

Model GPR-2000

Primary Pressure Regulating Valve

Instruction Manual

Please read this instruction manual thoroughly before using the primary pressure regulating valve, so that you may do so correctly and safely. Please carefully store this manual in a handy place.

- - - - - The following safety symbols are used in this manual. - - - - -

Warning

This symbol indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.

Caution

This symbol indicates a hazardous situation that, if not avoided, may result in minor or moderate injury. ("Caution" may also be used to indicate other unsafe practices or risks of property damage.)

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1 . Application of the product

Our model GPR-2000, primary pressure regulating valves for steam are the diaphragm type pilot operating primary pressure regulating valve that is applicable on heavy-duty use for the wide range of flow rate. The application of this model is vast such as construction site, airconditioning plants and factory facilities.

2 . Specification and performance

Model		GPR-2000		
Connection		Screwed (JIS Rc)	Flanged (JIS 20K RF)	Flanged (JIS 10K FF)
Nominal size		15 ~ 50A	15 ~ 100A	15 ~ 100A
Inlet pressure sensing method		External sensing		
Application		Steam		
Primary pressure regulating range	A	0.02 ~ 0.15 MPa 1		0.02 ~ 0.15 MPa 1
	B	0.1 ~ 1.1 MPa		0.1 ~ 1.0 MPa
	C	1.0 ~ 1.4 MPa		
Min. differential pressure		15% of Setting pressure (gauge pressure) (Minimum value : 0.10 MPa)		
Max. temperature		220		
Valve seat leakage		0.01% or less of rated flow		
Material	Body	Ductile cast iron		
	Main Valve	Stainless steel		
	Main Valve seat	Stainless steel		
	Pilot Valve	Stainless steel		
	Pilot Valve seat	Stainless steel		
	Diaphragm	Stainless steel		
Body hydraulic test		4.0 MPa		2.0 MPa

1 For the range of pressure setting between 0.02 to 0.1 MPa, please set the secondary pressure for 0 MPa.
(Refer to 5.1 Primary pressure regulating valve specification selection chart.)

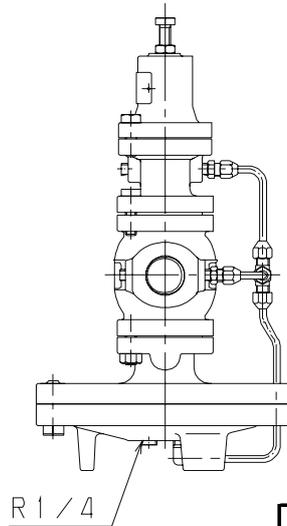
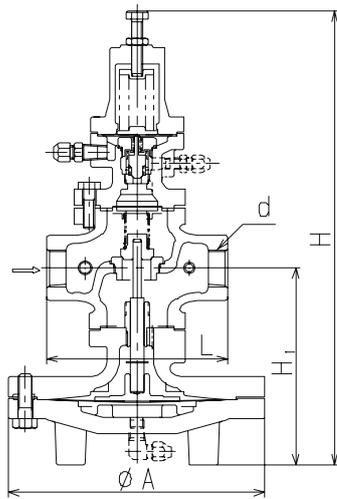
⚠ Caution

Please confirm if the indication written in the label on Products matches with your required specifications.

*If there should be any difference on the specification, please do not put in use until contacting us for confirmation.

3 . Dimensions and Weights

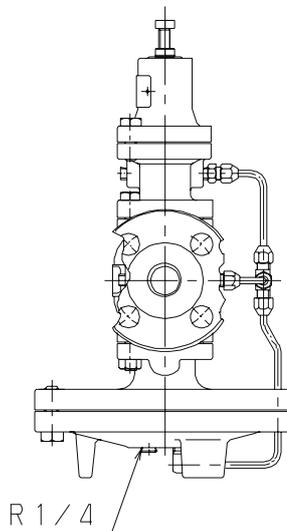
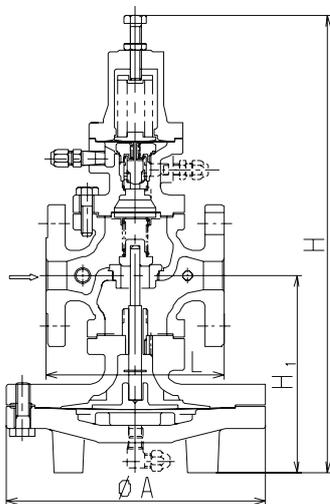
- Screwed (JIS Rc)



(mm)

Size	d	L	H ₁	H	A	Weight(kg)
15A	Rc 1/2	150	170	398	200	14.5
20A	Rc 3/4	150	170	398	200	14.5
25A	Rc 1	160	175	404	226	18.8
32A	Rc 1 1/4	180	192	434	226	22.0
40A	Rc 1 1/2	180	192	434	226	22.0
50A	Rc 2	230	216	498	276	33.6

- Flanged (JIS 20K RF)

