



Operation Manual

PRODUCT NAME

Relief Valve

MODEL / Series / Product Number

AP20-(F,N)01 ~ (F,N)02(B,E,G,H,M,N,S)(-1,Y,Z)-D

SMC Corporation

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Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of “**Caution**,” “**Warning**” or “**Danger**.” They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC)^{*1)}, and other safety regulations.

*1) ISO 4414: Pneumatic fluid power - General rules and safety requirements for systems and their components
ISO 4413: Hydraulic fluid power - General rules and safety requirements for systems and their components
IEC 60204-1: Safety of machinery - Electrical equipment of machines - Part 1: General requirements
ISO 10218-1: Robots and robotic devices - Safety requirements for industrial robots - Part 1: Robots
etc.



Danger

Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.



Warning

Warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.



Caution

Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

Warning

1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results. The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product. This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly. The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.

1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.
2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.
3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. Our products cannot be used beyond their specifications. Our products are not developed, designed, and manufactured to be used under the following conditions or environments. Use under such conditions or environments is not covered.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
2. Use for nuclear power, railways, aviation, space equipment, ships, vehicles, military application, equipment affecting human life, body, and property, fuel equipment, entertainment equipment, emergency shut-off circuits, press clutches, brake circuits, safety equipment, etc., and use for applications that do not conform to standard specifications such as catalogs and operation manuals.
3. Use for interlock circuits, except for use with double interlock such as installing a mechanical protection function in case of failure. Please periodically inspect the product to confirm that the product is operating properly.



Safety Instructions

Caution

We develop, design, and manufacture our products to be used for automatic control equipment, and provide them for peaceful use in manufacturing industries.

Use in non-manufacturing industries is not covered.

Products we manufacture and sell cannot be used for the purpose of transactions or certification specified in the Measurement Act.

The new Measurement Act prohibits use of any unit other than SI units in Japan.

Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following “Limited warranty and Disclaimer” and “Compliance Requirements”. Read and accept them before using the product.

Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first.*2)
Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.
2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.
This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.
3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.

***2) Vacuum pads are excluded from this 1 year warranty.**

A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.

Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty

Compliance Requirements

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited.
2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulations of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.

Precautions for Design

⚠ Warning

- (1) Polyacetal resin parts are used for the exterior. Organic solvents including thinner, acetone, alcohol and ethylene chloride; chemicals including sulphuric acid, nitric acid and hydrochloric acid; cutting oil, synthetic oils, ester-based compressor oil, alkali, kerosene, gasoline, lock material of screw are harmful. Do not use the product where these are present.
- (2) If no leakage is allowed due to the environment, it cannot be used. Or operating fluid is not air, it cannot be used.
- (3) Shield from ultraviolet light and radiation with protective cover.
- (4) Air is blown out of the EXH port when in use. Take safety precautions such as installing a silencer on the EXH port. Also, do not look into the EXH port when in use.
- (5) Do not supply air pressure from ports other than the IN(1) port, as may cause malfunction.
- (6) Do not use this product as a safety valve.

[Definition of safety valves (JIS):Valves used for ensuring pressure capacity and piping safety.]

Selection

⚠ Warning

- (1) Grease used on the internal sliding parts and seals may flow to the outlet side.
- (2) Long absence of operation may cause set pressure value fluctuation.
- (3) Since the safety margin is calculated to the maximum value of the set pressure range shown in the specification table, the pressure setting may be over the maximum value. However, use the product within the specified range.
- (4) Cannot be used in circuits that require high set precision.

Installation

⚠ Warning

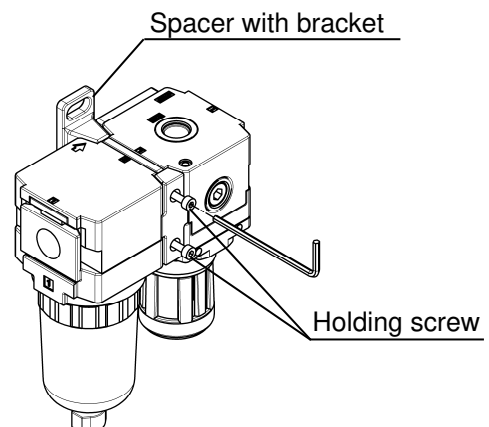
- (1) Install with enough space around the product to perform product maintenance and operation. Refer to section [12.Dimensions] (p. 20) for necessary space.
- (2) Do not drop or apply impact during transportation or installation. Damage of products or pressure gauge can result in malfunction.
- (3) Do not install in areas with high humidity or high temperature. It may lead to a malfunction of the pressure gauge.

⚠ Caution

- (1) Tighten the two set screws on the spacer with bracket and spacer evenly. Tighten them to the recommended tightening torque. Insufficient tightening torque may cause loosening or sealing failure, and excessive tightening torque may cause breakage of screws.

Recommended tightening torque Unit : N·m

Spacer with bracket P/N	Y200T-D
Spacer P/N	Y200-D
Torque	0.36±0.036



Adjustment

Warning

- (1) With no pressure supplied, turn the knob clockwise until it stops at the stopper, then start pressurizing and adjusting.
- (2) Pressurizing with a loose knob can be dangerous if a large amount of air is blown out of the EXH port.
- (3) Make sure that when the pressure exceeds the set pressure value, it starts to exhaust before starting to use the product with the equipment.
- (4) Do not use tools on the product knob as this may cause damage. It must be operated manually.

Caution

- (1) For the product with a pressure gauge, do not apply pressure exceeding the maximum scale of the pressure gauge in order to protect the gauge.
- (2) Rotate the knob clockwise to increase the set pressure value. Counterclockwise to decrease the pressure value. Moreover, please lock the knob after setting pressure.

Piping

Warning

- (1) Before piping is connected, it should be thoroughly blown out with air (flushing) or washed to remove chips, cutting oil and solid foreign material from inside the pipe. Contamination of piping may cause damage or malfunction.
- (2) When screwing together pipes and fittings, etc., be certain that chips from the pipe threads and sealant do not get inside the pipe. When a sealant tape is used, leave 1 thread ridges exposed at the end of the threads.
- (3) Connect piping/fittings using the recommended torque while holding the female thread side tightly. Insufficient tightening torque leads to cause of loosening or sealing failure, and excessive tightening torque leads to cause of breakage of screws. Tightening without holding female thread applies an excessive force to the piping bracket directly, leading to breakage.

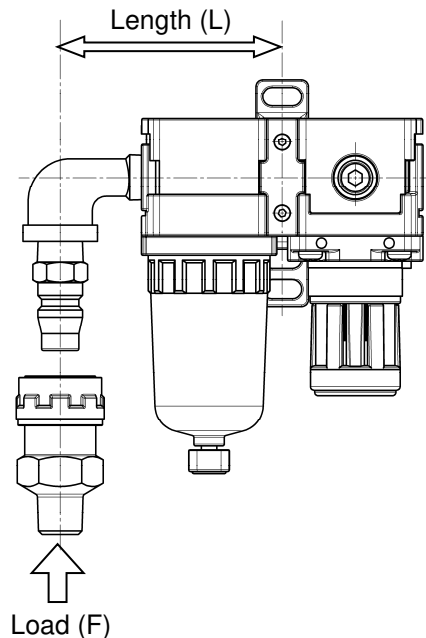
Recommended tightening torque for the port		Unit : N·m
Thread size	1/8	1/4
Torque	3 to 5	8 to 12

*Please refer to "10-4. Replacing the plug (with O-ring)" (P17), Replacement parts for the tightening torque of the plug (with O-ring).

