:23 +02'00' **Date:**

Contractor received for information. Not independently verified. Information Implemented : **Signature:** **Date:**

CROSSWIND ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK Project

Base Load Power Hub (BLPH)

Action N : 04	**Rev.:** 001
Action Title: HAZID Study	**Date:** 05/10/2023
Reference Document n:	
Node: 1-Electrical System	
Hazard/Parameter: Cadmium compounds and other heavy metals	**Deviation**
Cause: Leakage from UPS	
Consequence: Potential for personnel injury if exposed	
Safeguards: Operation & Maintenance (O&M) Procedure. Manual selector to inhibit release when people are inside. Inergen is not considered asphyxiant based on concentration	
Recommendation: Evaluate the possibility to use portable eye wash and shower	
Responsible Part: ROSETTI Technical Safety	
Response: Due to typology and number of site visit (scheduled inly twice a year), it has been decided that personnel will bring the portable eye wash prior each visit to the platform.	
Ref. Docs / Dwgs.: 123A90-DDL-EL-DG-20015; 123A90-DDL-PP-DS-70070;123A90-DDL-PR-DG-80003; 123A90-DDL-PR-DG-80004;123A90-DDL-PR-DG-80005;123A90-DDL-PR-DG-80006; 123A90-DDL-PR-DG-80007; 123A90-DDLPR-DG-80008	

RESPONSE ACCEPTANCE

Discipline Leader: Edoardo Carminati	**Signature:**	**Date: 05/08/2024**
HSE Leader: Carolina Caracciolo	**Signature:** CC	**Date: 05/08/2024**
Project Engineering Manager: Davide Lo Sterzo	**Signature:**	**Date: 05/08/2024**
Company:	**Signature:** Digitaal ondertekend door Paul van Rossum Datum: 2024.08.21	**Date:**

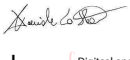
CROSSWIND ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK Project

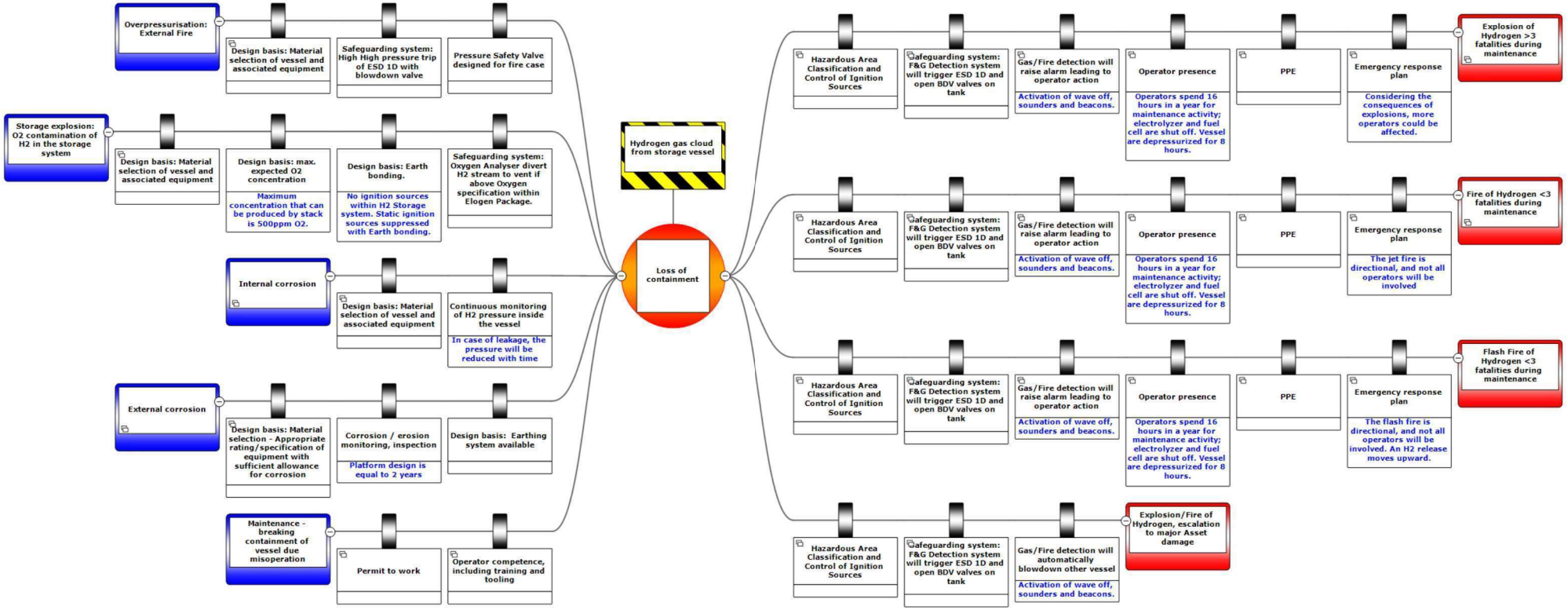
Base Load Power Hub (BLPH)

Action N : 5	**Rev.:** 001
Action Title: HAZID Study	**Date:** 05/10/2023
Reference Document n:	
Node:2-Hydrogen System	
Hazard/Parameter: Hydrogen	**Deviation**
Cause: Leakage from Hydrogen system.	
Consequence: Potential of Explosion. **Jet fire & impingement to adjacent vessel.** **Escalation.** **Invisible flames.**	
Safeguards: Fire & gas detection.Hydrogen Storage vessels segregated based on Leak Size Analysis -Technical Note (K559-2254-SE-TEN-001 Rev 0).Material selection.Emergency Shutdown.Fire Protection.Minimisation of Leak Sources.	
Recommendation: Develop a bow-tie for hydrogen hazard	
Responsible Part: ROSETTI & CROSSWIND Technical Safety	
Response: Bow-tie has been developed for hydrogen hazard. See 123A90-DDL-SAF-RE-30011 – ALARP Term of Reference attached	
Ref. Docs / Dwgs.: 123A90-DDL-EL-DG-20015; 123A90-DDL-PP-DS-70070;123A90-DDL-PR-DG-80003; 123A90-DDL-PR-DG-80004;123A90-DDL-PR-DG-80005;123A90-DDL-PR-DG-80006; 123A90-DDL-PR-DG-80007; 123A90-DDLPR-	

RESPONSE ACCEPTANCE

Discipline Leader: Edoardo Carminati	**Signature:** 	**Date: 05/08/2024**
HSE Leader: Carolina Caracciolo	**Signature:** CC	**Date: 05/08/2024**
Project Engineering Manager: Davide Lo Sterzo	**Signature:** 	**Date: 05/08/2024**
Company:	**Signature:** Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.12.04 20:27:28 +01'00'	**Date:**

APPENDIX 4 – BOW-TIE



CROSSWIND ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK Project

Base Load Power Hub (BLPH)

Action N : 06	**Rev.:** 001
Action Title: HAZID Study	**Date:** 05/10/2023
Reference Document n:	
Node: 2-Hydrogen System	
Hazard/Parameter: Hydrogen	**Deviation Hydrogen**
Cause: Venting of hydrogen when flying object is operating in the wind farm	
Consequence: Potential ignition of the vent Increased turbolence and potential for flying object crash (Risk not ranked because it is a Crosswind general hazard instead of a BLPH specific one)	
Safeguards: Vent dispersion and radiation study (to indicate the area affected by dispersion of fire)	
Recommendation: Ensure a no-fly zone is established around the facilities if required	
Responsible Part: CROSSWIND	
Response: Exclusion zone around BLPH will be implemented offshore by the Marine coordination, similar to the wind farm. Same altitude flight restriction for helicopter flying above the Crosswind wind turbine will apply for the BLPH. Hydrogen hazard with with the presence of the BLPH offshore has been reported to the Dutch Aviation Authorities , including BLPH exact GPS coordinates. Aviation Authorities will implement specific H2 warning mark on the aviation map prior the start of the offshore commissioning.	
Ref. Docs / Dwgs.	

RESPONSE ACCEPTANCE

Company Discipline Leader:	N LE BRUN	**Signature:**	LE BRUN	**Date:** 26/09/2024
Company HSE Leader:		**Signature:**	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.01 10:25:25 +02'00'	**Date:**
Company Project Manager:		**Signature:**	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.02 08:23:21 +02'00'	**Date:**
Contractor received for information. Not independently verified. Information Implemented :		**Signature:**		**Date:**

CROSSWIND

ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK Project

Base Load Power Hub (BLPH)

Action N : 07	**Rev.:** 001
Action Title: HAZID Study	**Date:** 05/10/2023
Reference Document n:	
Node: 2-Hydrogen System	
Hazard/Parameter: Excessive N2	**Deviation Excessive N2**
Cause: Leakage of nitrogen within electrolyzer container	
Consequence: Fatality	
Safeguards: Forced ventilation inside container. Operating and maintenance procedure	
Recommendation: Verify that electrolyzer container is not considered a confined space	
Responsible Part: CROSSWIND	
Response: Crosswind has received written confirmation from Elogen that the electrolyser process container will be classified as confined space area.	
Ref. Docs / Dwgs.	

RESPONSE ACCEPTANCE

Company Discipline Leader: N LE BRUN	**Signature:** LE BRUN		**Date:** 26-09-2024
Company HSE Leader:	**Signature:** Paul van Rossum	Digitaal ondertekend door Paul van Rossum Datum: 2024.10.01 10:25:49 +02'00'	**Date:**
Company Project Manager:	**Signature:** Dominik Sznajder	Digitally signed by Dominik Sznajder Date: 2024.10.02 08:23:56 +02'00'	**Date:**
Contractor received for information. Not independently verified. Information Implemented :	**Signature:**		**Date:**

CROSSWIND ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK Project

Base Load Power Hub (BLPH)

Action N : 8	**Rev.:** 001
Action Title: HAZID Study	**Date:** 05/10/2023
Reference Document n:	
Node:3- Water&Utilities	
Hazard/Parameter: Bottled gases under pressure	**Deviation**
Cause: Potential dropped objects on nitrogen bottle	
Consequence: Potential for rupture causing missiles potentially leading to fatality	
Safeguards: Bottles to be stored in secure area. Material handling philosophy. Lifting & Dropped object plan. Nitrogen distribution network to minimise handling of bottles.	
Recommendation: Establish requirements for nitrogen bottle on the platform. Update HER if required	
Responsible Part: ROSETTI Technical Safety	
Response: No nitrogen bottle is present on the platform, thus the cause is eliminated.	
Ref. Docs / Dwgs.: 123A90-DDL-EL-DG-20015; 123A90-DDL-PP-DS-70070;123A90-DDL-PR-DG-80003; 123A90-DDL-PR-DG-80004;123A90-DDL-PR-DG-80005;123A90-DDL-PR-DG-80006; 123A90-DDL-PR-DG-80007; 123A90-DDLPR-	

RESPONSE ACCEPTANCE

Discipline Leader: Edoardo Carminati	**Signature:**	**Date: 05/08/2024**
HSE Leader: Carolina Caracciolo	**Signature:** CC	**Date: 05/08/2024**
Project Engineering Manager: Davide Lo Sterzo	**Signature:**	**Date: 05/08/2024**
Company:	**Signature:** Digitaal ondertekend door Paul van Rossum Datum: 2024.08.21 08:28:11 +02'00'	**Date:**

CROSSWIND ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK Project

Base Load Power Hub (BLPH)

Action N : 9	**Rev.:** 001
Action Title: HAZID Study	**Date:** 05/10/2023
Reference Document n:	
Node:3- Water&Utilities	
Hazard/Parameter: Ultraviolet radiation	**Deviation**
Cause: UV radiation from water filter	
Consequence: No significant consequence	
Safeguards:	
Recommendation: Vendor to confirm that UV radiation is safe	
Responsible Part: ROSETTI Mechanical Engineer	

Response:

PSC confirm that the UV lamp is installed inside a close stainless-steel cylindrical chamber. For this reason, since the lamp is isolated from the ambient (not visible and reachable), there is no risk associated to the field operator

Please see GENERAL ARRANGEMENT - UV PACKAGE AND DATA SHEET / Document Number: 1724000448-MAC-DA-00011

Ref. Docs / Dwgs.:
123A90-DDL-EL-DG-20015; 123A90-DDL-PP-DS-70070;123A90-DDL-PR-DG-80003; 123A90-DDL-PR-DG-80004;123A90-DDL-PR-DG-80005;123A90-DDL-PR-DG-80006; 123A90-DDL-PR-DG-80007; 123A90-DDLPR-

RESPONSE ACCEPTANCE

Discipline Leader: F. Mura	**Signature:**		**Date:** 02/08/2024
HSE Leader: Carolina Caracciolo	**Signature:**	CC	**Date:** 30/08/2024
Project Engineering Manager: Davide Lo Sterzo	**Signature:**		**Date:** 30/08/2024
Company:	**Signature:**	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.12.20 08:16:48 +01'00'	**Date:**

Base Load Power Hub (BLPH)

GENERAL ARRANGEMENT - UV PACKAGE AND DATA SHEET

Document Number: 1724000448-MAC-DA-00011

Document Class: 3

Rev.	Date	Description	Prepared	Reviewed	Approved
02	30/08/2024	Issue for Information (IFI)	WR	RM	RM
01	22/07/2024	Issue for Information (IFI)	WR	RM	RM
00	05/06/2024	Issue for Information (IFI)	ED	RM	RM

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File: 1724000448-MAC-DA-00011_Rev.02_GENRAL ARRANGEMENT - UV PACKAGE AND DATA SHEET.pdf Any document printed shall be considered as "NOT CONTROLLED" copy

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SH.	DESCRIPTION	REVISIONS							
		00	01	02					
1	Cover	X	X	X					
2	Table of Contents	X	X	X					
3	Revision / Change Log	X	X	X					
4	Drawing	X	X	X					
5	Datasheet	X	X	X					

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Revision / Change Log

Rev.	Description
00	ISSUE FOR INFORMATION(IFI)
01	ISSUE FOR INFORMATION(IFI)
02	ISSUE FOR INFORMATION(IFI)

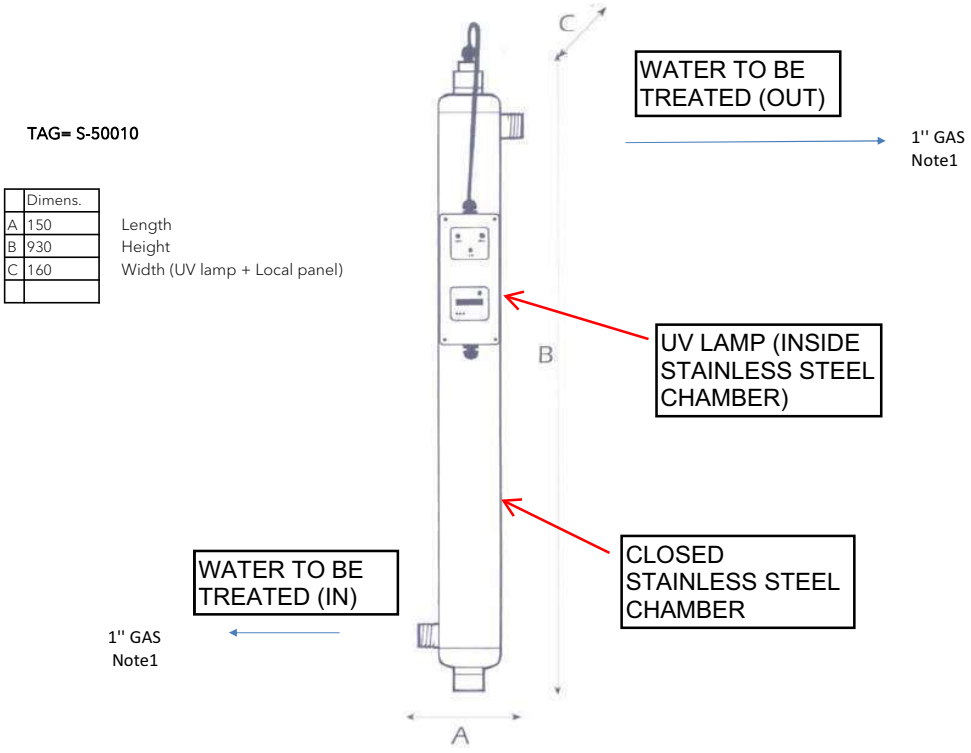
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Supplier: NOBEL

Models:1S



	Dimens.	
A	150	Length
B	930	Height
C	160	Width (UV lamp + Local panel)

Note 1: Process connection threaded 1" Gas (Male)

REFERENCE DOCUMENTS	
1724000448-MAC-DA-00005	GENERAL ARRANGEMENT DRAWINGS AND FOUNDATIONS LAODING CALCULATIONS
1724000448-PR-PID-00013	WATER TREATMENT PACKAGE-P&I DIAGRAM

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UV PACKAGE DATA SHEET

SPECIFICA PER LAMPADA UV

	PLANT: Impianto **Water treatment package**	**CUSTOMER:** Cliente **Rosetti Marino S.p.A**	**Page: 5/5**
	LOCATION: Località **HOLLANDSE KUST NOORD**	**JOB:** Commessa **PK2885**	**ITEM:** Sigla **S-50010**
DEPARTMENT : Reparto	**P&I :** **172400448-PR-PID-00013**	**MFR:** Costruttore **Nobel**	**DOC.Nr.** Doc. Nr. **PK2885-M-001**

1	SERVICE OF UNIT / Servizio:	**UV STERILIZER**		No. OF UNITS / No. di unità:	**1**
2	FLUID HANDLED / Fluido trattato:				**Fresh Water (TDS 350ppm)**
3	FLOW RATE / Portata:	OPERATING INLET	m^3/h		**0,8**
4	OPERATING / DESIGN PRESSURE / Pressione di esercizio /progetto		barg		**5 / 8**
5	OPERATING TEMPERATURE / Temperatura di esercizio:		°C		**10 / 20.2**
6	FLUID DENSITY/ Densità:		kg/m^3		**1000**
7	FLUID VISCOSITY / Viscosità:		mPa sec		**1,00**
8	DESIGN TEMPERATURE / Temperatura di progetto:		°C		**50**
9	UV STERILIZER DIMENSIONS		mm		**Please refer to sheet 4**
10	UV STERILIZER WEIGHT		kg		**15 (50 full)**
11	VESSELMATERIAL				**AISI 316**
12	LAMP / FLUID SEPARATORS				**Quartz Sleeves**
13	LIGHT SPECTRUM		Nm		**254**
14	CORROSION ALLOWANCE / Sovraspessore di corrosione:		mm		**-**
15	CONNECTIONS / Connessioni	IN /OUT			**1" GAS Male**
16		DRAIN / Scarico:			**1" GAS Male**
17		VENT / Sfiato:			**N.A.**
18	POWER SUPPLY		W		**40**
19	THERMAL INSULATION TYPE / Tipo isolamento:	**N.A.**	THICKNESS / Spessore: mm		**N.A.**
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					
38	**REMARKS**				
39					
40					
41					

REV. Rev.	DATE Data	DESCRIPTION Descrizione	PREPARED Compilato da	CHECKED Controllato da	APPR. BY Approvato da
2	30/08/2024	Issued for Information	WR	RM	RM
1	22/07/2024	Issued for Information	IT	WR	RM
0	24/06/2024	Issued for Information	IT	WR	RM

CROSSWIND ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK Project

Base Load Power Hub (BLPH)

Action N : 10	**Rev.:** 001
Action Title: HAZID Study	**Date:** 05/10/2023
Reference Document n:	
Node:3- Water&Utilities	
Hazard/Parameter: Chlorine	**Deviation**
Cause: Production of hydrogen from the electrolysis process	
Consequence: Production of hydrogen leading to formation of explosive atmosphere	
Safeguards:	
Recommendation: Verify with Vendor the amount of hydrogen produced by electroclorination package. Update the risk ranking and HER based on the outcome of this verification	
Responsible Part: ROSETTI Technical Safety	
Response: The current configuration of the package features a biocide injection, instead of electroclorination package. Biocide injection does not produce hydrogen. Hence the risk ranking and HER necessity no update. This solution has been shared with Crosswind as describe in vendor offers and TBE reviewed by Crosswind	
Ref. Docs / Dwgs.: 123A90-DDL-EL-DG-20015; 123A90-DDL-PP-DS-70070;123A90-DDL-PR-DG-80003; 123A90-DDL-PR-DG-80004;123A90-DDL-PR-DG-80005;123A90-DDL-PR-DG-80006; 123A90-DDL-PR-DG-80007; 123A90-DDLPR-	

RESPONSE ACCEPTANCE

Discipline Leader:	**Signature:**	**Date: 20-08-2024**
HSE Leader: Carolina Caracciolo	**Signature:** CC	**Date: 23/02/2024**
Project Engineering Manager: Davide Lo Sterzo	**Signature:**	**Date: 23/02/2024**
Company:	**Signature:** Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.01 14:03:47 +02'00'	**Date:**

47	**ELECTRO-CHLORINATOR**			**REPLACED WITH NON OXIDIZING BIOCIDE DOSING UNIT** **Detail below according to the proposed solution**	OFFER/TQ

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CROSSWIND

VENDOR IS ALLOWED TO INSERT ADDITIONAL ROWS TO BETTER DETAIL THE DESCRIPTION OF SUPPLY, BY USING RED COLORAND BOLD CHARACTER

HOLLANDSE KUST NOORD WIND PARK Project

Discipline: **MEC** System & Sub-sys:

Document Type: Equipment Type: **Water Treatment Package** **Attachment to TBE 123A90-DDL-MAC-TBE-50024**

POS.	DESCRIPTION	UNIT	REQUIREMENT	Bidder: PSC Offer no. OF6739 Revised offer: Rev.03 BIDDER DATA	CLARIFIED WITHIN
48	Quantity		1	Confirmed	OFFER/TQ
49	Media to be treated		Sea Water form Coarse filter	Confirmed	OFFER/TQ
50	~~Brine Supply Flow (Design)~~	m^3/h	~~6~~	100 Lt tank (with mixer)	OFFER/TQ
51	~~Brine Supply Pressure~~	barg	~~8,5~~	Tank Material :PP or PE	OFFER/TQ
52	~~Brine Supply Temperature~~	°C	~~1,3 ÷ 22,6~~	Tank des : Full liquid	OFFER/TQ
53	~~Clorine Capacity~~	g/h	VTA	Biocide pumps : dosing type, manual control (10÷100%)	OFFER/TQ
54	~~Hypoclorite Concentration~~	mg/l	VTA	2x100% dosing pump to sea water caisson	OFFER/TQ
55	~~Sea Water Flowrate Inlet~~	m^3/h	VTA	2x100% to inlet of WT Package	OFFER/TQ
56	~~Design Pressure~~	barg	VTA	2x100% dosing pump to waste water tank	OFFER/TQ
57	~~Electrodes Material~~		~~Suitable for Sea Water~~	Pumps Material: membrane PTFE	OFFER/TQ
58	~~Electolyzer absorbed power~~	W	VTA	Not applicable	OFFER/TQ
59	Power Supply Required	V/Ph/Hz	VTA	0,37 kW- 400/3/50	OFFER/TQ

CROSSWIND ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK Project

Base Load Power Hub (BLPH)

Action N : 11	**Rev.:** 001
Action Title: HAZID Study	**Date:** 05/10/2023
Reference Document n:	
Node:3- Water&Utilities	
Hazard/Parameter: Scale inhibitors	**Deviation**
Cause: Leakage from stored chemicals (e.g. nitric acid / acetic acid etc)	
Consequence: Potential Environmental consequence and personnel injury	
Safeguards: Bund's provided where required to contain leakages from storage tanks. Chemical selection to minimise environmental impact.	
Recommendation: Clarify type of chemical used as scale inhibitor and update HER afterwards, if required	
Responsible Part: ROSETTI Technical Safety	

Response:

The chemicals used in the WTP A-50000 are the following:

Biocide → EB-Biocide Plus (Everblue SRL). The product is classified as hazardous pursuant to the provisions set forth in (EC) Regulation 1272/2008 (CLP). For safety operation please refer to applicable Safety datasheet in order to manage safety and correctly the chemical. The tank material is compatible with the chemical used to avoid leakage problem due to tank corrosion. This substance has to be considered as 4B risk ranking categorization on people (see below extract from MSDS)

- Antiscalant → EVERBLUE 600 (Everblue SRL).. The product does not contain substances classified as being hazardous to human health or the environment pursuant to the provisions Regulation (EC) 1272/2008 (CLP) (and subsequent amendments and supplements) in such quantities as to require the statement. No need to update the HER (see below extract from MSDS)

For safety operation please refer to applicable Safety datasheet. The tank material is compatible with the chemical used to avoid leakage problem due to tank corrosion.

Caustic Soda (2% solution): the product is classified as hazardous. For the water treatment package, Caustic soda 20% shall be diluted with demineralised water on shore to obtain a Caustic soda solution 2%, then will be transported off-shore. 1B risk ranking categorization on people is considered, according with MSDS, for this substance (see below extract from MSDS)

On shore the operator shall follow the safety product datasheet during the dilution operation.

Ref. Docs / Dwgs.:

123A90-DDL-EL-DG-20015; 123A90-DDL-PP-DS-70070;123A90-DDL-PR-DG-80003; 123A90-DDL-PR-DG-80004;123A90-DDL-PR-DG-80005;123A90-DDL-PR-DG-80006; 123A90-DDL-PR-DG-80007; 123A90-DDLPR-DG-80008

RESPONSE ACCEPTANCE

Discipline Leader: Edoardo Carminati	**Signature:**	**Date:30/08/2024**
HSE Leader: Carolina Caracciolo	**Signature:** CC	**Date:** 30/08/2024
Project Engineering Manager: Davide Lo Sterzo	**Signature:**	**Date:** 30/08/2024
Company: Nicolas Le Brun	**Signature:** LE BRUN Signer ID: 5VSEXLUIBO...	**Date:** 04/09/2024

EVERBLUE EB-BIOCIDE PLUS MSDS:

Everblue	**EVERBLUE SRL**	Revision nr. 11
	EB-BIOCIDE PLUS	Dated 24/01/2023 Printed on 09/08/2023 Page n. 2/17 Replaced revision:10 (Printed on: 28/03/2022)

Any additional information concerning the risks for health and/or the environment are given in sections 11 and 12 of this sheet.

Hazard classification and indication:

Acute toxicity, category 4	H302	Harmful if swallowed.
Acute toxicity, category 4	H332	Harmful if inhaled.
Specific target organ toxicity - repeated exposure, category 1	H372	Causes damage to organs through prolonged or repeated exposure.
Serious eye damage, category 1	H318	Causes serious eye damage.
Skin irritation, category 2	H315	Causes skin irritation.
Skin sensitization, category 1	H317	May cause an allergic skin reaction.
Hazardous to the aquatic environment, chronic toxicity, category 2	H411	Toxic to aquatic life with long lasting effects.

EVERBLUE 600 MSDS:

	EVERBLUE 600	Printed on 21/04/2023 Page n. 1/11 Replaced revision:5 (Printed on: 31/01/2018)

Information Sheet outside the scope of application of art. 31 of REACH Regulation

SECTION 1. Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product name **EVERBLUE 600**

1.2. Relevant identified uses of the substance or mixture and uses advised against

Intended use **Antiscalant for membranes**

Identified Uses	Industrial	Professional	Consumer
Additive for industrial water treatment	✔	-	-

Uses Advised Against

Any use not included among those recommended

1.3 Details of the supplier of the safety data sheet

Name	**EVERBLUE SRL**
Full address	**Via Alberto Zanrè, 16**
District and Country	**43051 - Loc. Gotra - Albareto (PR)** **Italia**
	tel. 0039 0525 1920100
Produced for Everblue S.r.l. by:	**N. 408994 REA di Bologna**
e-mail address of the competent person responsible for the Safety Data Sheet	**info@everblue.it**
Resp. for placing on the market:	**EVERBLUE SRL**

1.4. Emergency telephone number

For urgent inquiries refer to **Italia:**
CAV Ospedale Niguarda Ca' Granda - Milano 02 66101029
CAV Azienda Ospedaliera Papa Giovanni XXII - Bergamo 800 883300
CAV Centro Nazionale di Informazione Tossicologica - Pavia 0382 24444
CAV Az. Osp. Careggi - Firenze 055 7947819
CAV Policlinico Gemelli - Roma 06 3054343
CAV Policlinico Umberto I - Roma 06 49978000
CAV Osp. Pediatrico Bambino Gesù - Roma 06 68593726
CAV Az. Osp. Cardarelli - Napoli 081 7472870
CAV Az. Osp. Univ. Foggia - Foggia 800183459

SECTION 2. Hazards identification

2.1. Classification of the substance or mixture

The product is not classified as hazardous pursuant to the provisions set forth in EC Regulation 1272/2008 (CLP) (and subsequent amendments and supplements).

CAUSTIC SODA 20%:

CAUSTIC SODA 20% SOLUTION
Safety Data Sheet

1. MATERIAL AND SUPPLY COMPANY IDENTIFICATION

Product name: CAUSTIC SODA 20% SOLUTION

Synonyms
Sodium Hydroxide 20%

Product Code
399

Recommended use: Cleaner and degreaser.

Supplier Name	**CLEAN PLUS CHEMICALS PTY LTD**
Address	16 George Young Street AUBURN NSW 2144
Telephone	02 9738 7444
Emergency	1800 201 700
Email	customerservice@cleanplus.com.au
Web Site	www.cleanplus.com.au
SDS Date	21 JANUARY 2021 Version 1.2

2. HAZARDS IDENTIFICATION

This material is hazardous according to health criteria of Safe Work Australia.



Signal Word
Danger

Hazard Classifications
Corrosive to Metals - Category 1
Skin Corrosion/Irritation - Category 1A
Serious Eye Damage/Irritation - Category 1

ITEM NO.	HAZARD	THREAT	CONSEQUENCE	SAFEGUARDS	RISK RANKING C-CONSEQUENCE; L-LIKELIHOOD; R-RISK												RECOMMENDATION	OWNER	PROJECT PHASE	COMMENTS
					People				Assets			Community			Environment					
H-20.10	HF	N/A																		
TOXIC LIQUID																				
H-21.01	Mercury	N/A																		
H-21.02	PCBs	N/A																		
H-21.03	Biocides	Refer to H20.05 (Chlorine)																		
H-21.04	Methanol	N/A																		
H-21.05	Brines	Refer to General Node																		
H-21.06	Glycols	N/A																		
H-21.07	Degreasers	N/A																		
H-21.08	Isocyanates	N/A																		
H-21.09	Sulphanol	N/A																		
H-21.10	Amines	N/A																		
H-21.11	Corrosion Inhibitors	N/A																		
H-21.12	Scale inhibitors	Leakage from stored chemicals *(e.g. nitric acid / acetic acid etc)*	Potential Environmental consequence and personnel injury	Bund's provided where required to contain leakages from storage tanks. Chemical selection to minimise environmental impact.	4		B	4B						1	B	1B	Clarify type of chemical used as scale inhibitor and update HER afterwards, if required	Contractor		

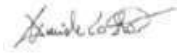
CROSSWIND ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK Project

Base Load Power Hub (BLPH)

Action N : 12	**Rev.:** 001
Action Title: HAZID Study	**Date:** 05/10/2023
Reference Document n:	
Node:3- Water&Utilities	
Hazard/Parameter: Chemicals for Cleaning RO Membrane	**Deviation**
Cause: Leak of Various chemicals (sodium hydroxide, nitric acid, sodium hypochlorite)	
Consequence: Personnel injury.	
Safeguards: Chemical Selection to reduce impact on personnel. Personnel Protective equipment (PPE). Emergency Response Plan (ERP).	
Recommendation: Clarify type of chemical used for cleaning RO membrane and update the HER	
Responsible Part: ROSETTI Technical Safety	
Response: CIP vessel has been replaced with the complete supply of the membranes needed by the process for the 2 years operation. Membranes will be replaced every 6 months. No chemical will be used for the cleaning of RO membrane. No need to update the HER.	
Ref. Docs / Dwgs.: 123A90-DDL-EL-DG-20015; 123A90-DDL-PP-DS-70070;123A90-DDL-PR-DG-80003; 123A90-DDL-PR-DG-80004;123A90-DDL-PR-DG-80005;123A90-DDL-PR-DG-80006; 123A90-DDL-PR-DG-80007; 123A90-DDLPR-	

RESPONSE ACCEPTANCE

Discipline Leader: Edoardo Carminati	**Signature:** 	**Date: 20/08/2024**
HSE Leader: Carolina Caracciolo	**Signature:** CC	**Date: 20/08/2024**
Project Engineering Manager: Davide Lo Sterzo	**Signature:** 	**Date: 20/08/2024**
Company:	**Signature:** Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.12.20 08:18:33 +01'00'	**Date:**

CROSSWIND | ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK Project

Base Load Power Hub (BLPH)

Action N : 13	**Rev.:** 001
Action Title: HAZID Study	**Date:** 05/10/2023
Reference Document n:	
Node:3- Water&Utilities	
Hazard/Parameter: Small animals	**Deviation**
Cause: Marine growth or small marine faune	
Consequence: Blockage of sea water intake systems. Impact to process. Potential for fish decomposing and health effect to personnel (scenario not ranked as not sufficient information are available)	
Safeguards: Sea water filtration & chemical dosing systems. Screen on the suction side of pumps. Backwash filter cleaning.	
Recommendation: Verify with Sea Water Treatment System Vendor if it is possible to have fish trapped and decomposing in the package	
Responsible Part: ROSETTI Mechanical	
Response: The feed water is delivered by P-50001 A/B out of WTP vendor scope. The pump has been purchased by RM. Pump feature a suction screen 7 mm mesh size, to avoid entry of foreign objects that could clog the pump. Pump internals, and caisson are injected with biocide to avoid presence of microorganisms, muscles spores, algae's, and very small fishes. According with Vendor, tighter mesh is not possible, because affect suction of the pump.	
Ref. Docs / Dwgs.: 123A90-DDL-EL-DG-20015; 123A90-DDL-PP-DS-70070;123A90-DDL-PR-DG-80003; 123A90-DDL-PR-DG-80004;123A90-DDL-PR-DG-80005;123A90-DDL-PR-DG-80006; 123A90-DDL-PR-DG-80007; 123A90-DDLPR-	

RESPONSE ACCEPTANCE

Discipline Leader:	**Signature:**		**Date:20-08-2024**
HSE Leader: Carolina Caracciolo	**Signature:**	**CC**	**Date: 20-08-2024**
Project Engineering Manager: Davide Lo Sterzo	**Signature:**		**Date: 20-08-2024**
Company:	**Signature:**	Digitaal ondertekend door Paul van Rossum Datum: 2024.08.23 14:08:26 +02'00'	**Date:**

Base Load Power Hub (BLPH)

PUMP DATA SHEETS INCLUDING WEIGHT DATA SHEET
For Sea Water Lift Progressive Cavity Pumps (P-50001 A/B)

Document Number: 1724000936-MAC-DS-00012

Document Class: 2

01	18/07/2024	Accepted for Construction (AFC)	APD	GLL	AHN
00	24/06/2024	Issue for Review (IFR)	APD	GLL	AHN
Rev.	Date	Description	Prepared	Reviewed	Approved

PCM | keep it moving

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Rev.	Description
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01	Accepted for Construction (AFC)

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CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project Contract No. CW-I-WP4-2023-05	ROSETTI MARINO
Document Title:	PUMP DATA SHEETS	Sh. 3 of 7 Date : 18/07/2024 Rev. 01

NOTE: ○ INDICATES INFORMATION TO BE COMPLETED BY PURCHASER ☐ BY MANUFACTURER

GENERAL

NO. MOTORS DRIVEN	2 (TWO)	OTHER DRIVER TYPE			
PUMP ITEM NO'S	P-5001A/B	PUMP ITEM NO'S			
MOTOR ITEM NO'S	PM-5001A/B	DRIVER ITEM NO'S		GEAR ITEM NO'S	
MOTOR PROVIDED BY	ABB	DRIVER PROVIDED BY	N/A	GEAR PROVIDED BY	NORD
MOTOR MOUNTED BY	PUMP VENDOR	DRIVER MOUNTED BY	N/A	GEAR MOUNTED BY	PUMP VENDOR
MOTOR DATA SHEET NO.	1724000936-MAC-DS-00014	DRIVER DATA SHEET NO.		GEAR DATA SHEET NO.	

● OPERATING CONDITIONS

- ● CAPACITY @ PT (m³/h):
  - @ MAXIMUM VISCOSITY _____ @ MIN. VISCOSITY **2,5**
- ● DISCHARGE PRESSURE (kPa)(BARG):
  - MAXIMUM **5.3 (note 3)** MINIMUM _____
- ● SUCTION PRESSURE (kPa)(BARG):
  - MAXIMUM _____ MINIMUM **Flooded (note 1)**
- ● DIFFERENTIAL PRESSURE (kPa)(BARG)
  - MAXIMUM _____ MINIMUM **(note 3)**
- ● NPSH AVAILABLE (m) **>7 @ level +0,00 (note 1)**
- ○ HYDRAULIC kW _____

PSV Set Value : 7.6 barg

● LIQUID

- ● TYPE OR NAME OF LIQUID **SEA WATER**
- ● PUMPING TEMPERATURE (°C):
  - NORMAL **20** MAX _____ MIN **1,3**
- ● SPECIFIC GRAVITY **1,03** MAXIMUM **1,02** MINIMUM
- ○ SPECIFIC HEAT _____ Cp (kJ/kg °C)
- ● VISCOSITY (Cp) **0,9** MINIMUM _____ MAXIMUM
- ● CORROSIVE/EROSIVE AGENTS **SAND/SALT PARTICLES**
- ● CHLORIDE CONCENTRATION (PPM) max 35,000 ppm
- ○ H_2S CONCENTRATION (PPM) _____

LIQUID ○ TOXIC ○ FLAMMABLE ○ OTHER _____

Fluid considered with no H2S / C02 / BTEX and TSS < 5%

■ PERFORMANCE

- ■ RATED CAPACITY (m³/h) **2,5**
- ■ NPSH REQUIRED (m) **0.56 mH2O**
- ■ RATED SPEED (RPM) **118**
- ■ DISPLACEMENT (m³/h) **3,3**
- ■ VOLUMETRIC EFFICIENCY (%) **81,6**
- ■ MECHANICAL EFFICIENCY (%) **56,7**
- ■ kW @ MAXIMUM VISCOSITY **1,45**
- ■ kW @ RELIEF VALVE SETTING **1,55**
- ■ MAXIMUM ALLOWABLE SPEED (RPM) **450**
- ■ MINIMUM ALLOWABLE SPEED (RPM) **100**

■ CONSTRUCTION

	SIZE	ANSI RATING	FACING	POSITION
CONNECTIONS				
SUCTION				**BOTTOM**
DISCHARGE	**1" 1/2**	**150#**	**RF**	**SIDE**
MOUNTING	**16"**	**150#**	**RF**	
DRAINS				
VENTS				
JACKET				

PUMP TYPE:

- ☐ INTRN'L GEAR ☐ TWIN-SCREW ☐ VANE
- ☐ EXTRN'L GEAR ☐ 3-SCREW ■ PROGRESSING CAVITY

GEAR TYPE

- ☐ SPUR ■ HELICAL
- ☐ OTHER _____

● SITE AND UTILITY DATA

LOCATION ○ INDOOR ● OUTDOOR

○ HEATED ● UNHEATED ○ UNDER ROOF

○ ELECTRICAL AREA CLASS SAFE GROUP _____ DIV _____

○ WINTERIZATION REQD ○ TROPICALIZATION REQD

SITE DATA

○ RANGE OF AMBIENT TEMPS:MIN/MAX -8 / 25 °C

UNUSUAL CONDITIONS

○ DUST ○ FUMES ● SALT ATMOSPHERE

○ OTHER _____

○ UTILITY CONDITIONS

ELECTRICITY	DRIVERS	HEATING	CONTROL	SHUTDOWN
VOLTAGE	**400**			
HERTZ	**5**			
PHASE	**50**			

COOLING WATER	INLET	RETURN	DESIGN	MAX Δ
TEMP °C		MAX		
PRESS. (BARG) (kPa)		MIN		
SOURCE				

INSTRUMENT AIR MAX MIN

PRESSURE (kPa)(BARG) _____ _____

APPLICABLE SPECIFICATIONS:

API 676 POSITIVE DISPLACEMENT PUMPS - ROTARY

○ GOVERNING SPECIFICATION (IF DIFFERENT) **(5)**

REMARKS: _____

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CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project Contract No. CW-I-WP4-2023-05	ROSETTI MARINO
Document Title:	PUMP DATA SHEETS	Sh. 4 of 7 Date : 18/07/2024 Rev. 01

CONSTRUCTION (CONTINUED)

CASING

- MAXIMUM ALLOWABLE PRESSURE: 20 (BARG) 20 °C
- HYDROSTATIC TEST PRESSURE: 30 (BARG)
- STEAM JACKET PRESSURE: (BARG) °C
- ROTOR MOUNT: ☐ BTWN. BEARINGS ■ OVERHUNG
- TIMING GEARS: ☐ YES ☐ NO
- BEARING TYPE: ■ RADIAL TIMKEN (2) ☐ THRUST
- LUBRICATION TYPE: ○ CONSTANT LEVEL OILERS
  - ☐ PUMPED FLUID ☐ RING OIL ☐ OIL MIST
  - ☐ EXTERNAL ☐ OIL FLOOD ■ GREASE
- ■ LUBRICANT TYPE: Fuchs Renolin CLP 220
- ● MECHANICAL SEALS
  - ■ MANUFACTURER AND MODEL: Flowserve / ISC2-PX
  - ■ MANUFACTURER CODE: 1CW-FX
- ● API 610 SEAL FLUSH PLAN: API PLAN 51
- ■ API 610 SEAL CODE: 21A-FFQ-060-13/51
- ○ PACKING: ○ LANTERN RING
  - ☐ MFR. AND TYPE ☐ NO. OF RINGS

DRIVE MECHANISM

- ○ DIRECT-COUPLED ○ V-BELT ■ GEAR
- ■ COUPLING MANUFACTURER: John Crane

DRIVERS

- ● MOTOR:
- ■ MANUFACTURER: ABB
- ■ TYPE: 4 poles, safe area induction motor
- ■ FRAME NO.: IEC 132
- ● CONSTANT SPEED
- ○ VARIABLE SPEED
- ■ kW: 5,5 RPM: 1463
- ● VOLTS: 400 PHASE: 3
- ● HERTZ: 50 SERVICE FACTOR: S1
- ● ENCLOSURE: TEFC
- ○
- ○ STEAM TURBINE
- ○ OTHER (SEE SEPARATE DATA SHEETS)

OTHER PURCHASER REQUIREMENTS

- NAMEPLATE UNITS: ○ U.S. CUSTOMARY ● SI
- ● RELIEF VALVES BY PUMP MFRG ● INTERNAL ○ EXTRNL.
- PIPING FOR SEAL FLUSH FURNISHED BY:
  - ● PUMP VENDOR ○ OTHERS
- PIPING FOR COOLING/HEATING FURNISHED BY:
  - ○ PUMP VENDOR ○ OTHERS
- ● PROVIDE TECHNICAL DATA MANUAL

MATERIALS (1)

- ■ CASING: Super Duplex SS (25%Cr)
- ■ STATOR: NBR
- ■ END PLATES: N/A
- ■ ROTOR (S): Super Duplex SS (25%Cr)
- ■ VANES: N/A
- ■ SHAFT: Super Duplex SS (25%Cr)
- ■ SLEEVE (S): Super Duplex SS (25%Cr)
- ■ GLAND (S): Super Duplex SS (25%Cr)
- ■ BEARING HOUSING: Cast Iron
- ■ TIMING GEARS: N/A
- ○ SPECIAL MATERIAL TESTS
- ○ LOW AMBIENT TEMP. MATERIALS TESTS

QA INSPECTION AND TEST

- ● COMPLIANCE WITH INSPECTORS CHECK LIST
- ● CERTIFICATION OF MATERIALS (Material certificate 3.1)
- ● FINAL ASSEMBLY CLEARANCES
- ● SURFACE AND SUBSURFACE EXAMINATIONS
  - ○ RADIOGRAPHY
  - ○ ULTRASONIC
  - ○ MAGNETIC PARTICLE
  - ● LIQUID PENETRANT: 100 % of welds
- ● CLEANLINESS PRIOR TO FINAL ASSEMBLY
- ○ HARDNESS OF PARTS, WELDS & HEAT AFFECTED ZONES
- ○ FURNISH PROCEDURES FOR OPTIONAL TESTS

TESTS	REQ'D	WIT	OBS
HYDROSTATIC	○	●	○
MEHANICAL RUN	○	●	○
PERFORMANCE	○	●	○
NPSH	○	○	○

PREPARATION FOR SHIPMENT

- ● DOMESTIC ○ EXPORT ○ EXPORT BOXING REQ'D
- ○ OUTDOOR STORAGE MORE THAN 6 MONTHS

WEIGHTS (kg)

■ PUMP 1836 ☐ BASE 0 ■ GEAR 26 ■ MOTOR 81

BASEPLATE

- ● BY PUMP MANUFACTURER ○ SUITABLE FOR EPOXY GROUT
- ○ EXTENDED FOR
- ● SUBSOLE PLATES BY PUMP MANUFACTURER
- ○ DRAIN-RIM ○ DRAIN-PAN

REMARKS

(1) DELETED

(2) Shaft sleeves hardnedned in correspondence of plain bearings

Plan 51 will be mounted on the pump assembly and connected to the seal with SS316L tubing and fitting.

Plan 51 is to be filled with clean fresh water. I t needs to be maintained at positive temperature.

Heating Jacket provided by PCM.

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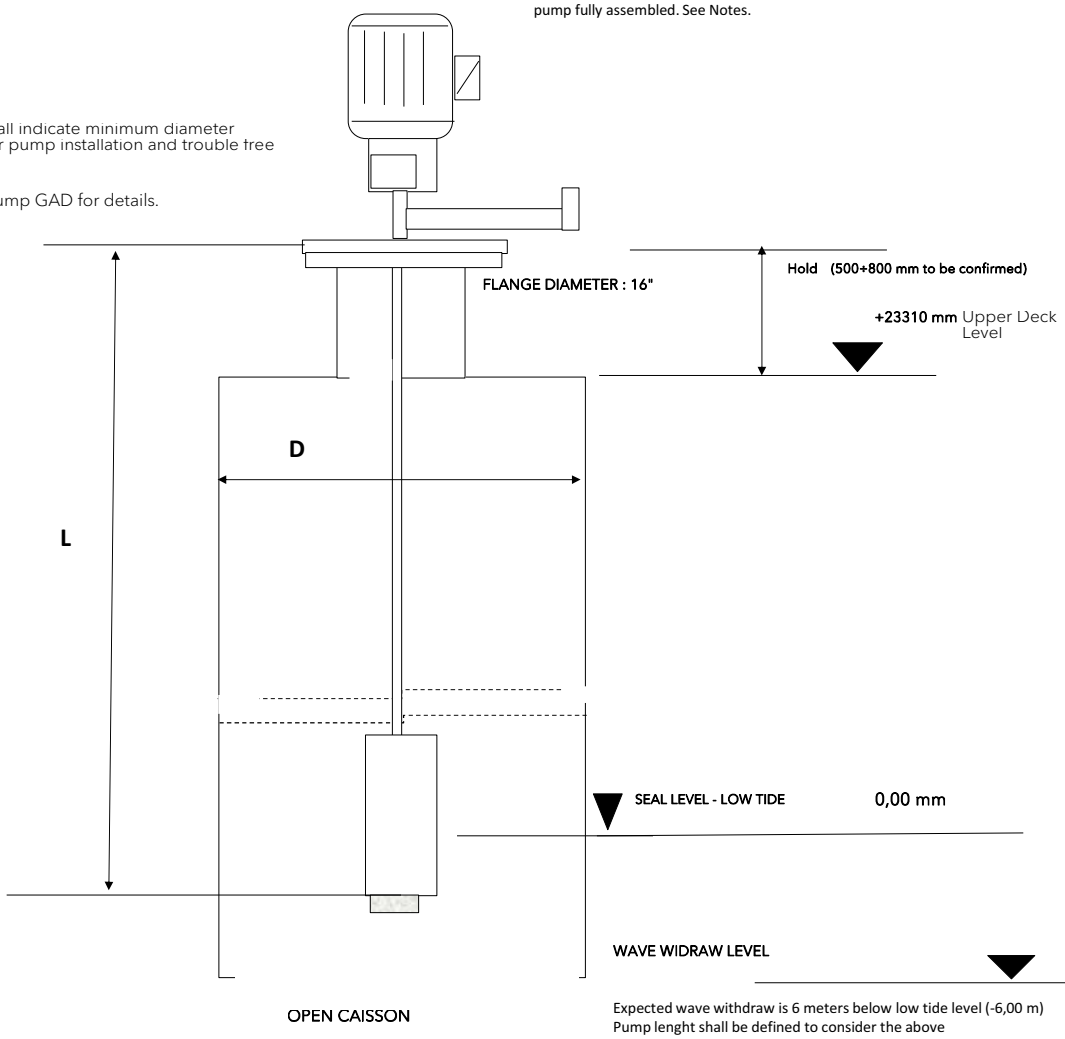
L 30.41 m

D 333.34 mm

NOTE:
Vendor shall indicate minimum diameter suitable for pump installation and trouble free operation

Refer to pump GAD for details.

Vendor to declare the mounting/dismountig clearance considering the pump fully assembled. See Notes.



OPEN CAISSON

Expected wave withdraw is 6 meters below low tide level (-6,00 m)
Pump lenght shall be defined to consider the above

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NOTES

1) For NPSHA vendor to consider 1bara at minimum seawater level (+ 0,00 mm)

2) Pump lenght to be calculated by vendor according to a reliable margin (VTA) between NPSHA vs NPSHR and minimum submergence
Vendor to advise the suction nozzle depth, according to the above sentence

3) Discharge pressure / head is referred to pump battery limit (i.e. dicharge nozzle)

4) Suction strainer to be provided by vendor.
Mesh size is 7mm diameter as per PCM standard design for the selected pumps.
Mesh size shall be minimized without jeopardizing suction condition.

5) Full compliance to API Std 676 is not strictly mandatory. Vendor to submit a list of deviation supported by reference list
Please refer to attached list of technical clarifications & deviations, including API 676.

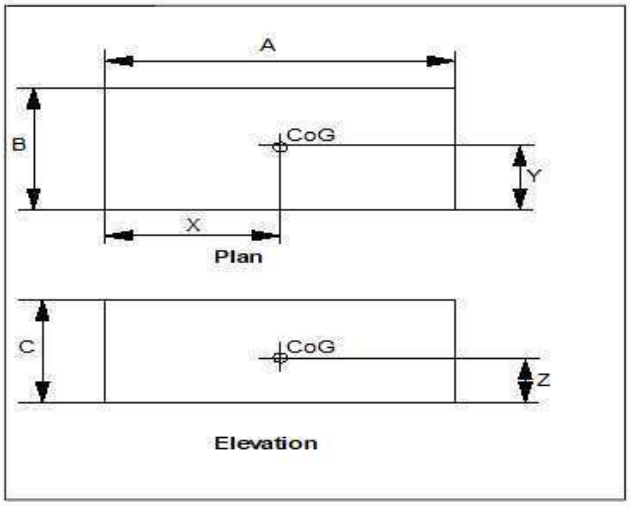
6) Vendor to declare mounting/dismantling clearance considerinf full assmbled pump
For full assembled pump mounting/ dismantling, the required minimum vertical clearance will be the total length of the equipment (including motor & all casing extensions : approx 35 m estimated), plus the required length for slings, depending on the lifting equipment to be used.
the supporting flange elevation.

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WEIGHT DATA (kg)

		Areas for input by Supplier	
Dry Weight	(I)	1943	kg
Content	(II)	2150	kg
Operating Weight	(I+II)	4093	kg
Auxiliaries' weight, included in I (specify under Notes)			kg
Test weight, i.e. filled with water			kg
Transport weight		1943	kg

CENTRE OF GRAVITY (CoG) DATA FOR INSTALLED DRY CONDITION



Overall dimensions		
A =	971	mm
B =	597	mm
C =	32170	mm

CoG location (mm)		
X =	7	mm
Y =	-1	mm
Z =	-12398	mm

NOTES

Datum point considered to locate the C.O.G of the pump is the center of the mounting flange.

WEIGHT AND CoG STATUS (TICK OFF AS APPROPRIATE)

☐ Estimated ☐ Calculated

☐ Catalogue data ☐ Weighed

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CROSSWIND ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK Project

Base Load Power Hub (BLPH)

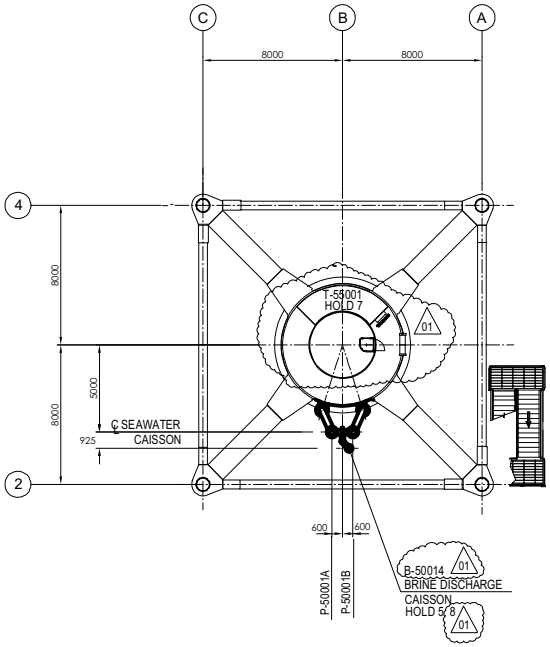
Action N : 14	**Rev.:** 001
Action Title: HAZID Study	**Date:** 05/10/2023
Reference Document n:	
Node: General Node	
Hazard/Parameter: Piracy, hijack, kidnap, terrorism	**Deviation**
Cause: Unauthorised access	
Consequence: Damage to facility	
Safeguards: Surveilance by marine operation HVAC room and electrical room are locked	
Recommendation: Consider to provide physical barrier on the stair	
Responsible Part: ROSETTI Architectural	
Response: An anti-intrusion security gate will be provided at the beginning of the platform access staircase. It will be represented in a Plot Plan Below Lower Deck drawing doc. N. 123A90-DDL-PP-DL-70071.	
Ref. Docs / Dwgs.:	

RESPONSE ACCEPTANCE

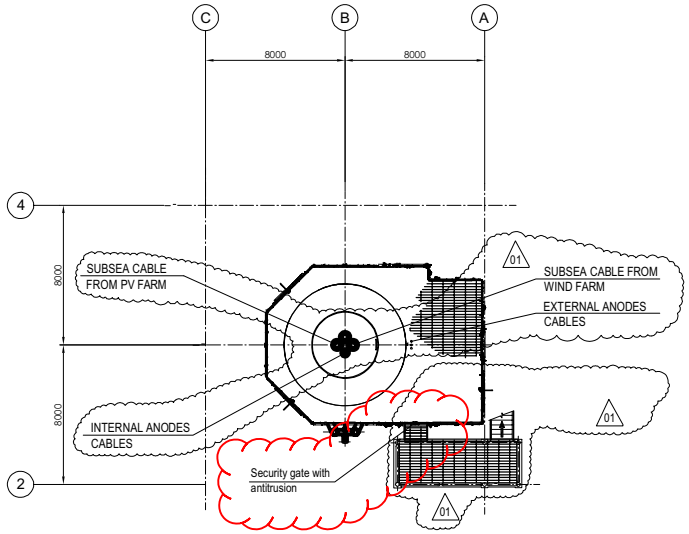
Discipline Leader: Maurizio Gatti	**Signature:** Maurizio Gatti (Autore firma digitale: Maurizio Gatti Nome distintivo: CN = Maurizio Gatti email = maurizio.gatti@rosetti.it C = IT O = Rosetti Marino SpA Data: 2024.02.26 14:46:05 +01'00')	**Date:**	**23/02/2024**
HSE Leader: Carolina Caracciolo	**Signature:** CC	**Date:**	**23/02/2024**
Project Engineering Manager: Davide Lo Sterzo	**Signature:**	**Date:**	**23/02/2024**
Company:	**Signature:** (Digitaal ondertekend door Paul van Rossum Datum: 2024.03.14 16:59:26 +01'00')	**Date:**	

DRAWING NO. 123A90-DDL-PP-DL-70071

REV. 01



PLAN ON TRANSITION PIECE
EL+21.710 T.O.S.

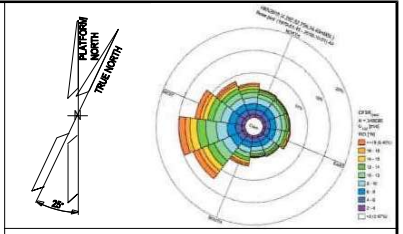


PLAN ON EXISTING
PLATFORM AT
EL+16.860 T.O.S.

EQUIPMENT LIST

TAG NUMBER	DESCRIPTION
P-50001A/B	SEAWATER LIFT PUMPS
T-55001	WASTE WATER TANK
B-50014	BRINE CAISSON

01



NOTES

1. ALL DIMENSIONS IN mm U.N.O
2. ALL ELEVATIONS IN METERS.
3. EQUIPMENT SIZES ARE BASED ON PRELIMINARY MASTER EQUIPMENT LIST 123A90-DDL-MAC-LIS-50000. 01
4. ALL ELEVATIONS RELATE TO LOWEST ASTRONOMICAL TIDE (LAT) = 0.000.
5. PLAN SHOWS PRIMARY ESCAPE/MATERIAL HANDLING ROUTES ONLY.
6. EQUIPMENT AND PACKAGE MAINTENANCE AND WITHDRAWAL AREAS TO BE CONFIRMED.
7. MISCELLANEOUS SAFETY EQUIPMENT ARE SHOWN IN DOC. 123A90-DDL-SAF-DL-3002516_Escape Routes, Fire Fighting, Life Saving Equipment and Safety Equipment Layouts Drawings.
8. PREVAILING WIND DIRECTION INFLUENCING EQUIPMENT/VENT LAYOUT FROM THE SOUTH WEST.
9. PLATFORM NORTH DIRECTION IS N 25°W.

LEGEND

DENOTES PLATED DECK

ESCAPE/MATERIAL HANDLING ROUTE

DENOTES OPEN GRATING

HOLDS

01
1. DELETED
2. PLATFORM CO-ORDINATES
3. DELETED
4. DELETED
5. BRINE DISCHARGE CAISSON LOCATION
6. DELETED
7. ARRANGEMENT TO BE CONFIRMED
8. DIMENSIONS TO BE CONFIRMED 01
9. DELETED

REFERENCE DOCUMENTS

123A90-DDL-PP-DS-70070	PLOT PLAN - LOWER & UPPER DECK
123A90-DDL-PP-DS-70072	PLOT PLAN - ELEVATION LOOKING NORTH & EAST

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
01	07/02/24	MMA	CBO	DLO	ISSUE FOR REVIEW (IFR)
0	31/10/23	MMA	CBO	DLO	ISSUE FOR REVIEW (IFR)

CROSSWIND

ROSETTI MARINO

TITLE :
BASE LOAD POWER HUB (BLPH)
PLOT PLAN
BELOW LOWER DECK

CONTRACT NO./TITLE CW-I-WP4-2023-05/HOLLANDSE KUST NOORD WIND PARK | SCALE 1:150

DRAWN M. MAGNI | CHECKED C. BORTOLIN | APPROVED D. LO STERZO | DATE 07/02/24

A1 | DRAWING NO. 123A90-DDL-PP-DL-70071 | SHEET 001 | REV. 01

File Name : 123A90-DDL-PP-DL-70071 Rev.01

4.3 FEED/EPC HAZOP RECOMMENDATIONS

SHEAM No.Feed HSSE Register_REV 01	Source Doc Ref.	Action	Study	Date Raised	Due by	Response	Status
24	1	Ensure adequate overpressure protection system is provided within electrolyser package to prevent overpressure of downstream piping.	FEED HAZOP	06-mar-23	CROSSWIND	Adequate protection has been installed, refer to CRW-01-R-01 for details.	CLOSED
25	1	Ensure adequate overpressure protection system is provided within electrolyser package to prevent overpressure of downstream piping.	FEED HAZOP		CROSSWIND	Adequate protection has been installed, refer to CRW-01-R-01 for details.	CLOSED
26	2	Ensure adequate over protection system for system downstream system of PVA & PVB including fuel cell	FEED HAZOP		CROSSWIND	PSV added….	CLOSED
27	2	Review possibility of water (saturated or free) being carried forward to downstream system& assess suitable means of protection for piping & equipment in hydrogen storage	FEED HAZOP	06-mar-23	CROSSWIND	Rosetti Marino: inlet piping is in SS and H2 storage vessel are in CS (no corrosion allowance). Both inlet piping and H2 storage vessels are designed for dry service Crosswind: Since the service is dry and the operational lifecycle equals to 2 years, any requirement for corrosion protection is deemed to be unecessary	CLOSED
28	3	Review possibility of oxygen being carried forward to downstream system& ensure suitable means of protection is provided for piping & equipment in hydrogen storage and within electrolyser package	FEED HAZOP	06-mar-23	CROSSWIND	Adequate protection has been installed, refer to CRW-01-R-01 for details	CLOSED
29	4	Identify possibility of any other contaminants in electrolyser package.	FEED HAZOP	06-mar-23	CROSSWIND	As per electrolyser HAZOP (CRW-01-R-01) there are 3 main contaminants: - Water - O2 - Zeolyte from the catalyst in the deox.	CLOSED
30	5	Consider within PEM Electrolyser package HAZOP.	FEED HAZOP	06-mar-23	CROSSWIND	This has been considered in the Electrolyser HAZOP (CRW-01-R-01). There is an NRV (CV-633) in the outlet of the electrolyser which has been considerd to be ALARP.	CLOSED
31	6	Review necessity of emergency blowdown for hydrogen feed & distribution manifold.	FEED HAZOP	06-mar-23	ROSETTI	Emergency blowdown system has been reviewed during EPC phase. For reference see P&iDs: 123A90-DDL-PR-PID-80012_01, 123A90-DDL PR-PID-80013_01 and 123A90-DDL-PR-PID-80014_01, attached to this Action as Attachment 1.	CLOSED
32		ensure adequate detection alarm is provided	FEED HAZOP			Action closed in Feed HSSE rev01	CLOSED IN HSSE REV 01
33		adequate F&G detection to be investigated	FEED HAZOP			Action closed in Feed HSSE rev01	CLOSED IN HSSE REV 01
34	7	Ensure heat input calculations for sizing fire case relief valves are based on heat input from hydrogen fire.	FEED HAZOP	06-mar-23	ROSETTI	Contractor confirms that heat input calculations for sizing fire case reliefvalves are based on heat input from hydrogen fire. For reference see “Attachment 1 - FEED HAZOP action n7”, which is part of the “Relief, Vent and Blowdown Report”	CLOSED
35	8	Ensure depressurisation system is adequately designed to prevent escalation of fire to hydrogen storage vessels. Taking account of heat input via BESS/ Hydrogen fire.	FEED HAZOP	06-mar-23	ROSETTI	Based on the results within FERA Fire and Explosion Risk Analysis (doc. no.123A90-DDL-SAF-RE-30020), PFP is not required. Consequently, noscenarios are expected to give escalation. Indeed, no area is above the 10-4 ev/yr requiring additional mitigation measures	CLOSED
36		consider requirement for additional sectionalization	FEED HAZOP			Action closed in Feed HSSE rev01	CLOSED IN HSSE REV 01
37		Review the requirement for PIC HH on Hydrogen Storage Vessel and perform a LOPA if required, based on maximum pressure that can be generated by upstream electrolyser (vendor package)	FEED HAZOP		ROSETTI	Maxiumum pressure generated upstream electrolyzer is 36 barg (see 123A90-DDL-SAF-RE-30006, Node 1, 1.7 Pressure high). PIC HH is confirmed due to the case of external fire on Hydrogen storage vessel (see as example 123A90-DDL-PID-80015 attached). LOPA is note required for this scenario.	CLOSED
38		Ensure material selection	FEED HAZOP			DDL-SAF-RE-30006, Node 1, 1.7 Pressure high). PIC HH is confirmed due to the	CLOSED IN HSSE REV 01
39	14	Review control system design to ensure that potential overpressure can be reliability detected, and PEM electrolyser package shutdown initiated.	FEED HAZOP	06-mar-23	ROSETTI	case of external fire on Hydrogen storage vessel (see as example 123A90-DDL-	CLOSED
40		review in SAFOP	FEED HAZOP			PID-80015 attached). LOPA is note required for this scenario.	CLOSED IN HSSE REV 01
41	10	The maintenance philosophy including isolation purging into service & out of service access, egress, needs to be further developed including into design. To be studied in more detail at next stage.	FEED HAZOP	06-mar-23	ROSETTI	Maintenance philosophy including isolation purging into service & out of service access, egress are detailed in parag. 7 of 123A90-DDL-PR-MAN-80001 - Operations and Maintenance Manuals	CLOSED
42	11	Facilities for start- up following maintenance, to be investigated and developed.	FEED HAZOP	06-mar-23	ROSETTI	This topic it is covered in the start-up procedure. See ProcessControl, Operation, Start-up and Shutdown philosophy123A90-DDL-PR-RE-80031	CLOSED
43	12	Ensure consequences of loss of supply of hydrogen to fuel cell is assessed in fuel cell vendor package HAZOP.	FEED HAZOP	06-mar-23	CROSSWIND	This has been assessed in the Fuel cell HAZOP, see document CRW-01-R-02 (former SGS-77-R-01) and snipped below	CLOSED

SHEAM No.Feed HSSE Register_REV 01	Source Doc Ref.	Action	Study	Date Raised	Due by	Response	Status
44	20	Review control requirements for PVA & PVB from fuel cell and delete if not required.	FEED HAZOP	06-mar-23	ROSETTI	As per project doc. P&ID " HYDROGEN STORAGE VESSELS HEADER (OUTLET)" n° 123A90-DDL-PR-PID-80014 rev.01, the pressure control valves 25-PV-055A/B are necessary to regulate the H2 pressure to Fuel Cell package and avoid the 80-PSV- 001 intervention.These pressure control valves are designed as “Typ.6” that means critical control valve.The typ. 6 foresees the following status feedbacks to better monitor the behavior of the control valves: - Open limit switch - Closed limit switch - Position transmitter	CLOSED
45	14	Ensure this is confirmed in fuel cell package with vendor.	FEED HAZOP	06-mar-23	CROSSWIND	The Fuel cell package has a pre-heater installed, see doc K559-2254-CWIWP4202202-C99-002 rev 001. Also discussed during the HAZOP, see snipped below and doc CRW-01-R-02 (former SGS-77-R-01)	CLOSED
46		action closed in Feed HSSE rev01	FEED HAZOP			Action closed in Feed HSSE rev01	CLOSED IN HSSE REV 01
47		action closed in Feed HSSE rev01	FEED HAZOP			Action closed in Feed HSSE rev01	CLOSED IN HSSE REV 01
48	16	Ensure secure nitrogen supply suitable for continuous purge of the hydrogen vent head is provided.	FEED HAZOP	06-mar-23	ROSETTI	Nitrogen supply suitable for continuos purge of the hydrogen vent head is provided. For details see attachment 1.	CLOSED
49	17	In case of failure of primary nitrogen purge, ensure a suitable contingency plan is developed.	FEED HAZOP	06-mar-23	ROSETTI	A liquid seal drum has been added. The aim of such seal is to avoid air ingress intohydrogen vent in case of loss of nitrogen purging. For reference see PID 123A90- DDL-PR-PID-80029, attachment 1	CLOSED
50	18	Assess possibility of ice formation in hydrogen vent lines, from individual users into header, and provide suitable mitig ation,	FEED HAZOP	06-mar-23	ROSETTI	The only possibility to have water within the vent system is from theElectrolyser Package H2 vent. As per Elogen’s reply to the TQ 123A90-PML-PM-TQ-00013 (attached), only water in the gas phase (H2 off-spec) is expected.Should part of this water condensate, all lines downstream relief andblowdown devices are sloped toward to the H2 Vent KOD, where water will be collected. Moreover, the H2 Vent KOD boot will be heated together with theliquid discharge line. Therefore, the ice formation on the sloped vent lines isnot a credible scenario. For reference see P&iDs 123A90-DDL-PR-PID-80011, 123A90-DDL-PR-PID-80028 and 123A90-DDL-PR-PID-80029 (attached).	CLOSED
51	19	Assess potential for oxygen/hydrogen explosion vendor package HAZOP.	FEED HAZOP	06-mar-23	CROSSWIND	Adequate protection has been installed, refer to CRW-01-R-01 for details	CLOSED
52	20	Asses potential for consequence with vendor HAZOP package.	FEED HAZOP	06-mar-23	CROSSWIND	There is no electrochlorination packages on BLPH facility, hence this recommendation is no longer applicable	CLOSED
53	21	Carry out flare network back pressure analysis when detailed information is available in order to ensure all users can access hydrogen vent when required.	FEED HAZOP	06-mar-23	ROSETTI	Flare network back pressure analysis has been carried out.The maximum back pressure that can be reached during the worst scenario is 1.27 barg. Forreference see “Attachment 1 - FEED HAZOP action n21”, which is part of the “Relief, Vent and Blowdown Report”. This value is well below all the pressure sources of the systems to be depressurized. Therefore, all users can access hydrogen vent when required.	CLOSED
54	22	Review means of sweeping residual air within hydrogen vent header prior to reintroduction of item/package that will shut down for maintenance.	FEED HAZOP	06-mar-23	ROSETTI	Sweeping of residual air within hydrogen vent header prior to reintroduction of item/package (that will shut down for maintenance) has been provided. The sweeping of residual air will be performed by means of nitrogen, that will be takenfrom the Nitrogen Package (A-64000). For reference see PID “123A90-DDL-PR-PID-80027_01”, attachment 1. The sweeping of the residual air will be performed through the H2 Storage Vessels (where a permanent nitrogen connection is provided). The inventory, which could contain residual air, will be then vented up to the exit of the H2 vent Q-43004.	CLOSED
55	23	Consider loss of flow of sea water in desalination unit HAZOP Package.	FEED HAZOP	06-mar-23	ROSETTI	Case of loss flow of sea water have been assessed during the HAZOP sessions. See attachment	CLOSED
56		Based on LOPA assessment, there is currently no requirement for 'LL' trip on fresh water tank , T-50008 to protect P50009A/B, hence this can be redesigned as a DCS based switch. Note that based on packages HAZOPs there might be a LOPA	FEED HAZOP		ROSETTI	Agreed, please note attached extract from System functional description (1724000448-MAC-SP-00003) and 1724000448-PR-PID-00013	CLOSED
57	24	Consider loss of fresh water to electro chlorination package and potential backflow from electrochrlorification unit in package HAZOP.	FEED HAZOP	06-mar-23	ROSETTI	Electro chlorination have been replace with non oxidizing biocide unit. This recommendations is superseded	CLOSED
58	25	Ensure electrochlorification package HAZOP reviews.	FEED HAZOP	06-mar-23	ROSETTI	Electrochlorination unit has been replace with non oxidizing biocide unit. This recommendations is superseded.	CLOSED
59	26	Ensure control system does not create hazard by deadheading P- 50001A/B.	FEED HAZOP	06-mar-23	ROSETTI	This action is superseeded by Hazop Review specifically dedicated to the Water Treatmemt supplier (PSC) Furthermore, in case of P 50001 A/B deadheading the components downstream the pump are protected by a PSV n° 50-PSV-007 (set 7.6 bar). See evidence attached.	CLOSED
60	27	Control logic should inhibit dual operation of lift pumps, P-50001A & B.	FEED HAZOP	06-mar-23	ROSETTI	As per project document "Process Control, Operation, Start-up and Shutdown Phisophy" rev 01 par 3.2.1.2, a control logic will be provided to prevent simultaneous running of both pumps P-50001A and P-50001B	CLOSED
61		Consider during vendor hazop package.	FEED HAZOP		ROSETTI	This scenario has been analyzed during WTP HAZOP on 17-18 June	CLOSED
62	28	Ensure local overflow is adequately sized & rooted to a safe location.	FEED HAZOP	06-mar-23	ROSETTI	T-50006 is part of Water treatment package. Overflow has been routed from outside the container, where the water treatment has been installed, to brine caisson.	CLOSED
63	29	Ensure local overflow is adequately sized & rooted to a safe location.	FEED HAZOP	06-mar-23	ROSETTI	T-50008 is part of Water treatment package. Overflow has been routed from outside the container, where the water treatment has been installed, to brine caisson.	CLOSED
64	30	Ensure this scenario is considered, during HAZOPS for vendors packages, for electrolyser,	FEED HAZOP	06-mar-23	CROSSWIND	More flow from upstream has been taken into account in the Electrolyser HAZOP, see CRW-01-R-01.	CLOSED
65	31	Control logic should inhibit dual operation of lift pumps, P-50009A & B.	FEED HAZOP	06-mar-23	ROSETTI	As per Vendor's document "WATER TREATMENT PACKAGE-PID DIAGRAM" n° 1724000448-PR-PID-00013 Note 9	CLOSED

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66	32	Consider during vendor hazop package	FEED HAZOP	06-mar-23	ROSETTI	This scenario has been analyzed during WTP HAZOP on 17-18 June. See 123A90-DDL-SAF-RE-30006	CLOSED
67		Consider during vendor hazop package	FEED HAZOP		ROSETTI	This scenario has been analyzed during WTP HAZOP on 17-18 June. See 123A90- DDL-SAF-RE-30006	CLOSED
68		Consider during vendor package HAZOP'S.	FEED HAZOP		ROSETTI	All Flow deviations on Sea Water Node have been analyzed during WTP Hazop. See 123A90-DDL-SAF-RE-30006	CLOSED
69		Consider during vendor hazop package	FEED HAZOP		CROSSWIND	Electrolyzer HAZOP has been done on the 4th of December, 2023 where it was considered.	CLOSED
70		Consider during vendor hazop package	FEED HAZOP		ROSETTI	This recommenadations is superseded. Electrochrlorification is no more present.	CLOSED
71	33	Consider during vendor hazop package.	FEED HAZOP	06-mar-23	ROSETTI	Case of potential for vacuum in sea water supply system due to pump failure has been considered during WTP HAZOP package. For this topic, nothing critical has been highlighted. Please refer to 123A90-DDL-SAF RE-30006	CLOSED
72	34	See Vendor Packages	FEED HAZOP	06-mar-23	ROSETTI	Low ambient temperature has been analyzed during WTP HAZOP on 17-18 June. See 123A90-DDL-SAF-RE-30006	CLOSED
73	35	Consider operational philosophy for long periods of no demand of use of water system.	FEED HAZOP	06-mar-23	ROSETTI	Reference is made to doc. N. 1724000448-MAC-CE-00004 - Water Treatment Package A-50000 - CAUSE EFFECT MATRIX and doc. N. 1724000448-PR-PID-00013. If valve 50-XV-020 will stay close for more than 30 days. (Note (4): With delay timer of 30 days).Following drain valves will be opened to drain the package:	CLOSED
74	37	To be examined within electrolyser package HAZOP	FEED HAZOP	06-mar-23	CROSSWIND	Loss of utilities have been analysed in the electrolyser package HAZOP, refer to CRW-01-R-01	CLOSED
75	38	Confirm if non return valve is required on individual feed lines into brine disposal manifold.	FEED HAZOP	06-mar-23	ROSETTI	Rosetti needs details from CPY to verify if there are any shutoff valves exiting the Packages. In any case, by performing drain operations one line at a time, the other valves will be closed, thus checks on individual drain lines would not be necessary. This will be implemented within Operations and Maintenance Manuals (Doc. No. 123A90-DDL-PR-MAN-80001, Planned Issue Date 31/08/24)	CLOSED
76		Confirm if non return valve is required on individual feed lines into brine disposal manifold.	FEED HAZOP		ROSETTI	It is confirmed that on individual feed lines into brine disposal manifold there is no requirement to have any non-return valve, as per PID 123A90-DDL-PR-PID-80025. See same recommendations 38 already closed	CLOSED
77		To be examined within electrolyser package HAZOP	FEED HAZOP		CROSSWIND	Electrolyser HAZOP has been done on the 4th of December 2023	CLOSED
78		Confirm if non return valve is required on individual feed lines into brine disposal manifold.	FEED HAZOP		ROSETTI	It is confirmed that on individual feed lines into brine disposal manifold there is no requirement to have any non-return valve, as per PID 123A90-DDL-PR-PID-80025. See same recommendations 38 already closed	CLOSED
79	39	Confirm maximum pressure of fluid discharge from electrolyser package and ensure brine disposal system is adequately designed.	FEED HAZOP	06-mar-23	CROSSWIND	This scenario is no longer applicable as the valve in the brine discharge line (BLPH-MV-412) is locked open on P&ID 123A90-DDL-PR-PID-80025-001 rev 02.	CLOSED
80	40	Consider winterization of brine drain line if required	FEED HAZOP	06-mar-23	ROSETTI	Since lines are on a slope, there should be no pockets and therefore no chance of water/ice formation. Anyway, this will be evaluated after EPC HAZOP Workshop.	CLOSED
81	41	To consider causes of high temperature within electrolyser HAZOP package, and ensure sufficient protection is provided such that environmental limit will not be exceeded.	FEED HAZOP	06-mar-23	CROSSWIND	No causes of high temperature has been identified in the electrolyser HAZOP (see doc CRW-01-R-01).	CLOSED
82	42	To assess potential consequences of hydrogen or oxygen release from top of brine caisson, in case of gas blowby via electrolyser package. And to provide suitable mitigation.	FEED HAZOP	06-mar-23	CROSSWIND	There is no credible scenario for a blowby of H2 from the electrolyser towards the brine.	CLOSED
83		To be examined within electrolyser package HAZOP	FEED HAZOP		CROSSWIND	Electrolyzer HAZOP has been done on the 4th of December 2023, where it was considered.	CLOSED
84	43	Review the impact of loss of instrument air on all vendor packages, and based on the consolidated outcome, rea- assess the LOPA for both the Low Low Pressure trips on the instrument air.	FEED HAZOP	06-mar-23	CROSSWIND	HAZOP has been performed for all vendor packages, it included the review of the loss of instrument air's impact. These scenarios were all ALARP due to the fail-safe direction of the valves involved.	CLOSED
85	44	Shut down on 'HH' in hydrogen KO drum vent should lead to system shut down but not depressurisation.	FEED HAZOP	06-mar-23	ROSETTI	As per TQ 123A90-PML-PM-TQ-00013 and as per point 4.1.15.1 of theEPC HAZOP, which states: QUOTE "5.1.15.1 90 Electrolyzer starts/yr, 0.5 hr/start-up, 3.2 kg/hr of water (worst credible scenario based on consideration of all water in stream), Platform visited for maintenance 2 times/yr where issue can be identified and rectified. 0.076 m3 of water within 2 m3 KO drum overfill of vessel not considered credible. UNQUOTE There is no requirement of having a HH liquid level in the H2 Vent KOD,since overfill of the vessel is not a credible scenario. Therefore, systemshut-down in case of HH liquid level is not applicable.	CLOSED

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86	45	Asses consequences of loss of safeguard of availability of vent system to upstream users.	FEED HAZOP	06-mar-23	ROSETTI	Pump 43003, as per PID 123A90-DDL-PR-PID-80029, is not more part of the design, so the action is not more valid.	CLOSED
87	50	Check with Technical Safety TA2 whether CoP modifier is allowed for this unmanned platform which will be visited for 2 shifts per year.	FEED HAZOP	06-mar-23	CROSSWIND	P-43003 removed. Recommendation is superseded	CLOSED
88	52	Ensure Level 'LY- HH' on hydrogen KO drum vent achieves a RRF of 120.	FEED HAZOP	06-mar-23	ROSETTI	Pump 43003, as per PID 123A90-DDL-PR-PID-80029, is not more part of the design, so the action is not more valid	CLOSED
89		Assess the requirement for flow meter downstream P-43003 with'LL' flow trip and evaluate if	FEED HAZOP		ROSETTI	The scenario of pump failure has been superseded since pump downstream the H2 Vent KOD has been deleted on the last revision of the FEED P&iD. This is also confirmed by the EPC P&iD "123A90-DDL-PR-PID-80029". See also recommendations 53 (94)already closed	CLOSED
90		Shut down on 'HH' in hydrogen KO drum vent should lead to system shut down but not depressurisation.	FEED HAZOP		ROSETTI	AS per C&E matrix, the ESD signal from 43LT001 will: 1) SHUTDOWN WATER TREATMENT PACKAGE A-50000; 2) SHUTDOWN ELECTROLYZER PACKAGE A-20000; 3) SHUTDOWN SEAWATER LIFT PUMP P-50001A; 4) SHUTDOWN SEAWATER LIFT PUMP P-50001B For reference see attachment 1	CLOSED
91		Asses consequences of loss of safeguard of availability of vent system to upstream users.	FEED HAZOP		ROSETTI	Level controller of V- 43001 and P-43003 removed from the scope. Recommendation is superseded	CLOSED
92		Check with Technical Safety TA2 whether CoP modifier is allowed for this unmanned platform which will be visited for 2 shifts per year.	FEED HAZOP		CROSSWIND	P-43003 removed. Recommendation is superseded.	CLOSED
93		Assess the requirement for flow meter downstream P- 43003 with'LL' flow trip and evaluate if this needs to be DCS or SIS.	FEED HAZOP		ROSETTI	The scenario of pump failure has been superseded since pump downstream the H2 Vent KOD has been deleted (see BLPH Piping and Instrumentation Diagram - Hydrogen Vent Drum, Doc. No. 123A90-DDL-PR-PID-80029). In any case, the requirement of having such LL flow trip has been assessed and it is confirmed that there is no need of having it since there are already some safeguards such as H and HH liquid level inside the KOD.	CLOSED
94	53	Assess the requirement for flow meter downstream P- 43003 with'LL' flow trip and evaluate if this needs to be DCS or SIS.	FEED HAZOP	06-mar-23	ROSETTI	The scenario of pump failure has been superseded since pump downstream the H2 Vent KOD has been deleted on the last revision of the FEED P&iD. This is also confirmed by the EPC P&iD "123A90-DDL-PR-PID-80029	CLOSED
95		Assess the requirement for flow meter downstream P- 43003 with'LL' flow trip and evaluate if this needs to be DCS or SIS.	FEED HAZOP		ROSETTI	P-43003 removed. Recommendation is superseded	CLOSED
96		action closed in Feed HSSE rev01	FEED HAZOP			Action closed in Feed HSSE rev01	CLOSED IN HSSE REV 01
97	46	Review need for winterisation of small bore piping & provide if required.	FEED HAZOP	06-mar-23	ROSETTI	Heat tracing has been provided downstream the boot of the H2 Vent KOD as shown in PID 123A90-DDL-PR-PID-80029.	CLOSED
98	48	Review necessity for provision of heater within hydrogen vent V- 43001, when information on potential liquid carry over is available.	FEED HAZOP	06-mar-23	ROSETTI	Necessity for provision of heater within hydrogen vent V-43001 has been investigated. It has been confirmed by the Electrolyser Package Vendor that no water in liquid phase is expected in the Hydrogen vent line coming from the Electrolyser Package; only water in gaseous phase is expected (see TQ No. 13, Doc. No. 123A90-PML-PM-TQ-00013). This means that liquid water could be accumulated in the Hydrogen vent KOD only in case of condensation of such off-spec stream from Elogen system. Such quantity will be accumulated within the boot of H2 Vent KOD, which is heat traced as well as the downstream discharge line (see BLPH Piping And Instrumentation Diagram - Hydrogen Vent Drum, Doc. No. 123A90-	CLOSED
99	51	Review scenario of freezing of small bore rundown piping from V- 43001, which may lead to temporary level build-up. It is not expected to reach high level and block the vent before the line unfreezes again, this assumption should be confirmed. If assumption is incorrect, re- assess the scenario.	FEED HAZOP	06-mar-23	ROSETTI	It has been confirmed by the Electrolyser Package Vendor that water in gaseous phase is expected in the Hydrogen vent line coming from the Electrolyser Package (see TQ No. 13, Doc. No. 123A90-PML-PM-TQ-00013), thus winterization will be provided. To be discussed during EPC Workshops.	CLOSED
100	47	Review design of pump with respect to possibility of running dry with hydrogen gas.	FEED HAZOP	06-mar-23	ROSETTI	Pumps in general, centrifugal type in particular are not suitable for dry running because this condition can cause damages due to overheating with consequent damages to wear rings and mechanical seal. Furthermore, severe axial thrust due to dry cavitation affect and damages bearings. RM recommendation is to shut down the pump if at least minimum continuous flow (30% of RTD flow at least) is not ensured. Dry running is not allowed.	CLOSED

SHEAM No.Feed HSSE Register_REV 01	Source Doc Ref.	Action	Study	Date Raised	Due by	Response	Status
101	49	Determine credibility of ingress of oxygen into liquid brine vent system. Leading to potential backflow into other cross connected systems & discharge from vent of brine caisson. If credible provide suitable mitigation.	FEED HAZOP	06-mar-23	ROSETTI	Ingress of oxygen into liquid brine vent system, leading to potential backflow into other cross connected systems & discharge from vent of brine caisson, is not credible since: 1) On the first inlet line 1-1/2"-WW-073-01CS-H there is a check valve BLPH-NRV-028 to prevent backflow (see aattachment1); 2) On the second inlet line 1"-WW-071-01CS-H there is a manual valve always closed to prevent backflow (see attachment 2).	CLOSED
102	47	Review design of pump with respect to possibility of running dry with hydrogen gas.	FEED HAZOP		ROSETTI	The pump has been removed from the design. The recommendation is superseded.	CLOSED
103		Action closed in HSSE register rev.01	FEED HAZOP			brine caisson, is not credible since:	CLOSED IN HSSE REV 01
104	55	Ensure all materials are suitable for oxygen service, during construction, commissioning & operations.	FEED HAZOP	06-mar-23	ROSETTI	Oxygen is present during construction, only in welding operations, but in this time no Hydrogen will be present on platform therefore no potetiality of combustion is present.During commissioning no welding activities will be performedin case of presence of Hydrogen.During operations, no oxigen is present as per Process design and Oxygen drum has been removed.	CLOSED
105	54	Review during electrolyser vendor package HAZOP	FEED HAZOP	06-mar-23	CROSSWIND	Electrolyser HAZOP has been done on the 4th of December, 2023.	CLOSED
106		Action closed in HSSE register rev.01	FEED HAZOP			2) On the second inlet line 1"-WW-071-01CS-H there is a manual	CLOSED IN HSSE REV 01
107		Action closed in HSSE register rev.01	FEED HAZOP			valve always closed to prevent backflow (see attachment 2).	CLOSED IN HSSE REV 01
108	57	Check with Technical Safety TA2 whether CoP modifier is allowed for this unmanned platform which will be visited for 2 shifts per year.	FEED HAZOP	06-mar-23	CROSSWIND	Discussion with Shell TA resulted in the manning level being designated an Enabling Factor with an associated Risk Reduction Factor of 1 order of magnitude. LOPA worksheet have been updated.	CLOSED
109	58	Ensure Level 'LY- HH' on Oxygen KO drum vent achieves a RRF of 120.	FEED HAZOP	06-mar-23	CROSSWIND	The Pump P-44003 and oxygen KO drum V-44001 have been deleted based on updated design. Therefore, action is no longer applicable.	CLOSED
110	59	Assess the requirement for flow meter downstream P- 44003 with'LL' flow trip and evaluate if this needs to be DCS or SIS.	FEED HAZOP	06-mar-23	CROSSWIND	he scenario of pump failure has been superseded since pump downstream the Oxygen Vent KO drum (and the Oxygen Vent KO drum itself) has been deleted. The HAZOP action is no longer applicable; FEED drawing reference K559-2254-PR PID-014, Revision 2 (see attachment 1).	CLOSED
111		Check with Technical Safety TA2 whether CoP modifier is allowed for this unmanned platform which will be visited for 2 shifts per year.	FEED HAZOP		CROSSWIND	Discussion with Shell TA resulted in the manning level being designated an Enabling Factor with an associated Risk Reduction Factor of 1 order of magnitude. LOPA worksheet have been updated.	CLOSED
112		Ensure Level 'LY-HH' on Oxygen KO drum vent achieves a RRF of 120.	FEED HAZOP		CROSSWIND	The oxygen KO Drum V-44001 and P-44003 have been deleted as per new design. Therefore action no longer applicable	CLOSED
113		Assess the requirement for flow meter downstream P-44003 with'LL' flow trip and evaluate if this needs to be DCS or SIS.	FEED HAZOP		CROSSWIND	The oxygen KO drum V-44001 and the pump P-44003 have been deleted based on the updated design; Therefore action no longer applicable	CLOSED
114		Action closed in HSSE register rev.01	FEED HAZOP			Action closed in Feed HSSE rev01	CLOSED IN HSSE REV 01
115		Action closed in HSSE register rev.01	FEED HAZOP			Action closed in Feed HSSE rev01	CLOSED IN HSSE REV 01
116	56	Review design of pump with respect to possibility of running dry with oxygen gas.	FEED HAZOP	06-mar-23	ROSETTI	KO drum has been removed. Recommendation is superseded	CLOSED
117		Action closed in HSSE register rev.01	FEED HAZOP			Action closed in Feed HSSE rev01	CLOSED IN HSSE REV 01
118	56	Review design of pump with respect to possibility of running dry with oxygen gas.	FEED HAZOP	06-mar-23	ROSETTI	KO drum has been removed. Recommendation is superseded	CLOSED

SHEAM No.Feed HSSE Register_REV 01	Source Doc Ref.	Action	Study	Date Raised	Due by	Response	Status
119	60	Consider installation of individual air reservoirs for blowdown valve's to enable hydrogen storage to be retained for sufficient time to allow intervention.	FEED HAZOP	06-mar-23	ROSETTI	The action is superseded since during HAZOP EPC no multiple causes of loss of pressure (within the H2 inventory) have been identified whose consequence is the opening of the blowdown valves. All scenarios that determine the opening of the blowdown valves are per doc. N. 123A90-DDL-PR-DG-80000 (see attachment 1). Therefore, there, is no any requirement of individual air reservoirs for blowdown valve's to enable hydrogen storage to be retained for sufficient time to allow intervention	CLOSED
120	61	Examine failure modes of local equipment rooms upon loss of instrument air and provide suitable mitigation to allow these to continue to operate electrical systems.	FEED HAZOP	06-mar-23	ROSETTI	Loss of instrument air has not impact to the shelter pressurization because it's not used to pressurize the shelter.Each local equipment room has redounded HVAC system (2x100%), each system able to provide pressurization needed. Upon loss of one HVAC system, the stand-by system will start immediately. Only in case of loss of both HVAC systems the pressurization will be lost. Anyway, the electricalsystems keep continue to operate and in case of high temperature a high temperature alarm will be sent to alert the operator in control room.See project doc. "Supply Specification for HV (66kV-6.6kV) Switchroom B- 100" n° 123A90-DDL-AR-SP-10000 rev.01 (the same philosophy is applied for containers B-200/300/400)	CLOSED
121	63	Consider requirements for nitrogen generation package in order to provide sufficient nitrogen supply.	FEED HAZOP	06-mar-23	ROSETTI	Nitrogen generation package has been provided as per PID 123A90-DDL-PR-PID-80027 (see attachment 1).Specific requirement for nitrogen generation package are mentioned on 123A90-DDL-MAC-SP-50039	CLOSED
122	62	Investigate practical means of providing sufficient volume of nitrogen for pressure purging hydrogen pressure storage vessels.	FEED HAZOP	06-mar-23	ROSETTI	The current design is to provide Nitrogen via the Nitrogen Generation Package (A-64000), configured as 1 x 100%. The design capacity is based on: 1) continuous purge of Hydrogen Vent system (see Attachment 1); 2) peak demand by: a) the electrolyser package, see Attachment 1; b) H2 Storage vessel purging, see Attachment 1. To be noted that the two above peak demand are not coincident. The design capacity is 60 Nm3/h, see Attachment 2. Also see P&iD 123A90-DDL-PR-PID-80027, rev02	CLOSED
123	64	Review sizing basis for wastewater tank, in order to reduce possibility of overflow and environmental pollution based on information from potential users	FEED HAZOP	06-mar-23	ROSETTI	Overflow from the wastewater tank has been deleted, therefore there is no possibility of having release of liquid to the sea from overflow line. The tank T 55001 is sized based on six months operability. A level transmitter on the wastewater tank T-55001 is also installed (55-LT-001) which alerts the operator (remotely) in case of high level inside the vessel. In any case it is not expected liquid to reach top of the tank over an operation period of 6 months. Refer to attachment 1	CLOSED
124	65	Determine which drain lines are in continuous duty and which are required in maintenance only. Consider revision of non-return valves in individual drain lines.	FEED HAZOP	06-mar-23	ROSETTI	The sources are those indicated on the attached PID where the tank T-55001 is shown (see attachment 1 where the sources are highlighted in blu). The flow is NNF (normally not flow), therefore as upset conditions we consider the following: 1. the discharged liqud volume from the water treatment package during maintenance. The maximum liquid inventory inside package is around 5.4 m3 (considering all tanks within the package); 2. from liquid seal drum is always zero. Should a a blowdown scenario occur , then the liquid volume discharge from the seal is very low compared to the T-55001 volume; 3. from the Electrolyser package the maximum volume that could be discarged toward T-55001 is 5 m3 in 6 months (as informed by Elogen and Crosswind). Considering that T-55001 volume is 16m3, there is no possibility to overfill the tank. In case of failure of filter (A-50003, installed at inlet of water treatment system), the water is not routed towards the T-55001, it is routed towards the brine discharge caisson (see attachment 2, where the line from A-50003 is highlighted in red). Therefore, no possibility to have a continuous flow towards T-55001 in case of A-50003 failure.	CLOSED
125	68	Ensure that vendor package HAZOPS'S examine possibility of gas blowby via this route & provide suitable mitigation as required.	FEED HAZOP	06-mar-23	CROSSWIND	Electrolyzer HAZOP has been done on the 4th of December 2023. WTP HAZOP has been done on the 17-18th of June, 2024. No credible gas blowby cases have been identified.	CLOSED
126	66	Winterisation of wastewater system as required.	FEED HAZOP	06-mar-23	ROSETTI	Winterization of the Waste Water Tank (T-55001) is not required, since the tank will be filled with 3500 kg of a ethylene glycol. This will guarantee that when the water from upstream sources will be discharged toward the tank over a period of six months (not only during maintenance but also during operation of the Electrolyser Package), the aqueous ethylene glycol solution will not freeze. With 3500 kg of ethylene glycol and 10000 kg of water (that is the maximum expected water quantity discharged toward the tank over a period of 6 months) the final concentration of the aqueous ethylene glycol solution will be around 25.9% (by weight). Such mixture has a freezing point of around -11°C and therefore it will not freeze since the minimum ambient temperature is -8.4 °C. For reference see attachment 1, where the freezing points of the aqueous ethylene glycol solution are shown. Moreover, no any corrosion inhibiter is required to the tank since specific painting for corrosion inhibition will be used, for reference see attachment 2. The procedure is detailed within the doc. "Operations and Maintenance Manuals", doc. n. "123A90-DDL-PR-MAN-80001"	CLOSED
127	67	Consider requirements for liquid seal within main drain line system.	FEED HAZOP	06-mar-23	ROSETTI	The recommendation has been superseded since the identified cause (during FEED HAZOP SESSION), "Loss of liquid level within T-55001. (Likely cause would be control loop failure of level control T-55001)" is not applicable and valid. As per EPC P&iD doc. N. "123A90-DDL-PR-PID-80026" (see attachment 1), the level control loop is not present. It is worth to note here that the same liquid control loop was already deleted on the last revision of FEED P&iD (see attachment 2).	CLOSED
128	69	Based on LOPA assessment, there is currently no requirement for 'LL' trip on waste water tank , T- 55001 to protect P55002, hence this can be redesigned as a DCS based switch independent from the level controller.	FEED HAZOP	06-mar-23	ROSETTI	Both Pump P55002 and LL level trip (inside the T-55001) have been deleted on the last revision of the FEED PID. This is also confirmed by the EPC P&iD. Therefore, the recommendation is superseded (see EPC PID "123A90-DDL-PR-PID-80026", attachment 1)	CLOSED

Item No	Study	Credible Causes	Ultimate Consequences	Reccomendation	By	Date	Response
#1	EPC HAZOP	1.2.2. 25BDV005 Fails open/inadvertently opened by operator 2.2.2. 25BDV005 Fails open/inadvertently opened by operator 1.3.1. 25XV003 inadvertently open by operator 2.2.3. 25PIC005 failure opening 25PV005 2.2.7. 25BDV022 Fails open/inadvertently opened by operator 2.2.9. 80XV001 remains open at end of purge cycle 3.2.1. 25PIC005 failure opening 25PV005 3.2.3. 25BDV022 Fails open/inadvertently opened by operator 3.2.6. 80XV001 Fails open	1.2.2.1. H2 sent to H2 vent header and vented to atmosphere, loss of product. Potential for fire/explosion of continuously vented H2 at top of H2 vent. A single H2 storage vessel can be depressurised while maintaining pressure in the other vessels. Consequences: **1.2.3.1, 1.3.1.1, 2.2.2.1, 2.2.3.1, 2.2.7.1, 2.2.9.1, 3.2.1.1, 3.2.3.1, 3.2.6.1**	1. Review the requirement for an alarm on 43FT001 and if required determine an appropriate set point to indicate continuous high pressure blowdown of H2 storage vessels.	ROSETTI	01/12/2023	In order to detect continuous flow of Hydrogen to the vent system, a "High Flow"alarm will be provided on 43-FT-001.The "alarm point" for the 43-FT-001 will be based on detecting "stable continuousflow" (which is greater than the normal Nitrogen purge rate) for an extended period, that is significantly greater than the period required by the Electrolyser Package A-20000 to produce on spec Hydrogen. The alarm will sound after this period to "alert the operator" that continues flow to Hydrogen vent system has been detected. The "detection period" will be set once the time required for producing on spec Hydrogen by the Electrolyser Package A-20000, is known.
#2	EPC HAZOP	1.2.2. 25BDV005 Fails open/inadvertently opened by operator 2.2.2. 25BDV005 Fails open/inadvertently opened by operator 1.3.1. 25XV003 inadvertently open by operator 2.2.3. 25PIC005 failure opening 25PV005 2.2.7. 25BDV022 Fails open/inadvertently opened by operator 2.2.9. 80XV001 remains open at end of purge cycle 3.2.1. 25PIC005 failure opening 25PV005 3.2.3. 25BDV022 Fails open/inadvertently opened by operator 3.2.6. 80XV001 Fails open	1.2.2.1. H2 sent to H2 vent header and vented to atmosphere, loss of product. Potential for fire/explosion of continuously vented H2 at top of H2 vent. A single H2 storage vessel can be depressurised while maintaining pressure in the other vessels. Consequences: **1.2.3.1, 1.3.1.1, 2.2.2.1, 2.2.3.1, 2.2.7.1, 2.2.9.1, 3.2.1.1, 3.2.3.1, 3.2.6.1**	2. Perform vent radiation and dispersion study to confirm that dispersion from continuous blowdown or fail open of: 1. 25PV005 of any single H2 storage vessel 2. 25XV003 (25RO003) 3. 25BDV005 (25RO005) 4. 80XV001 (80RO001) 5. 25BDV022 (25RO022) does not create a fire or explosion risk to the installation.	ROSETTI	01/12/2023	Worst case scenario has been analized. No issue is facing on the asset. Refer to Vent Gas Dispersion and Potential Radiation Study 123A90-DDL-SAF-RE-30021.
#3	EPC HAZOP	1.2.3. 25PIC005 failure opening 25PV006 2.2.3. 25PIC005 failure opening 25PV005 3.2.1. 25PIC005 failure opening 25PV005	1.2.3.1. H2 sent to H2 vent header and vented to atmosphere, loss of product. Potential for fire/explosion of continuously vented H2 at top of H2 vent. A single H2 storage vessel can be depressurised while maintaining pressure in the other vessels. Consequence **2.2.3.1, 3.2.1.1**	3. Review if it is credible to implement an interlock on 25PIC005 to prevent 25PV005 being opened outside of a purge cycle operation.	ROSETTI	01/12/2023	The TAG number of the valve 25PV005 and of the 25PIC005 (HAZOPED P&ID Revision 01, 24/11/2023) has been changed to 25PV035 and 25PIC035, respectively (ISSUED P&ID Revision 01, 15-02-2024).A software interlock on 25PIC035 to prevent 25PV035 being opened outside of a purge cycle operation has been provided, as per note 12 on the attached P&ID 123A90-DDL-PR-PID-80015_01, attachment 1 and as per "Process Control,Operation, Start-up and Shutdown Philosophy", doc n. "123A90-DDL-PR-RE- 80031_01", attachment 2
#4	EPC HAZOP	1.2.4. 25XV006 Driven open/inadvertently opened by operator	1.2.4.1. Pressurise downstream system to 25PV025A/B up to 30barg. Potential to exceed design pressure (3 times design pressure) downstream of 25PV025A/B, LOPC of H2 and explosion on ignition. 25PV025A/B are downstream pressure controlled and are potentially opened when fuel cell is not online.	4. Ensure that 80PSV001 is sized for failure of downstream isolation on H2 vessel during filling operation (i.e. 25XV006) with 25PV025A or B fully open.	ROSETTI	01/12/2023	80PSV001 has been verified also for the case "failure of downstreamisolation on H2 vessel during filling operation (i.e. 25XV006) with 25PV025A or B fully open ". Moreover, as per "Relief, Vent and Blowdown Report" docn. "123A90-DDL-PR-RE-80030_01", the above case is also the sizing case. For reference see attachment 1
#5	EPC HAZOP	2.2.5. Spectacle Blind on Waste Water Line left open following maintenance	2.2.5.1. Potential overpressure of waste water tank T55001 due to N2 pressurisation resulting in overpressure and rupture of waste water tank T55001. Potential impact on personal. This is performed as part of the re commissioning check prior to introduction H2.	5. Review whether a permanent connection to the waste water tank T55001 is required from the hydrogen storage vessels. If so then review the potential for open waste water drain on storage vessel V25001A-F to result in overpressurisation of waste water tank during an N2 pressure test of the vessel following maintenance activity. Also consider the required vent sizing of waste water tank T55001 (to be calculated).	ROSETTI	01/12/2023	Based on the Electrolyser Vendor information (see TQ number "123A90-PML-PM-TQ-00023", Attachment 1), the on-spec hydrogen, that is sent to the six Hydrogen Storage Vessel (V-25001A/F) is 99.999% pure (i.e. Dry hydrogen). Therefore, the liquid drain lines from each of the six vessels, leading to the Waste Water Tank (T- 55001) have been deleted, see Attachment 2 (P&ID "123A90-DDL-PR-PID- 80015_02").In the two-year life cycle of the BLPH facility, no maintenance activity inside the storage vessel is expected. However, if after maintenance activity drainage of liquid (used for cleaning purpose) is required then the liquid from the vessels will be removed via a temporary vacuum pump and the liquid disposed of in the same manner as the liquids from the Waste Water Tank. The precise procedure will be part of the maintenance / operating manual (yet to be developed).
#6	EPC HAZOP	1.2.5. 25FIC001 failure opening 25FV001 N2 valve 3.2.2. 25FIC001 failure opening 25FV001 N2 valve	1.2.5.1. Potential for N2 (7barg) into H2 storage vessel V25001A during filling operation resulting in off spec H2 sent to the Fuel Cell leading to operational issue no hazardous consequences as per Fuel Cell HAZOP (Cause 1.13.1). Consequence: **1.13.2.1, 3.2.2.1**	6. Review if it is credible to implement an interlock to prevent 25FV001 being opened outside of a purge cycle operation.	ROSETTI	01/12/2023	The TAG number of the valve 25FV001 (HAZOPED P&ID Revision 01,24/11/2023) has been changed to 25FV031 (ISSUED P&ID Revision 02, 12- 06-2024). A software interlock to prevent 25FV031 being opened outside of a purge cycle operation has been provided, as per note 13 on the attached P&ID 123A90-DDL-PR-PID-80015_02 (attachment1). Software interlock applies to all storage vessels N2 supply flow valve
#7	EPC HAZOP	1.2.5. 25FIC001 failure opening 25FV001 N2 valve 3.2.2. 25FIC001 failure opening 25FV001 N2 valve	1.2.5.3. Overpressure of N2 system resulting in LOPC of H2 and N2. 3.2.2.3. Overpressure of N2 system resulting in LOPC of H2 and N2.	7. Review the current design against for compliance with piping (utility connection DEP 31.38.01.11, version 2018) and overpressure (80.45.10.11) DEPs for connection of utility N2 to H2 storage vessels V25001A-F. If they are not compliant (and are not to be made compliant) review current design with LOPA.	ROSETTI	01/12/2023	The Shutdown Valve (SDV), 64-SDV-001, is installed on the sub-header of Nitrogen supply line to the Hydrogen Storage Vessels (V-25001A/F), as additional layer of protection between Nitrogen System and Hydrogen Storage Vessels (V-25001A/F), for reference see PID 123A90-DDL-PR-PID-80027, Rev 02 (see Attachment 1). During normal operation, when the Hydrogen Storage Vessels (V-25001A/F) are under pressure (between 30 barg and 4 barg), the 64-SDV-001 valve will be closed. The 64-SDV-001 is only open during Nitrogen purging of the Hydrogen Storage Vessels, to allow forward flow of Nitrogen. During this phase the Hydrogen Storage Vessels will be under low pressure, approximately ≤ 2 barg, (the pressure reduced by using up the hydrogen via the Fuel Cell or by venting). The maximum Nitrogen supply pressure is 7 barg. During normal operation, outside the Nitrogen purge cycle, the flow control valves (25 FV-031, 032, 033, 034, 038, 036), will be closed. In addition the Non-return valves (BLPH-NRV-014, 023, 027, 029, 030, 031), located upstream, are provided to prevent reverse flow.In the event of Flow Control valve driven open the reverse flow of Hydrogen is prevented by the check valves (BLPH-NRV- 014, 023, 027, 029, 030, 031). Should one of these valves leak then reverse flow is prevented by the normally closed SDV (64-SDV-001), providing additional layer of protection. It should be noted that during Nitrogen purging cycle the 64-SDV-001 will close upon Low Low pressure trip (of Nitrogen supply) detected / initiated via 64-PT-002. It is the Nitrogen system that pressurize the vessel during purging operation. Therefore, now with the installation of the SDV the back flow of hydrogen is not credible
#8	EPC HAZOP	1.2.5. 25FIC001 failure opening 25FV001 N2 valve 3.2.2. 25FIC001 failure opening 25FV001 N2 valve	1.2.5.3. Overpressure of N2 system resulting in LOPC of H2 and N2. Consequence **3.2.2.3.**	8. Ensure that 64PSV001 is verified for backflow of 30 barg H2 from storage vessels V25001A-F. Ensure that the vent from PSV is located in a safe location considering this flow will be H2. Also consider proximity of vent to N2 package which vents O2.	ROSETTI	01/12/2023	This recommendation is no longer applicable. See response on EPC HAZOP recommendation n.7, which states: "7. Review the current design against for compliance with piping (utility connection DEP 31.38.01.11, version 2018) and overpressure (80.45.10.11) DEPs for connection of utility N2 to H2 storage vessels V25001A-F. If they are not compliant (and are not to be made compliant) review current design with LOPA "
#9	EPC HAZOP	1.7.1. External Fire Consequence: 3.7.1.1	1.7.1.1. Potential overpressure of H2 storage vessel V25001A resulting in LOPC of H2 and explosion on ignition.	9. Review the ESD logic for activation of ESD 1D on activation of 25PI004 HH and F&G detection system. Consider under which circumstances a single vessel should be depressurised and when all vessels should be depressurised.	ROSETTI	01/12/2023	The only identified cause for having high pressure on single H2 storage vessel is the external fire. As per F&G C&E matrix, doc. n. 123A90-DDL-IN-CE-40002, the ESD-1D is activated for both gas and fire in open area.
#10	EPC HAZOP	1.18.2. Loss of Instrument Air 3.18.2. Loss of Instrument Air	1.18.2.1. Section of line between 25SDV001 and 25XV004 will be blocked in during ESD scenario. Consequence **3.18.2.1**	10. Review the requirement for a BDV (FO) with a bypass around (25XV003 and 25RO003) and (80XV001 and 80RO001) to allow emergency depressurisation on the manifold inlet line. See also recommendation 12.	ROSETTI	01/12/2023	Pressurized fluid and quantity trapped between (volume less than 0.05 m3 andquantity less than 0.11 kg): 1) 25SDV001 and 25XV004 (inlet manifold); 2) 25SDV0023 and FC Package (outlet manifold), is so limited that in case of random rupture possible fire scenario will last fewseconds and in any case less than 10 minutes (that is the minimum time for escalation as per assumption register 123A90-DDL-SAF-LIS-30014, see attachment 1). Also dangerous radaiation levels for injuring operators are limited to less than 10 meters. As reference please refer attached simulation performed with phast software (attachment 2).
#11	EPC HAZOP	1.18.2. Loss of Instrument Air 3.18.2. Loss of Instrument Air	1.18.2.1. Section of line between 25SDV001 and 25XV004 will be blocked in during ESD scenario. **Consequence 3.18.2.2.**	11. Ensure that the trapped volume between 25SVD023 and 25PV025A/B is minimised such that it does not require blowdown.	ROSETTI	01/12/2023	As per note 6 on PID 123A90-DDL-PR-PID-80014_01, SDV VALVE 25-SDV-023 will BE INSTALLED AS CLOSE AS POSSIBLE TO THE CONTROL VALVES 25-PV-055A/B. This is to ensure that pressurized than 0.11 kg) in the system is so limited that in case of random rupture possible fire scenario will last few seconds and in any case less than 10 minutes (that is the minimum time for escalation as per assumption register 123A90-DDL-SAF-LIS-314, attachment 1). Also dangerous radiation levels for injuring operators are limited to less than 10 meters. As reference please refer attached simulation performed with phast software (see attachment 2) fluid and quantity trapped (volume less than 0.05 m3 and quantity less

Item No	Study	Credible Causes	Ultimate Consequences	Reccomendation	By	Date	Response
#12	EPC HAZOP	1.18.2. Loss of Instrument Air Consequence: 2.18.2.3	1.18.2.1. Section of line between 25SDV001 and 25XV004 will be blocked in during ESD scenario.	12.Review the trapped volume between Fuel Cell Package and 25PV025A/B is minimised such that it does not require blowdown or consider providing a blowdown route. See also recommendation 10.	ROSETTI	01/12/2023	Pressurized fluid and quantity trapped in the system (volume less than 0.05 m3 and quantity less than 0.11 kg) is so limited that in case of random rupture possible fire scenario will last few seconds and in any case less than 10 minutes (that is the minimum time for escalation as per assumption register 123A90-DDL-SAF-LIS-314, see attachment 1). Also dangerous radiation levels for injuring operators are limited to less than 10 meters. As reference please refer attached simulation performed with phast software (attachment 2).
#13	EPC HAZOP	1.20.1. DC systems	1.20.1.1. Potential for electrically induced corrosion.	13. Ensure that the potential for electrically induced corrosion and requisite earthing is considered in the SAFOP.	Crosswind	01/12/2023	To prevent induced corrosion, all metallic items not welded to the structure, will be earthed/bounded to the structure. See Earthing layout: 123A90-DDL-EL-DL-20132÷20134, 123A90-DDL-EL-DL-20136÷20138 and 123A90-DDL-IN-DL-40013 only for ITER container.
#14	EPC HAZOP	1.3.2. 25XV008/11/14/17/20 open when not required and V25001B-F is at low pressure. Consequence: 1.5.1.1 2.5.1. 25XV008/11/14/17/20 open when not required and V25001B-F is at High pressure (30barg). 3.3.2. 25XV009/12/15/18/21 open when not required and V25001B-F is at Low pressure H2. 3.3.3. 25XV009/12/15/18/21 open when not required and V25001B-F is at Low pressure N2.	2.5.1.1. Additional H2 cycled into vessel under purge. Additional H2 is vented to atmosphere, loss of product. No hazardous consequences. 3.3.2.1. Rapid increase in Pressure in vessels V25001B-F from 0 to 30barg. Potential for exceeding design velocity or high vibration in piping and vessels V25001B-F leading to potential LOPC of H2. 3.3.3.1. Rapid increase in Pressure in vessels V25001B-F from 0 to 30barg. Potential for exceeding design velocity or high vibration in piping and vessels V25001B-F leading to potential LOPC of H2. 3.3.3.2. Contamination of Feed stream to Fuel Cell and off spec H2 sent to the Fuel Cell leading to operational issue no hazardous consequences as per Fuel Cell HAZOP (Cause 1.13.1)	14. Determine if high DP across any valves (likely to be up to 30bar) has the potential for high velocity (outside of pipe spec) or high vibration with the potential to damage pipework. If so consider how purging cycle can be performed without using SDV.	ROSETTI	01/12/2023	Vibration analisys has been performed and according to "Guidelines for theAvoidance of Vibration Induced Fatigue in Process Pipework". To be noted that thecalculation has been performed considering the worst scanerio in terms of maximumgas velocity, since the operating conditions that have been considered are 65°Cand 0 barg. As the pipe is being pressurized, velocity will be even lower, resulting ina lower calculated LOF. As it can be seen from calculation (attachment 1), in orderto have a maximum LOF of 0.3, a STIFF or MEDIUM STIFF type span length can beused. The maximum span lengths that are used within CROSSWIND project are asper doc. "123A90-DDL-PP-RE-70001" (attachment 2)
#15	EPC HAZOP	2.2.3. 25PIC005 failure opening 25PV005	2.2.3.2. Unable to achieve set point pressure for purge cycle. Unable to complete purge operation leading to a delay in start-up.	15.Review the requirement for a timer alarm on the H2 pressurisation section of the purge cycle in the control logic to determine if the purge valve 25PV005 has failed to close.	ROSETTI	01/12/2023	As per doc. "Process Control, Operation, Start-up and Shutdown philosophy" n° 123A90-DDL-PR-RE-80031 rev.01 par. 3.4.1.2, at the beginning of the purging operation a timer alarm, in the control logic, will be implemented to determinate if 25-PIC-035 failure opening 25-PV-035 control valve
#16	EPC HAZOP	2.2.6. 25FIC001 failure opening 25FV001 N2 valve 2.3.2. 25XV008/11/14/17/20 open when not required and V25001B-F contains N2 at low pressure	2.2.6.1. Potential for N2 (7barg) into H2 storage vessel V25001A during purge operation resulting in off spec H2 sent to the Fuel Cell leading to operational issue no hazardous consequences as per Fuel Cell HAZOP (Cause 1.13.1)	16.Implement 25FV001 as a Type 6 as it is critical to the operation of the fuel cell that N2 is excluded from the storage system.	ROSETTI	01/12/2023	As per P&IDs "Hydrogen Storage Vessel A/B/C/D/E/F" n° 123A90-DDL-PR-PID-80015/16/17/18/19/20 rev.01, all the Nitrogen flow control valves inlet to Storage Vessels are Type 6 as critical control valves.
#17	EPC HAZOP	2.13.2. N2 contamination of storage vessel 3.2.2. 25FIC001 failure opening 25FV001 N2 valve	2.13.2.1. Potential to contaminate H2 tank during purge cycle with no means of detecting contamination before use in Fuel Cell resulting in poor functioning of Fuel Cell. Operational issue, no hazardous consequences. 3.2.2.1. Potential for N2 (7barg) into H2 storage vessel V25001A at end of Fuel Cell operation resulting in off spec H2 sent to the Fuel Cell leading to operational issue no hazardous consequences as per Fuel Cell HAZOP (Cause 1.13.1).	17.Review the requirement for a separate header with an additional isolation on the N2 supply to the storage vessels to minimise the likelihood of N2 contamination of H2 storage vessels during purge cycle.	ROSETTI	01/12/2023	A separate header with an additional isolation valve 64SDV001 on the N2 supply to thestorage vessels has been provided, as shown in the attached P&iD 123A90-DDL-PR-PID- 80027, see attachment 1. IEC 61511 allows the use of a shutdown valve also as an XV valve. If our SDV was involved in a SIF (therefore SIL>=1) then we would have had to do a risk analysis. In CROSSWIND project the valve is not even involved in a SIF with SIL> =1, therefore is acceptable to use the SDV as XV valve.
#18	EPC HAZOP	2.15.1. N2 purging in preparation for maintenance	2.15.1.1. Unable to purge pipework between tee off for 25XV003 and Electrolyser. Potential for H2 to remain in pipework when broken for maintenance. Small LOPC of H2 likely to be insufficient to cause significant hazard.	18.Review where a N2 purge connection can be located close to Electrolyser discharge to enable N2 purging of H2 storage inlet system.	ROSETTI	01/12/2023	N2 purge connection has been provided close to Electrolyser discharge to enable N2 purging of H2 storage inlet system. As per note 9 (see attachment 1), "NITROGEN PURGING CONNECTION TO BE LOCATED AS CLOSE AS POSSIBLE TO MANUAL VALVE BLPH-MV-003" (see attachment 1). Moreover, note 11 has bene added (see attachment 1), which states:"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."
#19	EPC HAZOP	2.15.2. Fail closed of N2 valve 25FV001 when purging	2.15.2.1. Potential significant concentration H2 in vessel when breaking containment for maintenance.	19.Review the requirement for a means to detect that the concentration of H2 within the H2 storage vessels is above the allowable level prior to breaking containment on the vessel.	Rosetti/Crosswind	01/12/2023	During the 2 years operation no inspection inside the vessels is foreseen,therefore there will be no breaking of containment and thereforethere is no requirement of providing H2 fixed detector. In case of extraordinary maintenance, a dedicated opening procedure shall be developed. Recommendation for Crosswind Operation is to develop a procedure for extraordinary maintenance as follows: 1) Start unbolting manhole (no more than 30% of bolts) and place having portable H2 detectors close to the manhole. 2) Once portable detectors will not detect H2 anymore un bolt the remaining bolts. H2 is not expected anymore
#20	EPC HAZOP	3.1.17. BLPH-MV-492 SB Left in closed position on Downstream line 3.1.18. Blockage in line within Fuel Cell Package, considered to be failure to reopen main isolation valve following maintenance.	3.1.17.1. Upstream: Potential overpressure of pipework downstream of 25PV025A/B. LOPC of H2 and potential explosion on ignition. Not included in recommendation 21/22 for LOPA as the likelihood of this cause will not be significant. 3.1.18.1. Upstream: Potential	20.Ensure that 80PSV001 is verified for blocked discharge downstream of 25PV025A/B during fuel cell operation. No consideration is made of advantageous control from 25PCV025A/B as per Shell rule set.	ROSETTI	01/12/2023	As per "Relief, Vent and Blowdown Report" doc. n. "123A90-DDL-PR-RE-80030"revision 01, it is confirmed that the 80PSV001 has been verified for blocked discharge downstream of 25PV025A/B during fuel cell operation. See Section 3.3 of the above mentioned document, attached to this Action.
#21	EPC HAZOP	3.1.18. Blockage in line within Fuel Cell Package, considered to be failure to reopen main isolation valve following maintenance. 3.2.5. 25PIC025A/B control failure opening 25PV025A/B	3.1.18.1. Upstream: Potential overpressure of pipework downstream of 25PV025A/B. LOPC of H2 and potential explosion on ignition. 3.2.5.1. Potential overpressure of pipework downstream of 25PV025A/B. LOPC of H2 and potential explosion on ignition.	21. Review the required response time (PST) of 80PI002/25SDV023 to ensure that they are able to react to prevent exceedance of hydrotest pressure of the downstream pipework and Fuel Cell if 25PCV025A/B are fully opened.	Rosetti/Crosswind	01/12/2023	PSV 80PSV001 set pressure is 10 barg, while hydrotest pressure is 15 bar g. PSV opening time (≤ 100 msec) is enough to react to prevent exceedance of hydrotest pressure of the downstream pipework and Fuel Cell. See also EPC HAZOP Action No. 22.
#22	EPC HAZOP	3.2.5. 25PIC025A/B control failure opening 25PV025A/B 3.1.18. Blockage in line within Fuel Cell Package, considered to be failure to reopen main isolation valve following maintenance 1.2.4. 25XV006 Driven open/inadvertently opened by operator	3.2.5.1. Potential overpressure of pipework downstream of 25PV025A/B. LOPC of H2 and potential explosion on ignition. 1.2.4.1. Pressurise downstream system to 25PV025A/B up to 30barg. Potential to exceed design pressure (3 times design pressure) downstream of 25PV025A/B, LOPC of H2 and explosion on ignition. 25PV025A/B are downstream pressure controlled and are potentially opened when fuel cell is not online."	22. Review the required response time (PST) of 80PSV001 to ensure that it is able to react and depressurise the system quickly enough to prevent overpressure of the pipework and Fuel Cell if 25PCV025A/B are fully opened. Consider the opening times of storage vessels outlet XVs, e.g. 25XV006 and 25PV025A/B. .If PSV reaction time criteria cannot be met LOPA for 25PI002 must be reviewed.	Rosetti/Crosswind	01/12/2023	Pressurization calculation of the inventory downstream the control valves 25PV055A/B have been performed to calculate the time for the system to reaches the transient pressure acceptable to Fuel Cell in the event of the 80PSV001 lifting. As it can be seen from the "ATTACHMENT 1 - CALCULATION SHEET", the time to reach such transient pressure is higherthen the time for the 80PSV001 to fully open (100%). The calculation is based on informationpresented in Attachment 2, 3, 4 & 5. Therefore: 1) With the two conservative assumptions made on the attachment 1 and; 2) Considering that the time (102 msec) to reach 13.5 barg (Fuel Cell design pressure) is higher then the 80PSV001 valve opening time (≤ 100 msec), the 80PSV001 is able to react and depressurise the system quickly enough to prevent overpressure of the Fuel Cell Package A-80000
#23	EPC HAZOP	3.6.1. Low Pressure at inlet to Fuel Cell	3.6.1.1. Potential damage of Fuel Cell and loss of Power generation. Operational issue, no hazardous consequences. Low pressure likely to occur during normal operation when storage tank is depleted.	23. Review the requirement for a low pressure alarm on 25PIC025A/B to indicate that the PCV no longer has control over the downstream pressure due to depletion (low pressure) of the H2 storage vessel and low low pressure trip on 80PI002 to shutdown the Fuel Cell Package.	ROSETTI	01/12/2023	Requirement for: 1) a low pressure alarm on 22PIC055A/B(ex 25PIC025A/B) dowstream control valves 25PV055A/B, allerting the operator in case of low pressure at fuel cell inlet. 2) and low low pressure trip on 80PI002 to shutdown the fuel cell package, have been verified and added on P&IDs (see attachment-1 PID "123A90-DDI-PR-PID-80014" and attachment-2 PID "123A90-DDI-PR-PID-80012", respectively)
#24	EPC HAZOP	1.13.4. O2 contamination of H2 in the storage system	1.13.4.1. O2 contamination of H2 in the storage system. Potential for explosion in H2 storage vessel. For flammable concentration to be formed within the H2 storage vessel O2 would have to accumulate within the vessel and not be flushed out.	24. Review with Fuel Cell suppliers what the consequence of 500ppm of O2 in the H2 stream will be on the Fuel Cell. Will this be only be an impact on performance or likely to create a hazard? If credible hazard consider LOPA for Elogen OIHA800A/B.	Rosetti/Crosswind	01/12/2023	Exceeding the FC spec of 5ppm O2 in the H2 supply, the results of 500ppm (= 500 umol/ mol, 100x times the specification limit) is at most equipment degradation over a period of hours/days, with no danger to people or risk of hydrogen release. Please see attached email for further information.
#25	EPC HAZOP	1.13.4. O2 contamination of H2 in the storage system	1.13.4.1. O2 contamination of H2 in the storage system. Potential for explosion in H2 storage vessel. For flammable concentration to be formed within the H2 storage vessel O2 would have to accumulate within the vessel and not be flushed out.	25. Perform a calculation to determine how long/number of fill cycles it would require for a flammable concentration to be formed within the H2 storage vessel based on 500ppm O2 to determine if a flammable concentration is credible in the H2 storage vessel.	ROSETTI	01/12/2023	Calculation to determine how long/number of fill cycles it would require for a flammable concentration to be formed within the H2 storage vessel based on 500ppm O2 has been performed, see attached calculation sheet (attachment 1). According to result, a flammable concentration is not credible in the H2 storage vessel.
#26	EPC HAZOP	8.1.1. BLPH-MV-412 Caisson common inlet line left closed after maintenance	8.1.1.1. No outlet for discharges into Caisson. Discharge from Elogen RO cells potentially at high pressure (Elogen estimate 10barg). Potential pressurisation Caisson inlet header and reverse flow of RO discharge to other brine discharge streams.	Elogen to confirm to Rosetti the blocked in discharge pressure from the RO cells to the Brine Caisson Discharge system, i.e. the pressure in the line if the RO cell reject/discharge is blocked outside of the battery limit.	Crosswind	01/12/2023	There is a potential overpresssure scenario with a release of water and damage to piping whenBLPH-MV-412 caisson common inlet line is close. This valve has been made Locked-Open according to 123A90-DDL-PR-PID-80025 rev 02 and as such the scenario is ALARP
#27	EPC HAZOP	4.2.1. Full production rate of H2 from Elogen Electrolyser sent to vent	4.2.1.1. Full production of wet H2 sent to H2 vent. Potential high back pressure on other vent users and high moisture content of stream. No hazardous consequences as this is the design case for the vent system.	27. Determine the back pressure on the vent system for full wet production H2 sent to H2 vent. Determine the effects of high back pressure on other vent users, consider the effect on relief valve set points and Electrolyser Oxygen in Hydrogen analysers due to back pressure. Review impacts with interface units. See also recommendation 31	Crosswind	01/12/2023	Rosetti have performed the back pressure calculations and determined that the back pressure is lower than 0.5 barg (TQ-C63-ELO CWD-017)The H2 vent for sampling will be separate and routed to atmosphere. The vent location is assessed in C63-PTN-002, O2 & H2 Vent Technical specification. Therefore no increased backpressure on the sampling vent outlet when venting H2. Elogen have used these calculations to update their design to install additional valves to prevent H2 vapour breakthrough to water discharge
#28	EPC HAZOP	4.20.1. Lute provision on base of stack within Rosetti Package	4.20.1.1. Refer to Recommendation.	28. Review the requirement for a Lute within the Elogen Package H2 vent system as the package vent discharge is via a knockout pot V43001 within the Rosetti scope. If Elogen Lute not required consider removal of the Elogen package Lute	Crosswind	01/12/2023	The collection header of all hydrogen to vent system in Elogen is at a low point. Lute is still required to collect any condensation. Lute will remain in the system
#29	EPC HAZOP	4.2.3. Flow from Elogen Electrolyser sample system	4.2.3.1. Very small continuous flow, no significant impact. No hazardous consequences.	29. Review the impact of back pressure in the H2 vent system on the Elogen product sample system. Consider that the Electrolyser may be in start-up and venting wet H2 and this is the critical time for sampling of the product stream. See also recommendation 29	Crosswind	01/12/2023	H2 vent for sampling will be separate and routed to atmosphere. The vent location is assessed in C63-PTN-002, O2 & H2 Vent Technical specification. Therefore no increased backpressure on the sampling vent outlet when venting H2

Item No	Study	Credible Causes	Ultimate Consequences	Reccomendation	By	Date	Response
#30	EPC HAZOP	4.1.1. BLPH-MV-002 SB Left in closed position	4.1.1.1. Upstream: No flow from Electrolyser Package into H2 vent. Blocked outlet on Electrolyser relief and vent systems. Review in Elogen HAZOP. [Parking Lot; What: Review in Elogen HAZOP.]	30. Review the requirement for BLPH-MV-002 in the H2 vent system as this is a potential isolation point within a relief route. Also review the piping specification around the tie in point and identify it on P&ID to ensure compatibility.	ROSETTI	01/12/2023	The requirement for BLPH-MV-002 in the H2 vent system is confirmed, since it willbe used as an isolation valve when required. Moreover, the manual valve BLPH-MV- 002 is specified to be locked open ("LO"), therefore the scenario of leaving the valve in closed position is not credible (for reference see attachment 1)
#31	EPC HAZOP	4.1.4. BLPH-MV-033 DBB Left in closed position 4.1.10. BLPH-MV-005 DBB Left in closed position	4.1.4.1. Upstream: Unable to relieve vessel V-25001A when required. Potential escalation of existing incident or unable to prepare installation for maintenance. Consequence **4.1.10.1**	31. Review the location of the spec break downstream of: 1. 25PSV001A/BLPH-MV-033 2. 80PSV001/BLPH-MV-005 As pipework between PSV and manual valve will see upstream pressure if closed and a relief occurs.	ROSETTI	01/12/2023	Location of the spec break downstream of: 1. 25PSV001A/BLPH-MV-033 2. 80PSV001/BLPH-MV-005 are confirmed as they are, since all manual valves installed downstream PSVs are locked open "LO" (see attachment 1 and 2). The situation of having a release scenario and at same time a manual valve wrongly closed (due to human error) represents a double jeopardy. The simultaneous occurrence of two or more unrelated causes of overpressure (also known as double or multiple jeopardy) is not a basis for design. To be noted that the closure of a manual valve located downstream a PSV is not a cause of having overpressure in the analyzed system, in the sense that all PSVsobject of this HAZOP recommendation are required to be opened in case of: 1) upstream CV failure (80PSV001); 2) fire (25PSV001). Both scenarios above indicated are not caused by having closed the manual valve installed downstream the PSV. Therefore, the causes of overpressure are considered to be unrelated.
#32	EPC HAZOP	4.1.11. No flow from N2 package to H2 vent 4.1.12. BLPH-MV-171 Left in closed position on N2 system 4.1.13. BLPH-MV-172 Left in closed position on N2 system 4.2.3.1. Very small continuous flow, no significant impact. No hazardous consequences 2.6.1. During purge cycle vessel	4.1.11.2. Downstream: Potential for air to be drawn into system via vent stack resulting in a flammable mixture within the vent system. Potential explosion upon ignition in vent system. **Consequence: 4.18.2.1** 2.6.1.1. Potential for air ingress from vent system and contamination of	32. Review the requirement for level transmitter and low level alarm to detect low level in H2 vent liquid seal Q43004.	ROSETTI	01/12/2023	As per P&ID " Hydrogen Vent drum" n° 123A90-DDL-PR-PID-80029 rev.01, a Level Transmitter 43-LT-003 has been added with low level alarm to detect low level in H2 vent liquid seal Q43004.
#33	EPC HAZOP	4.2.4. Flow from Elogen HPP RVs	4.2.4.1. Potential full production flow via HPP RVs (may be wet or dry). Review consequences based on close out recommendation 35 (potential for high O2 concentration from HPP vent resulting in flammable mixture in H2 vent).	33. Review with Elogen/HPP suppliers the upper limit of O2 concentration that can be relieved/ vented to the vent system from the HPP. Determine if this concentration will result in a flammable mixture within the vent system. If this is the case consider if this vent may require segregation from the main vent system.	Crosswind	01/12/2023	A high value of O2 (with the mixture is within flammable range) is not allowed and expected anywhere in the system, including in Elogen HPP. Hence, no flammable mixture expected and no hazardous consequence for the vent.
#34	EPC HAZOP	4.3.1. Reverse flow of H2 to N2 system during ESD 1D	4.3.1.1. Based on loss of N2 triggering ESD 1D (64PI002) the Back pressure within H2 vent system is > N2 feed pressure. Potential reverse flow resulting in H2 being used in place of N2 in Electrolyser systems. Refer to Elogen HAZOP node 10.	34. Review the requirement for BLPH-NRV-020/021 to be class 1 for N2 utility service considering that the life span of the installation is considered to be 2 years with no significant turnaround within that time.	Crosswind	01/12/2023	Based on the close-out of recommendation 7 the NRV for the N2 utility does not need to be class one. An additional SDV (64SDV001) has been installed. See P&ID 123A 90 DDL PR PID 800 27
#35	EPC HAZOP	4.2.6. BLPH-MV-171 open more than required on N2 system	4.2.6.1. Potential for impact on other N2 users resulting in an inability to purge. Loss of safeguard.	35. Ensure sizing of the Needle Valve BLPH-MV-171 prevents excesive N2 use which may impact other users by selecting the CV of the valve and hence maximum flowrate.	ROSETTI	01/12/2023	According to PID 123A90-DDL-PR-PID-80028: 1)the manual valve MV-171 has been specified to be locked in place (LIC) see note 2 on attachment 1; 2)flow meter 64FG001 has been specified to be readable from manual valve MV-171 (see note 1, on attachment 1). The operator will open the MV-171 such that the nitrogen flow rate readable from the flow meter will be 9.2 Nm3/hr, as per 123A90-DDL-PR-Re-80037 Appendix01 (see attachment 2). This
#36	EPC HAZOP	4.2.7. 43LIC001 control loop failure opening 43LV001	4.2.7.1. Loss of liquid level in KO drum V43001 and gas blow-by to the Brine Discharge Caisson B50014. LOPC of H2 into sea below installation.	36. Perform a dispersion calculation for release of H2 via the B50014 Caisson from a gas blow by from the V43001 KO drum. Consider the maximum pressure the KO drum may reach under all scenarios. If a hazard is created at the installation see action 39.	ROSETTI	01/12/2023	Gas Blow by of H2 to B-50014 Caisson is not a credible scenario. Automatic valve has been replace by manual valve MV-409 (LC) that shall be open only after depresurizzation and purging during maintenance activities. See P&Ids 123A90-DDL-PR-PID-80029_03, see attachment 1
#37	EPC HAZOP	4.2.7. 43LIC001 control loop failure opening 43LV002	4.2.7.1. Loss of liquid level in KO drum V43001 and gas blow-by to the Brine Discharge Caisson B50014. LOPC of H2 into sea below installation.	37. Review the requirement for an additional SDV in the KO drum water drain line activated by 43LI002 low low level to prevent gas blow-by to the Caisson. To be evaluated with LOPA if required. Note that the liquid level in KO drum V43001 may be lost due to evaporation over time and if a trip is fitted this may result in a spurious trip of 43LI002 low low level alarm. Review against recommendation 40.	ROSETTI	01/12/2023	As per recommendation 38 (ex 40) and per P&IDs 123A90-DDL-PR-PID-80029_01, control valve on the liquid drain line of the H2 Vent KOD has been deleted, consequently the 43LIC001 controller has been removed. Shutdown valve has not been added due to the manual on-off valve (BLPH-MV-409) locked closed in normal operating condition.
#38	EPC HAZOP	4.10.1. Low level in Liquid boot of V43001	4.10.1.1. Low liquid level in KO drum V43001 is expected to be normal, potentially dropping below low low level alarm point overtime due to evaporation within KO drum.	38. Review how the liquid drain line from the KO drum V43001 can be safely routed for disposal considering that it may be subject to gas blow-by due to loss of liquid seal by evaporation. Review against recommendation 39.	ROSETTI	01/12/2023	As per P&IDs 123A90-DDL-PR-PID-80029_01, control valve on the liquid drain line of the H2 Vent KOD has been deleted. The manual valve installed on the drain line (valve BLPH-MV-409) has been specified to be "LC" (locked closed). See attached P&ID
#39	EPC HAZOP	4.10.2. Low level in H2 vent seal Q43004	4.10.2.1. Loss of liquid seal due to evaporation. Potential for air ingress in to system leading to a flammable mixture.	39. Ensure that consideration of top up of the glycol seal in vent Q43004 is made in the design, and that there will be a 6 month period between maintenance interventions which will allow top up.	ROSETTI	01/12/2023	As per P&iD doc. n. "123A90-DDL-PR-PID-80029"(attachment 1), a filling line has been provided to allow top up of the glycol seal in vent Q43004. During maintenance intervention, the filling line will allow top upof the glycol in the liquid seal drum of the H2 Vent Q43004.
#40	EPC HAZOP	4.11.1. Rain ingress into H2 vent stack	4.11.1.1. Potential for high level in liquid seal Q43004 and overflow to drain resulting in dilution of glycol concentration and potential for freezing of liquid seal and blockage of relief route. Consequence: **4.18.1.1**	40. Ensure the design of the vent Q43004 exit minimises the potential for rain ingress which may dilute the seal liquid potentially resulting in blocked outlet for the H2 vent system due to freezing.	ROSETTI	01/12/2023	As per note 4 of "TDS - Hydrogen Vent Package - Q-43004", doc. n. "123A90-DDL-MAC-DS-50044"a note has been specified to ensure the design of the vent Q43004 exit minimises the potential for rain ingress which may dilute the seal liquid potentially resulting in blocked outlet for the H2 vent system due to freezing. For reference see "attachment 1". Moreover, as per P&ID doc. n. "123A90-DDL-PR-PID-80029" the liquid seal drum is heat treaced, as per note 5 (see attachment 2)
#41	EPC HAZOP	4.3.3. BLPH-MV-419 left open after liquid seal top up	4.3.3.1. LOPC of vent gases (likely to be H2) to deck area of installation. LOPC of H2 and potential explosion within stack.	41. Ensure that the seal liquid top up procedure is considered as a safety critical procedure as failure to close BLPH-MV-419 top up valve will allow LOPC of H2 on to deck area with potential for an explosion within the vent stack.	Crosswind	01/12/2023	Seal Liquid top up procedure will be considered as a safety critical procedure in the Safety Critical Task Analyses Report (123A90-DDL-SAF-RE-30040)
#42	EPC HAZOP	4.18.3. Loss of Instrument Air	4.18.3.1. 43LV001 moves to air fail position.	42. Make air fail position of 43LV001 fail closed and type 6 (critical).	ROSETTI	01/12/2023	As per HAZOP worksheet, see note on point 4.1.14.1, which states: QUOTE 90 Electrolyser starts/yr, 0.5 hr/start-up, 3.2kg/hr of water(worst credible scenario based on condensation of all water in stream), Platform visited for maintenance 2 times/yr where issue can be identified and rectified. 0.076 m3 of water within 2m3 KO drum overfill of vessel not considered credible.UNQUOTEthe amount of water accumulated within the H2 Vent KOD V-43001 is very small and it can be stored over a period of 6 months. Therefore, 43LV001 has been deleted. In case water is accumulated within the vessel, then it will be drained off during maintenance, by opening a manual valve ("LC") installed on the liquid outlet line of the H2 Vent KOD.
#43	EPC HAZOP	5.1.2. P50001A pump tripped	5.1.2.1. No flow into coarse filter package A50003 resulting in failure of backwash cycle, operational issue requiring additional backwash cycles. No hazardous consequences. Review consequences of loss of main flow in A50003 package HAZOP	43. Update the control narrative to identify alternate seawater lift pump auto-start on 50PI001/002 low pressure alarm or 50XA001/003 trip/fault alarm.	ROSETTI	01/12/2023	Control narrative has been updated to guarantee low pressure alarm (50-PAL-001/002) will auto-start designated stand by pump. See 123A90-DDL-IN-RE-40095 attached
#44	EPC HAZOP	1.2.4. 25XV006 Driven open/inadvertently opened by operator 3.16.1. Start up of Fuel Cell 135 times/year	1.2.4.1. Pressurise downstream system to 25PV025A/B up to 30barg. Potential to exceed design pressure (3 times design pressure) downstream of 25PV025A/B, LOPC of H2 and explosion on ignition. 25PV025A/B are downstream pressure controlled and are potentially opened when fuel cell is not online. 3.16.1.1. Potential for overpressurisation of line and Fuel Cell downstream of 25PV025A/B due to reaction speed of 25PIC025A/B	44. As fuel cell runs down 25PIC025A/B opens 25PV025A/B. Ensure that when restart occurs 25PV025A/B are fully closed and review how the downstream pressure can be slowly increased to the point where 25PIC025A/B can be given automatic control.	ROSETTI	01/12/2023	As per doc. "Process Control, Operation, Start-up and Shutdown philosophy"" 123A90-DDL-PR-RE-80031 rev.01 par. 3.4.1.4, when the Fuel Cell is stopped, the control logic will force the operating control valve 25-PV-055A (or B) to fully close. As the Fuel Cell starts, the 25-PIC-055A/B controller will command the opening of the control valve 25-PV-055A (or B).
#45	EPC HAZOP	4.1.14. BLPH-MV-409 SB Left in closed position on V-43001 drain 4.1.15. 43LIC001 control loop failure closing 43LV001	4.1.14.1. Upstream: Unable to drain liquid from KO Drum V-43001 leading to potential high level in KO Drum and liquid into H2 relief header resulting in high back pressure to relieving streams. Rupture of relief streams, LOPC of H2 and explosion on ignition. 90 Electrolyser starts/yr, 0.5 hr/start-up, 3.2kg/hr of water(worst credible scenario based on condensation of all water in stream), Platform visited for maintenance 2 times/yr where issue can be identified and rectified. 0.076 m3 of water within 2m3 KO drum overfill of vessel not considered credible. Consequence **4.1.15.1**	45. Review the requirement for 43LI002 High High activating ESD 1 as no scenarios were identified within the HAZOP which would activate the trip. Verify before removal that there is no requirement from project applicable standards and good practice (DEP) for this trip.	ROSETTI	01/12/2023	For good practice of this project (DEP) the following has been performed: -Level transmitter 43-LT-001 will be kept and wired to ESD system instead of PCS system; -In case of HH trip, logic will trip Electrolyzer package, water treatment package and sea water pumps; -P&IDs, wiring diagram and logic will be revised accordingly
#46	EPC HAZOP	1.15.1. Maintenance of Relief Valves	1.15.1.1. Lifting of relief valves in to place during maintenance review requirement for accessibility and temporary lifting equipment.	46. As part of 3D / layout / HF reviews determine the requirements for lifting of relief valves into place during maintenance in terms of accessibility and use of temporary/permanent lifting equipment.	Rosetti/Crosswind	01/12/2023	AS per Vendor Maintenance plan (1724000518-IN-MAN-00010) no requirement for lifting relief valves into place are foreseen during the 2 years operation life. In case of extraordinary maintenance temporary scaffholding and necessary handling tools will be studied for the purpose.
#47	EPC HAZOP	5.20.1.	5.20.1.1.	47. Review the design basis operational time for the PSC units against the design requirements of the Rosetti scope and align the requirements. PSC design basis is 8-12 hours continuous twice a week for 6 months vs Rosetti requirements including purging and black start scenarios.	Rosetti/Crosswind	01/12/2023	The design has been reviewed and aligned according with RM scope. Off spec water feed will not feed Elogen package due to the presence of off spec valves (50-XV-032 and 50-XV-026), see 1724000448-PR-PID-00013

Item No	Study	Credible Causes	Ultimate Consequences	Reccomendation	By	Date	Response
#48	EPC HAZOP	5.1.27. 50-XV026 fails to open when required. Failure of conductivity control 50-AI024	5.1.27.1. Potential off spec water fed to Elogen water treatment. Potential fouling of Elogen RO cells and loss of purified water to electrolysis unit. Operational issue.	48. Review the effect of out of spec water fed to Elogen RO cells based on a temperature at the PSC RO cells of 40 degC with the chloride concentration based on this temperature. Identify in the Elogen HAZOP if it is credible that chloride is fed through to the electrolysis cells or if this is only an operational impact on RO cell performance (current assumption). If there is adverse impact on the cells, review if LOPA is required for this failure in the Rosetti HAZOP.	Rosetti/Crosswind	01/12/2023	PSC reply: Out of spec water to Elogen water treatment package is prevented by temperature transmitters 50-TT-022 (H value set to 25°C. At this set temperature activates Interlock I-020 will be activated closing XV-025 and opening XV-026, which is the sea water maximum temperature at RO inlet). Chloride concentration at the PSC RO cells at 25°C is expected 200 ppm. Crosswind reply: The RO experience membrane degradation, resulting in reduced performance and eventually to irreversible damage. No LOC. In the WTP of Elogen there is a conductivity analyser, downstream of the RO and internal filters. If this conductivity analyser measures a very high conductivity, because of the high chloride concentration, CAHH-300 alarm is triggered. CAHH-300 initiates IP16 (Problem on pure water feed to anodic loop), which stops the pumps downstream of the WTP, consequently stopping the water feed to the stacks (IP16: STOP IMMEDIATELY BY SETTING VAR300A/B TO 0% THE RUNNING LP-300 (A or B following status)
#49	EPC HAZOP	5.1.18. 50-XV021 closed failure in filter change over operation	5.1.18.2. Dry running of pumps P-50003A/B and loss of flow to P-50004A/B. Damage to pumps P-50003A/B and P-50004A/B.	49. 50-LI020LL should trip P-50004A/B on LL level in T-50006 to prevent pump damage	ROSETTI	01/12/2023	According with doc. 724000448-MAC-CE-00004 Water Treatment Package A-50000 Cause & effect Matrix attached, 50-LI020LL will trip pump P-5004 A/B
#50	EPC HAZOP	5.3.6. 50-XV027 opening when not on flushing cycle	5.3.6.1. Reduced pressure within RO cells and reduced fresh water production. Water directed towards brine caisson. No hazardous consequences.	50. Ensure that where multiple trains are implemented within the WTP package remote changeover between trains is available to onshore operators on request.	Rosetti/Crosswind	01/12/2023	As per all other actions, Rosetti confirms that no operator intervention is needed since the system is sized 2x100 as per doc 1724000448-MAC-SP-00003 and changeover is done periodically. Despite this, operator can anytime connect to the PLC trough modbus connection and do the change over manually, if required.
#51	EPC HAZOP	5.3.7. 50-XV023 flushing valve open when not required	5.3.7.1. Linking of T-50006 and T-50008 with potential of contantamination of T-50008 with filtered sea water. Filtered sea water fed forward to electrolysis unit with potential damage to RO unit in electrolysis package.	51. Add an NRV in the flushing water line between T-50008 and 50-XV023 / 50-XV024 to prevent reverse flow in the flushing line and potential contamination of T-50008 with filtered brine from T-50006.	ROSETTI	01/12/2023	Noted. The Check valve NRV-650 have been installed. See PID 1724000448-PR-PID-00013 SHEET 5
#52	EPC HAZOP	5.1.32. MV-563 / MV-566 inadvertently closed	5.1.32.1. Deadheading of P-50009A/B (7barg) potential overpressure of pump discharge pipe work (DP 6barg). Pump damage and potential LOC of fresh water within WTP container.	52. Determine how overpressure of fresh water system can be prevented should P-50009A/B be isolated on the downstream side as deadhead pressure of these pumps is 7barg and the design pressure of downstream system is 6barg.	ROSETTI	01/12/2023	A Relief valve (PSV) 50-PSV-053 has been installed upstream the softener S-50004 and downstream the manual ball valve MV-563. ThePVC-U pipe design pressure is16barg (PN16). See P&ID 1724000448-PR-PID-00013
#53	EPC HAZOP	10.2.1. P-50005A/B running. Failure of PH 50-AIC027	10.2.1.1. Overdosing of caustic resulting in high PH of treated water. Operational issue for electrolysis unit.	53. Review with Elogen the consequences of loss of PH control within the water treatment package on the electrolysis. If consequences are significant for electrolyser package review if additional safeguards for PH protection are required within electrolyser package.	Crosswind	01/12/2023	A change in pH value will impact the water treatment package of the electrolyser, leading to changes in water conductivity, which is unacceptable for theelectrolyser. There is an independent conductivity measurement sensor in the electrolyser water treatment package. If the conductivity exceeds alarm levels, the water treatment package (WTP) and the electrolyser will be shut down to prevent damage to the electrolyser membrane
#54	EPC HAZOP	5.2.1. P-50009A & B both operating	5.2.1.1. Potential overfill of Elogen WTP-300 and further consequences to be determined in WTP HAZOP.	54. Ensure logic for control of P-50009A/B prevents simultaneous running A & B pumps.	ROSETTI	01/12/2023	Ensure logic for control of P-50009A/B prevents simultaneous running A & B pumps
#55	EPC HAZOP	7.13.1. Air contamination of N2 supply to Elogen Package	7.13.1.1. Potential for flammable atmosphere within H2 systems within Elogen Package. No barriers within Elogen Package. To be reviewed within A-64000 N2 package HAZOP and LOPA	55. Review with Elogen the consequences of oxygen contamination of the N2 supply to the electrolysis unit and determine if consequences need to be considered in a LOPA analysis of the A-64000 oxygen analyser.	Crosswind	01/12/2023	The consequence of introducing air into the H2 loop of the electrolyser is a potential flammableatmosphere in H2 loop of the package with potential internal explosion. The N2 package A-64000 has an oxygen analyser to ensure the purity of the N2 supplied to the electrolyser.
#56	EPC HAZOP	7.13.2. Air contamination of N2 supply to H2 storage	7.13.2.1. Potential for flammable atmosphere within H2 storage systems. To be reviewed within A-64000 N2 package HAZOP and LOPA	56. Review with N2 package vendor the consequences of oxygen contamination of the N2 supply to the storage and vent systems and determine if consequences need to be considered in a LOPA analysis of the A-64000 oxygen analyser.	ROSETTI	01/12/2023	Due to the presence of Oxygen analyzer AI-151, in case of presence of oxygen (up to 3%) the valve XV-059 will open discharging all the contaminated nitrogen directly to the vent, avoiding storage contamination. The presence of O2 above spec is hence reduced to ALARP.