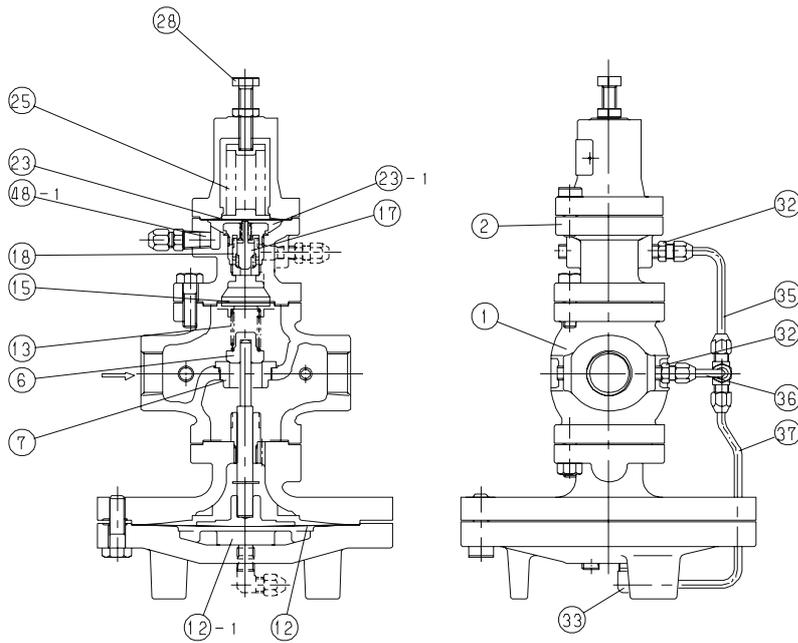


(mm)

Size	L	H ₁	H	A	Weight(kg)
15A	146	170	398	200	16.0
20A	146	170	398	200	16.5
25A	156	175	404	226	21.5
32A	176	192	434	226	24.5
40A	196	192	434	226	25.0
50A	222	216	498	276	36.6
65A	282	251	552	352	64.9
80A	302	264	575	352	72.1
100A	342	321	658	401	111.6

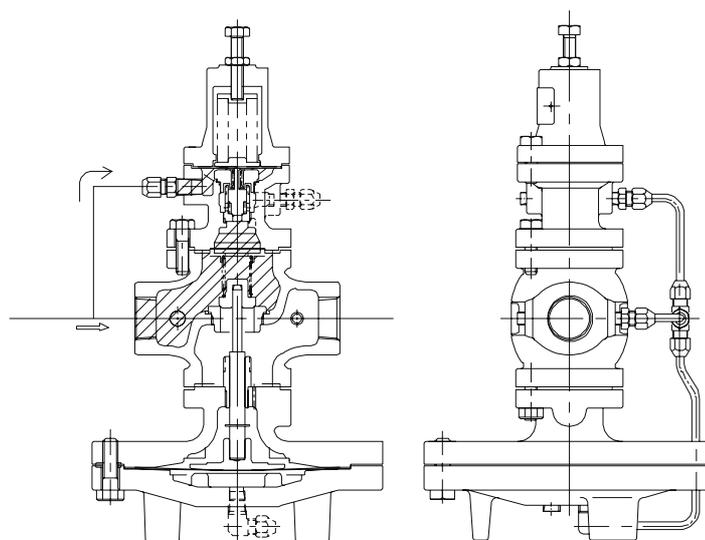
- 1) For the valves with flanges JIS 10K FF, size L and weight will be varied.
- 2) We can manufacture the valves with the different size of flanges than stated above.
- 3) For the valves from 50A to 100A, the structure will be varied from the drawing. (Refer to 8.5 Disassembly drawing.)

4 . Operation

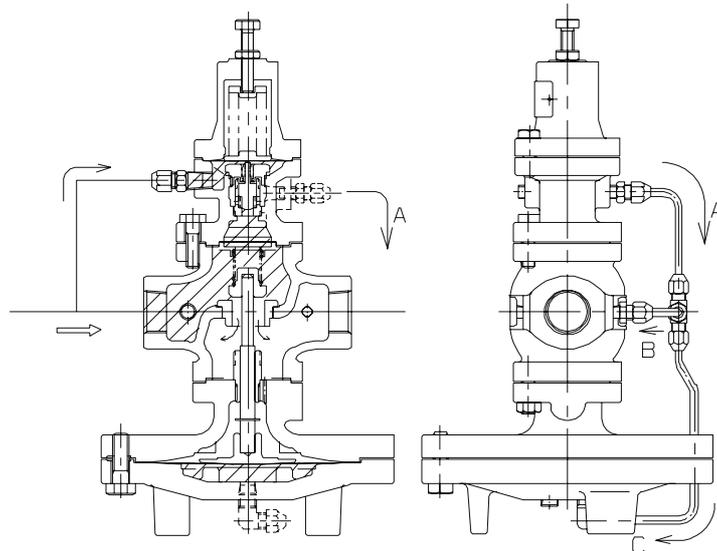


No.	Parts name
1	Body
2	Pilot body
6	Main valve
7	Main valve seat
12	Main diaphragm
13	Main valve spring
15	Screen
17	Pilot valve
18	Pilot valve seat
23	Pilot diaphragm
25	Spring
28	Adjusting Screw
32	Joint
33	Elbow
35,36,37	Pipe A, B, C
12 1	Main diaphragm chamber
23 1	Pilot diaphragm chamber
48 1	Inlet pressure sensing port

