RP-9,10,11 Type Pressure Reducing Valve (for Steam)

Pilot operated type pressure reducing valve for high-pressure steam.
This product works stably at maximum pressure reduction ratio 20:1 and high differential pressure.
The face-to-face dimensions are the same as those of the former RP-2H Type pressure-reducing valve, but the weight is 40% lighter.
Refer to Page 17 for valve size selection chart.

RP-9 Type

SPECIFICATIONS

Type		Ductile cast iron		Cast steel	Stainless steel
Model name		RP-9		RP-10	RP-11
Code name		RP9-L	RP9-M	RP10-C	RP11-D
Applicable fluid		Steam			
Fluid temperature		Max. 220°C		Max. 250°C*1.	Max. 250°C
Applicable primary pressure		Max. 2.0MPa		Max. 3.0MPa	
Adjustable secondary pressure		0.03~0.8MPa*2.			
Maximum reducing rate		20:1			
Minimum pressure differential across the disc		Size 15~80mm: 0.05MPa, Size 100~150mm: 0.07MPa			
Lock up pressure		Max. 0.02MPa			
Offset pressure		Within 0.02MPa (Adjustable secondary pressure 0.03~0.035MPa) Within 0.03MPa (Adjustable secondary pressure over 0.035~0.07MPa) Within 0.05MPa (Adjustable secondary pressure over 0.07~0.8 MPa)			
Leakage allowance		Less than 0.05% of rated flow			
End connection		Flanged JIS 20KRF*3.		Flanged JIS 30KRF*4.	
Materials	Body	Ductile cast iron		Cast steel	Stainless steel
	Disc & seat	Stainless steel			
	Piston & cylinder	Cast bronze	Stainless steel	Stainless steel	
Valve body pressure test		1.5 times of flange rated pressure			
Installation		Upright installation on horizontal pipe			

＊1. RP-10T Type for high-temperature steam (Max. 350°C) is also available.
＊2. RP-9N (size 15~80mm: 0.8~1.95 MPa; size 100~150mm: 0.8~1.93 MPa) and RP-10N, 11N Type (0.8~2.0 MPa) for high adjustable secondary pressure are also available.
＊3. Products with JIS 10, 16K flange are available.
＊4. Products with JIS10, 16, 20K flange are available.

DIMENSIONS
RP-9 Type (Body:Ductile cast iron)

(mm)

Size	L	G	H	d	Cv value	Mass(kg)
15(½″)	170	77	216	¼″	1	7.5
20(¾″)	170	77	216	¼″	2.5	7.5
25(1″)	210	77	216	¼″	4	9
32(1¼″)	210	96	237	¼″	6.5	12
40(1½″)	220	96	237	¼″	9	12.5
50(2″)	250	104	247	¼″	16	15.5
65(2½″)	290	115	262	⅜″	25	20.5
80(3″)	350	122	277	⅜″	36	26.5
100(4″)	384	142	342	⅜″	64	60
125(5″)	434	192	372	⅜″	100	90
150(6″)	544	209	407	⅜″	144	120

Flange code JIS 20KRF

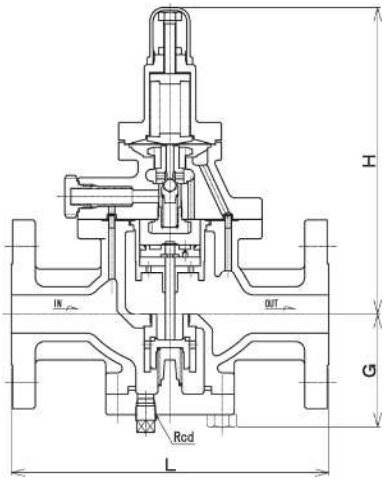
DIMENSIONS
RP-10 Type (Body:Cast steel), RP-11 Type (Body:Stainless steel)

(mm)

Size	L	G	H	d	Cv value	Mass(kg)
15(½″)	198	80	217	¼″	1	7.5
20(¾″)	198	80	217	¼″	2.5	7.5
25(1″)	228	80	221	¼″	4	9
32(1¼″)	232	97	238	¼″	6.5	12
40(1½″)	248	97	238	¼″	9	12.5
50(2″)	280	107	248	¼″	16	15.5
65(2½″)	288	119	263	⅜″	25	20.5
80(3″)	366	126	278	⅜″	36	26.5
100(4″)	426	146	342	⅜″	64	60
125(5″)	454	197	372	⅜″	100	90
150(6″)	564	216	407	⅜″	144	120

