Base Load Power Hub (BLPH)

FAT PROCEDURE – WATER TREATMENT PACKAGE
TAG. No. A-50000

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Revision / Change Log

Rev.	Description
00	Issue for Review (IFR)
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No.	Description
1	
2	
3	
4	

Table of contents

1 INTRODUCTION 5

1.1 PROJECT OVERVIEW 5

1.1.1 PROJECT LOCATION 5

1.1.2 PROJECT CONCEPT 6

2 DOCUMENT SCOPE 8

2.1 PROJECT REFERENCE 9

2.2 DEFINITIONS AND ABBREVIATIONS 9

3 FAT TESTS DESCRIPTION 11

3.1 VISUAL DIMENSIONAL TEST 11

3.2 PAINTING TEST 11

3.3 LEAKAGE TEST 11

3.4 FUNCTIONAL TEST OF THE ICS 11

4 INSPECTION REPORTS 13

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List of Figures

Figure 1 HOLLANDSE KUST NOORD WIND PARK Location Map 5
Figure 2 - Wind Park Details 6
Figure 3 – BLPH Concept 7

List of tables

Table 1 - Reference Documents 9
Table 2 - Definitions and Abbreviations 10

List of Attachments

Attachment 1: FAT TEST REPORTS

1 INTRODUCTION

1.1 PROJECT OVERVIEW

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

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

1.1.1 PROJECT LOCATION

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

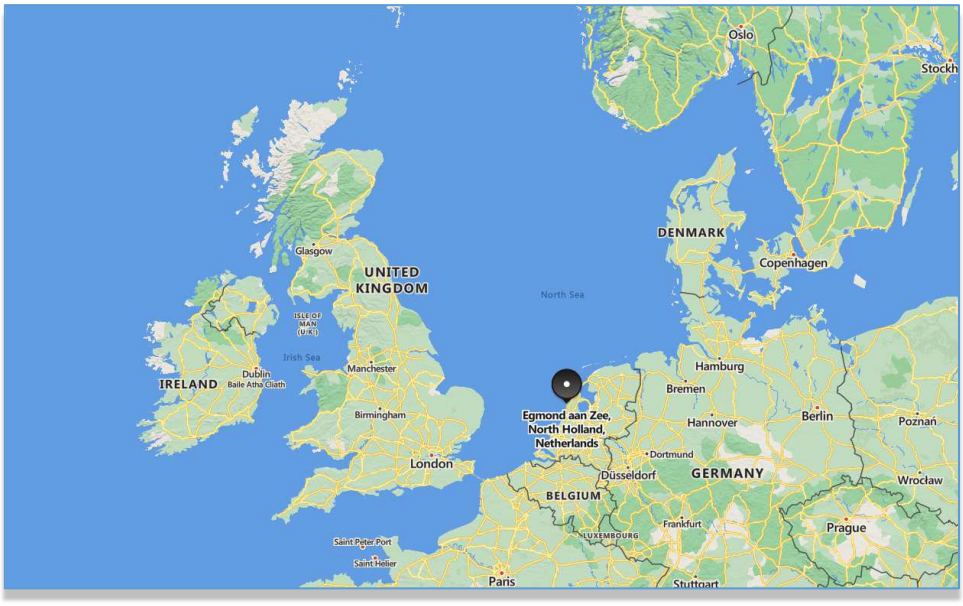


Figure 1 HOLLANDSE KUST NOORD WIND PARK Location Map



Figure 2 - Wind Park Details

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

1.1.2 PROJECT CONCEPT

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

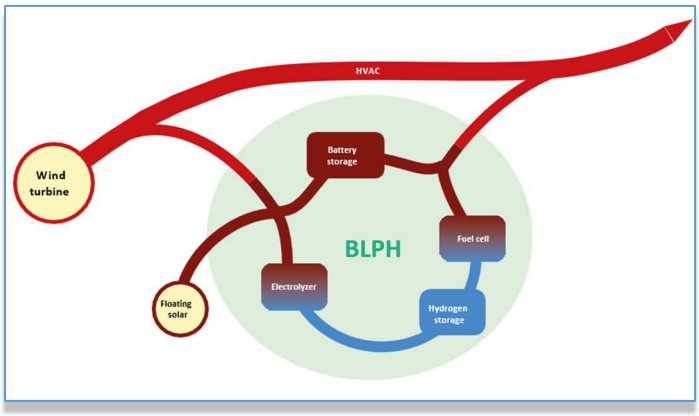


Figure 3 – BLPH Concept

Electricity in the BLPH will be stored in the form of electrons in a battery energy storage system (BESS) as well as converted into green hydrogen via water electrolysis. When the power output from the connecting wind turbine drops to below 1 MWe, the BLPH will return its stored energy to supplement the remaining power output. This will be by discharging the BESS, while stored hydrogen will be converted back into electricity using a fuel cell to extend the discharge duration.

