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EXTERNAL REFERENCE / VERSION

Report

Arrangement 5 - CVBD Demineralizer(26CVBD-DE-5409)) Equipment Summary

This document provides a summary of CVBD Demineralizer(26CVBD-DE-5409). Since nitrogen might be introduced during maintenance, fluid type is Gas /Group 2.

Approval Process			
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Document Security: Internal Use RO: Lioce Donato			
<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...		

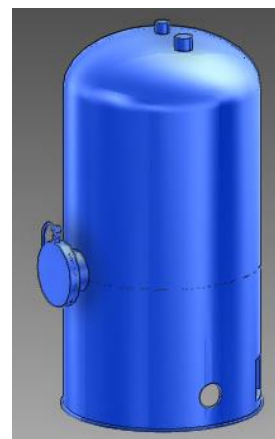
<i>Change Log</i>			
Arrangement 5 - CVBD Demineralizer(26CVBD-DE-5409)) Equipment Summary (8U6XAF)			
<i>Version</i>	<i>Latest Status</i>	<i>Issue Date</i>	<i>Description of Change</i>
v0.0	In Work	10 Mar 2023	
v1.0	Signed	12 Mar 2023	The first version for review.
v2.0	Signed	27 Mar 2023	Updated based 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

CVBD demineralizer is a mixed bed demineralizer which captures (activated) corrosion material in ionic form, produced in the piping network and client walls of IBED (Integrated loop of Blanket, ELM-VS, and Divertor) 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>	2.3 m x 2.3 m
<i>Inner Diameter:</i>	2.3m
<i>Approx. Height:</i>	3.5 m without support 4.5 m with skirt
<i>Approx. Weight:</i>	15 000 kg (wet)
<i>Approx. Resin Volume:</i>	6.5 m ³
<i>Tank Volume:</i>	13 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>	Platform / Bolting
<i>Component configuration</i>	Alone
<i>Design Life Time:</i>	20 years

ENVIRONMENTAL CONDITIONS

<i>Integrated Dose Rate 20yrs:</i>	≤ 100 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>	-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 %

WBS: Chemical & Volume Control System

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

Functional Reference: 26CVBD-DE-5409

REFERENCE DOCUMENTS

Sizing calculation: ITER_D_WVXWFF_v5.1

PID: ITER_D_XGXS95_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

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PARAMETERS

Parameter	Value
Nominal Temperature (°C)	50
Design Temperature (°C)	100
Nominal Pressure (MPa)	0.75
Design Pressure (MPa)	1.80
Nominal mass flowrate (kg/s)	45
Allowable Pressure Drop (kPa)	150
Thermal insulation thickness (mm)	10

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)	45
Total ionic species to be captured at end of resin life:	3800 equivalent
Outlet conductivity (μS/cm)	<0.1

NOZZLE SCHEDULE

I.D.	DN / Schedule	Service
N1	150 / 40S	Inlet
N2	150 / 40S	Outlet
N3	200 / 20	Resin loading
N4	25 / 40S	Nitrogen
N5	25 / 40S	demineralized water
N6	50 / 40S	Resin unloading
N8	600 (TBD)	Manway

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. Expected water quality of inlet water is as below:

Parameter	IBED PHTS
Conductivity @25°C, μS/ cm	<= 0.2
pH @25 °C	7.0 - 9.0
Sodium, ppb	<= 5
Chloride, ppb	<= 5
Hydrogen***, ppb	<= 350
Catalyzed Hydrazine****, ppb	<= 30
Ammonia****, ppb	<= 1,000
Oxygen, ppb	<= 10
ORP@25 °C, mV	(-400) - (-100)
Iron*****, ppb	<= 10
Copper*****, ppb	<= 10

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7. Service fluid is water during normal operation. However, nitrogen is introduced into the vessel to fluidize the resin during resin replacement.
8. 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	5.47E+04	56	2	1.95E+03
Cr	1.33E+04	52	3	7.70E+02
Ni	8.64E+03	58.7	2	2.94E+02
Mo	4.87E+02	96	2	1.01E+01
Cu	2.40E+04	63.5	2	7.56E+02
Zr	2.42E+01	91	2	5.32E-01

