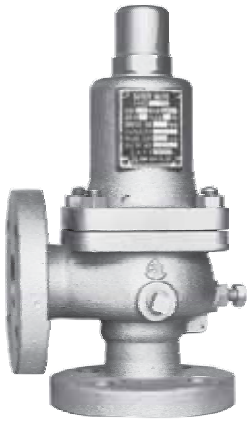
SL-23H, 24H Type Safety Valve (Lift Type)

SL-23H Type



SL-24H Type

SPECIFICATIONS

Model name		SL-23H	SL-23	SL-24H	SL-24
Code name		SL23H-G ☐	SL23-B ☐	SL24HB-G ☐*1.	SL24-B ☐
		※ Code No. of pressure division is required in ☐.			
Cap type		With lever		Without lever	
Size		15~65(½″~2½″)	80~150(3″~6″)	15~65(½″~2½″)	80~150(3″~6″)
Applicable fluid		Steam & air		Steam, air, gases & (liquids*1.)	
Set pressure range		0.035~1.0MPa			
Applicable temperature		−5~230℃		−5~184℃*3.	
End connection		Flanged JIS 10KFF*2.			
Valve body pressure test		Hydraulic 1.5MPa			
Materials	Body	Cast iron			
	Disc	Stainless steel	Cast bronze	Stainless steel	Cast bronze
	Seat ring	Size 15~100mm:Stainless steel, Size 125~150mm:Cast bronze			

*1. For liquids, size 15~65mm, use code name SL24HW-G☐.
*2. RF flange for outlet side is available upon your request.
*3. Applicable temperature Max. 230℃ is available upon your request.

DIMENSIONS

(mm)

Size d	Seat opening dia. D	Effective area (mm²) π Dℓ	Lift ℓ	Face to Face		Height H	Mass(kg)	
				L_1	L_2		SL-23H,23 Type	SL-24H,24 Type
15(½″)	15	18.8	0.4	70	70	116	3.2	3.1
20(¾″)	20	31.4	0.5	75	75	120	4.1	4
25(1″)	25	54.9	0.7	85	85	129	6	5.9
40(1½″)	40	125.6	1.0	100	95	226	13	12
50(2″)	50	204.1	1.3	110	105	255	16	15
65(2½″)	65	346.9	1.7	135	115	291	23	22
80(3″)	78.4	492.3	2.0	145	125	371	33	30
100(4″)	99.4	780.2	2.5	160	150	435	52	46
125(5″)	130 (125)	1347.0 (1256.0)	3.3 (3.2)	182	182	674	120	114
150(6″)	160 (150)	2009.6 (1789.8)	4.0 (3.8)	219	208	727	151	145

* Figures in ( ):Size 125 and 150mm for Cast iron body with Stainless steel disc and seat ring.

Flange code JIS 10KFF

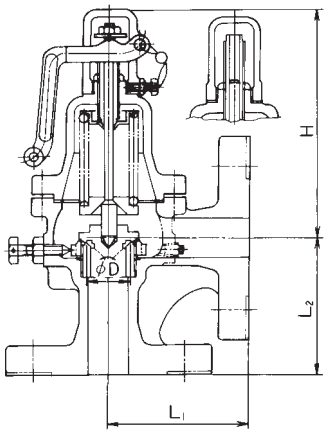
PRESSURE DIVISION

(MPa)

Code No.	SL23H-G ☐,SL24HB-G ☐	SL24HW-G ☐	SL24HW-G ☐	SL23-B ☐, SL24-B ☐	
	Size 15~65mm	Size 15~25mm	Size 40~65mm	Size 80~100mm	Size 125~150mm
1	0.035~0.15		0.035~0.07	0.035~0.15	0.035~0.07
2	Over 0.15~0.6		Over 0.07~0.15	Over 0.15~0.4	Over 0.07~0.1
3	Over 0.6~1.0		Over 0.15~0.3	Over 0.4~0.7	Over 0.1~0.3
4			Over 0.3~0.6	Over 0.7~1.0	Over 0.3~0.5
5			Over 0.6~1.0		Over 0.5~0.7
6					Over 0.7~0.85
7					Over 0.85~1.0

*Code No. of pressure division is required in ☐.

CONSTRUCTION



Depending on nominal diameter, the structure of the valve may be different from what is shown in the drawing.

Applicable Laws/Regulations and Formulas for Calculating Relieving Capacity

Coefficients assigned to equations may be those specified in applicable laws/regulations or in-house data. ※In-house data

1. PRESSURE VESSEL CONSTRUCTION CODE (from JIS B8210-1994)

(1) For steam

$Qm=5.246CK_d'A(P+0.1)\quad 0.9$

Qm: Nominal Relieving capacity (kg/h)
A: Seat opening area (mm^2)
Lift type: $A=\pi D\ell$
Full bore type: $A=\frac{\pi d^2}{4}$
D: Seat opening diameter (mm)
ℓ: Lift (mm)
d: Throat diameter (mm)

P: Relieving pressure (MPa)
(Select the larger one of set pressure 1.1 or set pressure +0.02)
C: Coefficient determined according the nature of steam (see Tab. 1 in page 87)
1: Set pressure is less than 0.4MPa, at saturated pressure
0.98: Set pressure is larger than 0.4MPa, at saturated pressure
In the case of super heated steam, see Tab.1, page 87.
K_d': Relieving coefficient
Lift type:0.96※
Full bore type:0.864

(2) For gasses

$Qm=C'K_d'AP_1\sqrt{\frac{M}{ZT}}\quad 0.9$

Qm: Nominal Relieving capacity (kg/h)
A: Seat opening area (mm^2)
Lift type: $A=\pi D\ell$
Full bore type: $A=\frac{\pi d^2}{4}$
D: Seat opening diameter (mm)
ℓ: Lift (mm)
d: Throat diameter (mm)
Z: Compression coefficient: 1※ (see Fig.1 in page 89)
T: Absolute temperature (K) of gasses at relieving pressure

C': Coefficient according to κ and P_2/P_1 (See Fig.3, page 89)
κ : Adiabatic exponent (Cρ/Cυ) (See Tab.2, page 87).
The value is considered 1 if it is not clear.
P_2: Back pressure (MPa･A)
K_d': Relieving coefficient
Lift type:0.96※
Full bore type:0.864
M: Molecular weight of gas (see Tab.2, page 87)
P_1: Relieving pressure (MPa･A)
(Select the larger absolute pressure of set pressure 1.1 or absolute pressure of set pressure +0.02)

■ Calculating maximum flow-in gas using the following formula:

$G=0.0028\,\upsilon\,\rho\,d^2$

G: Flow in gas (kg/h)
υ : Velocity of gas (m/sec)
(More than 20 for saturated steam, more than 30 for super-heated steam, or move than 10 for common gas)

ρ: Density of gas (kg/m^2)
d: Internal diameter of pipe (mm)

(3) For water/hot water (also applicable for hot water with temperature higher than 120℃)

(1) In case of searching from relieving capacity:

$$S=\frac{W}{87.7\sqrt{(P_1+0.1)\,\kappa\,\gamma_1}}$$

(2)In case of searching from thermal input of pressure vessel or thermal out put of hot water boiler:

$$S=\frac{Q\varepsilon}{87.7C\sqrt{(P_1+0.1)\,\kappa\,\gamma_1}}$$

(If $(P_1+0.1)\kappa > (P_1-P_2)$ in equations (1) and (2), replace (P_1-P_2) with $(P_1+0.1)\kappa$)

S: Seat opening area (mm^2)
W: Relieving capacity of valve (kg/h)

P_1: Relieving pressure (MPa) (see Note)
Lift type: set pressure 1.1
For SL-37~40, see page 69.
Full bore type: select the larger one of set pressure 1.15 or set pressure +0.034
Relief valve (type E・ED): select the larger one of set pressure 1.25 or set pressure +0.034
P_2: Outlet pressure (MPa)
κ : Correction coefficient (see Fig.2 in page 89)
Δt: Difference between the saturated temperature of relieving pressure P_1 and the temperature of hot water at inlet. (℃)
γ_1: Density hot water at inlet (kg/l) (see Tab.3 in page 88)
Q: Thermal input of pressure vessel or thermal output of hot water boiler (kJ/h)
ε : Coefficient of volumetrical expansion for water (l/℃) (see Tab.4 in page 88)
C : Specific heat of water at constant pressure (kJ/kg℃) (see Tab.4 in page 88)
Note: In the case of full bore type safety valve or relief valve, make sure the pressure does not exceed 1.1 times maximum working pressure of pressure vessel or hot water boiler (or maximum working pressure +0.034).

Applicable Laws/Regulations and Formulas for Calculating Relieving Capacity

Coefficients assigned to equations may be those specified in applicable laws/regulations or in-house data.

※In-house data

2. BOILER CONSTRUCTION CODE (from JIS B8210-1994)

(1) For steam

$Qm=5.246CK_d'A(P+0.1)\quad 0.9$

Qm: Nominal Relieving capacity (kg/h)

A: Seat opening area (mm^2)

Lift type: $A=\pi D\ell$

Full bore type: $A=\frac{\pi d^2}{4}$

D: Seat opening diameter (mm)

ℓ: Lift (mm)

d: Throat diameter (mm)

P:Relieving pressure (MPa)

(Select the larger one of set pressure 1.1 or set pressure +0.02)

C: Coefficient according the nature of steam (see Tab.1 in page 87)

1: set pressure is less than 0.4MPa, at saturated pressure

0.98: set pressure is larger than 0.4MPa, at saturated pressure

In the case of overheated steam, see Tab.1, page 87.

