

# SAFETY VALVE

## SIZING SHEET

### GENERAL INFO

1	TECHNICAL Ref. / Item	24-2385 R1 / 1	4	Project	PR 200	DELTA
2	Valve Code	3A0-E23-2Z	5	Quantity	2	
3	Tag Number	PSV-RU0001A-03, PSV-RU0001B-03				

### DESIGN DATA

6	Operating Pressure	3,7	bar g	10	Operating Temperature	-0,07	°C
7	Ambient Pressure	1,013	bar a	11	Sizing Code	API Std 520	
8	Basis	FIRE WETTED		12	Fire Case	Yes	
9	Governing Case	Yes		13	Rupture Disc	No	

### INSTALLATION DATA

14	Inlet	1" ANSI 300 RF			22	Outlet	2" ANSI 150 RF		
15	Valve Model	30000			23	Valve Type	CONVENTIONAL		
16	Superimposed Bkp				24	Seat Type	METAL-TO-METAL		
17	Constant	Pbcs	0	bar g	25	Set Pressure	Ps	22,000	bar g
18	Variable	Pbvs	0	bar g	26	CDTP		22,000	bar g
19	Total	Pbs	0	bar g	27	Overpressure	Overp	21	%
20	Built-up Backpressure	Pbb	0	bar g	28	Relieving Temperature	T <sub>0</sub>	70,1	°C
21	Total BackPressure	Pb	0	bar g	29	Required Flow Rate	W	3197,00	kg/h

### FLUID PROPERTIES

30	Phase		Gas		35	Density	$\rho$	53,3	kg/m3
31	Medium	PROPANE			36	Specific Volume	$v$	0,019	m3/kg
32	Ratio of Specific Heats		k	1,11	-	37	Specific Gravity	G	0,053
33	Molecular Weight		M	44,10	kg/kmol	38	Dynamic Viscosity	$\mu$	0,0078
34	Compressibility Factor		Z	0,8	-	39	Dryness Steam Factor	x0	-

### SIZING CRITICAL FLOW - GAS&VAPOURS - API 520

40	Critical / Subcritical Flow	CRITICAL		
41	Relieving Pressure	P <sub>0</sub>	27,633	bar a
42	C Factor	C	2,4890	-
43	Discharge Coefficient	K <sub>D</sub>	0,951	-
44	Backpressure Corr. Factor	K <sub>BP</sub>	1	-
45	Subcritical Corr. Factor	K <sub>b</sub>	-	-
46	Rupture Disk Corr. Factor	K <sub>C</sub>	1	-
47	Steam Correction Factor EN	k <sub>s</sub>	-	-
48	Superheat Corr. Factor	k <sub>sh</sub>	-	-
49	Supercritical Corr. Factor	k <sub>sc</sub>	-	-
50	Napier Factor	k <sub>n</sub>	-	-
51	Viscosity Corr. Factor	K <sub>v</sub>	-	-
52	Reynolds Number	Re	-	-
53	Calculated Area	A	1,3552	cm <sup>2</sup>
54	Orifice Designation	-	E	-
55	Selected Area	A <sub>s</sub>	1,389	cm <sup>2</sup>
56	Area Gain	-	2	%
57	Maximum Flow Rate	W <sub>T</sub>	3276,79	kg/h
58				

$$A = \frac{W}{0,9 C P_0 K_D K_{BP} K_C} \sqrt{\frac{Z T_0}{M}}$$

$$C = 3,948 \sqrt{k \left( \frac{2}{k+1} \right)^{\frac{(k+1)}{(k-1)}}}$$

$$W_T = \frac{W A_s}{A}$$

Units of measure

A [mm<sup>2</sup>]; W [kg/h]; P [kPa]; T [K]; M [kg/kg mole]

### REACTION FORCE API 520 PART II OPEN DISCHARGE TO ATMOSPHERE

59	Reaction force (Flow)	FF	264	N
60	Reaction force (Static Bkp)	FB	0	N
61	Total Reaction Force	FT	264	N

$$F_F = \frac{129 W_{MAX}}{0,9 * 3600} \sqrt{\frac{k T_0}{(k+1) M}} ; F_B = \frac{A_2 P_b}{10} ; F_T = F_F + F_B$$

