Model GD-20R
Primary Pressure Regulating Valve
Pressure Sustaining Valve

Please read this bulletin thoroughly before using the pressure reducing valve, so that you may do so correctly and safely. Please carefully store this bulletin 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.

Contents

YOSHITAKE

1. Specifications & Performance

1.1 Specifications

Table 1

Model	GD-20R	
Application (Fluid)	Hot and cold water, Air, Oil (+) (kerosene、heavy oil A･B) and Other non-dangerous fluids	
Nominal size	15～80A	100～150A
Inlet pressure (MPa)	(A) 0.05～0.25MPa (B) 0.26～0.7MPa	(A)0.05～0.25MPa (B)0.26～0.5MPa
Installation posture	Vertical or horizontal installation	Horizontal installation
Fluid temperature	5 - 80℃	
Connection	JIS 10K FF Flanged	
Coefficient of viscosity (cSt)	600 or less	
Surface treatment	15 - 100A : Electrodeposition paint 125 - 150A : Tar paint (Black) or electrodeposition paint	

* External sensing is also available.
* The rubber material FKM type is also available.
* The wetted parts made of stainless steel type and all stainless steel type are also available.
* Model with water drain plug is also available.

(+) Deterioration of rubbers may be accelerated depending on the additives contained in the oil used.

⚠ Caution

Please collate with attached nameplate and specification of ordered model.
*Please consult factory in case they do not match each other.

1.2 Flow Rate Characteristics Chart

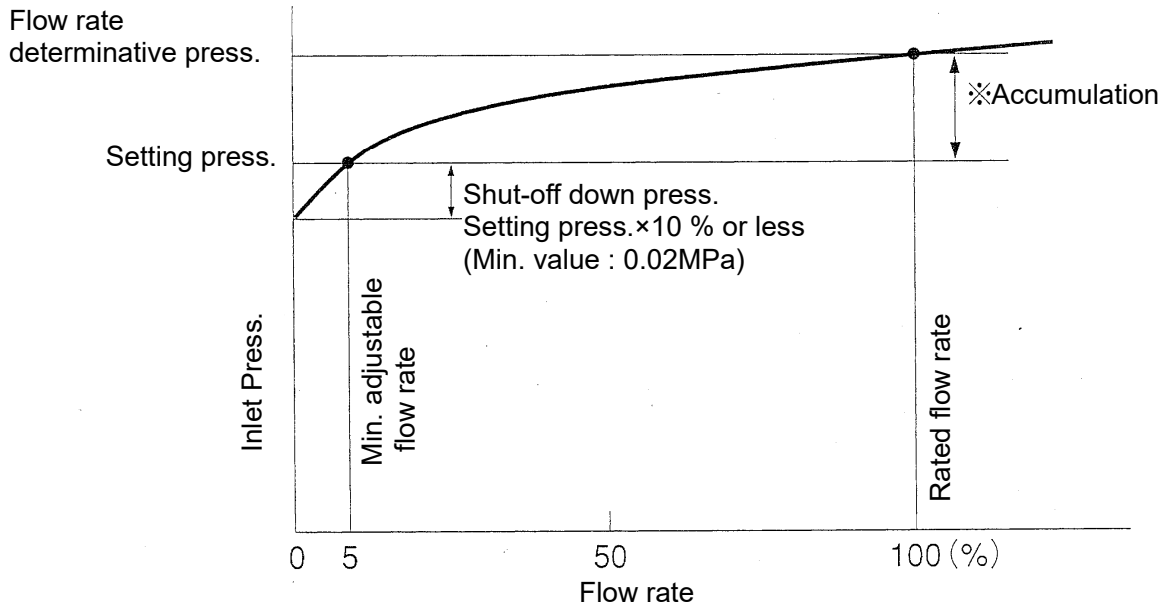


Fig. 1

Table 2

Setting range (MPa)	Accumulation (MPa)
0.05 - 0.25	0.05
0.26 - 0.7	0.105

2. Structure

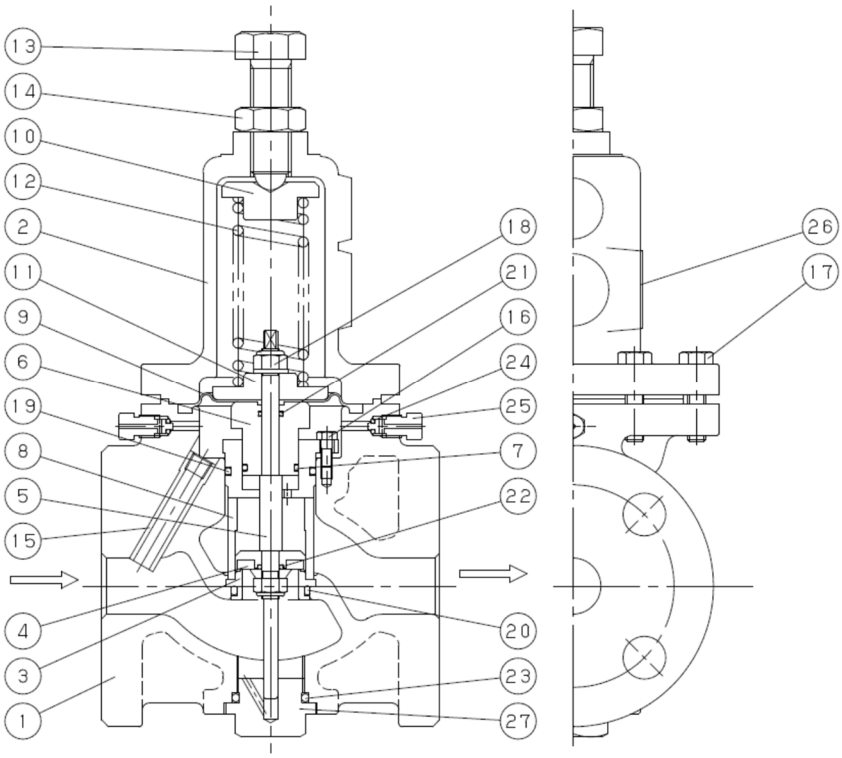


Fig.2

Table 3

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

∗The parts shape differs according to the nominal size.

