Base Load Power Hub (BLPH)

FUGITIVE TEST 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.

1.2 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.

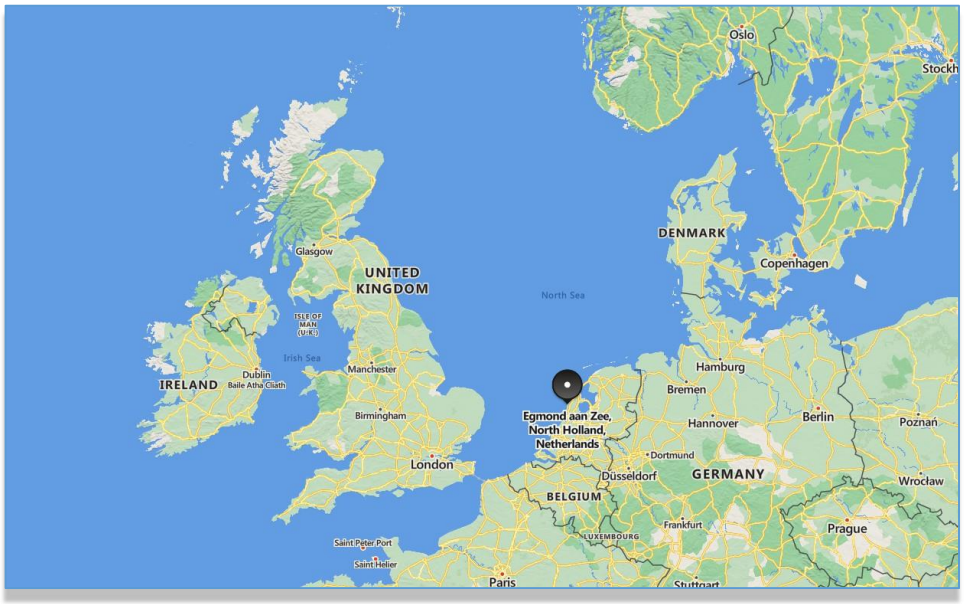


Figure 1 HOLLANDSE KUST NOORD WIND PARK Location Map

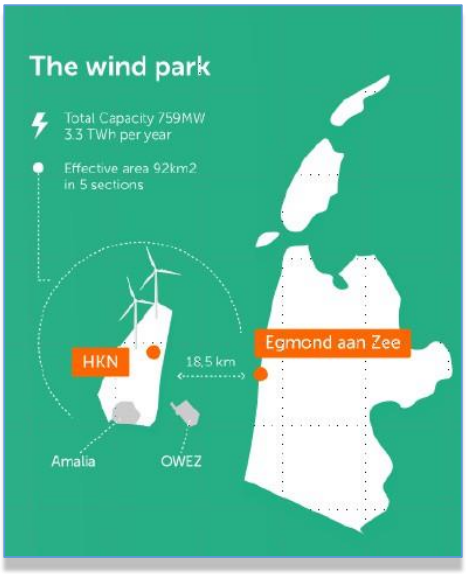


Figure 2 - Wind Park Details

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.

1.3 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.

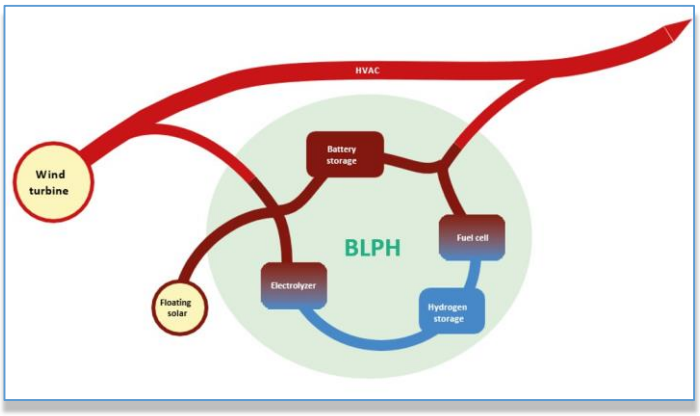


Figure 3 – BLPH Concept

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

This document includes FET TEST PROCEDURE

2.1 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

FET-2

PRODUCTION VALVES

THESE INSTRUCTIONS BELONG TO INDRA S.R.L.
ANY DISCLOSURE, REPRODUCTION OR TRANSFER OF ANY THIRD-PARTY CONTENTS MUST BE AUTHORISED BY THIS COMPANY.

