Base Load Power Hub (BLPH)

HAZOP 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.

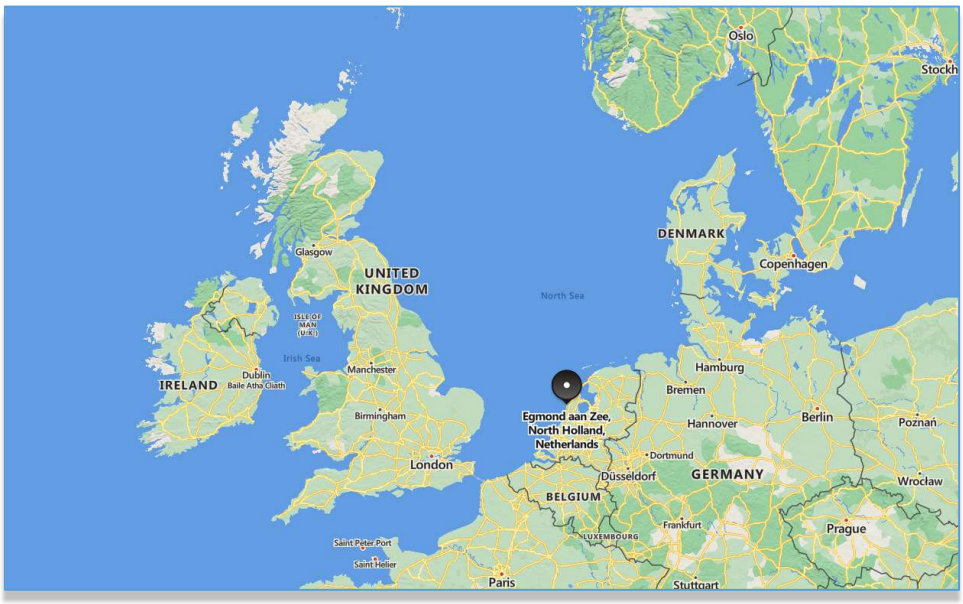


Figure 1 HOLLANDSE KUST NOORD WIND PARK Location Map

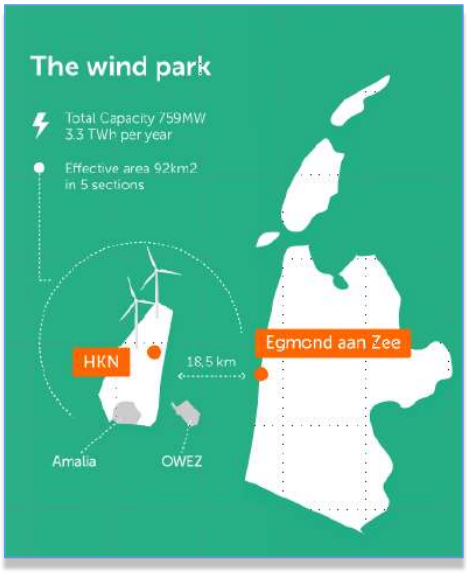


Figure 2 - Wind Park Details

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.

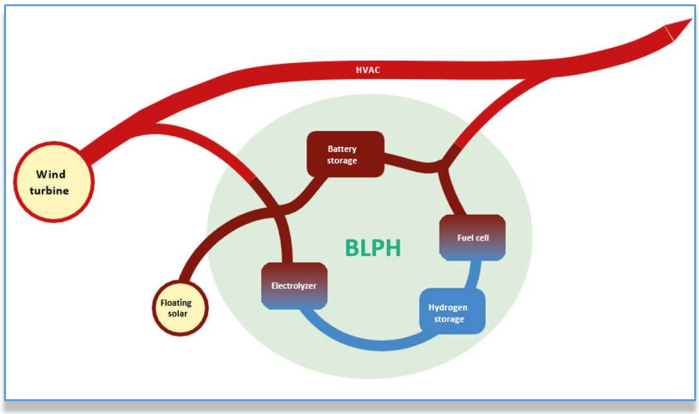


Figure 3 – BLPH Concept

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.

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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 HAZOP Close Out Report has been implemented on the Project to ensure that all key HSE actions raised from formal HAZOP workshops 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

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

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3 HAZOP CLOSE OUT REPORT

3.1 INTRODUCTION

For addition detail on HAZOP Action sheet refer to HSSE Action Tracking Register.

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).

3.4 FEED HAZOP ACTIONS

FEED HAZOP & LOPA Actions

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

3.5 EPC HAZOP ACTIONS

EPC HAZOP Actions

Status	Totals	%
Open	0	0
For Approval	0	0
Closed	56	100
TOTAL	**56**	**100**

4 HAZOP ACTIONS REGISTER

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

4.1 FEED HAZOP ACTIONS REGISTER

SHEAM No.Feed HSSE Register_ REV 01	Source Doc Ref.	Recommendations	Date	Due by
24	1	Ensure adequate overpressure protection system is provided within electrolyser package to prevent overpressure of downstream piping.	06-mar-23	CROSSWIND
25	1	Ensure adequate overpressure protection system is provided within electrolyser package to prevent overpressure of downstream piping.		CROSSWIND
26	2	Ensure adequate over protection system for system downstream system of PVA & PVB including fuel cell		CROSSWIND
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	06-mar-23	CROSSWIND
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	06-mar-23	CROSSWIND
29	4	Identify possibility of any other contaminants in electrolyser package.	06-mar-23	CROSSWIND
30	5	Consider within PEM Electrolyser package HAZOP.	06-mar-23	CROSSWIND
31	6	Review necessity of emergency blowdown for hydrogen feed & distribution manifold.	06-mar-23	ROSETTI
32	-	ensure adequate detection alarm is provided		
33	-	adequate F&G detection to be investigated		
34	7	Ensure heat input calculations for sizing fire case relief valves are based on heat input from hydrogen fire.	06-mar-23	ROSETTI
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.	06-mar-23	ROSETTI
36	-	consider requirement for additional sectionalization		
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)		ROSETTI
38	-	Ensure material selection		
39	14	Review control system design to ensure that potential overpressure can be reliability detected, and PEM electrolyser package shutdown initiated.	06-mar-23	ROSETTI
40	-	review in SAFOP		
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.	06-mar-23	ROSETTI
42	11	Facilities for start- up following maintenance, to be investigated and developed.	06-mar-23	ROSETTI
43	12	Ensure consequences of loss of supply of hydrogen to fuel cell is assessed in fuel cell vendor package HAZOP.	06-mar-23	CROSSWIND
44	20	Review control requirements for PVA & PVB from fuel cell and delete if not required.	06-mar-23	ROSETTI
45	14	Ensure this is confirmed in fuel cell package with vendor.	06-mar-23	CROSSWIND
46	-	action closed in Feed HSSE rev01		
47	-	action closed in Feed HSSE rev01		
48	16	Ensure secure nitrogen supply suitable for continuous purge of the hydrogen vent head is provided.	06-mar-23	ROSETTI
49	17	In case of failure of primary nitrogen purge, ensure a suitable contingency plan is developed.	06-mar-23	ROSETTI
50	18	Assess possibility of ice formation in hydrogen vent lines, from individual users into header, and provide suitable mitigation,	06-mar-23	ROSETTI
51	19	Assess potential for oxygen/hydrogen explosion vendor package HAZOP.	06-mar-23	CROSSWIND
52	20	Asses potential for consequence with vendor HAZOP package.	06-mar-23	CROSSWIND

SHEAM No.Feed HSSE Register_ REV 01	Source Doc Ref.	Recommendations	Date	Due by
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.	06-mar-23	ROSETTI
54	22	Review means of sweeping residual air within hydrogen vent header prior to reintroduction of item/package that will shut down for maintenance.	06-mar-23	ROSETTI
55	23	Consider loss of flow of sea water in desalination unit HAZOP Package.	06-mar-23	ROSETTI
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 requirement for a SIL rated safeguard, refer to recommen 49 and 50		CROSSWIND
57	24	Consider loss of fresh water to electro chlorination package and potential backflow from electrochrlorification unit in package HAZOP.	06-mar-23	ROSETTI
58	25	Ensure electrochlorification package HAZOP reviews.	06-mar-23	ROSETTI
59	26	Ensure control system does not create hazard by deadheading P- 50001A/B.	06-mar-23	ROSETTI
60	27	Control logic should inhibit dual operation of lift pumps, P-50001A & B.	06-mar-23	ROSETTI
61	-	Consider during vendor hazop package.		ROSETTI
62	28	Ensure local overflow is adequately sized & rooted to a safe location.	06-mar-23	ROSETTI
63	29	Ensure local overflow is adequately sized & rooted to a safe location.	06-mar-23	ROSETTI
64	30	Ensure this scenario is considered, during HAZOPS for vendors packages, for electrolyser,	06-mar-23	CROSSWIND
65	31	Control logic should inhibit dual operation of lift pumps, P-50009A & B.	06-mar-23	ROSETTI
66	32	Consider during vendor hazop package	06-mar-23	ROSETTI
67	-	Consider during vendor hazop package		ROSETTI
68	-	Consider during vendor package HAZOP'S.		ROSETTI
69	-	Consider during vendor hazop package		CROSSWIND
70	-	Consider during vendor hazop package		ROSETTI
71	33	Consider during vendor hazop package.	06-mar-23	ROSETTI
72	34	See Vendor Packages	06-mar-23	ROSETTI
73	35	Consider operational philosophy for long periods of no demand of use of water system.	06-mar-23	ROSETTI
74	37	To be examined within electrolyser package HAZOP	06-mar-23	CROSSWIND
75	38	Confirm if non return valve is required on individual feed lines into brine disposal manifold.	06-mar-23	ROSETTI
76	-	Confirm if non return valve is required on individual feed lines into brine disposal manifold.		ROSETTI
77	-	To be examined within electrolyser package HAZOP		CROSSWIND
78	-	Confirm if non return valve is required on individual feed lines into brine disposal manifold.		ROSETTI
79	39	Confirm maximum pressure of fluid discharge from electrolyser package and ensure brine disposal system is adequately designed.	06-mar-23	CROSSWIND
80	40	Consider winterization of brine drain line if required	06-mar-23	ROSETTI
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.	06-mar-23	CROSSWIND
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.	06-mar-23	CROSSWIND
83	-	To be examined within electrolyser package HAZOP		CROSSWIND
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.	06-mar-23	CROSSWIND

SHEAM No.Feed HSSE Register_ REV 01	Source Doc Ref.	Recommendations	Date	Due by
85	44	Shut down on 'HH' in hydrogen KO drum vent should lead to system shut down but not depressurisation.	06-mar-23	ROSETTI
86	45	Asses consequences of loss of safeguard of availability of vent system to upstream users.	06-mar-23	ROSETTI
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.	06-mar-23	CROSSWIND
88	52	Ensure Level 'LY- HH' on hydrogen KO drum vent achieves a RRF of 120.	06-mar-23	ROSETTI
89	-	Assess the requirement for flow meter downstream P- 43003 with'LL' flow trip and evaluate if this needs to be DCS or SIS.		ROSETTI
90	-	Shut down on 'HH' in hydrogen KO drum vent should lead to system shut down but not depressurisation.		ROSETTI
91	-	Asses consequences of loss of safeguard of availability of vent system to upstream users.		ROSETTI
92	-	Check with Technical Safety TA2 whether CoP modifier is allowed for this unmanned platform which will be visited for 2 shifts per year.		CROSSWIND
93	-	Assess the requirement for flow meter downstream P- 43003 with'LL' flow trip and evaluate if this needs to be DCS or SIS.		ROSETTI
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.	06-mar-23	ROSETTI
95	-	Assess the requirement for flow meter downstream P- 43003 with'LL' flow trip and evaluate if this needs to be DCS or SIS.		ROSETTI
96	-	action closed in Feed HSSE rev01		
97	46	Review need for winterisation of small bore piping & provide if required.	06-mar-23	ROSETTI
98	48	Review necessity for provision of heater within hydrogen vent V- 43001, when information on potential liquid carry over is available.	06-mar-23	ROSETTI
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.	06-mar-23	ROSETTI
100	47	Review design of pump with respect to possibility of running dry with hydrogen gas.	06-mar-23	ROSETTI
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.	06-mar-23	ROSETTI
102	47	Review design of pump with respect to possibility of running dry with hydrogen gas.		ROSETTI
103	-	Action closed in HSSE register rev.01		
104	55	Ensure all materials are suitable for oxygen service, during construction, commissioning & operations.	06-mar-23	ROSETTI
105	54	Review during electrolyser vendor package HAZOP	06-mar-23	CROSSWIND
106	-	Action closed in HSSE register rev.01		
107	-	Action closed in HSSE register 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.	06-mar-23	CROSSWIND
109	58	Ensure Level 'LY- HH' on Oxygen KO drum vent achieves a RRF of 120.	06-mar-23	CROSSWIND
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.	06-mar-23	CROSSWIND
111	-	Check with Technical Safety TA2 whether CoP modifier is allowed for this unmanned platform which will be visited for 2 shifts per year.		CROSSWIND
112	-	Ensure Level 'LY- HH' on Oxygen KO drum vent achieves a RRF of 120.		CROSSWIND
113	-	Assess the requirement for flow meter downstream P- 44003 with'LL' flow trip and evaluate if this needs to be DCS or SIS.		CROSSWIND
114	-	Action closed in HSSE register rev.01		
115	-	Action closed in HSSE register rev.01		

SHEAM No.Feed HSSE Register_ REV 01	Source Doc Ref.	Recommendations	Date	Due by
116	56	Review design of pump with respect to possibility of running dry with oxygen gas.	06-mar-23	ROSETTI
117	-	Action closed in HSSE register rev.01		
118	56	Review design of pump with respect to possibility of running dry with oxygen gas.	06-mar-23	ROSETTI
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.	06-mar-23	ROSETTI
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.	06-mar-23	ROSETTI
121	63	Consider requirements for nitrogen generation package in order to provide sufficient nitrogen supply.	06-mar-23	ROSETTI
122	62	Investigate practical means of providing sufficient volume of nitrogen for pressure purging hydrogen pressure storage vessels.	06-mar-23	ROSETTI
123	64	Review sizing basis for wastewater tank, in order to reduce possibility of overflow and environmental pollution based on information from potential users	06-mar-23	ROSETTI
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.	06-mar-23	ROSETTI
125	68	Ensure that vendor package HAZOPS'S examine possibility of gas blowby via this route & provide suitable mitigation as required.	06-mar-23	CROSSWIND
126	66	Winterisation of wastewater system as required.	06-mar-23	ROSETTI
127	67	Consider requirements for liquid seal within main drain line system.	06-mar-23	ROSETTI
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.	06-mar-23	ROSETTI

4.2 EPC HAZOP ACTIONS REGISTER

Item No	Recommendations	Date	Due by
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.	01/12/2023	Rosetti Process
2	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.	01/12/2023	Rosetti Tech Safety
3	3. Review if it is credible to implement an interlock on 25PIC005 to prevent 25PV005 being opened outside of a purge cycle operation.	01/12/2023	Rosetti Process
4	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.	01/12/2023	Rosetti Process
5	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).	01/12/2023	Rosetti Process
6	6. Review if it is credible to implement an interlock to prevent 25FV001 being opened outside of a purge cycle operation.	01/12/2023	Rosetti Process
7	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.	01/12/2023	Rosetti Process
8	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.	01/12/2023	Rosetti Process
9	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.	01/12/2023	Rosetti Tech Safety
10	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.	01/12/2023	Rosetti Process
11	11. Ensure that the trapped volume between 25SVD023 and 25PV025A/B is minimised such that it does not require blowdown.	01/12/2023	Rosetti Process
12	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.	01/12/2023	Rosetti Process
13	13. Ensure that the potential for electrically induced corrosion and requisite earthing is considered in the SAFOP.	01/12/2023	Crosswind Electrical
14	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.	01/12/2023	Rosetti Process
15	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.	01/12/2023	Rosetti Instrumentation
16	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.	01/12/2023	Rosetti Instrumentation

Item No	Recommendations	Date	Due by
17	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.	01/12/2023	Rosetti Process
18	18.Review where a N2 purge connection can be located close to Electrolyser discharge to enable N2 purging of H2 storage inlet system.	01/12/2023	Rosetti Process
19	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.	01/12/2023	Rosetti/ Crosswind Project
20	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.	01/12/2023	Rosetti Process
21	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.	01/12/2023	Rosetti/ Crosswind (Interface)
22	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.	01/12/2023	Rosetti/ Crosswind (Interface)
23	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.	01/12/2023	Rosetti Process
24	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.	01/12/2023	Rosetti/ Crosswind Project
25	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.	01/12/2023	Rosetti Process
26	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.	01/12/2023	Crosswind
27	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	01/12/2023	Crosswind
28	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	01/12/2023	Crosswind
29	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	01/12/2023	Crosswind
30	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.	01/12/2023	Rosetti Process
31	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.	01/12/2023	Rosetti Process

Item No	Recommendations	Date	Due by
32	32. Review the requirement for level transmitter and low level alarm to detect low level in H2 vent liquid seal Q43004.	01/12/2023	Rosetti Instrumentation
33	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.	01/12/2023	Crosswind
34	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.	01/12/2023	Crosswind
35	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.	01/12/2023	Rosetti Process
36	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.	01/12/2023	Rosetti Tech Safety
37	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.	01/12/2023	Rosetti Instrumentation
38	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.	01/12/2023	Rosetti Process
39	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.	01/12/2023	Rosetti Process
40	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.	01/12/2023	Rosetti Process
41	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.	01/12/2023	Crosswind
42	42. Make air fail position of 43LV001 fail closed and type 6 (critical).	01/12/2023	Rosetti Process
43	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.	01/12/2023	Rosetti Instrumentation
44	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.	01/12/2023	Rosetti Instrumentation
45	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.	01/12/2023	Rosetti Process
46	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.	01/12/2023	Rosetti/ Crosswind Project
47	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.	01/12/2023	Rosetti Process / Crosswind / PSC / Elogen

Item No	Recommendations	Date	Due by
48	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.	01/12/2023	Rosetti Process / Crosswind / PSC / Elogen
49	49. 50-LI020LL should trip P-50004A/B on LL level in T-50006 to prevent pump damage	01/12/2023	Rosetti
50	50. Ensure that where multiple trains are implemented within the WTP package remote changeover between trains is available to onshore operators on request.	01/12/2023	Rosetti / CRW
51	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.	01/12/2023	Rosetti
52	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.	01/12/2023	Rosetti
53	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.	01/12/2023	Crosswind
54	54. Ensure logic for control of P-50009A/B prevents simultaneous running A & B pumps.	01/12/2023	Rosetti Process
55	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.	01/12/2023	Crosswind
56	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.	01/12/2023	Rosetti Tech Safety

4.3 ATTACHMENT 1 - CLOSED FEED HAZOP CLOSE OUT SHEETS

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 Digitaal ondertekend door 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**

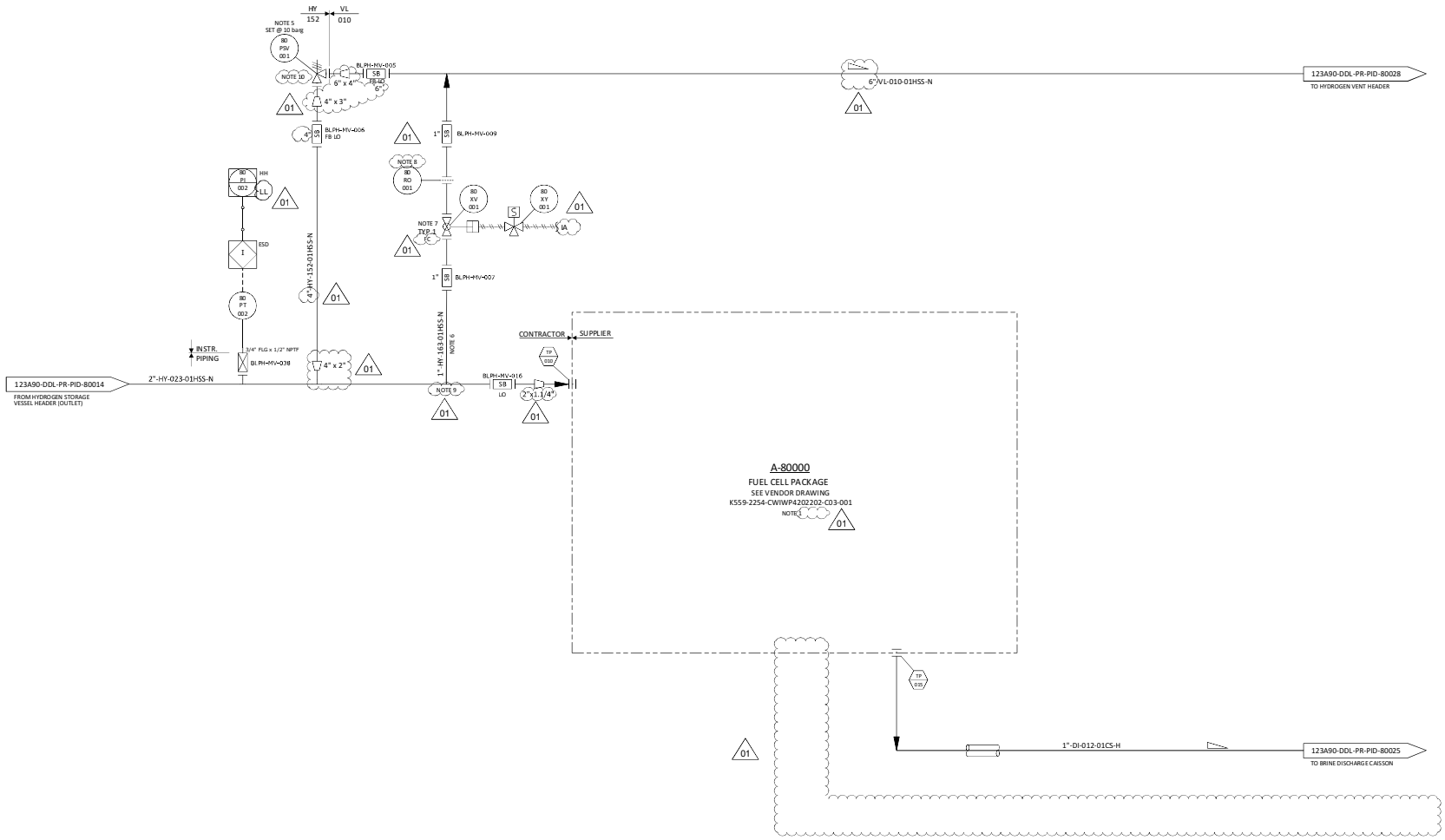
BLPH SHEAMS SIGNATURE FORM

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 Norme 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 :

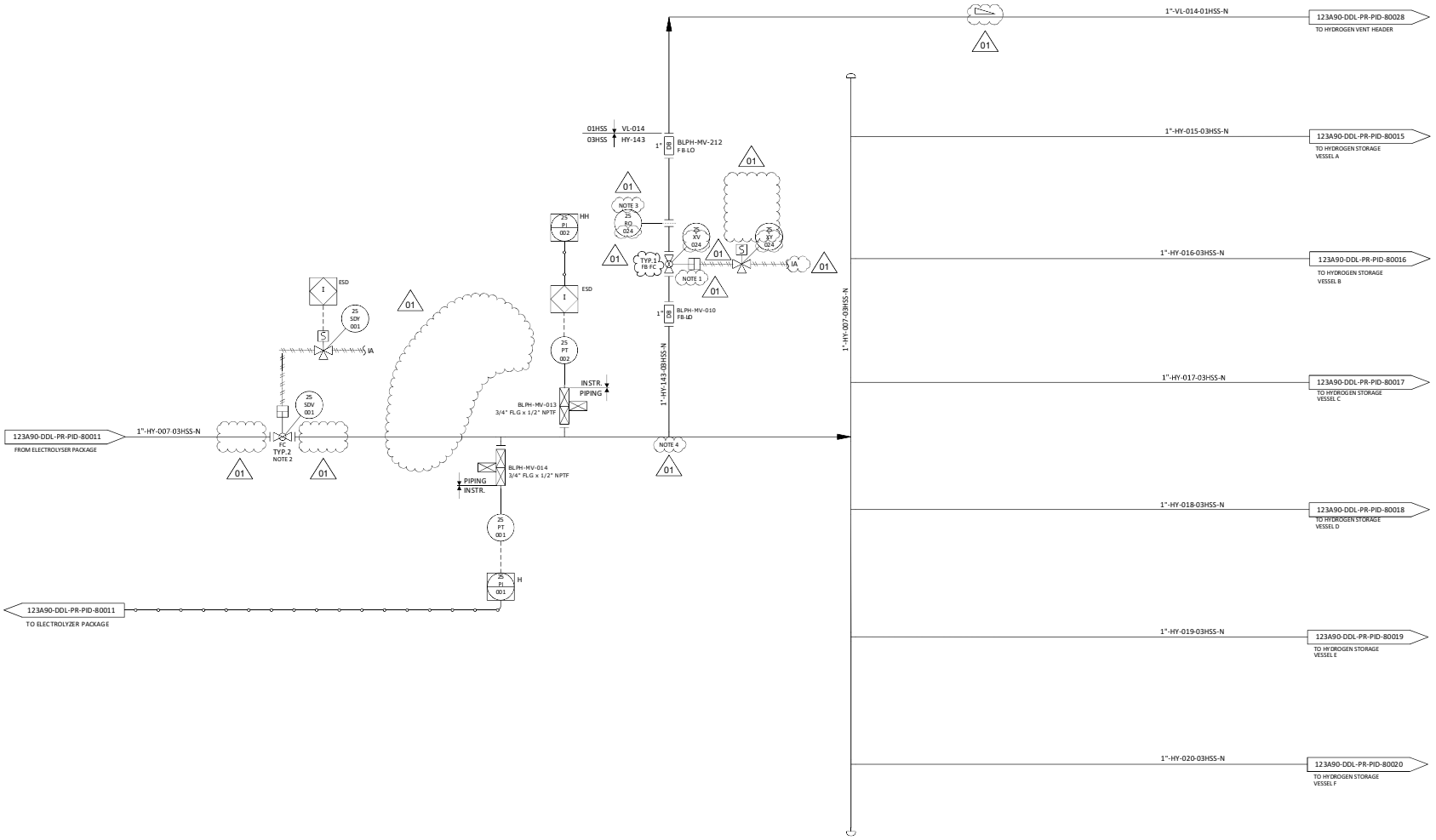
BLPH PIPING AND INSTRUMENTATION DIAGRAM
FUEL CELL PACKAGE

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

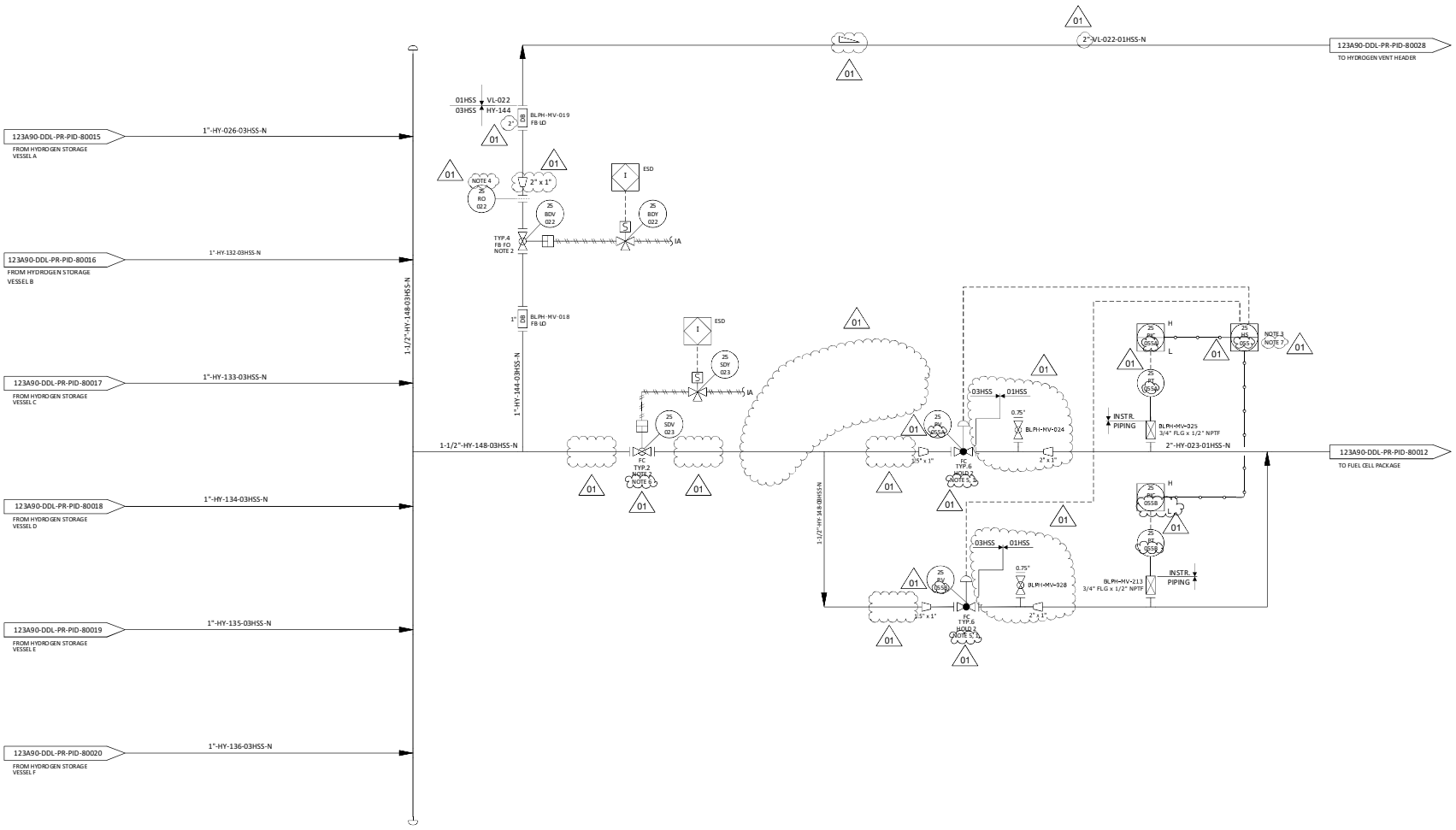
ROSETTI MARINO

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.

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

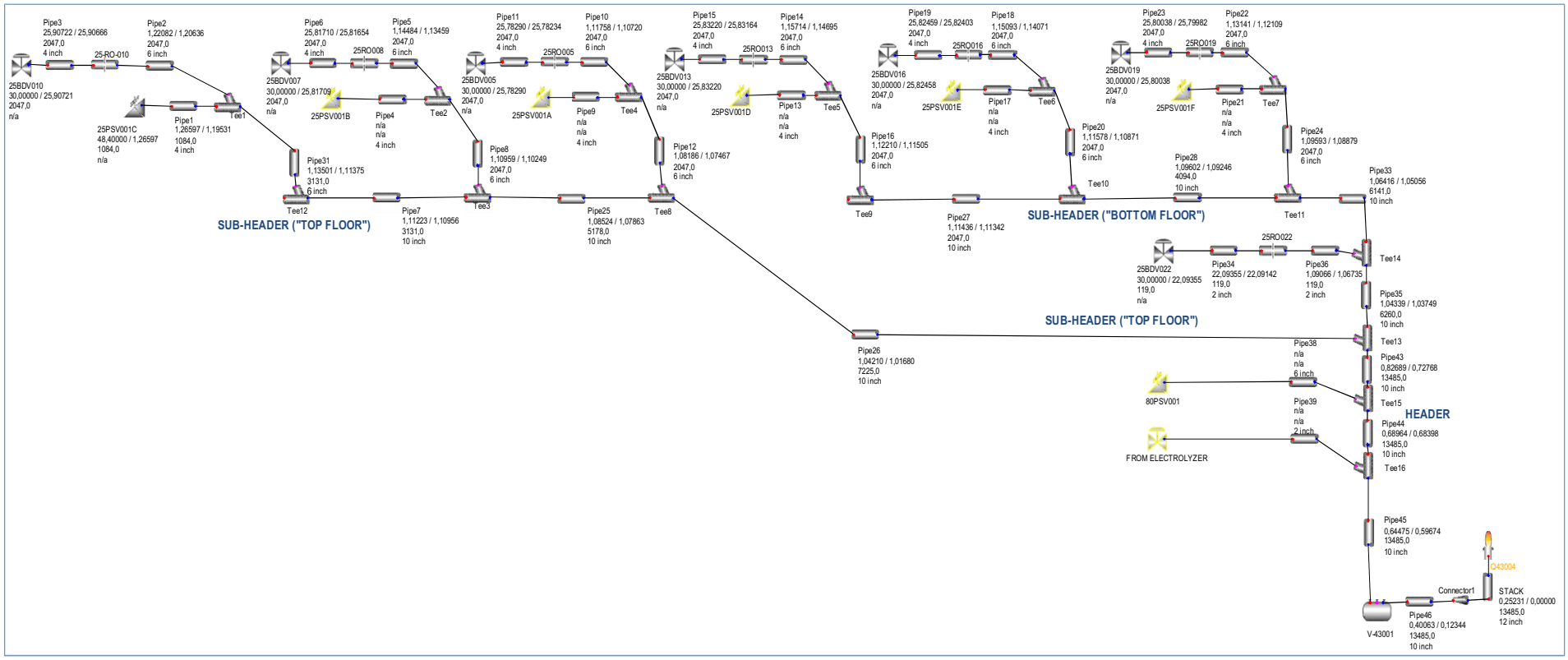
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Document Class: 1

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	Paul van Rossum Digitaal ondertekend door Paul van Rossum Datum: 2024.10.11 08:02:21 +02'00' **Sign**
Company Project Manager	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.10.11 12:57:21 +02'00' **Sign**
Contractor received for information. Not independently verified. Information implemented	**Sign**

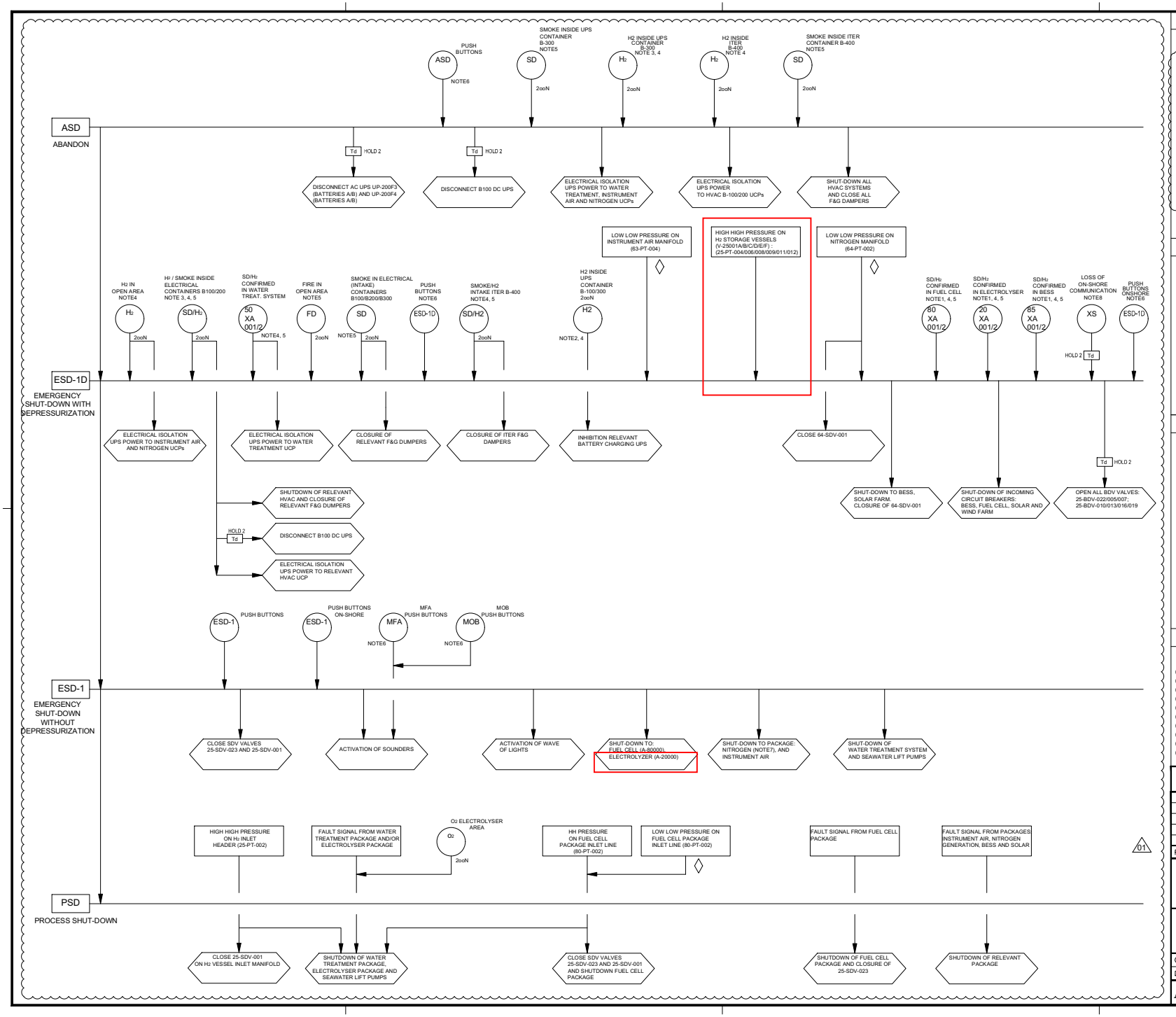
Node: 1. Fuel Cell Hydrogen and Air Feed

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. Goob 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 :

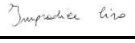
BASE LOAD POWER HUB (BLPH)
Process Safety Cause & Effect
Block Diagram

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

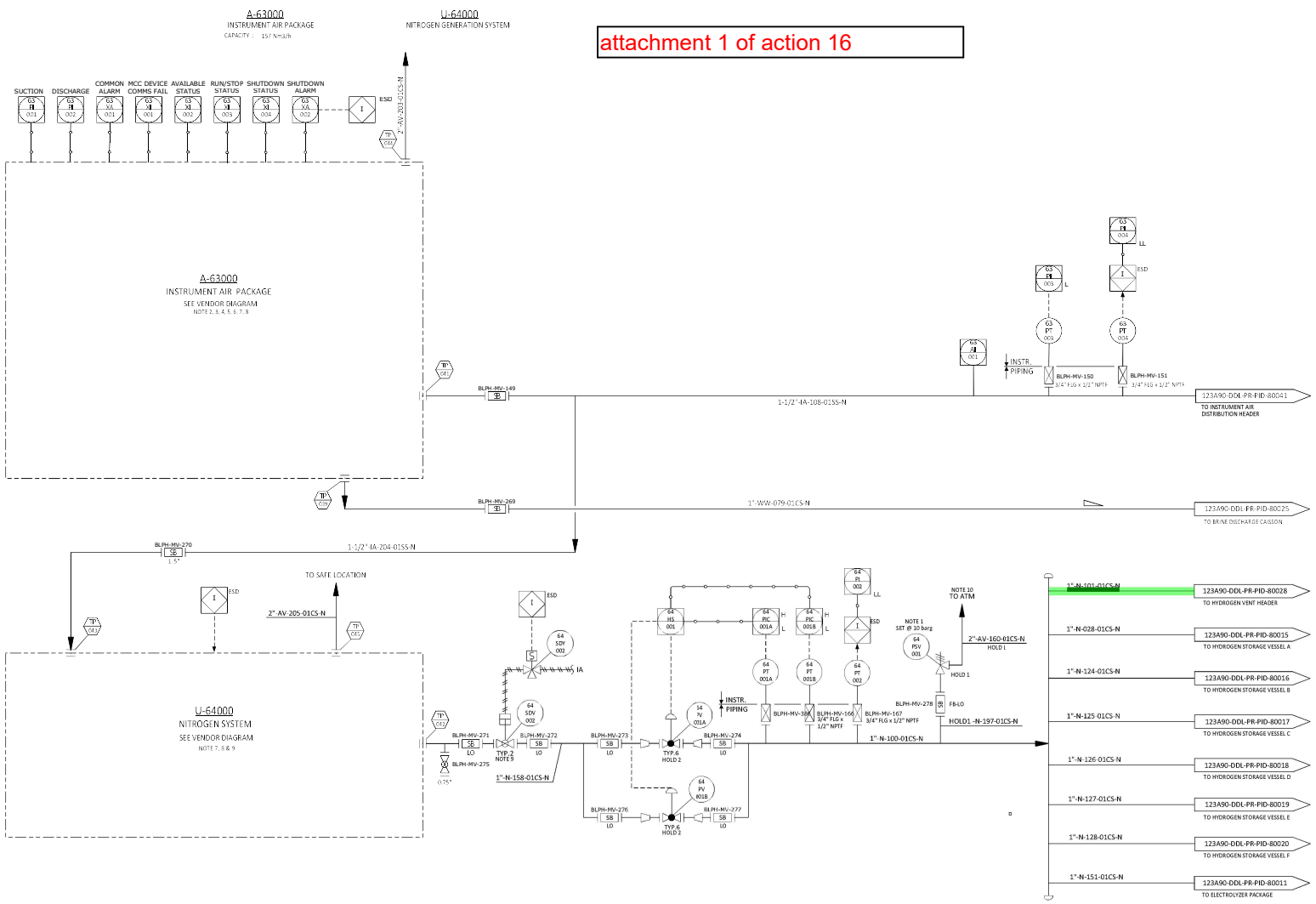
A1	DRAWING NO. 123A90-DDL-PR-DG-80000	SHEET 001	REV. 01

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	RZ	DLO	ISSUE FOR ACCEPTANCE (IFA)