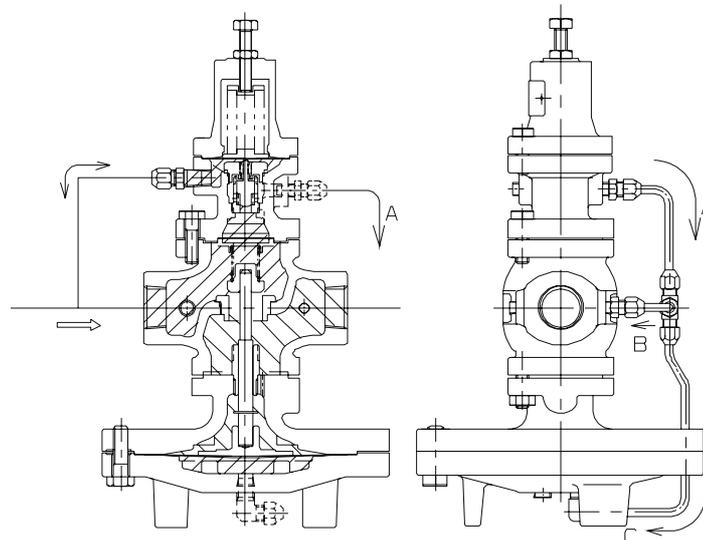
(1) When adjusting screw[28] is turned in the clockwise direction, spring[25] is compressed and pilot valve[17] is closed. When the inlet stop valve is opened, a flow of steam is introduced. This flow of steam proceeds to the back side of main valve[6] and pilot valve, and also flows through inlet pressure sensing port[48-1] and into through pilot diaphragm chamber[23-1].



- (2) As the inlet steam pressure increase, the pressure in the pilot diaphragm chamber also increases until it overcomes the adjustment spring load, thereby opening the pilot valve. The steam then proceeds through pilot valve seat[18] and through pipe A[35]. Part of the steam flow then proceeds through pipe B[36] and joint[32] to the outlet side of body[1]. The other part of the steam flow proceeds through pipe C[37] and elbow[33] to main diaphragm chamber[12-1]. As the steam pressure increases in the main diaphragm chamber, it forces the main valve open, releasing steam to the outlet side.

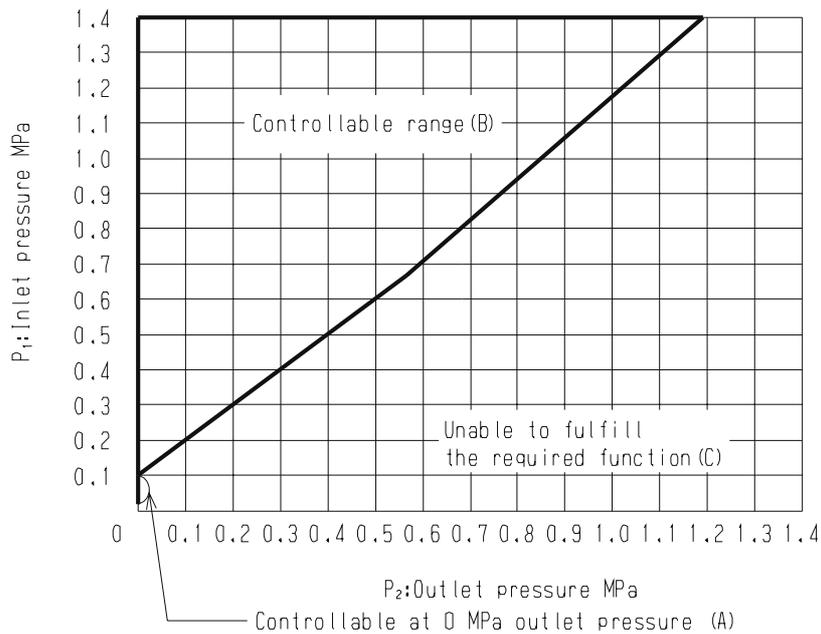


- (3) As the inlet steam pressure decreases, it is overcome by the spring load, causing the pilot valve to close. This decreases the steam pressure in the main diaphragm chamber, causing the main valve to close, and the flow of steam to stop. Because the inlet steam pressure in the pilot diaphragm is balanced against the spring load, the pilot valve opening increases and decreases in accordance with the rising and falling inlet pressure. The main valve opening is also adjusted in accordance with the amount of steam flowing into the main diaphragm chamber, thereby keeping the inlet pressure constant.