Flange code JIS 30KRF

CONSTRUCTION

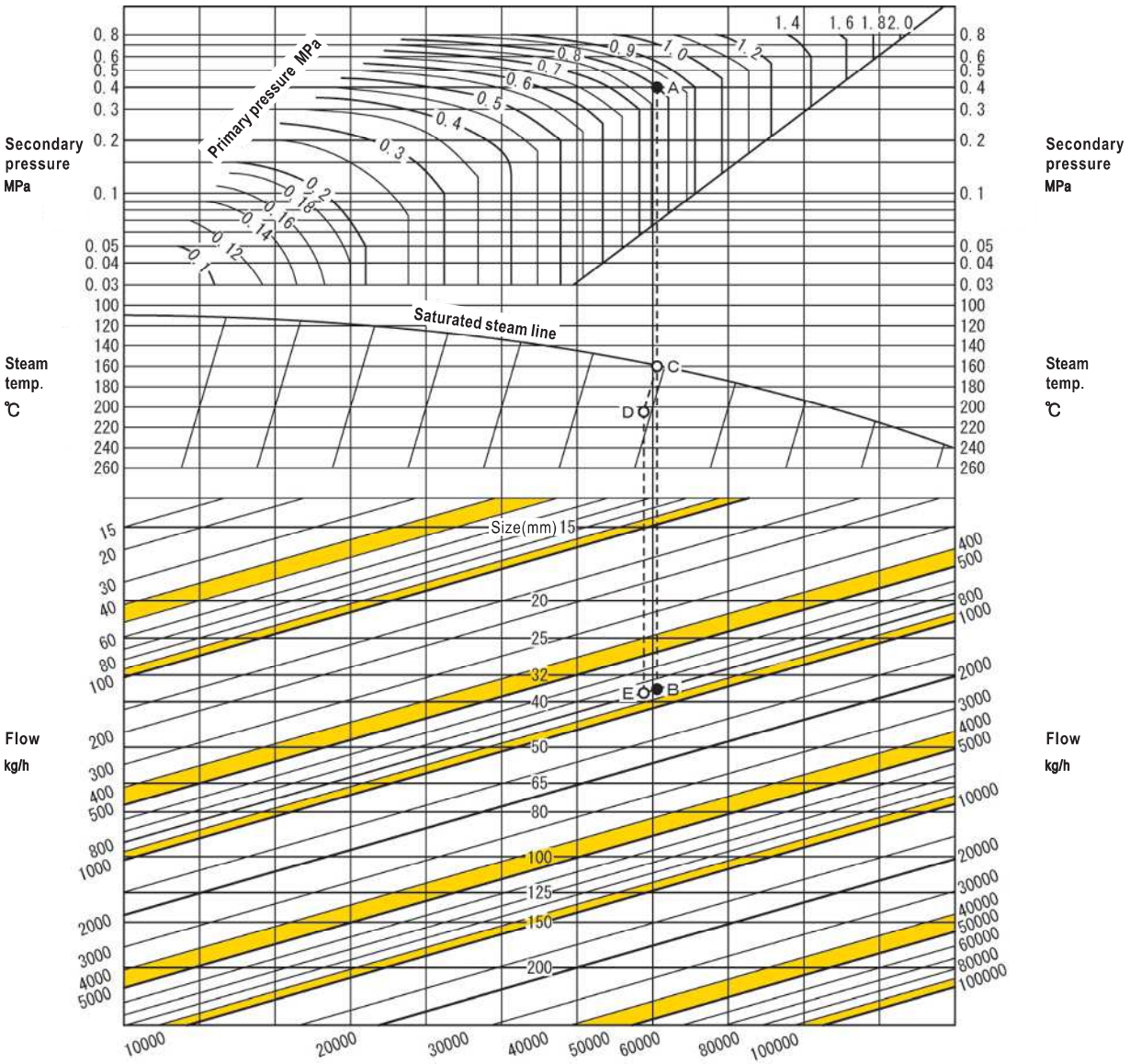


＊1. The structure may vary depending on material and nominal diameter.
＊2. The materials of main body and dimensions are the same as those of the former RP-2H model.

