Base Load Power Hub (BLPH)

INSTRUMENT AIR PACKAGE A-63000
SYSTEM/PACKAGE FUNCTIONAL DESCRIPTION

Document Number: 1724000428-MAC-SP-00003

Document Class: 3

02	02/04/2025	Issue for Information (IFI)	GT	SG	TM
01	02/01/2025	Issue for Information (IFI)	GT	SG	TM
00	22/10/2024	Issue for Information (IFI)	GT	SG	TM
Rev.	Date	Description	Prepared	Reviewed	Approved

COES

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

Revision / Change Log

Rev.	Description
00	Issue for Information (IFI)
01	Issue for Information (IFI)
02	Issue for Information (IFI)

HOLDS LIST

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 REFERENCES 8

2.2 DEFINITIONS AND ABBREVIATIONS 8

3 functional description 9

3.1 INSTRUMENT AIR PACKAGE brief description 9

3.2 INSTRUMENT AIR PACKAGE LOGICS 9

3.2.1 Local / Remote switch 10

3.2.2 Air Dryer logic 12

3.2.3 Fault 13

3.2.4 SHUTDOWN 13

3.3 ALARM DESCRIPTION: 14

3.3.1 AIR COMPRESSOR ALARM 14

3.3.2 AIR DRYER ALARM 14

3.3.3 PRE-FILTER ALARM 14

3.3.4 POST-FILTER ALARM 15

3.3.5 HIGH AIR TEMPERATURE ALARM [WARNING] 15

3.3.6 HIGH DEW-POINT ALARM [WARNING] 15

3.4 MONITORING: 15

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

List of Figures

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

List of tables

Table 1 - Reference Documents 8
Table 2 - Definitions and Abbreviations 8

List of Attachments

None

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

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.

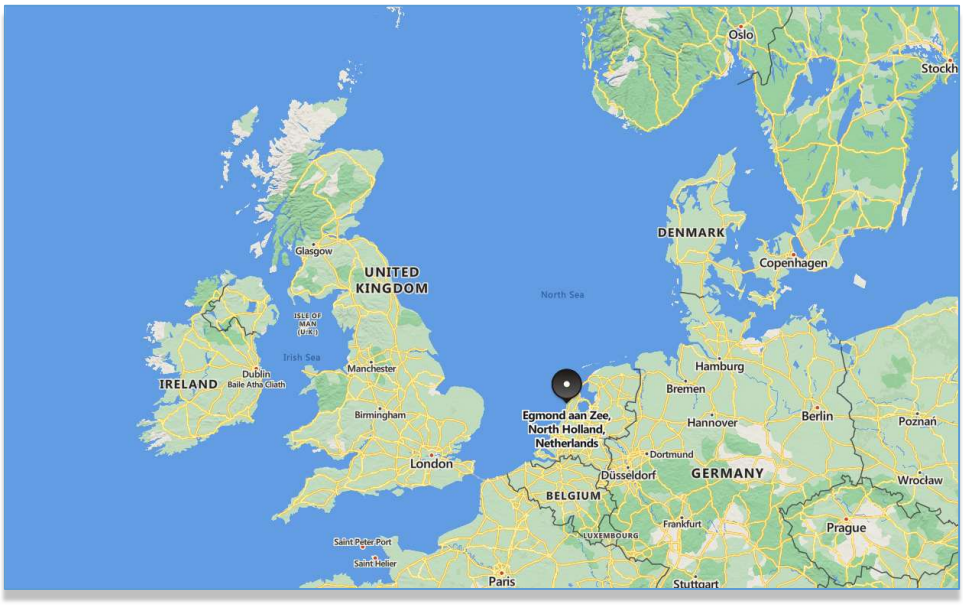


Figure 1 HOLLANDSE KUST NOORD WIND PARK Location Map

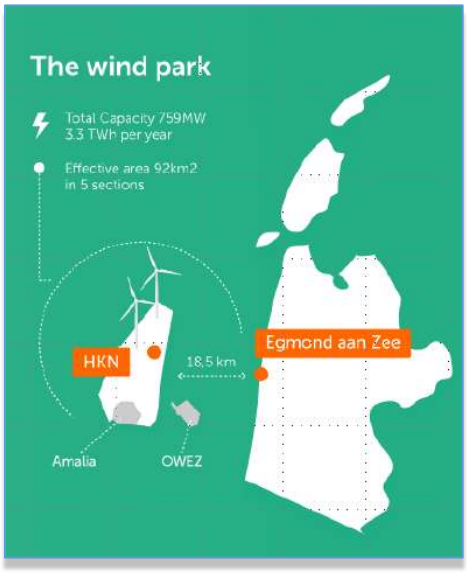


Figure 2 - Wind Park Details

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.

