

SL-39, 40 Type Series Safety Relief Valve (Lift Type)

for Stainless Steel Lines of (Pressure Vessels, Hot Water Boilers, Heat Exchangers, Secondary Side of Pressure Reducing Valves etc.

Safety relief valve is a category of valves with functions between those of safety valves, which are mainly for steam and gases, and those of relief valves, which are mainly for liquids.

Safety relief valve has simple structure, high corrosion resistance, and is made of high-grade materials. It is widely used as safety device for pressure vessels, machines/equipments, hot water boilers, water/hot water supply systems, air conditioning systems, and pressure reducing valves.

The soft-sheet type safety relief valve is featured of high airtightness. It is suitable for gases and applications where leakage of valve is not allowed.

FEATURES

- A sealed type safety relief valve with high corrosion resistant Stainless steel spring case, seat and disc, and Stainless steel spring.
- 1~2 sizes smaller and lighter than prior products of the same type.

SPECIFICATIONS

| Type | Standard item(Metal seated type) | | Soft seat type | |
|---|----------------------------------|--|--|---------------|
| Model name | SL-39 | SL-40 | SL-39V | SL-40V |
| Code name | SL39-D □ | SL40-D □ | SL39V-D □ | SL40V-D □ |
| ※ Code No. of pressure division is required in □. | | | | |
| Cap type(Closed type) | With lever*1 | Without lever | With lever | Without lever |
| Applicable fluid | Steam, air, gases & liquids*2 | | Air, gases & liquids*2 | |
| Set pressure range | 0.05~1.0MPa | | | |
| Applicable temperature | Max. 150°C(Max. 235°C*1) | Max. 235°C | Max. 120°C | |
| End connection | Screwed JIS Rc | | | |
| Materials | Body | Stainless steel(Spring case:Stainless steel) | | |
| | Disc | Stainless steel | Stainless steel(Disc tip:Synthetic rubber) | |
| Valve body pressure test | Hydraulic 2.0MPa | | | |

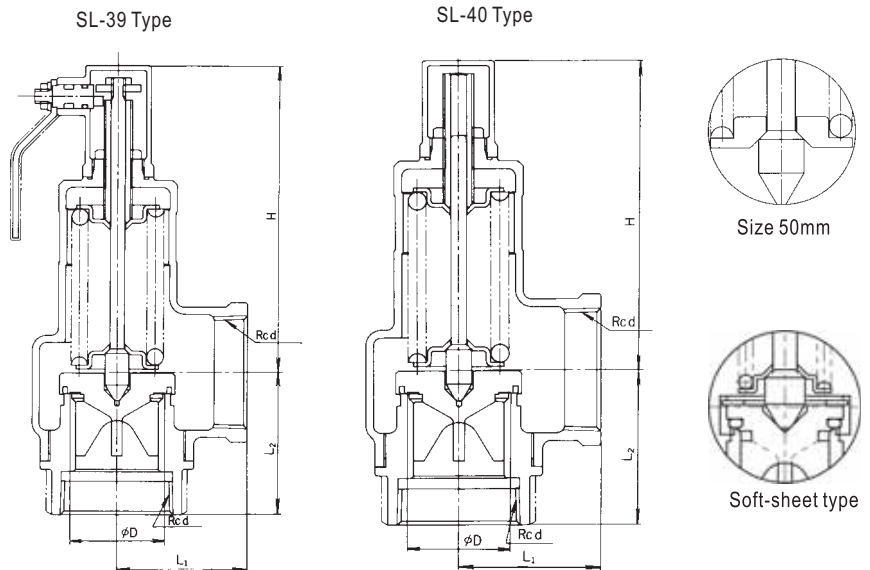
*1. For steam, the valve is provided with a release lever and can be used at steam temperature up to 235°C.
*2. Contact our local agent for gasoline, kerosene and as open type solvent medium use.

