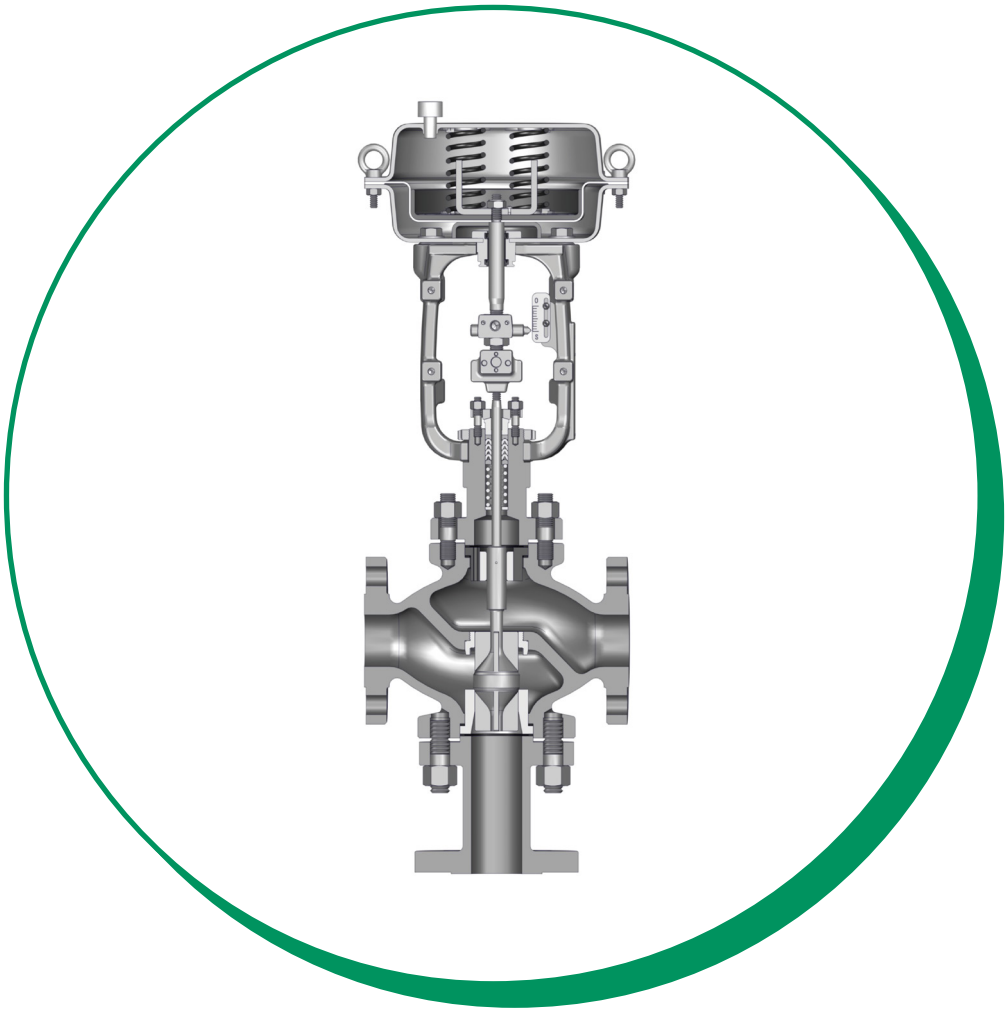
azbil

CM2-AMT100-2001D

Three-way Control Valve

Model AMT___

User's Manual



Azbil Control Instruments (Dalian) Co., Ltd

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.

Introduction

Thank you for purchasing this model AMT_ _ _ Three-Way control valve.
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

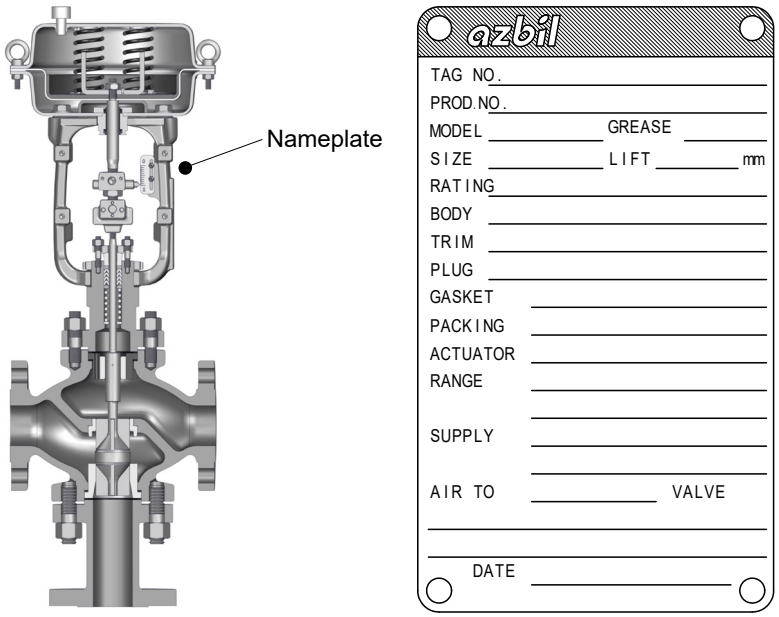
Unpacking

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.



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.
3. 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.
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.

⚠ **WARNING**	Warnings are indicated when mishandling this product may result in death or serious injury.
⚠ **CAUTION**	Cautions are indicated when mishandling this product may result in minor injury or property damage only.

■ Examples

	Indicates that caution is required in handling.
	The indicated action is prohibited.
	Be sure to follow the indicated instructions.

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.

⚠CAUTION
Do not stand on the device or use it as a step. There is a risk of falling.
Do not touch the device unnecessarily while it is operating. Depending on the operating conditions, the surface might be extremely hot or cold.
Since this product is heavy, when handling it, wear safety shoes and watch your step.
During work, wear protective goggles to prevent injury from flying objects.
During work, wear protective gloves to prevent injury due to burrs on bolt heads or edges.
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.
When assembling and disassembling diaphram, wear protective glove to avoid to prolonged cotact with human skin."prolonged contact with human skin "means continuous contact of more than 10 minutes duration or intermittent contact over a period of 30 minutes, per day.

Handling Precautions

Warnings and Cautions for Installation

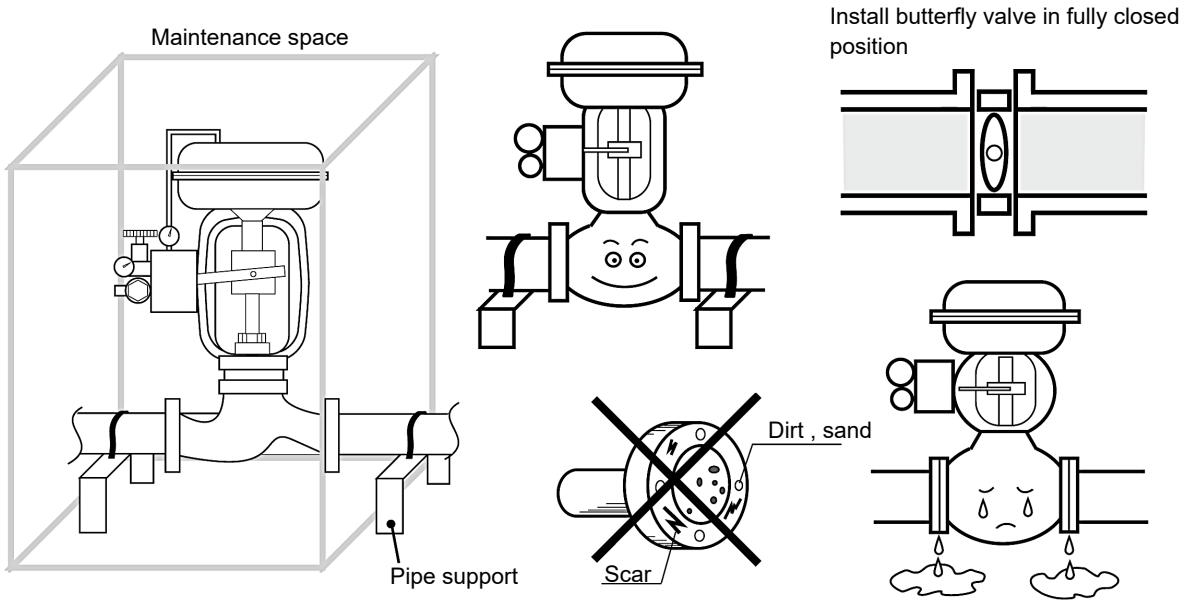
⚠WARNING
If the rated pressure or standards for connection are ignored when this device is used, damage to the product or leakage may cause a serious accident.
When connecting the valve to the piping, do not put your hand or foot under the valve or between flanges. You may lose your fingers or your foot 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.

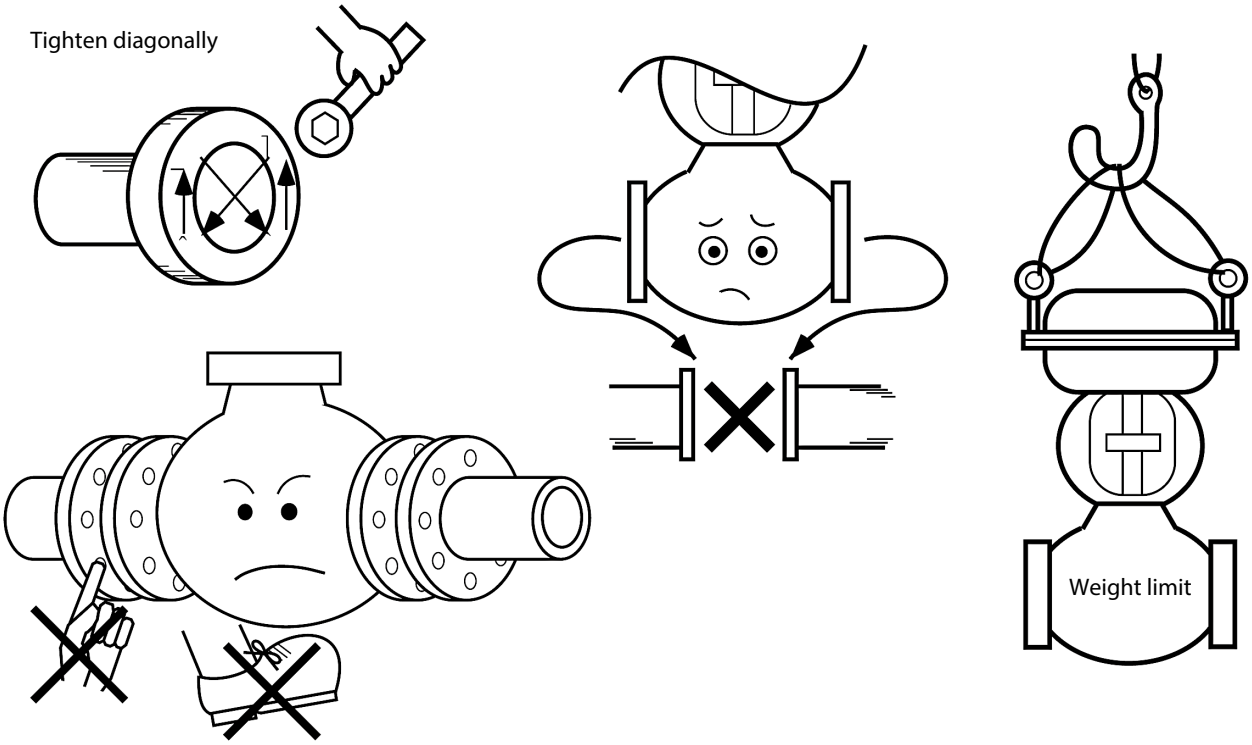
⚠CAUTION
Make sure that there is a straight pipe section at least 10 times the pipe diameter on the upstream side and 6 times the pipe diameter on the downstream side (D: nominal diameter). If the straight pipe sections are not long enough, insufficient valve capacity or unusual noise or vibration could result.
Install the valve in the correct direction, leaving clearance around the valve as much as possible for easy maintenance (piping, wiring, adjustment, etc.).
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 Valve and Valve for low-temperature fluid.)
If the valve is installed along a passageway used by outsiders, install a fence or cover as a protective measure.
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.
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.
Check that there is no damage to the valve (including the actuator and auxiliary equipment).
Check that there is no damage to the flanges or welded piping. Otherwise fluid leakage could result.
If pipe flanges connected to the valve are being welded, the valve surface may also heat up. Do not touch the valve unnecessarily.
Chamfer the edges of the pipe flanges. Sharp edges can cause an injury.
Check that the pipes on both sides of the valve are firmly supported. Insufficient support may cause leakage from pipe connections.
After installation, check that the pipes are still properly aligned. Misalignment may cause fluid leakage from pipe connections.
Install the butterfly valve with the valve (blade or disk) fully closed. Otherwise the valve might be damaged.
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.
Use bolts and nuts that conform to the standards for the pipe flange. Otherwise fluid leakage could result.

⚠CAUTION
Use new flange gaskets that are appropriate for the properties of the fluid, the operating temperature, and the pressure. Damaged gaskets may cause fluid leakage.
Open the valve fully before flushing the inside of the piping, and do not change the valve travel while the pipes are being flushed. Otherwise, the valve may be damaged by welding spatter or other foreign matter.

Handling Precautions

- Avoid installing the valve where it will be subject to vibration or other external forces that may affect its performance.
- 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.




Tighten diagonally
Weight limit

Precautions for Air Supply Piping and Electrical Work

⚠CAUTION
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.
Wiring work should be carried out only by qualified technicians following local electrotechnical standards.
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.
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.
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.
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.

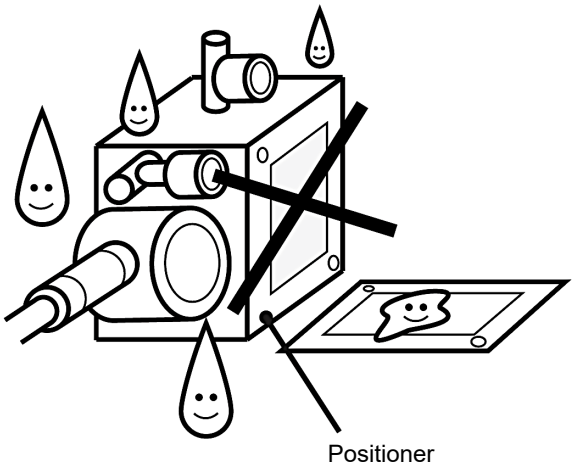
Handling Precautions

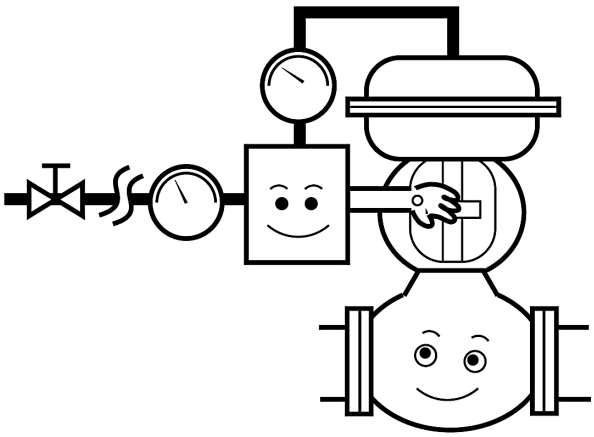
- The vibration specification is for the AVP positioner mounted on the PSA actuator.

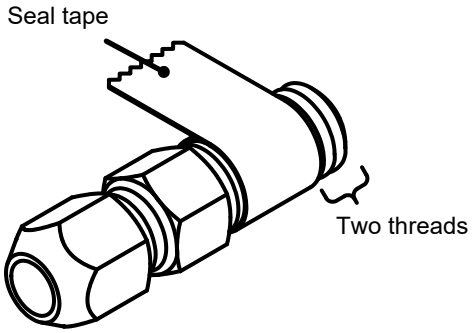
⚠CAUTION
If the pressure regulator with air filter is mounted on this device, install this device on the piping so that the drain of the pressure regulator with air filter faces downward. If the pressure regulator with air filter cannot be vertical (if its drain does not face downward), remove it from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

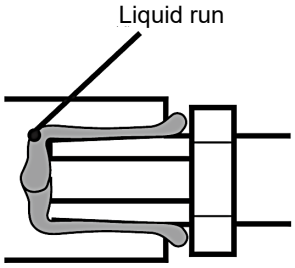
Handling Precautions

- 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.





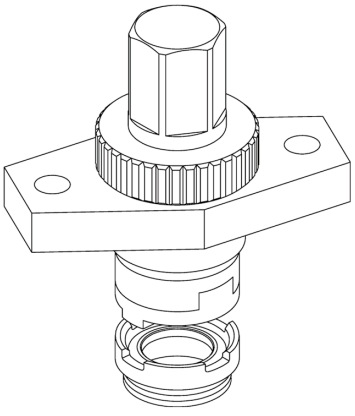


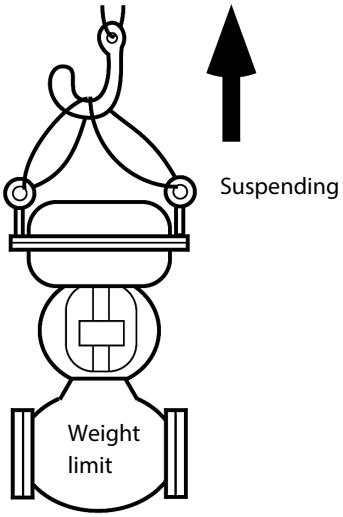


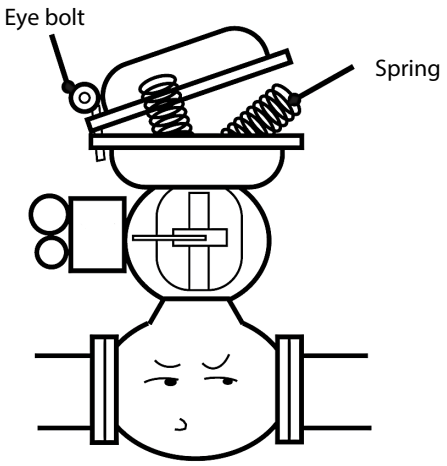
Precautions for Assembly and Disassembly

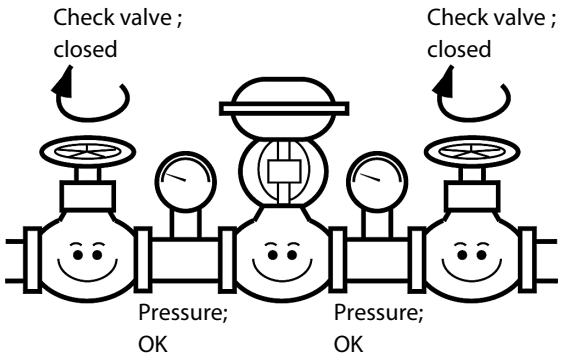
⚠WARNING
Before starting work, clean the inside of the valve, replace any residual gas, etc. Otherwise, the residual fluid may cause an injury.
Do not disassemble the pneumatic actuator while supply air pressure is being applied. The compressed air may cause an injury.
Because damaged or corroded bolts and nuts may damage the valve and cause injury, replace them with new ones.

