Airpack B.V. - Air Compressor –

Integrated Methanol and Ammonia Plant

17735-COM PSV sizing calculations (K020)

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

LIST OF REVISED PAGES

Page \ Rev.	01	02	03	04	05	Page \ Rev.	01	02	03	04	05	Page \ Rev.	01	02	03	04	05	Page \ Rev.	01	02	03	04	05
1	X					**26**						**51**						**76**					
2	X					**27**						**52**						**77**					
3	X					**28**						**53**						**78**					
4	X					**29**						**54**						**79**					
5	X					**30**						**55**						**80**					
6	X					**31**						**56**						**81**					
7	X					**32**						**57**						**82**					
8	X					**33**						**58**						**83**					
9	X					**34**						**59**						**84**					
10	X					**35**						**60**						**85**					
11	X					**36**						**61**						**86**					
12	X					**37**						**62**						**87**					
13						**38**						**63**						**88**					
14						**39**						**64**						**89**					
15						**40**						**65**						**90**					
16						**41**						**66**						**91**					
17						**42**						**67**						**92**					
18						**43**						**68**						**ATTACHMENT**					
19						**44**						**69**						**1**					
20						**45**						**70**						**2**					
21						**46**						**71**						**3**					
22						**47**						**72**						**4**					
23						**48**						**73**						**5**					
24						**49**						**74**						**6**					
25						**50**						**75**						**7**					

LESER The-Safety-Valve.com	Sizing acc. to API 520 for Gas VALVESTAR® – v.7.3.3.0331	Page:	1 of 2
		Date:	2024-04-24 09:55:29
		Project:	17735-47
		Tag No:	320PSV-8201
		LESER Job №	

Sizing - Medium				
1000	Designation	Air		
1004	Formula			
1001	Molar mass	M	29	kg/kmol
1002	Ratio of specific heats	k	1.400	
1003	Compressibility factor	Z	1.000	

Sizing - Service condition				
1009	Case for blow off		Blocked discharge	
1100	Maximum allowable working pressure			
1101	Set pressure	p	12.5	bar-g
1102	Constant superimposed back pressure	paf		
2102	Variable superimposed back pressure			
1103	Built up back pressure	pae		
1104	Backpressure			
1105	Overpressure	dp	10.00	%
1106	Environmental pressure	pu	1.013	bar
1107	Relieving Temperature	T	46	°C
1108	Required massflow	qm,ab	45.285	kg/h
1109	Volume flow to be discharged (working condition)	qvb,ab	2.807	m³/h
1110	Volume flow to be discharged (std condition) [T=0 °C P=101,325 Pa]	qvn,ab	35	Cm³/h
1120	Rupture disc correction factor	Kc	1.000	

Initial Sizing according to API 520 for conventional safety valve		
1150	NPS inlet Orifice NPS outlet	1D2
1151	PR inlet x PR oultet	#300 x #150
1152	Material	WCB
1153	Required orifice	D
1154	Selected orifice	D

Sizing - Calculation				
1200	Certified massflow	qm,zu	843.544	kg/h
1201	Certified volumeflow (operating condition)	qvb,zu	52.282	m³/h
1203	Certified volumeflow (standard condition)	qvn,zu	651.958	m³/h
1204	Maximum mass flow	qm,max	937.271	kg/h
1205	Maximum volume flow (working condition)	qvb,max	58.091	m³/h
1206	Maximum volume flow (standard condition)	qvn,max	724.398	m³/h
1207	Capacity exceed		1762.74	%

Name	AD 2000-Merkblatt A2				
Date	2024-04-24 09:55:29				
Rev.No	1				

Valve - Dimensions				
1400	Discharge area	Ao	153.938	mm²
1401	Discharge diameter	do	14	mm
1402	Centre to Face dimensions	a	105	mm
1403	Centre to Face dimensions	b	114	mm
1405	Height	H	440	mm
1406	Weight	M	17.3	kg
1411	Inlet flange thickness incl. raised face	S1	30	mm

Lift				
1507	Standard		1.5	mm

Valve - Calculation				
1200	Certified massflow	qm,zu	843.544	kg/h
1201	Certified volumeflow (operating condition)	qvb,zu	52.282	m³/h
1203	Certified volumeflow (standard condition)	qvn,zu	651.958	m³/h
1204	Maximum mass flow	qm,max	937.271	kg/h
1205	Maximum volume flow (working condition)	qvb,max	58.091	m³/h
1206	Maximum volume flow (standard condition)	qvn,max	724.398	m³/h
1207	Capacity exceed		1762.74	%
1600	Required actual discharge area	Ao, req	8.264	mm²
1601	Required discharge diameter	do,req	3.244	mm
1602	Noise level in 1m distance from the valve (acc. to AD2000:A2)	L	101.74	dB
1617	Back pressure correction factor	Kb	1.000	

