Total Safety Solution Provider!

JOKWANG

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Total Safety Solution Provider! JOKWANG Cat No. PF100 Vol.1

Cat No.
PF100 **Vol.1**

Think Safety!

JOKWANG

Pressure Relief Valves for UV Stamp

JSV-PF100

J • K SINCE 1968

JOKWANG I.L.I CO., LTD.

INTRODUCTION OF COMPANY

Since its establishment in 1968, JOKWANG I.L.I CO., LTD. with its JK trademark has put every effort in pioneering and specializing as one of the leading valve manufacturing companies. Its devotion has concentrated especially in the area of safety & relief valve, pressure reducing valve, stop valve and steam trap.

With almost half a century of experience, we have earned over a good reputation for quality, reliability, reasonable price and excellent performance.

We determined to contribute to serve your need for your heat control and energy saving effort through our precision design, strict testing, and precision processing. Your kind inquiries would be much appreciated, and we will do our best to give you our business suggestions on them, which can be competitive in your market. In closing, we promise for our continuous endeavor, for more research, and for development work to pay back your positive supports and encouragement.

COMPANY HISTORY

Nov. 1968	Founded JOKWANG Industries Company in Busan, Korea
May. 1987	Acquired K.S(Korean Industrial Standard) Mark
Apr. 1989	Acquired Type approval from KR(Korea)
Dec. 1992	Technical Collaboration with VENN in Japan
Dec. 1998	Acquired ISO 9001 Certificate
Dec. 1999	Changed Company name to JOKWANG I.L.I Co., Ltd.
Oct. 2000	Moved to Noksan Industrial Complex in Busan, Korea
Nov. 2003	Acquired Type approval from DNV(Norway)
Mar. 2004	Acquired Type approval from BV(France)
Apr. 2004	Acquired KEPIC Certificate
Jun. 2004	Acquired Type approval from LR(UK)
May. 2006	Acquired Safety Relief Valve ASME "UV" Stamp
Nov. 2006	Patent registered for Pilot-Operated Safety Valve
May. 2010	Acquired Type approval from GL(Germany)
Apr. 2011	Acquired Safety Relief Valve ASME "UV" Stamp(Up to 6,000psig)
Dec. 2011	Awarded Export Tower of 3 Mil. U.S Dollar
Dec. 2011	Acquired Type approval from CCS(China)
Dec. 2011	Acquired ISO14001 Certificate
Mar. 2012	Acquired OHSAS18001 Certificate
Mar. 2013	Acquired Pilot type Safety Relief Valve ASME "UV"Stamp
Jun. 2014	Acquired Safety Relief Valve ASME "V"Stamp
Jun. 2015	Acquired Safety Relief Valve C-Sel(China)
May. 2016	Renewed ASME "UV"Stamp
Jan. 2016	Moved to Sanmak Complex in Yangsan, Korea
Sep. 2016	Renewed ASME "V"Stamp

Certificate

Quality System Certificate

'UV' Stamp of ASME Sec. VIII
'V' Stamp of ASME Sec. I
Certificate of NBBI Safety Valve Capacity
ISO 9001 Certificate
ISO 14001 Certificate
OHSAS 18001 Certificate
C-SEL China Special Equipment License

Type Approval

GL - Germany
BV - Bureau Veritas
KR - Korean Register
CCS - China Classification Society
DNV • GL - Det norske Veritas
• Germanischer Veritas

General information

01 About SRV(Safety Relief Valve)

01 General Definition of Safety Relief Valve(SRV)

A pressure relief device is any device that can purge a system from an overpressure condition. More particularly, an SRV is a pressure relief device that is self-actuated, and whose primary purpose is the protection of life and equipment. Through a controlled discharge of a required(rated) amount of fluid at a predetermined pressure, an SRV must prevent overpressure in pressurized vessels and systems, and it operates within limits which are determined by international codes. An SRV is often the final control device in the prevention of accidents or explosions caused by overpressure.

The SRV must close at a predetermined pressure when the system pressure has returned to a safe lever at values determined by the codes.

SRVs must be designed with materials compatible with many process fluids, from simple air and water to the most corrosive and toxic media. They must also be designed to operate in a consistently smooth manner on a variety of fluids and fluid phases. These design parameters lead to a wide array of SRV products available in the market today, with the on constant being that they all must comply with the internationally recognized codes.

02 Where do SRVs fit in the process?

Every industrial process system is designed to work against a certain maximum pressure and temperature called its rating or design pressure. It is in the economic interest of the users to work as close as possible towards the maximum limits of this design pressure in order to optimize the process output, hence increase the profitability of the system.

Nowadays, pressures and flow in the process industry are controlled by electronic process systems and highly sophisticated instrumentation devices. Almost all control systems are powered by an outside power source(electric, pneumatic, hydraulic). The law requires that when everything fails regardless of the built-in redundancies, there is still an independent working device powered only by the medium it protects. This is the function of the SRV, which, when everything else works correctly in the system, should never have to work. However, practice proves the contrary, and there are a variety of incidents which will allow the system pressure to exceed the design pressure.

Although many pressure relief devices are called SRVs, not every SRV has the same characteristics of or operational precision. Only the choice of the correct pressure safety device for the right application will assure the safety of the system and allow the user to maximize process output and minimize down-time for maintenance purposes. Making the correct choice also means avoiding interference between the process instrumentation set points in the control loop and the pressure relief device limits selected. There SRV operation al limits can vary greatly even when all are complying with the codes.

03 Pressure Relief Devices

Pressure relief device

Actuated by inlet static pressure and designed to open during emergency or abnormal conditions to prevent a rise of internal fluid pressure in excess of a specified design value. The device also may be designed to prevent excessive internal vacuum. The device may be designed to prevent excessive internal vacuum. The device may be a pressure relief valve, a non-reclosing pressure relief device, or a vacuum relief valve.

Pressure relief valve

A pressure relief device designed to open and relieve excess pressure and to reclose and prevent the further flow of fluid after normal conditions have been restored.

a A relief valve

It is a spring loaded pressure relief valve actuated by the static pressure upstream of the valve. The valve opens normally in proportion to the pressure increase over the opening pressure. A relief valve is used primarily with incompressible fluids.

b A safety valve

It is a spring loaded pressure relief valve actuated by the static pressure upstream of the valve and characterized by rapid opening or pop action. A safety valve is normally used with compressible fluids.

c A safety relief valve

It is a spring loaded pressure relief valve that may be used as either a safety or reliefvalve depending on the application.

d A conventional pressure relief valve

It is a spring loaded pressure relief valve whose operational characteristics are directly affected by changes in the back pressure.

e A balanced pressure relief valve

A It is spring loaded pressure relief valve that incorporates a bellows or other means for minimizing the effect of back pressure on the operational characteristics of the valve.

f A pilot operated pressure relief valve

It is a pressure relief valve in which the major relieving device or main valve is combined with and controlled by a self actuated auxiliary pressure relief valve(pilot).

Non-reclosing pressure relief device

A pressure relief device which remains open after operation. A manual resetting means may be provided.

Rupture disk device

A non-reclosing pressure relief device actuated by static differential pressure between the inlet and outlet of the device and designed to function by the bursting of a rupture disk. A rupture disk device includes a rupture disk and a rupture disk holder.

About SRV(Safety Relief Valve)

a A rupture disk

It is a pressure containing, pressure and temperature sensitive element of a rupture disk device.

b A rupture disk holder

It is the structure which encloses and clamps the rupture disk in position.(Some disks are designed to be installed between standard flanges without holders.)

c A non fragmenting rupture disk

It is a rupture disk designed and manufactured to be installed upstream of other piping components, such as pressure relief valves, and will not impair the function of those components when the disk ruptures.

Pin-actuated device

A non-reclosing pressure relief device actuated by static pressure and designed to function by buckling or breaking a pin which holds a piston or a plug in place. Upon buckling or breaking of the pin, the piston or plug instantly moves to the full open position.

* Reference
- The Safety Relief Valve Handbook - API STD 520 Part 2.

02 Sizing Program Basis

Instruction of Sizing Program

After receiving the inquiry or P/O(purchase order) from our precious customers, we input the data for specification of PSV in the COMPUTER SIZING PROGRAM(see fig. 1).

This helps calculate the valve capacity and select the exact size compared than required capacity.

When we calculate the capacity, must-have information such as fluid name & states, temperature, pressure, required capacity and allowable overpressure condition(10%, 16%, 21%, etc.) are considered and reflected in the system according to the calculation standard as ASME Sec.VIII and API STD 520 and so on.

Also the variety of pressure unit including Kg/cm²g, Barg, Mpag, Kpag, pisg and so on could be used in the system.

The whole information for the each PSV is saved in our system and the data sheet with calculation sheet(see fig. 2) based on it could be printed out automatically.

It is possible to trace the saved information of each PSV with customer's name and serial number on the customer's request.

20	010200	Tag No(O)	PSV-001
30	010300	Service Line	
40	010800	Design Type	C : Conventional
100	010700	Bonnet Type(*)	C : Close
101	041900	Lever Type(*)	L : Plain Lever
102	020901	Inlet Connect Code(*)	ANSI ANSI
103	020902	Inlet-Rating(*)	150 : 150LB
104	020903	Inlet-Facing(*)	R :RF
105	021001	Outlet Connect Code(*)	ANSI ANSI
106	021002	Outlet-Rating(*)	150 :150LB
107	021003	Outlet-Facing(*)	R :RF
110	020803	Size(Inch)(*)	0.250SO : 1X2"
112	074400	Orifice Designation(*)	E :E(12.7)
200	031101	Body(*)	S-WCB : SA216 WCB
201	031200	Seat(*)	S-CF8M-S : SA351 CF8M(STELLITED)
202	031301	Disc(*)	SA316-S :SA 276 316(STELLITED)
203	031701	Bellows-M	NA :none
300	010100	Model No	JSV-FF100
400	052200	Code(*)	A6 : ASME sec. VIII
401	062502	Fluid State(*)	A : AIR
402	062501	Fluid Name(*)	Air
403	062700	Mol.weight or specificGravity*	28.96
404	063900	Compressibility Factor(*)	1
405	064000	Specific Heat(*)	1.4
407	069902	Pressure Unit(*)	KG : Kg/barg
409	069903	Temp. Unit	°C :℃
410	063100	Operating Temp.	
411	063200	Blowout Temp.(*:Gas/Air)	20
413	062900	Operating pressure	
414	063000	Setting pressure(*)	5
430	063600	Closing Pressure(*)	4.85
432	063700	Hydrostatic Test(*)	7.5
440	083300	Constant Back Pressure	
441	083400	Variable Back Pressure	
450	063800	Allowable Overpressure(%)	10 : 10
490	069901	Capacity Unit	KG :kg/h
491	069904	Area Unit	MM :㎟
492	082600	Required Capacity	120
494	074200	Calculated Area	26.593
496	074300	Selected Area	126.677
498	074500	Valve Capacity(*)	572
550	042100	Paint Color(*)	S : Silver
551	042000	GAG	Y : Yes
574	999997	Remark	
580	052400	Other	NA
581	052300	Fire	N : No
582	082800	Viscosity(Cp)	

Fig. 1 - Sizing Program – ERP System

JOKWANG I.L.I

Pressure Safety & Relief Valve Specification and Calculation Sheet

Sheet No.	65 of 114		Rev. No.		0
Project Name	RAPID and Petrochemicals Intergrated Development in Malaysia				
Project No.					
Date	2016. 04. 21		By		M. I LEE
Checked	M. K MIN		Approved		C.K.MIN

GENERAL	P&ID No.	1	3200-0701-1	SIZING & SELECTION	Required Capacity	54	74.21 barg
	Tag No.	2	PSV-7116		Valve Actual Capacity	55	1,008 kg/h
	Service Line	3	PSV return to HHD Storage Drum (3200-V-711)		Calculated Orifice Area	56	2.702 kg/h
	Model No	4	JSV-FF100		Selected Orifice Area	57	0.26 ㎠
	Quantity	5	1		Orifice Dia.(mm)	58	0.730 ㎠
TYPE	Nozzle Type	6	Semi		Reaction Force	59	-
	Design Type	7	Pilot		Noise Level	60	-
	Valve Action Type	8	Modulating		**Calculation**		
	Bonnet Type	9	Closed		Calculation of Area		
	Lever Type	10	-				
CONN.	Cap Type	11	Screwed		A1 = W1/(159.44*Kd*√((P*1.10-Pb*G))		
	Size, Inlet / Outlet	12	1" X 2"		= 21400/(159.44*0.615*√((10.2*1.10-0)*1000))		
	Inlet, Rating / Facing	13	ASME CL. 300 / RF		= 2.06 ㎠		
	Outlet, Rating / Facing	14	ASME CL. 150 / RF				
MATERIALS	Body	15	SA216 WCB		Calculation of Capacity		
	Body Cover	16	SA216 WCB				
	Piston	17	SA276 316 -st.		W = 159.44*A*Kd*√((P*1.10-Pb*G))		
	Seat	18	SA276 316 -st.		= 159.44*3.263*0.615*1*√((10.2*1.10-0)*1000)		
	Main Seat Seal	19	PTFE		= 33,912 kg/h		
	Seal	20	FKM				
	Spring	21	SWOSC				
RoHS	Approved by	22	UV				
	Comply with NACE	23	No				
	EN 10204	24	Type 3.1				
	Code	25	API STD 520				
	Fire	26	No				
	Sizing Basis	27	Closed Outlet				
	Rupture Disk	28	No				
SERVICE CONDITION	Fluid / State	29	PROPYLENE(L) / Liquid				
	Mol. Weight / Specific Gravity	30	1		W1	Required Capacity	1,008 kg/h
	Compressibility Factor	31	-		W	Valve Actual Capacity	2,702 kg/h
	Ratio of Specific Heat	32	-		A1	Calculated Orifice Area	0.26 ㎠
	Viscosity	33	0Cp		A	Selected Orifice Area	0.71 ㎠
	Operating / Relieving Temp.	34	40 / 40 ℃		P	Set Pressure	4.45 kgf/㎠g
	Design Min. / Design Max. Temp.	35	- / 80 ℃		G	Specific Weight	580 kg/㎥
	Operating / Set Pressure	36	0.5 / 4.4 barg		Pb	Back Pressure	2.25 kgf/㎠g
	Design Pressure / C.O.T.P	37	4.4 / 4.4 barg		Kd	Coefficient of Discharge	0.615
	Back Pressure: Superimposed – Constant	38	2.2 barg		**Remarks**		
	Back Pressure: Superimposed – Variable	39	-				
	Back Pressure: Built-up	40	0.00 barg				
	Back Pressure: Total	41	2.2003 barg				
	Allowable Overpressure	42	10%				
	Closing Pressure / Blowdown(%)	43	Min. 4.092 barg / 7%				
	Hydrostatic Test Pressure **(body)**	44	6.6 barg				
PILOT ACCESSARY	Back Flow Preventer	45	Yes				
	Remote Sensing	46	Yes				
	Manual Blowdown Valve	47	No				
	Filed Test Connection	48	Yes				
	Auxiliary Filter	49	No				
	External Filter	50	No				
ETC	Paint System & Color	51	Silver				
	Test Gag	52	No				
	Bug screen	53	Yes				