3. Operation

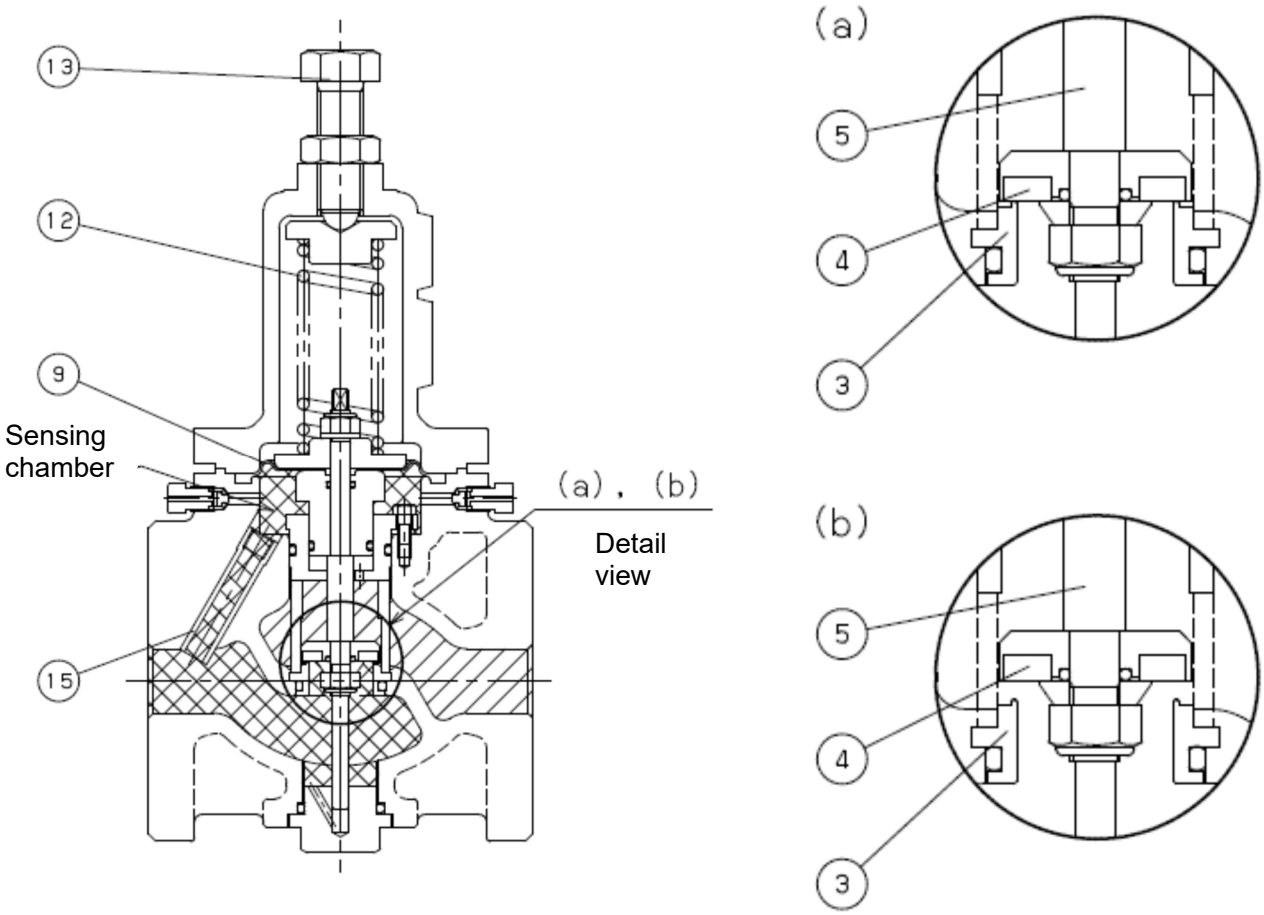


Fig. 3

∗The parts shape differs according to the nominal size.

If the adjusting screw [13] is turned right, the diaphragm [9] will be depressed with the adjusting spring [12] and valve [4] connected with spindle [5] will close. (a)

Fluid passes along a conductor pipe [15] and the sensing chamber under the diaphragm. If the pressure of the sensing chamber becomes higher than setting pressure, the load of the diaphragm bottom will overcome the load of the adjusting spring, will push up the valve, and will relieve excessive pressure. (b)

If the pressure of the sensing chamber falls below setting pressure, the valve will be again closed by the load of the adjusting spring.

4. Nominal Size Selection Method

When selecting pipe size, please take piping condition and application into consideration and secure a safety rate of 20% or more for the performance value.

4.1 Nominal Size Selection Chart

<For Liquid>

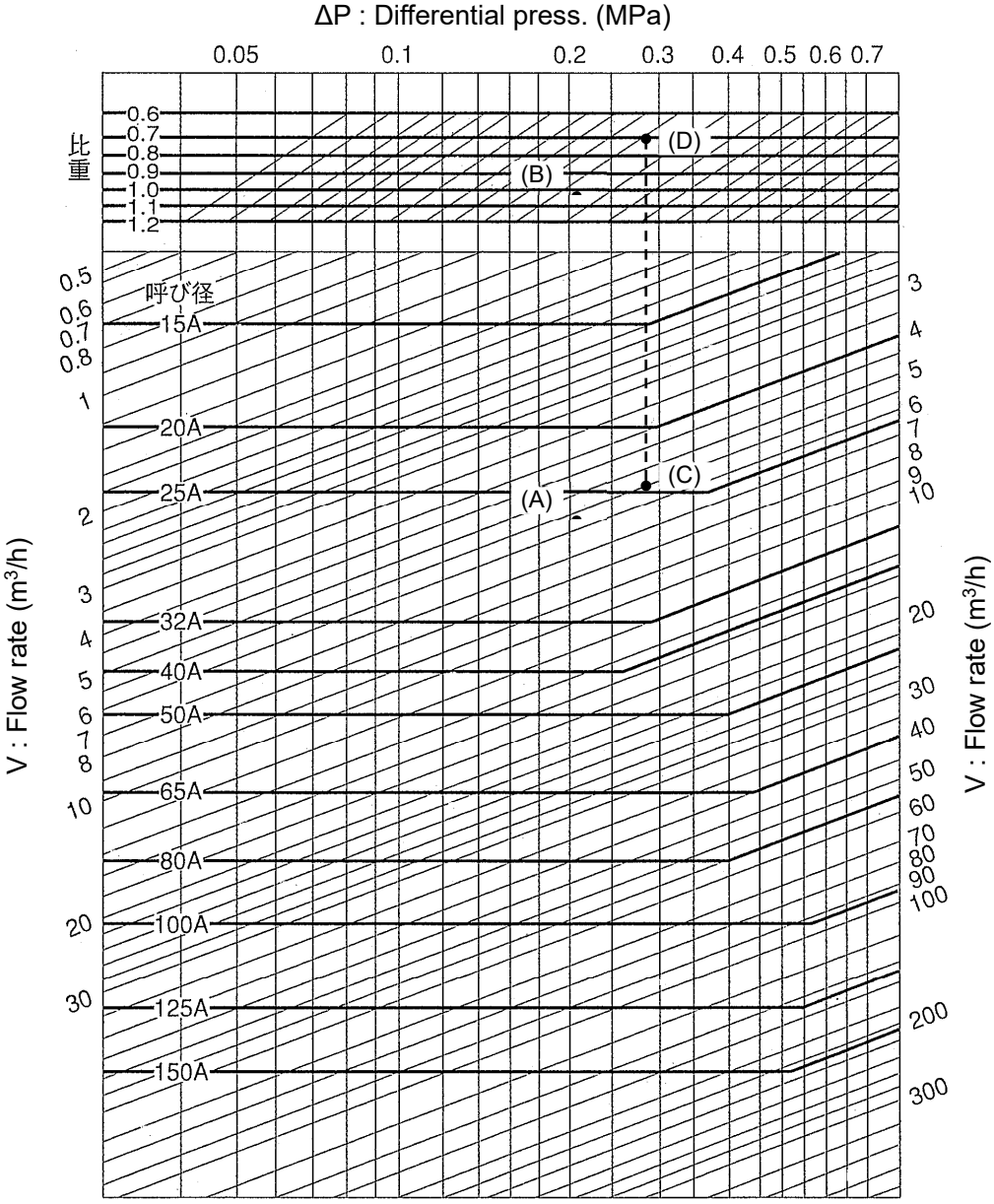


Fig. 4

Example of Selection

For example, take a pressure regulating valve whose pressure differential before/after a valve(ΔP) is 0.2MPa, specific gravity is 1(water), flow rate(V) is 5.5m3/h. Firstly, vertically proceed on the line of pressure differential 0.2MPa to come across the flow rate 5.5m3/h , and regard this point as(A). Point(A) is between nominal size 25A and 32A. Select the lager nominal size 32A.

