

CONVERGENCE ANALYSIS

Calculation method	Converge	Pressure	5.503	Flow Distribution	0.00%
Convergence at 100%	0.5	Absolute error	0.00%	Damping (No convergence at 100%)	40%
Error_Converge	0.002%	Error threshold for convergence	2.0%	New calculated value	30.00%
Error_Target	0.002%	Initial estimate	30.000	Used Estimate	5.503
Counter	3	Next estimate	5.503	Formula_block	29.36%
Max_Count	10			Est_numbers	29.36%
	Successful Convergence			Calc_numbers	

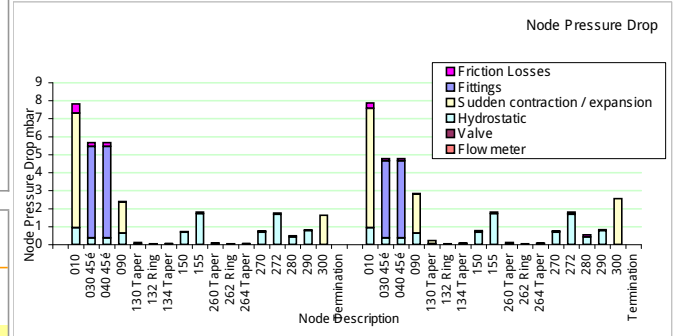
Heat Transfer Error #DIV/0! Design Analysis Worksheet

CALCULATE

Calculation method

Initial calculation

Convergence



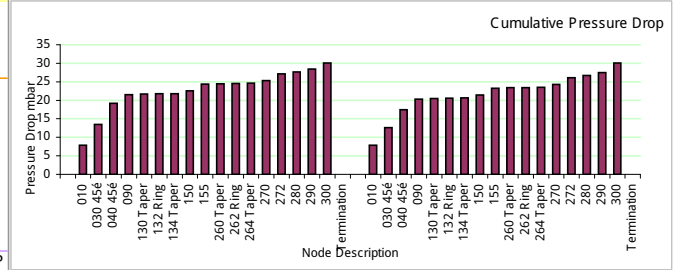
PRESSURE DROP ANALYSIS

Fluid Helium Ambient 24.00 °C

Drawing 318711-J LA-001-001-detail of Helium chimney-revB.PDF Chimney pipe heat flux 0 W / m² 75.20 °F

Include the obstruction of the conductor support in the pipe close to the CCR and the larger diameter of the pipe close to the CCR 297.15 K

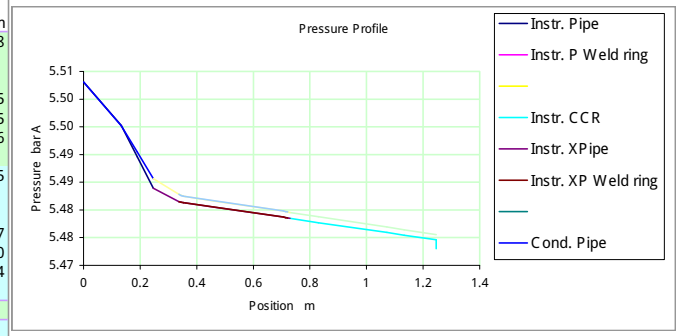
	SA	Heat Flux	Heating	Vent Flow	
Inlet pressure	5.503 bar A				
Inlet temperature	6.89 K	Helium vessel 10.055 m ³	0 W / m ²	0.0 W	0 kg / hr 0.0%
Outlet pressure	5.473 bar A	Helium vessel - ID 4.488 m ³	0 W / m ²	0.0 W	0 kg / hr 0.0%
Outlet temperature	6.88 K	oil Assy - Quench SA 2.706 m ³	24500 W / m ²	66.3 W	9594 kg / hr 100.0%
Instrument wire	Include	Coil Assy 10.556 m ³	0 W / m ²	0.0 W	0 kg / hr 0.0%
		Chimney 0.971 m ³	0 W / m ²	0.0 W	0 kg / hr 0.0%
		CCR 0.984 m ³	0 W / m ²	0.0 W	0 kg / hr 0.0%
		Total 29.76 m ³		66.3 W	9594 kg / hr 100.0%



Large Pipe

Lead Clamp Instrument	Lead Clamp Instrument	Area	Perimeter	Large diameter	Small diameter	Width - Large piece	Width small piece	Thickness
		1068.61 mm ²	140.67 mm	37.58 mm	7.195 mm	75.0 mm	36.0 mm	1.0 mm