CROSSWIND

ROSETTI MARINO

TITLE :
BLPH PIPING AND INSTRUMENTATION DIAGRAM
INSTRUMENT AIR PACKAGE

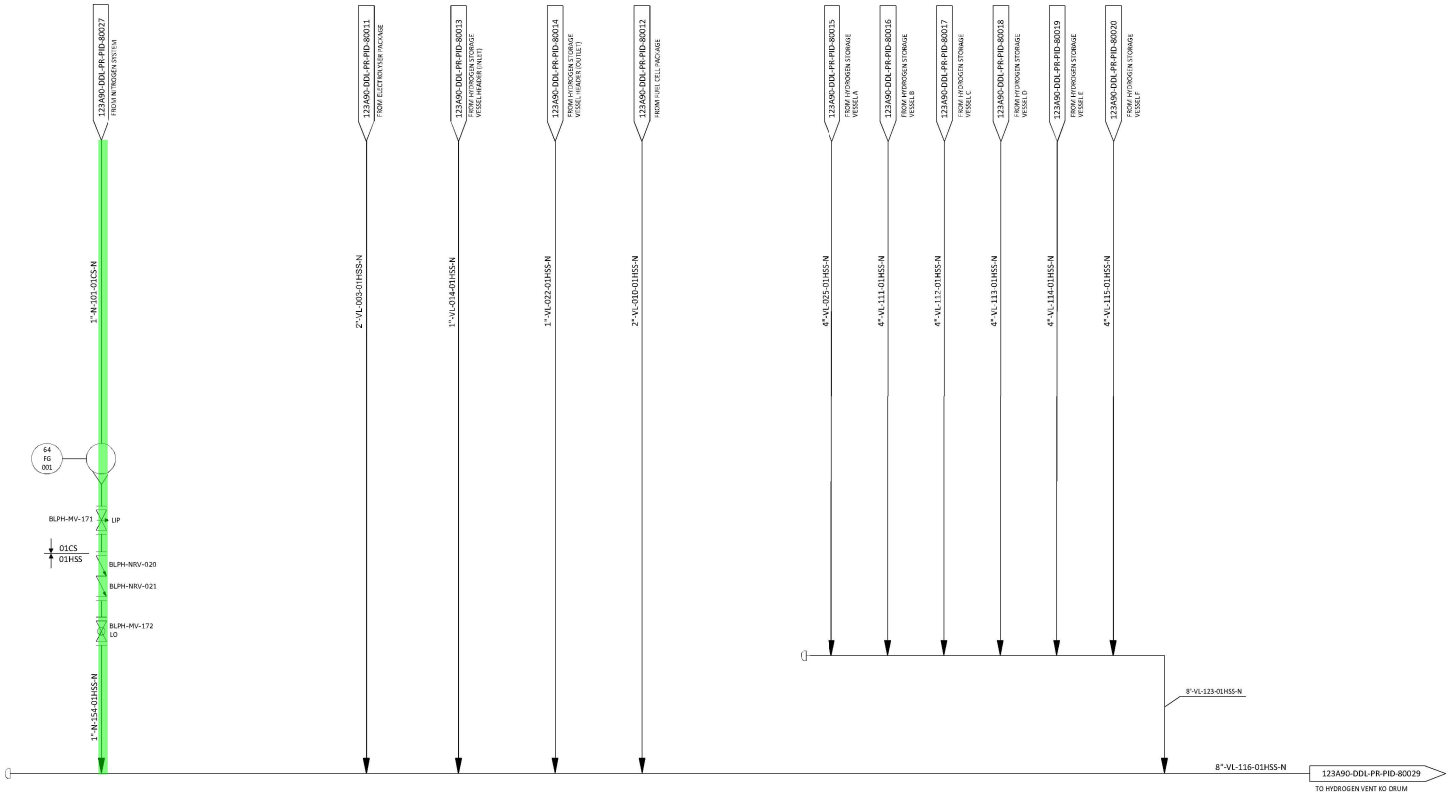
CONTRACT NO./TITLE	CW-I-WP4-2023-05/HOLLANDSE KUST NOORDWIND PARK	SCALE	NTS
DRAWN	CHECKED	APPROVED	DATE
A1	DRAWING NO. 123A90-DDL-PR-PID-80027	SHEET 001	REV. 00

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	23/10/2023	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

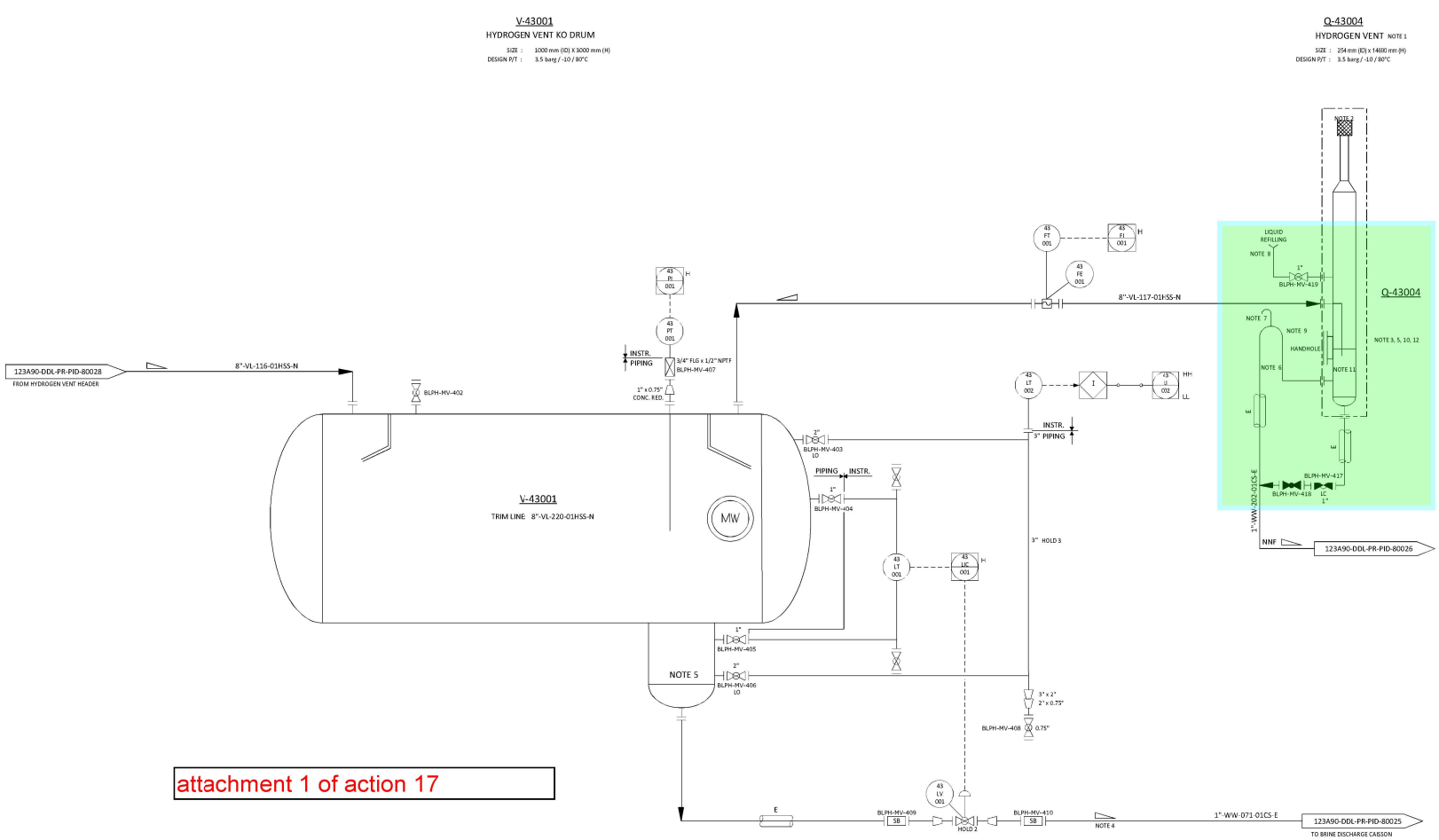
Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	17
Cause:	Loss of nitrogen at any cause
Consequence:	Potential air ingress into hydrogen vent. Leading to explosion, LOC & risk to personnel.
Safeguards:	
Actions:	In case of failure of primary nitrogen purge, ensure a 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. DRAWING_NO.

REV. 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	23/10/2023	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

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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 17

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.	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.

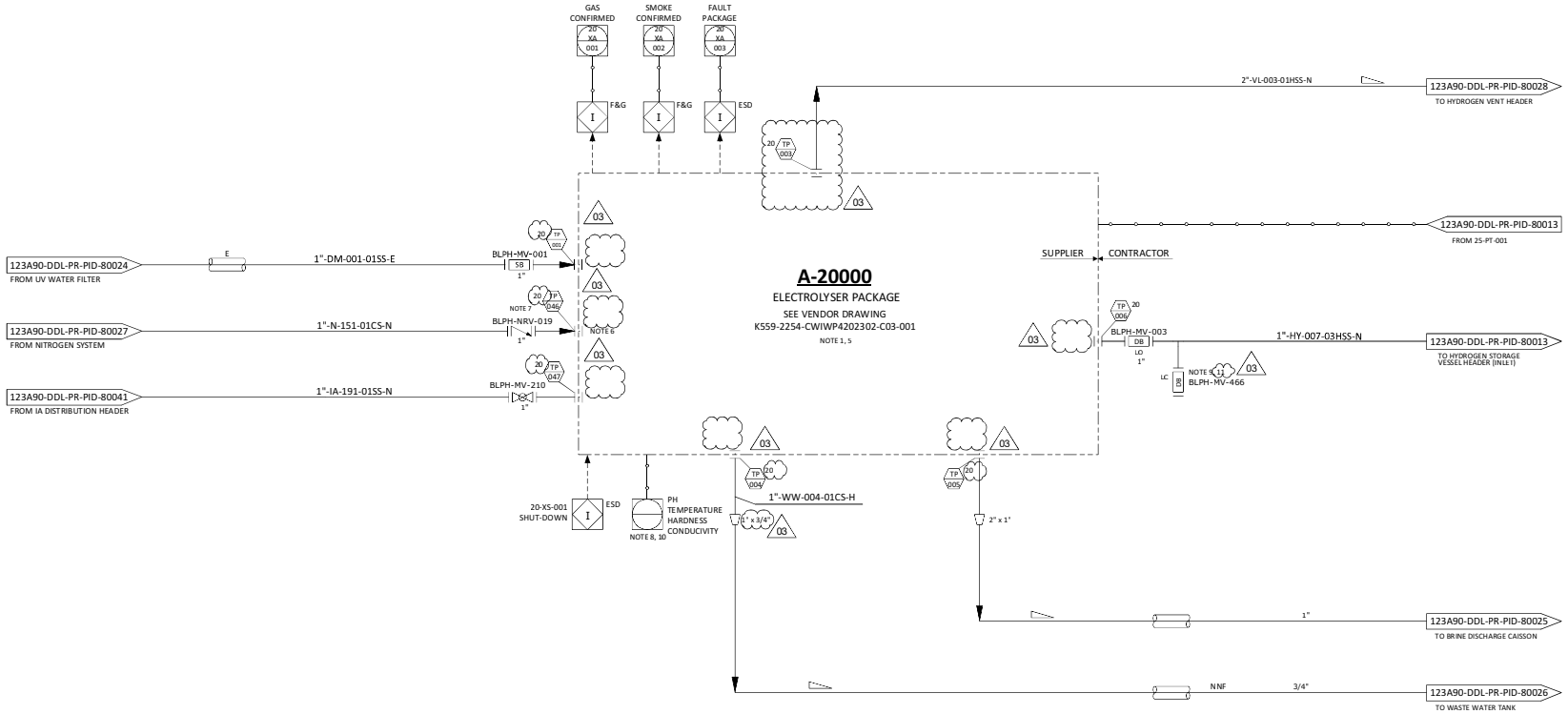
DRAWING NO. DRAWING_NO.

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

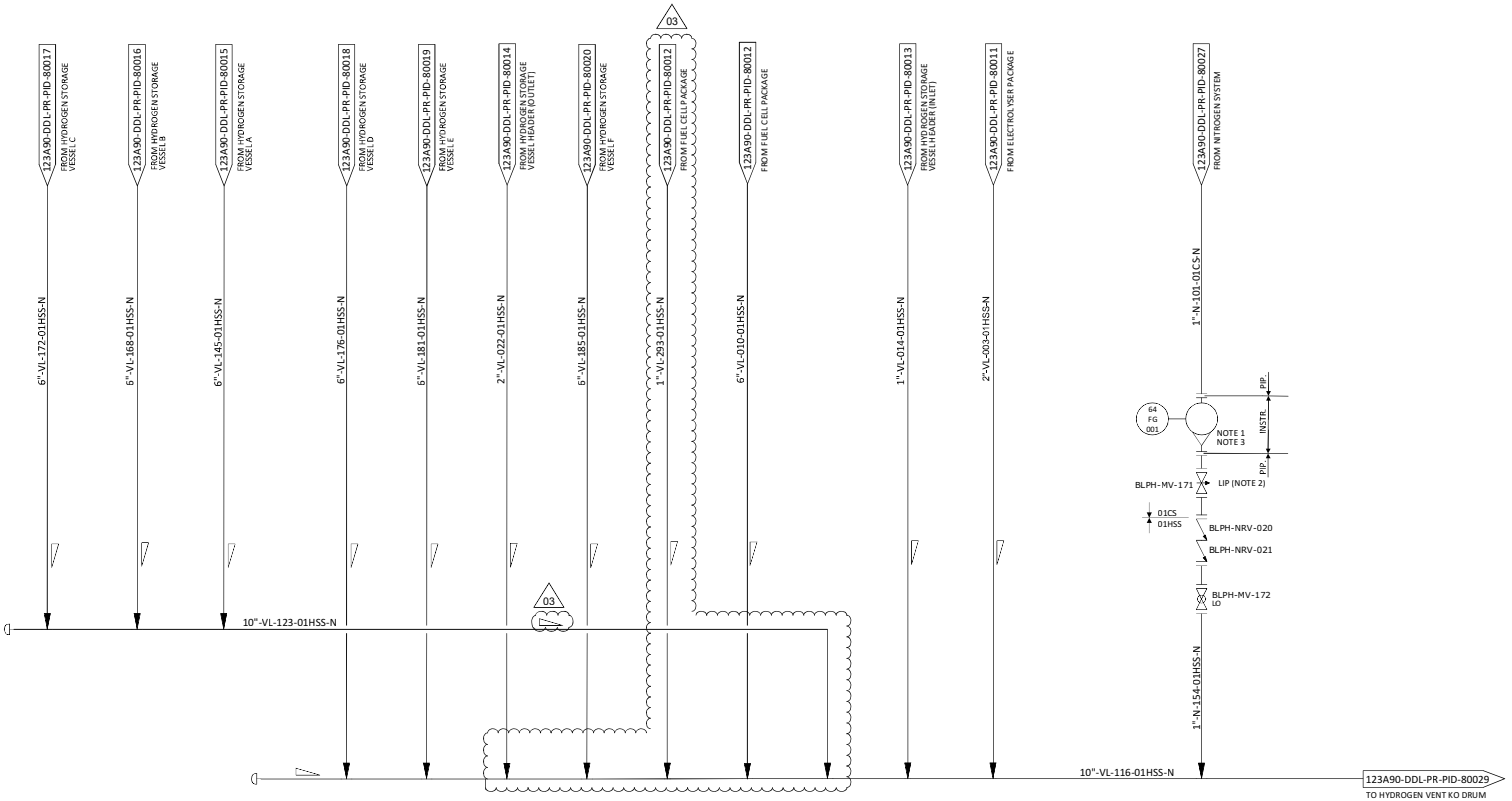
TITLE :
BLPH PIPING AND INSTRUMENTATION DIAGRAM
ELECTROLYSER PACKAGE

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

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.

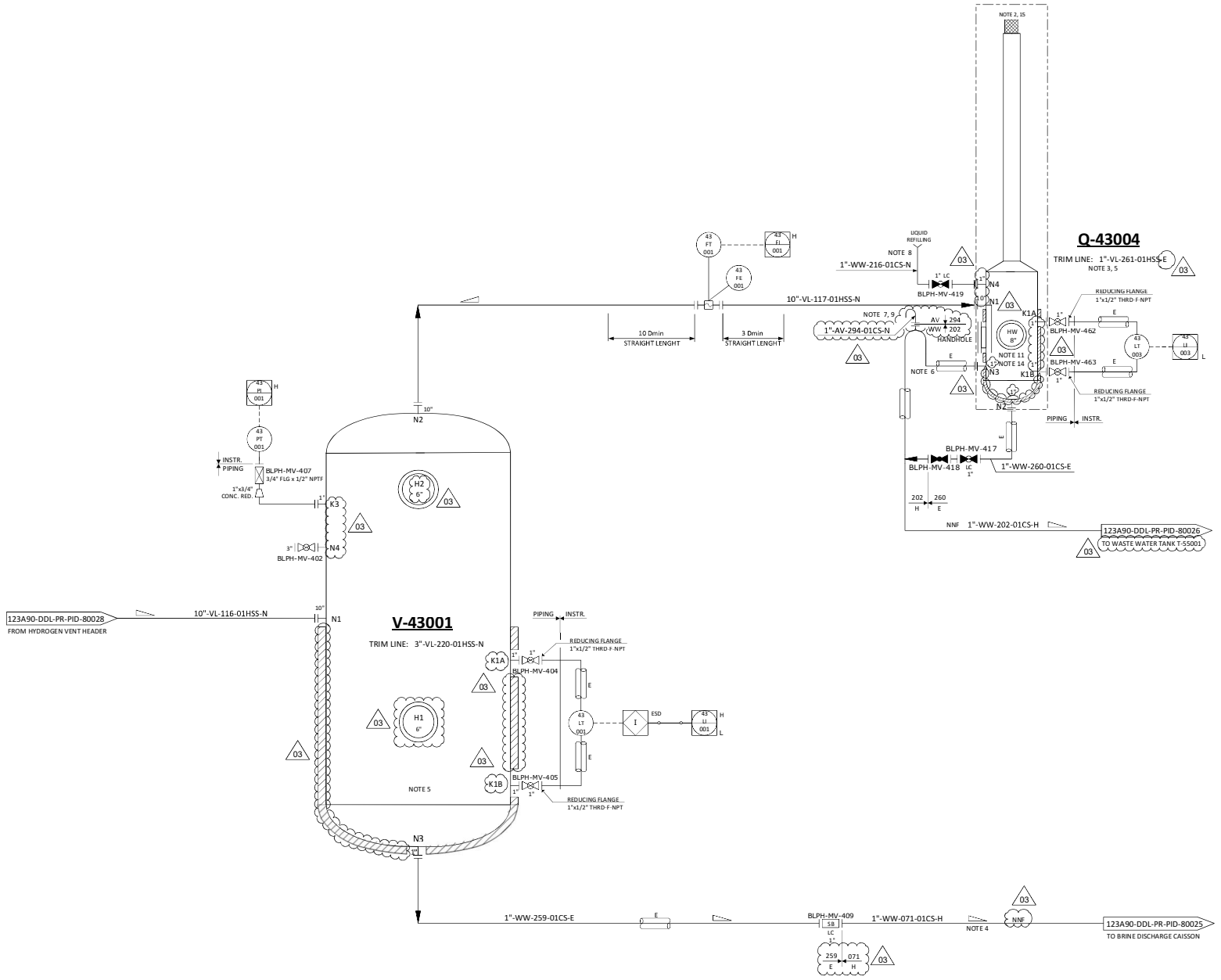
REV. REV

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**

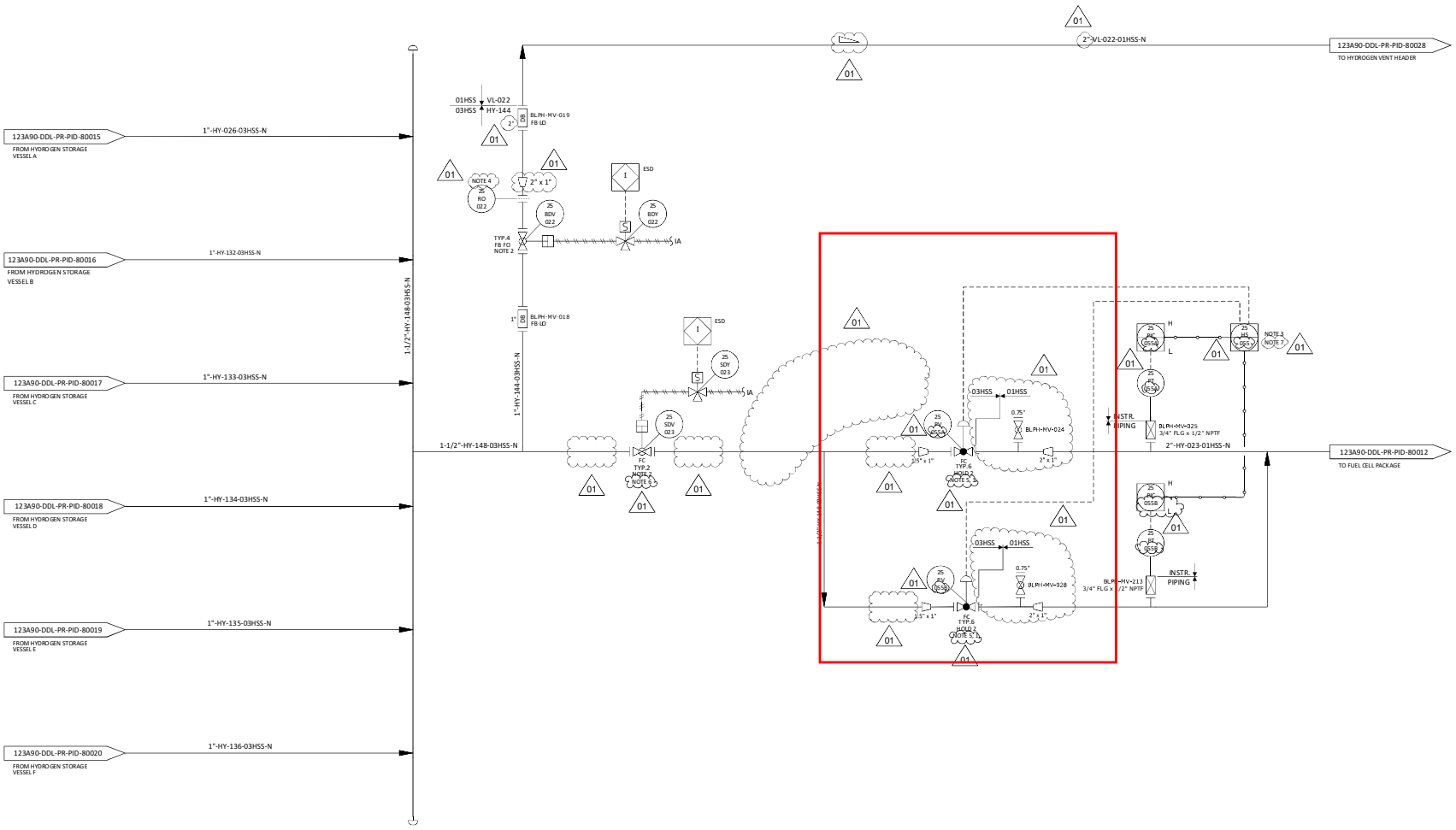
BLPH SHEAMS SIGNATURE FORM

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	Impradice Ciro
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

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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:

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

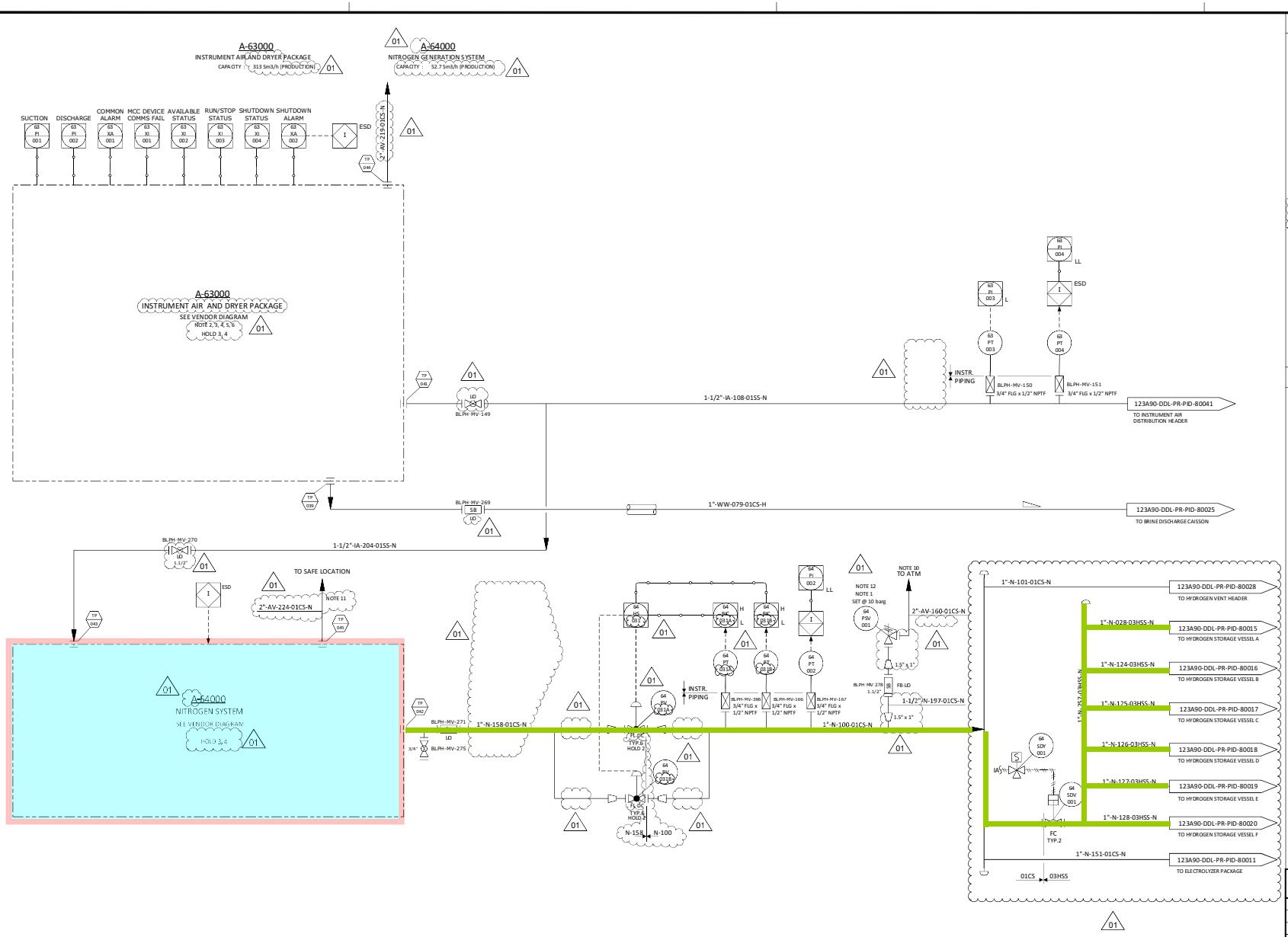
Where:

- 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.
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.
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 R	S	L	RR	LOPA?	Barriers: Barrier Tag	Barrier Description	Validity	Recommendation	Responsibility	ALARP Determination
	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

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

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**

Digitaal ondertekend door Paul van Rossum
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
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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
01
02
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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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email: tai@taimilano.it - web: www.taimilano.it

DIMENSIONAL OUTLINE DRAWING WITH MATERIAL LIST AND VALVE DATA

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

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

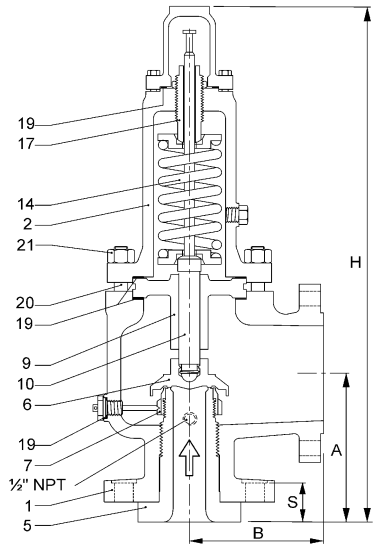
Tag
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PARTS AND MATERIAL LIST

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:	Hamant 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.

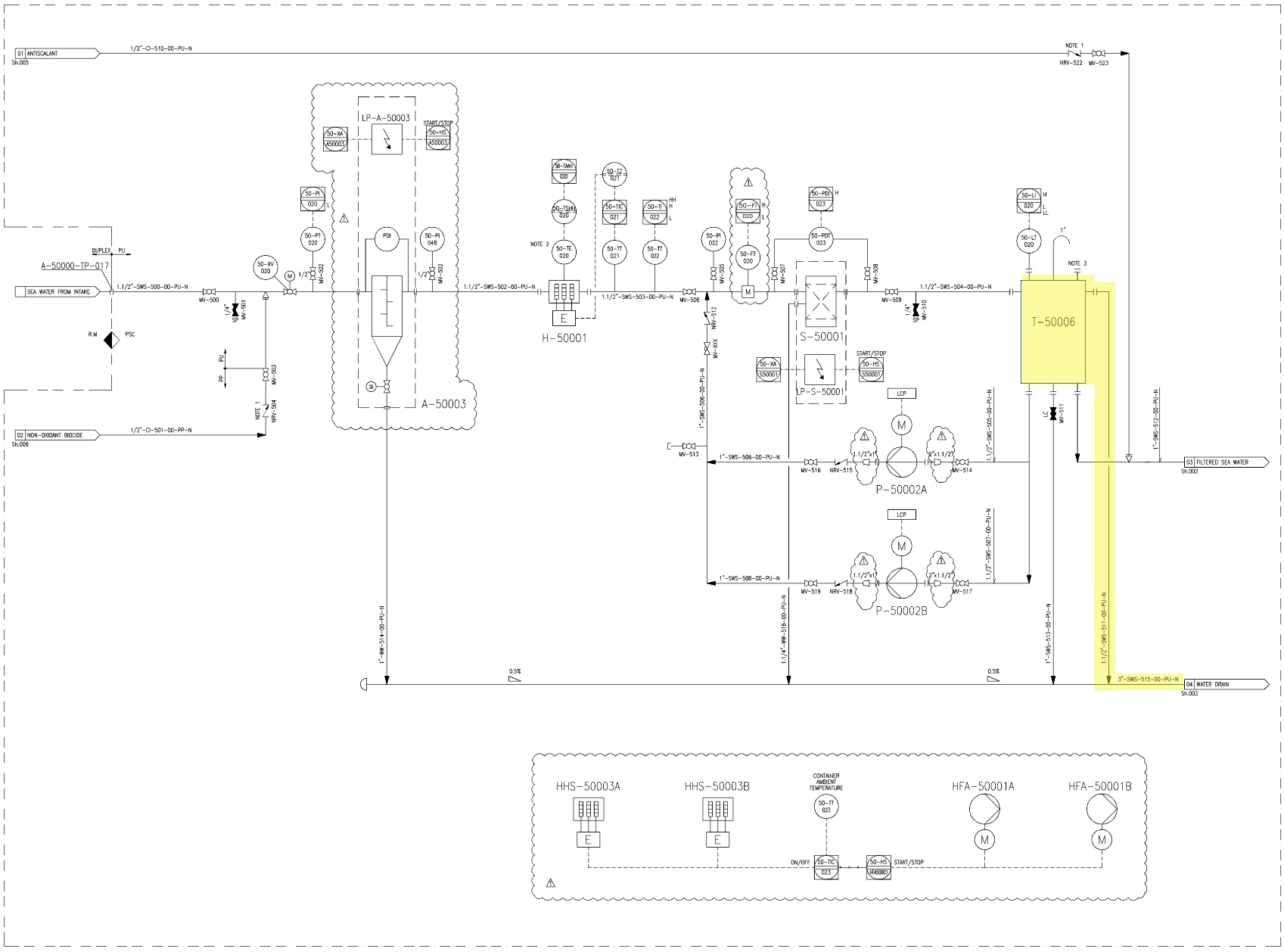
BLPH SHEAMS SIGNATURE FORM

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'

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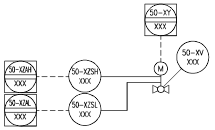
REV. 1



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 -

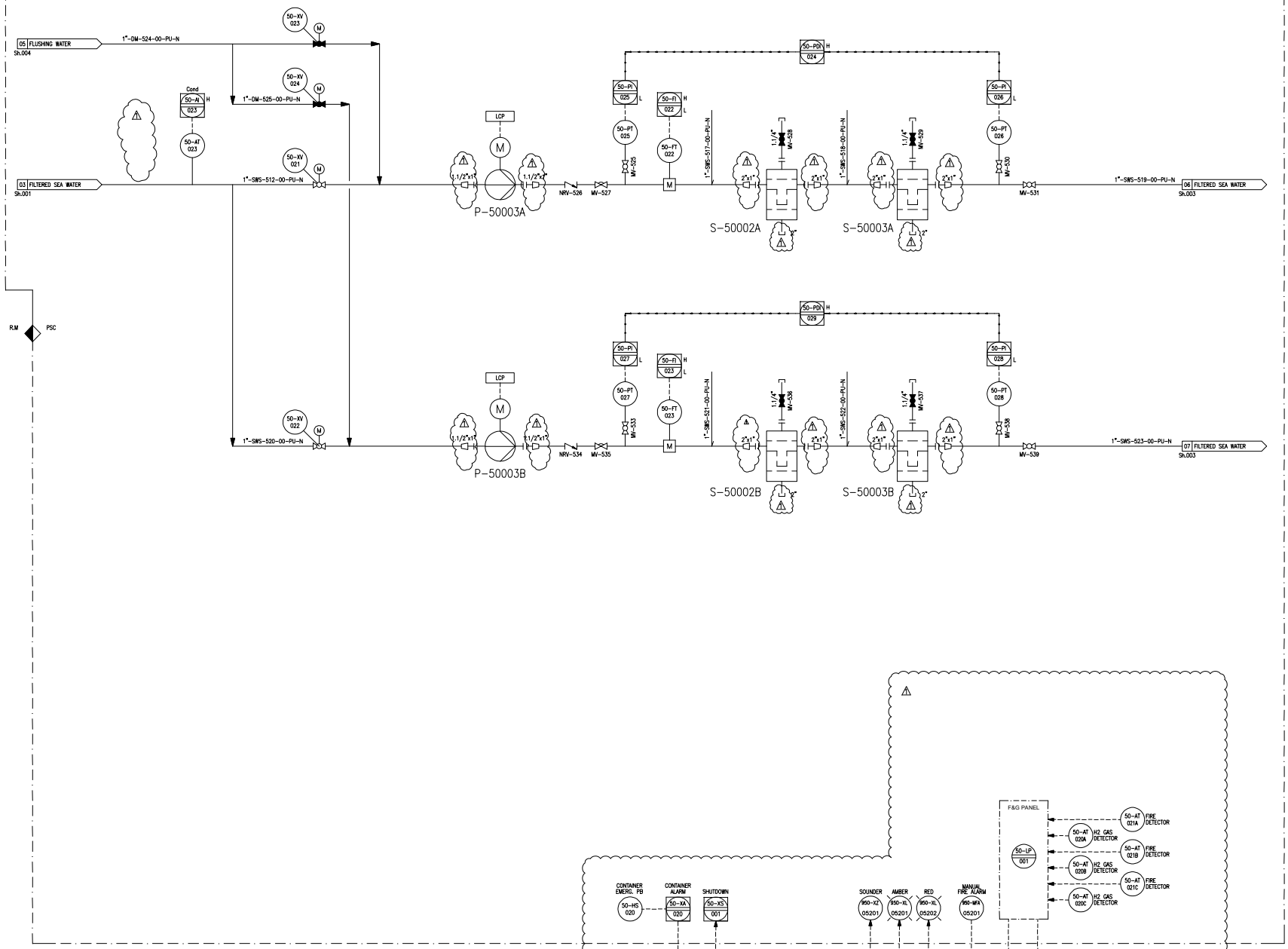
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File Name : 1724000448-PR-PID-00013 Rev01

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

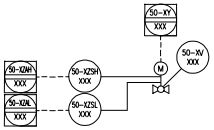
S-50002A/B	
SW 1ST CARTRIDGE FILTER	
FILTRATION RATE	20 µm
CAPACITY	2 m3/h
DES. PRESS.	7 barg
DES. TEMP.	50° C
MATERIAL	PP

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.
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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

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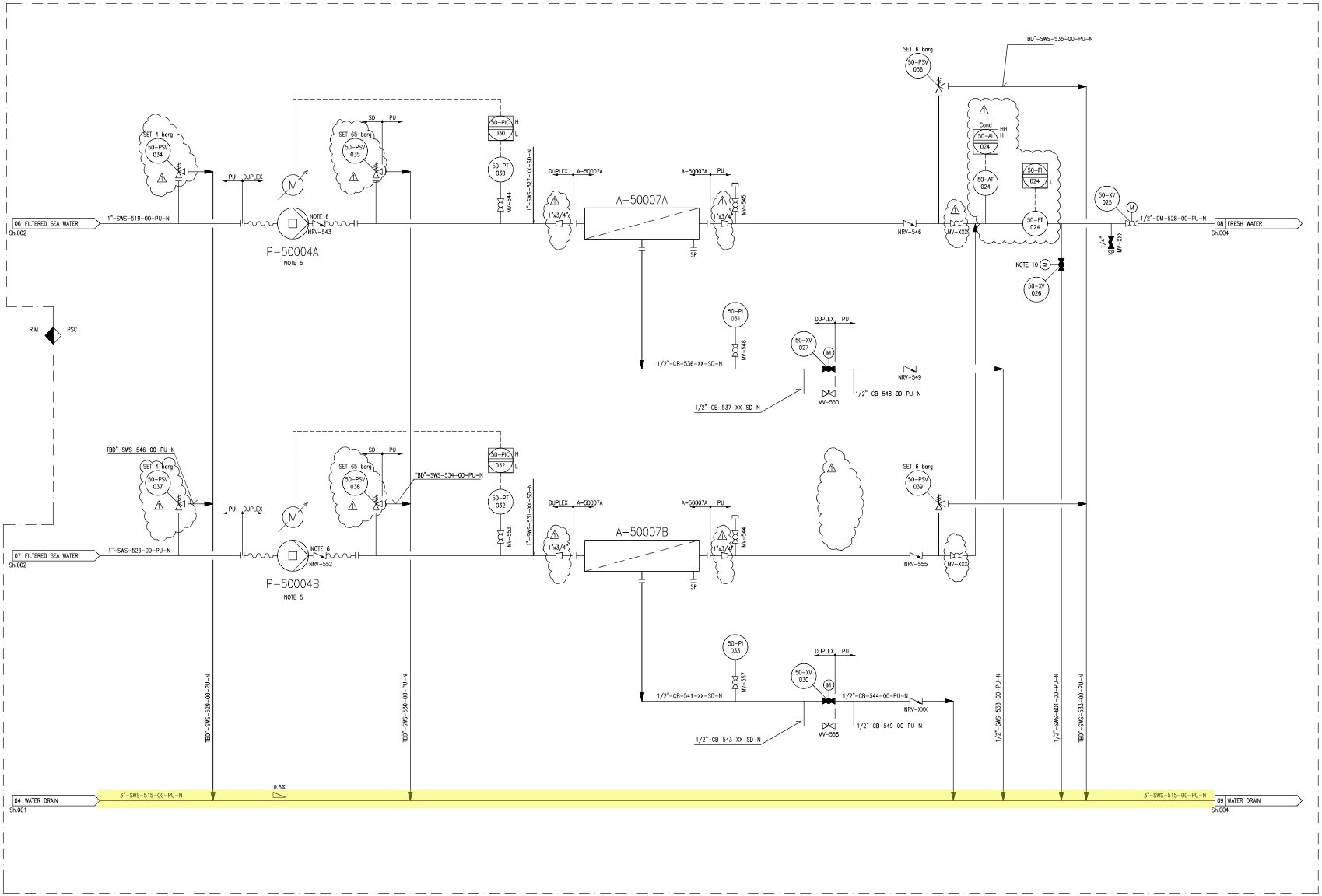
CROSSWIND

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



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

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

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13	OUTLET VALVE

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

CONTRACT NO./TITLE | SCALE -

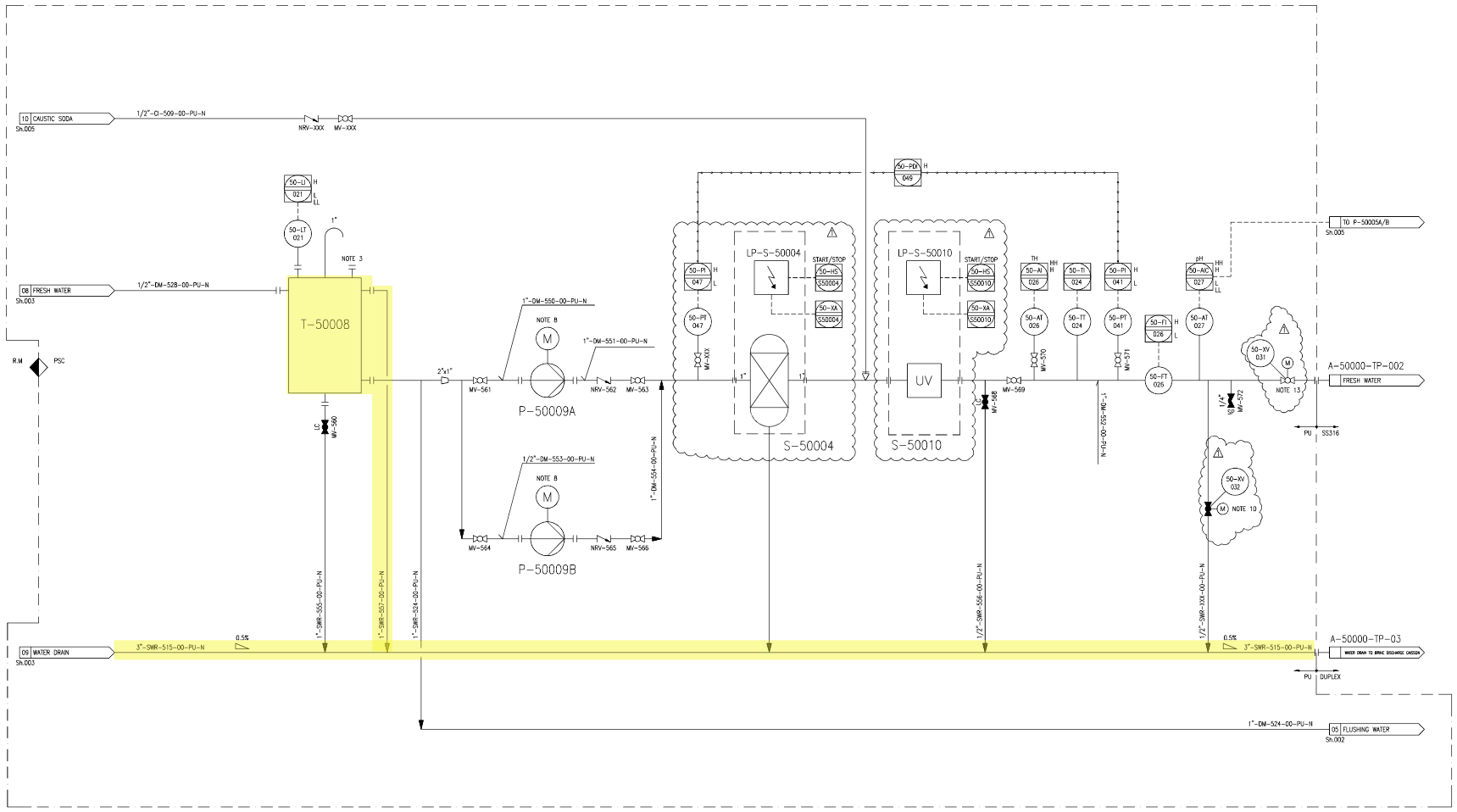
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DRAWING No. 1724000448-PR-PID-00013 REV. 1