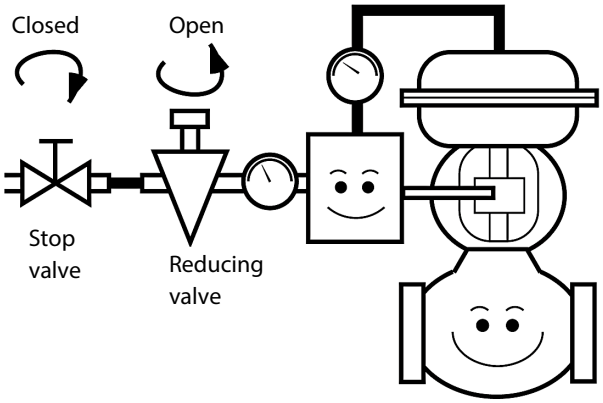
⚠CAUTION
Observe the tightening torques indicated in the user's manual when tightening bolts and nuts.
For an actuator that incorporates springs, follow the disassembly procedure when removing bolts, nuts, etc. Otherwise, the springs may jump out, causing injury.
When removing the valve from the piping, 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.
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.
Assemble the valve using the parts, bolts, nuts, etc., in the order stated in the assembly procedure. Otherwise, malfunction may result.
When reassembling the valve body, always use new packing and gaskets. The reuse of old parts will cause fluid leakage.



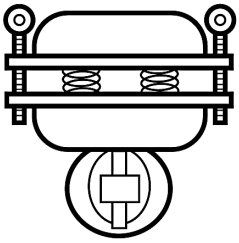




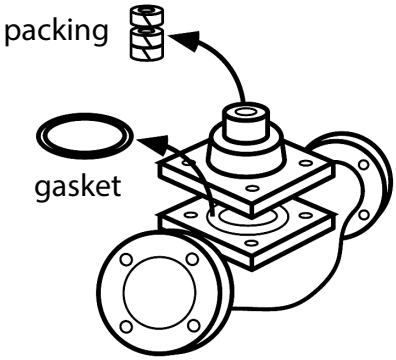




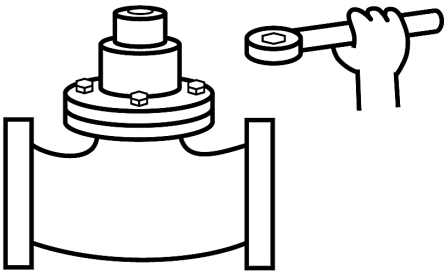
● Observe the assembly procedure



● Replace packing / gasket



● Tighten bolts to specified torque



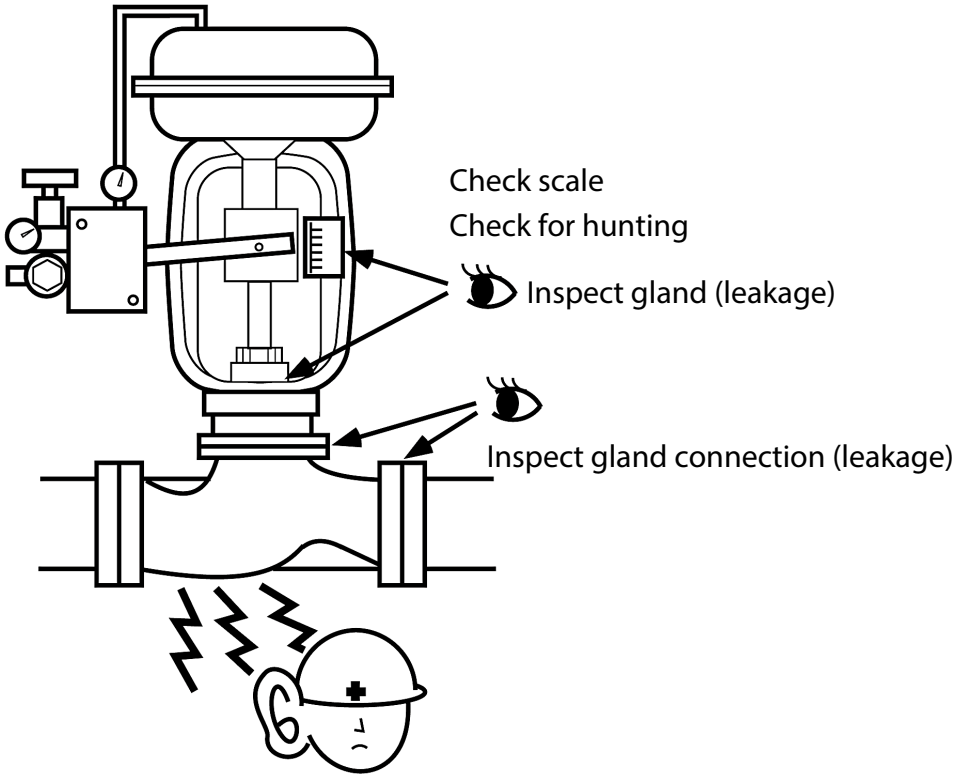
Precautions for Maintenance

⚠WARNING
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.

⚠CAUTION
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 scale
Check for hunting
Inspect gland (leakage)
Inspect gland connection (leakage)
Check for abnormal noise or vibration

1. GENERAL

1.1 Scope

This manual covers the instructions for the Three-way Control Valve.

Model AMT.

For the valve positioners, refer the operators manuals.

- Model VPE
- Model HTP
- Model AVP 30□/20□/10□/70□

1.2 Major Components of Control Valve

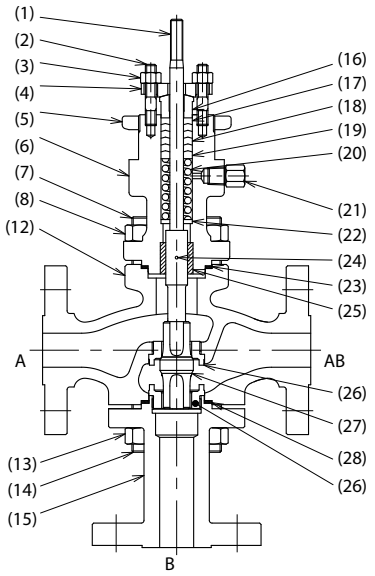
Each control valve is comprised of two major components, namely, a valve body and an actuator. Various combinations of valve body and actuator are available to meet various type of uses with different valve sizes, pressure ratings, types of connections, types of materials, and actuator sizes.

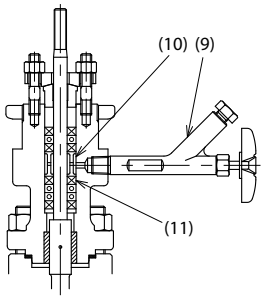
1.3 Structures

The structures of three way control Valve are shown Fig. 1-1.

The valve body is connected to the bonnet with stud bolts and nuts. Gaskets are provided at the connection section to seal against the internal fluid or to let the valve body make up a pressure vessel. The valve plug is supported by the guide ring and cage, and driven by the actuator. The actuator has multiple springs and a diaphragm, and converts the pneumatic control signal into a mechanical (positional) control signal with which to position the valve plug.

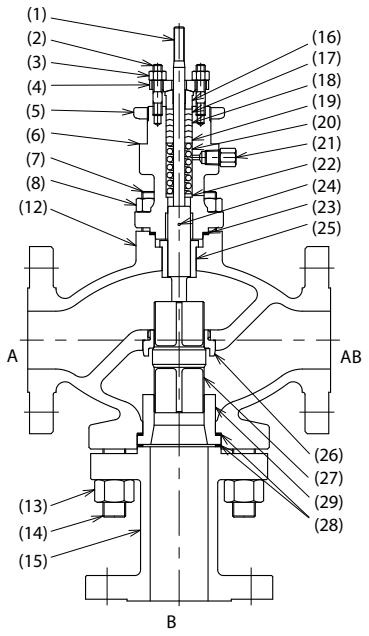
In the illustrations, for mixing service, the left and bottom ports are inlets and the right port is outlet. For diverting service, the right port is inlet.



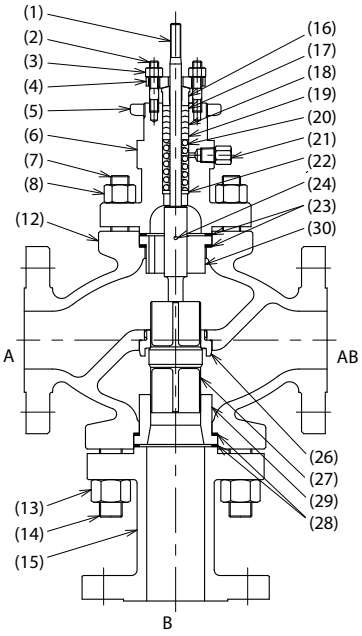


Valve body: 1"

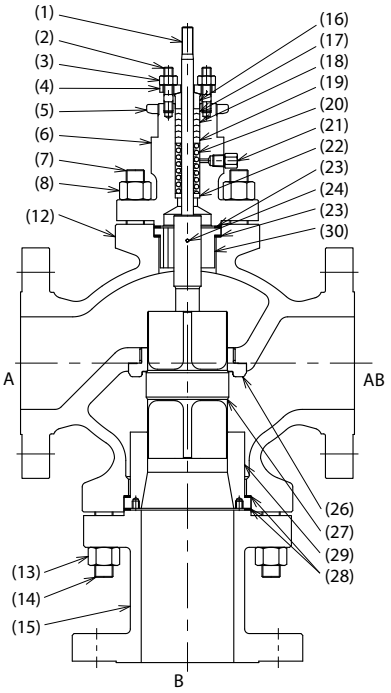
No.	Parts Name	No.	Parts Name
1	Valve Stem	16	Packing Follower
2	Stud Bolt	17	V-Packing Holder
3	Nut	18	V-PTFE Packing
4	Packing Flange	19	V-Packing Retainer
5	Yoke Lock Nut	20	V-Packing Spring
6	Bonnet	21	Blind Plug
7	Stud Bolt	22	Packing Ring
8	Nut	23	Gasket
9	Lubricator	24	Pin
10	Lantern Ring	25	Guide Bushing
11	Packing	26	Seat Ring
12	Valve Body	27	Valve Plug
13	Nut	28	Gasket
14	Stud Bolt	29	Seating Guide
15	Tail Piece	30	Guide Ring



Valve body: 1-1/2" and 2" (150#)



Valve body: 2" (300#)



Valve body: 2-1/2" or more

Fig. 1-1 Three-way Valve (AMT)

1.4 Nameplate

A nameplate as shown in Fig. 1-2 is posted on each control valve. The nameplate indicates the model number, valve size, pressure rating, trim material, date of manufacture and other major specifications of the control valve. Before installing the control valve, make sure that the specifications indicated on the nameplate conform with the conditions of use. The nameplate indicate also the product number (PROD.NO.) of the control valve. Please mention this number also when consulting your Azbil Corporation agent for replacement of parts or other modification of the control valve.

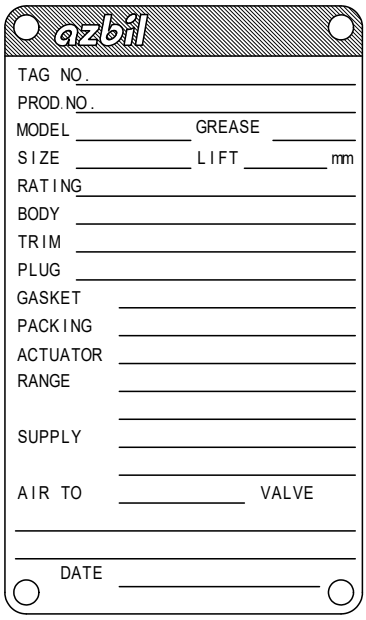


Fig. 1-2 Nameplate

2. INSTALLATION

2.1 Maximum Lifting Loads of Eyebolts

The diaphragm case has a pair of lifting eyebolts. These eyebolts primarily are for lifting the actuator alone. When using the eyebolts for other purposes (such as lifting an actuator bed to its valve body or other components), note that the allowable maximum lifting loads of the eyebolts are as shown in the following table.

Table 2-1 Maximum Lifting Loads of Eyebolts

Actuator Model No.	Allowable Maximum Lifting Load of Eyebolts	Weight of Actuator Alone
PSA1	160kg	8kg
HA2	160kg	16kg
HA3	160kg	32kg
HA4	220kg	68kg

Note: The eyebolts may be used to lift the actuator together with its valve body (cast globe valve) of up to pressure rating “Class 600”. When doing this, be extremely careful so that no shock or other abnormal force is applied to the actuator or the valve body.

2.2 Installing Valve in Process Pipe

(1) Before installing the valve in the process pipe, remove foreign matter (such as scales and welding chips) from both upstream and downstream sides of the process pipe.

(2) Confirm that the direction of process fluid flow conforms with that of the arrowhead mark provided on the valve body.

(3) Pay attention so that the pipe connection gaskets do not extrude into the process pipe inside. Be sure to use gaskets made of material which is suitable for the process fluid. The welding type of valve employ no gaskets.

(4) Pay attention so that no excessively large stress is conveyed from the process pipe to the valve body. Uniformly tighten the bolts of the process pipe connection flange. The high pressure type of Valve have no flanges, since they are connected to the process by welding.

(5) Before connecting the air pipes to the actuator and positioner, blow the pipes to clean them.

(6) Do not install any heating or cooling provisions on the bonnet.

2.3 Item to be Checked After Installation and Before Starting Operation

(1) Check that there is no leak from air piping.

(2) Check that the bolts and nuts of the diaphragm case are not loose. Standard tightening torques are as follows:

For HA2, HA3 (M8) : 12 N.m {120 kg-cm}

For HA4 (M12) : 42 N.m {420 kg-cm}

(3) Tighten the packing flange nuts to prevent leak from the gland packing section. Standard tightening torques are as shown in Table 2-2.

Table 2-2 Tightening Torques of Packing Flange Nuts

Unit: N•m{kgf/cm^2}

Valve Stem Diameter (mm)	V PTFE packing	PTFE Yarn Packing (P4519)	Expanded graphite Packing [P6610CH + P6528, P6610CH + M8590, T2200 + P6710CH (Type2)]	V PTFE + PTFE Yarn Packing [PTFE + V7233, PTFE + TK2006]
10	1 {8}	9 {90}	5 {50}	3 {30}
13		15 {150}	8 {80}	5 {50}
16		24 {240}	13 {130}	8 {80}
20		32 {320}	18 {180}	10 {100}
25		–	-28 {280}	15 {150}
30		66 {660}	36 {360}	20 {200}

Note: The tightening torques mentioned in the above are only to give you reference values. Note that tightening torques may vary depending on the type of packing.

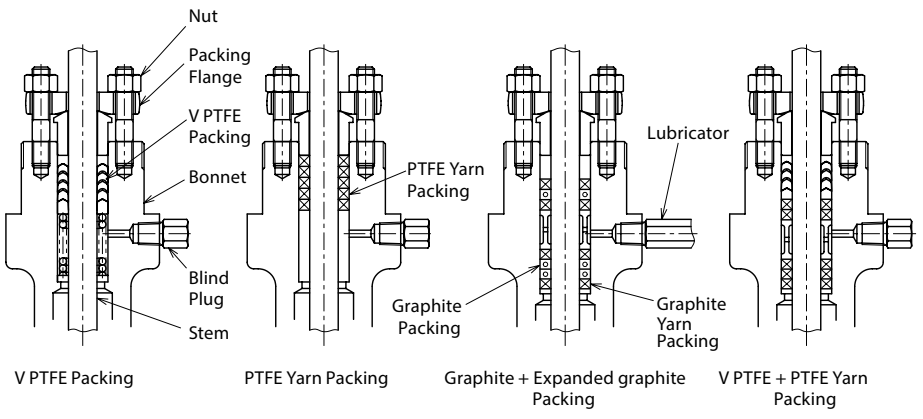


Fig. 2-1 Gland Section

(4) If the valve is provided with a lubricator as shown in Fig. 2-2, check whether the bonnet section has been lubricated or not. To do this, loosen the lubricator handwheel and turn the squeeze screw. If the squeeze screw turn lightly, and grease in the lubricating procedure mentioned below. (If the squeeze screw turns heavily, this means that grease has been applied.)

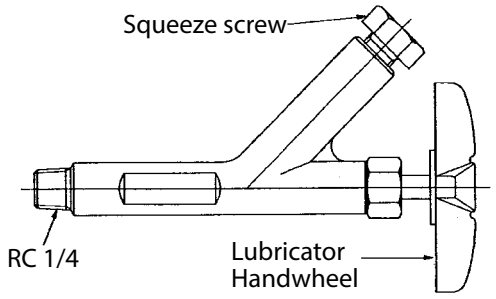


Fig. 2-2 Lubricator(Class 600 or under)

Lubricating Procedure

(a) prepare grease of the type indicated on the nameplate.

(b) Tightly close the lubricator handwheel.

(c) Remove the squeeze screw, apply grease, and set the squeeze screw.

(d) Loosen the lubricator handwheel and drive grease by turning the squeeze screw.

(e) Repeat the procedure of (b), (c) and (d) until turning of the squeeze screw becomes heavier. Tightly close lubricator handwheel.

(5) When raising temperature of a valve which is used for high temperature service, raise temperature gradually (standard rate is 100 ℃ per hour) and do not operate the valve when its temperature is being raised.

3. INSPECTION AND MAINTENANCE

Inspect and service the actuator as follows:

(1) Tightening the gland:
Tighten the gland once in every 6 months or thereabout.
The tightening procedure is as given in Section 2-3-(3).

