Base Load Power Hub (BLPH)

Welding Consumables Management Procedure

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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.

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.

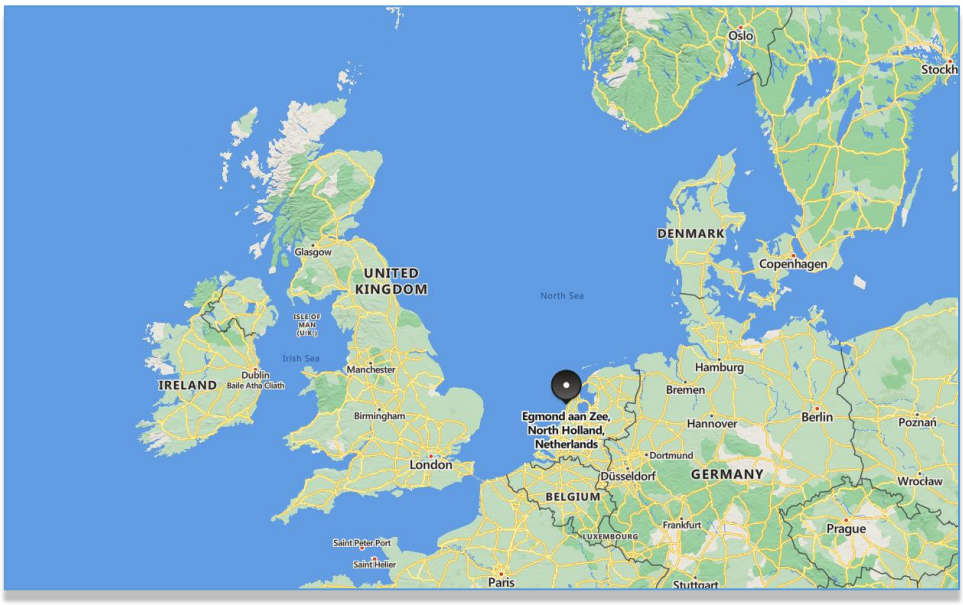


Figure 1 HOLLANDSE KUST NOORD WIND PARK Location Map

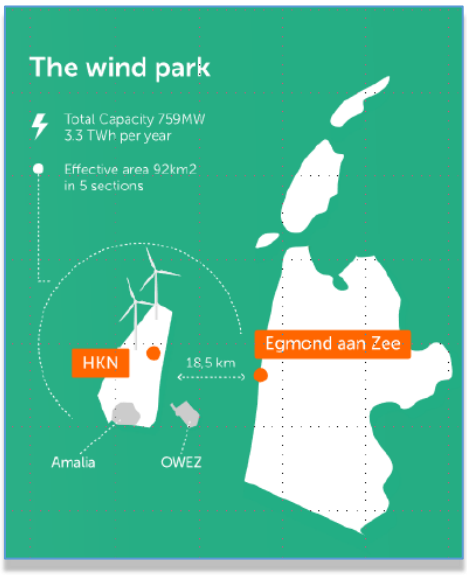


Figure 2 - Wind Park Details

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.

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.

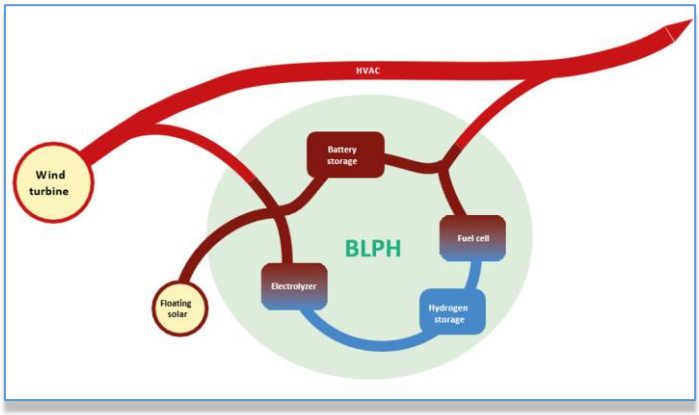


Figure 3 – BLPH Concept

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 scope of this procedure is to define all the operations and phases that occurs for handling and manage the filler metal welding consumables of Base Load Power Hub (BLPH).