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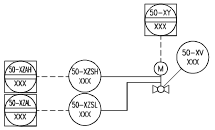
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TERMINAL POINT

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TP-017	1.1/2"	FLG.	150#	RF	DUPLEX	SEA WATER FROM INTAKE PUMPS
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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

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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

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1	29-MAY-24	CC	WR	RM	ISSUED FOR REVIEW
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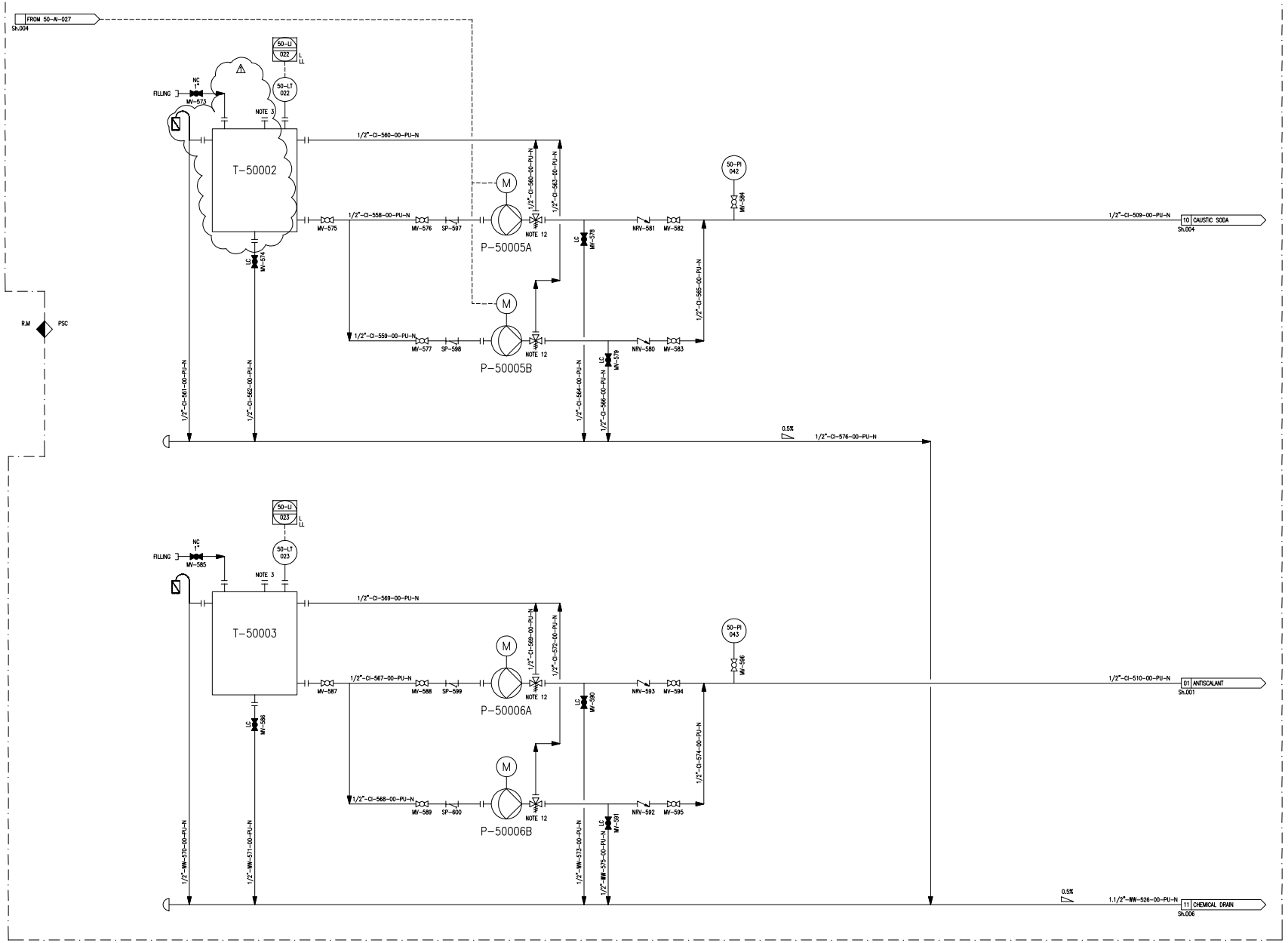
CROSSWIND

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

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
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TP-05	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTANK
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1	29-MAY-24	GG	WR	RM	ISSUED FOR REVIEW
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CROSSWIND ROSETTI MARINO

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

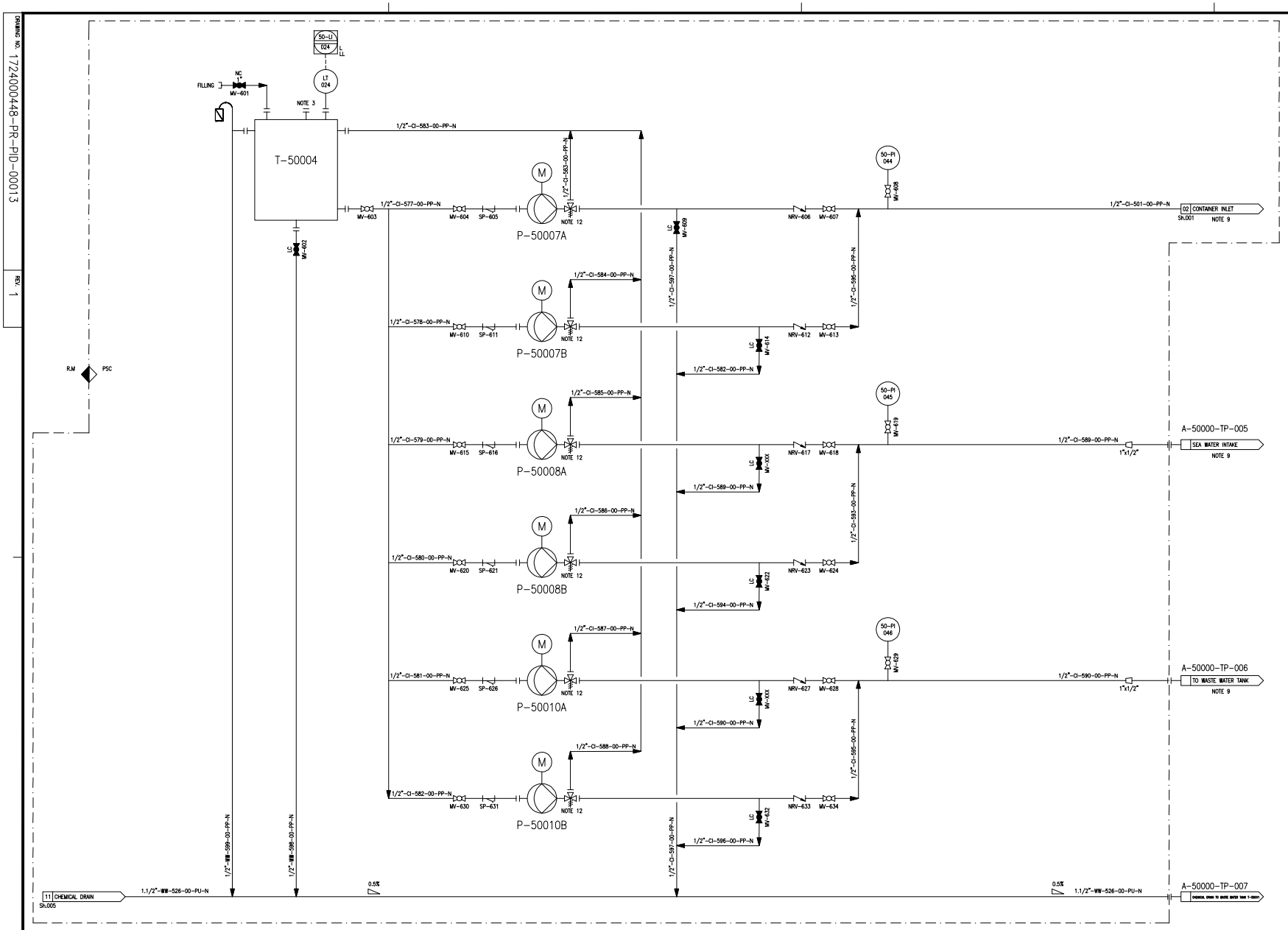
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DRAWN GC | CHECKED WR | APPROVED RM | DATE 29/05/24

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



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

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13	OUTLET VALVE

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

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ROSETTI MARINO

TITLE :
WATER TREATMENT PACKAGE
BIOCIDE DOSAGE
P&I DIAGRAM

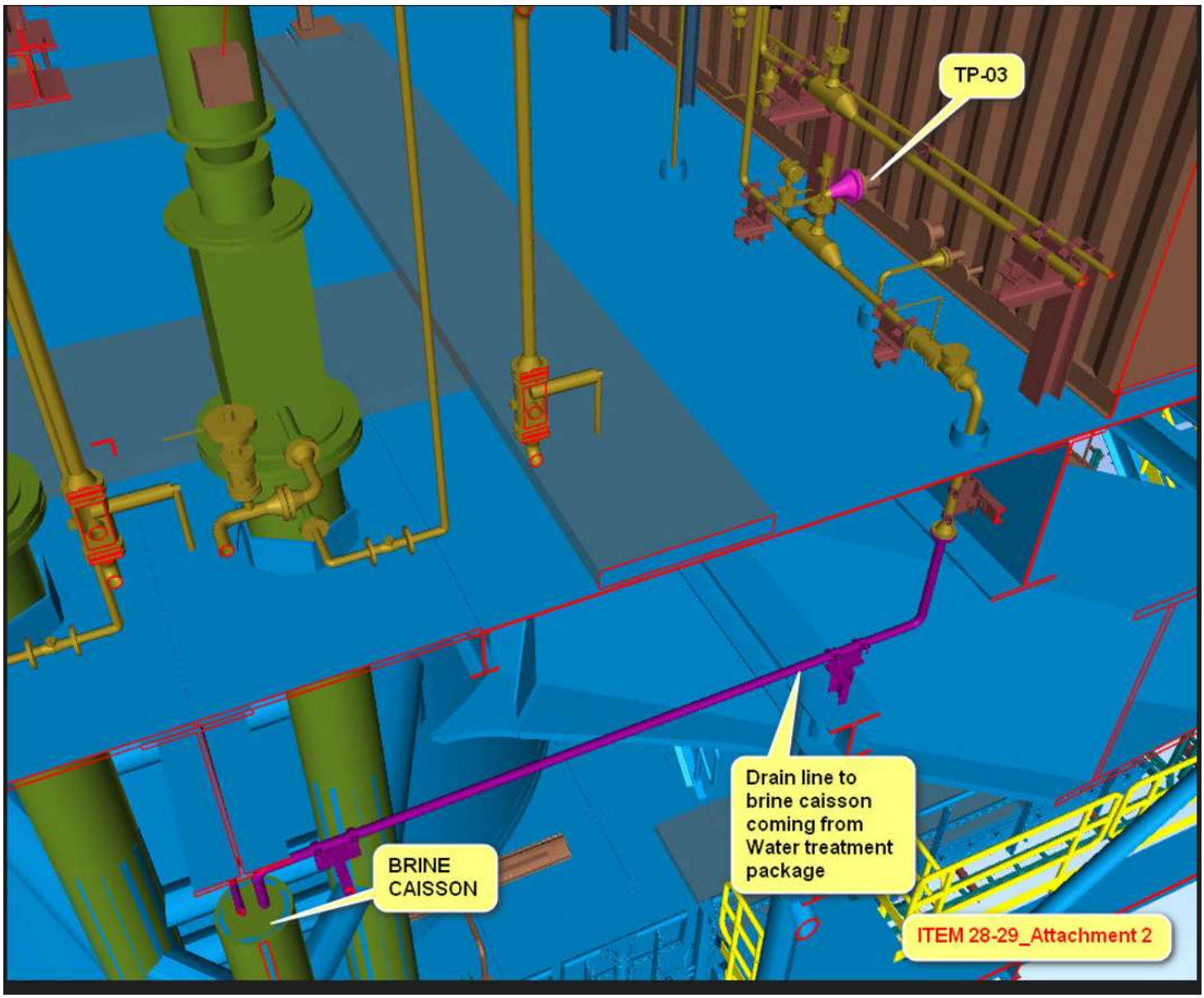
CONTRACT NO./TITLE | SCALE –

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

A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 006 | REV. 1

DRAWING NO. 1724000448-PR-PID-00013 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

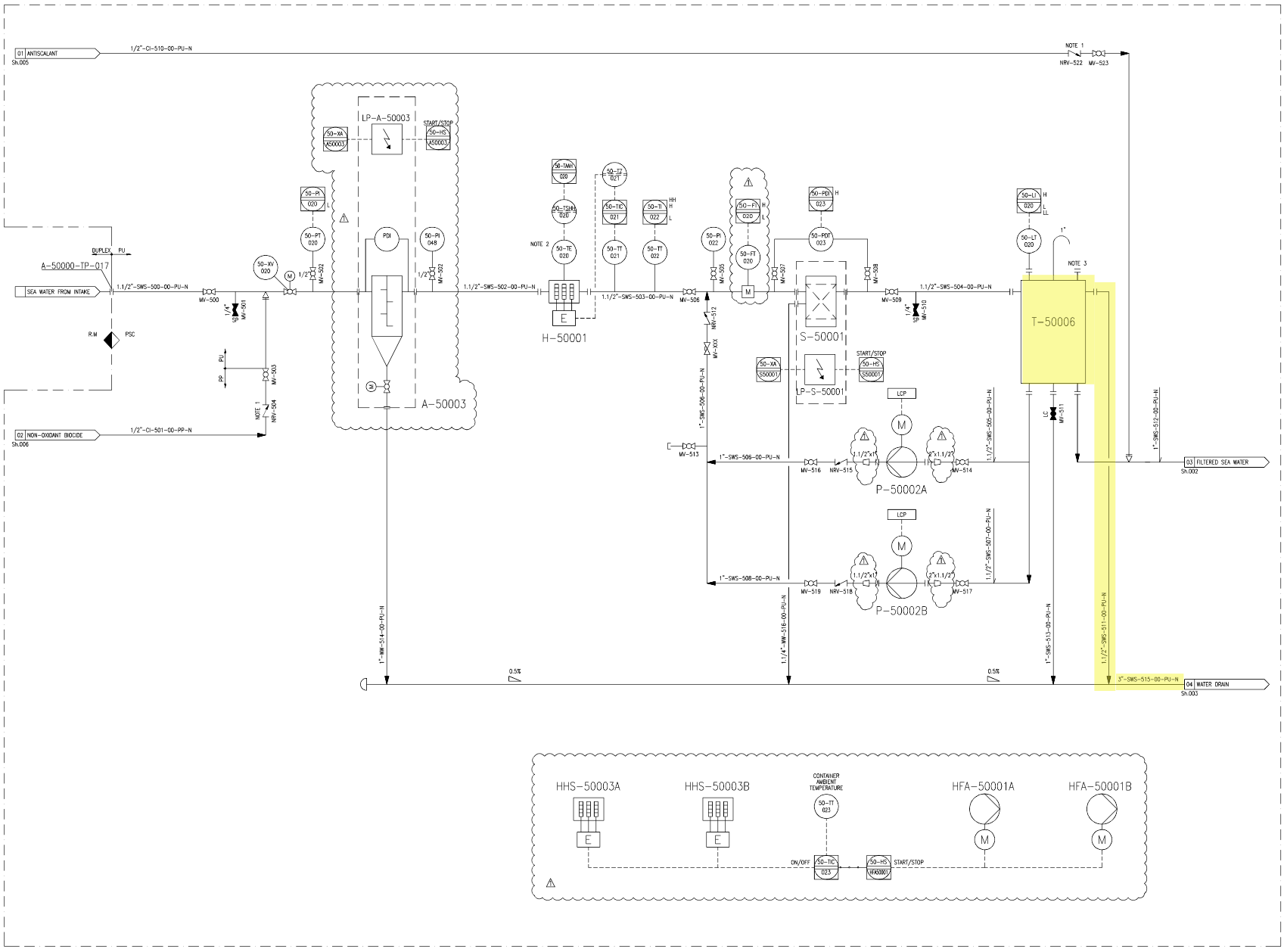
Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	29
Cause:	LVA & LVB Open
Consequence:	Refer to 3.3.4
Safeguards:	High level alarm on T- 50008 Local Overflow
Actions:	Ensure local overflow is adequately sized & rooted to a safe location.
Assigned Respondent (By)	ROSETTI 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

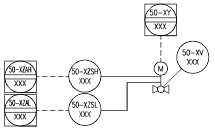
REV. 1



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 -

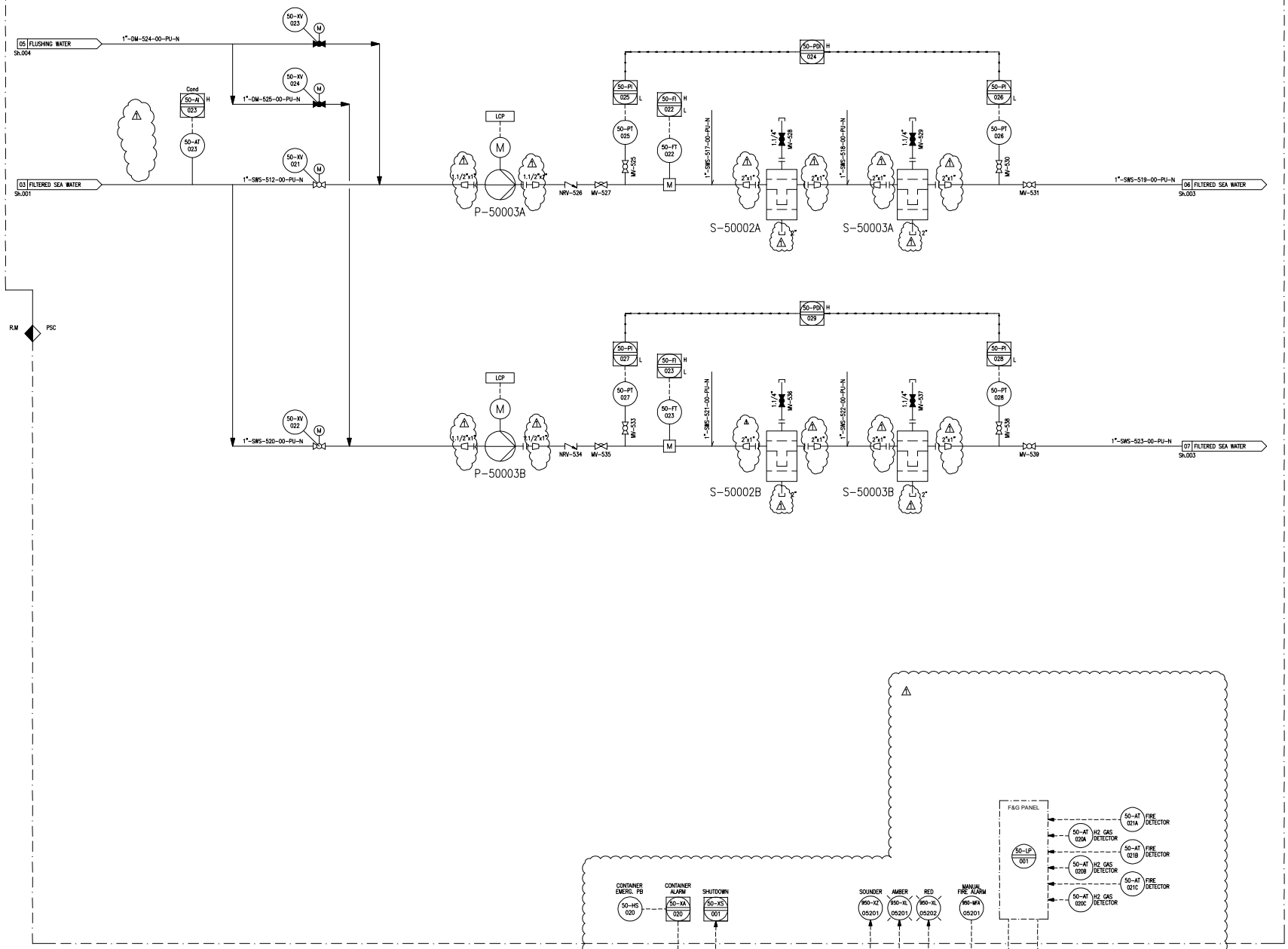
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A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 001 | REV. 1

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

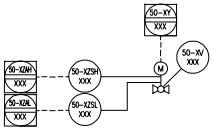
S-50002A/B	
SW 1ST CARTRIDGE FILTER	
FILTRATION RATE	20 µm
CAPACITY	2 m3/h
DES. PRESS.	7 barg
DES. TEMP.	50° C
MATERIAL	PP

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

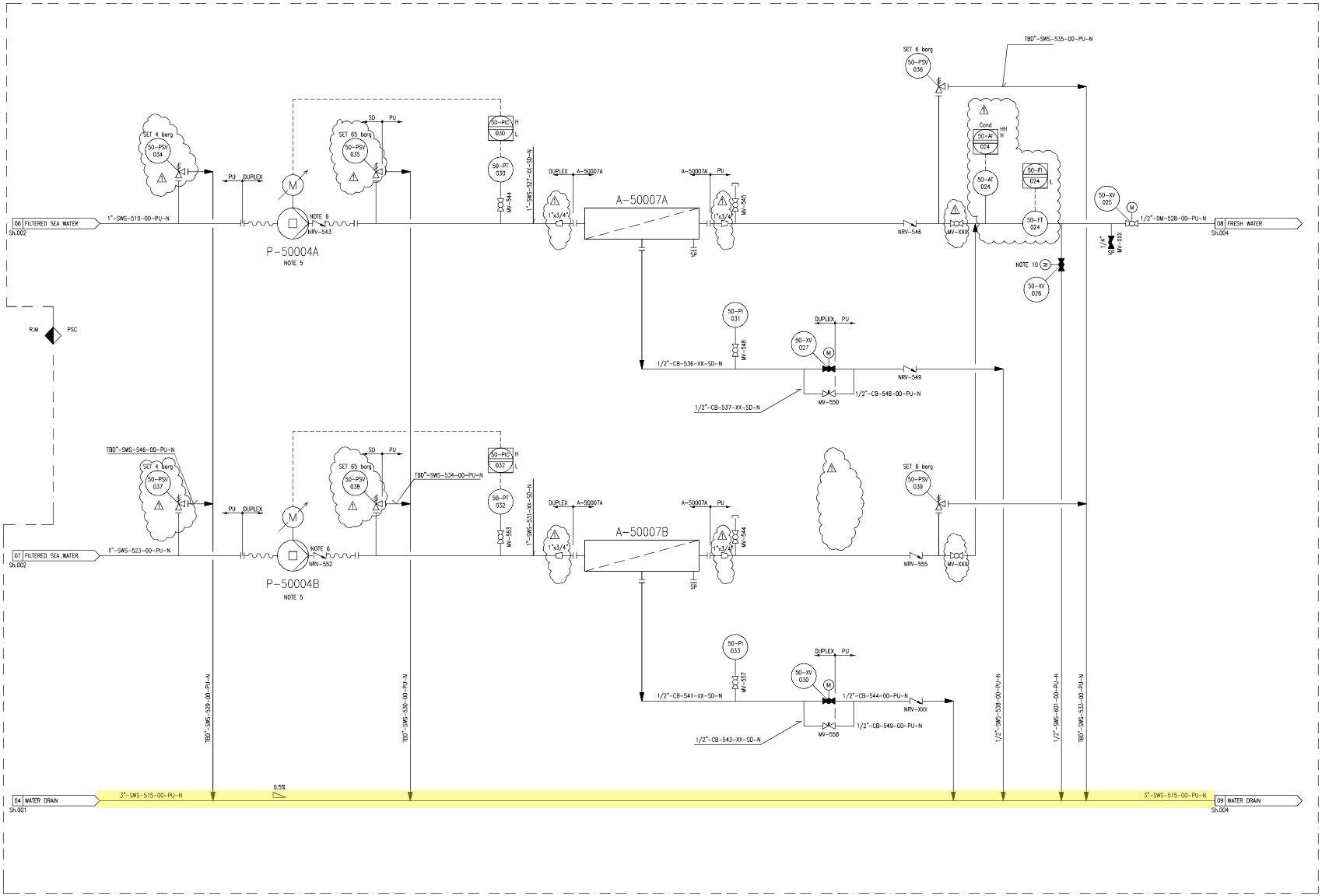
CROSSWIND

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



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

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	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 -

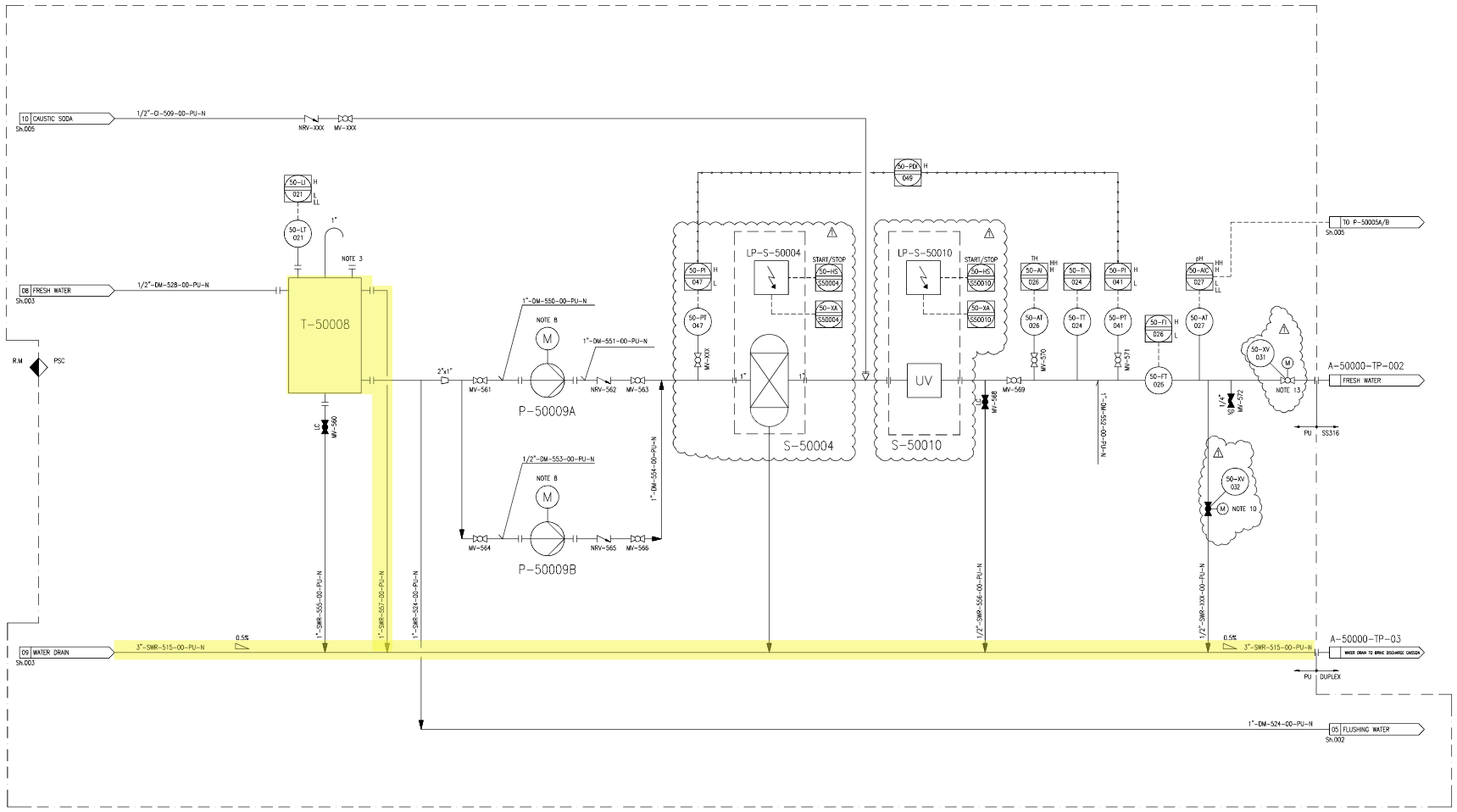
DRAWN CC | CHECKED WR | APPROVED RM | DATE 29/05/24

A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 003 | REV. 1

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

File Name : 1724000448-PR-PID-00013 Rev01

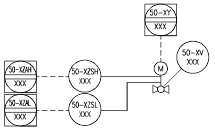
DRAWING NO. 1724000448-PR-PID-00013 REV. 1



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

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

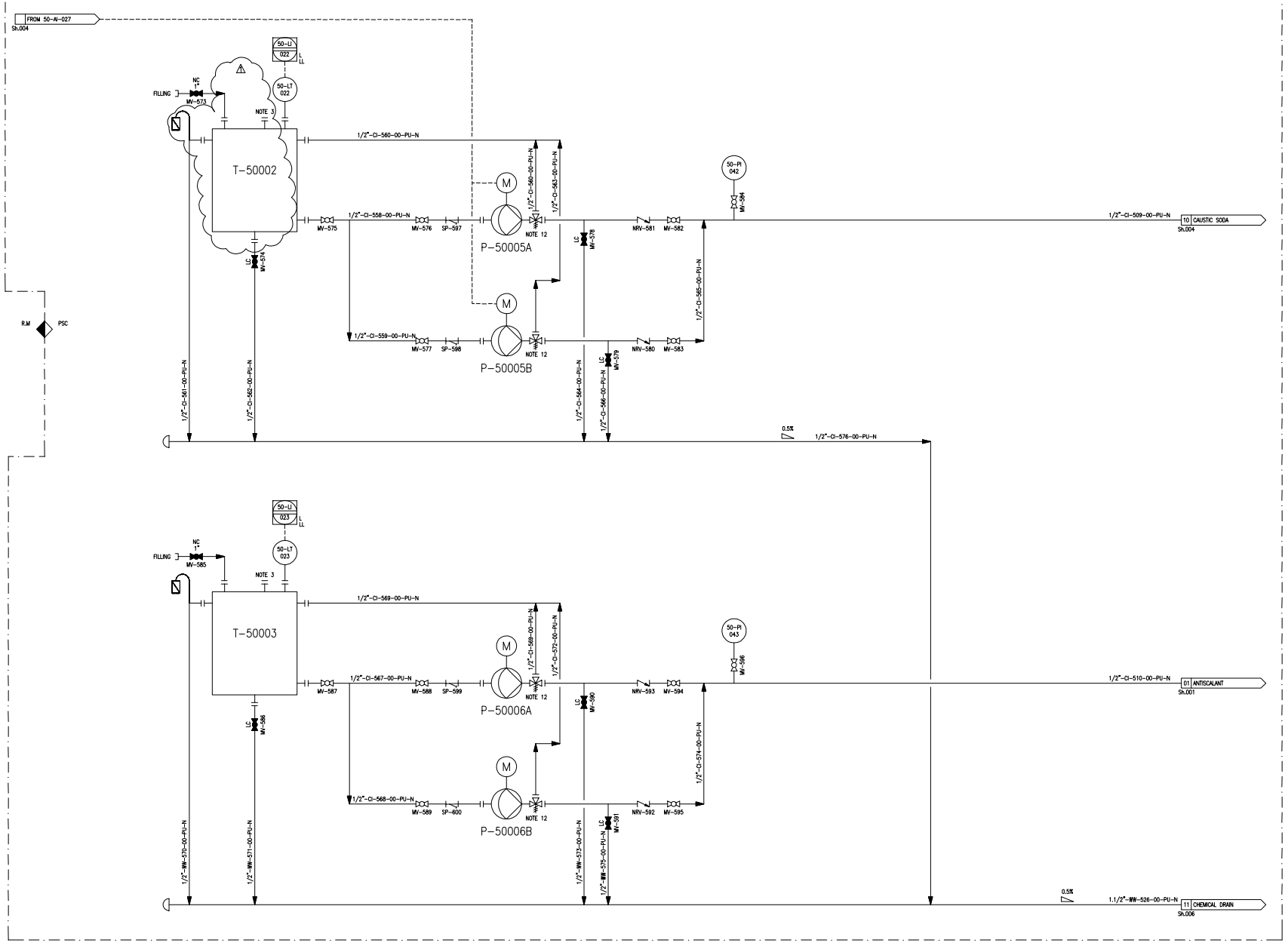
CROSSWIND

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

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
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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

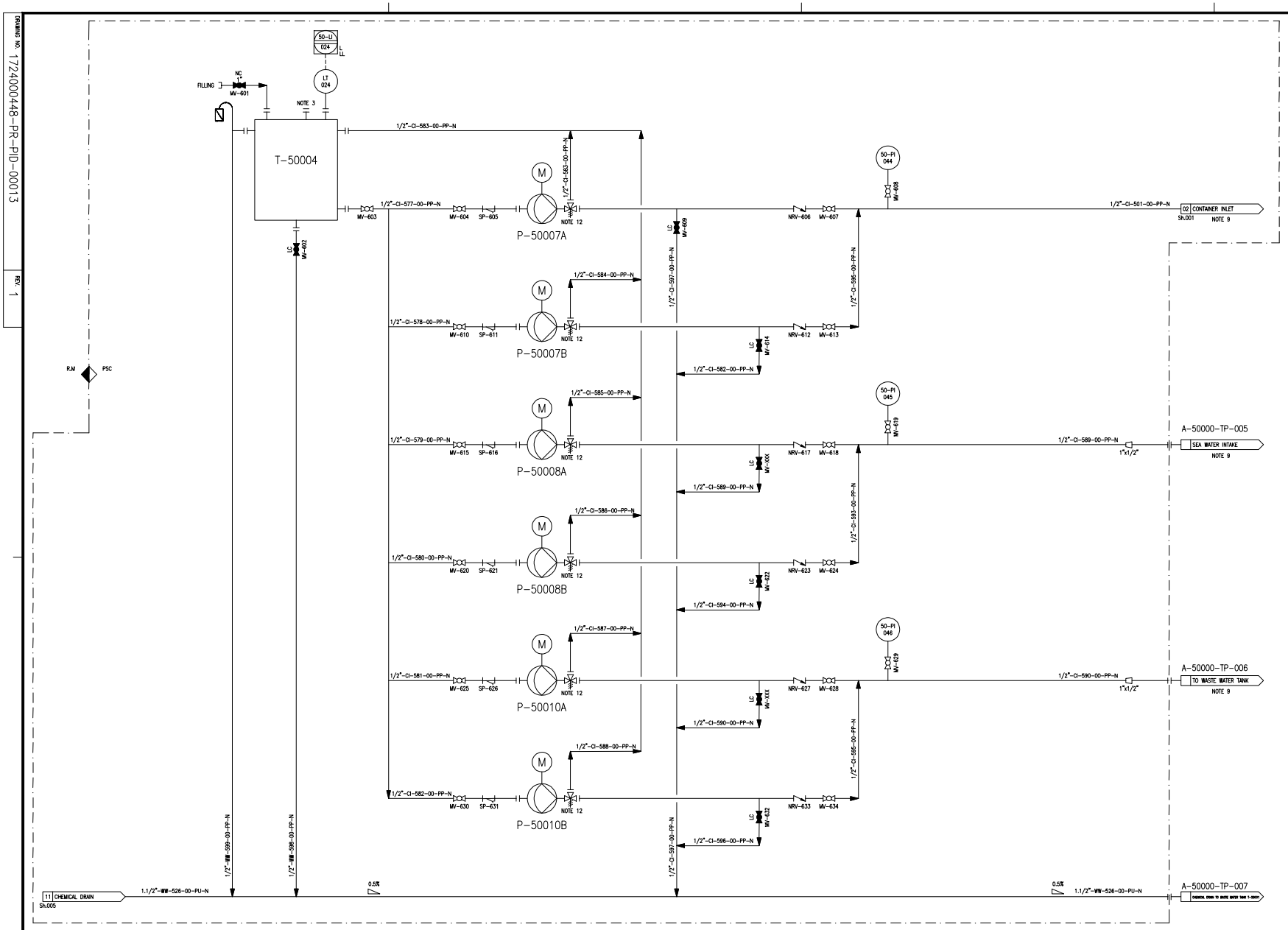
CONTRACT NO./TITLE | SCALE -

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



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

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

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

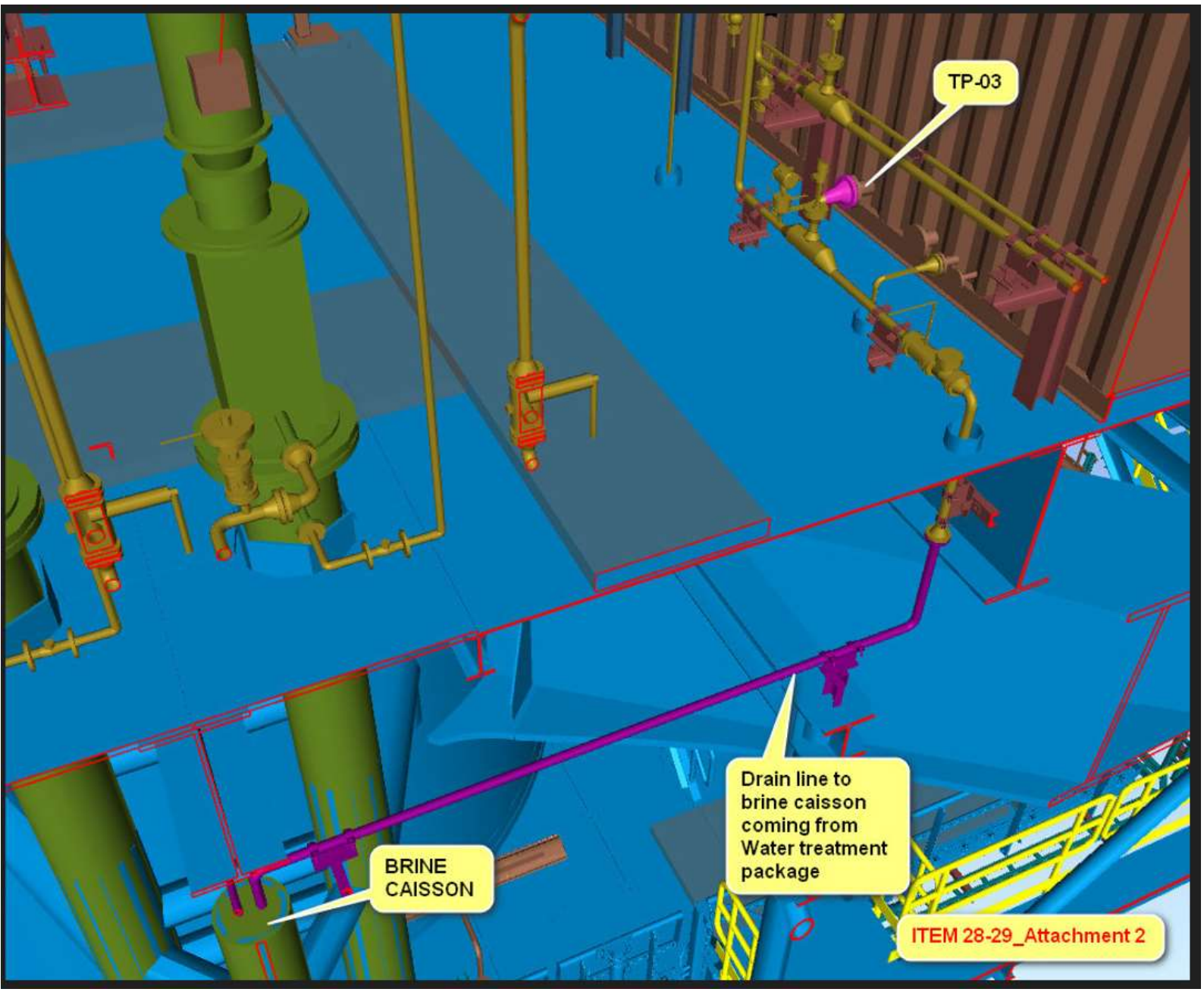
CONTRACT NO./TITLE | SCALE –

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

A1 | DRAWING NO. 1724000448-PR-PID-00013 | SHEET 006 | REV. 1

DRAWING NO. 1724000448-PR-PID-00013 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

