# Safety Relief Valve

# 3

## Step 0 Type/Structure/Features

Please refer to this for type, structure and features of Safety Relief Valve.

## Step 1 Selection

Please look at the ID chart to choose the right products depending on the intended uses. Details are on the product page.

## Step 2 Sizing

Please refer to nominal size selection value table or calculation formula of nominal size selection P.3-11 for selecting the suitable model and size.

## Step 3 Attentions for usage

Be sure to check guidelines for optimal usage of Safety Relief Valve such as installation.

# Type of Safety Valve and Its Main Purpose

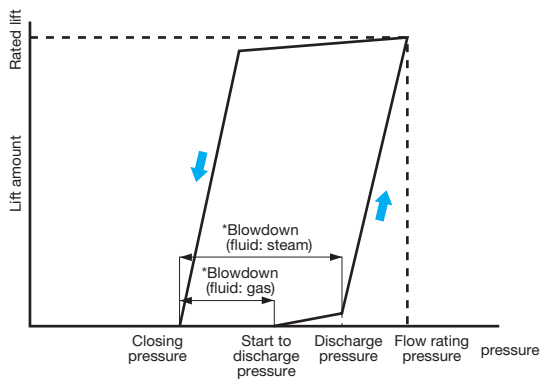
## What is safety valve?

**Safety valve ensures safety of equipment and system by automatically operating to open its valve when inlet pressure rises and reaches set pressure, and to close valve when inlet pressure falls to set pressure.**

| | | |
|---|---|---|
| **Full bore type safety valve**<br>The flow passage area at valve seat is bigger enough than the nozzle throat area at the inlet side. | → | · **Main purpose**<br>Lift type safety valve can be used when discharge amount is insufficient. Steam boiler needs this type. |
| **Lift type safety valve**<br>The lift of the valve is 1/40 or more and less than 1/4 of the inside diameter of valve seat, and the flow passage area of valve port becomes the smallest in the flow passage area when the valve disc is opened. | → | · **Main purpose**<br>It can be used as safety device for outlet side of pressure reducing valve, steam/air piping, pressure vessel. |
| **Relief valve**<br>The valve is mainly applied to liquid, and automatically operates to open its valve disc when inlet pressure rises and reaches set pressure, and to close the valve disc when inlet pressure falls to set pressure. | → | · **Main purpose**<br>It can be used for consecutive blow of cold and hot water piping, as safety device, or relief valve at outlet side of pump. |
| **Safety relief valve**<br>The valve is mainly applied to steam, gas and liquid, and has both functions of safety valve and relief valve. | → | · **Main purpose**<br>It can be used as safety device for piping and pressure vessel at line of steam/air/cold and hot water, or relief valve. |

## ■Operation of safety valve

**Operation**




* Blowdown = Set pressure – Closing pressure
Set pressure is, generally, discharge pressure for steam, and start to discharge pressure for gas.

**· Structure and definition of safety valve and relief valve**

| Structure | Definition |
|---|---|
| Closed type | Structure in which a part of blowout fluid is not discharged from other than outlet. |
| Closed lever type | |
| Closed handle type | |
| Open type | Structure in which a part of blowout fluid is discharged from other than outlet. |
| Open lever type | |

**· Set pressure of safety valve for alarm use (at outlet side of PRV for steam)**

| Set pressure of PRV (MPa) | Set pressure of safety valve (MPa) |
|---|---|
| 0.1 or less | Set pressure pf PRV + 0.05 or more |
| More than 0.1, to 0.4 or less | Set pressure pf PRV + 0.08 or more |
| More than 0.4, to 0.6 or less | Set pressure pf PRV + 0.1 or more |
| More than 0.6, to 0.8 or less | Set pressure pf PRV + 0.12 or more |
| More than 0.8 | Set pressure pf PRV + 15% |

* When safety valve is installed for alarm use at the outlet side of PRV, there is no laws or regulations specified to comply with. In this case, select a safety valve with discharge capacity around 10% of maximum flow rate of PRV.

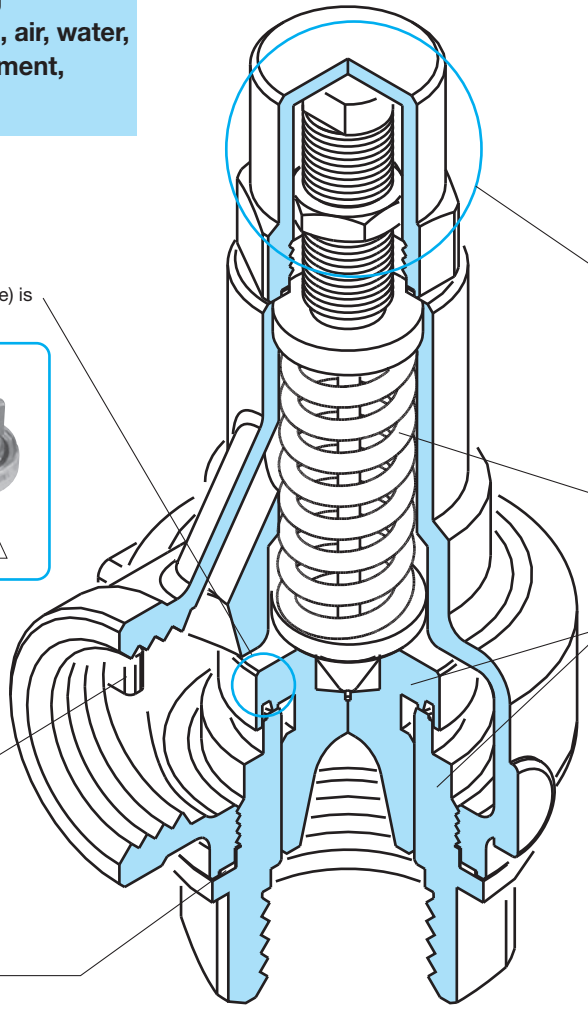
# Lift type Safety Valve –AL-150 Series–

Step 0

## Usages are as follows:

**Safety device for pressure vessel or measuring instrument of steam, air, water, oil at building equipment, factory equipment.**

Versatile safety relief valve can be used for fluid such as steam, air, water or oil. Long life and high corrosion resistance due to stainless steel used for adjusting spring, valve and valve seat.



### Closed, Lever, Handle

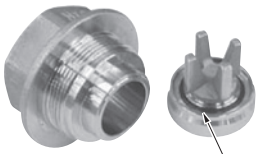
Type can be selected according to using purpose.

### Stainless Steel Spring

### Material of valve and valve seat is SCS14A.

Due to adoption of SCS14A (equivalent to SUS316) for standard product corrosion resistance is superior. Because material indication is made, environmental aspect (recycle) is considered.

* Non leak type (soft seat type) is available (AL-150T series).




### Prevention Measure

Installed as product protection. Stopper for over tightening is attached.

### PTFE Gasket (Fluorine Resin)

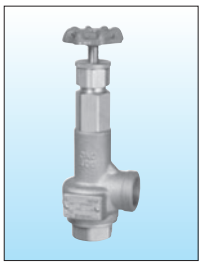
## Small, lightweight, simple structure, usable for various fluid, versatile type

**· Variation for various requirement**

**Lever type**
**AL-150 type**

**High pressure type**
**AL-150H type**

**Soft seat type**
**AL-150T type**



**Handle type soft seat type**
**AL-150TR type**

**Stainless steel made**
**AL-140, AL-140H type**

# Full Bore Type Safety Valve –AF-5 Series–

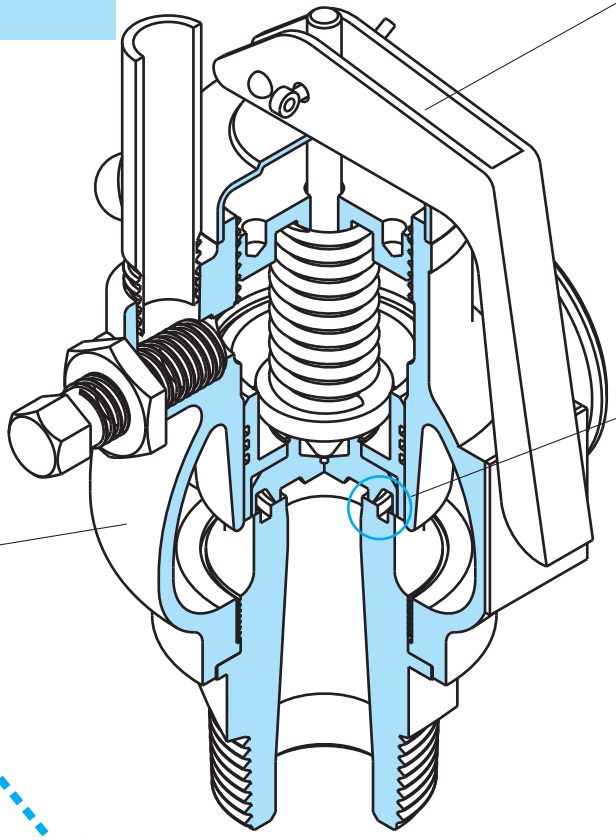
## Usages are as follows:

**Use as safety device for steam boiler, various pressure vessel or measuring instrument.**

AF-5 series safety valve is full bore type and small, lightweight (50 % of conventional product), high capacity and high quality type.

### Operational Check

Due to lever type, manual discharge inspection can be made. In addition, lever position can be rotated freely.

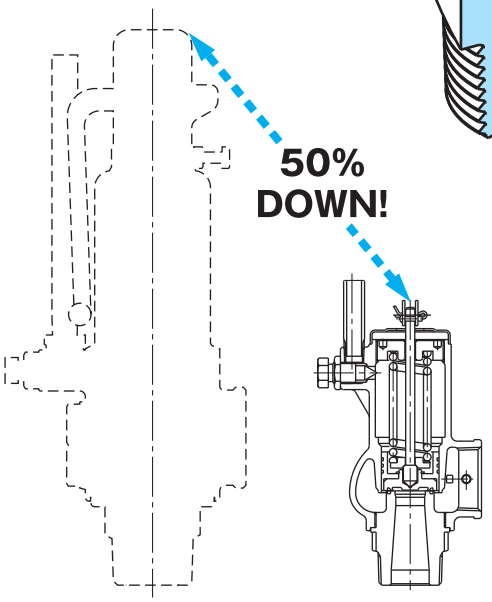


### High Sealing Design

Valve prevents valve leakage of heat expansion due to feather touch shape. Heat treated and long life.

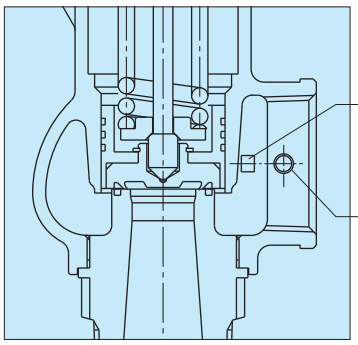
### Compact Design

Due to spring case shape discharging fluid effectively, this type has small shape but large discharge amount.




Size and weight are about half of conventional product.

· **Design considering piping arrangement and construction!**



Stopper for over tightening
For product function protection

Fixing Screw
For loosening protection of outlet side piping

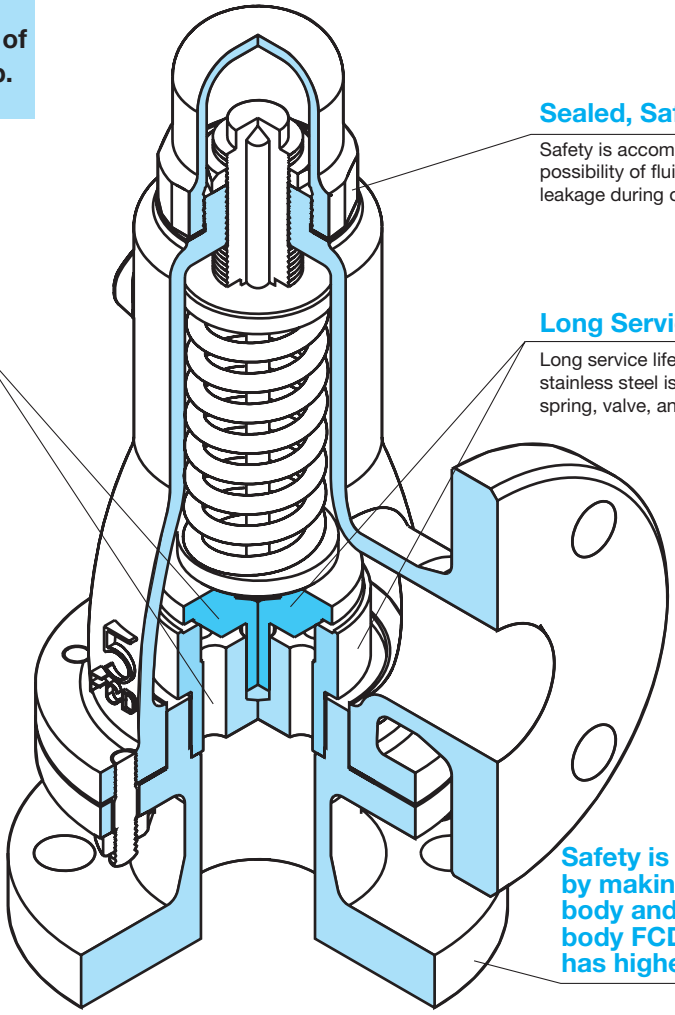
# Relief type Safety Valve –AL-280 Series–

Step 0



## Usages are as follows:

**Relief valve for the purpose of pressure regulation of pump.**



### Sealed, Safety

Safety is accomplished without possibility of fluid outside leakage during operation.

### Smooth and Secure Operation

Due to adoption of special valve structure, it has profound impact on the line with large pulsation or pressure fluctuation. Chattering or hunting can be prevented.

### Long Service Life

Long service life because stainless steel is used for adjusting spring, valve, and valve seat.

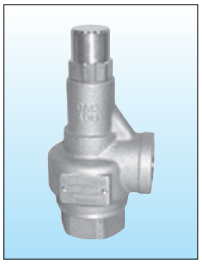
### Structure of wetted part (dash-pot)

Without popping action against fluid pressure change, the structure can discharge continuously.

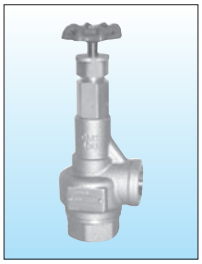
### Safety is increased by making spring body and valve body FCD which has higher strength.

## · Variation for various requirements

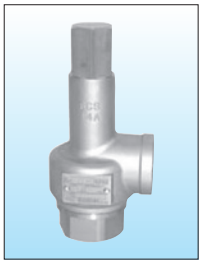
AL-27



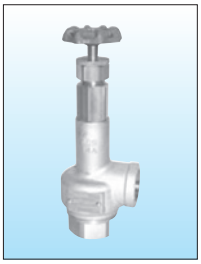
AL-260



AL-260R



AL-250



AL-250R

## Safety Relief Valve ID-Charts

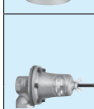
| | Model | Type | Fluid | Material (Body) | Press. (MPa) | Max. Temp. (℃) | Connection | Nominal Size | Feature | Page |
|---|---|---|---|---|---|---|---|---|---|---|
|  | **AL-150** | Lift type | Steam, Air | CAC406 | 0.05-1.0 | 220℃ | JIS Rc | 15-50A | · Stainless steel spring<br>· High durability<br>· General purpose | 3-14 |
| | | | Cold and hot water, Oil | | | 150℃ | | | | |
|  | **AL-150H** | | Steam, Air | | 1.0-1.6 | 220℃ | | 15-50A | · High pressure type of AL-150 | 3-19 |
| | | | Cold and hot water, Oil | | | 150℃ | | | | |
|  | **AL-150L** | | Steam, Air | | 0.05-1.0 | 220℃ | | 15-50A | · Lever type of AL-150 | 3-20 |
|  | **AL-150T** | | Air, Cold and hot water, Oil | | 0.05-1.0 | 120℃ | | 15-50A | · Soft seat type of AL-150<br>· Leakage “Zero” by O ring seat of fluoro-rubber | 3-15 |
| | **AL-150T-N** | | Cold and hot water | | 0.05-1.0 | 100℃ | | 15-50A | · Lead-free product<br>· For beverage | 3-15 |
|  | **AL-150TR** | | Cold and hot water, Oil | | 0.05-1.0 | 120℃ | | 15-50A | · Handle type of AL-150T | 3-16 |
|  | **AL-150TML** | | Air, Cold and hot water, Oil | | 0.05-1.0 | 120℃ | | 15-50A | · Lever type of AL-150T | 3-17 |
|  | **AL-140** | Lift type | Steam, Air | SCS14A or SCS13 | 0.05-1.0 | 220℃ | JIS Rc | 15-50A | · All stainless steel made type of AL-150 | 3-22 |
| | | | Cold and hot water, Oil | | | 150℃ | | | | |
|  | **AL-140H** | | Steam, Air | SCS13 | 1.0-2.0 | 220℃ | | 15-50A | · High pressure type of AL-140 | 3-22 |
| | | | Cold and hot water, Oil | | | 150℃ | | | | |
|  | **AL-140T** | | Air, Cold and hot water, Oil | SCS14A or SCS13 | 0.05-1.6 | 120℃ | | 15-50A | · Soft seat type of AL-140<br>· Leakage “Zero” by O ring seat of fluoro-rubber | 3-24 |
|  | **AL-17** | Lift type | Steam, Air | FCD450 | 0.05-1.6 | 220℃ | JIS Rc | 15-50A | | 3-31 |
| | | | Cold and hot water, Oil | | | 150℃ | | | | |

* Contact us for any other fluid or connection than the above.

| | Model | Type | Fluid | Material (Body) | Press. (MPa) | Max. Temp. (℃) | Connection | Nominal Size | Feature | Page |
|---|---|---|---|---|---|---|---|---|---|---|
|  | **AL-10** | Lift type | Steam | FCD450 | 0.05-1.0 | 220℃ | JIS Rc | 15-50A | · Lever type | 3-33 |
|  | | | | | | | | | · Without lever | |
|  | **AL-300** | Lift type | Steam | FCD450 | 0.05-1.0 | 220℃ | JIS 10KFF | 15-50A | | 3-37 |
| | **AL-301** | | Steam | | 0.05-1.6 | 220℃ | JIS 10KFF *1 (JIS 16KFF) | 15-50A | · Stainless steel wetted parts type of AL-300 | 3-37 |
|  | **AL-300T** | | Air | | 0.05-1.0 | 150℃ | JIS 10KFF | 15-50A | · Soft seat type of AL-300 | 3-38 |
| | | | Cold and hot water, Oil | | | 150℃ | | | | |
| | **AL-301T** | | Air | | 0.05-1.3 | 150℃ | JIS 10KFF *1 (JIS 16KFF) | 15-50A | · Stainless steel wetted parts type of AL-300 | 3-38 |
| | | | Cold and hot water, Oil | | | 150℃ | | | | |
|  | **AL-4** | Lift type | Steam | FCD450 | 0.05-1.5<br>For 150A, maximum press. 0.8 MPa | 220℃ | JIS 10KFF *1 (JIS 16KFF) | 65-150A | | 3-45 |
|  | **AL-4T** | | Air, Cold and hot water, Oil | | 0.05-1.0<br>0.05-1.5<br>For 150A, maximum press. 0.8 MPa | 150℃ | JIS 10KFF *1 (JIS 16KFF) | 65-150A | · Soft seat type of AL-4 | 3-45 |
|  | **AL-4S** | | Steam | FCD450 | 0.05-2.0 | 220℃ | JIS 20KFF | 65-100A | | 3-47 |
|  | **AL-4ST** | | Air, Cold and hot water, Oil | | 0.05-2.0 | 150℃ | JIS 20KFF | 65-100A | · Soft seat type of AL-4S | 3-47 |
|  | **AL-5** | Lift type | Steam | FCD450 | 0.05-1.0<br>0.05-1.5 | 220℃ | JIS 10·16KFF | 20-25A | · Lever type | 3-50 |

*1 Connection when applying pressure is more than 1.0 MPa * Contact us for any other fluid or connection than the above.

## Safety Relief Valve ID-Charts

| | Model | Type | Fluid | Material (Body) | Press. (MPa) | Max. Temp. (℃) | Connection | Nominal Size | Feature | Page |
|---|---|---|---|---|---|---|---|---|---|---|
|  | **AL-6** | Lift type | Steam | FCD450 | 0.05-1.5 | 220℃ | JIS 10·16KFF | 65-150A | · Large size type of AL-5<br>· Lever type | 3-51 |
|  | **AL-31** | Lift type | Steam, Air | SCS13 | 0.05-1.0 | 220℃ | JIS 10KFF | 15-50A | · Flanged type<br>· All stainless steel made | 3-43 |
| | | | Cold and hot water, Oil | | | 150℃ | | | | |
| | **AL-31H** | | Steam, Air | | 1.0-2.0 | 220℃ | JIS 16·20RF | 15-50A | · High pressure type of AL-31 | 3-43 |
| | | | Cold and hot water, Oil | | | 150℃ | | | | |
|  | **AL-260** | Relief type | Cold and hot water, Oil | CAC406 | 0.05-1.0 | 120℃ | JIS Rc | 15-50A | · For pump relief | 3-27 |
|  | **AL-260R** | | | | | | | 15-50A | · Handle type of AL-260<br>· For pump relief | 3-27 |
|  | **AL-250** | Relief type | Cold and hot water, Oil | SCS14A or SCS13 | 0.05-1.0 | 120℃ | JIS Rc | 15-50A | · For pump relief<br>· All stainless steel made | 3-26 |
|  | **AL-250R** | | | | | | | 15-50A | · Handle type of AL-250<br>· For pump relief | 3-26 |
|  | **AL-27** | Relief type | Cold and hot water, Oil | FCD450 | 0.05-1.6 | 120℃ | JIS Rc | 15-50A | · For pump relief<br>· High pressure type | 3-29 |
|  | **AL-280** | Relief type | Cold and hot water, Oil | FCD450 | 0.05-1.0 | 120℃ | JIS 10KFF | 15-50A | · Flanged type<br>· For pump relief | 3-40 |
|  | **AL-24** | Relief type | Cold and hot water | CAC406 | 0.1-0.7 | 60℃ | JIS Rc | 15-25A | · Diaphragm type<br>· Quick opening and closing | 3-35 |
| | **AL-24F** | | Cold and hot water, Oil | | | 120℃ | | 15-25A | · FKM (viton) type of AL-24<br>· High temperature type | |

* Contact us for any other fluid or connection than the above.

| | Model | Type | Fluid | Material (Body) | Press. (MPa) | Max. Temp. (℃) | Connection | Nominal Size | Feature | Page |
|---|---|---|---|---|---|---|---|---|---|---|
|  | **AF-5** | Full bore type | Steam | CAC406 | 0.1-1.6 | 220℃ | Inlet JIS R Outlet JIS Rc | 20-50A | · Full bore type, for general purpose · Lever type | 3-53 |
| | | | Air | | 0.1-1.0 | | | | | |
|  | **AF-5S** | | Steam, Air | SCS13 | 0.1-1.0 | | | 20-50A | · All stainless steel type of AF-5 | 3-53 |
|  | **AF-1** | Full bore type | Steam | FCD450 | 0.18-1.6 | 220℃ | Inlet JIS R Outlet JIS Rc | 20-50A | · Lever type | 3-57 |
|  | **AF-2** | Full bore type | Steam | FCD450 | 0.18-1.6 | 220℃ | Inlet JIS 10K RF *1 (Inlet JIS 20K RF) Outlet JIS 10K FF | 65-80A | · Lever type | 3-58 |
|  | **AF-4** | Full bore type | Steam, Air | FCD450 | 0.1-1.0 | 220℃ | JIS 10K FF or JIS 10K RF | 25-150A | · Lever type | 3-55 |
|  | **AF-4M** | | | | | | | 25-150A | · Without lever | 3-55 |
|  | **AF-7** | Full bore type | Steam, Air | SCPH2 | 0.1-1.0 | 350℃ | Inlet JIS 10K RF *1 (Inlet JIS 20K RF) Outlet JIS 10K FF | 25-100A | · Lever type | 3-59 |
|  | **AF-7M** | | Air | | | 300℃ | | 25-100A | · Without lever | 3-59 |
|  | **AF-6H** | Full bore type | Air | SCPH2 | 0.1-1.96 | 250℃ | Inlet JIS 20K RF Outlet JIS 10K FF | 25-100A | · Examined product of High Pressure Gas Safety Act | 3-61 |
| | **AF-6HS** | | | SCS13 | | | | 25-100A | · Examined product of High Pressure Gas Safety Act | 3-61 |
|  | **AF-9EN** | Full bore type | Steam, Air | Equivalent to FC250 | 0.045-1.0 | 250℃ | Inlet BSEN PN16 Outlet BSEN PN10 | 20-150A | · Conforming product to ISO 4126-1 | 3-63 |

*1 Connection when applying pressure is more than 1.0 MPa * Contact us for any other fluid or connection than the above.

# Calculation Formula for Selecting Nominal Size

## ■Fomula for certified capacity (JIS B 8210:2009)

### Boiler Structure Standard

$Qm = 5.25 \times C' \times Kdr \times AP$

### Pressure Vessel Structure Standard

[Steam]

$Qm = 5.25 \times C' \times Kdr \times AP$

[Gas]

$Qm = C' \times Kdr \times P_1 \times Kb \times \sqrt{\frac{M}{ZT}}$

Qm: Certified capacity (kg/h)
C': Coefficient depending on steam properties, which is shown in Table-5 on P. 3-68.
Kdr: Certified derated coefficient of discharge (= measured value x 0.9)
[Lift type: 0.883(AL-150H: 0.816) Full bore type: 0.777]
AL-160·150 Series 32A: 0.844
40A: 0.872
50A: 0.874
A: Flow area (mm²)
P: Absolute flow rating pressure (MPa)
For boiler, (set pressure x 1.03 + 0.101) or (set pressure + 0.015 + 0.101), whichever larger.
For pressure vessel, (set pressure x 1.1 + 0.101) or (set pressure + 0.020 + 0.101), whichever larger.
However, if allowable over pressure is specified, it shall be followed.

Qm: Certified capacity (kg/h)
C": Coefficient depending on adiabatic exponent (k), which is evaluated by the following formula.

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

When adiabatic exponent (k) is unknown, supposing that k = 1.001, C" = 23.96.
Kdr: Certified derated coefficient of discharge (=measured value x 0.9)
[Lift type: 0.883(AL-150H: 0.816) Full bore type: 0.777]
AL-160·150 Series 32A: 0.844
40A: 0.872
50A: 0.874
A: Flow area (mm²)
P₁: Absolute flow rating pressure (MPa)
P₁ = (set pressure x 1.1 + 0.101) or (set pressure x 0.020 + 0.101), whichever larger.
However, if allowable over pressure is specified, it shall be followed.
M: Molecular weight of gas (kg/kmol)
Z: Compression coefficient (if unknown, Z = 1.0)
T: Absolute temperature of gas at flow rating pressure (K)
Kb: Corrective coefficient of back pressure

When $\frac{P_2}{P_1} > \left(\frac{2}{k+1}\right)^{\frac{k}{k+1}}$

$$Kb = \frac{55.83}{C''}\sqrt{\frac{k}{(k-1)}\left(\left(\frac{P_2}{P_1}\right)^{\frac{2}{k}} - \left(\frac{P_2}{P_1}\right)^{\frac{k-1}{k}}\right)}$$

When $\frac{P_2}{P_1} \leq \left(\frac{2}{k+1}\right)^{\frac{k}{k+1}}$

Kb = 1.0

### Yoshitake standard (for liquid)
(Except for AL-150, 150T, 140, 140T series)

(When 25% accumulation)

$$V = \frac{AK}{12.4\sqrt{\frac{G}{P}}}$$

V: Discharge capacity ($m^3/h$)
A: Flow area ($mm^2$)
K: 0.7 (Flow rate coefficient)
G: Specific gravity
P: Opening pressure (MPa)

## ■AL-150, 150T, 140, 140T, 150TML, 150TR Calcuration formula for liquid

$$V = 0.161AK\sqrt{PG}$$

V: Discharge capacity ($m^3/h$)
A: Flow area ($mm^2$)
K: Flow rate coefficient:
0.5 (when set pressure is 0.1 MPa or less)
0.6 (when set pressure is more than 0.1 MPa)
P: Pressure to determine discharge capacity (MPa):
Opening pressure x 1.25
G: Specific gravity

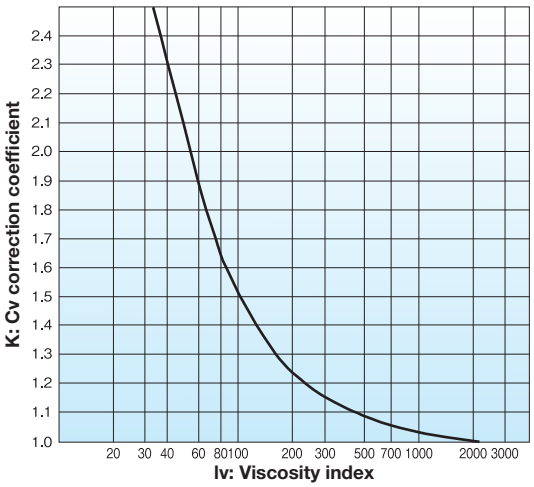
## ■Calculation formula for Viscosity correction

First, calculate the discharge capacity (V) without considering viscosity. Next, find viscosity index (Iv).

$$Iv = \frac{72780}{Mcst}\left(\frac{\Delta P}{G}\right)^{\frac{1}{4}} V^{\frac{1}{2}}$$

Obtain K, by using Fig.1 viscosity correction curve, from Iv calculated in the above formula.
The calculated discharge capacity (V) divided by this K is the value of the corrected flow rate.
Corrected discharge capacity: V' = V/K ($m^3/h$)

**Fig.1 Viscosity correction curve**




V: Discharge capacity ($m^3/h$)
A: Flow area ($mm^2$)
K: Correction coefficient
G: Specific gravity
P: Opening pressure (MPa)
ΔP: $P_1$-$P_2$ (MPa)
Cv: Cv value
Lv: Viscosity index
Mcst: Viscosity [cSt]

## Definition (extract from "Safety devices for protection against excessive pressure – Direct spring loaded safety valves for steam and gas service")

Step 2

**Start to Discharge Pressure** : The inlet pressure at which the safety valve actually starts to discharge and outflow of an extremely small quantity of fluid (steam or gas) is detected at the outlet. The extremely small quantity means a minimum amount of visually or audibly detectable steam, or a minimum amount of gas that can be detected audibly or by using soap solution. The outflow does not mean the leakage from the valve seat.

**Opening Pressure** : The inlet pressure at which the valve disc "Pops."
The opening pressure is also called "popping pressure."
"Popping" is an action of discharging fluid inside the valve due to the sudden rise of the valve disc.

**Set Pressure** : The opening pressure or start to discharge pressure determined in designing.

**Closing Pressure** : The inlet pressure fallen down to the level at which the valve disc and the valve seat are in contact and the lift becomes zero. It is also called "reseating pressure."

**Blowdown** : The difference between opening pressure or start to discharge pressure and closing pressure.

**Over Pressure** : The increasing pressure that exceeds the set pressure of the safety valve.

**Allowable Over Pressure** : The over pressure within the allowable range.

**Coefficient of Discharge** : The coefficient used to calculate the actual discharge capacity from the theoretical discharge capacity. The coefficient is the ratio between the two capacities, and it counts the frictional resistance.

**Certified Derated Coefficient of Discharge** : The coefficient of discharge to be applied to calculate the certified capacity.

**Flow Rating Pressure** : The inlet pressure taken as the basis for determining the certified capacity of the safety valve, which is the sum of the set pressure and the allowable over pressure.

**Back Pressure** : The pressures existing at the outlet of the safety valve. There are two types as the following:
(a) Accumulated back pressure: The pressure existing at the outlet of a safety valve caused by the resistance of the outlet side when the safety valve has been relieved.
(b) Existing back pressure: The pressure which has already been superimposed at the outlet before the safety valve is relieved.

**Theoretical Discharge Capacity** : The discharge capacity calculated supposing that the fluid is free from friction and its flow rate coefficient is 1, and that the valve discharges the ideal gas of fixed specific heat with isentropic change.

**Certified Capacity** : The certified discharge capacity for each safety valve, according to any of the followings:
(a) Measured Discharge Capacity x Derated Coefficient
(b) Theoretical Discharge Capacity x Derated Coefficient
(c) Theoretical Discharge Capacity x Certified Derated Coefficient of Discharge

**Lift** : The amount of travel, in axial direction of the valve or valve rod, away from the closed position to the opened position during discharge of the safety valve.