LESER The-Safety-Valve.com	Sizing acc. to API 520 for Gas VALVESTAR® - v.7.3.3.0331	Page:	1 of 2
		Date:	2024-04-24 10:00:21
		Project:	17735-47
		Tag No:	320PSV-8202
		LESER Job №	

Sizing - Medium				
1000	Designation	Air		
1004	Formula			
1001	Molar mass	M	29	kg/kmol
1002	Ratio of specific heats	k	1.400	
1003	Compressibility factor	Z	1.000	

Sizing - Service condition				
1009	Case for blow off		Blocked discharge	
1100	Maximum allowable working pressure			
1101	Set pressure	p	30.5	bar-g
1102	Constant superimposed back pressure	paf		
2102	Variable superimposed back pressure			
1103	Built up back pressure	pae		
1104	Backpressure			
1105	Overpressure	dp	10.00	%
1106	Environmental pressure	pu	1.013	bar
1107	Relieving Temperature	T	157	°C
1108	Required massflow	qm,ab	45.285	kg/h
1109	Volume flow to be discharged (working condition)	qvb,ab	1.616	m³/h
1110	Volume flow to be discharged (std condition) [T=0 °C P=101,325 Pa]	qvn,ab	35	Cm³/h
1120	Rupture disc correction factor	Kc	1.000	

Initial Sizing according to API 520 for conventional safety valve		
1150	NPS inlet Orifice NPS outlet	1D2
1151	PR inlet x PR oultet	#600 x #150
1152	Material	WCB
1153	Required orifice	D
1154	Selected orifice	D

Sizing - Calculation				
1200	Certified massflow	qm,zu	1,701.092	kg/h
1201	Certified volumeflow (operating condition)	qvb,zu	60.696	m³/h
1203	Certified volumeflow (standard condition)	qvn,zu	1,314.74	m³/h
1204	Maximum mass flow	qm,max	1,890.102	kg/h
1205	Maximum volume flow (working condition)	qvb,max	67.44	m³/h
1206	Maximum volume flow (standard condition)	qvn,max	1,460.823	m³/h
1207	Capacity exceed		3656.40	%

Name	AD 2000-Merkblatt A2				
Date	2024-04-24 10:00:21				
Rev.No	1				

Valve - Dimensions				
1400	Discharge area	Ao	153.938	mm²
1401	Discharge diameter	do	14	mm
1402	Centre to Face dimensions	a	105	mm
1403	Centre to Face dimensions	b	114	mm
1405	Height	H	440	mm
1406	Weight	M	17.3	kg
1411	Inlet flange thickness incl. raised face	S1	30	mm

Lift				
1507	Standard		1.5	mm

Valve - Calculation				
1200	Certified massflow	qm,zu	1,701.092	kg/h
1201	Certified volumeflow (operating condition)	qvb,zu	60.696	m³/h
1203	Certified volumeflow (standard condition)	qvn,zu	1,314.74	m³/h
1204	Maximum mass flow	qm,max	1,890.102	kg/h
1205	Maximum volume flow (working condition)	qvb,max	67.44	m³/h
1206	Maximum volume flow (standard condition)	qvn,max	1,460.823	m³/h
1207	Capacity exceed		3656.40	%
1600	Required actual discharge area	Ao, req	4.098	mm²
1601	Required discharge diameter	do,req	2.284	mm
1602	Noise level in 1m distance from the valve (acc. to AD2000:A2)	L	113.399	dB
1617	Back pressure correction factor	Kb	1.000	

LESER The-Safety-Valve.com	Sizing acc. to API 520 for Gas VALVESTAR® - v.7.3.3.0331	Page:	1 of 2
		Date:	2024-04-24 10:03:11
		Project:	17735-47
		Tag No:	320PSV-8203
		LESER Job №	

Sizing - Medium				
1000	Designation	Air		
1004	Formula			
1001	Molar mass	M	29	kg/kmol
1002	Ratio of specific heats	k	1.400	
1003	Compressibility factor	Z	1.000	

