SF-17, 17L, 18, 18L Type Safety Valve (Full Bore Type)

for Pressure Vessels, Steam Boiler, etc. (2.0MPa)

SF-17 Type

SF-18 Type

■ PRESSURE DIVISION

(MPa)

Code No.	Pressure division
1	1.0~1.3
2	Over 1.3~1.6
3	Over 1.6~2.0

■ SPECIFICATIONS

Model name	SF-17	SF -17L	SF-18	SF-18L
Code name	**SF17-C☐**	**SF17L-C☐**	**SF18-C☐**	**SF18L-C☐**
	※ Code No. of pressure division is required in ☐.			
Cap type	With lever		Without lever	
Applicable fluid	Air	Steam	Air, gases & liquids	Steam
Size	40~150(1½″~6″)			
Fluid temperature	−5~235℃			
Set pressure range	**1.0~2.0MPa**			
End connection	Inlet:Flanged JIS 16K, 20KRF(Thickness is based on table of DIMENSIONS)*1. Outlet:Flanged JIS 10KFF*1. *2.			
Materials	Body(Cast steel)*3., Disc & Seat ring(Stainless steel)			
	Disc & Seat ring:Stellited*4.			
Valve body pressure test	2 times of flange rated pressure. (Hydraulic)			

*1. Flange codes JIS B8210 10K(inlet)×JIS B2220 10K(outlet) and ASME(ANSI) Class 150×150 are also available upon your request.
*2. RF flange for outlet side is also available upon your request.
*3. For valve main body made of stainless steel, please contact our agent in your area.
*4. The valve for steam has split valve disc and only valve seat is stellite welded.
*5. For size 15~25mm, please see Page 82.

■ DIMENSIONS

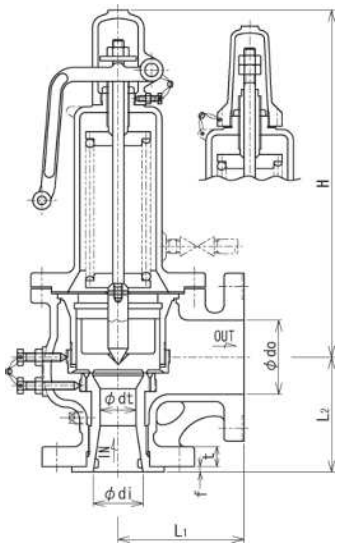
(mm)

Size Inlet×Throat dia.×Outlet	Seat opening dia.	Throat dia.	Throat area	Lift	Face to Face		Height H		Thickness of flange		Mass(kg)	
							SF-17 SF-17L Type	SF-18 SF-18L Type			SF-17 SF-17L Type	SF-18 SF-18L Type
di×dt×do	D	dt	a(mm²)	ℓ	L1	L2			t	f		
40(1½″)× 25/30 ×65(2½″)	35	25	490.6	6.5	127	125	290	291	24	6	22	22
		30	706.5	7.5								
50(2″)× 34/38 ×80(3″)	45	34	907.4	8.5	136	135	374	375	26	6	30	29
		38	1133.5	9.5								
65(2½″)× 43/49 ×100(4″)	58	43	1451.4	11.0	156	160	470	471	28	8	52	51
		49	1884.7	12.5								
80(3″)× 55/61 ×125(5″)	71	55	2374.6	14.0	176	180	528	529	30	8	80	79
		61	2920.9	15.5								
100(4″)× 69/76 ×150(6″)	88	69	3737.3	17.5	206	205	656	657	32	10	140	138
		76	4534.1	19.0								
125(5″)× 86/95 ×200(8″)	111	86	5805.8	21.5	225	240	809	811	34	10	197	194
		95	7084.6	24.0								
150(6″)× 105/115 ×200(8″)	134	105	8654.6	26.5	255	250	900	902	36	12	281	278
		115	10381.6	29.0								

Note: The weight is that of JIS 20K inlet flange.

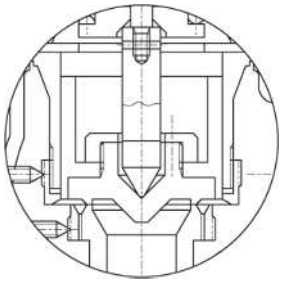
Flange code inlet JIS 16,20KRF
Outlet JIS 10K

■ CONSTRUCTION



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

● CONSTRUCTION OF SF-17L, 18L VALVE PART



Extract from JIS B8210-2009 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 gases

For valve for gases, 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 gases, 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 gases

For safety valves for gases, 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±0.015MPa).

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

■ 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 can be less than 10% of set pressure.

(2) For gases

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

Note: Unless otherwise specified in JIS B8210, Blowdown Standard of VENN shall apply.

■ Restriction of material use (pressure parts of safety valve) (Source: JIS B8210-2009)

(1) For steam

Material of pressure parts	Allowed range
Cast iron	Set pressure: Max.1.6 MPa. Fluid temperature: Max.230°C
Ductile iron casting	Set pressure: Max.2.4 MPa. Fluid temperature: Max.350°C

(2) For gases

Gas type / Material of pressure parts	Toxic,flammable gases	Gases other than toxic,flammable gases	Toxic,flammable gases, other gases
	Allowed range		
Cast iron	Not allowed	Set pressure: Max.0.2 MPa	Not allowed
Ductile cast iron	Set pressure: Max.0.2 MPa	Set pressure: Max.1.6 MPa	Not allowed
Ductile iron casting	A: Application in system for highly toxic gases such as phosgene and hydrogen cyanide,etc is not allowed. B: For gases other than those mentioned in A, the set pressure should be Max.2.4 MPa. C: Fluid temperature should be higher than -5°C and lower than 350°C.		

TABLE1. TOLERANCE OF OPENING PRESSURE OF SAFETY VALVES FOR STEAM

(MPa)

Set pressure	Tolerance
Below 0.5	±0.015
0.5 or more and less than 2.3	±(3% of set pressure)
2.3 or more and less than 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 ±0.015MPa).

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 opening 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 GASES

(MPa)

Set pressure	Blowdown	
	Metal seat 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 seated and metal seated types shall be in accordance with JIS B0100.

Note. Unless otherwise specified in JIS B8210, Blowdown Standard of VENN shall apply.

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 B8210-2009)

(1) For Steam

$Qm=5.25C'K_{dr}'AP$

Qm: 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: Absolute relieving pressure (MPa·A)

(Select the larger one of set pressure × 1.1 + 0.101 or set pressure + 0.020 + 0.101).

C': Coefficient determined according to the property of steam (See Tab.1 in Page 87.)

