Base Load Power Hub (BLPH)

CF – Load Out Manual

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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.

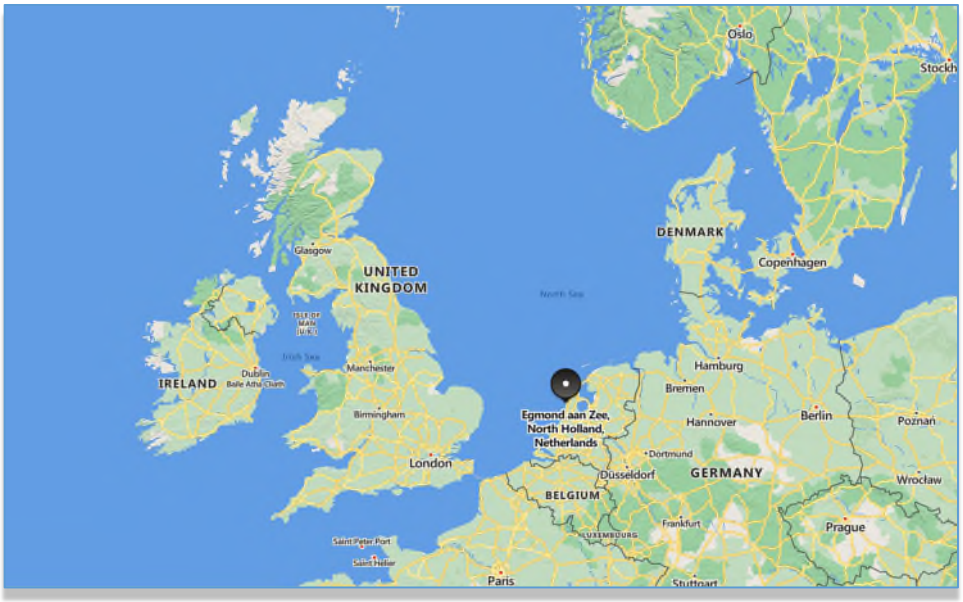


Figure 1.1 HOLLANDSE KUST NOORD WIND PARK Location Map

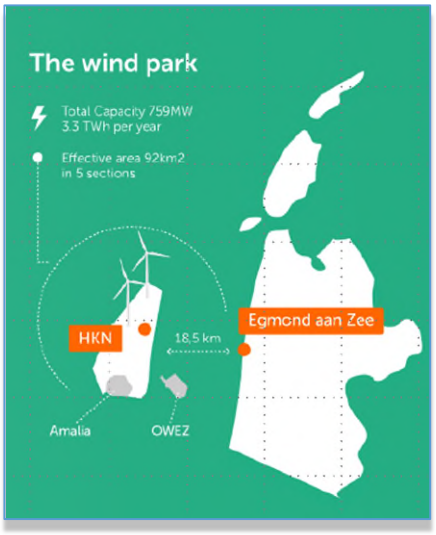


Figure 1.2 - Wind Park Details

The wind farm 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.

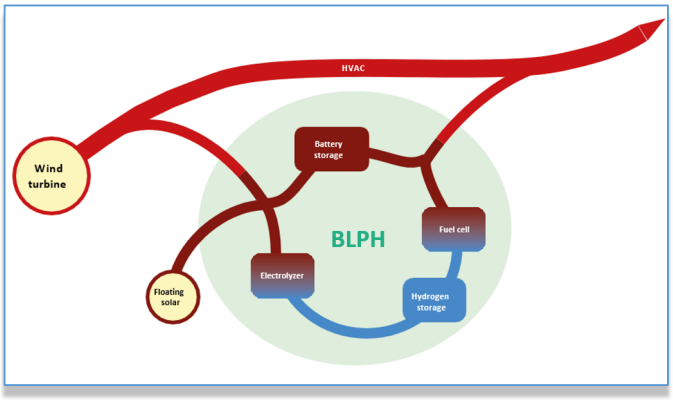


Figure 1.3 – BLPH Concept

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 SCOPE

This document deals with the work instruction to be followed for the loadout operation of Caisson frame by crane onto Vervece cargo barge.

The loadout operation has been scheduled for June 2025, week 26.

A dedicated HIRA (Hazard Identification and Risk Assessment) has been held to ensure a correct evaluation of the risks together with all parties involved (Rosetti, CW, MWS,).

