GVK(KSF SERIES)
PRESSURE SAFETY VALVE

AUTOMATION & REGULATIANG VALVES

VMV®

AUTOMATION & REGULATING VALVES

Total Engineering Solution Service

GvK Limited

HEAD OFFICE

Techno Valley C-503, 236, Jubuto-ro,
Bupyeong-gu, Incheon, Republic of Korea

TEL +82-32-678-7972
FAX +82-32-678-7973
E-MAIL ican@gvkvalve.com

www.gvk.co.kr
www.gvkvalve.com

GvK Limited, founded in June 2020 by a leader with 38 years of experience, focuses on R&D while ensuring quality, price, and functionality through domestic production. The company offers Process Valves, Valve Equipment, and Total Engineering services for industries such as Gas, Refining, Petroleum, Power generation, Environment, and Water treatment. With a management team possessing 30-40 years of experience, GVK has developed numerous patents and adheres to quality standards like ISO 9001, 14001, 45001, and CE, ASME “U” & ”PP”, EAC. Recognized for its advanced automatic control valves, GVK also supplies a range of Control Valves globally through OEM and ODM partnerships.

Although Still In The Early Design And Manufacturing Stages, GVK Has Emerged As A Leading Company In Korea, Equipped With Skilled Personnel And Testing Capabilities.
The Company Aims To Lower Production Costs, Enhance Efficiency And Improve Quality While Accumulating Hyper-intelligence Valve Engineering (Hive) Technology.
GvK Limited Is Committed To Meeting Customer Needs With Competitive Pricing And High Value-added Services.

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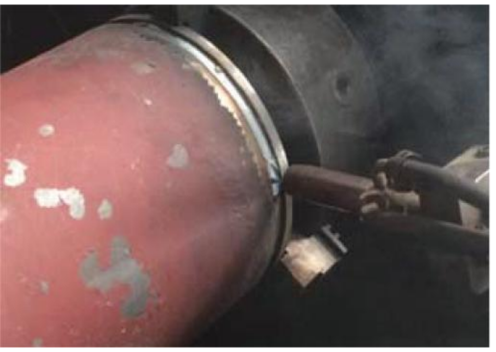

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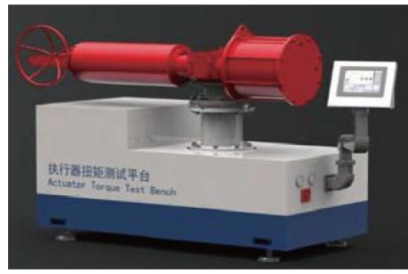


GLOBAL VISION KOREA

VMV®

Value MFG Valve

ACEFLOW

Valve Engineering

Mission

기초에 근거하여 원천 기술을 살리고 원천 기술을
극대화하여 세계 중심에 서는 것

To place oneself at the center of the global landscape by utilizing core groundbreaking technology and maximizing its capabilities.

Vision

우리는 옳은 일과 가치 있는 일에 주저함이 없이
최선을 다하고 실천하여 세계의 중심에 서자

Let us place ourselves at the forefront of the world by striving to do our best and confidently advocating for what is just and valuable.

Contents

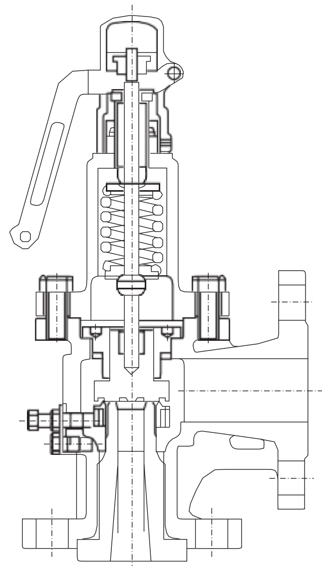
DESIGN FUNDAMENTALS

Introduction

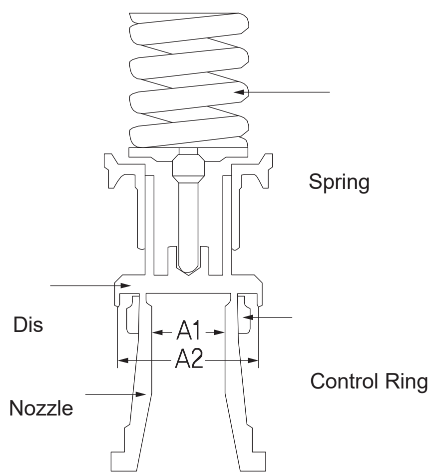
A pressure relief valve is a safety device designed to protect a pressurized vessel or system during an overpressure event. An overpressure event refers to any condition which would cause pressure in a vessel or system to increase beyond the specified design or maximum allowable working pressure. Since pressure relief valves are safety devices, there are many Codes and Regulations written to control their design and application. The purpose of this discussion is to familiarize you with the various parameters involved in the design of a pressure relief valve and provide brief introduction to some of the Codes and Standards which govern the design and use of pressure relief valves. Many electronic, pneumatic, and hydraulic systems exist today to control fluid system variables, such as pressure, temperature, and flow. Each of these system requires a power source of some type, such as electricity or compressed air in order to operate. A pressure relief valve must be capable of operating at all times, especially during a period of power failure when system controls are nonfunctional. The sole source of power for the pressure relief valve, therefore, is the process fluid. Once a condition occurs, which causes the pressure in a system or ressel to increase to a dangerous level, the pressure relief valve may be the only device remaining to prevent a catastrophic failure. Since reliability is directly related to the complexity of the device, it is important that the design of the pressure relief valve be as simple as possible. The pressure relief valve must open at a predetermined set pressure, flow a rated capacity at a specified overpressure, and shut off when the system pressure has returned to a safe level. Pressure relief valves must be designed with materials compatible with all process fluids from simple air and water to the most corrosive media. With means to derive maximum fluid capacity for a given pipe size, and with consistently smooth stable operation on all fluids and fluid phases.

Spring Loaded Design

The basic Spring Loaded pressure relief valve has been developed to meet the need for a simple, reliable system actuated device to provide overpressure protection. Figure 1 shows the construction of a spring loaded pressure relief valve. The valve consists of a valve inlet or nozzle mounted on the pressurized system, a disc held against the nozzle to prevent flow under normal system operating conditions, a spring to hold the disc closed, and a housing to contain the operating elements. The spring is adjustable the vary the pressure at which the valve will open. Figure 2 is a simple sketch showing the disc held in the closed position by the spring. When system pressure reaches the desired opening pressure. the force of pressure acting over Area A1 equals the force of spring and the disc will lift and allow fluid to flow out through the valve. When pressure in the system returns to a safe level, the valve will reclose. When a pressure relief valve begins to lift, the spring force increase. This means that system pressure must increase if lift is to continue. For this reason pressure relief valves are allowed an overpressure allowance to reach full lift. This allowable overpressure can vary from 3% for valves on fired vessels to 10% for valves on unfired systems. This margin is relatively small and some means must be provided to assist in the lift effort. Most pressure relief valves, therefore, have a secondary control chamber or huddling chamber to enhance lift. A typical configuration is shown in Figure 3. As the disc begins to lift. fluid enters the control chamber exposing a larger area of the disc to system pressure A2(Figure 2). This causes an incremental change in force which over compensates goes the increase in spring force and causes the valve to open at a rapid rate. At the same time, the direction of the fluid flow is reversed and the momentum effect resulting from the change in flow direction further enhances lift. These effects combine to allow the valve to achieve maximum lift and maximum flow within the allowable overpressure limits.

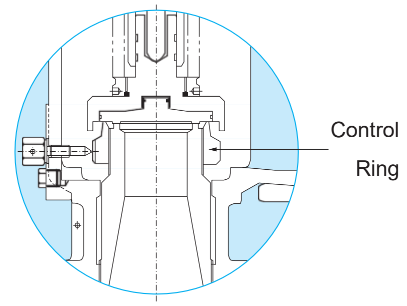


Spring Loaded Pressure Relief Valve
Figure 1



Valve Trim Diagram
Figure 2

Because of the larger disc Area A2(Figure 2) exposed to system pressure after the valve achieves lift, the valve will not shut off until system pressure has been reduced to some level below the set pressure. The design of the control Chamber determines where the shut off will occur. The difference between the set pressure and the shut off pressure is called blowdown and is usually expressed as a percentage of set pressure. The required blowdown can vary from 4% for valves on fired vessels to indeterminate values for valves on unfired systems. The design of the control or huddling chamber involves a series of design trade offs. If the design maximizes lift effort then blowdown will be long. If the design objective is to minimize blowdown, then the lift effort will be diminished. Many pressure relief valves are, therefore, equipped with a control ring which can be adjusted to vary the geometry of the control chamber to meet a particular system operating requirement(Figure 2 & 3). Compatibility with the process fluid is achieved by careful selection of materials of construction. Materials must be chosen with sufficient strength to withstand the pressure and temperature of the system fluid. Materials must also resist chemical attack by the process fluid and the local environment to insure valve function is not impaired over long periods of exposure. Bearing properties are carefully evaluated for parts with sliding surfaces and the ability to achieve a fine finish in the seating surfaces of the disc and nozzle is required for tight shut off.



Pressure Relief Valve Trim
Figure 3

Back Pressure Considerations

In the past, pressure relief valves were generally vented to atmosphere. As processes have become more sophisticated and the emission of hazardous materials has become a widespread concern, pressure relief valves are required to vent into closed systems. When valves are allowed to vent to atmosphere, the bonnet of the valve may be opened. This insures that pressure in the outlet of the valve is normally atmospheric and protects the spring from the harmful effects of high temperature fluid. With closed system applications, the bonnet must be totally enclosed. This introduces the possibility that back pressure will exist in the outlet of the valve. A review of the force balance on the disc(Figure 2) shows that the force of fluid pressure acting on the inlet side of the disc will be balanced by the force of the spring plus whatever pressure exists on the outlet side of the valve. If pressure in the valve outlet varies while the valve is closed, the valve set pressure will change. If back pressure varied while the valve is open and flowing, valve lift and flow rate through the valve can be affected. Care must be taken in the design and application of pressure relief valves to compensate for these variations by simply changing the disc insert in a matter of minutes with minimal conversion parts. Back pressure which may occur in the valve outlet system while the valve is closed is called static or superimposed back pressure. This back pressure may be a result of the valve outlet being connected to a normally pressurized system or may be caused by other pressure relief valves venting into a commo header. Compensation for superimposed back pressure which is constant may be provided by reducing the spring force. Under this condition the force of the spring plus back pressure acting on the disc would equal the force of the inlet set pressure acting to open the disc. It must be remembered, however, that the valve of the set pressure will vary directly with any change in back pressure. When superimposed back pressure is variable, a balanced bellows design is recommended. A typical balanced bellows style valve is shown in Figure 4. The bellows is designed with an effective pressure area equal to the seat area of the disc. The bonnet is vented to insure that the pressure area of the bellows will always be exposed to atmospheric pressure and to provide a tell-tale should the bellows begin to leak. Variations in back pressure, therefore, will have no effect on set pressure. Back pressure may, however, affet flow. Back pressure, which may occur after the valve is open and flowing, is called dynamic or built up back pressure. This type of back pressure may be caused by fluid flowing from the pressure relief valve into the downstream piping system. Developed back pressure will not affect the valve opening pressure, but may have an affect on valve lift and flow. Where developed back pressure is expected to exceed 10% of set pressure, a balanced bellows design is recommended.

Nozzle Type

The inlet construction of pressure valves is either a full nozzle or semi nozzle. In a full nozzle valve, only the nozzle and disc are exposed to the fluid media when the valve is closed. In a semi-nozzle valve the nozzle, disc, and part of the valve body are exposed to the inlet fluid when the valve is closed. Semi nozzles are usually welded into the body and cannot be easily removed.

Balanced Bellows

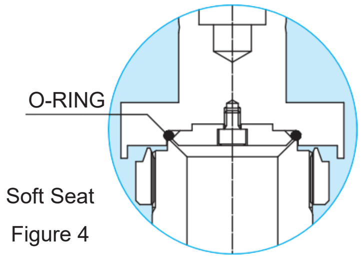
In addition to offsetting the effects of variable back pressure, the bellows acts to seal process fluid from escaping to atmosphere and isolates the spring, Bonnet, and guiding surface from contacting the process fluid. This is especially important for corrosive services.

Seat Leakage

Another important consideration in the design on a pressure relief valve is the ability to maintain tight shut off. Pressure relief valves are required to remain on systems for long periods of time under widely varying conditions of pressure and temperature. Seat leakage will result in continuous loss of system fluid and may cause progressive damage to the valve seating surfaces. Extreme leakage could result in premature opening of the valve. Allowable seat leakage limits for pressure relief valves are, therefore, many orders of magnitude more stringent than required for other types of valves. These extremes of tightness are achieved by close control of part alignment, optically flat seating surfaces, and careful selection of materials for each application. A diligent maintenance schedule must be carried out in the field to maintain the leak tight integrity of the valve, particularly on a system where the pressure relief valve is cycled often. For additional tightness, where system conditions permit, soft seat or elastomer seat construction may be employed. Must manufactures recommend that system operating pressure not exceed 90% of set pressure to achieve and maintain proper seat tight integrity.

Soft Seat

O- ring soft seat seals provide positive closure at service pressures closer to the set pressure than is possible with metal- to-metal seats assuring continuos, trouble-free service, and complete valve tightness after numerous pops.



Soft Seat
Figure 4

Code and Standard

Many Codes and Standards are published throughout the world which address the design and application of pressure relief valves. The most widely used and recognized of these is the ASME Boiler and Pressure Vessel Code, commonly called the ASME Code. Most Codes and Standards are voluntary which means that they are available for use by manufacturers and users and may be written into purchasing and construction specifications. The ASME Code is unique in the United States and Canada in that it has been adopted by the majority of sate and provincial legislatures and is mandated by law. The ASME Code provides rules for the design and construction of pressure vessels. Various sections of the Code cover fired vessels, nuclear vessels, unfired vessels, and additional subjects, such as, welding and nondestructive examination. Vessels manufactured in accordance with the ASME Code are required to have overpressure protection. The type and design of allowable overpressure protection devices is spelled out in detail in the Code. The ASME Code also provides specific rules governing the application of overpressure protection, determination of and allowable tolerance on set pressure, allowable overpressure, required blowdown, application of multiple valves, sizing for fire, requirements for materials of construction, and rules for installation. The most widely used pressure relief valve voluntary standards in the United States are published by the American Petroleum Institute(API). These Standards provide recommendations for pressure relief valve construction, sizing, installation, and maintenance. The API, more than any other body, has worked to standardize the ratings and size of pressure relief valves. API developed a series of inlet, orifice, outlet combinations for various flanged valve pressure classes which are utilized throughout the petroleum and process industry. These standard sizes are characterized by a series of fourteen(14) standard letter orifices ranging from D through T. Each letter refers to a specific effective orifice area. This orifice area is used in standard API formulations to calculate valve flow rate. The manufacturer is not required to produce a valve with a bore area equal to the effective area. Rather, he is obliged to produce a valve which will have a flow rate equal to or greater than that determined by the API formulation. Many other Standards are published which deal with the application and design of pressure relief valves peculiar to a specific industry. Additional Codes and Standards are written by various bodies throughout the world. A group is currently working within the International Standards Organization(ISO) to create an International Standard for pressure relief valve.

Sizing Pressure Relief Valve

The first step in applying overpressure protection to a vessel or system is to determine the set pressure allowable overpressure and required relieving capacity. The set pressure and allowable overpressure can be easily determined by reference to the operating pressure of the system and Code under which the system or vessel will be built and inspected. The most difficult task is in determining the required relieving capacity. The pressure relief valve must relieve a sufficient amount of fluid to insure that pressure in the vessel or system never exceeds the specified overpressure. This means that all possible sources and causes of overpressure must be evaluated. Some examples could be failure of a stop valve to close, control system failure, fire, pump failure, uncontrolled chemical reaction, vessel isolation, and many more. The worst case combination of these factors is used to determine the required capacity. Once these factors have been determined, the pressure relief valve is chosen so that the rated relieving capacity of the valve exceeds the required capacity derived from the worst case system failure analysis.

Summary

The purpose of this discussion has been to provide an introduction to some of the design considerations employed when designing a pressure relief valve and to the Codes and Standards which are employed in this industry to maintain a high level of product quality and reliability. More specific information may be found by referencing the ASME Code, various published Standards and by consulting literature published by the pressure relief valve manufactures. A key point to keep in mind is the pressure relief valve is a safety device employed to protect a pressure vessel or system from catastrophic failure. With this in mind, the application of pressure relief valves should be assigned only to fully trained personnel and rules provided by the governing Codes should be strictly complied with.

1. Scope

The Scope of this standard is to define pressure relief devices, their functional and operational characteristics, and to standardize the terminology covering such devices and their characteristics. These devices are intended to protect containers and equipment from abnormal internal or external pressure.

2. General

2.1 Pressure Relief Devices

A pressure relief devices is designed to open to prevent a rise of internal fluid pressure in excess of a specified valve due to exposure to emergency or abnormal conditions. It may also be a pressure relief valve, a non-reclosing pressure relief devices or a vacuum relief valve.

3. Type of Devices

3.1 Pressure Relief Valve

A pressure relief valve is a pressure relief device which is designed to reclose and prevent the further flow of fluid after normal conditions have been restored.

3.1-1 Safety Valve

A safety valve is a pressure relief valve actuated by inlet static pressure and characterized by rapid opening or pop action.

3.1-2 Relief Valve

A relief valve is a pressure relief valve actuated by inlet static pressure winch opens in proportion to the increase in pressure over the opening pressure.

3.1-3 Safety Relief Valve

A safety relief valve is a pressure relief valve characterized by rapid opening or pop action, or by opening in proportion to the increase in pressure over opening pressure, depending on application.

3.1-4 Conventional Safety Relief Valve

A safety relief valve is a pressure relief valve characterized by rapid opening or pop action, or by opening in proportion to the increase in pressure over opening pressure, depending on application.

3.1-5 Balanced Safety Relief Valve

A balanced safety relief valve incorporate means of minimizing the effect of back pressure on the operational characteristics(opening pressure, closing pressure and relieving capacity)

4. Parts of Pressure Relief Devices

4-1. Approach Channel

An approach channel is the passage through which the fluid must pass to reach the operating parts of a pressure relief device.

4-2. Discharge Channel

A discharge channel is the passage through which the fluid must pass beyond the operating parts of a pressure relief device.

4-3. Disc

A disc is the pressure containing movable element of a pressure relief valve which effects closure.

4-4. Lifting Device

A lifting device is a device for manually opening a pressure relief valve by the application of external force to lessen the spring loading which holds the valve closed.

4-5. Lifting Lever

See Lifting Device.

4-6. Nozzle

A nozzle is the pressure containing element which constitutes the inlet flow passage and includes the fixed portion of seat closure.

4-7. Seat

A seat is the pressure containing contact between the fixed and moving portions of the pressure containing elements of a valve.

5. Pressure Relief Valve Dimensional Characteristics

5-1. Actual Discharge Area
Actual discharge area is the measured minimum net area which determines the flow through a valve.

5-2. Bore Area
Bore area is the minimum cross sectional area of the nozzle.

5-3. Bore Diameter
Bore diameter is the minimum diameter of the nozzle.

5-4. Curtain Area
Curtain Area is the area of the cylindrical or conical discharge opening created between the seating surfaces by the lift of the disc above the seat.

5-5. Developed Lift
The developed lift is the actual travel of the disc from closed position to the position reached when the valve is at flow rating pressure.

5-6. Effective Discharge Area
Effective discharge area is a normal or computed area of flow through a pressure relief valve, differing from the actual discharge area, for use in recognized flow formulas to determine the capacity of a pressure relief valve.

5-6. Inlet Size
Effective discharge area is a normal or computed area of flow through a pressure relief valve, differing from the actual discharge area, for use in recognized flow formulas to determine the capacity of a pressure relief valve.

6. Operational Characteristics of Pressure Relief Valve

6-1. Back Pressure
Back pressure is the static pressure existing at the outlet of a pressure relief device due to pressure in the discharge system.

6-2. Blowdown
Blowdown is the difference between actual popping pressure of a pressure of a pressure relief valve and actual reseating pressure expressed as a percentage of set pressure units.

6-3. Blowdown Pressure
Blowdown pressure is the value of decreasing inlet static pressure at which no further discharge is detected at the outlet of a safety relief valve of the resilient disc type after the valve has been subjected to a pressure equal to or above the popping pressure.

6-4. Built-up Back Pressure
Built-up back pressure is pressure existing at the outlet of a pressure relief device occasioned by the flow through the particular device into a discharge system.

6-5. Closing Pressure
Closing pressure is the value of decreasing inlet static pressure at which the valve disc reestablished contact with the seat or at which lift becomes zero.

6-6. Coefficient of Discharge
Coefficient of discharge is the ratio of the measured relieving capacity to the theoretical relieving capacity.

6-7. Cold Differential Test Pressure
Cold differential test pressure is the inlet static pressure at which a pressure relief valve is adjusted to open on the test stand. This test pressure includes corrections for service condition of back pressure and or temperature.

6-8. Flow Rating Pressure
Flow rating pressure is the inlet static pressure at which the relieving capacity of a pressure relief device is measured for rating purposes.

6-9. Start-to-discharge Pressure
Start-to-discharge pressure is the value of increasing inlet static pressure at which the first bubble occurs when a safety relief valve of the resilient disc type is tested by means of air under a specified water seal on the outlet.

6-10. Leak Test Pressure
Leak test pressure is the specified inlet static pressure at which a quantitative seat leakage test is performed in accordance with a standard procedure.

6-11. Measured Relieving Capacity
Measured relieving capacity is the relieving capacity of a pressure relief device measured at the flow rating pressure, expressed in gravimetric or volumetric units.

6-12. Opening Pressure
Opening pressure is the value of increasing inlet static pressure of a pressure relief valve at which there is a measure lift, or at which the discharge becomes continuous as determined by seeing, feeling, or heating.

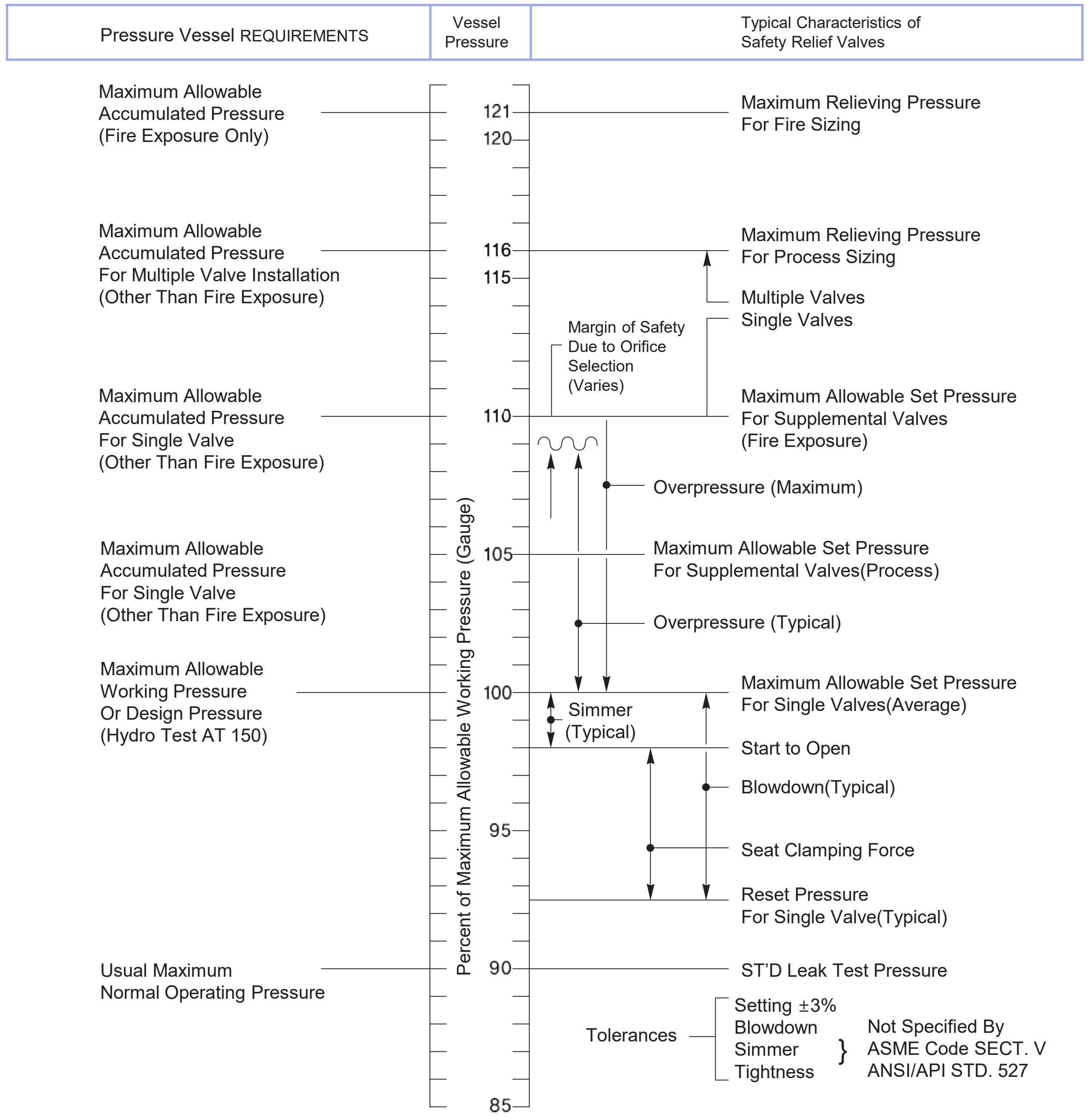
6-13. Overpressure
Overpressure is a pressure increase over the set pressure of a pressure relief valve, usually expressed as a percentage of a set pressure.

6-14. Popping Pressure
Popping pressure is the value of increasing inlet static pressure at which the disc moves in the opening direction at a faster rate as compared with corresponding movement at higher or lower pressures. It applies only to safety or safety relief valves on compressible fluid service.