For saturated steam, see the following table:

Absolute relieving pressure (MPa·A)	C': Coefficient determined according the property of steam
Max.0.5	1※
over 0.5~1.0	0.98※
over 1.0~2.0	0.97※
over 2.0	0.96※

For superheated steam, See Tab1. in Page 87.

K_{dr}': Relieving coefficient

Lift type:0.864※

Full bore type:0.777

(2) For Gases

$Qm=C''K_{dr}'P_1AK_b\sqrt{\frac{M}{ZT}}$

Qm: 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 90)

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

P_1: Relieving pressure (MPa·A)

(Select the larger one of set pressure × 1.1 + 0.101 or set pressure + 0.020 + 0.101.)

P_2: Back pressure (MPa·A)

C'': Coefficient determined according to κ (See Tab.5 in Page 88)

κ : Adiabatic exponent (Isentropic, See Tab.4 in Page 88).

The value will be 1.001 if it is not specified, in which case C''=23.95

K_{dr}': Relieving coefficient

Lift type:0.864※

Full bore type:0.777

K_b: Back pressure compensation coefficient (Depending on P_2/P_1 and κ . See Tab.6 in Page 89)

M: Molecular weight of gas (See Tab.4 in Page 88)

■ 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, or more than 30 for super-heated steam, or more than 10 for common gas)

ρ : Density of gas (kg/m^3)

d : Internal diameter of pipe (mm)

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

(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 output 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 formula (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, 43,44 type,see Page 65.

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 : Coefficient correction (See Fig.2 in Page 90)

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

γ_1: Density of the hot water at inlet (kg/L) (See Tab.2 in Page 87)

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

ε : Coefficient of volumetrical expansion for water(1/°C) (See Tab.3 in Page 87)

C: Specific heat of water at constant pressure (kJ/kg°C) (See Tab.3 in Page 87)

Note: In the case of full-bore valve and relief valve, make sure the relieving pressure (P_1) does not exceed "maximum working pressure of pressure vessel or hot water boiler X 1.1" 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 B8210-2009)

(1) For Steam

$Qm=5.25C'K_{dr}'AP$

Qm: 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: Absolute relieving pressure (MPa·A)

(Select the larger one of set pressure × 1.03 + 0.101 or set pressure + 0.015 + 0.101)

C': Coefficient determined according the property of steam (See Tab.1 in Page 87)

For saturated steam, see the following table:

Absolute relieving pressure (MPa·A)	C': Coefficient determined according the property of steam
Max.0.5	1※
over 0.5~1.0	0.98※
over 1.0~2.0	0.97※
over 2.0	0.96※

For superheated steam, see Tab.1 in Page 87.

K_{dr}': Relieving coefficient

Lift type:0.864※

Full bore type:0.777

(2) For hot water (applicable when temperature is less than 120°C. If temperature is higher than 120 °C, 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 thermal output of hot water boiler:

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

In formula (i) and (ii), if $(P_1+0.1)\,\kappa > (P_1-P_2)$, then $(P_1+0.1)\kappa$ should be replaced by (P_1-P_2).

S: Seat opening area (mm^2)

W: Required relieving capacity of valve (kg/h)

Note: In the case of full-bore valve and relief valve, make sure the relieving pressure (P_1) does not exceed "maximum working pressure of pressure vessel or hot water boiler X 1.1" or "maximum working pressure + 0.034".

P_1: Relieving pressure (MPa) (see Note)

Lift type: set pressure ×1.1

For SL-37~40,43,44 type see Page 65.

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 : Coefficient correction (See Fig.2 in Page 90)

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

γ_1: Density of the hot water at inlet (kg/L) (See Tab.2 in Page 87)

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

ε : Coefficient of volumetrical expansion for water(1/°C) (See Tab.3 in Page 87)

C: Specific heat of water at constant pressure (kJ/kg°C) (See Tab.3 in Page 87)

■ NOTE

It is necessary installing safety valve when water temperature exceeds 120°C. The fomula is as the following:

$Qm=5.25C'K_{dr}'AP$

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

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

W: Required relieving capacity of safety valve (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 of water (1/°C) (See Tab.3 in Page 87)

C: Specific heat of water at constant pressure (kJ/kg°C) (See Tab.3 in Page 87)

(3) For dowtherm boiler

$$Qm=C''K_{dr}'P_1AK_b\sqrt{\frac{M}{ZT}}$$

Qm: 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 90)

T: Absolute temperature (K) of gases at absolute relieving pressure

P_1: Absolute relieving pressure (MPa·A)

(Select the larger one of set pressure × 1.1 + 0.101 or set pressure + 0.020 + 0.101)

P_2: Absolute back pressure (MPa·A)

C': Coefficient determined according to κ (See Tab.5, Page 88)

κ : Adiabatic exponent (Isentropic, See Tab.4 in Page 88)

The value will be 1.001 if it is not specified, in which case C"=23.95

K_{dr}': Relieving coefficient

Lift type:0.864※

Full bore type:0.777

K_b: Back pressure compensation coefficient (Depending on P_2/P_1 and κ . See Tab.6 in Page 89)

M: Molecular weight of air (See Tab.4 in Page 88)

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. JIS B8210-2009: SPRING SAFETY VALVE FOR STEAM AND GAS

(1) For Steam

$Qm=5.25C'K_{dr}'AP$

Qm: 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: Absolute relieving pressure (MPa·A)

Products for boiler: (Select the larger one of set pressure × 1.03 + 0.101 or set pressure + 0.015 + 0.101)

Products for pressure vessels: (Select the larger one of set pressure × 1.1 + 0.101 or set pressure + 0.020 + 0.101)

C': Coefficient determined according to the property of steam (See Tab.1 in Page 87.)

For saturated steam, see the following table:

Absolute flow rating pressure (MPa·A)	C': Coefficient depending on the nature of steam
Max.0.5	1※
Over 0.5~1.0	0.98※
Over 1.0~2.0	0.97※
Over 2.0	0.96※

For superheated steam, See the table in Page 87.