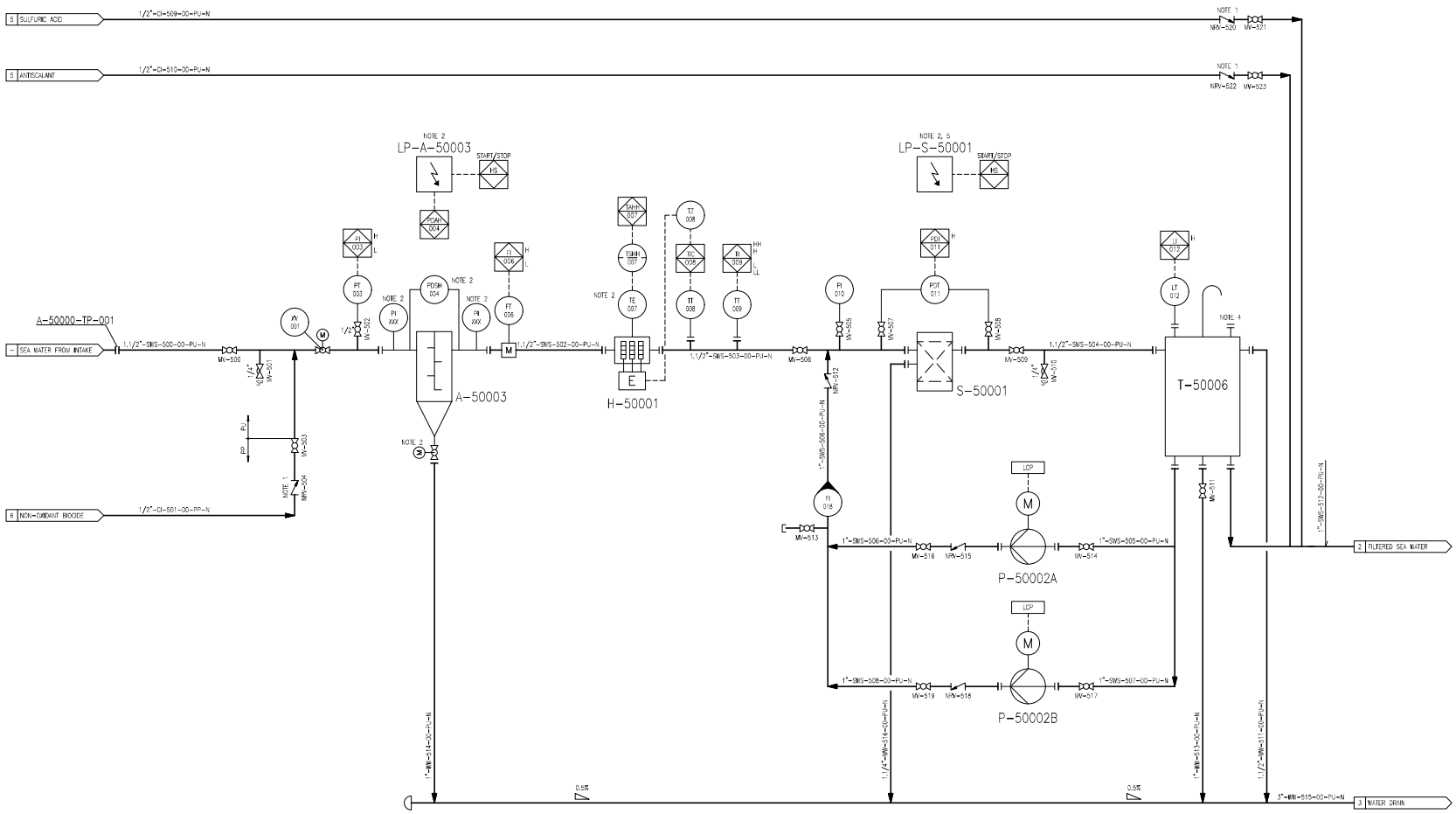
Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	31
Cause:	P-50009A & B operating
Consequence:	Unknown consequences for electrolyser package
Safeguards:	
Actions:	Control logic should inhibit dual operation of lift pumps, P-50009A & B.
Assigned Respondent (By)	ROSETTI 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 P50002A/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	–

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
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

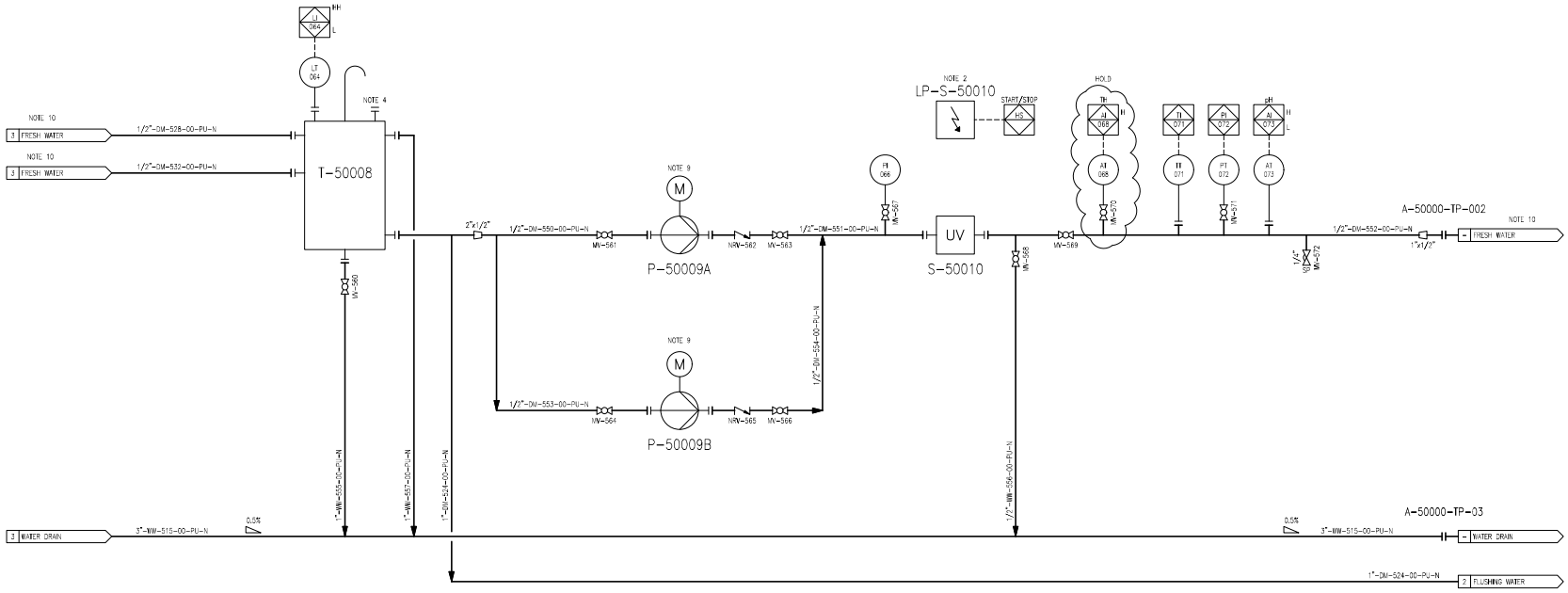
REV. 0

File Name : 1724000448-PR-PID-00013 Rev0

DO NOT SCALE DRAWING

REV. 0

1724000448-PR-PID-00013



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

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

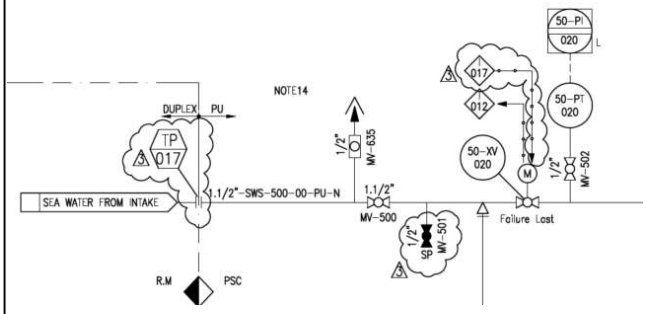
Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	34
Cause:	Low ambient temperature
Consequence:	Potential freezing of dead legs
Safeguards:	
Actions:	See Vendor Packages
Assigned Respondent (By)	CROSSWIND
RESPONSE	Low ambient temperature has been analyzed during WTP HAZOP 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

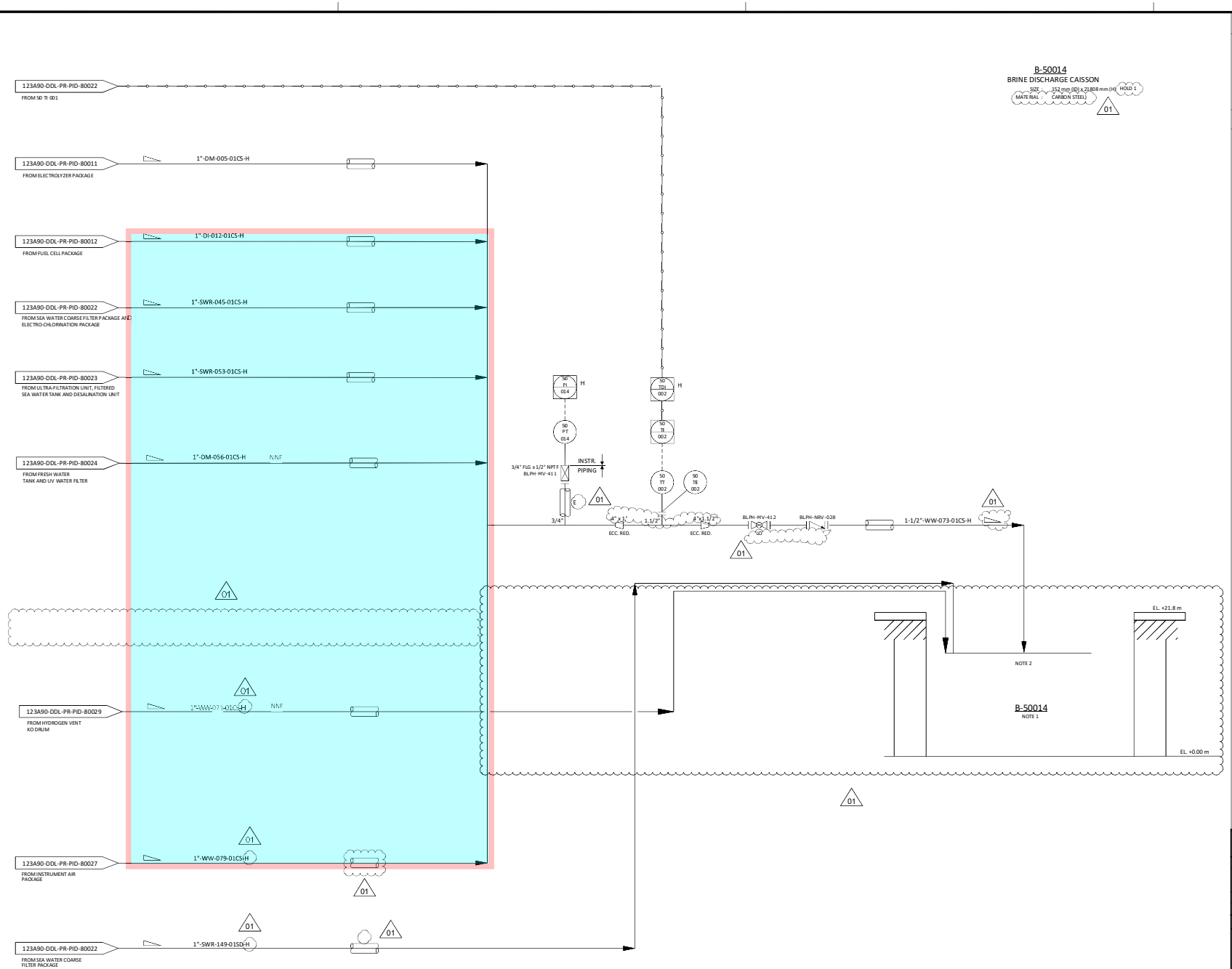
Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	37
Cause:	External Fire due to either hydrogen jet fire or BESS.
Consequence:	Potential to escalation for Hydrogen inventories.
Safeguards:	Fire detection. Emergency Isolation & Blowdown (PRV). PIC 'high high' alarm on 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 = Process 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)	

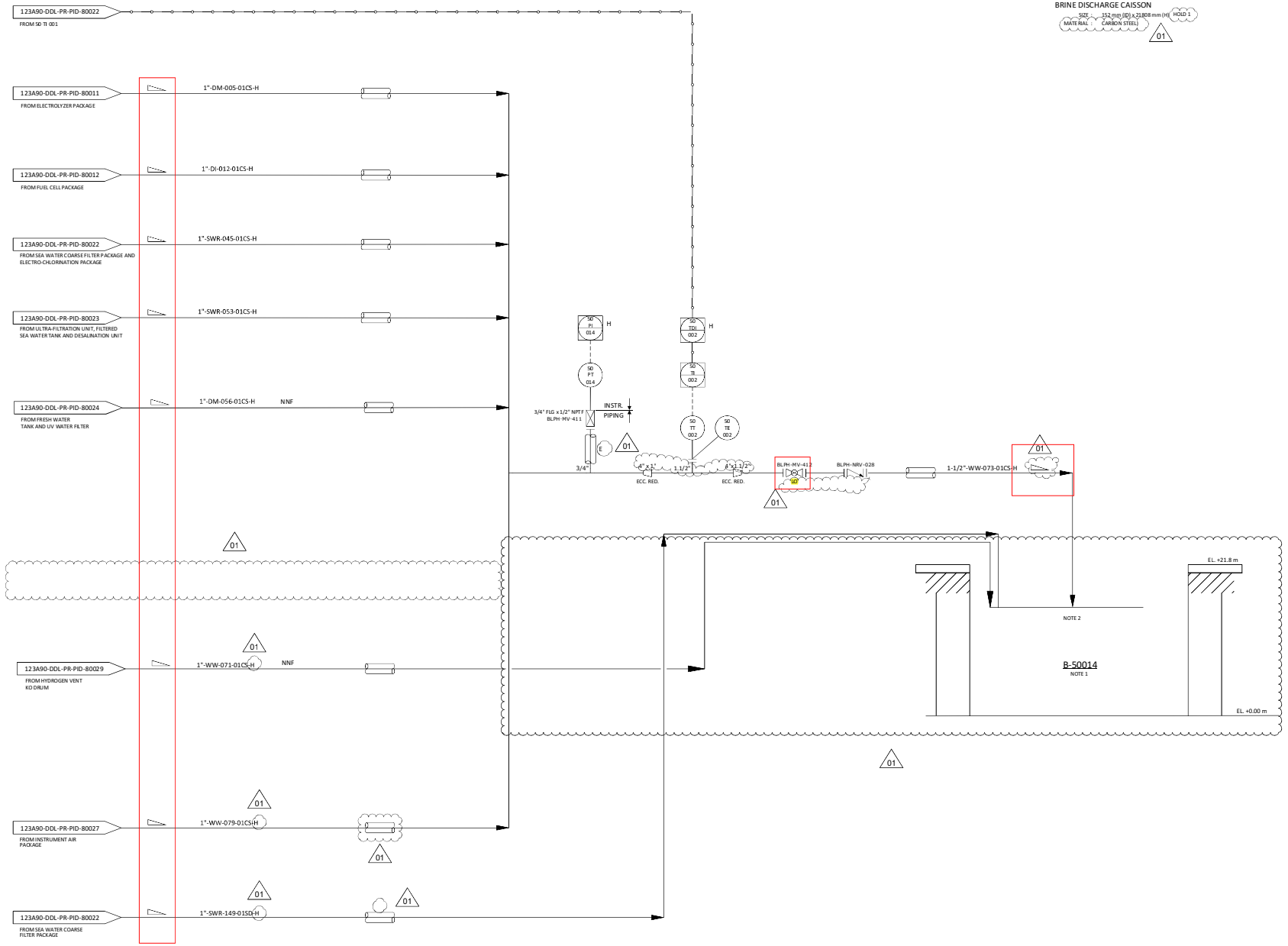
Approvals / Endorsements

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.	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

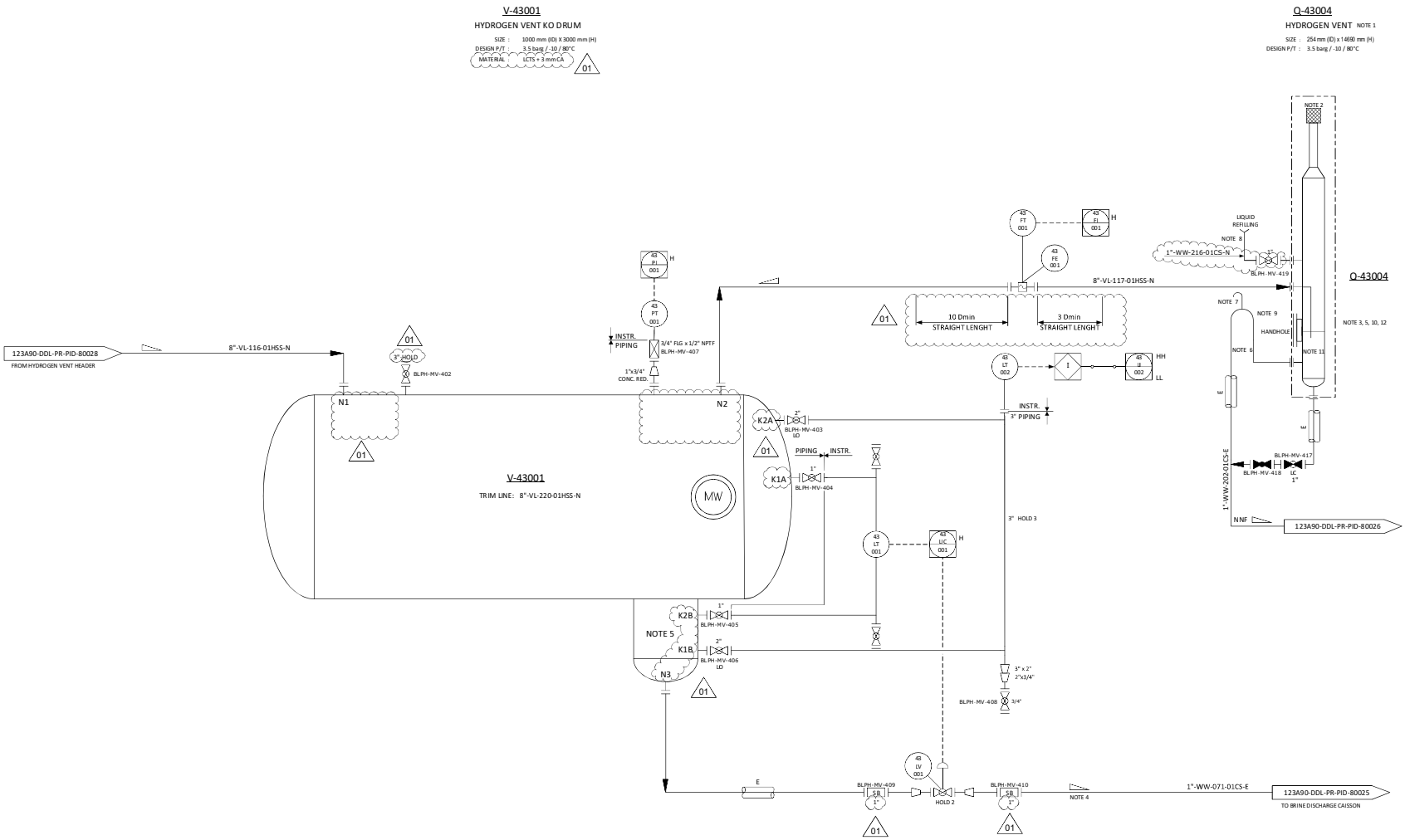
Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	45
Cause:	Pump Failure P- 43003
Consequence:	Potential overfill of hydrogen vent. Leading to blockage of hydrogen vent & discharge of water from vent. Potential loss of safeguard, and additional consequences to upstream 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'

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 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

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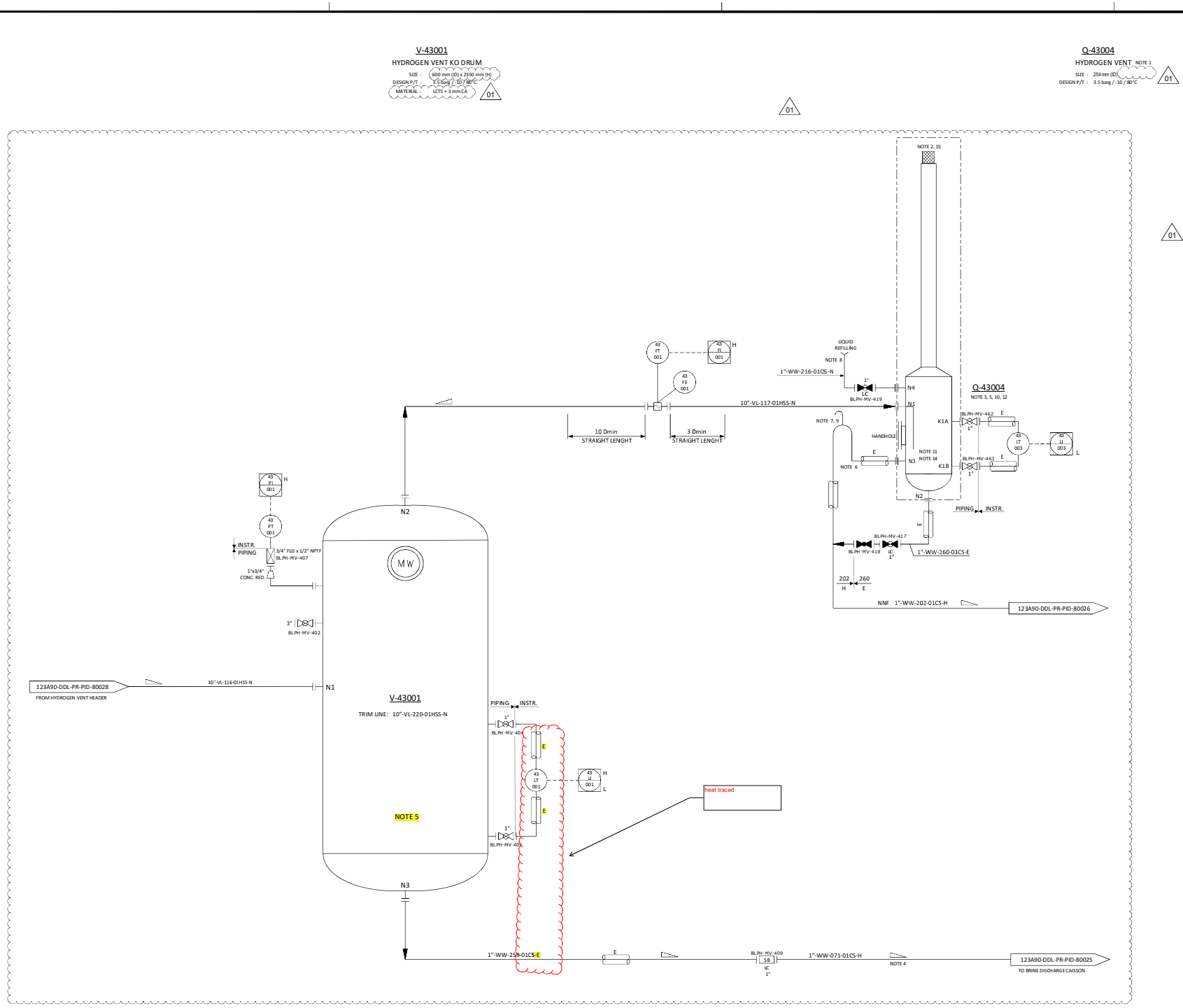
BLPH SHEAMS SIGNATURE FORM

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 dell'autore: 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'
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

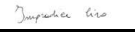
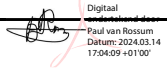
Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	47
Cause:	LIC on V- 43001 failure
Consequence:	Potential for pump to run dry & overheat leading to potential fire.
Safeguards:	LIC-L' level alarm on hydrogen KO drum vent, and 'Level Controller' stopping pump. (not valid, 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:

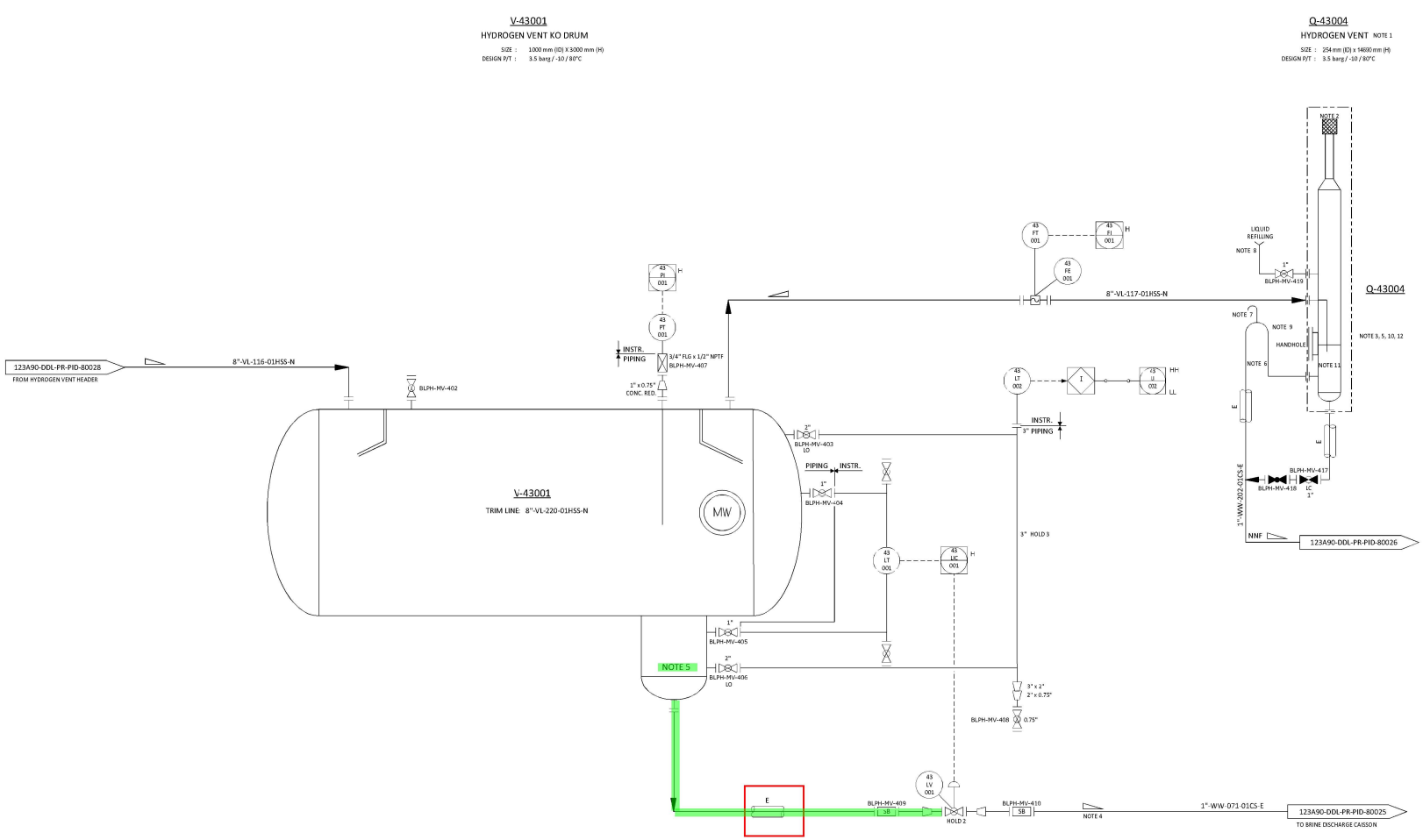
- more than 5 ppm O2 or
- more than 5 ppm N2 or
- more than 5 ppm H2O.

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. 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 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	23/10/2023	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

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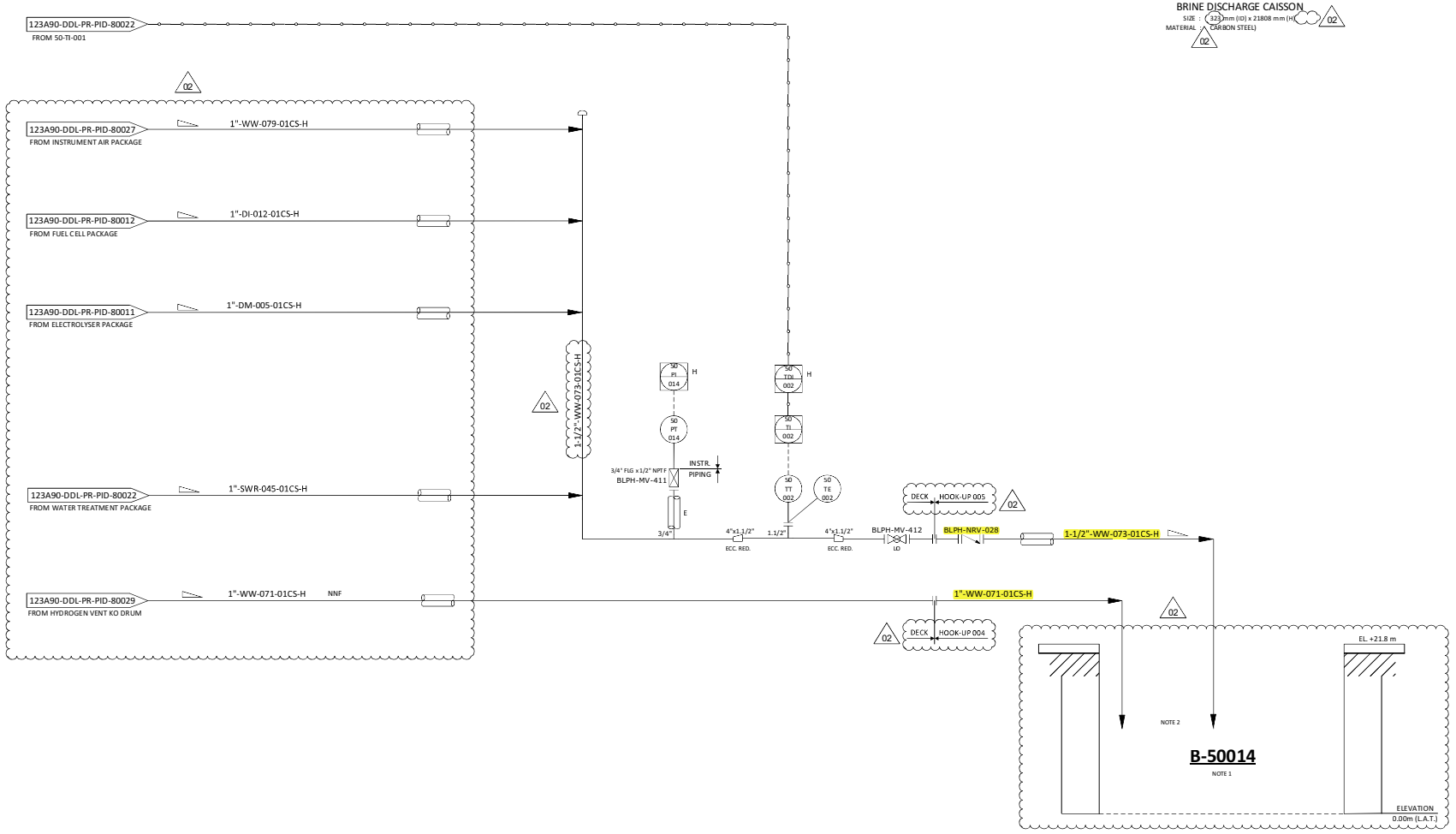
BLPH SHEAMS SIGNATURE FORM

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

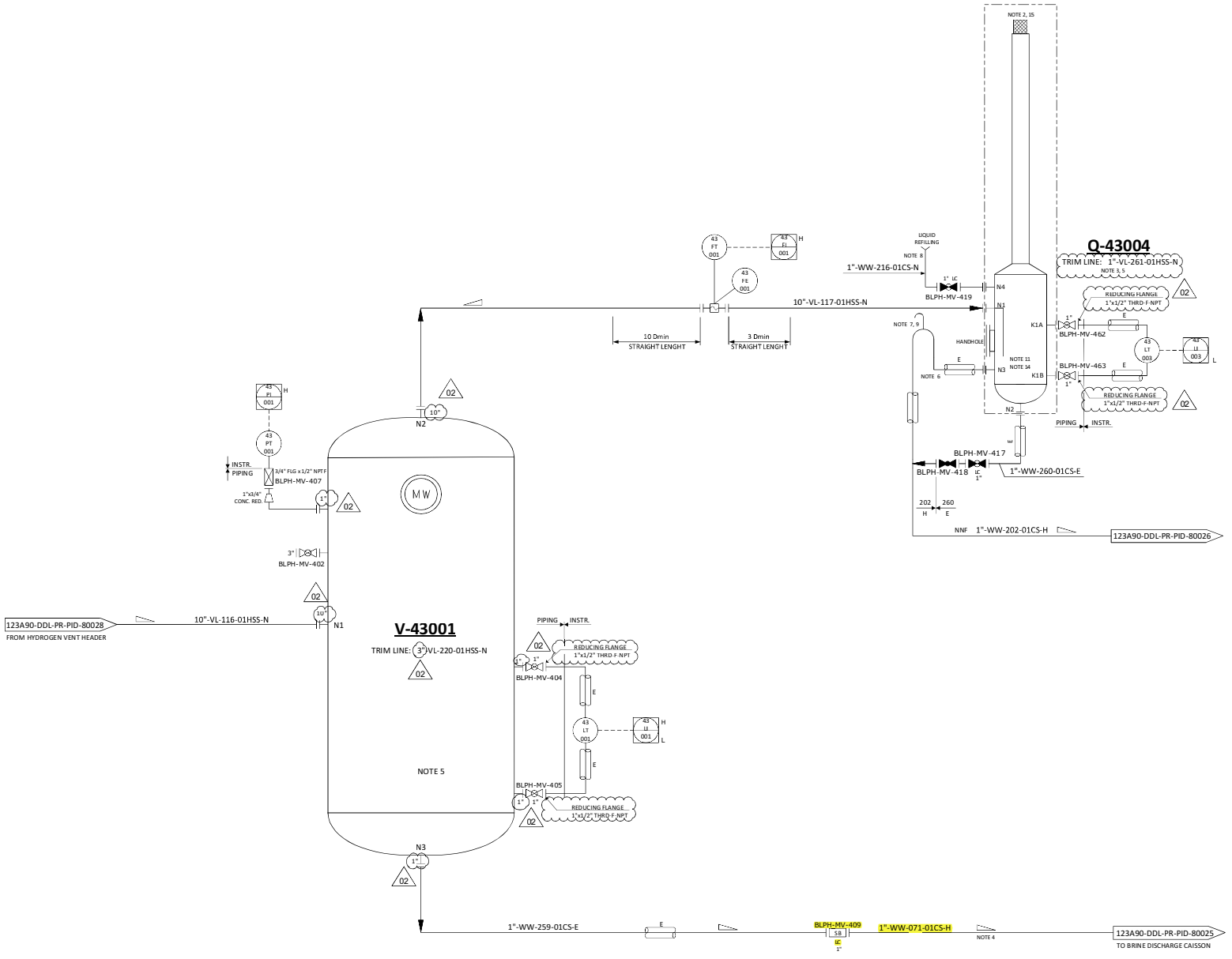
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DRAWING NO. DRAWING_NO.

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 02

Q-43004
HYDROGEN VENT NOTE 1
SIZE : 254 mm (ID)
DESIGN P/T : 3.5 barg / -10 / 80°C
MATERIAL : LTCS + 3 mm CA 02



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

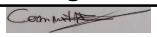
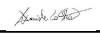
TITLE :
BLPH PIPING AND INSTRUMENTATION DIAGRAM
HYDROGEN VENT DRUM

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'

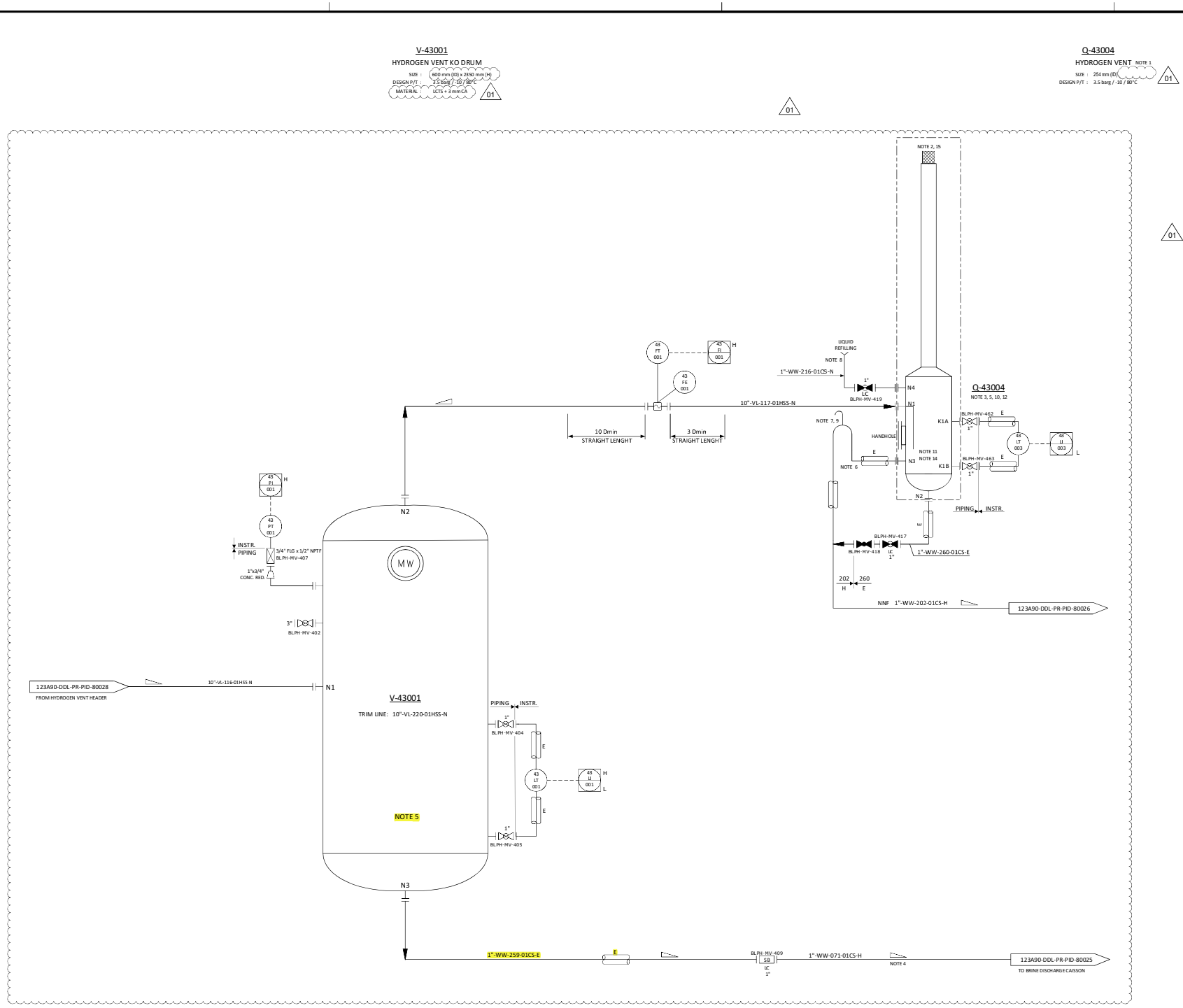
BLPH SHEAMS SIGNATURE FORM

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
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

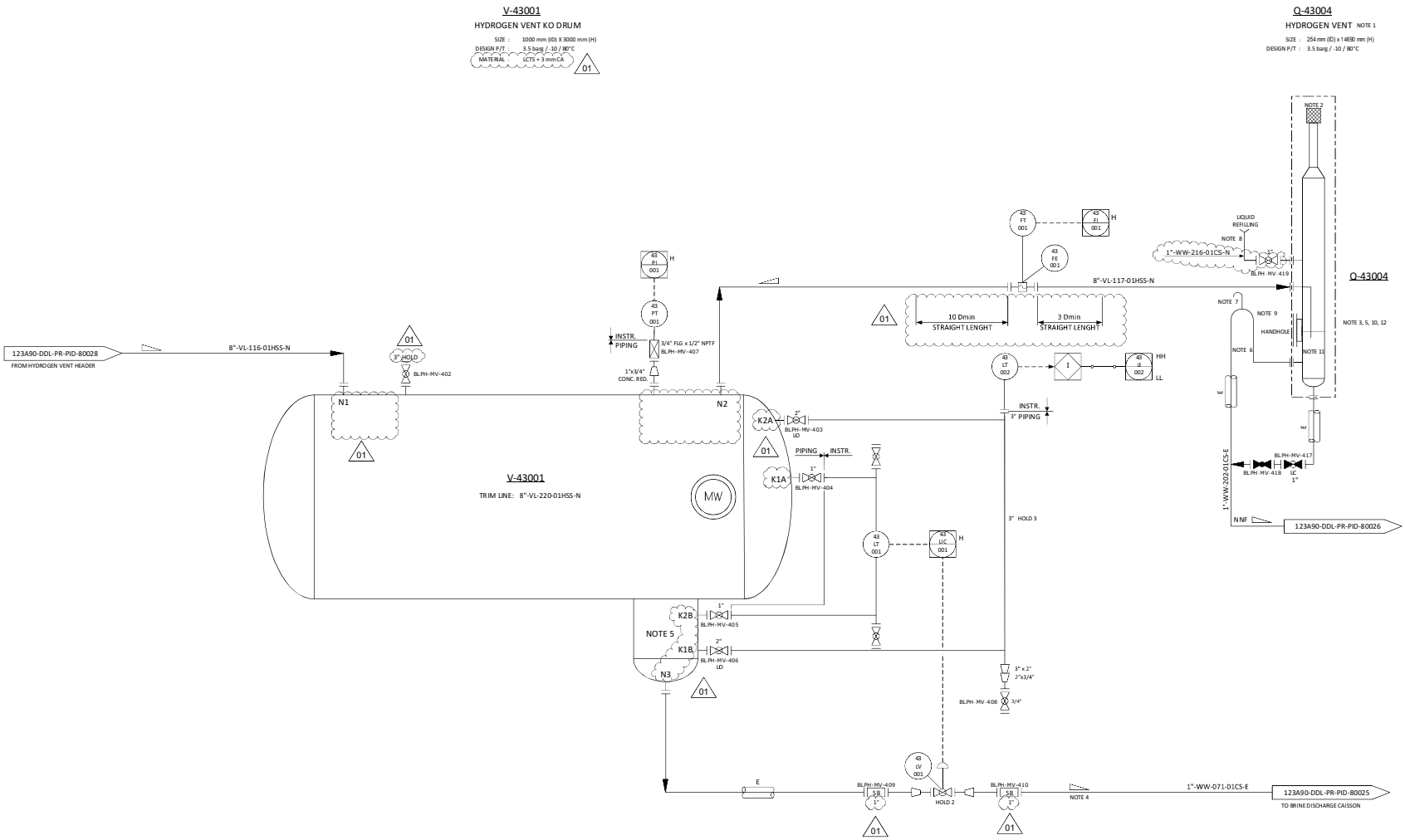
BLPH SHEAMS SIGNATURE FORM

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'