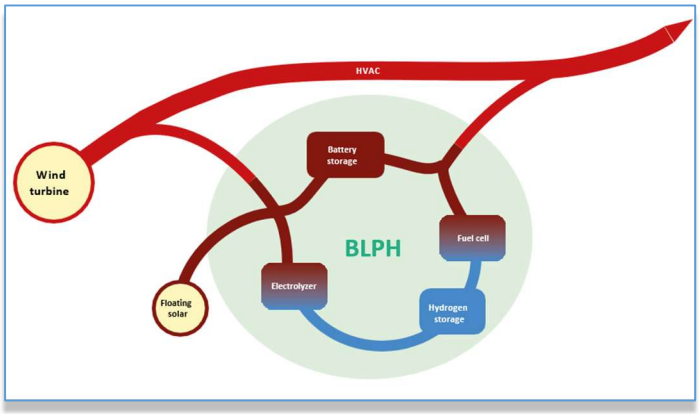


Figure 3 – BLPH Concept

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.

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

2 DOCUMENT SCOPE

This document identifies the functioning of the instrument air package.

2.1 REFERENCES

Doc. No.	Description
1724000428-PR-PID-00019	PACKAGE P&ID
1724000428-MAC-DS-00011	EQUIPMENT DATA SHEETS INCLUDING MOTORS, AIR COMPRESSOR, DRYERS, ETC.
1724000428-MAC-MAN-00030	INSTALLATION, OPERATING AND MAINTENANCE MANUAL (INCLUDING SITE ERECTION INSTRUCTIONS AND PROCEDURES)
1724000428-IN-LIS-00017	INSTRUMENT LIST WITH SET POINTS / CONTROL / ALARM / SHUTDOWN

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
DCS	Distributed Control System
LCP	Local Control Panel
NA	Not Applicable
SIS	Safety Interlock System

Table 2 - Definitions and Abbreviations

3 FUNCTIONAL DESCRIPTION

3.1 INSTRUMENT AIR PACKAGE BRIEF DESCRIPTION

The purpose of the instrumen air package is to generate instrument air.

The main items installed in the package are:

- No.2 air compressors
- No.2 pre-filters (one operating and one in stand-by)
- No.2 heatless air dryer units (one unit operating and one unit in stand-by)
- No.2 post filters (one operating and one in stand-by)

The outled net flow data are:

- Flowrate: 350 Sm^3/h
- Pressure: 9.0 barg
- Temperature: 35°C
- Dew point: -40°C @ 9.0 barg

3.2 INSTRUMENT AIR PACKAGE LOGICS

NOTES

From DCS (via Profinet) it will be possible to select the master/slave priority of the skid components, independently (Compressor K-63001A/K-63001B, Prefilter S-63001A/S-63001B, Dryer D-63001A/B / D-63002A/B, Postfilter S-63002A/S-63002B).

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

3.2.1 Local / Remote switch

In LOCAL, the sequence is activated from LCP by pressing the START button (63-HS-001) and for the first start-up, if there is no REMOTE preset, the following are activated by default:

Compressor K-63001A, Pre-filter S-63001A, Dryer D-63001A/B and Post-filter S-63002A.

In case of REMOTE presetting of another activation sequence (e.g. Compressor K-63001B, Pre-filter S-63001A, Dryer D-63001A/B, Post-filter S-63002B etc.) this selection is also maintained in LOCAL.

In REMOTE, the sequence is activated by DCS by the START command via Profinet.

The master compressor is activated and the skid waits for the threshold pressure of 63-PIT-064 to be reached (set: 8 barg).

All automatic valves are in the open position.

When the 63-PIT-064 threshold is reached, the automatic interception valves of the filters and the non-line dryer (slave) are closed and the dryer sequence is activated.

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

Example with default configuration Compressor K-63001A, Pre-filter S-63001A, Dryer D-63001A/B and Post-filter S-63002A:

63-XY-055	OFF	63-XV-055	OPEN
63-XY-056	ON	63-XV-056	CLOSED
63-XY-057	OFF	63-XV-057	OPEN
63-XY-058	ON	63-XV-058	CLOSED
63-XY-059	OFF	63-XV-059	OPEN
63-XY-060	ON	63-XV-060	CLOSED

To stop the system locally press the STOP button (63-HS-003) or REMOTELY via the STOP command via Profinet.

