

MODEL ASV-1000

AIR OPERATED 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.

Please download the English instruction manual for this product from
["https://www.yoshitake-inc.com"](https://www.yoshitake-inc.com)



日本語



汉语



คู่มือภาษาไทย

	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 or may result in only property damage.

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About After-Sales Service

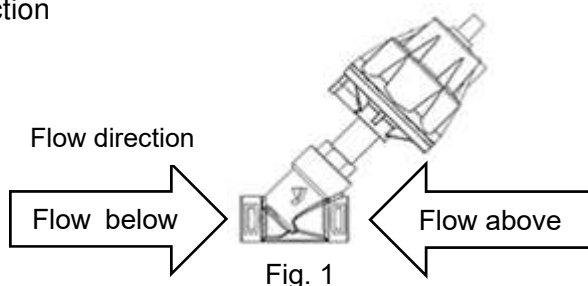


1. Specifications

Model	ASV-1000	ASV-1000-R	ASV-1000-C
Application	Steam, air, cold and hot water, oil, other fluids*2 (600cSt or less)	Steam, air, other gases*2	Steam, air, cold and hot water, oil, other fluids*2 (600cSt or less)
Flow direction*1	Flow below	Flow above	Flow below
Nominal size	15A ~ 50A		
Working pressure	15A: 0~1.5MPa 20A: 0~1.5MPa 25A: 0~0.9MPa 32A: 0~0.9MPa 40A: 0~0.6MPa 50A: 0~0.3MPa	15A: 0~1.5MPa 20A: 0~1.5MPa 25A: 0~1.5MPa 32A: 0~1.2MPa 40A: 0~1.0MPa 50A: 0~1.0MPa	15A: 0~1.5MPa 20A: 0~1.5MPa 25A: 0~1.5MPa 32A: 0~1.2MPa 40A: 0~1.0MPa 50A: 0~1.0MPa
Pilot air pressure *3	15A ~ 25A: 0.35 ~ 1.0MPa 32A ~ 50A: 0.55 ~ 1.0MPa	Refer to *1 below (Maximum pressure : 1.0MPa)	Refer to *2 below (Maximum pressure : 1.0MPa)
Minimum working differential Pressure	0MPa (Outlet pressure is equal to or less than inlet pressure)		
Working temperature range	-30 ~ 200°C(no freezing condition)		
Ambient temperature range	-15 ~ 60°C		
Material	Body	Stainless steel	
	Valve disc	PTFE	
	Actuator	Aluminum	
Installation posture	Any direction is possible		
Connection	JIS Rc, NPT		
Pilot port connection	G1/4		
Operation	Normally close		Normally open

- Do not use ASV-1000-R with liquids, as the pressure shock may cause the piping or product to rupture.
- For the specification other than the above, please contact us.

* 1 Flow direction



* 2. If flammable fluids are used, please contact us.

* 3. Pilot air pressure: Compressed air pressure supplied inside the actuator



Caution

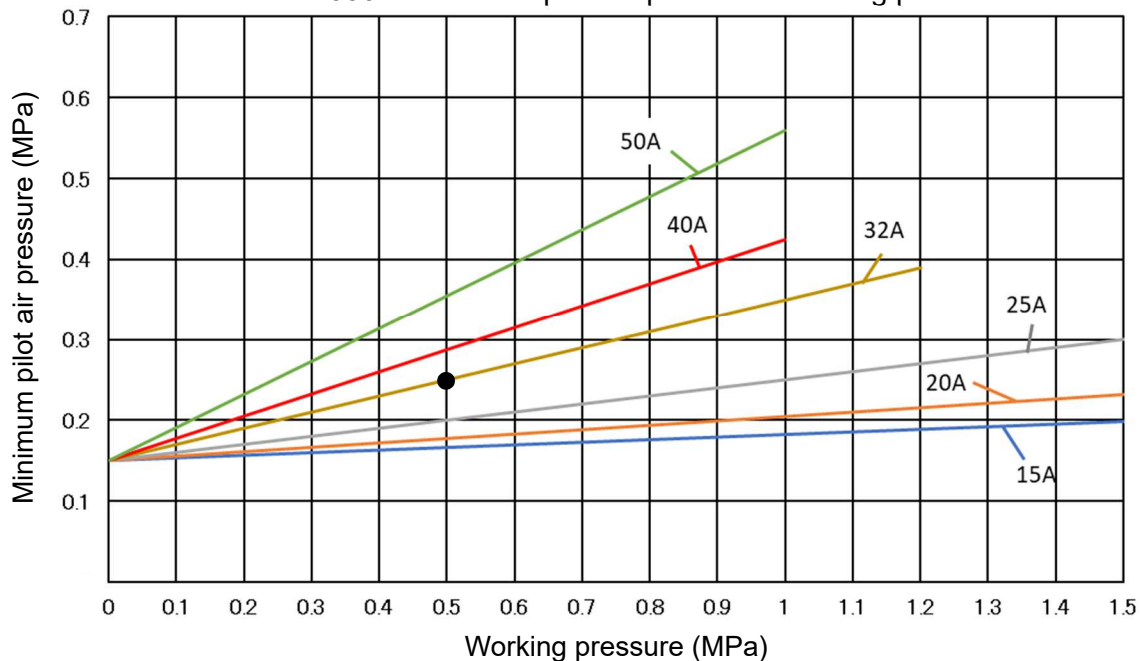
Please confirm that the tag indication of the product corresponds with the specifications of the ordered product model before use.

* If they are different, please contact us without using the product.