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 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

File Name : FILE_NAME

BLPH SHEAMS SIGNATURE FORM

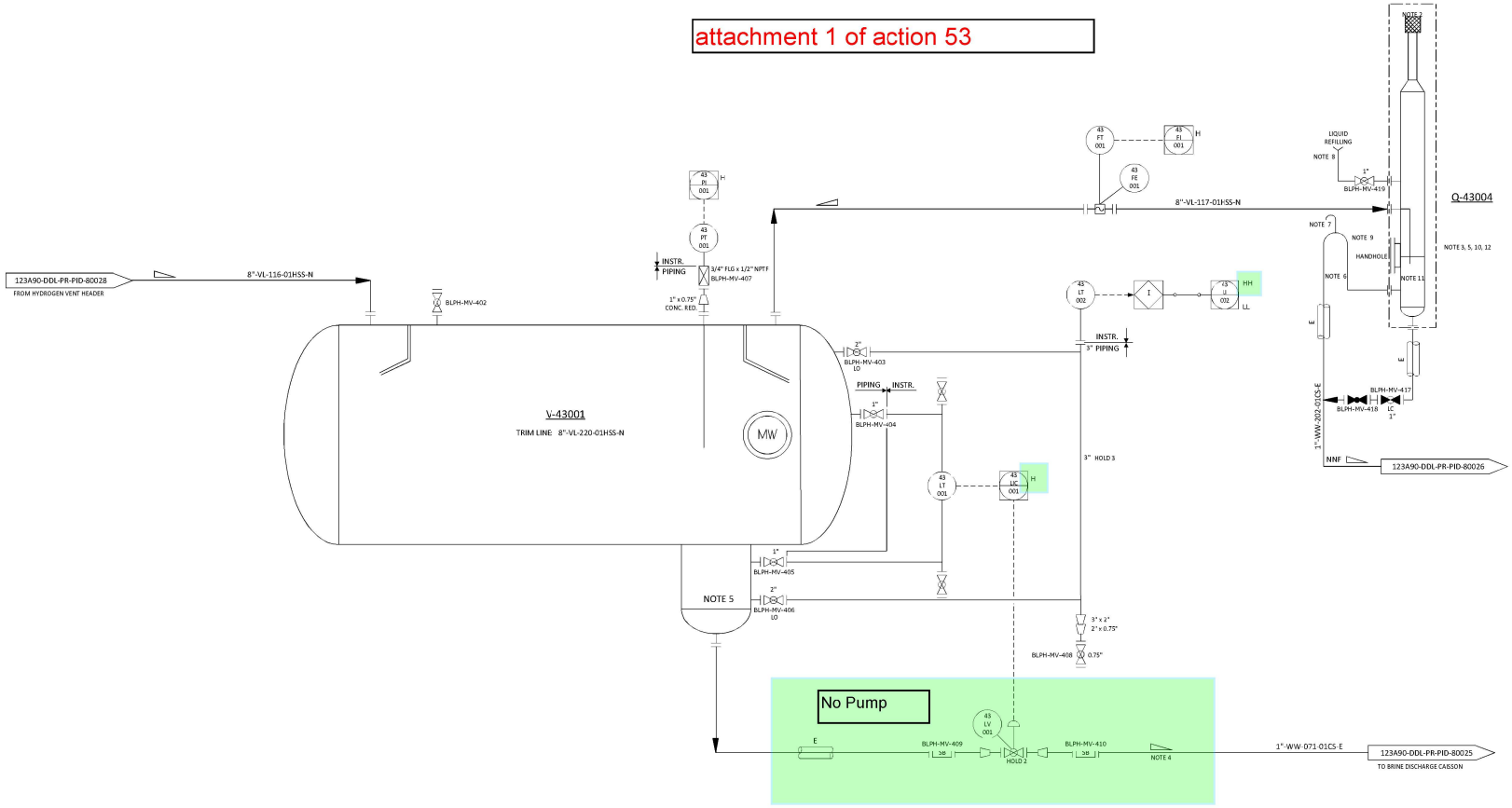
Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	53
Cause:	Pump Failure P- 43003
Consequence:	Potential overfill of hydrogen vent. Leading to blockage of hydrogen vent & discharge of water from vent. Potential loss of safeguard, and additional consequences to upstream 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	23/10/2023	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: **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	

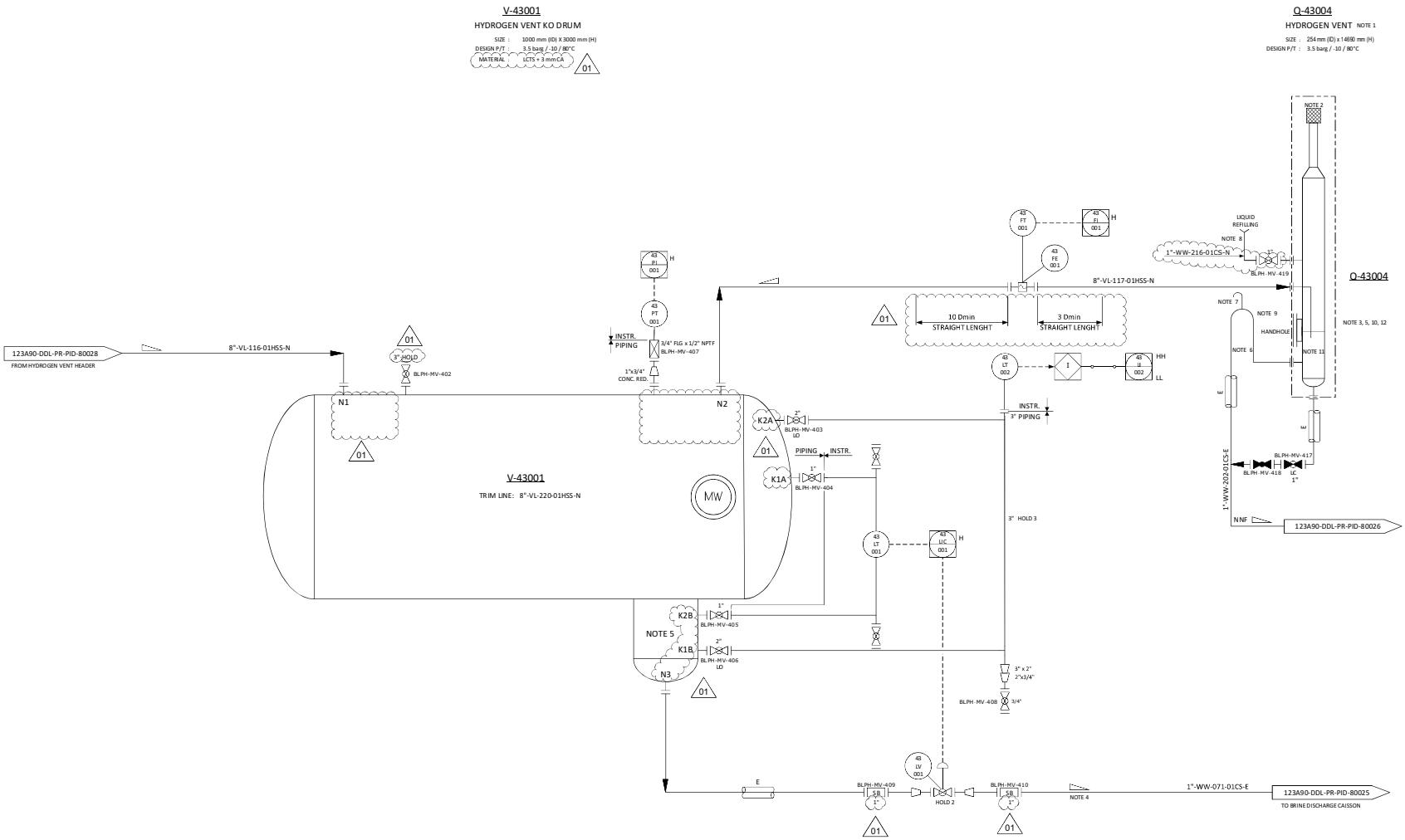
BLPH SHEAMS SIGNATURE FORM

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'

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 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

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

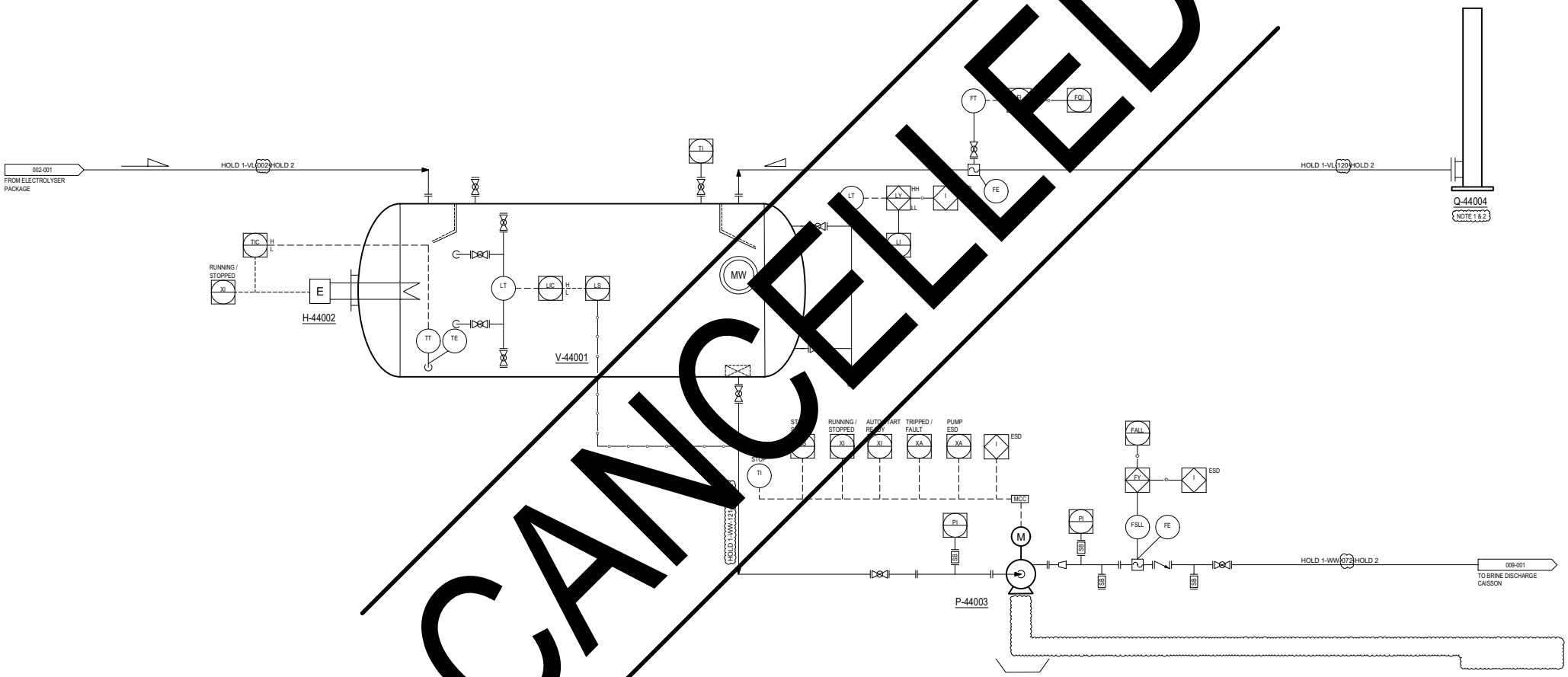
Approvals / Endorsements	
EPC Discipline Lead	Sign
Ciro Impradice	Ciro Impradice Autore firma digitale: Impradice Nome distintivo: CN = Ciro Impradice email = ciro.impradice@rosetti.it C = IT O = Rosetti Marino OU = Process Data: 2024.05.16 14:15:45 +02'00'
EPC HSE Lead	Sign
C.Caracciolo	CC
EPC Project 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

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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.

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

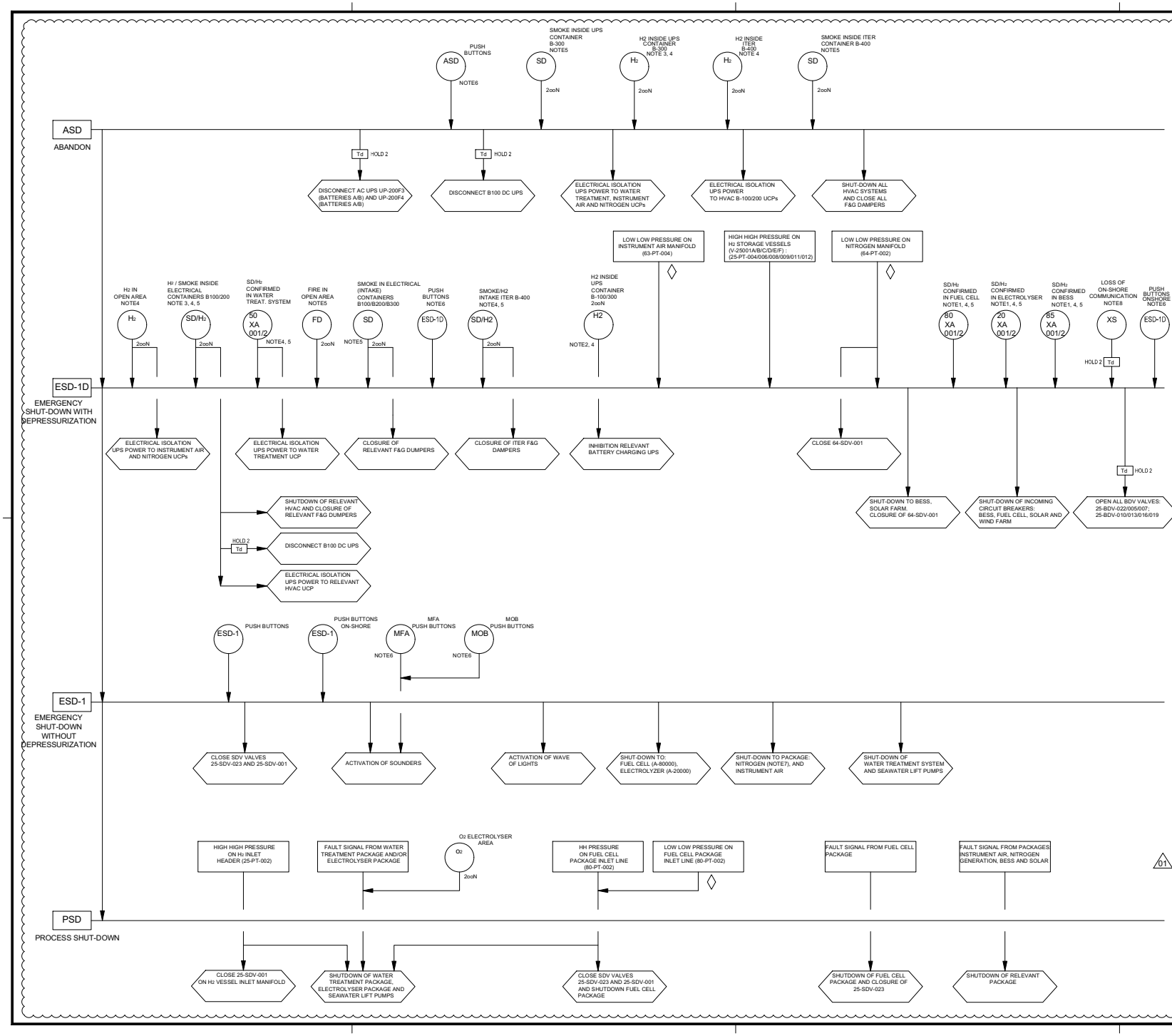
SHELL BLPH FEED
PIPING AND INSTRUMENTATION DIAGRAM
OXYGEN VENT DRUM

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

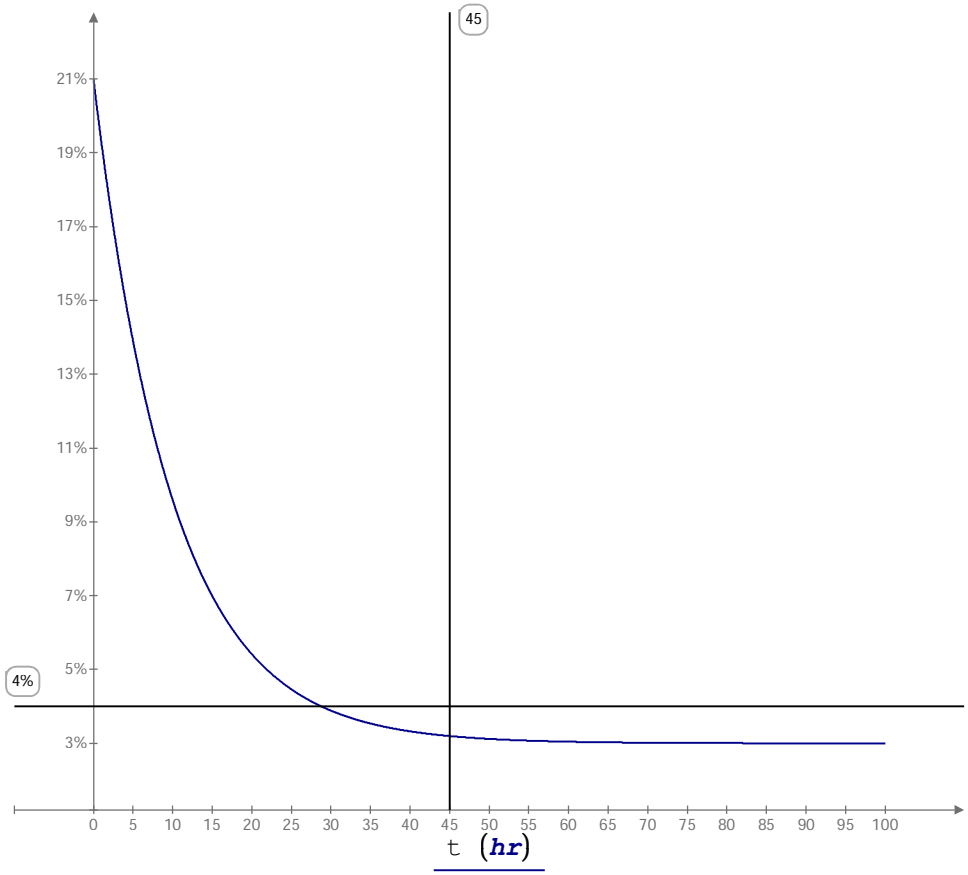
Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	62
Cause:	Requirement to depressure and gas free hydrogen storage vessels for maintenance
Consequence:	Significant volume of nitrogen required to pressure purge hydrogen storage vessels. Which may be impractical to store 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

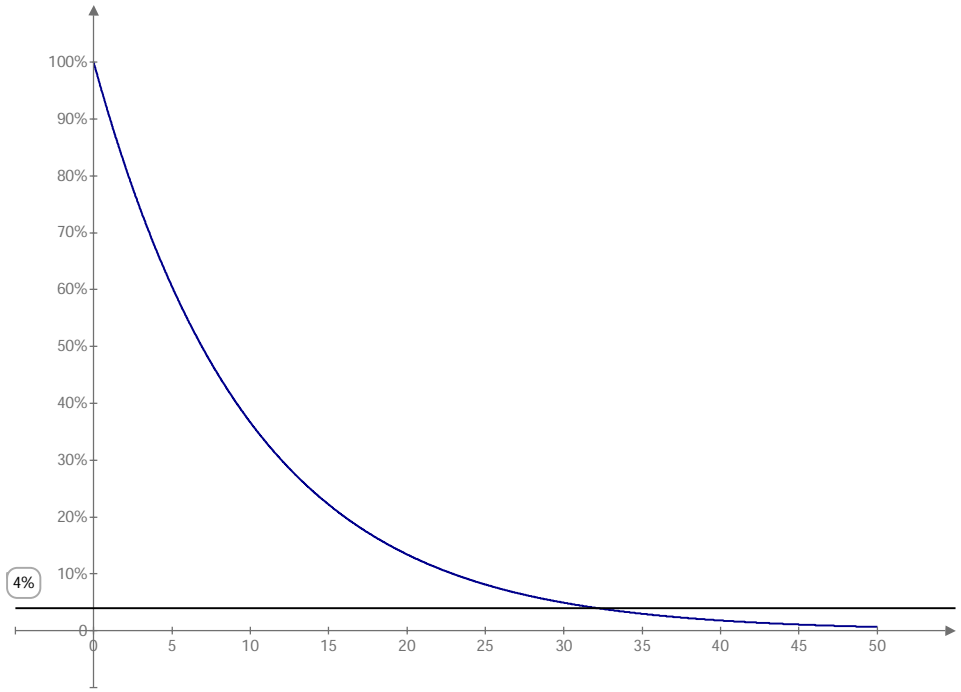
$V = 96\ m^3$ total vessel volume

$k = 0.25$ 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 / OF 3

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

	SIGLA TAG	DIAMETRO DIAMETER	TIPO TYPE	SERIE RATING	SERVIZIO SERVICE	NOTE REMARKS
15						
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

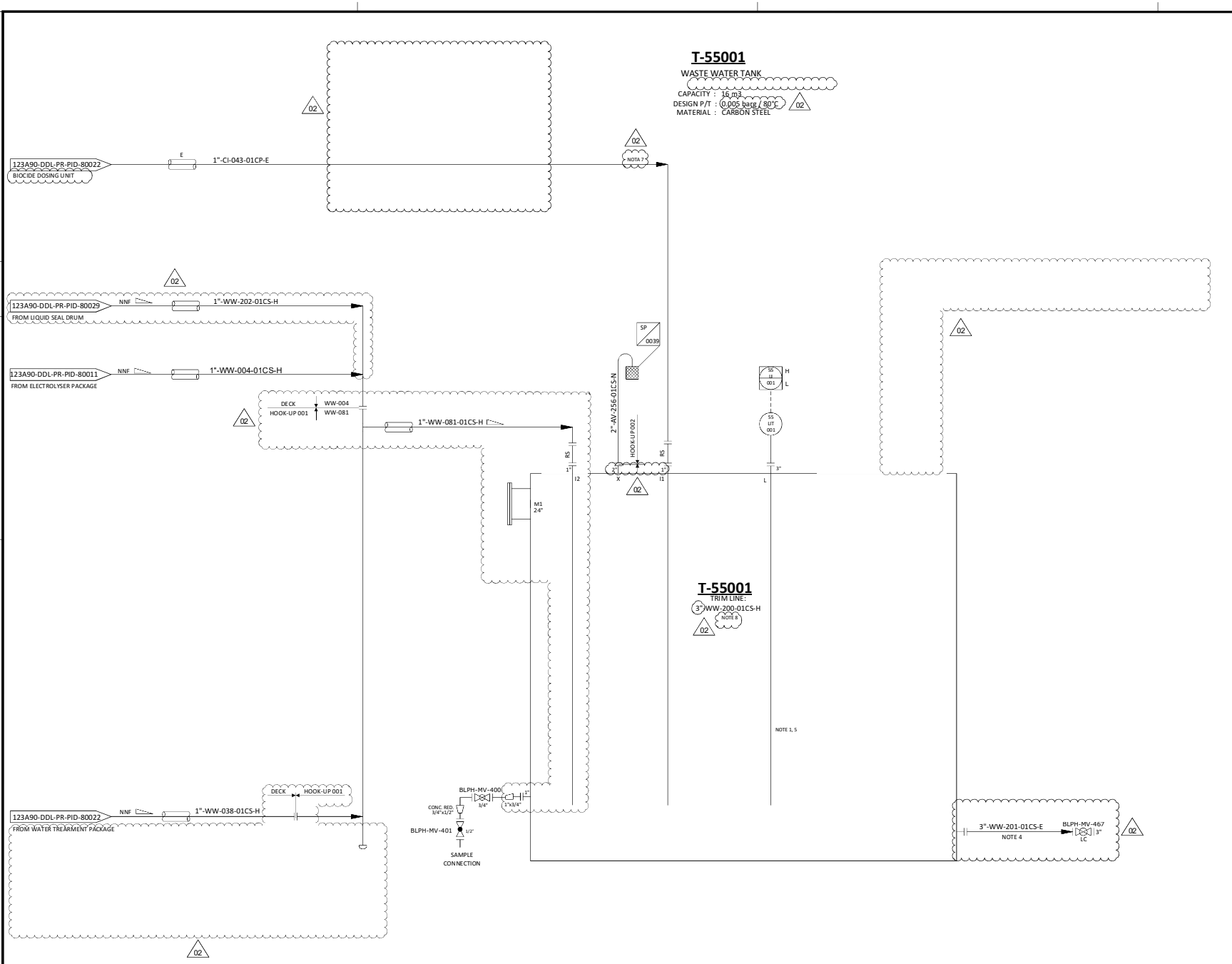
Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	63
Cause:	Potential requirement for continuous use of nitrogen by electrolyser.
Consequence:	Requirements for significant storage of nitrogen in order to satisfy demand.
Safeguards:	
Actions:	Consider requirements for nitrogen 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)	
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)

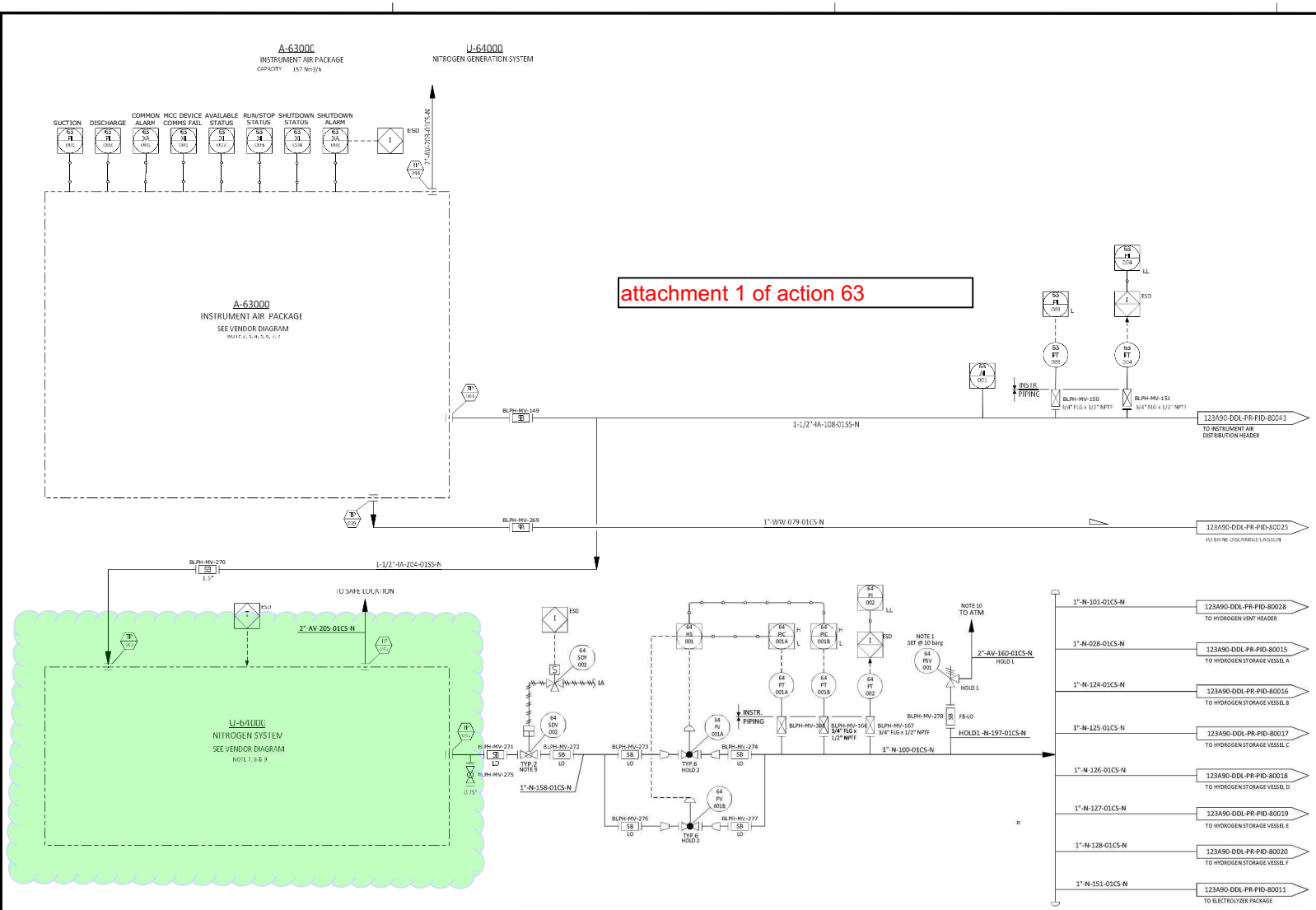
CROSSWIND

ROSETTI MARINO

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.
REV.
File Name : FILE_NAME



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 NOORD WIND 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

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)	

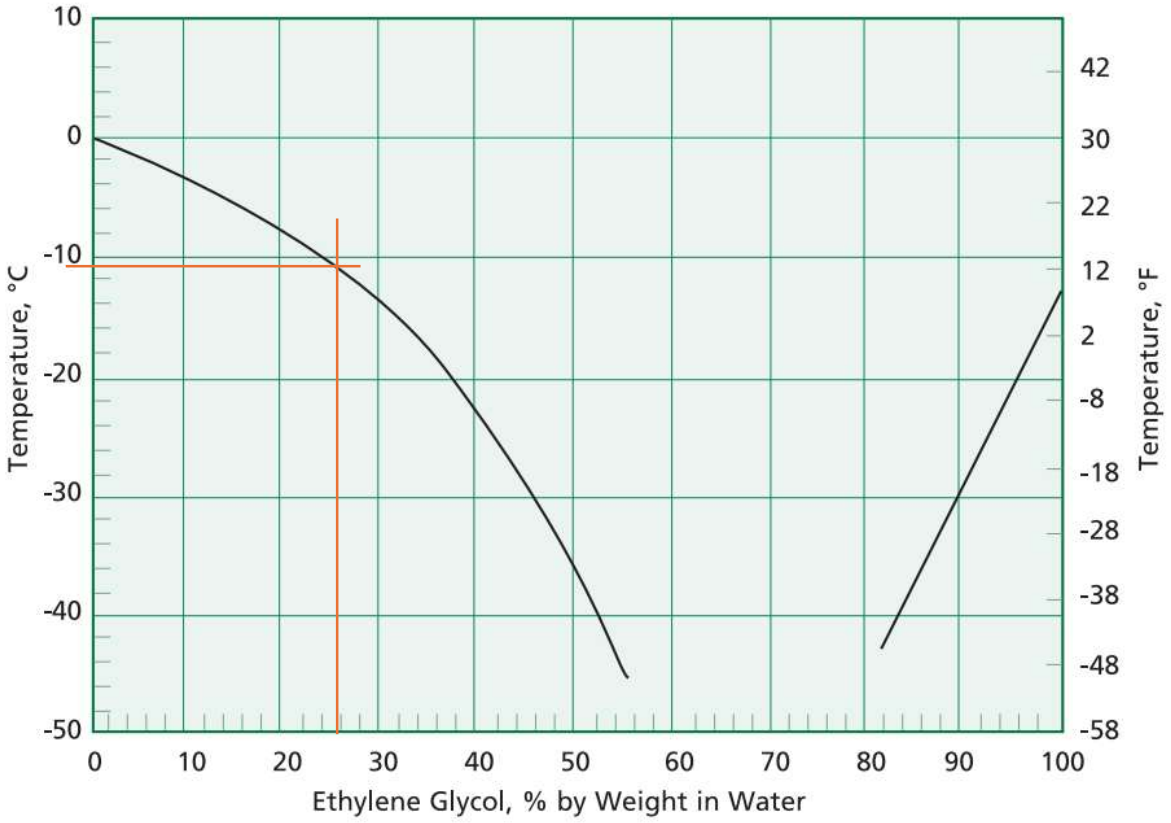
Approvals / Endorsements	
EPC Discipline Lead	**Sign**
C. Impradice (PROCESS)	C. Impradice
EPC HSE Lead	**Sign**
C.Caracciolo	CC
EPC Project Manager	**Sign**
D. Lo Sterzo	
Client	**Sign**
	Paul van Rossum — Digitaal ondertekend door Paul van Rossum Datum: 2024.10.12

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



Technical Data Sheet

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.

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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

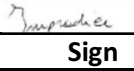
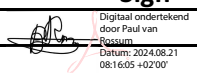
The information in this document is given to the best of Jotun's knowledge, based on laboratory testing and practical experience. Jotun's products are considered as semi-finished goods and as such, products are often used under conditions beyond Jotun's control. Jotun cannot guarantee anything but the 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.

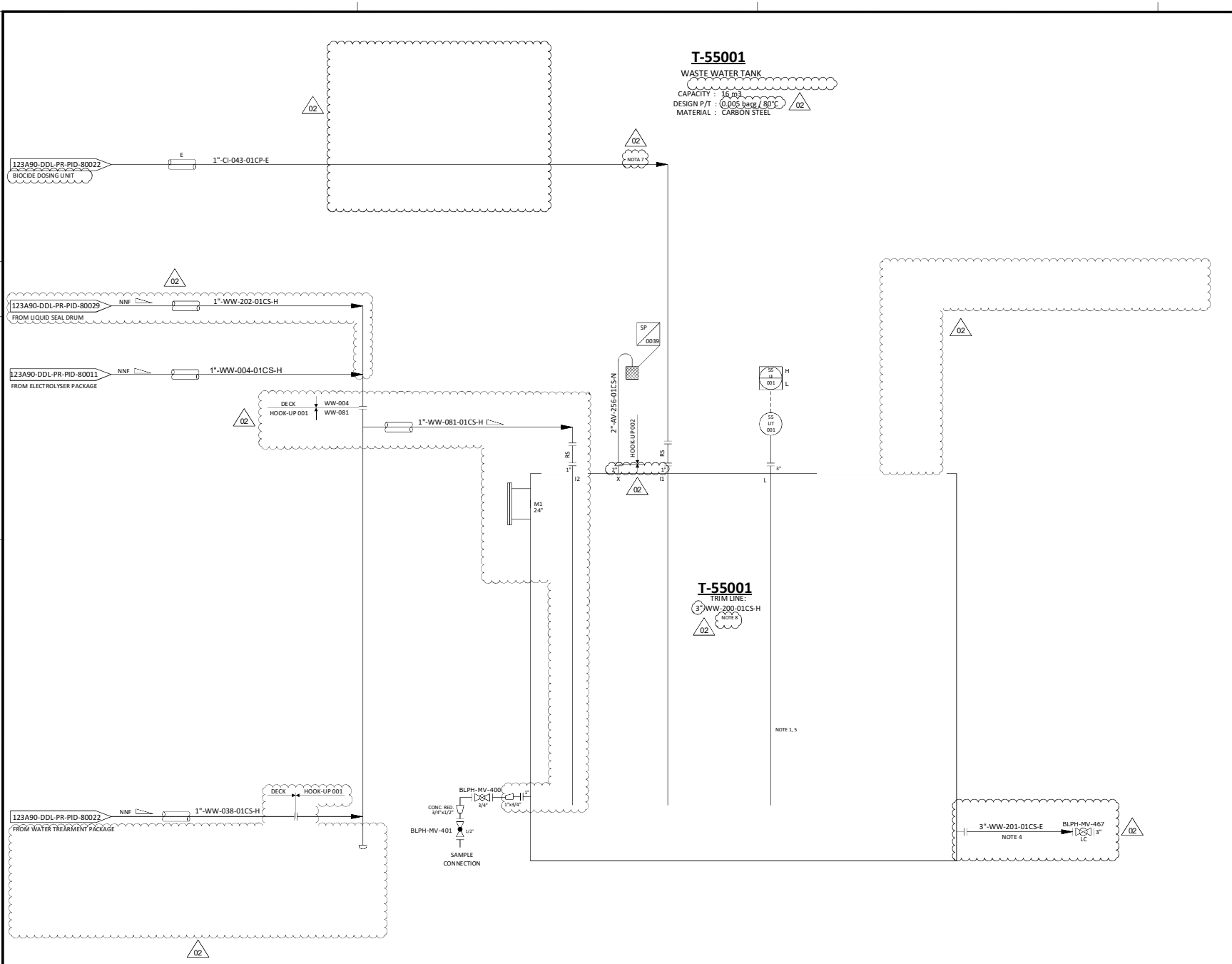
Users should always consult Jotun for specific guidance on the general suitability of this product for their needs and specific application practices.