This document, along with the associated documents, is intended to provide the guidelines for the execution of the operations.

The site where the operation will take place is the Piomboni Yard, located in Via del Marchesato n°37 - 48122 Marina di Ravenna - Ravenna, Italy.

CF, after construction completion, will be moved by RM trailer to the loadout area, in front of the STB side of cargo barge and then loaded out by RM yard crane.

3 REFERENCES

3.1 CODES AND STANDARDS

Doc. No.	Description
/1/ BS EN ISO 19900	General requirements for offshore structures - 2019
/2/ BS EN ISO 19901-1	Specific requirements for offshore structures - Part 1: Metocean design and operating considerations - 2015
/3/ BS EN ISO 19901-2	Seismic design procedures and criteria
/4/ BS EN ISO 19901-3	Specific requirements for offshore structures – Part 3: Topsides structure - 2014
/5/ BS EN ISO 19901-5	Specific requirements for offshore structures – Part 5: Weight Management - 2021
/6/ BS EN ISO 19901-6	Specific requirements for offshore structures – Part 6: Marine Operations – 2009
/7/ BS EN ISO 19902	Petroleum and natural gas industries - Fixed steel offshore structures – 2020
/8/ EN 1991-1-3:2003 & A1:2015	EN, Eurocode 1 – Actions on Structures – Part 1-3: General actions – Snow loads - Incorporating corrigenda December 2004 and March 2009, December 2015.
/9/ EN 1993-1-1	Design of steel structures – Part 1-1: General rules and rules for buildings
/10/ API RP 2A-WSD	Recommended practice for planning, designing and constructing fixed offshore platforms – Working stress design – 22nd edition – 2014
/11/ DNV-ST-N001	DNV - Marine operation and marine warranty - 2021
/12/ DNV-ST-0145	DNV, Offshore substations
/13/ DNV-RP-C201	DNV, Buckling Strength of Plated Structures, October 2010.
/14/ DNV-RP-C205	DNV - Environmental conditions and environmental loads - September 2019, amended September 2021.
/15/ DNV-OS-C101	Design of offshore steel structures, general- LRFD method, 2021

3.2 COMPANY SPECIFICATIONS

Doc. No.	Description
/16/ DEP 37.19.00.12	Gen - Offshore Topsides Structures

/17/ DEP 37.19.00.30	Gen - Fixed Steel Offshore Structures (Adoption of IOGP S-631-11, Amendments / Supplements to ISO 19902:2020).
/18/ DEP 37.81.10.19	Gen - Marine Operations Requirements – Loadout, Transportation and Installation of Offshore Structures (Amendments / Supplements to ISO 19901-6)
/19/ DEP 37.91.10.11	Mobile Mooring Systems (Amendments / Supplements to API RP 2SK, API RP 2SM AND API RP 2I)

3.3 PROJECT DOCUMENTS

Doc. No.	Description
/20/ 123A90-DDL-MD-RE-01006	Monthly Weight Report
/21/ 123A90-DDL-ST-SP-90017	Structural Design Basis
/22/ 123A90-DDL-ST-SP-90018	Structural Material Specification for Topside & TP
/23/ 123A90-DDL-ST-SP-90118	Structural Material Specification for Flange & Bolts
/24/ 123A90-DDL-ST-TN-90119	Evaluating ISO and DNV approaches
/25/ 123A90-DDL-TI-SP-99014	Specification for TP, Topside and Caissons Transportation and Installation
/26/ 123A90-DDL-ST-RE-90014	CF loadout analysis
/27/ 123A90-DDL-TI-RE-99007	CF Gr&SF report
/28/ 123A90-DDL-TI-DD-99047	CF – Grillage Assembly
/29/ 123A90-DDL-TI-DD-99048	CF – grillage and SF
/30/ 123A90-DDL-TI-RE-99012	TP & CF – Yard Checklist
/31/ 123A90-FDL-MT-DD-00411	CF – Loadout