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

2 DOCUMENT SCOPE

The final Factory Acceptance Test (FAT) for the Water Treatment Package (Unit A-50000) shall be performed in accordance with the test procedure described in this document.
The scope of FAT shall include:

- visual check on workmanship,
- functional checks in accordance to reference engineering documents

The procedure of this document only refers to the above equipment with strict reference to this project.

NOTES

1) This procedure does not refer to hydrostatic test for equipment/piping, or any other test or inspections applicable to each single component of the system
2) It is assumed that, before this FAT of Water treatment package, assembly intermediate checks and tests foreseen in the inspection test plan have been already carry out
3) During installation it is possible to prove the functionality of instrumentation and the correct wiring after their installation in the Water Treatment package
4) During the FAT test the power on of pumps / Heater / Filters / and in general equipment wired to the MCC cabinet, will be not performed.
5) Performance test is out of the scope this procedure.
   Please refer to document 1724000448-QC-PRO-00028 “PERFORMANCE TEST PROCEDURE” for the performance test

2.1 PROJECT REFERENCE

Doc. No.	Description
1724000448-PR-PID-00013	P&IDs
1724000448-MAC-DA-00005	GENERAL ARRANGEMENT DRAWINGS AND FOUNDATIONS LAODING CALCULATIONS
1724000448-IN-LIS-00021	INSTRUMENT LIST WITH SET POINTS/CONTROL/ALARM/SHUTDOWN
1724000448-EL-LIS-00022	CABLE LIST
1724000448-IN-LIS-00019	I/O LIST
1724000448-IN-DG-00014	PACKAGE WIRING DIAGRAM LCP
1724000448-MAT-PRO-00023	PAINTING SPECIFICATION FOR CONTAINER

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
HKN	Hollandse Kust Noord
BLPH	Base Load Power Hub
BESS	Battery Energy Storage System
PV	Photovoltaic
VooW	Van Oord Offshore Wind
FAT	Factory Acceptance Test
P&ID	Piping & Instrumentation Diagram
GA	General Arrangement
DFT	Dry Film Thickness
ICS	Industrial Control System
PLC	Programmable Logic Controller
COG	Center Of Gravity

I/O	Input / Output
LCP	Local Control Panel
RAL	Reichs-Ausschuß für Lieferbedingungen und Gütesicherung (National Commission for Delivery Deadlines and Quality Assurance)

Table 2 - Definitions and Abbreviations

3 FAT TESTS DESCRIPTION

3.1 VISUAL DIMENSIONAL TEST

The scope of visual and dimensional inspection is to verify that main Water Treatment package overall quotes and connections at battery limits and pre-fabricated piping correspond to figures shown on general arrangement drawings.
The dimensional inspection will be done using a bend meter.
The dimensional inspection will give a satisfactory result if sizes will be in accordance with those shown on general arrangement drawings.
If any dimension deviates to the approved G.A. drawing, with the approval of customer, a final as-built drawing will be issued.
All inspected items shall be free from visible defect and/or damages
The visual and dimensional inspection will include the checking of the correct positioning of the local panels supplied with the package and the checking of the cable routes installed to connect these local panels to the package equipment (where available). The visual and dimensional check of the individual local panels will only be subject to documentary review because already covered by the Factory Acceptance Test of each single local panel carried out prior to the installation in the package.
As per the rest of the package, the visual check of the local panel and cable routes will give positive results if all the inspected items correspond to the engineering documents, are clean ad free from visible defect or damages.

3.2 PAINTING TEST

The scope of painting inspection (applicable only to the external surface of the container) is to verify final color (RAL) of the container and to spot Dry Film Thickness (DFT) to be in accordance to reference painting procedure.
The spot DFT inspection will be done using a coating thickness gauge.
The painting inspection will give a satisfactory result if the color of the container external surface and DFT as well as paint report review, will be in accordance with the reference painting procedure.

