

# MODEL GD-21

## Differential Pressure Regulating Valve

### PRODUCT MANUAL

Thank you very much for choosing the Yoshitake's product. To ensure the correct and safe use of the product, please read this manual before use. This manual shall be kept with care for future references.

The symbols used in this manual have the following meanings.

 <b>Warning</b>	This symbol indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.
 <b>Caution</b>	This symbol indicates a hazardous situation that, if not avoided, may result in minor or moderate injury or may result in only property damage.

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### 1. Usage of the Product

The GD-21 is used for pump in a closed circuit of air-conditioning or heating equipment in mid-rise and high-rise buildings. While an open circuit requires a primary pressure reducing valve as relief valve for pump, a closed circuit requires a differential pressure regulating valve since it is necessary to operate the pump at a constant flow rate no matter how back pressure fluctuates.

### 2. Features

1. The product is the most suitable for pump in a closed circuit.
2. Since the main valve features a single-seat valve and a disc, leakage is prevented when closed.

### 3. Specifications

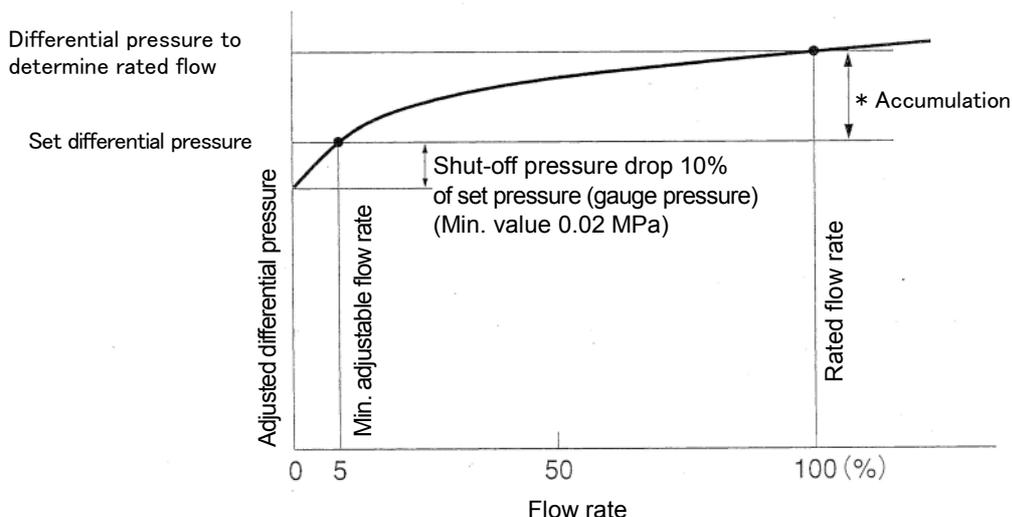
Model		GD-21	
Application		Cold and hot water	
Nominal size		15A-80A	100A-150A
Regulating differential pressure		(A) 0.05-0.25 MPa (B) 0.26-0.7 MPa	(A) 0.05-0.25 MPa (B) 0.26-0.5 MPa
Fluid temperature		5-80°C	
Material	Body	Ductile cast iron	
	Valve seat	Stainless Steel or Bronze	
	Valve disc	NBR	
	Diaphragm	NBR	
Connection		JIS 10K FF Flanged	
Inside surface treatment of body		15A-100A: Electrodeposition coating 125A-150A: Tar-based coating (black) or Electrodeposition coating	



**Caution**

Please confirm that the indications on the product correspond with the specifications of the ordered model before use.  
\* If they are different, do not use the product and contact us.

**Flow rate characteristics chart**



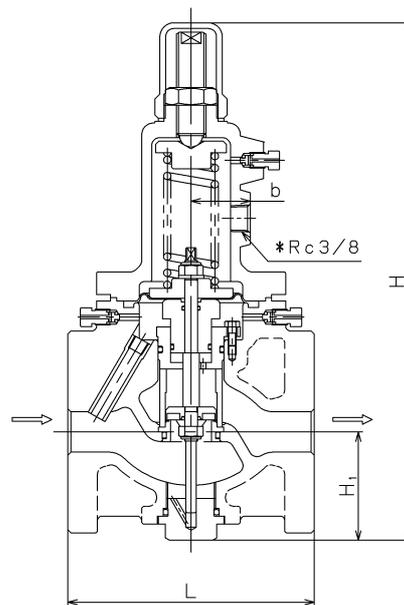
\* Accumulation

Set range (MPa)	Accumulation (MPa)
0.05-0.25	0.05 or below
0.26-0.7	0.105 or below