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	1
Cause:	1.1.2. 6 manual valves & SDV
Consequence:	1.1.2.1. Potential overpressure of piping downstream of electrolyser, leading to loss of containment (LOC) of hydrogen.
Safeguards:	
Actions:	Ensure adequate overpressure protection system is provided within electrolyser package to prevent overpressure of downstream piping.
Assigned Respondent (By)	CROSSWIND
RESPONSE	Adequate protection has been installed, refer to CRW-01-R-01 for details.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements

Company Discipline Lead	**Sign**
	Hamant Patel Digitally signed by Hamant Patel Date: 2024.10.09 16:02:58 +01'00'
Company HSE LEAD	**Sign**
	Paul van Rossum Digitally signed by Paul van Rossum Datum: 2024.10.11 08:03:03 +02'00'
Company Project Manager	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.11 07:35:39 +02'00'
Contractor received for information. Not independently verified. Information implemented	**Sign**

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	1
Cause:	Increased production of hydrogen from electrolyser. Due to unknown cause.
Consequence:	Overfill & potential overpressure of hydrogen storage, leading to potential LOC of hydrogen.
Safeguards:	
Actions:	Ensure adequate overpressure protection system is provided within electrolyser package to prevent overpressure of downstream piping.
Assigned Respondent (By)	CROSSWIND
RESPONSE	Adequate protection has been installed, refer to CRW-01-R-01 for details.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements

Company Discipline Lead	**Sign**
	Hamant Patel Digitally signed by Hamant Patel Date: 2024.10.09 15:55:08 +01'00'
Company HSE LEAD	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.11 07:48:45 +02'00'
Company Project Manager	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.11 07:35:19 +02'00'
Contractor received for information. Not independently verified. Information implemented	**Sign**

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	2
Cause:	Water
Consequence:	Potential for corrosion of downstream piping , leading to LOC of hydrogen
Safeguards:	
Actions:	Review possibility of water (saturated or free) being carried forward to downstream system& assess suitable means of protection for piping & equipment in hydrogen storage
Assigned Respondent (By)	CROSSWIND
RESPONSE	Rosetti Marino: inlet piping is in SS and H2 storage vessel are in CS (no corrosion allowance). Both inlet piping and H2 storage vessels are designed for dry service Crosswind: Since the service is dry and the operational lifecycle equals to 2 years, any requirement for corrosion protection is deemed to be unecessary
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements

Company Discipline Lead	**Sign**
	Hamant Patel
Company HSE Lead	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.09.23 07:26:18 +02'00'
Company Project Manager	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.09.24 09:16:32 +02'00'
Contractor received for information. Non independetly verified. Information implemented	

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	3
Cause:	Oxygen, due to unknown causes in PEM electrolyser.
Consequence:	Potential for corrosion of downstream piping , leading to LOC of hydrogen
Safeguards:	
Actions:	Review possibility of oxygen being carried forward to downstream system& ensure suitable means of protection is provided for piping & equipment in hydrogen storage and within electrolyser package
Assigned Respondent (By)	CROSSWIND
RESPONSE	Adequate protection has been installed, refer to CRW-01-R-01 for details.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements

Company Discipline Lead	**Sign**
	Hamant Patel Digitally signed by Hamant Patel Date: 2024.10.09 15:56:00 +01'00'
Company HSE LEAD	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.11 07:46:00 +02'00'
Company Project Manager	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.11 07:34:59 +02'00'
Contractor received for information. Not independently verified. Information implemented	**Sign**

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	4
Cause:	Other Contaniments (Gas, Liquid & Solids)
Consequence:	Unknown consequence
Safeguards:	
Actions:	Identify possibility of any other contaminants in electrolyser package.
Assigned Respondent (By)	CROSSWIND
RESPONSE	As per electrolyser HAZOP (CRW-01-R-01) there are 3 main contaminants: - Water - O2 - Zeolyte from the catalyst in the deox.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements

Company Discipline Lead	**Sign**
	Hamant Patel Digitally signed by Hamant Patel Date: 2024.10.09 15:57:20 +01'00'
Company HSE LEAD	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.11 07:46:28 +02'00'
Company Project Manager	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.11 07:34:37 +02'00'
Contractor received for information. Not independently verified. Information implemented	**Sign**

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	5
Cause:	Electrolyser declining in delivery pressure compared to vessels.
Consequence:	Potential Backflow from hydrogen storage to electrolyser with unknown consequences. Refer to Cause: 1.1.3
Safeguards:	Non return valve on inlet to storage vessels.
Actions:	Consider within PEM Electrolyser package HAZOP.
Assigned Respondent (By)	CROSSWIND
RESPONSE	This has been considered in the Electrolyser HAZOP (CRW-01-R-01). There is an NRV (CV-633) in the outlet of the electrolyser which has been considerd to be ALARP.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements

Company Discipline Lead	**Sign**
	Hamant Patel Digitally signed by Hamant Patel Date: 2024.10.09 15:57:58 +01'00'
Company HSE LEAD	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.11 07:45:41 +02'00'
Company Project Manager	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.11 07:34:18 +02'00'
Contractor received for information. Not independently verified. Information implemented	**Sign**

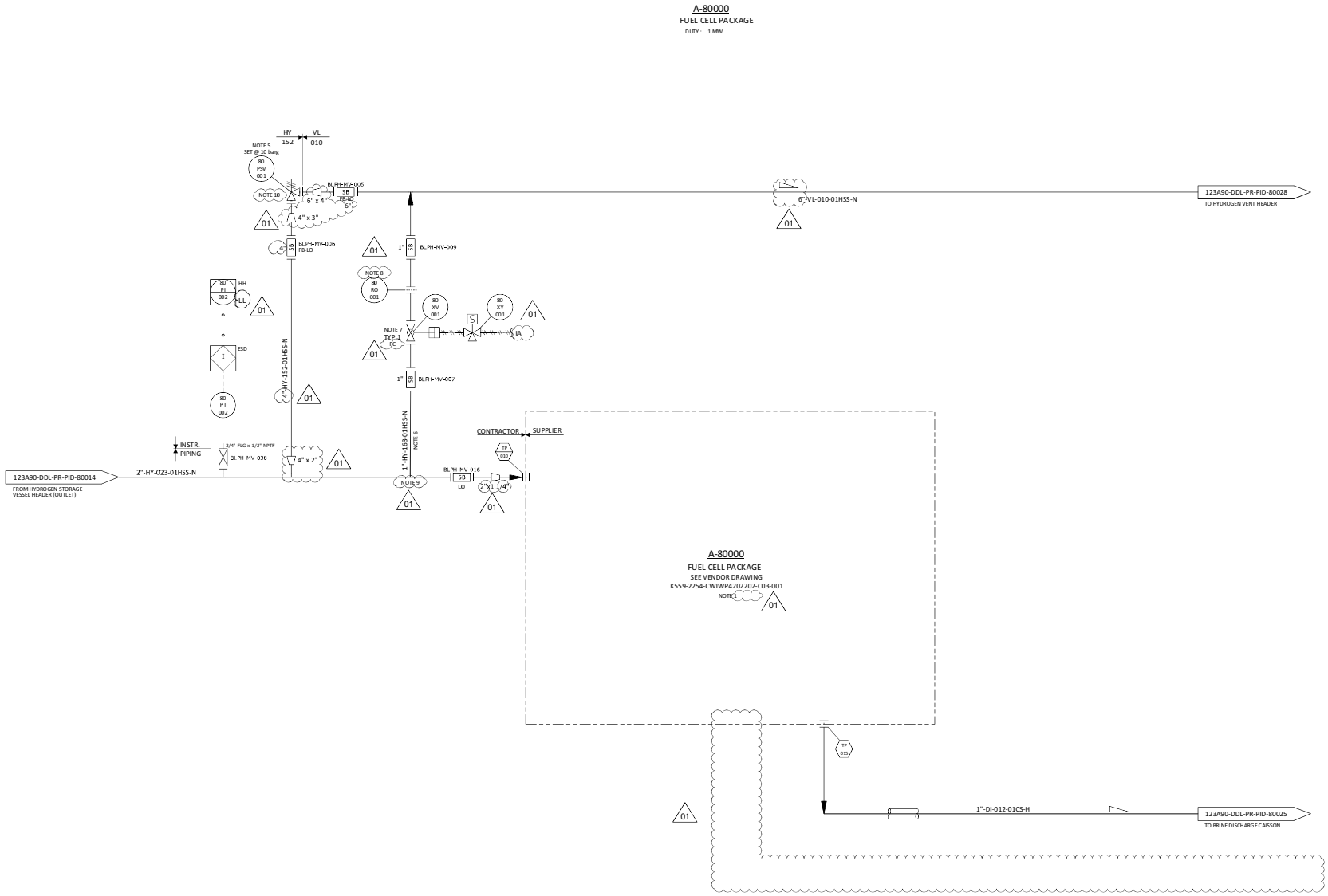
BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	6
Cause:	Open Blowdown Valve
Consequence:	Continuous venting of hydrogen. Leading to environmental emissions.
Safeguards:	
Actions:	Review necessity of emergency blowdown for hydrogen feed & distribution manifold.
Assigned Respondent (By)	ROSETTI Process Engineer
RESPONSE	Emergency blowdown system has been reviewed during EPC phase. For reference see P&iDs: 123A90-DDL-PR-PID-80012_01, 123A90-DDL-PR-PID-80013_01 and 123A90-DDL-PR-PID-80014_01, attached to this Action as Attachment 1.
Attachments:	
Issue Date	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
Ciro Impradice	Ciro Impradice Autore firma digitale: Ciro Impradice Nome distintivo: CN = Ciro Impradice email = ciro.impradice@rosetti.it C = IT O = Rosetti Marino OU = Private Data: 2024.04.15 09:15:42 +02'00'
EPC HSE Lead	**Sign**
Carolina Caracciolo	CC
EPC Project Manager	**Sign**
Davide Lo Sterzo	
Client	**Sign**
	Digitaal ondertekend door Paul van Rossum Datum: 2024.08.21 08:12:24 +02'00'

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

01

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. 80PSV001 SIZED FOR CV FAILURE OF UPSTREAM CONTROL VAVE 25PV055A/B.

01

HOLDS

1. DELETED.
2. DELETED.

01

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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 :

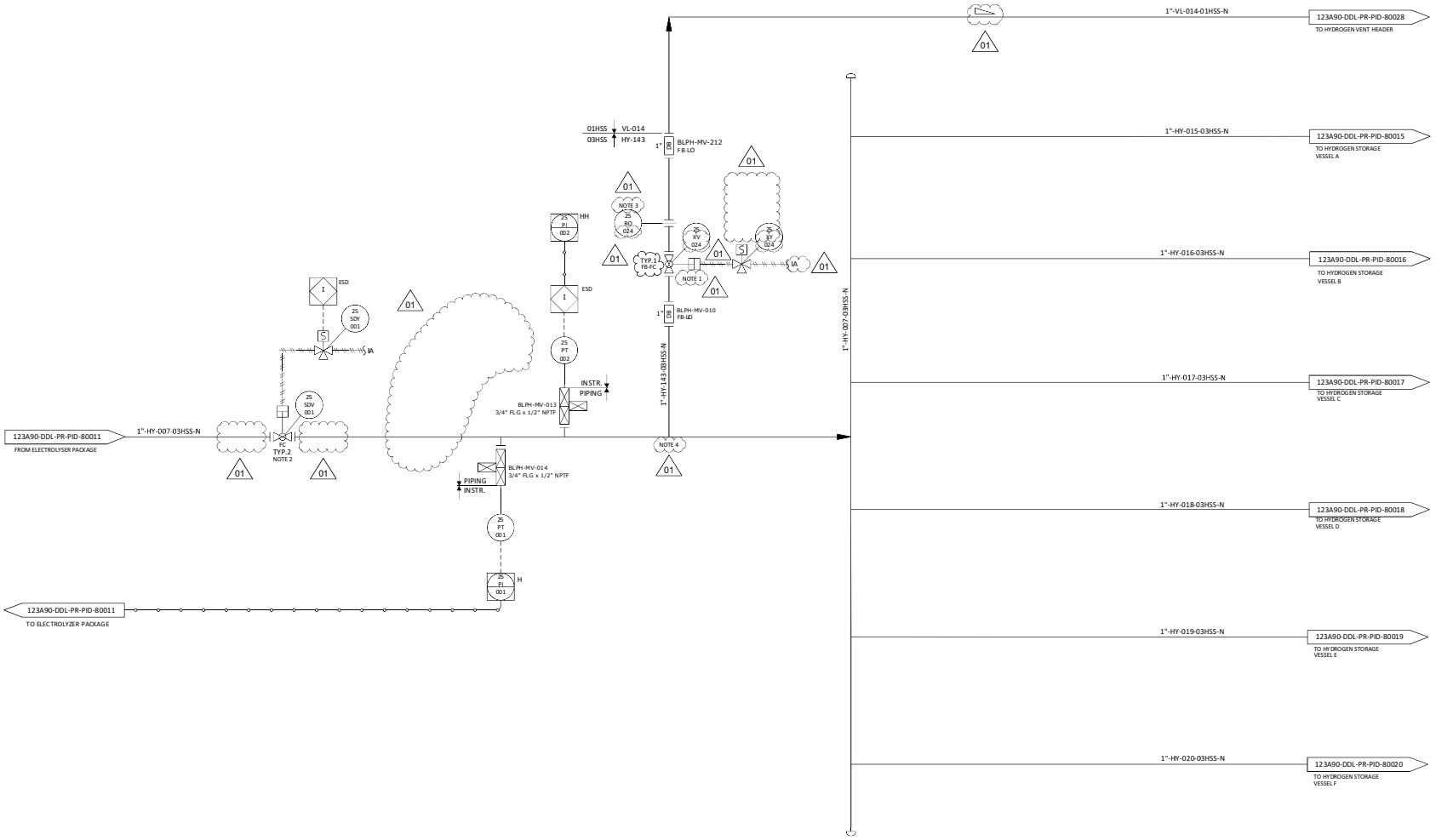
BLPH PIPING AND INSTRUMENTATION DIAGRAM
FUEL CELL PACKAGE

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-80012	SHEET 001	REV. 01

File Name : FILE_NAME

DRAWING NO. DRAWING_NO.

REV. REV.



NOTES

1. TIGHT SHUT OFF XV.
2. NECESSARY CONTROL SYSTEM SOFTWARE SHALL BE INCLUDED TO SUPPORT ADVACED VALVE CONTROL, PARTIAL STROKE TESTING AND DIAGNOSTICS FOR ANY SAFETY CRITICAL ON/OFF VALVES. THESE APPLICATION SHALL BE IDENTIFIED BY HAZOP AND LOPA EVALUATION IF PARTIAL STROKE TESTING WILL BE REQUIRED:
   THE "TYP. 3" SHALL BE CONSIDERED INSTEAD THE ACTUAL "TYP. 2" FOR SDV
   THE "TYP. 5" SHALL BE CONSIDERED INSTEAD THE ACTUAL "TYP. 4" FOR BDV.
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.

01

HOLDS

1. DELETED. 01

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

CROSSWIND

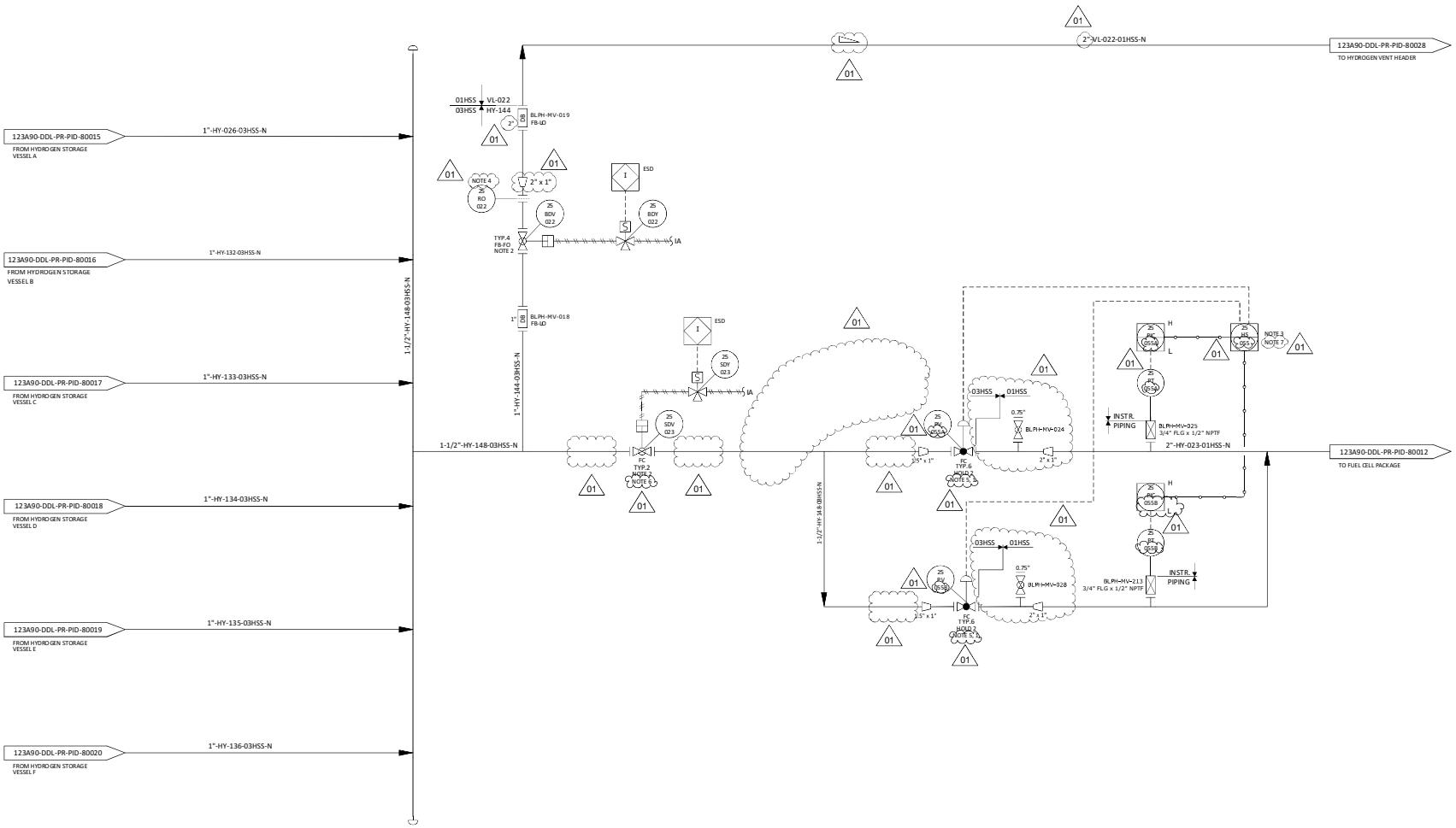
ROSETTI MARINO

TITLE :

BLPH PIPING AND INSTRUMENTATION DIAGRAM
HYDROGEN STORAGE 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. 01

File Name : FILE_NAME



NOTES

1. DELETED.
2. NECESSARY CONTROL SYSTEM SOFTWARE SHALL BE INCLUDED TO SUPPORT ADVACED VALVE CONTROL, PARTIAL STROKE TESTING AND DIAGNOSTICS FOR ANY SAFETY CRITICAL ON/OFF VALVES. THESE APPLICATION SHALL BE IDENTIFIED BY HAZOP AND LOPA EVALUATION IF PARTIAL STROKE TESTING WILL BE REQUIRED:
   THE "TYP. 3" SHALL BE CONSIDERED INSTEAD THE ACTUAL "TYP. 2" FOR SDV
   THE "TYP. 5" SHALL BE CONSIDERED INSTEAD THE ACTUAL "TYP. 4" FOR BDV
3. HAND SELECTOR TO ALLOW THE OPERATOR TO SELECT THE CONTROL LOOP (REMOTELY).
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 RUNNING.
6. SDV VALVE 25-SDV-023 TO BE INSTALLED AS CLOSE AS POSSIBLE TO THE CONTROL VALVES 25-PV-055A/B.
7. HS INCLUDES SOFTWARE INTERLOCK TO PREVENT BOTH VALVES TO BE ONLINE SIMULTANEOUSLY. SOFTWARE INTERLOCK PREVENTS VALVE 25PV055B TO OPEN IF VALVE 25PV055A IS NOT CLOSED.

01

HOLDS

1. DELETED.
2. CONTROL VALVE SIZE (BY VENDOR).

01

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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 VESSELS HEADER (OUTLET)

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-80014		SHEET 001	REV. 01

DRAWING NO. DRAWING_NO.

REV. REV.

File Name : FILE_NAME

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	7
Cause:	External Fire due to either hydrogen jet fire or BESS,
Consequence:	Potential to escalation for Hydrogen inventories.
Safeguards:	Fire detection. Emergency Isolation & Blowdown (PRV). PIC 'high high' alarm on hydrogen storage vessel
Actions:	Ensure heat input calculations for sizing fire case relief valves are based on heat input from hydrogen fire.
Assigned Respondent (By)	ROSETTI Process Engineer
RESPONSE	Contractor confirms that heat input calculations for sizing fire case relief valves are based on heat input from hydrogen fire. For reference see "Attachment 1 - FEED HAZOP action n7", which is part of the "Relief, Vent and Blowdown Report".
Attachments:	
Issue Date (21/02/24)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
Ciro Impradice	
EPC HSE Lead	**Sign**
Carolina Caracciolo	CC
EPC Project Engineering Manager	**Sign**
Davide Lo Sterzo	
Client	**Sign**

Digitaal ondertekend door Paul van Rossum
Datum: 2024.03.14 17:02:10 +01'00'

Base Load Power Hub (BLPH)

Relief, Vent and Blowdown Report

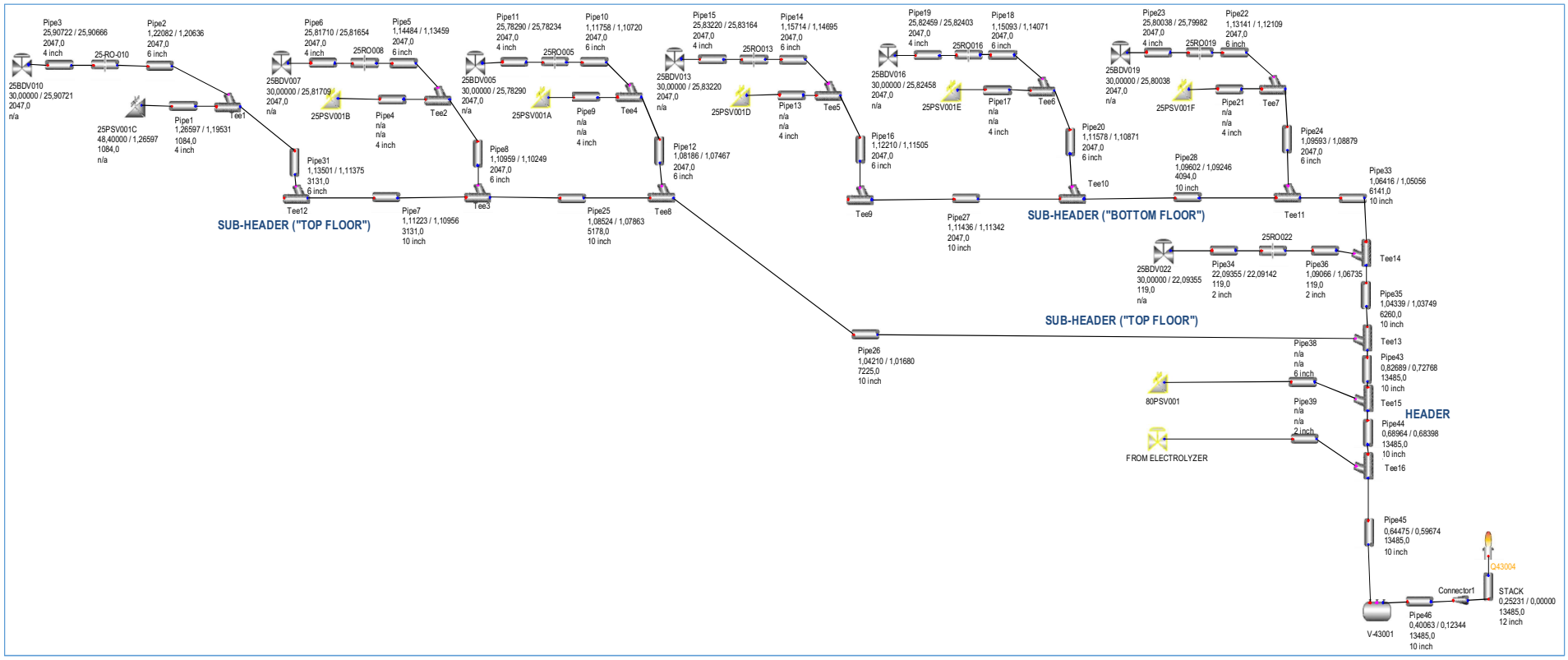
Document Number: 123A90-DDL-PR-RE-80030

Document Class: 1

01	05/02/2024	Accepted for Construction (AFC)	CIM	RZI	DLO
00	04/12/2023	Issue for Acceptance (IFA)	CIM	RZI	DLO
Rev.	Date	Description	Prepared	Reviewed	Approved

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6.4 APPENDIX 04 –VENT NETWORK DESIGN (PRESSURE(BARG)/MASSFLOW(KG/H)/SIZE(INCHES)) – GOVERNING SCENARIO



BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	8
Cause:	External Fire due to either hydrogen jet fire or BESS,
Consequence:	Potential to escalation for Hydrogen inventories.
Safeguards:	Fire detection. Emergency Isolation & Blowdown (PRV). PIC 'high high' alarm on hydrogen storage vessel
Actions:	Ensure depressurisation system is adequately designed to prevent escalation of fire to hydrogen storage vessels. Taking account of heat input via BESS/ Hydrogen fire.
Assigned Respondent (By)	ROSETTI Process Engineer
RESPONSE	Based on the results within FERA Fire and Explosion Risk Analysis (doc. no. 123A90-DDL-SAF-RE-30020), PFP is not required. Consequently, no scenarios are expected to give escalation. Indeed, no area is above the 10-4 ev/yr requiring additional mitigation measures
Attachments:	
Issue Date (28/02/2024)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
E. Carminati	
EPC HSE Lead	**Sign**
C. Caracciolo	
EPC Project Engineering Manager	**Sign**
D. Lo Sterzo	
Client	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.18 08:18:05 +02'00'

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 FERA CONCLUSIONS

On basis of the results of the FERA study, following considerations apply:

- there are no areas in the platform in which the thermal radiation threshold contours of 37.5 kW/m^2 from jet fire is equal to or above 1.0E-04 per year. The impact of jet fire scenarios on equipment is lower than target frequency and can be classified as tolerable .
- there are no areas in the platform in which the explosion threshold contours of 0.35, 0.27, 0.15 and 0.07 bar are equal to or above 1.0E-04 per year, thus the risk from VCE is considered tolerable .

6.2 RECOMMENDATIONS

On basis of the present FERA study results, only one recommendation has been raised. Its implementation allows a general improvement on project documentation, but no design impact is expected.

Ref. #	Description	Responsible
1	In order to reduce the escalation risk from section 2 (storage section) it is suggest to reduce the total hold up involved in the hazardous scenarios. At the present, all vessels are considered aligned, and in case of release, about 1200 kg are potentially involved in the release. It is recommended to define the logics of line-up and closure of each vessel automatically during normal operation. This action will significantly reduce the total amount of H_2 involved in a critical scenario, leading to the decrease of scenario duration and the risk of escalation.	Rosetti Marino

Table 16 – Recommendations

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	10
Cause:	Maintenance
Consequence:	Potential risk to personnel during maintenance activities.
Safeguards:	
Actions:	The maintenance philosophy including isolation purging into service & out of service access, egress, needs to be further developed including into design. To be studied in more detail at next stage.
Assigned Respondent (By)	ROSETTI Project Management
RESPONSE	Maintenance philosophy including isolation purging into service & out of service access, egress are detailed in parag. 7 of 123A90-DDL-PR-MAN-80001 - Operations and Maintenance Manuals
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements

EPC Discipline Lead	**Sign**
C.Giunchi	
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2025.02.24 10:54:42 +01'00'

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	11
Cause:	Maintenance
Consequence:	Potential risk to personnel during maintenance activities.
Safeguards:	
Actions:	Facilities for start- up following maintenance, to be investigated and developed.
Assigned Respondent (By)	ROSETTI Mechanical Engineer
RESPONSE	This topic it is covered in the start-up procedure. See Process Control, Operation, Start-up and Shutdown philosophy123A90-DDL-PR-RE-80031
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
F.Mura	
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.09.12

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	12
Cause:	Fail closure of PVA/B in line of fuel cell,.
Consequence:	Unknow consequences to fuel cell.
Safeguards:	
Actions:	Ensure consequences of loss of supply of hydrogen to fuel cell is assessed in fuel cell vendor package HAZOP
Assigned Respondent (By)	CROSSWIND
RESPONSE	This has been assessed in the Fuel cell HAZOP, see document CRW-01-R-02 (former SGS-77-R-01) and snipped below
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements

Company Discipline Lead	**Sign**
Hamant Patel	Digitally signed by Hamant Patel Date: 2024.10.09 15:58:34 +01'00'
Company HSE LEAD	**Sign**
Paul van Rossum	Digitaal ondertekend door Paul van Rossum Datum: 2024.10.11 08:02:21 +02'00'
Company Project Manager	**Sign**
Dominik Sznajder	Digitally signed by Dominik Sznajder Date: 2024.10.11 12:57:21 +02'00'
Contractor received for information. Not independently verified. Information implemented	**Sign**

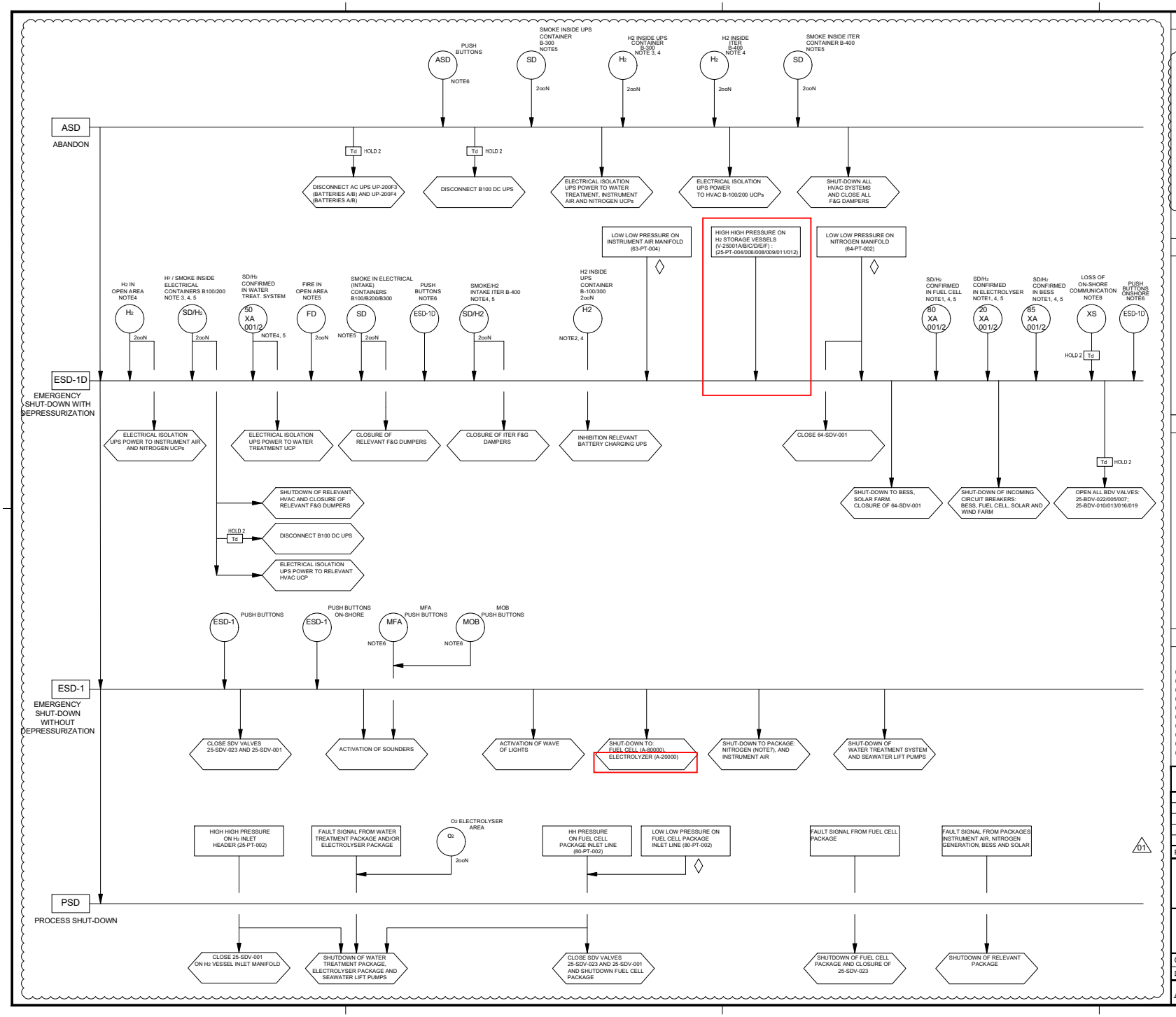
Node: 1. Fuel Cell Hydrogen and Air Feed

Deviation	Cause	Consequence	Hazard Register	SIF Summation - Threat	RAM Score				LOPA?	Barriers			Recommendation	Responsibility	ALARP Determination
					R	S	L	RR		Barrier Tag	Barrier Description	Validity			
1.1. Flow No/Less	1.1.1. No H2 flow from upstream system (e.g. control loop failure)	1.1.1.1. Loss of H2 to the Fuel Cells. H2 at the fuel cell will be consumed through the reaction, resulting in degradation of the Fuel Cell membranes. The Fuel Cells lose their performance due to consumption of the catalyst. After reintroduction of H2, the Fuel Cells will produce electricity at a much lower level. No hazardous consequences.	Asset damage to Fuel Cell membranes		A	3	C	3C	N		=HA01+DA02-BT01 H2 Inlet Pressure Control Loop to unload (electrically) the Fuel Cells. Independent from initiating event. #1 BPCS valid barrier. Control system of this package is completely separated from the control system of the upstream storage as such this barrier is not the #2 BPCS.	V			PHA Team considers this scenario to be ALARP and that adding additional barriers would be grossly disproportionate to the risk reduction achieved.
											Pressure Control at individual Fuel Cell with action to disconnect the Fuel Cells. 6006 have to work in order to mitigate all asset damage. Control system of this package is completely separated from the control system of the upstream storage as such this barrier is not the #3 BPCS.	V			
											DC/DC power drives =BA01+UC01-TA01/TA02 have a minimum accepted voltage configure with electrical control action to unload (electrically) Fuel Cells. Not valid as #3 BPCS.	NV			
		1.1.1.2. Loss of H2 to the Fuel Cells leading to loss of electricity output to the grid with no hazardous consequences.									BESS is able to momentarily take the electrical load of the Fuel Cells.				

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	14
Cause:	Electrolyser continue operation.
Consequence:	Overpressure of hydrogen storage. See 2.9- Pressure More.
Safeguards:	
Actions:	Review control system design to ensure that potential overpressure can be reliability detected, and PEM electrolyser package shutdown initiated.
Assigned Respondent (By)	Rosetti Instrumentation Engineer
RESPONSE	As per project doc. "Process Safety Cause & Effect Block Diagram" n° 123A90-DDL-PR-DG-80000 rev.01, in case of overpressure of Hydrogen Storage Tanks the Pressure Transmitters 25-PT-004/006/008/009/011/012 (High High Alarm) will activate the ESD-1D with shutdown of Electrolyser package.
Attachments:	
Issue Date	24-04-2024

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
L.Calabrese	
EPC HSE Lead	**Sign**
C. Caracciolo	CC
EPC Project Manager	**Sign**
D. Lo Sterzo	
Client	**Sign**
	Digitaal ondertekend door Paul van Rossum Datum: 2024.05.14 12:24:02 +02'00'



NOTES

1. F&G LOGIC VOTING IS MANAGED BY RELEVANT UCP (BESS, FUEL CELL AND ELECTROLYSER PACKAGES).
2. LOGIC ACTIVATION ONLY IN CASE OF 2ooN H2 CONFIRMED IS CAUSED BY H2 DETECTORS INSIDE UPS CONTAINERS (B-100/300) AND ALL THE OTHERS PLATFORM H2 DETECTORS SHALL NOT BE ALARMED/FAILED.
3. LOGIC ACTIVATION ONLY IN CASE OF 2ooN H2 CONFIRMED IS CAUSED BY H2 DETECTORS INSIDE UPS CONTAINERS (ONLY FOR B-100 OR B-300) AND AT LEAST ONE OF PLATFORM H2 DETECTORS (EXCLUDED INSIDE UPS CONTAINERS B-100/300) IS ALARMED/FAILED.
4. ACTIVATION OF AMBER BEACONS (H2).
5. ACTIVATION OF RED BEACONS (FIRE).
6. ACTIVATION OF BOTH AMBER AND RED BEACONS.
7. SHUTDOWN OF NITROGEN PACKAGE WILL BE PERFORMED ONLY AFTER THE ELECTROLYSER PACKAGE HAS BEEN SAFELY SHUTDOWN (IF IT IS ON LINE).
8. IN CASE OF LOSS OF ON-SHORE COMMUNICATION THE ESD-1D LOGIC WILL BE ACTIVATED DUE TO THE IMPOSSIBILITY OF REMOTE CONTROL DEPRESSURIZATION.

01

LEGEND

HOLDS

01

1. DELETED
2. TIME DELAY TO BE DEFINED.

LEGEND

◇ = START-UP INHIBIT

01

ABBREVIATIONS

FC: Fuel Cell (A-80000)
BESS: Battery Energy Storage System
Electrolyser Package (A-200000)

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
01	19/03/24	RZI	CIM	DLO	ACCEPTED FOR CONSTRUCTION (AFC)
00	10/11/23	RZI	CIM	DLO	ISSUE FOR ACCEPTANCE (IFA)

CROSSWIND

ROSETTI MARINO

TITLE :

BASE LOAD POWER HUB (BLPH)
Process Safety Cause & Effect
Block Diagram

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

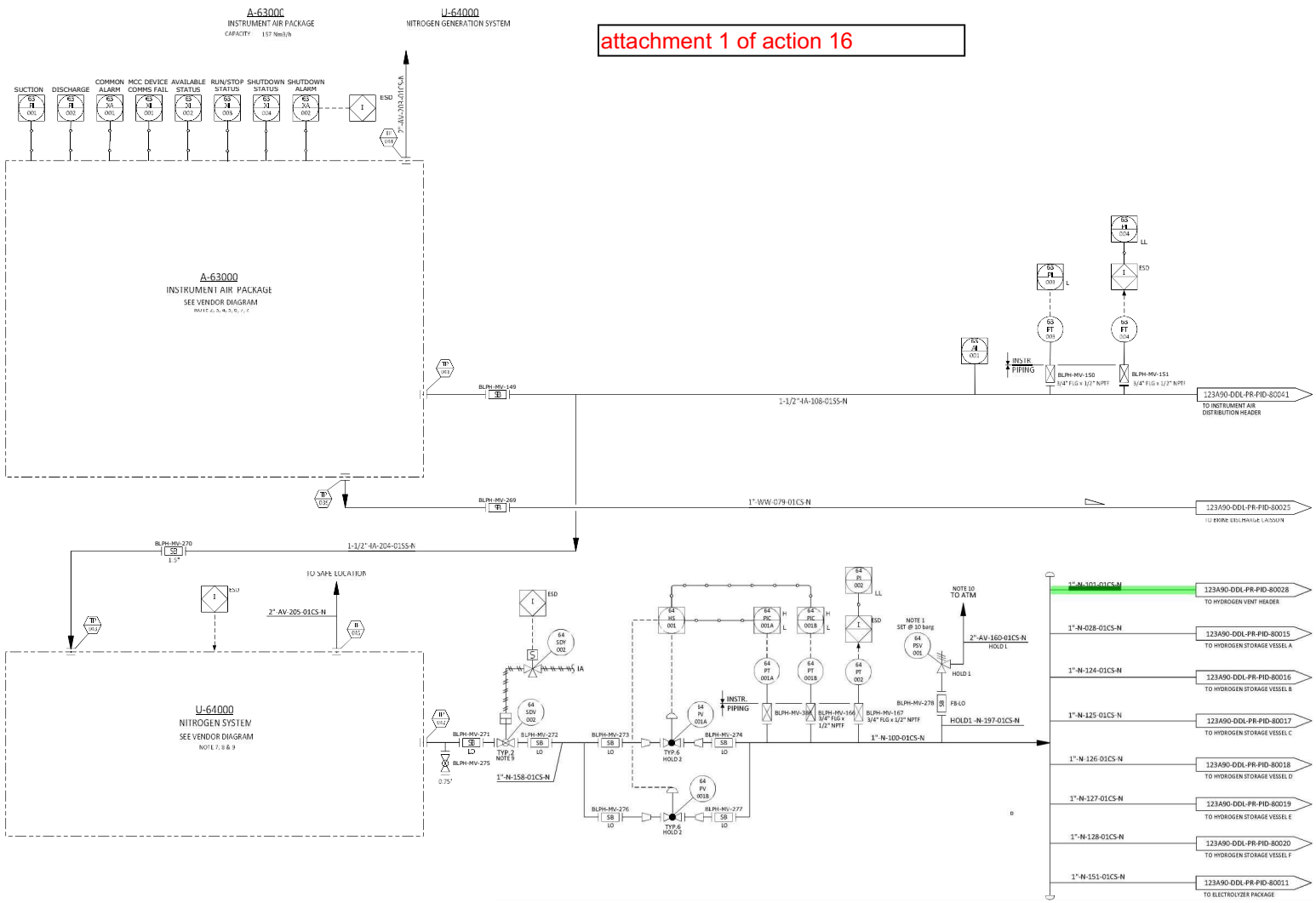
A1	DRAWING NO. 123A90-DDL-PR-DG-80000	SHEET 001	REV. 01

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	16
Cause:	Loss of nitrogen at any cause
Consequence:	Potential air ingress into hydrogen vent. Leading to explosion, LOC & risk to personnel.
Safeguards:	
Actions:	Ensure secure nitrogen supply suitable for continuous purge of the hydrogen vent head is provided.
Assigned Respondent (By)	ROSETTI Process Engineer
RESPONSE	Nitrogen supply suitable for continuous purge of the hydrogen vent head is provided. For details see attachment 1.
Attachments:	
Issue Date (19-01-24)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
Ciro Impradice (Process)	
EPC HSE Lead	**Sign**
Carolina Caracciolo	CC
EPC Project Engineering Manager	**Sign**
Davide Lo Sterzo	
Client	**Sign**
	Digitaal ondertekend door Paul.van.Rossum Datum: 2024.08.21 08:12:50 +02'00'

attachment 1 of action 16



NOTES

1. ONE UNINSTALLED SPARE PSV SHALL BE AVAILABLE.
2. COMPRESSORS AND DRIERS DESIGNED FOR 2 X 100% CONFIGURATION. INSTRUMENT AIR RECEIVER DESIGNED FOR 1 X 100%.
3. VENDOR TO PROVIDE NECESSARY CONTROLS, INSTRUMENTATIONS AND ISOLATIONS IN ORDER TO OPERATE THE PLANT IN SAFE MANNER.
4. COMPRESSORS WILL OPERATE ON THE BASIS OF ONE WORKING AND ONE ON STANDBY.
5. COMPRESSORS TO BE SCREW TYPE OIL FREE
6. AIR COMPRESSOR INLET TO BE LOCATED AWAY FROM ANY VENTS
7. PACKAGE DATA AND DESIGN TO BE CONFIRMED BY VENDOR AND DRAWING MADE AVAILABLE
8. PACKAGE VENDOR TO DEFINE INTERFACE WITH CONTRACTOR AND CCS CONNECTION REQUIREMENTS
9. NECESSARY CONTROL SYSTEM SOFTWARE SHALL BE INCLUDED TO SUPPORT ADVACED VALVE CONTROL, PARTIAL STROKE TESTING AND DIAGNOSTICS FOR ENY SAFETY CRITICAL ON/OFF VALVES. THESE APPLICATION SHALL BE IDENTIFIED BY HAZOP AND LAPA EVALUATION IF PARTIAL STROKE TESTING WILL BE REQUIRED
   THE "TYP. 3" SHALL BE CONSIDERED INSTEAD THE ACTUAL "TYP. 2" FOR SDV
   THE "TYP. 5" SHALL BE CONSIDERED INSTEAD THE ACTUAL "TYP. 4" FOR BDV
10. TO SAFE LOCATION, ROUTED AWAY FROM WALKWAYS

HOLDS

1. PSV AND LINE SIZE.
2. CONTROL VALVE SIZE (BY VENDOR).

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
00	20/10/2023	CIM	RZI	DLO	ISSUE FOR ACCEPTANCE (IFA)

CROSSWIND

ROSETTI MARINO

TITLE :
BLPH PIPING AND INSTRUMENTATION DIAGRAM
INSTRUMENT AIR PACKAGE

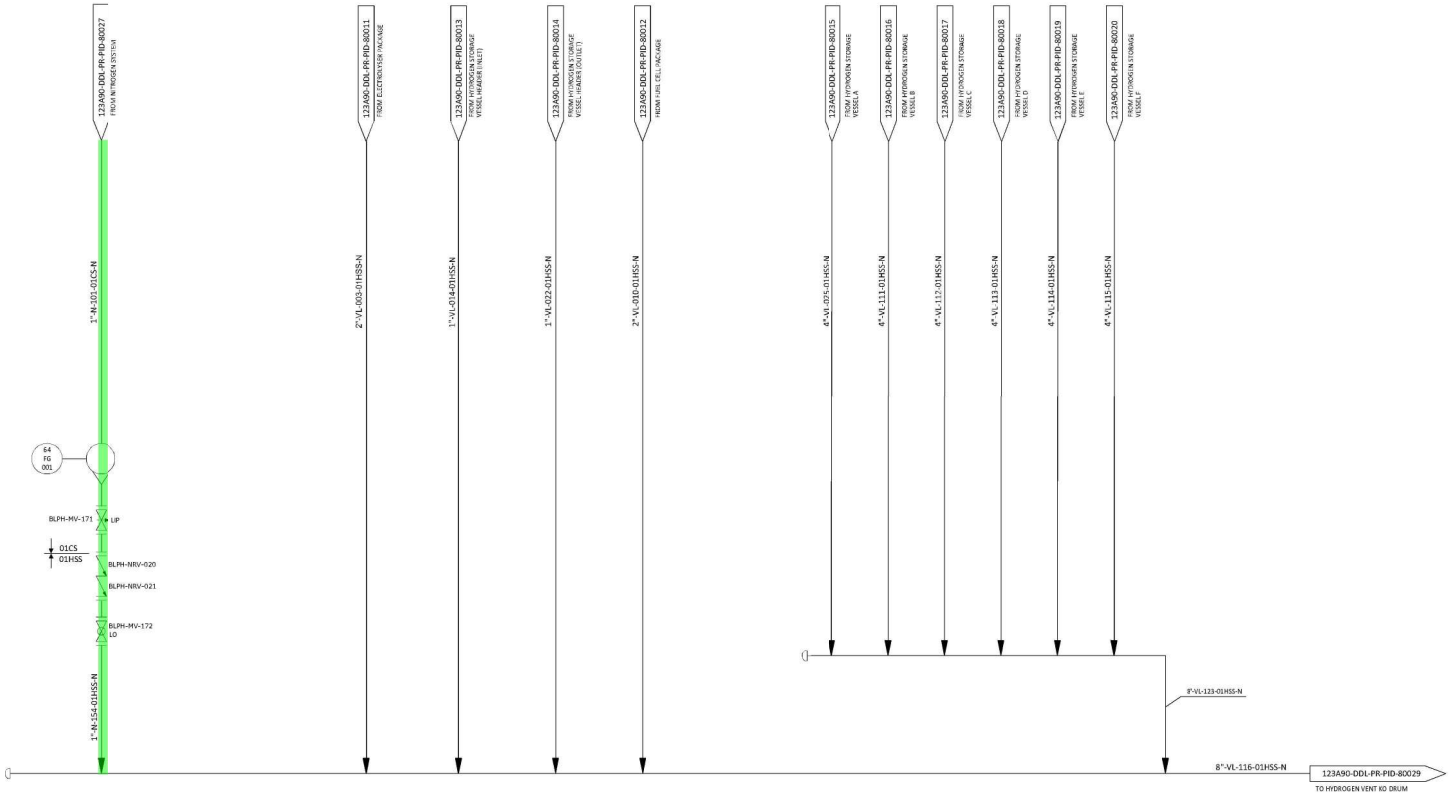
CONTRACT NO./TITLE	CW-I-WP4-2023-05/HOLLANDSE KUST NOORDWIND PARK		SCALE	NTS
DRAWN	CHECKED	APPROVED	DATE	
A1	DRAWING NO. 123A90-DDL-PR-PID-80027		SHEET 001	REV. 00

DRAWING_NO.

REV.

File Name : FILE_NAME

attachment 1 of action 16



NOTES

HOLDS

1. VENT LINES DIAMETER.

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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
A1	DRAWING NO. 123A90-DDL-PR-PID-80028	SHEET 001	REV. 00

DRAWING NO.

REV

File Name : FILE_NAME

Base Load Power Hub (BLPH)

Process Control, Operation, Start-up and Shutdown philosophy

Document Number: 123A90-DDL-PR-RE-80031

Document Class: 1

attachment 1 of action 16

00	13/12/2023	Issue for Approval (IFA)	CIM	RZI	DLO
Rev.	Date	Description	Prepared	Reviewed	Approved

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3.4 UTILITIES OTHER THAN WATER TREATMENT

3.4.1 Vent system and hydrogen vent KO Drum V-43001

The Hydrogen Vent will be comprised of:

- A gathering network of hydrogen gas emergency discharges or maintenance discharges
- A Hydrogen Knock-Out Drum V-43001
- A Hydrogen Vent Stack Q-43004 equipped with a Liquid seal at its bottom

The hydrogen vent will be required for all emergency relief and blowdown scenarios and to vent the H2 off-spec from the Electrolyser package (A-20000). Furthermore, the blowdown network is continuously purged with nitrogen in order to keep it slightly pressurized and inert.

3.4.1.1 Process Operation and Control Philosophy

attachment 1 of action 16

The hydrogen KO drum V-43001 is equipped with the following transmitters:

- 43-PT-001 as remote pressure indicator to DCS
- 43-LT-001 as remote level indicator that allows to control any liquid level inside the boot thanks to the control loop (43-LIC-001) handled via the level control valve 43-LV-001
- 43-LT-002 as additional interlock trip signal (HOLD4)

Moreover, at the exit of the V-43001 a flow transmitter (43-FT-001 with High alarm threshold) is provided to monitor the flowrate towards the stack.

3.4.1.2 Overpressure protection

No need for overpressure protection. The sole and only overpressure protection is established by the proper design of the network.

3.4.2 Instrument air package A-63000

The unit is fully prefabricated and self-standing package; thus in general, being a vendor specific item, for any further information and details the vendor's documentation shall be necessarily seen.

3.4.2.1 Process Operation and Control Philosophy

However, the instrument air package A-63000 will have the following main sensors installed at distribution header:

- 63-AI-001 that is a dew point analyzer
- 63-PT-003 to monitor the pressure value at the distribution header (signal to DCS)
- 63-PT-004 to procure shutdown effects in case of low-low pressure value at the distribution header (the signal is replicated to DCS via software link)

3.4.2.2 Start-up and Shut-Down philosophy

The following signals will inform about the package A-63000 status:

BLPH SHEAMS SIGNATURE FORM

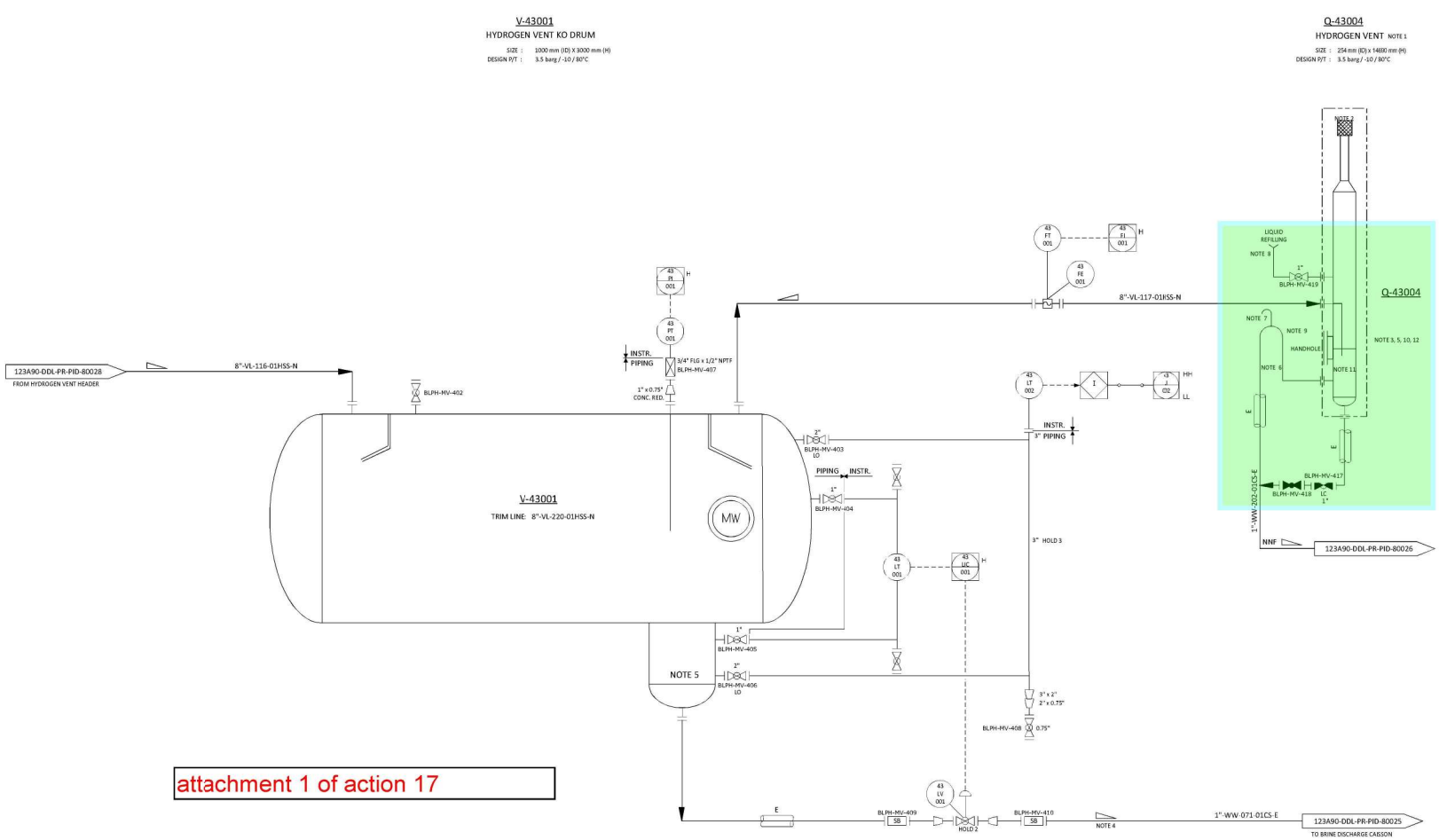
Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	17
Cause:	Loss of nitrogen at any cause
Consequence:	Potential air ingress into hydrogen vent. Leading to explosion, LOC & risk to personnel.
Safeguards:	
Actions:	In case of failure of primary nitrogen purge, ensure a suitable contingency plan is developed.
Assigned Respondent (By)	ROSETTI Process Engineer
RESPONSE	A liquid seal drum has been added. The aim of such seal is to avoid air ingress into hydrogen vent in case of loss of nitrogen purging. For reference see PID 123A90-DDL-PR-PID-80029, attachment 1
Attachments:	
Issue Date (19/01/24)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
Ciro Impradice (Process)	
EPC HSE Lead	**Sign**
Carolina Caracciolo	CC
EPC Project Engineering Manager	**Sign**
Davide Lo Sterzo	
Client	**Sign**

Digitaal ondertekend door Paul van Bossum
Datum: 2024.03.14 17:00:44 +01'00'

DRAWING NO.

REV



attachment 1 of action 17

NOTES

1. VENT TO SAFE LOCATION SEGREGATED FROM OTHER VENTS.
2. VENT TO BE EQUIPPED WITH FLAME ARRESTOR AND BIRD SCREEN.
3. LIQUID SEAL DRUM IS PART OF THE VENT SYSTEM.
4. LIQUID DRAINLINES TO BE ROUTED TO ENSURE GRAVITY DRAIN.
5. HYDROGEN VENT KO DRUM BOOT AND LIQUID SEAL DRUM TO BE HEAT TRACING.
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 FOR 1.5 m, INSULATED UP TO THE BEND.
10. LIQUID SEAL DRUM I.D. 590 mm, HEIGHT 2350 mm (T/T). TBC BY H2 VENT VENDOR.
11. INLET DIP LEG SUBMERSION HEIGHT OF 0,2 m.
12. FLUID HEIGHT OF 1.5 m FROM BOTTOM T.L.

HOLDS

1. VENT LINES DIAMETER.
2. CONTROL VALVE SIZE (BY VENDOR).
3. TO BE CONFIRMED.

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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. 00

File Name : FILE_NAME

Base Load Power Hub (BLPH)

attachment 1 of action 17

Process Control, Operation, Start-up and Shutdown philosophy

Document Number: 123A90-DDL-PR-RE-80031

Document Class: 1

00	13/12/2023	Issue for Approval (IFA)	CIM	RZI	DLO
Rev.	Date	Description	Prepared	Reviewed	Approved

This document undergoes an issuance cycle within EDMS Fusionlive". Its distribution is electronically controlled. Once printed shall be considered as "NOT CONTROLLED" copy

3.4 UTILITIES OTHER THAN WATER TREATMENT

3.4.1 Vent system and hydrogen vent KO Drum V-43001

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- A Hydrogen Knock-Out Drum V-43001
- A Hydrogen Vent Stack Q-43004 equipped with a Liquid seal at its bottom

The hydrogen vent will be required for all emergency relief and blowdown scenarios and to vent the H2 off-spec from the Electrolyser package (A-20000). Furthermore, the blowdown network is continuously purged with nitrogen in order to keep it slightly pressurized and inert.

3.4.1.1 Process Operation and Control Philosophy

attachment 1 of action 17

The hydrogen KO drum V-43001 is equipped with the following transmitters:

- 43-PT-001 as remote pressure indicator to DCS
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- 43-LT-002 as additional interlock trip signal (HOLD4)

Moreover, at the exit of the V-43001 a flow transmitter (43-FT-001 with High alarm threshold) is provided to monitor the flowrate towards the stack.

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3.4.2 Instrument air package A-63000

The unit is fully prefabricated and self-standing package; thus in general, being a vendor specific item, for any further information and details the vendor's documentation shall be necessarily seen.

3.4.2.1 Process Operation and Control Philosophy

However, the instrument air package A-63000 will have the following main sensors installed at distribution header:

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- 63-PT-003 to monitor the pressure value at the distribution header (signal to DCS)
- 63-PT-004 to procure shutdown effects in case of low-low pressure value at the distribution header (the signal is replicated to DCS via software link)

3.4.2.2 Start-up and Shut-Down philosophy

The following signals will inform about the package A-63000 status:

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	18
Cause:	Water Vapour/Water
Consequence:	Potential freezing of vent lines, leading to back pressure & potential overpressure. Loss of safeguards i.e. blowdown & relief.
Safeguards:	
Actions:	Assess possibility of ice formation in hydrogen vent lines, from individual users into header, and provide suitable mitigation,
Assigned Respondent (By)	ROSETTI Process Engineer
RESPONSE	The only possibility to have water within the vent system is from the Electrolyser Package H2 vent. As per Elogen's reply to the TQ 123A90-PML-PM-TQ-00013 (attached), only water in the gas phase (H2 off-spec) is expected. Should part of this water condensate, all lines downstream relief and blowdown devices are sloped toward to the H2 Vent KOD, where water will be collected. Moreover, the H2 Vent KOD boot will be heated together with the liquid discharge line. Therefore, the ice formation on the sloped vent lines is not a credible scenario. For reference see P&iDs 123A90-DDL-PR-PID-80011, 123A90-DDL-PR-PID-80028 and 123A90-DDL-PR-PID-80029 (attached).
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
Ciro Impradice (Process)	
EPC HSE Lead	**Sign**
C.Caracciolo	CC
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**

Paul van Rossum

Digitaal ondertekend door Paul van Rossum
Datum: 2025.01.20 08:50:49 +01'00'

CROSSWIND

ROSETTI MARINO

TECHNICAL QUERY
Hollandse Kust Noord

No. TQ :	123A90-PML-PM-TQ-00013	Rev:	01

Originating Party	Rosetti Marino					
Subject	Vent line					
Author	C. Impradice	TQ Aconex unique number: ROSMA-INN-BPH-TQ-00020				
Interface TQ - from		TQ interface source Aconex unique number:				
Type	Query x			Interface x		
	Deviation			Derogation (SHALL[PS])		
	Note: No deviations nor derogations which have an adverse effect on HSSE will be granted					
Workpackage						
Area(s) of application	Design & Eng.	x	Procurement		Construction	
	Commissioning		Operations		Other	
Issue date	06/09/2023		Urgent reply 5 days	x	Routine reply 10 days	
Close-out date						
Closed-out by			TQ status:		Closed-out	

1. Description

Reference documents / Aconex unique numbers:

Reference is made to P&iD K559-2254-PR-PID-002 "Piping and Instrumentation Diagram Electrolyser Package" :

1) A vent line sent to the Hydrogen Vent KO Drum is shown. Contractor understanding is that this line (2"-VL-003-01HCS) is from an emergency (and/or) a relief system, which are located inside the package. Vendor to confirm ;
2) Vendor to indicate process conditions of this line in terms of: temperature, fluid type, peak mass flow rate (kg/hr);
3) Vendor also to inform RM if this line only contains H2 gas or it can also contain water. If yes Vendor to infor RM about the peak mass flow rate of the liquid phase stream;
4) In general, in order to allow RM di well design the downstream vent system (outside vendor scope), RM needs to receive all discharge scenarious.

2. Response

Reference documents / Aconex unique numbers

Hydrogen vent could be from :

- depressurization of Electrolyser during a normal stop,
- depressurization of Electrolyser during a safety stop,
- analyzed hydrogen to vent (continuous),
- non-compliant hydrogen to vent,

This communication is issued for the recipient's information and to facilitate the obligations of the Parties under the Contract. This communication has no authority to amend or vary the Contract nor relieve either Party of any duties, obligations or responsibilities.

Type	In/Out	Description	Flow (m3/h)	Pressure (Barg)	Temperature (°C)
H2 Vent	Out	Hydrogen	500 Nm3/h	ATM	5-65

No liquid water is expected in Hydrogen vent line.

R01 Rosetti's reply: as per meeting held on 25/10/2023, RM requests stream composition of the H2 vent line. RM understood that the H2 vent stream outgoing from the package is an off-spec stream, therefore a stream with less than 99.9 % of H2. For this reason, RM needs to understand the complete composition of such stream (if more than one scenario is present, RM expects more than one composition will be communicated). Moreover, ELOGEN is requested to indicate if the H2 vent stream outgoing from the package shall be considered as gas-water-saturated stream or not.

ELOGEN Reply:

Elogen confirms that complete composition of H2 vent could be H2, vapor H2O and Nitrogen.
The content and its percentage depends on several details. However, the worst case for vapor H2O content is:

Mass Flowrates	Vapor
H2 [kg/h]	4,50E+01
H2O [kg/h]	3,27E+00

Atmospheric pressure and T=65°C.

For N2 content, it could be from 0 to 100% during venting process.

All the rest scenarios have less vapor water content, for example, non-compliant hydrogen is vented when there is:

- more than 5 ppm O2 or
- more than 5 ppm N2 or
- more than 5 ppm H2O.

It is confirmed that there is no liquid content, and water is in vapor phase in H2 vent.

This communication is issued for the recipient's information and to facilitate the obligations of the Parties under the Contract. This communication has no authority to amend or vary the Contract nor relieve either Party of any duties, obligations or responsibilities.

CROSSWIND

ROSETTI MARINO

TECHNICAL QUERY
Hollandse Kust Noord

No. TQ :	123A90-PML-PM-TQ-00023	Rev:	00

Originating Party	Rosetti Marino					
Subject	Electrolyser Process Information					
Author	C. Impradice	TQ Aconex unique number:				
Interface TQ - from		TQ interface source Aconex unique number:				
Type	Query x			Interface x		
	Deviation			Derogation (SHALL[PS])		
	Note: No deviations nor derogations which have an adverse effect on HSSE will be granted					
Workpackage						
Area(s) of application	Design & Eng.	x	Procurement		Construction	
	Commissioning		Operations		Other	
Issue date	22/09/2023		Urgent reply 5 days	x	Routine reply 10 days	
Close-out date						
Closed-out by			TQ status:		Closed-out	

1. Description

Reference documents / Aconex unique numbers:
K559-2254-PR-PID-002-001 - BLPH PIPING AND INSTRUMENTATION DIAGRAM ELECTROLYSER PACKAGE rev2

Reference is made to FEED document "K559-2254-PR-PID-002-001 - BLPH PIPING AND INSTRUMENTATION DIAGRAM ELECTROLYSER PACKAGE rev2", attached to this TQ. In accordance to note 4 of the attached PID ("PACKAGE VENDOR TO DEFINE INTERFACE WITH CONTRACTOR AND CCS CONNECTION REQUIREMENTS"), Vendor is requested:

1) to inform RM about process fluids type (H2, N2, Instrument Air and water or whatever), which are necessary for the proper working of the package;
2) to provide all process information (IN and OUT) of all fluids (operating and design conditions);
3) to inform RM if a vent line outgoing from the package is present (if yes, then Vendor to inform RM about all process conditions on this stream).

For sake of clarity Vendor is requested also to markup the attached PID, indicating all missing interface points with the external RM system.

2. Response

Reference documents / Aconex unique numbers

INTERFACES TABLE

This communication is issued for the recipient's information and to facilitate the obligations of the Parties under the Contract. This communication has no authority to amend or vary the Contract nor relieve either Party of any duties, obligations or responsibilities.

Type	In/Out	Description	Diameter & Fitting	Material	Flow (m3/h)	Pressure (Barg)	Design Pressure (Barg)	Temperature (°C)	Design Temperature (°C)
Water supply	In	Softened water	1" FLANGE ASME B16.5	SS316	0,805	4-6	6	10-35	40
H2 Production	Out	Hydrogen 99,999%	1" FLANGE ASME B16.5	SS316	500 Nm3/h	30	40	5-65	80
H2 Vent	Out	Hydrogen	2" FLANGE ASME B16.5	SS316	500 Nm3/h	ATM	40	5-65	80
Nitrogen supply	In	Nitrogen 97%	1" FLANGE ASME B16.5	SS316	The maximum/peak value of Nitrogen flowrate, related to the flushing time (almost 2 minutes), is 36 m3/hr at 7 barg.	7	10	AMB	45
Operating Drain No.1: drain from water treatment package	Out	Waste water	2" FLANGE ASME B16.5	SS316	Normal: 0,402 Maximum: 1,8 (during quality rinse of RO system)	ATM	6	5-35	80
Operating Drain No.2: drain from collector of H2 vent's drain and hydrogen purification unit's vent	Out	Pure water + Hydrogen+ Catalyst + Zeolite	2" FLANGE ASME B16.5	SS316	0,50	ATM	6	5-35	80
Maintenance Drain No. 1	Out	Pure water +Hydrogen	Drain valves, Refer to PID	SS316	Volume: 2 m3	ATM	6	5-35	80
Maintenance Drain No. 2	Out	Pure water +Oxygen	Drain valves, Refer to PID	SS316	Volume: 6 m3	ATM	6	5-35	80
Instrument air	In	Compressed air	1" FLANGE ASME B16.5	SS316	18Nm3/h peak	7,00	10	AMB	45

In PID sent with this TQ, compressed air supply is missing as nan interface.

INTERFACES TABLE

Type	In/Out	Description	Diameter & Fitting	Material	Flow (m3/h)	Pressure (Barg)	Design Pressure (Barg)	Temperature (°C)	Design Temperature (°C)
Water supply	In	Softened water	1" FLANGE ASME B16.5	SS316	0,805	4-6	6	10-35	40

This communication is issued for the recipient's information and to facilitate the obligations of the Parties under the Contract. This communication has no authority to amend or vary the Contract nor relieve either Party of any duties, obligations or responsibilities.

H2 Production	Out	Hydrogen 99,999%	1" FLANGE ASME B16.5	SS316	500 Nm3/h	30	40	5-65	80
H2 Vent	Out	Hydrogen	2" FLANGE ASME B16.5	SS316	500 Nm3/h	ATM	40	5-65	80
Nitrogen supply	In	Nitrogen 97%	1" FLANGE ASME B16.5	SS316	The maximum/peak value of Nitrogen flowrate, related to the flushing time (almost 2 minutes), is 36 m3/hr at 7 barg.	7	10	AMB	45
Operating Drain No.1: drain from water treatment package	Out	Waste water	2" FLANGE ASME B16.5	SS316	Normal: 0,402 Maximum: 1,8 (during quality rinse of RO system)	ATM	6	5-35	80
Operating Drain No.2: drain from collector of H2 vent's drain and hydrogen purification unit's vent	Out	Pure water + Hydrogen+ Catalyst + Zeolite	2" FLANGE ASME B16.5	SS316	0,50	ATM	6	5-35	80
Maintenance Drain No. 1	Out	Pure water +Hydrogen	Drain valves, Refer to PID	SS316	Volume: 2 m3	ATM	6	5-35	80
Maintenance Drain No. 2	Out	Pure water +Oxygen	Drain valves, Refer to PID	SS316	Volume: 6 m3	ATM	6	5-35	80
Instrument air	In	Compressed air	1" FLANGE ASME B16.5	SS316	18Nm3/h peak	7,00	10	AMB	45

In PID sent with this TQ, compressed air supply is missing is on interface.

This communication is issued for the recipient's information and to facilitate the obligations of the Parties under the Contract. This communication has no authority to amend or vary the Contract nor relieve either Party of any duties, obligations or responsibilities.

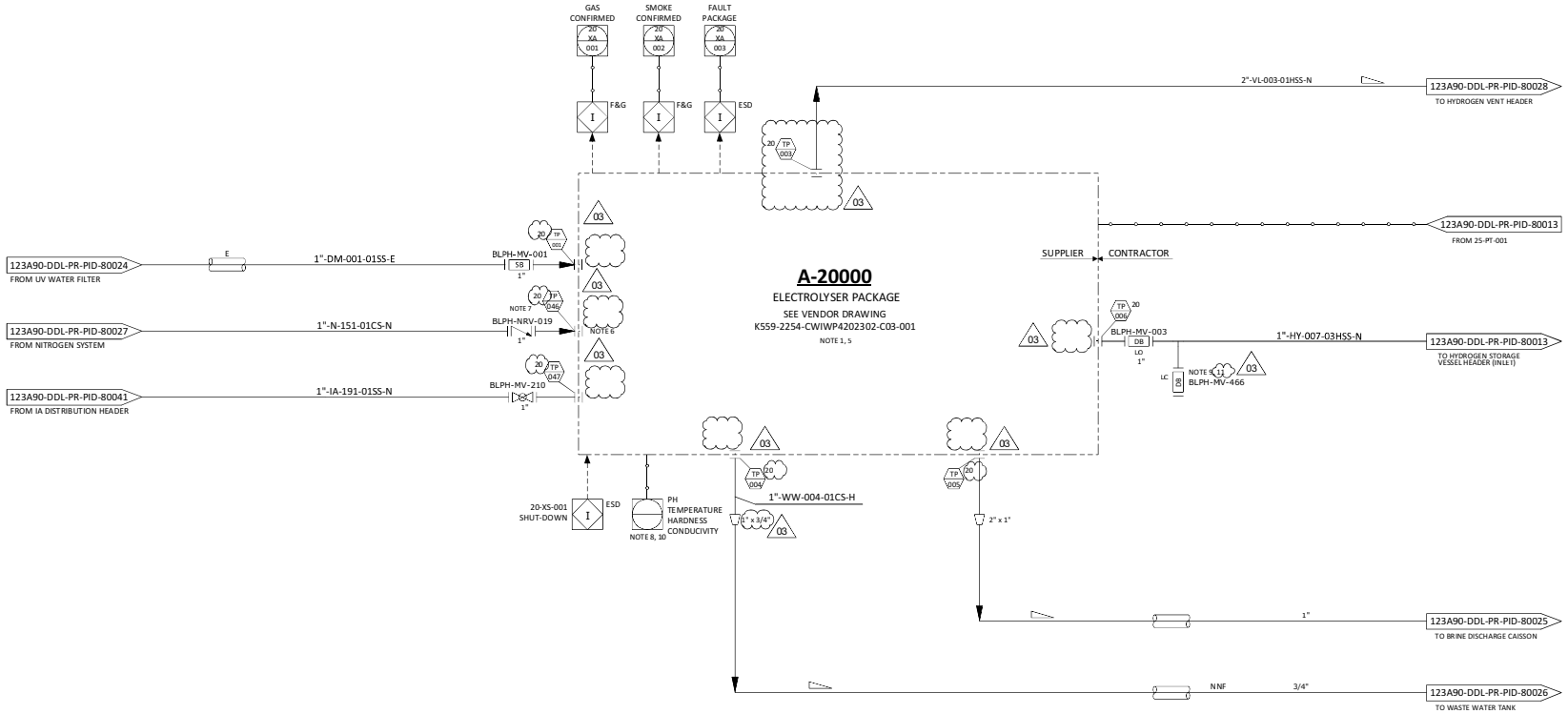
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REV. REV.

A-20000

ELECTROLYSER PACKAGE

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



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

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

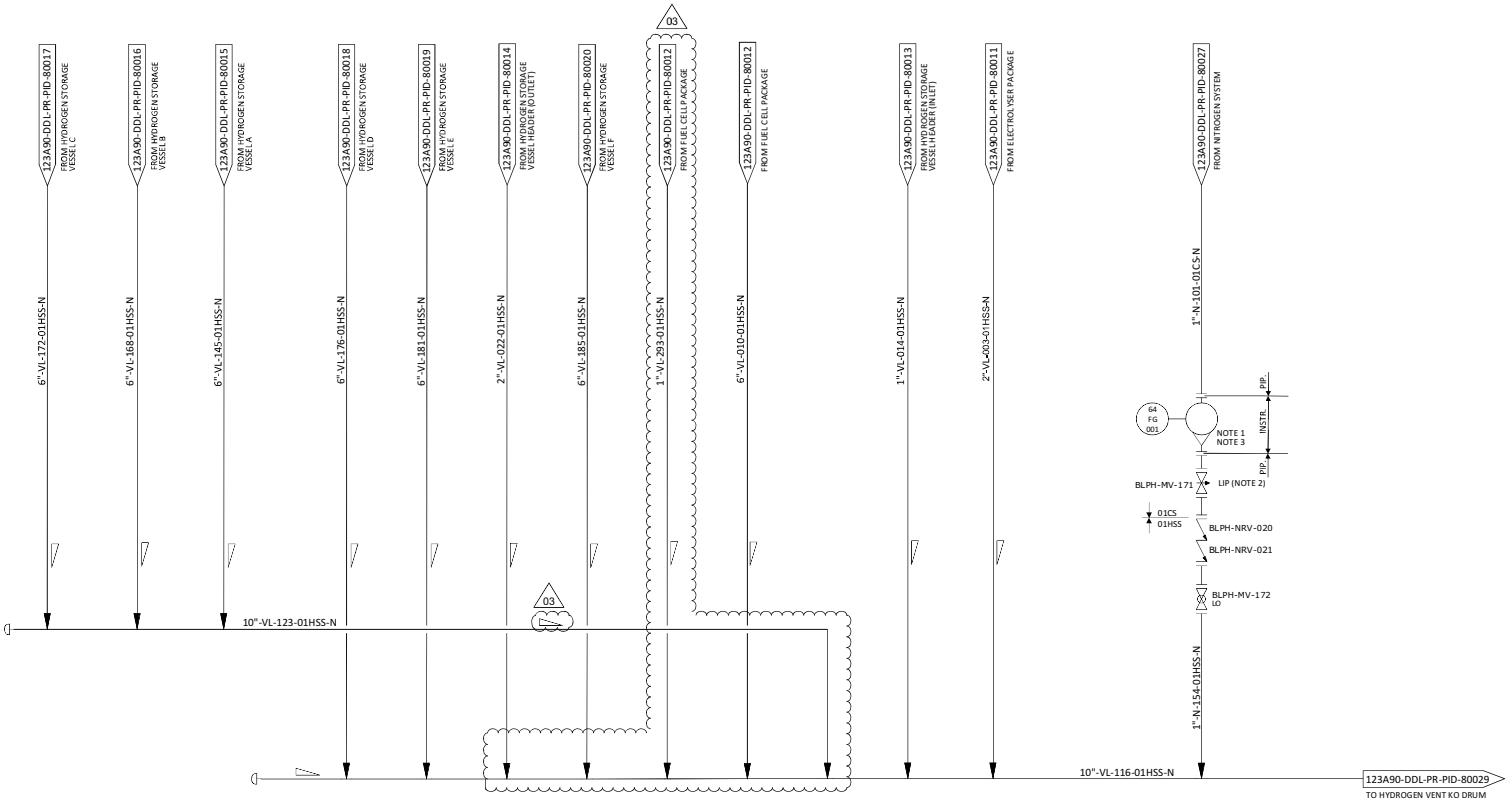
TITLE :
BLPH PIPING AND INSTRUMENTATION DIAGRAM
ELECTROLYSER PACKAGE

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-80011		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.

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
A1	DRAWING NO. 123A90-DDL-PR-PID-80028	SHEET 001	REV. 03

File Name : FILE_NAME

DRAWING NO. DRAWING_NO.

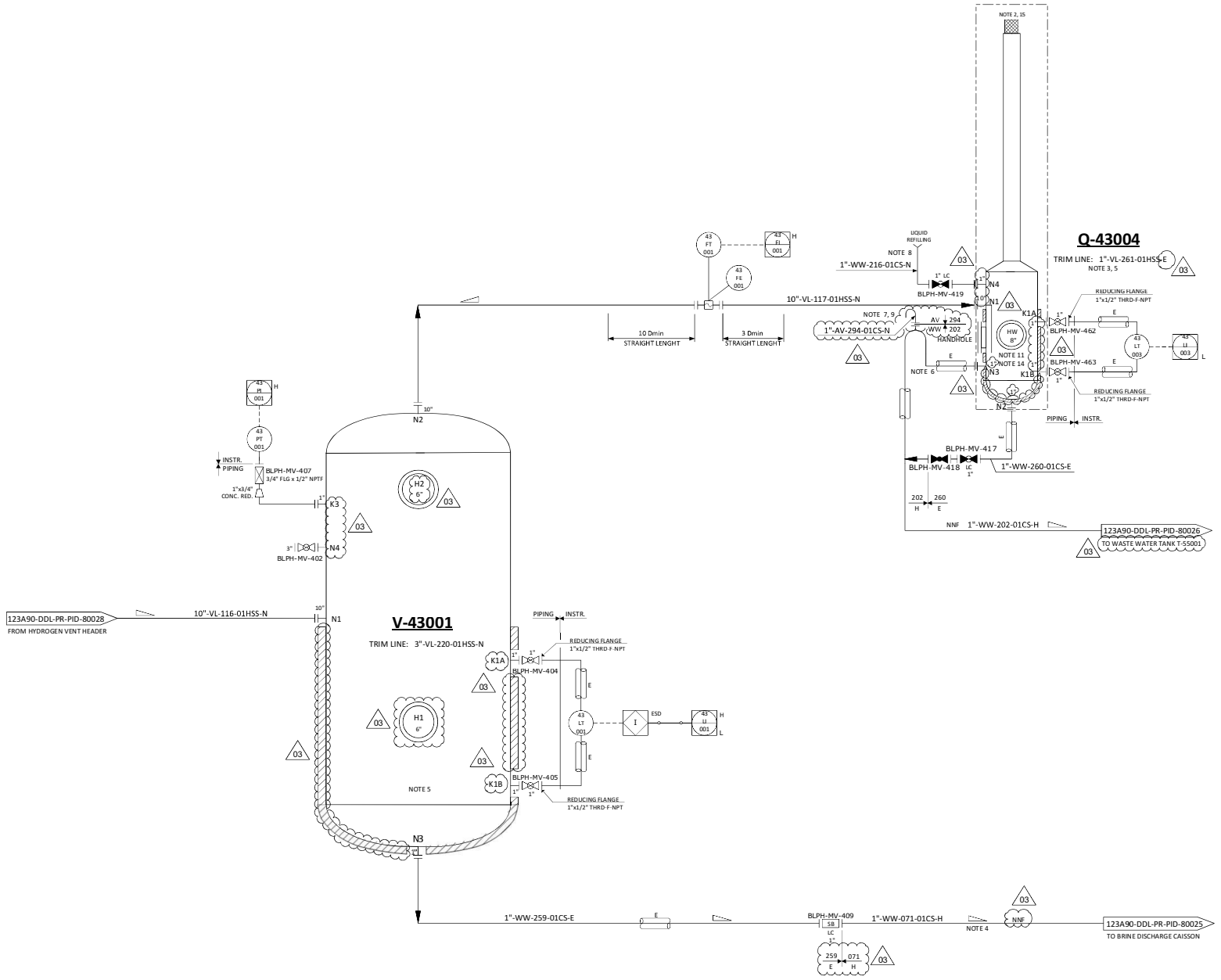
REV. REV

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.

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

File Name : FILE_NAME

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	19
Cause:	Oxygen From Electrolyser
Consequence:	Potential ignition & explosion within electrolyser/ hydrogen vent leading to LOC & risk to personnel & asset.
Safeguards:	
Actions:	Assess potential for oxygen/hydrogen explosion vendor package HAZOP.
Assigned Respondent (By)	CROSSWIND
RESPONSE	Adequate protection has been installed, refer to CRW-01-R-01 for details.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements

Company Discipline Lead	**Sign**
	Hamant Patel Digitally signed by Hamant Patel Date: 2024.10.09 15:59:46 +01'00'
Company HSE LEAD	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.11 08:00:02 +02'00'
Company Project Manager	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.11 07:32:44 +02'00'
Contractor received for information. Not independently verified. Information implemented	**Sign**

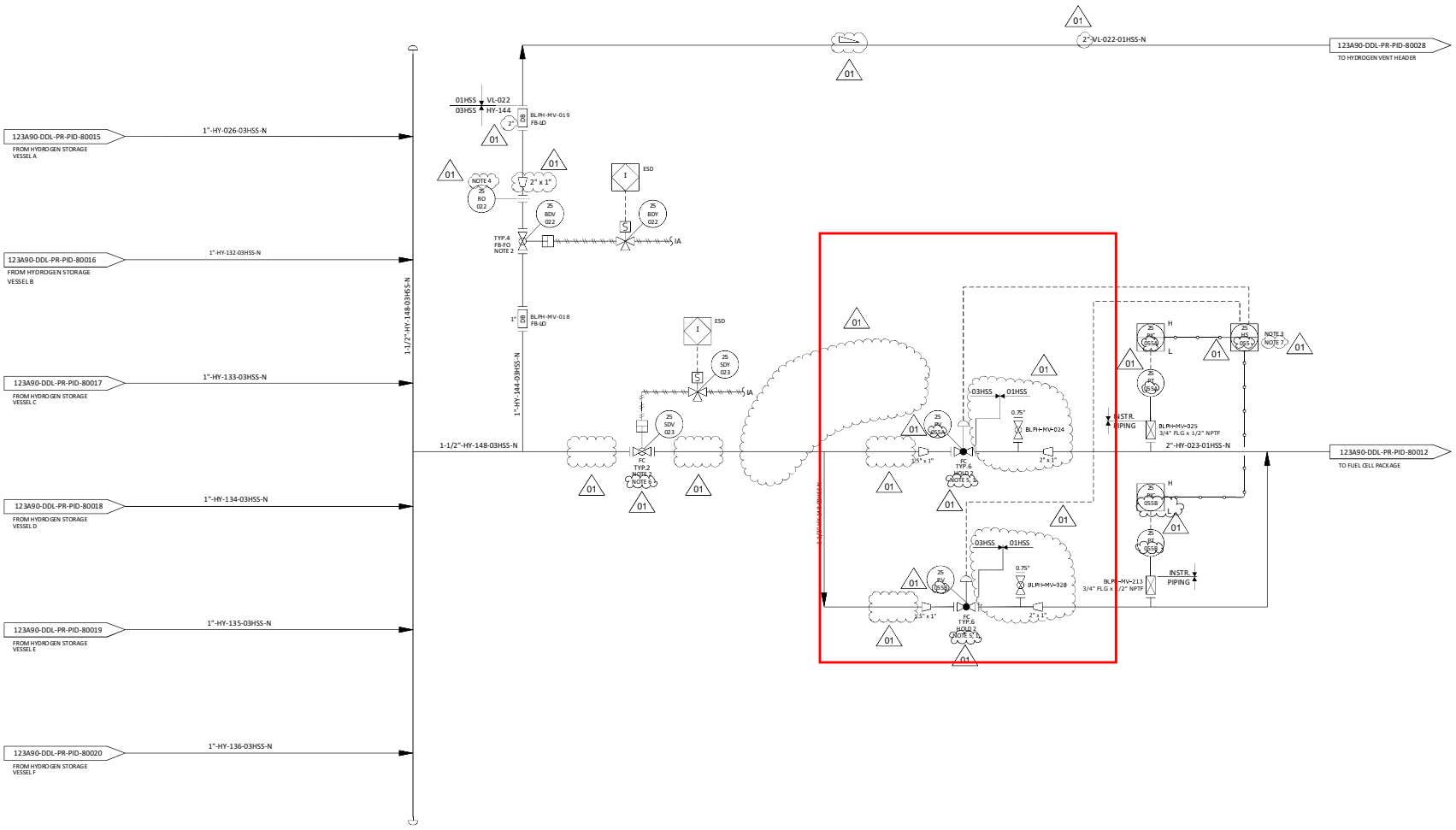
BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	20
Cause:	Fail closure of PVA/B in line of fuel cell,.
Consequence:	Unknow consequences to fuel cell.
Safeguards:	
Actions:	Review control requirements for PVA & PVB from fuel cell and delete if not required.
Assigned Respondent (By)	Rosetti Instrumentation Engineer
RESPONSE	As per project doc. P&ID " HYDROGEN STORAGE VESSELS HEADER (OUTLET)" n° 123A90-DDL-PR-PID-80014 rev.01, the pressure control valves 25-PV-055A/B are necessary to regulate the H2 pressure to Fuel Cell package and avoid the 80-PSV-001 intervention. These pressure control valves are designed as “Typ.6” that means critical control valve. The typ. 6 foresees the following status feedbacks to better monitor the behavior of the control valves: - Open limit switch - Closed limit switch - Position transmitter
Attachments:	
Issue Date	24-04-2024

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
L.Calabrese	
EPC HSE Lead	**Sign**
C. Caracciolo	CC
EPC Project Manager	**Sign**
D. Lo Sterzo	
Client	**Sign**
	Paul van Rossum Datum: 2024.05.10

DRAWING NO. DRAWING_NO.

REV. REV.



NOTES

1. DELETED.
2. NECESSARY CONTROL SYSTEM SOFTWARE SHALL BE INCLUDED TO SUPPORT ADVACED VALVE CONTROL, PARTIAL STROKE TESTING AND DIAGNOSTICS FOR ANY SAFETY CRITICAL ON/OFF VALVES. THESE APPLICATION SHALL BE IDENTIFIED BY HAZOP AND LOPA EVALUATION IF PARTIAL STROKE TESTING WILL BE REQUIRED:
   THE "TYP. 3" SHALL BE CONSIDERED INSTEAD THE ACTUAL "TYP. 2" FOR SDV
   THE "TYP. 5" SHALL BE CONSIDERED INSTEAD THE ACTUAL "TYP. 4" FOR BDV
3. HAND SELECTOR TO ALLOW THE OPERATOR TO SELECT THE CONTROL LOOP (REMOTELY).
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 RUNNING.
6. SDV VALVE 25-SDV-023 TO BE INSTALLED AS CLOSE AS POSSIBLE TO THE CONTROL VALVES 25-PV-055A/B.
7. HS INCLUDES SOFTWARE INTERLOCK TO PREVENT BOTH VALVES TO BE ONLINE SIMULTANEOUSLY. SOFTWARE INTERLOCK PREVENTS VALVE 25PV055B TO OPEN IF VALVE 25PV055A IS NOT CLOSED.

01

HOLDS

1. DELETED.
2. CONTROL VALVE SIZE (BY VENDOR).

01

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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 VESSELS HEADER (OUTLET)

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-80014		SHEET 001	REV. 01

File Name : FILE_NAME

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	20
Cause:	Other from elecrochlorination package
Consequence:	Unknown consequences
Safeguards:	
Actions:	Asses potential for consequence with vendor HAZOP package.
Assigned Respondent (By)	CROSSWIND
RESPONSE	There is no electrochlorination packages on BLPH facility, hence this recommendation is no longer applicable
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements

Company Discipline Lead	**Sign**
	Hamant Patel Digitally signed by Hamant Patel Date: 2024.10.09 16:00:24 +01'00'
Company HSE LEAD	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.11 07:52:18 +02'00'
Company Project Manager	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.11 07:32:21 +02'00'
Contractor received for information. Not independently verified. Information implemented	**Sign**

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	21
Cause:	Back pressure due to depressurisation blowdown
Consequence:	Potential for other users of hydrogen vent header to be unable to access vent due to back pressure.
Safeguards:	
Actions:	Carry out flare network back pressure analysis when detailed information is available in order to ensure all users can access hydrogen vent when required.
Assigned Respondent (By)	ROSETTI Process Engineer
RESPONSE	Flare network back pressure analysis has been carried out. The maximum back pressure that can be reached during the worst scenario is 1.27 barg. For reference see “Attachment 1 - FEED HAZOP action n21”, which is part of the “Relief, Vent and Blowdown Report”. This value is well below all the pressure sources of the systems to be depressurized. Therefore, all users can access hydrogen vent when required.
Attachments:	
Issue Date (21/02/24)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
Ciro Impradice	
EPC HSE Lead	**Sign**
Carolina Caracciolo	CC
EPC Project Engineering Manager	**Sign**
Davide Lo Sterzo	
Client	**Sign**
	Digitaal ondertekend door Paul van Rossum Datum: 2024.03.14 17:02:50 +01'00'

Base Load Power Hub (BLPH)

Relief, Vent and Blowdown Report

Document Number: 123A90-DDL-PR-RE-80030

Document Class: 1

01	05/02/2024	Accepted for Construction (AFC)	CIM	RZI	DLO
00	04/12/2023	Issue for Acceptance (IFA)	CIM	RZI	DLO
Rev.	Date	Description	Prepared	Reviewed	Approved

This document undergoes an issuance cycle within EDMS Fusionlive". Its distribution is electronically controlled. Once printed shall be considered as "NOT CONTROLLED" copy

maintenance and/or mitigation systems such as external insulation, depressuring systems, isolation of leaks, equipment and/or flange orientation and minimization and emergency response. On the other hands, unlike pool fire, a jet fire can, in essence, be "turned off" through isolation and depressurization of the jet fire source. Moreover, multiple studies show that in many cases, the installation of a PRV offers little or no protection therefore it provides an unfounded sense of security. Often and in many cases the vessel wall is weakened by high temperatures, before the PRV relieving pressure is reached. Thus, a transient thermomechanical response analysis has been carried out to accurately determine vessel rupture time. In general, it is demonstrated worldwide that only vessels with relatively thick walls may get a benefit from the presence of a PRV, while for most cases no appreciable increase in the vessel survival time beyond the onset of relief is observed.

Therefore, as mentioned before, we recommend that extreme caution should be taken, if and when designing relief systems for gas-filled vessels, and we propose the following recommendations:

- Never base relief valve sizing for gas-filled vessels on API 521 equations–except maybe for early phase studies. For detailed design and actual installation purposes, always base relief valve sizing on dynamic simulations with rigorous modelling of the heat transfer process in order to avoid grossly oversized PRVs
- Carefully consider if the vessel survival time actually benefits from an installed PRV by performing thermomechanical calculations of the vessel rupture time and taking the chosen material properties into account
- If the vessel rupture time is not significantly prolonged by the presence of a PRV, consider alternative means for protecting the vessel, such as e.g., insulation, fireproofing or even better, blowdown activated by fusible plugs or equivalent detection, deluge systems.

In case of protection against jet fire, never rely on a PRV; always consider alternative means of protection even if in conjunction with PRV (Ref. [14]). In particular for this project a blowdown system has been foreseen as an alternative means of protection against jet fire attack; however, additional protection (i.e.: fireproofing on vessel saddles) can be provided to furtherly reduce the risk of collapse.

3.2.1.1.1 Fire Heat Flux Modelling

The net heat flux (global) is calculated based on the Stefan–Boltzmann fire equation, being more appropriate to mimicking the jet-fire attack. The general formula is as follows:

$$Q_{fire} = \alpha_s \cdot \sigma \cdot \left(\varepsilon_f \cdot T_f^4 - \varepsilon_s \cdot T_s^4\right) + h_f \cdot \left(T_f - T_s\right)$$

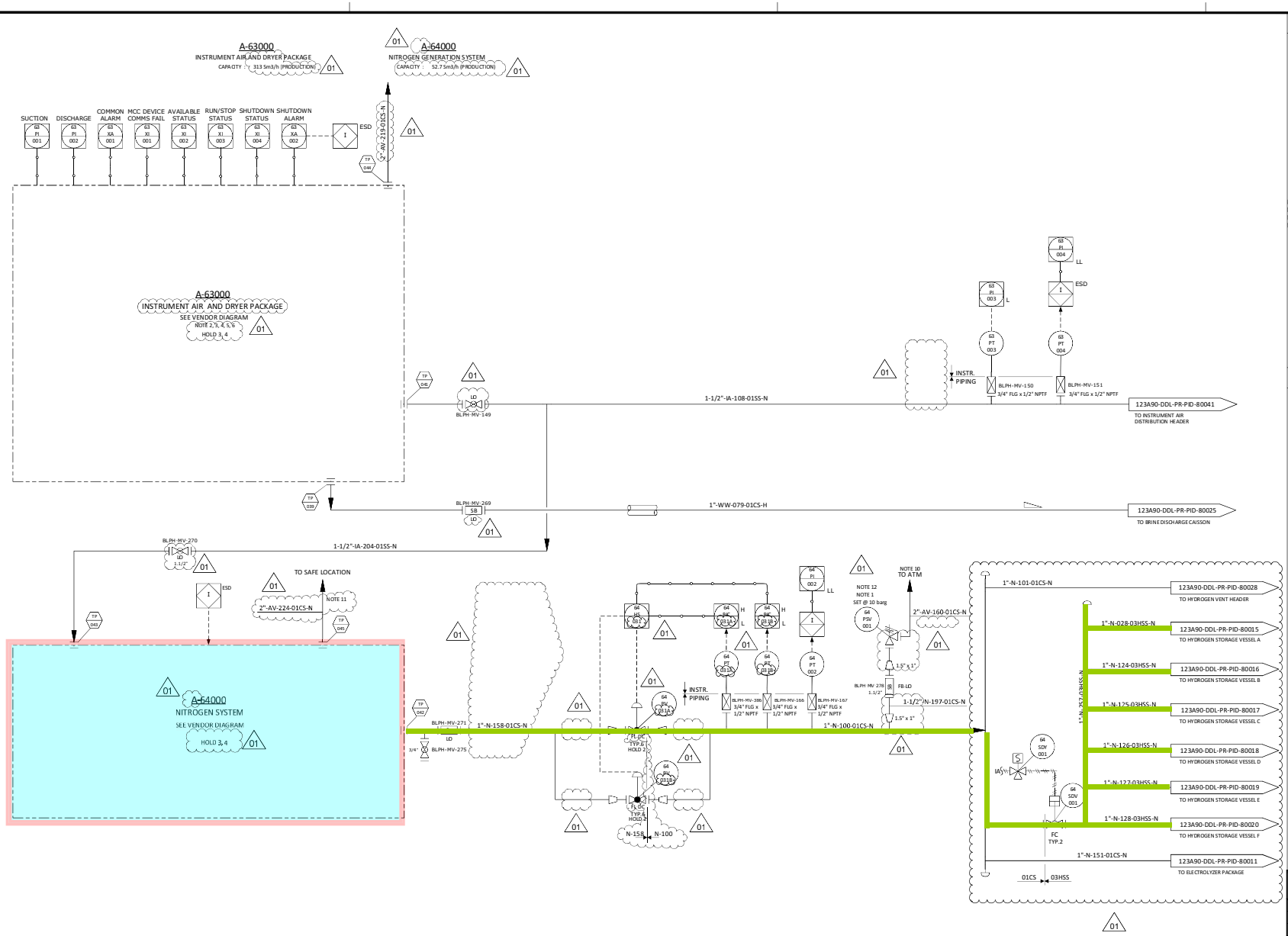
Where:

- Q_{fire}: heat absorbed by a segment (W/m^2)
- σ: Stefan–Boltzmann constant, 5.67×10^{-8} ($W/m^2\ K^4$)
- T_f: flame temperature (K)
- T_{amb}: ambient temperature (K)
- h_f: flame convective heat transfer coefficient ($W/m^2\ K$)
- α_s: surface absorptivity
- ε_s: surface emissivity
- ε_f: flame emissivity
- T_s: segment temperature (K) (time dependent)

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	22
Cause:	Restart of individual package/component after maintenance.
Consequence:	Potential for Air within hydrogen vent header & start- up, leading to possible hydrogen air mix & potential explosion & risk to personnel & asset.
Safeguards:	
Actions:	Review means of sweeping residual air within hydrogen vent header prior to reintroduction of item/package that will shut down for maintenance.
Assigned Respondent (By)	ROSETTI Process Engineer
RESPONSE	Sweeping of residual air within hydrogen vent header prior to reintroduction of item/package (that will shut down for maintenance) has been provided. The sweeping of residual air will be performed by means of nitrogen, that will be taken from the Nitrogen Package (A-64000). For reference see PID "123A90-DDL-PR-PID-80027_01", attachment 1. The sweeping of the residual air will be performed through the H2 Storage Vessels (where a permanent nitrogen connection is provided). The inventory, which could contain residual air, will be then vented up to the exit of the H2 vent Q-43004.
Attachments:	
Issue Date	28-02-2024

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
Ciro Impradice	Ciro Impradice Autore firma digitale: Ciro Impradice Nome distintivo: GN = Ciro Impradice email = ciro.impradice@rosetti.it C = IT O = RosettiMarino SpA Process Data: 2024.05.15 14:29:48 +02'00'
EPC HSE Lead	**Sign**
C.Caracciolo	CC
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**
	Digitaal ondertekend door Paul van Rossum Datum: 2024.06.24 08:04:30 +02'00'



NOTES

1. ONE UNINSTALLED SPARE PSV SHALL BE AVAILABLE.
2. COMPRESSORS AND DRIERS DESIGNED FOR 2 X 100% CONFIGURATION. INSTRUMENT AIR RECEIVER DESIGNED FOR 1 X 100%.
3. VENDOR TO PROVIDE NECESSARY CONTROLS, INSTRUMENTATIONS AND ISOLATIONS IN ORDER TO OPERATE THE PLANT IN SAFE MANNER.
4. COMPRESSORS WILL OPERATE ON THE BASIS OF ONE WORKING AND ONE ON STANDBY.
5. COMPRESSORS TO BE SCREW TYPE OIL FREE.
6. AIR COMPRESSOR INLET TO BE LOCATED AWAY FROM ANY VENTS.
7. DELETED.
8. DELETED.
9. DELETED.

01

10. TO SAFE LOCATION, ROUTED AWAY FROM WALKWAYS.
11. THE LINE 2"-AV-224-01CS-N IS PREDOMINATELY OXYGEN.
12. 64PSV001 SIZED FOR UPSTREAM CV FAILURE..

01

HOLDS

1. DELETED.

01

2. CONTROL VALVE SIZE (BY VENDOR).
3. CONTROL INTERFACES SHOWN FOR THE PACKAGES ARE IN HOLD UNTIL ALL DETAILS ARE PROVIDE BY THE RESPECTIVE VENDORS AND CONFIRMED.
4. VENDOR DOCUMENT NUMBER.

01

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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
INSTRUMENT AIR PACKAGE

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-80027		SHEET 001	REV. 01

DRAWING NO. DRAWING_NO.

REV. REV.

File Name : FILE_NAME

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	23
Cause:	P-50001A failure
Consequence:	Loss of flow towards sea water coarse filter, also to electro chlorination package, leading to loss of production of hypochlorite. Loss of sea water flow to ultra-filtration unit, filtered sea water tank, desalination unit, leading to unknown consequences to desalination unit.
Safeguards:	Low' Pressure alarm on discharge of P- 50001A. 'Low level' alarm on filtered sea water tank, T- 50006. 'LL' trip on filtered sea water tank , T- 50006. Standby pump P-50001B
Actions:	Consider loss of flow of sea water in desalination unit HAZOP Package.
Assigned Respondent (By)	Rosetti Mechanical
RESPONSE	Case of loss flow of sea water have been assessed during the HAZOP sessions. See attachment
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
F.Mura	
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D. Lo Sterzo	
Client	**Sign**

Digitaal ondertekend door Paul van Rossum
Datum: 2024.09.03 16:17:41 +02'00'

Node: 4. Hydrogen Vent System

Deviation	Cause	Consequence	Hazard Register	SIF Summation - Threat	RAM Score				LOPA?	Barriers			Recommendation	Responsibility	ALARP Determination
					R	S	L	RR		Barrier Tag	Barrier Description	Validity			
4.17. Catalysts	4.17.1. No credible causes														
4.18. Utilities	4.18.1. Loss of Power	4.18.1.1. Loss of heat tracing to instrumentation and seal pot. See 4.8.1 and 4.11.1: Cause: 4.11.1 Cause: 4.8.1													
	4.18.2. Loss of Nitrogen Supply	4.18.2.1. See No flow from N2 system 4.1.11: Cause: 4.1.11													
	4.18.3. Loss of Instrument Air	4.18.3.1. 43LV001 moves to air fail position.											42. Make air fail position of 43LV001 fail closed and type 6 (critical).	Rosetti Process	
4.19. Corrosion/Erosion	4.19.1. No additional causes.														
4.20. Other	4.20.1. Lute provision on base of stack within Rosetti Package	4.20.1.1. Refer to Recommendation.											28. Review the requirement for a Lute within the Elogen Package H2 vent system as the package vent discharge is via a knockout pot V43001 within the Rosetti scope. If Elogen Lute not required consider removal of the Elogen package Lute.	Crosswind	

Node: 5. Seawater and Treated Water Systems

Deviation	Cause	Consequence	Hazard Register	SIF Summation - Threat	RAM Score				LOPA?	Barriers			Recommendation	Responsibility	ALARP Determination
					R	S	L	RR		Barrier Tag	Barrier Description	Validity			
5.1. Flow No/Less	5.1.1. Blocked Caisson B-50013A (Marine debris or marine life)	5.1.1.1. Unable to pull seawater into system and damage to pump P-50001A or Caisson.	Asset Damage to Pump(s)		A	1	C	1C		50-XA001	Trip/Fault alarm on pump P-50001A				
										Spare Seawater Pump	2 x 100% capacity with automatic changeover.				
		5.1.1.2. No flow into seawater treatment system.													
	5.1.2. P-50001A pump tripped Consequence: 5.1.3.2 Consequence: 5.18.1.1	5.1.2.1. No flow into coarse filter package A-50003 resulting in failure of backwash cycle, operational issue requiring additional backwash cycles. No hazardous consequences.								50-XA001	Trip/Fault alarm on pump P-50001A		43. Update the control narrative to identify alternate seawater lift pump auto-start on 50-PI001/002 low pressure alarm or 50-XA001/003 trip/fault alarm.	Rosetti Instrumentation	
										50-PI001	Low Pressure alarm in discharge of P-50001A				
		5.1.2.2. No flow into T-50006 treated seawater tank leading to potential low level in tank resulting in loss of flow to desalination unit A-50007. No hazardous consequences.								50-XA001 / 50-XA003	Trip/Fault alarm on pump P-50001A/B				
										50-PI001	Low Pressure alarm in discharge of P-50001A				
										50-LI020L	Low level alarm on T-50006				
										50-LI020LL	Low low level trip on T-50006. Trips P-50002A/B and P-50003A/B				
	5.1.3. 50-XV001 fails closed / BLPH-MV-043 inadvertently closed	5.1.3.1. Block discharged of P-50001A leading to potential damage to pump.	Asset Damage to Pump(s)		A	1	C	1C		50-PI001	High Pressure alarm in discharge of P-50001A				
										50-PSV006	Relief valve on discharge of P-50001A				
		5.1.3.2. Loss of forward flow. See Cause: 5.1.2													
	5.1.4. 50-XV004 fails closed on return line on offline Pump / BLPH-MV-050 inadvertently closed	5.1.4.1. Loss of biocide dosed water to P-50001B leading to potential for bacterial growth and clogging of seawater system, operational issue. No hazardous consequences.													
	5.1.5. Inadvertent closure of MV-500	5.1.5.1. Potential deadheading of pumps P-50001A/B and exceeding DP of pipework with LOC of sea water. Potential flooding of WTP container. Damage to electrical equipment within container. Asset damage. Consequence: 5.1.6.1	Asset Damage to Electrical Equipment		A	1	B	1B		50-PSV011	Design for blocked outlet, set point 6 barg				
										50-PI020L	Low pressure alarm upstream of A-50003				
										50-FI020L	Low flow alarm upstream of S-50001				
					A	1	C	1C		50-PI020L	Low pressure alarm upstream of A-50003				

Node: 5. Seawater and Treated Water Systems

Deviation	Cause	Consequence	Hazard Register	SIF Summation - Threat	RAM Score				LOPA?	Barriers			Recommendation	Responsibility	ALARP Determination
					R	S	L	RR		Barrier Tag	Barrier Description	Validity			
		5.1.5.2. No flow to tank T-50006 potential low level in tank. Potential dry running of P-50002A/B resulting in damage to pump and asset damage to pump. Consequence: 5.1.6.1 Consequence: 5.2.3.1 Consequence: 5.2.4.1	Asset Damage to Pump (s)							50-FI020L	Low flow alarm upstream of S-50001				
										50-LI020L	Low level alarm on T-50006				
										50-LI020LL	Low low level trip on T-50006. Trips P-50002A/B and P-50003A/B				
		5.1.5.3. No flow to tank T-50006 potential low level in tank. Potential dry running of P-50003A/B resulting in damage to pump and asset damage to pump. Consequence: 5.1.6.1 Consequence: 5.2.3.1 Consequence: 5.2.4.1	Asset Damage to Pump (s)		A	1	C	1C		50-PI020L	Low pressure alarm upstream of A-50003				
										50-FI020L	Low flow alarm upstream of S-50001				
										50-LI020L	Low level alarm on T-50006				
										50-LI020LL	Low low level trip on T-50006. Trips P-50002A/B and P-50003A/B				
		5.1.5.4. No flow through H-50001. Potential overheating of PVC pipework (DT 60 degC) with damage to pipework and interuption of operation. Consequence: 5.1.6.1 Consequence: 5.2.3.1 Consequence: 5.2.4.1	Asset damage		A	1	C	1C		50-PI020L	Low pressure alarm upstream of A-50003				
										50-FI020L	Low flow alarm upstream of S-50001				
										50-TAAH20	High temperature trip (110 degC) of H-50001. Trip setting is internal to heater and appropriate for heater design temperature.				
		5.1.5.5. Continued dosage of biocide into stagnant system, potential overdose of biocide to downstream system. No significant hazard as biocide is removed by reverse osmosis unit.													
	5.1.6. Closure of 50-XV020 out of sequence Consequence: 5.1.7.1 Consequence: 5.1.8.1 Consequence: 5.1.9.1 Consequence: 5.1.10.1 Consequence: 5.1.11.1 Consequence: 5.1.12.1 Consequence: 5.1.13.1 Consequence: 5.18.3.2	5.1.6.1. See Consequence: 5.1.5.2 Consequence: 5.1.5.1 Consequence: 5.1.5.3 Consequence: 5.1.5.4													
		5.1.6.2. Potential reverse flow of sea water to biocide dosing. Potential over flow of concentrated biocide into waste water tank. Potential over flow of waste water tank T-55001 to sea, potential environmental incident.	Ethylene Glycol		E	3	B	3B		NRV-504	NRV in WTP inlet line				
										NVR-606 / NRV-612	NRV in P-50007A/B discharge				
										55-LI001H	High level alarm on T-55001				
										50-FI020L	Low flow alarm upstream of S-50001				
	5.1.7. High DP on coarse filter A-50003 Failure to initiate cleaning sequence. PDI failed.	5.1.7.1. See Cause: 5.1.6													
	5.1.8. No flow when required through coarse filter drain valve	5.1.8.1. Failure in cleaning sequence with build up of solids in coarse filter. See Cause: 5.1.6								50-XAA50003	General alarm from A-50003 package				
	5.1.9. Inadvertent closure of MV-506	5.1.9.1. See Cause: 5.1.6													
	5.1.10. Internal valve closure within S-50001. Potential failure 50-PDI023	5.1.10.1. See Cause: 5.1.6													
		5.1.10.2. Potential reverse flow through P-50002A/B into T-50006 bypassing sand filter S-50001. High load on cartdrige filters S-50002A/B and S-50003A/B reducing operational lifetime. Operational issue potentially requring early replacement of cartdridge filters.								NRV-512 / NRV-515 / NRV-518	NRV on P-50002A/B discharge				
										50-PDI024H / 50-PDI029H	High DP across S-50002A/B and S-50003A/B				
										50-XAS-50001	General alarm from S-50001 package				

Node: 5. Seawater and Treated Water Systems

Deviation	Cause	Consequence	Hazard Register	SIF Summation - Threat	RAM Score				LOPA?	Barriers			Recommendation	Responsibility	ALARP Determination
					R	S	L	RR		Barrier Tag	Barrier Description	Validity			
	5.1.11. No flow when required through sand filter drain valve. Valve not shown on P&ID	5.1.11.1. Failure in backwash operation with build up of solids in sand filter. See Cause: 5.1.6								50-PDI023H	High DP across S-50001 unit				
		5.1.11.2. Deadheading of P-50002A/B. Potential damage to pumps and asset damage.	Asset Damage to Pump (s)		A	1	C	1C		50-FI020L	Low flow alarm upstream of S-50001				
										50-XAS-50001	General alarm from S-50001 package				
										50-PDI023H	High DP across S-50001 unit				
	5.1.12. High DP on sand filter S-50001. Failure of 50-PDI023 to initiate back wash sequence	5.1.12.1. Failure in backwash operation with build up of solids in sand filter. See Cause: 5.1.6								50-FI020L	Low flow alarm upstream of S-50001				
										50-LI020L	Low level alarm on T-50006				
										50-LI020LL	Low low level trip on T-50006. Trips P-50002A/B and P-50003A/B				
	5.1.13. Inadvertent closure of MV-509	5.1.13.1. Loss of forward flow through sand filter. See Cause: 5.1.6								50-FI020L	Low flow alarm upstream of S-50001				
										50-LI020L	Low level alarm on T-50006				
										50-LI020LL	Low low level trip on T-50006. Trips P-50002A/B and P-50003A/B				
	5.1.14. Inadvertent closure of MV-514 on backwash loop	5.1.14.1. Failure in backwash operation with build up of solids in sand filter and eventual blockage of sand filters. Operational issue								50-FI020L	Low flow alarm upstream of S-50001				
										P-50002A/B	Installed spare				
		5.1.14.2. Loss of NPSH to pumps P-50002A/B resulting in caviation and damage to pumps	Asset Damage to Pump (s)		A	1	C	1C		50-FI020L	Low flow alarm upstream of S-50001				
	5.1.15. P-50002A stopped	5.1.15.1. Failure in backwash operation with build up of solids in sand filter and eventual blockage of sand filters. Operational issue								50-FI020L	Low flow alarm upstream of S-50001				
										P-50002A/B	Installed spare				
	5.1.16. Inadvertent closure of MV-516 on backwash loop	5.1.16.1. Failure in backwash operation with build up of solids in sand filter and eventual blockage of sand filters. Operational issue								50-FI020L	Low flow alarm upstream of S-50001				
										P-50002A/B	Installed spare				
		5.1.16.2. Deadheading of pumps P-50002A/B resulting in damage.	Asset Damage to Pump (s)		A	1	C	1C		50-FI020L	Low flow alarm upstream of S-50001				
	5.1.17. Inadvertent closure of MV-xxx on backwash loop	5.1.17.1. Failure in backwash operation with build up of solids in sand filter and eventual blockage of sand filters. Operational issue								50-FI020L	Low flow alarm upstream of S-50001				
		5.1.17.2. Deadheading of pumps P-50002A&B resulting in damage.	Asset Damage to Pump (s)		A	1	C	1C		50-FI020L	Low flow alarm upstream of S-50001				
	5.1.18. 50-XV021 closed failure in filter change over operation	5.1.18.1. High level in T-50006 potential overflow of tank to sea water caisson. No hazardous consequences.								50-LI020H	High level alarm on T-50006				
		5.1.18.2. Dry running of pumps P-50003A/B and loss of flow to P-50004A/B. Damage to pumps P-50003A/B and P-50004A/B.	Asset Damage to Pump (s)		A	1	C	1C		50-PI025L / 50-PI027L	Low pressure alarm at discharge of P-50003A/B		49. 50-LI020LL should trip P-50004A/B on LL level in T-50006 to prevent pump damage	PSC	
										50-FI022L / 50-FI023L	Low flow alarm at discharge of P-50003A/B				
		5.1.18.3. Loss of pressure to RO units A-50007A/B. No hazardous consequences.								50-PIC030L / 50-PIC032L	Low pressure on discharge of P-50004A/B				
		5.1.18.4. Loss of flow into T-50008. Loss of level in T-50008. Operational issue.								50-LI021L	Low level alarm on T-50008				
										50-LI021LL	Low low level trip on T-50008. Trips P-50009A/B and P-50003A/B when in flushing mode.				
	5.1.19. P-50003A stopped	5.1.19.1. High level in T-50006 potential overflow of tank to sea water caisson. No hazardous consequences.								50-LI020H	High level alarm on T-50006				
					A	1	C	1C		50-PI025L / 50-PI027L	Low pressure alarm at discharge of P-50003A/B			PSC	

Node: 5. Seawater and Treated Water Systems

Deviation	Cause	Consequence	Hazard Register	SIF Summation - Threat	RAM Score				LOPA?	Barriers			Recommendation	Responsibility	ALARP Determination
					R	S	L	RR		Barrier Tag	Barrier Description	Validity			
		5.1.19.2. Loss of pressure at inlet to P-50004A/B. Loss of forward flow through cartdrige filters. Asset damage to pumps and pipework.	Asset Damage to Pump (s)							50-FI022L / 50-FI023L	Low flow alarm at discharge of P-50003A/B		49. 50-LI020LL should trip P-50004A/B on LL level in T-50006 to prevent pump damage		
										50-PIC030L / 50-PIC032L	Low pressure alarm at discharge of P-50004A/B				
		5.1.19.3. Loss of pressure to RO units A-50007A/B. No hazardous consequences.								50-PIC030L / 50-PIC032L	Low pressure on discharge of P-50004A/B				
		5.1.19.4. Loss of flow into T-50008. Loss of level in T-50008. Operational issue.								50-LI021L	Low level alarm on T-50008				
										50-LI021LL	Low low level trip on T-50008. Trips P-50009A/B and P-50003A/B when in flushing mode.				
	5.1.20. MV-527 inadvertently closed Consequence: 5.1.21.1	5.1.20.1. Blocked discharge of P-50003A. Deadhead pressure of pump less than DP of pipework. No LOC. Potential damage to pump.	Asset Damage to Pump (s)		A	1	C	1C		50-PI025L / 50-PI027L	Low pressure alarm at discharge of P-50003A/B				
										50-FI022L / 50-FI023L	Low flow alarm at discharge of P-50003A/B				
		5.1.20.2. Loss of pressure at inlet to P-50004A/B. Loss of forward flow through cartdrige filters. Asset damage to pumps and pipework.	Asset Damage to Pump (s)		A	1	C	1C		50-PI025L / 50-PI027L	Low pressure alarm at discharge of P-50003A/B		49. 50-LI020LL should trip P-50004A/B on LL level in T-50006 to prevent pump damage	PSC	
										50-FI022L / 50-FI023L	Low flow alarm at discharge of P-50003A/B				
										50-PIC030L / 50-PIC032L	Low pressure alarm at discharge of P-50004A/B				
		5.1.20.3. Loss of pressure to RO units A-50007A/B. No hazardous consequences.								50-PIC030L / 50-PIC032L	Low pressure on discharge of P-50004A/B				
		5.1.20.4. Loss of flow into T-50008. Loss of level in T-50008. Operational issue.								50-LI021L	Low level alarm on T-50008				
										50-LI021LL	Low low level trip on T-50008. Trips P-50009A/B and P-50003A/B when in flushing mode.				
	5.1.21. S-50002A / S-50003A fouled	5.1.21.1. Reduced flow to RO cells. Similar but less impact. See Cause: 5.1.20								50-PDI024H / 50-PDI029H	High DP across S-50002A/B and S-50003A/B				
	5.1.22. MV-531 inadvertently closed	5.1.22.1. Blocked discharge of P-50003A. Deadhead pressure of pump less than DP of pipework. No LOC. Potential damage to pump.	Asset Damage to Pump (s)		A	1	C	1C		50-FI022L / 50-FI023L	Low flow alarm at discharge of P-50003A/B				
		5.1.22.2. Loss of pressure at inlet to P-50004A/B. Loss of forward flow through cartdrige filters. Asset damage to pumps and pipework.	Asset Damage to Pump (s)		A	1	C	1C		50-FI022L / 50-FI023L	Low flow alarm at discharge of P-50003A/B		49. 50-LI020LL should trip P-50004A/B on LL level in T-50006 to prevent pump damage	PSC	
										50-PIC030L / 50-PIC032L	Low pressure alarm at discharge of P-50004A/B				
		5.1.22.3. Loss of pressure to RO units A-50007A/B. No hazardous consequences.								50-PIC030L / 50-PIC032L	Low pressure on discharge of P-50004A/B				
		5.1.22.4. Loss of flow into T-50008. Loss of level in T-50008. Operational issue.								50-LI021L	Low level alarm on T-50008				
										50-LI021LL	Low low level trip on T-50008. Trips P-50009A/B and P-50003A/B when in flushing mode.				
	5.1.23. P-50004A stopped	5.1.23.1. Loss of inlet pressure to RO cells and loss of forward flow to T-50008. Operational issue. Forward flow continues through flushing valve and concentrate line. Water discharge to sea water caisson.								50-FI022L / 50-FI023L	Low flow alarm at discharge of P-50003A/B				
										50-PIC030L / 50-PIC032L	Low pressure alarm at discharge of P-50004A/B				
										50-FI024L	Low discharge flow from RO cells.				
	5.1.24. A-50007A fouled	5.1.24.1. Potential over pressure of RO cells with LOC from RO cells or inlet pipework into WTP container. Asset damage.	Asset Damage to Electrical Equipment		A	1	B	1B		50-PIC030	Discharge pressure control of P-50004A				
										50-PSV035	Pressure relief valve on P50004A. Designed for full flow relief				
	5.1.25. MV-xxx inadvertently closed Consequence: 5.1.26.1	5.1.25.1. Potential over pressure of RO cells discharge with LOC from PU pipework into WTP container. Asset damage.	Asset Damage to Electrical Equipment		A	1	B	1B		50-PSV036	Pressure relief valve designed for full flow relief downstream of A-50007A				
										50-FI024L	Low discharge flow from RO cells.				
	5.1.26. 50-XV025 closed	5.1.26.1. See Cause: 5.1.25													
	5.1.27. 50-XV026 fails to open when required. Failure of	5.1.27.1. Potential off spec water fed to Elogen water treatment. Potential fouling of Elogen RO cells and											48. Review the effect of out of spec water fed to Elogen RO cells based on a temperature at the PSC RO cells of 40 degC with the chloride concentration based on this temperature. Identify in the	Rosetti Process / Crosswind / PSC / Elogen	

Node: 5. Seawater and Treated Water Systems

Deviation	Cause	Consequence	Hazard Register	SIF Summation - Threat	RAM Score				LOPA?	Barriers			Recommendation	Responsibility	ALARP Determination
					R	S	L	RR		Barrier Tag	Barrier Description	Validity			
	conductivity control 50-AI024	loss of purified water to electrolysis unit. Operational issue.											Elogen HAZOP if it is credible that chloride is fed through to the electrolysis cells or if this is only an operational impact on RO cell performance (current assumption). If there is adverse impact on the cells, review if LOPA is required for this failure in the Rosetti HAZOP.		
	5.1.28. 50-XV027 closed whilst flushing	5.1.28.1. Low flushing flow through RO cells. Potential degradation of RO cells due to poor flushing. Operational issue. Forward flow continues through flushing valve and concentrate line. Water discharge to sea water caisson.								50-FI022L / 50-FI023L	Low flow alarm at discharge of P-50003A/B				
	5.1.29. MV-550 incorrectly set	5.1.29.1. Potential over pressure of RO cells with LOC from RO cells or inlet pipework into WTP container. Asset damage.	Asset Damage to Electrical Equipment		A	1	B	1B		50-PIC030	Discharge pressure control of P-50004A				
										50-PSV035	Pressure relief valve on P50004A. Designed for full flow relief				
	5.1.30. MV-561 inadvertently closed	5.1.30.1. Blocked inlet to P-50009A/B loss of NPSH to pumps and cavitation with potential for pump damage.	Asset Damage to Pump (s)		A	1	C	1C		50-PI047L	Low pressure alarm at discharge of P-50009A/B				
										50-FI028L	Low flow alarm on outlet of WTP unit				
		5.1.30.2. Loss of forward flow to electrolysis unit. Operational issue. No hazardous consequence.								50-FI028L	Low flow alarm on outlet of WTP unit				
		5.1.30.3. Potential overflow of T-50008 with overflow of fresh water to brine caisson. No hazardous consequences.								50-LI021H	High level alarm on T-50008				
	5.1.31. P-50009A/B not running	5.1.31.1. Loss of forward flow to electrolysis unit. Operational issue. No hazardous consequence.								50-FI026L	Low flow alarm on outlet of WTP unit				
		5.1.31.2. Potential overflow of T-50008 with overflow of fresh water to brine caisson. No hazardous consequences.								50-LI021H	High level alarm on T-50008				
		5.1.31.3. Potential reverse flow from electrolysis unit. Potential overflow of T-50008 with overflow of fresh water to brine caisson. No hazardous consequences.								NRV-562 / NRV-565	Non return valves on discharge of P-50009A/B				
		5.1.31.4. Potential overdose of caustic into fresh water system due to distance between dosing point and PH analysis								P-50005A/B stopped	Interlock of pump running signal with caustic dosing pump P-50005A/B				
	5.1.32. MV-563 / MV-566 inadvertently closed	5.1.32.1. Deadheading of P-50009A/B (7barg) potential overpressure of pump discharge pipe work (DP 6barg). Pump damage and potential LOC of fresh water within WTP container.	Asset Damage to Pump (s)		A	1	C	1C		50-FI026L	Low flow alarm on outlet of WTP unit		52. Determine how overpressure of fresh water system can be prevented should P-50009A/B be isolated on the downstream side as deadhead pressure of these pumps is 7barg and the design pressure of downstream system is 6barg.	PSC	
		5.1.32.2. Potential overflow of T-50008 with overflow of fresh water to brine caisson. No hazardous consequences.								50-LI021H	High level alarm on T-50008				
		5.1.32.3. Loss of forward flow to electrolysis unit. Operational issue. No hazardous consequence.								50-FI026L	Low flow alarm on outlet of WTP unit				
		5.1.32.4. Potential overdose of caustic into fresh water system due to distance between dosing point and PH analysis								None available	Interlock of pump running signal with caustic dosing pump P-50005A/B not a safeguard as pump is still running				
	5.1.33. S-50004 clogging not considered credible														
	5.1.34. MV-569 inadvertently closed Consequence: 5.1.35.1 Consequence: 5.1.36.1	5.1.34.1. Deadheading of P-50009A/B (7barg) potential overpressure of pump discharge pipe work (DP 6barg). Pump damage and potential LOC of fresh water within WTP container.	Asset Damage to Pump (s)		A	1	C	1C		50-FI026L	Low flow alarm on outlet of WTP unit		52. Determine how overpressure of fresh water system can be prevented should P-50009A/B be isolated on the downstream side as deadhead pressure of these pumps is 7barg and the design pressure of downstream system is 6barg.	PSC	
										50-PI046H	High pressure alarm on inlet to S-50004				
		5.1.34.2. Potential overflow of T-50008 with overflow of fresh water to brine caisson. No hazardous consequences.								50-LI021H	High level alarm on T-50008				
		5.1.34.3. Loss of forward flow to electrolysis unit. Operational issue. No hazardous consequence.								50-FI026L	Low flow alarm on outlet of WTP unit				