For example, take a pressure regulating valve whose condition is same as above, but specific gravity is 0.7. Firstly, vertically proceed on the line of pressure differential 0.2MPa to come across the line of specific gravity 1, and regard this point as (B). Move, in parallel to diagonal line, to intersection point (C) with the line of specific gravity 0.7. Vertically proceed from point (D) to come across the flow rate 5.5m3/h , and regard this point (E). Point (E) is between nominal size 20Aand 25A. Select the lager nominal size 25A.

<For Air>

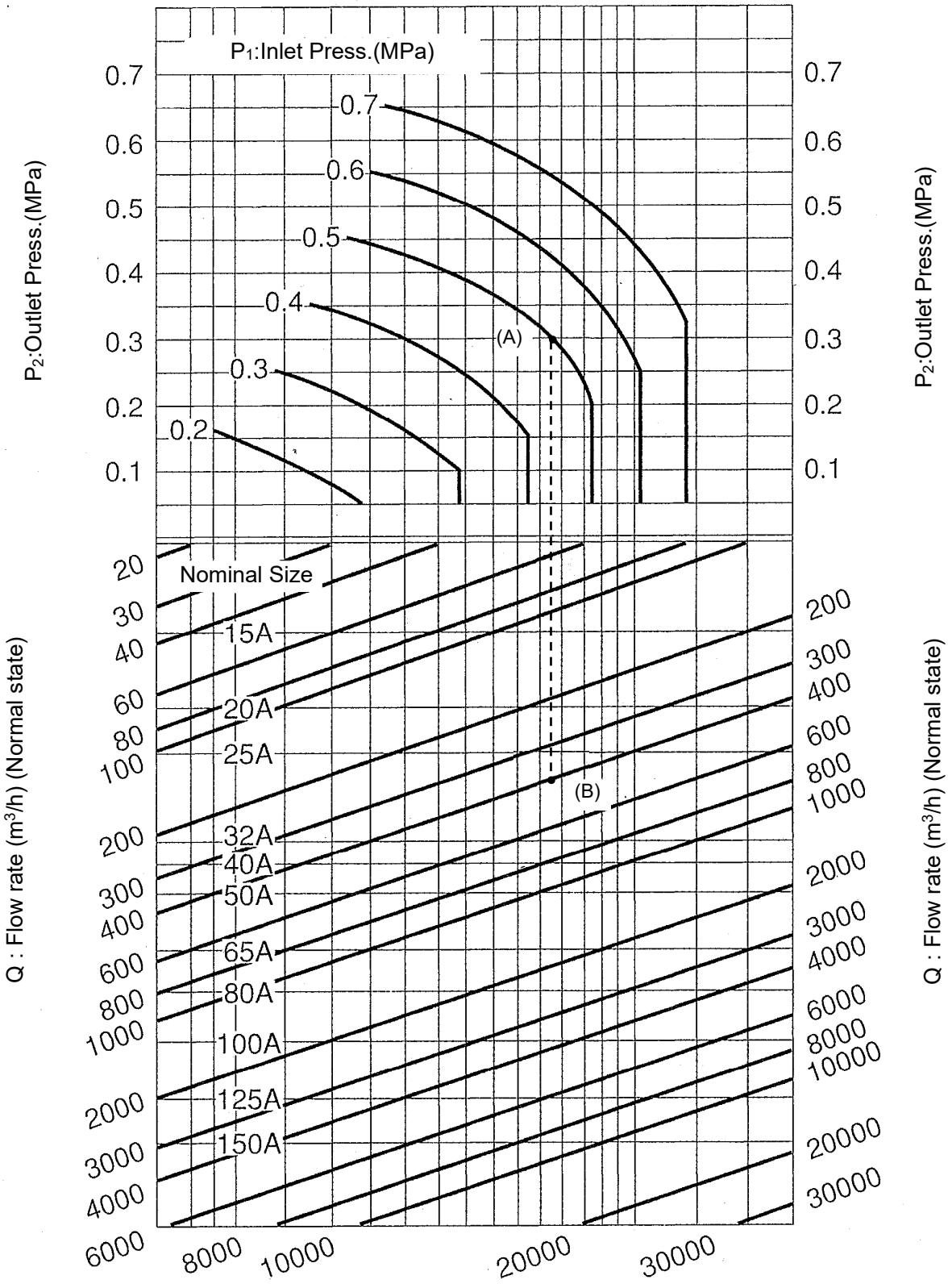


Fig. 5

Example of Selection

When the inlet pressure (P1) is 0.5 MPa, the outlet pressure (P2) is 0.3 MPa and the flow rate is 400Nm3/h, for instance, the size of the pressure regulating valve is selected as follows. Find the intersection point (A) of the inlet pressure (P1) 0.5 MPa and outlet pressure (P2) 0.3 MPa and go straight down from the point (A) to find the intersection (B) crossing the flow rate line. The point (B) is between line of 25A and 32A, and choose larger size 32A for application.

4.2 Selection Formula for Nominal Size

When selecting the nominal diameter by calculation, use the formula to find the required Cv value based on the usage conditions, and then select the nominal diameter with a Cv value that satisfies that value (see Table 4).

Table 4

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

≪For Gas≫

In case of $P_2 > \frac{P_1}{2}$

$$C_V = \frac{Q}{2940}\sqrt{\frac{(273+t)G}{\Delta P(P_1+P_2)}}$$

In case of $P_2 \leqq \frac{P_1}{2}$

$$C_v = \frac{Q\sqrt{(273+t)G}}{2550P_1}$$

≪ For Liquid≫

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

However, the maximum flow rate V should be 3 m/s or less (see Table 5).

Table 5

Nominal Size	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A
Flow rate at flow velocity 3m/s	2.20	3.96	6.46	10.81	14.67	23.72	39.09	55.21	94.00	145.05	204.21

For liquids with viscosity, apply the following viscosity correction calculation formula.
Find the Max. Flow rate (V) when the viscosity is ignored.

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

And find the viscosity index of Iv.

$$I_V = \frac{72780}{M_{cst}}\left(\frac{\Delta P}{G}\right)^{\frac{1}{4}} V^{\frac{1}{2}}$$

Find the value of K from the value of Iv, found through the above formula, with the viscosity correction curve. The calculated Max. flow rate divided by the value of K is the corrected value.

