

Problem	Solution
( 3 ) Valve chatter a. Over discharge b. Over resistance in inlet piping c. Over resistance in discharge piping d. Over spring constant  e. Improper adjusting ring position	Recalculate and select safety valve which discharge is approach to the equipment in accordance with its required discharge Increase size of inlet piping inner diameter to bigger than valve inlet diameter or shorten the inlet piping. Increase size of discharge piping inner diameter or shorten discharge piping. Inspect if spring working pressure is accordance with valve opening pressure or not. Adjust again till to reach the required, then tighten the bolts and seal with lead.

( Notes ) : The set differential pressure is stated in Gb12243—2005 “Spring loaded safety valve” .

1. The set differential pressure of safety valve in pressure vessel and piping:

when the set pressure is less than 0.5MPa, consider as  $\pm 0.014\text{MPa}$ . when the set pressure is more than or equal to 0.5MPa, consider  $\pm 3\%$  set pressure.

2. The set differential pressure of safety valve in steam boiler: when the set pressure is 0.5-2.3MPa, consider as  $\pm 3\%$ . When the set pressure is 2.3-7.0MPa, consider as  $\pm 0.07\text{MPa}$ . When the set pressure more than 7.0MPa,

## 6. Maintenance

To ensure safe operation and long service life, it should pay attention to the followings.

1. Valve should be inspected regularly to avoid abnormal phenomenon as leakage, block and spring rusting. To observe the adjusting bolt, lock nut of adjusting ring tighten bolt if loose or not. If find some problems, should solve properly in time.

2. Disassemble the valve to clean, inspect and grind regularly, to reuse after setting pressure.

3. If the safety valve installed in the outdoor, should make protect measure to prevent rainy, fog, dirt, and rust into safe valve and discharge piping. If the temperature below 00c environment, it should to make prevent frostbite manure to ensure the valve capacity.



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## 1. The selection of safety valve

Safety valve is an automatic pressure releasing device for pressure equipment, container, and pipeline. As the pressure of protected system rises to a pressure which is higher than it permitted, valve will open automatically to discharges some unnecessary medium to prevent the system pressure continues rising. As the pressure of the system falls to a specified rating, the valve can shut-off automatically. Thus it guarantees the system operate normally. How to select safety valve correctly is relate to the economic benefits and the security of the operator and the equipment. The following is some important points of selecting the safety valve.

### 1. The confirmation of working pressure (Pressure rating)

It can not be confused of the safety valve working pressure, nominal pressure and the spring working pressure. They are completely different. Working pressure is the static pressure when the safety valve normal operating. It is same as the working pressure of being protected system or equipment. The spring working pressure is a certain spring permitted pressure scope in which the safety valve of the opening pressure (set pressure) can change the compression of spring preload adjusted. The identical nominal pressure of the same safety valve, in accordance with spring design requirements, can be divided into different working pressure rating. The division condition is that ensure the upper and lower limits of all kinds of working pressure rating can meet the standards of work performance. The details division as following table:

Nominal Pressure (Mpa)	Working Pressure Rating					
1.6	>0.06-0.1	>0.1-0.16	>0.16-0.25	>0.25-0.4	>0.4-0.6	>0.6-0.8
	>0.8-1	>1-1.3	>1.3-1.6			
2.5	>1.3-1.6	>1.6-2	>2-2.5			
4.0	>1.3-1.6	>1.6-2	>2-2.5	>2.5-3.2	>3.2-4	
6.4	>2.5-3.2	>3.2-4	>4-5	>5-6.4		
10.0			>4-5	>5-6.4	>6.4-8	>8-10
16.0	>10-13	>13-16				
32.0	>16-19	>19-22	>22-25	>25-29	>29-32	

Problem	Solution
( 4 ) No inspection for long time	Disassemble, clean and change the valve according the parts damage, establish a system of periodic inspection.
3. The operation capacity doesn't meet the requirements ( 1 ) The differential of opening pressure exceed the allowance scope a. Set pressure incorrect operation or related parts loose b. The pressure of discharge piping charges c. Working temperature changes d. Spring corruption	<p>According to GB12243-2005 " Spring loaded safety valve" , it has a permitted scope of the set differential pressure. (note) If the pressure exceeds the permitted scope that is abnormal, should find the reason and take measure. Readjust the adjusting ring, tighten the lock nut when finish.</p> <p>Find the reason of backseat changing and solve it. To choose bellows seal balance safety valve if the back pressure changes obviously.</p> <p>The opening pressure will be fell when using in high condition but the safety valve adjusts in the normal temperature, suggest adjusting the adjusting ring. If select improper type, suggest applying safety valve with radiator.</p> <p>Change spring; suggest selecting spring with fluoroplastic or bellows safety valve with isolation.</p>
( 2 ) Relieving pressure or re-seating pressure change a. Adjusting ring change b. Over flow resistance in Discharge piping	<p>Recalculate and select safety valve which discharge is approach to the equipment in accordance with its required discharge</p> <p>Increase size of inlet piping inner diameter to bigger than valve inlet diameter or shorten the inlet piping.</p>