6-15. Rated Relieving Capacity
Rated relieving capacity is that portion of the measured relieving capacity permitted by the applicable code or regulation to be used as a basis for the application of a pressure relief device.

6-16. Relieving Pressure
Relieving pressure is set pressure plus overpressure.

6-17. Set Pressure
Set pressure is the value of increasing inlet static pressure at which a pressure relief valve displays one of the operational characteristics as defined under opening pressure popping pressure or start-to- discharge pressure depending on service or as designated by the applicable code or regulation. It is one value of pressure stamped on the pressure relief valve.



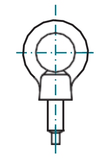
- Operating pressure may be any lower pressure required.

- Set pressure, and all ither values reted to it may be moved downward if operation pressure permits.

- This chart is in accordance with the requriements of the ASME Boiler and Pressure Vessel Code, Sect, VIII Div. 1 Pressure Vessels.

Numbering System

Model	Type	Lever	Use Condition
KSF – 8	Conventional	Yes	Steam, Air, Gas, Vapor
KSF – 8B	Bellows	Yes	Steam, Air, Gas, Vapor, Back Pressure
KSF – 10	Conventional	No	Steam, Air, Gas, Vapor, Liquid
KSF – 10B	Bellows	No	Steam, Air, Gas, Vapor, Liquid, Backpressure



K S F – 8 . 15A × D × 25A ASME 150# RF

Company Code
K : Korea Special Metal

Valve Name
S : Safety & Relief Valve

Connection Type
F : Flange Type

Valve Type
F8 : Lever
10 : No Lever
8B / 10B : Bellows

Inlet Size
15A ~ 300A

Orifice Code
See NOTE.1

Outlet Size
25A ~ 400A

Standard Code
ASME : American Society of Mechanical Engineers
KS : Korea Standard
JIS : Japanese Industrial Standard

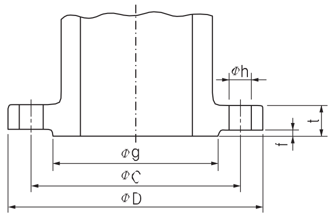
Pressure Class
ASME : 150# ~ 2500#
KS & JIS : 10K ~ 200K

Facing
RF : Raised Face
FF : Flat Face

Note. 1 / Orifice Code

(Unit : mm)

Code	D	e	f	g	h	j	k	l	m	n	p	q	r	t	v	w
Orifice	10	13	16	21	26	33	39	49	55	60	73	96	115	150	204	238



KS B 6216 Inlet Flange Dimension

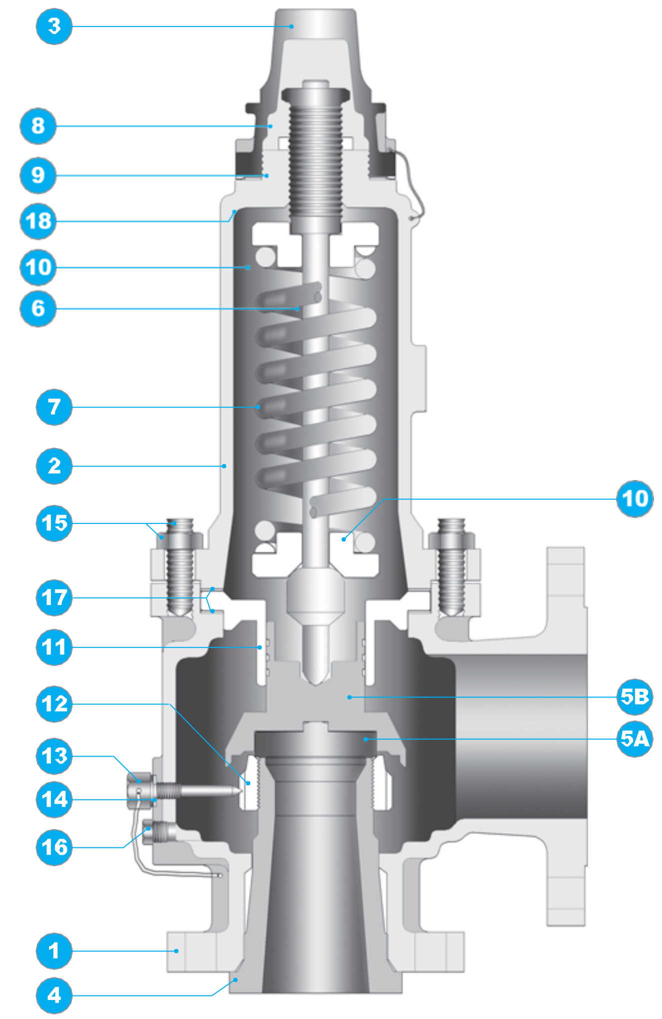
Nominal Pressure	Nominal Diameter	Flange				Bolt Hole			Bolt
		D	t (min)	f	g	C	Number	h	
10K	20	125	22	1	56	90	4	19	M16
	25	130	22	1	67	95	4	19	M16
	32	140	24	2	76	105	4	19	M16
	40	155	24	2	81	120	8	19	M16
	50	165	26	2	96	130	8	19	M16
	65	200	28	2	116	160	8	23	M20
	80	210	30	2	126	170	8	23	M20
	-90	225	30	2	136	185	8	23	M20
	100	245	32	2	151	205	8	23	M20
	125	280	34	2	182	235	12	25	M22
	150	325	36	2	212	280	12	25	M22
	200	385	38	2	262	335	12	27	M24
20K	20	130	22	1	56	95	4	19	M16
	25	135	22	1	67	100	4	19	M16
	32	160	24	2	76	120	4	23	M20
	40	165	24	2	81	130	8	19	M16
	50	185	26	2	96	145	8	23	M20
	65	210	30	2	116	170	8	23	M20
	80	230	32	2	132	185	8	25	M22
	-90	240	34	2	145	195	8	25	M22
	100	265	36	2	160	220	8	25	M22
	125	290	38	2	195	245	12	25	M22
	150	350	42	2	230	300	12	27	M24
	200	410	46	2	275	350	12	33	M30
30K	20	130	24	1	60	95	4	19	M16
	25	135	24	1	70	100	4	19	M16
	32	160	26	2	80	120	4	23	M20
	40	165	28	2	90	130	8	19	M16
	50	185	30	2	105	145	8	23	M20
	65	210	34	2	130	170	8	23	M20
	80	230	36	2	140	185	8	25	M22
	-90	250	38	2	150	205	8	25	M22
	100	285	40	2	160	235	8	27	M24
	125	315	44	2	195	265	12	27	M24
	150	375	48	2	235	315	12	33	M30
	200	435	54	2	280	370	12	36	M33
45K	20	140	30	1	60	100	4	23	M20
	25	150	30	1	65	110	4	23	M20
	32	175	34	2	75	130	4	25	M22
	40	185	36	2	90	145	8	23	M20
	50	205	38	2	100	160	8	25	M22
	65	230	42	2	120	185	8	25	M22
	80	255	44	2	130	205	8	27	M24
	-90	270	46	2	145	220	8	27	M24
	100	310	50	2	165	250	8	33	M30
	-115	325	52	2	175	265	8	33	M30
	125	335	54	2	195	275	12	33	M30
	150	400	58	2	235	335	12	33	M30
	200	460	66	2	285	390	12	39	M36
65K	20	149	40	6	51	101.5	4	25	M22
	25	159	40	6	63	111	4	25	M22
	32	178	46	6	73	124	4	27	M24
	40	216	52	6	92	165	8	25	M22
	50	244	56	6	105	190.5	8	27	M24
	65	267	62	6	127	203	8	33	M30
	80	311	68	6	157	241.5	8	33	M30
	-90	311	68	6	157	241.5	8	33	M30
	100	375	86	6	186	292	8	39	M36
	-115	375	86	6	186	292	8	39	M36
	125	394	96	6	216	317.5	12	39	M36
	150	483	105	6	270	393.5	12	46	M42
	200	584	121	6	324	482.5	12	52	M48

(Unit : mm)

Remark : The nominal diameter within ( ) shall not be used, if possible.

KSF – 10

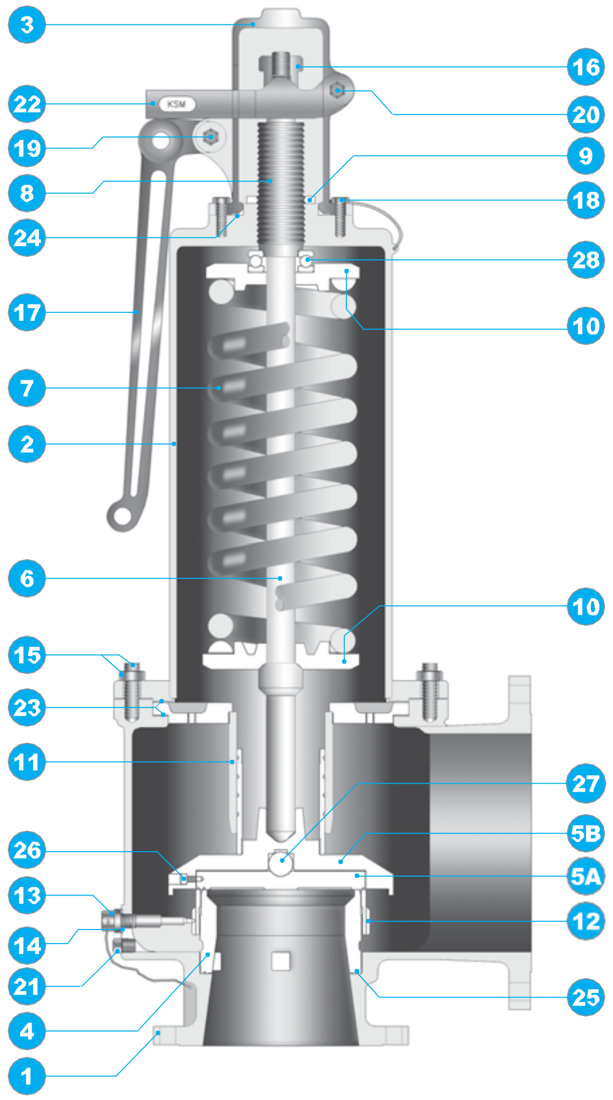
Size 1/2" (15A) ~ 8"(200A)



No.	Part Name	Standard Material
1	Body	Ductile
		Carbon steel stainless steel
2	Bonnet	Ductile
		Carbon steel stainless steel
3	Cap	Carbon steel
		Stainless steel
4	Seat	Stainless steel
5A	Disc	Stainless steel
5B	Disc holder	Stainless steel
6	Spindle	Carbon steel
		Stainless steel
7	Spring	Carbon steel
		Stainless steel high. Temp. Alloy
8	Adj. Screw	Bronze
		Carbon steel stainless steel
9	Adj. Screw lock n ut	Bronze carbon steel
		Stainless steel
10	Spring guide	Carbon steel
		Stainless steel
11	Disc guide	Brass
		Stainless steel
12	Blow down ring	Brass
		Stainless steel
13	Lock bolt	Carbon steel
		Stainless steel
14	Gasket	Non-asbestos
		Ptfe graphite
15	Stud. Bolts & nuts	Carbon steel
		Stainless steel
16	Drain plug	Brass
		Carbon steel stainless steel
17	Gasket	Non-asbestos
		Ptfe graphite
18	Gasket	Non-asbestos
		Ptfe graphite

KSF Series Semi Nozzle Type

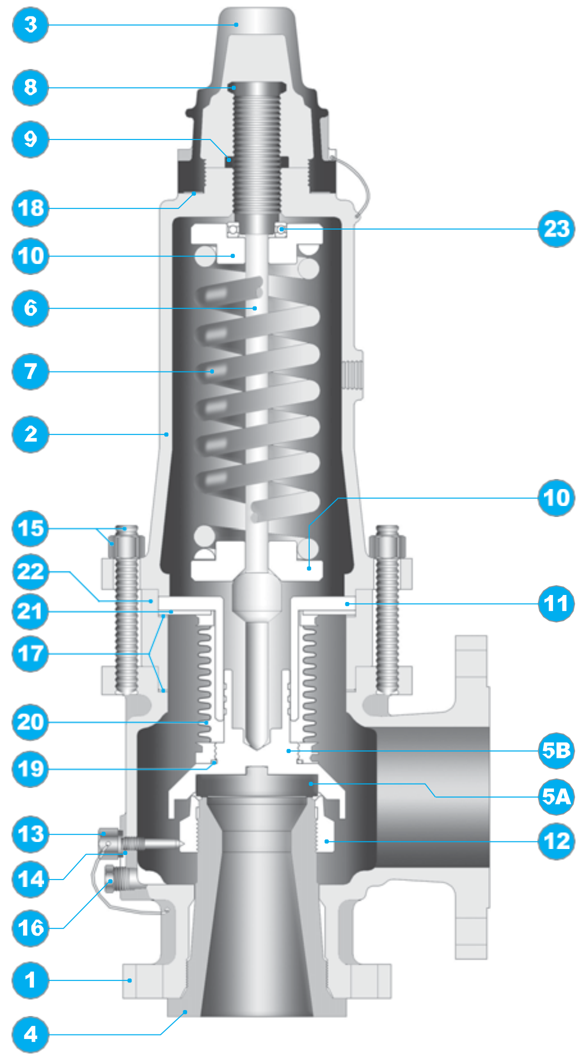
Size 10" (250A) ~ 20"(500A)



No.	Part Name	Standard Material
1	Body	Carbon steel
		Stainless steel
2	Bonnet	Carbon steel
		Stainless steel
3	Cap	Ductile
		Carbon steel stainless steel
4	Seat	Stainless steel
5a	Disc	Stainless steel
5b	Disc holder	Stainless steel
6	Spindle	Carbon steel
		Stainless steel
7	Spring	Carbon steel
		Stainless steel high. Temp. Alloy
8	Adj. Screw	Bronze
		Carbon steel stainless steel
9	Adj. Screw lock n ut	Bronze carbon steel
		Stainless steel
10	Spring guide	Carbon steel
		Stainless steel
11	Disc guide	Stainless steel
12	Blow down ring	Stainless steel
13	Lock bolt	Carbon steel
		Stainless steel
14	Gasket	Non-asbestos
		PTFE graphite
15	Stud. Bolts & nut s	Carbon steel
		Stainless steel
16	Lifting washer	Carbon steel
17	Lever	Ductile
18	Hex. Bolts	Carbon steel
		Stainless steel
19	Hex. Bolt & nut	Carbon steel
20	Hex. Bolt & nut	Carbon steel
21	Drain plug	Carbon steel
		Stainless steel
22	Fork lever	Ductile
23	Gasket	Non-asbestos
		PTFE graphite
24	Gasket	Non-asbestos
		PTFE graphite
25	O-ring	Viton
26	Wrench bolts	Stainless steel
27	Ball	Stainless steel
28	Bearing	Stainless steel

KSF Series Bellows Type

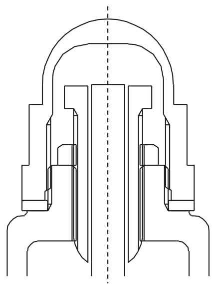
Size 1" (25A) ~ 8"(200A)



No.	Part Name	Standard Material
1	Body	Carbon steel
		Stainless steel
2	Bonnet	Carbon steel
		Stainless steel
3	Cap	Carbon steel
		Stainless steel
4	Seat	Stainless steel
5a	Disc	Stainless steel
5b	Disc holder	Stainless steel
6	Spindle	Carbon steel
		Stainless steel
7	Spring	Carbon steel
		Stainless steel high. Temp. Alloy
8	Adj. Screw	Carbon steel
		Stainless steel
9	Adj. Screw lock n ut	Carbon steel stainless steel
10	Spring guide	Carbon steel
		Stainless steel
11	Disc guide	Brass
		Stainless steel
12	Blow down ring	Brass
		Stainless steel
13	Lock bolt	Carbon steel
		Stainless steel
14	Gasket	Non-asbestos
		PTFE graphite
15	Stud. Bolts & nuts	Carbon steel
		Stainless steel
16	Drain plug	Brass
		Carbon stee stainless steel
17	Gasket	Non-asbestos
		PTFE graphite
18	Gasket	Non-asbestos
		PTFE graphite
19	Gasket	Viton
		Kalrez
20	Bellows	Stainless steel
21	Plate	Stainless steel
22	Middle guide	Carbon steel
		Stainless steel
23	Bearing	Stainless steel

Screwed Cap Type

Standard

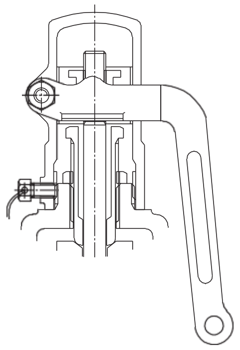


Screwed Cap and Test Gag Type

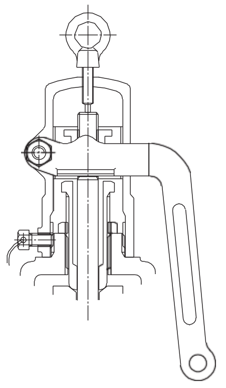
This test gag is handly for use in hydraulicstatic test. Replace with a plug and gasket after the test, otherwise the valve will not operate there by creating a dangerous situation.

Open Lever Type

This is used when hermetic sealing is not required. (with most uses for steam and air.)

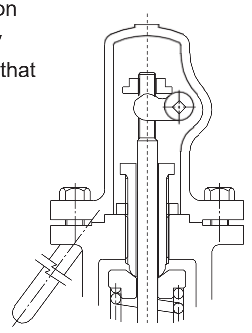


Open Lever and Test Gag Type

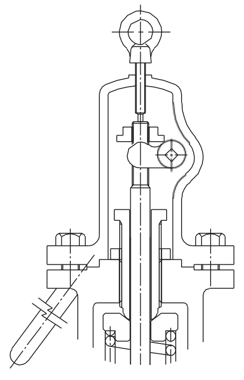


Packed Lever

For services where tightness on the discharge side is necessary and where conditions are such that periodic testing is desirable.

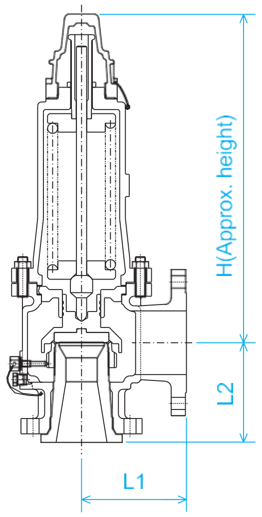


Packed Lever and Test Gag

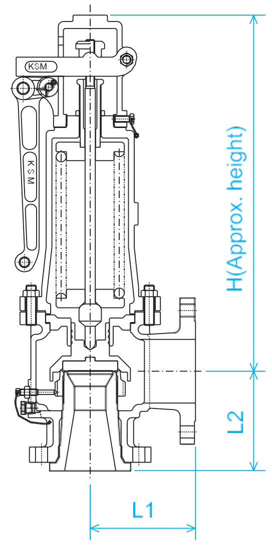


Application : Conventional Type

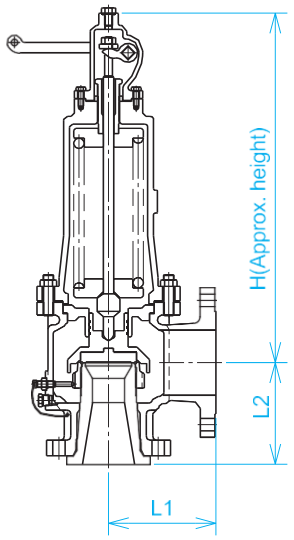
KSF - 10



KSF - 8



KSF – 10P



(Unit : mm)

Size Inlet x Orifice Dia. x Outlet	Orifice Code	Center to face L1	L2	Approx. Height H KSF-10	KSF-8	KSF-10P	Approx. Weight (kg)
1/2" x 10 x 1"	D	96	92	194	196	254	6
3/4" x 10 x 1"	D	96	92	194	196	254	7
1" x 10 x 2"	D	114	105	228	246	280	12
1" x 13 x 2"	E	114	105	228	246	280	13
1" x 19" x 1.1/2"	*	114	105	228	246	280	13
1.1/4" x 24 x 2"	*	125	127	277	311	-	14
1.1/2" x 16 x 2"	F	121	124	304	333	364	20
1.1/2" x 21 x 2.1/2"	G	121	124	304	333	364	22
1.1/2" x 30 x 2.1/2"	*	121	124	304	333	364	22
1.1/2" x 26 x 3"	H	121	124	304	333	364	23
2" x 33 x 3"	J	124	137	340	369	400	28
2" x 38 x 3"	*	124	137	340	369	400	30
2.1/2" x 49 x 4"	L	169	153	490	562	538	57
3" x 39 x 4"	K	165	156	490	562	538	61
3" x 49 x 4"	L	165	156	490	562	538	56
3" x 61 x 4"	*	165	156	490	562	538	63
4" x 55 x 6"	M	184	178	625	668	738	85
4" x 60 x 6"	N	210	197	625	668	738	90
4" x 73 x 6"	P	210	197	625	668	738	100
5" x 95 x 8"	*	241	248	723	770	748	173
6" x 96 x 8"	Q	241	240	780	841	820	180
6" x 115 x 8"	R	241	240	780	841	820	200
8" x 150 x 10"	T	279	276	880	942	920	260

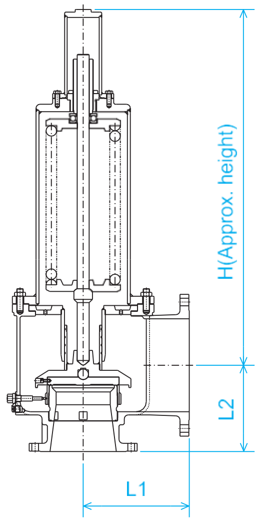
1) * : Special orifice area

2) Center to face tolerance : ±1.5mm for valve inlet sizes up to and including 4"
±3mm for valve inlet sizes larger than 4"

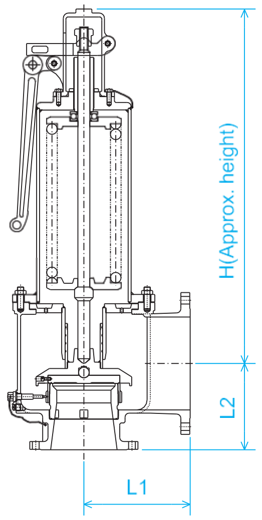
3) For inlet flange rating lager than 300 LBS may be change the dimension of center to face.

Application : Semi Nozzle Type

KSF - 10



KSF - 8



(Unit : mm)

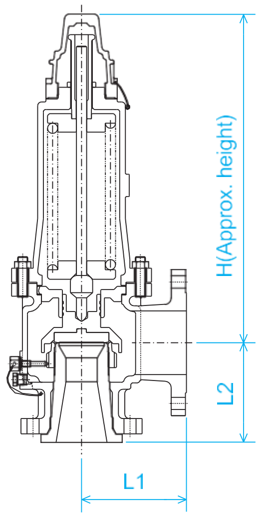
Size	Orifice Code	Set Pressure Limit (kgf/ cm² g)	Center	To face	Approx. Height		Approx. Weight
Inlet x Orifice Dia. x Outlet			L1	L2	H		(kg)
					KSF-10	KSF-8	
10" x 204 x 14"	V	7	400	325	1340	1335	600
12" x 238 x 16"	W	7	400	375	1360	1355	650
14" x 278 x 18"	Y	7	500	400	1460	1455	750
16" x 292 x 18"	Z	7	500	425	1485	1480	850
18" x 357 x 24"	A	7	630	500	1765	1760	1500
20" x 397 x 24"	B	6	630	500	1935	1930	1800

1) Center to face tolerance : ±3mm

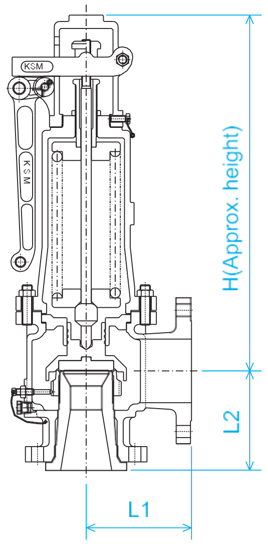
2) Inlet/outlet flange rating standard : ASME 150 LBS

Application : Bellows Type

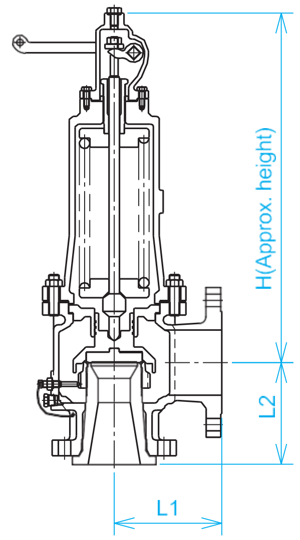
KSF – 10B



KSF – 8B



KSF – 10BP



(Unit : mm)

Size	Orifice Code	Center to Face		Approx. Height			Approx. Weight (kg)
Inlet x Orifice Dia. x Outlet		L1	L2	H			
				KSF-10B	KSF-8B	KSF-10BP	
3/4" x 10 x 1	D	96	92	226	228	287	10
1" x 10 x 2"	D	114	105	265	283	322	13
1" x 13 x 2"	E	114	105	265	283	322	14
1.1/2" x 16 x 2"	F	121	124	334	363	396	21
1.1/2" x 21 x 2.1/2"	G	121	124	334	363	396	24
1.1/2" x 26 x 3"	H	121	124	334	363	396	28
2" x 33 x 3"	J	124	137	393	422	455	35
3" x 39 x 4"	K	165	156	539	612	587	67
3" x 49 x 4"	L	165	156	539	612	587	63
4" x 55 x 6"	M	184	178	648	691	761	95
4" x 60 x 6"	N	210	197	648	691	761	100
4" x 73 x 6"	P	210	197	648	691	761	120
6" x 96 x 8"	Q	241	240	780	841	820	190
6" x 115 x 8"	R	241	240	780	841	820	210
8" x 150 x 10"	T	279	276	895	957	935	280

1) Center to face tolerance : ±1.5mm for valve inlet sizes up to and including 4"
±3mm for valve inlet sizes larger than 4"

2) For inlet flange rating lager than 300 LBS may be change the dimension of center to face.