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)

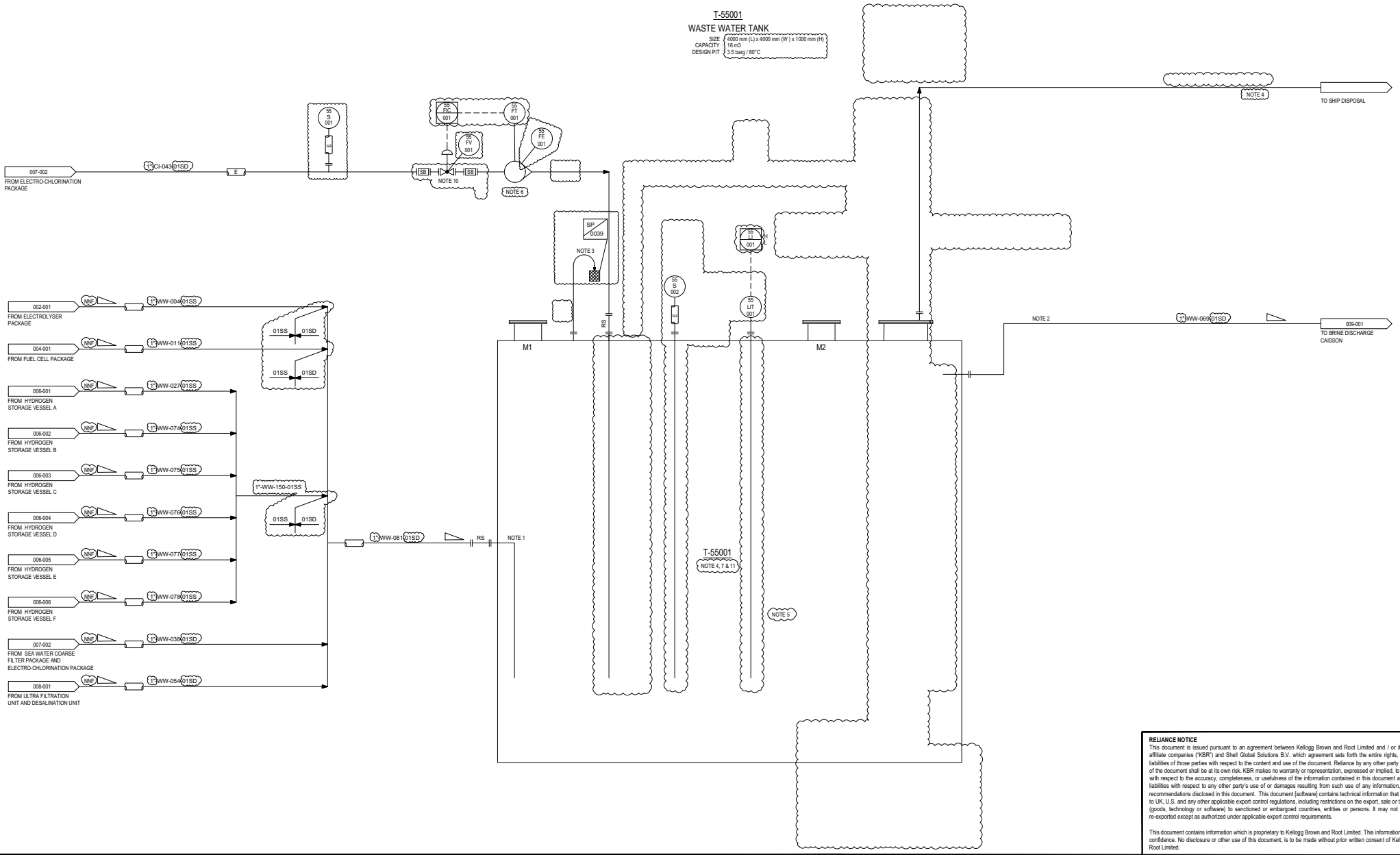
CROSSWIND

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.
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: 2024.09.12 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 Digitaal ondertekend door Paul van Rossum Datum: 2024.09.20 10:36:27 +02'00'
Company Project Manager	**Sign**
	Dominik Sznajder Digitally signed by Dominik Sznajder Date: 2024.09.24 09:18:54 +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.	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

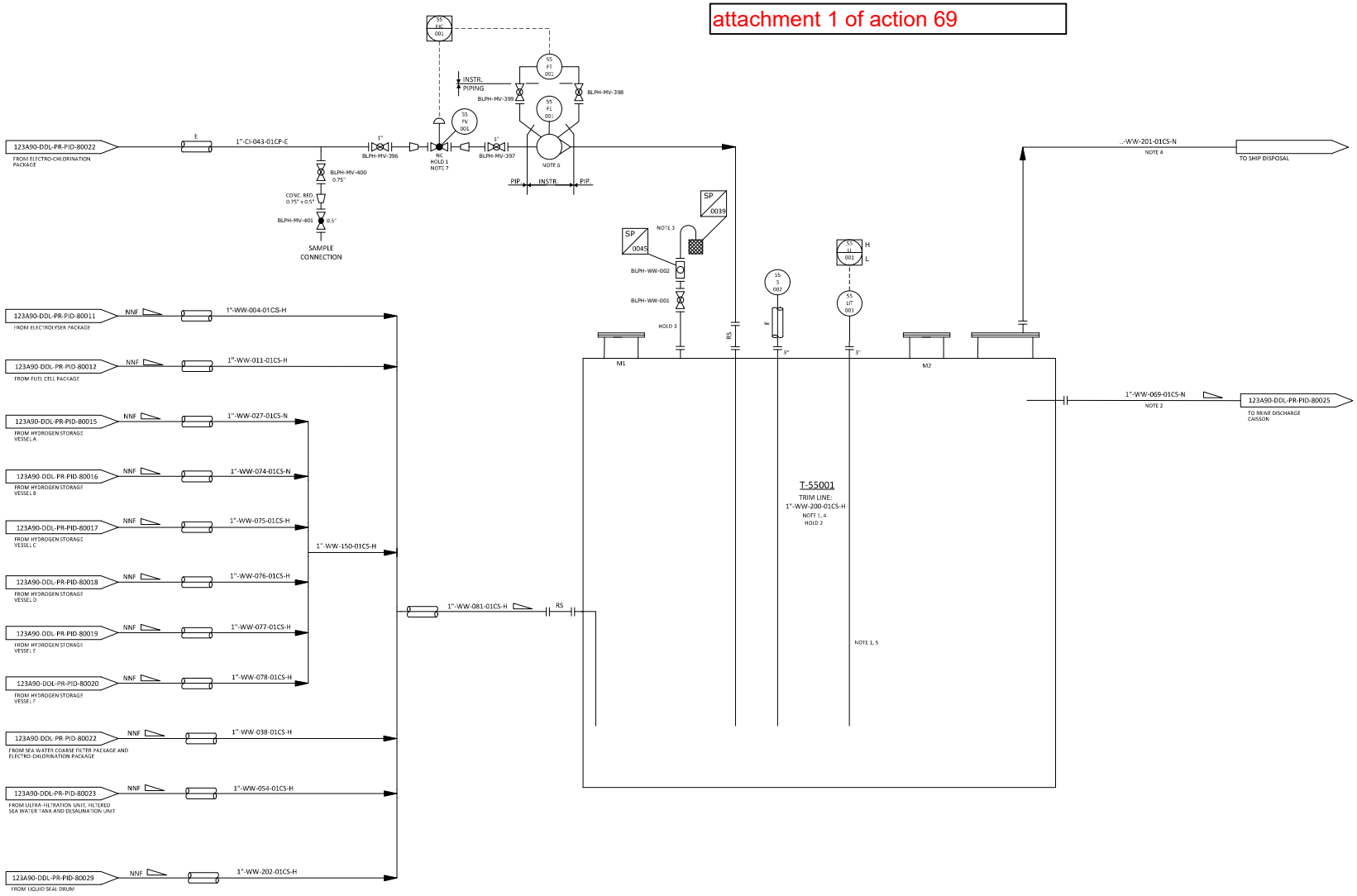
Action Title: **Ref. Doc.**	**HAZOP Study Actions** K559-2254-SE-REP-015
Item No.	69
Cause:	Loss of liquid level within T-55001. (Likely cause would be control loop failure of level control T-55001)
Consequence:	Pump P-55002 dry running, leading to pump damage
Safeguards:	Low level alarm (Not valid, 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 Hans van Nostum 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.	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 = Prid 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 14:30:0 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 17:43:57 +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)	

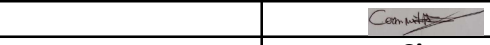
Approvals / Endorsements	
EPC Discipline Lead	**Sign**
C.Impradice	
EPC HSE Lead	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo Sterzo	
Client	**Sign**

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.	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 Datum: 2024.08.13 17:49:51 +02'00'

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 16:12:07 +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

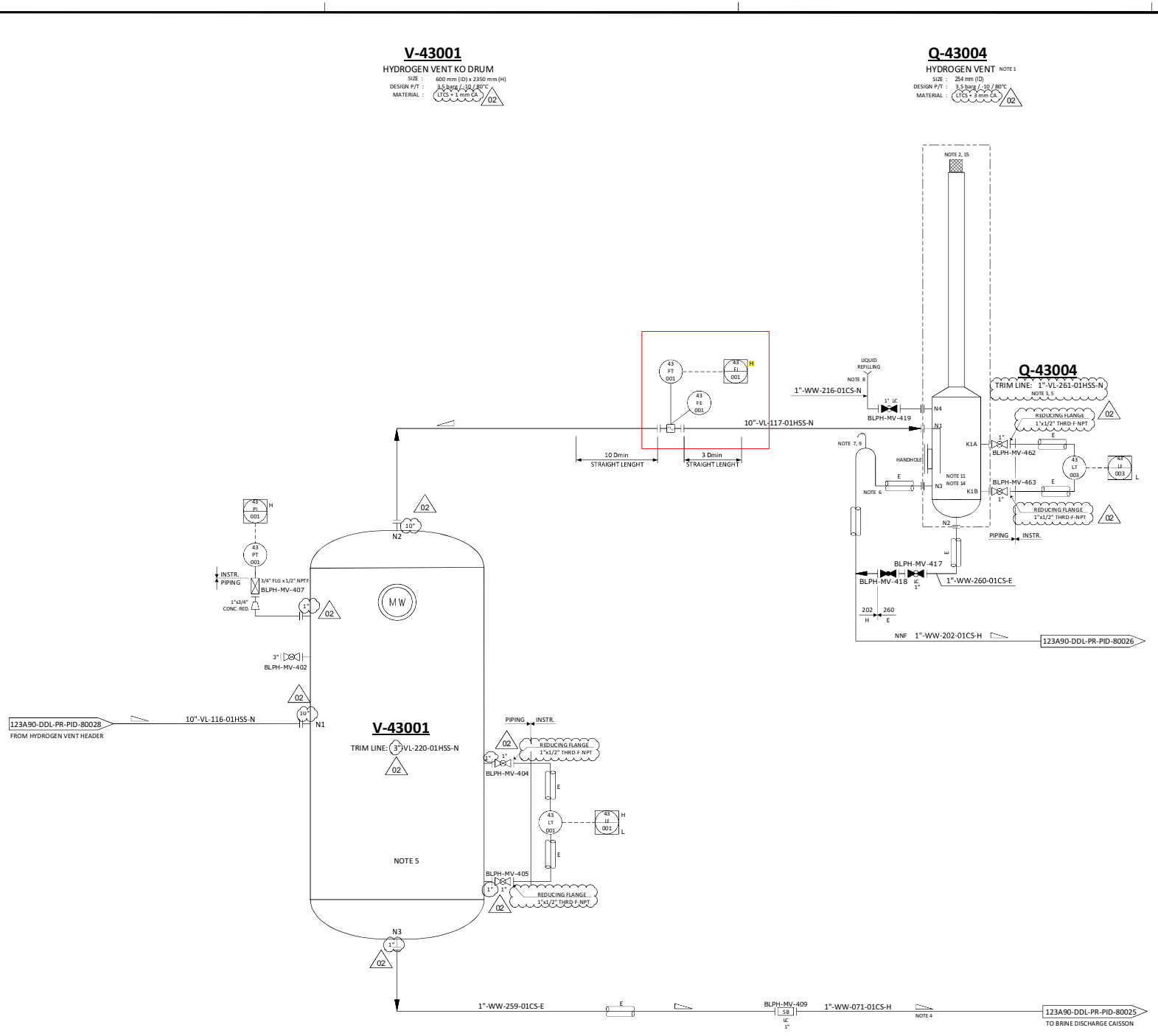
ROSETTI MARINO

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'



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 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

DRAWING NO. DRAWING_NO.

REV. REV

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**

Digitaal ondertekend door Paul van Bocxlaer
Datum: 2024.09.04 21:04:54 +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** #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	Cino Impradice	**Sign**
C. Impradice		
EPC HSE LEAD		**Sign**
C.Caracciolo	**03/05/2024**	**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client		**Sign**

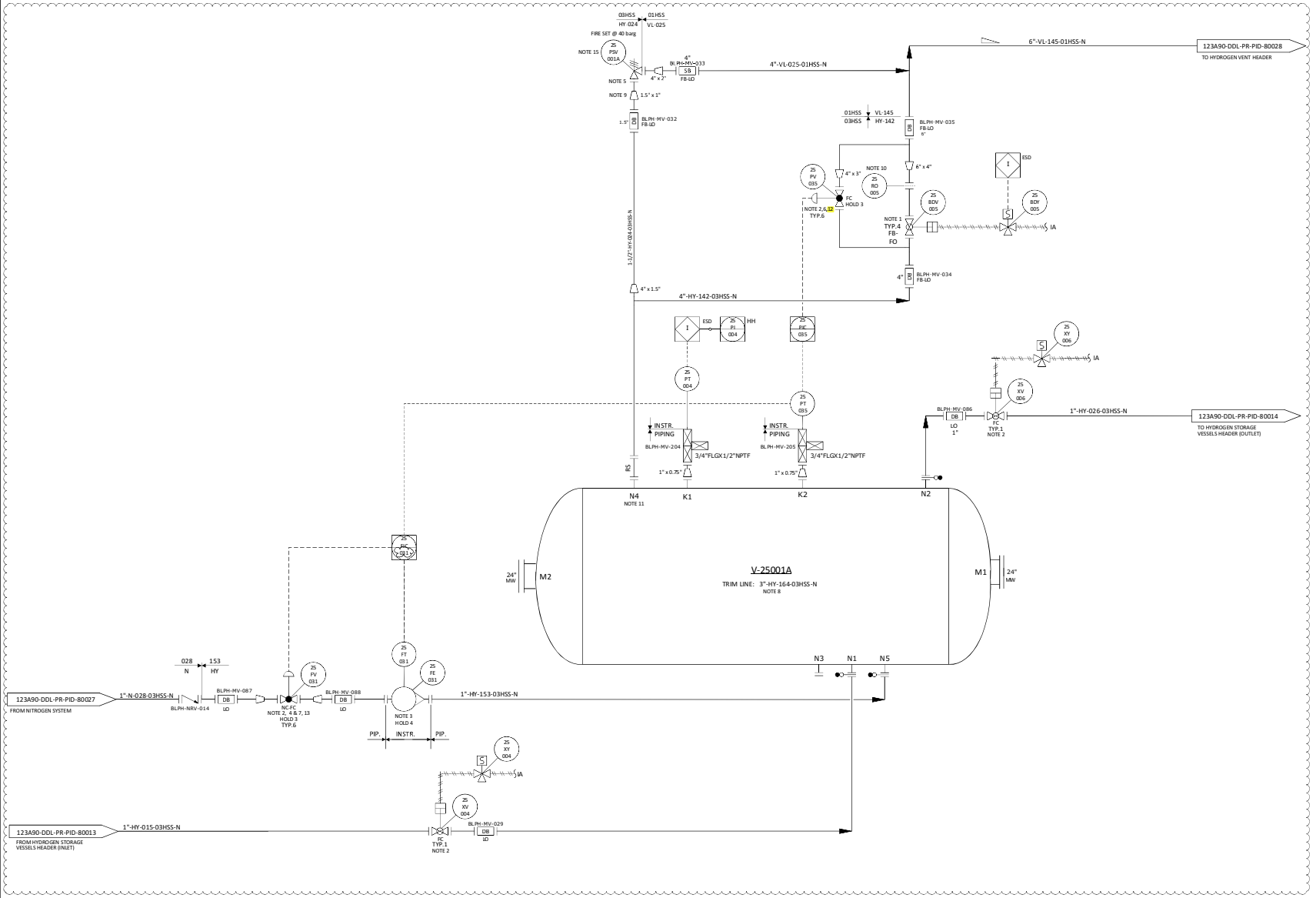
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REV. REV.

V-25001_A

HYDROGEN STORAGE VESSEL

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



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

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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** #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**

Autore firma digitale: Ciro Impradice
Nome distintivo: CN = Ciro Impradice E-mail = ciro.impradice@rosetti.it C = IT O = Rosetti Marino OU = Progetti
Data: 2024.04.15 09:16:05 02'00'

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.

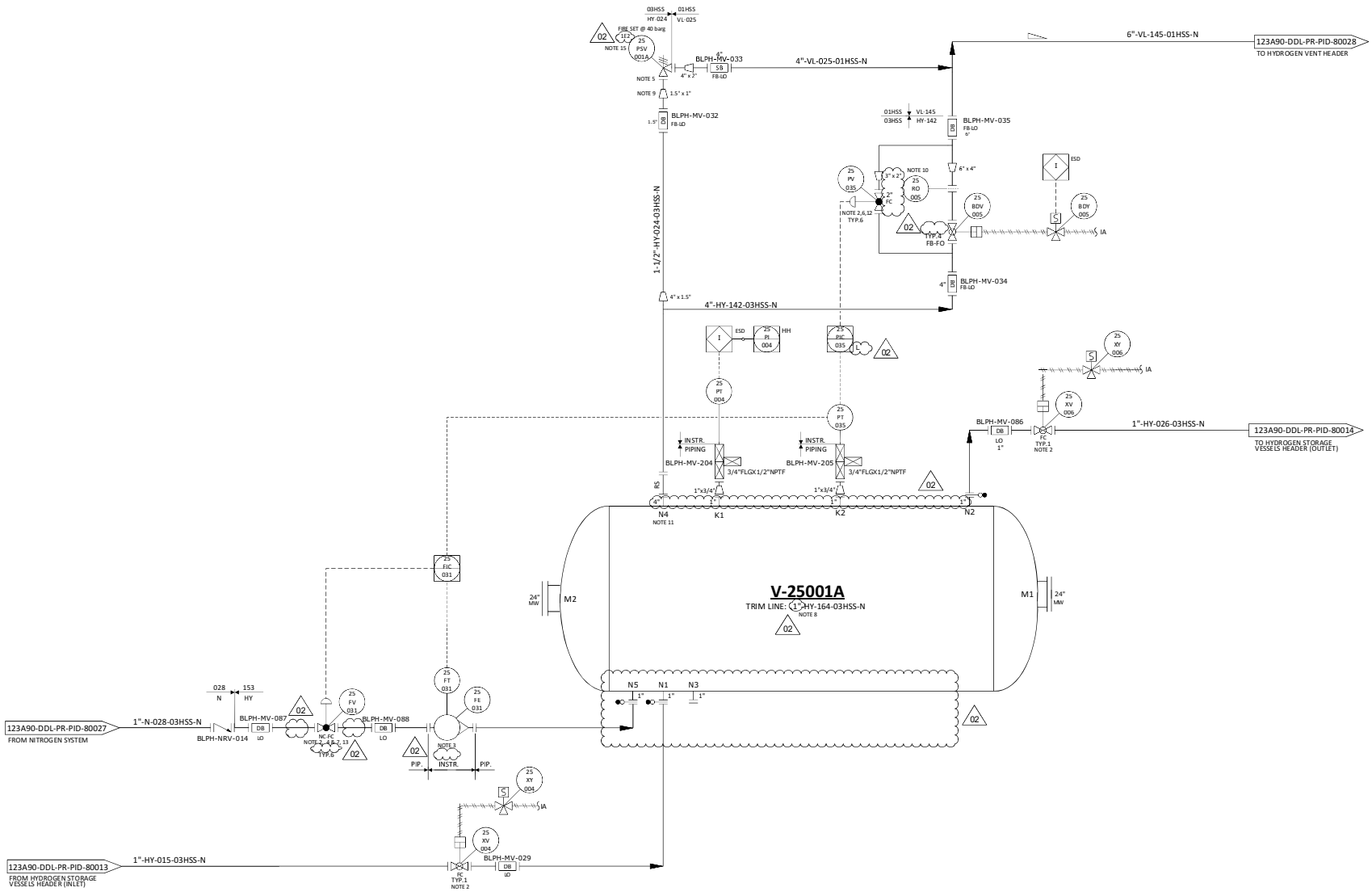
DRAWING NO. DRAWING_NO.

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 Datum: 2024.06.21 08:37:54 +02'00'

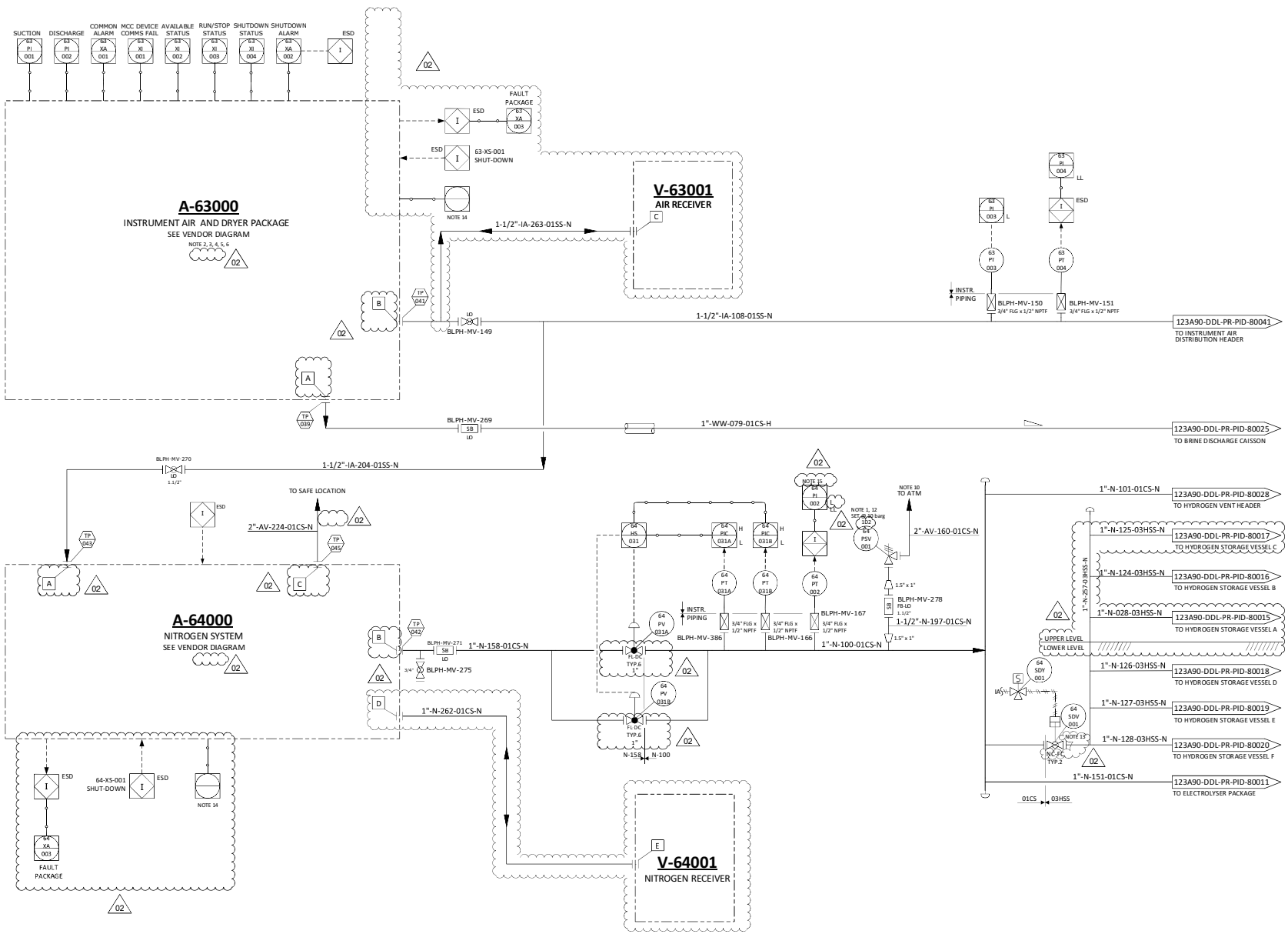
CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #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 — Digitaal 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

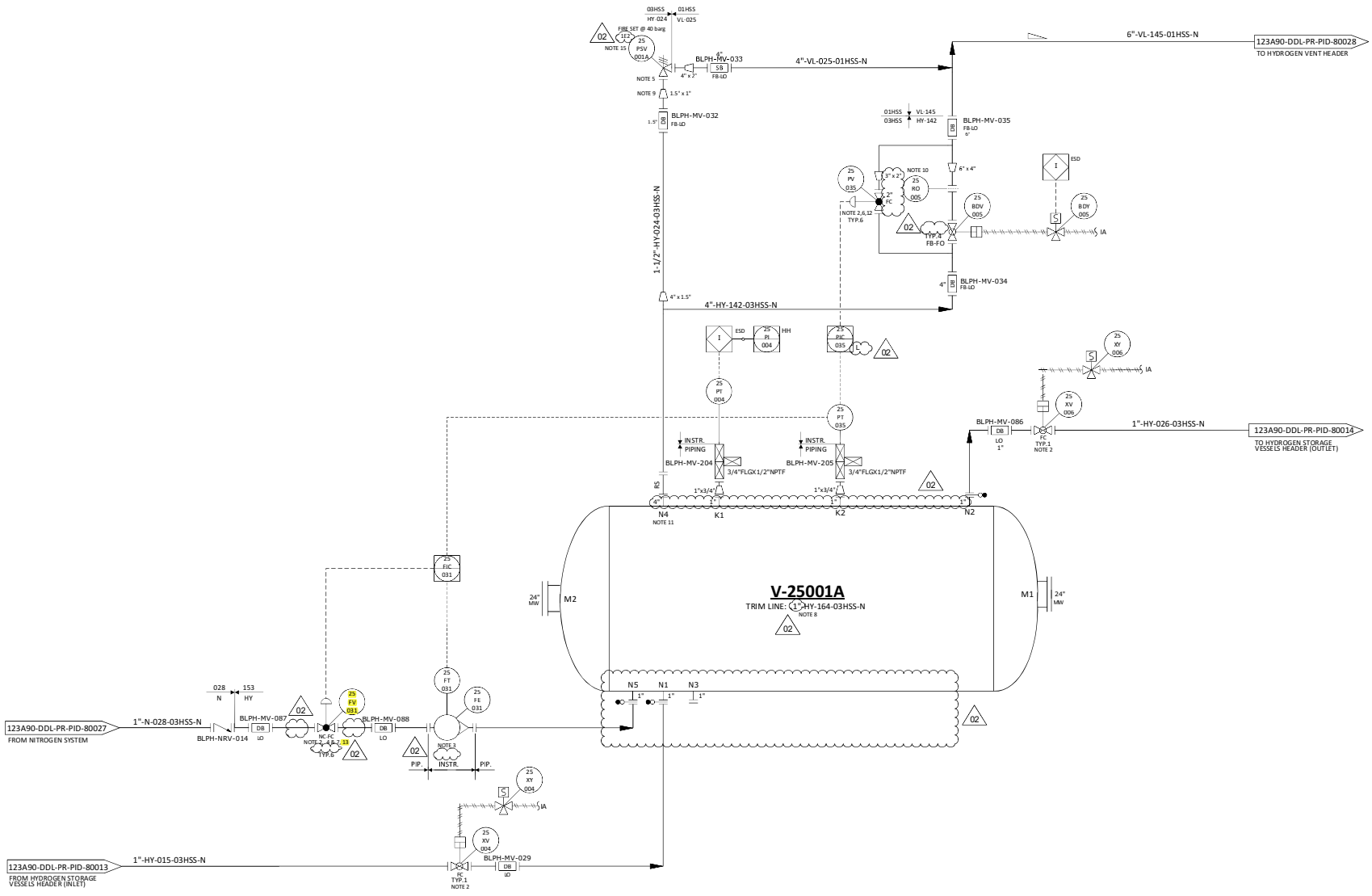
DRAWING NO. DRAWING_NO.

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**
		Impreshaa Siro
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**

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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

Column	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			

CAUSE

TAG Nos	DESCRIPTION	VOTING	INHIBITION	REMARK		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53
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% LI	2oo20			3	X		F		X				X		X						X																																			
					4																																																						
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					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																																			
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					41																																																						

NOTES:

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	Sheet. 13 of 17 / Rev. 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** #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
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					

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

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**

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Digitaal ondertekend door Paul van Rossum
Datum: 2024.06.21 14:15:43 +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
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- 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:

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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.

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Table 11 – Assumption #7

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Consequence Summary Report

Workspace: H2 vent

Study: Study

Summary Basis

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Discharge Results (after atmospheric expansion)

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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**
		Digitaal ondertekend door Paul van Rossum Datum: 2024.08.21 08:36:58 +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** #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

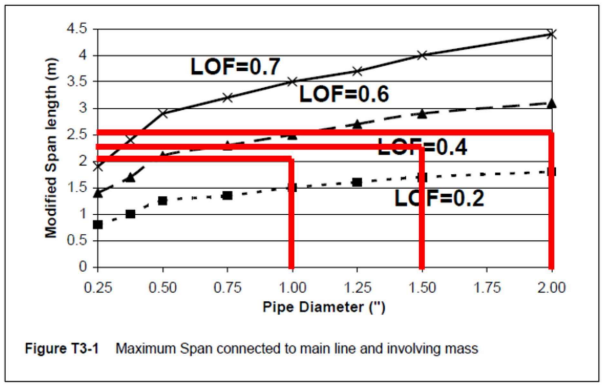


Figure T3-1 Maximum Span connected to main line and involving mass

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

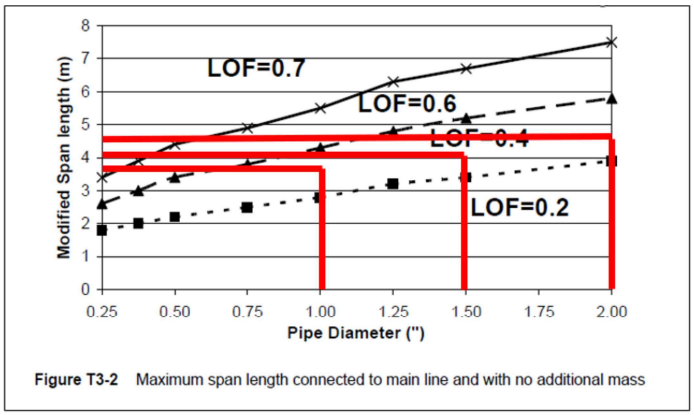


Figure T3-2 Maximum span length connected to main line and with no additional mass

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ROSETTI MARINO

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 Possum 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)

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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'

CROSSWIND

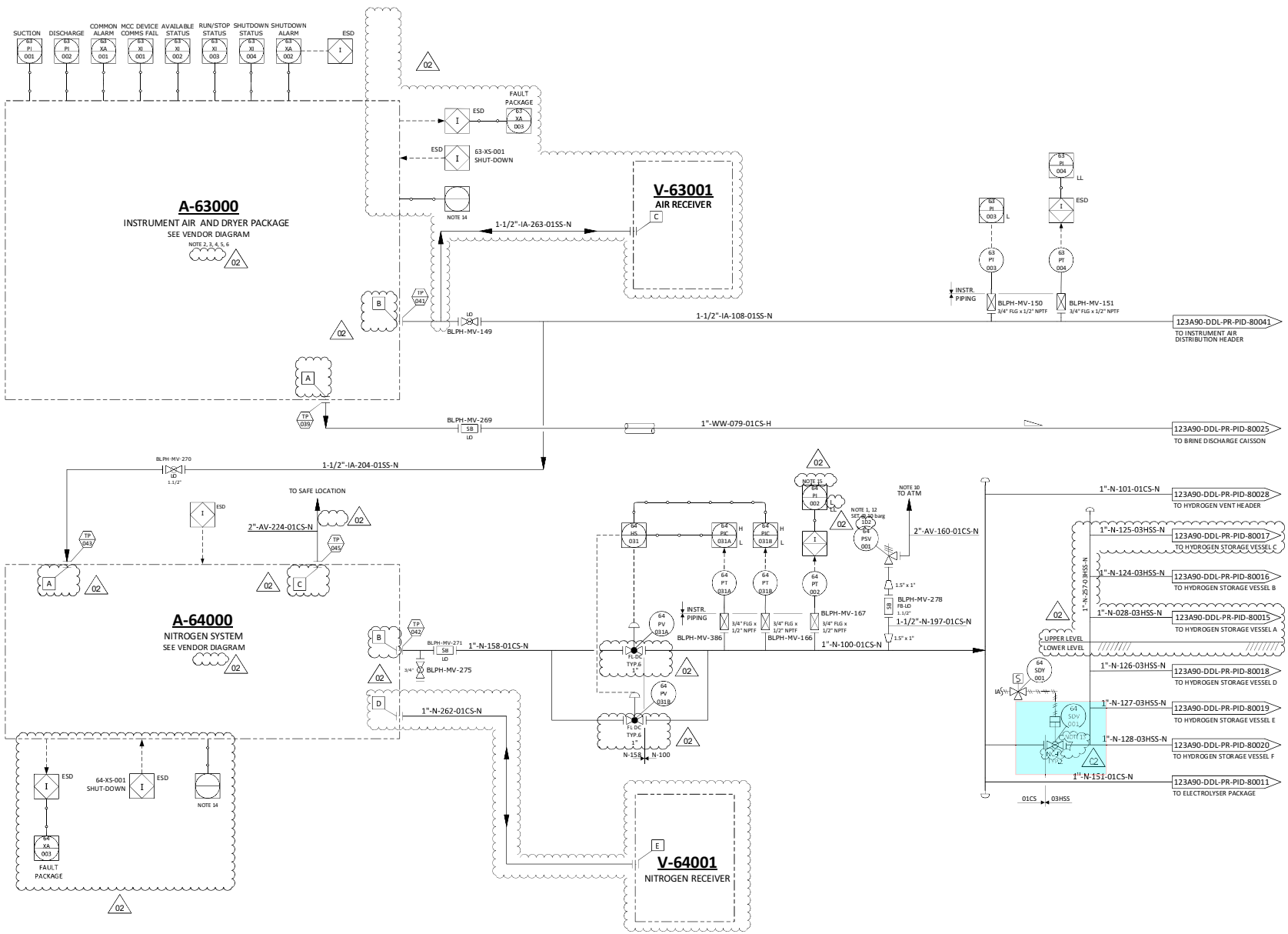
HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

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

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REV. REV.
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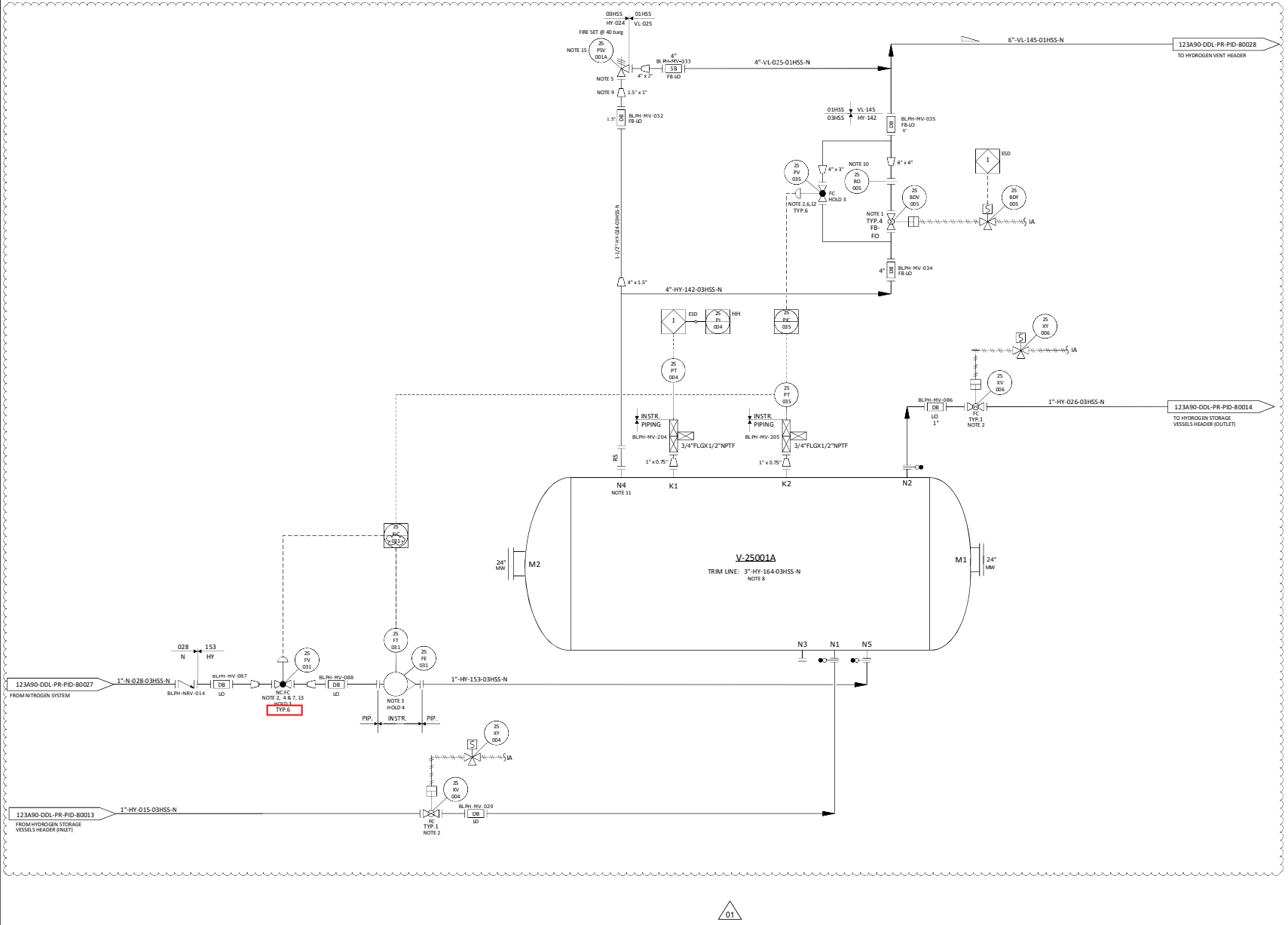
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REV. REV.

V-25001_A

HYDROGEN STORAGE VESSEL

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



NOTES

1. 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	
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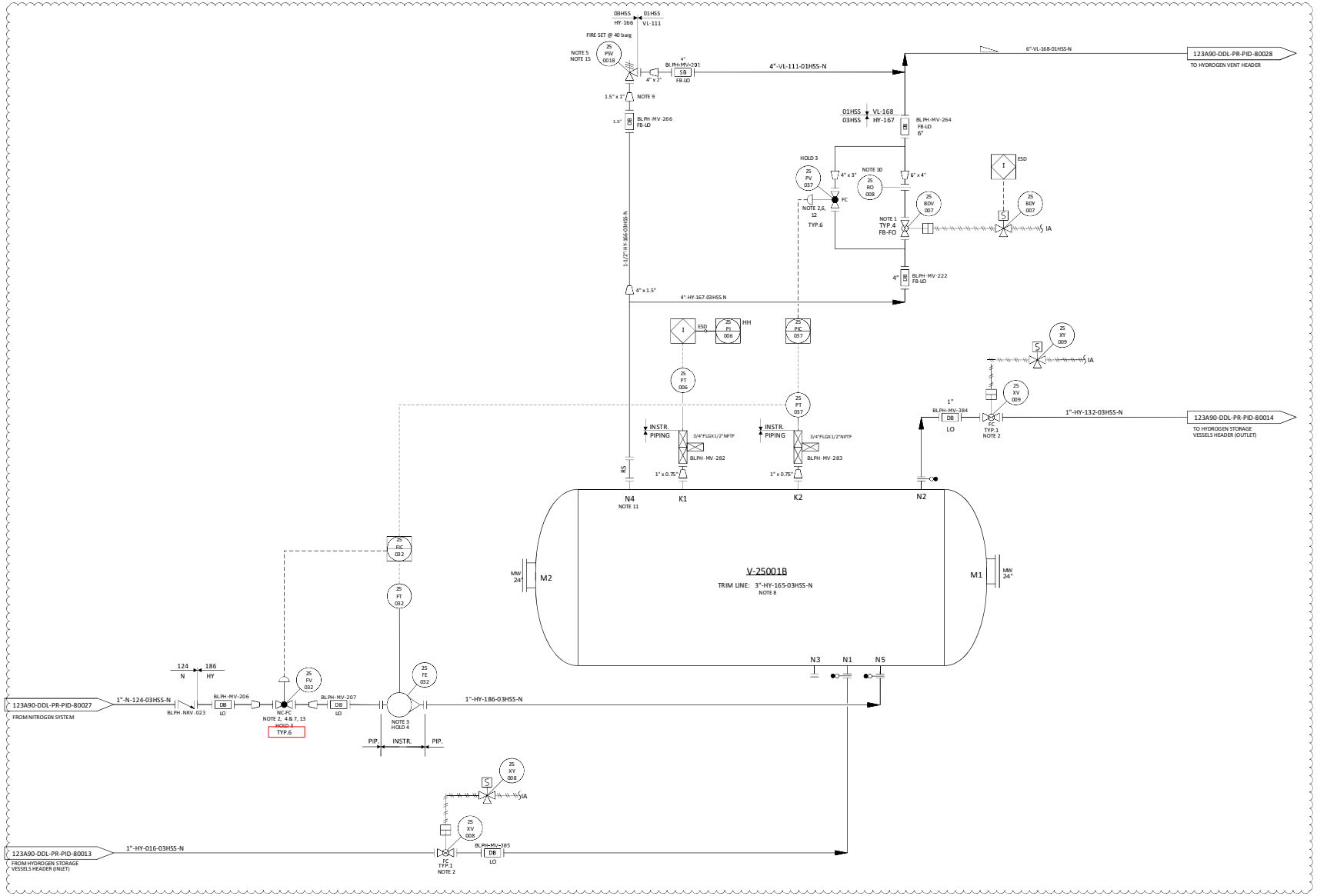
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V-25001_B

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. 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 B

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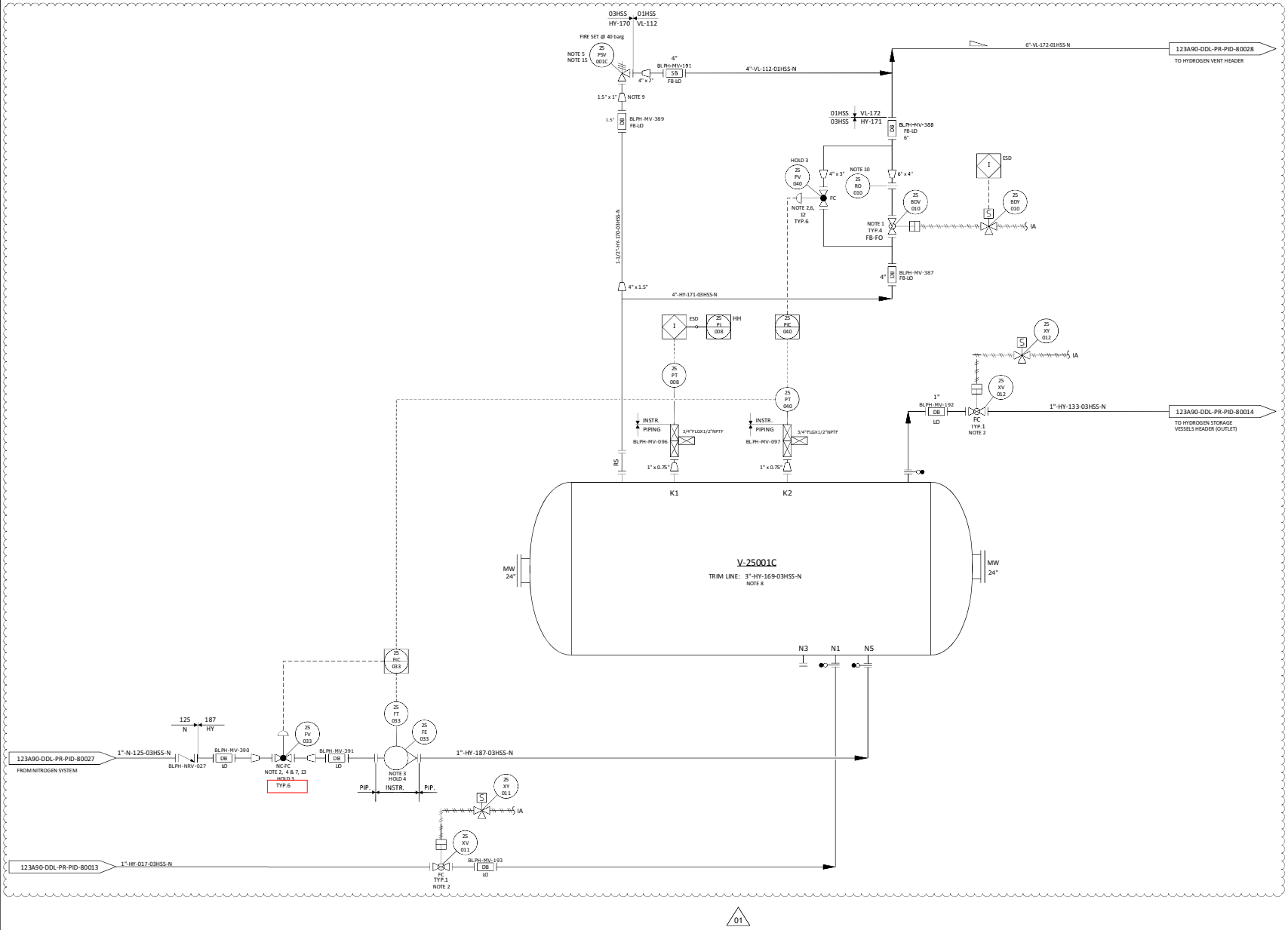
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REV. REV.

