Base Load Power Hub (BLPH)

HEAT TREATMENT PROCEDURES (inc. PWHT)

H2 STORAGE VESSEL

Document Number: 1723001756-QC-PRO-00011

Document Class: 2

2	24/07/2024	Accepted for contruction (AFC)	A. Sandonà	M. Carminati	N. Tosto
1	03/05/2024	Accepted for contruction (AFC)	A. Sandonà	M. Carminati	N. Tosto
0	21/11/2023	Issue for Review (IFR)	A. Sandonà	M. Carminati	N. Tosto
Rev.	Date	Description	Prepared	Reviewed	Approved

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Revision / Change Log

Rev.	Description
0	Issue for Information (IFI)
1	Accepted for contruction (AFC)
2	Accepted for contruction (AFC)

HOLDS LIST

No.	Description
1	
2	
3	
4	

POST WELD HEAT TREATMENT PROCEDURE

REFERENCE DOCUMENTS:

ASME BPV CODE Section VIII Div. 2 — 2021 Edition
Q.C. Manual
Project specification 123A90-DDL-MAC-SP-50026_0
Equipment datasheet 123A90-DDL-MAC-DS-50027_1

REVIEW FOR CONFORMANCE WITH REFERENCE CODE/DOCUMENTS REVISION:

Date:	Code Edition / Addenda:	Q.C.M.

Rev.	Date	Description	Issued by W.E.	Approved by Welding Dept. Manager	
2	24/07/2024	Revised as per comments	A. Sandonà	N. Tosto	
1	03/05/2024	Revised as per comments	A. Sandonà	N. Tosto	
0	21/11/2023	First issued for approval	A. Sandonà	N. Tosto	

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ABBREVIATIONS:

P.W.H.T. Post-Weld Heat Treatment
H.T. Heat Treatment
H.T.C.F. Heat Treatment Control Form
N.D.E. Non-Destructive Examination
P.T.P. Production Test Plate
TC Thermocouple

1. Scope

This procedure outlines the system used to perform **P.W.H.T.** of n°6 H2 Storage Vessel items V23001A÷F for Rosetti Marino/Crosswind Hollande Kust Noord Wind Park Project relevant to **B&R** job 23096.
P.W.H.T. shall be performed by B&R experienced personnel as per attached **H.T.C.F.**.

Following, list of Items to be treated for each furnace charge:

Item	Dwg. No.	Ref. HTCF Doc's	Components
V25001 A÷F	23096-01-EGA1	23096-01_HTCF	1) n°1 H2 Storage Vessel 2) n°2 Manhole flat cover 3) n°1 **P.T.P.**

2. P.W.H.T. time

P.W.H.T. shall be performed after final assembly and completion of welding for complete equipment and subjected to full visual, dimensional and N.D.E. required by Code and Spec.'s foreseen with satisfactory results.

3. Furnace

Furnace shall be permanently and closed type. Components shall be fully contained in the furnace.
Furnace heating shall be made by use of 18 gas burners, the construction details of the furnace is available in the "Appendix A" attached.

"Appendix A" and "Heat treatment control form" colors legend:

- Green → Mobile Carriage
- Red → Temporary Supports
- Brown → Burners

For the **P.W.H.T.** the equipment shall be placed on the furnace mobile carriege as indicated in relevant **H.T.C.F.** and then pushed into the furnace in the position indicated in relevant and "Appendix A".

4. Preparation

According to Technical Specification for CS Horizontal Pressure Vessels in H2 Service:

- The vessel or parts of the vessel shall be supported and protected so that deformation cannot occur.
  - Equipment shall be PWHTed on its own support saddles;
  - One (1) intermediate support shall be located at mid-length between the two saddles;
  - One support shall be located under each head knuckle.

  All the temporary supports shall be shaped to match equipment O.D.
- Machined surfaces, flange faces, etc., shall be protected from oxidation during heat treatment.

5. Thermocouples

Only calibrated thermocouples type K (Chrome-Alumel), typically red and yellow shielded wires, shall be used. Thermocouples shall be placed on the component according to a relevant **H.T.C.F.**.
Thermocouples shall be attached to the vessel by use of discharge capacitive welding machine, nut and bolt construction or other equivalent method. Temporary attachment for thermocouples shall be welded by BREMBANA&ROLLE.
Sub-supplier shall make available for review, all calibration certificates of thermocouples and recorders used in performing vessel **P.W.H.T.**.

After PWHT the locations of **TC**'s have to be ground and MT/PT-examined.

6. P.W.H.T. Temperatures

6.1 Temperature of the furnace shall room temperature at the time of the vessel is placed in it in order to permit the inspection step check of PWHT conditions and thermocouples placement. Above 800°F (425°C), the rate of heating shall be not more than 400°F/hr (222°C/h) divided by the maximum metal thickness of the shell or head plate in inches, but in no case more than 400°F/hr (222°C/h).

6.2 During the heating period there shall not be a greater variation in temperature throughout the portion of the vessel being heated than 250°F (140°C) within any 15 ft (4.6 m) interval.

6.3 Component shall be held at temperature and at holding time required by Code and Spec.'s.
During the holding period, there shall not be a greater difference than 180°F (100°C) between the highest and lowest temperature throughout the portion of the vessel being heated.

6.4 During the heating and holding periods, the furnace atmosphere shall be so controlled as to avoid excessive oxidation of the component surface. The furnace shall be such design as to prevent direct impingement of the flame on the vessel.
Burners shall always be equiped with a flame failure system that shuts off the fuel supply in any case of flame lapse thus preventing remainders of fuel entering the equipment.