4 DEFINITIONS AND ABBREVIATIONS

COMPANY or Client (CPY)	Crosswind
CONTRACTOR (CTR)	ROSETTI MARINO S.p.A.
PROJECT	HOLLANDSE KUST NOORD WIND PARK Project
TRANSPORT CONTRACTOR	OCEAN
ALS	Accidental Limit State
BESS	BATTERY ENERGY STORAGE SYSTEM
BG	Box Girder
BLPH	Base Load Power Hub
CF	Caisson Frame
CL	Concentrated Load
CoG	Centre of Gravity
CTV	Crew Transfer Vessel
CW	CrossWind
DAF	Dynamic Amplification Factor
DFF	Damage Fatigue Factors
DLB	Ductility Level Blast
DNV	Det Norske Veritas
DOP	Dropped Object Protection
El.	Elevation
EPCI	Engineering Procurement Construction and Installation
FEED	Front End Engineering Design
HAT	Highest Astronomical Tide
HKN	Hollandse Kust Noord
ICCP	Impressed Current Corrosion Protection
LAT	Lowest Astronomical Tide
LRFD	Load and Resistance Factor Design
MSL	Mean Sea Level
NTE	Not-to-Exceed
OD	Outside Diameter

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PAU	Pre-Assembled Unit (H2 Vessels)
PBY	Piomboni Yard Ravenna
PG	Plate Girder
SCE	Safety Critical Equipment
SHL	Static Hook Load
T&I	Transport & Installation
ToS	Top of Steel
TP	Transition Piece
UC	Unity Check
UDL	Uniformly Distributed Load
VIV	Vortex Induced Vibration
VOOW	Van Oord Offshore Wind
WTG	Wind Turbine Generator
W2W	Walk to Work

Table 4.1 - Definitions and Abbreviations

5 CF DESCRIPTION

The caisson frame is designed to structurally connect n.2 seawater lift caissons and n.1 brine discharge caisson to the Monopile CW70.

The support concept is that the CF form a structure similar to the boat landing frame, which has been successfully installed by Van Oord on monopile.

The brine caisson is "piggy-backed" off the CF. it is positioned on the outside of the CF and terminates 6m above the inlet to the seawater lift pump caissons. This to avoid, as far as possible, cross-contamination of waste brine water being dumped overboard with fresh seawater drawn for electrolysis.

The seawater lift caissons contain submersible pumps, so the caissons must be vertical.

5.1 COG POSITION

CoG position is taken from ref. /20/, and compared with TEKLA model:

- Loadout Expected Weight 32.5 ton (16% cont. included)

