

NOTICE

Be sure that the user receives this manual before the product is used.

Copying or duplicating this user's manual in part or in whole is forbidden. The information and specifications in this manual are subject to change without notice.

Considerable effort has been made to ensure that this manual is free from inaccuracies and omissions. If you should find an error or omission, please contact the azbil Group.

In no event is Azbil Corporation liable to anyone for any indirect, special or consequential damages as a result of using this product.

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Introduction

Thank you for purchasing this model VDN___low-noise cage type double-seated control valve. This valve reduces aerodynamic noise in compressible fluid services and has excellent low noise characteristics.

This user's manual describes how to use this device safely and reliably. Be sure to read this manual before using the product. After reading the manual, be sure to keep it in a place where users can refer to it at any time.

Unpacking and Storing the Product

Unpacking

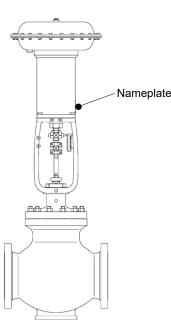
This device is a precision instrument. Take special care in handling the valve to prevent accidents, damage, etc.

When unpacking, check for the following items.

- The valve, actuator, and parts to be attached
- Any auxiliary devices that you ordered

Checking the Specifications

Check that the fluid conditions, valve number (tag No.), and the specifications printed on the name plate are correct and appropriate. The location of the product's nameplate is shown in the figure below.



O gzł	
TAG NO.	
PROD. NO .	
MODEL	GREASE
SIZE	LIFTmm
BODY	
TDIM	
PLUG	
GASKET	
PACKING	
ACTUATOR	
RANGE	
SUPPLY	
AIR TO	VALVE
\cup	C

Nameplate

Inquiries

For inquiries about this device, contact the azbil Group. When making an inquiry, have your model number and product number ready.

Precautions for Storage

Observe the following precautions in order to store the purchased valve properly.

- If the valve is packed in a cardboard box, store it indoors at room temperature and humidity.
- A valve packed in a wooden crate should also generally be stored indoors at room temperature and humidity. For outdoor storage, after unpacking the valve and checking the specifications, cover it with a polyethylene protective sheet to keep rainwater out.

To store a valve that has been used, follow the instructions below.

- 1. Wash out any fluid stuck to or remaining in the interior of the valve.
- 2. If it is likely that the valve will corrode, take preventive measures.
- Cover the openings for air supply and electrical conduit connections with waterproof caps or tape to keep water out. In addition, protect the threads on the connectors.
 - in addition, protect the threads on the connectors.
- 4. Protect the ends of piping connections (flanges, welded surfaces) using flange caps or the like.
- 5. Store the product in a location that is subject to minimal vibration and shock.

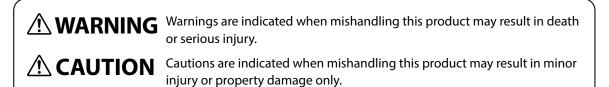
Safety Precautions

Symbols

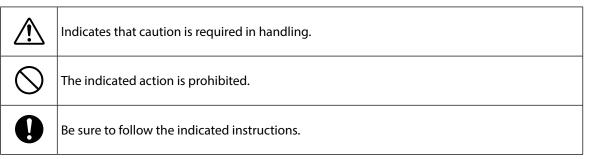
The safety precautions explained below aim to ensure safe and correct use of this product in order to prevent injury to you and others, and to prevent property damage. Be sure to observe these safety precautions.

The safety precautions described in this manual are indicated by various icons.

Their meaning is explained below. Be sure to understand the meaning before reading the rest of the manual.



Examples



Notes for Safe Operation



WARNING

Before starting to work, check that the pressure in the pipes has dropped to atmospheric pressure. If fluid spews out, injury may result.

\bigcirc	Do not stand on the device or use it as a step. There is a risk of falling.
\bigcirc	Do not touch the device unnecessarily while it is operating. Depending on the operating conditions, the surface might be extremely hot or cold.
0	Since this product is heavy, when handling it, wear safety shoes and watch your step.
0	During work, wear protective goggles to prevent injury from flying objects and harm from chemicals.
0	During work, wear protective gloves to prevent injury from burrs on bolt heads or edges and harm from chemicals.
\bigcirc	While this device is operating, do not touch movable parts such as the stem connector. Your hand, etc., may be caught in the mechanism and injured.
0	When assembling or disassembling the diaphragm, which is part of the actuator, wear protective gloves to prevent prolonged contact with your skin. "Prolonged contact" refers to total daily skin contact of 10 minutes continuously or 30 minutes intermittently.

Handling Precautions

V

Warnings and Cautions for Installation

WARNING

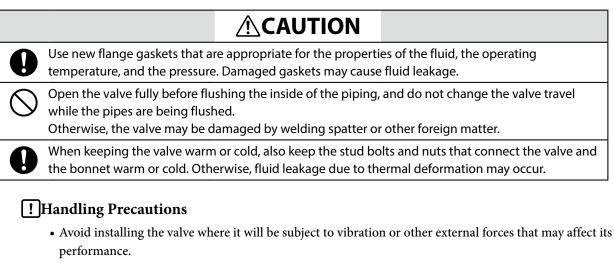
If the rated pressure or standards for connection are ignored when this device is used, damage to the product or leakage may cause a serious accident.

When connecting the valve to the piping, do not put your hand or foot under the valve or between flanges. You may lose your fingers or your foot may be injured.

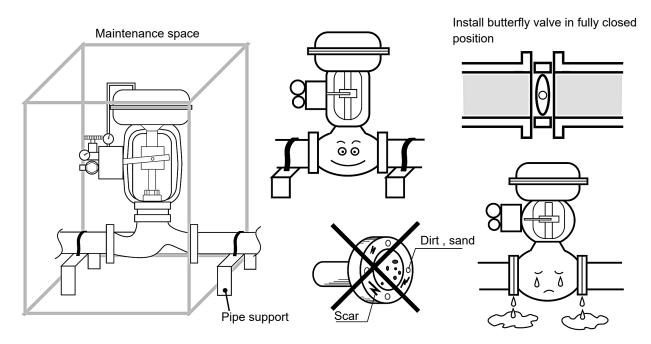
Before reinstalling the valve after maintenance or modification, wash out any residual fluid in the pipes or replace it with a safe fluid. Otherwise, the residual fluid may cause an injury.

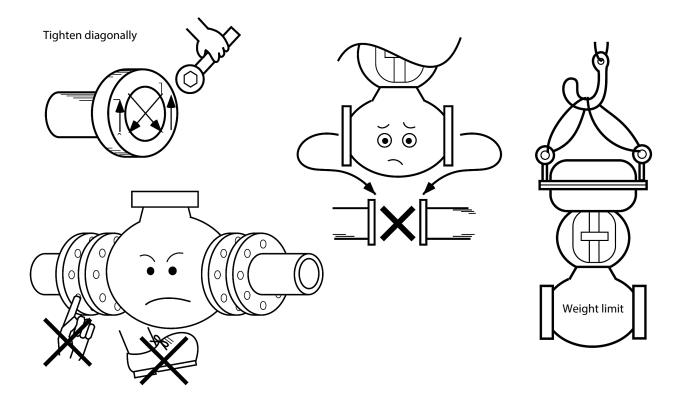
A CALITION

0	Make sure that there is a straight pipe section at least 10 times the pipe diameter on the upstream side and 6 times the pipe diameter on the downstream side (D: nominal diameter). If the straight pipe sections are not long enough, insufficient valve capacity or unusual noise or vibration could result.
0	Install the valve in the correct direction, leaving clearance around the valve as much as possible for easy maintenance (piping, wiring, adjustment, etc.).
0	Provide appropriate support for the valve itself and for connected pipes to prevent an excessive load from the weight and operation of the valve. (Care is needed especially for large valves and valves for low-temperature fluid.)
0	If the valve is installed along a passageway used by outsiders, install a fence or cover as a protective measure.
\bigcirc	Do not install the valve where it may be submerged by rainwater, covered with snow, or subject to freezing. Otherwise the valve might be damaged.
0	If the valve is exposed to radiant heat, provide a shielding plate or the like. Failure to do so may result in damage to the actuator or auxiliary equipment.
	If the valve is exposed to salt or a corrosive atmosphere, take measures against corrosion. Otherwise the valve might be damaged.
0	Check that there is no damage to the valve (including the actuator and auxiliary equipment).
9	Check that there is no damage to the flanges or welded piping. Otherwise fluid leakage could result.
0	If pipe flanges connected to the valve are being welded, the valve surface may also heat up. Do not touch the valve unnecessarily.
0	Chamfer the edges of the pipe flanges. Sharp edges can cause an injury.
0	Check that the pipes on both sides of the valve are firmly supported. Insufficient support may cause leakage from pipe connections.
0	After installation, check that the pipes are still properly aligned. Misalignment may cause fluid leakage from pipe connections.
0	Install the butterfly valve with the valve (blade or disk) fully closed. Otherwise the valve might be damaged.
0	If the eyebolts (eyenuts) attached to the actuator are used to lift the valve, make sure that the weight does not exceed the limit specified in the user's manual. An excessive load may damage the actuator or cause air leakage.
0	Use bolts and nuts that conform to the standards for the pipe flange. Otherwise fluid leakage could result.



- Protective covers are attached to the flanges to protect the gasket-contacting surfaces and to prevent foreign matter from entering the valve. When installing the valve, remove the covers.
- Check that there is no damage to the valve (including the actuator and auxiliary equipment).
- To prevent seat damage and impaired closing performance, remove foreign matter such as dust, sand, and welding spatter from the inside of the piping, and clean the inside of the valve.
- Check that the distance between the pipe flanges is equal to the total of the face-to-face length of the valve and the thickness of the gaskets.
- Tighten the bolts and nuts for the flanges evenly in a diagonal pattern.



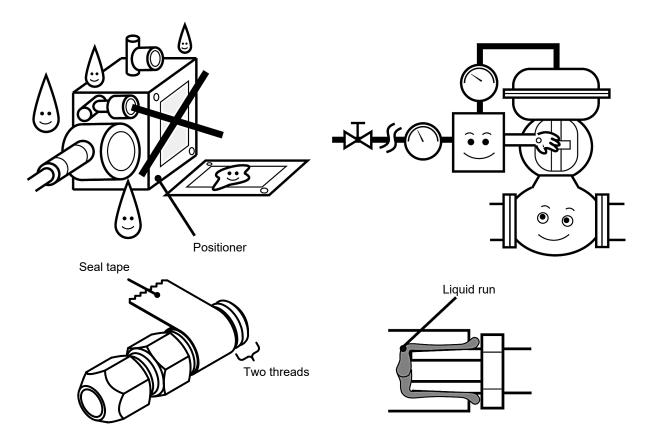


Precautions for Air Supply Piping and Electrical Work

0	For air supply, use pipes with an appropriate internal diameter so that pressure will not drop while the valve is operating. Failure to do so may result in poor valve performance.
0	Wiring work should be carried out only by qualified technicians following local electrotechnical standards.
0	Cabling should be carried out in accordance with facility conditions. Use an adapter (and packing) whose size is appropriate for the outer diameter of the cable.
\bigcirc	If sealing tape is applied to air supply pipe threads, leave the two threads nearest the tip bare. Clogging caused by pieces of tape may result in poor valve performance.
0	If liquid packing (thread lock sealant) is used for air supply piping work, do not allow it to enter inside the pipes. If it does, poor valve performance may result.
0	Avoid doing wiring work on a rainy day or in high humidity. Moisture inside connectors or the terminal box may cause a short-circuit or rust.

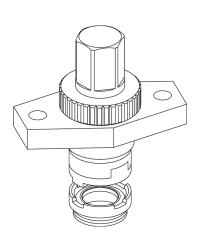
!Handling Precautions

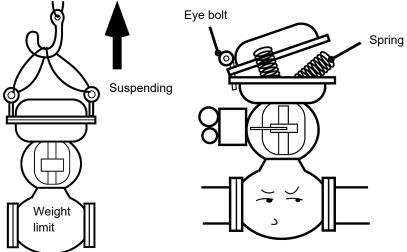
- A packing (gasket) is attached to the cap of auxiliary equipment such as positioners. Do not lose it during wiring work.
- If it is necessary to bend the air supply pipes, make gentle bends (using a dedicated tool like a tube bender), and use a band to hold parallel pipes together.

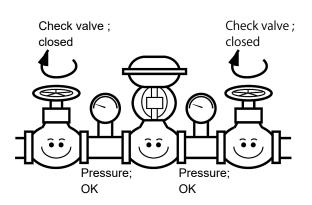


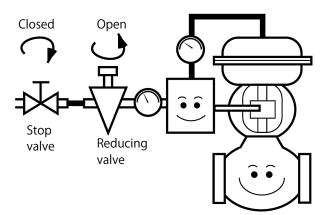
Precautions for Assembly and Disassembly

	WARNING
	Before starting work, clean the inside of the valve, replace any residual gas, etc. Otherwise, the residual fluid may cause an injury.
\oslash	Do not disassemble the pneumatic actuator while supply air pressure is being applied. The compressed air may cause an injury.
0	Because damaged or corroded bolts and nuts may damage the valve and cause injury, replace them with new ones.
9	Observe the tightening torques indicated in the user's manual when tightening bolts and nuts.
0	For an actuator that incorporates springs, follow the disassembly procedure when removing bolts, nuts, etc. Otherwise, the springs may jump out, causing injury.
0	When removing the valve from the piping, if the eyebolts (eyenuts) attached to the actuator are used to hoist the valve, make sure that the weight does not exceed the limit specified in the user's manual. Otherwise, the valve may fall.
0	Before removing or attaching the trim (internal valve), check whether a dedicated tool is necessary. If it is needed, be sure to use it. Otherwise, parts may be damaged.
9	Assemble the valve using the parts, bolts, nuts, etc., in the order stated in the assembly procedure. Otherwise, malfunction may result.
9	When reassembling the valve body, always use new packing and gaskets. The reuse of old parts will cause fluid leakage.

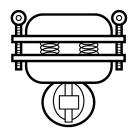




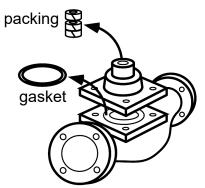




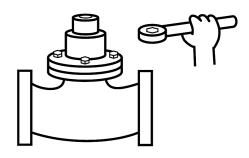
•Observe the assembly procedure



•Replace packing / gasket



•Tighten bolts to specified torque



Precautions for Maintenance

If fluid leakage from the valve is found, stay away from the valve until safety can be confirmed. Depending on the properties of the fluid, a serious accident or injury may result.

	!	
	1	

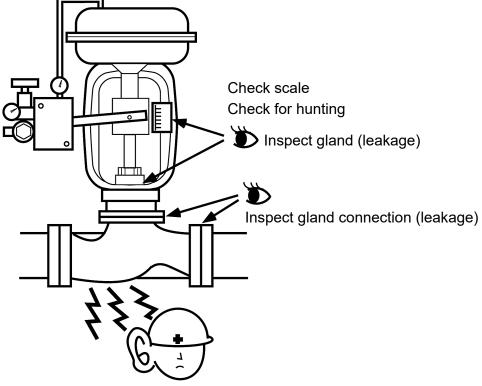
Check the gland daily, and tighten the packing if leakage is found.

Check valve operation daily, including a visual check for hunting.

During valve operation, look and listen for unusual noise or vibration.

!Handling Precautions

- Avoid installing the valve where it will be subject to vibration or other external forces that may affect its performance.
- A packing (gasket) is attached to the cap of auxiliary equipment such as positioners. Do not lose it during wiring work.
- Take care not to lose screws for the cap of auxiliary equipment such as positioners.
- Make sure that the seal of cable glands and electrical conduits is sufficient to prevent the entry of moisture.
- Dispose of old parts that were replaced during valve disassembly or maintenance as industrial waste. If they are burned or discarded carelessly, environmental pollution will result.
- When assembling the valve, check that the packing (gaskets) are in place and tighten the screws evenly.



Check for abnormal noise or vibration

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Chapter 1 Structure of the Control System

1-1 Overview of the Control System

This control valve operates by receiving 4–20 mA DC or 20–100 kPa signals and is driven by 270–500 kPa clean supply air. Figure1-1-1illustrates a typical control valve system.

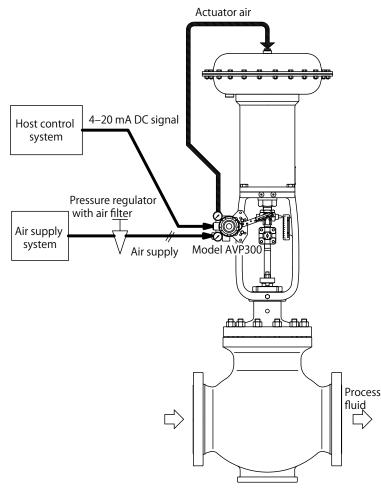


Figure 1-1. Control System

This manual contains operating instructions for low-noise cage type double-seated control valves, model VDN___. For details on positioners, refer to the user's manuals below.