Standard in the Firm

Materials			Type	Valve size	KSB6216 OR KSB1511 Flange Rating Raised Race	
Body & Bonnet	Seat & Disc	Spring		Inlet x orifice dia. x Outlet	Inlet	Outlet
Ductile	Stainless Steel	Carbon Steel	KSF-8			
Casting Steel			KSF-10			
Forged Steel				15A x10 x25A	10	10
				20A x 10 x 25A	10	10
				25A x 19 x40A	10	10
				40A x 30 x 65A	10	10
				50A x 38 x 80A	10	10
				65A x 49 x 100A	10	10
				80A x 61 x 100A	10	10
				100A x 73 x 150A	10	10
				125A x 95 x 200A	10	10
				150A x 115 x 200A	10	10
				200A x 150 x250A	10	10
Casting Steel	Stainless Steel	Carbon Steel	KSF-8			
Forged Steel			KSF-10			
				15A x10 x 25A	20, 30	10
				20A x10 x 25A	20, 30	10
				25A x19 x 40A	20, 30	10
				40A x30 x 65A	20, 30	10
				50A x 38 x 80A	20, 30	10
				65A x 49 x 100A	20, 30	10
				80A x 61 x 100A	20, 30	10
				100A x 73 x 150A	20, 30	10
				125A x 95 x 200A	20, 30	10
				150A x115 x 200A	20, 30	10
				200A x 150 x 250A	20, 30	10

(Orifice D Area) 0.11 in^2, 0.710㎠

0.785㎠ KSM actual area

Materials		Type	Valve Size	ASME Flange Rating Raised Face		Maximum Press (kgf/cm^2g)	
						Inlet Temperature Range	
Body & bonnet	Spring		Inlet x Orifice x Outlet	Inlet	Outlet	-28.9℃ to 232℃	315℃
Carbon Steel	Carbon Steel Stainless Steel	KSF-8 KSF-10	1" x D x 2"	150	150	20.0	13.0
			1" x D x 2"	300	150	40.0	20.0
Stainless Steel	Carbon Steel Stainless Steel	KSF-8 KSF-10	1" x D x 2"	150	150	13.0	5.6
			1" x D x 2"	300	150	40.0	20.0
Carbon Steel	Carbon Steel Stainless Steel	KSF-8 KSF-10	3/4" x D x 1"	150	150	16.0	13.0
			3/4" x D x 1"	300	150	40.0	19.0
Stainless Steel	Carbon Steel Stainless Steel	KSF-8 KSF-10	3/4" x D x 1"	150	150	13.0	5.6
			3/4" x D x 1"	300	150	19.0	16.0

(Orifice E Area) 0.196 in^2, 1.265㎠

1.32665㎠ KSM actual area

Materials		Type	Valve Size	ASME Flange Rating Raised Face		Maximum Press (kgf/cm^2g)	
						Inlet Temperature Range	
Body & bonnet	Spring		Inlet x Orifice x Outlet	Inlet	Outlet	-28.9℃ to 232℃	315℃
Carbon Steel	Carbon Steel Stainless Steel	KSF-8 KSF-10	1" x E x 2"	150	150	20.0	13.0
			1" x E x 2"	300	150	20.0	13.0
			1" x E x 2"	600	150	40.0	
Stainless Steel	Carbon Steel Stainless Steel	KSF-8 KSF-10	1" x E x 2"	150	150	13.0	5.6
			1" x E x 2"	300	150	20.0	20.0
			1" x E x 2"	600	150	40.0	

(Orifice F Area) 0.307 in^2, 1.981㎠

2.0096㎠ KSM actual area

Materials		Type	Valve Size	ASME Flange Rating Raised Face		Maximum Press (kgf/cm^2g)	
						Inlet Temperature Range	
Body & bonnet	Spring		Inlet x Orifice x Outlet	Inlet	Outlet	-28.9℃ to 232℃	315℃
Carbon Steel	Carbon Steel Stainless Steel	KSF-8 KSF-10	1. 1/2" x F x 2"	150	150	20.0	13.0
			1. 1/2" x F x 2"	300	150	20.0	13.0
			1. 1/2" x F x 2"	600	150	40.0	
Stainless Steel	Carbon Steel Stainless Steel	KSF-8 KSF-10	1. 1/2" x F x 2"	150	150	13.0	5.6
			1. 1/2" x F x 2"	300	150	20.0	20.0
			1. 1/2" x F x 2"	600	150	40.0	

(Orifice G Area) 0.503 in^2, 3.245㎠

3.46185㎠ KSM actual area

Materials		Type	Valve Size	ASME Flange Rating Raised Face		Maximum Press (kgf/cm^{2}g)	
Body & bonnet	Spring		Inlet x Orifice x Outlet	Inlet	Outlet	Inlet Temperature Range	
						-28.9℃ to 232℃	315℃
Carbon Steel	Carbon Steel Stainless Steel	KSF-8 KSF-10	1.1/2" x G x 2.1/2"	150	150	20.0	13.0
			1.1/2" x G x 2.1/2"	300	150	20.0	20.0
			1.1/2" x G x 2.1/2"	600	150	40.0	
Stainless Steel	Carbon Steel Stainless Steel	KSF-8 KSF-10	1.1/2" x G x 2.1/2"	150	150	13.0	5.6
			1.1/2" x G x 2.1/2"	300	150	20.0	20.0
			1.1/2" x G x 2.1/2"	600	150	40.0	

(Orifice H Area) 0.785 in^2, 5.065㎠

5.3066㎠ KSM actual area

Materials		Type	Valve Size	ASME Flange Rating Raised Face		Maximum Press (kgf/cm^{2}g)	
Body & bonnet	Spring		Inlet x Orifice x Outlet	Inlet	Outlet	Inlet Temperature Range	
						-28.9℃ to 232℃	315℃
Carbon Steel	Carbon Steel Stainless Steel	KSF-8 KSF-10	1.1/2" x H x 3"	150	150	20.0	13.0
			1.1/2" x H x 3"	300	150	20.0	20.0
			2" x H x 3"	300	150	20.0	20.0
			2" x H x 3"	600	150	40.0	
Stainless Steel	Carbon Steel Stainless Steel	KSF-8 KSF-10	1.1/2" x H x 3"	150	150	15.0	5.6
			1.1/2" x H x 3"	300	150	20.0	20.0
			2" x H x 3"	300	150	20.0	20.0
			2" x H x 3"	600	150	40.0	

(Orifice J Area) 1.287 in^2, 8.303㎠

8.54865㎠ KSM actual area

Materials		Type	Valve Size	ASME Flange Rating Raised Face		Maximum Press (kgf/cm^{2}g)	
Body & bonnet	Spring		Inlet x Orifice x Outlet	Inlet	Outlet	Inlet Temperature Range	
						-28.9℃ to 232℃	315℃
Carbon Steel	Carbon Steel Stainless Steel	KSF-8 KSF-10	2" x J x 3"	150	150	20.0	13.0
			2" x J x 3"	300	150	20.0	20.0
			2.1/2" x J x 4"	300	150	20.0	20.0
			2.1/2" x J x 4"	600	150	40.0	
Stainless Steel	Carbon Steel Stainless Steel	KSF-8 KSF-10	2" x J x 3"	150	150	13.0	5.6
			2" x J x 3"	300	150	20.0	20.0
			2.1/2" x J x 4"	300	150	20.0	20.0
			2.1/2" x J x 4"	600	150	40.0	

(Orifice K Area) 1.838 in^2, 11.858㎠

11.93985㎠ KSM actual area

Materials		Type	Valve Size	ASME Flange Rating Raised Face		Maximum Press (kgf/cm^{2}g)	
Body & bonnet	Spring		Inlet x Orifice x Outlet	Inlet	Outlet	Inlet Temperature Range	
						-28.9℃ to 232℃	315℃
Carbon Steel	Carbon Steel Stainless Steel	KSF-8 KSF-10	3" x K x 4"	150	150	20.0	13.0
			3" x K x 4"	300	150	20.0	20.0
			3" x K x 4"	600	150	40.0	
Stainless Steel	Carbon Steel Stainless Steel	KSF-8 KSF-10	3" x K x 4"	150	150	13.0	5.6
			3" x K x 4"	300	150	20.0	13.0
			3" x K x 4"	600	150	40.0	

(Orifice L Area) 2.853 in^2, 18.406㎠

18.84785㎠ KSM actual area

Materials		Type	Valve Size	ASME Flange Rating Raised Face		Maximum Press (kgf/cm^{2}g)	
Body & bonnet	Spring		Inlet x Orifice x Outlet	Inlet	Outlet	Inlet Temperature Range	
						-28.9℃ to 232℃	315℃
Carbon Steel	Carbon Steel Stainless Steel	KSF-8 KSF-10	3" x L x 4"	150	150	20.0	13.0
			3" x L x 4"	300	150	20.0	20.0
			4" x L x 6"	300	150	20.0	20.0
			4" x L x 6"	600	150	40.0	
Stainless Steel	Carbon Steel Stainless Steel	KSF-8 KSF-10	3" x L x 4"	150	150	13.0	5.6
			3" x L x 4"	300	150	20.0	13.0
			4" x L x 6"	300	150	20.0	13.0
			4" x L x 6"	600	150	40.0	

(Orifice M Area) 3.60 in^2, 23.226㎠

11.93985㎠ KSM actual area

Materials		Type	Valve Size	ASME Flange Rating Raised Face		Maximum Press (kgf/cm^{2}g)	
Body & bonnet	Spring		Inlet x Orifice x Outlet	Inlet	Outlet	Inlet Temperature Range	
						-28.9℃ to 232℃	315℃
Carbon Steel	Carbon Steel Stainless Steel	KSF-8 KSF-10	4" x M x 6"	150	150	20.0	13.0
			4" x M x 6"	300	150	20.0	20.0
			4" x M x 6"	600	150	40.0	
Stainless Steel	Carbon Steel Stainless Steel	KSF-8 KSF-10	4" x M x 6"	150	150	13.0	5.6
			4" x M x 6"	300	150	20.0	13.0
			4" x M x 6"	600	150	40.0	

(Orifice Q Area) 11.05 in², 71.29㎠

72.3456㎠ KSM actual area

Materials		Type	Valve Size	ASME Flange Rating Raised Face		Maximum Press (kgf/cm²g)	
						Inlet Temperature Range	
Body & bonnet	Spring		Inlet x Orifice x Outlet	Inlet	Outlet	-28.9℃ to 232℃	315℃
Carbon Steel	Carbon Steel Stainless Steel	KSF-8 KSF-10	6" x Q x 8"	150	150	11.6	11.6
			6" x Q x 8"	300	150	20.0	20.0
			6" x Q x 8"	600	150	40.0	
Stainless Steel	Carbon Steel Stainless Steel	KSF-8 KSF-10	6" x Q x 8"	150	150	11.6	5.6
			6" x Q x 8"	300	150	20.0	11.6
			6" x Q x 8"	600	150	40.0	

(Orifice R Area) 16.0 in², 103.226㎠

103.81625㎠ KSM actual area

Materials		Type	Valve Size	ASME Flange Rating Raised Face		Maximum Press (kgf/cm²g)	
						Inlet Temperature Range	
Body & bonnet	Spring		Inlet x Orifice x Outlet	Inlet	Outlet	-28.9℃ to 232℃	315℃
Carbon Steel	Carbon Steel Stainless Steel	KSF-8 KSF-10	6" x R x 8"	150	150	7.0	7.0
			6" x R x 8"	300	150	16.2	16.2
			6" x R x 8"	600	150	20.0	
Stainless Steel	Carbon Steel Stainless Steel	KSF-8 KSF-10	6" x R x 8"	150	150	7.0	5.6
			6" x R x 8"	300	150	16.2	11.6
			6" x R x 8"	600	150	20.0	

(Orifice T Area) 26.0 in², 167.742㎠

176.625㎠ KSM actual area

Materials		Type	Valve Size	ASME Flange Rating Raised Face		Maximum Press (kgf/cm²g)	
						Inlet Temperature Range	
Body & bonnet	Spring		Inlet x Orifice x Outlet	Inlet	Outlet	-28.9℃ to 232℃	315℃
Carbon Steel	Carbon Steel Stainless Steel	KSF-8 KSF-10	8" x T x 10"	150	150	4.6	4.6
			8" x T x 10"	300	150	16.2	13.0
Stainless Steel	Carbon Steel Stainless Steel	KSF-8 KSF-10	8" x T x 10"	150	150	4.6	5.6
			8" x T x 10"	300	150	16.2	11.6

Code : KS B 6126 or KOSHA for Steam

W = 5.2456 x c x Kd x A x (P+0.1) x 0.9, See Table(page 32)

Nomenclature

W	Capacity of Steam, kg / h
A	Nozzle orifice area, ㎟
P	For Set Pressure ≤ 0.1 Mpag P = Set Pressure + 0.02 Mpag For Set Pressure > 0.1 > Mpag P = Set Pressure x 1.03
K d	Coefficient of discharge, 0.864(Full Lift Type)
C	Superheat Correction Factor See Table 2 (page 34)

Code : ASME Section Ⅰ. For Steam

110kgf / ㎠ abs

$$W = 51.5 \times K \times A \times P \times 0.9 \times Ksh$$

110kgf / ㎠ abs

$$W = 51.5 \times K \times A \times P \times 0.9 \times Ksh \times \frac{(2.7109P - 1000)}{(3.2599P - 1061)}$$

Code : ASME Section Ⅷ. For Steam

For P 1 ≤ 117kgf / ㎠ abs

$$W = 51.5 \times Kd \times A \times P1 \times Ksh$$

For P 1 > 117kgf / ㎠ abs

$$W = 51.5 \times Kd \times A \times P1 \times Ksh \frac{(2.7109P1 - 1000)}{(3.2599P1 - 1061)}$$

Nomenclature

W	Weight of Steam (kg / h)
K	Coefficient of discharge = 0.975
K d	Coefficient of discharge = 0.878
A	Nozzle orifice area
P	(1.03 x Set Pressure) + 1.033 (kgf / ㎠ abs)
P 1	(1.10 x Set Pressure) + 1.033 (kgf / ㎠ abs)
K s h	Superheat Correction Factor See Table 3 (page 35,36)

SAFETY VALVE CAPACITY TABLE

Full Lift Type, For Set. Steam

Table 1

Size		15A	20A	25A			32A	40A			50A			65A	80A		100A	125A	150A	200A
Orifice Dia.(mm)		10	10	10	13	19	24	16	21	30	26	33	38	49	49	61	73	95	115	150
0.5	0.049	54.1	54.1	54.1	91.4	195	311	138	238	487	365	589	781	1299	1299	2013	2883	4884	7157	12176
0.7	0.069	60.5	60.5	60.5	102	218	348	154	266	544	409	659	873	1453	1453	2252	3225	5462	8004	13617
1	0.098	69.8	69.8	69.8	117	252	402	178	307	628	471	760	1008	1676	1676	2597	3720	6300	9232	15706
1.5	0.147	80.5	80.5	80.5	136	290	463	206	355	724	544	876	1162	1932	1932	2995	4290	7265	10647	18114
2	0.196	96.6	96.6	96.6	163	348	556	247	426	870	653	1052	1395	2321	2321	3597	5151	8724	12784	21750
2.5	0.245	112	112	112	190	407	649	288	497	1015	762	1228	1629	2709	2709	4198	6012	10182	14921	25386
3	0.294	128	128	128	217	465	742	330	568	1160	871	1404	1862	3097	3097	4799	6874	11641	17059	29023
3.5	0.343	145	145	145	245	524	836	371	640	1306	981	1580	2096	3485	3485	5401	7735	13100	19196	32659
4	0.392	161	161	161	272	582	929	412	711	1451	1090	1756	2329	3873	3873	6002	8596	14558	21334	36296
4.5	0.441	177	177	177	299	640	1022	454	782	1597	1199	1932	2562	4261	4261	6603	9457	16017	23471	39932
5	0.49	193	193	193	327	699	1115	495	853	1742	1309	2108	2796	4649	4649	7205	10319	17475	25608	43568
5.5	0.539	209	209	209	354	757	1208	537	925	1888	1418	2284	3029	5037	5037	7806	11180	18934	27746	47205
6	0.588	225	225	225	381	815	1301	578	996	2033	1527	2460	3262	5425	5425	8408	12041	20393	29883	50841
6.5	0.637	242	242	242	409	874	1394	619	1067	2179	1636	2636	3496	5813	5813	9009	12902	21851	32020	54478
7	0.686	258	258	258	436	932	1487	661	1139	2324	1746	2812	3729	6201	6201	9610	13764	23310	34158	58114
7.5	0.735	274	274	274	463	990	1580	702	1210	2470	1855	2988	3963	6589	6589	10212	14625	24768	36295	61750
8	0.784	290	290	290	491	1049	1673	743	1281	2615	1964	3164	4196	6977	6977	10813	15486	26227	38433	65387
8.5	0.833	306	306	306	518	1107	1767	785	1352	2760	2073	3340	4429	7365	7365	11414	16347	27686	40570	69023
9	0.882	322	322	322	545	1165	1860	826	1424	2906	2183	3516	4663	7753	7753	12016	17209	29144	42707	72659
9.5	0.931	339	339	339	573	1224	1953	868	1495	3051	2292	3692	4896	8141	8141	12617	18070	30603	44845	76296
9.9	0.97	351	351	351	594	1270	2027	901	1552	3167	2379	3832	5082	8450	8450	13096	18755	31764	46546	79190
10	0.98	355	355	355	600	1282	2046	909	1566	3197	2401	3868	5129	8529	8529	13219	18931	32061	46982	79932
10.3	1.009	364	364	364	616	1317	2101	933	1608	3283	2466	3972	5268	8759	8759	13575	19441	32925	48247	82084
10.5	1.029	371	371	371	627	1340	2139	950	1637	3342	2510	4044	5363	8917	8917	13820	19792	33520	49120	83569
11	1.078	387	387	387	655	1399	2232	992	1709	3488	2620	4220	5596	9305	9305	14421	20654	34979	51257	87205
11.5	1.127	403	403	403	682	1457	2325	1033	1780	3633	2729	4396	5830	9693	9693	15023	21515	36437	53394	90841
12	1.176	419	419	419	709	1515	2418	1074	1851	3779	2838	4572	6063	10081	10081	15624	22376	37896	55532	94478
12.5	1.225	436	436	436	736	1574	2511	1116	1923	3924	2947	4748	6296	10469	10469	16225	23237	39354	57669	98114
13	1.274	452	452	452	764	1632	2604	1157	1994	4070	3057	4924	6530	10857	10857	16827	24099	40813	59807	101751
13.5	1.323	468	468	468	791	1690	2697	1199	2065	4215	3166	5100	6763	11246	11246	17428	24960	42272	61944	105387
14	1.372	484	484	484	818	1749	2791	1240	2136	4360	3275	5276	6996	11634	11634	18030	25821	43730	64081	109023
14.5	1.421	500	500	500	846	1807	2884	1281	2208	4506	3384	5452	7230	12022	12022	18631	26682	45189	66219	112660
15	1.47	516	516	516	873	1865	2977	1323	2279	4651	3494	5628	7463	12410	12410	19232	27544	46647	68356	116296
15.5	1.519	533	533	533	900	1924	3070	1364	2350	4797	3603	5804	7697	12798	12798	19834	28405	48106	70493	119933
15.7	1.539	539	539	539	911	1948	3108	1381	2379	4856	3647	5876	7792	12956	12956	20079	28757	48701	71366	121417
16	1.568	549	549	549	928	1982	3163	1405	2421	4942	3712	5980	7930	13186	13186	20435	29266	49565	72631	123569
16.5	1.617	565	565	565	955	2040	3256	1447	2493	5088	3821	6156	8163	13574	13574	21037	30127	51023	74768	127205
17	1.666	581	581	581	982	2099	3349	1488	2564	5233	3931	6332	8397	13962	13962	21638	30989	52482	76906	130842
17.5	1.715	597	597	597	1010	2157	3442	1530	2635	5379	4040	6508	8630	14350	14350	22239	31850	53940	79043	134478
18	1.764	613	613	613	1037	2215	3535	1571	2707	5524	4149	6684	8863	14738	14738	22841	32711	55399	81180	138114
18.5	1.813	630	630	630	1064	2274	3628	1612	2778	5670	4258	6860	9097	15126	15126	23442	33573	56858	83318	141751
19	1.862	646	646	646	1092	2332	3721	1654	2849	5815	4368	7036	9330	15514	15514	24043	34434	58316	85455	145387
19.5	1.911	662	662	662	1119	2391	3815	1695	2920	5960	4477	7212	9564	15902	15902	24645	35295	59775	87593	149024
20	1.96	678	678	678	1146	2449	3908	1736	2992	6106	4586	7388	9797	16290	16290	25246	36156	61233	89730	152660
20.5	2.009	694	694	694	1173	2507	4001	1778	3063	6251	4695	7564	10030	16678	16678	25848	37018	62692	91867	156296
21	2.058	710	710	710	1201	2566	4094	1819	3134	6397	4805	7740	10264	17066	17066	26449	37879	64151	94005	159933
21.5	2.107	726	726	726	1228	2624	4187	1861	3205	6542	4914	7916	10497	17454	17454	27050	38740	65609	96142	163569
22	2.156	743	743	743	1255	2682	4280	1902	3277	6688	5023	8092	10730	17842	17842	27652	39601	67068	98279	167206
22.5	2.205	759	759	759	1283	2741	4373	1943	3348	6833	5132	8268	10964	18230	18230	28253	40463	68526	100417	170842
23	2.254	775	775	775	1310	2799	4466	1985	3419	6979	5242	8444	11197	18618	18618	28854	41324	69985	102554	174478
23.5	2.303	791	791	791	1337	2857	4559	2026	3491	7124	5351	8620	11431	19006	19006	29456	42185	71443	104692	178115
24	2.352	807	807	807	1365	2916	4652	2067	3562	7270	5460	8796	11664	19394	19394	30057	43046	72902	106829	181751
24.5	2.401	823	823	823	1392	2974	4745	2109	3633	7415	5569	8972	11897	19782	19782	30659	43908	74361	108966	185387
25	2.45	840	840	840	1419	3032	4839	2150	3704	7560	5679	9148	12131	20170	20170	31260	44769	75819	111104	189024
25.3	2.479	849	849	849	1435	3067	4894	2175	3747	7647	5743	9252	12269	20400	20400	31616	45279	76683	112369	191176
25.5	2.499	856	856	856	1447	3091	4932	2192	3776	7706	5788	9324	12364	20559	20559	31861	45630	77278	113241	192660
26	2.548	872	872	872	1474	3149	5025	2233	3847	7851	5897	9500	12597	20947	20947	32463	46491	78736	115379	196297
26.5	2.597	888	888	888	1501	3207	5118	2274	3918	7997	6006	9676	12831	21335	21335	33064	47353	80195	117516	199933
27	2.646	904	904	904	1529	3266	5211	2316	3989	8142	6116	9852	13064	21723	21723	33665	48214	81654	119653	203569
27.5	2.695	920	920	920	1556	3324	5304	2357	4061	8288	6225	10028	13298	22111	22111	34267	49075	83112	121791	207206
28	2.744	937	937	937	1583	3382	5397	2398	4132	8433	6334	10204	13531	22499	22499	34868	49936	84571	123928	210842
28.5	2.793	953	953	953	1610	3441	5490	2440	4203	8579	6443	10380	13764	22887	22887	35470	50798	86029	126066	214479
29	2.842	969	969	969	1638	3499	5583	2481	4275	8724	6553	10556	13998	23275	23275	36071	51659	87488	128203	218115
29.5	2.891	985	985	985	1665	3557	5676	2523	4346	8870	6662	10732	14231	23663	23663	36672	52520	88947	130340	221751
30	2.94	1001	1001	1001	1692	3616	5769	2564	4417	9015	6771	10908	14464	24051	24051	37274	53381	90405	132478	225388
30.5	2.989	1017	1017	1017	1720	3674	5863	2605	4488	9160	6880	11084	14698	24439	24439	37875	54243	91864	134615	229024
kgf/cm^{2}g	MPag																			
Pressure																				

W	Capacity of Air, kg / h
A	Nozzle orifice area, ㎟ $A = \frac{\pi \times D^2}{4}$ D : Orifice Diameter, mm
P 1	Upstream Relieving Pressure absolute, Mpa
K d	Molecular Weight

T	Absolute temperature of gas, K
C	Coefficient determined by ratio of the specific heats of the gas
K d	Coefficient of discharge, 0.864 (Full lift type)
Z	Compressibility factor

Code : KS B 6126 or KOSHA for Air & Gas

$$W = \frac{C \times Kd \times A \times P1 \times (M)^{1/2} \times 0.9}{(Z \times T)^{1/2}}$$