DATA/RP-9,10,11 Type Pressure Reducing Valve (for Steam)

NOMINAL DIAMETER SELECTION CHART (for Steam)

※This Size Selection Chart is for applications with applicable pressure at primary side less than 2.0 MPa.
For models RP-10, 11 Type (with applicable primary pressure higher than 2.0MPa) and those for high secondary pressure (RP-9N, 10N, and 11N Type), please contact our agent in your area.

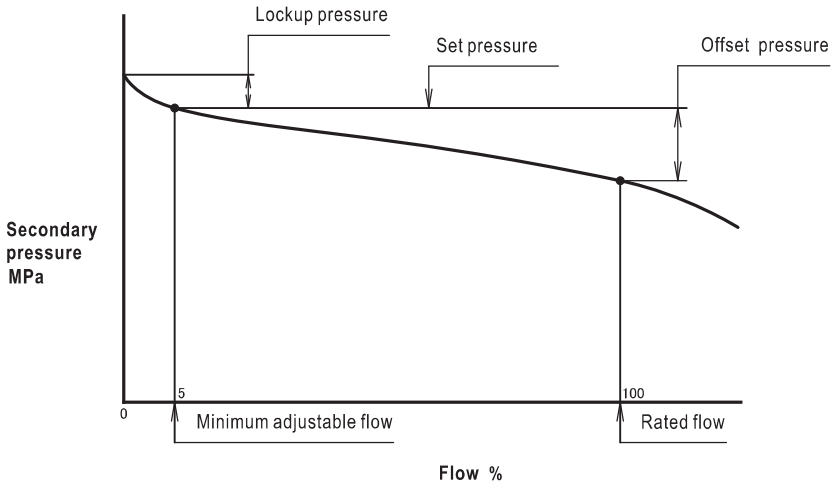


● HOW TO USE THE CHART

Example
Find out the size that is suitable for the following conditions:
Primary pressure: 0.8 MPa
Secondary pressure: 0.4 MPa
Pressure of saturated steam: 800 kg/h
First find out the point of intersection (point A) of the lines representing primary pressure 0.8 MPa and secondary pressure 0.4 MPa. Draw a vertical line from point A. This line intersects with the line representing 800kg/h flow rate at point B. Since point B is between size 32mm and size 40mm, the larger one, which is size 40mm, is selected.
Now assume the conditions are the same but the temperature is 205°C. Draw a vertical line from point A. This line intersects with the line representing temperature of saturated steam at point C. Make a parallel shift of point C until it intersects with the line representing 205°C at point D. Draw a vertical line from point D until it intersects with the line representing flow rate 800 kg/h at point E. Since point E is between size 32mm and size 40mm, the larger one, which is size 40mm, is selected.

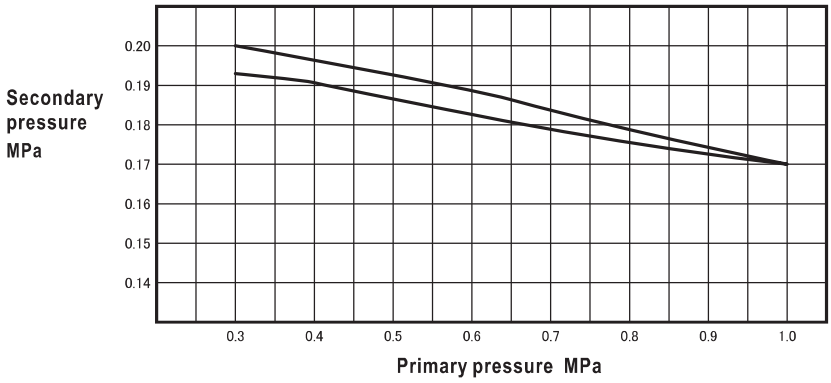
DATA/RP-Type Pressure Reducing Valve (RP-6,8,9,10,11 Type Series) (for Steam or Gases)

FLOW CHARACTERISTICS



PRESSURE CHARACTERISTICS

Example: RP-6 Type



The secondary pressure is set at 0.2 MPa when primary pressure is 0.3 MPa. The chart shows the change of secondary pressure when primary pressure changes between 0.3~1.0~0.3 MPa.