· Pneumatic single-acting valve positioner (model HTP): document No. OM2-8310-0200

- · Electro-pneumatic single-acting valve positioner (model HEP): document No. OM2-8313-0100
- · Pneumatic single-acting valve positioner (model VPE): document No. OM2-8310-0410
- · Smart valve positioner

Model AVP300/301/302 (integral type) and model AVP200/201/202 (remote type): document No. CM2-AVP300-2001 Model AVP701/702: document No. CM2-AVP702-2001

 \cdot Smart valve positioner (with fieldbus)

Model AVP703: document No. CM2-AVP703-2001

1-2 Control Valve Structure

This device is composed of a valve body and an actuator. The valve body consists of a valve, bonnet, valve plug, and other components. The actuator consists of a diaphragm, spring, and other components. Figure 1-2 illustrates the structure of this device.

The base of this device is a model VDC____cage type double-seated control valve, into which low-noise trim has been incorporated. Model VDC____ can be changed to model VDN___ by changing the trim only.

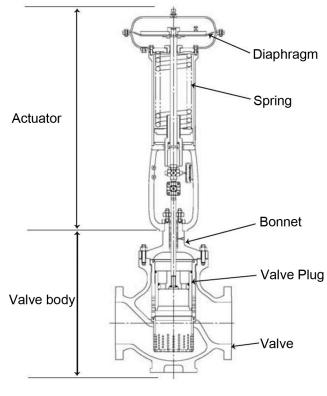


Figure1-2. Structure

Names and functions of the components are described below.

Name	Function
Valve body	Controls fluid flow. Connects to a pipe and contains all valve components.
Valve plug	· Regulates flow rate, pressure, etc. by changing the size of the flow area.
Valve	 The part through which the fluid flows. Connects to a pipe. The main component of the pressure vessel
Bonnet	· A component of the pressure vessel
Actuator	· Adjusts valve travel in accordance with the signal received.
Diaphragm	· Converts air pressure.
Spring	· Adjusts valve plug position.

For details on the structure of the valve body, refer to Figure 5-2. For details on the structure of the actuator, refer to Figure 6-1.

1-3 Specifications of the Control Valve

Since the control valve contacts the process fluid, its specifications must be appropriate for the process conditions and the purpose of use.

CAUTION
 The specifications of the control valve, such as the rated pressure and material of the valve body and trim material, are determined by the fluid conditions. Do not use the control valve for applications other than those for which it was designed. Failure to comply with this caution may result in burns or injuries due to high temperature or leakage of hazardous fluid.
 This control valve must be used in compliance with all applicable safety regulations,

specifications, and standards.

1-4 Dimensions and Weight

The dimensions and weight of model VDN___ are given in Appendix A, "Dimensions and Weight."

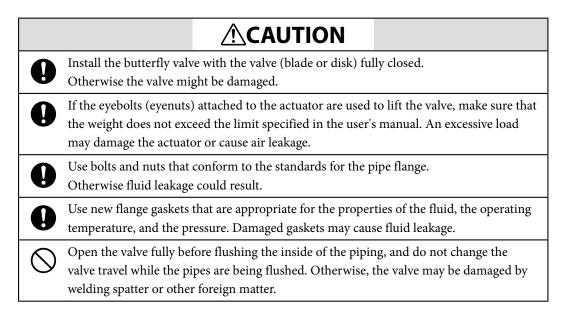
Refer to Appendix A when installing the valve or for other work.

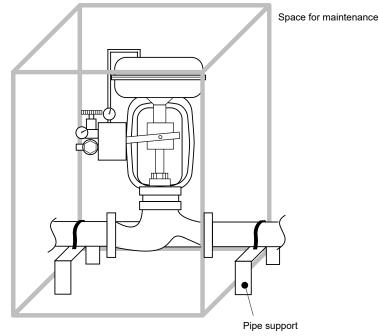
Chapter 2 Installation

2-1 Installation Location

Please observe the following cautions when selecting the installation site for the control valve.

	WARNING
0	If the rated pressure or standards for connection are ignored when this device is used, damage to the product or leakage may cause a serious accident.
\bigcirc	When connecting the valve to the piping, do not put your hand or foot under the valve or between flanges. You may lose your fingers or your foot may be injured.
0	Before reinstalling the valve after maintenance or modification, wash out any residual fluid in the pipes or replace it with a safe fluid. Otherwise, the residual fluid may cause an injury.
•	Make sure that there is a straight pipe section at least 10 times the pipe diameter on the upstream side and 6 times the pipe diameter on the downstream side. If the straight pipe sections are not long enough, insufficient valve capacity or unusual noise or vibration could result.
0	Install the valve in the correct direction, leaving clearance around the valve as much as possible for easy maintenance (piping, wiring, adjustment, etc.).
0	Provide appropriate support for the valve itself and for connected pipes to prevent an excessive load from the weight and operation of the valve. (Care is needed especially for large valves and valves for low-temperature fluid.)
0	If the valve is installed along a passageway used by outsiders, install a fence or cover as a protective measure.
\bigcirc	Do not install the valve where it may be submerged by rainwater, covered with snow, or subject to freezing. Otherwise the valve might be damaged.
0	If the valve is exposed to radiant heat, provide a shielding plate or the like. Failure to do so may result in damage to the actuator or auxiliary equipment.
0	If the valve is exposed to salt or a corrosive atmosphere, take measures against corrosion. Otherwise the valve might be damaged.
0	Check that there is no damage to the valve (including the actuator and auxiliary equipment).
0	Check that there is no damage to the flanges or welded piping. Otherwise fluid leakage could result.
0	If pipe flanges connected to the valve are being welded, the valve surface may also heat up. Do not touch the valve unnecessarily.
0	Chamfer the edges of the pipe flanges. Sharp edges can cause an injury.
0	Check that the pipes on both sides of the valve are firmly supported. Insufficient support may cause leakage from pipe connections.
0	After installation, check that the pipes are still properly aligned. Misalignment may cause fluid leakage from pipe connections.





The control valve is designed to withstand severe operating conditions. However, in order to achieve its optimal performance, install the valve to a location with the following conditions:

- Ambient temperature: -30 to +70 °C
- Relative humidity: 10 to 90 %
- Vibration: 2 G max. (5 to 400 Hz)

!Handling Precautions

• The vibration specification is for the AVP positioner mounted on the PSA actuator.

If the pressure regulator with air filter is mounted on this device, install this device on the piping so that the drain of the pressure regulator with air filter faces downward. If the pressure regulator with air filter cannot be vertical (if its drain does not face downward), remove it from this device.



Π

Rainwater may enter the pressure gauge, so install this device so that the gauge does not face upward or downward. Also, there is a rainwater drain hole at the bottom of the pressure gauge. The hole must be positioned facing downward.

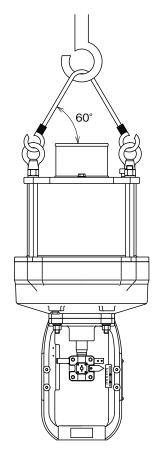
2-2 Inspection before Installation

Check the following before installing this device on the piping.

- 1. The specifications printed on the name plate are appropriate for the use.
- 2. There is no damage to the valve (including the actuator and auxiliary equipment).
- 3. There is no damage to the flanges on the piping.
- 4. If the eyebolts attached to the actuator are used to lift this control valve, make sure that the weight including accessories does not exceed the limit specified in Table 2-1. Max. weight for lifting with eyebolts.
- 5. If the eyebolts are used to lift the control valve, the angle between the actuator and the wire rope must be 60° or more.
- 6. The piping can support the weight of the control valve (refer to Table 2-1).

Actuator	Max. weight	Weight of actuator (without side handle)
PSA6R	600	210 (stroke: 100 mm)

Table 2-1. Max. weight for lifting with eyebolts





Lifting model VDN___

2-3 Installation on the Pipe

Standard Installation

Figure 2-2 illustrates standard installation.

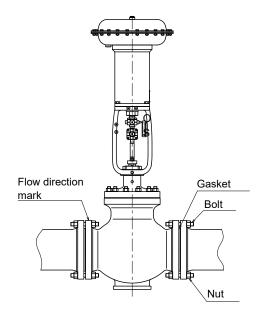


Figure 2-2. Installation on the pipe

Installation procedure

Step	Procedure	
1	Check that the flow direction of the process fluid is the same as the direction indicated on the control valve.	
2	Attach the valve and gaskets to the pipes. Loosely tighten the nuts of the flange bolts.	
3	Make sure that the gaskets do not protrude into the flow path and constrict the inner diameter of the valve.	
4	Tighten the bolts and nuts for the flanges evenly and securely in a diagonal pattern (refer to Figure 2-3).	
	Figure 2-3. Tightening in a diagonal pattern	
5	After installation is complete, check that all bolts and nuts are securely tightened and there is no leak from the piping.	

2-4 Air supply connection

See the user's manual for your positioner.

· Pneumatic single-acting valve positioner (model HTP): document No. OM2-8310-0200

• Electro-pneumatic single-acting valve positioner (model HEP): document No. OM2-8313-0100

Pneumatic single-acting valve positioner (model VPE): document No. OM2-8310-0410
Smart valve positioner

Model AVP300/301/302 (integral type), model AVP200/201/202 (remote type): document No. CM2-AVP300-2001

Model AVP701/702: document No. CM2-AVP702-2001

 \cdot Smart valve positioner (with fieldbus)

Model AVP703: document No. CM2-AVP703-2001

2-5 Inspection after Installation and Precautions for Operation

!Handling Precautions

- Check the air pipe connections for leakage before use.
- Make sure that the bolts and nuts of the diaphragm case, bonnet, etc., are firmly tightened.
- The temperature inside and outside the valve should be increased or decreased gradually (100 °C/h or less). Avoid operating the valve while the valve temperature is increasing or decreasing.
- When using the valve at low temperatures, gradually lower the temperature (50 °C/h or less)
- After applying pressure to the valve, check for leakage from the valve body, gland packing, and gaskets. It is especially important, if the process fluid temperature is 400 °C or higher, to tighten the nuts further after raising the temperature of the valve. By doing so, the valve will serve for a longer period without requiring maintenance. Use the torque indicated in Table 5-1to Table 5-3.
- For a valve with a lubricator, check whether the bonnet section has been lubricated or not. To do this, loosen the lubricator handle and turn the squeeze screw. If the squeeze screw turns lightly, replenish grease using the following procedure.

Grease replenishing procedure

- 1. Obtain grease of the type indicated on the nameplate.
- 2. Tightly close the lubricator handle.
- 3. Remove the squeeze screw, apply grease, and set the squeeze screw.
- 4. Loosen the lubricator handle and drive grease by turning the squeeze screw.
- 5. Repeat steps 2, 3, and 4 until turning of the squeeze screw becomes heavier. Tightly close the lubricator handle.

Chapter 3 Operation

3-1 Trial-Run Inspection and Adjustment

(1) Operation test

Send a 4–20 mA DC or other dummy signal (0 to 100 %) to the valve positioner or actuator to check that the rated travel is achieved.

Refer to Table 3-1 and if the allowable value is exceeded, adjust the valve positioner. For adjustment of the valve positioner, refer to the related user's manual on PG.

Positioner	Hysteresis	Linearity
HEP, HTP, AVP	Within 1 % FS	Within ±1 % FS

(2) Loop check

Send signals from the host control system, and check that signal wires are connected as specified and that the functional requirements for control are satisfied.

3-2 Use of the Side Handwheel

This section describes opening and closing the control valve with the side handwheel. If you need to use the side handwheel, refer to this section.

Precautions

If the handwheel is used when the equipment is running, make sure that manual opening/closing of the control valve does not affect the operation of the equipment.

Step	Procedure		
1	Remove the handle lock from the handwheel.		
2	Check the OPEN and SHUT arrows cast on the handwheel, and rotate the handwheel in the desired direction to open or close the valve.		
3	When the handwheel does not turn any further, stop trying to turn it and check the amount of valve travel.		
	CAUTION O Do not apply excessive force when the mechanical stop position of the control valve has been reached. Otherwise you may damage the valve stem. If the valve stops at an abnormal position, refer to Troubleshootingand take the necessary countermeasures.		
4	To resume automatic operation, turn the handwheel until the pointer on the side handle main unit reaches the AUTO position. Lock the handwheel, and resume automatic operation.		

<u>Procedure</u>

3-3 Use of the Top Handwheel

This section describes opening and closing the control valve with the top handwheel. If you need to use the top handwheel, refer to this section.

Precautions

If the handwheel is used when the equipment is running, make sure that manual opening/closing of the control valve does not affect the operation of the equipment.

Procedure

Step	Procedure		
1	Loosen the cross-shape locknut that holds the handwheel.		
2	Check the OPEN and SHUT arrows cast on the handwheel, and rotate the handwheel in the desired direction to open or close the valve.		
3	When the handwheel does not turn any further, stop trying to turn it and check the amount of valve travel.		
	CAUTION O Do not apply excessive force when the mechanical stop position of the control valve has been reached. Otherwise you may damage the valve stem. If the valve stops at an abnormal position, refer to Troubleshootingand take the necessary countermeasures.		
4	To resume automatic operation, lift the handle shaft fully (for direct-action models) or push down the handle shaft fully (for reverse-action models), tighten the locknut, and resume automatic operation.		

3-4 Troubleshooting

Problems that might occur during operation are described in Table 3-2. Control valve problem causes and countermeasures (continued from the previous page). Take necessary measures such as replacing parts, depending on the circumstances.

	Phenomenon	Cause	Countermeasure
	The valve hunts near the fully closed position.	The valve capacity is too large.	 Reduce the differential pressure between the inlet and outlet of the valve. Replace the valve trim with trim that has a smaller Cv.
		Reverse flow direction	• Check that the flow direction indicated on the valve is the same as the fluid direction. If not, change the direction.
Unreliable valve operation	Fluctuation in supply air pressure	Insufficient instrumentation air capacity of the equipment	 Increase the capacity of the compressor. Install an additional dedicated compressor.
valv		Failure of the air pressure regulator	\cdot Check the air pressure regulator.
/e opera	Hunting of signal pressure	The resistance or air volume of the control loop is not suitable.	 Insert an air volume tank or restrictor into the signal pressure line.
tion		Failure of the controller	· Check the controller.
	The valve hunts even though signals and supply air pressure are stable.	Hunting of the positioner circuit	 Check for wear of the positioner Check the positioner and pilot valve Reduce the sensitivity of the positioner
		Fluctuation in axial thrust due to changes in fluid pressure in pipes	 Reduce the differential pressure between the inlet and outlet of the valve. Replace the actuator with one that has more rigidity. Add a positioner.
Valı	The valve vibrates at any travel.	Insufficient support for the piping	· Support the inlet and outlet of the valve.
Valve vibration		There is a source of vibration around the valve.	· Remove the source of vibration.
		The guide is worn out.	· Replace the guide bushing and/or the valve plug.
Slow valve stroke	Valve stroke is slow in both opening and closing directions.	The valve plug guide, the fluid retaining part of the bonnet, etc., is clogged with slurry.	 Disassemble and clean. Install a steam jacket on the valve body.
		The gland packing is hardened.	· Replace the gland packing or the grease.

	Phenomenon	Cause	Countermeasure
	Supply air pressure is normal, but signal pressure does not increase	Leakage from the signal pipe	· Check the signal pipe (especially the fitting)
		Leakage from the diaphragm or damage to the diaphragm	· Replace the diaphragm.
		Leakage from the signal receiver of the positioner or damage to it	· Replace the bellows receiver and/or the diaphragm
		Failure of the controller	· Check the controller.
_	Signal pressure is normal, but supply air pressure	Clogging of the filter in the air pressure regulator	· Clean the filter.
Valve not operating	drops or air is not supplied	Leakage or clogging of the air pipe	\cdot Check the air pipe (especially the fitting)
t ope		Failure of the air pressure regulator	\cdot Check the air pressure regulator.
ratin	No positioner output	Failure of the positioner and pilot valve	\cdot Check the positioner and pilot valve.
Ũ		Leakage from the actuator diaphragm or damage to the diaphragm	· Replace the diaphragm.
	The valve does not operate even though air is supplied to the actuator	The valve stem, valve plug guide, etc., is stuck due to heat or foreign matter.	• Disassemble and inspect the valve body, and reprocess or replace the valve stem or guide bushing with new ones.
		Foreign matter is caught in the valve plug.	· Disassemble, inspect, and clean the valve body.
		The valve stem is bent.	· Repair the valve stem.
		Actuator failure	\cdot Check the operation of the actuator.
leakage	The valve stem is at the valve fully-open position.	The valve plug and/or the seat ring is corroded, eroded, abraded, or otherwise damaged.	 Lap the valve plug and seat Re-machine the valve plug and seat. Replace the valve plug or/and the seat ring (consider using hardened parts)
		Parts on the outer circumference of the seat ring (thread or gasket) are corroded or eroded.	 Replace the seat ring or the gasket. Use a different mounting method for the seat ring (e.g., welding).
		The fluid leaks from the partition of the valve body.	· Weld pinholes. · Replace the valve body.
e does r he valve	The valve stem does not reach the fully closed position.	The differential pressure of the fluid is too great.	 Reduce the differential pressure. Increase the output from the actuator.
Valve does not fully open / from the valve interior in large amounts		Foreign matter is caught in	· Disassemble, inspect, and clean the valve body.
		The valve stem, valve plug guide, etc., is stuck due to heat	• Separate these parts.