Size		15A	20A	25A			32A	40A			50A			65A	80A		100A	125A	150A	200A
Orifice Dia.(mm)		10	10	10	13	19	24	16	21	30	26	33	38	49	49	61	73	95	115	150
0.5	0.049	80	80	80	135	289	462	205	353	722	542	874	1158	1927	1927	2986	4277	7243	10614	18058
0.7	0.069	91	91	91	154	330	527	234	404	824	619	998	1323	2200	2200	3410	4884	8272	12122	20623
1	0.098	108	108	108	182	390	623	276	477	973	731	1178	1562	2597	2597	4025	5765	9764	14308	24342
1.5	0.147	136	136	136	230	491	784	348	600	1225	920	1482	1965	3268	3268	5064	7253	12284	18001	30626
2	0.196	164	164	164	277	592	944	419	723	1476	1108	1786	2368	3938	3938	6104	8742	14805	21695	36910
2.5	0.245	191	191	191	324	693	1105	491	846	1727	1297	2090	2772	4609	4609	7143	10230	17325	25388	43194
3	0.294	219	219	219	371	793	1266	562	969	1979	1486	2394	3175	5279	5279	8182	11718	19846	29082	49478
3.5	0.343	247	247	247	418	894	1427	634	1092	2230	1675	2698	3578	5950	5950	9221	13206	22366	32775	55761
4	0.392	275	275	275	466	995	1588	705	1216	2481	1864	3003	3981	6620	6620	10260	14695	24887	36469	62045
4.5	0.441	303	303	303	513	1096	1749	777	1339	2733	2052	3307	4385	7291	7291	11300	16183	27407	40162	68329
5	0.49	331	331	331	560	1197	1910	848	1462	2984	2241	3611	4788	7962	7962	12339	17671	29928	43856	74613
5.5	0.539	359	359	359	607	1297	2070	920	1585	3235	2430	3915	5191	8632	8632	13378	19160	32448	47549	80897
6	0.588	387	387	387	654	1398	2231	991	1708	3487	2619	4219	5595	9303	9303	14417	20648	34969	51243	87181
6.5	0.637	415	415	415	702	1499	2392	1063	1831	3738	2808	4523	5998	9973	9973	15457	22136	37489	54936	93465
7	0.686	443	443	443	749	1600	2553	1134	1955	3989	2996	4827	6401	10644	10644	16496	23624	40010	58630	99748
7.5	0.735	471	471	471	796	1701	2714	1206	2078	4241	3185	5131	6804	11314	11314	17535	25113	42530	62323	106032
8	0.784	499	499	499	843	1802	2875	1277	2201	4492	3374	5436	7208	11985	11985	18574	26601	45051	66017	112316
8.5	0.833	527	527	527	890	1902	3036	1349	2324	4744	3563	5740	7611	12655	12655	19613	28089	47571	69710	118600
9	0.882	555	555	555	938	2003	3197	1420	2447	4995	3752	6044	8014	13326	13326	20653	29578	50092	73404	124884
9.5	0.931	582	582	582	985	2104	3357	1492	2570	5246	3940	6348	8418	13997	13997	21692	31066	52613	77097	131168
9.9	0.97	605	605	605	1022	2184	3485	1549	2668	5446	4091	6590	8739	14530	14530	22519	32251	54619	80037	136169
10	0.98	610	610	610	1032	2205	3518	1563	2694	5498	4129	6652	8821	14667	14667	22731	32554	55133	80791	137452
10.3	1.009	627	627	627	1060	2265	3613	1606	2766	5646	4241	6832	9060	15064	15064	23346	33435	56625	82977	141171
10.5	1.029	638	638	638	1079	2306	3679	1635	2817	5749	4318	6956	9224	15338	15338	23770	34043	57654	84484	143735
11	1.078	666	666	666	1126	2406	3840	1706	2940	6000	4507	7260	9627	16008	16008	24809	35531	60174	88178	150019
11.5	1.127	694	694	694	1174	2507	4001	1778	3063	6252	4696	7565	10031	16679	16679	25849	37019	62695	91871	156303
12	1.176	722	722	722	1221	2608	4162	1849	3186	6503	4884	7869	10434	17349	17349	26888	38507	65215	95565	162587
12.5	1.225	750	750	750	1268	2709	4323	1921	3309	6754	5073	8173	10837	18020	18020	27927	39996	67736	99258	168871
13	1.274	778	778	778	1315	2810	4483	1992	3433	7006	5262	8477	11241	18691	18691	28966	41484	70256	102952	175155
13.5	1.323	806	806	806	1362	2911	4644	2064	3556	7257	5451	8781	11644	19361	19361	30006	42972	72777	106645	181439
14	1.372	834	834	834	1410	3011	4805	2135	3679	7508	5640	9085	12047	20032	20032	31045	44461	75297	110339	187722
14.5	1.421	862	862	862	1457	3112	4966	2207	3802	7760	5828	9389	12450	20702	20702	32084	45949	77818	114032	194006
15	1.47	890	890	890	1504	3213	5127	2278	3925	8011	6017	9694	12854	21373	21373	33123	47437	80338	117726	200290
15.5	1.519	918	918	918	1551	3314	5288	2350	4048	8262	6206	9998	13257	22043	22043	34162	48926	82859	121419	206574
15.7	1.539	929	929	929	1570	3355	5353	2379	4099	8365	6283	10122	13422	22317	22317	34587	49533	83888	122927	209139
16	1.568	946	946	946	1598	3415	5449	2421	4172	8514	6395	10302	13660	22714	22714	35202	50414	85379	125113	212858
16.5	1.617	973	973	973	1646	3516	5610	2493	4295	8765	6584	10606	14064	23384	23384	36241	51902	87900	128806	219142
17	1.666	1001	1001	1001	1693	3616	5770	2564	4418	9017	6772	10910	14467	24055	24055	37280	53390	90420	132500	225426
17.5	1.715	1029	1029	1029	1740	3717	5931	2636	4541	9268	6961	11214	14870	24726	24726	38319	54879	92941	136193	231710
18	1.764	1057	1057	1057	1787	3818	6092	2707	4664	9519	7150	11518	15273	25396	25396	39358	56367	95461	139887	237993
18.5	1.813	1085	1085	1085	1834	3919	6253	2779	4787	9771	7339	11823	15677	26067	26067	40398	57855	97982	143581	244277
19	1.862	1113	1113	1113	1881	4020	6414	2850	4911	10022	7527	12127	16080	26737	26737	41437	59344	100503	147274	250561
19.5	1.911	1141	1141	1141	1929	4120	6575	2922	5034	10273	7716	12431	16483	27408	27408	42476	60832	103023	150968	256845
20	1.96	1169	1169	1169	1976	4221	6736	2993	5157	10525	7905	12735	16887	28078	28078	43515	62320	105544	154661	263129
20.5	2.009	1197	1197	1197	2023	4322	6896	3065	5280	10776	8094	13039	17290	28749	28749	44554	63809	108064	158355	269413
21	2.058	1225	1225	1225	2070	4423	7057	3136	5403	11027	8283	13343	17693	29419	29419	45594	65297	110585	162048	275697
21.5	2.107	1253	1253	1253	2117	4524	7218	3208	5526	11279	8471	13647	18096	30090	30090	46633	66785	113105	165742	281980
22	2.156	1281	1281	1281	2165	4625	7379	3279	5649	11530	8660	13952	18500	30761	30761	47672	68273	115626	169435	288264
22.5	2.205	1309	1309	1309	2212	4725	7540	3351	5773	11781	8849	14256	18903	31431	31431	48711	69762	118146	173129	294548
23	2.254	1337	1337	1337	2259	4826	7701	3422	5896	12033	9038	14560	19306	32102	32102	49751	71250	120667	176822	300832
23.5	2.303	1364	1364	1364	2306	4927	7862	3494	6019	12284	9227	14864	19710	32772	32772	50790	72738	123187	180516	307116
24	2.352	1392	1392	1392	2353	5028	8023	3565	6142	12536	9415	15168	20113	33443	33443	51829	74227	125708	184209	313400
24.5	2.401	1420	1420	1420	2401	5129	8183	3637	6265	12787	9604	15472	20516	34113	34113	52868	75715	128228	187903	319684
25	2.45	1448	1448	1448	2448	5229	8344	3708	6388	13038	9793	15776	20919	34784	34784	53907	77203	130749	191596	325967
25.3	2.479	1465	1465	1465	2476	5289	8439	3751	6461	13187	9905	15956	21158	35181	35181	54522	78084	132241	193782	329686
25.5	2.499	1476	1476	1476	2495	5330	8505	3780	6512	13290	9982	16080	21323	35454	35454	54947	78691	133269	195290	332251
26	2.548	1504	1504	1504	2542	5431	8666	3851	6635	13541	10171	16385	21726	36125	36125	55986	80180	135790	198983	338535
26.5	2.597	1532	1532	1532	2589	5532	8827	3923	6758	13792	10359	16689	22129	36796	36796	57025	81668	138310	202677	344819
27	2.646	1560	1560	1560	2637	5633	8988	3994	6881	14044	10548	16993	22533	37466	37466	58064	83156	140831	206370	351103
27.5	2.695	1588	1588	1588	2684	5734	9149	4066	7004	14295	10737	17297	22936	38137	38137	59103	84645	143351	210064	357387
28	2.744	1616	1616	1616	2731	5834	9309	4137	7127	14546	10926	17601	23339	38807	38807	60143	86133	145872	213757	363671
28.5	2.793	1644	1644	1644	2778	5935	9470	4209	7251	14798	11115	17905	23742	39478	39478	61182	87621	148393	217451	369954
29	2.842	1672	1672	1672	2825	6036	9631	4280	7374	15049	11303	18209	24146	40148	40148	62221	89110	150913	221144	376238
29.5	2.891	1700	1700	1700	2873	6137	9792	4352	7497	15300	11492	18514	24549	40819	40819	63260	90598	153434	224838	382522
30	2.94	1728	1728	1728	2920	6238	9953	4423	7620	15552	11681	18818	24952	41489	41489	64299	92086	155954	228531	388806
30.5	2.989	1755	1755	1755	2967	6339	10114	4495	7743	15803	11870	19122	25356	42160	42160	65339	93574	158475	232225	395090
kgf/cm^2 g	MPag																			
Pressure																				

SUPERHEAT CORRECTION FACTOR FOR SAFETY VALVES

Safety Valve Capacity Table for Steam (Table 2)

Pressure(absolute) Kgf ㎠a(Mpa)	Saturation Temperature	Temperature (℃)																									
		200	220	240	260	280	300	320	340	360	380	400	420	440	460	480	500	520	540	560	580	600	620	640	660	680	700
5(0.5)	1.005	0.996	0.972	0.951	0.931	0.913	0.896	0.879	0.864	0.849	0.835	0.822															
10(1.0)	0.987	0.981	0.983	0.960	0.938	0.919	0.901	0.884	0.868	0.853	03838	0.825															
15(1.5)	0.977	0.967	0.970	0.972	0.947	0.925	0.906	0.888	0.872	0.856	0.841	0.828															
20(2.0)	0.972		0.957	0.964	0.955	0.932	0.912	0.893	0.846	0.880	0.845	0.830	0.817	0.804	0.792	0.780	0.768										
25(2.5)	0.959			0.961	0.961	0.937	0.918	0.898	0.880	0.863	0.848	0.833	0.819	0.806	0.793	0.782	0.770										
30(3.0)	0.957			0.962	0.957	0.949	0.924	0.903	0.885	0.867	0.851	0.836	0.822	0.808	0.795	0.783	0.774	0.763	0.748	0.742	0.730	0.721	0.712	0.703	0.695	0.687	0.679
40(4.0)	0.955				0.958	0.945	0.934	0.915	0.894	0.875	0.857	0.84	0.826	0.813	0.799	0.787	0.775	0.763	0.755	0.744	0.735	0.725	0.715	0.705	0.696	0.688	0.880
50(5.0)	0.966					0.955	0.953	0.927	0.904	0.884	0.865	0.848	0.832	0.817	0.803	0.790	0.778	0.766	0.755	0.747	0.737	0.723	0.717	0.708	0.697	0.689	0.681
60(6.0)	0.968					0.962	0.953	0.941	0.911	0.891	0.872	0.854	0.838	0.882	0.808	0.794	0.781	0.769	0.758	0.747	0.739	0.729	0.719	0.710	0.698	0.690	0.682
70(7.0)	0.971						0.958	0.954	0.924	0.901	0.881	0.861	0.844	0.827	0.812	0.798	0.785	0.772	0.761	0.749	0.739	0.731	0.721	0.708	0.702	0.691	0.683
80(8.0)	0.975						0.967	0.956	0.934	0.912	0.888	0.868	0.860	0.833	0.817	0.802	0.789	0.776	0.763	0.752	0.741	0.731	0.719	0.710	0.701	0.692	0.684
90(9.0)	0.980							0.962	0.957	0.926	0.897	0.846	0.856	0.838	0.822	0.807	0.792	0.779	0.766	0.754	0.743	0.733	0.722	0.711	0.702	0.693	0.685
100(10.0)	0.986							0.971	0.961	0.936	0.909	0.883	0.883	0.844	0.827	0.811	0.796	0.782	0.776	0.757	0.745	0.735	0.724	0.712	0.703	0.695	0.686
120(12.0)	0.999								0.975	0.964	0.926	0.903	0.876	0.857	0.838	0.818	0.805	0.789	0.775	0.768	0.750	0.739	0.728	0.718	0.706	0.697	0.688
140(14.0)	1.016								1.002	0.980	0.936	0.920	0.893	0.868	0.846	0.828	0.811	0.797	0.782	7.768	0.755	0.743	0.732	0.721	0.711	0.699	0.691
160(16.0)	1.036									1.000	0.964	0.942	0.907	0.883	0.858	0.838	0.819	0.803	0.787	0.774	0.760	0.748	0.736	0.725	0.714	0.704	0.693
180(18.0)	1.063									1.038	0.980	0.972	0.929	0.895	0.873	0.848	0.828	0.810	0.794	0.779	0.766	0.752	0.740	0.728	0.171	0.707	0.697
200(20.0)	1.094										1.000	1.006	0.963	0.914	0.885	0.861	0.835	0.818	0.801	0.786	0.770	0.757	0.744	0.732	0.120	0.710	0.700
220(22.0)	1.129										1.038	1.033	0.982	0.932	0.900	0.872	0.849	0.827	0.808	0.793	0.777	0.761	0.749	0.736	0.724	0.713	0.702
240(24.0)												1.059	1.016	0.968	0.915	0.885	0.861	0.837	0.815	0.797	0.83	0.766	0.752	0.740	0.727	0.716	0.705
260(26.0)												1.099	1.055	0.982	0.935	0.899	0.871	0.848	0.825	0.804	0.786	0.722	0.756	0.74	0.731	0.719	0.708
280(28.0)												1.167	1.096	1.013	0.956	0.913	0.833	0.853	0.834	0.811	0.793	0.776	0.762	0.747	0.735	0.720	0.710
300(30.0)													1.132	1.047	0.977	0.931	0.895	0.867	0.838	0.821	0.799	0.781	0.763	0.753	0.735	0.724	0.715
320(32.0)													1.169	1.089	1.009	0.952	0.908	0.877	0.849	0.824	0.0805	0.787	0.770	0.735	0.742	0.729	0.174
340(34.0)														1.136	1.032	0.968	0.823	0.888	0.859	0.835	0.812	0.792	0.775	0.757	0.746	0.729	0.718
360(36.0)														1.191	1.063	0.989	0.941	0.899	0.889	0.842	0.818	0.798	0.780	0.761	0.750	0.734	0.723
380(38.0)															1.098	1.016	0.956	0.913	0.878	0.850	0.823	0.804	0.785	0.765	0.750	0.739	0.726
400(40.0)															1.137	1.037	0.972	0.927	0.888	0.858	0.832	0.807	0.790	0.789	0.754	0.742	0.725
420(42.0)																1.064	0.995	0.944	0.901	0.868	0.839	0.815	0.792	0.774	0.758	0.745	0.729
440(44.0)																1.092	1.012	0.954	0.914	0.876	0.846	0.821	0.800	0.779	0.762	0.748	0.731
460(46.0)																1.122	1.035	0.971	0.924	0.888	0.854	0.828	0.805	0.785	0.766	0.753	0.738

Superheat Correction Factors for Safety Valves (Table 3)

Pressure = Set Pressure + Over Pressure + Atmospheric Pressure   1 Psig = 0.06895 barg = 0.070.1 kgf / ㎠g   1barg = 14.5035 psig = 1.0197 kgf / kgf / ㎠g

Pressure (bar absolute)	Saturation Temperature(℃)	Inlet Temperature(℃)																								
		150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350	360	370	380	390
2	120	1.00	1.00	1.00	1.00	1.00	0.99	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.91	0.90	0.89	0.89	0.88	0.87	0.86	0.86	0.85	0.84	0.83	0.83
3	133	1.00	1.00	1.00	1.00	1.00	0.99	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.91	0.90	0.89	0.89	0.88	0.87	0.86	0.86	0.85	0.84	0.84	0.83
4	144	1.00	1.00	1.00	1.00	1.00	0.99	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.91	0.90	0.90	0.89	0.88	0.87	0.86	0.86	0.85	0.84	0.84	0.83
5	152	1.00	1.00	1.00	1.00	1.00	0.99	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.91	0.90	0.90	0.89	0.88	0.87	0.87	0.86	0.85	0.84	0.84	0.83
6	159		1.00	1.00	1.00	1.00	0.99	0.99	0.98	0.96	0.95	0.94	0.93	0.92	0.92	0.91	0.90	0.89	0.88	0.87	0.87	0.86	0.85	0.84	0.84	0.83
7	165			1.00	1.00	1.00	0.99	0.99	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.92	0.90	0.89	0.88	0.87	0.87	0.86	0.85	0.84	0.84	0.83
8	170			1.00	1.00	1.00	1.00	0.99	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.92	0.90	0.89	0.88	0.88	0.87	0.86	0.85	0.85	0.84	0.83
9	175				1.00	1.00	1.00	0.99	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.92	0.90	0.89	0.88	0.88	0.87	0.86	0.85	0.85	0.84	0.83
10	180				1.00	1.00	1.00	0.99	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.92	0.90	0.89	0.88	0.88	0.87	0.86	0.85	0.85	0.84	0.83
11	184					1.00	1.00	0.99	0.99	0.97	0.96	0.95	0.94	0.93	0.92	0.92	0.90	0.89	0.89	0.88	0.87	0.86	0.85	0.85	0.84	0.83
12	188					1.00	1.00	0.99	0.99	0.98	0.97	0.95	0.94	0.93	0.92	0.92	0.90	0.90	0.89	0.88	0.87	0.86	0.85	0.85	0.84	0.83
13	192						1.00	1.00	0.99	0.98	0.97	0.95	0.94	0.93	0.92	0.92	0.91	0.90	0.89	0.88	0.87	0.86	0.86	0.85	0.84	0.83
14	195						1.00	1.00	0.99	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.86	0.86	0.85	0.84	0.83
15	198						1.00	1.00	0.99	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.86	0.86	0.85	0.84	0.84
16	201						1.00	1.00	0.99	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.91	0.90	0.89	0.88	0.88	0.87	0.86	0.85	0.84	0.84
17	204							1.00	0.99	0.99	0.98	0.96	0.95	0.94	0.93	0.92	0.91	0.90	0.89	0.88	0.88	0.87	0.86	0.85	0.84	0.84
18	207							1.00	1.00	0.99	0.98	0.96	0.95	0.94	0.93	0.92	0.91	0.90	0.89	0.88	0.88	0.87	0.86	0.85	0.84	0.84
19	210							1.00	1.00	0.99	0.98	0.97	0.96	0.95	0.93	0.92	0.91	0.90	0.89	0.88	0.88	0.87	0.86	0.85	0.85	0.84
20	212								1.00	0.99	0.98	0.97	0.96	0.95	0.93	0.92	0.91	0.90	0.89	0.89	0.88	0.87	0.86	0.85	0.85	0.84
21	215								1.00	0.99	0.98	0.97	0.96	0.95	0.94	0.92	0.91	0.90	0.90	0.89	0.88	0.87	0.86	0.85	0.85	0.84
22	217								1.00	0.99	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.86	0.85	0.85	0.84
23	220								1.00	0.99	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.86	0.86	0.85	0.84
24	222									1.00	0.99	0.98	0.97	0.95	0.94	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.86	0.86	0.85	0.84
26	226									1.00	0.99	0.98	0.97	0.95	0.94	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.87	0.86	0.85	0.84
28	230									1.00	0.99	0.99	0.98	0.96	0.95	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.87	0.86	0.85	0.84
30	234										0.99	0.99	0.98	0.96	0.95	0.94	0.93	0.91	0.90	0.90	0.89	0.88	0.87	0.86	0.85	0.84
32	237										1.00	0.99	0.98	0.96	0.95	0.94	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.86	0.85	0.84
34	241										1.00	0.99	0.98	0.97	0.96	0.95	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.86	0.85	0.84
36	244											1.00	0.99	0.97	0.96	0.95	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.86	0.86	0.84
38	247											1.00	0.99	0.97	0.96	0.95	0.94	0.92	0.91	0.90	0.90	0.88	0.87	0.87	0.86	0.85
40	250											1.00	0.99	0.98	0.97	0.96	0.94	0.93	0.92	0.90	0.90	0.89	0.88	0.87	0.86	0.85
42	253												0.99	0.98	0.97	0.96	0.94	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.86	0.85
44	256												1.00	0.98	0.97	0.96	0.94	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.86	0.85
46	259												1.00	0.99	0.97	0.96	0.95	0.94	0.92	0.91	0.90	0.89	0.88	0.87	0.86	0.85
48	261													0.99	0.98	0.97	0.95	0.94	0.93	0.92	0.90	0.89	0.88	0.87	0.86	0.86
50	264													0.99	0.98	0.97	0.95	0.94	0.93	0.92	0.91	0.89	0.88	0.87	0.87	0.86
52	266													0.99	0.98	0.97	0.96	0.94	0.93	0.92	0.91	0.90	0.88	0.88	0.87	0.86
54	269													1.00	0.99	0.97	0.96	0.95	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.86
56	271													1.00	0.99	0.98	0.96	0.95	0.94	0.93	0.91	0.90	0.89	0.88	0.87	0.86
58	273														0.99	0.98	0.96	0.95	0.94	0.93	0.91	0.90	0.89	0.88	0.87	0.86
60	276														0.99	0.98	0.97	0.95	0.94	0.93	0.92	0.90	0.89	0.88	0.87	0.86
62	278														0.99	0.99	0.97	0.96	0.94	0.93	0.92	0.91	0.90	0.88	0.88	0.87
64	280														1.00	0.99	0.97	0.96	0.95	0.94	0.92	0.91	0.90	0.89	0.88	0.87
66	282															0.99	0.97	0.96	0.95	0.94	0.92	0.91	0.90	0.89	0.88	0.87
68	284															0.99	0.98	0.96	0.95	0.94	0.93	0.91	0.90	0.89	0.88	0.87
70	286															0.99	0.98	0.97	0.95	0.94	0.94	0.92	0.90	0.89	0.88	0.87
75	290															1.00	0.99	0.97	0.96	0.95	0.94	0.92	0.91	0.90	0.89	0.88
80	295																0.99	0.98	0.96	0.96	0.94	0.93	0.91	0.91	0.89	0.88
85	299																1.00	0.98	0.97	0.96	0.95	0.93	0.92	0.91	0.90	0.88
90	303																	0.99	0.98	0.97	0.96	0.94	0.92	0.91	0.90	0.89
95	307																	0.99	0.98	0.97	0.97	0.95	0.93	0.92	0.90	0.89
100	311																	1.00	0.98	0.97	0.97	0.96	0.94	0.92	0.91	0.90
105	314																		0.99	0.98	0.97	0.97	0.95	0.93	0.92	0.90
110	318																		1.00	0.98	0.98	0.97	0.95	0.94	0.92	0.91
115	321																		1.00	0.98	0.98	0.97	0.96	0.94	0.92	0.91
120	324																			0.99	0.98	0.97	0.96	0.94	0.92	0.91
125	327																			0.99	0.98	0.97	0.97	0.95	0.93	0.91
130	331																			1.00	0.98	0.97	0.97	0.95	0.93	0.91
135	333																				0.99	0.97	0.96	0.95	0.93	0.91
140	336																				0.99	0.97	0.96	0.96	0.93	0.91
145	339																				1.00	0.98	0.96	0.96	0.94	0.92
150	342																				1.00	0.98	0.96	0.96	0.94	0.92
155	344																					0.99	0.97	0.96	0.94	0.92
160	347																					1.00	0.97	0.95	0.95	0.92
165	350																						0.97	0.95	0.95	0.92
170	352																						0.97	0.95	0.95	0.92
175	354																						0.98	0.95	0.94	0.93
180	357																						0.99	0.95	0.94	0.93
185	359																						1.00	0.96	0.94	0.93
190	361																						1.00	0.96	0.94	0.93
195	364																							0.96	0.94	0.92
200	366																							0.97	0.93	0.92
205	368																							0.98	0.93	0.92
210	370																							1.00	0.93	0.91
215	372																								0.94	0.91
220	374																								0.94	0.90

Superheat Correction Factors for Safety Valves (Table 3)

Pressure = Set Pressure + Over Pressure + Atmospheric Pressure   1 Psig = 0.06895 barg = 0.070.1 kgf / ㎠g   1barg = 14.5035 psig = 1.0197 kgf / kgf / ㎠g