Compensated Max. flow rate V'＝V / K（m³/h）

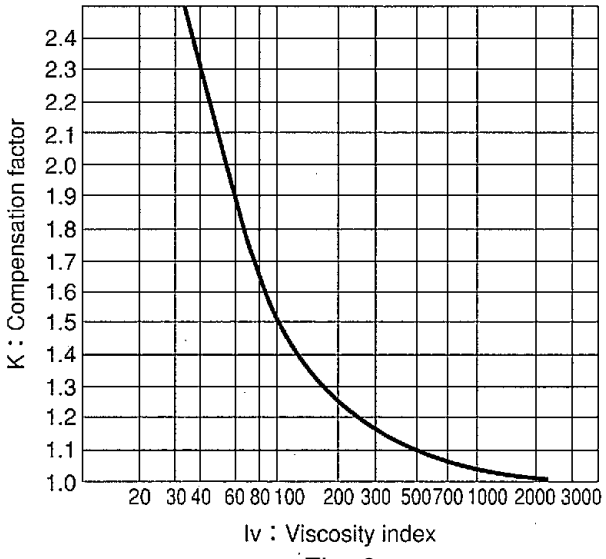


Fig. 6

P_1	: Inlet pressure	{MPa･A}
P_2	: Outlet pressure	{MPa･A}
ΔP	: P_1 - P_2	{MPa}
G	: Specific gravity (Gas : Specific gravity relative to air Liquid : Specific gravity relative to water)	
Q	: Max. gas flow rate	{m³/h}(Normal state)
V	: Max. liquid flow rate	{m³/h}
t	: Temperature	{℃}
Cv	: Cv value of the nominal size	
V'	: Corrected flow rate	{m³/h}
Iv	: Viscosity index	
Mcst	: Viscosity	{cSt}

4.3 Pressure Sustaining Valve Selection

For selection of Pressure sustaining valve, follow the directions listed below.

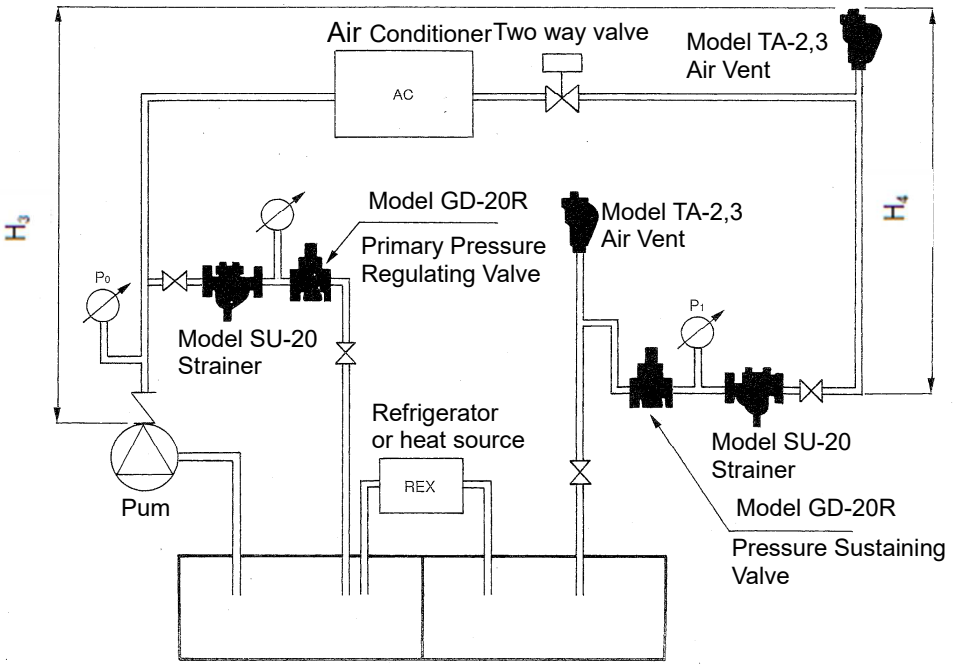


Fig. 7

Table 6

H_4 (m)	Pb (MPa)
5～20	0.02
21～40	0.04
41～70	0.06

①Please check the following items.

		Examples
Pump discharge pressure with designated flow rate (Maximum flow rate)	P_0 (MPa)	0.5
Designated flow rate	V (m^3/h)	20
Height from pump to the highest part of piping	H_3 (m)	18
Height from pressure sustaining valve to the highest part of piping	H_4 (m)	16
The sum total of piping resistance from pump outlet to the inlet of Pressure sustaining valve and resistance of machinery	W_1 (MPa)	0.22

②Calculate the following items and determine the piping system and nominal diameter.

If the judgment is passed, you can use the product with the specifications of the selection result.

			Examples
Shut-off down pressure (See table.9)		P_b (MPa)	0.02
Minimum setting pressure	$P = \frac{0.098\,H_4}{10} + P_b$	P (MPa)	0.176
Nominal size (Please select size from Figure 5 using P and V values)		(A)	65
Rated flow rate (Calculate the maximum flow rate using "4.2 Selection Formula for Nominal Size " and take a safety factor of 20% for that flow rate. However, the maximum flow rate should be 3 m/s or less.)	$V_1 = \frac{Cv\sqrt{P}}{0.365} \times 0.8$	V_1 (m^3/h)	21.3
Rated Accumulation (See table.2)		(MPa)	0.05
Accumulation with designated flow rate	$P_a = \frac{V}{V_1} \times \text{Rated Accumulation}$	Pa (MPa)	0.05
Inlet pressure of Pressure sustaining valve	$P_1 = P_0 - \frac{0.098\,(H_3 - H_4)}{10} - W_1$	P_1 (MPa)	0.26
Pump margin	$\alpha = P_1 - P - P_a$	α (MPa)	0.03
Judgement ① ⊿P ＞ P (If it does not pass, please review the piping system.) ② α ＞ 0 (If it does not pass, please increase the piping size.)			① 合格 ② 合格
Selection result		Size (A)	65A
Select the set pressure between P and P+α.		Setting press. range (MPa)	0.18 - 0.21

