



CONVERGENCE ANALYSIS

Calculation method Converge  
 Damping (No convergence at 100%) 0.5  
 Error\_Converge 0.002%  
 Error\_Target 0.002%  
 Counter 5  
 Max\_Count 10  
**Successful Convergence**

**CALCULATE**

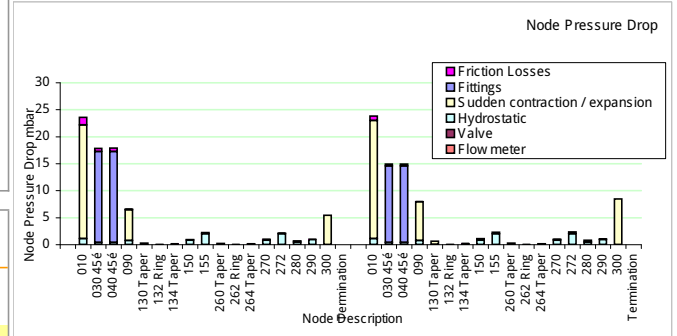
Calculation method

Initial calculation

Convergence

	Pressure	Flow Distribution
Absolute error	0.00%	0.00%
Error threshold for convergence	2.0%	
Damping (No convergence at 100%)	40%	30.00%
New calculated value	6.580	29.38%
Initial estimate	30.000	33.00%
Used Estimate	6.580	29.38%
Next estimate	6.580	29.38%

Heat Transfer Error #DIV/0! Design Analysis Worksheet

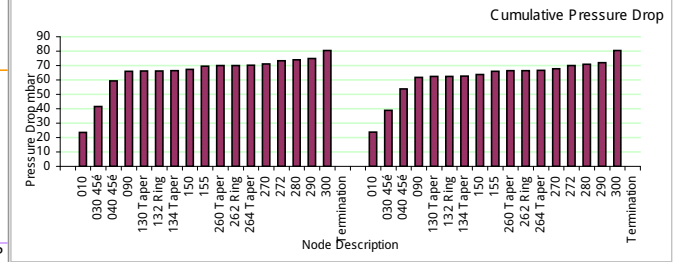


PRESSURE DROP ANALYSIS

Fluid Helium Ambient 24.00 °C  
 Drawing 318711-J-LA-001-001-detail of Helium chimney-revB.PDF Chimney pipe heat flux 0 W / m<sup>2</sup> 75.20 °F 297.15 K

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

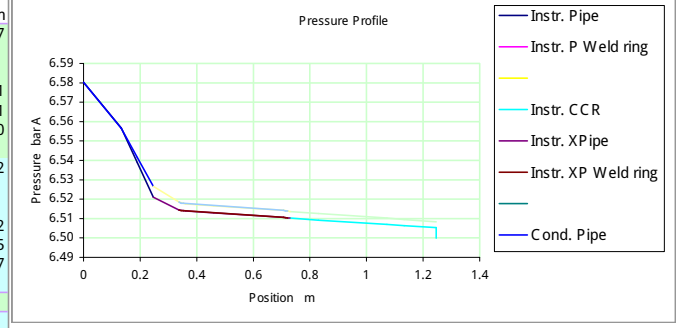
	SA	Heat Flux	Heating	Vent Flow	
Inlet pressure	6.580 bar A				
Inlet temperature	7.03 K	Helium vessel 10.055 m <sup>3</sup>	6691 W / m <sup>2</sup>	67.3 W	8778 kg / hr 44.4% Include
Outlet pressure Target	6.500 bar A	Helium vessel - ID 4.488 m <sup>3</sup>	6691 W / m <sup>2</sup>	30.0 W	3918 kg / hr 19.8% Include
Outlet pressure Calculated	6.500 bar A	oil Assy - Quench SA 2.706 m <sup>3</sup>	15225 W / m <sup>2</sup>	41.2 W	5376 kg / hr 27.2% Include
Outlet temperature	7.01 K	Coil Assy 10.556 m <sup>3</sup>	0 W / m <sup>2</sup>	0.0 W	0 kg / hr 0.0% Exclude
Instrument wire Include		Chimney 0.971 m <sup>3</sup>	6691 W / m <sup>2</sup>	6.5 W	848 kg / hr 4.3% Include
		CCR 0.984 m <sup>3</sup>	6691 W / m <sup>2</sup>	6.6 W	859 kg / hr 4.3% Exclude
		<b>Total</b> 29.76 m <sup>3</sup>		<b>151.6 W</b>	<b>19779 kg / hr 100.0%</b>