Pressure (bar absolute)	Saturation Temperature(℃)	Inlet Temperature(℃)																								
		400	410	420	430	440	450	460	470	480	490	500	510	520	530	540	550	560	570	580	590	600	610	620	630	640
2	120	0.82	0.82	0.81	0.80	0.80	0.79	0.79	0.78	0.77	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.73	0.72	0.72	0.71	0.70	0.70	0.71
3	133	0.82	0.82	0.81	0.80	0.80	0.79	0.79	0.78	0.78	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.73	0.72	0.72	0.71	0.70	0.70	0.71
4	144	0.82	0.82	0.81	0.80	0.80	0.79	0.79	0.78	0.78	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.73	0.72	0.72	0.71	0.70	0.70	0.71
5	152	0.82	0.82	0.81	0.80	0.80	0.79	0.79	0.78	0.78	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.74	0.73	0.73	0.72	0.72	0.71	0.70	0.70	0.71
6	159	0.82	0.82	0.81	0.80	0.80	0.79	0.79	0.78	0.78	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.74	0.73	0.73	0.72	0.72	0.71	0.70	0.70	0.71
7	165	0.82	0.82	0.81	0.80	0.80	0.79	0.79	0.78	0.78	0.77	0.76	0.76	0.76	0.75	0.74	0.74	0.74	0.73	0.73	0.72	0.72	0.71	0.70	0.70	0.71
8	170	0.82	0.82	0.81	0.80	0.80	0.79	0.79	0.78	0.78	0.77	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.72	0.71	0.70	0.70	0.71
9	175	0.83	0.82	0.81	0.80	0.80	0.79	0.79	0.78	0.78	0.77	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.72	0.71	0.70	0.70	0.71
10	180	0.83	0.82	0.81	0.80	0.80	0.79	0.79	0.78	0.78	0.77	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.72	0.71	0.71	0.70	0.71
11	184	0.83	0.82	0.81	0.80	0.80	0.79	0.79	0.78	0.78	0.77	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.72	0.71	0.71	0.70	0.71
12	188	0.83	0.82	0.81	0.81	0.80	0.79	0.79	0.78	0.78	0.77	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.72	0.71	0.71	0.70	0.71
13	192	0.83	0.82	0.81	0.81	0.80	0.80	0.79	0.78	0.78	0.77	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.72	0.71	0.71	0.70	0.71
14	195	0.83	0.82	0.81	0.81	0.80	0.80	0.79	0.78	0.78	0.77	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.72	0.71	0.71	0.70	0.71
15	198	0.83	0.82	0.81	0.81	0.80	0.80	0.79	0.78	0.78	0.77	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.72	0.71	0.71	0.70	0.71
16	201	0.83	0.82	0.82	0.81	0.80	0.80	0.79	0.78	0.78	0.77	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.72	0.71	0.71	0.70	0.71
17	204	0.83	0.82	0.82	0.81	0.80	0.80	0.79	0.78	0.78	0.77	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.72	0.71	0.71	0.70	0.71
18	207	0.83	0.82	0.82	0.81	0.80	0.80	0.79	0.78	0.78	0.77	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.72	0.72	0.71	0.70	0.71
19	210	0.83	0.82	0.82	0.81	0.80	0.80	0.79	0.78	0.78	0.77	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.72	0.72	0.71	0.70	0.71
20	212	0.83	0.82	0.82	0.81	0.80	0.80	0.79	0.78	0.78	0.77	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.72	0.72	0.71	0.70	0.71
21	215	0.83	0.82	0.82	0.82	0.80	0.80	0.79	0.78	0.78	0.77	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.72	0.72	0.71	0.70	0.71
22	217	0.83	0.83	0.82	0.82	0.80	0.80	0.79	0.78	0.78	0.77	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.72	0.72	0.71	0.70	0.71
23	220	0.84	0.83	0.82	0.82	0.80	0.80	0.79	0.79	0.78	0.77	0.77	0.77	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.72	0.72	0.71	0.70	0.71
24	222	0.84	0.83	0.82	0.82	0.80	0.80	0.79	0.79	0.78	0.77	0.77	0.77	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.72	0.72	0.71	0.70	0.71
26	226	0.84	0.83	0.82	0.82	0.81	0.80	0.79	0.79	0.78	0.78	0.77	0.77	0.76	0.76	0.75	0.74	0.74	0.73	0.73	0.73	0.72	0.72	0.71	0.70	0.71
28	230	0.84	0.83	0.82	0.82	0.81	0.80	0.79	0.79	0.78	0.78	0.77	0.77	0.76	0.76	0.75	0.75	0.74	0.73	0.73	0.73	0.72	0.72	0.71	0.70	0.71
30	234	0.84	0.83	0.82	0.82	0.81	0.80	0.79	0.79	0.78	0.78	0.77	0.77	0.76	0.76	0.75	0.75	0.74	0.73	0.73	0.73	0.72	0.72	0.71	0.70	0.71
32	237	0.84	0.83	0.82	0.82	0.81	0.80	0.79	0.79	0.79	0.78	0.77	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.72	0.71	0.70	0.71
34	241	0.84	0.83	0.82	0.82	0.81	0.80	0.80	0.79	0.79	0.78	0.77	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.72	0.71	0.70	0.71
36	244	0.84	0.83	0.83	0.82	0.81	0.81	0.80	0.79	0.79	0.78	0.77	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.72	0.71	0.70	0.71
38	247	0.84	0.83	0.83	0.82	0.81	0.81	0.80	0.79	0.79	0.78	0.78	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.72	0.71	0.70	0.71
40	250	0.84	0.83	0.83	0.82	0.81	0.81	0.80	0.79	0.79	0.78	0.78	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.72	0.71	0.70	0.71
42	253	0.84	0.84	0.83	0.82	0.81	0.81	0.80	0.79	0.79	0.78	0.78	0.77	0.77	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.72	0.71	0.71	0.71
44	256	0.84	0.84	0.83	0.82	0.81	0.81	0.80	0.80	0.79	0.78	0.78	0.77	0.77	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.72	0.71	0.71	0.72
46	259	0.85	0.84	0.83	0.82	0.82	0.81	0.80	0.80	0.79	0.78	0.78	0.77	0.77	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.72	0.71	0.71	0.72
48	261	0.85	0.84	0.83	0.82	0.82	0.81	0.80	0.80	0.79	0.78	0.78	0.77	0.77	0.76	0.75	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.71	0.71	0.72
50	264	0.85	0.84	0.83	0.83	0.82	0.81	0.80	0.80	0.79	0.79	0.78	0.77	0.77	0.76	0.75	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.71	0.71	0.72
52	266	0.85	0.84	0.83	0.83	0.82	0.81	0.81	0.80	0.79	0.79	0.78	0.77	0.77	0.76	0.75	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.71	0.71	0.72
54	269	0.85	0.84	0.84	0.83	0.82	0.81	0.81	0.80	0.79	0.79	0.78	0.77	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.71	0.71	0.72
56	271	0.85	0.84	0.84	0.83	0.82	0.81	0.81	0.80	0.79	0.79	0.78	0.78	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.71	0.71	0.72
58	273	0.85	0.85	0.84	0.83	0.82	0.82	0.81	0.80	0.80	0.79	0.78	0.78	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.71	0.71	0.72
60	276	0.85	0.85	0.84	0.83	0.82	0.82	0.81	0.80	0.80	0.79	0.78	0.78	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.71	0.71	0.72
62	278	0.86	0.85	0.84	0.83	0.82	0.82	0.81	0.80	0.80	0.79	0.78	0.78	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.71	0.71	0.72
64	280	0.86	0.85	0.84	0.83	0.83	0.82	0.81	0.80	0.80	0.79	0.78	0.78	0.77	0.77	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.71	0.71	0.72
66	282	0.86	0.85	0.84	0.84	0.83	0.82	0.81	0.80	0.80	0.79	0.78	0.78	0.77	0.77	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.71	0.71	0.72
68	284	0.86	0.85	0.84	0.84	0.83	0.82	0.81	0.81	0.80	0.79	0.79	0.78	0.77	0.77	0.76	0.76	0.75	0.74	0.74	0.73	0.73	0.72	0.71	0.71	0.72
70	286	0.86	0.85	0.84	0.84	0.83	0.82	0.81	0.81	0.80	0.79	0.79	0.78	0.77	0.77	0.76	0.76	0.75	0.74	0.74	0.73	0.73	0.72	0.71	0.71	0.72
75	290	0.87	0.85	0.85	0.84	0.83	0.82	0.81	0.81	0.80	0.79	0.79	0.78	0.78	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.71	0.72
80	295	0.87	0.86	0.85	0.84	0.83	0.83	0.82	0.81	0.80	0.80	0.79	0.78	0.78	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.71	0.72
85	299	0.87	0.86	0.85	0.84	0.83	0.83	0.82	0.81	0.81	0.80	0.79	0.78	0.78	0.77	0.77	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.71	0.72
90	303	0.88	0.87	0.86	0.84	0.84	0.83	0.82	0.81	0.81	0.80	0.79	0.79	0.78	0.77	0.77	0.76	0.76	0.75	0.74	0.74	0.73	0.73	0.72	0.71	0.72
95	307	0.88	0.87	0.86	0.85	0.84	0.83	0.82	0.82	0.81	0.80	0.80	0.79	0.78	0.78	0.77	0.76	0.76	0.75	0.75	0.75	0.73	0.73	0.72	0.71	0.72
100	311	0.88	0.87	0.86	0.85	0.85	0.84	0.83	0.82	0.81	0.80	0.80	0.79	0.78	0.78	0.77	0.76	0.76	0.75	0.75	0.75	0.74	0.73	0.72	0.71	0.73
105	314	0.89	0.88	0.87	0.86	0.85	0.84	0.83	0.82	0.81	0.81	0.80	0.79	0.78	0.78	0.77	0.77	0.76	0.75	0.75	0.75	0.74	0.73	0.72	0.72	0.73
110	318	0.89	0.88	0.87	0.86	0.85	0.84	0.83	0.82	0.81	0.81	0.80	0.79	0.78	0.78	0.77	0.77	0.76	0.75	0.75	0.75	0.74	0.73	0.72	0.72	0.72
115	321	0.89	0.88	0.87	0.86	0.85	0.84	0.83	0.82	0.81	0.81	0.80	0.79	0.78	0.78	0.77	0.76	0.76	0.75	0.75	0.75	0.74	0.73	0.72	0.71	0.72
120	324	0.89	0.88	0.87	0.86	0.85	0.84	0.83	0.82	0.81	0.81	0.80	0.79	0.78	0.78	0.77	0.76	0.76	0.75	0.74	0.74	0.73	0.73	0.72	0.71	0.72
125	327	0.90	0.88	0.87	0.86	0.85	0.84	0.83	0.82	0.81	0.80	0.80	0.79	0.78	0.77	0.77	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.71	0.71	0.72
130	331	0.90	0.88	0.87	0.86	0.85	0.84	0.83	0.82	0.81	0.80	0.79	0.79	0.79	0.77	0.76	0.76	0.75	0.75	0.74	0.74	0.73	0.72	0.71	0.71	0.72
135	333	0.90	0.88	0.87	0.86	0.85	0.84	0.83	0.82	0.81	0.80	0.79	0.78	0.78	0.77	0.76	0.76	0.75	0.74	0.74	0.74	0.73	0.72	0.71	0.70	0.71
140	336	0.90	0.88	0.87	0.86	0.85	0.83	0.82	0.82	0.81	0.80	0.79	0.78	0.77	0.77	0.76	0.75	0.75	0.74	0.73	0.73	0.72	0.72	0.71	0.70	0.71
145	339	0.90	0.88	0.87	0.86	0.84	0.83	0.82	0.81	0.80	0.80	0.79	0.78	0.77	0.76	0.76	0.75	0.74	0.74	0.73	0.73	0.72	0.71	0.70	0.70	0.71
150	342	0.90	0.88	0.87	0.86	0.84	0.83	0.82	0.81	0.80	0.79	0.78	0.78	0.77	0.76	0.75	0.75	0.74	0.73	0.73	0.73	0.72	0.71	0.70	0.70	0.71
155	344	0.90	0.88	0.87	0.86	0.84	0.83	0.82	0.81	0.80	0.79	0.78	0.77	0.77	0.76	0.75	0.74	0.74	0.73	0.72	0.73	0.71	0.71	0.70	0.69	0.70
160	347	0.90	0.88	0.87	0.86	0.84	0.83	0.82	0.81	0.80	0.78	0.78	0.77	0.76	0.76	0.75	0.74	0.73	0.73	0.72	0.72	0.71	0.70	0.69	0.69	0.70
165	350	0.90	0.88	0.87	0.86	0.84	0.83	0.82	0.80	0.79	0.78	0.78	0.77	0.76	0.75	0.74	0.74	0.73	0.72	0.72	0.72	0.71	0.70	0.69	0.68	0.70
170	352	0.90	0.88	0.86	0.86	0.84	0.82	0.81	0.80	0.79	0.78	0.77	0.76	0.76	0.75	0.74	0.73	0.73	0.72	0.71	0.71	0.70	0.70	0.69	0.68	0.69
175	354	0.90	0.88	0.86	0.86	0.83	0.82	0.81	0.80	0.79	0.78	0.77	0.76	0.75	0.74	0.74	0.73	0.72	0.72	0.71	0.71	0.70	0.69	0.68	0.68	0.69
180	357	0.90	0.88	0.86	0.86	0.83	0.82	0.80	0.79	0.78	0.77	0.76	0.76	0.75	0.74	0.73	0.73	0.72	0.71	0.71	0.71	0.69	0.69	0.68	0.67	0.68
185	359	0.90	0.88	0.86	0.85	0.83	0.81	0.80	0.79	0.78	0.77	0.76	0.75	0.74	0.74	0.73	0.72	0.71	0.71	0.70	0.70	0.68	0.68	0.67	0.67	0.68
190	361	0.90	0.88	0.86	0.84	0.82	0.81	0.80	0.79	0.78	0.77	0.76	0.75	0.74	0.73	0.73	0.72	0.71	0.70	0.70	0.70	0.68	0.68	0.67	0.66	0.67
195	364	0.90	0.87	0.85	0.83	0.82	0.80	0.79	0.79	0.77	0.76	0.75	0.74	0.73	0.72	0.72	0.71	0.70	0.70	0.69	0.69	0.68	0.67	0.66	0.66	0.67
200	366	0.90	0.87	0.85	0.83	0.81	0.79	0.79	0.78	0.76	0.75	0.74	0.74	0.73	0.72	0.72	0.70	0.70	0.69	0.68	0.68	0.67	0.67	0.65	0.65	0.66
205	368	0.90	0.87	0.85	0.83	0.81	0.79	0.78	0.77	0.76	0.75	0.74	0.73	0.72	0.71	0.71	0.70	0..69	0.68	0.68	0.68	0.66	0.66	0.65	0.64	0.66
210	370	0.90	0.87	0.84	0.82	0.80	0.79	0.78	0.76	0.75	0.74	0.73	0.72	0.71	0.70	0.70	0.69	0.68	0.68	0.67	0.67	0.66	0.65	0.64	0.64	0.65
215	372	0.89	0.86	0.84	0.82	0.80	0.78	0.77	0.76	0.74	0.73	0.72	0.71	0.71	0.70	0.69	0.68	0.67	0.67	0.66	0.66	0.65	0.64	0.63	0.63	0.64
220	374	0.89	0.86	0.83	0.81	0.79	0.78	0.76	0.75	0.74	0.73	0.72	0.71	0.70	0.69	0.68	0.67	0.67	0.66	0.65	0.65	0.64	0.64	0.62	0.62	0.63

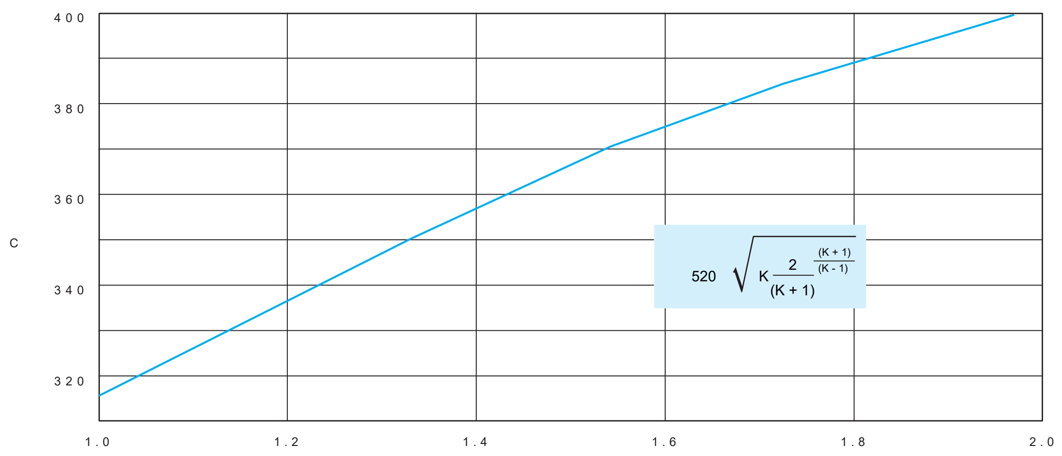
CALCULATION OF SAFETY VALVE CAPACITY

For Gas or Vapor (HPGCL)

$$W = \frac{C \times K_d \times K_b \times K_c \times P_1 \times A \times \sqrt{M}}{13160 \times \sqrt{T \times Z}}$$

W	Capacity of Gas or Vapor (kg / h)
C	Coefficient Determined Form an expression of the ratio of the specific heats (k = C p / C v) of the Gas or Vapor at inlet relieving conditions. (See Table 4)
K d	Coefficient of discharge, Safety valve 0.975
K b	Capacity correction factor due to back pressure. For conventional type valve, use a valve for K b equal to 1.0
C	Capacity correction factor for installations with a rupture Disk Upstream of the safety valve 1.0 When a rupture disk is not installed.

A	Orifice area, ㎟
P 1	Upstream relieving pressure absolute, kPag
M	Molecular weight of the gas or vapor at inlet relieving conditions
Z	Compressibility factor for the deviation of the actual gas from a perfect gas, a ratio evaluated at inlet Relieving conditions.(if a calculated compressibility is not Available, a Z value of 1.0 should be used.)
T	Relieving temperature of the inlet gas or vapor, K (℃ + 273)



Specific Heat Ratio, K = C p / C v

Table 4

k	C	k	C	k	C	k	C
1	315	1.2	337	1.4	356	1.6	373
1.02	318	1.22	339	1.42	358	1.62	374
1.04	320	1.24	341	1.44	360	1.65	376
1.06	322	1.26	343	1.46	361	1.66	377
1.08	325	1.28	345	1.48	363	1.68	379
1.1	327	1.3	347	1.5	365	1.7	380
1.12	329	1.32	349	1.52	366	1.8	387
1.14	331	1.34	351	1.54	368	1.9	394
1.16	333	1.36	353	1.56	369	1.95	397
1.18	335	1.38	354	1.58	371	2	400

For Water (HPGCL)

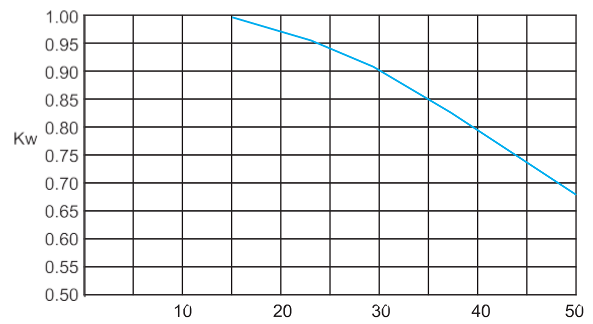
$$W = \frac{K_d \times K_w \times K_c \times K_v \times K_p \times A \times (1.25p - Pb)^{1/2}}{11.78 \times (G)^{1/2}}$$

A	Effective discharge area, ㎟
W	Flow rate, L/min
K d	Rated coefficient of discharge that should be obtained from the valve manufacturer. Safety valve 0.65.
K W	Correction factor due to back pressure. If back pressure is atmospheric, Kw=1. Balanced bellows valves in back pressure service will require the correction factor determined from Figure 5. Conventional valves require no special correction.
K c	Combination correction factor for installation with a rupture disk upstream of the safety valve. Use a value for Kc equal to 1.0 when a rupture disk does not exist.
K p	Correction factor due to overpressure. At 25% overpressure, Kp=1.0. For overpressures other than 25%, Kp is determined from Figure 7

G	Specific gravity of the liquid at the flowing temperature referred to water at standard conditions.
P	Set pressure, kPag
P b	Total back pressure, kPag
K v	Correction factor due to viscosity as determined from Figure 6 or from the following equation: $= \left(0.9935 + \frac{2.878}{R^{0.5}} + \frac{342.75}{R^{0.5}}\right)^{-1.0}$ $R = \frac{85,200}{U\sqrt{A}}$
R	Reynolds Number
u	Viscosity at the flowing temperature, in Saybolt Universal seconds, SSU.

Figure 5

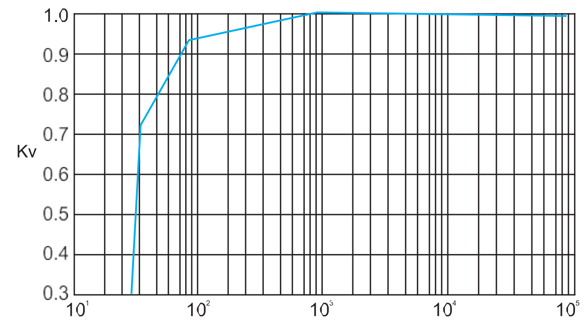
Correction Factor, Kw Due to back Pressure on Balanced Bellows



$$\text{Gauge Backpressure(\%)} = \frac{\text{Back pressure (kPa(g))}}{\text{Set pressure (kPa(g))}} \times 100$$

Figure 6

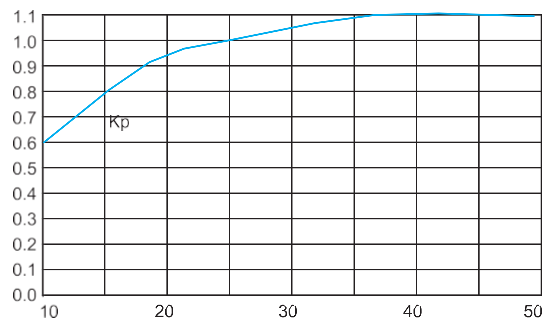
Correction factor, Kv, Due to Viscosity



R = Reynold's Number

Figure 7

Correction Factor, Kp Due to Overpressure



Overpressure (%)

Specific Heat Ratios Are At Atmospheric Pressure and 60 °F Unless Otherwise Noted

Table 5

Chemical medium	Gas & Vapor Phase			Liquid Phase				
	K Cp/Cv	M	SP.GR (AIR=1)	WATER=1 SP.GR	SP.GR@ TEMP °F	B.P.	Critical Temp °F	Critical pressure psia
Acetaldehyde	1.14	44	1.519	783	64	68	370	
Acetic acid	1.15	60	2.071	1.049	68	245	611	
Acetone	-	-	-	791	66	133	455	
Acetylene	1.26	26	0.898	-	-	-119	97	911
Air	1.4	29	1	-	-	-313	-220	547
Ammonia	1.31	17	0.587	817	-110	-28	270	1683
Argon	1.67	39.94	1.381	1.65	-387	-301	-188	
Benzene	1.12	78	2.7	0.879	68	176	551	700
Butadiene 1.3	1.12	54	1.922	0.621	68	24	306	661
Butane n	1.094	58	2.07	0.579	68	31	306	551
Iso	1.094	58	2.07	0.557	68	11	273	529
Carbon dioxide	1.29	44	1.53	1.101	-35	-109	88	1072
Carbon disulfide	1.21	76	2.628	1.263	68	116	523	
Carbone monoxide	1.4	28	967	0.814	-318	-314	-218	
Chlorine	1.36	70.9	2.45	1.56	-29	-30	291	
Cyclohexane	1.09	84	2.905	0.779	68	177	538	593
N-decane	1.03	142	4.91	0.734	60	345	655	320
Dowtherm a	1.046	166	5.696	0.997	212	496	-	
Dowtherm b	-	147	5.074	1.181	212	352	-	
Ethane	1.19	30	1.05	0.546	-126	-128	90	708
Ethyl alcohol	1.13	46	1.59	0.789	68	173	469	
Ethyl chloride	1.19	64.5	2.22	0.903	50	54	369	
Ethylene(ethene)	1.26	28.05	0.997	0.566	-152	-155	49	749
Freon 11	1.14	137.3	4.742	1.494	63	75	386	
Freon 12	1.14	120.9	4.174	1.486	-22	-21	234	
Freon 22	1.18	86.47	2.985	1.419	-42	-41	205	
Freon 114	1.09	170.92	5.9	1.538	30	38	295	
Gasoline	-	-	-	7.5**	68	158***	-	
Helium	1.66	4	0.138	-	-	-452	-450	
N-hexane	1.06	86	2.97	0.659	68	156	454	440
Hydrogen chloride	1.41	36.4	1.27	-	-	-118	127	
Hydrogen	1.41	2	0.07	0.709	-423	-423	-400	188
Hydrogen sulfide	1.32	34	1.19			-75	213	1306
Kerosene	-	-	-	0.815	60	-	-	
Methane	1.31	16	555	0.415	-263	-259	-116	673
Methyl alcohol	1.2	32	1.11	0.792	68	149	464	
Methyl butane	1.08	72.15	2.49	0.625	60	82	370	476
Methyl chloride	1.2	50.49	1.742	0.952	32	-11	290	
Natural gas	1.27	19**	0.656	-	-	-	-	
Nitric acid(hno2)	-	-	-	1.502	60	187	-	
Nitric oxide	1.4	30	1.036	1.269	-239	-240	-137	
Nitrogen	1.4	28	0.967	1.026	-422	-321	-233	
Nitrous oxide	1.3	44	1.519	1.226	-128	-131	98	
Nonane	1.04	128	4.43	0.718	68	303	613	345
N-octane	1.05	114	3.94	0.707	68	258	565	362
Oils.								
Fuel, bunker c	-	-	-	1.014	60	-	-	
Fuel, no.3	-	-	-	0.899	60	-	-	
Fuel, no.5 & 6	-	-	-	0.993	60	-	-	
Lube	-	-	-	0.91	60	-	-	
Mineral	-	-	-	0.91	60	-	-	
Oxygen	1.4	32	1.1	1.426	-422	-297	-182	
N-pentane	1.07	72	2.49	0.631	60	97	386	490
Propane	1.13	44	1.55	0.585	-49	-44	206	617
Propylene	1.15	42	1.476	0.609	-53	-54	197	667
Steam	1.33	18	0.622	1.00	39	212	706	3206
Styrene	1.07	104	3.6	0.906	68	293	706	
Sulfur dioxide	1.29	64	2.26	1.434	32	14	315	1141
Sulfuric acid	-	-	-	1.834	60	644***	-	
Toluene	1.09	92	3.18	0.866	68	231	609	611
N-heptane	1.05	100	3.49	0.684	60	209	513	397
Phenol	1.3	94	3.27			358		890

Constant back pressure only - Orifice area calculations

USA Unit formulas / **Metric Unit Formulas**

Gases or Vapors

Gases or Vapors (Lbs / hr)

$$A = \frac{W\sqrt{TZ}}{C\ Kd\ P1\ \sqrt{M\ Kb}}$$

Gases or Vapors (kg / hr)

$$A = \frac{W\sqrt{TZ}}{C\ Kd\ P1\ \sqrt{M\ Kb}}$$

Gases or Vapors (S.C.F.M)

$$A = \frac{V\sqrt{TZM}}{6.32\ C\ Kd\ P1\ Kb}$$

- or -

$$A = \frac{V\sqrt{TZG}}{1.175\ C\ Kd\ P1\ Kb}$$

Gases or Vapors (nm^3 / hr)

$$A = \frac{V\sqrt{TZM}}{22.4\ C\ Kd\ P1\ Kb}$$

- or -

$$A = \frac{V\sqrt{TZG}}{4.163\ C\ Kd\ P1\ Kb}$$

Air

Air... (S.C.F.M)

$$A = \frac{V\ a\sqrt{T}}{418\ Kd\ P1\ Kb}$$

Air... (nm^3 / hr)

$$A = \frac{V\ a\sqrt{T}}{1103\ Kd\ P1\ Kb}$$

Steam

Steam... (Lbs / hr)

$$A = \frac{W\ s}{51.5\ Kd\ P1\ Kb\ Ksh}$$

Steam... (kg / hr)

$$A = \frac{W\ s}{51.5\ Kd\ P1\ Kb\ Ksh}$$

Liquids

Liquid ... (G. P. M)

$$A = \frac{V_{gpm}\sqrt{G}}{38.0\ Kd\ Kp\ \sqrt{1.25P - Pb}\ Kv}$$

Liquid ... (liter / min)

$$A = \frac{V_{\ell}\sqrt{G}}{84.0\ Kd\ Kp\ \sqrt{1.25P - Pb}\ Kv}$$

Variable or Constant back pressure

The Balanced Bellows valves must be used when the variation in back pressure exceeds 10% of the set pressure. Sizing formulas of Balanced Bellows valves for gas or vapor are the same as above formulas of Conventional valves except that the factor Kb changes to Kb.