Sizing - Service condition				
1009	Case for blow off		Blocked discharge	
1100	Maximum allowable working pressure			
1101	Set pressure	p	39	bar-g
1102	Constant superimposed back pressure	paf		
2102	Variable superimposed back pressure			
1103	Built up back pressure	pae		
1104	Backpressure			
1105	Overpressure	dp	10.00	%
1106	Environmental pressure	pu	1.013	bar
1107	Relieving Temperature	T	116	°C
1108	Required massflow	qm,ab	45.285	kg/h
1109	Volume flow to be discharged (working condition)	qvb,ab	1.151	m³/h
1110	Volume flow to be discharged (std condition) [T=0 °C P=101,325 Pa]	qvn,ab	35	Cm³/h
1120	Rupture disc correction factor	Kc	1.000	

Initial Sizing according to API 520 for conventional safety valve		
1150	NPS inlet Orifice NPS outlet	1D2
1151	PR inlet x PR oultet	#600 x #150
1152	Material	WCB
1153	Required orifice	D
1154	Selected orifice	D

Sizing - Calculation				
1200	Certified massflow	qm,zu	2,272.271	kg/h
1201	Certified volumeflow (operating condition)	qvb,zu	57.731	m³/h
1203	Certified volumeflow (standard condition)	qvn,zu	1,756.194	m³/h
1204	Maximum mass flow	qm,max	2,524.746	kg/h
1205	Maximum volume flow (working condition)	qvb,max	64.146	m³/h
1206	Maximum volume flow (standard condition)	qvn,max	1,951.326	m³/h
1207	Capacity exceed		4917.70	%

Name	AD 2000-Merkblatt A2				
Date	2024-04-24 10:03:11				
Rev.No	1				

Valve - Dimensions				
1400	Discharge area	Ao	153.938	mm²
1401	Discharge diameter	do	14	mm
1402	Centre to Face dimensions	a	105	mm
1403	Centre to Face dimensions	b	114	mm
1405	Height	H	440	mm
1406	Weight	M	17.3	kg
1411	Inlet flange thickness incl. raised face	S1	30	mm

Lift				
1507	Standard		1.5	mm

Valve - Calculation				
1200	Certified massflow	qm,zu	2,272.271	kg/h
1201	Certified volumeflow (operating condition)	qvb,zu	57.731	m³/h
1203	Certified volumeflow (standard condition)	qvn,zu	1,756.194	m³/h
1204	Maximum mass flow	qm,max	2,524.746	kg/h
1205	Maximum volume flow (working condition)	qvb,max	64.146	m³/h
1206	Maximum volume flow (standard condition)	qvn,max	1,951.326	m³/h
1207	Capacity exceed		4917.70	%
1600	Required actual discharge area	Ao, req	3.068	mm²
1601	Required discharge diameter	do,req	1.976	mm
1602	Noise level in 1m distance from the valve (acc. to AD2000:A2)	L	113.362	dB
1617	Back pressure correction factor	Kb	1.000	

LESER The-Safety-Valve.com	Sizing acc. to API 520 for Gas VALVESTAR® - v.7.3.3.0331	Page:	1 of 2
		Date:	2024-04-24 10:34:06
		Project:	17735-47
		Tag No:	320PSV-8204
		LESER Job №	

Sizing - Medium				
1000	Designation	Air		
1004	Formula			
1001	Molar mass	M	29	kg/kmol
1002	Ratio of specific heats	k	1.400	
1003	Compressibility factor	Z	1.000	

Sizing - Service condition				
1009	Case for blow off		Tube rupture	
1100	Maximum allowable working pressure			
1101	Set pressure	p	7	bar-g
1102	Constant superimposed back pressure	paf		
2102	Variable superimposed back pressure			
1103	Built up back pressure	pae		
1104	Backpressure			
1105	Overpressure	dp	10.00	%
1106	Environmental pressure	pu	1.013	bar
1107	Relieving Temperature	T	46	°C
1108	Required massflow	qm,ab	45.285	kg/h
1109	Volume flow to be discharged (working condition)	qvb,ab	4.756	m³/h
1110	Volume flow to be discharged (std condition) [T=0 °C P=101,325 Pa]	qvn,ab	35	Cm³/h
1120	Rupture disc correction factor	Kc	1.000	

Initial Sizing according to API 520 for conventional safety valve		
1150	NPS inlet Orifice NPS outlet	1D2
1151	PR inlet x PR oultet	#150 x #150
1152	Material	WCB
1153	Required orifice	D
1154	Selected orifice	D

Sizing - Calculation				
1200	Certified massflow	qm,zu	497.858	kg/h
1201	Certified volumeflow (operating condition)	qvb,zu	52.282	m³/h
1203	Certified volumeflow (standard condition)	qvn,zu	384.785	m³/h
1204	Maximum mass flow	qm,max	553.176	kg/h
1205	Maximum volume flow (working condition)	qvb,max	58.091	m³/h
1206	Maximum volume flow (standard condition)	qvn,max	427.539	m³/h
1207	Capacity exceed		999.39	%

