ENGINEERING SERVICES DEPARTMENT

Scrubbing Liquid Circulation Pump P1502 Specification Sheet.

Project	NW PlasGas and CWOPG Projects	**Unit Tag Number**	P1502
Datasheet Document No.	ENS-NWPVR-SPE-24018	**Revision**	2
Description	Shared Pump P1502 is used to recirculate the scrubbing solution from the sump tank of scrubber S1501 through an external plate-heat exchanger H1504 in the Low-Level Waste Plasma Gasification (NW PlasGas) and the Uranium Contaminated Waste Oil Plasma Gasification (CWOPG) Demonstration Facilities [1], Note [u]. The solution is then returned to the top of the scrubber column.		
Plant Location	NECSA, Pelindaba, North-West Province.		
Equipment Location	Integrated NW PlasGas and (CWOPG) Facilities - Inside Laboratory 150, Building V-H2.		
Safety Classification	SC-3 (N) & SC-2 (C) Note [p]		
Quality Classification	QC-3 (N) & QC-2 (C) Note [n]		

FLUID PROPERTIES

	NW PLASGAS	CWOPG
Process Fluid	Liquid mixture of H_2O, KOH, KCl, K_2CO_3, and/or $KHCO_3$ Note [a]	Liquid mixture of H_2O, KOH, KF, KCl, K_2CO_3, $KHCO_3$ Note [b]
Solids Content	Strainer installed upstream of the pump, however, presence of small undissolved solid particles (KOH, KF and/or KCl) is possible in the fluid. Under abnormal conditions, ash and/or traces of uranium-containing solids (e.g. UO_3) may also be present.	
Corrosive Due To	KOH (aq) and K_2CO_3 (aq) .	KOH (aq), KF (aq) and K_2CO_3 (aq) .

			NW PLASGAS	CWOPG	
PARAMETERS	**UNITS**	**MINIMUM**	**NORMAL**		**MAXIMUM**
Operating Temperature	**°C**	18	56	49.5	60
Fluid Density	**kg/m³**	1288	1268	1271	1266
Viscosity	**kg/m.s**	$2{,}40 \times 10^{-3}$	$1{,}40 \times 10^{-3}$	$1{,}35 \times 10^{-3}$	$1{,}20 \times 10^{-3}$
Liquid Vapour Pressure	**kPa(a)**	1,07	9,33	6,67	10,67

HYDRAULIC PROPERTIES

PARAMETERS	**UNITS**	**MINIMUM**	**NORMAL**	**MAXIMUM**
Flow Rate [2]	**m³/h**	1,06	3,52	4,21
Pump Inlet Pressure [7]	**kPa(a)**	97,36	93,97	92,46
Pump Outlet Pressure [7]	**kPa(a)**	317,68	320,11	337,46
Pressure Differential [7]	**kPa**	220,32	226,14	245,00
Required Pump Head [5]	**m**	17,43	18,18	19,73
NPSH Available [5]	**m**	5,71	5,45	5,32

GENERAL PROPERTIES

Type of Pump Recommended	Centrifugal Pump			
Pump Direction	**Horizontal:**	☑	**Vertical:**	☐

ELECTRICAL & GENERAL PROPERTIES

Volts	Supplier to advise
Phase	Supplier to advise
Hz	Supplier to advise

MECHANICAL PROPERTIES

Type of Seal	**Mechanical**	☑	**Magnetic**	☐	**Stuffing box** ☐	
Dry Run Protection	Yes - Supplier to provide					
Impellor Material	Supplier to advise					
Pump Casing Material	Supplier to advise					
Type of Seal	Supplier to advise					
Shaft Material	Supplier to advise					

PIPE NOZZLE

Pipe Suction	**Size**	25 NB	**Rating**	150#	**Flange Spec.**	SS, ASTM A182-F304/304L, ASME B16.5, RF
Pipe Discharge	**Size**	25 NB	**Rating**	150#	**Flange Spec.**	SS, ASTM A182-F304/304L, ASME B16.5, RF

