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

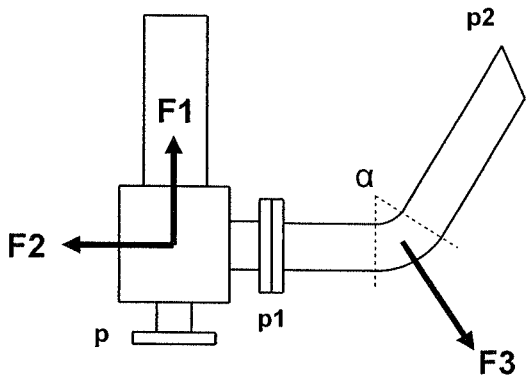
Project:	Keltan ACE
Item:	PSV 3C23
Project number:	31491.02
Drawing number:	
Made by:	Heinz Jansen
Issue number	–
Issue date:	27 May 2008
Page:	

INPUT DATA

Setpressure	p	=	4	barg		484000 N/m²	
Accumulation	Acc	=	21	%			
Back(over-)pressure at end of outlet pipe	p2	=	1,15	barg	=	115000 N/m²	} GEGEVENS
Pressure drop over outlet pipe	Δp2	=	0,45	bar	=	45000 N/m²	} PROCESS
Diameter inlet pipe	De	=	80	mm			
Diameter outlet pipe	Da	=	100	mm			
Smallest flow area	A0	=	1452	mm²	=	0,001452 m²	
Angle of the outlet elbow	α	=	90	°			
Dynamic shock factor	s	=	2,0	-			
— gas/vapour phase							
Discharge capacity (0 = liquid flow)	Qmeg	=	7385	kg/h	=	2,051 kg/s	
Density (0 if unknown)	ρ-g	=	0	kg/m³			
Relief temperature	T	=	130	°C	=	403,15 K	
Compressibility factor	Z	=	0,87	-			
Molar mass	M	=	86	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	=	5027	mm²	=	0,005027 m²
Cross-sectional area outlet pipe	Aa	=	7854	mm²	=	0,007854 m²
Absolute backpressure at end of outlet pipe	p2'	=	216325	N/m²	=	2,163 bara
Absolute pressure at valve inlet	p'	=	585325	N/m²	=	5,853 bara
Absolute pressure at valve outlet	p1'	=	261325	N/m²	=	2,613 bara
Overpressure at valve outlet	p1	=	160000	N/m²	=	1,600 barg
Gas velocity at orifice	we-g	=	94,08	m/s		
Gas velocity at valve outlet (non-critical)	wa-g	=	38,96	m/s		
Density of the gas at valve outlet	ρ-g	=	6,70	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	=	38,96	m/s		
Force in bend due to gas flow inpulse	F3b-g	=	79,91	N		
Force in bend due to liquid flow inpulse	F3b-l	=	0,00	N		



FINAL RESULTS

			first shock	stationary	
Force at valve inlet	F1	=	386	193	N
Force at valve outlet	F2	=	2673	0	N
Force in outlet elbow	F3	=	226	113	N