**Rated Lift** : The lift determined in designing, at which the certified capacity is exercised.

**Seat Diameter** : The inside diameter of setting surface of a valve with valve seat.

**Throat Diameter** : The diameter of the smallest portion of a nozzle from intake opening of fluid to valve seat face.

**Throat Area** : The flow passage area calculated using the throat diameter.

**Seat Flow Area** : The cylindrical or conical flow passage area between the valve and the valve seat secured when the valve lifts up. It is also called "curtain area."

**Flow Area** : The area of the part which determines the flow capacity that passes through a safety valve and is used to calculate the certified capacity.

# Guidelines for Installing Safety Valve

Step 3

## ■Pipe Mount for Installing Safety Valve

1. Pipe mount of a safety valve should have sufficient strength and rigidity against compression, shear stress, and bending stress caused by reaction because the pipe mount is subject to the reaction which is caused along the center line of outlet of a blowout pipe connected to the safety valve in the direction contrary to the discharging direction.
2. The pressure loss in the pipe mount for a safety valve makes the discharge quantity decreased and the function of the safety valve unstable. Therefore a safety valve should be installed vertically as near as possible to a vessel, a header, etc. (See Fig.1.)

## ■Exhaust Pipe of Safety Valve

An exhaust pipe and an drip pan elbow should be installed so that a safety valve may not be subject to stress caused by the thermal expansion of a boiler or equipment and by the expansion or contraction of a discharge pipe due to the thermal action of blowout of the safety valve. (See Fig.1.)

The inner diameter of a exhaust pipe should be as larger as possible than that of an outlet pipe of a safety valve, and the exhaust pipe should be lead to outside or a safe place.

## ■Installation of Safety Valve

1. Do not remove the blind plate before completing the preparation for installation so that any foreign matter does not come into a safety valve.
2. Be sure to remove foreign matter completely from equipment, pipes, and vessels by washing their insides before installation.
3. In installing a safety valve, do not apply a pipe wrench, etc. to the places other than the specified ones.
4. Do not apply any force from the outside.
5. Equip a valve casing and a exhaust pipe with a drain pipe for each to prevent raindrops and dirt, etc. from accumulating.

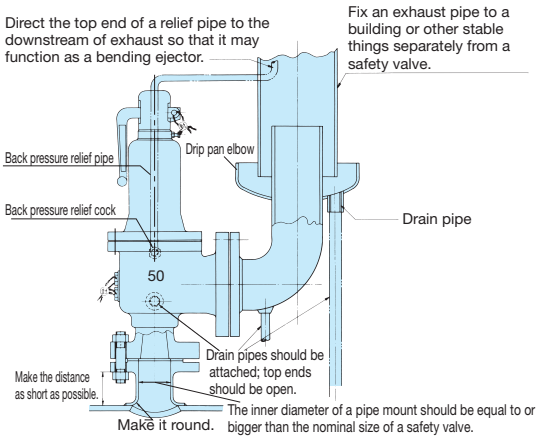
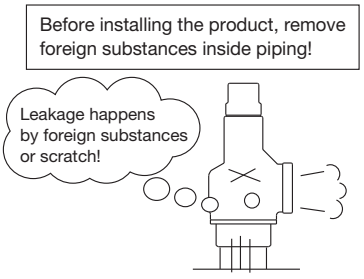



**Fig. 1**

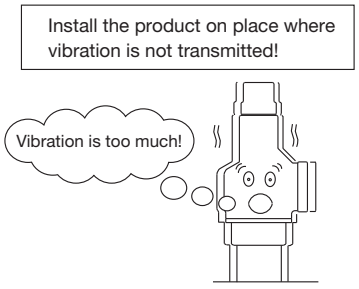
## Caution before use — SAFETY VALVE

1. Do not disassemble or readjust the product unnecessarily because pressure adjustment is completed. If disassembling and readjusting the product unnecessarily, it is dangerous because function of the product is not accomplished, such as not discharged at set pressure, or discharge at less than set pressure.
2. Most of problems with the pressure reducing valve are caused by foreign substances and scale in the piping. Be sure to remove them before using the product. Note that the customer is required to pay repair charge for any defect that occurs due to foreign substance inside piping or scale.
3. Install the product so that the product cannot receive excessive load, torque or vibration.
4. Install the product correctly, checking fluid flow direction and direction of inlet and outlet.




## Caution during use — SAFETY VALVE

1. Do not use the product for device or equipment which cannot accept valve seat leakage because the product which do not use soft seat on valve seat face have valve seat leakage within acceptable range.
2. Except for handle type, do not rotate adjusting screw. If doing so, the product may discharge at lower than set pressure, or not discharge at set pressure.
3. Do not remove the cap unnecessarily since without cap, fluid may discharge from adjusting screw part.




## Caution at disassembly and inspection — SAFETY VALVE

1. Ask professionals or us for disassembly and inspection. Residual pressure may lead to injury or scalds.

# AL-150

Full bore type | **Lift type** | Safety valve | Relief valve
Safety relief valve | Lever type | **Closed type** | Dash-pot structure
Handle type | Stainless | High pressure gas testing products
Diaphragm | Non-leakage

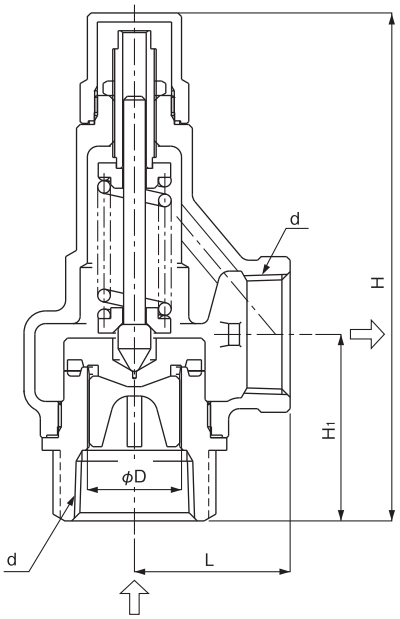

## ■Features

1. Versatile type, compatible with fluids such as steam, air, water, and oil.
2. Achieved the highest performance by segmentalize the pressure range and finished by ultra-precision technique.
3. The trim parts (valve and valve seat) and adjusting spring are made of stainless steel. Used for the trim parts is SCS14A (equivalent to SUS316) with outstanding corrosion resistance.
4. Closed structure prevents fluid leakage.

## ■Specifications

| | | |
|---|---|---|
| Structure | | Closed type |
| Application | | Steam, Air, Water, Oil, Other non-dangerous fluids |
| Working pressure | | 0.05-1.0 MPa |
| Working temperature | | 5-220℃ *1 |
| Material | Spring case | Bronze |
| | Valve, Valve seat | Stainless steel (SCS14A) |
| | Adjusting spring | Stainless steel |
| Connection | | JIS Rc screwed |

*1 The maximum temperature is 150℃ when using for water, oil, or other liquids.
· Please refer to the chart in P.3-76 for set pressure range.




## ■Dimensions and Weights

| Nominal size | Dimension (mm) | | | | | Flow area πDℓ (mm²) | Weight (kg) |
|---|---|---|---|---|---|---|---|
| | d | D | L | H1 | H | | |
| 15A | Rc 1/2 | 16 | 34 | 40 | 128 | 20.1 | 0.7 |
| 20A | Rc 3/4 | 21 | 38 | 43 | 128.5 | 34.6 | 0.8 |
| 25A | Rc 1 | 26 | 43 | 51.5 | 144.5 | 53.0 | 1.1 |
| 32A | Rc 1-1/4 | 33 | 50 | 61.5 | 181.5 | 93.3 | 1.8 |
| 40A | Rc 1-1/2 | 41 | 60 | 60 | 205 | 135.2 | 2.8 |
| 50A | Rc 2 | 51 | 75 | 76 | 245.5 | 208.2 | 4.7 |

# AL-150T,150T-N

Full bore type | **Lift type** | Safety valve | Relief valve
**Safety relief valve** | Lever type | **Closed type** | Dash-pot structure
Handle type | Stainless | High pressure gas testing products
Diaphragm | **Non-leakage**

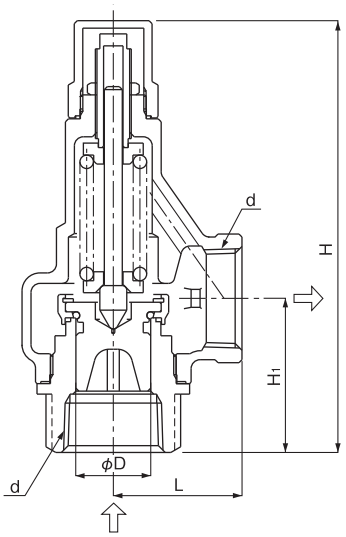

## ■Features

1. Safety relief valve with excellent airtightness ensured by the valve seat incorporating soft seat. Most suitable for applications where valve seat leakage is not tolerated.
2. The trim parts (valve and valve seat) and adjusting spring are made of stainless steel. Used for the trim parts is SCS14A (equivalent to SUS316) with outstanding corrosion resistance.
3. Simple structure and easy to handle.
4. Closed structure prevents fluid leakage.

## ■Specifications

| Model | | AL-150T | AL-150T-N |
|---|---|---|---|
| Structure | | Closed type | |
| Application | | Air, Cold and hot water, Oil, Other non-dangerous fluids * | Cold and hot water |
| Working pressure | | 0.05-1.0 MPa | |
| Working temperature | | 5-120℃ | 5-100℃ |
| Material | Spring case | Cast bronze | Cast bronze (NPb-treated) |
| | Valve, valve seat | Cast stainless steel (SCS14A) | |
| | Adjusting spring | Stainless steel | |
| | O-ring | FKM | |
| Connection | | JIS Rc screwed | |

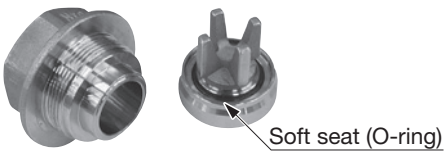
* Please contact us when using for oil.
· Please refer to the chart in P.3-76 for set pressure range.




## ■Dimensions and Weights

| Nominal size | Dimension (mm) | | | | | Flow area πDℓ (mm²) | Weight (kg) |
|---|---|---|---|---|---|---|---|
| | d | D | L | $H_1$ | H | | |
| 15A | Rc 1/2 | 16 | 34 | 40 | 128 | 20.1 | 0.7 |
| 20A | Rc 3/4 | 21 | 38 | 43 | 128.5 | 34.6 | 0.8 |
| 25A | Rc 1 | 26 | 43 | 51.5 | 144.5 | 53.0 | 1.1 |
| 32A | Rc 1-1/4 | 33 | 50 | 61.5 | 181.5 | 93.3 | 1.8 |
| 40A | Rc 1-1/2 | 41 | 60 | 60 | 205 | 135.2 | 2.8 |
| 50A | Rc 2 | 51 | 75 | 76 | 245.5 | 208.2 | 4.7 |

**Soft seat is used for the trim parts!**
Soft seat (O-ring) is used for the trim parts, ensuring the reliable airtightness of the valve seat.



# AL-150TR

Full bore type | **Lift type** | Safety valve | Relief valve
**Safety relief valve** | Lever type | **Closed type** | Dash-pot structure
**Handle type** | Stainless | High pressure gas testing products
Diaphragm | **Non-leakage**

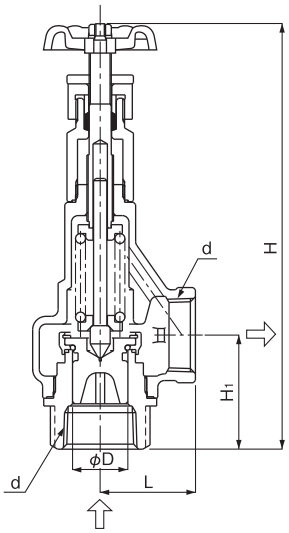
## ■Features

1. Handle type relief valve, pressure can be changed easily.
2. Excellent airtightness ensured by the valve seat incorporating soft seat. Most suitable for applications where valve seat leakage is not tolerated.
3. The trim parts (valve and valve seat) and adjusting spring are made of stainless steel. Used for the trim parts is SCS14A (equivalent to SUS316) with outstanding corrosion resistance.
4. Simple structure and easy to handle.
5. Closed structure prevents fluid leakage.

## ■Specifications

| | | |
|---|---|---|
| Structure | | Closed type with a handle |
| Application | | Cold and hot water, Oil, Other non-dangerous fluids * |
| Working pressure | | 0.05-1.0 MPa |
| Maximum temperature | | 120˚C |
| Material | Spring case | Cast bronze |
| | Valve, valve seat | Stainless steel (SCS14A) |
| | Adjusting spring | Stainless steel |
| | O-ring | FKM |
| Connection | | JIS Rc screwed |

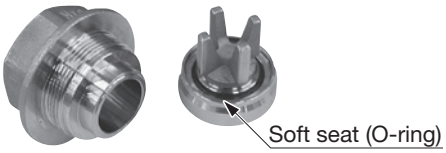
* Please contact us when using for oil.
· Please refer to the chart in P.3-76 for set pressure range.




## ■Dimensions and Weights

| Nominal size | Dimension (mm) | | | | | Flow area πDℓ (mm²) | Weight (kg) |
|---|---|---|---|---|---|---|---|
| | d | D | L | $H_1$ | H | | |
| 15A | Rc 1/2 | 16 | 34 | 40 | 184 | 20.1 | 1.0 |
| 20A | Rc 3/4 | 21 | 38 | 43 | 186 | 34.6 | 1.1 |
| 25A | Rc 1 | 26 | 43 | 51.5 | 203 | 53.0 | 1.4 |
| 32A | Rc 1-1/4 | 33 | 50 | 61.5 | 239 | 93.3 | 2.1 |
| 40A | Rc 1-1/2 | 41 | 60 | 60 | 276 | 135.2 | 3.2 |
| 50A | Rc 2 | 51 | 75 | 76 | 314 | 208.2 | 5.1 |

**Soft seat is used for the trim parts!**
Soft seat (O-ring) is used for the trim parts, ensuring the reliable airtightness of the valve seat.



# AL-150TML



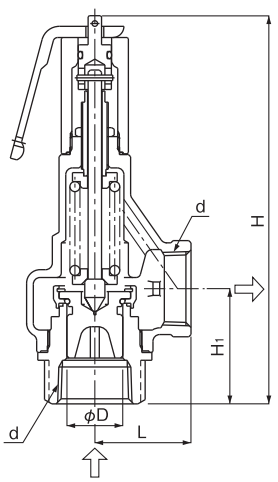
Full bore type | **Lift type** | Safety valve | Relief valve
Safety relief valve | **Lever type** | **Closed type** | Dash-pot structure
Handle type | Stainless | High pressure gas testing products
Diaphragm | **Non-leakage**

## ■Features

1. Lever type safety relief valve. A discharge inspection can be manually performed when the difference between the set pressure and the inlet pressure is as shown in Table 1 below.
2. Excellent airtightness ensured by the valve seat incorporating soft seat. Most suitable for applications where valve seat leakage is not tolerated.
3. The trim parts (valve and valve seat) and adjusting spring are made of stainless steel. Used for the trim parts is SCS14A (equivalent to SUS316) with outstanding corrosion resistance.
4. Simple structure and easy to handle.
5. Closed structure prevents fluid leakage.

**[Table 1] Required differential pressure at a discharge inspection**

| Nominal size | Difference between set pressure and inlet pressure |
|---|---|
| 15A-25A | 1.0 MPa or less |
| 32A, 40A | 0.6 MPa or less |
| 50A | 0.4 MPa or less |




## ■Specifications

| | | |
|---|---|---|
| Structure | | Closed type with a lever |
| Application | | Air, Cold and hot water, Oil, Other non-dangerous fluids * |
| Working pressure | | 0.05-1.0 MPa |
| Maximum temperature | | 120˚C |
| Material | Spring case | Cast bronze |
| | Valve, valve seat | Stainless steel (SCS14A) |
| | Adjusting spring | Stainless steel |
| | O-ring | FKM |
| Connection | | JIS Rc screwed |

* Please contact us when using for oil.
· Please refer to the chart in P.3-76 for set pressure range.

## ■Dimensions and Weights

| Nominal size | Dimension (mm) | | | | | Flow area $\pi D\ell$ (mm²) | Weight (kg) |
|---|---|---|---|---|---|---|---|
| | d | D | L | $H_1$ | H | | |
| 15A | Rc 1/2 | 16 | 34 | 40 | 157 | 20.1 | 0.8 |
| 20A | Rc 3/4 | 21 | 38 | 43 | 158 | 34.6 | 0.9 |
| 25A | Rc 1 | 26 | 43 | 51.5 | 174 | 53.0 | 1.3 |
| 32A | Rc 1-1/4 | 33 | 50 | 61.5 | 212 | 93.3 | 1.9 |
| 40A | Rc 1-1/2 | 41 | 60 | 60 | 246 | 135.2 | 3.0 |
| 50A | Rc 2 | 51 | 75 | 76 | 286 | 208.2 | 4.9 |

## ■Certified Capacity Table

**· AL-150 for steam (saturation temperature) <Pressure vessel structure standard>**

(kg/h)

| Nominal size \ Pressure MPa | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15A | 15 | 20 | 29 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 109 |
| 20A | 27 | 35 | 51 | 69 | 87 | 104 | 121 | 138 | 155 | 172 | 189 |
| 25A | 42 | 54 | 78 | 105 | 133 | 159 | 186 | 212 | 237 | 263 | 289 |
| 32A | 70 | 91 | 132 | 178 | 224 | 268 | 313 | 356 | 400 | 443 | 487 |
| 40A | 105 | 136 | 198 | 266 | 335 | 402 | 468 | 534 | 599 | 664 | 729 |
| 50A | 163 | 211 | 306 | 411 | 518 | 621 | 723 | 824 | 924 | 1025 | 1126 |

**· AL-150 · 150T · 150TML for air (20˚C) <Pressure vessel structure standard>**

(kg/h)

| Nominal size \ Pressure MPa | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15A | 25 | 33 | 48 | 65 | 81 | 98 | 114 | 131 | 147 | 164 | 181 |
| 20A | 44 | 57 | 83 | 111 | 140 | 169 | 197 | 226 | 254 | 283 | 311 |
| 25A | 67 | 87 | 127 | 171 | 215 | 258 | 302 | 346 | 390 | 433 | 477 |
| 32A | 113 | 147 | 214 | 288 | 362 | 435 | 509 | 582 | 656 | 730 | 803 |
| 40A | 169 | 221 | 321 | 431 | 542 | 652 | 762 | 872 | 982 | 1093 | 1203 |
| 50A | 262 | 341 | 496 | 666 | 836 | 1006 | 1176 | 1346 | 1516 | 1687 | 1857 |

**· AL-150 · 150T · 150TML · 150TR for water (accumulation: 25%) <Yoshitake standard>**

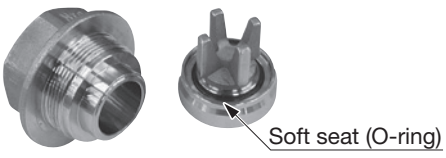
($m^3$/h)

| Nominal size \ Pressure MPa | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15A | 0.4 | 0.5 | 0.9 | 1.1 | 1.3 | 1.5 | 1.6 | 1.8 | 1.9 | 2.0 | 2.1 |
| 20A | 0.6 | 0.9 | 1.6 | 2.0 | 2.3 | 2.6 | 2.8 | 3.1 | 3.3 | 3.5 | 3.7 |
| 25A | 1.0 | 1.5 | 2.5 | 3.1 | 3.6 | 4.0 | 4.4 | 4.7 | 5.1 | 5.4 | 5.7 |
| 32A | 1.8 | 2.6 | 4.5 | 5.5 | 6.3 | 7.1 | 7.8 | 8.4 | 9.0 | 9.5 | 10.0 |
| 40A | 2.7 | 3.8 | 6.5 | 7.9 | 9.2 | 10.3 | 11.3 | 12.2 | 13.0 | 13.8 | 14.6 |
| 50A | 4.1 | 5.9 | 10.0 | 12.3 | 14.2 | 15.9 | 17.4 | 18.8 | 20.1 | 21.3 | 22.4 |

· Please refer to P.3-11 for the calculation procedure for nominal size selection.

**Soft seat is used for the trim parts!**

Soft seat (O-ring) is used for the trim parts,
ensuring the reliable airtightness of the valve seat.



# AL-150H



Full bore type | **Lift type** | Safety valve | Relief valve
Safety relief valve | Lever type | **Closed type** | Dash-pot structure
Handle type | Stainless | High pressure gas testing products
Diaphragm | Non-leakage


## ■Features

1. Popping structure ensures reliable discharge.
2. Used for the trim parts is SCS14A (equivalent to SUS316) with outstanding corrosion resistance.
3. Simple internal structure facilitates adjustment, maintenance and handling.
4. Closed structure prevents fluid leakage.

## ■Specifications

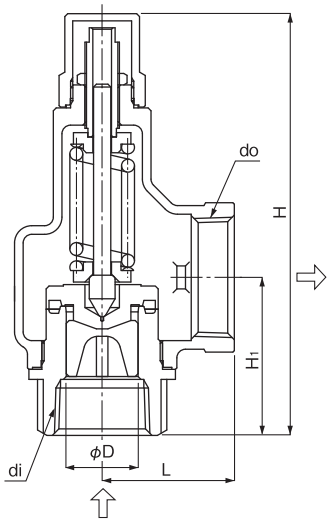
| | | |
|---|---|---|
| Structure | | Closed type |
| Application | | Steam, Air, Cold and hot water, Oil, Other non-dangerous fluids |
| Working pressure | | 1.0-1.6 MPa |
| Maximum temperature | | 220℃ * |
| Material | Spring case | Cast bronze |
| | Valve, valve seat | Cast stainless steel (SCS14A) |
| Connection | | JIS Rc screwed |

* The maximum temperature is 150℃ when using for water, oil, or other liquids.
· Please refer to the chart in P.3-76 for set pressure range.

## ■Dimensions and Weights

| Nominal size | Dimension (mm) | | | | Flow area $\pi D\ell$ (mm²) | Weight (kg) |
|---|---|---|---|---|---|---|
| | di x D x do | L | $H_1$ | H | | |
| 15A | Rc 1/2 x 16 x Rc 3/4 | 36 | 42 | 126 | 22.9 | 0.8 |
| 20A | Rc 3/4 x 21 x Rc 1 | 38 | 47 | 131 | 39.5 | 0.9 |
| 25A | Rc 1 x 26 x Rc 1-1/4 | 46 | 55.5 | 147.5 | 60.6 | 1.3 |
| 32A | Rc 1-1/4 x 33 x Rc 1-1/2 | 54 | 61.5 | 167.5 | 97.7 | 1.9 |
| 40A | Rc 1-1/2 x 41 x Rc 2 | 63 | 67 | 193.5 | 150.8 | 2.9 |
| 50A | Rc 2 x 51 x Rc 2-1/2 | 77 | 80 | 241.5 | 233.4 | 5.0 |

· The nominal size and size of screwed end connection are different. The size of screwed end connection have to be one size bigger.



# AL-150L

Full bore type | **Lift type** | Safety valve | Relief valve
Safety relief valve | **Lever type** | Closed type | Dash-pot structure
Handle type | Stainless | High pressure gas testing products
Diaphragm | Non-leakage

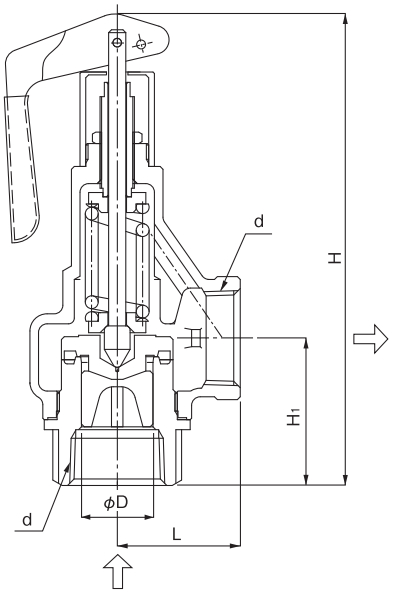
## ■Features

1. The trim parts (valve and valve seat) and adjusting spring are made of stainless steel. Used for the trim parts is SCS14A (equivalent to SUS316) with outstanding corrosion resistance.
2. Due to lift lever mechanism a discharge inspection can be manually performed at more than 75% of the opening pressure.

## ■Specifications

| | | |
|---|---|---|
| Structure | | Open type with a lever |
| Application | | Steam, Air |
| Working pressure | | 0.05-1.0 MPa |
| Maximum temperature | | 220˚C |
| Material | Spring case | Bronze |
| | Valve, Valve seat | Stainlesssteel (SCS14A) |
| Connection | | JIS Rc screwed |

· Please refer to the chart in P.3-76 for set pressure range.




## ■Dimensions and Weights

| Nominal size | Dimension (mm) | | | | | Flow area $\pi D\ell$ (mm$^2$) | Weight (kg) |
|---|---|---|---|---|---|---|---|
| | d | D | L | $H_1$ | H | | |
| 15A | Rc 1/2 | 16 | 34 | 40 | 148 | 20.1 | 0.8 |
| 20A | Rc 3/4 | 21 | 38 | 43 | 148 | 34.6 | 0.9 |
| 25A | Rc 1 | 26 | 43 | 51.5 | 165 | 53.0 | 1.2 |
| 32A | Rc 1-1/4 | 33 | 50 | 61.5 | 201 | 93.3 | 1.9 |
| 40A | Rc 1-1/2 | 41 | 60 | 60 | 226 | 135.2 | 2.9 |
| 50A | Rc 2 | 51 | 75 | 76 | 266 | 208.2 | 4.8 |

## ■Certified Capacity Table

**· AL-150L for steam (saturation temperature) <Pressure vessel structure standard>**

(kg/h)

| Pressure MPa / Nominal size | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15A | 15 | 20 | 29 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 109 |
| 20A | 27 | 35 | 51 | 69 | 87 | 104 | 121 | 138 | 155 | 172 | 189 |
| 25A | 42 | 54 | 78 | 105 | 133 | 159 | 186 | 212 | 237 | 263 | 289 |
| 32A | 70 | 91 | 132 | 178 | 224 | 268 | 313 | 356 | 400 | 443 | 487 |
| 40A | 105 | 136 | 198 | 266 | 335 | 402 | 468 | 534 | 599 | 664 | 729 |
| 50A | 163 | 211 | 306 | 411 | 518 | 621 | 723 | 824 | 924 | 1025 | 1126 |

**· AL-150H for steam (saturation temperature)**

(kg/h)

| Pressure MPa / Nominal size | 1.0 | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 |
|---|---|---|---|---|---|---|---|
| 15A | 115 | 126 | 136 | 146 | 156 | 167 | 177 |
| 20A | 199 | 217 | 235 | 252 | 270 | 288 | 306 |
| 25A | 306 | 333 | 360 | 387 | 415 | 442 | 469 |
| 32A | 493 | 537 | 581 | 625 | 669 | 713 | 757 |
| 40A | 761 | 830 | 897 | 965 | 1033 | 1100 | 1168 |
| 50A | 1179 | 1284 | 1389 | 1494 | 1599 | 1703 | 1808 |

**· AL-150L for air (20˚C) <Pressure vessel structure standard>**

(kg/h)

| Pressure MPa / Nominal size | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15A | 25 | 33 | 48 | 65 | 81 | 98 | 114 | 131 | 147 | 164 | 181 |
| 20A | 44 | 57 | 83 | 111 | 140 | 169 | 197 | 226 | 254 | 283 | 311 |
| 25A | 67 | 87 | 127 | 171 | 215 | 258 | 302 | 346 | 390 | 433 | 479 |
| 32A | 113 | 147 | 214 | 288 | 362 | 435 | 509 | 582 | 656 | 730 | 803 |
| 40A | 169 | 221 | 321 | 431 | 542 | 652 | 762 | 872 | 982 | 1093 | 1203 |
| 50A | 262 | 341 | 496 | 666 | 836 | 1006 | 1176 | 1346 | 1516 | 1687 | 1857 |

**· AL-150H for air (20˚C)**

(kg/h)

| Pressure MPa / Nominal size | 1.0 | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 |
|---|---|---|---|---|---|---|---|
| 15A | 190 | 208 | 225 | 243 | 260 | 278 | 295 |
| 20A | 328 | 359 | 389 | 419 | 449 | 479 | 509 |
| 25A | 504 | 550 | 597 | 643 | 689 | 735 | 782 |
| 32A | 813 | 888 | 962 | 1037 | 1111 | 1186 | 1260 |
| 40A | 1255 | 1370 | 1485 | 1600 | 1715 | 1831 | 1946 |
| 50A | 1943 | 2121 | 2299 | 2477 | 2655 | 2833 | 3011 |

**· AL-150H for water (accumulation: 25%) <Yoshitake standard>**

($m^3$/h)

| Pressure MPa / Nominal size | 1.0 | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 |
|---|---|---|---|---|---|---|---|
| 15A | 2.4 | 2.5 | 2.7 | 2.8 | 2.9 | 3.0 | 3.1 |
| 20A | 4.2 | 4.4 | 4.6 | 4.8 | 5.0 | 5.2 | 5.3 |
| 25A | 6.5 | 6.8 | 7.1 | 7.4 | 7.7 | 8.0 | 8.2 |
| 32A | 10.5 | 11.0 | 11.5 | 12.0 | 12.4 | 12.9 | 13.3 |
| 40A | 16.2 | 17.0 | 17.8 | 18.5 | 19.2 | 19.9 | 20.6 |
| 50A | 25.2 | 26.4 | 27.6 | 28.7 | 29.8 | 30.8 | 31.8 |

· Please refer to P.3-11 for the calculation procedure of nominal size selection.

# AL-140,140H

Full bore type | **Lift type** | Safety valve | Relief valve
**Safety relief valve** | Lever type | **Closed type** | Dash-pot structure
Handle type | **Stainless** | High pressure gas testing products
Diaphragm | Non-leakage

AL-140

AL-140H

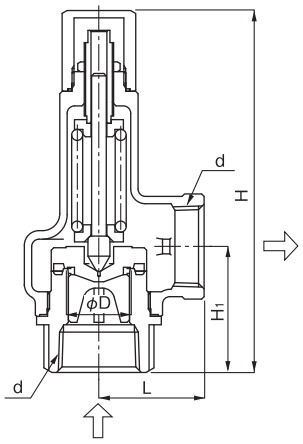
## ■Features

1. Safety relief valve of all stainless steel made. Used for the trim parts is SCS14A (equivalent to SUS316) with outstanding corrosion resistance.
2. Popping structure ensures reliable discharge.
3. Simple structure and easy to handle.
4. Closed structure prevents fluid leakage.

## ■Specifications

| Model | | AL-140 | AL-140H |
|---|---|---|---|
| Structure | | Closed type | |
| Application | | Steam, Air, Cold and hot water, Oil, Other non-dangerous fluids | |
| Working pressure | | 0.05-1.0 MPa | 1.0-2.0 MPa |
| Maximum temperature | | 220℃ * | |
| Material | Spring case | Cast stainless steel | |
| | Valve, valve seat | Cast stainless steel (SCS14A) | |
| Connection | | JIS Rc screwed | |

* The maximum temperature is 150℃ when using for water, oil, or other liquids.
· Please refer to the chart in P.3-76 for set pressure range.