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#### 4. Dimensions and Weight

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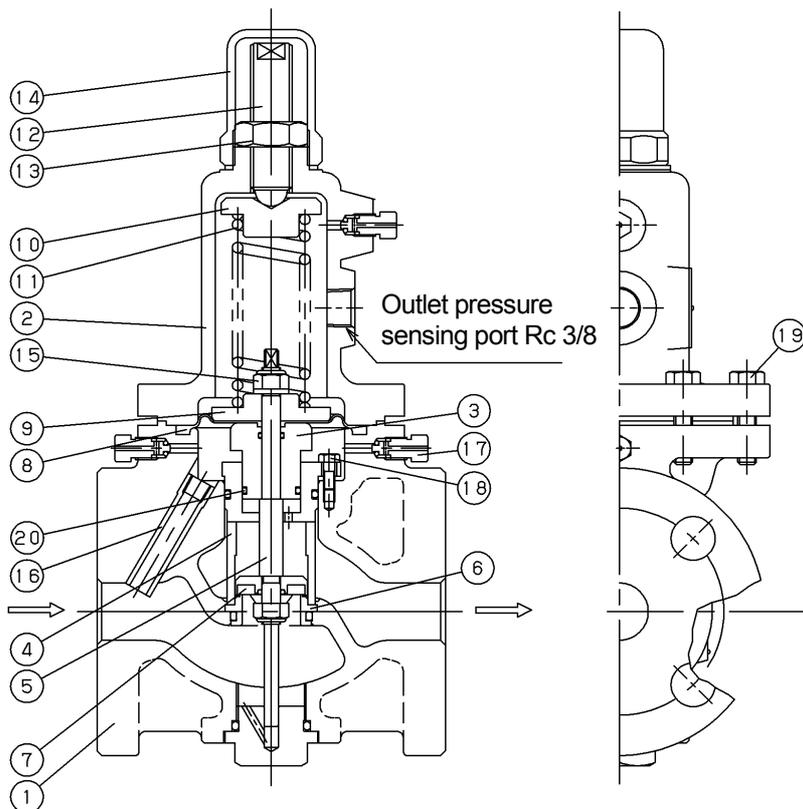


(mm)

Nominal size	L	H	H <sub>1</sub>	b	Weight (kg)
15A	145	298	57	36	8.3
20A	150	298	57	36	8.3
25A	150	320	67	36	10.1
32A	195	400	76	48	17.4
40A	195	400	76	48	17.4
50A	195	414	81	48	19.3
65A	270	572	110	63	40.1
80A	270	597	125	63	43.8
100A	308	665	143	68	70.1
125A	380	874	179	115	144.1
150A	400	929	204	115	173.1

5. Operation

Size 15A-50A



No.	Parts Name
1	Body
2	Spring Chamber
3	Retainer
4	Retainer Guide
5	Spindle
6	Valve Seat
7	Valve
8	Diaphragm
9	Spring Plate
10	Spring Plate
11	Adjusting Spring
12	Adjusting Screw
13	Lock Nut
14	Cap
15	U Nut
16	Conductor Pipe
17	Air Vent
18	Bolt
19	Bolt
20	O Ring

- The shapes differentiate slightly depending on the nominal size.

When fluid flows into the product, the inlet pressure is applied to the bottom side of the diaphragm [8] via the conductor pipe [16] and the outlet pressure is applied to the top side of the diaphragm [8] via outlet pressure sensing port.

