CKD

SM-284789-A

INSTRUCTION MANUAL

PRECISION REGULATOR

RP2000

- Please read this instruction manual carefully before using this product, particularly the section describing safety.
- Retain this instruction manual with the product for further consultation whenever necessary.

CKD Corporation

For Safety Use

To use this product safety, basic knowledge of pneumatic equipment, including materials, piping, electrical system and mechanism, is required (to the level pursuant to JIS B 8370 Pneumatic System Rules).

We do not bear any responsibility for accidents caused by any person without such knowledge or arising from improper operation.

Our customers use this product for a very wide range of applications, and we cannot keep track of all of them. Depending on operating conditions, the product may fail to operate to maximum performance, or cause an accident. Thus, before placing an order, examine whether the product meets your application, requirements, and how to use it.

This product incorporates many functions and mechanisms to ensure safety. However, improper operation could result in an accident. To prevent such accidents, read this operation manual carefully for proper operation.

Observe the cautions on handling described in this manual, as well as the following instructions:

⚠ **DANGER** : Failure to pay attention to DANGER notices may cause a situation that results in a fatality or serious injury and that requires urgent addressing.

⚠ **WARNING** : Failure to pay attention to WARNING notices may result in a fatality or serious injury.

⚠ **CAUTION** : Failure to pay attention to WARNING notices may result in injury or damage to equipment or facilities.

※1)ISO 4414 :Pneumatic fluid power・・・ Recommendations for the application of equipment to transmission and control systems.

※2)JIS B 8370:General rule for pneumatic systems

<Unpacking>

CAUTION

1) To prevent foreign matter from entering the inside of the product, do not unpack the product immediately before starting the piping.
2) If foreign matter enters the product through the piping port, this may cause the product to malfunction or operate incorrectly. In particular, if fine dust enters the product, this may cause the characteristics to be changed. Always carefully perform the piping.

<Installation>

Installation environment

CAUTION

Do not install the product in a place listed below.
Where:

1) The ambient temperature is beyond a range of -5°C - 60°C.
2) The air may be frozen.
3) The water drop or coolant is splashed onto the product.
4) The humidity is high and the temperature changes largely, causing dew condensation.
5) Sea breeze or seawater is splashed onto the product.
6) Corrosive gas or fluid, or chemical exists.
7) The product is exposed to the direct sunlight.
8) Excessive vibration or impact exists.
9) A large amount of fine particle dust exists around the product.

Installation

CAUTION

1) Do not move or swing the product with the pressure regulation knob kept held.
- Doing so may cause damage to the nozzle flapper or the performance to lower.

2) Install the product so that the bleeding port is not blocked.
- Failure to do so may cause the nozzle flapper mechanism to malfunction and the pressure not to be controlled correctly.

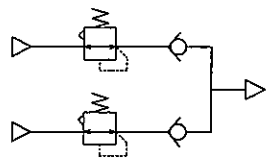
3) Install the product so that the EXH port is not blocked.
- Failure to do so may cause the back pressure to remain if the back pressure of the precision regulator increases.

4) If the product is mounted on the panel with it oriented horizontally, the weight and vibration of the product may cause the panel to break.

Piping

CAUTION

1) Flush the air piping to be used sufficiently before connecting the regulator to it.
2) If dust or sealant enters the inside of the product during piping work, this may cause the product to malfunction or operate incorrectly.
3) Before connecting the piping, always confirm the IN and OUT markings showing the inlet and outlet of the air. If the piping is connected reversely, this may cause the product to malfunction.
4) When connecting the piping, tighten it using a proper tightening torque.
5) Carefully connect the piping so that no bending moment caused by the piping load is applied to the main body and piping.
6) When connecting the products in parallel as shown below, do not close the secondary circuit.If the close circuit is required, always put a check valve on each secondary side.

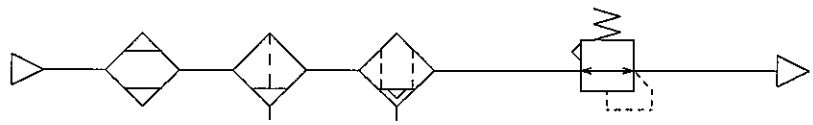


<Proper operation>

WARNING

1) Always operate the product within its specifications.
2) For media, always use the clean air that solid matter, water content, and oil content are removed completely using the dryer and filter and oil mist filter. Never flow the oily air.

<Recommended air circuit>



dryer filter oil mist filter precision regulator

If the secondary pressure needs to drop, the secondary air may be discharged to the EXH port through the inside of the regulator. Therefore, if the secondary piping or the inside of the load side is contaminated, this may affect the product, such as lowering of the characteristics. To prevent this, always purify the inside of the piping.

CAUTION

1) Do not use any gas other than compressed air. If air containing corrosive gas, fluid, or chemical is flown, this may cause damage to the main body or the rubber to deteriorate, resulting in incorrect adjustment of the pressure.
2) Before making the settings, check the primary pressure.
- If the pressure regulation knob is operated when the primary pressure is the atmospheric level, this may cause the performance to lower. Never attempt this operation.