AL-140

## ■Dimensions and Weights

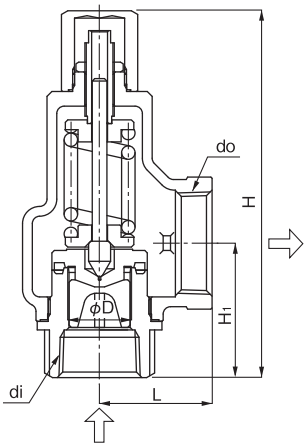
· **AL-140**

| Nominal size | Dimension (mm) | | | | | Flow area πDℓ (mm²) | Weight (kg) |
|---|---|---|---|---|---|---|---|
| | d | D | L | $H_1$ | H | | |
| 15A | Rc 1/2 | 16 | 34 | 40 | 128.5 | 20.1 | 0.7 |
| 20A | Rc 3/4 | 21 | 38 | 42 | 129 | 34.6 | 0.8 |
| 25A | Rc 1 | 26 | 43 | 51 | 148 | 53.0 | 1.1 |
| 32A | Rc 1-1/4 | 33 | 50 | 61.5 | 182 | 93.3 | 2.0 |
| 40A | Rc 1-1/2 | 41 | 60 | 64 | 206 | 135.2 | 3.0 |
| 50A | Rc 2 | 51 | 75 | 76 | 246.5 | 208.2 | 5.0 |

· **AL-140H**

| Nominal size | Dimension (mm) | | | | Flow area πDℓ (mm²) | Weight (kg) |
|---|---|---|---|---|---|---|
| | di x D x do | L | $H_1$ | H | | |
| 15A | Rc 1/2 x 16 x Rc 3/4 | 36 | 42 | 126.5 | 20.1 | 0.9 |
| 20A | Rc 3/4 x 21 x Rc 1 | 38 | 46 | 130.5 | 34.6 | 1.0 |
| 25A | Rc 1 x 26 x Rc 1-1/4 | 46 | 55 | 150.5 | 53.0 | 1.5 |
| 32A | Rc 1-1/4 x 33 x Rc 1-1/2 | 54 | 61.5 | 195 | 93.3 | 2.5 |
| 40A | Rc 1-1/2 x 41 x Rc 2 | 63 | 67 | 227.5 | 135.2 | 4.6 |
| 50A | Rc 2 x 51 x Rc 2-1/2 | 77 | 80 | 303.5 | 208.2 | 8.8 |

· The nominal size and size of screwed end connection are different. The size of screwed end connection have to be one size bigger.




AL-140H

## ■Certified Capacity Table

### · AL-140 for steam (saturation temperature) <Pressure vessel structure standard>

(kg/h)

| Nominal size \ Pressure MPa | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15A | 15 | 20 | 29 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 109 |
| 20A | 27 | 35 | 51 | 69 | 87 | 104 | 121 | 138 | 155 | 172 | 189 |
| 25A | 42 | 54 | 78 | 105 | 133 | 159 | 186 | 212 | 237 | 263 | 289 |
| 32A | 70 | 91 | 132 | 178 | 224 | 268 | 313 | 356 | 400 | 443 | 487 |
| 40A | 105 | 136 | 198 | 266 | 335 | 402 | 468 | 534 | 599 | 664 | 729 |
| 50A | 163 | 211 | 306 | 411 | 518 | 621 | 723 | 824 | 924 | 1025 | 1129 |

### · AL-140H for steam (saturation temperature)

(kg/h)

| Nominal size \ Pressure MPa | 1.0 | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 | 2.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15A | 109 | 119 | 129 | 139 | 149 | 158 | 168 | 178 | 188 | 198 | 207 |
| 20A | 189 | 206 | 222 | 239 | 256 | 273 | 290 | 306 | 324 | 340 | 357 |
| 25A | 289 | 315 | 341 | 367 | 393 | 418 | 444 | 470 | 496 | 522 | 547 |
| 32A | 487 | 531 | 574 | 617 | 661 | 704 | 747 | 791 | 835 | 878 | 921 |
| 40A | 729 | 795 | 860 | 924 | 990 | 1054 | 1119 | 1184 | 1250 | 1315 | 1380 |
| 50A | 1126 | 1227 | 1327 | 1427 | 1528 | 1627 | 1728 | 1828 | 1930 | 2030 | 2130 |

### · AL-140 for air (20˚C) <Pressure vessel structure standard>

(kg/h)

| Nominal size \ Pressure MPa | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15A | 25 | 33 | 48 | 65 | 81 | 98 | 114 | 131 | 147 | 164 | 181 |
| 20A | 44 | 57 | 83 | 111 | 140 | 169 | 197 | 226 | 254 | 283 | 311 |
| 25A | 67 | 87 | 127 | 171 | 215 | 258 | 302 | 346 | 390 | 433 | 477 |
| 32A | 113 | 147 | 214 | 288 | 362 | 435 | 509 | 582 | 656 | 730 | 803 |
| 40A | 169 | 221 | 321 | 431 | 542 | 652 | 762 | 872 | 982 | 1093 | 1203 |
| 50A | 262 | 341 | 496 | 666 | 836 | 1006 | 1176 | 1346 | 1516 | 1687 | 1857 |

### · AL-140H for air (20˚C)

(kg/h)

| Nominal size \ Pressure MPa | 1.0 | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 | 2.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15A | 181 | 197 | 214 | 230 | 247 | 264 | 280 | 297 | 313 | 330 | 347 |
| 20A | 311 | 340 | 368 | 397 | 426 | 454 | 483 | 511 | 540 | 568 | 597 |
| 25A | 477 | 521 | 565 | 608 | 652 | 696 | 740 | 783 | 827 | 871 | 915 |
| 32A | 803 | 877 | 950 | 1024 | 1098 | 1171 | 1245 | 1318 | 1392 | 1466 | 1539 |
| 40A | 1203 | 1313 | 1423 | 1533 | 1644 | 1754 | 1864 | 1974 | 2084 | 2195 | 2305 |
| 50A | 1857 | 2027 | 2197 | 2367 | 2537 | 2707 | 2877 | 3047 | 3217 | 3388 | 3558 |

### · AL-140 for water (accumulation: 25%) <Yoshitake standard>

($m^3$/h)

| Nominal size \ Pressure MPa | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15A | 0.4 | 0.5 | 0.9 | 1.1 | 1.3 | 1.5 | 1.6 | 1.8 | 1.9 | 2.0 | 2.1 |
| 20A | 0.6 | 0.9 | 1.6 | 2.0 | 2.3 | 2.6 | 2.8 | 3.1 | 3.3 | 3.5 | 3.7 |
| 25A | 1.0 | 1.5 | 2.5 | 3.1 | 3.6 | 4.0 | 4.4 | 4.7 | 5.1 | 5.4 | 5.7 |
| 32A | 1.8 | 2.6 | 4.5 | 5.5 | 6.3 | 7.1 | 7.8 | 8.4 | 9.0 | 9.5 | 10.0 |
| 40A | 2.7 | 3.8 | 6.5 | 7.9 | 9.2 | 10.3 | 11.3 | 12.2 | 13.0 | 13.8 | 14.6 |
| 50A | 4.1 | 5.9 | 10.0 | 12.3 | 14.2 | 15.9 | 17.4 | 18.8 | 20.1 | 21.3 | 22.4 |

### · AL-140H for water (accumulation: 25%)

($m^3$/h)

| Nominal size \ Pressure MPa | 1.0 | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 | 2.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15A | 2.1 | 2.2 | 2.3 | 2.4 | 2.5 | 2.6 | 2.7 | 2.8 | 2.9 | 2.9 | 3.0 |
| 20A | 3.7 | 3.9 | 4.0 | 4.2 | 4.4 | 4.5 | 4.7 | 4.8 | 5.0 | 5.1 | 5.2 |
| 25A | 5.7 | 6.0 | 6.2 | 6.5 | 6.7 | 7.0 | 7.2 | 7.4 | 7.6 | 7.8 | 8.0 |
| 32A | 10.0 | 10.5 | 11.0 | 11.4 | 11.9 | 12.3 | 12.7 | 13.1 | 13.5 | 13.8 | 14.2 |
| 40A | 14.6 | 15.3 | 15.9 | 16.6 | 17.2 | 17.8 | 18.4 | 19.0 | 19.5 | 20.1 | 20.6 |
| 50A | 22.4 | 23.5 | 24.6 | 25.6 | 26.6 | 27.5 | 28.4 | 29.3 | 30.1 | 30.9 | 31.8 |

· Please contact us for the calculation procedure for nominal size selection.

# AL-140T

| | | | |
|---|---|---|---|
| Full bore type | Lift type | Safety valve | Relief valve |
| Safety relief valve | Lever type | Closed type | Dash-pot structure |
| Handle type | Stainless | High pressure gas testing products | |
| Diaphragm | Non-leakage | | |



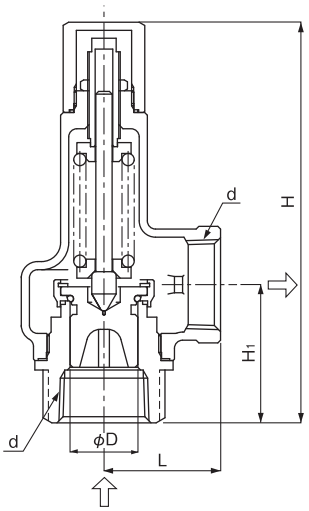

## ■Features

1. Safety relief valve of all stainless steel made, offering high corrosion resistance and durability in particular.
2. Excellent airtightness ensured by the valve seat incorporating soft seat. Most suitable for applications where valve seat leakage is not tolerated.
3. Closed structure prevents fluid leakage.

## ■Specifications

| | | |
|---|---|---|
| Structure | | Closed type |
| Application | | Air, Cold and hot water, Oil, Other non-dangerous fluids * |
| Working pressure | | 0.05-1.0 MPa |
| Maximum temperature | | 120℃ |
| Material | Spring case | Cast stainless steel |
| | Valve, valve seat | Cast stainless steel (SCS14A) |
| | Adjusting spring | Stainless steel |
| | O-ring | FKM |
| Connection | | JIS Rc screwed |

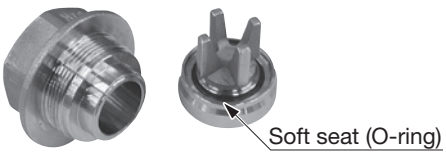
* Please contact us when using for oil.
· Please refer to the chart in P.3-76 for set pressure range.




## ■Dimensions and Weights

| Nominal size | Dimension (mm) | | | | | Flow area | Weight |
|---|---|---|---|---|---|---|---|
| | d | D | L | $H_1$ | H | $\pi D\ell$ ($mm^2$) | (kg) |
| 15A | Rc 1/2 | 16 | 34 | 40 | 128 | 20.1 | 0.7 |
| 20A | Rc 3/4 | 21 | 38 | 42 | 128.5 | 34.6 | 0.8 |
| 25A | Rc 1 | 26 | 43 | 51 | 148 | 53.0 | 1.1 |
| 32A | Rc 1-1/4 | 33 | 50 | 61.5 | 181.5 | 93.3 | 1.8 |
| 40A | Rc 1-1/2 | 41 | 60 | 64 | 205 | 135.2 | 2.8 |
| 50A | Rc 2 | 51 | 75 | 76 | 245.5 | 208.2 | 4.7 |

**Soft seat is used for the trim parts!**
Soft seat (O-ring) is used for the trim parts, ensuring the reliable airtightness of the valve seat.



## ■Certified Capacity Table

**· For air (20°C) <Pressure vessel structure standard>**

(kg/h)

| Nominal size \ Pressure MPa | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15A | 25 | 33 | 48 | 65 | 81 | 98 | 114 | 131 | 147 | 164 | 181 |
| 20A | 44 | 57 | 83 | 111 | 140 | 169 | 197 | 226 | 254 | 283 | 311 |
| 25A | 68 | 87 | 127 | 171 | 215 | 258 | 302 | 346 | 390 | 433 | 477 |
| 32A | 114 | 147 | 214 | 288 | 362 | 435 | 509 | 582 | 656 | 730 | 803 |
| 40A | 171 | 221 | 321 | 431 | 542 | 652 | 762 | 872 | 982 | 1093 | 1203 |
| 50A | 264 | 341 | 496 | 666 | 836 | 1006 | 1176 | 1346 | 1516 | 1687 | 1857 |

**· For water (accumulation: 25%) <Yoshitake standard>**

($m^3$/h)

| Nominal size \ Pressure MPa | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15A | 0.4 | 0.5 | 0.9 | 1.1 | 1.3 | 1.5 | 1.6 | 1.8 | 1.9 | 2.0 | 2.1 |
| 20A | 0.6 | 0.9 | 1.6 | 2.0 | 2.3 | 2.6 | 2.8 | 3.1 | 3.3 | 3.5 | 3.7 |
| 25A | 1.0 | 1.5 | 2.5 | 3.1 | 3.6 | 4.0 | 4.4 | 4.7 | 5.1 | 5.4 | 5.7 |
| 32A | 1.8 | 2.6 | 4.5 | 5.5 | 6.3 | 7.1 | 7.8 | 8.4 | 9.0 | 9.5 | 10.0 |
| 40A | 2.7 | 3.8 | 6.5 | 7.9 | 9.2 | 10.3 | 11.3 | 12.2 | 13.0 | 13.8 | 14.6 |
| 50A | 4.1 | 5.9 | 10.0 | 12.3 | 14.2 | 15.9 | 17.4 | 18.8 | 20.1 | 21.3 | 22.4 |

· Please refer to P.3-11 for the calculation procedure for nominal size selection.

# AL-250,250R

Full bore type | Lift type | Safety valve | **Relief valve**
Safety relief valve | Lever type | **Closed type** | **Dash-pot structure**
**Handle type** | **Stainless** | High pressure gas testing products
Diaphragm | Non-leakage

AL-250

AL-250R

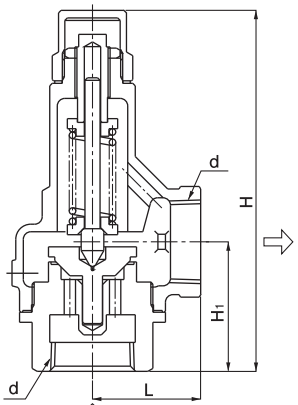
## ■Features

1. Relief valve of stainless steel made, offering high corrosion resistance and durability in particular.
2. Remarkably effective for lines of heavy pulsation or considerable pressure fluctuation due to unique valve structure. Prevents chattering and hunting.
3. Stable operation can be maintained against back pressure changes produced in continuous blow.
4. Simple structure, easy to handle.
5. Since the AL-250R is equipped with a handle, pressure change is easy.

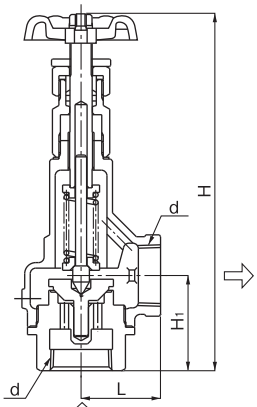
## ■Specifications

| Model | | AL-250 | AL-250R |
|---|---|---|---|
| Structure | | Closed type | Closed type with a handle |
| Application | | Cold and hot water, Oil, Other non-dangerous fluids | |
| Working pressure | | 0.05-1.0 MPa | |
| Maximum temperature | | 120℃ | |
| Material | Spring case | Cast stainless steel | |
| | Valve, valve seat | Stainless steel | |
| Connection | | JIS Rc screwed | |

· Please refer to the chart in P.3-76 for set pressure range.




AL-250




AL-250R

## ■Dimensions and Weights

(mm)

| Nominal size | d | L | $H_1$ | H | Weight (kg) |
|---|---|---|---|---|---|
| 15A | Rc 1/2 | 34 | 41.0 | 129 (185) | 0.7 (0.9) |
| 20A | Rc 3/4 | 38 | 45.0 | 132 (188) | 0.9 (1.1) |
| 25A | Rc 1 | 43 | 51.5 | 148 (203) | 1.2 (1.4) |
| 32A | Rc 1-1/4 | 50 | 63.5 | 184 (241) | 2.2 (2.5) |
| 40A | Rc 1-1/2 | 60 | 68.5 | 210 (278) | 3.2 (3.7) |
| 50A | Rc 2 | 75 | 80.0 | 250 (314) | 5.6 (6.0) |

· The values in parentheses are the dimensions and weights of the AL-250R.

**· Dashpot structure**

# AL-260,260R

Full bore type | Lift type | Safety valve | **Relief valve**
Safety relief valve | Lever type | **Closed type** | **Dash-pot structure**
**Handle type** | Stainless | High pressure gas testing products
Diaphragm | Non-leakage

AL-260 AL-260R

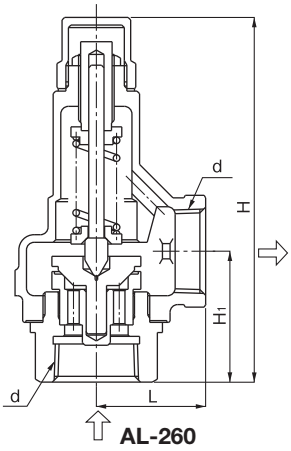
## ■Features

1. Stainless steel is used for the trim parts, and corrosion-resistant material for all wetted parts.
2. Remarkably effective for lines of heavy pulsation or considerable pressure fluctuation due to unique valve structure. Prevents chattering and hunting.
3. Stable operation can be maintained against back pressure changes produced in continuous blow.
4. Simple structure, easy to handle.
5. Since the AL-260R is equipped with a handle, pressure change is easy.

## ■Specifications

| Model | | AL-260 | AL-260R |
|---|---|---|---|
| Structure | | Closed type | Closed type with a handle |
| Application | | Cold and hot water, Oil, Other non-dangerous fluids | |
| Working pressure | | 0.05-1.0 MPa | |
| Maximum temperature | | 120℃ | |
| Material | Valve case | Cast bronze | |
| | Spring case | Cast bronze | |
| | Valve, valve seat | Stainless steel | |
| Connection | | JIS Rc screwed | |

· Please refer to the chart in P.3-76 for set pressure range.



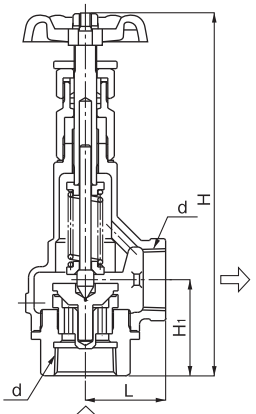

AL-260

## ■Dimensions and Weights

(mm)

| Nominal size | d | L | $H_1$ | H | Weight (kg) |
|---|---|---|---|---|---|
| 15A | Rc 1/2 | 34 | 41.0 | 129 (185) | 0.7 (1.0) |
| 20A | Rc 3/4 | 38 | 45.0 | 131 (187) | 0.9 (1.2) |
| 25A | Rc 1 | 43 | 51.5 | 145 (200) | 1.2 (1.5) |
| 32A | Rc 1-1/4 | 50 | 63.5 | 184 (241) | 1.9 (2.2) |
| 40A | Rc 1-1/2 | 60 | 68.5 | 210 (278) | 2.8 (3.2) |
| 50A | Rc 2 | 75 | 80.0 | 250 (314) | 4.9 (5.3) |

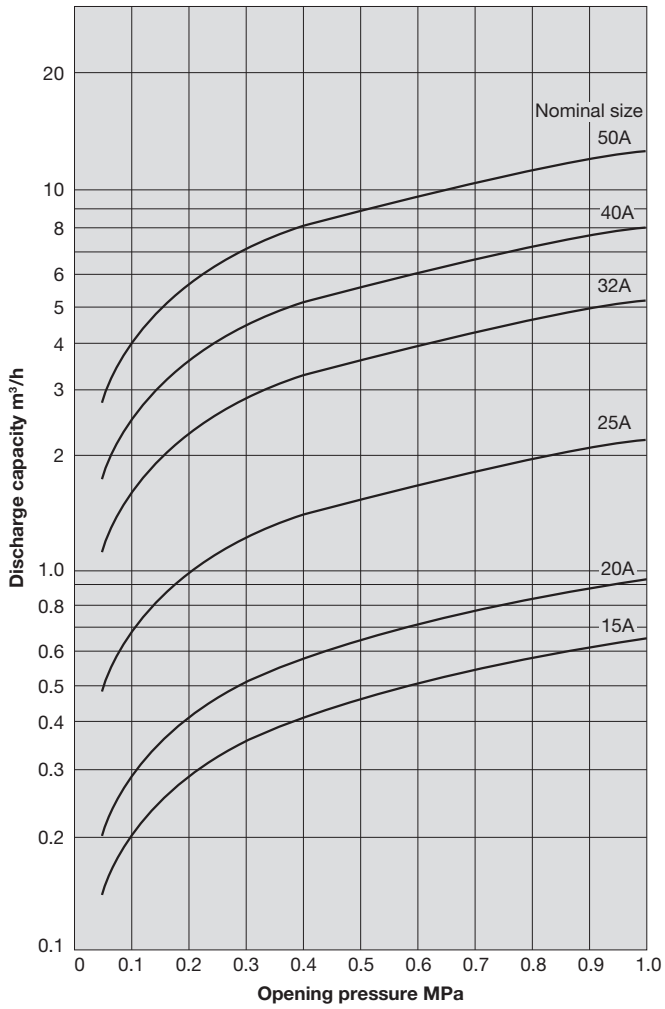
· The values in parentheses are the dimensions and weights of the AL-260R.




AL-260R

## ■Flow rate chart [water] (AL-250 · 250R · 260 · 260R)

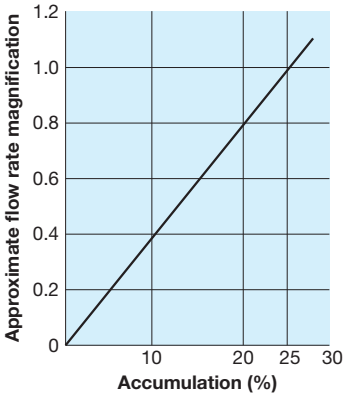
Shown in the chart is the flow rate at 25% accumulation.
For flow rates at other accumulation levels, use the approximate flow rate magnification chart.




### · Dashpot structure

### Approximate flow rate magnification chart

When the accumulation is not 25%, select an approximate flow rate magnification matching the accumulation based on this chart, and multiply the flow rate at 25% accumulation by the selected magnification.




### · Discharge capacity (accumulation: 25%)

(m³/h)

| Nominal size | Opening pressure (MPa) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
| 15A | 0.14 | 0.20 | 0.29 | 0.35 | 0.41 | 0.46 | 0.50 | 0.54 | 0.58 | 0.62 | 0.65 |
| 20A | 0.20 | 0.29 | 0.41 | 0.51 | 0.59 | 0.66 | 0.72 | 0.78 | 0.83 | 0.88 | 0.93 |
| 25A | 0.49 | 0.69 | 0.98 | 1.20 | 1.38 | 1.54 | 1.69 | 1.83 | 1.96 | 2.07 | 2.19 |
| 32A | 1.14 | 1.62 | 2.29 | 2.81 | 3.24 | 3.63 | 3.97 | 4.29 | 4.59 | 4.87 | 5.13 |
| 40A | 1.79 | 2.53 | 3.58 | 4.39 | 5.07 | 5.67 | 6.21 | 6.71 | 7.17 | 7.61 | 8.02 |
| 50A | 2.80 | 3.96 | 5.60 | 6.86 | 7.92 | 8.86 | 9.71 | 10.49 | 11.21 | 11.89 | 12.53 |

# AL-27

Full bore type | Lift type | Safety valve | **Relief valve**
Safety relief valve | Lever type | **Closed type** | **Dash-pot structure**
Handle type | Stainless | High pressure gas testing products
Diaphragm | Non-leakage

## ■Features

1. Relief valve, designed for pressure up to 1.6 MPa.
2. Remarkably effective for lines of heavy pulsation or considerable pressure fluctuation due to unique valve structure. Prevents chattering and hunting.
3. Stable operation can be maintained against back pressure changes produced in continuous blow.

## ■Specifications

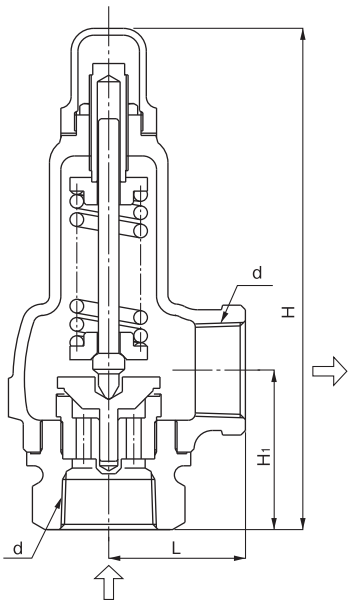
| | | |
|---|---|---|
| Structure | | Closed type |
| Application | | Cold and hot water, Oil, Other non-dangerous fluids |
| Working pressure | | 0.05-1.6 MPa |
| Maximum temperature | | 120℃ |
| Material | Valve case | Ductile cast iron |
| | Spring case | Ductile cast iron |
| | Valve, valve seat | Stainless steel |
| Connection | | JIS Rc screwed |

· Please refer to the chart in P.3-76 for set pressure range.

## ■Dimensions and Weights

(mm)

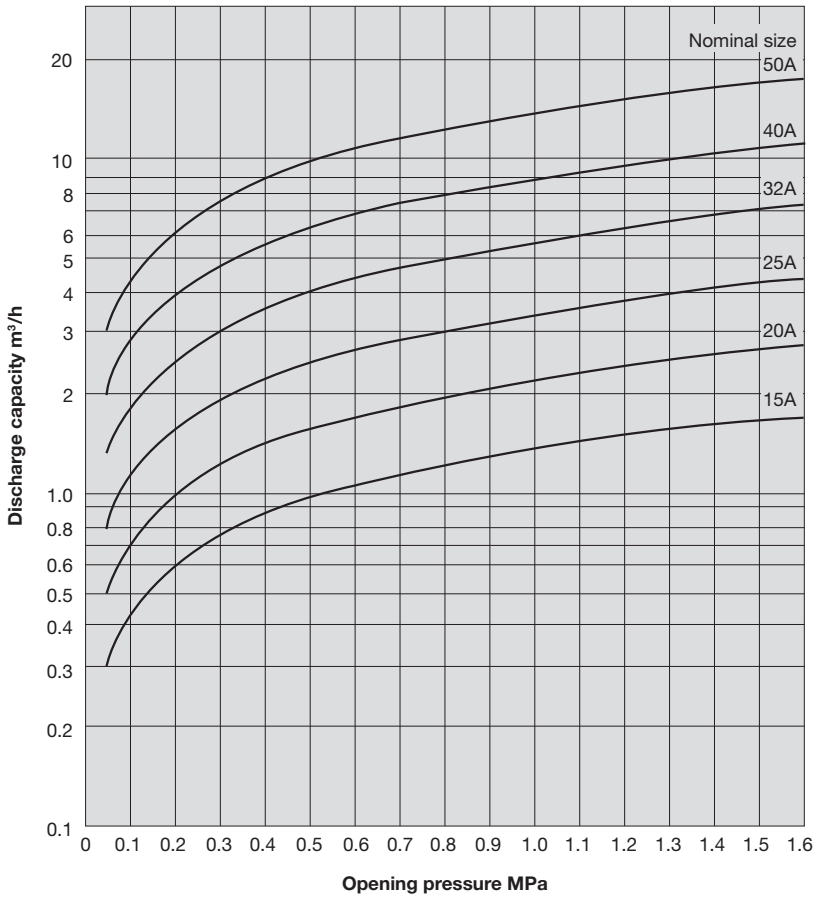
| Nominal size | d | L | $H_1$ | H | Weight (kg) |
|---|---|---|---|---|---|
| 15A | Rc 1/2 | 40 | 40 | 143 | 0.9 |
| 20A | Rc 3/4 | 45 | 50 | 162 | 1.3 |
| 25A | Rc 1 | 50 | 60 | 182 | 1.7 |
| 32A | Rc 1-1/4 | 60 | 70 | 220 | 2.9 |
| 40A | Rc 1-1/2 | 65 | 75 | 238 | 3.9 |
| 50A | Rc 2 | 80 | 85 | 272 | 6.4 |




**· Dashpot structure**

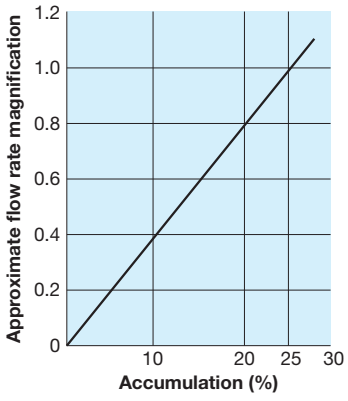
## ■Flow Rate Chart [water]

Shown in the chart is the flow rate at 25% accumulation.
For flow rates at other accumulation levels, use the approximate flow rate magnification chart.




### Approximate flow rate magnification chart

When the accumulation is not 25%, select an approximate flow rate magnification matching the accumulation based on this chart, and multiply the flow rate at 25% accumulation by the selected magnification.



# AL-17



Full bore type | **Lift type** | Safety valve | Relief valve
**Safety relief valve** | Lever type | **Closed type** | Dash-pot structure
Handle type | Stainless | High pressure gas testing products
Diaphragm | Non-leakage

## ■Features

1. Safety relief valve with the trim parts (valve and valve seat) of stainless steel, offering high corrosion resistance and durability in particular.
2. Popping structure ensures reliable discharge.
3. Blowdown can be adjusted with adjustable ring (seat ring).

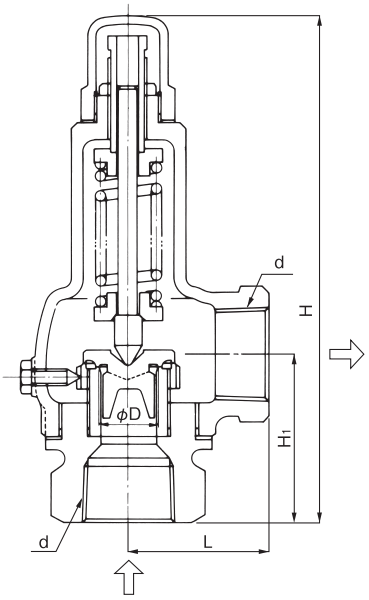
## ■Specifications

| | | |
|---|---|---|
| Structure | | Closed type |
| Application | | Steam, Air, Cold and hot water, Oil, Other non-dangerous fluids |
| Working pressure | | 0.05-1.6 MPa |
| Maximum temperature | | 220℃ * |
| Material | Spring case | Ductile cast iron |
| | Valve, valve seat | Stainless steel |
| Connection | | JIS Rc screwed |

* The maximum temperature is 150℃ when using for water, oil, or other liquids.
· Please refer to the chart in P.3-76 for set pressure range.

## ■Dimensions and Weights

| Nominal size | Dimension (mm) | | | | | Flow area $\pi D\ell$ (mm²) | Weight (kg) |
|---|---|---|---|---|---|---|---|
| | d | D | L | $H_1$ | H | | |
| 15A | Rc 1/2 | 16 | 40 | 40 | 143 | 20.1 | 0.9 |
| 20A | Rc 3/4 | 21 | 45 | 50 | 162 | 34.6 | 1.2 |
| 25A | Rc 1 | 26 | 50 | 60 | 182 | 53.0 | 1.7 |
| 32A | Rc 1-1/4 | 33 | 60 | 70 | 220 | 85.5 | 2.9 |
| 40A | Rc 1-1/2 | 41 | 65 | 75 | 238 | 132.0 | 3.8 |
| 50A | Rc 2 | 51 | 80 | 85 | 272 | 204.2 | 6.3 |



## ■Certified Capacity Table

**· For steam (saturation temperature) <Pressure vessel structure standard>**

(kg/h)

| Pressure MPa / Nominal size | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15A | 15 | 20 | 29 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 109 | 119 | 129 | 139 | 149 | 158 | 168 |
| 20A | 27 | 35 | 51 | 69 | 87 | 104 | 121 | 138 | 155 | 172 | 189 | 206 | 222 | 239 | 256 | 273 | 290 |
| 25A | 42 | 54 | 78 | 105 | 133 | 159 | 186 | 212 | 237 | 263 | 289 | 315 | 341 | 367 | 393 | 418 | 444 |
| 32A | 67 | 87 | 127 | 170 | 215 | 257 | 300 | 342 | 383 | 425 | 467 | 509 | 550 | 592 | 634 | 675 | 716 |
| 40A | 104 | 135 | 196 | 263 | 332 | 397 | 463 | 528 | 592 | 656 | 721 | 786 | 850 | 914 | 979 | 1042 | 1106 |
| 50A | 161 | 209 | 303 | 407 | 513 | 615 | 716 | 817 | 916 | 1016 | 1116 | 1216 | 1315 | 1414 | 1514 | 1612 | 1712 |

**· For air (20˚C) <Pressure vessel structure standard>**

(kg/h)

| Pressure MPa / Nominal size | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15A | 25 | 33 | 48 | 65 | 81 | 98 | 114 | 131 | 147 | 164 | 181 | 197 | 214 | 230 | 247 | 264 | 280 |
| 20A | 44 | 57 | 83 | 111 | 140 | 169 | 197 | 226 | 254 | 283 | 311 | 340 | 368 | 397 | 426 | 454 | 483 |
| 25A | 68 | 87 | 127 | 171 | 215 | 258 | 302 | 346 | 390 | 433 | 477 | 521 | 565 | 608 | 652 | 696 | 740 |
| 32A | 108 | 141 | 205 | 276 | 347 | 417 | 488 | 558 | 629 | 699 | 770 | 841 | 911 | 982 | 1052 | 1123 | 1193 |
| 40A | 168 | 218 | 317 | 426 | 535 | 644 | 753 | 862 | 971 | 1080 | 1189 | 1298 | 1407 | 1516 | 1625 | 1734 | 1843 |
| 50A | 259 | 338 | 491 | 660 | 828 | 997 | 1166 | 1334 | 1503 | 1671 | 1840 | 2008 | 2177 | 2345 | 2514 | 2682 | 2851 |

**· For water (accumulation: 25%) <Yoshitake standard>**

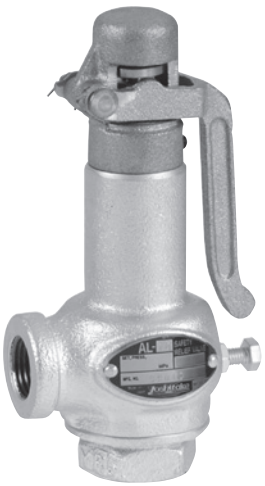
($m^3$/h)

| Pressure MPa / Nominal size | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15A | 0.2 | 0.3 | 0.5 | 0.6 | 0.7 | 0.8 | 0.8 | 0.9 | 1.0 | 1.0 | 1.1 | 1.1 | 1.2 | 1.2 | 1.3 | 1.3 | 1.4 |
| 20A | 0.4 | 0.6 | 0.8 | 1.0 | 1.2 | 1.3 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 | 2.0 | 2.1 | 2.2 | 2.3 | 2.3 | 2.4 |
| 25A | 0.6 | 0.9 | 1.3 | 1.6 | 1.8 | 2.1 | 2.3 | 2.5 | 2.6 | 2.8 | 2.9 | 3.1 | 3.2 | 3.4 | 3.5 | 3.6 | 3.7 |
| 32A | 1.0 | 1.5 | 2.1 | 2.6 | 3.0 | 3.4 | 3.7 | 4.0 | 4.3 | 4.5 | 4.8 | 5.0 | 5.2 | 5.5 | 5.7 | 5.9 | 6.1 |
| 40A | 1.6 | 2.3 | 3.3 | 4.0 | 4.7 | 5.2 | 5.7 | 6.2 | 6.6 | 7.0 | 7.4 | 7.8 | 8.1 | 8.4 | 8.8 | 9.1 | 9.4 |
| 50A | 2.5 | 3.6 | 5.1 | 6.3 | 7.2 | 8.1 | 8.9 | 9.6 | 10.3 | 10.9 | 11.5 | 12.0 | 12.6 | 13.1 | 13.6 | 14.1 | 14.5 |

* Please refer to P.3-11 for the calculation procedure for nominal size selection.

