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Pressure Relief Valve Sizing & Selection Report

No	Prpd.	Chk.	Appr.	Date	Revision
1	EVC			20-abr.-2022	New process data
0	EVC			27-jul.-2021	

Quote Number: 093-093

Client: *TECHNIP ENERGIES*
Location: *CARTAGENA, SPAIN*
End-User Ref. No.: *201754C001*
Project: *C43 "New Bios 2G Hydrotreatment Unit"*
Project Ref. No.: *U-608 Hydrogen Unit*

Valve ID

Tag No.	*608-PSV-1038*
Service	*C-231 fuel gas K.O. Drum*
PID No.	*P-C43-A-110990 H45*
Line No.	*1-1/2"-FG-4512-B4-P*
Quantity	1

GENERAL

Valve Type	*Balanced Bellows, Direct Spring-Op*		
Safety / Relief	*Safety*	Balanced	*Yes*
Nozzle	*Full*	Bonnet	*Vented*

CONNECTIONS

Inlet	*1"*	*Flngd.*	*300#*	*RF*	Standard
Outlet	*2"*	*Flngd.*	*150#*	*RF*	*ASME B16.5*

MATERIALS OF CONSTRUCTION

Body / Base	*CS SA216-WCB/WCC*
Bonnet / Cylinder	*CS SA216-WCB/WCC*
Nozzle	*316 SST*
Disc	*316 SST*
Seat	*Metal*
Spindle	*416 SST*
Guide	*SS A297 Gr. HE*
Spring	*Chrome Steel - Corr. Rest.*
Gaskets	*316 SST*
Bellows	*Inconel® 625*
Cap Type	*Screwed w/ Test Rod*
NACE MR0175/ISO 15156:2015	*No*

Accessories: *Bug Screen*

SIZING / SELECTION SUMMARY

Valve Model No.		*1D2JBS-E35K-P*		
Brand		*Crosby®*		
Area (cm²)	Calculated	Selected	*0.642*	*0.710*
	Data Set	Orifice	*API*	*D*
Flow	Unit	Required	kg/hr	455
		Maximum		503.131
Reaction Force, Open Discharge			*37 N*	
Noise Level (db), Open Discharge			*114.1 at 1.0000-m*	

SIZING DATA

Design Code	*ASME VIII/XIII - UV*	Sizing Std.	*API 520*
Sizing Basis	*Fire Case*		
Fluid State at Inlet	*Gas / Vapor*		
Relieving Case	*Pressure Relief*		

Fluid Properties

Fluid Name	*HYDROCARBON*
Molecular Weight, M	*45.52*
Compressibility, Z	*0.912*
Ratio of Sp. Heats, k (Cp / Cv)	*1.108*
Gas Constant, C	*248.7*

Sizing Coefficients — Unit: -

Effective K, Gas		*0.975*	
Kb	Kc	*0.968*	*1*

Required Capacity — Unit: kg/hr

Total	*455*

Pressures — Unit: kg/cm² g

MAWP	Operating	*5.8*	*3.7*
Set	CDTP	*5.8*	*5.800*
Over Pressure		*1.218*	*21%*
Back Pressure	Built-Up		*2.3*
	Constant Superimposed		*0*
	Variable Superimposed		*0*
	Total		*2.3*
Inlet Loss		*0*	*0%*
Atmospheric (Barometric)		*1.033*	*kg/cm² a*

Temperatures — Unit: °C

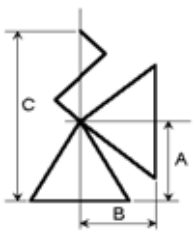
	Normal System		
Operating	Relieving	*38*	*67.9*
Design Min	Design Max		*150*

Tag Notes

1. Standard C4M acc. ISO 12944
2. Opening Adjustment:5%.
3. NAC E 0103 certificate required (disc & bellow).

Valve Dimensions

mm		kg	
A	104.90	Weight	16.33
B	114.30		
C	514.35		



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Pressure Relief Valve Calculation Report

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Project: *C43 "New Bios 2G Hydrotreatment Unit"*