Node: 5. Seawater and Treated Water Systems

Deviation	Cause	Consequence	Hazard Register	SIF Summation - Threat	RAM Score				LOPA?	Barriers			Recommendation	Responsibility	ALARP Determination
					R	S	L	RR		Barrier Tag	Barrier Description	Validity			
		5.1.34.4. Potential overdose of caustic into fresh water system due to distance between dosing point and PH analysis. Potential overpressure of system due to pressure of caustic dosing pump P-50005A/B. Potential LOC of fresh water / caustic (2% concentration) within WTP container.	Asset Damage to Electrical Equipment		A	1	B	1B		None available	Interlock of pump running signal with caustic dosing pump P-50005A/B not a safeguard as pump is still running				
										50-PI046H	High pressure alarm on inlet to S-50004				
										Multi-function valve downstream of P-50005A/B	Multi-function valve (also acting as relief valve) downstream of P-50005A/B				
	5.1.35. 50-XV031 closed	5.1.35.1. See Cause: 5.1.34													
	5.1.36. BLPH-MV-001 inadvertently closed	5.1.36.1. See Cause: 5.1.34													
5.2. Flow More	5.2.1. P-50009A & B both operating	5.2.1.1. Potential overfill of Elogen WTP-300 and further consequences to be determined in WTP HAZOP.											54. Ensure logic for control of P-50009A/B prevents simultaneous running A & B pumps.	Rosetti Process	
		5.2.1.2. Off spec purified water to Electrolyser leading to permanent damage of Electrolyser stacks. See Elogen HAZOP 1.13.									See Elogen Package for barriers against off spec water from WTP.				
	5.2.2. P-50001A & B both operating	5.2.2.1. High flowrate into T-50006 leading to potential overfill of T-50006 Filtered seawater tank and sending filtered chlorinated water overboard. Operational issue, no hazardous consequences.								50-LIC006A/B	High level alarm on filtered sea water tank.				
		5.2.2.2. Review within Seawater Coarse Filter package HAZOP A-50003 the consequences of high flow through the package when package is in operation.													
		5.2.2.3. Review within Electro-Chlorination package HAZOP A-50002 the consequences of high flow through the package when package is in operation.													
		5.2.2.4. Review within Ultra Filtration package HAZOP A50005 the consequences of high flow through the package when package is in operation.													
	5.2.3. Flow when not required through coarse filter drain valve	5.2.3.1. Loss of forward flow to T-50006. See Consequence: 5.1.5.2 Consequence: 5.1.5.3 Consequence: 5.1.5.4													
		5.2.3.2. Lift pump flow directed to water drain (brine discharge caisson). No significant hazard consequences													
	5.2.4. Flow when not required through sand filter drain valve	5.2.4.1. Loss of forward flow to T-50006. See Consequence: 5.1.5.2 Consequence: 5.1.5.3 Consequence: 5.1.5.4													
		5.2.4.2. Lift pump flow directed to water drain (brine discharge caisson). No significant hazard consequences													
	5.2.5. P-50002A/B running when not required (not on backwash sequence). Failure of back wash sequence	5.2.5.1. Deadheading of pumps P-50002A&B resulting in damage. Dead head pressure of pumps is less than pressure in main flow line from sea water lift pumps	Asset Damage to Pump (s)		A	1	C	1C		None Identified					
	5.2.6. P-50002A&B running when on backwash sequence	5.2.6.1. Higher flow through sand filters. No hazardous consequences								50-FI020H	High flow alarm upstream of sand filter				
	5.2.7. RO stream A and B both running. Not considered														

Node: 5. Seawater and Treated Water Systems

Deviation	Cause	Consequence	Hazard Register	SIF Summation - Threat	RAM Score				LOPA?	Barriers			Recommendation	Responsibility	ALARP Determination
					R	S	L	RR		Barrier Tag	Barrier Description	Validity			
	credible as this would require local override														
	5.2.8. 50-PIC030 failure running P-50004A faster than required	5.2.8.1. Potential over pressure of RO cells with LOC from RO cells or inlet pipe work into WTP container. Asset Damage to Electrical Equipment			A	1	B	1B		50-PSV035	Pressure relief valve on P50004A. Designed for full flow relief				
	5.2.9. MV-550 incorrectly set	5.2.9.1. More flow than required through MV-550. Operational issue. Low forward flow continues through flushing valve and concentrate line. Water discharge to sea water caisson.								50-FI024L	Low flow alarm at RO discharge				
	5.2.10. P-50009A&B running	5.2.10.1. Loss of level in T-50008 with eventual dry running of pumps P-50009A/B and loss of flow to electrolysis unit. Damage to pumps P-50009A/B.	Asset Damage to Pump (s)		A	1	C	1C		50-LI021L	Low level alarm on T-50008		49. 50-LI020LL should trip P-50004A/B on LL level in T-50006 to prevent pump damage	PSC	
										50-LI021LL	Low low level trip on T-50008. Trips P-50009A/B				
5.3. Flow Misdirected	5.3.1. 50-XV002 Driven open on pump discharge	5.3.1.1. Restricted orifice behind valve will minimise flow no significant consequences.													
	5.3.2. 50-XV003 Driven open on offline pump discharge	5.3.2.1. Reduced forward flow with water recycled to offline caisson. Operational issue, no hazardous consequences.								BLPH-NRV-008	NRV restricts reverse flow.				
	5.3.3. 50-SV020 open during backwash sequence	5.3.3.1. Wash water directed to sea via lift pump caissons. Emptying of tank T-50006. Potential dry running of P-50003A/B resulting in damage to pump and asset damage to pump.	Asset Damage to Pump (s)		A	1	C	1C		50-FI020L	Low flow alarm upstream of S-50001				
										50-LI020L	Low level alarm on T-50006				
										50-LI020LL	Low low level trip on T-50006. Trips P-50002A/B and P-50003A/B				
										50-XZAL020	Loss of closed signal from limit switch				
	5.3.4. 50-XV022 open when not required on offline train	5.3.4.1. No significant consequences, insufficient pressure to forward flow of sea water to RO cell. No hazardous consequences. Offline train will be full of (flushing) water.													
	5.3.5. 50-XV026 open when not required	5.3.5.1. Reduced flow to T-50008 with water directed to brine caisson. No hazardous consequences.													
		5.3.5.2. Potential to drain T-50008 and run pumps P-50009A/B dry resulting in pump damage.	Asset Damage to Pump (s)		A	1	C	1C		50-LI021L	Low level alarm on T-50008				
										50-LI021LL	Low low level trip on T-50008. Trips P-50009A/B and P-50003A/B when in flushing mode.				
	5.3.6. 50-XV027 opening when not on flushing cycle	5.3.6.1. Reduced pressure within RO cells and reduced fresh water production. Water directed towards brine caisson. No hazardous consequences.								50-PIC030L	Low discharge pressure on discharge P-50004A		50. Ensure that where multiple trains are implemented within the WTP package remote changeover between trains is available to onshore operators on request.	Rosetti / CRW	
										50-FI024L	Low fresh water flow to T-50008				
										50-XZL027	Loss of closed signal from limit switch				
		5.3.6.2. Potential to drain T-50008 and run pumps P-50009A/B dry resulting in pump damage.	Asset Damage to Pump (s)		A	1	C	1C		50-LI021L	Low level alarm on T-50008				
										50-LI021LL	Low low level trip on T-50008. Trips P-50009A/B and P-50003A/B when in flushing mode.				
	5.3.7. 50-XV023 flushing valve open when not required	5.3.7.1. Linking of T-50006 and T-50008 with potential of contantamination of T-50008 with filtered sea water. Filtered sea water fed forward to electrolysis unit with potential damage to RO unit in electrolysis package.	Asset damage		A	1	C	1C		50-AI026H	High total hardness alarm		51. Add an NRV in the flushing water line between T-50008 and 50-XV023 / 50-XV024 to prevent reverse flow in the flushing line and potential contamination of T-50008 with filtered brine from T-50006.	PSC	
										50-AI026HH	High high total hardness trip diverts RO cell output to brine caisson. Closing 50-XV031 and opening 50-XV032.				
										50-XZL023	Loss of closed signal from limit switch				
	5.3.8. 50-XV032 open when not required. Potential failure of 50-AI026 / 50-AI027	5.3.8.1. Purified water directed to brine caisson. No hazardous consequences. Loss of purified water to electrolysis unit.								50-XZL032	Loss of closed signal from limit switch				
	5.3.9. Drain valve S-50004 package open when not required	5.3.9.1. Purified water directed to brine caisson. No hazardous consequences. Loss of purified water to electrolysis unit.								50-XAS50004	General package alarm				

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	24
Cause:	P-50001A failure
Consequence:	Loss of flow to UV water filter. Loss of flow to electrolyser, leading to unknown consequences within electrolyser. Potential backflow from electrochrlorification unit due to unknown cause.
Safeguards:	Low Pressure alarm on discharge of P- 50009A.Low level alarm on fresh water tank, T-50008. 'LL' trip on fresh water tank , T-50008. Low Pressure alarm on outlet of P-50001A Non return valve Downstream of P-50001A
Actions:	Consider loss of fresh water to electro chlorination package and potential backflow from electrochrlorification unit in package HAZOP.
Assigned Respondent (By)	ROSETTI Mechanical
RESPONSE	Electro chlorination have been replace with non oxidizing biocide unit. This recommendations is superseded
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
F.Mura	
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D. Lo Sterzo	
Client	**Sign**
	Digitaal ondertekend door Paul van Rossum Datum: 2024.09.03 16:18:27 +02'00'

47	**ELECTRO-CHLORINATOR**			**REPLACED WITH NON OXIDIZING BIOCIDE DOSING UNIT** **Detail below according to the proposed solution**	OFFER/TQ

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CROSSWIND

VENDOR IS ALLOWED TO INSERT ADDITIONAL ROWS TO BETTER DETAIL THE DESCRIPTION OF SUPPLY, BY USING RED COLORAND BOLD CHARACTER

HOLLANDSE KUST NOORD WIND PARK Project

Discipline: **MEC** System & Sub-sys:

Document Type: Equipment Type: **Water Treatment Package** **Attachment to TBE 123A90-DDL-MAC-TBE-50024**

POS.	DESCRIPTION	UNIT	REQUIREMENT	Bidder: PSC Offer no. OF6739 Revised offer: Rev.03 BIDDER DATA	CLARIFIED WITHIN
48	Quantity		1	Confirmed	OFFER/TQ
49	Media to be treated		Sea Water form Coarse filter	Confirmed	OFFER/TQ
50	~~Brine Supply Flow (Design)~~	m^3/h	~~6~~	100 Lt tank (with mixer)	OFFER/TQ
51	~~Brine Supply Pressure~~	barg	~~8,5~~	Tank Material :PP or PE	OFFER/TQ
52	~~Brine Supply Temperature~~	°C	~~1,3 ÷ 22,6~~	Tank des : Full liquid	OFFER/TQ
53	~~Clorine Capacity~~	g/h	VTA	Biocide pumps : dosing type, manual control (10÷100%)	OFFER/TQ
54	~~Hypoclorite Concentration~~	mg/l	VTA	2x100% dosing pump to sea water caisson	OFFER/TQ
55	~~Sea Water Flowrate Inlet~~	m^3/h	VTA	2x100% to inlet of WT Package	OFFER/TQ
56	~~Design Pressure~~	barg	VTA	2x100% dosing pump to waste water tank	OFFER/TQ
57	~~Electrodes Material~~		~~Suitable for Sea Water~~	Pumps Material: membrane PTFE	OFFER/TQ
58	~~Electolyzer absorbed power~~	W	VTA	Not applicable	OFFER/TQ
59	Power Supply Required	V/Ph/Hz	VTA	0,37 kW- 400/3/50	OFFER/TQ

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	25
Cause:	Manual valve upstream of electro chlorination coarse package closed
Consequence:	Long term issue due loss of hypochlorite dosing leading to fouling if left undetected.
Safeguards:	
Actions:	Ensure electrochlorification package HAZOP reviews.
Assigned Respondent (By)	ROSETTI Mechanical
RESPONSE	Electrochlorination unit has been replace with non oxidizing biocide unit. This recommendations is superseded.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
F.Mura	
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**

Digitaal ondertekend door Paul van Rossum
Datum: 2024.09.03 16:18:03 +02'00'

47	**ELECTRO-CHLORINATOR**			**REPLACED WITH NON OXIDIZING BIOCIDE DOSING UNIT** **Detail below according to the proposed solution**	OFFER/TQ

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CROSSWIND

VENDOR IS ALLOWED TO INSERT ADDITIONAL ROWS TO BETTER DETAIL THE DESCRIPTION OF SUPPLY, BY USING RED COLORAND BOLD CHARACTER

HOLLANDSE KUST NOORD WIND PARK Project

Discipline: **MEC** System & Sub-sys:

Document Type: Equipment Type: **Water Treatment Package** **Attachment to TBE 123A90-DDL-MAC-TBE-50024**

POS.	DESCRIPTION	UNIT	REQUIREMENT	Bidder: PSC Offer no. OF6739 Revised offer: Rev.03 BIDDER DATA	CLARIFIED WITHIN
48	Quantity		1	Confirmed	OFFER/TQ
49	Media to be treated		Sea Water form Coarse filter	Confirmed	OFFER/TQ
50	~~Brine Supply Flow (Design)~~	m^3/h	~~6~~	100 Lt tank (with mixer)	OFFER/TQ
51	~~Brine Supply Pressure~~	barg	~~8,5~~	Tank Material :PP or PE	OFFER/TQ
52	~~Brine Supply Temperature~~	°C	~~1,3 ÷ 22,6~~	Tank des : Full liquid	OFFER/TQ
53	~~Clorine Capacity~~	g/h	VTA	Biocide pumps : dosing type, manual control (10÷100%)	OFFER/TQ
54	~~Hypoclorite Concentration~~	mg/l	VTA	2x100% dosing pump to sea water caisson	OFFER/TQ
55	~~Sea Water Flowrate Inlet~~	m^3/h	VTA	2x100% to inlet of WT Package	OFFER/TQ
56	~~Design Pressure~~	barg	VTA	2x100% dosing pump to waste water tank	OFFER/TQ
57	~~Electrodes Material~~		~~Suitable for Sea Water~~	Pumps Material: membrane PTFE	OFFER/TQ
58	~~Electolyzer absorbed power~~	W	VTA	Not applicable	OFFER/TQ
59	Power Supply Required	V/Ph/Hz	VTA	0,37 kW- 400/3/50	OFFER/TQ

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	26
Cause:	Manual valve downstream of filtered sea water tank closed.
Consequence:	LVA will be closed by control system, due to 'High level', leading to potential damage of P- 50001A. Refer to 3.1.2.
Safeguards:	
Actions:	Ensure control system does not create hazard by deadheading P- 50001A/B.
Assigned Respondent (By)	Rosetti Instrumentation Engineer
RESPONSE	This action is superseeded by Hazop Review specifically dedicated to the Water Treatmemt supplier (PSC) Furthermore, in case of P 50001 A/B deadheading the components downstream the pump are protected by a PSV n° 50-PSV-007 (set 7.6 bar). See evidence attached.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
F.MURA - MECHANICAL PSL	
EPC HSE Lead	**Sign**
C.Caracciolo	CC
EPC Project Manager	**Sign**
D. Lo Sterzo	
Client	**Sign**

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Datum: 2024.09.03 16:19:06 +02'00'

Serie: 3000W

TAI MILANO S.P.A.
Via Petrella, 21 - 20124 MILANO (ITALY)
Tel.: +39 02 29525941 - Fax: +39 02 29404417
email: tai@taimilano.it - web: www.taimilano.it

PRESSURE RELIEF VALVE CALCULATION SHEET

LIQUIDS IN ABSENCE OF CAVITATION OR FLASHING
(According to EN ISO 4126-1)

$$A = \frac{Q_v}{B_9 F_{dr} K F_V} \sqrt{\frac{G}{P_1 - P_2}}$$

$$Re = B_{14} \frac{Q_m}{\mu \sqrt{A'}}$$

TAI Ref.	Item Ref.	
24/8637	001	
Customer		**Sheet No.**
PCM EUROPE		1 of 1
Order No.		**dated**
Customer Ref.		**dated**
GIAN-392481		29/03/2024

Tag
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DIMENSION

01	MEDIUM	Sea Water			15	SPECIFIC VOLUME	**v**	0.00097 [m³/kg]
02	COEFFICIENT B7	**B_7**	---		16	SPECIFIC GRAVITY (H20=1)	**G**	1.03
03	COEFFICIENT B8	**B_8**	---		17	KINEMATIC VISCOSITY	ν	[ctsk]
04	COEFFICIENT B9	**B_9**	0.05091		18	DYNAMIC VISCOSITY	μ	0.9 [cpoise]
05	COEFFICIENT B13	**B_{13}**	---		19	REQUIRED MASS FLOW RATE	**Q_m**	2575 [kg/h]
06	COEFFICIENT B14	**B_{14}**	313.4			REQUIRED VOL. FLOW RATE	**Q_v**	2.5 [m³/h]
07	DISCHARGE COEFFICIENT	**K**	0.87		20	CALCULATED AREA(1)	**A**	22.014 [mm²]
08	DE-RATING FACTOR	**F_{dr}**	0.9		21	QTY. OF VALVES	**n**	1
09	OPERATING PRESSURE			[bar g]	22	SELECTED AREA	**A'**	78.5 [mm²]
10	SET PRESSURE			7.6 [bar g]	23	REYNOLDS NUMBER	**Re**	101204
11	OVERPRESSURE			10 [%]	24	LOW TURB. CORR. FACTOR	**Fv'**	1
12	RELIEVING PRESSURE	**P_1**		8.36 [bar g]	25	Fv' * n * A'/A (OK if >= 1)		3.566
13	BACK PRESSURE	**P_2**		0 [bar g]	26	ORIFICE		D
14	TEMPERATURE AT P1	**T_1**		293.2 [K]	27	CAPACITY		8.915 [m³/h]
		t_1		20.2 [°C]	28			

NOTES

(1) Fv assumed as equal to 1

REV.	DATE	COM / BY	DESCRIPTION
10			
09			
08			
07			
06			
05			
04			
03	06/06/2024	LV	
02	17/04/2024	LV	
01	03/04/2024	LV	First issue

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DIMENSIONAL OUTLINE DRAWING WITH MATERIAL LIST AND VALVE DATA

VALVE DATA

Series	Valve	Size	Spring	Accessories
3000W	3111W	1" X 2"	S	

Orifice	Area [mm²]	Cold differential test pressure [bar g]	Set pressure [bar g]	Overpressure [%]	Total backpressure [bar g]
D	78.5	7.6	7.6	10	0

Superimposed backpressure [bar g]	Relieving temperature [°C]	Minimum temperature [°C]	Maximum temperature [°C]	Service G	L	S	M
0	20.2	-29	100		X		

Inlet connection

Code	Size	Class/PN	Facing	Finish
ASME	1"	150	RF	125 AARH

Outlet connection

Code	Size	Class/PN	Facing	Finish
ASME	2"	150	RF	125 AARH

TAI Ref.	Item Ref.	Quantity
24/8637	001	2
Customer		**Sheet No.**
PCM EUROPE		1 of 1
Order No.		**dated**
Customer Ref.		**dated**
GIAN-392481		29/03/2024

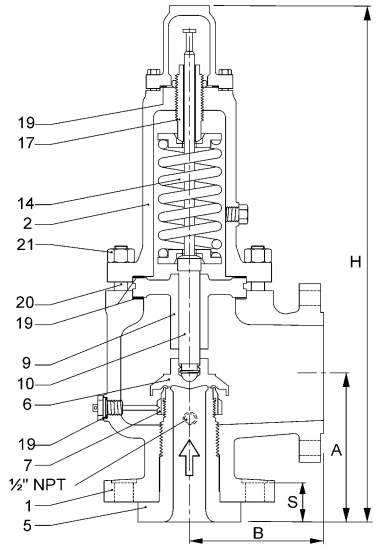
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PARTS AND MATERIAL LIST

Our material class: L1 /11 /30 /X3 /X7 /X9 /X13

001	Body	A352-LCC		020	Body studs	A320-L7 HDG	
002	Bonnet	A352-LCC		021	Body nuts	A194-7 HDG	
005	Nozzle	UNS S32760	/X3		Cap	A352-LCC	/X13
006	Disc	UNS N07718					
007	Blowdown adjusting ring	A351-CF8M					
009	Guide bushing	A351-CF8M					
010	Spindle	UNS N07718	/X7				
014	Spring	AISI 316					
017	Spring adj. screw	UNS N07718	/X9				
019	Set of gaskets	PTFE					

DRAWING



NOTES

Preliminary dimensions [mm] A	B	S	H	Mass [kg]
105	114	33	465	22

REV.	DATE	BY	DESCRIPTION
05			
04			
03	06/06/2024	LV	
02	17/04/2024	LV	
01	03/04/2024	LV	First issue

Printed by: LVarisco
Print date: 06/06/2024 08:46:45
Document: 24/8637-001-DAA R02

BLPH
SHEAMS SIGNATURE FORM

Action No:	**0026**	**Rev:**	1
Action Title:	**HAZOP Study Actions**	**Date:**	25/03/2023
Ref. Doc:	K559-2254-SE-REP-015		
Title:	BLPH HAZOP / LOPA Study		
Node:	1: Hydrogen (including storage)		
Reference Drawings:			
Parameter	Flow	**Deviation**	Flow More
Cause:	PVB or PVA fail open.		
Consequence:	Potential Overpressure of downstream system PVA & PBV. Leading to LOC of hydrogen.		
Safeguards:			
Action:	2 Ensure adequate over protection system for system downstream system of PVA & PVB including fuel cell		
RESPONSE:	**Responsible Discipline: Lead Process Engineer** Pressure Safety Valve (50-PSV-001) has been added to provide over pressure protection for the systems downstream of 25-PV-001A/B including the fuel cell. See P&ID K559-2254-PR-PID-004_001		
Attachments:	None		

Name: Signature: Raise PCN: Yes/No PCN No:

RESPONSE ACCEPTANCE:

Discipline Lead:	Harnant Patel	Signature:	Date: 2023-05-01 | 08:47 CDT
HSE Lead:	Samer Bachir	Signature:	Date: 2023-05-02 | 01:58 CDT
Proj. Manager:	John Schofield	Signature:	Date: 2023-05-02 | 08:06 BST
Client:	Paul Van Rossum	Signature:	Date: 2023-05-15 | 13:02 BST

FUTURE ACTION/CROSS REFERENCE:

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	27
Cause:	Both pumps operating P- 50001A/B
Consequence:	Potential overfill of T-50006, filtered water tank. Leading to overpressure of filtered water tank & upstream overpressured systems.
Safeguards:	
Actions:	Control logic should inhibit dual operation of lift pumps, P-50001A & B.
Assigned Respondent (By)	ROSETTI Instrumentation Engineer
RESPONSE	As per project document "Process Control, Operation, Start-up and Shutdown Philosophy" rev. 01 par. 3.2.1.2, a control logic will be provided to prevent simultaneous running of both pumps P-50001A and P-50001B.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements

EPC Discipline Lead	**Sign**
L.Calabrese	
EPC HSE Lead	**Sign**
C.Caracciolo	CC
EPC Project Manager	**Sign**
D. Lo Sterzo	
Client	**Sign**

Digitaal ondertekend door Paul van Rossum
Datum: 2024.09.03 16:22:52 +02'00'

Base Load Power Hub (BLPH)

Process Control, Operation, Start-up and Shutdown philosophy

Document Number: 123A90-DDL-PR-RE-80031

Document Class: 1

01	23/04/2024	Issue for Approval (IFA)	CIM	RZI	DLO
00	13/12/2023	Issue for Approval (IFA)	CIM	RZI	DLO
Rev.	Date	Description	Prepared	Reviewed	Approved

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Monitoring and control of BLPH will be remote (shore based control room) and the solar farm, battery and fuel-cell shall act cooperatively so that power from all sources will be combined to export power regardless of the prevailing weather. NOTE: Energy stored as hydrogen will leave only in the form of electricity through the Inter-Array Cable (IAC) connecting BLPH indirectly to a grid sub-station.

Whenever possible the fuel-cell will consume the platform's stored hydrogen prior to discharging the battery to ensure SoC is maintained high for it to react instantly to each demand for power.

From electrically point of view, following operation modes shall be applicable (Ref. [14]):

- Mode 0 = IDLE (power import only)
- Mode 1 = POWER IMPORT (charging)
- Mode 2 = HOT STANBY (power import no export required)
- Mode 3 = POWER EXPORT (Discharging)
- Mode 4 = COLD STANDBY (power export no export possible)
- Mode 4A = EMERGENCY (Island)
- Mode 5 = POWER OUT (black-out)
- Mode 6 = MAINTENANCE
- Mode 7 = RESEARCH

For details about under which above indicate scenario the Fuel Cell and Electrolyser Packages will run, reference shall be made to (Ref. [14]).

3.2 SEA WATER LIFT PUMPS P-50001A/B

(Reference P&ID: Doc. N.123A90-DDL-PR-PID-80021)

3.2.1.1 Main Operating data

The seawater lift pumps are characterized by the following main operating data:

- Normal Operating mass flowrate ~2500 kg/h
- Normal Operating volumetric flowrate ~2.5 m^3/h
- Normal Discharge pressure (min./max) ~4.0 / 5.0 barg
- Normal Discharge temperature ~ 22.4 °C

3.2.1.2 Process Operation and Control Philosophy

Seawater is the raw water to be treated and then electrochemically converted into hydrogen (for energy accumulation purposes) and oxygen (to be continuously vented when the plant runs); thus seawater is lifted by means of 2 x 100% submersible centrifugal pumps P–50001A/B (one running and the other in stand-by mode), and then fed through the water treatment plant to remove the biological and inorganic "pollutants" that shall be eliminated prior to be served to the electrolyser package.

A logic control will be provided to prevent simultaneous running of both pumps A ab B.

BLPH SHEAMS SIGNATURE FORM

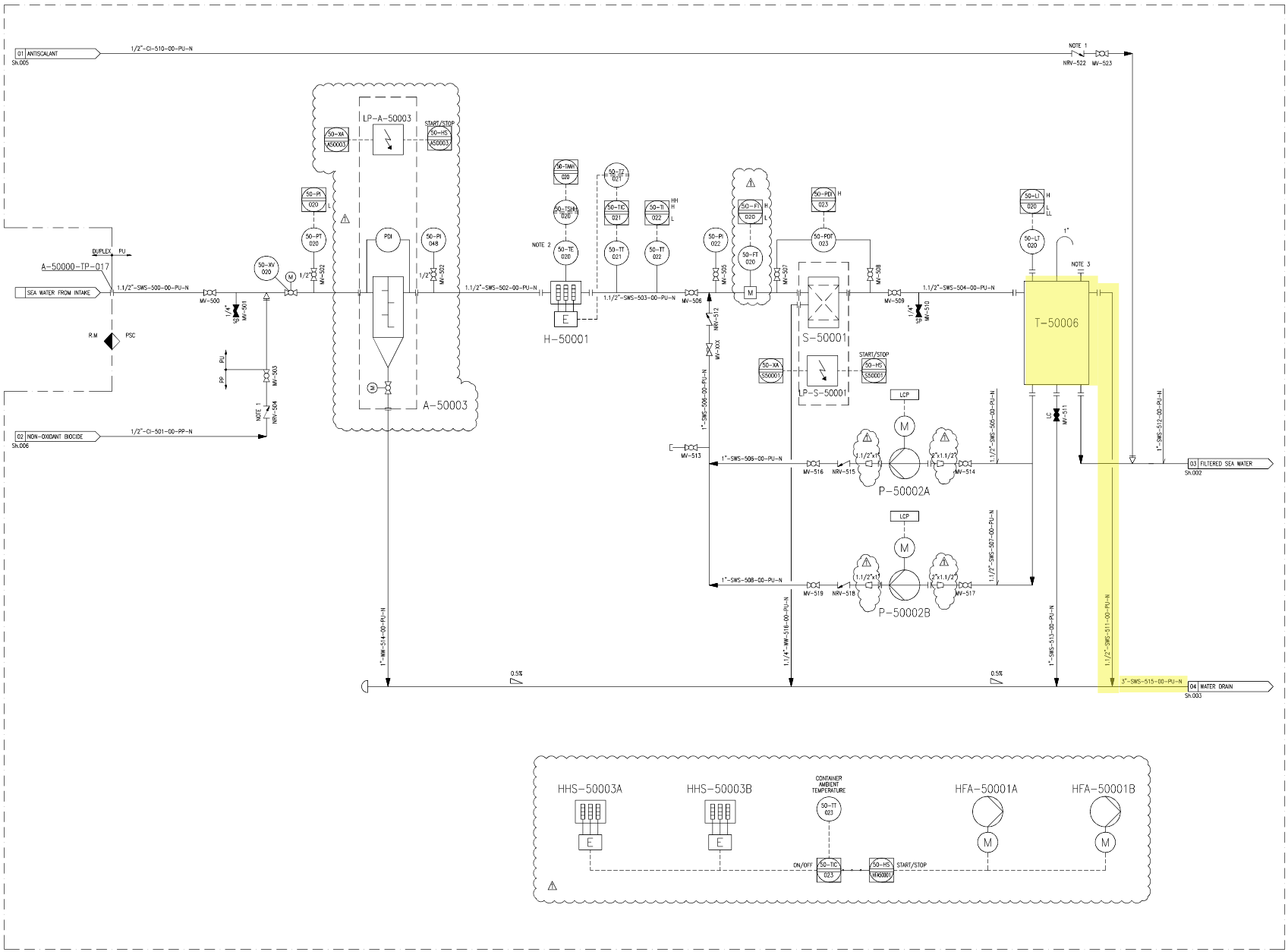
Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	28
Cause:	LVA upstream of filtered water tank open more than required
Consequence:	Potential overfill of & overpressure of tank T-50006
Safeguards:	High level alarm on T- 50006 Local Overflow
Actions:	Ensure local overflow is adequately sized & rooted to a safe location.
Assigned Respondent (By)	ROSETTI Piping & Layouts Engineer
RESPONSE	T-50006 is part of Water treatment package. Overflow has been routed from outside the container, where the water treatment has been installed, to brine caisson.
Attachments:	Item 28-29 Attachment 1 & Attachment 2
Issue Date (dd/mm/yy)	08/08/2024

Approvals / Endorsements

EPC Discipline Lead	**Sign**
C. Bortolin	Carla Bortolin
EPC HSE Lead	**Sign**
C.Caracciolo	CC
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**
	Digitaal ondertekend door Paul van Rossum Datum: 2024.08.21 08:13:10 +02'00'

DRAWING No. 1724000448-PR-PID-00013

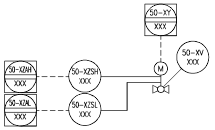
REV. 1



TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-02	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-03	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-05	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTANK
TP-06	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-07	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

TYPICAL FOR ON/OFF BALL VALVES



ITEM 28-29_ATTACHMENT 1

NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: BLPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOS BIOCIDE DOSAGE TO INTAKE PUMP: DISCONTINUOS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE

A-50003	
SEA WATER COARSE FILTER	
FILTRATION RATE	125 µm
CAPACITY	2.5 m3/h
DES. PRESS.	5 barg
DES. TEMP.	50° C
MATERIAL	PLASTIC MAT.

H-50001	
ELECTRIC HEATER	
POWER	30 kW
CAPACITY	2.5 m3/h
DES. PRESS.	5 barg
DES. TEMP.	40° C
MATERIAL	PVC-TITANIUM

S-50001	
SAND FILTER	
TYPE	PRESSURE,VERTICAL
CAPACITY	2.5 m3/h
DES. PRESS.	7 barg
DES. TEMP.	50° C
MATERIAL	FRP

T-50006	
FILTERED WATER TANK	
VOLUME	3 m3
DES. PRESS.	ATM
DES. TEMP.	50° C
MATERIAL	FRP

P-50002A/B	
BACKWASH PUMP	
TYPE	CENTRIFUGAL
CAPACITY	5 m3/h
HEAD	0.50 barg
DES. TEMP.	50° C
MATERIAL	PP

HHS-50003A/B	
CONTAINER ELECTRICAL HEATER	
POWER	TBD
DES. PRESS.	TBD
DES. TEMP.	TBD
MATERIAL	TBD

HFA-50001A/B	
CONTAINER AIR FAN	
POWER	TBD
DES. PRESS.	TBD
DES. TEMP.	TBD
MATERIAL	TBD

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN.	CHKD	APPD	DESCRIPTION
1	29-MAY-24	CC	WR	RM	ISSUED FOR REVIEW
0	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

ROSETTI MARINO

TITLE : WATER TREATMENT PACKAGE
SEA WATER FINE FILTRATION
P&I DIAGRAM

CONTRACT NO./TITLE | SCALE -

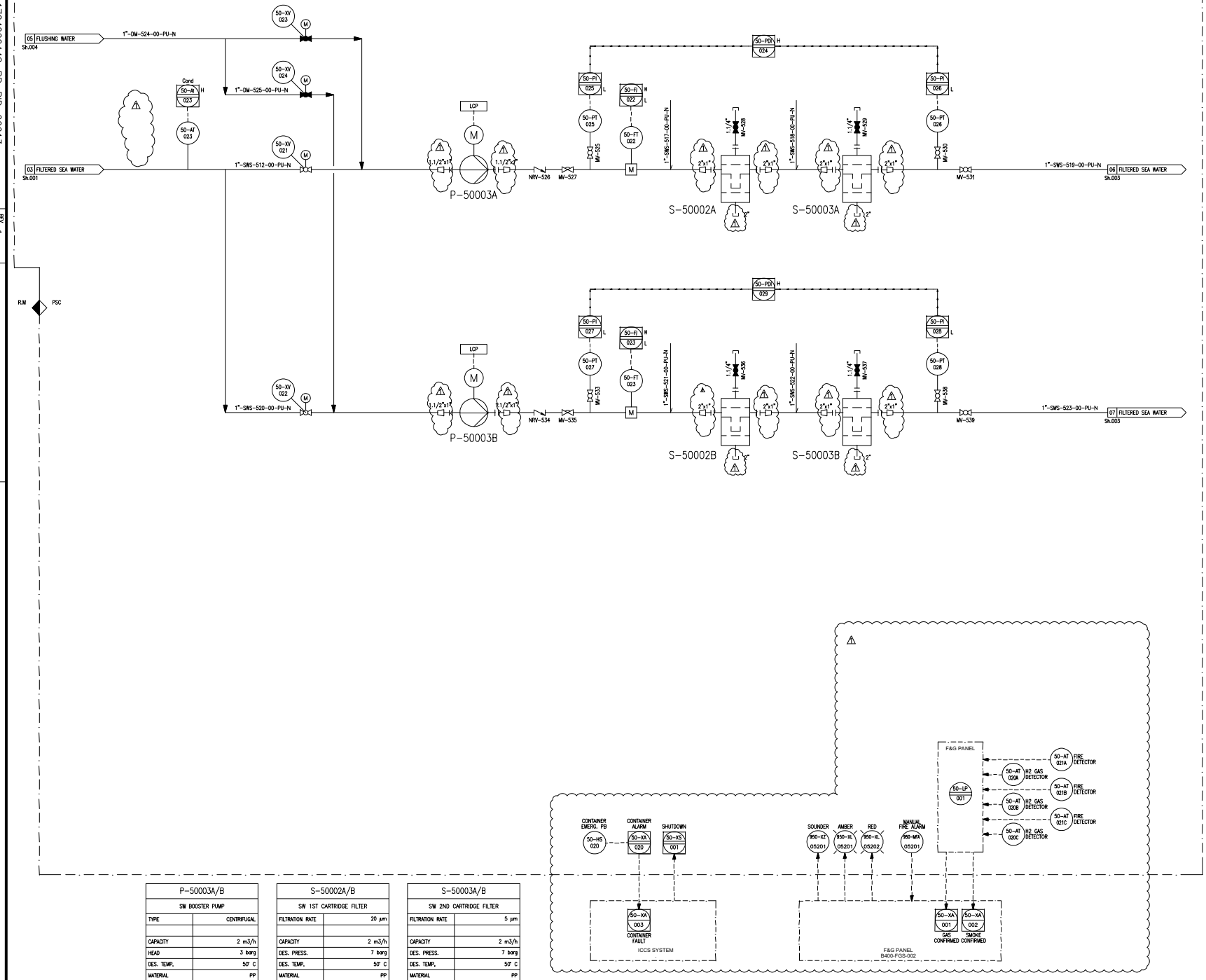
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A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 001 | REV. 1

File Name : 1724000448-PR-PID-00013 Rev01

DRAWING NO. 1724000448-PR-PID-00013

REV. 1



P-50003A/B	
SW BOOSTER PUMP	
TYPE	CENTRIFUGAL
CAPACITY	2 m3/h
HEAD	3 barg
DES. TEMP.	50° C
MATERIAL	PP

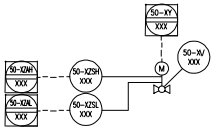
S-50002A/B	
SW 1ST CARTRIDGE FILTER	
FILTRATION RATE	20 µm
CAPACITY	2 m3/h
DES. PRESS.	7 barg
DES. TEMP.	50° C
MATERIAL	PP

S-50003A/B	
SW 2ND CARTRIDGE FILTER	
FILTRATION RATE	5 µm
CAPACITY	2 m3/h
DES. PRESS.	7 barg
DES. TEMP.	50° C
MATERIAL	PP

TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-02	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-03	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-05	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTANK
TP-06	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-07	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

TYPICAL FOR ON/OFF BALL VALVES



NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: BLPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOS BIOCIDE DOSAGE TO INTAKE PUMP: DISCONTINUOS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
1	29-MAY-24	GG	WR	RM	ISSUED FOR REVIEW
0	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

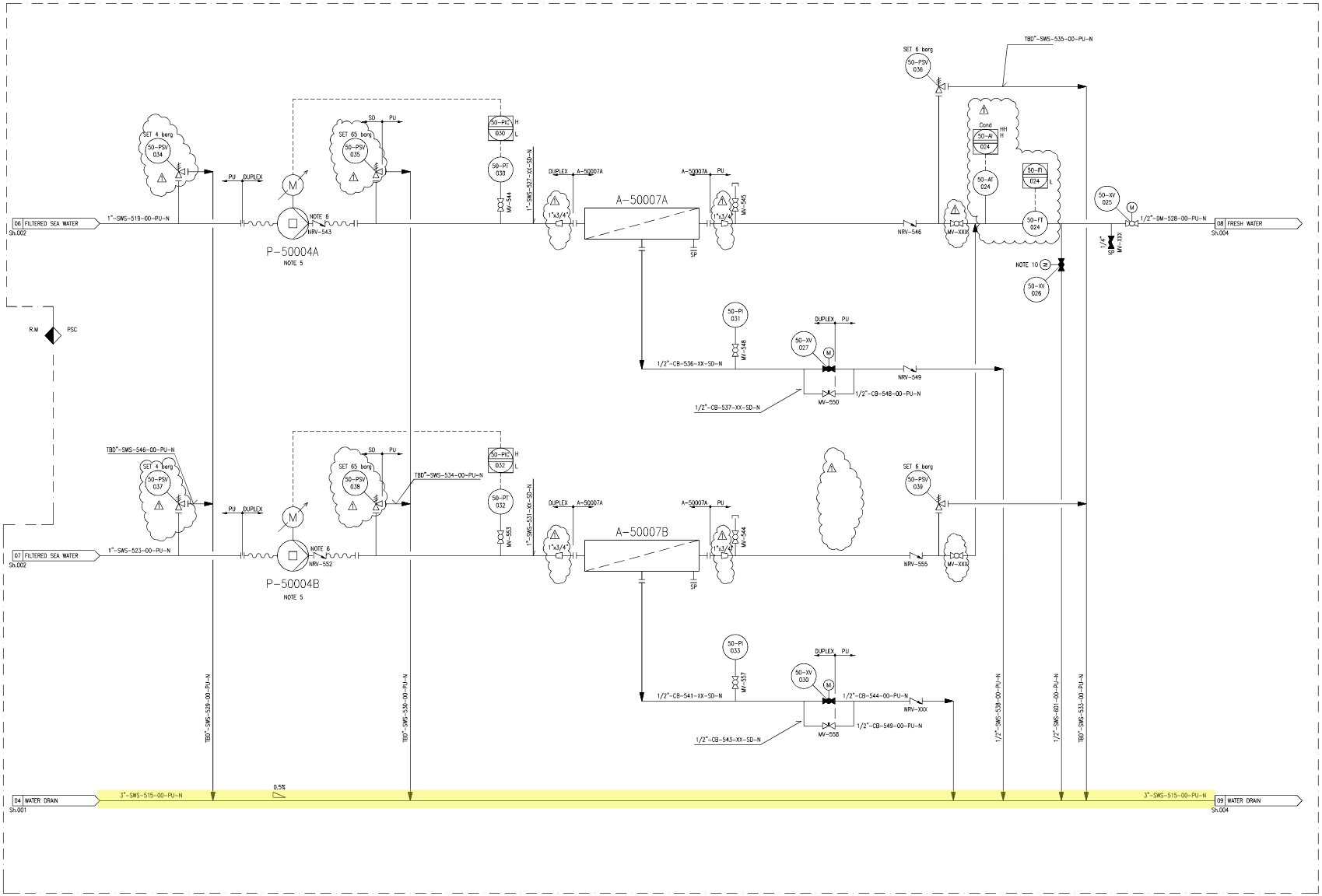
ROSETTI MARINO

TITLE : WATER TREATMENT PACKAGE
SEA WATER FINE FILTRATION
P&I DIAGRAM

CONTRACT NO./TITLE			SCALE –
DRAWN GC	CHECKED WR	APPROVED RM	DATE 29/05/24
A1	DRAWING NO. 1724000448-PR-PID-00013	SHEET 002	REV. 1

File Name : 1724000448-PR-PID-00013 Rev01

DRAWING No. 1724000448-PR-PID-00013 REV. 1



TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-02	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-03	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-05	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTANK
TP-06	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-07	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: BLPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOS BIOCIDE DOSAGE TO INTAKE PUMP: DISCONTINUOS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE

P-50004A/B	
HP PUMP	
TYPE	AXIAL ROTATING PISTONS
CAPACITY	2 m3/h
HEAD	70 barg
DES. TEMP.	50° C
MATERIAL	SS DUPLEX

A-50007A/B	
SEA WATER REVERSE OSMOSIS UNITS	
CAPACITY	0.8 m3/H
DES. PRESS.	69 barg
DES. TEMP.	50° C
MATERIAL	FRP

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
1	29-MAY-24	CC	WR	RM	ISSUED FOR REVIEW
0	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

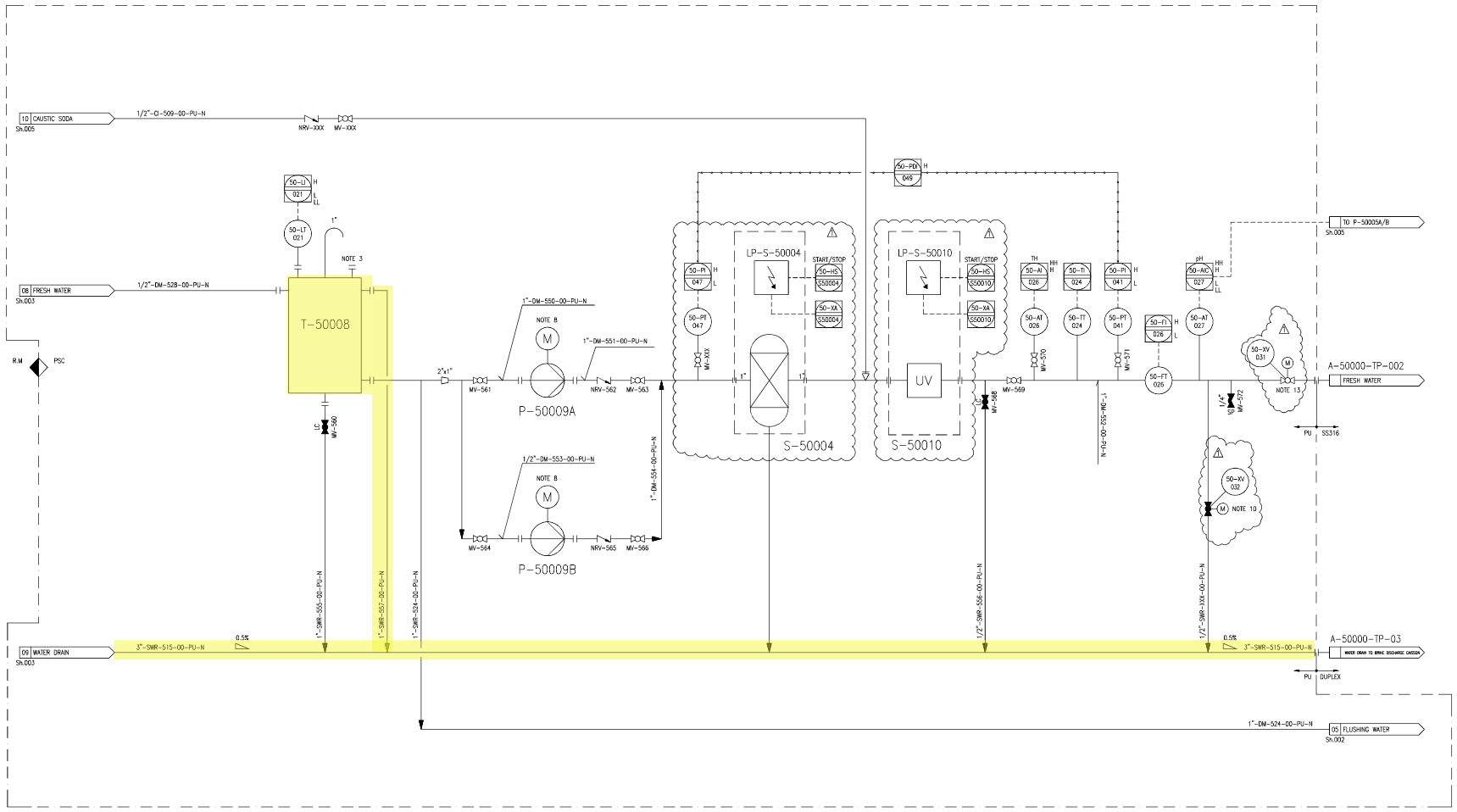
CROSSWIND

ROSETTI MARINO

TITLE :
WATER TREATMENT PACKAGE
SEA WATER REVERSE OSMOSIS
P&I DIAGRAM

CONTRACT NO./TITLE | SCALE -
DRAWN CC | CHECKED WR | APPROVED RM | DATE 29/05/24
A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 003 | REV. 1

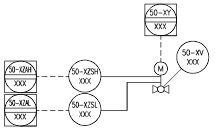
File Name : 1724000448-PR-PID-00013 Rev01



TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-02	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-03	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-05	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTANK
TP-06	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-07	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

TYPICAL FOR ON/OFF BALL VALVES



NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: BLPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOS BIOCIDE DOSAGE TO INTAKE PUMP: DISCONTINUOS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE

T-50008	
FRESH WATER TANK	
VOLUME	2.2 m3
DES. PRESS.	ATM
DES. TEMP.	50° C
MATERIAL	FRP

P-50009A/B	
FRESH WATER PUMP	
TYPE	CENTRIFUGAL
CAPACITY	0.8 m3/h
HEAD NOTE 11	3.1 barg
DES. TEMP.	50° C
MATERIAL	SS 316L

S-50010	
UV STERILIZER	
CAPACITY	0.8 m3/h
DES. PRESS.	5 barg
DES. TEMP.	50° C
MATERIAL	SS 316

S-50004	
SOFTENING FILTER	
CAPACITY	0.8 m3/h
DES. PRESS.	7 barg
DES. TEMP.	50° C
MATERIAL	FRP-PLASTIC

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
1	29-MAY-24	CC	WR	RM	ISSUED FOR REVIEW
0	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

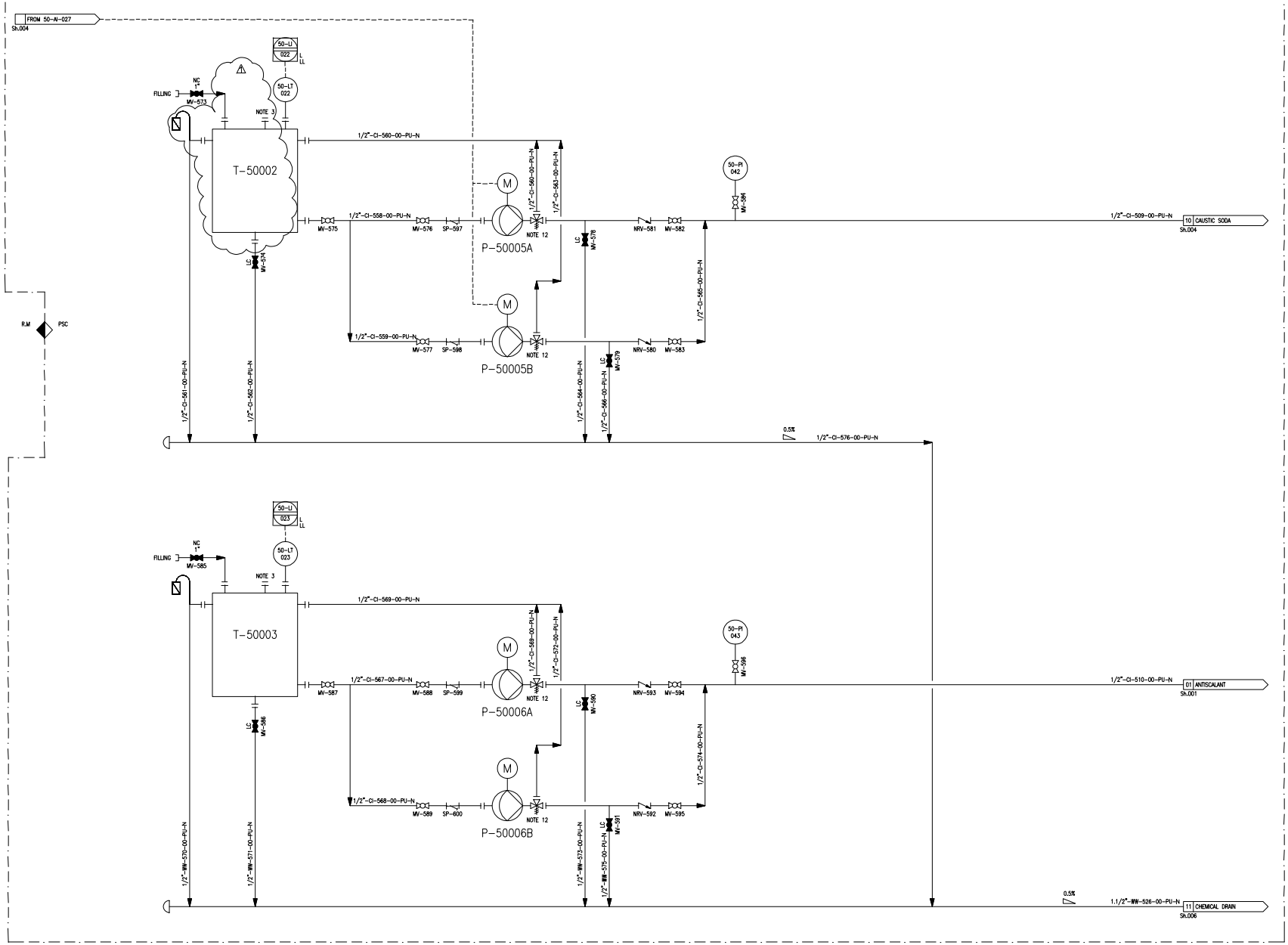
ROSETTI MARINO

TITLE :
WATER TREATMENT PACKAGE
FRESH WATER STORAGE
P&I DIAGRAM

CONTRACT NO./TITLE			SCALE -
DRAWN CC	CHECKED WR	APPROVED RM	DATE 29/05/24
A1	DRAWING NO. 1724000448-PR-PID-00013		SHEET 004 / REV. 1

DRAWING NO. 1724000448-PR-PID-00013 REV. 1

File Name : 1724000448-PR-PID-00013 Rev01



T-50002	
CAUSTIC SODA DOSING TANK	
VOLUME	0.05 m3
DES. PRESS.	ATM
DES. TEMP.	45° C
MATERIAL	PE

P-50005A/B	
CAUSTIC SODA DOSING PUMP	
TYPE	METERING DIAPHRAGM
CAPACITY	0.05 l/h
HEAD	2 barg
DES. TEMP.	50° C
MATERIAL	PVC

T-50003	
ANTISCALANT DOSING TANK	
VOLUME	0.05 m3
DES. PRESS.	ATM
DES. TEMP.	45° C
MATERIAL	PE

P-50006A/B	
ANTISCALANT DOSING PUMP	
TYPE	METERING DIAPHRAGM
CAPACITY	0.05 l/h
HEAD	2 barg
DES. TEMP.	50° C
MATERIAL	PVC

TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-02	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-03	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-05	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTANK
TP-06	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-07	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: BLPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOS BIOCIDE DOSAGE TO INTAKE PUMP: DISCONTINUOS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
1	29-MAY-24	GG	WR	RM	ISSUED FOR REVIEW
0	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

ROSETTI MARINO

TITLE : WATER TREATMENT PACKAGE
ACID & ANTISCALANT DOSAGES
P&I DIAGRAM

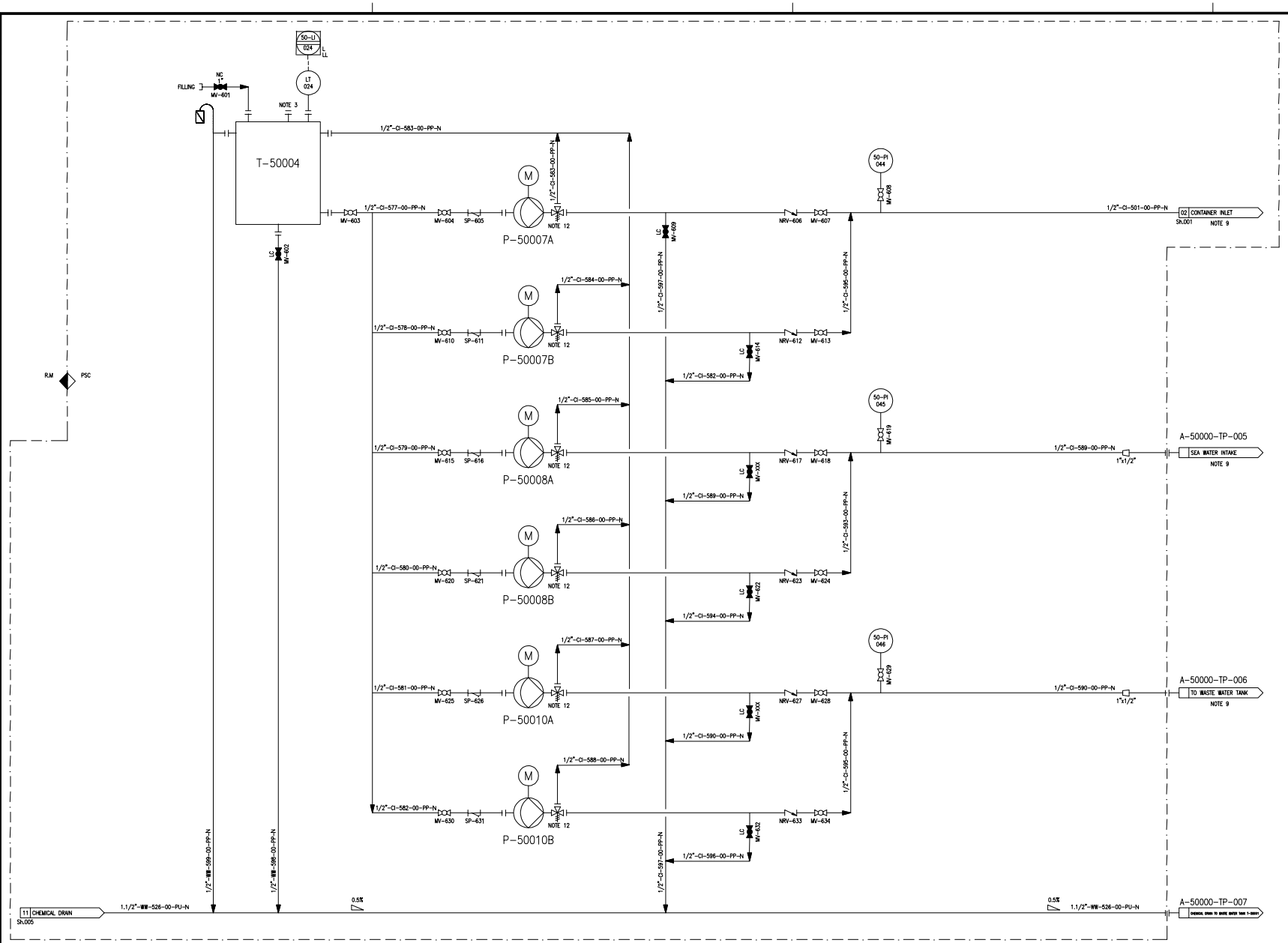
CONTRACT NO./TITLE | SCALE -

DRAWN GC | CHECKED WR | APPROVED RM | DATE 29/05/24

A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 005 | REV. 1

DRAWING NO. 1724000448-PR-PID-00013 REV. 1

File Name : 1724000448-PR-PID-00013 Rev01



T-50004	
NON-OXIDANT BIOCIDE DOSING TANK	
VOLUME	0.1 m3
DES. PRESS.	ATM
DES. TEMP.	45° C
MATERIAL	PE

P-50007A/B	
NON-OXIDANT BIOCIDE DOSING PUMP – CONTAINER INLET	
TYPE	METERING DIAPHRAGM
CAPACITY	0.1 l/h
HEAD	3.5 barg
DES. TEMP.	50° C
MATERIAL	PVC

P-50008A/B	
NON-OXIDANT BIOCIDE DOSING PUMP – SEA WATER INTAKE	
TYPE	METERING DIAPHRAGM
CAPACITY	2 l/h
HEAD	3.5 barg
DES. TEMP.	50° C
MATERIAL	PVC

P-50010A/B	
NON-OXIDANT BIOCIDE DOSING PUMP – WASTE WATER TANK	
TYPE	METERING DIAPHRAGM
CAPACITY	0.5 l/h
HEAD	3.5 barg
DES. TEMP.	50° C
MATERIAL	PVC

TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-02	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-03	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-05	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTANK
TP-06	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-07	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: BLPH–
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOS BIOCIDE DOSAGE TO INTAKE PUMP: DISCONTINUOS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
1	29-MAY-24	GG	WR	RM	ISSUED FOR REVIEW
0	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

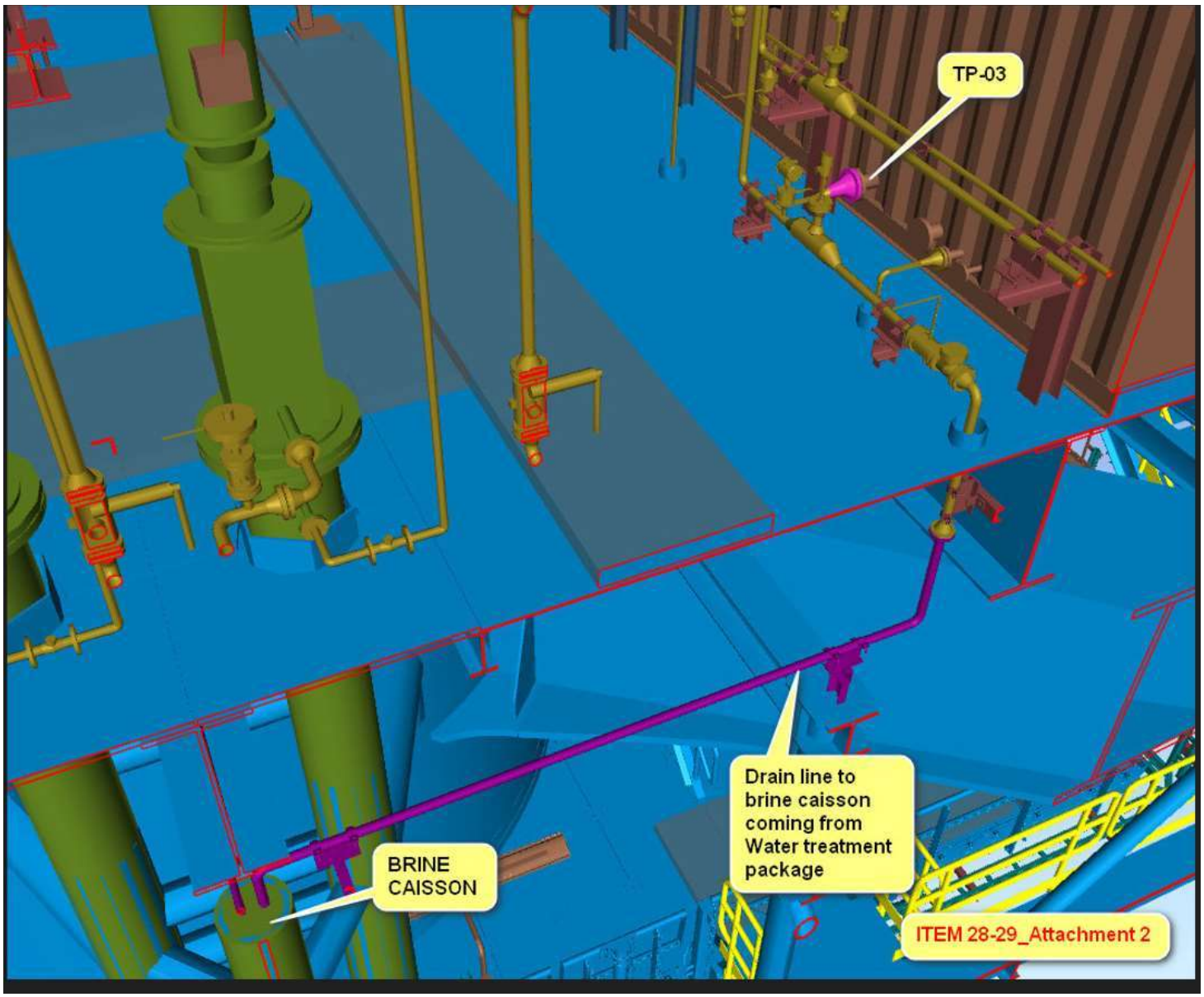
CROSSWIND

ROSETTI MARINO

TITLE :
WATER TREATMENT PACKAGE
BIOCIDE DOSAGE
P&I DIAGRAM

CONTRACT NO./TITLE			SCALE –
DRAWN GC	CHECKED WR	APPROVED RM	DATE 29/05/24
A1	DRAWING NO. 1724000448-PR-PID-00013	SHEET 006	REV. 1

File Name : 1724000448-PR-PID-00013 Rev01


TP-03
Drain line to brine caisson coming from Water treatment package
BRINE CAISSON
ITEM 28-29_Attachment 2

BLPH SHEAMS SIGNATURE FORM

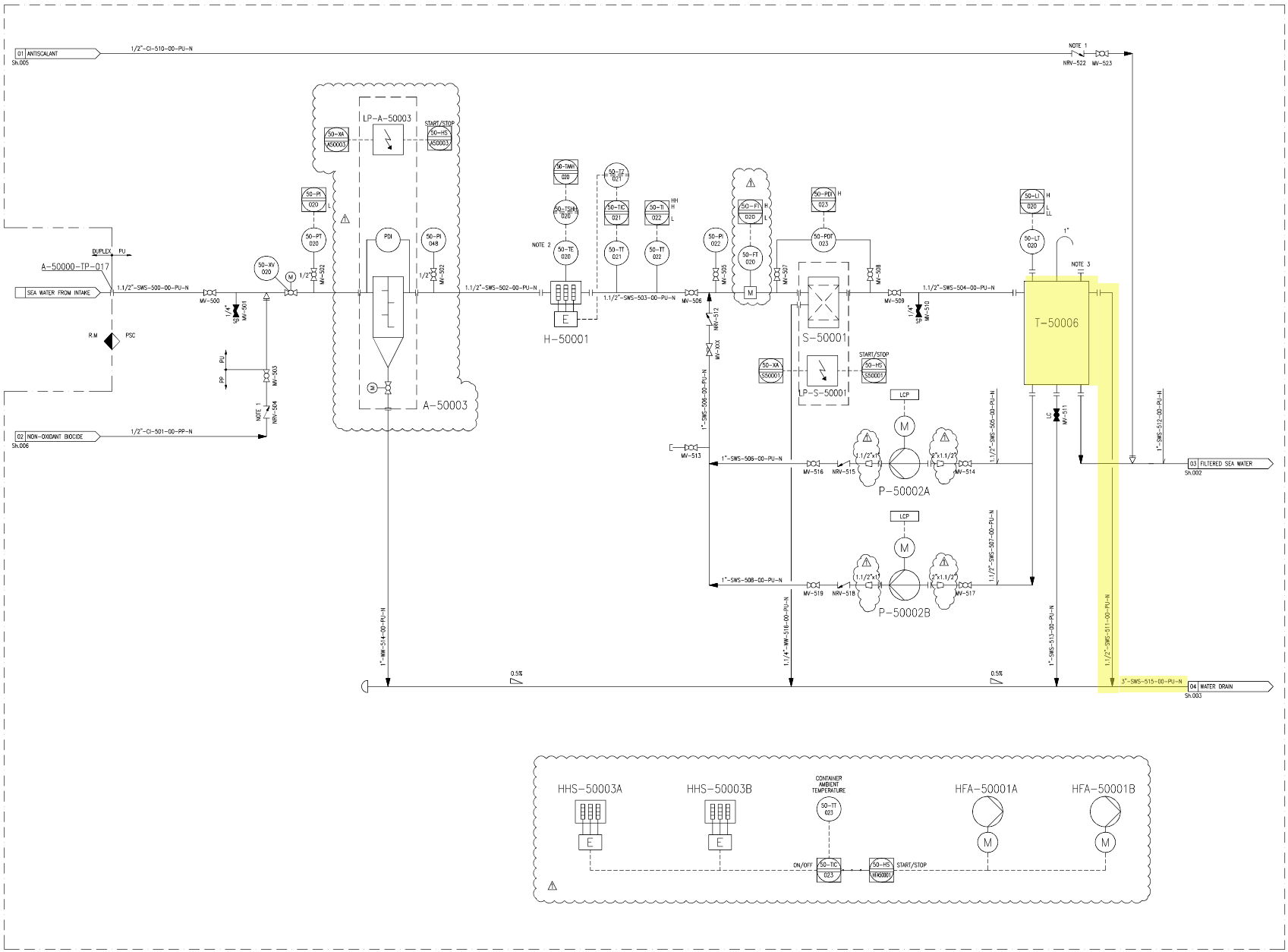
Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	29
Cause:	LVA & LVB Open
Consequence:	Refer to 3.3.4
Safeguards:	High level alarm on T- 50008 Local Overflow
Actions:	Ensure local overflow is adequately sized & rooted to a safe location.
Assigned Respondent (By)	ROSETTI Piping & Layouts Engineer
RESPONSE	T-50008 is part of Water treatment package. Overflow has been routed from outside the container, where the water treatment has been installed, to brine caisson.
Attachments:	Item 28-29 Attachment 1 & Attachment 2
Issue Date (dd/mm/yy)	08/08/2024

Approvals / Endorsements

EPC Discipline Lead	**Sign**
C. Bortolin	Carla Bortolin Autore firma digitale: Carla Bortolin Nome distintivo: CN = Carla Bortolin email = carla.bortolin@rosetti.it C = IT O = Rosetti Marino OU = 8761 Data: 2024.08.09 11:56:05 +02'00'
EPC HSE Lead	**Sign**
C.Caracciolo	CC
EPC Project Manager	**Sign**
D. Lo Sterzo	
Client	**Sign**
	Digitaal ondertekend door Paul van Rossum Datum: 2024.08.21 08:13:30 +02'00'

DRAWING No. 1724000448-PR-PID-00013

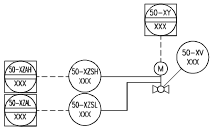
REV. 1



TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-02	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-03	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-05	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTANK
TP-06	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-07	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

TYPICAL FOR ON/OFF BALL VALVES



ITEM 28-29_ATTACHMENT 1

NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: BLPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOS BIOCIDE DOSAGE TO INTAKE PUMP: DISCONTINUOS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE

A-50003	
SEA WATER COARSE FILTER	
FILTRATION RATE	125 µm
CAPACITY	2.5 m3/h
DES. PRESS.	5 barg
DES. TEMP.	50° C
MATERIAL	PLASTIC MAT.

H-50001	
ELECTRIC HEATER	
POWER	30 kW
CAPACITY	2.5 m3/h
DES. PRESS.	5 barg
DES. TEMP.	40° C
MATERIAL	PVC-TITANIUM

S-50001	
SAND FILTER	
TYPE	PRESSURE,VERTICAL
CAPACITY	2.5 m3/h
DES. PRESS.	7 barg
DES. TEMP.	50° C
MATERIAL	FRP

T-50006	
FILTERED WATER TANK	
VOLUME	3 m3
DES. PRESS.	ATM
DES. TEMP.	50° C
MATERIAL	FRP

P-50002A/B	
BACKWASH PUMP	
TYPE	CENTRIFUGAL
CAPACITY	5 m3/h
HEAD	0.50 barg
DES. TEMP.	50° C
MATERIAL	PP

HHS-50003A/B	
CONTAINER ELECTRICAL HEATER	
POWER	TBD
DES. PRESS.	TBD
DES. TEMP.	TBD
MATERIAL	TBD

HFA-50001A/B	
CONTAINER AIR FAN	
POWER	TBD
DES. PRESS.	TBD
DES. TEMP.	TBD
MATERIAL	TBD

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN.	CHKD	APPD	DESCRIPTION
1	29-MAY-24	CC	WR	RM	ISSUED FOR REVIEW
0	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

ROSETTI MARINO

TITLE : WATER TREATMENT PACKAGE
SEA WATER FINE FILTRATION
P&I DIAGRAM

CONTRACT NO./TITLE | SCALE -

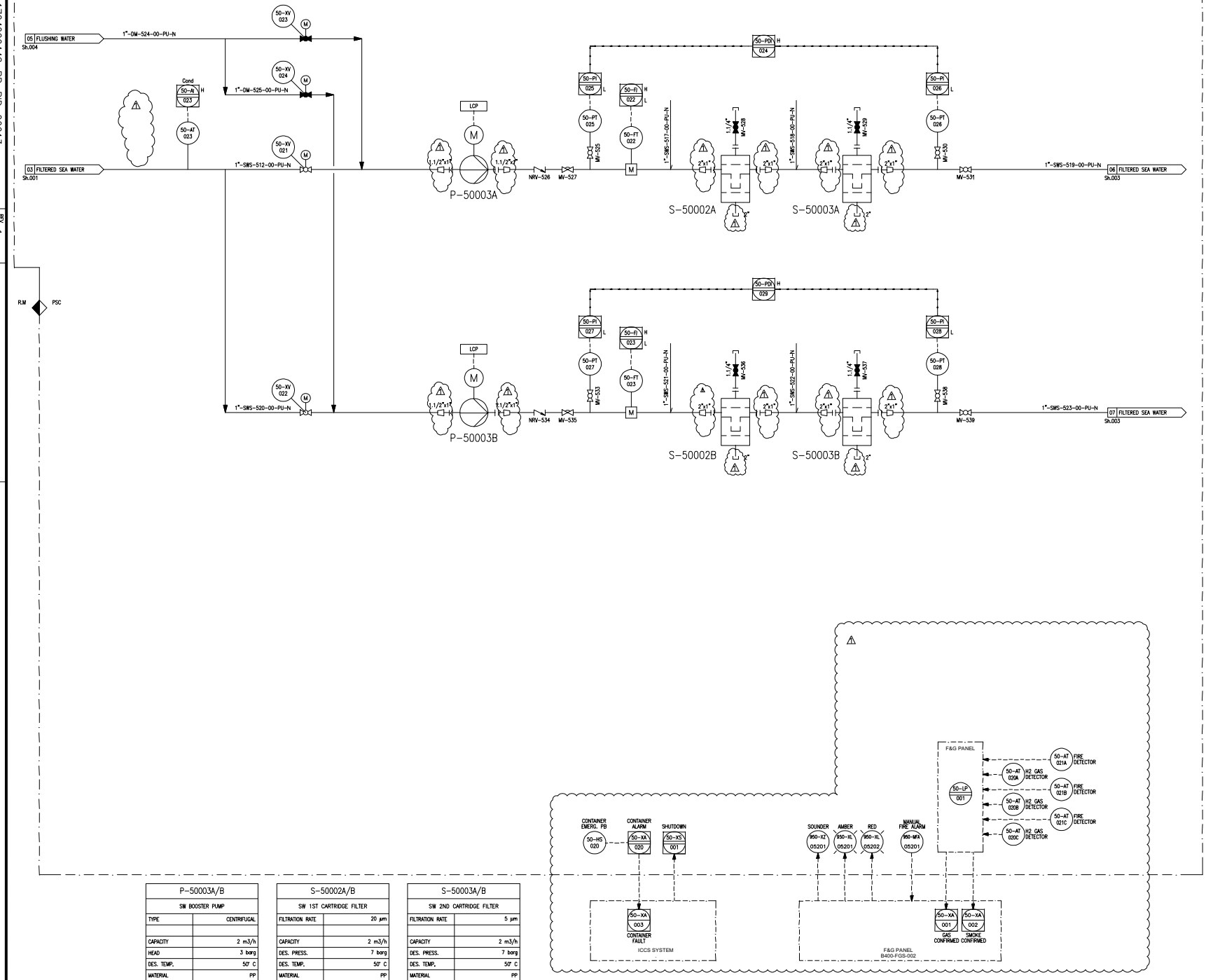
DRAWN CC | CHECKED WR | APPROVED RM | DATE 29/05/24

A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 001 | REV. 1

File Name : 1724000448-PR-PID-00013 Rev01

DRAWING NO. 1724000448-PR-PID-00013

REV. 1



P-50003A/B	
SW BOOSTER PUMP	
TYPE	CENTRIFUGAL
CAPACITY	2 m3/h
HEAD	3 barg
DES. TEMP.	50° C
MATERIAL	PP

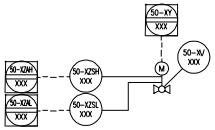
S-50002A/B	
SW 1ST CARTRIDGE FILTER	
FILTRATION RATE	20 µm
CAPACITY	2 m3/h
DES. PRESS.	7 barg
DES. TEMP.	50° C
MATERIAL	PP

S-50003A/B	
SW 2ND CARTRIDGE FILTER	
FILTRATION RATE	5 µm
CAPACITY	2 m3/h
DES. PRESS.	7 barg
DES. TEMP.	50° C
MATERIAL	PP

TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-02	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-03	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-05	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTANK
TP-06	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-07	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

TYPICAL FOR ON/OFF BALL VALVES



NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
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6	CHECK VALVE SUPPLIED WITH THE PUMP.
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10	OFF SPEC ON/OFF VALVE
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13	OUTLET VALVE

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
1	29-MAY-24	GG	WR	RM	ISSUED FOR REVIEW
0	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

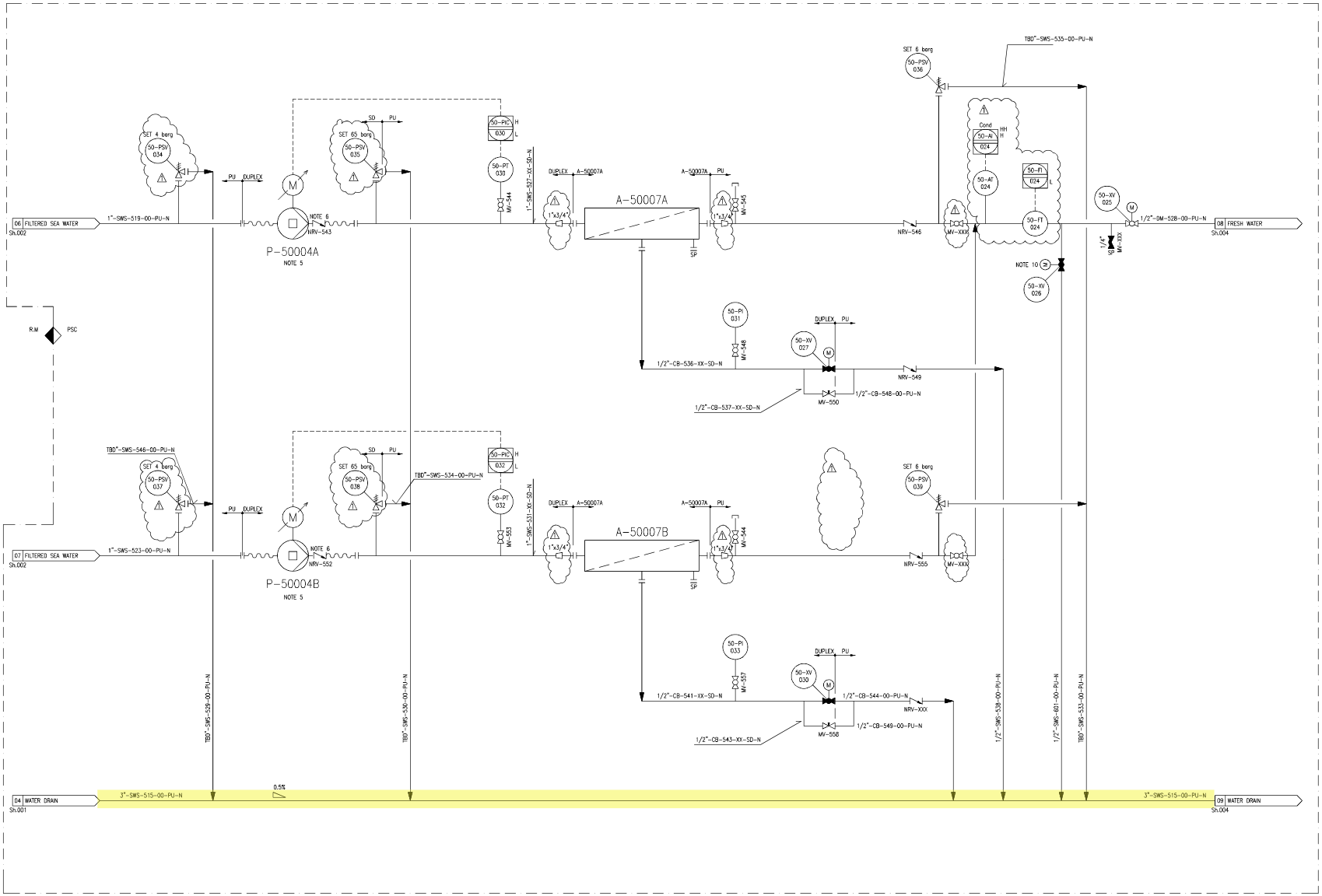
ROSETTI MARINO

TITLE : WATER TREATMENT PACKAGE
SEA WATER FINE FILTRATION
P&I DIAGRAM

CONTRACT NO./TITLE			SCALE –
DRAWN GC	CHECKED WR	APPROVED RM	DATE 29/05/24
A1	DRAWING NO. 1724000448-PR-PID-00013	SHEET 002	REV. 1

File Name : 1724000448-PR-PID-00013 Rev01

DRAWING No. 1724000448-PR-PID-00013 REV. 1



TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-02	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-03	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-05	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTANK
TP-06	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-07	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: BLPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOS BIOCIDE DOSAGE TO INTAKE PUMP: DISCONTINUOS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE

P-50004A/B	
HP PUMP	
TYPE	AXIAL ROTATING PISTONS
CAPACITY	2 m3/h
HEAD	70 barg
DES. TEMP.	50° C
MATERIAL	SS DUPLEX

A-50007A/B	
SEA WATER REVERSE OSMOSIS UNITS	
CAPACITY	0.8 m3/H
DES. PRESS.	69 barg
DES. TEMP.	50° C
MATERIAL	FRP

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
1	29-MAY-24	CC	WR	RM	ISSUED FOR REVIEW
0	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

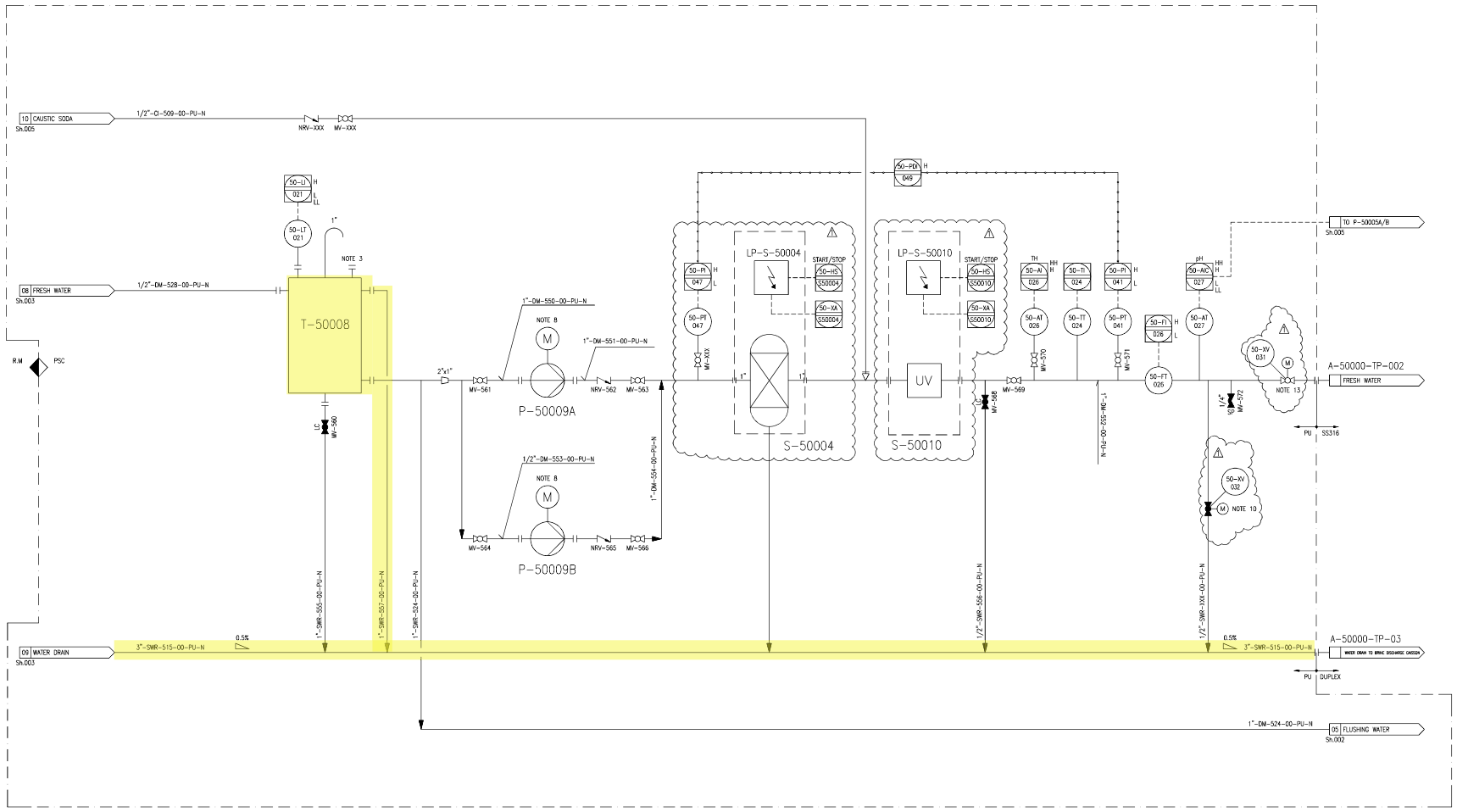
CROSSWIND

ROSETTI MARINO

TITLE :
WATER TREATMENT PACKAGE
SEA WATER REVERSE OSMOSIS
P&I DIAGRAM

CONTRACT NO./TITLE | SCALE -
DRAWN CC | CHECKED WR | APPROVED RM | DATE 29/05/24
A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 003 | REV. 1

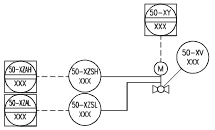
File Name : 1724000448-PR-PID-00013 Rev01



TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-02	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-03	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-05	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTANK
TP-06	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-07	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

TYPICAL FOR ON/OFF BALL VALVES



NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: BLPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOS BIOCIDE DOSAGE TO INTAKE PUMP: DISCONTINUOS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE

T-50008	
FRESH WATER TANK	
VOLUME	2.2 m3
DES. PRESS.	ATM
DES. TEMP.	50° C
MATERIAL	FRP

P-50009A/B	
FRESH WATER PUMP	
TYPE	CENTRIFUGAL
CAPACITY	0.8 m3/h
HEAD NOTE 11	3.1 barg
DES. TEMP.	50° C
MATERIAL	SS 316L

S-50010	
UV STERILIZER	
CAPACITY	0.8 m3/h
DES. PRESS.	5 barg
DES. TEMP.	50° C
MATERIAL	SS 316

S-50004	
SOFTENING FILTER	
CAPACITY	0.8 m3/h
DES. PRESS.	7 barg
DES. TEMP.	50° C
MATERIAL	FRP-PLASTIC

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
1	29-MAY-24	CC	WR	RM	ISSUED FOR REVIEW
0	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

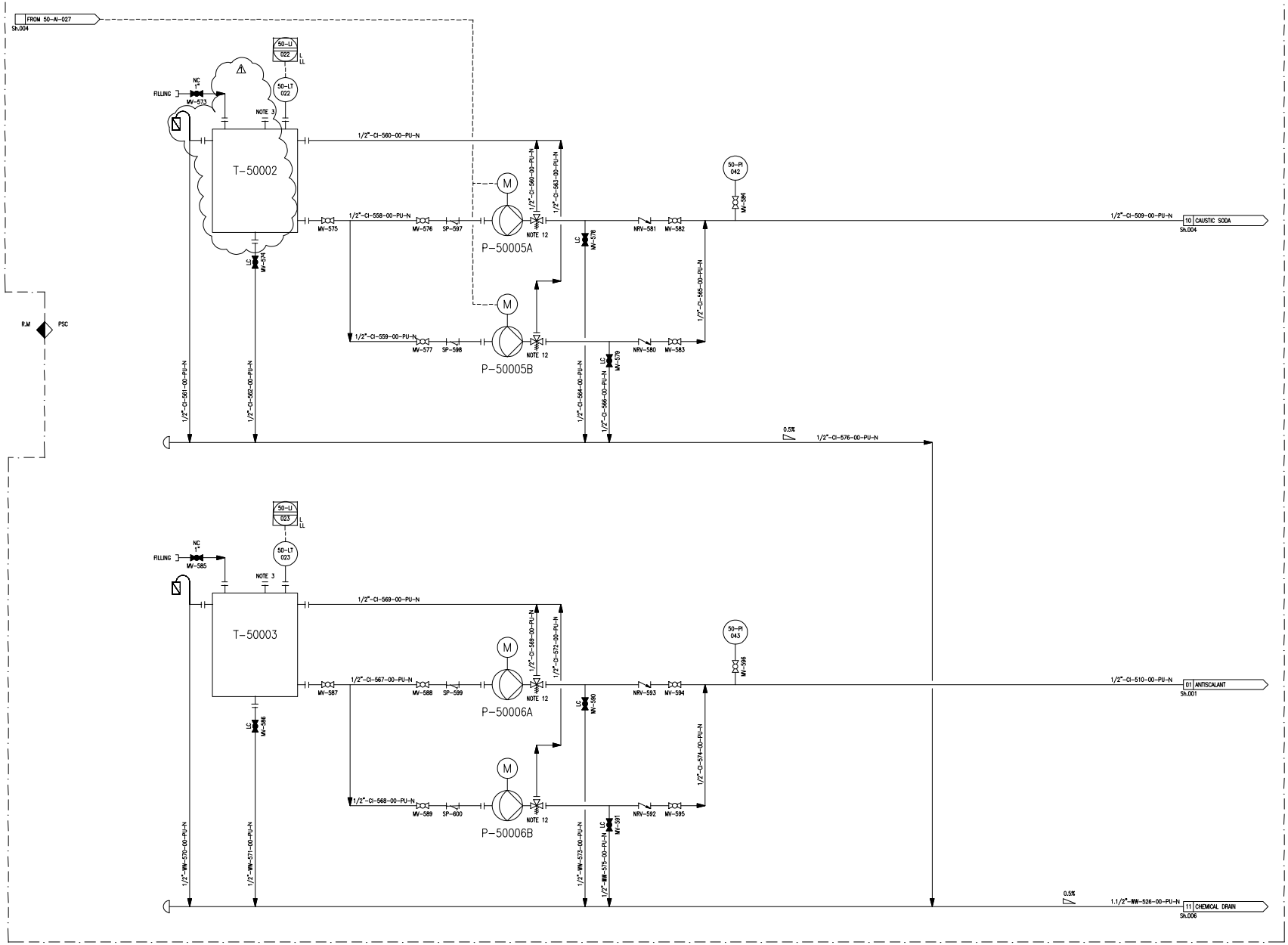
ROSETTI MARINO

TITLE :
WATER TREATMENT PACKAGE
FRESH WATER STORAGE
P&I DIAGRAM

CONTRACT NO./TITLE			SCALE -
DRAWN CC	CHECKED WR	APPROVED RM	DATE 29/05/24
A1	DRAWING NO. 1724000448-PR-PID-00013		SHEET 004 / REV. 1

DRAWING NO. 1724000448-PR-PID-00013 REV. 1

File Name : 1724000448-PR-PID-00013 Rev01



T-50002	
CAUSTIC SODA DOSING TANK	
VOLUME	0.05 m3
DES. PRESS.	ATM
DES. TEMP.	45° C
MATERIAL	PE

P-50005A/B	
CAUSTIC SODA DOSING PUMP	
TYPE	METERING DIAPHRAGM
CAPACITY	0.05 l/h
HEAD	2 barg
DES. TEMP.	50° C
MATERIAL	PVC

T-50003	
ANTISCALANT DOSING TANK	
VOLUME	0.05 m3
DES. PRESS.	ATM
DES. TEMP.	45° C
MATERIAL	PE

P-50006A/B	
ANTISCALANT DOSING PUMP	
TYPE	METERING DIAPHRAGM
CAPACITY	0.05 l/h
HEAD	2 barg
DES. TEMP.	50° C
MATERIAL	PVC

TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-02	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-03	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-05	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTANK
TP-06	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-07	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: BLPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOS BIOCIDE DOSAGE TO INTAKE PUMP: DISCONTINUOS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
1	29-MAY-24	GG	WR	RM	ISSUED FOR REVIEW
0	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

ROSETTI MARINO

TITLE : WATER TREATMENT PACKAGE
ACID & ANTISCALANT DOSAGES
P&I DIAGRAM

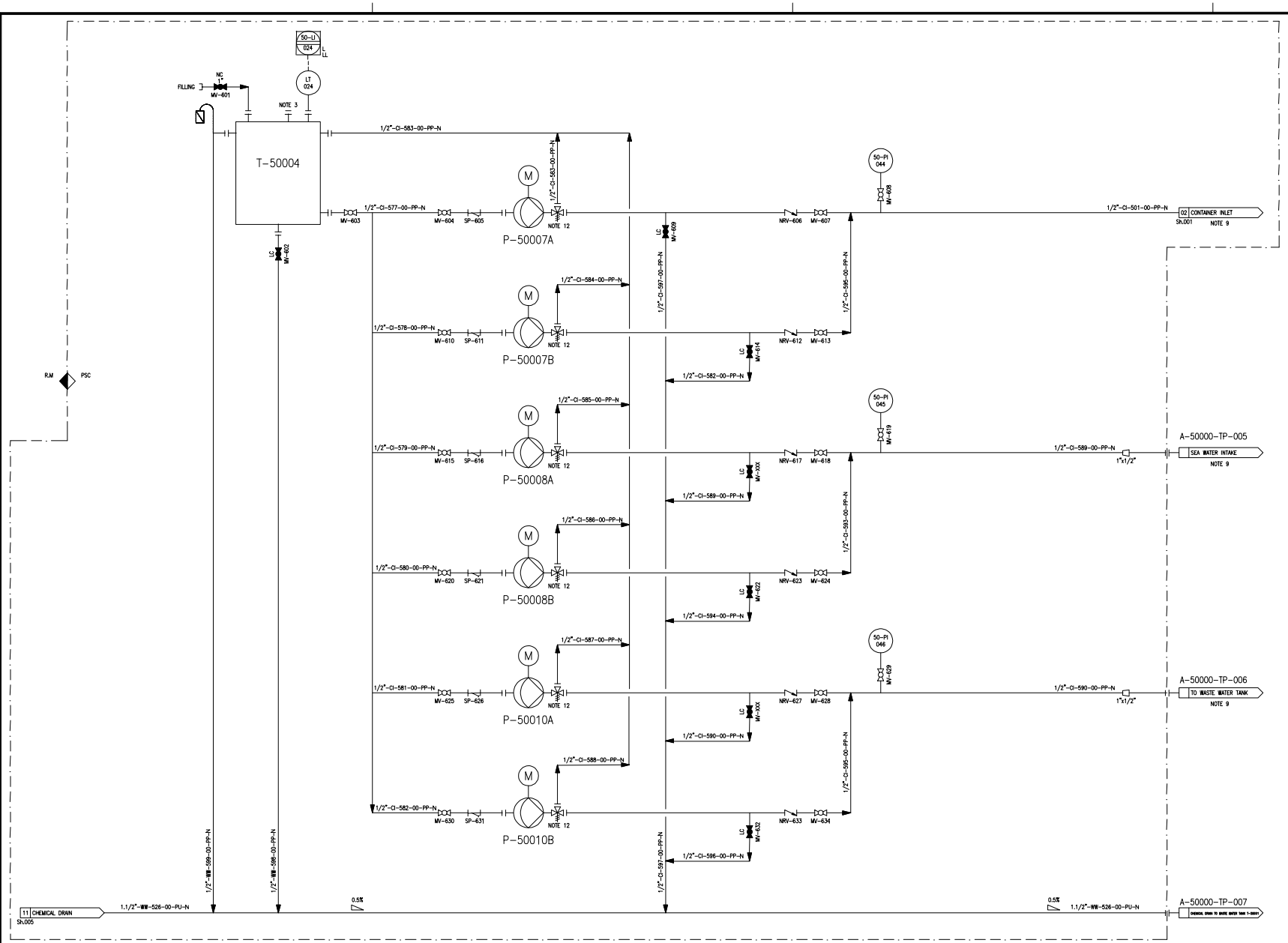
CONTRACT NO./TITLE | SCALE -

DRAWN GC | CHECKED WR | APPROVED RM | DATE 29/05/24

A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 005 | REV. 1

DRAWING NO. 1724000448-PR-PID-00013 REV. 1

File Name : 1724000448-PR-PID-00013 Rev01



T-50004	
NON-OXIDANT BIOCIDE DOSING TANK	
VOLUME	0.1 m3
DES. PRESS.	ATM
DES. TEMP.	45° C
MATERIAL	PE

P-50007A/B	
NON-OXIDANT BIOCIDE DOSING PUMP – CONTAINER INLET	
TYPE	METERING DIAPHRAGM
CAPACITY	0.1 l/h
HEAD	3.5 barg
DES. TEMP.	50° C
MATERIAL	PVC

P-50008A/B	
NON-OXIDANT BIOCIDE DOSING PUMP – SEA WATER INTAKE	
TYPE	METERING DIAPHRAGM
CAPACITY	2 l/h
HEAD	3.5 barg
DES. TEMP.	50° C
MATERIAL	PVC

P-50010A/B	
NON-OXIDANT BIOCIDE DOSING PUMP – WASTE WATER TANK	
TYPE	METERING DIAPHRAGM
CAPACITY	0.5 l/h
HEAD	3.5 barg
DES. TEMP.	50° C
MATERIAL	PVC

TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-02	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-03	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-05	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTANK
TP-06	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-07	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: BLPH–
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOS BIOCIDE DOSAGE TO INTAKE PUMP: DISCONTINUOS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
1	29-MAY-24	GG	WR	RM	ISSUED FOR REVIEW
0	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

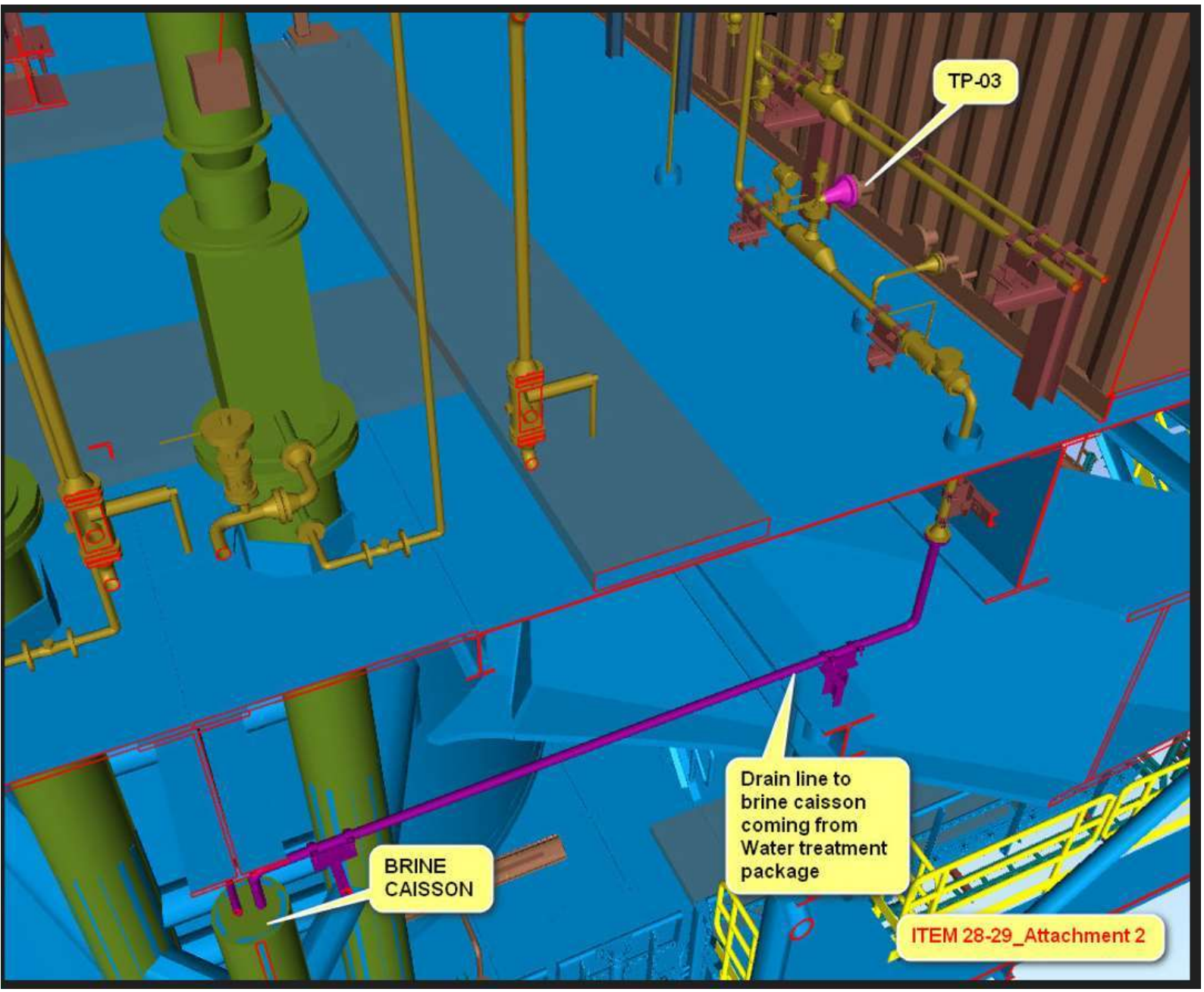
CROSSWIND

ROSETTI MARINO

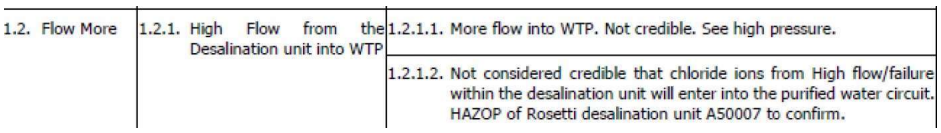
TITLE :
WATER TREATMENT PACKAGE
BIOCIDE DOSAGE
P&I DIAGRAM

CONTRACT NO./TITLE			SCALE –
DRAWN GC	CHECKED WR	APPROVED RM	DATE 29/05/24
A1	DRAWING NO. 1724000448-PR-PID-00013	SHEET 006	REV. 1

File Name : 1724000448-PR-PID-00013 Rev01


TP-03
Drain line to brine caisson coming from Water treatment package
BRINE CAISSON
ITEM 28-29_Attachment 2

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	30
Cause:	P-50009A & B both operating P- 50001A & B both operating
Consequence:	Unknown consequences for electrolyser package
Safeguards:	
Actions:	Ensure this scenario is considered, during HAZOPS for vendors packages, for electrolyser
Assigned Respondent (By)	CROSSWIND
RESPONSE	More flow from upstream has been taken into account in the Electrolyser HAZOP, see CRW-01-R-01. 
Attachments:	
Issue Date (dd/mm/yy)	

1.2. Flow More	1.2.1. High Flow from the Desalination unit into WTP	1.2.1.1. More flow into WTP. Not credible. See high pressure.
		1.2.1.2. Not considered credible that chloride ions from High flow/failure within the desalination unit will enter into the purified water circuit. HAZOP of Rosetti desalination unit A50007 to confirm.

Approvals / Endorsements

Company Discipline Lead	**Sign**
	Hamant Patel Digitally signed by Hamant Patel Date: 2024.10.09 16:01:37 +01'00'
Company HSE LEAD	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.11 07:51:52 +02'00'
Company Project Manager	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.11 07:31:09 +02'00'
Contractor received for information. Not independently verified. Information implemented	**Sign**

BLPH SHEAMS SIGNATURE FORM

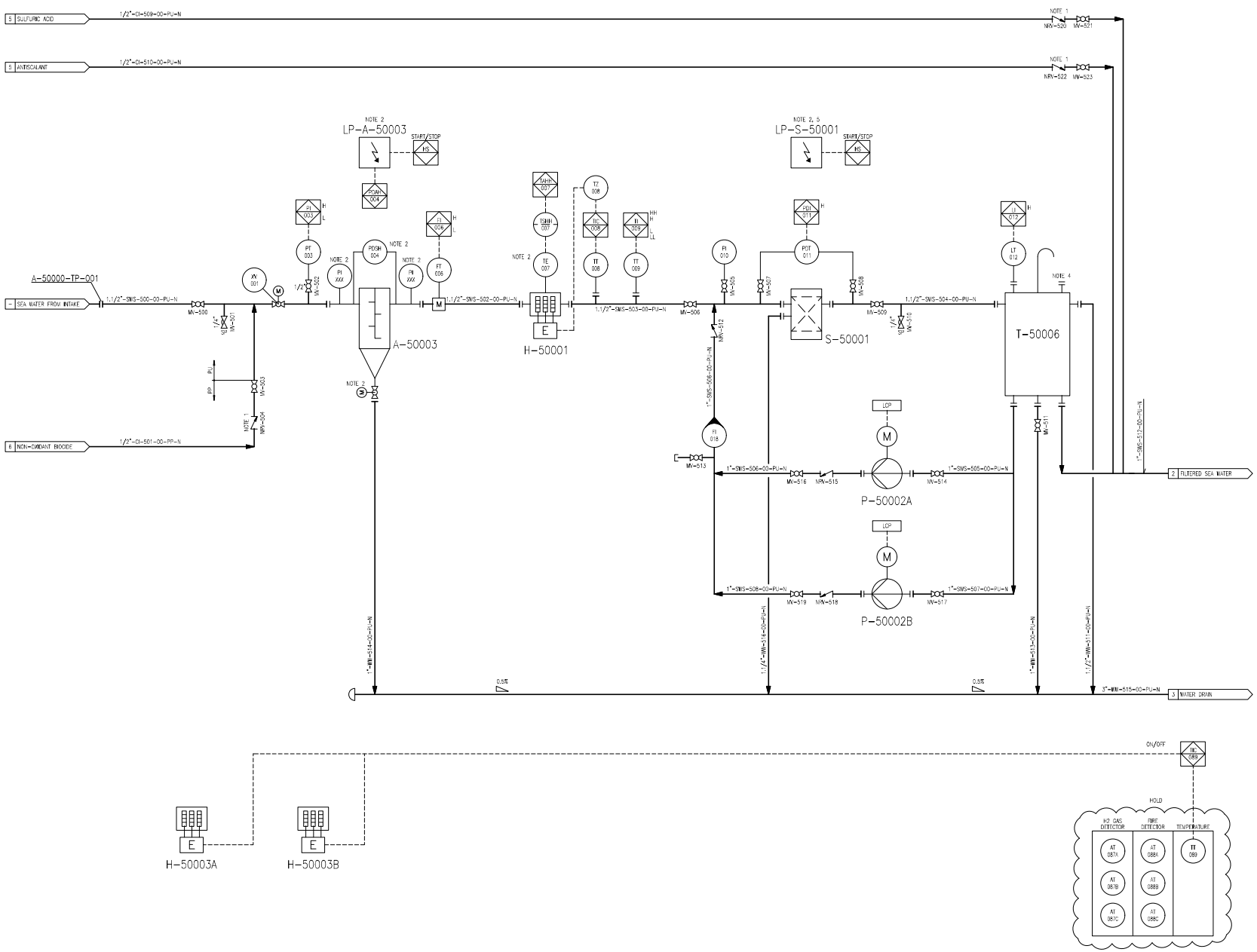
Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	31
Cause:	P-50009A & B operating
Consequence:	Unknown consequences for electrolyser package
Safeguards:	
Actions:	Control logic should inhibit dual operation of lift pumps, P-50009A & B.
Assigned Respondent (By)	ROSETTI Instrumentation Engineer
RESPONSE	As per Vendor's document "WATER TREATMENT PACKAGE-PID DIAGRAM" n° 1724000448-PR-PID-00013 Note 9.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
L.Calabrese	
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D. Lo Sterzo	
Client	**Sign**
	Digitaal ondertekend door Paul van Rossum Datum: 2024.09.03 16:21:25 +02'00'

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	32
Cause:	Unknown components from vendor packages Marine Contaminants
Consequence:	Unknown consequences in vendor packages Potential to exceed design limit of desalination unit package.
Safeguards:	Dossing of hypochlorite Caisson located at depth below expected marine growth. Caissons are segregated at different depths
Actions:	Consider duringVendor hazop package
Assigned Respondent (By)	ROSETTI Mechanical
RESPONSE	This scenario has been analyzed during WTP HAZOP on 17-18 June. See 123A90-DDL-SAF-RE-30006
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
F.Mura	
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.09.12 17:33:25 +02'00'



TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	DESCRIPTION
TP-01	1.1/2"	FLG.	150#	RF	SEA WATER FROM INTAKE PUMPS
TP-02	1"	FLG.	150#	RF	PRODUCT WATER
TP-03	3"	FLG.	150#	RF	SEA WATER DRAIN
TP-04	1"	FLG.	150#	RF	ACID DRAIN
TP-05	1"	FLG.	150#	RF	BIOCIDE TO SEA WATER INTAKE
TP-06	1"	FLG.	150#	RF	BIOCIDE TO WASTE WATER TAKE
TP-07	1.1/2"	FLG.	150#	RF	CHEMICAL DRAIN

NOTES:

1. SPRING LOADED CHECK VALVE.
2. SUPPLIED WITH EQUIPMENT.
3. CONNECTION ONLY DURING CIP CLEANING.
4. INSPECTION COVER.
5. FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
6. PUMP EQUIPPED WITH FLUSHING VALVE.
7. CHECK VALVE SUPPLIED WITH THE PUMP.
8. ALL MANUAL VALVES TAGS ARE PRECEDED BY: BLPH-
9. LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEUS RUNNING OF A PUMP A AND B IS PROVIDED.
10. PLEASE NOTE THAT DM FLUIDE CODE IS FRESH WATER AND NOT DEMI WATER.
11. OFF SPEC ON/OFF VALVE

A-50003	
PRE-FILTER	
FILTRATION RATE	125 µm
CAPACITY	2.5 m3/h
DES. PRESS.	6 bar
DES. TEMP.	50° C
MATERIAL	PLASTIC MAT.

H-50001	
ELECTRIC HEATER	
POWER	37 kW
CAPACITY	2.5 m3/h
DES. PRESS.	6 bar
DES. TEMP.	60° C
MATERIAL	S.S. – SUPER DUPLEX

S-50001	
SAND FILTER	
TYPE	PRESSURE,VERTICAL
CAPACITY	2.5 m3/h
DES. PRESS.	6 bar
DES. TEMP.	50° C
MATERIAL	FRP

T-50006	
FILTERED WATER TANK	
VOLUME	3 m3
DES. PRESS.	ATM
DES. TEMP.	50° C
MATERIAL	FRP

P-50002A/B	
BACKWASH PUMP	
TYPE	CENTRIFUGAL
CAPACITY	5 m3/h
DES. PRESS.	1.5 bar
DES. TEMP.	50° C
MATERIAL	HOLD

H-50003A/B	
CONTAINER ELECTRICAL HEATER	
POWER	13 kW
DES. PRESS.	ATM
DES. TEMP.	° C
MATERIAL	–

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
0	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

PSC DOC. REF: PK2885-B-001

CROSSWIND

ROSETTI MARINO

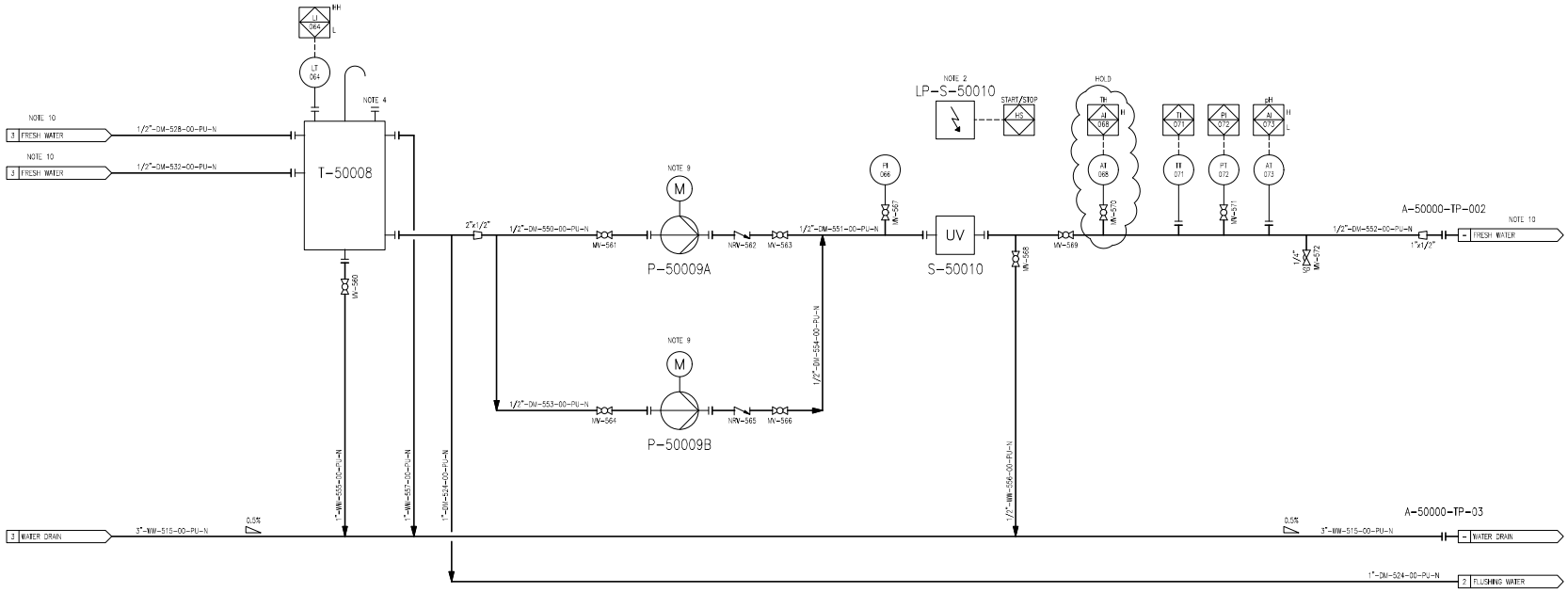
TITLE :

WATER TREATMENT PACKAGE
SEA WATER PRE-TREATMENT
P&I DIAGRAM

CONTRACT NO./TITLE			SCALE –
DRAWN UR	CHECKED RC	APPROVED RM	DATE 24/04/24
A1	DRAWING NO. 1724000448-PR-PID-00013	SHEET 001	REV. 0

File Name : 1724000448-PR-PID-00013 Rev0

DRAWING NO. : 1724000448-PR-PID-00013 REV. 0



T-50008	
FRESH WATER TANK	
VOLUME	2.2 m3
DES. PRESS.	ATM
DES. TEMP.	50° C
MATERIAL	FRP

P-50009A/B	
FRESH WATER PUMP	
TYPE	CENTRIFUGAL
CAPACITY	0.8 m3/h
HEAD	6 bar
DES. TEMP.	50° C
MATERIAL	SS 316L

S-50010	
UV STERILIZER	
CAPACITY	0.8 m3/h
DES. PRESS.	8 bar
DES. TEMP.	50° C
MATERIAL	SS 316

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
0	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND ROSETTI MARINO

TITLE :
WATER TREATMENT PACKAGE
FRESH WATER STORAGE
P&I DIAGRAM

CONTRACT NO./TITLE | SCALE -

DRAWN UR | CHECKED RC | APPROVED RM | DATE 24/04/24

A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 004 | REV. 0

DRAWING NO. 1724000448-PR-PID-00013 REV 0

File Name : 1724000448-PR-PID-00013 Rev0

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	33
Cause:	Unknown components from vendor packages Marine Contaminants
Consequence:	Potential for vacuum in sea water supply system due to pump failure, coincidence to blocked discharge on liquid full line.
Safeguards:	
Actions:	Consider duringVendor hazop package
Assigned Respondent (By)	ROSETTI Mechanical
RESPONSE	Case of potential for vacuum in sea water supply system due to pump failure has been considered during WTP HAZOP package. For this topic, nothing critical has been highlighted. Please refer to 123A90-DDL-SAF-RE-30006
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
F.Mura	
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**

Digitaal ondertekend door Paul van Rossum
Datum: 2024.09.03 16:19:51 +02'00'

BLPH SHEAMS SIGNATURE FORM

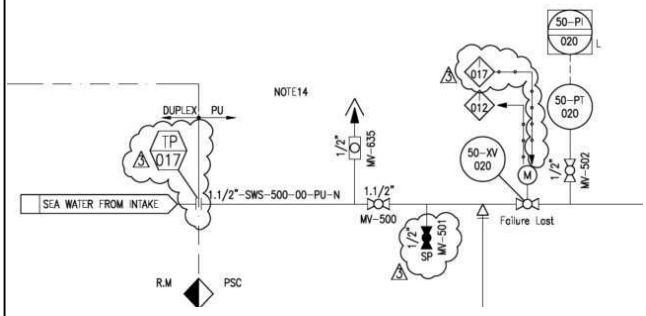
Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	34
Cause:	Low ambient temperature
Consequence:	Potential freezing of dead legs
Safeguards:	
Actions:	See Vendor Packages
Assigned Respondent (By)	CROSSWIND
RESPONSE	Low ambient temperature has been analyzed during WTP HAZOP on 17-18 June. See 123A90-DDL-SAF-RE-30006
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
F.Mura	
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**

Paul van Rossum

Digitaal ondertekend door Paul van Rossum
Datum: 2024.09.12 17:33:52 +02'00'

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	35
Cause:	Long periods of non-operation
Consequence:	Long period of stagnant water in water tanks, leading to marine growth.
Safeguards:	
Actions:	Consider operational philosophy for long periods of no demand of use of water system.
Assigned Respondent	ROSETTI Mechanical
RESPONSE	Reference is made to doc. N. 1724000448-MAC-CE-00004 - Water Treatment Package A-50000 - CAUSE EFFECT MATRIX and doc. N. 1724000448-PR-PID-00013:  If valve 50-XV-020 will stay close for more than 30 days: 1 | 50-XV-020 CLOSED | | | I-012 | 12 | X(4) | X(4) | X(4) | X(4) | X(4) | (Note (4): With delay timer of 30 days) Following drain valves will be opened to drain the package: TAG No. | DESCRIPTION | NOTES | SYS 50-XV-033 | OPEN DRAIN VALVE 50-XV-033 | | OTHER 50-XV-034 | OPEN DRAIN VALVE 50-XV-034 | | 50-XV-027 | OPEN DRAIN VALVE 50-XV-027 | | 50-XV-030 | OPEN DRAIN VALVE 50-XV-030 | | 50-XV-035 | OPEN DRAIN VALVE 50-XV-035 | |
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
C.Giunchi	
EPC HSE Lead	**Sign**
C.Caracciolo	CC
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.15 09:10:57 +02'00'

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	37
Cause:	Unknown cause within electrolyser package
Consequence:	unknown consequence within electrolyser package
Safeguards:	
Actions:	To be examined within electrolyser package HAZOP
Assigned Respondent (By)	CROSSWIND
RESPONSE	Loss of utilities have been analysed in the electrolyser package HAZOP, refer to CRW-01-R-01
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements

Company Discipline Lead	**Sign**
	Hamant Patel Digitally signed by Hamant Patel Date: 2024.10.09 16:02:21 +01'00'
Company HSE LEAD	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.11 07:51:26 +02'00'
Company Project Manager	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.11 07:31:57 +02'00'
Contractor received for information. Not independently verified. Information implemented	**Sign**

BLPH SHEAMS SIGNATURE FORM

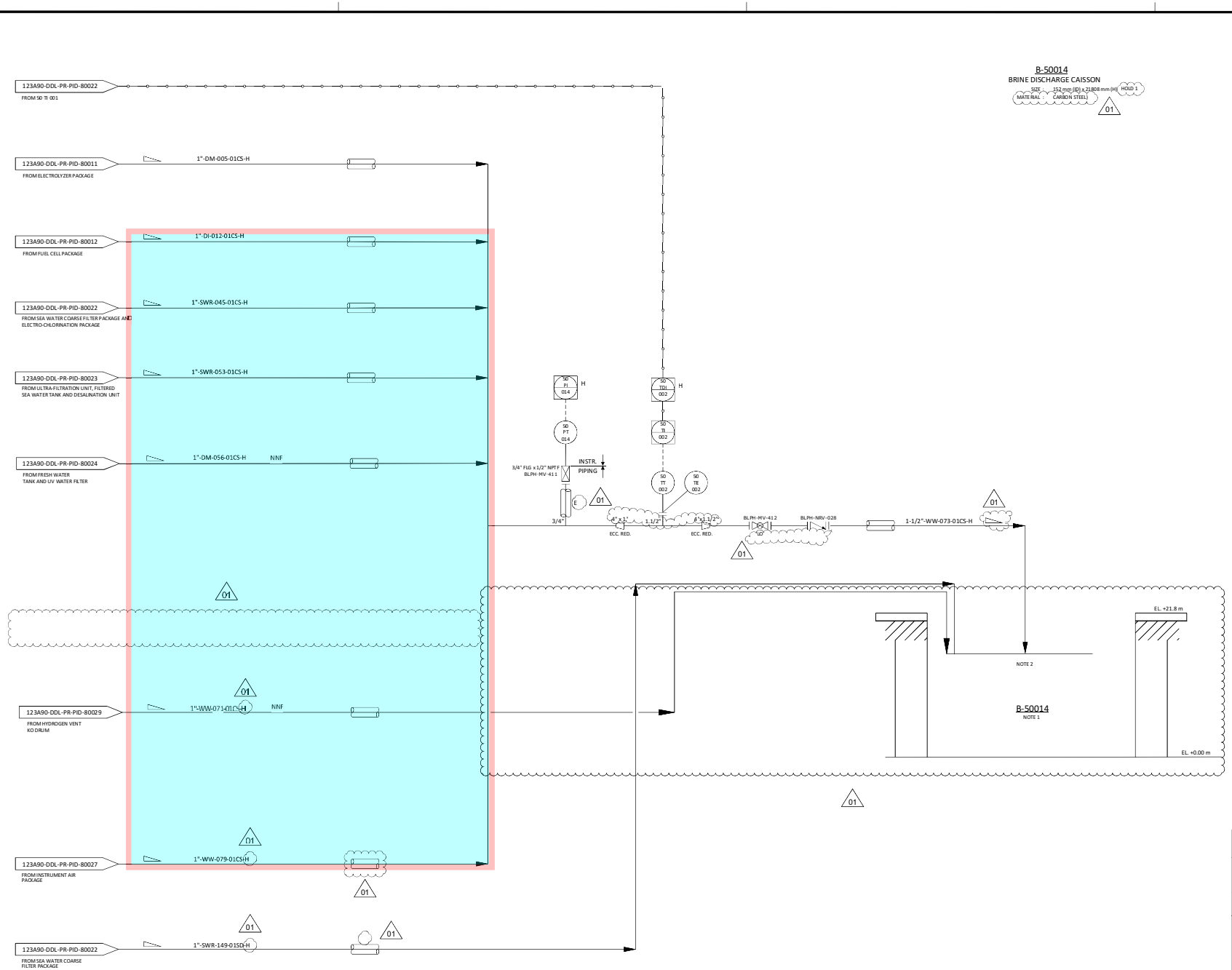
Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	37
Cause:	External Fire due to either hydrogen jet fire or BESS.
Consequence:	Potential to escalation for Hydrogen inventories.
Safeguards:	Fire detection. Emergency Isolation & Blowdown (PRV). PIC 'high high' alarm on hydrogen storage vessel
Actions:	Review the requirement for PIC HH on Hydrogen Storage Vessel and perform a LOPA if required, based on maximum pressure that can be generated by upstream electrolyser (vendor package)
Assigned Respondent (By)	ROSETTI Technical Safety
RESPONSE	Maxiumum pressure generated upstream electrolyzer is 36 barg (see 123A90-DDL-SAF-RE-30006, Node 1, 1.7 Pressure high). PIC HH is confirmed due to the case of external fire on Hydrogen storage vessel (see as example 123A90-DDL-PID-80015 attached). LOPA is note required for this scenario.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
E.Carminati	
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.09.12 17:34:54 +02'00'

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	38
Cause:	Partially closed non- return valve.
Consequence:	Potential backflow into other users of bring discharge.
Safeguards:	
Actions:	Confirm if non return valve is required on individual feed lines into brine disposal manifold.
Assigned Respondent (By)	ROSETTI Process Engineer
RESPONSE	It is confirmed that on individual feed lines into brine disposal manifold there is no requirement to have any non-return valve, as per PID 123A90-DDL-PR-PID-80025, attachment 1
Attachments:	
Issue Date	28-02-2024

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
Ciro Impradice	Ciro Impradice Autore firma digitale: Ciro Impradice Nome distintivo: CN = Ciro Impradice email = ciro.impradice@rosetti.it C = IT O = ROSETTI MARINO SPA OU = Procura Data: 2024.05.15 14:30:59 02'00'
EPC HSE Lead	**Sign**
C.Caracciolo	CC
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**
	Digitaal ondertekend door Paul van Rossum Datum: 2024.06.24 08:06:28 +02'00'



NOTES

1. CAISSON IS OPEN TOPPED.
2. ALL OVERBOARD LINES TO TERMINATE APPROXIMATLEY 5000 mm INSIDE CAISSON.

HOLDS

1. BRINE CAISSON INTERNAL DIAMETER. 01

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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
WATER DISPOSAL SHEET 1

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-80025	SHEET 001	REV. 01

DRAWING_NO. DRAWING_NO.

REV. REV.

File Name : FILE_NAME

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	39
Cause:	Unknow cause within electrolyser package
Consequence:	Potential overpressure of piping downstream for electrolyser up to closed manual valve.
Safeguards:	
Actions:	Confirm maximum pressure of fluid discharge from electrolyser package and ensure brine disposal system is adequately designed.
Assigned Respondent (By)	CROSSWIND
RESPONSE	This scenario is no longer applicable as the valve in the brine discharge line (BLPH-MV-412) is locked open on P&ID 123A90-DDL-PR-PID-80025-001 rev 02.
Attachments:	
Issue Date (dd/mm/yy)	

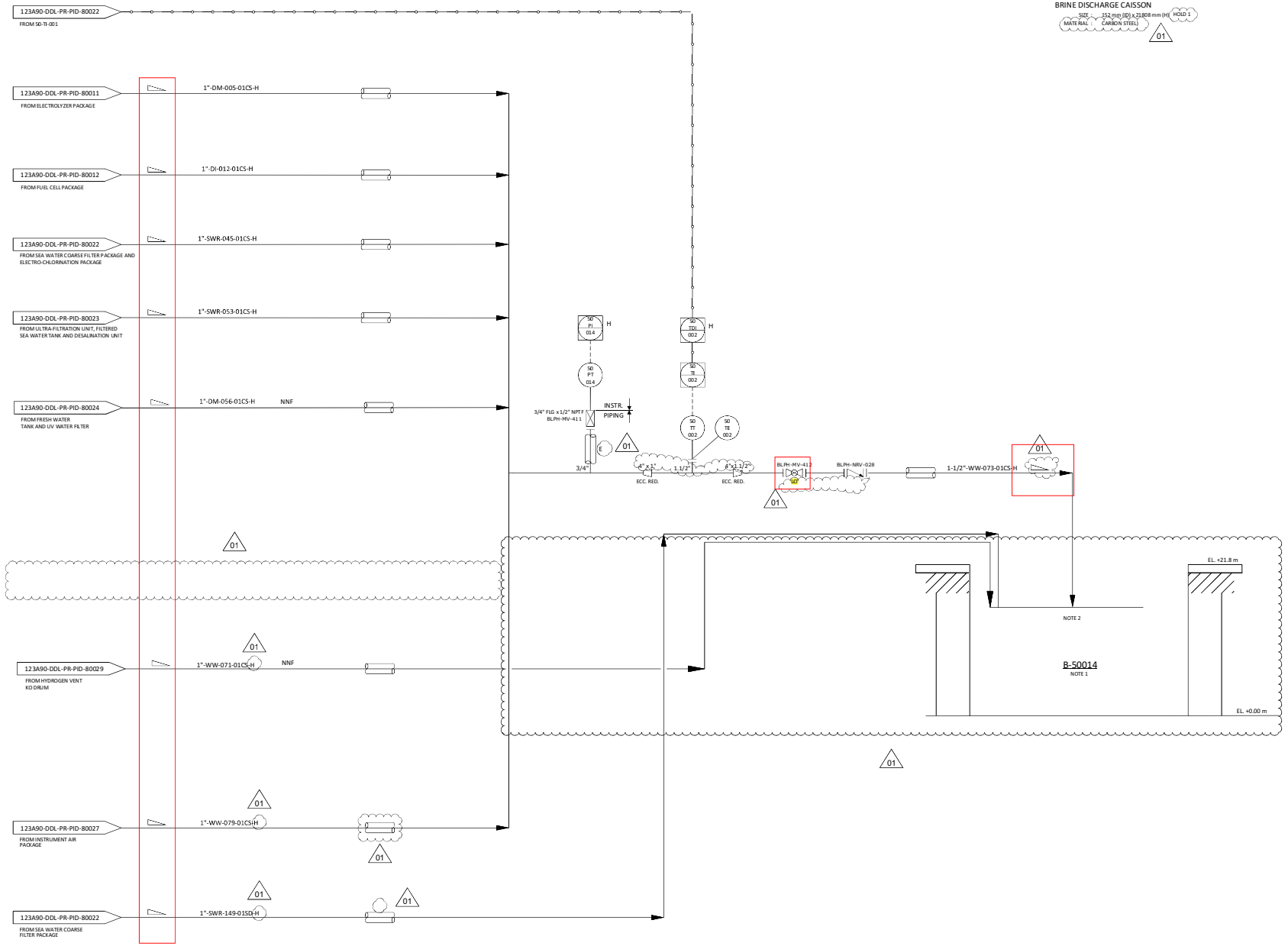
Approvals / Endorsements

Company Discipline Lead	**Sign**
	Hamant Patel Digitally signed by Hamant Patel Date: 2024.10.09 15:51:28 +01'00'
Company HSE LEAD	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.11 07:51:09 +02'00'
Company Project Manager	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.11 07:31:31 +02'00'
Contractor received for information. Not independently verified. Information implemented	**Sign**

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	40
Cause:	Low ambient temperature Consequence: 4.10.1.1
Consequence:	Potential freezing
Safeguards:	Insulated line
Actions:	Consider winterization of brine drain line if required
Assigned Respondent (By)	ROSETTI Process Engineer
RESPONSE	Winterization of brine lines entering to the brine discharge caisson has been reviewed and are indicated on the attached PID "123A90-DDL-PR-PID-80025_01". More specifically, there is no requirement to electrically trace the lines entering to the brine discharge caisson, since they are all slope toward the caisson and the only manual valve installed between caisson and equipment/package to drain (valve MV-412) is specified to be locked open ("LO"). Also, the part of line downstream the check valve NRV-028 is sloped. See attachment 1 HAZOP action 40 (FEED).
Attachments:	
Issue Date (28/02/2024)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
Ciro Impradice	Ciro Impradice
EPC HSE Lead	**Sign**
C.Caracciolo	CC
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**
	Digitaal ondertekend door Paul van Rossum Datum: 2024.03.22 16:10:02 +01'00'



NOTES

1. CAISSON IS OPEN TOPPED.
2. ALL OVERBOARD LINES TO TERMINATE APPROXIMATLEY 5000 mm INSIDE CAISSON.

HOLDS

1. BRINE CAISSON INTERNAL DIAMETER. 01

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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
WATER DISPOSAL SHEET 1

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-80025		SHEET 001	REV. 01

DRAWING NO. DRAWING_NO.
REV. REV.
File Name : FILE_NAME

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	41
Cause:	Unknown cause of high temperature within package
Consequence:	Potential to exceed environmental limit in vicinity of discharge caisson.
Safeguards:	Temperature indicator on common brine discharge line.
Actions:	To consider causes of high temperature within electrolyser HAZOP package, and ensure sufficient protection is provided such that environmental limit will not be exceeded.
Assigned Respondent (By)	CROSSWIND
RESPONSE	No causes of high temperature has been identified in the electrolyser HAZOP (see doc CRW-01-R-01).
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements

Company Discipline Lead	**Sign**
	Hamant Patel Digitally signed by Hamant Patel Date: 2024.10.09 15:53:10 +01'00'
Company HSE LEAD	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.11 07:50:48 +02'00'
Company Project Manager	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.11 07:30:41 +02'00'
Contractor received for information. Not independently verified. Information implemented	**Sign**

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	42
Cause:	Unknown cause of gas blowby via electrolyser package
Consequence:	Potential emission of hydrogen/oxygen from top of caisson. With potential for ignition & risk to personnel
Safeguards:	
Actions:	To assess potential consequences of hydrogen or oxygen release from top of brine caisson, in case of gas blowby via electrolyser package. And to provide suitable mitigation.
Assigned Respondent (By)	CROSSWIND
RESPONSE	There is no credible scenario for a blowby of H2 from the electrolyser towards the brine.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements

Company Discipline Lead	**Sign**
	Hamant Patel Digitally signed by Hamant Patel Date: 2024.10.14 09:03:24 +01'00'
Company HSE LEAD	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.11 08:10:30 +02'00'
Company Project Manager	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.24 10:46:33 +02'00'
Contractor received for information. Not independently verified. Information implemented	**Sign**

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	43
Cause:	Loss of Instrument air
Consequence:	Unknown consequences to various vendor packages
Safeguards:	
Actions:	Review the impact of loss of instrument air on all vendor packages, and based on the consolidated outcome, rea- assess the LOPA for both the Low Low Pressure trips on the instrument air.
Assigned Respondent (By)	CROSSWIND
RESPONSE	HAZOP has been performed for all vendor packages, it included the review of the loss of instrument air's impact. These scenarios were all ALARP due to the fail-safe direction of the valves involved.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
Company Discipline Lead	**Sign**
	Hamant Patel
Company HSE Lead	**Sign**
Company Project Manager	**Sign**
Contractor received for information. Not independetly verified. Information implemented	**Sign**

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	44
Cause:	Pump Failure P- 43003
Consequence:	Potential overfill of hydrogen vent. Leading to blockage of hydrogen vent & discharge of water from vent. Potential loss of safeguard, and additional consequences to upstream users & vent systems. Clarification: During a blowdown, the backpressure from V43001 may lead to overpressure of connected low pressure systems (e.g. hydrogensystems rated at 4 barg), leading to a Hydrogen release at grade. Potential for fire / VCE.
Safeguards:	Flow metre downstream of P-43003 with'LL' flow trip. Level 'H' alarm on hydrogen KO drum V- 43001Level 'LY-HH' on hydrogen KO drum vent, leading to system shutdown.
Actions:	Shut down on 'HH' in hydrogen KO drum vent should lead to system shut down but not depressurisation.
Assigned Respondent (By)	ROSETTI Process Engineer
RESPONSE	As per TQ 123A90-PML-PM-TQ-00013 and as per point 4.1.15.1 of the EPC HAZOP, which states: QUOTE 4.1.15.1. ... 90 Electrolyser starts/yr, 0.5 hr/start-up, 3.2kg/hr of water(worst credible scenario based on condensation of all water in stream), Platform visited for maintenance 2 times/yr where issue can be identified and rectified. 0.076 m3 of water within 2m3 KO drum overfill of vessel not considered credible. UNQUOTE There is no requirement of having a HH liquid level in the H2 Vent KOD, since overfill of the vessel is not a credible scenario. Therefore, system shut-down in case of HH liquid level is not applicable.
Attachments:	
Issue Date (21/02/24)	

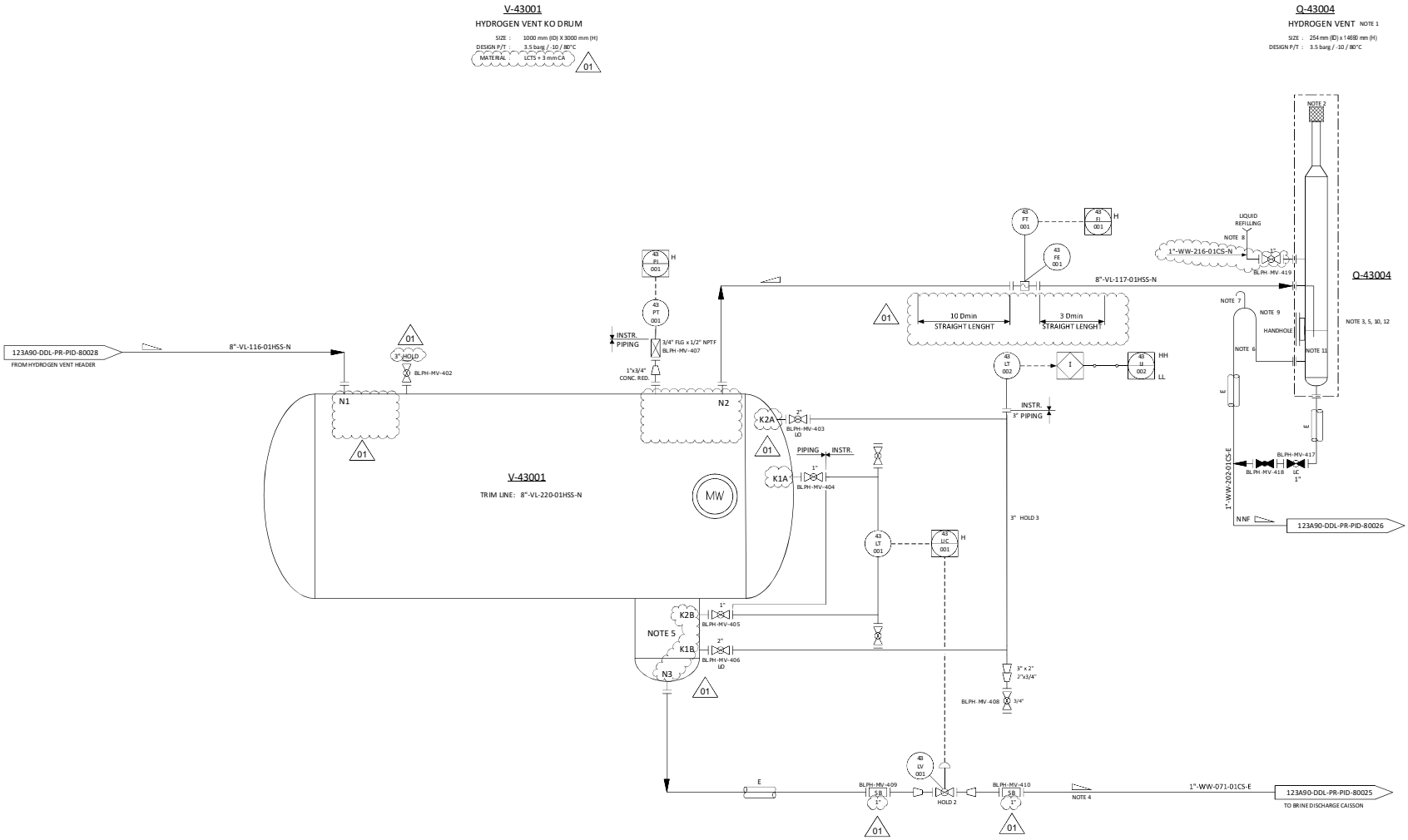
Approvals / Endorsements	
EPC Discipline Lead	**Sign**
Ciro Impradice	
EPC HSE Lead	**Sign**
Carolina Caracciolo	CC
EPC Project Engineering Manager	**Sign**
Davide Lo Sterzo	
Client	**Sign**

Digitaal ondertekend door Paul van Rossum
Datum: 2024.03.14 17:03:29 +01'00'

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	45
Cause:	Pump Failure P- 43003
Consequence:	Potential overfill of hydrogen vent. Leading to blockage of hydrogen vent & discharge of water from vent. Potential loss of safeguard, and additional consequences to upstream users & vent systems. Clarification: During a blowdown, the backpressure from V43001 may lead to overpressure of connected low pressure systems (e.g. hydrogen systems rated at 4 barg), leading to a Hydrogen release at grade. Potential for fire / VCE.
Safeguards:	Flow metre downstream of P-43003 with'LL' flow trip. Level 'H' alarm on hydrogen KO drum V- 43001 Level 'LY-HH' on hydrogen KO drum vent, leading to system shutdown.
Actions:	Asses consequences of loss of safeguard of availability of vent system to upstream users.
Assigned Respondent (By)	ROSETTI Technical Safety Engineer
RESPONSE	Pump 43003, as per PID 123A90-DDL-PR-PID-80029, is not more part of the design, so the action is not more valid.
Attachments:	PID 123A90-DDL-PR-PID-80029
Issue Date	03-05-24

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
Carolina Caracciolo	**CC**
EPC HSE Lead	**Sign**
Carolina Caracciolo	
EPC Project Manager	**Sign**
Davide Lo Sterzo	
Client	**Sign**
	Digitaal ondertekend door Paul van Nossum Datum: 2024.05.10 12:32:10 +02'00'



NOTES

1. VENT TO SAFE LOCATION SEGREGATED FROM OTHER VENTS.
2. VENT TO BE EQUIPPED WITH FLAME ARRESTOR AND BIRD SCREEN.
3. LIQUID SEAL DRUM IS PART OF THE VENT SYSTEM.
4. LIQUID DRAINLINES TO BE ROUTED TO ENSURE GRAVITY DRAIN.
5. HYDROGEN VENT KO DRUM BOOT AND LIQUID SEAL DRUM TO BE HEAT TRACING.
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 FOR 1.5 m, INSULATED UP TO THE BEND.
10. LIQUID SEAL DRUM I.D. 590 mm, HEIGHT 2350 mm (T/T). TBC BY H2 VENT VENDOR.
11. INLET DIP LEG SUBMERSION HEIGHT OF 0.2 m.
12. FLUID HEIGHT OF 1.5 m FROM BOTTOM T.L.
13. FOR DESCRIPTION AND SPECIFICATION OF VESSEL NOZZLE, REFERENCE SHALL BE MADE TO THE TECHNICAL DATA SHEET FOR H2 VENT KOD.

