Base Load Power Hub (BLPH)

BLPH Topside - Yard Checklist

Document Number: 123A90-DDL-TI-RE-99012

Document Class: 3

02	15/10/2025	Issue for Information (IFI)	A.Balzarotti	C.Giunchi	D.LoSterzo
01	25/06/2025	Issue for Information (IFI)	A.Balzarotti	C.Giunchi	D.LoSterzo
00	13/02/2025	Issue for Information (IFI)	A.Balzarotti	C.Giunchi	D.LoSterzo
Rev.	Date	Description	Prepared	Reviewed	Approved
TECON					

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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	

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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.

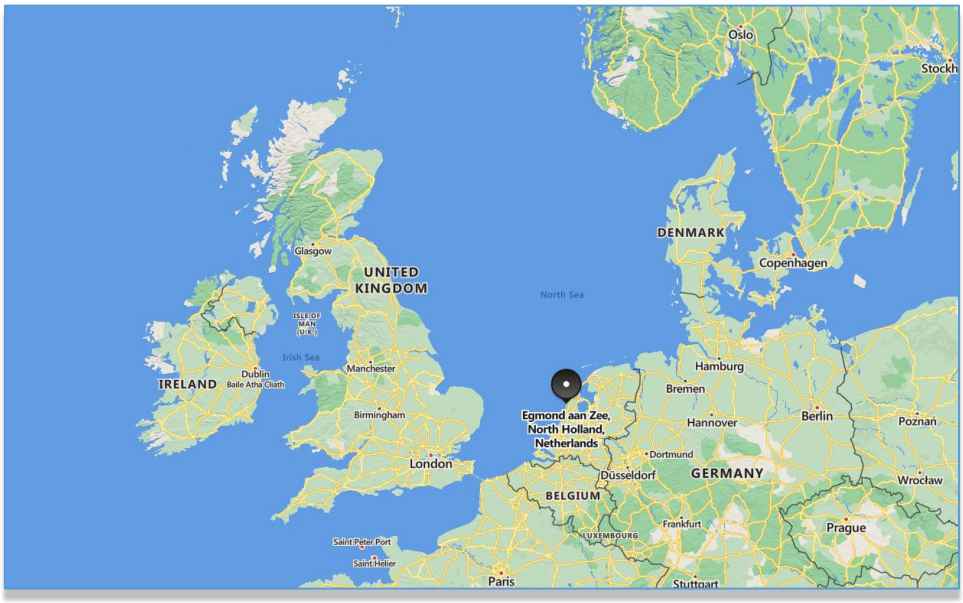


Figure 1.1 - HOLLANDSE KUST NOORD WIND PARK Location Map

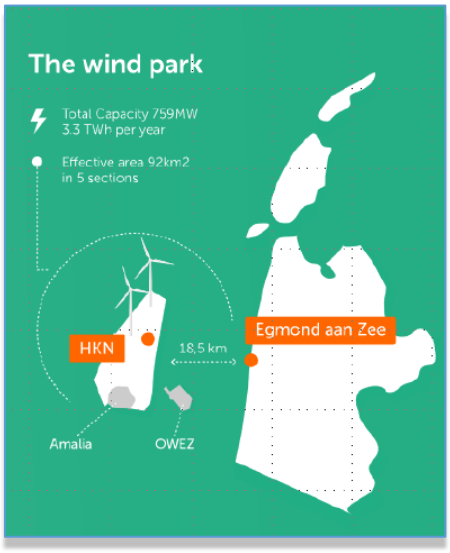


Figure 1.2 - Wind Park Details

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.

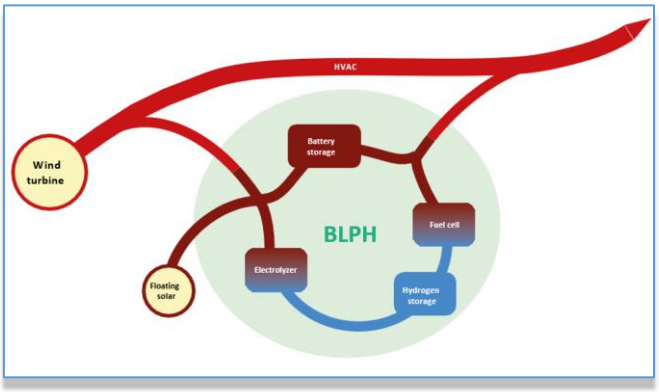


Figure 1.3 – BLPH Concept

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 DOCUMENT SCOPE

This document provides detailed check list to confirm the preparatory work on the fabricated component and transportation barge for the BLPH project, in particular for Topside.

