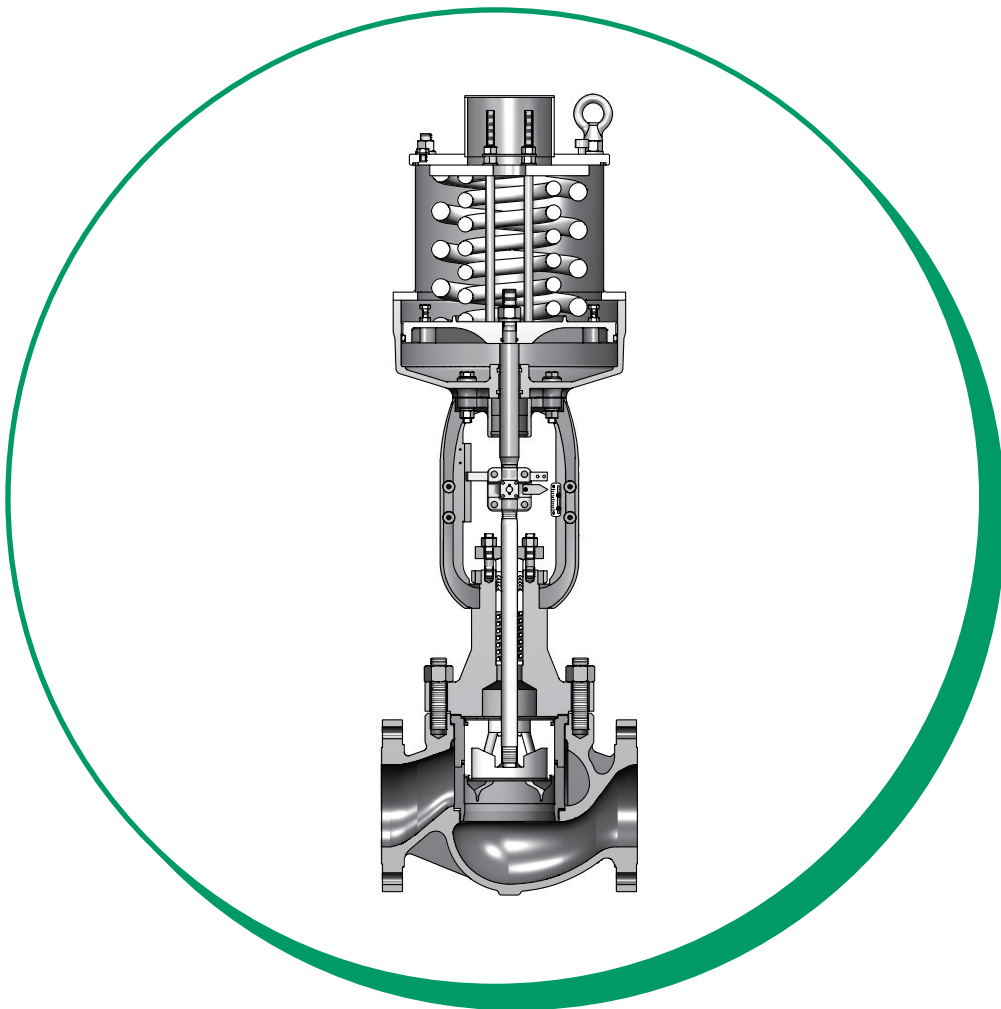


# **Low Leakage Pressure Balanced Cage Type Control Valves Model AC2**

## **User's Manual**



**Azbil Corporation**

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# Cautions and Warnings

■ About Icons


Cautions and warnings are intended to make sure that you use the product safely and correctly, in order to prevent injury to you and others and to prevent damage to property. Please heed these cautions and warnings.

Various icons appear in this document.

Their meaning is explained below. Please be sure you understand the icons before reading the rest of the manual.




**WARNING**

Warnings are indicated when mishandling this product might result in death or serious injury to the user.










**CAUTION**

Cautions are indicated when mishandling this product might result in minor injury to the user or material damage.

■ Examples:












|   |   |
|---|---|
|    | Use caution.                                  |
|   | The indicated action is prohibited.           |
|  | Be sure to follow the indicated instructions. |














## Precautions for safe work

|  <b>WARNING</b> |   |
|--|---|
|                 | Before starting to work, check that the pressure in the pipes has dropped to atmospheric pressure. There is a risk of injury if fluid spews out.    |
|  <b>CAUTION</b> |   |
|                 | Do not stand on the device or use it as a step. There is a risk of falling.   |
|                 | Do not touch this device without reason during operation. Depending on the operating conditions, the surfaces may 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 bolt heads or burrs.   |
|                 | 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. |