K_{dr}': Relieving coefficient

Lift type:0.864※

Full bore type:0.777

(2) For Gases

$Qm=C''K_{dr}'P_1AK_b\sqrt{\frac{M}{ZT}}$

Qm: 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 90)

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

P_1: Absolute relieving pressure (MPa·A)
(Select the larger one of set pressure × 1.1 + 0.101 or set pressure + 0.020 + 0.101)

P_2: Absolute back pressure (MPa·A)

C'': Coefficient determined according to κ (See Tab.5 in Page 88)

κ : adiabatic exponent (See Tab.4, Page 88)
The value will be 1.001 if it is not specified, in which case C"=23.95

K_{dr}': Relieving coefficient

Lift type:0.864※

Full bore type:0.777

K_b: Back pressure compensation coefficient (Depending on P_2/P_1 and κ . See Tab.6 in Page 89)

M: Molecular weight of air (See Tab.4 in Page 88)

4. ELECTRICITY BUSINESS ACT (Technical Standard for Thermal Equipments for Power Generation) (Formula source: JIS B8210-1994)

■ **Applicable for boilers and supporting equipments**

(1) For Steam

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

Qm: 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)

Set pressure≦0.1 MPa: Set pressure + 0.02

Set pressure >0.1 MPa: Set pressure × 1.03

C: Coefficient determined according to the property of steam (See Tab.1 in Page 87)

Set pressure is<0.5MPa·A, at saturated pressure:1

Set pressure is≧0.5MPa·A, at saturated pressure:0.98

Superheated steam: Please contact our agent in your area.

K_d': Rated discharge coefficient

Lift type:0.96※

Full bore type:0.864

(2) For Gases

$Qm=C'Kd'AP_1\sqrt{\frac{M}{ZT}}\times 0.9$

Qm: 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 90)

T: Absolute temperature (K) of gases at absolute relieving pressure

C': Coefficient determined according to κ and P_2/P_1 (See Fig.3 in Page 90)

κ : Adiabatic exponent (C_ρ/C_υ) (See Tab.4 in Page 88)
The value is considered as 1 if it is not clear.

P_2: Absolute back pressure (MPa·A)

K_d': Relieving coefficient

Lift type:0.96※

Full bore type:0.864

P_1: Absolute relieving pressure (MPa·A)
(Absolute value of "set pressure×1.1")

M: Molecular weight of gas (See Tab.4 in Page 88)

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

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

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

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 upon the inlet side temperature
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 C'

(JIS B8210-2009)

Absolute pressure (MPa) \ Temp. (℃)	Saturated temperature	200	220	240	260	280	300	320	340	360	380	400	420	440	460
0.5	1.004	0.994	0.971	0.950	0.931	0.912	0.895	0.879	0.863	0.848	0.834	0.821	0.808	0.796	0.784
1.0	0.986	0.980	0.982	0.960	0.938	0.919	0.900	0.883	0.867	0.852	0.837	0.824	0.810	0.798	0.786
1.5	0.976	0.975	0.969	0.969	0.946	0.925	0.906	0.888	0.871	0.855	0.843	0.826	0.813	0.800	0.788
2.0	0.971		0.966	0.963	0.955	0.932	0.912	0.893	0.875	0.859	0.844	0.829	0.815	0.802	0.790
2.5	0.968			0.960	0.965	0.940	0.918	0.898	0.880	0.863	0.847	0.832	0.818	0.805	0.792
3.0	0.966			0.961	0.956	0.948	0.925	0.904	0.884	0.867	0.850	0.835	0.821	0.807	0.794
4.0	0.964				0.957	0.953	0.939	0.915	0.895	0.875	0.857	0.841	0.826	0.811	0.798
5.0	0.965					0.955	0.952	0.929	0.905	0.884	0.865	0.847	0.831	0.816	0.802
6.0	0.968					0.962	0.953	0.943	0.917	0.893	0.873	0.854	0.837	0.821	0.807
7.0	0.971						0.959	0.954	0.930	0.904	0.881	0.861	0.843	0.826	0.811
8.0	0.975						0.968	0.956	0.944	0.915	0.890	0.869	0.849	0.832	0.816
9.0	0.980							0.963	0.960	0.927	0.900	0.877	0.856	0.837	0.820
10.0	0.987							0.972	0.962	0.941	0.911	0.885	0.863	0.843	0.825
12.0	1.000								0.977	0.973	0.935	0.904	0.878	0.856	0.836
14.0	1.019								1.005	0.982	0.964	0.926	0.896	0.870	0.848
16.0	1.039									1.005	1.001	0.952	0.916	0.886	0.861
18.0	1.068									1.044	1.007	0.977	0.933	0.903	0.875
20.0	1.100										1.036	1.011	0.958	0.917	0.890

* When pressure/temperature is an intermediate value, it is necessary to take the minimum value of absolute pressure/temperature division and do not apply the proportional method. When absolute pressure is below 0.5 MPa·A, then 0.5 MPa·A should be used as absolute pressure. For example, when relieving pressure (absolute pressure) is 1.6 MPa·A and temperature is 245°C, C' = 0.946.

TABLE2. HOT WATER SPECIFIC GRAVITY γ_t(kg/L)

(Source: Interpretation of Boiler Structure Standard)

Temp.℃ \ Pressure MPa・A	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

Note: Intermediate value should be calculated using the proportional method.
* Water density should be "1" when temperature is lower than 40°C.

TABLE3. SPECIFIC HEAT AND EXPANSION COEFFICIENT OF HOT WATER

(Source: Interpretation of Boiler Structure Standard)

Temp.℃	Specific heat of water at constant pressure C kJ/kg℃	Expansion coefficient ε 1/℃
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	4.371	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

Note: Intermediate value should be calculated using the proportional method.

Applicable Laws & Regulations and Formulas for Calculating Relieving Capacity

TABLE4. GAS PROPERTY

(JIS B8210-2009)

Gas names	Chemical symbol	Molecular weight *M* (kg/kmol)	Adiabatic (isentropic) index κ (1.013bar a,15℃)	Critical pressure *Pc* (bar a.)	Critical temp. *Tc* (K)	Critical pressure ratio
Acetylene	C_2H_2	26.02	1.26	62.82	309.15	0.553
Air	—	28.96	1.40	37.69	132.45	0.528
Ammonia	NH_3	17.03	1.31	112.98	405.55	0.544
Argon	Ar	39.91	1.66	48.64	151.15	0.488
Normal butane	C_4H_{10}	58.08	1.11	36.48	426.15	0.583
Carbon dioxide	CO_2	44.00	1.30	73.97	304.25	0.546
Carbon monoxide	CO	28.00	1.40	35.46	134.15	0.528
Chlorine	Cl_2	70.91	1.35	77.11	417.15	0.537
Chlorofluoromethane	$CHClF_2$	86.47	1.18	49.14	370.15	0.568
Ethane	C_2H_6	30.05	1.22	49.45	305.25	0.561
Ethylene	C_2H_4	28.03	1.25	51.57	282.85	0.555
Hydrogen	H_2	2.015	1.41	12.97	33.25	0.527
Hydrogen chloride	HCl	36.46	1.41	82.68	324.55	0.527
Hydrogen sulfide	H_2S	34.08	1.32	90.08	373.55	0.542
Isobutane	$CH(CH_3)_3$	58.08	1.11	37.49	407.15	0.583
Methane	CH_4	16.03	1.31	46.41	190.65	0.544
Methyl chloride	CH_3Cl	50.48	1.28	66.47	416.25	0.549
Nitrogen	N_2	28.02	1.40	33.94	126.05	0.528
Nitrogen suboxide	N_2O	44.02	1.30	72.65	309.65	0.546
Oxygen	O_2	32.00	1.40	50.36	154.35	0.528
Propane	C_3H_3	44.06	1.13	43.57	368.75	0.579
Propylene	C_3H_6	42.05	1.15	46.60	365.45	0.574
Sulfur dioxide	SO_2	64.07	1.29	78.73	430.35	0.548