TERMS

- **Primary pressure:** The inlet pressure of pressure reducing valve or the inlet pressure of piping that is near to pressure reducing valve.
- **Secondary pressure:** The outlet pressure of pressure reducing valve or the outlet pressure of piping that is near to pressure reducing valve.
- **Set pressure:** Secondary pressure at minimum adjustable flow.
- **Offset pressure:** The difference between secondary pressure and set pressure when primary pressure is kept at a constant level but flow increases gradually from minimal adjustable flow to the rated flow of pressure reducing valve.
- **Lockup pressure:** The increased pressure above set pressure when the secondary valve of pressure reducing valve is closed.
- **Minimum adjustable flow:** The minimum flow of pressure reducing valve for maintaining stable flow.
- **Rated flow:** The maximum flow at the specified offset pressure when primary pressure is kept at a constant level.

TIPS:HOW TO SELECT AN APPROPRIATE NOMINAL DIAMETER?

❶ When you select the size, use nominal diameter selection chart. Considering pressure loss and thermal loss, the flow amount for selecting the nominal diameter should be larger by 10-20% than designed flow amount, particularly in case of the pressure reducing rate is large or the set pressure is lower than 0.1MPa.

❷ The secondary pressure of a pressure reducing valve changes when primary pressure or flow changes. Therefore, when selecting nominal diameter, it is necessary to consider lockup pressure and offset.

(See flow characteristics and pressure characteristics.)

❸ In the case when primary and secondary pressure are not constant but change within a certain range, the nominal diameter can be determined using the primary and secondary pressures that produce the smallest differential pressure.

❹ In the case the pressure reduction rate exceeds its maximum value, it is required to perform two-step pressure reduction by using 2 pressure reducing valves. Although the flow at step 1 and step 2 are the same, the nominal diameter of the valve at step 1 should be different from that at step 2, because primary pressure is different from secondary pressure. Therefore, it is necessary to select two nominal diameters for the valves to be used.

❺ It is easy to understand that an extremely small valve allows only a tiny flow. However, this does not mean a large valve is better than a small valve. In fact, an extremely large valve may cause the occurrence of “hunting” , which can lead to abnormal wearing. Another thing to be noted is the minimum adjustable flow, which is about 5% of the rated flow. You should not select a valve which may be used when the flow is lower than the minimum adjustable flow. In winter or summer, flow may change extremely. It is recommended that you install two pressure reducing valves, a large one and a smaller one, and switch between them according to change of flow.

DATA/Pressure Reducing Valve (for Steam or Gases)

■ INSTALLATION EXAMPLE

Fig.1 With bypass piping

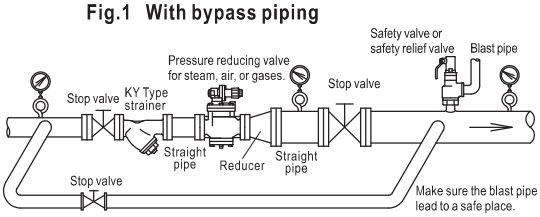
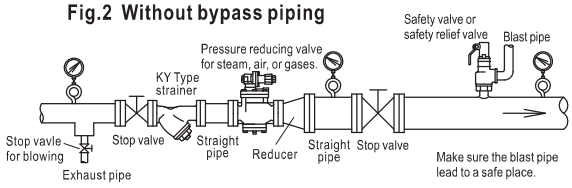


Fig.2 Without bypass piping



■ POINTS FOR INSTALLATION

- Installation of pressure reducing valve and piping.

1. Pressure reducing valve should be installed in horizontal pipe vertically.
2. Install safety valve or safety relief valve on the secondary side of pressure reducing valve.

※1. Equipment may be damaged due to increase of secondary pressure at the time of failure of pressure reducing valve.

※2. See Table 1 for set pressure of safety valve and safety relief valve.

※3. In the case safety valve or safety relief valve is used as an alarm, its nominal diameter should be big enough to allow discharge of 10% maximum flow of pressure reducing valve, which is about the leakage of pressure reducing valve. In very few cases, safety valve or safety relief valve may allow discharge of maximum flow of pressure reducing valve.(reference value: see Table 2 and Table 3).

TABLE1. SET PRESSURE FOR SAFETY RELIEF VALVE (MPa)

Set pressure of pressure reducing valve	Set pressure of safety valve※2.
0.1 or less	+ 0.05 (+0.08)
Over 0.1 and less than 0.4	+ 0.08 (+0.14)
0.4 or more and less than 0.6	+ 0.12 (+0.2)
0.6 or more and less than 0.8	+ 0.15 (+0.28)
0.8 or more and less than 1.0	+ 0.19
1.0 or more and 1.2 or less	+ 0.23

Add the above valve to set pressure of the pressure reducing valve.