3) Operate the product with the pressure difference between the primary and secondary sides kept at 0.1 MPa or more.
- If the pressure difference between the primary and secondary sides is large and the secondary piping is large, the secondary pressure may pulsate at a small flow rate. If this occurs, set the primary pressure level to "secondary pressure level + 0.1~ 0.2 MPa" or throttle the secondary line. If the pulsation cannot be eliminated even after the above measures have been taken, contact our company.

4) If the ON and OFF operations are repeated with the direction change valve used on the primary side of the regulator, this may cause the set pressure to be changed greatly. Therefore, it is recommended to install the direction change valve on the secondary side of the regulator.
5) If the output pressure exceeding the set pressure value of the regulator may cause the secondary unit to break or malfunction, always install an appropriate safety unit.
6) After the pressure has been regulated, always tighten the lock nut to secure the regulation knob.
7) The air always leaks from the bleeding hole. However, since this is absolutely required to precisely control the pressure, do not block this hole.

<Maintenance>

CAUTION

1) Pneumatic units shall be disassembled or assembled only by the authorized engineers who have the special knowledge. The engineers must understand the structure and operating principle of the pneumatic units, and have the knowledge about safety.
   - It is preferable that the engineers have 2nd or higher grade of the air pressure technical skill.
2) Before disassembling or assembling the pneumatic units, thoroughly read the instruction manual for relevant product to fully understand the disassembly and assembly work.
3) Before starting the maintenance work, turn OFF the power, shut down the supply pressure, and make sure that no residual pressure remains.

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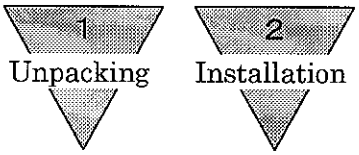
2001.6.26



1.Unpacking

CAUTION

1) To prevent foreign matter from entering the inside of the product, do not unpack the product immediately before starting the piping.
2) If foreign matter enters the product through the piping port, this may cause the product to malfunction or operate incorrectly. In particular, if fine dust enters the product, this may cause the characteristics to be changed. Always carefully perform the piping.

1) Make sure that the model number indicated on the product is matched with that you have ordered.
2) Check the exterior of the product for damage.
3) Before starting operation, thoroughly read this instruction manual, as well as that supplied with the product.

2.Installation

2.1 Installation environment

CAUTION

Do not install the product in a place listed below.
Where:
1) The ambient temperature is beyond a range of -5°C - 60°C.
2) The air may be frozen.
3) The water drop or coolant is splashed onto the product.
4) The humidity is high and the temperature changes largely, causing dew condensation.
5) Sea breeze or seawater is splashed onto the product.
6) Corrosive gas or fluid, or chemical exists.
7) The product is exposed to the direct sunlight.
8) Excessive vibration or impact exists.
9) A large amount of fine particle dust exists around the product.

2.2 Installation

CAUTION

1) Do not move or swing the product with the pressure regulation knob kept held.
- Doing so may cause damage to the nozzle flapper or the performance to lower.

2) Install the product so that the bleeding port is not blocked.
- Failure to do so may cause the nozzle flapper mechanism to malfunction and the pressure not to be controlled correctly.

3) Install the product so that the EXH port is not blocked.
- Failure to do so may cause the back pressure to remain if the back pressure of the precision regulator increases.

4) If the product is mounted on the panel with it oriented horizontally, the weight and vibration of the product may cause the panel to break.

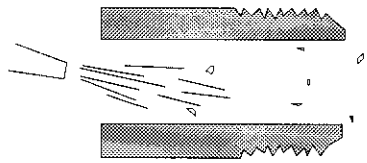
1) The product is installed in any mounting direction. However, if the product is installed in a place where fine particle dust may be produced, do not install it with the bleeding port and EXH port faced upward.
2) When installing the product on the panel, loosen the pressure regulation knob completely to remove it, insert the main body into Ø12.5 hole in the panel, and secure the main body to the panel by tightening the panel mounting nut. Next, screw the pressure regulation knob into the main body.