(2) Lubricating the gland:
Lubricating the gland once in every 6 months or thereabout.
The lubricating procedure is as given in Section 2-3-(4).

(3) Check for hunting of valve Position:
Refer to Section 10 “TROUBLESHOOTING.”

(4) Check for abnormal noise and vibration:
Refer to Section 10 “TROUBLESHOOTING.”

4. DISASSEMBLY AND ASSEMBLY

This section covers the disassembly and assembly procedures of the actuator for its overhaul or modification.

4.1 Detaching Actuator from Valve Body

See Fig. 4-4.

(1) Apply to the actuator an air pressure so that the valve position pointer is at a point of 10% - 20% above the fully closed point.

(2) Loosen the clamping-bolts of the stem connector, remove the stem connector, and detach the actuator stem from the valve stem.

(3) Remove the clamping-nut of the yoke.

(4) Raise the actuator to detach it from the valve body.

Precautions: For detaching the actuator from the valve body which is kept installed in the process pipe, be sure to shut down the process for and release the process pressure before detaching the actuator.

4.2 Disassembly and Assembly of Valve Body

To disassemble or assemble the valve body, refer to Fig. 4-1 through Fig. 4-3 and proceed as described below.

Disassembly Procedure

(1) Apply an air pressure to the diaphragm so that the valve opens between 10% and 90%, then hold it so that the valve plug does not touch the seat ring.

(2) Remove the stem connector to separate the actuator stem from the valve stem.

(3) Release an air pressure from the diaphragm and disconnect the air piping.

(4) Remove the yoke nut by turning it with a chisel and detach (pull up) the actuator from the valve body.

(5) Remove the tail piece from the valve body by loosening the bottom nuts on the body.

(6) Pull down the seating guide from the valve body. However, for 1” valve, unscrew and remove the seat ring from the tail piece as required.

(7) Loosen the gland packing flange nuts and remove the valve plug from the bottom of the valve body.

(8) Remove the bonnet assembling nuts and pull out the bonnet.

(9) To remove the seat ring, use the “special tool* for mounting and removing the seat ring.”
*: Separately ordered.

Inspection

Inspect the disassembled parts for damage. If any damage is found, replace the parts.

(When ordering parts, mention also the Prod. No. of the valve which is indicated on the nameplate.)

(1) Do not re-use the removed gland packing. Use fresh packing when assembling the valve. (When assembling, a vacuum service valve, pay special attention to the packing assembly method.)

(2) Check that the seating surfaces of plug, seat ring and cage are not damaged.

(3) Check that the gasket-contacting surfaces of valve body, bonnet and guide ring cage are not damaged. Do not re-use the removed gasket. Use fresh gasket when assembling the valve.

(4) Check that the plug guide section, the stem, and the guiding sections of guide bushing, seat ring and seating guide are not damaged.

Assembly Procedure

To assemble the valve, follow the disassembly procedure in the reverse order.

(1) To mount the seat ring, use the "special tool for mounting and removing the seat ring." (The tool is optional.)
For the tightening torques, see Table 4-1.

(2) Insert the valve plug (with valve stem mounted) from the tail piece side.

(3) Mount the seating guide and two gasket (one for 1" valve). (For 1" valve, seat ring should be inserted in the tail piece in advance.)

(4) Mount the guide ring and two gaskets (since 1" valve has the guide mounted in the bonnet and 1 1/2" and 2" valve in the valve body, only one gasket is used) from the top of the valve body and install the bonnet.

For assembling the tail piece and the bonnet with nuts, first tighten all nuts lightly with a hand further, gradually tighten them with a wrench evenly not to cause uneven tightness.

Refer to Table 4-2 for the tightening torque.

(5) Insert the gland packing into the bonnet. (See Fig. 2-1.)

Note: When installing yarn packings, stack them sheet by sheet with the cut sections of the mutally adjoining sheets making up the right angle (90 degrees).

(6) Install the packing follower and packing flange, and tighten the nut. For the tightening torque, see Table 2-2.

Size (in.)	Torque (N.m{kgf-cm})
1	150 {1,500}
1-1/2	150 {1,500}
2	180 {1,800}
2-1/2	300 {3,000}
3	390 {3,900}
4	390 {3,900}
5	540 {5,400}
6	540 {5,400}

Table 4-1 Seat Ring Tightening Torques

Bolt	Torque (N.m{kgf-cm})
M12	60 {600}
M16	100 {1,000}
M20	150 {1,500}
M22	200 {2,000}
M24	250 {2,500}
M27	350 {3,500}
M30	500 {5,000}
M33	660 {6,600}
M36	850 {8,500}
M39	1,000{10,000}
M42	1,200 {12,000}
M45	1,400 {14,000}

Table 4-2 Tightening Torque of Bonnet Stud Bolts

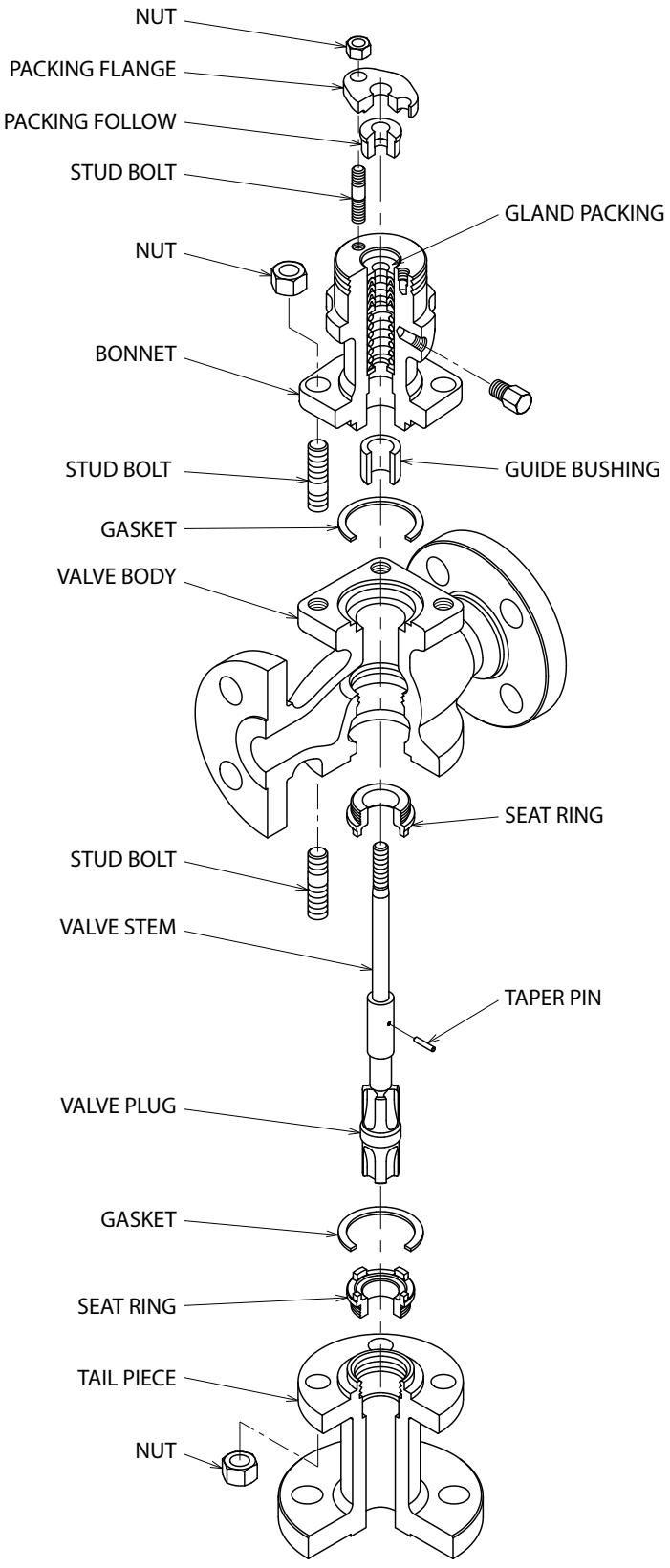


Fig. 4-1 Model AMT 1"

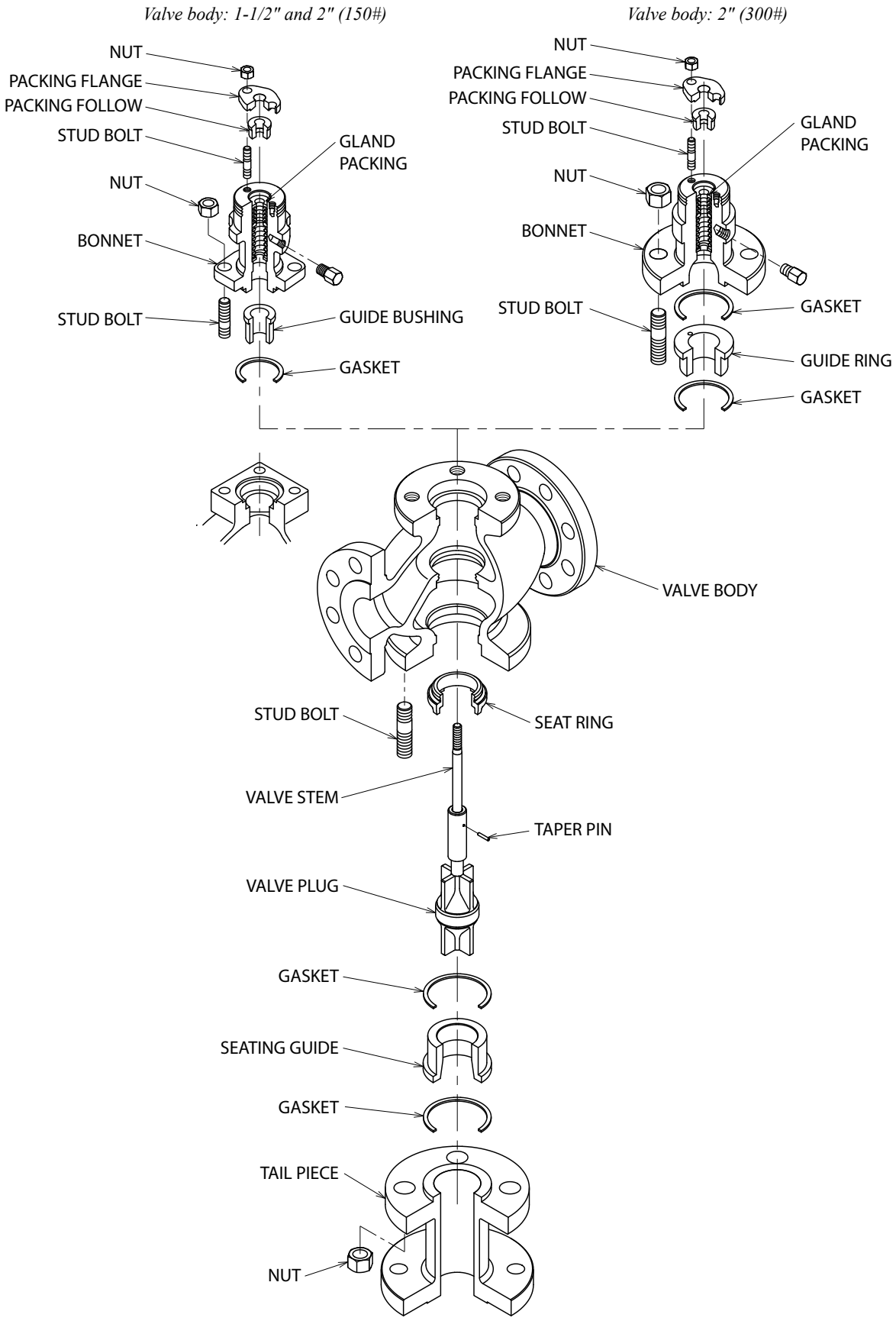


Fig. 4-2 Model AMT 1 1/2", 2"

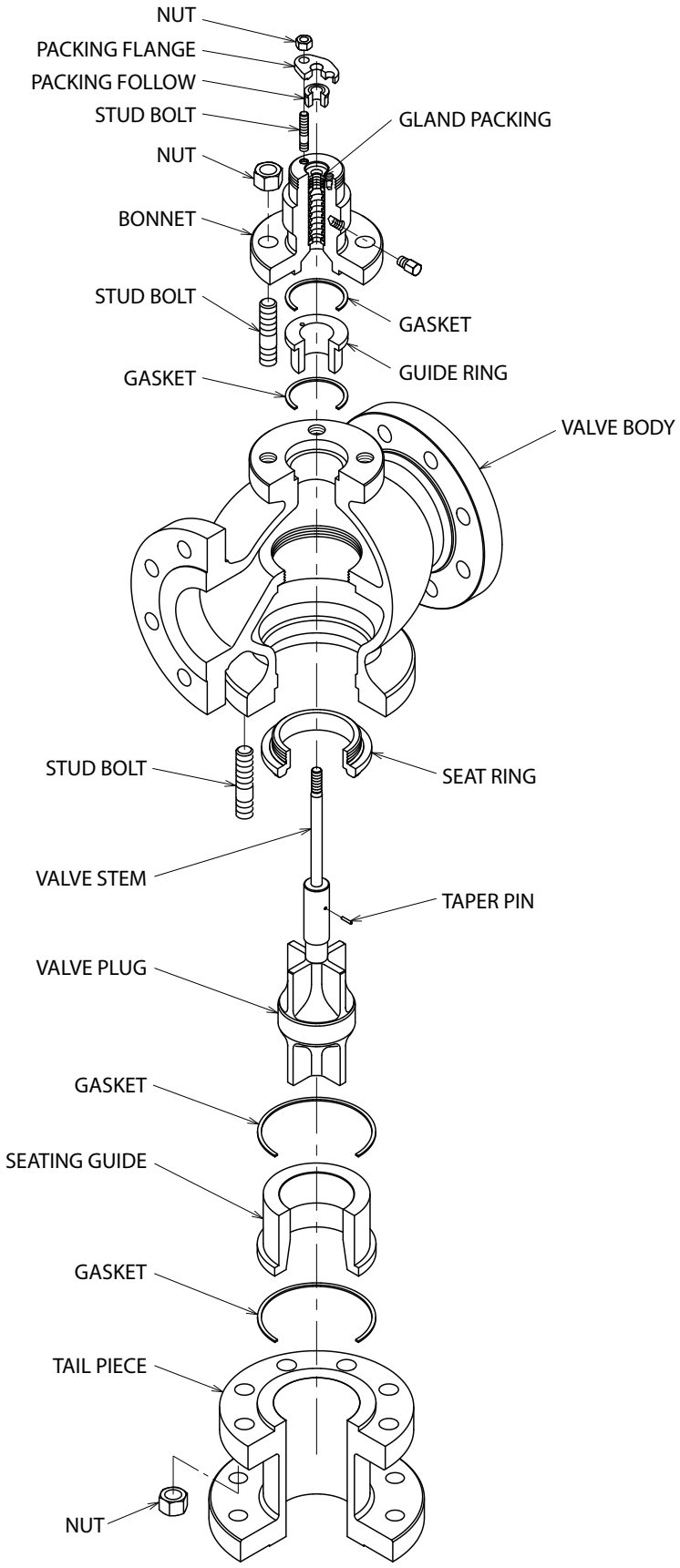


Fig. 4-3 Model AMT 2 1/2" - 6"

4.3 Disassembly and Assembly of Actuator

Normally the actuator requires no adjustment. However, it should be disassembled and assembled when installing it on a valve body, when modifying its specifications, or when replacing damaged parts. The disassembly and assembly procedure of the actuator for such purposes are covered in Sections 4-4 and 4-5.

To disassemble the actuator, refer to Fig. 4-10 and Fig. 4-18.

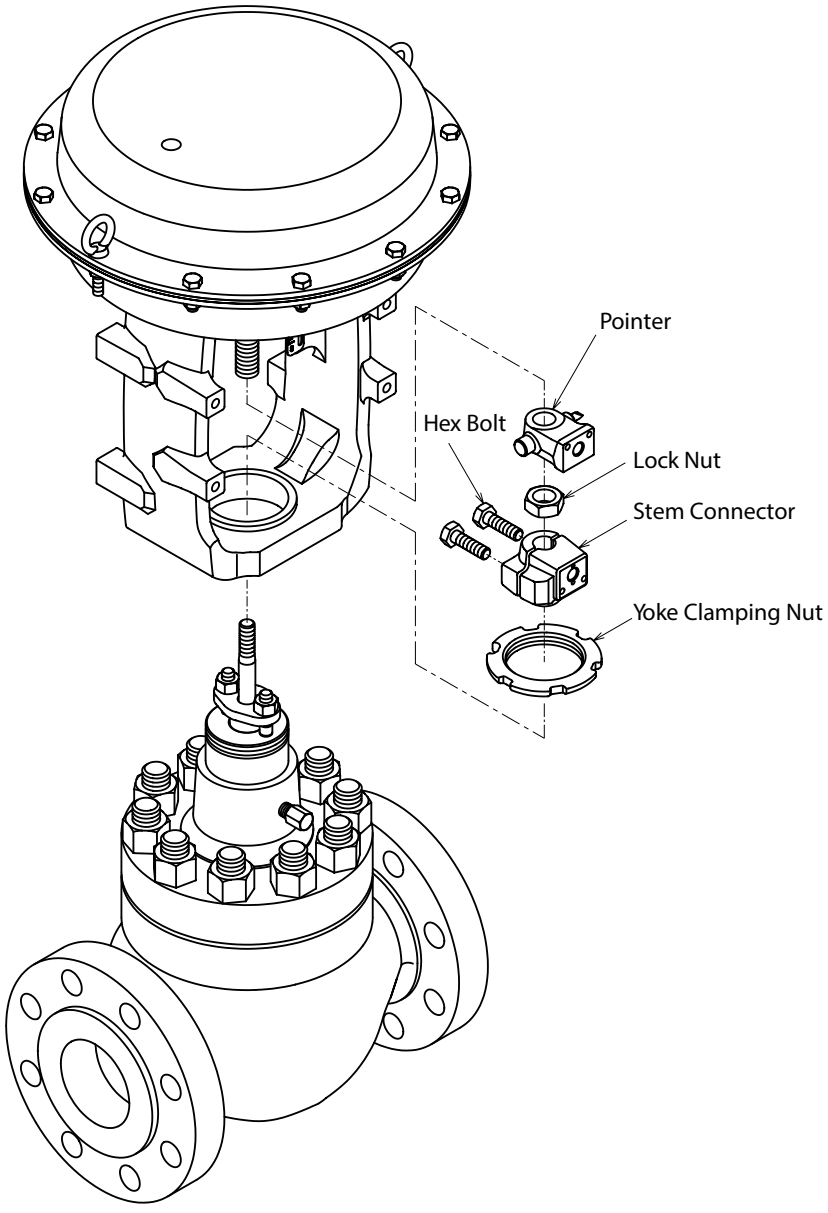


Fig. 4-4

When disassembling or assembling the actuator, keep it in the vertical attitude. For the tightening torques of bolts and nuts, see Table 4-3.