5. Installation

5.1 Example of Piping

○Primary Pressure Regulating Valve

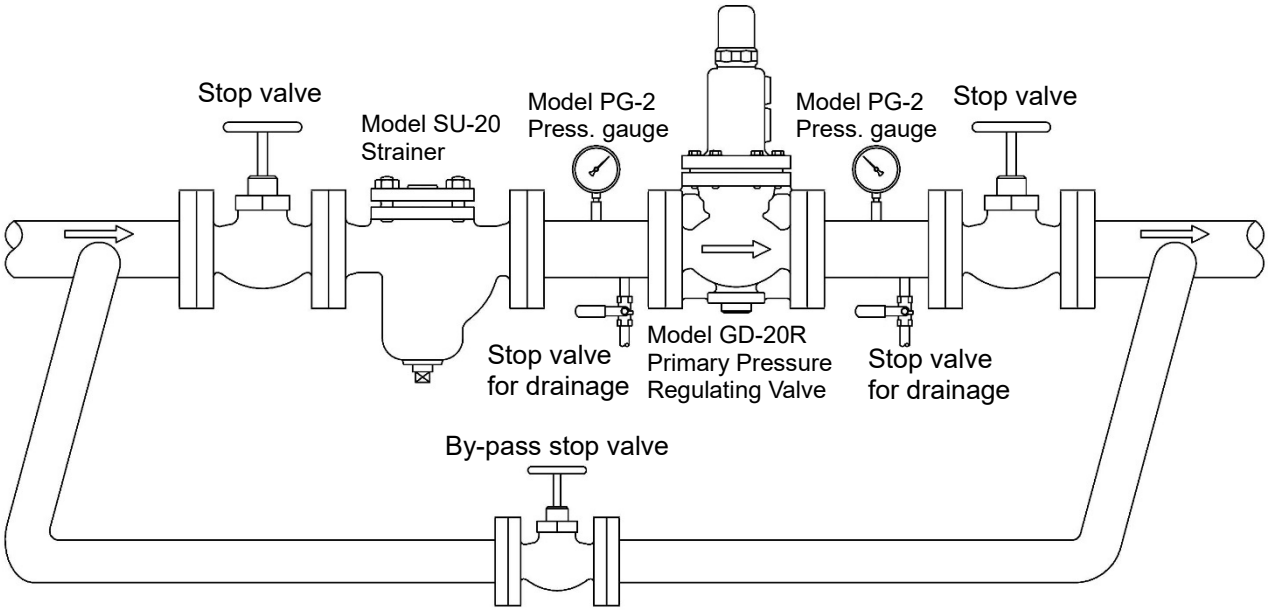
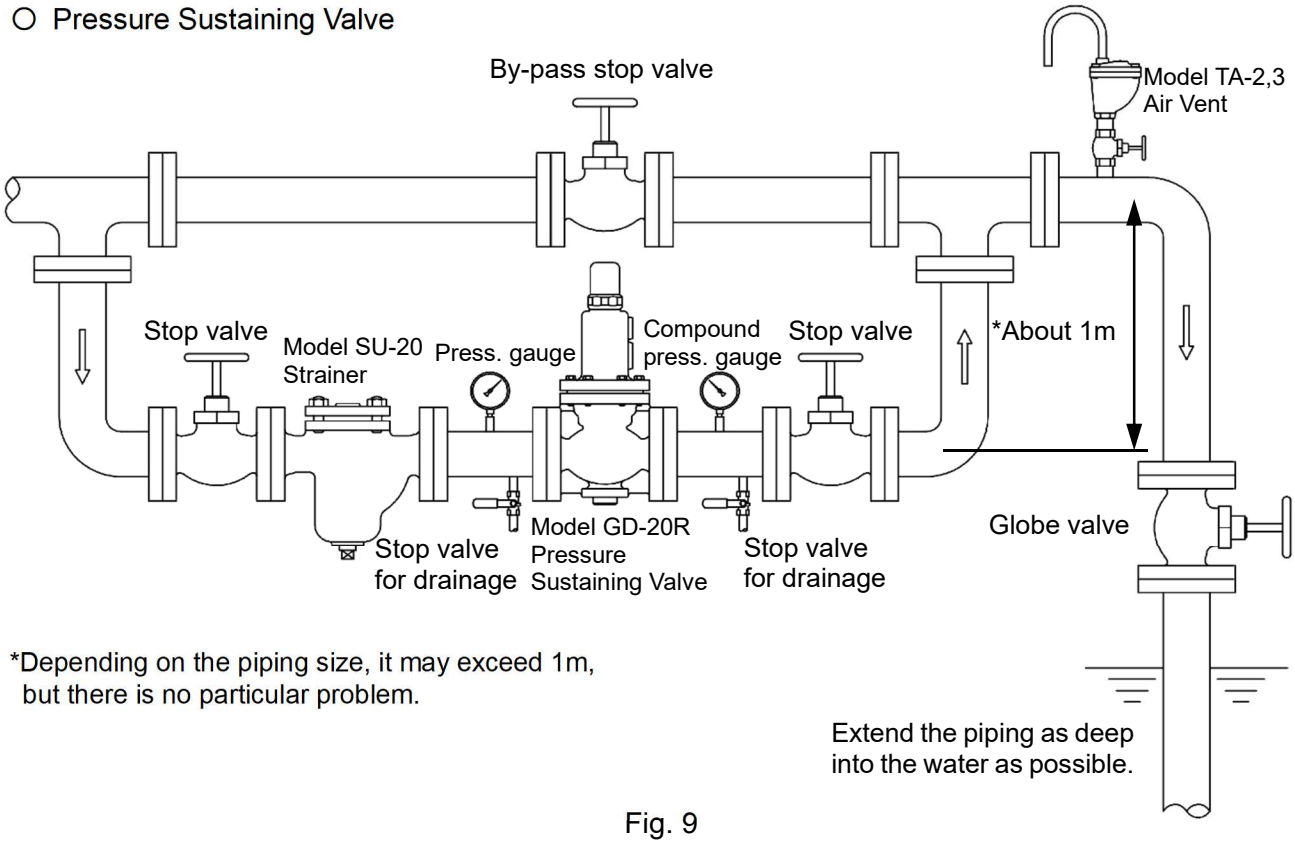


Fig. 8

○ Pressure Sustaining Valve



*Depending on the piping size, it may exceed 1m,
but there is no particular problem.