2.3 Piping

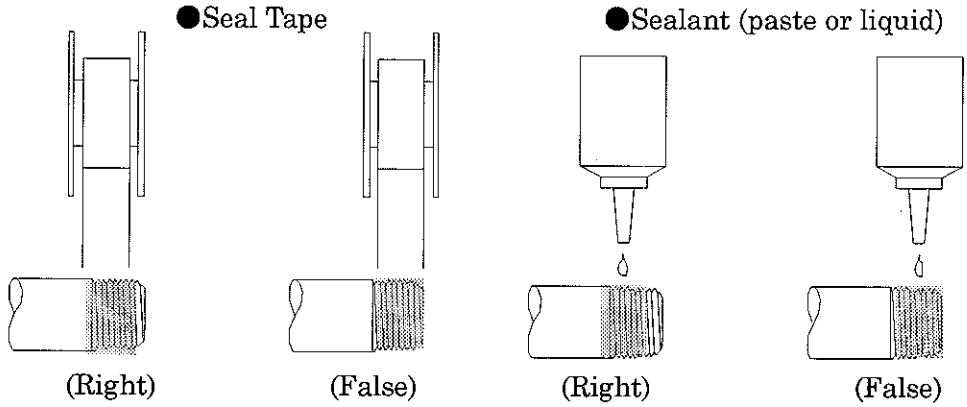
⚠ CAUTION

1) Flush the air piping to be used sufficiently before connecting the regulator to it.
2) If dust or sealant enters the inside of the product during piping work, this may cause the product to malfunction or operate incorrectly.
3) Before connecting the piping, always confirm the IN and OUT markings showing the inlet and outlet of the air. If the piping is connected reversely, this may cause the product to malfunction.

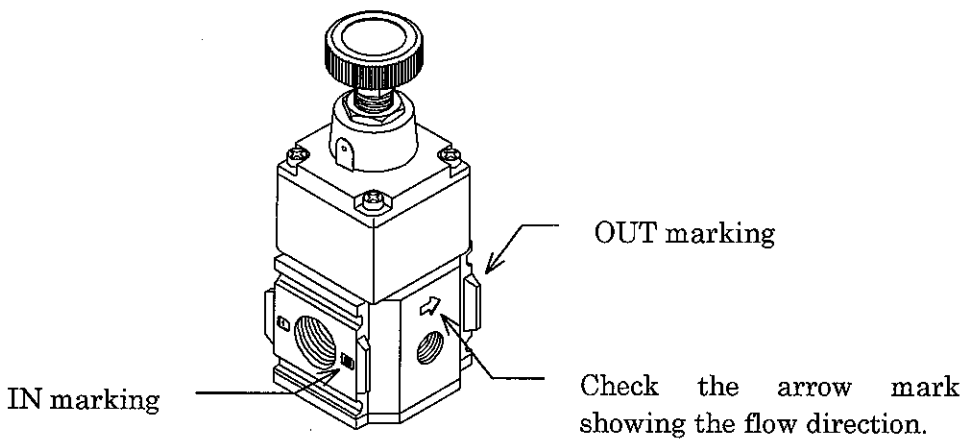
1) Flush air into the pipe to blow out foreign substances and chips before piping.



2) Refrain from mapplying sealant or sealing tape approx. two pitches of tread off the tip of the pipe to avoid residual substances from falling into the piping system.



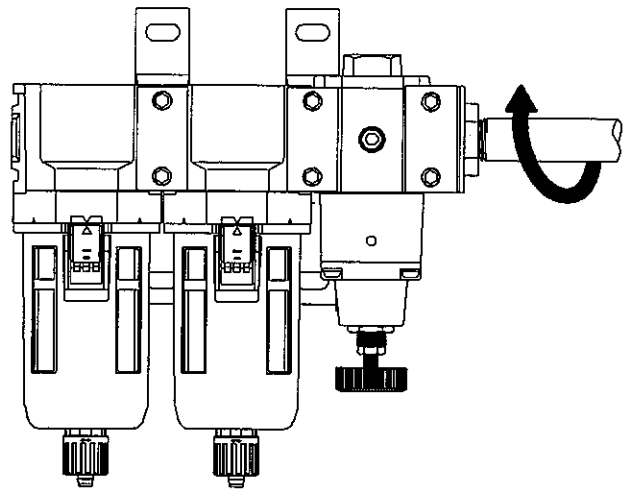
3) Before connecting the piping, always check the IN and OUT markings shown on the product.



⚠ CAUTION

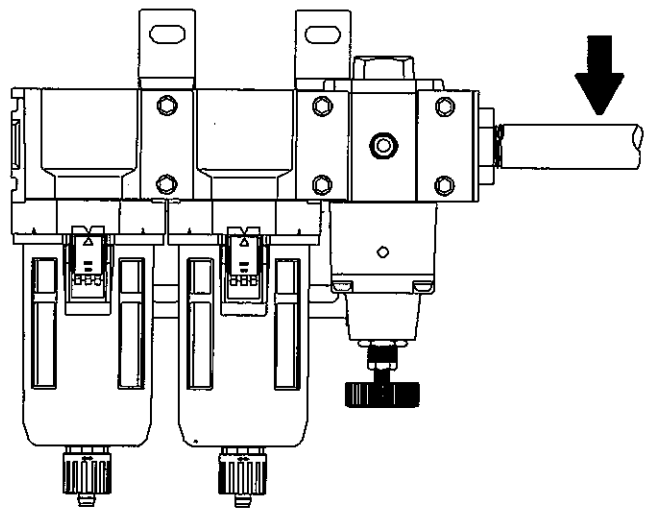
4) When connecting the piping, tighten it using a proper tightening torque.
5) Carefully connect the piping so that no bending moment caused by the piping load is applied to the main body and piping.
6) When connecting the products in parallel as shown below, do not close the secondary circuit.
If the close circuit is required, always put a check valve on each secondary side.

