

Design Report

Arrangement 5 - PHBD Main Heat Exchangers Coupled (26PHBD-HXs-1910/1920 and HXs-1970/1980) Equipment Summary

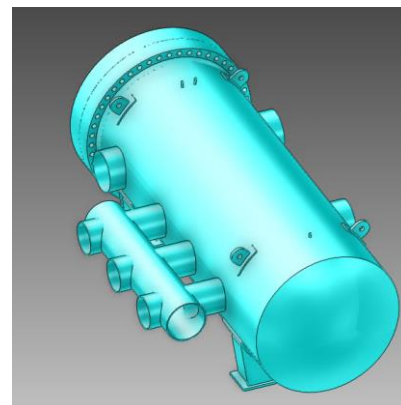
This document provides a summary of PHBD Baking Heat Exchanger Coupled (26PHBD-HXs-1910/1920 and HXs-1970/1980).

Approval Process			
	Name	Action	Affiliation
Author	Basili L.	06 Apr 2023:signed	IO/DG/CNST/PLD/MID/TCWS
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	Van hove W.	06 Apr 2023:recommended (Short Cycle)	ORNL - Oak Ridge National Laborator...
Previous Versions Reviews	Gao J.	04 Apr 2023:recommended (Short Cycle) v2.1	IO/DG/CORP/FPD/PCD/CAL
	Sharan S.	04 Apr 2023:recommended (Short Cycle) v2.1	IO/DG/CNST/PLD/MID/TCWS
	Ricou E.	28 Mar 2023:recommended v2.0	IO/DG/CNST/PLD/MID/TCWS
Approver	Lioce D.	07 Apr 2023:approved	IO/DG/CNST/PLD/MID/TCWS
Document Security: Internal Use RO: Lioce Donato			
Read Access	LG: Arrangement 5 Cost Estimation, LG: USDA Arrangement 5, LG: Management, GG: IO DDGs (and Senior Advisors), AD: IO_Director-General, AD: External Management Advisory Board, AD: OBS - Project Control Office (PCO), AD: IDM_Controller, AD: OBS - Procurement & Contracts Division (PCD), AD: Auditors, p...		

<i>Change Log</i>			
Arrangement 5 - PHBD Main Heat Exchangers Coupled (26PHBD-HXs-1910/1920 and HXs-1970/1980) Equipment Summary (26BPZ6)			
<i>Version</i>	<i>Latest Status</i>	<i>Issue Date</i>	<i>Description of Change</i>
v1.0	Signed	13 Mar 2023	
v2.0	Signed	27 Mar 2023	New version to implement reviewers' comments
v2.1	Signed	30 Mar 2023	change cobalt content
v2.2	Approved	06 Apr 2023	Implementation of comments review: - mounted on saddles - kW to MW - note 6 and 7 - tantalum below 0.01%

OPERATIONAL NARRATIVE

8 heat exchangers have the function of removing the heat collected by the clients. Every cooling train is provided of one heat exchanger. On the secondary side the heat exchangers are connected to the CCWS-1 that supply the water needed for cooling. HX-1910 and HX-1920 (as well as HX-1970 and HX-1980) are connected together through a common manifold, splitting the DN500 in 6 different nozzles, 3 for each heat exchanger. This layout is due to lack of space in the room. Due to the fact that all the nozzle should be welded, it is reasonable to consider that the manifold will be welded to one heat exchanger directly at the manufacturer facility. The other heat exchanger will then be welded at ITER site.

**Disclaimer:**

- Contents of this document have been assembled, reviewed and approved as for Information Only,
- May not be used for purchasing, fabrication or construction,
- May not be used as verified input to any document (may be used as unverified assumption).