5 . Selection of Nominal Size

5 . 1 Specifications selection chart

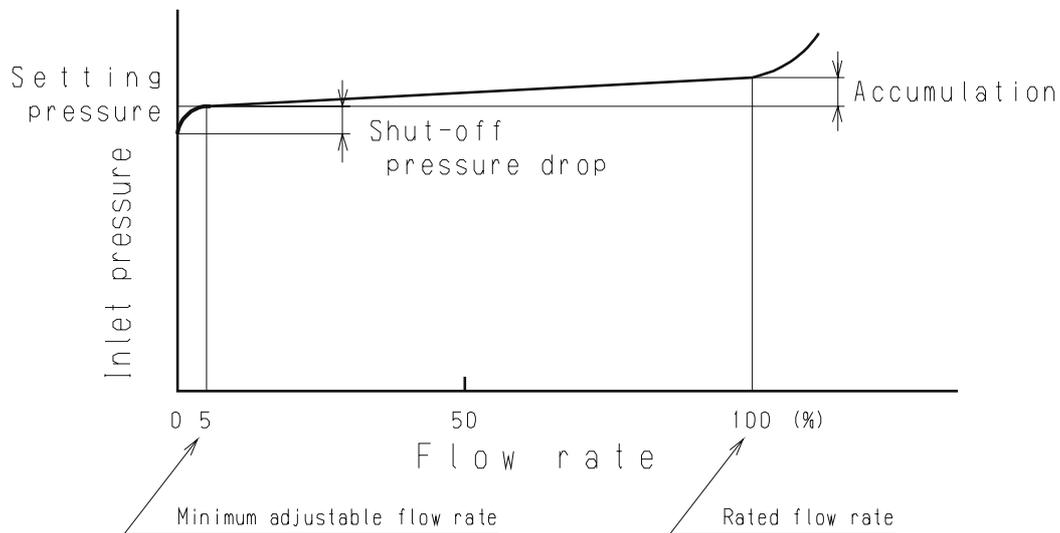


Find the point of intersection of primary and secondary pressure, in case that the point is located within the range A and B, the valve is suitable to regulate the pressure.

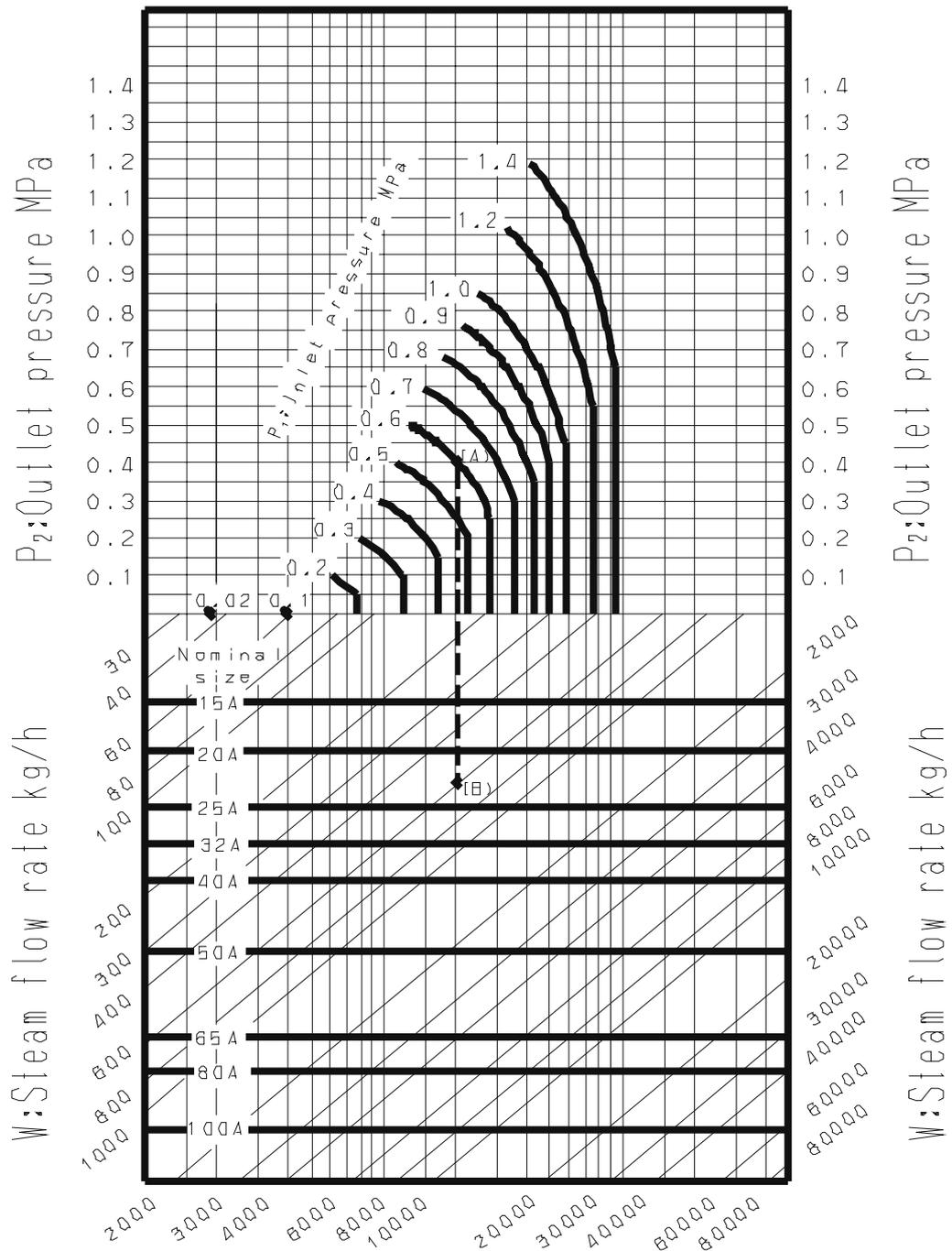
- Range (A) : Controllable at 0 MPa outlet pressure.
- Range (B) : Controllable range.
- Range (C) : Unable to fulfill the required function.

