

MOTOYAMA

Style *JNO/JNB*
Safety Relief Valves



MOTOYAMA ENGINEERING. WORKS, LTD.

MOTOYAMA Style JNO/JNB safety relief valves cover most process plant overprotection applications and complement our other extensive lines to satisfy your diversified requirements

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Features

1 Outstanding Performance

Smooth flow pattern enables to obtain large capacity of discharge in a stable manner. Capacities are certified by the National Board of Boiler and Pressure Vessel Inspectors.

2 Single Ring Adjustment

Blowdown control is provided with the adjustable nozzle ring only.

3 Positive Self Alignment

Double universal ball joint assures tight-seal and proper alignment.

4 Non Galling Troubles

Spindle guide employs the advantages of large guiding ratio and of difference in material hardness.

5 Excellent Seat Tightness

Flat and thermally balanced disc insert makes no thermal distortion.

6 High coefficient of Discharge for Liquid service

JLT liquid trim acquires high capacity.

7 Simple and Economical Maintenance

Minimized parts number saves customer's investment to own and to maintain valves.

Specifications

JNO/JNB full nozzle top guided and direct spring loaded safety relief valves are manufactured in accordance with requirements of **ASME Code Section VIII**.

TABLE 1

Allowable leak rate	API standard 527(2014) (except steam service) *1
Inlet flange rating	ASME 150 to 2500
Outlet flange rating	ASME 150 and 300
Temperature ranges	-196°C to +538°C (-320F to +1000F)
Sizes	1"D 2" to 8"T 10" *2
Orifices	D(0.709cm ²) to T(167.740cm ²)
Dimensions	Conforming to API standard 526(2018)

*1: For other than the ASME certification product, MOTOYAMA execute API standard 527(2014) by a request.

*2: 3/4 "D1" is not listed in API standard 527, but is manufacturable by a request.

Valve Styles and Services

◎Recommended

○Acceptable

TABLE 2

Style	Service	Gas or Vapor	Liquid	Steam	Overpressure (%)		Blowdown (%)		O-Ring soft seat
					Gas or Vapor or Steam	Liquid	Gas or Vapor or Steam	Liquid	
JNO (Conventional type)		◎	○	○	10	25	7	25	○
JNB (Balanced Bellows type)		◎	○	○	10	25	7	25	○
JLT-JNO、JLT-JNB (with liquid trim)		-	◎	-		10		10	○
JNO-H (Open bonnet type)		-	-	◎	10		7		-

Designation/Code for Style JNO/JNB

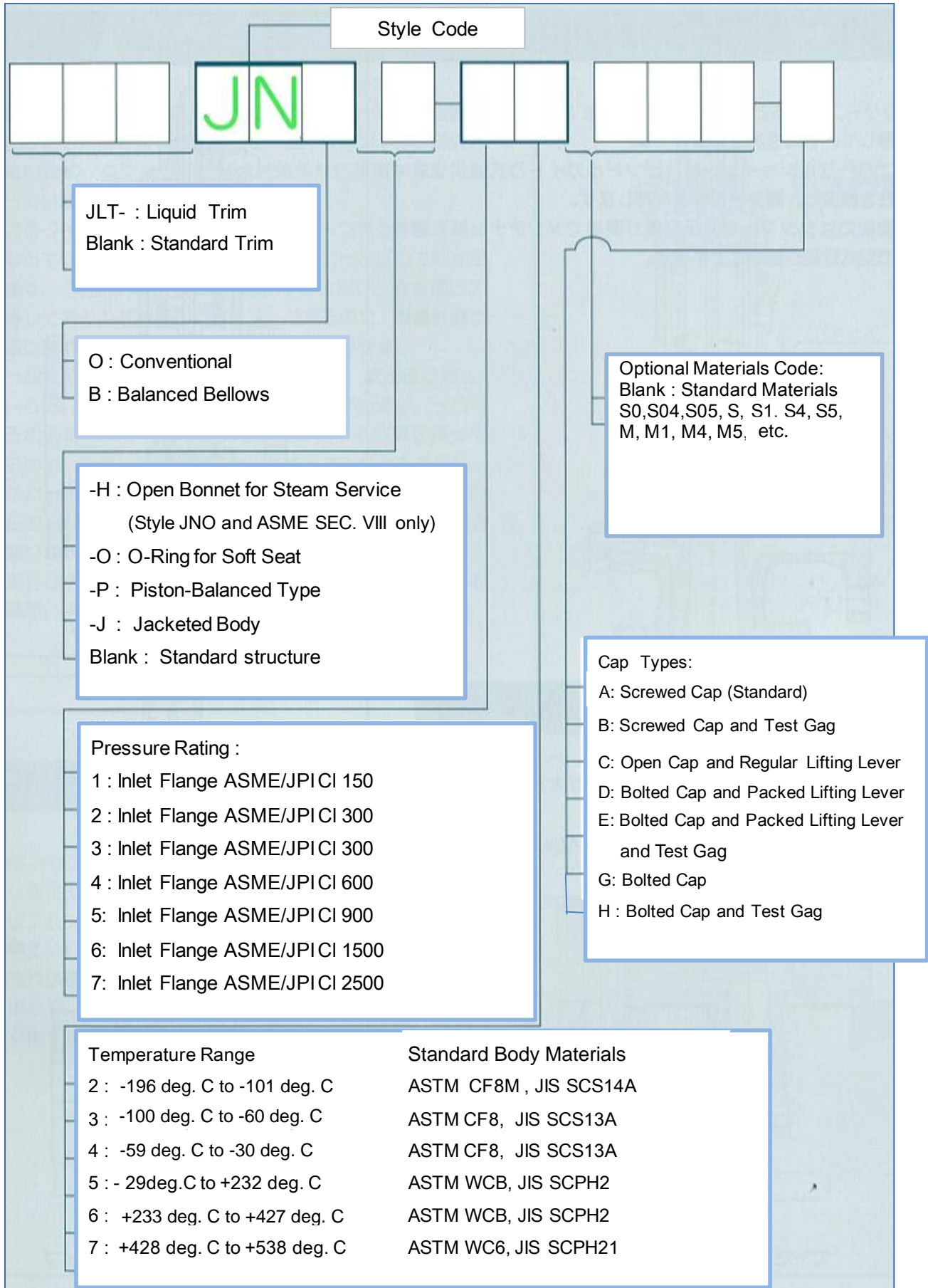


FIG.1

Construction

JNO & JNO-H

JNO Conventional type

JNO is a basic type of the J series and is a high-performance Safety valve acquiring certification of ASME Section VIII.

The closure member secures a high alignment by universal joint and spindle guide style and maintains high sealing characteristics.

Because JNO is simple structurally, part replacement is brief, and maintenance performance is high. Therefore, this series does not take the bother either.

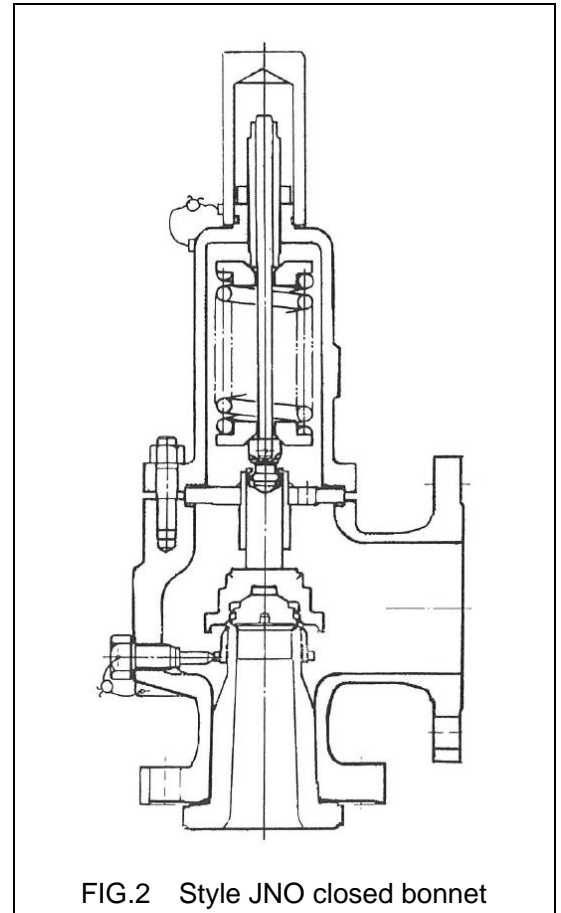


FIG.2 Style JNO closed bonnet

JNO-H Open Bonnet type

Style JNO-H with open bonnet and Type C regular lifting lever is available as an option ASME Section VIII steam applications. Only the bonnet need be changed to convert a Style JNO Type C to Style JNO-H.

With the open bonnet feature, carbon steel spring material can be used to +343°C (+650F).

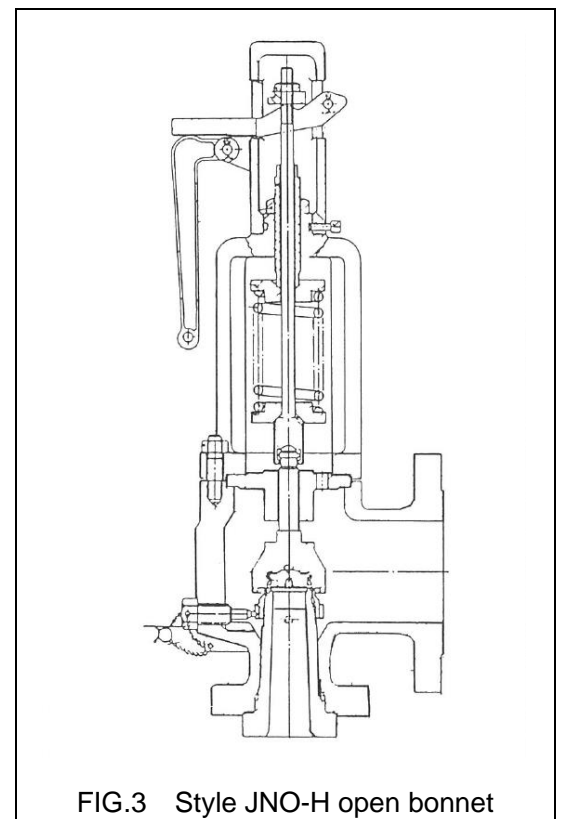
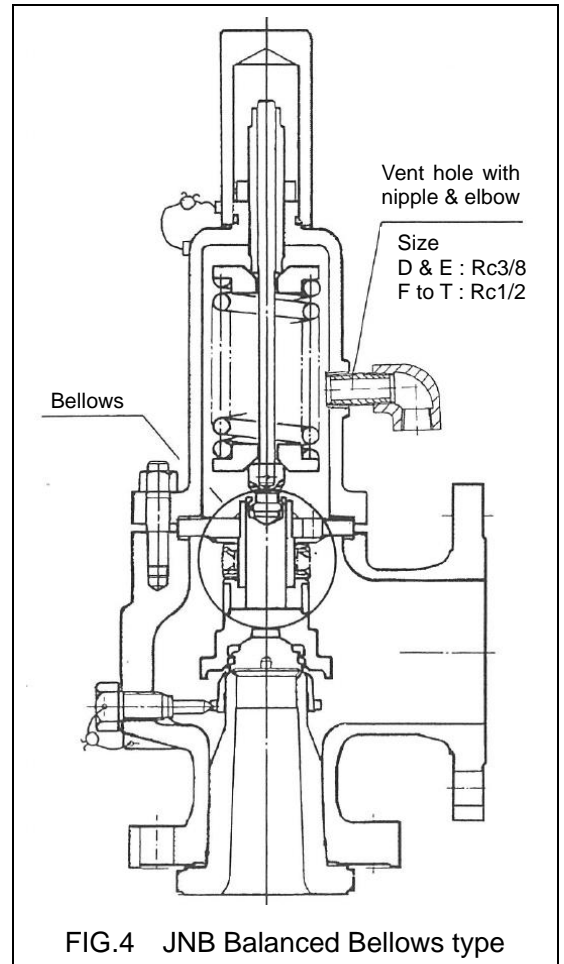


FIG.3 Style JNO-H open bonnet

JNB & JNB-P

JNB Balanced Bellows type

A high capacity Safety-Relief valve, but developed especially for services where the valve must operate under conditions of built-up or superimposed back pressure due to being connected to a closed blowdown system, and for those services where severe corrosion or fouling of working parts can be anticipated. The bellows subassembly is the only construction difference between style JNB and JNO valves and conversions from one style to the other does not take the bother.

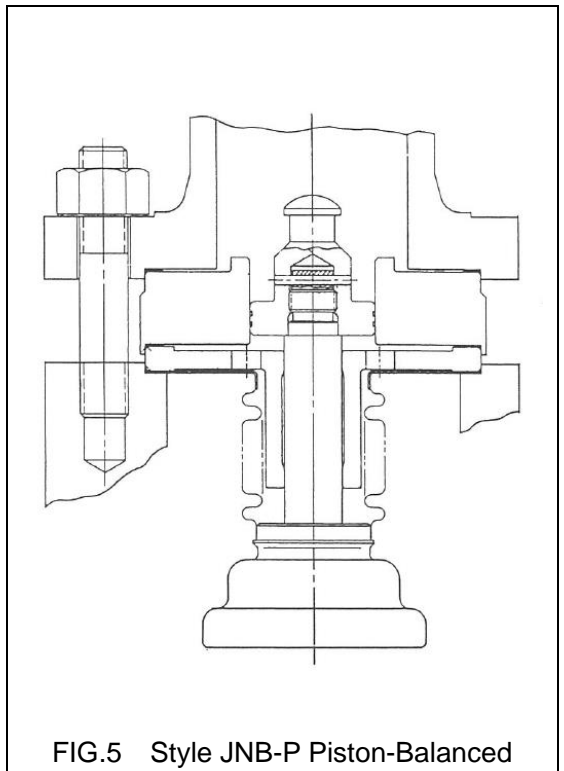


JNB-P Piston-Balanced type

JNB-P maintains certain performance without set pressure changing by action of the supporting piston even if the bellows are damaged by any possibility.

This piston is construction of the labyrinth seal and minimizes leakage of the fluid to the ambient in the bellows failure.

Therefore, this type establishes double security and keeps the characteristics of the safety valve until damaged bellows are exchanged.



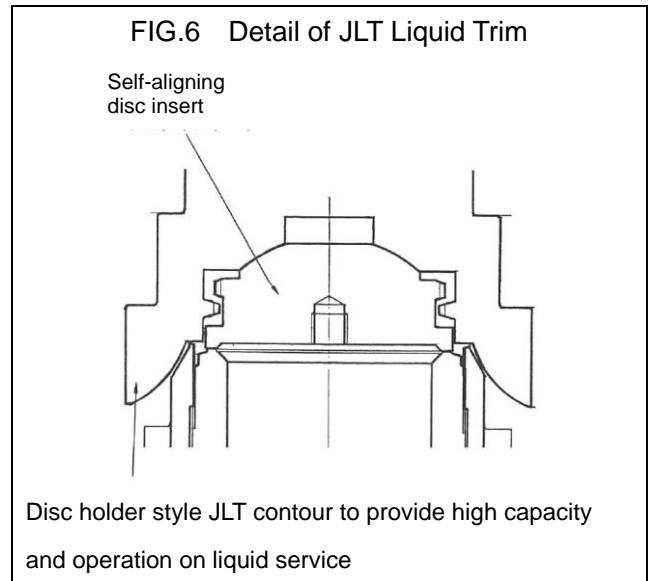
JLT-JNO & JLT-JNB

JLT Liquid Trim

Full lift and rated capacity at 10% overpressure with stable operation from a pressure relief valve specifically designed for liquid service.

High Coefficient of Discharge

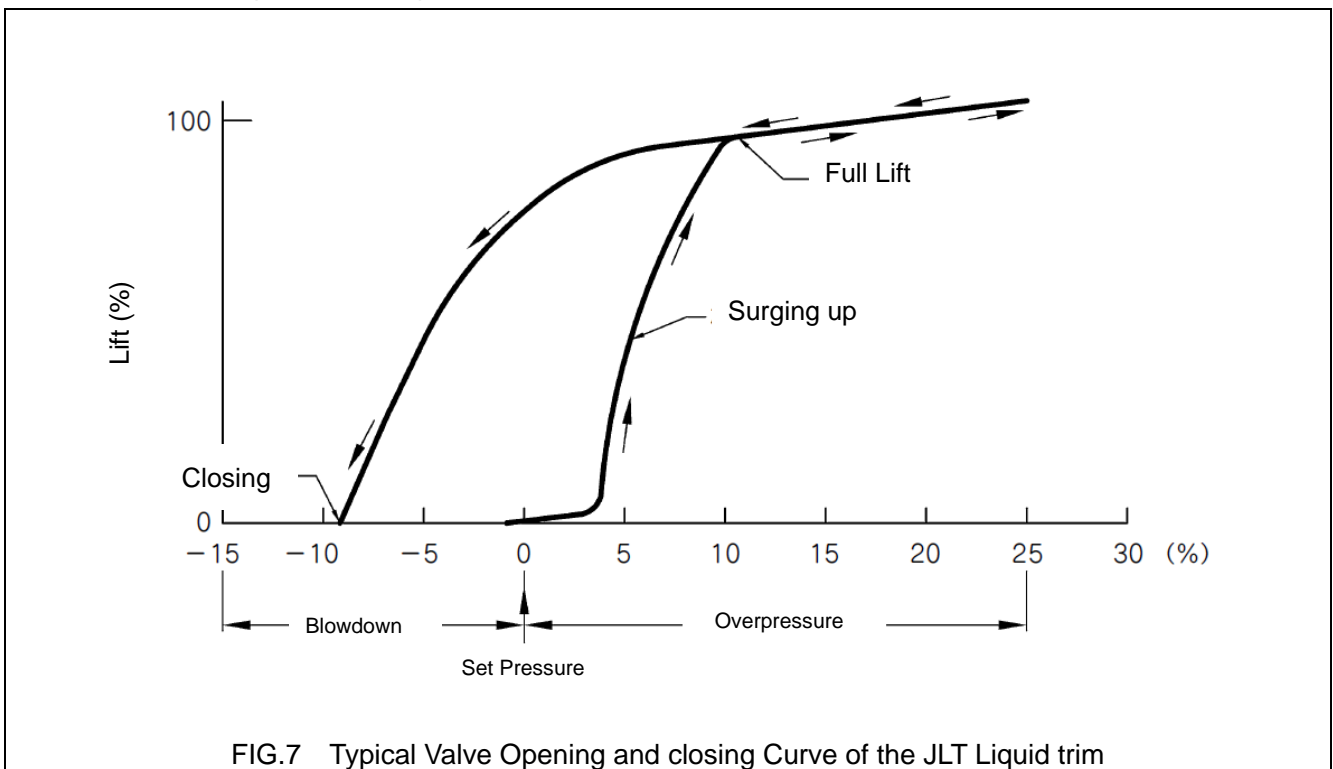
The JLT Liquid trim construction has a high coefficient of discharge. Generally a smaller JLT orifice size may be selected than that of a conventional pressure relief valve sized for the same application. Smaller orifice sizes mean reduced valve and related piping costs.