For the names of the parts, see Fig. 4-10 and Fig. 4-18.

Notes for Disassembly

1. The nuts for the eyebolts are made of stainless steel. Discriminate these nuts from other nuts when assembling the diaphragm case.
2. It is recommendable to make locating marks on the top and bottom diaphragm cases before disassembly. This will help you to find easily the air piping connector location.
3. Store the removed parts in a clean place.

Caution:	Never loosen or remove carelessly the bolts and nuts of the actuator. The actuator employs powerful compressed springs and if you remove the bolts and nuts carelessly, the springs may leap out causing hazards. When removing the bolts and nuts, be sure to observe the instructions given for disassembly and assembly procedures of the actuator and top handwheel.

4.4 Disassembly and assembly of model PSA 1

Disassembly procedure

A. Direct action model (see Fig. 4-5)

(1) Disconnect the air piping and detach the accessories from the actuator.

(2) Remove the stem connector.

(3) Remove the clamping bolts (except the pair of eyebolts) from the diaphragm case.

(4) Alternatively and evenly loosen the pair of eyebolts. The initial setting of the springs is achieved using these eyebolts.

(5) Removing the diaphragm case. Pull the actuator rod upward and out together with the diaphragm.

(6) Take out the springs.

B. Reverse action model (see Fig. 4-6)

(1) Disconnect the air piping and detach the accessories from the actuator

(2) Remove the stem connector.

(3) Remove the clamping bolts (except the pair of eyebolts) from the diaphragm case.

(4) Alternately and evenly loosen the pair of eyebolts. The initial setting of the springs is achieved using the eyebolts.

(5) Remove the diaphragm case. Take out the springs.

(6) Pull the actuator rod upward and out together with the diaphragm.

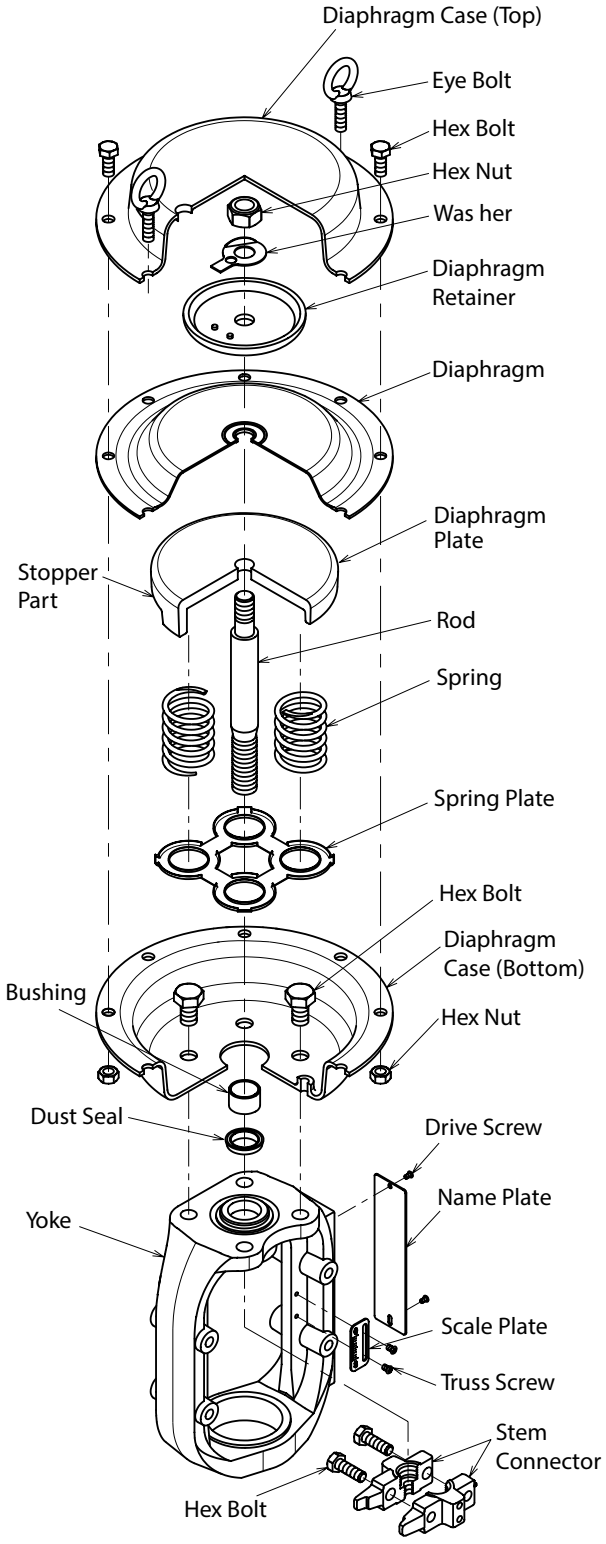


Fig. 4-5 Direct Action model PSA1D

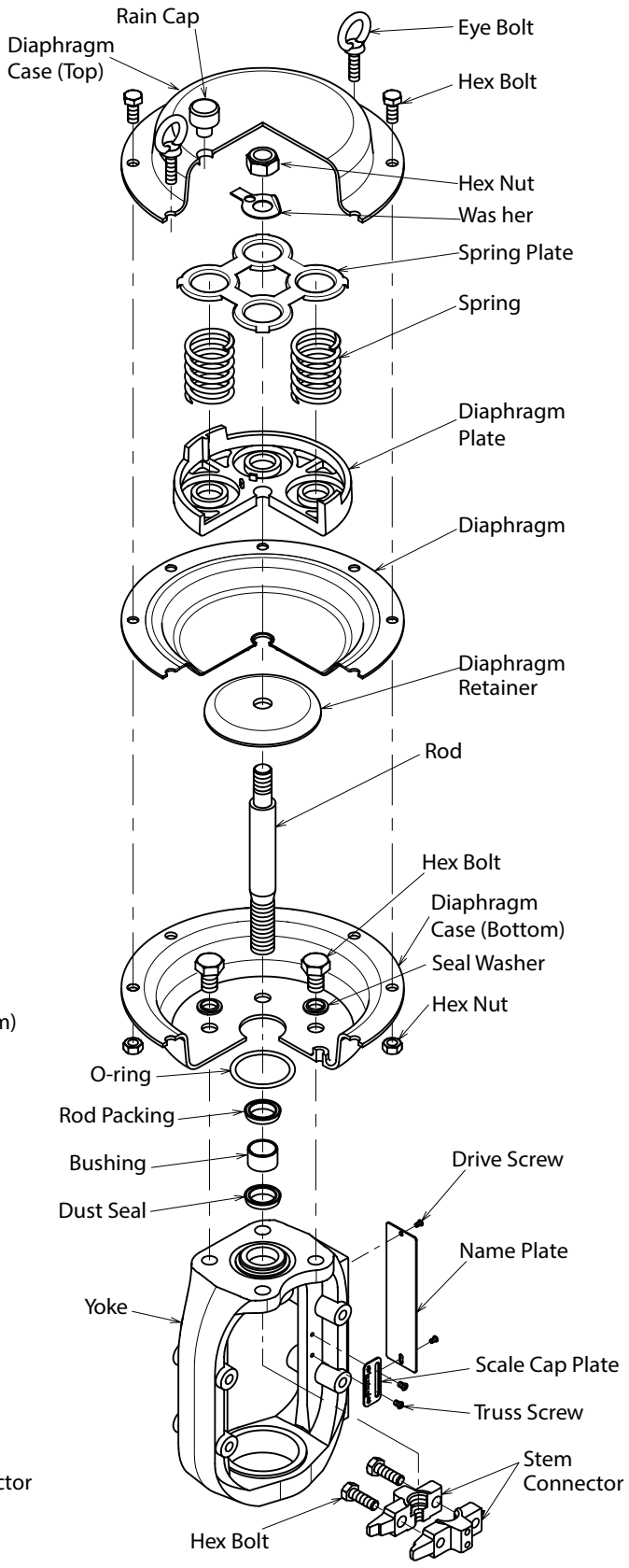


Fig. 4-6 Reverse Action model PSA1R

Assembly

Before assembly, check the parts for scratches, damage, deformation, peeling paint or any other abnormalities. To assemble the actuator, proceed as follows:

A. Direct action models

(1) Secure the diaphragm case (bottom) with the four bolts to the yoke. At the same time, set the air vent hole as in Fig. 4-7. For PSA1D actuator, secure the spring plate to the diaphragm case and yoke.

(2) Fasten the spring plate and install the springs onto the spring plate (see Fig. 4-7).

(3) Insert the actuator rod (with diaphragm connected) into the bushing. Be careful to prevent the bushing's inside surface or dust seal form being damaged by the threaded section of the rod. If possible, cover the threaded section with adhesive tape.

(4) Rotate the actuator rod, locating the diaphragm plate stopper as shown in Fig. 4-7.

(5) Place the top diaphragm case and secure it with the pair of eyebolts.

Note: Set the air pipe connection port to the location shown in Fig. 4-7. Tighten the pair of eyebolts uniformly and alternately. The initial setting of the springs is completed by tightening these eyebolts.

(6) Clamp the diaphragm case with clamping bolts.

(7) Install the stem connector. Connect the air pipe to its connection port at the top diaphragm case.

(8) After completing assembly, check the following:

- Apply air pressure of 490 kPa {5 kgf/cm^2} through the air pipe connection port at the top diaphragm case, and check the diaphragm periphery for air leakage with soapy water.
- Check that the actuator operates smoothly through to its full stroke by operating it as an independent unit.

⚠ CAUTION

Install packing for the rod and dustseal in the correct direction. Refer to Fig. 4-5.

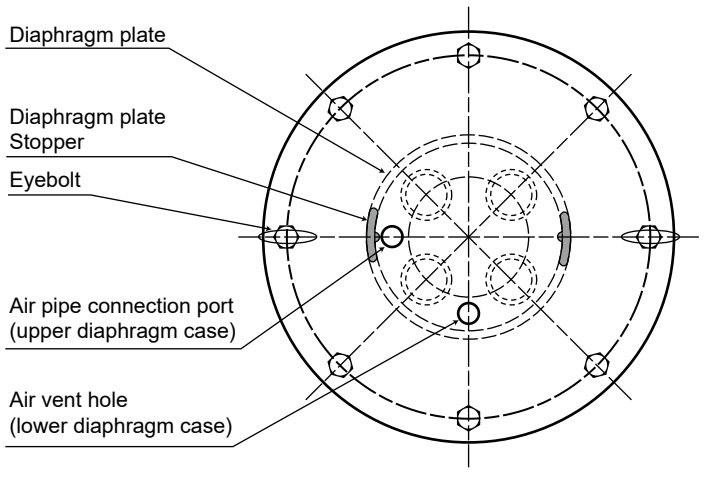


Fig. 4-7 Direct Action Models Model PSA1D Actuator

B. Revers action models

(1) Secure the bottom diaphragm case with the four bolts to the yoke. At the same time, set the air pipe connection port in the location shown in the Fig. 4-8.

(2) Insert the actuator rod (with diaphragm connected) into the bushing. Be careful to prevent the bushing's inside surface or dust seal from being damaged by the threaded section of the rod. If possible, cover the threaded section with adhesive tape.

(3) Rotate the actuator rod, locating its diaphragm plate stopper as shown in Fig. 4-8.

(4) Fasten the spring plate and install the springs onto the spring plate. (see Fig. 4-8).

(5) Place the top diaphragm case and secure it with the pair of eyebolts.

Note: Set the air vent hole to the location shown in Fig. 4-8. Uniformly and alternately tighten the eyebolts. The initial setting of the springs is completed by tightening these eyebolts.

(6) Clamp the diaphragm case with clamping bolts.

(7) Install the stem connector.

(8) Install the rain cap onto the air vent port.

(9) Connect the air pipe to its connection port at the bottom diaphragm case.

(10) After completing of assembly, check the following.

- Apply air pressure of 490 kPa {5 kgf/cm^2}through the air pipe connection port at the diaphragm case, and check the diaphragm periphery for air leakage with soapy water.
- Check that the actuator operates smoothly through to its full stroke by operating the actuator as an independent unit.

⚠ CAUTION

Install packing for the rod and dustseal in the correct direction. Refer to Fig. 4-6.

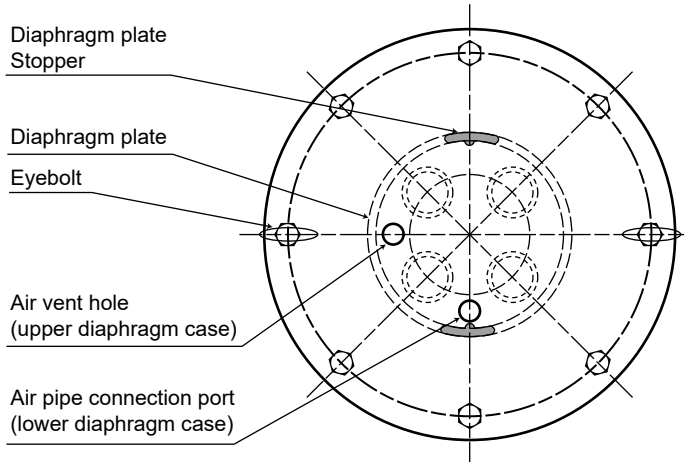
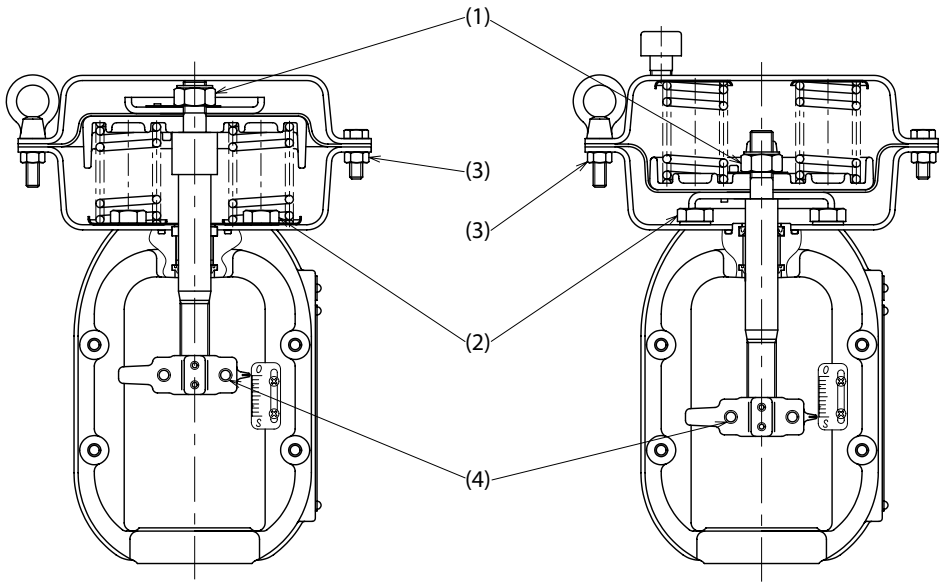


Fig. 4-8 Reverse Action Model Model PSA1R Actuator



Direct Action Type (Model PSA1D) *Reverse Action Type (Model PSA1R)*

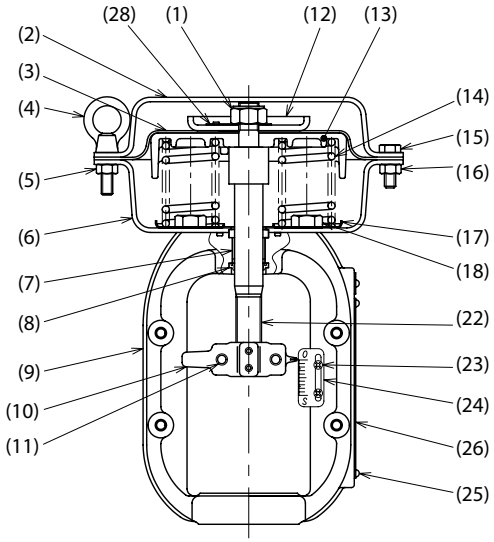
Fig. 4-9 Bolts and Nuts of Actuator

Table 4-3 Tihtening Torques of Bolts and Nuts of Actuator

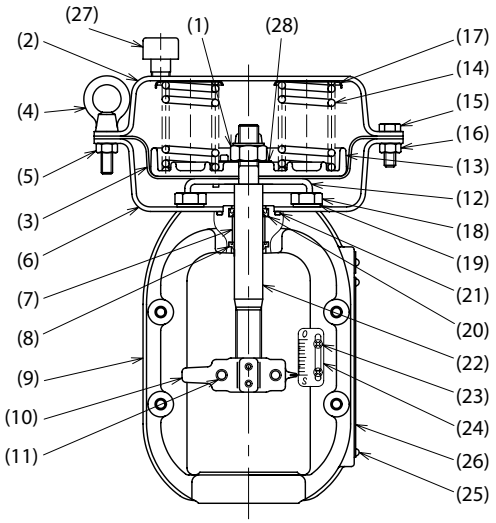
Unit:(N.m{kgf-cm})

No.	Materials	Model PSA1	
1	SK5 S45C	M14	45-70
			{460-710}
2	S30C	M12	35-50
			{360-510}
3	SUS304	M8	15-20
			{150-200}
4	SUS304	M8	10-15
			{100-150}

Note: Install the rain cap on the reverse actuator as follows. Drive the cap into the diaphragm case until the shoulder (brim) of the cap is brought into contact with the diaphragm case, then drive the cap further into the diaphragm case by half a turn.