4) When connecting the piping, tighten it using a proper tightening torque.
- Avoid applying too much torque to the body or the piping.



Connection port size	tightening torque N·m
Rc 1/8	3～5
Rc 1/4	6～8
Rc 3/8	13～15

5) Carefully connect the piping so that no bending moment caused by the piping load is applied to the main body and piping.
- Avoid applying a piping load or torque to the body or piping.



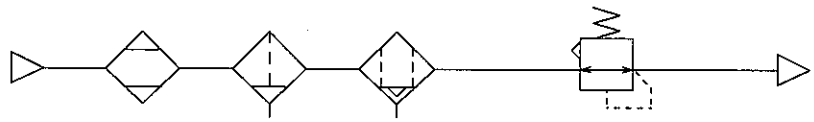
	MAX. torque N·m
RP2000	50

3.Proper operation

⚠ WARNING

1) Always operate the product within its specifications.
2) For media, always use the clean air that solid matter, water content, and oil content are removed completely using the dryer and filter and oil mist filter. Never flow the oily air.

<Recommended air circuit>



dryer filter oil mist filter precision regulator

If the secondary pressure needs to drop, the secondary air may be discharged to the EXH port through the inside of the regulator. Therefore, if the secondary piping or the inside of the load side is contaminated, this may affect the product, such as lowering of the characteristics. To prevent this, always purify the inside of the piping.

⚠ CAUTION

1) Do not use any gas other than compressed air. If air containing corrosive gas, fluid, or chemical is flown, this may cause damage to the main body or the rubber to deteriorate, resulting in incorrect adjustment of the pressure.
2) Before making the settings, check the primary pressure.

- If the pressure regulation knob is operated when the primary pressure is the atmospheric level, this may cause the performance to lower. Never attempt this operation.

3) Operate the product with the pressure difference between the primary and secondary sides kept at 0.1 MPa or more.

- If the pressure difference between the primary and secondary sides is large and the secondary piping is large, the secondary pressure may pulsate at a small flow rate. If this occurs, set the primary pressure level to "secondary pressure level + 0.1~ 0.2 MPa" or throttle the secondary line. If the pulsation cannot be eliminated even after the above measures have been taken, contact our company.

4) If the ON and OFF operations are repeated with the direction change valve used on the primary side of the regulator, this may cause the set pressure to be changed greatly. Therefore, it is recommended to install the direction change valve on the secondary side of the regulator.
5) If the output pressure exceeding the set pressure value of the regulator may cause the secondary unit to break or malfunction, always install an appropriate safety unit.
6) After the pressure has been regulated, always tighten the lock nut to secure the regulation knob.
7) The air always leaks from the bleeding hole. However, since this is absolutely required to precisely control the pressure, do not block this hole.

1) A pressure higher than the primary pressure cannot be set.
2) Turning the pressure regulation knob clockwise will increase the secondary pressure while turning the pressure regulation knob counterclockwise will decrease it.

4.Maintenance

4.1 Inspection

1) Daily inspection
   - Before operating the product, it is recommended to inspect the set pressure using a pressure gauge.
2) Periodic inspection
   - To operate the product in its optimal operating state, carry out the periodic inspection normally once every six months.
   - Inspect the set pressure using a pressure gauge.
   - Check that the bleeding exceeding the product specifications occurs in the bleeding port.
   - Check that unusual leak occurs in the EXH port.
     The air with a pressure of 1 [l/min. (ANR)] or less is exhausted to the atmosphere through the EXH port when the primary pressure is 0.7 MPa and the secondary pressure is 0.3 MPa.
   - Check that no leak occurs in the piping.

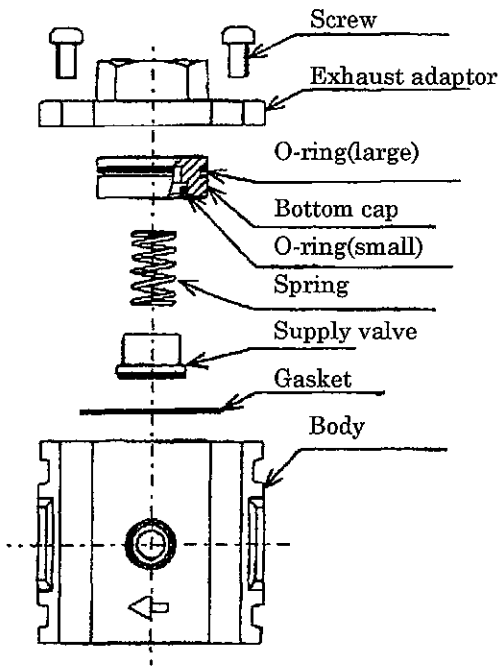
4.2 Disassembly and assembly

⚠ CAUTION

1) Pneumatic units shall be disassembled or assembled only by the authorized engineers who have the special knowledge. The engineers must understand the structure and operating principle of the pneumatic units, and have the knowledge about safety.
   - It is preferable that the engineers have 2nd or higher grade of the air pressure technical skill.
2) Before disassembling or assembling the pneumatic units, thoroughly read the instruction manual for relevant product to fully understand the disassembly and assembly work.
3) Before starting the maintenance work, turn OFF the power, shut down the supply pressure, and make sure that no residual pressure remains.

