



Customer Sigmaphi Project Jlab Q2-Q3 Quadrupole Pressure Relief Project Number SF / 13603 Description Vessel Vent Path Vessel to the Relief Valve Design Note 234 Issue 1  
 msg\_corner Version at 1 May 2016

Fluid	Helium					
Mass flow rate	9594.0 kg / hr				Pressure drop	
	2665.0 g / s					
Pressure	0.740 bar G					
	1.753 bar A				Total	57 mbar 100.0%
Vent temperature	7.02 K				Convergence error - Absolute	0.00%
Superheat	0.00 K					Successful Convergence
Gas temperature	7.02 K					

Column insertion		Valid	Valid	Valid		
Start Position		010	020	030	040	50
Finish Position		020	030	040	050	
Description	Entry Loss	010 to 020	020 to 030	030 to 040	040 to 050	Vent
Type						
Divertor Valve Kv						
Divertor Valve Cf						
Burst disc Sizing parameter						
Pressure	1.753	1.753	1.735	1.735	1.735	1.696 bar A
Temperature	7.020	7.020	7.011	7.011	7.066	7.102 K
Vapour density	13.850	13.845	13.709	13.709	13.559	kg / m³
Vapour viscosity	1.85E-06	1.85E-06	1.85E-06	1.85E-06	1.86E-06	kg / m.s
Speed of sound	147.4	147.4	147.4	147.4	148.2	in²
Pipe nominal bore	4.000 n.b., sched 40S	4.000 n.b., sched 40S	4.000 n.b., sched 40S	4.000 n.b., sched 40S	4.000 n.b., sched 40S	
Outside diameter	114.30	114.30	114.30	114.30	114.30	mm
Wall	6.02	6.02	6.02	6.02	6.02	mm
Inside diameter	102.26	102.26	102.26	102.26	102.26	mm
Length	0.0	159.6	0.0	76.2	76.2	mm
Flow area	8213.1	8213.1	8213.1	8213.1	8213.1	mm²
Mass flow	2665.0	2665.0	2665.0	2665.0	2665.0	g / s
Mass velocity	324	324	324	324	324	kg / m².s
Velocity	23.43	23.44	23.67	23.67	23.93	
Mach number	0.159	0.159	0.161	0.161	0.161	

<b>Pipe Contraction (Node Inlet)</b>	Geometry					
	Upstream diameter (Large)	108.20				
	Node Diameter	102.26				
	Length					
	Angle					
	Diameter ratio	0.945				
	Resistance coefficient	0.017				
	Pressure loss	0.63				mbar

<b>Pipe Friction Loss</b>	Reynolds number	1.79E+07	1.79E+07	1.79E+07	1.79E+07	
	Friction coefficient	0.00486	0.00486	0.00486	0.00486	
	Pressure drop per unit length	1.81	1.82	1.82	1.85	
	Pressure drop	0.29	0.00	0.14	0.14	mbar per m

<b>Pipe Enlargement (Node Outlet)</b>	Node Diameter				Sudden	102.26	mm
	Downstream diameter (Large)				Large		mm
	Length						mm
	Angle						
	Coefficient						
	Pressure loss					38.8	mbar

<b>Pipe Fitting (Node Outlet)</b>	Fitting	Elbow 90°				
	Velocity head loss index	1				
	Velocity head loss	0.45				
	Pressure loss	17.11				

(Enlargement & Fittings are mutually exclusive)

<b>Heating</b>	External Surface area	0	57307	0	27362	27362	mm³
	Heat Flux + contingency	0	0	33000	33000	33000	W / m²
	Heat Load	0.00	0.00	0.00	902.95	902.95	W

	Node outlet pressure	1.753	1.735	1.735	1.735	1.696	
	Inlet specific enthalpy	36.825	36.825	36.825	36.825	37.164	kJ / kg
	Specific enthalpy increment	0.000	0.000	0.000	0.339	0.339	kJ / kg
	Outlet specific enthalpy	36.825	36.825	36.825	37.164	37.503	kJ / kg
	Outlet temperature	7.020	7.011	7.011	7.066	7.102	K
	Temperature rise	0.000	-0.008	0.000	0.054	0.036	K

<b>Pressure Drop Summary</b>	Inlet contraction	0.63					mbar
	Pipe friction		0.29		0.14	0.14	mbar
	Outlet enlarger					38.83	mbar
	Pipe Fitting		17.11				mbar
	Divertor valve						mbar
	Burst disc						mbar
	TOTAL	0.63	17.40	0.00	0.14	38.97	mbar
	Node outlet pressure	1.75	1.74	1.74	1.74	1.70	bar A
	Node outlet temperature	7.02	7.01	7.01	7.07	7.10	K