- (4) Before using an SMC fitting and S coupler, please refer to "Tightening the threaded portion of the connection thread" of the Fittings & Tubing Precautions.

- (5) Do not apply torsion or bending moment other than the product's own weight. Support external piping separately as it may cause breakage. If moment applied to the equipment is unavoidable during operation, the moment should be lower than the maximum moment shown below. Non-flexible piping, such as steel tube piping, are prone to be affected by excess moment load or vibration. Use flexible piping in between to avoid such affects.

$$\text{Max.moment (M)} = \text{Length(L)} \times \text{Load (F)} = 14.5 \text{ N}\cdot\text{m}$$



- (6) For piping into the exhaust port, recommended installing a silencer. When installing resin built-in silencers (Optional Parts), after tightening by hand, use a suitable wrench on octagonal flats to tighten until it contacts to the end surface. When installing resin silencers (AN series), after tightening by hand, use a suitable wrench on the hexagonal flats to tighten an additional 1/4 turn. When installing one-touch fittings (KQ2 series) or the piping, add 1/2 turn after tightening by hand. Excess tightening torque may cause damage to resin silencers.

Air Source

Warning

- (1) Use clean air. Do not use compressed air containing chemicals, organic solvent, synthetic oil or corrosive gas as it may be cause of breakage of components or operation failure.
- (2) Air containing too much moisture may cause malfunction. Install an air drier or aftercooler before the product.

Maintenance

Warning

- (1) Release the pressure in the product to the atmosphere when replacing parts or removing piping.
- (2) Maintenance and checks should be done by following the procedure in this operation manual. Incorrect handling of the product may cause breakage or operation failure of the equipment or device.

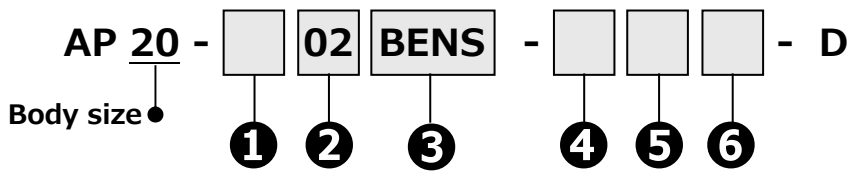
2. Application

This product aims to limit the pressure of the air lines.

3. Standard Specifications

Model	AP20-D
Port size	1/8,1/4
EXH port size	1/8
Pressure gauge port size	1/8
Fluid	Air
Ambient and fluid temperature	-5 to 60°C (No freezing)
Proof pressure	1.3 MPa
Max. operating pressure	0.85 MPa
Set pressure range	0.05 to 0.8 MPa
Weight	0.12 kg

4. How to Order



		Symbol	Description	Body size		
				20		
①	Thread type ^{Note1)}		Nil	Rc	●	
			N	NPT	●	
			F	G	●	
②	Port size		01	1/8	●	
			02	1/4	●	
③ Note2) Note3)	Option	a	Mounting	Nil	Without mounting option	●
				B	With bracket	●
				H	With set nut (for panel mount)	●
		b	Pressure gauge	Nil	Without pressure gauge	●
				E	Square embedded type pressure gauge (with limit indicator)	●
				G	Round type pressure gauge (with limit indicator)	●
				M	Round type pressure gauge (with color zone)	●
		c	Plug	Nil	Without plug	●
				N	With plug (for IN port)	●
	d	Silencer	Nil	Without silencer	●	
S			With built-in silencer (for EXH port)	●		
④	Set pressure		Nil	0.05 to 0.8MPa setting	●	
			1 ^{Note4)}	0.02 to 0.2MPa setting	●	
⑤	Knob		Nil	Downward	●	
			Y	Upward	●	
⑥	Unit indication		Nil	Unit on product label : MPa Pressure gauge in SI units : MPa	●	
			Z	Unit on product label : psi Pressure gauge : MPa/psi dual scale	○ ^{Note5)}	

Note1) Applicable to the IN port, EXH port, and pressure gauge port.

Note2) ③Option : Select one each for a to d.

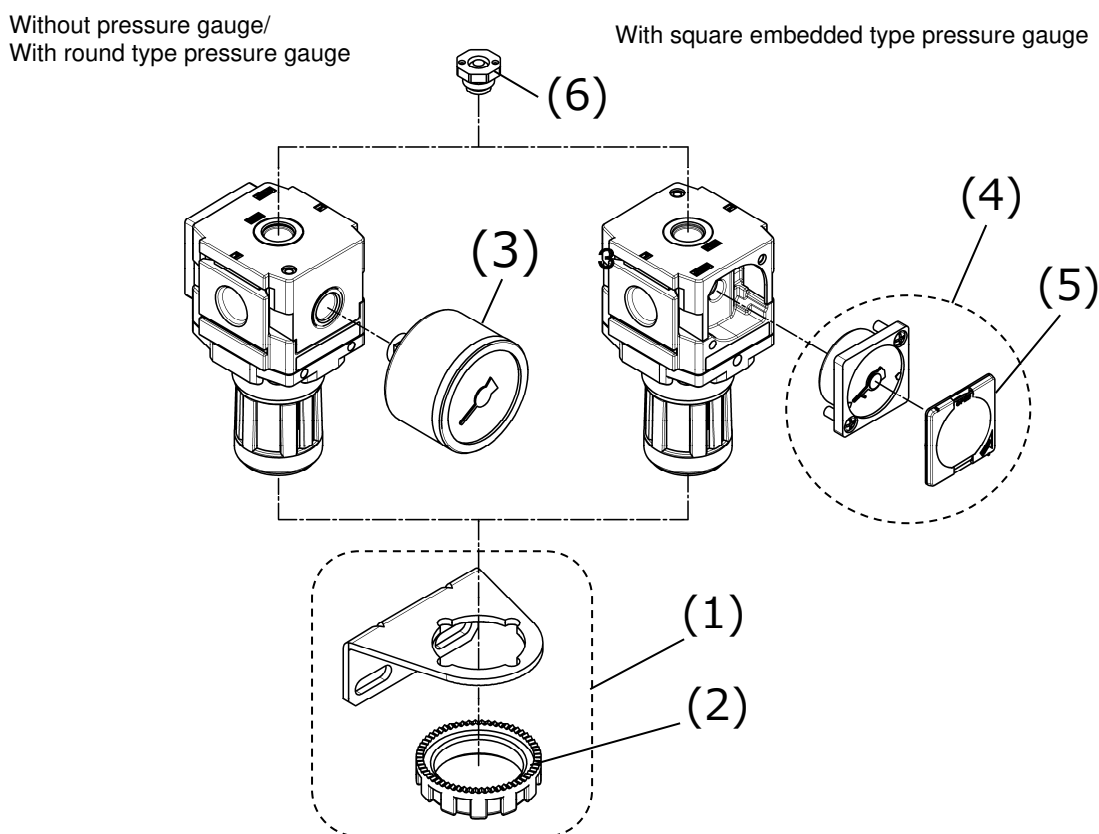
Note3) When more than one specification is required, indicate in alphanumeric order.

