Base Load Power Hub (BLPH)

Visual Examination Procedure – Piping

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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.

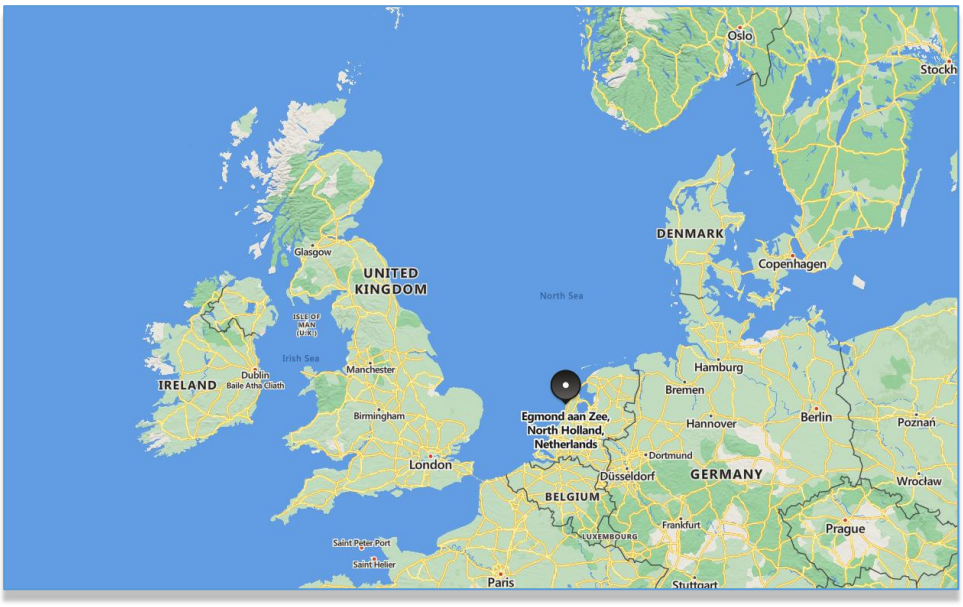


Figure 1 HOLLANDSE KUST NOORD WIND PARK Location Map

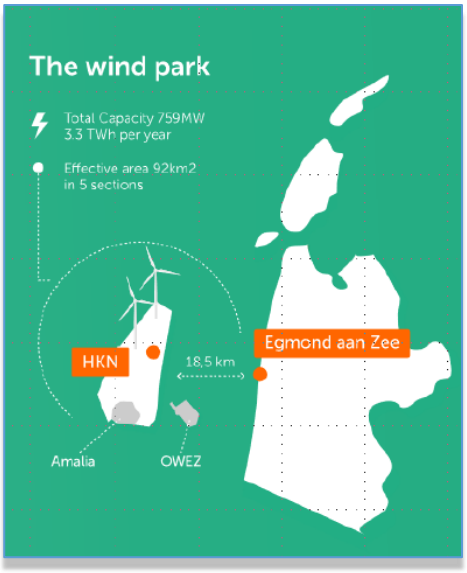


Figure 2 - Wind Park Details

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.

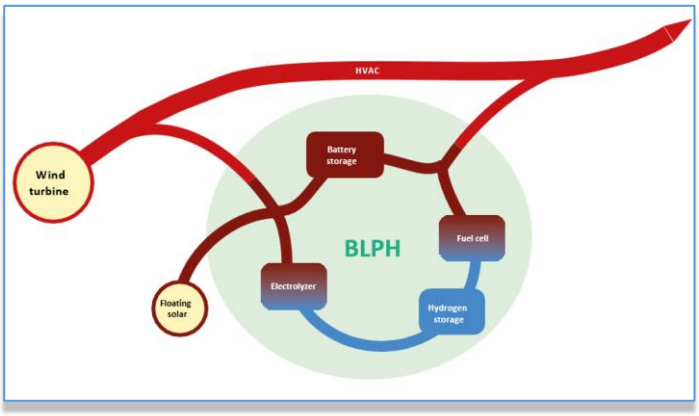


Figure 3 – BLPH Concept

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.