3.3 LEAKAGE TEST

The scope of leakage test is to verify good assembly and absence of leakages of bolted / threaded joints / fittings (where possible).
The leakage test (hydro test) has already performed on the duplex piping, instead the leakage test with process fluid (water) will be performed during the site acceptance test during the power on of the pumps and equipment.
Please refer to document number 1724000448-QC-PRO-00024 for hydrostatic test procedure
Please refer to document number 1724000448-QC-PRO-00028 for site acceptance test procedure

3.4 FUNCTIONAL TEST OF THE ICS

An industrial control system (ICS) is an electronic control system and associated instrumentation used for industrial process control. The scope of the functional test for the whole ICS supplied for

the package (that include instrumentation, logic solver and actuators) is to verify the correct operation of each electronic equipment/instruments when fully connected and powered from the local PLC panel.

In details:

1) For each transmitter the correct tagging and cables wiring shall be verified. The transmitter shall be powered from the local panel and evidence of congruence between the signal generated by the instrument and the value read on the PLC operator interface must be verified (including the correctness of the instrument's scale range).
2) For each discrete sensor (switch) the correct tagging and cables wiring shall be verified. The sensor shall be manually operated/forced to change its status and evidence of congruence between the signal generated by the switch and the indication read on the PLC operator interface must be verified.
3) For each actuator in field the correct tagging and cables wiring shall be verified. The actuator shall be powered from the local panel by mean of operator manual commands on the PLC operator interface and evidence of congruence between the command generated by the PLC and the behaviour of the actuator. If the actuator provides position feedback to the PLC, the feedback signals must also be verified in accordance with point 1 or 2.
4) For each electrical load powered by the power section of the local panel it will not be possible to check the operation of the motors because it will not be possible to connect the correct power supply to the switchboard. It will, however, be possible to supply power to the auxiliary circuits and to simulate the switching (run/stop) of each motor from the PLC operator interface, without supplying power to the field equipment.

Please note that the functional test of the electrical equipment (pumps / heaters / fans) will be performed at the site acceptance test. The electric equipment certifications released by equipment manufacturers will be collected in the final manufacturer data book.

All the above functional tests will give a positive result if all tested instruments and actuators are free of errors due to instrument malfunction, wrong interconnection or misconfiguration on the logic solver.

Please note that the scope of the test is to prove the functionality of instrumentation after installation on the Water Treatment Package. The calibration of instruments is assumed corresponding to the relevant Manufacturer's certification.

Please note that the verification of the proper serial communication between Client's ICS and Vendor's PLC will be testes at the site acceptance test.

4 INSPECTION REPORTS

The following test and inspection will be used during the tests

End Customer	:	**CROSSWIND C.V.**
Customer	:	**Rosetti Marino S.p.A**
Project Name	:	**123A90A – Base load Power Hub Platform**
Purchase Order No.	:	**1724000448 123A90A**
Project ID No.	:	**1724000448 123A90A**
PSC Project ID No.	:	**PK2885**

EQUIPMENT TESTED	
Item No.	Item Description
A-50000	Water Treatment Package

TEST RESULTS		
☐ Pass	☐ Pass with comments	☐ Fail

COMMENTS	

ATTACHMENTS	
☐	Appendix A1 – Water Treatment Package VISUAL AND DIMENSIONAL CHECK
☐	Appendix A2 – Water Treatment Package LEAKAGE TEST WITH AIR
☐	Appendix A3 – Water Treatment Package INSTRUMENTS CHECK
☐	Appendix A4 – Water Treatment Package SHUT OFF VALVES
☐	Appendix A5 – Water Treatment Package Grounding check
☐	Appendix B1 – PUNCH LIST

DATE	PSC	CUSTOMER	END CUSTOMER

APPENDIX "A"

FAT REPORTS

Test performed	VISUAL AND DIMENSIONAL CHECK

#	TEST DESCRIPTION	REFERENCE	PASS	FAIL	NOTES
1	Container dimensions check	GA drawing **1724000448-MAC-DA-00005**	☐	☐	
2	Container painting RAL check (only external surface)	Painting Specification **1724000448-MAT-PRO-00023**	☐	☐	
3	Container painting DFT check (only external surface)	Painting Specification **1724000448-MAT-PRO-00023**	☐	☐	
4	Water Treatment Package Terminal points dimension check	GA drawing **1724000448-MAC-DA-00005**	☐	☐	
5	Valves nameplate check	P&ID **1724000448-PR-PID-00013**	☐	☐	
6	Equipment nameplate check	P&ID **1724000448-PR-PID-00013**	☐	☐	
7			☐	☐	
			☐	☐	
			☐	☐	
			☐	☐	

