

ENGINEERING SERVICES DEPARTMENT



SCRUBBER SPECIFICATION SHEET

Project	PTFE Filter Destruction	Unit Tag Number	S83123
Datasheet Document No.	ENS-FDP-SPE-24009	Revision	R2,0
Description	KOH Scrubber		
Plant	PTFE Filter Destruction Demonstration Facility		
Plant Location	Building V-H2, Laboratory 131H (housed inside a secondary enclosure Y82020)		
Safety Classification	SC-2(C) and SC-3(N)		
Quality Classification	QC-2(C) and QC-3(N)		

FLUID PROPERTY DATA

		UNITS	GAS	LIQUID
Fluid Description			CO ₂ , HF, H ₂ O, O ₂ , N ₂ , UF ₆ ^{Note 1}	H ₂ O, KOH, KF, K ₂ CO ₃ , KHCO ₃ , UO ₃ ^{Note 1, 2}
Density (at average temperature)		kg/m ³	0.963	1274.8
Viscosity		cP	0.015	1.6
Operating Temperature	Minimum	°C	25	25
	Normal - in	°C	35	35
	Normal - out	°C	44.19	44.19
	Maximum	°C	80	60
Flow rate (feed to scrubber) ^{Note 4}		kg/h	28	3336.5
		m ³ /h ^{Note 3}	22	4.3
Operating pressure	Minimum	kPa(g)	-10	190
	Normal	kPa(g)	-5	220
	Maximum	kPa(g)	0	250
Permissible pressure drop over packed bed		kPa	0.25	
Design pressure drop over packed bed		kPa	Supplier to advise	
Design temperature		°C	80	
Design pressure		kPa	2000	

CAPACITY DATA

Column diameter	Inner diameter 257.8 mm		
Bed height	Minimum 1.54 m, to be increased to maximum feasible with available ceiling height		
Type of packing	Pall rings		
Packing material	Polypropylene		
Packing size	16 mm		
Sump volume	2 m ³		
Sump dimensions	Supplier to advise		
Instrumentation	Ultra guided radar level indicator transmitter on the scrubber sump		
Accessories	Liquid redistribution every 1.29 m (maximum); supplier to advise optimal position		
	Demister on gas outlet		
	Spray nozzles for introduction of recycled scrubbing liquid		
	Mechanism for gas injection		
	Packing support		
Operating hours	6 hours per day, 5 days per week		

MECHANICAL SECTION

Process exposed material	Polypropylene (scrubber sump and column)		
Process connections	Flanged (150lb rated)		

SITE CONDITIONS

Altitude	m	1300 m
Site Location		Pelindaba East, H-Building
Atmospheric Pressure	kPa(a)	Min: 87.4 kPa; Max: 88.3 kPa
Ambient Temperature (min./max.)	°C	Min: 2°C; Max: 32°C

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REFERENCE DRAWINGS AND DOCUMENTS

[1] ENS-FDP-CLC-24016: Scrubber Design Calculation for the PTFE Filter Destruction System

[2] ENS-FDP-PID-24003: PTFE Filter Destruction System KOH Scrubber P&ID

NOTES

Note 1: The composition of the gas entering the scrubber is (w/w) : 53.59% CO₂, 28.74% HF, 7.80% H₂O, 5.86% O₂, 10.89% N₂, and 0.14% UF₆.

Note 2: The sump tank of scrubber S83123 will be charged with a batch of aqueous 30% KOH solution at the start and this solution will then recirculated through the heat exchanger H83125 during the scrubbing process. The scrubber solution composition will change over time due to the chemical reactions taking place in the scrubber. The scrubbing process is divided into three phases. During the first phase, KOH will start decreasing, while KF and K₂CO₃ start forming. At the end of this phase, the composition of the scrubbing solution will be 66.81% water, 11.01% KF, 22.16% K₂CO₃ and approximately 13 ppm UO₃. At the end of the next phase, the solution composition of the scrubbing solution will be 68.04% water, 16.62% KF, 15.27% KHCO₃ and approximately 19 ppm UO₃. At the end of the final phase, the solution composition will be 68.95% water, 18.30% KF, 12.72% KHCO₃ and approximately 21 ppm UO₃. At this point the solution will be replaced with a fresh batch of aqueous 30% KOH solution. All solids are dissolved in the solution, with the exception of some possible precipitation of KHCO₃. The precipitate will be captured by the filters in the recycle.

Note 3: Gas flow rate given at normal conditions: 20°C and 101,325 kPa

Note 4: Flow to scrubber may be two-phase flow, since reaction may already be taking place in the liquid ring pump

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