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EXTERNAL REFERENCE / VERSION

Report

Arrangement 5 - CVNB Demineralizer(26CVNB-DE-5303) Equipment Summary

This document provides a summary of CVNB Demineralizer(26CVNB-DE-5303). Since nitrogen might be introduced during maintenance, fluid type is Gas /Group 2.

<i>Approval Process</i>			
	<i>Name</i>	<i>Action</i>	<i>Affiliation</i>
<i>Author</i>	Kanda K.	29 Mar 2023:signed	IO/DG/CNST/PLD/MID/TCWS
<i>Co-Authors</i>	West S.	30 Mar 2023:signed	IO/DG/CNST/PLD/MID/TCWS
<i>Reviewers</i>	Berruyer F. Ciampichetti A. Gao J. Ghirelli N. Ricou E. Van hove W.	04 Apr 2023:recommended 06 Apr 2023:recommended 04 Apr 2023:recommended 03 Apr 2023:recommended	IO/DG/CNST/PLD/MID/TCWS IO/DG/CNST/PLD/MID/CMW IO/DG/CORP/FPD/PCD/CAL IO/DG/CNST/PLD/MID/TCWS IO/DG/CNST/PLD/MID/TCWS ORNL - Oak Ridge National Laborator...
<i>Approver</i>	Lioce D.	07 Apr 2023:approved	IO/DG/CNST/PLD/MID/TCWS
<i>Document Security: Internal Use</i> <i>RO: Lioce Donato</i>			
<i>Read Access</i>	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...		

Change Log

Arrangement 5 - CVNB Demineralizer(26CVNB-DE-5303) Equipment Summary (8U6X8N)

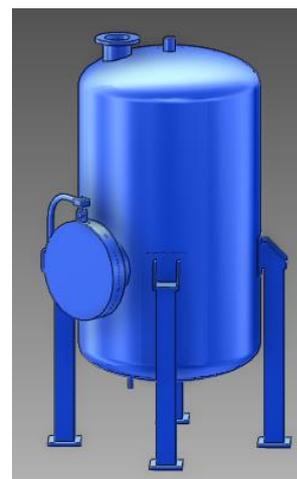
<i>Version</i>	<i>Latest Status</i>	<i>Issue Date</i>	<i>Description of Change</i>
v0.0	In Work	10 Mar 2023	
v1.0	Signed	12 Mar 2023	The first version for review.
v2.0	Signed	27 Mar 2023	Updated based on the reviewer's comment.
v2.1	Approved	29 Mar 2023	Updated based on the reviewer's comment. The native word file with revision track with respect to the first version is attached.

OPERATIONAL NARRATIVE

CVNB demineralizer is a mixed bed demineralizer which captures (activated) corrosion material in ionic form, produced in the piping network and client walls of NBI (Neutral Beam Injector) PHTS (Primary Heat Transfer System) during operation.

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>	Mixed bed demineralizer
<i>Number of equipment:</i>	1
<i>Type:</i>	Vertical Vessel
<i>Approx. Footprint:</i>	2.0 m x 2.0 m
<i>Inner Diameter:</i>	1.3 m
<i>Approx. Height:</i>	2.5 m without support 3.5 m with support
<i>Approx. Weight:</i>	5 000 kg (wet)
<i>Approx. Resin Volume:</i>	1.3 m ³
<i>Tank Volume:</i>	3.0 m ³
<i>Service Fluid:</i>	Water
<i>Material Notes:</i>	Vessel, Internal/mesh: 304L or 316L with composition requirement: cobalt <0.20 wt%, Niobium < 0.1 wt% and Tantalum < 0.05 wt%.
<i>Anchoring system</i>	EP / Bolting
<i>Component configuration</i>	Alone
<i>Design Life Time:</i>	20 years

ENVIRONMENTAL CONDITIONS

<i>Integrated Dose Rate 20yrs:</i>	≤ 200 Gy
<i>Magnetic Field:</i>	≤ 105 mT
<i>Normal temperature</i>	5 – 35 °C
<i>Normal Humidity</i>	40 – 60 %
<i>Normal Pressure relative to atm:</i>	+/- 5 kPa
<i>Accidental Temperature</i>	130 °C
<i>Accidental Pressure relative to atm:</i>	-5 to +100 kPa
<i>Accidental Humidity</i>	100 %

WBS: Chemical & Volume Control System

PBS: 26CVNB / GBS: 11-L4-04

Functional Reference: 26CVNB-DE-5303

REFERENCE DOCUMENTS

Sizing calculation: ITER_D_WVZ79G_v7.1

PID: ITER_D_XJ36P5_v2.4

DESIGN CODES AND SHIPPING

<i>French Law Pressure Category / Nuclear Class:</i>	ESPN / IV / N3
<i>European Law:</i>	PED
<i>Fluid Type / Fluid group</i>	Gas / Group 2
<i>Conformity Assessment Module:</i>	IV, module G
<i>Construction Codes:</i>	ASME VIII Div2
<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 (CEL), Oversea packing per ASME NQA-1 Level C, DAP at ITER site

CVNB – Demineralizer (26CVNB-DE-5303)