01

HOLDS

1. VENT LINES DIAMETER.
2. CONTROL VALVE SIZE (BY VENDOR).
3. STAND PIPE DIAMETER TO BE CONFIRMED. 01

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
01	24/11/2023	CIM	RZI	DLO	ISSUE FOR HAZOP (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. 01

DRAWING NO. DRAWING_NO.

REV. REV

File Name : FILE_NAME

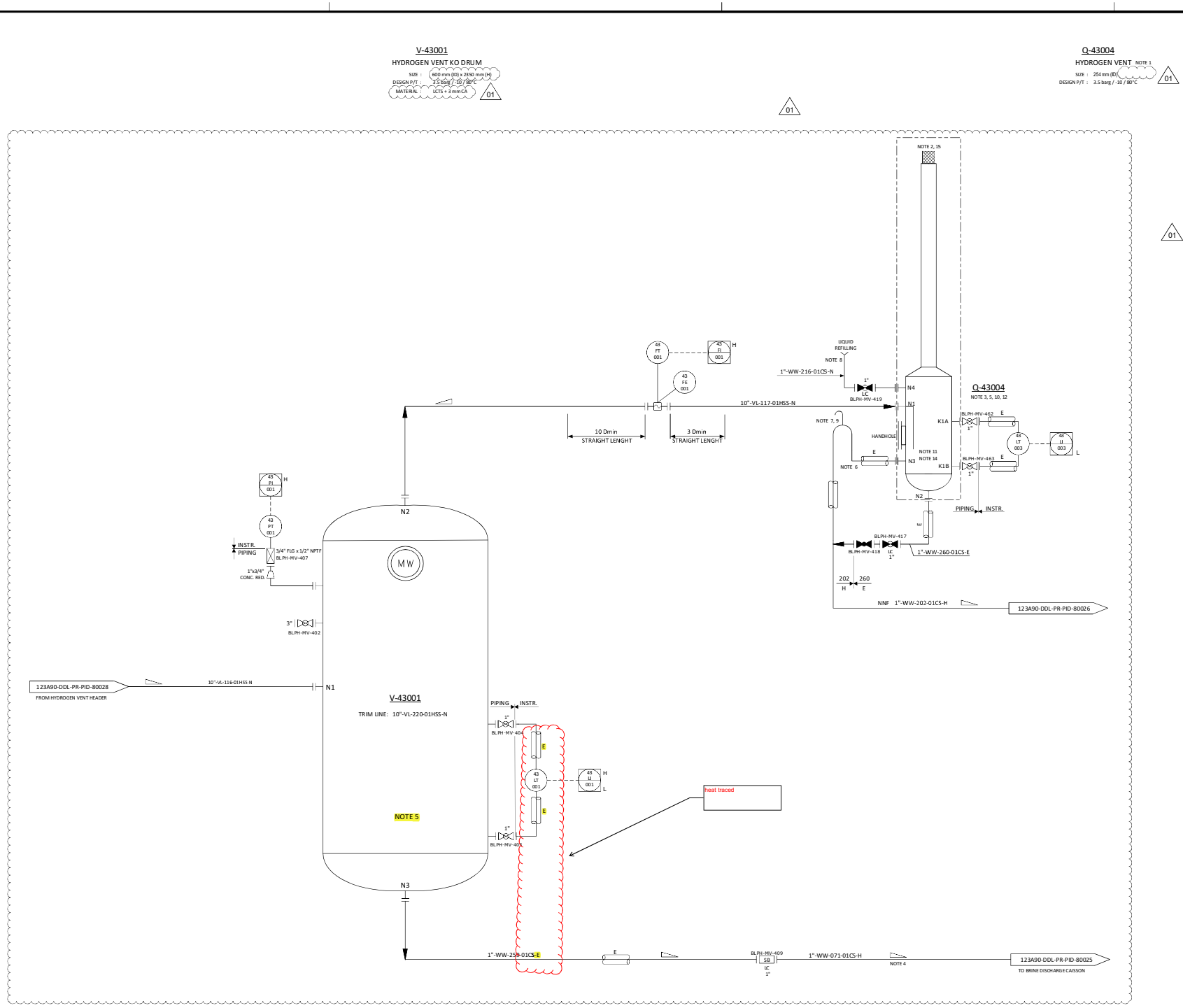
BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	46
Cause:	Low ambient temperature
Consequence:	Freezing of the stagnant water in the pipe or vessel, leading to blocked outlet. Potential overfill of hydrogen vent. Leading to blockage of hydrogen vent & discharge of water from vent. Potential loss of safeguard, and additional consequences to upstream users & vent systems. Clarification: freezing of small bore rundown piping may lead to temporary level build-up. It is not expected to reach high level and block the vent before the line unfreezes again.
Safeguards:	Level 'LY-HH' on hydrogen KO drum vent, leading to system shutdown. 'LIC-H' level alarm on hydrogen KO drum vent Insulation of liquid outlet from KO drum to caisson. Heater H- 43002, 'TIC' for heater & temperature alarm 'High'
Actions:	Review need for winterisation of small bore piping & provide if required.
Assigned Respondent (By)	ROSETTI Process Engineer
RESPONSE	As per EPC HAZOP action n47, the maximum expected quantity of liquid that can be accumulated in the H2 Vent KOD over a period of six months is 0.053 m^3. Therefore, in order to avoid freezing of stagnant water, the bottom side of the KOD has been heat traced, together with the liquid exit line and the small-bore piping on the liquid level instrument, as per PID 123A90-DDL-PR-PID-80029_01, attachment 1.
Attachments:	
Issue Date	28-02-2024

Approvals / Endorsements	
EPC Discipline Lead Ciro Impradice	**Sign** Autore firma digitale: Ciro Impradice Nome distintivo: CN = Ciro Impradice email = ciro.impradice@rosetti.it C = IT O = Rosetti Marino O U = Process Data: 2024.05.15 15:26:35 02'00'
Ciro Impradice	
EPC HSE Lead	**Sign**
C.Caracciolo	CC
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**
	Digitaal ondertekend door Paul van Nossum Datum: 2024.06.24 08:07:47 +02'00'

DRAWING NO. DRAWING_NO.

REV. REV



NOTES

1. VENT TO SAFE LOCATION SEGREGATED FROM OTHER VENTS.
2. VENT TO BE EQUIPPED WITH FLAME ARRESTOR AND BIRD SCREEN.
3. LIQUID SEAL DRUM IS PART OF THE VENT SYSTEM.
4. LIQUID DRAINLINES TO BE ROUTED TO ENSURE GRAVITY DRAIN.
5. HYDROGEN VENT KO DRUM BOOT AND LIQUID SEAL DRUM TO BE HEAT TRACING.
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. LIQUID SEAL DRUM I.D. 590 mm, HEIGHT 2350 mm (T/T). TBC BY H2 VENT VENDOR.
11. INLET DIP LEG SUBMERSION HEIGHT OF 0.2 m (TBC BY VENDOR).
12. FLUID HEIGHT OF 1.5 m FROM BOTTOM T.L. (TBC BY VENDOR).
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 40% VOLUME OF GLYCOLE.
15. TOP OF TIP OF H2 VENT SHALL BE AT AS MINIMUM 6.2 m FROM HIGHEST REACHABLE PLATFORM.

01

HOLDS

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

01

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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. 01

File Name : FILE_NAME

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	47
Cause:	LIC on V- 43001 failure
Consequence:	Potential for pump to run dry & overheat leading to potential fire.
Safeguards:	LIC-L' level alarm on hydrogen KO drum vent, and 'Level Controller' stopping pump. (not valid, part of IE) Level 'LY-LL' on hydrogen KO drum vent, leading to pump shutdown.
Actions:	Review design of pump with respect to possibility of running dry with hydrogen gas.
Assigned Respondent (By)	ROSETTI Mechanical Engineer
RESPONSE	The pump has been removed from the design. The recommendation is superseded.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements

EPC Discipline Lead	**Sign**
F. Mura	
EPC HSE Lead	**Sign**
C. Caracciolo	**CC**
EPC Project Manager	**Sign**
D. Lo Sterzo	
Client	**Sign**
	Digitaal ondertekend door Paul van Possum Datum: 2024.09.03 16:17:02 +02'00'

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	48
Cause:	Low ambient temperature
Consequence:	Freezing of the stagnant water in the pipe or vessel, leading to blocked outlet. Potential overfill of hydrogen vent. Leading to blockage of hydrogen vent & discharge of water from vent. Potential loss of safeguard, and additional consequences to upstream users & vent systems. Clarification: freezing of small bore rundown piping may lead to temporary level build-up. It is not expected to reach high level and block the vent before the line unfreezes again.
Safeguards:	Level 'LY-HH' on hydrogen KO drum vent, leading to system shutdown. 'LIC-H' level alarm on hydrogen KO drum vent Insulation of liquid outlet from KO drum to caisson. Heater H- 43002, 'TIC' for heater & temperature alarm 'High'
Actions:	Review necessity for provision of heater within hydrogen vent V- 43001, when information on potential liquid carry over is available.
Assigned Respondent (By)	ROSETTI Process Engineer
RESPONSE	Necessity for provision of heater within hydrogen vent V-43001 has been investigated. It has been confirmed by the Electrolyser Package Vendor that no water in liquid phase is expected in the Hydrogen vent line coming from the Electrolyser Package; only water in gaseous phase is expected (see TQ No. 13, Doc. No. 123A90-PML-PM-TQ-00013). This means that liquid water could be accumulated in the Hydrogen vent KOD only in case of condensation of such off-spec stream from Elogen system. Such quantity will be accumulated within the boot of H2 Vent KOD, which is heat traced as well as the downstream discharge line (see BLPH Piping And Instrumentation Diagram - Hydrogen Vent Drum, Doc. No. 123A90-DDL-PR-PID-80029). Therefore, there is no need to install any heater inside the Hydrogen Vent KOD.
Attachments:	
Issue Date (28/02/24)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
C. Impradice (Process)	
EPC HSE Lead	**Sign**
C. Caracciolo	
EPC Project Engineering Manager	**Sign**
D. Lo Sterzo	
Client	**Sign**
	Digitaal ondertekend door Paul van Rossum Datum: 2024.03.14 17:04:09 +01'00'

CROSSWIND

ROSETTI MARINO

TECHNICAL QUERY
Hollandse Kust Noord

No. TQ :	123A90-PML-PM-TQ-00013	Rev:	01

Originating Party	Rosetti Marino					
Subject	Vent line					
Author	C. Impradice	TQ Aconex unique number: ROSMA-INN-BPH-TQ-00020				
Interface TQ - from		TQ interface source Aconex unique number:				
Type	Query x			Interface x		
	Deviation			Derogation (SHALL[PS])		
	Note: No deviations nor derogations which have an adverse effect on HSSE will be granted					
Workpackage						
Area(s) of application	Design & Eng.	x	Procurement		Construction	
	Commissioning		Operations		Other	
Issue date	06/09/2023		Urgent reply 5 days	x	Routine reply 10 days	
Close-out date						
Closed-out by			TQ status:		Closed-out	

1. Description

Reference documents / Aconex unique numbers:

Reference is made to P&iD K559-2254-PR-PID-002 "Piping and Instrumentation Diagram Electrolyser Package" :

1) A vent line sent to the Hydrogen Vent KO Drum is shown. Contractor understanding is that this line (2"-VL-003-01HCS) is from an emergency (and/or) a relief system, which are located inside the package. Vendor to confirm ;
2) Vendor to indicate process conditions of this line in terms of: temperature, fluid type, peak mass flow rate (kg/hr);
3) Vendor also to inform RM if this line only contains H2 gas or it can also contain water. If yes Vendor to infor RM about the peak mass flow rate of the liquid phase stream;
4) In general, in order to allow RM di well design the downstream vent system (outside vendor scope), RM needs to receive all discharge scenarious.

2. Response

Reference documents / Aconex unique numbers

Hydrogen vent could be from :

- depressurization of Electrolyser during a normal stop,
- depressurization of Electrolyser during a safety stop,
- analyzed hydrogen to vent (continuous),
- non-compliant hydrogen to vent,

This communication is issued for the recipient's information and to facilitate the obligations of the Parties under the Contract. This communication has no authority to amend or vary the Contract nor relieve either Party of any duties, obligations or responsibilities.

Type	In/Out	Description	Flow (m3/h)	Pressure (Barg)	Temperature (°C)
H2 Vent	Out	Hydrogen	500 Nm3/h	ATM	5-65

No liquid water is expected in Hydrogen vent line.

R01 Rosetti's reply: as per meeting held on 25/10/2023, RM requests stream composition of the H2 vent line. RM understood that the H2 vent stream outgoing from the package is an off-spec stream, therefore a stream with less than 99.9 % of H2. For this reason, RM needs to understand the complete composition of such stream (if more than one scenario is present, RM expects more than one composition will be communicated). Moreover, ELOGEN is requested to indicate if the H2 vent stream outgoing from the package shall be considered as gas-water-saturated stream or not.

ELOGEN Reply:

Elogen confirms that complete composition of H2 vent could be H2, vapor H2O and Nitrogen.
The content and its percentage depends on several details. However, the worst case for vapor H2O content is:

Mass Flowrates	Vapor
H2 [kg/h]	4,50E+01
H2O [kg/h]	3,27E+00

Atmospheric pressure and T=65°C.

For N2 content, it could be from 0 to 100% during venting process.

All the rest scenarios have less vapor water content, for example, non-compliant hydrogen is vented when there is:

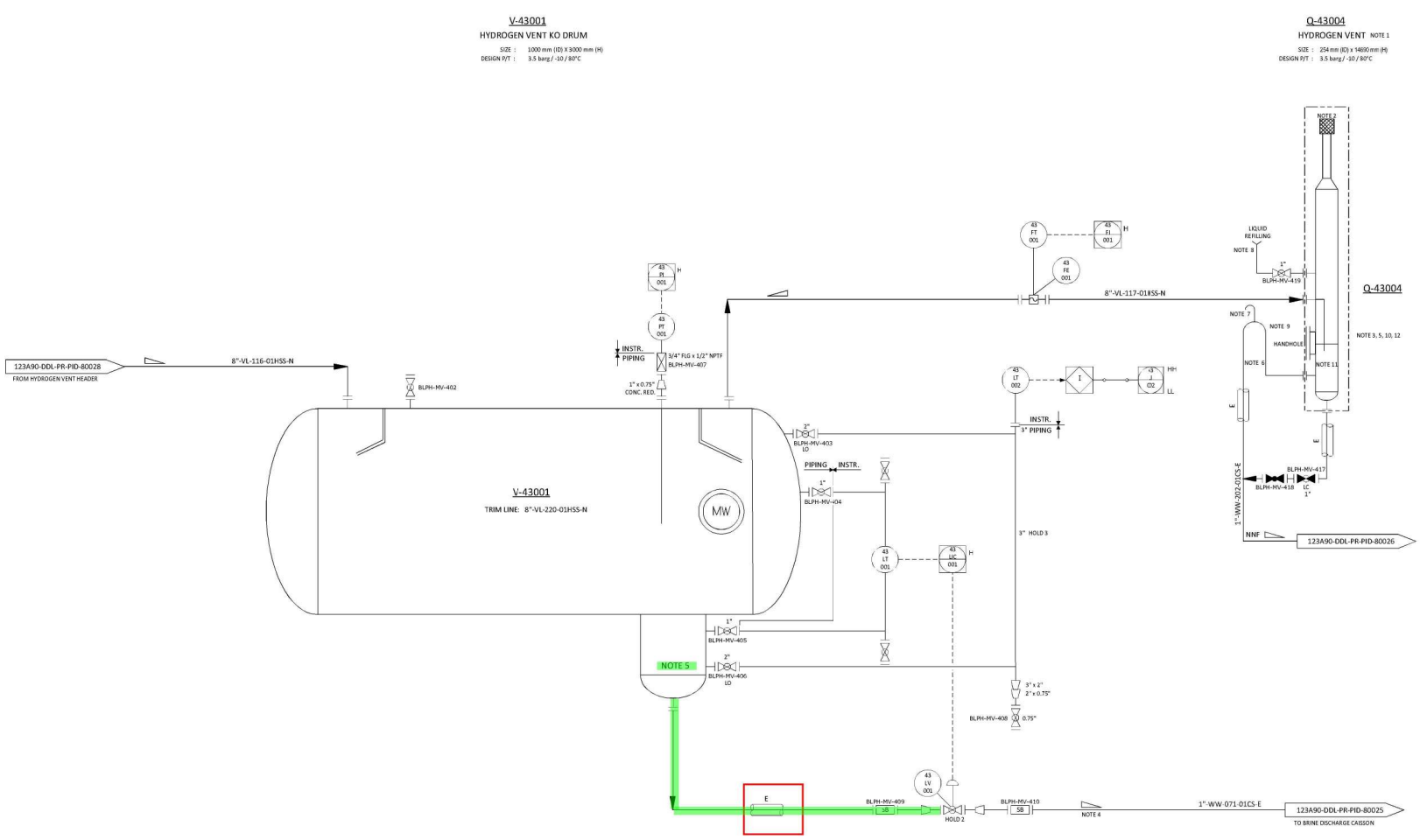
- more than 5 ppm O2 or
- more than 5 ppm N2 or
- more than 5 ppm H2O.

It is confirmed that there is no liquid content, and water is in vapor phase in H2 vent.

This communication is issued for the recipient's information and to facilitate the obligations of the Parties under the Contract. This communication has no authority to amend or vary the Contract nor relieve either Party of any duties, obligations or responsibilities.

DRAWING NO.

REV



NOTES

1. VENT TO SAFE LOCATION SEGREGATED FROM OTHER VENTS.
2. VENT TO BE EQUIPPED WITH FLAME ARRESTOR AND BIRD SCREEN.
3. LIQUID SEAL DRUM IS PART OF THE VENT SYSTEM.
4. LIQUID DRAINLINES TO BE ROUTED TO ENSURE GRAVITY DRAIN.
5. HYDROGEN VENT KO DRUM BOOT AND LIQUID SEAL DRUM TO BE HEAT TRACING.
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 FOR 1.5 m, INSULATED UP TO THE BEND.
10. LIQUID SEAL DRUM I.D. 590 mm, HEIGHT 2350 mm (T/T). TBC BY H2 VENT VENDOR.
11. INLET DIP LEG SUBMERSION HEIGHT OF 0,2 m.
12. FLUID HEIGHT OF 1.5 m FROM BOTTOM T.L.

HOLDS

1. VENT LINES DIAMETER.
2. CONTROL VALVE SIZE (BY VENDOR).
3. TO BE CONFIRMED.

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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. 00

File Name : FILE_NAME

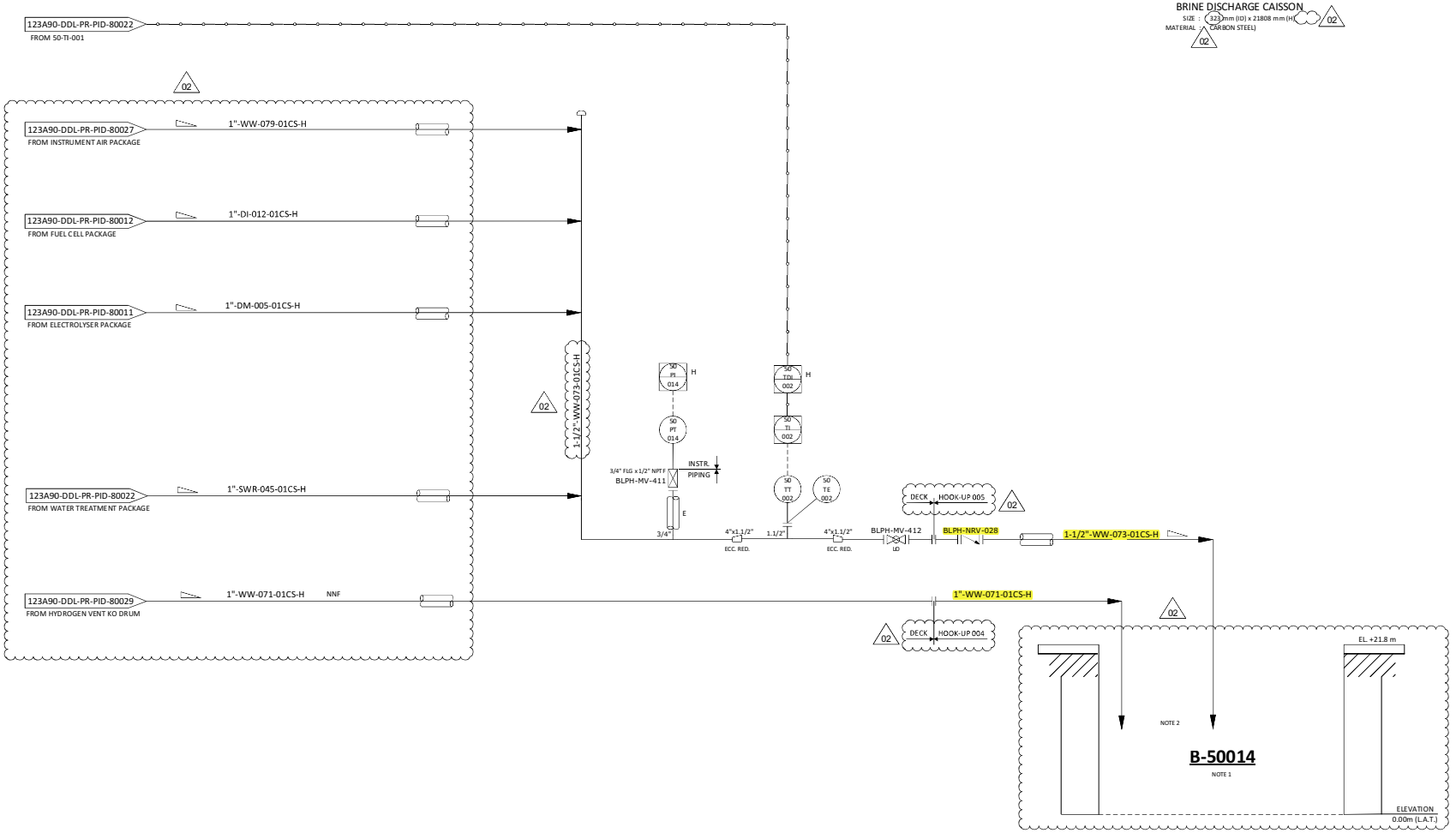
BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	49
Cause:	LIC on V- 43001 failure
Consequence:	7.3.1.2. Potential for oxygen ingress into liquid brine vent system.
Safeguards:	
Actions:	Determine credibility of ingress of oxygen into liquid brine vent system. Leading to potential backflow into other cross connected systems & discharge from vent of brine caisson. If credible provide suitable mitigation.
Assigned Respondent (By)	ROSETTI Process Engineer
RESPONSE	Ingress of oxygen into liquid brine vent system, leading to potential backflow into other cross connected systems & discharge from vent of brine caisson, is not credible since: 1) On the first inlet line 1-1/2"-WW-073-01CS-H there is a check valve BLPH-NRV-028 to prevent backflow (see aattachment1); 2) On the second inlet line 1"-WW-071-01CS-H there is a manual valve always closed to prevent backflow (see attachment 2).
Attachments:	
Issue Date	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
C. Impradice	Ciro Impradice Autore firma digitale: Ciro Impradice Nome distintivo: CN = Ciro Impradice email = ciro.impradice@rosetti.it C = IT O = Rosetti Marino OU = Process Data: 2024.06.28 16:10:54 +02'00'
EPC HSE Lead	**Sign**
C.Caracciolo	CC
EPC Project Manager	**Sign**
D.Lo.Sterzo	
Client	**Sign**
	Digitaal ondertekend door Paul van Rossum Datum: 2024.08.21 08:13:52 +02'00'

DRAWING NO. DRAWING_NO.

REV. REV.



NOTES

1. CAISSON IS OPEN TOPPED.
2. ALL LINES TO TERMINATE APPROXIMATLEY 0.00 mm BELOW SEAWATER LEVEL (LAT)

02

HOLDS

1. DELETED 02

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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

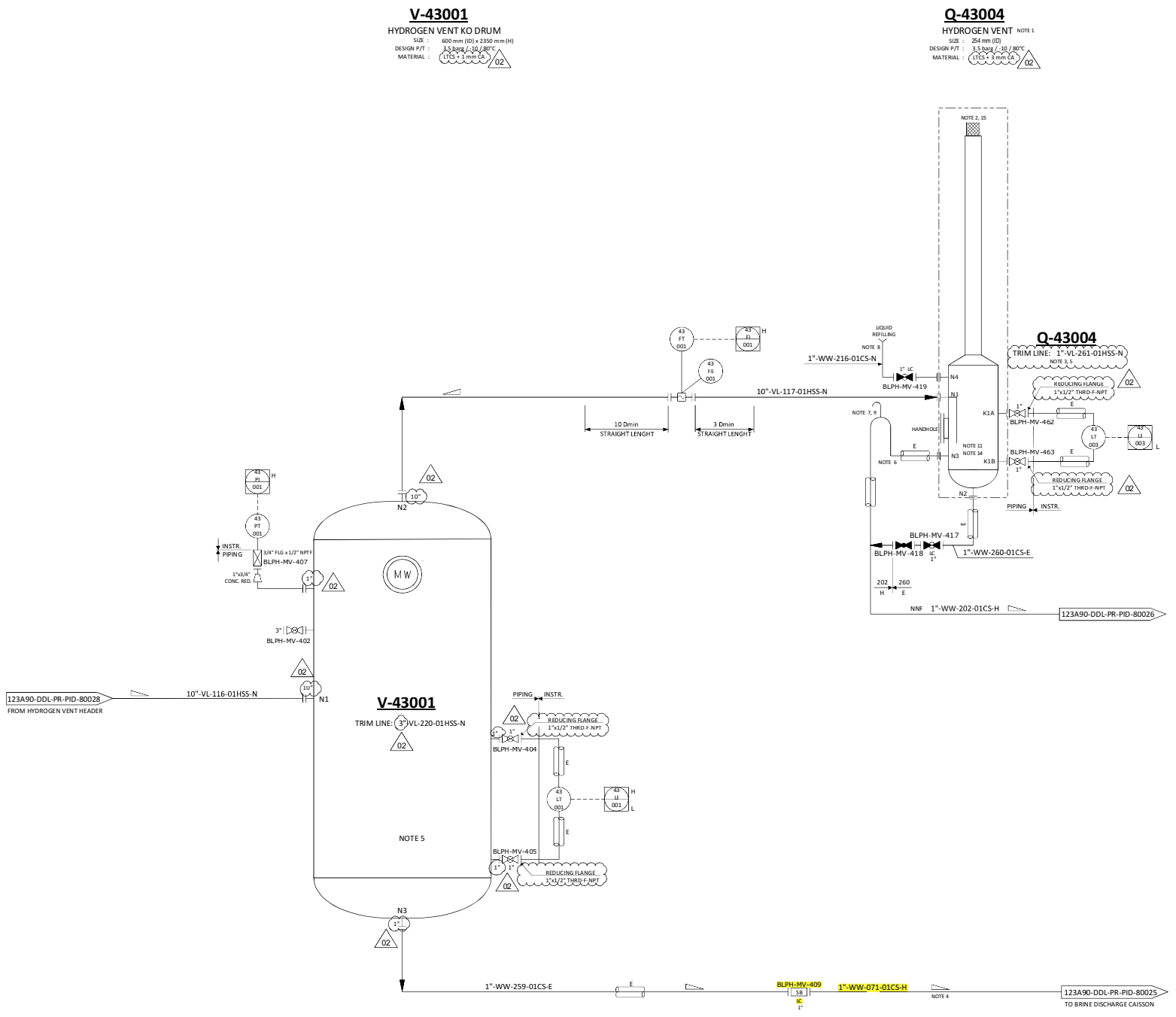
TITLE :
BLPH PIPING AND INSTRUMENTATION DIAGRAM
WATER DISPOSAL SHEET 1

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-80025		SHEET 001 / REV. 02

File Name : FILE_NAME

DRAWING NO. DRAWING_NO.

REV. REV



NOTES

1. VENT TO SAFE LOCATION SEGREGATED FROM OTHER VENTS.
2. VENT TO BE EQUIPPED WITH FLAME ARRESTOR AND 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. 02
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. 02
11. INLET DIP LEG SUBMERSION HEIGHT OR 0.6 m. 02
12. DELETED. 02
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 40% VOLUME OF GLYCOL.
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.

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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 :

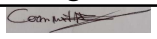
BLPH PIPING AND INSTRUMENTATION DIAGRAM
HYDROGEN VENT DRUM

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. 02

File Name : FILE_NAME

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	50
Cause:	Pump Failure P- 43003
Consequence:	Potential overfill of hydrogen vent. Leading to blockage of hydrogen vent & discharge of water from vent. Potential loss of safeguard, and additional consequences to upstream users & vent systems. Clarification: During a blowdown, the backpressure from V43001 may lead to overpressure of connected low pressure systems (e.g. hydrogen systems rated at 4 barg), leading to a Hydrogen release at grade. Potential for fire / VCE.
Safeguards:	Flow metre downstream of P-43003 with'LL' flow trip. Level 'H' alarm on hydrogen KO drum V- 43001 Level 'LY-HH' on hydrogen KO drum vent, leading to system shutdown.
Actions:	Check with Technical Safety TA2 whether CoP modifier is allowed for this unmanned platform which will be visited for 2 shifts per year.
Assigned Respondent (By)	Rosetti Technical Safety
RESPONSE	P-43003 and associated control loop has been removed. Recommendation is superseded.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
E.Carminati	
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.12.23 14:23:35 +01'00'

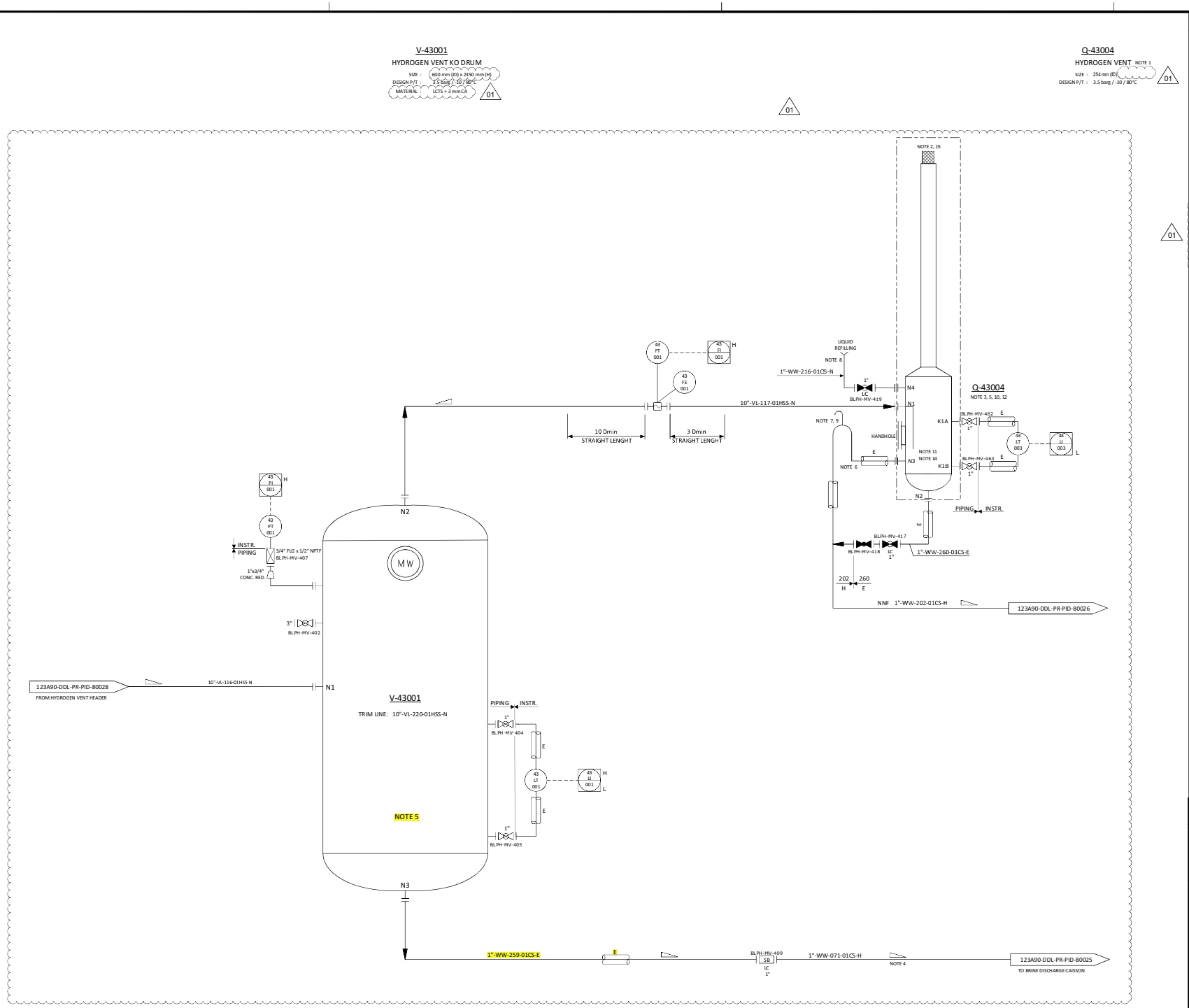
BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	51
Cause:	Low ambient temperature
Consequence:	Freezing of the stagnant water in the pipe or vessel, leading to blocked outlet. Potential overfill of hydrogen vent. Leading to blockage of hydrogen vent & discharge of water from vent. Potential loss of safeguard, and additional consequences to upstream users & vent systems. Clarification: freezing of small bore rundown piping may lead to temporary level build-up. It is not expected to reach high level and block the vent before the line unfreezes again.
Safeguards:	Level 'LY-HH' on hydrogen KO drum vent, leading to system shutdown. 'LIC-H' level alarm on hydrogen KO drum vent Insulation of liquid outlet from KO drum to caisson. Heater H- 43002, 'TIC' for heater & temperature alarm 'High'
Actions:	Review scenario of freezing of small bore rundown piping from V- 43001, which may lead to temporary level build-up. It is not expected to reach high level and block the vent before the line unfreezes again, this assumption should be confirmed. If assumption is incorrect, re- assess the scenario.
Assigned Respondent (By)	ROSETTI Process Engineer
RESPONSE	The assumption that is not expected to reach high level and block the vent before the line unfreezes again is confirmed since it is not credible to have high liquid level inside the KOD (see EPC HAZOP action n44). Moreover, the very small quantity of liquid that can be accumulated over a period of six months will not freeze since the bottom side of the KOD is heat traced (see attachment 1-123A90-DDL-PR-PID-80029). Also, the liquid discharge line from the bottom side of the KOD is heat traced too, therefore up to the first manual valve BLPH-MV-409 (“LC”) liquid freezing is not a credible scenario
Attachments:	
Issue Date	28-02-2024

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
Ciro Impradice	Ciro Impradice Autore firma digitale Nome distintivo: CN = Ciro Impradice email = ciro.impradice@rosetti.it C = IT O = Rosetti Marino S.p.A. Data: 2024.06.06 23:02:07
EPC HSE Lead	**Sign**
C.Caracciolo	CC
EPC Project Manager	Sign
D.Lo Sterzo	
Client	**Sign**
	Digitaal ondertekend door Paul van Rossum Datum: 2024.06.24 08:14:30 +02'00'

DRAWING NO. DRAWING_NO.

REV. REV



NOTES

1. VENT TO SAFE LOCATION SEGREGATED FROM OTHER VENTS.
2. VENT TO BE EQUIPPED WITH FLAME ARRESTOR AND BIRD SCREEN.
3. LIQUID SEAL DRUM IS PART OF THE VENT SYSTEM.
4. LIQUID DRAINLINES TO BE ROUTED TO ENSURE GRAVITY DRAIN.
5. HYDROGEN VENT KO DRUM BOOT AND LIQUID SEAL DRUM TO BE HEAT TRACING.
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. LIQUID SEAL DRUM I.D. 590 mm, HEIGHT 2350 mm (T/T). TBC BY H2 VENT VENDOR.
11. INLET DIP LEG SUBMERSION HEIGHT OF 0.2 m (TBC BY VENDOR).
12. FLUID HEIGHT OF 1.5 m FROM BOTTOM T.L. (TBC BY VENDOR).
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 40% VOLUME OF GLYCOLE.
15. TOP OF TIP OF H2 VENT SHALL BE AT AS MINIMUM 6.2 m FROM HIGHEST REACHABLE PLATFORM.

01

HOLDS

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

01

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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

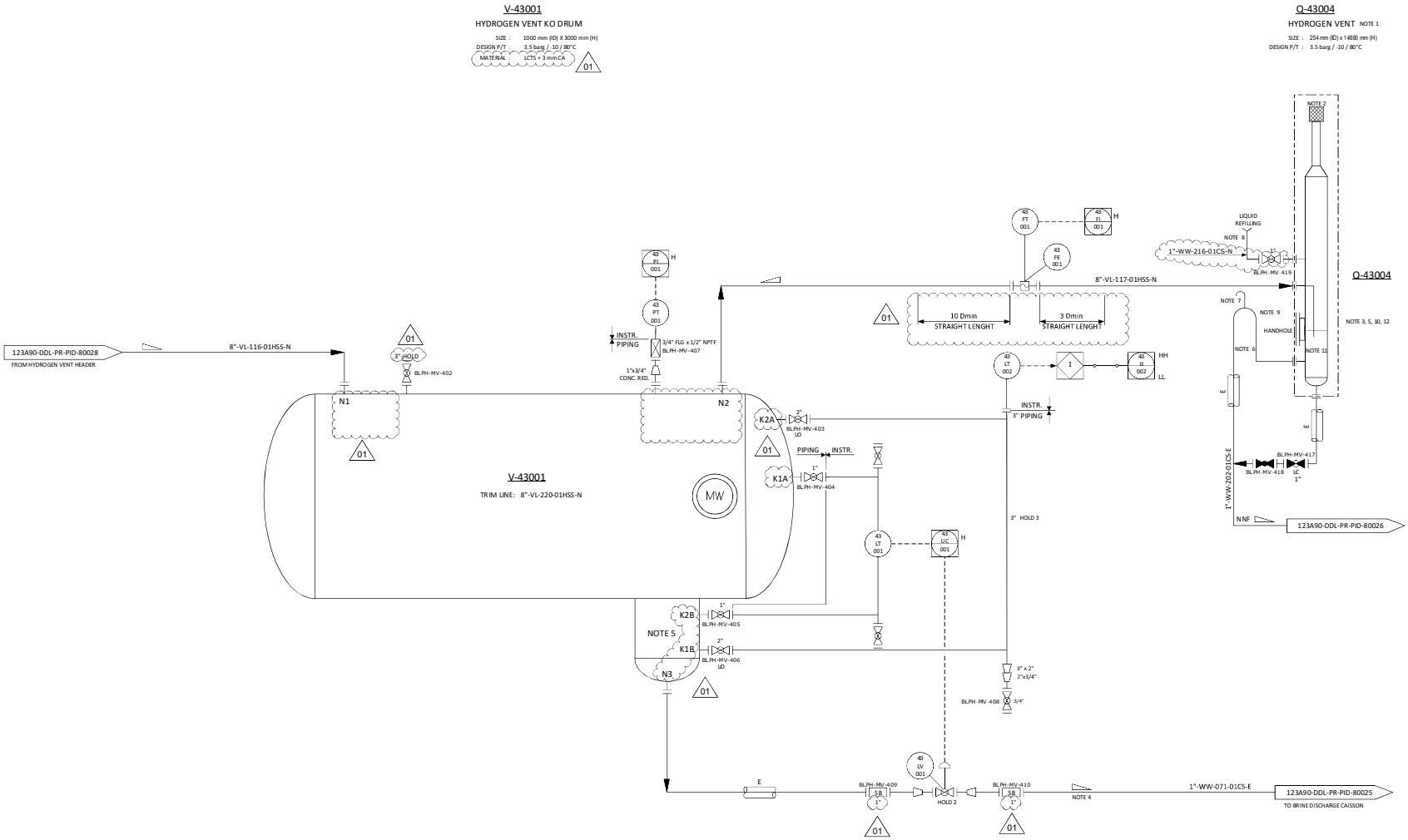
CONTRACT NO./TITLE CW-I-WP4-2023-05/HOLLANDSE KUST NOORD WIND PARK			SCALE NTS
DRAWN	CHECKED	APPROVED	DATE
A1	DRAWING NO. 123A90-DDL-PR-PID-80029		SHEET 001 / REV. 01

File Name : FILE_NAME

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	52
Cause:	Pump Failure P- 43003
Consequence:	Potential overfill of hydrogen vent. Leading to blockage of hydrogen vent & discharge of water from vent. Potential loss of safeguard, and additional consequences to upstream users & vent systems. Clarification: During a blowdown, the backpressure from V43001 may lead to overpressure of connected low pressure systems (e.g. hydrogen systems rated at 4 barg), leading to a Hydrogen release at grade. Potential for fire / VCE.
Safeguards:	Flow metre downstream of P-43003 with'LL' flow trip. Level 'H' alarm on hydrogen KO drum V- 43001 Level 'LY-HH' on hydrogen KO drum vent, leading to system shutdown.
Actions:	Ensure Level 'LY- HH' on hydrogen KO drum vent achieves a RRF of 120.
Assigned Respondent (By)	ROSETTI Technical Safety Engineer
RESPONSE	Pump 43003, as per PID 123A90-DDL-PR-PID-80029, is not more part of the design, so the action is not more valid.
Attachments:	PID 123A90-DDL-PR-PID-80029
Issue Date	03-05-24

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
Carolina Caracciolo	**CC**
EPC HSE Lead	**Sign**
Carolina Caracciolo	
EPC Project Manager	**Sign**
Davide Lo Sterzo	
Client	**Sign**
	Digitaal ondertekend door Paul van Rossum Datum: 2024.05.10 12:36:29 +02'00'



NOTES

1. VENT TO SAFE LOCATION SEGREGATED FROM OTHER VENTS.
2. VENT TO BE EQUIPPED WITH FLAME ARRESTOR AND BIRD SCREEN.
3. LIQUID SEAL DRUM IS PART OF THE VENT SYSTEM.
4. LIQUID DRAINLINES TO BE ROUTED TO ENSURE GRAVITY DRAIN.
5. HYDROGEN VENT KO DRUM BOOT AND LIQUID SEAL DRUM TO BE HEAT TRACING.
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 FOR 1.5 m, INSULATED UP TO THE BEND.
10. LIQUID SEAL DRUM I.D. 590 mm, HEIGHT 2350 mm (T/T). TBC BY H2 VENT VENDOR.
11. INLET DIP LEG SUBMERSION HEIGHT OF 0.2 m.
12. FLUID HEIGHT OF 1.5 m FROM BOTTOM T.L.
13. FOR DESCRIPTION AND SPECIFICATION OF VESSEL NOZZLE, REFERENCE SHALL BE MADE TO THE TECHNICAL DATA SHEET FOR H2 VENT KOD.

01

HOLDS

1. VENT LINES DIAMETER.
2. CONTROL VALVE SIZE (BY VENDOR).
3. STAND PIPE DIAMETER TO BE CONFIRMED. 01

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
01	24/11/2023	CIM	RZI	DLO	ISSUE FOR HAZOP (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. 01

DRAWING NO. DRAWING_NO.

REV. REV

File Name : FILE_NAME

BLPH SHEAMS SIGNATURE FORM

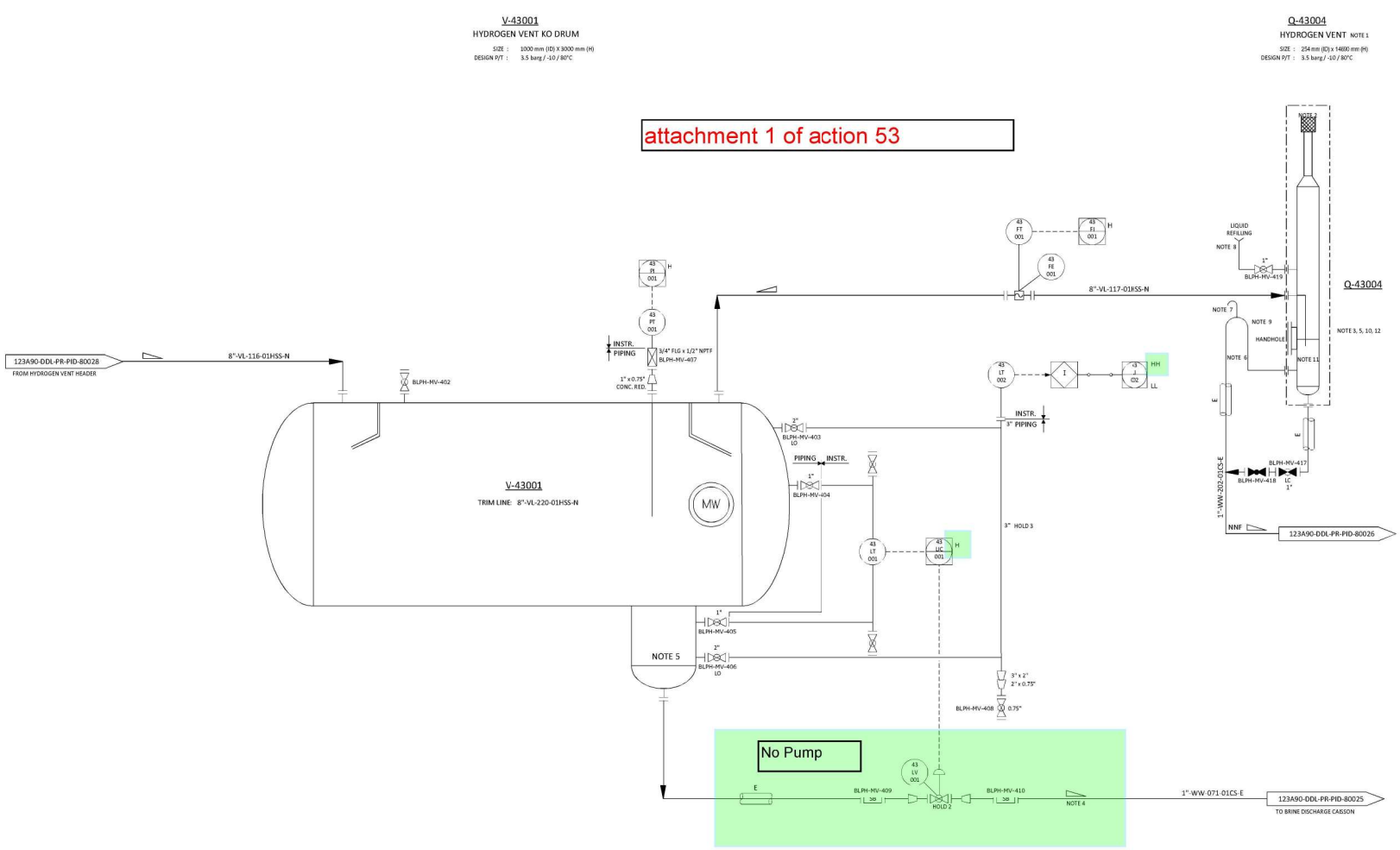
Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	53
Cause:	Pump Failure P- 43003
Consequence:	Potential overfill of hydrogen vent. Leading to blockage of hydrogen vent & discharge of water from vent. Potential loss of safeguard, and additional consequences to upstream users & vent systems.
Safeguards:	Flow metre downstream of P- 43003 with'LL' flow trip. Level 'H' alarm on hydrogen KO drum V- 43001 Level 'LY-HH' on hydrogen KO drum vent, leading to system shutdown.
Actions:	Assess the requirement for flow meter downstream P- 43003 with'LL' flow trip and evaluate if this needs to be DCS or SIS.
Assigned Respondent (By)	ROSETTI Process Engineer
RESPONSE	The scenario of pump failure has been superseded since pump downstream the H2 Vent KOD has been deleted on the last revision of the FEED P&iD. This is also confirmed by the EPC P&iD “123A90-DDL-PR-PID-80029”.
Attachments:	
Issue Date (19-01-24)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
Ciro Impradice (Process)	
EPC HSE Lead	**Sign**
Carolina Caracciolo	CC
EPC Project Engineering Manager	**Sign**
Davide Lo Sterzo	
Client	**Sign**
	Digitaal ondertekend door [illegible] Datum: 2024.08.21 08:14:37 +02'00'

DRAWING NO. DRAWING_NO.

REV REV

attachment 1 of action 53



NOTES

1. VENT TO SAFE LOCATION SEGREGATED FROM OTHER VENTS.
2. VENT TO BE EQUIPPED WITH FLAME ARRESTOR AND BIRD SCREEN.
3. LIQUID SEAL DRUM IS PART OF THE VENT SYSTEM.
4. LIQUID DRAINLINES TO BE ROUTED TO ENSURE GRAVITY DRAIN.
5. HYDROGEN VENT KO DRUM BOOT AND LIQUID SEAL DRUM TO BE HEAT TRACING.
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 FOR 1.5 m, INSULATED UP TO THE BEND.
10. LIQUID SEAL DRUM I.D. 590 mm, HEIGHT 2350 mm (T/T). TBC BY H2 VENT VENDOR.
11. INLET DIP LEG SUBMERSION HEIGHT OF 0,2 m.
12. FLUID HEIGHT OF 1.5 m FROM BOTTOM T.L.

HOLDS

1. VENT LINES DIAMETER.
2. CONTROL VALVE SIZE (BY VENDOR).
3. TO BE CONFIRMED.

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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. 00

File Name : FILE_NAME

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	54
Cause:	No significant consequence.
Consequence:	
Safeguards:	
Actions:	Review duringelectrolyser vendor package HAZOP
Assigned Respondent (By)	CROSSWIND
RESPONSE	Electrolyser HAZOP has been done on the 4th of December, 2023.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
Company Discipline Lead	**Sign**
	Hamant Patel
Company HSE Lead	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum
Company Project Manager	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.09.24 09:20:34 +02'00'
Contractor received for information. Not independently verified. Information implemented	

BLPH SHEAMS SIGNATURE FORM

Action Title: **Action No:** **Ref. Doc.**	**HAZOP Study Actions** 55 K559-2254-SE-REP-015
Item No.	55
Cause:	Potential for materials unsuitable for oxygen service to be present within system.
Consequence:	Potential combustion of material reactive with oxygen, leading to LOC & risk to personnel & asset.
Safeguards:	
Actions:	Ensure all materials are suitable for oxygen service, during construction, commissioning & operations.
Assigned Respondent (By)	ROSETTI Project Management
RESPONSE	Oxygen is present during construction, only in welding operations, but in this time no Hydrogen will be present on platform therefore no potetiality of combustion is present. During commissioning no welding activities will be performedin case of presence of Hydrogen. During operations, no oxigen is present as per Process design and Oxygen drum has been removed.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
Davide Lo Sterzo	
EPC HSE Lead	**Sign**
C.Caracciolo	CC
EPC Project Manager	**Sign**
Davide Lo Sterzo	
Client	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.09.12 17:35:33 +02'00'

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	56
Cause:	LIC on V- 44001 failure
Consequence:	Potential for pump to run dry & overheat leading to potential fire.
Safeguards:	LIC-L' level alarm on oxygen KO drum vent, and 'Level Controller' stopping pump. Not valid, part of IE Level 'LY-LL' on oxygen KO drum vent, leading to pump shutdown.
Actions:	Review design of pump with respect to possibility of running dry with oxygen gas.
Assigned Respondent (By)	Rosetti Mechanical Engineer
RESPONSE	KO drum has been removed. Recommendation is superseded
Attachments:	
Issue Date (28/02/24)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
F. Mura	
EPC HSE Lead	**Sign**
C. Caracciolo	
EPC Project Engineering Manager	**Sign**
D. Lo Sterzo	
Client	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.09.13 11:24:57 +02'00'

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	56
Cause:	P-50001A failure
Consequence:	Loss of feed to fresh water tank, leading to potential loss of level, leading to potential damage to pump P-50009A.
Safeguards:	Low' Pressure alarm on discharge of P 50009A. Low level alarm on fresh water tank, T 50008. 'LL' trip on fresh water tank , T-50008.
Actions:	Based on LOPA assessment, there is currently no requirement for 'LL' trip on fresh water tank , T-50008 to protect P50009A/B, hence this can be redesigned as a DCS based switch. Note that based on packages HAZOPs there might be a LOPA requirement for a SIL rated safeguard, refer to recommen 49 and 50
Assigned Respondent (By)	ROSETTI Technical Safety
RESPONSE	Agreed, please note attached extract from System functional description (1724000448-MAC-SP-00003) and 1724000448-PR-PID-00013
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
E.Carminati	**CC**
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**

Digitaal ondertekend door Paul van Rossum
Datum: 2024.08.21 08:15:04 +02'00'

4.3.2 Description of the process operation

The level in the Fresh Water Tank T-50008 in measured by level transmitter 50-LT-021. An alarm is activated in case of high and low level, 50-LAH-021 and 50-LAL-021.

The pressure downstream the Fresh Water Pumps P-50009A/B is measured by pressure transmitter 50-PT-047. An alarm is activated in case of high or low pressure, 50-PAH-047, 50-PAL-047.

DRAWING NO. 1724000448-PR-PID-00013

REV. 02

MANUAL VALVES

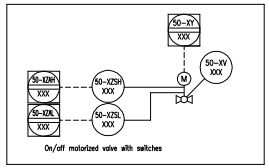
	GATE VALVE
	BALL VALVE
	CHECK VALVE
	NEEDLE VALVE
	"Y" TYPE FILTER
	DIAPHRAGM VALVE
	AUTOMATIC AIR VENT VALVE

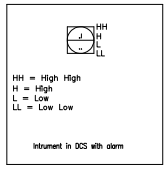
OPERATED VALVES

M	MOTORIZED ACTUATOR ON-OFF BALL VALVE
	PRESSURE SAFETY VALVE

OTHER SYMBOLS

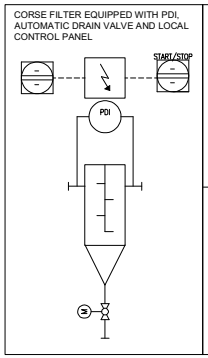
	Local instrument
J	Instrument in DCS
	Interlock in DCS
	Software signal
	Electric signal

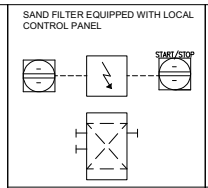


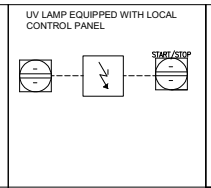


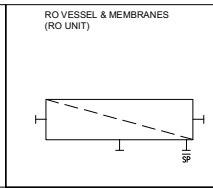
INSTRUMENTS IDENTIFICATION – REFER TO ISA S5.1 FOR DETAILS

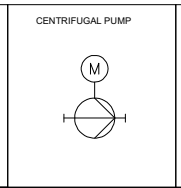
Letter	FIRST LETTER	LETTERS FOLLOW		
	Measure or process variable	Modification	Letter or passive function	Output function
A	Analysis		Alarm	
B	Flame detection		Optional user	Optional user
C	Conductivity	Control		Regulation
D	Density	Differential		
E	Electrical voltage	Element	Primary el.	
F	Flow	Relationship		
G	Choice user			
H	Manual override			
I	Electricity		Indication	
J	Power	Scansion		
K	Time schedule or time	Rate of change		
L	Level		Light	
M	Choice user	Momentary or instant.		
N	Choice user		Optional user	Optional user
O	Choice user		Orifice or restriction	
P	Pressure		Handheld	
Q	Quantity	Full or score.		
R	Radioactivity		Registration	
S	Speed or frequency	Security		Interruption
T	Temperature	Transmitter		Transmission
U	General alarm			Multifunction
V	Vibration or mechanical analysis	Valve	Valve	
W	Weight or force		Well or sheath	
X	Variable unclassified	X axis	Not rated	Not rated
Y	State or event	Y axis		Computing module
Z	Position or size	Z axis		

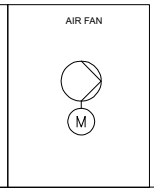


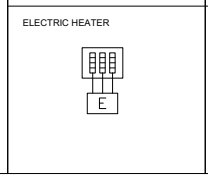


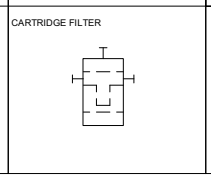


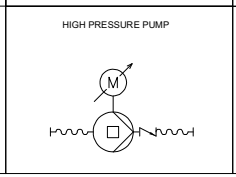


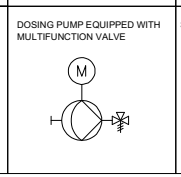


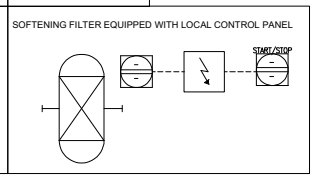












PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
02	22-AUG-24	UR	WR	RM	ISSUED FOR REVIEW
01	29-MAY-24	GG	WR	RM	ISSUED FOR REVIEW
00	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

ROSETTI MARINO

TITLE :
WATER TREATMENT PACKAGE
SEA WATER FINE FILTRATION
P&I DIAGRAM

CONTRACT NO./TITLE | SCALE –

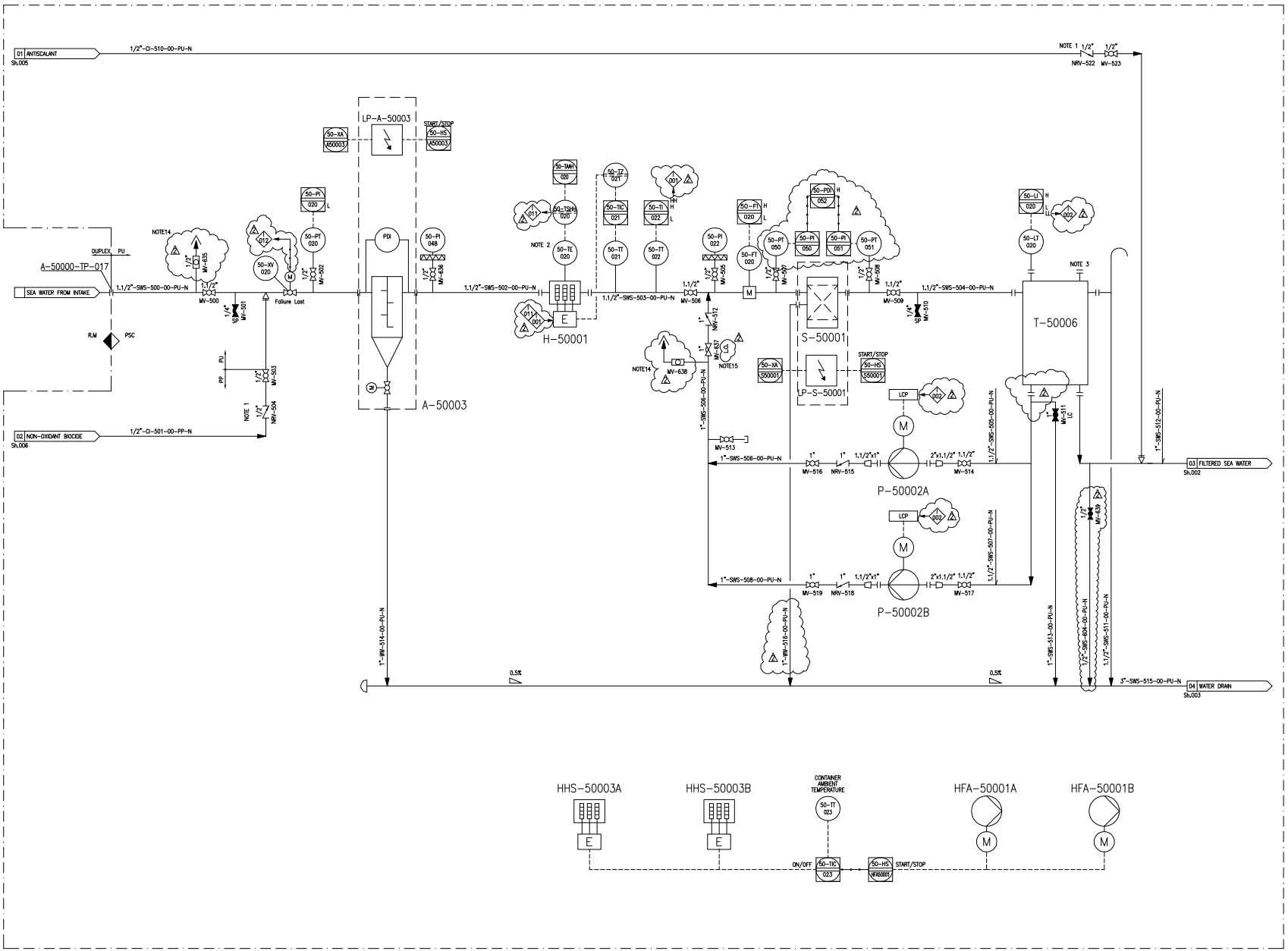
DRAWN UR | CHECKED WR | APPROVED RM | DATE 22/08/24

A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 001 | REV. 02

File Name : 1724000448-PR-PID-00013 Rev02

DRAWING NO. 1724000448-PR-PID-00013

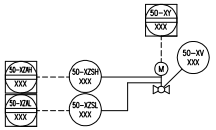
REV. 2



TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-002	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-003	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-005	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTAKE
TP-006	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-007	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

TYPICAL FOR ON/OFF BALL VALVES



NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: BLPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOUS BIOCIDE DOSAGE TO INTAKE PUMP: CONTINUOUS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOUS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE
14	AUTOMATIC AIR VENT VALVE
15	POSITION TO BE DEFINED DURING COMMISSIONING
16	POLYAMIDE TUBING (RILSAN TYPE)
17	CHECK VALVE (NO SPRING TYPE)
18	DRAIN PAN FOR ANALYZER. DRAIN PAN VOLUME= 5 L

A-50003	
SEA WATER COARSE FILTER	
FILTRATION RATE	125 µm
CAPACITY	2.5 m3/h
DES. PRESS.	5 barg
DES. TEMP.	50° C
MATERIAL	PLASTIC MAT.

H-50001	
ELECTRIC HEATER	
POWER	30 kW
CAPACITY	2.5 m3/h
DES. PRESS.	6 barg
DES. TEMP.	60° C
MATERIAL	PVC-TITANIUM

S-50001	
SAND FILTER	
TYPE	PRESSURE,VERTICAL
CAPACITY	2.5 m3/h
DES. PRESS.	7 barg
DES. TEMP.	50° C
MATERIAL	FRP

T-50006	
FILTERED WATER TANK	
VOLUME	3 m3
DES. PRESS.	ATM
DES. TEMP.	50° C
MATERIAL	FRP

P-50002A/B	
BACKWASH PUMP	
TYPE	CENTRIFUGAL
DES. PRESSURE	6 barg
CAPACITY	5 m3/h
HEAD	0,50 barg
DES. TEMP.	60 °C
MATERIAL	PP

HHS-50003A/B	
CONTAINER ELECTRICAL HEATER	
POWER	8.4 kW
DES. PRESS.	ATM
DES. TEMP.	65°C

HFA-50001A/B	
CONTAINER AIR FAN	
POWER	110 W
DES. PRESS.	ATM
DES. TEMP.	60°C

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
02	22-AUG-24	UR	WR	RM	ISSUED FOR REVIEW
01	29-MAY-24	GG	WR	RM	ISSUED FOR REVIEW
00	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

ROSETTI MARINO

TITLE : WATER TREATMENT PACKAGE
SEA WATER FINE FILTRATION
P&I DIAGRAM

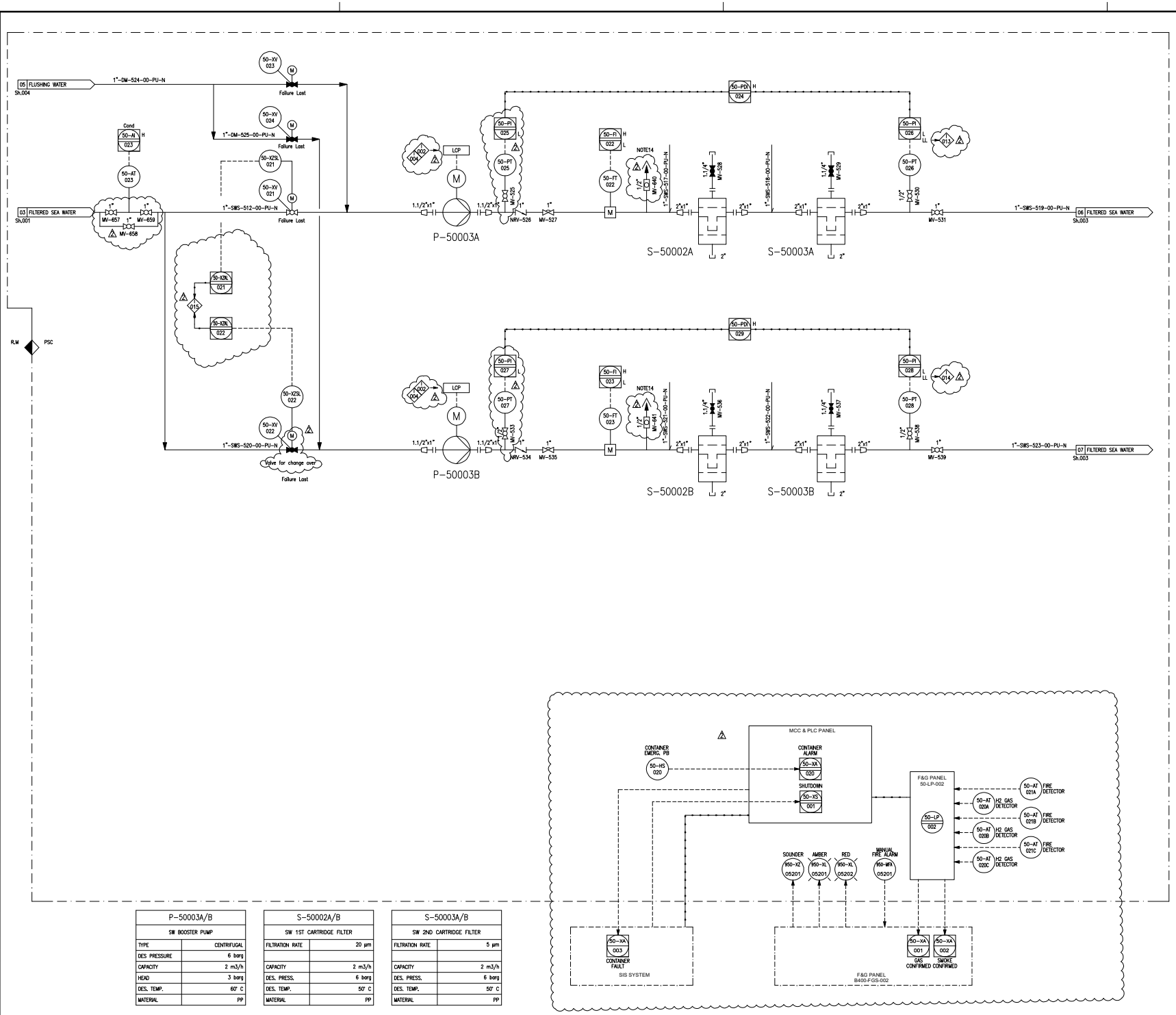
CONTRACT NO./TITLE | SCALE –

DRAWN UR | CHECKED WR | APPROVED RM | DATE 22/08/24

A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 002 | REV. 02

File Name : 1724000448-PR-PID-00013 Rev02

DRAWING NO. 1724000448-PR-PID-00013 | REV. 2



P-50003A/B	
SW BOOSTER PUMP	
TYPE	CENTRIFUGAL
DES PRESSURE	6 barg
CAPACITY	2 m3/h
HEAD	3 barg
DES. TEMP.	60° C
MATERIAL	PP

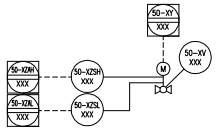
S-50002A/B	
SW 1ST CARTRIDGE FILTER	
FILTRATION RATE	20 µm
CAPACITY	2 m3/h
DES. PRESS.	6 barg
DES. TEMP.	50° C
MATERIAL	PP

S-50003A/B	
SW 2ND CARTRIDGE FILTER	
FILTRATION RATE	5 µm
CAPACITY	2 m3/h
DES. PRESS.	6 barg
DES. TEMP.	50° C
MATERIAL	PP

TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-002	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-003	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-005	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTAKE
TP-006	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-007	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

TYPICAL FOR ON/OFF BALL VALVES



NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: BLPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOUS BIOCIDE DOSAGE TO INTAKE PUMP: DISCONTINUOUS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOUS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE
14	AUTOMATIC AIR VENT VALVE
15	POSITION TO BE DEFINED DURING COMMISSIONING
16	POLYAMIDE TUBING (RILSAN TYPE)
17	CHECK VALVE (NO SPRING TYPE)
18	DRAIN PAN FOR ANALYZER. DRAIN PAN VOLUME= 5 L

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
02	22-AUG-24	UR	WR	RM	ISSUED FOR REVIEW
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00	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

ROSETTI MARINO

TITLE : WATER TREATMENT PACKAGE
SEA WATER FINE FILTRATION
P&I DIAGRAM

CONTRACT NO./TITLE | SCALE –

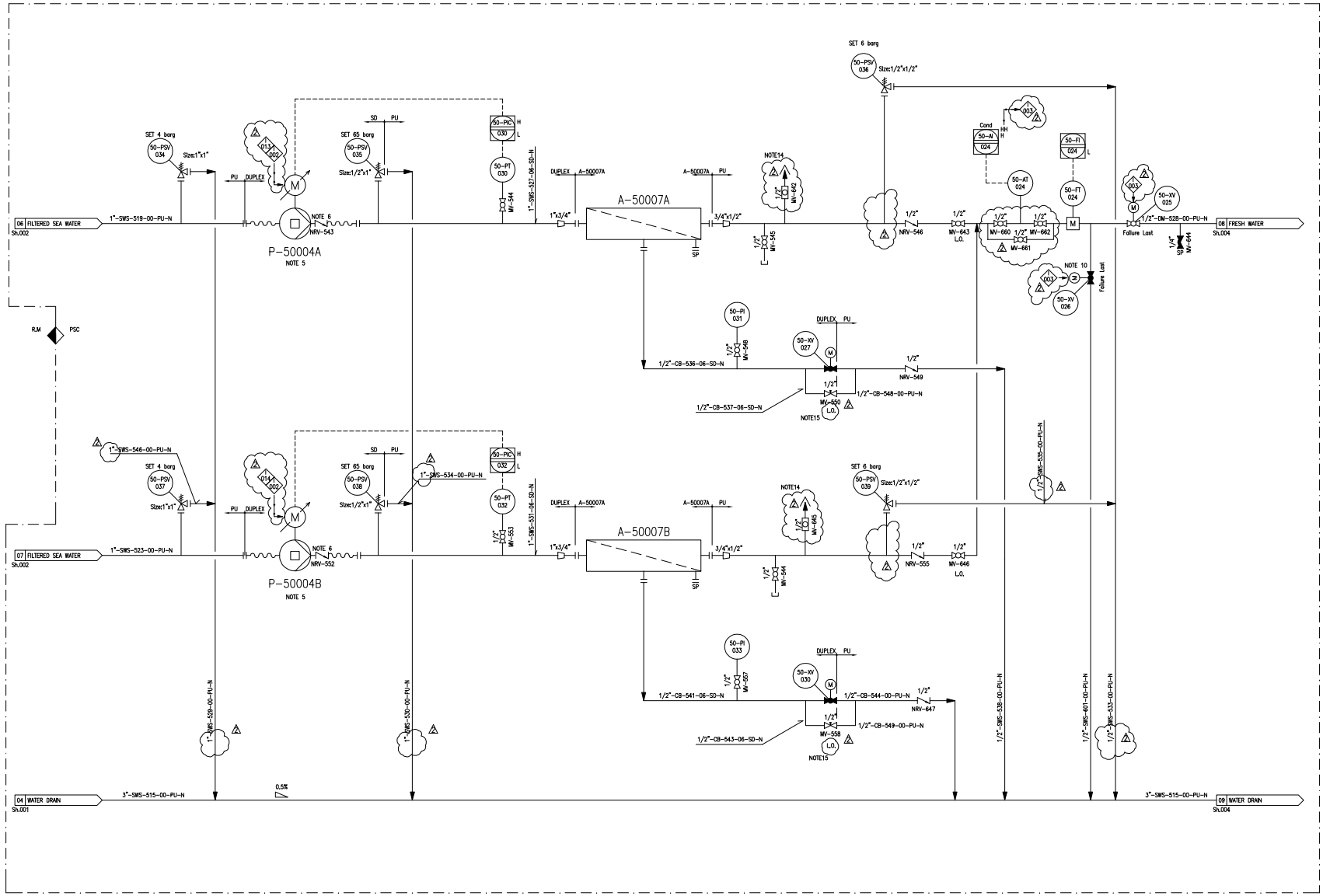
DRAWN UR | CHECKED WR | APPROVED RM | DATE 22/08/24

A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 003 | REV. 02

File Name : 1724000448-PR-PID-00013 Rev02

DRAWING NO. 1724000448-PR-PID-00013

REV. 2



TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-002	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-003	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-005	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTAKE
TP-006	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-007	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: BLPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOUS BIOCIDE DOSAGE TO INTAKE PUMP: DISCONTINUOUS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOUS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE
14	AUTOMATIC AIR VENT VALVE
15	POSITION TO BE DEFINED DURING COMMISSIONING
16	POLYAMIDE TUBING (RILSAN TYPE)
17	CHECK VALVE (NO SPRING TYPE)
18	DRAIN PAN FOR ANALYZER. DRAIN PAN VOLUME= 5 L

P-50004A/B	
HP PUMP	
TYPE	AXIAL ROTATING PISTONS
DES PRESSURE	83 barg
CAPACITY	2 m3/h
HEAD	63,5 barg
DES. TEMP.	50° C
MATERIAL	SS DUPLEX

A-50007A/B	
SEA WATER REVERSE OSMOSIS UNITS	
CAPACITY	0.8 m3/h
DES. PRESS.	69 barg
DES. TEMP.	45° C
MATERIAL	FRP

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
02	22-AUG-24	UR	WR	RM	ISSUED FOR REVIEW
01	29-MAY-24	GG	WR	RM	ISSUED FOR REVIEW
00	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

ROSETTI MARINO

TITLE : WATER TREATMENT PACKAGE
SEA WATER REVERSE OSMOSIS
P&I DIAGRAM

CONTRACT NO./TITLE | SCALE -

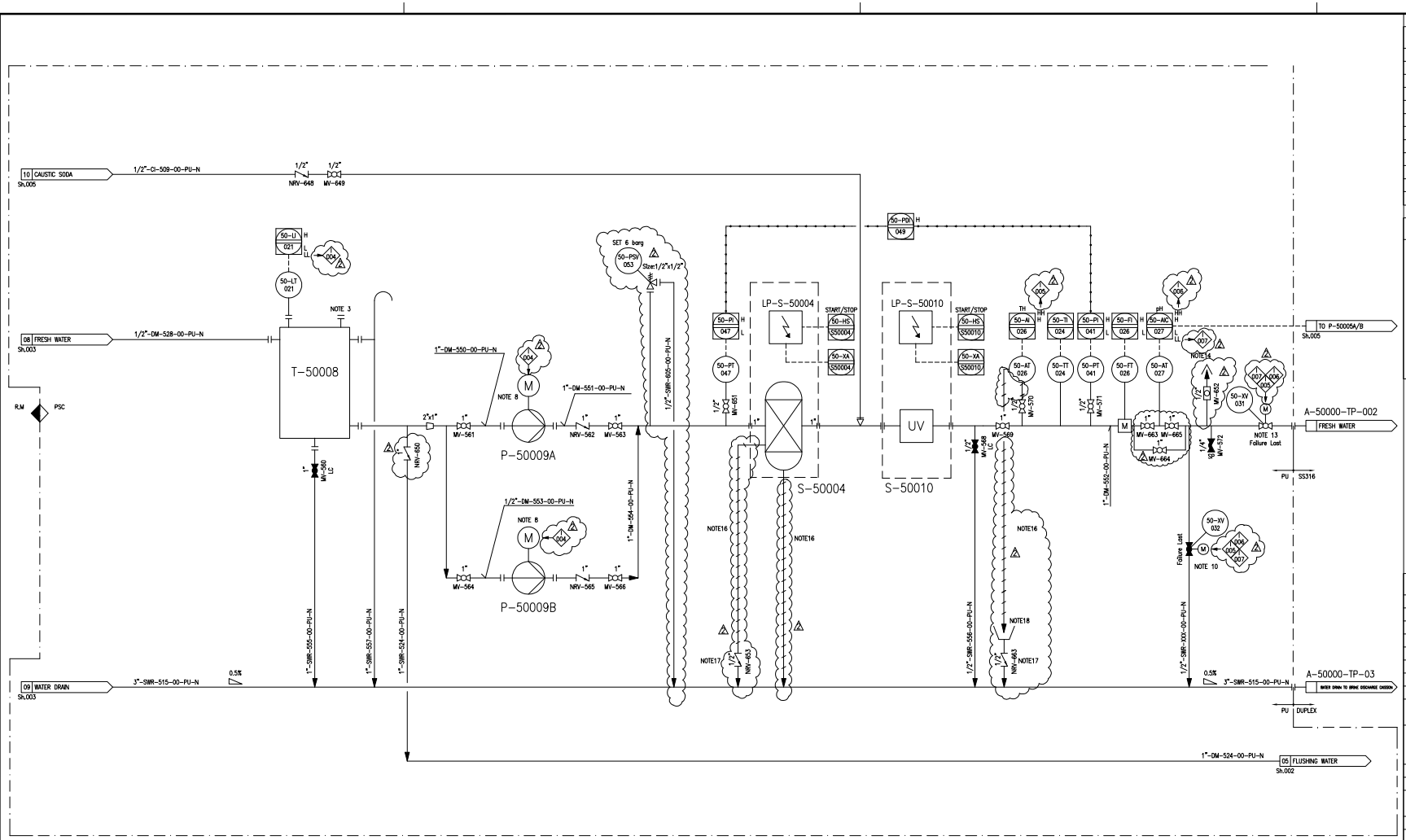
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A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 004 | REV. 02

File Name : 1724000448-PR-PID-00013 Rev02

DRAWING NO. 1724000448-PR-PID-00013

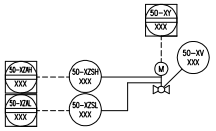
REV. 2



TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-002	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-003	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-005	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTAKE
TP-006	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-007	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

TYPICAL FOR ON/OFF BALL VALVES



NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: BLPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOUS BIOCIDE DOSAGE TO INTAKE PUMP: DISCONTINUOUS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOUS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE
14	AUTOMATIC AIR VENT VALVE
15	POSITION TO BE DEFINED DURING COMMISSIONING
16	POLYAMIDE TUBING (RILSAN TYPE)
17	CHECK VALVE (NO SPRING TYPE)
18	DRAIN PAN FOR ANALYZER. DRAIN PAN VOLUME= 5 L

T-50008	
FRESH WATER TANK	
VOLUME	2.2 m3
DES. PRESS.	ATM
DES. TEMP.	50° C
MATERIAL	FRP

P-50009A/B	
FRESH WATER PUMP	
TYPE	CENTRIFUGAL
DES PRESSURE	25 barg
CAPACITY	0.8 m3/h
HEAD NOTE 11	4.2 barg
DES. TEMP.	120° C
MATERIAL	SS 316L

S-50010	
UV STERILIZER	
CAPACITY	0,8 m3/h
DES. PRESS.	8 barg
DES. TEMP.	50° C
MATERIAL	SS 316

S-50004	
SOFTENING FILTER	
CAPACITY	0,8 m3/h
DES. PRESS.	6 barg
DES. TEMP.	40° C
MATERIAL	FRP-PLASTIC

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
02	22-AUG-24	UR	WR	RM	ISSUED FOR REVIEW
01	29-MAY-24	GG	WR	RM	ISSUED FOR REVIEW
00	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

ROSETTI MARINO

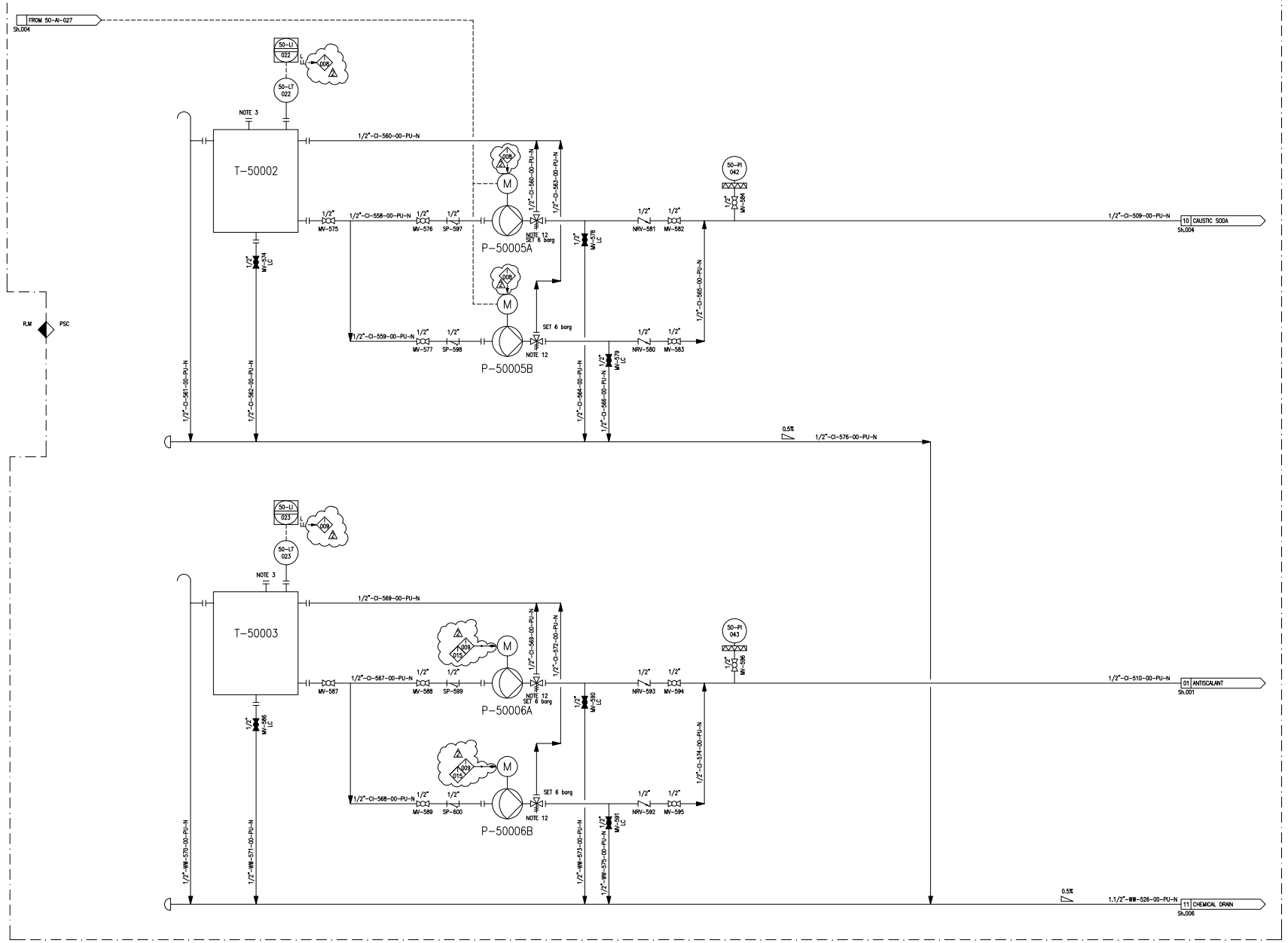
TITLE :
WATER TREATMENT PACKAGE
FRESH WATER STORAGE
P&I DIAGRAM

CONTRACT NO./TITLE | SCALE –

DRAWN UR | CHECKED WR | APPROVED RM | DATE 22/08/24

A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 005 | REV. 02

File Name : 1724000448-PR-PID-00013 Rev02



T-50002	
CAUSTIC SODA DOSING TANK	
VOLUME	0,05 m3
DES. PRESS.	ATM
DES. TEMP.	45° C
MATERIAL	PE

P-50005A/B	
CAUSTIC SODA DOSING PUMP	
TYPE	METERING DIAPHRAGM
DES PRESSURE	10 barg
CAPACITY	0,05 l/h
HEAD	3 barg
DES. TEMP.	45° C
MATERIAL	PVC

T-50003	
ANTISCALANT DOSING TANK	
VOLUME	0,05 m3
DES. PRESS.	ATM
DES. TEMP.	45° C
MATERIAL	PE

P-50006A/B	
ANTISCALANT DOSING PUMP	
TYPE	METERING DIAPHRAGM
DES PRESSURE	10 barg
CAPACITY	0.01 l/h
HEAD	3 barg
DES. TEMP.	45° C
MATERIAL	PVC

TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-002	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-003	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-005	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTAKE
TP-006	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-007	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: BLPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOUS BIOCIDE DOSAGE TO INTAKE PUMP: DISCONTINUOUS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOUS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE
14	AUTOMATIC AIR VENT VALVE
15	POSITION TO BE DEFINED DURING COMMISSIONING
16	POLYAMIDE TUBING (RILSAN TYPE)
17	CHECK VALVE (NO SPRING TYPE)
18	DRAIN PAN FOR ANALYZER. DRAIN PAN VOLUME= 5 L

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
02	22-AUG-24	UR	WR	RM	ISSUED FOR REVIEW
01	29-MAY-24	GG	WR	RM	ISSUED FOR REVIEW
00	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

ROSETTI MARINO

TITLE :
WATER TREATMENT PACKAGE
ACID & ANTISCALANT DOSAGES
P&I DIAGRAM

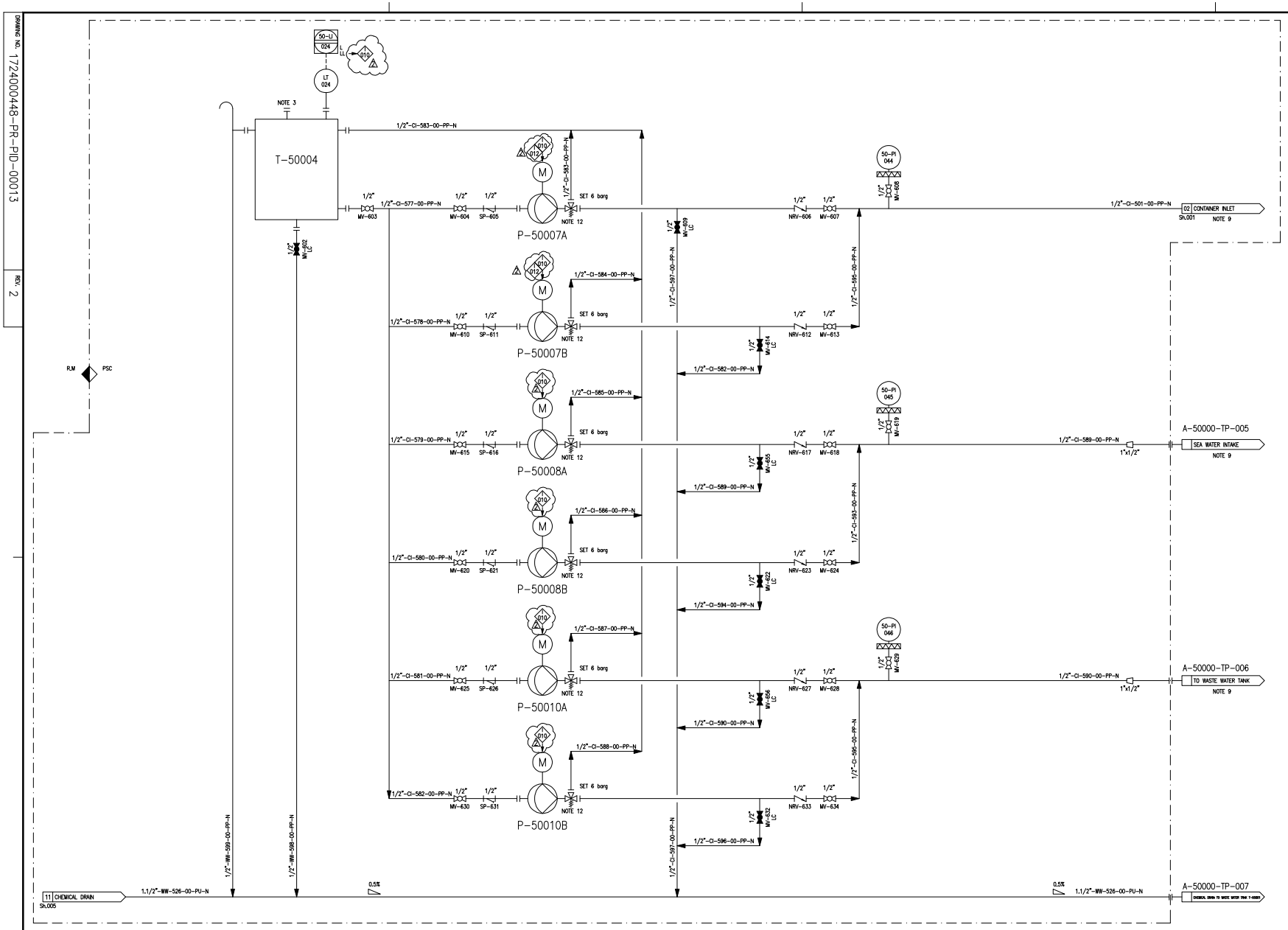
CONTRACT NO./TITLE | SCALE –

DRAWN UR | CHECKED WR | APPROVED RM | DATE 22/08/24

A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 006 | REV. 02

DRAWING NO. 1724000448-PR-PID-00013 | REV. 2

File Name : 1724000448-PR-PID-00013 Rev02



TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-002	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-003	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-005	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTAKE
TP-006	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-007	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: BLPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOUS BIOCIDE DOSAGE TO INTAKE PUMP: DISCONTINUOUS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOUS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE
14	AUTOMATIC AIR VENT VALVE
15	POSITION TO BE DEFINED DURING COMMISSIONING
16	POLYAMIDE TUBING (RILSAN TYPE)
17	CHECK VALVE (NO SPRING TYPE)
18	DRAIN PAN FOR ANALYZER. DRAIN PAN VOLUME= 5 L

T-50004	
NON-OXIDANT BIOCIDE DOSING TANK	
VOLUME	0.1 m3
DES. PRESS.	ATM
DES. TEMP.	45° C
MATERIAL	PE

P-50007A/B	
NON-OXIDANT BIOCIDE DOSING PUMP – CONTAINER INLET	
TYPE	METERING DIAPHRAGM
DES PRESSURE	10 barg
CAPACITY	0,03 l/h
HEAD	3.5 barg
DES. TEMP.	45° C
MATERIAL	PVC

P-50008A/B	
NON-OXIDANT BIOCIDE DOSING PUMP – SEA WATER INTAKE	
TYPE	METERING DIAPHRAGM
DES PRESSURE	10 barg
CAPACITY	0,85 l/h
HEAD	3.5 barg
DES. TEMP.	45° C
MATERIAL	PVC

P-50010A/B	
NON-OXIDANT BIOCIDE DOSING PUMP – WASTE WATER TANK	
TYPE	METERING DIAPHRAGM
DES PRESSURE	10 barg
CAPACITY	0,33 l/h
HEAD	3.5 barg
DES. TEMP.	45° C
MATERIAL	PVC

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
02	22-AUG-24	UR	WR	RM	ISSUED FOR REVIEW
01	29-MAY-24	GG	WR	RM	ISSUED FOR REVIEW
00	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

ROSETTI MARINO

TITLE :
WATER TREATMENT PACKAGE
BIOCIDE DOSAGE
P&I DIAGRAM

CONTRACT NO./TITLE — SCALE –

DRAWN UR | CHECKED WR | APPROVED RM | DATE 22/08/24

A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 007 | REV. 02

DRAWING NO. 1724000448-PR-PID-00013 REV. 2

File Name : 1724000448-PR-PID-00013 Rev02

BLPH SHEAMS SIGNATURE FORM

Action Title: **Action No:** **Ref. Doc.**	**HAZOP Study Actions** 57 K559-2254-SE-REP-015
Item No.	57
Cause:	Pump Failure P- 44003
Consequence:	Potential overfill of oxygen vent. Leading to blockage of oxygen vent & discharge of water from vent. Potential loss of safeguard, and additional consequences to electrolyser. Unknown impact on electrolyser package
Safeguards:	Flow meter downstream of P-44003 with'LL' flow trip. Level 'H' alarm on oxygen KO drum V-44001 Level 'LY-HH' on oxygen KO drum vent, leading to system shutdown.
Actions:	Check with Technical Safety TA2 whether CoP modifier is allowed for this unmanned platform which will be visited for 2 shifts per year.
Assigned Respondent (By)	CROSSWIND
RESPONSE	Discussion with Shell TA resulted in the manning level being designated an Enabling Factor with an associated Risk Reduction Factor of 1 order of magnitude. LOPA worksheet have been updated.
Attachments:	
Issue Date (dd/mm/yy)	

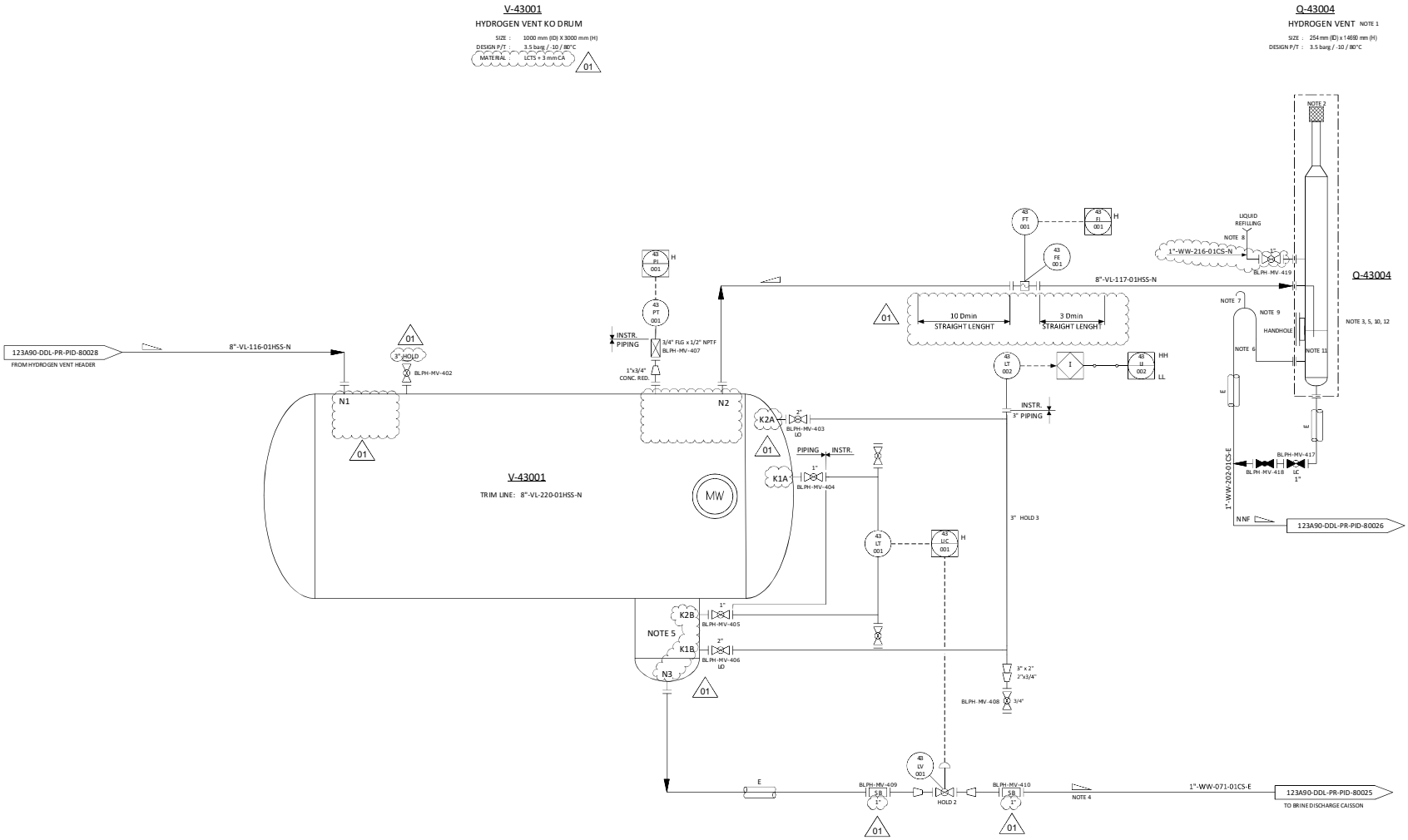
Approvals / Endorsements	
Company Discipline Lead	**Sign**
	Hamant Patel
Company HSE Lead	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.09.23 15:44:53 +02'00'
Company Project Manager	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.09.24 09:21:18 +02'00'
Contractor received for information. Not independently verified. Information	
Implemented	

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	58
Cause:	Pump Failure P- 44003
Consequence:	Potential overfill of oxygen vent. Leading to blockage of oxygen vent & discharge of water from vent. Potential loss of safeguard, and additional consequences to electrolyser. Unknown impact on electrolyser package
Safeguards:	Flow meter downstream of P-44003 with'LL' flow trip. Level 'H' alarm on oxygen KO drum V-44001 Level 'LY-HH' on oxygen KO drum vent, leading to system shutdown.
Actions:	Ensure Level 'LY- HH' on Oxygen KO drum vent achieves a RRF of 120.
Assigned Respondent (By)	ROSETTI Technical Safety Engineer
RESPONSE	Pump 43003, as per PID 123A90-DDL-PR-PID-80029, is not more part of the design, so the action is not more valid.
Attachments:	PID 123A90-DDL-PR-PID-80029
Issue Date	03-05-24

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
Carolina Caracciolo	**CC**
EPC HSE Lead	**Sign**
Carolina Caracciolo	
EPC Project Manager	**Sign**
Davide Lo Sterzo	
Client	**Sign**

Digitaal ondertekend door Paul van Rossum
Datum: 2024.05.10 12:32:50 +02'00'



NOTES

1. VENT TO SAFE LOCATION SEGREGATED FROM OTHER VENTS.
2. VENT TO BE EQUIPPED WITH FLAME ARRESTOR AND BIRD SCREEN.
3. LIQUID SEAL DRUM IS PART OF THE VENT SYSTEM.
4. LIQUID DRAINLINES TO BE ROUTED TO ENSURE GRAVITY DRAIN.
5. HYDROGEN VENT KO DRUM BOOT AND LIQUID SEAL DRUM TO BE HEAT TRACING.
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 FOR 1.5 m, INSULATED UP TO THE BEND.
10. LIQUID SEAL DRUM I.D. 590 mm, HEIGHT 2350 mm (T/T). TBC BY H2 VENT VENDOR.
11. INLET DIP LEG SUBMERSION HEIGHT OF 0.2 m.
12. FLUID HEIGHT OF 1.5 m FROM BOTTOM T.L.
13. FOR DESCRIPTION AND SPECIFICATION OF VESSEL NOZZLE, REFERENCE SHALL BE MADE TO THE TECHNICAL DATA SHEET FOR H2 VENT KOD.

01

HOLDS

1. VENT LINES DIAMETER.
2. CONTROL VALVE SIZE (BY VENDOR).
3. STAND PIPE DIAMETER TO BE CONFIRMED. 01

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
01	24/11/2023	CIM	RZI	DLO	ISSUE FOR HAZOP (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. 01

DRAWING NO. DRAWING_NO.

REV. REV

File Name : FILE_NAME

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	59
Cause:	Pump Failure P- 44003
Consequence:	Potential overfills of oxygen vent. Leading to blockage of oxygen vent & discharge of water from vent. Potential loss of safeguard, and additional consequences to electrolyser. Unknown impact on electrolyser package
Safeguards:	Flow meter downstream of P-44003 with'LL' flow trip. Level 'H' alarm on oxygen KO drum V-44001 Level 'LY-HH' on oxygen KO drum vent, leading to system shutdown.
Actions:	Assess the requirement for flow meter downstream P- 44003 with'LL' flow trip and evaluate if this needs to be DCS or SIS.
Assigned Respondent (By)	ROSETTI Process Engineer
RESPONSE	The scenario of pump failure has been superseded since pump downstream the Oxygen Vent KO drum (and the Oxygen Vent KO drum itself) has been deleted. The HAZOP action is no longer applicable; FEED drawing reference K559-2254-PR-PID-014, Revision 2 (see attachment 1).
Attachments:	
Issue Date	28-02-2024

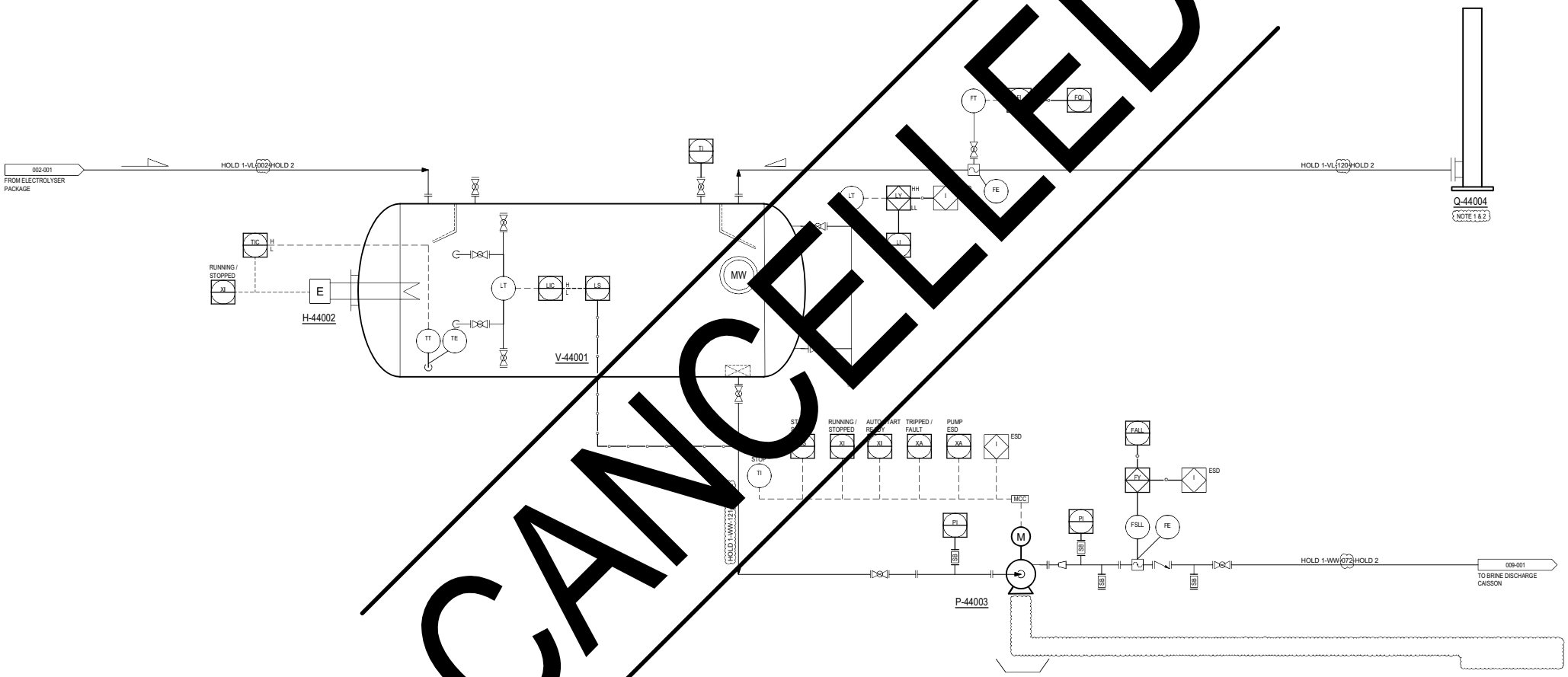
Approvals / Endorsements	
EPC Discipline Lead	Sign
Ciro Impradice	Ciro Impradice Autore firma digitale: Impradice Nome distintivo: CN = Ciro Impradice email = ciro.impradice@rosetti.it C = IT O = Rosetti Marino OU = Process Data: 2024.05.16 14:15:45 +02'00'
EPC HSE Lead	Sign
C.Caracciolo	CC
EPC Project Manager	Sign
D.Lo Sterzo	
Client	**Sign**
	Digitaal ondertekend door Paul van Rossum Datum: 2024.08.21 08:15:04 +02'00'

H-44002
OXYGEN VENT KO DRUM
HEATER
DUTY : HOLD 4

V-44001
OXYGEN VENT KO DRUM
SIZE : HOLD 4
DESIGN P/T : HOLD 4
MATERIAL : HOLD 4
OPERATING P/T : HOLD 4

P-44003
OXYGEN VENT DRUM PUMP
RATED FLOW : HOLD 4
A/P : HOLD 4
MOTOR : HOLD 4
RATED BHP : HOLD 4
TYPE : CENTRIFUGAL

Q-44004
OXYGEN VENT
SIZE : HOLD 4
TIP : HOLD 4
CAPACITY : HOLD 4
DESIGN P/T : HOLD 4
MATERIAL : HOLD 4
OPERATIONAL P/T : HOLD 4



CANCELLED

NOTES:

1. VENT TO SAFE LOCATION SEGREGATED FROM OTHER VENTS.
2. VENT TO BE EQUIPPED WITH FLAME ARRESTOR AND BIRD SCREEN.

HOLDS:

1. LINE SIZES.
2. PIPING SPECIFICATION.
3. VALVE SIZES.
4. EQUIPMENT SPECIFICATIONS.
5. INSTRUMENT TAGGING.
6. HEAT TRACING AND INSULATION REQUIREMENTS FOR WINTERISATION.

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REFERENCE DRAWINGS

REV	DATE	DESCRIPTIONS	ORG'D	CHK'D	APPR'D
2	24/03/2023	ISSUE FOR CANCELLATION	TS	HVP	JS
1	24/01/2023	ISSUE FOR HAZOP	TS	AD	HVP
0	06/01/2023	ISSUE FOR CLIENT REVIEW	AD	TS	HVP

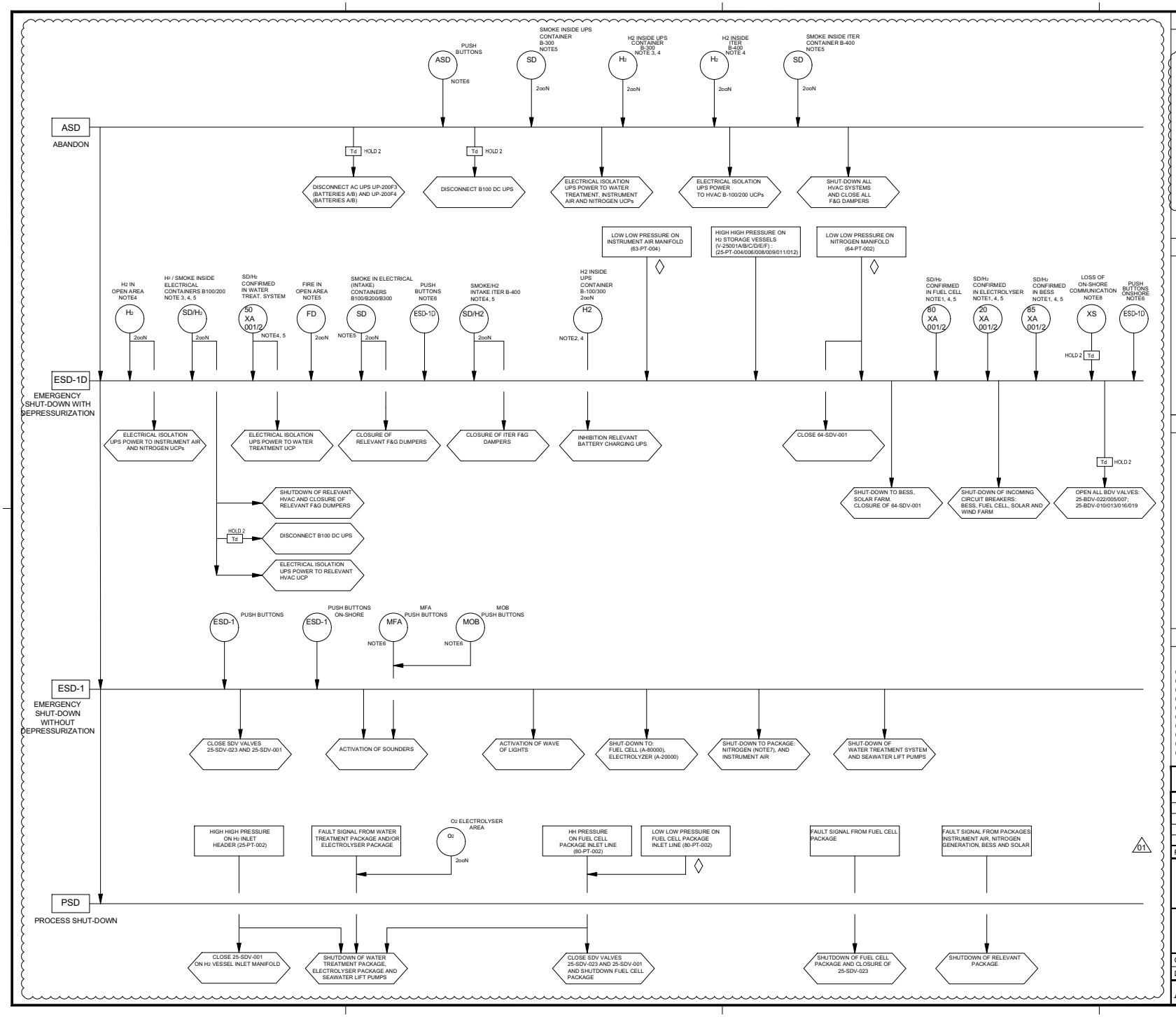
SHELL BLPH FEED
PIPING AND INSTRUMENTATION DIAGRAM
OXYGEN VENT DRUM

SCALE	1:100	DWG NO.:	SHEET	REV
FORMAT	A1	K559-2254-PR-PID-014	001	2

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	60
Cause:	Multiple causes of loss of pressure
Consequence:	
Safeguards:	Immediate release of hydrogen from storage to vent.
Actions:	Consider installation of individual air reservoirs for blowdown valve's to enable hydrogen storage to be retained for sufficient time to allow intervention.
Assigned Respondent (By)	ROSETTI Process Engineer
RESPONSE	The action is superseded since during HAZOP EPC no multiple causes of loss of pressure (within the H2 inventory) have been identified whose consequence is the opening of the blowdown valves. All scenarios that determine the opening of the blowdown valves are per doc. N. 123A90-DDL-PR-DG-80000 (see attachment 1). Therefore, there, is no any requirement of individual air reservoirs for blowdown valve's to enable hydrogen storage to be retained for sufficient time to allow intervention.
Attachments:	
Issue Date (dd/mm/yy)	16/07/24

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
Ciro Impradice	Ciro Impradice
EPC HSE Lead	**Sign**
Carolina Caracciolo	
EPC Project Manager	**Sign**
Davide Lo Sterzo	
Client	**Sign**
	Digitaal ondertekend door Paul Van Rossum Datum: 2024.08.21 08:15:24 +02'00'



NOTES

1. F&G LOGIC VOTING IS MANAGED BY RELEVANT UCP (BESS, FUEL CELL AND ELECTROLYSER PACKAGES).
2. LOGIC ACTIVATION ONLY IN CASE OF 2ooN H2 CONFIRMED IS CAUSED BY H2 DETECTORS INSIDE UPS CONTAINERS (B-100/300) AND ALL THE OTHERS PLATFORM H2 DETECTORS SHALL NOT BE ALARMED/FAILED.
3. LOGIC ACTIVATION ONLY IN CASE OF 2ooN H2 CONFIRMED IS CAUSED BY H2 DETECTORS INSIDE UPS CONTAINERS (ONLY FOR B-100 OR B-300) AND AT LEAST ONE OF PLATFORM H2 DETECTORS (EXCLUDED INSIDE UPS CONTAINERS B-100/300) IS ALARMED/FAILED.
4. ACTIVATION OF AMBER BEACONS (H2).
5. ACTIVATION OF RED BEACONS (FIRE).
6. ACTIVATION OF BOTH AMBER AND RED BEACONS.
7. SHUTDOWN OF NITROGEN PACKAGE WILL BE PERFORMED ONLY AFTER THE ELECTROLYSER PACKAGE HAS BEEN SAFELY SHUTDOWN (IF IT IS ON LINE).
8. IN CASE OF LOSS OF ON-SHORE COMMUNICATION THE ESD-1D LOGIC WILL BE ACTIVATED DUE TO THE IMPOSSIBILITY OF REMOTE CONTROL DEPRESSURIZATION.

△01

LEGEND

HOLDS

△01

1. DELETED
2. TIME DELAY TO BE DEFINED.

LEGEND

◇ = START-UP INHIBIT

△01

ABBREVIATIONS

FC: Fuel Cell (A-80000)
BESS: Battery Energy Storage System
Electrolyser Package (A-200000)

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
01	19/03/24	RZI	CIM	DLO	ACCEPTED FOR CONSTRUCTION (AFC)
00	10/11/23	RZI	CIM	DLO	ISSUE FOR ACCEPTANCE (IFA)

CROSSWIND

ROSETTI MARINO

TITLE :

BASE LOAD POWER HUB (BLPH)
Process Safety Cause & Effect
Block Diagram

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

A1	DRAWING NO. 123A90-DDL-PR-DG-80000	SHEET 001	REV. 01

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	61
Cause:	Multiple causes of loss of pressure
Consequence:	
Safeguards:	Loss of utilities
Actions:	Examine failure modes of local equipment rooms upon loss of instrument air and provide suitable mitigation to allow these to continue to operate electrical systems.
Assigned Respondent (By)	ROSETTI Instrumentation Engineer
RESPONSE	Loss of instrument air has not impact to the shelter pressurization because it's not used to pressurize the shelter. Each local equipment room has redounded HVAC system (2x100%), each system able to provide pressurization needed. Upon loss of one HVAC system, the stand-by system will start immediately. Only in case of loss of both HVAC systems the pressurization will be lost. Anyway, the electrical systems keep continue to operate and in case of high temperature a high temperature alarm will be sent to alert the operator in control room. See project doc. "Supply Specification for HV (66kV-6.6kV) Switchroom B-100" n° 123A90-DDL-AR-SP-10000 rev.01 (the same philosophy is applied for containers B-200/300/400)
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
L.Calabrese	
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**

Digitaal ondertekend door Paul van Rossum
Datum: 2024.09.03 17:10:46 +02'00'

Base Load Power Hub (BLPH)

Supply Specification for **HV (66kV-6.6kV) Switchroom B-100**

Document Number: 123A90-DDL-AR-SP-10000

Document Class: 2

01	22/04/2024	Accepted for construction (AFC)	R. Bossi	M. Gatti	D. Lo Sterzo
00	27/10/2023	Issue for Review (IFR)	R. Bossi	M. Gatti	D. Lo Sterzo
Rev.	Date	Description	Prepared	Reviewed	Approved
STILOG					

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The performance of the air ventilation units must be evaluated considering the environmental conditions in which the units will be installed and must have characteristics able to guarantee the normal ageing of the components.

All equipment, materials and instruments must guarantee their functionality at the minimum and maximum temperatures of the site.

All dampers and equipment must be supplied with a support junction box to which the necessary electrical connections can be made, and to which the connection cables to the local HVAC and lighting power and control panel will be connected.

All HVAC system, except fire dampers, will be feeded and controlled by the HVAC and lighting power and control panel.

All system provided shall comprehend suitable supports for the aim and the environment where they will be installed.

6.5.5 Air Ventilation System

As previously specified, due to limited spaces available both inside and outside the shelter, the air ventilation system will be composed by 2x100% AHUs (Air Handling Units) provided of heating system, and will be mounted on the module roof.

Each ventilation unit will be able to maintain the internal design conditions of the project by means of the temperature difference between indoor air and supply air temperature. In addition, each system will guarantee the airflow rate required to maintain an overpressure against external pressure equal to 50 Pa, and the minimum air changes requested for the module.

AHU units shall be powered directly from the HVAC UCP; also signal cables will be connected with the HVAC and lighting power and control panel. More details are reported on related paragraph.

Each HVAC system will be provided of supply ducts. Inlet openings will be placed on the module walls, in combination of a sleeve; no. 1 fire and gas damper will be provided and flanged to the internal side of each sleeve.

The air shall be exhausted from an opening placed on wall, at a height next to the roof, with the aim to avoid interferences with other components (e.g. cable trays, etc.). No. 1 pressure relief damper and no. 1 fire and gas damper will be provided and flanged to the internal side of the outlet sleeve. The pressure relief damper shall guarantee the overpressure requested inside the module, as previously specified. An outlet duct piece with bird screen wire mesh shall be installed on the external side of the sleeve, designed to avoid rain from entering the module.

The treated air is conveyed into the module through ducts made of stainless steel, according to the above-mentioned prescriptions. Supply air shall be filtered to remove salt, moisture and dust from the airflow, and heated by the electric heating coil if needed; subsequently the air will be supplied by means of a fan. All entering air will be exhausted through the pressure relief damper.

Each AHU unit shall be provided with non-return damper to isolate the relative system when is turned off.

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	61
Cause:	Both pumps operating P- 50001A/B
Consequence:	
Safeguards:	
Actions:	Consider during vendor hazop package.
Assigned Respondent (By)	ROSETTI Mechanical
RESPONSE	This scenario has been analyzed during WTP HAZOP on 17-18 June
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
F.Mura	
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**
	Digitaal ondertekend door Paul van Rossum Datum: 2024.08.21 08:15:04 +02'00'

BLPH SHEAMS SIGNATURE FORM

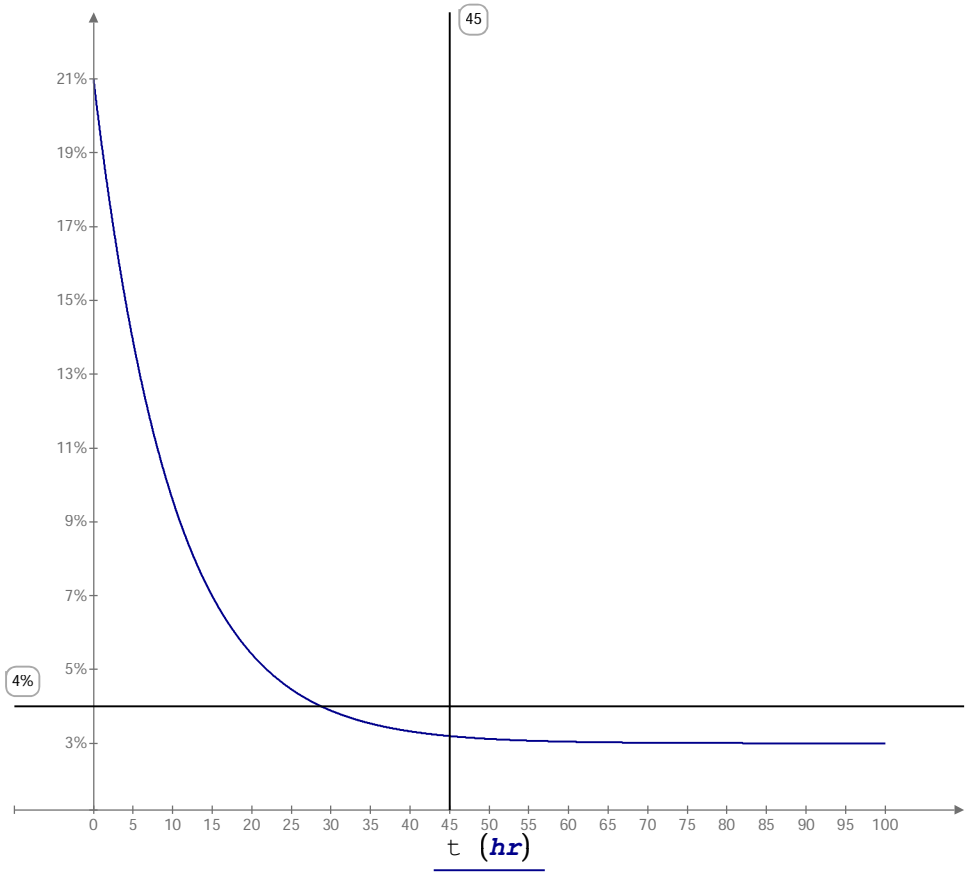
Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	62
Cause:	Requirement to depressure and gas free hydrogen storage vessels for maintenance
Consequence:	Significant volume of nitrogen required to pressure purge hydrogen storage vessels. Which may be impractical to store on platform.
Safeguards:	
Actions:	Investigate practical means of providing sufficient volume of nitrogen for pressure purging hydrogen pressure storage vessels.
Assigned Respondent (By)	ROSETTI Process Engineer
RESPONSE	The current design is to provide Nitrogen via the Nitrogen Generation Package (A-64000), configured as 1 x 100%. The design capacity is based on: 1) continuous purge of Hydrogen Vent system (see Attachment 1); 2) peak demand by: a) the electrolyser package, see Attachment 1; b) H2 Storage vessel purging, see Attachment 1. To be noted that the two above peak demand are not coincident. The design capacity is 60 Nm3/h, see Attachment 2. Also see P&iD 123A90-DDL-PR-PID-80027, rev02
Attachments:	
Issue Date	19-06-2024

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
Ciro Impradice (PROCESS)	Ciro Impradice Autore firma digitale: Ciro Impradice Nome distintivo: CN = Ciro Impradice email = ciro.impradice@rosetti.it C = IT O = Rosetti Marino OU = Process Data: 2024.06.19 16:11:24 +02'00'
EPC HSE Lead	**Sign**
Carolina Caracciolo	CC
EPC Project Manager	**Sign**
Davide Lo Sterzo	
Client	**Sign**
	Digitaal ondertekend door Paul van Rossum Datum: 2024.08.21 08:15:44 +02'00'

$x_{O2}(t) := x_{O2in} - (x_{O2in} - x_{O2s}) \cdot e^{\frac{-k \cdot M \cdot (Ncm)^{-1}}{N_{tot} \cdot \left(\frac{mol}{22.4 \cdot 10^{-3}}\right)^{-1}} \cdot t}$ Model equation

$t := 0,1\ min..100\ hr$

$x_{O2}(45\ hr) = 3.2\%$ time required to obtain x_{O2} lower than 4%



1.5.1.B) CASE (B): REMOVAL OF LOW PRESSURE HYDROGEN INSIDE THE VESSEL(planned SHUTDOWN)

Similarly to the above theory, making a mass balance on H2 one can obtain the time required to obtain a molar fraction of :

$x_{H20} := 100\%$ initial mole fraction of H2 inside the vessel

$M = 42.5\ \frac{Ncm}{hr}$ assumed molar flowrate of purging gas (**comp.97%N2; 3%O2**)

$P = 1.2\ bar$ operating pressure during purging activity

$T = 20\ °C$ operating temperature during purging activity

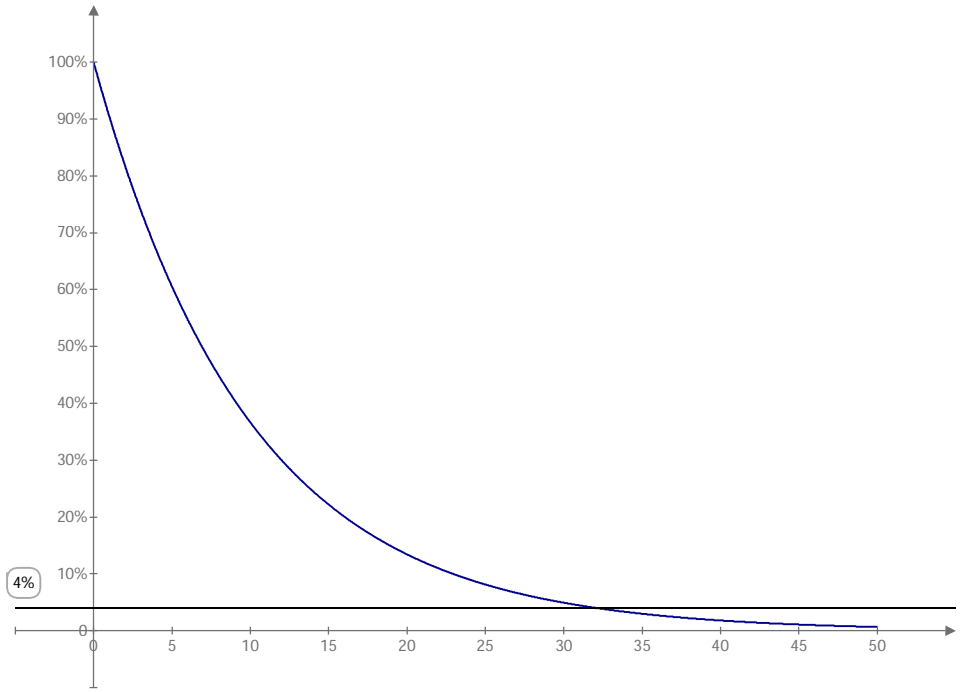
$V = 96\ m^3$ total vessel volume

$k = 0.25$ mixing coefficient (to account for mixing inefficiency)

$N_{tot} = 4726.4\ mol$ moles of gas inside the vessel during purging

$$x_{H2}(t) := x_{H20} \cdot e^{\frac{-k \cdot M \cdot (Ncm)^{-1}}{N_{tot} \cdot \left(\frac{mol}{22.4 \cdot 10^{-3}}\right)^{-1}} \cdot t}$$ Model equation

$x_{H2}(35\ hr) = 2.98\%$ time required to obtain a residual concentration of H2 lower than 4%



$x_{H2}(t)$

In order to estimate the final mole fraction of N2,O2 and H2 at the end of 35 hours, one can solve the following system of linear equations:

Guess Values

$X_{O2} := 1\%$ $X_{N2} := 1\%$ $X_{H2} := 1\%$

Constraints

$X_{O2} + X_{H2} + X_{N2} = 1$

$\frac{X_{O2}}{X_{N2}} = \frac{3\%}{97\%}$

$X_{H2} = x_{H2}(35\ hr)$

Solver

$\begin{bmatrix} a \\ b \\ c \end{bmatrix} := \mathbf{find}(X_{O2}, X_{N2}, X_{H2})$

Thus, the final concentration will be as follows:

$a = 2.91\%$ final mole fraction of O2

$b = 94.11\%$ final mole fraction of N2

$c = 2.98\%$ final mole fraction of H2

$Q_{N2V} := M = 42.5 \frac{Ncm}{hr}$ Assumed Nitrogen flowrate for purging

$Ha := 2.5$ Nitrogen generator "Air Factor" (**HOLD1**)

$F_{N1} := Ha \cdot M = 106.3 \frac{Ncm}{hr}$ Air demand for Nitrogen generator

Thus, as per the above executions (A) and (B), one obtains the time for purging (**considering the reasonable size and then the limitation of the nitrogen generation size being nearly 52.7 Scm/hr**):

$time_A := 45\ hr$ to purge n.1 vessel (say O2 "displacement")

$time_B := 35\ hr$ to purge n.1 vessel (say H2 "displacement")

By considering a "back to back" philosophy it will take the following total time for purging (excluding any "dead time"):

$6 \cdot time_A = 11.25\ day$ to purge n.6 vessel (O2 "displacement")

$6 \cdot time_B = 8.75\ day$ to purge n.6 vessel (H2 "displacement")

1.5.2) ELECTROLYZER PURGING DEMAND

The electrolyzer has a nitrogen demand as follows (Ref.[3]):

$Q_{N2E} := 36 \frac{Ncm}{hr}$ Nitrogen flowrate required for purging of electrolyzer (Ref.[3])

$Ha := 2.5$ Nitrogen generator "Air Factor" (**HOLD1**)

$F_{N2} := Ha \cdot Q_{N2E} = 90 \frac{Ncm}{hr}$ Air demand for Nitrogen generator

1.5.3) PURGE GAS RATE (HUSA's correlation)

The purge gas rate for continuous purge requirements in open flare/vent without the effect of buoyancy seal is given by Husa correlation(Ref.[4]):

$O_2 := 3\%$ Acceptable O2 volume fraction

$C_0 := 98\%$ Volume fraction of N2

$K_0 := 1.707$ Constant for N2

$C_1 := 2\%$ Volume fraction of H2

$K_1 := 5.783$ Constant for N2

$ID := 0.254\ m$ Assumed internal diameter for stack

$y := min(7.62\ m, 10 \cdot ID) = 2.54\ m$ Distance down the stack

$$Q := 190.8 \cdot \left(\left(\frac{ID}{m}\right)^{3.46}\right) \cdot \left(\frac{1}{\left(\frac{y}{m}\right)} \cdot \ln\left(\frac{20.9}{O_2}\right)\right) \cdot \sum_{i=0}^{1} C_i^{0.65} \cdot K_i \ \frac{Ncm}{hr} = 9.2 \frac{Ncm}{hr}$$ Purge gas consumption

Base Load Power Hub (BLPH)

NITROGEN GENERATION PACKAGE
EQUIPMENT DATA SHEETS
INCLUDING PSA, ETC.