1) Disassembling and assembling the supply valve
   - When four screws are removed from the exhaust adaptor using a Phillips screwdriver, the product can be disassembled as shown in the Fig. Additionally, when assembling the components, tighten the screws evenly with a tightening torque of about 1.8 N·m.

CAUTION: If fine particle dust enters the product, this may cause the characteristics to be changed. Always carefully assemble the product so that no foreign matter enters the product.



2) Disassembling and assembling the pilot assembly, top body assembly, and pressure regulation spring

[Disassembling]

1. By turning the pressure regulation knob, loosen it so that the compression force of the pressure regulation spring does not exist.
2. When four screws are removed from the cover using a Phillips screwdriver, the product can be disassembled as shown in Fig. 1.

[Assembling]

1. Assemble the components in the reverse order of disassembly. Assemble the components while referring to Fig. 1.
2. Assemble the gasket (A) into the groove on the body assembly and put the top body assembly on it. Next, make two holes in the gasket (B) matched with those in the top body assembly as shown in Fig. 2 and place them on the components assembled previously.
3. Put the pilot assembly on the top body assembly. Pay special attention so that the cover and top body assembly have their assembling directions.
4. Put the pressure regulation spring, spring rest, and cover on them. The cover and top body assembly have their assembling directions. Make the convex part on the cover matched with the concave part on the top body assembly as shown in Fig. 3.
5. Tighten four cover screws evenly with a tightening torque of about 1.8 N·m.

CAUTION: If fine particle dust enters the product, this may cause the characteristics to be changed. Always carefully assemble the product so that no foreign matter enters the product.

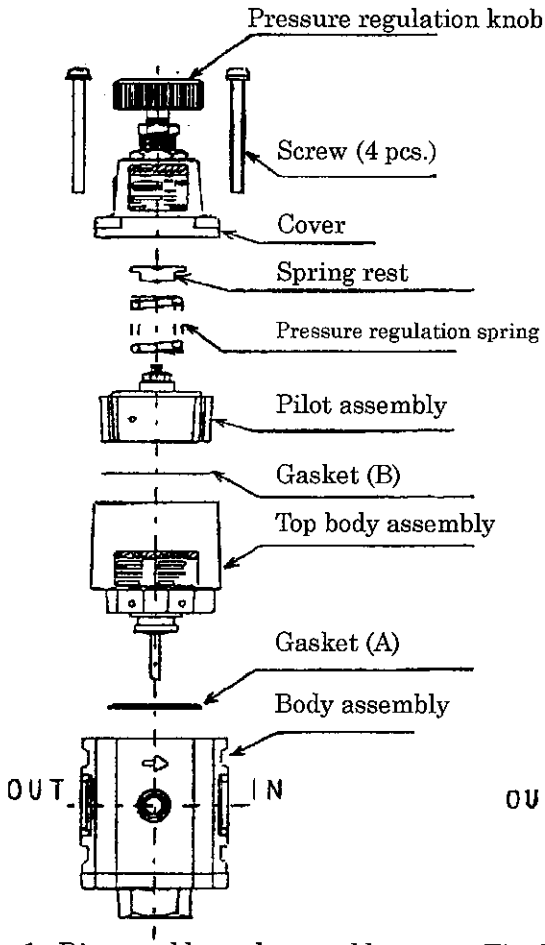


Fig. 1 Disassembly and assembly diagram

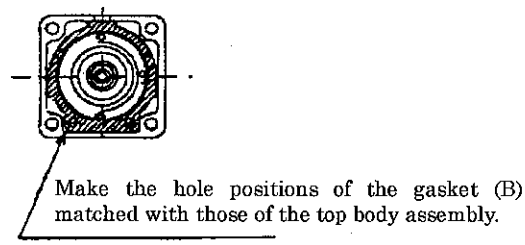


Fig. 2 Explanation diagram of hole position.