Large Pipe

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

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	2.65	33.67	21.07	1.97		59.36	10.77
Instr. P Weld ring	Smooth	48.20		1	0.0									
Instr. CCR	Smooth	82.80		1	0.0	0.517	0.517	0.52		5.55	4.24		10.31	1.01
Instr. XPipe	Smooth	77.90		1	0.0	0.452	0.452	0.46		5.89	3.71		10.06	1.01
Instr. XP Weld ring	Smooth	73.90		1	0.0	0.031	0.031	0.04		0.40	0.25		0.70	1.30
Cond. Pipe	Smooth	52.50		2	0.0	0.246	0.238	1.58	28.33	21.87	1.97		53.75	6.42
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	0.84		8.69	4.24		13.77	1.62
Cond. XPipe	Smooth	77.90		2	0.0	0.452	0.452	0.52		7.59	3.71		11.83	1.15
Cond. XP Weld ring	Smooth	73.90		2	0.0	0.031	0.031	0.04		0.79	0.26		1.09	1.27
Cond. XP Clamp	Smooth	82.80		2	0.0									
<b>Total Instr. Path</b>						1.247	1.239	3.67	33.67	32.92	10.17		80.43	
<b>Total Cond. Path</b>						1.247	1.239	2.98	28.33	38.95	10.17		80.43	