## Handling Precautions

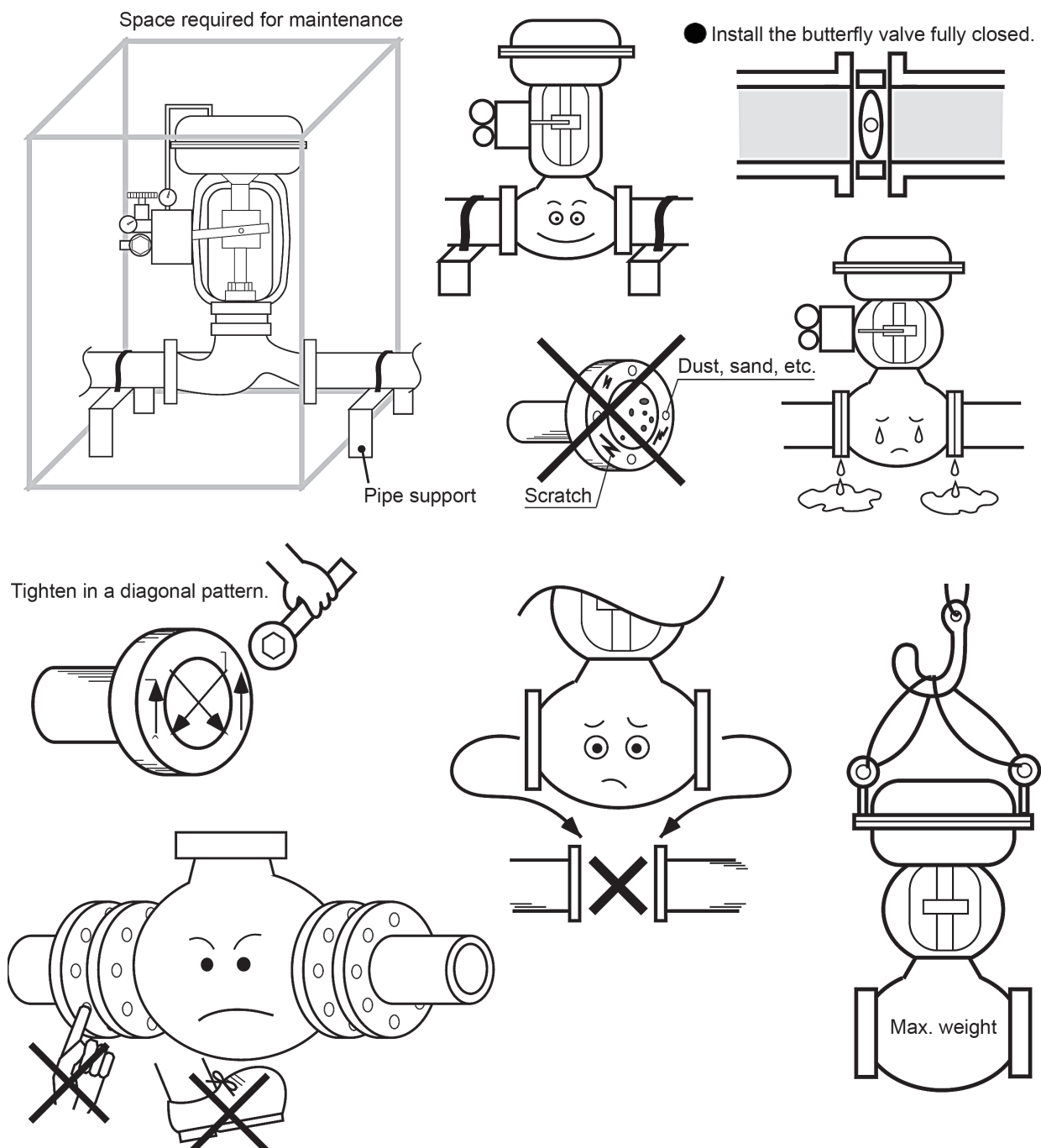
### Installation Precautions

|  <b>WARNING</b> |  |
|--|--|
|                 | If the rated pressure or connection rating is ignored when this device is used, a serious accident involving damage or leakage could occur.  |
|                 | When connecting the valve to the piping, to avoid losing fingers or injuring your foot, do not put your hand or foot under the valve or between flanges.   |
|                 | 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.  |
|  <b>CAUTION</b> |  |
|                 | Ensure 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. |
|                 | 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 action of the valve. (Care is needed especially for large valves and valves for low temperature fluid.)  |
|                 | If the valve is installed along a passageway used by outside persons, install a fence or cover as a protective measure.  |
|                 | Avoid installing the valve where it may be submerged by rain water, covered with snow, or subject to freezing. Conditions such as these can damage the valve.  |
|                 | 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.  |

| <div>  <b>CAUTION</b> </div> |  |
|---|--|
|                              | If the valve is exposed to salt damage or a corrosive atmosphere, take countermeasures against corrosion.<br>Otherwise the valve may 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.<br>Otherwise fluid leakage could result.  |
|                              | If a pipe flange connected to the valve is being welded, the valve surface may also heat up. Do not touch the valve unnecessarily.   |
|                              | Chamfer the edges of the pipe flanges.<br>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.<br>Otherwise the valve could be damaged.  |
|                              | If the eyebolts (eyenuts) attached to the actuator are used to lift the valve, make sure that the mass 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 for flanges that conform to the flange rating.<br>Otherwise fluid leakage could result.   |
|                            | Use new flange gaskets that are compatible with the fluid properties and operating temperature. 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.
- There are protective covers on the flanges to protect the gasket-contacting surfaces and 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 valve seat damage and impaired closing performance, remove foreign matter such as dust, sand, and welding spatters from the inside of the piping, and clean the inside of the valve.
- Check that the distance between the pipe flanges is appropriate for the total of the body length of the valve and the thickness of the gaskets.
- Tighten the bolts and nuts for the flanges evenly in a diagonal pattern.