## 5. The safety valve common faults and solutions

Safety valve selection or operation improperly will cause valve fault. If the fault unsolved in time, it will affect the valve function and use age, even no protect to safe. The common faults and solutions as following table:

Problem	Solution
1. Leakage ( 1 ) Dirt in the sealing ( 2 ) Sealing damage	Open the valve several times with lift lever to blow off dirt. If were unable to blow off, should disassemble the valve to clean, then assemble and adjust. Disassemble the valve, repair with grind or after turning according to damage degree. Ensure the sealing smoothness no less than $0.2\sqrt{}$
( 3 ) Incorrect installation or the additional load of piping	Install again or remove additional load of piping
( 4 ) Adjusting temperature or corruption medium	Change the spring or valve as per the conditions. If the spring incorrect adjusting, it should screw down or loose the bolts.
( 5 ) The opening pressure is approach to working pressure of equipment	Set the pressure in the scope of spring working pressure. If exceed the scope, it should to change the accordance pressure spring.
2、Nonflexible operation ( 1 ) Block in operating parts ( 2 ) Uncleaness in equipment or piping	The reason may be improper installation, dirt or parts rust and so on. It should to find the reason and solve it. Install the safety valve after equipment or piping cleaning.
( 3 ) Parts damage or rust	Repair or change according to the damage degree.

Safety valves selection should according to the required pressure of opening pressure to sure valve work pressure rating.

### 2. Selection Conditions

#### ( 1 ) Nominal Diameter Selection

The nominal diameter of safety valve is selected according to the required discharge of protected system. The certified capacity of the selecting safety valve should greater than or approach to the essential capacity. The essential capacity is the medium discharged in order to prevent excessive overpressure when abnormal and overpressure. It is decided by the system or equipment working condition, capacity as well as possible overpressure.

#### ( 2 ) Material Selection

Selection of the material safety valve should consider working temperature, working pressure, medium performance, material technology, economy and other factors. The customers select according to the list of our company catalog. If you have special requirements for material, please consult with us when placing order.

#### ( 3 ) Special struction safety valve selection

##### 1 ) Radiator safety valve

This type of safety valve is suitable for high temperature medium environment in order to cool the spring internal temperature. Generally, when the operation temperature of sealed type safety valve higher than 300℃ and 350℃ of the exposed type, we suggest selecting radiator safety valve.

##### 2 ) Bellows safety valve

To withstand the superimposed back pressure of safety valve and that varies than 10% set pressure, suggest choosing this type. Moreover for the corrosive medium to prevent the spring and the guidance parts are corroded by the medium, also should select this kind of safety valve .

#### 3. General safety valve ordering instructions:

Order general safety valve has to give clear indication of the following

##### 1 ) Model,nominal diameter, nominal pressure



- 2 ) Working pressure and opening pressure ( setpressure )
- 3 ) Body material and seal material
4. Special safety valve ordering instructions

Besides the model, nominal diameter and opening pressure, when ordering special safety valve, should state the followings:

- ( 1 ) Maximum discharge pressure and minimum re-seating pressure (blowdown pressure)
- ( 2 ) The required discharge of protected system or equipment and the quantity of valve planning to install.
- ( 3 ) Applicable medium and density ( liquid ) or molecular weight ( gas )
- ( 4 ) Inlet medium temperature of valve
- ( 5 ) The type of under pressure and value
- ( 6 ) Other requirements
- 1 ) Sealed type or exposed type

The bonnet and protector of sealed type safe valve are sealed which have two effects. One is to protect inner parts so that prevent the dust in, it is no required to seal test. Another is to prevent the toxic, flammable and other types of medium overflow, it is required to seal test.If it needs outlet side air seal test, please state when ordering.The bonnet of exposed type safety valve is opened, advantage in cooling the temperature of spring internal. It is suitable for high temperature environment as the steam and etc.