DIMENSIONS

| Size | Seat opening dia. D | Effective area (mm ²) π D ² /4 | Lift ℓ | Face to Face | | Height H | | End connection d | Mass(kg) | |
|------------|---------------------|---|-----------|----------------|----------------|----------------|----------------|------------------|----------------|----------------|
| | | | | L ₁ | L ₂ | SL-39,39V Type | SL-40,40V Type | | SL-39,39V Type | SL-40,40V Type |
| 15(1/2") | 14(13) | 17.5 | 0.4(0.43) | 30 | 36 | 96 | 85 | 1/2" | 0.6 | 0.5 |
| 20(3/4") | 19(18.6) | 29.8 | 0.5(0.51) | 35 | 40 | 100 | 89 | 3/4" | 0.7 | 0.6 |
| 25(1") | 23(21.9) | 43.3 | 0.6(0.63) | 40 | 46 | 104 | 93 | 1" | 0.9 | 0.8 |
| 32(1 1/4") | 32(29.4) | 80.3 | 0.8(0.87) | 50 | 54 | 126 | 115 | 1 1/4" | 1.5 | 1.4 |
| 40(1 1/2") | 40(36.7) | 125.6 | 1.0(1.09) | 55 | 60 | 131 | 120 | 1 1/2" | 2 | 1.9 |
| 50(2") | 50(47.1) | 204.1 | 1.3(1.38) | 65 | 73 | 166 | 152 | 2" | 3.4 | 3.2 |

* Figures in () are for SL-39V, 40V Type.

CONSTRUCTION



SL-39 Type Series



SL-40 Type Series

PRESSURE DIVISION

(MPa)

| Code No. | Pressure division |
|----------|-------------------|
| 1 | 0.05~0.1 |
| 2 | Over 0.1~0.2 |
| 3 | Over 0.2~0.5 |
| 4 | Over 0.5~1.0 |

Note: See page 69 for relieving capacity.

Discharge Capacity

1. RELIEVING CAPACITY FOR STEAM (Pressure Vessel Construction Code)

(kg/h)

| Size | Set pressure(MPa) | | | | | | | | | | |
|------------|-------------------|------|------|------|------|------|-----|------|------|------|------|
| | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
| 15(1/2") | 13.4 | 17.4 | 25.3 | 34.1 | 41.9 | 50.5 | 59 | 67.6 | 76.1 | 84.7 | 93.2 |
| 20(3/4") | 22.9 | 29.7 | 43.2 | 58 | 71.4 | 86 | 100 | 115 | 129 | 144 | 158 |
| 25(1") | 33.3 | 43.1 | 62.8 | 84.3 | 103 | 125 | 146 | 167 | 188 | 209 | 230 |
| 32(1 1/4") | 61.8 | 80 | 116 | 156 | 192 | 231 | 271 | 310 | 349 | 388 | 428 |
| 40(1 1/2") | 96.7 | 125 | 182 | 244 | 301 | 362 | 424 | 485 | 546 | 608 | 669 |
| 50(2") | 157 | 203 | 296 | 397 | 489 | 589 | 689 | 788 | 888 | 988 | 1080 |

Calculating formula:

$$Q_m = 5.246CKd^2A(P+0.1)^{0.9}$$

Qm: Relieving discharge capacity kg/h

C: 0.98 (An coefficient depending on the nature of steam.)

C=1 when set pressure is less than 0.4MPa and at saturation temperature)

Kd': 0.96 (Relieving coefficient)

A: Seat opening area mm²

P: Relieving pressure MPa

(set pressure +0.02) or (set pressure - 1.1) whichever larger.

