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ENGINEERING SERVICES DEPARTMENT
INSTRUMENT LOOP SPECIFICATION SHEET

Project	NW PlasGas Demonstration Facility	Unit Tag Number	PCV1302B
Datasheet Document No.	ENS-NWPVR-SPE-24005	Revision	1
Description	Pressure regulator on the main nitrogen gas supply line to the NW PlasGas Demonstration Facility		
Plant Location	Necsa, Pelindaba, North-West Province.		
Equipment Location	NW PlasGas Demonstration Facility - Outside Laboratory 150, Building V-H2.		
Safety Classification	Non-classified(N) and SC-3(C)		
Quality Classification	Non-classified(N) and QC-3(C)		

PROCESS CONDITIONS	UNITS	MINIMUM	NORMAL	MAXIMUM	ACCURACY
Measurement Range	kPa(g)	400	600	1000	Medium
Controlled Range	kPa(g)	-	400	-	Medium

GENERAL	MEASUREMENT POINT	CONTROL POINT
Process Fluid	Nitrogen	
Fluid State	Gas	
P&ID Number	ENS-NWPVR-PID-24004 [6]	
Line Number	15-13-NHVP-11 [6]	Same as for measurement point
Design Temperature [°C]	93	
Design Pressure [kPa(g)]	21340	
SIL Rating	-	

MEASUREMENT SPECIFICATION

FLUID PROPERTIES	UNITS	MINIMUM	NORMAL	MAXIMUM	REFERENCE
Molecular Weight	kg/kmol	-	28,013	-	Table 2-164 page 2-139 [1]
Operating Temperature	°C	-2.6	25	40	[2]
Operating Pressure (upstream)	kPa(g)	400	600	1000	Minimum from Page 6 [3] Normal from [5]
Compressibillity Factor	-	0,97	0,98	0,99	Fig A.9, page 278 [6]
Density (@ min., normal, and max. for both operating pressure and temperature.)	kg/m^3	5,79	7,78	13,55	Note 1
Viscosity (@ min., normal, and max. for operating temperature.)	Pa.s	1,60E-04	1,80E-04	1,85E-04	Fig.2-32 page 2-321 [1]
Specific Heat Ratio (Cp/Cv)	-	-	1,410	-	Table 4.3, Page 165 [7]
Thermal Conductivity	W/m.K	0,0226	0,0254	0,026	Note 2
Required Measured Range (upstream)	kPa(g)	0	-	1500	-
Required Measured Range (downstream)	kPa(g)	0	-	1500	-

CONTROL INFORMATION

VALVE SIZING INFO. & SPECIFICATION	UNITS	MINIMUM	NORMAL	MAXIMUM	REFERENCE
Valve Inlet Pressure	kPa(g)	400	600	1000	Minimum from Page 6 [3] Normal from [5]
Valve Outlet Pressure = Regulator Setpoint Pressure	kPa(g)	-	400	-	[5]
Maximum Differential Pressure Allowed Across Control Valve	kPa	-	-	600	-
Critical Flow	-	-	No	-	-
Mass Flowrate	kg/h	-	5,9	-	Page 6 [3]
P$_c$ - Critical Pressure	kPa(a)	-	3390	-	Table 2-164 page 2-139 [1]
Fail Action	-	N/A			-
Seat Leakage Class		Supplier to advise		-
Maximum Shut - Off Differential Pressure	kPa(g)	1000			-

VALVE MECHANICAL PROPERTIES
MATERIAL OF CONSTRUCTION

Body	Bellows	Spring	Seat	Disk and STEM
316 SS	Supplier To advise	NA	Die Formed Flexible Graphite With Anti-Extrusion Rings	316 SS
Bonnet/Cap		Type	Wetted parts	Non-wetted parts
316 SS		Two-stage	SS	SS

PROCESS CONNECTION

	Flange Spec.	Flange Rating	Pipe Size (NB)
Inlet	SS, ASTM A182-F316/316L, ASME B16.5 (Supplier Shall Advise of Alternative)	Class 1500	15
Outlet	SS, ASTM A182-F316/316L, ASME B16.5 (Supplier Shall Advise of Alternative)	Class 1500	15
Valve rating	Class 1500		

ALARM / SWITCH	FALLING		RISING		UNITS or %	INTERLOCKS
	LowLow	Low	High	High High		
LOCAL ALARM	-	-	-	-		
REMOTE ALARM	-	-	-	-		N/A
SWITCH ONLY	-	-	-	-		

DISPLAY	LOCAL	REMOTE	RECORDING
	Yes	-	-

REFERENCE DRAWINGS / DOCUMENTS

[1] Perry, R. H., & Green, D. W. (1997). Perry's Chemical Engineers Handbook 7th Edition, McGraw-Hill Company.
[2] SHEQ-2011-REP-01017,2011: Pelindaba Site, Site Description Rev 2, NECSA
[3] ENS-NWPVR-CLC-24013, Process Gases Requirements for the NW PlasGas Demonstration System
[4] Sinnot, R. K. (2005). Coulson & Richardson's CHEMICAL ENGINEERING, Chemical Engineering Design, Volume 6, 4th Edition.
[5] ENS-NWPVR-PID-24004, NW PlasGas Demonstration Plant P&ID Diagram, Subsystem 13
[6] Rase, H. F. (1963). Piping Design for Process Plant. New York: John Wiley & Sons, Inc.
[7] Joseph F. Louvar, Daniel A Crowl, 2011: Chemical Process Safety Fundamentals with Applications, 3rd edition

NOTES
1) Minimum density was calculated from the highest temperature and lowest pressure, normal density at normal conditions, and maximum density at the lowest temperature and highest pressure
2) Thermal conductivity was calculated from Equation 8.13 on Section 8.8.3 page 321 [4]. The specific heat capacity used in the equation was calculated from Equation on Appendix C, Page 939 of [4] at minimum, normal and maximum temperature.

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