K_d': Relieving coefficient

Lift type:0.96※

Full bore type:0.864

(2) For hot water (Applicable when temperature is less than 120℃. If temperature is higher than 120 ℃, then use the formula described in (1))

(1) In case of searching from relieving capacity:

$$S=\frac{W}{87.7\sqrt{(P_1+0.1)\,\kappa\,\gamma_1}}$$

(2)In case of searching from thermal input of pressure vessel or thermal out put of hot water boiler:

$$S=\frac{Q\varepsilon}{87.7C\sqrt{(P_1+0.1)\,\kappa\,\gamma_1}}$$

(If $(P_1+0.1)^{\kappa}>(P_1-P_2)$ in equations (1) and (2), replace (P_1-P_2) with $(P_1+0.1)^{\kappa}$)

S: Seat opening area (mm^2)

W: Relieving capacity of valve (kg/h)

P_1: Relieving pressure (MPa) (see Note)

Lift type: set pressure 1.1

For SL-37~40, see page 69.

Full bore type: select the larger one of set pressure 1.15 or set pressure +0.034

Relief valve (type E・ED): select the larger one of set pressure 1.25 or set pressure+0.034

P_2: Outlet pressure (MPa)

κ : Correction coefficient (see Fig.2 in page 89)

Δt: Difference between the saturated temperature of relieving pressure P_1 and the temperature of hot water at inlet. (℃)

γ_1: Density hot water at inlet (kg/l) (see Tab.3 in page 88)

Q: Thermal input of pressure vessel or thermal output of hot water boiler (kJ/h)

ε : Coefficient of volumetrical expansion for water (l/℃) (see Tab.4 in page 88)

C: Specific heat of water at constant pressure (kJ/kg℃) (see Tab.4 in page 88)

■ NOTE

It is necessary installing safety valve when water temperature exceeds 120℃. The formula is as the following:

$Qm=5.246CK_d'A(P+0.1)\quad 0.9$

In this case, the required relieving capacity (kg/h) of safety valve can be calculated using the following formula:

$$W=\frac{Q}{h_1-h_2}$$

W: Relieving capacity (kg/h)

Q: Thermal output of hot water boiler (kJ/h)

h_1: Enthalpy of saturated steam that is equivalent to the maximum working pressure of boiler (kJ/kg).

h_2: Enthalpy of water supply (kJ/kg)

$$W=\frac{Q\varepsilon}{C}$$

ε : Coefficient of volumetrical expansion for water (l/℃) (see Tab.4 in page 88)

C: Specific heat of water at constant pressure (kJ/kg℃) (see Tab.4 in page 88)

(3) For Dowtherm boiler

$$Qm=C'K_d'AP_1\sqrt{\frac{M}{ZT}}\quad 0.9$$

Qm: Nominal relieving capacity (kg/h)

A: Seat opening area (mm^2)

Lift type: $A=\pi D\ell$

Full bore type: $A=\frac{\pi d^2}{4}$

D: Seat opening diameter (mm)

ℓ : Lift (mm)

d : Throat diameter (mm)

Z: Compression coefficient: 1※ (see Fig.1 in page 89)

T: Absolute temperature (K) of gasses at relieving pressure

C': Coefficient according to κ and P_2/P_1 (See Fig.3, page 89)

κ : Adiabatic exponent (C_P/C_V) (See Tab.2, page 87). The value is considered 1 if it is not clear.

P_2: Back pressure (MPa A)

K_d': Relieving coefficient

Lift type:0.96※

Full bore type:0.864

M: Molecular weight of gas (see Tab.2, page 87)

P_1: Relieving pressure (MPa A)

(Select the larger absolute pressure of set pressure 1.1 or absolute pressure of set pressure +0.02)

Applicable Laws/Regulations and Formulas for Calculating Relieving Capacity

Coefficients assigned to equations may be those specified in applicable laws/regulations or in-house data.

※In-house data

3. IN-HOUSE STANDARDS (for liquids other than water and hot water)

$W=161\ AK\sqrt{PG}$

W: Relieving capacity (kg/h)
A: Seat opening area (mm^2)
Lift type: $A=\pi D\ell$
Full bore type: $A=0.785d^2$
D: Seat opening diameter (mm)
ℓ: Lift (mm)
d: Throat diameter (mm)

G: Specific gravity
P: Relieving pressure (MPa)
K: Flow coefficient
Lift type: 0.55 for upper guide type
0.45 for blade type [The value may be different depending on type and accumulation]
Full bore type: 0.60

TABLE1. COEFFICIENT ACCORDING TO PROPERTY OF STEAM

Absolute pressure Mpa \ Temp. ℃	Saturated temperature	200	220	240	260	280	300	320	340	360	380	400	420	440	460
0.5	1.005	0.996	0.972	0.951	0.931	0.913	0.896	0.879	0.864	0.894	0.835	0.822			
1.0	0.987	0.981	0.983	0.960	0.938	0.919	0.901	0.884	0.868	0.853	0.838	0.825			
1.5	0.977	0.976	0.970	0.972	0.947	0.925	0.906	0.888	0.872	0.856	0.841	0.828			
2.0	0.972		0.967	0.964	0.955	0.932	0.912	0.893	0.876	0.860	0.845	0.830	0.817	0.804	0.792
2.5	0.969			0.961	0.961	0.937	0.918	0.898	0.880	0.863	0.848	0.833	0.819	0.806	0.793
3.0	0.967			0.962	0.957	0.949	0.924	0.903	0.885	0.867	0.851	0.836	0.822	0.808	0.795
4.0	0.965				0.958	0.954	0.934	0.915	0.894	0.875	0.857	0.841	0.826	0.813	0.799
5.0	0.966					0.955	0.953	0.927	0.904	0.884	0.865	0.848	0.832	0.817	0.803
6.0	0.968					0.962	0.953	0.941	0.911	0.891	0.872	0.854	0.838	0.822	0.808
7.0	0.971						0.958	0.954	0.924	0.901	0.881	0.861	0.844	0.827	0.812
8.0	0.975						0.967	0.956	0.937	0.912	0.888	0.868	0.850	0.833	0.817
9.0	0.980							0.962	0.957	0.926	0.897	0.876	0.856	0.838	0.822
10.0	0.986							0.971	0.961	0.936	0.909	0.883	0.863	0.844	0.827
12.0	0.999								0.975	0.964	0.926	0.903	0.876	0.857	0.838
14.0	1.016								1.002	0.980	0.956	0.920	0.893	0.868	0.846
16.0	1.036									1.000	0.988	0.942	0.907	0.883	0.858
18.0	1.063									1.038	1.004	0.972	0.929	0.895	0.873
20.0	1.094										1.028	1.006	0.953	0.914	0.885

＊Intermediate values of pressure and temperature in this table are calculated by proportional method. However, In case of Absolute pressure less than 0.5MPa refer at absolute pressure 0.5MPa.
Example. Incase of Absolute pressure:1.2MPa, Temperature:230℃, C=0.960

TABLE2. GAS PROPERTY

Name \ Physical property	Chemical symbol	Molecular weight	Adiabatic index Cp/Cv κ	Critical temp. Tc K	Critical pressure Pc MPa
Acetylene	C_2H_2	26.04	1.28	308.5	6.25
Air		28.96	1.40	—	—
Ammonia	NH_3	17.03	1.31	405.6	11.46
Argon	Ar	39.94	1.67	150.8	4.94
Benzene	C_6H_6	78.11	1.12	562.8	4.96
Isobutane	iso-C_4H_{10}	58.12	1.10	408.2	3.70
Normal butane	n-C_4H_{10}	58.12	1.09	425.5	3.75
Carbon disulfide	CS_2	76.14	1.21	549.2	7.65
Carbon dioxide	CO_2	44.01	1.29	304.2	7.63
Carbon monoxide	CO	28.01	1.40	133.0	3.62
Chlorine	Cl_2	70.90	1.36	417.2	7.83
Cyclohexane	C_6H_{12}	84.16	1.09	481.6	4.06
Normal decane	n-$C_{10}H_{22}$	142.29	1.03	618.4	2.13
Ethane	C_2H_6	30.07	1.19	305.4	4.89
Ethyl alcohol	C_2H_5OH	46.07	—	516.2	6.38
Ethylene	C_2H_4	28.05	1.24	282.7	5.09
Helium	He	4.00	1.66	5.3	0.24
Normal heptane	n-$CH_3(CH_2)_5CH_3$	100.21	1.05	540.2	2.73
Normal hexane	n-C_6H_{14}	86.18	1.06	507.7	3.03
Hydrogen chloride	HCl	36.46	1.41	324.7	8.43
Hydrogen	H_2	2.16	1.41	33.2	1.32
Hydrogen sulfide	H_2S	34.08	1.32	373.6	9.16
Methane	CH_4	16.04	1.31	190.9	4.71
Methyl alcohol	CH_3OH	32.04	1.20	512.6	8.02
Methyl chloride	CH_3Cl	50.49	1.20	416.3	6.75
Nitrogen	N_2	28.01	1.40	126.3	3.44
Nitrogen suboxide	N_2O	44.01	1.30	309.3	7.39
Normal nonane	n-$CH_3(CH_2)_7CH_3$	128.26	1.04	594.7	2.30
Oxygen	O_2	32.00	1.40	154.7	5.12
Normal pentane	n-$CH_3(CH_2)_3CH_3$	72.15	1.07	470.1	3.35
Normal propane	n-$CH_3CH_2CH_3$	44.11	1.13	370.0	4.27
Steam	H_2O	18.02	1.33	647.1	22.12
Sulfur dioxide	SO_2	64.06	1.29	593.6	4.23
Toluene	$C_6H_5CH_3$	92.14	1.09	593.6	4.23
Propylene	CH_3CHCH_2	42.08	1.15	365.1	4.60
Octane	C_8H_{18}	114.23	1.05	—	—

＊1. For air, Tc=132.45(K) and Pc=3.769(MPa･A)
＊2. When obtaining the compression factor Z of hydrogen and helium, add 8 to both Tc and add 0.8 to both Pc.