※ House data

2. RELIEVING CAPACITY FOR AIR (Pressure Vessel Construction Code)

(kg/h)

| Size | Set pressure(MPa) | | | | | | | | | | |
|------------|-------------------|------|------|------|------|------|------|------|------|------|------|
| | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
| 15(1/2") | 21.8 | 28.2 | 41 | 55.1 | 69.3 | 83.4 | 97.5 | 111 | 125 | 139 | 154 |
| 20(3/4") | 37.1 | 48 | 69.9 | 93.9 | 118 | 142 | 166 | 190 | 214 | 238 | 262 |
| 25(1") | 53.9 | 69.8 | 101 | 136 | 171 | 206 | 241 | 276 | 311 | 346 | 381 |
| 32(1 1/4") | 100 | 129 | 188 | 253 | 318 | 382 | 447 | 512 | 577 | 641 | 706 |
| 40(1 1/2") | 156 | 202 | 294 | 396 | 497 | 598 | 700 | 801 | 902 | 1000 | 1100 |
| 50(2") | 254 | 329 | 479 | 643 | 808 | 972 | 1130 | 1300 | 1460 | 1630 | 1790 |

Calculating formula:

$$Q_m = C \cdot K_d \cdot A \cdot P_1 \cdot \sqrt{\frac{M}{ZT}} \cdot 0.9$$

Qm: Relieving discharge capacity kg/h

C: 27.0 (Coefficient)

Kd': 0.96* (Relieving coefficient)

A: Seat opening area mm²

M: 28.96 (Molecular weight of air)

Z: 1 (Compression coefficient)

T: 293 (Absolute temperature K)

P₁: Relieving pressure MPa

(set pressure - 1.1+0.1) or (set pressure +0.02+0.1) whichever larger.

■ Converting kg/h to m³/h (standard state) (for reference only)

$$m^3/h(\text{Standard state}) = \frac{\text{Value in the table above (kg/h)}}{1.226 \text{ kg/m}^3}$$

※ House data

3. RELIEVING CAPACITY FOR WATER AND HOT WATER (Pressure Vessel Construction Code)

(kg/h)

| Size | Set pressure(MPa) | | | | | | | | | | |
|------------|-------------------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
| 15(1/2") | 375 | 531 | 742 | 875 | 976 | 1070 | 1150 | 1230 | 1310 | 1380 | 1450 |
| 20(3/4") | 640 | 905 | 1260 | 1490 | 1660 | 1820 | 1970 | 2110 | 2240 | 2360 | 2470 |
| 25(1") | 930 | 1310 | 1830 | 2160 | 2410 | 2650 | 2860 | 3060 | 3250 | 3430 | 3600 |
| 32(1 1/4") | 1720 | 2430 | 3400 | 4010 | 4480 | 4910 | 5310 | 5680 | 6030 | 6360 | 6680 |
| 40(1 1/2") | 2690 | 3810 | 5320 | 6280 | 7000 | 7690 | 8310 | 8890 | 9440 | 9950 | 10400 |
| 50(2") | 4380 | 6200 | 8650 | 10200 | 11300 | 12400 | 13500 | 14400 | 15300 | 16100 | 16900 |

Calculation formula:

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

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

(If (P₁+0.1) κ > (P₁-P₂), replace (P₁+0.1) κ with (P₁-P₂))

W: Relieving capacity kg/h

S: Seat opening area mm²

P₁: Relieving pressure MPa

Set pressure 1.2: 0.05MPa ≤ set pressure < 0.17MPa

Set pressure +0.034: 0.17MPa ≤ set pressure < 0.34MPa

Set pressure 1.1: 0.34MPa ≤ set pressure

P₂: Outlet pressure MPa

κ: Coefficient of correction (see Fig.2 in page 89)

Δt: difference between saturation temperature at P₁ (Relieving pressure) and the temperature of water/hot water at inlet side of valve °C

γ₁: Density of water/hot water at inlet side of valve kg/l (water(15 °C)=1)

■ Converting kg/h to l/min (Standard state) (for reference only)

Weight of 1 liter water (l) = 1kg.

$$l/min = \frac{\text{Value in the table above (kg/h=l/h)}}{60}$$

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

3 SAFETY VALVES, RELIEF VALVES

■ **Allowed deviation of discharge-starting pressure**

(1) **For steam**

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

(2) **For gasses**

For valve for gasses, the allowed deviation of start to discharge pressure is set pressure $\pm 5\%$ (minimum pressure: $\pm 0.025\text{MPa}$). In case of allowed deviation, which is not allowed to exceed set pressure, add the "+" side to "-" side.