	Phenomenon	Cause	Countermeasure
	Fluid leaks from the gland packing.	Looseness of the gland packing or bolts	\cdot Tighten the gland packing or bolts.
		Grease depleted (for graphite yarn packing)	· Replenish the grease.
		The gland packing has deteriorated.	· Replace the gland packing (consider using a packing of a different material)
		The valve stem, interior of the packing box, etc., is damaged, corroded, or eroded.	 Disassemble and re-machine or replace parts. Attach a felt ring or rubber bellows to protect the valve stem (if there is a lot of foreign matter).
	The fluid leaks from the gasket.	The gasket is damaged, corroded, or eroded.	· Replace the gasket (consider using a gasket of a different material)
	The amount of valve travel or the control rangeability have narrowed	The valve characteristic has changed because the valve plug is corroded, eroded, or abraded.	•Replace the valve plug, seat ring, etc. (consider using parts of a different material for better corrosion-resistance and rigidity)

Table 3-2. Control valve problem causes and countermeasures (continued from the previous page)

Chapter 4 Maintenance

4-1 Inspection of the Control Valve

Check the control valve in accordance with the following instructions in order to maintain proper performance, prevent accidents, and detect problems early.

Daily inspection and periodic inspection (overhaul) must be carried out. When inspecting the valve, be sure to observe the instructions below.

Daily Inspection

The following items should be checked in daily inspections of the equipment.

<u>Checklist</u>

(1) Gland

Check for a fluid leak from the gland. If a leak is found, take necessary measures, referring to Troubleshooting.

(2) Flange connections

Check the flange between the valve body and the bonnet, and the flange between the valve body and the piping, for fluid leakage. If a leak is found, take necessary measures, referring to Troubleshooting.

(3) Control valve operation

Check for any abnormal operation such as hunting. If the valve is hunting, take necessary measures, referring to Troubleshooting.

(4) Abnormal noise or sound

Check that there is no abnormal sound or vibration from the device during operation. If any problem is found, take necessary measures, referring to Troubleshooting.

If fluid leakage from the valve is found, stay away from the valve until safety can be confirmed. Depending on the properties of the fluid, a serious accident or injury may result.

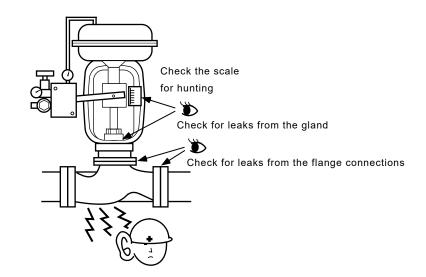


Check the gland daily for leakage.



Check valve operation daily for hunting.

Check that there is no abnormal sound or vibration from the device during operation.



Periodic Inspection

Disassemble the control valve once every two or three years. Replace consumables and repair or replace any parts that have deteriorated. When disassembling the valve, be sure to observe the instructions in Disassembly and Reassembly of the Control Valve.

Recording inspection results

Recording the results of periodic inspection on the following items is recommended. The records will be useful in estimating the remaining service life of the product, troubleshooting, identifying consumables that should be replaced, and in other various circumstances.

Precautions

- Before uninstalling the control valve from the equipment, check that removal of the valve will not affect the performance of the equipment.
- When disassembling the control valve, refer to "Precautions for disassembly" for each model and take necessary notes for reassembly of the valve.
- Before disassembling the control valve, send dummy inputs to the actuator or the positioner to check for any problems.

<u>Checklist</u>

(1) Appearance

Check the diaphragm case, waterproof cap, yoke, stem connector, bonnet, valve, bolts, nuts, and air piping for damage or corrosion, and check that all necessary parts are attached. In addition, check if the paint is worn out.

(2) Damage to stems

Check the valve stem and actuator stem for damage.

(3) Leakage from the valve body and bonnet connection

Check the connection between the valve body and the bonnet for any signs of leakage.

(4) Leakage from the gland

Check the gland for any signs of leakage.

(5) Damage to the valve plug or seat ring

Check the valve plug and cage-contacting surfaces for damage or deterioration, such as corrosion, which will cause a leak from the valve seat. If a problem is found, lap, re-machine, or replace the part.

(6) Damage to the guide caused by foreign matter

Check the guide for the valve plug and the guide in the bonnet for burrs, deformation, and

damage caused by foreign matter. If a problem is found, repair or replace the part.

(7) Scale in the valve

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Check the valve body, valve plug, the guide in the bonnet, the gland box, cage, etc., for scale. Remove any scale that has accumulated in the valve.

(8) Damage or corrosion on the inside of the gland box

Check the gland box for damage or deterioration, such as corrosion, which will cause a leak from the gland. If such problem is found, re-machine or replace the part.

(9) Damage or corrosion on the gasket-contacting surface

Check the gasket-contacting surfaces of the valve and bonnet for damage or deterioration, such as corrosion, which will cause a leak. If a problem is found, repair, re-machine, or replace the part.

Dispose of old parts that were replaced during valve disassembly or maintenance as industrial waste. If they are burned or discarded carelessly, environmental pollution will result.

4-2 Removing the Control Valve

This section provides instructions for removing the control valve from the equipment for a periodical inspection or other purposes.

Refer to the following instructions or cautions when removing the valve.

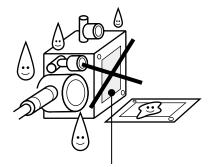
!Handling Precautions

- Allow enough space to work.
- Check that removal of the valve will not affect the performance of the equipment.
- Be sure to shut off the fluid in the piping and release the process pressure.
- Check that the temperature near the control valve is safe.
- Before removing the control valve from the equipment, remove all the bolts at pipe connections to avoid applying excessive force.

Removing the control valve

(1) Removing wires

Shut off all signals and power from electric equipment that is connected to the control valve, and remove the wires.



 Positioner

 Image: Caution

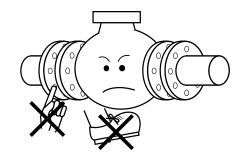
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(2) Removing air pipes

Shut off the air supply to the control valve with a stop valve, etc., and remove the air pipes. Seal the ends of the removed pipes with tape, etc. See Air supply connection.

(3) Removal from the piping

Secure the control value by slinging or by other means. Then, remove bolts and nuts from the flanges and detach the control value from the piping.



Do not use the eyebolts (eyenuts) attached to the actuator to lift the valve. Damage to the actuator or air leakage may result. Lift the valve by slinging the yoke of the actuator.

When connecting the valve to the piping, do not put your hand or foot under the valve or between flanges. You may lose your fingers or your foot may be injured.

Chapter 5 Disassembly and Reassembly of the Control Valve

This section gives instructions on disassembly and reassembly of the control valve. If you need to disassemble and reassemble the valve for periodic inspection, troubleshooting, or other circumstances, refer to the instructions.

5-1 Before Disassembly

- Allow enough space to work. If you disassemble several control valves at the same time, allow extra space to avoid mixing parts up.
- If you detach only the actuator, leaving the control valve on the piping, be sure to shut off the fluid in the piping and release the process pressure.
- Check that the temperature near the control valve is normal.
- Have all tools necessary for disassembly or detachment ready.
- Write down the information printed on the nameplate and the model No. of the positioner.

5-2 Necessary tools

A hammer, chisel, punch, open-end wrench or box wrench, special tools, compressed air source (390 kPa max.) to test the valve. Contact us for the special tools.

5-3 Removal of the Actuator from the Valve Body and Reassembly, and Changing the Orientation of the Actuator

Removal of the Actuator from the Valve Body and Reassembly <u>Disassembly procedure</u>

Step	Procedure		
1	 Detaching the air pipes Detach the air pipes, etc., from the actuator. 		
2	 Marking With the hammer and chisel or punch, place matching marks so that the actuator, valve body, and bonnet can be reassembled in the same positions. 		
3	Detaching the stem connector Apply air pressure to the actuator so that the pointer indicates about 10 to 20 % above the fully closed position, and maintain that pressure. Loosen the hex bolts that hold the stem connector, remove the stem connector, and detach the actuator stem from the valve stem.		
4	 Removing the accessories Remove accessories such as the positioner and limit switch. Protect the air supply and air output connections of the removed positioner with plastic tape, etc. 		
5	Removing the actuator from the valve body With the hammer and chisel, loosen and remove the nuts that hold the yoke. Lift and remove the actuator from the valve body.		

Note 1: Before disassembling a control valve that is installed on the piping, be sure to shut off the fluid in the piping and release the process pressure.

Assembly procedure

Step	Procedure
1	 Mounting the actuator on the valve body Mount the actuator on the valve body, aligning the matching marks. Tighten the nuts that hold the yoke to secure the actuator in place.
2	 Attaching the accessories Attach the accessories such as the positioner and limit switch.
3	■ Attaching the stem connector Apply air pressure to the actuator and adjust the position of the actuator stem, and temporarily attach the stem connector. Make adjustment so that the threads on the actuator stem and valve stem fit properly into the threads on the stem connector. (Be careful not to rotate the valve stem during adjustment.) Firmly tighten the hex bolts on the stem connector.
4	 Attaching the air pipes Attach the air pipes, etc., to the actuator.
5	 Readjusting the positioner Readjust the positioner (for the AVP, use the auto setup function).

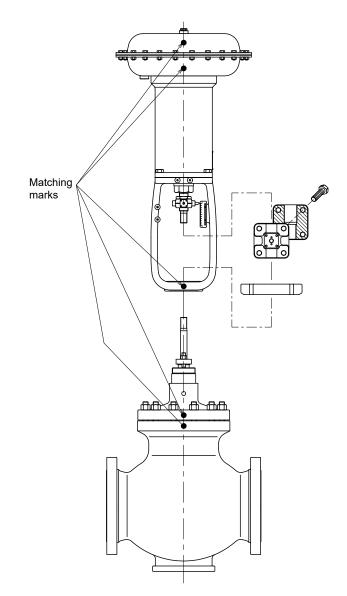
Procedure for Changing the Mounting Orientation of the Actuator



Note that the specification for leakage from the valve seat cannot be guaranteed if the mounting orientation of the actuator is changed by anyone other than our service personnel.

Procedure

Step	Procedure
1	Remove the actuator from the valve body by using the disassembly procedure in Removal of the Actuator from the Valve Body and Reassembly.
2	Rotate the actuator to the desired position, paying attention not to rotate the valve stem.
3	Assemble the valve body and the actuator by using the assembly procedure in Removal of the Actuator from the Valve Body and Reassembly.





5-4 Disassembling the Valve Body

Precautions for disassembly

- Disassemble the valve body on a rag, etc., to avoid damaging the valve.
- After disassembling the valve body, protect the gasket-contacting surfaces, the valve plugcontacting surfaces, sliding areas, cage, etc., with a rag or the like.

Dispose of old parts that were replaced during valve disassembly or maintenance as industrial waste. If they are burned or discarded carelessly, environmental pollution will result.

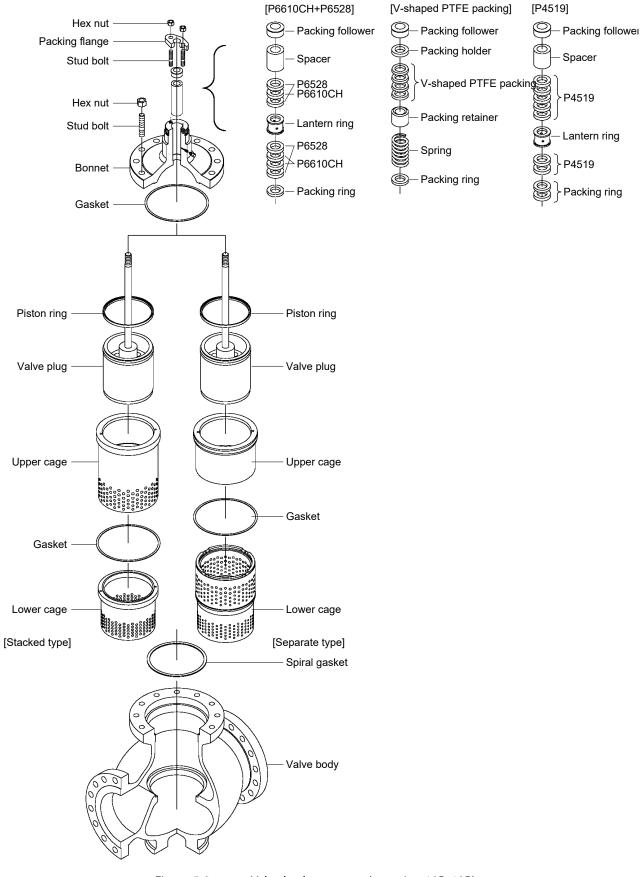
Disassembly procedure

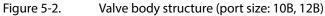
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Disassemble the control valve, referring to Figure 5-2 "Valve body structure."

(1) Detaching the bonnet from the valve

Step	Procedure	
1	Loosen the nuts for the packing flange.	
2	With the open-end wrench or box wrench, loosen the hex nuts that hold the bonnet to the valve.	
3	Check if the pressure in the valve has been released completely. Remove the nuts.	
4	Remove the bonnet from the valve. Be sure to lift the bonnet slowly and vertically by, for example, using a lifting tool, so that the valve stem does not move to the side. If the valve plug comes off along with the bonnet, tap the plug lightly with a plastic hammer so that the seat of the valve plug and cage is not damaged, and slide it off from the bonnet by its own weight.	
5	Remove the gasket between the valve and the bonnet. WARNING	
	Before disassembling the valve body, check that the pressure in the valve has dropped to atmospheric pressure. If fluid spews out, injury may result.	
	Before disassembling the valve body, wash out the inside the valve or replace the fluid. Otherwise, the residual fluid in the pipe may cause an injury.	





(2) Removing the trim

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Step	Procedure
1	Remove the valve plug.
2	For a valve with stacked cages, take out the cages, the lower gasket, and then the spiral gasket from the valve body. The cages are not screwed into the valve body, so pull them out straight up. To lift the cages, use the screw holes on the top. (See the table below for the screw hole size.) For a valve with separate cages, remove the upper cage and then the lower gasket. To remove the lower cage, which is screwed into the valve body, use a special tool for cage disassembly. For a valve with separate cages, there is no spiral gasket.

Valve stem size	Screw hole
10B	M8
12B	M10
The same for stacked and separate	
	cages

(3) Taking out the gland parts

Take out the gland parts with a pipe, etc. Take notes of the type, quantity, order, etc., of parts such as the packing and spacers in order to facilitate reassembly.

Use the special seat ring wrench to remove the trim (internal valve). Otherwise, the trim may be damaged.

5-5 Reassembling the Valve Body

Precautions

- Check that there is no problem with the parts, referring to the checklist in Periodic Inspection. If a problem is found, repair or replace the part as needed.
- Always use new gland packing and gaskets.
- Note that the quantity, stacking order and direction of packing differs depending on the type of packing and fluid conditions.
- Check that foreign matter produced by maintenance do not remain inside the valve.
- For washing-restricted models (e.g., degreased or waterproof models), additional materials and sealing material with special specifications are required. Please refer to the specifications.

Assembly procedure

Assemble in the reverse of the disassembly order. Check the nominal diameter of the pipe connection of the control valve, and reassemble the valve referring to Figure 5-2 "Valve body structure."

(1) Mounting the cages

Step	Procedure	
1	For a model with standard specifications, apply an agent to prevent galling ^{*1} to the screws and between the valve body and the lower cage. For a degreased model, do not apply grease.	
2	Attach the spiral gasket. CAUTION Do not reuse the removed spiral gasket.	
3	Place the special tool on the valve, and screw the lower cage into the valve to the torque specified in Table 5-1.	
4	Apply a thin layer of anti-galling agent on the gasket and insert it into the valve body.	

*1. Use Never-Seez made by the U.S. company Bostik or the equivalent.

[Torque unit: N•m]

Port size (inches)	Lower cage tightening torque
10	1372 to 1568
12	2254 to 2646

Table 5-1.

Lower cage tightening torque

			[Torque unit: N•m]
Port size (inches)	re (inches) Pressure rating Tighte		Tightening	
	Class 150	Class 300	Class 600	torque
	JIS10K	JIS20/30K	JIS40K	(N•m)
10	M24	M24	M30	392 to 441
12	M24	M24	M33	392 to 441

Table 5-2. Bonnet hex nut tightening torque

[Torque unit: N•m]

Valve stem size	P4519	V-shaped PTFE* packing tightening torque	Graphite packing
φ30	60 to 72	4	36.2
φ40		1	26.1

*Polytetrafluoroethylene

Note: The torque may vary depending on the type of packing. Use the indicated torque as a rough guideline.