Fig. 2 - Data & Calculation Sheet

03 Numbering System

F1	B	-	1	D	2	A	2	1	-	2	1	1	-	1	B	P

Model
P1 : PF100

Pilot Part
P : Pop(Snap) Action
M : Modulating

Inlet Size
1″ ~ 2″

Orifice
D ~ B2

Outlet Size
2″ ~ 24″

Connection Code
A : ASME

Inlet Flange Rating
1 : 150 lb
2 : 300 lb
3 : 600 lb
4 : 900 lb
5 : 1500 lb
6 : 2500 lb

Outlet Flange Rating
1 : 150 lb
2 : 300 lb

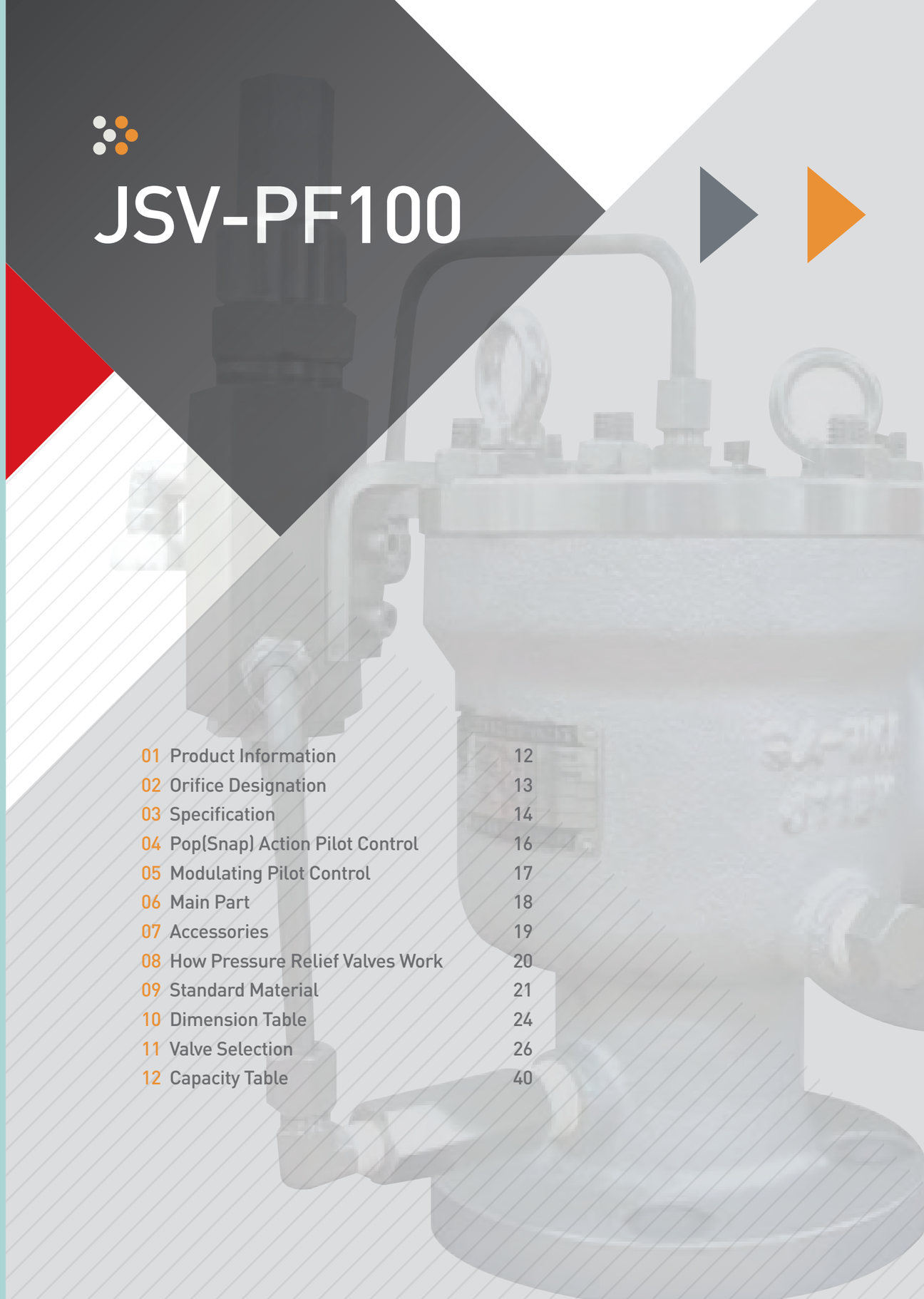
Body Material
1 : Carbon Steel
2 : Stainless Steel
3 : etc.

Trim Material
1 : 316 SS
2 : etc.

Spring Material
1 : Stainless Steel
2 : Inconel X-750

Accessories
1BP : Backflow Preventer
1FC : Field Test Connection
1SF : Pilot Supply Filter
1HE : Heat Exchanger
1RS : Remote Pressure Sense Connction
2SR : 1SF + 1RS
2FF : 1FC + 1SF
2HR : 1HE + 1RS
etc

JSV-PF100



01 Product Information

INTRODUCTION :

Over almost half a century, we have been supplying a variety of safety relief valves to satisfy the highly variable requirements of customers.

JSV-PF100 as representative POSRV of Jokwang is designed and produced based on the accumulated technology of long experience.

We strongly recommend JSV-PF100 to protect overpressure of the vessel and process line using in the various industries.

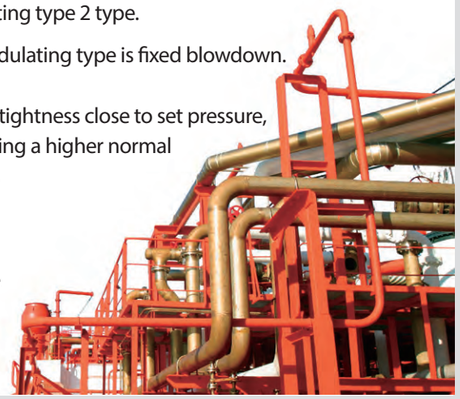
APPLICABLE CODES, STANDARD and AUTHORIZATIONS :

The JSV-PF100 series is compliant with the following codes and standards.

- ASME Section VIII
- Relieving Capacity Tested&Certified by NBBI
- API STD 520 / Sizing, Selection and Installation of pressure-Relieving Device in Refinerise
- API STD 526 / Flanged Steel Safety-Relief Valves
- API STD 527 / Seat tightness of Pressure Relief Valves
- ASME B16.34 / Valves-Flanged, Threaded, and Welding End

DESIGN FEATURE :

- Certified Discharge Capacity
  JSV-PF100 is designed and manufactured in accordance with ASME Sec.VIII.
  Also the discharge capacity is certified by NBBI (National Board of Boiler and Pressure Vessel Inspections) as well.
- The POSRV consists of two basic components
  Main part provides the capacity
  Pilot part controls the main valve
  The pilot unit has a Pop(Snap) Action type and Modulating type 2 type.
- Pop(Snap) Action type adjusts available blowdown, Modulating type is fixed blowdown.
  Metal to Rubber contact with high airtightness.
  The inherent ability of a POSRV is to maintain premium tightness close to set pressure, allowing optimization of the process output, thus allowing a higher normal system-operating pressure than with direct spring SRVs
- International Code applied
  Length(center to face dimension), Flange ,
  Size and Pressure & Temperature limit are in accordance with the international standard.



02 Orifice Designation

Orifice	Flow Area		Diameter	
	Sq. in	Sq. mm	In	mm
D	0.150	96.77	0.437	11.10
E	0.225	145.16	0.535	13.59
F	0.371	239.35	0.437	11.10
G	0.559	360.64	0.844	17.45
H	0.873	563.22	1.054	26.77
J	1.430	922.58	1.350	34.29
K	2.042	1317.42	1.612	40.95
L	3.170	2045.16	2.009	51.03
M	4.000	2580.64	2.257	57.33
N	4.822	3110.96	2.487	63.17
P	7.087	4572.25	3.004	76.30
Q	12.27	7916.11	3.952	100.38
R	17.78	11470.94	4.758	120.85
T	28.94	18670.93	6.070	154.18
V	44.18	28503.17	7.500	190.50
W	63.62	41045.08	9.000	228.60
Y	86.59	55864.40	10.680	271.27
Z	95.38	61535.36	11.020	279.90
Z2	113.1	72967.60	12.000	304.80
A	143.1	92322.40	13.498	342.85
B	176.7	113999.8	15.000	381.00
B2	227.0	146451.3	17.000	431.80

03 Specification

Type	Pilot Operated Safety Relief Valve
Applicable Code	ASME Sec. VIII
Size	1" × 2" ~ 20" × 24
Orifice	D(0.437 Sq.in.)~B2(17.000Sq.in.)
Air/Gas Set Pressure Range	15 ~ 6170 psig(1.03 ~ 425.4 bar)
Allowable Leakage	API Standard 527

* Please contact us for the product over 6170psig.
UV Stamp can be applied up to 10000psig .

Orifice Area Sq.in. (mm)	D 0.437 (11.10)	E 0.535 (13.59)	F 0.687 (17.45)	G 0.844 (21.44)	H 1.054 (26.77)	J 1.350 (34.29)	K 1.612 (40.95)	Inlet Flange Rating B16.34	Outlet Flange Rating B16.34
Inlet × Outlet Size (inch)	1×2 1 ½×2	1×2 1 ½×2	1×2 1 ½×2	(1)2×(2)3 1 ½×(2)3	1½×(2)3 2×3	1½×(2)3 (2)3×(3)4	2×3 3×4	150	150
	1×2 1 ½×2	1×2 1 ½×2	1×2 1 ½×2	(1)2×(2)3 1 ½×(2)3	1½×(2)3 2×3	1½×(2)3 (2)3×(3)4	2×3 3×4	300	
	1×2 1 ½×2	1×2 1 ½×2	1×2 1 ½×2	(1)2×(2)3 1 ½×(2)3	1½×(2)3 2×3	1½×(2)3 (2)3×(3)4	2×3 3×4	600	
	1×2 1 ½×2	1×2 1 ½×2	1×2 1 ½×2	(1)2×(2)3 1 ½×(2)3	1½×(2)3 2×3	1½×(2)3 (2)3×(3)4	2×3 3×4	900	300
	1×2 1 ½×2	1×2 1 ½×2	1×2 1 ½×2	(1)2×(2)3 1 ½×(2)3	1½×(2)3 2×3	1½×(2)3 (2)3×(3)4	2×3 3×4	1500	
	1×2 1 ½×2	1×2 1 ½×2	1×2 1 ½×2	(1)2×(2)3 1 ½×(2)3	1½×(2)3 2×3	1½×(2)3 2×3	2×3	2500	

Orifice Area Sq.in. (mm)	L 2.009 (51.03)	M 2.257 (57.33)	N 2.487 (63.17)	P 3.004 (76.30)	Q 3.952 (100.38)	R 4.758 (120.85)	T 6.070 (154.18)	Inlet Flange Rating B16.34	Outlet Flange Rating B16.34
Inlet × Outlet Size (inch)	3×4 4×6	3×4 4×6	3×4 4×6	4×6	6×8	6×8	8×10	150	150
	3×4 4×6	3×4 4×6	3×4 4×6	4×6	6×8	6×8	8×10	300	
	3×4 4×6	3×4 4×6	3×4 4×6	4×6	6×8	6×8	8×10	600	
	3×4 4×6	3×4 4×6	3×4 4×6	4×6				900	300
	3×4 4×6	3×4 4×6	3×4 4×6	4×6				1500	
	3×4 4×6	3×4 4×6	3×4 4×6	4×6				2500	

Orifice Area Sq.in. (mm)	V 7.500 (190.50)	W 9.000 (228.60)	Y 10.680 (271.27)	Z 11.020 (279.90)	Z2 12.000 (304.80)	A 13.498 (342.85)	B 15.000 (381.00)	Inlet Flange Rating B16.34	Outlet Flange Rating B16.34
Inlet × Outlet Size (inch)	10×14	12×16	14×20	16×20	16×20	18×24	20×24	150	150
	10×14	12×16	14×20	16×20	16×20	18×24	20×24	300	

Type	Pilot Operated Safety Relief Valve
Applicable Code	ASME Sec. VIII
Size	1" × 2" ~ 20" × 24
Orifice	D(0.437 Sq.in.)~B2(17.000Sq.in.)
Liquid Set Pressure Range	15 ~ 2160 psig(1.03 ~ 148.9 bar)
Allowable Leakage	API Standard 527

* Please contact us for the product over 2160psig.
UV Stamp can be applied up to 6170psig .