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

■ **Allowed deviation of opening pressure (popping pressure)**

(1) **For steam**

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

(2) **For gasses**

For safety valves for gasses, the allowed deviation of discharge-starting pressure is less than 1.1 times of start to discharge pressure. However, in the case of setting opening pressure, the deviation should be $\pm 3\%$ set pressure (minimum $\pm 0.014\text{MPa}$).

■ **BLOWDOWN**

(1) **For steam**

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

(2) **For gasses**

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

TABLE1. TOLERANCE OF OPENING PRESSURE OF SAFETY VALVES FOR STEAM

(MPa)

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

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

*2. The tolerance of the opening pressure of the safety valves for steam used other than in boilers can be $\pm 3\%$ of the set pressure (minimum value $\pm 0.014\text{MPa}$).

TABLE2. BLOWDOWN PRESSURE OF SAFETY VALVES FOR STEAM

(MPa)

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

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

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

TABLE3. BLOWDOWN PRESSURE OF SAFETY VALVES FOR GAS

(MPa)

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

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

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

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

Key Points for Installation of Safety Valve and Relief Valve

1. Installation

- ❶ Safety valve should be vertical to pipe. Before installation, remove scale and dust and clean the surfaces that contact with gasket.
- ❷ The diameter of the installation pipe should be larger than the diameter of valve. To reduce pressure loss to minimum degree, the stand pipe should be as short as possible.
- ❸ The stand pipe should be rigid and hard enough to bear the compression force, shearing force, bending stress or other counterforce caused by relieving of safety valve.
- ❹ Compared with the diameter of the outlet of safety valve, the diameter of the discharge pipe should be as large as possible. The discharge pipe should be as short as possible, without any bending, lead to outside of the door or other safe place, and be properly supported to avoid the occurrence of undesired stress (including thermal stress).

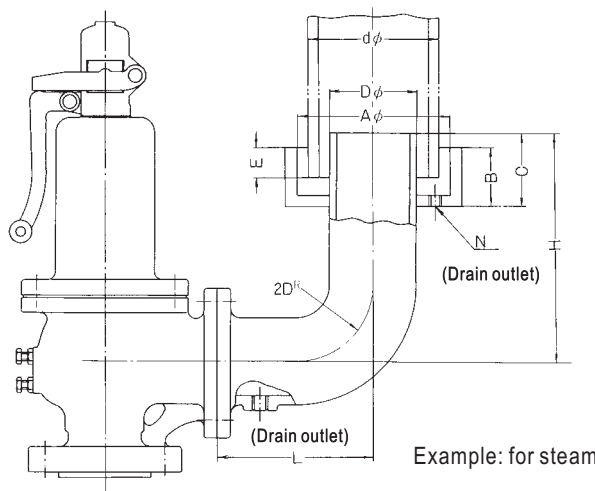
When deciding the place that the outlet of the discharge pipe faces, pay attention to the following issues.

- To avoid installation place where is influenced by explosive sound and blast.
- Avoid damage to electrical equipments, machines, tools etc. in the case the fluid is steam or water.
- Avoid corrosion, poisoning, anoxia etc. in the case the fluid is harmful gas.

- ❺ In the case of screwed type safety valve or relief valve, install union joint at the discharge pipe of the outlet side to allow easy dismounting (see Fig.1 in next page).
- ❻ At parts of the discharge pipe where drain or rain may accumulate, install the drain outlet, which is possible to discharge drain completely, and connect to dike.
- ❼ In the case of full bore type safety valve for liquids or harmful gasses and have faucet for adjusting back pressure, install the valve on the outlet discharge pipe (see Fig.3 in next page).