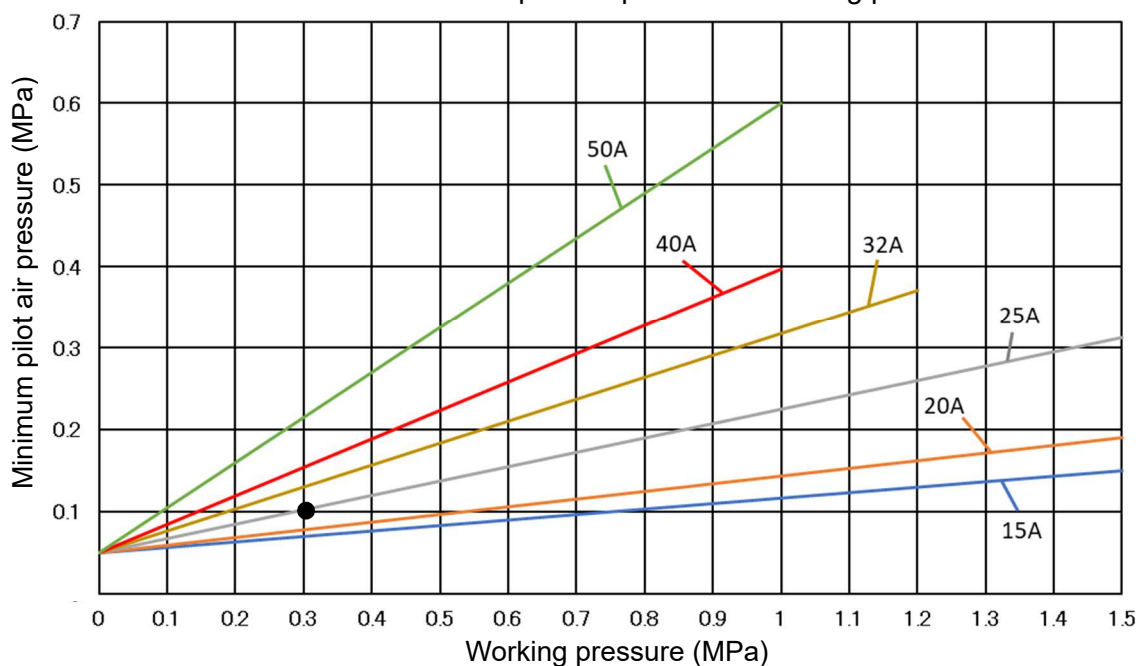
Refer to the chart below for the minimum pilot air pressure - working pressure for ASV-1000-R and 1000-C.

* Do not use a Pilot air pressure in excess of 1.0 MPa in the actuator.
Also, do not supply any fluid other than compressed air inside the actuator.

* 1 ASV-1000-R Minimum pilot air pressure - working pressure



* 2 ASV-1000-C Minimum pilot air pressure - working pressure



How to read the minimum pilot air pressure - working pressure chart

(EXAMPLE)

•ASV-1000-R

When the working pressure is 0.5 MPa for nominal size 32A, pilot air pressure of 0.25 MPa or higher is required for the valve disc to open.

•ASV-1000-C

When the working pressure is 0.3 MPa for nominal size 25A, pilot air pressure of 0.1 MPa or more is required for the valve disc to close.

2. Operation

•ASV-1000、1000-R

1. Closing operation

When pilot air pressure is not applied in the actuator, valve disc is closed by power of spring.

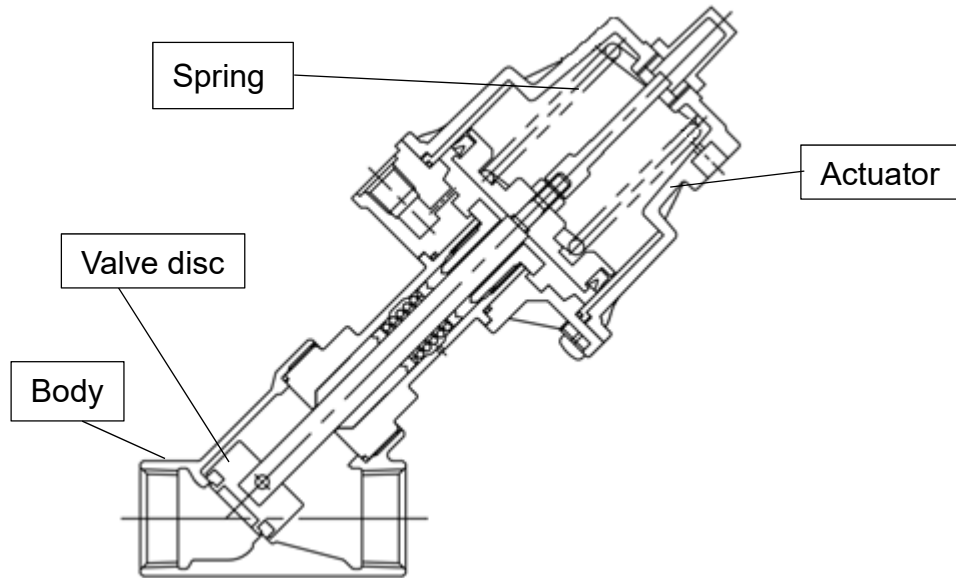


Fig. 2

2. Opening operation

When compressed air is applied from the pilot port, pilot air pressure is added to the bottom part of the piston, overcoming the load of the spring and pushing the piston up, causing the valve disc to open. The indicator connected to the piston is also pushed up at the same time, then valve opening can be checked from outside visually.

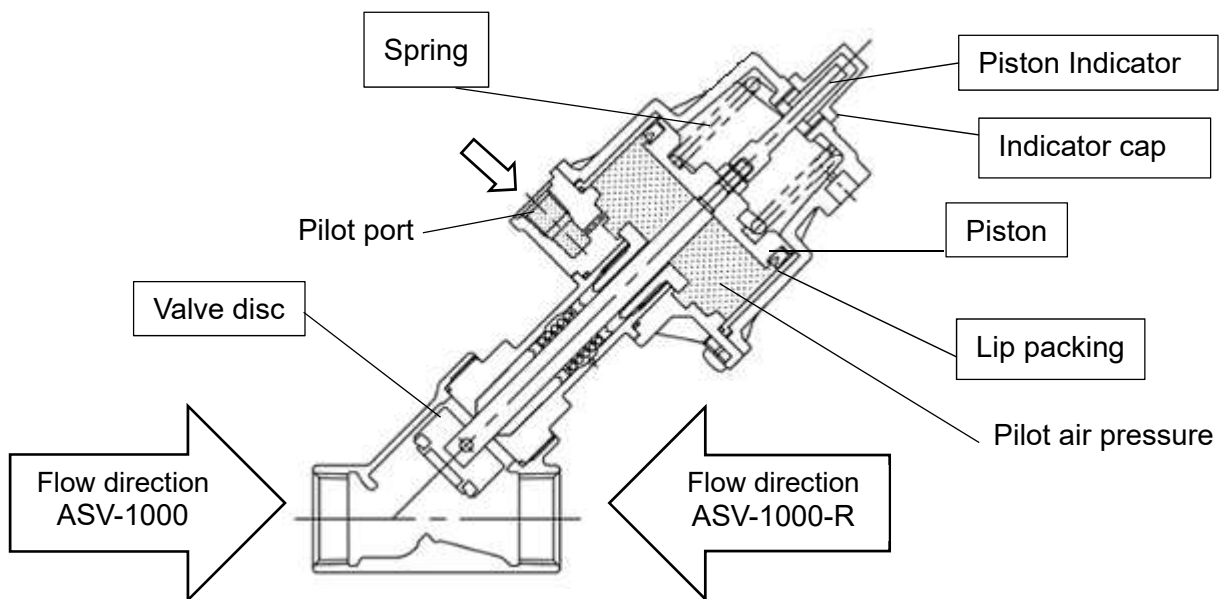


Fig. 3

•ASV-1000-C

1. Opening operation

When pilot air pressure is not applied in the actuator, valve disc is closed by power of spring.