The formulas of Liquid are as follows :

Liquids

G. P. M

$$A = \frac{V_{gpm}\sqrt{G}}{38.0\ Kd\ Kp\ \sqrt{1.25P - Pb}\ Kv}$$

liter / min

$$A = \frac{V_{\ell}\sqrt{G}}{84.0\ Kd\ Kp\ \sqrt{1.25P - Pb}\ Kv}$$

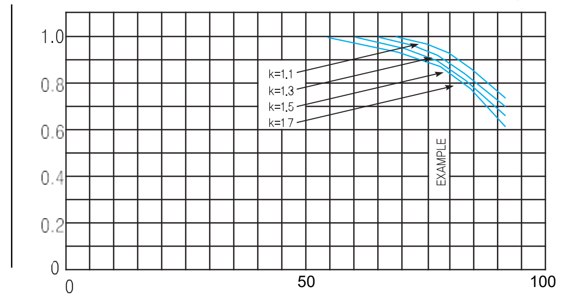
(Unit : mm)

Nomenclature	USA UNIT Formulas	Metric UNIT Formulas
A = Required orifice area	in^2	cm^2
W = Required flow through valve	Lbs/hr	kg/hr
C = Coefficient determined by ratio of the specific heats of the gas of vapor.		
$C = 520\sqrt{k\left(\frac{2}{K+1}\right)^{\frac{k+1}{k-1}}}$ (in case of Lbs, in Runkin UNIT) $C = 520\sqrt{k\left(\frac{2}{K+1}\right)^{\frac{k+1}{k-1}}}$ (in case of kg, cm Kelvin UNIT)		
of select from table 6 and 7 on page 43 K = ratio of the specific heats, Cp/Cv of the gas or vapor This value is constant for an ideal gas. if this ratio is unknown, the value k=1.001 may be used. Kd = Coefficient of discharge = 0.975 for gas, vapor, air, steam for API sizing = 0.62 for liquids method = 0.869 for gas, vapor, air steam for ASME 90% of = 0.558 for liquids actual capacity V = Required flow through valve at 14.7 psia and 60 °F (in USA unit) at 1.0332kgf/cm^2 abs and 0 ℃ (in Metric unit) P1 = Upstream relieving pressure absolute This is the set pressure plus the allowable over pressure, plus the atmospheric pressure.	S.C.F.M. Psia (set P+over P+14.7)	NM3/hr. kgf/cm2abs (set P-over P+1.033)
Kb = Constant back pressure correction factor $= \frac{735}{C}\sqrt{\frac{k}{k-1}\left(\frac{P2}{P1}\right)^{\frac{2}{k}} - \left(\frac{P2}{P1}\right)^{\frac{k}{k-1}}}$ (USA UNIT) $= \frac{548}{C}\sqrt{\frac{k}{k-1}\left(\frac{P2}{P1}\right)^{\frac{k}{1}} - \left(\frac{P2}{P1}\right)^{\frac{k}{k-1}}}$ (Metric UNIT) or from Fig 8 on page 42 P1 and P2=Upstream pressure and back pressure in absolute. kb=1.0 when back pressure is below 50% of abs. relieving pressure.	psia	kgf/cm^2abs.
M = Molecular weight of the gas or vapor. T = Absolute temperature of the inlet. Z = Compressibility factor corresponding to P1 and T. (if this factor is not available, compressibility correction can be safely ignored by using a value of Z=1.0)	°F + 460	℃ -273
G = Specific gravity of gas(air=1.0) or specific gravity of liquid(water=1.0) Va = Required air flow through valve. Ws = Required steam flow through valve	S.C.F.M.	NM3/hr kgf/hr
Ksh = 1.0 for sat. steam Vgpm=Required liquid flow / Ksh = Super heat correction factor	Lbs/hr	
Vℓ = Required liquid flow	U.S	
Kp = Liquid capacity correction factor due to overpressure. Kp = 1.00 at 25% overpressure The factor for other overpressure can be obtained from Fig 10 on page 42	gallons/mi	
Kv = Viscosity correction factor from curve Fig 12 on page 42 Kv = 1.0 at normal viscosity		Liter / min
Kw = Back pressure correction factor for liquid service from Fig 11 on page 42 Balanced bellows type only.		
Kb = Back pressure correction factor for gas or vapor service from Fig 9 on page 42 Balanced bellows type only.		
P = Set pressure at inlet		kgf/cm^2g
Pb = Back pressure at outlet.	psig	kgf/cm^2g

Kb = Back pressure Correction factor

Kb

Fig. 8

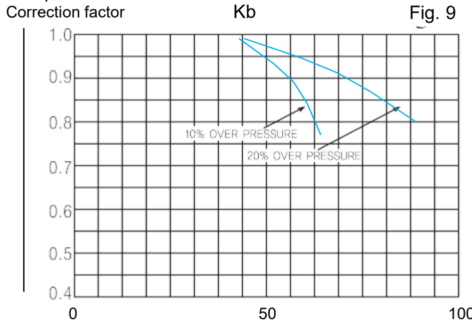


$\text{Absolute back pressure} = \frac{\text{Back pressure} \cdot \text{Overpressure absolute}}{\text{Set Pressure} \cdot \text{Overpressure absolute}} \times 100 = r \times 100$

Kb = Back pressure Correction factor

Kb

Fig. 9

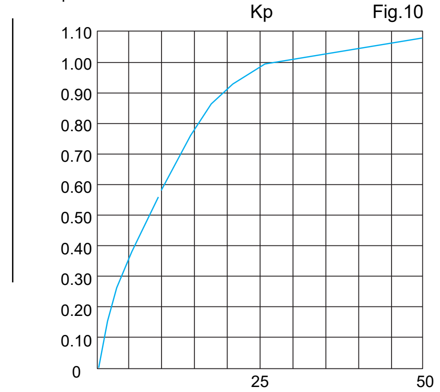


$\text{Gauge back pressure} = \frac{\text{Back pressure Gauge}}{\text{Set Pressure Gauge}} \times 100$

Correction factor Kp

Kp

Fig.10

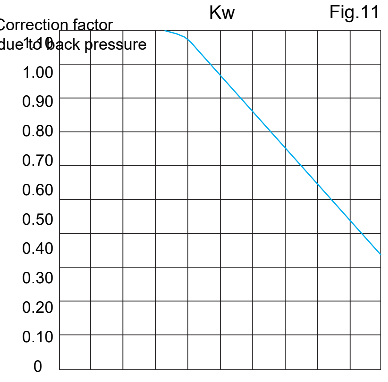


note: the above curve shows that up to and including 25% overpressure, capacity is affected by the change in lift, the change in-orifice discharge coefficient, and the change in overpressure. above 25%, capacity is affected only by the change in overpressure, valves operating at low overpressures lend to "chatter" : therefore, overpressure of less than 10% should be avoided. fig.10 capacity correction factors due to overpressure for relief and safety relief valves in liquid service

Kw = Correction factor due to back pressure

Kw

Fig.11



$\text{Gauge back pressure} = \frac{\text{Back pressure Gauge}}{\text{Set Pressure Gauge}} \times 100$

Fig.11 – Capacity correction factor, Kw, Due to back pressure on Balanced – Bellows pressure relief valves in Liquid Service

When a relief valve is sized for viscous liquid service, it is suggested that if be sized first as for nonviscous type application in order to obtain a preliminary required discharge Area. A, from manufactures, standard orifice sizes, the next larger orifice size should be Used in determining the Reynold's number, R from either of the following relationships :

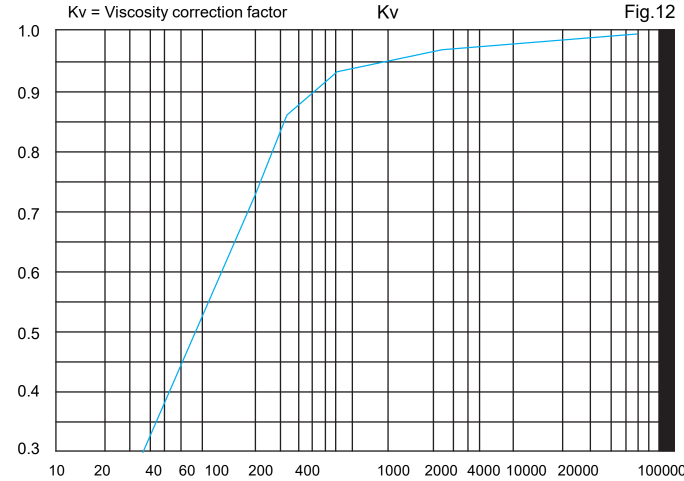
$$R = \frac{gpm(2{,}800G)}{V\sqrt{A}}$$

$$R = \frac{12{,}700gpm}{U\sqrt{A}}$$

Kv = Viscosity correction factor

Kv

Fig.12



R・Reynold's Number

Fig. 12 – Cappacity correction factor, Kv, Due to viscosity

Where
gpm = flow rate at the flowing temperature, in U.S gallons per minute.
G = specific gravity of the liquid at the flowing temperature referred to water = 1.00 at 70 °F.
V = absolute viscosity at the flowing temperature, in Saybolt universal seconds. After the valve of R is determined, the factor Kv is obtained from Fig.12. Fac-corrected area exceeds the "chosen standard orifice area" if the above calculations should be repeated using the next larger standard orifice (Per API RP520).

Values of Coefficient C(Per API RP 520) — In USA Unit Table 6

kn	C	kn	C	kn	C	kn	C	kn	C	kn	C
0.41	219.28	0.71	276.09	1.01	316.56	1.31	347.91	1.61	373.32	1.91	394.56
0.42	221.59	0.72	277.64	1.02	317.74	1.32	348.84	1.62	374.09	1.92	395.21
0.43	223.86	0.73	279.18	1.03	318.9	1.33	349.77	1.63	374.85	1.93	395.86
0.44	226.1	0.74	280.7	1.04	320.05	1.34	350.68	1.64	375.61	1.94	396.5
0.45	228.3	0.75	282.2	1.05	321.19	1.35	351.6	1.65	376.37	1.95	397.14
0.46	230.47	0.76	283.69	1.06	322.32	1.36	352.5	1.66	377.12	1.96	397.78
0.47	232.61	0.77	285.16	1.07	323.44	1.37	353.4	1.67	377.86	1.97	398.41
0.48	234.71	0.78	286.62	1.08	324.55	1.38	354.29	1.68	378.61	1.98	399.05
0.49	236.78	0.79	288.07	1.09	325.65	1.39	355.18	1.69	379.34	1.99	399.67
0.5	238.83	0.8	289.49	1.1	326.75	1.4	356.06	1.7	380.08	2	400.3
0.51	240.84	0.81	290.91	1.11	327.83	1.41	356.94	1.71	380.8	2.01	400.92
0.52	242.82	0.82	292.31	1.12	328.91	1.42	357.81	1.72	381.53	2.02	401.53
0.53	244.78	0.83	293.7	1.13	329.98	1.43	358.67	1.73	382.52	2.03	402.15
0.54	246.72	0.84	295.07	1.14	331.04	1.44	359.53	1.74	382.97	2.04	402.76
0.55	248.66	0.85	296.43	1.15	332.09	1.45	360.88	1.75	383.68	2.05	403.37
0.56	250.5	0.86	297.78	1.16	333.14	1.46	361.23	1.76	384.39	2.06	403.97
0.57	252.36	0.87	299.11	1.17	334.17	1.47	362.07	1.77	385.09	2.07	404.58
0.58	254.19	0.88	300.43	1.18	335.2	1.48	362.9	1.78	385.79	2.08	405.18
0.59	256	0.89	301.73	1.19	336.22	1.49	363.74	1.79	386.49	2.09	405.77
0.6	257.79	0.9	303.04	1.2	337.24	1.5	364.56	1.8	387.18	2.1	406.37
0.61	259.55	0.91	304.33	1.21	338.24	1.51	365.39	1.81	387.87	2.11	406.96
0.62	261.29	0.92	305.6	1.22	339.24	1.52	366.2	1.82	388.56	2.12	407.55
0.63	263.01	0.93	306.86	1.23	340.23	1.53	367.01	1.83	389.24	2.13	408.13
0.64	264.71	0.94	308.11	1.24	341.22	1.54	367.82	1.84	389.92	2.14	408.71
0.65	266.4	0.95	309.35	1.25	342.19	1.55	368.62	1.85	390.59	2.15	409.29
0.66	268.06	0.96	310.58	1.26	343.16	1.56	369.41	1.86	391.26	2.16	409.87
0.67	269.7	0.97	311.8	1.27	344.13	1.57	370.21	1.87	391.93	2.17	410.44
0.68	271.33	0.98	313.01	1.28	345.08	1.58	370.99	1.88	392.59	2.18	411.01
0.69	272.93	0.99	314.19	1.29	346.03	1.59	371.77	1.89	393.25	2.19	411.58
0.7	274.52	1	315.38	1.3	346.98	1.6	372.55	1.9	393.91	2.2	412.15

Interpolated values C becomes indeterminate as either n or K approachers 1.00.

k : Ratio of specific heat. $K = \frac{Cp}{Cv}$ n : isentropic expansion coefficient.

C : Coefficient determined by the ratio of the specific heats of the gas or vapor at standard condition

Values of Coefficient C — In Metric Unit Table 7

kn	C	kn	C	kn	C	kn	C	kn	C	kn	C
0.41	163.44	0.71	205.79	1.01	235.95	1.31	259.32	1.61	278.26	1.91	294.09
0.42	165.16	0.72	206.94	1.02	236.83	1.32	260.01	1.62	278.83	1.92	294.57
0.43	166.86	0.73	208.09	1.03	237.69	1.33	260.7	1.63	279.4	1.93	295.06
0.44	168.52	0.74	209.22	1.04	238.55	1.34	261.38	1.64	279.96	1.94	295.53
0.45	170.16	0.75	210.34	1.05	239.4	1.35	262.07	1.65	280.53	1.95	296.01
0.46	171.78	0.76	211.45	1.06	240.24	1.36	262.74	1.66	281.09	1.96	296.49
0.47	173.38	0.77	212.55	1.07	214.08	1.37	263.41	1.67	281.64	1.97	296.96
0.48	174.94	0.78	213.63	1.08	241.91	1.38	264.07	1.68	282.2	1.98	297.43
0.49	176.49	0.79	214.71	1.09	242.73	1.39	264.74	1.69	282.74	1.99	297.9
0.5	178.01	0.8	215.77	1.1	243.55	1.4	265.39	1.7	283.29	2	298.37
0.51	179.51	0.81	216.83	1.11	244.35	1.41	266.05	1.71	283.83	2.01	298.83
0.52	180.99	0.82	217.88	1.12	245.16	1.42	266.7	1.72	284.38	2.02	299.28
0.53	182.45	0.83	218.91	1.13	246.95	1.43	267.34	1.73	284.91	2.03	299.74
0.54	183.89	0.84	219.93	1.14	246.74	1.44	267.98	1.74	285.45	2.04	300.2
0.55	185.34	0.85	220.95	1.15	247.53	1.45	268.61	1.75	285.98	2.05	300.62
0.56	186.71	0.86	221.95	1.16	248.31	1.46	269.24	1.76	286.51	2.06	301.1
0.57	188.1	0.87	222.94	1.17	249.08	1.47	269.67	1.77	287.03	2.07	301.56
0.58	189.46	0.88	223.93	1.18	249.84	1.48	270.5	1.78	287.55	2.08	302
0.59	190.81	0.89	224.9	1.19	250.6	1.49	271.12	1.79	288.07	2.09	3.0.44
0.6	192.15	0.9	225.87	1.2	251.36	1.5	271.73	1.8	288.59	2.1	302.89
0.61	193.46	0.91	226.83	1.21	252.11	1.51	272.35	1.81	289.1	2.11	303.33
0.62	194.75	0.92	227.78	1.22	252.85	1.52	272.95	1.82	289.62	2.12	303.77
0.63	196.04	0.93	228.72	1.23	253.59	1.53	273.55	1.83	290.12	2.13	304.2
0.64	197.31	0.94	229.65	1.24	254.33	1.54	274.16	1.84	290.63	2.14	304.63
0.65	198.56	0.95	230.58	1.25	255.05	1.55	274.75	1.85	291.13	2.15	305.07
0.66	199.8	0.96	231.49	1.26	255.78	1.56	275.34	1.86	291.63	2.16	305.5
0.67	201.02	0.97	232.4	1.27	256.5	1.57	275.94	1.87	292.13	2.17	305.92
0.68	202.24	0.98	233.3	1.28	257.21	1.58	276.52	1.88	292.62	2.18	306.35
0.69	203.43	0.99	234.18	1.29	257.92	1.59	277.1	1.89	293.11	2.19	306.77
0.7	204.62	1	235.07	1.3	258.62	1.6	277.68	1.9	293.6	2.2	307.2

Interpolated values since C becomes indeterminate as either n or K approachers 1.00.

k : Ratio of specific heat. $K = \frac{Cp}{Cv}$ n : isentropic expansion coefficient.

C : Coefficient determined by the ratio of the specific heats of the gas or vapor at standard condition

1. Outline

It is necessary to select the type, size, material, etc of the safety valve matching to the facility to prevent disasters such as damage or explosion of utensil resulted from the extraordinarily increasing internal pressure by installing it in the pressure-generating device such as gas, heat, etc or a pressure vessel to maintain it If is not properly selected, sometimes it does not function sufficiently as a safety valve to cause a disaster. Therefore, we will indicate the note for handing that you should know as a final user(consumer) to exactly use the safety valve and explain its basic points.

2. Definition and type of a safety valve

2-1. Definition of a safety valve

A safety valve should keep the original airtight condition by discharging a fluid of excessive pressure automatically not depending on other assistant power or human power and reducing the pressure in the equipment to the fixed one. The safety valve is defined as follows in ISO international standard. A safety valve is the valve to be closed by automatically emitting the pressure by a fluid without any other assistance except for its own power and recovering it to the normal when the pressure of a fluid exceeds the fixed pressure. Also, in Japanese Industrial Standard, it is explained as a valve with the ability to emit the fluid(steam and gas) of nominal emitting amount by automatically operating at a pre-fixed pressure at the entrance and becoming a normal condition again when the pressure decreases.

2-2 Type of a safety valve

There are various types of different structures but a lot of them cannot be found in the existing market so we mention the general spring-type safety valve here.

a. Lift and full bore safety valve

A safety valve can be classified into lift safety valve and full bore safety valve according to the type of a device.(KS B 6216-1998)

- Lift safety valve (Figure 13)

The lift shall be more than 1/40 of the seat caliber or be less than 1/4 and with the disc opened, the area of the fluid passage of the seat caliber shall be minimum.

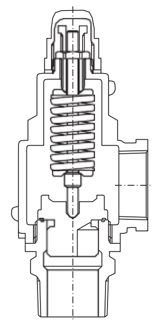


Figure 13
Lift Safety Valve

- Full bore safety valve (Figure 14)

The seat caliber shall exceed 1.15 times of that of the neck. The area of the fluid passage of the seat orifice when the disc is opened shall exceed 1.05 times of neck caliber while the area of the fluid passage of safety valve entrance and pipe shall exceed 1.7 times.
(Refer to the catalogue for the names of each part.)

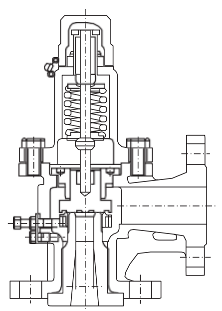


Figure 14
Full Bore Safety Valve

B. Types according to the differences of forms

- Lever type (Figure 15)

A lever is to check any defect of lift device on the pressurized condition and it is installed for the manual discharge from the safety valve irrespective of the operation condition to promptly discharge with parts of heat on operation. Provided that it is inappropriate for toxic gas, heating gas, liquid, etc.

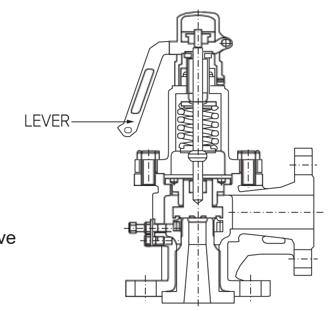


Figure 15
Lever Type

- Closed Type

The structure of a valve is closed as it is dangerous to discharge toxic gas or heating gas close to the facility.

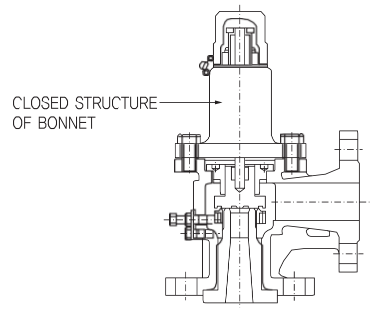


Figure 16
Closed Type

- Open Type

It is the structure to discharge directly into the air with the safety valve operating and the fluid discharged. The operation is relatively smooth as it is not so much effected by the pressure
Provided that it is inappropriate
for toxic gas, heating gas, liquid, etc.

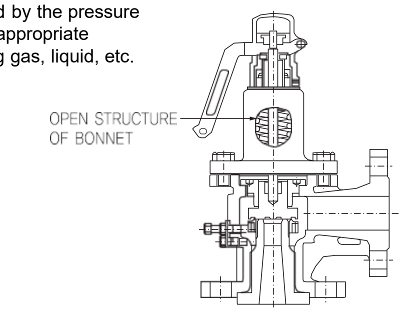


Figure 17
Open Type

- Top Guide

The disc is of piston structure for the smooth upward and downward movement of disc, which is supported by valve guide of cylinder type.
The both of entrance and exit have less pressure
loss and good discharge coefficient.

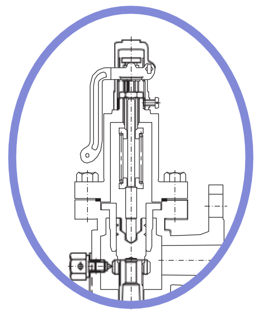


Figure 18
Top Guide

- Wing Guide

The guide part of disc is inserted in the seat for compact and the possibility for pressure loss on the discharged part will be less than the top guide type but it tends to have worse discharge coefficient
than top guide as the guide in the seat
causes resistance to the fluid.

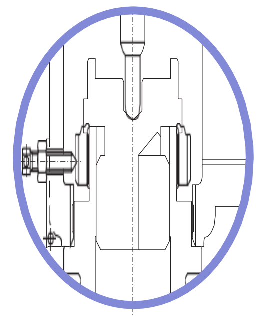


Figure 19
Wing Guide

- Soft Seat

It uses the soft synthetic resin on the seat of the safety valve and thanks to the elasticity, it attaches to the seat well. Provided that the application scope of resin shall be applied and lower than the metal seat.

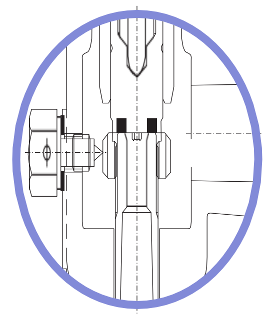


Figure 20
Soft Seat

2-3. Safety Valve and Relief Valve

As explained in the section above, the object of the safety valve is to secure safety of the facility so it is necessary to set up not to operation under normal operation condition. The relief valve is the one with the function to automatically open according to the increase of the liquid pressure at a certain value and it has the object to limit the fixed pressure uniformly. In terms of structure, it is similar to the safety valve so except for special cases, the safety valve can be used as a relief valve. Also, there are some cases to call the structure, which can be used for gas and liquid, as a safety relief valve.

3. Meaning of Terms

The meanings of the terms used for the safety valve are defined as follows in KS B6216-1998. Also, besides the standard terms, the frequently used words can be indicated as follows.

・Extract from KS B6216 - 1998

(1) Safety Valve
The valve with the ability to discharge the fluid(vapor and gas) of nominal discharge amount to automatically operate when the entrance pressure reaches the prescribed pressure and to restore to the normal condition again when the pressure decreases.

(2) Fixed Pressure
Pressure indicated on the nameplate as a discharge pressure fixed on the design for the safety valve demanding the discharge pressure and as a discharge starting pressure for the safety valve demand the discharge starting pressure.

(3) Discharge Starting Pressure
As a pressure the safety valve starts to discharge, it is the pressure at the entrance when small amount of fluid(vapor or gas) discharge detected at the exit.

(4) Discharge Pressure
As a pressure at the entrance when the fluid is discharged by the operation of the safety valve, it is the pressure with the lift to the extent, which can be measured or on the condition, which can recognize the consecutive discharge condition.

(5) Pressure to Determine the Nominal Discharge Amount
Pressure to determine the nominal discharge amount, which is prescribed by the attached department.

(6) Discharge Stop Pressure
The pressure at the entrance when the movement becomes 0 as the discharge pressure decreases, the safety valve is closed and the flow of the fluid stops actually.

(7) Pressure of Discharge Difference
Difference between the discharge pressure and discharge stop pressure at the safety valve demanding the discharge pressure and the difference between the discharge start pressure and the discharge stop pressure at the safety valve demanding the discharge start pressure.

(8) Movement
Movement on the axis direction of the disc or valve from the valve closing location to the valve opening location in the course of safety valve discharge.

(9) Nominal Discharge Amount
The discharge amount guaranteeing for each safety valve. Amount to be calculated according to the provision of 5. of KS B 6352(method to measure the discharge coefficient of the safety valve) and the provision of addendum.

