Airpack B.V. - Air Compressor –

Integrated Methanol and Ammonia Plant

17735-COM PSV sizing calculations (K020)

Code 1
M.Dalakeh

REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED
02	25-06-2024	Issued for Approval	L.K.	J.J.	S.K.
01	08-05-2024	Issued for Approval	L.K.	J.J.	S.K.

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3	X	X				**28**						**53**						**78**					
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VALVITALIA GROUP

API Recommended Practice 520 Part 1, 10th Edition Oct 2020

$$A = \frac{W}{C.Kd.P1.Kb.Kc} \times \sqrt{\frac{T.Z}{M}}$$ Critical Gas Equation

$$A = \frac{17.9 \times W}{F2.Kd.Kc} \times \sqrt{\frac{Z.T}{M.P1(P1-P2)}}$$ Sub-critical Gas Equation

$$A = \frac{11.78 \times Q}{Kd.Kb.Kc.Kv} \times \sqrt{\frac{G}{P1-P2}}$$ Liquid Equation

$$A = \frac{190.5 \times W}{P1.Kd.Kb.Kc.Kn.Ksh}$$ Steam Equation

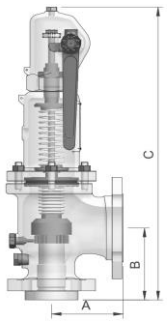
Customer Name:	Virago Valves	
Customer Ref:	17735 VV-0301	
Broady Ref:	Q-149119	
Date	Data Sheet Rev	Sales Engineer
18 June 2024		WM
Tag or Item Number	320PSV-8201	

Sizing Case	Blocked Discharge		
Safety Valve Type & Code	Conventional	API 520	
Fluid Name	Air		
Fluid State (Gas or Liquid)	Gas		
Set Pressure, P_s	12.500	*Barg*	
Constant Back Pressure, P_c	0.000	*Barg*	
Variable Back Pressure, P_v	0.000	*Barg*	
Total Back Pressure, P_b	0.000	*Barg*	
Over Pressure	10.00	*%*	
Flow rate	35	*Nm3/hr*	
Molecular Weight	28.97	*kg/kmol*	
Ratio of specific heat, Cp/Cv	1.400		
Compressibility, z	1.000		
Relief Temperature	75.00	*C*	
			Psig/F
Design Pressure(Min/Max)		12.50 *Barg*	181.25
Design Temperature (Min/Max)		75.00 *C*	167
Critical Flow ?	Yes		
			Bara
Relieving Pressure	1476.30	*kPaa*	14.763
Back Pressure	101.30	*kPaa*	1.013
Pcf =	779.902	*kPaa*	
Gas Constant	0.02703		
Co-efficient of Discharge, K_d	0.975		
	1		
Back Pressure Correction Factor, K_b	1.00		
Bursting Disc Correction Factor, Kc	1.000		
			Barg
Spring Cold Set Pressure	**12.50**	Barg	12.50
Orifice Area Calculation per API 520	**0.0063**	in^2	
Or	**4.03**	mm^2	
Selected Orifice Area	**0.110**	in^2	
API 526 Orifice Designation	**D**		
Maximum Discharge Capacity	**664.32**	Nm3/hr	
SPL per API 521 5.8.10.3 in (dB)	**86.5**	open discharge	
Reaction Force API 520 Pt 2 5.8.2.1 (Kgf)	**8.3**	open discharge	

Safety Valve Data Sheet

Inlet Size	1	in
Inlet Finish	ANSI #300	RF
Outlet Size	2	in
Outlet Finish	ANSI #150	RF

Body	Stainless Steel - ASME SA351 CF8M
Bonnet	Stainless Steel - ASME SA351 CF8M
Screwed Cap	Stainless Steel - ASME SA351 CF8M
Nozzle	316SS/316LSS (UNS S31600/UNS S31603)
Disc	316SS/316LSS (UNS S31600/UNS S31603)
Guide Flange	316SS/316LSS (UNS S31600/UNS S31603)
Spindle	316SS/316LSS (UNS S31600/UNS S31603)
Spring	Stainless Steel
Fasteners	SS-ASME SA193 Grd B8M/ SA194 Grd 8M
Accessories	Test Gag
	Packed Lever
Notes	
Valve Series	3500
Model Number	3531D-SN-021A0