High Capacity at 10% Overpressure

Published valve capacities are based on capacity certification tests performed at 10% overpressure. This eliminates the need to use the traditional overpressure derating factor based on 25% overpressure is based on the ASME Boiler and Pressure Vessel Code that permits pressure in a vessel to rise 10% above the maximum allowable working pressure (MAWP) of the vessel during an overpressure excursion.

Typical Valve Opening and closing Curve



JNO-O & JNB-O

O-Ring Soft Seat

This O-Ring of JNO/JNB is placed in a groove of the disc insert and slightly touches nozzle seat. The spring load is supported with metal seat.

Moreover, it was in the construction which had superior closure characteristics to use inlet pressure because an O-Ring was located inside of nozzle seat.

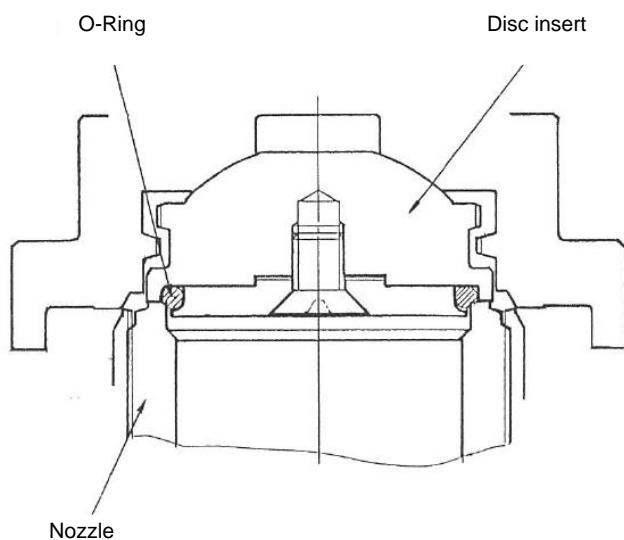
TABLE 3

Type of the O-Ring Material
FKM
NBR
Q
EPDM
Kalrez®

TABLE 4

ORIFICE	MAXIMUM SET PRESSURE LIMITS	
	MPaG	PSIG
D	10.2	1480
E	10.2	1480
F	10.2	1480
G	10.2	1480
H	10.2	1480
J	10.2	1480
K	10.2	1480
L	6.89	1000
M	6.89	1000
N	6.89	1000
P	6.89	1000
Q	4.13	600
R	2.06	300
T	2.06	300

FIG.8 Detail of the O-Ring soft seat



JNO-J & JNB-J

Jacketed body

This series is the construction that enclosed a body portion in jacket and is the type which can warm a valve in hot oil, steam or hot water.

This type is most suitable for a paraffin series fluid having high viscosity coefficient at atmospheric temperature.

There are the semi-jacket type which only a valve casing enclosed and the full-jacket type enclosed to a valve casing, an inlet and an outlet.

Rc1/2 is normal, but can produce NPT(F)1/2 by a request about the connection of an inlet and outlet of the jacket.

Semi Jacket Type

FIG.9

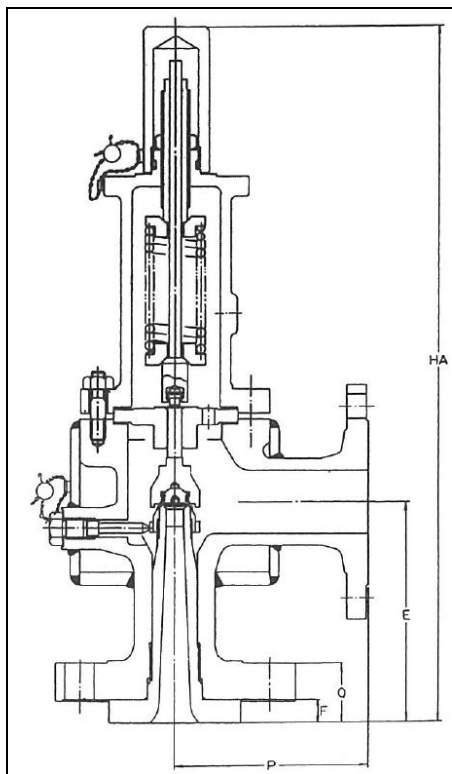


TABLE 5

Unit(mm)

O R I F I C E	SIZE (")	RATING	INLET RATING ASME	DIMENSIONS HA				APPROX. HEIGHT	
				E	P	F	Q	CAP TYPE	
								A,B	C,D,E
D	3/4 x 1	1()	150	160	130	18.5	41	470	515
		2(), 3()	300	160	130	18.5	41	470	515
		4()	600	160	130	18.5	41	470	515
D E	1 x 2	1()	150	160	125	18.5	41	470	515
		2(), 3()	300	160	125	18.5	41	470	515
		4()	600	160	125	18.5	41	470	515
F	1-1/2 x 2	1()	150	175	152.5	18.5	41	550	595
		2()	300	175	152.5	18.5	41	550	595
		3()	300	175	152.5	18.5	41	550	595
		4()	600	175	152.5	18.5	41	550	595
G	1-1/2 x 2-1/2	1()	150	150	135	18.5	41	525	570
		2()	300	150	135	18.5	41	525	570
		3()	300	180	152.5	18.5	41	555	600
		4()	600	180	152.5	18.5	41	555	600
H	1-1/2 x 3	1()	150	185	150	18.5	47.5	580	625
		2()	300	185	150	18.5	47.5	580	625
H	2 X 3	3()	300	180	150	18	44	580	625
		47	600	180	150	18	44	580	625
		4()	600	200	170	18	50	630	680
J	2 X 3	1()	150	165	160	18	41	540	585
		2()	300	165	160	18	41	540	585
J	2-1/2 x 4	3()	300	220	190	16	45	670	710
		47	600	220	190	16	45	670	710
		4()	600	220	190	16	45	755	795

Full Jacket Type FIG.10

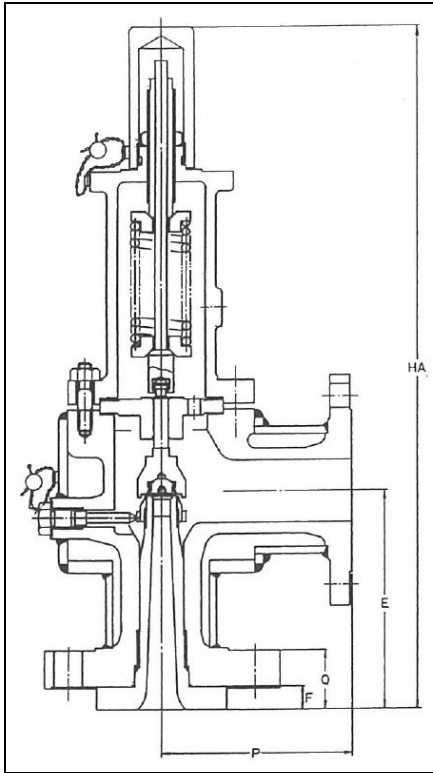


TABLE 6

Unit(mm)

O R I F I C E	SIZE (") () x () CONNECT FLANGE	RATING	INLET RATING ASME	DIMENSIONS HA				APPROX. HEIGHT	
				E	P	F	Q	CAP TYPE	
								A,B	C,D,E
D	3/4 x 1 (1-1/2) x (2)	1()	150	160	130	18.5	41	470	515
		2(),3()	300	160	130	18.5	41	470	515
		4()	600	160	130	18.5	41	470	515
D E	1 x 2 (2) x (3)	1()	150	160	125	18.5	41	470	515
		2(), 3()	300	160	125	18.5	41	470	515
		4()	600	160	125	18.5	44.5	470	515
F	1-1/2 x 2 (2-1/2) x (3)	1()	150	175	152.5	18.5	47.5	550	595
		2()	300	175	152.5	18.5	47.5	550	595
		3()	300	175	152.5	18.5	47.5	550	595
		4()	600	175	152.5	18.5	47.5	550	595
G	1-1/2 x 2-1/2 (2-1/2) x (4)	1()	150	180	152.5	18.5	47.5	555	600
		2()	300	180	152.5	18.5	47.5	555	600
		3()	300	180	152.5	18.5	47.5	555	600
		4()	600	180	152.5	18.5	47.5	555	600
H	1-1/2 x 3 (3) x (5)	1()	150	185	150	18.5	47.5	580	625
		2()	300	185	150	18.5	47.5	580	625
H	2 X 3 (3) x (5)	3()	300	190	150	18	50	590	635
		47	600	190	150	18	50	590	635
		4()	600	200	170	18	50	630	680
J	2 X 3 (3) x (5)	1()	150	185	160	18	41	560	605
		2()	300	185	160	18	47	560	605
J	2-1/2 x 4 (4) x (6)	3()	300	230	190	16	55	680	720
		47	600	230	190	16	55	680	720
		4()	600	230	190	16	55	765	805

Selection of the safety valve

When an engineer decides really a safety valve, the person confirms the application law or standard, and it is necessary to know fluid condition in detail as possible exactly. Additionally, it is necessary to consider the specification of the material for the corrosive fluid (see page 17 on the material code) and the cap type (see page 14). In the sizing in particular, the engineer must understand requirements such as relieving pressure, back pressure, the required relieving capacity, molecular weight, relieving temperature as possible exactly.

For example, when an engineer calculates liquid service with gas by mistake and greatly roughly estimates required relieving capacity. The calculated safety valve size is large, and a safety valve having the orifice area that is excessive than really required orifice area may be chosen.

When such a safety valve operates, chattering and hunting phenomenon occur and cause the damage of equipment and the safety valve.

The selection of the safety valve, please follow the following procedures.

1 Calculation of the required relieving area

Please calculate required relieving area according to each application law or standard shown in page 12 and 13.

Please consider the correction such as the overpressure or viscosity coefficient.

2 Determination of the orifice size

The determination orifice is larger than previous calculated required relieving area and the nearest orifices is chosen.

3 Determination of a valve type, a size and the connection

The combination of inlet size, outlet size and connection rating for each orifice was decided based on long-time experience and experiment to meet design (strength, flow rate) in the relieving.

Therefore, please avoid evaluating a special safety valve expect this combination. Additionally, it is the reason that it does not often satisfy relieving capacity to select excessive orifice except this combination.

4 Selection of a cap and the special material

See page 14, 15 and 17

The application law & calculating equation

For applicable code/standard and state of service fluid, select one of calculation form No. from the following table. And then make sure that allowable overpressure confirm to purpose of the overpressure protection at the customer's specification. Calculate required effective discharge area by substituting each value in the service conditions of customer's inquiry with each designation in the following equation. Any specific coefficient to be substituted in the relevant equation can be referred in ENGINEERING HANDBOOK (PRESSURE RELIEF VALVES).

TABLE 7

Calculation Form No.	State of fluids	Applicable Code and Standard		
		Equations for Required Orifices Area	Unit of Area	Description for Designation in Equation
SI01	Steam	MOTOYAMA STANDARD/API STD.520,PART1 Sizing and selection (2008 to 2020)/ASME Sec.VIII (PRESSURE VESSEL)		
		$A' = \frac{190.5 W'}{P1 K Kw Kc Kn Ksh}$	mm ²	<p>A' = required effective discharge area (mm²) W' = required flow rate (kg/h) P1 = the upstream relieving pressure (kPaA) P1 = P(1+OVRP)+101.3 P = set pressure (kPaG) OVRP = allowable overpressure (%)</p> <p>When 207kPaG of set pressure and 10% overpressure is required, P1 will be P1 = P+21+101.3</p> <p>K = effective coefficient of discharge, K = 0.975 Kw = backpressure correction factor which is the capacity correction factor due to back pressure, for conventional PRV, use Kw = 1.0. Kc = combination correction factor for installation with a rupture disk upstream of the PRV Kc = 1.0, when a rupture disk is not installed; Kc = 0.9, when a rupture disk is installed in combination with a PRV and the combination does not have a certified value; Kn = correction factor for the Napier equation and Kn = 1.0 (P1 ≤ 10339 kPaA) Ksh = superheat correction factor, for saturated steam at any pressure, Ksh = 1.0.</p>
SI03	Gas & vapor	MOTOYAMA STANDARD/API STD.520,PART1 Sizing and selection (2008 to 2020)/ASME Sec.VIII (PRESSURE VESSEL)		
		$A' = \frac{W'}{C K P1 Kw Kc \sqrt{\frac{M}{Z T}}}$ <p style="text-align: center;">and</p> $C = 0.03948 \sqrt{k \left(\frac{2}{k+1} \right)^{\frac{k+1}{k-1}}}$	mm ²	<p>A' = required effective discharge area (mm²) W' = required flow rate (kg/h) P1 = the upstream relieving pressure (kPaA) P1 = P(1+OVRP)+101.3 P = set pressure (kPaG) OVRP = allowable overpressure (%)</p> <p>When 207kPaG of set pressure and 10% overpressure is required, P1 will be P1 = P+21+101.3</p> <p>K = effective coefficient of discharge, K = 0.975 C = a function of ratio of the ideal gas specific heats (k = Cp/Cv) of gas or vapor at inlet relieving temperature Kw = backpressure correction factor which is the capacity correction factor due to back pressure, for conventional PRV, use Kw = 1.0. Kc = combination correction factor for installation with a rupture disk upstream of the PRV Kc = 1.0, when a rupture disk is not installed; Kc = 0.9, when a rupture disk is installed in combination with a PRV and the combination does not have a certified value; M = molecular weight of the service fluid Z = compressibility factor. If it is unknown, use Z = 1.0 T = relieving temperature (Absolute Temperature : K)</p>

MOTOYAMA STANDARD/API STD.520,PART1 Sizing and selection (2008 to 2020)/ASME Sec.VIII (PRESSURE VESSEL)				
SI04	Liquid	<p>(This equation is applied for style of JLT-JNO or JLT-JNB)</p> $A' = \frac{11.78 W'}{K K_w K_c K_v \sqrt{\frac{P_1 - P_B}{G}}}$	mm ²	<p>A' = required effective discharge area (mm²) W' = required flow rate (kg/h) P1 = the upstream relieving pressure (kPaG) P1 = P(1+OVRP)+101.3 P = set pressure (kPaG) OVRP = allowable overpressure (%) When 207kPaG of set pressure and 10% overpressure is required, P1 will be P1 = P+21 PB = backpressure (kPaG) K = effective coefficient of discharge, K = 0.65 Kw = backpressure correction factor which is the capacity correction factor due to back pressure, for conventional PRV, use Kw = 1.0. Kc = combination correction factor for installation with a rupture disk upstream of the PRV Kc = 1.0, when a rupture disk is not installed; Kc = 0.9, when a rupture disk is installed in combination with a PRV and the combination does not have a certified value; Kv = capacity correction factor due to viscosity. G = specific gravity of the liquid at the flowing temperature referred to water at standard conditions</p>
API STANDARD 520 PART1 Sizing and selection (2008 to 2020)				
SI44	Liquid	$A' = \frac{11.78 W'}{K K_w K_c K_v K_p \sqrt{\frac{1.25 P - P_B}{G}}}$	mm ²	<p>A' = required effective discharge area (mm²) W' = required flow rate (L/min) P = set pressure (kPaG) PB = total backpressure (kPaG) K = effective coefficient of discharge, K = 0.62 Kw = backpressure correction factor which is the capacity correction factor due to back pressure, for conventional PRV, use Kw = 1.0. Kc = combination correction factor for installation with a rupture disk upstream of the PRV Kc = 1.0, when a rupture disk is not installed; Kc = 0.9, when a rupture disk is installed in combination with a PRV and the combination does not have a certified value; Kv = capacity correction factor due to viscosity. Kp = correction factor due to overpressure; at 25% overpressure, Kp is equal to 1.0. G = specific gravity of the liquid at the flowing temperature referred to water at standard conditions</p>

Orifice Table

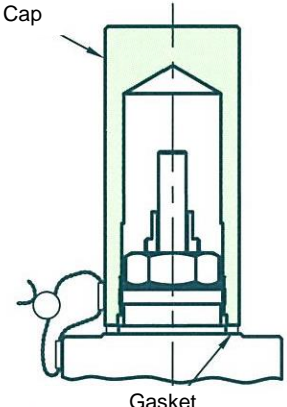
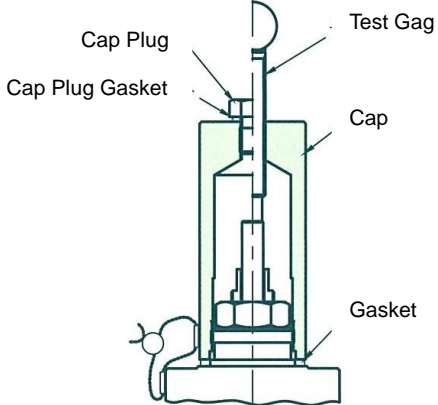
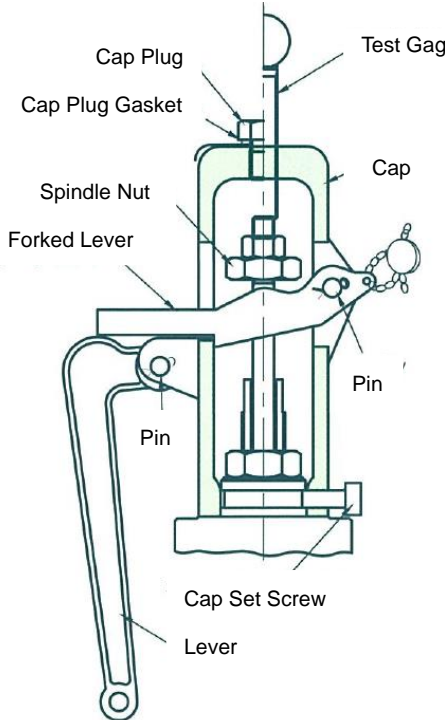
Based on the result of the effective area calculation, please choose an orifice satisfying a required orifice area.