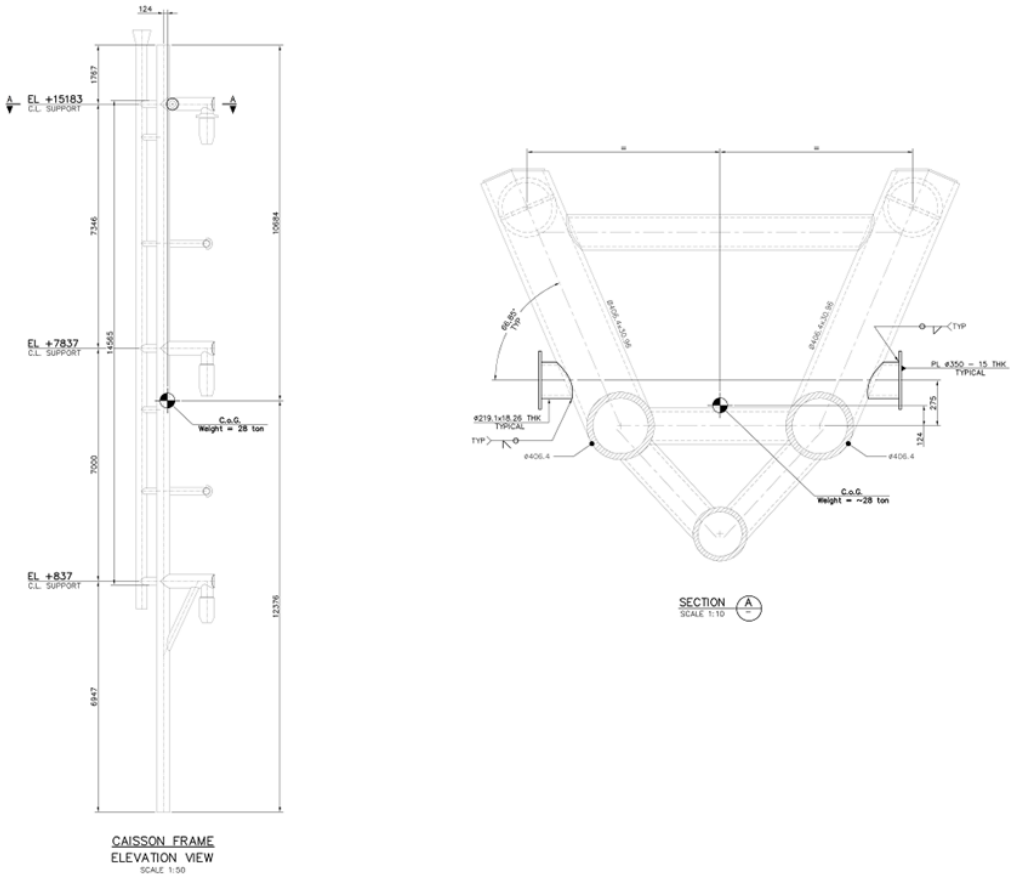


Figure 5.1 – CF COG position

6 SITE MAIN DATA

6.1 YARD GENERAL DATA

The area dedicated to erection and loadout activities is located in the North side of YPB and the waterfront overlooks an internal harbour area of Marina di Ravenna.

The location is free from the influence of waves and currents and the main variations in terms of water level are only dependent on tide variation. Before loadout operation, Rosetti Marino will inform Ravenna Harbor Authority to avoid traffic near loadout involved area during loadout operation.

The elevation of quay capping beam above M.S.L. is 1,75 m, tide tables relevant to Ravenna Harbor (see Appendix "L" for details) show that maximum water level excursion is less than +/- 0,4 m around M.S.L.

The following Picture shows YPB location:



Figure 6.1 – Yard Piomboni Location

6.2 TOPSIDE LOCATION IN YARD

The area dedicated to erection and loadout activities of the Topside is located in YPB as shown in Fig. 6.2. For detailed drawings, refer to Appendix "B".