(10) Nominal Discharge Coefficient
Coefficient applied to the nominal discharge amount. it shall be determined in the method according to the provision of 4.2.3 of KS B 6352 or the equivalent.

(11) DISC Seat Caliber
Inner diameter of contact of seat and disc.

(12) Discharge Area
As an area of the part to determine the fluid amount to pass through the safety valve, it is the area used for calculation of nominal discharge amount.

(13) Caliber of The Neck
The inner diameter of the narrowest part of the nozzle from the orifice to collect the fluid and the seat side.

(14) Discharge Pressure
Pressure at the exit of the safety valve. There are two kinds of discharge pressure here.

(a) Pressure generated at the exit of the safety valve by the resistance of exhaust at the discharge of the safety valve.
(b) Pressure already existing at the exhaust before the safety valve discharges.

Other terms(JIS).

Other Terms(JIS)

Chattering - It means the condition to generate incomplete operation that the disc chatters the seat with the weak up and down vibration on the condition of incomplete discharge or starting the discharge.

Hunting - It means the condition that the disc operation hits the seat seriously by the severe up and down movement due to the local pressure change in the connecting device or pipe resulted from the discharge of the safety valve.

Flutter - It means the condition that the disc vibrates upward and downward to the extent not to chatter the seat in the course of lift when the safety valve is operating.

Flashing - It means the condition that part of the liquid of high temperature evaporates when it is discharged into the air through the relief valve.

Accumulation - It means % of the established pressure of the difference between the pressure to determine the discharge amount and the established pressure.

4. Principle of operatic

Hop orifice is required for the clear operation as a safety valve as indicated in figure 21.
The spring-type safety valve keeps airtight by always pressing the disc to the seat with the power of spring. This spring power is designed and assembled to break the airtight balance at the fixed pressure. After all, at the time when a small amount starts to flow out as the balance becomes upset by the inner pressure to reach the fixed pressure(this phenomenon is referred to as discharge start). At that time, the discharged fluid is saved at the HOP orifice for a moment. At this time, the pressure is cast and the disc pushes upward.(this phenomenon is called to be discharge). The pushing disc become sealed again with the increased spring power as the inner pressure decreases. (this phenomenon is called to be discharge stop)

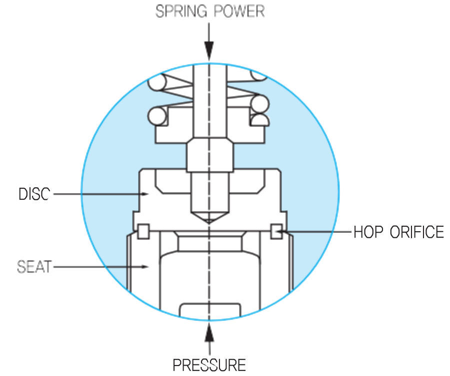


Figure 21
Structure of Seat Part(A)

Figure 22 explains the operation flow.

In this figure, if the time between the discharge start and discharge is short, 'POP operates promptly' That is, as the safety increases, it becomes the safety valve of high efficiency. Besides, there is something with the shape as indicated in Figure 23 to play the role in freely adjusting the HOP orifice and improving other capability but the principle of operation is same as HOP orifice type in Figure 21 as discussed.

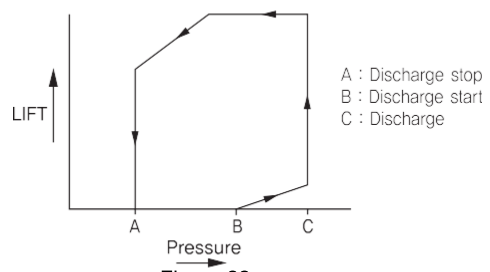


Figure 22
Operation Flow

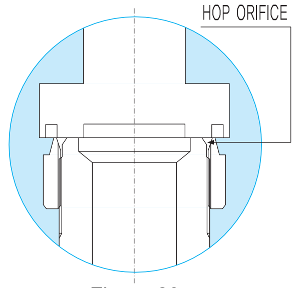


Figure 23
Structure of Seat Part(B)

5. Note for Handling

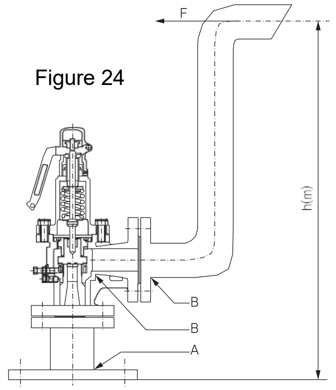
5-1. Note for Planning

(a) The safety valve shall be installed vertically on the ground of the place, where it is easy to repair, inspect or adjust it and it is not dangerous to human body at the time of discharge.

(b) The length in installing the safety valve shall be designed for the decrease of the fluid pressure not to exceed 3% of the discharge pressure at the time of discharge of the safety valve and shall be over the inner diameter of the safety valve entrance.

(c) The safety valve is rebound in the opposite direction of the exhaust. In the design for installation, it shall have the enough strength against the compression, tensile and bending by rebound.(Figure 24)

Figure 24



Opening and Closing of Rebound According to KSB 6216

$$F = \frac{W\sqrt{\frac{K\ T\ 1}{(K+1)M}}}{274}$$

(d) The length of the safety valve discharge pipe shall be as short as possible making sure that the back pressure at the exit when the safety valve discharges, do not exceed 10% of the discharge pressure. Also, it shall be more than the exit diameter of the safety valve.

(e) If uniting 2 safety valve discharge pipes or more, the angle shall be less than 45 (Y-type) and the pipe are of the jointed bottom shall be more than the sum of each pipe area.

(f) If inevitably installing the safety valve in the pipe, the length of the joint pipe shall be as short as possible.

(g) The open drainage shall be installed at the bottom lower than the valve seat in the valve body exit of the safety valve attaching the discharge pipe. Provided that the drainage of discharge pipe can be shared if the designation diameter is less than 50mm. The drainage of the safety valve, whose valve body is cast iron or cast steel and whose designation diameter exceeds 65mm, shall comply with the provision of KSB 0222. (official taper screw)

5-2. Note for Piping Installation

(a) If installing the screw-type safety valve, do not turn it by holding the body but make sure to connect it by using the hexagonal side of the screw. If turning and connecting it by holding the body, it may cause leakage, etc. Also, bind the seal tape out of the edge so it is not entangled on the edge of the screw. If it is entangled on the edge, the tape will be cut when draining to cause leakage.

(b) Precise lapping processing has been done to increase the sealing performance on the seat of the safety valve.
If foreign substances such as dust or scale contact the seat in the operation of the safety valve, it may cause the leakage of the seat. Therefore, clean the tank and piping thoroughly before installing the safety valve and carry out the air purge.

6. Repair and Inspection

6-1. Please perform the repair and inspection at the same interval as the appearance inspection of the facility.

(a) Appearance inspection

1 - Check whether the valve box is rotten or cracked.

2 - Whether the safety valve leaks under the normal pressure. (check the leakage noise and temperature change)

3 - Whether the installation section of the safety valve leaks

4 - Check any abnormal vibration of the facility

5- Check the opening of the main valve of the safety valve.(Keep it opened)

6-2. Safety Inspection

(a) The regular inspection shall be done every 6 months and sometimes check the following items.

1 - Condition on the flange side.(corrosion, damage, etc)

2 - Attachment condition of the foreign substance, scale, etc at the passage of the entrance.

3 - Corrosion and damage of the valve box

4 - Piping inspection

(b) In principle, perform the inspection of item a of 6-1 above after the popping of the safety valve and immediately repair any defect.

(c) Operation pressure check

1 - Check whether there is no change by comparing the discharge start pressure or discharge pressure and stop pressure with the values indicated on the nameplate of the safety valve for the operation pressure.

2 - At this time, please use air or incombustible gas in principle for the fluid.

(d) Seat sealing check

1 - Check whether there is no leakage at 90% of the fixed pressure.

7. Adjustment

If it is not necessary to adjust the discharge pressure or discharge difference pressure, it can be done as follows.

7-1. Adjustment of discharge pressure

(Note) 1 - At this time, make sure that the pressure is removed.

2 - It is dangerous if the safety valve is operated while adjusting it, so do not make the face upward nor stand on the side of the exhaust.

The discharge pressure is strictly adjusted in the performance inspection by our company but there are
some cases of some differences according to the variation of conditions such as safety valve design location, distance to the pressure gauge, etc.
The tolerance of the discharge pressure for ‘hot air and gas spring safety valve’ of KS B 6216-1998 is prescribed as indicated in the following table.

Table 1

For Hot Air	
Fixed Pressure kgf / ㎠ {MPa}	Tolerance kgf / ㎠ {MPa}
Less than {0.5}	± 0.14 {0.014}
From 5 {0.5} to 23 {2.3}	± (3% of the fixed pressure)
From 23 {2.3} to 70 {7.0}	± 0.7 {0.07}
More than 70 {7.0}	± (1% of the fixed pressure)

for Gas

From the fixed pressure to 1.1 times of the fixed pressure

(a) Closed-type safety valve (Figure 25)
1 - Detach the sealing and CAP A(Figure 25)
2 - Loosen the stop nut C(Figure 25)
3 - The discharge pressure can be adjusted by turning the adjusting screw B(Figure 25)
(turn it clockwise on the top to increase the discharge pressure and counterclockwise to decrease it)
4 - Fasten the stop nut C(Figure 25) after the adjustment.
(At this time, make sure that the adjusting screw B(Figure 25) do not turn together)
5 – Also the adjustment scope shall be less than ±10%.

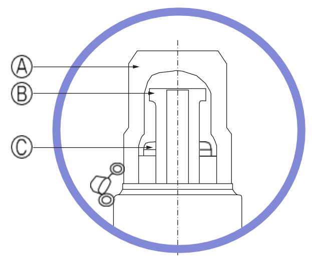


Figure 25

for Gas

From the fixed pressure to 1.1 times of the fixed pressure

(a) Closed-type safety valve (Figure 25)
1 - Detach the sealing and CAP A(Figure 25)
2 - Loosen the stop nut C(Figure 25)
3 - The discharge pressure can be adjusted by turning the adjusting screw B(Figure 25)
(turn it clockwise on the top to increase the discharge pressure and counterclockwise to decrease it)
4 - Fasten the stop nut C(Figure 25) after the adjustment.
(At this time, make sure that the adjusting screw B(Figure 25) do not turn together)
5 – Also the adjustment scope shall be less than ±10%.

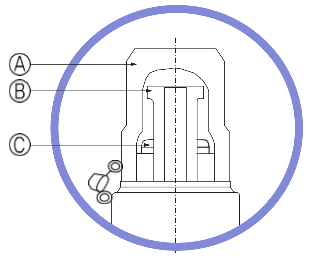


Figure 25

(b)Lever-type safety valve (Figure 26)

1 - Cut the sealing, pull the rivet C(Figure 26) out and remove handle B(Figure 26).
2 - Remove the hexagonal stop screw D(Figure 26) and then the lever cap A (Figure 26)
3 - After this, the discharge pressure can be adjusted just like the closed type safety valve of 7-1.a.
4 - In reassembling, make sure the lever B(Figure 26) is 1mm apart from the screw washer.

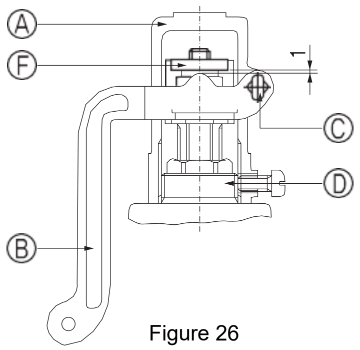


Figure 26

7-2. Adjustment of Discharge Difference Pressure (Figure 27)

(Note)
1 - At this time, make sure that the pressure is removed.
2 - It is dangerous if the safety valve is operated while adjusting it, so do not make the face upward nor stand on the side of the exhaust. As for those with the device, which can adjust the discharge difference pressure by type. (adjusting ring section), it can be adjusted as follows.

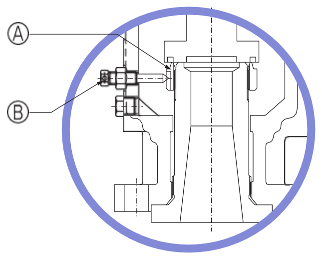


Figure 27

8. Cause and Measure of Trouble

The cause of the safety valve trouble are various according to the conditions such as the surrounding atmospheres of the using fluid and it is difficult to explain all of them so we select and describe the representative items among them here.

8-1. Seat Leakage

The sealing performance of the safety valve depends of technology mostly. There were some leaky safety valves before the present lapping technology was developed but as the lapping technology greatly develops lately, it becomes possible to manufacture the safety valve of no leakage. However, if not paying sufficient attention to handling it, the leakage may be caused from the beginning of the use.(refer to 5-2 for the note for piping installation)

(a) By foreign substances
If not thoroughly performing the air purge for the piping, or in case of trial run with the sludge inserted in the fluid, there are some cases to put foreign substances in the seat and disc. At this time, they may be removed by manual operation simply but even after the operation, the seal side shall be sufficiently checked against any damage or foreign substances. In case of this damage or foreign substances, it is hard to handle in the user's position so it is necessary to return it to manufacturer promptly.

(b) Pipe pressure
1 - Personal cause
When doing the secondary piping for the safety valve, if turning the safety valve severely, the seat may spin in the aspect of the safety valve structure. At this time, the sealing side gets damaged or the location of the adjustment ring changes, which may cause the weakness of the functioning. In this case, there are cases that the user repair or it is necessary to return to the manufacturer for replacement. It is required to sufficiently recognize and judge them and promptly handle it.

2 - Inner stress cause
There is a case to have an adverse influence on the safety valve by the heat stress or remaining stress of the pipe. The problems of this is almost similar as the a forementioned personal causes but it is important to lay pipes, which can completely absorb the stress after the piping work.

(c) Balance of use stress and fixed stress
We explain the procedure from voltage boosting to discharge stop in the operation principle of the safety valve. As explained here, there is a phenomenon of discharge start before the discharge of the safety valve. If the use pressure considerably approaches to the fixed pressure, the phenomenon of discharge start is repeated as stated above, which may cause a disaster. It is desirable to design the use pressure to be less than 85% of the fixed pressure.

8-2. Incomplete operation

The phenomenons of hunting, chattering and flutter in the explanation of terms occur if the discharge stop is not too large(considerably close to the fixed pressure) or if applying not too much back pressure when discharging the fluid(if it becomes difficult to exhaust the discharged fluid). Naturally, the sealing side or frictional section gets damaged by the upward or downward movement of the disc. It is good to design the back pressure on the discharge side not to exceed 10% of the discharge pressure.

8-3. Corrosion

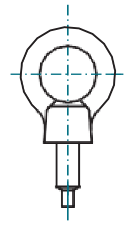
The problem of corrosion can be solved by sufficient prior discussion between users and manufacturer in general but there are some cases that a fluid of non corrosion or materials, which are not corroded normally, corrode under some situations.(for example, electrolytic corrosion). It is important to sufficiently check it when inspecting for repair of the safety valve and to immediately handle it.

Numbering System

KST Series – Screw Type, Low Lift Type

Selecting and specifying KSM Safety & Relief Valves is simple using the numbering system that follows. Each digit of the part number has a distinct significance. The digits describe the basic valve series, valve type, inlet / outlet type and connection type.

Model	Type	Lever	Use Condition
KST - 11	Conventional	No	Steam, Air & Gas, Vapor, Water & Liquid
KST - 12	Conventional	Yes	Steam, Air & Gas, Vapor


Option : Test gag

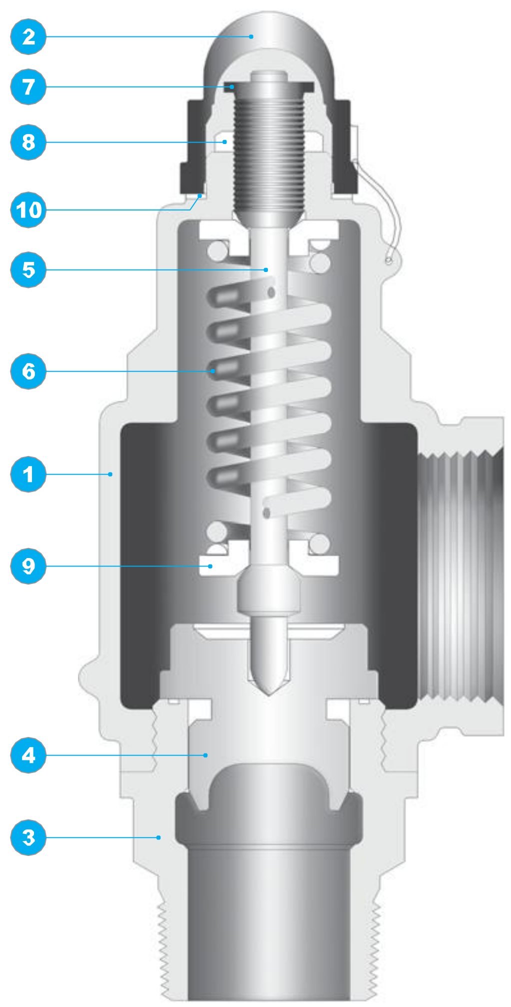
Example to Describe Model (KST-11, 15A M.PT x 20A F.PT)

K	S	T	11	15A	M	PT	20A	F	PT
Company Code	Valve Name	Connection Type	Valve Type	Inlet Size	Inlet Screw Connection	Inlet Connection	Outlet Size	Outlet Screw Connection	Outlet Connection
K : Korea Special Metal	S : Safety & Relief Valve	T : Screw Type	11: No lever 12 : Lever	15A, 20A, 25A 32A, 40A, 50A	M : Male F : Female	PT : Pipe Taper Thread NPT : National Pipe Taper Thread	20A, 25A, 32A 40A, 50A	M : Male F : Female	PT : Pipe Taper Thread NPT : National Pipe Taper Thread

BILL OF MATERIALS

Series KST – 11 (Size 15A/20A/32A)

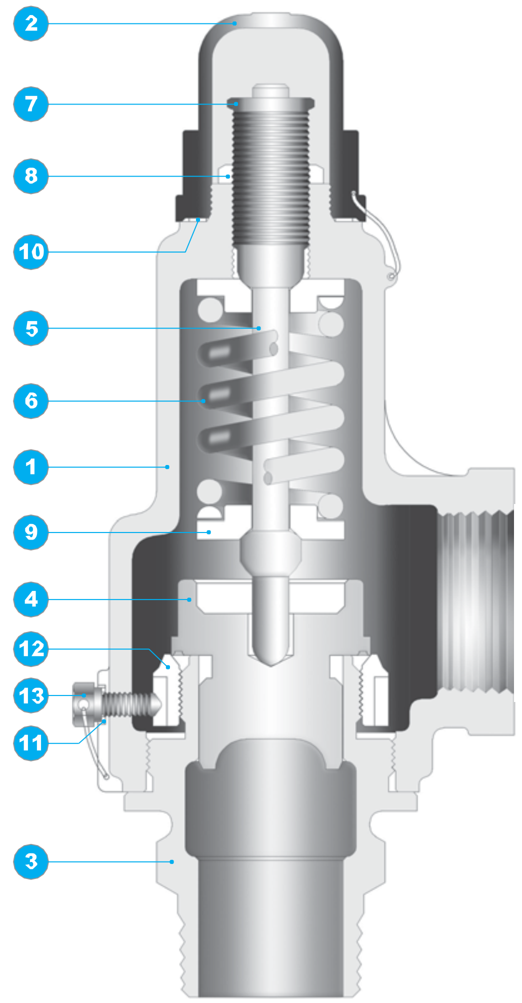
This valves are small, compact and high-performance valves widely used for small boiler, thermal expansion and the petrochemical industry as well as chemical and general industries and cover the wide pressure range, from low to high, of steam, air and gas, vapor, water and liquid.



No.	Part Name	Standard Material
1	Body	Bronze Cast Steel Stainless Steel
2	Cap	Bronze Cast Steel Stainless Steel
3	Seat	Bronze Stainless Steel
4	Disc	Brass Stainless Steel
5	Spindle	Brass Carbon Steel Stainless Steel
6	Spring	Carbon Steel Stainless Steel
7	Adjusting Screw	Brass Carbon Steel Stainless Steel
8	Adjusting Screw Nut	Brass Carbon Steel Stainless Steel
9	Spring Guide	Brass Carbon Steel Stainless Steel
10	Gasket	Non-Asbestos PTFE Graphite

Series KST – 11 (Size 40A/50A)

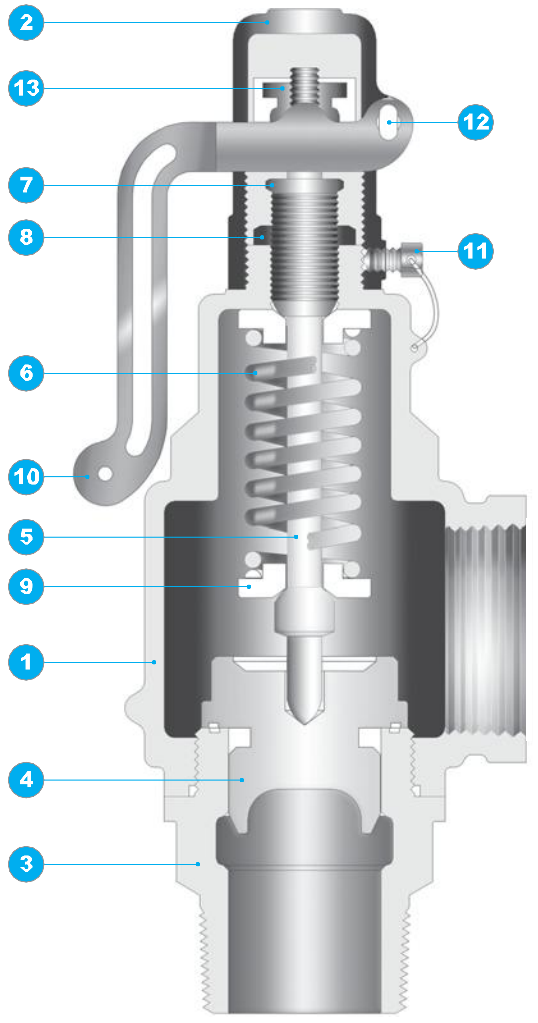
This valves are small, compact and high-performance valves widely used for small boiler, thermal expansion and the petrochemical industry as well as chemical and general industries and cover the wide pressure range, from low to high, of steam, air and gas, vapor, water and liquid.



No.	Part Name	Standard Material
1	Body	Ductile Cast Steel Stainless Steel
2	Cap	Bronze Cast Steel Stainless Steel
3	Seat	Bronze Stainless Steel
4	Disc	Brass Stainless Steel
5	Spindle	Carbon Steel Stainless Steel
6	Spring	Carbon Steel Stainless Steel
7	Adjusting Screw	Brass Carbon Steel Stainless Steel
8	Adjusting Screw Nut	Brass Carbon Steel Stainless Steel
9	Spring Guide	Brass Carbon Steel Stainless Steel
10	Gasket	Non-Asbestos PTFE Graphite
11	Gasket	Non-Asbestos PTFE Graphite
12	Blow Down Ring	Brass Stainless Steel
13	Lock Bolt	Brass Carbon Steel Stainless Steel

Series KST – 12 (Size 15A/20A/32A)

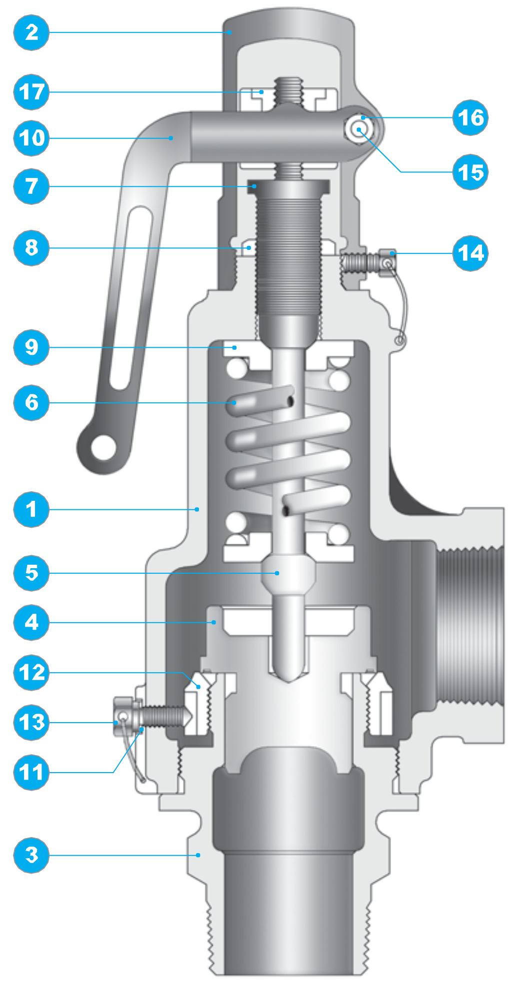
This valves are small, compact and high-performance valves widely used for small boiler, thermal expansion and the petrochemical industry as well as chemical and general industries and cover the wide pressure range, from low to high, of steam, air and gas, vapor.



No.	Part Name	Standard Material
1	Body	Bronze Cast Steel Stainless Steel
2	Cap	Bronze Cast Steel Stainless Steel
3	Seat	Bronze Stainless Steel
4	Disc	Brass Stainless Steel
5	Spindle	Brass Carbon Steel Stainless Steel
6	Spring	Carbon Steel Stainless Steel
7	Adjusting Screw	Brass Carbon Steel Stainless Steel
8	Adjusting Screw Nut	Brass Carbon Steel Stainless Steel
9	Spring Guide	Brass Carbon Steel Stainless Steel
10	Lever	Bronze
11	HEX. Bolt	Brass
12	Pin	Brass
13	Lifting Washer	Brass

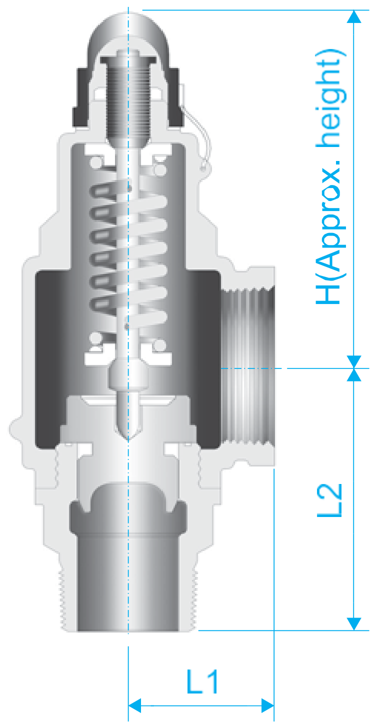
Series KST – 12 (Size 40A/50A)

This valves are small, compact and high performance valves widely used for small boiler, thermal expansion and the petrochemical industry as well as chemical and general industries and cover the wide pressure range, from low to high, of steam, air and gas, vapor.