Applicable Laws/Regulations and Formulas for Calculating Relieving Capacity

TABLE3. HOT WATER SPECIFIC GRAVITY γ_1(kg/ℓ)

Pressure MPa A / Temp.℃	0.1	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.5
40	0.992	0.992	0.992	0.993	0.993	0.993	0.993	0.993	0.993	0.993	0.993	0.993	0.993
50	0.998	0.988	0.988	0.988	0.988	0.988	0.989	0.989	0.989	0.989	0.989	0.989	0.989
60	0.983	0.983	0.983	0.983	0.983	0.984	0.984	0.984	0.984	0.984	0.984	0.984	0.984
70	0.978	0.978	0.978	0.978	0.978	0.978	0.978	0.978	0.978	0.978	0.979	0.979	0.979
80	0.972	0.972	0.972	0.972	0.972	0.972	0.972	0.972	0.972	0.972	0.973	0.973	0.973
90	0.965	0.965	0.965	0.965	0.965	0.966	0.966	0.966	0.966	0.966	0.966	0.966	0.966
100		0.958	0.958	0.958	0.958	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959
110		0.951	0.951	0.951	0.951	0.951	0.951	0.951	0.951	0.951	0.952	0.952	0.952
120		0.943	0.943	0.943	0.943	0.943	0.943	0.943	0.944	0.944	0.944	0.944	0.944
130			0.935	0.935	0.935	0.935	0.935	0.935	0.935	0.935	0.935	0.936	0.936
140			0.926	0.926	0.926	0.926	0.926	0.926	0.927	0.927	0.927	0.927	0.927
150				0.917	0.917	0.917	0.917	0.917	0.917	0.918	0.918	0.918	0.918
160					0.907	0.908	0.908	0.908	0.908	0.908	0.908	0.908	0.908
170					0.897	0.897	0.898	0.898	0.898	0.898	0.898	0.898	0.898
180							0.887	0.887	0.887	0.887	0.888	0.888	0.888
190								0.876	0.876	0.876	0.877	0.877	0.877
200									0.865	0.865	0.865	0.865	0.865
210											0.853	0.853	0.853
220													0.841

Remarks:Intermediate values in this table are calculated by proportional method.
* In case of below 40℃:1

TABLE4. COEFFICIENT OF VOLUMETRICAL EXPANSION FOR WATER

Temp.℃	Specific heat C kJ/kg℃	Expansion coefficient ε ℓ/℃
Below 40℃	4.150	0.00039
40	4.179	0.00039
50	4.181	0.00046
60	4.185	0.00053
70	4.190	0.00060
80	4.197	0.00066
90	4.205	0.00072
100	4.216	0.00079
110	4.229	0.00085
120	4.245	0.00090
130	4.263	0.00097
140	4.285	0.00103
150	4.310	0.00110
160	4.339	0.00118
170	4.317	0.00126
180	4.408	0.00134
190	4.449	0.00145
200	4.497	0.00155
210	4.551	0.00165
220	4.613	0.00179

Remarks:Intermediate values in this table are calculated by proportional method.

TABLE5. Value C against κ

κ	C	P_2/P_1	κ	C	P_2/P_1	κ	C	P_2/P_1	κ	C	P_2/P_1
1.00	2380	0.606	1.20	2550	0.563	1.40	2700	0.528	1.60	2820	0.496
1.02	2410	0.602	1.22	2570	0.559	1.42	2710	0.525	1.62	2830	0.493
1.04	2420	0.597	1.24	2590	0.556	1.44	2720	0.522	1.64	2850	0.490
1.06	2440	0.593	1.26	2600	0.552	1.46	2730	0.518	1.66	2860	0.488
1.08	2460	0.588	1.28	2620	0.549	1.48	2750	0.515	1.68	2870	0.485
1.10	2480	0.584	1.30	2630	0.545	1.50	2760	0.512	1.70	2880	0.482
1.12	2490	0.580	1.32	2650	0.542	1.52	2770	0.509	1.80	2940	0.468
1.14	2500	0.576	1.34	2660	0.538	1.54	2790	0.505	1.90	2980	0.456
1.16	2520	0.571	1.36	2680	0.535	1.56	2800	0.502	2.00	3030	0.444
1.18	2540	0.567	1.38	2690	0.531	1.58	2810	0.499	2.20	3130	0.422

* In case κ takes middle value. Obtain P_2/P_1 with interpolation and disregard below 4 places to decimals, and disregard below decimal point for C.

Fig.1 Coefficient of compressibility Z

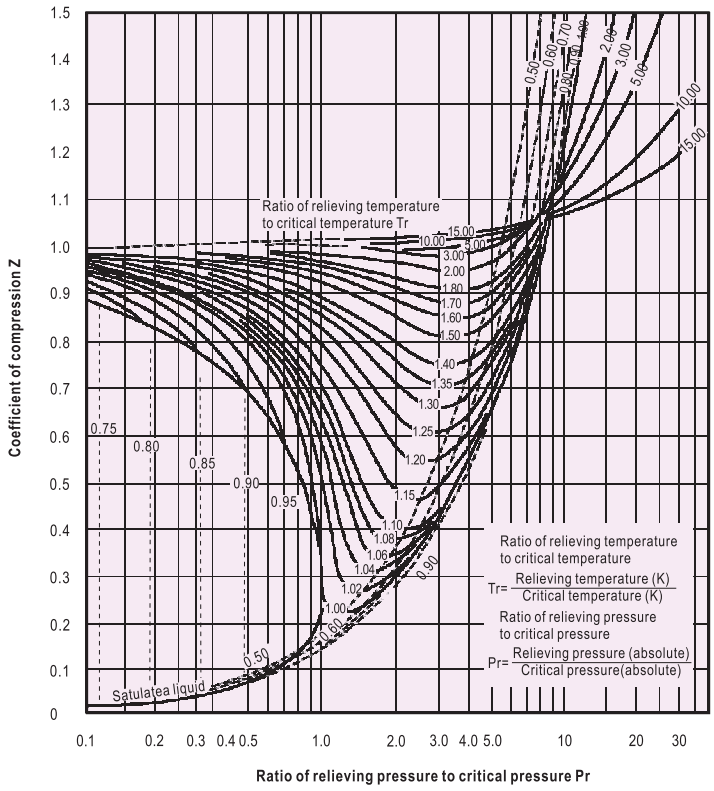


Fig.2 Δt℃ correction coefficient κ

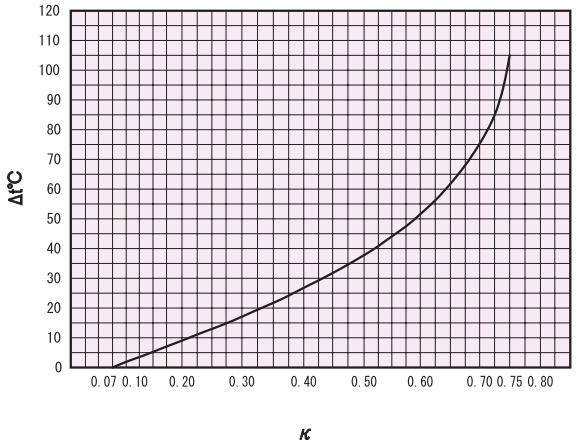
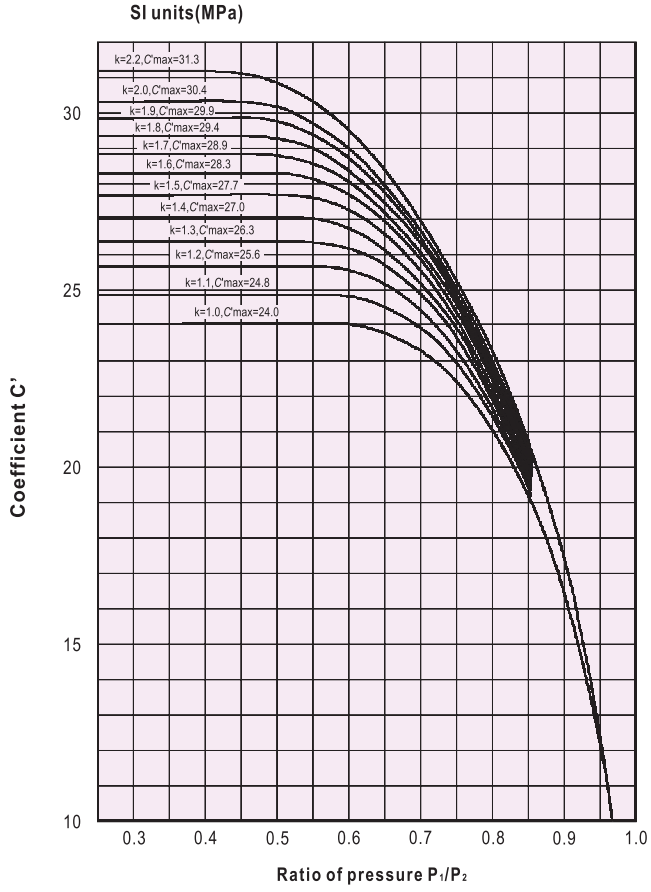