V-25001_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



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 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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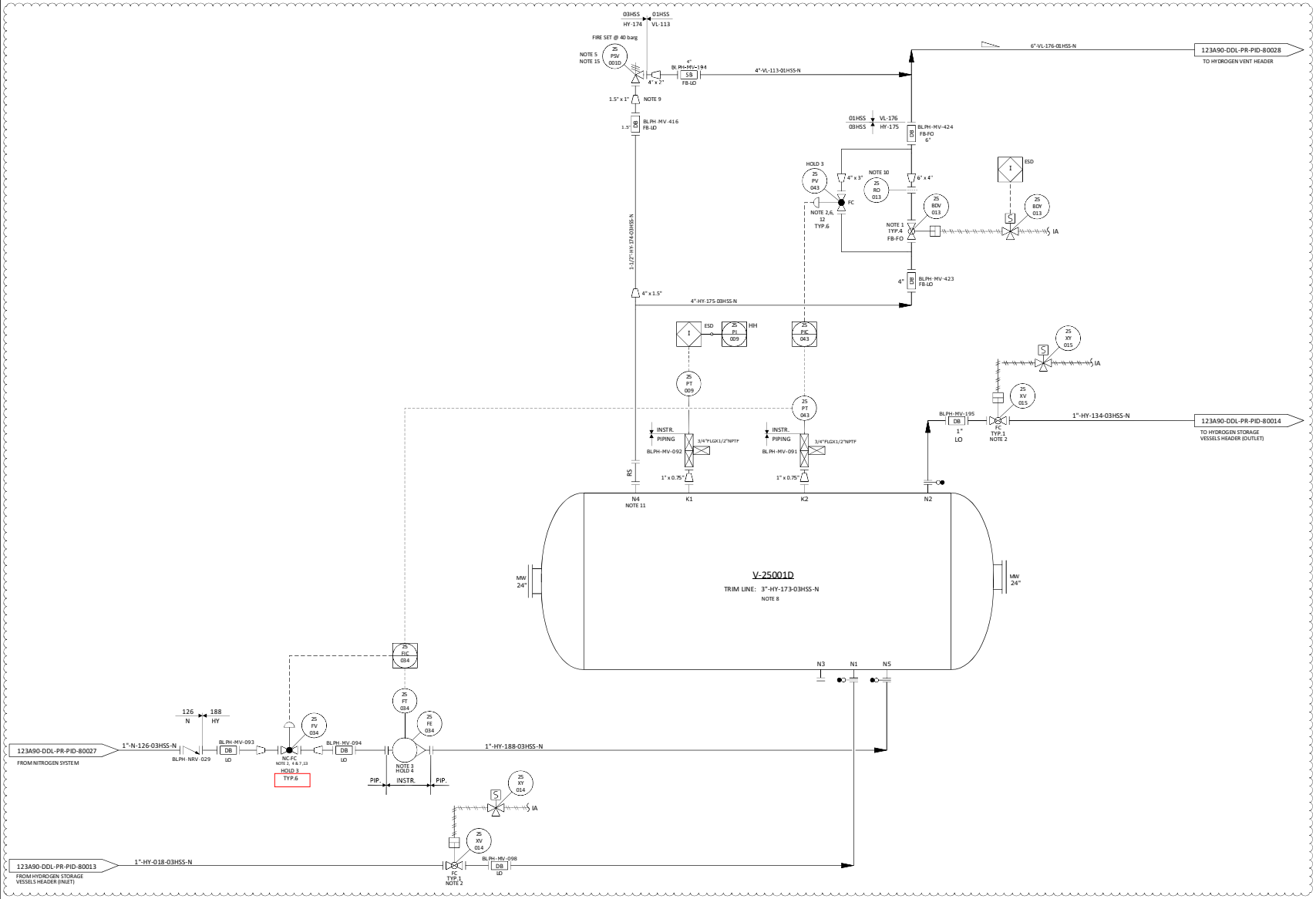
DRAWING NO. DRAWING_NO.

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	
A1	DRAWING NO. 123A90-DDL-PR-PID-80018		SHEET 001	REV. 01

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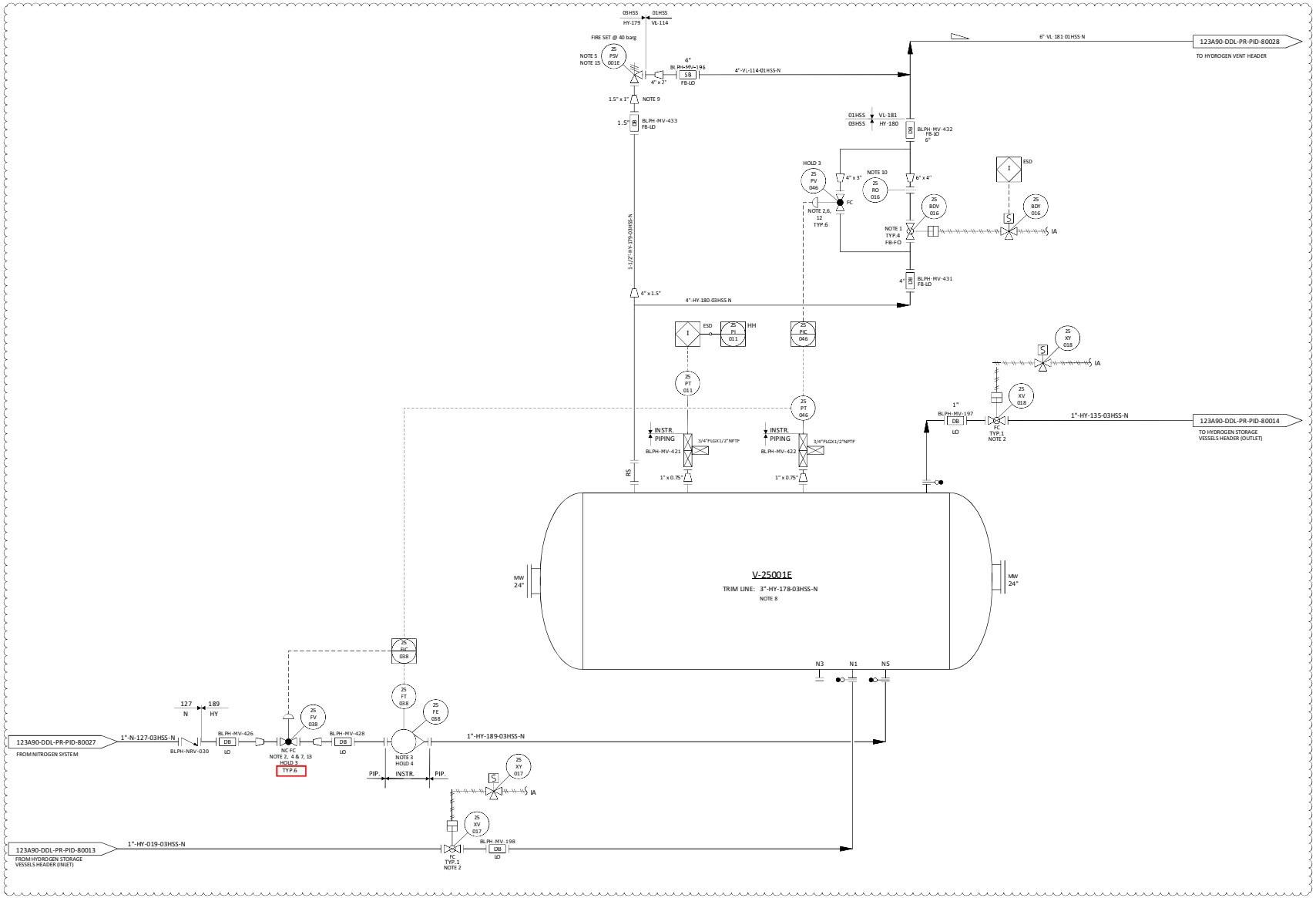
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REV. REV.

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	
A1	DRAWING NO. 123A90-DDL-PR-PID-80019		SHEET 001	REV. 01

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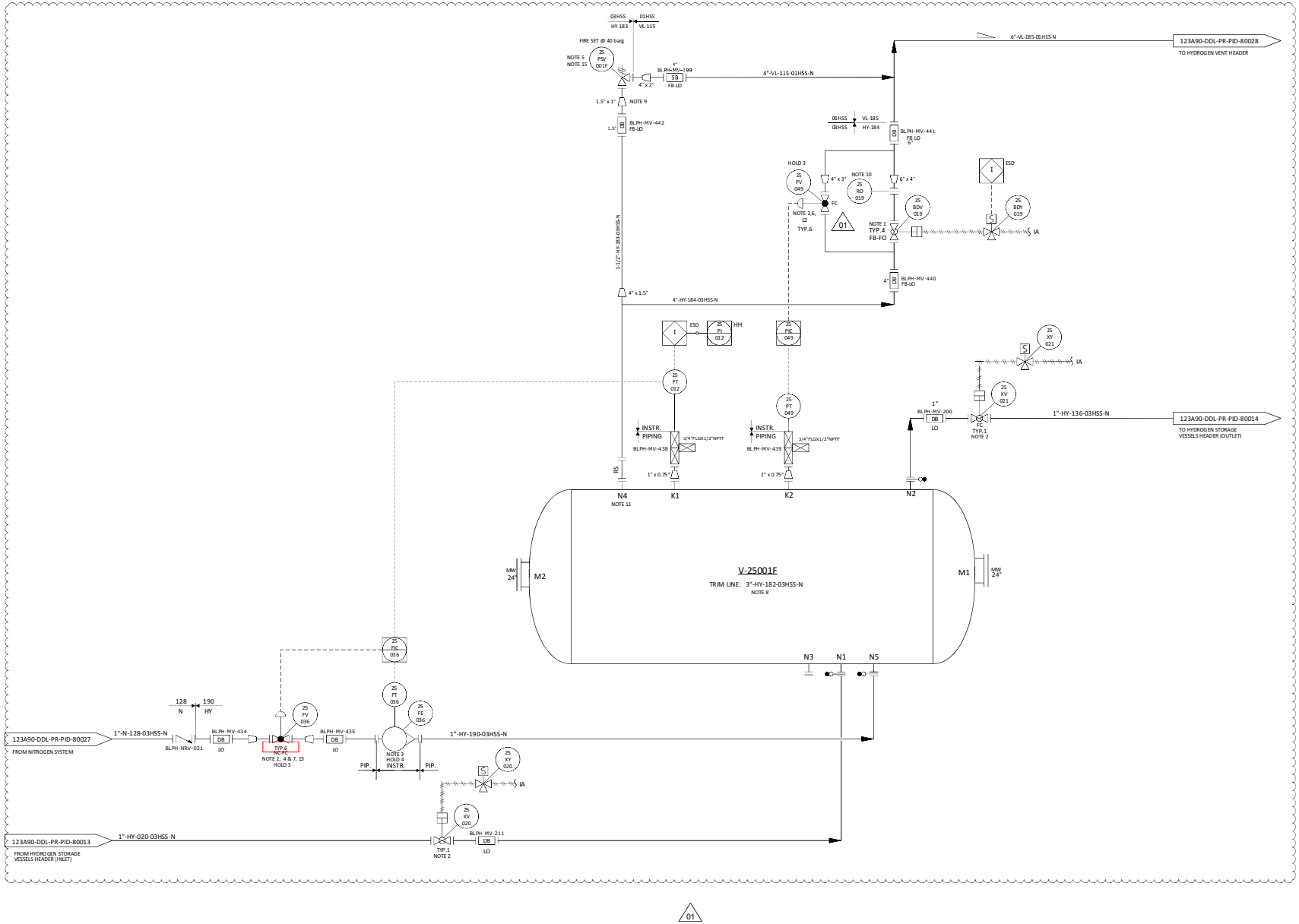
DRAWING NO. DRAWING_NO.

REV. REV.

V-25001_F

HYDROGEN STORAGE VESSEL

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



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 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. 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 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**
EPC HSE LEAD	**Sign**
C.Caracciolo	**CC**
EPC Project Manager	**Sign**
D.Lo.Sterzo	
Client	**Sign**
	Paul van Rossum

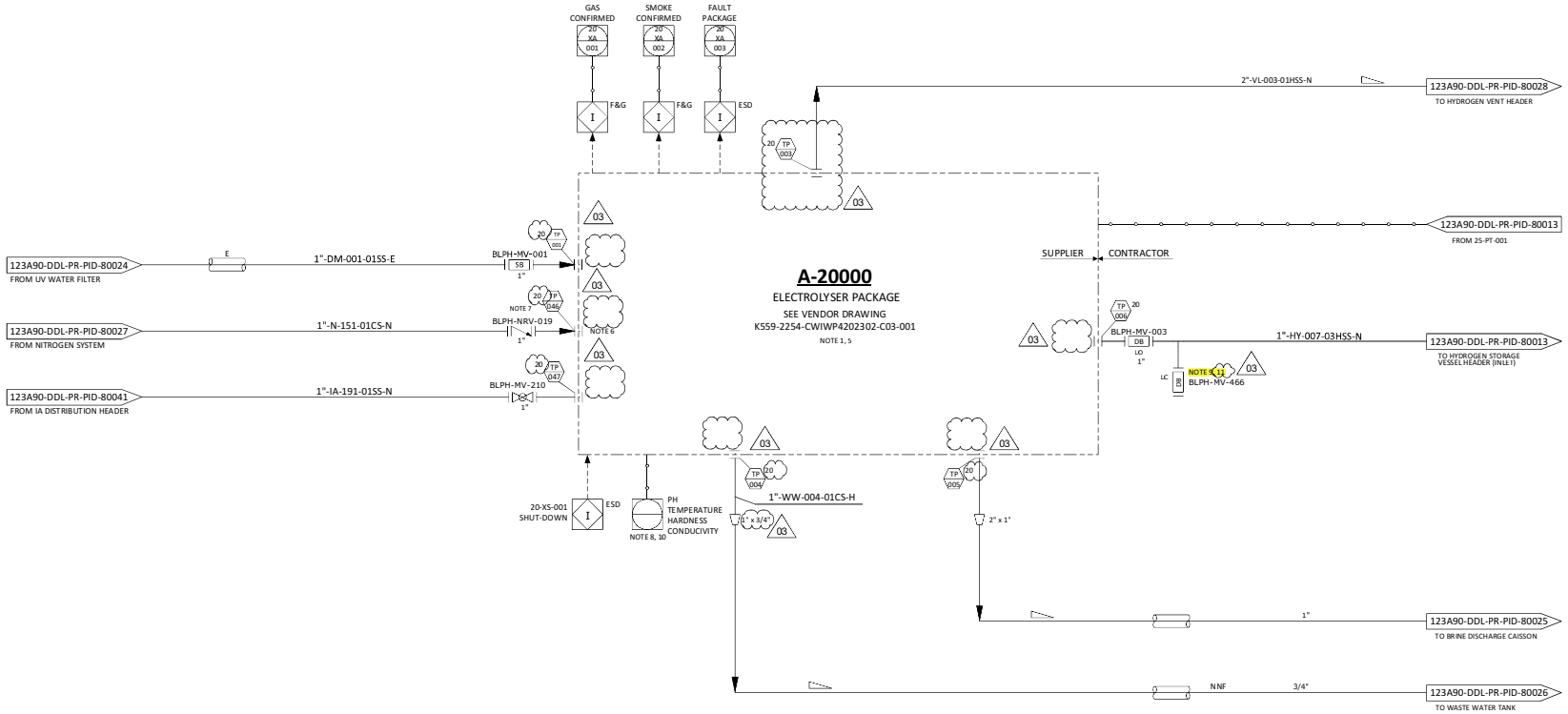
DRAWING NO. DRAWING_NO.

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 Autore firma digitale: Ciro Impradice Nome distintivo: CN = Ciro Impradice email = ciro.impradice@rosetti.it C = IT O = Rosetti Marino OU = Process Data: 2024.06.27 12:57:49 +02'00'	**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

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

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**

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
20					
21					

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.	Date	Reason For Issue	EM / CK / APP
Rev Index.	0			RC / RC / RC

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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):

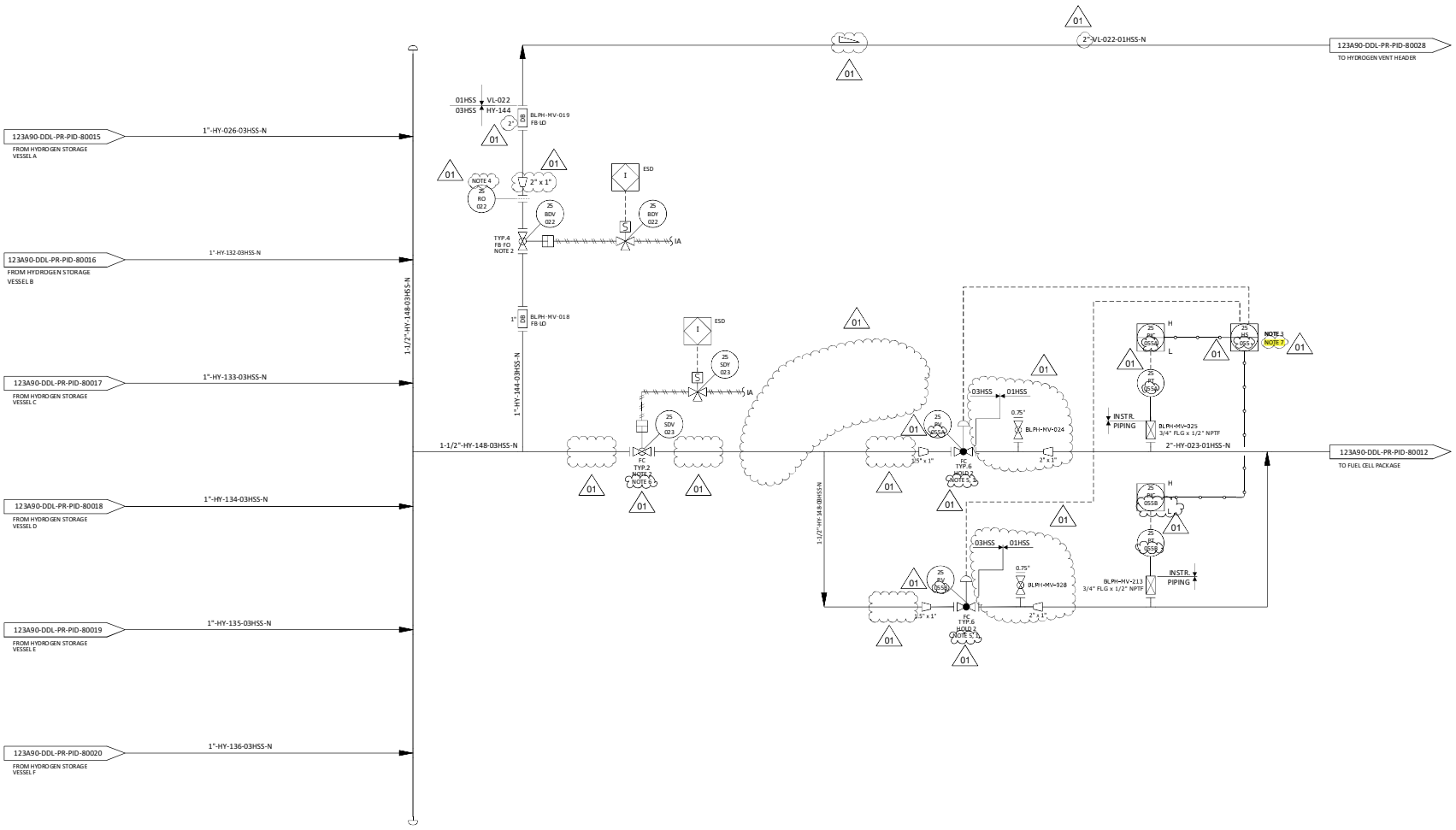
This communication is issued for the recipient's information and to facilitate the obligations of the Parties under the Contract. This communication has no authority to amend or vary the Contract nor relieve either Party of any duties, obligations or responsibilities.

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

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.



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

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

ITALIAN VALVES MANUFACTURER SINCE 1973

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	cm²
54	Orifice Designation	-	**K**	-
55	Selected Area	A_S	**12,940**	cm²
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	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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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 Szrajder Digitally signed by Dominik Szrajder 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: 2024.10.24 10:47:52 +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: 2024.11.02 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

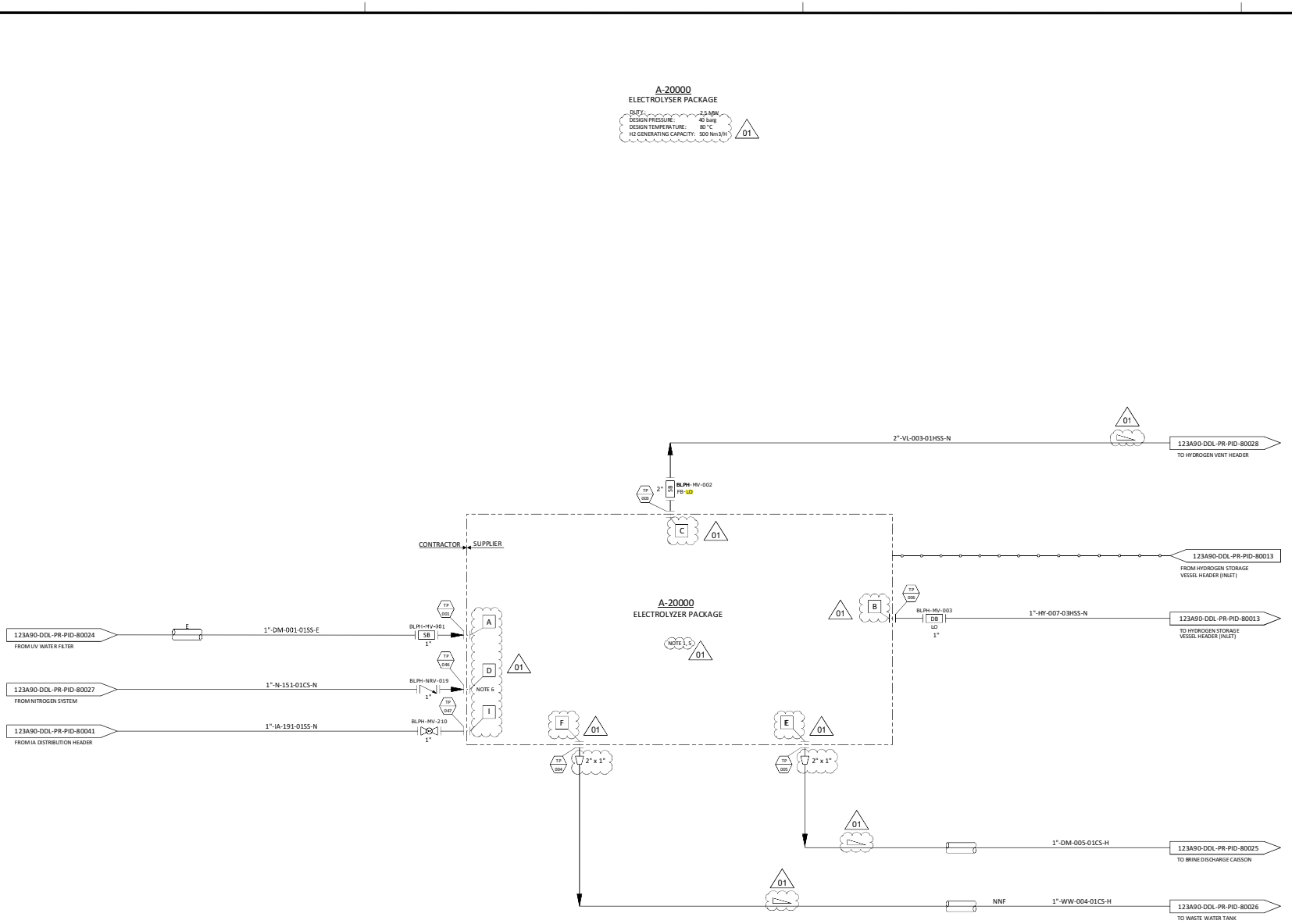
EPC Discipline Lead	Ciro Impradice	**Sign**
Ciro Impradice		
EPC HSE LEAD		**Sign**
C.Caracciolo		**CC**
EPC Project Manager		**Sign**
D.Lo.Sterzo		
Client		**Sign**

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)

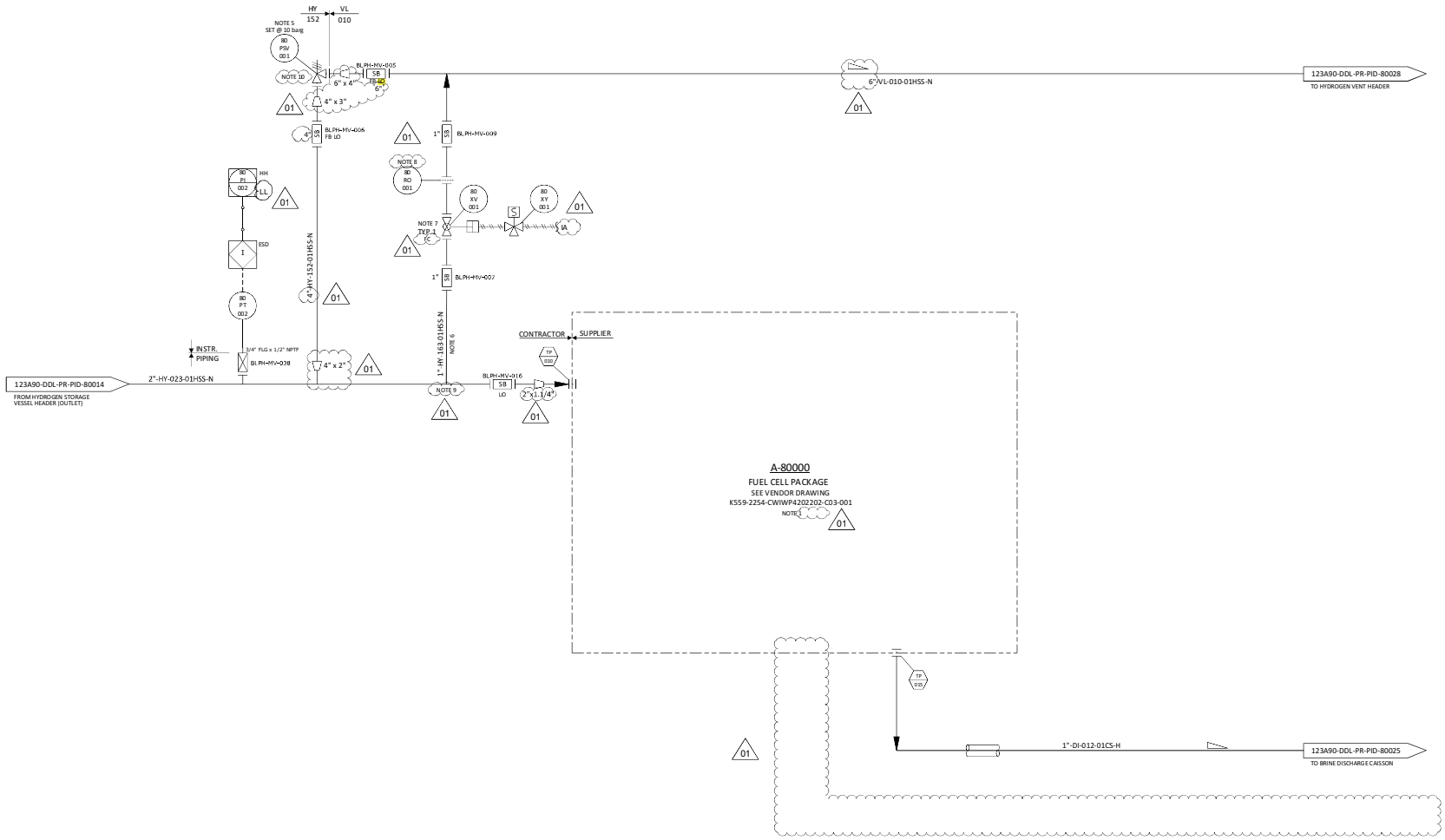
ROSETTI MARINO

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 Impradice	**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. DRAWING_NO.

REV. REV.



NOTES

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

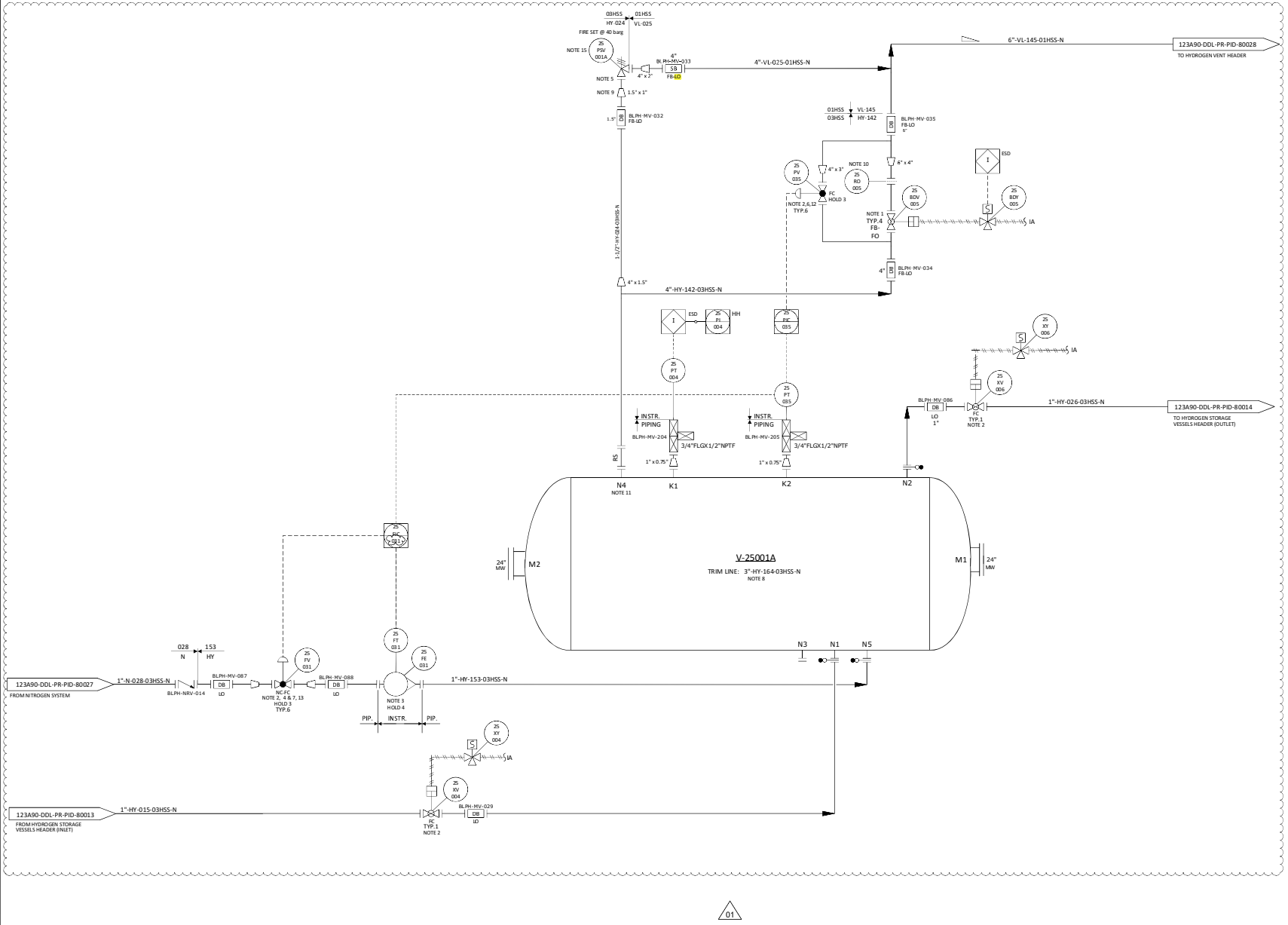
DRAWING NO. DRAWING_NO.

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

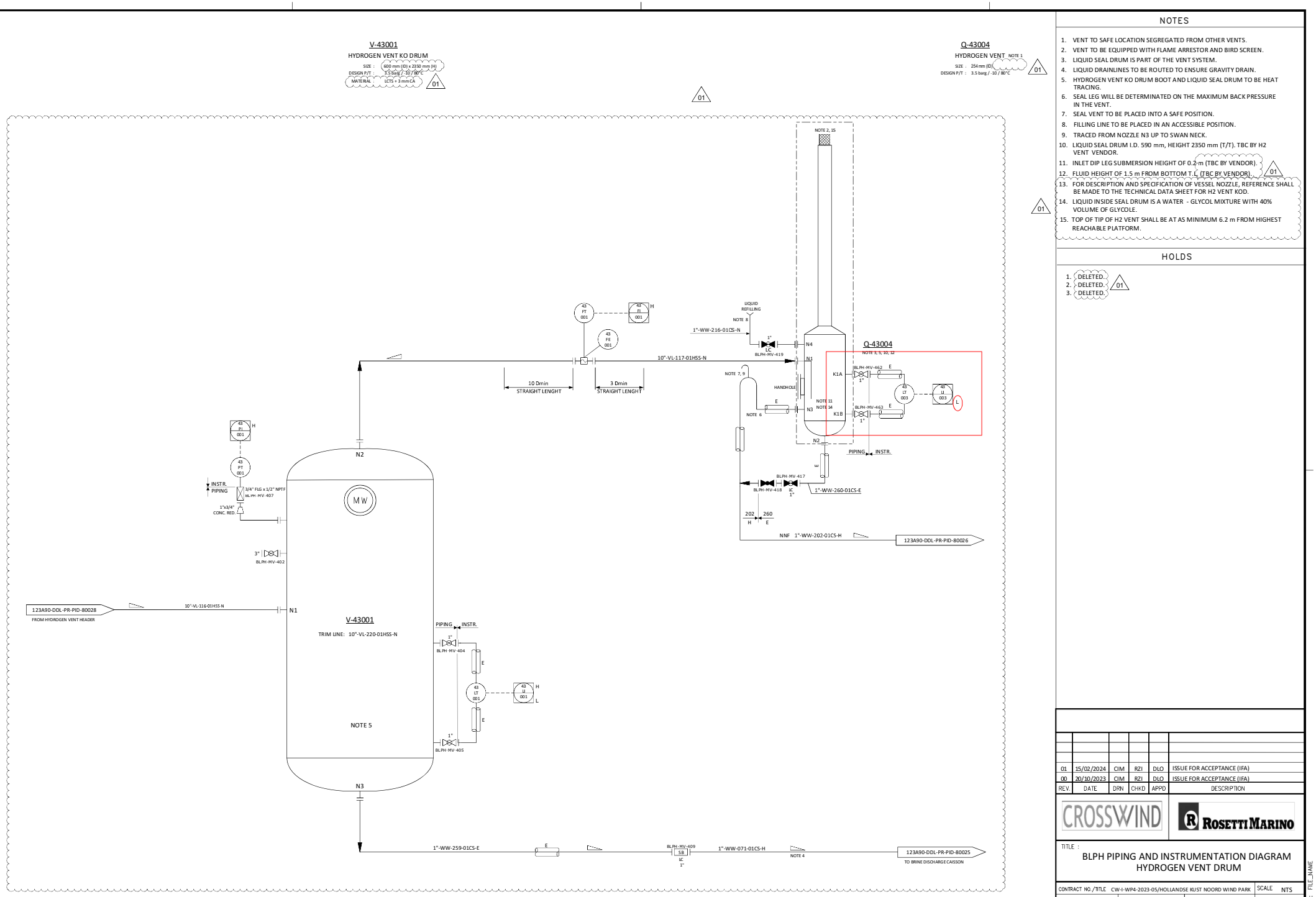
HOLLANDSE KUST NOORD WIND PARK

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 Digitally signed by Dominik Sznajder Date: 2024.10.24 10:47:01 +02'00'
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

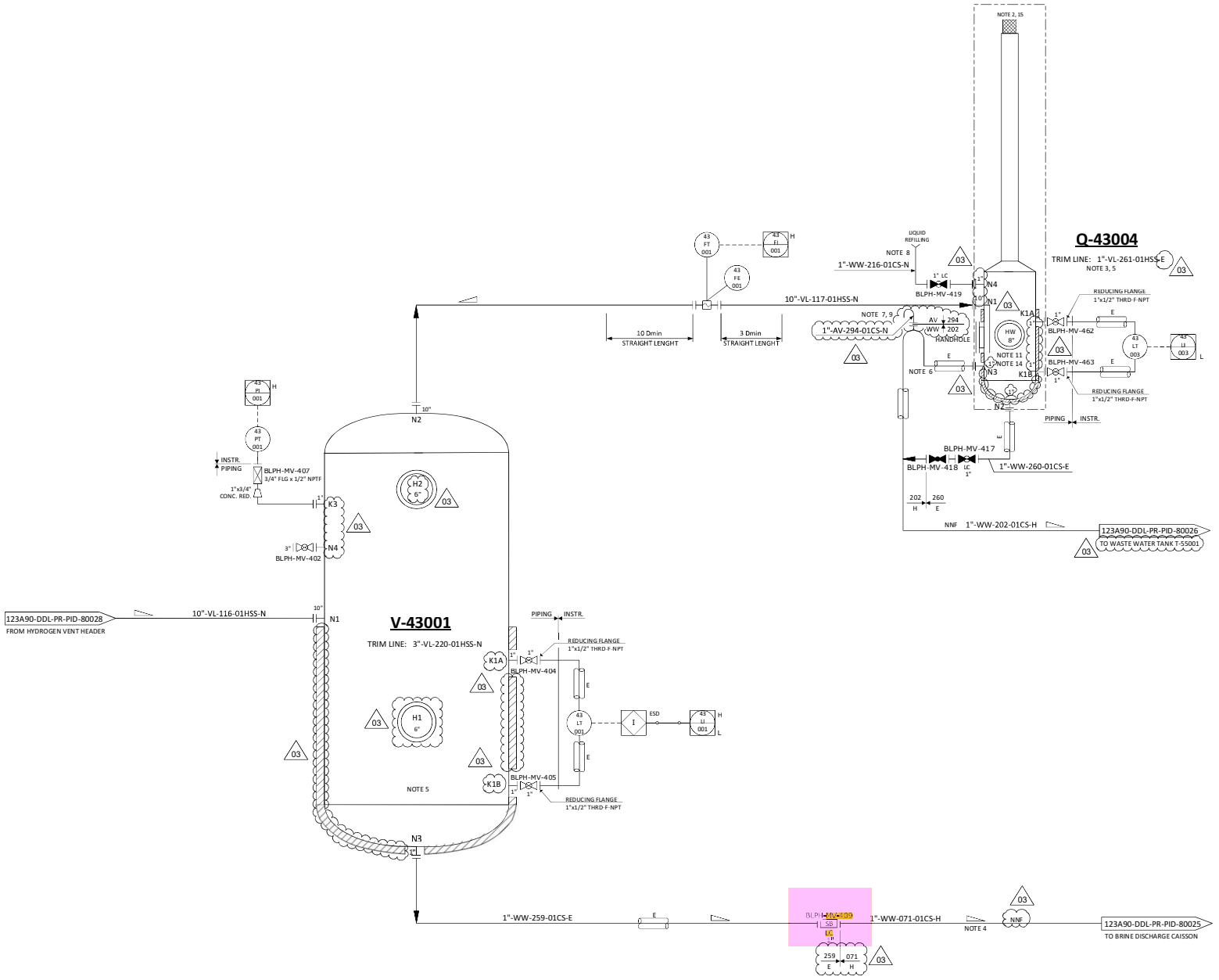
HYDROGEN VENT KO DRUM

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 (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

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.