Revision: 0	Drawn up	Checked	Approved
Date	19/07/2024	19/07/2024	19/07/2024
Signature	C.Poni	M.Minora	A.Giunta

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1. INTRODUCTION

The objective of this document is to define the procedure on how to carry out the production test correctly.

This procedure complies with the requirements of ISO 15848-2

2. SCOPE

This document specifies testing procedures for evaluation of external leakage of valve stems and body joints.

3. NORMATIVE REFERENCES

ISO 15848-1:2015, *Industrial valves — Measurement, test and qualification procedures for fugitive emissions — Part 1: Classification system and qualification procedures for type testing of valves*

ISO 15848-2:2015, *Industrial valves — Measurement, test and qualification procedures for fugitive emissions — Part 2: Production acceptance test of valves*

4. PREPARING THE VALVE

4.1 Selecting the valve

- Only a fully assembled valve must be used for the test.

- At least one valve per batch, randomly selected from each production batch, must be tested for each valve type, pressure class and nominal size.

4.2 Preparation

Before carrying out the test, the valves must fulfil the following conditions:

a) The valve design must have been successfully tested according to ISO 15848-1.
b) The valves selected must have been successfully tested in line with the applicable production procedures and/or standards and/or customer specifications.
c) The inside of the valve must be dry and free from lubricant.
d) The valve and test equipment must be clean and free from water, oil and/or dust.
e) No protective coating must have been applied to the test valve.
f) The valves to be tested shall be set up in an area protected from draughts.

4.3 Adjusting the stem seal

The initial compression of the stem seals must be adjusted as set out in the production procedures.

5. SAFETY REQUIREMENTS DURING TESTING

High pressure levels of the test fluid combined with high temperatures require operators to apply appropriate safety measures when carrying out tests and measurements.

6. TEST CONDITIONS

6.1 Test fluid

The test fluid must be helium gas with a minimum purity of 97% by volume.

6.2 Test pressure

The test pressure must be 6 bar (1 bar = 0.1 MPa = 10^5 Pa) unless otherwise agreed.

6.3 Test temperature

The test must be performed at room temperature as specified in ISO 15848-1.

** Room temperature: in the range of -29 °C to +40 °C (ISO 15848-1)*

6.4 Measuring the leak

Leaks must be measured using the sniffing method in compliance with ISO 15848-1: 2015 (Annex B) and values must be expressed in ppmv.

The sniffing method (with a measuring probe as shown in figure 1) enables the measurement of leakage from both the stem and body seals.

Leak Detector: Pfeiffer Vacuum ASM 340

Prober: Pfeiffer Vacuum Standard Sniffer Probe

1. Valve stem
2. Sniffers

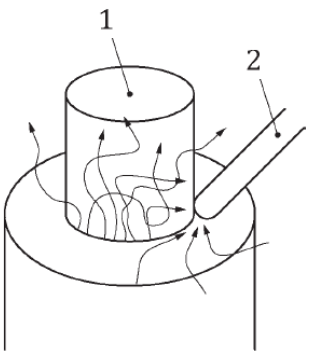


Figure 1

Sequence of operations for correctly measuring the leak:

a) Start the helium mass spectrometer as per manufacturer's instructions and wait until it has heated up.
b) Initial calibration of the leak detector shall be performed with an auto-calibration mode that use the certified internal calibrated leak. Only if requested, initial calibration shall be performed with the certified external calibrated leak.
c) Measure the ambient helium concentration.
Before each measurement, the ambient helium concentration around the source must be 5 ppmv ±0.3
The probe must be placed at 1 or 2 m from the source.
d) During the measurement, the probe must be placed as close as possible to the potential leakage point, which should never be more than 3 mm away.
e) Move the probe along the entire perimeter of the joint while observing the measured value given by the instrument. Adjust the speed with which the perimeter is scanned based on the instrument's response time.
f) If a higher leakage value is observed during the measurement, scan the perimeter where the leak is located more slowly until you find the point where the maximum leakage value is detected.
g) Record the maximum leakage value measured.
h) The different between this value and the ambient helium concentration value (measured as indicated in point b) determines the actual leakage value of the valve.

7. TEST PROCEDURE AND EVALUATION OF RESULTS

7.1 Measuring leaks from the stem seal

The procedure for measuring leaks from stem seals is as follows:

a) Half open the valve and pressurise it to the pressure value given in section 6.2. After the test pressure has stabilised, measure the leak using the method described in section 6.4.
b) Fully open and close the valve 5 times while keeping it under pressure.
c) Half open the valve and measure the stem seal leak again using the method described in section 6.4.
d) If the value measured is higher than the values given in Table 1 (for the relevant Class), the test has failed. In this case, the entire batch of valves must be rejected, and corrective actions must be taken.