Name	AD 2000-Merkblatt A2				
Date	2024-04-24 10:34:06				
Rev.No	1				

Valve - Dimensions				
1400	Discharge area	Ao	153.938	mm²
1401	Discharge diameter	do	14	mm
1402	Centre to Face dimensions	a	105	mm
1403	Centre to Face dimensions	b	114	mm
1405	Height	H	440	mm
1406	Weight	M	17.3	kg
1411	Inlet flange thickness incl. raised face	S1	30	mm

Lift				
1507	Standard		1.5	mm

Valve - Calculation				
1200	Certified massflow	qm,zu	497.858	kg/h
1201	Certified volumeflow (operating condition)	qvb,zu	52.282	m³/h
1203	Certified volumeflow (standard condition)	qvn,zu	384.785	m³/h
1204	Maximum mass flow	qm,max	553.176	kg/h
1205	Maximum volume flow (working condition)	qvb,max	58.091	m³/h
1206	Maximum volume flow (standard condition)	qvn,max	427.539	m³/h
1207	Capacity exceed		999.39	%
1600	Required actual discharge area	Ao, req	14.002	mm²
1601	Required discharge diameter	do,req	4.222	mm
1602	Noise level in 1m distance from the valve (acc. to AD2000:A2)	L	97.847	dB
1617	Back pressure correction factor	Kb	1.000	

LESER The-Safety-Valve.com	**Sizing acc. to API 520 for Liquid VALVESTAR® - v.7.3.3.0331**	Page:	1 of 2
		Date:	2024-04-24 10:05:16
		Project:	17735-47
		Tag No:	320PSV-8204
		LESER Job №	

Sizing - Medium				
1000	Designation	Water		
1004	Formula	H2O		
1005	Density	ρ	998	kg/m³
1006	Viscosity	μ or ή		

Sizing - Service condition				
1009	Case for blow off	Thermal expansion		
1100	Maximum allowable working pressure			
1101	Set pressure	p	7	bar-g
1102	Constant superimposed back pressure	paf		
2102	Variable superimposed back pressure			
1103	Built up back pressure	pae		
1104	Backpressure			
1105	Overpressure	dp	10.00	%
1106	Environmental pressure	pu	1.013	bar
1107	Relieving Temperature	T	135	°C
1108	Required massflow	qm,ab	998	kg/h
1109	Volume flow to be discharged (working condition)	qvb,ab	1	m³/h
1120	Rupture disc correction factor	Kc	1.000	

Initial Sizing according to API 520 for conventional safety valve		
1150	NPS inlet Orifice NPS outlet	1D2
1151	PR inlet x PR oultet	#150 x #150
1152	Material	WCB
1153	Required orifice	D
1154	Selected orifice	D

Sizing - Calculation				
1200	Certified massflow	qm,zu	7,449.67	kg/h
1201	Certified volumeflow (operating condition)	qvb,zu	7.465	m³/h
1203	Certified volumeflow (standard condition)	qvn,zu		
1204	Maximum mass flow	qm,max	8,277.412	kg/h
1205	Maximum volume flow (working condition)	qvb,max	8.294	m³/h
1206	Maximum volume flow (standard condition)	qvn,max		
1207	Capacity exceed		646.46	%

Name	AD 2000-Merkblatt A2				
Date	2024-04-24 10:05:16				
Rev.No	1				

Valve - Dimensions				
1400	Discharge area	Ao	153.938	mm²
1401	Discharge diameter	do	14	mm
1402	Centre to Face dimensions	a	105	mm
1403	Centre to Face dimensions	b	114	mm
1405	Height	H	440	mm
1406	Weight	M	17.3	kg
1411	Inlet flange thickness incl. raised face	S1	30	mm

Lift				
1507	Standard		1.5	mm

Valve - Calculation				
1200	Certified massflow	qm,zu	7,449.67	kg/h
1201	Certified volumeflow (operating condition)	qvb,zu	7.465	m³/h
1203	Certified volumeflow (standard condition)	qvn,zu		
1204	Maximum mass flow	qm,max	8,277.412	kg/h
1205	Maximum volume flow (working condition)	qvb,max	8.294	m³/h
1206	Maximum volume flow (standard condition)	qvn,max		
1207	Capacity exceed		646.46	%
1600	Required actual discharge area	Ao, req	20.622	mm²
1601	Required discharge diameter	do,req	5.124	mm