Orifice Area Sq.in. (mm)	D 0.437 (11.10)	E 0.535 (13.59)	F 0.687 (17.45)	G 0.844 (21.44)	H 1.054 (26.77)	J 1.350 (34.29)	K 1.612 (40.95)	Inlet Flange Rating B16.34	Outlet Flange Rating B16.34
Inlet × Outlet Size (inch)	1×2 1 ½×2	1×2 1 ½×2	1×2 1 ½×2	(1)2×(2)3 1 ½×(2)3	1½×(2)3 2×3	1½×(2)3 (2)3×(3)4	2×3 3×4	150	150
	1×2 1 ½×2	1×2 1 ½×2	1×2 1 ½×2	(1)2×(2)3 1 ½×(2)3	1½×(2)3 2×3	1½×(2)3 (2)3×(3)4	2×3 3×4	300	
	1×2 1 ½×2	1×2 1 ½×2	1×2 1 ½×2	(1)2×(2)3 1 ½×(2)3	1½×(2)3 2×3	1½×(2)3 (2)3×(3)4	2×3 3×4	600	
	1×2 1 ½×2	1×2 1 ½×2	1×2 1 ½×2	(1)2×(2)3 1 ½×(2)3	1½×(2)3 2×3	1½×(2)3 (2)3×(3)4	2×3 3×4	900	300
	1×2 1 ½×2	1×2 1 ½×2	1×2 1 ½×2	(1)2×(2)3 1 ½×(2)3	1½×(2)3 2×3	1½×(2)3 (2)3×(3)4	2×3 3×4	1500	
	1×2 1 ½×2	1×2 1 ½×2	1×2 1 ½×2	(1)2×(2)3 1 ½×(2)3	1½×(2)3 2×3	1½×(2)3 2×3		2500	

Orifice Area Sq.in. (mm)	L 2.009 (51.03)	M 2.257 (57.33)	N 2.487 (63.17)	P 3.004 (76.30)	Q 3.952 (100.38)	R 4.758 (120.85)	T 6.070 (154.18)	Inlet Flange Rating B16.34	Outlet Flange Rating B16.34
Inlet × Outlet Size (inch)	3×4 4×6	3×4 4×6	3×4 4×6	4×6	6×8	6×8	8×10	150	150
	3×4 4×6	3×4 4×6	3×4 4×6	4×6	6×8	6×8	8×10	300	
	3×4 4×6	3×4 4×6	3×4 4×6	4×6	6×8	6×8	8×10	600	
	3×4 4×6							900	300
	3×4 4×6							1500	

Orifice Area Sq.in. (mm)	V 7.500 (190.50)	W 9.000 (228.60)	Y 10.680 (271.27)	Z 11.020 (279.90)	Z2 12.000 (304.80)	A 13.498 (342.85)	B 15.000 (381.00)	Inlet Flange Rating B16.34	Outlet Flange Rating B16.34
Inlet × Outlet Size (inch)	10×14	12×16	14×20	16×20	16×20	18×24	20×24	150	150
	10×14	12×16	14×20	16×20	16×20	18×24	20×24	300	

04 Pop(Snap) Action Pilot Control

Pop(Snap) Action, Non-Flowing type

During the relief cycle of the piston in the main valve, there is no fluid going through the pilot.

Set Pressure Ranges

15 to 6170 psig
(1.03 to 425.4 bar)

* Please contact us for the product over 6170psig.
  UV Stamp can be applied up to 10000psig .

Blow down

Adjustable type
5 to 10% of set pressure

Standard Material

316 Stainless Steel
Seal material is FKM

Special Material

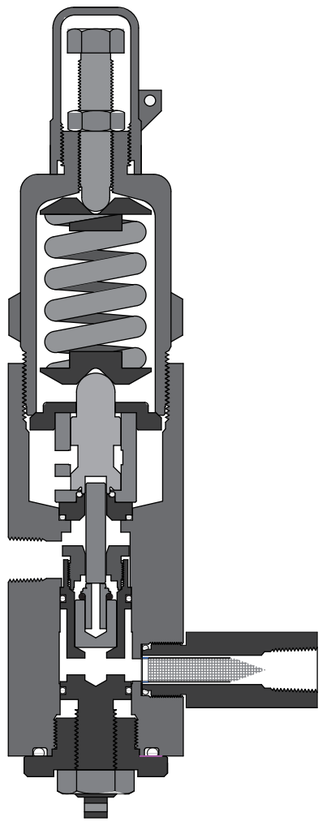
Monel, Hastelloy C
Seal material is FFKM
Spring material is Inconel X750

Fluid Services

Gas/Vapor and Steam
Our company doesn't have "UV" stamp
for Liquid Service

Soft Seals Notices

Main valve and Pilot part soft seal is based upon set pressure and relieving temperature.



05 Modulating Pilot Control

Modulating Action, Non-Flowing type

During the relief cycle of the piston in the main valve, there is no fluid going through the pilot.

Set Pressure Ranges

15 to 2160 psig
(1.03 to 148.9bar)

* Please contact us for the product over 2160psig.
  UV Stamp can be applied up to 6170psig .

Blow down

Fixed type
7 to 15% of set pressure

Standard Material

316 Stainless Steel
Seal material is FKM
Spring : 1.03~50.99bar St. St.316
52.01~148bar Inconel X750

Special Material

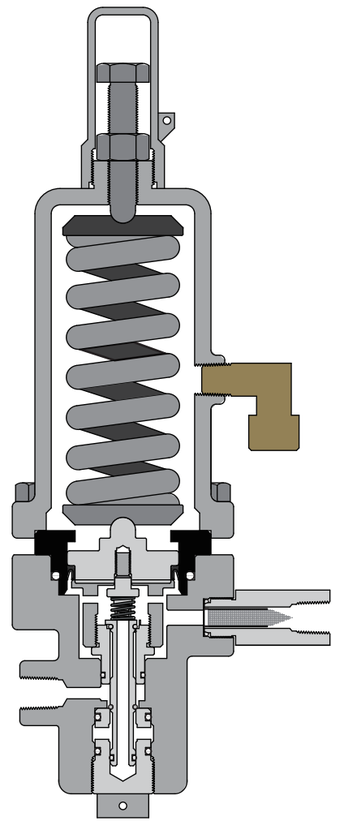
Monel, Hastelloy C Seal
material is FFKM

Fluid Services

Gas/Vapor
Liquid

Soft Seals Notices

Main valve and Pilot part soft seal is based upon set pressure and relieving temperature.



06 Main Part

Standard Material

316 St. St
Seal is FKM

Special Material

Monel, Hastelloy C
Seal is FFKM
Spring is Inconel X750

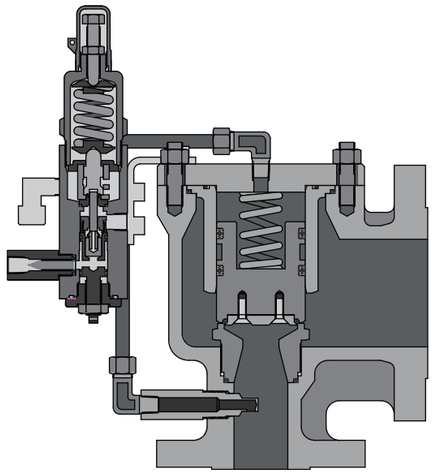
The certified coefficient of discharge Kd

Kd is 0.873 for air, gas and steam service
Kd is 0.795 for liquid service

Seal Temperature Ranges

NBR	– 34℃ to 120℃
EPDM	– 57℃ to 120℃
FKM	– 26℃ to 200℃
FFKM	– 26℃ to 320℃
VMQ	– 60℃ to 230℃

Since the temperature range of the seal can be different according to the manufacturer, please contact us if the temperature range of the seal which is close to the maximum temperature or the minimum temperature



Standard Nozzle

Semi nozzle type (Matel to Rubber)
Semi nozzle type (Metal to Metal)

Soft Seals Notices

1. Main valve soft seal is based upon set pressure and relieving temperature.
2. Teflon used for Main Seat Seal for all Main parts with CL900, 1500, 2500 inlet flanges.

07 Accessories

Backflow Prevent

The pilot operated safety valve should not discharge directly into the air and the exit side discharge line needs to have back pressure. If the pressure of the exit side discharge line exceeds the pressure on the valve entrance side, the piston rises and backflow is caused through the main valve.

A backflow preventing divice can be used to keep this situation in check. A sensing line is connected to the exit side of the main body and the main dome, preventing backflow and guaranteeing an accurate pressure differential.

Field Test Connection

For end connections, 1/4" FPT Field Test Connection is the standard, and end connections may be changed. The structure and operating principle is the same as the backflow preventer, The pilot section can be inspected only, using nitrogen or air.

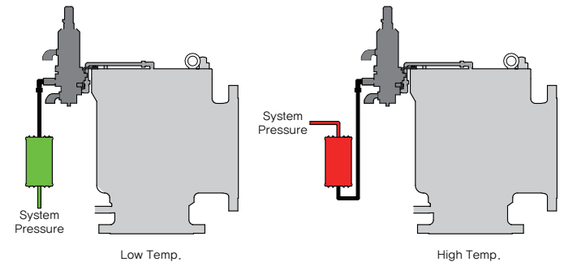
When installed in the field, inspection is usually performed through system overpressure, but using auxiliary equipment such as nitrogen tanks and regulators, inspection without overpressure is made possible by connecting to the field test connections.

Filter

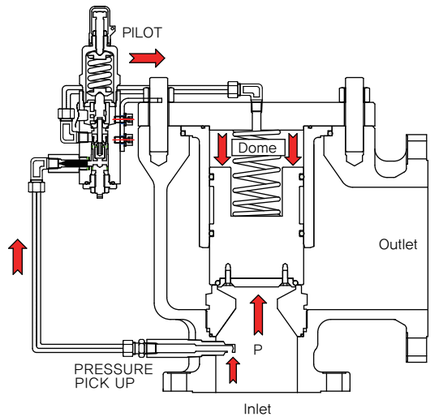
The filter option is installed in the line in front of the system line pilot section, and filters can be used in locations where remote sensing lines are required. Also usable for foreign debris or dirty applications.

Heat Exchanger

Can be used for High Temp. (Media above 500°F) / Low Temp. (Media above -40°F). As shown in Figure 1, the bottom connection for the system input line applies to low temp. applications. Figure 2, the top connection for the system input line applies to high temp. applications.

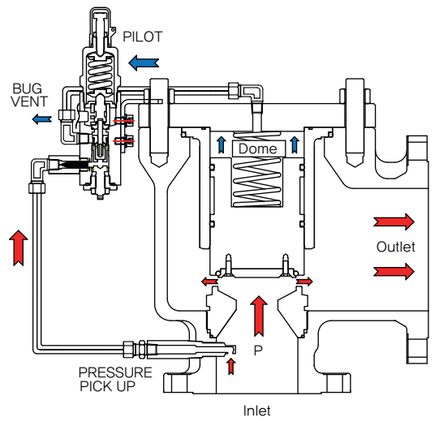


08 How Pressure Relief Valves Work



Initial POSRV state

When primary pressure enters the inlet, pressure passes the hole of the
pressure pick up, and reaches the doom space via the pop action parts
of the pilot section. (Pilot section always remains open)
Ratio between seat (dt) and piston external diameter (1:1.2), piston weight and spring tension prevents action when the primary side pressure and doom pressure are the same.



Operating state of POSRV

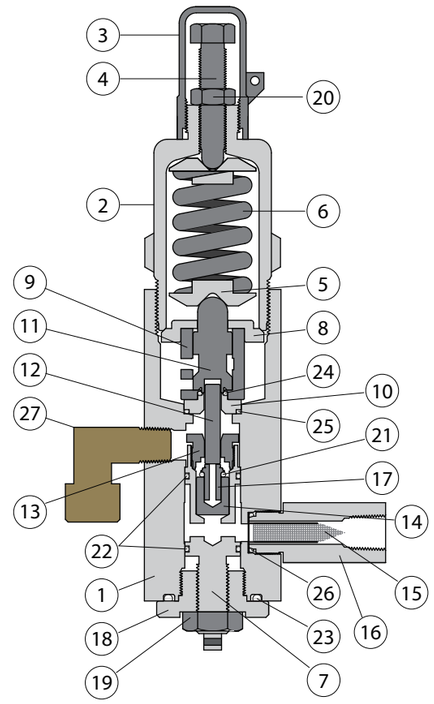
Detectors before triggering of the POSRV, like the conventional safety valves in the pilot secion, are activated when the spring setting value is reached.

When spring strength is exceeded, the pilot section shuts off primary side pressure. Simultaneously, the primary pressure that existed between the pressure inside the doom space and the pilot section is released through the bug vent of the pilot section.

In the main section primary pressure to the pilot section is cut off, and, in the room section, loss of pressure causes the piston to rise and discharge the fluid. When the required amount of fluid is discharged, the pilot secion opens primary side pressure, supplying pressure until the doom space and returning to the initial state.

09 Standard Material

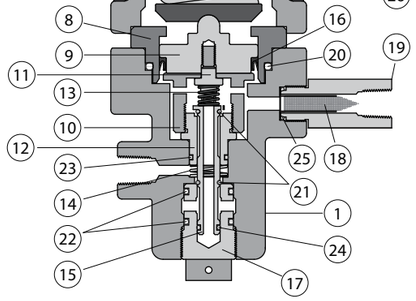
PILOT - Pop(Snap) Action Type



No	Part Name	Material
1	Body	SA351 CF8M
2	Bonnet	SA351 CF8M
3	Cap	Stainless Steel
4	Adjust Screw	A276 316
5	Spring Buttons	A276 316
6	Spring	SS316
7	B/D Adjuster	A276 316
8	Guide Flange	A276 316
9	Guide	A276 316
10	Upper Seat	A276 316
11	Piston	A276 316
12	B/D Relay	A276 316
13	Lower Seat	A276 316
14	Poppet	A276 316
15	Filter	A276 316
16	Filter Housing	A276 316
17	Retainer	A276 316
18	B/D Adjust Cap	A276 316
19	Lock Nut	A276 316
20	Jam Nut	A276 304
21	Lower Seat Seal	FKM
22	Seal Adjust	FKM
23	Adjust Cap Seal	FKM
24	Upper Seat Seal	FKM
25	Static Seal, Body	FKM
26	Static Seal, Filter	FKM
27	Bug Vent	C3604

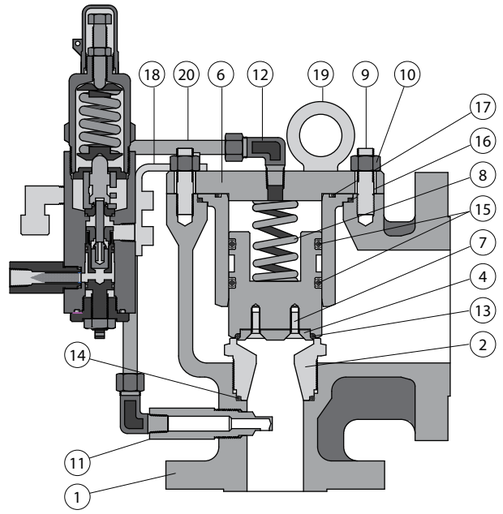
The material could be changeable upon request.