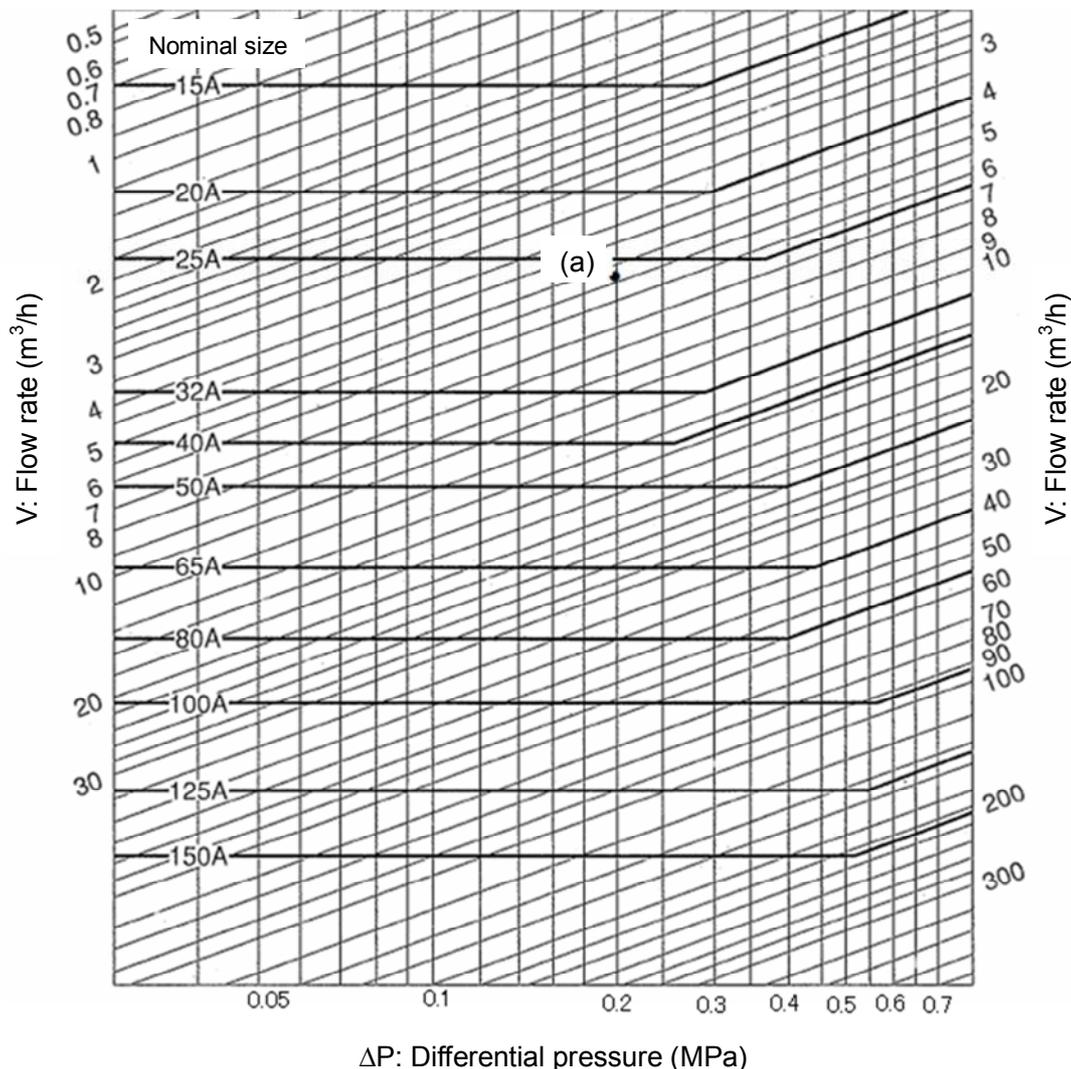
The product is kept closed while the pressure difference between before and after the product is less than the set pressure.

When the pressure difference goes over the set pressure, the load of the differential pressure between the top and bottom sides of the diaphragm [8] overcomes the load of the adjusting spring [11] to lift up the valve [7] apart from the valve seat [6], opening the product.

When the pressure difference falls below the set pressure, the product closes again so that the pressure difference between before and after the product can be kept at constant level.

## 6. Nominal Size Selection

### 6.1 Nominal size selection chart (For water)



#### [Example]

When selecting the nominal size of a differential pressure regulating valve with differential pressure ( $\Delta P$ ) of 0.2 MPa and flow rate ( $V$ ) of  $5.5 \text{ m}^3/\text{h}$ , find the intersection point (a) of differential pressure ( $\Delta P$ ) and the flow rate ( $V$ ).

Since the intersection (a) lies between nominal sizes 25A and 32A, select the larger one, 32A.