Table 5-3.Packing flange hex nut tightening torque

(2) Lap the contacting surfaces

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Step	Procedure	
1	Put an old gasket in place on the valve and set the upper cage.	
2	Apply a small amount of compound to the surface of the seat ring where the valve plug makes contact.	
3	Insert the valve plug into the upper cage, then press and turn the plug gently onto the seat to lap it (if you attach the stem connector to the top of the valve plug, you can use it as a knob). Check that there are no fine scratches, etc., on the surface.	
4	When lapping is complete, wipe off the compound. Remove the stem connector and old gasket.	

Lap the contacting surfaces of the valve plug and the cage.

(3) Assembling the valve plug and bonnet

Step	Procedure		
1	Insert the plug into the cage.		
2	Insert the valve plug into the bonnet, then place the bonnet on the valve. Be sure to align the matching marks, which were placed before disassembly, in order to set the bonnet in the right position.		
3	Apply an agent for preventing galling ^{*1} to the threads of the stud bolts. Mount the bonnet on the valve and tighten the nuts using a wrench. Be sure to tighten the nuts evenly in a diagonal pattern to prevent uneven compression of the bonnet and to keep the valve stem centered.		
4	When done, all the nuts should be tightened to the torque specified in Table 5-2.		
	When reassembling the valve body, always use new packing and gaskets. The reuse of old parts will cause fluid leakage.		
	Observe the tightening torques indicated in this user's manual when tightening bolts and nuts. Damaged or corroded bolts and nuts may damage the valve and cause injury, so they should be replaced with new ones.		
	Tighten the nuts for connecting the bonnet to the valve evenly in a diagonal pattern.		

*1. For a model of standard specifications, use Never-Seez made by the American company Bostik or the equivalent. For a degreased model, use GPL 207 made by Krytox or the equivalent.

(4) Assembling the gland

Step	Procedure					
1	Insert the parts of the gland in the right order, referring to the notes that were taken during disassembly and to the figure in Figure 5-2, which illustrates the structure of the gland. Insert the parts all the way to the bottom with a pipe, etc. If PTFE yarn packing is used, insert it with the cut part of the packing shifted by 180°.					
2	Check that the O-ring (optional part) for the packing follower is inside the gland box. If extra parts are inserted or an incorrect amount of packing is inserted, the packing follower and packing flange will not be in the right place.					
3	Apply an agent for preventing galling ^{*1} to the stud bolts and nuts for tightening the packing flange. Tighten the packing flange with the stud bolts and nuts. The stud nuts should be tightened to the torque specified in Table 5-3.					
	MARNING					
	Observe the tightening torques indicated in this user's manual when tightening bolts and nuts. Damaged or corroded bolts and nuts may damage the valve and cause injury, so they should be replaced with new ones.					

*1. Use Never-Seez made by the U.S. company Bostik or the equivalent.

Chapter 6 Disassembly and Reassembly of the Spring Type Diaphragm Actuator (Model VA5)

Precautions for disassembly

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- Place the removed parts in a clean place.
- Stand the actuator up vertically during disassembly.
- For actuators that are equipped with a side handlheel, refer to Removing the Side Handwheel from the Actuator.
- Release the air in the diaphragm case before disassembly.



Do not disassemble the pneumatic actuator while supply air pressure is being applied.

The compressed air may cause an injury.

Dispose of old parts that were replaced during valve disassembly or maintenance as industrial waste. If they are burned or discarded carelessly, environmental pollution will result.

Disassembly procedure

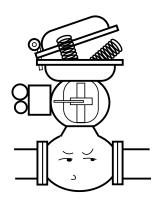
Check the size of the actuator and disassemble it, referring to Figure 6-1.

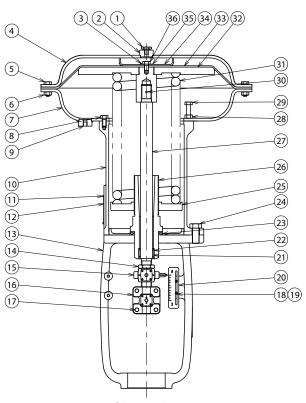
(1) Marking and parts protection

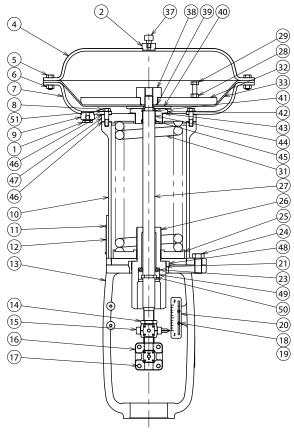
Step	Procedure
1	Place matching marks on the upper and lower diaphragm case and on the boss of the yoke for remounting the case.
2	Wrap plastic tape around the threads of the rod to protect the sealing parts and the bushing.

(2) Removing bolts and nuts from the diaphragm case

Step	Procedure				
1	For a direct-action actuator, remove the stem connector, pointer, and locknut.				
2	Turn the spring adjuster left or right to reduce the amount of spring tightening to zero.				
3	Remove the bolts from the upper diaphragm case				
	CAUTION For disassembly of an actuator that contains springs, follow the disassembly procedure when removing bolts, nuts, etc. Otherwise,				
	the springs may jump out, causing injury.				







Direct action

Reverse	action
11010150	action

No.	Part name	No.	Part name	No.	Part name
1	Pipe bushing	18	Truss head screw	35	Washer
2	Pipe boss	19	Speed nut	36	Hexagon head bolt
3	Cross recessed self-tapping screw	20	Scale	37	Rain cap
4	Upper diaphragm case	21	Tape liner	38	Nut
5	Hexagon head bolt	22	Guide bushing	39	O-ring
6	Hexagon nut	23	Thrust bearing	40	Plate
7	Lower diaphragm case	24	Hexagon head bolt	41	O-ring
8	Hexagon head bolt	25	Spring flange	42	O-ring nut
9	Pipe boss	26	Spring adjuster	43	Gasket
10	Spring case	27	Actuator stem	44	Tape liner
11	Drive screw	28	Hexagon nut	45	Rod seal
12	Nameplate	29	Hexagon head bolt	46	Gasket
13	Yoke	30	Taper pin	47	Reverse ring
14	Locknut	31	Spring	48	Guide
15	Pointer	32	Diaphragm plate	49	Ring
16	Stem connector	33	Diaphragm sheet	50	Split ring
17	Hexagon head bolt	34	Stopper	51	Washer

Figure 6-1. Structure

Structure of the actuator (model: VA5)

(3) Removing the upper diaphragm case and the diaphragm unit

Step	Procedure
1	Remove the upper diaphragm case.
2	For direct-action actuators, remove the stopper, and then remove parts in the following order: diaphragm sheet, diaphragm plate, springs, spring case, spring adjuster (including spring flange), and bearing. For reverse-action actuators, remove parts in the following order: diaphragm plate, springs, and diaphragm unit. When removing the diaphragm unit, pull out the rod along with it.

6-1 Assembly of the VA5 Actuator

Precautions

- Check that there is no problem with the parts, referring to the checklist in "Periodic Inspection" on page 17. If any damage is found, repair or replace the parts as needed.
- • Always use a new O-ring, tape liner, and rod seal.
- Before starting assembly, check the inside of the diaphragm case to make sure there is no foreign matter produced by maintenance.
 For mounting of the side handwheel on the actuator after assembly of the actuator, refer to Mounting the Actuator on the Valve Body.
- • Assemble the actuator to the tightening torques indicated in Table 6-1.

Assembly procedure for direct-action actuators

Check the size of the actuator and assemble it, referring to Figure 6-1.

(1) Mounting the spring adjuster and springs

Step	Procedure
1	Attach the tape liner to the guide bushing of the spring adjuster.
2	Grease the thrust bearing and mount it in the spring adjuster.
3	Apply Never-Seez to the threads of the spring adjuster and screw it deeply into the spring flange.
4	Insert the spring adjuster into the spring case.
5	Insert the springs into the spring case.

(2) Assembling the actuator stem

Step	Procedure
1	Grease the sliding part of the actuator stem.
2	Insert the actuator stem into the spring case.
3	Screw the pointer onto the thread of the actuator stem all the way, and secure it with the locknut.

(3) Mounting the diaphragm plate

Step	Procedure				
1	Place the diaphragm sheet and stopper on the diaphragm plate.				
2	Apply Never-Seez [*] to the thread of the hex bolts, insert the bolts to the bolt holes in the diaphragm plate, and tighten the bolts.				
	Be careful not to get grease on the contact surfaces of the diaphragm sheet and diaphragm plate.				
3	Align the bolt holes in the lower diaphragm case with those in the diaphragm sheet, and temporarily tighten the four bolts in a diagonal pattern. Check that the pointer of the actuator stem faces the scale, and tighten the hex bolts.				

* Use Never-Seez made by Bostik, Inc., or the equivalent.

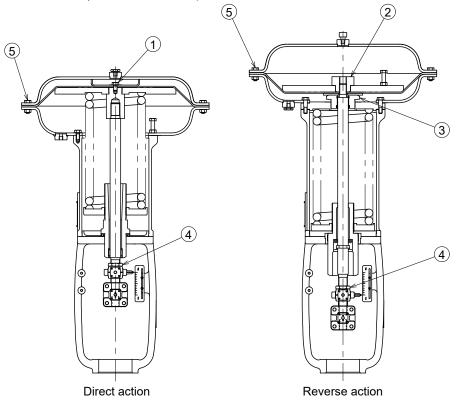


Figure 6-2. Threaded parts to tighten (on the VA5 actuator)

Part name	Material	VA5 tightening torque			
		Screw	Direct action	Reverse action	
(1) Diaphragm hex bolt	\$20C	M12	43 to 53	_	
(2) Diaphragm nut	\$20C	M30 (LIFT100)	_	275 to 333	
(3) O-ring nut	_	_	_	425 to 520	
(4) Locknut	\$20C	M40	471 to 559		
(5)Diaphragm case nut, eyenut	\$30C	M12	30 to 34		

Table 6-1. Tightening torque for the actuator

(4) Mounting the upper diaphragm case

Step	Procedure
1	Set the upper diaphragm case in place. Check that the matching marks that were made before disassembly are aligned.
2	Apply Never-Seez to the hex bolts and nuts, and use them to attach the upper and lower diaphragm cases.
3	Tighten the screws evenly in a diagonal pattern.

(5) Inspection after reassembly

Step	Procedure
1	Apply air at a pressure of 490 kPa to the diaphragm case through the air pipe connection port of the case. Using soapy water, check the exterior of the diaphragm case (for direct-action models) or the exterior of the rod (for reverse-action models) for air leakage.
2	Change the air pressure within the supply air pressure specified for the actuator to check that the valve moves smoothly for all openings, and that the spring range for a valve opening is the same as the range printed on the nameplate.

Assembly procedure for reverse-action actuators

Check the size of the actuator and assemble it, referring to Figure 6-1.

(1) Mounting the actuator stem and springs

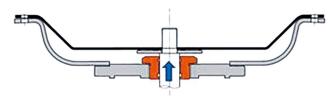
Step	Procedure
1	Apply Never-Seez to the threads of the spring adjuster and screw it deeply into the spring flange.
2	Put the ring on the actuator stem from the stem connector side.
3	Set the split rings in the groove of the stem, and cover them with the ring.
4	Place the thrust bearing tightly against the ring.
5	Put the spring adjuster on the actuator stem from the thrust bearing side.
6	Attach the tape liner to the guide bush.
7	Grease the spring adjuster and attach it to the spring case.
8	Insert the springs into the spring case from the top of the case. Check that the springs are securely set in the groove of the spring case.

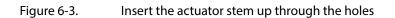
(2) Mounting the lower diaphragm case

Step	Procedure
1	Grease the O-ring and rod seal, and attach them to the reverse ring.
2	Apply a thin layer of grease on the gaskets, and mount a gasket, the reverse ring, a gasket, and the lower diaphragm case in that order on the spring case.
3	Apply a thin layer of grease on the washers, and tighten the bolts evenly in a diagonal pattern.

(3) Mounting the diaphragm sheet and diaphragm plate

Step	Procedure
1	Place the plate, diaphragm sheet, diaphragm plate, and O-ring in that order on the lower diaphragm case. Lift the actuator stem and pass the threaded part of the stem through the hole in the center of the above items (see Figure 6-3).
	Be careful not to get grease on the contact surfaces of the diaphragm sheet and diaphragm plate.
2	Check that the pointer of the actuator stem faces the scale, and tighten the hex bolts.





(4) Mounting the upper diaphragm case

Step	Procedure
1	Set the upper diaphragm case in place. Check that the matching marks that were made before disassembly are aligned.
2	Apply Never-Seez to the hex bolts and nuts, and use them to attach the upper and lower diaphragm cases.
3	Tighten the screws evenly in a diagonal pattern.
4	Attach the rain cap.
5	Screw the pointer onto the thread of the actuator stem all the way, and secure it with the locknut.

(5) Inspection after reassembly

Step	Procedure
1	Apply air at a pressure of 490 kPa to the diaphragm case through the air pipe connection port of the case. Using soapy water, check the exterior of the diaphragm case (for direct operation models) or the exterior of the rod (for reverse operation models) for air leakage.
2	Change the air pressure within the supply air pressure specified for the actuator to check that the valve moves smoothly for all openings, and that the spring range for a valve opening is the same as the range printed on the nameplate.

Adjustment of the VA5 actuator

Adjustment procedure

The procedure for adjusting the stroke and spring range of the VA5 actuator is explained below.

Step	Procedure
1	Apply the maximum air pressure of the spring range to the VA5. Check that the end of the stem is in the required position.
2	If the bottom of the stem is in a different position, release the air and rotate the spring adjuster. (To loosen the springs, rotate the spring adjuster clockwise as seen when viewing the diaphragm sheet from below.)
3	Loosen the setscrew on the scale, and align the pointer with the valve closed position on the scale.

Mounting the Actuator on the Valve Body

Mounting procedure

In addition to the following instructions, refer to Figure 6-1.

(1) Mounting the actuator

Step	Procedure
1	Apply an anti-galling agent*1 to the connections of the bonnet, yoke, and the yoke nut.
2	Place the actuator and yoke nut on the valve body. Rotate the actuator so that the matching marks that were placed before disassembly are aligned.
3	Tighten the yoke nut by hand. Tighten the yoke nut firmly with a hammer and chisel.

*1. Use Never-Seez made by the U.S. company Bostik or the equivalent.

(2) Attaching the stem connector

• For direct-action actuators

Step	Procedure
1	Push the valve plug down to set it on the seat.
2	Check the spring range indicated on the nameplate and apply the upper-limit air pressure to the actuator.
3	Further increase the pressure to the supply air pressure.
4	Reduce the air pressure slightly and set the air pressure to the spring range upper limit again. In this state, temporarily connect the actuator stem and the valve stem with the stem connector.
5	Decrease the air pressure until the valve travel is several percent. In this state, tighten the hex bolts of the stem connector.

• For reverse-action actuators

Step	Procedure
1	Push the valve plug down to set it on the seat.
2	Check the spring range indicated on the nameplate and apply the lower-limit air pressure to the actuator.
3	Further decrease the air pressure and check that the actuator stem moves several mm in response.
4	Increase the air pressure slightly, and then lower the air pressure to the spring range lower limit. In this state, temporarily connect the actuator stem and the valve stem with the stem connector.
5	Increase the air pressure until the valve travel is several percent. In this state, tighten the hex bolts of the stem connector.
	When attaching the stem connector, make sure that the threads of both stems are equally covered by the connector.

(3) Attaching the accessories

Attach the accessories in their original position.

(4) Inspection after reassembly

Send the specified control signals and air pressure to the positioner or the actuator. Check the air pipes and their joints for leakage.

· Change the control signal to check if the valve operates properly in accordance with the signal.

 \cdot Check seat leakage to confirm that the performance meets the specification.

•Carry out a pressure shell test for the valve body to confirm that fluid does not leak from between the valve and bonnet and from the gland.

•For models with a handwheel, turn the handwheel to check that the valve opens and closes smoothly. Then, turn the handwheel so that the pointer indicates AUTO, and check that the valve opens and closes smoothly in accordance with input signals.

Removing the Side Handwheel from the Actuator

Removal procedure

Check the size of the actuator and remove the side handwheel from the actuator, referring to Figure 6-4.

(1) Before removal

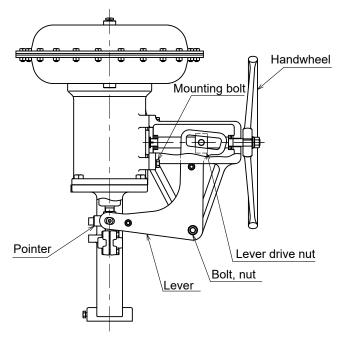
Check that the pointer on the side handwheel main unit indicates AUTO.