PILOT - MODULATING TYPE



No	Part Name	Material
1	Body	SA351 CF8M
2	Bonnet	SA351 CF8M
3	Cap	Stainless Steel
4	Adjust Screw	A276 316
5	Spring Buttons	A276 316
6	Spring	SS316
7	Jam Nut	A194 8
8	Guide	A276 316
9	Piston	A276 316
10	Retainer	A276 316
11	Retainer Screw	A276 316
12	B/D Relay	A276 316
13	Spool Return Spring	SS316
14	Low Return Spring	SS316
15	Spool	A276 316
16	Energized Seal	Carbon + PTFE
17	Spool Cap	A276 316
18	Filter	A276 316
19	Filter Housing	A276 316
20	Piston Seal	FKM
21	Body Seal	FKM
22	Spool Cap Seal	FKM
23	Seat Seal	FKM
24	Spool Seal	FKM
25	Filter Seal	FKM
26	Stud Bolt	A193 B8M
27	Bug Vent	C3604

MAIN PART



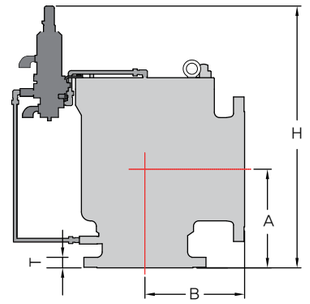
No	Part Name	Material
1	Body	SA216 WCB
2	Nozzle	A351CF8M
3	Piston	A276 316
4	Retainer	A276 316
5	Guide	A351CF8M
6	Cover	A276 316
7	Retainer Screw	A276 316
8	Main Spring	SS316
9	Stud Bolt	A193 B8M
10	Stud Nut	A194 B8
11	Pressure Pick Up	A276 316
12	Nipple	SS316
13	Main Seat Seal	FKM
14	Nozzle Seal	FKM
15	Piston Seal	FKM
16	Guide Seal	FKM
17	Cover Seal	FKM
18	Bracket	A240 304
19	I-Bolt	SS304
20	Tube	A312 TP316

The material could be changeable upon request.

10 Dimension Table

Safety Relief Vlave Dimension	A [in]	B [in]	H (Modu) [in]	H Pop [in]	T [in]	A [in]	B [in]	H (Modu) [in]	H Pop [in]	T [in]	A [in]	B [in]	H (Modu) [in]	H Pop [in]	T [in]
Flange Rating Class	150 × 150					300 × 150					600 × 150				
Valve Size	1 D 2					1 D 2					1 D 2				
D	4 1/8	4 1/2	15 2/7	12 2/3	5/7	4 3/8	4 1/2	15 5/9	13	1	4 3/8	4 1/2	15 5/9	13	1
Valve Size	1 1/2 D 2					1 1/2 D 2					1 1/2 D 2				
D	4 7/8	4 3/4	16	13 2/5	3/4	4 7/8	4 3/4	16	13 2/5	6/7	4 7/8	4 3/4	16	13 2/5	1 1/6
Valve Size	1 E 2					1 E 2					1 E 2				
E	4 1/8	4 1/2	15 2/7	12 2/3	5/7	4 3/8	4 1/2	15 5/9	13	1	4 3/8	4 1/2	15 5/9	13	1
Valve Size	1 1/2 E 2					1 1/2 E 2					1 1/2 E 2				
E	4 7/8	4 3/4	16	13 2/5	3/4	4 7/8	4 3/4	16	13 2/5	6/7	4 7/8	4 3/4	16	13 2/5	1 1/6
Valve Size	1 F 2					1 F 2					1 F 2				
F	4 1/8	4 1/2	15 2/7	12 2/3	5/7	4 3/8	4 1/2	15 5/9	13	1	4 3/8	4 1/2	15 5/9	13	1
Valve Size	1 1/2 F 2					1 1/2 F 2					1 1/2 F 2				
F	4 7/8	4 3/4	16	13 2/5	3/4	4 7/8	4 3/4	16	13 2/5	6/7	4 7/8	4 3/4	16	13 2/5	1 1/6
Valve Size	1 1/2 G 3					1 1/2 G 3					1 1/2 G 3				
G	5 1/8	4 7/8	17	14 1/6	3/4	5 1/8	4 7/8	17	14 1/6	5/6	5 1/8	4 7/8	17	14 1/6	1 1/6
Valve Size	2 G 3					2 G 3					2 G 3				
G	5 3/8	4 7/8	17	14 3/8	4/5	5 3/8	4 7/8	17	14 3/8	1	5 3/8	4 7/8	17	14 3/8	1 2/7
Valve Size	1 1/2 H 3					1 1/2 H 3					1 1/2 H 3				
H	5 1/8	4 7/8	16 3/4	14 1/6	3/4	5 1/8	4 7/8	16 3/4	14 1/6	6/7	5 1/8	4 7/8	16 3/4	14 1/6	1 1/6
Valve Size	2 H 3					2 H 3					2 H 3				
H	5 3/8	4 7/8	17	14 3/8	3/4	5 3/8	4 7/8	17	14 3/8	6/7	5 3/8	4 7/8	17	14 3/8	1 1/6
Valve Size	2 J 3					2 J 3					2 J 3				
J	5 3/8	4 7/8	17	14 3/8	4/5	5 3/8	4 7/8	17	14 3/8	1	5 3/8	4 7/8	17	14 3/8	1 2/7
Valve Size	3 J 4					3 J 4					3 J 4				
J	6 1/8	6 3/8	19	16 1/2	1	6 1/8	6 3/8	19	16 1/2	1 1/6	6 3/8	6 3/8	19	16 1/2	1 1/2
Valve Size	3 K 4					3 K 4					3 K 4				
K	6 1/8	6 3/8	19	16 1/2	1	6 1/8	6 3/8	19	16 1/2	1 1/6	6 3/8	6 3/8	19	16 1/2	1 1/2
Valve Size	3 L 4					3 L 4					3 L 4				
L	6 1/8	6 3/8	19	16 1/2	1	6 1/8	6 3/8	19	16 1/2	1 1/6	6 3/8	6 3/8	19	16 1/2	1 1/2
Valve Size	4 L 6					4 L 6					4 L 6				
L	7 3/4	8 1/4	21 4/5	19 1/7	1	7 3/4	8 1/4	22 1/8	19 1/2	1 2/7	7 3/4	8 1/4	22 2/3	20	1 4/5
Valve Size	4 M 6					4 M 6					4 M 6				
M	7 3/4	8 1/4	21 4/5	19 1/5	1	7 3/4	8 1/4	22 1/8	19 1/2	1 2/7	7 3/4	8 1/4	22 2/3	20	1 4/5
Valve Size	4 N 6					4 N 6					4 N 6				
N	7 3/4	8 1/4	21 4/5	19 1/5	1	7 3/4	8 1/4	22 1/8	19 1/2	1 2/9	7 3/4	8 1/4	22 2/3	20	1 4/5
Valve Size	4 P 6					4 P 6					4 P 6				
P	7 3/4	8 1/4	21 4/5	19 1/5	1	7 3/4	8 1/4	22 1/8	19 1/2	1 2/7	7 3/4	8 1/4	22 2/3	20	1 4/5
Valve Size	6 Q 8					6 Q 8					6 Q 8				
Q	9 7/16	9 1/2	26 2/9	23 5/8	1	9 7/16	9 1/2	26 2/3	24	1 1/2	9 11/16	9 1/2	27	24 1/3	2 1/6
Valve Size	6 R 8					6 R 10					6 R 10				
R	9 7/ 16	9 1/2	26 2/9	23 5/8	1	9 7/16	9 1/2	26 2/3	24	1 1/2	9 11/16	9 1/2	27	24 1/3	2 1/6
Valve Size	8 T 10					8 T 10					8 T 10				
T	10 7/8	11	28 5/6	26 2/9	1 1/6	10 7/8	11	28 5/6	26 2/9	1 1/6	11 11/16	11	28 5/6	27	2 1/2

A [in]	B [in]	H (Modu) [in]	H Pop [in]	T [in]	A [in]	B [in]	H (Modu) [in]	H Pop [in]	T [in]	A [in]	B [in]	H (Modu) [in]	H Pop [in]	T [in]
900 × 300					1500 × 300					2500 × 300				
1 D 2					1 D 2					1 D 2				
4 15/16	4 3/4	16	13 2/5	1 1/2	4 15/16	4 3/4	16	13 2/5	1 1/2	4 15/16	4 3/4	16	13 2/5	1 3/4
1 1/2 E 2					1 1/2 E 2					1 1/2 E 2				
5 7/8	5 1/2	17	14 3/8	1 1/2	5 7/8	5 1/2	17	14 3/8	1 1/2	5 7/8	5 1/2	17	14 3/8	2
1 E 2					1 E 2					1 E 2				
4 15/16	4 3/4	16	13 2/5	1 1/2	4 15/16	4 3/4	16	13 2/5	1 1/2	4 15/16	4 3/4	16	13 2/5	2
1 1/2 E 2					1 1/2 E 2					1 1/2 E 2				
5 7/8	5 1/2	17	14 3/8	1 1/2	5 7/8	5 1/2	17	14 3/8	1 1/2	5 7/8	5 1/2	17	14 3/8	2
1 F 2					1 F 2					1 F 2				
4 15/16	4 3/4	16	13 2/5	1 1/2	4 15/16	4 3/4	16	13 2/5	1 1/2	4 15/16	4 3/4	16	13 2/5	1 3/4
1 1/2 F 2					1 1/2 F 2					1 1/2 F 2				
5 7/8	5 1/2	17	14 3/8	1 1/2	5 7/8	5 1/2	17	14 3/8	1 1/2	5 7/8	5 1/2	17	14 3/8	2
1 1/2 G 3					1 1/2 G 3					1 1/2 G 3				
6 3/8	6 3/4	18 1/9	15 5/9	1 1/2	6 3/8	6 3/4	18 1/9	15 5/9	1 1/2	6 3/8	6 3/4	18 1/9	15 5/9	2
2 G 3					2 G 3					2 G 3				
6 9/16	6 3/4	19	16 3/7	2 2/9	6 9/16	6 3/4	19	16 3/7	2 2/9	7	6 3/4	19	16 3/7	2 2/7
1 1/2 H 3					1 1/2 H 3					1 1/2 H 3				
6 3/8	6 3/4	18 1/9	15 5/9	1 1/2	6 3/8	6 3/4	18 1/9	15 5/9	1 1/2	6 3/8	6 3/4	18 1/9	15 5/9	2
2 H 3					2 H 3					2 H 3				
6 9/16	6 3/4	19	16 3/7	1 1/2	6 9/16	6 3/4	19	16 3/7	1 1/2	7	6 3/4	19	16 3/7	2 3/7
2 J 3					2 J 3					2 J 3				
6 9/16	6 3/4	17 1/4	16 3/7	2 2/9	6 9/16	6 3/4	17 1/4	16 3/7	2 2/9	7	6 3/4	17 1/4	16 3/7	2 2/7
3 J 4					3 J 4									
7 1/2	7 1/8	20 1/2	17 5/6	1 4/5	7 1/2	7 1/8	20 1/2	17 5/6	2 1/6					
3 K 4					3 K 4									
7 1/2	1 1/8	20 1/2	17 5/6	1 4/5	7 1/2	1 1/8	20 1/2	17 5/6	2 1/6					
3 L 4					3 L 4									
7 1/2	7 1/8	20 1/2	17 5/6	1 4/5	7 1/2	7 1/8	20 1/2	17 5/6	2 1/6					
4 L 6					4 L 6									
9 13/16	9 3/16	24 5/7	22 1/8	2	9 13/16	9 3/16	24 5/7	22 1/8	2 2/5					
4 M 6					4 M 6									
9 13 /16	9 3/16	24 5/7	22 1/8	2	9 13 /16	9 3/16	24 5/7	22 1/8	2 2/5					
4 N 6					4 N 6									
9 13 /16	9 3/16	24 5/7	22 1/8	2	9 13 /16	9 3/16	24 5/7	22 1/8	2 2/5					
4 P 6					4 P 6									
9 13/16	9 3/16	24 5/7	22 1/8	2	9 13/16	9 3/16	24 5/7	22 1/8	2 2/5					



* H : [Modu] -> Modulating
  [Pop] -> Pop(Snap)

11 Valve Selection

D orifice

Flow Area : 0.150 sq. in.
Diameter : 0.437 in.

USC Units

Size	Connections ASME Flanges		Maximum Set Pressure (psig)			Outlet Pressure Limit (psig)	Standard Materials	
	Inlet	Outlet	-450℉ ~ -76℉	-20℉ ~ 100℉	500℉	100℉	Body / Bonnet	Spring
1 × 2	150	150		285	170	285	Carbon Steel	Carbon Steel
1 × 2	300	150		740	605	285		
1 × 2	600	150		1480	1205	285		
1 × 2	900	300		2220	1810	740		
1 × 2	1500	300		3705	3015	740		
1 × 2	2500	300		6170	5025	740		
1 1/2 × 2	150	150		285	170	285		
1 1/2 × 2	300	150		740	605	285		
1 1/2 × 2	600	150		1480	1205	285		
1 1/2 × 2	900	300		2220	1810	740		
1 1/2 × 2	1500	300		3705	3015	740		
1 1/2 × 2	2500	300		6170	5025	740		
1 × 2	150	150	275	275	170	275	Austenitic Stainless Steel	Stainless Steel or Alloy Steel
1 × 2	300	150	720	720	480	275		
1 × 2	600	150	1440	1440	955	275		
1 × 2	900	300	2160	2160	1435	720		
1 × 2	1500	300	3600	3600	2390	720		
1 × 2	2500	300	6000	6000	3980	720		
1 1/2 × 2	150	150	275	275	170	275		
1 1/2 × 2	300	150	720	720	480	275		
1 1/2 × 2	600	150	1440	1440	955	275		
1 1/2 × 2	900	300	2160	2160	1435	720		
1 1/2 × 2	1500	300	3600	3600	2390	720		
1 1/2 × 2	2500	300	6000	6000	3980	720		

Metric Units

Size	Connections ASME Flanges		Maximum Set Pressure. (bar)			Outlet Pressure Limit (bar)	Standard Materials	
	Inlet	Outlet	-450℃ ~ -76℃	-20℃ ~ 100℃	500℃	100℃	Body / Bonnet	Spring
1 × 2	150	150		20	12	20	Carbon Steel	Carbon Steel
1 × 2	300	150		51	42	20		
1 × 2	600	150		102	83	20		
1 × 2	900	300		153	125	51		
1 × 2	1500	300		255	208	51		
1 × 2	2500	300		425	346	51		
1 1/2 × 2	150	150		20	12	20		
1 1/2 × 2	300	150		51	42	20		
1 1/2 × 2	600	150		102	83	20		
1 1/2 × 2	900	300		153	125	51		
1 1/2 × 2	1500	300		255	208	51		
1 1/2 × 2	2500	300		425	346	51		
1 × 2	150	150	19	19	12	19	Austenitic Stainless Steel	Stainless Steel or Alloy Steel
1 × 2	300	150	50	50	33	19		
1 × 2	600	150	99	99	66	19		
1 × 2	900	300	149	149	99	50		
1 × 2	1500	300	248	248	165	50		
1 × 2	2500	300	413	413	274	50		
1 1/2 × 2	150	150	19	19	12	19		
1 1/2 × 2	300	150	50	50	33	19		
1 1/2 × 2	600	150	99	99	66	19		
1 1/2 × 2	900	300	149	149	99	50		
1 1/2 × 2	1500	300	248	248	165	50		
1 1/2 × 2	2500	300	413	413	274	50		

E orifice

Flow Area : 0.225 sq. in.
Diameter : 0.535 in.