The objective of the yard check list is:

- To enable proper checks being performed before loadout and sail away on all the items being fabricated in the yard
- To ensure Client, RM and MWS are aware of the final configuration/content of the items to be transported.

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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 19901-3	Specific requirements for offshore structures – Part 3: Topsides structure - 2024
/4/ BS EN ISO 19901-5	Specific requirements for offshore structures – Part 5: Weight Management - 2021
/5/ BS EN ISO 19901-6	Specific requirements for offshore structures – Part 6: Marine Operations – 2009
/6/ BS EN ISO 19902	Petroleum and natural gas industries - Fixed steel offshore structures – 2020
/7/ ISO 19906:2019	Petroleum and natural gas industries – Arctic offshore structures
/8/ UNI EN 1993-1-1	Design of steel structures - Part 1-1: General rules and rules for buildings
/9/ UNI EN 1993-1-5	Design of Steel Structures – Part 1-5: Plated structural elements
/10/ DNV-ST-N001	DNV - Marine operation and marine warranty - 2023
/11/ DNV-ST-0145	DNV, Offshore substations, 2021
/12/ DNV-ST-0126	Support structures for wind turbine, 2021
/13/ DNV-RP-C201	DNV, Buckling Strength of Plated Structures, October 2023.

3.2 COMPANY SPECIFICATIONS

Doc. No.	Description
/14/ DEP 37.19.00.12	Gen - Offshore Topsides Structures
/15/ DEP 37.19.00.30	Gen - Fixed Steel Offshore Structures (Adoption of IOGP S-631-11, Amendments / Supplements to ISO 19902:2020).
/16/ DEP 37.81.10.19	Gen - Marine Operations Requirements – Loadout, Transportation and Installation of Offshore Structures (Amendments / Supplements to ISO 19901-6)

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3.3 PROJECT DOCUMENTS

Doc. No.	Description
/17/ HOLD	Weighing Report
/18/ 123A90-DDL-TI-SP-99014	Specification for TP, Topside and Caissons Transportation and Installation
/19/ 123A90-DDL-ST-RE-90002	BLPH Topside Transportation Analysis
/20/ 123A90-DDL-ST-RE-90001	Topside Loadout analysis
/21/ 123A90-DDL-TI-RE-99001	Topside Grillage and SF calculation report
/22/ 123A90-DDL-TI-DD-99021	Topside Grillage assembly
/23/ 123A90-DDL-TI-DD-99023	Topside Grillage – Plan and sections
/24/ 123A90-DDL-TI-DD-99024	Topside sea fastening – Row A
/25/ 123A90-DDL-TI-DD-99025	Topside sea fastening – Row C
/26/ 123A90-DDL-TI-DD-99015	Barge Layout
/27/ 123A90-DDL-EL-DL-20100	Base Load Power Hub - Electrical Equipment Layout - Top Deck
/28/ 123A90-DDL-EL-DL-20101	BASE LOAD POWER HUB (BLPH) - ELECTRICAL EQUIPMENT LAYOUT - LOWER DECK
/29/ 123A90-DDL-EL-DL-20104	Base Load Power Hub (BLPH) - Electrical Equipment Layout - HV Switchroom
/30/ 123A90-DDL-EL-DL-20105	Base Load Power Hub (BLPH) - Electrical Equipment Layout - LV Switchroom
/31/ 123A90-DDL-EL-DL-20106	Base Load Power Hub (BLPH) - Electrical Equipment Layout - UPSs & Batteries Switchroom
/32/ 123A90-DDL-EL-DL-20107	Base Load Power Hub (BLPH) - Electrical Cables Routing Layout - Top Deck
/33/ 123A90-DDL-EL-DL-20108	Electrical Cables Routing Layout - Lower Deck
/34/ 123A90-DDL-EL-DL-20110	Base Load Power Hub (BLPH) Electrical Cables Routing Layout - Iter switchroom
/35/ 123A90-DDL-EL-DL-20111	Base Load Power Hub (BLPH) - Electrical Cable Routing Layout - HV Switchroom
/36/ 123A90-DDL-EL-DL-20112	BASE LOAD POWER HUB (BLPH) - Electrical Cable Routing Layout - LV Switchroom
/37/ 123A90-DDL-EL-DL-20113	BASE LOAD POWER HUB (BLPH) - Electrical Cable Routing Layout - UPSs & Batteries Switchroom
/38/ 123A90-DDL-EL-DL-20114	Electrical MCT Layout – Top Deck