TABLE5. COEFFICIENT DEPENDING ON ADIABATIC (ISENTROPIC) EXPONENT (κ) (C") (JIS B8210-2009)

κ	C"	κ	C"	κ	C"	κ	C"	κ	C"	κ	C"
0.41	16.65	0.71	20.96	1.01	24.04	1.31	26.41	1.61	28.34	1.91	29.96
0.42	16.82	0,72	21.08	1.02	24.12	1.32	26.49	1.62	28.40	1.92	30.01
0.43	17.00	0.73	21.20	1.03	24.21	1.33	26.56	1.63	28.46	1.93	30.06
0.44	17.17	0.74	21.31	1.04	24.30	1.34	26.63	1.64	28.52	1.94	30.10
0.45	17.33	0.75	21.43	1.05	24.39	1.35	26.69	1.65	28.58	1.95	30.15
0.46	17.50	0.76	21.54	1.06	24.47	1.36	26.76	1.66	28.63	1.96	30.20
0.47	17.66	0.77	21.65	1.07	24.56	1.37	26.83	1.67	28.69	1.97	30.25
0.48	17.82	0.78	21.76	1.08	24.64	1.38	26.90	1.68	28.74	1.98	30.30
0.49	17.98	0.79	21.87	1.09	24.72	1.39	26.97	1.69	28.80	1.99	30.34
0.50	18.13	0.80	21.98	1.10	24.81	1.40	27.03	1.70	28.86	2.00	30.39
0.51	18.29	0.81	22.09	1.11	24.89	1.41	27.10	1.71	28.91	2.01	30.44
0.52	18.44	0.82	22.19	1.12	24.97	1.42	27.17	1.72	28.97	2.02	30.49
0.53	18.58	0.83	22.30	1.13	25.05	1.43	27.23	1.73	29.02	2.03	30.53
0.54	18.73	0.84	22.40	1,14	25.13	1.44	27.30	1.74	29.08	2.04	30.58
0.55	18.88	0.85	22.51	1.15	25.21	1.45	27.36	1.75	29.13	2.05	30.63
0.56	19.02	0.86	22.61	1.16	25.29	1.46	27.43	1.76	29.18	2.06	30.67
0.57	19.16	0.87	22.71	1.17	25.37	1.47	27.49	1.77	29.24	2.07	30,72
0.58	19.30	0.88	22.81	1.18	25.45	1.48	27.55	1.78	29.29	2.08	30.76
0.59	19.44	0.89	22.91	1.19	25.53	1.49	27.62	1.79	29.34	2.09	30.81
0.60	19.57	0.90	23.01	1.20	25.60	1.50	27.68	1.80	29.40	2.10	30.85
0.61	19.71	0.91	23.11	1.21	25.68	1.51	27.74	1.81	29.45	2.11	30.90
0.62	19.84	0.92	23.20	1.22	25.76	1.52	27.80	1.82	29.50	2.12	30.94
0.63	19.97	0.93	23.30	1.23	25.83	1.53	27.86	1.83	29.55	2.13	30.99
0.64	20.10	0.94	23.39	1.24	25.91	1.54	27.93	1.84	29.60	2.14	31.03
0.65	20.23	0.95	23.49	1.25	25.98	1.55	27.99	1.85	29.65	2.15	31.07
0.66	20.35	0.96	23.58	1.26	26.05	1.56	28.05	1.86	29.71	2.16	31.12
0.67	20.48	0.97	23.67	1.27	26.13	1.57	28.11	1.87	29.76	2.17	31.16
0.68	20.60	0,98	23.76	1.28	26.20	1.58	28.17	1.88	29.81	2.18	31.21
0,69	20.72	0.99	23.86	1.29	26.27	1.59	28.23	1.89	29.86	2.19	31.25
0.70	20.84	1.001	23.95	1.30	26.34	1.60	28.29	1.90	29.91	2.20	31.29

Note: Intermediate value should be calculated using the interpolational method.

Calculation formula

$$C=39.48\sqrt{\kappa\left(\frac{2}{\kappa+1}\right)^{\frac{\kappa+1}{\kappa-1}}}$$

Fig.1 Coefficient of compressibility Z (JIS B8210-2009)

