Base Load Power Hub (BLPH)

INTERNAL (indoor & outdoor) SEA FASTENING PROCEDURE

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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 DEFINITIONS 8

3 ENVIRONMENTAL AND DESIGN CONDITIONS 9

3.1 Environmental Conditions 9

3.2 Transport acceleration table 9

4 MATERIALS 10

4.1 Cargo strap and rope 10

4.2 Wood support 11

5 SEA FASTENING CRITERIA 12

5.1 External 12

5.2 Typical Sea fastening 12

5.3 Alternative Sea fastening system 23

6 INTERNAL 25

7 SEA FASTENING REQUIREMENTS OF CPI (Company Provided Items) 31

8 ACTIVITY MANAGEMENT AND EVIDENCE TRACKING 34

9 ANNEXE 1: OFFSHORE INTERNAL SEA FASTENING CHECKLIST 35

List of Figures

Figure 1 HOLLANDSE KUST NOORD WIND PARK Location Map 5

Figure 2 - Wind Park Details 6

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Figure 3 – BLPH Concept 6

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.

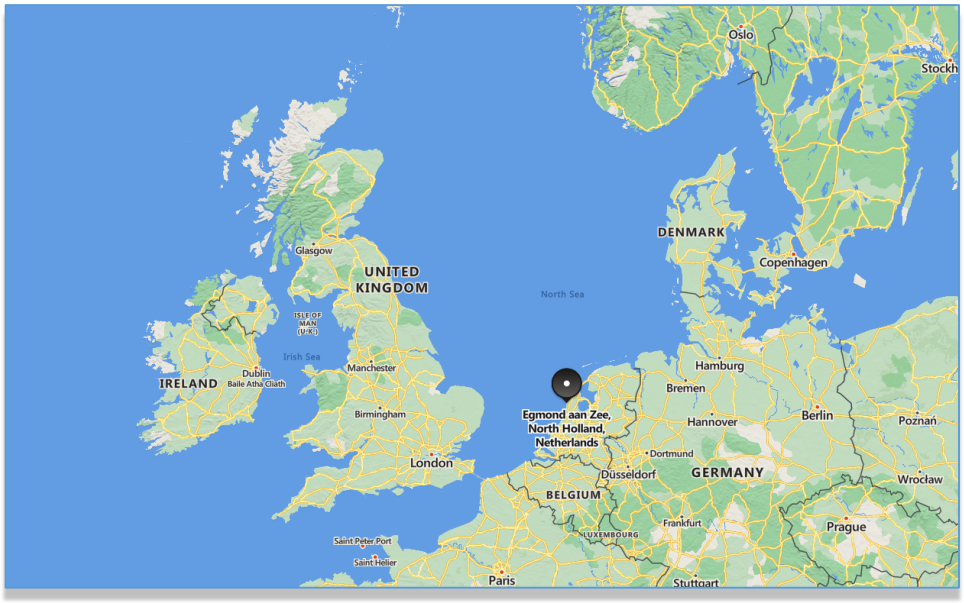


Figure 1 HOLLANDSE KUST NOORD WIND PARK Location Map

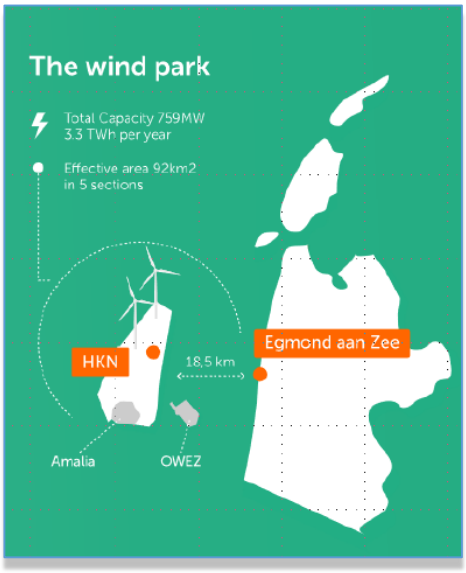


Figure 2 - Wind Park Details

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.