USC Units

Size	Connections ASME Flanges		Maximum Set Pressure (psig)			Outlet Pressure Limit (psig)	Standard Materials	
	Inlet	Outlet	-450℉ ~ -76℉	-20℉ ~ 100℉	500℉	100℉	Body / Bonnet	Spring
1 × 2	150	150		285	170	285	Carbon Steel	Carbon Steel
1 × 2	300	150		740	605	285		
1 × 2	600	150		1480	1205	285		
1 × 2	900	300		2220	1810	740		
1 × 2	1500	300		3705	3015	740		
1 × 2	2500	300		6170	5025	740		
1 1/2 × 2	150	150		285	170	285		
1 1/2 × 2	300	150		740	605	285		
1 1/2 × 2	600	150		1480	1205	285		
1 1/2 × 2	900	300		2220	1810	740		
1 1/2 × 2	1500	300		3705	3015	740		
1 1/2 × 2	2500	300		6170	5025	740		
1 × 2	150	150	275	275	170	275	Austenitic Stainless Steel	Stainless Steel or Alloy Steel
1 × 2	300	150	720	720	480	275		
1 × 2	600	150	1440	1440	955	275		
1 × 2	900	300	2160	2160	1435	720		
1 × 2	1500	300	3600	3600	2390	720		
1 × 2	2500	300	6000	6000	3980	720		
1 1/2 × 2	150	150	275	275	170	275		
1 1/2 × 2	300	150	720	720	480	275		
1 1/2 × 2	600	150	1440	1440	955	275		
1 1/2 × 2	900	300	2160	2160	1435	720		
1 1/2 × 2	1500	300	3600	3600	2390	720		
1 1/2 × 2	2500	300	6000	6000	3980	720		

Metric Units

Size	Connections ASME Flanges		Maximum Set Pressure. (bar)			Outlet Pressure Limit (bar)	Standard Materials	
	Inlet	Outlet	-450℃ ~ -76℃	-20℃ ~ 100℃	500℃	100℃	Body / Bonnet	Spring
1 × 2	150	150		20	12	20	Carbon Steel	Carbon Steel
1 × 2	300	150		51	42	20		
1 × 2	600	150		102	83	20		
1 × 2	900	300		153	125	51		
1 × 2	1500	300		255	208	51		
1 × 2	2500	300		425	346	51		
1 1/2 × 2	150	150		20	12	20		
1 1/2 × 2	300	150		51	42	20		
1 1/2 × 2	600	150		102	83	20		
1 1/2 × 2	900	300		153	125	51		
1 1/2 × 2	1500	300		255	208	51		
1 1/2 × 2	2500	300		425	346	51		
1 × 2	150	150	19	19	12	19	Austenitic Stainless Steel	Stainless Steel or Alloy Steel
1 × 2	300	150	50	50	33	19		
1 × 2	600	150	99	99	66	19		
1 × 2	900	300	149	149	99	50		
1 × 2	1500	300	248	248	165	50		
1 × 2	2500	300	413	413	274	50		
1 1/2 × 2	150	150	19	19	12	19		
1 1/2 × 2	300	150	50	50	33	19		
1 1/2 × 2	600	150	99	99	66	19		
1 1/2 × 2	900	300	149	149	99	50		
1 1/2 × 2	1500	300	248	248	165	50		
1 1/2 × 2	2500	300	413	413	274	50		

F orifice

Area = 0.371 sq. in.
Diameter : 0.687 in.

USC Units

Size	Connections ASME Flanges		Maximum Set Pressure (psig)			Outlet Pressure Limit (psig)	Standard Materials	
	Inlet	Outlet	-450℉ ~ -76℉	-20℉ ~ 100℉	500℉	100℉	Body / Bonnet	Spring
1 × 2	150	150		285	170	285	Carbon Steel	Carbon Steel
1 × 2	300	150		740	605	285		
1 × 2	600	150		1480	1205	285		
1 × 2	900	300		2220	1810	740		
1 × 2	1500	300		3705	3015	740		
1 × 2	2500	300		6170	5025	740		
1 1/2 × 2	150	150		285	170	285		
1 1/2 × 2	300	150		740	605	285		
1 1/2 × 2	600	150		1480	1205	285		
1 1/2 × 2	900	300		2220	1810	740		
1 1/2 × 2	1500	300		3705	3015	740		
1 1/2 × 2	2500	300		6170	5025	740		
1 × 2	150	150	275	275	170	275	Austenitic Stainless Steel	Stainless Steel or Alloy Steel
1 × 2	300	150	720	720	480	275		
1 × 2	600	150	1440	1440	955	275		
1 × 2	900	300	2160	2160	1435	720		
1 × 2	1500	300	3600	3600	2390	720		
1 × 2	2500	300	6000	6000	3980	720		
1 1/2 × 2	150	150	275	275	170	275		
1 1/2 × 2	300	150	720	720	480	275		
1 1/2 × 2	600	150	1440	1440	955	275		
1 1/2 × 2	900	300	2160	2160	1435	720		
1 1/2 × 2	1500	300	3600	3600	2390	720		
1 1/2 × 2	2500	300	6000	6000	3980	720		

Metric Units

Size	Connections ASME Flanges		Maximum Set Pressure. (bar)			Outlet Pressure Limit (bar)	Standard Materials	
	Inlet	Outlet	-450℃ ~ -76℃	-20℃ ~ 100℃	500℃	100℃	Body / Bonnet	Spring
1 × 2	150	150		20	12	20	Carbon Steel	Carbon Steel
1 × 2	300	150		51	42	20		
1 × 2	600	150		102	83	20		
1 × 2	900	300		153	125	51		
1 × 2	1500	300		255	208	51		
1 × 2	2500	300		425	346	51		
1 1/2 × 2	150	150		20	12	20		
1 1/2 × 2	300	150		51	42	20		
1 1/2 × 2	600	150		102	83	20		
1 1/2 × 2	900	300		153	125	51		
1 1/2 × 2	1500	300		255	208	51		
1 1/2 × 2	2500	300		425	346	51		
1 × 2	150	150	19	19	12	19	Austenitic Stainless Steel	Stainless Steel or Alloy Steel
1 × 2	300	150	50	50	33	19		
1 × 2	600	150	99	99	66	19		
1 × 2	900	300	149	149	99	50		
1 × 2	1500	300	248	248	165	50		
1 × 2	2500	300	413	413	274	50		
1 1/2 × 2	150	150	19	19	12	19		
1 1/2 × 2	300	150	50	50	33	19		
1 1/2 × 2	600	150	99	99	66	19		
1 1/2 × 2	900	300	149	149	99	50		
1 1/2 × 2	1500	300	248	248	165	50		
1 1/2 × 2	2500	300	413	413	274	50		

G orifice

Area = 0.559 sq. in.
Diameter : 0.844 in.

USC Units

Size	Connections ASME Flanges		Maximum Set Pressure (psig)			Outlet Pressure Limit (psig)	Standard Materials	
	Inlet	Outlet	-450℉ ~ -76℉	-20℉ ~ 100℉	500℉	100℉	Body / Bonnet	Spring
1 1/2 × 3	150	150		285	170	285	Carbon Steel	Carbon Steel
1 1/2 × 3	300	150		740	605	285		
1 1/2 × 3	600	150		1480	1205	285		
1 1/2 × 3	900	300		2220	1810	740		
1 1/2 × 3	1500	300		3705	3015	740		
1 1/2 × 3	2500	300		6170	5025	740		
2 × 3	150	150		285	170	285		
2 × 3	300	150		740	605	285		
2 × 3	600	150		1480	1205	285		
2 × 3	900	300		2220	1810	740		
2 × 3	1500	300		3705	3015	740		
2 × 3	2500	300		6170	5025	740		
1 1/2 × 3	150	150	275	275	170	275	Austenitic Stainless Steel	Stainless Steel or Alloy Steel
1 1/2 × 3	300	150	720	720	480	275		
1 1/2 × 3	600	150	1440	1440	955	275		
1 1/2 × 3	900	300	2160	2160	1435	720		
1 1/2 × 3	1500	300	3600	3600	2390	720		
1 1/2 × 3	2500	300	6000	6000	3980	720		
2 × 3	150	150	275	275	170	275		
2 × 3	300	150	720	720	480	275		
2 × 3	600	150	1440	1440	955	275		
2 × 3	900	300	2160	2160	1435	720		
2 × 3	1500	300	3600	3600	2390	720		
2 × 3	2500	300	6000	6000	3980	720		

Metric Units

Size	Connections ASME Flanges		Maximum Set Pressure. (bar)			Outlet Pressure Limit (bar)	Standard Materials	
	Inlet	Outlet	-450℃ ~ -76℃	-20℃ ~ 100℃	500℃	100℃	Body / Bonnet	Spring
1 1/2 × 3	150	150		20	12	20	Carbon Steel	Carbon Steel
1 1/2 × 3	300	150		51	42	20		
1 1/2 × 3	600	150		102	83	20		
1 1/2 × 3	900	300		153	125	51		
1 1/2 × 3	1500	300		255	208	51		
1 1/2 × 3	2500	300		425	346	51		
2 × 3	150	150		20	12	20		
2 × 3	300	150		51	42	20		
2 × 3	600	150		102	83	20		
2 × 3	900	300		153	125	51		
2 × 3	1500	300		255	208	51		
2 × 3	2500	300		425	346	51		
1 1/2 × 3	150	150	19	19	12	19	Austenitic Stainless Steel	Stainless Steel or Alloy Steel
1 1/2 × 3	300	150	50	50	33	19		
1 1/2 × 3	600	150	99	99	66	19		
1 1/2 × 3	900	300	149	149	99	50		
1 1/2 × 3	1500	300	248	248	165	50		
1 1/2 × 3	2500	300	413	413	274	50		
2 × 3	150	150	19	19	12	19		
2 × 3	300	150	50	50	33	19		
2 × 3	600	150	99	99	66	19		
2 × 3	900	300	149	149	99	50		
2 × 3	1500	300	248	248	165	50		
2 × 3	2500	300	413	413	274	50		

H orifice

Area = 0.873 sq. in.
Diameter : 1.054 in.

USC Units

Size	Connections ASME Flanges		Maximum Set Pressure (psig)			Outlet Pressure Limit (psig)	Standard Materials	
	Inlet	Outlet	-450℉ ~ -76℉	-20℉ ~ 100℉	500℉	100℉	Body / Bonnet	Spring
1 1/2 × 3	150	150		285	170	285	Carbon Steel	Carbon Steel
1 1/2 × 3	300	150		740	605	285		
1 1/2 × 3	600	150		1480	1205	285		
1 1/2 × 3	900	300		2220	1810	740		
1 1/2 × 3	1500	300		3705	3015	740		
1 1/2 × 3	2500	300		6170	5025	740		
2 × 3	150	150		285	170	285		
2 × 3	300	150		740	605	285		
2 × 3	600	150		1480	1205	285		
2 × 3	900	300		2220	1810	740		
2 × 3	1500	300		3705	3015	740		
2 × 3	2500	300		6170	5025	740		
1 1/2 × 3	150	150	275	275	170	275	Austenitic Stainless Steel	Stainless Steel or Alloy Steel
1 1/2 × 3	300	150	720	720	480	275		
1 1/2 × 3	600	150	1440	1440	955	275		
1 1/2 × 3	900	300	2160	2160	1435	720		
1 1/2 × 3	1500	300	3600	3600	2390	720		
1 1/2 × 3	2500	300	6000	6000	3980	720		
2 × 3	150	150	275	275	170	275		
2 × 3	300	150	720	720	480	275		
2 × 3	600	150	1440	1440	955	275		
2 × 3	900	300	2160	2160	1435	720		
2 × 3	1500	300	3600	3600	2390	720		
2 × 3	2500	300	6000	6000	3980	720		

Metric Units

Size	Connections ASME Flanges		Maximum Set Pressure. (bar)			Outlet Pressure Limit (bar)	Standard Materials	
	Inlet	Outlet	-450℃ ~ -76℃	-20℃ ~ 100℃	500℃	100℃	Body / Bonnet	Spring
1 1/2 × 3	150	150		20	12	20	Carbon Steel	Carbon Steel
1 1/2 × 3	300	150		51	42	20		
1 1/2 × 3	600	150		102	83	20		
1 1/2 × 3	900	300		153	125	51		
1 1/2 × 3	1500	300		255	208	51		
1 1/2 × 3	2500	300		425	346	51		
2 × 3	150	150		20	12	20		
2 × 3	300	150		51	42	20		
2 × 3	600	150		102	83	20		
2 × 3	900	300		153	125	51		
2 × 3	1500	300		255	208	51		
2 × 3	2500	300		425	346	51		
1 1/2 × 3	150	150	19	19	12	19	Austenitic Stainless Steel	Stainless Steel or Alloy Steel
1 1/2 × 3	300	150	50	50	33	19		
1 1/2 × 3	600	150	99	99	66	19		
1 1/2 × 3	900	300	149	149	99	50		
1 1/2 × 3	1500	300	248	248	165	50		
1 1/2 × 3	2500	300	413	413	274	50		
2 × 3	150	150	19	19	12	19		
2 × 3	300	150	50	50	33	19		
2 × 3	600	150	99	99	66	19		
2 × 3	900	300	149	149	99	50		
2 × 3	1500	300	248	248	165	50		
2 × 3	2500	300	413	413	274	50		

J orifice

Area = 1.430 sq. in.
Diameter : 1.350 in.