Example) AP20-N02BENS-1YZ-D

Note4) When the pressure gauge is attached, the maximum operating pressure is 0.4 MPa.

Note5) ○: For NPT thread type only.

5. Options



Options

No.	Part name	Piping Thread type	Semi-standard specification	Part No.
(1)	Bracket assembly ^{Note 1)}	-	-	AR23P-270AS
(2)	Set nut	-	-	AR23P-260S
(3)	Round type pressure gauge ^{Note2)}	Rc	-	G36-10-01
		NPT	-	G36-10-N01
			Z: Both in MPa and psi	G36-P10-N01-X30
	Round type pressure gauge ^{Note2)} (with color zone)	G	-	G36-10-01
		Rc	-	G36-10-01-L
		NPT	-	G36-10-N01-L
(4)	Square embedded type pressure gauge ^{Note 3)} (Including part (5))	-	-	GC3-10AS-D
		NPT	Z: Both in MPa and psi	GC3-P10AS-D-X30
(5)	Pressure gauge cover assembly	-	-	GC3P-030AS
(6)	Silencer assembly	Rc/NPT/G		VHS24P-190AS

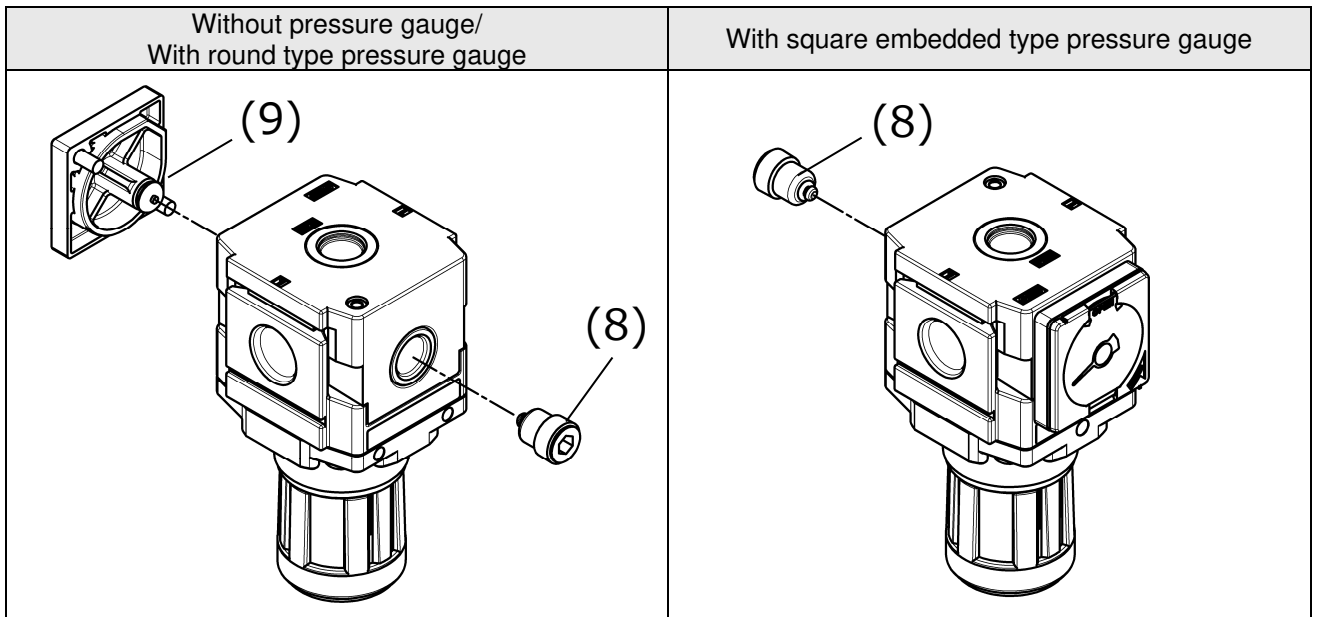
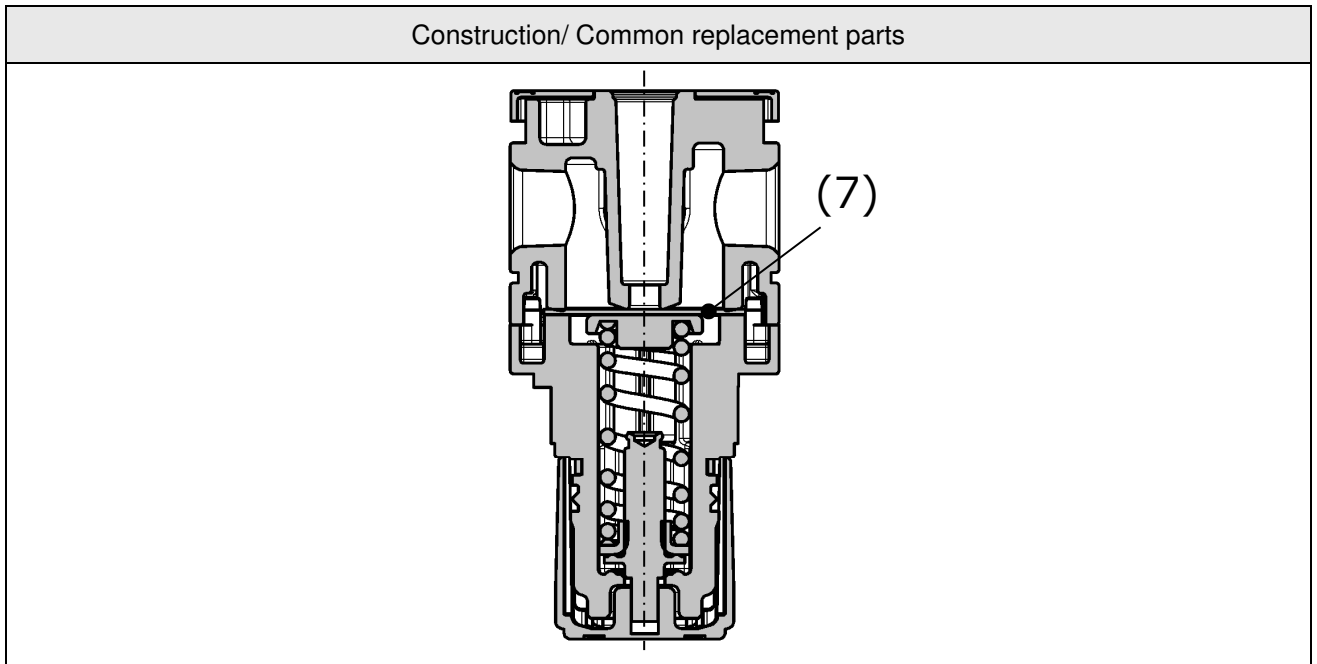
Note) The numbers in the table and structural drawings are consistent with the numbers in sections [10. How to Replace the Components] (P14-17) and [11. Disassembly Drawing] (P18-19).

Note1) This is an assembly of a bracket and set nut (2).

Note2) Part number for 0.2 MPa: G36-4-01 (Rc type) / G36-4-N01 (NPT type) / G36-P4-N01-X30 (NPT, Z type).