3 REFERENCES

Doc. No.	Rev.	Date	Description - Title
K559-2254-MT-SPE-001	01	06/03/2023	Structural Fabrication Specification
EEMUA 158	Third ededition	2014	Construction Specification for Fixed Offshore Structures.
ISO 19902	Second edition	2020-11	Petroleum and Natural Gas Industries - Fixed Steel Offshore Structures.
ISO 19901-3	Dec-2014	Dec-2014	Petroleum and Natural Gas Industries - Specific Requirements for Offshore Structures - Topsides Structure.

Table 1 - Reference Documents

4 DEFINITIONS AND ABBREVIATIONS

COMPANY or Client (CPY):	Crosswind
CONTRACTOR (CTR):	ROSETTI MARINO S.p.A.
PROJECT:	HOLLANDSE KUST NOORD WIND PARK Project
CA	Certifying Authority
DP	Dye Penetrant
ITP	Inspection and Test Plan
MPI	Magnetic Particle Inspection
NDT	Non-Destructive Testing
QA	Quality Assurance
QC	Quality Control
RT	Radiographic Testing
UT	Ultrasonic Testing
WPQ	Welder Performance Qualification
WPQR (aka PQR)	Welding Procedure Qualification Record
WPS	Welding Procedure Specification
CJP	Complete Joint Penetration
PJP	Partial Joint Peneteration
FW	Fillet weld joint
WI	Welding Inspector
WS	Welding Supervisor
WT	Wall Thickness

Table 2 - Definitions and Abbreviations

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5 RESPONSIBILITIES AND TASKS

Storekeeper: He shall store welding materials in a suitable place, in accordance with this procedure.

Moreover, supported by the Welders Supervisor, he is in charge of distribution and transport of welding materials to dehydration ovens (when applicable).

Welding Engineer: He shall verify the conformity of documents relevant to welding materials.

Welders Supervisor: He shall verify that during the different phases, welding materials are handled in accordance with this procedure.

6 PROCEDURE

This procedure shall be applied only to welding materials as electrodes (vacuum pack), wire, flux and gas.

The operational procedure includes the following activities:

- Receiving,
- Storage and distribution of welding materials,
- Handling of welding materials

7 MATERIALS RECEIVING

The check of technical documents shall be performed by the Welding Department.

Materials with acceptable inspection results are released for fabrication.

The non-conforming material shall be moved to a separate area or clearly identified as “not to be used” material.

Each heat, lot of consumables shall be subject to inspection and approval by the Inspector. 3.1

Mill test certificates from consumables manufacturers showing test results actually obtained on the said lot shall be submitted to the Inspector.

All consumable batches (lots) used in production shall be tested (for SAW, all flux batches as well as wire batches are to be tested).

All the documents (including reports and records) shall be filed by the Welding Department and, upon demand, given to the Project Quality Manager (PQM) involved so as he can provide for filing then in final Project documentation.

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As far as welding gasses provided under form of cylinder packs are concerned, after the certification has been accepted by the Welding Engineer, the Welding Supervisor shall apply a sticker indicating the percentage of gasses mixture on the pack of cylinders.

It is acceptable that consumables are certified 2.2.

8 MATERIALS STORAGE

After having been received, the welding materials shall be stored in warehouses at ROSETTI workshop and containers at ROSETTI Yard (workshop), external workshop controlled by ROSETTI Yard subcontractors and temporary sites.
Premises shall be air-conditioned in order to obtain a temperature of minimum 20°C and a relative humidity ≤ 60%.
Electrodes, wire and flux shall be placed on shelves adequately identified to allow their correct identification.
The electrodes, flux and wires shall be stored with their original protective packing in such as way to avoid protective packing damage.