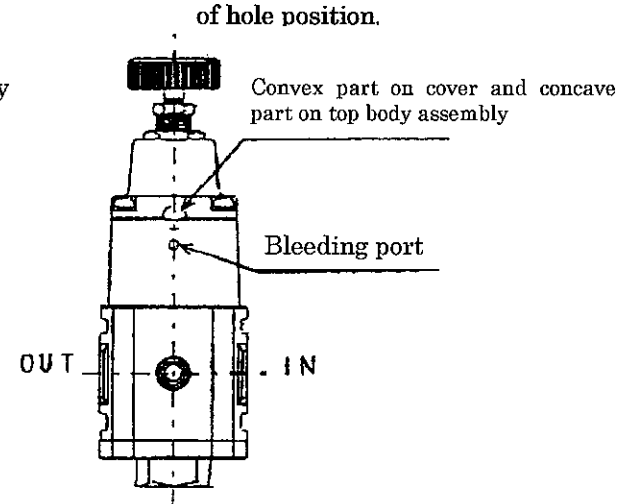
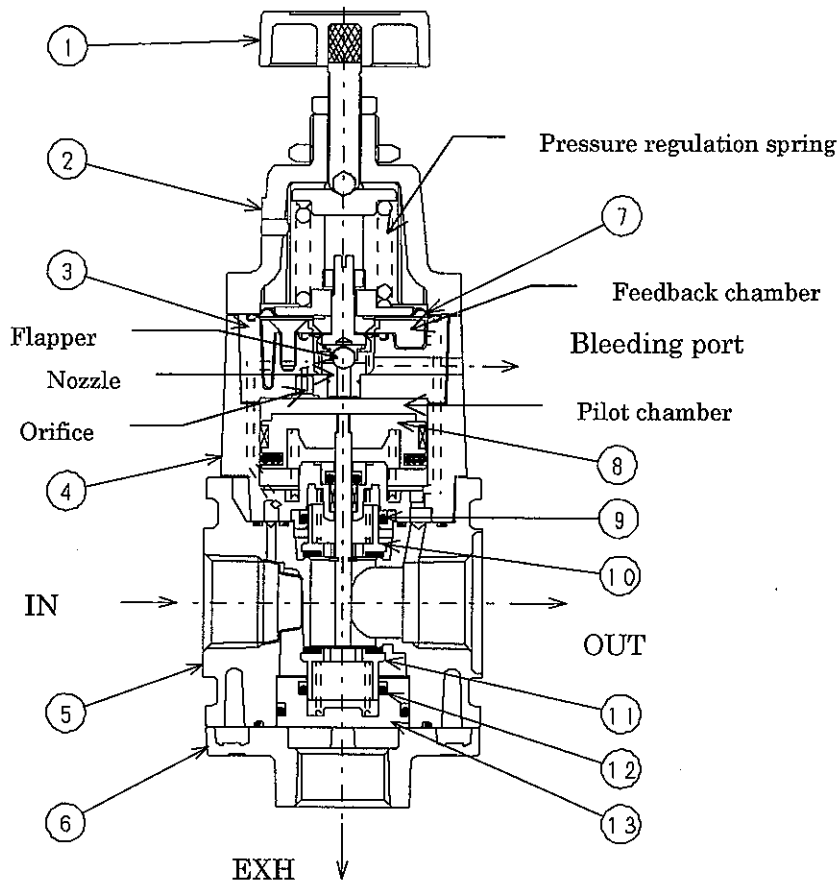


Fig. 3 Explanation diagram of cover position

5.Troubleshooting

Trouble symptom	Cause	Remedy
Pressure does not increase.	Primary pressure is insufficient.	Primary pressure level must be "secondary pressure level + 0.1 MPa". Check the primary pressure.
	Primary piping is too long or throttled.	Make the primary piping shorter or the piping size larger.
	Needle on the pressure gauge does not move.	Replace the pressure gauge with a new one.
	Orifice is clogged. (Check that no bleeding is performed from the bleeding port.)	Replace the pilot assembly while referring to section 11, Disassembling and assembling the pilot assembly.
Unusual leak occurs from the EXH port. (The air with a pressure of 1 [l/min. (ANR)] or less is exhausted to the atmosphere through the EXH port when the primary pressure is 0.7 MPa and the secondary pressure is 0.3 MPa.)	IN and OUT ports are connected reversely.	Correct the mounting direction.
	Back pressure is applied to the regulator.	Check if the system has any problem.
	Dust is sticking to the valve.	Disassemble the valve while referring to section 10 ~ 11, Disassembling and assembling the valve, and then remove the dust.
	Valve is damaged.	Replace the valve while referring to section 10 ~ 11, Disassembling and assembling the valve.
Leak occurs from the cover.	Diaphragm is broken.	Replace the pilot assembly while referring to section 11, Disassembling and assembling the pilot assembly.
Leak exceeding the product specification occurs from the bleeding port.	Diaphragm inside the pilot assembly is broken.	Replace the pilot assembly while referring to section 11, Disassembling and assembling the pilot assembly.
Secondary pressure pulsates.	The secondary piping size is large and the pressure difference between the primary and secondary sides is large.	Throttle the secondary piping. Set the pressure difference between the primary and secondary sides to 0.1 ~ 0.2 MPa. Set the pressure in the pressure decreasing direction (from high pressure to low pressure).

6.Internal structure



Part No.	Part name	Material
1	Knob	POM,SUS303,SUJ2
2	Cover	ADC12
3	Pilot body assembly	ADC12,SUS304,C3604,SUS440C
4	Top body assembly	ADC12,C3604,HNBR,SUS304,NBR,POM,A2011
5	Body	ADC12
6	Exhaust adaptor	ADC12
7	Pilot diaphragm	HNBR
8	Piston Assembly	SUS304,NBR,POM,A2011
9	O-ring	NBR
10	Exhaust valve	C3604,HNBR
11	Supply valve	C3604,HNBR
12	O-ring	NBR
13	Bottom cap	C3604

7.Operating description

The air supplied from the IN side is stopped by the supply valve ⑪ not to flow toward the OUT side. A part of the supplied air is passed through the orifice and flown into the pilot chamber.

