Forces on a safety relief valve during discharging
acc. to Sempell catalogue K27E
ONE-PHASE AND TWO-PHASE FLOW

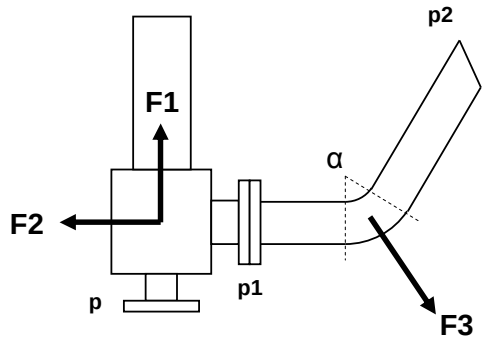
Project:	Keltan ACE DSM DEE
Item:	1PSV 3A02
Project number:	31491.02
Drawing number:	
Made by:	Heinz Jansen
Issue number	–
Issue date:	28 Mar 2008
Page:	1

INPUT DATA

Setpressure	p	=	23	barg		2783000	N/m²
Accumulation	Acc	=	21	%			
Back(over-)pressure at end of outlet pipe	p2	=	1,75	barg	=	175000	N/m²
Pressure drop over outlet pipe	Δp2	=	0,6	bar	=	60000	N/m²
Diameter inlet pipe	De	=	50	mm			
Diameter outlet pipe	Da	=	80	mm			
Smallest flow area	A0	=	616	mm²	=	0,000616	m²
Angle of the outlet elbow	α	=	90	°			
Dynamic shock factor	s	=	2,0	-			
–– gas/vapour phase							
Discharge capacity (0 = liquid flow)	Qmeg	=	11216	kg/h	=	3,116	kg/s
Density (0 if unknown)	ρ-g	=	0	kg/m³			
Relief temperature	T	=	122	℃	=	395,15	K
Isentropic exponent (= cp/cv)	κ	=	1,07	-			
Compressibility factor	Z	=	1	-			
Molar mass	M	=	67	kg/kmol			
–– liquid phase							
Discharge capacity (0 = gas flow)	Qmel	=	0	kg/h	=	0,000	kg/s
Density	ρ-l	=	0	kg/m³			

INTERMEDIATE RESULTS

Cross-sectional area inlet pipe	Ae	=	1963	mm²	=	0,001963	m²
Cross-sectional area outlet pipe	Aa	=	5027	mm²	=	0,005027	m²
Absolute backpressure at end of outlet pipe	p2'	=	276325	N/m²	=	2,763	bara
Absolute pressure at valve inlet	p'	=	2884325	N/m²	=	28,843	bara
Absolute pressure at valve outlet	p1'	=	336325	N/m²	=	3,363	bara
Overpressure at valve outlet	p1	=	235000	N/m²	=	2,350	barg
Gas velocity at orifice	we-g	=	85,99	m/s			
Gas velocity at valve outlet, theoretically	wa-g-th	=	90,37	m/s			
Gas sound velocity	wa-g-max	=	229,06	m/s			
Gas velocity at valve outlet	wa-g	=	90,37	m/s			
Density of the gas at valve outlet	ρ-g	=	6,86	kg/m³			
Liquid velocity at valve inlet	we-l	=	0,00	m/s			
Liquid velocity at valve outlet	wa-l	=	0,00	m/s			
Actual 2-phase fluid velocity at valve outlet	waa	=	90,37	m/s			
Force in bend due to gas flow inpulse	F3b-g	=	281,55	N			
Force in bend due to liquid flow inpulse	F3b-l	=	0,00	N			



FINAL RESULTS

			first shock	stationary	
Force at valve inlet	**F1**	=	**536**	**268**	**N**
Force at valve outlet	**F2**	=	**2926**	**0**	**N**
Force in outlet elbow	**F3**	=	**796**	**398**	**N**