Document Number: 1724000437-MAC-DS-00011

Document Class: 2

01	08/05/2024	Issue for Review (IFR)	GT	MC	TM
00	28/03/2024	Issue for Review (IFR)	GT	MC	TM
Rev.	Date	Description	Prepared	Reviewed	Approved

COES

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coes	CLIENTE CUSTOMER	:	ROSETTI MARINO	COMM: JOB:	:	167/24	
	RIFERIMENTO REFERENCE	:	CROSSWIND	UNITA' ITEM	:	/	
	IMPIANTO DRYING UNIT	:	NITROGEN GENERATION PACKAGE	FOGLIO N° SHEET	:	1	DI : 3 OF

FOGLIO DATI PER IMPIANTO GENERATORE AZOTO
NITROGEN GENERATOR DATA SHEET

DATI GENERALI
GENERAL DATA

1	QUANTITA' QUANTITY	:	1	
2	ITEM TAG	:	C-64001A/B	
3	SERVIZIO SERVICE	:	NITROGEN GENERATOR	
4	RIGENERAZIONE REGENERATION	:	PSA	

DATI PROGETTO MECCANICO
MECHANICAL DESIGN DATA

5	PRESSIONE PROGETTO SERBATOI VESSELS DESIGN PRESSURE	:	12 barg	TEMPERATURA PROGETTO SERBATOI VESSELS DESIGN TEMPERATURE	:	-29 / +80°C	
6	MATERIALE SERBATOI VESSELS MATERIAL	:	LTCS	SOVRASPESS. CORROSIONE SERBATOI VESSELS CORROSION OVER-THICKNESS	:	3 mm	
7	NORMATIVA PROGETTO SERBATOI VESSELS DESIGN CODE	:	ASME VIII DIV.1	NORMATIVA COLLAUDO SERBATOI VESSELS INSPECTION CODE	:	2014/68/EU PED	
8							

DATI FUNZIONALI
FUNCTIONAL DATA

9	PORTATA ARIA IN INGRESSO INLET AIR FLOWRATE	:	150	Nm3/h	
10	PRESSIONE DI ESERCIZIO OPERATING PRESSURE	:	9	barg	
11	TEMPERATURA DI ESERCIZIO OPERATING TEMPERATURE	:	35	°C	
12	PUNTO DI RUGIADA IN INGRESSO INLET DEW POINT	:	-40	°C	
13	TIPO MATERIALE ADSORBENTE DESICCANT MATERIAL TYPE	:	CARBON MOLECULAR SIEVE		
14	QUANTITA' ADSORBENTE PER TORRE DESICCANT QUANTITY/EACH TOWER	:	200	kg	
15	PORTATA AZOTO IN USCITA OUTLET NITROGEN FLOWRATE	:	60	Nm3/h	
16	PUREZZA AZOTO IN USCITA OUTLET NITROGEN PURITY	:	97	%	
17	POTENZA TOTALE INSTALLATA TOTAL DEMANDE RATE	:	0.05	kW	
18	PERDITA DI CARICO PRESSURE DROP	:	0.5	bar	
19	DURATA CICLO LENGHT OF CYCLE	:	1+1	min	
20	CONSUMO kWh PER RIGENERAZIONE kWh CONSUMPTION/EACH REGENERATION	:	/		
21	TENSIONE DI ALIMENTAZIONE SUPPLY VOLTAGE	:	24	VDC	AUX.
22	GRADO DI PROTEZIONE PROTECTION DEGREE	:	IP 65		
23	CLASSIFICAZIONE AREA AREA CLASSIFICATION	:	SAFE		
24	RADIOGRAFIE RT TEST	:	☐ YES	☒ NO	
25	VERNICIATURA PAINTING	:	☒ EXTERNAL	☐ INTERNAL	
26	ZINCATURA GALVANIZING	:	☐ YES	☒ NO	
27	RUMOROSITA' NOISE LEVEL	:	85dB(A) max PRESSURE LEVEL at 1 m		
28					
29	Notes: - details of nozzle are included into equipment sectional drawing				

REV. REV.	DESCRIZIONE DESCRIPTION	EMESSO ISSUED	APPROVATO APPROVED	DATA DATE
01	ISSUE FOR REVIEW	GT	TM	08-mag-24
00	ISSUE FOR REVIEW	GT	TM	28-mar-24

coes	CLIENTE / CUSTOMER	:	ROSETTI MARINO	COMM: / JOB:	:	167/24	
	RIFERIMENTO / REFERENCE	:	CROSSWIND	UNITA' / ITEM	:	/	
	IMPIANTO / DRYING UNIT	:	NITROGEN GENERATION PACKAGE	FOGLIO N° / SHEET	:	2	DI : 3 / OF

FOGLIO DATI PER SERBATOIO
PRESSURE VESSEL DATA SHEET

DATI PROGETTO MECCANICO
MECAHNICAL DESIGN DATA

1	QUANTITA' / QUANTITY	:	1			
2	ITEM / TAG	:	V-64001			
3	SERVIZIO / SERVICE	:	SERBATOIO AZOTO / NITROGEN TANK			
4	TIPO / TYPE	:	VERTICALE / VERTICAL			
5	MATERIALE / MATERIAL	:	LTCS			
6	NORMATIVA PROGETTO / DESIGN CODE	:	ASME VIII DIV.1	NORMATIVA COLLAUDO / INSPECTION CODE	:	2014/68/EU PED
7	MATERIALE / MATERIAL	:	LTCS	SOVRASPESS. CORROSIONE / CORROSION OVER-THICKNESS	:	3 mm
8	PRESSIONE PROGETTO / DESIGN PRESSURE	:	12 barg	TEMPERATURA PROGETTO / DESIGN TEMPERATURE	:	-29 / +80 °C
9	DIAMETRO ESTERNO / EXTERNAL DIAMETER	:	2000 mm	LUNGHEZZA T/T / T/T LENGHT	:	2900 mm
10	VOLUME / VOLUME	:	11 m3			
11	RADIOGRAFIE / RT TEST	:	☒ YES SPOT	☐ NO		
12	VERNICIATURA / PAINTING	:	☒ EXTERNAL	☐ INTERNAL		
11	ZINCATURA / GALVANIZING	:	☐ YES	☒ NO		
12						
13	Notes: - details of nozzle are included into equipment sectional drawing					
14						

ELENCO CONNESSIONI
NOZZLES LIST

15	SIGLA / TAG	DIAMETRO / DIAMETER	TIPO / TYPE	SERIE / RATING	SERVIZIO / SERVICE	NOTE / REMARKS
16	N1	1"	WN	ANSI 150	PROCESS INLET/OUTLET	
17	N2	1"	WN	ANSI 150	SAFETY VALVE	
18	N3	1/2"	NPT	3000#	PRESSURE GAUGE	HALF COUPLING
19	N4	1/2"	NPT	3000#	PRESSURE TRANSMITTER	HALF COUPLING
20	N5	1"	WN	ANSI 150	DRAIN	
21	N6	16"	WN	ANSI 150	MAN HOLE	
22						
23						

STRUMENTI - ACCESSORI
INSTRUMENTS - ACCESSORIES

24	☒	VALVOLA DI SICUREZZA / SAFETY VALVE
25	☒	MANOMETRO / PRESSURE GAUGE
26	☒	TRASMETTITORE DI PRESSIONE / PRESSURE TRANSMITTER
27	☒	VALVOLA DI DRENAGGIO MANUALE / MANUAL DRAIN VALVE
28	☐	SCARICATORE DI CONDENSA / DRAIN TRAP
29		

REV. / REV.	DESCRIZIONE / DESCRIPTION	EMESSO / ISSUED	APPROVATO / APPROVED	DATA / DATE
01	ISSUE FOR REVIEW	GT	TM	08-mag-24
00	ISSUE FOR REVIEW	GT	TM	28-mar-24

coes	CLIENTE / CUSTOMER	:	ROSETTI MARINO	COMM: / JOB:	:	167/24	
	RIFERIMENTO / REFERENCE	:	CROSSWIND	UNITA' / ITEM	:	/	
	IMPIANTO / DRYING UNIT	:	NITROGEN GENERATION PACKAGE	FOGLIO N° / SHEET	:	3	DI / OF : 3

FOGLIO DATI PER FILTRO
FILTER DATA SHEET

DATI GENERALI
GENERAL DATA

1	QUANTITA' / QUANTITY	:	2
2	ITEM / TAG	:	S-64001A/B
3	SERVIZIO / SERVICE	:	DUST REMOVING
4			

DATI PROGETTO CALDARERIA
VESSELS DESIGN DATA

5	PRESSIONE PROGETTO / DESIGN PRESSURE	:	12 barg	TEMPERATURA PROGETTO / DESIGN TEMPERATURE	:	-29 / +80 °C	
6	MATERIALE / MATERIAL	:	LTCS	SOVRASPESS. CORROSIONE / CORROSION OVER-THICKNESS	:	3 mm	
7	NORMATIVA PROGETTO / DESIGN CODE	:	ASME VIII DIV.1	NORMATIVA COLLAUDO / INSPECTION CODE	:	2014/68/EU PED	
8							

DATI FUNZIONALI
FUNCTIONAL DATA

9	GAS DA TRATTARE / GAS TO BE TREATED	:	NITROGEN 97%	PORTATA IN INGRESSO / INLET FLOWRATE	:	60 Nm3/h	
10	PRESSIONE DI ESERCIZIO / OPERATING PRESSURE	:	8.5 barg	TEMPERATURA DI ESERCIZIO / OPERATING TEMPERATURE	:	35 °C	
11	PERDITA DI CARICO/FILTRO PULITO / PRESSURE DROP/CLEAN FILTER	:	0,1 bar	PERDITA DI CARICO/FILTRO SPORCC / PRESSURE DROP/DIRTY FILTER	:	0.3 bar	
12	EFFICIENZA / EFFICIENCY	:	99.9 %	GRADO DI FILTRAZIONE / FILTRATION DEGREE	:	1 µm	
13	OLIO RESIDUO / RESIDUAL OIL	:	N/A				
14							

CARATTERISTICHE ELEMENTI FILTRANTI
FILTRATION ELEMENTS DATA

15	TIPO ELEMENTO FILTRANTE / FILTRATION ELEMENT TYPE	:	CARTRIDGE	MATERIALE / MATERIAL	:	COALESCING MICROFIBER	
16	N° CARTUCCE PER FILTRO / No. OF ELEMENTS/EACH FILTER	:	1	MODELLO / MODEL	:	30A	
17							

STRUMENTI - ACCESSORI
INSTRUMENTS - ACCESSORIES

18	☐ BY-PASS FILTRO / FILTER BY-PASS					
19	☒ TUBAZIONE DI RACCORDO FILTRO / CONNECTION PIPE TO FILTER					
20	☒ VALVOLE INTERCETTAZIONE / ON/OFF VALVES	☒ 2 VIE / 2-WAY	☐ 3 VIE / 3-WAY	☐ AUTOMATICHE / AUTOMATIC		
21	☐ MANOMETRO DIFFERENZIALE / DIFFERENTIAL PRESSURE GAUGE					
22	☒ TRASMETTITORE DI PRESSIONE DIFFERENZIALE / DIFFERENTIAL PRESSURE TRANSMITTER	AS PER P&ID NO. 1724000437-PR-PID-00018				
23	☒ VALVOLA DI DRENAGGIO / DRAIN VALVE					
24	☐ SCARICATORE DI CONDENSA / STEAM TRAP		☐ AUTOMATICO / AUTOMATIC	☐ GALLEGGIANTE / FLOATING		
25	☐ VALVOLE DI SICUREZZA / SAFETY VALVES					

NOTE / REMARKS :

REV. / REV.	DESCRIZIONE / DESCRIPTION	EMESSO / ISSUED	APPROVATO / APPROVED	DATA / DATE
01	ISSUE FOR REVIEW	GT	TM	08-mag-24
00	ISSUE FOR REVIEW	GT	TM	28-mar-24

BLPH SHEAMS SIGNATURE FORM

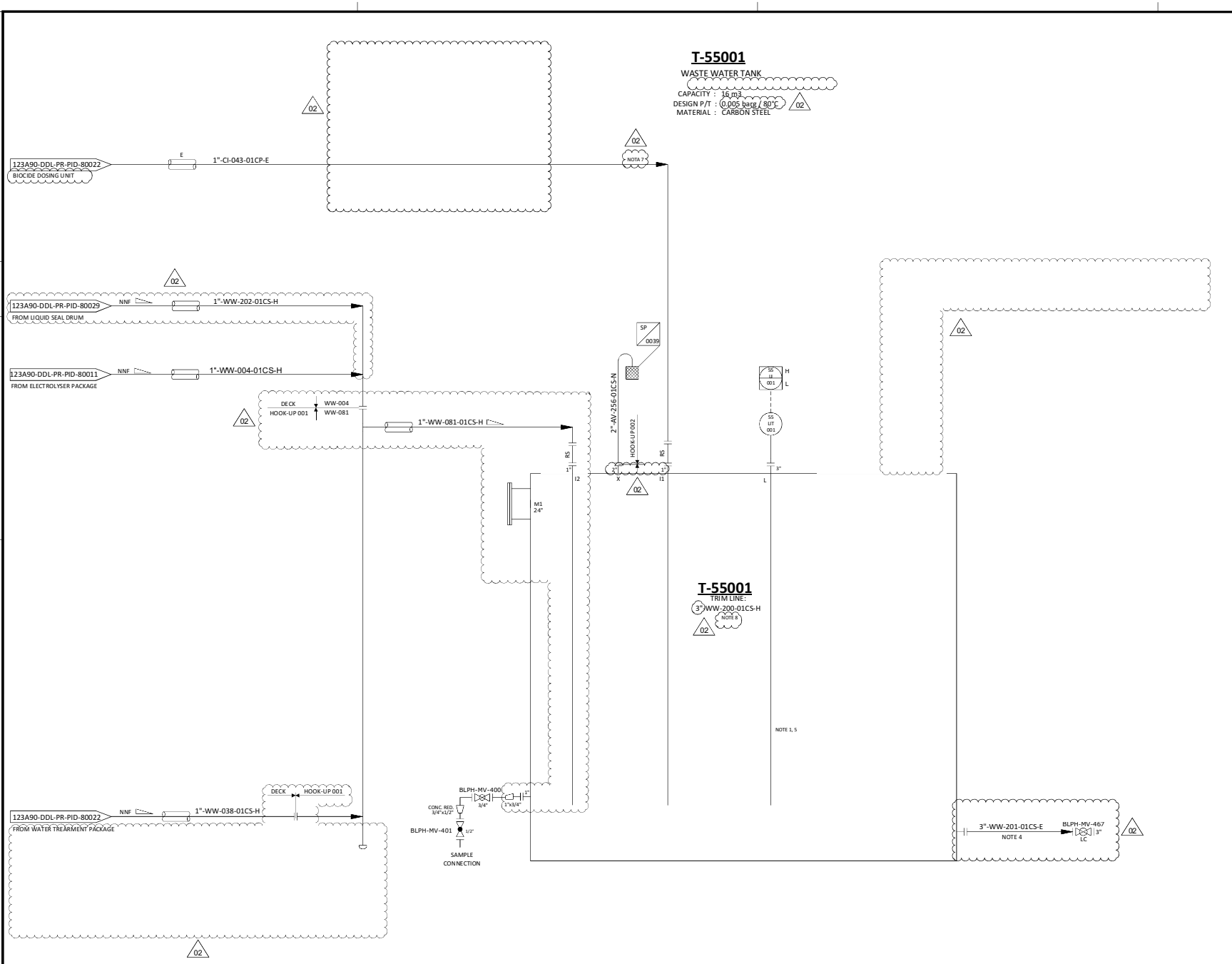
Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	63
Cause:	Potential requirement for continuous use of nitrogen by electrolyser.
Consequence:	Requirements for significant storage of nitrogen in order to satisfy demand.
Safeguards:	
Actions:	Consider requirements for nitrogen generation package in order to provide sufficient nitrogen supply.
Assigned Respondent (By)	ROSETTI Process Engineer
RESPONSE	Nitrogen generation package has been provided as per PID 123A90-DDL-PR-PID-80027 (see attachment 1) Specific requirement for nitrogen generation package are mentioned on 123A90-DDL-MAC-SP-50039
Attachments:	
Issue Date (19-01-24)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
Ciro Impradice (Process)	Impradice Ciro
EPC HSE Lead	**Sign**
Carolina Caracciolo	CC
EPC Project Engineering Manager	**Sign**
Davide Lo Sterzo	
Client	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.12.23 14:25:24 +01'00'

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	64
Cause:	Unknow Cause in electrolyser package
Consequence:	Potential overfills of tank leading to, potential overflow to brine discharge caisson, Leading to potential environmental pollution.
Safeguards:	Level Controller on wastewater tank T-55001
Actions:	Review sizing basis for wastewater tank, in order to reduce possibility of overflow and environmental pollution based on information from potential users
Assigned Respondent (By)	ROSETTI Process Engineer
RESPONSE	Overflow from the wastewater tank has been deleted, therefore there is no possibility of having release of liquid to the sea from overflow line. The tank T-55001 is sized based on six months operability. A level transmitter on the wastewater tank T-55001 is also installed (55-LT-001) which alerts the operator (remotely) in case of high level inside the vessel. In any case it is not expected liquid to reach top of the tank over an operation period of 6 months. Refer to attachment 1
Attachments:	
Issue Date	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
Ciro Impradice	
EPC HSE Lead	**Sign**
Caterina Caracciolo	**CC**
EPC Project Manager	**Sign**
Davide Lo Sterzo	
Client	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.12 11:15:06 +02'00'



NOTES

1. ALL STILLING TUBES AND DIP PIPES SHALL BE SUPER DUPLEX.
2. DELETED.
3. DELETED.
4. DRAIN LINE TO SHIP DISPOSAL.
5. PERFORATED STILLING TUBE.
6. DELETED.
7. FOR PERIODIC DOSING OF THE WASTE WATER TANK.
8. FOR DESCRIPTION AND SPECIFICATION OF VESSEL NOZZLE, REFERENCE SHALL BE MADE TO THE TECHNICAL DATA SHEET FOR WASTE WATER TANK - T-55001, DOC. N. "123A90-DDL-MAC-DS-50008"

HOLDS

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

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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

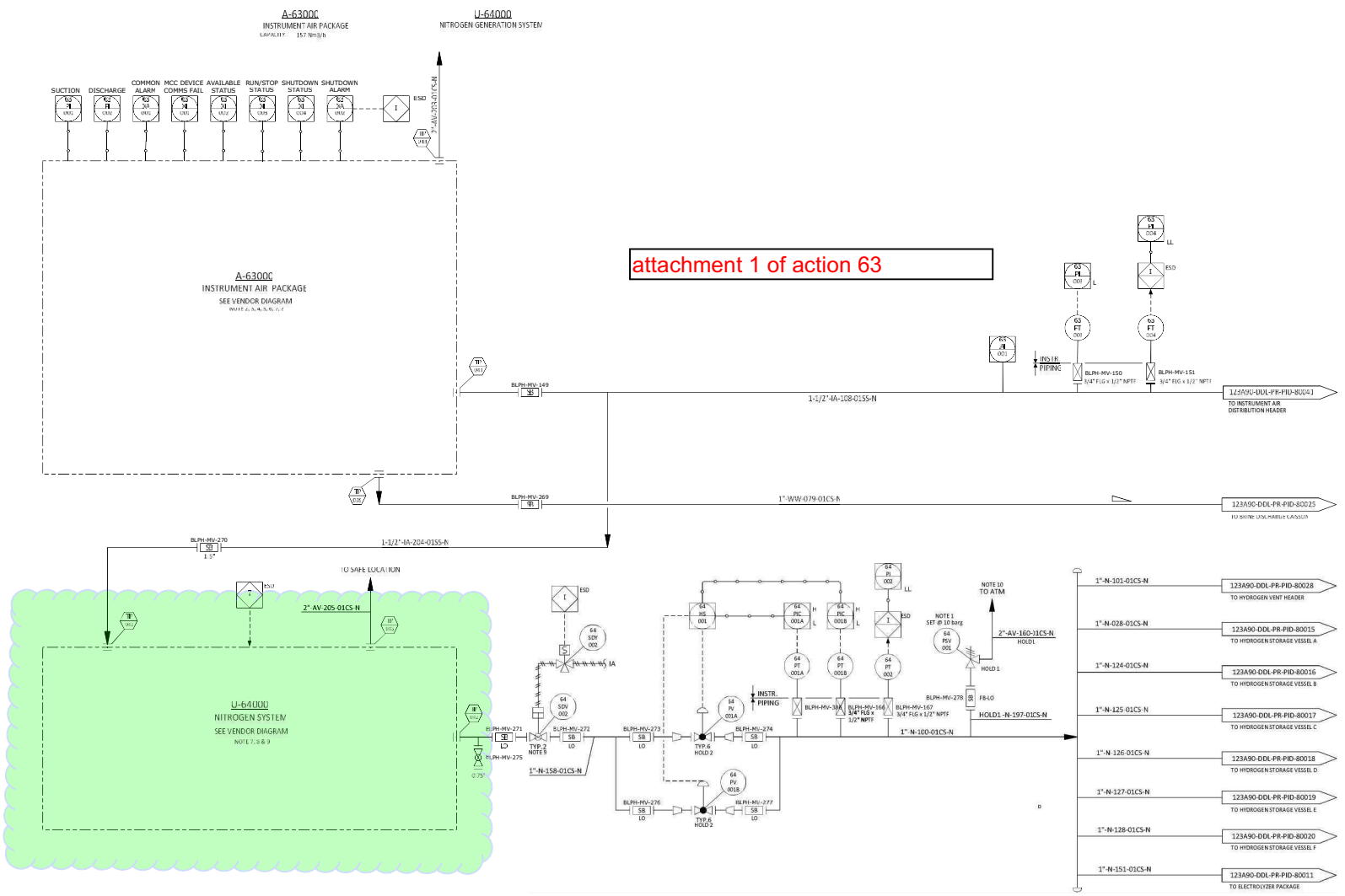
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BLPH PIPING AND INSTRUMENTATION DIAGRAM
WATER DISPOSAL SHEET 2

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-80026		SHEET 001	REV. 02

DRAWING NO. DRAWING_NO.
REV. REV.
File Name : FILE_NAME

DRAWING NO. DRAWING_NO.

REV. REV



NOTES

1. ONE UNINSTALLED SPARE PSV SHALL BE AVAILABLE
2. COMPRESSORS AND DRIERS DESIGNED FOR 2 X 100% CONFIGURATION INSTRUMENT AIR RECEIVER DESIGNED FOR 1 X 100%.
3. VENDOR TO PROVIDE NECESSARY CONTROLS, INSTRUMENTATIONS AND ISOLATIONS IN ORDER TO OPERATE THE PLANT IN SAFE MANNER
4. COMPRESSORS WILL OPERATE ON THE BASIS OF ONE WORKING AND ONE ON STANDBY
5. COMPRESSORS TO BE SCREW TYPE OIL FREE.
6. AIR COMPRESSOR INLET TO BE LOCATED AWAY FROM ANY VENTS
7. PACKAGE DATA AND DESIGN TO BE CONFIRMED BY VENDOR AND DRAWING MADE AVAILABLE.
8. PACKAGE VENDOR TO DEFINE INTERFACE WITH CONTRACTOR AND CCS CONNECTION REQUIREMENTS
9. NECESSARY CONTROL SYSTEM SOFTWARE SHALL BE INCLUDED TO SUPPORT ADVACED VALVE CONTROL, PARTIAL STROKE TESTING AND DIAGNOSTICS FOR ENY SAFETY CRITICAL ON/OFF VALVES. THESE APPLICATION SHALL BE IDENTIFIED BY HAZOP AND LAPA EVAIUATION IF PARTIAL STROKE TESTING WILL BE REQUIRED
   THE "TYP. 3" SHALL BE CONSIDERED INSTEAD THE ACTUAL "TYP. 2" FOR SDV
   THE "TYP. 5" SHALL BE CONSIDERED INSTEAD THE ACTUAL "TYP. 4" FOR BDV
10. TO SAFE LOCATION, ROUTED AWAY FROM WALKWAYS

HOLDS

1. PSV AND LINE SIZE
2. CONTROL VALVE SIZE (BY VENDOR).

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
00	20/10/2023	CIM	RZI	DLO	ISSUE FOR ACCEPTANCE (IFA)

CROSSWIND

ROSETTI MARINO

TITLE :
BLPH PIPING AND INSTRUMENTATION DIAGRAM
INSTRUMENT AIR PACKAGE

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-80027		SHEET 001	REV. 00

File Name : FILE_NAME

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	65
Cause:	Partial blockage in feed line to wastewater tank.
Consequence:	Potential backflow to other users. Potential for backfilling of other users with unknown consequences
Safeguards:	
Actions:	Determine which drain lines are in continuous duty and which are required in maintenance only. Consider revision of non-return valves in individual drain lines.
Assigned Respondent (By)	ROSETTI Process Engineer
RESPONSE	The sources are those indicated on the attached PID where the tank T-55001 is shown (see attachment 1 where the sources are highlighted in blu). The flow is NNF (normally not flow), therefore as upset conditions we consider the following: 1. the discharged liqud volume from the water treatment package during maintenance. The maximum liquid inventory inside package is around 5.4 m3 (considering all tanks within the package); 2. from liquid seal drum is always zero. Should a a blowdown scenario occur , then the liquid volume discharge from the seal is very low compared to the T-55001 volume; 3. from the Electrolyser package the maximum volume that could be discarged toward T-55001 is 5 m3 in 6 months (as informed by Elogen and Crosswind). Considering that T-55001 volume is 16m3, there is no possibility to overfill the tank. In case of failure of filter (A-50003, installed at inlet of water treatment system), the water is not routed towards the T-55001, it is routed towards the brine discharge caisson (see attachment 2, where the line from A-50003 is highlighted in red). Therefore, no possibility to have a continuous flow towards T-55001 in case of A-50003 failure.
Attachments:	
Issue Date (dd/mm/yy)	

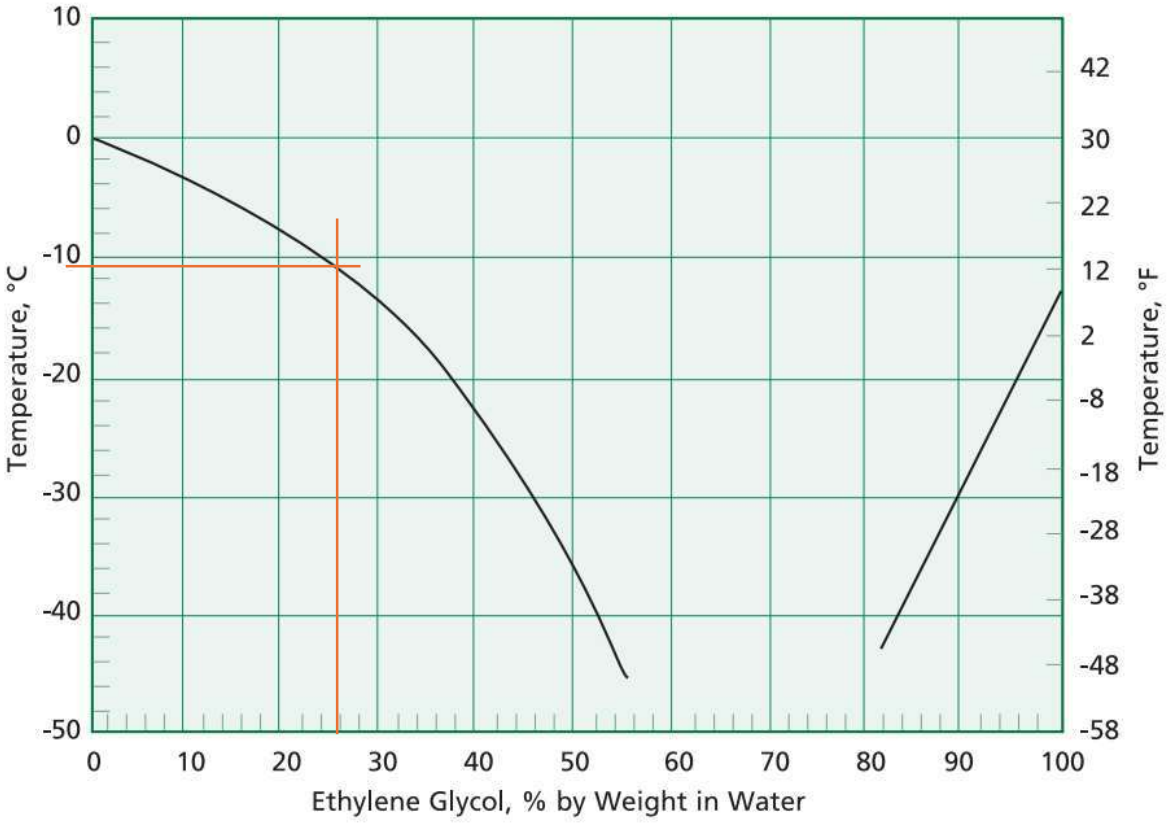
Approvals / Endorsements	
EPC Discipline Lead	**Sign**
C. Impradice (PROCESS)	Impradice Ciro
EPC HSE Lead	**Sign**
C.Caracciolo	CC
EPC Project Manager	**Sign**
D. Lo Sterzo	
Client	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.12 11:19:33 +02'00'

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	66
Cause:	Low ambient temperature
Consequence:	Potential freezing
Safeguards:	
Actions:	Winterisation of wastewater system as required.
Assigned Respondent (By)	ROSETTI Process Engineer
RESPONSE	Winterization of the Waste Water Tank (T-55001) is not required, since the tank will be filled with 3500 kg of a ethylene glycol. This will guarantee that when the water from upstream sources will be discharged toward the tank over a period of six months (not only during maintenance but also during operation of the Electrolyser Package), the aqueous ethylene glycol solution will not freeze. With 3500 kg of ethylene glycol and 10000 kg of water (that is the maximum expected water quantity discharged toward the tank over a period of 6 months) the final concentration of the aqueous ethylene glycol solution will be around 25.9% (by weight). Such mixture has a freezing point of around -11°C and therefore it will not freeze since the minimum ambient temperature is -8.4 °C. For reference see attachment 1, where the freezing points of the aqueous ethylene glycol solution are shown. Moreover, no any corrosion inhibiter is required to the tank since specific painting for corrosion inhibition will be used, for reference see attachment 2. The procedure is detailed within the doc. “Operations and Maintenance Manuals”, doc. n. “123A90-DDL-PR-MAN-80001”
Attachments:	
Issue Date (10/03/2025)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
Ciro Impradice (Process)	Impradice Ciro
EPC HSE Lead	**Sign**
Carolina Caracciolo	CC
EPC Project Manager	**Sign**
Claudia Giunchi	Claudia Giunchi
Client	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2025.03.11 17:27:06 +01'00'

Figure 2: Freezing Points of Aqueous Ethylene Glycol Solutions



Tankguard Plus

Product description

This is a two component polyamine cured phenolic/novolac epoxy coating. It has a high resistance to most sour crude oils and a wide range of chemicals and solvents. It has outstanding chemical resistance to crude oil at temperatures up to 160 °C. Can be used as primer, mid coat or finish coat in atmospheric and immersed environments. Suitable for properly prepared carbon steel, galvanised steel, stainless steel and concrete substrates.

Typical use

Protective:
Specially designed as an internal lining for offshore, onshore and buried tanks and pipes such as chemical storage, waste water, grey water, process water, concrete bund, fire service lines and drilling mud tanks. This coating has very good resistance to high temperature products. Refer to Protective Product Resistance List.

Colours

buff, white

Product data

Property	Test/Standard	Description
Solids by volume	ISO 3233	70 ± 2 %
Gloss level (GU 60 °)	ISO 2813	semi gloss (35-70)
Flash point	ISO 3679 Method 1	28 °C
Density	calculated	1.6 kg/l

Region	Regulation	Test Standard	VOC Value
US	CARB(SCM)2020 / SCAQMD rule 1113	Calculated	342 g/l
Hong Kong	Air Pollution Control (VOC) Regulation	Calculated	342 g/l
EU	European Paint Directive 2004/42/CE	Calculated	342 g/l
EU IED	Industrial Emission Directive 2010/75/EU	Calculated	342 g/l
Korea	Korea Clean Air Conservation Act	KS M ISO 11890-1	259 g/l
China	GB 30981-2020 Limit of harmful substances of industrial protective coatings	GB/T 23985-2009 8.3	237 g/l

The provided data is typical for factory produced products, subject to slight variation depending on colour.

Gloss description: According to Jotun Performance Coatings' definition.

This Technical Data Sheet supersedes those previously issued.
The Technical Data Sheet (TDS) is recommended to be read in conjunction with the Safety Data Sheet (SDS) and the Application Guide (AG) for this product. For your nearest local Jotun office, please visit our website at www.jotun.com

Film thickness per coat

Typical recommended specification range

Dry film thickness	100	-	150	µm
Wet film thickness	140	-	215	µm
Theoretical spreading rate	7	-	4.7	m²/l

Surface preparation

Surface preparation summary table

Substrate	Surface preparation	
	Minimum	**Recommended**
Carbon steel	Sa 2½ (ISO 8501-1)	Sa 2½ (ISO 8501-1)
Stainless steel	The surface shall be hand or machine abraded with non-metallic abrasives or bonded fibre machine or hand abrasive pads to impart a scratch pattern to the surface.	Abrasive blast cleaning to achieve a surface profile using non-metallic abrasive media which is suitable to achieve a sharp and angular surface profile.
Galvanised steel	The surface shall be clean, dry and appear with a rough and dull profile.	Sweep blast-cleaning using non-metallic abrasive leaving a clean, rough and even pattern.
Concrete	Dry abrasive blast cleaning to SSPC-SP 13/NACE No. 6.	Dry abrasive blast cleaning to SSPC-SP 13/NACE No. 6.

Application

Application methods

The product can be applied by

Spray:	Use airless spray.
Brush:	Recommended for stripe coating and small areas, care must be taken to achieve the specified dry film thickness.
Roller:	Roller application only to be used for scallops, ratholes, small pipes etc.

This Technical Data Sheet supersedes those previously issued.
The Technical Data Sheet (TDS) is recommended to be read in conjunction with the Safety Data Sheet (SDS) and the Application Guide (AG) for this product. For your nearest local Jotun office, please visit our website at www.jotun.com

Product mixing ratio (by volume)

Tankguard Plus Comp A	4 part(s)
Tankguard Plus Comp. B	1 part(s)

Thinner/Cleaning solvent

Thinner: Jotun Thinner No. 17 / Jotun Thinner No. 23

Guiding data for airless spray

Nozzle tip (inch/1000):	17-21
Pressure at nozzle (minimum):	150 bar/2100 psi

Drying and Curing time

Substrate temperature	5 °C	10 °C	15 °C	23 °C	30 °C	40 °C
Surface (touch) dry	24 h	16 h	6 h	4 h	3 h	2 h
Walk-on-dry	36 h	24 h	10 h	7 h	5 h	3 h
Dry to over coat, minimum	52 h	36 h	30 h	20 h	14 h	10 h
Dried/cured for service	14 d	10 d	7 d	5 d	4 d	3 d

For maximum overcoating intervals, refer to the Application Guide (AG) for this product.

If a hot cure is performed Tankguard Plus can be returned to service in half the "Dried/cured for service" time, as stated below:

5 °C: 7 d included 8 h @ 60 °C
10 °C: 5 d included 8 h @ 60 °C
15 °C: 3.5 d included 8 h @ 60 °C
23 °C: 2.5 d included 8 h @ 60 °C
30 °C: 2 d included 8 h @ 60 °C
40 °C: 1.5 d included 8 h @ 60 °C

Hot cure (by air) can be initiated after the last coat has become "Dry to overcoat", and can be achieved by heating with hot air until a steel temperature of 60 °C is held for 8 hours. Total curing time must be as outlined above.

Drying and curing times are determined under controlled temperatures and relative humidity below 85 %, and at average of the DFT range for the product.

Surface (touch) dry: The state of drying when slight pressure with a finger does not leave an imprint or reveal tackiness.

Walk-on-dry: Minimum time before the coating can tolerate normal foot traffic without permanent marks, imprints or other physical damage.

Dry to over coat, minimum: The recommended shortest time before the next coat can be applied.

Dried/cured for service: Minimum time before the coating can be permanently exposed to the intended environment/medium.

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Induction time and Pot life

Paint temperature	23 °C
Induction time	15 min
Pot life	2 h

Heat resistance

	Temperature	
	Continuous	Peak
Dry, atmospheric	160 °C	-
Immersed, sea water	90 °C	95 °C
Immersed, crude oil	160 °C	-

Further resistance information can be found in Protective Product Resistance List available on Jotun's website, or contact your local Jotun office.

Peak temperature duration max. 1 hour.

The temperatures listed relate to retention of protective properties. Aesthetic properties may suffer at these temperatures.

Note that the coating will be resistant to various immersion temperatures depending on the specific chemical and whether immersion is constant or intermittent. Heat resistance is influenced by the total coating system. If used as part of a system, ensure all coatings in the system have similar heat resistance.

Product compatibility

Depending on the actual exposure of the coating system, various primers and topcoats can be used in combination with this product. Some examples are shown below. Contact Jotun for specific system recommendation.

Previous coat:	itself only
Subsequent coat:	itself only

Packaging (typical)

	Volume (litres)	Size of containers (litres)
Tankguard Plus Comp A	16	20
Tankguard Plus Comp. B	4	5

The volume stated is for factory made colours. Note that local variants in pack size and filled volumes can vary due to local regulations.

Storage

This Technical Data Sheet supersedes those previously issued.
The Technical Data Sheet (TDS) is recommended to be read in conjunction with the Safety Data Sheet (SDS) and the Application Guide (AG) for this product. For your nearest local Jotun office, please visit our website at www.jotun.com

The product must be stored in accordance with national regulations. Keep the containers in a dry, shaded, cool, well-ventilated space and away from sources of heat and ignition. Containers must be kept tightly closed. Handle with care.

Shelf life at 23 °C

Tankguard Plus Comp A	24 month(s)
Tankguard Plus Comp. B	24 month(s)

In some markets commercial shelf life can be dictated shorter by local legislation. The above is minimum shelf life, thereafter the paint quality is subject to re-inspection.

Caution

This product is for professional use only. The applicators and operators shall be trained, experienced and have the capability and equipment to mix/stir and apply the coatings correctly and according to Jotun's technical documentation. Applicators and operators shall use appropriate personal protection equipment when using this product. This guideline is given based on the current knowledge of the product. Any suggested deviation to suit the site conditions shall be forwarded to the responsible Jotun representative for approval before commencing the work.

Health and safety

Please observe the precautionary notices displayed on the container. Use under well ventilated conditions. Do not inhale spray mist. Avoid skin contact. Spillage on the skin should immediately be removed with suitable cleanser, soap and water. Eyes should be well flushed with water and medical attention sought immediately.

Colour variation

When applicable, products primarily meant for use as primers or antifoulings may have slight colour variations from batch to batch. Such products and epoxy based products used as a finish coat may chalk when exposed to sunlight and weathering.

Colour and gloss retention on topcoats/finish coats may vary depending on type of colour, exposure environment such as temperature, UV intensity etc., application quality and generic type of paint. Contact your local Jotun office for further information.

Disclaimer

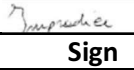
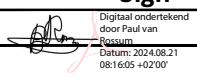
The information in this document is given to the best of Jotun's knowledge, based on laboratory testing and practical experience. Jotun's products are considered as semi-finished goods and as such, products are often used under conditions beyond Jotun's control. Jotun cannot guarantee anything but the quality of the product itself. Minor product variations may be implemented in order to comply with local requirements. Jotun reserves the right to change the given data without further notice.

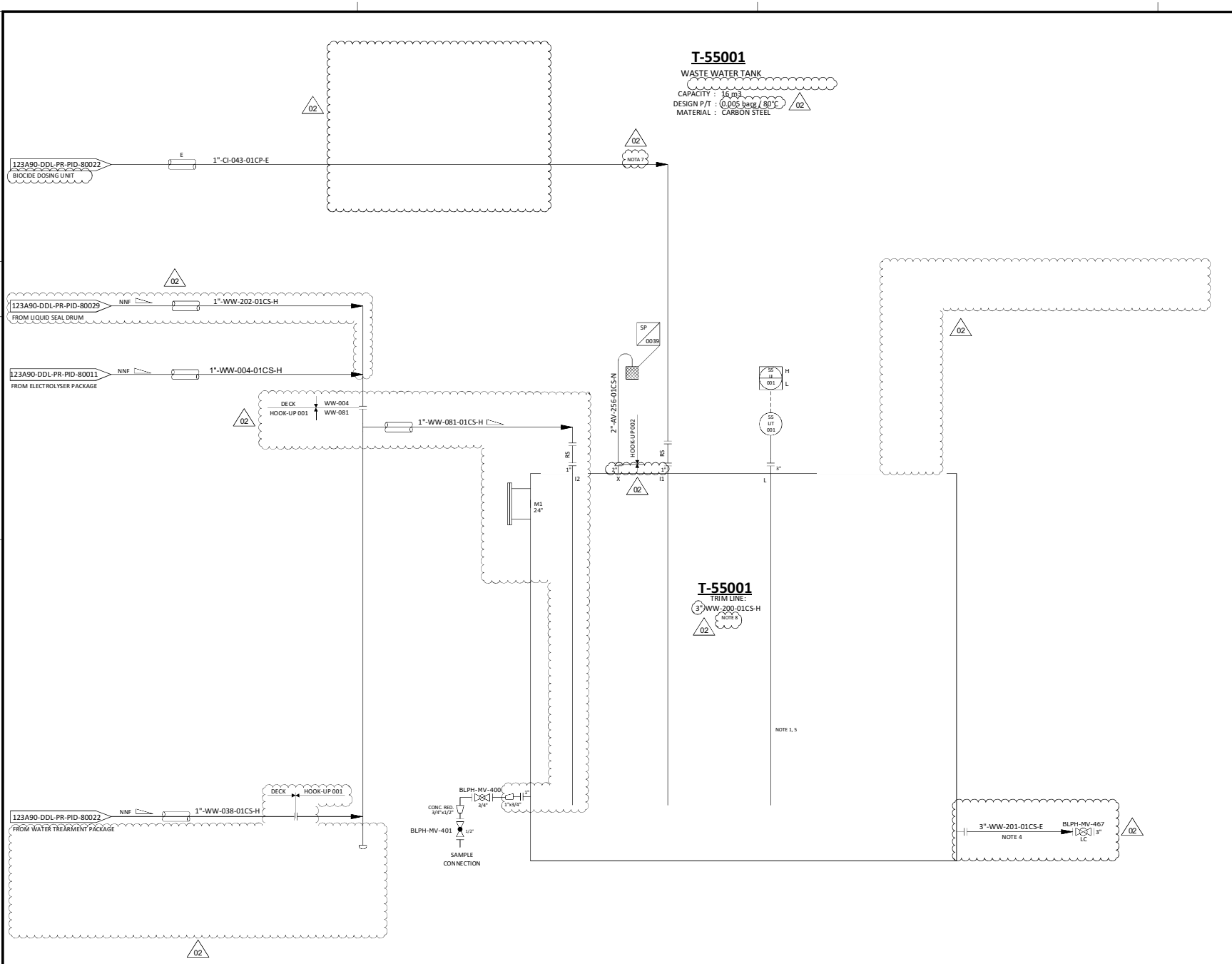
Users should always consult Jotun for specific guidance on the general suitability of this product for their needs and specific application practices.

If there is any inconsistency between different language issues of this document, the English (United Kingdom) version will prevail.

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	67
Cause:	Loss of liquid level within T-55001. (Likely cause would be control loop failure of level control T-55001)
Consequence:	T-55001 could become dry after an extended period, leading to potential air ingress into piping that contains hydrogen. Leading to potential for ignition/explosion & risk to personnel.
Safeguards:	Low level alarm (Not valid, part of IE) 'Low Low 'liquid level alarm (trip enunciation).
Actions:	Consider requirements for liquid seal within main drain line system.
Assigned Respondent (By)	ROSETTI Process Engineer
RESPONSE	The recommendation has been superseded since the identified cause (during FEED HAZOP SESSION), "*Loss of liquid level within T-55001. (Likely cause would be control loop failure of level control T-55001)*" is not applicable and valid. As per EPC P&iD doc. N. "123A90-DDL-PR-PID-80026" (see attachment 1), the level control loop is not present. It is worth to note here that the same liquid control loop was already deleted on the last revision of FEED P&iD (see attachment 2).
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
C. Impradice	
EPC HSE Lead	**Sign**
C.Caracciolo	CC
EPC Project Manager	**Sign**
D. Lo Sterzo	
Client	**Sign**
	



NOTES

1. ALL STILLING TUBES AND DIP PIPES SHALL BE SUPER DUPLEX.
2. DELETED.
3. DELETED.
4. DRAIN LINE TO SHIP DISPOSAL.
5. PERFORATED STILLING TUBE.
6. DELETED.
7. FOR PERIODIC DOSING OF THE WASTE WATER TANK.
8. FOR DESCRIPTION AND SPECIFICATION OF VESSEL NOZZLE, REFERENCE SHALL BE MADE TO THE TECHNICAL DATA SHEET FOR WASTE WATER TANK - T-55001, DOC. N. "123A90-DDL-MAC-DS-50008"

HOLDS

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

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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)

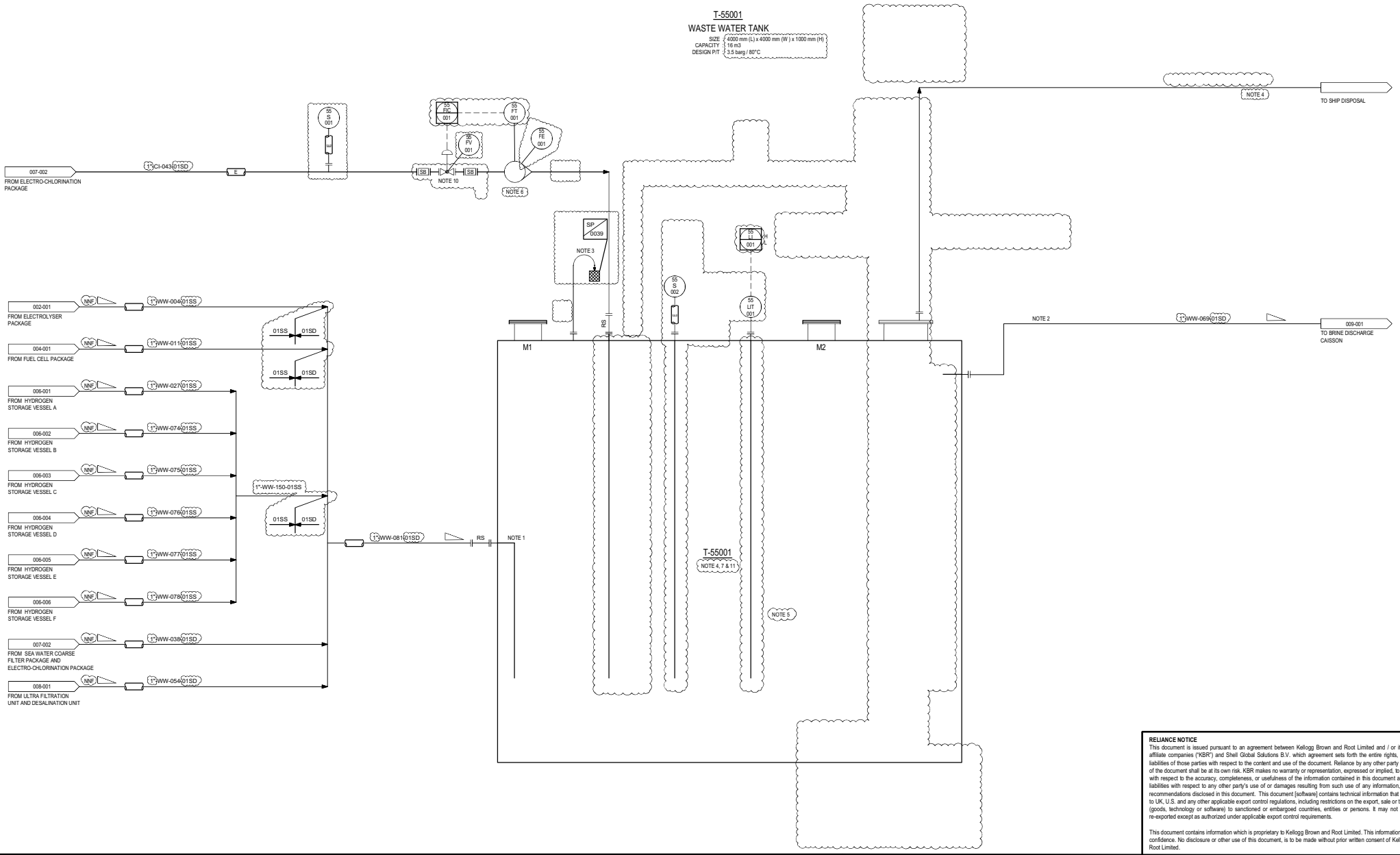
CROSSWIND

ROSETTI MARINO

TITLE :
BLPH PIPING AND INSTRUMENTATION DIAGRAM
WATER DISPOSAL SHEET 2

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-80026		SHEET 001	REV. 02

DRAWING NO. DRAWING_NO.
REV. REV.
File Name : FILE_NAME



NOTES:

1. DELETED.
2. OVERFLOW TO RISE ABOVE DECK TO MAXIMISE TANK WORKING CAPACITY.
3. LOCATE VENT DISCHARGE AWAY FROM WALKWAYS ETC.
4. IN DECK TANK WITH EXAMPLE EXPORT LINE SHOWN FOR CLARITY.
5. PERFORATED STILLING TUBE.
6. VARIABLE AREA FLOW METER TO BE INSTALLED VERTICALLY WITH DIRECTION OF FLOW UPWARDS.
7. METHODOLOGY FOR EMPTYING THE WASTE WATER TANK TO BE DEVELOPED IN THE NEXT PHASE, WHEN DETAILED REQUIREMENTS ARE KNOWN.
8. HEAT TRACING AND INSULATION REQUIREMENT TO BE DETERMINED IN THE NEXT PHASE, ONCE WINTERISATION REQUIREMENTS ARE DEFINED.
9. HAZOP ACTIONS TO BE INCORPORATED IN THE NEXT PHASE.
10. FOR PERIODIC DOSING OF THE WASTE WATER TANK.
11. ALL STILLING TUBES AND DIP PIPES SHALL BE SUPER DUPLEX.

HOLDS:

1. DELETED.
2. DELETED.
3. DELETED.
4. DELETED.
5. DELETED.
6. DELETED.

REFERENCE DRAWINGS

REV	DATE	DESCRIPTIONS	ORG'D	CHK'D	APPR'D
2	24/03/2023	ISSUE FOR INFORMATION	TS	HVP	JS
1	24/01/2023	ISSUE FOR HAZOP	TS	AD	HVP
0	11/01/2023	ISSUE FOR CLIENT REVIEW	AD	TS	HVP

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SHELL BLPH FEED
PIPING AND INSTRUMENTATION DIAGRAM
WATER DISPOSAL

SCALE	1:100	DWG NO.:	SHEET	REV
FORMAT	A1	K559-2254-PR-PID-009	002	2

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	67
Cause:	Re circulation of brine water
Consequence:	Potential to exceeddesign limit of desalination unit package
Safeguards:	Caissons are segregated at different depth
Actions:	Consider during vendor hazop package.
Assigned Respondent (By)	ROSETTI Technical Safety
RESPONSE	This scenario has been analyzed during WTP HAZOP on 17-18 June. See 123A90-DDL-SAF-RE-30006
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
F.Mura	
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.06.12 17:39:11 +02'00'

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	68
Cause:	Potential gas blowby during wastewater tank from unknown causes within package (intention is to depressurise & make package safe before drainage commences).
Consequence:	Potential for gas release (hydrogen). Local to tank vent, with potential ignition/explosion & risk to personnel
Safeguards:	
Actions:	Ensure that vendor package HAZOPS'S examine possibility of gas blowby via this route & provide suitable mitigation as required.
Assigned Respondent (By)	CROSSWIND
RESPONSE	Electrolyzer HAZOP has been done on the 4th of December 2023. WTP HAZOP has been done on the 17-18th of June, 2024. No credible gas blowby cases have been identified.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
Company Discipline Lead	**Sign**
	Hamant Patel
Company HSE Lead	**Sign**
	Paul van Rossum
Company Project Manager	**Sign**
	Dominik Sznajder
Contractor received for information. Not independetly verified. Information implemented	

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	68
Cause:	Unknown components from vendor package
Consequence:	
Safeguards:	
Actions:	Consider during vendor package HAZOP'S.
Assigned Respondent (By)	ROSETTI Technical Safety
RESPONSE	All Flow deviations on Sea Water Node have been analyzed during WTP Hazop. See 123A90-DDL-SAF-RE-30006
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
E.Carminati	**CC**
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**

Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.09.12 17:39:54 +02'00'

BLPH SHEAMS SIGNATURE FORM

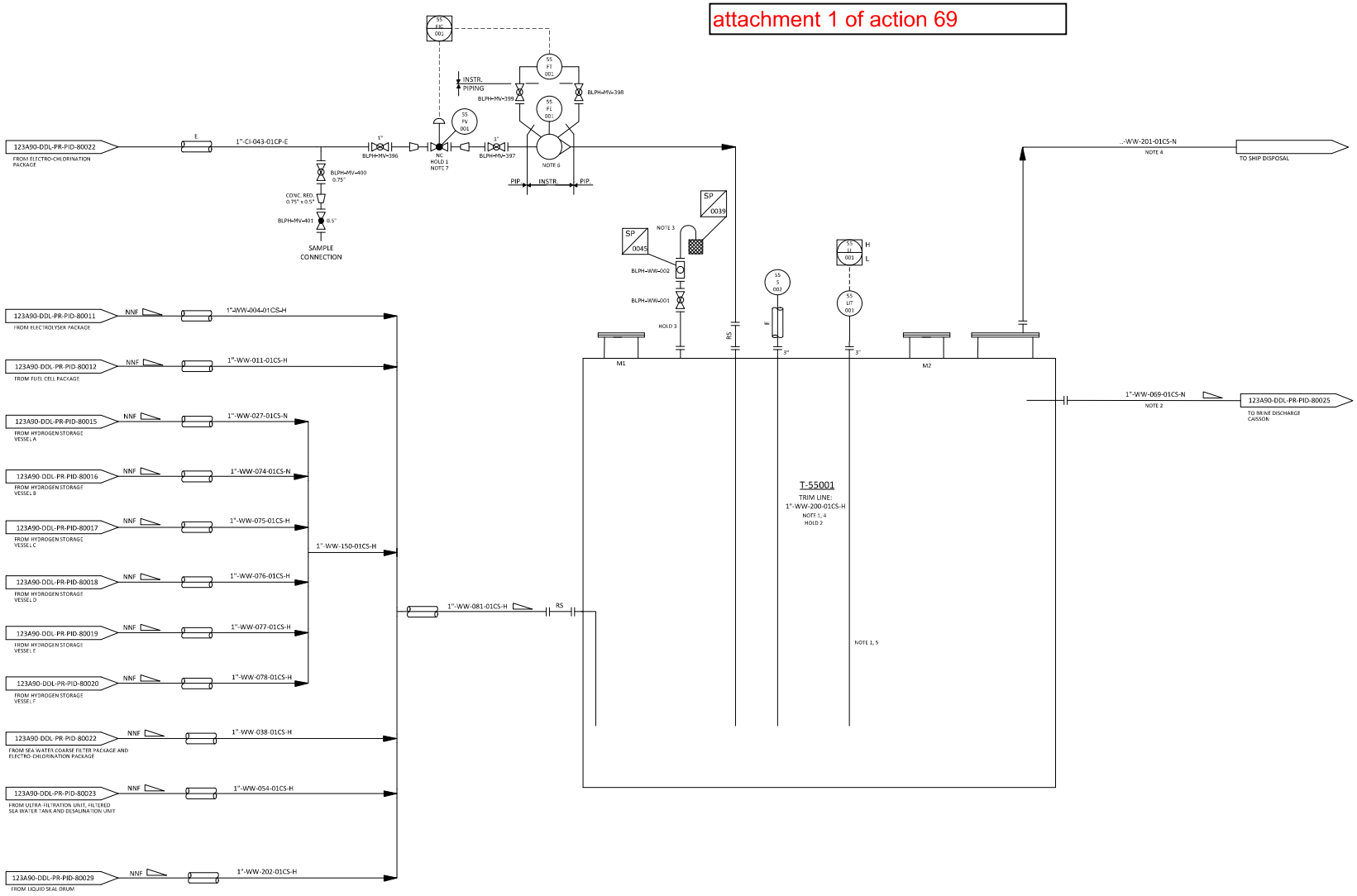
Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	69
Cause:	Loss of liquid level within T-55001. (Likely cause would be control loop failure of level control T-55001)
Consequence:	Pump P-55002 dry running, leading to pump damage
Safeguards:	Low level alarm (Not valid, part of IE) 'Low Low 'liquid level alarm (trip enunciation).
Actions:	Based on LOPA assessment, there is currently no requirement for 'LL' trip on waste water tank , T- 55001 to protect P55002, hence this can be redesigned as a DCS based switch independent from the level controller.
Assigned Respondent (By)	ROSETTI Process Engineer
RESPONSE	Both Pump P55002 and LL level trip (inside the T-55001) have been deleted on the last revision of the FEED PID. This is also confirmed by the EPC P&iD. Therefore, the recommendation is superseded (see EPC PID “123A90-DDL-PR-PID-80026”, attachment 1)
Attachments:	
Issue Date (19-01-24)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
Ciro Impradice (Process)	
EPC HSE Lead	**Sign**
Carolina Caracciolo	CC
EPC Project Engineering Manager	**Sign**
Davide Lo Sterzo	
Client	**Sign**
	Digitaal ondertekend door Paul van Hossum Datum: 2024.08.21 08:16:25 +02'00'

DRAWING NO. DRAWING_NO.

REV. REV

attachment 1 of action 69



NOTES

1. ALL STILLING TUBES AND DIP PIPES SHALL BE SUPER DUPLEX.
2. OVERFLOW TO RISE ABOVE DECK TO MAXIMISE TANK WORKING CAPACITY.
3. LOCATE VENT DISCHARGE AWAY FROM WALKWAYS ETC.
4. IN DECK TANK WITH EXAMPLE EXPORT LINE SHOWN FOR CLARITY.
5. PERFORATED STILLING TUBE.
6. VARIABLE AREA FLOW METER TO BE INSTALLED VERTICALLY WITH DIRECTION OF FLOW UPWARDS.
7. FOR PERIODIC DOSING OF THE WASTE WATER TANK.

HOLDS

1. CONTROL VALVE SIZE (BY VENDOR)
2. METHODOLOGY FOR EMPTIYNG THE WASTE WATER TANK.
3. VENT LINE DIAMETER.

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
00	20/10/2023	CIM	RZI	DLO	ISSUE FOR ACCEPTANCE (IFA)

CROSSWIND

ROSETTI MARINO

TITLE :
BLPH PIPING AND INSTRUMENTATION DIAGRAM
WATER DISPOSAL SHEET 2

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-80026	SHEET 001	REV. 00

File Name : FILE_NAME

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	69
Cause:	Excess Hypochlorite
Consequence:	Unknown components from vendor electrolyzer package
Safeguards:	
Actions:	Consider during vendor hazop package.
Assigned Respondent (By)	CROSSWIND
RESPONSE	Electrolyzer HAZOP has been done on the 4th of December, 2023 where it was considered.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
Company Discipline Lead	**Sign**
	Hamant Patel
Company HSE Lead	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.09.19 09:19:49 +02'00'
Company Project Manager	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.09.24 09:27:27 +02'00'
Contractor received for information. Not independently verified. Information Implemented	

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	70
Cause:	Pump failure P-50001A
Consequence:	Potential backflow from electrochrlorification unit due to unknown cause
Safeguards:	Non return valve Downstream of P-50001A.
Actions:	Consider during vendor hazop package
Assigned Respondent (By)	ROSETTI Mechanical
RESPONSE	This recommenadations is superseded. Electrochrlorification is no more present.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
F.Mura	
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.06.12 17:40:26 +02'00'

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	76
Cause:	Unknown cause of more flow via package.
Consequence:	Potential backflow into other users of bring discharge.
Safeguards:	
Actions:	Confirm if non return valve is required on individual feed lines into brine disposal manifold.
Assigned Respondent (By)	ROSETTI Process Engineer
RESPONSE	It is confirmed that on individual feed lines into brine disposal manifold there is no requirement to have any non-return valve, as per PID 123A90-DDL-PR-PID-80025. See same recommendations 38 already closed
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements

EPC Discipline Lead	**Sign**
C.Impradice	Ciro Impradice Autore firma digitale: Ciro Nome distintivo: CN = Cir Impradice email = ciro. impradice@rosetti.it C = I Rosetti Marino SpA = Pro Data: 2024.05.15 14:30:0 02'00'
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.09.12 17:41:16 +02'00'

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	77
Cause:	Unknown cause within electrolyser package
Consequence:	unknown consequence within electrolyser package
Safeguards:	
Actions:	To be examined within electrolyser package HAZOP
Assigned Respondent (By)	CROSSWIND
RESPONSE	Electrolyser HAZOP has been done on the 4th of December 2023
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements

Company Discipline Lead	**Sign**
	Hamant Patel
Company HSE Lead	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.09.20 10:36:54 +02'00'
Company Project Manager	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.09.24 09:26:27 +02'00'
Contractor received for information. Not independently verified. Information implemented	

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	78
Cause:	
Consequence:	No significant consequence.
Safeguards:	
Actions:	Confirm if non return valve is required on individual feed lines into brine disposal manifold.
Assigned Respondent (By)	ROSETTI Process Engineer
RESPONSE	It is confirmed that on individual feed lines into brine disposal manifold there is no requirement to have any non-return valve, as per PID 123A90-DDL-PR-PID-80025. See same recommendations 38 already closed
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements

EPC Discipline Lead	**Sign**
C.Impradice	Ciro Impradice Autore firma digitale: Ciro Impradice Nome distintivo: CN = Ciro Impradice email = ciro.impradice@rosetti.it C = it Rosetti Marino OU = PRO Data: 2024.05.15 14:30:00 02'00'
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.09.12 17:43:57 +02'00'

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	83
Cause:	Unknown cause within electrolyser package
Consequence:	Leading to potential discharge of sodium hypochlorite, or other contaminants in water. Leading to potential environmental pollution.
Safeguards:	
Actions:	To be examined within electrolyser package HAZOP
Assigned Respondent (By)	CROSSWIND
RESPONSE	Electrolyzer HAZOP has been done on the 4th of December 2023, where it was considered.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements

Company Discipline Lead	**Sign**
	Hamant Patel
Company HSE Lead	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.09.23 07:20:33 +02'00'
Company Project Manager	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.09.24 09:29:31 +02'00'
Contractor received for information. Not independetly verified. Information implemented	

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	89
Cause:	Pump Failure P- 43003
Consequence:	Potential overfill of hydrogen vent.Leading to blockage of hydrogen vent & discharge of water from vent. Potential loss of safeguard, and additional consequences to upstream users & vent systems.Clarification: During a blowdown, the backpressure from V43001 may lead to overpressure of connected low pressure systems (e.g. hydrogen systems rated at 4 barg), leading to a Hydrogen release at grade. Potential for fire / VCE.
Safeguards:	Flow metre downstream of P-43003 with'LL' flow trip. Level 'H' alarm on hydrogen KO drum V- 43001. Level 'LY-HH' on hydrogen KO drum vent, leading to system shutdown.
Actions:	Assess the requirement forflow meterdownstream P-43003 with'LL' flowtrip and evaluate if this needs to be DCS or SIS.
Assigned Respondent (By)	ROSETTI Process Engineer
RESPONSE	The scenario of pump failure has been superseded since pump downstream the H2 Vent KOD has been deleted on the last revision of the FEED P&iD. This is also confirmed by the EPC P&iD “123A90-DDL-PR-PID-80029”. See also recommendations 53 (94)already closed
Attachments:	
Issue Date (dd/mm/yy)	

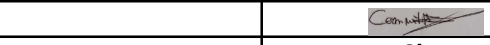
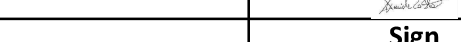
Approvals / Endorsements	
EPC Discipline Lead	**Sign**
C.Impradice	
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**

Paul van Rossum

Digitaal ondertekend door Paul van Rossum
Datum: 2024.09.12 17:45:44 +02'00'

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	91
Cause:	Control loop failure of level control V- 43001 (not starting P-43003)
Consequence:	Potential overfill of hydrogen vent. Leading to blockage of hydrogen vent & discharge of water from vent. Potential loss of safeguard, and additional consequences to upstream users & vent systems. Clarification: During a blowdown, the backpressure from V43001 may lead to overpressure of connected low pressure systems (e.g. hydrogen systems rated at 4 barg), leading to a Hydrogen release at grade. Potential for fire / VCE.
Safeguards:	Flow metre downstream of P-43003 with'LL' flow trip. Level 'H' alarm on hydrogen KO drum V- 43001 Level 'LY-HH' on hydrogen KO drum vent, leading to system shutdown.
Actions:	Asses consequences of loss of safeguard of availability of vent system to upstream users.
Assigned Respondent (By)	ROSETTI Technical Safety
RESPONSE	Level controller of V- 43001 and P-43003 removed from the scope. Recommendation is superseded.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
E.Carminati	
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.01 15:12:35 +02'00'

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	-
Cause:	Pump Failure P- 43003
Consequence:	Potential overfill of hydrogen vent. Leading to blockage of hydrogen vent & discharge of water from vent. Potential loss of safeguard, and additional consequences to upstream users & vent systems. Clarification: During a blowdown, the backpressure from V43001 may lead to overpressure of connected low pressure systems (e.g. hydrogensystems rated at 4 barg), leading to a Hydrogen release at grade. Potential for fire / VCE.
Safeguards:	Flow metre downstream of P-43003 with'LL' flow trip. Level 'H' alarm on hydrogen KO drum V- 43001Level 'LY-HH' on hydrogen KO drum vent, leading to system shutdown.
Actions:	Shut down on 'HH' in hydrogen KO drum vent should lead to system shut down but not depressurisation.
Assigned Respondent (By)	ROSETTI Process Engineer
RESPONSE	AS per C&E matrix, the ESD signal from 43LT001 will: 1) SHUTDOWN WATER TREATMENT PACKAGE A-50000; 2) SHUTDOWN ELECTROLYZER PACKAGE A-20000; 3) SHUTDOWN SEAWATER LIFT PUMP P-50001A; 4) SHUTDOWN SEAWATER LIFT PUMP P-50001B For reference see attachment 1
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
C. Impradice	
EPC HSE Lead	**Sign**
C. Caracciolo	CC
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**
	Digitaal ondertekend door Paul van Rossum Datum: 2024.08.21 08:15:04 +02'00'

DRAWING NO. DRAWING_NO.

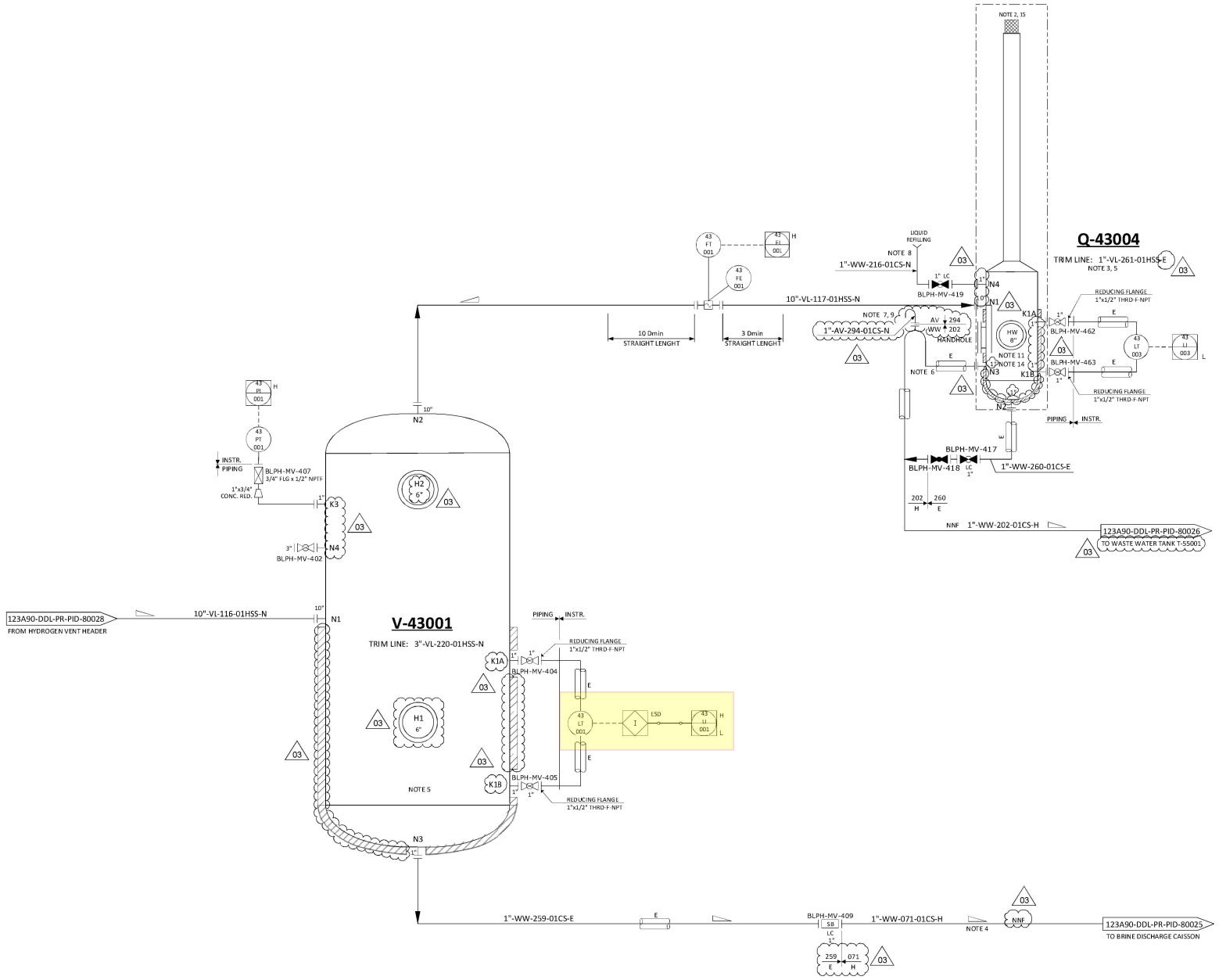
REV. REV

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 (IDi
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 „EG 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.

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
03	09/05/2024	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

File Name : FILE_NAME

CAUSE AND EFFECT CHARTS

PSD

EFFECT

Col.	Group	To sheet	P&ID	Description	PSD	Action	Tag No.
1	ALARM / INTERFACE			WORKSTATION HMI's - EVENT/ALARM			
3	ALARM / INTERFACE			ALARM ON CAP ONSHORE			
8	SHUT-DOWN VALVES		80013	CLOSE 25-SDV-001 ON H2 HEADER TO STORAGE TANKS	PSD		25-SDY-001
10	SHUT-DOWN VALVES		80027	CLOSE 64-SDV-001 NITROGEN TO H2 STORAGE TANKS	PSD		64-SDY-001
12	SHUT-DOWN VALVES		80014	CLOSE 25-SDV-023 ON OUTLET H2 HEADER TO FUEL CELL PGK	PSD		25-SDY-023
14	PROCESS/POWER PACKAGES		80022/23/2	SHUTDOWN WATER TREATMENT PACKAGE A-90000	PSD		50-XS-001
16	PROCESS/POWER PACKAGES		80011	SHUTDOWN ELECTROLYZER PACKAGE A-20000	PSD		20-XS-001
18	PROCESS/POWER PACKAGES		80012	SHUTDOWN FUEL CELL PACKAGE A-80000	PSD		80-XS-001
20	PROCESS/POWER PACKAGES			SHUTDOWN BESS PACKAGE A-85000	PSD		85-XS-001
22	PROCESS/POWER PACKAGES		80027	SHUTDOWN INSTRUMENT AIR PACKAGE A-63000	PSD		63-XS-001
24	PROCESS/POWER PACKAGES		80027	SHUTDOWN NITROGEN PACKAGE A-64000	PSD		64-XS-001
26	PROCESS/POWER PACKAGES			SHUTDOWN SOLAR (Note 1)			83-XS-001
28	PROCESS/POWER PACKAGES			SHUTDOWN SEAWATER LIFT PUMP P-50001A			83-XS-001A
30	PROCESS/POWER PACKAGES			SHUTDOWN SEAWATER LIFT PUMP P-50001B			83-XS-001B
32	HVAC SYSTEM			SHUTDOWN HVAC SYSTEM OF B-100 (HV CONTAINER)			77-XS-001
34	HVAC SYSTEM			SHUTDOWN HVAC SYSTEM OF B-200 (LV CONTAINER)			77-XS-002
36	HVAC SYSTEM			SHUTDOWN HVAC SYSTEM OF B-300 (UPS CONTAINER)			77-XS-003
38	HVAC SYSTEM			SHUTDOWN HVAC SYSTEM OF B-400 (ITER CONTAINER)			77-XS-004

CAUSE

PSD	DESCRIPTION	TAG NO.	FUNC.	By-Pass / Reset	P&ID NO 123A90-DDL-PR-PID-.	NOTE		1	3	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38
ESD-1	PSD ACTIVATION IN CASCADE FROM ESD-1					Sh.7	2													X	X				
PSD	LOW PRESSURE ON NITROGEN MANIFOLD	64-PT-002	LO	X	80027		4	X			X														
PSD	LOW LOW PRESSURE ON OUTLET H2 HEADER TO FUEL CELL PACKAGE	80-PT-002	LO_LO	X	80012		6	X	F	X		X		X	X					X	X				
PSD	HIGH HIGH PRESSURE ON INLET H2 HEADER TO STORAGE TANKS	25-PT-002	HI_HI	X	80013		8	X	F	X				X						X	X				
PSD	HIGH HIGH PRESSURE ON OUTLET H2 HEADER TO FUEL CELL PACKAGE	80-PT-002	HI_HI	X	80012		10	X	F	X		X		X	X					X	X				
PSD	S/D ELECTROLYZER PKG FROM FGS SYSTEM FOR O2 CONFIRMED	70-XA-003				2	12						X	X						X	X				
PSD	HIGH LEVEL H2 VENT KO DRUM	43-LT-001	HI	X	80029		14	X					X	X						X	X				
	F&G UCP PANEL FAULT WATER TREATMENT PKG	50-XA-003					16	X					X	X						X	X				
	ELECTROLYZER PACKAGE CUMULATIVE CRITICAL FAULT	20-XA-003					18	X					X	X						X	X				
	FUEL CELL PACKAGE CUMULATIVE CRITICAL FAULT	80-XA-003					20	X				X			X										
	BESS PACKAGE CUMULATIVE CRITICAL FAULT	85-XA-003					22	X								X									
	INSTRUMENT PACKAGE CUMULATIVE CRITICAL FAULT	63-XA-003					24	X									X								
	NITROGEN PACKAGE CUMULATIVE CRITICAL FAULT	64-XA-003					26	X										X							
	HVAC PACKAGE CUMULATIVE CRITICAL FAULT B-100 (HV CONTAINER)	77-XA-001					28	X														X			
	HVAC PACKAGE CUMULATIVE CRITICAL FAULT B-200 (LV CONTAINER)	77-XA-002					30	X															X		
	HVAC PACKAGE CUMULATIVE CRITICAL FAULT B-300 (UPS CONTAINER)	77-XA-003					32	X																X	
	HVAC PACKAGE CUMULATIVE CRITICAL FAULT B-400 (ITER CONTAINER)	77-XA-004					34	X																	X
	NAVAIDS PACKAGE CUMULATIVE CRITICAL FAULT	72-XA-001					36	X																	
	SOLAR PACKAGE CUMULATIVE CRITICAL FAULT					Note 1	38	X											X						

NOTES

1. SERIAL SIGNALS THROUGH FIBER OPTIC CABLE.
2. FGS AND SIS SYSTEM EXCHANGE DATA BETWEEN THEM BY USING THE Vnet/IP NETWORK. THIS IS IMPLEMENTED AS REDUNDANT SAFETY COMMUNICATION, APPROVED FOR SIL 3 LOOP.

HOLDS

1. T1= xx hours
2. T2= xx sec.
3. T3= xx sec.
4. T4= xx sec. (T4<T3)
5. T5= xx hours (T1+ T2)

Reference

Document Title	Document Number
Fire & Gas Cause & Effect Matrix	123A90-DDL-IN-CE-40002
Process Safety Cause and Effect Block Diagram	123A90-DDL-PR-DG-80000

LEGEND

CCR	CENTRAL CONTROL ROOM (ONSHORE)
OER	ONSHORE EQUIPMENT ROOM
ITER	OFFSHORE CONTROL ROOM
R	RESET
EL	EVENT LOG
F	FLASHING LIGHT INDICATION ON CAP
T	TIME DELAY

Rev.	Date	Description	Issued by	Checked by	Approved by
00	24/11/2023	Issue for Acceptance (IFA)	LCA	MGA	DLO
01	08/03/2024	Accepted For Construction (AFC)	LCA	MGA	DLO
02	12/06/2024	Accepted For Construction (AFC)	LCA	MGA	DLO
03	08/10/2024	Accepted For Construction (AFC)	LCA	MGA	DLO

Process Safety Cause & Effect Matrix

PSD: PROCESS SHUT DOWN

Document Reference: **123A90-DDL-IN-CE-40000**

Rev: 03 Status: **AFC**

Contract No. CW-I-WP4-2023-05

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	92
Cause:	Control loop failure of level control V- 43001 (not starting P-43003)
Consequence:	Potential overfill of hydrogen vent. Leading to blockage of hydrogen vent & discharge of water from vent. Potential loss of safeguard, and additional consequences to upstream users & vent systems. Clarification: During a blowdown, the backpressure from V43001 may lead to overpressure of connected low pressure systems (e.g. hydrogen systems rated at 4 barg), leading to a Hydrogen release at grade. Potential for fire / VCE.
Safeguards:	Flow metre downstream of P-43003 with'LL' flow trip. Level 'H' alarm on hydrogen KO drum V- 43001 Level 'LY-HH' on hydrogen KO drum vent, leading to system shutdown.
Actions:	Check with Technical Safety TA2 whether CoP modifier is allowed for this unmanned platform which will be visited for 2 shifts per year.
Assigned Respondent (By)	ROSETTI Technical Safety
RESPONSE	P-43003 and associated control loop has been removed. Recommendation is superseded.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
E.Carminati	
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.12.23 14:23:02 +01'00'

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	93
Cause:	Control loop failure of level control V- 43001 (not starting P-43003)
Consequence:	Potential overfill of hydrogen vent. Leading to blockage of hydrogen vent & discharge of water from vent. Potential loss of safeguard, and additional consequences to upstream users & vent systems. Clarification: During a blowdown, the backpressure from V43001 may lead to overpressure of connected low pressure systems (e.g. hydrogen systems rated at 4 barg), leading to a Hydrogen release at grade. Potential for fire / VCE.
Safeguards:	Flow metre downstream of P-43003 with'LL' flow trip. Level 'H' alarm on hydrogen KO drum V- 43001 Level 'LY-HH' on hydrogen KO drum vent, leading to system shutdown.
Actions:	Assess the requirement for flow meter downstream P- 43003 with'LL' flow trip and evaluate if this needs to be DCS or SIS.
Assigned Respondent (By)	ROSETTI Technical Safety
RESPONSE	P-43003 removed. Recommendation is superseded.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
E.Carminati	
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.01 15:16:08 +02'00'

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	95
Cause:	Closed valve & suction of the pump
Consequence:	Potential damage to P-43003. Nohazardous consequence. Note: no backflow potential as this discharge goes to Brine Discharge Caisson (sea)
Safeguards:	
Actions:	Assess the requirement for flow meter downstream P- 43003 with'LL' flow trip and evaluate if this needs to be DCS or SIS.
Assigned Respondent (By)	ROSETTI Technical Safety
RESPONSE	P-43003 removed. Recommendation is superseded
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
EPC Discipline Lead	**Sign**
E.Carminati	
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	111
Cause:	
Consequence:	Potential overfill of oxygen vent. Leading to blockage of oxygen vent & discharge of water from vent. Potential loss of safeguard, and additional consequences to electrolyser. Unknown impact on electrolyser package
Safeguards:	Flow meter downstream of P-44003 with'LL' flow trip. Level 'H' alarm on oxygen KO drum V-44001 Level 'LY-HH' on oxygen KO drum vent, leading to system shutdown.
Actions:	Check with Technical Safety TA2 whether CoP modifier is allowed for this unmanned platform which will be visited for 2 shifts per year.
Assigned Respondent (By)	CROSSWIND
RESPONSE	Discussion with Shell TA resulted in the manning level being designated an Enabling Factor with an associated Risk Reduction Factor of 1 order of magnitude. LOPA worksheet have been updated.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements

Company Discipline Lead	**Sign**
	Hamant Patel
Company HSE Lead	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.09.23 15:45:22 +02'00'
Company Project Manager	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.09.24 09:30:03 +02'00'
Contractor received for information. Not independetly verified. Information implemented	

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	112
Cause:	Control loop failure of level control V- 44001 (not starting P-44003)
Consequence:	Potential overfill of oxygen vent.Leading to blockage of oxygen vent & discharge of water from vent. Potential loss of safeguard, and additional consequences tomelectrolyser.Unknown impact on electrolyser package
Safeguards:	Flow metre downstream of P-44003 with'LL' flow trip. Level 'H' alarm on oxygen KO drum V-44001 (not valid, part of IE) Level 'LY-HH' on oxygen KO drum vent, leading to system shutdown.
Actions:	Ensure Level 'LY- HH' on Oxygen KO drum vent achieves a RRF of 120.
Assigned Respondent (By)	CROSSWIND
RESPONSE	The oxygen KO Drum V-44001 and P-44003 have been deleted as per new design. Therefore action no longer applicable
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements

Company Discipline Lead	**Sign**
	Hamant Patel
Company HSE Lead	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.09.23 18:12:07 +02'00'
Company Project Manager	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.09.24 09:30:29 +02'00'
Contractor received for information. Not independetly verified. Information implemented	

BLPH SHEAMS SIGNATURE FORM

Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	113
Cause:	Control loop failure of level control V- 44001 (not starting P-44003)
Consequence:	Potential overfill of oxygen vent. Leading to blockage of oxygen vent & discharge of water from vent. Potential loss of safeguard,and additional consequences to electrolyser. Unknown impact on electrolyser package
Safeguards:	Flow metre downstream of P-44003 with'LL' flow trip. Level 'H' alarm on oxygen KO drum V-44001 (not valid, partof IE) Level 'LY-HH'on oxygen KO drum vent, leading to system shutdown.
Actions:	Assess the requirement for flow meter downstream P- 44003 with'LL' flow trip and evaluate if this needs to be DCS or SIS.
Assigned Respondent (By)	CROSSWIND
RESPONSE	The oxygen KO drum V-44001 and the pump P-44003 have been deleted based on the updated design; Therefore action no longer applicable.
Attachments:	
Issue Date (dd/mm/yy)	

Approvals / Endorsements	
Company Discipline Lead	**Sign**
	Hamant Patel
Company HSE Lead	**Sign**
	Paul van Rossum Digitally signed by Paul van Rossum Datum: 2024.09.23 16:12:28 +02'00'
Company Project Manager	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.09.24 09:30:53 +02'00'
Contractor received for information. Not independetly verified. Information	

4.4 ATTACHMENT 2 - CLOSED EPC HAZOP CLOSE OUT SHEETS

CROSSWIND

ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

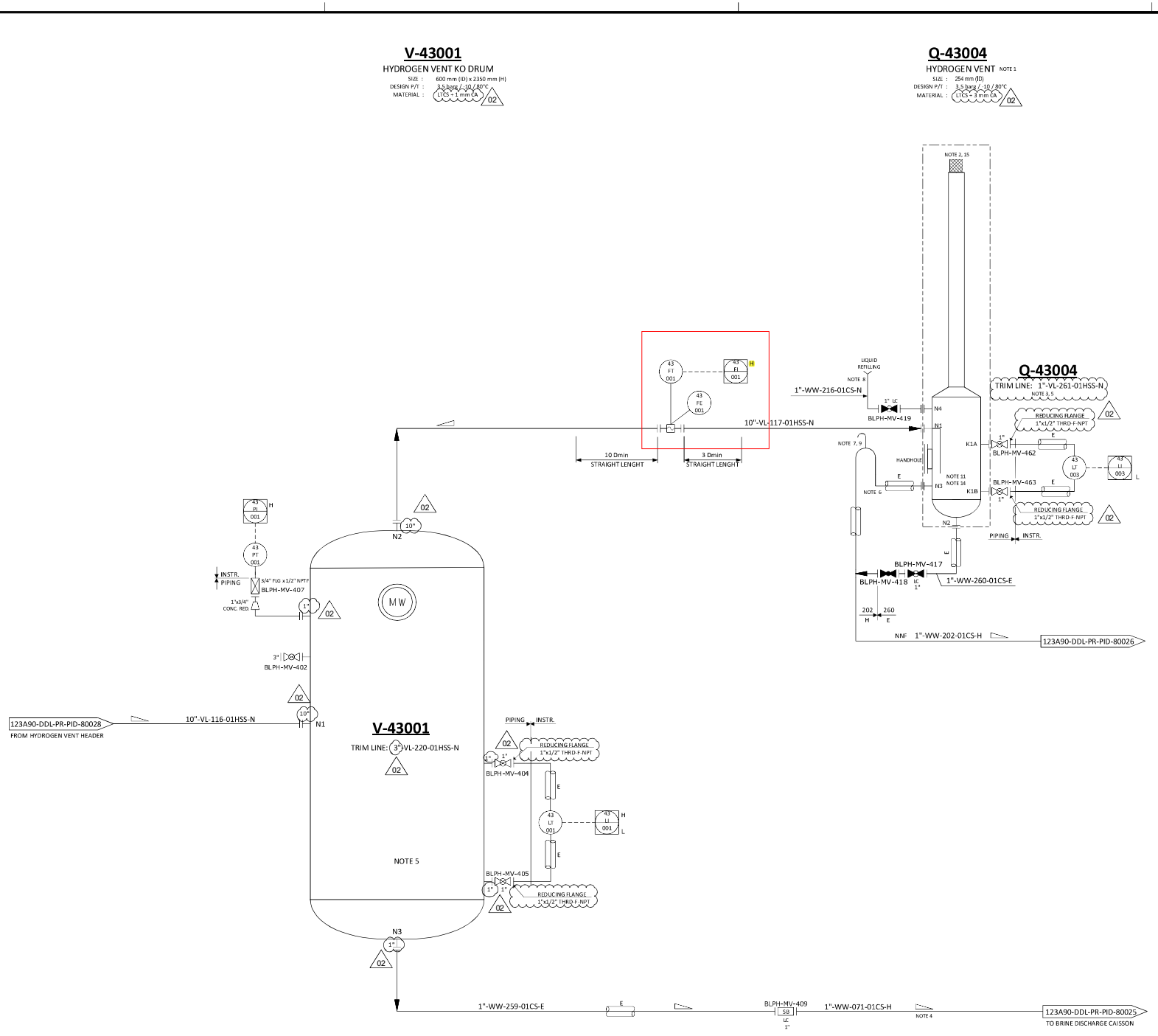
Action Title:	**EPC HAZOP Study Actions**
Action No:	#1
Ref Doc	123A90-DDL-SAF-RE-30006
Item No.	#1
Causes	1.2.2. 25BDV005 Fails open/inadvertently opened by operator 2.2.2. 25BDV005 Fails open/inadvertently opened by operator 1.3.1. 25XV003 inadvertently open by operator 2.2.3. 25PIC005 failure opening 25PV005 2.2.7. 25BDV022 Fails open/inadvertently opened by operator 2.2.9. 80XV001 remains open at end of purge cycle 3.2.1. 25PIC005 failure opening 25PV005 3.2.3. 25BDV022 Fails open/inadvertently opened by operator 3.2.6. 80XV001 Fails open
Consequences	1.2.2.1. H2 sent to H2 vent header and vented to atmosphere, loss of product. Potential for fire/explosion of continuously vented H2 at top of H2 vent. A single H2 storage vessel can be depressurised while maintaining pressure in the other vessels. Consequences: 1.2.3.1, 1.3.1.1, 2.2.2.1, 2.2.3.1, 2.2.7.1, 2.2.9.1, 3.2.1.1, 3.2.3.1, 3.2.6.1
Recommendation	1. Review the requirement for an alarm on 43FT001 and if required determine an appropriate set point to indicate continuous high pressure blowdown of H2 storage vessels.
Actions	In order to detect continuous flow of Hydrogen to the vent system, a “High Flow” alarm will be provided on 43-FT-001. The “alarm point” for the 43-FT-001 will be based on detecting “stable continuous flow” (which is greater than the normal Nitrogen purge rate) for an extended period, that is significantly greater than the period required by the Electrolyser Package A-20000 to produce on spec Hydrogen. The alarm will sound after this period to “alert the operator” that continues flow to Hydrogen vent system has been detected. The “detection period” will be set once the time required for producing on spec Hydrogen by the Electrolyser Package A-20000, is known.
Assigned Respondent (By)	Process
Issue Date (01-12-2023)	
Action Response	

Approvals / Endorsements

EPC Discipline Lead		**Sign**
Ciro Impradice		Impradice Ciro
EPC HSE LEAD		**Sign**
C.Caracciolo		**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client		**Sign**
		Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.11 11:53:47 +02'00'

DRAWING NO. DRAWING_NO.

REV. REV



NOTES

1. VENT TO SAFE LOCATION SEGREGATED FROM OTHER VENTS.
2. VENT TO BE EQUIPPED WITH BIRD SCREEN. 02
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. 02
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. 02
11. INLET DIP LEG SUBMERSION HEIGHT OR 0.6 m. 02
12. DELETED. 02
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 40% VOLUME OF GLYCOL.
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.

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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. 02

File Name : FILE_NAME

CROSSWIND HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)
ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #2 123A90-DDL-SAF-RE-30006
Item No.	#2
Causes	1.2.2. 25BDV005 Fails open/inadvertently opened by operator 2.2.2. 25BDV005 Fails open/inadvertently opened by operator 1.3.1. 25XV003 inadvertently open by operator 2.2.3. 25PIC005 failure opening 25PV005 2.2.7. 25BDV022 Fails open/inadvertently opened by operator 2.2.9. 80XV001 remains open at end of purge cycle 3.2.1. 25PIC005 failure opening 25PV005 3.2.3. 25BDV022 Fails open/inadvertently opened by operator 3.2.6. 80XV001 Fails open
Consequences	1.2.2.1. H2 sent to H2 vent header and vented to atmosphere, loss of product. Potential for fire/explosion of continuously vented H2 at top of H2 vent. A single H2 storage vessel can be depressurised while maintaining pressure in the other vessels. Consequences: 1.2.3.1, 1.3.1.1, 2.2.2.1, 2.2.3.1, 2.2.7.1, 2.2.9.1, 3.2.1.1
Recommendation	2. Perform vent radiation and dispersion study to confirm that dispersion from continuous blowdown or fail open of: 1. 25PV005 of any single H2 storage vessel 2. 25XV003 (25RO003) 3. 25BDV005 (25RO005) 4. 80XV001 (80RO001) 5. 25BDV022 (25RO022) does not create a fire or explosion risk to the installation.
Actions	
Assigned Respondent (By)	Tech Safety
Issue Date(01-12-2023)	
Action Response	Worst case scenario has been analized. No issue is facing on the asset. Refer to Vent Gas Dispersion and Potential Radiation Study 123A90-DDL-SAF-RE-30021.

Approvals / Endorsements

EPC Discipline Lead		**Sign**
C.Caracciolo	**04/09/24**	
EPC HSE LEAD		**Sign**
C.Caracciolo	**04/09/24**	
EPC Project Manager		**Sign**
D.Lo.Sterzo	**04/09/24**	
Client		**Sign**

CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #3 123A90-DDL-SAF-RE-30006
Item No.	#3
Causes	1.2.3. 25PIC005 failure opening 25PV006 2.2.3. 25PIC005 failure opening 25PV005 3.2.1. 25PIC005 failure opening 25PV005
Consequences	1.2.3.1. H2 sent to H2 vent header and vented to atmosphere, loss of product. Potential for fire/explosion of continuously vented H2 at top of H2 vent. A single H2 storage vessel can be depressurised while maintaining pressure in the other vessels. Consequence 2.2.3.1, 3.2.1.1
Recommendation	3. Review if it is credible to implement an interlock on 25PIC005 to prevent 25PV005 being opened outside of a purge cycle operation.
Actions	The TAG number of the valve 25PV005 and of the 25PIC005 (HAZOPED P&ID Revision 01, 24/11/2023) has been changed to 25PV035 and 25PIC035, respectively (ISSUED P&ID Revision 01, 15-02-2024).A software interlock on 25PIC035 to prevent 25PV035 being opened outside of a purge cycle operation has been provided, as per note 12 on the attached P&ID 123A90-DDL-PR-PID-80015_01, attachment 1 and as per "Process Control,Operation, Start-up and Shutdown Philosophy", doc. n. "123A90-DDL-PR-RE- 80031_01", attachment 2
Assigned Respondent (By)	Process
Issue Date (01-12-2023)	
Action Response	

Approvals / Endorsements

EPC Discipline Lead		**Sign**
C. Impradice	Cinzia Impradice	
EPC HSE LEAD		**Sign**
C.Caracciolo	**03/05/2024**	**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client		**Sign**

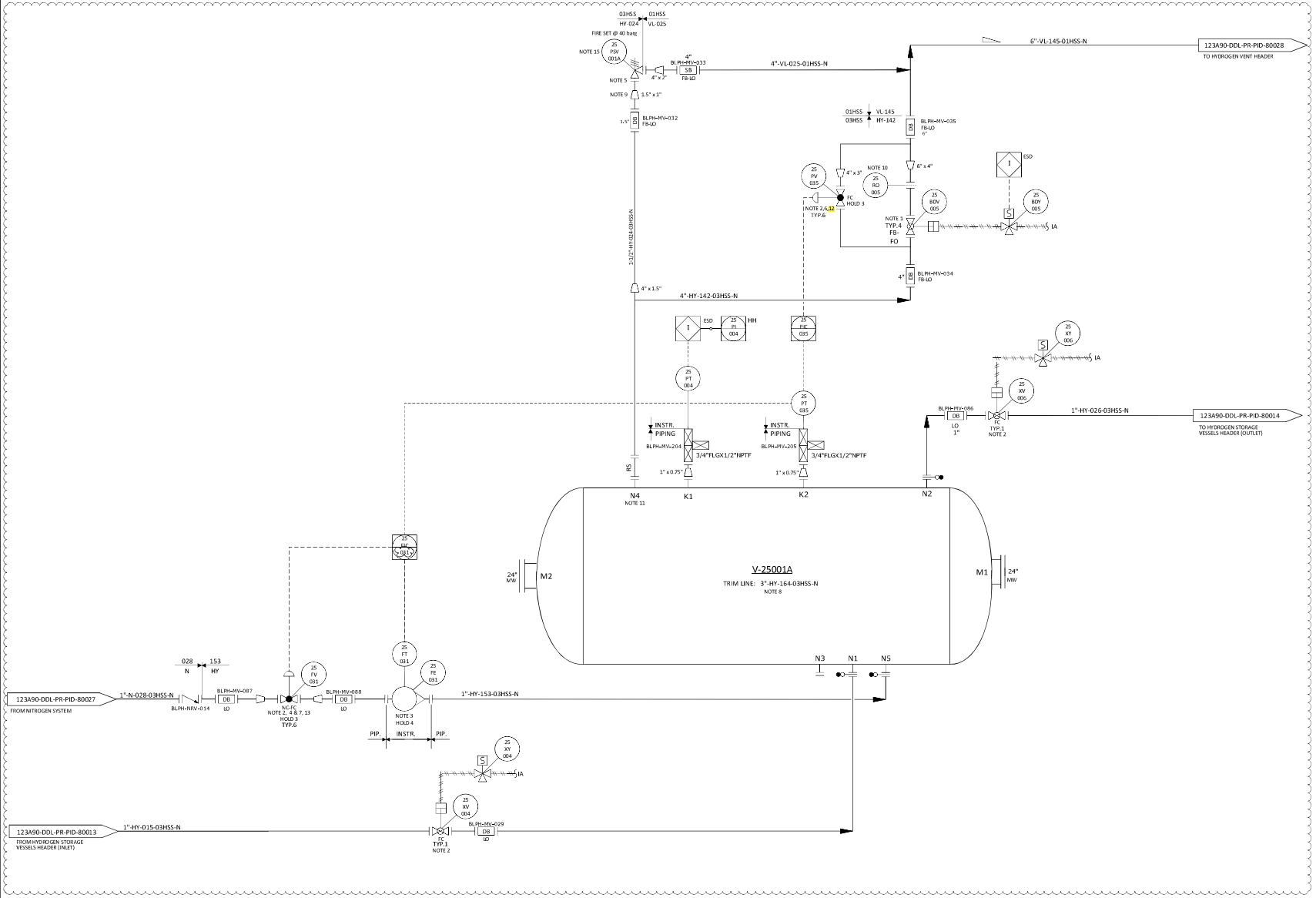
DRAWING NO. DRAWING_NO.

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



01

NOTES

1. NECESSARY CONTROL SYSTEM SOFTWARE SHALL BE INCLUDED TO SUPPORT ADVACED VALVE CONTROL, PARTIAL STROKE TESTING AND DIAGNOSTICS FOR ANY SAFETY CRITICAL ON/OFF VALVES. THESE APPLICATION SHALL BE IDENTIFIED BY HAZOP AND LOPA EVALUATION IF PARTIAL STROKE TESTING WILL BE REQUIRED:
   THE "TYP. 3" SHALL BE CONSIDERED INSTEAD THE ACTUAL "TYP. 2" FOR SDV
   THE "TYP. 5" SHALL BE CONSIDERED INSTEAD THE ACTUAL "TYP. 4" FOR BDV
2. TIGHT SHUT OFF VALVE.
3. VARIABLE AREA FLOWMETER TO BE INSTALLED VERTICALLY WITH DIRECTION OF FLOW UPWARDS.
4. NITROGEN CONTROL VALVE (25-FV-001), 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. 01
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 25PV035 BEING OPENED OUTSIDE OF A PURGE CYCLE OPERATION. CONTROL VALVE 25PV035 IS USED ONLY IN CASE OF VESSEL PURGING.
13. SOFTWARE INTERLOCK TO PREVENT 25FV031 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 25PV035 HAS FAILED TO CLOSE.
15. 25PSV001A SIZED FOR FIRE.

HOLDS

1. DELETED.
2. DELETED.

01

3. CONTROL VALVE SIZE (BY VENDOR).
4. MULTIVARIABLE FLOWMETERS REQUIRE 7 DIAMETERS STRAIGHT LENGHT UPSTREAM AND 5 DIAMETERS STRAIGHT LENGHT DOWNSTREAM (TO BE CONFIRMED BY VENDOR).

01

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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 A

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-80015		SHEET 001	REV. 01

File Name : FILE_NAME

Base Load Power Hub (BLPH)

Process Control, Operation, Start-up and Shutdown philosophy

Document Number: 123A90-DDL-PR-RE-80031

Document Class: 1

01	23/04/2024	Issue for Approval (IFA)	CIM	RZI	DLO
00	13/12/2023	Issue for Approval (IFA)	CIM	RZI	DLO
Rev.	Date	Description	Prepared	Reviewed	Approved

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Should be the operating pressure (PV) fall under the PID regulator SP, the controller drives the control valve to decrease opening (Cv); vice versa, should the operating pressure (PV) rise above the PID regulator SP, the controller drives the control valve to increase its opening (Cv).

At the beginning of the purging operation a timer alarm, in the control logic, will be implemented to determine if 25-PIC-035 failure opening the valve 25-PV-035. It is expected that, according to flow rate of N2 entering to the vessel under purging operation, it will reach the desired pressure at which purging shall be performed within almost 40 minutes. Therefore, after 40 minutes, should the 25-PT-035 indicate a pressure less than the above indicate value of 2 barg, a time alarm will alert the operator that the vessel has not reach the pressure within the desired time. Once the pressure has been reached, then the time alarm shall be deactivated.

The control valve 25-PV-035 is used only in case of vessel purging. Therefore, a software interlock is provided to prevent 25-PV-035 being opened outside of a purge cycle operation. The same software interlock prevents the opening of the control valve 25-FV-031 outside of a purge cycle operation.

Moreover, once the desired pressure of 2 barg has been reached, should the pressure inside the vessel under purging operation fall below the set point of 2 barg, a low pressure alarm on the pressure transmitter 25-PT-035 is provided, to alert the operator. This low pressure alarm will be deactivated at beginning of the purging operation (during the pressurization phase), when the desired pressure is not yet reached. Once 2 barg has been reached, then the alarm will be activated. This is to prevent the low pressure alarm is triggered unnecessarily.

The above-described control loop is relevant to H2 Storage Vessel V-25001A under purging operation. The same applies to the others five H2 Storage Vessel V-25001B/C/D/E/F.

The same control loops 25-FIC-031 and 25-PIC-035 (for the vessel A) above described is used when, after maintenance activities, displacement of air is required, before to reinsert H2 inside the vessel. The purpose of displacing the air from the vessel is to create an inert atmosphere inside the vessel before starting the hydrogen loading phase.

Moreover, at inlet manifold of the vessels, there is a pressure transmitter (25-PT-001) that indicates the pressure value to the DCS with a high alarm threshold. This signal is replicated via software/serial link to the electrolyser package A-20000 in order to communicate the pressure level established inside the whole buffer volume.

Finally, an XV valve located at inlet hydrogen manifold allows for nitrogen purging during maintenance campaign.

3.4.1.3 Start-up and Shut-Down philosophy

No particular start-up or shutdown requirements are provided or needed for these vessels. Except that a dedicated pressure transmitter (25-PT-004/006/008/009/011/012) that handles the plant ESD in case of system overpressure. The emergency high-high level pressure signal is replicated to DCS. Moreover no

CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #4 123A90-DDL-SAF-RE-30006
Item No.	#4
Causes	1.2.4. 25XV006 Driven open/inadvertently opened by operator
Consequences	1.2.4.1. Pressurise downstream system to 25PV025A/B up to 30barg. Potential to exceed design pressure (3 times design pressure) downstream of 25PV025A/B, LOPC of H2 and explosion on ignition.
Recommendation	4. Ensure that 80PSV001 is sized for failure of downstream isolation on H2 vessel during filling operation (i.e. 25XV006) with 25PV025A or B fully open.
Actions	80PSV001 has been verified also for the case "*failure of downstream isolation on H2 vessel during filling operation (i.e. 25XV006) with 25PV025A or B fully open* ". Moreover, as per "Relief, Vent and Blowdown Report" doc n. "123A90-DDL-PR-RE-80030_01", the above case is also the sizing case. For reference see attachment 1
Assigned Respondent (By)	Process
Issue Date (01-12-2023)	
Action Response	

Approvals / Endorsements

EPC Discipline Lead	Ciro Impradice	**Sign**
Ciro Impradice	**08-04-2024**	
EPC HSE LEAD		**Sign**
C.Caracciolo	**08-04-2024**	**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client		**Sign**

Digitaal ondertekend door Paul van Rossum
Datum: 2024.08.21 08:43:19 +02'00'

Base Load Power Hub (BLPH)

Relief, Vent and Blowdown Report

Document Number: 123A90-DDL-PR-RE-80030

Document Class: 1

01	05/02/2024	Accepted for Construction (AFC)	CIM	RZI	DLO
00	04/12/2023	Issue for Acceptance (IFA)	CIM	RZI	DLO
Rev.	Date	Description	Prepared	Reviewed	Approved

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3.3 PSV CALCULATION SUMMARY

The following table summarizes applicable scenarios and sizing results of each PSV, the detailed calculation are shown through the Appendix 01 Section.6.1:

PSV TAG	PID n°	Type	Set P (barg)	Case	Calc. load (kg/h)	Rated Flow (kg/h)	PSV size
25-PSV-001A to F (*)	123A90-DDL-PR-PID-80015 to PID-80020	Conventional	40	Fire	627	1067	1E2 300lbX150lb
80-PSV-001	123A90-DDL-PR-PID-80012	Conventional	10	Bloc.disch	106	185	1D2 150lbX150lb
				CV fail	2679	3095	3K4 150lbX150lb
64-PSV-001	123A90-DDL-PR-PID-80027	Conventional	10	Bloc.disch	61.4	690.4	1D2 150lbX150lb
				Reverse flow (H2 from vessel)	23.8	185	1D2 150lbX150lb

Table 4 – PSV calculation summary

(*) The PSV set pressure is reached only after 4.4 minutes and after that time the PSV valve starts to discharge at a pressure slightly above the set pressure value (~44 bara) as shown along the below APPENDIX 01 – PSV CALCULATION SHEETS.

See APPENDIX 01 – PSV CALCULATION SHEETS

CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action No:	**EPC HAZOP Study Actions** #5
Ref Doc	123A90-DDL-SAF-RE-30006
Item No.	#5
Causes	2.2.5. Spectacle Blind on Waste Water Line left open following maintenance
Consequences	2.2.5.1. Potential overpressure of waste water tank T55001 due to N2 pressurisation resulting in overpressure and rupture of waste water tank T55001. Potential impact on personal.
Recommendation	5. Review whether a permanent connection to the waste water tank T55001 is required from the hydrogen storage vessels. If so then review the potential for open waste water drain on storage vessel V25001A-F to result in overpressurisation of waste water tank during an N2 pressure test of the vessel following maintenance activity. Also consider the required vent sizing of waste water tank T55001 (to be calculated).
Actions	Based on the Electrolyser Vendor information (see TQ number "123A90-PML-PM-TQ-00023", Attachment 1), the on-spec hydrogen, that is sent to the six Hydrogen Storage Vessel (V-25001A/F) is 99.999% pure (i.e. Dry hydrogen). Therefore, the liquid drain lines from each of the six vessels, leading to the Waste Water Tank (T-55001) have been deleted, see Attachment 2 (P&iD "123A90-DDL-PR-PID-80015_02"). In the two-year life cycle of the BLPH facility, no maintenance activity inside the storage vessel is expected. However, if after maintenance activity drainage of liquid (used for cleaning purpose) is required then the liquid from the vessels will be removed via a temporary vacuum pump and the liquid disposed of in the same manner as the liquids from the Waste Water Tank. The precise procedure will be part of the maintenance / operating manual (yet to be developed).
Assigned Respondent (By)	Process
Issue Date (01-12-2023)	
Action Response	

Approvals / Endorsements

EPC Discipline Lead		**Sign**
C.Impradice		Ciro Impradice
EPC HSE LEAD		**Sign**
C.Caracciolo	**19/06/2024**	**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client		**Sign**
		Digitaal ondertekend door Paul van Bossum Datum: 2024.08.21 08:35:43 +02'00'

CROSSWIND

ROSETTI MARINO

TECHNICAL QUERY
Hollandse Kust Noord

No. TQ :	123A90-PML-PM-TQ-00023	Rev:	00

Originating Party	Rosetti Marino					
Subject	Electrolyser Process Information					
Author	C. Impradice	TQ Aconex unique number:				
Interface TQ - from		TQ interface source Aconex unique number:				
Type	Query x			Interface x		
	Deviation			Derogation (SHALL[PS])		
	Note: No deviations nor derogations which have an adverse effect on HSSE will be granted					
Workpackage						
Area(s) of application	Design & Eng.	x	Procurement		Construction	
	Commissioning		Operations		Other	
Issue date	22/09/2023		Urgent reply 5 days	x	Routine reply 10 days	
Close-out date						
Closed-out by			TQ status:		Closed-out	

1. Description

Reference documents / Aconex unique numbers:
K559-2254-PR-PID-002-001 - BLPH PIPING AND INSTRUMENTATION DIAGRAM ELECTROLYSER PACKAGE rev2

Reference is made to FEED document "K559-2254-PR-PID-002-001 - BLPH PIPING AND INSTRUMENTATION DIAGRAM ELECTROLYSER PACKAGE rev2", attached to this TQ. In accordance to note 4 of the attached PID ("PACKAGE VENDOR TO DEFINE INTERFACE WITH CONTRACTOR AND CCS CONNECTION REQUIREMENTS"), Vendor is requested:

1) to inform RM about process fluids type (H2, N2, Instrument Air and water or whatever), which are necessary for the proper working of the package;
2) to provide all process information (IN and OUT) of all fluids (operating and design conditions);
3) to inform RM if a vent line outgoing from the package is present (if yes, then Vendor to inform RM about all process conditions on this stream).

For sake of clarity Vendor is requested also to markup the attached PID, indicating all missing interface points with the external RM system.

2. Response

Reference documents / Aconex unique numbers

INTERFACES TABLE

This communication is issued for the recipient's information and to facilitate the obligations of the Parties under the Contract. This communication has no authority to amend or vary the Contract nor relieve either Party of any duties, obligations or responsibilities.

Type	In/Out	Description	Diameter & Fitting	Material	Flow (m3/h)	Pressure (Barg)	Design Pressure (Barg)	Temperature (°C)	Design Temperature (°C)
Water supply	In	Softened water	1" FLANGE ASME B16.5	SS316	0,805	4-6	6	10-35	40
H2 Production	Out	Hydrogen 99,999%	1" FLANGE ASME B16.5	SS316	500 Nm3/h	30	40	5-65	80
H2 Vent	Out	Hydrogen	2" FLANGE ASME B16.5	SS316	500 Nm3/h	ATM	40	5-65	80
Nitrogen supply	In	Nitrogen 97%	1" FLANGE ASME B16.5	SS316	The maximum/peak value of Nitrogen flowrate, related to the flushing time (almost 2 minutes), is 36 m3/hr at 7 barg.	7	10	AMB	45
Operating Drain No.1: drain from water treatment package	Out	Waste water	2" FLANGE ASME B16.5	SS316	Normal: 0,402 Maximum: 1,8 (during quality rinse of RO system)	ATM	6	5-35	80
Operating Drain No.2: drain from collector of H2 vent's drain and hydrogen purification unit's vent	Out	Pure water + Hydrogen+ Catalyst + Zeolite	2" FLANGE ASME B16.5	SS316	0,50	ATM	6	5-35	80
Maintenance Drain No. 1	Out	Pure water +Hydrogen	Drain valves, Refer to PID	SS316	Volume: 2 m3	ATM	6	5-35	80
Maintenance Drain No. 2	Out	Pure water +Oxygen	Drain valves, Refer to PID	SS316	Volume: 6 m3	ATM	6	5-35	80
Instrument air	In	Compressed air	1" FLANGE ASME B16.5	SS316	18Nm3/h peak	7,00	10	AMB	45

In PID sent with this TQ, compressed air supply is missing as nan interface.

INTERFACES TABLE

Type	In/Out	Description	Diameter & Fitting	Material	Flow (m3/h)	Pressure (Barg)	Design Pressure (Barg)	Temperature (°C)	Design Temperature (°C)
Water supply	In	Softened water	1" FLANGE ASME B16.5	SS316	0,805	4-6	6	10-35	40

This communication is issued for the recipient's information and to facilitate the obligations of the Parties under the Contract. This communication has no authority to amend or vary the Contract nor relieve either Party of any duties, obligations or responsibilities.

H2 Production	Out	Hydrogen 99,999%	1" FLANGE ASME B16.5	SS316	500 Nm3/h	30	40	5-65	80
H2 Vent	Out	Hydrogen	2" FLANGE ASME B16.5	SS316	500 Nm3/h	ATM	40	5-65	80
Nitrogen supply	In	Nitrogen 97%	1" FLANGE ASME B16.5	SS316	The maximum/peak value of Nitrogen flowrate, related to the flushing time (almost 2 minutes), is 36 m3/hr at 7 barg.	7	10	AMB	45
Operating Drain No.1: drain from water treatment package	Out	Waste water	2" FLANGE ASME B16.5	SS316	Normal: 0,402 Maximum: 1,8 (during quality rinse of RO system)	ATM	6	5-35	80
Operating Drain No.2: drain from collector of H2 vent's drain and hydrogen purification unit's vent	Out	Pure water + Hydrogen+ Catalyst + Zeolite	2" FLANGE ASME B16.5	SS316	0,50	ATM	6	5-35	80
Maintenance Drain No. 1	Out	Pure water +Hydrogen	Drain valves, Refer to PID	SS316	Volume: 2 m3	ATM	6	5-35	80
Maintenance Drain No. 2	Out	Pure water +Oxygen	Drain valves, Refer to PID	SS316	Volume: 6 m3	ATM	6	5-35	80
Instrument air	In	Compressed air	1" FLANGE ASME B16.5	SS316	18Nm3/h peak	7,00	10	AMB	45

In PID sent with this TQ, compressed air supply is missing is on interface.

This communication is issued for the recipient's information and to facilitate the obligations of the Parties under the Contract. This communication has no authority to amend or vary the Contract nor relieve either Party of any duties, obligations or responsibilities.

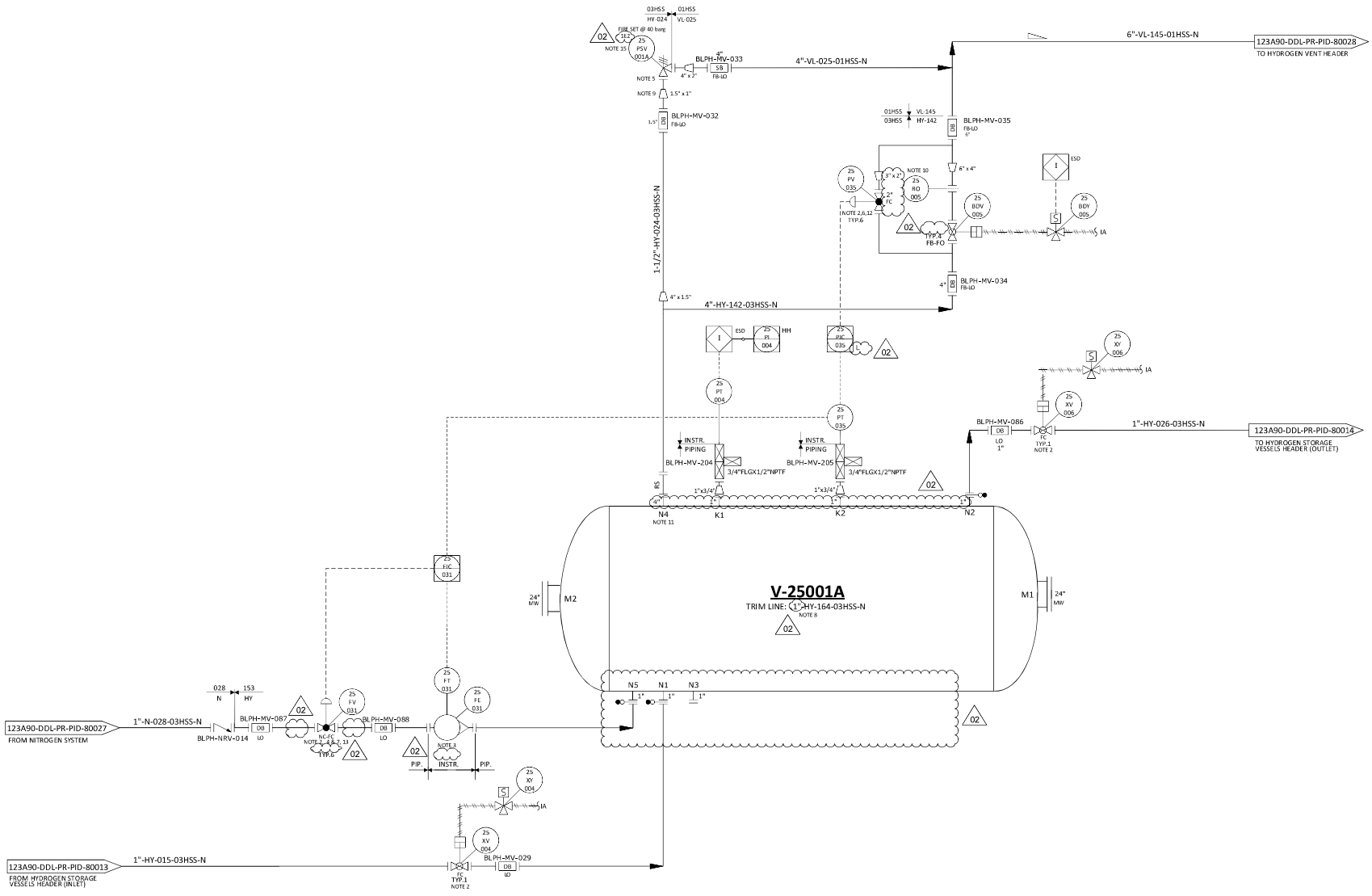
DRAWING NO. DRAWING_NO.

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. 02
2. TIGHT SHUT OFF VALVE.
3. VARIABLE AREA FLOWMETER TO BE INSTALLED VERTICALLY WITH DIRECTION OF FLOW UPWARDS.
4. NITROGEN CONTROL VALVE (25-FV-001), 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 25PV035 BEING OPENED OUTSIDE OF A PURGE CYCLE OPERATION. CONTROL VALVE 25PV035 IS USED ONLY IN CASE OF VESSEL PURGING.
13. SOFTWARE INTERLOCK TO PREVENT 25FV031 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 25PV035 HAS FAILED TO CLOSE.
15. 25PSV001A SIZED FOR FIRE.

HOLDS

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

02

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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 A

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-80015		SHEET 001	REV. 02

File Name : FILE_NAME

CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #6 123A90-DDL-SAF-RE-30006
Item No.	#6
Causes	1.2.5. 25FIC001 failure opening 25FV001 N2 valve 3.2.2. 25FIC001 failure opening 25FV001 N2 valve
Consequences	1.2.5.1. Potential for N2 (7barg) into H2 storage vessel V25001A during filling operation resulting in off spec H2 sent to the Fuel Cell leading to operational issue no hazardous consequences as per Fuel Cell HAZOP (Cause 1.13.1). Consequence: 1.13.2.1, 3.2.2.1
Recommendation	6. Review if it is credible to implement an interlock to prevent 25FV001 being opened outside of a purge cycle operation.
Actions	The TAG number of the valve 25FV001 (HAZOPED P&ID Revision 01, 24/11/2023) has been changed to 25FV031 (ISSUED P&ID Revision 02, 12-06-2024). A software interlock to prevent 25FV031 being opened outside of a purge cycle operation has been provided, as per note 13 on the attached P&ID 123A90-DDL-PR-PID-80015_02 (attachment1). Software interlock applies to all storage vessels N2 supply flow valve
Assigned Respondent (By)	Process
Issue Date (01-12-2023)	
Action Response	

Approvals / Endorsements

EPC Process Lead		**Sign**
C.Impradice		Ciro Impradice
EPC HSE LEAD		**Sign**
C.Caracciolo	**20-06-2024**	**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client		**Sign**
		Digitaal ondertekend door Paul van Rossum

CROSSWIND

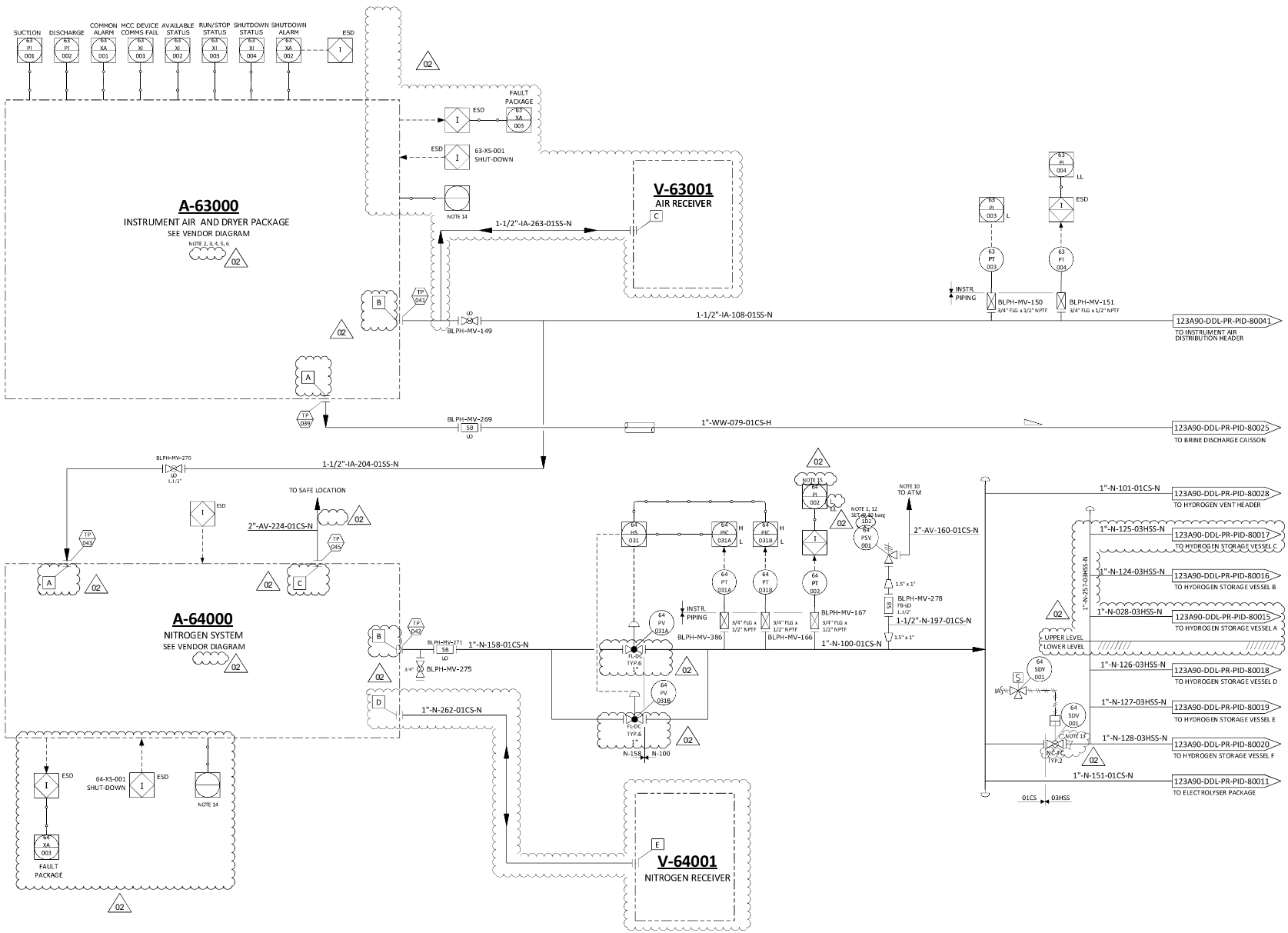
HOLLANDSE KUST NOORD WIND PARK

Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #7 123A90-DDL-SAF-RE-30006
Item No.	#7
Causes	1.2.5. 25FIC001 failure opening 25FV001 N2 valve 3.2.2. 25FIC001 failure opening 25FV001 N2 valve
Consequences	1.2.5.3. Overpressure of N2 system resulting in LOPC of H2 and N2. 3.2.2.3. Overpressure of N2 system resulting in LOPC of H2 and N2.
Recommendation	7. Review the current design against for compliance with piping (utility connection DEP 31.38.01.11, version 2018) and overpressure (80.45.10.11) DEPs for connection of utility N2 to H2 storage vessels V25001A-F. If they are not compliant (and are not to be made compliant) review current design with LOPA
Actions	
Assigned Respondent (By)	Process
Issue Date (01-12-2023)	
Action Response	The Shutdown Valve (SDV), 64-SDV-001, is installed on the sub-header of Nitrogen supply line to the Hydrogen Storage Vessels (V-25001A/F), as additional layer of protection between Nitrogen System and Hydrogen Storage Vessels (V-25001A/F), for reference see PID 123A90-DDL-PR-PID-80027, Rev 02 (see Attachment 1). During normal operation, when the Hydrogen Storage Vessels (V-25001A/F) are under pressure (between 30 barg and 4 barg), the 64-SDV-001 valve will be closed. The 64-SDV-001 is only open during Nitrogen purging of the Hydrogen Storage Vessels, to allow forward flow of Nitrogen. During this phase the Hydrogen Storage Vessels will be under low pressure, approximately ≤ 2 barg, (the pressure reduced by using up the hydrogen via the Fuel Cell or by venting). The maximum Nitrogen supply pressure is 7 barg. During normal operation, outside the Nitrogen purge cycle, the flow control valves (25-FV-031, 032, 033, 034, 038, 036), will be closed. In addition the Non-return valves (BLPH-NRV-014, 023, 027, 029, 030, 031), located upstream, are provided to prevent reverse flow. In the event of Flow Control valve driven open the reverse flow of Hydrogen is prevented by the check valves (BLPH-NRV-014, 023, 027, 029, 030, 031). Should one of these valves leak then reverse flow is prevented by the normally closed SDV (64-SDV-001), providing additional layer of protection. It should be noted that during Nitrogen purging cycle the 64-SDV-001 will close upon Low Low pressure trip (of Nitrogen supply) detected / initiated via 64-PT-002. It is the Nitrogen system that pressurize the vessel during purging operation. Therefore, now with the installation of the SDV the back flow of hydrogen is not credible.

Approvals / Endorsements		
EPC Discipline Lead / Construction		**Sign**
Ciro Impradice		Impradice Ciro
EPC HSE LEAD		**Sign**
C.Caracciolo		**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client		**Sign**
		Paul van Rossum — Originele ondertekend door Paul van Rossum Datum: 2024.10.11 11:59:19 +02'00'



NOTES

1. ONE UNINSTALLED SPARE PSV SHALL BE AVAILABLE.
2. COMPRESSORS AND DRIERS DESIGNED FOR 2 X 100% CONFIGURATION. INSTRUMENT AIR RECEIVER DESIGNED FOR 1 X 100%.
3. VENDOR TO PROVIDE NECESSARY CONTROLS, INSTRUMENTATIONS AND ISOLATIONS IN ORDER TO OPERATE THE PLANT IN SAFE MANNER.
4. COMPRESSORS WILL OPERATE ON THE BASIS OF ONE WORKING AND ONE ON STANDBY.
5. COMPRESSORS TO BE ROTARY SCREW TYPE OIL FREE.
6. AIR COMPRESSOR INLET TO BE LOCATED AWAY FROM ANY VENTS.
7. DELETED. 02
8. DELETED.
9. DELETED.
10. TO SAFE LOCATION, ROUTED AWAY FROM WALKWAYS.
11. DELETED. 02
12. 64PSV001 SIZED FOR UPSTREAM CV FAILURE.
13. 64SDV001 IS NORMALLY CLOSED. IF REQUIRED THE OPERATOR CAN REMOTELY OPEN THE VALVE TO ALLOW PURGING OPERATION. VALVE 64SDV001 IS ALSO CONNECTED TO THE PCS SYSTEM.
14. SERIAL COMMUNICATION WITH CONTROL SYSTEM.
15. THE ALARM 64-PAL-002 WILL CLOSE 64-SDV-001 THROUGH SAFETY SYSTEM.

02

HOLDS

1. DELETED.
2. DELETED. 02
3. DELETED.
4. DELETED.

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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
INSTRUMENT AIR PACKAGE

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-80027		SHEET 001	REV. 02

DRAWING NO. DRAWING_NO.
REV. REV.
File Name : FILE_NAME

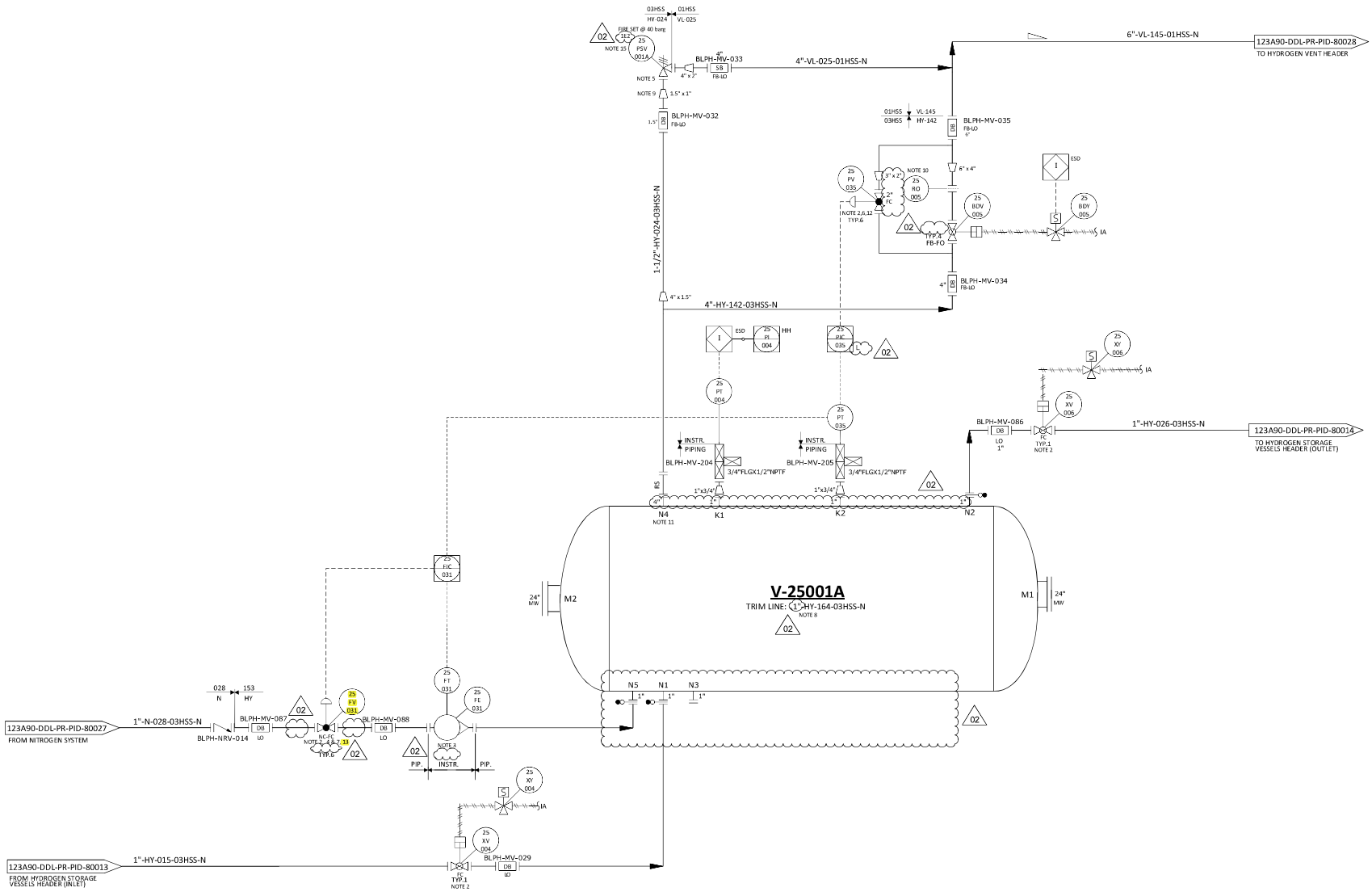
DRAWING NO. DRAWING_NO.

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. 02
2. TIGHT SHUT OFF VALVE.
3. VARIABLE AREA FLOWMETER TO BE INSTALLED VERTICALLY WITH DIRECTION OF FLOW UPWARDS.
4. NITROGEN CONTROL VALVE (25-FV-001), 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 25PV035 BEING OPENED OUTSIDE OF A PURGE CYCLE OPERATION. CONTROL VALVE 25PV035 IS USED ONLY IN CASE OF VESSEL PURGING.
13. SOFTWARE INTERLOCK TO PREVENT 25FV031 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 25PV035 HAS FAILED TO CLOSE.
15. 25PSV001A SIZED FOR FIRE.

HOLDS

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

02

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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 A

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-80015		SHEET 001	REV. 02

File Name : FILE_NAME

CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #8 123A90-DDL-SAF-RE-30006
Item No.	#8
Causes	1.2.5. 25FIC001 failure opening 25FV001 N2 valve 3.2.2. 25FIC001 failure opening 25FV001 N2 valve
Consequences	1.2.5.3. Overpressure of N2 system resulting in LOPC of H2 and N2. Consequence 3.2.2.3.
Recommendation	8. Ensure that 64PSV001 is verified for backflow of 30 barg H2 from storage vessels V25001A-F. Ensure that the vent from PSV is located in a safe location considering this flow will be H2. Also consider proximity of vent to N2 package which vents O2.
Actions	
Assigned Respondent (By)	Process
Issue Date (01-12-2023)	
Action Response	This recommendation is no longer applicable. See response on EPC HAZOP recommendation n.7, which states: "*7. Review the current design against for compliance with piping (utility connection DEP 31.38.01.11, version 2018) and overpressure (80.45.10.11) DEPs for connection of utility N2 to H2 storage vessels V25001A-F. If they are not compliant (and are not to be made compliant) review current design with LOPA.* "

Approvals / Endorsements		
EPC Discipline Lead / Construction		**Sign**
		Impresa Lino
EPC HSE LEAD		**Sign**
C.Caracciolo		**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client		**Sign**
		Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.11 11:59:56 +02'00'

CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #9 123A90-DDL-SAF-RE-30006
Item No.	#9
Causes	1.7.1. External Fire Consequence: 3.7.1.1
Consequences	1.7.1.1. Potential overpressure of H2 storage vessel V25001A resulting in LOPC of H2 and explosion on ignition.
Recommendation	9. Review the ESD logic for activation of ESD 1D on activation of 25PI004 HH and F&G detection system. Consider under which circumstances a single vessel should be depressurised and when all vessels should be depressurised.
Actions	
Assigned Respondent (By)	Tech Safety
Issue Date(01-12-2023)	
Action Response	The only identified cause for having high pressure on single H2 storage vessel is the external fire. As per F&G C&E matrix, doc. n. 123A90-DDL-IN-CE-40002, the ESD-1D is activated for both gas and fire in open area.