Geometry & Pressure Drop	Section	Diam or width	Inner diam or depth	Flow Paths	Heat Load per path	Length	Vertical Rise / -Fall	Change on Losses	Fittings	Section Change hydrostatic	Valve Flowmeter	Total	Unit DP
Instr. Pipe	Smooth	52.20		1	0.0	0.246	0.238	0.93	10.18	6.38	1.67	19.16	3.78
Instr. P Weld ring	Smooth	48.20		1	0.0								
Instr. CCR	Smooth	82.80		1	0.0	0.517	0.517	0.18		1.67	3.61	5.47	0.35
Instr. XPipe	Smooth	77.90		1	0.0	0.452	0.452	0.16		1.78	3.16	5.09	0.35
Instr. XP Weld ring	Smooth	73.90		1	0.0	0.031	0.031	0.01		0.12	0.22	0.35	0.46
Cond. Pipe	Smooth	52.50		2	0.0	0.246	0.238	0.56	8.58	6.63	1.67	17.44	2.25
Cond. P Weld Ring	Smooth	48.50		2	0.0								
Cond. P Clamp	Coaxial	37.58	7.20	2	0.0								
Cond. CCR	Smooth	82.80		2	0.0	0.517	0.517	0.29		2.63	3.61	6.53	0.57
Cond. XPipe	Smooth	77.90		2	0.0	0.452	0.452	0.18		2.30	3.16	5.64	0.40
Cond. XP Weld ring	Smooth	73.90		2	0.0	0.031	0.031	0.01		0.24	0.22	0.47	0.44
Cond. XP Clamp	Smooth	82.80		2	0.0								
Total Instr. Path						1.247	1.239	1.29	10.18	9.96	8.65	30.07	
Total Cond. Path						1.247	1.239	1.04	8.58	11.80	8.65	30.07	