# AL-10

Full bore type | **Lift type** | **Safety valve** | Relief valve
Safety relief valve | **Lever type** | Closed type | Dash-pot structure
Handle type | Stainless | High pressure gas testing products
Diaphragm | Non-leakage



Open type with a lever

Open type without a lever

## ■Features

1. Compact and lightweight lift safety valve, installation is easy.
2. Simple structure and easy maintenance.
3. Due to lift valve lever mechanism a discharge inspection can be manually performed at more than 75% of the opening pressure (open type with a lever).
4. Blowdown can be adjusted with adjustable ring (seat ring).

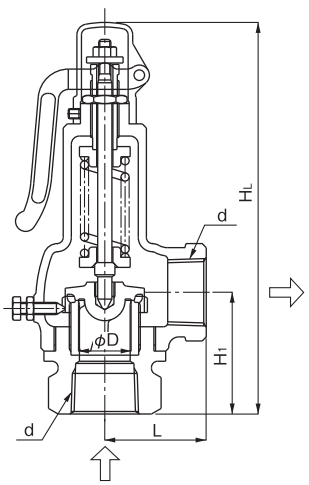
## ■Specifications

| | | |
|---|---|---|
| Structure | | Open type |
| Application | | Steam |
| Working pressure | | 0.05-1.0 MPa |
| Maximum temperature | | 220°C |
| Material | Spring case | Ductile cast iron |
| | Valve, valve seat | Cast bronze or stainless steel |
| Connection | | JIS Rc screwed |

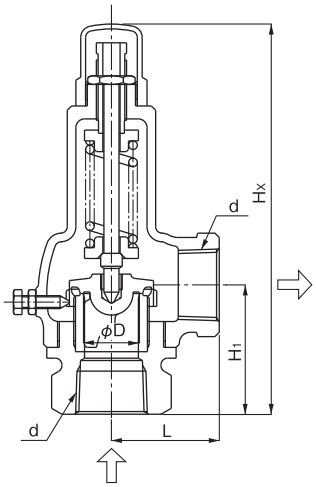
· Please refer to the chart in P.3-76 for set pressure range.

## ■Dimensions and Weights

| Nominal size | Dimension (mm) | | | | | | Flow area $\pi D\ell$ (mm²) | Weight (kg) |
|---|---|---|---|---|---|---|---|---|
| | d | L | $H_1$ | $H_L$ | $H_X$ | D | | |
| 15A | Rc 1/2 | 40 | 40 | 154 | 142 | 16 | 20.1 | 1.0 |
| 20A | Rc 3/4 | 45 | 50 | 173 | 161 | 21 | 34.6 | 1.5 |
| 25A | Rc 1 | 50 | 60 | 193 | 181 | 26 | 53.0 | 1.8 |
| 32A | Rc 1-1/4 | 60 | 70 | 232 | 219 | 33 | 85.5 | 3.1 |
| 40A | Rc 1-1/2 | 65 | 75 | 250 | 237 | 41 | 132.0 | 4.5 |
| 50A | Rc 2 | 80 | 85 | 284 | 271 | 51 | 204.2 | 6.2 |




Open type with a lever




Open type without a lever

## ■Certified Capacity Table

**· For steam (saturation temperature) <Pressure vessel structure standard>**

(kg/h)

| Pressure MPa / Nominal size | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15A | 15 | 20 | 29 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 109 |
| 20A | 27 | 35 | 51 | 69 | 87 | 104 | 121 | 138 | 155 | 172 | 189 |
| 25A | 42 | 54 | 78 | 105 | 133 | 159 | 186 | 212 | 237 | 263 | 289 |
| 32A | 67 | 87 | 127 | 170 | 215 | 257 | 300 | 342 | 383 | 425 | 467 |
| 40A | 104 | 135 | 196 | 263 | 332 | 397 | 463 | 528 | 592 | 656 | 721 |
| 50A | 161 | 209 | 303 | 407 | 513 | 615 | 716 | 817 | 916 | 1016 | 1116 |

· Please refer to P.3-11 for the calculation procedure for nominal size selection.

## ■At the Time of Ordering

When ordering, please specify with or without lever and the material of the valve body and valve seat in addition to the set pressure.

# AL-24,24F

Full bore type | Lift type | Safety valve | **Relief valve**
Safety relief valve | Lever type | Closed type | Dash-pot structure
**Handle type** | Stainless | High pressure gas testing products
**Diaphragm** | Non-leakage

## ■Features

1. No need to worry about rust by made of bronze for valve case and stainless steel for valve seat. Operation is reliable since the valve is diaphragm type with no sliding part.
2. Wide set pressure range is available by only one spring. Changing set pressure is easy, because the adjusting screw is handle type and lock nut is butterfly nut.
3. Opening and closing are smooth even when the valve operates continuously, and surely relief the fluid at set pressure. Also it can operate stably from small to large flow rate.
4. Diaphragm and valve materials can be chosen from NBR or FKM (fluororubber) depends on the specification.
5. Can be connected in any direction (horizontal or vertical).

## ■Specifications

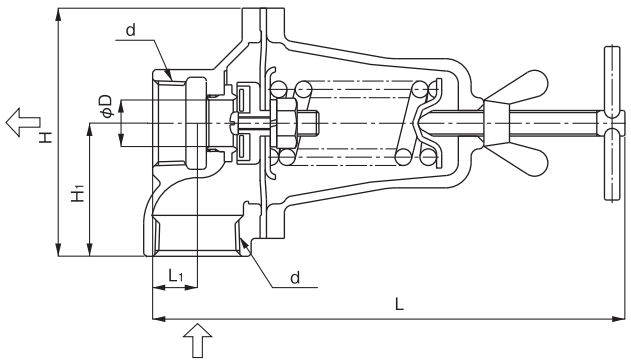
| Model | | AL-24 | AL-24F |
|---|---|---|---|
| Application | | Cold and hot water | Cold and hot water, Oil, Other non-dangerous fluids |
| Working pressure | | 0.1-0.7 MPa *1 | |
| Maximum temperature | | 60℃ | 120℃ |
| Material | Valve case | Bronze *2 | |
| | Valve | NBR | FKM |
| | Valve seat | Stainless steel | |
| | Diaphragm | NBR (heat-resistant nylon contained) | FKM (heat-resistant nylon contained) |
| Connection | | JIS Rc screwed | |

*1 Available with working pressure between 0.05MPa and 0.1MPa.
*2 Available with NPb-treated.

## ■Dimensions and Weights

(mm)

| Nominal size | d | L | $L_1$ | H | $H_1$ | D | Weight (kg) |
|---|---|---|---|---|---|---|---|
| 15A | Rc 1/2 | 180.5 | 20.5 | 91 | 46 | 15 | 1.4 |
| 20A | Rc 3/4 | 181.5 | 18.5 | 92 | 47 | 15 | 1.4 |
| 25A | Rc 1 | 187.5 | 17.5 | 97 | 52 | 18.2 | 1.6 |



## ■Certified Capacity Table

**· Set pressure range 0.1 to 0.7 MPa (accumulation 25%)**

($m^3/h$)

| Nominal size | Set pressure (MPa) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0.10 | 0.15 | 0.20 | 0.25 | 0.30 | 0.35 | 0.40 | 0.45 | 0.50 | 0.55 | 0.60 | 0.65 | 0.70 |
| 15A | 0.31 | 0.38 | 0.44 | 0.49 | 0.54 | 0.58 | 0.63 | 0.66 | 0.70 | 0.73 | 0.77 | 0.80 | 0.83 |
| 20A | 0.31 | 0.38 | 0.44 | 0.49 | 0.54 | 0.58 | 0.63 | 0.66 | 0.70 | 0.73 | 0.77 | 0.80 | 0.83 |
| 25A | 0.46 | 0.56 | 0.65 | 0.73 | 0.80 | 0.86 | 0.92 | 0.98 | 1.03 | 1.08 | 1.13 | 1.18 | 1.22 |

**· Set pressure range 0.05 to 0.1 MPa (accumulation 25%)**

($m^3/h$)

| Nominal size | Set pressure (MPa) | | | | | |
|---|---|---|---|---|---|---|
| | 0.05 | 0.06 | 0.07 | 0.08 | 0.09 | 0.10 |
| 15A | 1.27 | 1.39 | 1.50 | 1.61 | 1.70 | 1.80 |
| 20A | 1.27 | 1.39 | 1.50 | 1.61 | 1.70 | 1.80 |
| 25A | 1.87 | 2.05 | 2.21 | 2.37 | 2.51 | 2.65 |

**· Calculation formula**

$$V = \frac{AK}{12.4\sqrt{\frac{G}{P}}}$$

V: Discharge capacity ($m^3/h$)
D: Seat diameter (mm)
$\ell$ : Lift (mm)
0.1-0.7 MPa $\ell = D/40$
0.05-0.1 MPa $\ell = D/7$
A: Effective area ($m^2$)
$A = \pi D\ell$
K: 0.7(Flow rate coefficient)
G: Specific gravity
P: Opening pressure (MPa)
Viscosity is calculated from formula for viscosity correction.

# AL-300,301

Full bore type | **Lift type** | Safety valve | Relief valve
Safety relief valve | Lever type | **Closed type** | Dash-pot structure
Handle type | Stainless | High pressure gas testing products
Diaphragm | Non-leakage

## ■Features

1. Safety valve, simple structure and easy maintenance.
2. Easy adjustment.

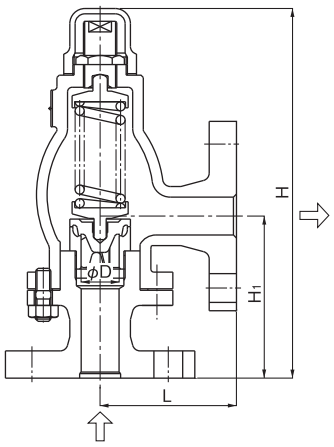
## ■Specifications

| Model | | AL-300 | AL-301 |
|---|---|---|---|
| Structure | | Closed type | |
| Application | | Steam | |
| Working pressure | | 0.05-1.0 MPa | 0.05-1.6 MPa |
| Maximum temperature | | 220℃ | |
| Material | Valve case | Ductile cast iron | |
| | Spring case | Ductile cast iron | |
| | Valve, valve seat | Cast bronze | Stainless steel |
| Connection | | JIS 10K FF flanged | JIS 10K FF flanged<br>JIS 16K FF flanged * |

* JIS 16K FF flanged when working pressure is more than 1.0 MPa.
· Please refer to the chart in P.3-76 for set pressure range.

## ■Dimensions and Weights

| Nominal size | Dimension (mm) | | | | Flow area | Weight |
|---|---|---|---|---|---|---|
| | L | $H_1$ | H | D | $\pi D\ell$ ($mm^2$) | (kg) |
| 15A | 90 | 108 | 245 | 25 | 49.1 | 4.7 |
| 20A | 90 | 108 | 245 | 25 | 49.1 | 5.0 |
| 25A | 90 | 108 | 245 | 25 | 49.1 | 6.2 |
| 32A | 91 | 115 | 285 | 37 | 107.6 | 8.6 |
| 40A | 91 | 115 | 285 | 38 | 113.5 | 8.8 |
| 50A | 105 | 132 | 311 | 50 | 196.4 | 12.6 |



# AL-300T,301T

Full bore type | **Lift type** | Safety valve | Relief valve
**Safety relief valve** | Lever type | **Closed type** | Dash-pot structure
Handle type | Stainless | High pressure gas testing products
Diaphragm | Non-leakage



## ■Features

1. Safety relief valve, simple structure and easy maintenance.
2. Easy adjustment.
3. Fluororesin disc ensures reliable seating.

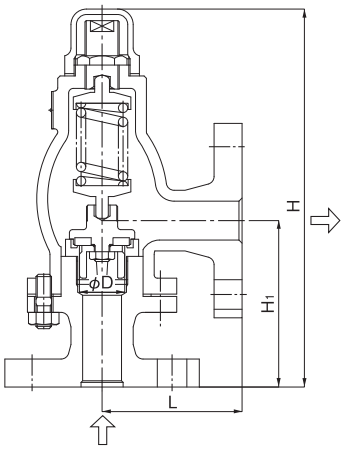
## ■Specifications

| Model | | AL-300T | AL-301T |
|---|---|---|---|
| Structure | | Closed type | |
| Application | | Air, Cold and hot water, Oil, Other non-dangerous fluids | |
| Working pressure | | 0.05-1.0 MPa | 0.05-1.3 MPa *1 |
| Maximum temperature | | 150˚C | |
| Material | Valve case, spring case | Ductile cast iron | |
| | Valve, valve seat | Cast bronze・PTFE | Stainless steel・PTFE |
| Connection | | JIS 10K FF flanged | JIS 10K FF flanged<br>JIS 16K FF flanged *2 |

*1 Please contact us if working pressure is between 1.31 MPa and 1.6 MPa.
*2 JIS 16K FF flanged when working pressure is more than 1.0 MPa.
· Please refer to the chart in P.3-76 for set pressure range.

## ■Dimensions and Weights

| Nominal size | Dimension (mm) | | | | Flow area $\pi D\ell$ (mm$^2$) | Weight (kg) |
|---|---|---|---|---|---|---|
| | L | $H_1$ | H | D | | |
| 15A | 90 | 108 | 245 | 29 | 66.1 | 4.7 |
| 20A | 90 | 108 | 245 | 29 | 66.1 | 5.0 |
| 25A | 90 | 108 | 245 | 29 | 66.1 | 6.2 |
| 32A | 91 | 115 | 285 | 37 | 107.6 | 8.6 |
| 40A | 91 | 115 | 285 | 37 | 107.6 | 8.8 |
| 50A | 105 | 132 | 311 | 50 | 196.4 | 12.6 |



## ■Certified Capacity Table for AL-300 · 301

**· For steam (saturation temperature) <Pressure vessel structure standard>**

(kg/h)

| Pressure MPa / Nominal size | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15A | 38 | 50 | 73 | 98 | 123 | 148 | 172 | 196 | 220 | 244 | 268 | 292 | 316 | 340 | 364 | 387 | 411 |
| 20A | 38 | 50 | 73 | 98 | 123 | 148 | 172 | 196 | 220 | 244 | 268 | 292 | 316 | 340 | 364 | 387 | 411 |
| 25A | 38 | 50 | 73 | 98 | 123 | 148 | 172 | 196 | 220 | 244 | 268 | 292 | 316 | 340 | 364 | 387 | 411 |
| 32A | 85 | 110 | 160 | 214 | 270 | 324 | 377 | 430 | 482 | 535 | 588 | 640 | 693 | 745 | 798 | 849 | 902 |
| 40A | 89 | 116 | 168 | 226 | 285 | 342 | 398 | 454 | 509 | 564 | 620 | 675 | 731 | 786 | 841 | 896 | 951 |
| 50A | 155 | 201 | 292 | 392 | 494 | 592 | 689 | 785 | 881 | 977 | 1073 | 1169 | 1265 | 1360 | 1456 | 1551 | 1646 |

## ■Certified Capacity Table for AL-300T · 301T

**· For air (20˚C) <Pressure vessel structure standard>**

(kg/h)

| Pressure MPa / Nominal size | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15A | 84 | 109 | 159 | 213 | 268 | 322 | 377 | 432 | 486 | 541 | 595 | 650 | 704 | 759 | 604 | 645 | 685 |
| 20A | 84 | 109 | 159 | 213 | 268 | 322 | 377 | 432 | 486 | 541 | 595 | 650 | 704 | 759 | 604 | 645 | 685 |
| 25A | 84 | 109 | 159 | 213 | 268 | 322 | 377 | 432 | 486 | 541 | 595 | 650 | 704 | 759 | 604 | 645 | 685 |
| 32A | 136 | 178 | 259 | 347 | 436 | 525 | 614 | 703 | 792 | 880 | 969 | 1058 | 1147 | 1236 | 1324 | 1413 | 1502 |
| 40A | 136 | 178 | 259 | 347 | 436 | 525 | 614 | 703 | 792 | 880 | 969 | 1058 | 1147 | 1236 | 1397 | 1491 | 1584 |
| 50A | 249 | 325 | 473 | 635 | 797 | 959 | 1121 | 1283 | 1445 | 1607 | 1769 | 1932 | 2094 | 2256 | 2418 | 2580 | 2742 |

**· For water (accumulation: 25%) <Yoshitake standard>**

($m^3$/h)

| Pressure MPa / Nominal size | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15A | 0.8 | 1.1 | 1.6 | 2.0 | 2.3 | 2.6 | 2.8 | 3.1 | 3.3 | 3.5 | 3.7 | 3.9 | 4.0 | 4.2 | 3.2 | 3.3 | 3.5 |
| 20A | 0.8 | 1.1 | 1.6 | 2.0 | 2.3 | 2.6 | 2.8 | 3.1 | 3.3 | 3.5 | 3.7 | 3.9 | 4.0 | 4.2 | 3.2 | 3.3 | 3.5 |
| 25A | 0.8 | 1.1 | 1.6 | 2.0 | 2.3 | 2.6 | 2.8 | 3.1 | 3.3 | 3.5 | 3.7 | 3.9 | 4.0 | 4.2 | 3.2 | 3.3 | 3.5 |
| 32A | 1.3 | 1.9 | 2.7 | 3.3 | 3.8 | 4.2 | 4.7 | 5.0 | 5.4 | 5.7 | 6.0 | 6.3 | 6.6 | 6.9 | 7.1 | 7.4 | 7.6 |
| 40A | 1.3 | 1.9 | 2.7 | 3.3 | 3.8 | 4.2 | 4.7 | 5.0 | 5.4 | 5.7 | 6.0 | 6.3 | 6.6 | 6.9 | 7.5 | 7.8 | 8.1 |
| 50A | 2.4 | 3.5 | 4.9 | 6.0 | 7.0 | 7.8 | 8.5 | 9.2 | 9.9 | 10.5 | 11.0 | 11.6 | 12.1 | 12.6 | 13.1 | 13.5 | 14.0 |

· Please refer to P.3-11 for the calculation procedure for nominal size selection.

# AL-280

Full bore type | Lift type | Safety valve | **Relief valve**
Safety relief valve | Lever type | **Closed type** | **Dash-pot structure**
Handle type | Stainless | High pressure gas testing products
Diaphragm | Non-leakage

## ■Features

1. Relief valve, exclusive for the pressure control of pumps with high pulsation pressure or large pressure fluctuation.
2. The trim parts (valve and valve seat) are designed to continuously discharge fluid against its set pressure change without popping (patent pending), preventing chattering and hunting.
3. Stainless steel with excellent corrosion resistance is used for the adjusting spring.

## ■Specifications

| | | |
|---|---|---|
| Structure | | Closed type |
| Application | | Cold and hot water, Oil (heavy oil A, heavy oil B, kerosene) |
| Working pressure | | 0.05-1.0 MPa |
| Maximum temperature | | 120℃ |
| Material | Valve case | Ductile cast iron |
| | Spring case | Ductile cast iron |
| | Valve, valve seat | Stainless steel |
| | Adjusting spring | Stainless steel |
| Connection | | JIS 10K FF flanged |

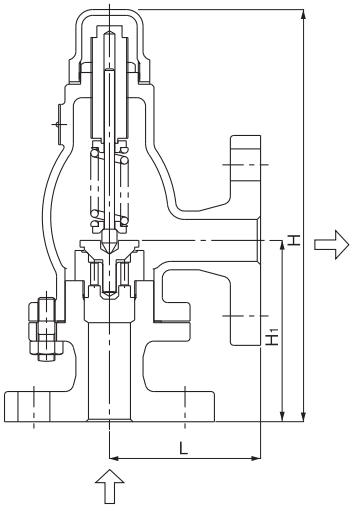
· Please refer to the chart in P.3-76 for set pressure range.

**· Dashpot structure**

## ■Dimensions and Weights

(mm)

| Nominal size | L | H | $H_1$ | Weight (kg) |
|---|---|---|---|---|
| 15A | 90 | 245 | 108 | 4.7 |
| 20A | 90 | 245 | 108 | 5.0 |
| 25A | 90 | 245 | 108 | 6.2 |
| 32A | 91 | 285 | 115 | 8.6 |
| 40A | 91 | 285 | 115 | 8.8 |
| 50A | 105 | 331 | 132 | 13.0 |



## ■Flow rate chart

The flow rate to each nominal size when the accumulation (overpressure to the set pressure) is 25% is as shown in Fig. 1. See Fig. 2 when the accumulation is less than 25%.

**Fig. 1: Nominal size selection chart**

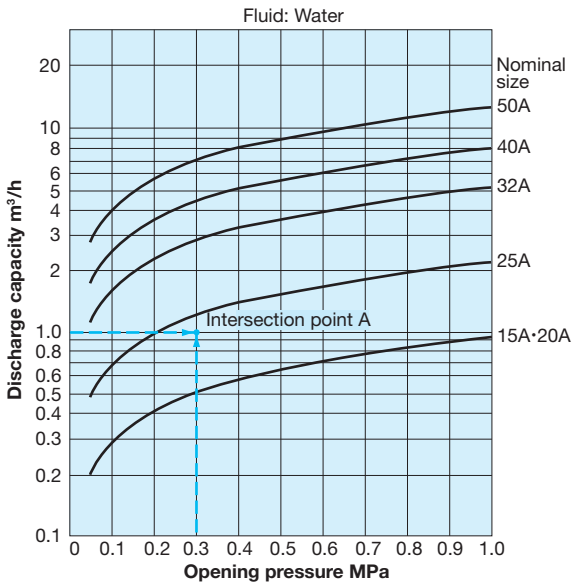
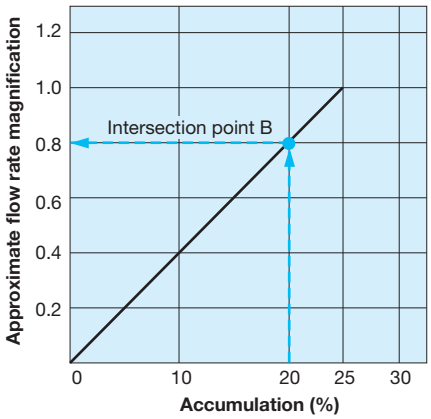



**Fig. 2: Approximate flow rate magnification**

When the accumulation is less than 25%, select an approximate flow rate magnification matching the accumulation based on this chart, and multiply the flow rate at 25% accumulation by the selected magnification.




[Example]
To select a nominal size when the working conditions are pressure: 0.3 MPa and discharge capacity: 1.0 $m^3$/h, first find intersection point A of the pressure of 0.3 MPa on the horizontal axis and the discharge capacity of 1.0 $m^3$/h on the vertical axis in Fig. 1.
Since intersection point A lies between the curve of nominal sizes 15A · 25A and the curve of nominal size 25A, select the larger one, 25A.

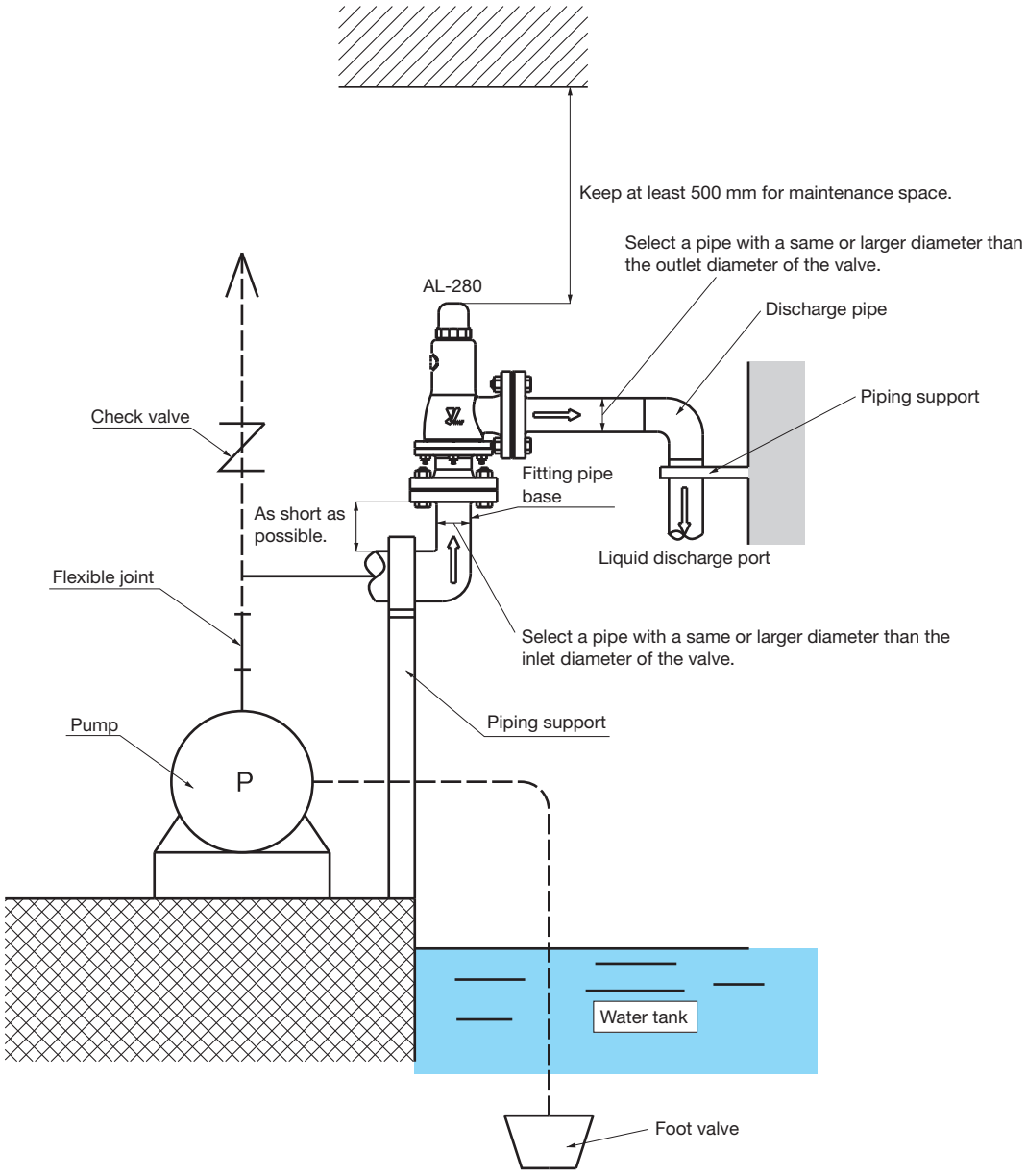
[Example]
To obtain the flow rate when the working conditions are nominal size: 25A, setting pressure: 0.1 MPa, and accumulation: 20%, first find the flow rate at an accumulation of 25% in Fig. 1. Then, mark intersection point B of the accumulation of 20% and the diagonal straight line in Fig. 2. Trace horizontally to the left from this intersection point B, and reach the point of 0.8 on the axis of approximate flow rate magnification.

**· Discharge capacity (reference) (accumulation: 25%)**

($m^3$/h)

| Nominal size | Flow area ($mm^2$) | Opening pressure (MPa) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
| 15A·20A | 16.7 | 0.20 | 0.29 | 0.41 | 0.51 | 0.59 | 0.66 | 0.72 | 0.78 | 0.83 | 0.88 | 0.93 |
| 25A | 36.2 | 0.49 | 0.69 | 0.98 | 1.20 | 1.38 | 1.54 | 1.69 | 1.83 | 1.96 | 2.07 | 2.19 |
| 32A | 91.9 | 1.14 | 1.62 | 2.29 | 2.81 | 3.24 | 3.63 | 3.97 | 4.29 | 4.59 | 4.87 | 5.13 |
| 40A | 143.6 | 1.79 | 2.53 | 3.58 | 4.39 | 5.07 | 5.67 | 6.21 | 6.71 | 7.17 | 7.61 | 8.02 |
| 50A | 224.3 | 2.80 | 3.96 | 5.60 | 6.86 | 7.92 | 8.86 | 9.71 | 10.49 | 11.21 | 11.89 | 12.53 |

## ■Relief Valve Discharge Piping



# AL-31,31H

Full bore type | **Lift type** | Safety valve | Relief valve
**Safety relief valve** | Lever type | **Closed type** | Dash-pot structure
Handle type | **Stainless** | High pressure gas testing products
Diaphragm | Non-leakage

**AL-31**

## ■Features

1. Safety relief valve of all stainless steel made, offering high corrosion resistance and durability in particular.
2. Popping structure ensures reliable discharge.

## ■Specifications

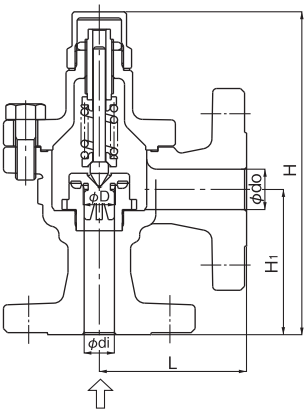
| Model | | AL-31 | AL-31H |
|---|---|---|---|
| Structure | | Closed type | |
| Application | | Steam, Air, Cold and hot water, Oil, Other non-dangerous fluids | |
| Working pressure | | 0.05-1.0 MPa | 1.0-2.0 MPa |
| Maximum temperature | | 220℃ * | |
| Material | Valve case | Cast stainless steel | |
| | Spring case | Cast stainless steel | |
| | Valve, valve seat | Stainless steel | |
| Connection | | JIS 10K RF flanged | JIS 16K RF flanged<br>JIS 20K RF flanged |

* The maximum temperature is 150℃ when using for water, oil, or other liquids.
· Please refer to the chart in P.3-76 for set pressure range.

## ■Dimensions and Weights

| Nominal size | Dimension (mm) | | | | Flow area $\pi D\ell$ (mm²) | Weight (kg) |
|---|---|---|---|---|---|---|
| | di x D x do | L | $H_1$ | H | | |
| 15A | 15 x 16 x 20 | 73 | 72 | 160 | 20.1 | 3.4 |
| 20A | 20 x 21 x 25 | 77 | 74 | 163 | 34.6 | 4.5 |
| 25A | 25 x 26 x 32 | 91 | 87 | 187 | 53.0 | 6.5 |
| 32A | 32 x 33 x 40 | 96 | 92 | 238 | 85.5 | 8.1 ( 8.3) |
| 40A | 40 x 41 x 50 | 114 | 100 | 277 | 132.0 | 11.4 (11.7) |
| 50A | 50 x 51 x 65 | 116 | 107 | 315 (357) | 204.2 | 15.0 (18.0) |

· The above values in parentheses are the dimensions and weights of JIS 20K RF flanged.
· The nominal size and size of screwed end connection are different. The size of screwed end connection have to be one size bigger.