9 HANDLING OF WELDING MATERIAL

Welding materials relative to this procedure are the filler metal and fluxes to be used for the SAW and ESW processes; the SMAW low-hydrogen and vacuum-pack electrodes and FCAW wires

10 HANDLING OF FLUX IN STANDARD PACKAGES

Fluxes handling foresees the following activities:

Drying

If the fluxes are stored in accordance with par. 9 drying is not necessary.

The content of unprotected flux hoppers should be placed in a drying oven at a minimum temperature of 150 ± 25°C, after an 8 hours shift.

Maintenance

After drying, the flux not utilized for a period of 8 hours, shall be maintained at minimum 150 ± 25°C.

Re-drying

In case of opened bags, damaged plastic protective covers or storage in non-controlled areas for extended shifts and in severe conditions;

re-drying shall be performed at minimum 275°C as for Flux Supplier Recommendation, with a holding time of 2 hours.

Re-dried flux not immediately used should be stored at 150 ± 25°C.

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11 FLUX IN SEALED VACUUM PACK PACKAGES

Aluminium lined BigBags" FLUXES with an integral wrapping may be used without undergoing the drying treatment provided what follows is taken into consideration.

1. Check if protective foil still sound and sealed;
2. 8 hours as a maximum shall elapse after the first opening of the package;
3. flux not utilized shall be maintained at 150 ± 25°C;

In case of opened bags, damaged plastic protective covers or storage in non-controlled areas; re-drying shall be performed

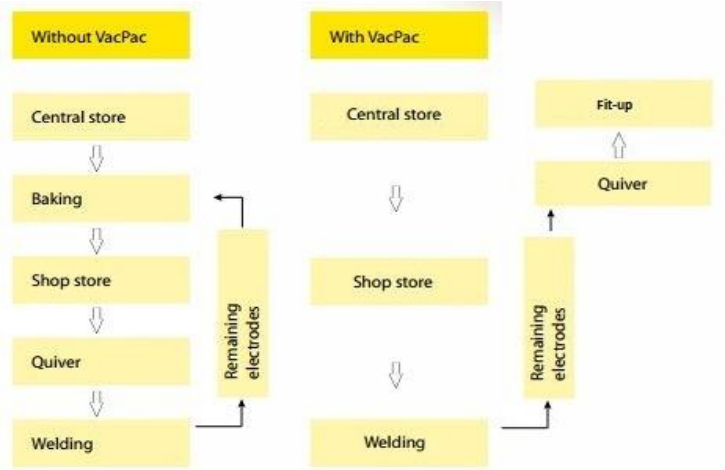
12 ELECTRODES HANDLING

After receiving, electrodes shall be stored in the warehouse (workshop) or in containers (yard and/or temporary sites).
Premises shall be air-conditioned as indicated at paragraph 8
Electrodes shall be placed on shelves adequately identified (kind of electrode, diameter, project n°, etc..) to allow their correct identification.
Materials are distributed by the Storekeeper according to the Welding Supervisor instructions and they are recorded on a withdrawal coupon.

12.1 HANDLING OF VACUUM PACK ELECTRODES

Vacuum pack" electrodes (low-hydrogen electrodes with guarantee a maximum of 5ml hydrogen/100 grams of weld metal) with an integral wrapping may be used without undergoing the drying treatment provided what follows is taken into consideration.

1. Check if protective foil still contains a vacuum;
2. Make sure to warm up to at least the ambient temperature before opening the package;
3. On opening the packaging the date, time and welder id shall be indicated on it;
4. One electrode at a time shall be withdrawn and the packaging shall be always closed again;
5. 10 hours as a maximum shall elapse after the first opening of the package. Electrodes which are not used during 11 hours (work shift) are introduced in a maintenance furnace or quiver at 80 ÷ 120°C and used for tack-weld only.