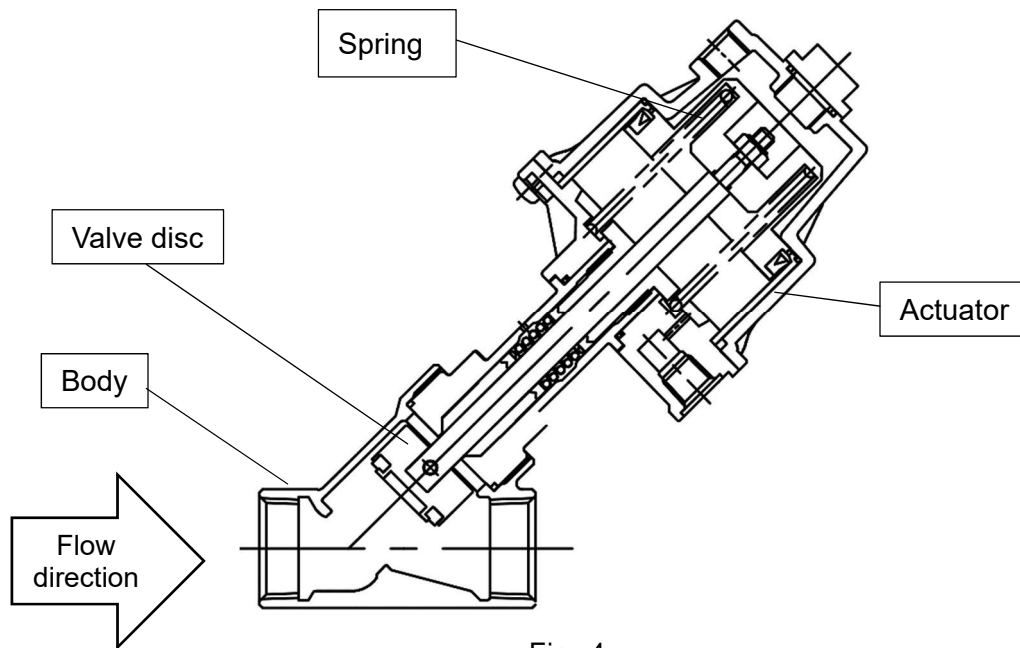


Fig. 4

2. Close operation

When compressed air is applied from the upper pilot port, pilot air pressure is added to the upper part of the piston, overcoming the load of the spring and pushing the piston down, causing the valve disc to close.

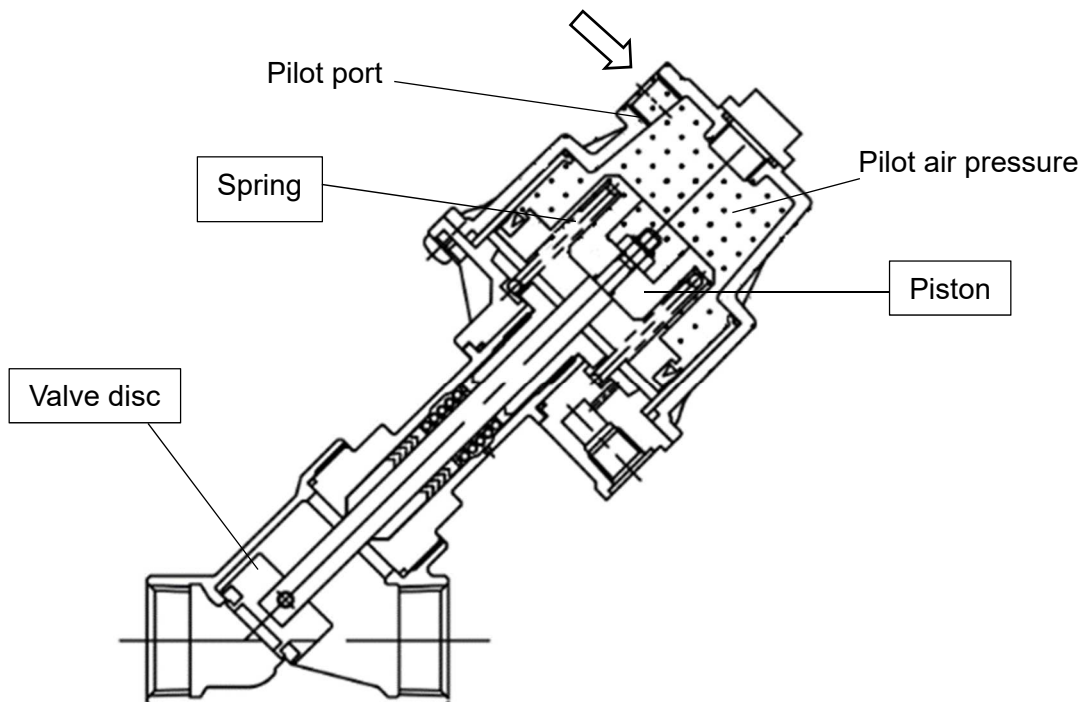


Fig. 5

3. Nominal size selection

3. 1 Calculation formula

■ Calculation formula for Cv value

《For steam》

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

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

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

$$C_v = \frac{W k}{120 P_1}$$

《For gas》

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

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

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

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

《For liquid》

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

Cv: Cv value of each nominal size

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

Q: Max. gas flow rate [m³/h (standard condition)]

V: Max. liquid flow rate [m³/h]

P₁: Inlet pressure [MPa·A]

P₂: Outlet pressure [MPa·A]

ΔP: P₁-P₂ [MPa]

k: 1+0.0013 × {superheated steam temp. [°C]- saturated steam temp. [°C]}

G: Specific gravity (relative to air for gas, or relative to water for liquid)

■ Cv value

Nominal size	15A	20A	25A	32A	40A	50A
ASV-1000、1000-R ASV-1000-C	8.4	13.7	22.0	34.0	50.6	64.7

