Base Load Power Hub (BLPH)

DATA SHEETS - HV CABLE

Document Number: 1724002000-EL-DS-00003

Document Class: Class 3

ROSETTI MARINO

1	NO COMMENTS - APPROVED - WORK MAY PROCEED
2	MINOR COMMENTS - REVISE AND RESUBMIT - WORK MAY PROCEED
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Sign	Date
Andrea Fadoschi	17/12/2024

Rev.	Date	Description	Prepared	Reviewed	Approved
02	17/12/2024	Issue for Information (IFI)	T. Papadimitriou	P. Maniatis	G. Keser
01	19/11/2024	Issue for Information (IFI)	T. Papadimitriou	P. Maniatis	G. Keser
00	04/11/2024	Issue for Information (IFI)	T. Papadimitriou	P. Maniatis	G. Keser

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Revision / Change Log

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

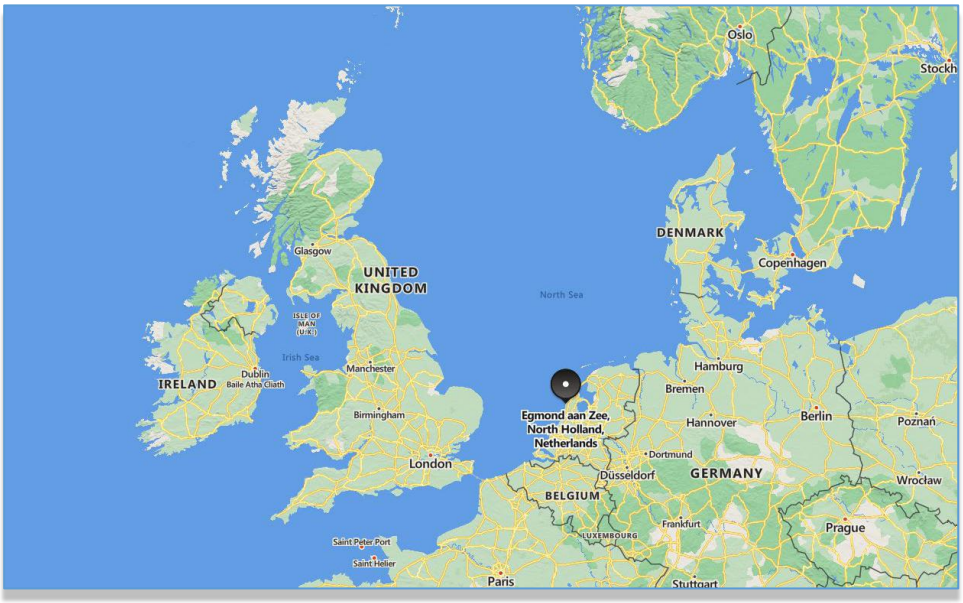


Figure 1 HOLLANDSE KUST NOORD WIND PARK Location Map



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.

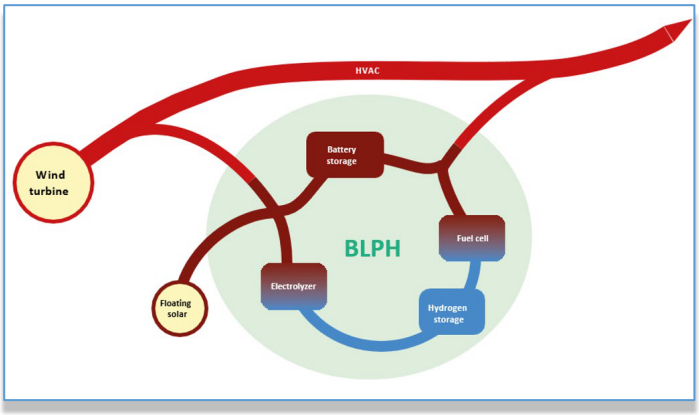


Figure 3 – BLPH Concept

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

Providing the technical specifications of the cables to determine the dimensions and properties so the cable accessories and interface components can be adapted to this and compatibility be verified. The document also references to applied standards and (Employer) requirements.

2.1 REFERENCES

Doc. No.	Description
IEC 60840	Power Cables with Extruded Insulation and their Accessories for Rated Voltages above 30 kV (Um= 36 kV) up to 150 kV (Um = 170 kV) – Test Methods and requirements
IEC 60228	Conductors of Insulated Cables

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

Table 2 - Definitions and Abbreviations

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3 HV CABLE DATA SHEET

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Power cable >= 1 kV, for permanent installation

Cu/XLPE/CWS/LAT/LSZH 36/66 kV

Article number: 58239 03-07-2024

Description

1 x 240 / 50



* This image may differ from the actual product.