USC Units

Size	Connections ASME Flanges		Maximum Set Pressure (psig)			Outlet Pressure Limit (psig)	Standard Materials	
	Inlet	Outlet	-450℉ ~ -76℉	-20℉ ~ 100℉	500℉	100℉	Body / Bonnet	Spring
2 × 3	150	150		285	170	285	Carbon Steel	Carbon Steel
2 × 3	300	150		740	605	285		
2 × 3	600	150		1480	1205	285		
2 × 3	900	300		2220	1810	740		
2 × 3	1500	300		(3705)	3015	740		
2 × 3	2500	300		(4620)	(4620)	740		
3 × 4	150	150		285	170	285		
3 × 4	300	150		740	605	285		
3 × 4	600	150		1480	1205	285		
3 × 4	900	300		2220	1810	740		
3 × 4	1500	300		3705	3015	740		
2 × 3	150	150	275	275	170		Austenitic Stainless Steel	Stainless Steel or Alloy Steel
2 × 3	300	150	720	720	480			
2 × 3	600	150	1440	1440	955			
2 × 3	900	300	2160	2160	1435			
2 × 3	1500	300	3600	3600	2390			
2 × 3	2500	300	(4495)	(4495)	(3550)			
3 × 4	150	150	275	275	170			
3 × 4	300	150	720	720	480			
3 × 4	600	150	1440	1440	955			
3 × 4	900	300	2160	2160	1435			
3 × 4	1500	300	3600	3600	2390			

Metric Units

Size	Connections ASME Flanges		Maximum Set Pressure. (bar)			Outlet Pressure Limit (bar)	Standard Materials	
	Inlet	Outlet	-450℃ ~ -76℃	-20℃ ~ 100℃	500℃	100℃	Body / Bonnet	Spring
2 × 3	150	150		20	12	20	Carbon Steel	Carbon Steel
2 × 3	300	150		51	42	20		
2 × 3	600	150		102	83	20		
2 × 3	900	300		153	125	51		
2 × 3	1500	300		(255)	208	51		
2 × 3	2500	300		(318)	(318)	51		
3 × 4	150	150		20	12	20		
3 × 4	300	150		51	42	20		
3 × 4	600	150		102	83	20		
3 × 4	900	300		153	125	51		
3 × 4	1500	300		255	208	51		
2 × 3	150	150	19	19	12	0	Austenitic Stainless Steel	Stainless Steel or Alloy Steel
2 × 3	300	150	50	50	33	0		
2 × 3	600	150	99	99	66	0		
2 × 3	900	300	149	149	99	0		
2 × 3	1500	300	248	248	165	0		
2 × 3	2500	300	-310	(310)	(245)	0		
3 × 4	150	150	19	19	12	0		
3 × 4	300	150	50	50	33	0		
3 × 4	600	150	99	99	66	0		
3 × 4	900	300	149	149	99	0		
3 × 4	1500	300	248	248	165	0		

K orifice

Area = 2.042 sq. in.
Diameter : 1.612 in.

USC Units

Size	Connections ASME Flanges		Maximum Set Pressure (psig)			Outlet Pressure Limit (psig)	Standard Materials	
	Inlet	Outlet	-450℉ ~ -76℉	-20℉ ~ 100℉	500℉	100℉	Body / Bonnet	Spring
3 × 4	150	150		285	170	285	Carbon Steel	Carbon Steel
3 × 4	300	150		740	605	285		
3 × 4	600	150		1480	1205	285		
3 × 4	900	300		2220	1810	740		
3 × 4	1500	300		3705	3015	740		
3 × 4	150	150	275	275	170	275	Austenitic Stainless Steel	Stainless Steel or Alloy Steel
3 × 4	300	150	720	720	480	275		
3 × 4	600	150	1440	1440	955	275		
3 × 4	900	300	2160	2160	1435	720		
3 × 4	1500	300	3600	3600	2390	720		

Metric Units

Size	Connections ASME Flanges		Maximum Set Pressure. (bar)			Outlet Pressure Limit (bar)	Standard Materials	
	Inlet	Outlet	-450℃ ~ -76℃	-20℃ ~ 100℃	500℃	100℃	Body / Bonnet	Spring
3 × 4	150	150		20	12	20	Carbon Steel	Carbon Steel
3 × 4	300	150		51	42	20		
3 × 4	600	150		102	83	20		
3 × 4	900	300		153	125	51		
3 × 4	1500	300		255	208	51		
3 × 4	150	150	19	19	12	19	Austenitic Stainless Steel	Stainless Steel or Alloy Steel
3 × 4	300	150	50	50	33	19		
3 × 4	600	150	99	99	66	19		
3 × 4	900	300	149	149	99	50		
3 × 4	1500	300	248	248	165	50		

L orifice

Area = 3.170 sq. in.
Diameter : 2.009 in.

USC Units

Size	Connections ASME Flanges		Maximum Set Pressure (psig)			Outlet Pressure Limit (psig)	Standard Materials	
	Inlet	Outlet	-450℉ ~ -76℉	-20℉ ~ 100℉	500℉	100℉	Body / Bonnet	Spring
3 × 4	150	150		285	170	285	Carbon Steel	Carbon Steel
3 × 4	300	150		740	605	285		
3 × 4	600	150		(1425)	1205	285		
3 × 4	900	300		2220	1810	740		
3 × 4	1500	300		(3630)	3015	740		
4 × 6	150	150		285	170	285		
4 × 6	300	150		740	605	285		
4 × 6	600	150		1480	1205	285		
4 × 6	900	300		2220	1810	740		
4 × 6	1500	300		3705	3015	740		
3 × 4	150	150	275	275	170	275	Austenitic Stainless Steel	Stainless Steel or Alloy Steel
3 × 4	300	150	720	720	480	275		
3 × 4	600	150	(1200)	(1375)	955	275		
3 × 4	900	300	2160	2160	1435	720		
3 × 4	1500	300	(3530)	(3530)	2390	720		
4 × 6	150	150	275	275	170	275		
4 × 6	300	150	720	720	480	275		
4 × 6	600	150	1440	1440	955	275		
4 × 6	900	300	2160	2160	1435	720		
4 × 6	1500	300	3600	3600	2390	720		

Metric Units

Size	Connections ASME Flanges		Maximum Set Pressure. (bar)			Outlet Pressure Limit (bar)	Standard Materials	
	Inlet	Outlet	-450℃ ~ -76℃	-20℃ ~ 100℃	500℃	100℃	Body / Bonnet	Spring
3 × 4	150	150		20	12	20	Carbon Steel	Carbon Steel
3 × 4	300	150		51	42	20		
3 × 4	600	150		-98	83	20		
3 × 4	900	300		153	125	51		
3 × 4	1500	300		(250)	208	51		
4 × 6	150	150		20	12	20		
4 × 6	300	150		51	42	20		
4 × 6	600	150		102	83	20		
4 × 6	900	300		153	125	51		
4 × 6	1500	300		255	208	51		
3 × 4	150	150	19	19	12	19	Austenitic Stainless Steel	Stainless Steel or Alloy Steel
3 × 4	300	150	50	50	33	19		
3 × 4	600	150	-83	(95)	66	19		
3 × 4	900	300	149	149	99	50		
3 × 4	1500	300	(243)	(243)	165	50		
4 × 6	150	150	19	19	12	19		
4 × 6	300	150	50	50	33	19		
4 × 6	600	150	99	99	66	19		
4 × 6	900	300	149	149	99	50		
4 × 6	1500	300	248	248	165	50		

Morifice

Area = 4.000 sq. in.
Diameter : 2.257 in.

USC Units

Size	Connections ASME Flanges		Maximum Set Pressure (psig)			Outlet Pressure Limit (psig)	Standard Materials	
	Inlet	Outlet	-450℉ ~ -76℉	-20℉ ~ 100℉	500℉	100℉	Body / Bonnet	Spring
4 × 6	150	150		285	170	285	Carbon Steel	Carbon Steel
4 × 6	300	150		740	605	285		
4 × 6	300	150		1480	1205	285		
4 × 6	600	150		2220	1810	740		
4 × 6	900	150		3705	3015	740		
4 × 6	150	150	275	275	170	275	Austenitic Stainless Steel	Stainless Steel or Alloy Steel
4 × 6	300	150	720	720	480	275		
4 × 6	300	150	1440	1440	955	275		
4 × 6	600	150	2160	2160	1435	720		
4 × 6	900	150	3600	3600	2390	720		

Metric Units

Size	Connections ASME Flanges		Maximum Set Pressure. (bar)			Outlet Pressure Limit (bar)	Standard Materials	
	Inlet	Outlet	-450℃ ~ -76℃	-20℃ ~ 100℃	500℃	100℃	Body / Bonnet	Spring
4 × 6	150	150		20	12	20	Carbon Steel	Carbon Steel
4 × 6	300	150		51	42	20		
4 × 6	300	150		102	83	20		
4 × 6	600	150		153	125	51		
4 × 6	900	150		255	208	51		
4 × 6	150	150	19	19	12	19	Austenitic Stainless Steel	Stainless Steel or Alloy Steel
4 × 6	300	150	50	50	33	19		
4 × 6	300	150	99	99	66	19		
4 × 6	600	150	149	149	99	50		
4 × 6	900	150	248	248	165	50		

N orifice

Area = 4.822 sq. in.
Diameter : 2.487 in.

USC Units

Size	Connections ASME Flanges		Maximum Set Pressure (psig)			Outlet Pressure Limit (psig)	Standard Materials	
	Inlet	Outlet	-450℉ ~ -76℉	-20℉ ~ 100℉	500℉	100℉	Body / Bonnet	Spring
4 × 6	150	150		285	170	285	Carbon Steel	Carbon Steel
4 × 6	300	150		740	605	285		
4 × 6	600	150		1480	1205	285		
4 × 6	900	150		2220	1810	740		
4 × 6	1500	150		3705	3015	740		
4 × 6	150	150	275	275	170	275	Austenitic Stainless Steel	Stainless Steel or Alloy Steel
4 × 6	300	150	720	720	480	275		
4 × 6	600	150	1440	1440	955	275		
4 × 6	900	150	2160	2160	1435	720		
4 × 6	1500	150	3600	3600	2390	720		

Metric Units

Size	Connections ASME Flanges		Maximum Set Pressure. (bar)			Outlet Pressure Limit (bar)	Standard Materials	
	Inlet	Outlet	-450℃ ~ -76℃	-20℃ ~ 100℃	500℃	100℃	Body / Bonnet	Spring
4 × 6	150	150		20	12	20	Carbon Steel	Carbon Steel
4 × 6	300	150		51	42	20		
4 × 6	600	150		102	83	20		
4 × 6	900	150		153	125	51		
4 × 6	1500	150		255	208	51		
4 × 6	150	150	19	19	12	19	Austenitic Stainless Steel	Stainless Steel or Alloy Steel
4 × 6	300	150	50	50	33	19		
4 × 6	600	150	99	99	66	19		
4 × 6	900	150	149	149	99	50		
4 × 6	1500	150	248	248	165	50		

P orifice

Area = 7.087 sq. in.
Diameter : 3.004 in.

USC Units

Size	Connections ASME Flanges		Maximum Set Pressure (psig)			Outlet Pressure Limit (psig)	Standard Materials	
	Inlet	Outlet	-450℉ ~ -76℉	-20℉ ~ 100℉	500℉	100℉	Body / Bonnet	Spring
4×6	150	150		285	170	285	Carbon Steel	Carbon Steel
4×6	300	150		740	605	285		
4×6	600	150		(1425)	1205	285		
4×6	600	300		1480	1205	740		
4×6	900	300		2220	1810	740		
4×6	1500	300		(3630)	3015	740		
4×6	1500	600		3705	3015	1480		
4×6	150	150	275	275	170	275	Austenitic Stainless Steel	Stainless Steel or Alloy Steel
4×6	300	150	720	720	480	275		
4×6	600	300	1440	1440	955	720		
4×6	900	300	2160	2160	1435	720		
4×6	1500	600	3600	3600	2390	1440		

Metric Units

Size	Connections ASME Flanges		Maximum Set Pressure. (bar)			Outlet Pressure Limit (bar)	Standard Materials	
	Inlet	Outlet	-450℃ ~ -76℃	-20℃ ~ 100℃	500℃	100℃	Body / Bonnet	Spring
4×6	150	150		20	12	20	Carbon Steel	Carbon Steel
4×6	300	150		51	4	20		
4×6	600	150		(98)	83	20		
4×6	600	300		102	83	51		
4×6	900	300		153	125	51		
4×6	1500	300		(250)	208	51		
4×6	1500	600		255	208	102		
4×6	150	150	19	19	12	19	Austenitic Stainless Steel	Stainless Steel or Alloy Steel
4×6	300	150	50	50	33	19		
4×6	600	300	99	99	66	50		
4×6	900	300	149	149	99	50		
4×6	1500	600	248	248	165	99		

Q orifice

Area = 12.27 sq. in.
Diameter : 3.952 in.

USC Units

Size	Connections ASME Flanges		Maximum Set Pressure (psig)			Outlet Pressure Limit (psig)	Standard Materials	
	Inlet	Outlet	-450℉ ~ -76℉	-20℉ ~ 100℉	500℉	100℉	Body / Bonnet	Spring
6×8	150	150		285	170	285	Carbon Steel	Carbon Steel
6×8	300	150		740	605	285		
6×8	600	150		(1450)	1205	285		
6×8	900	150		1480	1205	740		
6×8	1500	150	275	275	170	275	Austenitic Stainless Steel	Stainless Steel or Alloy Steel
6×8	150	150	720	720	480	275		
6×8	300	150	(1400)	(1400)	955	275		
6×8	600	150	1440	1440	955	720		

Metric Units

Size	Connections ASME Flanges		Maximum Set Pressure. (bar)			Outlet Pressure Limit (bar)	Standard Materials	
	Inlet	Outlet	-450℃ ~ -76℃	-20℃ ~ 100℃	500℃	100℃	Body / Bonnet	Spring
6×8	150	150		20	12	20	Carbon Steel	Carbon Steel
6×8	300	150		51	42	20		
6×8	600	150		(100)	83	20		
6×8	600	300		102	83	51		
6×8	150	150	19	19	12	19	Austenitic Stainless Steel	Stainless Steel or Alloy Steel
6×8	300	150	50	50	33	19		
6×8	600	150	(96)	(96)	66	19		
6×8	600	300	99	99	66	50		

R orifice

Area = 17.78 sq. in.
Diameter : 4.758 in.