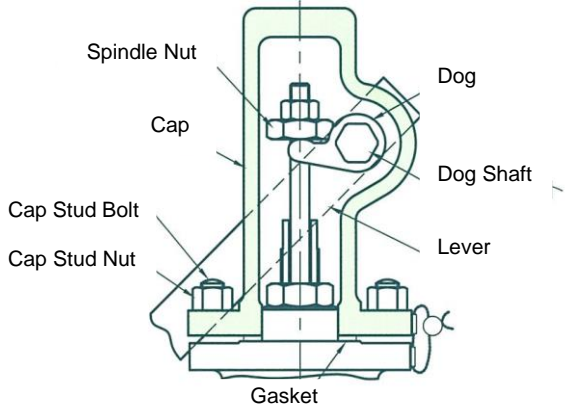
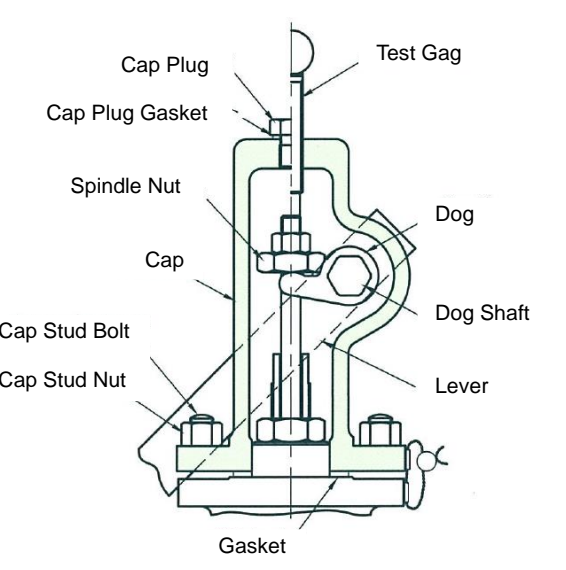
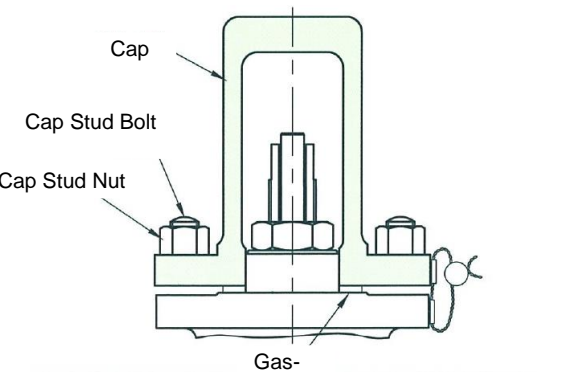
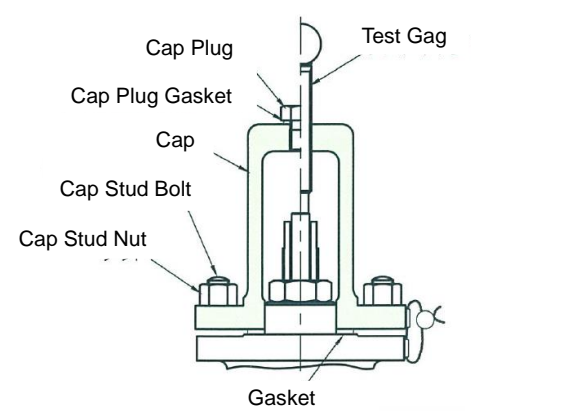
TABLE 8

ORIFICE	LIFT	ORIFICE DIAMETER	ORIFICE AREA	PREESSURE-TEMPERATURE
DESIGNATION	L (mm)	dt (mm)	A (cm ²)	LIMIT
D	2.4	9.6	0.709	P.18
E	3.2	12.7	1.264	P.19
F	4.0	15.9	1.980	P.20
G	5.1	20.4	3.245	P.21
H	6.4	25.4	5.064	P.22
J	8.2	32.6	8.303	P.23
K	9.8	38.9	11.858	P.24
L	12.1	48.5	18.406	P.25
M	13.6	54.4	23.225	P.26
N	15.0	59.8	27.999	P.27
P	18.1	72.4	41.161	P.28
Q	23.9	95.3	71.290	P.29
R	28.7	114.7	103.220	P.30
T	36.6	146.2	167.740	P.31

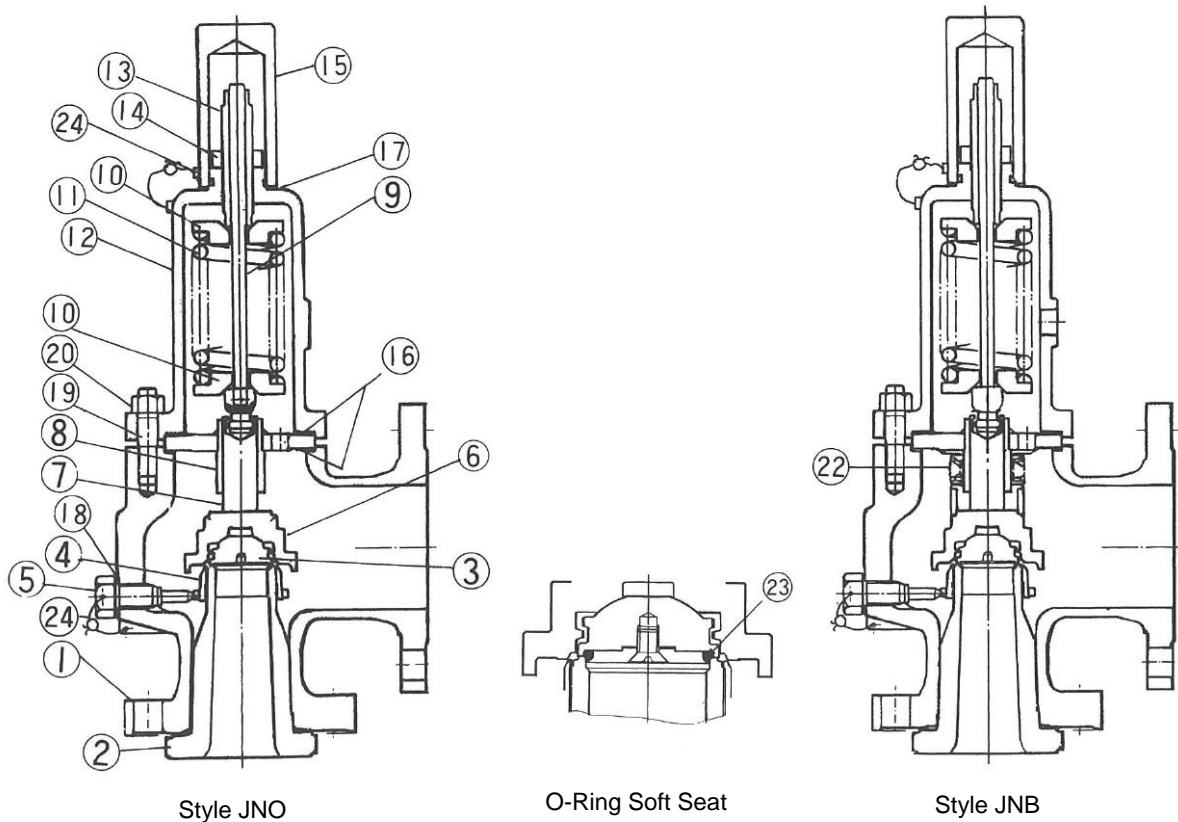
Caps and lifting levers

TABLE 9

Cap Types	Top Construction	Application
<p>Type A Screwed Cap</p>	 <p>The diagram shows a cross-section of a valve with a standard screwed cap. The cap is shown in its closed position, resting on a gasket. Labels include 'Cap' at the top and 'Gasket' at the bottom of the cap's seating area.</p>	<p>This is standard cap, If no other cap type is required, it is automatically selected.</p>
<p>Type B Screwed Cap and Test Gag</p>	 <p>The diagram shows a cross-section of a valve with a screwed cap and a test gag. The test gag is inserted into the cap, and a cap plug is used to seal the top. Labels include 'Cap Plug', 'Cap Plug Gasket', 'Test Gag', 'Cap', and 'Gasket'.</p>	<p>Test Gag is used to maintain the hydrostatic test (or airtight test) of the system and the closure of the valve. In that case, the test pressure is based on either low set pressure or spring set pressure of the safety valve, and the test pressure must not exceed 1.1 times of the pressure based on. Moreover, please tighten up the retightening of the Test Gag by hand.</p>
<p>Type C Open Cap and Regular Lifting Lever</p>	 <p>The diagram shows a cross-section of a valve with an open cap and a regular lifting lever. The cap is open, and the lever is in the down position. Labels include 'Cap Plug', 'Cap Plug Gasket', 'Test Gag', 'Cap', 'Spindle Nut', 'Forked Lever', 'Pin', 'Cap Set Screw', and 'Lever'.</p>	<p>For steam and air service where the valve cap is not required to be tight on the discharge side and where conditions are such that periodic testing is desirable, regular lifting lever may be furnished with a supplementary gagging device on special order. When inlet pressure of pressure relief valve is pressurized at 75% and over of set pressure, you can lift the lever up to discharge and relief the pressure.</p>

Cap Types	Top Construction	Application
<p>Type D Bolted Cap and Packed Lifting Lever</p>	 <p>Spindle Nut Cap Cap Stud Bolt Cap Stud Nut Dog Dog Shaft Lever Gasket</p>	<p>For services where tightness on the discharge side is necessary and where conditions are such that periodic testing is desirable. Also recommended for hot water services. When inlet pressure of pressure relief valve is pressurized at 75% and over of set pressure, you can lift the lever up to discharge and relief the pressure.</p>
<p>Type E Bolted Cap and Packed Lifting Lever and Test Gag</p>	 <p>Cap Plug Cap Plug Gasket Spindle Nut Cap Cap Stud Bolt Cap Stud Nut Dog Dog Shaft Lever Gasket Test Gag</p>	<p>Valve with screwed cap, packed lever or bolted cap can be fitted to accommodate test gag which will hold the valve closed when the equipment on which are installed is hydrostatically tested. When inlet pressure of pressure relief valve is pressurized at 75% and over of set pressure, you can lift the lever up to discharge and relief the pressure.</p>
<p>Type G Bolted Cap</p>	 <p>Cap Cap Stud Bolt Cap Stud Nut Gas-</p>	<p>Bolted Cap is available on request as option. Better seal tightness than that of screwed cap can be obtained.</p>
<p>Type H Bolted Cap and Test Gag</p>	 <p>Cap Plug Cap Plug Gasket Cap Cap Stud Bolt Cap Stud Nut Gasket Test Gag</p>	<p>Type G Bolted Cap changes to Type H Bolted Cap and Test Gag.</p>

Materials



Standard valve materials

TABLE 10

No.	Part Name	-29°C~+232°C	+233°C~+427°C	+428°C~+538°C	-59°C~-30°C	-100°C~-60°C	-196°C~-101°C
		JNO/JNB () 5	JNO/JNB () 6	JNO/JNB () 7	JNO/JNB () 4	JNO/JNB () 3	JNO/JNB () 2
	1 Body	SCPH2/A216 WCB	→	SCPH21/A217 WC6	SCS13A/A351 CF8	→	SCS14A/A351 CF8M
※1	2 Nozzle	SUS304 or SCS13A(A351 CF8)	→	→	→	→	SUS316 or SCS14A(A351 CF8M)
●※1	3 Disc Insert	SUS304	→	→	→	→	SUS316
	4 Nozzle Ring	Stainless Steel	→	→	→	→	→
	5 Set Screw	Stainless Steel	→	→	→	→	→
●	6 Disc Holder	Stainless Steel	→	→	→	→	→
※0	7 Guide Stem	Stainless Steel	→	→	→	→	→
	8 Guide	Stainless Steel	→	→	→	→	→
	9 Spindle	Stainless Steel	→	→	→	→	→
●	10 Spring Washer	Stainless Steel or Carbon Steel	→	→	→	Stainless Steel	→
●	11 Spring	Carbon Steel or Alloy Steel	Alloy Steel	→	Carbon Steel	Stainless Steel (316)	→
	12 Bonnet	SCPH2/A216 WCB	→	SCPH21/A217 WC6	SCS13A/A351 CF8	→	SCS14A/A351 CF8M
	13 Adjusting Bolt	Stainless Steel	→	→	→	→	→
	14 Adjusting Bolt Nut	Stainless Steel	→	→	→	→	→
	15 "A" Cap	Carbon Steel	→	→	Stainless Steel	→	→
●	16 Guide Gasket	Dead Soft Steel	→	→	Stainless Steel	→	→
●	17 Cap Gasket	Dead Soft Steel	→	→	Stainless Steel	→	→
●	18 Set Screw Gasket	Dead Soft Steel	→	→	Stainless Steel	→	→
	19 Bonnet Stud	Alloy Steel	→	→	Stainless Steel	→	→
	20 Bonnet Nut	Carbon Steel	→	→	Stainless Steel	→	→
●	22 Bellows	SUS316L	→	→	→	→	→
※2	23 O-Ring	Please specify materials	/	/	/	/	/
	24 Seal & Wire	Stainless Steel + Sn	→	→	→	→	→

Special valve materials

Table 11

No.	Part Name	Standard Material	SCPH2/SUS304	SCPH2/SUS316		SCS13A/SUS304	
		JNO/JNB () 5	() () S04	() () S1	() () S4	() () S05	() () S0
	1 Body	SCPH2/A216 WCB	→	→	→	SCS13A/A351 CF8	→
※1	2 Nozzle	SUS304 or SCS13A(A351 CF8)	→	SUS316 or SCS14A (A351 CF8M)	→	SUS304 or SCS13A(A351 CF8)	→
●※1	3 Disc Insert	SUS304	→	SUS316	→	SUS304	→
	4 Nozzle Ring	Stainless Steel	→	→	→	→	→
	5 Set Screw	Stainless Steel	→	→	Stainless S. (316)	Stainless Steel	→
●	6 Disc Holder	Stainless Steel	→	→	Stainless S. (316)	Stainless Steel	→
※0	7 Guide Stem	Stainless Steel	→	→	Stainless S. (316)	Stainless Steel	→
	8 Guide	Stainless Steel	→	→	Stainless S. (316)	Stainless Steel	→
	9 Spindle	Stainless Steel	Stainless S. (304)	Stainless S.	Stainless S. (316)	Stainless S.(304)	→
●	10 Spring Washer	Stainless Steel or Carbon Steel	→	→	→	→	Stainless S. (304)
●	11 Spring	Carbon Steel or Alloy Steel	→	→	→	→	Stainless S. (316)
	12 Bonnet	SCPH2/A216 WCB	→	→	→	SCS13A/A351 CF8	→
	13 Adjusting Bolt	Stainless Steel	Stainless S. (304)	Stainless S.	Stainless S. (316)	Stainless S.(304)	→
	14 Adjusting Bolt Nut	Stainless Steel	Stainless S. (304)	Stainless S.	Stainless S. (316)	Stainless S.(304)	→
	15 "A" Cap	Carbon Steel	→	→	→	Stainless Steel	→
●	16 Guide Gasket	Dead Soft Steel	Stainless Steel	Dead Soft Steel	Stainless Steel	→	→
●	17 Cap Gasket	Dead Soft Steel	Stainless Steel	Dead Soft Steel	Stainless Steel	→	→
●	18 Set Screw Gasket	Dead Soft Steel	Stainless Steel	Dead Soft Steel	Stainless Steel	→	→
	19 Bonnet Stud	Alloy Steel	→	→	→	Stainless Steel	→
	20 Bonnet Nut	Carbon Steel	→	→	→	Stainless Steel	→
●	22 Bellows	SUS316L	→	→	→	→	→
※2	23 O-Ring	Please specify materials	→	→	→	→	→
	24 Seal & Wire	Stainless Steel + Sn	→	→	→	→	→