Fig.3 Coefficient (C') based on κ and P_2/P_1



E070436A

■ FULL BORE TYPE

$Qm=5.246CK_d'A(P+0.1)\ 0.9$ ····· { C=0.98(C=1 if set pressure<0.4MPa), K_d'=0.864 ; P is the larger one of (set pressure +0.02) or (set pressure 1.1) }

(kg/h)

Model name	Size mm	dt	A	Set pressure MPa 0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0
SF-1H, 2H	20	15	176.6	158	230	309	381	458	536	614	691	769	847	924	100	1080	1150	1230	1310	1390	1460	1540	1620										
	25	19	283.3	254	369	496	611	736	860	985	1100	1230	1350	1480	1600	1730	1850	1980	2100	2230	2350	2480	2600										
	40	30	706.5	634	922	1230	1520	1830	2140	2450	2760	3070	3380	3690	4010	4320	4630	4640	5250	5560	5870	6180	6490										
	50	38	1133.5	1010	1470	1980	2440	2940	3440	3940	4440	4930	5430	5930	6430	6930	7430	7920	8420	8920	9420	9920	10400										
SF-19L, 20L	15	11	94.9	85.1	123	166	204	246	288	330	371	413	455	496	538	580	622	663	705	747	789	830	872	914	956	997	1030	1080	1120	1160	1200	1240	1280
	20	15	176.6	158	230	309	381	458	536	614	691	769	847	924	1000	1080	1150	1230	1310	1390	1460	1540	162	1700	1770	1850	1930	2010	2080	2160	2240	2320	2400
	25	19	283.3	254	369	496	611	736	860	985	1100	1230	1350	1480	1600	1730	185	1980	2100	2230	2350	2480	2600	2720	2850	2970	3100	3220	3350	3470	3600	3720	3850
SF-13L, 14L	25	19	283.3	254	369	496	611	736	860	985	1100	1230	1350																				
SF-13L SF-16L (0.1~1MPa)	40	25	490.6	440	640	860	1050	1270	1490	1700	1920	2130	2350	2560	2780	3000	3210	3430	3640	3860	4070	4290	5410	4720	4940	5150	5370	5580	5800	6020	6230	6450	6660
		30	706.5	634	922	1230	1520	1830	2140	2450	2760	3070	3380	3690	4010	4320	4630	4940	5250	5560	5870	6180	6490	6800	7110	7420	7730	8040	8360	8670	8980	9290	9600
	50	34	907.4	814	1180	1590	1950	2350	2750	3150	3550	3950	4350	4750	5150	5550	5940	6340	6740	7140	7540	7940	8340	8740	9140	9540	9930	10300	10700	11100	11500	11900	12300
		38	1133.5	1010	1470	1980	2440	2940	3440	3940	4440	4930	5430	5930	6430	6930	7430	7920	8420	8920	9420	9920	10400	10900	11400	11900	12400	12900	13400	13900	14400	14900	15400
	65	43	1451.4	1300	1890	2540	3130	3770	4400	5040	5680	6320	6960	7600	8230	8870	9510	10100	10700	11400	12000	12700	13300	13900	14600	15200	15800	16500	17100	17800	18400	19000	19700
		49	1884.7	1690	2460	3300	4060	4890	5720	6550	7380	8210	9040	9870	10600	11500	12300	13100	14000	14800	15600	16500	17300	18100	18900	19800	20600	21400	22300	23100	23900	24700	25600
SF-17L SF-18L (1~2MPa)	80	55	2374.6	2130	3090	4160	5120	6170	7210	8250	9300	10300	11300	12400	13400	14500	15500	16600	17600	18700	19700	20700	21800	22800	23900	24900	26000	27000	28000	29100	30100	31200	32200
		61	2920.9	2620	3810	5120	6300	7580	8870	10100	11400	12700	14000	15200	16500	17800	19100	20400	21700	23000	24200	25500	26800	28100	29400	30700	31900	33200	34500	35800	37100	38400	39700
	100	69	3737.3	3350	4870	6550	8060	9710	11300	12900	14600	16200	17900	19500	21200	22800	24500	26100	27700	29400	31000	32700	34300	36000	37600	39200	40900	42500	44200	45800	47500	49100	50700
		76	4534.1	4060	5910	7950	9780	11700	13700	15700	17700	19700	21700	23700	25700	27700	29700	31700	33700	35700	37700	39600	41600	43600	45600	47600	49600	51600	53600	55600	57600	59600	61600
SF-19L SF-20L (2~3MPa)	125	86	5805.8	5210	7570	10100	12500	15000	17600	20100	22700	25200	27800	30400	32900	35500	38000	40600	43100	45700	48200	50800	53300	55900	58400	61000	63500	66100	68700	71200	73800	76300	78900
		95	7084.6	6350	9240	12400	15200	18400	21500	24600	27700	30800	33900	37100	40200	43300	46400	49500	52600	55700	58900	62000	65100	68200	71300	74400	77600	80700	83800	86900	90000	93100	96200
	150	105	8654.6	7760	11200	15100	18600	22400	26200	30100	33900	37700	41500	45300	49100	52900	56700	60500	64300	68100	71900	75700	79500	83300	87100	90900	94700	98600	102000	106000	110000	113000	117000
		115	10381.6	9310	13500	18200	22400	26900	31500	36100	40600	45200	49800	54300	58900	63400	68000	72600	77100	81700	86300	90800	95400	100000	104000	109000	113000	118000	122000	127000	131000	136000	141000

dt:Throat dia.(mm), A:Seat opening area(mm^2)

■ LIFT TYPE

$Qm=5.246CK_d'A(P+0.1)\ 0.9$ ····· { C=0.98(C=1 if set pressure<0.4MPa), K_d'=0.96 ; P is the larger one of (set pressure +0.02) or (set pressure 1.1) }

(kg/h)

Size mm	D	A	Set pressure MPa 0.05	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0
15	15	18.8	14.4	18.7	27.2	36.6	45	54.2	63.4	72.6	81.8	91	100	109	118	127	136	146	155	164	173	182	192	201	210	219	228	237	247	256	265	274	283
20	20	31.4	24.1	31.3	45.5	61.1	75.3	90.6	106	121	163	152	167	182	198	213	228	244	259	274	290	305	320	336	351	366	382	397	412	428	443	458	474
25	25	54.9	42.3	54.7	79.6	106	131	158	185	212	238	265	292	319	346	373	399	426	453	480	507	534	560	587	614	641	668	695	721	748	775	802	829
32	32	80.3	61.8	80	116	156	192	231	271	310	349	388	428	467	506	545	548	624	663	702	741	781	820	859	898	938	977	1010	1050	1090	1130	1170	1210
40	40	125.6	96.7	125	182	244	301	362	424	485	546	608	669	730	792	853	914	976	1030	1090	1160	1220	1280	1340	1400	1460	1520	1590	1650	1710	1770	1830	1890
50	50	204.1	157	203	296	397	489	589	689	788	888	988	1080	1180	1280	1380	1480	1580	1680	1780	1880	1980	2080	2180	2280	2380	2480	2580	2680	2780	2880	2980	3080
65	65	346.9	267	345	503	676	832	1000	1170	1340	1510	1670	1840	2010	2180	2350	2520	2690	2860	3030	3200	3370	3540	3710	3880	4050	4220	4390	4560	4730	4900	5060	5230
75	75	447.4	344	446	648	871	1070	1290	1510	1720	1940	2160	2380	2600	2820	3040	3250	3470	3690	3910	4130	4350	4570	4780	5000	5220	5440	5660	5880	6100	6310	6530	6750
80	78.4	492.3	379	490	714	959	1180	1420	1660	1900	2140	2380	2620																				
100	100	785.0	604	782	1130	1520	1880	2260	2650	3030	3410	3800	4180	4560	4950	5330	5710	6100	6480	6860	7250	7630	8010	8400	8780	9170	9550	9330	10300	10700	11000	11400	11800
	99.4	780.2	601	777	1130	1520	1870	2250	2630	3010	3390	3770	4150																				
125	125	1256.0	976	1250	1820	2440	3010	3620	4240	4850	5460	6080	6690	7300	7920	8530	9140	9760	10300	10900	11600	12200	12800	13400	14000	14600	15200	15900	16500	17100	17700	18300	18900
	130	1347.0	1030	1340	1950	2620	3230	3880	4540	5200	5860	6520	7170																				
150	150	1789.8	1370	1780	2590	3480	4290	5160	6040	6910	7790	8660	9540	10400	11200	12100	13000	13900	14700	15600	16500	17400	18200	19100	20000	20900	21700	22600	23500	24400	25200	26100	27000
	160	2009.6	1540	2000	2910	3910	4820	5800	6780	7760	8740	9720	10700																				

D:Seat opening dia.(mm), A:Seat opening area(mm^2) * Refer to page 69 for safety relief valves (SL-37~40F Type).