- 2 ) With lifting lever or not

According the regulation of state steam boiler safe inspection, steam boiler safety valve should choose safety valve with lever to open and test timely. Once the medium pressure exceed to 75% of opening pressure may use the lifting lever to lift disc slightly and inspect the flexibility of opening.

Outlet, enter the thin iron rod to adjust directly from outlet. For the sake of safety, it should to reduce the inlet pressure before adjusting. (Generally, less than 80% of opening pressure to prevent the valve opens suddenly and cause accident)

2 ) Do not revolve the adjusting ring oversize, recommend with 2-5 pitches. Screw down the adjusting lock bolt after finishing the adjustment, and make the end of bolt in the recess between two pitches of adjusting ring to prevent loosening.

3 ) For the safety valve with lower and upper adjusting ring, suggest adjusting lower adjusting ring first.

After relieving pressure reach to the scheduled value, adjust the upper adjusting ring. If mutually interference occurs, should adjust repeatedly until satisfaction.

When screw the lower adjusting ring in counter-clockwise, its position lift, relieving pressure and re-seating pressure falls. Otherwise, screw clockwise, the position falls, relieving pressure and re-seating rises.

The upper adjusting ring screw in counter-clockwise, the position lifts, relieving pressure and re-seating pressure rises. Otherwise, it helps safety valve disc opening when the adjusting ring position downs. The relieving pressure falls with re-seating pressure

4 ) The test machine needs enough atmospheric flows when adjusting between relieving pressure and re-seating pressure to ensure valve fully open (reach the valve list of safety valve) then to test, or the data of relieving pressure and re-seating pressure will be incorrect.

5 ) It will influence the capacity of valve if the position between upper and lower adjusting rings are closely after adjusting. Generally, the ring area between upper and lower adjusting rings will not less than the throat diameter.

6 ) In the process of thermal adjusting should avoid abnormal operation as chatter, flutter, to prevent sealing damage.

In brief, the thermal adjusting is a complex and careful work, it need cooperation between supplier and buyer. Generally, the user may adjust according to the installation instructions. If ask our company to adjust, we will require charge according to the valve price and distance to customer' s city.

### 1. Set pressure (opening pressure) adjusting

Opening the upper lead sealing, taking down the lifting support and loosening the valve cap, unscrew lock nut in the working pressure scope of the spring, revolve adjusting bolt to change the spring pretight compression, carrying on the adjustment to the opening pressure. Slowly raises the inlet pressure to make valve tripping one time. If the opening pressure is too low, relieve the inlet pressure, tighten the adjusting bolt clockwise. If the opening pressure is too high, unscrews it with counter-clockwise. When adjust to the required opening pressure, tighten the lock nut and assemble cap. If the required opening pressure exceeds spring working pressure, it should change to another spring of different pressure, and then readjust. After changing the spring, you should revise corresponding data in nameplate.

Pay attention to the followings for adjusting set pressure

1) It should be cleaned the valve internal and test with clean medium before adjustment.

2) When the opening pressure approach to the pressure in front of valve (that is exceed than 80% of opening pressure), do not screw the adjusting bolt in order to prevent the disc revolving and damage the sealing.

3) In the permitted condition, to apply the medium approach the actual operating conditions to adjust that ensure the accuracy of opening pressure. In the contrast, if can't apply the medium approach the actual operating conditions, air or steam safety valve apply air medium to adjust set pressure. Liquid or water safety valve applies normal temperature to adjust. If it has great differences between the actual medium temperature and adjustment medium temperature, should consider the temperature compensation.

### 2. Relieving pressure and re-seating pressure adjusting

1) For the safety valve which has already adjust opening pressure, if its relieving pressure and re-seating doesn't according the required, than may adjust the adjusting ring position. There are two kinds of structure of safety valve (see Figure 5, Figure 6), one is single adjusting ring, and another is double adjusting ring. The adjustment process is open the lower lead sealing and unscrew the adjusting ring lock bolt, then adjust the adjusting ring gear with tool as thin iron rod. If the safety valve without connection piping in

## 2. The transportation and storage of safety valve

Care should be taken in the transport and storage from leaving factory to installation, or will be influence the valve performance, even suffer the damage. Safety valve should fix in the box and no shock in the transport. It should storage in dry and vent environment. It should have ends cover when in storage or transport.