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/39/ 123A90-DDL-EL-DL-20115	BASE LOAD POWER HUB (BLPH) - Electrical MCT Layout - Lower Deck
/40/ 123A90-DDL-EL-DL-20118	Base Load Power Hub - Lighting & Socket Layout - Top Deck
/41/ 123A90-DDL-EL-DL-20119	Base Load Power Hub - Lighting & Socket Layout - Lower Deck
/42/ 123A90-DDL-EL-DL-20122	Base Load Power Hub (BLPH) - Lighting & Socket Layout - HV Switchroom
/43/ 123A90-DDL-EL-DL-20123	Base Load Power Hub (BLPH) - Lighting & Socket Layout - LV Switchroom
/44/ 123A90-DDL-EL-DL-20124	Base Load Power Hub (BLPH) - Lighting & Socket Layout - UPSs & Batteries Switchroom
/45/ 123A90-DDL-EL-DL-20132	Base Load Power Hub (BLPH) - Earthing & Lightining Layout - Top Deck
/46/ 123A90-DDL-EL-DL-20133	Base Load Power Hub (BLPH) - Earthing & Lightining Layout - Lower Deck
/47/ 123A90-DDL-EL-DL-20136	BASE LOAD POWER HUB (BLPH) - Earthing & Lightining Layout - HV Switchroom
/48/ 123A90-DDL-EL-DL-20137	BASE LOAD POWER HUB (BLPH) - Earthing & Lightining Layout - LV Switchroom
/49/ 123A90-DDL-EL-DL-20138	BASE LOAD POWER HUB (BLPH) - Earthing & Lightining Layout - UPSs & Batteries Switchroom
/50/ 123A90-DDL-EL-DL-20139	Navigation Aid System General Layouts
/51/ 123A90-DDL-EL-DL-20140	Electrical Heat Tracing - (EHT) Junction Box Layouts
/52/ 123A90-DDL-EL-LIS-20094	Ex equipment register
/53/ 123A90-DDL-EL-LIS-20142	Electrical Equipment List
/54/ 123A90-DDL-SAF-LIS-30000	Hazardous Material Register and Inventory
/55/ 123A90-DDL-IN-DL-40012	BASE LOAD POWER HUB - OFFSHORE ITER - EQUIPMENT LAYOUT
/56/ 123A90-DDL-IN-DL-40013	Earthing layouts drawings (Onshore CCR, Offshore ITER)
/57/ 123A90-DDL-IN-DL-40080	Instrument Layout - Lower Deck - TOS EL. 23.310m
/58/ 123A90-DDL-IN-DL-40081	Instrument Layout - Upper Deck- TOS EL. 30.310m
/59/ 123A90-DDL-IN-DL-40082	Instrument Main Cables Routing - Lower Deck - TOS EL. 23.310m
/60/ 123A90-DDL-IN-DL-40083	Instrument Main Cables Routing - Upper Deck- TOS EL. 30.310m
/61/ 123A90-DDL-IN-DL-40084	Base Load Power Hub (BLPH) - Instrument Tubing Layout - Lower Deck - TOS EL. 23.310m