### 6.2 Calculation formula for Cv value

■ Cv value

Nominal size	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A
Cv value	1.5	2.7	4	8.5	11	14	23	32.5	48	75	108

■ Calculation formula for Cv value

$$Cv = \frac{0.365V\sqrt{G}}{\sqrt{\Delta P}}$$

- $P_1$ : Inlet pressure [MPa·A]
- $P_2$ : Outlet pressure [MPa·A]
- $\Delta P$ :  $P_1 - P_2$  [MPa]
- $G$ : Specific gravity (relative to water)
- $V$ : Max. liquid flow rate [ $\text{m}^3/\text{h}$ ]
- $Cv$ : Cv value of each nominal size

**7. Installation**

**7.1 Precautions for installation**

**⚠ Caution**

1. As the product is heavy, support it securely by lifting device while installation.  
\* Failure to follow this notice may result in bodily injury due to a drop accident.
2. Do not disassemble the product unless it is necessary.  
\* Disassembly may prevent the product from functioning properly.
3. Be sure to remove foreign substances and scales from the piping before connecting the product.  
\* Foreign substances and scales may prevent the product from functioning properly.
4. Install the product vertically to the horizontal piping. If installing it to a vertical piping is inevitable due to limited space, the product can be installed to the vertical piping as long as its size is less than 100A.  
\* Do not install the product of 100A or larger to a vertical piping.
5. Be sure to install pressure gauges to both the inlet and outlet sides of the product. In addition, install strainer and bypass line to the piping around the product.  
\* Failure to follow this notice may hamper correct pressure adjustment.
6. Be sure to install a strainer (60-80 mesh) at the inlet side of the product.  
\* Foreign substances or scales may prevent the product from functioning properly.
7. Quick operating valve shall be installed more than 3 meters away from the product.  
\* Failure to follow this notice may result in malfunction or a drastically shortened service life of the product.
8. Do not apply excessive load, torque or vibration to the valve when piping.  
\* Failure to follow this notice may result in malfunction or a drastically shortened service life of the product.
9. Place a drain pipe between the stop valve and the product for easier maintenance and inspections.  
\* Failure to follow this notice may cause fluid spill when disassembling.  
\* Guide the drain pipe to a drain ditch if there is a risk of contamination on the surroundings due to the fluid spill.
10. Install a needle valve to the outlet side of the product and plumb it to the pressure sensing pipe using copper piping.  
\* Failure to follow this instruction hampers correct pressure adjustment.

- (1) Joint for the outlet pressure sensing is not included with the product package.
- (2) Secure the space specified in the table below (H<sub>2</sub>) since it is required for maintenance and inspection. H<sub>2</sub> indicates the required height above the horizontal center line of the piping (see Fig. 1 below).

■ Space required for disassembly (mm)

Nominal size	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A
H <sub>2</sub>	500	500	500	650	650	650	800	800	1000	1200	1400