2 DOCUMENT SCOPE

The purpose of this procedure is to define the methods to be applied for the performance of direct visual examination during cutting, assembling and welding of piping components in accordance with the applicable documents and valid for Rosetti Marino and sub-contractor.

All welds shall be subject to 100% visual examination.

2.1 REFERENCES DOCUMENTS (Latest edition applicable)

Doc. No.	Description
123A90-DDL-PP-SP-70029_2	TSS-Piping materials narrative
ASME V Art.9	Asme Boiler and Pressure Vessel Code – Nondestructive Examination
ASME B31.3	Process Piping
ISO 9712	Non-destructive testing – Qualification and certification of NDT personnel
CSWIP	International certification welding inspector

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
NDT:	Non Destructive test
VT	Visual test

Table 2 - Definitions and Abbreviations

3 PERSONNEL QUALIFICATION

The technician that carries out visual examinations and evaluates the results shall be qualified as a level 2 in the VT method in accordance with the requirements of ISO9712 or CSWIP in the relevant product sector.

Personnel shall have valid a near vision acuity test which permits reading, a minimum of Times Roman N°4.5 or equivalent letters Jaeger 1 at not less than 30 cm with one or both eyes, either corrected or uncorrected.

Colour vision shall be sufficient that the candidate can distinguish contrast between the colours used in NDT method.

4 SURFACE PREPARATION

The surface to be examined shall be sufficiently lighted by natural or artificial light (a minimum light intensity of 1076 lx is required on the surface to be examined.

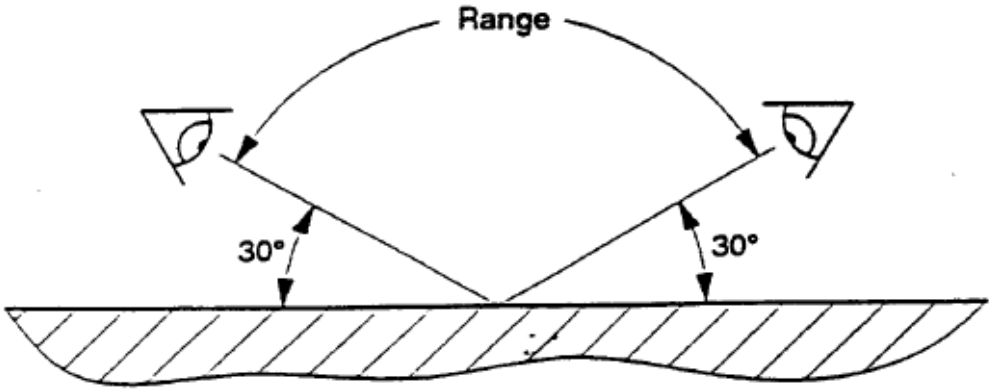
Examination shall be performed using a direct viewing at a distance of 600 mm from the surface and the viewing angle shall be minimum 30° in conditions of adequate visibility of parts to be examined; in case of limited access the remote viewing by inspection mirrors can be used.

Magnifying lenses can be used for the examination of questionable areas or when a more accurate inspection is needed.

The surface and the adjacent area to be examined shall be clean and free of all dirt, grease, paint, spatter, heavy oxidation, etc., that may interfere with the examination.

The weld shall be prepared by grinding if necessary, to assure that the examination shall be performed properly and that the surface condition of the weld is not causing misleading interpretations of the results.

NDE shall be performed prior to application of linings and coatings.



5 EXAMINATION

Visual examination shall be performed during the following operations:

- after cutting and beveling parts to be welded
- after fit-up
- Following back-gouging, before the commencement of second-side welding
- after welding
- After performing remedial grinding works

6 VISUAL EXAMINATION ON BEVEL

For visual examination of bevel ends, the following shall be verified:

- all surfaces shall be clean and free from paint, oil, scale, rust and any other deleterious foreign material prior to welding. Degreasing shall be applied where applicable.
- base materials shall be cleaned to a distance of 25mm from the fusion face
- bevels are in accordance with applicable Welding Procedure Specification (WPS) and applicable shop drawing.