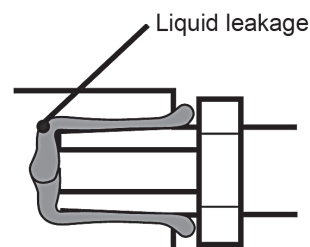
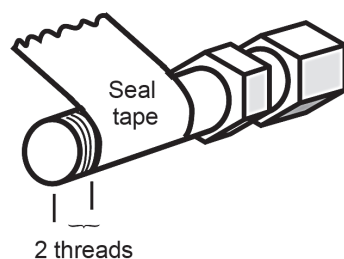
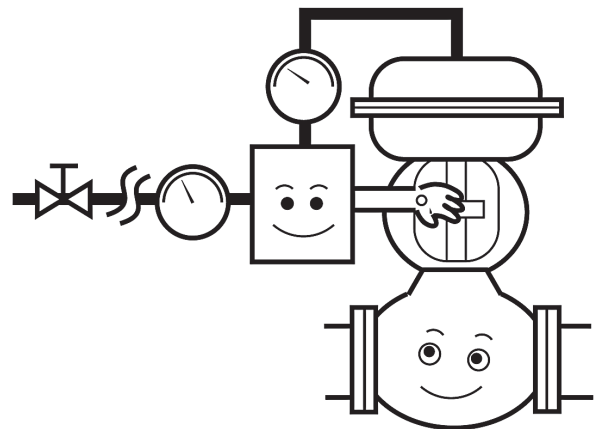
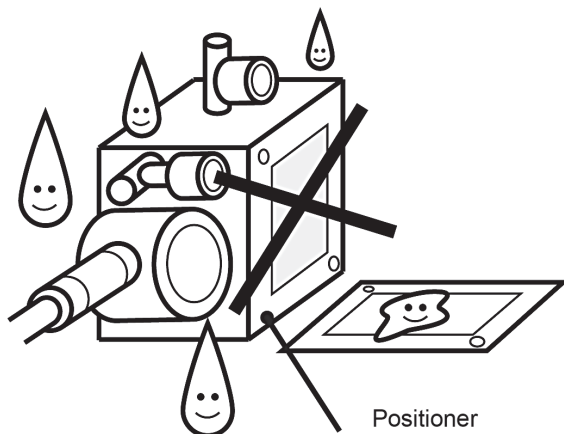


## Precautions for air supply piping work and electrical work

| ! CAUTION |  |
|-----------|--|
| !         | For air supply, use pipes whose internal diameter does not cause a pressure drop while the valve is running.<br>Failure to do so could result in poor valve performance.                       |
| !         | Wiring work should be carried out only by qualified technicians following local electrotechnical standards.  |
| !         | Cabling should be carried out according to facility conditions. Use a size of adapter (packing) that is correct for the outer diameter of the cable.   |
| ⊘         | If seal tape is wrapped around the air supply pipe threads, leave the two threads nearest the tip bare. Failure to do so may cause the valve to malfunction due to clogging by pieces of tape. |
| !         | If thread lock sealant is used for air supply piping work, do not allow it to enter inside the piping. Doing so may cause the valve to malfunction.  |
| !         | Avoid doing wiring work on a rainy day or in high humidity. Moisture inside a connector or terminal box can cause a short-circuit or rust.   |

### ! Handling Precautions

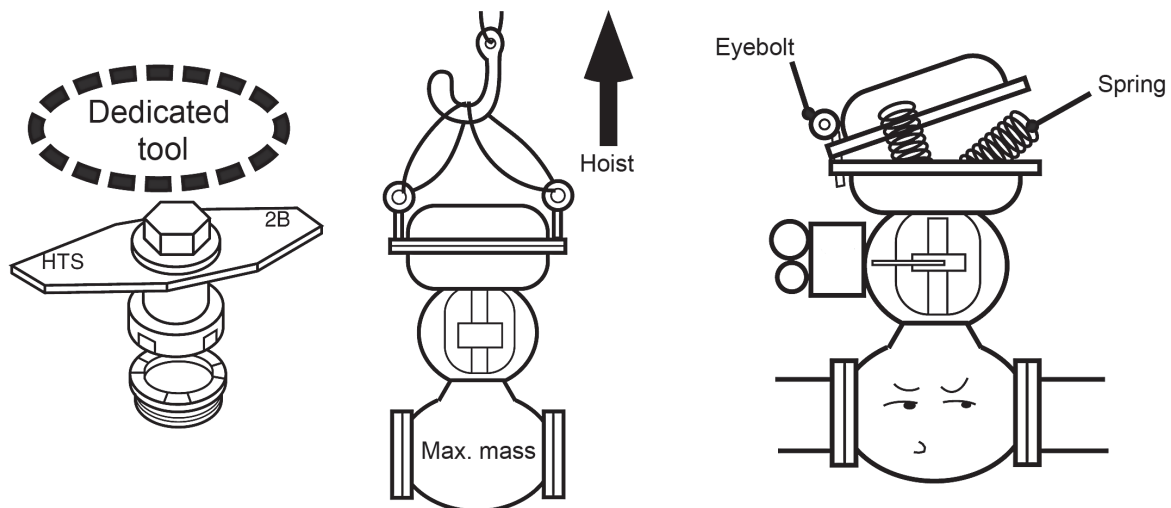
- There is a gasket in the cap of auxiliary equipment such as positioners. Take care not to lose it during wiring work.
- If air supply piping is bent, make gentle curves (using a dedicated tool like a tube bender), and use a band to hold parallel pipes together.