USC Units

Size	Connections ASME Flanges		Maximum Set Pressure (psig)			Outlet Pressure Limit (psig)	Standard Materials	
	Inlet	Outlet	-450℉ ~ -76℉	-20℉ ~ 100℉	500℉	100℉	Body / Bonnet	Spring
6 × 8	150	150		285	170	285	Carbon Steel	Carbon Steel
6 × 8	300	150		740	600	285		
6 × 8	600	150		(1020)	(1020)	285		
6 × 8	150	150	275	275	170	275	Austenitic Stainless Steel	Stainless Steel or Alloy Steel
6 × 8	300	150	720	720	480	275		
6 × 8	600	150	(985)	(985)	955	275		

Metric Units

Size	Connections ASME Flanges		Maximum Set Pressure. (bar)			Outlet Pressure Limit (bar)	Standard Materials	
	Inlet	Outlet	-450℃ ~ -76℃	-20℃ ~ 100℃	500℃	100℃	Body / Bonnet	Spring
6 × 8	150	150		20	12	20	Carbon Steel	Carbon Steel
6 × 8	300	150		51	41	20		
6 × 8	600	150		(70)	(70)	20		
6 × 8	150	150	19	19	12	19	Austenitic Stainless Steel	Stainless Steel or Alloy Steel
6 × 8	300	150	50	50	33	19		
6 × 8	600	150	(68)	(68)	66	19		

T orifice

Area = 26.021 sq. in.
Diameter : 5.756 in.

USC Units

Size	Connections ASME Flanges		Maximum Set Pressure (psig)			Outlet Pressure Limit (psig)	Standard Materials	
	Inlet	Outlet	-450℉ ~ -76℉	-20℉ ~ 100℉	500℉	100℉	Body / Bonnet	Spring
8 × 10	150	150		285	170	285	Carbon Steel	Carbon Steel
8 × 10	300	150		740	600	285		
8 × 10	600	150		(985)	(985)	285		
8 × 10	150	150	275	275	170	275	Austenitic Stainless Steel	Stainless Steel or Alloy Steel
8 × 10	300	150	720	720	480	275		
8 × 10	600	150	(950)	(950)	(950)	275		

Metric Units

Size	Connections ASME Flanges		Maximum Set Pressure. (bar)			Outlet Pressure Limit (bar)	Standard Materials	
	Inlet	Outlet	-450℃ ~ -76℃	-20℃ ~ 100℃	500℃	100℃	Body / Bonnet	Spring
8 × 10	150	150		20	12	20	Carbon Steel	Carbon Steel
8 × 10	300	150		51	41	20		
8 × 10	600	150		(68)	(68)	20		
8 × 10	150	150	19	19	12	19	Austenitic Stainless Steel	Stainless Steel or Alloy Steel
8 × 10	300	150	50	50	33	19		
8 × 10	600	150	(65)	(65)	(65)	19		

12 Capacity Table

ASME SEC VIII Air/ Gas Capacity

Capacity for Air / Gas (lb/h at 60°F with 10% Overpressure) = $\frac{CKdAP\sqrt{MKc}}{\sqrt{ZT}}$

Set Pressure psig(bar)		Orifice Letter and Effective Area (in^2)																							Set Pressure psig(bar)	
		D	E	F	G	H	J	K	L	M	N	P	Q	R	T	V	W	Y	Z	Z2	A	B	B2		
API		0.11	0.196	0.307	0.503	0.785	1.287	1.838	2.853	3.6	4.34	6.38	11.05	16	26									API	
Actual		0.15	0.225	0.371	0.559	0.873	1.43	2.042	3.17	4	4.82	7.08	12.27	17.78	28.94	44.18	63.62	86.59	95.38	113.1	143.1	176.7	227	Actual	
15	1.03	343	515	849	1,279	1,998	3,272	4,673	7,254	9,153	11,034	16,217	28,078	40,686	66,224	101,098	145,583	198,145	218,260	258,809	327,458	404,346	519,448	15	1.03
20	1.37	404	606	999	1,505	2,350	3,849	5,496	8,533	10,767	12,979	19,076	33,027	47,859	77,898	118,920	171,246	233,075	256,735	304,432	385,183	475,625	611,018	20	1.37
30	2.06	525	787	1,298	1,956	3,054	5,003	7,144	11,090	13,994	16,870	24,794	42,926	62,203	101,246	154,563	222,574	302,934	333,686	395,679	500,633	618,183	794,156	30	2.06
40	2.75	646	969	1,597	2,407	3,758	6,157	8,791	13,648	17,221	20,760	30,511	52,826	76,548	124,594	190,207	273,901	372,793	410,636	486,926	616,084	760,740	977,295	40	2.75
50	3.51	767	1,150	1,897	2,858	4,463	7,310	10,439	16,205	20,448	24,650	36,229	62,725	90,892	147,943	225,850	325,228	442,652	487,587	578,172	731,534	903,298	1,160,434	50	3.51
60	4.13	888	1,332	2,196	3,309	5,167	8,464	12,086	18,763	23,675	28,541	41,947	72,624	105,237	171,291	261,494	376,556	512,511	564,537	669,419	846,984	1,045,856	1,343,573	60	4.13
70	4.82	1,009	1,513	2,495	3,760	5,871	9,618	13,734	21,320	26,902	32,431	47,664	82,523	119,581	194,639	297,137	427,883	582,370	641,488	760,666	962,434	1,188,414	1,526,712	70	4.82
80	5.51	1,130	1,695	2,795	4,211	6,576	10,771	15,381	23,878	30,130	36,321	53,382	92,422	133,926	217,987	332,781	479,210	652,229	718,439	851,912	1,077,884	1,330,972	1,709,851	80	5.51
90	6.20	1,251	1,876	3,094	4,662	7,280	11,925	17,029	26,435	33,357	40,211	59,100	102,321	148,270	241,335	368,424	530,537	722,088	795,389	943,159	1,193,334	1,473,350	1,892,989	90	6.20
100	6.89	1,372	2,058	3,393	5,113	7,984	13,079	18,676	28,993	36,584	44,102	64,817	112,221	162,615	264,683	404,068	581,865	791,947	872,340	1,034,406	1,308,784	1,616,087	2,076,128	100	6.89
150	10.34	1,977	2,965	4,890	7,368	11,506	18,847	26,913	41,780	52,719	63,553	93,405	161,717	234,337	381,424	582,285	838,501	1,141,242	1,257,093	1,490,639	1,886,034	2,328,877	2,991,822	150	10.34
200	13.78	2,582	3,873	6,386	9,622	15,028	24,616	35,150	54,568	68,855	83,005	121,994	211,212	306,060	498,165	760,503	1,095,137	1,490,537	1,641,845	1,946,873	2,463,284	3,041,666	3,907,516	200	13.78
250	17.23	3,187	4,781	7,883	11,877	18,549	30,384	43,388	67,355	84,990	102,456	150,582	260,708	377,783	614,906	938,720	1,351,774	1,839,832	2,026,598	2,403,106	3,040,535	3,754,455	4,823,210	250	17.23
300	20.68	3,792	5,688	9,379	14,132	22,071	36,153	51,625	80,142	101,126	121,907	179,170	310,204	449,505	731,647	1,116,937	1,608,410	2,189,127	2,411,351	2,859,340	3,617,785	4,467,244	5,738,904	300	20.68
350	24.13	4,397	6,596	10,876	16,387	25,592	41,921	59,862	92,930	117,262	141,359	207,758	359,700	521,228	848,388	1,295,155	1,865,046	2,538,421	2,796,104	3,315,573	4,195,035	5,180,033	6,654,598	350	24.13
400	27.57	5,002	7,504	12,373	18,642	29,114	47,690	68,099	105,717	133,397	160,810	236,347	409,196	592,951	965,129	1,473,372	2,121,683	2,887,716	3,180,857	3,771,807	4,772,286	5,892,822	7,570,292	400	27.57
450	31.02	5,607	8,411	13,869	20,897	32,636	53,458	76,336	118,505	149,533	180,262	264,935	458,692	664,673	1,081,870	1,651,590	2,378,319	3,237,011	3,565,610	4,228,040	5,349,536	6,605,612	8,485,987	450	31.02
500	34.47	6,213	9,319	15,366	23,152	36,157	59,226	84,574	131,292	165,668	199,713	293,523	508,188	736,396	1,198,611	1,829,807	2,634,956	3,586,306	3,950,363	4,684,273	5,926,786	7,318,401	9,401,681	500	34.47
550	37.92	6,818	10,226	16,862	25,407	39,679	64,995	92,811	144,080	181,804	219,165	322,111	557,684	808,119	1,315,352									550	37.92
600	41.36	7,423	11,134	18,359	27,662	43,200	70,763	101,048	156,867	197,940	238,616	350,699	607,180	879,841	1,432,093									600	41.36
650	44.81	8,028	12,042	19,855	29,917	46,722	76,532	109,285	169,655	214,075	258,068	379,288	656,675	951,564	1,548,833									650	44.81
700	48.26	8,633	12,949	21,352	32,172	50,243	82,300	117,523	182,442	230,211	277,519	407,876	706,171	1,023,287	1,665,574									700	48.26
750	51.71	9,238	13,857	22,849	34,427	53,765	88,069	125,760	195,229	246,346	296,970	436,464	755,667	1,095,009	1,782,315									750	51.71
800	55.15	9,843	14,765	24,345	36,682	57,287	93,837	133,997	208,017	262,482	316,422	465,052	805,163	1,166,732	1,899,056									800	55.15
850	58.60	10,448	15,672	25,842	38,937	60,808	99,606	142,234	220,804	278,617	335,873	493,640	854,659	1,238,454	2,015,797									850	58.60
900	62.05	11,053	16,580	27,338	41,192	64,330	105,374	150,471	233,592	294,753	355,325	522,229	904,155	1,310,177	2,132,538									900	62.05
950	65.50	11,658	17,487	28,835	43,447	67,851	111,143	158,709	246,379	310,889	374,776	550,817	953,651	1,381,900	2,249,279									950	65.50
1000	68.94	12,263	18,395	30,331	45,702	71,373	116,911	166,946	259,167	327,024	394,228	579,405	1,003,147	1,453,622	2,366,020									1000	68.94
1050	72.39	12,868	19,303	31,828	47,957	74,895	122,680	175,183	271,954	343,160	413,679	607,993	1,052,643	1,525,345	2,482,761									1050	72.39
1100	75.84	13,474	20,210	33,325	50,212	78,416	128,448	183,420	284,742	359,295	433,131	636,581	1,102,138	1,597,068	2,599,502									1100	75.84
1150	79.28	14,079	21,118	34,821	52,466	81,938	134,217	191,657	297,529	375,431	452,582	665,170	1,151,634	1,668,790	2,716,243									1150	79.28
1200	82.73	14,684	22,026	36,318	54,721	85,459	139,985	199,895	310,316	391,566	472,033	693,758	1,201,130	1,740,513	2,832,983									1200	82.73
1250	86.18	15,289	22,933	37,814	56,976	88,981	145,753	208,132	323,104	407,702	491,485	722,346	1,250,626	1,812,236	2,949,724									1250	86.18
1300	89.63	15,894	23,841	39,311	59,231	92,503	151,522	216,369	335,891	423,838	510,936	750,934	1,300,122	1,883,958	3,066,465									1300	89.63
1350	93.07	16,499	24,748	40,808	61,486	96,024	157,290	224,606	348,679	439,973	530,388	779,523	1,349,618	1,955,681	3,183,206									1350	93.07
1400	96.52	17,104	25,656	42,304	63,741	99,546	163,059	232,844	361,466	456,109	549,839	808,111	1,399,114	2,027,404	3,299,947									1400	96.52
1450	99.97	17,709	26,564	43,801	65,996	103,067	168,827	241,081	374,254	472,244	569,291	836,699	1,448,610	2,099,126	3,416,688									1450	99.97
1480	102.04	18,072	27,108	44,699	67,349	105,180	172,288	246,023	381,926	481,926	580,961	853,852	1,478,307	2,142,160	3,486,733									1480	102.04
1500	103.42	18,314	27,471	45,297	68,251	106,589	174,596	249,318	387,041	488,380	588,742	865,287	1,498,105	2,170,849										1500	103.42
1550	106.86	18,919	28,379	46,794	70,506	110,111	180,364	257,555	399,829	504,516	608,193	893,875	1,547,601	2,242,571										1550	106.86
1600	110.31	19,524	29,287	48,290	72,761	113,632	186,133	265,792	412,616	520,651	627,645	922,464	1,597,097	2,314,294										1600	110.31
1650	113.76	20,130	30,194	49,787	75,016	117,154	191,901	274,030	425,403	536,787	647,096	951,052	1,646,593	2,386,017										1650	113.76
1700	117.21	20,735	31,102	51,284	77,271	120,675	197,670	282,267	438,191	552,922	666,548	979,640	1,696,089	2,457,739										1700	117.21
1750	120.65	21,340	32,010	52,780	79,526	124,197	203,438	290,504	450,978	569,085	685,999	1,008,228	1,745,585	2,529,462										1750	120.65
1800	124.10	21,945	32,917	54,277	81,781	127,718	209,207	298,741	463,766	585,193	705,451	1,036,816	1,795,081	2,601,185										1800	124.10
1850	127.55	22,550	33,825	55,773	84,036	131,240	214,975	306,978	476,553	601,329	724,902	1,065,405	1,844,577	2,672,907										1850	127.55
1900	131.00	23,155	34,732	57,270	86,291	134,762	220,744	315,216	489,341	617,465	744,354	1,093,993	1,894,073	2,744,630										1900	131.00
2000	137.89	24,365	36,548	60,263	90,801	141,805	232,281	331,690	514,916	649,736	783,256	1,151,169	1,993,064	2,888,075										2000	137.89
2100	144.78	25,575	38,363	63,256	95,310	148,848	243,817	348,165	540,490	682,007	822,159	1,208,346												2100	144.78
2200	151.68	26,785	40,178	66,249	99,820	155,891	255,354	364,639	566,065	714,278	861,062	1,265,522												2200	151.68
2300	158.57	27,996	41,993	69,242	104,330	162,934	266,891	381,113	591,640	746,549	899,965	1,322,699												2300	158.57
2400	165.47	29,206	43,809	72,236	108,840	169,978	278,428	397,588	617,215	778,820	938,868	1,379,875												2400	165.47
2500	172.36	30,416	45,624	75,229	113,350	177,021	289,965	414,062	642,790	811,092	977,771	1,437,051												2500	172.36
2600	179.26	31,626	47,439	78,222	117,860	184,064	301,502	430,537	668,365	843,363	1,016,674													2600	179.26
2700	186.15	32,836	49,254	81,215	122,370	191,107	313,039	447,011	693,940	875,634	1,055,577													2700	186.15
2800	193.05	34,046	51,070	84,208	126,880	198,150	324,576	463,485	719,515	907,905	1,094,479													2800	193.05
2900	199.94	35,257	52,885	87,201	131,390	205,193	336,113	479,960	745,090	940,176	1,133,382													2900	199.94
3000	206.84	36,467	54,700	90,194	135,900	212,237	347,650	496,434	770,664	972,447	1,172,285													3000	206.84
3500	241.31	42,518	63,776	105,160	158,449	247,453	405,335	578,806	898,539	1,133,803														3500	241.31
4000	275.79	48,568	72,853	120,126	180,998	282,668	463,019	661,179	1,026,413	1,295,159														4000	275.79
4500	310.26	54,619	81,929	135,092	203,548	317,884	520,704	743,551																4500	310.26
5000	344.73	60,670	91,005	150,057	226,097	353,100	578,389	825,923																5000	344.73
5500	379.21	66,721	100,081	165,023	248,647	388,316	636,073																	5500	379.21
6000	413.68	72,772	109,158	179,989	271,196	423,532	693,758																	6000	413.68
6170	425.40	74,829	112,244	185,077	278,863																			6170	425.40