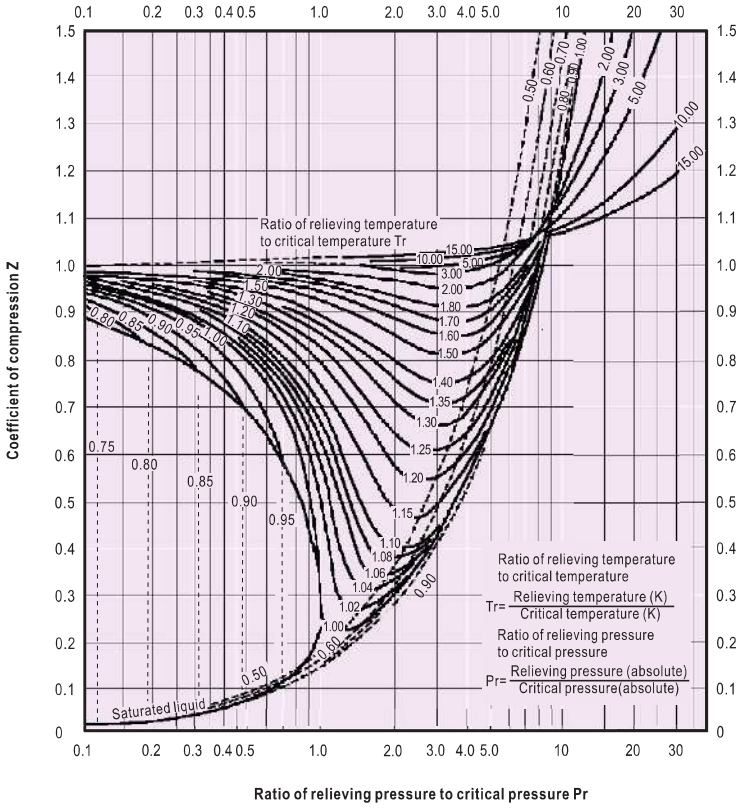


Fig.2 Δt°C correction coefficient κ

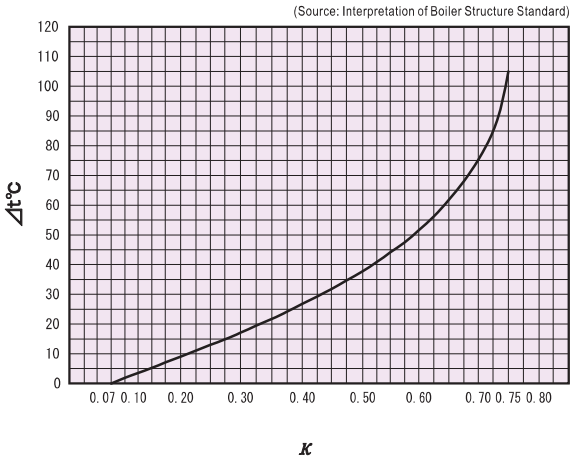
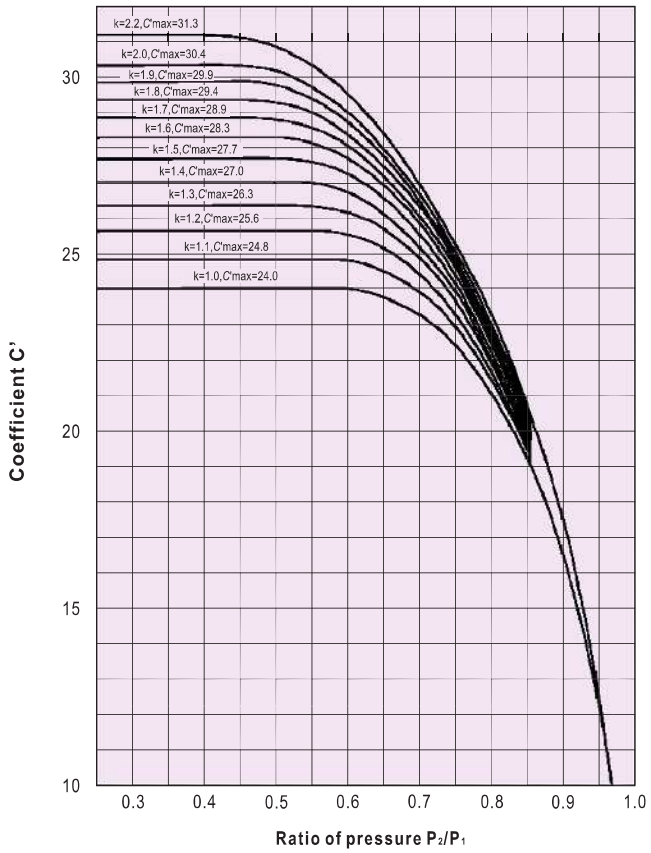


Fig.3 Coefficient (C') based on κ and P_2/P_1 (JIS B8210-2009)



Key Points for Installation of Safety Valves and Relief Valves

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.

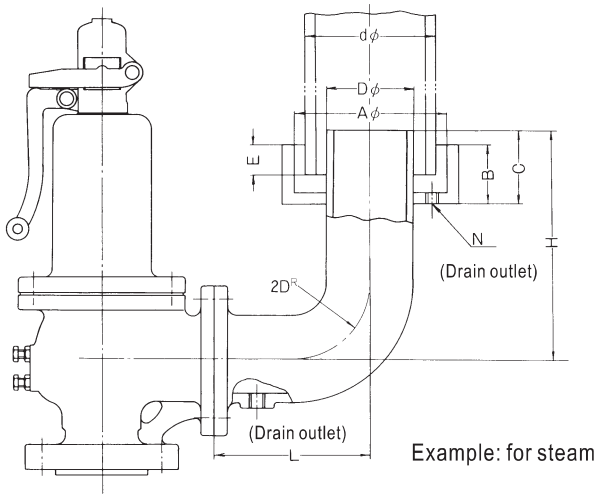
- To avoid installation place where is influenced by explosive sound and blast.
- Avoid damage to electrical equipments, machines, tools etc. in the case the fluid is steam or water.
- Avoid corrosion, poisoning, anoxia etc. in the case the fluid is harmful gas.
- In the case of screwed type safety valve 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 gases 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 Valves and Relief Valves