5 . 2 Flow rate characteristics chart

- Shut-off pressure drop : 0.02 MPa or less
- Accumulation : 10% or less of setting pressure
(Minimum value : 0.02 MPa)



5.3 Nominal size selection chart



For example, take a primary pressure regulating valve whose inlet pressure(P_1) is 0.6 MPa, outlet pressure(P_2) 0.4 MPa, flow rate 600 kg/h. When determining the nominal size, find the point of intersection(A) of inlet pressure 0.6 MPa and outlet pressure 0.4 MPa. Vertically proceed from point(A) to come across the flow rate 600 kg/h, and regard this point as (B). Point(B) is between nominal sizes 20A and 25A. Select the larger nominal size (in this example, nominal size 25A).

5.4 Nominal size selection calculation formula

In case selecting the suitable valve size from calculation, find the Cv value with formula, which value will be defined by applying criteria, and select the valve size that fulfills the said Cv value.

- Cv value calculation

$$P_2 > \frac{P_1}{2}$$

$$C_v = \frac{Wk}{138\sqrt{\Delta P(P_1 + P_2)}}$$

$$P_2 \leq \frac{P_1}{2}$$

$$C_v = \frac{Wk}{120P_1}$$

W : Max. steam flow rate [kg/h]

P_1 : Inlet pressure [MPa · A]

P_2 : Outlet pressure [MPa · A]

ΔP : $P_1 - P_2$ [MPa]

k : $1 + 0.0013 \times \{ \text{super-heated steam temp [} \quad] - \text{saturated steam temp [} \quad] \}$

C_v : Cv value of the nominal size

- Cv value chart

15A	20A	25A	32A	40A	50A	65A	80A	100A
5.0	7.2	10.9	14.3	18.8	32.0	60.0	78.0	120.0

- Flow rate calculation example of GPR-2000 primary pressure regulating valve

The flow rate of the primary pressure regulating valve is calculated under the following conditions : Nominal size 15A, saturated steam, Inlet pressure of 0.6 MPa, Outlet pressure of 0.4 MPa.

$P_1 = 0.7$ [MPa · A], $P_2 = 0.5$ [MPa · A], you can find that Cv value of 15A is 5.0 from the chart. The following formula is established.

$$0.5(P_2) > \frac{0.7(P_1)}{2}$$

$$C_v = \frac{Wk}{138\sqrt{\Delta P(P_1 + P_2)}}$$

$$W = \frac{138C_v\sqrt{\Delta P(P_1 + P_2)}}{k}$$

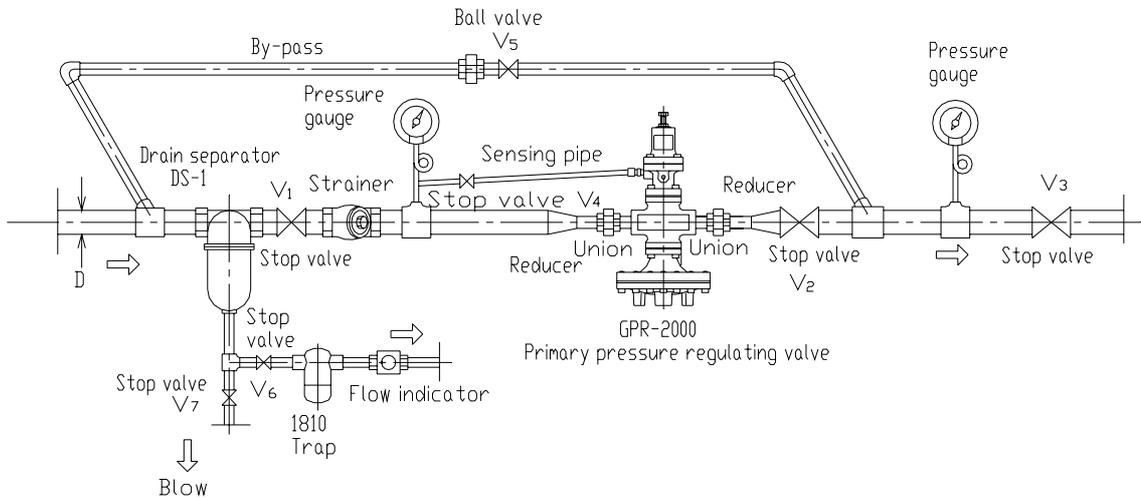
$$= \frac{138 \times 5 \times \sqrt{0.2 \times (0.7 + 0.5)}}{1}$$

$$= 338 \quad \text{kg/h}$$

Secure a safety rate of 80 to 90%

6 . Installation procedures

6 . 1 Example of piping



6 . 2 Warnings/Cautions during installation

⚠ Warning

(1) **As this product is considerably heavy in weight, please secure it with lifting devices for installation on piping. As to the weight of product, please refer to "3. Dimension and weight."**

* Falling the product may cause the injury of personnel.