NOTES	

TEST RESULTS		
☐ Pass	☐ Pass with comments	☐ Fail

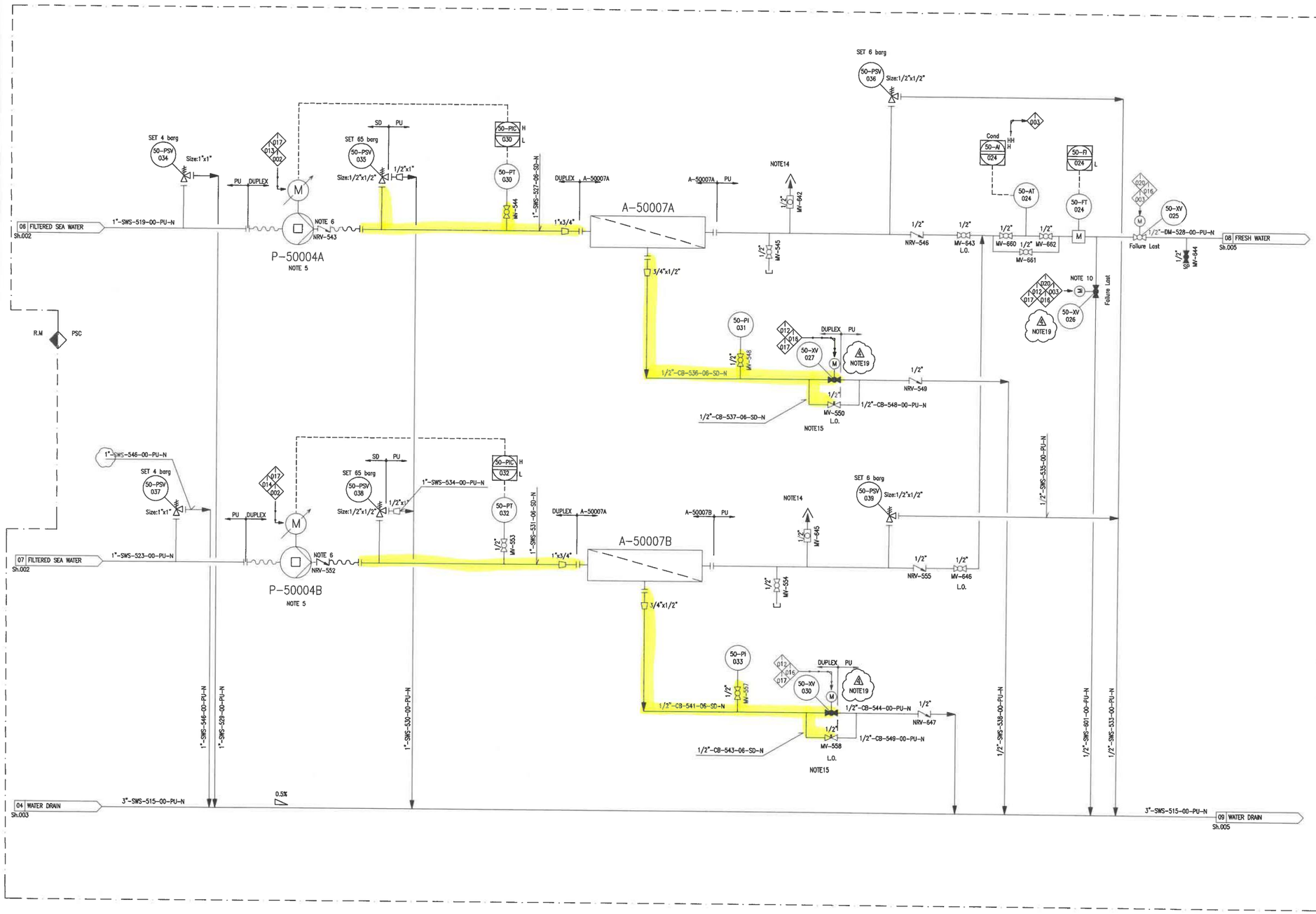
ATTACHMENTS	
	Description
☐	Punch list

DATE	PSC	CUSTOMER	END CUSTOMER

Test performed	LEAKAGE TEST WITH AIR

#	TEST DESCRIPTION	REFERENCE	PASS	FAIL	NOTES
1	Piping leakage test with pneumatic air (0.5 barg) Note: The leakage test for the PCV and PP piping will be performed directly at the Site Acceptance Test. At the Site acceptance test all the assembled piping and system will be also tested. The Hydraulic test has been already performed on duplex piping and the certification of its hydraulic test will be available in the final MDR book. For reference, please find at the following page the tested duplex piping part highlighted on the P&ID	FAT Procedure **1724000448-QC-PRO-00025**	☐	☐	