Note3) With O-ring (1 pc.) and mounting screws (2 pcs.). Part number for 0.2 MPa: GC3-4AS-D (Rc, NPT type) / GC3-P4AS-D-X30 (NPT, Z type).

6. Structural Drawing and Replacement Parts



Note) No plug is mounted onto the pressure gauge port of product with a round type pressure gauge.

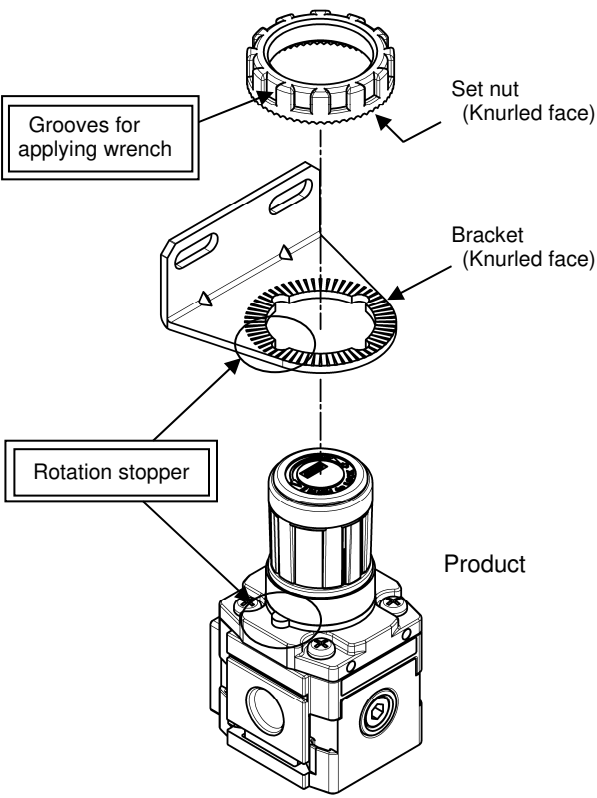
Replacement parts

No.	Part name	Piping thread type	Semi-standard specification	Part No.
(7)	Diaphragm	-	-	AP24P-150S
(8)	Plug (with O-ring)	Rc/G	-	AR24P-370AS-01
		NPT	-	AR24P-370AS-N01
(9)	Blanking plate assembly	-	-	AR24P-250AS

Note) The numbers in the table and structural drawings are consistent with the numbers in sections [10. How to Replace the Components] (P14-17) and [11. Disassembly Drawing] (P18-19).

7. Assembly of Optional Parts

7-1. Bracket (Panel mount)

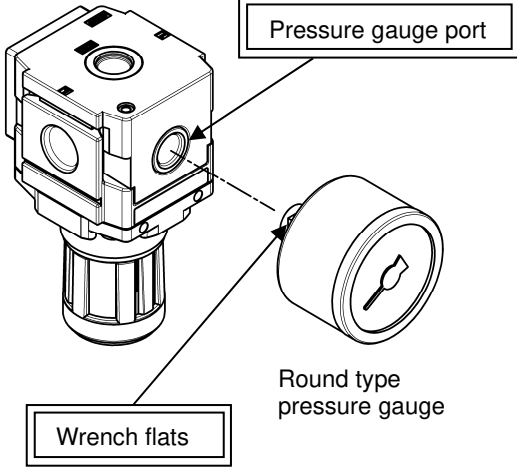


- 1) **Bracket mounting**
Mount the bracket to the regulator as shown in the picture.
Assemble so that the rotation stopper of the regulator and the bracket are engaged properly.
- 2) **Secure with the set nut**
Ensure that the knurled faces of the bracket and the set nut are facing each other.
- 3) **Tightening**
Turn the set nut while the regulator is aligned correctly with the bracket. The knurling of the bracket and set nut stops loosening of the screw. Usually, these can be tightened adequately by hand. (Extra tightening is recommended for panel mounting).

* **When retightening**
Please use a hook wrench on the grooves of the set nut.
After hand tightening, follow the values in the table below for retightening.

Tool size	Amount of retightening	Reference torque
34/38	2 to 5 notch	2.0+/-0.2 N·m

7-2. Round type pressure gauge



- 1) **Round type pressure gauge mounting**
Before mounting the pressure gauge onto the pressure gauge port of the regulator, confirm that sealing material has been applied to the pressure gauge.
Please refer to "Piping" on page 5 when using sealing tape.

Wrench size
14

Note1) **Positioning of pressure gauge**
Adjust the pressure gauge position by tightening it. Adjustment in loosening direction may cause air leakage.

Note2) **No plug is mounted onto the pressure gauge port of product with a round type pressure gauge.**

Note3) **Torque control**
Please use the value in the torque table described in "Piping" on page 5.

8. Operation and Adjustment

8-1. Pressure setting

Orange mark

Knob

IN port

EXH port

- (1) Pull the knob in the arrow direction for unlocking, revealing an orange mark.
- (2) With no pressure supplied, turn the knob clockwise until it stops at the stopper.
[Approximate amount to turn] 12 to 14 turns from the knob completely loose
- (3) Pressurize the IN port at the pressure value to be set.
* If the handle is not turned enough in the procedure (2), air may blow out of the EXH port during pressurization.
- (4) Slowly turn the knob counterclockwise until exhaust starts from the EXH port.
- (5) Turn the knob clockwise until the exhaust stops again to complete the setting.
- (6) Make sure that when the pressure exceeds the set pressure value, it starts to exhaust. After adjusting pressure, lock the knob by pushing it in the arrow direction.

8-2. Indicator adjustment of the square embedded type pressure gauge

Opening of transparent cover

Indicator (green)

- (1) Pull the opening of the transparent cover to unlock.
- (2) Open the transparent cover as in the drawing and adjust the indicator to the upper and lower limit positions to be controlled.
- (3) Close the transparent cover after adjusting the indicator.

9. Trouble Shooting

Refer to sections [10. How to Replace the Components] (P14-17) and [11. Disassembly Drawing] (P18-19).

Trouble		Possible cause	Countermeasure	Page for reference
Category	Failure			
Pressure	The Exhaust pressure can not be adjusted. (Exhaust does not stop.)	1. Foreign materials caught in seating part of the diaphragm.	Remove the bonnet and eliminate foreign materials. When the condition is not improved, replace the diaphragm.	P14
		2. Diaphragm is damaged.	Replace the diaphragm.	P14
Air leakage	Air leaks from the bonnet exhaust port.	1. Diaphragm is damaged.	Replace the diaphragm.	P14
	Air leaks from between the bonnet and the body.	2. Loosened bonnet screws.	Fasten the bonnet.	P14