### NOISE EVALUATION API 521 Not Applicable for Liquid

62	Noise Level @ 30m	L30	103,8	dB
63	Distance d	d	1	m
64	Outlet Tube Diameter	da	0,05	m
65	Noise Level @ distance d	Ld	133,8	dB

$$L_{30} = L + 10 \log_{10} \left( \frac{W_{M-MAX} c^2}{3600 * 0,9 * 2} \right) ; c = 91,2 \left( \frac{k T_0}{M} \right)^{0,5}$$

$$L_p = L_{30} - 20 \log_{10} \left( \frac{d}{30} \right)$$

REMARKS: Process data are under customer responsibility.

2	09/09/2024	FIRST ISSUE	TCH		B. CAVALIERI
REV	DATE	DESCRIPTION	PREP.	CHECK.	APPROV.

# SAFETY VALVE

## SIZING SHEET

### GENERAL INFO

1	TECHNICAL Ref. / Item	24-2385 R1 / 2	4	Project	PR 200	DELTA
2	Valve Code	3A0-FA3-2Z	5	Quantity	2	
3	Tag Number	PSV-RU0001A-02, PSV-RU0001B-0 - Eq. Tag No: RU0001A-AE-01, RU0001B-AE-02 - Eq. Descr.: CONDENSER				

### DESIGN DATA

6	Operating Pressure	18,7	bar g	10	Operating Temperature	56,32	°C
7	Ambient Pressure	1,013	bar a	11	Sizing Code	API Std 520	
8	Basis	FIRE WETTED		12	Fire Case	Yes	
9	Governing Case	Yes		13	Rupture Disc	No	

### INSTALLATION DATA

14	Inlet	1½" ANSI 300 RF			22	Outlet	2" ANSI 150 RF		
15	Valve Model	30000			23	Valve Type	CONVENTIONAL		
16	Superimposed Bkp				24	Seat Type	METAL-TO-METAL		
17	Constant	Pbcs	0	bar g	25	Set Pressure	Ps	22,000	bar g
18	Variable	Pbvs	0	bar g	26	CDTP		22,000	bar g
19	Total	Pbs	0	bar g	27	Overpressure	Overp	21	%
20	Built-up Backpressure	Pbb	0	bar g	28	Relieving Temperature	T <sub>0</sub>	70,1	°C
21	Total BackPressure	Pb	0	bar g	29	Required Flow Rate	W	3479,00	kg/h

### FLUID PROPERTIES

30	Phase		Gas			35	Density		$\rho$	53,3	kg/m3	
31	Medium	PROPANE					36	Specific Volume		v	0,019	m3/kg
32	Ratio of Specific Heats		k	1,11	-	37	Specific Gravity		G	0,053	-	
33	Molecular Weight		M	44,10	kg/kmol	38	Dynamic Viscosity		$\mu$	0,0078	cP	
34	Compressibility Factor		Z	0,8	-	39	Dryness Steam Factor		x0	-	-	

### SIZING

### CRITICAL FLOW - GAS&VAPOURS - API 520

40	Critical / Subcritical Flow	CRITICAL		
41	Relieving Pressure	P <sub>0</sub>	27,633	bar a
42	C Factor	C	2,4890	-
43	Discharge Coefficient	K <sub>D</sub>	0,951	-
44	Backpressure Corr. Factor	K <sub>BP</sub>	1	-
45	Subcritical Corr. Factor	K <sub>b</sub>	-	-
46	Rupture Disk Corr. Factor	K <sub>C</sub>	1	-
47	Steam Correction Factor EN	k <sub>s</sub>	-	-
48	Superheat Corr. Factor	k <sub>sh</sub>	-	-
49	Supercritical Corr. Factor	k <sub>sc</sub>	-	-
50	Napier Factor	k <sub>n</sub>	-	-
51	Viscosity Corr. Factor	K <sub>v</sub>	-	-
52	Reynolds Number	Re	-	-
53	Calculated Area	A	1,4748	cm²
54	Orifice Designation	-	F	-
55	Selected Area	A <sub>s</sub>	2,164	cm²
56	Area Gain	-	47	%
57	Maximum Flow Rate	W <sub>T</sub>	5105,09	kg/h
58				

$$A = \frac{W}{0,9 C P_0 K_D K_{BP} K_C} \sqrt{\frac{Z T_0}{M}}$$

$$C = 3,948 \sqrt{k \left( \frac{2}{k+1} \right)^{\frac{(k+1)}{(k-1)}}}$$

$$W_T = \frac{W A_s}{A}$$

Units of measure

A [mm²]; W [kg/h]; P [kPa]; T [K]; M [kg/kg mole]