■ FULL BORE TYPE

$$Qm = C' K_d' A P_1 \sqrt{\frac{M}{ZT}} \quad 0.9$$

C'=27.0, P_1 is the larger one of (set pressure +0.02+0.1) or (set pressure 1.1+0.1)
K_d'=0.864, M=28.96, Z=1, T=293

(kg/h)

Model name	Size mm	dt	A	Set pressure MPa 0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0
SF-1H, 2H	20	15	176.6	256	373	501	629	757	885	1010	1140	1270	1390	1520	1650	1780	1910	2030	2160	2290	2420	2550	2680										
	25	19	283.3	411	598	804	1000	1210	1420	1620	1830	2030	2240	2440	2650	2860	3060	3270	3470	3680	3880	4090	4300										
	40	30	706.5	1020	1490	2000	2510	3030	3540	4050	4570	5080	5590	6100	6620	7130	7640	8160	8670	9180	9690	10200	10700										
	50	38	1133.5	1640	2390	3210	4040	4860	5680	6500	7330	8150	8970	9800	10600	11400	12200	13000	13900	14700	15500	16300	17200										
SF-19L, 20L	15	11	94.9	137	200	269	338	407	476	544	613	682	751	820	889	958	1020	1090	1160	1230	1300	1370	1440	1500	1570	1640	1710	1780	1850	1920	1990	2060	2120
	20	15	176.6	256	373	501	629	757	885	1010	1140	1270	1390	1520	1650	1780	1910	2030	2160	2290	2420	2550	2680	2800	2930	3060	3190	3320	3450	3570	3700	3830	3960
	25	19	283.3	411	598	804	1000	1210	1420	1620	1830	2030	2240	2440	2650	2860	3060	3270	3470	3680	3880	4090	4300	4500	4710	4910	5120	5320	5530	5740	5940	6150	6350
SF-13L, 14L	25	19	283.3	411	598	804	1000	1210	1420	1620	1830	2030	2240																				
SF-13L SF-16L (0.1~1MPa) SF-17L SF-18L (1~2MPa) SF-19L SF-20L (2~3MPa)	40	25	490.6	712	1030	1390	1740	2100	2460	2810	3170	3520	3880	4240	4590	4950	5310	5660	6020	6370	6730	7090	7440	7800	8160	8510	8870	9220	9580	9940	10200	10600	11000
		30	706.5	1020	1490	2000	2510	3030	3540	4050	4570	5080	5590	6100	6620	7130	7640	8160	8670	9180	6990	10200	10700	11200	11700	12200	12700	13200	13800	14300	14800	15300	15800
	50	34	907.4	1310	1910	2570	3230	3890	4550	5210	5860	6520	7180	7840	8500	9160	9820	10400	11100	11700	12400	13100	13700	14400	15000	15700	16400	17000	17700	18300	19000	19700	20300
		38	1133.5	1640	2390	3210	4040	4860	5680	6500	7330	8150	8970	9800	10600	11400	12200	13000	13900	14700	15500	16300	17200	18000	18800	19600	20500	21300	22100	22900	23700	24600	25400
	65	43	1451.4	2100	3060	4110	5170	6220	7280	8330	9380	10400	11400	12500	13600	14600	15700	16700	17800	18800	19900	20900	22000	23000	24100	25100	26200	27300	28300	29400	30400	31500	32500
		49	1884.7	2730	3980	5340	6710	8080	9450	10800	12100	13500	14900	16200	17600	19000	20400	21700	23100	24500	25800	27200	28600	29900	31300	32700	34000	35400	36800	38100	39500	40900	42200
	80	55	2374.6	3440	5010	6730	8460	10100	11900	13600	15300	17000	18800	20500	22200	23900	25700	27400	29100	30800	32600	34300	36000	37700	39400	41200	42900	44600	46300	48100	49800	51500	53200
		61	2920.9	4240	6160	8290	10400	12500	14600	16700	18800	21000	23100	25200	27300	29400	31600	33700	35800	37900	40100	42200	44300	46400	48500	50700	52800	54900	57000	59100	61300	63400	65500
	100	69	3737.3	5420	7890	10600	13300	16000	18700	21400	24100	26800	29600	32300	35000	37700	40400	43100	45800	48500	51300	54000	56700	59400	62100	64800	67500	70300	73000	75700	78400	81100	83800
		76	4534.1	6580	9570	12800	16100	19400	22700	26000	29300	32600	35900	39200	42400	45700	49000	52800	55600	58900	62200	65500	68800	72100	75400	78700	82000	85200	88500	91800	95100	98400	101000
	125	86	5805.8	8430	12200	16400	20600	24900	29100	33300	37500	41700	45900	50200	54400	58600	62800	67000	71200	75400	79700	83900	88100	92300	96500	100000	105000	109000	113000	117000	121000	126000	130000
		95	7084.6	10200	14900	20100	25200	30300	35500	40600	45800	50900	56100	61200	66400	71500	76600	81800	86900	92100	97200	102000	107000	112000	117000	122000	128000	133000	138000	143000	148000	153000	158000
	150	105	8654.6	12500	18200	24500	30800	37100	43400	49600	55900	62200	68500	74800	81100	87400	93600	99900	106000	112000	118000	125000	131000	137000	143000	150000	156000	162000	169000	175000	181000	187000	194000
		115	10381.6	15000	21900	29400	37000	44500	52000	59600	67100	74600	82200	89700	97300	104000	112000	199000	127000	134000	142000	150000	157000	165000	172000	180000	187000	195000	202000	210000	217000	225000	232000

dt:Throat dia.(mm), A:Seat opening area(mm^2)

■ LIFT TYPE

$$Qm = C' K_d' A P_1 \sqrt{\frac{M}{ZT}} \quad 0.9$$

C'=27.0, P_1 is the larger one of (set pressure +0.02+0.1) or (set pressure 1.1+0.1)
K_d'=0.96, M=28.96, Z=1, T=293

(kg/h)

Size mm	D	A	Set pressure MPa 0.05	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0
15	15	18.8	23.4	30.3	44.1	59.2	74.4	89.6	104	119	135	150	165	180	195	210	226	241	256	271	286	301	317	332	347	362	377	392	408	423	438	453	468
20	20	31.4	39.1	50.6	73.6	99	124	149	175	200	225	251	276	301	327	352	377	403	428	453	479	504	529	554	580	605	630	656	681	706	732	757	782
25	25	54.9	68.4	88.5	128	173	217	261	306	350	394	438	483	527	517	616	660	704	748	793	837	881	926	970	1010	1050	1100	1140	1190	1230	1280	1320	1360
32	32	80.3	100	129	188	253	318	382	447	512	577	641	706	771	836	901	965	1030	1090	1160	1220	1280	1350	1410	1480	1540	1610	1670	1740	1800	1870	1930	2000
40	40	125.6	156	202	294	396	497	598	700	801	902	1000	1100	1200	1300	1400	1510	1610	1710	1810	1910	2010	2110	2210	2320	2420	2520	2620	2720	2820	2920	3030	3130
50	50	204.1	254	329	479	643	808	972	1130	1300	1460	1630	1790	1960	2120	2290	2450	2610	2780	2940	3110	3270	3440	3600	3770	3930	4100	4260	4430	4590	4760	4920	5080
65	65	346.9	432	559	814	1090	1370	1650	1930	2210	2490	2770	3050	3330	3610	3890	4170	4450	4730	5010	5290	5570	5850	6130	6410	6690	6970	7250	7530	7810	8090	8370	8650
75	75	447.4	557	721	1040	1410	1770	2130	2490	2850	3210	3570	3930	4290	4650	5020	5380	5740	6100	6460	6820	7180	7540	7900	8260	8620	8990	9350	9710	10000	10400	10700	11100
80	78.4	492.3	613	794	1150	1550	1940	2340	2740	3140	3530	3930	4330																				
100	100	785.0	978	1260	1840	2470	3100	3740	4370	5000	5640	6270	6900	7540	8170	8800	9440	10000	10700	11300	11900	12600	13200	13800	14500	15100	15700	16400	17000	17600	18300	18900	19500
	99.4	780.2	972	1250	1830	2460	3080	3710	4340	4970	5600	6230	6860																				
125	125	1256.0	1560	2020	2940	3960	4970	5980	7000	8010	9020	10000	11000	12000	13000	14000	15100	16100	17100	18100	19100	20100	21100	22100	23200	24200	25200	26200	27200	28200	29200	30300	31300
	130	1347.0	1670	2170	3160	4240	5330	6420	7500	8590	9680	10700	11800																				
150	150	1789.8	2230	2880	4200	5640	7080	8530	9970	11400	12800	14300	15700	17100	18600	20000	21500	22900	24400	25800	27300	28700	30100	31600	33000	34500	35900	37400	38800	40200	41700	43100	44600
	160	2009.6	2500	3240	4710	6330	7950	9580	11200	12800	14400	16000	17600																				

D:Seat opening dia.(mm), A:Seat opening area(mm^2) * Refer to page 69 for safety relief valves (SL-37~40F Type).