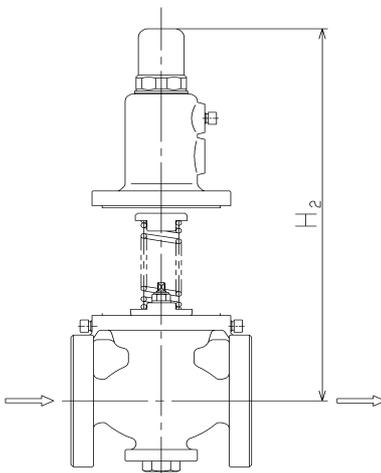


Fig. 1 Space required for disassembly

7.2 Piping example

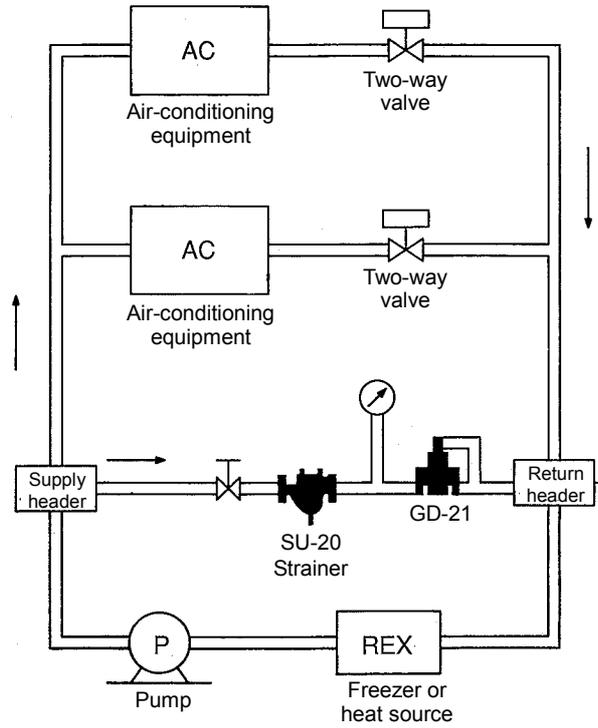
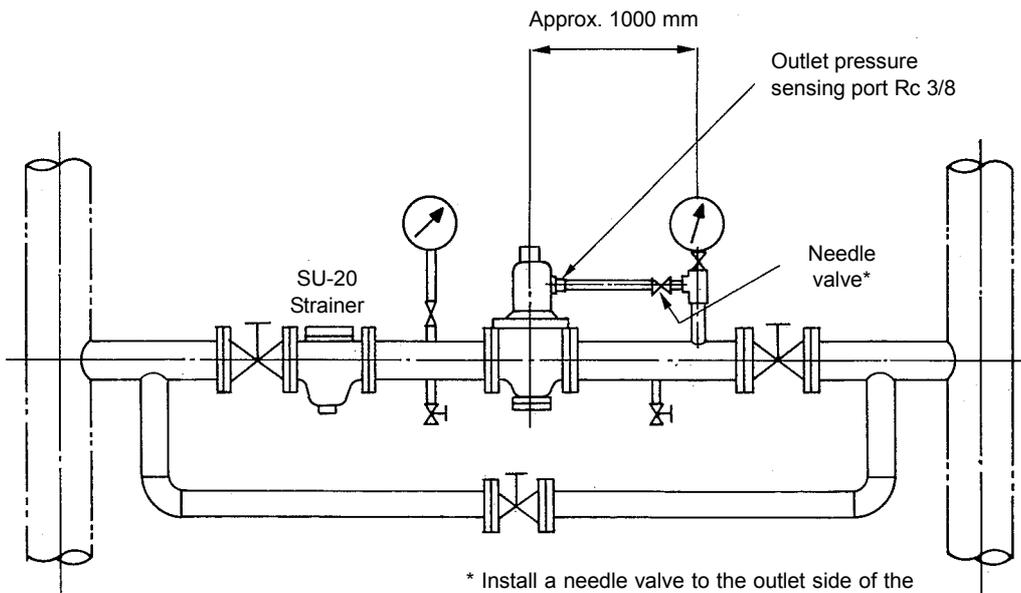


Fig. 2



\* Install a needle valve to the outlet side of the product and plumb it to the pressure sensing pipe using copper piping

Fig. 3

## 8. Operating procedure

### 8.1 Precautions for operation



#### Warning

Do not touch the product with bare hands when the fluid has a high-temperature.  
\* Failure to this notice may scald your skin.



#### Caution

1. Before leading fluid into the product, close the stop valves before and after the product and remove all foreign substances or scales via the bypass line.  
\* Foreign substance or scales may prevent the product from functioning properly.
2. Before leaving the product not operated for a long time, discharge the fluid inside of the product and piping completely, and close the stop valves before and after the product.  
\* Failure to follow this notice may cause malfunction due to rust generated inside the product and piping, or result in damage due to freezing.  
\* The fluid can be drained out of the product efficiently with the air vent valve (see “8.2 Precaution for air vent”).
3. Pressure regulation of the product shall be performed while the fluid running. To increase the set differential pressure, loosen the lock nut [13], and then slowly turn the adjusting screw [12] clockwise. To decrease the set differential pressure, slowly turn the adjusting screw [12] counterclockwise.  
\* The fluid leaks if the cap [14] is removed. In this case, use a waste cloth to wipe it out.
4. Remove air accumulated in top and bottom sides of diaphragm using the air vents in accordance with the procedures described in “8.3 How to use air vent.”  
\* Air accumulated in the top and bottom sides of the diaphragm may cause malfunction of the product.

### 8.2 Precautions for air vent



#### Warning

Do not stand in front of the air vent valve during use.  
\* Failure to follow this notice may result in scalds or bodily injury due to blow-off of the fluid inside.



#### Caution

Do not rotate the air vents more than 1/2 turn when use.  
\* Failure to follow this notice may make the air vents detached from the body. In this case, the air vents may not be reattached.

### 8.3 How to use air vent

- (1) Rotate the screw of the air vent [17] counterclockwise to loosen it in order to discharge air.
- (2) Rotate the screw of the air vent [17] clockwise to the original closed position after discharging air.