Dimensional Information

	mm/kg
A	115
B	104
C	454
Mass	15

Please check with Broady's before using dimensions for pipe work/design

BRODY FLOW CONTROL

Calculation & Valve Data Sheet
Safety Relief Valve

VALVITALIA GROUP

API Recommended Practice 520 Part 1, 10th Edition Oct 2020

$$A = \frac{W}{C.Kd.P1.Kb.Kc} \times \sqrt{\frac{T.Z}{M}}$$ Critical Gas Equation

$$A = \frac{17.9 \times W}{F2.Kd.Kc} \times \sqrt{\frac{Z.T}{M.P1(P1-P2)}}$$ Sub-critical Gas Equation

$$A = \frac{11.78 \times Q}{Kd.Kb.Kc.Kv} \times \sqrt{\frac{G}{P1-P2}}$$ Liquid Equation

$$A = \frac{190.5 \times W}{P1.Kd.Kb.Kc.Kn.Ksh}$$ Steam Equation

Customer Name:	Virago Valves	
Customer Ref:	17735 VV-0301	
Broady Ref:	Q-149119	
Date	Data Sheet Rev	Sales Engineer
18 June 2024		WM
Tag or Item Number	320PSV-8202	

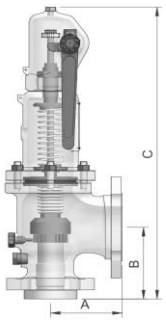
Sizing Case	Blocked Discharge		
Safety Valve Type & Code	Conventional	API 520	
Fluid Name	Air		
Fluid State (Gas or Liquid)	Gas		
Set Pressure, P_s	30.500	*Barg*	
Constant Back Pressure, P_c	0.000	*Barg*	
Variable Back Pressure, P_v	0.000	*Barg*	
Total Back Pressure, P_b	0.000	*Barg*	
Over Pressure	10.00	*%*	
Flow rate	35	*Nm3/hr*	
Molecular Weight	28.97	*kg/kmol*	
Ratio of specific heat, Cp/Cv	1.400		
Compressibility, z	1.000		
Relief Temperature	175.00	*C*	
			Psig/F
Design Pressure(Min/Max)	30.50	*Barg*	442.25
Design Temperature (Min/Max)	175.00	*C*	347
Critical Flow ?	Yes		
			Bara
Relieving Pressure	3456.30	*kPaa*	34.563
Back Pressure	101.30	*kPaa*	1.013
Pcf =	1825.900	*kPaa*	
Gas Constant	0.02703		
Co-efficient of Discharge, K_d	0.975		
	1		
Back Pressure Correction Factor, K_b	1.00		
Bursting Disc Correction Factor, Kc	1.000		
			Barg
Spring Cold Set Pressure	**31.11**	Barg	31.11
Orifice Area Calculation per API 520	**0.0030**	in^2	
Or	**1.95**	mm^2	
Selected Orifice Area	**0.110**	in^2	
API 526 Orifice Designation	**D**		
Maximum Discharge Capacity	**1370.83**	Nm3/hr	
SPL per API 521 5.8.10.3 in (dB)	**87.6**	open discharge	
Reaction Force API 520 Pt 2 5.8.2.1 (Kgf)	**19.5**	open discharge	

Safety Valve Data Sheet

Inlet Size	1	in
Inlet Finish	ANSI #600	RF
Outlet Size	2	in
Outlet Finish	ANSI #150	RF

Body	Stainless Steel - ASME SA351 CF8M
Bonnet	Stainless Steel - ASME SA351 CF8M
Screwed Cap	Stainless Steel - ASME SA351 CF8M
Nozzle	316SS/316LSS (UNS S31600/UNS S31603)
Disc	316SS/316LSS (UNS S31600/UNS S31603)
Guide Flange	316SS/316LSS (UNS S31600/UNS S31603)
Spindle	316SS/316LSS (UNS S31600/UNS S31603)
Spring	Stainless Steel
Fasteners	SS-ASME SA193 Grd B8M/ SA194 Grd 8M
Accessories	Test Gag
	Packed Lever
Notes	
Valve Series	3500