## ■Certified Capacity Table for AL-31, 31H

### · AL-31 for steam (saturation temperature) <Pressure vessel structure standard>

(kg/h)

| Pressure MPa / Nominal size | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15A | 15 | 20 | 29 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 109 |
| 20A | 27 | 35 | 51 | 69 | 87 | 104 | 121 | 138 | 155 | 172 | 189 |
| 25A | 42 | 54 | 78 | 105 | 133 | 159 | 186 | 212 | 237 | 263 | 289 |
| 32A | 67 | 87 | 127 | 170 | 215 | 257 | 300 | 342 | 383 | 425 | 467 |
| 40A | 104 | 135 | 196 | 263 | 332 | 397 | 463 | 528 | 592 | 656 | 721 |
| 50A | 161 | 209 | 303 | 407 | 513 | 615 | 716 | 817 | 916 | 1016 | 1116 |

### · AL-31H for steam (saturation temperature)

(kg/h)

| Pressure MPa / Nominal size | 1.0 | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 | 2.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15A | 109 | 119 | 129 | 139 | 149 | 158 | 168 | 178 | 188 | 198 | 207 |
| 20A | 189 | 206 | 222 | 239 | 256 | 273 | 290 | 306 | 324 | 340 | 357 |
| 25A | 289 | 315 | 341 | 367 | 393 | 418 | 444 | 470 | 496 | 522 | 547 |
| 32A | 467 | 509 | 550 | 592 | 634 | 675 | 716 | 758 | 800 | 842 | 883 |
| 40A | 721 | 786 | 850 | 914 | 979 | 1042 | 1106 | 1171 | 1236 | 1300 | 1364 |
| 50A | 1116 | 1216 | 1315 | 1414 | 1514 | 1612 | 1712 | 1811 | 1912 | 2011 | 2110 |

### · AL-31 for air (20˚C) <Pressure vessel structure standard>

(kg/h)

| Pressure MPa / Nominal size | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15A | 25 | 33 | 48 | 65 | 81 | 98 | 114 | 131 | 147 | 164 | 181 |
| 20A | 44 | 57 | 83 | 111 | 140 | 169 | 197 | 226 | 254 | 283 | 311 |
| 25A | 67 | 87 | 127 | 171 | 215 | 258 | 302 | 346 | 390 | 433 | 477 |
| 32A | 108 | 141 | 205 | 276 | 347 | 417 | 488 | 558 | 629 | 699 | 770 |
| 40A | 168 | 218 | 317 | 426 | 535 | 644 | 753 | 862 | 971 | 1080 | 1189 |
| 50A | 259 | 338 | 491 | 660 | 828 | 997 | 1166 | 1334 | 1503 | 1671 | 1840 |

### · AL-31H for air (20˚C)

(kg/h)

| Pressure MPa / Nominal size | 1.0 | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 | 2.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15A | 181 | 197 | 214 | 230 | 247 | 264 | 280 | 297 | 313 | 330 | 347 |
| 20A | 311 | 340 | 368 | 397 | 426 | 454 | 483 | 511 | 540 | 568 | 597 |
| 25A | 477 | 521 | 565 | 608 | 652 | 696 | 740 | 783 | 827 | 871 | 915 |
| 32A | 770 | 841 | 911 | 982 | 1052 | 1123 | 1193 | 1264 | 1335 | 1405 | 1476 |
| 40A | 1189 | 1298 | 1407 | 1516 | 1625 | 1734 | 1843 | 1952 | 2061 | 2170 | 2279 |
| 50A | 1840 | 2008 | 2177 | 2345 | 2514 | 2682 | 2851 | 3020 | 3188 | 3357 | 3525 |

### · AL-31 for water (accumulation: 25%) <Yoshitake standard>

($m^3$/h)

| Pressure MPa / Nominal size | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15A | 0.2 | 0.3 | 0.5 | 0.6 | 0.7 | 0.8 | 0.8 | 0.9 | 1.0 | 1.0 | 1.1 |
| 20A | 0.4 | 0.6 | 0.8 | 1.0 | 1.2 | 1.3 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 |
| 25A | 0.6 | 0.9 | 1.3 | 1.6 | 1.8 | 2.1 | 2.3 | 2.5 | 2.6 | 2.8 | 2.9 |
| 32A | 1.0 | 1.5 | 2.1 | 2.6 | 3.0 | 3.4 | 3.7 | 4.0 | 4.3 | 4.5 | 4.8 |
| 40A | 1.6 | 2.3 | 3.3 | 4.0 | 4.7 | 5.2 | 5.7 | 6.2 | 6.6 | 7.0 | 7.4 |
| 50A | 2.5 | 3.6 | 5.1 | 6.3 | 7.2 | 8.1 | 8.9 | 9.6 | 10.3 | 10.9 | 11.5 |

### · AL-31H for water (accumulation: 25%)

($m^3$/h)

| Pressure MPa / Nominal size | 1.0 | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 | 2.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15A | 1.1 | 1.1 | 1.2 | 1.2 | 1.3 | 1.3 | 1.4 | 1.4 | 1.5 | 1.5 | 1.6 |
| 20A | 1.9 | 2.0 | 2.1 | 2.2 | 2.3 | 2.3 | 2.4 | 2.5 | 2.6 | 2.6 | 2.7 |
| 25A | 2.9 | 3.1 | 3.2 | 3.4 | 3.5 | 3.6 | 3.7 | 3.9 | 4.0 | 4.1 | 4.2 |
| 32A | 4.8 | 5.0 | 5.2 | 5.5 | 5.7 | 5.9 | 6.1 | 6.2 | 6.4 | 6.6 | 6.8 |
| 40A | 7.4 | 7.8 | 8.1 | 8.4 | 8.8 | 9.1 | 9.4 | 9.7 | 9.9 | 10.0 | 10.5 |
| 50A | 11.5 | 12.0 | 12.6 | 13.1 | 13.6 | 14.1 | 14.5 | 15.0 | 15.4 | 15.8 | 16.3 |

· AL-31: 0.05-1.0 MPa AL-31H: 1.0-2.0 MPa

· Please refer to P.3-11 for the calculation procedure for nominal size selection.

# AL-4,4T

Full bore type | **Lift type** | Safety valve | Relief valve
Safety relief valve | Lever type | **Closed type** | Dash-pot structure
Handle type | **Stainless** | High pressure gas testing products
Diaphragm | Non-leakage

## ■Features

1. Safety valve, simple structure and easy maintenance.
2. Easy adjustment.
3. Fluororesin disc ensures reliable seating. (AL-4T)

## ■Specifications

**· AL-4**

| | | |
|---|---|---|
| Structure | | Open type |
| Application | | Steam |
| Working pressure | | 0.05-1.5 MPa *1 |
| Maximum temperature | | 220˚C |
| Material | Valve case | Ductile cast iron |
| | Spring case | Ductile cast iron |
| | Valve, valve seat | Stainless steel |
| Connection | | JIS 10K FF flanged<br>JIS 16K FF flanged *2 |

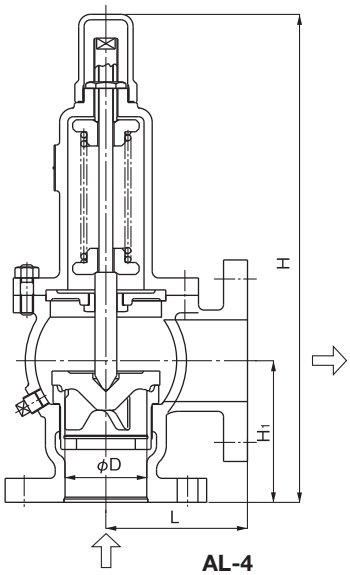
*1 Maximum working pressure for 150A type is 0.8 MPa (connection: JIS 10K FF flanged).
*2 JIS 16K FF flanged when working pressure is more than 1.0 MPa.
· Please refer to the chart in P.3-76 for set pressure range.

**· AL-4T**

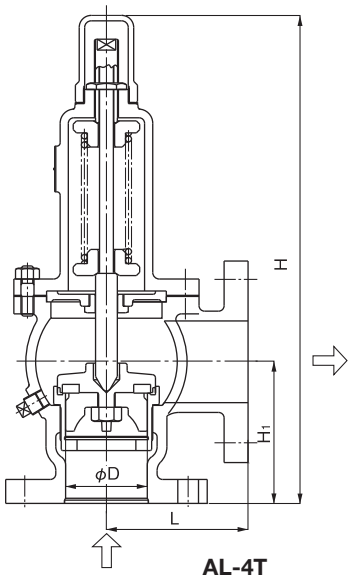
| Type | | Standard | With SUS trim parts |
|---|---|---|---|
| Structure | | Closed type | |
| Application | | Air, Cold and hot water, Oil, Other non-dangerous fluids | |
| Working pressure | | 0.05-1.0 MPa *1 | 0.05-1.5 MPa *1 *2 |
| Maximum temperature | | 150˚C | |
| Material | Valve case | Ductile cast iron | |
| | Spring case | Ductile cast iron | |
| | Valve, valve seat | Cast bronze<br>(PTFE disc incorporated) | Stainless steel<br>(PTFE disc incorporated) |
| Connection | | JIS 10K FF flanged | JIS 10K FF flanged<br>JIS 16K FF flanged *3 |

*1 Maximum working pressure for 150A is 0.8 MPa (connection: JIS 10K FF flanged).
*2 When working pressure is more than 1.2 MPa (for 65A and 80A) or 1.0 MPa (for 100A and 125A), a metal-to-metal seating is incorporated in.
*3 JIS 16K FF flanged is used when working pressure is more than 1.0 MPa.

## ■Dimensions and Weights




AL-4




AL-4T

**· AL-4 (JIS 10K)**

| Nominal size | Dimension (mm) | | | | Flow area πDℓ (mm²) | Weight (kg) |
|---|---|---|---|---|---|---|
| | L | $H_1$ | H | D | | |
| 65A | 120 | 120 | 432 | 65 | 331.9 | 20 |
| 80A | 130 | 130 | 447 | 75 | 441.8 | 22 |
| 100A | 160 | 150 | 595 | 100 | 785.4 | 44 |
| 125A | 200 | 205 | 779 | 125 | 1227.2 | 88 |
| 150A | 210 | 215 | 835 | 150 | 1767.2 | 113 |

**· AL-4T (JIS 10K)**

| Nominal size | Dimension (mm) | | | | Flow area πDℓ (mm²) | Weight (kg) |
|---|---|---|---|---|---|---|
| | L | $H_1$ | H | D | | |
| 65A | 120 | 120 | 434 | 65 | 331.9 | 20 |
| 80A | 130 | 130 | 449 | 75 | 441.8 | 22 |
| 100A | 160 | 150 | 597 | 100 | 785.4 | 44 |
| 125A | 200 | 205 | 781 | 125 | 1227.2 | 88 |
| 150A | 210 | 215 | 837 | 150 | 1767.2 | 113 |

**· AL-4 · AL-4T (JIS 16K)**

| Nominal size | Dimension (mm) | | | | Flow area πDℓ (mm²) |
|---|---|---|---|---|---|
| | L | $H_1$ | H | D | |
| 65A | 120 | 120 | 432 (434) | 65 | 331.9 |
| 80A | 132 | 130 | 449 (451) | 75 | 441.8 |
| 100A | 162 | 150 | 597 (599) | 100 | 785.4 |
| 125A | 202 | 205 | 781 (783) | 125 | 1227.2 |

· The above values in parentheses are the dimensions of the AL-4T.

## ■At the Time of Ordering

When ordering, please specify with or without lever and the material of the valve body and valve seat in addition to the set pressure.

# AL-4S,4ST

Full bore type | **Lift type** | Safety valve | Relief valve
**Safety relief valve** | Lever type | **Closed type** | Dash-pot structure
Handle type | Stainless | High pressure gas testing products
Diaphragm | Non-leakage

## ■Features

1. Safety relief valve, simple structure and easy maintenance.
2. Easy adjustment.
3. Fluororesin disc ensures reliable seating. (AL-4ST)

## ■Specifications

**· AL-4S**

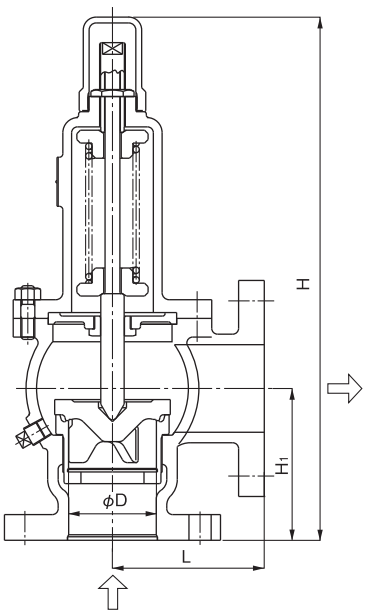
| | | |
|---|---|---|
| Structure | | Closed type |
| Application | | Steam |
| Working pressure | | 0.05-2.0 MPa |
| Maximum temperature | | 220℃ |
| Material | Valve case | Ductile cast iron |
| | Spring case | Ductile cast iron * |
| | Valve, valve seat | Stainless steel |
| Connection | | JIS 10K FF flanged<br>JIS 16K FF flanged<br>JIS 20K FF flanged |

* Available with stainless steel made.
· Please refer to the chart in P.3-76 for set pressure range.

**· AL-4ST**

| | | |
|---|---|---|
| Structure | | Closed type |
| Application | | Air, Water, Oil, Other non-dangerous fluids |
| Working pressure | | 0.05-2.0 MPa *1 |
| Maximum temperature | | 150℃ |
| Material | Valve case | Ductile cast iron *2 |
| | Spring case | |
| | Valve, valve seat | Stainless steel (PTFE disc incorporated) |
| Connection | | JIS 10K FF flanged<br>JIS 16K FF flanged<br>JIS 20K FF flanged |

*1 When working pressure is more than 1.2 MPa (for 65A and 80A) or 1.0 MPa (for 100A and 125A), a metal-to-metal seating is incorporated in.
*2 Available with stainless steel made.




The shape of AL-4ST is slightly different.

## ■Dimensions and Weights

**· AL-4S**

| Nominal size | Dimension (mm) | | | | Flow area πDℓ (mm²) |
|---|---|---|---|---|---|
| | L | $H_1$ | H | D | |
| 65A | 135 | 125 | 442 | 65 | 331.9 |
| 80A | 135 | 135 | 457 | 75 | 441.8 |
| 100A | 160 | 150 | 597 | 100 | 785.4 |

**· AL-4ST**

| Nominal size | Dimension (mm) | | | | Flow area πDℓ (mm²) |
|---|---|---|---|---|---|
| | L | $H_1$ | H | D | |
| 65A | 135 | 125 | 444 | 65 | 331.9 |
| 80A | 135 | 135 | 459 | 75 | 441.8 |
| 100A | 160 | 150 | 599 | 100 | 785.4 |

## ■Certified Capacity Table for AL-4

**· For steam (saturation temperature) <Pressure vessel structure standard>**

(kg/h)

| Pressure MPa / Nominal size | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 65A | 263 | 340 | 493 | 663 | 834 | 1000 | 1165 | 1328 | 1489 | 1651 | 1814 |
| 80A | 350 | 452 | 657 | 882 | 1111 | 1331 | 1550 | 1767 | 1983 | 2198 | 2415 |
| 100A | 622 | 804 | 1168 | 1569 | 1975 | 2367 | 2756 | 3142 | 3525 | 3908 | 4294 |
| 125A | 972 | 1257 | 1826 | 2451 | 3086 | 3699 | 4307 | 4910 | 5508 | 6107 | 6709 |
| 150A | 1400 | 1810 | 2629 | 3530 | 4445 | 5327 | 6203 | 7071 | 7932 | – | – |

(kg/h)

| Pressure MPa / Nominal size | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 |
|---|---|---|---|---|---|
| 65A | 1976 | 2138 | 2299 | 2461 | 2621 |
| 80A | 2631 | 2846 | 3060 | 3276 | 3489 |
| 100A | 4677 | 5059 | 5440 | 5825 | 6203 |
| 125A | 7309 | 7906 | 8500 | 9102 | 9692 |
| 150A | – | – | – | – | – |

## ■Certified Capacity Table for AL-4T

**· For air (20˚C) <Pressure vessel structure standard>**

(kg/h)

| Pressure MPa / Nominal size | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 65A | 422 | 550 | 799 | 1073 | 1347 | 1621 | 1895 | 2169 | 2443 | 2717 | 2991 |
| 80A | 562 | 732 | 1064 | 1428 | 1793 | 2158 | 2522 | 2887 | 3252 | 3616 | 3981 |
| 100A | 999 | 1302 | 1891 | 2540 | 3188 | 3836 | 4484 | 5133 | 5781 | 6429 | 7077 |
| 125A | 1562 | 2035 | 2955 | 3968 | 4981 | 5994 | 7007 | 8020 | 9033 | 10046 | 11059 |
| 150A | 2249 | 2930 | 4256 | 5715 | 7173 | 8632 | 10091 | 11549 | 13008 | – | – |

(kg/h)

| Pressure MPa / Nominal size | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 |
|---|---|---|---|---|---|
| 65A | 3264 | 3538 | 3812 | 4086 | 4360 |
| 80A | 4346 | 4710 | 5075 | 5440 | 5804 |
| 100A | 7726 | 8374 | 9022 | 9671 | 10319 |
| 125A | 12072 | 13085 | 14098 | 15111 | 16124 |
| 150A | – | – | – | – | – |

**· For water (accumulation: 25%) <Yoshitake standard>**

($m^3$/h)

| Pressure MPa / Nominal size | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 65A | 4.1 | 5.9 | 8.3 | 10.2 | 11.8 | 13.2 | 14.5 | 15.6 | 16.7 | 17.7 | 18.7 |
| 80A | 5.5 | 7.8 | 11.1 | 13.6 | 15.7 | 17.6 | 19.3 | 20.8 | 22.3 | 23.6 | 24.9 |
| 100A | 9.9 | 14.0 | 19.8 | 24.2 | 28.0 | 31.3 | 34.3 | 37.0 | 39.6 | 42.0 | 44.3 |
| 125A | 15.4 | 21.9 | 30.9 | 37.9 | 43.8 | 48.9 | 53.6 | 57.9 | 61.9 | 65.7 | 69.2 |
| 150A | 22.3 | 31.5 | 44.6 | 54.6 | 63.0 | 70.5 | 77.2 | 83.4 | 89.2 | – | – |

($m^3$/h)

| Pressure MPa / Nominal size | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 |
|---|---|---|---|---|---|
| 65A | 19.6 | 20.5 | 21.3 | 22.1 | 22.9 |
| 80A | 26.1 | 27.3 | 28.4 | 29.5 | 30.5 |
| 100A | 46.4 | 48.5 | 50.5 | 52.4 | 54.2 |
| 125A | 72.6 | 75.8 | 78.9 | 81.9 | 84.8 |
| 150A | – | – | – | – | – |

· Please refer to P.3-11 for the calculation procedure for nominal size selection.

## ■Certified Capacity Table for AL-4S

**· For steam (saturation temperature) <Pressure vessel structure standard>**

(kg/h)

| Pressure MPa / Nominal size | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 65A | 263 | 340 | 493 | 663 | 834 | 1000 | 1165 | 1328 | 1489 | 1651 | 1814 |
| 80A | 350 | 452 | 657 | 882 | 1111 | 1331 | 1550 | 1767 | 1983 | 2198 | 2415 |
| 100A | 622 | 804 | 1168 | 1569 | 1975 | 2367 | 2756 | 3142 | 3525 | 3908 | 4294 |

(kg/h)

| Pressure MPa / Nominal size | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 | 2.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| 65A | 1976 | 2138 | 2299 | 2461 | 2621 | 2783 | 2944 | 3108 | 3269 | 3430 |
| 80A | 2631 | 2846 | 3060 | 3276 | 3489 | 3704 | 3919 | 4138 | 4352 | 4566 |
| 100A | 4677 | 5059 | 5440 | 5825 | 6203 | 6586 | 6968 | 7357 | 7737 | 8118 |

## ■Certified Capacity Table for AL-4ST

**· For air (20˚C) <Pressure vessel structure standard>**

(kg/h)

| Pressure MPa / Nominal size | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 65A | 422 | 550 | 799 | 1073 | 1347 | 1621 | 1895 | 2169 | 2443 | 2717 | 2991 |
| 80A | 562 | 732 | 1064 | 1428 | 1793 | 2158 | 2522 | 2887 | 3252 | 3616 | 3981 |
| 100A | 999 | 1302 | 1891 | 2540 | 3188 | 3836 | 4484 | 5133 | 5781 | 6429 | 7077 |

(kg/h)

| Pressure MPa / Nominal size | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 | 2.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| 65A | 3264 | 3538 | 3812 | 4086 | 4360 | 4364 | 4908 | 5182 | 5456 | 5730 |
| 80A | 4346 | 4710 | 5075 | 5440 | 5804 | 6169 | 6534 | 6898 | 7263 | 7628 |
| 100A | 7726 | 8374 | 9022 | 9671 | 10319 | 10967 | 11615 | 12264 | 12912 | 13560 |

**· For water (accumulation: 25%) <Yoshitake standard>**

($m^3$/h)

| Pressure MPa / Nominal size | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 65A | 4.1 | 5.9 | 8.3 | 10.2 | 11.8 | 13.2 | 14.5 | 15.6 | 16.7 | 17.7 | 18.7 |
| 80A | 5.5 | 7.8 | 11.1 | 13.6 | 15.7 | 17.6 | 19.3 | 20.8 | 22.3 | 23.6 | 24.9 |
| 100A | 9.9 | 14.0 | 19.8 | 24.2 | 28.0 | 31.3 | 34.3 | 37.0 | 39.6 | 42.0 | 44.3 |

($m^3$/h)

| Pressure MPa / Nominal size | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 | 2.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| 65A | 19.6 | 20.5 | 21.3 | 22.1 | 22.9 | 23.6 | 24.4 | 25.1 | 25.8 | 26.4 |
| 80A | 26.1 | 27.3 | 28.4 | 29.5 | 30.5 | 31.5 | 32.5 | 33.4 | 34.3 | 35.2 |
| 100A | 46.4 | 48.5 | 50.5 | 52.4 | 54.2 | 56.0 | 57.8 | 59.4 | 61.1 | 62.6 |

· Please refer to P.3-11 for the calculation procedure for nominal size selection.

# AL-5

Full bore type | **Lift type** | **Safety valve** | Relief valve
Safety relief valve | **Lever type** | Closed type | Dash-pot structure
Handle type | Stainless | High pressure gas testing products
Diaphragm | Non-leakage



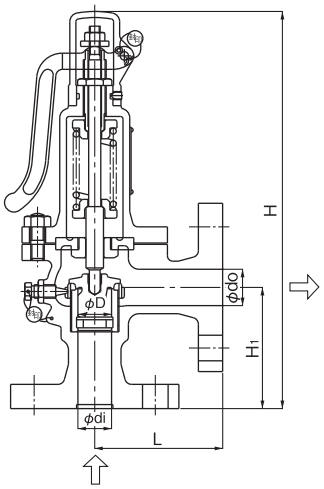
## ■Features

1. Due to lift lever mechanism a discharge inspection can be manually performed at more than 75% of the opening pressure.

## ■Specifications

| | | | |
|---|---|---|---|
| Structure | | Open type with a lever | |
| Application | | Steam | |
| Working pressure | | 0.05-1.0 MPa | 0.05-1.5 MPa |
| Maximum temperature | | 220℃ | |
| Material | Valve case | Ductile cast iron | |
| | Spring case | Ductile cast iron | |
| | Valve, valve seat | Bronze | Stainless steel |
| Connection | | JIS 10K FF flanged | JIS 10K FF flanged<br>JIS 16K FF flanged * |

* JIS 16K FF flanged when working pressure is more than 1.0 MPa.
· Please refer to the chart in P.3-76 for set pressure range.




## ■Dimensions

| Nominal size | Dimension (mm) | | | | Flow area πDℓ (mm²) |
|---|---|---|---|---|---|
| | L | $H_1$ | H | D | |
| 20A | 90 | 75 | 276 | 21 | 34.6 |
| 25A | 95 | 90 | 295 | 25 | 49.1 |
| 32A | 100 | 95 | 331 | 35 | 96.2 |
| 40A | 110 | 105 | 347 | 40 | 125.6 |
| 50A | 115 | 110 | 388 | 50 | 196.4 |

## ■Certified Capacity Table

**· For steam (saturation temperature) <Pressure vessel structure standard>**

(kg/h)

| Pressure MPa / Nominal size | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20A | 27 | 35 | 51 | 69 | 87 | 104 | 121 | 138 | 155 | 172 | 189 | 206 | 222 | 239 | 256 | 273 |
| 25A | 38 | 50 | 73 | 98 | 123 | 148 | 172 | 196 | 220 | 244 | 268 | 292 | 316 | 340 | 364 | 387 |
| 32A | 76 | 98 | 143 | 192 | 241 | 290 | 337 | 384 | 431 | 478 | 525 | 572 | 619 | 666 | 713 | 759 |
| 40A | 99 | 128 | 186 | 250 | 315 | 378 | 440 | 502 | 563 | 625 | 686 | 748 | 809 | 870 | 931 | 991 |
| 50A | 155 | 201 | 292 | 392 | 494 | 592 | 689 | 785 | 881 | 977 | 1073 | 1169 | 1265 | 1360 | 1456 | 1551 |

**<Boiler structure standard>**

(kg/h)

| Pressure MPa / Nominal size | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20A | 26 | 34 | 50 | 66 | 83 | 98 | 114 | 130 | 146 | 162 | 178 | 194 | 209 | 225 | 241 | 257 |
| 25A | 37 | 49 | 71 | 94 | 117 | 140 | 163 | 185 | 208 | 230 | 253 | 275 | 297 | 320 | 342 | 365 |
| 32A | 74 | 96 | 140 | 185 | 230 | 274 | 319 | 363 | 407 | 451 | 495 | 539 | 583 | 627 | 671 | 715 |
| 40A | 96 | 125 | 183 | 242 | 301 | 358 | 416 | 474 | 532 | 589 | 647 | 704 | 762 | 819 | 876 | 934 |
| 50A | 151 | 196 | 287 | 378 | 471 | 560 | 652 | 742 | 832 | 921 | 1012 | 1102 | 1191 | 1280 | 1371 | 1461 |

· Please refer to P.3-11 for the calculation procedure for nominal size selection.

## ■At the Time of Ordering

When ordering, please specify with or without lever and the material of the valve body and valve seat in addition to the set pressure.

# AL-6

Full bore type | Lift type | Safety valve | Relief valve
Safety relief valve | Lever type | Closed type | Dash-pot structure
Handle type | Stainless | High pressure gas testing products
Diaphragm | Non-leakage

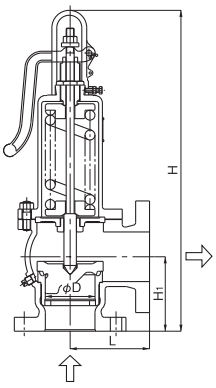
## ■Features

1. Lift safety valve, designed in compliance with JIS B 8210 "Spring loaded safety valves for steam boilers and pressure vessels".
2. Due to lift lever mechanism a discharge inspection can be manually performed at more than 75% of the opening pressure.

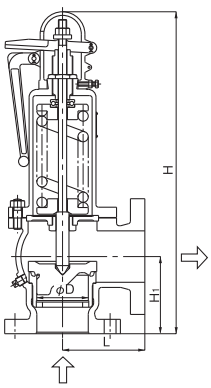
## ■Specifications

| | | |
|---|---|---|
| Structure | | Open type with a lever |
| Application | | Steam |
| Working pressure | | 0.05-1.5 MPa *1 |
| Maximum temperature | | 220°C |
| Material | Valve case | Ductile cast iron |
| | Spring case | Ductile cast iron |
| | Valve, valve seat | Cast stainless steel |
| Connection | | JIS 10K FF flanged<br>JIS 16K FF flanged *2 |

*1 Maximum working pressure for 150A is 0.8 MPa.
*2 JIS 16K FF flanged when working pressure is more than 1.0 MPa.
· Please refer to the chart in P.3-76 for set pressure range.




65A·80A




100A-150A

## ■Dimensions and Weights

| Nominal size | Dimension (mm) | | | | Flow area | Weight (kg) |
|---|---|---|---|---|---|---|
| | L | $H_1$ | H | D | $\pi D\ell$ ($mm^2$) | |
| 65A | 120 | 120 | 479 | 65 | 331.9 | 20.2 |
| 80A | 130 | 130 (132) | 493 (495) | 75 | 441.8 | 24.0 |
| 100A | 160 | 150 (152) | 626 (628) | 100 | 785.4 | 44.0 |
| 125A | 200 | 205 (207) | 835 (837) | 125 | 1227.2 | 88.0 |
| 150A | 210 | 215 (217) | 845 (847) | 150 | 1767.2 | 113.0 |

· The values in parentheses are the dimensions of JIS 16K FF flanged.

## ■Certified Capacity Table

**· For steam (saturation temperature) <Pressure vessel structure standard>**

(kg/h)

| Pressure MPa / Nominal size | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 65A | 263 | 340 | 493 | 663 | 834 | 1000 | 1165 | 1328 | 1489 | 1651 | 1814 | 1976 | 2138 | 2299 | 2461 | 2621 |
| 80A | 350 | 452 | 657 | 882 | 1111 | 1331 | 1550 | 1767 | 1983 | 2198 | 2415 | 2631 | 2846 | 3060 | 3276 | 3489 |
| 100A | 622 | 804 | 1168 | 1569 | 1975 | 2367 | 2756 | 3142 | 3525 | 3908 | 4294 | 4677 | 5059 | 5440 | 5825 | 6203 |
| 125A | 972 | 1257 | 1826 | 2451 | 3086 | 3699 | 4307 | 4910 | 5508 | 6107 | 6709 | 7309 | 7906 | 8500 | 9102 | 9692 |
| 150A | 1400 | 1810 | 2629 | 3530 | 4445 | 5327 | 6203 | 7071 | 7932 | 8794 | 9661 | 10525 | 11385 | 12241 | 13107 | 13957 |

**<Boiler structure standard>**

(kg/h)

| Pressure MPa / Nominal size | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 65A | 255 | 332 | 486 | 640 | 796 | 947 | 1101 | 1254 | 1407 | 1557 | 1710 | 1862 | 2013 | 2164 | 2317 | 2469 |
| 80A | 339 | 442 | 647 | 851 | 1059 | 1261 | 1466 | 1670 | 1873 | 2073 | 2276 | 2479 | 2680 | 2881 | 3084 | 3286 |
| 100A | 604 | 786 | 1150 | 1514 | 1884 | 2242 | 2607 | 2968 | 3330 | 3686 | 4047 | 4407 | 4765 | 5122 | 5483 | 5843 |
| 125A | 944 | 1228 | 1797 | 2366 | 2944 | 3504 | 4074 | 4638 | 5204 | 5760 | 6324 | 6886 | 7446 | 8003 | 8567 | 9129 |
| 150A | 1359 | 1769 | 2588 | 3407 | 4239 | 5046 | 5866 | 6680 | 7494 | 8295 | 9107 | 9917 | 10723 | 11525 | 12337 | 13147 |

· Please refer to P.3-11 for the calculation procedure for nominal size selection.

# AF-5,5S

Full bore type | Lift type | Safety valve | Relief valve
Safety relief valve | Lever type | Closed type | Dash-pot structure
Handle type | Stainless | High pressure gas testing products
Diaphragm | Non-leakage

AF-5

AF-5S

## ■Features

1. Full bore safety valve with increased safety. Compact and lightweight (about half size of the conventional full bore type safety valve).
2. Popping structure ensures reliable discharge.
3. A material of excellent quality is used for the trim parts. High performance is maintained by precision processing and heat treatment.
4. Corrosion-free due to corrosion-resistant material (the AF-5S is all stainless made, offering high corrosion resistance and durability).
5. Due to lift lever mechanism a discharge inspection can be manually performed at more than 75% of the opening pressure.