## 9. Maintenance

### 9.1 Precautions for disassembly and maintenance



#### Warning

1. Disassembling and inspections must be performed by experienced professional or valve manufacturer.
2. Before disassembly or inspection, completely release internal pressure of the product, piping and equipment. When the fluid is hot, cool down the product to the condition that it can be touched with bare hands.  
\* Residual pressure may cause bodily injury or scalds and may contaminate surroundings of the product.

## 9.2 Disassembly

- (1) Release the internal pressure from the piping completely, and make sure that the pressure gauge shows that the pressure is zero.
- (2) Remove the cap [14] and slightly loosen the lock nut [13], and then turn the adjusting screw [12] counterclockwise so that the adjusting spring [11] can be in no load condition.
- (3) Remove the spring chamber [2] by unscrewing the bolt [19], and then take out the adjusting spring [11] and the spring plate [10].
- (4) Remove the diaphragm [8] by fixing the spindle [5] and loosening the U nut [15].
- (5) To remove the retainer [3], by loosening the bolt [18] and pulling out the retainer guide [4] together with the retainer [3].

If the retainer guide [4] is difficult to be removed, do as indicated in Fig. 4 or Fig. 5 below

### Nominal size 15-50A

To remove the retainer guide [4] easily, reattach the spring plate [9] and U nut [15] to the spindle [5], then pull up the spring plate [9].

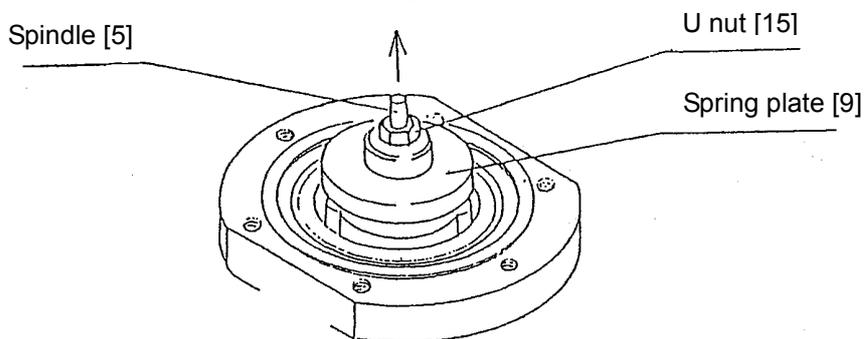


Fig. 4

### Nominal size 65-150A

To remove the retainer guide [4] easily, screw the bolt [18] to the retainer guide [4] and pull them out. (See Fig. 5)

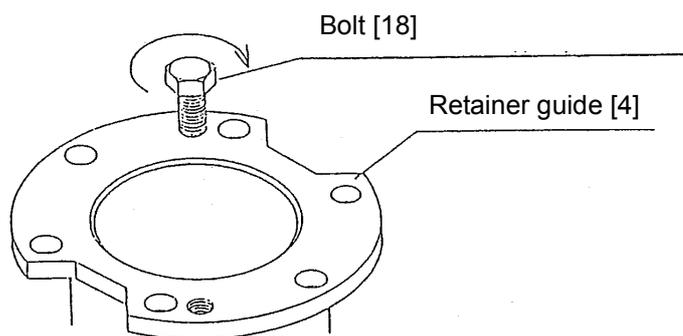


Fig. 5

## 9.3 Reassembly

To reassemble the product, take reverse procedure to disassembly.