4. Installation

4.1 Piping example

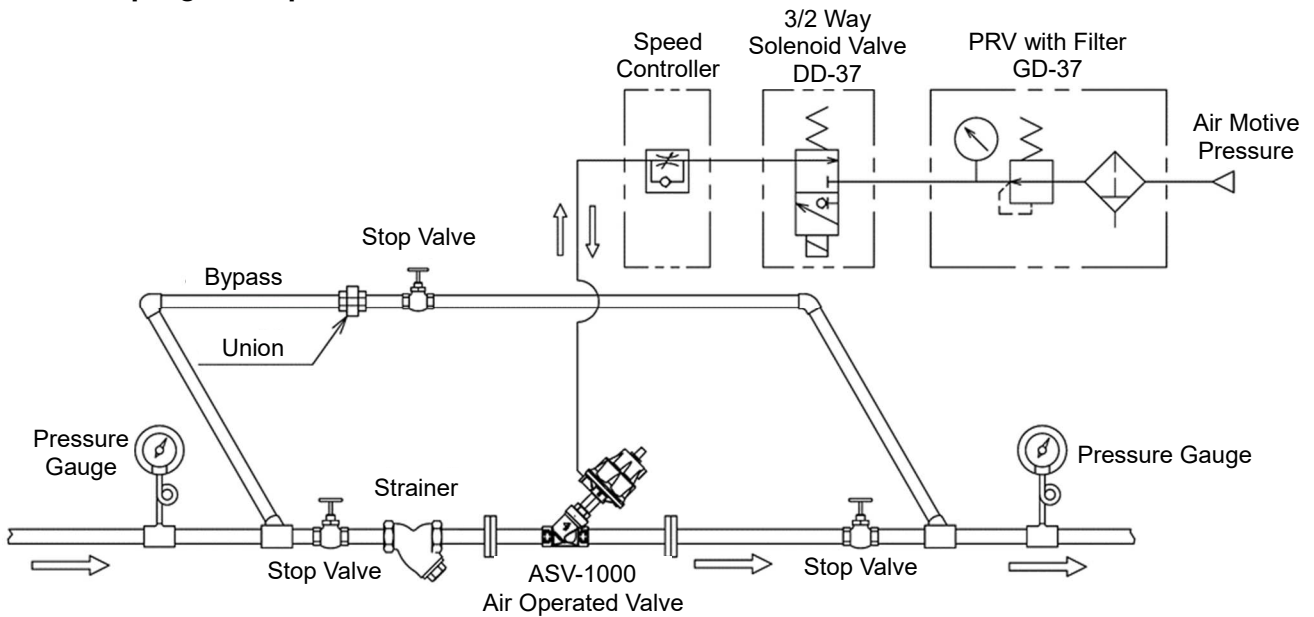


Fig. 6

4.2 Precaution for installation

Caution

1. Do not disassemble the product unless it is necessary.
* Failure to follow this notice may prevent the product from functioning properly.
2. Before installing the product in piping, be sure to remove foreign substance and scale from the piping.
* Failure to follow this notice may prevent the product from achieving its intended performance and lead to malfunction due to the ingress of foreign substances and scale into the product.
3. Be sure to install a strainer (40 mesh recommended for liquids, 80 mesh for gases) at the inlet side of the product.
* Failure to follow this notice may prevent the product from achieving its intended performance and lead to malfunction due to the ingress of foreign substances and scale into the product.
4. Install stop valves and bypass piping for the product.
* Failure to follow this notice may prevent the product from maintenance and inspection.
5. When installation, check the direction of the product so that the fluid flowing and the arrow marked on the product are in the same direction.
* Failure to follow this notice may prevent the product from functioning properly.
6. Connect the product to piping securely so that fluid cannot leak.
* Insufficient connection may lead to leakage by vibration. Also, high temperature fluid can cause scald. There is also a possibility of contaminating the surrounding area.
* If using seal agent for piping to connection part, prevent it from commingling into the product. Seal agent commingles into the product may hamper proper operation.
7. If there is possibility of freezing, take measures to prevent fluid from freezing.
* Failure to follow this notice may damage the product due to freezing of the product.
8. Install pipes so that excessive load, torque or vibration cannot be applied to the product.
* Failure to follow this notice may lead to malfunction or drastically shortened service life of the product.
9. When connecting the product to piping, connect it by grasping hexagonal part of inlet and outlet sides of the body with tool. Do not screw the product into piping with grasping the actuator part.
10. Be sure to secure enough space required for maintenance.
* Failure to follow this notice prevents required operation at the time of maintenance. (See Fig. 8 and 9 below*1)

11. Air supply piping and valves used to operate the product should be installed in a way that unreasonable loads, torque, vibration, cannot be applied to the product.
* Failure to follow this notice may lead to malfunction or drastically shortened service life of the product.
12. Before driving the system, check if the product functions properly.
13. For installation posture, any direction is possible.
14. Compressed air to supply to actuator should be clean and dry air without commingling of water, oil, or foreign substances.
* Commingling of foreign substances leads to malfunction of the product.
15. To change the connection position of the pilot port, apply compressed air through the pilot port, let the valve disc rise (check the indicator rise), and then rotate the actuator. (See Fig. 7.) For the ASV-1000-C, rotate the actuator without applying compressed air.
* Rotating the valve disc while it is down may damage the disc (See 7.3 Exploded View) and cause valve leakage.

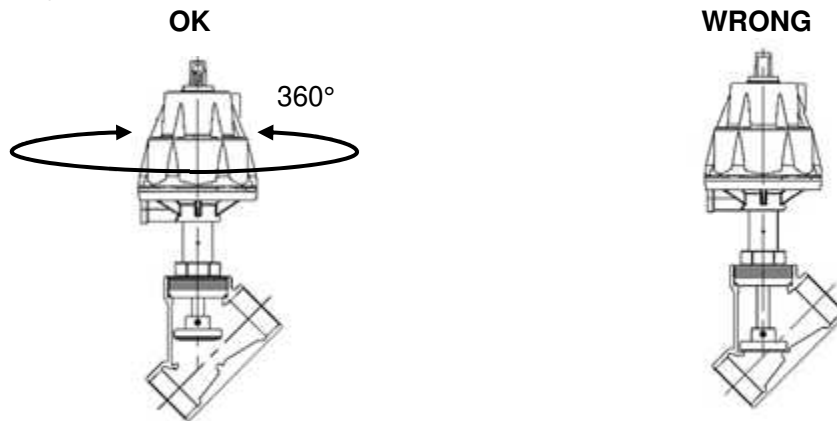


Fig. 7

16. If the outlet pressure is higher than the inlet pressure, backflow may occur even when the valve is closed. In this case, install a check valve on the outlet.
17. If the product is used for steam, etc., and the outlet pressure becomes negative when the product is closed, install a vacuum relief valve on the outlet of the product.
18. If used for steam, install a steam trap in the piping system.
* The product may malfunction due to condensate failure.
19. When using high temperature fluid, it is recommended to use a nylon tube for the pilot port connection piping.
20. If an automatic control valve is installed on the inlet or outlet side of the product, install it at least 3 m away from the product.
* Insufficient differential pressure during valve operation causes unstable operation, resulting in malfunction.
21. When used for steam, piping should be installed to prevent condensate from accumulating in the product's inlet.
* This may cause malfunctions.
22. When using the product outdoors, etc., place an eave over the top of the product to prevent direct water exposure to the product. Avoid installing the product in a place where it will be exposed to high humidity for a long period of time.
23. Viscous (over 600cSt) fluids can stick to parts and cause malfunctions.
24. Do not pipe with dissimilar metals, which may cause a potential difference. The product and its parts will corrode.
25. Product selection should be made in consideration of usage conditions (frequency of use and durability).