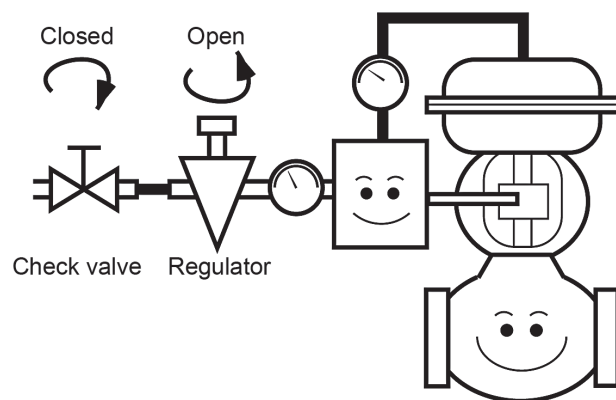
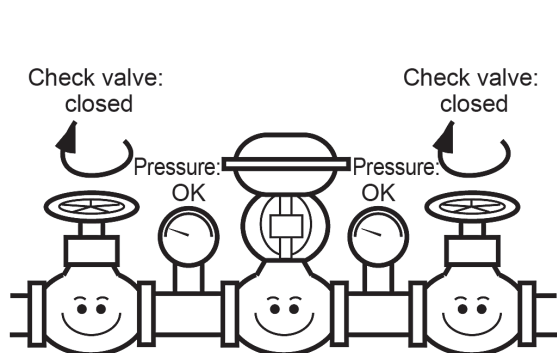
## Precautions for assembly and disassembly

| ! WARNING |   |
|-----------|---|
| !         | Before starting work, clean the inside of the valve and replace the gas. Otherwise the remaining gas may cause an injury.     |
| ⊘         | Do not disassemble the pneumatic actuator while supply air pressure is being applied. The compressed air may cause an injury. |
| !         | Since damaged or corroded bolts and nuts may damage the valve causing injury, replace them with new ones.                     |

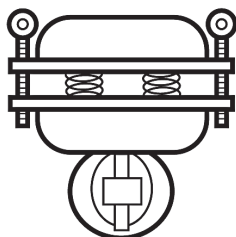
| ! CAUTION |  |
|-----------|--|
| !         | Observe the tightening torques indicated in the user's manual when tightening the bolts and nuts during assembly.  |
| !         | In the case of an actuator that incorporates springs, follow the disassembly procedure when removing bolts, nuts, etc. Otherwise, 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 there is a danger of the valve falling. |
| !         | Before removing or attaching the valve trim, check whether a dedicated tool is necessary. If it is needed, be sure to use it. Otherwise, damaged parts could result.   |
| !         | Follow the procedure for assembling the parts, bolts, nuts, etc. Otherwise, malfunction could result.  |
| !         | When the valve is reassembled, use new packing and gaskets. The reuse of used parts can cause fluid leakage.   |



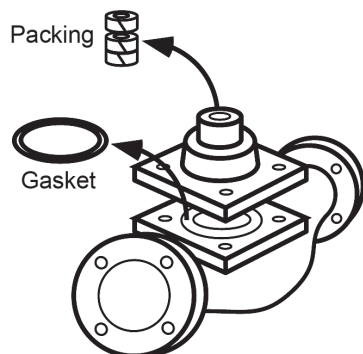




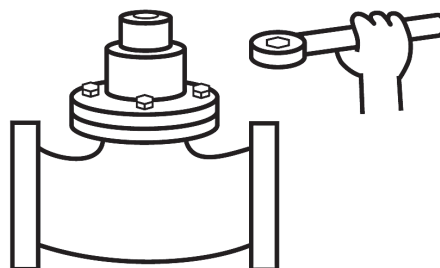
- Observe the assembly procedure



- Replacement of packing and gasket



- Tighten bolts to specified torque



## Maintenance Precautions

### ! 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, there may be danger of a serious accident or injury.

### ! CAUTION



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



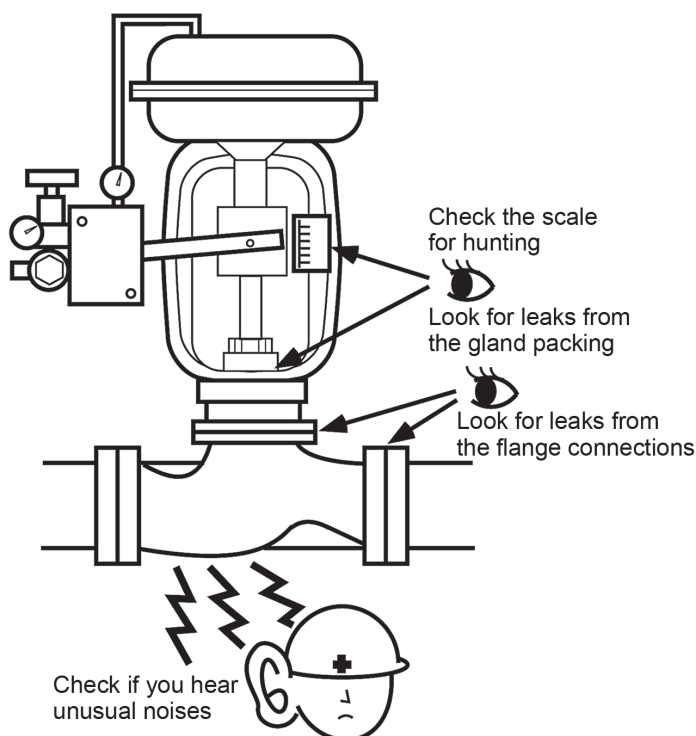
Check valve operation daily, including a visual check for hunting.