No.	Part Name	Standard Material	SCS14A/SUS316		SCPH2/Ni-Cu Alloy		Ni-Cu/Ni-Cu	
		JNO/JNB () 5	() () S5	() () S	() () M1	() () M4	() () M5	() () M
	1 Body	SCPH2/A216 WCB	SCS14A/A351 CF8M	→	SCPH2/A216 WCB	→	Ni-Cu Alloy	→
※1	2 Nozzle	SUS304 or SCS13A(A351 CF8)	SUS316 or SCS14A(A351 CF8M)	→	ALLOY 400 or K500	→	→	→
●※1	3 Disc Insert	SUS304	SUS316	→	ALLOY 400 or K500	→	→	→
	4 Nozzle Ring	Stainless Steel	Stainless S. (316)	→	Stainless Steel	Ni-Cu Alloy	Ni-Cu Alloy	→
	5 Set Screw	Stainless Steel	Stainless S. (316)	→	Stainless Steel	Ni-Cu Alloy	Ni-Cu Alloy	→
●	6 Disc Holder	Stainless Steel	Stainless S. (316)	→	Stainless Steel	Ni-Cu Alloy	Ni-Cu Alloy	→
※0	7 Guide Stem	Stainless Steel	Stainless S. (316)	→	Stainless Steel	Ni-Cu Alloy	Ni-Cu Alloy	→
	8 Guide	Stainless Steel	Stainless S. (316)	→	Stainless Steel	Ni-Cu Alloy	Ni-Cu Alloy	→
	9 Spindle	Stainless Steel	Stainless S. (316)	→	Stainless Steel	Ni-Cu Alloy	Ni-Cu Alloy	→
●	10 Spring Washer	Stainless Steel or Carbon Steel	→	Stainless S. (316)	Stainless Steel or Carbon Steel	→	→	Ni-Cu Alloy
●	11 Spring	Carbon Steel or Alloy Steel	→	Stainless S. (316)	Carbon Steel or Alloy Steel	→	→	Ni-Cu Alloy or ALLOY X-750
	12 Bonnet	SCPH2/A216 WCB	SCS14A/A351 CF8M	→	SCPH2/A216 WCB	→	Ni-Cu Alloy	→
	13 Adjusting Bolt	Stainless Steel	Stainless S. (316)	→	Stainless Steel	Ni-Cu Alloy	Ni-Cu Alloy	→
	14 Adjusting Bolt Nut	Stainless Steel	Stainless S. (316)	→	Stainless Steel	Ni-Cu Alloy	Ni-Cu Alloy	→
	15 "A" Cap	Carbon Steel	Stainless S. (316)	→	Carbon Steel	→	Ni-Cu Alloy	→
●	16 Guide Gasket	Dead Soft Steel	Stainless Steel	→	Dead Soft Steel	Ni-Cu Alloy	Ni-Cu Alloy	→
●	17 Cap Gasket	Dead Soft Steel	Stainless Steel	→	Dead Soft Steel	Ni-Cu Alloy	Ni-Cu Alloy	→
●	18 Set Screw Gasket	Dead Soft Steel	Stainless Steel	→	Dead Soft Steel	Ni-Cu Alloy	Ni-Cu Alloy	→
	19 Bonnet Stud	Alloy Steel	Stainless Steel	→	Alloy Steel	→	Stainless S.	→
	20 Bonnet Nut	Carbon Steel	Stainless Steel	→	Carbon Steel	→	Stainless S.	→
●	22 Bellows	SUS316L	→	→	→	Ni-Cu Alloy	→	→
※2	23 O-Ring	Please specify materials	→	→	→	→	→	→
	24 Seal & Wire	Stainless Steel + Sn	→	→	→	→	→	→

● : Recommended spare parts

※0 : As for the orifice (D to H), a guide stem is united with a disc holder.

※1 : For steam service, CoCr alloy is deposited by welding on a surface of parts

※2 : The elastomer materials depend on the fluid condition, and please refer to page 8.

The Hastelloy®C-based materials are manufacturable too, and please contact for the temperature pressure limit of the special valve materials mentioned above to our sales office as P.18 to P.31 just applies to only standard valve material.

Size, pressure, temperature limits

Low Set Pressure Limits JNO : 0.10MPaG (1.0kg/cm²G)、JNB : 0.17MPaG (1.75kg/cm²G)

Upper temperature limit of JNO-H-15,25,35 and 45 valves is +343°C (+650F)

D Orifice

(0.709 cm² Effective Area)

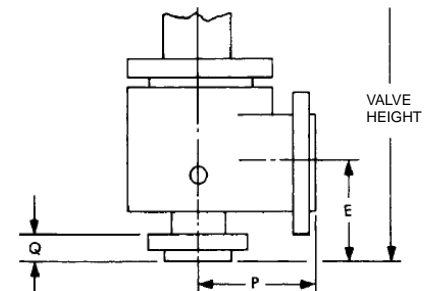
TABLE 12

Valve Style	Valve Size(*)		Standard Connection ASME Flanges	Maximum Set Pressure (MPaG) *1									Back Pressure Limit(MPaG) @ Outlet 38°C		Maximum Set Pressure (kg/cm ² G) *1									Back Pressure Limit (kg/cm ² G) @ Outlet 38°C							
	Inlet X Outlet			Inlet Temperature (°C)											Inlet Temperature (°C)																
	Inlet	Outlet		-196 to -101	-100 to -60	-59 to -30	-29 to 38	232	427	538	JNO	JNB	-196 to -101	-100 to -60	-59 to -30	-29 to 38	232	427	538	JNO	JNB										
JNO JNB	12	150	3/4x1、1x2	150	1.89													19.3													
	22	300			1.89															19.3											
	32	300			4.96																50.6										
	42	600			9.92																101.2										
	13	150					1.89														19.3								19.3		
	23	300					1.89														19.3								19.3		
33	300			4.96														50.6								50.6					
43	600			9.92														101.2								101.2					
14	150				1.89													19.3													
24	300				1.89													19.3													
34	300				4.96													50.6													
44	600				9.92													101.2													
15	150						1.96	1.27										20.0	13.0												
25	300						1.96	1.96										20.0	20.0												
35	300						5.10	4.24										52.0	43.2												
45	600						10.20	8.51										104.0	86.8												
16	150							1.27	0.55									13.0	5.6												
26	300							1.96	1.96									20.0	20.0												
36	300							4.24	2.82									43.2	28.8												
46	600							8.51	5.68									86.8	58.0												
37	300								3.51	1.48								35.8	15.1												
47	600								6.99	2.96								71.3	30.2												
55	1-1/2x2	900	3/4x1、1x2	150				15.30	12.72				4.13					156.0	129.7							42.1					
65	1-1/2x2	1500							25.54	21.23					4.13				260.5	216.5							42.1				
75	1-1/2x3(2-1/2)	2500							41.36	41.36					5.10				421.8	421.8							52.0				
56	1-1/2x2	900								12.72	8.51				4.13					129.7	86.8						42.1				
66	1-1/2x2	1500								21.23	14.20				4.13					216.5	144.8						42.1				
76	1-1/2x3(2-1/2)	2500								41.36	23.64				5.10					421.8	241.1						52.0				
57	1-1/2x2	900							10.51	4.48			4.13					107.2	45.7						42.1						
67	1-1/2x2	1500							17.51	7.44			4.13					178.5	75.9						42.1						
77	1-1/2x3(2-1/2)	2500							29.16	12.41			5.10					297.4	126.5						52.0						

*1 : Depending on a material, the ASME flange may be limited by ASME B16.5 (Pipe Flanges and Flanged Fittings).

TABLE 13

Valve Style	Valve Size(*)	Valve Dimensions (mm)					Approx. Weight (kg) Type A *2
		Center to Face		Used to find Bolt Length	Approx. Height		
		Inlet	Outlet		Cap Type		
		E	P	Q	A,B,G	C,D,E	
12、13、14、15、16 22、23、24、25、26 32、33、34、35、36、37 42、43、44、45、46、47	3/4x1	95.0	110.0	31.3	395	440	10
12、13、14、15、16 22、23、24、25、26 32、33、34、35、36、37 42、43、44、45、46、47	1x2	105.0	114.5	39	405	450	15
55、56、57、65、66、67	1-1/2x2	105.0	139.5	51	445	515	20
75、76、77	1-1/2x3	139.5	178.0	63	475	545	32
75、76、77	(1-1/2x2-1/2)	(139.5)	(165.0)	(63)	(475)	(545)	(30)



() are dimensions according to an old edition of API standard 526.

*2: Weight of D or E cap increases by 6 kg.

E Orifice

(1.264 cm² Effective Area)

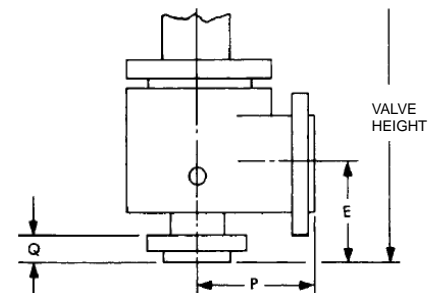
TABLE 14

Valve Style	Valve Size(“)		Standard Connection ASME Flanges		Maximum Set Pressure (MPaG) *1							Back Pressure Limit(MPaG) @ Outlet 38°C		Maximum Set Pressure (kg/cm ² G) *1							Back Pressure Limit (kg/cm ² G) @ Outlet 38°C	
	Inlet X Outlet				Inlet Temperature (°C)									Inlet Temperature (°C)								
	Inlet	Outlet	-196 to -101	-100 to -60	-59 to -30	-29 to 38	232	427	538	JNO	JNB	-196 to -101	-100 to -60	-59 to -30	-29 to 38	232	427	538	JNO	JNB		
JNO JNB	12 22 32 42	1X2	150	150	1.89						1.89	1.58	19.3						19.3	16.1		
	300		1.89						19.3													
	600		4.96						50.6													
JNO JNB	13 23 33 43	1X2	150	150		1.89					1.89	1.58		19.3					19.3	16.1		
	300		1.89						19.3													
	600		4.96						50.6													
JNO JNB	14 24 34 44	1X2	150	150			1.89				1.89	1.58			19.3				19.3	16.1		
	300		1.89						19.3													
	600		4.96						50.6													
JNO JNB JNO-H	15 25 35 45	1x2	150	150				1.96	1.27		1.96	1.58				20.0	13.0		20.0	16.1		
	300						1.96	1.96		20.0			20.0									
	600						5.10	4.24		52.0			43.2									
JNO JNB JNO-H	16 26 36 46	1x2	150	150					1.27	0.55	1.96	1.58				13.0	5.6		20.0	16.1		
	300						1.96	1.96		20.0			20.0									
	600						4.24	2.82		43.2			28.8									
JNO JNB	37 47	1x2	300	150						3.51	1.48	1.96	1.58					35.8	15.1	20.0	16.1	
	600							6.99	2.96							71.3	30.2					
JNO JNB	55 65 75	1-1/2x2 1-1/2x2 1-1/2x3(2-1/2)	900	300				15.30	12.72		3.44	3.44				156.0	129.7		42.1	35.1		
	1500						25.54	21.23		260.5			216.5									
	2500						41.36	41.36		421.8			421.8									
JNO JNB	56 66 76	1-1/2x2 1-1/2x2 1-1/2x3(2-1/2)	900	300					12.72	8.51	3.44	3.44				129.7	86.8		42.1	35.1		
	1500						21.23	14.20		216.5			144.8									
	2500						41.36	23.64		421.8			241.1									
JNO JNB	57 67 77	1-1/2x2 1-1/2x2 1-1/2x3(2-1/2)	900	300					10.51	4.48	3.44	3.44				107.2	45.7		42.1	35.1		
	1500						17.51	7.44		178.5			75.9									
	2500						29.16	12.41		297.4			126.5									

*1 : Depending on a material, the ASME flange may be limited by ASME B16.5 (Pipe Flanges and Flanged Fittings).

TABLE 15

Valve Style	Valve Size(“)	Valve Dimensions (mm)					Approx. Weight (kg) Type A *2
		Center to Face		Used to find Bolt Length	Approx. Height		
		Inlet	Outlet		Cap Type		
		E	P	A,B,G	A,B,G	C,D,E	
12, 13, 14, 15, 16 22, 23, 24, 25, 26 32, 33, 34, 35, 36, 37 42, 43, 44, 45, 46, 47	1x2	105.0	114.5	39	405	450	15
55, 56, 57, 65, 66, 67	1-1/2x2	105.0	139.5	51	445	515	20
75, 76, 77	1-1/2x3	139.5	178.0	63	475	545	32
75, 76, 77	(1-1/2x2-1/2)	(139.5)	(165.0)	(63)	(475)	(545)	(30)



() are dimensions according to an old edition of API standard 526.

2: Weight of D or E cap increases by 6 kg.

F Orifice

(1.980 cm² Effective Area)

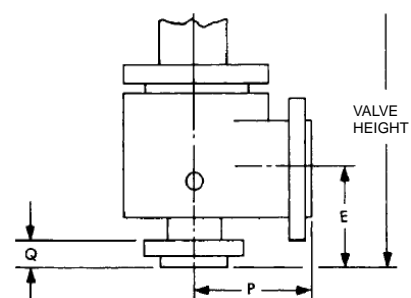
TABLE 16

Valve Style	Valve Size(“)		Standard Connection ASME Flanges		Maximum Set Pressure (MPaG) *1							Back Pressure Limit(MPaG) @ Outlet 38°C		Maximum Set Pressure (kg/cm ² G) *1							Back Pressure Limit (kg/cm ² G) @ Outlet 38°C																
	Inlet X Outlet				Inlet Temperature (°C)									Inlet Temperature (°C)																							
	Inlet	Outlet	-196 to -101	-100 to -60	-59 to -30	-29 to 38	232	427	538	JNO	JNB	-196 to -101	-100 to -60	-59 to -30	-29 to 38	232	427	538	JNO	JNB																	
JNO JNB	12 22 32 42	1-1/2X2	150	150	1.89							19.3									1.89	1.58	19.3							19.3	16.1						
	300		1.89										19.3											19.3													
	600		4.96										50.6													50.6											
JNO JNB JNO-H	13 23 33 43	1-1/2x2	150	150																																	
	300		1.89																																		
	600		4.96																																		
JNO JNB JNO-H	14 24 34 44	1-1/2x2	150	150			1.89																														
	300		1.89																																		
	600		4.96																																		
JNO JNB JNO-H	15 25 35 45	1-1/2x2	150	150				1.96	1.27																												
	300																																				
	600																																				
JNO JNB JNO-H	16 26 36 46	1-1/2x2	150	150					1.27	0.55																											
	300																																				
	600																																				
JNO JNB	37 47	1-1/2x3(2-1/2)	300	300						3.51	1.48																										
	600																																				
JNO JNB	55 65 75	1-1/2x3(2-1/2)	900	300				15.30	12.72																												
	1500																																				
	2500																																				
JNO JNB	56 66 76	1-1/2x3(2-1/2)	900	300				12.72	8.51																												
	1500																																				
	2500																																				
JNO JNB	57 67 77	1-1/2x3(2-1/2)	900	300				10.51	4.48																												
	1500																																				
	2500																																				

*1 : Depending on a material, the ASME flange may be limited by ASME B16.5 (Pipe Flanges and Flanged Fittings).

TABLE 17

Valve Style	Valve Size(“)	Valve Dimensions (mm)					Approx. Weight (kg) Type A *2
		Center to Face		Used to find Bolt Length	Approx. Height		
		Inlet	Outlet		Cap Type		
		E	P	A,B,G	A,B,G	C,D,E	
12, 13, 14, 15, 16 22, 23, 24, 25, 26	1-1/2x2	124.0	120.5	41	495	540	20
152.5			43	24			
152.5			43	24			
55, 56, 57, 65, 66, 67	1-1/2x3	124.0	165.0	51	510	555	32
75, 76, 77	1-1/2x3	139.5	178.0	63	585	680	42
55, 56, 57, 65, 66, 67	(1-1/2x2-1/2)	(124.0)	(152.5)	(51)	(510)	(555)	(30)
75, 76, 77	(1-1/2x2-1/2)	(139.5)	(165.0)	(63)	(585)	(680)	(40)



() are dimensions according to an old edition of API standard 526.

*2: Weight of D or E cap increases by 6 kg.