PARAMETERS

Parameter	Value
Nominal Temperature (°C)	38
Design Temperature (°C)	100
Nominal Pressure (MPa)	0.25 – 1.70
Design Pressure (MPa)	2.60
Nominal mass flowrate (kg/s)	20
Allowable Pressure Drop (kPa)	150
Thermal insulation thickness (mm)	50

NOZZLE SCHEDULE

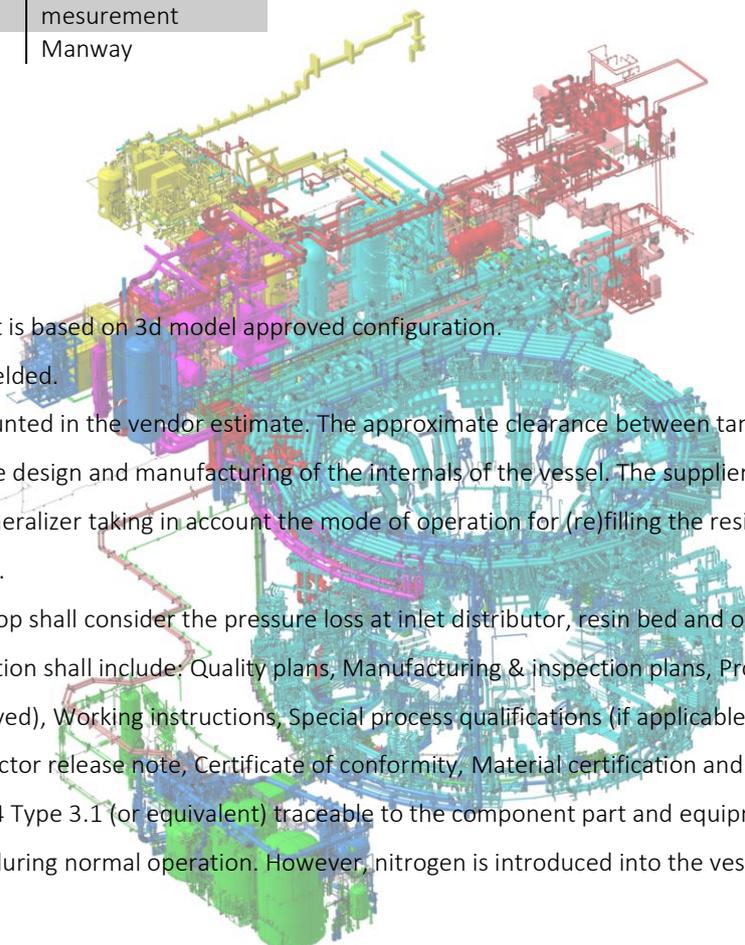
I.D.	DN / Schedule	Service
N1	80 / 40S	Inlet
N2	80 / 40S	Outlet
N3	25 / 40S	demineralized water
N4	200 / 20	Resin loading
N5	50 / 40S	Resin unloading
N6	25 / 40S	Nitrogen
N7	15/40S	Pressure difference measurement
TBD	600 /TBD	Manway

RESIN SPECIFICATION

Parameter	Value
Resin Type:	Nuclear grade mixed bed resin (Amberlite IRN170 or equivalent)
Operating temperature (°C):	18 – 50 °C
Provision of regeneration:	no
Number of bed:	1
Water treatment capacity (kg/s)	20
Total ionic species to be captured at end of resin life:	240 equivalent
Outlet conductivity (μS/cm)	<0.1

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. The approximate clearance between tank bottom and floor is 1.0 m.
4. The scope includes the design and manufacturing of the internals of the vessel. The supplier is expected to design the internals of this demineralizer taking in account the mode of operation for (re)filling the resins and flushing out the resins with water flow.
5. Allowable pressure drop shall consider the pressure loss at inlet distributor, resin bed and outlet retention system.
6. Minimum documentation shall include: Quality plans, Manufacturing & inspection plans, Procedures, Calculation note (where design is involved), Working instructions, Special process qualifications (if applicable), Operator qualifications, As-built drawings, Contractor release note, Certificate of conformity, Material certification and inspection documents according to EN 10204 Type 3.1 (or equivalent) traceable to the component part and equipment.
7. Service fluid is water during normal operation. However, nitrogen is introduced into the vessel to fluidize the resin during resin replacement.
8. Expected water quality of inlet water is as below:



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Parameter	NBI PHTS
Conductivity @25°C, $\mu\text{S}/\text{cm}$	≤ 0.1
pH @25 °C	6.5 - 7.5
Sodium, ppb	≤ 5
Chloride, ppb	≤ 5
Hydrogen ^{***} , ppb	≤ 100
Catalyzed Hydrazine ^{****} , ppb	-
Ammonia ^{****} , ppb	-
Oxygen, ppb	≤ 10
ORP@25 °C, mV	(-400) - (-100)
Iron ^{*****} , ppb	≤ 10
Copper ^{*****} , ppb	≤ 10

9. Total amount of ionic species to be captured at end of resin life is as below:

	Mol	Molar mass	Valence	Equivalent
	mol	g/mol		eq
Fe	6.63E+02	56	2	2.37E+01
Cr	2.14E+02	52	3	1.24E+01
Ni	1.09E+02	58.7	2	3.72E+00
Mo	5.86E+00	96	2	1.22E-01
Cu	6.29E+03	63.5	2	1.98E+02
Zr	6.36E+00	91	2	1.40E-01