Direct Action Type (Model PSA1D)



Reverse Action type (Model PSA1R)

Fig. 4-10 Model PSA Actuator

No.	Parts Name	Material
1	Nut	S45C, SUS301
2	Diaphragm Case (Top)	SAPH400
3	Diaphragm	EPDM, Polyimide
4	Eye Bolt	SUS304
5	Hex Nut	SUS304
6	Diaphragm Case (Bottom)	SAPH370
7	Bushing	SPCC, Bronze, PTFE
8	Dust Seal	NBR
9	Yoke	A216WBC
10	Stem Connector	SCS13A
11	Hex Bolt	SUS304
12	Diaphragm Retainer	SS400
13	Diaphragm Plate	AC4A-F
14	Spring	SWOSM-B

No.	Parts Name	Material
15	Hex Bolt	SUS304
16	Hex Nut	SUS304
17	Spring Plate	SUS304CP
18	Hex Bolt	S30C
19	Seal Washer	NBR, SPCC
20	Rod Packing	NBR
21	O-Ring	NBR
22	Rod	SUS304
23	Truss Screw	SUS304, SK5
24	Scale Plate	SUS304CP
25	Drive Screw	SUS304
26	Name Plate	SUS304CP
27	Rain Cap	SUS304
28	Washer	SUS304CP

4.5 Disassembly and Assembly of Model HA2, HA3, or HA4 Actuator

Disassembly Procedure

(a) Direct Action Type

(1) Disconnect the air piping and detach the accessories from the actuator.

(2) Remove the stem connector, pointer and lock nut. (See Fig. 4-18.)

(3) Remove the clamping-bolts (except the pair of eyebolts) of the diaphragm case.

(4) Loosen evenly and alternately the pair of eyebolts. (The initial setting of the springs is done by these eyebolts.)

(5) Remove the diaphragm case. Pull out upward the actuator rod together with the diaphragm.

(6) Take out the springs.

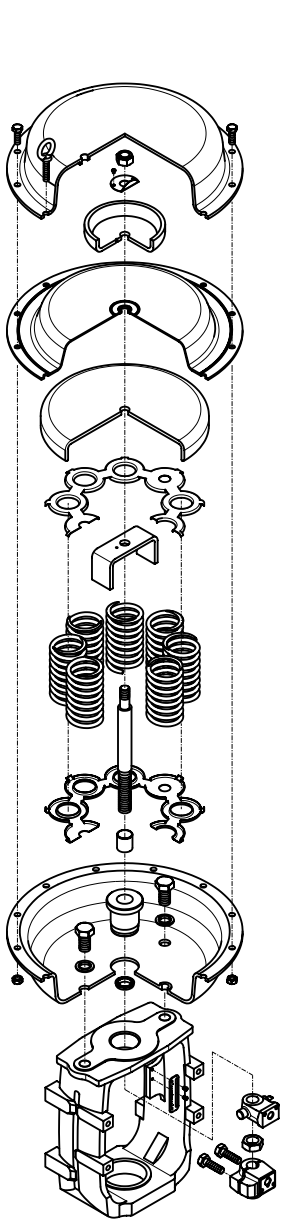


Fig. 4-11 HA2D or HA3D Actuator

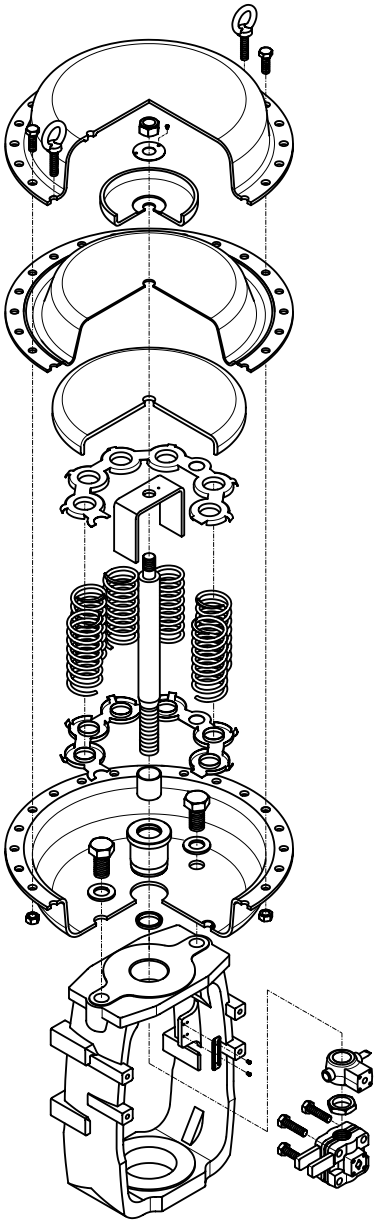


Fig. 4-12 HA4D Actuator

(b) Reverse Action Type

(1) Disconnect the air piping and detach other external items from the actuator.

(2) Remove the stem connector, pointer and lock nut. (See Fig. 4-18.)

(3) Remove the clamping-bolts (except the pair of eyebolts) of the diaphragm case.

(4) Loosen evenly and alternately the pair of eyebolts. (The initial setting of the springs is done by these eyebolts.)

(5) Remove the diaphragm case. Take out the springs.

(6) Pull out upward the actuator rod together with the diaphragm.

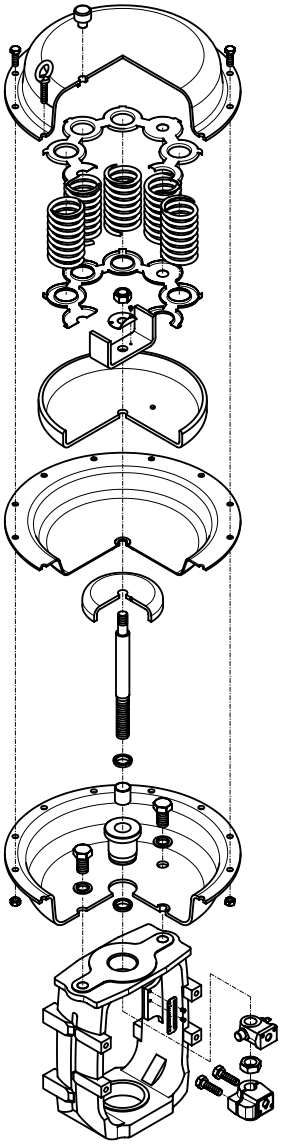


Fig. 4-13 HA2R or HA3R Actuator

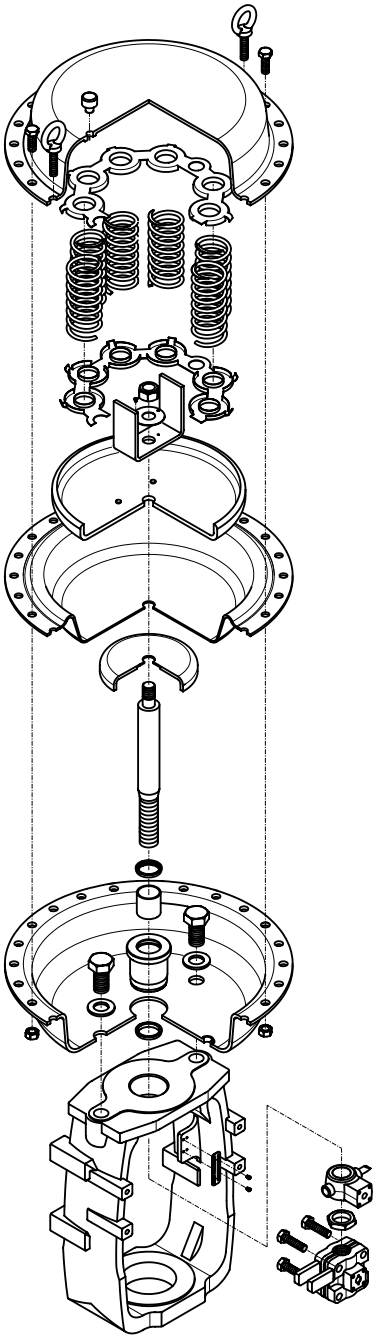


Fig. 4-14 HA4R Actuator

Assembly Procedure

Before assembly, check the parts for scrapes, damage, deformation, peeling off of paint, and other abnormality. To assemble the actuator, proceed as follows:

(a) Direct Action Type

(1) Fix the bottom diaphragm case and yoke with the bolts. (For models HA2D and HA3D, install the diaphragm case and spring plate together.)

(2) Install the springs on the spring plate. The quantities of springs are as follows;

HA2 .....4 springs

HA3, HA4.....8 springs

Except particular models as follows:

HA2, 38 mm stroke,
80 - 240 kPa (0.8 - 2.4 kgf/cm^2) ..... Total 8 springs (with double springs)

HA3, 50 mm stroke,
80 - 240 kpa (0.8 - 2.4 kgycm^2) ..... Total 16 springs (with double springs)

HA4, 75 mm stroke,
80 - 240 kPa (0.8 - 2.4 kgf/cm^2) ..... Total l6 springs (with double springs)

(3) Insert the actuator rod (to which the diaphragm is connected) into the bushing, exercising are not to damage the bushing inside surface or dust seal with the threaded section of the rod. (For example, cover the threaded section with adhesive tape to prevent damaging the hushing.) Set the stopper in parallel with the yoke.

(4) Place the top diaphragm case and fix it with the pair of eyebolts.

Notes:
- Set the air piping connection port in the location shown in the illustration. (Fig. 4-15)
- Tighten the pair of eyebolts uniformly by tightening them alternately. The initial setting of the springs is complete by tightening of these eyebolts.

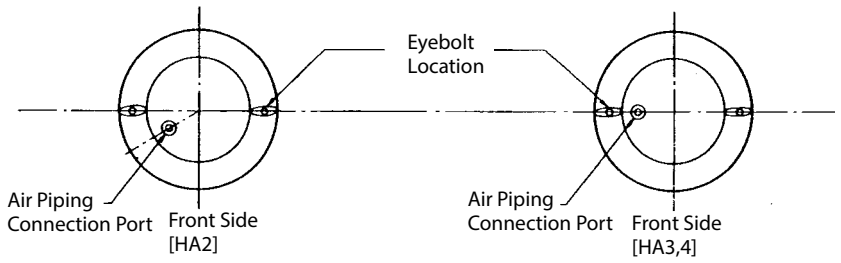


Fig. 4-15 Direct Action Type

(5) Clamp the diaphragm case with other clamping-bolts than the pair of eyebolts.

(6) Install the pointer, secure the lock nut, and install the stem connector. (Connect the air pipe to the air piping connection port of the top diaphragm case.)

(7) After the assembly is complete as above, check the following.

1. Applying an air pressure of 490 kPa (5kgf/cm^2) via the air piping connection port of the top diaphragm case, check the diaphragm periphery for air leak by using soapsuds.
2. Check that the actuator smoothly operates for its full stroke.

Note: Check this operation by operating the actuator as an independent unit.

(b) Reverse Action Type

(1) Fix the bottom diaphragm case and yoke with the bolts.

(2) Insert the actuator rod (to which the diaphragm is connected) into the bushing, exercising care not to make the bushing inside surface and dust seal damaged by the thread section of the rod. (For example, cover the threaded section with adhesive tape to prevent damaging the bushing.)

(3) Make the stopper (in the diaphragm plate) in parallel with the yoke by turning the rod.

(4) Install the springs on the spring plate. The quantities of springs are as follows:

HA2 .....4 springs

HA3, HA4.....8 springs

Except particular models as follows:

HA2, 38 mm stroke,
80 - 240 kPa (0.8 - 2.4 kgf/cm^2) ..... Total 8 springs (with double springs)

HA3, 50 mm stroke,
80 - 240 kpa (0.8 - 2.4 kgycm^2) ..... Total 16 springs (with double springs)

HA4, 75 mm stroke,
80 - 240 kPa (0.8 - 2.4 kgf/cm^2) ..... Total l6 springs (with double springs)

(5) Place the top diaphragm case and fix it with the pair of eyebolts. Set the air vent hole in the location shown in the illustration (Fig. 4-16). Uniformly and alternately tighten the eyebolts. The initial setting of the springs is complete by tightening of these eyebolts.

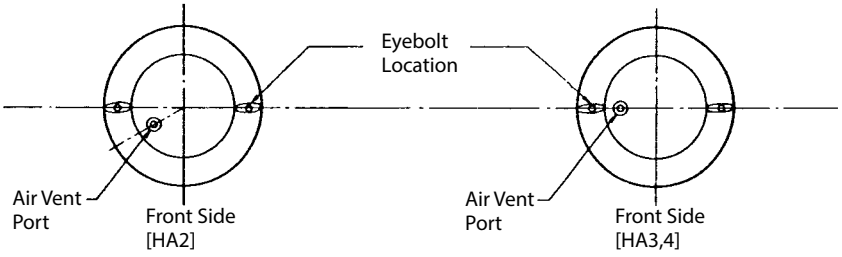


Fig. 4-16 Reverse Action Type

(6) Clamp the diaphragm case with other clamping-bolts than the pair of eyebolts.

(7) Install the pointer, secure the lock nut, and install the stem connector.

(8) Install the rain cap on the air vent port.

(9) Connect the air pipe to the air piping connection port of the bottom diaphragm case.

(10) After the assembly is complete as above, check the following.

1. Applying an air pressure of 490kPa (5kgf/cm^2) via the air Piping connection port of the bottom diaphragm case, check the diaphragm periphery for air leak by using soapsuds.
2. Check that the actuator smoothly operates for its full stroke.

Note: Check this operation by operating the actuator as an independent unit.

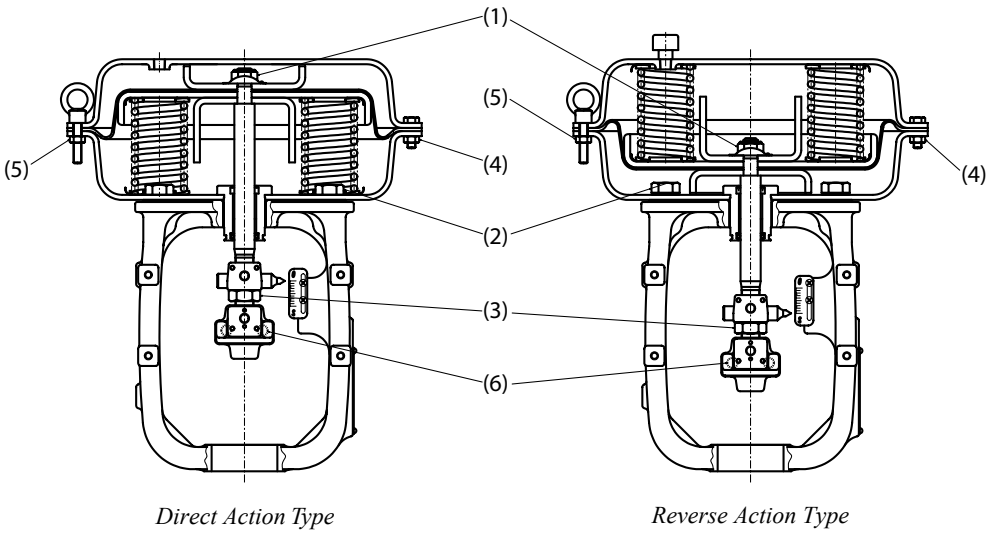
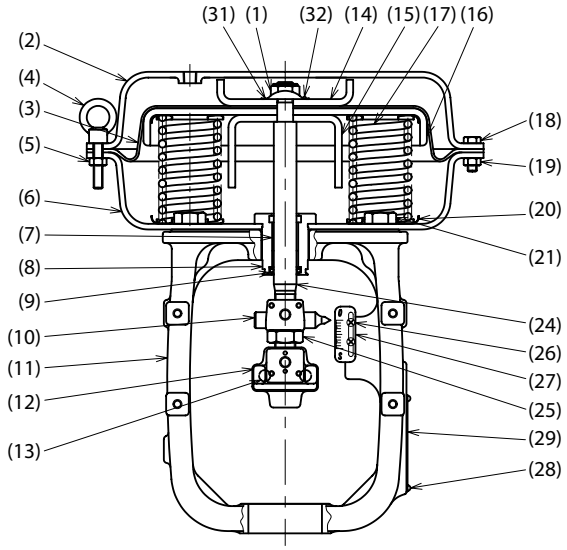


Fig. 4-17 Bolts and Nuts of Actuator

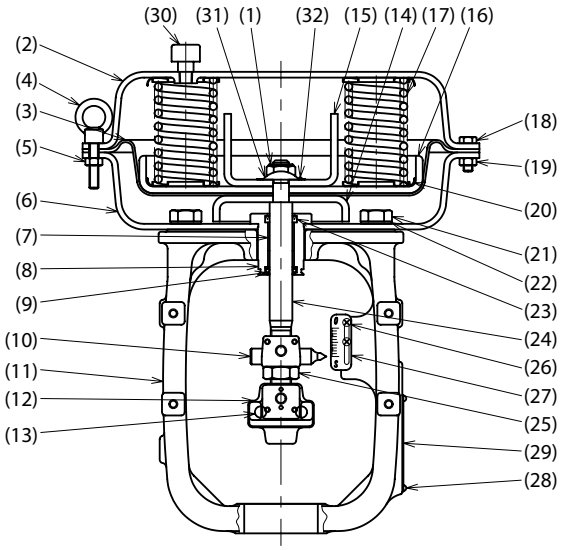
Table 4-4 Tightening Torques of Bolts and Nuts of Actuator

Unit:(N.m{kgf-cm})

No.	Materials	For Model HA2		For Model HA3		For Model HA4	
1	S45C/SUS301	M10	37 {370}	M14	100 {1,000}	M20	310 {3,170}
2	S30C	M12	42 {420}	M16	100 {1,000}	M24	360 {3,360}
3	S20C	M14	69 {690}	M18	140 {1,400}	M30	710 {7,160}
4	S20C	M8	16{160}	M8	16{160}	M12	55 {550}
5	SUS304	M8	18{180}	M8	18{180}	M12	63 {630}
6	SUS304	M10	56{560}	M10	56{560}	M12	63 {630}



Direct Action Type (Model HA3D)



Reverse Action Type (Model HA3R)

No.	Parts Name	Material
1	Nut	S45C, SUS301
2	Diaphragm Case (Top)	SAPH370
3	Diaphragm	EPDM+Nylon66
4	Eye Bolt	SUS304
5	Hex Nut	SUS304
6	Diaphragm Case (Bottom)	SAPH370
7	Bushing	SPCC, Bronze, PTFE
8	Bearing	S25C
9	Dust Seal	NBR
10	Pointer	S25C
11	Yoke	SCPH2, A216WBC
12	Stem Connector	S25C, S20C
13	Hex Bolt	SUS304, S30C
14	Diaphragm Retainer	SS400
15	Stopper	SS400
16	Diaphragm Plate	SS400

No.	Parts Name	Material
17	Spring	SWOSM-B
18	Hex Bolt	SUS304
19	Hex Nut	SUS304
20	Spring Plate	SPCC
21	Hex Bolt	S30C
22	Seal Washer	NBR, SPCC
23	Rod Packing	NBR
24	Rod	SUS304
25	Lock Nut	SUS304
26	Truss Screw, Spring Washer Nut, or Speed Nut	SUS304, SK5
27	Scale Plate	SUS304CP
28	Screw	SUS304
29	Name Plate	SUS304CP
30	Rain Cap	SUS304
31	Washer	SPCC
32	Tapping Screw	S20C

Fig. 4-18 Cut View of Actuator

5. ADJUSTMENT AND CALIBRATION

Normally, the diaphragm-type control valve requires no adjustment or calibration. When it is serviced for overhaul or parts replacement, however, it should be adjusted and calibrated as described in this section.