(2) Removal from the actuator stem

Loosen the bolt that connects the levers to each other and remove the levers from the pointer (or from the lever mounting nut).

(3) Removal from the actuator

Remove the bolts that connect the yoke to the side handwheel main unit, and remove the side handwheel from the actuator.





Side handwheel structure

Disassembly of the Side Handwheel

Disassembly procedure

Check the size of the actuator and disassemble the side handwheel, referring to Figure 6-4.

Step	Procedure
1	Check that the pointer on the side handwheel main unit is in the AUTO position.
	Remove the side handwheel from the actuator.
2	Loosen the bolt that connects the levers to each other and remove the levers from the
	pointer (or from the lever mounting nut).
3	Remove the locknut from the handwheel and detach the handwheel.
4	Tap the shaft toward the side handwheel main unit with a plastic hammer, etc., to
	remove it from the main unit.
5	Remove the retaining ring (a special tool is required) and the bearing.

Assembly of the Side Handwheel

Assembly procedure

Assemble it in the reverse order of disassembly.

Mounting the Side Handwheel on the VA5 Actuator

Step	Procedure
1	Turn the handwheel so that the pointer on the lever drive nut indicates AUTO.
2	Loosen the bolts and nuts on the levers to widen the space between the levers.
3	Attach the side handwheel main unit to the actuator tightly with the bolt.
4	Hook the boss on the stem connector into the holes near the front of the lever, and at the same time hook the boss of the lever drive nut into the holes near the other front edge of the lever.
5	Secure the lever with the bolts and nuts to complete assembly.
6	Rotate the handwheel to check for smooth operation of the control valve.
7	Before starting automatic operation of the control valve on the equipment, set the pointer on the side handwheel main unit to the AUTO position and lock the handwheel with the handle lock.

Disassembling the top handwheel of the VA actuator

Disassembly procedure

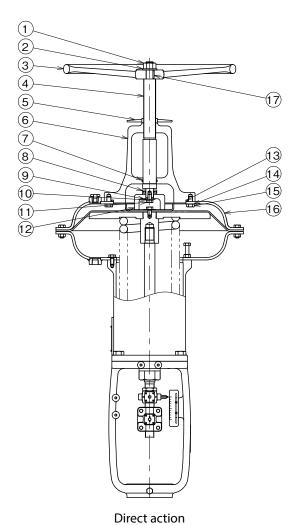
Check the size of the actuator and disassemble the top handwheel, referring to Figure 6-5.

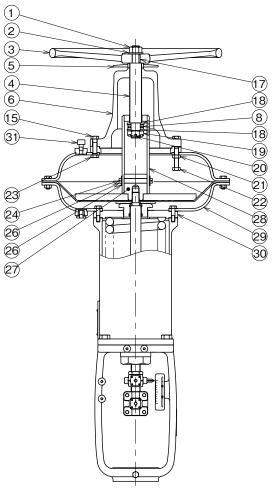
• For direct-action actuators

Step	Procedure
1	Remove the air pipes and accessories.
2	Turn the spring adjuster clockwise to loosen the springs.
3	Remove the upper diaphragm case.
4	Screw in the screw shaft and remove the handwheel and the locknut. Screw in the
	shaft further to remove it from the housing.
5	Remove the O-ring.

• For reverse-action actuators

Step	Procedure		
1	Remove the air pipes and turn the spring adjuster clockwise to loosen the springs.		
2	Remove the hex nut, handwheel, and locknut.		
3	Loosen the housing mounting bolts and remove the housing.		
4	Remove the upper diaphragm case.		
5	Pull out the cotter pin and remove the parallel pin.		
6	Pull out the cotter pin and remove the grooved nut.		
7	Remove the bearing washer and bearing.		





Reverse action

No.	Part name	No.	Part name	No.	Part name
1	Hex nut	11	O-ring hex bolt	21	Hex nut
2	Washer	12	Spring holder	22	Hex bolt
3	Handwheel	13	O-ring	23	Hex bolt
4	Screw shaft	14	Gasket	24	Cotter pin
5	Locknut	15	Hex bolt	25	Parallel pin
6	Housing	16	Upper diaphragm case	26	Washer
7	O-ring	17	Кеу	27	Connection
8	Bearing	18	Bearing washer	28	Bearing case
9	Holding plate	19	Grooved nut	29	Lower diaphragm case
10	Spring washer	20	Cotter pin	30	Ring adapter
				31	Rain cap

Figure 6-5.

Structure of the actuator with top handwheel (model: VA5)

Assembling the top handlwheel of the VA actuator

Assembly procedure

Assemble it in the reverse order of disassembly.

For an actuator that incorporates springs, be sure to follow the assembly procedure when attaching bolts and nuts. Otherwise, malfunction may result.



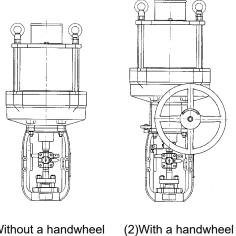
Keep the O-ring and O-ring groove clean and apply a small amount of silicone grease.

Disassembly and Reassembly of the Spring Chapter 7 **Type Piston Cylinder (Model PSA6)**

Overview 7-1

Structure

This actuator consists of a cylinder, a spring unit, a lift stopper, a spring holder, hex staybolts, a yoke, a handwheel, a positioner (if needed), and other accessory devices. For an external view of the actuator, refer to Figure 7-1. Exterior of PSA6R.



(1)Without a handwheel

Figure 7-1. Exterior of PSA6R

Mounting on the Valve Body

Mount the yoke on the valve body with the assembly nuts that are supplied with the valve body. Connect the actuator rod and the valve stem with the stem connector.

Air piping

When using the PSA6 as part of a control valve, install a single-acting positioner and connect the air piping to it.

For details on single-acting positioners, refer to the user's manuals below.

- Pneumatic single-acting valve positioner (model HTP): document No. OM2-8310-0200
- · Electro-pneumatic single-acting valve positioner (model HEP): document No. OM2-8313-0100

· Smart valve positioner Model AVP300/301/302 (integral type), model AVP200/201/202 (remote type) : document No. CM2-AVP300-2001

Model AVP701/702: document No. CM2-AVP702-2001

· Smart valve positioner (with fieldbus) Model AVP703: document No. CM2-AVP703-2001

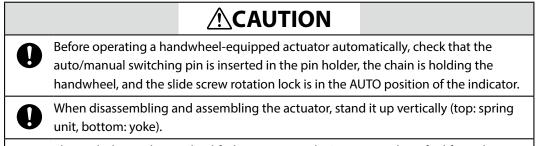
Calibration

This actuator does not need calibration.

When connecting the valve stem of the valve body and the actuator rod with the stem connector, adjust so that the valve plug contacts the seat ring when the valve is fully closed. Next, loosen the screws on the actuator scale and position the scale so that the pointer indicates the correct position in accordance with the valve stroke.

Then, adjust the single-acting positioner, referring to its user's manual.

Cautions on operation and handling



The eyebolts can be used to lift the actuator only. Do not use them for lifting the actuator when it is still mounted on the valve body. Doing so is dangerous.

7-2 Auto/Manual Switching Method

Refer to Figure 7-2. Auto/manual switching mechanism.

For a handwheel-equipped actuator, automatic operation that uses input signals and manual operation that uses the handwheel can be switched.

Auto/manual can be switched at any valve travel during operation.

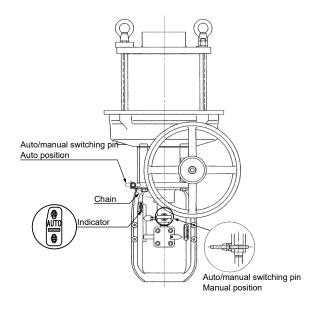


Figure 7-2. Auto/manual switching mechanism



Figure 7-3.

Operation instruction label

Step	Procedure				
1	Pull the auto/manual switching pin out of its holder, and disengage the chain that holds the handwheel.				
2	Check Figure 7-3. Operation instruction labelon the handwheel, and turn the handwheel in the SHUT direction to lower the slide screw.				
3	Align the round hole in the slide screw with the round hole in the actuator rod, insert the switching pin all the way in, and turn the pin to fix it in place.				
4	Check the OPEN and SHUT arrows shown on the operation instruction label, and rotate the handwheel in the desired direction in order to open or close the valve. The turning torque should be 127 N (13 kgf) or less.				
5 When the handwheel does not turn any further, stop trying to turn it amount of valve travel.					
	 Do not apply excessive force when the mechanical stop position of the control valve has been reached. Otherwise you may damage the valve stem. If the valve stops at an abnormal position, refer to Troubleshootingand take the necessary countermeasures. 				
6	To resume automatic operation, remove the switching pin and turn the handwheel until the slide screw rotation lock reaches the AUTO position of the indicator (see the figure below). Run the chain attached to the pin through the handwheel in order to restrict its movement, and then set the pin into its holder. After checking the position of these parts, resume automatic operation.				
	Figure 7-4.				

7-3 Disassembly and Reassembly of the Actuator

This section gives instructions on disassembly and reassembly of the actuator. If you need to disassemble and reassemble the valve for periodic inspection, troubleshooting, or other circumstances, refer to the instructions.

Disassembly of the Actuator

Disassembly procedure

This section describes the procedure for disassembling the actuator. In addition to the following instructions, refer to Figure 7-5and Figure 7-6.

(1) Marking and parts protection

Step	Procedure				
1	Place matching marks on the spring holder at the top of the actuator and lift stopper, cylinder, and yoke boss for cylinder assembly.				
2	Wrap plastic tape around the threads of the rod to protect the sealing parts and the guide bushing.				

(2) Removing the slide screw rotation lock

Step	Procedure
1	Remove the hex bolt (No. 50) and hex nut (No. 51) that hold the slide screw rotation lock (No. 49).
2	Remove the slide screw rotation lock (No. 49).

(3) Removing the spring holder

Step	Procedure			
1	Loosen and remove the hex nuts (No. 2) and eyenuts (No.1) at the top of the actuator.			
2	Lift the spring holder (No. 17) straight up to remove it.			

(4) Removing the lift stopper and spring unit

Step	Procedure			
1	Loosen and remove the long and short hex staybolts, Nos. 4 and 9 (two each) that connect the lift stopper (No. 20) and the cylinder (No. 21).			
2	ift the lift stopper (No. 20) straight up to remove it.			
3	Attach eyebolts to the screw holes (M12 \times 2) of the spring flange (No. 59) at the top of the spring unit, and lift the spring unit (about 120 kg) upward with a crane.			
4	At this point, remove the tape liner (No. 7) and O-ring (No. 8) that seal the piston (No. 57).			

(5) Removing the slide screw and cylinder

Step	Procedure			
1	Turn and pull out the slide screw (No. 34) by hand from the bottom.			
2	Loosen and remove the four hex bolts (No. 12) that connect the cylinder (No. 21) and the handwheel.			
3	Lift the cylinder (No. 21) straight up to remove it.			

(6) Removing the worm wheel unit

Step	Procedure				
1	Remove the bearing holder (No. 31), upper single-column angular bearing (No. 32), worm wheel (No. 33), lower single-column angular bearing (No. 32) in that order.				
2	Loosen and remove the four hex bolts (No. 12) that connect the gear case (No. 30) and the yoke (No. 29).				

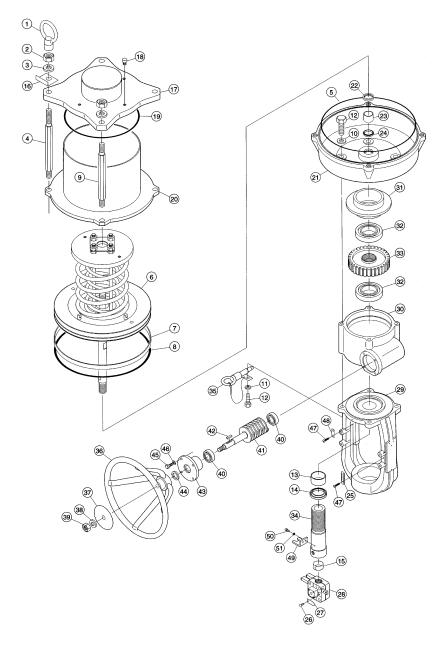
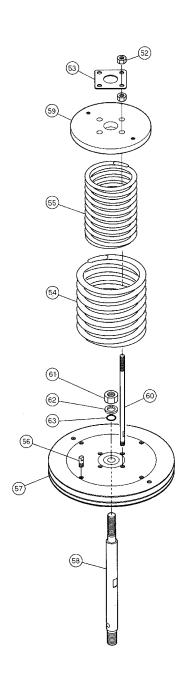


Figure 7-5. Structure of the PSA6R



No.	Part name	No	э.	Part name
1	Eyenut	33	3	Worm wheel
2	Hex nut	34	4	Slide screw
3	Spring washer	35	5	Lock pin
4	Long hex staybolt	36	5	Handwheel
5	O-ring	37	7	Operation instruction label
6	Piston unit	38	3	Spring washer
7	Tape liner	39	9	Locknut
8	O-ring	40)	Single-column angular bearing
9	Short hex staybolt	4	1	Worm shaft
10	Sealing washer	42	2	Кеу
11	Spring washer	43	3	Gear case cap
12	Hex bolt	44	1	Dust seal
13	Round bushing	45	5	Hex bolt
14	Dust seal	46	5	Spring washer
15	Wear ring	47	7	Truss head screw
16	Nameplate	48	3	Indicator
17	Spring holder	49	9	Slide screw rotation lock
18	Rain cap	50)	Hex bolt
19	O-ring	5	1	Hex nut
20	Lift stopper	52	2	Hex nut
21	Cylinder	53	3	Stopper holder
22	Rod packing	54	1	Spring (large)
23	Guide bushing	55	5	Spring (small)
24	Dust seal	56	5	Spring stopper
25	Scale	57	7	Piston
26	Truss head screw	58	3	Rod
27	Pointer	59)	Spring flange
28	Stem connector	60)	Stopper
29	Yoke	6	1	Locknut
30	Gear case	62	2	Spring washer
31	Bearing holder	63	3	O-ring
32	Single-column angular bearing			

Figure 7-6. Structure of the spring unit

Table 7-1.

Disassembly of the Spring Unit

Disassembly procedure

This section describes the procedure for disassembling the spring unit. In addition to the following instructions, refer to Figure 7-6.

Disassembly is not necessary when only the piston sealing parts (tape liner, O-ring) are replaced.

(1) Removing the spring

Step	Procedure			
1	Loosen and remove the upper four hex nuts (No. 52).			
2	Remove the stopper holder (No. 53).			
3	Loosen the lower four hex nuts (No. 52) evenly until the compression of the large spring (No. 54) and small spring (No. 55) is reduced to zero, and remove the nuts. Image: Ima			
4	Remove the spring flange (No. 59).			
5	Remove the large and small springs (Nos. 54-55).			

(2) Removing the piston

Step	Procedure			
1	Loosen and remove the stopper (No. 60).			
2	Loosen and remove the locknut (No. 61), while holding the two flat surfaces of the rod (No. 58) with a wrench.			
3	Remove the spring washer (No. 62) and O-ring (No. 63). Be careful not to damage the O-ring with the threaded part of the rod.			
4	Separate the rod (No. 58) from the piston (No. 57).			

Reassembly of the Actuator

Precautions

- Check that there is no problem with the parts, referring to the checklist in "Daily Inspection" on page 16. If a problem is found, repair or replace the part as needed.
- The O-ring on the sliding parts should always be replaced at the time of periodic disassembly. Replace the O-ring on the fixed part if it is deformed, expanded, or damaged during disassembly.
- Clean the O-ring, oil seal, wear ring, and tape liner O-ring groove, and then apply lubricant sufficiently.
- Check that any foreign matter produced by maintenance work does not remain on the cylinder's sliding parts or in the guide bushing.

Actuator with Handwheel

Assembly procedure

In addition to the following instructions, refer to Figure 7-5.

(1) Assembly of the handwheel section and cylinder

Step	Procedure		
1	With the yoke (No. 29) set up vertically, place the gear case (No. 30) on it and temporarily attach them together with four hex bolts (No. 12).		
2	Apply lubricant [*] on the upper and lower single-column angular bearings (No. 32), and assemble the lower bearing, worm wheel (No.33), upper bearing, and the bearing holder (No. 31) in that order. Refer to the figure below for how to assemble the bearings and worm wheel.		
	Figure 7-7.		
3	Mount the tape liner (No. 7) on the slide screw (No. 34). From the bottom, screw in the side screw. Apply lubricant on the threaded part of the slide screw (No. 34).		
4	Attach the slide screw rotation lock (No. 49) to the slide screw (No. 34) with the hex bolt (No. 50) and the hex nut (No. 51). Assemble them so that the recessed part of the screw rotation lock fits the rib of the yoke.		
5	Apply lubricant on the rod packing (No. 22) and the dust seal (No. 24), and assemble them on the cylinder (No. 21).		
6	Place the cylinder (No. 21) on the gear case (No. 30), and temporarily attach them with four hex bolts (No. 12) and sealing washers (No. 10) that are coated with a liquid sealant.		
7	Adjust the position of the the cylinder (No. 21) using the rod (No. 58), check that the rod moves smoothly, and then tighten screws to the torque specified in Table 7-2. If the rod does not move smoothly, tap the cylinder or the gear case with a plastic hammer to adjust the position.		