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 can affect valve performance.
- There is a gasket in the cap of auxiliary equipment such as positioners. Take care not to lose it during wiring work.
- Take care not to lose the retaining screws for the cap of auxiliary equipment such as positioners.
- Seal cable gland and electrical conduit threads well to prevent the entry of moisture.
- Dispose of old parts replaced during valve disassembly or maintenance as industrial waste. If they are burned or discarded carelessly, environmental pollution will result.
- After checking that the gasket in the positioner cap, etc., is in place, tighten the retaining screws evenly to prevent uneven compression of the gasket.



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# Chapter 1    General

## 1-1    Scope

This manual covers the instructions for:

- Model AC2.....Low Leakage Pressure Balanced Cage Type Control Valves

For valve positioners, refer to the following manuals:

|  |                 |
|--|-----------------|
| Model HTP .....                        | OM2-8310-0200   |
| Model HEP15/17 .....                   | OM2-8313-0100   |
| Model HEP25/26 .....                   | CM2-8313-0300   |
| Model AVP300/301/302/200/201/202 ..... | CM2-AVP300-2001 |
| Model AVP701/702 .....                 | CM2-AVP702-2001 |
| Model AVP703 .....                     | CM2-AVP703-2001 |

## 1-2    Main components of control valves

Control valves are composed of two main components, a valve body and an actuator. Various combinations of valve body and actuator are available to meet various types of uses with different valve sizes, pressure ratings, types of connections, types of materials, and actuator sizes.

For detailed specifications, refer to specification sheet SS2-AC2001-0100.

### 1-3 Structures

The structure of this Low Leakage Pressure Balanced Cage Type Control Valve is shown in Figure 1-1.

The valve body is connected to the bonnet with stud bolts and nuts. Two gaskets are provided at the connection section to seal the internal fluid so that the valve body acts as a pressure vessel. The valve plug is supported by the cage, and driven by the actuator. The actuator has springs and a piston, and converts a pneumatic control signal into a mechanical (positional) control signal with which to position the valve plug.

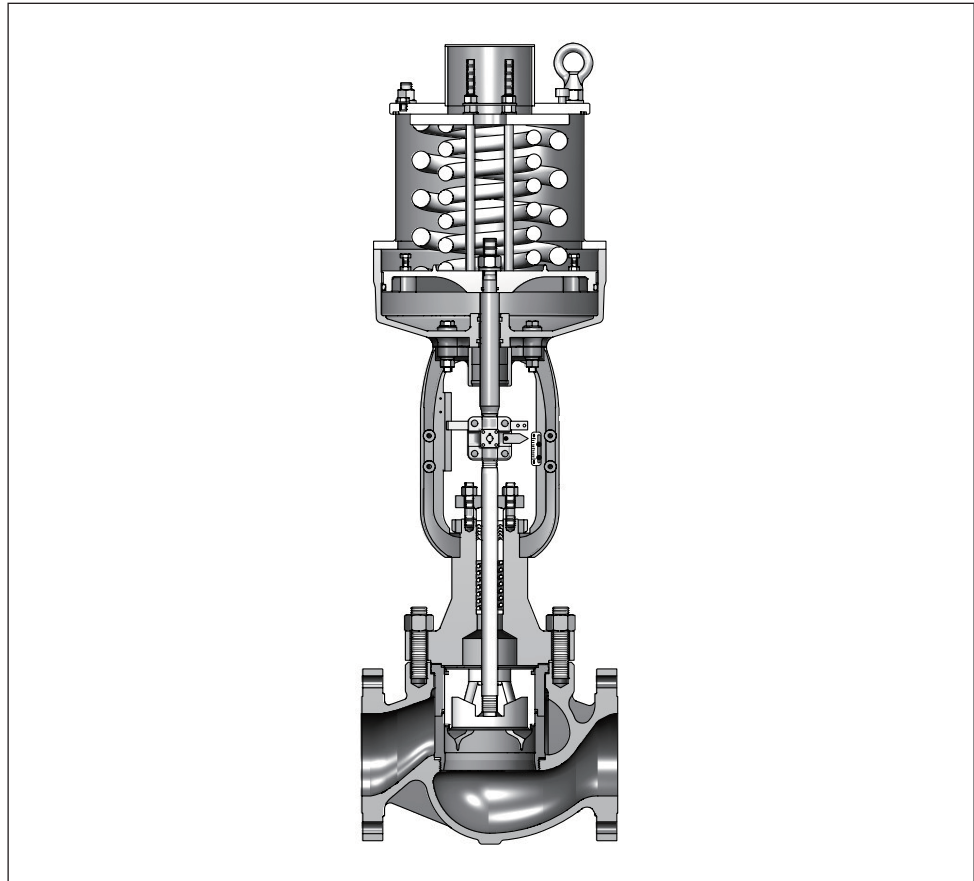


Figure 1-1. Low Leakage Pressure Balanced Cage Type Control Valve, model AC2

## 1-4 Nameplate

A nameplate, as shown in Figure 1-2, is attached to 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 valve, make sure that the specifications indicated on the nameplate conform to the conditions of use. The nameplate also indicates the product number (PROD.NO.) of the control valve. Please mention this number when consulting your Azbil Corporation representative for parts replacement or any other modification of the control valve.

The nameplate is a rectangular label with a black border. At the top left is the Azbil logo. Below it are several rows of text, each followed by a horizontal line for a handwritten entry. The fields are: TAG NO., PROD.NO., MODEL, GREASE, SIZE, LIFT (with 'mm' at the end), RATING, BODY, TRIM, PLUG, GASKET, PACKING, ACTUATOR, RANGE, SUPPLY, AIR TO, and VALVE. At the bottom left is a field for DATE. At the bottom right, between two small circles, is the text 'MADE IN JAPAN'.