(2) **When installing the combination valve, be sure to connect the provided sensing pipe and joint.**

* Unless the sensing pipe is connected, the valve will not operate. Further, steam may blow off, resulting burns.

< Sensing pipe connection method >

Connect the provided sensing pipe ($\phi 8-2\text{m}$) and joint ($\phi 8-R1/4$) as shown in the illustration in Fig.1.

1. Wind sealing tape around the joint and insert the joint into the pressure sensing side.
2. Fully insert the sensing pipe into the valve and the pressure sensing side joint. Tighten the cap nut until it can no longer be rotated manually, and then turn the cap nut about one and quarter times with a tool.

3. Note that the sensing pipe must be connected so that the valve side is higher than the pressure sensing side.

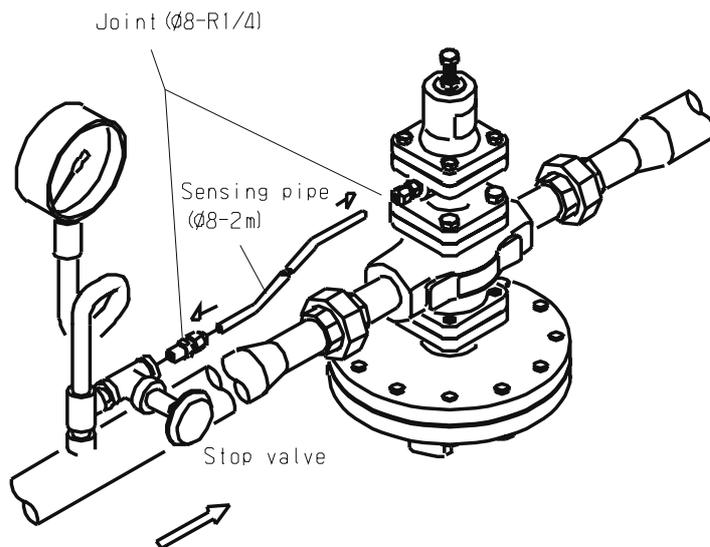


Fig.1

⚠ Caution

- (1) **Do not disassemble the valve unreasonably.**
* Disassembling the valve at your discretion may affect the original performance.
- (2) **Remove foreign matter and scales from the lines before connecting the valve.**
* Failure to do so may prevent the valve from functioning correctly.
- (3) **Install a strainer (80 ~ 100-mesh or equivalent) at the valve inlet side.**
* Failure to do so may hamper correct pressure control, which affects the original performance.
- (4) **Install a pressure gauge at both the inlet and outlet sides of the valve. Further, install the gauge at the outlet side as close to the sensing pipe (pressure sensing side) as possible.**
* Failure to do so may hamper correct pressure control, which affects the original performance.
- (5) **Install a trap to the bottom of rising pipes and the end of other pipes connected to the inlet and outlet sides of the valve. When connecting a branch pipe from the main line, be sure to connect the trap draining drip leg from the bottom of the main line.**
* Failure to do so may result in drainage problem, which affects the original performance.
- (6) **Install the valve perpendicularly to horizontal lines with the diaphragm chamber located at the bottom.**
* Failure to do so may affect the original performance.
- (7) **Be extremely careful not to damage the copper pipe .**
* Damage to the copper pipe may prevent the valve from functioning correctly.
- (8) **Do not apply excessive load, torque or vibration to the valve .**
* Doing so may result in drastically shortened service life or operational failure.
- (9) **Use the sensing pipe (8-2m) and joint (8-R1/4) provided.**
* Using other sensing pipes may affect the original performance.
- (10) **Do not connect the sensing pipe close to valves and elbows. Choose the position with the least vibration. (Recommended straight length: 10 times the line pipe diameter)**
* Failure to do so may cause inconsistent reduced pressure, which hampers correct pressure control.
- (11) **Use the gate valve as a stop valve at the inlet and outlet sides of the combination valve.**
* Using a valve with large resistance, such as a globe valve, may affect the original performance.
- (12) **When installing, reserve the space shown below (Fig.2) in both upper and lower side of the pipe center of the product for the maintenance and checking.**

- (1) Install by-pass pipes around the product. (Refer to 6.1 Example of piping)
- (2) In case the steam consumption is large in volume, install an expander to prevent the excess flow velocity.
(In case that the fluid is steam, the recommendable flow velocity in pipe is below 30m/s.)

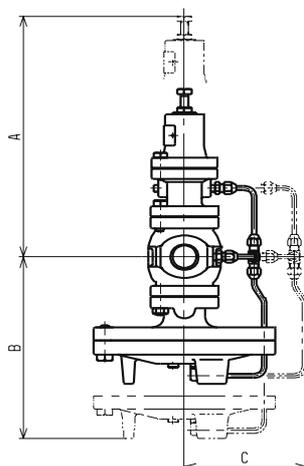


Fig.2

(mm)

Size	A	B	C
15A	340	340	180
20A		350	
25A	360	380	200
32A		380	
40A	400	430	220
50A	420	370	260
65A	430	390	
80A	450	470	280

7 . Operation procedures

7 . 1 Warnings/Cautions during operation

⚠ Warning

(1) **Do not touch the valve directly with bare hands.**

* Doing so may result in burns.