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

3.2.2 Air Dryer logic

Cycle steps of the Air Dryer in operating conditions (D-63001A/B)

	TOWER D-63001A	TOWER D-63001B	TIME DURATION
PHASE 0	READY TO START	READY TO START	NA
PHASE 1	ADSORPTION	REGENERATION	240s
PHASE 2	ADSORPTION	PRESSURIZATION	60s
PHASE 3	REGENERATION	ADSORPTION	240s
PHASE 4	PRESSURIZATION	ADSORPTION	60s
PHASE 5	FAULT	FAULT	NA

Solenoid valves operating condition for dryer in operating condition:

	SOV 63-XY-051	SOV 63-XY-052	DELAY TIME
PHASE 0	OFF	OFF	NA
PHASE 1	OFF	ON*	* 3s
PHASE 2	OFF	OFF	
PHASE 3	ON	ON*	* 3s
PHASE 4	ON	OFF	
PHASE 5	NA	NA	NA

CHANGE OVER ALARM (set: 5barg [ON= >5 barg])

	63-PS-054	63-PS-056	DELAY TIME
PHASE 0	ON	ON	NA
PHASE 1	ON	OFF**	**20s
PHASE 2	ON	ON***	***30s
PHASE 3	OFF**	ON	**20s
PHASE 4	ON***	ON	***30s

Cycle steps of the Air Dryer in stand-by conditions (D-63002A/B)

	TOWER D-63002A	TOWER D-63002B	TIME DURATION
PHASE 0	READY TO START	READY TO START	NA

Solenoid valves operating condition for dryer in stand-by conditions

	SOV 63-XY-053	SOV 63-XY-054	DELAY TIME
PHASE 0	OFF	OFF	NA

3.2.3 Fault

In case of Fault of one of the master components (Compressor, Pre-filters, Dryer or Post-filters) the slave component starts automatically and upon feedback of the slave commissioning the master is excluded.

A dedicated alarm (with retention) is generated and sent to DCS via profinet and the "general alarm" lamp on the local LCP lights up.

The lamp switches off when the cause of the alarm disappears while the dedicated alarm must be reset by DCS.

3.2.4 SHUTDOWN

The system shutdown can be activated locally by pressing the mushroom button on the LCP (63-LP-001) or by command from SIS.

In case of shutdown, the compressors are stopped and the valves are brought to "fail position" by deactivating the command to the solenoid valves.

To reset the shutdown, you must act on the LCP (63-LP-001) by pressing the "SAFETY RELAY RESET" button (63-HS-003).

3.3 ALARM DESCRIPTION:

3.3.1 AIR COMPRESSOR ALARM

Compressor general alarm [FAULT]

- Generates a dedicated alarm via Profinet (retention alarm)
- Switch on the "General alarm" lamp on LCP
- Activates the switch of the two compressors (slave compressor in line and subsequent exclusion of the master compressor).

3.3.2 AIR DRYER ALARM

Change over alarm [FAULT]

- Generates a dedicated alarm via Profinet (retention alarm)
- Switch on the "General alarm" lamp on LCP
- Activates the switch of the two dryers (dryer slave in line and subsequent exclusion of the dryer master)

3.3.3 PRE-FILTER ALARM

Hig differential pressure drop alarm (set: 0.5 bar) [FAULT]

- Generates a dedicated alarm via Profinet (retentive alarm).
- Switch on the "General alarm" lamp on LCP.
- Activates the switch of the two filters (slave in line and subsequent exclusion of the master filter).

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

3.3.4 POST-FILTER ALARM

High differential pressure drop alarm (set: 0.5 bar)[FAULT]

- Generates a dedicated alarm via Profinet (retentive alarm).
- Switch on the "General alarm" lamp on LCP.
- Activates the switch of the two filters (slave in line and subsequent exclusion of the master filter).

3.3.5 HIGH AIR TEMPERATURE ALARM [WARNING]

Temperature transmitter 63-TIT-051/052 (set: >40°C)

- Switch on the "General alarm" lamp on LCP.

3.3.6 HIGH DEW-POINT ALARM [WARNING]

Dew point analyzer 63-AIT-051 (set: >-40°C)

- Switch on the "General alarm" lamp on LCP.

3.4 MONITORING:

FLOW [MONITORING]

Flow transmitter 63-FIT-051 (RANGE: 0 to 500Sm^3/h) (Design value 350 Sm^3/h)