



Customer: Sigmaphi  
 Project: JLab Dipole Pressure Relief  
 Description: Helium Vessel Exit Relief Pipe Reservoir to the Relief Valve

54.102

SF / 12605

Design Note 210 Issue

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Fluid Helium												
Mass flow rate	6699 g / s	24115 kg / hr										
Pressure	4.460 bar G											Total Calculated Pressure Drop
	5.473 bar A											0.181
Vent temperature	6.590 K											bar A
Superheat	0.000 K											
Gas temperature	6.590 K											
		Entry Loss	NRV			Tee as Elbow	Tee as Elbow			Relief Valve Inlet		
Pressure		5.473	5.458	5.458	5.362	5.361	5.361	5.327	5.327	5.292	5.292	bar A
Temperature		6.590	6.587	6.590	6.572	6.589	6.602	6.614	6.633	6.644	6.662	K
Vapour density		83.174	83.048	82.883	81.856	81.109	80.573	80.020	78.545	78.099	76.640	kg / m³
Vapour viscosity		2.71E-06	2.70E-06	2.70E-06	2.68E-06	2.67E-06	2.66E-06	2.66E-06	2.64E-06	2.63E-06	2.62E-06	kg / m.s
Speed of sound		152.1	151.9	151.8	150.5	150.2	150.0	149.8	149.0	148.9	148.1	
Burst Disc MNFA												in²
Pipe nominal bore		4.000 n.b., sched 10S	4.000 n.b., sched 10S	4.000 n.b., sched 10S	4.000 n.b., sched 10S	4.000 n.b., sched 10S	4.000 n.b., sched 10S	4.000 n.b., sched 10S	4.000 n.b., sched 10S	4.000 n.b., sched 10S	4.000 n.b., sched 10S	
Outside diameter		114.30	114.30	180.00	114.30	114.30	114.30	114.30	114.30	114.30	114.30	mm
Wall		3.05	3.05		3.05	3.05	3.05	3.05	3.05	3.05	3.05	mm
Inside diameter		108.20	108.20	108.20	108.20	108.20	108.20	108.20	108.20	108.20	108.20	mm
Length		0.0	127.0	100.0	576.0	88.9	433.4	200.0	76.2	200.0	76.2	mm
Flow area		9195.5	9195.5	9195.5	9195.5	9195.5	9195.5	9195.5	9195.5	9195.5	9195.5	mm²
Parallel paths		1	1	1	1	1	1	1	1	1	1	
Single path mass flow rate		6698.6	6698.6	6698.6	6698.6	6698.6	6698.6	6698.6	6698.6	6698.6	6698.6	g / s
Mass velocity		728	728	728	728	728	728	728	728	728	728	kg / m².s
Velocity		8.76	8.77	8.79	8.90	8.98	9.04	9.10	9.27	9.33	9.51	m / s
Mach number		0.058	0.058	0.058	0.059	0.060	0.060	0.061	0.062	0.063	0.064	
Reynolds number			2.92E+07		2.94E+07	2.95E+07	2.96E+07		2.99E+07		3.01E+07	
Friction coefficient			0.00430		0.00429	0.00429	0.00428		0.00427		0.00426	
Pressure drop per unit length			1.27		1.29	1.30	1.30		1.33		1.36	mbar per m
Pressure drop			0.16		0.74	0.12	0.57		0.10		0.10	mbar
Sudden contraction	Large ID	Large										mm
	Small ID	108.20										mm
	Diameter ratio	0.000										
	Resistance coefficient	0.464										
	Pressure loss	14.81										mbar
Tee as elbow	Resistance coefficient											1.02
	Pressure loss											33.82
												34.65
												mbar
Valve	Valve Kv	270										
	Valve Cf	0.8										
	Maximum Subcritical pressure drop	1746.6										mbar
	Calculated pressure drop	96.2										mbar
	Pressure drop	96.2										mbar
Heating	External Surface area	0	45604	56549	206832	31923	155623	71817	27362	71817	27362	mm²
	Heat Flux + contingency	7000	7000	7000	7000	33000	7000	33000	33000	33000	33000	W / m²
	Heat Load	0.00	319.23	395.84	1447.83	1053.44	1089.36	2369.95	902.95	2369.95	902.95	W
	Node outlet pressure	5.458	5.458	5.362	5.361	5.361	5.361	5.327	5.327	5.292	5.292	bar A
	Inlet specific enthalpy	17.398	17.398	17.445	17.504	17.721	17.878	18.041	18.394	18.529	18.883	kJ / kg
	Specific enthalpy increment	0.000	0.048	0.059	0.216	0.157	0.163	0.354	0.135	0.354	0.135	kJ / kg
	Outlet specific enthalpy	17.398	17.445	17.504	17.721	17.878	18.041	18.394	18.529	18.883	19.018	kJ / kg
	Outlet temperature	6.587	6.590	6.572	6.589	6.602	6.614	6.633	6.644	6.662	6.673	K
	Temperature rise	-0.003	0.004	-0.018	0.017	0.012	0.013	0.019	0.010	0.018	0.010	K
Total pressure drop	Pipe friction		0.16		0.74	0.12	0.57		0.10		0.10	mbar
	Sudden contraction	14.81										mbar
	Tee as elbow						33.82		34.65			mbar
	Valve			96.25								
	TOTAL	14.81	0.16	96.25	0.74	0.12	0.57	33.82	0.10	34.65	0.10	mbar
	Node outlet pressure	5.46	5.46	5.36	5.36	5.36	5.36	5.33	5.33	5.29	5.29	bar A
	Node outlet temperature	6.59	6.59	6.57	6.59	6.60	6.61	6.63	6.64	6.66	6.67	K