(2) **Prior to letting the steam run in the system, make sure that all connecting part are properly connected and there is no danger when the steam flows out of pipe end.**

* In case the steam flows out of connecting part or pipe end, there will be a danger of personnel being scalded.

⚠ Caution

(1) **Before carrying out steam blow, close the stop valves at both inlet and outlet side of the product, and make sure to flush the foreign matter or scales out of piping system using the by-pass line.**

Also open the relative stop valves in the piping system gradually.

*Once the foreign matter or scales come into the product, it may not function as designed. Sudden opening the stop valve may cause the hunting or water hammer and result in damage the product or relative equipment.

(2) **In order to adjust the pressure, turn the adjusting screw slowly.**

*The hunting or water hammer may damage the product or equipment.

(3) **Remove condensation completely from the line, and close the stop valves located at front and rear of the valve when not using it for long periods of times.**

*By the rust gathered in the product or inside of pipes, the product may malfunction.

7.2 Adjustment

Follow the steps in 7.2. Adjustment, and slowly turn the adjusting screw to control pressure.

* Incorrect adjustment may cause hunting, water hammer, etc., resulting in damage to the valve and other equipment.

(1) Check that all stop valves (V₁ to V₇) are closed.

(2) Open the stop valve (V₆) for the trap installed before the primary pressure regulating valve.

(3) Open the stop valve (V₃) and adjust the valve travel of the by-pass pipe glove valve (V₅). Taking sufficient time, blow off the fluid to remove foreign matter. After blowing, close the by-pass line glove valve.

(4) Loosen lock nut. With adjusting screw loosen until it turns freely (no compression) turn it about 5turns in the clockwise direction (Clockwise rotation increases the setting pressure, and counterclockwise rotation decreases it).

(5) Open the stop valve (V₄) on the sensing pipe.

(6) Open the stop valve (V₂ and V₃) at the outlet side of the primary pressure regulating valve.

(7) Confirm that the condensation is discharged from the inside of the primary pressure regulating valve, and slowly open the stop valve (V₁) on the inlet side. If steam flows from the inlet primary pressure regulating valve at this time, turn the adjustment screw in the clockwise direction until this steam flow is stopped.

(8) Slowly turn the adjusting screw counterclockwise while observing the pressure gauge on the inlet side to begin the flow of steam, and set the desired pressure.

(9) When the entire system has stabilized, conduct fine adjustment as necessary.

(10) After adjustment, tighten the lock nut.

8 . Maintenance procedures

8 . 1 Troubleshooting

Problem	Cause	Solution
Adjustment is impossible.	<ol style="list-style-type: none"> 1. Main diaphragm [12] is damaged. 2. Orifice of tee [34] is clogged. 3. Screen [15] is clogged. 4. Sensing pipe is clogged. 5. Pressure gauge is malfunctioning. 6. Incorrect pressure is being used. 	<ol style="list-style-type: none"> 1. Remove pipe C [37], and open the by-pass valve. If fluid runs out from elbow [33], replace main diaphragm. 2. Remove and clean it. 3. Remove and clean it. 4. Remove and clean it. 5. Replace the pressure gauge. 6. Correct the pressure.
Excessive leakage	<ol style="list-style-type: none"> 1. Check for foreign matter stuck to main valve [6] and main valve seat [7], or for scratches on these. 2. Check for foreign matter stuck to pilot valve [17] and pilot valve seat [18], or for scratches on these. 3. Seal bellows [21] is damaged. 4. Fluid leaks from by-pass valve. 	<ol style="list-style-type: none"> 1. Remove pipe A [35]. If fluid runs out from tee when it is supplied from inlet side of the primary pressure regulating valve at a pressure below the setting level, clean the main valve and main valve seat. When any scratches are identified, lap the main valve and main valve seat. 2. If fluid runs out from joint [32] when it is supplied as 1.above, remove the pilot valve assembly to clean or replace it. 3. Remove the joint [32] (to pilot body). If fluid runs out from the joint when it is supplied from joint [48] (pressure sensing port), replace the seal bellows. 4. Repair or replace it.
Inlet pressure increases beyond the prescribed level.	<ol style="list-style-type: none"> 1. Nominal size is too small for the specs. 2. The amount of steam released (amount used) at the primary pressure regulating valve's outlet side is insufficient. 3. Malfunction caused by drain. 4. The flow of steam is being obstructed at the outlet pipe of the primary pressure regulating valve. 5. The pipe diameter for outlet side is too small. 6. Strainer placed in front of primary pressure regulating valve is clogged. 	<ol style="list-style-type: none"> 1. Change to an appropriate nominal size. 2. Increase the amount of released steam. 3. Install a trap. 4. Check the pipe diameter and the stop valve opening amount, etc. 5. Make the selection of pipe diameter in order to let the flow velocity less than 30m/s. 6. Disassemble and clean it.
Excessive error.	<ol style="list-style-type: none"> 1. Movement of spindle [9] or pilot valve [17] is not smooth. 2. Flow at the connection of the sensing pipe fluctuates excessively. 3. Malfunction caused by drain. 4. Drain is present in the sensing pipe. 	<ol style="list-style-type: none"> 1. Remove and clean it, or replace it. 2. Examine the connecting place and change it. 3. Install a trap. 4. Connect the sensing pipe in upward slope to the primary pressure regulating valve.