*1 Minimum maintenance space for disassembly

•ASV-1000、1000-R

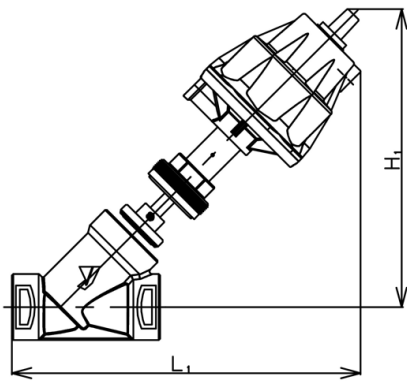


Fig. 8

(mm)		
Size	H ₁	L ₁
15A	211	235
20A	219	243
25A	222	250
32A	239	274
40A	242	274
50A	252	295

•ASV-1000-C

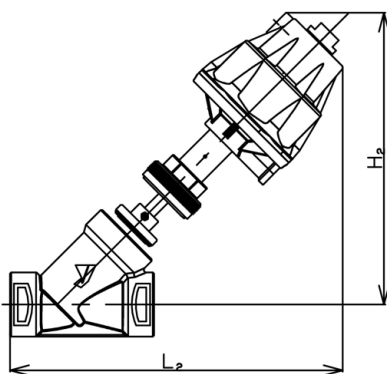


Fig. 9

(mm)		
Size	H ₂	L ₂
15A	195	215
20A	202	223
25A	205	230
32A	222	253
40A	225	253
50A	235	275

5. Operating procedure

5. 1 Warning and caution for operation

⚠ Warning

1. Do not touch the product with bare hands in case of high temperature fluid.
* Failure to follow this notice may scald your skin.
2. Before letting fluid flow, be sure to check that there is no danger if fluid flows to end of piping, the product is connected firmly, and air supply piping is connected firmly to pilot port.
* Failure to follow this notice may contaminate the surroundings. Also, fluid with high temperature may scald your skin.

! 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. Also, foreign substance stuck inside the product leads to malfunction.
2. Slowly open each stop valve in the piping to avoid water hammer or condensate obstruction when leading fluid to the product.
* Rapid opening of stop valve may break the product or peripheral equipment.
3. If fluid leakage from piping connection part of the product is found after leading fluid to the product, stop the fluid immediately and discharge inner pressure of the product, piping and peripheral equipment, and retighten piping connection (for fluid with high temperature, after cooling the product).
* Failure to follow this notice may result in making the surroundings dirty. Also, fluid with high temperature may scald your skin.
4. When pressure is suddenly applied, the valve may open instantly and fluid may leak out.

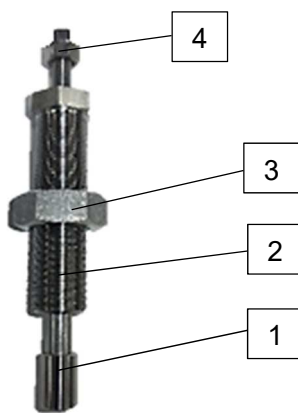
6. Optional item

6. 1 Specifications

*Optional items can be used with ASV-1000 and 1000-R, not with ASV-1000-C.

•Stroke limiter

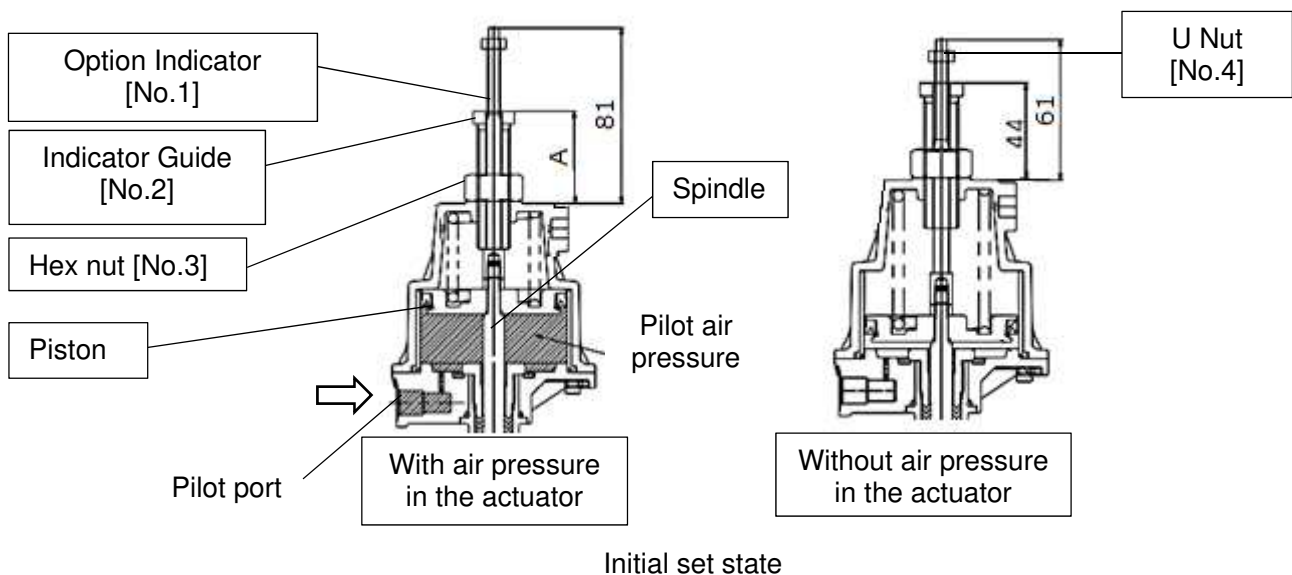
It is possible to adjust the maximum flow rate and minimum flow rate (not fully closed).