Figure 1-2. Nameplate





## Chapter 2 Installation

### 2-1 Maximum lift limits of eyebolts

The actuator case has a pair of lifting eyebolts. These eyebolts are primarily for lifting the actuator alone. Before using the eyebolts for other purposes (such as lifting an actuator attached to the valve body or other components), take note of the allowable maximum lifting loads of the eyebolts that are as shown in Table 2-1.

Table 2-1. Maximum lifting loads of eyebolts

| Actuator   | Allowable Maximum Lifting Load of Eyebolts | Weight of Actuator Alone without Handwheel |
|------------|--|--|
| PSA6       | 600kg                                      | 165kg (stroke 50mm)                        |
|            |  | 210kg (stroke 100mm)                       |
| PSA7       | 950kg                                      | 450kg                                      |
| DAP560     | 630kg                                      | 190kg                                      |
| DAP1000(X) | 630kg                                      | 235kg(295kg)                               |
| DAP1500    | 630kg                                      | 320kg                                      |

Note The eyebolts may be used to lift the actuator together with a cast globe valve body of up to pressure rating “Class 600.” When hoisting, be very careful that no shock or other abnormal force is applied to the actuator or the valve body.

### 2-2 Installing valve on process pipe

- (1) Before installing the valve on the process pipe, remove foreign substances (such as scale and welding tips) from both upstream and downstream sides of the process pipe.
- (2) Confirm that the direction of process fluid flow conforms with that of the arrow on the valve body.
- (3) Take care so that the pipe connection gaskets do not protrude into the process pipe inside. Be sure to use gaskets made of material which is suitable for the process fluid. The welded type of valve employs no gaskets.
- (4) Make sure that no excessively large stress is conveyed from the process pipe to the valve body. Uniformly tighten the bolts of the process pipe connection flanges. High-pressure valves have no flanges, since they are welded to the process pipe.
- (5) Before connecting the air pipes to the actuator and positioner, blow air through the pipes to clean them.
- (6) Do not install any heating or cooling insulation on the bonnet.

## 2-3 Items to check after installation and before starting operation

- (1) Check that there is no leakage from the air piping.
- (2) Check that the bolts and nuts of the diaphragm case are not loose. Standard tightening torques are listed below.
- (3) Tighten the packing flange nuts to prevent leakage from the gland packing section. Standard tightening torques are given in Table 2-2.

Table 2-2. Tightening torques of packing flange nuts

[Unit: N·m]

| Valve stem diameter (mm) | V PTFE Packing | PTFE Yarn Packing (P4519) | Expanded graphite Packing P6610CH + P6528 |
|--------------------------|----------------|---------------------------|---|
| 30                       | 4 {40}         | 66 {660}                  | 36 {360}                                  |
| 40                       | 1 {10}         | 54 {540}                  | 26 {260}                                  |
| 50                       | 2 {20}         | 73 {730}                  | 35 {350}                                  |

Note The tightening torques mentioned above are only reference values. Tightening torques may vary depending on the type of packing.

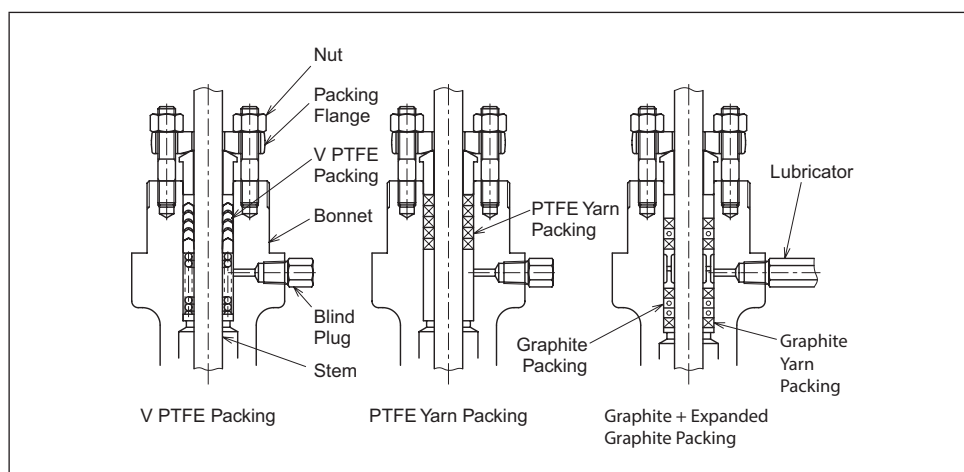


Figure 2-1. Gland section

- (4) If the valve has a lubricator as shown in Figure 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 turns easily, apply grease following the lubricating procedure mentioned below. (If turning the squeeze screw requires more torque, grease has already been applied.)