Approvals / Endorsements

EPC Discipline Lead		**Sign**
C.Caracciolo	05-04-24	
EPC HSE LEAD		**Sign**
C.Caracciolo	05-04-24	
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client		**Sign**
		Digitaal ondertekend door Paul van Rossum Datum: 2024.05.10 12:21:49 +02'00'

FIRE ZONE 01/02/03/05
HYDROGEN OPEN AREA

FZ-01= FUEL CELL AREA
FZ-02= H2 STORAGE VESSELS AREA
FZ-03= ELECTROLYZER AREA
FZ-04= B-200/B-300/B-400 CONTAINERS AREA
FZ-05= BESS AREA
FZ-06= B-100 CONTAINER AREA
FZ-07= MASTER POINT AREA
FZ-08= TRANSITION PIECE AREA

EFFECT

No.	SYS	NOTES	DESCRIPTION	TAG No.
1	AUDIO / VISUAL ALERT		OPERATOR WORKSTATION DISPLAY - EVENT/ALARM	
2	AUDIO / VISUAL ALERT			
3	AUDIO / VISUAL ALERT		F&G ALARM ON CAP ONSHORE	
4	AUDIO / VISUAL ALERT			
5	AUDIO / VISUAL ALERT	TO SHEET 17	GAS BEACON ACTIVATION - AMBER	
6	AUDIO / VISUAL ALERT			
7	AUDIO / VISUAL ALERT	TO SHEET 17	FIRE BEACON ACTIVATION - RED	
8	AUDIO / VISUAL ALERT			
9	AUDIO / VISUAL ALERT	TO SHEET 17	SOUNDER ACTIVATION	
10	AUDIO / VISUAL ALERT			
11	AUDIO / VISUAL ALERT		WAVE-OFF LIGHT ACTIVATION TO NAVAIDS	72-XS-001
12–16	AUDIO / VISUAL ALERT			
17	SIS SYSTEM		H2 IN OPEN AREA TO SIS SYST. (TRIP EQ. NOT FOR ZONE 1 IN OPEN AREA)	70-XS-005
18–26	SIS SYSTEM			
27–32	ELECTRIC ISOLATION			
33–53	OTHER			

NOTES:

TAG Nos	CAUSE DESCRIPTION	VOTING	INHIBITION	REMARK	No.	1	3	5	9	11	17
950-GDZ-02101 950-GDZ-02102 950-GDZ-02103 950-GDZ-02104 950-GDZ-02105 950-GDZ-02106 950-GDZ-02107 950-GDZ-02108 950-GDZ-02109 950-GDZ-02110 950-GDZ-02111 950-GDZ-02112 950-GDZ-02113 950-GDZ-02114 950-GDZ-02115 950-GDZ-02116 950-GDZ-02117 (ULTRAS.) 950-GDZ-02118 (ULTRAS.) 950-GDZ-02119 (ULTRAS.) 950-GDZ-02120 (ULTRAS.)	FZ-02 - H2 GAS LOW (ELECT./ ULTRAS. POINT 5% LFL)	1oo20	X		1	X	F				
	FZ-02 - H2 GAS HIGH (ELECT./ ULTRAS. POINT 10% LFL)	1oo20	X		2	X	F				
	FZ-02 - H2 GAS HIGH CONFIRMED (ELECT./ ULTRAS. POINT 10% L	2oo20			3	X	F	X	X	X	X
					4						
					5						
					6						
					7						
					8						
					9						
					10						
					11						
					12						
950-GDZ-01101 (ULTRAS.) 950-GDZ-01102 (ULTRAS.) 950-GDZ-01103 (ULTRAS.)	FZ-01 - H2 GAS LOW (ULTRAS. POINT 5% LFL)	1oo3	X		13	X	F				
	FZ-01 - H2 GAS HIGH (ULTRAS. POINT 10% LFL)	1oo3	X		14	X	F				
	FZ-01 - H2 GAS HIGH CONFIRMED (ULTRAS. POINT 10% LFL)	2oo3			15	X	F	X	X	X	X
					16						
950-GDZ-03101 (ULTRAS.) 950-GDZ-03102 (ULTRAS.) 950-GDZ-03103 (ULTRAS.) 950-GDZ-03104 (ULTRAS.) 950-GDZ-03105 (ULTRAS.)	FZ-03 - H2 GAS LOW (ULTRAS. POINT 5% LFL)	1oo5	X		17	X	F				
	FZ-03 - H2 GAS HIGH (ULTRAS POINT 10% LFL)	1oo5	X		18	X	F				
	FZ-03 - H2 GAS HIGH CONFIRMED (ULTRAS POINT 10% LFL)	2oo5			20	X	F	X	X	X	X
					21						
950-GDZ-05101 950-GDZ-05102 950-GDZ-05103	FZ-05 - H2 GAS LOW (ELECTROCHEM. POINT 5% LFL)	1oo3	X		22	X	F				
	FZ-05 - H2 GAS HIGH (ELECTROCHEM. POINT 10% LFL)	1oo3	X		23	X	F				
	FZ-05 - H2 GAS HIGH CONFIRMED (ELECTROCHEM. POINT 10% LFL)	2oo3			24	X	F	X	X	X	X
					25						
					26						
					27						
					28						
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					35						
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					39						
					40						
					41						

LEGEND

TITLE	NUMBER

REFERENCE DOCUMENTS	
TITLE	NUMBER
Process Safety Cause and Effect Matrix	123A90-DDL-IN-CE-40000
Process Safety Cause and Effect Block Diagram	123A90-DDL-PR-DG-80000
F&G detectors Layout - Lower deck and Upper deck	123A90-DDL-SAF-DL-30027
F&G detectors Layout - Below Lower deck	123A90-DDL-SAF-DL-30028

Rev.	Date	Status	Description	DRN	CHKD	APPD
00	08/03/2024	IFA	Issue for Acceptance (IFA)	LCA	MGA	DLO

CROSSWIND — ROSETTI MARINO

Fire & Gas Cause & Effect Matrix: HYDROGEN OPEN AREA

DATE 08/03/2024

HOLLANDSE KUST NOORD WIND PARK Project
Contract No. CW-I-WP4-2023-05

CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #10 123A90-DDL-SAF-RE-30006
Item No.	#10
Causes	1.18.2. Loss of Instrument Air 3.18.2. Loss of Instrument Air
Consequences	1.18.2.1. Section of line between 25SDV001 and 25XV004 will be blocked in during ESD scenario. Consequence 3.18.2.1
Recommendation	10. Review the requirement for a BDV (FO) with a bypass around (25XV003 and 25RO003) and (80XV001 and 80RO001) to allow emergency depressurisation on the manifold inlet line. See also recommendation 12.
Actions	Pressurized fluid and quantity trapped between (volume less than 0.05 m3 and quantity less than 0.11 kg): 1) 25SDV001 and 25XV004 (inlet manifold); 2) 25SDV0023 and FC Package (outlet manifold), is so limited that in case of random rupture possible fire scenario will last few seconds and in any case less than 10 minutes (that is the minimum time for escalation as per assumption register 123A90-DDL-SAF-LIS-30014, see attachment 1). Also dangerous radaiation levels for injuring operators are limited to less than 10 meters. As reference please refer attached simulation performed with phast software (attachment 2).
Assigned Respondent (By)	Process
Issue Date (01-12-2023)	
Action Response	

Approvals / Endorsements		
EPC Discipline Lead / Construction		**Sign**
Ciro Impradice		
EPC HSE LEAD		**Sign**
C.Caracciolo	**19/04/2024**	**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client		**Sign**

Ciro Impradice

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Datum: 2024.05.10 11:10:41 +02'00'

Base Load Power Hub (BLPH)

Assumption Register

Document Number: 123A90-DDL-SAF-LIS-30014

Document Class: 1

02	12/03/2024	Issue for Acceptance (IFA)	G. Giani	C. Caracciolo	D. Lo Sterzo
01	25/01/2024	Issue for Acceptance (IFA)	G. Giani	C. Caracciolo	D. Lo Sterzo
00	14/12/2023	Issue for Review (IFR)	G. Giani	C. Caracciolo	D. Lo Sterzo
Rev.	Date	Description	Prepared	Reviewed	Approved
ICARO					

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Time for detection

The rapidity of detection of a leak of a flammable substance is related to the extent of the release itself but also to the capacity of the detection systems available in the unit.

Time for isolation

Once the leak is identified the isolatable section can be isolated by closing the on-off valves by the intervention of F&G system. The time for the intervention is limited to the required time to close the valves, which show diameter less than 3 inches. Considering that a typical valve closure velocity is 2 second for inch, the isolation time is in the order of some seconds.

Time for emptying the circuit

Emptying of the isolatable section is function of dimension of the release hole and the hold up of the isolatable section.

In conclusion, in case of effective intervention of ESD system, the total release time for each hole diameter in the table below is summarized.

Type of release	Detection/Isolation (minutes)	Emptying
Small release	10	Depending on hold up of the section and release rate from the hole (calculated via Phast software, considering the dynamic flow rate)
Medium hole	5	
Full bore	1	

In case of ineffective intervention of ESD system, the scenarios will be not-isolated for each release hole, and the duration is assumed higher that 10 minutes (which is the threshold for escalation effects, see assumption 7).

Table 10 – Assumption #6

Study:	QRA, FERA		
Subject:	Scenario consequences calculation and reference threshold for QRA / FERA		
Assumption #	7	Rev.	1
Reference:	5, 6,7, 13, 17, 24, 29,30		

Scenario consequence modelling

The scenario consequences will be modelled with the package Phast released by DNV (8.9 latest revision available), in order to assess the spatial distribution of physical effects of scenarios. Operating pressure and temperature and composition of the hazardous fluid will be selected from H&M Balance project documentation. For gas releases the pressure in the system, and hence the release rate, could slowly decrease following isolation, resulting in a time dependent release. As a conservative approach, the calculated initial release rate is assumed constant over the release duration for such scenarios; the scenarios consequences will be evaluated at time = 0, where the release flow rate shows the maximum value. The orientation of the release is an important factor because it will define the orientation of jet fires and their impact. The orientation of release will be modelled as follows:

- horizontal non-impinged for jet fire, in order to maximize damage distances scenarios.
- horizontal (50 % of probability) and down impingement (50 % of probability) for flammable gas dispersion (FF and explosion), in order to maximize damage distances scenarios.

Reference thresholds for QRA

This paragraph provides information on the vulnerability of humans.

Jet fire exposure:

The values for humans' fatality are reported below:

- 37.5 kW/m^2: Probability of human lethality: 100%
- 12.5 kW/m^2: Probability of human lethality: 30%
- 4.73 kW/m^2: Probability of human lethality: 3%

Flash fire exposure:

The values for humans' fatality are reported below:

- LFL: Probability of human lethality: 100%
- LFL/2: Probability of human lethality: 50%

Overpressure exposure:

The values for humans' fatality are reported below:

- 0.5 bar: Probability of human lethality: 100%
- 0.3 bar: Probability of human lethality: 50%

Reference threshold for FERA

This paragraph provides information on the effects of fire and explosion on asset and structure.

Jet fire exposure:

The 37.5 kW/m^2 represent the threshold which unprotected steel will reach thermal stress temperatures that can cause failure. Anyway, for determination of escalation effect it is required to calculate the time which the target is involved in such critical thermal radiation. According to generally adopted exclusion criteria related to the duration of fire scenarios, a possible escalation effect can be expected in case of exposure to jet fire from more than 10 minutes.

For the determination of probability of escalation, a dedicated iso-damage contours will be calculated as the sum of all jet fire scenarios which duration equal or higher than 10 minutes.

Overpressure exposure:

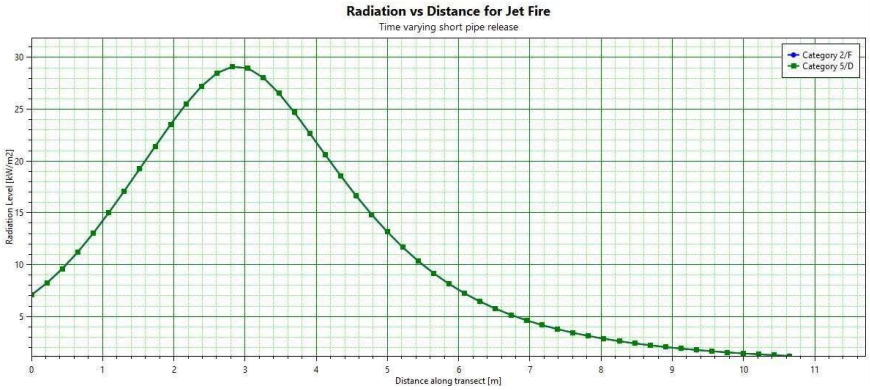
The values for vulnerability to explosion for asset and structure are reported in the tables below.

Overpressure (bar)	Effect on asset/structure
0.35	Collapse of steel girder framed buildings
0.27	Frameless, self-framing steel panel building demolished
0.15	Partial collapse of roofs and walls of buildings.
0.07	Large and small windows usually shattered; occasional damage to windows frame.

Table 11 – Assumption #7

Outlet manifold

Audit Number	746
Crosswind Distance	0 m
Equipment	Pressure vessel
Height of interest	0 m
Material	HYDROGEN
Program	Phast 8,9
Scenario	Time varying short pipe release
Weather	Multiple Weather
Workspace	H2 vent



Consequence Summary Report

Workspace: H2 vent

Study: Study

Summary Basis

These tables will only report global values set in the parameters. Values that are modified in the study tree will not be reported.
The report is context sensitive, and filters up to the study level. You will need to generate multiple summary reports if you have multiple studies in your workspace.
The results in this report are from the non-CFD calculations only.

Discharge Results (after atmospheric expansion)

Path	Scenario	Weather	Peak Flowrate [kg/s]	Temperature [degC]	Liquid mass fraction in material [fraction]	Droplet diameter [um]	Velocity [m/s]	End time of release [s]
Study\Pressure vessel	Time varying short pipe release	Category 2/F	0,111268	-75,4366	0	0	396,359	3,74239
		Category 5/D	0,111268	-75,4366	0	0	396,359	3,74239

CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #11 123A90-DDL-SAF-RE-30006
Item No.	#11
Causes	1.18.2. Loss of Instrument Air 3.18.2. Loss of Instrument Air
Consequences	1.18.2.1. Section of line between 25SDV001 and 25XV004 will be blocked in during ESD scenario. Consequence 3.18.2.2.
Recommendation	11. Ensure that the trapped volume between 25SVD023 and 25PV025A/B is minimised such that it does not require blowdown.
Actions	
Assigned Respondent (By)	Process
Issue Date (01-12-2023)	
Action Response	As per note 6 on PID 123A90-DDL-PR-PID-80014_01, SDV VALVE 25-SDV-023 will BE INSTALLED AS CLOSE AS POSSIBLE TO THE CONTROL VALVES 25-PV-055A/B. This is to ensure that pressurized fluid and quantity trapped (volume less than 0.05 m3 and quantity less than 0.11 kg) in the system is so limited that in case of random rupture possible fire scenario will last few seconds and in any case less than 10 minutes (that is the minimum time for escalation as per assumption register 123A90-DDL-SAF-LIS-314, attachment 1). Also dangerous radiation levels for injuring operators are limited to less than 10 meters. As reference please refer attached simulation performed with phast software (see attachment 2)

Approvals / Endorsements		
EPC Discipline Lead	Ciro Impradice	**Sign**
Ciro Impradice		
EPC HSE LEAD		**Sign**
C.Caracciolo	**19/04/2024**	**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client		**Sign**

Base Load Power Hub (BLPH)

Assumption Register

Document Number: 123A90-DDL-SAF-LIS-30014

Document Class: 1

02	12/03/2024	Issue for Acceptance (IFA)	G. Giani	C. Caracciolo	D. Lo Sterzo
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Rev.	Date	Description	Prepared	Reviewed	Approved
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Time for detection

The rapidity of detection of a leak of a flammable substance is related to the extent of the release itself but also to the capacity of the detection systems available in the unit.

Time for isolation

Once the leak is identified the isolatable section can be isolated by closing the on-off valves by the intervention of F&G system. The time for the intervention is limited to the required time to close the valves, which show diameter less than 3 inches. Considering that a typical valve closure velocity is 2 second for inch, the isolation time is in the order of some seconds.

Time for emptying the circuit

Emptying of the isolatable section is function of dimension of the release hole and the hold up of the isolatable section.

In conclusion, in case of effective intervention of ESD system, the total release time for each hole diameter in the table below is summarized.

Type of release	Detection/Isolation (minutes)	Emptying
Small release	10	Depending on hold up of the section and release rate from the hole (calculated via Phast software, considering the dynamic flow rate)
Medium hole	5	
Full bore	1	

In case of ineffective intervention of ESD system, the scenarios will be not-isolated for each release hole, and the duration is assumed higher that 10 minutes (which is the threshold for escalation effects, see assumption 7).

Table 10 – Assumption #6

Study:	QRA, FERA		
Subject:	Scenario consequences calculation and reference threshold for QRA / FERA		
Assumption #	7	Rev.	1
Reference:	5, 6,7, 13, 17, 24, 29,30		

Scenario consequence modelling

The scenario consequences will be modelled with the package Phast released by DNV (8.9 latest revision available), in order to assess the spatial distribution of physical effects of scenarios. Operating pressure and temperature and composition of the hazardous fluid will be selected from H&M Balance project documentation. For gas releases the pressure in the system, and hence the release rate, could slowly decrease following isolation, resulting in a time dependent release. As a conservative approach, the calculated initial release rate is assumed constant over the release duration for such scenarios; the scenarios consequences will be evaluated at time = 0, where the release flow rate shows the maximum value. The orientation of the release is an important factor because it will define the orientation of jet fires and their impact. The orientation of release will be modelled as follows:

- horizontal non-impinged for jet fire, in order to maximize damage distances scenarios.
- horizontal (50 % of probability) and down impingement (50 % of probability) for flammable gas dispersion (FF and explosion), in order to maximize damage distances scenarios.

Reference thresholds for QRA

This paragraph provides information on the vulnerability of humans.

Jet fire exposure:

The values for humans' fatality are reported below:

- 37.5 kW/m^2: Probability of human lethality: 100%
- 12.5 kW/m^2: Probability of human lethality: 30%
- 4.73 kW/m^2: Probability of human lethality: 3%

Flash fire exposure:

The values for humans' fatality are reported below:

- LFL: Probability of human lethality: 100%
- LFL/2: Probability of human lethality: 50%

Overpressure exposure:

The values for humans' fatality are reported below:

- 0.5 bar: Probability of human lethality: 100%
- 0.3 bar: Probability of human lethality: 50%

Reference threshold for FERA

This paragraph provides information on the effects of fire and explosion on asset and structure.

Jet fire exposure:

The 37.5 kW/m^2 represent the threshold which unprotected steel will reach thermal stress temperatures that can cause failure. Anyway, for determination of escalation effect it is required to calculate the time which the target is involved in such critical thermal radiation. According to generally adopted exclusion criteria related to the duration of fire scenarios, a possible escalation effect can be expected in case of exposure to jet fire from more than 10 minutes.

For the determination of probability of escalation, a dedicated iso-damage contours will be calculated as the sum of all jet fire scenarios which duration equal or higher than 10 minutes.

Overpressure exposure:

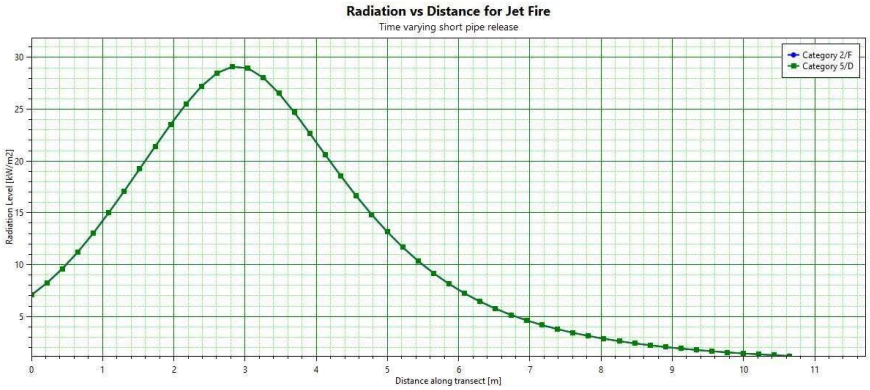
The values for vulnerability to explosion for asset and structure are reported in the tables below.

Overpressure (bar)	Effect on asset/structure
0.35	Collapse of steel girder framed buildings
0.27	Frameless, self-framing steel panel building demolished
0.15	Partial collapse of roofs and walls of buildings.
0.07	Large and small windows usually shattered; occasional damage to windows frame.

Table 11 – Assumption #7

Outlet manifold

Audit Number	746
Crosswind Distance	0 m
Equipment	Pressure vessel
Height of interest	0 m
Material	HYDROGEN
Program	Phast 8,9
Scenario	Time varying short pipe release
Weather	Multiple Weather
Workspace	H2 vent



Consequence Summary Report

Workspace: H2 vent

Study: Study

Summary Basis

These tables will only report global values set in the parameters. Values that are modified in the study tree will not be reported.
The report is context sensitive, and filters up to the study level. You will need to generate multiple summary reports if you have multiple studies in your workspace.
The results in this report are from the non-CFD calculations only.

Discharge Results (after atmospheric expansion)

Path	Scenario	Weather	Peak Flowrate [kg/s]	Temperature [degC]	Liquid mass fraction in material [fraction]	Droplet diameter [um]	Velocity [m/s]	End time of release [s]
Study\Pressure vessel	Time varying short pipe release	Category 2/F	0,111268	-75,4366	0	0	396,359	3,74239
		Category 5/D	0,111268	-75,4366	0	0	396,359	3,74239

CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #12 123A90-DDL-SAF-RE-30006
Item No.	#12
Causes	1.18.2. Loss of Instrument Air Consequence: 2.18.2.3
Consequences	1.18.2.1. Section of line between 25SDV001 and 25XV004 will be blocked in during ESD scenario.
Recommendation	12.Review the trapped volume between Fuel Cell Package and 25PV025A/B is minimised such that it does not require blowdown or consider providing a blowdown route. See also recommendation 10.
Actions	
Assigned Respondent (By)	Process
Issue Date (01-12-2023)	
Action Response	Pressurized fluid and quantity trapped in the system (volume less than 0.05 m3 and quantity less than 0.11 kg) is so limited that in case of random rupture possible fire scenario will last few seconds and in any case less than 10 minutes (that is the minimum time for escalation as per assumption register 123A90-DDL-SAF-LIS-314, see attachment 1). Also dangerous radiation levels for injuring operators are limited to less than 10 meters. As reference please refer attached simulation performed with phast software (attachment 2).

Approvals / Endorsements

EPC Discipline Lead / Construction	Ciro Impradice	**Sign**
Ciro Impradice		
EPC HSE LEAD		**Sign**
C.Caracciolo	**19/04/2024**	**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client		**Sign**

Base Load Power Hub (BLPH)

Assumption Register

Document Number: 123A90-DDL-SAF-LIS-30014

Document Class: 1

02	12/03/2024	Issue for Acceptance (IFA)	G. Giani	C. Caracciolo	D. Lo Sterzo
01	25/01/2024	Issue for Acceptance (IFA)	G. Giani	C. Caracciolo	D. Lo Sterzo
00	14/12/2023	Issue for Review (IFR)	G. Giani	C. Caracciolo	D. Lo Sterzo
Rev.	Date	Description	Prepared	Reviewed	Approved
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Time for detection

The rapidity of detection of a leak of a flammable substance is related to the extent of the release itself but also to the capacity of the detection systems available in the unit.

Time for isolation

Once the leak is identified the isolatable section can be isolated by closing the on-off valves by the intervention of F&G system. The time for the intervention is limited to the required time to close the valves, which show diameter less than 3 inches. Considering that a typical valve closure velocity is 2 second for inch, the isolation time is in the order of some seconds.

Time for emptying the circuit

Emptying of the isolatable section is function of dimension of the release hole and the hold up of the isolatable section.

In conclusion, in case of effective intervention of ESD system, the total release time for each hole diameter in the table below is summarized.

Type of release	Detection/Isolation (minutes)	Emptying
Small release	10	Depending on hold up of the section and release rate from the hole (calculated via Phast software, considering the dynamic flow rate)
Medium hole	5	
Full bore	1	

In case of ineffective intervention of ESD system, the scenarios will be not-isolated for each release hole, and the duration is assumed higher that 10 minutes (which is the threshold for escalation effects, see assumption 7).

Table 10 – Assumption #6

Study:	QRA, FERA		
Subject:	Scenario consequences calculation and reference threshold for QRA / FERA		
Assumption #	7	Rev.	1
Reference:	5, 6,7, 13, 17, 24, 29,30		

Scenario consequence modelling

The scenario consequences will be modelled with the package Phast released by DNV (8.9 latest revision available), in order to assess the spatial distribution of physical effects of scenarios. Operating pressure and temperature and composition of the hazardous fluid will be selected from H&M Balance project documentation. For gas releases the pressure in the system, and hence the release rate, could slowly decrease following isolation, resulting in a time dependent release. As a conservative approach, the calculated initial release rate is assumed constant over the release duration for such scenarios; the scenarios consequences will be evaluated at time = 0, where the release flow rate shows the maximum value. The orientation of the release is an important factor because it will define the orientation of jet fires and their impact. The orientation of release will be modelled as follows:

- horizontal non-impinged for jet fire, in order to maximize damage distances scenarios.
- horizontal (50 % of probability) and down impingement (50 % of probability) for flammable gas dispersion (FF and explosion), in order to maximize damage distances scenarios.

Reference thresholds for QRA

This paragraph provides information on the vulnerability of humans.

Jet fire exposure:

The values for humans' fatality are reported below:

- 37.5 kW/m^2: Probability of human lethality: 100%
- 12.5 kW/m^2: Probability of human lethality: 30%
- 4.73 kW/m^2: Probability of human lethality: 3%

Flash fire exposure:

The values for humans' fatality are reported below:

- LFL: Probability of human lethality: 100%
- LFL/2: Probability of human lethality: 50%

Overpressure exposure:

The values for humans' fatality are reported below:

- 0.5 bar: Probability of human lethality: 100%
- 0.3 bar: Probability of human lethality: 50%

Reference threshold for FERA

This paragraph provides information on the effects of fire and explosion on asset and structure.

Jet fire exposure:

The 37.5 kW/m^2 represent the threshold which unprotected steel will reach thermal stress temperatures that can cause failure. Anyway, for determination of escalation effect it is required to calculate the time which the target is involved in such critical thermal radiation. According to generally adopted exclusion criteria related to the duration of fire scenarios, a possible escalation effect can be expected in case of exposure to jet fire from more than 10 minutes.

For the determination of probability of escalation, a dedicated iso-damage contours will be calculated as the sum of all jet fire scenarios which duration equal or higher than 10 minutes.

Overpressure exposure:

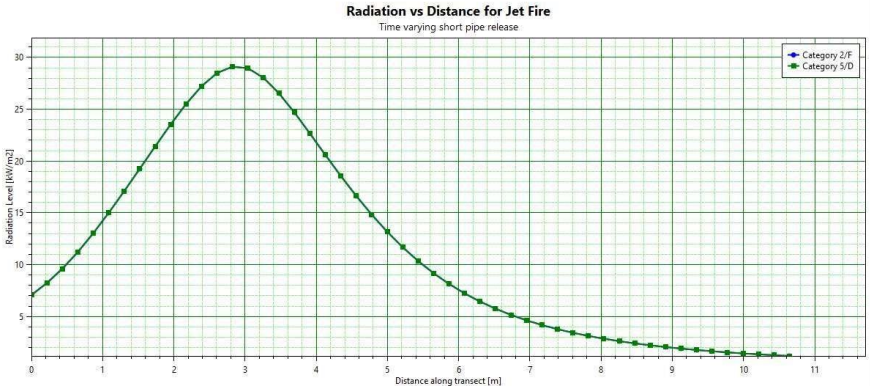
The values for vulnerability to explosion for asset and structure are reported in the tables below.

Overpressure (bar)	Effect on asset/structure
0.35	Collapse of steel girder framed buildings
0.27	Frameless, self-framing steel panel building demolished
0.15	Partial collapse of roofs and walls of buildings.
0.07	Large and small windows usually shattered; occasional damage to windows frame.

Table 11 – Assumption #7

Outlet manifold

Audit Number	746
Crosswind Distance	0 m
Equipment	Pressure vessel
Height of interest	0 m
Material	HYDROGEN
Program	Phast 8,9
Scenario	Time varying short pipe release
Weather	Multiple Weather
Workspace	H2 vent



Consequence Summary Report

Workspace: H2 vent

Study: Study

Summary Basis

These tables will only report global values set in the parameters. Values that are modified in the study tree will not be reported.
The report is context sensitive, and filters up to the study level. You will need to generate multiple summary reports if you have multiple studies in your workspace.
The results in this report are from the non-CFD calculations only.

Discharge Results (after atmospheric expansion)

Path	Scenario	Weather	Peak Flowrate [kg/s]	Temperature [degC]	Liquid mass fraction in material [fraction]	Droplet diameter [um]	Velocity [m/s]	End time of release [s]
Study\Pressure vessel	Time varying short pipe release	Category 2/F	0,111268	-75,4366	0	0	396,359	3,74239
		Category 5/D	0,111268	-75,4366	0	0	396,359	3,74239

CROSSWIND

ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #13 123A90-DDL-SAF-RE-30006
Item No.	#1
Cause	1.20.1. DC systems
Consequences	1.20.1.1. Potential for electrically induced corrosion.
Recommendation	13. Ensure that the potential for electrically induced corrosion and requisite earthing is considered in the SAFOP.
Actions	To prevent induced corrosion, all metallic items not welded to the structure, will be earthed/bounded to the structure. See Earthing layout: 123A90-DDL-EL-DL-20132÷20134, 123A90-DDL-EL-DL-20136÷20138 and 123A90-DDL-IN-DL-40013 only for ITER container.
Assigned Respondent (By)	Process
Issue Date (01-12-2023)	
Action Response	

Approvals / Endorsements		
EPC Discipline Lead / Construction	**Date**	**Sign**
A. Madaschi	22/07/24	
EPC HSE LEAD		**Sign**
C.Caracciolo	22/07/24	
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client		**Sign**

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CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #14 123A90-DDL-SAF-RE-30006
Item No.	#1
Causes	1.3.2. 25XV008/11/14/17/20 open when not required and V25001B-F is at low pressure. Consequence: 1.5.1.1 2.5.1. 25XV008/11/14/17/20 open when not required and V25001B-F is at High pressure (30barg). 3.3.2. 25XV009/12/15/18/21 open when not required and V25001B-F is at Low
Consequences	2.5.1.1. Additional H2 cycled into vessel under purge. Additional H2 is vented to atmosphere, loss of product. No hazardous consequences. 3.3.2.1. Rapid increase in Pressure in vessels V25001B-F from 0 to 30barg. Potential for exceeding design velocity or high vibration in piping and vessels V25001B-F leading to potential LOPC of H2. 3.3.3.1. Rapid increase in Pressure in vessels V25001B-F from 0 to 30barg. Potential for exceeding design velocity or high vibration in piping and vessels V25001B-F leading to potential LOPC of H2. 3.3.3.2. Contamination of Feed stream to Fuel Cell and off spec H2 sent to the Fuel Cell leading
Recommendation	14. Determine if high DP across any valves (likely to be up to 30bar) has the potential for high velocity (outside of pipe spec) or high vibration with the potential to damage pipework. If so consider how purging cycle can be performed without using SDV.
Comments	
Assigned Respondent	Process
Issue Date (01-12-2023)	
Action Response	Vibration analisys has been performed and according to "Guidelines for the Avoidance of Vibration Induced Fatigue in Process Pipework". To be noted that the calculation has been performed considering the worst scanerio in terms of maximum gas velocity, since the operating conditions that have been considered are 65° C and 0 barg. As the pipe is being pressurized, velocity will be even lower, resulting in a lower calculated LOF. As it can be seen from calculation (attachment 1), in order to have a maximum LOF of 0.3, a STIFF or MEDIUM STIFF type span length can be used. The maximum span lengths that are used within CROSSWIND project are as per doc. "123A90-DDL-PP-RE-70001" (attachment 2)

Approvals / Endorsements		
EPC Discipline Lead /	**Date**	**Sign**
C. Impradice	**03/09/24**	Ciro Impradice
EPC HSE LEAD	**Date**	**Sign**
C.Caracciolo	**03/09/24**	
EPC Project Manager	**Date**	**Sign**
D.Lo.Sterzo	04/09/24	
Client	**Date**	**Sign**
		Digitaal ondertekend door Paul van Rossum Datum: 2024.09.04 10:41:15 +02'00'

Line Sizing Calculation sheet

1	General Data	Line number	-	1"-HY-015-03HSS-N									
2		Reference P&ID	-	123A90-DDL-PR-PID-80015									
3		From / To	-	1"-HY-007-03HSS-N		V-25001A							
4		H&MB case / PFD stream n°	-	N/A / N/A		N/A / N/A		/		/		/	
5		Service	-	☐ PUMP SUCTION		☐ PUMP SUCTION		☐ PUMP SUCTION		☐ PUMP SUCTION		☐ PUMP SUCTION	
6				☐ PUMP DISCH. or PRESS.LIQ.Line		☐ PUMP DISCH. or PRESS.LIQ.Line		☐ PUMP DISCH. or PRESS.LIQ.Line		☐ PUMP DISCH. or PRESS.LIQ.Line		☐ PUMP DISCH. or PRESS.LIQ.Line	
7		Overdesign margin	-	0.00%									
8		Operating Pressure	barg	0.00									
9		Operating Temperature	°C	65.00									
10		Phase	Gas/Liq/Mix	Gas									
11	For C constant assessment	FLUID		Dry or non-cond.gas									
12		MATERIAL		SS									
13		CORROSION CONTROL	no-inh./inh.	no inhibition									
14		WITH SOLIDS/WITHOUT SOLIDS	LE-C/SE-C	N.A.									
15		POTENTIAL CORROSIVITY	Low/Med/High	Medium									
16	Gas Process Data	Mass flow (NO MARGIN)	kg/h	45									
17		Mass flow (WITH MARGIN)	kg/h	45		0		0		0		0	
18		Flowrate	MSm^3/d	0.01									
19		Molecular Weight	g/mol	2.01									
20		Compress. Factor (Z)	-	1.0000									
21		Viscosity	cP	0.0100									
22		Cp/Cv	-	1.300									
23		Mass density	kg/m^3	0.07									
24	Liquid Process Data	Mass flow (NO MARGIN)	kg/h										
25		Mass flow (WITH MARGIN)	kg/h	0		0		0		0		0	
26		Mass density	kg/m^3										
27		Viscosity	cP										
28		Volumetric flow	Am^3/h	0.00		0.00		0.00		0.00		0.00	
29	Water Process Data	Mass flow (NO MARGIN)	kg/h										
30		Mass flow (WITH MARGIN)	kg/h	0		0		0		0		0	
31		Mass density	kg/m^3										
32		Viscosity	cP										
33		Volumetric flow	Am^3/h	0.00		0.00		0.00		0.00		0.00	
34	Overall liquid Process Data	Mass flow (WITH MARGIN)	kg/h	0		0		0		0		0	
35		Mass density	kg/m^3	0.00		0.00		0.00		0.00		0.00	
36		Viscosity	cP	0.000		0.000		0.000		0.000		0.000	
37		Volumetric flow	Am^3/h	0.00		0.00		0.00		0.00		0.00	
38	Mixed phases Process Data	Mass flow (WITH MARGIN)	kg/h	45		0		0		0		0	
39		Mass density	kg/m^3	0.07		0.00		0.00		0.00		0.00	
40		Viscosity	cP	0.010		0.000		0.000		0.000		0.000	
41		Volumetric flow	Am^3/h	621.34		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
42	Line Characteristics	Nominal diameter	inch	1.00									
43		Outside diameter	inch	1.32		0.00		0.00		0.00		0.00	
44		OD	mm	33.40		0.00		0.00		0.00		0.00	
45		Piping class	-	03HSS		S-N							
46		Schedule	-	40S									
47		Thickness	mm	3.38									
48		Corrosion allowance	mm	0.00									
49		Internal diameter (uncorroded)	inch	1.05		0.00		0.00		0.00		0.00	
50		Σ pipe wall thk (excluding c.a.)	mm	3.38		0.00		0.00		0.00		0.00	
51		Length	m			100		100		100		100	
52		Surface roughness for		Commercial steel (CS new,SS, CuNi,Ti,Duplex)									
53		Roughness	ft	0.0001499		#N/D		#N/D		#N/D		#N/D	
54	DETERMINATION OF MAX ALLOWABLE ρv^2 for PIPING SUPPORT ARRANGEMENT	FVF	-	0.10		1.00		1.00		1.00		1.00	
55		Stiff	a	-	467782	446187		446187		446187		446187	
56			b	-	-1.02	#NUM!		#NUM!		#NUM!		#NUM!	
57			ρv^2 max allow	Pa	**134710**	**#DIV/0!**		**#DIV/0!**		**#DIV/0!**		**#DIV/0!**	
58		Medium Stiff (std)	a	-	296287	283921		283921		283921		283921	
59			b	-	-1.11	#NUM!		#NUM!		#NUM!		#NUM!	
60			ρv^2 max allow	Pa	**69442**	**#DIV/0!**		**#DIV/0!**		**#DIV/0!**		**#DIV/0!**	
61		Medium	a	-	N.A.	N.A.		N.A.		N.A.		N.A.	
62			b	-	N.A.	N.A.		N.A.		N.A.		N.A.	
63			ρv^2 max allow	Pa	**N.A.**	**N.A.**		**N.A.**		**N.A.**		**N.A.**	
64		Flexible	a	-	N.A.	N.A.		N.A.		N.A.		N.A.	
65			b	-	N.A.	N.A.		N.A.		N.A.		N.A.	
66			ρv^2 max allow	Pa	**N.A.**	**N.A.**		**N.A.**		**N.A.**		**N.A.**	
67	Calculation Results	Reynolds number	-	59685		0		0		0		0	
68		Friction factor	-	#RIF!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
69		Equivalent Res. Coeff.	-	#RIF!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
70		Vf, Fluid velocity (CALCULATED)	m/s	**309.63**		**0.00**		**0.00**		**0.00**		**0.00**	
71		ρv^2 (CALCULATED)	Pa	**6943**		**0**		**0**		**0**		**0**	
72		ρv^3 (CALCULATED)	kg/s^3	2149926		0		0		0		0	
73		Mach number	-	0.23		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
74		Selected C(acc.to NOC-COR-004)	US units	N.A.		N.A.		N.A.		N.A.		N.A.	
75		Ve Erosional velocity (API RP14E)	m/s	N.A.		N.A.		N.A.		N.A.		N.A.	
76		Vmax (SD-NOC-COR-004)	m/s	N.A.		N.A.		N.A.		N.A.		N.A.	
77		Vmax (API RP 14E)(pump suct/disch)	m/s	N.A.		N.A.		N.A.		N.A.		N.A.	
78		Pressure drop gradient (ΔP)	bar/km	**0.000**		**0.000**		**0.000**		**0.000**		**0.000**	
79		ΔP per each 0 meters	bar	#RIF!		0.000		0.000		0.000		0.000	
80		ΔP/P (Tot.Press.Drop on Upstr.P)		#RIF!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
81	CRITERIA ECP-103 CHECK	AVOID.OF EROS.-CORR. (1st check)	Vf < Ve	N.A.		N.A.		N.A.		N.A.		N.A.	
82		AVOID.OF EROS.-CORR. (2nd check)	Vf < Vmax	N.A.		N.A.		N.A.		N.A.		N.A.	
83		REQUIR. PIPING SUPP. ARRANGEMENT	Medium Stiff	Medium Stiff		**Flexible**		**Flexible**		**Flexible**		**Flexible**	
84		MULTIPHASE SERVICE	vol.LiqFrac.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
85	NOTES												
86													
87													

Base Load Power Hub (BLPH)

Stress & Vibration Analysis Report

Document Number: 123A90-DDL-PP-RE-70001

Document Class: 2

01	12/07/2024	Accepted for Construction (AFC)	CMO	AME	DLO
00	15/03/2024	Issue for Review (IFR)	CMO	AME	DLO
Rev.	Date	Description	Prepared	Reviewed	Approved

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4.8 VIBRATION ANALYSIS

To avoid any vibration phenomena due to AIV and/or FIV and guarantee a good engineering of piping supports design, it has been verified that all lines subjected to computer analysis have a minimum natural frequency of 4 Hz for all mode of vibrations.

Regarding small bore connections (SBC) ≤ 2", considering LOF=0.3 according to Energy Institute Guidelines the maximum piping span to avoid vibrations are as follows.

1. SBC piping support span to be applied near valve groups (with involving concentrated masses) according to Figure T3-1:
   - NPS 1" → 2 mt
   - NPS 1 ½" → 2,2 mt
   - NPS 2" → 2,5 mt

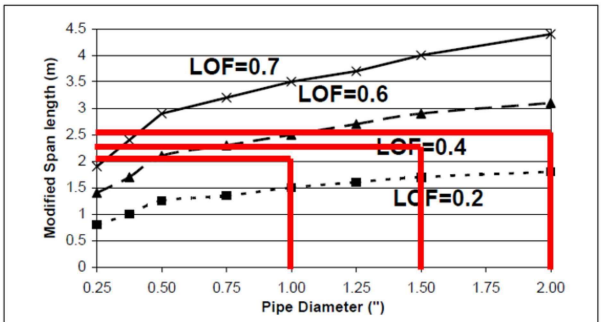


Figure T3-1 Maximum Span connected to main line and involving mass

2. SBC piping support span to be applied for straight pipe (without involving concentrated masses or valves) according to Figure T3-2:
   - NPS 1" → 3,5 mt
   - NPS 1 ½" → 4 mt
   - NPS 2" → 4,5 mt

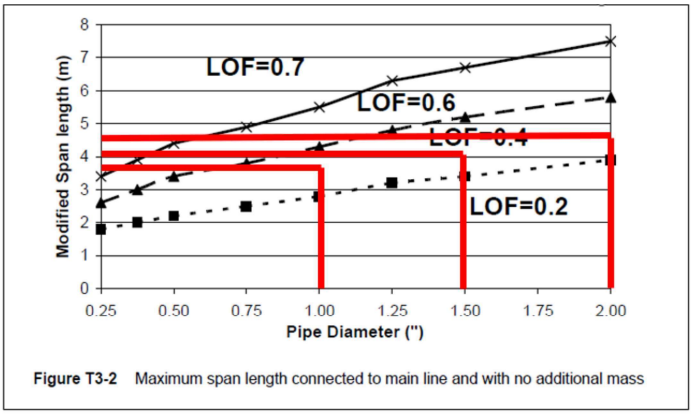


Figure T3-2 Maximum span length connected to main line and with no additional mass

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HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #15 123A90-DDL-SAF-RE-30006
Item No.	#15
Causes	2.2.3. 25PIC005 failure opening 25PV005
Consequences	2.2.3.2. Unable to achieve set point pressure for purge cycle. Unable to complete purge operation leading to a delay in start-up.
Recommendation	15.Review the requirement for a timer alarm on the H2 pressurisation section of the purge cycle in the control logic to determine if the purge valve 25PV005 has failed to close.
Actions	
Assigned Respondent (By)	Instrumentation
Issue Date(01-12-2023)	
Action Response	As per doc. "Process Control, Operation, Start-up and Shutdown philosophy" n° 123A90-DDL-PR-RE-80031 rev.01 par. 3.4.1.2, at the beginning of the purging operation a timer alarm, in the control logic, will be implemented to determinate if 25-PIC-035 failure opening 25-PV-035 control valve.

Approvals / Endorsements

EPC Discipline Lead		**Sign**
L.Calabrese	**14/05/2024**	
EPC HSE LEAD		**Sign**
C.Caracciolo	**10/05/2024**	**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client		**Sign**
		Digitaal ondertekend door Paul van Rossum Datum: 2024.09.04 16:31:32 +02'00'

Base Load Power Hub (BLPH)

Process Control, Operation, Start-up and Shutdown philosophy

Document Number: 123A90-DDL-PR-RE-80031

Document Class: 1

01	23/04/2024	Issue for Approval (IFA)	CIM	RZI	DLO
00	13/12/2023	Issue for Approval (IFA)	CIM	RZI	DLO
Rev.	Date	Description	Prepared	Reviewed	Approved

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Should be the operating pressure (PV) fall under the PID regulator SP, the controller drives the control valve to decrease opening (Cv); vice versa, should the operating pressure (PV) rise above the PID regulator SP, the controller drives the control valve to increase its opening (Cv).

At the beginning of the purging operation a timer alarm, in the control logic, will be implemented to determine if 25-PIC-035 failure opening the valve 25-PV-035. It is expected that, according to flow rate of N2 entering to the vessel under purging operation, it will reach the desired pressure at which purging shall be performed within almost 40 minutes. Therefore, after 40 minutes, should the 25-PT-035 indicate a pressure less than the above indicate value of 2 barg, a time alarm will alert the operator that the vessel has not reach the pressure within the desired time. Once the pressure has been reached, then the time alarm shall be deactivated.

The control valve 25-PV-035 is used only in case of vessel purging. Therefore, a software interlock is provided to prevent 25-PV-035 being opened outside of a purge cycle operation. The same software interlock prevents the opening of the control valve 25-FV-031 outside of a purge cycle operation.

Moreover, once the desired pressure of 2 barg has been reached, should the pressure inside the vessel under purging operation fall below the set point of 2 barg, a low pressure alarm on the pressure transmitter 25-PT-035 is provided, to alert the operator. This low pressure alarm will be deactivated at beginning of the purging operation (during the pressurization phase), when the desired pressure is not yet reached. Once 2 barg has been reached, then the alarm will be activated. This is to prevent the low pressure alarm is triggered unnecessarily.

The above-described control loop is relevant to H2 Storage Vessel V-25001A under purging operation. The same applies to the others five H2 Storage Vessel V-25001B/C/D/E/F.

The same control loops 25-FIC-031 and 25-PIC-035 (for the vessel A) above described is used when, after maintenance activities, displacement of air is required, before to reinsert H2 inside the vessel. The purpose of displacing the air from the vessel is to create an inert atmosphere inside the vessel before starting the hydrogen loading phase.

Moreover, at inlet manifold of the vessels, there is a pressure transmitter (25-PT-001) that indicates the pressure value to the DCS with a high alarm threshold. This signal is replicated via software/serial link to the electrolyser package A-20000 in order to communicate the pressure level established inside the whole buffer volume.

Finally, an XV valve located at inlet hydrogen manifold allows for nitrogen purging during maintenance campaign.

3.4.1.3 Start-up and Shut-Down philosophy

No particular start-up or shutdown requirements are provided or needed for these vessels. Except that a dedicated pressure transmitter (25-PT-004/006/008/009/011/012) that handles the plant ESD in case of system overpressure. The emergency high-high level pressure signal is replicated to DCS. Moreover no

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HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title:	**EPC HAZOP Study Actions**
Action No:	#16
Ref Doc	123A90-DDL-SAF-RE-30006
Item No.	#16
Causes	2.2.6. 25FIC001 failure opening 25FV001 N2 valve 2.3.2. 25XV008/11/14/17/20 open when not required and V25001B-F contains N2 at low pressure
Consequences	2.2.6.1. Potential for N2 (7barg) into H2 storage vessel V25001A during purge operation resulting in off spec H2 sent to the Fuel Cell leading to operational issue no hazardous consequences as per Fuel Cell HAZOP (Cause 1.13.1). 2.3.2.1. Potential for N2 into H2 storage vessel V25001A under purge operation resulting in off spec H2 sent to the Fuel Cell leading to operational issue no hazardous consequences as per Fuel Cell HAZOP (Cause 1.13.1).
Recommendation	16.Implement 25FV001 as a Type 6 as it is critical to the operation of the fuel cell that N2 is excluded from the storage system.
Actions	
Assigned Respondent (By)	Instrumentation
Issue Date(01-12-2023)	
Action Response	As per P&IDs "Hydrogen Storage Vessel A/B/C/D/E/F" n° 123A90-DDL-PR-PID-80015/16/17/18/19/20 rev.01, all the Nitrogen flow control valves inlet to Storage Vessels are Type 6 as critical control valves.

Approvals / Endorsements

EPC Discipline Lead / Construction		**Sign**
L. Calabrese	02/04/2024	
EPC HSE LEAD		**Sign**
C.Caracciolo	16/04/24	
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client		**Sign**
		Digitaal ondertekend door Paul van Rossum Datum: 2024.05.10 12:38:00 +02'00'

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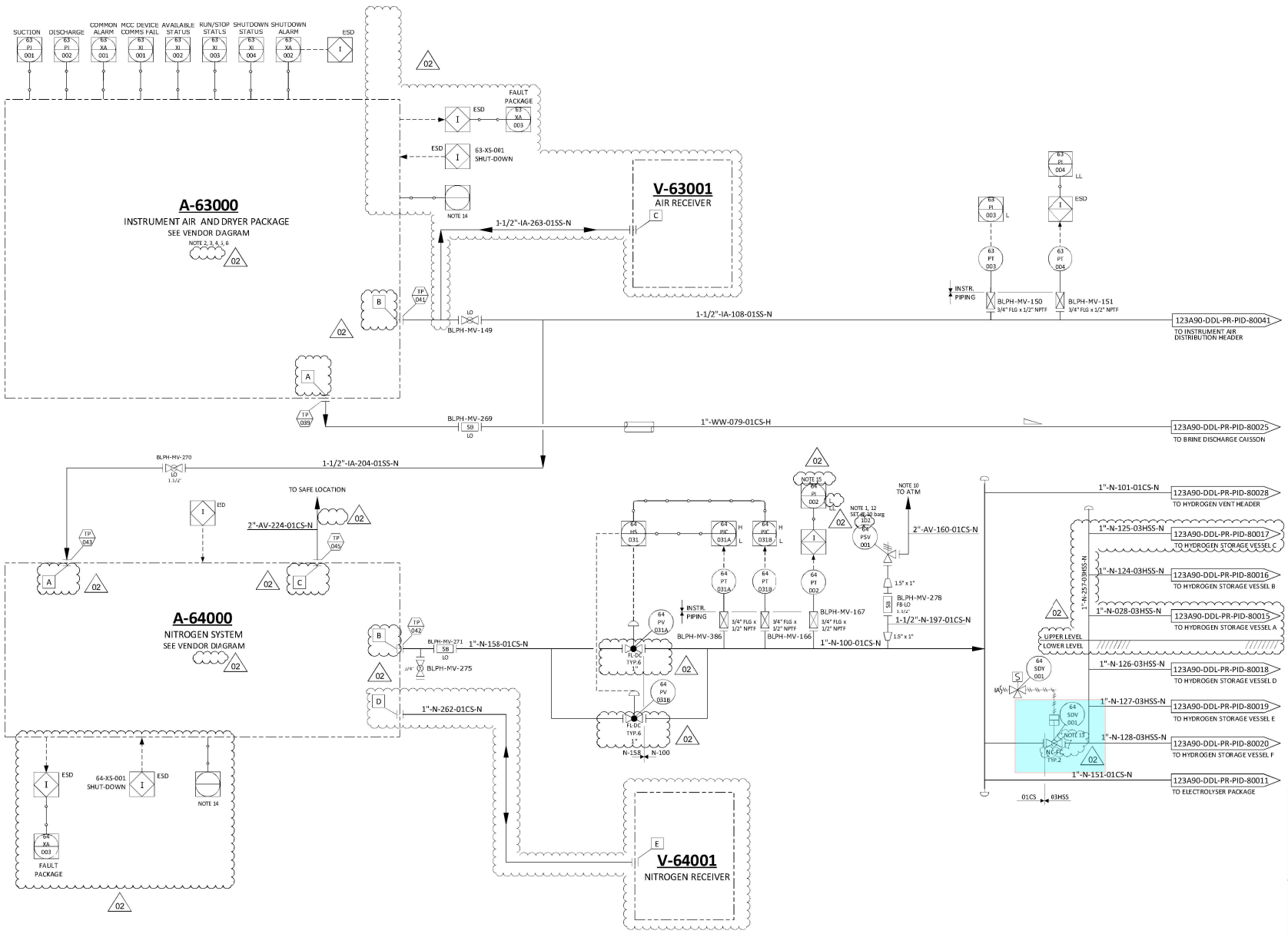
HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #17 123A90-DDL-SAF-RE-30006
Item No.	#17
Causes	2.13.2. N2 contamination of storage vessel 3.2.2. 25FIC001 failure opening 25FV001 N2 valve
Consequences	2.13.2.1. Potential to contaminate H2 tank during purge cycle with no means of detecting contamination before use in Fuel Cell resulting in poor functioning of Fuel Cell. Operational issue, no hazardous consequences. 3.2.2.1. Potential for N2 (7barg) into H2 storage vessel V25001A at end of Fuel Cell operation resulting in off spec H2 sent to the Fuel Cell leading to operational issue no hazardous consequences as per Fuel Cell HAZOP (Cause 1.13.1).
Recommendation	17.Review the requirement for a separate header with an additional isolation on the N2 supply to the storage vessels to minimise the likelihood of N2 contamination of H2 storage vessels during purge cycle.
Actions	A separate header with an additional isolation valve 64SDV001 on the N2 supply to the storage vessels has been provided, as shown in the attached P&iD 123A90-DDL-PR-PID-80027, see attachment 1. IEC 61511 allows the use of a shutdown valve also as an XV valve. If our SDV was involved in a SIF (therefore SIL>=1) then we would have had to do a risk analysis. In CROSSWIND project the valve is not even involved in a SIF with SIL> =1, therefore is acceptable to use the SDV as XV valve.
Assigned Respondent (By)	Process
Issue Date (01-12-2023)	
Action Response	

Approvals / Endorsements

EPC Process Lead		**Sign**
C.Impradice		
EPC HSE LEAD		**Sign**
C.Caracciolo		**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client		**Sign**
		Paul van Rossum Digitaal ondertekend door Paul van Rossum 17:26:12 +02'00'



NOTES

1. ONE UNINSTALLED SPARE PSV SHALL BE AVAILABLE.
2. COMPRESSORS AND DRIERS DESIGNED FOR 2 X 100% CONFIGURATION. INSTRUMENT AIR RECEIVER DESIGNED FOR 1 X 100%.
3. VENDOR TO PROVIDE NECESSARY CONTROLS, INSTRUMENTATIONS AND ISOLATIONS IN ORDER TO OPERATE THE PLANT IN SAFE MANNER.
4. COMPRESSORS WILL OPERATE ON THE BASIS OF ONE WORKING AND ONE ON STANDBY.
5. COMPRESSORS TO BE ROTARY SCREW TYPE OIL FREE.
6. AIR COMPRESSOR INLET TO BE LOCATED AWAY FROM ANY VENTS.
7. DELETED. 02
8. DELETED.
9. DELETED.
10. TO SAFE LOCATION, ROUTED AWAY FROM WALKWAYS.
11. DELETED. 02
12. 64PSV001 SIZED FOR UPSTREAM CV FAILURE.
13. 64SDV001 IS NORMALLY CLOSED. IF REQUIRED THE OPERATOR CAN REMOTELY OPEN THE VALVE TO ALLOW PURGING OPERATION. VALVE 64SDV001 IS ALSO CONNECTED TO THE PCS SYSTEM.
14. SERIAL COMMUNICATION WITH CONTROL SYSTEM.
15. THE ALARM 64-PAL-002 WILL CLOSE 64-SDV-001 THROUGH SAFETY SYSTEM. 02

HOLDS

1. DELETED.
2. DELETED. 02
3. DELETED.
4. DELETED.

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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
INSTRUMENT AIR PACKAGE

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-80027		SHEET 001	REV. 02

DRAWING NO. DRAWING_NO.
REV. REV.
File Name : FILE_NAME

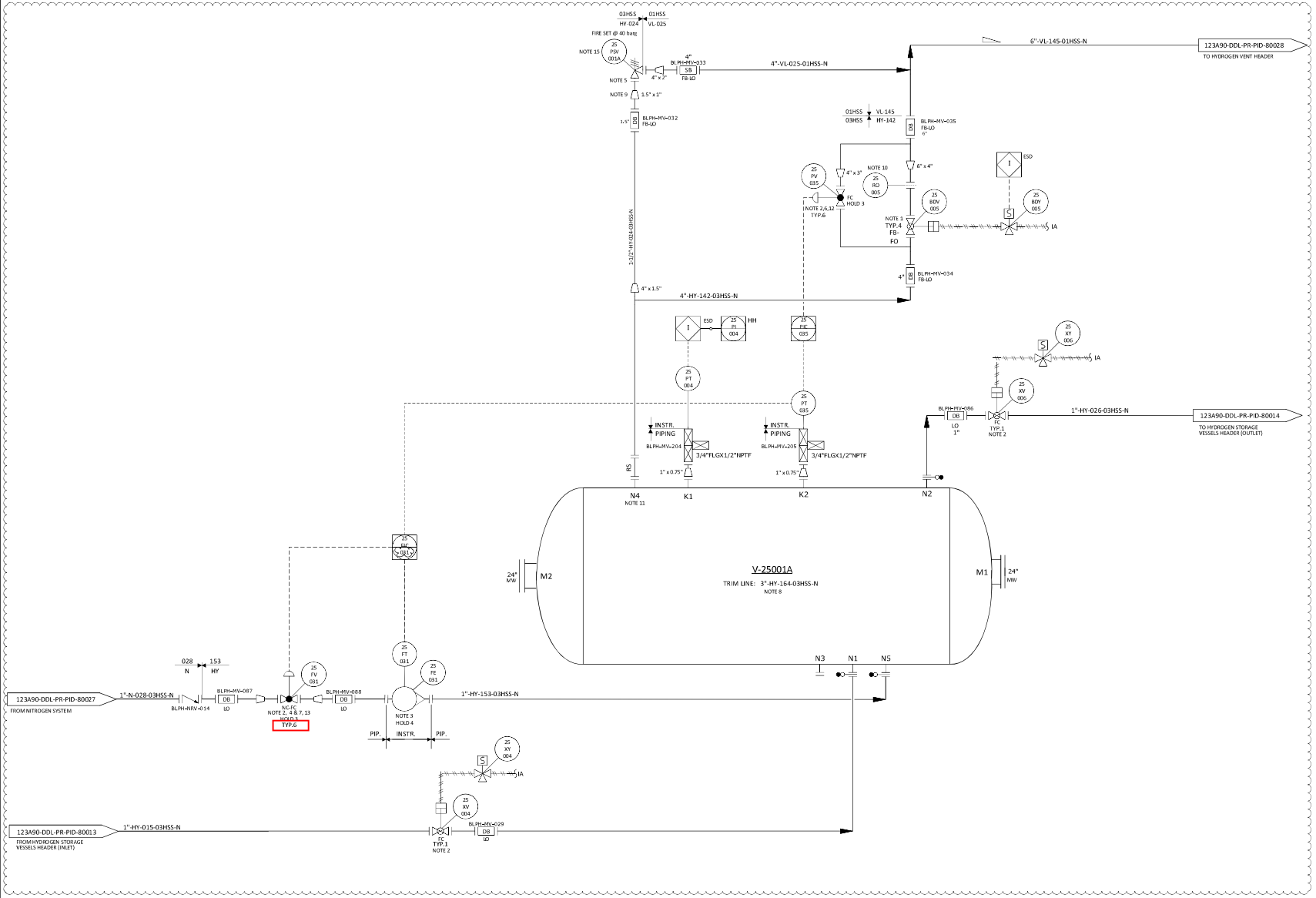
DRAWING NO. DRAWING_NO.

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. NECESSARY CONTROL SYSTEM SOFTWARE SHALL BE INCLUDED TO SUPPORT ADVACED VALVE CONTROL, PARTIAL STROKE TESTING AND DIAGNOSTICS FOR ANY SAFETY CRITICAL ON/OFF VALVES. THESE APPLICATION SHALL BE IDENTIFIED BY HAZOP AND LOPA EVALUATION IF PARTIAL STROKE TESTING WILL BE REQUIRED:
   THE "TYP. 3" SHALL BE CONSIDERED INSTEAD THE ACTUAL "TYP. 2" FOR SDV
   THE "TYP. 5" SHALL BE CONSIDERED INSTEAD THE ACTUAL "TYP. 4" FOR BDV
2. TIGHT SHUT OFF VALVE.
3. VARIABLE AREA FLOWMETER TO BE INSTALLED VERTICALLY WITH DIRECTION OF FLOW UPWARDS.
4. NITROGEN CONTROL VALVE (25-FV-001), 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. 01
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 25PV035 BEING OPENED OUTSIDE OF A PURGE CYCLE OPERATION. CONTROL VALVE 25PV035 IS USED ONLY IN CASE OF VESSEL PURGING.
13. SOFTWARE INTERLOCK TO PREVENT 25FV031 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 25PV035 HAS FAILED TO CLOSE.
15. 25PSV001A SIZED FOR FIRE.

HOLDS

1. DELETED.
2. DELETED. 01
3. CONTROL VALVE SIZE (BY VENDOR).
4. MULTIVARIABLE FLOWMETERS REQUIRE 7 DIAMETERS STRAIGHT LENGHT UPSTREAM AND 5 DIAMETERS STRAIGHT LENGHT DOWNSTREAM (TO BE CONFIRMED BY VENDOR).

01

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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 A

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-80015		SHEET 001	REV. 01

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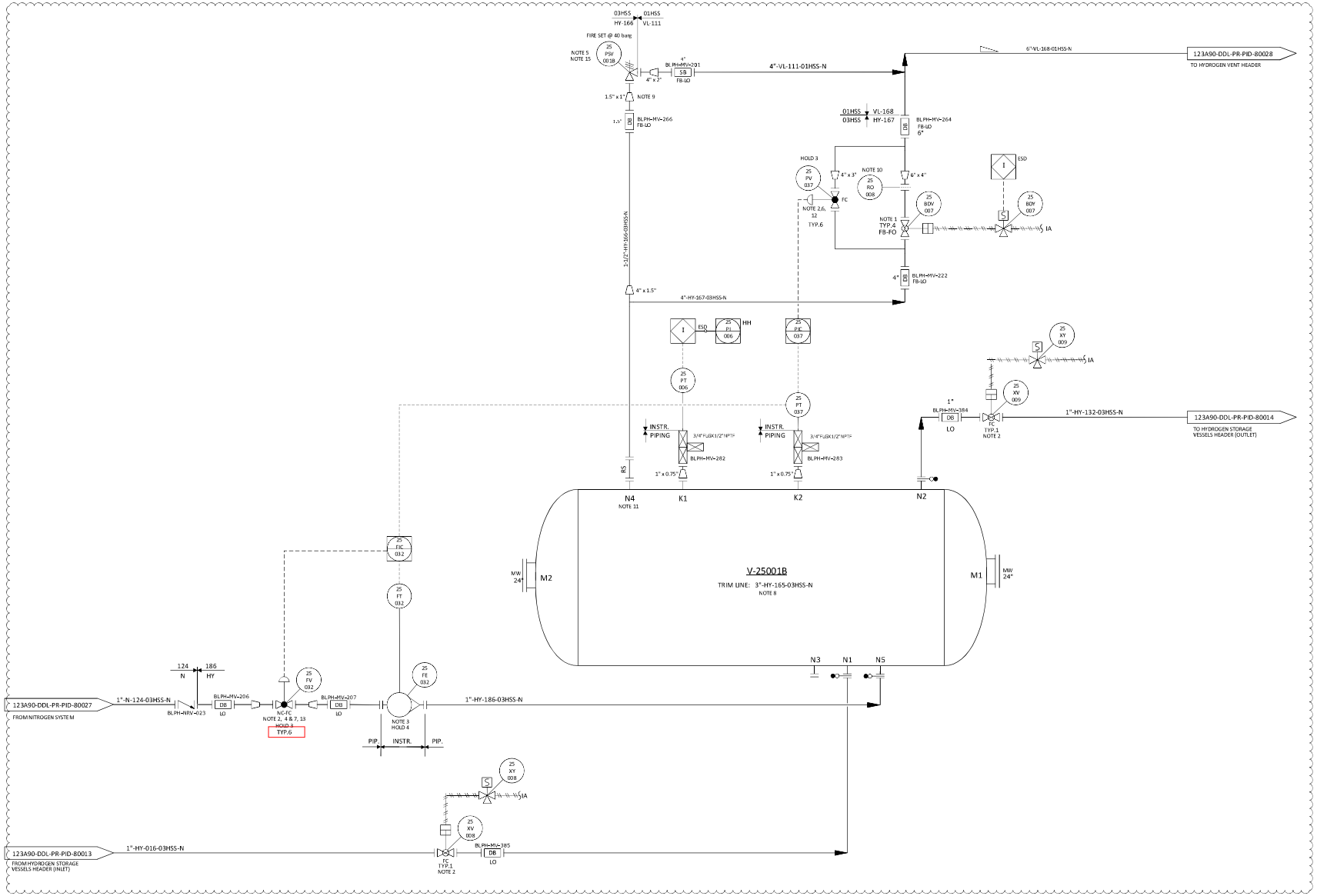
DRAWING NO. DRAWING_NO.

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



01

NOTES

1. NECESSARY CONTROL SYSTEM SOFTWARE SHALL BE INCLUDED TO SUPPORT ADVACED VALVE CONTROL, PARTIAL STROKE TESTING AND DIAGNOSTICS FOR ANY SAFETY CRITICAL ON/OFF VALVES. THESE APPLICATION SHALL BE IDENTIFIED BY HAZOP AND LOPA EVALUATION IF PARTIAL STROKE TESTING WILL BE REQUIRED:
   THE "TYP. 3" SHALL BE CONSIDERED INSTEAD THE ACTUAL "TYP. 2" FOR SDV
   THE "TYP. 5" SHALL BE CONSIDERED INSTEAD THE ACTUAL "TYP. 4" FOR BDV
2. TIGHT SHUT OFF VALVE.
3. VARIABLE AREA FLOWMETER TO BE INSTALLED VERTICALLY WITH DIRECTION OF FLOW UPWARDS.
4. NITROGEN CONTROL VALVE (25-FV-001), 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. 01
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 25PV037 BEING OPENED OUTSIDE OF A PURGE CYCLE OPERATION. CONTROL VALVE 25PV037 IS USED ONLY IN CASE OF VESSEL PURGING.
13. SOFTWARE INTERLOCK TO PREVENT 25FV032 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 25PV037 HAS FAILED TO CLOSE.
15. 25PSV001B SIZED FOR FIRE.

HOLDS

1. DELETED.
2. DELETED. 01
3. CONTROL VALVE SIZE (BY VENDOR).
4. MULTIVARIABLE FLOWMETERS REQUIRE 7 DIAMETERS STRAIGHT LENGHT UPSTREAM AND 5 DIAMETERS STRAIGHT LENGHT DOWNSTREAM (TO BE CONFIRMED BY VENDOR).

01

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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. 00

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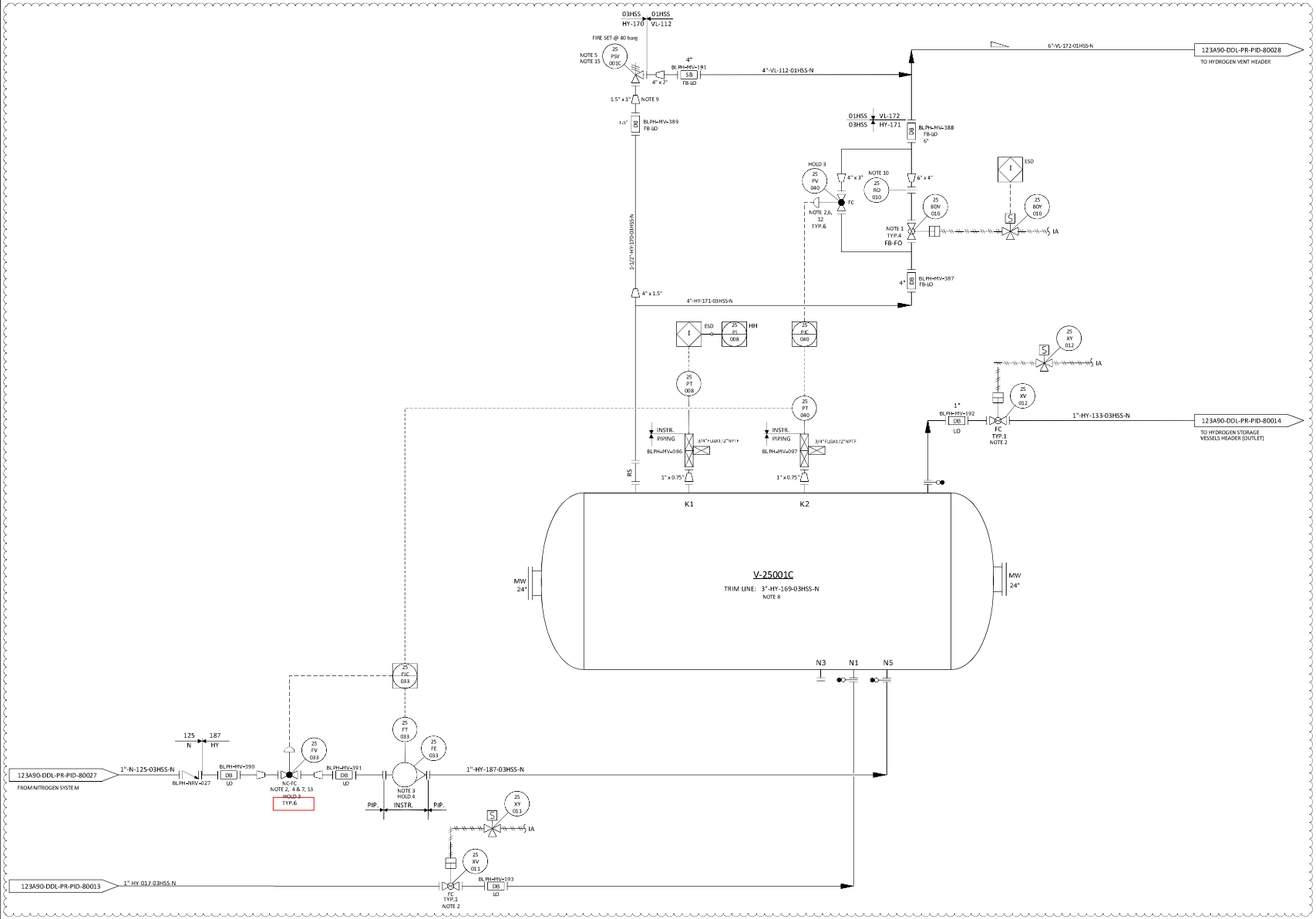
DRAWING NO. DRAWING_NO.

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. NECESSARY CONTROL SYSTEM SOFTWARE SHALL BE INCLUDED TO SUPPORT ADVACED VALVE CONTROL, PARTIAL STROKE TESTING AND DIAGNOSTICS FOR ANY SAFETY CRITICAL ON/OFF VALVES. THESE APPLICATION SHALL BE IDENTIFIED BY HAZOP AND LOPA EVALUATION IF PARTIAL STROKE TESTING WILL BE REQUIRED:
   THE "TYP. 3" SHALL BE CONSIDERED INSTEAD THE ACTUAL "TYP. 2" FOR SDV
   THE "TYP. 5" SHALL BE CONSIDERED INSTEAD THE ACTUAL "TYP. 4" FOR BDV
2. TIGHT SHUT OFF VALVE.
3. VARIABLE AREA FLOWMETER TO BE INSTALLED VERTICALLY WITH DIRECTION OF FLOW UPWARDS.
4. NITROGEN CONTROL VALVE (25-FV-001), 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. 01
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 25PV040 BEING OPENED OUTSIDE OF A PURGE CYCLE OPERATION. CONTROL VALVE 25PV040 IS USED ONLY IN CASE OF VESSEL PURGING.
13. SOFTWARE INTERLOCK TO PREVENT 25FV033 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 25PV040 HAS FAILED TO CLOSE.
15. 25PSV001C SIZED FOR FIRE.

HOLDS

1. DELETED.
2. DELETED. 01
3. CONTROL VALVE SIZE (BY VENDOR).
4. MULTIVARIABLE FLOWMETERS REQUIRE 7 DIAMETERS STRAIGHT LENGHT UPSTREAM AND 5 DIAMETERS STRAIGHT LENGHT DOWNSTREAM (TO BE CONFIRMED BY VENDOR).

01

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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	
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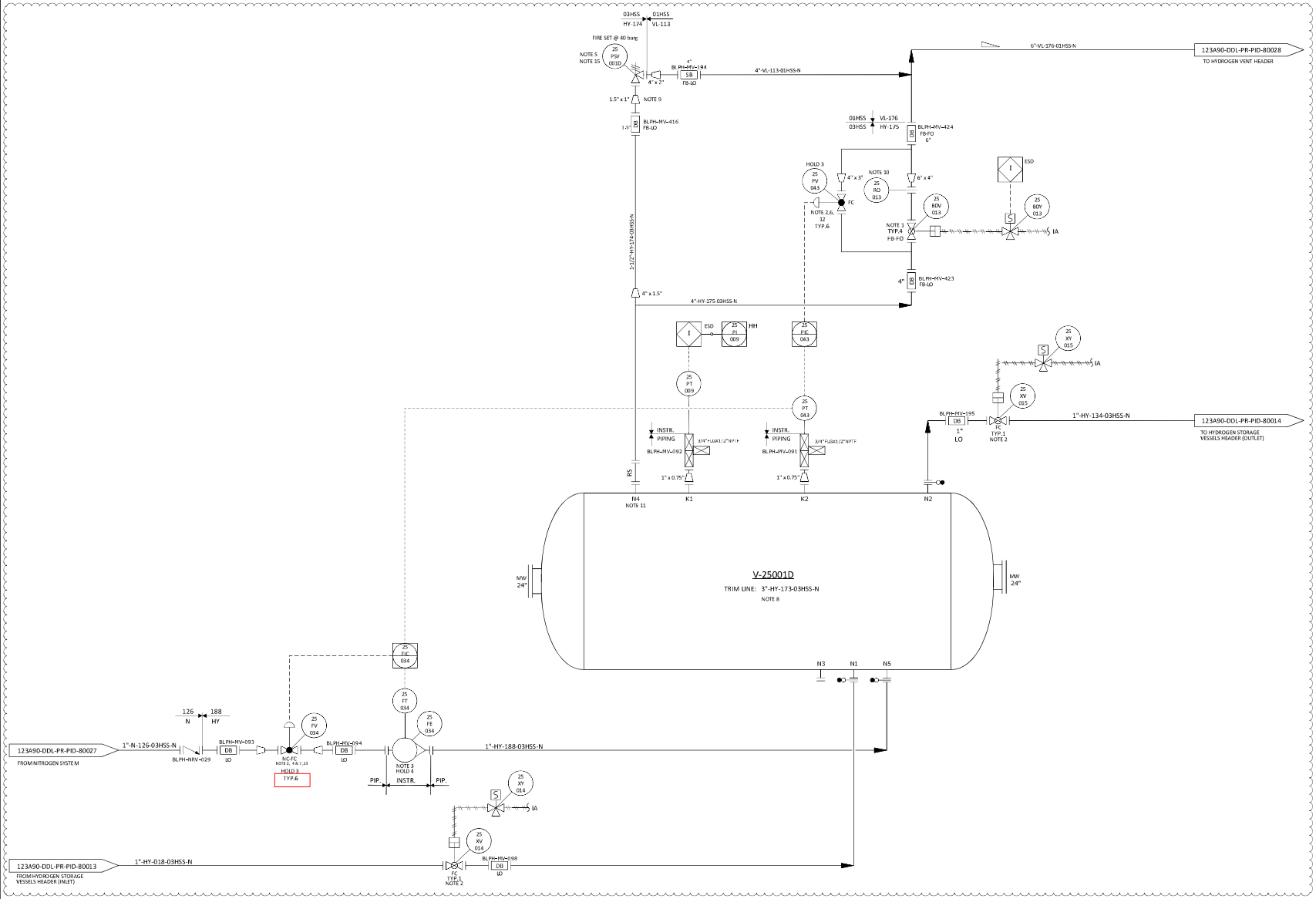
DRAWING NO. DRAWING_NO.

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



01

NOTES

1. NECESSARY CONTROL SYSTEM SOFTWARE SHALL BE INCLUDED TO SUPPORT ADVACED VALVE CONTROL, PARTIAL STROKE TESTING AND DIAGNOSTICS FOR ENY SAFETY CRITICAL ON/OFF VALVES. THESE APPLICATION SHALL BE IDENTIFIED BY HAZOP AND LAPA EVALUATION IF PARTIAL STROKE TESTING WILL BE REQUIRED:
   THE "TYP. 3" SHALL BE CONSIDERED INSTEAD THE ACTUAL "TYP. 2" FOR SDV
   THE "TYP. 5" SHALL BE CONSIDERED INSTEAD THE ACTUAL "TYP. 4" FOR BDV
2. TIGHT SHUT OFF VALVE.
3. VARIABLE AREA FLOWMETER TO BE INSTALLED VERTICALLY WITH DIRECTION OF FLOW UPWARDS.
4. NITROGEN CONTROL VALVE (25-FV-001), 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. 01
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 25PV043 BEING OPENED OUTSIDE OF A PURGE CYCLE OPERATION. CONTROL VALVE 25PV043 IS USED ONLY IN CASE OF VESSEL PURGING
13. SOFTWARE INTERLOCK TO PREVENT 25FV034 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 25PV043 HAS FAILED TO CLOSE.
15. 25PSV001D SIZED FOR FIRE.

HOLDS

1. DELETED.
2. DELETED. 01
3. CONTROL VALVE SIZE (BY VENDOR).
4. MULTIVARIABLE FLOWMETERS REQUIRE 7 DIAMETERS STRAIGHT LENGHT UPSTREAM AND 5 DIAMETERS STRAIGHT LENGHT DOWNSTREAM (TO BE CONFIRMED BY VENDOR).

01

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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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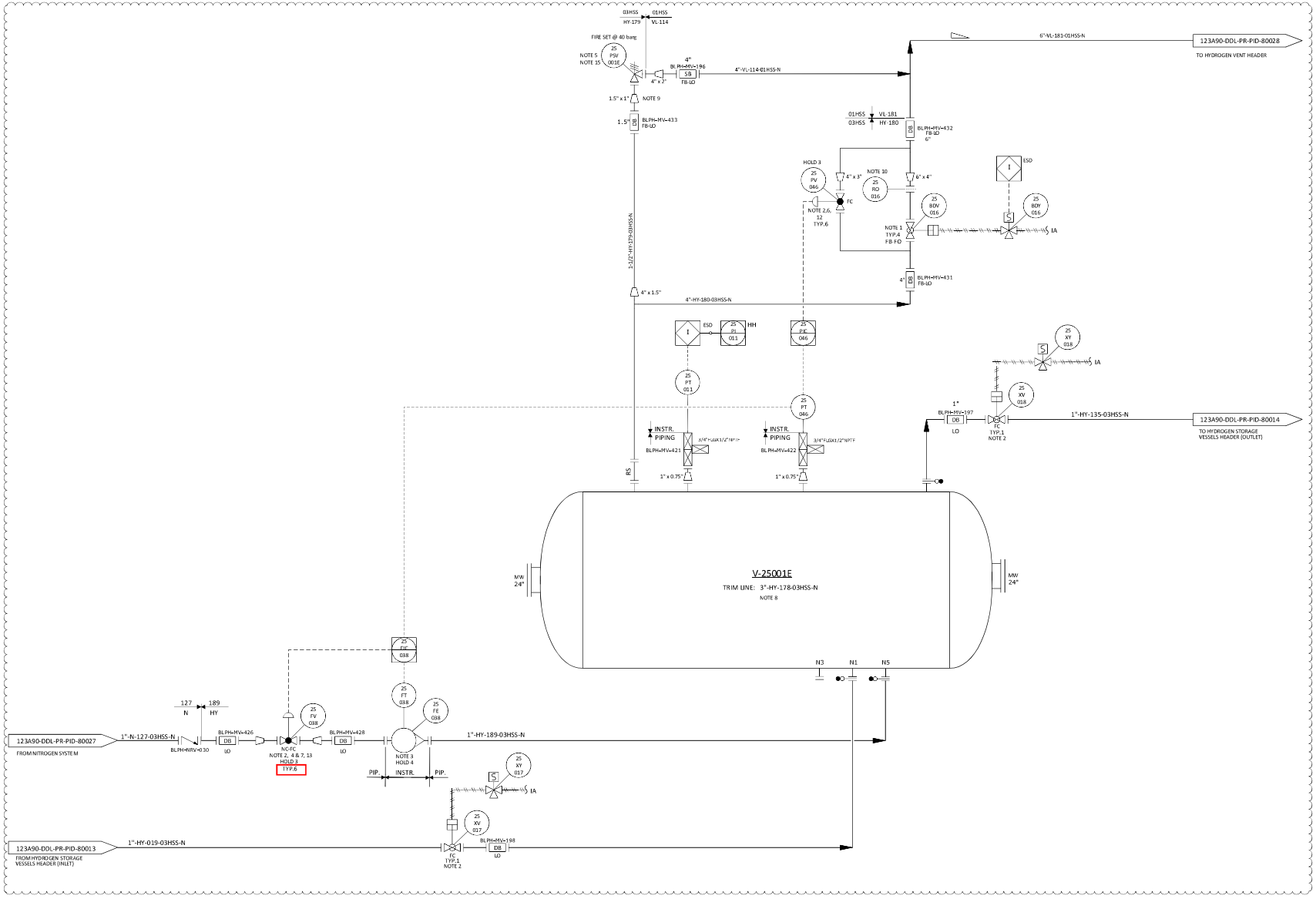
DRAWING NO. DRAWING_NO.

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



01

NOTES

1. NECESSARY CONTROL SYSTEM SOFTWARE SHALL BE INCLUDED TO SUPPORT ADVACED VALVE CONTROL, PARTIAL STROKE TESTING AND DIAGNOSTICS FOR ENY SAFETY CRITICAL ON/OFF VALVES. THESE APPLICATION SHALL BE IDENTIFIED BY HAZOP AND LAPA EVALUATION IF PARTIAL STROKE TESTING WILL BE REQUIRED:
   THE "TYP. 3" SHALL BE CONSIDERED INSTEAD THE ACTUAL "TYP. 2" FOR SDV
   THE "TYP. 5" SHALL BE CONSIDERED INSTEAD THE ACTUAL "TYP. 4" FOR BDV
2. TIGHT SHUT OFF VALVE.
3. VARIABLE AREA FLOWMETER TO BE INSTALLED VERTICALLY WITH DIRECTION OF FLOW UPWARDS.
4. NITROGEN CONTROL VALVE (25-FV-001), 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. 01
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 25PV046 BEING OPENED OUTSIDE OF A PURGE CYCLE OPERATION. CONTROL VALVE 25PV046 IS USED ONLY IN CASE OF VESSEL PURGING
13. SOFTWARE INTERLOCK TO PREVENT 25FV038 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 25PV046 HAS FAILED TO CLOSE.
15. 25PSV001E SIZED FOR FIRE.

HOLDS

1. DELETED. 01
2. DELETED.
3. CONTROL VALVE SIZE (BY VENDOR).
4. MULTIVARIABLE FLOWMETERS REQUIRE 7 DIAMETERS STRAIGHT LENGHT UPSTREAM AND 5 DIAMETERS STRAIGHT LENGHT DOWNSTREAM (TO BE CONFIRMED BY VENDOR).

01

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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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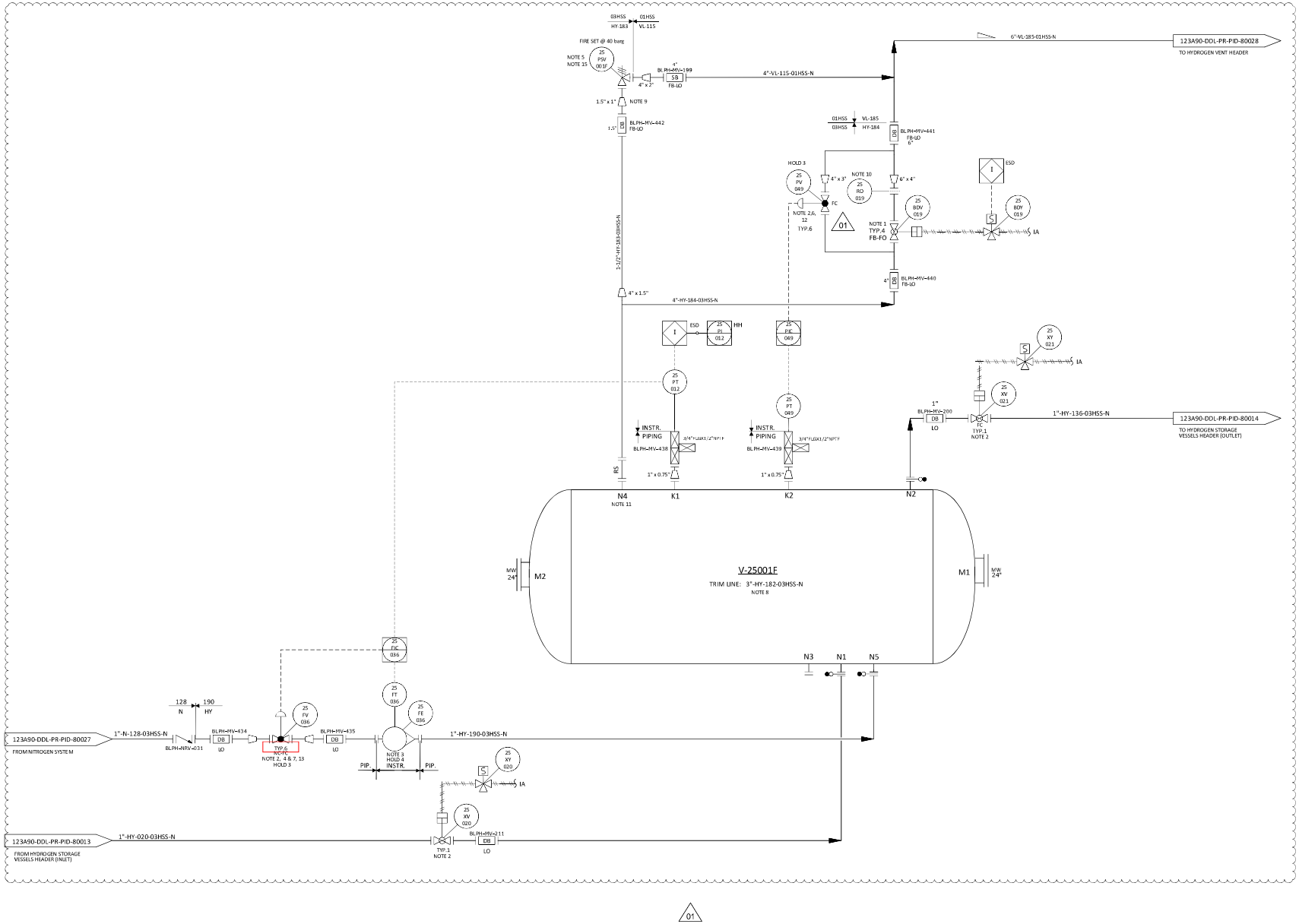
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REV.

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. NECESSARY CONTROL SYSTEM SOFTWARE SHALL BE INCLUDED TO SUPPORT ADVACED VALVE CONTROL, PARTIAL STROKE TESTING AND DIAGNOSTICS FOR ENY SAFETY CRITICAL ON/OFF VALVES. THESE APPLICATION SHALL BE IDENTIFIED BY HAZOP AND LAPA EVALUATION IF PARTIAL STROKE TESTING WILL BE REQUIRED:
   THE "TYP. 3" SHALL BE CONSIDERED INSTEAD THE ACTUAL "TYP. 2" FOR SDV
   THE "TYP. 5" SHALL BE CONSIDERED INSTEAD THE ACTUAL "TYP. 4" FOR BDV
2. TIGHT SHUT OFF VALVE.
3. VARIABLE AREA FLOWMETER TO BE INSTALLED VERTICALLY WITH DIRECTION OF FLOW UPWARDS.
4. NITROGEN CONTROL VALVE (25-FV-001), 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. 01
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 25PV049 BEING OPENED OUTSIDE OF A PURGE CYCLE OPERATION. CONTROL VALVE 25PV049 IS USED ONLY IN CASE OF VESSEL PURGING.
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 25PV049 HAS FAILED TO CLOSE.
15. 25PSV001F SIZED FOR FIRE.

HOLDS

1. DELETED.
2. DELETED. 01
3. CONTROL VALVE SIZE (BY VENDOR).
4. MULTIVARIABLE FLOWMETERS REQUIRE 7 DIAMETERS STRAIGHT LENGHT UPSTREAM AND 5 DIAMETERS STRAIGHT LENGHT DOWNSTREAM (TO BE CONFIRMED BY VENDOR).

01

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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

TITLE :
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. 00

File Name : FILE_NAME

CROSSWIND

ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #18 123A90-DDL-SAF-RE-30006
Item No.	#18
Causes	2.15.1. N2 purging in preparation for maintenance
Consequences	2.15.1.1. Unable to purge pipework between tee off for 25XV003 and Electrolyser. Potential for H2 to remain in pipework when broken for maintenance. Small LOPC of H2 likely to be insufficient to cause significant hazard.
Recommendation	18.Review where a N2 purge connection can be located close to Electrolyser discharge to enable N2 purging of H2 storage inlet system.
Actions	N2 purge connection has been provided close to Electrolyser discharge to enable N2 purging of H2 storage inlet system. As per note 9 (see attachment 1), "NITROGEN PURGING CONNECTION TO BE LOCATED AS CLOSE AS POSSIBLE TO MANUAL VALVE BLPH-MV-003" (see attachment 1). Moreover, note 11 has bene added (see attachment 1), which states: "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."
Assigned Respondent (By)	Process
Issue Date (01-12-2023)	
Action Response	

Approvals / Endorsements

EPC Discipline Lead **C. Impradice**	**Sign** Ciro Impradice
EPC HSE LEAD	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo.Sterzo	
Client	**Sign**
	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.09.12 17:27:39 +02'00'

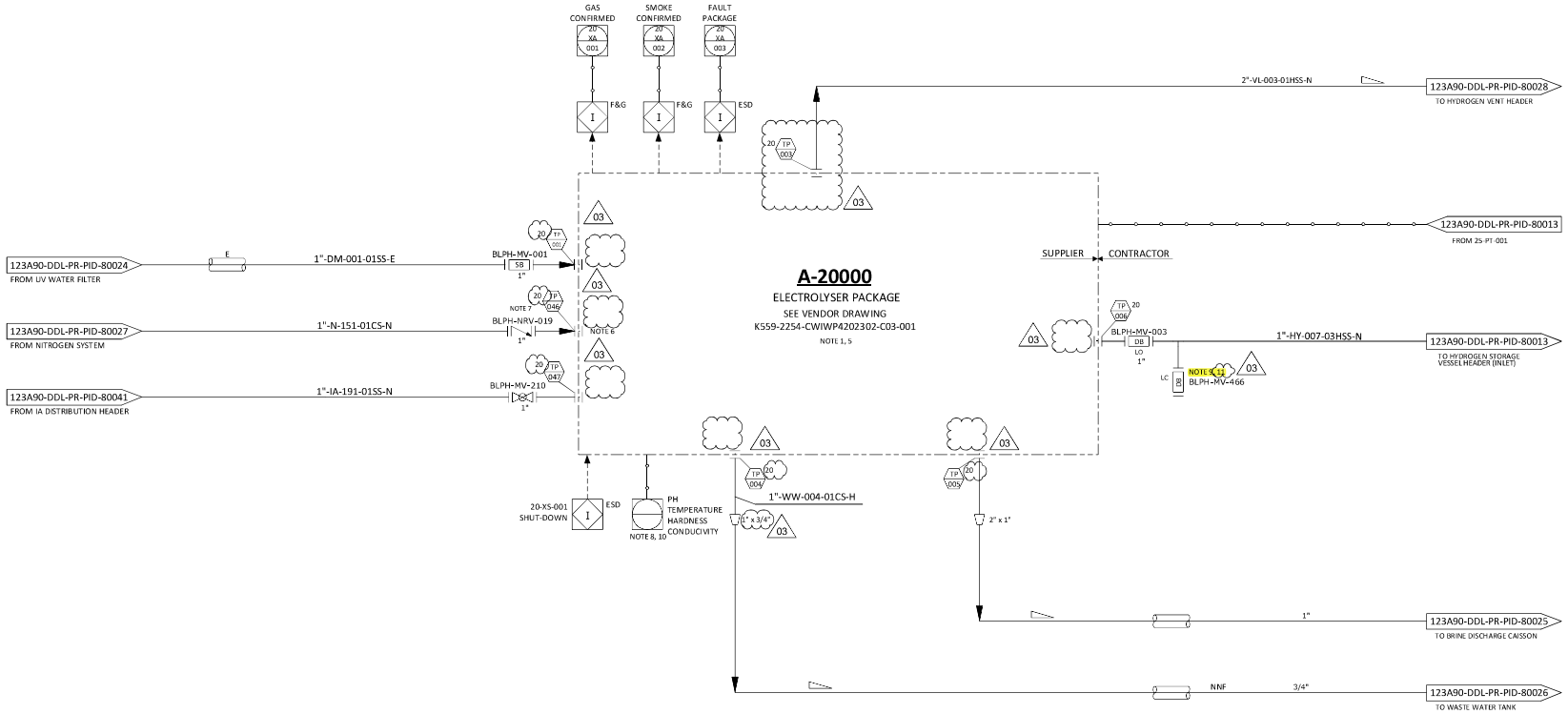
DRAWING NO. DRAWING_NO.

REV. REV.

A-20000

ELECTROLYSER PACKAGE

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



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

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

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-80011	SHEET 001	REV. 03

File Name : FILE_NAME

CROSSWIND

ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK

Project Base Load Power Hub (BLPH)

Action Title:	**EPC HAZOP Study Actions**
Action No:	#19
Ref Doc	123A90-DDL-SAF-RE-30006
Item No.	#19
Causes	2.15.2. Fail closed of N2 valve 25FV001 when purging
Consequences	2.15.2.1. Potential significant concentration H2 in vessel when breaking containment for maintenance.
Recommendation	19.Review the requirement for a means to detect that the concentration of H2 within the H2 storage vessels is above the allowable level prior to breaking containment on the vessel.
Actions	During the 2 years operation, no inspection inside the vessels are foreseen, therefore there will be no breaking containment. In case of extraordinary maintenance, purging of vessel will be performed
Assigned Respondent (By)	Rosetti/Crosswind Project
Issue Date (01-12-2023)	
Action Response	During the 2 years operation no inspection inside the vessels is foreseen,therefore there will be no breaking of containment and therefore there is no requirement of providing H2 fixed detector. In case of extraordinary maintenance, a dedicated opening procedure shall be developed. Recommendation for Crosswind Operation is to develop a procedure for extraordinary maintenance as follows: 1) Start unbolting manhole (no more than 30% of bolts) and place having portable H2 detectors close to the manhole. 2) Once portable detectors will not detect H2 anymore un bolt the remaining bolts. H2 is not expected anymore.

Approvals / Endorsements		
EPC Discipline Lead		**Sign**
C.Giunchi		
EPC HSE LEAD		**Sign**
C.Caracciolo		**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.01 14:07:07 +02'00'	**Sign**

CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #20 123A90-DDL-SAF-RE-30006
Item No.	#20
Causes	3.1.17. BLPH-MV-492 SB Left in closed position on Downstream line 3.1.18. Blockage in line within Fuel Cell Package, considered to be failure to reopen main isolation valve following maintenance.
Consequences	3.1.17.1. Upstream: Potential overpressure of pipework downstream of 25PV025A/B. LOPC of H2 and potential explosion on ignition. Not included in recommendation 21/22 for LOPA as the likelihood of this cause will not be significant. 3.1.18.1. Upstream: Potential overpressure of pipework downstream of 25PV025A/B. LOPC of H2 and potential explosion on ignition.
Recommendation	20.Ensure that 80PSV001 is verified for blocked discharge downstream of 25PV025A/B during fuel cell operation. No consideration is made of advantageous control from 25PCV025A/B as per Shell rule set.
Actions	
Issue Date (01-12-2023)	
Action Response	As per "Relief, Vent and Blowdown Report" doc. n. "123A90-DDL-PR-RE-80030" revision 01, it is confirmed that the 80PSV001 has been verified for blocked discharge downstream of 25PV025A/B during fuel cell operation. See Section 3.3 of the above mentioned document, attached to this Action.

Approvals / Endorsements

EPC Discipline Lead	Ciro Impradice	**Sign**
C.Impradice	13/03/2024	
EPC HSE LEAD		**Sign**
C.Caracciolo	13/03/2024	**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client		**Sign**
		Digitaal ondertekend door Paul van Rossum Datum: 2024.08.21 08:38:22 +02'00'

Base Load Power Hub (BLPH)

Relief, Vent and Blowdown Report

Document Number: 123A90-DDL-PR-RE-80030

Document Class: 1

01	05/02/2024	Accepted for Construction (AFC)	CIM	RZI	DLO
00	04/12/2023	Issue for Acceptance (IFA)	CIM	RZI	DLO
Rev.	Date	Description	Prepared	Reviewed	Approved

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Revision / Change Log

Rev.	Description
00	Issue for Acceptance (IFA)
01	Accepted for Construction (AFC)

HOLDS LIST

No.	Description
HOLD1	"Deleted"
HOLD2	"Deleted"
HOLD3	"Deleted"
HOLD4	"Deleted"

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3.3 PSV CALCULATION SUMMARY

The following table summarizes applicable scenarios and sizing results of each PSV, the detailed calculation are shown through the Appendix 01 Section.6.1:

PSV TAG	PID n°	Type	Set P (barg)	Case	Calc. load (kg/h)	Rated Flow (kg/h)	PSV size
25-PSV-001A to F (*)	123A90-DDL-PR-PID-80015 to PID-80020	Conventional	40	Fire	627	1067	1E2 300lbX150lb
80-PSV-001	123A90-DDL-PR-PID-80012	Conventional	10	Bloc.disch	106	185	1D2 150lbX150lb
				CV fail	2679	3095	3K4 150lbX150lb
64-PSV-001	123A90-DDL-PR-PID-80027	Conventional	10	Bloc.disch	61.4	690.4	1D2 150lbX150lb
				Reverse flow (H2 from vessel)	23.8	185	1D2 150lbX150lb

Table 4 – PSV calculation summary

(*) The PSV set pressure is reached only after 4.4 minutes and after that time the PSV valve starts to discharge at a pressure slightly above the set pressure value (~44 bara) as shown along the below APPENDIX 01 – PSV CALCULATION SHEETS.

See APPENDIX 01 – PSV CALCULATION SHEETS

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CROSSWIND

HOLLANDSE KUST NOORD WIND PARK

Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #21 123A90-DDL-SAF-RE-30006
Item No.	#21
Causes	3.1.18. Blockage in line within Fuel Cell Package, considered to be failure to reopen main isolation valve following maintenance. 3.2.5. 25PIC025A/B control failure opening 25PV025A/B
Consequences	3.1.18.1. Upstream: Potential overpressure of pipework downstream of 25PV025A/B. LOPC of H2 and potential explosion on ignition. 3.2.5.1. Potential overpressure of pipework downstream of 25PV025A/B. LOPC of H2 and potential explosion on ignition.
Recommendation	21. Review the required response time (PST) of 80PI002/25SDV023 to ensure that they are able to react to prevent exceedance of hydrotest pressure of the downstream pipework and Fuel Cell if 25PCV025A/B are fully opened.
Actions	PSV 80PSV001 set pressure is 10 barg, while hydrotest pressure is 15 bar g. PSV opening time (≤ 100 msec) is enough to react to prevent exceedance of hydrotest pressure of the downstream pipework and Fuel Cell. See also EPC HAZOP Action No. 22.
Assigned Respondent (By)	Rosetti/Crosswind (Interface)
Issue Date (01-12-2023)	
Action Response	

Approvals / Endorsements

EPC Discipline Lead / Construction		Ciro Impradice **Sign**
C. Impradice		
EPC HSE LEAD		**Sign**
C.Caracciolo		CC
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client		Paul van Rossum **Sign** Digitaal ondertekend door Paul van Rossum Datum: 2024.10.23 09:33:01 +02'00'

CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #22 123A90-DDL-SAF-RE-30006
Item No.	#22
Causes	3.2.5. 25PIC025A/B control failure opening 25PV025A/B 3.1.18. Blockage in line within Fuel Cell Package, considered to be failure to reopen main isolation valve following maintenance 1.2.4. 25XV006 Driven open/inadvertently opened by operator
Consequences	3.2.5.1. Potential overpressure of pipework downstream of 25PV025A/B. LOPC of H2 and potential explosion on ignition. 1.2.4.1. Pressurise downstream system to 25PV025A/B up to 30barg. Potential to exceed design pressure (3 times design pressure) downstream of 25PV025A/B, LOPC of H2 and explosion on ignition. 25PV025A/B are downstream pressure controlled and are potentially opened when fuel cell is not online."
Recommendation	22. Review the required response time (PST) of 80PSV001 to ensure that it is able to react and depressurise the system quickly enough to prevent overpressure of the pipework and Fuel Cell if 25PCV025A/B are fully opened. Consider the opening times of storage vessels outlet XVs, e.g. 25XV006 and 25PV025A/B. .If PSV reaction time criteria cannot be met LOPA for 25PI002 must be reviewed.
Actions	Pressurization calculation of the inventory downstream the control valves 25PV055A/B have been performed to calculate the time for the system to reaches the transient pressure acceptable to Fuel Cell in the event of the 80PSV001 lifting. As it can be seen from the "ATTACHMENT 1 - CALCULATION SHEET", the time to reach such transient pressure is higher then the time for the 80PSV001 to fully open (100%). The calculation is based on information presented in Attachment 2, 3, 4 & 5. Therefore: 1) With the two conservative assumptions made on the attachment 1 and; 2) Considering that the time (102 msec) to reach 13.5 barg (Fuel Cell design pressure) is higher then the 80PSV001 valve opening time (≤ 100 msec), the 80PSV001 is able to react and depressurise the system quickly enough to prevent overpressure of the Fuel Cell Package A-80000.
Assigned Respondent (By)	Rosetti/Crosswind (Interface)
Issue Date(01-12-2023)	
Action Response	

Approvals / Endorsements

EPC Discipline Lead / Crosswind		**Sign**
C.Impradice (Rosetti) / Hamant Patel (Crosswind)		
EPC HSE LEAD		**Sign**
C.Caracciolo		**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client		**Sign**
		Digitaal ondertekend door Paul van Rossum Datum: 2024.08.21 08:39:17 +02'00'

CALCULATION SHEET - ATTACHMENT 1

		Lines			
		2"-HY-023-01HSS-N	4"-HY-152-01HSS-N	1"-HY-163-01HSS-N	UoM
3	ID pipe	0.055	0.108	0.027	m
4	Pipe length	21.2	11.7	25.2	m
5	Pipe volume	0.05	0.11	0.01	m3
6	Volume beetwen 25PV055A/B and FC inlet (TP010)	0.172			m3
7					
8	Temperature	25.0			°C
9	80PSV001 set pressure	10.0			barg
10	H2 density @PSV set	0.895			kg/m3
11	H2 mass @PSV set (t1 = 0 sec)	0.153			kg
12	FC design pressure (Note3)	13.5			barg
13	H2 density @ FC design P	1.179			kg/m3
14	H2 mass @ FC design P	0.202			kg
15	Delta mass between PSV set point and FC design P	0.049			kg
16	Number of control valves considered fully open (Note4)	1			-
17	Max H2 flow rate through one control valves (Note1)	1725.0			kg/hr
18	Max H2 flow rate through fully open control valve(s)	1725.0			kg/hr
19	Time, t2	**102**			msec

NOTES:

Note1: max H2 flow rate through one control valve calculated considering 100% valve open and corresponding CV of 13 (**Ref.[1]**)

Note2: as per 80PSV001 Vendor information, valve opening time ≤ 100 msec (t1), (**Ref.[4]**).

Note3: as per TQ doc. n. "CWHKN-INN-BPH-TQ-00053" (**Ref.[2]**), the transient pressure acceptable to Fuel Cell in the event of PSV lifting, is <=13.5 barg

Note4: According to note 7 of PID 123A90-DDL-PR-PID-80014_01, only one control valve is considered fully open. Note7 says (see **Ref.[3]**):
"*HS INCLUDES SOFTWARE INTERLOCK TO PREVENT BOTH VALVES TO BE ONLINE SIMULTANEOUSLY.*
SOFTWARE INTERLOCK PREVENTS VALVE 25PV055B TO OPEN IF VALVE 25PV055A IS NOT CLOSED "
This reduces the possibility of having both control valves fully opened at the same time.

CONSERVATIVE ASSUMPTIONS:

a) Gas flow through the 80PSV001 is considered to be zero, but i reality at the time of reaching PSV set pressure there will be gas outgoing from the pressurized system. This means that after t2 msec the pressure inside the system is still below the "FC design pressure" of 13.5 barg.

b) Available piping volume within the FC system is considered to be zero, this is conservative from time calculation point of view since the higher volume is the higher is the time to pressurize the system

REFERENCE DOCUMENTS

Attachment 2 - Ref.[1]: 1724000740-IN-DS-00003, SIZING CALCULATION SHEET (INCLUDING NOISE LEVEL DATA SHEETS, CONTROL VALVE CURVES)

Attachment 3 - Ref.[2]: CWHKN-INN-BPH-TQ-00053, Design of Hydrogen Supply Pressure Control Valves 25-PV-055 A B

Attachment 4 - Ref.[3]: 123A90-DDL-PR-PID-80014, BLPH PIPING AND INSTRUMENTATION DIAGRAM HYDROGEN STORAGE VESSELS HEADER (OUTLET)

Attachment 5 - Ref.[4]: 1724000518-IN-DS-00004, INSTRUMENTS DATA SHEETS PSV (INCLUDING SIZING CALCULATION SHEETS)

Base Load Power Hub (BLPH)

SIZING CALCULATION SHEET (INCLUDING NOISE LEVEL DATA SHEETS, CONTROL VALVE CURVES)

Document Number: 1724000740-IN-DS-00003

Document Class: 2

00	27/05/2024	Issue for Review (IFR)	AT	AP	AP
Rev.	Date	Description	Prepared	Reviewed	Approved

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CALCULATION FORM FOR CONTROL VALVES

Customer	ROSETTI MARINO SPA	QUOTE	CV2400221
Order	1724000740 123A90A	Sheet	13
Plant		Created By	RC

PIPELINE DATA

	INLET	OUTLET
Nominal diameter	1 1/2"	1 1/2"
Schedule	40	40
External Diameter, mm	48,30	48,30
Internal Diameter, mm	40,9	40,9
Thickness, mm	3,7	3,7

VALVE DATA

Valve TAG	**25-PV-055A**
Serial AST	
AST Ref.	130
Upstream Fluid State	GAS

VALVE DATA: BODY

Valve Family	CV-8400
Valve Model	CV-8407
Valve Description	Globe - Straigth way - Contoured Plug
Unit	NPS
Body Size	1 1/2"
Fluid	HYDROGEN

VALVE DATA: TRIM

Trim Configuration	CP-E
Stroke, mm	20
Port Size, Inch	1"
Flow Characteristic	Equal%
Flow Action	FTO
Selected Flow Coefficient	13

PROCESS DATA

		Units	#1	#2	#3	#4	NOTES
Fluid	-	-	GAS	GAS			
Flow Rate	Q/W	kg/h	106,00	106,00			
Inlet Temperature	T1	°C	15,00	15,00			
Inlet Pressure	P1	bar (g)	30,000	4,500			
Outlet Pressure	P2		3,500	3,500			
Differential Pressure	ΔP	-	26,500	1,000			
Fluid density at P1 and T1	ρ1	kg/m³	2,563	0,456			
Dynamic Viscosity	μ	cP					
Molecular Weight	MW	kg/kmol	2,000	2,000			
Specific Heat Ratio (cp/cv)	γ	-	1,420	1,420			
Compressibility Factor	Z	-	1,010	1,010			
Critical Pressure	Pcrit	bar (A)					
Vapor pressure	Pvap	bar (A)					
Calculated Flow Coefficient	**C**	**-**	**0,7563**	**6,271**			
Selected Flow Coefficient	**Cv**	-	13	13			
Calculated / Selected	C/Cv	%	5,817	48,24			
Pressure Recovery Factor	F_L	-	0,9345	0,919			
Valve Style Modifier	F_d	-	0,07612	0,2445			
Pressure Differential Ratio Factor	X_T	-	0,7336	0,7097			
Stroke %		**%**	**32,7**	**82,4**			
Predicted Noise SPL	-	dB	84,95	76,25			
Valve Outlet Velocity	v2	m/s	59,96	59,96			
Valve Outlet Mach Number	M2	-	0,04597	0,04597			
Downstream Pipe Fluid Velocity	vP2	m/s	59,96	59,96			
Flow Regime	-	-	Choked	Normal			
Upstream Fluid State	-	-	Gaseous	Gaseous			
Downstream Fluid State	-	-	Gaseous	Gaseous			

NOTES

Rev Index.	0			RC / RC / RC
	Rev.	**Date**	**Reason For Issue**	**EM / CK / APP**

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CROSSWIND

TECHNICAL QUERY
Hollandse Kust Noord

No. TQ :	CW-ROS-TQ-0016	Rev:	1

Originating Party	CrossWind					
Subject	Design of Hydrogen Supply Pressure Control Valves : 25-PV-055 A/B					
Author	Paul Kyle	TQ Aconex unique number: CWHKN-INN-BPH-TQ-00053				
Interface TQ - from	Rosetti	TQ interface source Aconex unique number:				
Type	Query		Interface	X		
	Deviation		Derogation (SHALL[PS])			
	Note: No deviations nor derogations which have an adverse effect on HSSE will be granted					
Work package						
Area(s) of application	Design & Eng.	X	Procurement		Construction	
	Commissioning		Operations	X	Other	
Issue date	20-05-2024		Urgent reply 5 days	X	Routine reply 10 days	
Close-out date						
Closed-out by			TQ status:		Open	

1. Description

Reference documents / Aconex unique numbers :

Ref.: Ballard, "Fuel Cell Package Hydrogen Usage and Fuel Cell Module Alarm Limits", Rev.001, 24/04/2024



HydrogenFlowRates rev1.pdf

Contractor kindly asks RM to consider the below data to design the H2 control system upstream of the fuel cell interface:

- Normal Hydrogen Storage Vessel Pressure (i.e. upstream pressure): 30 barg to 5 barg.
  - Extreme pressure expected, upstream of the PVs, will be High High Pressure Alarm Point.
- Normal Hydrogen supply temperature (ambient temperatures): -8.4 ºC to 25 ºC.
- Hydrogen Supply flow range: 0.9 g/s (3.24 kg/hr) to 29.4 g/s (105.84 kg/hr).
- Hydrogen supply pressure to Fuel Cell: 4 barg to 6.5 barg.
- Normal supply pressure to be controlled at 6 barg.
- PSV (80-PSV-001) set point is 10 barg.
- Transient pressure acceptable to Fuel Cell in the event of PSV lifting, is <=13.5 barg.

Other Parameter that should be considered in determining the control response are the below Hydrogen Consumption scenarios (Ref.: Ballard, "Fuel Cell Package Hydrogen Usage and Fuel Cell Module Alarm Limits", Rev.001, 24/04/2024):

This communication is issued for the recipient's information and to facilitate the obligations of the Parties under the Contract. This communication has no authority to amend or vary the Contract nor relieve either Party of any duties, obligations or responsibilities.

Scenario	Fuel Cell Modules	Description	Hydrogen Usage Initial [g/s]	Hydrogen Flowrate After [g/s]	Duration of change [s]
Startup	1	A single fuel cell module start up	0	0.9	3
Startup	3	Half (3) of the fuel cell module start up	0	2.7	3
Startup	6	All (6) of the fuel cell module start up	0	5.4	3
Ramp-up	1	Single module ramps from idle to full power	0.9	3.6	18
Ramp-up	3	Half (3) module ramps from idle to full power	2.7	10.8	18
Ramp-up	6	All (6) module ramps from idle to full power	5.4	21.6	18
Stopdown	1	A single fuel cell module performs a controlled stop	4.9 (worst) 3.9 (expected)	0	15
Stopdown	3	Half (3) fuel cell module performs a controlled stop	14.9 (worst) 10.8 (expected)	0	15
Stopdown	6	All (6) fuel cell module performs a controlled stop	29.4 (worst) 23.4 (expected)	0	15
ESD	1	A single fuel cell module performs an emergency stop	4.9 (worst) 3.6 (expected)	0	0.02 (20 ms)
ESD	6	All fuel cell modules perform an emergency stop	29.4 (worst) 23.4 (expected)	0	0.02 (20 ms)

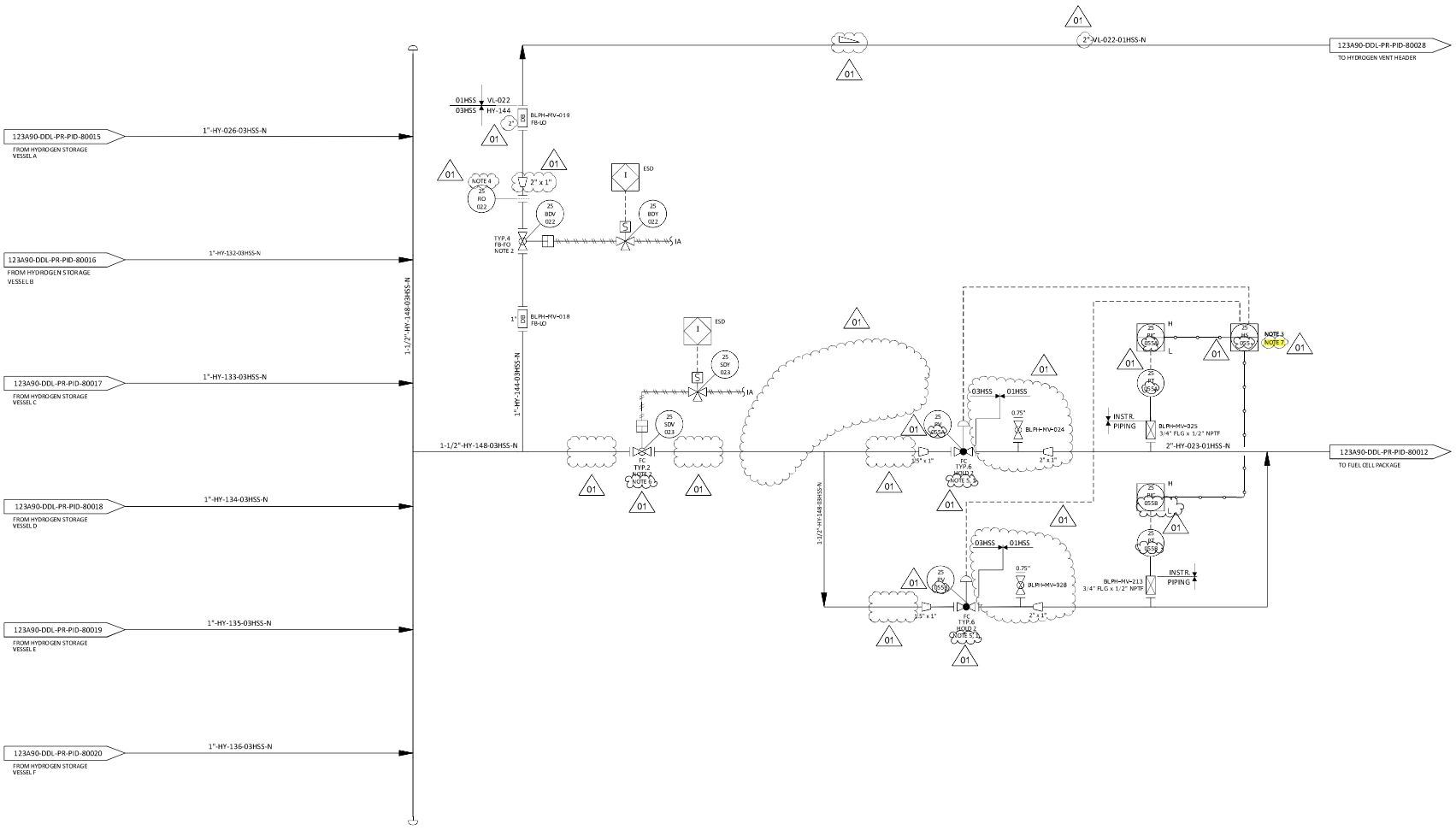
2. Response

Reference documents / Aconex unique numbers

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DRAWING NO. DRAWING_NO.

REV. REV.



NOTES

1. DELETED.
2. NECESSARY CONTROL SYSTEM SOFTWARE SHALL BE INCLUDED TO SUPPORT ADVACED VALVE CONTROL, PARTIAL STROKE TESTING AND DIAGNOSTICS FOR ANY SAFETY CRITICAL ON/OFF VALVES. THESE APPLICATION SHALL BE IDENTIFIED BY HAZOP AND LOPA EVALUATION IF PARTIAL STROKE TESTING WILL BE REQUIRED:
   THE "TYP. 3" SHALL BE CONSIDERED INSTEAD THE ACTUAL "TYP. 2" FOR SDV
   THE "TYP. 5" SHALL BE CONSIDERED INSTEAD THE ACTUAL "TYP. 4" FOR BDV
3. HAND SELECTOR TO ALLOW THE OPERATOR TO SELECT THE CONTROL LOOP (REMOTELY).
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 RUNNING.
6. SDV VALVE 25-SDV-023 TO BE INSTALLED AS CLOSE AS POSSIBLE TO THE CONTROL VALVES 25-PV-055A/B.
7. HS INCLUDES SOFTWARE INTERLOCK TO PREVENT BOTH VALVES TO BE ONLINE SIMULTANEOUSLY. SOFTWARE INTERLOCK PREVENTS VALVE 25PV055B TO OPEN IF VALVE 25PV055A IS NOT CLOSED.

01

HOLDS

1. DELETED.
2. CONTROL VALVE SIZE (BY VENDOR).

01

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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 VESSELS HEADER (OUTLET)

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-80014		SHEET 001	REV. 01

File Name : FILE_NAME

Base Load Power Hub (BLPH)

INSTRUMENTS DATA SHEETS PSV (INCLUDING SIZING CALCULATION SHEETS)

Document Number: 1724000518-IN-DS-00004

Document Class: 2

02	29/05/2024	Issue for Review (IFR)	Di Virgilio L.	Delponte P.L.	Bianchi R.
01	11/04/2024	Issue for Review (IFR)	Di Virgilio L.	Delponte P.L.	Bianchi R.
00	22/03/2024	Issue for Review (IFR)	Di Virgilio L.	Delponte P.L.	Bianchi R.
Rev.	Date	Description	Prepared	Reviewed	Approved

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SAFETY VALVE
SIZING SHEET

GENERAL INFO

1	TECHNICAL Ref. / Item	23-3962 / 10	4	Project	HOLLANDSE KUST NOORD WIND PARK	ROSETTI MARINO SPA	
2	Valve Code	320-K10-5L	5	Quantity	2		
3	Tag Number	80-PSV-001 + 80-PSV-001_S					

DESIGN DATA

6	Operating Pressure	6,5	bar g	10	Operating Temperature	25	ºC
7	Ambient Pressure	1,013	bar a	11	Sizing Code	API Std 520	
8	Basis	Upstream fail open		12	Fire Case	No	
9	Governing Case	Yes		13	Rupture Disc	No	

INSTALLATION DATA

14	Inlet	3" 150# RF		22	Outlet	4" 150# RF		
15	**Valve Model**	**30000**		23	Valve Type	CONVENTIONAL		
16	Superimposed Bkp			24	Seat Type	METAL-TO-METAL		
17	Constant	Pbcs	0 bar g	25	Set Pressure	Ps	10,000	bar g
18	Variable	Pbvs	0 bar g	26	CDTP		10,000	bar g
19	Total	Pbs	0 bar g	27	Overpressure	Overp	10	%
20	Built-up Backpressure	Pbb	0,17 bar g	28	Relieving Temperature	T_0	25,0	ºC
21	Total BackPressure	Pb	0,17 bar g	29	Required Flow Rate	W	2678,00	kg/h

FLUID PROPERTIES

30	Phase	GAS		35	Density	ρ	-	kg/m3
31	Medium	Hydrogen		36	Specific Volume	v	-	m3/kg
32	Ratio of Specific Heats	k	1,405 -	37	Specific Gravity	G	-	-
33	Molecular Weight	M	2,02 kg/kmol	38	Dynamic Viscosity	μ	0,008754	cP
34	Compressibility Factor	Z	1,004 -	39	Dryness Steam Factor	x0	-	-

SIZING — **CRITICAL FLOW - GAS&VAPOURS - API 520**

40	Critical / Subcritical Flow		CRITICAL	
41	Relieving Pressure	P_0	12,013	bar a
42	C Factor	C	2,7066	-
43	Discharge Coefficient	K_D	**0,940**	-
44	Backpressure Corr. Factor	K_{BP}	1	-
45	Subcritical Corr. Factor	Kb	-	-
46	Rupture Disk Corr. Factor	K_C	1	-
47	Steam Correction Factor EN	ks	-	-
48	Superheat Corr. Factor	ksh	-	-
49	Supercritical Corr. Factor	ksc	-	-
50	Napier Factor	kn	-	-
51	Viscosity Corr. Factor	K_V	-	-
52	Reynolds Number	Re	-	-
53	Calculated Area	A	11,8631	cm^2
54	Orifice Designation	-	**K**	-
55	Selected Area	A_S	**12,940**	cm^2
56	Area Gain	-	9	%
57	Maximum Flow Rate	W_T	2921,12	kg/h
58				

$$A = \frac{W}{0{,}9\ C\ P_0\ K_D K_{BP} K_C}\sqrt{\frac{Z T_0}{M}}$$

$$C = 3{,}948\sqrt{k\left(\frac{2}{k+1}\right)^{\frac{(k+1)}{(k-1)}}}$$

$$W_T = \frac{W\ \ As}{A}$$

Units of measure
A [mm^2]; W [kg/h]; P [kPa]; T [K]; M [kg/kg mole]

REACTION FORCE — **API 520 PART II** — **OPEN DISCHARGE TO ATMOSPHERE**

59	Reaction force (Flow)	FF	1081	N
60	Reaction force (Static Bkp)	FB	133	N
61	Total Reaction Force	FT	1215	N

$$F_F = \frac{129 W_{MAX}}{0{,}9 * 3600}\sqrt{\frac{k\ T_0}{(k+1)M}}\ ;\ F_B = \frac{A_2 P_b}{10}\ ;\ F_T = F_F + F_B$$

NOISE EVALUATION — **API 521** — **Not Applicable for Liquid**

62	Noise Level @ 30m	L30	116,6	dB
63	Distance d	d	1	m
64	Outlet Tube Diameter	da	0,1	m
65	Noise Level @ distance d	Ld	146,2	dB

$$L_{30} = L + 10 log_{10}\left(\frac{W_{M-MAX}\ c^2}{3600 * 0{,}9 * 2}\right);\ c = 91{,}2\left(\frac{k\ T_0}{M}\right)^{0{,}5}$$

$$L_p = L_{30} - 20 log_{10}\left(\frac{d}{30}\right)$$

REMARKS: Process data are under customer responsibility.

Testing according to Doc. 1724000518-QC-ITP-00002

Valve opening time ≤ 100 msec

REV	DATE	DESCRIPTION	PREP.	CHECK.	APPROV.
2	29/05/2024	ADD. VALVE	TCH	L. DI VIRGILIO	P.L.DELPONTE
1	11/04/2024	MOD. PAINTING SYSTEM	TCH	L. DI VIRGILIO	P.L.DELPONTE
0	18/03/2024	FIRST ISSUE	TCH	C. PASQUALINI	P.L.DELPONTE

CROSSWIND

ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK

Project Base Load Power Hub (BLPH)

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #23 123A90-DDL-SAF-RE-30006
Item No.	#23
Causes	3.6.1. Low Pressure at inlet to Fuel Cell
Consequences	3.6.1.1. Potential damage of Fuel Cell and loss of Power generation. Operational issue, no hazardous consequences. Low pressure likely to occur during normal operation when storage tank is depleted.
Recommendation	23. Review the requirement for a low pressure alarm on 25PIC025A/B to indicate that the PCV no longer has control over the downstream pressure due to depletion (low pressure) of the H2 storage vessel and low low pressure trip on 80PI002 to shutdown the Fuel Cell Package.
Actions	Requirement for: 1) a low pressure alarm on 25PIC055A/B (ex 25PIC025A/B) downstream control valves 25PV055A/B, allerting the operator in case of low pressure at Fuel Cell inlet; 2) and low low pressure trip on 80PI002 to shutdown the Fuel Cell Package, have been verified and added on P&iDs (see attachment-1 PID "123A90-DDL-PR-PID-80014" and attachment-2 PID "123A90-DDL-PR-PID-80012", respectively)
Assigned Respondent (By)	Process
Issue Date (01-12-2023)	
Action Response	

Approvals / Endorsements

EPC Discipline Lead		**Sign**
Ciro Impradice	**22/03/2024**	
EPC HSE LEAD		**Sign**
C.Caracciolo	**22/03/2024**	**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client		**Sign**

CROSSWIND HOLLANDSE KUST NOORD WIND PARK

Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #24 123A90-DDL-SAF-RE-30006
Item No.	#24
Causes	1.13.4. O2 contamination of H2 in the storage system
Consequences	1.13.4.1. O2 contamination of H2 in the storage system. Potential for explosion in H2 storage vessel. For flammable concentration to be formed within the H2 storage vessel O2 would have to accumulate within the vessel and not be flushed out.
Recommendation	24. Review with Fuel Cell suppliers what the consequence of 500ppm of O2 in the H2 stream will be on the Fuel Cell. Will this be only be an impact on performance or likely to create a hazard? If credible hazard consider LOPA for Elogen OIHA800A/B.
Actions	
Assigned Respondent (By)	Rosetti/Crosswind Project
Issue Date (01-12-2023)	
Action Response	Exceeding the FC spec of 5ppm O2 in the H2 supply, the results of 500ppm (= 500 umol/mol, 100x times the specification limit) is at most equipment degradation over a period of hours/days, with no danger to people or risk of hydrogen release. Please see attached email for further information.

Approvals / Endorsements

Company Discipline Lead	Digitally signed by Paul kyle Paul kyle 119514BD67584BC...	**Sign**
Company HSE LEAD	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.18 08:10:55 +02'00'	**Sign**
Company Project Manager		Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.28 07:54:14 +01'00' **Sign**
Contractor received for information. Not independently verified. Information implemented		**Sign**

Paul Kyle

From: Peter Vajhøj Blach <pbl@ballardeurope.com>
Sent: 16 October 2024 07:37
To: Paul Kyle; Mads Hjorth Andersen
Cc: Erich Zell; Stephen Bremner; marta.iacopetti@crosswindhkn.nl; Paul van Rossum
Subject: [External] RE: BLPH - Ballard - HAZOP Action input required

Proprietary \ KBR confidential

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hello Paul and team,

Yeah, I believe I have replied to Stephen on this previously, but no issue in repeating it.

The fuel quality standard, ISO 14687:2019, Grade D – proscribes at most 5 ppm of O2.

Table 2 — Fuel quality specification for PEM fuel cell road vehicle application

Constituents[a] (assay)	Type I, Type II grade D
Hydrogen fuel index (minimum mole fraction)[b]	99,97 %
Total non-hydrogen gases (maximum)	300 µmol/mol
Maximum concentration of individual contaminants	
Water (H_2O)	5 µmol/mol
Total hydrocarbons except methane[c] (C1 equivalent)	2 µmol/mol
Methane (CH_4)	100 µmol/mol
Oxygen (O_2)	5 µmol/mol
Helium (He)	300 µmol/mol

[a] For the constituents that are additive, such as total hydrocarbons and total sulphur compounds, the sum of the constituents shall be less than or equal to the acceptable limit.

[b] The hydrogen fuel index is determined by subtracting the "total non-hydrogen gases" in this table, expressed in mole percent, from 100 mole percent.

[c] Total hydrocarbons except methane include oxygenated organic species. Total hydrocarbons except methane shall be measured on a C1 equivalent (µmol/mol).

[d] The sum of measured CO, HCHO and HCOOH shall not exceed 0,2 µmol/mol.

[e] As a minimum, total sulphur compounds include H_2S, COS, CS_2 and mercaptans, which are typically found in natural gas.

[f] All halogenated compounds which could potentially be in the hydrogen gas [for example, hydrogen chloride (HCl) and organic chlorides (R-Cl)] should be determined by the hydrogen quality control plan discussed in ISO 19880-8. Halogenated compounds shall be measured on a halogen ion equivalent (µmol/mol).

[g] Particulate includes solid and liquid particulates comprises of oil mist. Large particulates can cause issues with vehicle components and should be limited by using filter as specified in ISO 19880-1. No visible oil shall be found in fuel at a nozzle.

Exceeding that, the results of 500ppm (= 500 umol/mol, 100x times the specification limit) is at most equipment degradation over a period of hours/days, with no danger to people or risk of hydrogen release.

The increased O2 content – 500ppm – causes increased degradation of the fuel cell membranes, as the oxygen oxidizes the platinum on the membrane. The platinum is essential to the function of the fuel cell, so the platinum being captured as platinum oxide lowers performance. This performance loss is recoverable to some degree via recovery methods on the fuel cell modules.

Mvh./Best Regards
Peter Vajhøj Blach | Senior Solution and Application Engineer

T +45.8843 5525 M +45.3156 3517 | pbl@ballardeurope.com | www.ballard.com

From: Paul Kyle <Paul.Kyle@kbr.com>
Sent: Tuesday, 15 October 2024 17.48
To: Peter Vajhøj Blach <pbl@ballardeurope.com>; Mads Hjorth Andersen <mha@ballardeurope.com>
Cc: Erich Zehl <eze@ballardeurope.com>; Stephen Bremner <stephen.bremner@crosswindhkn.nl>; marta.iacopetti@crosswindhkn.nl; Paul van Rossum <paul.vanrossum@crosswindhkn.nl>
Subject: BLPH - Ballard - HAZOP Action input required

Proprietary \ KBR confidential

Peter,

As I pinged you on teams we have an open HAZOP action:

Review with Fuel Cell suppliers what the consequence of 500ppm of O2 in the H2 stream will be on the Fuel Cell. Will this be only be an impact on performance or likely to create a hazard?

I think this was discussed at some point, and it would be an efficiency / reduction in output issue? Rather than a hazard issue?

Regards,

Paul Kyle
KBR | Technical Professional Leader - Mechanical,
Integrity Solutions - International
Hill Park Court, Springfield Drive I Leatherhead, Surrey, KT22 7NL | UK
Paul.Kyle@kbr.com

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Reg. Office: Hill Park Court, Springfield Drive, Leatherhead, Surrey, KT22 7NL

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CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #25 123A90-DDL-SAF-RE-30006
Item No.	#25
Causes	1.13.4. O2 contamination of H2 in the storage system
Consequences	1.13.4.1. O2 contamination of H2 in the storage system. Potential for explosion in H2 storage vessel. For flammable concentration to be formed within the H2 storage vessel O2 would have to accumulate within the vessel and not be flushed out.
Recommendation	25. Perform a calculation to determine how long/number of fill cycles it would require for a flammable concentration to be formed within the H2 storage vessel based on 500ppm O2 to determine if a flammable concentration is credible in the H2 storage vessel.
Actions	
Assigned Respondent (By)	Process
Issue Date (01-12-2023)	
Action Response	Calculation to determine how long/number of fill cycles it would require for a flammable concentration to be formed within the H2 storage vessel based on 500ppm O2 has been performed, see attached calculation sheet (attachment 1). According to result, a flammable concentration is not credible in the H2 storage vessel.

Approvals / Endorsements		
EPC Discipline Lead	Ciro Impradice	**Sign**
Ciro Impradice		
EPC HSE LEAD		**Sign**
C.Caracciolo	**08-04-2024**	**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client		**Sign**

Digitaal ondertekend door Paul van Rossum Datum: 2024.05.10 11:52:52 +02'00'

		UoM
Pressure inside the vessel at end of filling operation	30.0	*barg*
Temperature inside the vessel at end of filling operation	30.0	*°C*
Fluid density at end of vessel filling operation	2.5	*kg/m3*
Vessel ID	2.8	*m*
Vessel length	15.5	*m*
One vessel volume	101.2	*m3*
H2 mass inside the vessel at end of filling operation	248.2	*kg*
Max O2 concentration in the inlet H2 stream	500.0	*ppm*
O2 mass inside the vessel at end of first filling operation, *mO2initial*	0.124	*kg*
Hydrogen pressure inside vessel (at end FC operation)	5.0	*barg*
Fluid density at end of FC operation	0.5	*kg/m3*
H2 mass inside the vessel at end of FC operation	48.1	*kg*
H2 mass fed to the vessel in one cycle, after the first filling	200.1	*kg*
O2 mass fed to the vessel in one cycle, after the first filling, *mO2cycle*	0.100	*kg*
Max permitted O2 concentration	4.0	*%*
Max permitted O2 mass inside vessel, *mO2max*	9.93	*kg*
Max number of fill cycles to reach max permitted O2 concentration, *n*	99.0	-

n = 1 + [(mO2max - mO2initial) / mO2cycle]

ASSUMPTION

- The total accumulated O2 mass over all filling cycle has been calculated taking into consideration that no oxygen will leave the vessel during Fuel Cell operation. This assumption is very conservative from max oxygen calculation point of view, since in the reality, due to the time required to allow settling of oxygen mass in the bottom side of the vessel, there could be always a small O2 quantity that will leave the vessel as the H2 is fed to the Fuel Cell package. Therefore, one could say that the number of filling cycles required to create a flammable concentration to be formed within the H2 storage vessel will be even higher than the calculated one.

CONCLUSION

- As per above calcolation, and considering the following:

90 Electrolyser starts/yr, as per ELOGEN information,

the number of filling cycles required to form a flammable concentration is higher than the number of time the electrolyse starts in one year, therefore flammable concentartion formation is not credible.

CROSSWIND HOLLANDSE KUST NOORD WIND PARK

ROSETTI MARINO

Project Base Load Power Hub (BLPH)

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #26 123A90-DDL-SAF-RE-30006
Item No.	#26
Causes	8.1.1. BLPH-MV-412 Caisson common inlet line left closed after maintenance
Consequences	8.1.1.1. No outlet for discharges into Caisson. Discharge from Elogen RO cells potentially at high pressure (Elogen estimate 10barg). Potential pressurisation Caisson inlet header and reverse flow of RO discharge to other brine discharge streams.
Recommendation	Elogen to confirm to Rosetti the blocked in discharge pressure from the RO cells to the Brine Caisson Discharge system, i.e. the pressure in the line if the RO cell reject/discharge is blocked outside of the battery limit.
Actions	
Assigned Respondent (By)	Crosswind
Issue Date (01-12-2023)	
Action Response	There is a potential overpresssure scenario with a release of water and damage to piping when BLPH-MV-412 caisson common inlet line is close. This valve has been made Locked-Open according to 123A90-DDL-PR-PID-80025 rev 02 and as such the scenario is ALARP

Approvals / Endorsements

Company Discipline Lead		**Sign**
		Hamant Patel Digitally signed by Hamant Patel Date: 2024.10.14 08:34:55 +01'00'
Company HSE LEAD	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.12 11:36:25 +02'00'	**Sign**
Company Project Manager		Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.24 10:14:05 +02'00' **Sign**
Contractor received for information. Not independently verified.		**Sign**
Information implemented		

CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #27 123A90-DDL-SAF-RE-30006
Item No.	#27
Causes	4.2.1. Full production rate of H2 from Elogen Electrolyser sent to vent
Consequences	4.2.1.1. Full production of wet H2 sent to H2 vent. Potential high back pressure on other vent users and high moisture content of stream. No hazardous consequences as this is the design case for the vent system.
Recommendation	27. Determine the back pressure on the vent system for full wet production H2 sent to H2 vent. Determine the effects of high back pressure on other vent users, consider the effect on relief valve set points and Electrolyser Oxygen in Hydrogen analysers due to back pressure. Review impacts with interface units. See also recommendation 31
Actions	
Assigned Respondent (By)	Crosswind
Action Response	Rosetti have performed the back pressure calculations and determined that the back pressure is lower than 0.5 barg (TQ-C63-ELO-CWD-017) The H2 vent for sampling will be separate and routed to atmosphere. The vent location is assessed in C63-PTN-002, O2 & H2 Vent Technical specification. Therefore no increased backpressure on the sampling vent outlet when venting H2. Elogen have used these calculations to update their design to install additional valves to prevent H2 vapour breakthrough to water discharge

Approvals / Endorsements

Company Discipline Lead		**Sign**
		Hamant Patel
Company HSE LEAD	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.01 17:09:29 +02'00'	**Sign**
Company Project Manager	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.02 08:25:04 +02'00'	**Sign**
Contractor received for information. Not independently verified.		**Sign**
	Information implemented	

CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title:	**EPC HAZOP Study Actions**
Action No:	#28
Ref Doc	123A90-DDL-SAF-RE-30006
Item No.	#28
Causes	4.20.1. Lute provision on base of stack within Rosetti Package
Consequences	4.20.1.1. Refer to Recommendation.
Recommendation	28. Review the requirement for a Lute within the Elogen Package H2 vent system as the package vent discharge is via a knockout pot V43001 within the Rosetti scope. If Elogen Lute not required consider removal of the Elogen package Lute
Actions	.
Assigned Respondent (By)	Crosswind
Issue Date(01-12-2023)	
Action Response	The collection header of all hydrogen to vent system in Elogen is at a low point. Lute is still required to collect any condensation. Lute will remain in the system.

Approvals / Endorsements

Company Discipline Lead		**Sign**
		Hamant Patel Digitally signed by Hamant Patel Date: 2024.10.14 08:38:07 +01'00'
Company HSE LEAD	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.12 11:34:24 +02'00'	**Sign**
Company Project Manager		**Sign**
		Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.14 14:47:53 +02'00'
Contractor received for information. Not	**independently verified. Information implemented**	**Sign**

CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #29 123A90-DDL-SAF-RE-30006
Item No.	#29
Causes	4.2.3. Flow from Elogen Electrolyser sample system
Consequences	4.2.3.1. Very small continuous flow, no significant impact. No hazardous consequences.
Recommendation	29. Review the impact of back pressure in the H2 vent system on the Elogen product sample system. Consider that the Electrolyser may be in start-up and venting wet H2 and this is the critical time for sampling of the product stream. See also recommendation 29
Actions	
Assigned Respondent (By)	Crosswind
Issue Date(01-12-2023)	
Action Response	H2 vent for sampling will be separate and routed to atmosphere. The vent location is assessed in C63-PTN-002, O2 & H2 Vent Technical specification. Therefore no increased backpressure on the sampling vent outlet when venting H2.