### REACTION FORCE

### API 520 PART II

### OPEN DISCHARGE TO ATMOSPHERE

59	Reaction force (Flow)	FF	411	N
60	Reaction force (Static Bkp)	FB	0	N
61	Total Reaction Force	FT	411	N

$$F_F = \frac{129 W_{MAX}}{0,9 * 3600} \sqrt{\frac{k T_0}{(k+1) M}} ; F_B = \frac{A_2 P_b}{10} ; F_T = F_F + F_B$$

### NOISE EVALUATION

### API 521

### Not Applicable for Liquid

62	Noise Level @ 30m	L30	106,1	dB
63	Distance d	d	1	m
64	Outlet Tube Diameter	da	0,05	m
65	Noise Level @ distance d	Ld	135,7	dB

$$L_{30} = L + 10 \log_{10} \left( \frac{W_{M-MAX} c^2}{3600 * 0,9 * 2} \right) ; c = 91,2 \left( \frac{k T_0}{M} \right)^{0,5}$$

$$L_p = L_{30} - 20 \log_{10} \left( \frac{d}{30} \right)$$

REMARKS: Process data are under customer responsibility.

2	09/09/2024	FIRST ISSUE	TCH		B. CAVALIERI
REV	DATE	DESCRIPTION	PREP.	CHECK.	APPROV.

N° RIFERIMENTO - REF.No : 24-2385  
CLIENTE - Customer : DELTA GmbH :

SIGLA - TAG PSV-RU0001A-03, PSV-RU0001B-03

**RUMORE CON USCITA CONVOGLIATA - CALCULATED NOISE WITH OUTLET PIPE**

**1 metro/meter**

$$N_{1c} = L_1 + 10 \cdot \text{LOG}_{10}[(Q \cdot X \cdot T)/M] + 10 \cdot \text{LOG}_{10}[3 \cdot 10^{-13} \cdot (c_2 \cdot Di/s)^2 / (p_2 \cdot c_2/415+1)] = 65 \text{ dB}$$

**2 metri/meters**

$$N_{2c} = N_{1c} - 20 \cdot \text{LOG}_{10}(2) = 59,3 \text{ dB}$$

con - with :

L1	=	rumore calcolato @ 1 mt	-	Calculated Noise @ 1 mt distance	133,8	[dB]
q	=	portata effettiva	-	actual flow rate	3276,79	[kg/h]
M	=	peso molecolare	-	molecular weight	44,1	[kg/kmol]
P0	=	pressione di set	-	set pressure	22	[bar g.]
Ov.Pr.	=	sovrappressione	-	overpressure	21	[%]
P1	=	pressione di scarico	-	upstream relieving pressure	27,6	[bar a.]
P2	=	pressione a valle	-	back pressure	1,013	[bar a.]
T	=	temperatura di scarico	-	relieving temperature	70,1	[°C]
T	=	temperatura ass.	-	relieving abs. temperature	343	[K]
x	=	rapporto calori specifici	-	ratio of the specific heats	1,11	[n°]
T2	=	temperatura in P2	-	temperature at P2	247,25	[K]
p2	=	densità in P2	-	density at P2	2,20	[kg/m³]
Di	=	diametro interno tubo	-	internal pipe diameter	52,50	[mm]
s	=	spessore tubo	-	pipe thickness	3,91	[mm]
c <sub>2</sub>	=	velocità di scarico	-	outlet velocity		
$c_2 = (Q/M \cdot 22,414 \cdot 273/T_2)/3600/(Di \cdot Di \cdot 3,14/10000) =$					59,02	[m/s]

N° RIFERIMENTO - REF. No : 24-2385  
CLIENTE - Customer : DELTA GmbH :