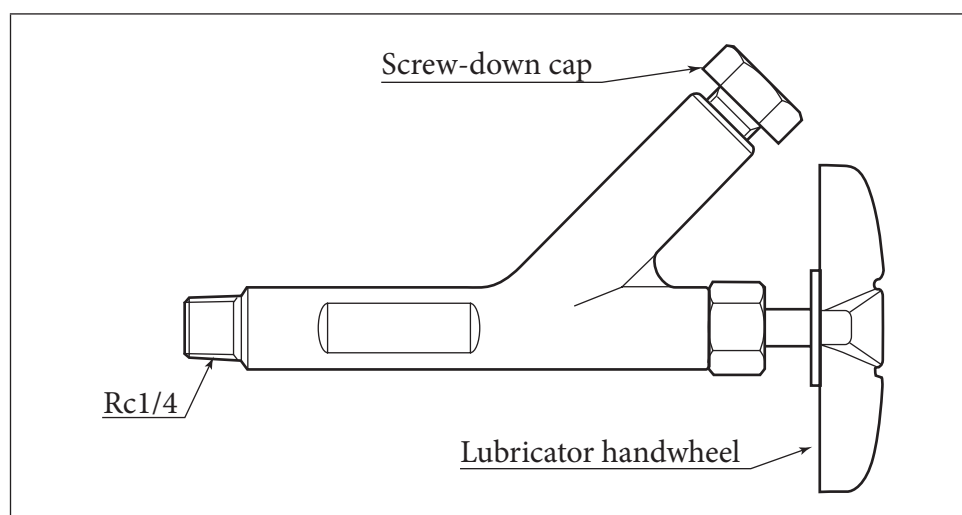


Figure 2-2. Lubricator (Class 600 or under)

**Lubricating Procedure**

| Step | Procedure   |
|------|---|
| a    | Prepare grease of the type indicated on the nameplate.  |
| b    | Tightly close the lubricator handwheel.   |
| c    | Remove the screw-down cap, apply grease, and then replace the screw-down cap.   |
| d    | Loosen the lubricator handwheel and drive the grease by turning the screw-down cap.                                       |
| e    | Repeat steps (b), (c) and (d) until turning of the screw-down cap becomes harder. Tightly close the lubricator handwheel. |

- (5) Apply pressure to the internal valve and check that there is no leakage from the gasket sections between the valve body and process pipe. If leakage is found, tighten the nuts. (Especially if the process fluid temperature is 400 °C or higher, tighten the nuts again after raising the temperature of the valve so that it may remain in service for a longer period without requiring maintenance.) Standard tightening torques are given in Table 2-2 and Table 4-1.
- (6) When raising the temperature of a valve which is used for high temperature service, do so gradually (the standard rate is 100 °C per hour) and do not operate the valve while the temperature is being raised.



## Chapter 3 Inspection and Maintenance

Maintenance and inspection periods are as follows:

**Tightening the gland:**

Tighten the gland about once every 6 months. The tightening procedure is given in Chapter 2-3 (3).

**Lubricating the gland:**

Lubricate the gland about once every 6 months. The lubricating procedure is as given in Chapter 2-3 (4).

**Check for hunting of valve position:**

Refer to Chapter 6, “Troubleshooting.”

**Check for abnormal noise and vibration:**

Refer to Chapter 6, “Troubleshooting.”



## Chapter 4 Disassembly and Assembly

This chapter covers disassembly and assembly procedures for overhaul inspection or if parts replacement is necessary for modification of specifications, etc.

### 4-1 Detaching actuator from valve body

- (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 hex 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: Before detaching the actuator from a valve body that remains installed on the process pipe, be sure to shut off the process fluid and release the process pressure.

### 4-2 Disassembly and assembly of valve body

This section covers the assembly and disassembly of valve bodies made for use in various temperature ranges.

## 4-2-1 Disassembly and assembly of plain bonnet ( $-17 \leq t < 230\text{ }^{\circ}\text{C}$ ) and extension 1 bonnet ( $-45 \leq t < 17\text{ }^{\circ}\text{C}$ ) valve bodies

### 4-2-1-1 Disassembly procedure

| Step | Procedure   |
|------|---|
| 1    | Loosen the packing flange nuts.   |
| 2    | Remove the hex nuts from the bonnet (or extension 1 bonnet).  |
| 3    | Lift and remove the bonnet. If the valve plug and upper cage are to be extracted together with the bonnet, first turn the plug and upper cage to remove them from the bonnet, exercising care not to damage the stem. Then turn the upper cage to extract the plug from the upper cage exercising care not to damage the seat ring. The seat ring and scraper ring may be damaged if the plug is extracted from the bottom of the upper cage. |
| 4    | Pull out the plug and then pull out the lower cage from the valve body.   |

### 4-2-1-2 Inspection

Inspect the disassembled parts for damage. If any damage is found, replace the parts. (When ordering parts, mention the Prod. No. of the valve which is indicated on the nameplate.)

- (1) Do not reuse the removed gland packing. Use fresh packing when reassembling the valve.
- (2) Check to ensure that there is no damage to the sliding portions of the plug, upper cage, lower cage, seat face, or stem.
- (3) Check to ensure that there is no damage to the sliding parts of the seal ring and scraper ring. For guidelines on parts replacement, refer to Chapter 7, "Recommended spare parts."
- (4) Check to ensure that there is no damage to the body, bonnet, or gasket surfaces. Do not reuse the gasket once it is removed. Always use a new one when reassembling. For guidelines on parts replacement, refer to Chapter 7, "Recommended spare parts."