POWER

Absorbed Power	Supplier to provide
Installed Power	Supplier to advise
Noise Criteria	Maximum allowable sound level is 85 dB(A) at a distance of 1 m from pump

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VENDOR DATA REQUIRED WITH TENDER

1. **Pump performance curve**
2. **Pump duty**
3. **Pump efficiency**
4. **Pump rotational speed**
5. **Pump dimensions with baseplate**

REFERENCE DRAWINGS AND DOCUMENTS

[1] ENS-FDP-PID-24002: Filter Destruction Project P&I Diagram – Reactor System 820

[2] ENS-OWPVR-REP-25009: Centrifugal Pumps Sizing Report for Uranium Contaminated Waste Oil Plasma Gasification (CWOPG) Facililty

[3] Oxychem: Caustic Potash Handbook

[4] ENS-NWPVR-SPE-24020: Scrubber S1501 Specification Sheet

[5] ENS-NWPVR-REP-24030: Centrifugal Pumps Sizing Report for NW PlasGas Facility

[6] SHEQ-2011-REP-01017, 2011 : Pelindaba Site, Site Description Rev 2, NECSA

[7] Learman, Simon. (2009). Pump Sizing Calculator, Blackmonk Engineering Ltd

[8] ENS-OWPVR-PID-24005: Uranium Contaminated Waste Oil Plasma Gasification P&ID – Off-Gas Handling System

NOTES AND ABBREVIATIONS

[a] For the NW PlasGas Facility, the sump tank of scrubber S1501 will be charged with a batch of aqueous 30% KOH solution at the start, and this solution will then be recirculated through the heat exchanger H1504 before it is split between the scrubber and quench. 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 in the scrubbing solution will react with HCl and CO_2 in the gas entering the scrubber until all the KOH is consumed. At the end of this phase, the composition of the scrubbing solution will be 68% water, 1% KCl and 31% K_2CO_3. At the end of the second phase, the solution composition of the scrubbing solution will be 59.6% water, 1.9% KCl and 38.5% $KHCO_3$. At the end of the third phase, the solution composition will be 63.8% water, 4.4% KCl and 31.8% $KHCO_3$. At this point, the solution is considered to be spent and will be replaced with a fresh batch of aqueous 30% KOH solution.

[b] For the CWOPG Facility, the sump tank of scrubber S1501 will also be charged with a batch of aqueous 30% KOH solution at the start, and the scubber solution composition will change over time due to the chemical reactions taking place in the scrubber. At the end of phase 1, the composition (w/w) will be 67.2% water, 0.01% KCl, <0.01% KF, and 32.7% K_2CO_3. At the end of phase 2, the composition will be 60.2% water, 0.02% KCl, <0.01% KF, and 39.7% $KHCO_3$. At the end of the final phase, the composition will be 65.3% water, 0.06% KCl, 0.01% KF, and 34.6% $KHCO_3$.

[c] ASME - American Society of Mechanical Engineers

[d] ASTM - American Society for Testing and Materials

[e] dB - Decibel

[f] H_2O - Water

[g] K_2CO_3 - Potassium Carbonate

[h] KCl - Potassium Chloride

[i] KF - Potassium Fluoride

[j] $KHCO_3$ - Potassium Bicarbonate

[k] KOH - Potassium Hydroxide

[l] NB - Nominal Bore

[m] N/A - Nominal Applicable

[n] QC - Quality Class

[o] RF - Raised Face

[p] SC - Safety Class

[q] SS - Stainless Steel

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NOTES AND ABBREVIATIONS

[r] UO_3 - Uranium Trioxide

[s] % - Mass Fraction Percentage for all compositions specified

[t] Supplier to advise on special requirements for installation of pump.

[u] The NW PlasGas and CWOPG Facilities will not be operated simultaneously. Therefore, the KOH circulation pump will service only one of the facilities at any given time.

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