Fig. 9

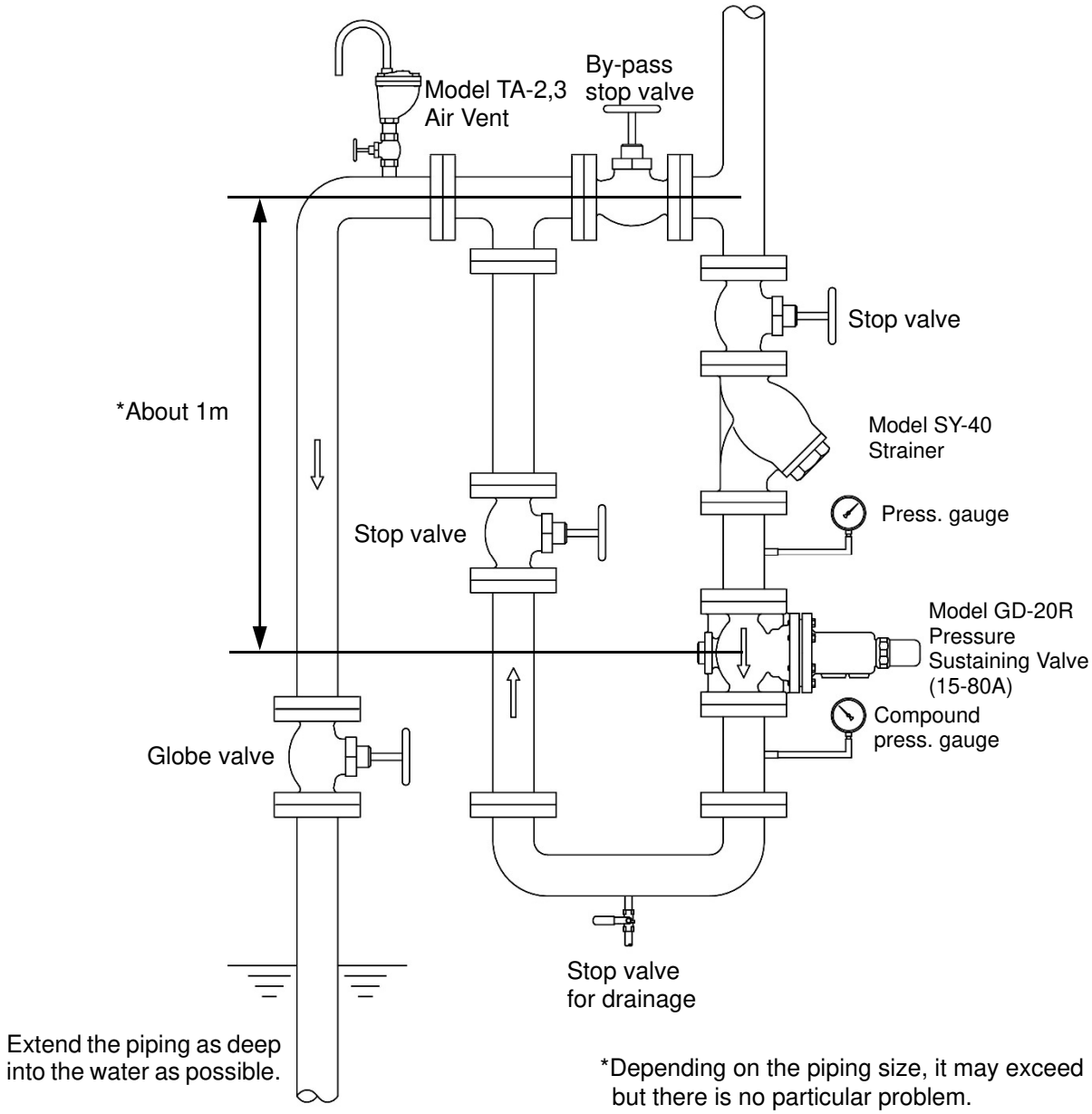

Model TA-2,3
Air Vent
By-pass
stop valve
Stop valve
*About 1m
Model SY-40
Strainer
Press. gauge
Stop valve
Model GD-20R
Pressure
Sustaining Valve
(15-80A)
Compound
press. gauge
Globe valve
Stop valve
for drainage
Extend the piping as deep
into the water as possible.
*Depending on the piping size, it may exceed 1m,
but there is no particular problem.

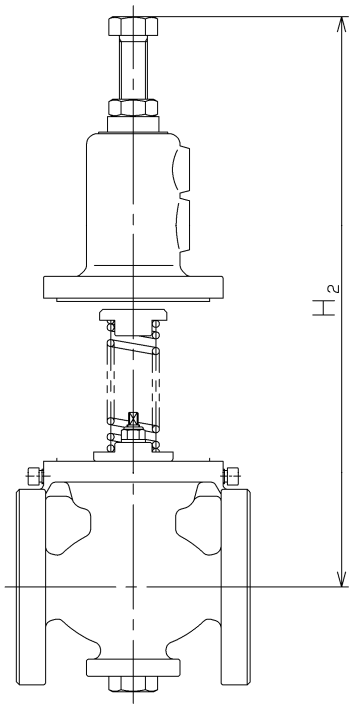
Fig. 10

5.2 Precautions before Operation

⚠ Caution

(1) Depending on the water quality, brass parts may corrode or be promoted, causing product malfunction. In an environment where corrosion may occur, select a product made of a compatible material such as stainless steel.
(2) If components having negative influence on internal parts are included in fluid or surroundings, deterioration of rubber parts is accelerated and then outside leakage or functional disorder is caused.
(3) The product or parts will be damaged if an impact due to sudden pressure fluctuations such as water hammer is applied.
(4) If the product is in a closed pipe state, the fluid in the pipe will expand in volume due to the rise in fluid temperature, and the product will be damaged.
(5) Sticky fluids can cause parts to stick together and cause malfunction.
(6) Since it is weight thing, this product should use lifting equipment etc., and please support a product certainly and install it in piping.
* There is a possibility that it may be injured, by fall of product.
(7) Do not disassemble the product unless it is necessary.
* Unnecessary disassembly prevents the product from functioning properly.
(8) Install a by-pass pipe.
* If a bypass pipe is not installed, system operation will need to be stopped in the event of product failure.
(9) Before installing the product in the piping, be sure to remove foreign substances and scale from the piping. Keep foreign substances from entering the piping, including seal tape or liquid seal agent for piping connection.
* Ingress of foreign substances, scale or seal agent into the product leads to valve leakage or malfunction of the product.
(10) Be sure to install a strainer at the inlet side of the product.
* Ingress of foreign substances or scale into the product leads to malfunction of the product. It is recommended to use a strainer of 60 mesh or more.
(11) Be sure to install pressure gauges at the inlet and outlet sides of the product.
* Failure to follow this notice hampers correct pressure adjustment.
(12) Install pipes so that excessive load, torque or vibration is not applied to the product.
* Doing so may result in malfunction or drastically shortened service life.
(13) For gas application, install a trap to the inlet sides of the valve to prevent drainage problem.
* Failure to do so may result in drainage problem, affecting the original performance.
(14) Do not use dissimilar metal piping that causes a potential difference.
* Products and parts will corrode.
(15) Install the product properly by checking the inlet, outlet and proper posture. The product can be installed either horizontally or vertically (nominal size 15A to 80A). In the case of the nominal size 100A to 150A, install the product horizontally.
* Installing the product in wrong directions prevents the product from functioning properly.
(16) When releasing water into an open tank, the secondary piping should be raised approximately 1m from the product and an air vent valve should be installed. Additionally, extend the piping as deep into the water as possible (see Fig. 10,11).
* Failure to do so may result in malfunction or drastically shortened service life.
(17) To maintain easily, install a drainpipe between stop valve and primary pressure regulating valve.
(18) Above the center of the pipe line, be sure to reserve space larger than H_2. Please see the Fig. 11.
(19) Before performing the water pressure test, close the stop valves upstream and downstream of the product.
*The test pressure may damage the product.

≪ Inspection space≫



（mm）

Size	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A
H_2	500	500	500	650	650	650	800	800	1000	1200	1400

Fig. 11

6. Operating Procedure

6.1 Precautions for Operation

⚠ Warning

(1) When the product is used for hot fluid, do not touch the product with bare hands.
    * The product having hot fluid may scald your skin.
(2) Before leading fluid, make sure that there is no danger even if fluid leads to the piping end.

⚠ Caution

(1) Before leading fluid into the product, close the stop valves at the inlet and outlet of the product and remove foreign substances and scale from the piping completely by using a bypass line.
* Failure to follow this notice may prevent the product from functioning properly due to the ingress of foreign substances and scale into the product.

(2) To adjust the set pressure, turn the adjusting screw slowly.
* Failure to follow this notice may result in damage to the product and other equipment due to hunting or other cause.

(3) If closing outlet side of the product and keeping fluid inside the product for an extended period, sliding parts become stuck and it causes malfunction of the product.
*Check if the product operates normally when resuming the product.

(4) If there is a possibility of freezing or the product is not used for an extended period, completely discharge fluid from the product and pipes, and close the stop valves at the inlet and outlet sides of the product.
* Failure to follow this notice causes malfunction of the product due to rusting inside the product and the pipes or damaged by freezing.