Trading information

Product group	Power cable >= 1 kV, for permanent installation
Type	Cu/XLPE/CWS/LAT/LSZH 36/66 kV
Net. Weight	4.11 kg/m
Sheath marking	{Length} TKF - Cu/XLPE/CWS/LAT/LSZH 36/66 kV 1 x 240/50 IEC 60840 - {Year} {Batch}

Trade lengths

	Minimal order
(58239 / 8713182481131)	1 MTR

Construction characteristics

Standardization	IEC 60840
Number of cores	1
Nominal cross section conductor	240 mm²
Conductor material	Copper
Conductor surface	Bare

Power cable >= 1 kV, for permanent installation

Cu/XLPE/CWS/LAT/LSZH 36/66 kV

Article number: 58239 03-07-2024

Construction characteristics

Standardization conductor material	IEC 60228
Shape of conductor	Round
Conductor category	Class 2c = stranded & compacted
Conductor shield	Semiconductive Compound
Material core insulation	XLPE++
Insulation shield	Semiconductive compound with semiconductive swellable tape
Earthscreen construction	Copper round wire + copper tape counter spiral
Nominal earthscreen cross section	50 mm²
Material outer sheath	LSZH
Colour outer sheath	Black
Diameter conductor	18.6 mm
Insulation thickness	9.5 mm
Diameter over insulation	39.2 mm
Aluminium sheath thickness	0.2 mm
Diameter shield wires	1.15 mm
Diameter over shield	41.7 mm
Outer sheath thickness	2.5 mm
Outer diameter approx.	48.1 mm

Power cable >= 1 kV, for permanent installation

Cu/XLPE/CWS/LAT/LSZH 36/66 kV

Article number: 58239 03-07-2024

Properties

Flame retardant	IEC 60332-3-24 Cat. C
Halogen free	IEC 60754-1 / IEC 60754-2
Low smoke	IEC 61034-1 & IEC 61034-2
Longitudinal water blocking	Yes
Radial water blocking	Yes
Radial watertight construction	Al/PE
UV resistant	Yes
UV protection	NEN EN 50289-4-17A

Technical characteristics

Min. bending radius during installation	870 mm
Min. bending radius after installation	755 mm
Tensile force with pullinghead	12,000 N
Tensile force with pullingsleeve	4,620 N
Max. conductor temperature	90 °C
Max. operating temperature	70 °C
Minimum installation temperature	-10 °C

Electrical characteristics

Nominal voltage U0	36 kV
Nominal voltage U	60 kV
Nominal voltage Umax	72.5 kV
Conductor DC resistance @ 20°C	0.0754 Ohm/km
Conductor AC resistance @ max. cont. Conductor temp.	0.0973 Ohm/km
Shield DC resistance	0.387 Ohm/km

Subject to technical modifications | No rights can be derived from this information

Power cable >= 1 kV, for permanent installation

Cu/XLPE/CWS/LAT/LSZH 36/66 kV

Article number: 58239 03-07-2024

Electrical characteristics

Mutual capacitance (Nominal)	0.21 µF/km
Max. thermal short-circuit current conductor 0,5 sec	48.5 kA
Max. thermal short-circuit current conductor 1 sec	34.3 kA
Max. short-circuit temperature conductor	250 °C
Max. thermal short-circuit current shield 0,5 sec	10.51 kA
Max. thermal short-circuit current shield 1 sec	7.43 kA
Max. short-circuit temperature shield	250 °C
E-Max fieldstrength	5.38 kV/mm
E-Min fieldstrength	2.77 kV/mm
Charging current per core	2.373 A/km
Frequency	50 Hz
Operating reactance trefoil arrangement	0.12 Ohm/km
Operating reactance flat arrangement	0.18 Ohm/km
*) Theoretical calculated values	Depends on application
Maximum current buried trefoil arrangement	455 A
Maximum current buried flat arrangement	455 A
Maximum current in air trefoil arrangement	630 A
Maximum current in air flat arrangement	730 A
Homopolar resistance Ro (trefoil) *)	2.1899 Ohm/km
Homopolar resistance Ro (flat) *)	2.1894 Ohm/km
Homopolar reactance Xo (trefoil) *)	0.3877 Ohm/km
Homopolar reactance Xo (flat) *)	0.6233 Ohm/km
Homopolar impedance Zo (trefoil) *)	2.2239 Ohm/km
Homopolar impedance Zo (flat) *)	2.2764 Ohm/km