No.	Name	Specifications
1	Option Indicator	The operation of the valve can be checked. Width across flats 3mm
2	Indicator Guide	Width across flats 17mm Used in regulating maximum flow rate.
3	Hexagon nut	Width across flats 24mm Used to prevent loosening.
4	U Nut	Width across flats 10mm Used in regulating minimum flow rate.

6. 2 Installation and use

1. Put compressed air (0.6MPa recommend) into the pilot port and make sure the indicator is up.
2. With air pressure on, remove the indicator cap and indicator (See Fig.8).
3. Hand-tighten the optional indicator [No. 1] on the stroke limiter and the threaded part of the valve stem.
4. Grasp the width across flat part of the optional indicator with a spanner and tighten it with 6 N · m of torque
5. Screw the indicator guide [No.2] into the actuator until it hits the optional indicator [No.1]. (At that time, the distance A between the top of the indicator guide and the top of the actuator should be about 44 mm.) This state is the initial set state.



How to adjust the stroke limiter

1. When adjusting the maximum flow rate

- 1-1. When adjusting the maximum flow rate (valve opening), make sure that there is no pilot air pressure in the actuator in the initial set state. At that time, make sure that the U nut is not in contact with the indicator guide [No. 2]. If there is contact, screw in the indicator guide until there is no contact.
- 1-2. Grasp the hexagonal width across flats of the indicator guide [No.2] with a spanner and screw it in clockwise to adjust the opening. When doing so, keep the hexagon nut [No.3] raised so that it does not hit the actuator. Note that turning it counterclockwise loosens the indicator guide and increase the flow rate.
- 1-3. Check if the flow rate is reduced by adding compressed air into the actuator.
- 1-4. If the flow rate is too low or too high, grasp the hexagonal width across flats of the indicator guide [No.2] with a spanner to adjust the flow rate.
- 1-5. After adjustment is complete, screw the hexagon nut [No. 3] all the way to the top of the actuator to prevent loosening.

The adjustment length A for the indicator guide when the CV value is halved is shown in the table below.

Size	15A	20A	25A	32A	40A	50A
Adjustment length A for the indicator guide (mm)	27	27	28	29	31	32

2. When adjusting the minimum flow rate (not fully closed)

- 2-1. When adjusting the minimum flow rate (valve opening), screw the hexagon nut [No.3] all the way to the top of the actuator in the initial set state, and keep the piston in the raised position with compressed air inside the actuator.
- 2-2. Grasp the width across flats of the optional indicator [No. 1] with a spanner and screw the U nut [No. 4] in clockwise to adjust the opening.
- 2-3. Relieve the pilot air pressure in the actuator and check the flow rate.
- 2-4. If the flow rate is too high, apply compressed air again and follow steps 2-2 through 2-3 to adjust the flow rate.

 **Caution**

1. Do not adjust the maximum flow rate with air pressure in the actuator.
 - * The screw may be damaged due to the load on the screw.
2. Do not adjust the minimum flow rate without air pressure in the actuator.
 - * The load on the screw may cause damage to the threads and the nut may become stuck.

7. Maintenance

Most of problems with the product are caused by foreign substances and scale in the piping. A phenomenon similar to valve failure could occur due to the failure of the pressure gauge, leakage or insufficient tightening of the stop valve in the by-pass line, clogging of the strainer, and other causes. Check the above possible causes and take a proper remedy and preventive measures specified in “7.2 Troubleshooting”.

Failures caused by foreign substances caught in the product during use will be repaired for a fee. Thank you for your understanding.

7. 1 Warning and Caution for maintenance and inspection

 **Warning**


1. Conduct periodic inspections to maintain functions and performance of the product.
 - * General users should ask experts (staff of facility management/engineering companies, etc.) to perform periodic inspection.
 - * Refer to "7.2 Troubleshooting" for the troubleshooting to be taken in case of abnormality.
2. When conducting disassembly or inspection, be sure to discharge inner pressure of the product, piping and equipment, and cool down the body of the product until it can be touched by bare hands. Do not touch it with bare hands directly till it is cooled completely.
 - * Failure to follow this notice may result in scalds or injury due to the residual pressure. Also, it may make the surroundings dirty.

 **Caution**

1. Completely discharge the fluid inside of the product and piping before leaving the product not operated for a long time or at the time of regular inspection.
 - * Failure to follow this notice may cause malfunction due to foreign substance or occurrence of scale inside of the piping.
2. After leaving the product not operated for a long period, perform inspection before start-up of operation.
3. If any abnormality is found during daily or periodic inspections, be sure to ask for guidance from experts.

7.1.1 Consumable parts and replacement time

To maintain product function and performance, the following parts have recommended replacement times. When the recommended replacement time has arrived, please replace the parts on a periodic basis.

 Caution	
1. When the recommended replacement time has arrived, please replace the parts on a periodic basis. For consumable parts, service life differs according to frequency of usage or usage condition. Rough indication of replacement term is as follows	
●Periodic Replacement Parts List	
Parts name	Replacement term
Actuator (set) *	1 million operations
Gasket	3years
O-ring	3years
*Marked parts must be replaced as an actuator set.	

7.1.2 Regular inspection items and period to maintain function and performance

Regular inspection items and period are as follows:

To maintain product function and performance, please perform periodic inspections and replacements.

- Periodic inspection (Perform the following inspection items at least once a year.)