Lift Adjustment

• For Valve with Direct-action Actuator

Keeping the stem connector disconnected, make air piping to apply an air pressure to the diaphragm. Apply an air pressure to the actuator so that the actuator stem (pointer) is pressed downward by 2mm and, in this state, set the pointer to B-AB point of the scale. Next, increase the air pressure until the pointer indicates the A-AB point of the scale. On the other hand, press down the valve stem until the valve plug is seated on the lower seat ring. Now connect the actuator stem to the valve stem with the stem connector.

By adjusting the air pressure applied to the diaphragm, check that the lift (stroke) of the valve is normal.

Next, with the valve position at a midposition of the stroke, slightly loosen the screw of the stem connector so that it can be rotated with your hand. By adjusting the air pressure, let the valve plug seated on the upper and lower seat rings. The seated state can be known as the stem cannot be rotated with your hand when in this state. If the stem connector can be rotated with your hand, this means that the valve plug is not seated on the seat. If this is the case, repeat the adjustment all over again.

• For Valve with Reverse-action Actuator

Keeping the stem connector disconnected, make air piping to apply an air pressure to the diaphragm. Apply an air pressure to the actuator so that the actuator stem (pointer) is pressed upward by 2mm and, in this state, set the pointer to A-AB point of the scale. On the other hand, press down the valve stem until the valve plug is seated on the lower seat ring. Now connect the actuator stem to the valve stem with the stem connector.

By adjusting the air pressure applied to the diaphragm, check that the lift (stroke) of the valve is normal.

Next, with the valve position at a midposition of the stroke, slightly loosen the screw of the stem connector so that it can be rotated with your hand. By adjusting the air pressure, let the valve plug seated on the upper and lower seat rings. The seated state can be known as the stem connector cannot be rotated with your hand when in this state. If the stem connector can be rotated with your hand, this means that the valve plug is not seated on the seat. If this is the case, repeat the adjustment all over again.

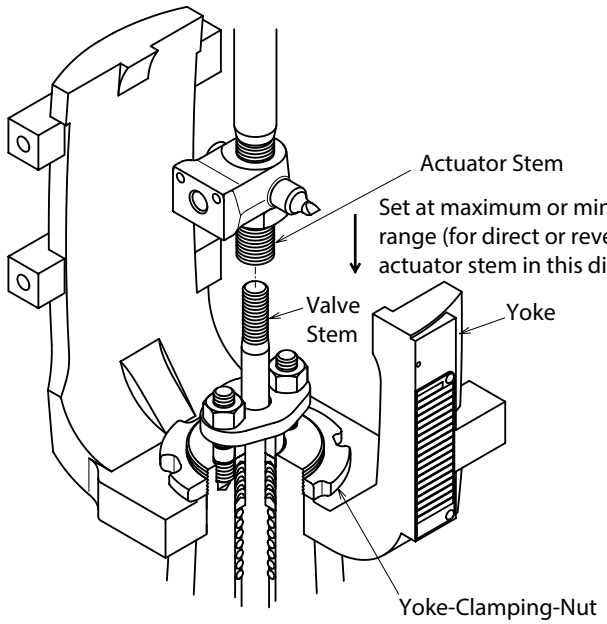

Actuator Stem
Set at maximum or minimum value of spring range (for direct or reverse action) by moving actuator stem in this direction.
Valve Stem
Yoke
Yoke-Clamping-Nut

Fig. 5-1

6. DIRECT/REVERSE ACTION TYPE CONVERSION AND SPRING RANGE CHANGE OF ACTUATOR

6.1 Direct/Reverse Action Change

As a general rule it is most recommendable to prepare separately the direct type and reverse type of actuators and not to convert actuators into different types. However, when it has become unavoidable to convert actuators into other types, conversions may be done by using the parts mentioned below (Table 6-1 and Table 6-2). The parts marked "+" are the ones which are newly needed and those marked "-" are ones which are not used.

Table 6-1 To Convert the Direct-Action Thpe into the Reverse Action Type

PSA1D -> PSA1R	
Part name	Q'ty
Rod unite	+1
Rod	-1
Seal washer	+4
Rod packing	+1
Rain cap	+1
Washer	+1
"O" ring	+1

HA2D -> HA2R	
Part name	Q'ty
Seal washers	+2
Rod packing	+1
Rod unit	+1
Rain cap	+1
Rod	(-1)

HA3D -> HA3R	
Part name	Q'ty
Seal washers	+2
Rod packing	+1
Rod unit	+1
Rain cap	+1
Rod	(-1)

HA4D -> HA4R	
Part name	Q'ty
Seal washers	+2
Rod packing	+1
Rod unit	+1
Rain unit	(-1)
Rain cap	+1
Flat washers	(-2)

Table 6-2 To Convert the Reverse Action Type into the Direct Action Type

PSA1R -> PSA1D	
Part name	Q'ty
Rod unite	+1
Rod	-1
Seal washer	-4
Rod packing	-1
Rain cap	-1
Washer	-1
"O" ring	+1

HA2R -> HA2D	
Part name	Q'ty
Seal washers	(-2)
Rod packing	(-1)
Rod unit	+1
Rod	(-1)
Rain cap	(-1)

HA3R -> HA3D	
Part name	Q'ty
Seal washers	(-2)
Rod packing	(-1)
Rod unit	+1
Rod	(-1)
Rain cap	(-1)

HA4R -> HA4D	
Part name	Q'ty
Seal washers	(-2)
Flat washaers	+2
Rod packing	(-1)
Rod unit	(-1)
Rod	+1
Rain cap	(-1)

For the conversion procedure, refer to Section 4 "DISASSEMBLY AND ASSEMBLY"

6.2 Stroke And Range Spring Change

As a general rule it is most recommendable to prepare separately actuators for diffent strokes and spring ranges to avoid modifications. However, modifications can be done by using the parts mentioned below.

Of Models HA2 and HA3, there are two different diameters of bonnet connection sections. For these models, note the following:

Of Model HA2, modification for change between rated stroke of 14.3 or 25mm and that of 38mm cannot be done.

Of Model HA3, modification for change between rated stroke of 25 or 38mm and that of 50mm cannot be done.

Table 6-3 Parts Required for Respective Stroke Ranges

Note:spring force is equivalent to air pressure(kPa{kgf/cm^2})

Actuator		PSA1D -> PSA1R
Part name		Q'ty
Scale plate		1
Spring	20-98{0.2-0.1}	4
	80-240{0.8-2.4}	4
Rod unit	R (Reverse action)	1
	D (Direct action)	1
Washer		1

Actuator		HA2D -> HA2R
Part name		Q'ty
Scale plate		1
Spring	20-98{0.2-0.1}	4
	80-240{0.8-2.4}	4
Rod unit	R (Reverse action)	1
	D (Direct action)	1

Actuator		HA3D -> HA3R
Part name		Q'ty
Scale plate		1
Spring	20-98{0.2-0.1}	8
	80-240{0.8-2.4}	8
Rod unit	R (Reverse action)	1
	D (Direct action)	1

Actuator		HA4D -> HA4R
Part name		Q'ty
Scale plate		1
Spring	20-98{0.2-0.1}	8
	80-240{0.8-2.4}	8
Rod unit	R (Reverse action)	1
	D (Direct action)	1

*:The quantity of springs is 8 set, with 2 springs for each set, or total 16 springs.

Color Codes and Dimensions of the Springs of Model HA Actuators

The color codes and dimensions of the springs of Model HA Actuators are as shown in the following table. The color codes may help you confirm springs when disassembling and assembling actuators for modification or other purpose.

Table 6-4 Color Codes and Dimensions of Springs

Rated stroke \ Model / Range		PSA1	HA2	HA3	HA4
14.3	20-98 {0.2-1.0}	Red 64.6	Red 86	Yellow and Green 99.2	
	80-240 {0.8-2.4}	Blue 69.8	Blue 90	Red and Green 103.6	
25	20-98 {0.2-1.0}	Green 68.7	Yellow 91.4	Red 99.3	Yellow and Green 148.1
	80-240 {0.8-2.4}	Purple 78.8	Brown 99	Blue 107	Red and Green 155.3
38	20-98 {0.2-1.0}		Green 95	Yellow 102.9	Red 152.8
	80-240 {0.8-2.4}		Purple 107	Brown 114.9	Blue 163.7
50	20-98 {0.2-1.0}			Green 106.5	Yellow 156.3
	80-240 {0.8-2.4}			Purple 122.2	Brown 170.6
75	20-98 {0.2-1.0}				Green 163.4
	80-240 {0.8-2.4}				Purple NOTE 1 182, 186.7*

Note: 1. Each set is comprised of two springs.
2. "0.2-1.0" and "0.8-2.4" are spring forces corresponding to air pressures in the unit of kPa{kgf/cm^2}.
3. The dimensions indicated are free lengths of springs.

7. INSTRUCTIONS FOR TOP HANDWHEEL OF ACTUATOR

7.1 Model PSA1 Actuator

7.1.1 Operating Instructions

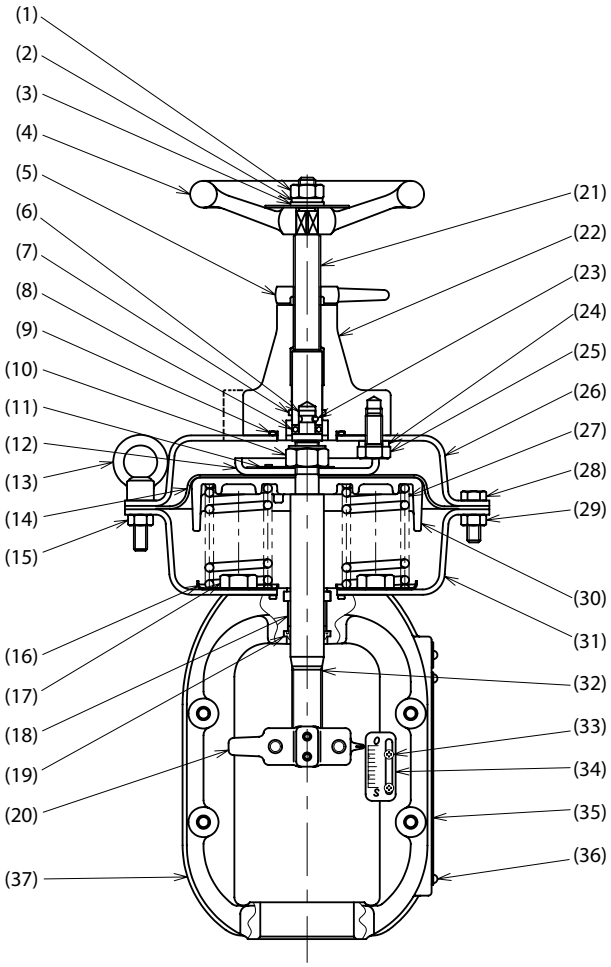
To manually operate the actuator, refer to Fig. 7-1 and proceed as follows:

(1) Loosen the lock nut of the handwheel and turn the handwheel in the direction indicated by the corresponding arrowhead mark.

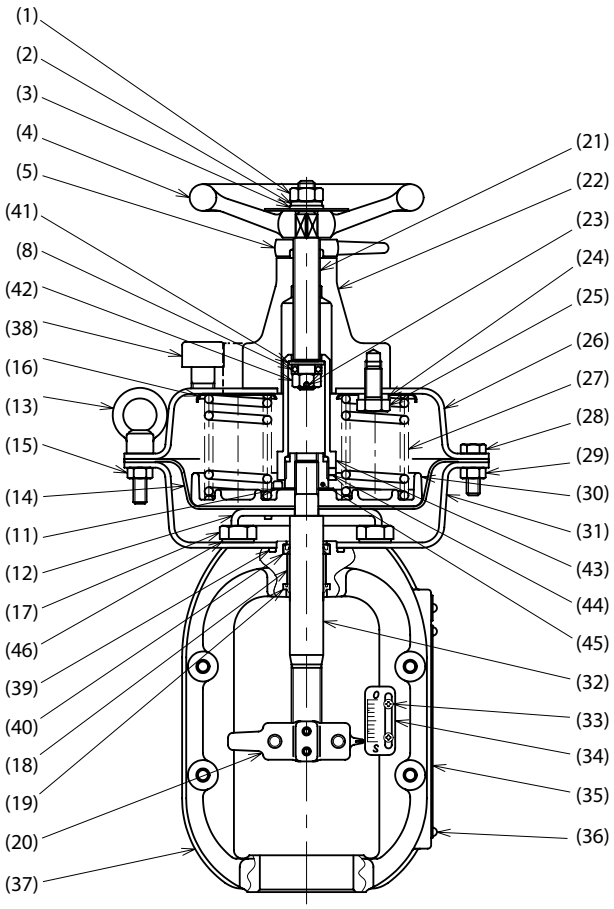
As you turn the handwheel clockwise, the actuator stem moves downward regardless of whether the actuator is of the direct action type or reverse action type. The handwheel bears the "SHUT" mark to indicate that the valve is closed as the handwheel is turned clockwise and the "OPEN" mark to indicate that the valve is made open as the handwheel is turned counterclockwise.

(2) For automatic operation of the actuator, fully raise the handwheel if the actuator is of the direct action type or fully lower the handwheel if the actuator is of reverse action type, and then tighten the lock nut to secure the handwheel in such position.

Precautions: If you forcefully turn the handwheel after it has reached the mechanical stop position, the valve stem may be damaged. Do not turn the handwheel with forces larger than 16 kgf at the outermost periphery of the handwheel.



Direct Action Type



Reverse Action Type

No.	Parts name
1	Hex Nut
2	Spring Washer
3	Washer
4	Handwheel
5	Lock Nut
6	Washer
7	O-Ring
8	Bearing
9	O-Ring
10	Nut
11	Washer
12	Diaphragm Retainer
13	Eye bolt
14	Diaphragm
15	Hex Nut
16	Spring Plate

No.	Parts name
17	Hex Bolt
18	Bushing
19	Dust Seal
20	Stem Connector
21	Screw Shaft
22	Housing
23	Spring Pin
24	Seal Washer
25	Hex Bolt
26	Diaphragm Case (Top)
27	Spring
28	Hex Bolt
29	Hex Nut
30	Diaphragm Plate
31	Diaphragm Case (Bottom)

No.	Parts name
32	Rod
33	Truss Screw
34	Scale Plate
35	Name Plate
36	Drive Screw
37	Yoke
38	Rain Cap
39	O-Ring
40	Rod Packing
41	Bearing Washer
42	Nut
43	Bearing Case
44	Setscrew
45	Connection
46	Seal Washer

Fig. 7-1 Model PSA1 Actuator with Top Handwheel

7.1.2 Disassembly and Assembly of Top Handwheel

To disassemble or assemble the top handwheel, refer to Fig. 7-2 through Fig. 7-3 and proceed as described in this section. For disassembly work, keep the actuator in the vertical attitude.

(a) Direct Action Type

(1) Disconnect the air piping.

(2) Set the handwheel shaft in the automatic operation position (fully raise the handwheel shaft).

(3) Remove the top diaphragm case. When doing this, loosen the pair of eyebolts uniformly and alternately, after removing all other clamping-bolts of the diaphragm case.

(4) Sufficiently insert the handwheel shaft by turning it and then remove the handwheel and the lock nut. Insert the shaft further and then remove the screw shaft from the housing.

(5) Remove the O-ring.

To assemble the top handwheel, follow the disassembly procedure in the reverse order.

(b) Reverse Action Type

(1) Disconnect the air piping.

(2) Set the handwheel shaft in the automatic operation position (fully lower the handwheel shaft).

(3) Remove the handwheel and the lock nut. Insert the shaft into the housing by means of the threading until the threaded sections are disengaged.

(4) Remove the top diaphragm case. When doing this, loosen the pair of eyebolts uniformly and alternately, after removing all other clamping-bolts of the diaphragm case.

(5) Remove the housing by loosening its clamping-screw.

(6) Remove the setscrew and then remove the bearing case.

(7) Remove the spring pin and then remove the castle nut.

(8) Remove the bearing retainer and then remove the bearing.

To assemble the top handwheel, follow the disassembly procedure in the reverse order.

(c) Inspection After Assembly

(1) Check that the handwheel turns smoothly for the full stroke.

(2) For the direct action type of actuator, check by means of soapsuds that there is no air leak from the connecting section of the top diaphragm case.