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/62/ 123A90-DDL-IN-DL-40085	Base Load Power Hub (BLPH) - Instrument Tubing Layout - Upper Deck - TOS EL. 30.310m
/63/ 123A90-DDL-IN-DL-40086	Instrument and Telecom MCT Layout - Lower Deck - TOS EL. 23.310m
/64/ 123A90-DDL-IN-DL-40087	Instrument and Telecom MCT Layout - Upper Deck- TOS EL. 30.310m
/65/ 123A90-DDL-IN-DL-40113	Base Load Power HUB Cables Tray Layout - B-100 Container Lower Deck - TOS EL. 23.310m
/66/ 123A90-DDL-IN-DL-40114	Base Load Power HUB Cables Tray Layout - B-200 Container Lower Deck - TOS EL. 23.310m
/67/ 123A90-DDL-IN-DL-40115	Base Load Power HUB Cables Tray Layout - B-300 Container Lower Deck - TOS EL. 23.310m
/68/ 123A90-DDL-IN-DL-40116	Base Load Power HUB Cables Tray Layout - B-400 Container Lower Deck - TOS EL. 23.310m
/69/ 123A90-DDL-IN-LIS-40088	Instrument List
/70/ 123A90-PML-DIG-LIS-00005	Master Tag Register

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4 DEFINITIONS AND ABBREVIATIONS

COMPANY or Client (CPY)	Crosswind
CONTRACTOR (CTR)	ROSETTI MARINO S.p.A.
PROJECT	HOLLANDSE KUST NOORD WIND PARK Project
T&I CONTRACTOR	DEME
ALS	Accidental Limit State
BLPH	Base Load Power Hub
CF	Caisson Frame
CoG	Centre of Gravity
CW	CrossWind
El.	Elevation
EPCI	Engineering Procurement Construction and Installation
GR	Grillage
HKN	Hollandse Kust Noord
LAT	Lowest Astronomical Tide
LRFD	Load and Resistance Factor Design
MSL	Mean Sea Level
NTE	Not-to-Exceed
PAU	Pre-Assembled Unit (H2 Vessels)
PG	Plate Girder
SF	Sea fastening
SHL	Static Hook Load
T&I	Transport & Installation
TP	Transition Piece
UDL	Uniformly Distributed Load
WTG	Wind Turbine Generator
W2W	Walk to Work
SPMT	Self-propelled modular Trailer

Table 4.1 - Definitions and Abbreviations

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5 SUMMARY

The following items are to be fabricated and Transported:

Topside	Description
Expected weight	1890 ton
CoG shift factor	5% (0.8m x 2.0m)
Weight Contingency factor	3% (based on weighing apparatus tolerance)
Length	40 meters (45m overall including stairs and WTW platforms)
Width	16 meters (30m overall including stairs and walkways)
Height	20 meters (27m including vent tip)

Table 5.1 – Topside properties

Topside will be transferred onto the cargo barge by SPMT's. Prior to carrying out the LO, the Topside will be inspected to confirm its readiness (e.g. installation aids, internal fittings, lashings, etc)

After the signature of the Ready for Loadout certificate the activity can commence. Once on the barge, the set down with shimming and seafastening activities will be carried out.

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6 YARD CHECKLIST QUAYSIDE AND TOPSIDE

No.	Punch List Item	Drawing Ref.	Date	Comments	Check
A-1.0	Barge arrival				
1.1	Check if the quay is free of obstacles and appropriate berthing and mooring scheme is in place	123A90-DDL-TI-DD-99034 123A90-DDL-TI-DD-99035		latest bathymetry / tidal information and weather forecast to be shared to check UKC and mooring arrangement	
A-2.0	Topside general inspection				
2.1	visual inspection			check for potential dropped objects	
2.2	check nothing is protruding below lower deck main beams for SPMTs insertion			see. Fagioli drawing/yard survey	
2.3	check lower deck compliance with drawings	123A90-DDL-PP-DL-70070		plot plan	
2.4	check upper deck compliance with drawings	123A90-DDL-PP-DL-70070		plot plan	
2.5	check Topside weight control report			Weighed weight certificate	
2.6	verify position of CoG	123A90-DDL-ST-DA-90055		Weighed weight certificate	
2.7	Crane block secured				
2.8	Entrance doors			installed and checked the closure system (external side doors will be edge sealed with heavy-duty tape)	
2.9	handrails all installed				
	- lower deck				
	- upper deck				
	- PAU access platforms				
2.10	gratings all installed				
	- lower deck				
	- upper deck				
	- PAU access platforms				
2.11	access gate NS and SS close and secured	123A90-DDL-ST-DD-90117			
2.12	bottom flange of the four main joints not painted around the hole for offshore welding				
2.13	Elogen module UD secured by gusset plates (facing row A)				
2.14	All the temporary preservatives applied during Construction and Commissioning phases shall be removed				
2.15	A thorough cleaning of external areas shall be executed				
2.16	A thorough cleaning of internal areas of each Shelter shall be executed				
2.17	A thorough cleaning of Equipment shall be executed				
	Drying agents shall be used inside each Shelter.. Desiccates for these purposes shall be placed inside each room but outside cabinets and not in direct contact with metallic surfaces			The use of desiccants is foreseen to sustain a state of dryness in the Rooms during transportation when the HVAC System or temporary portable air conditioners are not in service	