Line number (Typical)	Crvostat	Instr. Pipe 010	Instr. Pipe 030 45° Elbow	Instr. Pipe 040 45° Elbow	Instr. Pipe 090	Instr. XP V Taper	Instr. XP V 130 Ring	Instr. XP V 134 Taper	Instr. XP V 150	Instr. XP V 155	Instr. XP V 260 Taper	Instr. XP V 262 Ring	Instr. XP V 264 Taper	Instr. CCR 270	Instr. CCR 272	Instr. CCR 280	Instr. CCR 290	Instr. CCR 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	6.580	6.580	6.557	6.539	6.521	6.514	6.514	6.514	6.513	6.511	6.510	6.510	6.510	6.509	6.507	6.506	6.505	6.500
Outlet pressure	bar A	6.580	6.557	6.539	6.521	6.514	6.514	6.514	6.513	6.511	6.510	6.510	6.510	6.509	6.507	6.506	6.505	6.500	6.500
Inlet temperature	°C	7.03	7.03	7.03	7.02	7.02	7.02	7.02	7.02	7.02	7.02	7.02	7.02	7.02	7.02	7.01	7.01	7.01	7.01
Heat (imposed at outlet)	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	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
	Gas flow rate	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
	Liquid flow rate	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
	Mass flows	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	Error	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Flow rate	Gas kg / hr	1544.1	1544.1	1544.1	1544.1	1544.1	1544.1	1544.1	1544.1	1544.1	1544.1	1544.1	1544.1	1544.1	1544.1	1544.1	1544.1	1544.1	1544.1
	Liquid kg / hr	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
	Gas g / s	1544.1	1544.1	1544.1	1544.1	1544.1	1544.1	1544.1	1544.1	1544.1	1544.1	1544.1	1544.1	1544.1	1544.1	1544.1	1544.1	1544.1	1544.1
	Liquid used 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	-266.12	-266.12	-266.13	-266.13	-266.13	-266.13	-266.13	-266.13	-266.13	-266.13	-266.13	-266.13	-266.13	-266.13	-266.14	-266.14	-266.14	-266.14
	K	7.03	7.03	7.03	7.02	7.02	7.02	7.02	7.02	7.02	7.02	7.02	7.02	7.02	7.01	7.01	7.01	7.01	7.01
Outlet temperature	°C	-266.12	-266.13	-266.13	-266.13	-266.13	-266.13	-266.13	-266.13	-266.13	-266.13	-266.13	-266.13	-266.13	-266.14	-266.14	-266.14	-266.14	-266.14
	K	7.03	7.02	7.02	7.02	7.02	7.02	7.02	7.02	7.02	7.02	7.02	7.02	7.01	7.01	7.01	7.01	7.01	7.01
GEOMETRY	Length m	0.0000	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	0.0000	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	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Maximum diameter / depth mm	1000.00	52.20	52.20	52.20	77.90	73.90	77.90	73.90	77.90	77.90	73.90	77.90	73.90	77.90	82.80	82.80	82.80	82.80
	Minimum diameter / width																		
Obstruction	Instr 1 Diam mm	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00
	Instr 2 Diam mm	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
	Instr 3 Diam mm	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
	Weld Strip Width - Pair mm																		
	Weld Strip Depth - Pair mm																		
	Conductor width 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
	Conductor depth 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
	Conductor S support width 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
	Conductor S support depth 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
	Conductor S support recess 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
	Conductor struts width 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
	Conductor struts width 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
	Conductor struts thickness 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
	Obstructed area mm <sup>2</sup>	373.06	373.06	373.06	373.06	373.06	373.06	373.06	413.06	413.06	373.06	373.06	373.06	373.06	373.06	373.06	373.06	373.06	373.06
	Obstruction perimeter mm	116.24	116.24	116.24	116.24	116.24	116.24	116.24	124.24	124.24	116.24	116.24	116.24	116.24	116.24	116.24	116.24	116.24	116.24
	Free flow area mm <sup>2</sup>	2140.08	2140.08	2140.08	2140.08	2140.08	2140.08	2140.08	2140.08	2140.08	2140.08	2140.08	2140.08	2140.08	2140.08	2140.08	2140.08	2140.08	2140.08
	Free flow perimeter mm	163.99	163.99	163.99	163.99	163.99	163.99	163.99	163.99	163.99	163.99	163.99	163.99	163.99	163.99	163.99	163.99	163.99	163.99
	Flow area mm <sup>2</sup>	785398.2	1767.0	1767.0	1767.0	4393.1	3916.2	3916.2	4393.1	4353.1	4353.1	3916.2	3916.2	4393.1	5011.5	5011.5	5011.5	5011.5	232909.8
	Perimeter mm	3141.59	280.23	280.23	280.23	360.97	348.40	348.40	360.97	368.97	368.97	348.40	348.40	360.97	376.36	376.36	376.36	376.36	1828.41
	Hydraulic diameter mm	1000.0	25.2	25.2	25.2	48.7	45.0	45.0	48.7	47.2	47.2	45.0	45.0	48.7	53.3	53.3	53.3	53.3	509.5
FITTINGS	Description	Elbow 45° - Std	Elbow 45° - Std	Elbow 45° - Std	Elbow 45° - Std	Elbow 45° - Std	Elbow 45° - Std	Elbow 45° - Std	Elbow 45° - Std	Elbow 45° - Std	Elbow 45° - Std	Elbow 45° - Std	Elbow 45° - Std	Elbow 45° - Std	Elbow 45° - Std	Elbow 45° - Std	Elbow 45° - Std	Elbow 45° - Std	Elbow 45° - Std
CONTRACTION / EXPANSION LOSSES - NODE INLET	Node upstream effective diameter mm	1000.00	1000.00	47.43	47.43	47.43	47.43	74.79	74.79	70.61	70.61	74.79	74.45	74.45	70.61	70.61	74.79	79.88	79.88
	Node effective diameter mm	1000.00	47.43	47.43	47.43	74.79	70.61	74.79	74.45	74.45	70.61	70.61	74.79	79.88	79.88	79.88	79.88	79.88	79.88
	Section Change	Contract - Sudden	Contract - Sudden	Contract - Sudden	Contract - Sudden	Expand - Divergent	Contract - Converge	Expand - Divergent	Expand - Divergent	Contract - Converge	Expand - Divergent	Expand - Divergent	Expand - Sudden	Expand - Sudden	Expand - Sudden	Expand - Sudden	Expand - Sudden	Expand - Sudden	Expand - Sudden
NODE PRESSURE DROP	Friction Losses mbar	0.00	1.44	0.61	0.61	0.09	0.01	0.01	0.10	0.25	0.01	0.01	0.01	0.07	0.17	0.21	0.08	0.00	0.00
	Fittings mbar	0.00	0.00	16.82	16.85	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	21.07	0.00	0.00	5.73	0.22	0.00	0.08	0.00	0.00	0.19	0.00	0.08	0.11	0.00	0.00	0.00	5.44
	Hydrostatic mbar	0.00	1.10	0.43	0.43	0.75	0.06	0.07	0.06	0.82	2.02	0.06	0.07	0.06	0.82	1.99	0.50	0.93	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	DR mbar	0.00	23.61	17.86	17.89	6.57	0.29	0.08	0.15	0.92	2.27	0.26	0.08	0.15	1.00	2.16	0.71	1.00	5.44
	bar	0.00	0.024	0.018	0.018	0.007	0.000	0.000	0.001	0.002	0.002	0.000	0.000	0.000	0.002	0.002	0.001	0.001	0.005
GAS FLOW REGIME	Viscosity kg / m.s	2.8E-06	2.8E-06	2.8E-06	2.8E-06	2.8E-06	2.8E-06	2.8E-06	2.8E-06	2.8E-06	2.8E-06	2.8E-06	2.8E-06	2.8E-06	2.8E-06	2.8E-06	2.8E-06	2.8E-06	2.8E-06
	Density kg / mE	84.150	84.150	83.974	83.841	83.707	83.658	83.658	83.658	83.654	83.647	83.630	83.628	83.628	83.627	83.619	83.603	83.597	83.590
	G kg / mE	1.97	873.83	873.83	873.83	351.48	394.28	394.28	351.48	354.71	354.71	394.28	394.28	351.48					