7 VISUAL EXAMINATION ON FIT-UP AND DURING WELDING

For visual examination of fit-up, the following shall be verified:

- root face and root opening of the joint are in accordance with Welding Specifications and applicable shop drawing
- Tack welds are removed prior to final welding.
- Fit-up and internal alignment prior to welding
- Welding position, welding products and all other parameters defined in the applicable welding procedures
- Slag removal and weld condition between passes

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8 VISUAL EXAMINATION ON WELD

During visual examination of welds, the following shall be verified:

- complete removal of all extraneous material resulting from the use of temporary alignments near the joint
- possible arc strikes
- possible surface defects such as visible cracks, craters, undercut
- profile of the weld face and the height of any excess weld metal meet the requirements of the acceptance standard.
- weld reinforcement.

9 EXAMINATION OF REPAIRS PERFORMED BY GRINDING

During visual examination done after repairs on base meterial performed by grinding, it is necessary to verify that defects have been removed and that the area concerned has the minimum acceptable thickness.

10 ACCEPTANCE CRITERIA

The acceptance criteria shall be in accordance with ASME B31.3 Table 341..3.2

Criteria (A to M) for Types of Welds and for Service Conditions [Note (1)]										Weld Imperfection	Examination Methods	
Normal and Category M Fluid Service			Severe Cyclic Conditions			Category D Fluid Service						
Girth, Miter Groove, and Branch Connection Welds [Note (2)]	Longitudinal Groove Weld [Note (3)]	Fillet Weld [Note (4)]	Girth, Miter Groove, and Branch Connection Welds [Note (2)]	Longitudinal Groove Weld [Note (3)]	Fillet Weld [Note (4)]	Girth and Miter Groove Welds	Longitudinal Groove Weld [Note (3)]	Fillet Weld [Note (4)]	Branch Connection Weld [Note (2)]		Visual	Radiography
A	A	A	A	A	A	A	A	A	A	Crack	✓	✓
A	A	A	A	A	A	C	A	N/A	A	Lack of fusion	✓	✓
B	A	N/A	A	A	N/A	C	A	N/A	B	Incomplete penetration	✓	✓
E	E	N/A	D	D	N/A	N/A	N/A	N/A	N/A	Rounded Indications	...	✓
G	G	N/A	F	F	N/A	N/A	N/A	N/A	N/A	Linear indications	...	✓
H	A	H	A	A	A	I	A	H	H	Undercutting	✓	✓
A	A	A	A	A	A	A	A	A	A	Surface porosity or exposed slag inclusion [Note (5)]	✓	...
N/A	N/A	N/A	J	J	J	N/A	N/A	N/A	N/A	Surface finish	✓	...
K	K	N/A	K	K	N/A	K	K	N/A	K	Concave surface, concave root, or burn-through	✓	✓
L	L	L	L	L	L	M	M	M	M	Weld reinforcement or internal protrusion	✓	...

GENERAL NOTES:
(a) Weld imperfections are evaluated by one or more of the types of examination methods given, as specified in paras. 341.4.1, 341.4.2, 341.4.3, and M341.4, or by the engineering design.
(b) "N/A" indicates the Code does not establish acceptance criteria or does not require evaluation of this kind of imperfection for this type of weld.
(c) Check (✓) indicates examination method generally used for evaluating this kind of weld imperfection.
(d) Ellipsis (...) indicates examination method not generally used for evaluating this kind of weld imperfection.

NOTES:
(1) Criteria given are for required examination. More-stringent criteria may be specified in the engineering design. See also paras. 341.5 and 341.5.3.
(2) Branch connection weld includes pressure containing welds in branches and fabricated laps.
(3) Longitudinal groove weld includes straight and spiral (helical) seam. Criteria are not intended to apply to welds made in accordance with a standard listed in Table A-1, Table A-1M, or Table 326.1. Alternative Leak Test requires examination of these welds; see para. 345.9.
(4) Fillet weld includes socket and seal welds, and attachment welds for slip-on flanges, branch reinforcement, and supports.
(5) These imperfections are evaluated only for welds ≤5 mm ($^{5}/_{16}$ in.) in nominal thickness.