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A-3.0	Lift points				
3.1	trunnions fabricated dimensionally correct	123A90-DDL-ST-DA-90056		check as-built report	
	- Leg A2				
	- Leg A4				
	- Leg B2				
	- Leg B4				
3.2	welds correct and NDT performed	123A90-DDL-ST-DA-90056		collect NDT reports	
	- Leg A2				
	- Leg A4				
	- Leg B2				
	- Leg B4				
3.3	sharp edges provided	123A90-DDL-ST-DA-90056			
	- Leg A2				
	- Leg A4				
	- Leg B2				
	- Leg B4				
A-4.0	Installation AIDS				
4.1	access from cargo barge to SF cutting el.			installed after LO	
4.2	internal seafastening approved by MWS				
A-5.0	Shipped loose items				
5.1	grating connecting access stair to lower deck from TP			fastened close to install. Location	
5.2	Primer and Paint			ready for touch-up	
A-6.0	Dimensional Control				
6.1	dimensional data for liftpoints available and within specification				
6.2	dimensional control of leg to leg distances			cross checked with TP	
A-7.0	Grillage and SF				
7.1	Lower grillage fabricated and positioned on barge as per drawing				
7.2	grillage shimmed per plan				
7.3	shims provide 100% bearing			Available at loadout	
7.4	wing plates installed per plan				
7.5	Shear plate ready			positioned before sail-away	
7.6	all welds tested/inspected				
7.7	SF pipes and gusset plates available				
7.8	SF welded to cargo barge with barge in towing config.			check for min. SF. Collect NDT of GR&SF welds	
A-8.0	Fluids				
8.1	see dedicated Table in sect. 7				
A-9.0	Mechanical				
9.1	Pumps string sections				

9.2	Bolts for string assembly			n. 5 centralizer each string	
9.3	lifting eyes M16 for pump lift and string lift				
9.4	vent tip installed			flange to be secured with gusset plates	
A-10	Electrical and Instrumental				
10.1	Any multi-cable transits (MCT) aperture shall be fixed in the closed position and covered with a securely attached cover and edges sealed with appropriate tape.				
10.2	Panel internals and externals shall be cleaned				
10.3	Internal PLCs, cards and all other electronic devices shall be protect against shock and vibrations				
10.4	All panels doors shall be closed and locked				
10.5	All the delicate parts as ammeters, voltmeters, lights mounted in the external side of panels will be protected				
10.6	All glass doors shall be covered				
10.7	CORTEC VpCI 126 CoExtruded Film Emitter (or equivalent) on all the external surface of Cabinets sensitive to moisture and/or corrosion shall be installed avoiding the risk of corrosion for 12 months, the locking of VpCI 126 shall be executed with extendable film (see Photo 6 - Example).				
10.8	Small electrical and instrument items (lightingh fixture, detectors, push button, jb, etc.):				
	Item externals shall be cleaned				
	Case A: Small items indoor installed (shelter) and for the small items with IP < 66 outdoor installed				
	CORTEC VpCI emitters (or equivalent) shall be placed inside the item				
	CORTEC VpCI film (or equivalent) on all the external surface of Item shall be installed avoiding the risk of corrosion for 12 months, the locking of VpCI shall be executed with extendable film.				
	Case B: Small items with IP ≥ 66 (≤ 20 liters) outdoor installed			The item shall be only protected with heavy duty plastic sheet aim at cover it against sea spray and dirt from possible flocks of birds during transport.	
	Case C: Small items with IP ≥ 66 (> 20 liters) outdoor installed				
	CORTEC VpCI emitters (or equivalent) shall be placed inside the item				
	CORTEC VpCI film (or equivalent) on all the external surface of Item shall be installed avoiding the risk of corrosion for 12 months, the locking of VpCI shall be executed with extendable film.				
10.9	FRAGILE EQUIPMENT (e.g. computers, video units, etc)			Sufficient buffering material shall be wrapped around fragile items, including instruments, to protect against shock damage.	