When the pressure regulation knob ① is turned, the pressure regulation spring is compressed to push down the pilot diaphragm ⑦ and flapper. The nozzle is then closed.

The pressure in the pilot chamber then increases to push down the piston ⑧. The supply valve ⑪ is then opened to flow the supply air to the OUT side. The flown air then enters the feed-back chamber to activate the pilot diaphragm ⑦. When the pressure increases to a level equivalent to the compression force of the pressure regulation spring, the pilot diaphragm ⑦ and flapper are then pushed up to open the nozzle. As a slight amount of air is flown to the atmosphere, the pressure in the pilot chamber is decreased to adjust the pressure. At the same time, the pressure on the OUT side activates the piston ⑧ to push it up. The supply valve ⑪ is then closed to adjust the pressure to the set pressure.

When the air is consumed on the OUT side and the pressure on the OUT side is decreased, the pressure in the feedback chamber is also decreased. The pilot diaphragm ⑦ and flapper are then pushed down to close the nozzle.

The pressure in the pilot chamber is increased to activate the piston ⑧. The supply valve ⑪ is then opened and functions to correct the pressure drop.

When the pressure on the OUT side becomes larger than the set pressure level, the pressure in the feed back chamber is also increased. The pilot diaphragm ⑦ and flapper are then pushed up to open the nozzle. The pressure in the pilot chamber is then decreased to push up the piston ⑧. The exhaust valve ⑩ is then opened and excess pressure on the OUT side is then exhausted to the atmosphere through the EXH port.

As described above, use of pilot pressure control method with the nozzle and flapper makes it possible to follow-up slight pressure deviation, ensuring precise pressure control.

8.Consumable parts

List of consumable parts

Part No.	Part name	Model No.
3	Pilot body assembly	RP2000 – Pilot assembly
7	Pilot diaphragm	
4	Top body assembly	RP2000 – Top body assembly
11	Supply valve	RP2000 – Bottom valve assembly
12	O-ring	
13	Bottom cap	

9.Product specifications and how to order

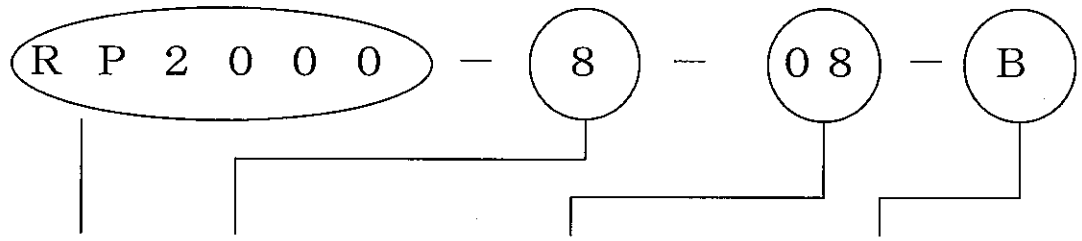
9.1 Product specifications

Item		RP2000-8-08	RP2000-10-08
Working media		Cleaned compressed air (See section 9.)	
Max. working pressure	MPa	1.0	
Min. working pressure	MPa	Set pressure + 0.1 Note 1	
Proof pressure	MPa	1.5	
Ambient temperature and working media temperature	°C	- 5 to 60 (No condensation allowed.)	
Set pressure range	MPa	0.03～0.85	
Sensitivity		Within 0.2% of full span	
Repeatability		Within ±0.5% of full span	
Air consumption	l/min (ANR)	5 or less Note 2	
Pipe size (IN･OUT)		Rc1/4	Rc3/8
Pipe size (EXH)		Rc3/8	
Pressure gauge pipe size		Rc1/8	
Mass	g	470(Without attachment)	

Note 1 The condition is that the secondary flow rate is 0.

Note 2 The conditions are that the primary pressure is 0.7 MPa and the set pressure is 0.3 MPa. The air is always discharged from the bleeding and EXH ports. The air consumption is sum of the volume of air discharged from the bleeding port and that from the EXH port. Normally, the air is discharged from the EXH port at a flow rate of 1L/min. (ANR).