G Orifice

(3.245 cm² Effective Area)

TABLE 18

Valve Style	Valve Size(“)		Standard Connection ASME Flanges		Maximum Set Pressure (MPaG) *1							Back Pressure Limit(MPaG) @ Outlet 38°C		Maximum Set Pressure (kg/cm ² G) *1							Back Pressure Limit (kg/cm ² G) @ Outlet 38°C									
	Inlet X Outlet		Inlet	Outlet	Inlet Temperature (°C)							JNO	JNB	Inlet Temperature (°C)							JNO	JNB								
					-196 to -101	-100 to -60	-59 to -30	-29 to 38	232	427	538			-196 to -101	-100 to -60	-59 to -30	-29 to 38	232	427	538			JNO	JNB						
JNO JNB	12 22 32 42	1-1/2X3(2-1/2)	150	150	1.89								1.89	1.58	19.3															
	300		1.89													19.3														
	600		4.96														50.6													
JNO JNB	13 23 33 43	1-1/2X3(2-1/2)	150	150		1.89							1.89	1.58	19.3															
	300		1.89													19.3														
	600		4.96														50.6													
JNO JNB JNO-H	14 24 34 44	1-1/2x3(2-1/2)	150	150			1.89						1.89	1.58	19.3															
	300															19.3														
	600																50.6													
JNO JNB JNO-H	15 25 35 45	1-1/2x3(2-1/2)	150	150				1.96	1.27				1.96	1.58					20.0	13.0										
	300																			20.0	20.0									
	600																				52.0	43.2								
JNO JNB JNO-H	16 26 36 46	1-1/2x3(2-1/2)	150	150					1.27	0.55			1.96	1.58					13.0	5.6										
	300																				20.0	20.0								
	600																					43.2	28.8							
JNO JNB	37 47	1-1/2x3(2-1/2)	300	300									3.51	1.48																
	600																					35.8	15.1							
																							71.3	30.2						
JNO JNB	55 65 75	1-1/2x3(2-1/2) 2x3 2x3	900	300				15.30	12.72				5.10	3.24					156.0	129.7										
	1500																				260.5	216.5								
	2500																					260.5	260.5							
JNO JNB	56 66 76	1-1/2x3(2-1/2) 2x3 2x3	900	300					12.72	8.51			5.10	3.24					129.7	86.8										
	1500																					216.5	144.8							
	2500																						260.5	241.1						
JNO JNB	57 67 77	1-1/2x3(2-1/2) 2x3 2x3	900	300					10.51	4.48			5.10	3.24					107.2	45.7										
	1500																						178.5	75.9						
	2500																							263.6	126.5					

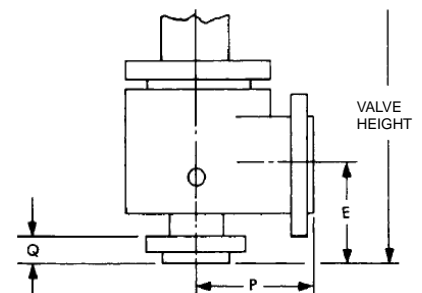
*1 : Depending on a material, the ASME flange may be limited by ASME B16.5 (Pipe Flanges and Flanged Fittings).

TABLE 19

Valve Style	Valve Size(“)	Valve Dimensions (mm)					Approx. Weight (kg) Type A *2
		Center to Face		Used to find Bolt Length	Approx. Height		
		Inlet	Outlet		Cap Type		
		E	P	A,B,G	A,B,G	C,D,E	
12, 13, 14, 15, 16 22, 23, 24, 25, 26 32, 33, 34, 35, 36, 37 42, 43, 44, 45, 46, 47	1-1/2x3(2-1/2)	124.0	120.5	41	495	540	22(20)
152.5			43	26(24)			
152.5			43	26(24)			
55, 56, 57	1-1/2x3	124.0	165.0	51	565	660	37
55, 56, 57	(1-1/2x2-1/2)	(124.0)	(152.5)	(51)	(565)	(660)	(35)
65, 66, 67, 75, 76, 77	2x3	155.5	171.5	70	590	685	45

() are dimensions according to an old edition of API standard 526.

*2: Weight of D or E cap increases by 6 kg.



H Orifice

(5.064 cm² Effective Area)

TABLE 20

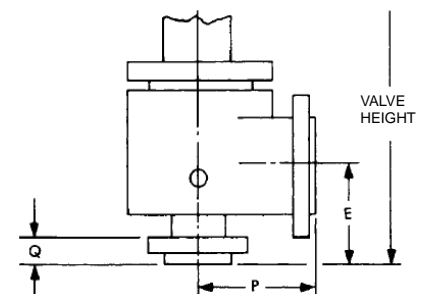
Valve Style	Valve Size(“)		Standard Connection ASME Flanges		Maximum Set Pressure (MPaG) *1							Back Pressure Limit(MPaG) @ Outlet 38°C		Maximum Set Pressure (kg/cm ² G) *1							Back Pressure Limit (kg/cm ² G) @ Outlet 38°C			
	Inlet X Outlet				Inlet Temperature (°C)									Inlet Temperature (°C)										
	Inlet	Outlet	-196 to -101	-100 to -60	-59 to -30	-29 to 38	232	427	538	JNO	JNB	-196 to -101	-100 to -60	-59 to -30	-29 to 38	232	427	538	JNO	JNB				
JNO JNB	12	1-1/2X3	150	150	1.89						1.89	1.58	19.3					19.3	16.1					
	22	1-1/2x3	300		1.89								19.3											
	32	2x3	300		4.96									50.6										
	42	2x3	600		9.92									101.2										
	13	1-1/2X3	150			1.89											19.3							
	23	1-1/2x3	300			1.89											19.3							
JNO JNB JNO-H	33	2x3	300	150	4.96						1.96	1.58	50.6					20.0	16.1					
	43	2x3	600		9.92									101.2										
	14	1-1/2X3	150			1.89											19.3							
	24	1-1/2x3	300			1.89											19.3							
	34	2x3	300			4.96											50.6							
	44	2x3	600			9.92											101.2							
JNO JNB JNO-H	15	1-1/2X3	150	150				1.96	1.27		1.96	1.58					20.0	13.0	20.0	16.1				
	25	1-1/2x3	300					1.96	1.96												20.0	20.0		
	35	2x3	300					5.10	4.24												52.0	43.2		
	45	2x3	600					10.20	8.51												104.0	86.8		
	16	1-1/2X3	150						1.27	0.55												13.0	5.6	
	26	1-1/2x3	300						1.96	1.96												20.0	20.0	
JNO JNB	36	2x3	300	150				4.24	2.82								43.2	28.8						
	46	2x3	600					8.51	5.68								86.8	58.0						
	37	2x3	300						3.51	1.48								35.8	15.1					
47	2x3	600					6.99	2.96								71.3	30.2							
JNO JNB	55	2x3	900	150				15.30	12.72		1.96	1.58					156.0	129.7	20.0	16.1				
	65	2x3	1500	300				18.96	18.96		5.10	2.86					193.3	193.3	52.0	29.1				
	56	2x3	900	150				12.72	8.51		1.96	1.58					129.7	86.8	20.0	16.1				
	66	2x3	1500	300				18.96	14.20		5.10	2.86					193.3	144.8	52.0	29.1				
	57	2x3	900	150					10.51	4.48	1.96	1.58						107.2	45.7	20.0	16.1			
67	2x3	1500	300					17.51	7.44	5.10	2.86						178.5	75.9	52.0	29.1				

*1 : Depending on a material, the ASME flange may be limited by ASME B16.5 (Pipe Flanges and Flanged Fittings).

TABLE 21

Valve Style	Valve Size(“)	Valve Dimensions (mm)					Approx. Weight (kg) Type A *2
		Center to Face		Used to find Bolt Length	Approx. Height		
		Inlet	Outlet		Cap Type		
		E	P	A,B,G	A,B,G	C,D,E	
12, 13, 14, 15, 16 22, 23, 24, 25, 26	1-1/2x3	130.5	124.0	41	510	555	23
32, 33, 34, 35, 36, 37, 47	2x3	130.5	124.0	43	510	555	28
42, 43, 44, 45, 46	2x3	154.0	162.0	43	570	620	36
55, 56, 57, 65, 66, 67	2x3	154.0	162.0	57	625	720	50

*2: Weight of D or E cap increases by 6 kg.



J Orifice

(8.303 cm² Effective Area)

TABLE 22

Valve Style		Valve Size(“)	Standard Connection ASME Flanges		Maximum Set Pressure (MPaG) *1							Back Pressure Limit(MPaG) @ Outlet 38°C		Maximum Set Pressure (kg/cm ² G) *1							Back Pressure Limit (kg/cm ² G) @ Outlet 38°C	
					Inlet Temperature (°C)									Inlet Temperature (°C)								
		Inlet	Outlet	-196 to -101	-100 to -60	-59 to -30	-29 to 38	232	427	538	JNO	JNB	-196 to -101	-100 to -60	-59 to -30	-29 to 38	232	427	538	JNO	JNB	
JNO	12	2X3	150	150	1.89						1.89	1.58	19.3					19.3	16.1			
	22	2x3	300		1.89								19.3									
	32	3(2-1/2)x4	300		3.45									19.3								
	42	3(2-1/2)x4	600		4.30									43.9								
JNB	13	2X3	150			1.89								19.3								
	23	2x3	300			1.89								19.3								
	33	3(2-1/2)x4	300			3.45								35.1								
	43	3(2-1/2)x4	600			4.30								43.9								
JNO	14	2X3	150			1.89											19.3					
	24	2x3	300			1.89											19.3					
	34	3(2-1/2)x4	300			4.96											50.6					
	44	3(2-1/2)x4	600			9.92											101.2					
JNB	15	2X3	150				1.96	1.27			1.96	1.58					20.0	13.0				
	25	2x3	300				1.96	1.96										20.0	20.0			
	35	3(2-1/2)x4	300				5.10	4.24										52.0	43.2			
	45	3(2-1/2)x4	600				10.20	8.51										104.0	86.8			
JNO-H	16	2X3	150					1.27	0.55								13.0	5.6				
	26	2x3	300					1.96	1.96								20.0	20.0				
	36	3(2-1/2)x4	300					4.24	2.82								43.2	28.8				
	46	3(2-1/2)x4	600					8.51	5.68								86.8	58.0				
JNO	37	3(2-1/2)x4	300						3.51	1.48								35.8	15.1			
	47	3(2-1/2)x4	600						6.99	2.96								71.3	30.2			
JNB	55	3x4	900	150				15.30	12.72		1.96	1.58					156.0	129.7		20.0	16.1	
	65	3x4	1500	300				18.61	18.61		4.13	1.58					189.8	189.8		42.1	16.1	
	56	3x4	900	150					12.72	8.51	1.96	1.58					129.7	86.8		20.0	16.1	
	66	3x4	1500	300					18.61	14.20	4.13	1.58					189.8	144.8		42.1	16.1	
JNB	57	3(2-1/2)x4	900	150						10.51	4.48	1.96	1.58					107.2	45.7	20.0	16.1	
	67	3x4	1500	300						17.51	7.44	4.13	1.58					178.5	75.9	42.1	16.1	

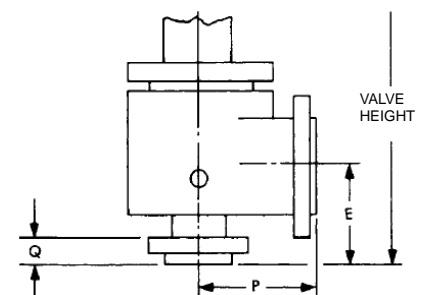
*1 : Depending on a material, the ASME flange may be limited by ASME B16.5 (Pipe Flanges and Flanged Fittings).

TABLE 23

Valve Style	Valve Size(“)	Valve Dimensions (mm)					Approx. Weight (kg) Type A *2
		Center to Face		Used to find Bolt Length	Approx. Height		
		Inlet	Outlet		Cap Type		
		E	P	A,B,G	A,B,G	C,D,E	
12, 13, 14, 15, 16	2x3	136.5	124.0	41	495	540	24
22, 23, 24, 25, 26	3x4	184.0	181.0	52	615	660	40
32, 33, 34, 35, 36, 37, 47	3x4	184.0	181.0	52	700	740	55
42, 43, 44, 45, 46	(2-1/2x4)	(136.5)	(143.0)	(46)	(565)	(610)	(36)
32, 33, 34, 35, 36, 37, 47	(2-1/2x4)	(155.5)	(171.5)	(46)	(670)	(710)	(47)
55, 56, 57, 65, 66, 67	3x4	184.0	181.0	68	730	825	70
57	(2-1/2x4)	(155.5)	(171.5)	(62)	(655)	(750)	(55)

() are dimensions according to an old edition of API standard 526.

*2: Weight of D or E cap increases by 6 kg.



K Orifice

(11.858 cm² Effective Area)

TABLE 24

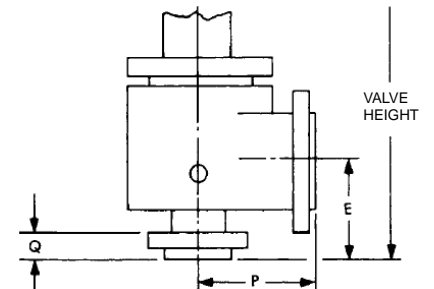
Valve Style	Valve Size(“)		Standard Connection ASME Flanges		Maximum Set Pressure (MPaG) *1							Back Pressure Limit(MPaG) @ Outlet 38°C	Maximum Set Pressure (kg/cm ² G) *1							Back Pressure Limit (kg/cm ² G) @ Outlet 38°C		
	Inlet X Outlet				Inlet Temperature (°C)								Inlet Temperature (°C)									
	Inlet	Outlet	-196 to -101	-100 to -60	-59 to -30	-29 to 38	232	427	538	JNO	JNB		-196 to -101	-100 to -60	-59 to -30	-29 to 38	232	427	538			JNO
JNO JNB	3x4	150	150	150	1.89						1.89	1.03	19.3					19.3	10.5			
			300		1.89					1.03		19.3					10.5					
			300		3.61					1.03		36.9					10.5					
			600		4.13					1.37		42.1					14.0					
			150							1.03			19.3				10.5					
			300							1.03			19.3				10.5					
300				1.89								19.3					10.5					
34				4.96								50.6					10.5					
44				9.92								101.2					10.5					
JNO JNB JNO-H	3x4	150	150	150				1.96	1.27		1.96	1.03					20.0	13.0	20.0	10.5		
			300					1.96	1.96			1.03				20.0	20.0	10.5				
			300					5.10	4.24			1.03				52.0	43.2	10.5				
			600					10.20	8.51			1.37				104.0	86.8	14.0				
			150							1.27		0.55						13.0		5.6	10.5	
			300							1.96		1.96						20.0		20.0	10.5	
300						4.24	2.82						43.2	28.8	10.5							
46						8.51	5.68						86.8	58.0	14.0							
37									3.51	1.48						35.8	15.1	10.5				
47									6.99	2.96						71.3	30.2	14.0				
JNO JNB	3x6	150	900	150				15.30	12.72		1.96	1.03					156.0	129.7	20.0	20.0		
			1500	300				15.30	15.30			4.13				156.0	156.0	42.1				
			900	150				12.72	8.51			1.96				129.7	86.8	20.0				
			1500	300				15.30	14.20			4.13				156.0	144.8	42.1				
			900	150						10.51		4.48		1.37						107.2	45.7	20.0
			1500	300						15.30		7.44			4.13					156.0	75.9	42.1

*1 : Depending on a material, the ASME flange may be limited by ASME B16.5 (Pipe Flanges and Flanged Fittings).

TABLE 25

Valve Style	Valve Size(“)	Valve Dimensions (mm)					Approx. Weight (kg) Type A *2
		Center to Face		Used to find Bolt Length	Approx. Height		
		Inlet	Outlet		Cap Type		
		E	P	A,B,G	A,B,G	C,D,E	
12, 13, 14, 15, 16 22, 23, 24, 25, 26	3x4	155.5	162.0	52	670	715	52
32, 33, 34, 35, 36, 37, 47		155.5	162.0	52	670	715	55
42, 43, 44, 45, 46		184.0	181.0	52	745	790	70
55, 56, 57	3x6	198.5	216.0	68	850	985	70
65, 66, 67		197.0	216.0	68	850	985	70

*2: Weight of D or E cap increases by 10 kg.



L Orifice

(18.406 cm² Effective Area)

TABLE 26

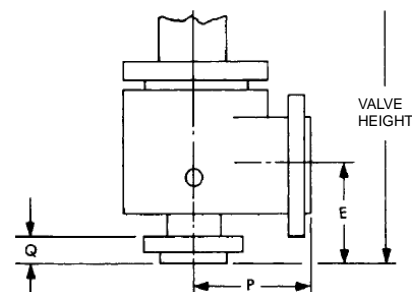
Valve Style	Valve Size(“)		Standard Connection ASME Flanges	Maximum Set Pressure (MPaG) *1									Back Pressure Limit(MPaG) @ Outlet 38°C	Maximum Set Pressure (kg/cm ² G) *1									Back Pressure Limit (kg/cm ² G) @ Outlet 38°C		
	Inlet X Outlet			Inlet Temperature (°C)										Inlet Temperature (°C)											
	Inlet	Outlet		-196 to -101	-100 to -60	-59 to -30	-29 to 38	232	427	538	JNO	JNB		-196 to -101	-100 to -60	-59 to -30	-29 to 38	232	427	538	JNO	JNB			
JNO JNB	12	3x4	150	150	1.89							1.89	0.68	19.3					19.3	7.0					
	22	3X4	300		1.89								0.68	19.3								7.0			
	32	4X6	300		3.68								1.17	37.6								11.9			
	42	4X6	600		3.68								1.17	37.6								11.9			
	13	3x4	150			1.89								0.68		19.3						19.3	7.0		
	23	3X4	300			1.89								0.68		19.3						19.3	7.0		
	33	4X6	300			3.68								1.17		37.6						37.6	11.9		
	43	4X6	600			3.68								1.17		37.6						37.6	11.9		
	14	3x4	150				1.89							0.68			19.3						7.0		
24	3X4	300			1.89						0.68			19.3					7.0						
34	4X6	300			4.96						1.17			50.6					11.9						
44	4X6	600			6.89						1.17			70.3					11.9						
JNO JNB JNO-H	15	3x4	150	150				1.96	1.27			1.96	0.68					20.0	13.0	20.0	7.0				
	25	3X4	300					1.96	1.96				0.68						20.0		20.0	7.0			
	35	4X6	300					5.10	4.24				1.17						52.0		43.2	11.9			
	45	4X6	600					6.89	6.89				1.17						70.3		70.3	11.9			
	16	3x4	150						1.27	0.55				0.68							13.0	5.6	7.0		
	26	3X4	300						1.96	1.96				0.68							20.0	20.0	7.0		
	36	4X6	300						4.24	2.82				1.17							43.2	28.8	11.9		
	46	4X6	600						6.89	5.68				1.17							70.3	58.0	11.9		
	37	4x6	300							3.51	1.48			1.17							35.8	15.1	11.9		
47	4x6	600						6.89	2.96		1.17						70.3	30.2	11.9						
JNO JNB	55	4x6	900	150				10.34	10.34			1.96	1.17					105.4	105.4	20.0	11.9				
	56		900					10.34	8.51													105.4	86.8		
	66		1500					10.34	10.34														105.4	105.4	
	57		900							10.34	4.48													105.4	45.7
	67		1500							10.34	7.44													105.4	75.9

*1 : Depending on a material, the ASME flange may be limited by ASME B16.5 (Pipe Flanges and Flanged Fittings).