10.10	For any cables disconnected at one side the cable terminations will be protected with extensible film “STRECH FILM VpCI” and multi bubble wrap, then placed on appropriate supports and fixed by textile strapping. No metallic strapping is allowed in order to avoid damage				
A-11	Barge Sail-Away documentation				
11.1	sail away certificate signed by MWS				
11.2	checklist signed by:				
	Client rep.				
	RM rep.				
	END of CHECKLIST	signatures		CW	RM

NOTE

1- Desiccants shall not be used in combination with VpCIs inside equipment.

2- If the item is ATEX certified the CORTEC VpCI emitters (or equivalent) shall be placed outside the item and under the CORTEC VpCI film (or equivalent).



Figure 6.1 – Example of CORTEC VpCI Emitter

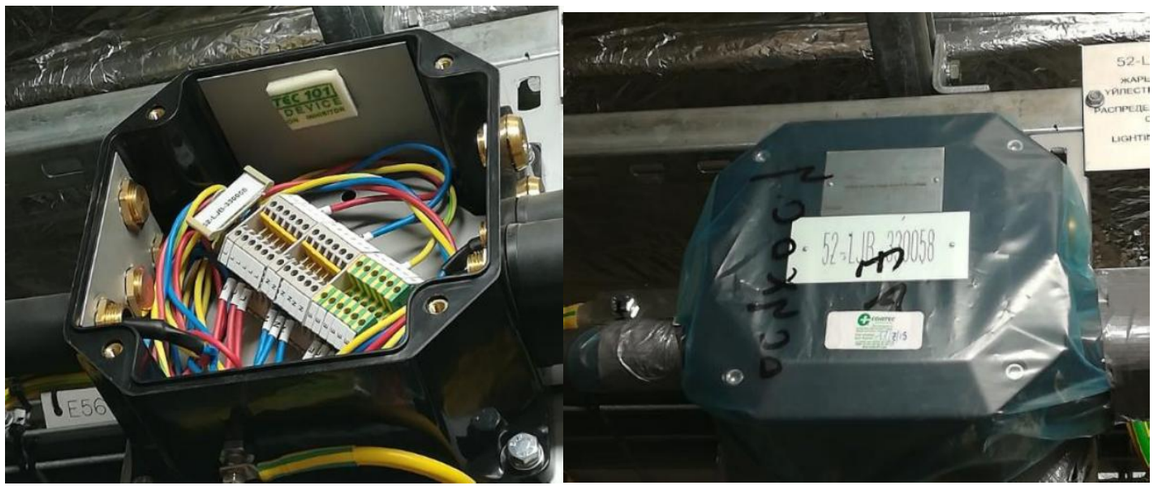


Figure 6.2 – Example of Item preserved with Cortec VpCI Emitters

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7 LIST OF FLUIDS IN TOPSIDE

Ref. document /54/.