Criterion		
Symbol	Measure	Acceptable Value Limits [Note (1)]
A	Extent of imperfection	Zero (no evident imperfection)
B	Cumulative length of incomplete penetration	≤38 mm (1.5 in.) in any 150 mm (6 in.) weld length or 25% of total weld length, whichever is less
C	Cumulative length of lack of fusion and incomplete penetration	≤38 mm (1.5 in.) in any 150 mm (6 in.) weld length or 25% of total weld length, whichever is less
D	Size and distribution of rounded indications	See ASME BPVC, Section VIII, Division 1, Appendix 4 [Note (2)]
E	Size and distribution of rounded indications	For $T_w \le 6$ mm (¼ in.), limit is same as D [Note (2)] For $T_w > 6$ mm (¼ in.), limit is 1.5 × D [Note (2)]
F	Linear indications	
	Individual length	$\le T_w/3$
	Individual width	≤2.5 mm (3/32 in.) and $\le T_w/3$
	Cumulative length	$\le T_w$ in any 12 T_w weld length [Note (2)]
G	Linear indications	
	Individual length	$\le 2T_w$
	Individual width	≤3 mm (⅛ in.) and $\le T_w/2$
	Cumulative length	$\le 4T_w$ in any 150 mm (6 in.) weld length [Note (2)]
H	Depth of undercut	≤1 mm (1/32 in.) and $\le T_w/4$
	Cumulative length of internal and external undercut	≤38 mm (1.5 in.) in any 150 mm (6 in.) weld length or 25% of total weld length, whichever is less
I	Depth of undercut	≤1.5 mm (1/16 in.) and ≤[$T_w/4$ or 1 mm (1/32 in.)]
	Cumulative length of internal and external undercut	≤38 mm (1.5 in.) in any 150 mm (6 in.) weld length or 25% of total weld length, whichever is less
J	Surface roughness	≤12.5 μm (500 μin.) R_a in accordance with ASME B46.1
K	Depth of surface concavity, root concavity, or burn-through	Total joint thickness, including weld reinforcement, $\ge T_w$ [Notes (3) and (4)]
L	Height of reinforcement or internal protrusion [Note (5)] in any plane through the weld shall be within limits of the applicable height value in the tabulation at right, except as provided in Note (6). Weld metal shall merge smoothly into the component surfaces.	For T_w, mm (in.) / Height, mm (in.) ≤6 (¼) / ≤1.5 (1/16) >6 (¼), ≤13 (½) / ≤3 (⅛) >13 (½), ≤25 (1) / ≤4 (3/32) >25 (1) / ≤5 (3/16)
M	Height of reinforcement or internal protrusion [Note (5)] as described in L. Note (6) does not apply.	Limit is twice the value applicable for L above

NOTES:
(1) Where two limiting values are separated by "and," the lesser of the values determines acceptance. Where two sets of values are separated by "or," the larger value is acceptable. T_w is the nominal wall thickness of the thinner of two components joined by a butt weld.

NOTES: (Cont'd)
(2) Porosity and inclusions such as slag or tungsten are defined as rounded indications where the maximum length is three times the width or less. These indications may be circular, elliptical, or irregular in shape; may have tails; and may vary in density. Indications where the length is greater than three times the width are defined as linear indications and may also be slag, porosity, or tungsten.
(3) For circumferential groove welded joints in pipe, tube, and headers made entirely without the addition of filler metal, external concavity shall not exceed the lesser of 1 mm (1/32 in.) or 10% of the joint nominal thickness. The contour of the concavity shall blend smoothly with the base metal. The total joint thickness, including any reinforcement, shall not be less than the minimum wall thickness, t_m.
(4) For radiography, acceptability may be determined by comparing the density of the image through the affected area to the density through the adjacent base metal (T_w). If digital radiography is used, brightness comparison may be utilized. A density or brightness darker than the adjacent base metal is cause for rejection.
(5) For groove welds, height is the lesser of the measurements made from the surfaces of the adjacent components; both reinforcement and internal protrusion are permitted in a weld. For fillet welds, height is measured from the theoretical throat, Figure 328.5.2A; internal protrusion does not apply.
(6) For welds in aluminum alloy only, internal protrusion shall not exceed the following values:
(a) 1.5 mm (1/16 in.) for thickness ≤2 mm (5/64 in.)
(b) 2.5 mm (3/32 in.) for thickness >2 mm and ≤6 mm (¼ in.)
For external reinforcement and for greater thicknesses, see the tabulation for symbol L.