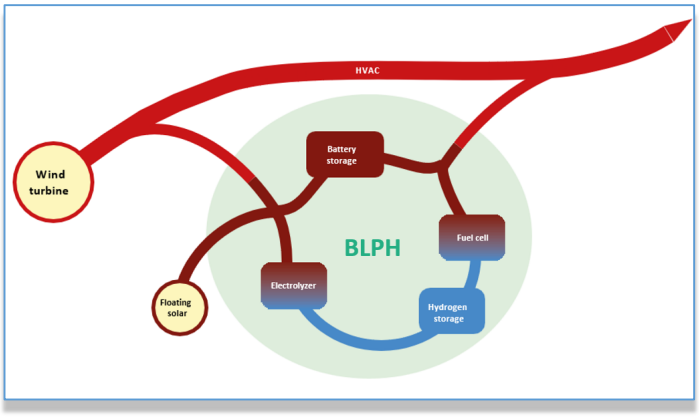


Figure 3 – BLPH Concept

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

During the transport phase of the modules by sea, the components (structures, pipes, equipment, etc.) are subject to stresses deriving from the accelerations generated by the oscillations of the means of transport due to wave motion. Such stresses can be of entities and of a very different nature from the operating conditions for which they were normally designed and manufactured.

It is therefore necessary to provide temporary devices to absorb these stresses and prevent damage during transport; The aim is to ensure thus the structural and functional integrity of all components.

The devices can be of the flexible type (ratchet or cargo straps, tape tensioner, steel wire, etc.) or of the rigid type (temporary supports, contrasts or retainers by means of wood or plastic elements, etc.); it is also necessary to protect the surface part from reciprocal sliding or hammering using neoprene, rubber, Teflon, etc.

The purpose of this specification is to provide instructions and recommendations to ensure an Internal Sea fastening effective against action arising from the transport of the platform from Yard Piomboni in Ravenna (Italy) to the wind park Hollandse Kust Noord (Netherlands).

Regarding preservation, please note that the installed items requiring preservation will already be in preserved condition, in accordance with the PRESERVATION PROCEDURE Document Number 123A90-PML-QHSE-PRO-00126.

2.1 DEFINITIONS

COMPANY SHELL&ENECO

CONTRACTOR ROSETTI MARINO S.P.A

The party that holds the contract to carry out all or part of the design, engineering, procurement, construction, commissioning, or management on behalf of COMPANY

3 ENVIRONMENTAL AND DESIGN CONDITIONS

3.1 ENVIRONMENTAL CONDITIONS

Sea fastening shall be designed for the following conditions:

Climate	Marine, offshore
Outside temperatures	-10°c + 22°c
Outdoor relative humidity	100% at -1°c; 80% at +22°c
Inside temperatures:	+20°c to +24 °c
Area classification:	Safe

3.2 TRANSPORT ACCELERATION TABLE

LEVEL	ACCELERATIONS	
	a_H[g]	a_V[g]
Lower Deck	±0.60	±0.5
Upper Deck	±0.70	±0.5

Where:

- aH is the horizontal acceleration
- aV is the vertical acceleration

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4 MATERIALS

4.1 CARGO STRAP AND ROPE



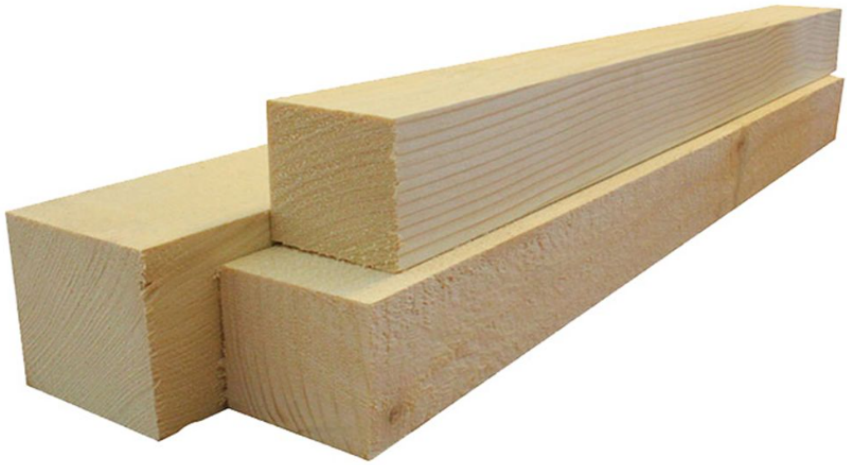




Care should be taken that the web lashing is not damaged by the sharp edges of the load on which it is used. The webbing shall be protected against friction, abrasion and damage from loads with sharp edges by using protective sleeves and or corner protectors. Web lashings shall never be used when knotted. Damage shall be prevented by keeping them away from sharp edges of the load and, if possible, from the load. A visual inspection before and after each use is recommended

4.2 WOOD SUPPORT

For elements such as cabinets, battery racks, transformers, a smooth wooden support consisting of beams, pillars and bracing should be used for the sea fastening. The support structure shall be joined by screws or bolts and the e shall prevent movement of the object. The section of the wooden supports shall be proportionate to the size and weight of the object to which the reinforcement is applied. Neoprene or similar will be inserted to protect items from sharp edge.



5 SEA FASTENING CRITERIA

5.1 EXTERNAL

To evaluate the stability and fastening of external items (lights, cameras, valves, speakers etc.) installed on posts or Øglænd supports, shake the element with hands and check that there are no significant movements of the support. If the support does not guarantee a secure fixing of the element, this shall be reinforced using ropes or cargo straps.

Temporary rigid metal fasteners are not allowed, and welding is not allowed additional to piping. Fixings with non-metallic material such as textiles, plastics, nylon, Teflon, neoprene, wood etc. in order not to superficially damage the pipes. The bands in cargo strap type nylon are the typical fastening of pipes.

5.2 TYPICAL SEA FASTENING



Secure lights with ropes or cargo strap (purple lines) and wood support to the handrail.

During preservation and sea fastening activities proper cleaning will be performed.

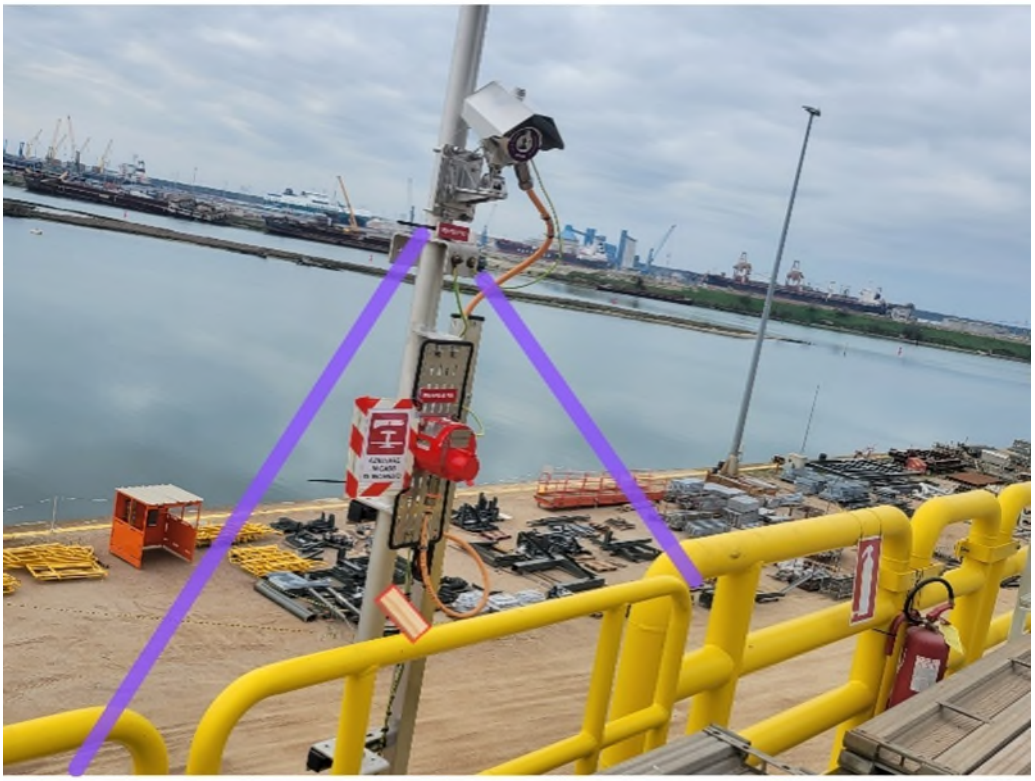




Secure valves with ropes or cargo strap (purple lines) to the structure, to the supports, to fixed point