PHYSICAL ATTRIBUTES

<i>Commodity Type:</i>	Shell & Tube Heat Exchanger
<i>Type:</i>	NXU Horizontal
<i>Number of units:</i>	2
<i>Approx. Footprint:</i>	6 m x 2.3 m
<i>Approx. Height:</i>	2.2 m
<i>Approx. Total Weight (wet)</i>	≈ 37 000 kg
<i>Volume</i>	10.5 m ³
<i>Service Fluid:</i>	Demineralized Water
<i>Material Notes:</i>	304L / 316L with composition requirement: cobalt <0.05 wt%, Niobium < 0.1 wt% and Tantalum < 0.01 wt%.
<i>Anchoring system</i>	Embedded Plates. Adequate anchoring to be determined
<i>Component configuration</i>	Mounted on saddles
<i>Design Life Time:</i>	20 years

WBS: IBED System

PBS: 26PHBD

Functional Reference: 26PHBD-HX-1910; HX-1970

GBS: 11-L3-02E

REFERENCE DOCUMENTS

Sizing calculation: ITER_D_PAVZLW_v3.3

PID: ITER_D_SNJ3LL_v4_2

DESIGN CODES AND SHIPPING

<i>French Law Pressure Category / Nuclear Class:</i>	ESPN / IV / N2
<i>Fluid Type / Fluid group</i>	Gas/Group 2
<i>Related Codes:</i>	ASME Code Sec VIII Div 2/ TEMA
<i>Conformity Assessment Module:</i>	Cat IV, module G
<i>Safety Class:</i>	SIC-1
<i>Quality Class:</i>	QC-1
<i>Seismic Class:</i>	SC1 (S)
<i>Fire:</i>	Eurocode 2h
<i>Shipping Information:</i>	Conventional Exceptional Load, Oversea packing per ASME NQA-1 Level C, DAP at ITER site

ENVIRONMENTAL CONDITIONS

<i>Dose Rate:</i>	≤ 1.2 kGy/h
<i>Integrated Dose Rate 20yrs:</i>	≤ 20 000 kGy
<i>Magnetic Field:</i>	≤ 168 mT
<i>Normal temperature</i>	5 – 35 °C
<i>Normal Humidity</i>	40 – 60 %
<i>Normal Pressure relative to atm:</i>	-0.14 kPa
<i>Accidental Temperature</i>	130 °C
<i>Accidental Pressure relative to atm:</i>	-5 to +100 kPa
<i>Accidental Humidity</i>	100 %

HX-1910; 1970 – Heat Exchangers

PARAMETERS

Parameter	Shell side	Tube side
Fluid Type	Demineralized water	Demineralized water
Inlet Temperature (°C)	31	114.1
Outlet Temperature (°C)	78.69	69.5
Inlet Pressure (MPa,a)	0.8	1.5
HX Mass flow (kg/s)	601	615
Allowable Pressure Drop (MPa)	0.25	0.1
Fouling resistance (m ² K/W)	0.0001	5e-05
Heat Duty (MW)	117.5	
Design Pressure (MPa,a)	5	5
Design Temperature (°C)	150	150
Number pass per shell	2	2
Thermal insulation thickness (mm)	50	50
Roughness	N/A	1.6 µm

NOZZLE SCHEDULE

I.D.	DN / Schedule	Service
N01	DN 500 / 80	Inlet Tube side
N02	DN 500 / 80	Outlet Tube side
N03.1	DN 400 / 80	Inlet Shell side
N03.2	DN 400 / 80	Inlet Shell side
N03.3	DN 400 / 80	Inlet Shell side
N04	DN 500 / 80	Outlet Shell side
N08	DN 25 / 40S	Tube side drain 1
N09	DN 25 / 40S	To DR shell side
N10	DN 25 / 40S	To Tube side drain 2
N11	DN 25 / 40S	Tube side Vent 1
N12	DN 25 / 40S	Tube side Vent 2

Notes:

1. Approximate footprint is based on 3d model approved configuration.
2. All nozzles are butt-welded.
3. Support shall be accounted in the vendor estimate.
4. The connecting piece (manifold with 3 nozzles) has to be forged.
5. The shell side as an inlet suggested to be divided into 3 nozzles for mixing purposes. Then heat exchanger + the welded manifold should come together. ‘
6. The roughness of the water-box should be the same as tube side.
7. For the Floor Response Spectra refer to the Cover Main Document.