TAG	MATERIAL	INVENTORY	OPERATING TEMPERATURE [°C]	OPERATING PRESSURE [barg]	NOTES	LOCATION	Design considered sea transport accelerations	Quantity Inside equipment during L/O	Quantity Inside equipment during T&I
V-25001 A/B/C/D/E/F	Hydrogen	1680 kg maximum inventory (extreme scenario only if temperature decrease up to -8), normally 1200 kg expected	-0.12	30	Six H2 vessels sized as 2.8ID x 15.5 m	PAU structure	0.7g trasv, 0.5g vert.	to be purged before LO	-
A-20000	O2 & H2	-	65	0.1	Note: by-product inside CPI scope and directly send to atmosphere	Electrolizer - upper deck		to be purged before LO	-
A-20000	Instrument Air	-				Electrolizer - upper deck		to be purged before LO	
A-20000	Glycol (MPG 40%)	4200L - Drained for transport				Electrolizer - upper deck	0.7g trasv, 0.5g vert.	100%	100%
A-20000	Resin (IRN160)	508L FH-600 and 158L FH-620, total <666L				Electrolizer - upper deck	0.7g trasv, 0.5g vert.	100%	100%
A-20000	Ultra pure water	Present in stacks and FH Inventory stacks 8x 60 L 640L (FH-600) and 206L (FH-620 Total 1326L				Electrolizer - upper deck	0.7g trasv, 0.5g vert.	100%	100%
A-20000	Nitrogen	Present, all process lines are purged to 3barg.				Electrolizer - upper deck	0.7g trasv, 0.5g vert.	100%	100%
A-20000	Oil Transformer (ENVIROTEMP FR3 FLUID)	Present, vegetable oil (98,5%) 2220L				Electrolizer - upper deck	0.7g trasv, 0.5g vert.	100%	100%
A-20000	Refrigerant (R513a, gas)	Present, 2x 40kg				Electrolizer - upper deck	0.7g trasv, 0.5g vert.	100%	100%
A-50000	Chemical drain	16 m_3	35	atm	-	WTP - lower deck	0.6g trasv, 0.5g vert.	100%	100%
P-50001 A/B	Lube oil – AXA GR1 – by TOTAL	170 g (model 25AV24)	amb	atm	The quantity of lubricant used per sheath depends on the pump model	pumps - lower deck	0.6g trasv, 0.5g vert.	100%	100%
A-50000	Biocide – DBNPA EB Biocide Plus	110 l per yr	amb	atm	It is used inside the water treatment package	lower deck	0.6g trasv, 0.5g vert.	100%	100%
A-50000	Antiscalant - Everblue 600	12 l per yr	amb	atm	It is used inside the water treatment package	lower deck	0.6g trasv, 0.5g vert.	100%	100%

A-50000	Caustic soda 20%	58 l @10°C per yr 47 l @23°C per yr	23	atm	It is used inside the water treatment package to control pH.	lower deck	0.6g trasv, 0.5g vert.	100%	100%
A-80000	BASF Glysantin J21725 Premix 50%	300 l	-10 / 70 °C	atm	Coolant circuit for the Internal HT loop	Fuel cell - upper deck	0.7g trasv, 0.5g vert.	100%	100%
A-80000	Glad Long Life Ethylene Glycol Premix 50%	1761 l	amb	atm	Coolant circuit for the External HT and LT loops	Fuel cell - upper deck		to be purged before LO	-
V-43001	Ethylene Glycol water	4.7 m_3	amb	atm	Inside the liquid seal drum of the vent package	KOD - upper deck	0.7g trasv, 0.5g vert.	100%	100%
T-55001	Ethylene Glycol water (25%)	3500 kg	amb	atm	To avoid freezing inside			-	-
A-64000	Nitrogen	11 m_3	amb	8.1 bar	Nitrogen package			100%	100%
B-100	Dry air	6.6kg per bottle, 7 bottles in total	20°C	200kPa	For maintain the GIS 2 pressurized air bottles are required. (42l per bottle, overall volume 294l for the 7 required)			100%	100%
B-300	batteries					UPS - lower deck	0.6g trasv, 0.5g vert.	100%	100%
A-20000	Compressed air MPG40% + water Oxygen				Electrolyzer package, for detail refer to Supplier documentation	Upper deck	0.7g trasv, 0.5g vert.	100%	100%
A-85000	Battery cells				BESS package, for detail refer to Supplier documentation	Lower deck	0.7g trasv, 0.5g vert.	<=30%	<=30%
-	ABC Dry Powder	9 kg	-20°C – 60°C	12 bar	Fire extinguisher media		0.7g trasv, 0.5g vert.	100%	100%
-	CO2	5 kg	-30°C – 60°C		Fire extinguisher media		0.7g trasv, 0.5g vert.	100%	100%
-	NAV AIDS				batteries		0.7g trasv, 0.5g vert.	100%	100%
TR-100AD1 (66/6.6 kV – 7 MVA)	syntetic organic liquid	7000 kg	-50°C-120°C		transformer	Lower deck	0.7g trasv, 0.5g vert.	100%	100%
TR-200DE1 (6.6/0.4 kV – 1.6 MVA)	syntetic organic liquid	750 kg	-50°C-120°C		transformer	Lower deck	0.7g trasv, 0.5g vert.	100%	100%
TR-200ED1 (6.6/0.8 kV – 0.5 MVA)	syntetic organic liquid	540 kg	-50°C-120°C		transformer	Lower deck	0.7g trasv, 0.5g vert.	100%	100%

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