※ 1.The above value is added to the set pressure of pressure-reducing valve.
※ 2. The values in parentheses are applicable to soft-seated type (SL-37V~40FV, 43V, 44V Type).

TABLE2. FLOW FOR SAFETY RELIEF VALVE (Saturated steam)
SL-37~40 TYPE (kg/h)

Set pressure (MPa)	Size(mm)					
	15(½″)	20(¾″)	25(1″)	32(1¼″)	40(1½″)	50(2″)
0.05	13.5	23.1	33.5	62.2	97.4	158
0.1	17.5	29.8	43.4	80.4	125	204
0.2	25.4	43.3	63	116	182	297
0.3	34.2	58.2	84.6	156	245	399
0.4	42	71.6	104	193	302	490
0.5	50.6	86.2	125	232	363	590
0.6	59.2	100	146	271	424	690
0.7	67.7	115	167	310	486	790
0.8	76.3	129	188	350	547	890
0.9	84	143	207	385	602	979
1.0	92.4	157	228	424	663	1070

TABLE3. FLOW FOR SAFETY RELIEF VALVE (Air)
SL-37~40 TYPE (kg/h)

Set pressure (MPa)	Size(mm)					
	15(½″)	20(¾″)	25(1″)	32(1¼″)	40(1½″)	50(2″)
0.05	21.7	37	53.8	99.8	156	253
0.1	28.3	48.3	70.2	130	203	331
0.2	41.2	70.2	102	189	296	481
0.3	55.3	94.3	137	254	397	645
0.4	69.5	118	171	318	498	810
0.5	83.6	142	206	383	600	975
0.6	97.7	166	241	448	701	1140
0.7	111	190	276	513	803	1300
0.8	126	214	311	578	904	1470
0.9	140	238	346	643	1000	1630
1.0	154	262	381	708	1100	1790

3. Install strainer at the primary side of pressure reducing valve.

4. For devices that cannot be stopped, install bypass piping (with stop valve) from the primary side to the secondary side of pressure reducing valve. If bypass piping is not suitable, then install blowing stop valve, which is derived from the main pipe before the primary side of pressure reducing valve, so as to make flushing possible.

5. Install straight piping, stop valve, and pressure gauge before and after pressure reducing valve.
If end connection of pressure reducing valve is realized using screw, then use union joint to make it easy to fix and remove.

※ The diameter of piping before and after pressure reducing valve should be determined based on the standard velocity of flow of fluid. Generally, since the nominal diameter of secondary piping of pressure reducing valve for steam and gases is larger than the diameter of pressure reducing valve, it is necessary to use reducer.

6. If you install solenoid valve (on/off operation) or control valve at the secondary side of pressure reducing valve, there should be an interval (L) between such solenoid valve or control valve and pressure reducing valve. The interval (L) should be larger than 2m in the case of solenoid valve.As for control valve, the interval should be larger than 1m if nominal diameter is less than 100mm, and larger than 1.5m if nominal diameter is larger than 125mm(see Fig.3).

7. In the case of 2-step pressure reduction, the interval between 2 valves should be 1~2m (see Fig.4).

Fig.3 INTERVAL BETWEEN PRESSURE REDUCING VALVE AND CONTROL VALVE

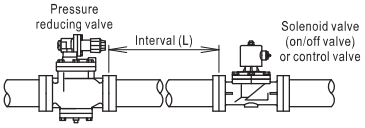
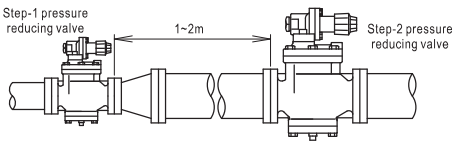


Fig.4 INTERVAL BETWEEN VALVES (2-STEP PRESSURE REDUCTION)



DATA/Pressure Reducing Valve (for Steam or Gases)

8. For pressure reducing valve for steam, "hunting" or vibration may occur if drain accumulates.
To prevent hunting and vibration, it is necessary to prevent drain from entering into the piping or install steam trap at the primary side.
In addition, since pressure reducing valve cannot be closed completely, it is necessary to install steam trap at the secondary side if the amount of steam used is near zero. (See Fig.7)