Approvals / Endorsements

Company Discipline Lead		**Sign**
		Hamant Patel
Company HSE LEAD	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.01 16:55:45 +02'00'	**Sign**
Company Project Manager	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.02 08:25:42 +02'00'	**Sign**
Contractor received for information. Not independently verified.		**Sign**
Information implemented		

CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #30 ~~123A90-DDL-SAF-RE-30006~~
Item No.	#30
Causes	4.1.1. BLPH-MV-002 SB Left in closed position
Consequences	4.1.1.1. Upstream: No flow from Electrolyser Package into H2 vent. Blocked outlet on Electrolyser relief and vent systems. Review in Elogen HAZOP. [Parking Lot; What: Review in Elogen HAZOP.]
Recommendation	30. Review the requirement for BLPH-MV-002 in the H2 vent system as this is a potential isolation point within a relief route. Also review the piping specification around the tie in point and identify it on P&ID to ensure compatibility.
Actions	The requirement for BLPH-MV-002 in the H2 vent system is confirmed, since it will be used as an isolation valve when required. Moreover, the manual valve BLPH-MV-002 is specified to be locked open ("LO"), therefore the scenario of leaving the valve in closed position is not credible (for reference see attachment 1)
Assigned Respondent (By)	Process
Issue Date (01-12-2023)	
Action Response	

Approvals / Endorsements

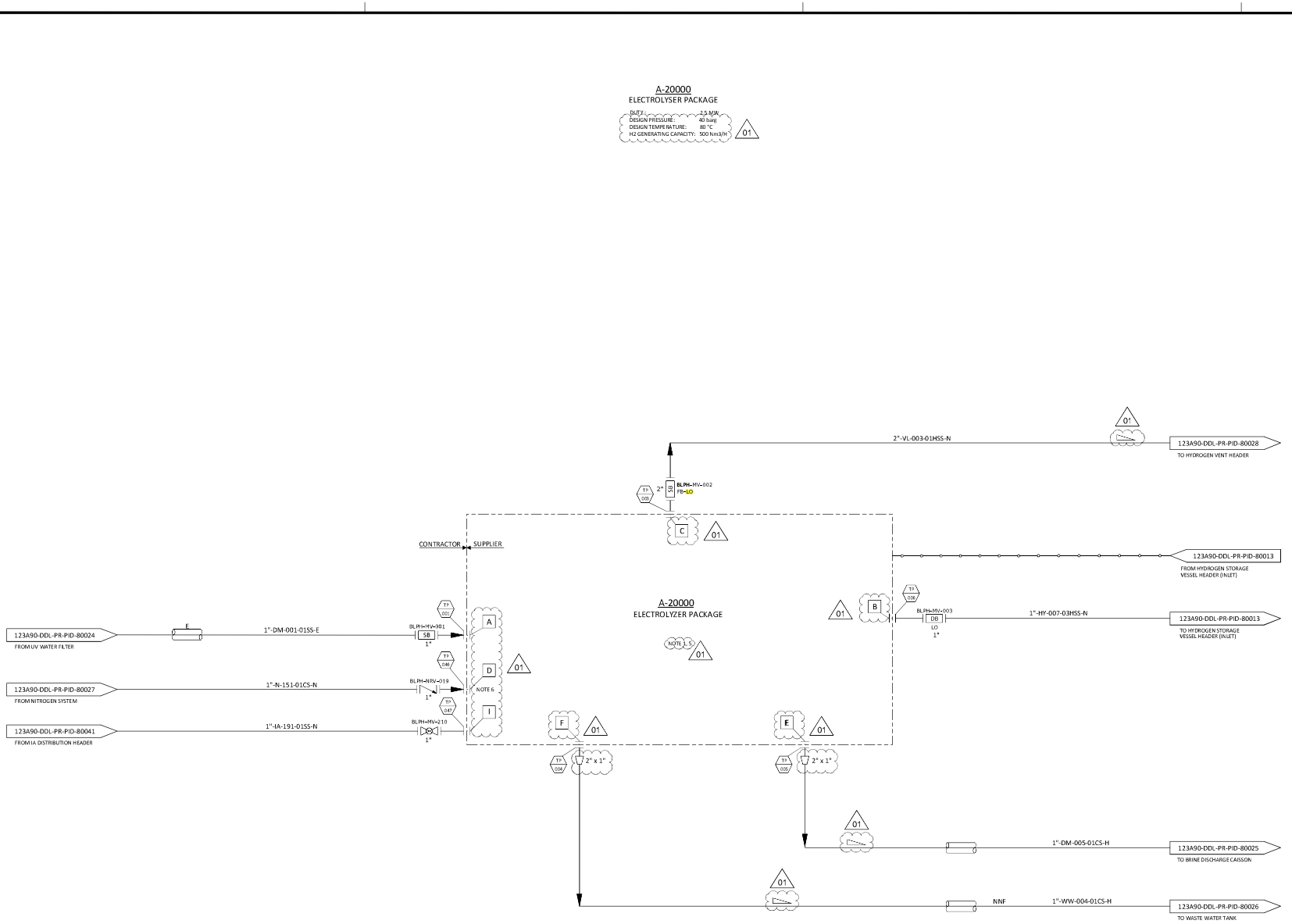
EPC Discipline Lead	Ciro Impradice	**Sign**
Ciro Impradice		
EPC HSE LEAD		**Sign**
C.Caracciolo		**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client		**Sign**

Autore firma digitale: Ciro Impradice
Nome distintivo: CN = Ciro Impradice email = ciro.impradice@rosetti.it C = IT O = Rosetti Marino OU = Process
Data: 2024.06.06 11:28:42 +02'00'

Digitaal ondertekend door Paul van Rossum
Datum: 2024.06.21 14:49:29 +02'00'

DRAWING NO. DRAWING_NO.

REV. REV.



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.

01

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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

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-80011		SHEET 001	REV. 01

File Name : FILE_NAME

CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

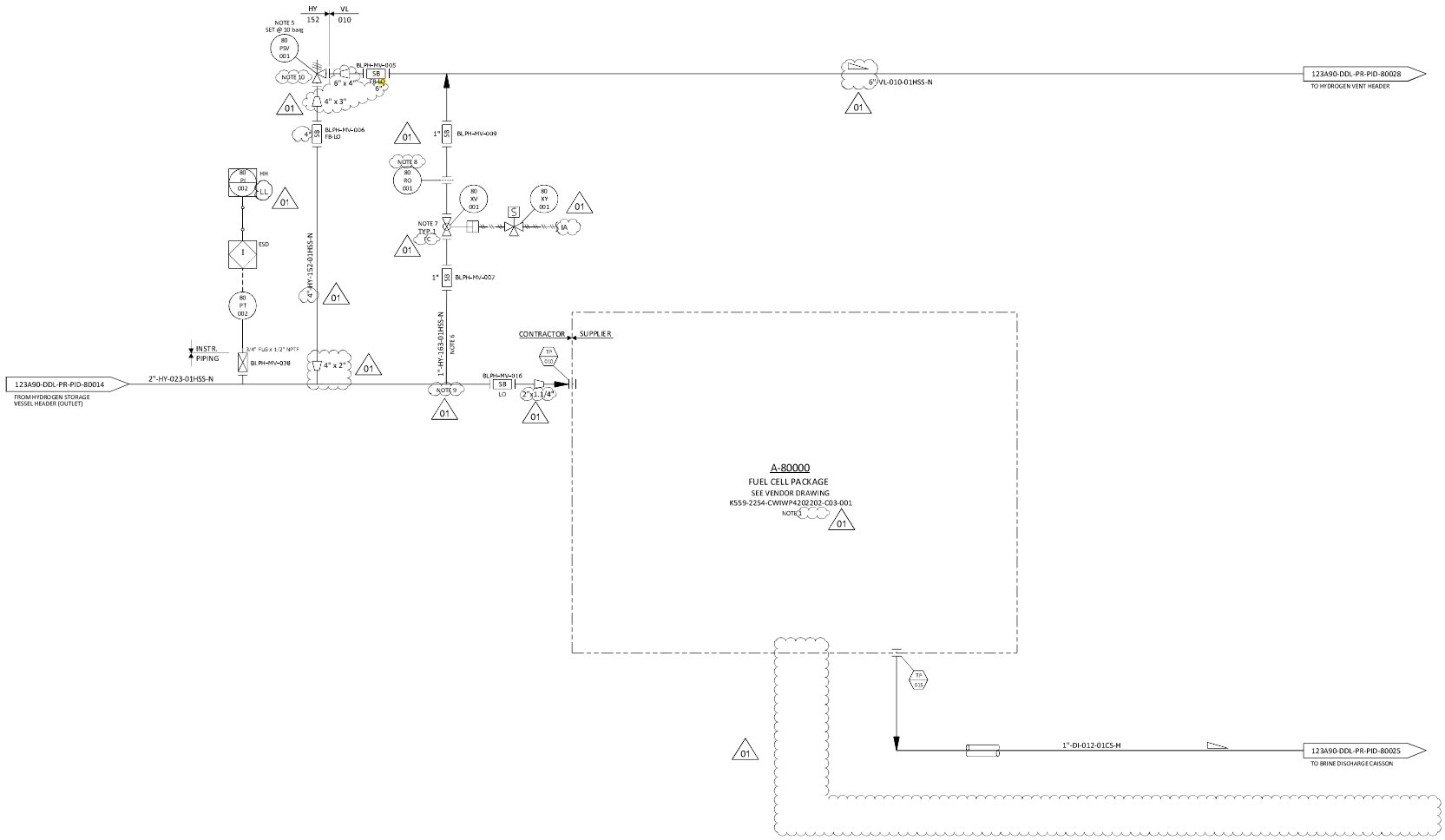
ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** 31 123A90-DDL-SAF-RE-30006
Item No.	31
Causes	4.1.4. BLPH-MV-033 DBB Left in closed position 4.1.10. BLPH-MV-005 DBB Left in closed position
Consequences	4.1.4.1. upstream: Unable to relieve vessel V-25001A when required. Potential escalation of existing incident or unable to prepare installation for maintenance. Consequence 4.1.10.1
Recommendation	31 Review the location of the spec break downstream of: 1. 25PSV001A/BLPH-MV-033 2. 80PSV001/BLPH-MV-005 As pipework between PSV and manual valve will see upstream pressure if closed and a relief occurs.
Actions	
Assigned Respondent (By)	Process
Issue Date (01-12-2023)	
Action Response	Location of the spec break downstream of: 1. 25PSV001A/BLPH-MV-033 2. 80PSV001/BLPH-MV-005 are confirmed as they are, since all manual valves installed downstream PSVs are locked open "LO" (see attachment 1 and 2). The situation of having a release scenario and at same time a manual valve wrongly closed (due to human error) represents a double jeopardy. The simultaneous occurrence of two or more unrelated causes of overpressure (also known as double or multiple jeopardy) is not a basis for design. To be noted that the closure of a manual valve located downstream a PSV is not a cause of having overpressure in the analyzed system, in the sense that all PSVs object of this HAZOP recommendation are required to be opened in case of: 1) upstream CV failure (80PSV001); 2) fire (25PSV001). Both scenarios above indicated are not caused by having closed the manual valve installed downstream the PSV. Therefore, the causes of overpressure are considered to be unrelated.

Approvals / Endorsements		
EPC Discipline Lead	Ciro Impradi ce	**Sign**
Ciro Impradice		
EPC HSE LEAD		**Sign**
C.Caracciolo	**10/06/2024**	**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client		**Sign**
		Digitaal ondertekend door Paul van Rossum Datum: 2024.08.21 08:38:41 +02'00'

DRAWING_NO.

REV.



NOTES

1. THE VENDOR PACKAGE WILL CONTAIN AIR INTAKE AND EXHAUST, SUITABLY SAFEGUARDED AND SEPARATED.
2. DELETED.
3. DELETED.
4. DELETED

01

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. 80PSV001 SIZED FOR CV FAILURE OF UPSTREAM CONTROL VAVE 25PV055A/B.

01

HOLDS

1. DELETED.
2. DELETED.

01

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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
FUEL CELL PACKAGE

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-80012		SHEET 001	REV. 01

File Name : FILE_NAME

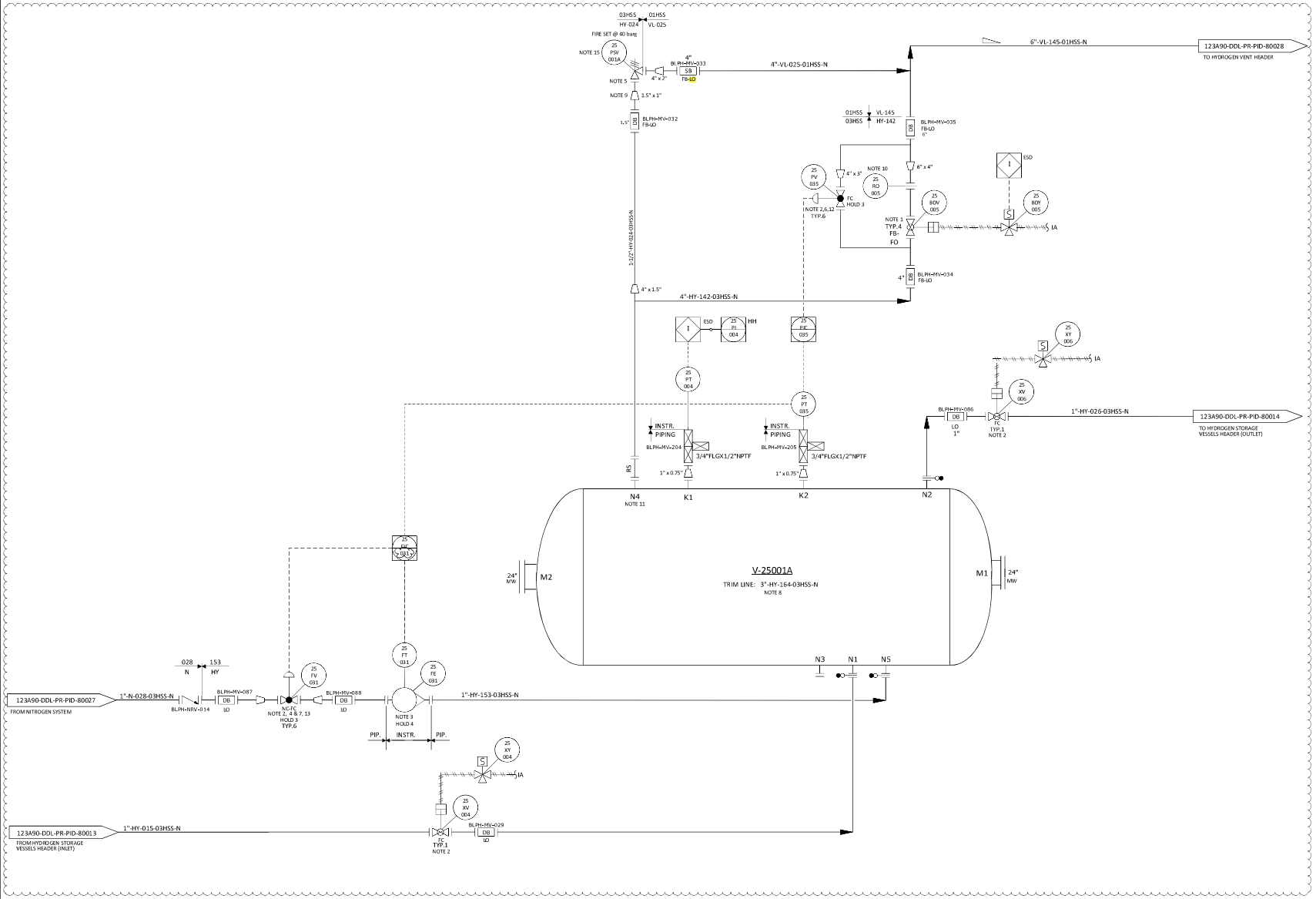
DRAWING NO. DRAWING_NO.

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



01

NOTES

1. NECESSARY CONTROL SYSTEM SOFTWARE SHALL BE INCLUDED TO SUPPORT ADVACED VALVE CONTROL, PARTIAL STROKE TESTING AND DIAGNOSTICS FOR ANY SAFETY CRITICAL ON/OFF VALVES. THESE APPLICATION SHALL BE IDENTIFIED BY HAZOP AND LOPA EVALUATION IF PARTIAL STROKE TESTING WILL BE REQUIRED:
   THE "TYP. 3" SHALL BE CONSIDERED INSTEAD THE ACTUAL "TYP. 2" FOR SDV
   THE "TYP. 5" SHALL BE CONSIDERED INSTEAD THE ACTUAL "TYP. 4" FOR BDV
2. TIGHT SHUT OFF VALVE.
3. VARIABLE AREA FLOWMETER TO BE INSTALLED VERTICALLY WITH DIRECTION OF FLOW UPWARDS.
4. NITROGEN CONTROL VALVE (25-FV-001), 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. 01
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 25PV035 BEING OPENED OUTSIDE OF A PURGE CYCLE OPERATION. CONTROL VALVE 25PV035 IS USED ONLY IN CASE OF VESSEL PURGING.
13. SOFTWARE INTERLOCK TO PREVENT 25FV031 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 25PV035 HAS FAILED TO CLOSE.
15. 25PSV001A SIZED FOR FIRE.

HOLDS

1. DELETED.
2. DELETED.

01

3. CONTROL VALVE SIZE (BY VENDOR).
4. MULTIVARIABLE FLOWMETERS REQUIRE 7 DIAMETERS STRAIGHT LENGHT UPSTREAM AND 5 DIAMETERS STRAIGHT LENGHT DOWNSTREAM (TO BE CONFIRMED BY VENDOR).

01

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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 A

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-80015		SHEET 001	REV. 01

File Name : FILE_NAME

ROSETTI MARINO

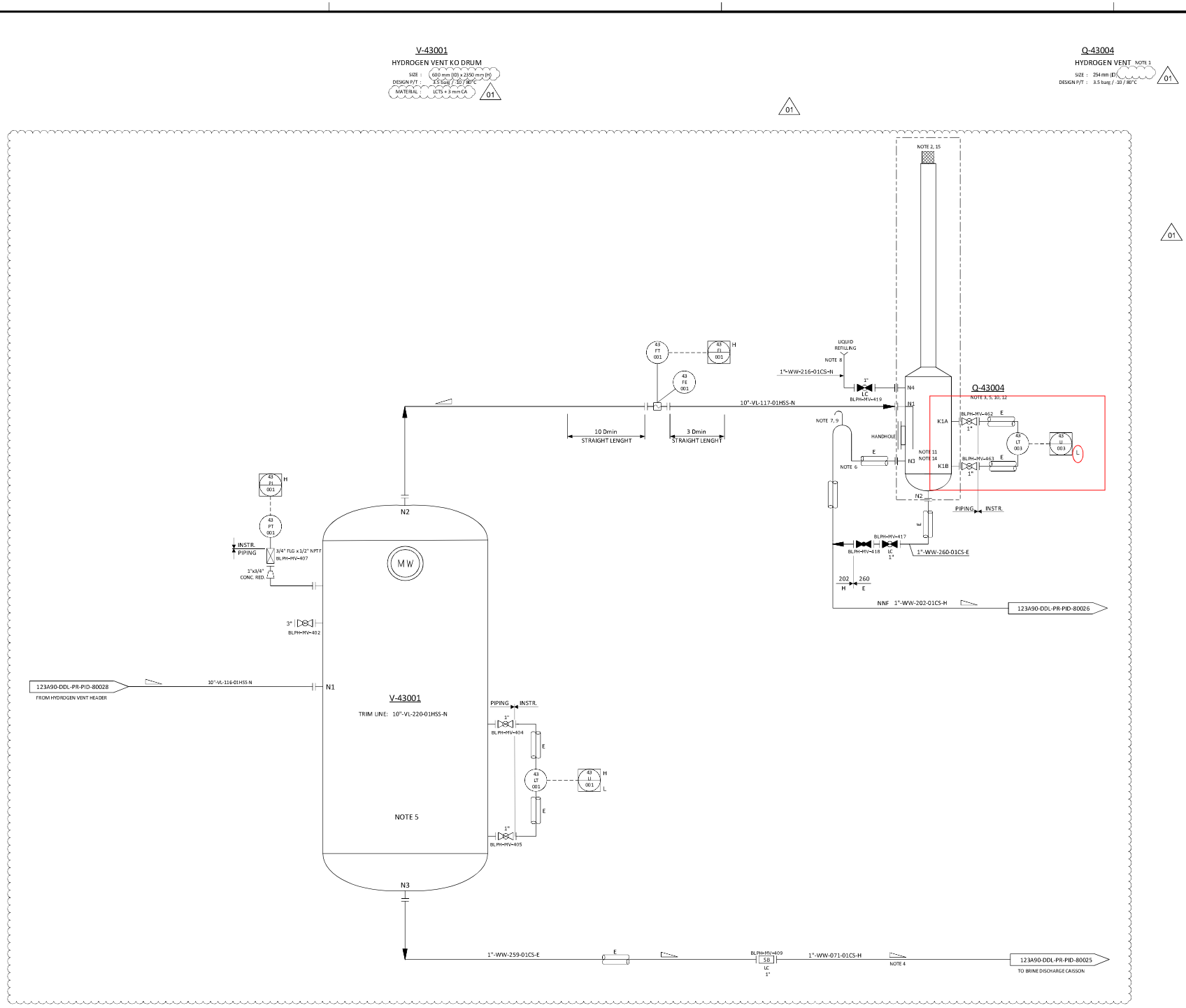
HOLLANDSE KUST NOORD WIND PARK

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** 32 123A90-DDL-SAF-RE-30006
Item No.	32
Causes	4.1.11. No flow from N2 package to H2 vent 4.1.12. BLPH-MV-171 Left in closed position on N2 system 4.1.13. BLPH-MV-172 Left in closed position on N2 system 4.2.3.1. Very small continuous flow, no significant impact. No hazardous consequences. 2.6.1. During purge cycle vessel pressure drops lower than intended (estimated 1.1barg) 4.3.2. BLPH-MV-417 and BLPH-MV-418 inadvertently opened (1 action) 4.10.2. Low level in H2 vent seal Q43004
Consequences	4.1.11.2. Downstream: Potential for air to be drawn into system via vent stack resulting in a flammable mixture within the vent system. Potential explosion upon ignition in vent system. Consequence: 4.18.2.1 2.6.1.1. Potential for air ingress from vent system and contamination of vent system 4.3.2.1. Loss of liquid seal. Potential for air ingress in to system leading to a flammable mixture. 4.10.2.1. Loss of liquid seal due to evaporation. Potential for air ingress in to system leading to a flammable mixture.
Recommendation	32 Review the requirement for level transmitter and low level alarm to detect low level in H2 vent liquid seal Q43004.
Actions	
Assigned Respondent (By)	Instrumentation
Issue Date(01-12-2023)	
Action Response	As per P&ID " Hydrogen Vent drum" n° 123A90-DDL-PR-PID-80029 rev.01, a Level Transmitter 43-LT-003 has been added with low level alarm to detect low level in H2 vent liquid seal Q43004.

Approvals / Endorsements		
EPC Discipline Lead / Construction		**Sign**
L. Calabrese	**02/04/2024**	
EPC HSE LEAD		**Sign**
C.Caracciolo	02/04/24	
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client		**Sign**
		Digitaal ondertekend door Paul van Rossum Datum: 2024.05.10

DRAWING NO. DRAWING_NO.

REV. REV



NOTES

1. VENT TO SAFE LOCATION SEGREGATED FROM OTHER VENTS.
2. VENT TO BE EQUIPPED WITH FLAME ARRESTOR AND BIRD SCREEN.
3. LIQUID SEAL DRUM IS PART OF THE VENT SYSTEM.
4. LIQUID DRAINLINES TO BE ROUTED TO ENSURE GRAVITY DRAIN.
5. HYDROGEN VENT KO DRUM BOOT AND LIQUID SEAL DRUM TO BE HEAT TRACING.
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. LIQUID SEAL DRUM I.D. 590 mm, HEIGHT 2350 mm (T/T). TBC BY H2 VENT VENDOR.
11. INLET DIP LEG SUBMERSION HEIGHT OF 0.2 m (TBC BY VENDOR).
12. FLUID HEIGHT OF 1.5 m FROM BOTTOM T.L. (TBC BY VENDOR).
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 40% VOLUME OF GLYCOLE.
15. TOP OF TIP OF H2 VENT SHALL BE AT AS MINIMUM 6.2 m FROM HIGHEST REACHABLE PLATFORM.

01

HOLDS

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

01

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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. 01

File Name : FILE_NAME

CROSSWIND LLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #33 123A90-DDL-SAF-RE-30006
Item No.	#33
Causes	4.2.4. Flow from Elogen HPP RVs
Consequences	4.2.4.1. Potential full production flow via HPP RVs (may be wet or dry). Review consequences based on close out recommendation 35 (potential for high O2 concentration from HPP vent resulting in flammable mixture in H2 vent).
Recommendation	33. Review with Elogen/HPP suppliers the upper limit of O2 concentration that can be relieved/ vented to the vent system from the HPP. Determine if this concentration will result in a flammable mixture within the vent system. If this is the case consider if this vent may require segregation from the main vent system.
Actions	A high value of O2 (with the mixture is within flammable range) is not allowed and expected anywhere in the system, including in Elogen HPP. Hence, no flammable mixture expected and no hazardous consequence for the vent.
Assigned Respondent (By)	Crosswind
Issue Date (01-12-2023)	
Action Response	A high value of O2 (with the mixture is within flammable range) is not allowed and expected anywhere in the system, including in Elogen HPP. Hence, no flammable mixture expected and no hazardous consequence for the vent.

Approvals / Endorsements

Company Discipline Lead		**Sign**
		Hamant Patel Digitally signed by Hamant Patel Date: 2024.10.14 08:42:10 +01'00'
Company HSE LEAD	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.12 11:21:26 +02'00'	**Sign**
Company Project Manager	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.24 10:49:23 +02'00'	**Sign**
Contractor received for information. Not independently verified. Information implemented		**Sign**

CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #34 123A90-DDL-SAF-RE-30006
Item No.	#34
Causes	4.3.1. Reverse flow of H2 to N2 system during ESD 1D
Consequences	4.3.1. Based on loss of N2 triggering ESD 1D (64PI002) the Back pressure within H2 vent system is > N2 feed pressure. Potential reverse flow resulting in H2 being used in place of N2 in Electrolyser systems. Refer to Elogen HAZOP node 10.
Recommendation	34. Review the requirement for BLPH-NRV-020/021 to be class 1 for N2 utility service considering that the life span of the installation is considered to be 2 years with no significant turnaround within that time.
Actions	
Assigned Respondent (By)	Crosswind
Issue Date (01-12-2023)	
Action Response	Based on the close-out of recommendation 7 the NRV for the N2 utility does not need to be class one. An additional SDV (64SDV001) has been installed. See P&ID 123A 90 DDL PR PID 800 27

Approvals / Endorsements

Company Discipline Lead		**Sign**
		Hamant Patel Digitally signed by Hamant Patel Date: 2024.10.14 08:43:11 +01'00'
Company HSE LEAD	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.12 11:15:55 +02'00'	**Sign**
Company Project Manager		**Sign**
		Dominik Sznajder
Contractor received for information. Not independently verified.		**Sign**
Information implemented		

CROSSWIND

ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK

Project Base Load Power Hub (BLPH)

Action Title:	**EPC HAZOP Study Actions**
Action No:	35
Ref Doc	123A90-DDL-SAF-RE-30006
Item No.	35
Causes	4.2.6. BLPH-MV-171 open more than required on N2 system
Consequences	4.2.6.1. Potential for impact on other N2 users resulting in an inability to purge. Loss of safeguard.
Recommendation	35 Ensure sizing of the Needle Valve BLPH-MV-171 prevents excessive N2 use which may impact other users by selecting the CV of the valve and hence maximum flowrate.
Actions	According to PID 123A90-DDL-PR-PID-80028: 1) the manual valve MV-171 has been specified to be locked in place (LIC), see note2 on attachment 1; 2) flow meter 64FG001 has been specified to be readable from manual valve MV-171 (see note 1, on attachment 1). The operator will open the MV-171 such that the nitrogen flow rate readable from the flow meter will be 9.2 Nm3/hr, as per 123A90-DDL-PR-RE-80037 APPENDIX01 (see attachemt 2). This will then prevents excessive N2 use for continuous vent header purging purpose.
Assigned Respondent (By)	Process
Issue Date (01-12-2023)	
Action Response	

Approvals / Endorsements

EPC Discipline Lead		**Sign**
Ciro Impradice	**22/03/2024**	
EPC HSE LEAD		**Sign**
C.Caracciolo	**22/03/2024**	**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client		**Sign**

CROSSWIND OLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #36 123A90-DDL-SAF-RE-30006
Item No.	#36
Causes	4.2.7. 43LIC001 control loop failure opening 43LV001
Consequences	4.2.7.1. Loss of liquid level in KO drum V43001 and gas blow-by to the Brine Discharge Caisson B50014. LOPC of H2 into sea below installation.
Recommendation	36. Perform a dispersion calculation for release of H2 via the B50014 Caisson from a gas blow by from the V43001 KO drum. Consider the maximum pressure the KO drum may reach under all scenarios. If a hazard is created at the installation see action 39.
Actions	
Assigned Respondent (By)	Process
Issue Date (01-12-2023)	
Action Response	Gas Blow by of H2 to B-50014 Caisson is not a credible scenario. Automatic valve has been replace by manual valve MV-409 (LC) that shall be open only after depresurizzation and purging during maintenance activities. See P&Ids 123A90-DDL-PR-PID-80029_03, see attachment 1

Approvals / Endorsements		
EPC Discipline Lead / Construction		**Sign**
C.Impradice		Ciro Impradice
EPC HSE LEAD		**Sign**
C.Caracciolo		CC
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client		**Sign**
		Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.07 10:48:03 +02'00'

DRAWING NO. DRAWING_NO.

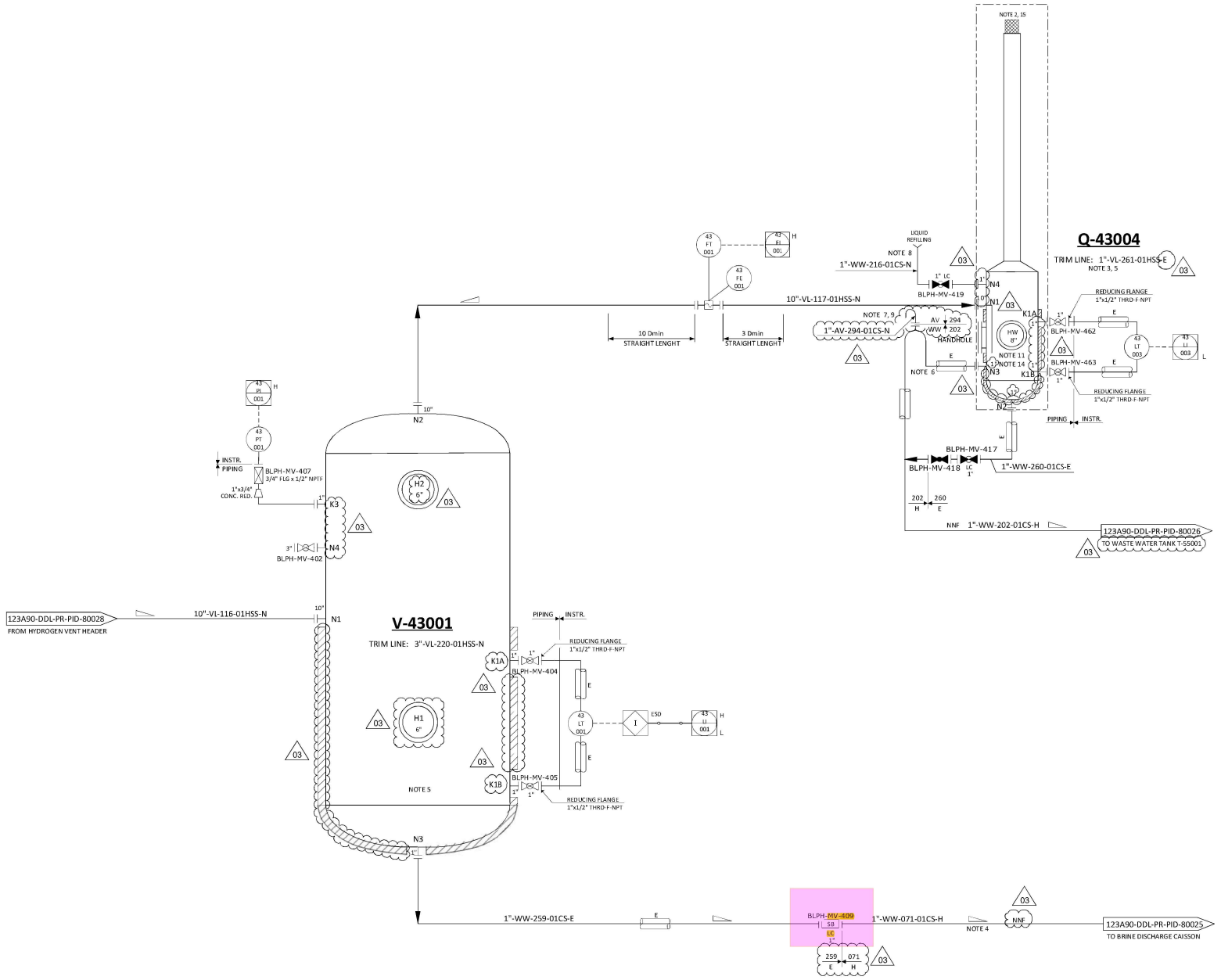
REV. REV

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 (IDi
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 „EG 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.

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
03	09/05/2024	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

File Name : FILE_NAME

CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title:	**EPC HAZOP Study Actions**
Action No:	#37
Ref Doc	123A90-DDL-SAF-RE-30006

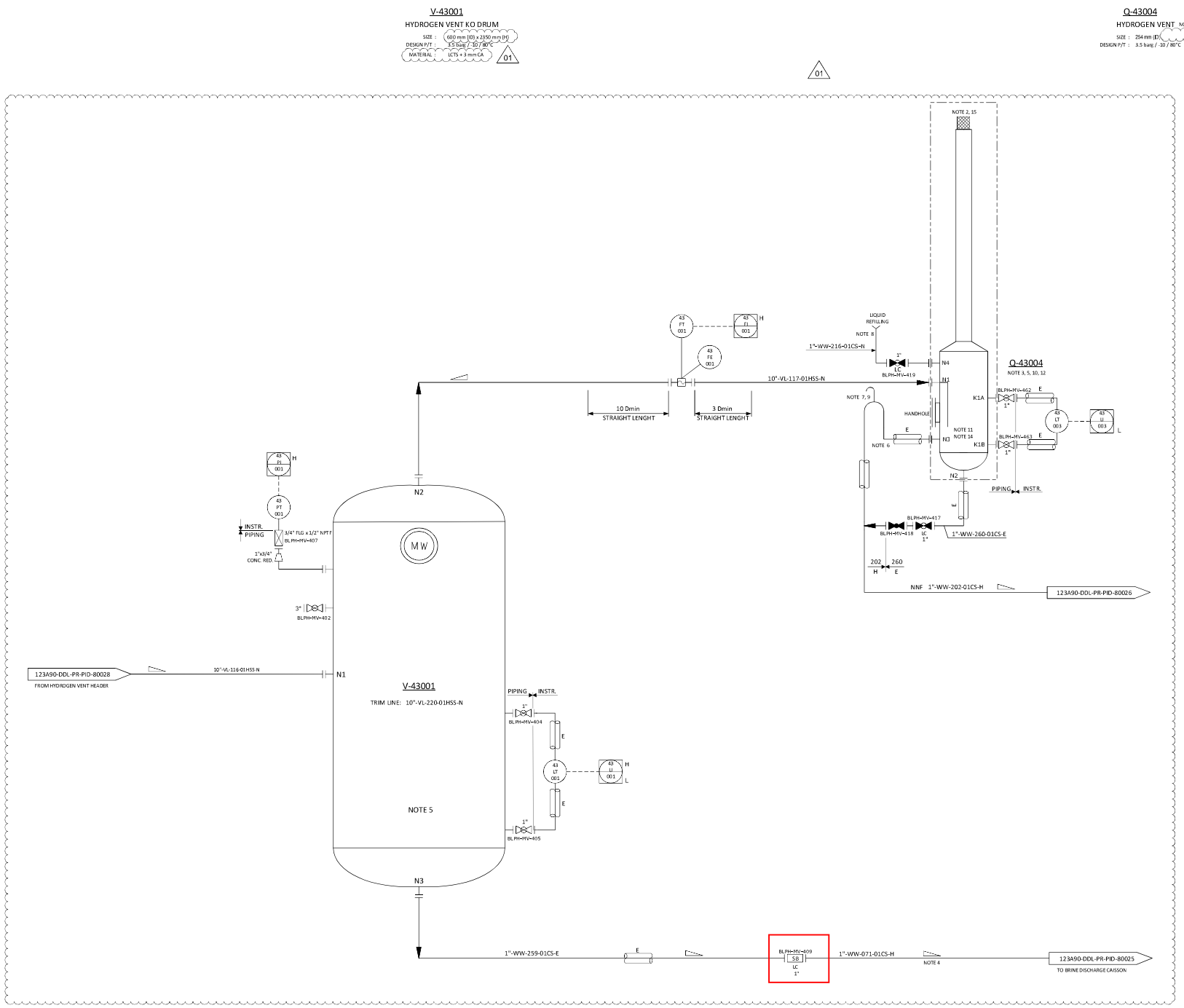
Item No.	#37
Causes	4.2.7. 43LIC001 control loop failure opening 43LV002
Consequences	4.2.7.1. Loss of liquid level in KO drum V43001 and gas blow-by to the Brine Discharge Caisson B50014. LOPC of H2 into sea below installation.
Recommendation	37. Review the requirement for an additional SDV in the KO drum water drain line activated by 43LI002 low low level to prevent gas blow-by to the Caisson. To be evaluated with LOPA if required. Note that the liquid level in KO drum V43001 may be lost due to evaporation over time and if a trip is fitted this may result in a spurious trip of 43LI002 low low level alarm. Review against recommendation 40.
Actions	Review against recommendation 40.
Assigned Respondent (By)	Instrumentation
Issue Date(01-12-2023)	
Action Response	As per recommendation 38 (ex 40) and per P&iDs 123A90-DDL-PR-PID-80029_01, control valve on the liquid drain line of the H2 Vent KOD has been deleted, consequently the 43LIC001 controller has been removed. Shutdown valve has not been added due to the manual on-off valve (BLPH-MV-409) locked closed in normal operating condition.

Approvals / Endorsements

EPC Discipline Lead / Construction		**Sign**
L. Calabrese	**29/03/2024**	
EPC HSE LEAD		**Sign**
C.Caracciolo	**03/09/24**	
EPC Project Manager		**Sign**
D.Lo.Sterzo	04/09/2024	
Client		**Sign**
		Digitaal ondertekend door Paul van Rossum Datum: 2024.09.04 10:12:01 +02'00'

DRAWING NO. DRAWING_NO.

REV. REV



NOTES

1. VENT TO SAFE LOCATION SEGREGATED FROM OTHER VENTS.
2. VENT TO BE EQUIPPED WITH FLAME ARRESTOR AND BIRD SCREEN.
3. LIQUID SEAL DRUM IS PART OF THE VENT SYSTEM.
4. LIQUID DRAINLINES TO BE ROUTED TO ENSURE GRAVITY DRAIN.
5. HYDROGEN VENT KO DRUM BOOT AND LIQUID SEAL DRUM TO BE HEAT TRACING.
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. LIQUID SEAL DRUM I.D. 590 mm, HEIGHT 2350 mm (T/T). TBC BY H2 VENT VENDOR.
11. INLET DIP LEG SUBMERSION HEIGHT OF 0.2 m (TBC BY VENDOR).
12. FLUID HEIGHT OF 1.5 m FROM BOTTOM T.L. (TBC BY VENDOR).
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 40% VOLUME OF GLYCOLE.
15. TOP OF TIP OF H2 VENT SHALL BE AT AS MINIMUM 6.2 m FROM HIGHEST REACHABLE PLATFORM.

01

HOLDS

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

01

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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. 01

File Name : FILE_NAME

CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

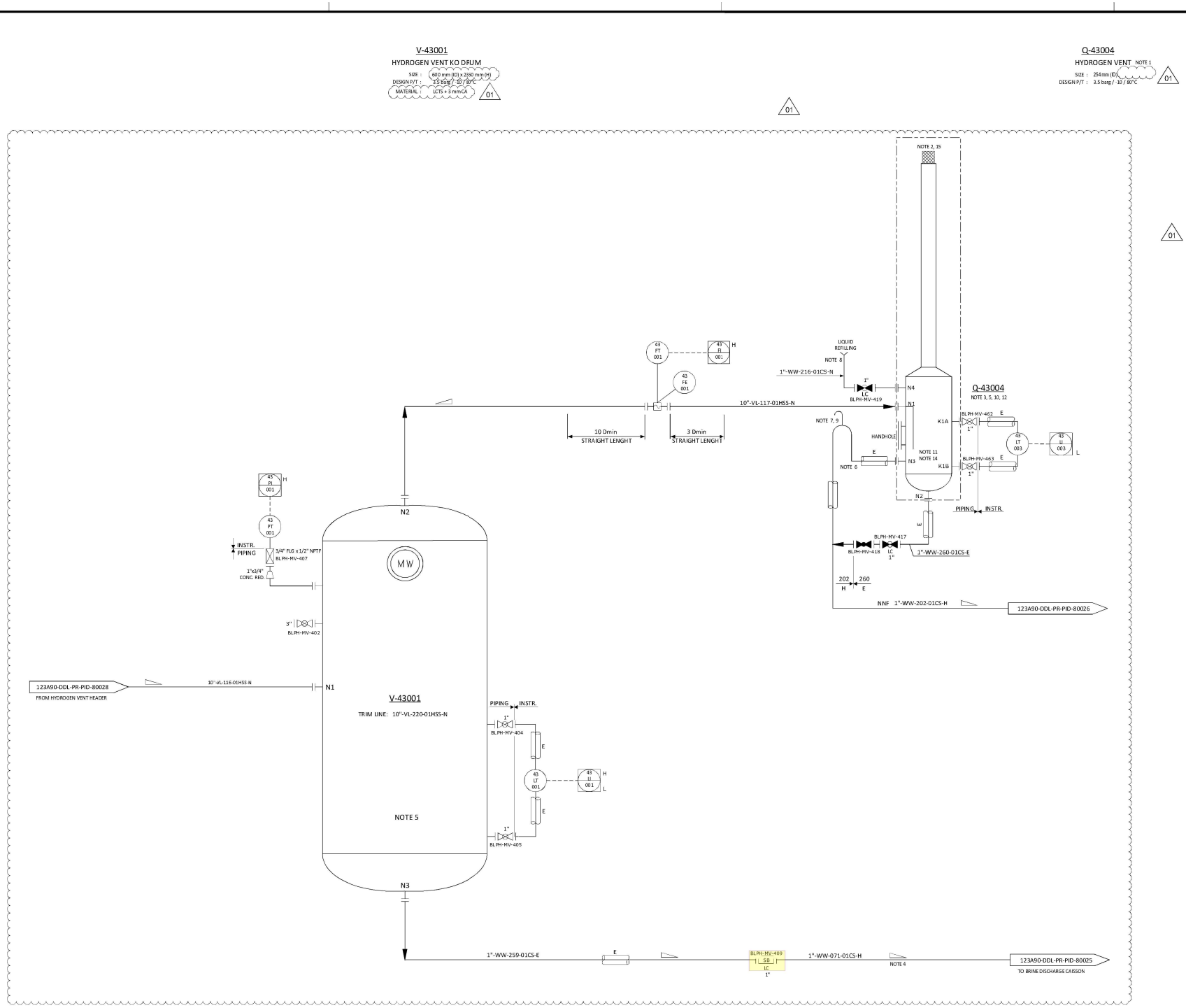
ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** 38 123A90-DDL-SAF-RE-30006
Item No.	38
Causes	4.10.1. Low level in Liquid boot of V43001
Consequences	4.10.1.1. Low liquid level in KO drum V43001 is expected to be normal, potentially dropping below low low level alarm point overtime due to evaporation within KO drum.
Recommendation	38 Review how the liquid drain line from the KO drum V43001 can be safely routed for disposal considering that it may be subject to gas blow-by due to loss of liquid seal by evaporation. Review against recommendation 39.
Actions	
Assigned Respondent (By)	Process
Issue Date (01-12-2023)	
Action Response	As per P&iDs 123A90-DDL-PR-PID-80029_01, control valve on the liquid drain line of the H2 Vent KOD has been deleted. The manual valve installed on the drain line (valve BLPH-MV-409) has been specified to be "LC" (locked closed). See attached P&iD.

Approvals / Endorsements		
EPC Discipline Lead / Construction		**Sign**
C.Impradice (EPC Process LEAD)	13/03/2024	Ciro Impradice
EPC HSE LEAD		**Sign**
C.Caracciolo	13/03/2024	**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client	Digitaal ondertekend door Paul van Rossum Datum: 2024.03.19 15:13:52 +01'00'	**Sign**

DRAWING NO. DRAWING_NO.

REV. REV



NOTES

1. VENT TO SAFE LOCATION SEGREGATED FROM OTHER VENTS.
2. VENT TO BE EQUIPPED WITH FLAME ARRESTOR AND BIRD SCREEN.
3. LIQUID SEAL DRUM IS PART OF THE VENT SYSTEM.
4. LIQUID DRAINLINES TO BE ROUTED TO ENSURE GRAVITY DRAIN.
5. HYDROGEN VENT KO DRUM BOOT AND LIQUID SEAL DRUM TO BE HEAT TRAC NG.
6. SEAL .EG 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. LIQUID SEAL DRUM I.D. 590 mm, HEIGHT 2350 mm (T/T). TBC BY H2 VENT VENDOR.
11. INLET DIP LEG SUBMERSION HEIGHT OF 0.2 m (TBC BY VENDOR).
12. FLUID HEIGHT OF 1.5 m FROM BOTTOM T.L. (TBC BY VENDOR). 01
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 40% VOLUME OF GLYCOLE.
15. TOP OF TIP OF H2 VENT SHALL BE AT AS MINIMUM 6.2 m FROM HIGHEST REACHABLE PLATFORM.

01

HOLDS

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

01

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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. 01

File Name : FILE_NAME

CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

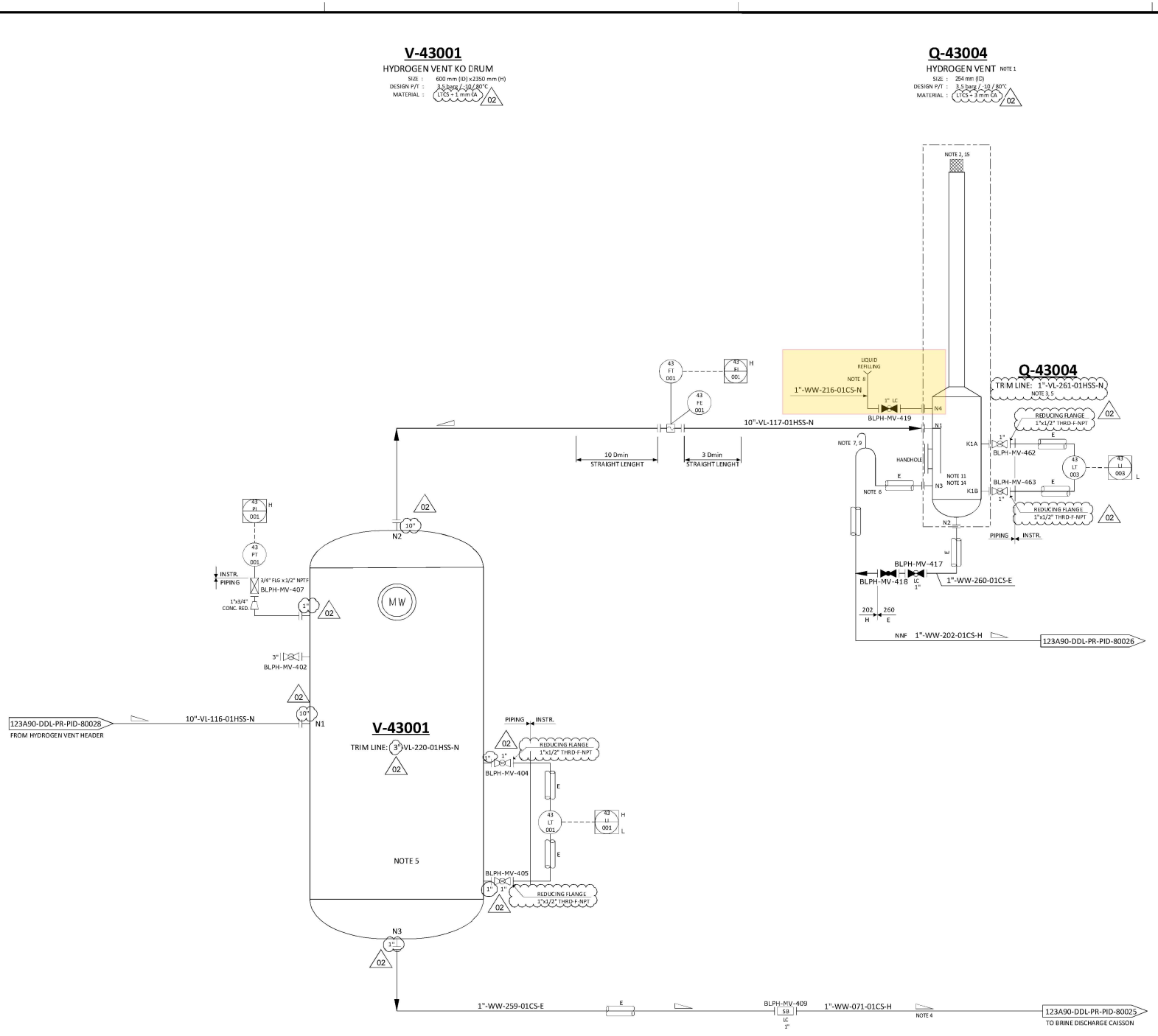
ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #39 123A90-DDL-SAF-RE-30006
Item No.	#39
Causes	4.10.2. Low level in H2 vent seal Q43004
Consequences	4.10.2.1. Loss of liquid seal due to evaporation. Potential for air ingress in to system leading to a flammable mixture.
Recommendation	39. Ensure that consideration of top up of the glycol seal in vent Q43004 is made in the design, and that there will be a 6 month period between maintenance interventions which will allow top up.
Actions	
Assigned Respondent (By)	Process
Issue Date (01-12-2023)	
Action Response	As per P&iD doc. n. "123A90-DDL-PR-PID-80029"(attachment 1), a filling line has been provided to allow top up of the glycol seal in vent Q43004. During maintenance intervention, the filling line will allow top up of the glycol in the liquid seal drum of the H2 Vent Q43004.

Approvals / Endorsements		
EPC Discipline Lead / Construction		**Sign**
Ciro Impradice		Impradice Ciro
EPC HSE LEAD		**Sign**
C.Caracciolo		**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.01 14:08:24 +02'00'	**Sign**

DRAWING NO. DRAWING_NO.

REV. REV



NOTES

1. VENT TO SAFE LOCATION SEGREGATED FROM OTHER VENTS.
2. VENT TO BE EQUIPPED WITH BIRD SCREEN. 02
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 .EG WILL BE DETERMINATED ON THE MAXIMUM BACK PRESSURE IN THE VENT. 02
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. 02
11. INLET DIP LEG SUBMERSION HEIGHT OF 0.6 m. 02
12. DELETED. 02
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 40% VOLUME OF GLYCOL.
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.

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
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. 02

File Name : FILE_NAME

CROSSWIND

ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #40 123A90-DDL-SAF-RE-30006
Item No.	#40
Causes	4.11.1. Rain ingress into H2 vent stack
Consequences	4.11.1.1. Potential for high level in liquid seal Q43004 and overflow to drain resulting in dilution of glycol concentration and potential for freezing of liquid seal and blockage of relief route. Consequence: 4.18.1.1
Recommendation	40. Ensure the design of the vent Q43004 exit minimises the potential for rain ingress which may dilute the seal liquid potentially resulting in blocked outlet for the H2 vent system due to freezing.
Actions	
Assigned Respondent (By)	Process
Issue Date (01-12-2023)	
Action Response	As per note 4 of ″TDS – Hydrogen Vent Package – Q–43004″, doc. n. ″123A90–DDL–MAC–DS–50044″a note has been specified to ensure the design of the vent Q43004 exit minimises the potential for rain ingress which may dilute the seal liquid potentially resulting in blocked outlet for the H2 vent system due to freezing. For reference see ″attachment 1″. Moreover, as per P&iD doc. n. ″123A90–DDL–PR–PID–80029″ the liquid seal drum is heat treaced, as per note 5 (see attachment 2)

Approvals / Endorsements		
EPC Discipline Lead / Construction		**Sign**
Ciro Impradice		Impradice Ciro
EPC HSE LEAD		**Sign**
C.Caracciolo		**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.01 14:09:22 +02'00'	**Sign**

Base Load Power Hub (BLPH)

TDS - Hydrogen Vent Package - Q-43004

Document Number: 123A90-DDL-MAC-DS-50044

Document Class: 2

00	09/02/2024	Issue for Review (IFR)	GC	FM	DL
Rev.	Date	Description	Prepared	Reviewed	Approved

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Rev

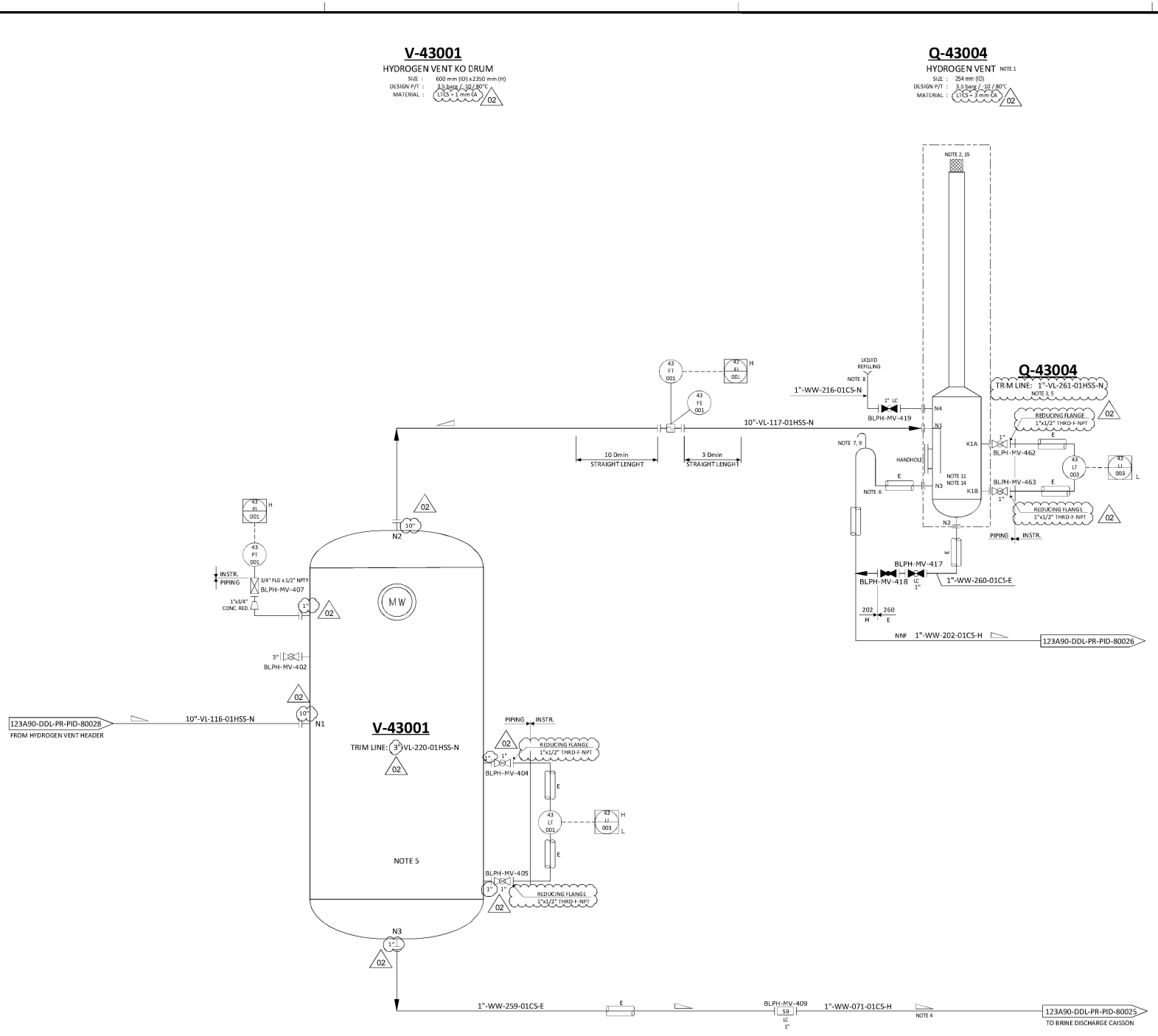
Process Minimum Requirements and notes

1. Vendor is responsible to verify / define the material selection of whole package (main equipment, ancillaries and piping) considering the fluids characteristics and the operating conditions.
2. Process Design codes:
   API STD 521
3. Liquid drain lines inside the package to be routed to ensure gravity drain
   Seal leg and drum dimensions will be determinated on the maximum vapour-released scenario
   as well as to provide a sufficient seal such that any vacuum generated within the vent system upstream
   will not break the seal
4. Ensure the design of the vent Q43004 exit minimises the potential for rain ingress which may dilute the seal liquid resulting in blocked outlet for the H2 vent system due to freezing.

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DRAWING NO. DRAWING_NO.

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NOTES

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2. VENT TO BE EQUIPPED WITH BIRD SCREEN. 02
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HOLDS

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2. DELETED.
3. DELETED.

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

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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. 02

File Name : FILE_NAME

CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #41 123A90-DDL-SAF-RE-30006
Item No.	#41
Causes	4.3.3. BLPH-MV-419 left open after liquid seal top up
Consequences	4.3.3.1. LOPC of vent gases (likely to be H2) to deck area of installation. LOPC of H2 and potential explosion within stack.
Recommendation	41. Ensure that the seal liquid top up procedure is considered as a safety critical procedure as failure to close BLPH-MV-419 top up valve will allow LOPC of H2 on to deck area with potential for an explosion within the vent stack.
Actions	
Assigned Respondent (By)	Crosswind
Issue Date(01-12-2023)	
Action Response	Seal Liquid top up procedure will be considered as a safety critical procedure in the Safety Critical Task Analyses Report (123A90-DDL-SAF-RE-30040)

Approvals / Endorsements

Company Discipline Lead		**Sign**
		Hamant Patel
Compnay HSE LEAD	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.01 17:15:34 +02'00'	**Sign**
Company Project Manager	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.02 08:27:12 +02'00'	**Sign**
Contractor received for information.	**Not independently verified. Information implemented**	**Sign**

CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** 42 123A90-DDL-SAF-RE-30006
Item No.	42
Causes	4.18.3. Loss of Instrument Air
Consequences	4.18.3.1. 43LV001 moves to air fail position.
Recommendation	42 Make air fail position of 43LV001 fail closed and type 6 (critical).
Actions	
Assigned Respondent (By)	Process
Issue Date (01-12-2023)	
Action Response	As per HAZOP worksheet, see note on point 4.1.14.1, which states: QUOTE 90 Electrolyser starts/yr, 0.5 hr/start–up, 3.2kg/hr of water(worst credible scenario based on condensation of all water in stream), Platform visited for maintenance 2 times/yr where issue can be identified and rectified. 0.076 m3 of water within 2m3 KO drum overfill of vessel not considered credible. UNQUOTE the amount of water accumulated within the H2 Vent KOD V–43001 is very small and it can be stored over a period of 6 months. Therefore, 43LV001 has been deleted. In case water is accumulated within the vessel, then it will be drained off during maintenance, by opening a manual valve (“LC”) installed on the liquid outlet line of the H2 Vent KOD.

Approvals / Endorsements		
EPC Discipline Lead / Construction		**Sign**
C.Impradice (EPC Process LEAD)	13/03/2024	Ciro Impradice **Sign**
EPC HSE LEAD		**Sign**
C.Caracciolo	13/03/2024	**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client	Digitaal ondertekend door Paul van Rossum Datum: 2024.03.19 15:13:11 +01'00'	**Sign**

CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #43 123A90-DDL-SAF-RE-30006
Item No.	#43
Causes	5.1.2. P50001A pump tripped
Consequences	5.1.2.1. No flow into coarse filter package A50003 resulting in failure of backwash cycle, operational issue requiring additional backwash cycles. No hazardous consequences. Review consequences of loss of main flow in A50003 package HAZOP
Recommendation	43. Update the control narrative to identify alternate seawater lift pump auto-start on 50PI001/002 low pressure alarm or 50XA001/003 trip/fault alarm.
Actions	
Assigned Respondent (By)	Instrumentation
Issue Date(01-12-2023)	
Action Response	Control narrative has been updated to guarantee low pressure alarm (50-PAL-001/002) will auto-start designated stand by pump. See 123A90-DDL-IN-RE-40095 attached.

Approvals / Endorsements

EPC Discipline Lead	Ciro Impradice Autore firma digitale: Ciro Impradice Nome distintivo: CN = Ciro Impradice email = ciro.impradice@rosetti.it C = IT O = Data: 2024.12.17 16:23:16 +01'00'	**Sign**
C.Impradice		
EPC HSE LEAD		**Sign**
C.Caracciolo		CC
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.12.20 08:13:19 +01'00'	**Sign**

4 PROCESS CONTROL AND SHUTDOWN PHILOSOPHY

4.1 SEA WATER LIFT PUMPS P-50001A/B

4.1.1 General

Seawater is the raw water to be treated and then electrochemically converted into hydrogen (for energy accumulation purposes) and oxygen (to be continuously vented when the plant runs); seawater is lifted by means of 2 x 100% submersible centrifugal pumps P–50001A/B (one running and the other in stand-by mode), and then fed through the water treatment plant to remove the biological and inorganic "pollutants" that shall be eliminated prior to be served to the electrolyser package.

4.1.2 Lift Pumps Control Philosophy

Reference P&ID: Doc. N.123A90-DDL-PR-PID-80021.

The sea water lift pumps P–50001A/B are electric type pumps.

The pumps are provided with pressure relief valves (50-PSV-006 for P-50001A and 50-PSV-007 for P-50001B) to protect from overpressure due to a blocked discharge.

To protect the water treatment package from overpressure due to a blocked discharge the 50-PSV-011 is installed.

The discharge of the pumps can be monitored remotely with pressure transmitters 50-PT-001 for P-50001A and 50-PT-002 for P-50001B (the onshore indications are 50-PI-001 for P-50001A and 50-PI-002 for P-50001B).

Pump discharges are also equipped with high and low alarms available onshore control room (50-PAH/PAL-001 for P-50001A and 50-PAH/PAL-002 for P-50001B) to alert the operator.

All signals for motor control (start/stop) and monitoring are exchanged between SG-200N1 (LV switchgear) and PCS via modbus TCP/IP. The pumps shutdown commands are from SIS with hardwired communication.

A **software interlock** is provided to prevent simultaneous running of both pumps A and B (only one (1) pump is run at a time).

The main sea water Lift Pump is automatically started/stopped by PCS following electrical control logic requirements (see chapter 3). In addition, PCS requires automatic opening/closing of the (on/off) discharging isolation valves (50-XV-001 for P-50001A and 50-XV-003 for P-50001B).

Another **software interlock** is provided to prevent pump from starting in case the relevant XV valve is closed:

1) If the valve 50-XV-001 is closed (50-ZSL-001 closed valve status active), the software interlock prevents pump "A" to start;
2) If the valve 50-XV-003 is closed (50-ZSL-003 closed valve status active), the software interlock prevents pump "B" to start.

Auto start of designed stand-by pump will be activated on:

- loss of running status of duty pump
- low pressure alarm (50-PAL-001/002) of duty pump

In case of:

1. Pressure transmitter on duty discharge line in High Pressure Alarm (50-PAH-001 or 50-PAH-002), duty pump will be stopped.
2. Pressure transmitter on duty discharge line in Low Pressure Alarm (50-PAL-001 or 50-PAL-002) when the main pump is already started, duty pump will be stopped and stand-by pump started.
3. Running Status (50-XL-001A or 50-XL-001B) of duty pump missing during pump operation, duty pump will be stopped and stand-by pump started.
4. If after the selected pump is started, the relevant PT doesn't reach the min set value, within 2 minuts (Adjustable time), the stand-by pump shall be started.
5. The main seawater pump will be stopped when sand filter S-50001 is in backwash sequence (see section 4.2.2). The signal 50-HS-005S will be serial type from Water Treatment package 50-LP-001 panel to PCS.

The signals of Table 4 will inform about each pump status/commands:

SIGNAL	P-50001A	P-50001B
RUNNING (at 1) STATUS	50-XL-001A	50-XL-001B
LOCAL (at 1)/REMOTE (at 0) STATUS	50-XL-002A	50-XL-002B
AUTO START READY STATUS (at 1)	50-XL-003A	50-XL-003B
FAULT/TRIPPED STATUS (at 1)	50-XA-004A	50-XA-004B
START COMMAND (at 1)	50-HS-001A	50-HS-001B
STOP COMMAND (at 1)	50-HS-005A	50-HS-005B
SHUTDOWN COMMAND	83-XS-001A	83-XS-001B
AUTO/MANUAL MODE	50-HS-002A	50-HS-002B
STAND-BY MODE	50-HS-003	

Table 4 – Lift Pumps Signals

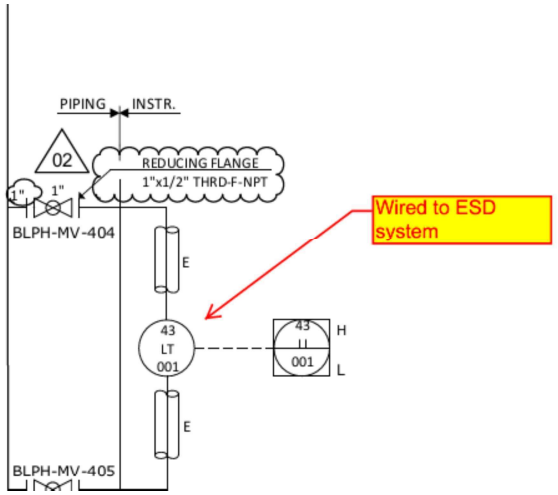
In front of SG-200N1 (LV switchgear) the following selectors/push buttons are provided for each pump:

- Local/Remote selector SA1 (called SA1-A in this document) for pump P–50001A
- Local Start push button PM-1 (called PM1-A in this document) for pump P–50001A

CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** 45 123A90-DDL-SAF-RE-30006
Item No.	45
Causes	4.1.14. BLPH-MV-409 SB Left in closed position on V-43001 drain 4.1.15. 43LIC001 control loop failure closing 43LV001
Consequences	4.1.14.1. Upstream: Unable to drain liquid from KO Drum V-43001 leading to potential high level in KO Drum and liquid into H2 relief header resulting in high back pressure to relieving streams. Rupture of relief streams, LOPC of H2 and explosion on ignition. 90 Electrolyser starts/yr, 0.5 hr/start-up, 3.2kg/hr of water(worst credible scenario based on condensation of all water in stream), Platform visited for maintenance 2 times/yr where issue can be identified and rectified. 0.076 m3 of water within 2m3 KO drum overfill of vessel not considered credible. Consequence 4.1.15.1
Recommendation	45 Review the requirement for 43LI002 High High activating ESD 1 as no scenarios were identified within the HAZOP which would activate the trip. Verify before removal that there is no requirement from project applicable standards and good practice (DEP) for this trip.
Actions	For good practice of this project (DEP) the following has been performed: • Level transmitter 43-LT-001 will be kept and wired to ESD system instead of PCS system; • In case of HH trip, logic will trip Electrolyser package, water treatment package and sea water pumps; • P&IDs, wiring diagram and logic will be revised accordingly **V-43001** TRIM LINE: 3" VL-220-01HSS-N 02 NOTE 5 

Assigned Respondent (By)	Process	
Issue Date		
Action Response		
Approvals / Endorsements		
EPC Process Lead		**Sign**
C.Impradice	**04/09/24**	
EPC HSE LEAD		**Sign**
C.Caracciolo	**04/09/24**	
EPC Project Manager		**Sign**
D.Lo.Sterzo	**04/09/24**	
Client		**Sign**

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Datum: 2024.09.04 16:36:08 +02'00'

CROSSWIND

ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #46 123A90-DDL-SAF-RE-30006
Item No.	#46
Causes	1.2.4. 25XV006 Driven open/inadvertently opened by operator 3.16.1. Start up of Fuel Cell 135 times/year
Consequences	1.2.4.1. Pressurise downstream system to 25PV025A/B up to 30barg. Potential to exceed design pressure (3 times design pressure) downstream of 25PV025A/B, LOPC of H2 and explosion on ignition. 25PV025A/B are downstream pressure controlled and are potentially opened when fuel cell is not online. 3.16.1.1. Potential for overpressurisation of line and Fuel Cell downstream of 25PCV025A/B due to reaction speed of 25PIC025A/B. Insufficient time for control system to react to prevent downstream overpressure. Assumption is that as fuel cell runs down 25PIC025A/B opens 25PV025A/B such that when restart occurs 25PV025A/B are fully open.
Recommendation	46. As fuel cell runs down 25PIC025A/B opens 25PV025A/B. Ensure that when restart occurs 25PV025A/B are fully closed and review how the downstream pressure can be slowly increased to the point where 25PIC025A/B can be given automatic control.
Actions	
Assigned Respondent (By)	Instrumentation
Issue Date(01-12-2023)	
Action Response	As per doc. "Process Control, Operation, Start-up and Shutdown philosophy"° 123A90-DDL-PR-RE-80031 rev.01 par. 3.4.1.4, when the Fuel Cell is stopped, the control logic will force the operating control valve 25-PV-055A (or B) to fully close. As the Fuel Cell starts, the 25-PIC-055A/B controller will command the opening of the control valve 25-PV-055A (or B).

Approvals / Endorsements

EPC Discipline Lead		**Sign**
L.Calabrese	**14/05/2024**	
EPC HSE LEAD		**Sign**
C.Caracciolo	**10/05/2024**	**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client		**Sign**

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Datum: 2024.06.21 15:41:40 +02'00'

Base Load Power Hub (BLPH)

Process Control, Operation, Start-up and Shutdown philosophy

Document Number: 123A90-DDL-PR-RE-80031

Document Class: 1

01	23/04/2024	Issue for Approval (IFA)	CIM	RZI	DLO
00	13/12/2023	Issue for Approval (IFA)	CIM	RZI	DLO
Rev.	Date	Description	Prepared	Reviewed	Approved

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- 80-PSV-001 to protect the downstream FC package from any failure of the upstream 25-PV-055A/B (or in case of blocked discharge)
- 80-XV-001 to allow for nitrogen purging prior to maintenance campaign

The Fuel Cell pressure control valve(s) control(s) the hydrogen supply to the Fuel Cell by means of the control loop identified with:

1) pressure controllers: 25-PIC-055A/B;
2) pressure transmitters: 25-PT-055A/B (Process Variable, PV);
3) final elements: 25-PV-055A/B;
4) SP value: 3.5 barg;
5) Sub-Controller(s) action: REVERSE (pressure increase, valve close);
6) Failure direction: FC

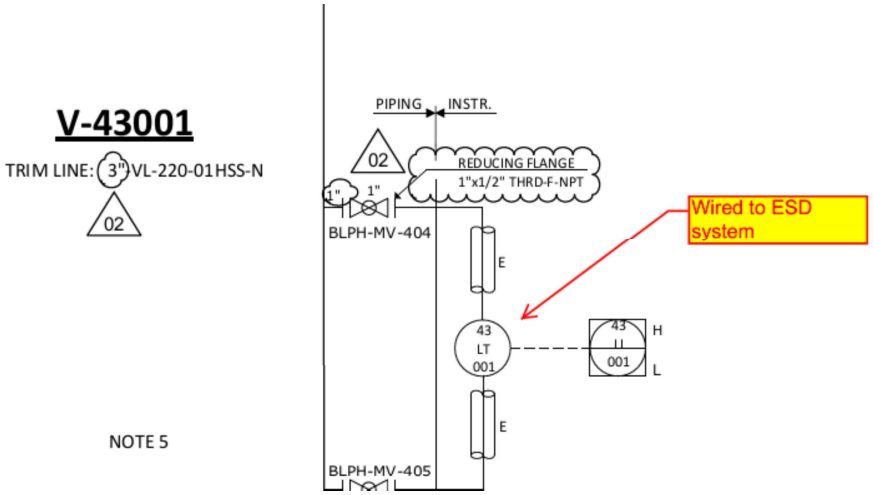
Should be the operating pressure (PV) fall under the PID regulator SP, the controller drives the relevant control valve to increase its opening (Cv); vice versa, should the operating pressure (PV) rise above the PID regulator SP, the controller drives the relevant control valve to decrease its opening (Cv).

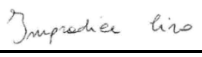
During Fuel Cell operation, only one valve (25-PV-055 A or B) will be used, while the other one will be fully closed. The operator has the possibility to choose which control loop (and then which control valve) to use by means of the hand selector 25-HS-055. The hand selector includes software interlock to prevent both valves to be online simultaneously. Therefore, the software interlock prevents valve 25-PV-055B to open if control valve 25-PV-055A is not closed. Moreover, software interlock prevents opening of the control valves 25-PV-055A/B in case Fuel Cell package (A-80000) is not running.

As Fuel Cell stops, the control logic will force the operating control valve 25-PV-055A (or B) to fully close. As the Fuel Cell starts, the 25-PIC-055A/B controller will command the opening of the control valve 25-PV-055A (or B) such that the downstream pressure will slowly increase to the point where 25-PIC-055A (or B) can be given automatic control, by fixing a control valve opening lower than the required operating point for a period that allows the fuel cells to run at full load.

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Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #47 123A90-DDL-SAF-RE-30006
Item No.	#47
Causes	4.1.14. BLPH-MV-409 SB Left in closed position on V-43001 drain 4.1.15. 43LIC001 control loop failure closing 43LV001
Consequences	4.1.14.1. Upstream: Unable to drain liquid from KO Drum V-43001 leading to potential high level in KO Drum and liquid into H2 relief header resulting in high back pressure to relieving streams. Rupture of relief streams, LOPC of H2 and explosion on ignition. 90 Electrolyser starts/yr, 0.5 hr/start-up, 3.2kg/hr of water(worst credible scenario based on condensation of all water in stream), Platform visited for maintenance 2 times/yr where issue can be identified and rectified. 0.076 m3 of water within 2m3 KO drum overfill of vessel not considered credible. Consequence 4.1.15.1
Recommendation	47. Review the requirement for 43LI002 High High activating ESD 1 as no scenarios were identified within the HAZOP which would activate the trip. Verify before removal that there is no requirement from project applicable standards and good practice (DEP) for this trip.
Actions	For good practice of this project (DEP) the following has been performed: • Level transmitter 43-LT-001 will be kept and wired to ESD system instead of PCS system; • In case of HH trip, logic will trip Electrolyser package, water treatment package and sea water pumps; • P&IDs, wiring diagram and logic will be revised accordingly 

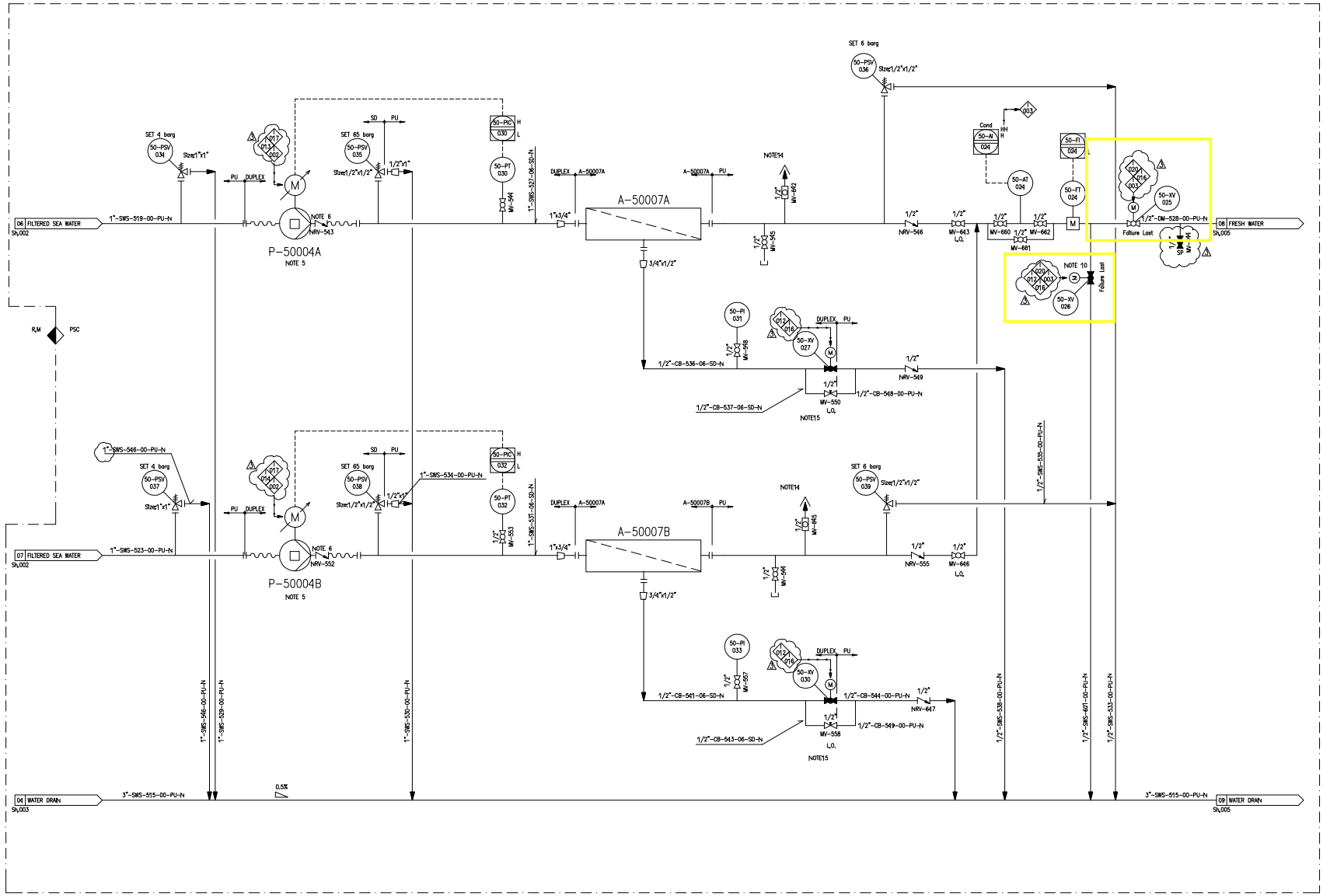
Assigned Respondent (By)	Process	
Issue Date		
Action Response		
Approvals / Endorsements		
EPC Process Lead		**Sign**
C.Impradice	**04/09/24**	
EPC HSE LEAD		**Sign**
C.Caracciolo	**04/09/24**	
EPC Project Manager		**Sign**
D.Lo.Sterzo	**04/09/24**	
Client		**Sign**
		

CROSSWIND HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #48 123A90-DDL-SAF-RE-30006
Item No.	**#48**
Causes	5.1.27. 50-XV026 fails to open when required. Failure of conductivity control 50-AI024
Consequences	5.1.27.1. Potential off spec water fed to Elogen water treatment. Potential fouling of Elogen RO cells and loss of purified water to electrolysis unit. Operational issue.
Recommendation	48. Review the effect of out of spec water fed to Elogen RO cells based on a temperature at the PSC RO cells of 40 degC with the chloride concentration based on this temperature. Identify in the Elogen HAZOP if it is credible that chloride is fed through to the electrolysis cells or if this is only an operational impact on RO cell performance (current assumption). If there is adverse impact on the cells, review if LOPA is required for this failure in the Rosetti
Actions	
Assigned Respondent (By)	Rosetti Process / Crosswind / PSC / Elogen
Issue Date (01-12-2023)	
Action Response	PSC reply: Out of spec water to Elogen water treatment package is prevented by temperature transmitters 50-TT-022 (H value set to 25° C. At this set temperature activates Interlock I-020 will be activated closing XV-025 and opening XV-026, which is the sea water maximum temperature at RO inlet). Chloride concentration at the PSC RO cells at 25° C is expected 200 ppm. Crosswind reply: The RO experience membrane degradation, resulting in reduced performance and eventually to irreversible damage. No LOC. In the WTP of Elogen there is a conductivity analyser, downstream of the RO and internal filters. If this conductivity analyser measures a very high conductivity, because of the high chloride concentration, CAHH-300 alarm is triggered. CAHH-300 initiates IP16 (Problem on pure water feed to anodic loop), which stops the pumps downstream of the WTP, consequently stopping the water feed to the stacks (IP16: STOP IMMEDIATELY BY SETTING VAR300A/B TO 0% THE RUNNING LP-300 (A or B following status)

Approvals / Endorsements		
EPC Discipline Lead / Construction		**Sign**
F.Mura		
EPC HSE LEAD		**Sign**
C.Caracciolo		**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.12.13 08:00:54 +01'00'	**Sign**



P-50004A/B	
HP PUMP	
TYPE	AXIAL ROTATING PISTONS
DES PRESSURE	83 barg
CAPACITY	2 m3/h
HEAD	64,5 bar(a)
DES. TEMP.	50° C
MATERIAL	SS DUPLEX

A-50007A/B	
SEA WATER REVERSE OSMOSIS UNITS	
CAPACITY	0.8 m3/h
DES. PRESS.	69 barg
DES. TEMP.	45° C
MATERIAL	FRP

TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	PVC	SEA WATER FROM INTAKE PUMPS
TP-002	1"	FLG.	150#	RF	PVC	PRODUCT WATER
TP-003	3"	FLG.	150#	RF	PVC	SEA WATER DRAIN
TP-005	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTAKE
TP-006	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-007	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN
TP-008	1/2"	FLG.	150#	RF	PVC	CONTAINER OPEN DRAIN

NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: ELPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOUS BIOCIDE DOSAGE TO INTAKE PUMP: DISCONTINUOUS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOUS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE
14	AUTOMATIC AIR VENT VALVE
15	POSITION TO BE DEFINED DURING COMMISSIONING
16	POLYAMIDE TUBING (RILSAN TYPE)
17	CHECK VALVE (NO SPRING TYPE)
18	DRAIN PAN FOR ANALYZER, DRAIN PAN VOLUME= 5 L

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
03	30-SEP-24	UR	WR	RM	ACCEPTED FOR CONSTRUCTION
02	22-AUG-24	UR	WR	RM	ISSUED FOR REVIEW
01	29-MAY-24	GG	WR	RM	ISSUED FOR REVIEW
00	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

ROSETTI MARINO

TITLE :
WATER TREATMENT PACKAGE
SEA WATER REVERSE OSMOSIS
P&I DIAGRAM

CONTRACT NO./TITLE			SCALE –
DRAWN UR	CHECKED WR	APPROVED RM	DATE 30/09/24
A1	DRAWING NO. 1724000448-PR-PID-00013		SHEET 004 / REV. 03

DRAWING NO. 1724000448-PR-PID-00013 REV. 03

File Name : 1724000448-PR-PID-00013 Rev03

Water Treatment Package A-50000
Cause & effect Matrix

FZ-01= FUEL CELL AREA
FZ-02= H2 STORAGE VESSELS AREA
FZ-03= ELECTROLYZER AREA
FZ-04= B-200/B-300/B-400 CONTAINERS AREA
FZ-05= BESS AREA
FZ-06= B-100 CONTAINER AREA
FZ-07= MASTER POINT AREA
FZ-08= TRANSITION PIECE AREA

EFFECT — SYS: OTHER

Col.	DESCRIPTION	TAG No.	NOTES
33	OPEN DRAIN VALVE 50-XV-033	50-XV-033	
34	OPEN DRAIN VALVE 50-XV-034	50-XV-034	
35	OPEN DRAIN VALVE 50-XV-027	50-XV-027	
36	OPEN DRAIN VALVE 50-XV-030	50-XV-030	
37	OPEN DRAIN VALVE 50-XV-035	50-XV-035	
38	CLOSE BATTERY LIMIT VALVE 50-XV-020	50-XV-020	
39	TRIP COARSE FILTER A-50003	A-50003	
40	TRIP SAND FILTER S-50001	S-50001	
41	TRIP SOFTENING FILTER S-50004	S-50004	
42	CONTAINER ELECTRICAL HEATER TRIP	HHS-50003A	
43	CONTAINER ELECTRICAL HEATER TRIP	HHS-50003B	
44	CONTAINER AIR FAN TRIP	HFA-50001A	
45	CONTAINER AIR FAN TRIP	HFA-50001B	
46	CONTAINER AIR FAN TRIP	HFA-50001C	
47	TRIP UV LAMP S-50010	S-50010	
48	TRIP HEATER H-50001	H-50001	
49	STOP PUMP P-50002A	P-50002A	
50	STOP PUMP P-50002B	P-50002B	
51	STOP PUMP P-50003A	P-50003A	Note 1
52	STOP PUMP P-50003B	P-50003B	Note 1
53	CLOSE FORWARD VALVE 50-XV-025	50-XV-025	
54	OPEN OF-SPEC VALVE 50-XV-026	50-XV-026	
55	STOP PUMP P-50009A	P-50009A	
56	STOP PUMP P-50009B	P-50009B	
57	CLOSE FORWARD VALVE 50-XV-031	50-XV-031	
58	OPEN OF-SPEC VALVE 50-XV-032	50-XV-032	
59	STOP PUMP P-50004A	P-50004A	
60	STOP PUMP P-50004B	P-50004B	
61	STOP PUMP P-50005A	P-50005A	
62	STOP PUMP P-50005B	P-50005B	
63	STOP PUMP P-50006A	P-50006A	Note 2
64	STOP PUMP P-50006B	P-50006B	Note 2
65	STOP PUMP P-50007A	P-50007A	
66	STOP PUMP P-50007B	P-50007B	
67	STOP PUMP P-50008A	P-50008A	
68	STOP PUMP P-50008B	P-50008B	
69	STOP PUMP P-50010A	P-50010A	
70	STOP PUMP P-50010B	P-50010B	

TAG Nos	REV.	CAUSE DESCRIPTION	VOTING	INHIBITION	REMARK		33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70
50-TIHH-022	1	H-50001 OUTLET TEMPERATURE HIGH HIGH			I-001	1																X																						
50-LILL-020	1	T-50006 LOW LOW LEVEL			I-002	2																	X	X	X	X							X	X										
50-AIHH-024	1	CONDUCTIVITY VALUE HIGH HIGH			I-003	3																					X	X																
50-LILL-021	1	T-50008 LOW LOW LEVEL			I-004	4																			X(1)	X(1)			X	X														
50-AIHH-026	1	TOTAL HARDNESS VALUE HIGH HIGH			I-005	5																									X	X												
50-AIHH-027	1	pH VALUE HIGH HIGH			I-006	6																									X	X												
50-AILL-027	1	pH VALUE LOW LOW			I-007	7																									X	X												
50-LILL-022	1	T-50002 LOW LOW LEVEL			I-008	8																													X	X								
50-LILL-023	1	T-50003 LOW LOW LEVEL			I-009	9																															X	X						
50-LILL-024	1	T-50004 LOW LOW LEVEL			I-010	10																																	X	X	X	X	X	X
50-TSHH-020	1	HEATER (H-50001) ELEMENT SKIN TEMPERATURE HIGH HIGH			I-011	11																X																						
50-XZAL-020	1	50-XV-020 CLOSED			I-012	12	X(4)	X(4)	X(4)	X(4)	X(4)																	X(4)			X(4)	X(4)							X	X				
50-PILL-026	1	PRESSURE LOW LOW VALUE			I-013	13																											X											
50-PILL-028	1	PRESSURE LOW LOW VALUE			I-014	14																												X										
50-XZAL-021 AND 50-XZAL-022	1	50-XV-021 AND 50-XV-022 CLOSED			I-015	15																															X(2)	X(2)						
HOLD (Signal by Rosetti Marino)	2	SYSTEM LONG STOP <3> (RM to confirm)			I-016	16	X	X	X	X	X	X																X			X	X												
50-XS-001	2	SHUTDOWN SIGNAL <3>			I-017	17	X	X	X	X	X	X	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)		X	X(5)	X(5)	X	X	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)
50-XI-500009A	2	P-50009A RUNNING			I-018	18																								X(2)														
50-XI-500009B	2	P-50009B RUNNING			I-019	19																							X(2)															
50-TIH-022	2	SEA WATER TEMPERATURE HIGH			I-020	20																					X	X																
						21																																						
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NOTES:

1. Only if SWRO system is in flushing (50-XV-023 open or 50-XV-024 open)
2. No Start
3. In column named "remark" interlock tag numbers are indicated
4. With delay timer of 30 days
5. Only Hardwire

LEGEND

Rev.	Date	Status	Description	DRN	CHKD	APPD
00	03/06/2024	IFI	Issue for Information (IFI)	PSC	WR	RM
01	22/08/2024	IFI	Issue for Information (IFI)	PSC	WR	RM
02	04/10/2024	IFI	Issue for Information (IFI)	PSC	WR	RM

CROSSWIND — ROSETTI MARINO

Water Treatment Package A-50000 Cause & effect Matrix — DATE 04/10/2024

HOLLANDSE KUST NOORD WIND PARK Project
Contract No. CW-I-WP4-2023-05

4 FUNCTIONAL DESCRIPTION / PROCESS CONTROL NARRATIVES

4.1 SEA WATER PRE-TREATMENT SYSTEM

4.1.1 Purpose of the process control

The purpose process control of the Sea Water Pre-Treatment System is to ensure the correct filtration and heating of the stream of sea water entering the package. The Sea Water Coarse Filter A-50003 (see Section 3.1.1) is a self-cleaning filter and provide the first filtration of the inlet sea water stream.

The Electric Heater H-50001 (see Section 3.1.2), heats the sea water up to 10°C and operates in cold time when the sea water temperature entering the system is low.

The Sand Filter S-50001 (see Section 3.1.3) provides a better filtration of the sea water. The Sand Filter requires periodic backwash for cleaning.

The filtered water is stored in the Filtered Water Tank T-50006 and the Backwash Pumps P-50002A/B (one operating and the other stand-by) provide water at required pressure for the Sand Filter backwash.

4.1.2 Description of the process operation

A stream of sea water enters the package at the required conditions (controlled by Customer) of 4-5 barg and 2.5 m^3/h.

A small flow of biocide is added to the stream before coarse filtration. The flow of biocide is stopped if valve 50-XV-020 is closed, see par. 4.6.

The stream passes through the shutoff valve 50-XV-020, that is opened during the normal operation of the Sea Water Treatment System and it's closed when the Sea Water Filter is in backwash.

The position of the shutoff valve is indicated by the limit switches 50-XZSH-020 (open) and 50-XZSL-020 (closed).

The pressure of the inlet steam is measured and indicated by pressure transmitter 50-PT-020. An alarm is activated in case of low inlet pressure 50-PAL-020.

The Sea Water Coarse Filter A-50003 is a self operating package. An internal sensor starts the self-cleaning operation in case of high differential pressure (or based on a timer) and activates the rotation of cleaning blade while opening the bottom discharge valve to flush the filtered solid and clean the filter surface. The operation lasts approx. 15 seconds and it's activated every 15-30 minutes or more, depending on the inlet sea water quality.

The Sea Water Coarse Filter A-50003 package generates a cumulative alarm output 50-XA-A50003.

The sea water pressure downstream the Sea Water Coarse Filter A-50003 is indicated the pressure gauge 50-PI-048.

The temperature downstream the Electric Heater H-50001 is controlled by 50-TIC-021. The temperature is measured by temperature transmitter 50-TT-021. If the temperature measured by 50-TT-021 is below set point of 12°C (adjustable), the controller 50-TIC-021 increase the power of the electric heater (controlled via

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SCR). If the temperature measured by 50-TT-021 is above set point the controller 50-TIC-021 decrease the power of the electric heater.

The pressure at Sand Filter S-50001 inlet is indicated by pressure gauge 50-PI-022.

The sea water flowrate at Sand Filter S-50001 inlet is measured and indicated by flow transmitter 50-FT-020. An alarm is activated in case of low or high flowrate, 50-FAL-020 / 50-FAH-020. (Note: set point of alarms during normal operation are different than during sand filter backwash).

The differential pressure across Sand Filter S-50001 is measured by differential pressure transmitter 50-PDT-023. An alarm is activated in case of high differential pressure 50-PDH-023.

The Sand Filter S-50001 is a self operating package. The backwash operation in case of differential pressure 50-PDI-023 above a set point of 0.7 bar (adjustable). The regeneration sequence starts only at the end of the production cycle.

Sand Filter S-50001 backwash sequence:

- Check the T-50006 level. Wait for high level > 80% to have enough water holdup for backwash; otherwise the Sand Filter is kept in operation until high level is achieved in the tank and the rotation of speed of High Pressure Pump P-50004A/B is decreased at minimum value;
- Stop the heater H-50001;
- If 50-TI-020 is >50°C, wait 120 sec for heater cooling;
- Stop the Sea Water Intake Pump (signal tag XXXX by ROSETTI) and simultaneously stop SW Booster Pumps P-5003A/B, HP Pumps P-50004A/B;
- When the Sea Water Intake Pump is stopped (signal tag XXXX by ROSETTI), close the inlet shutoff valve 50-XV-020. In case of valve position failure, the backwash sequence cannot proceed and advice alarm is displayed;
- Start the Sand Filter self cleaning sequence;
- Start the Backwash Pump P-50002A (or P-50002B);
- Wait for backwash complete (timer 20 min, adjustable);
- Stop the Sand Filter self cleaning sequence;
- Stop the Backwash Pump P-50002A (or P-50002B);
- Open the inlet shutoff valve 50-XV-020, restart Sea Water Intake Pump (signal tag XXXX by ROSETTI);
- Start the Electric Heater H-50001 and temperature controller 50-TIC-021;
- High level in Filtered Water Tank T-50006 restart again the SW Booster Pump P-50003A/B, that was in previous service before filter backwashing.

The filtered water is collected in the Filtered Water Tank T-50006. The level of this tank is measured and indicated by level transmitter 50-LT-020. An alarm is activated in case of low level or high level, 50-LAH-020 / 50-LAL-020.

The flowrate downstream the Backwash Pump P-50002A/B is measured by flow transmitter 50-FT-020.

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4.1.3 Safeguarding intent

The main safeguarding of the system are:

- Prevent overheating of water downstream Electric Heater H-50001
- Prevent heater H-50001 element's overheating and damage
- Prevent dry running of Backwash Pumps P-50002A/B and SW Booster Pumps P-50003A/B
- Prevent high level of chlorides in fresh water.

In order to prevent overheating of water downstream H-50001and high level of chlorides in fresh water, temperature transmitter 50-TT-022 measures the seawater temperature and the following events will happen:

- if the temperature > 22°C pre-alarm 50-TAH-022 is activated;
- in case of temperature > 25 °C, an alarm 50-TAHH1-022 is displayed and interlock I-020 is activated to open off-spec valve 50-XV-026, close forward valve 50-XV-025;
- for high temperature > 40° C an alarm 50-TAHH2-022 is displayed and interlock I-001 is activated to stop electric heater H-50001.

In order to prevent Heater H-50001 element's overheating, a temperature element 50-TE-020 is embedded in one of the heater's element. In case of high high temperature (> 110°C) 50-TSHH-020 interlock I-011 trips the electric heater.

In order to prevent dry running of pumps P-50002A/B and P-50003A/B, Filtered Water Tank T-50006 level is monitored by 50-LT-020, in case of low low level 50-LALL-20 activates interlock I-002 that stops pumps P-50002A/B, P-50003A/B and 50004A/B. In case of low level PLC will send a permissive signal to DCS to start Sea Water Intake pumps. In case of high level, PLC starts SW Boster pumps and High Pressure pumps (and no simultaneously running of Backwash pumps). In case high high level, PLC sends to DCS a signal to stop Sea Water Intake pumps.

At startup the Coarse Filter A-50003, the Electric Heater E-50001 and the Sand Filter S-50001 are off and valve 50-XV-020 is closed.

Start Sea Water Pump (tag signal by ROSETTI), then valve 50-XV-020 is then opened to allow the flow of seawater. Once the inlet flowrate is established (check 50-FT-020) and the feed pressure is at minimum 1.5 barg it is possible to start automatically Coarse Filter A-50003, the Electric Heater E-50001 control loop 50-TIC-021 and the Sand Filter S-50001.

Adjust manual valve MV-509 (outlet of sand filter) to have a back pressure of 1.3 barg at the outlet of Sea Water Coarse Filter A-50003 by reading pressure gauge 50-PI-048 and a flowrate of 2.5 m^3/h. Re-check that the feed pressure is 1.5 barg. If the feed pressure is higher than 5 barg (50-PT-020), stop the Sea Water Pump and close the inlet valve 50-XV-020.

Check also the proper operation of the air vent valve MV-635.

CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #49 123A90-DDL-SAF-RE-30006
Item No.	#49
Causes	5.1.18. 50-XV021 closed failure in filter change over operation
Consequences	5.1.18.2. Dry running of pumps P-50003A/B and loss of flow to P-50004A/B. Damage to pumps P-50003A/B and P-50004A/B.
Recommendation	49. 50-LI020LL should trip P-50004A/B on LL level in T-50006 to prevent pump damage
Actions	
Assigned Respondent (By)	Rosetti
Issue Date(01-12-2023)	
Action Response	According with doc. 724000448-MAC-CE-00004 Water Treatment Package A-50000 Cause & effect Matrix attached, 50-LI020LL will trip pump P-5004 A/B

Approvals / Endorsements		
EPC Discipline Lead		**Sign**
F.Mura		
EPC HSE LEAD		**Sign**
C.Caracciolo		**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.15 09:06:49 +02'00'	**Sign**

Water Treatment Package A-50000
Cause & effect Matrix

FZ-01= FUEL CELL AREA
FZ-02= H2 STORAGE VESSELS AREA
FZ-03= ELECTROLYZER AREA
FZ-04= B-200/B-300/B-400 CONTAINERS AREA
FZ-05= BESS AREA
FZ-06= B-100 CONTAINER AREA
FZ-07= MASTER POINT AREA
FZ-08= TRANSITION PIECE AREA

EFFECT — SYS: OTHER

No.	TAG No.	DESCRIPTION	NOTES
33	50-XV-033	OPEN DRAIN VALVE 50-XV-033	
34	50-XV-034	OPEN DRAIN VALVE 50-XV-034	
35	50-XV-027	OPEN DRAIN VALVE 50-XV-027	
36	50-XV-030	OPEN DRAIN VALVE 50-XV-030	
37	50-XV-035	OPEN DRAIN VALVE 50-XV-035	
38	50-XV-020	CLOSE BATTERY LIMIT VALVE 50-XV-020	
39	A-50003	TRIP COARSE FILTER A-50003	
40	S-50001	TRIP SAND FILTER S-50001	
41	S-50004	TRIP SOFTENING FILTER S-50004	
42	HHS-50003A	CONTAINER ELECTRICAL HEATER TRIP	
43	HHS-50003B	CONTAINER ELECTRICAL HEATER TRIP	
44	HFA-50001A	CONTAINER AIR FAN TRIP	
45	HFA-50001B	CONTAINER AIR FAN TRIP	
46	HFA-50001C	CONTAINER AIR FAN TRIP	
47	S-50010	TRIP UV LAMP S-50010	
48	H-50001	TRIP HEATER H-50001	
49	P-50002A	STOP PUMP P-50002A	
50	P-50002B	STOP PUMP P-50002B	
51	P-50003A	STOP PUMP P-50003A	Note 1
52	P-50003B	STOP PUMP P-50003B	Note 1
53	50-XV-025	CLOSE FORWARD VALVE 50-XV-025	
54	50-XV-026	OPEN OF-SPEC VALVE 50-XV-026	
55	P-50009A	STOP PUMP P-50009A	
56	P-50009B	STOP PUMP P-50009B	
57	50-XV-031	CLOSE FORWARD VALVE 50-XV-031	
58	50-XV-032	OPEN OF-SPEC VALVE 50-XV-032	
59	P-50004A	STOP PUMP P-50004A	
60	P-50004B	STOP PUMP P-50004B	
61	P-50005A	STOP PUMP P-50005A	
62	P-50005B	STOP PUMP P-50005B	
63	P-50006A	STOP PUMP P-50006A	Note 2
64	P-50006B	STOP PUMP P-50006B	Note 2
65	P-50007A	STOP PUMP P-50007A	
66	P-50007B	STOP PUMP P-50007B	
67	P-50008A	STOP PUMP P-50008A	
68	P-50008B	STOP PUMP P-50008B	
69	P-50010A	STOP PUMP P-50010A	
70	P-50010B	STOP PUMP P-50010B	

CAUSE

TAG Nos	REV.	DESCRIPTION	VOTING	INHIBITION	REMARK	No.	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
50-TIHH-022	1	H-50001 OUTLET TEMPERATURE HIGH HIGH			I-001	1																X				
50-LILL-020	1	T-50006 LOW LOW LEVEL			I-002	2																	X	X	X	X
50-AIHH-024	1	CONDUCTIVITY VALUE HIGH HIGH			I-003	3																				
50-LILL-021	1	T-50008 LOW LOW LEVEL			I-004	4																			X(1)	X(1)
50-AIHH-026	1	TOTAL HARDNESS VALUE HIGH HIGH			I-005	5																				
50-AIHH-027	1	pH VALUE HIGH HIGH			I-006	6																				
50-AILL-027	1	pH VALUE LOW LOW			I-007	7																				
50-LILL-022	1	T-50002 LOW LOW LEVEL			I-008	8																				
50-LILL-023	1	T-50003 LOW LOW LEVEL			I-009	9																				
50-LILL-024	1	T-50004 LOW LOW LEVEL			I-010	10																				
50-TSHH-020	1	HEATER (H-50001) ELEMENT SKIN TEMPERATURE HIGH HIGH			I-011	11																X				
50-XZAL-020	1	50-XV-020 CLOSED			I-012	12	X(4)	X(4)	X(4)	X(4)	X(4)															
50-PILL-026	1	PRESSURE LOW LOW VALUE			I-013	13																				
50-PILL-028	1	PRESSURE LOW LOW VALUE			I-014	14																				
50-XZAL-021 AND 50-XZAL-022	1	50-XV-021 AND 50-XV-022 CLOSED			I-015	15																				
HOLD (Signal by Rosetti Marino)	2	BLACK START (RM to confirm Black Out condition)			I-016	16	X	X	X	X	X															
50-XS-001	2	SHUTDOWN SIGNAL			I-017	17						X	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)
50-XI-500009A	2	P-50009A RUNNING			I-018	18																				
50-XI-500009B	2	P-50009B RUNNING			I-019	19																				
50-TIH-022	2	SEA WATER TEMPERATURE HIGH			I-020	20																				
						21																				
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						41																				

No.	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70
1																		
2							X	X										
3	X	X																
4			X	X														
5					X	X												
6					X	X												
7					X	X												
8									X	X								
9											X	X						
10													X	X	X	X	X	X
11																		
12		X(4)			X(4)	X(4)							X	X				
13							X											
14								X										
15											X(2)	X(2)						
16		X			X	X												
17			X(5)	X(5)	X		X(5)	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)	X(5)
18				X(2)														
19			X(2)															
20	X	X																

NOTES:

1. Only if SWRO system is in flushing (50-XV-023 open or 50-XV-024 open)
2.No Start
3. In column named "remark" interlock tag numbers are indicated
4. With delay timer of 30 days
5. Only Hardwire

LEGEND

Rev.	Date	Status	Description	DRN	CHKD	APPD
00	03/06/2024	IFI	Issue for Information (IFI)	PSC	WR	RM
01	22/08/2024	IFI	Issue for Information (IFI)	PSC	WR	RM
02	04/10/2024	IFI	Issue for Information (IFI)	PSC	WR	RM

CROSSWIND ROSETTI MARINO

Water Treatment Package A-50000 Cause & effect Matrix

DATE 04/10/2024

HOLLANDSE KUST NOORD WIND PARK Project
Contract No. CW-I-WP4-2023-05

 Rev. 02

CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title:	**EPC HAZOP Study Actions**
Action No:	# 50
Ref Doc	123A90-DDL-SAF-RE-30006
Causes	5.3.6. 50-XV027 opening when not on flushing cycle
Consequences	5.3.6.1. Reduced pressure within RO cells and reduced fresh water production. Water directed towards brine caisson. No hazardous consequences.
Recommendation	50. Ensure that where multiple trains are implemented within the WTP package remote changeover between trains is available to onshore operators on request.
Comments	
Assigned Respondent (By)	Rosetti / CRW Process
Issue Date	19/06/2024
Action Response	As per all other actions, Rosetti confirms that no operator intervention is needed since the system is sized 2x100 as per doc 1724000448-MAC-SP-00003 and changeover is done periodically. Despite this, operator can anytime connect to the PLC trough modbus connection and do the change over manually, if required.

Approvals / Endorsements

Discipline Lead		**Sign**
HSE LEAD		**Sign**
Project Manager		**Sign**
		Sign
		Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.09.12 17:30:18 +02'00'

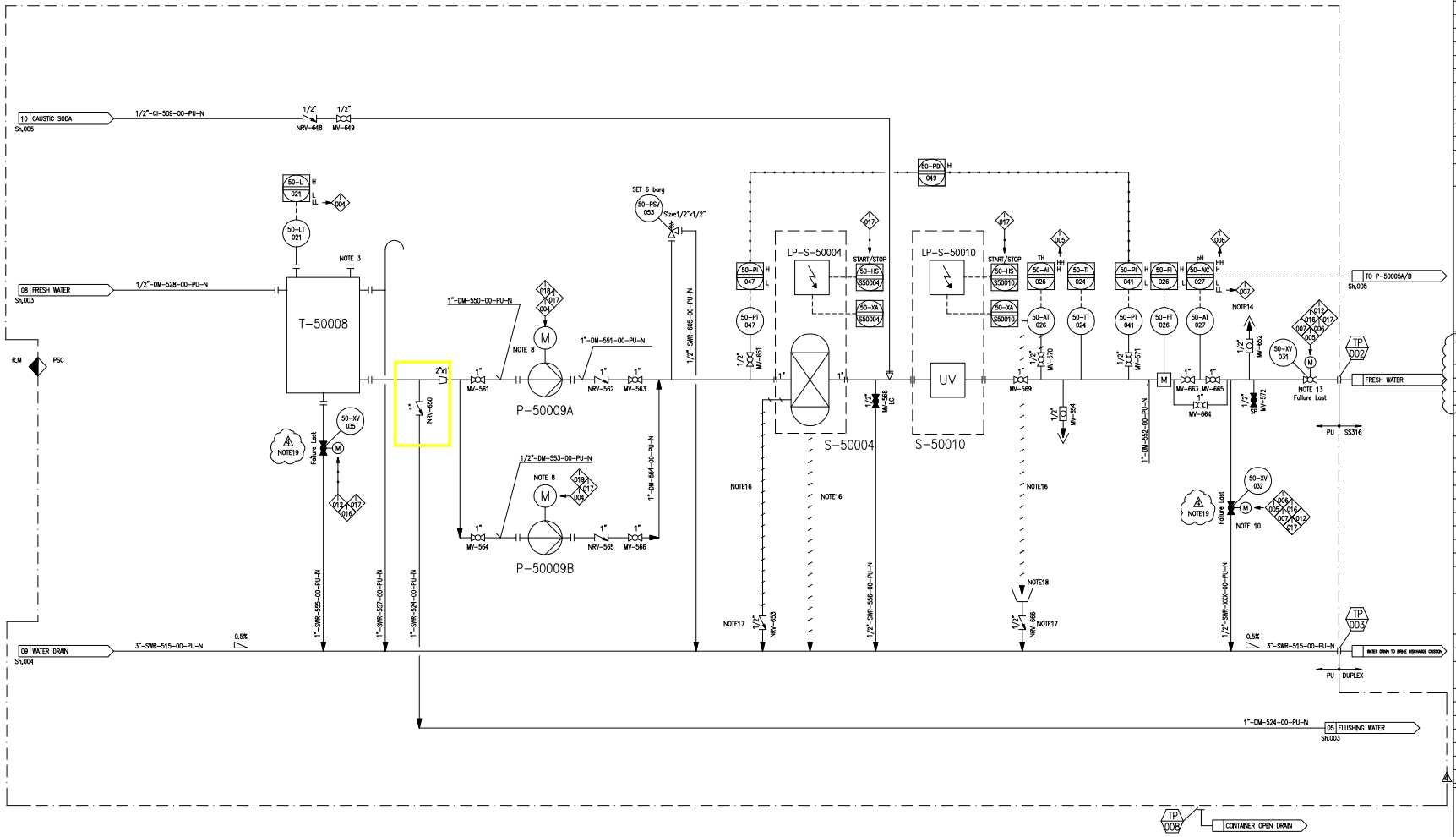
CROSSWIND LANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #51 123A90-DDL-SAF-RE-30006
Item No.	#51
Causes	5.3.7. 50-XV023 flushing valve open when not required
Consequences	5.3.7.1. Linking of T-50006 and T-50008 with potential of contantamination of T-50008 with filtered sea water. Filtered sea water fed forward to electrolysis unit with potential damage to RO unit in electrolysis package.
Recommendation	51. Add an NRV in the flushing water line between T-50008 and 50-XV023 / 50-XV024 to prevent reverse flow in the flushing line and potential contamination of T-50008 with filtered brine from T-50006.
Actions	
Assigned Respondent (By)	Rosetti
Issue Date(01-12-2023)	
Action Response	Noted. The Check valve NRV-650 have been installed. See PID 1724000448-PR-PID-00013 SHEET 5

Approvals / Endorsements		
EPC Discipline Lead / Construction		**Sign**
F.Mura		
EPC HSE LEAD		**Sign**
C.Caracciolo		**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.12.18 15:20:25 +01'00'	**Sign**

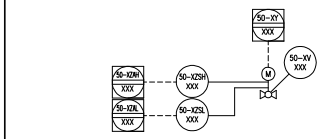
DRAWING NO. 1724000448-PR-PID-00013 REV. 04



TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	PVC	SEA WATER FROM INTAKE PUMPS
TP-002	1"	FLG.	150#	RF	PVC	PRODUCT WATER
TP-003	3"	FLG.	150#	RF	PVC	SEA WATER DRAIN
TP-005	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTAKE
TP-006	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-007	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN
TP-008	1/2"	FLG.	150#	RF	PVC	CONTAINER OPEN DRAIN

TYPICAL FOR ON/OFF BALL VALVES



REFERENCE DOCUMENTS

DOCUMENT NUMBER	TITLE
1724000448-MAC-SP-00003	SYSTEM/PACKAGE FUNCTIONAL DESCRIPTION
1724000448-MAC-CE-00004	PACKAGE CAUSE EFFECT MATRIX

NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY; ELPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOUS BIOCIDE DOSAGE TO INTAKE PUMP: CONTINUOUS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOUS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER; BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE
14	AUTOMATIC AIR VENT VALVE
15	POSITION TO BE DEFINED DURING COMMISSIONING
16	POLYAMIDE TUBING (RILSAN TYPE)
17	CHECK VALVE (NO SPRING TYPE)
18	DRAIN PAN FOR ANALYZER. DRAIN PAN VOLUME= 5 L
19	VALVE FOR AUTOMATIC SYSTEM DRAINING IN CASE OF SHUT DOWN OR LONG STOP PERIOD OF THE SYSTEM

T-50008	
FRESH WATER TANK	
VOLUME	2,2 m3
DES. PRESS.	ATM
DES. TEMP.	50° C
MATERIAL	FRP

P-50009A/B	
FRESH WATER PUMP	
TYPE	CENTRIFUGAL
DES PRESSURE	25 barg
CAPACITY	0,8 m3/h
HEAD NOTE 11	5,2 bar(a)
DES. TEMP.	120° C
MATERIAL	SS 316L

S-50010	
UV STERILIZER	
CAPACITY	0,8 m3/h
DES. PRESS.	8 barg
DES. TEMP.	50° C
MATERIAL	SS 316

S-50004	
SOFTENING FILTER	
CAPACITY	0,8 m3/h
DES. PRESS.	6 barg
DES. TEMP.	40° C
MATERIAL	FRP-PLASTIC

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
04	11-NOV-24	UR	WR	RM	ACCEPTED FOR CONSTRUCTION
03	30-SEP-24	UR	WR	RM	ACCEPTED FOR CONSTRUCTION
02	22-AUG-24	UR	WR	RM	ISSUED FOR REVIEW
01	29-MAY-24	GG	WR	RM	ISSUED FOR REVIEW
00	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

ROSETTI MARINO

TITLE : WATER TREATMENT PACKAGE
FRESH WATER STORAGE
P&I DIAGRAM

CONTRACT NO./TITLE			SCALE –
DRAWN UR	CHECKED WR	APPROVED RM	DATE 11/11/24
A1	DRAWING NO. 1724000448-PR-PID-00013	SHEET 005	REV. 04

File Name : 1724000448-PR-PID-00013 Rev04

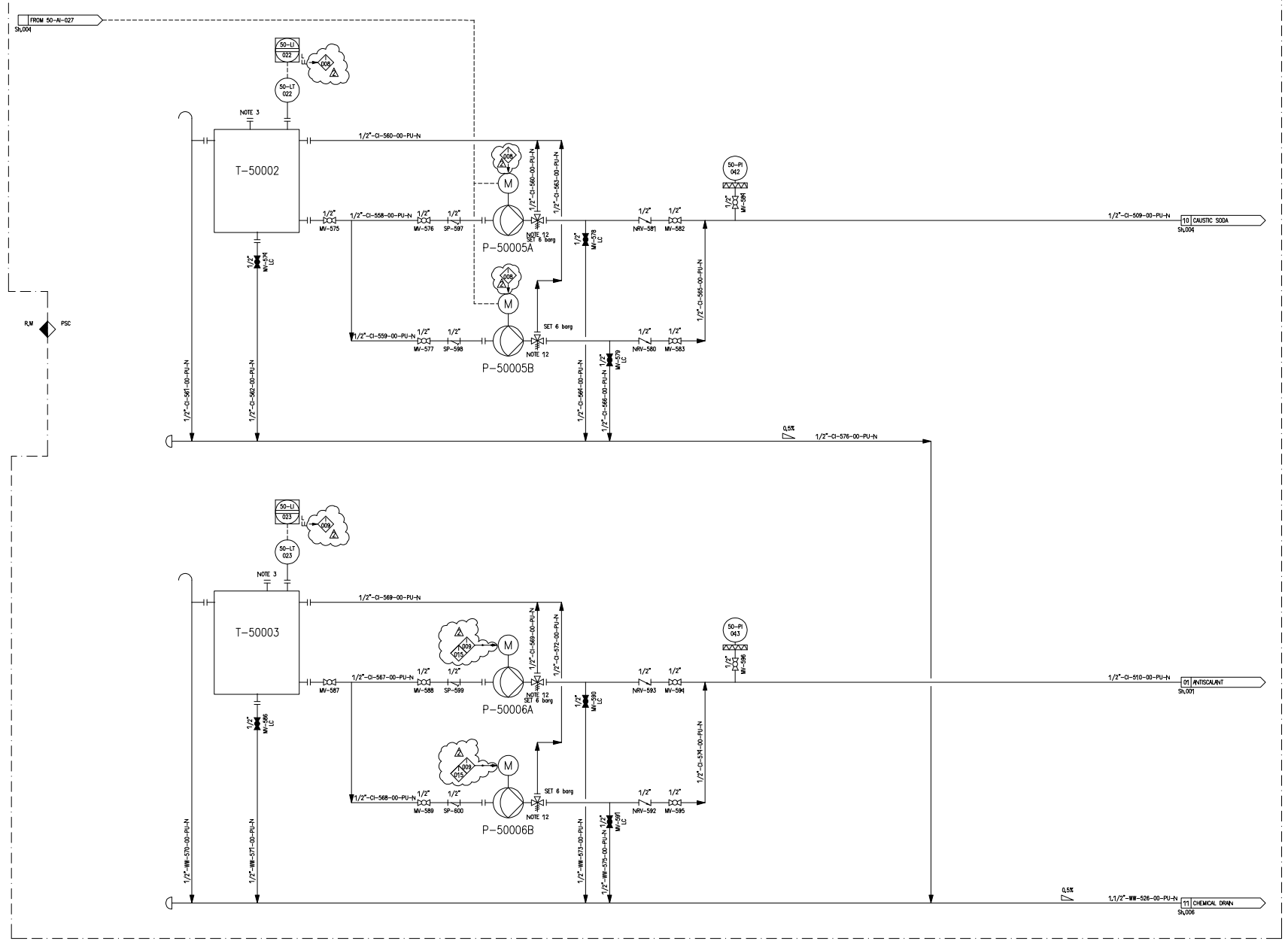
CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #52 123A90-DDL-SAF-RE-30006
Item No.	#52
Causes	5.1.34. MV-569 inadvertently closed Consequence: 5.1.35.1 Consequence: 5.1.36.1
Consequences	5.1.34.1. Deadheading of P-50009A/B (7barg) potential overpressure of pump discharge pipe work (DP 6barg). Pump damage and potential LOC of fresh water within WTP container.
Recommendation	52. Determine how overpressure of fresh water system can be prevented should P-50009A/B be isolated on the downstream side as deadhead pressure of these pumps is 7barg and the design pressure of downstream system is 6barg.
Actions	
Assigned Respondent (By)	PSC
Issue Date(01-12-2023)	
Action Response	A Relief valve (PSV) 50-PSV-053 has been installed upstream the softener S-50004 and downstream the manual ball valve MV-563. . ThePVC-U pipe design pressure is16barg (PN16) [redacted] e P&ID 1724000448-PR-PID-00013

Approvals / Endorsements		
EPC Discipline Lead / Construction		**Sign**
F.Mura		
EPC HSE LEAD		**Sign**
C.Caracciolo		**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.01 14:46:54 +02'00'	**Sign**



T-50002	
CAUSTIC SODA DOSING TANK	
VOLUME	0,05 m3
DES. PRESS.	ATM
DES. TEMP.	45° C
MATERIAL	PE

P-50005A/B	
CAUSTIC SODA DOSING PUMP	
TYPE	METERING DIAPHRAGM
DES PRESSURE	10 barg
CAPACITY	0,05 l/h
HEAD	3 barg
DES. TEMP.	45° C
MATERIAL	PVC

T-50003	
ANTISCALANT DOSING TANK	
VOLUME	0,05 m3
DES. PRESS.	ATM
DES. TEMP.	45° C
MATERIAL	PE

P-50006A/B	
ANTISCALANT DOSING PUMP	
TYPE	METERING DIAPHRAGM
DES PRESSURE	10 barg
CAPACITY	0.01 l/h
HEAD	3 barg
DES. TEMP.	45° C
MATERIAL	PVC

TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-002	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-003	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-005	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTAKE
TP-006	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-007	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: ELPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOUS BIOCIDE DOSAGE TO INTAKE PUMP: DISCONTINUOUS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOUS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE
14	AUTOMATIC AIR VENT VALVE
15	POSITION TO BE DEFINED DURING COMMISSIONING
16	POLYAMIDE TUBING (RILSAN® TYPE)
17	CHECK VALVE (NO SPRING TYPE)
18	DRAIN PAN FOR ANALYZER. DRAIN PAN VOLUME= 5 L

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
02	22-AUG-24	UR	WR	RM	ISSUED FOR REVIEW
01	29-MAY-24	GG	WR	RM	ISSUED FOR REVIEW
00	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND ROSETTI MARINO

TITLE : WATER TREATMENT PACKAGE
ACID & ANTISCALANT DOSAGES
P&I DIAGRAM

CONTRACT NO./TITLE | SCALE -
DRAWN UR | CHECKED WR | APPROVED RM | DATE 22/08/24
A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 006 | REV. 02

DRAWING NO. 1724000448-PR-PID-00013 REV. 2

File Name : 1724000448-PR-PID-00013 Rev02

CROSSWIND HOLLANDSE KUST NOORD WIND PARK

ROSETTI MARINO

Project Base Load Power Hub (BLPH)

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #53 123A90-DDL-SAF-RE-30006
Item No.	#53
Causes	10.2.1. P-50005A/B running. Failure of PH 50-AIC027
Consequences	10.2.1.1. Overdosing of caustic resulting in high PH of treated water. Operational issue for electrolysis unit.
Recommendation	53. Review with Elogen the consequences of loss of PH control within the water treatment package on the electrolysis. If consequences are significant for electrolyser package review if additional safeguards for PH protection are required within electrolyser package.
Actions	
Assigned Respondent (By)	Crosswind
Issue Date(01-12-2023)	
Action Response	see below reply

Approvals / Endorsements

Company Discipline Lead		**Sign**
		Hamant Patel
Company HSE LEAD	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.01 17:15:57 +02'00'	**Sign**
Company Project Manager	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.02 08:29:04 +02'00'	**Sign**
Contractor received for information. Not independently verified. Information implemented		**Sign**

ACTION RESPONSE: A change in pH value will impact the water treatment package of the electrolyser, leading to changes in water conductivity, which is unacceptable for the electrolyser. There is an independent conductivity measurement sensor in the electrolyser water treatment package. If the conductivity exceeds alarm levels, the water treatment package (WTP) and the electrolyser will be shut down to prevent damage to the electrolyser membrane.

CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

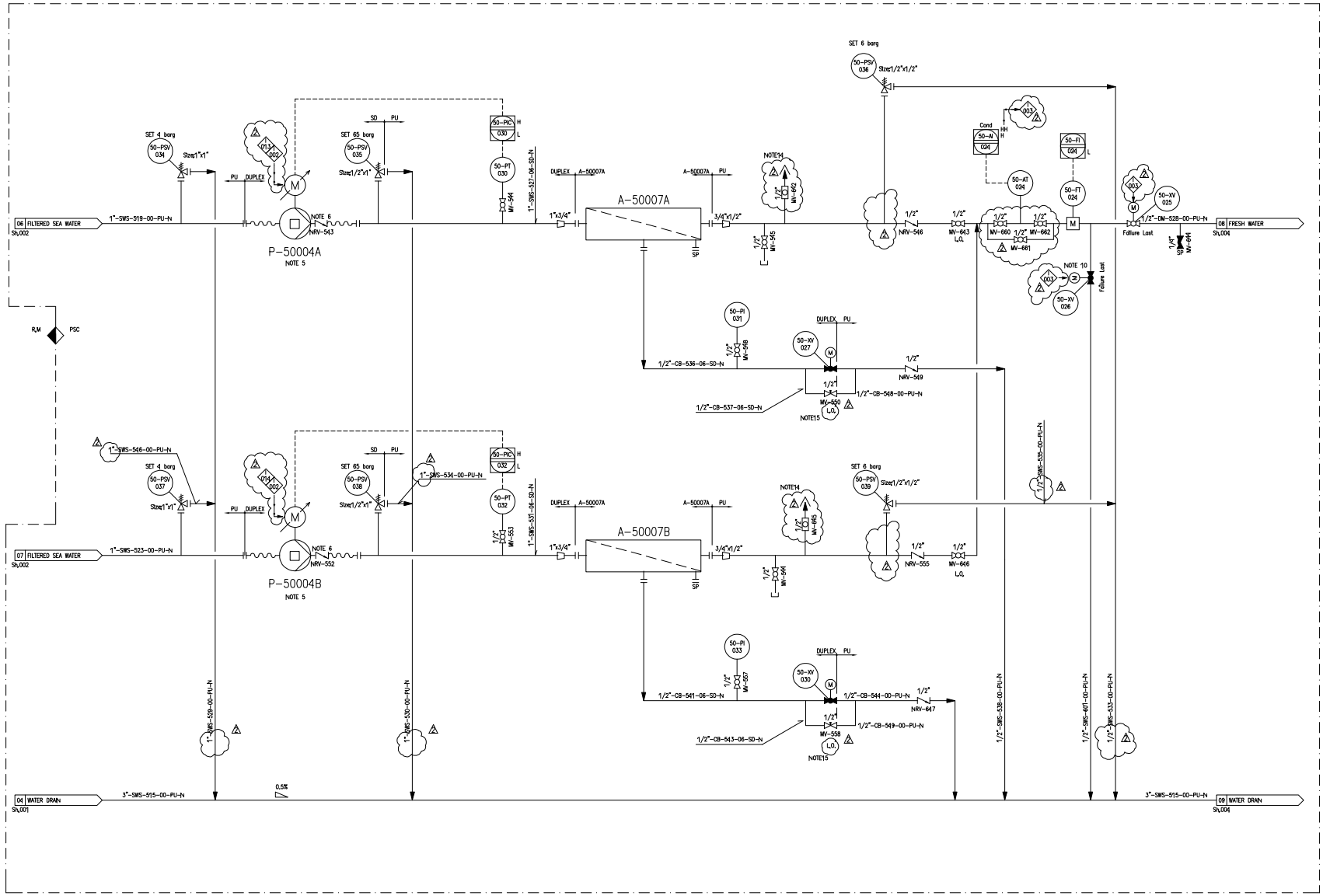
ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #54 123A90-DDL-SAF-RE-30006
Item No.	#54
Causes	5.2.1. P-50009A & B both operating
Consequences	5.2.1.1. Potential overfill of Elogen WTP-300 and further consequences to be determined in WTP HAZOP.
Recommendation	54. Ensure logic for control of P-50009A/B prevents simultaneous running A & B pumps.
Actions	
Assigned Respondent (By)	Rosetti Process
Issue Date(01-12-2023)	
Action Response	As per P&ID 1724000448-PR-PID-00013 NOTE 8: Logic for control of P50009A/B that prevents simultaneous running of pump A and B is provided.

Approvals / Endorsements		
EPC Discipline Lead / Construction		**Sign**
F.Mura		
EPC HSE LEAD		**Sign**
C.Caracciolo		**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.01 14:48:21 +02'00'	**Sign**

DRAWING NO. 1724000448-PR-PID-00013

REV. 2



P-50004A/B	
HP PUMP	
TYPE	AXIAL ROTATING PISTONS
DES PRESSURE	83 barg
CAPACITY	2 m3/h
HEAD	63,5 barg
DES. TEMP.	50° C
MATERIAL	SS DUPLEX

A-50007A/B	
SEA WATER REVERSE OSMOSIS UNITS	
CAPACITY	0.8 m3/h
DES. PRESS.	69 barg
DES. TEMP.	45° C
MATERIAL	FRP

TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-002	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-003	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-005	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTAKE
TP-006	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-007	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: ELPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOUS BIOCIDE DOSAGE TO INTAKE PUMP: DISCONTINUOUS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOUS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE
14	AUTOMATIC AIR VENT VALVE
15	POSITION TO BE DEFINED DURING COMMISSIONING
16	POLYAMIDE TUBING (RILSAN TYPE)
17	CHECK VALVE (NO SPRING TYPE)
18	DRAIN PAN FOR ANALYZER, DRAIN PAN VOLUME= 5 L

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
02	22-AUG-24	UR	WR	RM	ISSUED FOR REVIEW
01	29-MAY-24	GG	WR	RM	ISSUED FOR REVIEW
00	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

ROSETTI MARINO

TITLE :

WATER TREATMENT PACKAGE
SEA WATER REVERSE OSMOSIS
P&I DIAGRAM

CONTRACT NO./TITLE | SCALE -

DRAWN UR | CHECKED WR | APPROVED RM | DATE 22/08/24

A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 004 | REV. 02

File Name : 1724000448-PR-PID-00013 Rev02

CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title:	**EPC HAZOP Study Actions**
Action No:	# 55
Ref Doc	123A90-DDL-SAF-RE-30006
Causes	7.13.1. Air contamination of N2 supply to Elogen Package
Consequences	7.13.1.1. Potential for flammable atmosphere within H2 systems within Elogen Package.
Recommendation	55. Review with Elogen the consequences of oxygen contamination of the N2 supply to the electrolysis unit and determine if consequences need to be considered in a LOPA analysis of the A-64000 oxygen analyser.
Comments	
Assigned Respondent (By)	Crosswind
Issue Date	01/10/2024
Action Response	The consequence of introducing air into the H2 loop of the electrolyser is a potential flammable atmosphere in H2 loop of the package with potential internal explosion. The N2 package A-64000 has an oxygen analyser to ensure the purity of the N2 supplied to the electrolyser.

Approvals / Endorsements

Discipline Lead		**Sign**
		Hamant Patel
HSE LEAD	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.03 13:07:26 +02'00'	**Sign**
Project Manager		Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.08 10:34:59 +02'00' **Sign**
Approved		**Sign**
	Contractor received for information. Not independently verified. Information implemented	

CROSSWIND HOLLANDSE KUST NOORD WIND PARK

ROSETTI MARINO

Project Base Load Power Hub (BLPH)

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #56 123A90-DDL-SAF-RE-30006
Item No.	#56
Causes	7.13.2. Air contamination of N2 supply to H2 storage
Consequences	7.13.2.1. Potential for flammable atmosphere within H2 storage systems. To be reviewed within A-64000 N2 package HAZOP and LOPA
Recommendation	56. Review with N2 package vendor the consequences of oxygen contamination of the N2 supply to the storage and vent systems and determine if consequences need to be considered in a LOPA analysis of the A-64000 oxygen analyser.
Actions	
Assigned Respondent (By)	Rosetti Tech Safety
Issue Date(01-12-2023)	
Action Response	Due to the presence of Oxygen analyzer AI-151, in case of presence of oxygen (up to 3%) the valve XV-059 will open discharging all the contaminated nitrogen directly to the vent, avoiding storage contamination. The presence of O2 above spec is hence reduced to ALARP.

Approvals / Endorsements		
EPC Discipline Lead / Construction		**Sign**
EPC HSE LEAD		**Sign**
C.Caracciolo		CC
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client		**Sign**
		Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.01 14:53:31 +02'00'

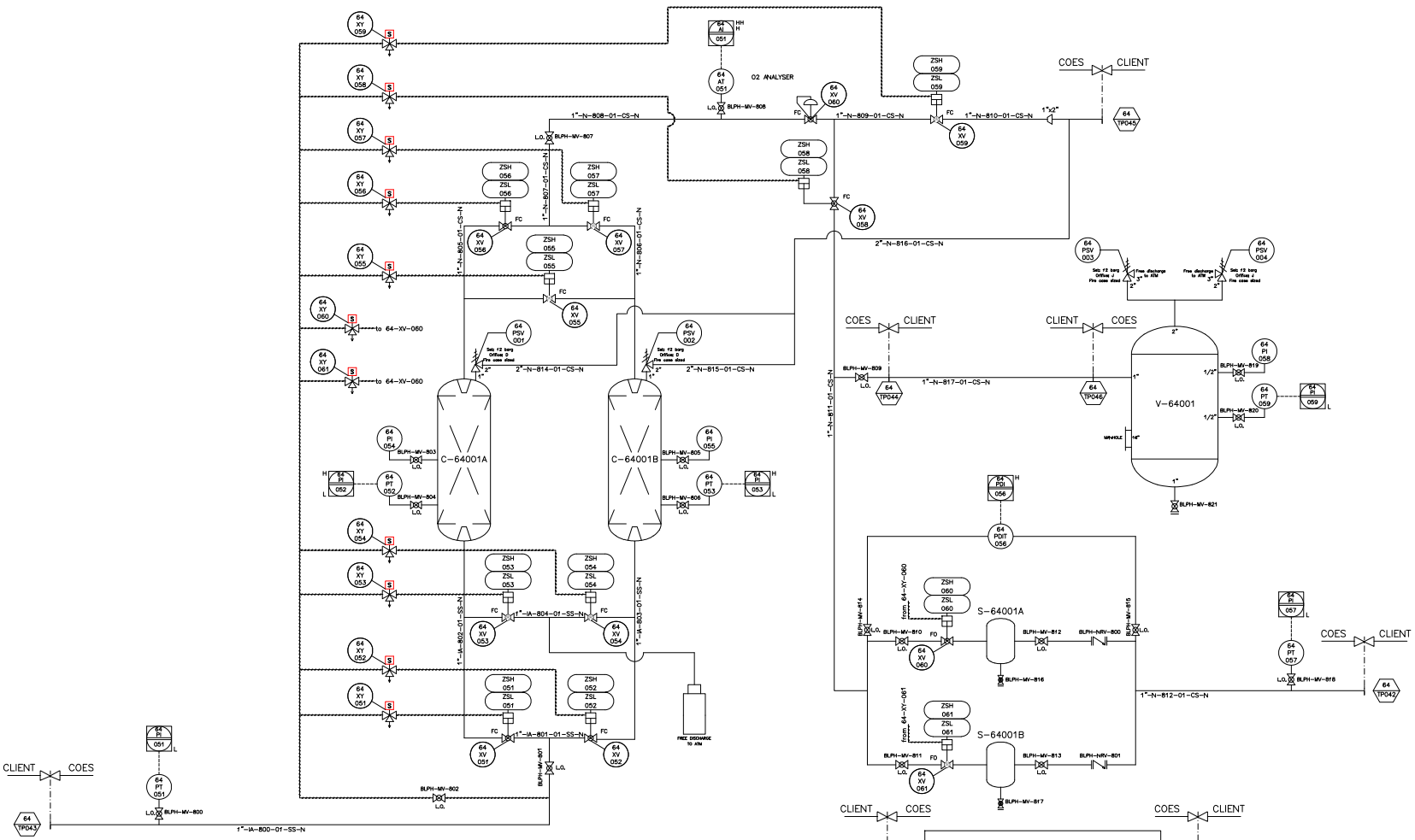
DRAWING NO. 1724000437-PR-PID-00018

REV. 03

TAG: C-64001A/C-64001B	
PSA TOWERS	
DESIGN CAPACITY	150 Nm3/h
DESIGN PRESSURE	12 barg
DESIGN TEMPERATURE	80°C
OPERATING PRESSURE	9 barg
MATERIAL	CARBON STEEL

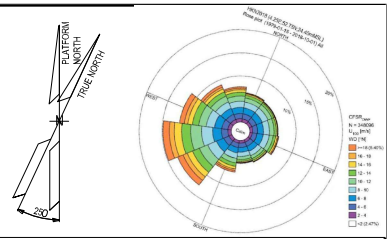
TAG: S-64001A/S64001B	
PSA AFTER-FILTERS	
DESIGN CAPACITY	60 Nm3/h
DESIGN PRESSURE	12 barg
DESIGN TEMPERATURE	80°C
OPERATING PRESSURE	8.5 barg
MATERIAL	CARBON STEEL

TAG: V-64001	
N2 RECEIVER	
DESIGN PRESSURE	12 barg
DESIGN TEMPERATURE	80°C
OPERATING PRESSURE	8.4 barg
VOLUME	11 m3
DIAMETER	2000 mm
T-T	3500 mm
MATERIAL	LTCS



BATTERY LIMIT CONNECTIONS

POS.	DESCRIPTION	TYPE	DIMENSIONS	DN	MATERIAL	FLOW (normal)	FLOW (design)	NOTES
TP043	DRY AIR INLET	ANSI B16.15 - RF	ø1" 150#	25	SS 316/316L	125 Nm3/h @9 barg	150 Nm3/h @9 barg	
TP042	NITROGEN OUTLET	ANSI B16.15 - RF	ø1" 150#	25	CS	50 Nm3/h @8 barg	60 Nm3/h @8 barg	PURITY=97%
TP045	NITROGEN VENT	ANSI B16.15 - RF	ø2" 150#	25	CS	MAX 50 Nm3/h	MAX 60 Nm3/h	LOW PURITY
TP044	CONNECTION TO RECEIVER	ANSI B16.15 - RF	ø1" 150#	25	CS			
TP046	INLET/OUTLET RECEIVER	ANSI B16.15 - RF	ø1" 150#	25	CS			



NOTES

1) NITROGEN RECEIVER IS SUPPLIED LOOSE
2) FOR THE EXCHANGED SERIAL SIGNALS SEE VENDOR'S DOCUMENT "I/O LIST" NUMBER 1724000437-IN-LIS-00015

LEGEND

- SKID MOUNTED INSTRUMENT
- TIE-IN POINT
- SKID PLC SIGNAL
- PROCESS LINE
- INSTRUMENT AIR / IMPULSE LINE
- ELECTRICAL / INSTRUMENT SIGNAL
- SOFTWARE SIGNAL
- SILENCER
- TEMPORIZED DRAIN TRAP
- THREADED BALL VALVE
- ACTUATED BALL VALVE
- FLANGED BALL VALVE
- CHECK VALVE
- PRESSURE RELIEF VALVE
- SOLENOID VALVE
- SELF-ACTUATED BALL VALVE

HOLDS

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
03	05/09/24	GT	MC	TM	ACCEPTED FOR CONSTRUCTION (AFC)
02	04/07/24	GT	MC	TM	ISSUE FOR REVIEW (IFR)
01	02/05/24	GT	MC	TM	ISSUE FOR REVIEW (IFR)
00	21/03/24	GT	MC	TM	ISSUE FOR REVIEW (IFR)

CROSSWIND

ROSETTI MARINO

TITLE :
BASE LOAD POWER HUB (BLPH)
PACKAGE P&ID
NITROGEN GENERATION PACKAGE

CONTRACT NO./TITLE CW-I-WP4-2023-05/HOLLANDSE KUST NOORD WIND PARK			SCALE N/A
DRAWN GT	CHECKED MC	APPROVED TM	DATE 05/09/24
A1	DRAWING NO. 1724000437-PR-PID-00018	SHEET 001	REV. 03

File Name : 1724000437-PR-PID-00018

4.4 EPC HFE RECOMMENDATIONS

CROSSWIND

ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK Project

Base Load Power Hub (BLPH)

Action Title: Human Factor Workshop

Action n.: 1

Reference Document n: 123A90-DDL-SAF-RE-30049

Item n.: BLPH Interface level, BLPH Lower deck, BLPH Upper Deck (where applicable considering the presence of rungs)

Cause: requirements from NORSOK S-002, Annex B

Are rungs provided with a non-slip surface?