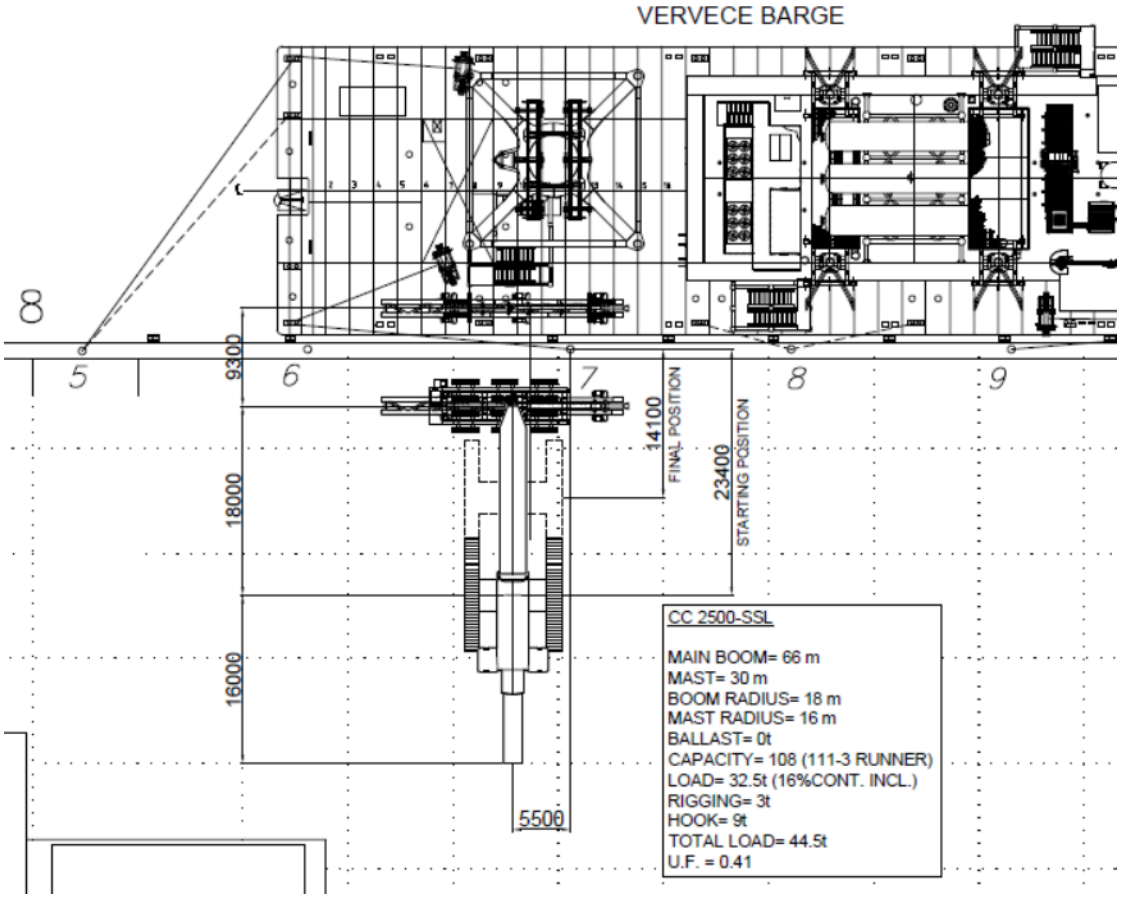


Figure 6.2 – CF position on PBY

6.3 WEATHER FORECASTING ARRANGMENT FOR THE YARD

Weather forecast for load out operation will be obtained from website www.windy.it and www.windfinder.com, during the week prior loadout operation weather forecast will be checked.

7 ENVIRONMENTAL LIMITS

7.1 TIDE

Operation is not tide sensitive.

7.2 WAVE

Not present being in a closed basin. Marine traffic will be limited and wind wave negligible having limitation on max wind speed.

7.3 WIND

The loadout activities will be performed with good weather conditions and favorable weather forecast. The maximum wind speed should not exceed 10 m/s during loadout. Prior to start the load out the wind speed will be checked by means of an anemometer (hand anemometer available on yard).

The maximum wind speed assumed for mooring design is:

- 10 m/s for mooring during load out (barge moored perpendicular to Quay).

LOADOUT OPERATION -DESIGN WIND SPEED				
References	**DNV-GL-N001**			
INPUT DATA				
Max Forecast / operational Wind Speed	v_{ope}=	10	m/s	
Planned Operation Period	T=	48	h	
Wind speed 10 return period	v_{10}=	22.6	m/s	
Alpha Factor	Alfa=	0.67	-	Table 2-15
OUTPUT DATA				
Design Wind Speed	v_{des}=	**14.9**	m/s	

Table 7.1 – Wind Speed Design – Loadout Condition

8 LOADOUT PROCEDURE

8.1 MAIN LOADOUT STEPS

The following table summarizes the main steps necessary to carry out Topside Loadout:

STEP	ACTION	REFERENCE
01	CF moved by RM trailer from actual position in yard to Loadout area.	-
02	CF roll-up by crane	-
03	CF loadout by crane	Appendix "B"
04	Set down and shimming with wooden wedge	Appendix "A"

Table 8.1 – Main Loadout steps

8.2 QUAY AND BARGE PREPARATION

8.2.1 Quay side

Activities required before the loadout listed as follows:

1. Clean off all material and equipment not strictly required for the loadout;
2. Check that no sharp objects will be present along trailer route;
3. Check that no obstacles will be present between the fenders and the barge;
4. Perform safety inspection;
5. Cordon off the area involved for the operation;
6. Disposal of all the mooring equipment close to the designated bollards and check of compliance of the equipment itself;
7. Check and preparation of bollards and anchor points on-shore;

8.2.2 Barge Preparation

List of activities to be carried out before starting the loadout:

1. Check that grillage beams are properly welded and positioned on the barge deck and welding adjustments/intervention to be performed if necessary;
2. Check dimensional compliance concerning grillage height on barge deck;
3. Check all barge appurtenances have been removed/installed (bollard/closure frame);

4. Check that no clashes will occur between topside and barge appurtenances and / or grillages , if any remove;
5. Preparation of seafastening materials to support work immediately after CF set-down;

8.2.3 Personnel preparation

List of activities to be carried out before starting the loadout:

1. Tool box with all personnel involved into loadout operation carried out;
2. Check radio communications (walkie-talkie and spare batteries tested);
3. Check first aids availability;

9 LOADOUT ORGANIZATION

9.1 ROLES AND RESPONSIBILITY

A description of the functions and responsibilities of the key personnel involved in the operation is given here below:

- *Loadout Manager* is responsible for the whole loadout operations. Client, Certifying Authority and Marine Warranty surveyor representatives liaise only and directly with Loadout Manager. Loadout Manager is also responsible for external parties interface / communication (harbor tugs, port authority and emergency services).
- *Mooring System Superintendent* is responsible for mooring the barge onto the quay and for adjusting the barge alignment throughout the load out operation.
- *Intervention Team Superintendent* is responsible for the intervention team equipped with cranes, welding machines, cutting gear etc. which will be ready to intervene throughout the operation.
- *HSE Manager* is responsible for all the aspects related to safety including control of access within the restricted area and the liaison with the first aid team.
- *CPY Representative* is responsible for interface with Rosetti project team, loadout manager and Marine Surveyor.
- *ABL Marine Surveyor* Issue Certificate of Approval to start the loadout. (A signed copy must be handed to CPY Site Rep prior to topside liftoff). Witness loadout operation. Interface with CPY and Rosetti as required.
- *Project Quality Manager* is responsible for providing all documentation and certification required by MWS and to ensure checklists are completed and signed off.
- *Construction Manager*, in collaboration with Loadout Manager is the responsible all barge / quay activities necessary to perform loadout.

9.1.1 Contact details of key personnel

Here are the following contact details of key personnel:

- *Massimiliano Brunelli – Project Manager;*
  mobile: +39 334 6143049
  e-mail: massimiliano.brunelli@rosetti.it
- *Alessandro Balzarotti – Project Structural Engineer ;*

mobile: *+39 345 1449272*
e-mail: alessandro.balzarotti@teconsrl.it

- *Wolmer Borghi – Construction Manager;*
  mobile: *+39 366 6497967*
  e-mail: wolmer.borghi@rosetti.it
- *Daniele Ricci Picciloni –Project HSE Manager;*
  phone: *+39 335 1225148*
  e-mail: *daniele.riccipicciloni@rosetti.it*
- *Alessandro Berti –Yard Manager & Loadout Manager;*
  mobile: *+39 338 5300679*
  e-mail: *alessandro.berti@rosetti.it*
- *Kevin Sirski– ABL Marine Warranty Surveyor;*
  phone: *+44 (0) 7442 786279*
  e-mail: *k.sirski@abl-group.com*
- *Jan Duinhoven - Company Representative;*
  mobile *+31 642048772*
  e-mail: *jan.duinhoven@crosswindhkn.nl*
- *Jeroen van Loon - Floating Solar Lead & BLPH Construction Manager*
  mobile *31 (0)6 – 43103041*
  e-mail: *jeroen.vanloon@crosswindhkn.nl*

9.2 COMMUNICATIONS

The Loadout Manager has overall responsibility and control of the operation. The Loadout Manager communicates with the Loadout team via walkie-talkie and is the only one entitled to give orders.

The Loadout Team is in constant communication with the Loadout Manager and follows his instructions. In case of any mismatch with expected data and conditions, each Loadout Team component must inform immediately the Load out Manager, who is the only entitled to decide relevant intervention.

In case of immediate danger to the Health and Safety of any operator each Loadout Team component must STOP the operation immediately and then inform the Loadout Manager.

In any case, the Loadout Manager is the only one entitled to restart the operation.

Communication among the load-out key personnel will be made via portable radio. Load-out Manager will be linked to the surveyor superintendent in charge of continuously monitoring the barge draft, trim and heel. The tank sounding will be read in by measuring the ullage through the manholes.

Prior to start the operations the correct functionality of the walkie-talkies (batteries, radio frequency...) will be checked. Each walkie-talkie will be provided with a spare battery ready in case of substitution. A dedicated RF Channel will be employed for loadout operation.

A toolbox talk will be carried out before the load out commences. All personnel involved in the loadout, as per the Operational Organizational Chart, should be present so that everybody understands the operation and is aware of their responsibilities.

Italian will be used throughout the operation. All communications with CPY and Marine Surveyor will be conducted in English.

In the event of the operation being stopped for unforeseen circumstances, as described in this section, the Loadout Manager will inform CPY and the MWS of the nature of the problem and the proposed corrective course of action.

9.3 HSE REQUIREMENTS

For general Safety Measures refer to Project HSE Plan applicable revision and Risk Assessment.

A dedicated HIRA will be held to ensure a correct risk assessment.

ATTACHMENT A – CF GENERAL ARRANGEMENT ON VERVECE

ATTACHMENT B – CF LOADOUT DRAWING

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ATTACHMENT C – CARGO BARGE VERVECE - SPECIFICATIONS