The most unstable valve actuator (susceptible to oscillations to the effect of motion waves) must be fixed to the nearest structural parts by means of cargo straps or wooden props.



Secure flame detector and manual fire activation with wood support and cargo strap (purple lines) to the handrail



Secure crane and chain with cargo strap (red lines) to fixed point.
Locking mechanism will be engaged prior sail away



Secure crane and chain with cargo strap (red lines) to fixed point.
Locking mechanism will be engaged prior sail away

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Secure piping with cargo strap (purple lines) to fixed point



Secure piping with cargo strap (purple lines) to fixed point



Secure gas detector with cargo strap (purple lines) to fixed point



Secure hydrogen heater assembly with cargo strap (purple lines) to fixed point



Secure hydrogen vent with cargo strap (purple lines) to fixed point

5.3 ALTERNATIVE SEA FASTENING SYSTEM



In this case it was not possible to anchor to the handrail, alternatively it is always necessary to apply it to fixed point for example supports or piping lines



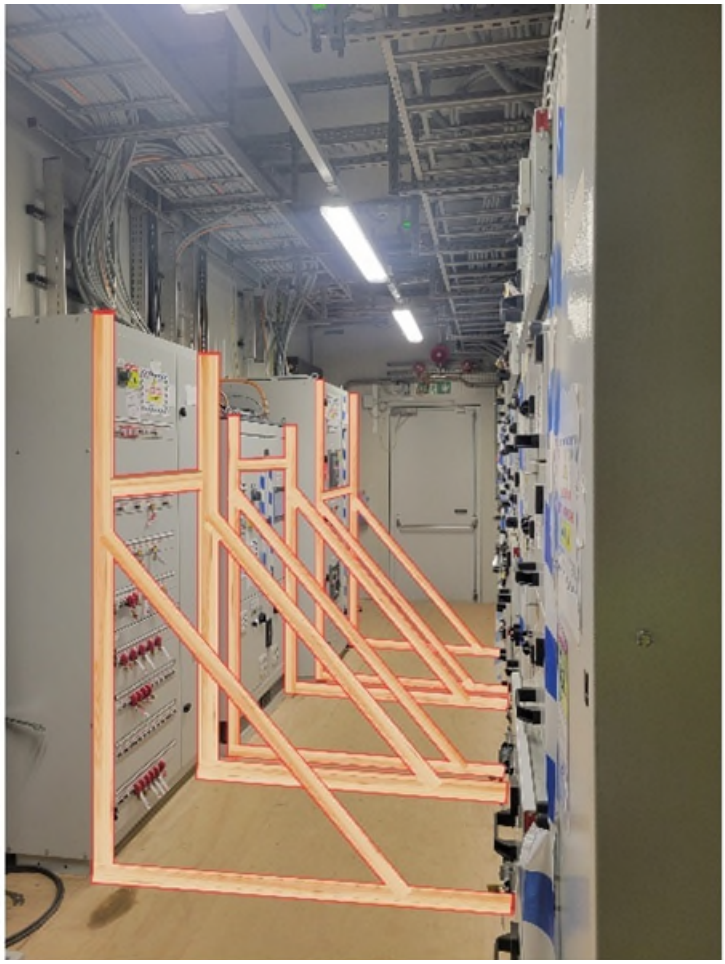
In this case it was not possible to anchor to the handrail, alternatively it is always necessary to apply it to fixed point for example supports or piping lines