## ■Specifications

| Model | | AF-5 | | AF-5S |
|---|---|---|---|---|
| Structure | | Open type with a lever | | |
| Application | | Steam | Air, Other non-dangerous fluids | Steam, Air, Other non-dangerous fluids |
| Working pressure | | 0.1-1.6 MPa | 0.1-1.0 MPa | 0.1-1.0 MPa |
| Maximum temperature | | 220°C | | |
| Material | Spring case | Cast bronze | | Cast stainless steel |
| | Valve, valve seat | Stainless steel | | |
| Connection | | Inlet: JIS R screwed<br>Outlet: JIS Rc screwed | | |

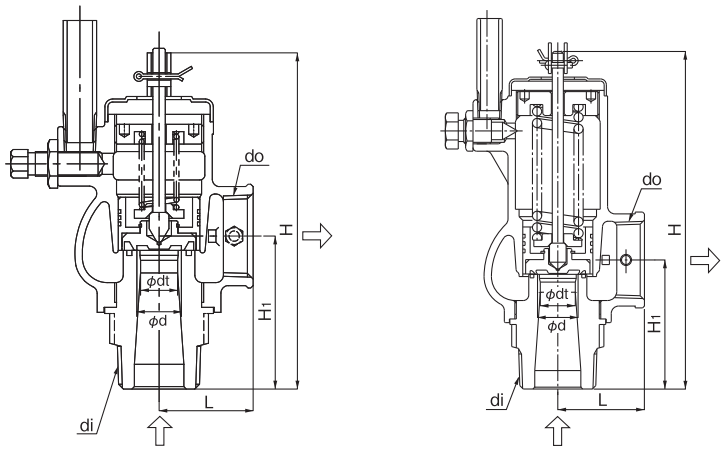
## ■Dimensions and Weights

| Nominal size | Inlet diameter x Throat diameter x Outlet diameter<br>di x dt x do | Flow area<br>$\frac{\pi}{4}dt^2$ (mm²) | Lift<br>R (mm) | Dimension(mm)<br>L | <br>$H_1$ | <br>H | Plug | Weight<br>(kg) |
|---|---|---|---|---|---|---|---|---|
| 20A | R 1 x 15 x Rc 1 | 176.6 | 3.3 | 38 (40) | 61 ( 62) | 136 (163) | R 1/8 | 1.24 (1.65) |
| 25A | R 1-1/4 x 19 x Rc 1-1/4 | 283.3 | 4.4 | 45 (47) | 70 ( 70) | 157 (190) | R 1/8 | 1.88 (2.35) |
| 32A | R 1-1/2 x 24 x Rc 1-1/2 | 452.1 | 5.5 | 52 (52) | 80 ( 79) | 183 (208) | R 1/8 | 2.62 (2.90) |
| 40A | R 2 x 30 x Rc 2 | 706.5 | 6.8 | 65 (65) | 98 ( 98) | 216 (248) | R 1/4 | 5.10 (5.30) |
| 50A | R 2-1/2 x 38 x Rc 2-1/2 | 1133.5 | 8.7 | 77 (77) | 121 (121) | 262 (315) | R 1/4 | 8.40 (9.20) |

· The nominal size and the connection size are different.
· The values in parentheses are the dimensions and weights of the AF-5S.

## ■At the Time of Ordering

When ordering, please inform set pressure and application. (If the application is steam, please also specify Pressure vessel structure standard or Boiler structure standard.)




AF-5　　AF-5S

## ■Certified Capacity Table

**· For steam (saturation temperature)　<Pressure vessel structure standard>**

(kg/h)

| Pressure MPa / Nominal size | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20A | 159 | 231 | 310 | 390 | 468 | 545 | 621 | 697 | 773 | 849 | 925 | 1001 | 1076 | 1152 | 1227 | 1303 |
| 25A | 255 | 370 | 498 | 627 | 751 | 875 | 997 | 1118 | 1240 | 1362 | 1484 | 1606 | 1726 | 1849 | 1968 | 2090 |
| 32A | 407 | 591 | 794 | 1000 | 1199 | 1396 | 1591 | 1785 | 1979 | 2175 | 2369 | 2562 | 2755 | 2950 | 3142 | 3336 |
| 40A | 636 | 925 | 1242 | 1563 | 1874 | 2182 | 2487 | 2790 | 3093 | 3398 | 3702 | 4005 | 4306 | 4611 | 4910 | 5213 |
| 50A | 1021 | 1484 | 1992 | 2508 | 3007 | 3501 | 3991 | 4477 | 4963 | 5453 | 5940 | 6425 | 6909 | 7398 | 7877 | 8364 |

· AF-5: 0.1 MPa to 1.6 MPa　AF-5S: 0.1 MPa to 1.0 MPa

**<Boiler structure standard>**

(kg/h)

| Pressure MPa / Nominal size | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20A | 155 | 227 | 299 | 372 | 443 | 515 | 587 | 659 | 729 | 800 | 872 | 942 | 1013 | 1084 | 1156 | 1227 |
| 25A | 249 | 365 | 480 | 598 | 711 | 827 | 942 | 1057 | 1170 | 1284 | 1398 | 1512 | 1625 | 1740 | 1854 | 1968 |
| 32A | 398 | 582 | 767 | 954 | 1136 | 1320 | 1503 | 1687 | 1867 | 2050 | 2232 | 2413 | 2594 | 2777 | 2959 | 3141 |
| 40A | 622 | 910 | 1198 | 1491 | 1775 | 2063 | 2350 | 2636 | 2918 | 3204 | 3488 | 3772 | 4054 | 4340 | 4625 | 4909 |
| 50A | 998 | 1461 | 1923 | 2393 | 2848 | 3311 | 3770 | 4229 | 4681 | 5140 | 5597 | 6052 | 6505 | 6963 | 7420 | 7876 |

**· For air (20˚C)　<Pressure vessel structure standard>**

(kg/h)

| Pressure MPa / Nominal size | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| 20A | 257 | 374 | 502 | 630 | 759 | 887 | 1015 | 1143 | 1272 | 1400 |
| 25A | 413 | 600 | 806 | 1011 | 1217 | 1423 | 1629 | 1835 | 2040 | 2246 |
| 32A | 659 | 958 | 1286 | 1614 | 1943 | 2271 | 2600 | 2928 | 3256 | 3585 |
| 40A | 1030 | 1497 | 2010 | 2523 | 3036 | 3550 | 4063 | 4576 | 5089 | 5602 |
| 50A | 1654 | 2402 | 3225 | 4049 | 4872 | 5695 | 6518 | 7342 | 8165 | 8988 |

· Please refer to P.3-11 for the calculation procedure for nominal size selection.

# AF-4,4M

Full bore type | Lift type | Safety valve | Relief valve
Safety relief valve | Lever type | Closed type | Dash-pot structure
Handle type | Stainless | High pressure gas testing products
Diaphragm | Non-leakage

AF-4

AF-4M

## ■Features

1. Lift safety valve, designed in compliance with JIS B 8210 "Spring loaded safety valves for steam boilers and pressure vessels".
2. Larger discharge capacity than lift type.
3. Due to lift lever mechanism a discharge inspection can be manually performed at more than 75% of the opening pressure (AF-4).
4. Blowdown pressure can be adjusted with a back pressure throttle valve.
5. A material of excellent quality is used for the trim parts. High performance is maintained by precision processing and heat treatment.

## ■Specifications

| | | |
|---|---|---|
| Structure | | Open type |
| Application | | Steam, Air, Other non-dangerous fluids |
| Working pressure | | 0.1-1.0 MPa |
| Maximum temperature | | 220℃ |
| Material | Valve case | Ductile cast iron |
| | Spring case | Ductile cast iron |
| | Valve, valve seat | Stainless steel |
| Connection | | JIS 10K FF flanged<br>JIS 10K RF flanged * |

* JIS 10K RF flanged when nominal size is more than 100A.

## ■Dimensions and Weights

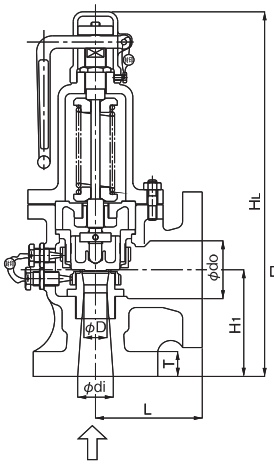
| Nominal size | Inlet diameter x Throat diameter x Outlet diameter | Flow area $\frac{\pi}{4}dt^2$ (mm²) | LiftR (mm) | Dimension (mm) | | | | Flange | | | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | $H_1$ | $H_L$ | $H_X$ | Inlet | T (mm) | Outlet | |
| 25A | 25 x 16 x 40 | 200.9 | 3.7 | 100 | 100 | 356 | 335 | 25A | 26 | 40A | 12 |
| 40A | 40 x 26 x 65 | 530.6 | 6.0 | 120 | 120 | 410 | 408 | 40A | 28 | 65A | 21 |
| 50A | 50 x 30 x 75 | 706.5 | 6.8 | 130 | 130 | 458 | 453 | 50A | 30 | 80A | 27 |
| 65A | 65 x 40 x 100 | 1256.0 | 9.0 | 150 | 150 | 514 | 537 | 65A | 32 | 100A | 41 |
| 80A | 80 x 49 x 125 | 1884.7 | 11.1 | 165 | 160 | 677 | 648 | 80A | 32 | 125A | 41 |
| 100A | 100 x 76 x 150 | 4534.1 | 16.8 | 215 | 200 | 799 | 779 | 100A | 32 | 150A | 115 |
| 125A | 125 x 84 x 200 | 5538.9 | 19.1 | 220 | 210 | 858 | 835 | 125A | 36 | 200A | 135 |
| 150A | 150 x 100 x 200 | 7850.0 | 22.7 | 250 | 230 | 1006 | 966 | 150A | 38 | 200A | 203 |

· The connection flange standard is JIS B 2239 10K FF.

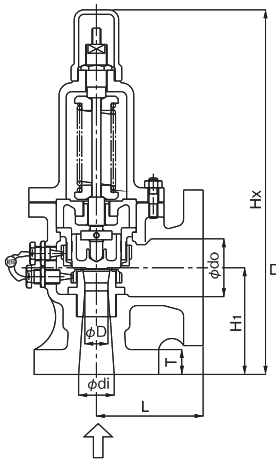
## ■At the Time of Ordering

When ordering, please inform set pressure and application. (If the application is steam, please also specify Pressure vessel structure standard or Boiler structure standard.)

<Inlet: JIS 10K FF flanged>



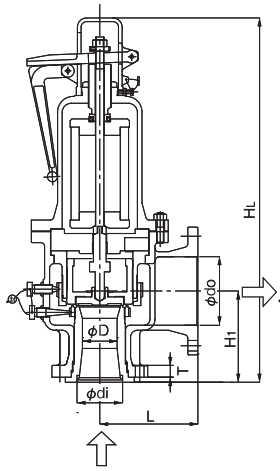

AF-4 (open type with a lever)



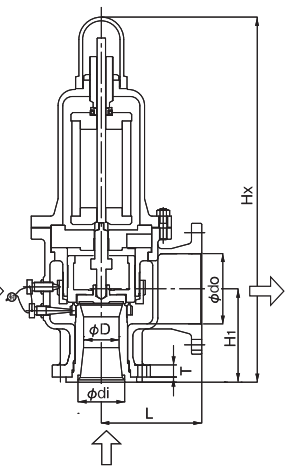

AF-4M (open type without a lever)

25A-80A

<Inlet: JIS 10K RF flanged>




AF-4 (open type with a lever)




AF-4M (open type without a lever)

100A-150A

## ■Certified Capacity Table

**· For steam (saturation temperature) <Pressure vessel structure standard>**

(kg/h)

| Nominal size \ Pressure MPa | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| 25A | 181 | 263 | 353 | 444 | 532 | 620 | 707 | 793 | 879 | 966 |
| 40A | 478 | 694 | 932 | 1174 | 1407 | 1638 | 1868 | 2095 | 2323 | 2552 |
| 50A | 636 | 925 | 1242 | 1563 | 1874 | 2182 | 2487 | 2790 | 3093 | 3398 |
| 65A | 1132 | 1644 | 2208 | 2780 | 3332 | 3879 | 4422 | 4960 | 5500 | 6042 |
| 80A | 1699 | 2467 | 3313 | 4171 | 4999 | 5821 | 6636 | 7444 | 8253 | 9067 |
| 100A | 4087 | 5937 | 7971 | 10036 | 12028 | 14004 | 15964 | 17908 | 19855 | 21813 |
| 125A | 4993 | 7252 | 9738 | 12260 | 14694 | 17108 | 19502 | 21877 | 24256 | 26647 |
| 150A | 7076 | 10279 | 13801 | 17375 | 20825 | 24246 | 27640 | 31005 | 34377 | 37766 |

**<Boiler structure standard>**

(kg/h)

| Nominal size \ Pressure MPa | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| 25A | 177 | 258 | 340 | 424 | 504 | 586 | 668 | 749 | 829 | 911 |
| 40A | 467 | 683 | 900 | 1120 | 1333 | 1550 | 1764 | 1980 | 2191 | 2406 |
| 50A | 622 | 910 | 1198 | 1491 | 1775 | 2063 | 2350 | 2636 | 2918 | 3204 |
| 65A | 1106 | 1619 | 2131 | 2651 | 3156 | 3669 | 4177 | 4687 | 5187 | 5696 |
| 80A | 1660 | 2429 | 3198 | 3978 | 4735 | 5505 | 6269 | 7033 | 7784 | 8547 |
| 100A | 3995 | 5844 | 7694 | 9572 | 11393 | 13245 | 15081 | 16920 | 18728 | 20563 |
| 125A | 4880 | 7139 | 9399 | 11693 | 13918 | 16180 | 18424 | 20670 | 22878 | 25120 |
| 150A | 6916 | 10118 | 13321 | 16572 | 19725 | 22931 | 26111 | 29294 | 32424 | 35601 |

**· For air (20˚C) <Pressure vessel structure standard>**

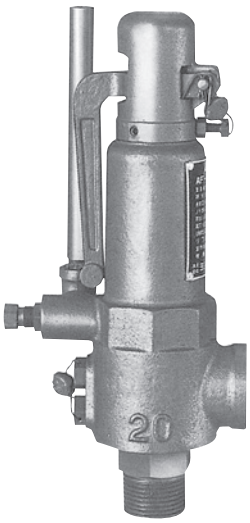
(kg/h)

| Nominal size \ Pressure MPa | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| 25A | 293 | 425 | 571 | 717 | 863 | 1009 | 1155 | 1301 | 1447 | 1593 |
| 40A | 774 | 1124 | 1510 | 1895 | 2280 | 2666 | 3051 | 3436 | 3822 | 4207 |
| 50A | 1030 | 1497 | 2010 | 2523 | 3036 | 3550 | 4063 | 4576 | 5089 | 5602 |
| 65A | 1832 | 2662 | 3574 | 4486 | 5398 | 6311 | 7223 | 8135 | 9047 | 9960 |
| 80A | 2750 | 3994 | 5363 | 6732 | 8101 | 9470 | 10839 | 12207 | 13576 | 14945 |
| 100A | 6616 | 9610 | 12903 | 16196 | 19489 | 22782 | 26076 | 29369 | 32662 | 35955 |
| 125A | 8082 | 11739 | 15762 | 19785 | 23808 | 27831 | 31854 | 35877 | 39900 | 43923 |
| 150A | 11454 | 16638 | 22339 | 28041 | 33742 | 39444 | 45146 | 50847 | 56549 | 62250 |

· Please refer to P.3-11 for the calculation procedure for nominal size selection.

# AF-1

Full bore type | Lift type | Safety valve | Relief valve
Safety relief valve | Lever type | Closed type | Dash-pot structure
Handle type | Stainless | High pressure gas testing products
Diaphragm | Non-leakage



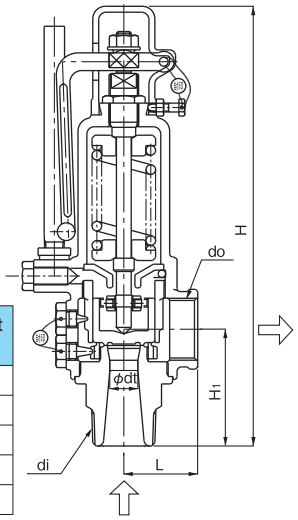
## ■Features

1. Larger discharge capacity than lift type.
2. Due to lift lever mechanism a discharge inspection can be manually performed at more than 75% of the opening pressure.

## ■Specifications

| | | |
|---|---|---|
| Structure | | Open type with a lever |
| Application | | Steam |
| Working pressure | | 0.18-1.6 MPa |
| Maximum temperature | | 220℃ |
| Material | Valve case | Ductile cast iron (FCD450) |
| | Valve, Valve seat | Stainlesssteel |
| Connection | | Inlet: JIS R screwed Outlet: JIS Rp screwed |

* Rp is a parallel screw applicable to taper pipe thread.




## ■Dimensions and Weights

| Nominal size | Inlet diameter x Throat diameter x Outlet diameter di x dt x do | Flow area $\frac{\pi}{4}dt^2$ (mm²) | Lift ℓ (mm) | Dimensions (mm) | | | | Weight (kg) |
|---|---|---|---|---|---|---|---|---|
| | | | | Seat diameter | L | H1 | H | |
| 20A | R 1 x 15 x Rp 1 | 176.6 | 3.3 | 19 | 47 | 67 | 258 | 3.0 |
| 25A | R 1-1/4 x 19 x Rp 1-1/4 | 283.3 | 4.4 | 23 | 50 | 79 | 297 | 4.2 |
| 32A | R 1-1/2 x 26 x Rp 1-1/2 | 530.6 | 6.0 | 31 | 62 | 92 | 362 | 7.2 |
| 40A | R 2 x 30 x Rp 2 | 706.5 | 6.8 | 37 | 70 | 108 | 408 | 10.5 |
| 50A | R 2-1/2 x 38 x Rp 2-1/2 | 1133.5 | 8.7 | 46 | 89 | 123 | 466 | 18.5 |

* The nominal size and the connection size are different.

## ■Certified Capacity Table

**· For steam (saturation temperature) <Pressure vessel structure standard>**

(kg/h)

| Nominal size \ Pressure MPa | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20A | 231 | 310 | 390 | 468 | 545 | 621 | 697 | 773 | 849 | 925 | 1001 | 1076 | 1152 | 1227 | 1303 |
| 25A | 370 | 498 | 627 | 751 | 875 | 997 | 1118 | 1240 | 1362 | 1484 | 1606 | 1726 | 1849 | 1968 | 2090 |
| 32A | 694 | 932 | 1174 | 1407 | 1638 | 1868 | 2095 | 2323 | 2552 | 2780 | 3008 | 3234 | 3463 | 3687 | 3915 |
| 40A | 925 | 1242 | 1563 | 1874 | 2182 | 2487 | 2790 | 3093 | 3398 | 3702 | 4005 | 4306 | 4611 | 4910 | 5213 |
| 50A | 1484 | 1992 | 2508 | 3007 | 3501 | 3991 | 4477 | 4963 | 5453 | 5940 | 6425 | 6909 | 7398 | 7877 | 8364 |

**<Boiler structure standard>**

(kg/h)

| Nominal size \ Pressure MPa | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20A | 227 | 299 | 372 | 443 | 515 | 587 | 659 | 729 | 800 | 872 | 942 | 1013 | 1084 | 1156 | 1227 |
| 25A | 365 | 480 | 598 | 711 | 827 | 942 | 1057 | 1170 | 1284 | 1398 | 1512 | 1625 | 1740 | 1854 | 1968 |
| 32A | 683 | 900 | 1120 | 1333 | 1550 | 1764 | 1980 | 2191 | 2406 | 2620 | 2833 | 3045 | 3259 | 3473 | 3687 |
| 40A | 910 | 1198 | 1491 | 1775 | 2063 | 2350 | 2636 | 2918 | 3204 | 3488 | 3772 | 4054 | 4340 | 4625 | 4909 |
| 50A | 1461 | 1923 | 2393 | 2848 | 3311 | 3770 | 4229 | 4681 | 5140 | 5597 | 6052 | 6505 | 6963 | 7420 | 7876 |

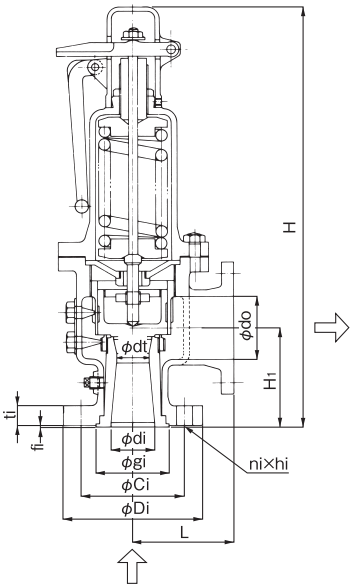
*Please refer to P.3-11 for the calculation procedure of nominal size selection.

# AF-2

Full bore type | Lift type | Safety valve | Relief valve
Safety relief valve | Lever type | Closed type | Dash-pot structure
Handle type | Stainless | High pressure gas testing products
Diaphragm | Non-leakage

## ■Features

1. Lift safety valve, designed in compliance with JIS B 8210 "Spring loaded safety valves for steam boilers and pressure vessels".
2. Larger discharge capacity than lift type.
3. Due to lift lever mechanism a discharge inspection can be manually performed at more than 75% of the opening pressure.
4. Blowdown pressure can be adjusted with a back pressure throttle valve.
5. A material of excellent quality is used for the trim parts. High performance is maintained by precision processing and heat treatment.




## ■Specifications

| | | |
|---|---|---|
| Structure | | Open type with a lever |
| Application | | Steam |
| Working pressure | | 0.18-1.6 MPa |
| Maximum temperature | | 220℃ |
| Material | Valve case | Ductile cast iron |
| | Spring case | Ductile cast iron |
| | Valve, valve seat | Stainless steel |
| Connection | | Inlet: JIS B 8210 10K RF flanged *<br>Outlet: JIS B 2239 10K FF flanged |

* JIS B 8210 20K RF flanged when working pressure is more than 1.0 MPa.

## ■Dimensions and Weights

| Nominal size | Inlet diameter x Throat diameter x Outlet diameter<br>di x dt x do | Flow area<br>$\frac{\pi}{4}dt^2$ (mm²) | Lift<br>ℓ (mm) | Dimension (mm) | | | Connection (mm) | | | | | | Outlet | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | $H_1$ | H | Inlet: JIS B 8210 10K | | | | | | | |
| | | | | | | | Di | Ci | gi | ti | fi | ni x hi | | |
| 65A | 65 x 49 x 90 | 1884.7 | 11.1 | 150 | 142 | 630 | 200 | 160 | 105 | 30 | 2 | 8 x 23 | 100A | 50.0 |
| 80A | 75 x 57 x 100 | 2550.7 | 13.0 | 165 | 160 | 682 | 210 | 170 | 125 | 32 | 2 | 8 x 23 | | 62.3 |

## ■Certified Capacity Table

**· For steam (saturation temperature) <Pressure vessel structure standard>**

(kg/h)

| Nominal size \ Pressure MPa | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 65A | 2467 | 3313 | 4171 | 4999 | 5821 | 6636 | 7444 | 8253 | 9067 | 9877 | 10684 | 11488 | 12300 | 13098 | 13907 |
| 80A | 3339 | 4484 | 5645 | 6766 | 7878 | 8981 | 10074 | 11170 | 12271 | 13368 | 14460 | 15547 | 16647 | 17727 | 18821 |

**<Boiler structure standard>**

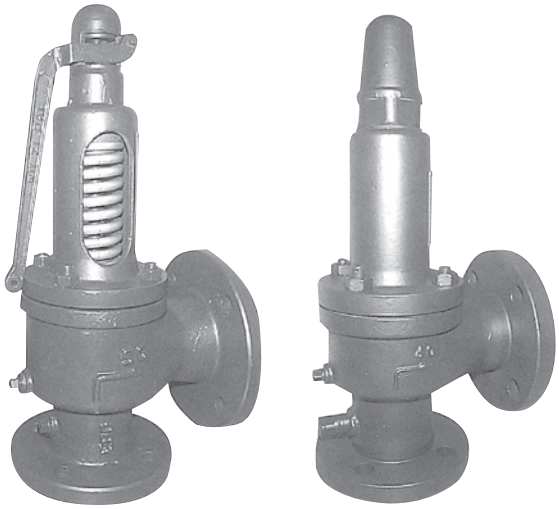
(kg/h)

| Nominal size \ Pressure MPa | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 65A | 2429 | 3198 | 3978 | 4735 | 5505 | 6269 | 7033 | 7784 | 8547 | 9306 | 10063 | 10816 | 11578 | 12338 | 13096 |
| 80A | 3287 | 4328 | 5385 | 6409 | 7451 | 8484 | 9518 | 10535 | 11567 | 12595 | 13619 | 14638 | 15669 | 16698 | 17725 |

· Please refer to P.3-11 for the calculation procedure for nominal size selection.

# AF-7,7M

Full bore type | Lift type | Safety valve | Relief valve
Safety relief valve | Lever type | Closed type | Dash-pot structure
Handle type | Stainless | High pressure gas testing products
Diaphragm | Non-leakage



AF-7 AF-7M

## ■Features

1. Due to lift lever mechanism a discharge inspection can be manually performed at more than 75% of the opening pressure.
2. AF-7M is closed type structure which can prevent fluid leakage.

## ■Specifications

| Model | | AF-7 | AF-7M |
|---|---|---|---|
| Structure | | Open type with a lever | Closed type |
| Application | | Steam, Air, Other non-dangerous fluids | Air, Other non-dangerous fluids |
| Working pressure | | 0.1-1.0MPa * | |
| Maximum temperature | | 350℃ | 300℃ |
| Material | Valve case | Cast carbon steel | Cast carbon steel |
| | Valve, Valve seat | Stainlesssteel | Stainlesssteel |
| Connection | Inlet | JIS 10K RF flanged | JIS 10K RF flanged |
| | Outlet | JIS 10K FF flanged | JIS 10K FF flanged |

* Available with working pressure between 1.0 MPa and 1.6 MPa (Inlet: JIS 20K RF flanged).

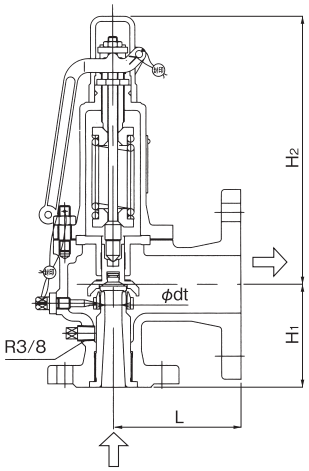
## ■Dimensions and Weights

| Nominal size | Inlet diameter x Outlet diameter | Throat diameter dt (mm) | Flow area $\frac{\pi}{4}dt^2$ ($mm^2$) | Lift ℓ (mm) | L (mm) | H1 (mm) | *$H_2$ (mm) | | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | AF-7 | AF-7M | |
| 25A | 25 x 32 | 16 | 200.9 | 4.0 | 100 | 85 | 226 | 231 | 10 |
| 40A | 40 x 50 | 25 | 490.6 | 6.3 | 120 | 110 | 273 | 270 | 20 |
| 50A | 50 x 65 | 32 | 803.8 | 8.0 | 135 | 120 | 325 | 321 | 25 |
| 65A | 65 x 80 | 40 | 1256.0 | 10.0 | 160 | 125 | 366 | 361 | 40 |
| 80A | 80 x 100 | 50 | 1962.5 | 12.5 | 170 | 135 | 375 | 370 | 52 |
| 100A | 100 x 125 | 65 | 3316.6 | 16.3 | 205 | 160 | 612 | 580 | 75 |

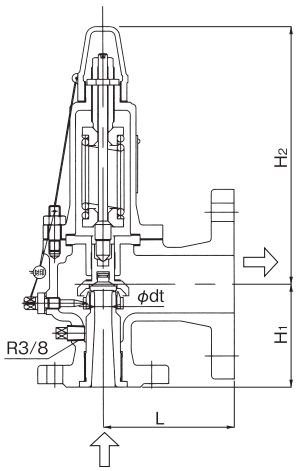
· Both AF-7 and AF-7S are same value except for $H_2$.
· The connection flange standard is JIS B 2238.

## ■At the Time of Ordering

When ordering, please inform set pressure and application. (If the application is steam, please also specify Pressure vessel structure standard or Boiler structure standard.)




AF-7 <Open type with a lever>




AF-7M <Closed type>

* Structure will be different depends on nominal size.

## ■Certified Capacity Table

**· For steam (saturation temperature)** **<Pressure vessel structure standard>**

(kg/h)

| Nominal size | Throat diameter dt (mm) | Flow area ($mm^2$) | Set pressure (MPa) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
| 25A | 16 | 200.9 | 181 | 263 | 353 | 444 | 532 | 620 | 707 | 793 | 879 | 966 |
| 40A | 25 | 490.6 | 442 | 642 | 862 | 1085 | 1301 | 1515 | 1727 | 1937 | 2148 | 2360 |
| 50A | 32 | 803.8 | 724 | 1052 | 1413 | 1779 | 2132 | 2482 | 2830 | 3174 | 3520 | 3867 |
| 65A | 40 | 1256.0 | 1132 | 1644 | 2208 | 2780 | 3332 | 3879 | 4422 | 4960 | 5500 | 6042 |
| 80A | 50 | 1962.5 | 1769 | 2569 | 3450 | 4343 | 5206 | 6061 | 6910 | 7751 | 8594 | 9441 |
| 100A | 65 | 3316.6 | 2989 | 4342 | 5831 | 7341 | 8798 | 10244 | 11677 | 13099 | 14524 | 15956 |

**<Boiler structure standard>**

(kg/h)

| Nominal size | Throat diameter dt (mm) | Flow area ($mm^2$) | Set pressure (MPa) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
| 25A | 16 | 200.9 | 177 | 258 | 340 | 424 | 504 | 586 | 668 | 749 | 829 | 911 |
| 40A | 25 | 490.6 | 432 | 632 | 832 | 1035 | 1232 | 1433 | 1631 | 1830 | 2026 | 2224 |
| 50A | 32 | 803.8 | 708 | 1036 | 1364 | 1696 | 2019 | 2348 | 2673 | 2999 | 3320 | 3645 |
| 65A | 40 | 1256.0 | 1106 | 1619 | 2131 | 2651 | 3156 | 3669 | 4177 | 4687 | 5187 | 5696 |
| 80A | 50 | 1962.5 | 1729 | 2529 | 3330 | 4143 | 4931 | 5732 | 6527 | 7323 | 8106 | 8900 |
| 100A | 65 | 3316.6 | 2922 | 4275 | 5628 | 7002 | 8334 | 9688 | 11032 | 12376 | 13699 | 15041 |

**· For air (20°C)** **<Pressure vessel structure standard>**

(kg/h)

| Nominal size | Throat diameter dt (mm) | Flow area ($mm^2$) | Set pressure (MPa) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
| 25A | 16 | 200.9 | 293 | 425 | 571 | 717 | 863 | 1009 | 1155 | 1301 | 1447 | 1593 |
| 40A | 25 | 490.6 | 715 | 1039 | 1396 | 1752 | 2108 | 2465 | 2821 | 3177 | 3534 | 3890 |
| 50A | 32 | 803.8 | 1172 | 1703 | 2287 | 2871 | 3455 | 4038 | 4622 | 5206 | 5790 | 6374 |
| 65A | 40 | 1256.0 | 1832 | 2662 | 3574 | 4486 | 5398 | 6311 | 7223 | 8135 | 9047 | 9960 |
| 80A | 50 | 1962.5 | 2863 | 4159 | 5584 | 7010 | 8435 | 9861 | 11286 | 12711 | 14137 | 15562 |
| 100A | 65 | 3316.6 | 4839 | 7029 | 9438 | 11847 | 14256 | 16665 | 19074 | 21482 | 23891 | 26300 |

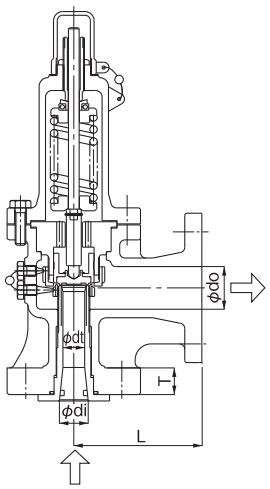
· Please refer to P.3-11 for the calculation procedure of nominal size selection.