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

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



REFERENCE DIMENSION FOR EXHAUST PIPE

(mm)

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

2. Maintenance and operating instructions

- ❶ At the installation of safety valves avoid the place where there is possibility to obstruct their functions by vibration or corrosion and do not give impact from outside.
- ❷ After installation, make sure the pressure of the device has reached at least 75% discharge pressure of the valve before using the test lever to start the valve.
- ❸ Normal working pressure of the equipment shall not exceed 90% of the blowdown pressure of the valve and 80 to 85% when pulsation is expected.

- ❹ If possible, remove safety valve before making water pressure test. To make water pressure test without removing safety valve, pay attention to the following below (see Fig.4 in the next page).
 - ⓐ To prevent valve from being damaged due to improper load, when the pressure of the device reaches 80~90% of discharge pressure, install test gag* and press lightly on the end of valve shaft. The test gag must be rotated using hand. If you rotate it using

spanner or other tools, there may have excessively large pressing force, the seat may be damaged, the shaft may be bended, and the valve may not function normally.

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

※ The test gag is optional item.

Key Points for Installation of Safety Valve and Relief Valve

PIPING EXAMPLE

Fig.1 Example: Pressure tank installation

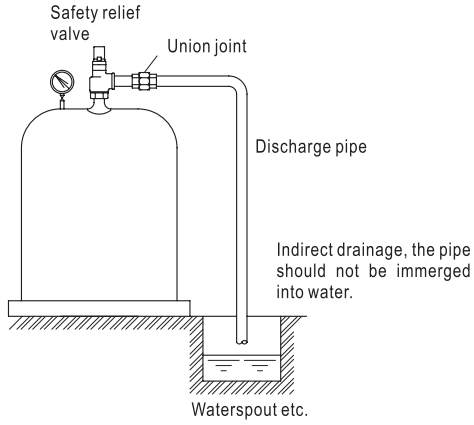


Fig.2 Example: Installation of the secondary side of pressure reducing valve

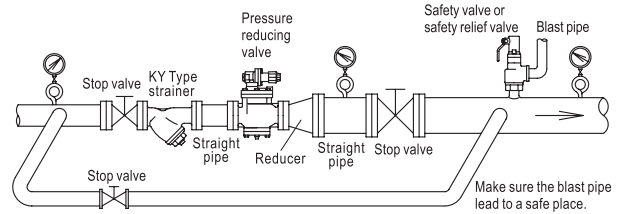


Fig.3 Example connection of (back pressure adjusting cock)

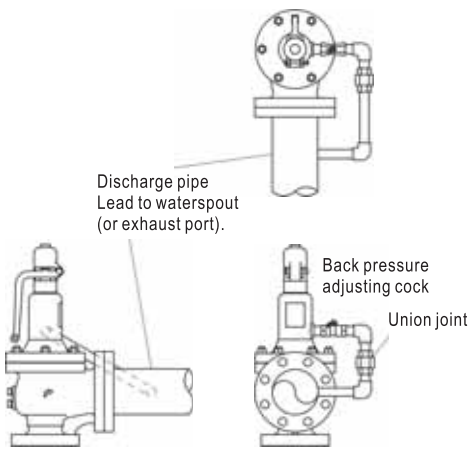


Fig.4 Installation of test gag

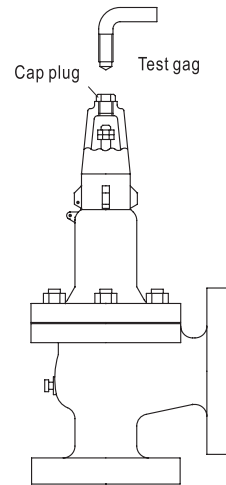


Fig.5 Lever structure

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