6 INTERNAL



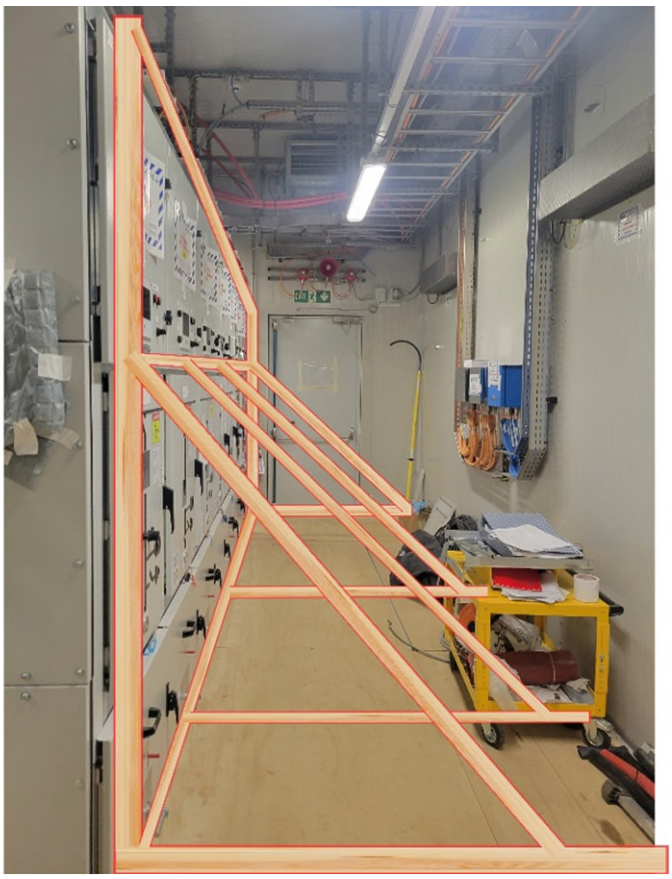
Secure battery racks with wooden bracings and posts, solution applicable for B 300 AC UPS room at lower deck.

During our sea fastening activities, if additional wood supports are required, they will be installed. Horizontal pieces will be installed on top and on bottom structure.



Secure battery racks with wooden bracings and posts, solution applicable for B 200 LV Switch room at lower deck.

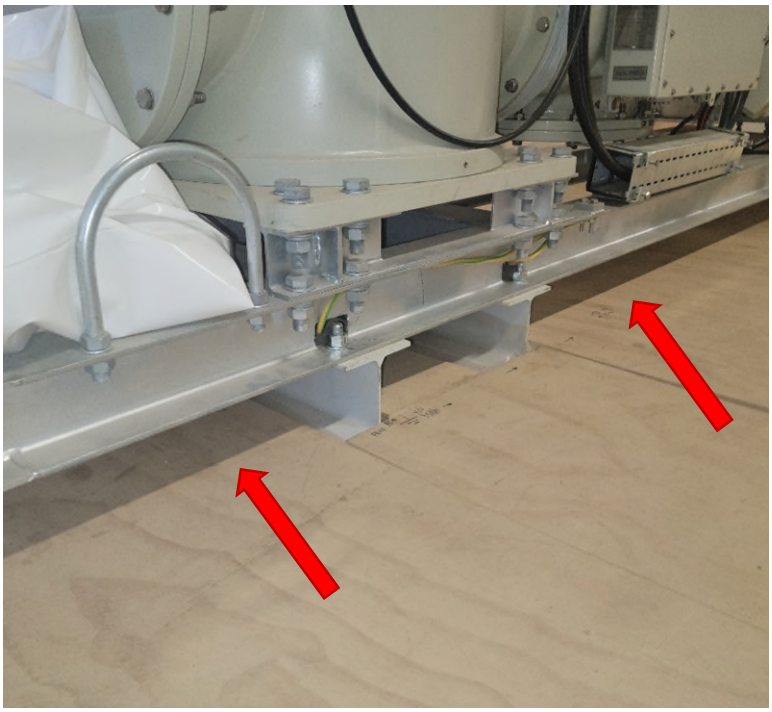
During our sea fastening activities, if additional wood supports are required, they will be installed. Horizontal pieces will be installed on top and on bottom structure.