10. How to Replace the Components

⚠ Warning

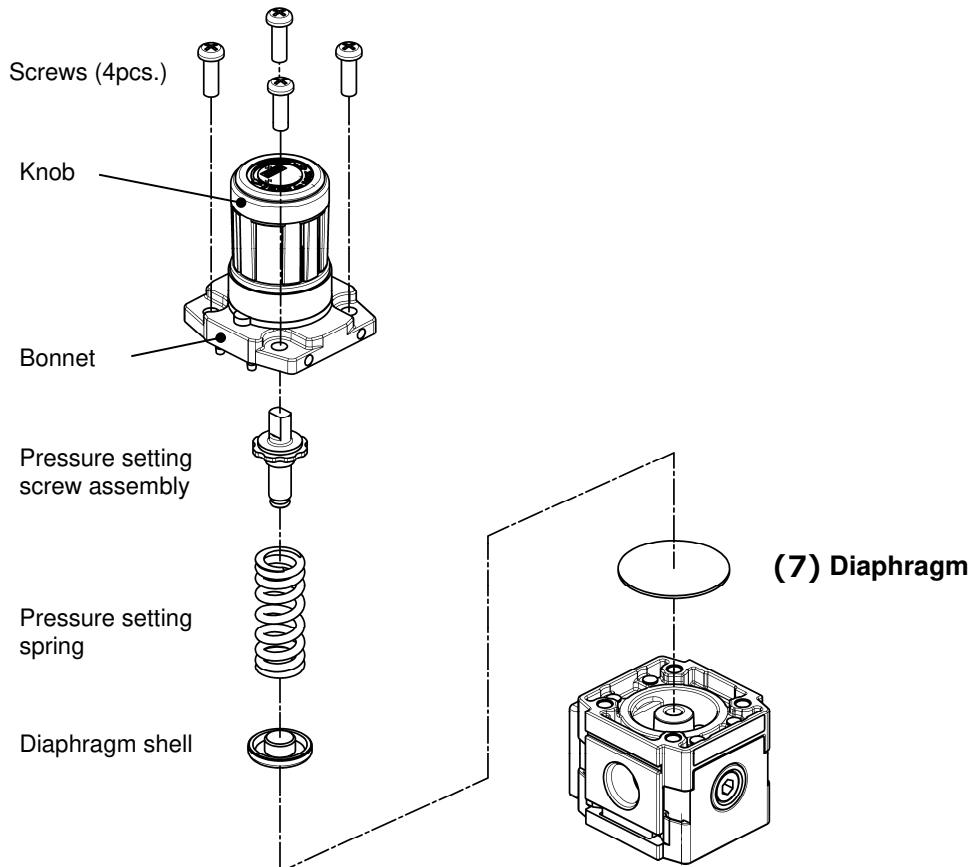
Before replacement, make sure that no pressure remains in the equipment.

Also, make sure to loosen the knob of the product so that the set pressure is zero.

After replacement, confirm that the product satisfies specific functions and no external leakage occurs before operating it.

10-1. Diaphragm Replacement

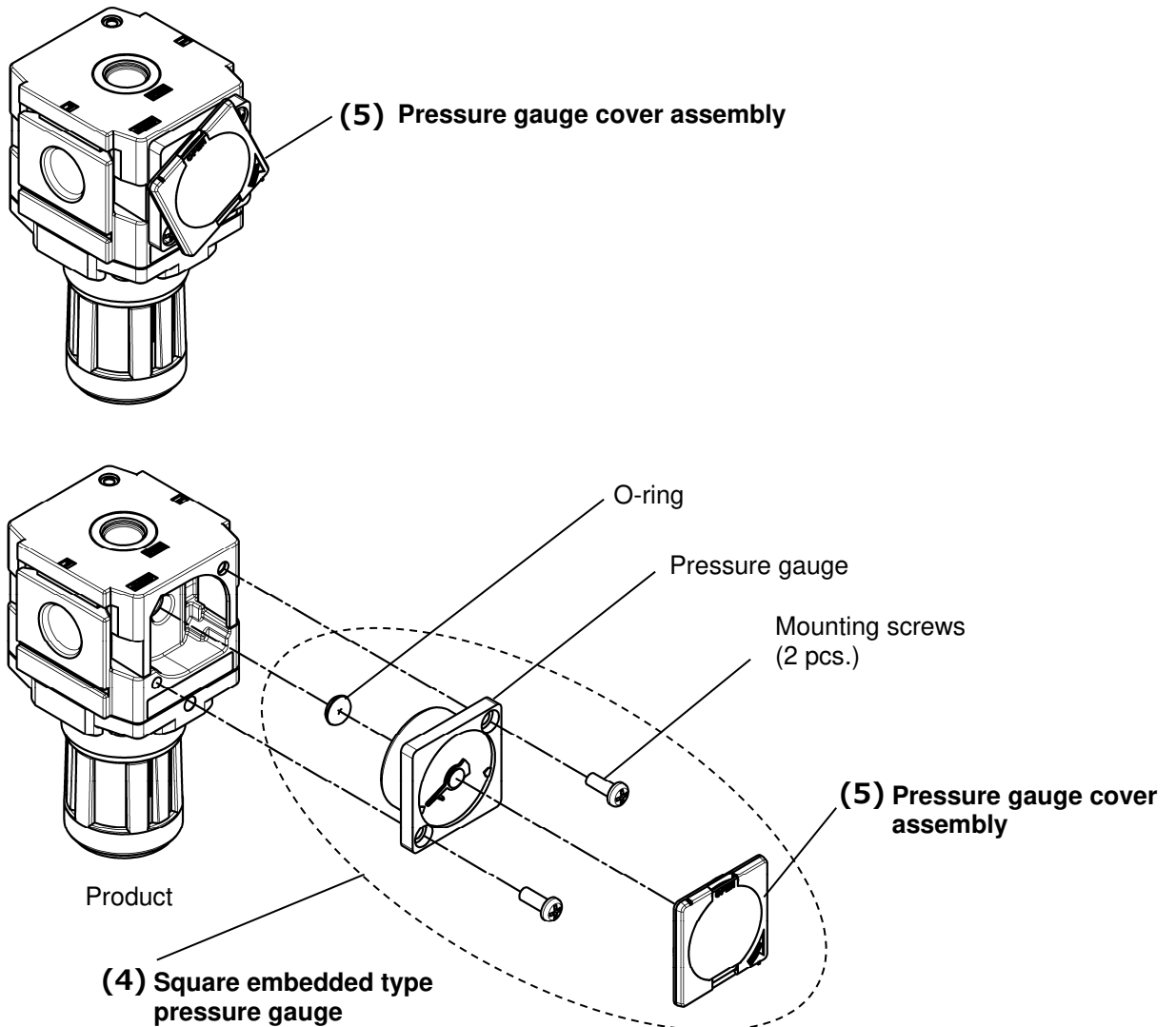
Work category	Procedure	Tool	Criteria
Disassembly	1) Loosen the knob completely before disassembly.	-	-
	2) Remove the 4 screws and remove the bonnet.	Phillips screwdriver	-
	3) Remove the pressure setting screw assembly, pressure setting spring, diaphragm shell and diaphragm in that order.	-	-
Assembly	4) Assemble the diaphragm, diaphragm shell, pressure setting spring, and then pressure setting screw assembly.	-	Direction of diaphragm shell and diaphragm
	5) Assemble the bonnet to the body. While the convex side of the bonnet is facing the IN side, mount it onto the body. Then tighten the 4 mounting screws temporarily, before tightening them diagonally and evenly to fix the bonnet.	Phillips screwdriver	Tightening torque 2.35 +/- 0.3•N•m