Table 1

Class	Leak measured (ppmv)
A	≤50
B	≤100
C	≤200

7.2 Measuring leaks from the body seal

The procedure for measuring leaks from the body seal is as follows:

a) Half open the valve and pressurise it to the pressure value given in section 6.2. After the test pressure has stabilised, measure the leak using the method described in section 6.4.
b) If the value measured is higher than the values given in Table 2, the test has failed. In this case, the entire batch of valves must be rejected, and corrective actions must be taken.

Table 2

Leak Measured (ppmv)
≤50

8. TEST REPORT

VALVES & CONTROLS ITALY	*FUGITIVE EMISSION PRODUCTION TEST (ISO 15848-2)* *TEST REPORT* *- INDRA VALVES -*	MD-02-20-IT-UK-FE Rev. 0 Data: 10/10/2019

Nr. Certificato / *Certificate No.* _____ **Data** / *Date :* _____ *Rev. 0*

Cliente / *Customer :* _____

Ordine Nr. / *Order Nr.* _____ **Data** / *Date :* _____

Ns. commessa Nr. / *Our job Nr.* _____ **Data** / *Date :* _____

Ns. D.D.T. Nr. / *Our advise note Nr.* _____ **Data** / *Date :* _____

CONDIZIONI DI PROVA / TEST CONDITIONS

TEST (according to ISO 15848-2)	TEMPERATURA DI PROVA (Test Temperature)	CLASSE DI PERDITA (Tightness class)	MAX. PERDITA AMMISSIBILE (ISO 15848-2) (Max allowable leakage)	FLUIDO DI PROVA (Test Fluid)	PRESSIONE DI PROVA (Test Pressure)	RUMORE DI FONDO (Backgrund noise)	ENDURANCE CLASS	MANOMETRO N° (Gauge ID)	DATA SCADENZA (Due Date)
Body / Closure seal	25° C	B	≤ 50 ppmv	Elium >97%	6 bar	4,7 ppmv	5 cycles	118735	23/10/2024
Body / Body bonnet seal			≤ 50 ppmv						
Stem seal			≤ 100 ppmv						
Gland Plate / Trunnion seal			≤ 50 ppmv						

INDRA POS. (ITEM)	CUSTOMER POS. (ITEM)	CODICE INDRA (INDRA CODE)	MODELLO INDRA / NR. DI SERIE (INDRA MODEL / SERIAL NUMBER)	CODICE CLIENTE (CUSTOMER CODE)	QTA' (QTY) PRODUCED	QTA' (QTY) TESTED	VALVE TYPE	NPS	FLANGE TYPE	RATING		Ball valve: Body / Closure seal Leak detected (ppmv)	Ball valve: Stem seal Leak detected (ppmv)	Ball valve: Trunnion seal Leak detected (ppmv)	Ball valve: Gland Plate seal Leak detected (ppmv)	Needle valve: Stem seal Leak detected (ppmv)	Needle valve: Body bonnet seal Leak detected (ppmv)
											Value before cycles						
											Value after 5 cycles						
											Value before cycles						
											Value after 5 cycles						
											Value before cycles						
											Value after 5 cycles						
											Value before cycles						
											Value after 5 cycles						
											Value before cycles						
											Value after 5 cycles						

TEST RESULT: ▫ **SATISFACTORY** ▫ **NOT SATISFACTORY**

Ispettore / Inspector — *Si / Yes* ▫ *No / No* ▫

Strumentazione *(Equipment)* :
- Spettrometro di massa *(Mass Spectrometer)* : PFEIFFER VACUUM ASM 340 (SN.: HLD1901233)
  Minima perdita rilevabile *(Min. leak detectable)* : 5x10E-09 mbar*l/s (sniffing mode)
- Valore nominale fuga calibrata *(Calibrated leak nominal value)* : 6x10E-06 mbar*l/s (SN.: 40116306)

Nominativo / Name — *Timbro e Firma / Stamp and Signature*

Data / Date

PROCEDURA DI TEST
(Test procedure)
PFET

COLLAUDATO DA: TESTED BY:	DATA / DATE: 12/03/2014	APPROVATO DA: APPROVED BY: **P. FAGNANI**	DATA / DATE: 12/03/2014