Secure battery racks with wooden bracings and posts, solution applicable for B 100 HV Switch room at lower deck.

During our sea fastening activities, if additional wood supports are required, they will be installed. Horizontal pieces will be installed on top and on bottom structure.





The GIS, located in the lower deck of B-100, does not require the application of wooden supports as it is already securely fixed using a carbon steel support.



Secure transformer with wooden bracings and posts, solution applicable for transformers at lower deck.



Secure electrical panel with wooden bracings and posts, solution applicable for water treatment package at lower deck.

7 SEA FASTENING REQUIREMENTS OF CPI (COMPANY PROVIDED ITEMS)

This section outlines the general sea fastening principles applicable to all CPI involved in the CrossWind BLPH Project. Each CPI vendor provides specific procedures and technical recommendations for securing their equipment for transport, whether during yard storage or offshore delivery.

The sea-fastening strategy must ensure the mechanical stability of each CPI during marine transport by restraining movements, minimising vibrations, and protecting all fragile components. All activities must comply with relevant lifting, storage, and transport specifications, as well as vendor-specific sea fastening procedures.

Sea fastening preparation activities for Company Provided Items (CPI) shall be performed in accordance with the specific vendor documentation provided for each system. In particular:

- For the Elogen CPI, including Electrolyser, Transformer, Rectifier and WTP:
  Refer to procedure C063-ELO-PRO-CO-0007 Rev.04 – Sea Fastening and Preservation and technical instruction C63-TRA-001 Rev.02 – Drainage and Sealing Instruction.
- For the Ballard CPI (Fuel Cell modules):
  Refer to procedure BALLARD_R04 Preservation and Ready for Sail Away Rev.002.
- For the Freqcon CPI, including BESS and PCS systems:
  Refer to procedure 23A2007_241110_FREQCON_BESS_Long_Term_Storage_Strategy Rev.3.0 and to technical drawing 54732 Sea Fastening – BESS.

All preservation and mechanical securing activities shall be carried out under the responsibility of the Vendor, with Contractor support limited to assistance as needed.

The execution of the above activities shall follow the roles and responsibilities defined in the attached preservation for transport matrix.

Package	Component	Eng Doc/Procedure	Resp.	Material Supply	Resp.	Installation	Resp.
FUEL CELLS		R04 Preservation and ready for Sail Away Rev 002.pdf	Ballard	Transport Brackets	Ballard	Drainage activities SF mech installation	Ballard (1 person from ROS to support)
				Other SF Material (Lash Straps, Wooden Support, Foam Blocks, Corner protector)	ROS		
				2 IBCs + 4 sets of small scaffold	ROS		
BESS		- 23A2007_241110_FREQCON_BESS_Long_ Term_Storage_Strategy_v3.0.pdf; - 54712 Sea Fastening - PCS.pdf; - 54732 Sea Fastening - BESS.pdf	Freqcon	- Wooden Profiles - Protection Material	ROS		Freqcon (ROS to support)
				Dessiccants Sticks	Freqcon		

Package	Component	Eng Doc/Procedure	Resp.	Material Supply	Resp.	Installation	Resp.
ELECTRO-LYSER(1)	Process loops	C63-TRA-001 Drainage and sealing of the process loops	Elogen	N2	FORES	Drain the electrolyser loop by loop, 600 & 620 (thanks to nitrogen inerting) and keep it pressurised at 3 barg	FORES
	Stacks	C63-PRO-001 Procedure For Preserving Finalized Stack	Elogen	- N2, Ultra pure water, stack handling tools; '- Flange/valve/gasket/ bolting (4per stack) to isolate them; -Gasket and flange to block the flexibles on headers,	- FORES - Elogen (Stack Flanges)	Stacks to be isolated and to be filled up with ultra pure water	FORES
	OVIVO	SWL0000767	OVIVO	Permeate Sodium Bisulfite Glycerin Fittings and hoses	FORES	To drain the package To fill ROs up with the referred chemical mixture	FORES
	HPP	C63-TRA-001 Drainage and sealing of the process loops	Aquagas	N2	FORES	Drain and Flush with Nitrogen	FORES
	HVAC	C0063-FOR-SPE-CS-001	Elogen	IBCs for 4200l of glycol, hoses	FORES	Drain the system and store MPG40% is a temporary tanks	
	Rectifier/Transformer	C0063-FOR-SPE-CS-001 (C63-NID-ELO-REP00/01)	Nidec	Temporary fixings as per procedure	FORES	Minor actions on fixation	FORES
	General	C0063-FOR-SPE-CS-001	Fores	Wooden profiles and general seafasten materials	FORES	Preservation and seafastening operations	FORES
	General	C63-ELO-PRO-CO-0007	Elogen	Silica gel desiccant bags	FORES	Preservation / indoor / each shelter	FORES