(2) Mounting the piston unit, lift stopper, and spring holder

Step	Procedure
1	Screw eyebolts into the screw holes $(M12 \times 2)$ in the spring holder (No. 59) at the top of the piston unit, and lift the unit straight up with a crane.
2	With the piston unit lifted, assemble the lubricated O-ring (No. 8) and tape liner (No. 7) on the piston (No. 57).
3	Insert the piston unit into the cylinder (No. 21) from the top. Make sure that the round hole on the rod (No. 58) faces the front.
4	Mount the O-ring (No. 5) for the lift stopper onto the groove on the top of the cylinder (No. 21).
5	Insert the lift stopper (No. 20) from the top, and connect the stopper and the cylinder with the long and short hex staybolts, Nos. 4 and 9 (two each). Tighten the ones of the same length in a diagonal pattern.
6	Pass the long and short hex staybolts (No. 4, No. 9) through the bolt holes in the spring holder (No. 17).
7	Secure the spring holder (No. 17) in place with four hex nuts (No. 2).
8	Screw the two eyenuts (No. 1) onto the long hex staybolts (No. 4).

Actuator without Handwheel

For an actuator without a handwheel, use the procedure described in Actuator with Handwheel, excluding the steps for assembling the handwheel.

Main Parts to be Replaced 7-4

Parts of this actuator can be used for a long period of time, but the following parts should be replaced at every periodic inspection.

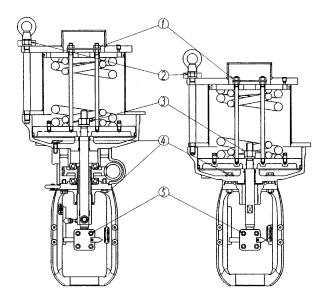
- Tape liner: Every five years
- Bushing: Every five years (for replacement, please contact us.)
- Every five years • Wear ring:
- Sealing washer: Every five years
- Dust seal: Every five years (and whenever disassembling)
- Rod seal: Every five years (and whenever disassembling)
- Every five years (and whenever disassembling) • O-ring:

Tightening torque for the actuator

The tightening torque for the actuator is shown in Figure 7-8. Tightening torque for the actuator.

Key No.	Size	Tightening torque (N·m)
(1)	M14	80 to 120
(2)	M20	270 to 365
(3)	M24	305 to 415
(4)	M14	80 to 120
(5)	M12	50 to 60

Table 7-2.



Tightening torque for the actuator

Figure 7-8.

Chapter 8 Disassembly and Reassembly of the Springless Piston Cylinder (Model DAP)

8-1 Overview

Structure

This actuator consists of upper and lower bonnets, a cylinder, staybolts, a yoke, a rod cover (if there is no SHM*), a snubber (if there is an SHM), a hydraulic pump (if there is an SHM), a positioner (if needed), and other accessory devices.

*SHM: Side mounted manual operation lever

For an external view of the actuator, refer to Figure 8-1 and Figure 8-2.

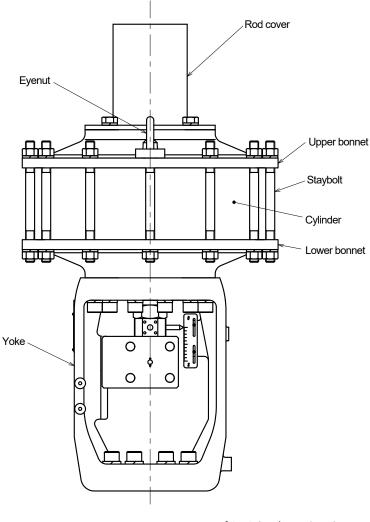


Figure 8-1. Appearance of DAP (without SHM)

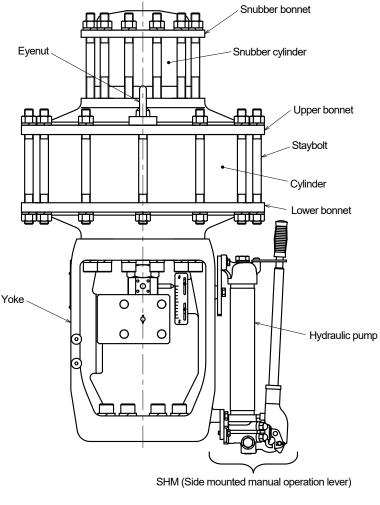


Figure 8-2. Appearance of DAP (with SHM)

The DAP with an SHM is equipped with a hydraulic pump for manual operation and a stop valve for switching between manual and automatic operation.

This pump consists of a handle and a body, which includes an oil sump, a plunger-type pump, a check valve, and a pressure balance adjustment valve (refer to Figure 8-3).

Note: There is an air vent plug over the oil sump, so install the control valve with the pump vertical or tilted so that the plug will always be above the oil pocket.

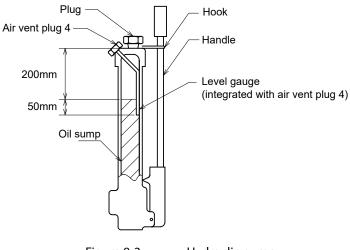


Figure 8-3. Hydraulic pump

Mounting on the valve body

The actuator (DAP1000) can be mounted on the control valve with hex socket bolts. To connect the valve stem to the piston rod, with the valve plug set in the fully closed position, apply air pressure to the actuator's lower bonnet and check that the piston rod has risen about 3 mm. Then, connect the valve stem to the piston rod with the stem connector.

Next, loosen the truss head screw on the scale and position the scale so that the pointer indicates the correct position in accordance with the valve stroke (see Figure 8-4).

Then, adjust the positioner, referring to its user's manual. For details, refer to the user's manual for the control valve.

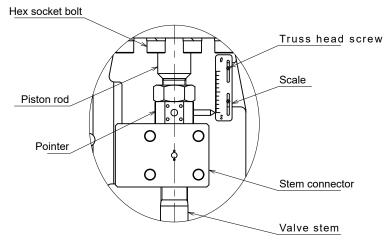


Figure 8-4. Connection with the control valve

Air piping

When using the DAP as part of a control valve, install a double-acting positioner and connect the air piping to it.

For details on double-acting positioners, refer to the user's manuals below.

· Smart valve positioner (model AVP300/301):

document No. CM2-AVP300-2001 document No. OM2-8310-0100

Electro-pneumatic valve positioner (model HEP): document No. OM2-8310-0100
Double-acting pneumatic valve positioner (model VPP02/03): document No. OM2-8310-0300

Handling precautions

The M20 eyenuts (No. 5 in Figure 8-5) (No. 17 in Figure 8-6) on the top of the actuator can be used to lift the actuator only. Do not use them for lifting the actuator when it is still mounted on the valve body. Doing so is dangerous.

The installation orientation should be no more than $\pm 45^{\circ}$ from the vertical position. If the actuator is positioned at an angle outside of this range, the service life of sealing parts, etc., may be shortened.

8-2 Disassembly, Inspection, and Reassembly of the Actuator

To disassemble, inspect, and reassemble the actuator for periodic inspections, use the following procedures.



Because individual components are heavy, use eyebolts and eyenuts. Hoist each component using a crane with the service taps of the components.

Items needed	Where used
M12 eyebolt (× 2)	Piston
Chisel and hammer	Piston
M20 eyebolt (× 2)	Upper and lower bonnets
Rag	For oil-drain in snubber
Тгау	For oil-drain in snubber

Removing the actuator from the valve body

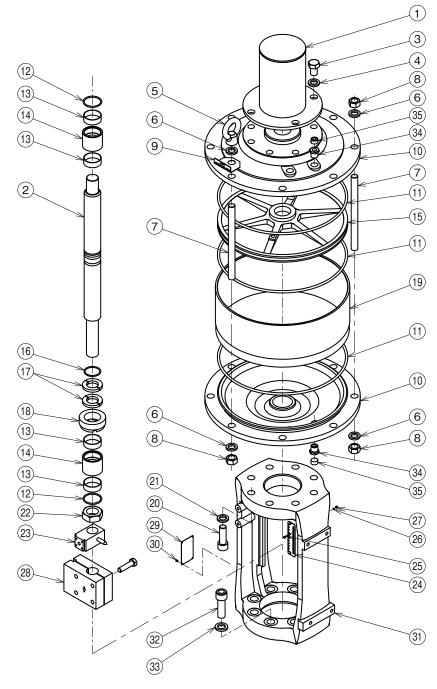
See section 5.3.1, "Removal of the Actuator from the Valve Body and Reassembly" in chapter 5, "Disassembly and Reassembly of the Control Valve."

Disassembly of the actuator

When disassembling the actuator, stand it vertically so that the yoke (No. 31 or No. 40) is at the bottom, and secure the bottom of the yoke so that it cannot move.

	No.	Part name	Qty.		No.	Part name	Qty.
1		Rod cover	1	20		Hex socket bolt	8
2		Piston rod	1	21		Spring washer	8
3		Hex bolt	4	22		Locknut	1
4		Spring washer	4	23		Pointer	1
5		Eyenut	2	24		Scale	1
6		Spring washer	16	25		Truss head screw	2
7		Staybolt	8	26		Spring washer	2
8		Hex nut	14	27		Hex nut	2
9		Instruction plate for eyenut	1			Stem connector assembly	1a
10		Bonnet	2	28	28-1	Stem connector	1
11		O-ring	3	-	28-2	Hex bolt	4
12		O-ring	2	29		Nameplate	1
13		Tape liner	4	30		Drive screw	4
14		Bushing	2	31		Yoke	1
15		Piston	1	32		Hex socket bolt	8
16		O-ring	1	33		Spring washer	8
17		Split ring	2 sets	34		Bushing	2
18		Plate tightening nut	1	35		Hex socket tapered plug	2
19		Cylinder	1				

Table 8-1.DAP1000 (without SHM): Table of parts

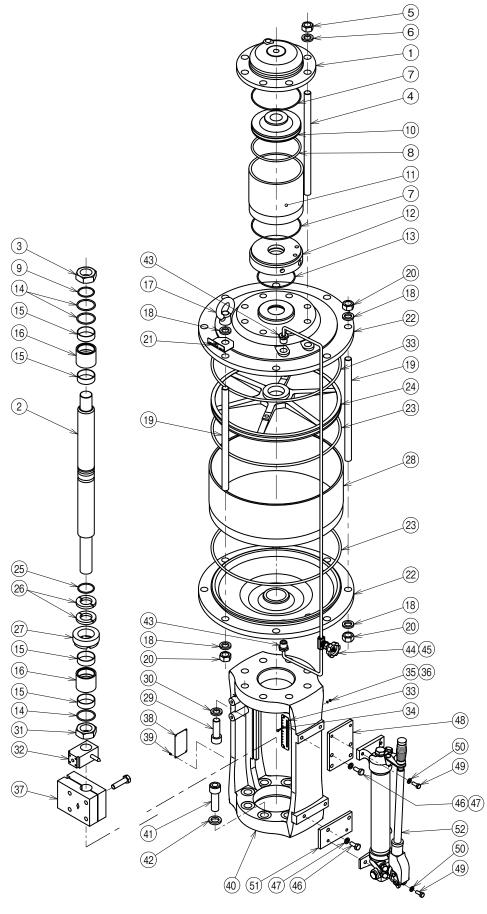




Structure of DAP (without SHM)

No.	Part name	Qty.	l I	No.	Part name	Qty.
1	Snubber bonnet	1	28		Cylinder	1
2	Piston rod	1	29		Hex socket bolt	8
3	Locknut	1	30		Spring washer	8
4	Staybolt	8	31		Locknut	1
5	Hex nut	8	32		Pointer	1
6	Spring washer	8	33		Scale	1
7	O-ring	2	34		Truss head screw	2
8	O-ring	1	35		Spring washer	2
9	O-ring	1	36		Hex nut	2
10	Snubber piston	1			Stem connector assembly	1a
11	Snubber cylinder	1	37	37-1	Stem connector	1
12	Snubber piece	1		37-2	Hex bolt	4
13	O-ring	1	38		Nameplate	1
14	O-ring	3	39		Drive screw	4
15	Tape liner	4	40		Yoke	1
16	Bushing	2	41		Hex socket bolt	8
17	Eyenut	2	42		Spring washer	8
18	Spring washer	16	43		Bushing	2
19	Staybolt	8	44		Stop valve	1
20	Hex nut	14	45		Instruction plate for stop valve	1
21	Instruction plate for eyenut	1	46		Hex bolt	4
22	Bonnet	2	47		Spring washer	4
23	O-ring	3	48		Hydraulic handle mount- ing plate (upper)	1
24	Piston	1	49		Hex bolt	4
25	O-ring	1	50		Spring washer	4
26	Split ring	2 sets	51		Hydraulic handle mount- ing plate (lower)	1
27	Plate tightening nut	1	52		Hydraulic handle	1

Table 8-2.DAP1000 (with SHM): Table of parts





Structure of DAP (with SHM)

• For DAP without SHM

This section describes the procedure for disassembling an actuator without an SHM. In addition to the following instructions, refer to Figure 8-5.

(1) Marking and parts protection

Step	Procedure
1	Place matching marks on the rod cover (No. 1), upper bonnet (No. 10), cylinder (No. 19), lower bonnet (No. 10), and yoke (No. 31).
2	Remove the pointer (No. 23) and the locknut (No. 22). Wrap plastic tape around the threads of the piston rod (No. 2) to protect the O-ring (No. 12) and sliding parts (bushings (No. 14), tape liners (No. 13)) during disassembly.

(2) Removing the rod cover (No. 1)

Step	Procedure
1	Loosen and remove the hex bolts (No. 3) at the top of the actuator and remove the spring washers (No. 4).
2	Lift the rod cover (No. 1) straight up to remove it.

(3) Removing the upper bonnet (No. 10) and staybolts (No. 7)

Step	Procedure
1	Loosen and remove the hex nuts (No. 8) and eyenuts (No. 5) that secure the upper bonnet (No. 10), and then remove the spring washers (No. 6) and staybolts (No. 7).
2	Lift the upper bonnet (No. 10) straight up to remove it, and remove the O-ring (No. 11), tape liners (No. 13), and O-ring (No. 12).

(4) Removing the piston rod (No. 2) and piston (No. 15)

Step	Procedure
1	With the piston (No. 15) mounted on the piston rod (No. 2), pull it out of the cylinder (No. 19) and remove the O-ring (No. 11) on the outer periphery of the piston (No. 15).
2	Place the piston rod (No. 2, with the piston still attached), upside down on a table with a hole (the table must be high enough so that the piston rod does not reach the surface below).
3	Loosen and remove the plate tightening nut (No. 18), pull the piston rod (No. 2) out of the piston (No. 15), and remove the split rings (No. 17) and O-ring (No. 16).

(5) Removing the cylinder (No. 19), lower bonnet (No. 10), and yoke (No. 31)

Step	Procedure
1	Remove the cylinder (No. 19), and remove the hex socket bolts (No. 20) that connect the lower bonnet (No. 10) to the yoke (No. 31).
2	Lift the lower bonnet (No. 10) straight up to remove it, and remove the O-ring (No. 11), tape liners (No. 13), and O-ring (No. 12).

• For DAP with SHM

This section gives the procedure for disassembling the actuator with SHM. In addition to the following instructions, refer to Figure 8-6.

(1) Marking and parts protection

Step	Procedure
1	Place matching marks on the snubber bonnet (No. 1), snubber cylinder (No. 11), snubber piece (No. 12), upper bonnet (No. 22), cylinder (No. 28), lower bonnet (No. 22), and yoke (No. 40).
2	Remove the pointer (No. 32) and the locknut (No. 31). Wrap plastic tape around the threads of the piston rod (No. 2) to protect the O-ring (No. 14) and sliding parts (bushings (No. 16), tape liners (No. 15)) during disassembly.

(2) Draining the oil (see Figure 8-3 and Figure 8-7)

Step	Procedure	
1	Stand the actuator up vertically, lower the piston to the bottom using the handle, and remove the plug.	
2	Remove joints A and B of the switching cock and then place a tray under the pipe outlet.	
3	Close stop valve 2, open stop valve 3, apply air pressure to the lower bonnet (No. 22), and then drain the oil by raising the snubber piston (No. 10) to the top.	
4	Then, slowly release the air pressure that has been supplied to the lower bonnet.	
	 The oil in the snubber cylinder (No. 11) and hydraulic piping cannot be completely drained, so a small amount of oil will remain inside them. Therefore, cover the snubber piece (No. 12) and hydraulic pipe port with rags before disassembling the snubber cylinder (No. 11) and hydraulic piping. Be sure to remove the air pressure slowly. Quick release of the air pressure is very dangerous. For manual operations, refer to chapter 3. 	