DRAWING NO. 1724000448-PR-PID-00013 REV. 04



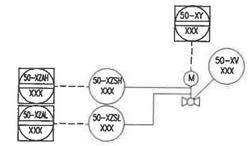
P-50004A/B	
HP PUMP	
TYPE	AXIAL ROTATING PISTONS
DES PRESSURE	83 barg
CAPACITY	2 m3/h
HEAD	64.5 bar(a)
DES. TEMP.	50° C
MATERIAL	SS DUPLEX

A-50007A/B	
SEA WATER REVERSE OSMOSIS UNITS	
CAPACITY	0.8 m3/h
DES. PRESS.	69 barg
DES. TEMP.	45° C
MATERIAL	FRP

TERMINAL POINT

TP No.	NPS	FINISH	RATING	FACE	MATERIAL	DESCRIPTION
TP-017	1.1/2"	FLG.	150#	RF	PVC	SEA WATER FROM INTAKE PUMPS
TP-002	1"	FLG.	150#	RF	PVC	PRODUCT WATER
TP-003	3"	FLG.	150#	RF	PVC	SEA WATER DRAIN
TP-005	1"	FLG.	150#	RF	PP	BIOCIDE TO SEA WATER INTAKE
TP-006	1"	FLG.	150#	RF	PP	BIOCIDE TO WASTE WATER TANK
TP-007	1.1/2"	FLG.	150#	RF	PVC	CHEMICAL DRAIN
TP-008	1/2"	FLG.	150#	RF	PVC	CONTAINER OPEN DRAIN

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

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
SEA WATER FINE FILTRATION
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 004	REV. 04

File Name : 1724000448-PR-PID-00013 Rev04

NOTES	

TEST RESULTS		
☐ Pass	☐ Pass with comments	☐ Fail

ATTACHMENTS	
	Description
☐	Punch list

DATE	PSC	CUSTOMER	END CUSTOMER

Test performed	**INSTRUMENTS CHECK**

#	TEST DESCRIPTION	REFERENCE	PASS	FAIL	NOTES
1	Instruments nameplate tag check	P&ID **1724000448-PR-PID-00013**	☐	☐	
2	Instrument wiring check (Cable gland installation / wire type will be checked and verified)	Package wiring diagram LCP **1724000448-IN-DG-00014**	☐	☐	
3	PLC wiring check (Including verification of continuity of the protective bonding circuit / wire type / ingress protection of enclosure / cable gland / wire tag/ Panel tag)	Package wiring diagram LCP **1724000448-IN-DG-00014**	☐	☐	
4	Instruments functional electric test	Package wiring diagram LCP **1724000448-IN-DG-00014**	☐	☐	
5			☐	☐	
			☐	☐	
			☐	☐	
			☐	☐	
			☐	☐	
			☐	☐	

NOTES	

TEST RESULTS		
☐ Pass	☐ Pass with comments	☐ Fail

ATTACHMENTS	
	Description
☐	Punch list

DATE	PSC	CUSTOMER	END CUSTOMER

Test performed	SHUT OFF VALVES CHECK

#	TEST DESCRIPTION	REFERENCE	PASS	FAIL	NOTES
1	Shut off valves functional electric test (Including limit switches)	Package wiring diagram LCP **1724000448-IN-DG-00014**	☐	☐	
2			☐	☐	
			☐	☐	
			☐	☐	
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			☐	☐	
			☐	☐	

NOTES	

TEST RESULTS		
☐ Pass	☐ Pass with comments	☐ Fail

ATTACHMENTS	
	Description
☐	Punch list

DATE	PSC	CUSTOMER	END CUSTOMER

Test performed	GROUNDING CHECK

#	TEST DESCRIPTION	REFERENCE	PASS	FAIL	NOTES
1	Instruments & Panel grounding check, including Container grounding test	N.A.	☐	☐	
2			☐	☐	
			☐	☐	
			☐	☐	
			☐	☐	
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			☐	☐	
			☐	☐	
			☐	☐	
			☐	☐	

NOTES	

TEST RESULTS		
☐ Pass	☐ Pass with comments	☐ Fail

ATTACHMENTS	
	Description
☐	Punch list

DATE	PSC	CUSTOMER	END CUSTOMER

APPENDIX "B"

PUNCH LIST

NOTES	