(5) If the systems have been out of service for a long time, please perform the following operational checks before restarting the systems.
・Check if the set pressure changes when turning the adjustment screw (see Fig. 13).
・Check whether the primary pressure is stable at the adjusted pressure.
* If there is any abnormality, please ask a professional to take measures.

(6) In case of primary pressure for size 65A to 150A is unstable because of an air obstruction or etc. adjust opening of needle valve at detecting pipe. It is fully opened at the time of shipment.

(7) The set pressure may be affected by ambient temperature (external temperature) and fluid temperature. Install pipes so that the product may not be exposed to direct sunlight.

(8) Follow the steps below, and slowly turn the adjusting screw to set pressure. Incorrect adjustment may cause hunting, water hammer, etc., resulting in damage to the valve and other equipment.

6.2 Adjustment Procedure

(1) Close the stop valves at both sides of the valve, and thoroughly purge the system through the by-pass line. When completed, be sure to close the by-pass valve.
(2) Loosen the lock nut [14] (see Table 7).
(3) Slowly open the inlet stop valve, then fully open the outlet stop valve, allowing a trickle to be discharged.
(4) Slowly turn the adjusting screw [13] (clockwise to increase, counterclockwise to reduce) while observing the pressure gauge on the inlet side (see Fig. 12).
(5) After the adjustment, tighten the lock nut.

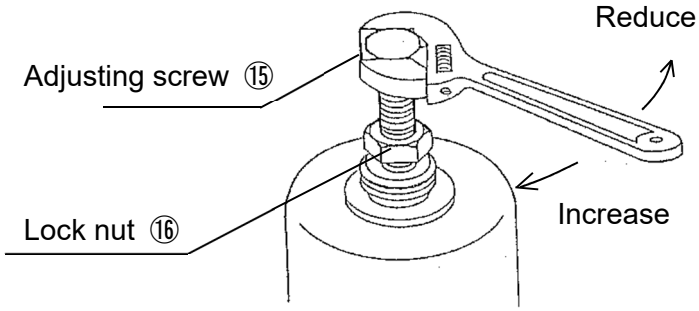


Fig. 12

Table 7 (mm)

Size	15-50A	65-100A	125-150A
Width across flats	27	36	55

7. Maintenance Procedure

7.1 Troubleshooting

Problem	Causes	Solutions
Primary pressure increases	1. Nominal size is too small for these specifications.	1. Replace with the correct nominal sized item. (Refer to the “4. Nominal Size Selection Method”.)
	2. Incorrect adjustment.	2. Re-adjust according to the adjustment procedure. (Refer to the “6.2 Adjustment Procedure”.)
	3. Poor sliding of internal parts.	3. Disassemble and clean.
	4. Strainer is clogged.	4. Disassemble and clean.
	5. Pressure gauge malfunction.	5. Replace the pressure gauge.
	6. The conductor pipe [15] is clogged with foreign matter.	6. Disassemble and clean.
Primary pressure drops	1. Foreign matter is embedded in the valve [4] and/or valve seat [3], or else scratches exist.	1. Disassemble and clean. If scratches exist, replace them.
	2. Incorrect adjustment.	2. Re-adjust according to the adjustment procedure. (Refer to the “6.2 Adjustment Procedure”.)
	3. Poor sliding of internal parts.	3. Disassemble and clean.
	4. By-pass valve is leaking.	4. Repair or replace the valve.
	5. Diaphragm [9] or O rings is broken.	5. Replace the parts.
Outside leakage	1. Diaphragm [9] is broken.	1. Replace Diaphragm.
	2. O ring [23] or Cover gasket [23] is broken.	2. Replace the parts.
	3. O ring [24] is broken.	3. Replace O ring .
Abnormal noise	1. Nominal size is too large for these specifications.	1. Replace with the correct nominal sized item. (Refer to the “4. Nominal Size Selection Method”.)
	2. Air problem is caused. (Liquid use)	2. Install a trap.

* Foreign matter and scales in pipe may cause most of problems of pressure reducing valve. Be careful sufficiently to foreign matter in pipe.

* Phenomenon alike valve trouble may happen by fault of pressure gauge, fluid leakage from by-pass valve, forgetting to close the by-pass valve, clogging strainer, etc. First, check the said before above troubleshooting.

7.2 Precautions for Maintenance

⚠ Warning

(1) The valve shall be disassembled and inspected by qualified persons.
(2) Completely discharge internal pressure from the valves, lines, and equipment, and cool the valve down to a level where you can touch it with bare hands before disassembly and inspection.
* Failure to do so may result in injury or burns due to residual pressure or spillage around the valve.

⚠ Caution

(1) Perform periodical inspection to maintain product functions and performance.
* General users shall request countermeasures to installers or maintenance companies.
(2) Rubber parts and components shown below are consumables. Note that the life expectancy depends on the conditions under which they are used.

Table 8

Recommended replacement period	Parts name
3 years	Valve, O ring, Diaphragm

7.3 Periodic Inspection

Conduct daily and periodic inspections in order to maintain the optimal performance of the product. See ”7.1 Troubleshooting” for the remedies if trouble is observed.

● Daily inspection (once a day)

Items	Standards for Inspection
Inlet pressure	There should be maintained at the set pressure.
Outside leakage	There should be no outside leakage.
Abnormal noise	There should be no abnormal noise

● Periodic inspection (once a year)

Items	Standards for Inspection
Valve and valve seat	There should be no scratches, wear, or foreign matters caught on the seat surface.
Retainer sliding part	There should be no scratches, or foreign matters caught on the surface of the part.
O ring	There should be no damage on the O-ring.

7.4 Disassembly

(1) Release the internal pressure completely, and make sure of zero pressure.
(2) Slightly loosen the lock nut [14] and turn the adjusting screw [13] counter clockwise to relieve the adjusting spring [12] (Unload the spring).
(3) Remove the hexagon bolt [29] from the spring chamber [2], then remove the spring chamber, and take out the adjusting spring [14] and the spring plate [10].
(4) To remove the diaphragm [9], fix the spindle [5] and remove the U nut [18].
(5) To remove the retainer [6], loosen and remove the retainer guide [8] clamping bolt [16] and pull the retainer guide. Remove it by the bellow method (Fig.13, Fig.14) when it is difficult to remove the retainer guide].
(6) To remove the valve seat [3], pull the spindle.
(7) Fix two planar sections at spindle and loosen U nut for spindle to remove it, then the valve can be dismounted.