# AF-6H,6HS

High-pressure gas approved product

Full bore type | Lift type | Safety valve | Relief valve
Safety relief valve | Lever type | Closed type | Dash-pot structure
Handle type | Stainless | High pressure gas testing products
Diaphragm | Non-leakage

AF-6H



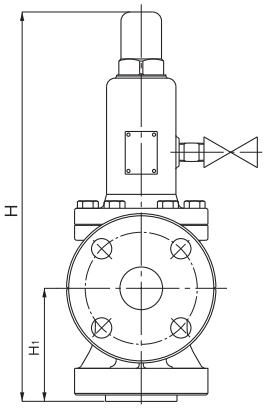

## ■Features

1. Lift safety valve, designed in compliance with JIS B 8210 “Spring loaded safety valves for steam boilers and pressure vessels”.
2. Corresponds to High Pressure Gas Safety Act.

## ■Specifications

| Model | | AF-6H | AF-6HS |
|---|---|---|---|
| Structure | | Closed type | |
| Application | | Air, Other non-dangerous fluids | |
| Working pressure | | 0.1-1.96 MPa | |
| Maximum temperature | | 250℃ *1 | |
| Material | Valve case, Spring case | Cast carbon steel | Stainless steel |
| | Valve, Valve seat | Stellite overlaid stainlesssteel | |
| Connection | | Inlet: JIS 20K RF flanged Outlet: JIS 10K FF flanged *2 | |

*1 The material of gasket is different depending on fluid and pressure and also temperature specification change.
*2 The inlet flange is thicker than JIS standard value.




## ■Dimensions and Weights

| Nominal size | Inlet diameter x Throat diameter x Outlet diameter di x dt x do | Flow area $\frac{\pi}{4}dt^2$ (mm²) | Lift ℓ (mm) | Dimensions (mm) | | | | Flange | | | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Seat diameter | L | H1 | H | Inlet | T | Outlet | |
| 25A | 25 x 19 x 40 | 283.3 | 4.4 | 22 | 120 | 106 | 348 | 25A | 25 | 40A | 15 |
| 40A | 40 x 30 x 65 | 706.5 | 6.8 | 35 | 135 | 126 | 483 | 40A | 31 | 65A | 26 |
| 50A | 50 x 38 x 80 | 1133.5 | 8.7 | 44 | 155 | 140 | 528 | 50A | 33 | 80A | 37 |
| 65A | 65 x 49 x 100 | 1884.7 | 11.1 | 57 | 170 | 160 | 703 | 65A | 34 | 100A | 73 |
| 80A | 80 x 61 x 125 | 2920.9 | 13.8 | 71 | 190 | 180 | 837 | 80A | 36 | 125A | 111 |
| 100A | 100 x 76 x 150 | 4534.1 | 17.3 | 88 | 205 | 205 | 935 | 100A | 40 | 150A | 167 |

· When ordering, please inform application, pressure, material, flow rates and things as follows.
(1) Name of end user (2) Installing place (3) Normal operation pressure and temperature
[Normal operation pressure and temperature for high-pressure gas means, the maximum pressure and temperature which the gas may transform into normal gas or liquefied gas under normal operation.]

## ■Certified Capacity Table for AF-6H, 6HS

**· For air (20˚C) <Pressure vessel structure standard>**

(kg/h)

| Pressure MPa / Nominal size | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| 25A | 413 | 600 | 806 | 1011 | 1217 | 1423 | 1629 | 1835 | 2040 | 2246 |
| 40A | 1030 | 1497 | 2010 | 2523 | 3036 | 3550 | 4063 | 4576 | 5089 | 5602 |
| 50A | 1654 | 2402 | 3225 | 4049 | 4872 | 5695 | 6518 | 7342 | 8165 | 8988 |
| 65A | 2750 | 3994 | 5363 | 6732 | 8101 | 9470 | 10839 | 12207 | 13576 | 14945 |
| 80A | 4262 | 6190 | 8312 | 10433 | 12555 | 14676 | 16798 | 18919 | 21041 | 23162 |
| 100A | 6616 | 9610 | 12903 | 16196 | 19489 | 22782 | 26076 | 29369 | 32662 | 35955 |

**· For air (20˚C) <High Pressure Gas Safety Act>**

(kg/h)

| Pressure MPa / Nominal size | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| 25A | 392 | 598 | 804 | 1009 | 1215 | 1421 | 1626 | 1832 | 2038 | 2243 |
| 40A | 979 | 1492 | 2005 | 2518 | 3030 | 3543 | 4056 | 4569 | 5082 | 5595 |
| 50A | 1571 | 2393 | 3216 | 4039 | 4862 | 5685 | 6508 | 7331 | 8154 | 8977 |
| 65A | 2612 | 3980 | 5348 | 6717 | 8085 | 9453 | 10822 | 12190 | 13558 | 14927 |
| 80A | 4048 | 6169 | 8289 | 10410 | 12530 | 14651 | 16772 | 18892 | 21013 | 23133 |
| 100A | 6284 | 9576 | 12867 | 16159 | 19451 | 22743 | 26035 | 29326 | 32618 | 35910 |

**· For air (20˚C)**

(kg/h)

| Pressure MPa / Nominal size | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 | 1.96 |
|---|---|---|---|---|---|---|---|---|---|---|
| 25A | 2449 | 2655 | 2860 | 3066 | 3272 | 3477 | 3683 | 3889 | 4094 | 4221 |
| 40A | 6108 | 6621 | 7134 | 7647 | 8160 | 8673 | 9186 | 9698 | 10211 | 10528 |
| 50A | 9800 | 10623 | 11446 | 12269 | 13092 | 13915 | 14737 | 15560 | 16383 | 16892 |
| 65A | 16295 | 17663 | 19031 | 20400 | 21768 | 23136 | 24505 | 25873 | 27241 | 28087 |
| 80A | 25254 | 27375 | 29495 | 31616 | 33736 | 35857 | 37978 | 40098 | 42219 | 43529 |
| 100A | 39202 | 42494 | 45785 | 49077 | 52369 | 55661 | 58953 | 62244 | 65536 | 67570 |

*Please refer to P.3-11 for the calculation procedure of nominal size selection.

# AF-9EN

Full bore type | Lift type | Safety valve | Relief valve
Safety relief valve | Lever type | Closed type | Dash-pot structure
Handle type | Stainless | High pressure gas testing products
Diaphragm | Non-leakage

## ■Features

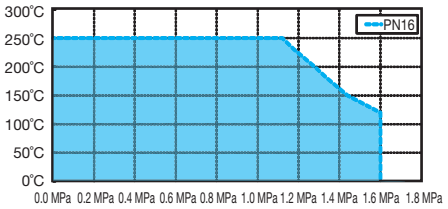
1. Full bore safety valve of open type.
2. Large discharge capacity.
3. Due to lift lever mechanism, a discharge inspection can be manually performed at least 80% of working pressure.

## ■Specifications

| Model | | AF- 9EN | | |
|---|---|---|---|---|
| Application | | Steam, Air, Other non-dangerous fluids | | |
| Nominal size | | 20A-100A | 125A | 150A |
| Working pressure | | 0.045-1.6 MPa | 0.045-1.25 MPa | 0.045-1.0 MPa |
| | | * According to P/T rating. | | |
| Max. temperature | | 250℃ | | |
| Material | Body | Cast Iron | | |
| | Spring case | Ductile Cast Iron | | |
| | Valve | Stainless steel | | |
| | Valve seat | Stainless steel | | |
| Connection | | Inlet: PN16, Outlet: PN10<br>EN1092-2 | | |

· Spring replacement does not need any other part replacement but gaskets, however, it requires training by Yoshitake. Only certified person is allowed to replace the spring.
· AF-9EN is not closed type.
· Please contact us for any further information.

## ■Pressure and Temperature Rating




* This chart shows PT rating of PN16 for cast iron flanges accoding to EN 1092-2.

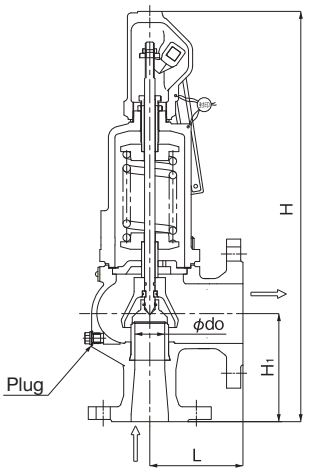
## ■Spring Range

(MPa)

| (A) | (B) | (C) | (D) |
|---|---|---|---|
| 0.045-0.068 | 0.066-0.10 | 0.095-0.14 | 0.13-0.19 |
| (E) | (F) | (G) | (H) |
| 0.18-0.26 | 0.25-0.36 | 0.35-0.50 | 0.48-0.63 |
| (I) | (J) | (K) | (L) |
| 0.6-0.8 | 0.75-1.0 | 0.95-1.25 | 1.2-1.6 |

## ■Dimensions and Weights

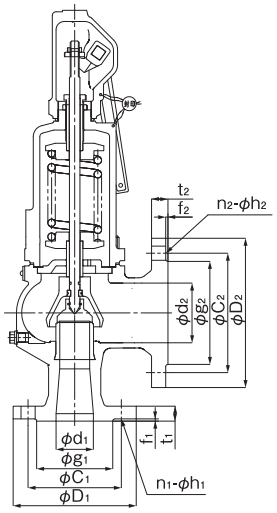
| Nominal size | Inlet dia. x Throat dia. x Outlet dia . | Flow area ($mm^2$) | Lift (mm) | Dimension (mm) | | | Flange | | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | L | $H_1$ | H | Inlet | Outlet | |
| 20A | 20 x 16 x 32 | 201 | 6 | 85 | 95 | 345 | 20A | 32A | 7.5 |
| 25A | 25 x 20 x 40 | 314 | 7.5 | 95 | 105 | 395 | 25A | 40A | 9 |
| 32A | 32 x 25 x 50 | 491 | 9 | 100 | 110 | 420 | 32A | 50A | 13 |
| 40A | 40 x 32 x 65 | 804 | 11.5 | 115 | 130 | 495 | 40A | 65A | 19 |
| 50A | 50 x 40 x 80 | 1257 | 14.5 | 125 | 145 | 550 | 50A | 80A | 25 |
| 65A | 65 x 50 x 100 | 1964 | 18 | 140 | 150 | 660 | 65A | 100A | 37 |
| 80A | 80 x 63 x 125 | 3117 | 23 | 155 | 170 | 710 | 80A | 125A | 52 |
| 100A | 100 x 77 x 150 | 4657 | 28 | 175 | 180 | 810 | 100A | 150A | 77 |
| 125A | 125 x 93 x 200 | 6793 | 34 | 215 | 220 | 860 | 125A | 200A | 90 |
| 150A | 150 x 110 x 250 | 9503 | 40 | 225 | 245 | 990 | 150A | 250A | 140 |




* Structure will be different depends on nominal size.

## ■Dimensions (Connection)

| Nominal size | Inlet flange BSEN PN16 RF | | | | | | | Outlet flange BSEN PN10 RF | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $d_1$ | $D_1$ | $t_1$ | $f_1$ | $g_1$ | $C_1$ | $n_1$-$h_1$ | $d_2$ | $D_2$ | $t_2$ | $f_2$ | $g_2$ | $C_2$ | $n_2$-$h_2$ |
| 20A | 20 | 105 | 16 | 2 | 56 | 75 | 4-14 | 32 | 140 | 18 | 3 | 76 | 100 | 4-19 |
| 25A | 25 | 115 | 16 | 3 | 65 | 85 | 4-14 | 40 | 150 | 18 | 3 | 84 | 110 | 4-19 |
| 32A | 32 | 140 | 18 | 3 | 76 | 100 | 4-19 | 50 | 165 | 20 | 3 | 99 | 125 | 4-19 |
| 40A | 40 | 150 | 18 | 3 | 84 | 110 | 4-19 | 65 | 185 | 20 | 3 | 118 | 145 | 4-19 |
| 50A | 50 | 165 | 20 | 3 | 99 | 125 | 4-19 | 80 | 200 | 22 | 3 | 132 | 160 | 8-19 |
| 65A | 65 | 185 | 20 | 3 | 118 | 145 | 4-19 | 100 | 220 | 24 | 3 | 156 | 180 | 8-19 |
| 80A | 80 | 200 | 22 | 3 | 132 | 160 | 8-19 | 125 | 250 | 26 | 3 | 184 | 210 | 8-19 |
| 100A | 100 | 220 | 24 | 3 | 156 | 180 | 8-19 | 150 | 285 | 26 | 3 | 211 | 240 | 8-23 |
| 125A | 125 | 250 | 26 | 3 | 184 | 210 | 8-19 | 200 | 340 | 26 | 3 | 266 | 295 | 8-23 |
| 150A | 150 | 285 | 26 | 3 | 211 | 240 | 8-23 | 250 | 395 | 28 | 3 | 319 | 350 | 12-23 |




## ■Certified Capacity Table

**· For steam (saturation temperature) <EN ISO 4126-1: 2004>**

(kg/h)

| Nominal size | Pressure (MPa) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0.045 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | 1.1 | 1.2 |
| 20A | 115 | 164 | 268 | 357 | 446 | 535 | 623 | 711 | 798 | 886 | 974 | 1,060 | 1,147 |
| 25A | 180 | 256 | 418 | 558 | 697 | 835 | 973 | 1,110 | 1,247 | 1,384 | 1,521 | 1,657 | 1,792 |
| 32A | 282 | 401 | 654 | 872 | 1,090 | 1,306 | 1,521 | 1,736 | 1,950 | 2,165 | 2,378 | 2,590 | 2,802 |
| 40A | 461 | 656 | 1,071 | 1,428 | 1,784 | 2,139 | 2,491 | 2,843 | 3,193 | 3,545 | 3,894 | 4,242 | 4,588 |
| 50A | 721 | 1,026 | 1,674 | 2,233 | 2,790 | 3,344 | 3,895 | 4,445 | 4,993 | 5,542 | 6,089 | 6,631 | 7,173 |
| 65A | 1,127 | 1,603 | 2,615 | 3,489 | 4,359 | 5,225 | 6,086 | 6,945 | 7,801 | 8,659 | 9,513 | 10,361 | 11,208 |
| 80A | 1,788 | 2,545 | 4,150 | 5,537 | 6,918 | 8,292 | 9,658 | 11,021 | 12,381 | 13,742 | 15,098 | 16,444 | 17,787 |
| 100A | 2,672 | 3,802 | 6,201 | 8,273 | 10,336 | 12,389 | 14,430 | 16,467 | 18,498 | 20,531 | 22,558 | 24,568 | 26,575 |
| 125A | 3,897 | 5,546 | 9,045 | 12,067 | 15,077 | 18,072 | 21,049 | 24,019 | 26,982 | 29,948 | 32,904 | 35,837 | 38,764 |
| 150A | 5,452 | 7,758 | 12,654 | 16,881 | 21,092 | 25,282 | 29,446 | 33,602 | 37,746 | 41,896 | 46,031 | — | — |

**· For Air (20°C) <EN ISO 4126-1: 2004>**

(kg/h)

| Nominal size | Pressure (MPa) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0.045 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | 1.1 | 1.2 | 1.4 | 1.6 |
| 20A | 185 | 258 | 426 | 573 | 720 | 866 | 1,013 | 1,159 | 1,306 | 1,452 | 1,599 | 1,746 | 1,892 | 2,185 | 2,478 |
| 25A | 289 | 404 | 666 | 895 | 1,124 | 1,353 | 1,582 | 1,811 | 2,040 | 2,269 | 2,498 | 2,727 | 2,956 | 3,414 | 3,872 |
| 32A | 451 | 631 | 1,042 | 1,400 | 1,758 | 2,116 | 2,474 | 2,832 | 3,190 | 3,548 | 3,906 | 4,264 | 4,622 | 5,338 | 6,054 |
| 40A | 739 | 1,033 | 1,706 | 2,292 | 2,878 | 3,464 | 4,051 | 4,637 | 5,223 | 5,810 | 6,396 | 6,982 | 7,568 | 8,741 | 9,913 |
| 50A | 1,156 | 1,615 | 2,667 | 3,583 | 4,500 | 5,416 | 6,333 | 7,250 | 8,166 | 9,083 | 9,999 | 10,916 | 11,833 | 13,666 | 15,499 |
| 65A | 1,806 | 2,524 | 4,166 | 5,598 | 7,031 | 8,463 | 9,895 | 11,327 | 12,759 | 14,191 | 15,624 | 17,056 | 18,488 | 21,352 | 24,217 |
| 80A | 2,866 | 4,005 | 6,612 | 8,885 | 11,158 | 13,431 | 15,704 | 17,977 | 20,250 | 22,523 | 24,796 | 27,069 | 29,342 | 33,887 | 28,433 |
| 100A | 4,281 | 5,984 | 9,879 | 13,275 | 16,671 | 20,067 | 23,463 | 26,859 | 30,254 | 33,650 | 37,046 | 40,442 | 43,838 | 50,630 | 57,422 |
| 125A | 6,245 | 8,729 | 14,410 | 19,364 | 24,317 | 29,271 | 34,224 | 39,178 | 44,131 | 49,085 | 54,038 | 58,992 | 63,945 | — | — |
| 150A | 8,737 | 12,212 | 20,159 | 27,089 | 34,018 | 40,948 | 47,878 | 54,807 | 61,737 | 68,666 | 75,596 | — | — | — | — |

# Safety Relief Valve – Annex

# Abstract of JIS B 8210 "Steam boilers and pressure vessels-Spring loaded safety valves"

| | |
|---|---|
| ⚠ Warning | Do not apply the product to devices which do not allow any valve seat leakage.<br>* The product has allowable valve seat leakage and does not close completely (valve seat leakage cannot be zero). |
| ⚠CAUTION | Please refer to the manual attached to the product for procedures for installation and operation. |

## ■Capability

### 1. Tolerance of start to discharge pressure

#### · Safety valve for steam

There is no regulation for start to discharge pressure of safety valve for steam.

#### · Safety valve for gas

Tolerance of start to discharge pressure of safety valve for gas is ±5% (however, ±0.025 MPa in minimum). If exceeding set pressure is not acceptable, add absolute value of positive side to one of negative. For gas, set pressure is generally start to discharge pressure.

### 2. Tolerance of opening (popping) pressure

#### · Safety valve for steam

Opening pressure tolerance of safety valve for steam is shown in Table-1 below. If exceeding set pressure is not acceptable, add absolute value of positive side to one of negative.

**Table-1 Opening pressure tolerance of safety valve for steam**

(MPa)

| Set pressure | Tolerance |
|---|---|
| Less than 0.5 | ±0.015 |
| 0.5-2.29 | ±(3% of set pressure) |
| 2.3-6.99 | ±0.07 |
| 7.0 or more | ± (1% of set pressure) |

Note 1) As to safety valve for steam, set pressure is generally start to discharge pressure.
2) Opening pressure tolerance of safety valve for steam except for boilers is ±3% (however, ±0.015 MPa in minimum).

#### · Safety valve for gas

Opening pressure tolerance of safety valve for gas is less than 1.1 times of start to discharge pressure. However, to set by set pressure, opening pressure tolerance is ±3% (±0.015 MPa in minimum) of set pressure.

### 3. Blowdown

#### · Safety valve for steam

Opening of safety valve for steam is shown in Table-2 below. If discharge pressure of safety valve for steam, which is used for through flow boiler, reheater and piping, exceeds 0.3 MPa, blowdown can be less than 10% of set pressure.

**Table-2 Blowdown of safety valve for steam**

(MPa)

| Set pressure | Blowdown |
|---|---|
| 0.4 or less | 0.03 |
| More than 0.4 | 7% (4%) or less of set pressure |

Note 1) As to safety valve for gas, blowdown is generally difference between start to discharge pressure and closing pressure.
2) If there is an agreement between the parties, the value in ( ) can be applied.

#### · Safety valve for gas

Blowdown of safety valve for gas is shown in Table-3 below.

**Table-3 Blowdown of safety valve for gas**

(MPa)

| Set pressure | Blowdown | |
|---|---|---|
| | Metal seat type | Soft seat type |
| 0.2 or less | 0.03 or less | 0.05 or less |
| More than 0.2 | 15% or less of set pressure | 25% or less of set pressure |

Note 1) As to safety valve for gas, blowdown is generally difference between start to discharge pressure and closing pressure. However, to set by start to discharge pressure, it is difference between opening pressure and closing pressure.
2) As to the definitions of metal seat type and soft seat type, see JIS B 0100.

#### · Safety valve for liquid (Yoshitake standard)

Blowdown of safety valve for liquid is shown in Table-4 below.

**Table-4 Blowdown of safety valve for liquid**

(MPa)

| Set pressure | Blowdown | |
|---|---|---|
| | Metal seat type | Soft seat type |
| 0.2 or less | 0.03 or less | 0.05 or less |
| More than 0.2 | 15% or less of set pressure | 25% or less of set pressure |

Note 1) As to the definitions of metal seat type and soft seat type, see JIS B 0100.

# Calculation Methods of Certified Capacity for Safety Valve

| | |
|---|---|
| ⚠ Warning | **Do not apply the product to devices which do not allow any valve seat leakage.**<br>*** The product has allowable valve seat leakage and does not close completely (valve seat leakage cannot be zero).** |
| ⚠CAUTION | **Please refer to the manual attached to the product for procedures for installation and operation.** |

## 1. Certified capacity for safety valve for steam

(1) To calculate by certified coefficient of discharge, use the following formula:

Qm = 5.25 x C" x Kdr x AP

Qm: Certified capacity (kg/h)

A: Flow area ($mm^2$)

P: For boiler, (set pressure x 1.03 + 0.101) or (set pressure + 0.015 + 0.101), whichever larger.
For pressure vessel, (set pressure x 1.1 + 0.101) or (set pressure + 0.020 + 0.101), whichever larger.
However, if allowable over pressure is specified, it shall be followed.

Kdr: Certified derated coefficient of discharge
(= measured value x 0.9)

C': Coefficient depending on the properties of steam, which is shown in Table-5 on page 3-68.

(2) If not measuring certified coefficient of discharge, calculate certified capacity using the value of Kdr' in Fig. 1 below instead of Kdr in (1). For full bore type safety valve, use Kdr' = 0.777.

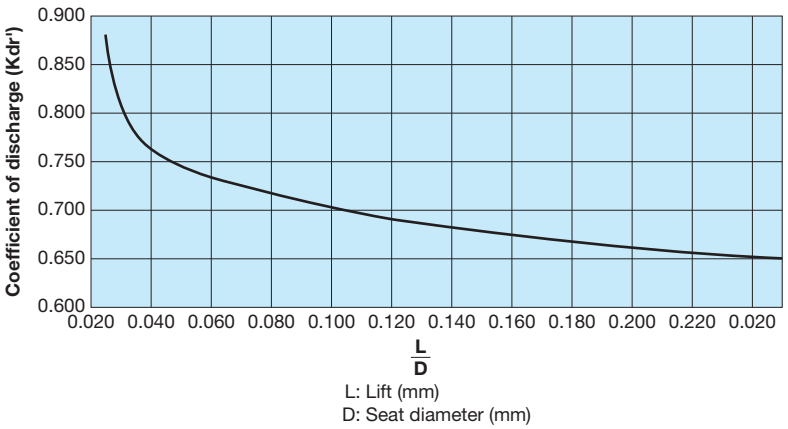



**Fig. 1 Coefficient of discharge Kdr'**

# Calculation Methods of Certified Capacity for Safety Valve

**⚠ Warning** Do not apply the product to devices which do not allow any valve seat leakage.
* The product has allowable valve seat leakage and does not close completely (valve seat leakage cannot be zero).

**⚠CAUTION** Please refer to the manual attached to the product for procedures for installation and operation.



**Table-5 Coefficient depending on properties of steam (C')**

| Absolute pressure MPa | Saturation pressure | Temperature °C | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 200 | 220 | 240 | 260 | 280 | 300 | 320 | 340 | 360 | 380 | 400 | 420 | 440 | 460 | 480 | 500 | 520 | 540 | 560 | 580 | 600 | 620 | 640 | 660 | 680 | 700 |
| 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 | 0.773 | 0.763 | 0.752 | 0.742 | 0.733 | 0.724 | 0.715 | 0.706 | 0.698 | 0.690 | 0.682 | 0.675 |
| 1 | 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 | 0.775 | 0.764 | 0.753 | 0.743 | 0.734 | 0.725 | 0.716 | 0.707 | 0.699 | 0.691 | 0.683 | 0.675 |
| 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 | 0.777 | 0.765 | 0.755 | 0.745 | 0.735 | 0.726 | 0.717 | 0.709 | 0.700 | 0.692 | 0.684 | 0.676 |
| 2 | 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 | 0.778 | 0.767 | 0.756 | 0.746 | 0.736 | 0.727 | 0.717 | 0.709 | 0.700 | 0.692 | 0.684 | 0.676 |
| 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 | 0.780 | 0.769 | 0.758 | 0.747 | 0.737 | 0.728 | 0.718 | 0.709 | 0.701 | 0.693 | 0.685 | 0.677 |
| 3 | 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 | 0.782 | 0.770 | 0.759 | 0.748 | 0.738 | 0.729 | 0.719 | 0.710 | 0.702 | 0.693 | 0.685 | 0.678 |
| 4 | 0.964 | | | | 0.957 | 0.953 | 0.939 | 0.915 | 0.895 | 0.875 | 0.857 | 0.841 | 0.826 | 0.811 | 0.798 | 0.785 | 0.773 | 0.762 | 0.751 | 0.741 | 0.731 | 0.721 | 0.712 | 0.703 | 0.695 | 0.687 | 0.679 |
| 5 | 0.965 | | | | | 0.955 | 0.952 | 0.929 | 0.905 | 0.884 | 0.865 | 0.847 | 0.831 | 0.816 | 0.802 | 0.789 | 0.776 | 0.765 | 0.753 | 0.743 | 0.733 | 0.723 | 0.714 | 0.705 | 0.696 | 0.688 | 0.680 |
| 6 | 0.968 | | | | | 0.962 | 0.953 | 0.943 | 0.917 | 0.893 | 0.873 | 0.854 | 0.837 | 0.821 | 0.807 | 0.793 | 0.780 | 0.768 | 0.756 | 0.745 | 0.735 | 0.725 | 0.715 | 0.706 | 0.698 | 0.689 | 0.681 |
| 7 | 0.971 | | | | | | 0.959 | 0.954 | 0.930 | 0.904 | 0.881 | 0.861 | 0.843 | 0.826 | 0.811 | 0.797 | 0.783 | 0.771 | 0.759 | 0.748 | 0.737 | 0.727 | 0.717 | 0.708 | 0.699 | 0.690 | 0.682 |
| 8 | 0.975 | | | | | | 0.968 | 0.956 | 0.944 | 0.915 | 0.890 | 0.869 | 0.849 | 0.832 | 0.816 | 0.801 | 0.787 | 0.774 | 0.762 | 0.750 | 0.739 | 0.729 | 0.719 | 0.709 | 0.701 | 0.691 | 0.683 |
| 9 | 0.980 | | | | | | | 0.963 | 0.960 | 0.927 | 0.900 | 0.877 | 0.856 | 0.837 | 0.820 | 0.805 | 0.791 | 0.777 | 0.765 | 0.753 | 0.741 | 0.731 | 0.721 | 0.711 | 0.702 | 0.693 | 0.685 |
| 10 | 0.987 | | | | | | | 0.972 | 0.962 | 0.941 | 0.911 | 0.885 | 0.863 | 0.843 | 0.825 | 0.809 | 0.794 | 0.780 | 0.767 | 0.755 | 0.744 | 0.733 | 0.723 | 0.713 | 0.703 | 0.695 | 0.686 |
| 12 | 1.000 | | | | | | | | 0.977 | 0.973 | 0.935 | 0.904 | 0.878 | 0.856 | 0.836 | 0.818 | 0.802 | 0.787 | 0.773 | 0.761 | 0.748 | 0.737 | 0.726 | 0.716 | 0.707 | 0.697 | 0.688 |
| 14 | 1.019 | | | | | | | | 1.005 | 0.982 | 0.964 | 0.926 | 0.896 | 0.870 | 0.848 | 0.828 | 0.811 | 0.795 | 0.780 | 0.766 | 0.753 | 0.741 | 0.730 | 0.720 | 0.710 | 0.700 | 0.691 |
| 16 | 1.039 | | | | | | | | | 1.005 | 1.001 | 0.952 | 0.916 | 0.886 | 0.861 | 0.839 | 0.820 | 0.802 | 0.786 | 0.772 | 0.758 | 0.746 | 0.734 | 0.723 | 0.713 | 0.703 | 0.694 |
| 18 | 1.068 | | | | | | | | | 1.044 | 1.007 | 0.977 | 0.933 | 0.903 | 0.875 | 0.851 | 0.829 | 0.811 | 0.793 | 0.778 | 0.764 | 0.751 | 0.738 | 0.727 | 0.716 | 0.706 | 0.696 |
| 20 | 1.100 | | | | | | | | | | 1.036 | 1.011 | 0.958 | 0.917 | 0.890 | 0.863 | 0.840 | 0.819 | 0.801 | 0.785 | 0.769 | 0.756 | 0.743 | 0.731 | 0.720 | 0.709 | 0.699 |
| 22 | 1.136 | | | | | | | | | | 1.081 | 1.038 | 0.989 | 0.937 | 0.903 | 0.877 | 0.851 | 0.828 | 0.809 | 0.791 | 0.775 | 0.761 | 0.747 | 0.735 | 0.723 | 0.712 | 0.702 |
| 24 | | | | | | | | | | | | 1.068 | 1.024 | 0.963 | 0.919 | 0.888 | 0.863 | 0.839 | 0.817 | 0.798 | 0.783 | 0.767 | 0.752 | 0.740 | 0.727 | 0.716 | 0.705 |
| 26 | | | | | | | | | | | | 1.116 | 1.065 | 0.989 | 0.940 | 0.902 | 0.873 | 0.849 | 0.827 | 0.805 | 0.787 | 0.772 | 0.757 | 0.742 | 0.731 | 0.719 | 0.708 |
| 28 | | | | | | | | | | | | 1.185 | 1.105 | 1.022 | 0.962 | 0.917 | 0.886 | 0.856 | 0.834 | 0.813 | 0.794 | 0.777 | 0.762 | 0.748 | 0.734 | 0.721 | 0.711 |
| 30 | | | | | | | | | | | | | 1.142 | 1.059 | 0.986 | 0.936 | 0.898 | 0.869 | 0.841 | 0.821 | 0.800 | 0.782 | 0.764 | 0.752 | 0.737 | 0.725 | 0.714 |
| 32 | | | | | | | | | | | | | 1.180 | 1.103 | 1.015 | 0.956 | 0.912 | 0.880 | 0.852 | 0.827 | 0.807 | 0.788 | 0.771 | 0.754 | 0.743 | 0.728 | 0.715 |
| 34 | | | | | | | | | | | | | | 1.154 | 1.042 | 0.974 | 0.928 | 0.891 | 0.862 | 0.837 | 0.813 | 0.793 | 0.776 | 0.758 | 0.747 | 0.730 | 0.719 |
| 36 | | | | | | | | | | | | | | 1.210 | 1.075 | 0.998 | 0.946 | 0.903 | 0.872 | 0.844 | 0.819 | 0.800 | 0.781 | 0.762 | 0.749 | 0.735 | 0.724 |
| 38 | | | | | | | | | | | | | | | 1.112 | 1.023 | 0.961 | 0.918 | 0.881 | 0.852 | 0.826 | 0.805 | 0.786 | 0.766 | 0.751 | 0.740 | 0.725 |
| 40 | | | | | | | | | | | | | | | 1.152 | 1.047 | 0.980 | 0.933 | 0.892 | 0.861 | 0.834 | 0.810 | 0.790 | 0.770 | 0.755 | 0.743 | 0.726 |
| 42 | | | | | | | | | | | | | | | | 1.075 | 1.001 | 0.947 | 0.906 | 0.871 | 0.841 | 0.817 | 0.795 | 0.775 | 0.759 | 0.746 | 0.729 |
| 44 | | | | | | | | | | | | | | | | 1.104 | 1.021 | 0.961 | 0.918 | 0.881 | 0.849 | 0.823 | 0.802 | 0.781 | 0.7623 | 0.750 | 0.733 |
| 46 | | | | | | | | | | | | | | | | 1.135 | 1.045 | 0.978 | 0.928 | 0.893 | 0.857 | 0.831 | 0.807 | 0.787 | 0.767 | 0.755 | 0.741 |

Note 1) Intermediate value of pressure and temperature in this chart is calculated by proportion method.
2) Absolute pressure shall be absolute value of pressure to determine discharge capacity.