SIGLA - TAG PSV-RU0001A-02, PSV-RU0001B-02

**RUMORE CON USCITA CONVOGLIATA - CALCULATED NOISE WITH OUTLET PIPE**

**1 metro/meter**

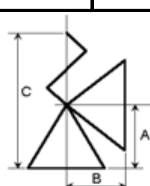
$$N_{1c} = L_1 + 10 \cdot \text{LOG}_{10}[(Q \cdot X \cdot T)/M] + 10 \cdot \text{LOG}_{10}[3 \cdot 10^{-13} \cdot (c_2 \cdot Di/s)^2 / (p_2 \cdot c_2/415+1)] = 71 \text{ dB}$$

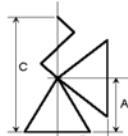
**2 metri/meters**

$$N_{2c} = N_{1c} - 20 \cdot \text{LOG}_{10}(2) = 64,6 \text{ dB}$$

con - with :

L1	=	rumore calcolato @ 1 mt	-	Calculated Noise @ 1 mt distance	135,7	[dB]
q	=	portata effettiva	-	actual flow rate	5105,09	[kg/h]
M	=	peso molecolare	-	molecular weight	44,1	[kg/kmol]
P0	=	pressione di set	-	set pressure	22	[bar g.]
Ov.Pr.	=	sovrappressione	-	overpressure	21	[%]
P1	=	pressione di scarico	-	upstream relieving pressure	27,6	[bar a.]
P2	=	pressione a valle	-	back pressure	1,013	[bar a.]
T	=	temperatura di scarico	-	relieving temperature	70,1	[°C]
T	=	temperatura ass.	-	relieving abs. temperature	343	[K]
x	=	rapporto calori specifici	-	ratio of the specific heats	1,11	[n°]
T2	=	temperatura in P2	-	temperature at P2	247,25	[K]
p2	=	densità in P2	-	density at P2	2,20	[kg/m³]
Di	=	diametro interno tubo	-	internal pipe diameter	52,50	[mm]
s	=	spessore tubo	-	pipe thickness	3,91	[mm]
c <sub>2</sub>	=	velocità di scarico	-	outlet velocity		
$c_2 = (Q/M \cdot 22,414 \cdot 273/T_2)/3600/(Di \cdot Di \cdot 3,14/10000) =$					91,95	[m/s]