(3) Removing the snubber bonnet (No. 1), snubber cylinder (No. 11), and staybolts (No. 4)

Step	Procedure
1	Loosen and remove the hex nuts (No. 5) at the top of the actuator and remove the spring washers (No. 6).
2	Lift the snubber bonnet (No. 1) straight up to remove it.
3	Remove the O-ring (No. 7) that is attached to the snubber bonnet (No. 1).
4	Wipe off the oil remaining in the snubber cylinder (No. 11) with a rag.
5	Remove the staybolts (No. 4) and then remove the snubber cylinder (No. 11).

(4) Removing the snubber piston (No. 10) and snubber piece (No. 12)

Step	Procedure		
1	Apply air pressure to the lower bonnet (No. 22). With the pneumatic cylinder fully opened, loosen and remove the locknuts (No. 3) that hold the snubber piston (No. 10), and then remove the snubber piston (No. 10) and O-rings (Nos. 8–9).		
2	Release the air pressure slowly.		
	Be sure to release the air pressure slowly. Quick release of the air pressure is very dangerous.		
3	Remove the snubber piece (No. 12) and the O-rings (Nos. 7, 14, and 13).		

(5) Removing the upper bonnet (No. 22) and staybolts (No. 19)

Step	Procedure
1	Loosen and remove the hex nuts (No. 20) and eyenuts (No. 17) that secure the upper bonnet (No. 22), and then remove the spring washers (No. 18) and staybolts (No. 19).
2	Lift the upper bonnet (No. 22) straight up to remove it, and remove the O-ring (No. 23), tape liners (No. 15), and O-rings (No. 14).

(6) Removing the piston rod (No. 2) and piston (No. 24)

Step	Procedure	
1	With the piston (No. 24) mounted on the piston rod (No. 2), pull it out of the cylinder (No. 28) and remove the O-ring (No. 23) on the outer periphery of the piston (No. 24).	
2	Place the piston rod (No. 2, with the piston still attached) upside down on a table with a hole (the table must be high enough so that the piston rod does not reach the surface below).	
3	Loosen and remove the plate tightening nut (No. 27), pull the piston rod (No. 2) out of the piston (No. 24), and remove the split rings (No. 26) and O-ring (No. 25).	

(7) Removing the cylinder (No. 28), lower bonnet (No. 22), and yoke (No. 40)

Step	Procedure
1	Remove the cylinder (No. 28), and remove the hex socket bolts (No. 29) that connect the lower bonnet (No. 22) to the yoke (No. 40).
2	Lift the lower bonnet (No. 22) straight up to remove it, and remove the O-ring (No. 23), tape liners (No. 15), and O-ring (No. 14).

Parts inspection

Check the removed parts for damage. The service life of the DAP is 10 years if the parts with a limited service life are replaced on the recommended cycle. Parts of this actuator can be used for a long period of time. However, if any damage is found, repair or replace them as needed. Table 8-3 and Table 8-4 show a list of parts with a limited service life. Replace parts according to these tables.

No.	Part name	Recommended replacement cycle	Note	Qty.
11	O-ring	5 years	Also replace	3
12	O-ring		whenever disassem- bling	2
13	Tape liner			4
16	O-ring		Also replace whenever disassem- bling	1

Table 8-3.Parts with a limited service life (DAP without SHM)

Table 8-4.Parts with limited service life (DAP with SHM)	

No.	Part name	Recommended replacement cycle	Note	Qty.
7	O-ring	5 years	Also replace	2
8	O-ring		whenever disassem- bling	1
9	O-ring			1
13	O-ring		5	1
14	O-ring			3
15	Tape liner			4
23	O-ring		Also replace	3
25	O-ring		whenever disassem- bling	1

Assembly of the actuator

Before assembly, clean the parts with a rag, etc. When assembling the actuator, be sure to prevent foreign matter from enterting the sliding section.

Apply supplementary material to the O-rings, tape liner, inner surface of the cylinder without dirt. For details on the supplementary materials and application locations, refer to Table 8-5and Table 8-6.

For information on tightening screws, refer to Table 8-7to Table 8-10 and apply the specified tightening torque.

Assemble the actuator so that the matching marks that were made before disassembly are aligned.

No.	Part name	Applied location and supplementary material
3	Hex bolt	Threaded part:
5	Eyenut	Never-Seez, made by Bostik, Inc.
8	Hex nut	
18	Plate tightening nut	
20	Hex socket bolt	
22	Locknut	
23	Pointer	
28-1	Stem connector	
28-2	Hex bolt	
32	Hex bolt	
	Hex socket bolt	
33	Yoke tightening nut	
11	O-ring	All sliding parts, mounting grooves:
12	O-ring	Plastilube No. 3 non-dripping grease, made by Sulflo
13	Tape liner	Inc.
16	O-ring	
19	Inner surface of the cylinder	Nichimoly C powder, made by Daizo Corp. Plastilube No. 3 non-dripping grease, made by Sulflo Inc.
34	Bushing	Tapered threaded part
35	Hex socket tapered plug	Sealing tape, made by Valqua Ltd.

Table 8-5.List of supplementary materials (DAP without SHM)

 Before assembly, clean the O-rings, tape liners, and O-ring grooves, and then apply lubricant sufficiently.
 Note that any damage to the bushing, foreign matter on the bushing, insufficient

lubrication, or improper assembly may affect the performance of this device.

• Thoroughly apply molybdenum disulfide to the inner surface of the cylinder. Then, lightly apply Plastilube No.3 to it.

No.	Part name	Applied location and supplementary material		
3	Locknut	Threaded part:		
4	Staybolt	Never-Seez, made by Bostik, Inc.		
5	Hex nut			
17	Eyenut			
20	Hex nut			
27	Plate tightening nut			
29	Hex socket bolt			
31	Locknut			
32	Pointer			
37-1	Stem connector			
37-2	Hex bolt			
41	Hex bolt			
	Hex socket bolt			
42	Yoke tightening nut			
46	Hex bolt			
49	Hex bolt			
7	O-ring	All sliding parts, mounting grooves:		
8	O-ring	Plastilube No. 3 non-dripping grease, made by Sulflo		
9	O-ring	Inc.		
13	O-ring			
14	O-ring			
15	Tape liner			
23	O-ring			
25	O-ring			
28	Inner surface of the	Nichimoly C powder, made by Daizo Corp.		
	cylinder	Plastilube No. 3 non-dripping grease, made by Sulflo Inc.		
43	Bushing	Tapered threaded part Sealing tape, made by Valqua Ltd.		
	Hydraulic oil	Super Hyrando 32, made by Nippon Petrochemicals Co., Ltd		
		Equivalent product: Swaloop R032, made by Cosmo Oil Co., Ltd. Amount of hydraulic oil (unit: L)		
		Stroke (mm) DAP1000		
		100 4		

Table 8-6.List of supplementary materials (DAP with SHM)

Table 8-7.Tightening torque for stainless steel screws (DAP without SHM)(N·m)

		. ,.		
No.	Part name	DAP1000		
		Screw size	Tightening	
			torque	
3	Hex bolt	M20	130 to 175	
8	Hex nut	M20	130 to 175	
20	Hex socket bolt	M20	250 to 340	
22	Locknut	M36 × 1.5	480	
28-2	Hex bolt	M14	80 to 110	
32	Hex socket bolt	M22	160 to 215	

Note: These tightening torques are for stainless steel bolts and nuts that are exposed to the air.

Table 8-8.Tightening torque for stainless steel screws (DAP with SHM)(N·m)

No.	Part name	DAP1000	
		Screw size	Tightening
		SCIEW SIZE	torque
3	Locknut	M36 × 1.5	480
5	Hex nut	M20	130 to 175
20	Hex nut	M20	130 to 175
29	Hex socket bolt	M20	250 to 340
31	Locknut	M36 × 1.5	480
37-2	Hex bolt	M14	80 to 110
41	Hex socket bolt	M22	160 to 215
46	Hex bolt	M10	30 to 40
49	Hex bolt	M8	15 to 20

Note: These tightening torques are for stainless steel bolts and nuts that are exposed to the air.

No.	Part name	DAP1000	
		Screw size	Tightening
			torque
3	Hex bolt	M20	130 to 175
8	Hex nut	M20	130 to 175
20	Hex socket bolt	M20	130 to 175
22	Locknut	M36 × 1.5	480
28-2	Hex bolt	M14	50 to 70
32	Hex socket bolt	M22	180 to 240

Note: These tightening torques are for carbon steel bolts and nuts that are exposed to the air.

ie 8-10.	lightening torque for c	arbon steel screw	s (DAP with Shivi)
No.	Part name	DAP1000	
		Screw size	Tightening
		SCIEW SIZE	torque
3	Locknut	M36 × 1.5	480
5	Hex nut	M20	130 to 175
20	Hex nut	M20	130 to 175
29	Hex socket bolt	M20	130 to 175
31	Locknut	M36 × 1.5	480
37-2	Hex bolt	M14	50 to 70
41	Hex socket bolt	M22	180 to 240
46	Hex bolt	M10	20 to 25
49	Hex bolt	M8	10 to 13

Table 8-10. Tightening torque for carbon steel screws (DAP with SHM)(N·m)

Note: These tightening torques are for carbon steel bolts and nuts that are exposed to the air.

• For DAP without SHM

This section gives the procedure for assembling an actuator without an SHM.

(1) Assembling the piston (No. 15) and piston rod (No. 2)

Step	Procedure
1	Place the piston (No. 15) upside down on a table with a hole, and mount the O-rings (No. 11).
2	Insert the piston rod (No. 2) into the piston (No. 15), and mount the O-ring (No. 16) and the split rings (No. 17).
3	Secure them with the plate tightening nut (No. 18).

(2) Assembling the lower bonnet (No. 10), yoke (No. 31), cylinder (No. 19), and piston rod (No. 2)

Step	Procedure
1	Mount the O-rings (Nos. 11–12) and the tape liner (No. 13) on the lower bonnet (No. 10). Place the bonnet on the yoke (No. 31) so that their screw holes are aligned. Then, secure them using the hex socket bolts (No. 20) with the spring washers (No. 21) attached.
2	Mount the cylinder (No. 19), and then the piston rod (No. 2) with the piston that was attached to it in step 1.

(3) Mounting the upper bonnet (No. 10) and staybolts (No. 7)

Step	Procedure
1	Mount the O-rings (Nos. 11–12) and the tape liner (No. 13) on the upper bonnet (No. 10). Then, place the upper bonnet on the lower bonnet (No. 10), aligning the screw holes in the bonnets.
2	Mount the staybolts (No. 7), spring washers (No. 6), and instruction plate for the eyenuts (No. 9). Then, secure them with the eyenuts (No. 5) and hex nuts (No. 8).

(4) Mounting the rod cover (No. 1)

Step	Procedure
1	Place the rod cover (No. 1) on the upper bonnet (No. 10) so that their screw holes are aligned.
2	Secure them using the hex nuts (No. 3) with the spring washers (No. 4) attached.

(5) Mounting the locknut (No. 22) and pointer (No. 23)

Step	Procedure
1	Mount the locknut (No. 22) and the pointer (No. 23) on the piston rod (No. 2).

• For DAP with SHM

This section gives the procedure for assembling an actuator with an SHM.

(1) Assembling the piston (No. 24) and piston rod (No. 2)

Step	Procedure
1	Place the piston (No. 24) upside down on a table with a hole, and mount the O-rings (No. 23).
2	Insert the piston rod (No. 2) into the piston (No. 24), and mount the O-ring (No. 25) and the split rings (No. 26).
3	Secure them with the plate tightening nuts (No. 27).

(2) Assembling the lower bonnet (No. 22), yoke (No. 40), cylinder (No. 28), and piston rod (No. 2)

Step	Procedure
1	Mount the O-rings (No. 14, No. 23) and the tape liner (No. 15) on the lower bonnet (No. 22). Place the bonnet on the yoke (No. 40) so that their screw holes are aligned. Then, secure them using the hex socket bolts (No. 29) with the spring washers (No. 30) attached.
2	Mount the cylinder (No. 28), and then the piston rod (No. 2) with the piston that was attached to it in step 1.

(3) Mounting the upper bonnet (No. 22) and staybolts (No. 19)

Step	Procedure
1	Mount the O-rings (No. 14, No. 23) and the tape liner (No. 15) on the upper bonnet (No. 22). Then, place the upper bonnet on the lower bonnet (No. 22), aligning the screw holes in the bonnets.
2	Mount the staybolts (No. 19), spring washers (No. 18), and instruction plate for eyenuts (No. 21). Then, secure them with the eyenuts (No. 17) and hex nuts (No. 20).

(4) Mounting the snubber piece (No. 12)

Step	Procedure
1	Mount the O-ring (No. 13) on the upper bonnet (No. 22), and then install the snubber piece (No. 12) with O-rings (No. 7, No. 14) mounted.

(5) Mounting the snubber piston (No. 10) and snubber cylinder (No. 11)

Step	Procedure	
1	Apply air pressure to the lower bonnet (No. 22). With the pneumatic cylinder fully opened, mount the O-rings (Nos. 8–9) on the snubber piston (No. 10) and attach the piston to the piston rod (No. 2), and fasten with the locknut (No. 3).	
2	Release the air pressure slowly.	
	Be sure to release the air pressure slowly. Quick release of the air pressure is very dangerous.	
3	Mount the snubber cylinder (No. 11).	

(6) Mounting the snubber bonnet (No. 1) and staybolts (No. 4)

Step	Procedure
1	Mount the O-ring (No. 7) on the snubber bonnet (No. 1), and place the snubber bonnet on the upper bonnet (No. 22) so that their screw holes are aligned.
2	Insert the staybolts (No. 4) through the screw holes in the snubber bonnet (No. 1) and the upper bonnet (No. 22), and fasten it with the spring washers (No. 6) and the hex nuts (No. 5).

(7) Mounting the locknut (No. 31) and pointer (No. 32)

Step	Procedure
1	Mount the locknut (No. 31) and the pointer (No. 32) on the piston rod (No. 2).

(8) Lubrication (refer to Figure 8-3 and Figure 8-7)

Stand the cylinder up vertically before lubrication.

0	Do not remove plugs 1 and 4 at the same time. If they are removed, oil may flow out of plug 4.
\oslash	How to remove the hook of the hydraulic pump While pulling the hook with one hand in the direction of removal, push the handle toward the oil sump with the other hand to remove it At this time, do not loosen hook 2.

Step	Procedure
1	With the piping devices set for automatic operation ((A) in Table 8-11), lower the piston to the bottom, remove plugs 1 and 2, and pour sufficient oil into the hole in plug 1. Then, close plugs 1 and 2.
2	With the piping devices set for opening the valve manually ((C) in Table 8-11), remove plugs 3 and 4, and open cock 2.
3	Pour oil through the hole in plug 4 into the oil sump of the hydraulic pump until it is approximately half filled. With stop valve 3 opened, operate the hydraulic pump to send oil to the bottom of the piston. When oil starts flowing out from the hole of plug 3, close plug 3.
4	Using the hydraulic pump, fully open and close the valve once or twice in order to remove any air remaining in the hydraulic piping.
5	Finally, use the hydraulic pump to raise the piston to the top. Referring to the level gauge attached to plug 4, pour oil into the oil sump up to a position 200 mm from the top (see fig. 8-3). Then, close plug 4 and cock 2. During this operation, make sure that the piston is positioned at the top. Do not do it if the piston is not at the top.

Mounting the actuator on the valve body

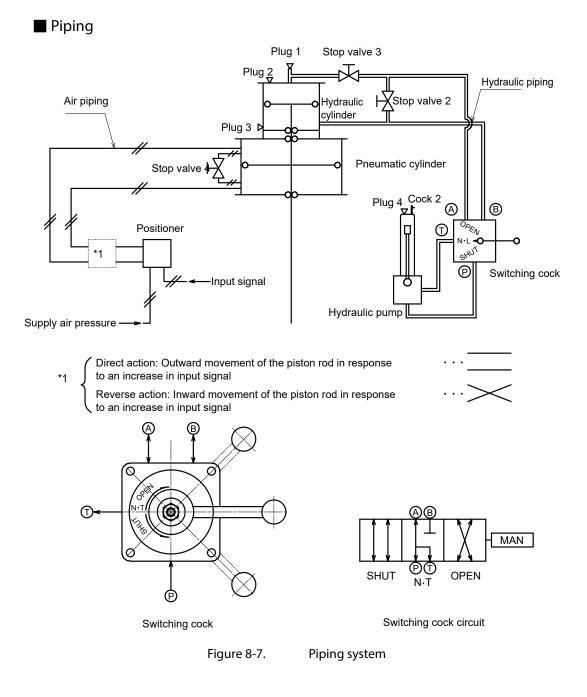
• For DAP without SHM

Step	Procedure
1	Lift the actuator using the eyenuts (No. 5) and place it on the valve body.
2	Attach the yoke (No. 31) to the valve body using the hex socket bolts (No. 32) with spring washers (No. 33) attached.
3	Check that the valve plug is in the fully closed position. Apply air pressure to the lower bonnet (No. 10) until the pointer indicates the fully closed position.
4	Connect the piston rod (No. 2) to the valve stem with the stem connector (No. 28).
5	Mount the positioner and connect the air pipes.

