



LIDCO, Pars SEE Zone, Assaluyeh,
Integrated Methanol and Ammonia
Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT



PSV sizing calculations

Document No. 17735-47

Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision	Page
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**Airpack B.V. - Air Compressor –
Integrated Methanol and Ammonia Plant
17735-COM PSV sizing calculations (K020)**

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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PSV sizing calculations

Document No. 17735-47

Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision
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5	X	X				30						55						80						
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8	X					33						58						83						
9	X					34						59						84						
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API Recommended Practice 520 Part 1, 10th Edition Oct 2020

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

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

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

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

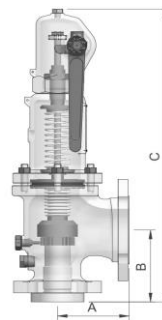
Customer Name:	Virago Valves	
Customer Ref:	17735 VV-0301	
Broady Ref:	Q-149119	
Date	Data Sheet Rev	Sales Engineer
18 June 2024		WM
Tag or Item Number	320PSV-8201	

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	Nm ³ /hr
Molecular Weight	28.97	kg/kmol
Ratio of specific heat, Cp/Cv	1.400	
Compressibility, z	1.000	
Relief Temperature	75.00	C
Design Pressure (Min/Max)		12.50 Barg
Design Temperature (Min/Max)		75.00 C
Critical Flow ?	Yes	
Relieving Pressure	1476.30	kPaa
Back Pressure	101.30	kPaa
Pcf =	779.902	kPaa
Gas Constant	0.02703	
Co-efficient of Discharge, K _d	0.975	
Back Pressure Correction Factor, K _b	1.00	
Bursting Disc Correction Factor, K _c	1.000	
Spring Cold Set Pressure	12.50	Barg
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	Nm ³ /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 (Kgfi)	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

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

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

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

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

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

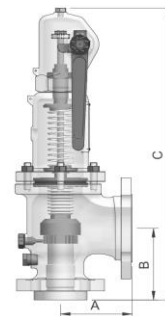
Customer Name:	Virago Valves	
Customer Ref:	17735 VV-0301	
Broady Ref:	Q-149119	
Date	Data Sheet Rev	Sales Engineer
18 June 2024		WM
Tag or Item Number	320PSV-8202	

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	Nm ³ /hr
Molecular Weight	28.97	kg/kmol
Ratio of specific heat, Cp/Cv	1.400	
Compressibility, z	1.000	
Relief Temperature	175.00	C
Design Pressure (Min/Max)		30.50 Barg
Design Temperature (Min/Max)		175.00 C
Critical Flow ?	Yes	
Relieving Pressure	3456.30	kPaa
Back Pressure	101.30	kPaa
Pcf =	1825.900	kPaa
Gas Constant	0.02703	
Co-efficient of Discharge, K _d	0.975	
Back Pressure Correction Factor, K _b	1.00	
Bursting Disc Correction Factor, K _c	1.000	
Spring Cold Set Pressure	31.11	Barg
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	Nm ³ /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

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

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

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

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

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

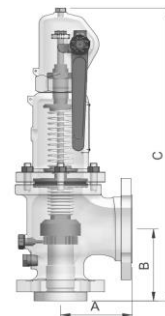
Customer Name:	Virago Valves	
Customer Ref:	17735 VV-0301	
Broady Ref:	Q-149119	
Date	Data Sheet Rev	Sales Engineer
18 June 2024		WM
Tag or Item Number	320PSV-8203	

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	Nm ³ /hr
Molecular Weight	28.97	kg/kmol
Ratio of specific heat, Cp/Cv	1.400	
Compressibility, z	1.000	
Relief Temperature	135.00	C
Design Pressure (Min/Max)		39.00 Barg
Design Temperature (Min/Max)		135.00 C
Critical Flow ?	Yes	
Relieving Pressure	4391.30	kPaa
Back Pressure	101.30	kPaa
Pcf =	2319.844	kPaa
Gas Constant	0.02703	
Co-efficient of Discharge, K _d	0.975	
Back Pressure Correction Factor, K _b	1.00	
Bursting Disc Correction Factor, K _c	1.000	
Spring Cold Set Pressure	39.78	Barg
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	Nm ³ /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

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

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

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

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

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

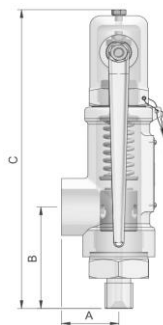
Customer Name:	Virago Valves	
Customer Ref:	17735 VV-0301	
Broady Ref:	Q-149119	
Date	Data Sheet Rev	Sales Engineer
18 June 2024		WM
Tag or Item Number	320PSV-8204	

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	Nm ³ /hr
Molecular Weight	28.97	kg/kmol
Ratio of specific heat, Cp/Cv	1.400	
Compressibility, z	1.000	
Relief Temperature	135.00	C
Design Pressure (Min/Max)		7.00 Barg
Design Temperature (Min/Max)		75.00 C
Critical Flow ?	Yes	
Relieving Pressure	871.30	kPaa
Back Pressure	101.30	kPaa
Pcf =	460.292	kPaa
Gas Constant	0.02703	
Co-efficient of Discharge, K _d	0.975	
Back Pressure Correction Factor, K _b	1.00	
Bursting Disc Correction Factor, K _c	1.000	
Spring Cold Set Pressure	7.14	Barg
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	Nm ³ /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 (Kgff)	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