GENERAL INFO										
TECHNICAL Ref. / Item		24-2385 R1 / 1			Customer		DELTA			
Project		PR 200								
VALVE ID										
1	Tag Number	PSV-RU0001A-03, PSV-RU0001B-03								
2	Valve Code	3A0-E23-2Z			47	Quantity	2			
VALVE DESCRIPTION					SIZING DATA					
3	Valve Type	CONVENTIONAL			48	Sizing Code	API Std 520			
4	Lift Type / Value	Nozzle Type	FULL LIFT / 3,1 mm	Full	49	Basis	FIRE WETTED			
5	Bonnet Type		Closed		50	Fire Case	Yes	Governing Case	Yes	
6	Inlet	Outlet	1" ANSI 300 RF	2" ANSI 150 RF	51	Rupture Disc	No			
7	Orifice Designation/Area			E - 1,389 cm <sup>2</sup>	MEDIUM PROPERTIES					
8	Seat Type			METAL-TO-METAL	52	Medium	PROPANE			
9	NACE Compliance	Valve Stamp	NONE	UV stamp	53	Phase	Gas			
10	Seat Tightness Test Code			Acc. To API 527	54	Ratio of Specific Heats	k	1,110	-	
11	Valve Model	Overall Dimensions	30000	Acc. to API 526	55	Molecular Weight	M	44,10	kg/kmol	
12	Cap Type			Screwed	56	Compressibility Factor	Z	0,800	-	
MATERIALS					57	Density	ρ	53,30	kg/m <sup>3</sup>	
13	Body	A352 LCB			58	Specific Volume	v	0,019	m <sup>3</sup> /kg	
14	Bonnet	A352 LCB			59	Specific Gravity	G	0,05	-	
15	Cap	A216 WCB			60	Dynamic Viscosity	μ	0,01	cP	
16	Nozzle	A351 CF3M / A479 316L			REQUIRED CAPACITY					
17	Disc	A479 316L / A182 F316L			61	Required Flow Rate	W	3197	kg/h	
18	Guide	SS 316L			PRESSURES					
19	Stem	SS 316L			62	Design Pressure	Pd	22	bar g	
20	Blowdown Ring	SS 316L			63	Operating Pressure	Pop	3,7	bar g	
21	Disc-Holder	SS 316L			64	Ambient Pressure	Patm	1,013	bar a	
22	Spring	Alloy Steel			65	Set Pressure	Ps	22	bar g	
23	Spring Washer	CARBON STEEL			66	CDTP		22	bar g	
24	Gaskets	ARMED GRAPHITE + SS 316L			67	Overpressure		21	%	
25	Bolting / Nut	A193 B8M / A194 8M			68	Relieving Pressure	P0	27,63	bar a	
ACCESSORIES					69	Superimposed Bkp	Constant	Pbvs	0,00	bar g
26	Bellows	N/A			70		Variable	Pbcs	0,00	bar g
27	Balanced Piston	N/A			71		Total	Pbs	0,00	bar g
28	Lifting Lever	N/A			72	Built-up Backpressure	Pbb	0,00	bar g	
29	Test Gag	YES			73	Total BackPressure	Pb	0,00	bar g	
30	Jacket	N/A			74	Blowdown	7-10%			
31	Flushing Nozzle	N/A			TEMPERATURES					
32	Bug Screen	N/A			75	Design Temp.		-45/+120	°C	
33	Body Spacer	N/A			76	Operating Temp.		-0,07	°C	
34	Trevi Test (coupling)	N/A			77	Relieving Temperature		70,1	°C	
35	Valve Painting	PJCT SPEC			78	Ambient Temp.		-	°C	
SIZING RESULTS					SIZING CRITICAL FLOW - GAS&VAPOURS - API 520					
36	Calculated Area	A	1,3552	cm <sup>2</sup>	79	Critical / Subcritical Flow	CRITICAL			
37	Selected Orifice/Area	E - 1,389 cm <sup>2</sup>			80	C Factor	C	2,489	-	
38	Area Gain	-	2,00	%	81	Discharge Coefficient	KD	0,951	-	
39	Maximum Flow Rate	WT	3276,79	kg/h	82	Backpressure Corr. Factor	KBP	1,00	-	
40	Reaction force (Flow)	FF	264,00	N	83	Subcritical Corr. Factor	Kb	-	-	
41	Reaction force (Static Bkp)	FB	0,00	N	84	Rupture Disk Corr. Factor	KC	1,0	-	
42	Total Reaction Force	FT	264,00	N	85	Subcritical Corr. Factor	Kb	-	-	
43	Noise Level @ 30m	L30	103,84	dB	86	Viscosity Corr. Factor	KV	-	-	
44	Distance d	d	1,00	m	87	Reynolds Number	Re	-	-	
45	Outlet Tube Diameter	da	0,05	m	 <p>DIM. (mm) &amp; WT (kg): 105 (A); 115 (B); 365 (C); 15 (WT)</p>					
46	Noise Level @ distance d	Ld	133,77	dB						
Process data are under customer responsibility.										
2	09/09/2024	FIRST ISSUE				TCH	B. CAVALIERI			
REV	DATE	DESCRIPTION				PREP.	CHECK.	APPROV.		