Most primary pressure regulating valve problems are the result if scaling caused by foreign particles such as sand and dust, etc., inside the piping. Therefore, be sure that the piping has been thoroughly cleaned out.

Problems caused by faulty pressure gauges, failure to close the by-pass valve, clogged strainers, etc., are often mistakenly thought to be temperature regulator malfunctions. To avoid such a mistake, verify that all equipment is functioning properly before resorting to the troubleshooting instructions given below.

In case it is unsure to define the parts is still in usable condition or in need to renew, please contact us.

8.2 Warnings/Cautions during maintenance and checking

⚠ Warning

- (1) **On disassembling or checking, relief the pressure out of the product, piping and equipment thoroughly, and let cool them down till you can touch them by hand. Do not touch them until cooled down with bare hand.**

*The remaining pressure may injure or be scalded. Or may soil the surrounding with the drainage.

⚠ Caution

- (1) **In order to maintain the product's function and performance, carry out the daily checking and periodical inspection. Also carry out the self-imposed inspection in accordance with the relative regulations.**

*For the general user, it is recommendable to entrust specialists the inspection.

- (2) **Carry out the disassembling or checking by the skilled specialist or specialized dealer.**

*When the product is in abnormal condition or malfunctioned, contact the specialized dealer for troubleshooting.

- (3) **When disassembling the product, prepare a container or pan to receive the drainage as it remains inside and may flow out. Also, let all steam (drainage) out of the product prior to disassembling.**

*The overflowed drainage may soil the surrounding.

- (4) **After stopping the system for long period of time, carry out the function checking prior to re-starting.**

*When any abnormal condition detected, contact the specialized dealer for troubleshooting .

8.3 Disassembly

Anytime prior to disassembling, confirm if both stop valves at inlet and outlet side of the product are at closed position. Also, make sure that no pressure and drainage remains inside of the product.

(1) Pilot valve

1. Slightly loosen lock nut [29] and turn adjusting screw [28] counterclockwise to release spring [25] (no compression).
2. Remove bolt [38] of spring chamber [3]. Remove the spring chamber, spring, top spring plate [26], bottom spring plate [27], gasket[24], and pilot diaphragm [23].
3. Remove seal bellows [21] using a ring spanner or socket wrench (nominal size 30), and remove gasket [22], pilot valve [17], and pilot valve spring [19].
4. Remove pilot valve seat [18] using a socket wrench (nominal size 17).

(2) Main valve

1. Remove pipe A [35] at joint [32] and tee [34].
2. For nominal sizes 15A to 40A, remove bolt [39] of pilot body [2]. Dismount the pilot body from the body [1]. And remove screen [15], spring plate [14], main valve spring [13], and main valve [6].
For nominal sizes 50A to 100A, remove bolt [50] of spacer [51] and remove the spacer from the main body, main valve spring [13], and entire main valve [52,53,6,9] (for nominal size 50A, main valve spring [13], and main valve [6]).

(3) Main diaphragm

1. Remove pipe C [37] at tee [34].
2. Remove bolt [42] of bottom dia. case [5]. Dismount the bottom dia. case, main diaphragm [12], retainer [11], and spindle [9] (adapter [56] and retainer [11] for nominal sizes 65A to 100A).

8 . 4 Cautions during re-assembling

⚠ Caution

(1) Check that there is no damage on the main valve, main valve seat, pilot valve, and pilot valve seat.

*If any scratches exist on the seating surface of valve seat, they may cause increasing the outlet pressure and excess temperature. When any scratches exist on the main valve and valve seat, carry out lapping to remove them. If it is not possible to remove them, replace with new parts. When any scratches exist on the pilot valve and valve seat, replace with new parts.

(2) Move the sliding section (pilot valve, main spindle, etc.) two to three times and confirm they move smoothly.

* If they do not move smoothly, original performance may be affected.

(3) Replace gaskets with new ones when disassembling.

*Reusing the gasket as it is, the steam may leak outside.

(4) After the main valve, spring, and spring plate (spacer for nominal sizes 50A to 100A) are assembled correctly, mount the main diaphragm.

* Incorrect assembly may affect the original performance.

(5) Carry out re-assembling in reverse order of disassembling. Tighten all hexagon bolts evenly on each bolt in turn of diagonal position.

* When re-assembling the product in wrong order, the proper function may not be available. Uneven tightening of bolts may cause the leakage of steam.

Parts within the frame are consumable. Please contact us for purchase of these consumable parts.
 Apply the liquid gasket, heat-resisting and steam resisting type (recommendable product: SOLVEST 110), on sealing surface between the pilot diaphragm and upper cover, also between upper and lower sealing surface of the main diaphragm.
 Install the tee (㉔) onto the pilot body with its slit part. (Refer to the drawing below.)
 Different type of tees will be used depend on size.