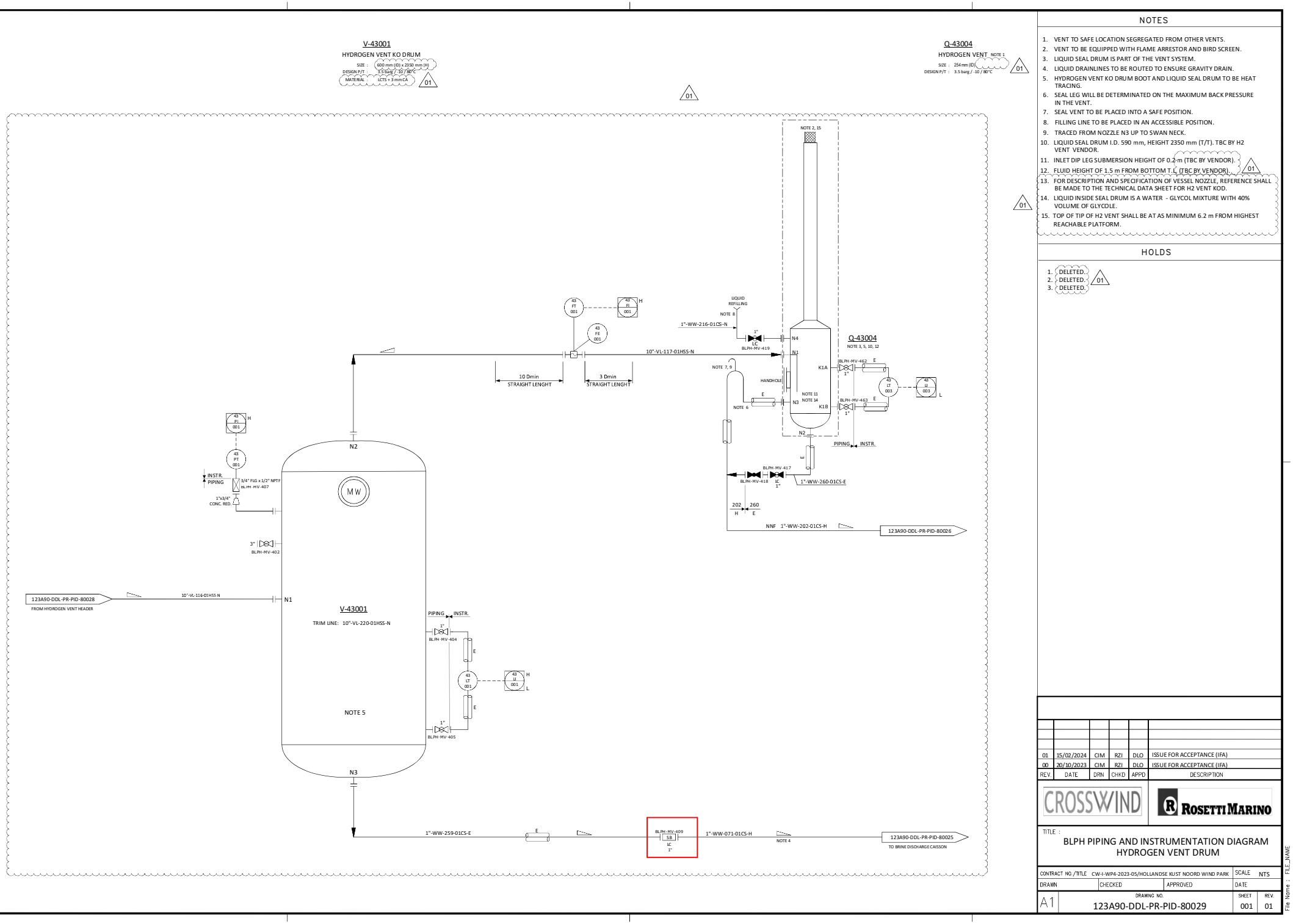
Approvals / Endorsements

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)

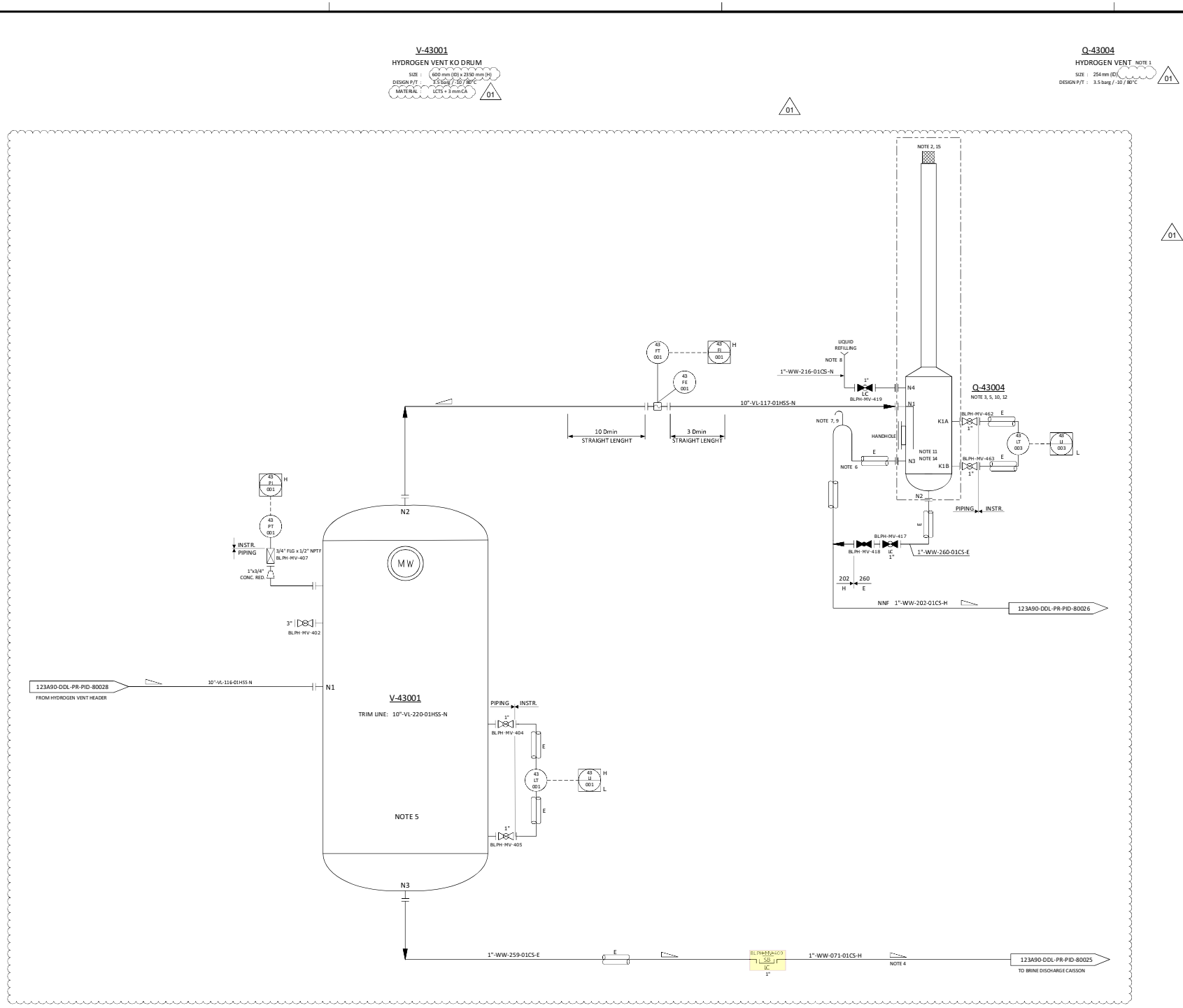
ROSETTI MARINO

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 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

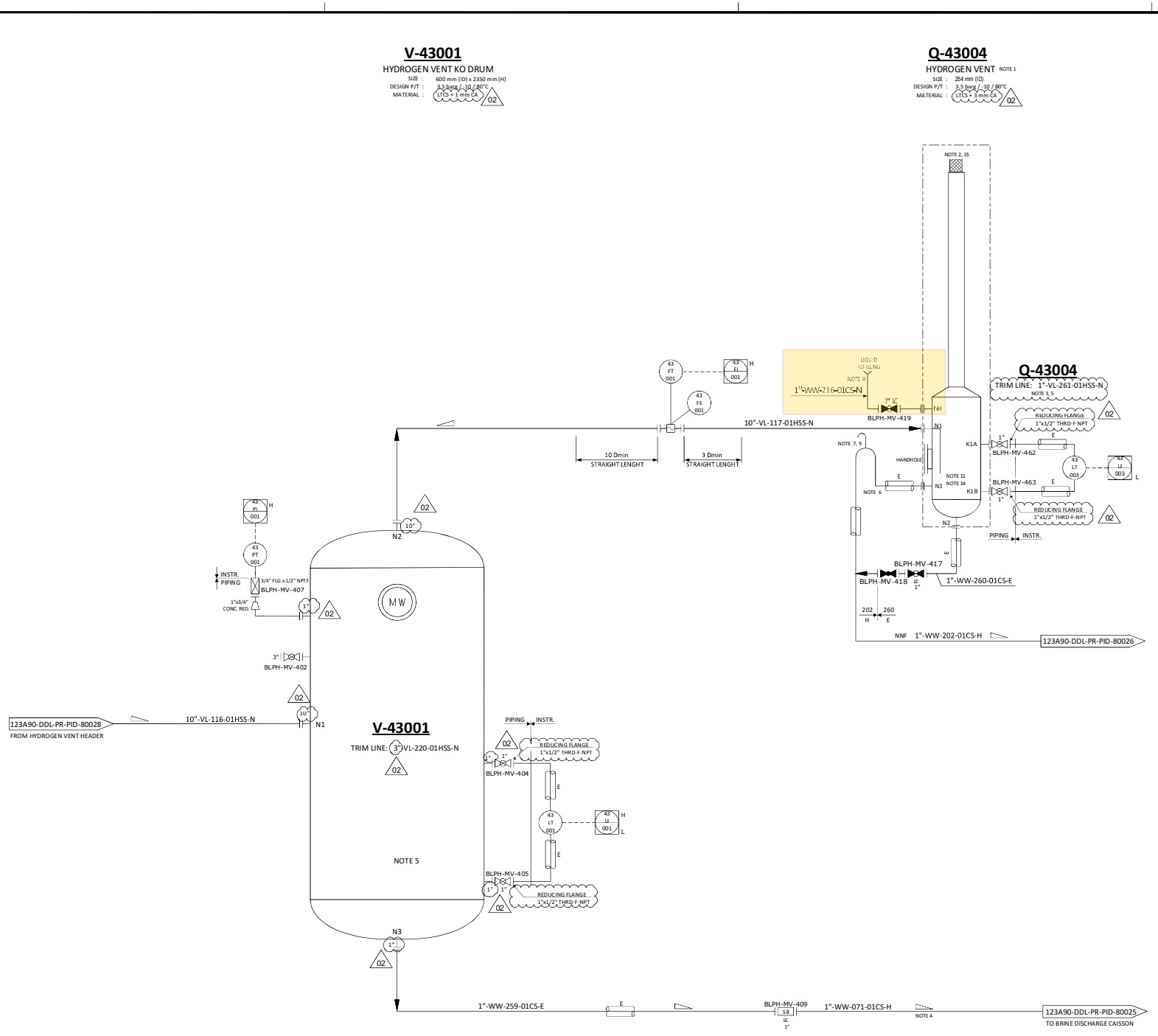
CROSSWIND

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #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**



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 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

DRAWING NO. DRAWING_NO.

REV. REV

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

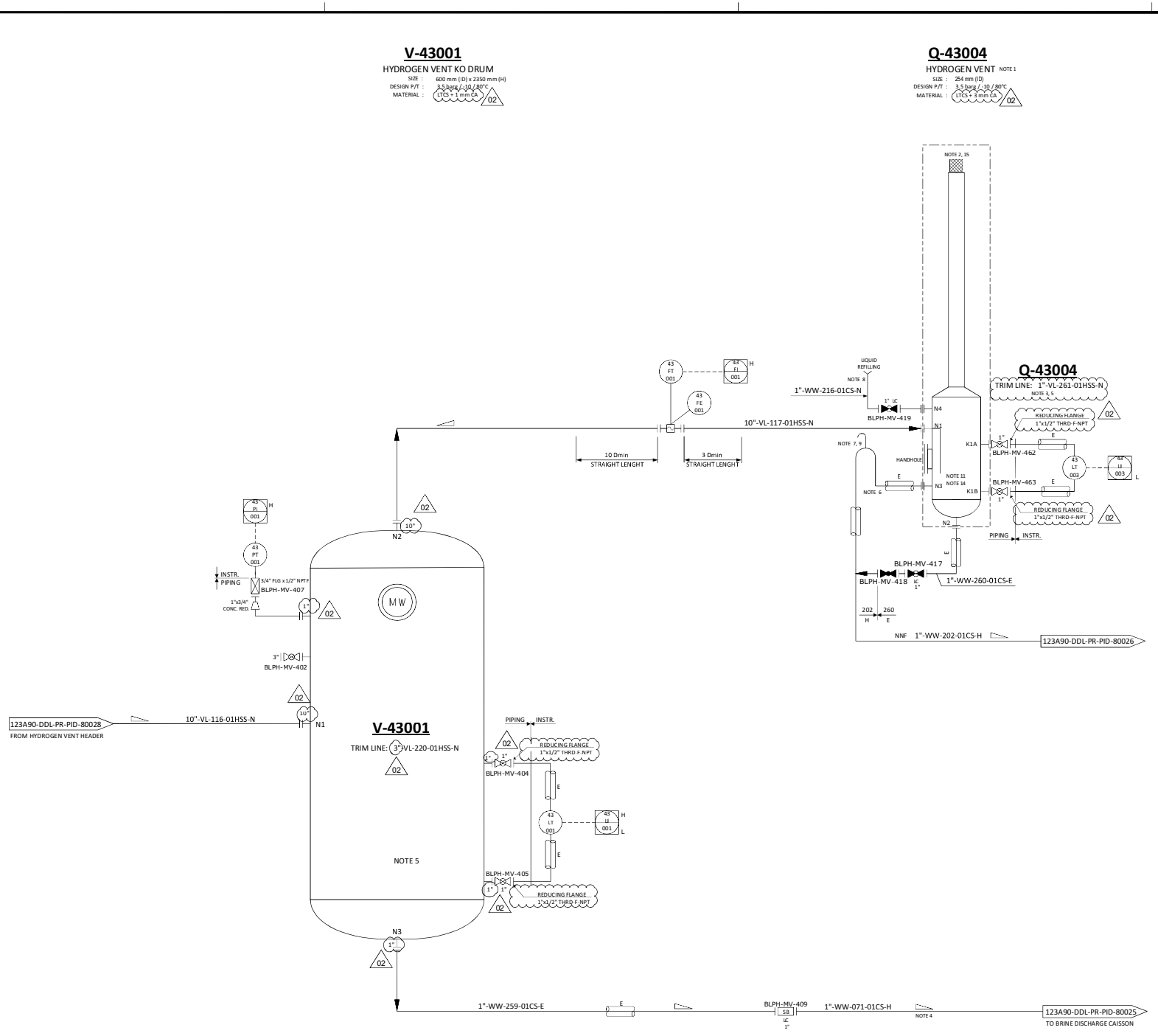
Process Minimum Requirements and notes

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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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 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 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:	**EPC HAZOP Study Actions**
Action No:	42
Ref Doc	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 Bossum 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 = Rosetti Marino ON = Progetti 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

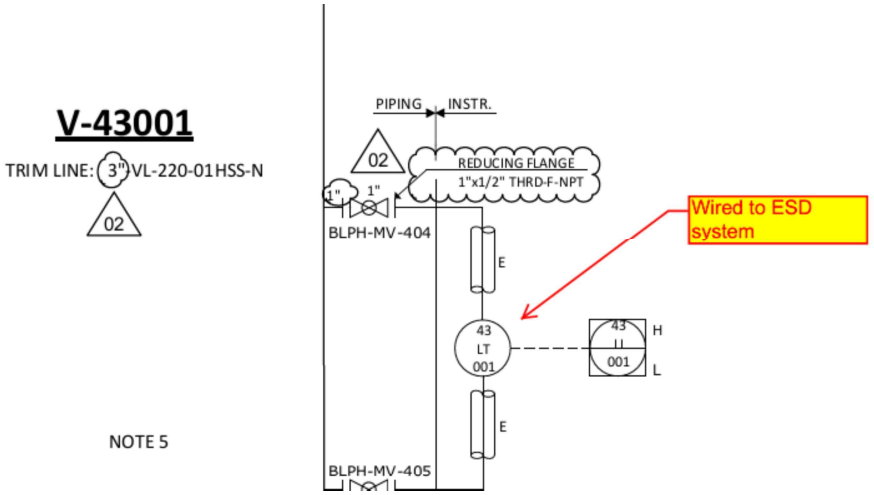
In front of SG-200N1 (LV switchgear) the following selectors/push buttons are provided for each pump:

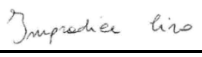
- Local/Remote selector SA1 (called SA1-A in this document) for pump P–50001A
- Local Start push button PM-1 (called PM1-A in this document) for pump P–50001A

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 

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

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**
		Digitaal ondertekend door Paul van Rossum 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

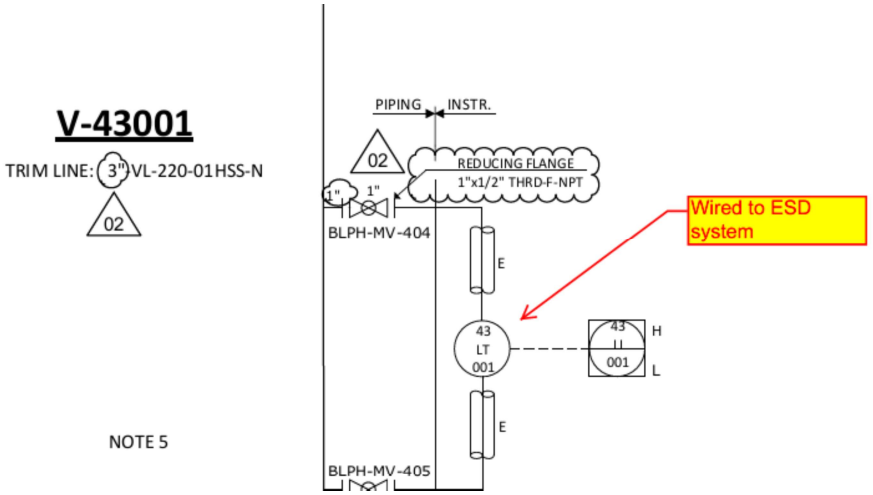
Should be the operating pressure (PV) fall under the PID regulator SP, the controller drives the relevant control valve to increase its opening (Cv); vice versa, should the operating pressure (PV) rise above the PID regulator SP, the controller drives the relevant control valve to decrease its opening (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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CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project Base Load Power Hub (BLPH)	ROSETTI MARINO

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**

Digitaal ondertekend door Paul van Rossum
Datum: 2024.09.04 16:36:08 +02'00'

CROSSWIND HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

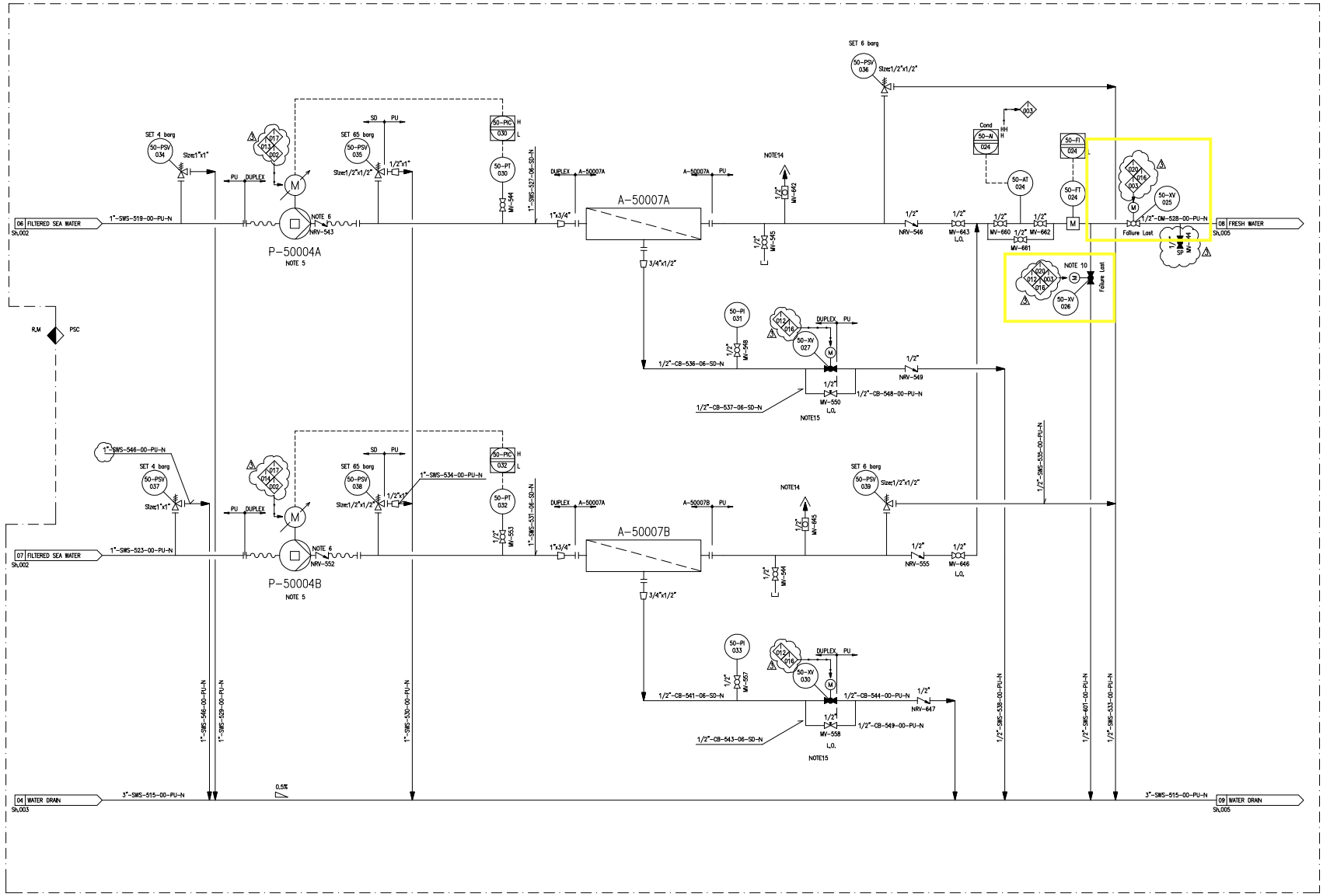
ROSETTI MARINO

Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #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**

DRAWING NO. 1724000448-PR-PID-00013

REV. 03



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: 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	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

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

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

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

EFFECT — SYS: OTHER

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
						NOTES																			Note 1	Note 1											Note 2	Note 2						
						DESCRIPTION	OPEN DRAIN VALVE 50-XV-033	OPEN DRAIN VALVE 50-XV-034	OPEN DRAIN VALVE 50-XV-027	OPEN DRAIN VALVE 50-XV-030	OPEN DRAIN VALVE 50-XV-035	CLOSE BATTERY LIMIT VALVE 50-XV-020	TRIP COARSE FILTER A-50003	TRIP SAND FILTER S-50001	TRIP SOFTENING FILTER S-50004	CONTAINER ELECTRICAL HEATER TRIP	CONTAINER ELECTRICAL HEATER TRIP	CONTAINER AIR FAN TRIP	CONTAINER AIR FAN TRIP	CONTAINER AIR FAN TRIP	TRIP UV LAMP S-50010	TRIP HEATER H-50001	STOP PUMP P-50002A	STOP PUMP P-50002B	STOP PUMP P-50003A	STOP PUMP P-50003B	CLOSE FORWARD VALVE 50-XV-025	OPEN OF-SPEC VALVE 50-XV-026	STOP PUMP P-50009A	STOP PUMP P-50009B	CLOSE FORWARD VALVE 50-XV-031	OPEN OF-SPEC VALVE 50-XV-032	STOP PUMP P-50004A	STOP PUMP P-50004B	STOP PUMP P-50005A	STOP PUMP P-50005B	STOP PUMP P-50006A	STOP PUMP P-50006B	STOP PUMP P-50007A	STOP PUMP P-50007B	STOP PUMP P-50008A	STOP PUMP P-50008B	STOP PUMP P-50010A	STOP PUMP P-50010B
						TAG No.	50-XV-033	50-XV-034	50-XV-027	50-XV-030	50-XV-035	50-XV-020	A-50003	S-50001	S-50004	HHS-50003A	HHS-50003B	HFA-50001A	HFA-50001B	HFA-50001C	S-50010	H-50001	P-50002A	P-50002B	P-50003A	P-50003B	50-XV-025	50-XV-026	P-50009A	P-50009B	50-XV-031	50-XV-032	P-50004A	P-50004B	P-50005A	P-50005B	P-50006A	P-50006B	P-50007A	P-50007B	P-50008A	P-50008B	P-50010A	P-50010B
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																																						
						22																																						
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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

Sheet. 5 of 5 — Rev. 02

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

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

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
						NOTES																			Note 1	Note 1											Note 2	Note 2						
						DESCRIPTION	OPEN DRAIN VALVE 50-XV-033	OPEN DRAIN VALVE 50-XV-034	OPEN DRAIN VALVE 50-XV-027	OPEN DRAIN VALVE 50-XV-030	OPEN DRAIN VALVE 50-XV-035	CLOSE BATTERY LIMIT VALVE 50-XV-020	TRIP COARSE FILTER A-50003	TRIP SAND FILTER S-50001	TRIP SOFTENING FILTER S-50004	CONTAINER ELECTRICAL HEATER TRIP	CONTAINER ELECTRICAL HEATER TRIP	CONTAINER AIR FAN TRIP	CONTAINER AIR FAN TRIP	CONTAINER AIR FAN TRIP	TRIP UV LAMP S-50010	TRIP HEATER H-50001	STOP PUMP P-50002A	STOP PUMP P-50002B	STOP PUMP P-50003A	STOP PUMP P-50003B	CLOSE FORWARD VALVE 50-XV-025	OPEN OF-SPEC VALVE 50-XV-026	STOP PUMP P-50009A	STOP PUMP P-50009B	CLOSE FORWARD VALVE 50-XV-031	OPEN OF-SPEC VALVE 50-XV-032	STOP PUMP P-50004A	STOP PUMP P-50004B	STOP PUMP P-50005A	STOP PUMP P-50005B	STOP PUMP P-50006A	STOP PUMP P-50006B	STOP PUMP P-50007A	STOP PUMP P-50007B	STOP PUMP P-50008A	STOP PUMP P-50008B	STOP PUMP P-50010A	STOP PUMP P-50010B
						TAG No.	50-XV-033	50-XV-034	50-XV-027	50-XV-030	50-XV-035	50-XV-020	A-50003	S-50001	S-50004	HHS-50003A	HHS-50003B	HFA-50001A	HFA-50001B	HFA-50001C	S-50010	H-50001	P-50002A	P-50002B	P-50003A	P-50003B	50-XV-025	50-XV-026	P-50009A	P-50009B	50-XV-031	50-XV-032	P-50004A	P-50004B	P-50005A	P-50005B	P-50006A	P-50006B	P-50007A	P-50007B	P-50008A	P-50008B	P-50010A	P-50010B
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	BLACK START (RM to confirm Black Out condition)			I-016	16	X	X	X	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)			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)
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

HOLLANDSE KUST NOORD WIND PARK
Project Base Load Power Hub (BLPH)

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

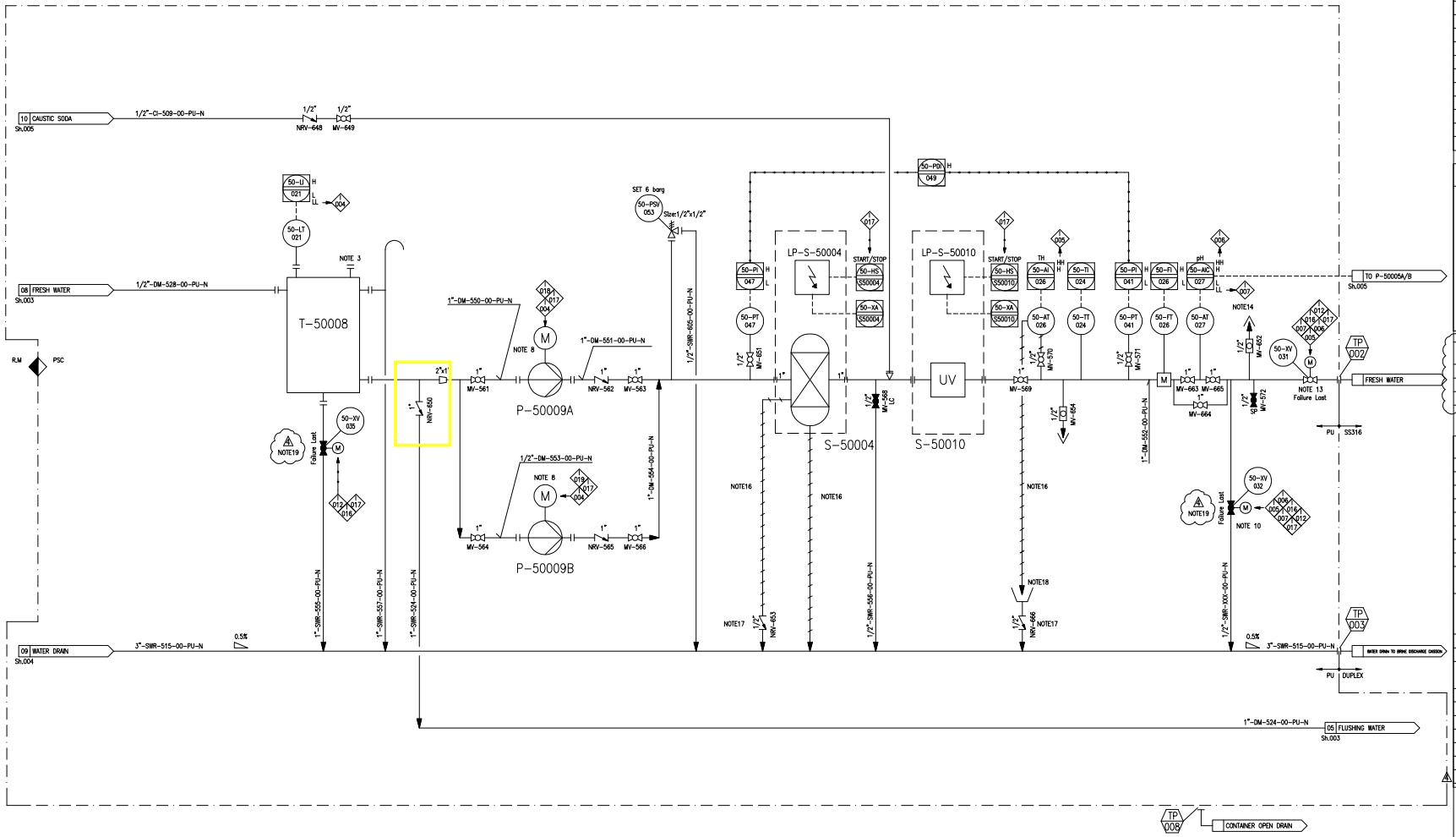
Action Title: **Action No:** **Ref Doc**	**EPC HAZOP Study Actions** #51 123A90-DDL-SAF-RE-30006
Item No.	#51
Causes	5.3.7. 50-XV023 flushing valve open when not required
Consequences	5.3.7.1. Linking of T-50006 and T-50008 with potential of contantamination of T-50008 with filtered sea water. Filtered 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

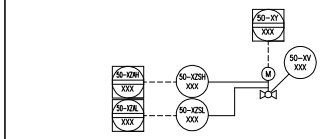
REV. 04



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: 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
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

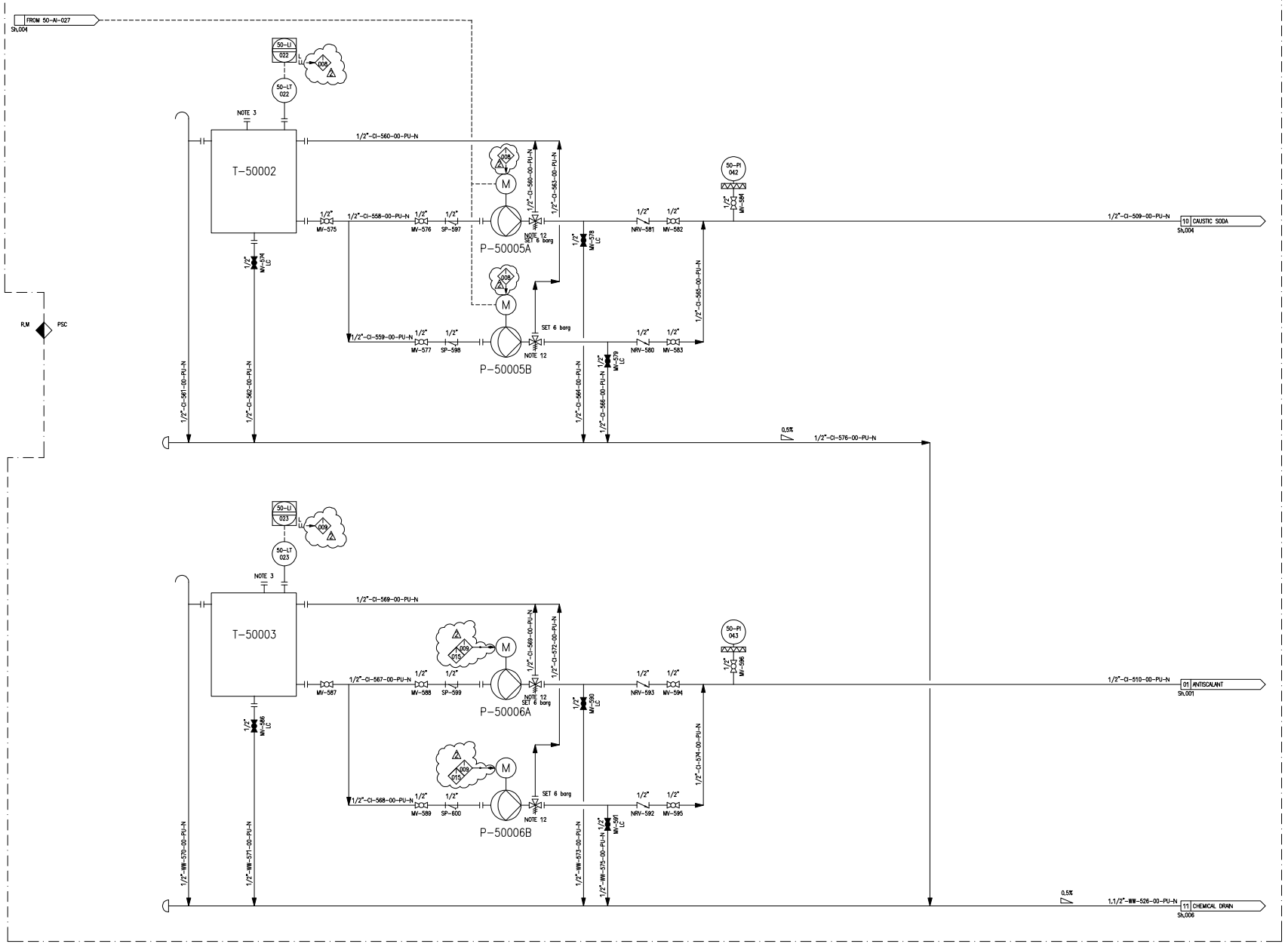
CROSSWIND

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) 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)

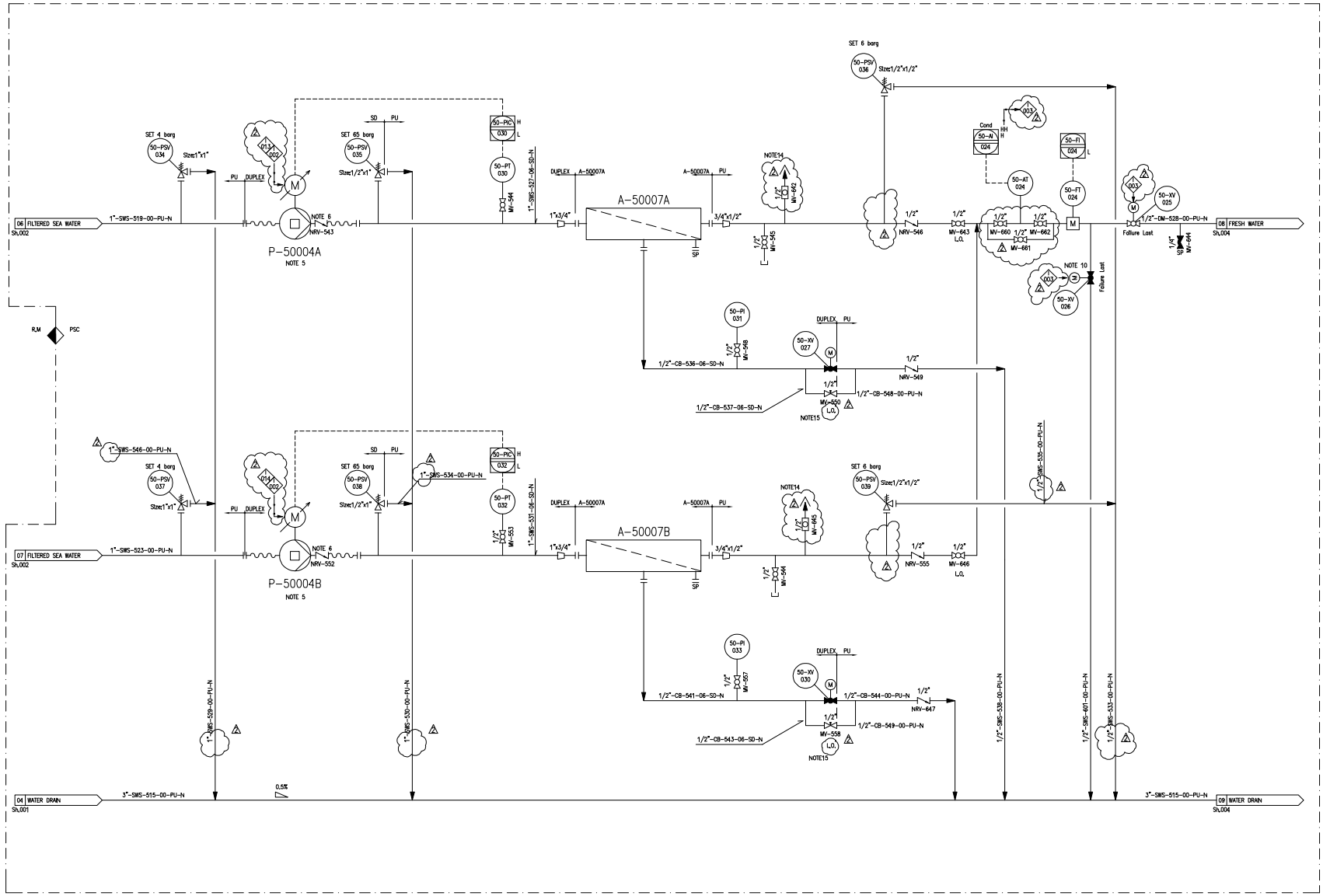
ROSETTI MARINO

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



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: 8LPH-
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

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'

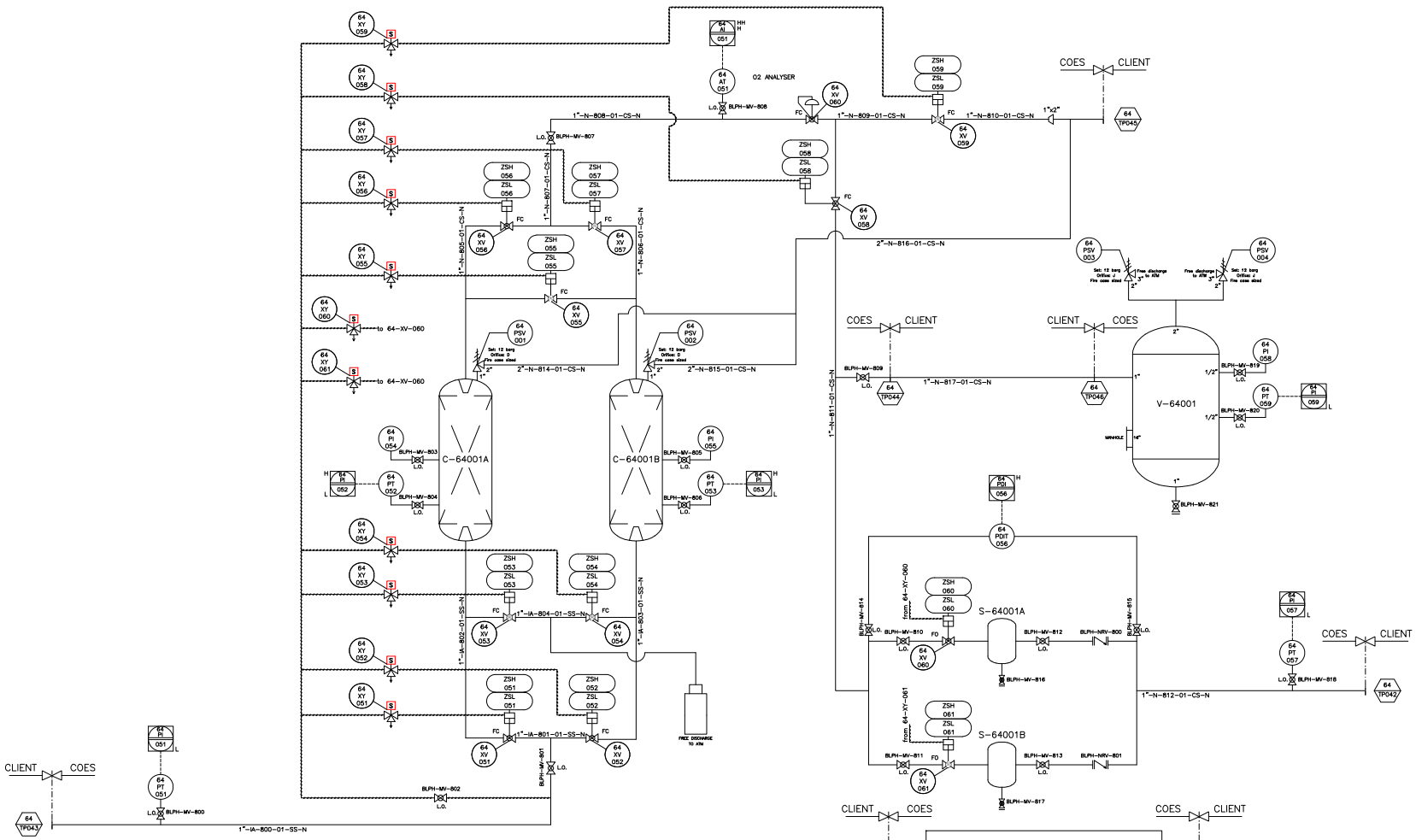
DRAWING NO. 1724000437-PR-PID-00018

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

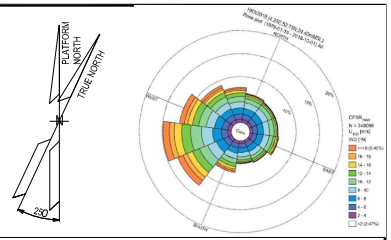
TAG: S-64001A/S64001B	
PSA AFTER-FILTERS	
DESIGN CAPACITY	60 Nm3/h
DESIGN PRESSURE	12 barg
DESIGN TEMPERATURE	80°C
OPERATING PRESSURE	8.5 barg
MATERIAL	CARBON STEEL

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

coes

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