Model Number: 3551D-SN-021A0



Dimensional Information

	mm/kg
A	115
B	104
C	454
Mass	15

Please check with Broady's before using dimensions for pipe work/design

BRODY FLOW CONTROL

Calculation & Valve Data Sheet
Safety Relief Valve

VALVITALIA GROUP

API Recommended Practice 520 Part 1, 10th Edition Oct 2020

$$A = \frac{W}{C.Kd.P1.Kb.Kc} \times \sqrt{\frac{T.Z}{M}}$$ Critical Gas Equation

$$A = \frac{17.9 \times W}{F2.Kd.Kc} \times \sqrt{\frac{Z.T}{M.P1(P1-P2)}}$$ Sub-critical Gas Equation

$$A = \frac{11.78 \times Q}{Kd.Kb.Kc.Kv} \times \sqrt{\frac{G}{P1-P2}}$$ Liquid Equation

$$A = \frac{190.5 \times W}{P1.Kd.Kb.Kc.Kn.Ksh}$$ Steam Equation

Customer Name:	Virago Valves	
Customer Ref:	17735 VV-0301	
Broady Ref:	Q-149119	
Date	Data Sheet Rev	Sales Engineer
18 June 2024		WM
Tag or Item Number	320PSV-8203	

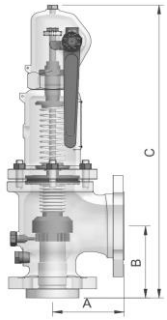
Sizing Case	Blocked Discharge		
Safety Valve Type & Code	Conventional	API 520	
Fluid Name	Air		
Fluid State (Gas or Liquid)	Gas		
Set Pressure, P_s	39.000	*Barg*	
Constant Back Pressure, P_c	0.000	*Barg*	
Variable Back Pressure, P_v	0.000	*Barg*	
Total Back Pressure, P_b	0.000	*Barg*	
Over Pressure	10.00	*%*	
Flow rate	35	*Nm3/hr*	
Molecular Weight	28.97	*kg/kmol*	
Ratio of specific heat, Cp/Cv	1.400		
Compressibility, z	1.000		
Relief Temperature	135.00	*C*	
			Psig/F
Design Pressure(Min/Max)	39.00	*Barg*	565.5
Design Temperature (Min/Max)	135.00	*C*	275
Critical Flow ?	Yes		
			Bara
Relieving Pressure	4391.30	*kPaa*	43.913
Back Pressure	101.30	*kPaa*	1.013
Pcf =	2319.844	*kPaa*	
Gas Constant	0.02703		
Co-efficient of Discharge, K_d	0.975		
	1		
Back Pressure Correction Factor, K_b	1.00		
Bursting Disc Correction Factor, Kc	1.000		
			Barg
Spring Cold Set Pressure	**39.78**	Barg	39.78
Orifice Area Calculation per API 520	**0.0023**	in^2	
Or	**1.47**	mm^2	
Selected Orifice Area	**0.110**	in^2	
API 526 Orifice Designation	**D**		
Maximum Discharge Capacity	**1825.01**	Nm3/hr	
SPL per API 521 5.8.10.3 in (dB)	**87.2**	open discharge	
Reaction Force API 520 Pt 2 5.8.2.1 (Kgf)	**24.8**	open discharge	

Safety Valve Data Sheet

Inlet Size	1	in
Inlet Finish	ANSI #600	RF
Outlet Size	2	in
Outlet Finish	ANSI #150	RF

Body	Stainless Steel - ASME SA351 CF8M
Bonnet	Stainless Steel - ASME SA351 CF8M
Screwed Cap	Stainless Steel - ASME SA351 CF8M
Nozzle	316SS/316LSS (UNS S31600/UNS S31603)
Disc	316SS/316LSS (UNS S31600/UNS S31603)
Guide Flange	316SS/316LSS (UNS S31600/UNS S31603)
Spindle	316SS/316LSS (UNS S31600/UNS S31603)
Spring	Stainless Steel
Fasteners	SS-ASME SA193 Grd B8M/ SA194 Grd 8M
Accessories	Test Gag
	Packed Lever
Notes	
Valve Series	3500