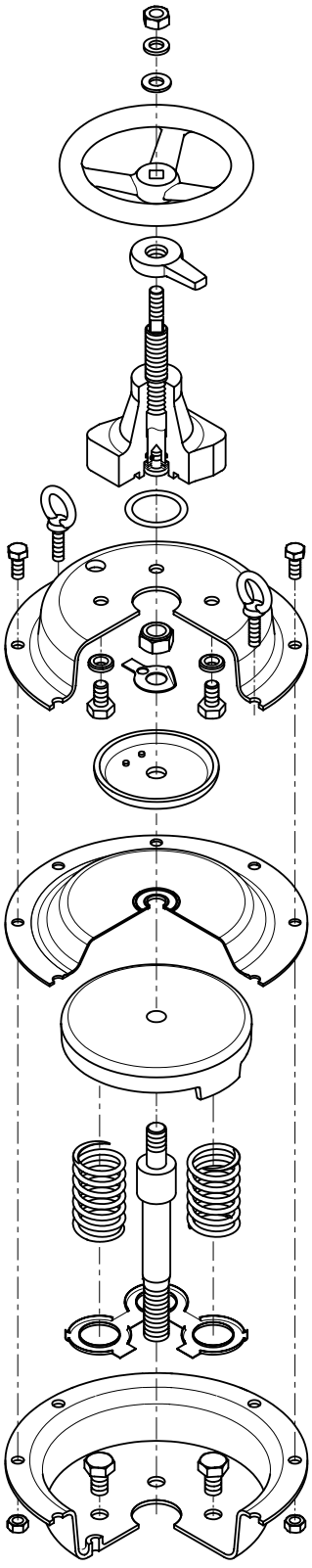


Fig. 7-2 Model PSA1D (Direct Action Type)

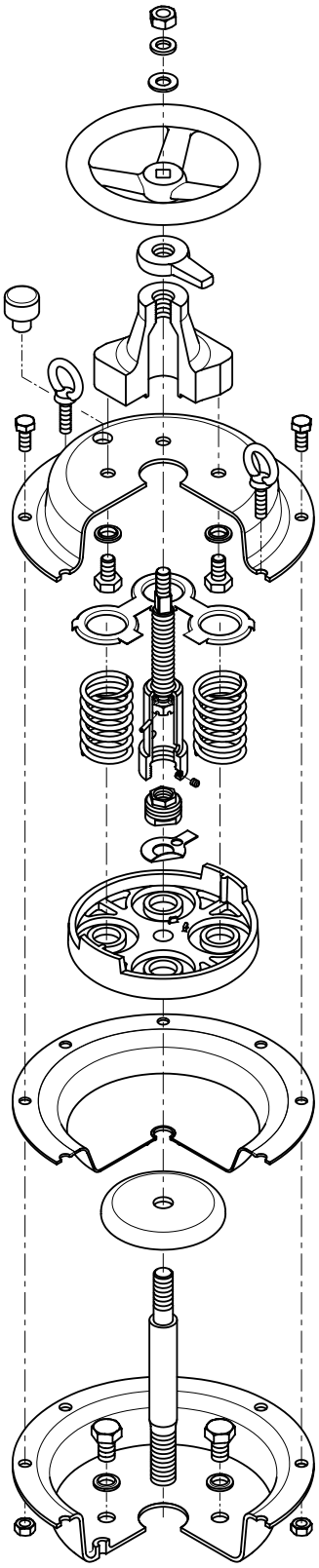


Fig. 7-3 Model PSA1R (Reverse Action Type)

7.2 Model HA2, HA3, or HA4 Actuator

7.2.1 Operating Instructions

To manually operate the actuator, refer to Fig. 7-4 through Fig. 7-7 and proceed as follows:

(1) First, loosen the lock nut which has a bar-shape handle and which locks the handwheel, and turn the handwheel in the direction indicated by the corresponding arrowhead mark.

As you turn the handwheel clockwise, the actuator stem moves downward regardless of whether the actuator is of the direct action type or reverse action type. The handwheel bears the “SHUT’ mark to indicate that the valve is closed as the handwheel is tuned clockwise and the ‘’OPEN’ mark to indicate that the valve is made open as the handwheel is tuned counterclockwise.

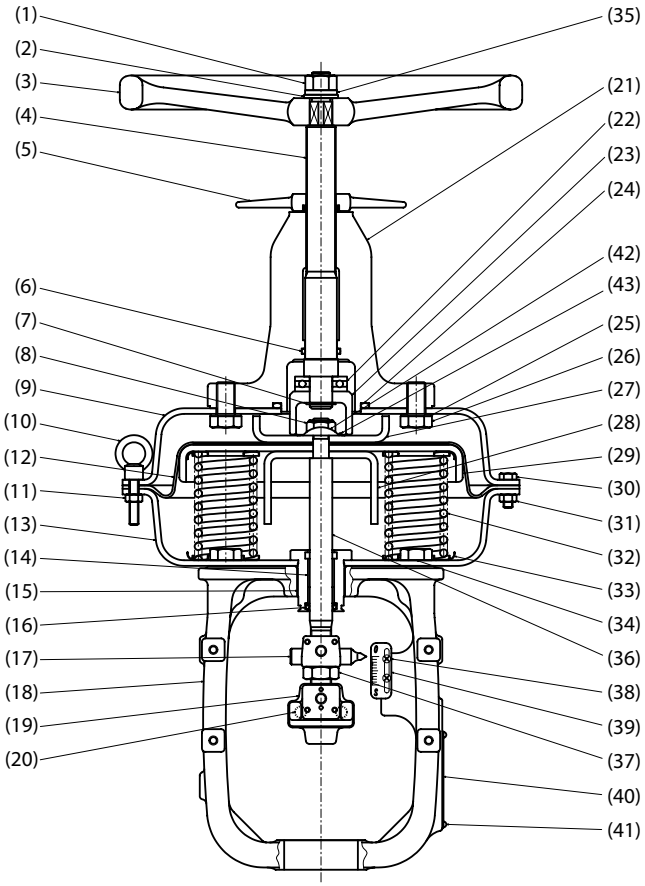
(2) For automatic operation of the actuator, fully raise the handwheel if the actuator is of the direct action type or fully lower the handwheel if the actuator is of the reverse action type, and then tighten the lock nut to secure the handwheel in such position.

Precautions: If you forcefully turn the handwheel after it has reached the mechanical stop position, the valve stem may be damaged. Do not turn the handwheel with forces larger than the below-mentioned limits.

Model HA2: 190N {19 kgf}

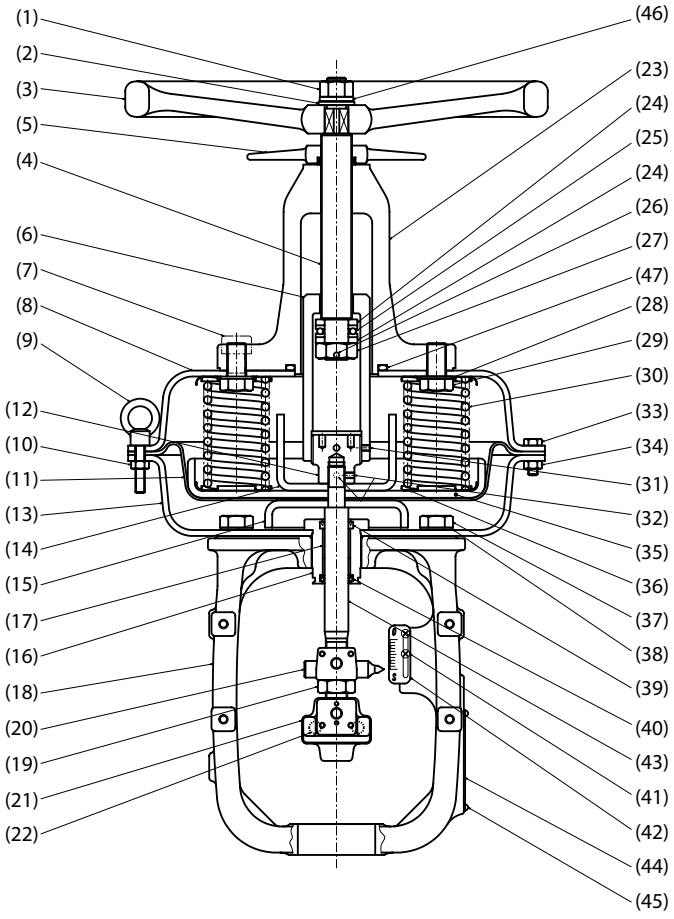
Model HA3: 260N {26 kgf}

Model HA4: 410N {41 kgf}
(at the outermost periphery of the handwheel)



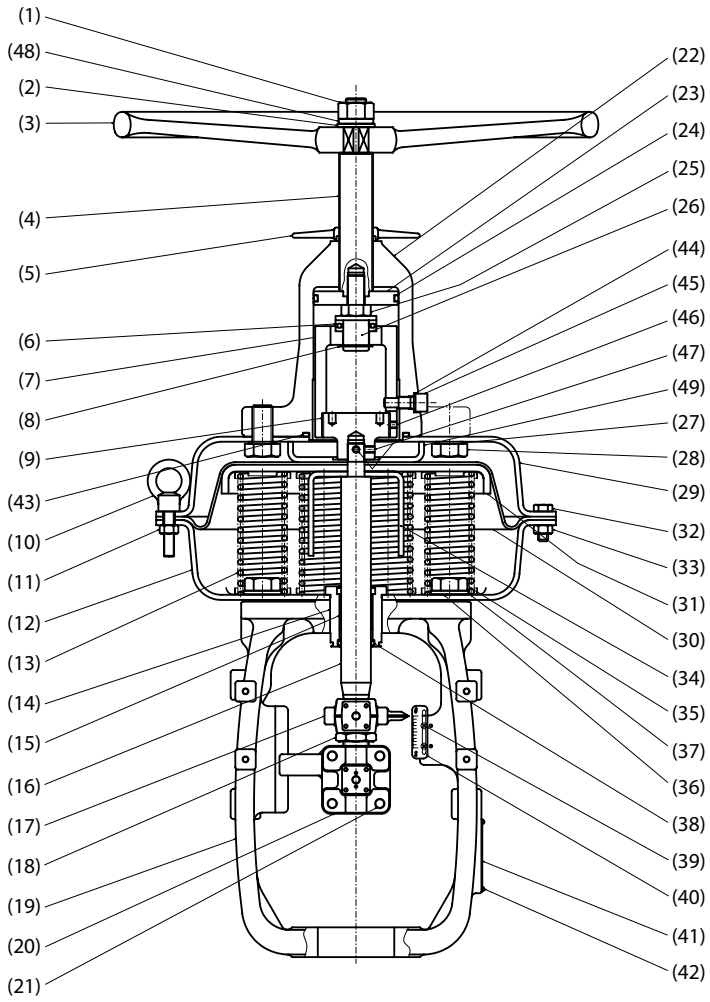
No.	Parts name
1	Hex Nut
2	Washer
3	Handwheel
4	Screw Shaft
5	Lock Nut
6	O-Ring
7	C type Retaining Ring
8	Nut
9	Diaphragm Case (Top)
10	Eye Bolt
11	Hex Nut
12	Diaphragm
13	Diaphragm Case (Bottom)
14	Bushing
15	Bearing
16	Dust Seal
17	Pointer
18	Yoke
19	Stem Connector
20	Hex Bolt
21	Housing
22	Bearing
23	Spring Retainer
24	O-Ring
25	Seal Washer
26	Hex Bolt
27	Diaphragm Retainer
28	Stopper
29	Diaphragm Plate
30	Hex Bolt
31	Hex Nut
32	Spring
33	Spring Plate
34	Hex Bolt
35	Spring Washer
36	Rod
37	Lock Nut
38	Truss Screw, Spring Washer Nut or Speed Nut
39	Scale Plate
40	Name Plate
41	Drive Screw
42	Washer
43	Tapping Screw

Fig. 7-4 Model HA2/3 Actuator with Top Handwheel (Direct Action Type)



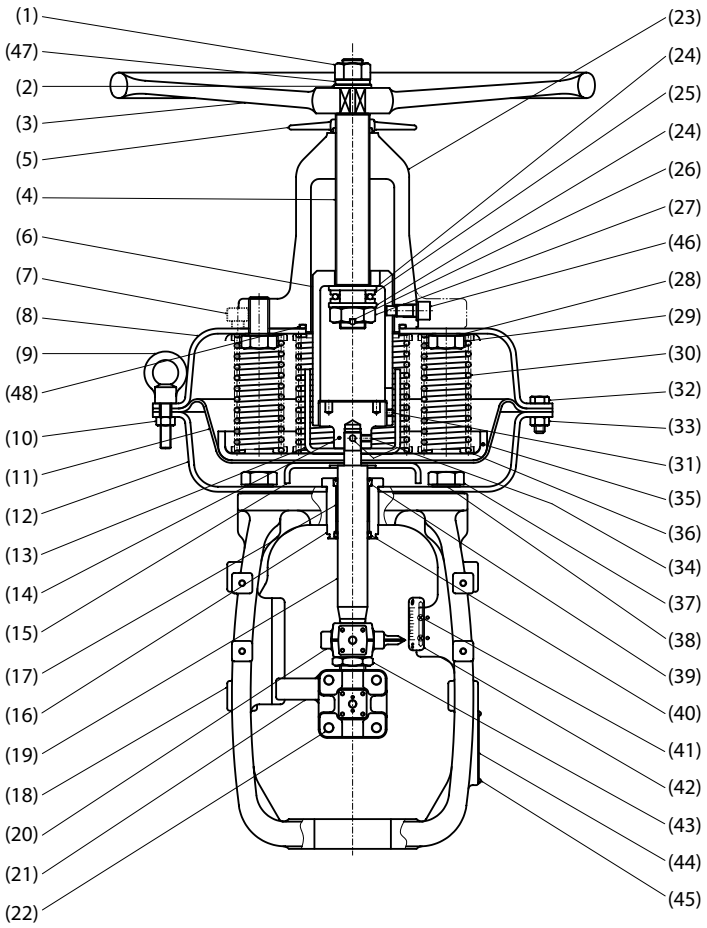
No.	Parts name
1	Nut
2	Washer
3	Handwheel
4	Lock Nut
5	Screw Shaft
6	Bearing Case
7	Cap
8	Diaphragm Case (Top)
9	Eyebolt
10	Nut
11	Through Bolt
12	Diaphragm
13	Connector
14	Diaphragm Case (Bottom)
15	Stopper
16	Diaphragm Retainer
17	Bearing
18	Bushing
19	Yoke
20	Lock Nut
21	Pointer
22	Stem Connector
23	Stem Connector Bolt
24	Housing
25	Bearing Washer
26	Bearing
27	Cotter Pin
28	Castle Nut
29	Seal Washer
30	Bolt
31	Compressed Coil Spring
32	Setscrew
33	Setscrew
34	Bolt
35	Nut
36	Diaphragm Plate
37	Spring Plate
38	Bolt
39	Seal Washer
40	Packing For Rod
41	Dust Seal
42	Truss Screw, Spring Washer Nut, or Speed Nut
43	Scale
44	Rod
45	Nameplate
46	Drive Screw
47	Spring Washer
48	O-Ring

Fig. 7-5 Model HA2/3 Actuator with Top Handwheel (Reverse Action Type)



No.	Parts name
1	Nut
2	Washer
3	Handwheel
4	Screw Shaft
5	Lock Nut
6	Bearing
7	Bearing Case
8	Cotter
9	Connector
10	Eyebolt
11	Nut
12	Through Bolt
13	Diaphragm Case (Bottom)
14	Coil Spring
15	Bearing
16	Bushing
17	Rod
18	Pointer
19	Lock Nut
20	Yoke
21	Stem Connector
22	Stem Connector Bolt
23	Housing
24	Piston Plate
25	O-Ring
26	Bolt
27	Bearing Retainer
28	Seal Washer
29	Bolt
30	Diaphragm Case (Top)
31	Diaphragm
32	Diaphragm Plate
33	Bolt
34	Nut
35	Stopper
36	Bolt
37	Spring Plate
38	Washer
39	Dust Seal
40	Truss Screw, Speed Nut
41	Scale
42	Nameplate
43	Drive Screw
44	O-Ring
45	Seal Washer
46	Keybolt
47	Setscrew
48	Setscrew
49	Spring Washer
50	Diaphragm Retainer

Fig. 7-6 Model HA4 Actuator with Top Handwheel (Direct Action Type)



No.	Parts name
1	Nut
2	Washer
3	Handwheel
4	Lock Nut
5	Screw Shaft
6	Bearing Case
7	Cap
8	Diaphragm Case (Top)
9	Eyebolt
10	Nut
11	Through Bolt
12	Diaphragm
13	Diaphragm Case (Bottom)
14	Stopper
15	Connector
16	Diaphragm Retainer
17	Bearing
18	Bushing
19	Yoke
20	Rod
21	Pointer
22	Stem Connector
23	Stem Connector Bolt
24	Housing
25	Washer
26	Bearing
27	Bearing
28	Cotter Pin
29	Seal Washer
30	Bolt
31	Coil Spring
32	Setscrew
33	Bolt
34	Nut
35	Setscrew
36	Diaphragm Plate
37	Spring Plate
38	Bolt
39	Seal Washer
40	Packing
41	Dust Seal
42	Truss Screw, Speed Nut
43	Scale
44	Lock Nut
45	Nameplate
46	Drive Screw
47	Keybolt
48	Spring Washer
49	O-Ring

Fig. 7-7 Model HA4 Actuator with Top Handwheel (Reverse Action Type)

7.2.2 Disassembly and Assembly of Top Handwheel

To disassemble or assemble the top handwheel, refer to Fig. 7-4 through Fig. 7-9 and proceed as described in this section. For disassembly and assembly work, keep the actuator in the vertical attitude.

(a) Direct Action Type

(1) Disconnect the air piping.

(2) Set the handwheel shaft in the automatic operation position (fully raise the handwheel shaft).

(3) Remove the top diaphragm case. When doing this, loosen the pair of eyebolts uniformly and alternately, after removing all other clamping-bolts of the diaphragm case.

(4) Sufficiently insert the handle shaft by turning it and then remove the handwheel and the lock nut. Insert the shaft further and then remove the screw shaft from the housing.

(5) Remove the O-ring.

To assemble the top handwheel, follow the disassembly procedure in the reverse order.

(b) Reverse Action Type

(1) Disconnect the air piping.

(2) Set the handwheel shaft in the automatic operation position (fully lower the handwheel shaft).

(3) Remove the handwheel and the lock nut. Insert the shaft into the housing by means of the threading until the threading sections are disengaged.

(4) Remove the top diaphragm case. When doing this, loosen the pair of eyebolts uniformly and alternately, after removing all other clamping-bolts of the diaphragm use.

(5) Remove the housing by loosening its clamping-screws.

(6) Remove the setscrew and then remove the bearing case.

(7) Remove the pin and then remove the castle nut.

(8) Remove the bearing retainer and then remove the bearing.

To assemble the top handwheeI, follow the disassembly procedure in the reverse order.

(c) Inspection After Assembly

(1) Check that the handwheel turns smoothly for the full stroke.

(2) For the direct action type of actuator, check by means of soapsuds that there is no air leak from the connecting sections of the housing and top diaphragm case.