TABLE 27

Valve Style	Valve Size(“)	Valve Dimensions (mm)					Approx. Weight (kg) Type A *2
		Center to Face		Used to find Bolt Length	Approx. Height		
		Inlet	Outlet		Cap Type		
E	P	A,B,G	A,B,G	C,D,E			
12, 13, 14, 15, 16	3x4	155.5	165.0	49	745	785	65
22, 23, 24, 25, 26	3x4	179.5	181.0	55	775	815	81
32, 33, 34, 35, 36, 37	4x6	179.5	203.0	58	790	835	97
42, 43, 44, 45, 46, 47	4x6	179.5	203.0	58	790	835	97
55, 56, 57, 66, 67	4x6	197.0	222.0	74	870	1005	110

*2: Weight of D or E cap increases by 10 kg.



M Orifice

(23.225 cm² Effective Area)

TABLE 28

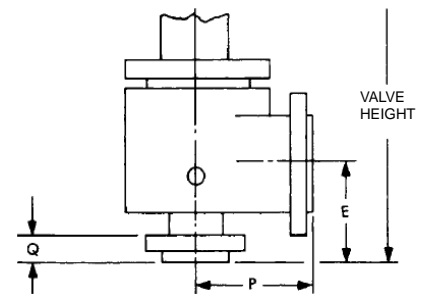
Valve Style	Valve Size(“)		Standard Connection ASME Flanges		Maximum Set Pressure (MPaG) *1							Back Pressure Limit(MPaG) @ Outlet 38°C		Maximum Set Pressure (kg/cm ² G) *1							Back Pressure Limit (kg/cm ² G) @ Outlet 38°C	
	Inlet X Outlet				Inlet Temperature (°C)									Inlet Temperature (°C)								
	Inlet	Outlet	-196 to -101	-100 to -60	-59 to -30	-29 to 38	232	427	538	JNO	JNB	-196 to -101	-100 to -60	-59 to -30	-29 to 38	232	427	538	JNO	JNB		
JNO JNB	4x6	150	150	1.89						1.89	0.55	19.3						19.3	5.6			
			300	1.89							0.55	19.3								5.6		
			300	3.61							1.10	36.9									11.3	
			600	4.13							1.10	42.1										11.3
			150	1.89							0.55		19.3									5.6
			300	1.89							0.55		19.3									5.6
JNO JNB JNO-H	4x6	150	150			1.89				1.96	0.55			19.3				20.0	5.6			
			300			1.89					0.55			19.3						5.6		
			300			4.96					1.10			50.6							11.3	
			600			7.58					1.10			77.3							11.3	
			150				1.96	1.27				0.55				20.0	13.0					5.6
			300				1.96	1.96				0.55				20.0	20.0					5.6
JNO JNB JNO-H	4x6	150	150							1.96	0.55							20.0	5.6			
			300								0.55									5.6		
			300					1.27	0.55			0.55					13.0		5.6		5.6	
			600					4.24	2.82			1.10					43.2		28.8		11.3	
			300									1.10					77.3		58.0		11.3	
			600									1.10										11.3
JNO JNB	4x6	150	900					7.58	7.58	1.96	1.10							20.0	11.3			
			900							7.58	4.48	1.10							77.3	45.7		

*1 : Depending on a material, the ASME flange may be limited by ASME B16.5 (Pipe Flanges and Flanged Fittings).

TABLE 29

Valve Style	Valve Size(“)	Valve Dimensions (mm)					Approx. Weight (kg) Type A *2
		Center to Face		Used to find Bolt Length	Approx. Height		
		Inlet	Outlet		Cap Type		
E	P	A,B,G	A,B,G	C,D,E			
12, 13, 14, 15, 16	4x6	178.0	184.0	55	750	795	81
22, 23, 24, 25, 26		178.0	184.0	55	805	850	95
32, 33, 34, 35, 36, 37		178.0	203.0	59	875	915	113
42, 43, 44, 45, 46, 47	4x6	197.0	222.0	65	945	1080	120
56, 57		197.0	222.0	65	945	1080	120

*2: Weight of D or E cap increases by 10 kg.



N Orifice

(27.999 cm² Effective Area)

TABLE 30

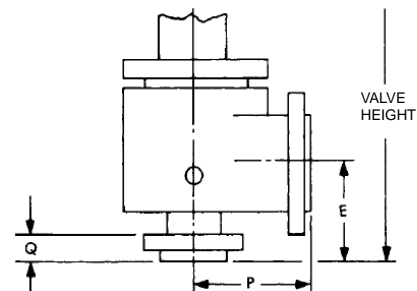
Valve Style	Valve Size(“)		Standard Connection ASME Flanges	Maximum Set Pressure (MPaG) *1									Back Pressure Limit(MPaG) @ Outlet 38°C	Maximum Set Pressure (kg/cm ² G) *1									Back Pressure Limit (kg/cm ² G) @ Outlet 38°C			
	Inlet X Outlet			Inlet Temperature (°C)										Inlet Temperature (°C)												
	Inlet	Outlet		-196 to -101	-100 to -60	-59 to -30	-29 to 38	232	427	538	JNO	JNB		-196 to -101	-100 to -60	-59 to -30	-29 to 38	232	427	538	JNO	JNB				
JNO JNB	12 22 32 42	4X6	150	150	1.89							1.89	0.55	19.3					19.3	5.6						
			300		1.89						0.55		19.3							5.6						
			300		3.10						1.10		31.6								11.3					
	600	3.44							1.10	35.1										11.3						
	13 23 33 43	4X6	150			1.89								0.55		19.3						0.55	19.3	5.6		
			300			1.89								0.55		19.3						1.10	31.6	5.6		
			300			3.10								1.10		35.1						1.10	35.1	11.3		
	14 24 34 44	4X6	150				1.89							0.55			19.3					0.55	19.3	5.6		
			300				1.89							0.55		19.3						1.10	31.6	5.6		
300					4.96						1.10		50.6					1.10	70.3	11.3						
600			6.89						1.10		70.3						1.10	70.3	11.3							
JNO JNB JNO-H	15 25 35 45	4x6	150	150				1.96	1.27			1.96	0.55				20.0	13.0		20.0	5.6					
			300					1.96	1.96					0.55				20.0	20.0			0.55	20.0	5.6		
			300					5.10	4.24					1.10				52.0	43.2			1.10	52.0	11.3		
	600						6.89	6.89					1.10				70.3	70.3			1.10	70.3	11.3			
	16 26 36 46		4x6		150					1.27	0.55				0.55						13.0	5.6		0.55	13.0	5.6
					300					1.96	1.96				0.55				20.0		20.0		0.55	20.0	5.6	
					300					4.24	2.82				1.10				43.2		28.8		1.10	43.2	11.3	
	600							6.89	5.68				1.10				70.3	58.0			1.10	70.3	11.3			
	37 47		4x6		300						3.51		1.48			1.10						35.8	15.1		1.10	35.8
600								6.89	2.96			1.10					70.3	30.2		1.10	70.3	11.3				

*1 : Depending on a material, the ASME flange may be limited by ASME B16.5 (Pipe Flanges and Flanged Fittings).

TABLE 31

Valve Style	Valve Size(“)	Valve Dimensions (mm)					Approx. Weight (kg) Type A *2
		Center to Face		Used to find Bolt Length	Approx. Height		
		Inlet	Outlet		Cap Type		
		E	P	A,B,G	A,B,G	C,D,E	
12, 13, 14, 15, 16 22, 23, 24, 25, 26	4x6	197.0	209.5	55	905	950	111
32, 33, 34, 35, 36, 37		197.0	209.5	55	905	950	111
42, 43, 44, 45, 46, 47		197.0	222.5	59	905	950	119

*2: Weight of D or E cap increases by 10 kg.



P Orifice

(41.161 cm² Effective Area)

TABLE 32

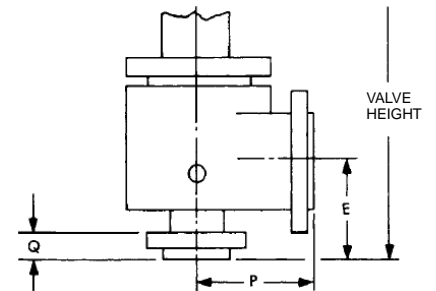
Valve Style	Valve Size(“)		Standard Connection ASME Flanges		Maximum Set Pressure (MPaG) *1							Back Pressure Limit(MPaG) @ Outlet 38°C		Maximum Set Pressure (kg/cm ² G) *1							Back Pressure Limit (kg/cm ² G) @ Outlet 38°C	
	Inlet X Outlet				Inlet Temperature (°C)									Inlet Temperature (°C)								
	Inlet	Outlet	-196 to -101	-100 to -60	-59 to -30	-29 to 38	232	427	538	JNO	JNB	-196 to -101	-100 to -60	-59 to -30	-29 to 38	232	427	538	JNO	JNB		
JNO JNB	12	4X6	150	150	1.20							0.55	12.3					19.3	5.6			
	22		300		1.20						1.89	0.55	12.3						19.3	5.6		
	32		300		2.06						1.03	0.55	12.3						19.3	5.6		
	42		600		3.30						1.03	1.03	21.0						36.9	10.5		
	13		150		1.20						1.03	0.55	12.3							19.3	5.6	
	23		300		1.20						1.03	0.55	12.3							19.3	5.6	
33	300	2.06						1.03	0.55	12.3							19.3	5.6				
43	600	3.30						1.03	1.03	21.0							36.9	10.5				
14	150	1.89							1.03	0.55			19.3				70.3	5.6				
24	300	1.89							1.03	0.55			19.3				70.3	5.6				
34	300	3.62							1.03	1.03			36.9				70.3	10.5				
44	600	6.89							1.03	1.03			70.3				30.2	10.5				
JNO JNB JNO-H	15	4x6	150	150				1.96	1.27			0.55						20.0	5.6			
	25		300					1.96	1.96		1.96	0.55						20.0	5.6			
	35		300					3.61	3.61		1.96	1.03						36.9	20.0			
	45		600					6.89	6.89		6.89	1.03						70.3	36.9			
	16		150		1.27	0.55						0.55							13.0	5.6		
	26		300		1.27	0.55					1.96	0.55							20.0	5.6		
36	300	3.61	1.03					2.82	1.03							36.9	28.8					
46	600	6.89	1.03					5.68	1.03							70.3	58.0					
37	300	3.51	1.03					1.48	1.03								35.8	15.1				
47	600	6.89	1.03					2.96	1.03								70.3	30.2				

*1 : Depending on a material, the ASME flange may be limited by ASME B16.5 (Pipe Flanges and Flanged Fittings).

TABLE 33

Valve Style	Valve Size(“)	Valve Dimensions (mm)					Approx. Weight (kg) Type A *2
		Center to Face		Used to find Bolt Length	Approx. Height		
		Inlet	Outlet		Cap Type		
E	P	A,B,G	A,B,G	C,D,E			
12, 13, 14, 15, 16 22, 23, 24, 25, 26	4x6	181.0	228.5	52	935	1050	115
32, 33, 34, 35, 36, 37		225.5	254.0	58	980	1095	122
42, 43, 44, 45, 46, 47		225.5	254.0	58	1030	1145	171

*2: Weight of D or E cap increases by 24 kg.



Q Orifice

(71.290 cm² Effective Area)

TABLE 34

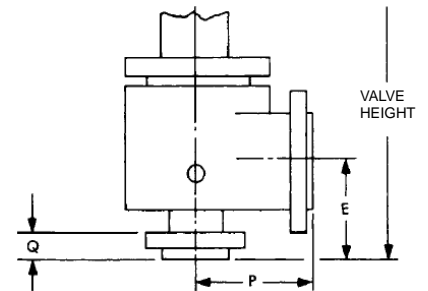
Valve Style	Valve Size(“)		Standard Connection ASME Flanges	Maximum Set Pressure (MPaG) *1									Back Pressure Limit(MPaG) @ Outlet 38°C	Maximum Set Pressure (kg/cm ² G) *1									Back Pressure Limit (kg/cm ² G) @ Outlet 38°C
	Inlet X Outlet			Inlet Temperature (°C)										Inlet Temperature (°C)									
	Inlet	Outlet		-196 to -101	-100 to -60	-59 to -30	-29 to 38	232	427	538	JNO	JNB		-196 to -101	-100 to -60	-59 to -30	-29 to 38	232	427	538	JNO	JNB	
JNO JNB	12 22 32 42	6x8	150	150	1.13							0.79	0.48	11.6					8.0	4.9			
			300		1.13						0.48		11.6					4.9					
			600		1.72						0.79		17.5					8.0					
	13 23 33 43	6x8	150			1.13								0.48		11.6							4.9
			300			1.13							0.48		11.6							4.9	
			600			1.72							0.79		17.5								8.0
	14 24 34 44	6x8	150				1.13							0.48			11.6						4.9
			300				1.13						0.48			11.6						4.9	
			600				2.06						0.79			21.0						8.0	
JNO JNB JNO-H	15 25 35 45	6x8	150	150				1.13	1.13			0.79	0.48				11.6	11.6		4.9			
			300					1.13	1.13				0.48			11.6	11.6		4.9				
			600					2.06	2.06				0.79			21.0	21.0		8.0				
	16 26 36 46	6x8	150						1.13	0.55				0.48				11.6	5.6		8.0		
			300						1.13	1.13			0.48			11.6	11.6		4.9				
			600						2.06	2.06			0.79			21.0	21.0		8.0				
	37 47	6x8	300							1.13	1.13			0.79					11.6	11.6		8.0	
			600								4.13		2.96		0.79				42.1	30.2		8.0	

*1 : Depending on a material, the ASME flange may be limited by ASME B16.5 (Pipe Flanges and Flanged Fittings).

TABLE 35

Valve Style	Valve Size(“)	Valve Dimensions (mm)					Approx. Weight (kg) Type A *2
		Center to Face		Used to find Bolt Length	Approx. Height		
		Inlet	Outlet		Cap Type		
		E	P	A,B,G	A,B,G	C,D,E	
12, 13, 14, 15, 16 22, 23, 24, 25, 26	6x8	239.5	241.5	57	1065	1180	220
32, 33, 34, 35, 36, 37		239.5	241.5	57	1065	1180	220
42, 43, 44, 45, 46, 47		239.5	241.5	68	1165	1280	260

*2: Weight of D or E cap increases by 24 kg.



R Orifice

(103.220 cm² Effective Area)

TABLE 36

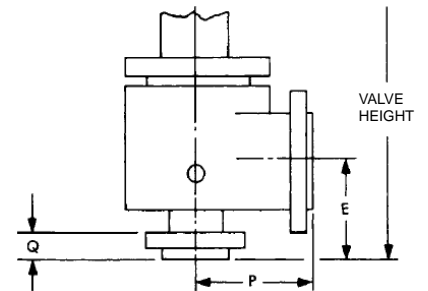
Valve Style	Valve Size(“)		Standard Connection ASME Flanges	Maximum Set Pressure (MPaG) *1									Back Pressure Limit(MPaG) @ Outlet 38°C		Maximum Set Pressure (kg/cm ² G) *1									Back Pressure Limit (kg/cm ² G) @ Outlet 38°C	
	Inlet X Outlet			Inlet Temperature (°C)											Inlet Temperature (°C)										
	Inlet	Outlet		-196 to -101	-100 to -60	-59 to -30	-29 to 38	232	427	538	JNO	JNB	-196 to -101	-100 to -60	-59 to -30	-29 to 38	232	427	538	JNO	JNB				
JNO JNB	12	6x8	150								0.41	0.41	3.8						4.2	4.2					
	22	6x8	300								0.41	0.41	3.8						4.2	4.2					
	32	6x10	300								0.68	0.68	10.5						7.0	7.0					
	42	6x10	600								0.68	0.68	14.0						7.0	7.0					
	13	6x8	150								0.41	0.41		3.8					4.2	4.2					
	23	6x8	300								0.41	0.41		3.8					4.2	4.2					
	33	6x10	300								0.68	0.68		10.5					7.0	7.0					
	43	6x10	600								0.68	0.68		14.0					7.0	7.0					
JNO JNB	14	6x8	150			0.68					0.41	0.41			7.0				4.2	4.2					
	24	6x8	300			0.68					0.41	0.41			7.0				4.2	4.2					
	34	6x10	300			1.58					0.68	0.68			16.1				7.0	7.0					
	44	6x10	600			2.06					0.68	0.68			21.0				7.0	7.0					
JNO JNB JNO-H	15	6x8	150				0.68	0.68			0.41	0.41			7.0	7.0			4.2	4.2					
	25	6x8	300				0.68	0.68			0.41	0.41			7.0	7.0			4.2	4.2					
	35	6x10	300				1.58	1.58			0.68	0.68			16.1	16.1			7.0	7.0					
	45	6x10	600				2.06	2.06			0.68	0.68			21.0	21.0			7.0	7.0					
	16	6x8	150					0.68	0.55		0.41	0.41				7.0	5.6		4.2	4.2					
	26	6x8	300					0.68	0.68		0.41	0.41				7.0	7.0		4.2	4.2					
	36	6x10	300					1.58	1.58		0.68	0.68				16.1	16.1		7.0	7.0					
	46	6x10	600					2.06	2.06		0.68	0.68				21.0	21.0		7.0	7.0					
37	6x8	300						0.68	0.68	0.41	0.41					7.0	7.0	4.2	4.2						
47	6x10	600						2.06	2.06	0.68	0.68					21.0	21.0	7.0	7.0						

*1 : Depending on a material, the ASME flange may be limited by ASME B16.5 (Pipe Flanges and Flanged Fittings).