#### 9.4 Precautions for reassembly

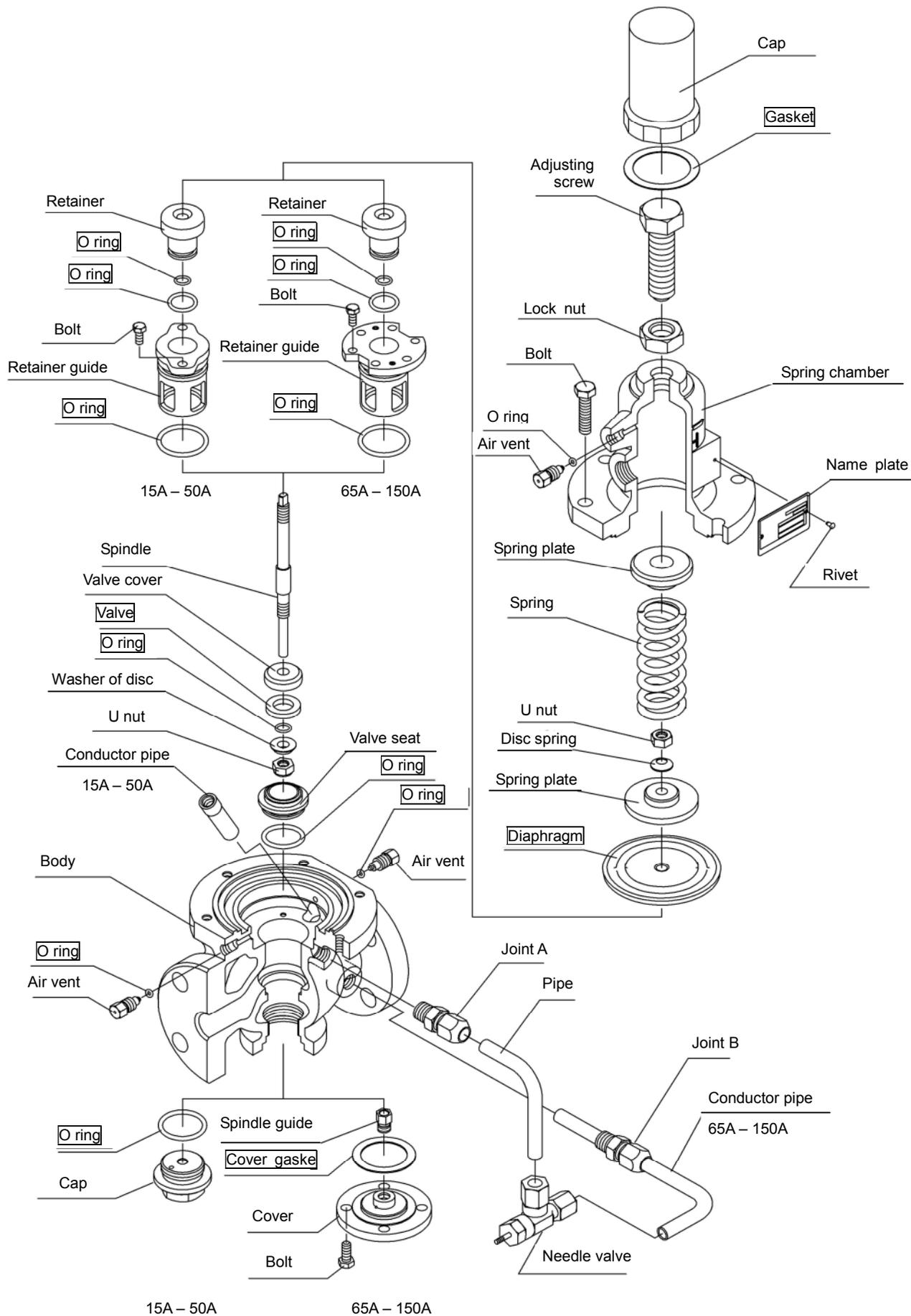
#### **Caution**

1. Make sure that there are no flaws on the diaphragm [8], the valve seat [6] and the valve [7].  
\* Flaws on them may prevent the product from functioning properly.
2. Apply silicon grease to the O-ring [20] after confirming that there are no flaws on it.  
\* Without silicon grease, the O-ring may be torn.
3. Confirm that the lip of the diaphragm [8] is fitted in the grooves on the body [1], and then attach the spring chamber [2].  
\* Failure to follow this notice may prevent the product from functioning properly.
4. There should be a gap between the retainer guide [4] and the body [1] when properly assembled.  
Tighten the bolts evenly to avoid over-tightening them.

### 10. Troubleshooting

Trouble	Cause	Remedy
Excessive leakage Adjustment is impossible.	1. Foreign substances stuck between valve [7] and valve seat [6]. Or damage on valve [7] and/or valve seat [6].	1. Disassemble and clean, or replace.
	2. Damage on diaphragm [8] and/or O-ring.	2. Replace diaphragm [8] and/or O-ring [20].
	3. Nominal size is too small for the specifications.	3. Replace the product to obtain proper nominal size (see "6.1 Nominal size selection chart").
	4. Pressure gauge is out of order.	4. Replace.
Abnormal sound is observed	1. Air-induced problem occurs.	1. Install exhaust equipment.
	2. Nominal size is too large for the specifications.	2. Replace the product to obtain proper nominal size (see "6.1 Nominal size selection chart").

11. Exploded Drawing



The parts name shown in the rectangle boxes are available as consumable supply.