## ENGINEERING SERVICES DEPARTMENT
## INSTRUMENT LOOP SPECIFICATION SHEET

| | | | |
|---|---|---|---|
| **Project** | PTFE Filter Destruction Project | **Unit Tag Number** | PCV83342B |
| **Datasheet Document No.** | ENS-FDP-SPE-24042 | **Revision** | 1 |
| **Description** | Pressure regulator on the main nitrogen gas supply line to the PTFE Filter Destruction Facility | | |
| **Plant Location** | Necsa, Pelindaba, North-West Province. | | |
| **Equipment Location** | PTFE Filter Destruction Facility - Outside Laboratory 131, 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) | 450 | 600 | 1000 | Medium |
| **Controlled Range** | kPa(g) | - | 400 | - | Medium |

| **GENERAL** | **MEASUREMENT POINT** | **CONTROL POINT** |
|---|---|---|
| **Process Fluid** | Nitrogen | Same as for measurement point |
| **Fluid State** | Gas | |
| **P&ID Number** | ENS-FDP-PID-24005 [6] | |
| **Line Number** | 15-833-NHVP-058 | |
| **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)** | 450 | 600 | 1000 | Minimum (Section 4.2.3 [3]). |
| **Compressibillity Factor** | **Z** | 0,97 | 0,98 | 0,99 | Fig A.9, page 278 [7] |
| **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 [8] |
| **Thermal Conductivity** | **W/m.K** | 0,0226 | 0,0254 | 0,026 | Note 2 |
| **Required Measured Range (upstream)** | **kPa(g)** | 0 | - | 1500 | Page 11 [4] |
| **Required Measured Range (downstream)** | **kPa(g)** | 0 | - | 1500 | Page 11 [4] |

**CONTROL INFORMATION**

| **VALVE SIZING INFO. & SPECIFICATION** | **UNITS** | **MINIMUM** | **NORMAL** | **MAXIMUM** | **REFERENCE** |
|---|---|---|---|---|---|
| **Valve Inlet Pressure** | **kPa(g)** | 450 | 600 | 1000 | Minimum (Section 4.2.3 [3]). |
| **Valve Outlet Pressure = Regulator Setpoint Pressure** | **kPa(g)** | - | 400 | - | [6] |
| **Maximum Differential Pressure Allowed Across Control Valve** | **kPa** | - | - | 1000 | - |
| **Critical Flow** | **-** | - | No | - | - |
| **Mass Flowrate** | **kg/h** | 0 | 3 | 10 | Page 11 [4] |
| **$P_c$ - 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** | **INTERLOCKS** |
|---|---|---|---|---|---|---|
| | **LowLow** | **Low** | **High** | **High High** | **or %** | |
| **LOCAL ALARM** | - | - | - | - | - | N/A |
| **REMOTE ALARM** | - | - | - | - | - | |
| **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-FDP-CLC-24014, Mass Balance Calculation for the PTFE Filter Destruction System

[4] ENS-FDP-LST-24003, PTFE Filter Destruction Plant Instrumentation List

[5] Sinnot, R. K. (2005). Coulson & Richardson's CHEMICAL ENGINEERING, Chemical Engineering Design, Volume 6, 4th Edition.

[6] ENS-FDP-PID-24004, PTFE Filter Destruction Project - P&ID Diagram: Gas Supply System 833

[7] Rase, H. F. (1963). Piping Design for Process Plant. New York: John Wiley & Sons, Inc.

[8] 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 [5]. The specific heat capacity used in the equation was calculated from Equation on Appendix C, Page 939 of [5] at minimum, normal and maximum temperature. | | | |
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