11 EXAMINATION REPORT

The results of visual examinations executed on joints before and after welding shall be reported on the "weld production log", digitally signed by the qualified appointed inspector and recorded as well on "Welding Register" (Attachment 1).

12 ATTACHMENT

Attachment 1 – Welding production log and welding register

Attachment 1 – Production Log

ROSETTI MARINO Group of Companies	PRODUZIONE SALDATURE WELDS PRODUCTION LOG	Progetto / Project: TOLMOUNT DEVELOPMENT PROJECT - TOPSIDE Cliente / Client: PREMIER OIL	Comm. / Job: 118A50C	Data / Date: 20-12-2019 Nr. 208 VT Procedure AB-TO-ROS-PM-QA-PR-0005 Rev.C01
Disciplina / Discipline: **Piping**	**Fabrication**	Ubicazione / Location : **YARD AXO**		Preparato da / Prepared by: **AXO**

PRODUZIONE - PRODUCTION DEPT.							QC		CONTROLLI NON DISTRUTTIVI - NON-DESTRUCTIVE EXAMINATION				
Dis/Fg/Marca/N° Sald Dwg/Sh/Mark/Weld Nr.	Saldatore Welder	Root Hot Fill/Cap Back	WPS	Spess. Thk	Dimensioni Dimension	Visivo Visual	Firma Signature	Metodo Tecnique	%	IDL	Esito Result	Operatore / Operator	Data / Date	Note / Remarks
C 1 59/1/_/1			C1B	15,240	Hub 3,000	OK	DDP	ITEM						Inspection Cat: A
Marca/Mark 1: _ Marca/Mark 2: _	Pos.1: 5 Pos.2: 1		Tipo.Mat./Mat.Type 1: Stainless steel Tipo.Mat./Mat.Type 2: Stainless steel		Colata/Heat 1: 106837 Colata/Heat 2: 55247									Weld Length: 0,279 Mt
	AX47	Root Hot Fill/Cap						LP	100					
								PMI	10					
								RT	100					

Welding Register

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Welding Register

Project: 118A50C TOLMOUNT DEVELOPMENT PROJECT - TOPSIDE
Client: PREM PREMIER OIL **Order Number:** ITT-POUK/C2296
Discipline: ST Structure ITEM

Weld Number Class	Insp.	Rev. Cont	Prod. Date Examination	Fog.Prod phase	Welders IDL	Oper.	Item type Exam. %	Dimension Report n.	Films n.	Thickness Result	Bevels WPS	Rip.	Weld Length Weld Tecn.	P/M Repair length	Material	WPS Exam. Date	Weld Tecn. Remarks	Conn. type	Accept. Date	Spool
1/278/1/DKA068		0	06-04-2019	62	AZFM		PIPE	406,00 MM		12,70 mm	FILL		0,688 m	P	C.S.	6AA	FCAW	F	10-04-2019	
	1	VIS	FIT-UP and on weld completion			GFUSSI	100 %	OK		A						08-04-2019				
		MT	Weld Completion		IDL-QCI-MT-0006-00	ROM	100 %	000746		A						10-04-2019				
2/278/1/DKA068		0	06-04-2019	62	AZFM		PIPE	406,00 MM		12,70 mm	FILL		0,678 m	P	C.S.	6AA	FCAW	F	10-04-2019	
	1	VIS	FIT-UP and on weld completion			GFUSSI	100 %	OK		A						08-04-2019				
		MT	Weld Completion		IDL-QCI-MT-0006-00	ROM	100 %	000747		A						10-04-2019				