Consequence: Rungs have a square shape, that prevent slipping off the end of the rungs, but the surface is not classified non-slip surface.

Actions: Consider to provide non-slip surface to the rungs of vertical ladders

Assigned Respondent (By): Rosetti - Structural

Issue date: 27/02/2024

Action Response: As per doc. "Boat landing and ladder", n. 144671-VOOW-TF-ENG-REP-1401, non-slip surfaces will be provided at all ladders.

Approvals / Endorsement:

EPC Discipline Lead / Construction	Date	Sign
A. Balzarotti	02-09-24	Alessandro Balzarotti Digitally signed by Alessandro Balzarotti DN: cn=Alessandro Balzarotti, o, ou=Tecon srl, email=alessandro.balzarotti@teconsrl.it, c=IT Date: 2024.09.04 15:47:03 +02'00'
EPC HSE Lead	**Date**	**Sign**
C. Caracciolo	02-09-24	**CC**
EPC Project Engineering Manager	**Date**	**Sign**
D. Lo Sterzo	**06/09/2024**	
Client	**Date**	**Sign**
N LE BRUN	06/09/2024	LE BRUN Signer ID: 5VSEXLUBO

A check of the clearances between the vessel and the access ladder is included in this section.

According to IMCA (ref. [32], quoted text italic):

"Leave a safe zone between the vessel bow and the boat landing ladder to eliminate the risk of crushing between the vessel and the ladder. The safe zone should provide:

- *A minimum of 500mm clearance between the vessel fender and the ladder rungs*
- *A maximum stepping distance of 650mm between a suitable and safe non-slip surface on the vessel and the ladder on the boat landing.*

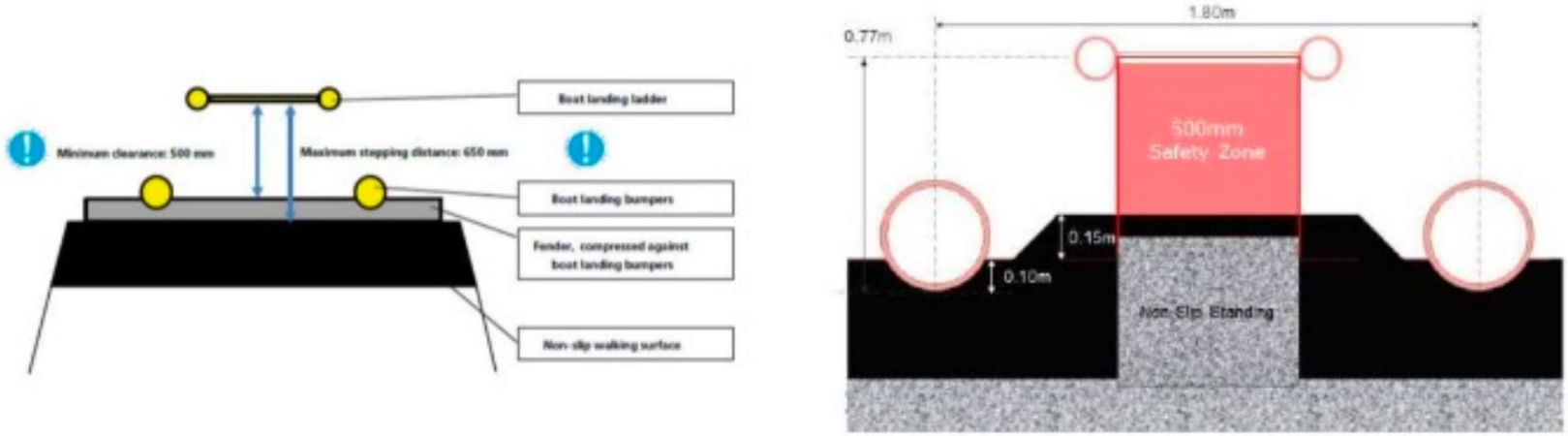


Figure 4-6, IMCA recommendations (ref. [32]).

There is still some room for interpretation in the new guidance and therefore a common interpretation is proposed below:

- *The 500mm clearance should be measured from the face of the fender to the closest point of the rung (not the centreline of the rung or the closest face of the stringer);*
- *The stepping distance of 650mm should be measured from the closest point of the non-slip surface to the centreline of the rung;*

CROSSWIND

ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK Project

Base Load Power Hub (BLPH)

Action Title: Human Factor Workshop

Action n.: 2

Reference Document n: 123A90-DDL-SAF-RE-30049

Item n.: BLPH Interface level

Cause: requirements from DNVGL-OS-A101

Easily accessible muster areas shall be clearly defined on the offshore installation. All muster areas shall be located with direct and ready access to the escape mean or other life-saving appliances.

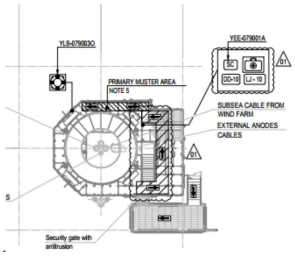
Consequence: Requirement partially satisfied (presence of safety cabinet and other life saving appliances, see 123A90-DDL-SAF-DL-30025)

Actions: Verify the type and position of stair for transition piece entrance in order to avoid possible interference with primary muster point.

Assigned Respondent (By): Rosetti - Structural & Safety

Issue date: 27/02/2024

Action Response: As shown on Escape Route layout, doc. n. 123A90-DDL-SAF-DL-30025 rev 01, no interference is present with the Primary Muster Area moved to the north side of the deck

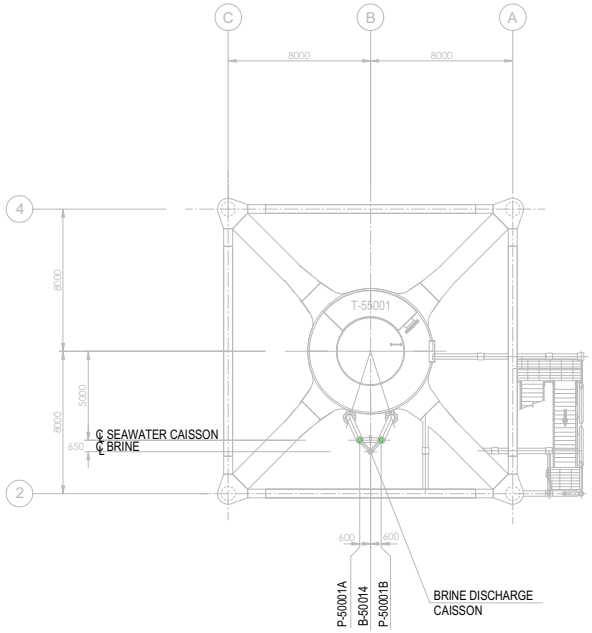


Approvals / Endorsement:

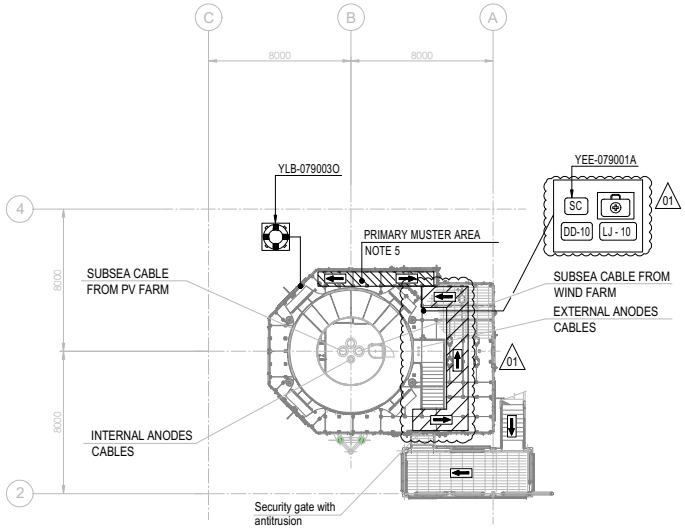
EPC Discipline Lead / Construction	Date	Sign
C.Caracciolo	02-09-24	CC
EPC HSE Lead	**Date**	**Sign**
C. Caracciolo	02.09.24	CC
EPC Project Engineering Manager	**Date**	**Sign**
D. Lo Sterzo	04/09/2024	
Client	**Date**	**Sign**
N LE BRUN	04/09/2024	LE BRUN Signer ID: 5VSEXLUIBO...

DRAWING NO. 123A90-DDL-SAF-DL-30025

REV. 01

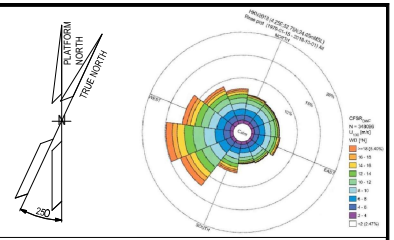


PLAN ON TRANSITION PIECE
EL+21.710 T.O.S.



PLAN ON EXISTING
PLATFORM AT
EL+16.860 T.O.S.

SYMBOL	DESCRIPTION
	LIFE BUOY(FITTED WITH LIGHT, SMOKE SIGNAL & LIFELINE)
	FIRST AID KIT
	01
LJ-XX	LIFE JACKET (INSIDE CABINET)
SC	SAFETY CABINET
DD	DESCENT DEVICE 01



NOTES

1. ALL DIMENSIONS IN mm U.N.O
2. ALL ELEVATIONS IN METERS.
3. PRIMARY ESCAPE ROUTES SHALL BE MINIMUM 1.2m WIDTH AND 2.3m HEIGHT.
4. SECONDARY ESCAPE ROUTES SHALL BE MINIMUM 0.8m WIDTH AND 2.3m HEIGHT.
5. PRIMARY MUSTER AREA SHALL BE SIZED IN ORDER TO PROVIDE SUFFICIENT SPACE FOR THE MAXIMUM POB OF 10 ON THE PLATFORM, CONSIDERING AS MINIMUM 0.8 m^2 PER PERSON.
6. THE EVACUATION PHILOSOPHY IS AS FOLLOW:
   - PRIMARY MEANS OF EVACUATION - VIA PRIMARY MUSTER AREA,LOCATED AT PLATFORM ON TRANSITION PIECE THEN TO CREW TRANSFER VESSEL.
   - SECONADRY MEANS OF EVACUATION - VIA SECONDARY MUSTER AREA, LOCATED AT THE NORTH-EAST CORNER OF THE LOWER DECK, THEN TO LIFERAFTS.
7. ESCAPE MASKS, ELECTRICAL SAFETY KIT, RESUSCITATION UNIT, IMMERSION SUITS, LIFE JACKET AND FIRST AID KID TO BE LOCATED IN WEATHERPROOF CABINETS, AT STRATEGIC POSITIONS.
8. EACH LIFERAFT TO BE SIZED FOR MAXIMUM POB OF 10 PERSONS.
9. 2 NOS. OF PORTABLE CO2 EXTINGUISHERS TO BE LOCATED IN EACH ROOM (ITER, HV & LV ROOMS AND UPS ROOM).
10. EYEWASH BOTTLES TO BE PORTABLE AND CARRIED BY OPERATORS ONLY DURING MAINTENACE PERIOD.
11. ALL PORTABLE EXTINGUISHERS LOCATED IN OPEN AREA WILL BE EQUIPPED WITH A WEATHERPROOF CABINET. (01)
12. LIFE RAFT ACCESS WILL BE GUARANTED BY MEANS OF DESCENT DEVICE.

LEGEND

PRIMARY ESCAPE ROUTE

SECONDARY ESCAPE ROUTE

HOLDS

REFERENCE DOCUMENTS

123A90-DDL-PP-DS-70071	PLOT PLAN - BELOW LOWER DECK

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
01	10/07/24	MMA	CCA	DLO	ACCEPTED FOR CONSTRUCTION (AFC)
0	31/01/24	MMA	CCA	DLO	ISSUE FOR REVIEW (IFR)

CROSSWIND

ROSETTI MARINO

TITLE :
ESCAPE ROUTES, FIRE FIGHTING, LIFE SAVING EQUIPMENT AND SAFETY EQUIPMENT LAYOUTS DRAWINGS

CONTRACT NO./TITLE CW-I-WP4-2023-05/HOLLANDSE KUST NOORD WIND PARK			SCALE 1:150
DRAWN M. MAGNI	CHECKED C. CARACCIOLO	APPROVED D. LO STERZO	DATE 10/07/24
A1	DRAWING NO. 123A90-DDL-SAF-DL-30025	SHEET 001	REV. 01

File Name : 123A90-DDL-SAF-DL-30025 Rev.01

CROSSWIND

ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK Project

Base Load Power Hub (BLPH)

Action Title: Human Factor Workshop

Action n.: 3

Reference Document n: 123A90-DDL-SAF-RE-30049

Item n.: BLPH Lower deck workplaces and equipment inspection activities

Cause: requirements from NORSOK S-002, Annex B

Are horizontal workspaces for fixed equipment minimum 700 mm?

Consequence: Position of the pumps and related piping is not yet defined.

Actions: Ensure adequate space for maintenance activities of water pumps in the final position.

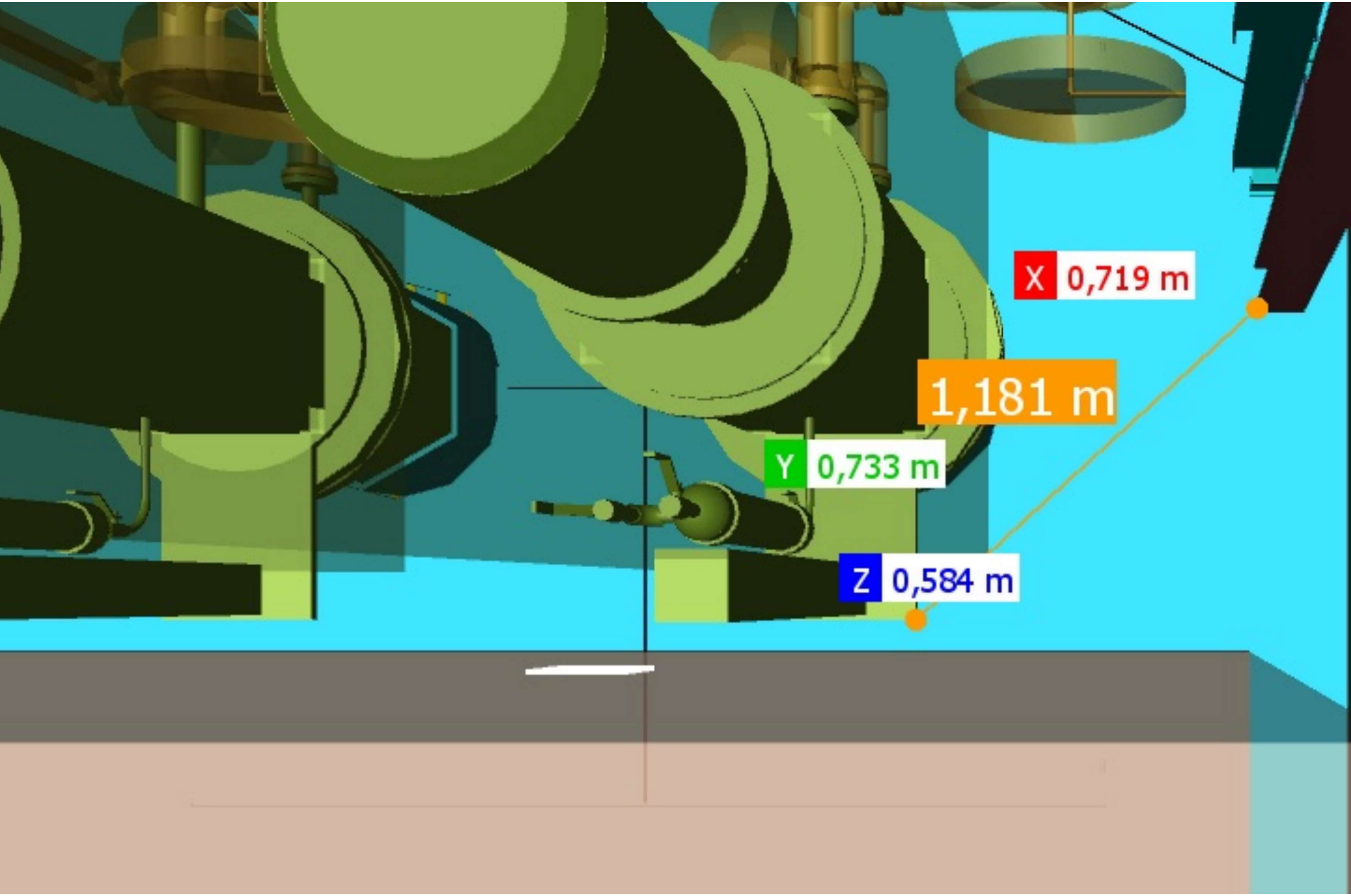
Assigned Respondent (By): Rosetti - Piping

Issue date: 27/02/2024

Action Response: **Adequate space for maintenance has been provided as shown in the 3D model, refer to below 3D model snapdhot.**

Approvals / Endorsement:

EPC Discipline Lead / Construction	Date	Sign
C. Bortolin	02-09-24	
EPC HSE Lead	**Date**	**Sign**
C. Caracciolo	02-09-24	CC
EPC Project Engineering Manager	**Date**	**Sign**
D. Lo Sterzo	04/09/2024	
Client	**Date**	**Sign**
N LE BRUN	04/09/2024	LE BRUN Signer ID: 5V7SEXLUIBO...


X 0,719 m
1,181 m
Y 0,733 m
Z 0,584 m

CROSSWIND

ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK Project

Base Load Power Hub (BLPH)

Action Title: Human Factor Workshop

Action n.: 4

Reference Document n: 123A90-DDL-SAF-RE-30049

Item n.: BLPH Lower deck workplaces and equipment inspection activities

Cause: requirements from NORSOK S-002, Annex B

Are spaces between external diameter of flanges and fixed obstructions min. 250 mm?

Consequence: BL of WTP piping not finalized at the present project stage

Actions: Ensure adequate space for maintenance activities for flanges/ valves near the WTP

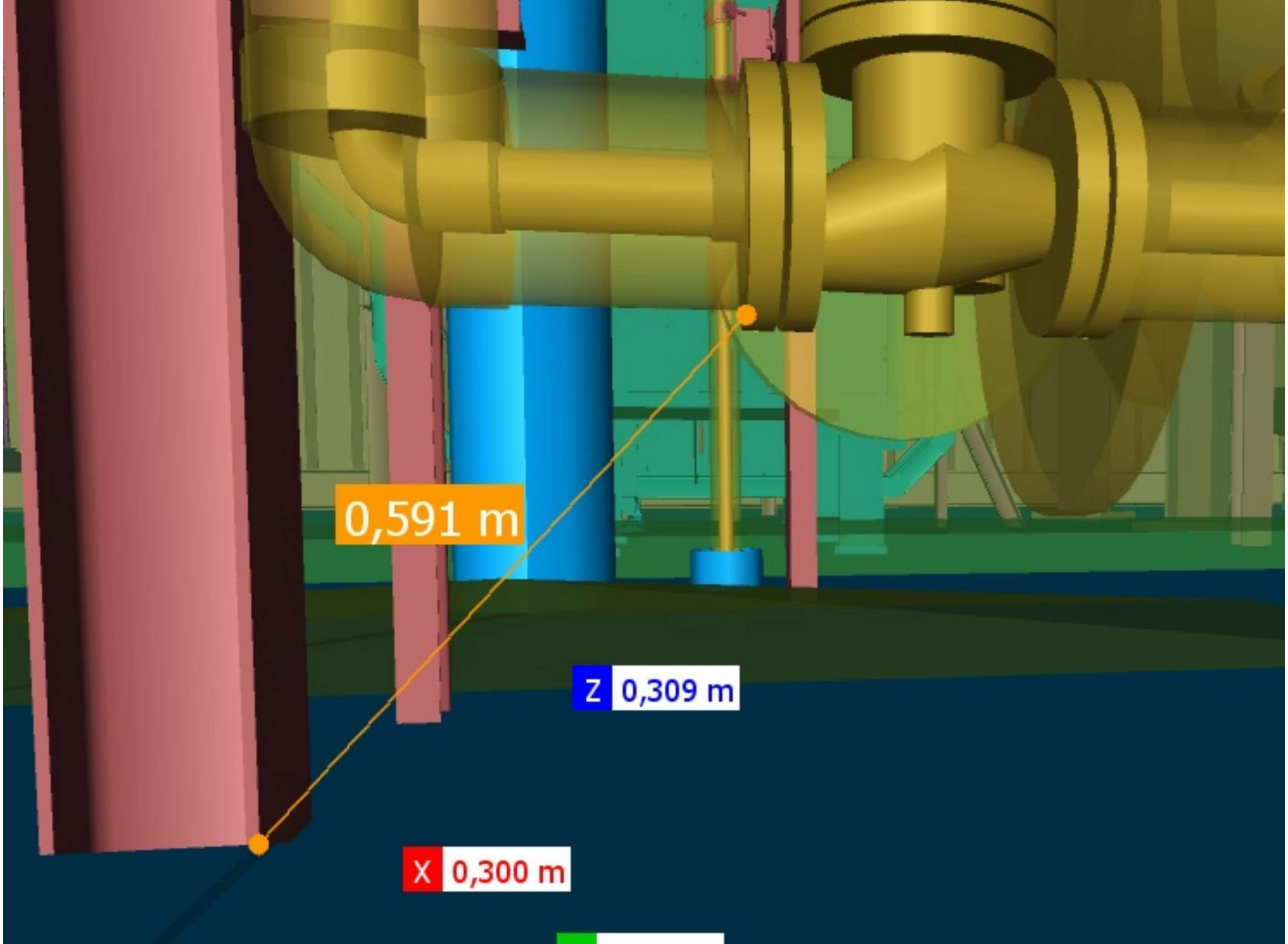
Assigned Respondent (By): Rosetti - Piping

Issue date: 27/02/2024

Action Response: **Requisite is complied with as shown on below extract from 3D model (eg. flange shown in the 3D model snapshot is at z = 309mm.**

Approvals / Endorsement:

EPC Discipline Lead / Construction	**Date**	**Sign**
C. Bortolin	**03-09-24**	
EPC HSE Lead	**Date**	**Sign**
C. Caracciolo	**03-09-24**	**CC**
EPC Project Engineering Manager	**Date**	**Sign**
D. Lo Sterzo	04/09/2024	
Client	**Date**	**Sign**
N LE BRUN	04/09/2024	LE BRUN Signer ID: 5VSEXLUIBQ...


0,591 m
Z 0,309 m
X 0,300 m

CROSSWIND

ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK Project

Base Load Power Hub (BLPH)

Action Title: Human Factor Workshop

Action n.: 7

Reference Document n: 123A90-DDL-SAF-RE-30049

Item n.: BLPH Lower deck workplaces and equipment inspection activities

Cause: requirements from NORSOK S-002, Annex B

Are access opening in vertical partitions into cofferdam, tanks etc. equipped with hand grips on both sides above the opening?

Consequence: To date, the access is not yet defined in the 3D model.

Actions: Ensure that the access will be equipped with vertical ladder to reach equipment on top of TP

Assigned Respondent (By): Rosetti – Structural

Issue date: 27/02/2024

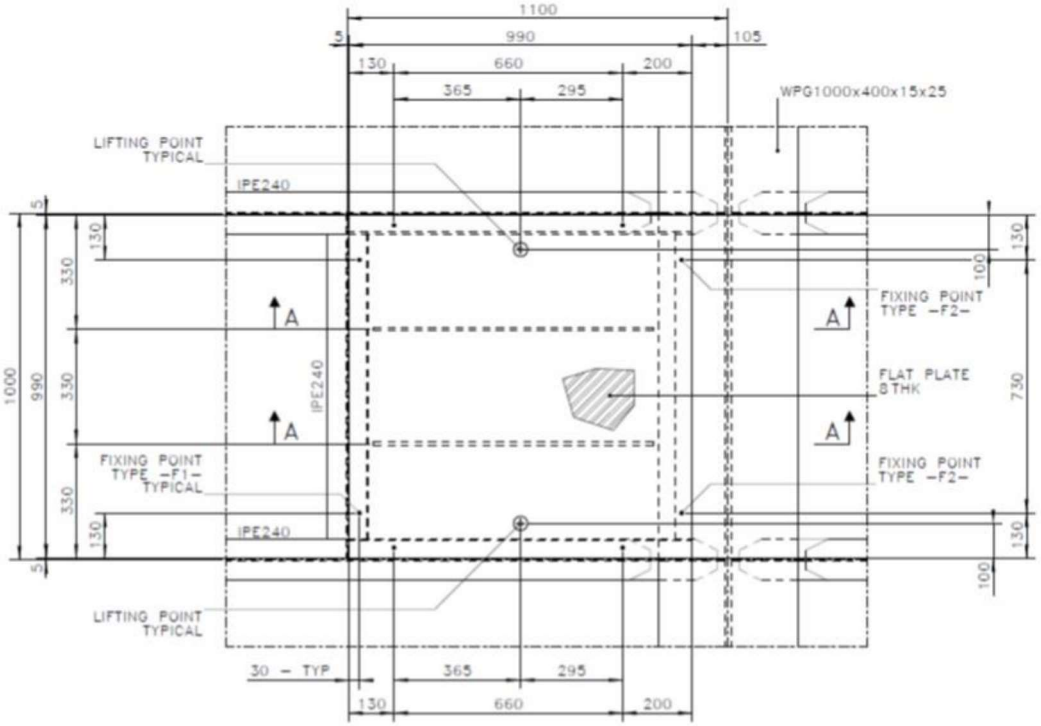
Action Response: Access to the top of the TP is through a removable cover on the lower deck. Access to the top of the TP is only foreseen in exceptional cases due to the overhead height of 600mm.

Therefore, no access ladder is provided, but a temporary aluminum ladder will be fitted if deemed necessary.

Ref drawing of temporary hatch is 123A90-DDL-ST-DD-90122_01

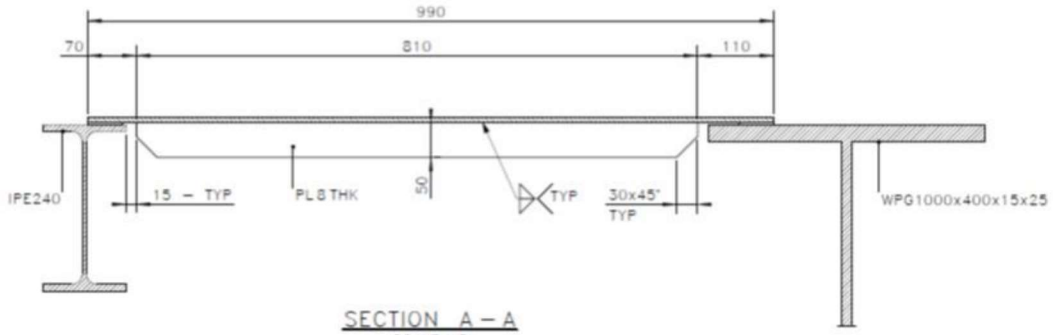
Approvals / Endorsement:

EPC Discipline Lead / Construction	**Date**	**Sign**
A.Balzarotti	**03-09-2024**	Alessandro Balzarotti Digitally signed by Alessandro Balzarotti DN: cn=Alessandro Balzarotti, o=Rosetti Marino, ou=Engineering, email=alessandro.balzarotti@teconsrl.it, c=IT Date: 2024.09.06 10:30:08 +02'00'
EPC HSE Lead	**Date**	**Sign**
C. Caracciolo	**03-09-2024**	
EPC Project Engineering Manager	**Date**	**Sign**
D. Lo Sterzo	**06/09/2024**	
Client	**Date**	**Sign**
N LE BRUN	06/09/2024	LE BRUN Signer ID: 5VSEXLUIBO...



HATCH - PLAN VIEW

SCALE 1:10



SECTION A - A

SCALE 1:5

CROSSWIND

ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK Project

Base Load Power Hub (BLPH)

Action Title: Human Factor Workshop

Action n.: 6

Reference Document n: 123A90-DDL-SAF-RE-30049

Item n.: BLPH Lower deck workplaces and equipment inspection activities

Cause: requirements from NORSOK S-002, 5.4.1, NORSOK S-DP-003

Are drip trays provided under all sampling / filling points and other places where spillage might occur?

Consequence: Drip trays are not provided under biocide sampling point, but deck is plated. The risk to spillage in the sea is negligible.

Actions: Rosetti to investigate if sample collection is needed to check biocide concentration.

Assigned Respondent (By): Rosetti - Process

Issue date: 27/02/2024

Action Response: As per water treatment package no sample collection point is included on tank biocide. Sample points are at intermediate system to ensure performance of the water treatment package.

Approvals / Endorsement:

EPC Discipline Lead / Construction	Date	Sign
F. Mura	03-09-24	
EPC HSE Lead	**Date**	**Sign**
C. Caracciolo	03-09-24	CC
EPC Project Engineering Manager	**Date**	**Sign**
D. Lo Sterzo	04/09/2024	
Client	**Date**	**Sign**
N LE BRUN	04/09/2024	LE BRUN Signer ID: 5VSEXLUIBO...

DRAWING NO. 1724000448-PR-PID-00013

REV. 02

MANUAL VALVES

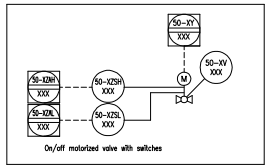
- GATE VALVE
- BALL VALVE
- CHECK VALVE
- NEEDLE VALVE
- "Y" TYPE FILTER
- DIAPHRAGM VALVE
- AUTOMATIC AIR VENT VALVE

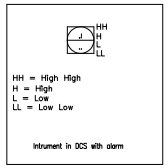
OPERATED VALVES

- MOTORIZED ACTUATOR ON-OFF BALL VALVE
- PRESSURE SAFETY VALVE

OTHER SYMBOLS

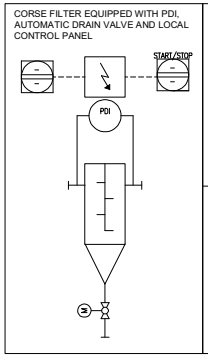
- Local instrument
- Instrument in DCS
- Interlock in DCS
- Software signal
- Electric signal

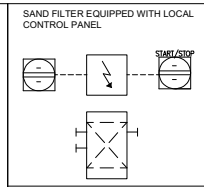


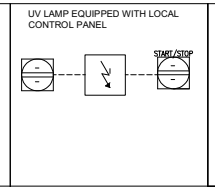


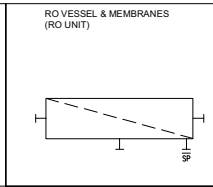
INSTRUMENTS IDENTIFICATION – REFER TO ISA S5.1 FOR DETAILS

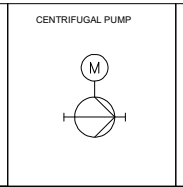
Letter	FIRST LETTER	LETTERS FOLLOW		
	Measure or process variable	Modification	Letter or passive function	Output function
A	Analysis		Alarm	
B	Flame detection		Optional user	Optional user
C	Conductivity	Control		Regulation
D	Density	Differential		
E	Electrical voltage	Element	Primary el.	
F	Flow	Relationship		
G	Choice user			
H	Manual override			
I	Electricity		Indication	
J	Power	Scansion		
K	Time schedule or time	Rate of change		
L	Level		Light	
M	Choice user	Momentary or instant.		
N	Choice user		Optional user	Optional user
O	Choice user		Orifice or restriction	
P	Pressure		Handheld	
Q	Quantity	Full or score.		
R	Radioactivity		Registration	
S	Speed or frequency	Security		Interruption
T	Temperature	Transmitter		Transmission
U	General alarm			Multifunction
V	Vibration or mechanical analysis	Valve	Valve	
W	Weight or force		Well or sheath	
X	Variable unclassified	X axis	Not rated	Not rated
Y	State or event	Y axis		Computing module
Z	Position or size	Z axis		

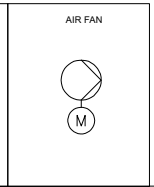


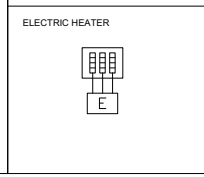


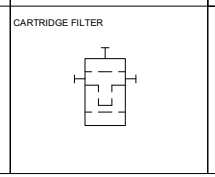


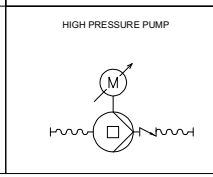


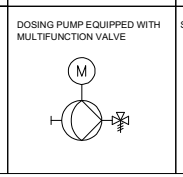


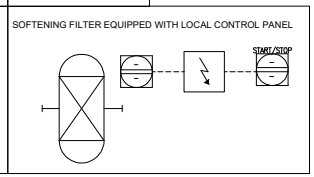












PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
02	22-AUG-24	UR	WR	RM	ISSUED FOR REVIEW
01	29-MAY-24	GG	WR	RM	ISSUED FOR REVIEW
00	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

ROSETTI MARINO

TITLE :
WATER TREATMENT PACKAGE
SEA WATER FINE FILTRATION
P&I DIAGRAM

CONTRACT NO./TITLE | SCALE –

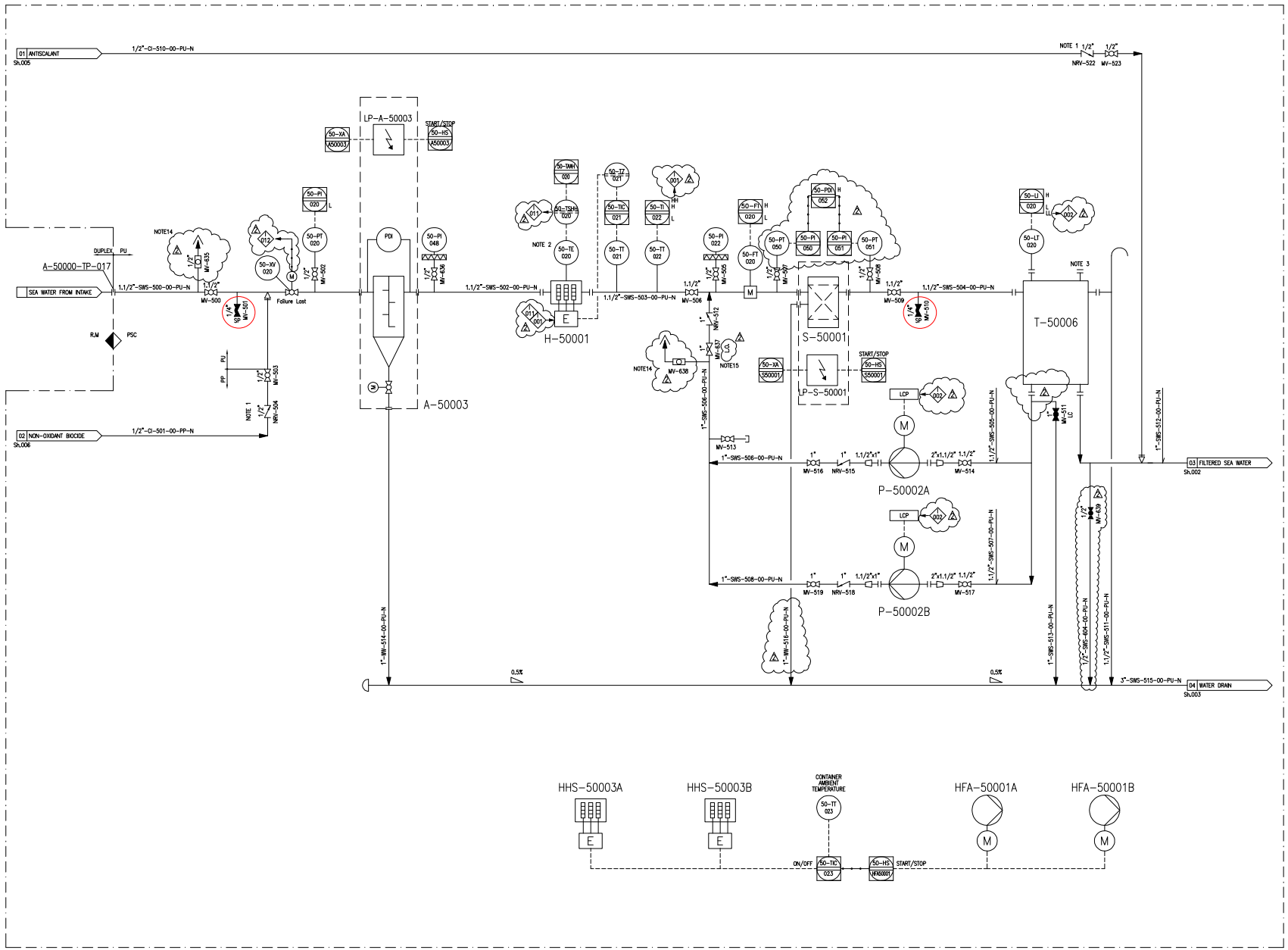
DRAWN UR | CHECKED WR | APPROVED RM | DATE 22/08/24

A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 001 | REV. 02

File Name : 1724000448-PR-PID-00013 Rev02

DRAWING NO. 1724000448-PR-PID-00013

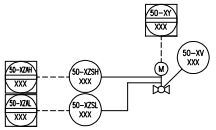
REV. 2



TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-002	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-003	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-005	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTAKE
TP-006	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-007	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

TYPICAL FOR ON/OFF BALL VALVES



NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: BLPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOUS BIOCIDE DOSAGE TO INTAKE PUMP: CONTINUOUS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOUS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE
14	AUTOMATIC AIR VENT VALVE
15	POSITION TO BE DEFINED DURING COMMISSIONING
16	POLYAMIDE TUBING (RILSAN TYPE)
17	CHECK VALVE (NO SPRING TYPE)
18	DRAIN PAN FOR ANALYZER. DRAIN PAN VOLUME= 5 L

A-50003	
SEA WATER COARSE FILTER	
FILTRATION RATE	125 µm
CAPACITY	2.5 m3/h
DES. PRESS.	5 barg
DES. TEMP.	50° C
MATERIAL	PLASTIC MAT.

H-50001	
ELECTRIC HEATER	
POWER	30 kW
CAPACITY	2.5 m3/h
DES. PRESS.	6 barg
DES. TEMP.	60° C
MATERIAL	PVC-TITANIUM

S-50001	
SAND FILTER	
TYPE	PRESSURE,VERTICAL
CAPACITY	2.5 m3/h
DES. PRESS.	7 barg
DES. TEMP.	50° C
MATERIAL	FRP

T-50006	
FILTERED WATER TANK	
VOLUME	3 m3
DES. PRESS.	ATM
DES. TEMP.	50° C
MATERIAL	FRP

P-50002A/B	
BACKWASH PUMP	
TYPE	CENTRIFUGAL
DES. PRESSURE	6 barg
CAPACITY	5 m3/h
HEAD	0,50 barg
DES. TEMP.	60 °C
MATERIAL	PP

HHS-50003A/B	
CONTAINER ELECTRICAL HEATER	
POWER	8.4 kW
DES. PRESS.	ATM
DES. TEMP.	65°C

HFA-50001A/B	
CONTAINER AIR FAN	
POWER	110 W
DES. PRESS.	ATM
DES. TEMP.	60°C

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
02	22-AUG-24	UR	WR	RM	ISSUED FOR REVIEW
01	29-MAY-24	GG	WR	RM	ISSUED FOR REVIEW
00	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

ROSETTI MARINO

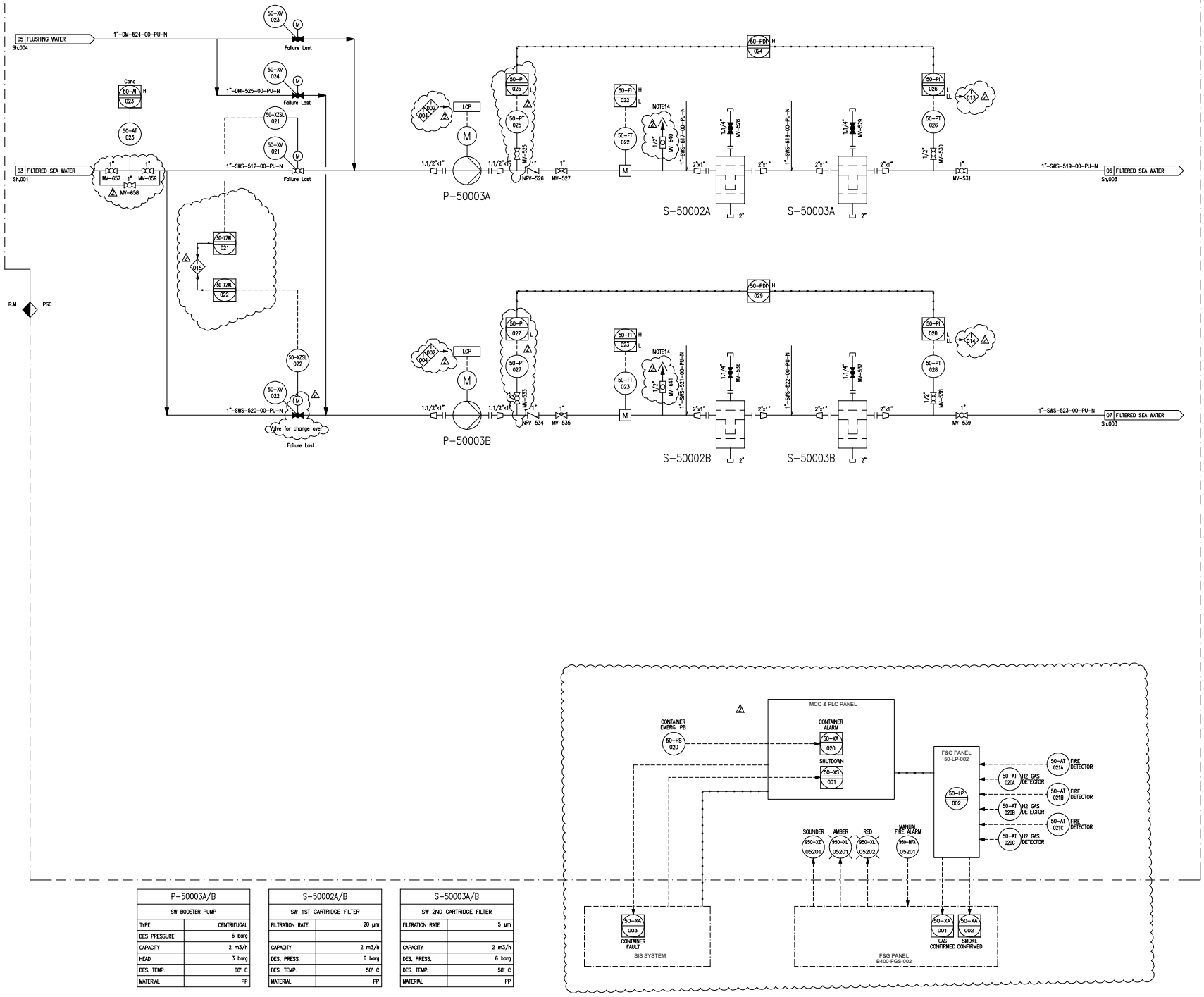
TITLE : WATER TREATMENT PACKAGE
SEA WATER FINE FILTRATION
P&I DIAGRAM

CONTRACT NO./TITLE			SCALE –
DRAWN UR	CHECKED WR	APPROVED RM	DATE 22/08/24
A1	DRAWING NO. 1724000448-PR-PID-00013	SHEET 002	REV. 02

File Name : 1724000448-PR-PID-00013 Rev02

DRAWING NO. 1724000448-PR-PID-00013

REV. 2



P-50003A/B	
SW BOOSTER PUMP	
TYPE	CENTRIFUGAL
DES PRESSURE	6 barg
CAPACITY	2 m3/h
HEAD	3 barg
DES. TEMP.	60° C
MATERIAL	PP

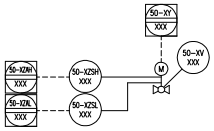
S-50002A/B	
SW 1ST CARTRIDGE FILTER	
FILTRATION RATE	20 µm
CAPACITY	2 m3/h
DES. PRESS.	6 barg
DES. TEMP.	50° C
MATERIAL	PP

S-50003A/B	
SW 2ND CARTRIDGE FILTER	
FILTRATION RATE	5 µm
CAPACITY	2 m3/h
DES. PRESS.	6 barg
DES. TEMP.	50° C
MATERIAL	PP

TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-002	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-003	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-005	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTAKE
TP-006	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-007	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

TYPICAL FOR ON/OFF BALL VALVES



NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: BLPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOUS BIOCIDE DOSAGE TO INTAKE PUMP: DISCONTINUOUS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOUS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE
14	AUTOMATIC AIR VENT VALVE
15	POSITION TO BE DEFINED DURING COMMISSIONING
16	POLYAMIDE TUBING (RILSAN TYPE)
17	CHECK VALVE (NO SPRING TYPE)
18	DRAIN PAN FOR ANALYZER. DRAIN PAN VOLUME= 5 L

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
02	22-AUG-24	UR	WR	RM	ISSUED FOR REVIEW
01	29-MAY-24	GG	WR	RM	ISSUED FOR REVIEW
00	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

ROSETTI MARINO

TITLE :
WATER TREATMENT PACKAGE
SEA WATER FINE FILTRATION
P&I DIAGRAM

CONTRACT NO./TITLE | SCALE –

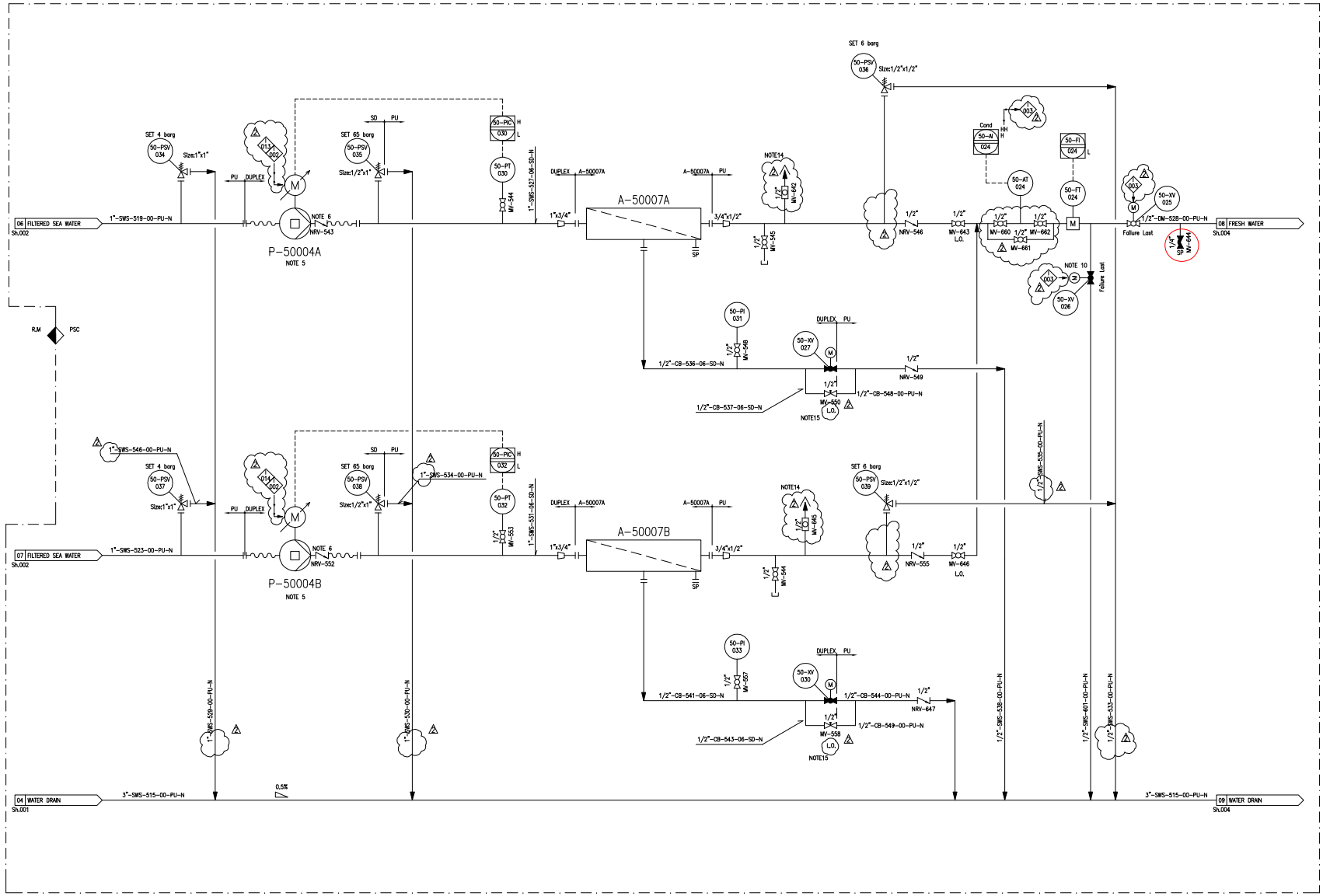
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A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 003 | REV. 02

File Name : 1724000448-PR-PID-00013 Rev02

DRAWING NO. 1724000448-PR-PID-00013

REV. 2



TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-002	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-003	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-005	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTAKE
TP-006	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-007	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: BLPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOUS BIOCIDE DOSAGE TO INTAKE PUMP: DISCONTINUOUS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOUS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE
14	AUTOMATIC AIR VENT VALVE
15	POSITION TO BE DEFINED DURING COMMISSIONING
16	POLYAMIDE TUBING (RILSAN TYPE)
17	CHECK VALVE (NO SPRING TYPE)
18	DRAIN PAN FOR ANALYZER. DRAIN PAN VOLUME= 5 L

P-50004A/B	
HP PUMP	
TYPE	AXIAL ROTATING PISTONS
DES PRESSURE	83 barg
CAPACITY	2 m3/h
HEAD	63,5 barg
DES. TEMP.	50° C
MATERIAL	SS DUPLEX

A-50007A/B	
SEA WATER REVERSE OSMOSIS UNITS	
CAPACITY	0.8 m3/h
DES. PRESS.	69 barg
DES. TEMP.	45° C
MATERIAL	FRP

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
02	22-AUG-24	UR	WR	RM	ISSUED FOR REVIEW
01	29-MAY-24	GG	WR	RM	ISSUED FOR REVIEW
00	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

ROSETTI MARINO

TITLE : WATER TREATMENT PACKAGE
SEA WATER REVERSE OSMOSIS
P&I DIAGRAM

CONTRACT NO./TITLE | SCALE -

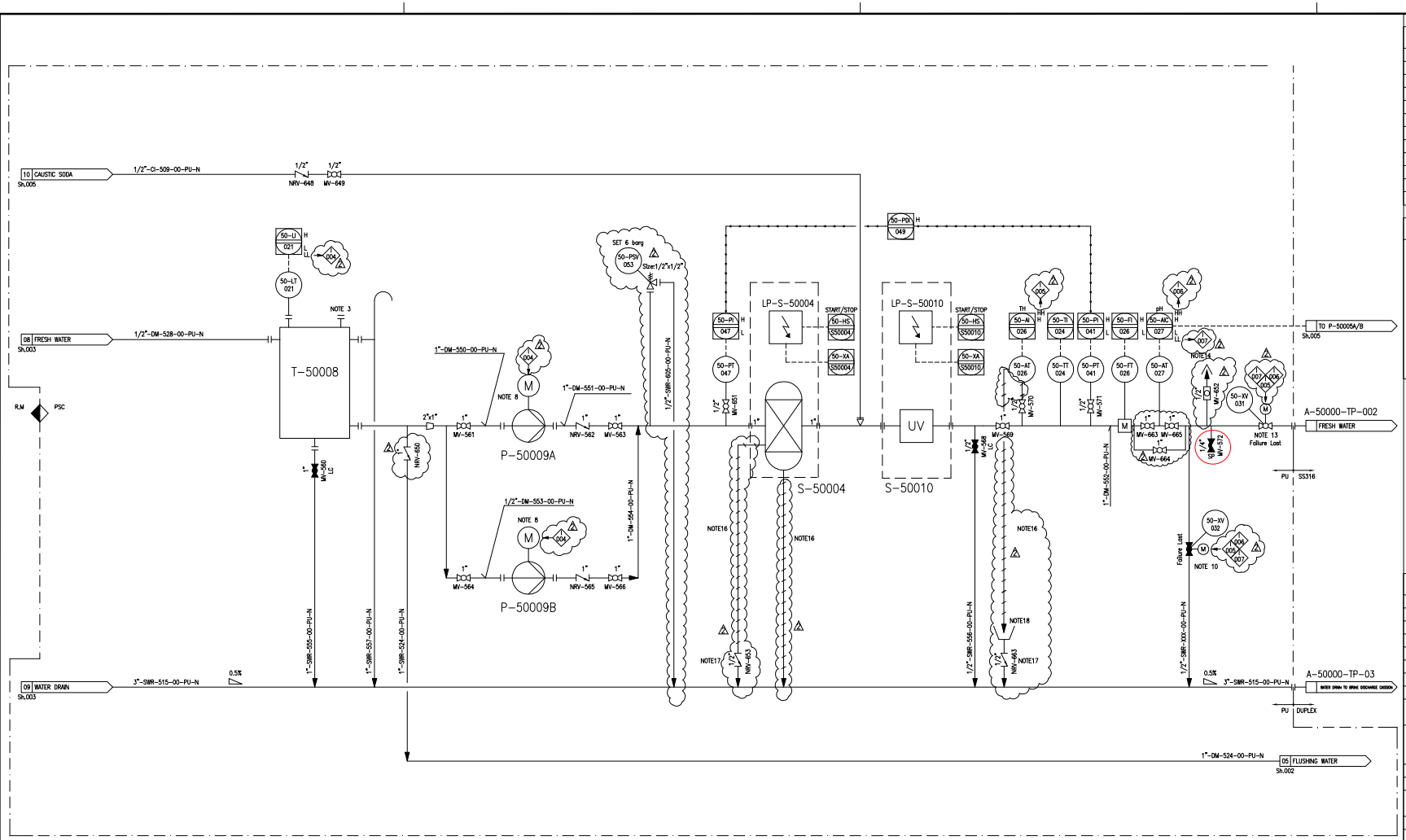
DRAWN UR | CHECKED WR | APPROVED RM | DATE 22/08/24

A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 004 | REV. 02

File Name : 1724000448-PR-PID-00013 Rev02

DRAWING NO. 1724000448-PR-PID-00013

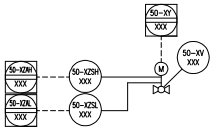
REV. 2



TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-002	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-003	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-005	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTAKE
TP-006	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-007	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

TYPICAL FOR ON/OFF BALL VALVES



NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: ELPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOUS BIOCIDE DOSAGE TO INTAKE PUMP: DISCONTINUOUS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOUS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE
14	AUTOMATIC AIR VENT VALVE
15	POSITION TO BE DEFINED DURING COMMISSIONING
16	POLYAMIDE TUBING (RILSAN TYPE)
17	CHECK VALVE (NO SPRING TYPE)
18	DRAIN PAN FOR ANALYZER. DRAIN PAN VOLUME= 5 L

T-50008	
FRESH WATER TANK	
VOLUME	2.2 m3
DES. PRESS.	ATM
DES. TEMP.	50° C
MATERIAL	FRP

P-50009A/B	
FRESH WATER PUMP	
TYPE	CENTRIFUGAL
DES PRESSURE	25 barg
CAPACITY	0.8 m3/h
HEAD NOTE 11	4.2 barg
DES. TEMP.	120° C
MATERIAL	SS 316L

S-50010	
UV STERILIZER	
CAPACITY	0,8 m3/h
DES. PRESS.	8 barg
DES. TEMP.	50° C
MATERIAL	SS 316

S-50004	
SOFTENING FILTER	
CAPACITY	0,8 m3/h
DES. PRESS.	6 barg
DES. TEMP.	40° C
MATERIAL	FRP-PLASTIC

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
02	22-AUG-24	UR	WR	RM	ISSUED FOR REVIEW
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00	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

ROSETTI MARINO

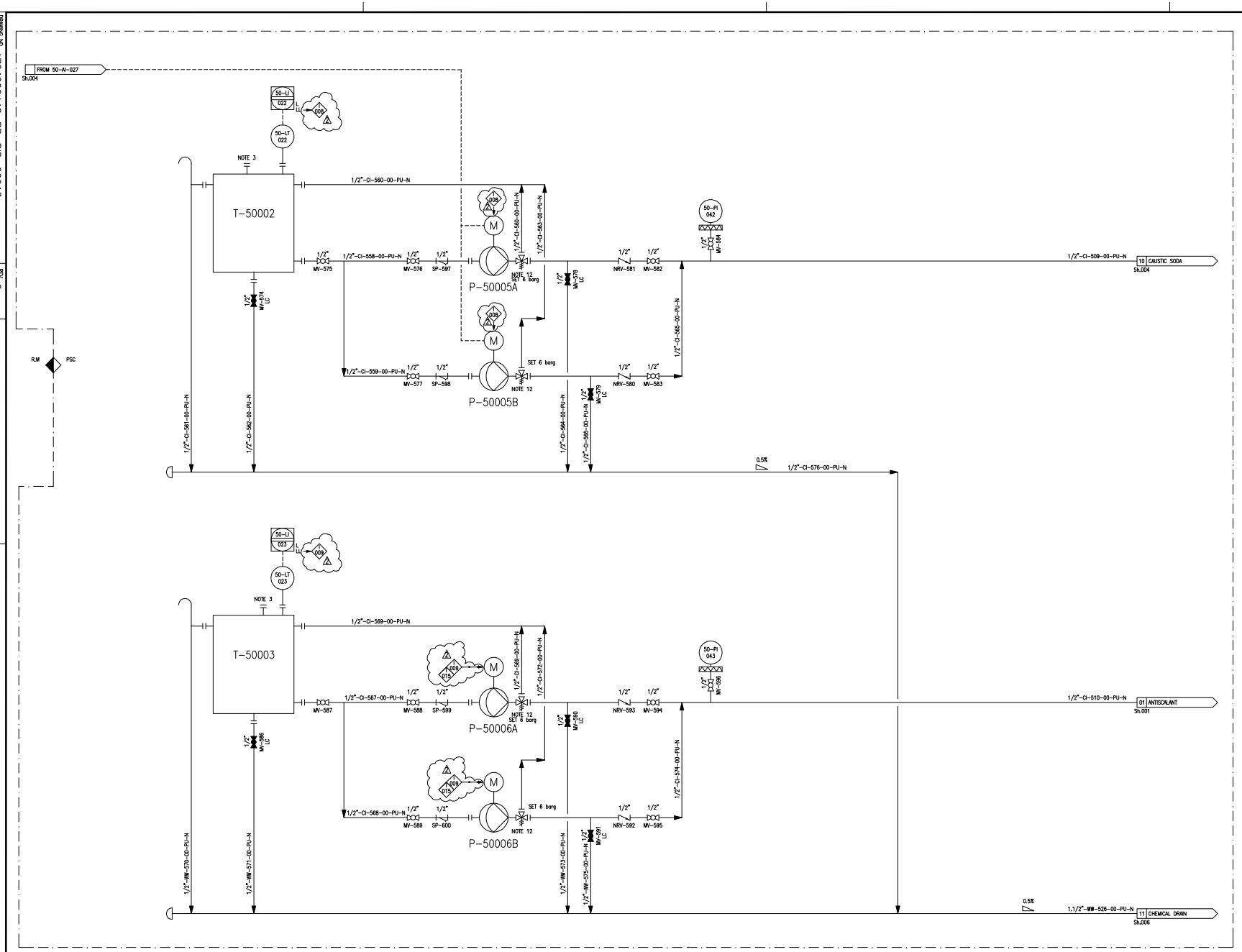
TITLE :
WATER TREATMENT PACKAGE
FRESH WATER STORAGE
P&I DIAGRAM

CONTRACT NO./TITLE | SCALE –

DRAWN UR | CHECKED WR | APPROVED RM | DATE 22/08/24

A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 005 | REV. 02

File Name : 1724000448-PR-PID-00013 Rev02



T-50002	
CAUSTIC SODA DOSING TANK	
VOLUME	0,05 m3
DES. PRESS.	ATM
DES. TEMP.	45° C
MATERIAL	PE

P-50005A/B	
CAUSTIC SODA DOSING PUMP	
TYPE	METERING DIAPHRAGM
DES PRESSURE	10 barg
CAPACITY	0,05 l/h
HEAD	3 barg
DES. TEMP.	45° C
MATERIAL	PVC

T-50003	
ANTISCALANT DOSING TANK	
VOLUME	0,05 m3
DES. PRESS.	ATM
DES. TEMP.	45° C
MATERIAL	PE

P-50006A/B	
ANTISCALANT DOSING PUMP	
TYPE	METERING DIAPHRAGM
DES PRESSURE	10 barg
CAPACITY	0.01 l/h
HEAD	3 barg
DES. TEMP.	45° C
MATERIAL	PVC

TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-002	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-003	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-005	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTAKE
TP-006	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-007	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: BLPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOUS BIOCIDE DOSAGE TO INTAKE PUMP: DISCONTINUOUS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOUS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE
14	AUTOMATIC AIR VENT VALVE
15	POSITION TO BE DEFINED DURING COMMISSIONING
16	POLYAMIDE TUBING (RILSAN TYPE)
17	CHECK VALVE (NO SPRING TYPE)
18	DRAIN PAN FOR ANALYZER. DRAIN PAN VOLUME= 5 L

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
02	22-AUG-24	UR	WR	RM	ISSUED FOR REVIEW
01	29-MAY-24	GG	WR	RM	ISSUED FOR REVIEW
00	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

ROSETTI MARINO

TITLE :
WATER TREATMENT PACKAGE
ACID & ANTISCALANT DOSAGES
P&I DIAGRAM

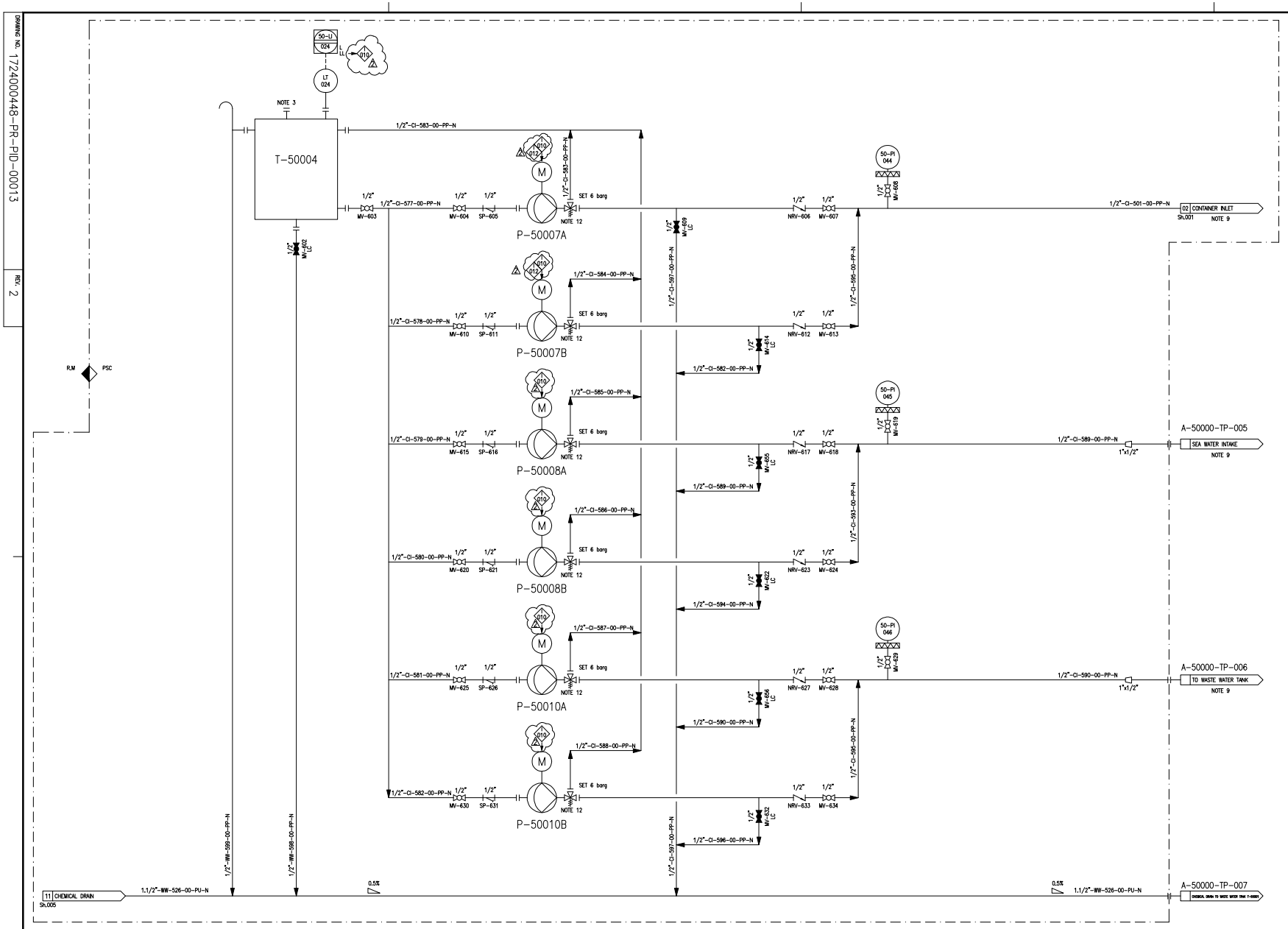
CONTRACT NO./TITLE | SCALE –

DRAWN UR | CHECKED WR | APPROVED RM | DATE 22/08/24

A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 006 | REV. 02

DRAWING NO. 1724000448-PR-PID-00013 | REV. 2

File Name : 1724000448-PR-PID-00013 Rev02



TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-002	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-003	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-005	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTAKE
TP-006	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-007	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: BLPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOUS BIOCIDE DOSAGE TO INTAKE PUMP: DISCONTINUOUS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOUS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE
14	AUTOMATIC AIR VENT VALVE
15	POSITION TO BE DEFINED DURING COMMISSIONING
16	POLYAMIDE TUBING (RILSAN TYPE)
17	CHECK VALVE (NO SPRING TYPE)
18	DRAIN PAN FOR ANALYZER. DRAIN PAN VOLUME= 5 L

T-50004	
NON-OXIDANT BIOCIDE DOSING TANK	
VOLUME	0.1 m3
DES. PRESS.	ATM
DES. TEMP.	45° C
MATERIAL	PE

P-50007A/B	
NON-OXIDANT BIOCIDE DOSING PUMP – CONTAINER INLET	
TYPE	METERING DIAPHRAGM
DES PRESSURE	10 barg
CAPACITY	0,03 l/h
HEAD	3.5 barg
DES. TEMP.	45° C
MATERIAL	PVC

P-50008A/B	
NON-OXIDANT BIOCIDE DOSING PUMP – SEA WATER INTAKE	
TYPE	METERING DIAPHRAGM
DES PRESSURE	10 barg
CAPACITY	0,85 l/h
HEAD	3.5 barg
DES. TEMP.	45° C
MATERIAL	PVC

P-50010A/B	
NON-OXIDANT BIOCIDE DOSING PUMP – WASTE WATER TANK	
TYPE	METERING DIAPHRAGM
DES PRESSURE	10 barg
CAPACITY	0,33 l/h
HEAD	3.5 barg
DES. TEMP.	45° C
MATERIAL	PVC

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
02	22-AUG-24	UR	WR	RM	ISSUED FOR REVIEW
01	29-MAY-24	GG	WR	RM	ISSUED FOR REVIEW
00	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

ROSETTI MARINO

TITLE : WATER TREATMENT PACKAGE
BIOCIDE DOSAGE
P&I DIAGRAM

CONTRACT NO./TITLE | SCALE –

DRAWN UR | CHECKED WR | APPROVED RM | DATE 22/08/24

A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 007 | REV. 02

DRAWING NO. 1724000448-PR-PID-00013 REV. 2

File Name : 1724000448-PR-PID-00013 Rev02

CROSSWIND

ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK Project

Base Load Power Hub (BLPH)

Action Title: Human Factor Workshop

Action n.: 7

Reference Document n: 123A90-DDL-SAF-RE-30049

Item n.: BLPH Lower deck technical rooms

Cause: requirements from NORSOK S-002, Annex B

Are centre heights of control devices for standing operations (including valve handles) max. 1800 mm above base?

Are the centre heights of control devices for normal operation controls and for controls where access in an emergency is required 900-1500 mm above base?

Consequence: Requirement partially satisfied (all cabinets are installed > 1800 mm).

Actions: Rosetti to provide portable step ladders in case of operation in the top of cabinets.

Assigned Respondent (By): Rosetti - Architectural

Issue date: 27/02/2024

Action Response: **Height of the steps will be adjustable in order to adapt to each container door. The ladders weight will not exceed a normal weight to be lifted from/to inside containers.**

Approvals / Endorsement:

EPC Discipline Lead / Construction	**Date**	**Sign**
M. Gatti	**03-09-24**	Maurizio Gatti — Autore firma digitale: Maurizio Gatti; Nome distintivo: CN = Maurizio Gatti email = maurizio.gatti@rosetti.it C = IT O = Rosetti Marino SpA; Data: 2024.09.04 12:59:13 +02'00'
EPC HSE Lead	**Date**	**Sign**
C. Caracciolo	**03-09-24**	**CC**
EPC Project Engineering Manager	**Date**	**Sign**
D. Lo Sterzo	**04/09/2024**	
Client	**Date**	**Sign**
N LE BRUN	06/09/2024	LE BRUN — Signer ID: 5VSEXLUIBO...

CROSSWIND

ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK Project

Base Load Power Hub (BLPH)

Action Title: Human Factor Workshop

Action n.: 2

Reference Document n: 123A90-DDL-SAF-RE-30049

Item n.: BLPH Interface level

Cause: requirements from DNVGL-OS-A101

Easily accessible muster areas shall be clearly defined on the offshore installation. All muster areas shall be located with direct and ready access to the escape mean or other life-saving appliances.

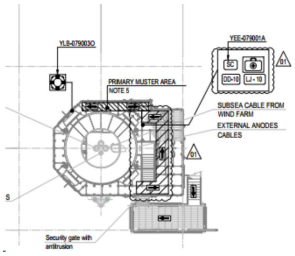
Consequence: Requirement partially satisfied (presence of safety cabinet and other life saving appliances, see 123A90-DDL-SAF-DL-30025)

Actions: Verify the type and position of stair for transition piece entrance in order to avoid possible interference with primary muster point.

Assigned Respondent (By): Rosetti - Structural & Safety

Issue date: 27/02/2024

Action Response: As shown on Escape Route layout, doc. n. 123A90-DDL-SAF-DL-30025 rev 01, no interference is present with the Primary Muster Area moved to the north side of the deck

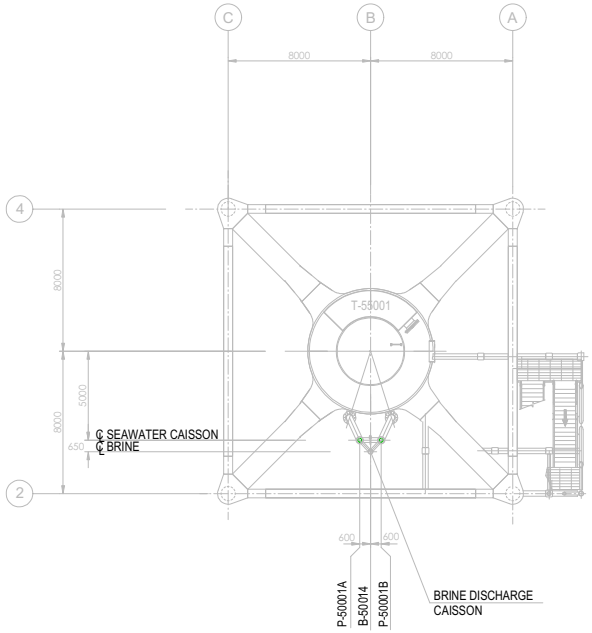


Approvals / Endorsement:

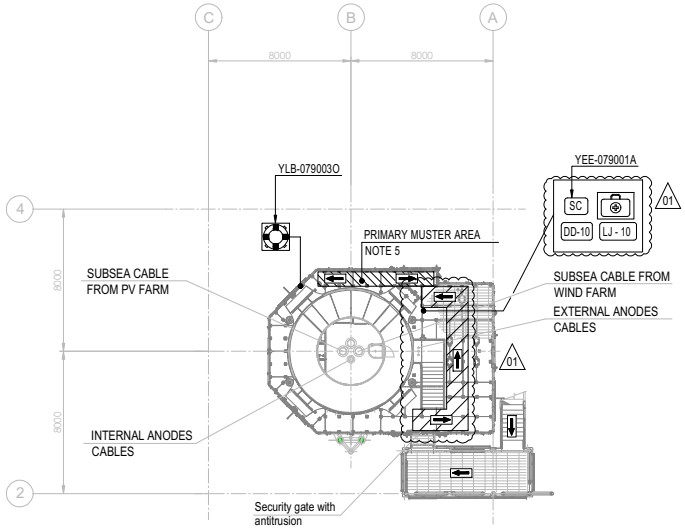
EPC Discipline Lead / Construction	Date	Sign
C.Caracciolo	02-09-24	CC
EPC HSE Lead	**Date**	**Sign**
C. Caracciolo	02.09.24	CC
EPC Project Engineering Manager	**Date**	**Sign**
D. Lo Sterzo	04/09/2024	
Client	**Date**	**Sign**
N LE BRUN	04/09/2024	LE BRUN Signer ID: 5VSEXLUIBO...

DRAWING NO. 123A90-DDL-SAF-DL-30025

REV. 01

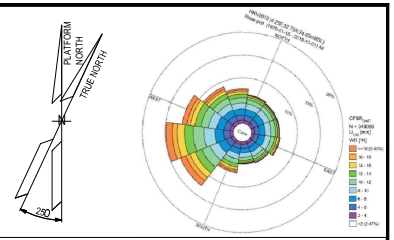


PLAN ON TRANSITION PIECE
EL+21.710 T.O.S.



PLAN ON EXISTING
PLATFORM AT
EL+16.860 T.O.S.

SYMBOL	DESCRIPTION
	LIFE BUOY(FITTED WITH LIGHT, SMOKE SIGNAL & LIFELINE)
	FIRST AID KIT
	01
LJ-XX	LIFE JACKET (INSIDE CABINET)
SC	SAFETY CABINET
DD	DESCENT DEVICE 01



NOTES

1. ALL DIMENSIONS IN mm U.N.O
2. ALL ELEVATIONS IN METERS.
3. PRIMARY ESCAPE ROUTES SHALL BE MINIMUM 1.2m WIDTH AND 2.3m HEIGHT.
4. SECONDARY ESCAPE ROUTES SHALL BE MINIMUM 0.8m WIDTH AND 2.3m HEIGHT.
5. PRIMARY MUSTER AREA SHALL BE SIZED IN ORDER TO PROVIDE SUFFICIENT SPACE FOR THE MAXIMUM POB OF 10 ON THE PLATFORM, CONSIDERING AS MINIMUM 0.8 m^2 PER PERSON.
6. THE EVACUATION PHILOSOPHY IS AS FOLLOW:
   - PRIMARY MEANS OF EVACUATION - VIA PRIMARY MUSTER AREA,LOCATED AT PLATFORM ON TRANSITION PIECE THEN TO CREW TRANSFER VESSEL.
   - SECONADRY MEANS OF EVACUATION - VIA SECONDARY MUSTER AREA, LOCATED AT THE NORTH-EAST CORNER OF THE LOWER DECK, THEN TO LIFERAFTS.
7. ESCAPE MASKS, ELECTRICAL SAFETY KIT, RESUSCITATION UNIT, IMMERSION SUITS, LIFE JACKET AND FIRST AID KID TO BE LOCATED IN WEATHERPROOF CABINETS, AT STRATEGIC POSITIONS.
8. EACH LIFERAFT TO BE SIZED FOR MAXIMUM POB OF 10 PERSONS.
9. 2 NOS. OF PORTABLE CO2 EXTINGUISHERS TO BE LOCATED IN EACH ROOM (ITER, HV & LV ROOMS AND UPS ROOM).
10. EYEWASH BOTTLES TO BE PORTABLE AND CARRIED BY OPERATORS ONLY DURING MAINTENACE PERIOD.
11. ALL PORTABLE EXTINGUISHERS LOCATED IN OPEN AREA WILL BE EQUIPPED WITH A WEATHERPROOF CABINET. (01)
12. LIFE RAFT ACCESS WILL BE GUARANTED BY MEANS OF DESCENT DEVICE.

LEGEND

PRIMARY ESCAPE ROUTE

SECONDARY ESCAPE ROUTE

HOLDS

REFERENCE DOCUMENTS

123A90-DDL-PP-DS-70071	PLOT PLAN - BELOW LOWER DECK

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
01	10/07/24	MMA	CCA	DLO	ACCEPTED FOR CONSTRUCTION (AFC)
0	31/01/24	MMA	CCA	DLO	ISSUE FOR REVIEW (IFR)

CROSSWIND

ROSETTI MARINO

TITLE :
ESCAPE ROUTES, FIRE FIGHTING, LIFE SAVING EQUIPMENT AND SAFETY EQUIPMENT LAYOUTS DRAWINGS

CONTRACT NO./TITLE CW-I-WP4-2023-05/HOLLANDSE KUST NOORD WIND PARK			SCALE 1:150
DRAWN M. MAGNI	CHECKED C. CARACCIOLO	APPROVED D. LO STERZO	DATE 10/07/24
A1	DRAWING NO. 123A90-DDL-SAF-DL-30025	SHEET 001	REV. 01

File Name : 123A90-DDL-SAF-DL-30025 Rev.01

CROSSWIND

ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK Project

Base Load Power Hub (BLPH)

Action Title: Human Factor Workshop

Action n.: 3

Reference Document n: 123A90-DDL-SAF-RE-30049

Item n.: BLPH Lower deck workplaces and equipment inspection activities

Cause: requirements from NORSOK S-002, Annex B

Are horizontal workspaces for fixed equipment minimum 700 mm?

Consequence: Position of the pumps and related piping is not yet defined.

Actions: Ensure adequate space for maintenance activities of water pumps in the final position.

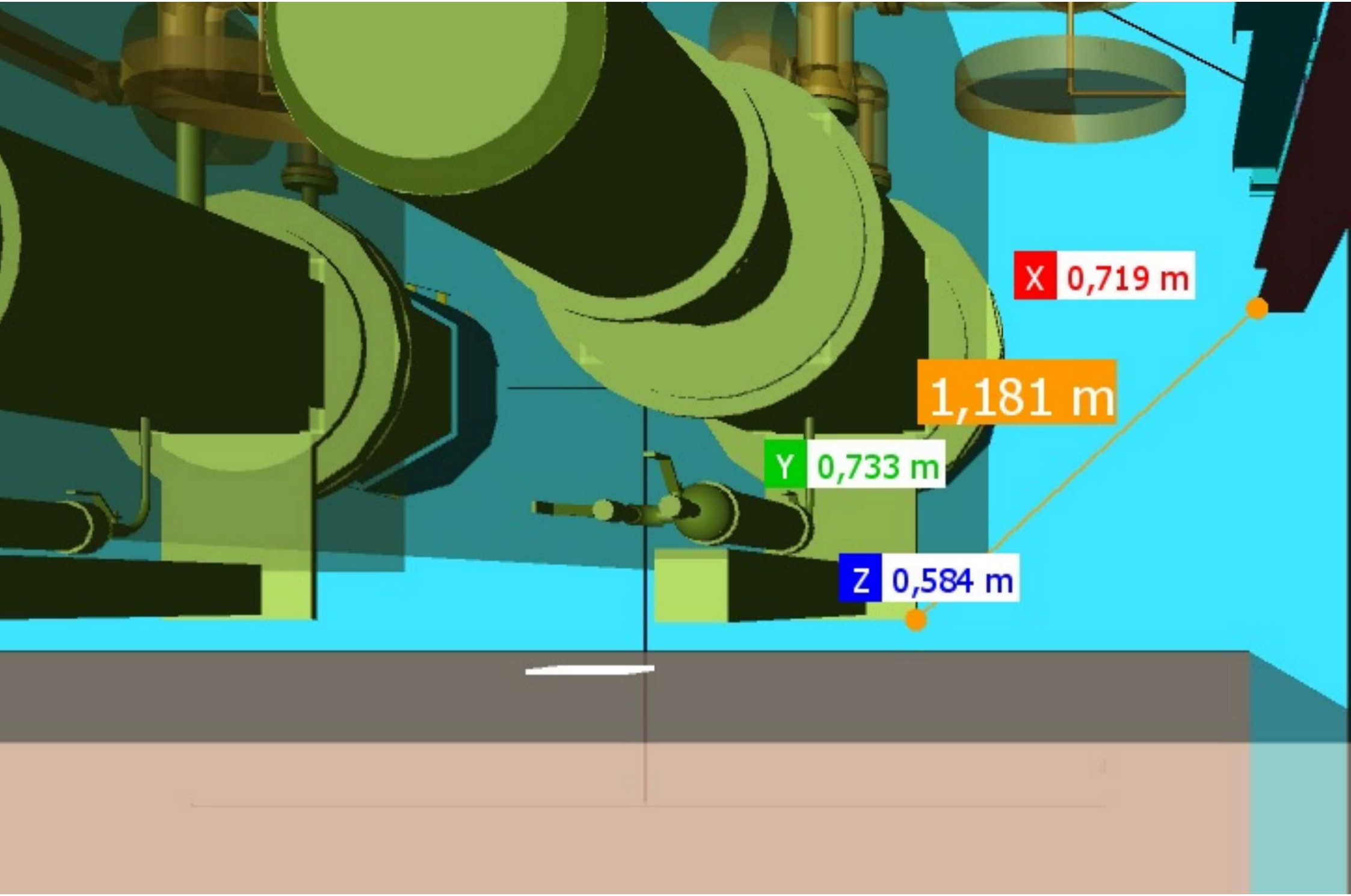
Assigned Respondent (By): Rosetti - Piping

Issue date: 27/02/2024

Action Response: **Adequate space for maintenance has been provided as shown in the 3D model, refer to below 3D model snapdhot.**

Approvals / Endorsement:

EPC Discipline Lead / Construction	Date	Sign
C. Bortolin	02-09-24	
EPC HSE Lead	**Date**	**Sign**
C. Caracciolo	02-09-24	CC
EPC Project Engineering Manager	**Date**	**Sign**
D. Lo Sterzo	04/09/2024	
Client	**Date**	**Sign**
N LE BRUN	04/09/2024	LE BRUN Signer ID: 5V7SEXLUIBO...


X 0,719 m
1,181 m
Y 0,733 m
Z 0,584 m

CROSSWIND

ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK Project

Base Load Power Hub (BLPH)

Action Title: Human Factor Workshop

Action n.: 4

Reference Document n: 123A90-DDL-SAF-RE-30049

Item n.: BLPH Lower deck workplaces and equipment inspection activities

Cause: requirements from NORSOK S-002, Annex B

Are spaces between external diameter of flanges and fixed obstructions min. 250 mm?

Consequence: BL of WTP piping not finalized at the present project stage

Actions: Ensure adequate space for maintenance activities for flanges/ valves near the WTP

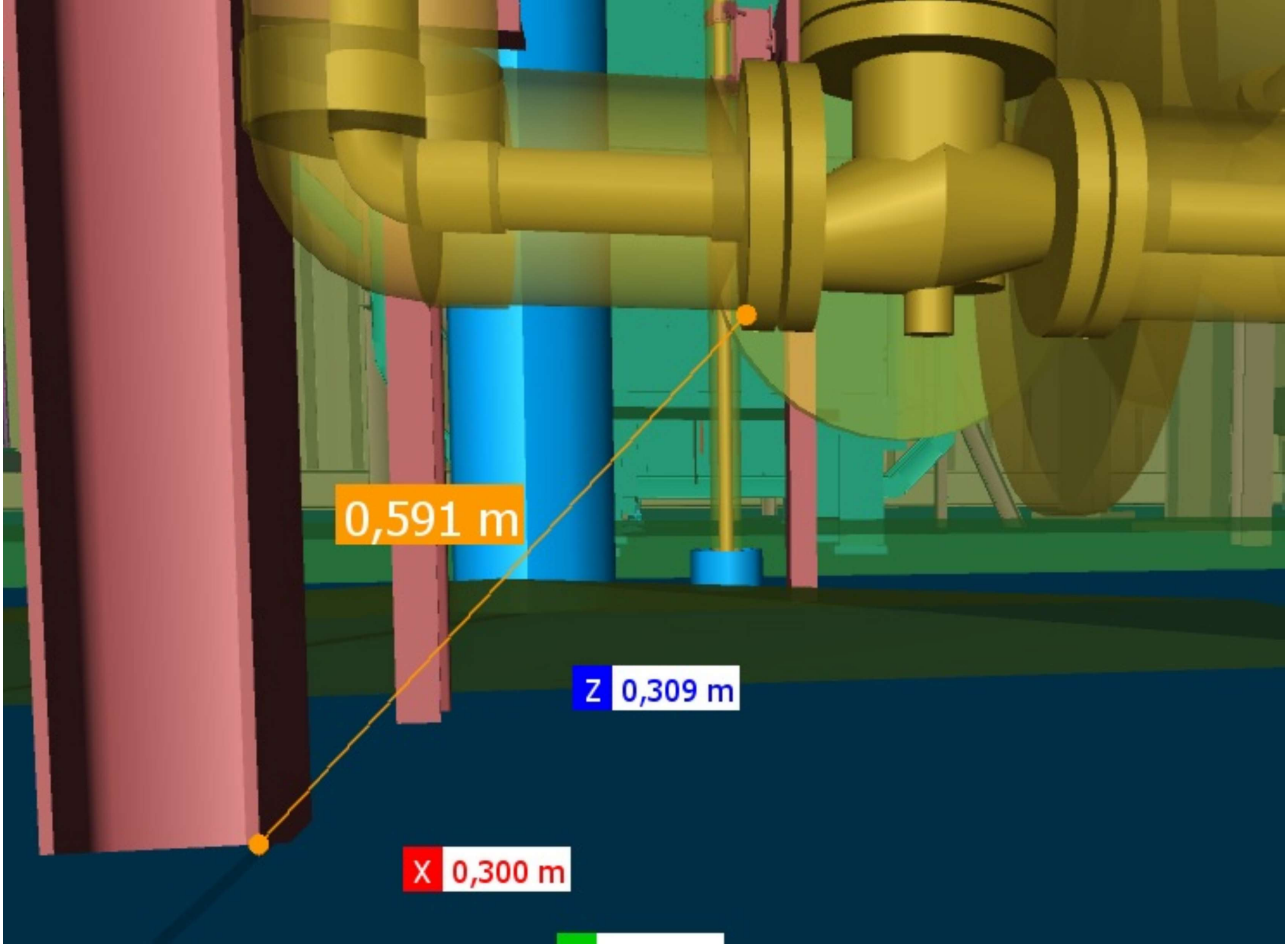
Assigned Respondent (By): Rosetti - Piping

Issue date: 27/02/2024

Action Response: **Requisite is complied with as shown on below extract from 3D model (eg. flange shown in the 3D model snapshot is at z = 309mm.**

Approvals / Endorsement:

EPC Discipline Lead / Construction	**Date**	**Sign**
C. Bortolin	**03-09-24**	
EPC HSE Lead	**Date**	**Sign**
C. Caracciolo	**03-09-24**	**CC**
EPC Project Engineering Manager	**Date**	**Sign**
D. Lo Sterzo	04/09/2024	
Client	**Date**	**Sign**
N LE BRUN	04/09/2024	LE BRUN Signer ID: 5VSEXLUIBQ...


0,591 m
Z 0,309 m
X 0,300 m

CROSSWIND

ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK Project

Base Load Power Hub (BLPH)

Action Title: Human Factor Workshop

Action n.: 7

Reference Document n: 123A90-DDL-SAF-RE-30049

Item n.: BLPH Lower deck workplaces and equipment inspection activities

Cause: requirements from NORSOK S-002, Annex B

Are access opening in vertical partitions into cofferdam, tanks etc. equipped with hand grips on both sides above the opening?

Consequence: To date, the access is not yet defined in the 3D model.

Actions: Ensure that the access will be equipped with vertical ladder to reach equipment on top of TP

Assigned Respondent (By): Rosetti – Structural

Issue date: 27/02/2024

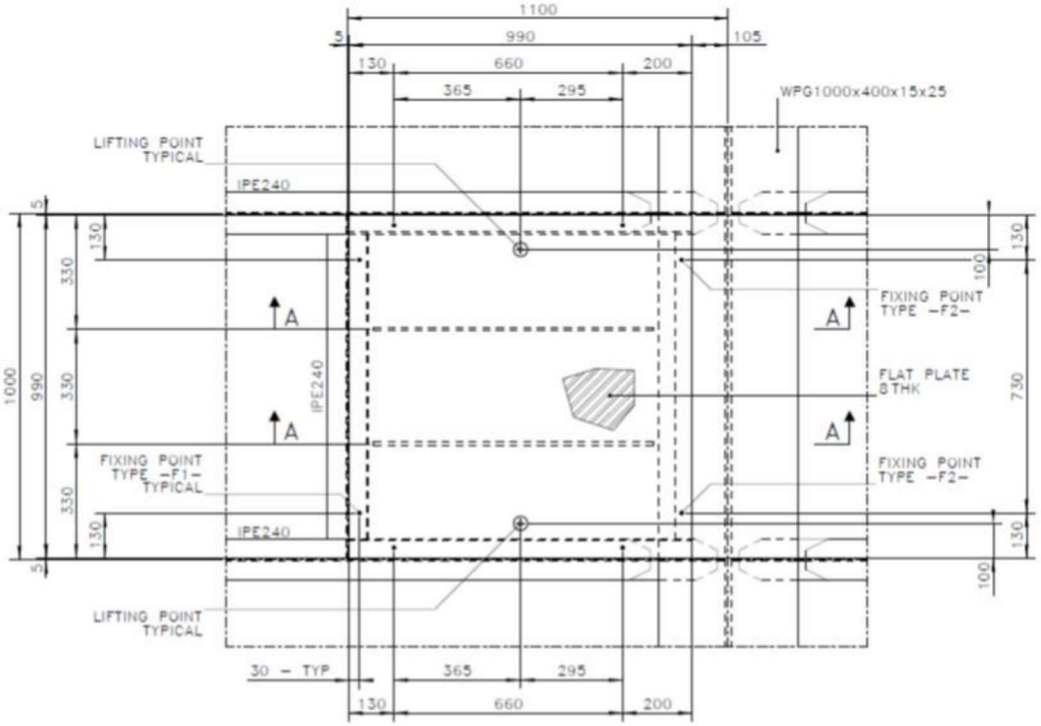
Action Response: Access to the top of the TP is through a removable cover on the lower deck. Access to the top of the TP is only foreseen in exceptional cases due to the overhead height of 600mm.

Therefore, no access ladder is provided, but a temporary aluminum ladder will be fitted if deemed necessary.

Ref drawing of temporary hatch is 123A90-DDL-ST-DD-90122_01

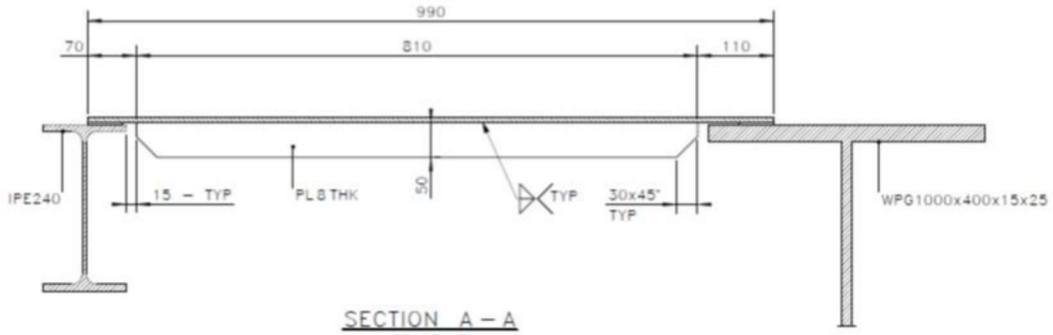
Approvals / Endorsement:

EPC Discipline Lead / Construction	**Date**	**Sign**
A.Balzarotti	**03-09-2024**	Alessandro Balzarotti Digitally signed by Alessandro Balzarotti DN: cn=Alessandro Balzarotti, o=Rosetti Marino, ou=Engineering, email=alessandro.balzarotti@teconsrl.it, c=IT Date: 2024.09.06 10:30:08 +02'00'
EPC HSE Lead	**Date**	**Sign**
C. Caracciolo	**03-09-2024**	
EPC Project Engineering Manager	**Date**	**Sign**
D. Lo Sterzo	**06/09/2024**	
Client	**Date**	**Sign**
N LE BRUN	06/09/2024	LE BRUN Signer ID: 5VSEXLUIBO...



HATCH - PLAN VIEW

SCALE 1:10



SECTION A - A

SCALE 1:5

CROSSWIND

ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK Project

Base Load Power Hub (BLPH)

Action Title: Human Factor Workshop

Action n.: 6

Reference Document n: 123A90-DDL-SAF-RE-30049

Item n.: BLPH Lower deck workplaces and equipment inspection activities

Cause: requirements from NORSOK S-002, 5.4.1, NORSOK S-DP-003

Are drip trays provided under all sampling / filling points and other places where spillage might occur?

Consequence: Drip trays are not provided under biocide sampling point, but deck is plated. The risk to spillage in the sea is negligible.

Actions: Rosetti to investigate if sample collection is needed to check biocide concentration.

Assigned Respondent (By): Rosetti - Process

Issue date: 27/02/2024

Action Response: As per water treatment package no sample collection point is included on tank biocide. Sample points are at intermediate system to ensure performance of the water treatment package.

Approvals / Endorsement:

EPC Discipline Lead / Construction	Date	Sign
F. Mura	03-09-24	
EPC HSE Lead	**Date**	**Sign**
C. Caracciolo	03-09-24	CC
EPC Project Engineering Manager	**Date**	**Sign**
D. Lo Sterzo	04/09/2024	
Client	**Date**	**Sign**
N LE BRUN	04/09/2024	LE BRUN Signer ID: 5VSEXLUIBO...

DRAWING NO. 1724000448-PR-PID-00013

REV. 02

MANUAL VALVES

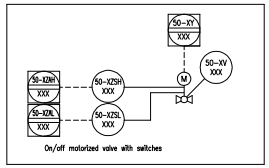
- GATE VALVE
- BALL VALVE
- CHECK VALVE
- NEEDLE VALVE
- "Y" TYPE FILTER
- DIAPHRAGM VALVE
- AUTOMATIC AIR VENT VALVE

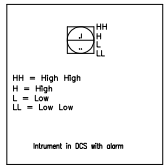
OPERATED VALVES

- MOTORIZED ACTUATOR ON-OFF BALL VALVE
- PRESSURE SAFETY VALVE

OTHER SYMBOLS

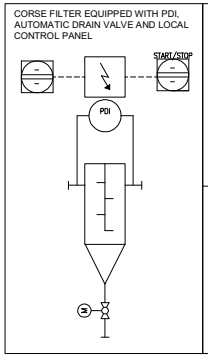
- Local instrument
- Instrument in DCS
- Interlock in DCS
- Software signal
- Electric signal

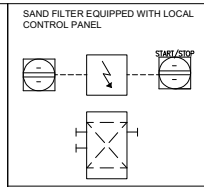


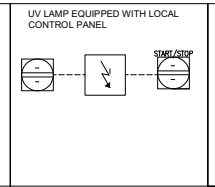


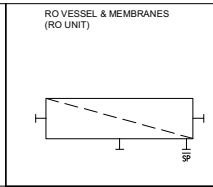
INSTRUMENTS IDENTIFICATION – REFER TO ISA S5.1 FOR DETAILS

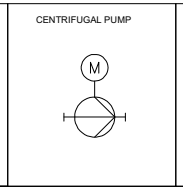
Letter	FIRST LETTER	LETTERS FOLLOW		
	Measure or process variable	Modification	Letter or passive function	Output function
A	Analysis		Alarm	
B	Flame detection		Optional user	Optional user
C	Conductivity	Control		Regulation
D	Density	Differential		
E	Electrical voltage	Element	Primary el.	
F	Flow	Relationship		
G	Choice user			
H	Manual override			
I	Electricity		Indication	
J	Power	Scansion		
K	Time schedule or time	Rate of change		
L	Level		Light	
M	Choice user	Momentary or instant.		
N	Choice user		Optional user	Optional user
O	Choice user		Orifice or restriction	
P	Pressure		Handheld	
Q	Quantity	Full or score.		
R	Radioactivity		Registration	
S	Speed or frequency	Security		Interruption
T	Temperature	Transmitter		Transmission
U	General alarm			Multifunction
V	Vibration or mechanical analysis	Valve	Valve	
W	Weight or force		Well or sheath	
X	Variable unclassified	X axis	Not rated	Not rated
Y	State or event	Y axis		Computing module
Z	Position or size	Z axis		

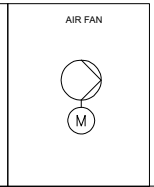


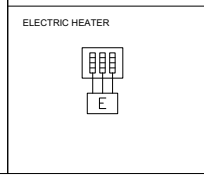


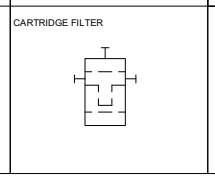


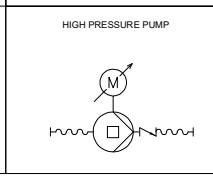


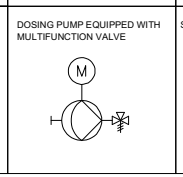


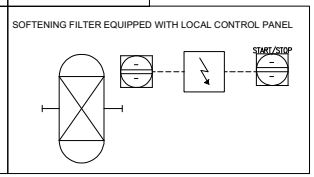












PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
02	22-AUG-24	UR	WR	RM	ISSUED FOR REVIEW
01	29-MAY-24	GG	WR	RM	ISSUED FOR REVIEW
00	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

ROSETTI MARINO

TITLE :
WATER TREATMENT PACKAGE
SEA WATER FINE FILTRATION
P&I DIAGRAM

CONTRACT NO./TITLE | SCALE –

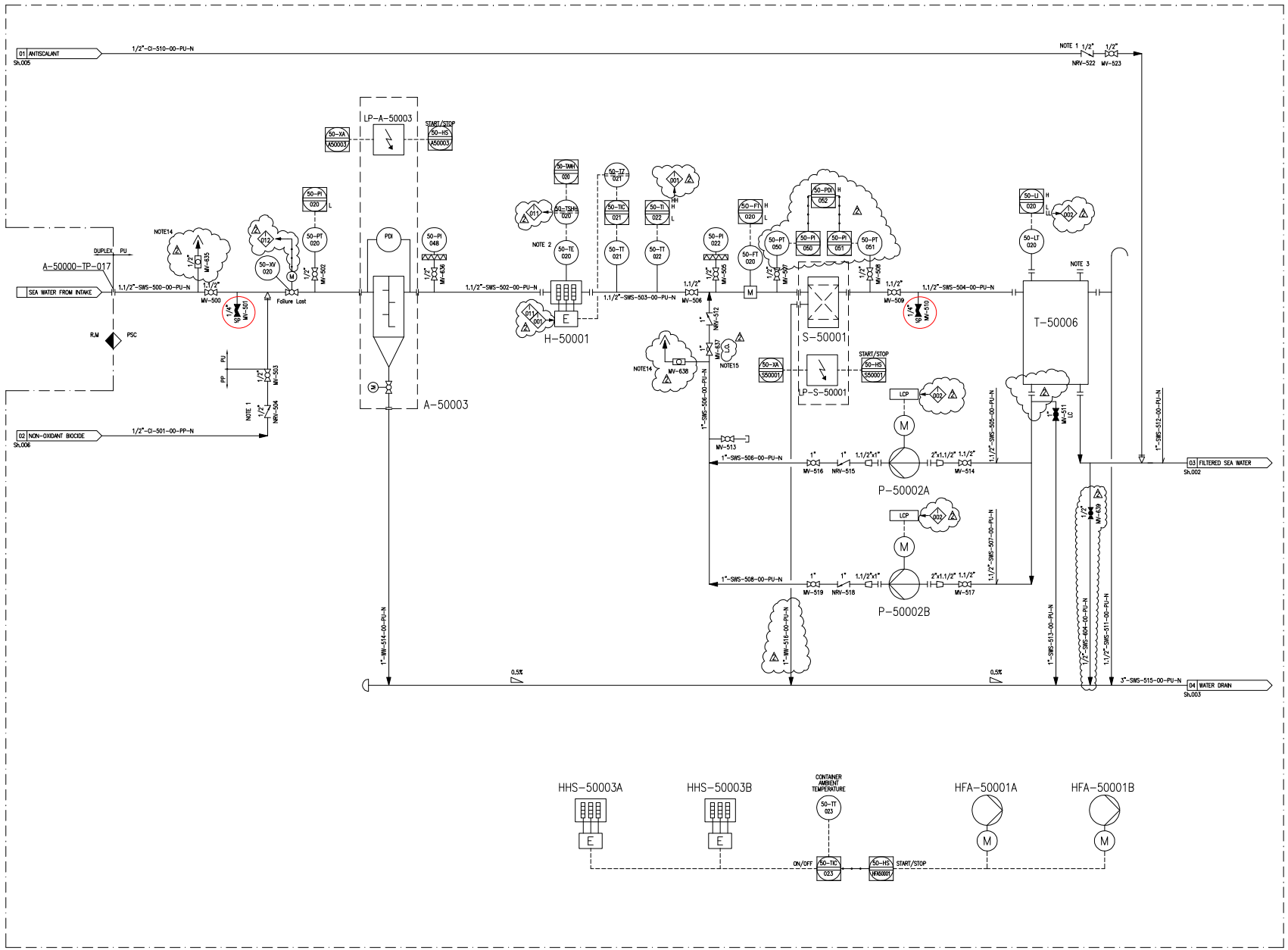
DRAWN UR | CHECKED WR | APPROVED RM | DATE 22/08/24

A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 001 | REV. 02

File Name : 1724000448-PR-PID-00013 Rev02

DRAWING NO. 1724000448-PR-PID-00013

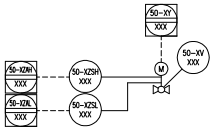
REV. 2



TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-002	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-003	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-005	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTAKE
TP-006	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-007	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

TYPICAL FOR ON/OFF BALL VALVES



NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: BLPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOUS BIOCIDE DOSAGE TO INTAKE PUMP: CONTINUOUS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOUS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE
14	AUTOMATIC AIR VENT VALVE
15	POSITION TO BE DEFINED DURING COMMISSIONING
16	POLYAMIDE TUBING (RILSAN TYPE)
17	CHECK VALVE (NO SPRING TYPE)
18	DRAIN PAN FOR ANALYZER. DRAIN PAN VOLUME= 5 L

A-50003	
SEA WATER COARSE FILTER	
FILTRATION RATE	125 µm
CAPACITY	2.5 m3/h
DES. PRESS.	5 barg
DES. TEMP.	50° C
MATERIAL	PLASTIC MAT.

H-50001	
ELECTRIC HEATER	
POWER	30 kW
CAPACITY	2.5 m3/h
DES. PRESS.	6 barg
DES. TEMP.	60° C
MATERIAL	PVC-TITANIUM

S-50001	
SAND FILTER	
TYPE	PRESSURE,VERTICAL
CAPACITY	2.5 m3/h
DES. PRESS.	7 barg
DES. TEMP.	50° C
MATERIAL	FRP

T-50006	
FILTERED WATER TANK	
VOLUME	3 m3
DES. PRESS.	ATM
DES. TEMP.	50° C
MATERIAL	FRP

P-50002A/B	
BACKWASH PUMP	
TYPE	CENTRIFUGAL
DES. PRESSURE	6 barg
CAPACITY	5 m3/h
HEAD	0,50 barg
DES. TEMP.	60 °C
MATERIAL	PP

HHS-50003A/B	
CONTAINER ELECTRICAL HEATER	
POWER	8.4 kW
DES. PRESS.	ATM
DES. TEMP.	65°C

HFA-50001A/B	
CONTAINER AIR FAN	
POWER	110 W
DES. PRESS.	ATM
DES. TEMP.	60°C

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
02	22-AUG-24	UR	WR	RM	ISSUED FOR REVIEW
01	29-MAY-24	GG	WR	RM	ISSUED FOR REVIEW
00	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

ROSETTI MARINO

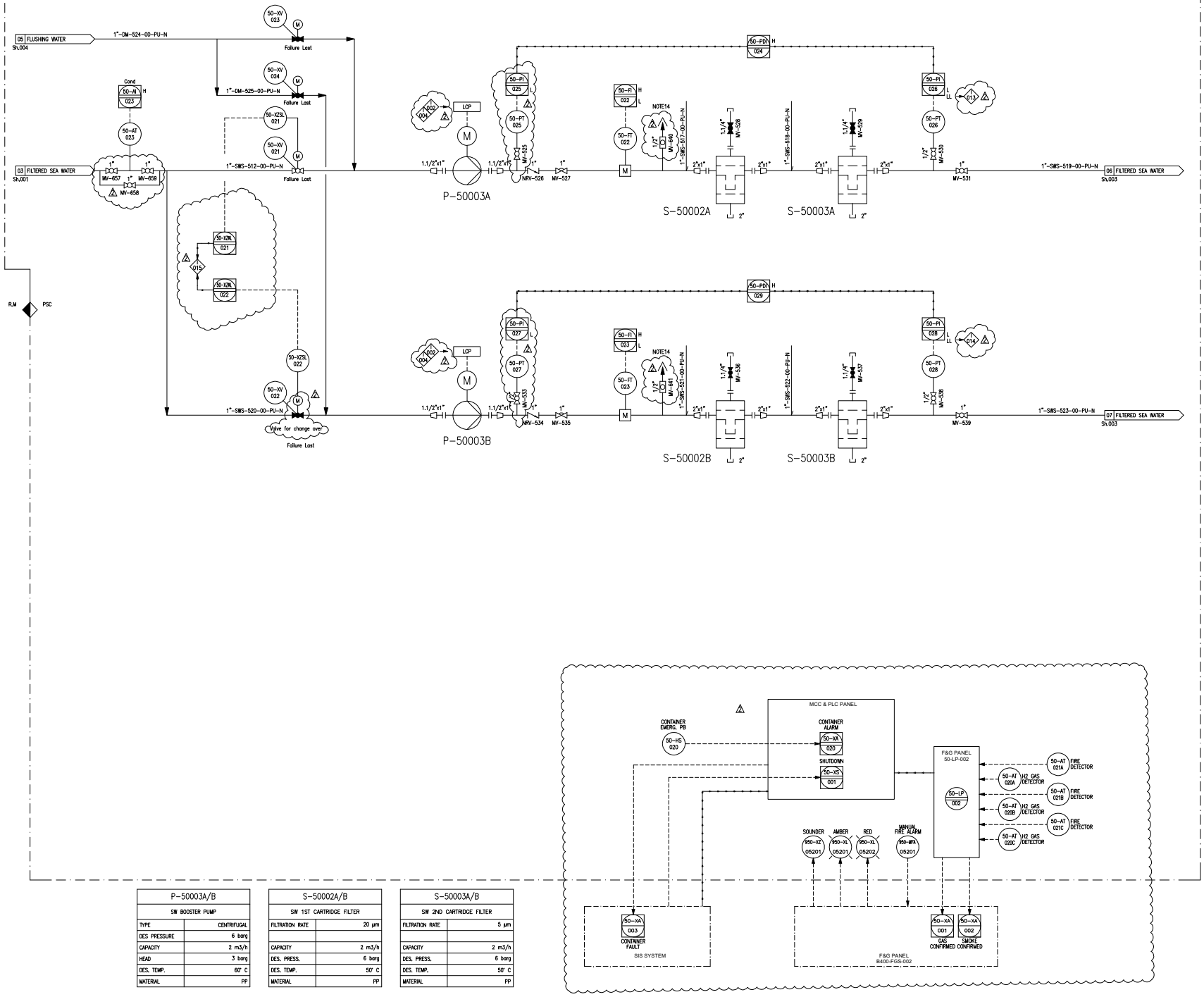
TITLE : WATER TREATMENT PACKAGE
SEA WATER FINE FILTRATION
P&I DIAGRAM

CONTRACT NO./TITLE			SCALE –
DRAWN UR	CHECKED WR	APPROVED RM	DATE 22/08/24
A1	DRAWING NO. 1724000448-PR-PID-00013	SHEET 002	REV. 02

File Name : 1724000448-PR-PID-00013 Rev02

DRAWING NO. 1724000448-PR-PID-00013

REV. 2



P-50003A/B	
SW BOOSTER PUMP	
TYPE	CENTRIFUGAL
DES PRESSURE	6 barg
CAPACITY	2 m3/h
HEAD	3 barg
DES. TEMP.	60° C
MATERIAL	PP

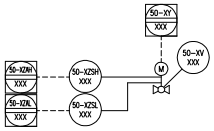
S-50002A/B	
SW 1ST CARTRIDGE FILTER	
FILTRATION RATE	20 µm
CAPACITY	2 m3/h
DES. PRESS.	6 barg
DES. TEMP.	50° C
MATERIAL	PP

S-50003A/B	
SW 2ND CARTRIDGE FILTER	
FILTRATION RATE	5 µm
CAPACITY	2 m3/h
DES. PRESS.	6 barg
DES. TEMP.	50° C
MATERIAL	PP

TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-002	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-003	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-005	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTAKE
TP-006	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-007	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

TYPICAL FOR ON/OFF BALL VALVES



NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: BLPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOUS BIOCIDE DOSAGE TO INTAKE PUMP: DISCONTINUOUS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOUS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE
14	AUTOMATIC AIR VENT VALVE
15	POSITION TO BE DEFINED DURING COMMISSIONING
16	POLYAMIDE TUBING (RILSAN TYPE)
17	CHECK VALVE (NO SPRING TYPE)
18	DRAIN PAN FOR ANALYZER. DRAIN PAN VOLUME= 5 L

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
02	22-AUG-24	UR	WR	RM	ISSUED FOR REVIEW
01	29-MAY-24	GG	WR	RM	ISSUED FOR REVIEW
00	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

ROSETTI MARINO

TITLE :
WATER TREATMENT PACKAGE
SEA WATER FINE FILTRATION
P&I DIAGRAM

CONTRACT NO./TITLE | SCALE –

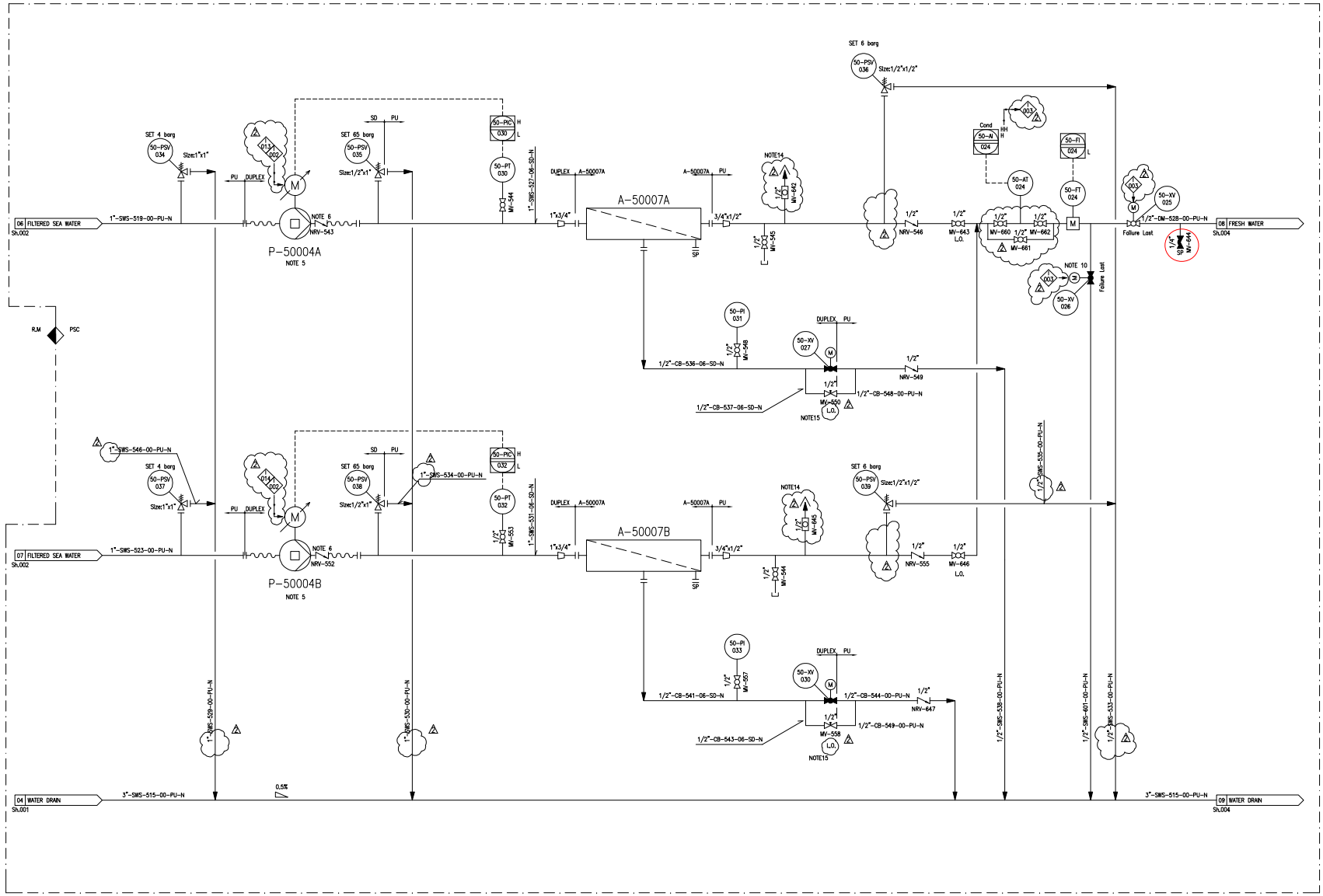
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A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 003 | REV. 02

File Name : 1724000448-PR-PID-00013 Rev02

DRAWING NO. 1724000448-PR-PID-00013

REV. 2



TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-002	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-003	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-005	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTAKE
TP-006	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-007	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: BLPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOUS BIOCIDE DOSAGE TO INTAKE PUMP: DISCONTINUOUS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOUS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE
14	AUTOMATIC AIR VENT VALVE
15	POSITION TO BE DEFINED DURING COMMISSIONING
16	POLYAMIDE TUBING (RILSAN TYPE)
17	CHECK VALVE (NO SPRING TYPE)
18	DRAIN PAN FOR ANALYZER. DRAIN PAN VOLUME= 5 L

P-50004A/B	
HP PUMP	
TYPE	AXIAL ROTATING PISTONS
DES PRESSURE	83 barg
CAPACITY	2 m3/h
HEAD	63,5 barg
DES. TEMP.	50° C
MATERIAL	SS DUPLEX

A-50007A/B	
SEA WATER REVERSE OSMOSIS UNITS	
CAPACITY	0.8 m3/h
DES. PRESS.	69 barg
DES. TEMP.	45° C
MATERIAL	FRP

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
02	22-AUG-24	UR	WR	RM	ISSUED FOR REVIEW
01	29-MAY-24	GG	WR	RM	ISSUED FOR REVIEW
00	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

ROSETTI MARINO

TITLE : WATER TREATMENT PACKAGE
SEA WATER REVERSE OSMOSIS
P&I DIAGRAM

CONTRACT NO./TITLE | SCALE -

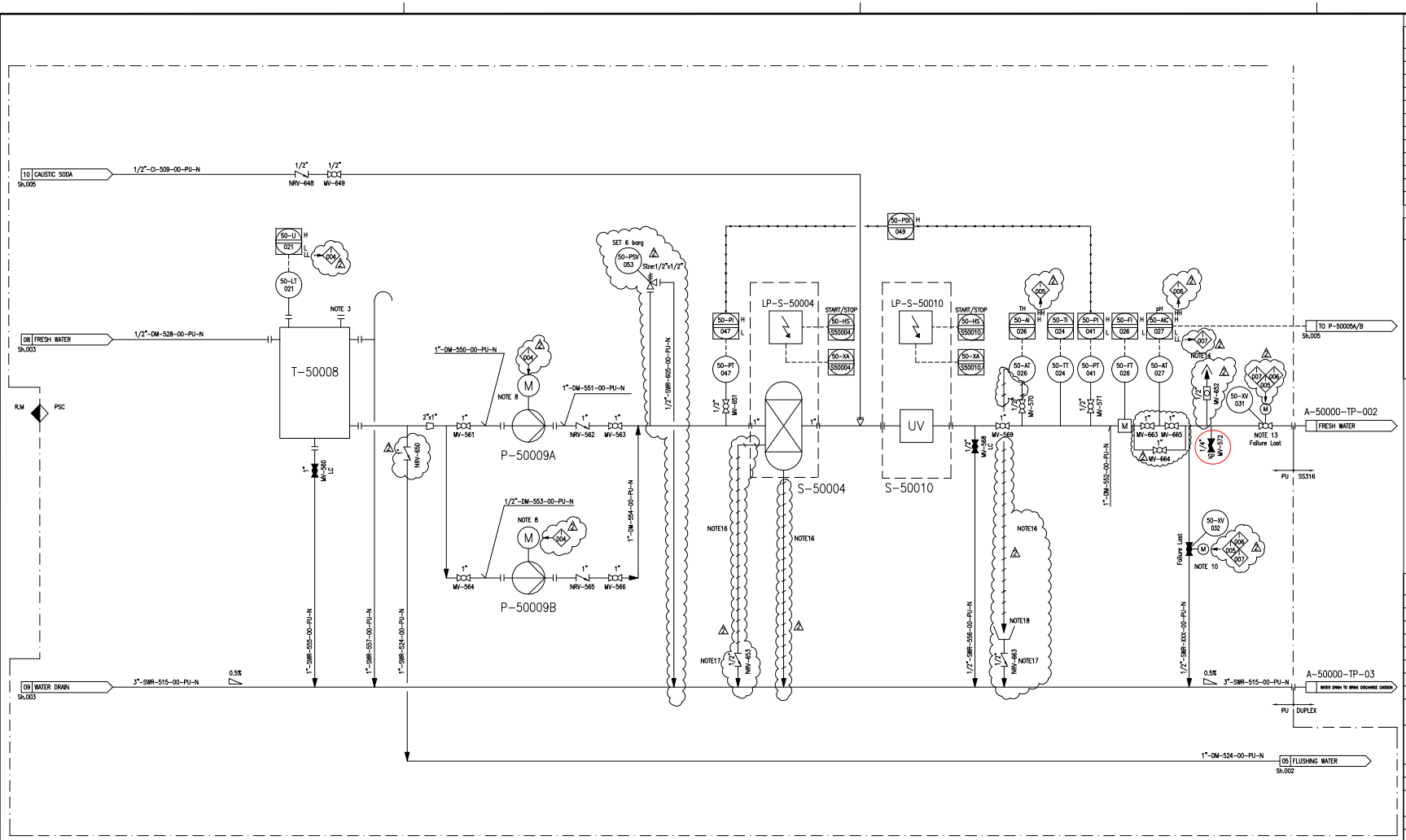
DRAWN UR | CHECKED WR | APPROVED RM | DATE 22/08/24

A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 004 | REV. 02

File Name : 1724000448-PR-PID-00013 Rev02

DRAWING NO. 1724000448-PR-PID-00013

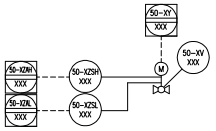
REV. 2



TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-002	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-003	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-005	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTAKE
TP-006	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-007	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

TYPICAL FOR ON/OFF BALL VALVES



NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: ELPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOUS BIOCIDE DOSAGE TO INTAKE PUMP: DISCONTINUOUS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOUS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE
14	AUTOMATIC AIR VENT VALVE
15	POSITION TO BE DEFINED DURING COMMISSIONING
16	POLYAMIDE TUBING (RILSAN TYPE)
17	CHECK VALVE (NO SPRING TYPE)
18	DRAIN PAN FOR ANALYZER. DRAIN PAN VOLUME= 5 L

T-50008	
FRESH WATER TANK	
VOLUME	2.2 m3
DES. PRESS.	ATM
DES. TEMP.	50° C
MATERIAL	FRP

P-50009A/B	
FRESH WATER PUMP	
TYPE	CENTRIFUGAL
DES PRESSURE	25 barg
CAPACITY	0.8 m3/h
HEAD NOTE 11	4.2 barg
DES. TEMP.	120° C
MATERIAL	SS 316L

S-50010	
UV STERILIZER	
CAPACITY	0,8 m3/h
DES. PRESS.	8 barg
DES. TEMP.	50° C
MATERIAL	SS 316

S-50004	
SOFTENING FILTER	
CAPACITY	0,8 m3/h
DES. PRESS.	6 barg
DES. TEMP.	40° C
MATERIAL	FRP-PLASTIC

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
02	22-AUG-24	UR	WR	RM	ISSUED FOR REVIEW
01	29-MAY-24	GG	WR	RM	ISSUED FOR REVIEW
00	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

ROSETTI MARINO

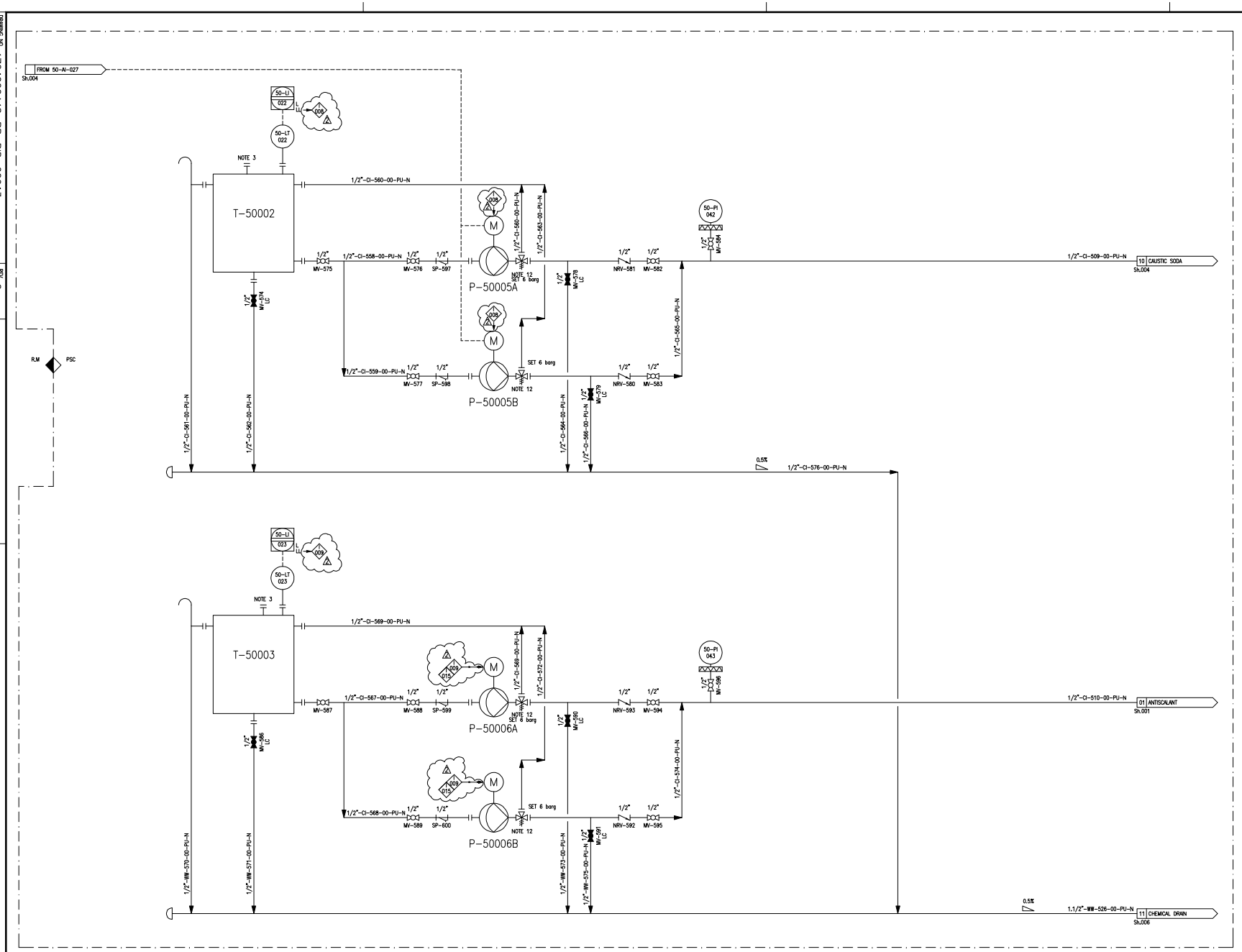
TITLE :
WATER TREATMENT PACKAGE
FRESH WATER STORAGE
P&I DIAGRAM

CONTRACT NO./TITLE | SCALE –

DRAWN UR | CHECKED WR | APPROVED RM | DATE 22/08/24

A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 005 | REV. 02

File Name : 1724000448-PR-PID-00013 Rev02



T-50002	
CAUSTIC SODA DOSING TANK	
VOLUME	0,05 m3
DES. PRESS.	ATM
DES. TEMP.	45° C
MATERIAL	PE

P-50005A/B	
CAUSTIC SODA DOSING PUMP	
TYPE	METERING DIAPHRAGM
DES PRESSURE	10 barg
CAPACITY	0,05 l/h
HEAD	3 barg
DES. TEMP.	45° C
MATERIAL	PVC

T-50003	
ANTISCALANT DOSING TANK	
VOLUME	0,05 m3
DES. PRESS.	ATM
DES. TEMP.	45° C
MATERIAL	PE

P-50006A/B	
ANTISCALANT DOSING PUMP	
TYPE	METERING DIAPHRAGM
DES PRESSURE	10 barg
CAPACITY	0.01 l/h
HEAD	3 barg
DES. TEMP.	45° C
MATERIAL	PVC

TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-002	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-003	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-005	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTAKE
TP-006	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-007	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: BLPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOUS BIOCIDE DOSAGE TO INTAKE PUMP: DISCONTINUOUS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOUS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE
14	AUTOMATIC AIR VENT VALVE
15	POSITION TO BE DEFINED DURING COMMISSIONING
16	POLYAMIDE TUBING (RILSAN TYPE)
17	CHECK VALVE (NO SPRING TYPE)
18	DRAIN PAN FOR ANALYZER. DRAIN PAN VOLUME= 5 L

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
02	22-AUG-24	UR	WR	RM	ISSUED FOR REVIEW
01	29-MAY-24	GG	WR	RM	ISSUED FOR REVIEW
00	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

ROSETTI MARINO

TITLE :
WATER TREATMENT PACKAGE
ACID & ANTISCALANT DOSAGES
P&I DIAGRAM

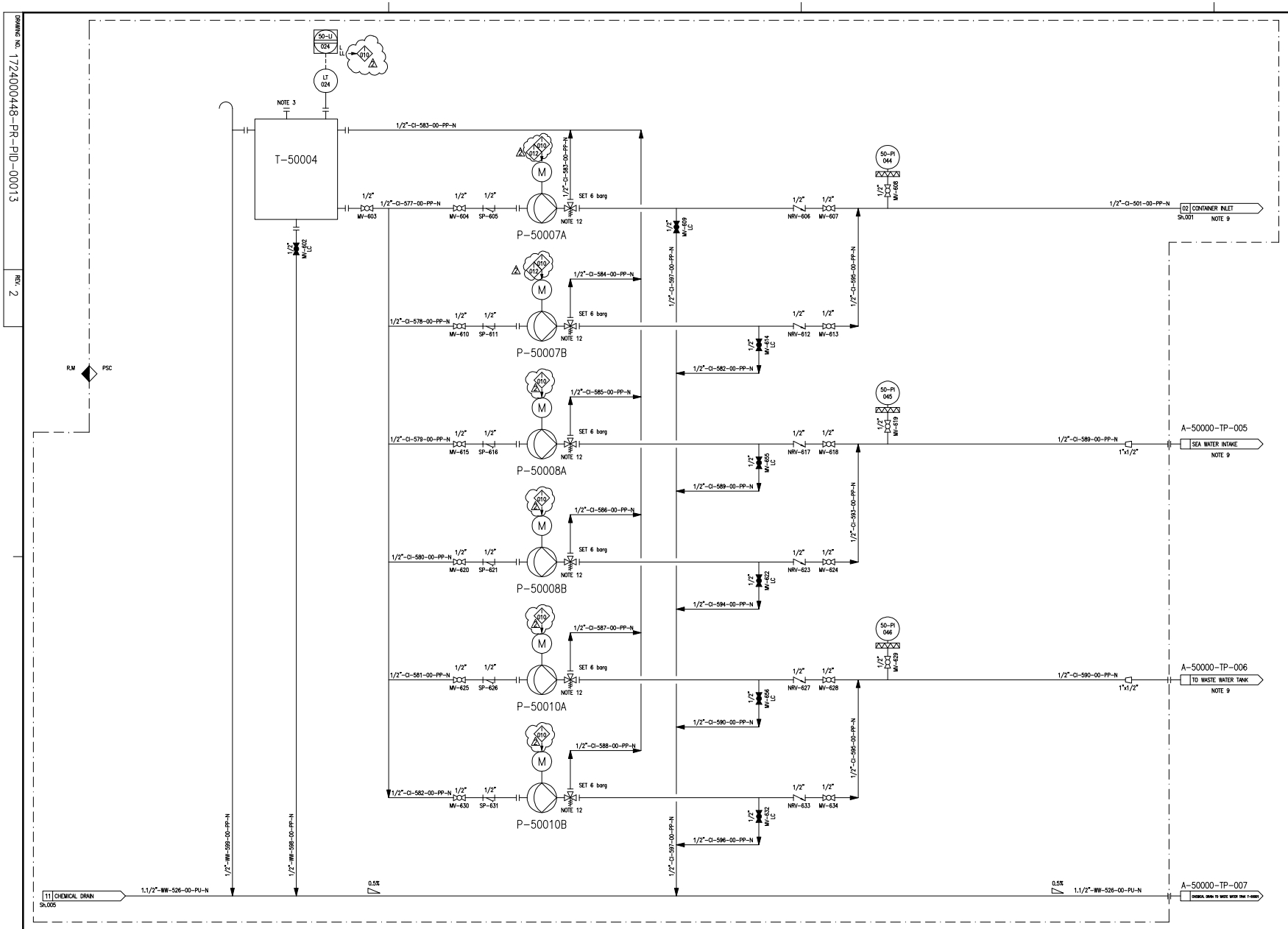
CONTRACT NO./TITLE | SCALE –

DRAWN UR | CHECKED WR | APPROVED RM | DATE 22/08/24

A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 006 | REV. 02

DRAWING NO. 1724000448-PR-PID-00013 | REV. 2

File Name : 1724000448-PR-PID-00013 Rev02



TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
TP-002	1"	FLG.	150#	RF	SS 316	PRODUCT WATER
TP-003	3"	FLG.	150#	RF	DUPLEX	SEA WATER DRAIN
TP-005	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTAKE
TP-006	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-007	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN

NOTES

No.	DESCRIPTION
1	SPRING LOADED CHECK VALVE.
2	SUPPLIED WITH EQUIPMENT.
3	INSPECTION COVER.
4	FILTER WITH PANEL AND AUTOMATIC MULTIPORT VALVE.
5	PUMP EQUIPPED WITH FLUSHING VALVE.
6	CHECK VALVE SUPPLIED WITH THE PUMP.
7	ALL MANUAL VALVES TAGS ARE PRECEDED BY: BLPH-
8	LOGIC FOR CONTROL OF P50009A/B THAT PREVENTS SIMULTANEOUS RUNNING OF A PUMP A AND B IS PROVIDED.
9	BIOCIDE DOSAGE TO CONTAINER INLET: CONTINUOUS BIOCIDE DOSAGE TO INTAKE PUMP: DISCONTINUOUS BIOCIDE DOSAGE TO WASTE WATER TANK: DISCONTINUOUS
10	OFF SPEC ON/OFF VALVE
11	SHUT OFF PRESSURE OF P-50009A/B = 6 barg
12	MULTIFUNCTIONAL VALVE BY PUMP SUPPLIER: BACKPRESSURE, PRESSURE RELIEF, ANTI-OVERFLOW AND SAFETY VALVE FUNCTION.
13	OUTLET VALVE
14	AUTOMATIC AIR VENT VALVE
15	POSITION TO BE DEFINED DURING COMMISSIONING
16	POLYAMIDE TUBING (RILSAN TYPE)
17	CHECK VALVE (NO SPRING TYPE)
18	DRAIN PAN FOR ANALYZER. DRAIN PAN VOLUME= 5 L

T-50004	
NON-OXIDANT BIOCIDE DOSING TANK	
VOLUME	0.1 m3
DES. PRESS.	ATM
DES. TEMP.	45° C
MATERIAL	PE

P-50007A/B	
NON-OXIDANT BIOCIDE DOSING PUMP – CONTAINER INLET	
TYPE	METERING DIAPHRAGM
DES PRESSURE	10 barg
CAPACITY	0,03 l/h
HEAD	3.5 barg
DES. TEMP.	45° C
MATERIAL	PVC

P-50008A/B	
NON-OXIDANT BIOCIDE DOSING PUMP – SEA WATER INTAKE	
TYPE	METERING DIAPHRAGM
DES PRESSURE	10 barg
CAPACITY	0,85 l/h
HEAD	3.5 barg
DES. TEMP.	45° C
MATERIAL	PVC

P-50010A/B	
NON-OXIDANT BIOCIDE DOSING PUMP – WASTE WATER TANK	
TYPE	METERING DIAPHRAGM
DES PRESSURE	10 barg
CAPACITY	0,33 l/h
HEAD	3.5 barg
DES. TEMP.	45° C
MATERIAL	PVC

PSC DOC. REF: PK2885-B-001

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
02	22-AUG-24	UR	WR	RM	ISSUED FOR REVIEW
01	29-MAY-24	GG	WR	RM	ISSUED FOR REVIEW
00	24-APR-24	UR	RC	RM	ISSUED FOR REVIEW

CROSSWIND

ROSETTI MARINO

TITLE : WATER TREATMENT PACKAGE
BIOCIDE DOSAGE
P&I DIAGRAM

CONTRACT NO./TITLE | SCALE –

DRAWN UR | CHECKED WR | APPROVED RM | DATE 22/08/24

A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 007 | REV. 02

DRAWING NO. 1724000448-PR-PID-00013 REV. 2

File Name : 1724000448-PR-PID-00013 Rev02

CROSSWIND

ROSETTI MARINO

HOLLANDSE KUST NOORD WIND PARK Project

Base Load Power Hub (BLPH)

Action Title: Human Factor Workshop

Action n.: 7

Reference Document n: 123A90-DDL-SAF-RE-30049

Item n.: BLPH Lower deck technical rooms

Cause: requirements from NORSOK S-002, Annex B

Are centre heights of control devices for standing operations (including valve handles) max. 1800 mm above base?

Are the centre heights of control devices for normal operation controls and for controls where access in an emergency is required 900-1500 mm above base?

Consequence: Requirement partially satisfied (all cabinets are installed > 1800 mm).

Actions: Rosetti to provide portable step ladders in case of operation in the top of cabinets.

Assigned Respondent (By): Rosetti - Architectural

Issue date: 27/02/2024

Action Response: **Height of the steps will be adjustable in order to adapt to each container door. The ladders weight will not exceed a normal weight to be lifted from/to inside containers.**

Approvals / Endorsement:

EPC Discipline Lead / Construction	**Date**	**Sign**
M. Gatti	**03-09-24**	Maurizio Gatti — Autore firma digitale: Maurizio Gatti; Nome distintivo: CN = Maurizio Gatti email = maurizio.gatti@rosetti.it C = IT O = Rosetti Marino SpA; Data: 2024.09.04 12:59:13 +02'00'
EPC HSE Lead	**Date**	**Sign**
C. Caracciolo	**03-09-24**	**CC**
EPC Project Engineering Manager	**Date**	**Sign**
D. Lo Sterzo	**04/09/2024**	
Client	**Date**	**Sign**
N LE BRUN	06/09/2024	LE BRUN — Signer ID: 5VSEXLUIBO...