Fig.5: Proper installation

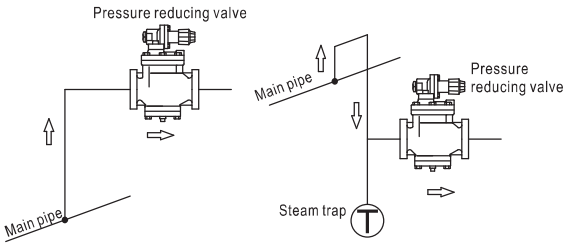


Fig.6:Improper installation

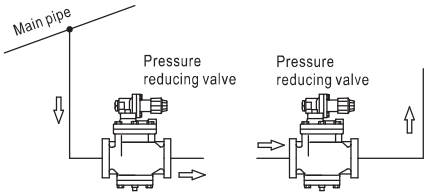
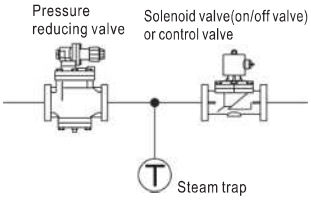


Fig.7:In case of zero steam consumption at secondary side of pressure reducing valve



9. Make sure sufficient space should be left for maintenance.

10. Apply appropriate support to pressure reducing valve to make sure it should not bear the weight of piping, bending force, or vibration directly.

11. If there is possibility of freezing, apply thermal insulation or discharge the drain.

12. The secondary pressure of the valve is not adjusted at delivery. Therefore, you should adjust the secondary pressure to the desired pressure before use.

※ The secondary pressure of a non-adjusted valve is near to zero.

※ How to adjust the secondary pressure:

① Close the stop valves at primary and secondary sides.

② Open the blowing stop valve or stop valve in bypass and remove any content inside. Such operation is called flushing and should be carried out sufficiently by spending sufficient time on it.Take care not to make the secondary pressure rise excessively.

③ Close the stop valve in by pass or blowing stop valve completely.

④ Make sure there is not any spring load caused by adjusting screw.

⑤ Open the stop valve at primary side gradually.

⑥ Make sure you have adjusted the secondary pressure. Open the stop valve at the secondary side slightly to allow small flow.

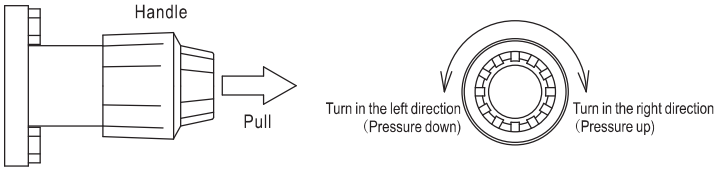
⑦ Apply a small spring load using handle or adjusting screw.
Once the fluid starts flowing, open the stop valve at the secondary side gradually.

⑧ Read the pressure gauge and apply more spring load to make the pressure reach the set pressure. The pressure rises if you turn the handle or adjusting screw in the right direction and falls if you turn them in the left direction.

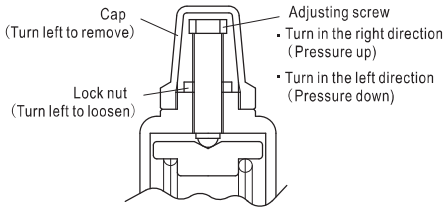
⑨ Once the desired pressure is reached, use the lock nut to lock the adjusting screw. After the screw is locked, the spring load will not change.

• ADJUSTING SECONDARY PRESSURE

For RP-6 Type series and RD-40 Type series.



• OTHER PRESSURE REDUCING VALVES



■ DIAMETER OF PIPING BEFORE AND AFTER PRESSURE REDUCING VALVE

The nominal diameter of pressure reducing valve can be determined using relevant graphs made for such purpose. The diameter of piping before and after pressure reducing valve must be determined based on the standard velocity of fluid.
Extremely small diameter or large velocity of fluid may cause large loss of pressure inside the piping and wearing, vibration of the piping. Therefore, it is necessary to consider the standard velocity of fluid when determining the diameter of piping.

● **Table of velocity of steam as standard condition.**

Item	For steam	Standard velocity (m/s)
Pipage	Saturated steam (0.2~0.5MPa)	15~20
	Saturated steam (0.5~1.5MPa)	20~30
(Steam engine)	Saturated steam	20~30
	Super heated steam	30~40

● **Table of velocity of air as standard condition.**

Item	For air	Standard velocity(m/s)
Pipage	(0.1~0.2MPa)	8~15
	(20~30MPa)	5~7
(Compressor)	Saturated line	10~20
	Low pressure supplyline	20~30
	High pressure supply line	10~15