■ PIPING EXAMPLE

Fig.1 Example: Pressure tank installation

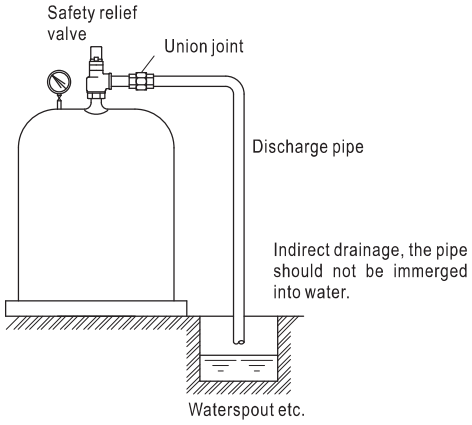


Fig.2 Example: Installation of the secondary side of pressure reducing valve

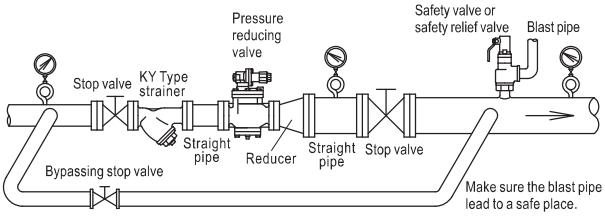


Fig.3 Example connection of back pressure adjusting cock

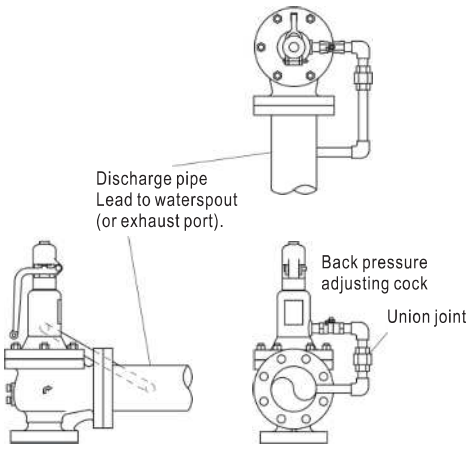


Fig.4 Installation of test gag

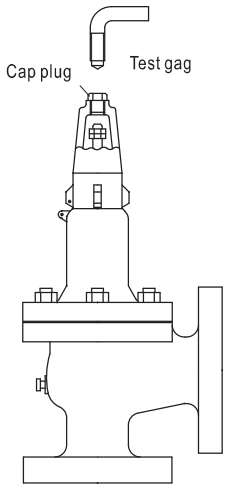
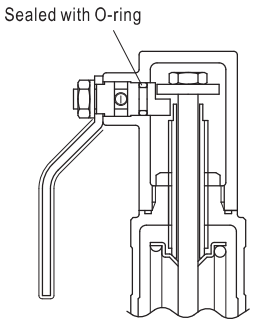
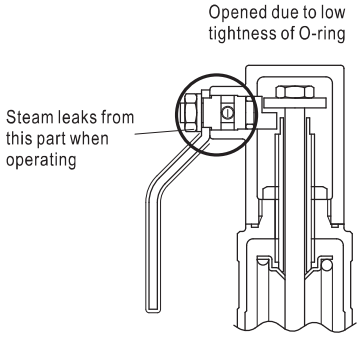


Fig.5 Lever structure

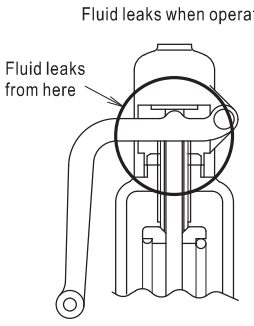
Lever structure of SL-37, 39, 39F,43 Type
For air, gas, or liquid



For steam



Open type lever structure



■ FULL BORE TYPE

Qm=5.25C'K_{dr}'AP ..... { C'=1 (when P≦0.5MPa·A) or 0.98 (when P is over 0.5~1.0 MPa·A) or 0.97 (when P is over 1.0~2.0 MPa·A) or 0.96 (when P>2.0 MPa·A)
K_{dr}'=0.777, P (MPa·A): the larger one of (set pressure × 1.1 + 0.101) or (set pressure + 0.02 + 0.101).) }

(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		159	231	310	381	459	537	614	692	762	839	916	992	1060	1140	1220	1300	1370	1430	1510	1590										
	25	19	283.3		255	370	498	612	737	861	986	1110	1220	1340	1460	1590	1710	1830	1960	2080	2200	2300	2430	2550										
	40	30	706.5		636	925	1240	1520	1830	2140	2460	2770	3040	3350	3660	3970	4270	4580	4890	5200	5500	5750	6060	6360										
	50	38	1133.5		1020	1480	1990	2450	2940	3440	3940	4440	4890	5380	5870	6370	6860	7360	7850	8340	8840	9230	9720	10200										
SF-19L, 20L	15	11	94.9		85.5	124	166	205	246	288	330	372	409	450	492	533	574	616	657	698	740	773	814	855	896	936	977	1010	1050	1100	1140	1180	1220	1260
	20	15	176.6		159	231	310	381	459	537	614	692	762	839	916	992	1060	1140	1220	1300	1370	1430	1510	1590	1660	1740	1810	1890	1970	2040	2120	2190	2270	2350
	25	19	283.3		255	370	498	612	737	861	986	1110	1220	1340	1460	1590	1710	1830	1960	2080	2200	2300	2430	2550	2670	2790	2910	3040	3160	3280	3400	3520	3650	3770
SF-13L, 14L	25	19	283.3		255	370	498	612	737	861	986	1110	1220	1340																				
SF-13L SF-16L (0.1~1MPa)	40	25	490.6		442	642	862	1060	1270	1490	1700	1920	2110	2330	2540	2750	2970	3180	3390	3610	3820	3990	4200	4420	4630	4840	5050	5260	5470	5680	5900	6110	6320	6530
		30	706.5		636	925	1240	1520	1830	2140	2460	2770	3040	3350	3660	3970	4270	4580	4890	5200	5500	5750	6060	6360	6670	6970	7270	7580	7880	8190	8490	8800	9100	9400
	50	34	907.4		818	1180	1590	1960	2360	2760	3150	3550	3910	4310	4700	5100	5490	5890	6280	6680	7070	7390	7780	8170	8560	8950	9340	9740	10100	10500	10900	11300	11600	12000
		38	1133.5		1020	1480	1990	2450	2940	3440	3940	4440	4890	5380	5870	6370	6860	7360	7850	8340	8840	9230	9720	10200	10700	11100	11600	12100	12600	13100	13600	14100	14600	15000
	65	43	1451.4		1300	1900	2550	3130	3770	4410	5050	5690	6260	6890	7520	8160	8790	9420	10000	10600	11300	11800	12400	13000	13700	14300	14900	15500	16200	16800	17400	18000	18700	19300
		49	1884.7		1690	2460	3310	4070	4900	5730	6560	7390	8130	8950	9770	10500	11400	12200	13000	13800	14600	15300	16100	16900	17700	18600	19400	20200	21000	21800	22600	23400	24200	25100
SF-17L SF-18L (1~2MPa)	80	55	2374.6		2140	3100	4170	5130	6170	7220	8260	9310	10200	11200	12300	13300	14300	15400	16400	17400	18500	19300	20300	21300	22400	23400	24400	25400	26500	27500	28500	29500	30600	31600
		61	2920.9		2630	3820	5130	6310	7600	8880	10100	11400	12600	13800	15100	16400	17600	18900	20200	21500	22700	23800	25000	26300	27500	28800	30000	31300	32600	33800	35100	36300	37600	38900
	100	69	3737.3		3360	4890	6570	8080	9720	11300	13000	14600	16100	17700	19300	21000	22600	24200	25800	27500	29100	30400	32000	33600	35200	36800	38500	40100	41700	43300	44900	46500	48100	49700
		76	4534.1		4080	5930	7970	9800	11700	13700	15700	17700	19500	21500	23500	25400	27400	29400	31400	33300	35300	36900	38900	40800	42800	44700	46700	48600	50600	52500	54500	56400	58400	60300
SF-19L SF-20L (2~3MPa)	125	86	5805.8		5230	7600	10200	12500	15100	17600	20200	22700	25000	27500	30100	32600	35100	37600	40200	42700	45200	47300	49800	52300	54800	57300	59800	62300	64800	67300	69800	72300	74800	77300
		95	7084.6		6380	9270	12400	15300	18400	21500	24600	27700	30500	33600	36700	39800	42900	46000	49000	52100	55200	57700	60700	63800	66800	69900	72900	76000	79000	82100	85200	88200	91300	94300
	150	105	8654.6		7800	11300	15200	18700	22500	26300	30100	33900	37300	41100	44800	48600	52400	56100	59900	63700	67400	70500	74200	77900	81700	85400	89100	92800	96600	100000	104000	107000	111000	115000
		115	10381.6		9350	13500	18200	22400	27000	31500	36100	40700	44800	49300	53800	58300	62800	67400	71900	76400	80900	84600	89000	93500	98000	102000	106000	111000	115000	120000	124000	129000	133000	138000