No.	Part Name	Standard Material
1	Body	Ductile Cast Steel Stainless Steel
2	Cap	Bronze Cast Steel Stainless Steel
3	Seat	Bronze Stainless Steel
4	Disc	Brass Stainless Steel
5	Spindle	Carbon Steel Stainless Steel
6	Spring	Carbon Steel Stainless Steel
7	Adjusting Screw	Brass Carbon Steel Stainless Steel
8	Adjusting Screw Nut	Brass Carbon Steel Stainless Steel
9	Spring Guide	Brass Carbon Steel Stainless Steel
10	Lever	Bronze
11	Gasket	Non-Asbestos PTFE Graphite
12	Blow Down Ring	Brass Stainless Steel
13	Lock Bolt	Brass Carbon Steel Stainless Steel
14	HEX. Bolt	Brass
15	HEX. Bolt	Carbon Steel
16	Nut	Carbon Steel
17	Lifting Washer	Brass

KST - 11



Inet / Outlet Screw - PT

Low Lift Type

(Unit : mm)

Size Inlet x Outlet	Discharge Area (㎟)	Center to Face L1	Center to Face L2	Approx. Height H	Approx. Height (kg)
15A x 20A	25.434	34	53	82	0.85
20A x 20A	25.434	34	53	82	0.90
25A x 25A	45.216	40	65	96	1.25
32A x 32A	75.4385	45	78	105	1.70
40A x 40A	113.354	64	104	155	3.90
50A x 50A	180.864	83	113	192	7.20

Center to Face Tolerance : ± 1.5mm

Inet / Outlet Screw - PT or NPT

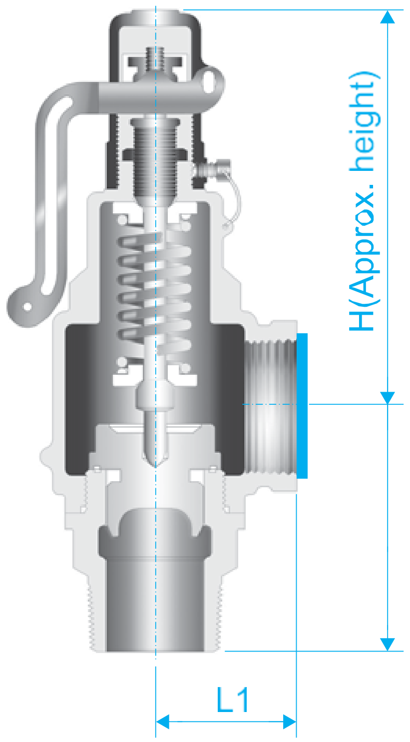
Full Lift Type

(Unit : mm)

Size Inlet x Outlet	Orifice Area (㎟)	Center to Face L1	Center to Face L2	Approx. Height H	Approx. Height (kg)
15A x 20A	78.5	43	66	116	1.48
20A x 25A	78.5	45	69	116	1.52
25A x 40A	132.665	64	104	155	4.10

Center to Face Tolerance : ± 1.5mm

KST - 12



Inet / Outlet Screw - PT

Low Lift Type

(Unit : mm)

Size Inlet x Outlet	Discharge Area (㎟)	Center to Face L1	Center to Face L2	Approx. Height H	Approx. Height (kg)
15A x 20A	25.434	34	53	101	0.90
20A x 20A	25.434	34	53	101	0.95
25A x 25A	45.216	40	65	117	1.30
32A x 32A	75.4385	45	78	126	1.90
40A x 40A	113.354	64	104	184	4.15
50A x 50A	180.864	83	113	221	7.45

Center to Face Tolerance : ± 1.5mm

Inet / Outlet Screw - PT or NPT

Full Lift Type

(Unit : mm)

Size Inlet x Outlet	Orifice Area (㎟)	Center to Face L1	Center to Face L2	Approx. Height H	Approx. Height (kg)
15A x 20A	78.5	43	66	126	1.64
20A x 25A	78.5	45	69	126	1.69
25A x 40A	132.665	64	104	184	4.10

Center to Face Tolerance : ± 1.5mm

Low Lift Type

(Unit : mm)

Materials: Body	Materials: Seat & Disc	Materials: Spring	Type	Valve Size: Inlet x Orifice DIA. x Outlet	End Connection: Inlet (Male)	End Connection: Outlet (Female)
Bronze	Bronze & Brass	Carbon Steel	KST - 11	15A x 12.5 x 20A	PT	PT
Carbon Steel	Stainless Steel	Stainless Steel	KST - 12	20A x 18 x 25A		
Stainless Steel {32A and Smaller}				25A x 24 x 25A 32A x 31 x 32A		
Ductile	Bronze & Brass	Carbon Steel	KST - 11	40A x 38 x 40A		
Carbon Steel	Stainless Steel	Stainless Steel	KST - 12	50A x 48 x 50A		
Stainless Steel {40A and Larger}						

Full Lift Type

(Unit : mm)

Materials: Body	Materials: Seat & Disc	Materials: Spring	Type	Valve Size: Inlet x Orifice DIA. x Outlet	End Connection: Inlet (Male)	End Connection: Outlet (Female)
Carbon Steel	Stainless Steel	Carbon Steel	KST - 11	15A x 10 x 20A	PT	PT
Stainless Steel		Stainless Steel	KST - 12	20A x 10 x 25A	or	or
{32A and Smaller}				25A x 13 x 40A	NPT	NPT

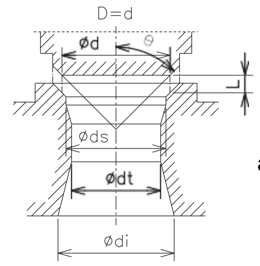
If at particular over pressure the valve attains high lift, the discharge area is established by measurement of the inlet passage at its least diameter. Some safety valves operate at low lift, in which case the controlling flow area is the so-called curtain area. This area is the product of the circumference of the minimum passage through the valve seat and valve lift.

Formulas for the Curtain Area are :

$= \pi DL$ (Flat Seat) - Lift Type

$= \pi DL \sin\theta$ (Conical Seat) - Lift Type

$= \pi / 4 \; d_t^2$ (Full Lift Type)



In case d s < d as Conical Seat

Where.

A : Effective Discharge Area (㎟)

D : Diameter of Disc Seat Opening (mm)

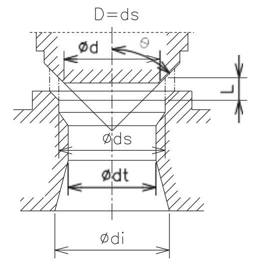
θ : Angle between the discharging part and the valve axis -> $\sin 45^\circ = 0.707$

d : Inside Diameter of Disc Seat Face on the Disc Side (mm)

d t : Throat Diameter (mm)

d s : Bore of Disc Seat Face (mm)

d i : Diameter of in Take Opening for Steam or Gas (Nominal Diameter)



In case d s > d a as Conical Seat

Fig. 1
Effective Discharge Area and Diameter of Disc Seat Opening

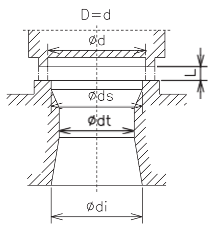
CALCULATION OF SAFETY & RELIEF VALVE CAPACITY

Code : KS B 6216 or KOSHA for Steam

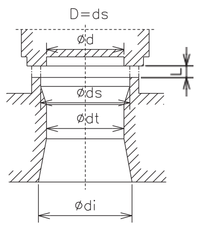
$$W = 5.246 \times C \times Kd \times A \times (P+0.1) \times 0.9$$

Nomenclature

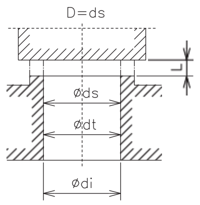
W	Capacity of Steam, kg / h
A	Effective Discharge Area, ㎟ Low Lift Type : A = π DL D = Diameter of Disc Seat (mm) L = Lift (mm)
P	For Set Pressure ≤ 0.1 MPa P = Set Pressure + 0.02 MPa For Set Pressure > 0.1 MPa P = Set Pressure x 1.03
K d	Coefficient of Discharge (Fig.3, page 12)
C	Superheat Correction Factor



In case d s < d as Flat Seat



In case d s > d as Flat Seat



In case d s = d t as Flat Seat

Fig. 2
Effective Discharge Area and Diameter of Disc Seat Opening

Capacity Table of Sat. Steam

Low Lift Type (Unit : kg / h)

Size		15A	20A	25A	32A	40A	50A
Dia. of Disc Seat (mm)		18	18	24	31	38	48
Lift (mm)		0.45	0.45	0.6	0.775	0.95	1.2
0.2	0.02	16.5	16.5	29.3	48.9	73.5	117
0.3	0.029	17.5	17.5	31.2	52.1	78.3	124
0.5	0.049	19.9	19.9	35.4	59.1	88.8	141
0.7	0.069	22.2	22.2	39.6	66.1	99.3	158
0.9	0.088	24.5	24.5	43.6	72.7	109	174
1	0.098	25.7	25.7	45.7	76.2	114	182
1.2	0.118	26.1	26.1	46.4	77.4	116	185
1.5	0.147	29.6	29.6	52.7	87.9	132	210
1.7	0.167	32	32	57	95.1	142	228
2	0.196	35.5	35.5	63.2	105	158	253
2.2	0.216	38	38	67.6	112	169	270
2.5	0.245	41.5	41.5	73.8	123	185	295
2.7	0.265	43.9	43.9	78.1	130	196	312
3	0.294	47.5	47.5	84.4	140	211	337
3.2	0.314	49.9	49.9	88.7	148	222	355
3.5	0.343	53.4	53.4	95	158	238	380
3.7	0.363	55.8	55.8	99.3	165	249	397
4	0.392	59.4	59.4	105	176	264	422
4.2	0.412	61.8	61.8	109	183	275	439
4.5	0.441	65.3	65.3	116	193	291	464
4.7	0.461	67.7	67.7	120	201	302	482
5	0.49	71.3	71.3	126	211	317	507
5.2	0.51	73.7	73.7	131	218	328	524
5.5	0.539	77.2	77.2	137	229	344	549
5.7	0.559	79.6	79.6	141	236	355	566
6	0.588	83.2	83.2	147	246	370	591
6.2	0.608	85.6	85.6	152	254	381	608
6.5	0.637	89.1	89.1	158	264	397	634
6.7	0.657	91.5	91.5	162	271	408	651
6.9	0.676	93.8	93.8	166	278	418	667
7	0.686	95.1	95.1	169	282	423	676
7.2	0.706	97.5	97.5	173	289	434	693
7.5	0.735	101	101	179	299	450	718
7.7	0.755	103	103	183	306	461	735
8	0.784	107	107	190	317	476	761
8.2	0.804	109	109	194	324	487	778
8.5	0.833	112	112	200	335	503	803
8.7	0.853	115	115	205	342	514	820
9	0.882	118	118	211	352	530	845
9.2	0.902	121	121	215	359	540	862
9.5	0.931	124	124	221	370	556	887
9.7	0.951	127	127	226	377	567	905
10	0.98	130	130	232	388	583	930
10.2	1	133	133	236	395	593	947
10.5	1.029	136	136	243	405	609	972
Kgf / ㎠ g Pressure	MPag	-					

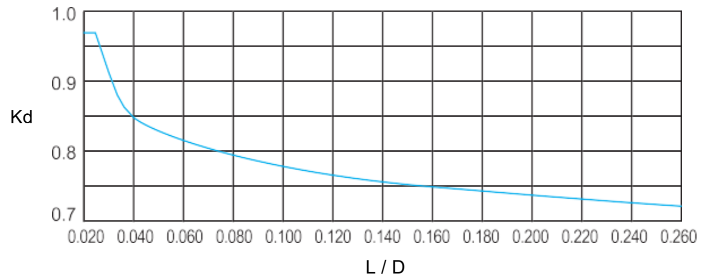
Code : KS B 6216 or KOSHA for Air

$$W = \frac{C \times K d \times A \times P1 \times (M)^{1/2}}{(Z \times T)^{1/2}} \times 0.9$$

Nomenclature

W	Capacity of Air, kg / h
A	Effective Discharge Area, ㎟ Low Lift Type : A = π DL D = Diameter of Disc Seat (mm) L = Lift (mm)
P1	Upstream Relieving Pressure Absolute, MPa
M	Molecular Weight Air = 28.96
T	Absolute Temperature of Gas, K
C	Coefficient Determined by Ratio of the Specific Heats of Gas
K d	Coefficient of Discharge (Fig. 3, page 12)
Z	Compressibility Factor

Figure 3 Coefficient of Discharge Kd



L : Lift (mm)
D : Diameter of Valve Seat Opening

Capacity Table of Air

Low Lift Type (Unit : kg / h)

Size		15A	20A	25A	32A	40A	50A
Dia. of Disc Seat (mm)		18	18	24	31	38	48
Lift (mm)		0.45	0.45	0.6	0.775	0.95	1.2
0.2	0.02	23.4	23.4	41.7	69.6	104	166
0.3	0.029	25.3	25.3	45	75.2	113	180
0.5	0.049	29.5	29.5	52.5	87.6	131	210
0.7	0.069	33.7	33.7	60	100	150	240
0.9	0.088	37.7	37.7	67	111	168	268
1	0.098	39.8	39.8	70.8	118	177	283
1.2	0.118	44	44	78.2	130	196	313
1.5	0.147	50.1	50.1	89.1	148	223	356
1.7	0.167	54.3	54.3	96.5	161	242	386
2	0.196	60.4	60.4	107	179	269	429
2.2	0.216	64.6	64.6	114	191	287	459
2.5	0.245	70.6	70.6	125	209	315	502
2.7	0.265	74.8	74.8	133	222	333	532
3	0.294	80.9	80.9	143	240	360	575
3.2	0.314	85.1	85.1	151	252	379	605
3.5	0.343	91.2	91.2	162	270	406	648
3.7	0.363	95.4	95.4	169	283	425	678
4	0.392	101	101	180	301	452	722
4.2	0.412	105	105	187	313	471	751
4.5	0.441	111	111	198	331	498	795
4.7	0.461	116	116	206	344	517	825
5	0.49	122	122	217	362	544	868
5.2	0.51	126	126	224	374	562	898
5.5	0.539	132	132	235	392	590	941
5.7	0.559	136	136	242	405	608	971
6	0.588	142	142	253	423	635	1014
6.2	0.608	146	146	261	435	654	1044
6.5	0.637	152	152	271	453	681	1087
6.7	0.657	157	157	279	466	700	1117
6.9	0.676	161	161	286	477	718	1146
7	0.686	163	163	290	484	727	1160
7.2	0.706	167	167	297	496	746	1190
7.5	0.735	173	173	308	514	773	1234
7.7	0.755	177	177	315	527	792	1263
8	0.784	183	183	326	545	819	1307
8.2	0.804	188	188	334	557	837	1337
8.5	0.833	194	194	345	575	865	1380
8.7	0.853	198	198	352	588	883	1410
9	0.882	204	204	363	606	910	1453
9.2	0.902	208	208	370	618	929	1483
9.5	0.931	214	214	381	636	956	1526
9.7	0.951	218	218	389	649	975	1556
9.9	0.97	222	222	396	661	993	1584
10	0.98	224	224	399	667	1002	1599
10.2	1	229	229	407	679	1021	1629
Kgf / ㎠ g Pressure	MPag	-					

Code : KS B 6216 or KOSHA for Nitrogen

$$W = \frac{C \times Kd \times A \times P1 \times (M)^{1/2} \times 0.9}{(Z \times T)^{1/2}}$$

Nomenclature

W	Capacity of Nitrogen, kg / h
A	Effective Discharge Area, ㎟ Low Lift Type : A = π DL D = Diameter of Disc Seat (mm) L = Lift (mm)
P1	Upstream Relieving Pressure Absolute, MPa
M	Molecular Weight Nitrogen = 28
T	Absolute Temperature of Gas, K
C	Coefficient Determined by Ratio of the Specific Heats of Gas
Kd	Coefficient of Discharge (Fig. 3, page 12)
Z	Compressibility Factor

Capacity Table of Nitrogen

Low Lift Type (Unit : kg / h)

Size		15A	20A	25A	32A	40A	50A
Dia. of Disc Seat (mm)		18	18	24	31	38	48
Lift (mm)		0.45	0.45	0.6	0.775	0.95	1.2
0.2	0.02	23	23	41	68.4	102	164
0.3	0.029	24.9	24.9	44.3	73.9	111	177
0.5	0.049	29	29	51.6	86.2	129	206
0.7	0.069	33.1	33.1	59	98.4	147	236
0.9	0.088	37.1	37.1	65.9	110	165	263
1	0.098	39.1	39.1	69.6	116	174	278
1.2	0.118	43.3	43.3	76.9	128	192	307
1.5	0.147	49.2	49.2	87.6	146	219	350
1.7	0.167	53.4	53.4	94.9	158	238	379
2	0.196	59.4	59.4	105	176	264	422
2.2	0.216	63.5	63.5	112	188	283	451
2.5	0.245	69.5	69.5	123	206	309	494
2.7	0.265	73.6	73.6	130	218	328	523
3	0.294	79.6	79.6	141	236	354	566
3.2	0.314	83.7	83.7	148	248	373	595
3.5	0.343	89.7	89.7	159	266	399	638
3.7	0.363	93.8	93.8	166	278	418	667
4	0.392	99.8	99.8	177	296	445	710
4.2	0.412	103	103	184	308	463	739
4.5	0.441	109	109	195	326	490	781
4.7	0.461	114	114	202	338	508	811
5	0.49	120	120	213	356	535	853
5.2	0.51	124	124	220	368	553	883
5.5	0.539	130	130	231	386	580	925
5.7	0.559	134	134	238	398	598	955
6	0.588	140	140	249	416	625	997
6.2	0.608	144	144	256	428	643	1027
6.5	0.637	150	150	267	446	670	1069
6.7	0.657	154	154	274	458	688	1098
6.9	0.676	158	158	281	470	706	1126
7	0.686	160	160	285	476	715	1141
7.2	0.706	164	164	292	488	733	1170
7.5	0.735	170	170	303	506	760	1213
7.7	0.755	174	174	310	518	778	1242
8	0.784	180	180	321	536	805	1285
8.2	0.804	184	184	328	548	823	1314
8.5	0.833	190	190	339	566	850	1357
8.7	0.853	194	194	346	578	869	1386
9	0.882	200	200	357	596	895	1429
9.2	0.902	205	205	364	608	914	1458
9.5	0.931	211	211	375	626	940	1501
9.7	0.951	215	215	382	638	959	1530
9.9	0.97	219	219	389	649	976	1558
10	0.98	221	221	393	656	985	1573
10.2	1	225	225	400	668	1004	1602
Kgf / ㎠ g	MPag	-					
Pressure							

Code : HPGCL for Water

$$W = \frac{Kd \times Kw \times Kc \times Kp \times A \times (1.25P - Pb)^{1/2}}{11.78 \times (G)^{1/2}} \times 60$$

Nomenclature

W	Capacity of Water, kg / h
A	Effective Discharge Area, ㎟ Low Lift Type : A = π DL D = Diameter of Disc Seat (mm) L = Lift (mm)
Kd	Coefficient of Discharge, 0.65
Kp	The factor of Over Pressure, 0.6 at 10%
P	Set Pressure, kPag
G	Specific Gravity of water
Kw	Back Pressure Correction factor
Kv	Viscosity Correction Factor
Pb	Back Pressure, kPag
Kc	Safety Valve 1.0

Capacity Table of Water

Low Lift Type (Unit : kg / h)

Size		15A	20A	25A	32A	40A	50A
Dia. of Disc Seat (mm)		18	18	24	31	38	48
Lift (mm)		0.45	0.45	0.6	0.775	0.95	1.2
0.2	0.02	252	252	449	749	1125	1796
0.3	0.029	304	304	540	902	1355	2163
0.5	0.049	395	395	702	1172	1762	2811
0.7	0.069	469	469	834	1391	2091	3336
0.9	0.088	529	529	942	1571	2361	3768
1	0.098	559	559	994	1658	2492	3976
1.2	0.118	613	613	1090	1819	2734	4363
1.5	0.147	684	684	1217	2031	3052	4870
1.7	0.167	729	729	1297	2165	3253	5190
2	0.196	790	790	1405	2345	3524	5623
2.2	0.216	830	830	1475	2462	3699	5903
2.5	0.245	884	884	1571	2622	3940	6287
2.7	0.265	919	919	1634	2727	4098	6538
3	0.294	968	968	1721	2872	4316	6887
3.2	0.314	1000	1000	1779	2968	4460	7117
3.5	0.343	1046	1046	1859	3102	4662	7439
3.7	0.363	1076	1076	1913	3192	4796	7652
4	0.392	1118	1118	1988	3317	4984	7952
4.2	0.412	1146	1146	2038	3400	5109	8153
4.5	0.441	1186	1186	2108	3518	5286	8435
4.7	0.461	1212	1212	2156	3597	5405	8624
5	0.49	1250	1250	2222	3708	5572	8891
5.2	0.51	1275	1275	2267	3783	5685	9071
5.5	0.539	1311	1311	2331	3889	5844	9325
5.7	0.559	1335	1335	2374	3961	5952	9496
6	0.588	1369	1369	2435	4062	6104	9740
6.2	0.608	1392	1392	2476	4131	6207	9904
6.5	0.637	1425	1425	2534	4228	6353	10137
6.7	0.657	1447	1447	2573	4294	6452	10295
6.9	0.676	1468	1468	2610	4356	6545	10443
7	0.686	1479	1479	2630	4388	6593	10520
7.2	0.706	1500	1500	2668	4451	6689	10672
7.5	0.735	1531	1531	2722	4542	6825	10889
7.7	0.755	1552	1552	2759	4603	6917	11037
8	0.784	1581	1581	2811	4691	7048	11246
8.2	0.804	1601	1601	2847	4750	7138	11389
8.5	0.833	1630	1630	2898	4835	7265	11593
8.7	0.853	1649	1649	2932	4893	7352	11731
9	0.882	1677	1677	2982	4975	7476	11929
9.2	0.902	1696	1696	3015	5031	7560	12063
9.5	0.931	1723	1723	3064	5112	7681	12256
9.7	0.951	1741	1741	3096	5166	7763	12387
9.9	0.97	1759	1759	3127	5218	7840	12510
10	0.98	1768	1768	3143	5244	7880	12574
10.2	1	1786	1786	3175	5298	7960	12702
Kgf / ㎠ g	MPag	-					
Pressure							

NOTE

CERTIFICATE

ISO 9001:2015	ISO 14001:2015	ISO 45001:2018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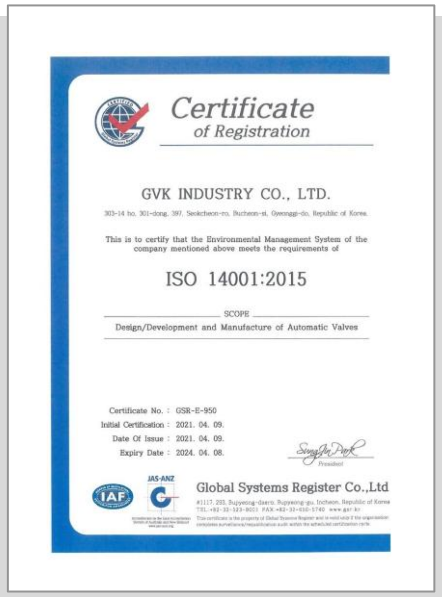
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기업부설연구소 인정서

과학기술정보통신부

한국산업기술진흥협회

Venture Company	Material・Part・ Equipment	Rooting Enterprise


벤처기업확인서

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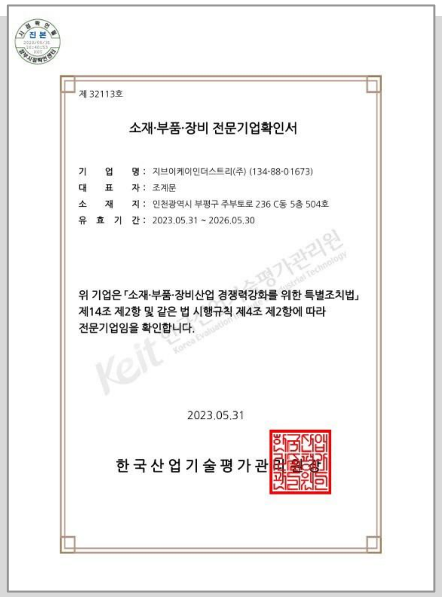
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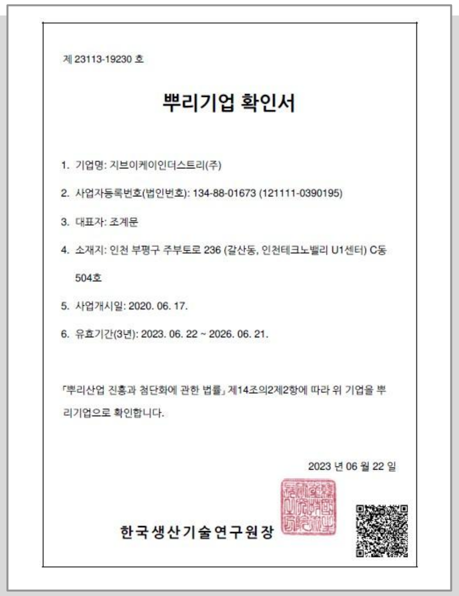
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