12.2 HANDLING OF SAW, GTAW & FCAW WIRES

To avoid condensation, wire will be kept in the original packaging and the wire will be kept as per paragraph 8, until its withdrawal for use.
The filler metal package will be warmed up to at least the ambient temperature before its opening.
In the case of contamination from hydrogen-containing substances, such as oil, grease, corrosives or from substances that could absorb moisture, the wires will be scrapped.
During workshop production stoppages of more than 24 hours; SAW, GTAW and FCAW wires at the welding site shall be taken back to the store-room and kept as per paragraph 8
the wire is kept in its original unopened packaging, in a climate of ≥ 20°C, with less than 60% relative humidity, its shelf life will be treated as unlimited, however, it will be employed into production, on a basis of first arrived, first to be used after soundness verification against rust and other hydrogen-containing substances like oil, grease etc..

12.3 DISTRIBUTION AT WORKSHOP AND ALL OTHER SITES

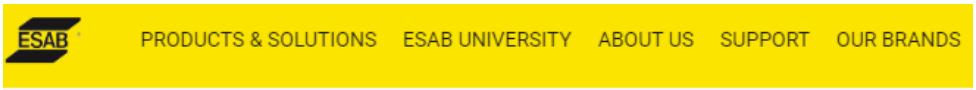
At the beginning of every shift and on the basis of the applicable welding procedure specifications, materials are distributed by the Storekeeper following the Welders Foreman instructions and they are recorded on a withdrawal coupon.

12.4 SUB-CONTRACTORS AT ROSETTI YARD OR TEMPORARY SITES

Welding materials which shall be used at the Company's yard or external sites shall be clearly identified and entirely packed.
Any open or untied packages shall be destroyed.
On introduction into the yard, welding materials shall have the Supplier's certification (as per paragraph 8).

ANNEX: FLUX DATASHEET AND SUPPLIER RECOMMENDATIONS

https://esab.com/us/nam_en/esab-university/blogs/handling-and-storage-of-welding-fluxes/



Handling and Storage of Welding Fluxes

Cutting Automation | PPE & Safety | Welding

Managing Your Welding Fluxes Effectively

By carefully selecting raw materials and optimizing manufacturing conditions the Exaton fluxes have guaranteed as-delivered moisture content from the factory.

Normally, the fluxes are delivered in steel drums, each containing 25 kg (55 lbs). Each pallet has a net weight of 500–1000 kg (1100–2200 lbs) and is shrink-wrapped in plastic or packed in wooden crates before delivery from the factory.

To maintain the as-delivered moisture content, as long as possible, the handling and storage of the flux must be done according to the following requirements.



Storage

Unopened flux drums must be kept under properly maintained storage conditions as follows:

- Temperature: 20 ± 10°C.
- Relative humidity: as low as possible, not exceeding 70%.
- Flux stored according to these conditions has a lifetime of max 5 years.
- The content of unprotected flux hoppers must, after an 8 hours shift, be placed in a drying cabinet or heated flux hopper at a temperature of 150 ± 25°C.
- The remaining flux from opened drums must also be placed at a temperature of 150 ± 25°C.

Recycling

- Moisture and oil must, in a suitable way, be removed from the compressed air used in the recirculation system.
- The addition of new flux must be done with the proportion of at least one part new flux to three parts recycled flux.
- Foreign material such as mill scale, dross, etc., should be removed by suitable sieving.

Rebaking

When handled and stored as above, the Exaton fluxes can normally be used as they are. If, however, a severe application is considered, as given by the material specification, rebaking of flux is recommended.

Furthermore, if flux, due to unfavorable handling or storage, has picked up moisture, rebaking can return the flux to its original state.

Rebaking shall be performed as follows:

- 350 ± 25°C for a minimum of 4 hours.
- Rebaking must be done on shallow plates with a flux height not exceeding 50 mm.
- Rebaked flux, not immediately used, must be kept at 150 ± 25°C before use.