Model Number: 3551D-SN-021A0



Dimensional Information

	mm/kg
A	115
B	104
C	454
Mass	15

Please check with Broady's before using dimensions for pipe work/design

BRODY FLOW CONTROL

Calculation & Valve Data Sheet
Safety Relief Valve

VALVITALIA GROUP

API Recommended Practice 520 Part 1, 10th Edition Oct 2020

$$A = \frac{W}{C.Kd.P1.Kb.Kc} \times \sqrt{\frac{T.Z}{M}}$$ Critical Gas Equation

$$A = \frac{17.9 \times W}{F2.Kd.Kc} \times \sqrt{\frac{Z.T}{M.P1(P1-P2)}}$$ Sub-critical Gas Equation

$$A = \frac{11.78 \times Q}{Kd.Kb.Kc.Kv} \times \sqrt{\frac{G}{P1-P2}}$$ Liquid Equation

$$A = \frac{190.5 \times W}{P1.Kd.Kb.Kc.Kn.Ksh}$$ Steam Equation

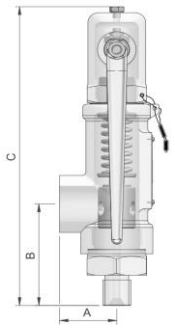
Customer Name:	Virago Valves	
Customer Ref:	17735 VV-0301	
Broady Ref:	Q-149119	
Date	Data Sheet Rev	Sales Engineer
18 June 2024		WM
Tag or Item Number	320PSV-8204	

Sizing Case	Tube rupture			
Safety Valve Type & Code	Conventional	API 520		
Fluid Name	Air			
Fluid State (Gas or Liquid)	Gas			
Set Pressure, P_s	7.000		*Barg*	
Constant Back Pressure, P_c	0.000		*Barg*	
Variable Back Pressure, P_v	0.000		*Barg*	
Total Back Pressure, P_b	0.000		*Barg*	
Over Pressure	10.00		*%*	
Flow rate	35		*Nm3/hr*	
Molecular Weight	28.97		*kg/kmol*	
Ratio of specific heat, Cp/Cv	1.400			
Compressibility, z	1.000			
Relief Temperature	135.00		*C*	
				Psig/F
Design Pressure(Min/Max)		7.00	*Barg*	101.5
Design Temperature (Min/Max)		75.00	*C*	167
Critical Flow ?	Yes			
				Bara
Relieving Pressure	871.30		*kPaa*	8.713
Back Pressure	101.30		*kPaa*	1.013
Pcf =	460.292		*kPaa*	
Gas Constant	0.02703			
Co-efficient of Discharge, K_d	0.975			
	1			
Back Pressure Correction Factor, K_b	1.00			
Bursting Disc Correction Factor, Kc	1.000			
				Barg
Spring Cold Set Pressure	**7.14**		Barg	7.14
Orifice Area Calculation per API 520	**0.0115**		in^2	
Or	**7.40**		mm^2	
Selected Orifice Area	**0.040**		in^2	
NA				
Maximum Discharge Capacity	**122.09**		Nm3/hr	
SPL per API 521 5.8.10.3 in (dB)	**86.8**		open discharge	
Reaction Force API 520 Pt 2 5.8.2.1 (Kgf)	**1.7**		open discharge	

Safety Valve Data Sheet

Inlet Size	0.75	in
Inlet Finish	NPT	(M)
Outlet Size	1	in
Outlet Finish	NPT	(F)

Body	Carbon Steel - ASME SA216 WCB
Bonnet	N/A
Screwed Cap	316SS/316LSS (UNS S31600/UNS S31603)
Nozzle	316SS/316LSS (UNS S31600/UNS S31603)
Disc	316SS/316LSS (UNS S31600/UNS S31603)
Guide Flange	N/A
Spindle	316SS/316LSS (UNS S31600/UNS S31603)
Spring	Stainless Steel
Fasteners	N/A
Accessories	Test Gag
	Broady Standard Paint
	Packed Lever
Notes	
Valve Series	2600
Model Number	26002-CN-021A1



Dimensional Information

	mm/kg
A	81
B	97
C	231
Mass	6

Please check with Broady's before using dimensions for pipe work/design