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

■ LIFT TYPE

Qm=5.25C'Kdr'AP ..... { C'=1 (when P≦0.5MPa·A) or 0.98 (when P is over 0.5~1.0 MPa·A) or 0.97 (when P is over 1.0~2.0 MPa·A) or 0.96 (when P>2.0 MPa·A)
Kdr'=0.864, P (MPa·A): the larger one of (set pressure ×1.1 + 0.101) or (set pressure + 0.02 + 0.101).) }

(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		14.5	18.8	27.3	36.7	45.2	54.4	63.5	72.7	81.9	90.2	99.3	108	117	126	135	144	153	163	170	179	188	197	206	215	224	233	242	251	260	269	278
20	20	31.4		24.3	31.4	45.7	61.3	75.5	90.8	106	121	136	150	165	181	196	211	226	241	257	272	284	299	314	329	344	359	374	389	404	419	434	449	465
25	25	54.9		42.5	55	79.9	107	132	158	185	212	239	263	290	316	343	369	396	422	449	476	497	523	550	576	602	628	655	681	707	734	760	786	813
32	32	80.3		62.2	80.4	116	156	193	232	271	310	350	385	424	463	502	540	579	618	657	696	727	766	804	843	881	919	958	996	1030	1070	1110	1150	1180
40	40	125.6		97.4	125	182	245	302	363	424	486	547	602	663	724	785	846	906	967	1020	1080	1130	1190	1250	1310	1370	1430	1490	1550	1610	1670	1730	1790	1860
50	50	204.1		158	204	297	399	490	590	690	790	890	979	1070	1170	1270	1370	1470	1570	1670	1770	1840	1940	2040	2140	2240	2330	2430	2530	2630	2720	2820	2920	3020
65	65	346.9		269	347	505	678	834	1000	1170	1340	1510	1660	1830	2000	2160	2330	2500	2670	2840	3000	3140	3300	3470	3640	3800	3970	4140	4300	4470	4630	4800	4970	5130
75	75	447.4		347	448	651	874	1070	1290	1510	1730	1950	2140	2360	2580	2790	3010	3230	3440	3660	3870	4050	4260	4480	4690	4910	5120	5340	5550	5760	5980	6190	6410	6620
80	78.4	492.3		381	493	716	962	1180	1420	1660	1900	2140	2360	2600																				
100	100	785.0		608	786	1140	1530	1880	2270	2650	3030	3420	3760	4140	4520	4900	5280	5660	6040	6420	6800	7110	7480	7860	8240	8610	8990	9360	9740	10100	10400	10800	11200	11600
	99.4	780.2		605	782	1130	1520	1870	2250	2630	3020	3400	3740	4120																				
125	125	1256.0		974	1250	1820	2450	3020	3630	4240	4860	5470	6020	6630	7240	7850	8460	9060	9670	10200	10800	11300	11900	12500	13100	13700	14300	14900	15500	16100	16700	17300	17900	18600
	130	1347.0		1040	1350	1960	2630	3230	3890	4550	5210	5870	6460	7110																				
150	150	1789.8		1380	1790	2600	3490	4300	5170	6050	6920	7800	8590	9450	10300	11100	12000	12900	13700	14600	15500	16200	17000	17900	18700	19600	20500	21300	22200	23000	23900	24700	25600	26500
	160	2009.6		1550	2010	2920	3920	4830	5810	6790	7780	8760	9640	10600																				

D:Seat opening dia.(mm), A:Seat opening area(mm^2) * Refer to Page 65 for safety relief valves (SL-37~40, 39F, 40F, 43, 44 Type).

■ FULL BORE TYPE

Qm=5.25C'Kdr'AP ..... { C'=1 (when P≦0.5MPa·A), or 0.98 (when P is over 0.5~1.0 MPa·A), or 0.97 (when P is over 1.0~2.0 MPa·A), or 0.96 (when P>2.0 MPa·A)
Kdr'=0.777, P (MPa·A): the larger one of (set pressure ×1.1 + 0.101) or (set pressure + 0.02 + 0.101).) }