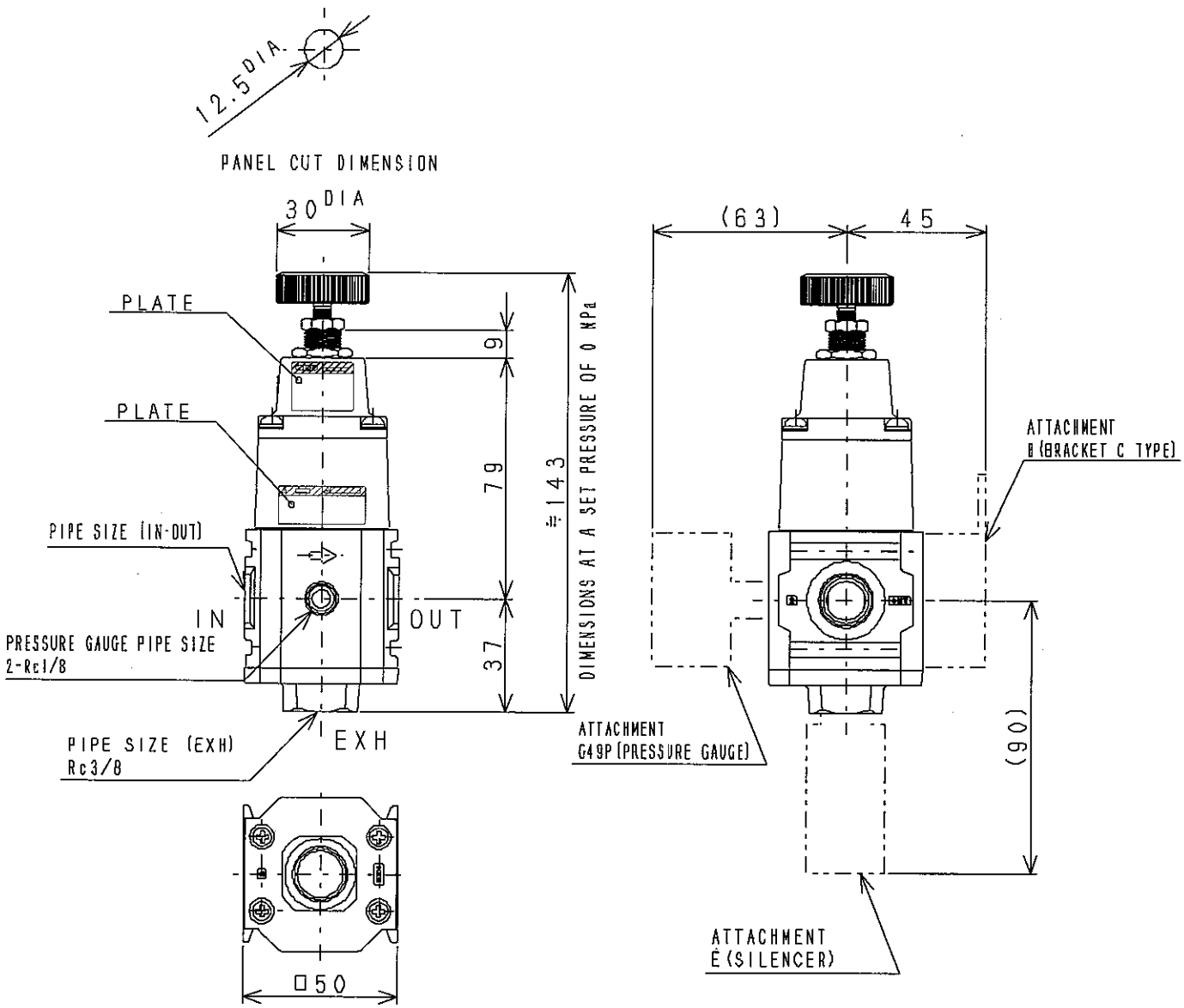
9.2 How to order

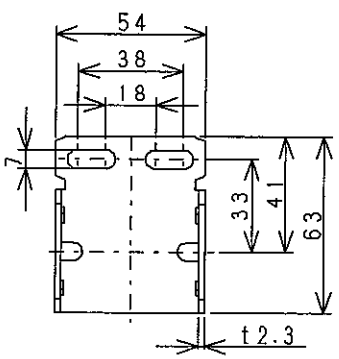
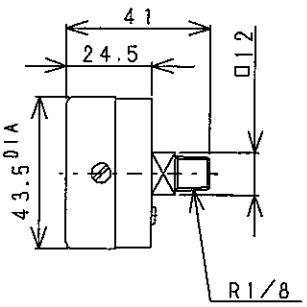
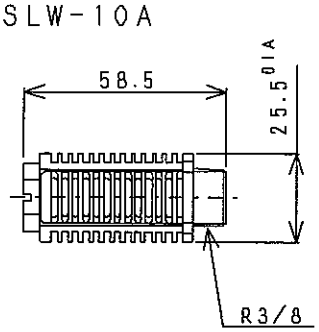


Model No.	Pipe size		Set pressure range		Attachment	
RP2000	8	Rc 1/4	08	MAX 0.85 MPa	No Code	None
	10	Rc 3/8			G49P	Pressure gauge
					B	Bracket C type
					E	Silencer

Model No. of sole attachment

Model	Model No. of sole attachment
G49P	G49D-6-P10
B	B220
E	SLW-10A



	B (BRACKET C TYPE)	G49P (PRESSURE GAUGE)	E (SILENCER)	NO CODE
DIMENSION DIAGRAM	B220 	G49D-6-P10 	SLW-10A 	NONE
MASS	150g	86g	15g	