Further details concerning the responsibility allocation for the Electrolyser are provided in the dedicated matrix below.

Item	Activity	Details of activity	Main consumable	By
1a	Package/OVIVO	To drain the package	N/A	Fores
1b	Package/OVIVO	To fill ROs up with the referred chemical mixture	200L permeate 2.33L Sodium Bisulfite 34L Glycerin 99%	Fores
2	Rectifier	Minor actions on fixation	To be checked by Fores	Fores
3	HPP	Drain and Flush with Nitrogen	N2 (Estimated Volume: flow at 1044L/h for 3 hours and 40 minutes) Estimated Pressure: Nitrogen line pressure	Fores
4	Process loops	Drain the electrolyser loop by loop, 600 & 620 (thanks to nitrogen inerting) and keep it pressurised at 3 barg	N2 *(Estimated Volume: 4m3/hr min for less than 8 hours on H2 side-11 m3/hr min for less than 8 hours on O2 side)* Estimated Pressure: 7 barg	Fores
5	Glycol loop	Drain the system and store MPG40% is a temporary tank	Temporary tank (MPG volume is 4200 L)	Fores
6	Stacks	Case 2: The stacks should be disconnected from the header/distributor lines from the four flanged connections on the stacks, Fill the stacks with ultra-pure water (conductivity < 0.1 µS/cm), then isolate them with the counter flanges provided by Elogen. 4. Remove flexible hoses and revert the header/distributor setup to the previous configuration without stacks in the loop (with temporary flexible hoses).	1. N2 (included in item 5) 2. Ultra pure water to fill up the stacks 3. The referred tools in the stack preservation document 4. Flange/valve/gasket/bolting (4per stack) to isolate them 5. Gasket and flange to block the flexibles on headers	Fores
7	General	Preservation and seafastening actions listed in 224J10-DDL-CON-SP-00001	Add materials please	Fores
8	General	Preservation / indoor / each shelter	Silica gel desiccant bags	Fores

8 ACTIVITY MANAGEMENT AND EVIDENCE TRACKING

Execution and control of all sea-fastening activities shall be supported by the Sea-Fastening Check-List provided in Annexe 1. The check-list is a living document: it is updated in real time by the preservation/sea fastening lead, thereby providing verifiable, date-stamped evidence of every task performed.

Check-list structure	Purpose & content
Sheet 1 – "Planning & Methods"	Defines the standard fastening/preservation methods to be applied to each equipment family. Includes a forward-looking schedule that links every task to a target date, workforce and discipline responsibility, enabling progress monitoring against the plan.
Sheet 2 – "Tag Register"	Lists all platform tags already maintained in PROVERLIS for Mechanical Completion (MC) and Commissioning (COMM). For each tag, it records whether sea-fastening and/or preservation is required, the actual completion status (Y/N), and any additional remarks or punch-list notes. Serves as the formal logbook that demonstrates compliance with vendor procedures and project specifications.

The annexed checklist will be updated at the following project milestones:

- Day-by-day execution – confirmation of work performed, anomalies, and photographic evidence reference.
- Sail-away readiness review – final sign-off by ROS and CW representatives, with the completed checklist filed.

All personnel involved in sea-fastening work must ensure that no activity is closed out until the corresponding entry in the checklist is fully updated and signed.

The checklist is a live document that is updated in real-time during activity execution.

9 ANNEXE 1: OFFSHORE INTERNAL SEA FASTENING CHECKLIST

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