E070436A

■ FULL BORE TYPE

Qm=5.246CKd'A(P+0.1) 0.9 ····· { C=0.98(C=1 if set pressure<0.4MPa), Kd'=0.864 / P=set pressure 1.03 (In case of set pressure<0.1MPa,P=set pressure +0.02MPa) }

(kg/h)

Model name	Size mm	dt	A	Set pressure MPa	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0
SF-1H, 2H	20	15	176.6		158	220	294	361	434	506	579	652	725	797	9870	943	1010	1080	1160	1230	1300	1370	1450	1520										
	25	19	283.3		254	353	472	579	696	813	929	1040	1160	1270	1390	1510	1620	1740	1860	1970	2090	2210	2320	2440										
	40	30	706.5		634	881	1170	1440	1730	2020	2310	2600	2900	3190	3480	3770	4060	4350	4640	4930	5220	5510	5800	6100										
	50	38	1133.5		1010	1410	1890	2320	2780	3250	3720	4180	4650	5120	5580	6050	6520	6980	7450	7920	8380	8850	9320	9780										
SF-19L, 20L	15	11	94.9		85.1	118	158	194	233	272	311	350	389	428	467	506	545	585	624	663	702	741	780	819	858	897	936	975	1010	1050	1090	1130	1170	1210
	20	15	176.6		158	220	294	361	434	506	579	652	725	797	870	943	1010	1080	1160	1230	1300	1370	1540	1520	1590	1670	1740	1810	1880	1960	2030	2100	2170	2250
	25	19	283.3		254	353	472	579	696	813	929	1040	1160	1270	1390	1510	1620	1740	1860	1970	2090	2210	2320	2440	2560	2670	2790	2910	3020	3140	3260	3370	3490	3610
SF-13L, 14L	25	19	283.3		254	353	472	579	696	813	929	1040	1160	1270																				
SF-13L SF-16L (0.1~1MPa) SF-17L SF-18L (1~2MPa) SF-19L SF-20L (2~3MPa)	40	25	490.6		440	612	818	1000	1200	1400	1610	1810	2010	2210	2410	2620	2820	3020	3220	3420	3630	3830	4030	4230	4430	4640	4840	5040	5240	5440	5650	5850	6050	6250
		30	706.5		634	881	1170	1440	1730	2020	2310	2600	2900	3190	3480	3770	4060	4350	4640	4930	5220	5510	5800	6100	6390	6680	6970	7260	7550	7840	8130	8420	8710	9000
	50	34	907.4		814	1130	1510	1850	2230	2600	2970	3350	3720	4090	4470	4840	5210	5590	5960	6340	6710	7080	7460	7830	8200	8580	8950	9320	9700	10000	10400	10800	11100	11500
		38	1133.5		1010	1410	1890	2320	2780	3250	3720	4180	4650	5120	5580	6050	6520	6980	7450	7920	8380	8850	9320	9780	10200	10700	11100	11600	12100	12500	13000	13500	13900	14400
	65	43	1451.4		1300	1810	2420	2970	3560	4160	4760	5360	5950	6550	7150	7750	8340	8940	9540	10100	10700	11300	11900	12500	13100	13700	14300	14900	15500	16100	16700	17300	17900	18500
		49	1884.7		1690	2350	3140	3850	4630	5400	6180	6960	7730	8510	9290	10000	10800	11600	12300	13100	13900	14700	15400	16200	17000	17800	18600	19300	20100	20900	21700	22400	23200	24000
	80	55	2374.6		2130	2960	3960	4860	5830	6810	7790	8770	9740	10700	11700	12600	13600	14600	15600	16500	17500	18500	19500	20500	21400	22400	23400	24400	25300	26300	27300	28300	29300	30200
		61	2920.9		2620	3640	4870	5970	7180	8380	9580	10700	11900	13100	14300	15600	16800	18000	19200	20400	21600	22800	24000	25200	24600	27600	28800	30000	31200	32400	33600	34800	36000	37200
	100	69	3737.3		3350	4660	6230	7640	9180	10700	12200	13800	15300	16800	18400	19900	21400	23000	24500	26100	27600	29100	30700	32200	33800	35300	36800	38400	39900	41500	43000	44500	46100	47600
		76	4534.1		4060	5650	7560	9280	11100	13000	14800	16700	18600	20400	22300	24200	26000	27900	29800	31600	33500	35400	37200	39100	41000	42800	44700	46600	48400	50300	52200	54000	55900	57800
	125	86	5805.8		5210	7240	9680	11800	14200	16600	19000	21400	23800	26200	28600	31000	33300	35700	38100	40500	42900	45300	47700	50100	52500	54900	57300	59600	62000	64400	66800	69200	71600	74000
		95	7084.6		6350	8840	11800	14500	17400	20300	23200	26100	29000	32000	34900	37800	40700	43600	46500	49500	52400	55300	58200	61100	64000	67000	69900	72800	57500	78600	81500	84500	87400	90300
	150	105	8654.6		7760	10800	14400	17700	21200	24800	28400	31900	35500	39000	42600	46200	49700	53300	56900	60400	64000	67600	71100	74700	78200	81800	85400	88900	92500	96100	99600	103000	106000	110000
		115	10381.6		9310	12900	17300	21200	25500	29700	34000	38300	42600	46800	51100	55400	59700	63900	68200	72500	76800	81000	85300	89600	93900	98100	102000	106000	111000	115000	119000	123000	128000	132000

dt:Throat dia.(mm), A:Seat opening area(mm^2)

■ LIFT TYPE

Qm=5.246CKd'A(P+0.1) 0.9 ····· { C=0.98(C=1 if set pressure<0.4MPa), Kd'=0.96 / P=set pressure 1.03 (In case of set pressure<0.1MPa,P=set pressure +0.02MPa) }

(kg/h)

Size mm	D	A	Set pressure MPa	0.05	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0
15	15	18.8		14.4	18.7	26	34.8	42.7	51.3	59.9	68.5	77.1	85.7	94.3	102	111	120	128	137	145	154	163	171	180	188	197	206	214	223	231	240	249	257	266
20	20	31.4		24.1	31.3	43.5	58.2	71.4	85.7	100	114	128	143	157	171	186	200	215	229	243	258	272	286	301	315	329	344	358	373	387	401	416	430	444
25	25	54.9		42.3	54.7	76.1	101	124	149	175	200	225	250	275	300	325	350	376	401	426	541	476	501	526	551	576	620	627	652	677	702	727	752	777
32	32	80.3		61.8	80	111	148	182	219	256	292	329	366	403	439	476	513	550	586	623	660	696	733	770	807	843	880	917	945	990	1020	1060	1100	1130
40	40	125.6		96.7	125	174	232	285	343	400	458	515	572	630	687	745	802	860	917	975	1030	1090	1140	1200	1260	1310	1370	1430	1490	1540	1600	1660	1720	1770
50	50	204.1		157	203	283	378	464	557	650	744	837	931	1020	1110	1210	1300	1390	1490	1580	1670	1770	1860	1950	2050	2140	2230	2330	2420	2510	2610	2700	2790	2890
65	65	346.9		267	345	481	643	788	947	1100	1260	1420	1580	1740	1890	2050	2210	2370	2530	2690	2850	3010	3160	3320	3480	3640	3800	3960	4120	4280	4430	4590	4750	4910
75	75	447.4		344	446	620	829	1010	1220	1420	1630	1830	2040	2240	2450	2650	2850	3060	3260	3470	3670	3880	4080	4290	4490	4700	4900	5110	5310	5520	5720	5930	1630	6330
80	78.4	492.3		379	490	682	912	1110	1340	1570	1790	2020	2240	2470																				
100	100	785.0		604	782	1080	1450	1780	2140	2500	2860	3220	3580	3940	4290	4650	5010	5370	5730	6090	6540	6810	7170	7530	7890	8240	8600	8960	9320	9680	10000	10400	10700	11100
	99.4	780.2		601	777	1080	1440	1770	2130	2480	2840	3200	3550	3910																				
125	125	1256.0		976	1250	1740	2320	2850	3430	4000	4580	5150	5720	6300	6870	7450	8020	8600	9170	9750	10300	10900	11400	12000	12600	13100	13700	14300	14900	15400	16000	16600	17200	17700
	130	1347.0		1030	1340	1860	2490	3060	3670	4290	4910	5520	6140	6760																				
150	150	1789.8		1370	1780	2480	3310	4070	4880	5700	6520	7340	8160	8980	9800	10600	11400	12200	13000	13800	14700	15500	16300	17100	17900	18800	19600	20400	21200	22000	22900	23700	24500	25300
	160	2009.6		1540	2000	2780	3720	4570	5480	6400	7320	8240	9160	10000																				

D:Seat opening dia.(mm), A:Seat opening area(mm^2)

RELIEVING CAPACITY (VENN STANDARD)

<Liquids>
(Except Hot water and water)

■ FULL BORE TYPE

W=161 $AK\sqrt{PG}$ (K=0.6, G=1, Accumulation 15% $A=0.785dt^2$)

(10^3kg/h)