10-2. Square Embedded Type Pressure Gauge Replacement

Work category	Procedure	Tool	Criteria
Disassembly	1) Remove the pressure gauge cover. Rotate the pressure gauge cover 15 degrees in the arrow direction (counterclockwise) and pull it out.	-	-
	2) Remove the pressure gauge. Remove the 2 mounting screws and remove the pressure gauge.	Phillips screwdriver	-
Assembly	3) Confirm that the O-ring is mounted onto the pressure gauge. When the O-ring comes out or is left on the product, mount the O-ring to the pressure gauge correctly.	-	Presence of the O-ring
	4) Mount the pressure gauge. Mount the pressure gauge to the product with the mounting screws and tighten the screws referring to the tightening torque specified in the right column.	Phillips screwdriver	Tightening torque 0.85 +/- 0.05 N·m
	5) Mount the pressure gauge cover. Set the pressure gauge cover with its arrow on the lower right corner. Mate the 2 fingers of the pressure gauge cover with the 2 finger slits of the pressure gauge and rotate the pressure gauge cover 15 degrees to the opposite direction of the arrow (clockwise).	-	-

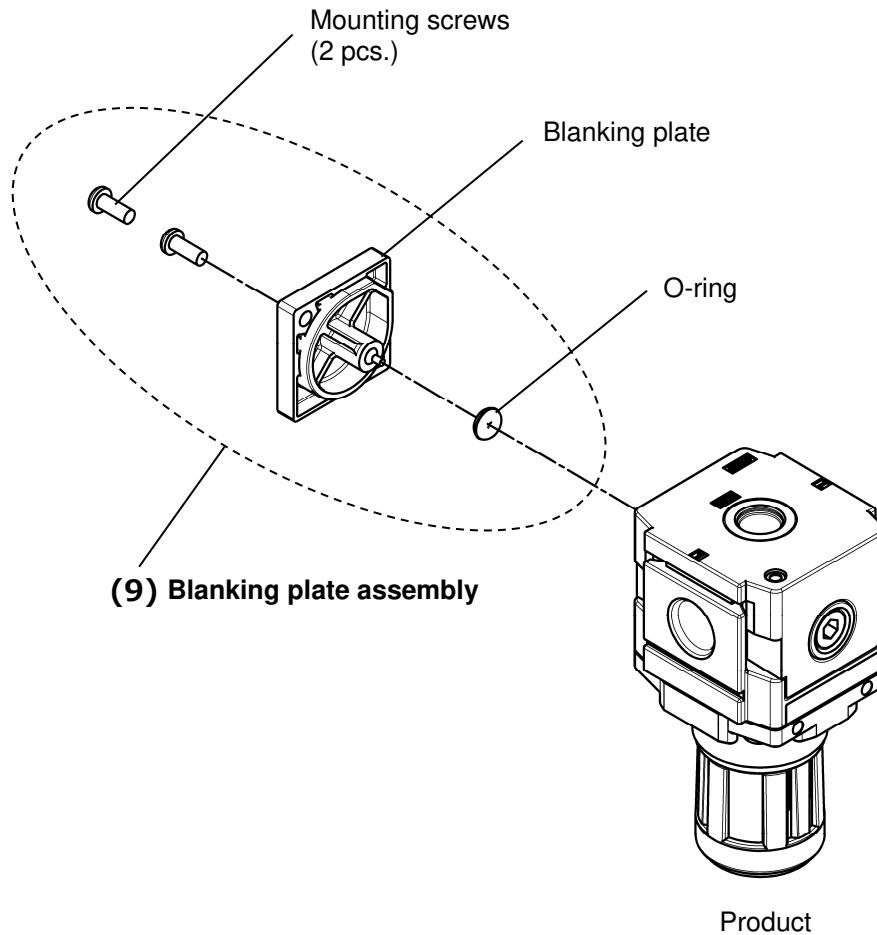
Note) Applicable to the product with square embedded type pressure gauge (E).



10-3. Blanking Plate Assembly Replacement

Work category	Procedure	Tool	Criteria
Disassembly	1) Remove the blanking plate. Remove the 2 mounting screws and remove the blanking plate.	Phillips screwdriver	-
Assembly	2) Confirm that the O-ring is mounted onto the blanking plate. When the O-ring comes out or is left on the product, mount the O-ring to the blanking plate correctly.	-	Presence of the O-ring
	3) Mount the blanking plate. Mount the blanking plate to the product with the mounting screws and tighten the screws referring to the tightening torque specified in the right column.	Phillips screwdriver	Tightening torque 0.6 +/- 0.05 N•m

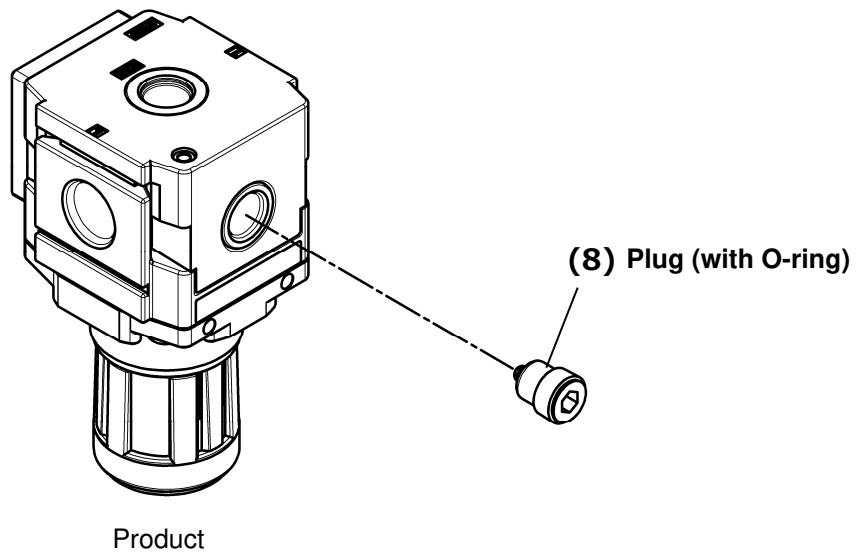
Note) Applicable to the product without pressure gauge or with round type pressure gauge (G,M).