6.5 Above 800°F (425°C), cooling shall be done in a closed furnace or cooling chamber at a rate not greater than 500°F/hr (280°C/h) divided by the maximum metal thickness of the shell or head plate in inches, but in no case more than 500°F/hr (280°C/h). At temperatures above 800°F (425°C), temperature variations within the heated portion during the cooling phase shall not be greater than 250°F (140°C) within any 15 ft (4.6 m) interval. From 800°F (425°C), the vessel may be cooled in still air.

6.6 When more stringent requirements have to be applied, then the data shown **H.T.C.F.** will prevail on general provision of points 6.1 to 6.5.

7. Report

A heat treatment record chart shall be issued showing time/temperature diagram according to the above mentioned prescription. The **H.T.** record chart shall be completed with heat treatment number, date, item involved and signed by sub-supplier.
H.T. record chart shall be delivered together with the vessel and shall be maintained in Quality Control department file.

HEAT TREATMENT CONTROL FORM

Date: 24 July 2024
Rev. 2
Sheet 5 of 5

PURCHASER DATA		MANUFACTURER DATA	
PURCHASER	Rosetti Marino	**JOB No.**	23096
PLANT	Crosswind Hollande Kust Noord Wind Park Project	**DWG. No.**	23096-01-EGA1
P.O.	1723001756 123A90A	**SERIAL No.**	23096-01÷06-SNA
ITEM	V25001 A÷F H2 Storage Vessel	**DOC. No.**	23096-01/HTCF

APPLICABLE CODE:

- ASME BPV CODE Sections VIII Div.2 2021 Edition

APPLICABLE STANDARD/SPECIFICATION:

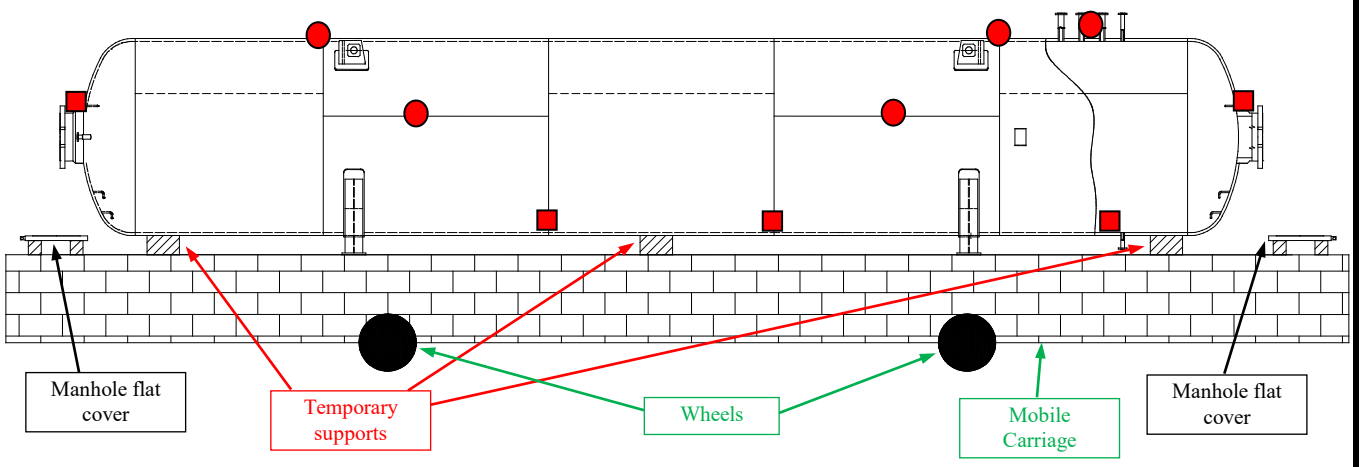
- Customer Specifications 123A90-DDL-MAC-SP-50026_0

Sub-Supplier: _____ ■ GAS FURNACE ☐ ELECTRICAL RESISTANCES

Part to be Heat Treated: See sketch below **Heat Treatment Type:** Stress relieving

Material Spec's: SA 516 Gr.60 – SA 350 LF2 **Max. Thk. to be Heat Treated:** 44 mm

Thermocouples location: ● *EXTERNAL SIDE* ■ *INTERNAL SIDE*



NOTE: Thermocouples attached by capacitor discharge welding with max power output less than 125W-sec.
All areas where thermocouples has been removed shall be checked by visual inspection and PT or MT.

Thermocouples Type : K UNI 7938 G II E 230 st. | H.T. Record Type : Potentiometric

HEAT TREATMENT DATA

COMPONENT INSERTION [°C]	HEATING RATE [°C/h]	HEATING RATE Max. Δt [°C]	SOAKING TEMPERATURE [°C]	HOLDING TIME [h./min.]	COOLING RATE [°C/h]	COOLING RATE Max. Δt [°C]	COOLING IN STILL AIR FROM [°C]
Room Temperature	**≤60**	**120**	**610 ± 10**	**3h.**	**≤60**	**120**	**<300**

Brembana&Rolle T.P.	Bembana&Rolle ENG.	A.I. / Inspection Agency
N.Tosto – Tecnological Department Mgr.	D.Passerini – E.M.	

Comparison against Sub Supplier Heat Treatment Record Chart No. _____ DATED _____

RESULT: ❑ SATISFACTORY ❑ UNSATISFACTORY ❑ _____

Material is: ❑ ACCEPTED ❑ REJECTED ❑ _____

Brembana&Rolle Q.C.	A.I. / Inspection Agency
M.Galli – Q.C.M.	

APPENDIX A

(PWHT furnace Construction drawing)

Albignasego site