Project Ref. No.: *U-608 Hydrogen Unit*

1	**VALVE ID**				11	**CALCULATION NOTES**	
2	Tag No.	608-PSV-1038			12	1. Standard C4M acc. ISO 12944	
3	Valve Model No.	1D2JBS-E35K-P	Qty. 1		13	2. Opening Adjustment:5%.	
4	**SIZING DATA**				14	3. NAC E 0103 certificate required (disc & bellow).	
5	Design Code	ASME VIII/XIII - UV	Sizing Std.	API 520	15		
6	Fluid State at Inlet	Gas / Vapor			16		
7	**CALCULATION SUMMARY**						
8	Flow	Required	455	kg/hr	18	Area	Required	0.642	cm²
9		Maximum	503.131	kg/hr	19		Selected	0.710	cm²
10	Reaction Force, Open Discharge		37	N	20	Noise Level (db), Open Discharge		114.1	at 1.0000 m

Variable Type	Variable Name	Symbol	Input Value		Equation Value	
Fluid Properties	Molecular Weight	M	45.52		45.52	
	Ratio of Specific Heats	k	1.108		1.108	
	Compressibility	Z	0.912		0.912	
Process Cond.	Required Mass Flow	Wreq	455	kg/hr	455	kg/hr
	Set Pressure	Pset	5.8	kg/cm² g	5.688	barg
	Over Pressure	Pover	1.218	kg/cm² g	1.194	barg
	Inlet Line Loss	Ploss	0	kg/cm² g	0	barg
	Back Pressure	Pback	2.3	kg/cm² g	2.256	barg
	Atmospheric Pressure	Patm	1.033	kg/cm² a	1.013	bara
	Relieving Temperature	T	67.9	°C	341.050	°K
	Distance from Valve (noise)	r	1.0000	m	1.0000	m
	Rupture Disc CCF	Kc	1		1	
Valve Data	Discharge Coefficient (API)	K,API	0.975		0.975	
	Orifice Area	A	0.710	cm²	0.710	cm²
	Back Press. Correction Factor	Kb	0.968		0.968	
	Outlet Diameter	Do	52.5	mm	5.25	cm
Calculate Inlet Relieving Pressure, Outlet Pressure, Absolute Pr essure Ratio						
P1 = Pset + Pover - Ploss + Patm		**P1**			7.896	bara
P2 = Pback + Patm		**P2**			3.269	bara
PR = P2 / P1		**PR**			0.414	
Calculate Gas Constant		**C**			248.7	
C = 394.8 * {k * [2 / (k + 1)]^[(k + 1) / (k - 1)] }^0.5						
Calculate Mass Critical Flow		**W**	503.131	kg/hr	503.131	kg/hr
W = A * C * K,API * P1 * Kb * Kc * [M / (T * Z)]^0.5						
Calculate Required Orifice Area		**Areq**	0.642	cm²	0.642	cm²
Areq = A * Wreq / W						

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1	**VALVE ID**			
2	Tag No.	608-PSV-1038		
3	Valve Model No.	1D2JBS-E35K-P	Qty. 1	
4	**SIZING DATA**			
5	Design Code	ASME VIII/XIII - UV	Sizing Std.	API 520
6	Fluid State at Inlet	Gas / Vapor		

11	**CALCULATION NOTES**
12	1. Standard C4M acc. ISO 12944
13	2. Opening Adjustment:5%.
14	3. NAC E 0103 certificate required (disc & bellow).
15	
16	

7	**CALCULATION SUMMARY**							
8	Flow	Required	455	kg/hr	18	Area	Required	0.642 cm²
9		Maximum	503.131	kg/hr	19		Selected	0.710 cm²
10	Reaction Force, Open Discharge		37	N	20	Noise Level (db), Open Discharge		114.1 at 1.0000 m

Calculate Noise Level at 100-ft (30-m) **L100** 84.5 db

L100 = [87.75 * log(1/PR) + 14.09] + [10 * log(1.1552 * W * k * T / M)]

Calculate Noise Level at Distance, r **Lp** 114.1 db

Lp = L100 - 20 * log(r / 30)

Calculate Reaction Force for Open Discharge **Fr** 37 N 37 N

Fr = (A * C * K,API * P1 * Kc / 27.907) * {k / [(k + 1) * Z]}^0.5