[Nominal Size: 15A~50A]

To remove the retainer guide [8] easily, install the spring plate [11] and U nut [18] to spindle [5] again and pull the spring plate. (Fig. 13)

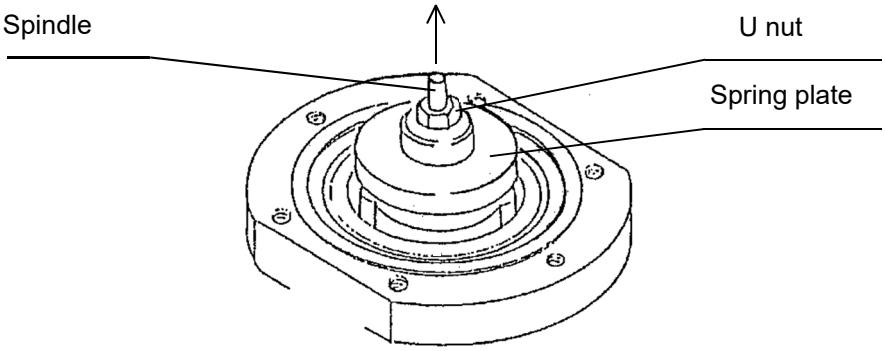


Fig. 13

[Nominal Size: 65A~150A]

To remove the retainer guide [8] easily, screw the bolt [18] to retainer guide and pull it. (Fig.14)

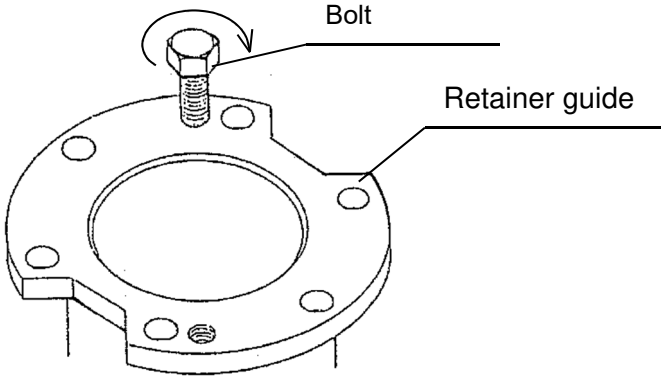


Fig. 14

7.5 Assembly

When assembling, follow the steps in the reverse order of disassembly.

※Precautions during assembly

(1) Make sure that the diaphragm [9], the valve seat [3], and the valve [4] have no scratches.
(2) Apply the silicon grease to the O-Ring [7] after confirm whether there is any flaw on the O-Ring.
(3) Install the spring chamber [2] after the confirm whether the border of diaphragm is fitted with the groove of body [1].
(4) It is normal for there to be a gap between the retainer guide [8] and the body. Tighten the bolts evenly and be careful not to overtighten them.

8. Exploded Drawing

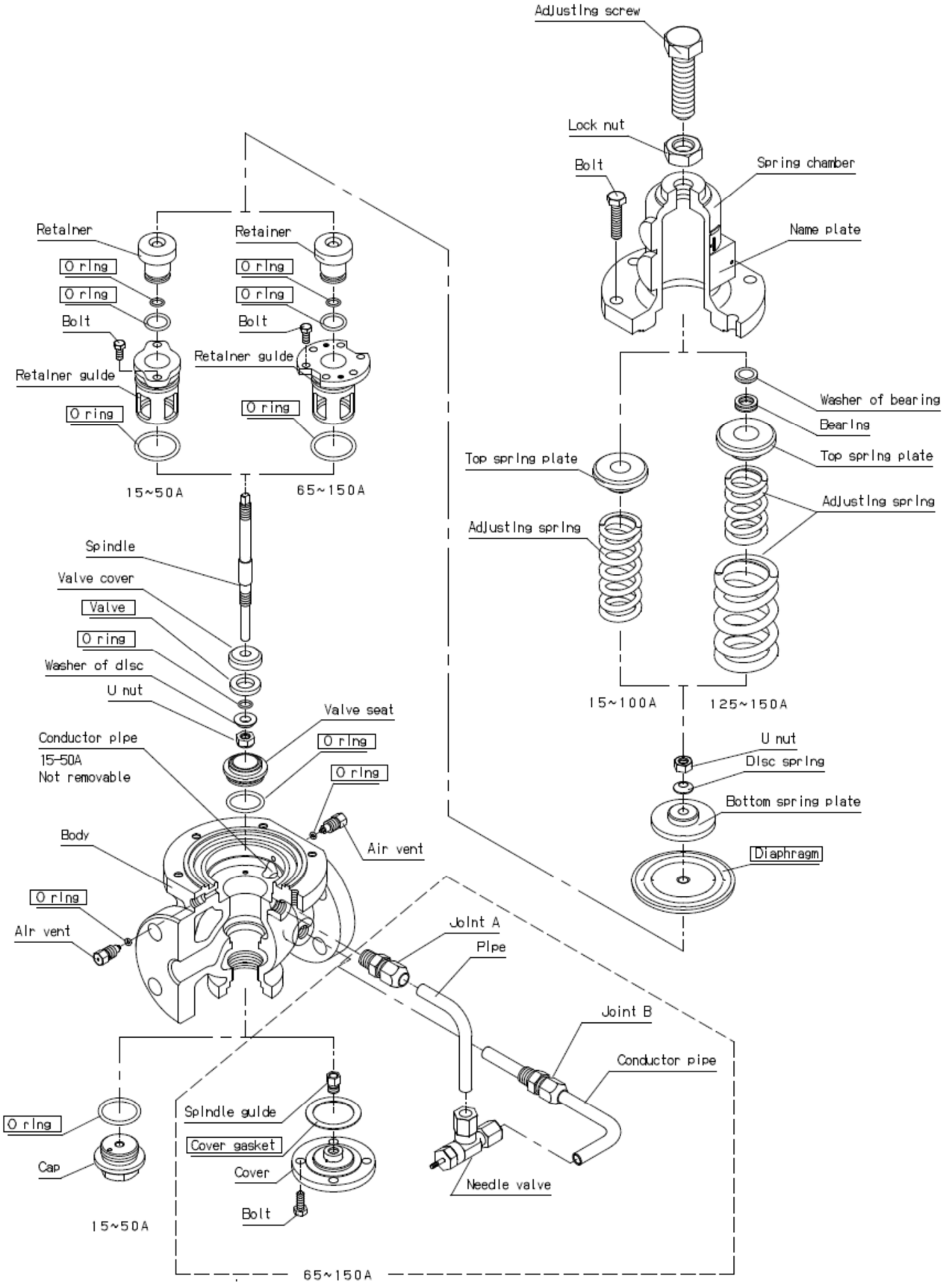


Fig. 15

Enclosed parts are offered as consumable.

Warranty Information

1. Limited warranty

   This product has been manufactured using highly-advanced techniques and subjected to strict quality control. Please be sure to use the product in accordance with instructions on the manual and the label attached to it.

   Yoshitake warrants the product to be free from any defects in material and workmanship under normal usage for a period of one year from the date of receipt by the original user, but no longer than 24 months from the date of shipment from Yoshitake's factory.

2. Parts supply after product discontinuation

   This product may be subject to discontinuation or change for improvement without any prior notice. After the discontinuation of the product, Yoshitake supplies the repair parts for 5 years otherwise individually agreed.

3. This warranty does not cover the damage due to any of below:
   (1) Valve seat leakage or malfunction caused by foreign substances inside piping.
   (2) Improper handling or misuse.
   (3) Improper supply conditions such as abnormal water pressure/quality.
   (4) Water scale or freezing.
   (5) Trouble with power/air supply.
   (6) Any alteration made by other than Yoshitake.
   (7) Use under severe conditions deviating from the design specifications
   (e.g. in case of corrosion due to outdoor use).
   (8) Fire, flood, earthquake, thunder and other natural disasters.
   (9) Consumable parts such as O-ring, gasket, diaphragm and etc.

   Yoshitake is not liable for any damage or loss caused by malfunction or defect of the product.

YOSHITAKE