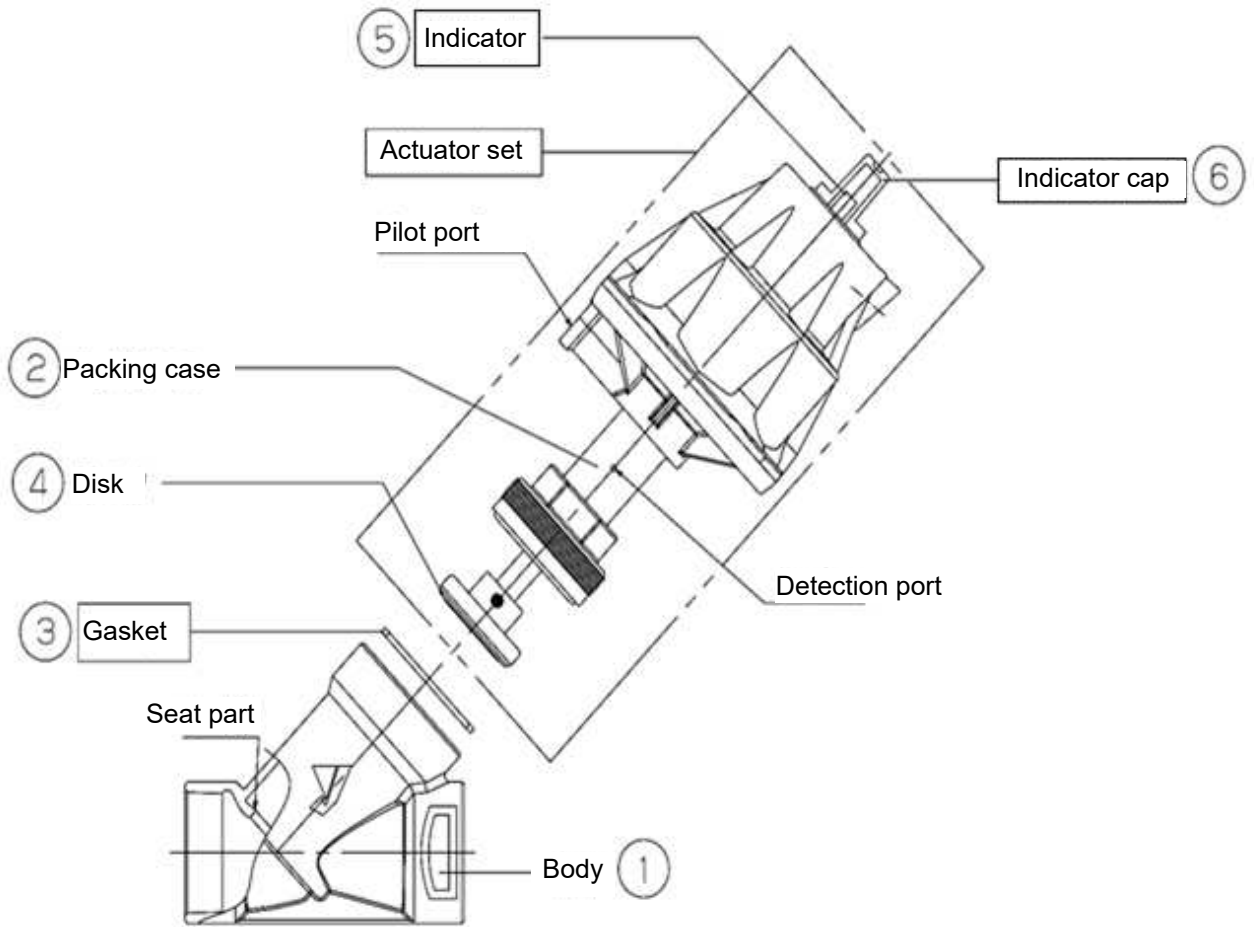
Inspection items	method	Remedy when abnormality
External leakage	Visual check	If there is leakage, replace with a new gasket or actuator set.
Leakage from detection port (See Fig. 10, 11)	Visual check	If there is leakage, replace with a new actuator set.
Leakage from indicator cap (See Fig. 10) and plug (See Fig. 11)	Visual check	If there is leakage from the indicator cap, replace the actuator set. If there is leakage from the plug section, replace the O-ring.

7. 2 Troubleshooting (Refer to "2 Operation", "7.3 Exploded View" and "7.4 Disassembly and reassembly".)

Trouble	Cause	Remedy
1. Fluid does not flow (Valve disc is kept closed and does not open).	Compressed air is not supplied	Check air supply piping
	Pilot air pressure is low.	Apply pilot air pressure as specified in "1. Specification".
	Poor sealing of lip packing (See Fig. 4). (Air leaks continuously from the top hole of the actuator)	Replace the actuator set.
	The pilot air pressure is applied. (ASV-1000-C)	Remove pilot air pressure from the pilot port.
2. Fluid keeps flowing, does not stop. (Valve disc is kept opened and does not close.) Or, there is valve leakage.	Leakage from stop valve on bypass piping.	Close stop valve. Or, leakage still occurs even if closing stop valve, replace stop valve.
	Poor sealing of lip packing (See Fig. 4). (Air leaks continuously from the bottom hole of the actuator) (ASV-1000-C)	Replace the actuator set.
	The pilot air pressure is applied. (ASV-1000, 1000-R)	Remove pilot air pressure from the pilot port.
	Foreign substance is stuck on the seat part (See Fig.10) between valve disc [4] and body [1].	Clean the seat part (See Fig.10) between valve disc [4] and body [1].
	There is damage on the seat part (See Fig.10) between valve disc [4] and body [1].	If there is damage on valve disc [4], replace the actuator set. If there is damage on the seat part (See Fig.10) of body [1], replace the product.
	Defect of spring inside actuator.	Replace the actuator set.
3. Fluid leaks from the connection part of packing case [2] and body [1].	Leakage from gasket due to loosening of packing case [2].	Tighten packing case [2] with the specified tightening torque. (See Table 1 for packing case width across flats and tightening torque.)
	Leakage from gasket [3] due to deterioration.	Replace gasket
4. Fluid leaks from the detection port (See Fig. 10, 11)	Leakage due to deterioration or deformation of packing, etc. inside the actuator set.	Replace the actuator set.
5. Pilot air pressure leaks from the plug. (See Figure 11)	Leakage due to deterioration of O ring. (ASV-1000-C)	Replace O ring
6. Indicator cap, indicator damaged. (See Figure 10)	Damage due to external impact.	Replace with a new indicator cap and indicator.