• For DAP with SHM

Step	Procedure
1	Lift the actuator using the eyenuts (No. 17) and place it on the valve body.
2	Attach the yoke (No. 40) to the valve body using the hex socket bolts (No. 41) with spring washers (No. 42) attached.
3	Check that the valve stem is in the fully closed position. Apply air pressure to the lower bonnet (No. 22) until the pointer indicates 2–3 mm above the full-close position.
4	Connect the piston rod (No. 2) to the valve stem with the stem connector (No. 37).
5	Mount the positioner and connect the air pipes.

8-3 Piping and Operation Methods



Manual/automatic operation methods

• Status of the devices on the piping

There are the following four operation modes, and the status of devices on the piping must be changed according to the mode.

- (A) Automatic operation
- (B) Closing the valve manually
- (C) Opening the valve manually
- (D) Locking the valve in the desired position

Operation modes must be switched in the order shown by arrows (1) to (6) in Figure 8-8.

That is, when switching between (A), (B), and (C), first set the devices to the status for

(D), which locks the value in the desired position, and then change the status to the one for the desired operation mode. In addition, after manual operation, reset the devices' status to the one for (D), which locks the value in the desired position for safety.

The status of the devices connected to the piping for each operation mode is shown in Table 8-11.

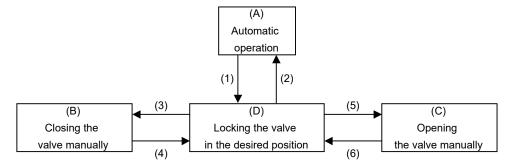




Table 8-11.Status of the devices connected to the piping							
Operation mode Device name	(A) Automatic operation	(B) Closing the valve manually	(C) Opening the valve manually	(D) Locking the valve in the de- sired position			
Switching cock	N·L position	SHUT position	OPEN position	N·L position			
Stop valve 2	OPEN	SHUT	SHUT	SHUT			
Stop valve 3	OPEN	OPEN when operating SHUT when not opera pump (Refer to (3) and (5) in procedure" below).	SHUT				
Stop valve 4	SHUT	OPEN	OPEN	OPEN			

• Switching operation procedure

For switching operations (1) to (6) in figure 8-8, refer to Figure 8-2, Figure 8-3, and Figure 8-7, and be sure to use the procedure below.





The procedure below takes into account the force that the valve receives from the fluid, so it must be followed.

Also, before and after switching the operation mode, check that the devices connected to the piping are in the status specified in Table 8-11.

- (1) (A) Automatic operation \rightarrow (D) Locking the value in the desired position
- (1)-1 Set the supply air pressure to the positioner and set the input signal.
- (1)-2 Fully close stop valves 2 and 3.
- (1)-3 Fully open stop valve 4.

(2) (D) Locking the value in the desired position \rightarrow (A) Automatic operation

- (2)-1 Set the supply air pressure to the positioner and set the input signal.
- (2)-2 Fully close stop valve 4.
- (2)-3 Gradually open stop valves 2 and 3 until they are fully open.



Open the stop valves slowly while checking the travel indication by the pointer on the control valve in order to avoid quick opening of the control valve.

- (3) (D) Locking the value in the desired position \rightarrow (B) Closing the value manually
- (3)-1 Move the switching cock to the SHUT position.
- (3)-2 Slowly open stop valve 3. With stop valve 3 fully open, operate the hydraulic pump to close the control valve.

When the desired valve travel is reached, fully close stop valve 3.

Open the stop valves slowly while checking the travel indication by the pointer on the control valve in order to avoid quick opening of the control valve. Also, do not operate the hydraulic pump with stop valve 3 fully closed.

(4) (B) Closing the valve manually \rightarrow (D) Locking the valve in the desired position

(4)-1 Fully close stop valve 3.

(4)-2 Move the switching cock to the N-L position.

(5) (D) Locking the value in the desired position \rightarrow (C) Opening the value manually

(5)-1 Move the switching cock to the OPEN position.

(5)-2 Slowly open stop valve 3. With stop valve 3 fully open, operate the hydraulic pump to open the control valve.

Open the stop valves slowly while checking the travel indication by the pointer on the control valve in order to avoid quick opening of the control valve. Also, do not operate the hydraulic pump with stop valve 3 fully closed.

- (6) (C) Opening the valve manually \rightarrow (D) Locking the valve in the desired position
- (6)-1 Fully close stop valve 3.

 \bigcirc

(6)-2 Move the switching cock to the N·L position.

Chapter 9 Maintenance Information

Maintenance Information

Maintenance parts and our maintenance support are explained below. Please refer to the following when ordering consumables or if there is a problem with the control valve.

Ordering

Please contact the azbil Group, having the name and part No. of the necessary parts ready.

Maintenance service

The azbil Group offers various service programs that provide the advantage of maintenance knowhow accumulated over a long period.

We also offer a prompt response to problems in cooperation with our Quality Assurance Department.

Please contact the azbil Group for maintenance of the control valve.

Chapter 10 Disposal

If this device is no longer needed, dispose of it appropriately as industrial waste, in accordance with local regulations. Do not reuse all or a part of the device.

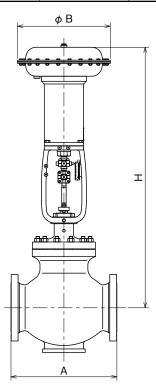
AppendixA Dimensions and Weight

External dimensions and weight of the control valve are indicated in Table A-1 and Table A-2. Note that dimensions and weight may vary depending on the optional specifications.

				lable <i>i</i>	A-I.	Dimension	>			
									Si	ize (mm)
	A			н						
Port size (inches)	Actuator	JIS10K FF, RF ANSI150 RF JPI150 RF	JIS16K, 20K, 30K, RF ANSI300 RF JPI300 RF	JIS40K RF ANSI600 RF JPI600 RF	ANSI150 RJ JPI150 RJ	ANSI300 RJ JPI300 RJ	ANSI600 RJ JPI600 RJ	Normal temp. bonnet	High temp. bonnet	φΒ
10	VA5D	673	708	752	686	724	756	1757	2012	φ620
	VA5R							1887	2142	φ620
	PSA6R							1813	2068	φ479
	DAP1000							1613	1777	φ470
12	VA5D	737	775	819	749	791	822	1808	1958	φ620
[VA5R							1938	2088	φ620
	PSA6R							1864	2014	φ479
	DAP1000							1633	1828	φ470

Table A-1.	Dimensions
	Dimensions

				10010712.	Weight		
							Unit: ko
Port size (inches)	Actuator JEIIJU		JIS16K, 20K, 30K, RF ANSI300 RF JPI300 RF		JIS40K RF ANSI600 RF JPI600 RF		
		Normal temp. bonnet	High temp. bonnet	Normal temp. bonnet	High temp. bonnet	Normal temp. bonnet	High temp. bonnet
10	VA5D	600	620	710	730	757	787
	VA5R	635	655	745	765	792	822
	PSA6R	590	610	700	720	747	777
	DAP1000	658	661	768	771	812	814
12	VA5D	836	856	976	996	1058	1158
	VA5R	871	891	1011	1031	1093	1193
	PSA6R	826	846	966	936	1048	1148
	DAP1000	903	908	1043	1048	1098	1211



AppendixB Main Parts to be Replaced

Parts of this actuator can be used for a long period of time, but the following parts should be replaced at every periodic inspection.

Valve body

Gland packing Gasket

Actuator

- Diaphragm: Every five years
- Cap: Every five years
- Sealing washer: Every five years (and whenever disassembling)
- Dust seal:Every five years (and whenever disassembling)
- Rod seal:Every five years (and whenever disassembling)
- Bushing: Every five years (for replacement, please contact us.)

Terms and Conditions

We would like to express our appreciation for your purchase and use of Azbil Corporation's products.

You are required to acknowledge and agree upon the following terms and conditions for your purchase of Azbil Corporation's products (system products, field instruments, control valves, and control products), unless otherwise stated in any separate document, including, without limitation, estimation sheets, written agreements, catalogs, specifications and instruction manuals.

1. Warranty period and warranty scope

1.1 Warranty period

Azbil Corporation's products shall be warranted for one (1) year from the date of your purchase of the said products or the delivery of the said products to a place designated by you.

1.2 Warranty scope

In the event that Azbil Corporation's product has any failure attributable to azbil during the aforementioned warranty period, Azbil Corporation shall, without charge, deliver a replacement for the said product to the place where you purchased, or repair the said product and deliver it to the aforementioned place. Notwithstanding the foregoing, any failure falling under one of the following shall not be covered under this warranty:

- (1) Failure caused by your improper use of azbil product (noncompliance with conditions, environment of use, precautions, etc. set forth in catalogs, specifications, instruction manuals, etc.);
- (2) Failure caused for other reasons than Azbil Corporation's product;
- Failure caused by any modification or repair made by any person other than Azbil Corporation or Azbil Corporation's subcontractors;
- (4) Failure caused by your use of Azbil Corporation's product in a manner not conforming to the intended usage of that product;
- (5) Failure that the state-of-the-art at the time of Azbil Corporation's shipment did not allow Azbil Corporation to predict; or
- (6) Failure that arose from any reason not attributable to Azbil Corporation, including, without limitation, acts of God, disasters, and actions taken by a third party.

Please note that the term "warranty" as used herein refers to equipment-only-warranty, and Azbil Corporation shall not be liable for any damages, including direct, indirect, special, incidental or consequential damages in connection with or arising out of Azbil Corporation's products.

2. Ascertainment of suitability

You are required to ascertain the suitability of Azbil Corporation's product in case of your use of the same with your machinery, equipment, etc. (hereinafter referred to as "Equipment") on your own responsibility, taking the following matters into consideration:

- (1) Regulations and standards or laws that your Equipment is to comply with.
- (2) Examples of application described in any documents provided by Azbil Corporation are for your reference purpose only, and you are required to check the functions and safety of your Equipment prior to your use.
- (3) Measures to be taken to secure the required level of the reliability and safety of your Equipment in your use Although azbil is constantly making efforts to improve the quality and reliability of Azbil Corporation's products, there exists a possibility that parts and machinery may break down. You are required to provide your Equipment with safety design such as fool-proof design,^{*1} and fail-safe design^{*2} (anti-flame propagation design, etc.), whereby preventing any occurrence of physical injuries, fires, significant damage, and so forth. Furthermore, fault avoidance,^{*3} fault tolerance,^{*4} or the like should be incorporated so that the said Equipment can satisfy the level of reliability and safety required for your use.
 - *1. A design that is safe even if the user makes an error.
 - *2. A design that is safe even if the device fails.
 - *3. Avoidance of device failure by using highly reliable components, etc.
 - *4. The use of redundancy.

3. Precautions and restrictions on application

3.1 Restrictions on application

Please follow the table below for use in nuclear power or radiation-related equipment.

	Nuclear power quality ^{*5} required	Nuclear power quality*5 not required
Within a radiation controlled area*6	Cannot be used (except for limit switches for nuclear power*7)	Cannot be used (except for limit switches for nuclear power*7)
Outside a radiation controlled area*6	Cannot be used (except for limit switches for nuclear power*7)	Can be used

- *5. Nuclear power quality: compliance with JEAG 4121 required
- *6. Radiation controlled area: an area governed by the requirements of article 3 of "Rules on the Prevention of Harm from Ionizing Radiation," article 2 2 4 of "Regulations on Installation and Operation of Nuclear Reactors for Practical Power Generation," article 4 of "Determining the Quantity, etc., of Radiation-Emitting Isotopes,"etc.
- *7. Limit switch for nuclear power: a limit switch designed, manufactured and sold according to IEEE 382 and JEAG 4121.

Any Azbil Corporation's products shall not be used for/with medical equipment.

The products are for industrial use. Do not allow general consumers to install or use any Azbil Corporation's product. However, azbil products can be incorporated into products used by general consumers. If you intend to use a product for that purpose, please contact one of our sales representatives.

3.2 Precautions on application

you are required to conduct a consultation with our sales representative and understand detail specifications, cautions for operation, and so forth by reference to catalogs, specifications, instruction manual, etc. in case that you intend to use azbil product for any purposes specified in (1) through (6) below. Moreover, you are required to provide your Equipment with fool-proof design, fail-safe design, antiflame propagation design, fault avoidance, fault tolerance, and other kinds of protection/safety circuit design on your own responsibility to ensure reliability and safety, whereby preventing problems caused by failure or nonconformity.

- (1) For use under such conditions or in such environments as not stated in technical documents, including catalogs, specification, and instruction manuals
- (2) For use of specific purposes, such as:
 - Nuclear energy/radiation related facilities
 [When used outside a radiation controlled area and where nuclear power quality is not required]
 [When the limit switch for nuclear power is used]
 - Machinery or equipment for space/sea bottom
 - Transportation equipment
 - [Railway, aircraft, vessels, vehicle equipment, etc.]
 - * Antidisaster/crime-prevention equipment
 - * Burning appliances
 - * Electrothermal equipment
 - * Amusement facilities
 - * Facilities/applications associated directly with billing
- (3) Supply systems such as electricity/gas/water supply systems, large-scale communication systems, and traffic/air traffic control systems requiring high reliability
- (4) Facilities that are to comply with regulations of governmental/public agencies or specific industries
- (5) Machinery or equipment that may affect human lives, human bodies or properties
- (6) Other machinery or equipment equivalent to those set forth in items (1) to (5) above which require high reliability and safety
- 4. Precautions against long-term use

Use of Azbil Corporation's products, including switches, which contain electronic components, over a prolonged period may degrade insulation or increase contact-resistance and may result in heat generation or any other similar problem causing such product or switch to develop safety hazards such as smoking, ignition, and electrification. Although acceleration of the above situation varies depending on the conditions or environment of use of the products, you are required not to use any Azbil Corporation's products for a period exceeding ten (10) years unless otherwise stated in specifications or instruction manuals.

5. Recommendation for renewal

Mechanical components, such as relays and switches, used for Azbil Corporation's products will reach the end of their life due to wear by repetitious open/close operations.

In addition, electronic components such as electrolytic capacitors will reach the end of their life due to aged deterioration based on the conditions or environment in which such electronic components are used. Although acceleration of the above situation varies depending on the conditions or environment of use, the number of open/close operations of relays, etc. as prescribed in specifications or instruction manuals, or depending on the design margin of your machine or equipment, you are required to renew any Azbil Corporation's products every 5 to 10 years unless otherwise specified in specifications or instruction manuals. System products, field instruments (sensors such as pressure/flow/level sensors, regulating valves, etc.) will reach the end of their life due to aged deterioration of parts. For those parts that will reach the end of their life due to aged deterioration, recommended replacement cycles are prescribed. You are required to replace parts based on such recommended replacement cycles.

6. Other precautions

Prior to your use of Azbil Corporation's products, you are required to understand and comply with specifications (e.g., conditions and environment of use), precautions, warnings/cautions/notices as set forth in the technical documents prepared for individual Azbil Corporation's products, such as catalogs, specifications, and instruction manuals to ensure the quality, reliability, and safety of those products.

7. Changes to specifications

Please note that the descriptions contained in any documents provided by azbil are subject to change without notice for improvement or for any other reason. For inquires or information on specifications as you may need to check, please contact our branch offices or sales offices, or your local sales agents.

8. Discontinuance of the supply of products/parts

Please note that the production of any Azbil Corporation's product may be discontinued without notice. After manufacturing is discontinued, we may not be able to provide replacement products even within the warranty period.

For repairable products, we will, in principle, undertake repairs for five (5) years after the discontinuance of those products. In some cases, however, we cannot undertake such repairs for reasons, such as the absence of repair parts. For system products, field instruments, we may not be able to undertake parts replacement for similar reasons.

9. Scope of services

Prices of Azbil Corporation's products do not include any charges for services such as engineer dispatch service. Accordingly, a separate fee will be charged in any of the following cases:

- (1) Installation, adjustment, guidance, and attendance at a test run
- (2) Maintenance, inspection, adjustment, and repair
- (3) Technical guidance and technical education
- (4) Special test or special inspection of a product under the conditions specified by you

Please note that we cannot provide any services as set forth above in a nuclear energy controlled area (radiation controlled area) or at a place where the level of exposure to radiation is equivalent to that in a nuclear energy controlled area.

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