TABLE 37

Valve Style	Valve Size(“)	Valve Dimensions (mm)					Approx. Weight (kg) Type A *2
		Center to Face		Used to find Bolt Length	Approx. Height		
		Inlet	Outlet		Cap Type		
E	P	A,B,G	A,B,G	C,D,E			
12, 13, 14, 15, 16	6x8	239.5	241.5	58	1205	1320	231
22, 23, 24, 25, 26, 37		239.5	266.5	68	1205	1320	250
32, 33, 34, 35, 36	6x10	239.5	266.5	68	1205	1320	250
42, 43, 44, 45, 46, 47	6x10	239.5	266.5	68	1205	1320	260

*2: Weight of D or E cap increases by 24 kg.



T Orifice

(167.740 cm² Effective Area)

TABLE 38

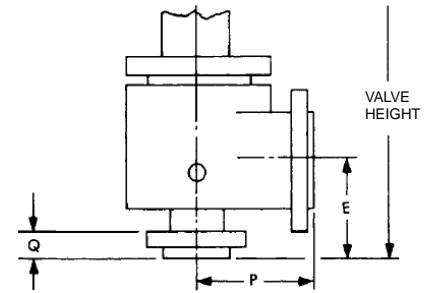
Valve Style	Valve Size(“)		Standard Connection ASME Flanges		Maximum Set Pressure (MPaG) *1							Back Pressure Limit(MPaG) @ Outlet 38°C		Maximum Set Pressure (kg/cm ² G) *1							Back Pressure Limit (kg/cm ² G) @ Outlet 38°C	
	Inlet X Outlet				Inlet Temperature (°C)									Inlet Temperature (°C)								
	Inlet	Outlet	-196 to -101	-100 to -60	-59 to -30	-29 to 38	232	427	538	JNO	JNB	-196 to -101	-100 to -60	-59 to -30	-29 to 38	232	427	538	JNO	JNB		
JNO JNB	12 22 32	8x10	150	150	0.34						0.20	0.20	3.5					2.1	2.1			
			300		0.34						0.20	0.20	3.5						2.1	2.1		
			300		0.44						0.41	0.41	4.5							4.2	4.2	
JNO JNB	13 23 33	8x10	150	150		0.34					0.20	0.20		3.5				2.1	2.1			
			300		0.34					0.20	0.20		3.5						2.1	2.1		
			300		0.44					0.41	0.41		4.5						4.2	4.2		
JNO JNB	14 24 34	8x10	150	150			0.44				0.20	0.20			4.5			2.1	2.1			
			300		0.44				0.20	0.20		4.5						2.1	2.1			
			300		0.82				0.41	0.41		8.4							4.2	4.2		
JNO JNB JNO-H	15 25 35 45	8x10	150	150				0.44	0.44		0.20	0.20				4.5	4.5	2.1	2.1			
			300					0.44	0.44		0.20	0.20				4.5	4.5	2.1	2.1			
			300					0.82	0.82		0.41	0.41				8.4	8.4		4.2	4.2		
JNO JNB JNO-H	16 26 36 46	8x10	150	150					0.44	0.44		0.20	0.20				4.5	4.5	2.1	2.1		
			300					0.44	0.44		0.20	0.20				4.5	4.5	2.1	2.1			
			300					0.82	0.82		0.41	0.41				8.4	8.4		4.2	4.2		
JNO JNB JNO-H	46 37	8x10	300	150					2.06	2.06		0.68	0.68				21.0	21.0	7.0	7.0		
			300							2.06	1.48		0.68	0.68				21.0	15.1	7.0	7.0	

*1 : Depending on a material, the ASME flange may be limited by ASME B16.5 (Pipe Flanges and Flanged Fittings).

TABLE 39

Valve Style	Valve Size(“)	Valve Dimensions (mm)					Approx. Weight (kg) Type A *2
		Center to Face		Used to find Bolt Length	Approx. Height		
		Inlet	Outlet		Cap Type		
E	P	A,B,G	A,B,G	C,D,E			
12, 13, 14, 15, 16 22, 23, 24, 25, 26	8x10	276.0	279.5	65	1410	1495	350
32, 33, 34, 35, 36, 37	8x10	276.0	279.5	65	1410	1495	380
45, 46	8x10	276.0	279.5	65	1410	1495	390

*2: Weight of D or E cap increases by 24 kg.



Seat tightness

Metal-to-Metal seat and soft seat

As system pressure approaches the valve set pressure, the differential force tending to hold the seats in contact is diminished. Consequently, to obtain an acceptable degree of tightness capability, the valve must be designed and built with a high level of quality.

MOTOYAMA pressure relief valves are carefully engineered and manufactures provide those features essential for good valve performance and continuous long term protection. The inherent high degree of seat tightness founded in MOTOYAMA pressure relief valves is possible due to the following design features.

1. Positive alignment of the seats through generous guiding and ball joints.
2. Minimum distortion as a result of full nozzle construction and thermally balanced disc design.
3. Excellent flatness and surface finish of the seating surfaces by precision machining and custom lapping.

Cleanliness of the system and proper installation of the valve are also essential for good seat tightness.

Definition

Ambiguous terms such as “bubble tight”, “drop tight”, “zero leakage” and “commercial tightness” have been used in the past. Since these terms were used without uniform definition, they lacked true practical meaning.

Now with the adoption of a standard that defines the terminology used to describe pressure relief devices (ASME PTC 25(2019)), and the adoption of a standard describing a method of determining seat tightness of relief valves (API standard 527(2014)), there should exist a degree of uniformity throughout the industry.

”Commercial” Seat Tightness Standard (API standard 527(2014))

The following API standard of “commercial”tightness has been adopted by industry and users in order to clarify testing methods and tightness standards for the sake of uniformity. It applies to pressure relief valves.

The API standard is as follows

① Scope

This standard describes a method of determining seat tightness of pressure relief valves as covered in *API standard 527 Seat Tightness of Pressure Relief Valves*. The maximum acceptable leakage rates are defined for commercial pressure relief valves with, metal-to-metal and soft seats for set pressures up to 41400kPaG (6000 psiG). If greater tightness is required it can be supplied but must be specified on the purchase order or inquiry. See page 8 for O-Ring soft seat.

② Test Apparatus

A typical test arrangement for determining seat tightness for pressure relief valves is shown in Fig.11. Leakage measurement shall be made with use of a 7.9 mm (5/16in) OD tubing with 0.89 mm (0.035in) wall. The tube end shall be cut square and smooth. The tube opening shall be 12.7 mm (1/2in) below the surface of the water. It shall be perpendicular to the surface of the water.

③ Procedure

With the valve mounted vertically, as shown in Fig.11, the leakage rate in bubbles per minute shall be determined with pressure at the valve inlet held at 90 % of the cold differential test pressure, except for valves set at 345 kPaG (50psiG) or below, in which case the pressure shall be held at 34.5 kPaG (5psiG) below the cold

differential test pressure.

The test pressure shall be applied for a minimum of 1 minute for valves of inlet sizes through 50 mm (2in); 2 minutes for sizes 65 mm, 80 mm, 100 mm (2-1/2in, 3in and 4in); 5 minutes for sizes 150 mm (6in) or larger. The valve shall then be observed for leakage for at least 1 minute. Air at approximately atmospheric temperature shall be used as the pressure medium.

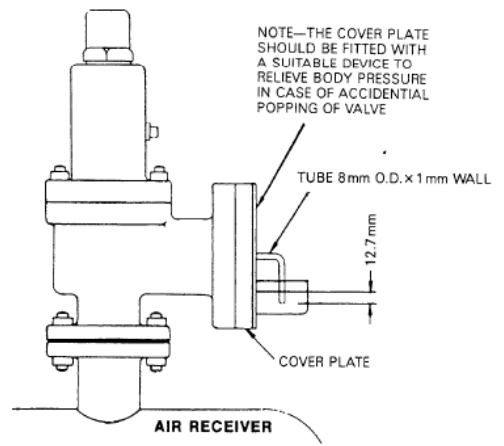


FIG.11

④ **Tightness standard**

The leakage rate in bubbles per minute shall not exceed the values indicated in Table 1 below. For soft seated valves there shall be zero bubbles for 1 minute.

Table 40 Maximum Seat Leakage Rate (Metal-to-Metal)

Set Pressure at 15.6°C (60F)	Orifice Diameter less than or equal to 18 mm (0.7in)		Orifice Diameter greater than 18 mm (0.7in)	
	Leakage Rate (Bubbles/ min.)	Approximate Leakage/24hr Standard m ³ (ft ³)	Leakage Rate (Bubbles/ min.)	Approximate Leakage/24hr Standard m ³ (ft ³)
103 to 6896 kPaG(15 to 1000psiG)	40	0.017 (0.6)	20	0.085 (0.3)
10300 kPaG(1500psiG)	60	0.026 (0.9)	30	0.013 (0.45)
13800 kPaG(2000psiG)	80	0.034 (1.2)	40	0.017 (0.6)
17200 kPaG(2500psiG)	100	0.043 (1.5)	50	0.021 (0.75)
20700 kPaG(3000psiG)	100	0.043 (1.5)	60	0.026 (0.9)
27600 kPaG(4000psiG)	100	0.043 (1.5)	80	0.034 (1.2)
34400 kPaG(5000psiG)	100	0.043 (1.5)	100	0.043 (1.5)
41400 kPaG(6000psiG)	100	0.043 (1.5)	100	0.043 (1.5)

MOTOYAMA Seat Tightness Standard- Water Service Valves (Style JLT)

MOTOYAMA pressure relief valves are checked for seat tightness by a quantitative seat leakage test. All of the test fluid passing through an assembled valve is collected and measured under the following test conditions:

1. The inlet pressure is adjusted to a test pressure which is 90% of the “Cold Differential Test Pressure”. Valves set below 345 kPaG (50psiG) are tested at 34.5 kPaG (5psiG) below the cold differential test pressure.
2. The seat leak pressure is maintained for a period of not less than 10 minutes.

Allowable Leak Rate

The maximum allowable leakage rate should not exceed 10cm³/hr. per inch of diameter of nominal valve inlet size. For nominal valve sizes of 25.4mm (1in.) or less the leakage rate shall not exceed 10cm³/hr. For soft seated valves there shall be zero leakage for 1 minute.

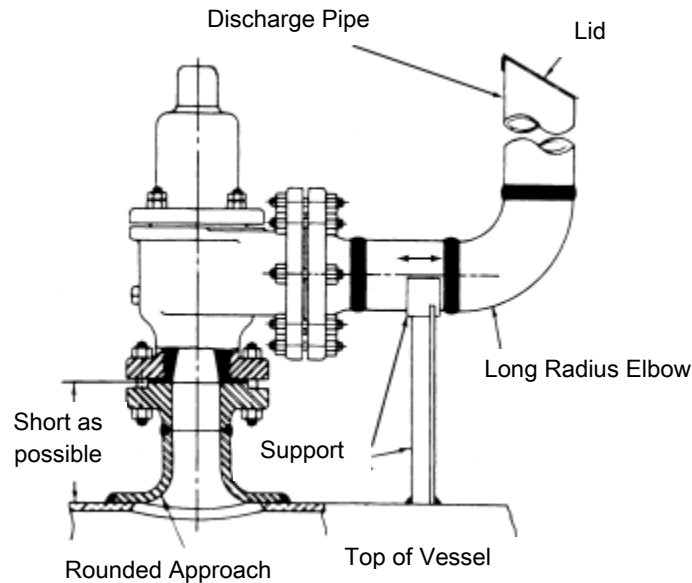
Valve installation

Pressure relief valves must be handled carefully and never subjected to sharp impact loads. Good installation of the PRV brings good popping or relieving function, seat tightness and performance.

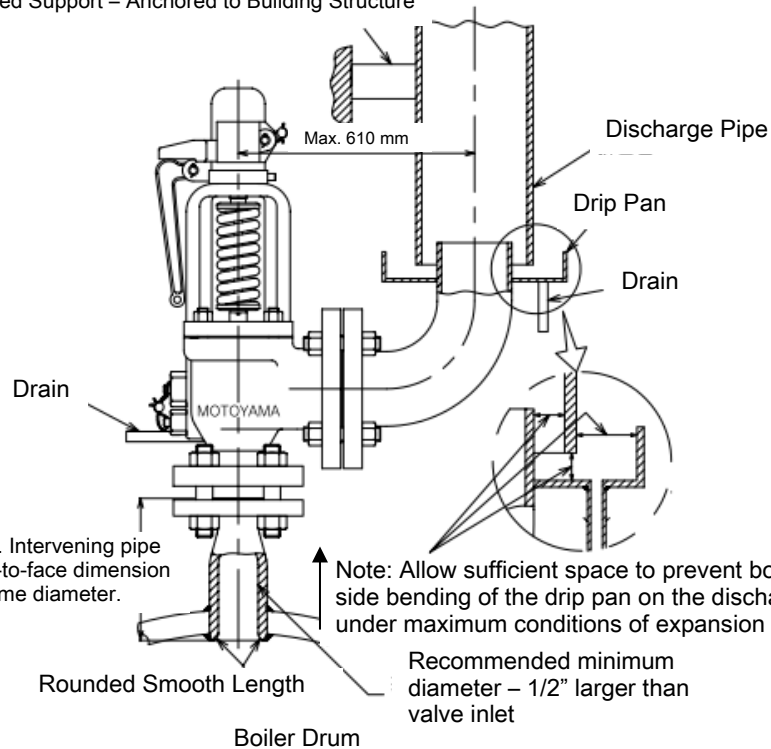
The following figures show examples of recommended installation for spring-loaded PRV to discharge atmosphere and the PRV should be mounted vertically in an upright position either directly on a nozzle from the pressure vessel or on a short connecting fitting that provides direct and unobstructed flow between the vessel and the PRV.

Installing the PRV on other position than this might adversely affect its operation. A PRV should never be installed on a fitting having a smaller inside diameter than the inlet connection of the valve.

Before installation of the PRV, both of the valve inlet and the vessel and/or line on which the PRV is mounted must be thoroughly cleaned of all foreign materials like dirt, spatters and scales etc. The inlet connection bolts or studs should be drawn down evenly to avoid straining the valve body with possible distortion of nozzle flange or base.



Fixed Support – Anchored to Building Structure



Attach as close as possible to the boiler. Intervening pipe and fitting shall not longer than the face-to-face dimension of the corresponding tee fitting of the same diameter.

(Partly quoted from PG-71.2, ASME SEC I)

Note: Allow sufficient space to prevent bottoming or side bending of the drip pan on the discharge pipe under maximum conditions of expansion

Recommended minimum diameter – 1/2” larger than valve inlet

FIG.12 Recommended Installation

Inlet Piping

Inlet piping connection attached to a vessel and/or system must have rounded approach and/or round smooth length at entrance of nozzles, fittings, adapter, and reducers between the vessel and/or the system and the pressure relief valve to make fluid flow through them smooth and stable.

For reference, the followings are examples of internal contours of inlet nozzles, fittings, adapter, and reducers between the vessel and/or the system and pressure relief valve which are recommended in ASME PTC 25 (2019)

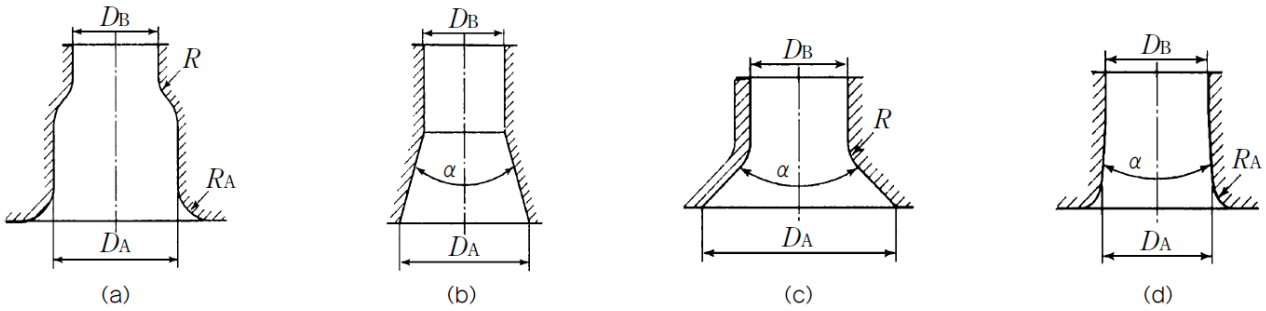


FIG.13 Recommended Internal Contours of Nozzles, Fittings, Adapter and Reducers between Test Vessel and Test Device (ASME PTC 25 (2019))

GENERAL NOTE: In no case shall the size of the fitting exceed the size of the connection on the vessel and/or the system.