10-4. Plug (with O-ring) Replacement

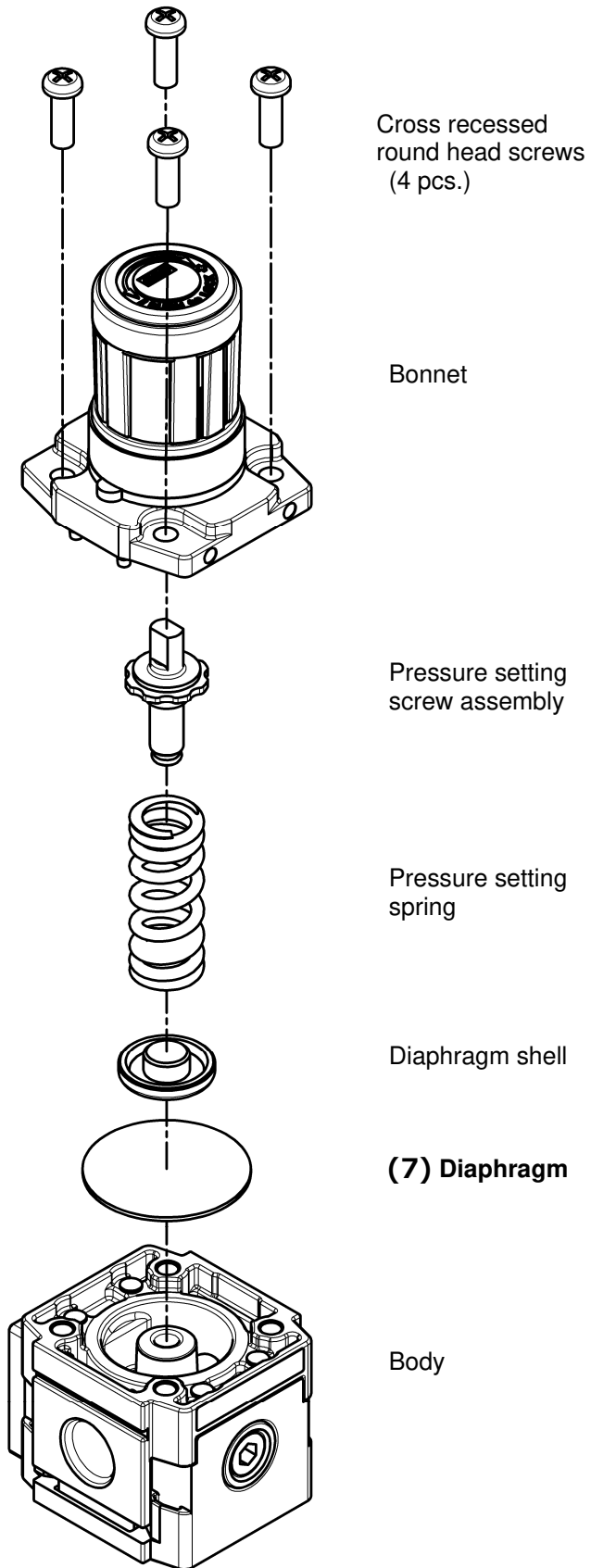
Work category	Procedure	Tool	Criteria
Disassembly	1) Remove the plug (with O-ring).	Hexagon wrench (Nominal size: 4)	-
Assembly	2) Assemble the plug (with O-ring).	Hexagon wrench (Nominal size: 4)	Tightening torque 0.6 +/- 0.05 N•m

Note) Applicable to the product without pressure gauge or with square embedded type pressure gauge (E).



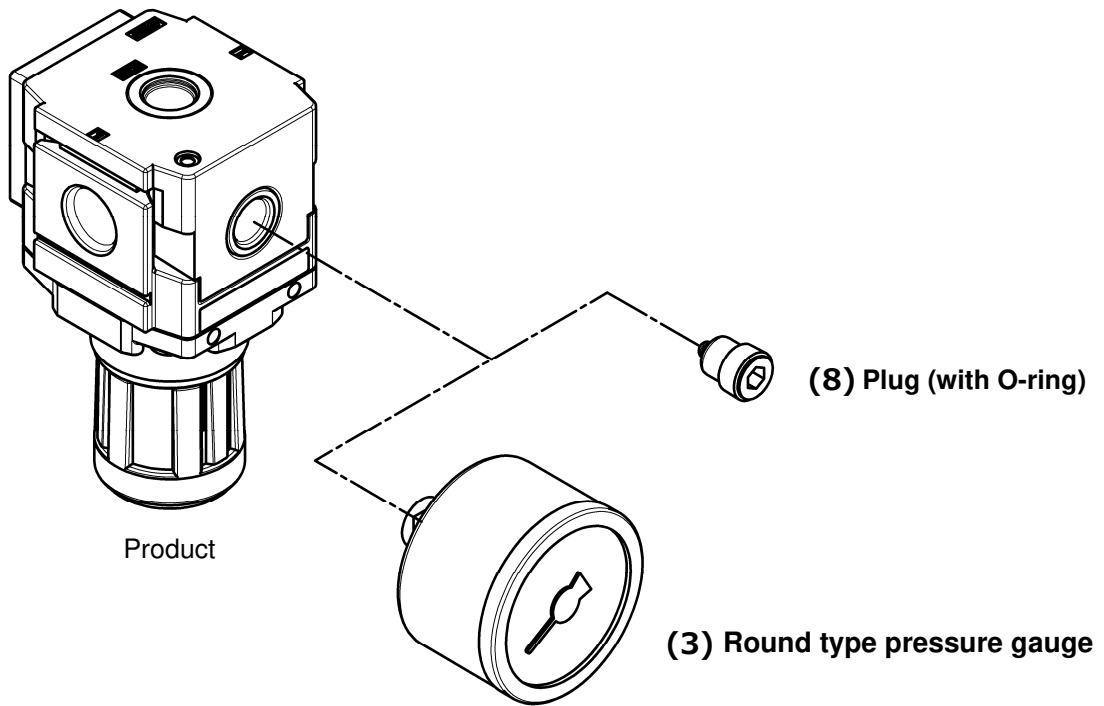
11. Disassembly Drawing

11-1. Disassembly Drawing of the Product



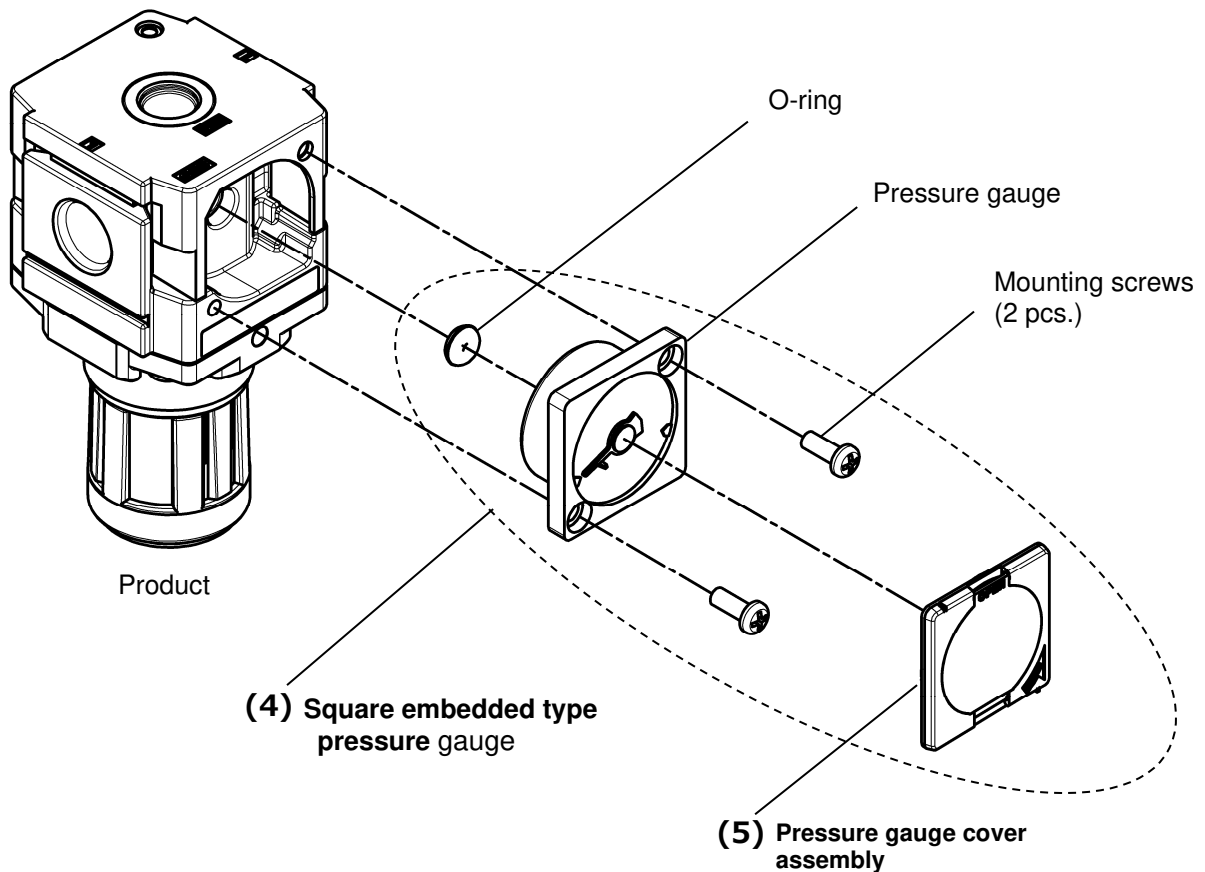
11-2. Disassembly Drawing of the Pressure Gauge Port