It must to inspect the safe valve before storage, once inlet protector damage or water, dirt in it, please clean and plug up with wax paper or plastic in dry and vent environment.

## 3. The installation of safety valve

The valve should be cleaned by cleaning kerosene or gasoline in inlet and outlet internal. It should be installed correctly that relating to the operating, even to capability and sealing.

### 1. Safety valve installation position

When installing the safety valve in protected system or equipment, please pay attention to the followings:

1) Safety valve should be installed vertical in the sensitive part of the protected vessel or equipment, such as the top of pressure vessel, main piping of steam-gas and etc.

2) When the pressure source of protected system is a pulsate device (for example air compressor), and the pressure pulsation upper limit is close with the safety valve opening pressure, then the safety valve should install in the position that is a suitable distance from pressure source and stabilizer to prevent the abnormal chatter.

3) The Safety valve should be installed in the position which convenience in disassembly to inspect and maintain

### 2. Safety valve inlet piping installation



The safety valve should be installed in vertical upright position and direct from the vessel or equipment being protected. The inlet piping should be as short as possible, and must not be smaller than the inner diameter of the safety valve if install inlet piping. This will help to reduce the piping resistance and moment of the safety valve discharges reacting force to the vessel.

### 3. Discharge piping installation of safety valve

For the sake of reducing the effect of safety valve performance, should pay attention to the following points when install discharge piping.

1) The discharge piping inner diameter should bigger than the outlet diameter of safety valve so that will prevent high back pressure or influence valve operating.

For the different mediums it has different installation methods. ( see the figure 1 2 3 )

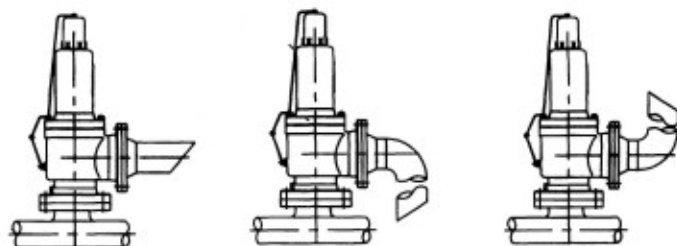


Figure 1 for air or other gas    figure 2 for water or other liquid    Figure 3 for air, gas or steam

2) Supports are recommended that to prevent piping strain (install strain and thermal expansion) of piping that will influence the valve performance. Figure 4 is one of discharge piping installation

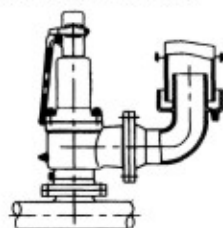


Figure 4

3) In principle, a safety valve uses with single discharge piping. However, when two or above safety valves use in one which should have enough discharge area, the discharge piping guides to collecting piping and the turning of flows should be small.

4) Discharge piping should have some suitable discharge holes to prevent rain, snow condensate and etc. in the discharge piping.

5) It is unreasonable to withdraw valve weight by safety valve outlet piping. It should special support to withdraw it which can prevent moving or shocking in the reaction of discharge.

## 4. Performance adjusting and guiding of safety valve

The Safety valve of our company is tested in the normal temperature according to the standard. It has temperature difference for the safety valve actual working condition and normal temperature set pressure, so result in the difference for set pressure (opening pressure) of constant pressure and working condition. For sake of this, should apply thermal state adjust the safety valve if great difference. It has set pressure (opening pressure) adjusting and discharge re-seating pressure adjusting. Our two kinds of product as a example in the following (Figure 5. figure6).

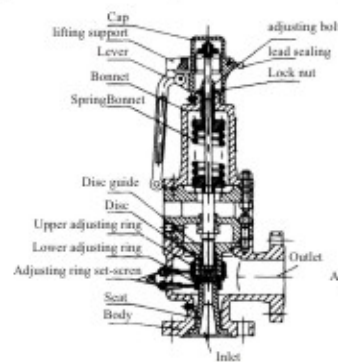


Figure 5

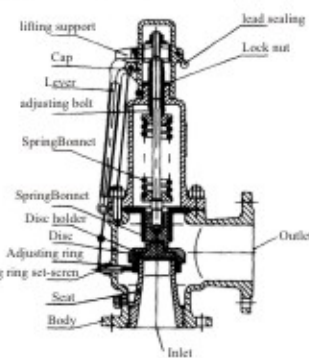


Figure 6