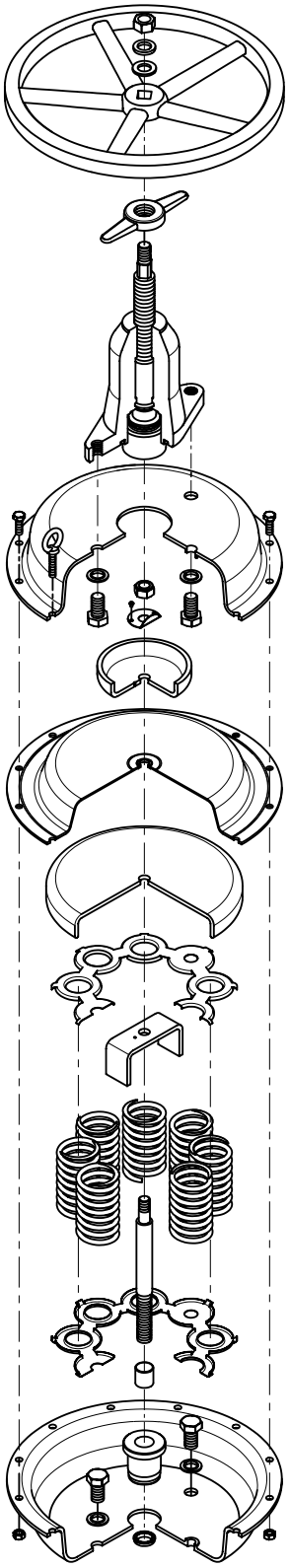


Fig. 7-8 Model HA3 Actuator with Top Handwheel (Direct Action Type)

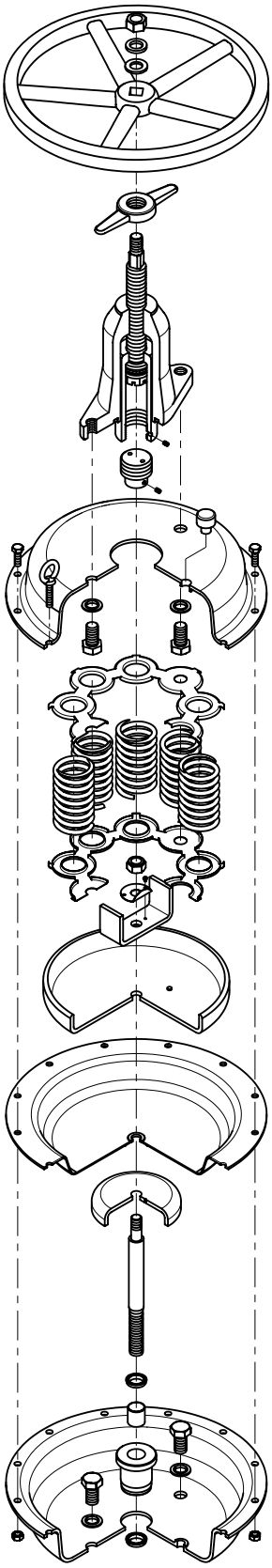


Fig. 7-9 Model HA3 Actuator with Top Handwheel (Reverse Action Type)

8. INSTRUCTIONS FOR SIDE HANDWHEEL OF ACTUATOR

As you turn the handwheel clockwise, the actuator stem moves downward regardless of whether the actuator is of the direct action type or reverse action type. The handwheel bears the ‘’SHUT’ mark to indicate that the valve is closed as the handwheel is tuned clockwise and the “OPEN’’ mark to indicate that the valve is made open as the handwheel is tuned counterclockwise.

8.1 Installation Procedure

To install the side handwheel, refer to Fig. 8-1 and proceed as follows:

(1) Prepare a manual operation kit (a side handwheel set and its mounting accessories).
To install the handwheel, no machining or other physical processing on the actuator is necessary.

(2) By turning the handwheel, set the pointer of the operation nut at the AUTO position.

(3) Loosen the bolt (item number 6 as-show in Fig. 8-1) and widen the distance between levers.

(4) Install the handwheel on the mounting pad at the back of the actuator, with the mounting-bolts.

(5) Engage the holes at the end of two levers to the pointer boss and engage those of the other ends to the boss of the operation nut, and then tighten the bolt.

(6) When the control valve is in the automatic mode of operation, set the pointer of the operation nut at the AUTO position and keep the handwheel locked.

8.2 Operating Instructions

(1) To manually operate the actuator, remove the handwheel lock (the fork-shaped component) which locks the handwheel and turn the handwheel in the direction indicated by the corresponding arrowhead mark.

(2) To return to the automatic operation, turn the handwheel so that the pointer of the operation nut is set at the AUTO position and then apply the handwheel lock.

Precautions: If you forcefully turn the handwheel after it has reached the mechanical stop position, the valve stem may be damaged. Do not turn the handwheel with forces larger than the below-mentioned limits.

Model PSA1: 80N {8kgf}
Model HA2: 190N {l9kgf}
Model HA3: 290N {29kgf}
Model HA4: 460N {46kgf}
(at the outermost periphery of the handwheel)

8.3 Disassembly of Assembly of Side Handwheel

Before starting disassembly, check that the pointer is set at the AUTO position.
(Refer to Fig. 8-1)

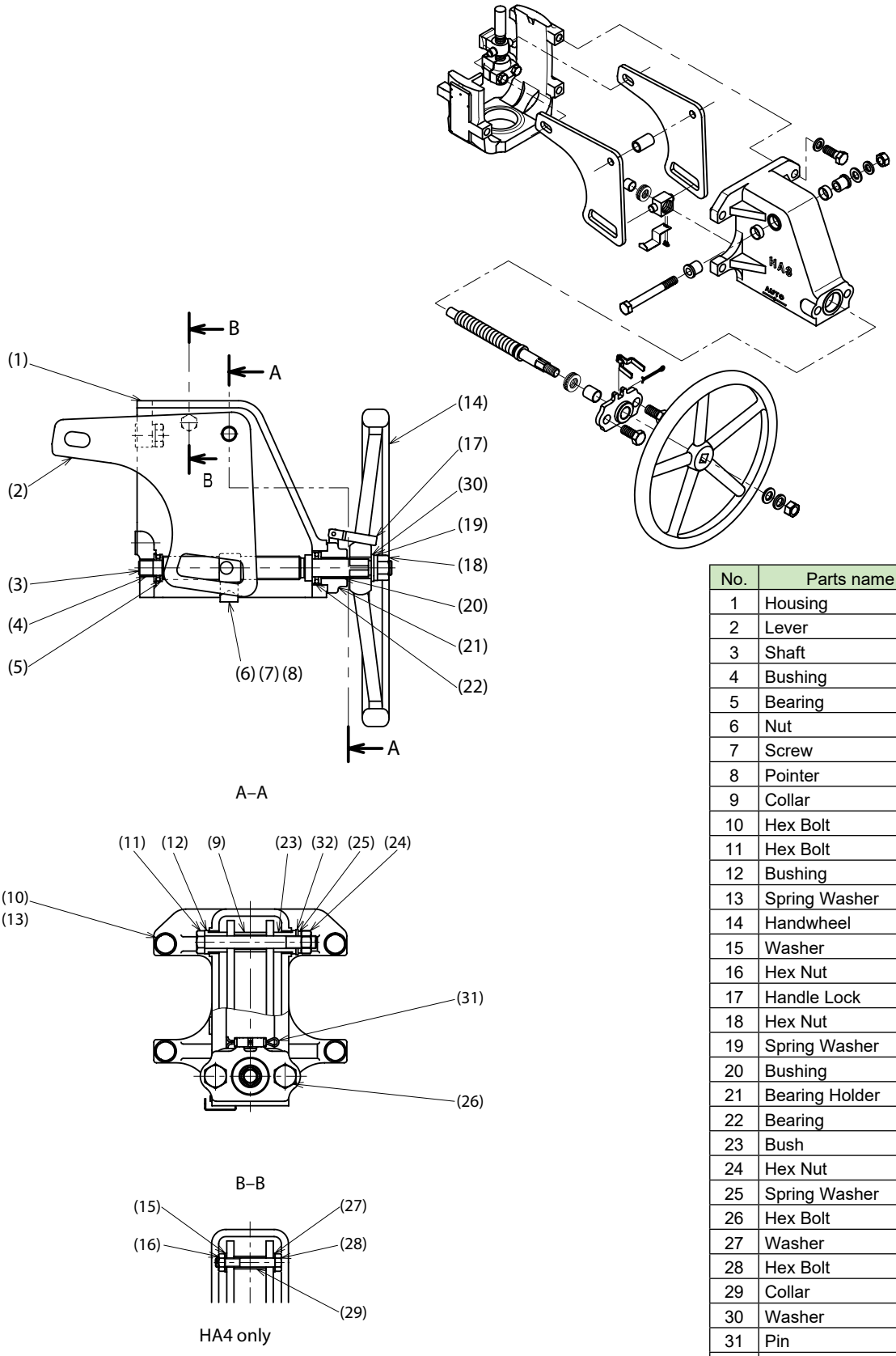
(1) Loosen the bolt 6 which connects the levers 2 and then disengage the levers from the pointer.

(2) Undo the mounting-bolts 1 of the side handwheel unit and detach it from the actuator.

(3) Remove the lock nut of the handwheel and then remove the handwheel.

(4) Loosen the bolt 8 of the bearing holder and then remove the feed shaft 7.

To assemble the side handwheel, refer to Fig. 8-1 and follow the disassembly procedure in the reverse order.



No.	Parts name
1	Housing
2	Lever
3	Shaft
4	Bushing
5	Bearing
6	Nut
7	Screw
8	Pointer
9	Collar
10	Hex Bolt
11	Hex Bolt
12	Bushing
13	Spring Washer
14	Handwheel
15	Washer
16	Hex Nut
17	Handle Lock
18	Hex Nut
19	Spring Washer
20	Bushing
21	Bearing Holder
22	Bearing
23	Bush
24	Hex Nut
25	Spring Washer
26	Hex Bolt
27	Washer
28	Hex Bolt
29	Collar
30	Washer
31	Pin
32	Washer

Fig. 8-1 View of Side-Handwheel

9. Mechanical stopper

Refer to “Fig. 9-1” on page 52 for details of construction. This device can be used as MIN. stopper or MAX. stopper as required. Also, it can be used as MIN/MAX stopper.

The MIN. stopper (limits valve’s minimum opening for direct acting valve) regulates the maximum suction of stopper shaft, and the MAX stopper (limits valve’s maximum opening for reverse acting valve) regulates maximum extrusion of stopper shaft 4.

9.1 Adjustment of MIN. stopper

(1) Loosen detent 2 and remove MAX. stopper 1 (adjust cover) from housing 5.

(2) Loosen hexnut 3 for MIN. stopper and remove from stopper shaft 4. Although the stopper does not function in this condition, the valve can operate across the rated range of lift.

(3) Manipulate positioner signal, supply air pressure or manual handle to set the valve at the stopper’s set position.

(4) Lock the detent at the position when it hits housing 5 while the valve is set.

(5) Assemble and lock MAX. stopper and detent 2 at the position where they do not hit the maximum protruding position of stopper shaft 4.

9.2 Adjustment of MAX. stopper

(1) Loosen detent 2 and remove MAX. stopper 1 (adjust cover) from housing 5.

(2) Loosen hexnut 3 for MIN. stopper and remove from stopper shaft 4. Although the stopper does not function in this condition, the valve can operate across the rated range of lift.

(3) Manipulate positioner signal, supply air pressure or manual handle to set the valve at fully open position.

(4) Screw hex nut for MIN. stopper 3 onto stopper shaft 4. The hexnut for MIN. stopper 3 should be locked at the top end of the stopper shaft 4 to make the distance between the lower face of the hexnut 3 and housing 5 larger than the rated lift.

(5) Manipulate positioner signal, supply air pressure or manual handle to set the valve at the stopper’s set position.

(6) Screw MAX. stopper 1 onto housing 5, and when MAX. stopper 1 seats against hexnut for MIN. stopper 3 or stopper shaft 4, lock MAX. stopper 1 with detent 2.

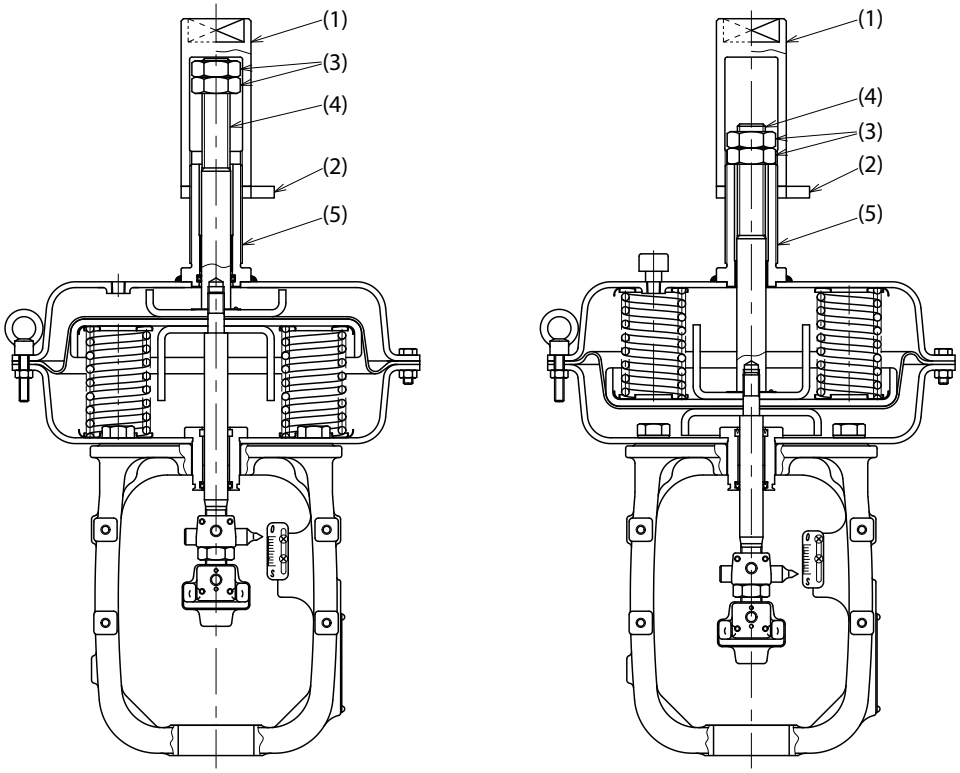
9.3 Adjustment of dual MIN. MAX. stopper

Perform adjustments as described in both “9.1: Adjustment of MIN. stopper” and “9.2: Adjustment of MAX. stopper”.

Described below is a normally expected maljunction during operation.

⚠ CAUTION

When hexnut for MIN. stopper is tightened or loosened, apply wrenches on top and bottom of the nut so that no excessive torque is applied to stopper shaft 4.



Direct acting model *Reverse acting model*

Fig. 9-1

No.	Nomenclature
1	MAX. stopper (adjust cover)
2	Detent
3	Hex nut for MIN. stopper
4	Stopper shaft
5	Housing

10. TROUBLESHOOTING

This section covers the symptoms, causes and remedies of most probable types of troubles. Parts may be required to be replaced depending on the type of trouble.

For further troubles, please order your Azbil Corporation agent for repair.

Table 10-1 Troubleshooting

Symptom	Cause and Remedy
Unstable valve operation	
• Valve position hunting occurs when almost fully closed.	• Cv value is too large. Reduce Cv value. • For a single seat Valve, the valve is Installed in the reverse flow direction.
• Air supply pressure is unstable.	• Large air consuming equipment is hooked up to the same air supply line. Check that the air supply capacity piping capacity and restriction capacity are appropriate. • Supply air pressure regulator is inadequate or not operating properly.
• Signal pressure is unstable.	• Controller is not properly tuned. Property tune the controller (properly set the proportional band and other parameters). • Check that the controller output does not change abnormally.
• Valve position hunting occurs even when signal pressure is stable.	• Hunting of output of positioner itself. Check and repair or replace the positioner. • Being affected by pressure change of process fluid as power of the actuator is insufficient. Replace the actuator with a larger one.
Vibration of valve	
• Valve vibrates (generate noise) at any position of valve plug.	• Piping is vibrating. Securely fix the piping. • Check for other sources of vibration. Worn valve plug or guides. Check the parts and replace them as required.
• Valve vibrates (generate noise) only when valve plug is set at a certain position.	• Check for change in process fluid flow conditions (change in restriction orifice, Cv value, etc.) • Check for change in plug configuration (change in flow control characteristics.)
Sluggish valve operation or inoperative Valve	• Air leak from piping • Air leak from actuator • Foreign matter entrapped in guide section of valve plug. • Aged and hardened gland packing, causing increased hysteresis • Malfunctioning positioner (Check the positioner by operating it directly on an air supply known to be operating normally.)
Fluid leak from gland section	• Check for loose packing flange. • Check for insufficient grease. • Check for damaged valve shaft.
Liquid leak from gasket section	• Check for loose nuts of bonnet. • Check for defective gasket (deformed or damaged).

Symptom	Cause and Remedy
Even when valve plug is in closed position, large flow leaks to downstream side.	• Air leak at actuator section. • For trial, apply the air supply pressure or atmospheric pressure to the actuator. (Check the air supply source and positioner.) • Check whether the valve plug is actually the closed position or not. (Check the valve plug lift) • Check the plug seat ring for corrosion and erosion. • Check the guide sections for binding.

11. RECOMMENDED SPARE PARTS

It is most recommendable to replace the following parts when servicing the control valve.

- **Valve Body**

  Be sure to replace the following parts with fresh ones whenever the valve body is disassembled:

  - Gland packing
  - Gaskets

- **Actuator**

  Replace the following Parts at every 5 years or thereabout.

  - Diaphragm
  - Bushing
  - Rain cap
  - Seal washer
  - Dust seal
  - Rod seal

  } Be sure to replace these parts whenever the actuator is disassembly.

Of the bellows sealed type of control Valve, the bellows seal assembly* must be replaced periodically. The period of replacement depends on temperature, pressure and other conditions of use. A typical service longevity of the bellows assembly is 10,000 vertical stroke cycles.

* The bellows seal assembly has the seal bellows and valve stem (including the bellows seat) assembled together.

Please mention the parts name and the product number indicated on the name plate when ordering those spare parts.

12. ABOUT DISPOSAL

When this product is no longer needed, please dispose of the industrial waste according to the ordinance of each local government. Do not reuse any or all of this product.

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;
   (3) 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, anti-flame 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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