	Size mm	Set pressure MPa	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0
SF-20	15	11	3.10	4.39	5.38	6.21	6.95	7.61	8.22	8.79	9.32	9.83	10.3	10.7	11.2	11.6	12.0	12.4	12.8	13.1	13.5	13.9	14.2	14.5	14.9	15.2	15.5	15.8	16.1	16.4	16.7	17.0
	20	15	5.78	8.18	10.0	11.5	12.9	14.1	15.3	16.3	17.3	18.2	19.1	20.0	20.8	21.6	22.4	23.1	23.8	24.5	25.2	25.8	26.5	27.1	27.7	28.3	28.9	29.4	30.3	30.6	31.1	31.6
	25	19	9.28	13.1	16.0	18.5	20.7	22.7	24.5	26.2	27.8	29.3	30.7	32.1	33.4	34.7	35.9	37.1	38.2	39.3	40.4	41.5	42.5	43.5	44.5	45.4	46.4	47.3	48.2	49.1	49.9	50.8
SF-14	25	19	9.28	13.1	16.0	18.5	20.7	22.7	24.5	26.2	27.8	29.3																				
SF-14 SF-16 (0.1~1MPa) SF-18 (1~2MPa) SF-20 (2~3MPa)	40	25	16.0	22.7	27.8	32.1	35.9	39.3	42.5	45.4	48.2	50.8	53.3	55.6	57.9	60.1	62.2	64.2	66.2	68.1	70.0	71.8	73.6	75.3	77.0	78.7	80.3	81.9	83.5	85.0	86.5	88.0
		30	23.1	32.7	40.0	46.2	51.7	56.6	61.2	65.4	69.4	73.1	76.7	80.1	83.4	86.5	89.6	92.5	95.4	98.1	100	103	106	108	110	113	115	118	120	122	124	126
	50	34	29.7	42.0	51.4	59.4	66.4	72.8	78.6	84.0	89.1	93.9	98.5	102	107	111	115	118	122	126	129	132	136	139	142	145	148	151	154	157	160	162
		38	37.1	52.5	64.3	74.2	83.0	90.9	98.2	105	111	117	123	128	133	138	143	148	153	157	161	166	170	174	178	181	185	189	192	196	199	203
	65	43	47.5	67.2	82.3	95.0	106	116	125	134	142	150	157	164	171	177	184	190	196	201	207	212	217	223	228	232	273	242	247	251	256	260
		49	61.7	87.3	107	123	138	151	163	174	185	195	204	213	222	231	239	246	254	261	269	276	282	289	296	302	308	314	320	326	332	338
	80	55	77.7	110	135	156	174	190	205	220	233	245	257	269	280	291	301	311	320	330	33.9	347	356	364	373	381	388	396	404	411	418	426
		61	95.6	135	166	191	214	234	253	270	287	302	317	331	344	358	370	382	394	405	417	427	438	448	458	468	478	487	497	506	515	524
	100	69	122	173	212	245	274	299	323	346	367	387	406	424	441	458	474	489	504	519	533	547	561	574	587	599	612	624	636	647	659	670
		76	149	210	257	297	332	363	392	420	445	469	490	514	535	555	575	594	612	630	647	664	680	696	712	727	742	757	771	785	799	813
	125	86	190	269	329	380	425	465	503	537	570	601	630	658	685	711	736	760	784	806	829	850	871	892	912	931	950	969	988	1000	1020	1040
		95	232	328	402	464	519	568	614	656	696	733	769	803	836	868	898	928	956	984	1010	1030	1060	1080	1110	1130	1160	1180	1200	1220	1240	1270
	150	105	284	401	491	567	634	694	750	801	850	896	940	982	1020	1060	1090	1130	1160	1200	1230	1260	1290	1320	1350	1380	1410	1440	1470	1500	1520	1550
		115	340	481	589	680	760	833	899	961	1020	1070	1120	1170	1220	1270	1310	1360	1400	1440	1480	1520	1550	1590	1630	1660	1700	1730	1760	1790	1830	1860

P:Relieving pressure(MPa), dt:Throat dia.(mm)

∗1. Coefficient K and Accumulation are different according to types.
∗2. P (MPa), which is for actual calculation to decide discharge amount, is (P)+(Accumulation)−(Back pressure)

■ LIFT TYPE

W=161 $AK\sqrt{PG}$ (K=0.55, G=1, Accumulation 10% $A=\pi D\ell$)

(10^3kg/h)

Size mm	D \ Set pressure MPa	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0
15	15	0.552	0.780	0.956	1.10	1.23	1.35	1.46	1.56	1.65	1.74	1.83	1.91	1.99	2.06	2.13	2.20	2.27	2.34	240	2.46	2.53	2.58	2.64	2.70	2.76	2.81	2.86	2.92	2.97	3.02
20	20	0.922	1.30	1.59	1.84	2.06	2.25	2.43	2.60	2.76	2.91	3.05	3.19	3.32	3.45	3.57	3.68	3.80	3.91	4.01	4.12	4.22	4.32	4.42	4.51	4.61	4.70	4.79	4.87	4.96	5.05
25	25	1.61	2.28	2.79	3.22	3.60	3.94	4.26	4.56	4.83	5.09	5.34	5.58	5.18	6.03	6.24	6.44	6.64	6.84	7.02	7.21	7.38	7.56	7.73	7.89	8.06	8.22	8.37	8.53	8.68	8.83
32	32	2.35	3.33	4.08	4.71	5.27	5.77	6.23	6.67	7.07	7.45	7.82	8.16	8.50	8.82	9.13	9.43	9.72	10.0	10.2	10.5	10.8	11.0	11.3	11.5	11.7	12.0	12.2	12.4	12.6	12.9
40	40	3.68	5.21	6.38	7.37	8.24	9.03	9.75	10.4	11.0	11.6	12.5	12.7	13.2	13.8	14.2	14.7	15.2	15.6	16.0	16.4	16.9	17.3	17.6	18.0	18.4	18.8	19.1	19.5	19.8	20.2
50	50	5.99	8.47	10.3	11.9	13.4	14.6	15.8	16.9	17.9	18.9	19.8	20.7	21.6	22.4	23.2	23.9	24.7	25.4	26.1	26.8	27.4	28.1	28.7	29.3	29.9	30.5	31.1	31.7	32.2	32.8
65	65	10.1	14.4	17.6	20.3	22.7	24.9	26.9	28.8	30.5	32.2	33.7	35.2	36.7	38.1	39.4	40.7	42.0	43.2	44.4	45.5	46.6	47.7	48.8	49.9	50.9	51.9	52.9	53.9	54.8	55.8
75	75	13.1	18.5	22.7	26.2	29.3	32.1	34.7	37.1	39.4	41.5	43.5	45.5	74.3	49.1	50.8	52.5	54.1	55.7	57.2	58.7	60.2	61.6	63.0	64.3	65.6	66.9	68.2	69.5	70.7	71.9
80	78.4	14.4	20.4	25.0	28.9	32.3	35.4	38.2	40.8	43.3	45.7	47.9	50.0	52.1	54.0	55.9	57.8	59.6	61.3	63.0	64.6	66.2	67.8	69.3	70.8	72.2	73.7	75.1	76.5	77.8	79.1
100	100	22.9	32.4	39.6	45.8	51.2	56.1	60.6	64.8	68.7	72.4	75.9	79.3	82.6	85.7	88.7	91.6	94.4	97.2	99.8	102	105	107	109	112	114	116	119	121	123	125
	99.4	23.0	32.6	39.9	46.1	51.5	56.4	60.9	65.2	69.1	72.9	76.4	79.8	83.1	86.2	89.2	92.2	95.0	97.8	100	103	105	108	110	112	115	117	119	121	124	126
125	125	36.8	52.1	63.8	73.7	82.4	90.3	97.5	104	110	116	122	127	132	138	142	147	152	156	160	164	169	173	176	180	184	188	191	195	198	202
	130	39.5	55.9	68.5	79.1	88.4	69.9	104	111	118	125	131	137	142	148	153	158	163	167	172	176	181	185	189	193	197	201	205	209	213	216
150	150	52.5	74.3	91.0	105	117	128	139	148	157	166	174	182	189	196	203	210	216	223	229	235	240	246	252	257	262	268	273	278	283	287
	160	59.0	83.4	102	118	131	144	156	166	177	186	195	204	212	220	228	236	243	250	257	263	270	276	283	289	295	300	306	312	317	323

P:Relieving pressure (MPa), D:Seat opening dia.(mm), R:Lift(A)

∗1. Coefficient K, Accumulation and Lift are different according to types.
∗2. Refer to page 69 for safety relief valves (SL-37~40F Type).
∗3. P (MPa), which is for actual calculation to decide discharge amount, is (P)+(Accumulation)−(Back pressure)

Extract from JIS B8210-1994 Spring Safety Valve for Steam and Gases

■ Allowed deviation of discharge-starting pressure

(1) For steam

There is no provision on the relief pressure of safety valve for steam.

(2) For gasses

For valve for gasses, the allowed deviation of start to discharge pressure is set pressure ±5% (minimum pressure: ±0.025MPa). In case of allowed deviation, which is not allowed to exceed set pressure,add the "+" side to "−" side.

Note: For valves for gasses, the set pressure is generally the start to discharge pressure.

■ Allowed deviation of opening pressure (popping pressure)

(1) For steam

See Table 1 for the deviation of opening pressure. In case of allowed deviation, which is not allowed to exceed set pressure, add the "+" side to "−" side.

(2) For gasses

For safety valves for gasses, the allowed deviation of discharge-starting pressure is less then1.1 times of star to discharge pressure. However, in the case of setting opening pressure, the deviation should be ±3% set pressure (minimum±0.014MPa).

■ BLOWDOWN

(1) For steam

See Table 2 for the blowdown pressure of safety valves for steam. For valves for steam used with through flow boilers, re-heater, and piping, which opening pressure exceeds 0.3MPa, the blowdown pressure should be less than 10% of set pressure.

(2) For gasses

See Table 3 for blowdown pressure of safety valves for gasses.

TABLE1. TOLERANCE OF OPENING PRESSURE OF SAFETY VALVES FOR STEAM

(MPa)

Set pressure	Tolerance
Below 0.5	±0.014 or less
0.5 or more and below 2.3	±(3% of set pressure)
2.3 or more and below 7.0	±0.07
7.0 or more	±(1% of set pressure)

∗1. For steam, generally the set pressure is assumed to be the opening pressure.