- (a) If $D_B \geq 0.75 D_A$, then $R_A \geq 0.25 D_A$, If $D_B < 0.75 D_A$, then $R \geq 0.25 D_B$
- (b) If $\alpha \leq 30 \text{ deg.}$ and $D_B < 0.75 D_A$, break all edge
- (c) If $\alpha > 30 \text{ deg.}$ and $D_B < 0.75 D_A$ then $R \geq 0.25 D_B$
- (d) If $\alpha \leq 30 \text{ deg.}$ and $D_B \geq 0.75 D_A$, then $R_A \geq 0.25 D_A$

The pressure relief valve shall not be connected to the connecting pipe whose internal diameter is less than that of the PRV inlet or length is too long to get stable performance.

Pressure relief valves shall be connected vertically and directly to the nozzle of the pressure vessel or to the short pipe joint installed with preventing it from blocking any flow between the pressure vessel and the PRV in order to ensure the valve performance.

If the PRV could not be installed close to the vessel or should be installed on the radius elbow, larger size of piping than inlet size of the PRV, as shown in Fig. 14, should be connected to the PRV as close as possible.

To prevent the PRV from instability of action such as chattering, the total non-recoverable pressure loss between the protected equipment and the pressure-relief valve should not exceed 2% of the PRV set pressure.

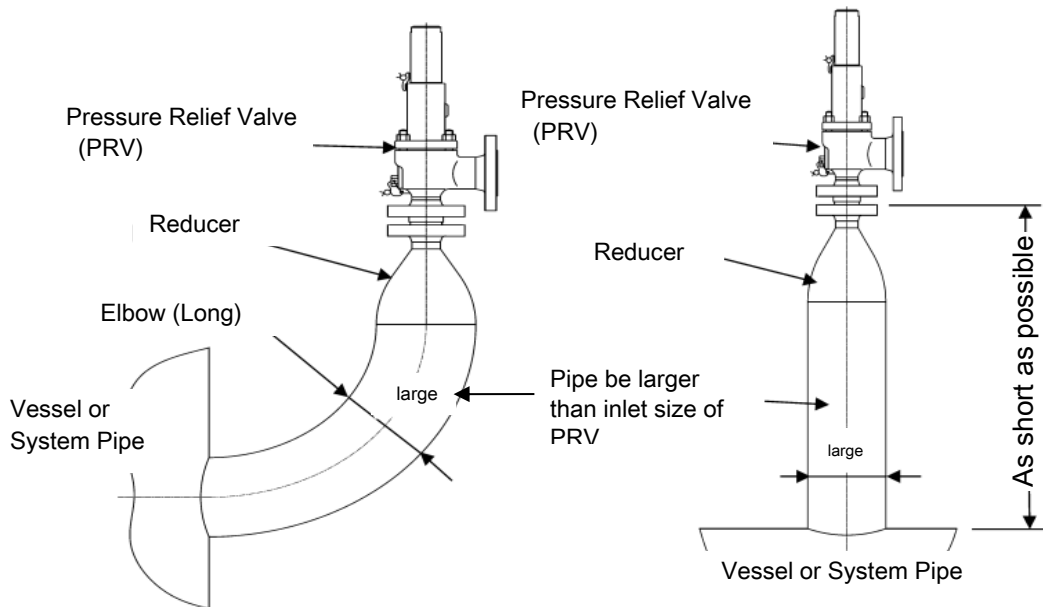


FIG.14 Example of Installation apart from Vessel and System

Discharge Piping

When discharge piping is applied to outlet of the PRV, improper installations like the followings are not allowed because it may cause excess stress on the piping and invasion of drain and/or rain, and increase built-up back-pressure to react when the PRV releases the pressure and the flow.

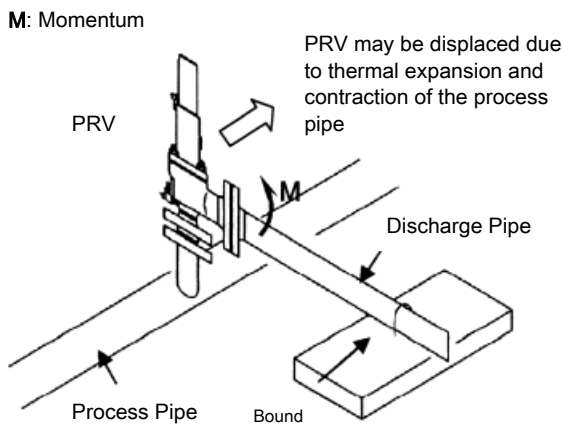
① Improper Piping Stress on Discharge Pipe

When installing the PRV, more care must be taken to prevent the PRV from an excessive stress on discharge piping. It may cause seat leakage and malfunction of the PRV. There are three (3) examples of problem caused by improper installation of discharge pipe and excessive stress.

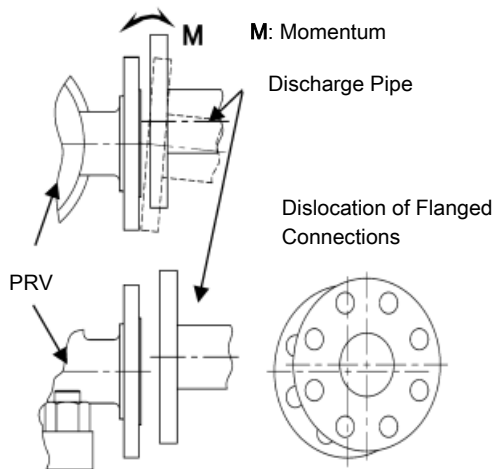
Example 1: If a discharge pipe is bound and fixed on a structure and there is difference in temperature between the process before operation and the process during operating, the discharge piping, during operation of the process, may expand and/or extend and contract and/or shorten, and the PRV may be displaced with it, which would cause excess stress on the piping.

Example 2: If a discharge pipe is connected to the PRV by force when positional deviation between flanged outlet of the PRV and flange of discharge pipe exists, improper piping stress would occur during operation of the system.

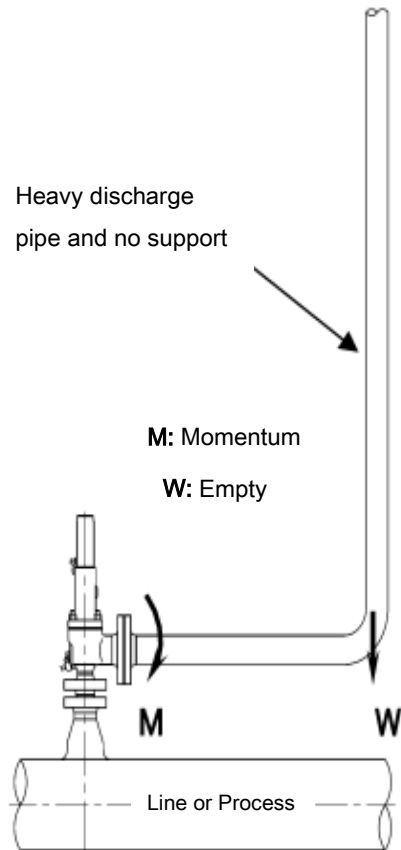
Example 3: If a discharge pipe with very long elbow without any support as shown left is attached to a PRV, the PRV could not hold the empty weight of the pipe itself and improper stress is added to connecting part, etc. It is said in BS Standard that allowable load of discharge pipe to the PRV is generally limited to sum of weight of short elbow and its flanged connection.



Example 1: Piping Stress Due to Thermal Expansion and Contraction



Example 2: Piping Stress Due to Dislocation of Piping



Example 3: Piping Stress Due to Empty Weight of Discharge Pipe without Support

FIG.15 Improper piping stress

② Built-Up Backpressure at Outlet of Pressure Relief Valve When Relieving

The effect of superimposed or built-up back pressure on the operating characteristics of the valves should be carefully examined. The discharge piping system should be designed so that the built-up backpressure caused by the flow through the valve under consideration does not reduce the capacity below that required of any PRV that can be relieved simultaneously. The discharge piping system of conventional PRV should be sized to limit the built-up backpressure to that allowed by API standard 520 part1(2020). Additionally, the effect of superimposed backpressure from other valves upon the set pressure should be considered.

It is advisable that the discharge pipe is to be independent and to have single disposal line in each PRVs. If multiple discharge pipes have to be connected to one header or disposal line, the header or disposal line have to be sized to have flowing capacity enough to cover the sum of maximum relieving capacities of PRVs that relieve simultaneously at overpressure contingency in the systems or vessels.

The use of angle entry to the header, for example, an entry at 45° or even 30° to the header axis, for laterals is much more common in relieving system than in most process-piping systems. The two main reasons for this approach are:

- low pressure drop (including velocity head losses), and
- reduced reaction forces.

Since laterals in relieving systems can often be sized at velocities approaching sonic, pressure losses or recoveries caused by velocity change can become a significant factor in system analysis. These resultant density changes can produce large reaction forces.

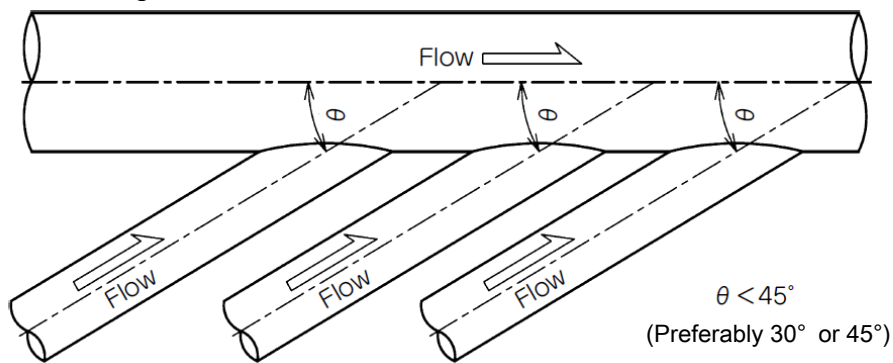


FIG.16 Example of Multiple Discharges Piping to Header

③ Protection against Drain and/or Rain Coming in

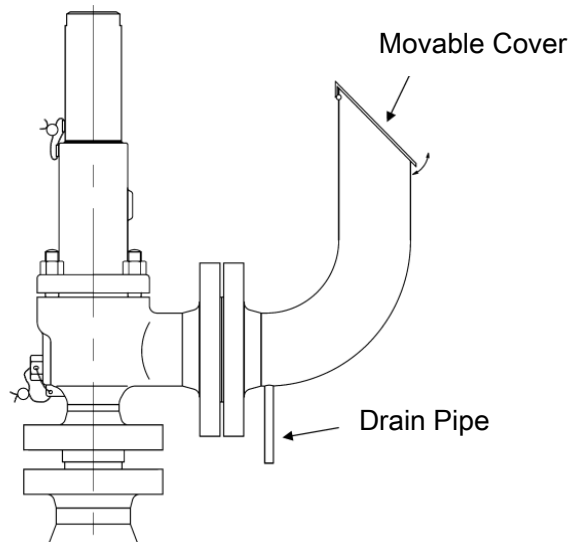


FIG.17 Example of Movable Cover and Drain Pipe

When there is possibility of drain and/or rain which will come in discharge pipe of the PRV, set movable cover on the top of the discharge pipe and drain pipe at bottom of the elbow. If drain and/or rain flow into the valve body and the valve seat is locally cooled down, it may cause leakage from valve seat with strain due to thermal expansion during vessel or system operation.

Ordering information

The primary purpose of Style JNO/JNB safety relief valves is to protect lives and property. In order to select the proper valve for your application, please provide the information listed below.

Details of the process fluid and conditions are especially important. If there is any doubt as to selection or application of valves or parts, please contact our International Sales Sect.

To replace a valve in service, the serial number, set pressure and previous order number should be specified.

Order for products

Ordering information	Example
Quantity	5
Nominal valve size (inlet x orifice x outlet)	4 x L x 6
Valve style	JNO-45
Inlet connection rating and facing	600 RF
Outlet connection rating and facing	150 RF
Service (liquid, gas or vapor)	Air
Set pressure	790 psiG
Back pressure if any, and whether constant or variable	atmosphere
Maximum service temperature	ambient 15°C
Cap or lifting lever type	Type C
Valve material	standard
Seat material	metal-to-metal standard
Code requirements	ASME Unfired Pressure Vessel Code Section VIII
Required capacity	1217 Nm ³ /min
Accumulation (allowable overpressure)	10 %
Molecular weight	-
Specific gravity	1.0
Viscosity	-

Order for renewal parts for the existing valve

To order parts, the following information should be included:

1. Quantity
2. Part name, i.e.(disc insert)
3. Size, style and valve number
4. Serial number (from valve nameplate)
5. Original purchase order number (if serial number has been destroyed)

Exchange of the spring

To order springs, the required valve set pressure must also be specified in addition to the above parts information.

On site acceptance inspection

When checking set pressure with test bench

Regarding the setting pressure check (popping test) by the test bench, the set pressure may not be confirmed because the capacity of the test bench is small. In that case, you will need to check the setting pressure by adjusting the set position of the nozzle ring.

When adjusting the setting position of the nozzle ring, it is necessary to release the sealed part in the set screw part.

Set position nozzle ring at shipment	Nozzle ring set position on test bench
<p>Rotate the nozzle ring to the right and raise it to the position where it hits the disc holder and lower it to the recommended ring position.</p>	<p>Rotate the nozzle ring to the right and raise it to the position where it hit the disc holder and lower 2 notches.</p>
<p>This set is the ring position at shipment and recommended setting position.</p> <p>In this case, since the gas supply capacity is small, the disc insert does not sufficiently lift up, so the set pressure is sure it may be difficult to recognize.</p>	<p>Because the clearance is narrow, you can temporarily lift the disc insert with a small amount of gas supply capacity.</p> <p>Note: If this nozzle ring position is used as it is, blowdown will not be performed reliably, causing chattering and damage to the parts.</p>
<p>After the test is completed, it is necessary to lower the set position of the nozzle ring to the specified position (the position of the shipment state). Also, please make sure to seal the set screw part.</p>	

TABLE 41

About blowdown (blowdown pressure)

At factory shipment, the ring position of the nozzle ring which adjusts the blowdown is shipped at the recommended ring position. The blowdown value is delivered depending on the fluid condition and the amount of fluid blown out used in the actual equipment, the piping and vessel capacity before and after the valve etc. It may differ from the design guarantee value stated in the written form and the inspection report.

Please be forewarned that if you need to adjust the blowdown, you will need to make adjustments with actual equipment.

OTHER PRODUCTS

Series 900 Thermal relief and small size



Please refer to MCJ/E-902

SIZE : 1/2" X 1"、3/4" X 1"、1" X 1"

ORIFICE AREA : 0.47cm²、0.709cm²

CONNECTION : Threaded (MNPT、FNPT)、

Flanged (ASME 150 to 2500)

TEMPERATURE : -196°C to +399°C (-320F to +750F)

JPV Pilot valves

SIZE : 1" D 2" to 8" T 10"

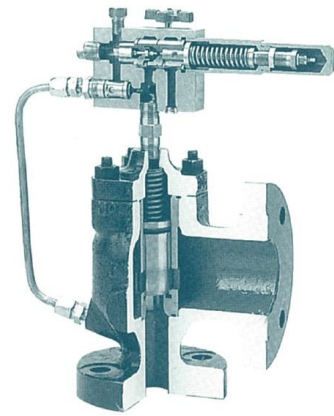
ORIFICE : D (0.709cm²) to T (167.740cm²)

CONNECTION : ASME 150 to 600

SET PRESSURE : 0.2MPaG to 10.2MPaG (30psiG to 1480psiG)

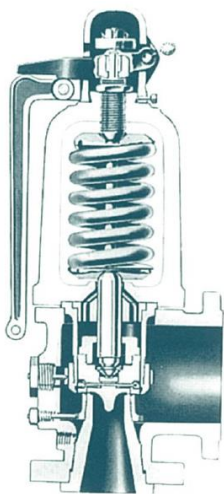
APPLICATION : GAS or VAPOR

TEMPERATURE : -40°C~+200°C (-40F to 392F)



Please refer to MC-C5112

Series H For Steam



Please refer to MCJ/E-C5014

SIZE : 1-1/2" F 2" to 8" T 10"

HS : Max. Pressure 6.18MPaG (900psiG)、

Max. Temperature 400°C (750F)

HSA : Max. Pressure 6.18MPaG (900psiG)、

Max. Temperature 550°C (1020F)

SIZE : 1-1/2" H 3" to 6" R 10"

HC : Max. Pressure 10.3MPaG (1500psiG)、

Max. Temperature 400°C (750F)

HCA : Max. Pressure 20.59MPaG (3000psiG)、

Max. Temperature 550°C (1020F)



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