# Calculation Methods of Certified Capacity for Safety Valve

| | |
|---|---|
| ⚠ Warning | **Do not apply the product to devices which do not allow any valve seat leakage.**<br>*** The product has allowable valve seat leakage and does not close completely (valve seat leakage cannot be zero).** |
| ⚠CAUTION | **Please refer to the manual attached to the product for procedures for installation and operation.** |

## 2. Certified capacity for safety valve for gas

(1) To calculate by certified coefficient of discharge, use the following formula:

$$Qm = C'' \times Kdr \times P_1 \times A \times Kb \times \sqrt{\frac{M}{ZT}}$$

Qm: Certified capacity (kg/h)

C'': Coefficient depending on adiabatic exponent (k), calculated by the following formula:.

$$C'' = 39.48\left\{\sqrt{\frac{2}{k+1}}\right\}^{\frac{k+1}{k-1}}$$

If adiabatic exponent (k) is unknown, setting k = 1.001, C'' = 23.96

$P_1$: Absolute flow rating pressure (MPa)

$P_1$ = (set pressure x 1.1 + 0.101) or (set pressure + 0.020 + 0.101), whichever greater.

However, if allowable over pressure is specified, it shall be followed.

Kdr: Certified derated coefficient of discharge (= measured value x 0.9)

A: Flow area ($mm^2$)

M: Molecular weight of gas (kg/kmol)

Z: Compression coefficient shown in Table 2 (if unknown, Z = 1.0)

T: Absolute temperature of gas under flow rating pressure (K)

Kb: Corrective coefficient of back pressure

In case of $\frac{P_2}{P_1} > \left(\frac{2}{k+1}\right)^{\frac{k}{k+1}}$

$$Kb = \frac{55.83}{C''}\sqrt{\frac{k}{(k-1)}\left\{\left(\frac{P_2}{P_1}\right)^{\frac{2}{k}} - \left(\frac{P_2}{P_1}\right)^{\frac{k-1}{k}}\right\}}$$

In case of $\frac{P_2}{P_1} \leqq \left(\frac{2}{k+1}\right)^{\frac{k}{k+1}}$

Kb = 1.0

(2) If not measuring certified coefficient of discharge, calculate certified capacity using the value of Kdr' in Fig. 2 below instead of Kdr in (1). For full bore type safety valve, set Kdr = 0.777.

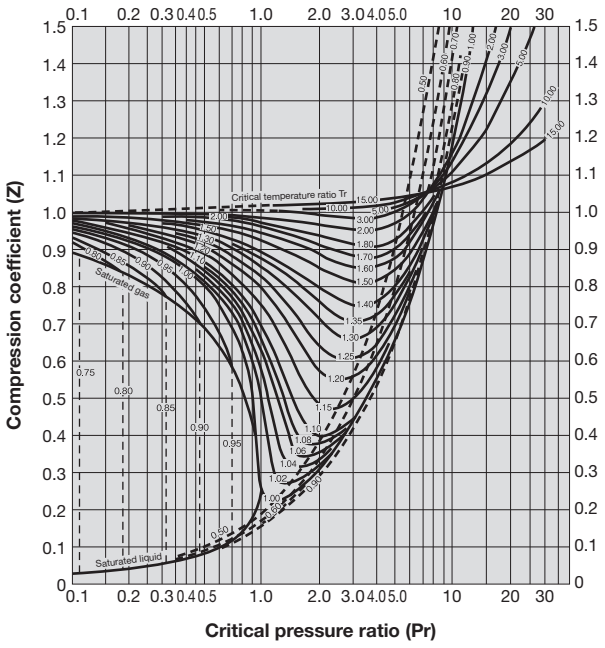



Fig. 2

Note) Critical temperature ratio

$$Tr = \frac{\text{Discharge temperature (K)}}{\text{Critical temperature (K)}}$$

Critical pressure ratio

$$Pr = \frac{\text{Opening pressure (absolute value)}}{\text{Critical pressure (absolute value)}}$$

# Abstract of "Construction code for pressure vessels"

| | |
|---|---|
| ⚠ Warning | **Do not apply the product to devices which do not allow any valve seat leakage.**<br>*** The product has allowable valve seat leakage and does not close completely (valve seat leakage cannot be zero).** |
| ⚠CAUTION | **Please refer to the manual attached to the product for procedures for installation and operation.** |

**<Reference>**

**[Definition of Class-1 pressure vessel]**

1. The vessels heating solids or liquids by receiving vapor or other heat media or by generating vapor, those having an internal pressure exceeding the atmospheric pressure (dizestor, sterilizer, etc);
2. The vessels generating vapor by chemical, nuclear or other reactions, those having an internal pressure exceeding the atmospheric pressure (autoclave, reactor, etc);
3. The vessels for generating vapor by heating liquids contained therein to separate components of the said liquids, those with an internal pressure exceeding the atmospheric pressure (distiller, evaporator);
4. The vessels containing liquids at a temperature exceeding their boiling points at the atmospheric pressure (steam accumulator).

**[Definition of Class-2 pressure vessel]**

The vessels containing gas with a gauge pressure of 0.2 MPa or more (excluding the class-1 pressure vessels) listed in followings:

1. The vessels with an inner cubic volume of 0.04 $m^3$ or more;
2. The vessels with a drum having inner diameter of 200 mm or more and length 1,000 mm or more (air tank, drying roller, high pressure gas tank, steam receiver, deaerator, vacuum evaporator, etc).

**[The vessels which excluded from application of CONSTRUCTION CODE FOR PRESSURE VESSEL]**

1. vessels used at a gauge pressure of 0.1 MPa or less with an inner cubic volume of 0.04 $m^3$ or less or with an inner diameter of 200 mm or less and the length 1,000 mm or less;
2. vessels of the maximum operating gauge pressure expressed in MPa multiplied by the internal cubic volume expressed in $m^3$ are 0.004 or less.

(Safety Valves and Alternative Safety Devices)

**Article 64.**

1. Any Class-1 pressure vessel shall be equipped with a safety valve or an alternative safety device for each of those parts which are subject to exposure to different levels of pressure, to ensure that the internal pressure working on any of such parts will not rise above the maximum allowable working pressure. However, this provision does not apply to those parts of a Class-1 pressure vessel (other than a reactor) which are connected with a boiler or some other source of pressure and of which the maximum allowable working pressure is not lower than that of such pressure source.
2. Safety valves for Class-1 pressure vessels shall be attached to those parts of the vessel itself or of its tubing which are easily accessible for checkup purposes, and shall be installed in such a manner that their stems will be upright.
3. Safety valves for those Class-1 pressure vessels in which flammable or toxic vapours may be generated shall be hermetically sealed or so configured that they can burn, absorb or otherwise dispose of such vapours safely.

**52 Related to Article 64**

(1) Related to paragraph 1

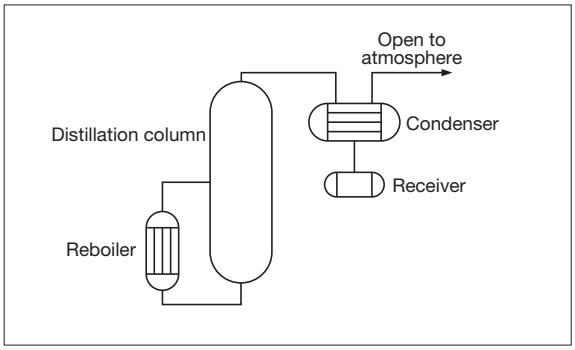
A. Capacity of safety valve and other safety equipment shall be in accordance with the provision of 12.1.6 (1) of JIS B 8270. However, the provisions pertaining to (2) and (3) in the same provision shall not be applied.

B. Regarding pressure vessel equipped with more than two safety valve, a part of it shall be able to be made to safety valve with a spring pilot. In this case, half or more of total discharge capacity of safety valve required for the above pressure vessel shall be by spring type safety valve other than safety valve with spring pilot.
The above safety valve with spring pilot shall work securely by steam pressure on the place the above safety valve is installed on.

C. In case that pipe side (the side connecting to distillation column) of normal pressure distillation column reboiler is open for atmosphere via the distillation column and condenser as shown in the figure below, and maximum using pressure on pipe side is over than pressure under part of distillation column, safety valve does not need to be installed to pipe side of reboiler pursuant to the proviso of paragraph 1.
In case that heating and evaporating liquid by water vapor for jaketted pressure vessel, and maximum using pressure on the side of liquid to be heated is over than saturated pressure of the liquid at maximum temperature of heating water vapor, it is acceptable even if safety device is not installed on the side of the liquid to be heated.

D. Reactor vessel without factor raising pressure inside shall be excluded from reactor vessel of the proviso of paragraph 1.

E. Discharge capacity of safety valve shall be over than maximum capacity of gas flowing into pressure vessel or maximum capacity of gas generating inside pressure vessel, and as calculation method, for example, the following shall be considered:




(a) Maximum amount of flow-in gas shall be calculated by the following formula:

$G = 0.0028\ vpd^2$

In this formula, G, v, p and d shall mean following value by each:

- G Gas sending amount (unit: kg/h)
- v Flow velocity of gas. 20 or more for saturated steam, 30 or more for overheated steam, and 10 or more for normal gas (unit: m/s)
- p Density of gas (unit: $kg/m^3$)
- d Inner diameter of piping (unit: mm)

# Abstract of "Construction code for pressure vessels"

| | |
|---|---|
| ⚠ Warning | **Do not apply the product to devices which do not allow any valve seat leakage.**<br>*** The product has allowable valve seat leakage and does not close completely (valve seat leakage cannot be zero).** |
| ⚠CAUTION | **Please refer to the manual attached to the product for procedures for installation and operation.** |

(b) Maximum evaporation amount of direct fire type Class-1 pressure vessel shall be calculated by the following formula:

$$W = \frac{HQ\eta}{i_1 - i_2}$$

In this formula, W, H, Q, $\eta$, $i_1$ and $i_2$ shall mean following value by each:

W Maximum evaporation amount of steam (unit: kg/h)
H Heat generation amount of fuel (unit: kJ/kg)
Q Use amount of fuel (unit: kg/h)
$\eta$ Heat efficiency of the above pressure vessel
$i_1$ Enthalpy of generating steam (unit: KJ/kg)
$i_2$ Enthalpy that internal liquid had before heating (unit: KJ/kg)

F. As calculation method for discharge capacity of safety valve for steam, for example, there shall be a method according to the stipulation of JIS B 8210 appendix (Calculation method of certified capacity for safety valve).

G. As "other safety device", for example, there shall be following things:
(a) Device which stops pressure rise automatically.
(b) Pressure reducing valve with safety valve is installed at its outlet side.
(c) Alarm device with safety valve used.
(d) Relief valve (limited to its nominal size is 15 mm or more) or relief pipe.
For relief valve, the term "0.02 MPa" in 12. 1. 6 (1) of JIS B 8270 shall be deemed to be replaced with "0.034 MPa".
(e) Rapture disc (limited to the case that content of pressure vessel makes working of safety valve difficult)

H. Pressure regulating device, temperature regulating device, etc shall not fall on (a) of G.

I. It shall be acceptable to install stop valve between pressure vessel and safety valve in (b) of G.

J. F and the provision of Article 65 shall not apply to the safety device stipulated in (b) and (c) of G.

K. Rapture disc in (e) of G shall conform to the stipulation of JIS B 8226 (rapture disc type safety device).

L. Because it is difficult to gurantee the maximum usage pressure of steam accumulator by safety valve, in case that the maximum usage pressure of system accumlator is smaller than the muximum usage pressure of boiler, safety device in (b) of G shall be installed.

M. Regarding vessels of indirect heating such as coloring tank or strage tank, in case that vapor does not almost originate on heated side of high temperature fluid, it is acceptable to admit relief valve as alternative safety device of safety valve. Also, regarding relief valve installed on strage tank etc, it is acceptable to consider that there is no limitation about valve diameter.

N. In case of installing safety valve on piping annexed on Class-1 pressure vessel, closing device such as relief valve shall not be installed between safety valve and vessel. Provided, however, that this shall not apply when the case falls under any of the followings:
(a) In case that installing the device equipped with two or more safety valve, and, they cannot be closed on the same time.
(b) As for workplace that head of relevant labor standards supervision office admits performance check can be conducted during operation, regarding Class-1 pressure vessel installed on the said workplace, is always open other than when closing devices are closed during minimum necessary time for inspection or repair of safety valve, and, in order to prevent this from being operated without reason, locked, sealed or implementing measures of the same as or more than them, and also, installing the plate indicating no-operation.
Moreover, when closing devices are closed, implement all the measures as follows:
①Operation of the said Class-1 pressure vessel shall be made stable, and operation condition shall not be changed;
②Pressure of the said Class-1 pressure vessel and related equipment shall be monitored in any time, and measures at the time of pressure abnormal rise shall be prepared in advance.
③If removing safety valve for the purpose of inspection or repair, preparing spare safety valve in advance, measures to shorten closing time as possible shall be implemented such as rapid installation.

(2) Related to Article 3
As "structure can be treated safely", there shall be structures that eliminate danger of catching fire or explosion, for example, dispersing steam blown from safety valve to the places without fire or other things can become ignition source such as altitude of outdoors.

(April 30, 2003 Labor Standards Bureau Notification No. 0430004)

# Abstract of "Construction code for boilers"

| | |
|---|---|
| ⚠ Warning | **Do not apply the product to devices which do not allow any valve seat leakage.**<br>*** The product has allowable valve seat leakage and does not close completely (valve seat leakage cannot be zero).** |
| ⚠CAUTION | **Please refer to the manual attached to the product for procedures for installation and operation.** |

(Safety Valve)

**Article 62.**

1. Steam boilers shall be equipped with at least two safety valves to ensure that its internal pressure will never exceed the maximum allowable working pressure. For those steam boilers which have a heating surface area not larger than 50 $m^2$, however, the number of safety valves to be installed may be reduced to one.
2. Safety valves shall be attached directly to proper parts of the boiler itself which are easily accessible for inspections and care shall be taken to ensure that their spindles will be upright.
3. All safety valves, when used for steam boilers generating flammable vapours, shall be either hermetically sealed or so configured as to send exhausts from them into a safe place outside the boiler room.

**43 Related to Article 62**

(1) Related to paragraph 1

A. As capacity of safety valve can maintain internal pressure at maximum usage pressure or less, for example, there shall be capacity according to the stipulation of 15.1 in JIS B 8201 (except for the stipulations after annex).
In this case, the term "35 kPa" in the same stipulation shall be deemed to be replaced with "0.034 MPa".

B. Discharge capacity of safety valve for steam boiler shall be maximum evaporation amount of the said boiler or more.
If maximum evaporation amount is not clear, it shall be obtained from actual measurement of fuel consumption amount, etc. However, if it burns wood debris and it is difficult to obtain maximum evaporation amount, it is acceptable to follow the table below:

| Kind of boiler | Evaporation amount per heat-transfer area 1 $m^2$ (unit: kg/h) | | | | | |
|---|---|---|---|---|---|---|
| | Boiler body | | | Water-cooled furnace wall | | |
| | Hand firing | Stoker firing | Burning of oil, gas or pulverized coal | Hand firing | Stoker firing | Burning of oil, gas or pulverized coal |
| Boiler other than water tube boiler | 25 | 35 | 40 | 40 | 50 | 70 |
| Water tube boiler | 30 | 40 | 50 | 40 | 60 | 80 |

In addition, maximum evaporation amount of waste heat boiler shall be calculated on the basis of flow rate of waste gas and specific enthalpy of waste gas.

C. As a method to calculate discharge capacity of safety valve of steam bolier, for example, there shall be a method according to the stipulation of annex 2 of JIS B 8210 (Spring safety valve for steam and for gas), and moreover, this shall be according to (a) and (b) as follows:
(a) To decide discharging coefficient by measurement, it shall be nominal discharge coefficient stipulated in JIS B 8210 (Safety valves-Measuring methods for coefficient of discharge), or coefficient decided by method can be deemd equal to this.
(b) In case that steam pressure is less than 0.4 MPa and fluid is saturated steam, coefficient by steam character (C) shall be C value at temperature corresponding to steam pressure 0.4 MPa in table 1 of JIS B 8210 annex.

D. As method to calculate discharge capacity of safety valve of dowtherm boiler, for example, there shall be a method according to the stipulation of annex 3 of JIS B 8210. Regarding flow rating pressure, absolute pressure value of 1.1 times as much as designed pressure or absolute pressure value which is designed pressure added to 0.02 MPa, whichever greater.

E. Because flow area of lift type safety valve is $\pi$ DI (D: diameter of valve seat hole, I: lift), if sectional area of steam incoming port $\pi$ D'2/4 (D': diameter of steam incoming port) is larger than this value, it shall be acceptable that D'<D. However, if D' is too small, rapid change of steam flow velocity shall be prevented.

F. As nominal diameter of safety valve of steam boiler, for example, nominal size shall be 25A or more. In this case, regarding safety valve of steam boiler according to the stipulation of 15.6 in JIS B 8201, and full bore type safety valve and lift type safety valve with lift which is 1/15 or more of seat diameter. Its nominal size shall be able to be made 20A or more.

G. To install more than one safety valve on the common pipe mount, sectional area of steam passage on the mount shall be equal to or larger than sum of total area of steam incoming port of safety valve. However, total area of safety valve is less than effective sectional area but equal to or larger than area of safety valve required for boiler, it is acceptable to admit it.

(2) Related to paragraph 3

"Safety place" shall mean high place at outdoors, without fire or other ignitable articles, and the place where danger of ignition and explosion of steam by diffusion can be eliminated.

(April 30, 2003 Labor Standards Bureau Notification No. 0430004)

(Relief Valve or Safety Valve for Hot Water Boilers)

**Article 65.**

1. Any hot water boiler not exceeding 120˚C in working water temperature shall be equipped with a relief valve that is immediately actuated whenever the pressure in the boiler reaches the maximum allowable working pressure and keeps the internal pressure not exceeding the maximum allowable working pressure. However, this provision does not apply where a water relief pipe that keeps the internal pressure not exceeding the maximum allowable working pressure is installed at the part of such boiler which is easily accessible for inspections.
2. Hot water boilers exceeding 120˚C in working water temperature shall be equipped with a safety valve.

# Abstract of "Construction code for boilers"

| | |
|---|---|
| ⚠ Warning | **Do not apply the product to devices which do not allow any valve seat leakage.**<br>*** The product has allowable valve seat leakage and does not close completely (valve seat leakage cannot be zero).** |
| ⚠CAUTION | **Please refer to the manual attached to the product for procedures for installation and operation.** |

**46 Related to Article 65**

(1) As relief valve or relief pipe in accordance with paragraph 1, for example, there shall be followings:

A. For relief valve, nominal size (15A at smallest) and quantity shall be decided without exceeding the value of hot water boiler pressure plus 10% or more of maximum usage pressure (0.034 MPa when this value is less than 0.034 MPa) .
Size of relief valve shall be on annex 1 "calculation formula to determine the size of relief valve for hot water".

B. Internal diameter of relief pipe shall conform to the stipulation of 15. 15 in JIS B 8201.

(2) As safety valve equipped with hot water boiler in paragraph 2, for example, nominal size shall be 20A or more and 100A or less, and its discharge capacity calculation shall conform to annex 2 of JIS B 8210. However, in this case, evaporation amount (unit: kg/h) shall be the value obtained by dividing heat output by difference between specific enthalpy of saturated steam corresponding to maximum usage pressure and specific enthalpy of water supply.

(3) Regarding hot water boiler using heat medium such as oil, in case that temperature of the said heat medium exceeds boiling point at atmospheric pressure, it shall be handled as what safetey valve is installed on in conformity with paragraph 2. However, as discharge capacity in this case, for example, it shall conform to the stipulation of JIS B 8210 annex 3, and steam amount (unit kg/h) in this case shall be the value obtained by dividing heat output by difference between specific enthalpy of saturated steam corresponding to maximum usage pressure and specific enthalpy of water supply.

(April 30, 2003 Labor Standards Bureau Notification No. 0430004)

**· Reference: calculation formula to determine the size of relief valve for hot water (related to boilers)**

(1) Using required discharge capacity of valves

$$S = \frac{W}{87.7\sqrt{(P_1 + 0.1)\,\kappa\gamma_1}} \quad \cdots\cdots(1)$$

S : Flow area ($mm^2$)
W : Required discharge capacity of valve (kg/h)
$P_1$ : Discharge capacity deciding pressure(1) (MPa)
$\kappa$ : Difference between saturated temperature ts℃ of discharge capacity deciding pressure $P_1$ and hot water temperature at inlet side of valve Δt℃ correction coefficient for t1℃, conforming to Table 1.
$\gamma$ 1: Density of hot water at inlet side of valve (kg/l), conforming to Table 1.

However, at formula 1, if the value of $(P_1 + 0.1)\ \kappa$MPa exceeds the value of difference between discharge capacity deciding pressure P1 MPa and pressure at outlet side of valve P2 MPa, $(P_1 + 0.1)\ \kappa$ shall be replaced by $(P_1 - P_2)$ and calculated.

(Notice)(1) The said discharge capacity deciding pressure means, at construction code for boilers and construction code for pressure vessels, the set pressure of relief valve plus the value corresponding to its 10% (0.034 MPa at minimum).

Remark
Only for hot water boiler, relief valve for hot water is applied to in case that hot water temperature is 120℃ or less.
Exceeding 120℃, according to the article 65 paragraph 2 of construction codes for boilers, safety valve shall be equipped. Its largeness can be obtained by the formula to calculate discharge capacity of safety valve stipulated in L, second, 43 (1) 3. In this case, according to the article 65 paragraph 2 of construction codes for boilers, required discharge capacity of safety valve W (kg/h) is obtained by the following formula:

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

Q: Heat output (kJ/h)
$h_1$: Enthalpy of saturated steam corresponding to maximum usage pressure of boiler (kJ/kg)
$h_2$: Enthalpy of water supply (kJ/kg)

$$S = \frac{Q\varepsilon}{87.7C\sqrt{(P_1 + 0.1)\,\kappa\gamma_1}} \quad \cdots\cdots(2)$$

Q : Heat input of pressure vessel or heat output of boiler for hot water (kJ/h)
$\varepsilon$ : Coefficient of volume expansion for water, conforming to Table 2.
C : Specific heat at constant pressure for water (kJ/kg ℃)

| ⚠ Warning | Do not apply the product to devices which do not allow any valve seat leakage.<br>* The product has allowable valve seat leakage and does not close completely (valve seat leakage cannot be zero). |
|---|---|
| ⚠CAUTION | Please refer to the manual attached to the product for procedures for installation and operation. |

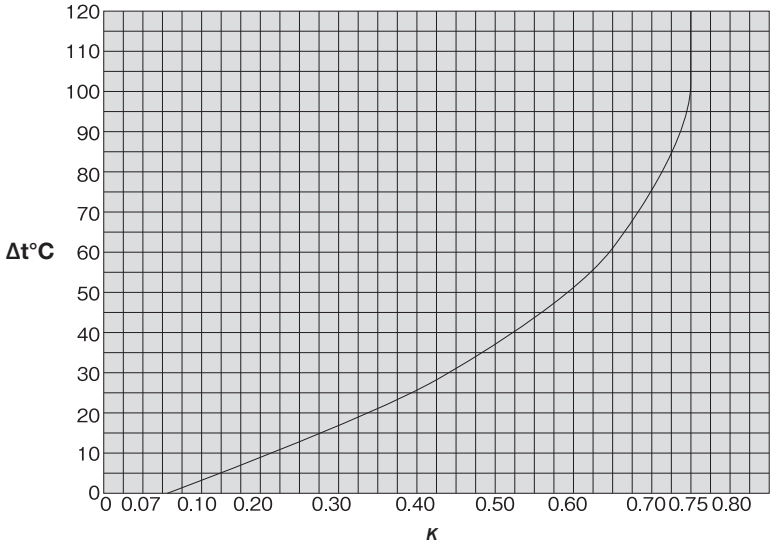
**Table-6 Density of hot water**

(kg/L)

| Pressure MPa·A / Temperature ℃ | 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 | 0.988 | 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 | | 0.985 | 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 |

Remark Intermediate value of this table shall be calculated by proportional method.

**Fig. 3 Correction coefficient $\kappa$**



| ⚠ Warning | Do not apply the product to devices which do not allow any valve seat leakage.<br>* The product has allowable valve seat leakage and does not close completely (valve seat leakage cannot be zero). |
|---|---|
| ⚠CAUTION | Please refer to the manual attached to the product for procedures for installation and operation. |

**Table-7 Specific heat at constant pressure and coefficient of volume expansion**

| Temperature ˚C | Specific heat at constant pressure kJ/kg˚C | Coefficient of volume expansion L/˚C |
|---|---|---|
| 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 |

Remark Intermediate value of this table shall be calculated by proportional method.

## Apply Pressure Classification List for Each Safety Valve Model

(unit: MPa)

| Model | Nominal size | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|---|
| AL-150·150L·140 | 15A | 0.05-0.2 | 0.21-0.3<br>0.31-0.4 | 0.41-0.55 | 0.56-0.75 | 0.76-1.0 | | | |
| | 20A | 0.05-0.2 | 0.21-0.35 | 0.36-0.45 | 0.46-0.6 | 0.61-0.75 | 0.76-1.0 | | |
| | 25A | 0.05-0.2 | 0.21-0.35 | 0.36-0.45 | 0.46-0.55 | 0.56-0.8 | 0.81-1.0 | | |
| | 32A | 0.05-0.2 | 0.21-0.3<br>0.31-0.4 | 0.41-0.65 | 0.66-1.0 | | | | |
| | 40A·50A | 0.05-0.2 | 0.21-0.3<br>0.31-0.4 | 0.41-0.65 | 0.66-0.8 | 0.81-1.0 | | | |
| AL-150H | 15A | | | | | | 1.0-1.6 | | |
| | 20A·25A | | | | | | | 1.0-1.6 | |
| | 32A | | | | | 1.0-1.6 | | | |
| | 40A·50A | | | | | | 1.0-1.6 | | |
| AL-140H | 15A | | | | | | 1.0-1.3 | 1.31-2.0 | |
| | 20A·25A | | | | | | | 1.0-1.6 | 1.61-2.0 |
| | 32A | | | | | 1.0-1.6 | 1.61-2.0 | | |
| | 40A·50A | | | | | | 1.0-1.6 | 1.61-2.0 | |
| AL-150T·150T-N·150TR<br>AL-150TML·140T | 15A | 0.05-0.2 | 0.21-0.4 | 0.41-0.55 | 0.56-0.75 | 0.76-1.0 | | | |
| | 20A | 0.05-0.2 | 0.21-0.35 | 0.36-0.45 | 0.46-0.6 | 0.61-0.75 | 0.76-1.0 | | |
| | 25A | 0.05-0.2 | 0.21-0.35 | 0.36-0.45 | 0.46-0.55 | 0.56-0.8 | 0.81-1.0 | | |
| | 32A | 0.05-0.2 | 0.21-0.4 | 0.41-0.65 | 0.66-1.0 | | | | |
| | 40A·50A | 0.05-0.2 | 0.21-0.4 | 0.41-0.65 | 0.66-0.8 | 0.81-1.0 | | | |
| AL-17·27 | 15A - 50A | 0.05-0.2 | 0.21-0.4 | 0.41-0.65 | 0.66-1.0 | 1.01-1.6 | | | |
| AL-10 | 15A - 40A | 0.05-0.2 | 0.21-0.4 | 0.41-0.65 | 0.66-1.0 | | | | |
| | 50A | 0.05-0.1<br>0.11-0.2 | 0.21-0.4 | 0.41-0.65 | 0.66-1.0 | | | | |
| AL-250·250R<br>AL-260·260R | 15A | 0.05-0.2 | 0.21-0.4 | 0.41-0.55 | 0.56-0.75 | 0.76-1.0 | | | |
| | 20A | 0.05-0.2 | 0.21-0.35 | 0.36-0.45 | 0.46-0.6 | 0.61-0.75 | 0.76-1.0 | | |
| | 25A | 0.05-0.2 | 0.21-0.35 | 0.36-0.45 | 0.46-0.55 | 0.56-0.8 | 0.81-1.0 | | |
| | 32A | 0.05-0.2 | 0.21-0.4 | 0.41-0.65 | 0.66-1.0 | | | | |
| | 40A·50A | 0.05-0.2 | 0.21-0.4 | 0.41-0.65 | 0.66-0.8 | 0.81-1.0 | | | |
| AL-300·301 | 15A - 50A | 0.05-0.25 | 0.26-0.5 | 0.51-0.75 | 0.76-1.6 | | | | |
| AL-300T·301T | 15A - 50A | 0.05-0.25 | 0.26-0.5 | 0.51-0.75 | 0.76-1.3 | | | | |
| AL-280 | 15A·20A | 0.05-0.2 | 0.21-0.35 | 0.36-0.45 | 0.46-0.6 | 0.61-0.75 | 0.76-1.0 | | |
| | 25A | 0.05-0.2 | 0.21-0.35 | 0.36-0.45 | 0.46-0.55 | 0.56-0.8 | 0.81-1.0 | | |
| | 32A | 0.05-0.2 | 0.21-0.4 | 0.41-0.65 | 0.66-1.0 | | | | |
| | 40A·50A | 0.05-0.2 | 0.21-0.4 | 0.41-0.65 | 0.66-0.8 | 0.81-1.0 | | | |
| AL-4·4T | 65A | 0.05-0.1 | 0.11-0.25 | 0.26-0.55 | 0.56-1.0 | 1.01-1.5 | | | |
| | 80A - 125A | 0.05-0.1 | 0.11-0.2 | 0.21-0.4 | 0.41-0.8 | 0.81-1.5 | | | |
| | 150A | 0.05-0.1 | 0.11-0.2 | 0.21-0.4 | 0.41-0.8 | | | | |
| AL-4S·4ST | 65A | 0.05-0.1 | 0.11-0.25 | 0.26-0.55 | 0.56-1.0 | 1.01-2.0 | | | |
| | 80A·100A | 0.05-0.1 | 0.11-0.2 | 0.21-0.4 | 0.41-0.8 | 0.81-1.6 | 1.61-2.0 | | |
| AL-5 | 20A | 0.05-0.12 | 0.13-0.21 | 0.22-0.35 | 0.36-0.63 | 0.64-0.99 | 1.0-1.5 | | |
| | 25A | 0.05-0.08 | 0.09-0.15 | 0.16-0.25 | 0.26-0.45 | 0.46-0.75 | 0.76-1.0 | 1.01-1.1 | 1.11-1.5 |
| | 32A | 0.05-0.08 | 0.09-0.17 | 0.18-0.25 | 0.26-0.45 | 0.46-0.75 | 0.76-1.0 | 1.01-1.1 | 1.11-1.5 |
| | 40A | 0.05-0.08 | 0.09-0.15 | 0.16-0.4 | 0.41-0.7 | 0.71-1.0 | 1.01-1.1 | 1.11-1.5 | |
| | 50A | 0.05-0.09 | 0.1-0.25 | 0.26-0.5 | 0.51-0.7 | 0.71-1.0 | 1.01-1.1 | 1.11-1.5 | |
| AL-6 | 65A | 0.05-0.1 | 0.11-0.25 | 0.26-0.55 | 0.56-1.0 | 1.01-1.5 | | | |
| | 80A | 0.05-0.1 | 0.11-0.2 | 0.21-0.4 | 0.41-0.8 | 0.81-1.0 | 1.01-1.5 | | |
| | 100A | 0.05-0.1 | 0.11-0.2 | 0.21-0.4 | 0.41-0.8 | 0.81-1.0 | 1.01-1.5 | | |
| | 125A | 0.05-0.1 | 0.11-0.2 | 0.21-0.4 | 0.41-0.8 | 0.81-1.0 | 1.01-1.5 | | |
| | 150A | 0.05-0.1 | 0.11-0.2 | 0.21-0.4 | 0.41-0.8 | | | | |
| AL-31·31H | 15A | 0.05-0.15 | 0.16-0.25<br>0.26-0.35 | 0.36-0.45<br>0.46-0.55 | 0.56-0.65<br>0.66-0.75 | 0.76-0.85<br>0.86-1.0 | 1.0-1.3 | 1.31-1.6<br>1.61-2.0 | |
| | 20A | 0.05-0.2 | 0.21-0.3 | | 0.31-0.4<br>0.41-0.5 | 0.51-0.7 | 0.71-1.0 | 1.0-1.3<br>1.31-1.6 | 1.61-2.0 |
| | 25A | 0.05-0.2 | 0.21-0.3 | 0.31-0.45 | 0.46-0.55 | 0.56-0.65<br>0.66-0.8 | 0.81-1.0 | 1.0-1.6 | 1.61-2.0 |
| | 32A - 50A | 0.05-0.2 | 0.21-0.3 | 0.31-0.5 | 0.51-0.65 | 0.66-0.8 | 0.81-1.0 | 1.0-1.6 | 1.61-2.0 |