ACCIAIO AL CARBONIO

ARCO SOMMERSO

ESAB

OK Flux 10.62

Flusso agglomerato ad elevato grado di basicit , completamente minerale, che non trasferisce elementi di lega nel deposito. L analisi chimica che si ottiene ? indipendente dai parametri di saldatura utilizzati e pu essere perci completamente controllata attraverso una opportuna scelta del filo di saldatura. Idoneo per saldature in multipass di grossi spessori sia a filo singolo che con pi fili. L OK 10.62 ? consigliato per saldature testa a testa a passate multiple di acciai al carbonio a media/elevata resistenza, acciai basso legati, con valori di tenacit sino a -60°C. Sopporta elevate correnti di saldatura sia in AC che DC. Particolarmente adatto per cianfrini narrow-gap in funzione dell eccellente distacco della scoria e del favorevole raccordo dei cordoni di saldatura con le pareti del cianfrino. Testato CTOD con diversi fili di saldatura trova il suo impiego ottimale nei segmenti caldareria e strutture offshore. L OK Flux 10.62 consente di ottenere depositi con bassi valori di ossigeno (300 ppm) e di idrogeno diffusibile (inferiori a 5 ml/100 g).

Specifiche	
Classificazioni	EN ISO 14174 : S A FB 1 55 AC H5 EN ISO 14174 : S A FB 1 55 AC H4 only BlockPac/moisture-protection
Omologazioni	CE : EN 13479 DB : 51.039.07 NAKS/HAKC : RD 03-613-03

Idrogeno diffusibile	max 5 ml H/100g weld metal (Redried flux); max 4 ml H/100g in BlockPac (moisture protection)
Tipo di scoria	Fluoride-basic
Trasferimento lega	No Silicon or Manganese alloying
Densit	nom: 1.1 kg/dm3
Indice di basicit	nom: 3.2
Dimensioni grano	0.2-1.6 mm (10x65 mesh)

Consumo di Flusso		
Volt	kg flusso/ kg filo DC+	kg flusso/ kg filo AC
34 V	1.3 kg	1.2 kg
30 V	1.0 kg	0.9 kg
26 V	0.7 kg	0.6 kg
38 V	1.6 kg	1.4 kg

Dimensioni	Amp	Velocit di avanzamento
Ø 4.0 mm	580 A	55 cm/min

Classificazioni				
filo	SFA/AWS - EN ISO	EN-come saldato	AWS-come saldato	AWS-Trattamento termico post saldatura
ESAB SA10K	A5.17:EH10K		A5.17: F7A6-EH10K	A5.17: F7P8-EH10K
OK Autrod 12.22	A5.17:EM12K/ 14171-A: S2Si	14171-A: S 38 5 FB S2Si	A5.17: F7A8-EM12K	A5.17: F6P8-EM12K
OK Autrod 12.24	A5.23:EA2/ 14171-A:S2Mo; 24598-A:S S Mo	14171-A: S 46 4 FB S2Mo	A5.23: F8A6-EA2-A2	A5.23: F8P6-EA2-A2
OK Autrod 12.24L	A5.23:EA2/ 14171-B: SU2M3		A5.23: F8A4-EA2-A2	A5.23: F8P4-EA2-A2
OK Autrod 12.32	A5.17:EH12K/ 14171-A: S3Si	14171-A: S 46 6 FB S3Si	A5.17: F7A8-EH12K	A5.17: F7P8-EH12K
OK Autrod 12.33L	A5.23:EA3K		A5.23: F10A4-EA3K-G	A5.23: F9P4-EA3K-G
OK Autrod 12.34	A5.23:EA4/ 14171-A:S3Mo; 24598-A:S S MnMo	14171-A: S 50 4 FB S3Mo	A5.23: F8A6-EA4-A4	A5.23: F8P6-EA4-A4
OK Autrod 12.40	A5.17:EH14/ 14171-A:S4	14171-A: S 50 4 FB S4	A5.17: F7A6-EH14	A5.17: F7P6-EH14
OK Autrod 12.40L	A5.17:EH14/ 14171-B:SU41		A5.17: F7A6-EH14	A5.17: F7P6-EH14
OK Autrod 12.40L India	A5.17:EH14		A5.17: F7A6-EH14	A5.17: F7P6-EH14