Cond. Pipe

Line number (Typical)	Cvsostat	Cond. Pipe 010	Cond. Pipe 030 45° Elbow	Cond. Pipe 040 45° Elbow	Cond. Pipe 090 Divergent	Cond. Pipe 130 Taper	Cond. Pipe 132 Ring	Cond. Pipe 134 Taper	Cond. Pipe 150	Cond. Pipe 155	Cond. Pipe 260 Taper	Cond. Pipe 262 Ring	Cond. Pipe 264 Taper	Cond. Pipe 270	Cond. Pipe 272	Cond. Pipe 280	Cond. Pipe 290	Cond. Pipe 300	CCR Termination		
Description																					
Conditions	"Two phase" or "gas"	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas		
Inlet pressure	bar A	5.503	5.503	5.495	5.490	5.486	5.483	5.483	5.482	5.482	5.480	5.480	5.480	5.480	5.479	5.477	5.476	5.476	5.473		
Outlet pressure	bar A	5.503	5.495	5.490	5.486	5.483	5.483	5.483	5.482	5.482	5.480	5.480	5.480	5.480	5.479	5.477	5.476	5.476	5.473		
Inlet temperature	°C																				
Heat (imposed at outlet)	K	6.89	6.89	6.89	6.89	6.89	6.88	6.88	6.88	6.88	6.88	6.88	6.88	6.88	6.88	6.88	6.88	6.88	6.88		
W		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		
Checking data entry	Mixture	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK		
Temperature	°C	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK		
Temperature	°C	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK		
Gas flow rate	kg / hr	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK		
Liquid flow rate	g / s	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK		
Mass flows	kg / hr	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK		
Section change		OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK		
Flow rate	Gas kg / hr																				
Liquid kg / hr		1882.5																			
Gas g / s			1882.5	1882.5	1882.5	1882.5	1882.5	1882.5	1882.5	1882.5	1882.5	1882.5	1882.5	1882.5	1882.5	1882.5	1882.5	1882.5	1882.5		
Liquid g / s		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Inlet temperature	°C	-266.26	-266.26	-266.26	-266.26	-266.26	-266.27	-266.27	-266.27	-266.27	-266.27	-266.27	-266.27	-266.27	-266.27	-266.27	-266.27	-266.27	-266.27		
K		6.89	6.89	6.89	6.89	6.89	6.88	6.88	6.88	6.88	6.88	6.88	6.88	6.88	6.88	6.88	6.88	6.88	6.88		
Outlet temperature	°C	-266.26	-266.26	-266.26	-266.27	-266.27	-266.27	-266.27	-266.27	-266.27	-266.27	-266.27	-266.27	-266.27	-266.27	-266.27	-266.27	-266.27	-266.27	-266.27	
K		6.89	6.89	6.89	6.89	6.88	6.88	6.88	6.88	6.88	6.88	6.88	6.88	6.88	6.88	6.88	6.88	6.88	6.88		
GEOMETRY	Length m	0.000	0.1336	0.0564	0.0564	0.0909	0.0075	0.0081	0.0075	0.1000	0.2462	0.0075	0.0081	0.0075	0.1000	0.2430	0.0610	0.1130	0.0000		
Vertical rise m		0.000	0.1336	0.0524	0.0524	0.0909	0.0075	0.0081	0.0075	0.1000	0.2462	0.0075	0.0081	0.0075	0.1000	0.2430	0.0610	0.1130	0.0000		
Type		Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth		
Number of flow paths		1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2		
Maximum diameter / depth mm		1000.00	52.50	52.50	52.50	77.90	73.90	73.90	77.90	77.90	77.90	73.90	77.90	77.90	82.80	82.80	82.80	82.80	545.00		
Minimum diameter / width																					
Obstruction	Instr 1 Diam mm	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a		
Instr 2 Diam mm		n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a		
Instr 3 Diam mm		n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a	n-a		
Weld Strip Width - Pair mm											10.00	10.00									
Weld Strip Depth - Pair mm											2.00	2.00									
Conductor width mm		20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00		
Conductor depth mm		4.00	4.00	4.00	4.00	4.00	12.00	12.00	12.00	12.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00		
Conductor S support width mm																50.80	50.80	50.80	50.80		
Conductor S support depth mm																9.50	9.50	9.50	9.50		
Conductor S support recess mm																4.00	4.00	4.00	4.00		
Conductor struts width mm									75.00						75.00						
Conductor struts thickness mm									36.00						36.00						
									1.00						1.00						
Obstructed area mm ²		160.00	160.00	160.00	160.00	480.00	480.00	480.00	782.00	560.00	320.00	320.00	320.00	542.00	1125.20	1125.20	1125.20	1125.20	257.20		
Obstruction perimeter mm		96.00	96.00	96.00	96.00	128.00	128.00	128.00	372.00	144.00	112.00	112.00	112.00	340.00	257.20	257.20	257.20	257.20	257.20		
Free flow area mm ²		4329.51	4329.51	4329.51	4329.51	9532.24	8578.45	8578.45	9532.24	9532.24	8578.45	8578.45	9532.24	10769.13	10769.13	10769.13	10769.13	10769.13	#####		
Free flow perimeter mm		329.87	329.87	329.87	329.87	489.46	464.33	464.33	489.46	489.46	464.33	464.33	489.46	520.25	520.25	520.25	520.25	520.25	3424.34		
Flow area mm ²		785398.2	4169.5	4169.5	4169.5	9372.2	8098.4	8098.4	9052.2	8750.2	8972.2	8258.4	8258.4	9212.2	10227.1	9643.9	9643.9	9643.9	465440.6		
Penimeter mm		425.87	425.87	425.87	425.87	585.46	592.33	592.33	617.46	861.46	633.46	633.46	633.46	601.46	860.25	777.45	777.45	777.45	3681.54		
Hydraulic diameter mm		1000.00	39.2	39.2	39.2	64.0	54.7	54.7	58.6	40.6	56.7	57.3	57.3	61.3	47.6	49.6	49.6	49.6	505.7		
Elbow 45° - Std																					
Elbow 45° - Std																					
CONTRACTION / EXPANSION LOSSES	Node upstream effective diameter mm	1000.00	1000.00	72.86	72.86	72.86	72.86	109.24	101.54	101.54	107.36	107.36	105.55	106.88	102.54	102.54	108.30	114.11	110.81	110.81	110.81
Node effective diameter mm		1000.00	72.86	72.86	72.86	109.24	101.54	101.54	107.36	105.55	106.88	106.88	105.55	106.88	102.54	102.54	108.30	114.11	110.81	110.81	110.81
Section Change		Contract - Sudden	Contract - Sudden	Contract - Sudden	Contract - Sudden	Expand - Divergent	Contract - Converge	Expand - Divergent	Contract - Sudden	Expand - Divergent	Contract - Sudden	Expand - Divergent	Contract - Sudden	Expand - Divergent	Contract - Sudden	Expand - Divergent	Contract - Sudden	Expand - Divergent	Contract - Sudden		
NODE PRESSURE DROP	Friction Losses mbar	0.00	0.30	0.13	0.13	0.03	0.00	0.00	0.00	0.06	0.09	0.00	0.00	0.00	0.04	0.09	0.12	0.04	0.00		
Fittings mbar		0.00	0.00	4.29	4.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Sudden contraction / expansion mbar		0.00	6.63	0.00	0.00	2.18	0.17	0.00	0.04	0.03	0.00	0.06	0.00	0.04	0.03	0.03	0.00	0.00	2.57		
Hydrostatic mbar		0.00	0.94	0.37	0.37	0.64	0.05	0.06	0.05	0.70	1.72	0.05	0.06	0.05	0.70	1.70	0.43	0.79	0.00		
Valve mbar		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Flow meter mbar		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
TOTAL NODE PRESSURE DROP mbar		0.00	7.87	4.78	4.78	2.84	0.23	0.06	0.10	0.79	1.81	0.12	0.06	0.09	0.76	1.82	0.54	0.83	2.57		
bar		0.000	0.009	0.005	0.005	0.003	0.000	0.000	0.000	0.001	0.002	0.000	0.000	0.000	0.001	0.002	0.001	0.001	0.003		
GAS FLOW REGIME	Viscosity kg / m.s	2.6E-06	2.6E-06	2.6E-06	2.6E-06	2.6E-06	2.6E-06	2.6E-06	2.6E-06	2.6E-06	2.6E-06	2.6E-06	2.6E-06	2.6E-06	2.6E-06	2.6E-06	2.6E-06	2.6E-06	2.6E-06		
Density kg / mE		71.371	71.371	71.305	71.264	71.223	71.199	71.197	71.197	71.196	71.189	71.174	71.173	71.172	71.172	71.165	71.150	71.145	71.138		
G kg / mE		2.40	451.49	451.49	451.49	200.86	232.45	232.45	207.96	215.13	209.81	227.95	227.95	204.34	184.07	195.20	195.				