【 Applicable model : without pressure gauge / with round type pressure gauge 】



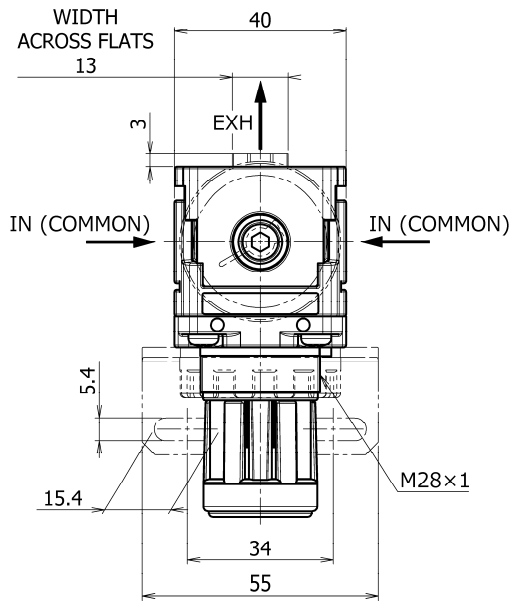
11-3. Disassembly Drawing of the Pressure Gauge Port

【 Applicable model : with square embedded type pressure gauge 】

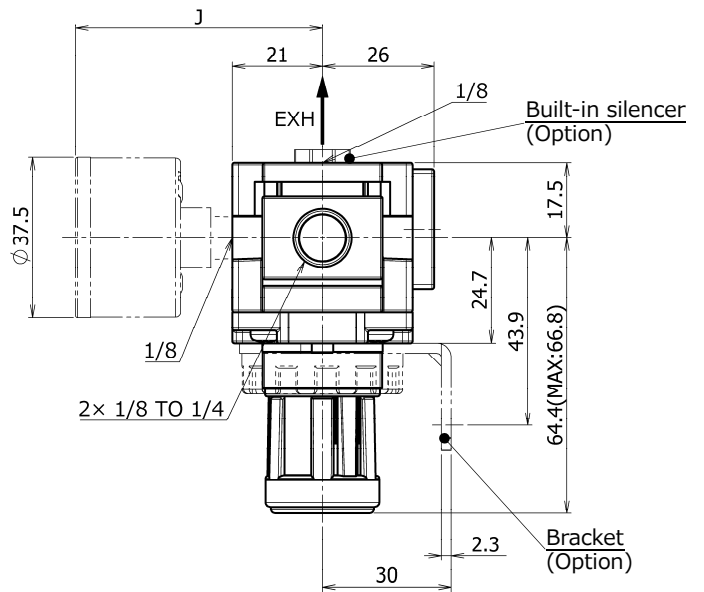
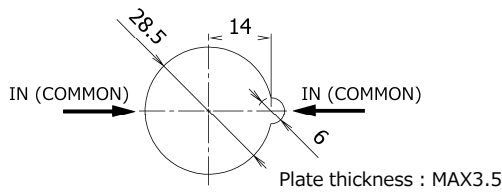


12. Dimensions

12-1. Without pressure gauge / With round type pressure gauge



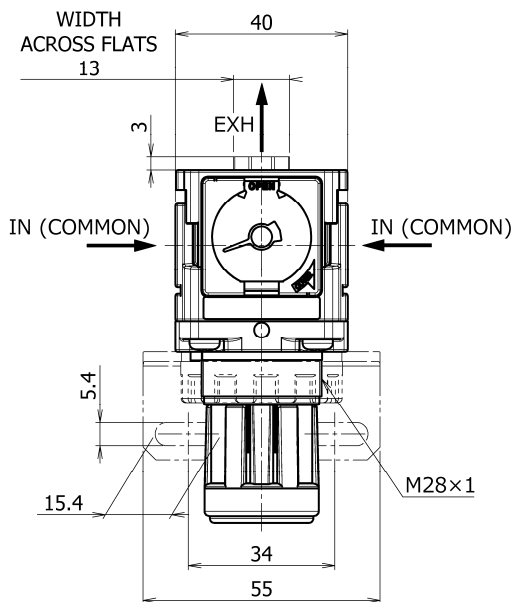
PANEL MOUNTING DIMENSIONS



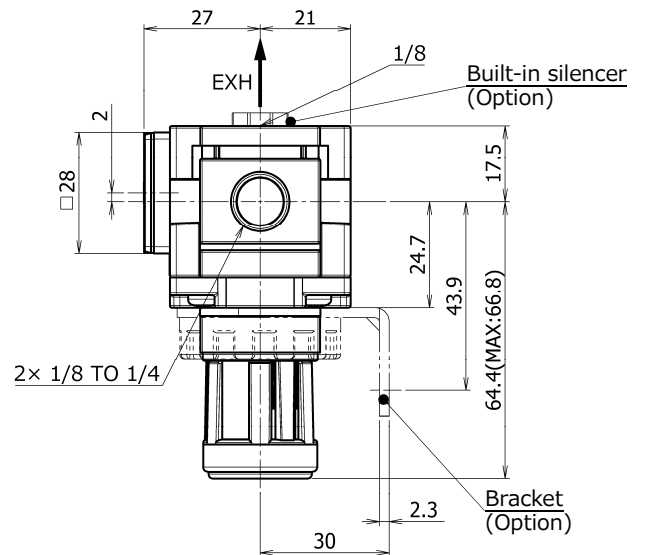
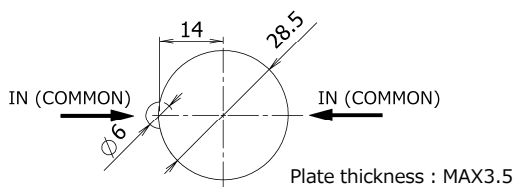
Pressure gauge dimensions : J

Round type pressure gauge	Round type pressure gauge (with color zone)
57.5	58.5

12-2. with square embedded type pressure gauge



PANEL MOUNTING DIMENSIONS



Revision history

SMC Corporation

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Note: Specifications are subject to change without prior notice and any obligation on the part of the manufacturer.
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