GENERAL INFO										
TECHNICAL Ref. / Item		24-2385 R1 / 2			Customer		DELTA			
Project		PR 200								
VALVE ID										
1	Tag Number	PSV-RU0001A-02, PSV-RU0001B-0 - Eq. Tag No: RU0001A-AE-01, RU0001B-AE-02 - Eq. Descr.: CONDENSER								
2	Valve Code	3A0-FA3-2Z			47	Quantity	2			
VALVE DESCRIPTION					SIZING DATA					
3	Valve Type	CONVENTIONAL			48	Sizing Code	API Std 520			
4	Lift Type / Value	Nozzle Type	FULL LIFT / 4 mm	Full	49	Basis	FIRE WETTED			
5	Bonnet Type		Closed		50	Fire Case	Yes	Governing Case	Yes	
6	Inlet	Outlet	1½" ANSI 300 RF	2" ANSI 150 RF	51	Rupture Disc	No			
7	Orifice Designation/Area		F - 2,164 cm²		MEDIUM PROPERTIES					
8	Seat Type		METAL-TO-METAL		52	Medium	PROPANE			
9	NACE Compliance	Valve Stamp	NONE	UV stamp	53	Phase	Gas			
10	Seat Tightness Test Code		Acc. To API 527		54	Ratio of Specific Heats	k	1,110	-	
11	Valve Model	Overall Dimensions	30000	Acc. to API 526	55	Molecular Weight	M	44,10	kg/kmol	
12	Cap Type		Screwed		56	Compressibility Factor	Z	0,800	-	
MATERIALS					57	Density	ρ	53,30	kg/m³	
13	Body	A352 LCB			58	Specific Volume	v	0,019	m³/kg	
14	Bonnet	A352 LCB			59	Specific Gravity	G	0,05	-	
15	Cap	A216 WCB			60	Dynamic Viscosity	μ	0,01	cP	
16	Nozzle	A351 CF3M / A479 316L			REQUIRED CAPACITY					
17	Disc	A479 316L / A182 F316L			61	Required Flow Rate	W	3479	kg/h	
18	Guide	SS 316L			PRESSURES					
19	Stem	SS 316L			62	Design Pressure	Pd	22	bar g	
20	Blowdown Ring	SS 316L			63	Operating Pressure	Pop	18,7	bar g	
21	Disc-Holder	SS 316L			64	Ambient Pressure	Patm	1,013	bar a	
22	Spring	Alloy Steel			65	Set Pressure	Ps	22	bar g	
23	Spring Washer	CARBON STEEL			66	CDTP		22	bar g	
24	Gaskets	ARMED GRAPHITE + SS 316L			67	Overpressure		21	%	
25	Bolting / Nut	A193 B8M / A194 8M			68	Relieving Pressure	P0	27,63	bar a	
ACCESSORIES					69	Superimposed Bkp	Constant	Pbvs	0,00	bar g
26	Bellows	N/A			70		Variable	Pbcs	0,00	bar g
27	Balanced Piston	N/A			71		Total	Pbs	0,00	bar g
28	Lifting Lever	N/A			72	Built-up Backpressure		Pbb	0,00	bar g
29	Test Gag	YES			73	Total BackPressure		Pb	0,00	bar g
30	Jacket	N/A			74	Blowdown		7-10%		
31	Flushing Nozzle	N/A			TEMPERATURES					
32	Bug Screen	N/A			75	Design Temp.	-45/+120		°C	
33	Body Spacer	N/A			76	Operating Temp.	56,32		°C	
34	Trevi Test (coupling)	N/A			77	Relieving Temperature	70,1		°C	
35	Valve Painting	PICT SPEC			78	Ambient Temp.	-		°C	
SIZING RESULTS					SIZING CRITICAL FLOW - GAS&VAPOURS - API 520					
36	Calculated Area	A	1,4748	cm²	79	Critical / Subcritical Flow	CRITICAL			
37	Selected Orifice/Area	F - 2,164 cm²			80	C Factor	C	2,489	-	
38	Area Gain	-	47,00	%	81	Discharge Coefficient	KD	0,951	-	
39	Maximum Flow Rate	WT	5105,09	kg/h	82	Backpressure Corr. Factor	KBP	1,00	-	
40	Reaction force (Flow)	FF	411,00	N	83	Subcritical Corr. Factor	Kb	-	-	
41	Reaction force (Static Bkp)	FB	0,00	N	84	Rupture Disk Corr. Factor	KC	1,0	-	
42	Total Reaction Force	FT	411,00	N	85	Subcritical Corr. Factor	Kb	-	-	
43	Noise Level @ 30m	L30	106,15	dB	86	Viscosity Corr. Factor	KV	-	-	
44	Distance d	d	1,00	m	87	Reynolds Number	Re	-	-	
45	Outlet Tube Diameter	da	0,05	m	 <p>DIM. (mm) &amp; WT (kg): 124 (A); 152 (B); 420 (C); 21 (WT)</p>					
46	Noise Level @ distance d	Ld	135,69	dB						
Process data are under customer responsibility.										
2	09/09/2024	FIRST ISSUE			TCH	B. CAVALIERI				
REV	DATE	DESCRIPTION			PREP.	CHECK.	APPROV.			