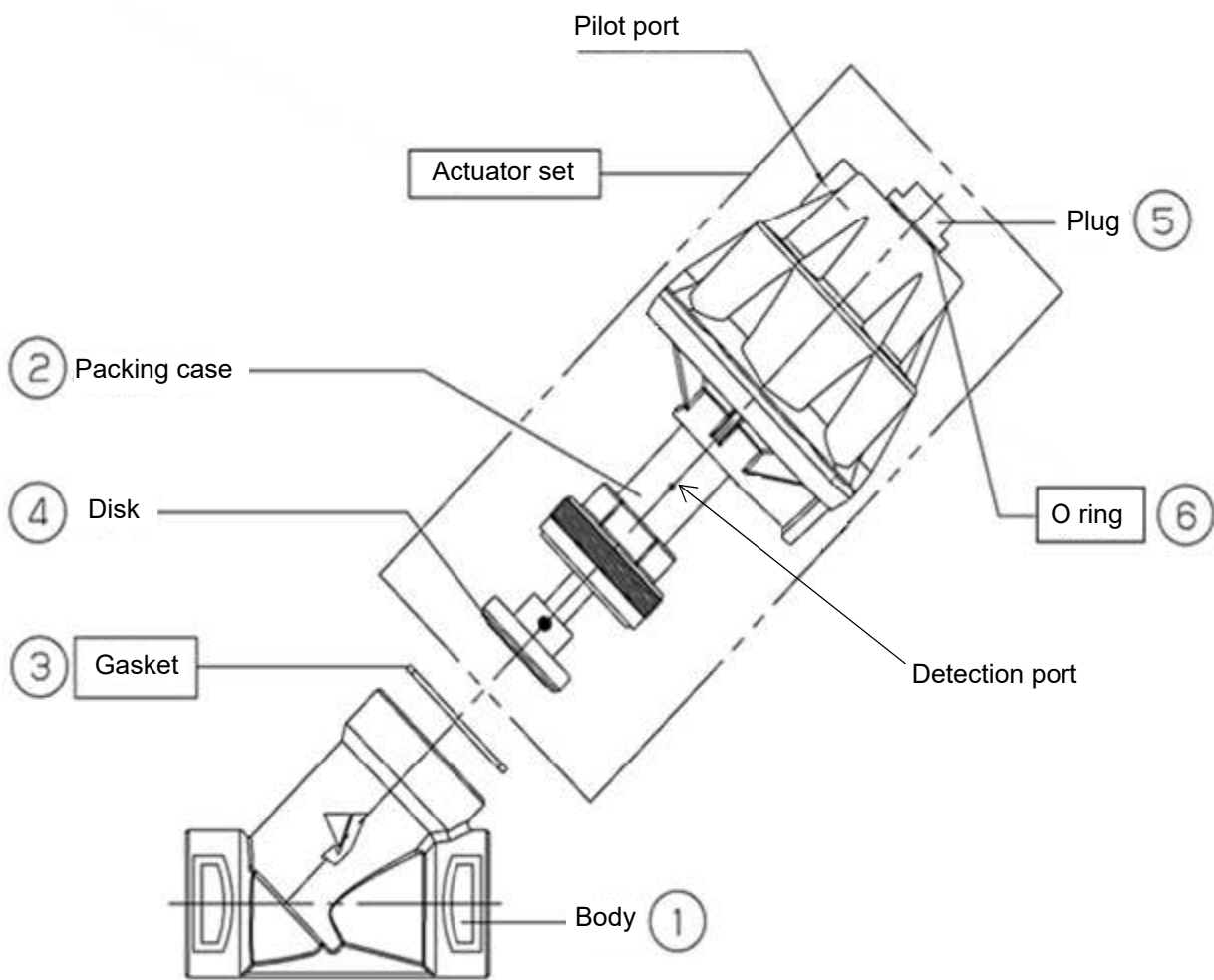
7. 3 Exploded view

•ASV-1000、1000-R



The parts name shown in are available as consumable supply.

Fig.10



The parts name shown in are available as consumable supply.

Fig.11

7.4 Disassembly and reassembly

7.4.1 Disassembly

7.4.1.1 Warning before disassembly

Warning

1. Never try to disassemble the actuator set.
* Failure to follow this notice makes inner spring fly out and results in injury.
2. When removing actuator set from the ASV-1000, 1000-R body [1], first apply compressed air from the pilot port, and never shut off the supplied compressed air until the work is completed.
* The actuator set cannot be removed unless compressed air is applied to the pilot port. If the compressed air is cut off during operation, the actuator set may fly out of the body [1], which is very dangerous and may cause injury.
3. When conducting disassembly or inspection, be sure to discharge inner pressure of the product, piping and equipment, and cool down the body of the product until it can be touched by bare hands. Do not touch it with bare hand directly till it is cooled completely.
* Failure to follow this notice may result in scalds or injury due to the residual pressure. Also, it may make the surroundings dirty.

7.4.1.2 Disassembly procedure

•ASV-1000、1000-R

1. Adding compressed air through pilot port, check that valve disc [4] is up by indicator.
2. Grasp and loosen hexagonal width across flats (See Table 1 in 7.4.3) of packing case [2] with spanner, and remove actuator set from body [1].
3. Remove gasket [3].

•ASV-1000-C

1. With no pilot air pressure in the actuator, grasp and loosen the hexagonal width across flats of the packing case [2] (See Table 1 in 7.4.3) with a spanner, and remove actuator set from the body [1].
2. Remove gasket [3].

7.4.2 Reassembly

7.4.2.1 Warning and caution for reassembly after disassembly

Warning

1. To install ASV-1000, 1000-R actuator set on body [1], supply compressed air from pilot port. Also, be sure not to stop compressed air during supply till the work is finished.
* The actuator set cannot be assembled to the body [1] without pilot air pressure, because the disk [4] is lowered. If the compressed air is cut off during reassembly, the actuator set may fly out of the body [1], which is very dangerous and may cause injury.

Caution

1. Check that there is no damage on valve disc [4] and seat part of body (See Fig. 10).
* Damage on valve disc [4] or seat part of body (See Fig. 9) leads to valve leakage. Also, replace gasket [3] with new one. If not, it leads to outside leakage.
* For gasket, be sure to use gasket which Yoshitake prepares. If using other gasket, it may lead to outside leakage.
2. For operation after reassembly, follow “5.1 Warning and caution for operation”.

7.4.2.2 Reassembly procedure

•ASV-1000、1000-R

1. Add pilot air pressure through pilot port of the actuator set.
2. Put new gasket [3] into the body [1], and then screw in the actuator set with pilot air pressure by hand.
Apply lubricant (Recommended: CLUBER PASTE UH1 96-402 NSF) to the gasket [3] before inserting it into the body [1].
3. Tighten the packing case [2] hexagonal width across flats with the torque indicated in Table 1 of "7.4.3 Recommended Torque for actuator set".
4. After the reassembly, be sure to check opening and closing operation and that there is no leakage from gasket [3].

•ASV-1000-C

1. Put new gasket [3] into the body [1], and then screw in the actuator set by hand.
Apply lubricant (Recommended: CLUBER PASTE UH1 96-402 NSF) to the gasket [3] before inserting it into the body [1]. Also, do not apply compressed air from the pilot port during assembly.
2. Tighten the packing case [2] hexagonal width across flats with the torque indicated in Table 1 of "7.4.3 Recommended Torque for actuator set".
3. After the reassembly, be sure to check opening and closing operation and that there is no leakage from gasket [3].

7.4.3 Recommended torque for actuator set

To install actuator set on body, tighten to the following tightening torque with torque wrench. Also, refer to the table below for the hexagonal two-sided width of the packing case.

Table 1 "Width across flats and tightening torque of packing case"

Size	Width across flats (mm)	Tightening torque
15A	24	100N·m
20A	27	
25A	30	
32A	32	150N·m
40A	32	
50A	32	

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.