(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	155	227	299	364	434	507	580	653	725	798	871	943	1010	1080	1160	1230	1300	1380	1450	1520										
	25	19	283.3	249	365	480	584	697	814	930	1040	1160	1280	1390	1510	1630	1740	1860	1980	2090	2210	2330	2440										
	40	30	706.5	622	910	1190	1450	1730	2030	2320	2610	2900	3190	3480	3770	4060	4350	4640	4930	5230	5520	5810	6100										
	50	38	1133.5	998	1460	1920	2330	2790	3250	3720	4190	4650	5120	5590	6050	6520	6990	7450	7920	8390	8850	9320	9790										
SF-19L, 20L	15	11	94.9	83.6	122	161	195	233	272	311	350	390	429	468	507	546	585	624	663	702	741	780	819	858	897	937	976	1010	1050	1090	1130	1170	1210
	20	15	176.6	155	227	299	364	434	507	580	653	725	798	871	943	1010	1080	1160	1230	1300	1380	1450	1520	1590	1670	1740	1810	1880	1960	2030	2100	2180	2250
	25	19	283.3	249	365	480	584	697	814	930	1040	1160	1280	1390	1510	1630	1740	1860	1980	2090	2210	2330	2440	2560	2680	2790	2910	3030	3140	3260	3380	3490	3610
SF-13L, 14L	25	19	283.3	249	365	480	584	697	814	930	1040	1160	1280																				
SF-13L SF-16L (0.1~1MPa) SF-17L SF-18L (1~2MPa) SF-19L SF-20L (2~3MPa)	40	25	490.6	432	632	832	1010	1200	1410	1610	1810	2010	2210	2420	2620	2820	3020	3220	3430	3630	3830	4030	4230	4440	4640	4840	5040	5240	5450	5650	5850	6050	6250
		30	706.5	622	910	1190	1450	1730	2030	2320	2610	2900	3190	3480	3770	4060	4350	4640	4930	5230	5520	5810	6100	6390	6680	6970	7260	7550	7840	8130	8430	8720	9010
	50	34	907.4	799	1160	1530	1870	2230	2600	2980	3350	3720	4100	4470	4840	5220	5590	5970	6340	6710	7090	7460	7830	8210	8580	8950	9330	9700	10000	10400	10800	11200	11500
		38	1133.5	998	1460	1920	2330	2790	3250	3720	4190	4650	5120	5590	6050	6520	6990	7450	7920	8390	8850	9320	9790	10200	10700	11100	11600	12100	12500	13000	13500	13900	14400
	65	43	1451.4	1270	1870	2460	2990	3570	4170	4760	5360	5960	6560	7150	7750	8350	8950	9550	10100	10700	11300	11900	12500	13100	13700	14300	14900	15500	16100	16700	17300	17900	18500
		49	1884.7	1660	2420	3190	3880	4640	5410	6190	6960	7740	8520	9290	10000	10800	11600	12400	13100	13900	14700	15500	16200	17000	17800	18600	19300	20100	20900	21700	22400	23200	24000
	80	55	2374.6	2090	3060	4020	4890	5840	6820	7800	8780	9750	10700	11700	12600	13600	14600	15600	16600	17500	18500	19500	20500	21400	22400	23400	24400	25400	26300	27300	28300	29300	30200
		61	2920.9	2570	3760	4950	6020	7190	8390	9590	10800	12000	13200	14400	15600	16800	18000	19200	20400	21600	22800	24000	25200	26400	27600	28800	30000	31200	32400	33600	34800	36000	37200
	100	69	3737.3	3290	4810	6340	7700	9200	10700	12200	13800	15300	16800	18400	19900	21500	23000	24500	26100	27600	29200	30700	32200	33800	35300	36900	38400	39900	41500	43000	44500	46100	47600
		76	4534.1	3990	5840	7690	9350	11100	13000	14800	16700	18600	20500	22300	24200	26100	27900	29800	31700	33500	35400	37300	39100	41000	42900	44700	46600	48500	50300	52200	54100	55900	57800
	125	86	5805.8	5110	7480	9850	11900	14200	16600	19000	21400	23800	26200	28600	31000	33400	35800	38200	40500	42900	45300	47700	50100	52500	54900	57300	59700	62100	64400	66800	69200	71600	74000
		95	7084.6	6240	9130	12000	14600	17400	20300	23200	26100	29100	32000	34900	37800	40700	43700	46600	49500	52400	55300	58200	61200	64100	67000	69900	72800	75700	78700	81600	84500	87400	90300
	150	105	8654.6	7620	11100	14600	17800	21300	24800	28400	32000	35500	39100	42600	46200	49800	53300	56900	60500	64000	67600	71200	74700	78300	81800	85400	89000	92500	96100	99700	103000	106000	110000
		115	10381.6	9140	13300	17600	21400	25500	29800	34100	38300	42600	46900	51200	55400	59700	64000	68300	72500	76800	81100	85400	89600	93900	98200	102000	106000	111000	115000	119000	123000	128000	132000

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

■ LIFT TYPE

Qm=5.25C'K_{dr}'AP ..... { C'=1 (when P≦0.5MPa·A), or 0.98 (when P is over 0.5~1.0 MPa·A), or 0.97 (when P is over 1.0~2.0 MPa·A), or 0.96 (when P>2.0 MPa·A)
K_{dr}'=0.864, P (MPa·A): the larger one of (set pressure × 1.1 + 0.101) or (set pressure + 0.02 + 0.101).) }

(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*	14.1	18.4	26.9	35.4	43.1	51.4	60	68.6	77.3	85.9	94.5	103	111	120	128	137	146	154	163	171	180	189	197	206	215	223	232	240	249	258	266
20	20	31.4*	23.6	30.7	45	59.2	72	85.9	100	114	129	143	157	172	186	200	215	229	244	258	272	287	301	316	330	344	359	373	387	402	416	431	445
25	25	54.9*	41.3	53.7	78.6	103	125	150	175	200	225	250	276	301	326	351	376	401	426	451	477	502	527	552	577	602	627	653	678	703	728	753	778
32	32	80.3	60.4	78.6	115	151	184	219	256	293	330	366	403	440	477	514	550	587	624	661	697	734	771	808	844	881	918	955	991	1020	1060	1100	1130
40	40	125.6	94.5	123	180	237	288	343	401	458	516	573	631	688	746	803	861	919	976	1030	1090	1140	1200	1260	1320	1370	1430	1490	1550	1600	1660	1720	1780
50	50	204.1	153	199	292	385	468	558	652	745	839	932	1020	1110	1210	1300	1390	1490	1580	1680	1770	1860	1960	2050	2140	2240	2330	2420	2520	2610	2700	2800	2890
65	65	346.9	261	339	497	654	795	949	1100	1260	1420	1580	1740	1900	2060	2220	2370	2530	2690	2850	3010	3170	3330	3490	3650	3800	3960	4120	4280	4440	4600	4760	4920
75	75	447.4	336	438	641	844	1020	1220	1420	1630	1830	2040	2240	2450	2650	2860	3060	3270	3470	3680	3880	4090	4290	4500	4700	4910	5110	5320	5520	5730	5930	6140	6340
80	78.4	492.3	370	482	705	928	1120	1340	1570	1790	2020	2240	2470																				
100	100	785.0	591	769	1120	1480	1800	2140	2500	2860	3220	3580	3940	4300	4660	5020	5380	5740	6100	6460	6820	7180	7540	7900	8250	8610	8970	9330	9690	10000	10400	10700	11100
	99.4	780.2	587	764	1110	1470	1780	2130	2490	2850	3200	3560	3920																				
125	125	1256.0	945	1230	1800	2370	2880	3430	4010	4580	5160	5730	6310	6880	7460	8030	8610	9190	9760	10300	10900	11400	12000	12600	13200	13700	14300	14900	15500	16000	16600	17200	17800
	130	1347.0	1010	1310	1930	2540	3080	3680	4300	4920	5530	6150	6770																				
150	150	1789.8	1340	1750	2560	3370	4100	4900	5720	6530	7350	8170	8990	9810	10600	11400	12200	13000	13900	14700	15500	16300	17100	18000	18800	19600	20400	21200	22100	22900	23700	24500	25300
	160	2009.6	1510	1960	2880	3790	4600	5500	6420	7340	8260	9180	10100																				

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

※ The seat opening area and relieving capacity of safety relief vales (SL-37~40, 39F, 40F Type (Page 62~64) and SL-43, 44 Type (Page 66)) are different from the values in this table.