ASME SEC VIII Liquid Capacity

Capacity for Liquid (lb/h at 60˚F with 10% Overpressure) = $159.44A\ Kd\sqrt{(P-Pb)}\ G\ Kc$

Set Pressure psig(kg/cm²g)		Orifice Letter and Effective Area (in²)																							Set Pressure psig(kg/cm²g)	
		D	E	F	G	H	J	K	L	M	N	P		Q	R	T	V	W	Y	Z	Z2	A	B	B2		
API		0.11	0.196	0.307	0.503	0.785	1.287	1.838	2.853	3.6	4.34	6.38		11.05	16.00	26.00									API	
Actual		0.15	0.225	0.371	0.559	0.873	1.430	2.042	3.170	4.0	4.82	7.08		12.27	17.78	28.94	44.18	63.62	86.59	95.38	113.10	143.10	176.70	227.00	Actual	
15	1.05	9,212	13,818	22,784	34,329	53,612	87,818	125,402	194,673	245,645	296,002	434,791		753,515	1,091,890	1,777,238	2,713,144	3,906,976	5,317,590	5,857,393	6,945,599	8,787,932	10,851,346	13,940,326	15	1.05
20	1.40	10,637	15,955	26,308	39,640	61,906	101,403	144,801	224,789	283,646	341,793	502,053		870,084	1,260,806	2,052,178	3,132,868	4,511,387	6,140,224	6,763,535	8,020,086	10,147,430	12,530,055	16,096,902	20	1.40
30	2.10	13,027	19,541	32,221	48,548	75,819	124,193	177,345	275,310	347,394	418,610	614,887		1,065,630	1,544,165	2,513,394	3,836,965	5,525,298	7,520,207	8,283,605	9,822,560	12,428,013	15,346,121	19,714,598	30	2.10
40	2.81	15,043	22,564	37,205	56,059	87,548	143,406	204,780	317,900	401,136	483,369	710,010		1,230,484	1,783,049	2,902,218	4,430,545	6,380,065	8,683,587	9,565,083	11,342,115	14,350,633	17,720,174	22,764,457	40	2.81
50	3.51	16,818	25,227	41,597	62,676	97,882	160,333	228,951	355,423	448,483	540,423	793,816		1,375,723	1,993,509	3,244,778	4,953,500	7,133,130	9,708,546	10,694,088	12,680,870	16,044,496	19,811,757	25,451,437	50	3.51
60	4.21	18,423	27,635	45,567	68,658	107,224	175,636	250,803	389,347	491,289	592,003	869,582		1,507,029	2,183,780	3,554,476	5,426,287	7,813,952	10,635,179	11,714,787	13,891,197	17,575,865	21,702,693	27,880,652	60	4.21
70	4.92	19,899	29,849	49,218	74,159	115,815	189,708	270,898	420,542	530,653	639,437	939,255		1,627,777	2,358,752	3,839,273	5,861,060	8,440,033	11,487,306	12,653,416	15,004,208	18,984,104	23,441,587	30,114,546	70	4.92
80	5.62	21,273	31,910	52,616	79,279	123,811	202,807	289,602	449,579	567,292	683,586	1,004,106		1,740,167	2,521,612	4,104,355	6,265,737	9,022,774	12,280,447	13,527,071	16,040,173	20,294,861	25,060,111	32,193,804	80	5.62
90	6.32	22,564	33,846	55,808	84,088	131,322	215,109	307,170	476,850	601,704	725,053	1,065,016		1,845,726	2,674,573	4,353,326	6,645,817	9,570,098	13,025,381	14,347,625	17,013,172	21,525,950	26,580,261	34,146,686	90	6.32
100	7.03	23,784	35,677	58,827	88,637	138,425	226,745	323,785	502,644	634,251	764,273	1,122,625		1,945,566	2,819,247	4,588,809	7,005,307	10,087,769	13,729,957	15,123,725	17,933,458	22,690,344	28,018,056	35,993,767	100	7.03
150	10.54	29,130	43,695	72,048	108,557	169,536	277,705	396,554	615,611	776,796	936,039	1,374,929		2,382,822	3,452,859	5,620,120	8,579,713	12,354,943	16,815,695	18,522,704	21,963,911	27,789,882	34,314,970	44,083,182	150	10.54
200	14.06	33,636	50,454	83,194	125,351	195,763	320,666	457,902	710,846	896,967	1,080,845	1,587,631		2,751,446	3,987,018	6,489,556	9,907,000	14,266,259	19,417,092	21,388,177	25,361,740	32,088,992	39,623,514	50,902,873	200	14.06
250	17.57	37,606	56,410	93,013	140,147	218,870	358,515	511,950	794,750	1,002,840	1,208,422	1,775,026		3,076,210	4,457,622	7,255,544	11,076,362	15,950,163	21,708,968	23,912,708	28,355,287	35,876,584	44,300,436	56,911,143	250	17.57
300	21.09	41,196	61,794	101,891	153,523	239,760	392,734	560,813	870,605	1,098,556	1,323,760	1,944,444		3,369,819	4,883,080	7,948,050	12,133,547	17,472,528	23,780,983	26,195,059	31,061,661	39,300,828	48,528,696	62,343,033	300	21.09
350	24.60	44,497	66,745	110,055	165,824	258,970	424,201	605,747	940,361	1,186,576	1,429,824	2,100,239		3,639,821	5,274,329	8,584,875	13,105,729	18,872,487	25,686,398	28,293,898	33,550,428	42,449,746	52,416,982	67,338,172	350	24.60
400	28.12	47,569	71,353	117,654	177,273	276,851	453,490	647,571	1,005,288	1,268,503	1,528,546	2,245,250		3,891,132	5,638,495	9,177,618	14,010,613	20,175,537	27,459,914	30,247,449	35,866,917	45,380,688	56,036,111	71,987,534	400	28.12
450	31.63	50,454	75,682	124,791	188,027	293,645	480,999	686,852	1,066,269	1,345,450	1,621,268	2,381,447		4,127,169	5,980,527	9,734,334	14,860,500	21,399,389	29,125,638	32,082,265	38,042,610	48,133,488	59,435,271	76,354,310	450	31.63
500	35.15	53,184	79,775	131,541	198,198	309,529	507,017	724,006	1,123,947	1,418,229	1,708,966	2,510,266		4,350,418	6,304,029	10,260,889	15,664,342	22,556,936	30,701,118	33,817,676	40,100,432	50,737,151	62,650,277	80,484,510	500	35.15
550	38.66	55,779	83,669	137,961	207,871	324,636	531,764	759,344	1,178,805	1,487,451	1,792,379	2,632,789		4,562,757	6,611,721	10,761,711									550	38.66
600	42.18	58,260	87,390	144,096	217,115	339,072	555,409	793,109	1,231,222	1,553,592	1,872,079	2,749,858		4,765,644	6,905,718	11,240,240									600	42.18
650	45.69	60,639	90,958	149,980	225,980	352,917	578,088	825,494	1,281,496	1,617,030	1,948,521	2,862,143		4,960,240	7,187,699	11,699,213									650	45.69
700	49.21	62,928	94,392	155,641	234,510	366,239	599,911	856,655	1,329,872	1,678,071	2,022,076	2,970,187		5,147,484	7,459,028	12,140,847									700	49.21
750	52.73	65,136	97,705	161,104	242,741	379,093	620,966	886,723	1,376,548	1,736,969	2,093,048	3,074,435		5,328,152	7,720,827	12,566,971									750	52.73
800	56.24	67,273	100,909	166,387	250,702	391,526	641,331	915,803	1,421,693	1,793,934	2,161,690	3,175,263		5,502,892	7,974,036	12,979,112									800	56.24
850	59.76	69,343	104,014	171,508	258,418	403,576	661,069	943,988	1,465,447	1,849,145	2,228,219	3,272,986		5,672,251	8,219,448	13,378,562									850	59.76
900	63.27	71,353	107,030	176,480	265,910	415,276	680,235	971,356	1,507,933	1,902,754	2,292,819	3,367,875		5,836,699	8,457,742	13,766,427									900	63.27
950	66.79	73,309	109,963	181,316	273,196	426,656	698,875	997,973	1,549,254	1,954,894	2,355,647	3,460,163		5,996,638	8,689,504	14,143,659									950	66.79
1000	70.30	75,213	112,819	186,027	280,294	437,739	717,030	1,023,899	1,589,501	2,005,679	2,416,843	3,550,052		6,152,420	8,915,243	14,511,088									1000	70.30
1050	73.82	77,070	115,606	190,621	287,216	448,549	734,737	1,049,184	1,628,753	2,055,209	2,476,527	3,637,721		6,304,355	9,135,406	14,869,440									1050	73.82
1100	77.33	78,884	118,326	195,106	293,974	459,105	752,028	1,073,874	1,667,082	2,103,574	2,534,807	3,723,326		6,452,713	9,350,386	15,219,357									1100	77.33
1150	80.85	80,657	120,985	199,491	300,581	469,423	768,929	1,098,010	1,704,550	2,150,851	2,591,776	3,807,007		6,597,736	9,560,533	15,561,408									1150	80.85
1200	84.36	82,392	123,588	203,782	307,046	479,520	785,467	1,121,625	1,741,211	2,197,111	2,647,519	3,888,887		6,739,639	9,766,160	15,896,100									1200	84.36
1250	87.88	84,091	126,136	207,984	313,378	489,408	801,664	1,144,754	1,777,116	2,242,417	2,702,113	3,969,079		6,878,615	9,967,545	16,223,889									1250	87.88
1300	91.39	85,756	128,634	212,103	319,584	499,100	817,540	1,167,425	1,812,310	2,286,826	2,755,625	4,047,682		7,014,839	10,164,941	16,545,186									1300	91.39
1350	94.91	87,390	131,084	216,144	325,672	508,607	833,114	1,189,663	1,846,833	2,330,388	2,808,118	4,124,788		7,148,467	10,358,577	16,860,360									1350	94.91
1400	98.42	88,993	133,490	220,110	331,648	517,940	848,402	1,211,494	1,880,723	2,373,151	2,859,647	4,200,478		7,279,642	10,548,658	17,169,751									1400	98.42
1450	101.94	90,568	135,853	224,006	337,518	527,108	863,419	1,232,938	1,914,012	2,415,157	2,910,265	4,274,829		7,408,495	10,735,375	17,473,664									1450	101.94
1480	104.05	91,501	137,251	226,311	340,992	532,533	872,305	1,245,627	1,933,711	2,440,014	2,940,217	4,318,825		7,484,743	10,845,862	17,653,500									1480	104.05
1500	105.46	92,117	138,175	227,835	343,288	536,119	878,179	1,254,015	1,946,733																1500	105.46
1550	108.97	93,639	140,459	231,601	348,963	544,981	892,695	1,274,744	1,978,912																1550	108.97
1600	112.49	95,138	142,707	235,307	354,547	553,701	906,980	1,295,141	2,010,577																1600	112.49
1650	116.00	96,613	144,919	238,956	360,044	562,287	921,042	1,315,222	2,041,751																1650	116.00
1700	119.52	98,066	147,099	242,549	365,458	570,742	934,893	1,335,001	2,072,455																1700	119.52
1750	123.03	99,497	149,246	246,090	370,794	579,075	948,542	1,354,491	2,102,712																1750	123.03
1800	126.55	100,909	151,363	249,581	376,053	587,289	961,997	1,373,705	2,132,539																1800	126.55
1850	130.06	102,301	153,451	253,024	381,241	595,390	975,267	1,392,653	2,161,955																1850	130.06
1900	133.58	103,674	155,511	256,420	386,358	603,382	988,358	1,411,348	2,190,975																1900	133.58
2000	140.61	106,367	159,551	263,082	396,395	619,057	1,014,034	1,448,012	2,247,893																2000	140.61
2100	147.64	108,994	163,491	269,578	406,184	634,345	1,039,076	1,483,771	2,303,405																2100	147.64
2200	154.67	111,559	167,338	275,922	415,743	649,273	1,063,528	1,518,688	2,357,610																2200	154.67
2300	161.70	114,066	171,099	282,124	425,086	663,865	1,087,430	1,552,820	2,410,597																2300	161.70
2400	168.73	116,519	174,779	288,191	434,229	678,143	1,110,818	1,586,218	2,462,444																2400	168.73
2500	175.76	118,922	178,383	294,134	443,183	692,127	1,133,724	1,618,927	2,513,221																2500	175.76
2600	182.79	121,277	181,916	299,959	451,960	705,834	1,156,177	1,650,988	2,562,993																2600	182.79
2700	189.82	123,588	185,381	305,673	460,569	719,279	1,178,201	1,682,438	2,611,816																2700	189.82
2800	196.85	125,855	188,783	311,282	469,021	732,478	1,199,821	1,713,311	2,659,743																2800	196.85
2900	203.89	128,083	192,125	316,792	477,323	745,443	1,221,059	1,743,637	2,706,822																2900	203.89
3000	210.92	130,273	195,409	322,208	485,483	758,187	1,241,933	1,773,445	2,753,096																3000	210.92
3500	246.07	140,711	211,066	348,024	524,381	818,936	1,341,441	1,915,540	2,973,683																3500	246.07
4000	281.22	150,426	225,639	372,053	560,587	875,479	1,434,061																		4000	281.22
4500	316.38	159,551	239,326	394,622	594,593	928,586	1,521,051																		4500	316.38
5000	351.53	168,181	252,272	415,968	626,756	978,815	1,603,328																		5000	351.53
5500	386.68	176,390	264,585	436,271	657,347	1,026,590	1,681,585																		5500	386.68
6000	421.84	184,233	276,350	455,671	686,576	1,072,238	1,756,358																		6000	421.84
6170	433.79	186,825	280,238	462,081	696,235	1,087,322	1,781,066																		6170	433.79