∗2. The tolerance of the opening pressure of the safety valves for steam used other than in boilers can be ±3% of the set pressure (minimum value ±0.014MPa).

TABLE2. BLOWDOWN PRESSURE OF SAFETY VALVES FOR STEAM

(MPa)

Set pressure	Blowdown
0.4 or less	0.03
Over 0.4	7%(4%) or less of set pressure

∗1. Generally, the blowdown pressure for steam shall be the difference between the popping pressure and the reseating pressure.

∗2. The figures in ( ) can be determinated in accordance with the agreement between the parties concerned.

TABLE3. BLOWDOWN PRESSURE OF SAFETY VALVES FOR GAS

(MPa)

Set pressure	Blowdown	
	Metal seated type	Soft seat type
0.2 or less	0.03 or less	0.05 or less
Over 0.2	15% or less of set pressure	25% or less of set pressure

∗1. Generally, the blowdown pressure for gases shall be the difference between the start to discharge pressure and the reseating pressure.
However, when set by the opening pressure, it shall be the difference between the opening pressure and the reseating pressure.

∗2. The definition of the soft seat and metal seated types shall be in accordance with JIS B 0100.

Note. The blowdown pressure defined by Venn shall be in accordance with the Venn standard unless otherwise specified by JIS B8210.

Key Points for Installation of Safety Valve and Relief Valve

1. Installation

❶ Safety valve should be vertical to pipe. Before installation, remove scale and dust and clean the surfaces that contact with gasket.

❷ The diameter of the installation pipe should be larger than the diameter of valve. To reduce pressure loss to minimum degree, the stand pipe should be as short as possible.

❸ The stand pipe should be rigid and hard enough to bear the compression force, shearing force, bending stress or other counterforce caused by relieving of safety valve.

❹ Compared with the diameter of the outlet of safety valve, the diameter of the discharge pipe should be as large as possible. The discharge pipe should be as short as possible, without any bending, lead to outside of the door or other safe place, and be properly supported to avoid the occurrence of undesired stress (including thermal stress).

When deciding the place that the outlet of the discharge pipe faces, pay attention to the following issues.

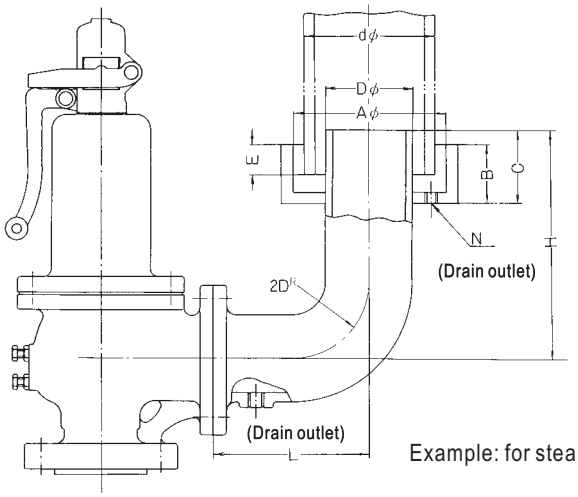
- To avoid installation place where is influenced by explosive sound and blast.
- Avoid damage to electrical equipments, machines, tools etc. in the case the fluid is steam or water.
- Avoid corrosion, poisoning, anoxia etc. in the case the fluid is harmful gas.
- In the case of screwed type safety valve or relief valve, install union joint at the discharge pipe of the outlet side to allow easy dismounting (see Fig.1 in next page).

❺ At parts of the discharge pipe where drain or rain may accumulate, install the drain outlet, which is possible to discharge drain completely,and connect to dike.

❻ In the case of full bore type safety valve for liquids or harmful gasses and have faucet for adjusting back pressure, install the valve on the outlet discharge pipe (see Fig.3 in next page).

❼ To avoid adverse impact on safety valve that is caused by thermal expansion of devices or discharge pipe, install proper expansion joint at the outlet of valve and install a discharge pipe at the end (see the figure below). To limit counterforce, the distance between the axes of the valve and the center of discharge pipe should be as short as possible, and the radius of the elbow pipe should be at least 2D (D: the internal diameter of the elbow). below figure also shows the standard dimensions of the discharge pipe of safety valve.

❽ Cares should be paid on installation of valves with lever (open type). It may effuse fluid from upper cap when such valves are operating (see Fig.5 in the next page).



Example: for steam

■ REFERENCE DIMENSION FOR EXHAUST PIPE

(mm)

Outlet size	D	d	(A)	B	C	E	L	H	N
40(1½″)	40	65	130	60	80	30	130	220	Rc⅜″
50(2″)	50	80	150	60	90	40	150	230	Rc½″
65(2½″)	65	100	200	60	100	40	180	270	Rc½″
80(3″)	80	125	200	70	120	50	200	310	Rc½″
100(4″)	100	150	250	70	140	60	250	370	Rc¾″
125(5″)	125	200	300	80	160	70	300	430	Rc1″
150(6″)	150	200	300	80	180	70	350	500	Rc1″
200(8″)	200	250	380	100	220	80	450	610	Rc1″

2. Maintenance and operating instructions

❶ At the installation of safety valves avoid the place where there is possibility to obstruct their functions by vibration or corrosion and do not give impact from outside.

❷ After installation, make sure the pressure of the device has reached at least 75% discharge pressure of the valve before using the test lever to start the valve.

❸ Normal working pressure of the equipment shall not exceed 90% of the blowdown pressure of the valve and 80 to 85% when pulsation is expected.

❹ If possible, remove safety valve before making water pressure test. To make water pressure test without removing safety valve, pay attention to the following below (see Fig.4 in the next page).

ⓐ To prevent valve from being damaged due to improper load, when the pressure of the device reaches 80~90% of discharge pressure, install test gag* and press lightly on the end of valve shaft. The test gag must be rotated using hand. If you rotate it using spanner or other tools, there may have excessively large pressing force, the seat may be damaged, the shaft may be bended, and the valve may not function normally.

ⓑ After water pressure test and the pressure reduces to 80~90% relieving pressure,remove test gag immediately.

※ The test gag is optional item.

Key Points for Installation of Safety Valve and Relief Valve

■ PIPING EXAMPLE

Fig.1 Example: Pressure tank installation

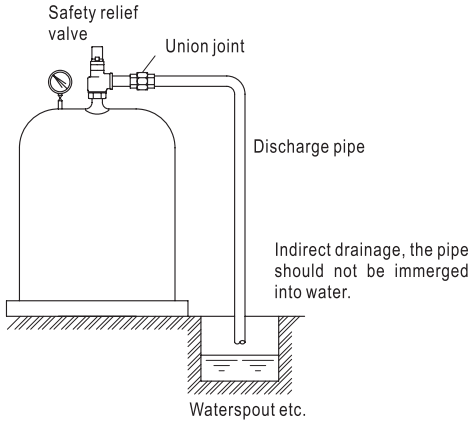


Fig.2 Example: Installation of the secondary side of pressure reducing valve

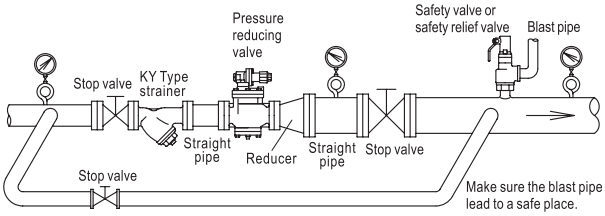


Fig.3 Example connection of(back pressure adjusting cock)

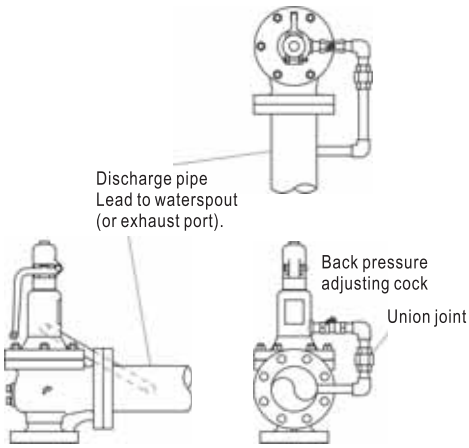


Fig.4 Installation of test gag

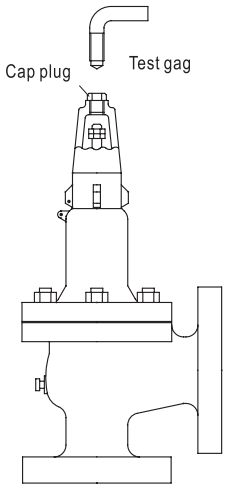
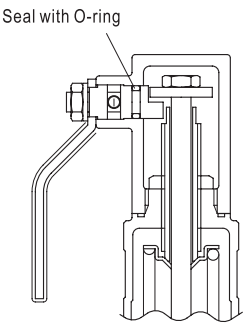
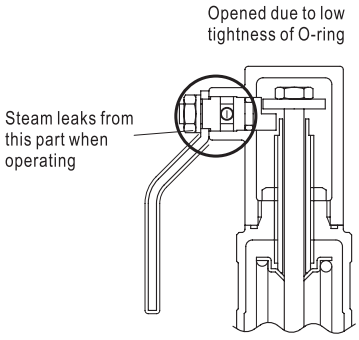


Fig.5 Lever structure

Lever structure of SL-37, 39, 39F Type
For air, gas, or liquid



For steam



Open type lever structure