**4-2-1-3 Assembly procedure**

| Step | Procedure   |
|------|---|
| 1    | Insert the spiral gasket into valve body. (Apply Never-seize* on all valves except degreased valves for oil-free application.)  |
| 2    | Insert lower cage into the valve body.  |
| 3    | Coat the seal ring lightly with silicone grease, place it in the groove on the upper cage and insert plug into the cage. Align the matchmarks on the cage and valve body. Refer to Figure 4-2 for the position of the matchmarks.   |
| 4    | Insert lower gasket into the valve body. (Apply Never-seize* on all gaskets except degreased valves for oil-free application.)  |
| 5    | Coat the entire scraper ring lightly with silicone grease, place it in the groove on the upper part of the plug and insert the plug into the cage. When the plug's tip passes through seal ring, apply even load on the plug to push it in until the tip of the plug touches and sits against the seat on the lower cage. |
| 6    | Insert the upper gasket into the upper cage. (Apply Never-seize* on all gaskets except those on degreased valves for oil-free application.)   |
| 7    | Put the bonnet on the valve body and check that the bonnet is correctly mated with the indented section of the valve body. Tighten the hex nuts uniformly (tighten alternately the ones located opposite each other). For tightening torques, see Table 4-1.  |
| 8    | Insert the gland packing as shown in Figure 2-1.<br>Note When yarn packing sheets are used, overlap sheets in such a way that their cut ends are positioned alternately.  |
| 9    | Put the packing follower and packing flange into place, and tighten the nuts. For the tightening torques, See Table 2-2, "Tightening torques of packing flange nuts".   |

Table 4-1. Tightening torque of bonnet stud bolts

| Nominal size<br>[inches] | Bolt size           |                        |                     | Torque<br>[N•m {kgf-cm}]  |
|--------------------------|---------------------|------------------------|---------------------|---------------------------|
|                          | Class 150<br>JIS10K | Class 300<br>JIS20/30K | Class 600<br>JIS40K |                           |
| 6                        | M22                 | -                      | -                   | 200 to 230 {2000 to 2300} |
|                          | -                   | M30                    | M30                 | 500 to 580 {5000 to 5800} |
| 8                        | M24                 | -                      | -                   | 250 to 290 {2500 to 2900} |
|                          | -                   | M33                    | M33                 | 650 to 780 {6500 to 7800} |
| 10                       | M24                 | M24                    | -                   | 500 to 580 {5000 to 5800} |
|                          | -                   | -                      | M30                 | 580 to 680 {5800 to 6800} |
| 12                       | M24                 | M24                    | -                   | 500 to 580 {5000 to 5800} |
|                          | -                   | -                      | M33                 | 690 to 780 {6900 to 7800} |

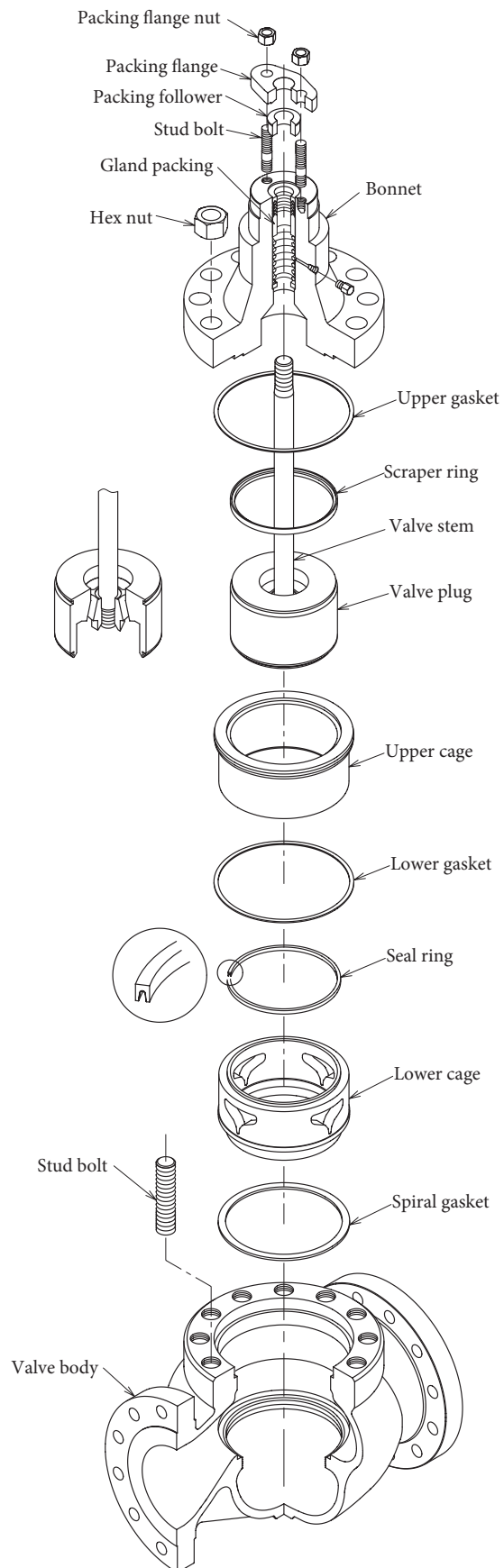


Figure 4-1. Model AC2 control valve with plain bonnet

## 4-2-2 Disassembly and assembly of extension 1 bonnet ( $230 \leq t < 400$ °C) valve body

### 4-2-2-1 Disassembly procedure

| Step | Procedure   |
|------|---|
| 1    | Loosen the packing flange nuts.   |
| 2    | Remove the hex nuts of the extension bonnet, using a wrench.  |
| 3    | Lift and remove the bonnet. Remove the gaskets which are attached to the upper and lower sides of the upper cage. If only the bonnet is extracted, remove the upper cage from the body after removing the plug.<br>Eyebolts screw holes used for suspension are drilled on the upper cage.<br>Remove the upper cage using an eyebolt (refer to Figure 4-3).<br>If the valve plug is extracted together with the upper cage, turn the plug to remove it from the upper cage, exercising care not to damage the stem. Please take care not to drop the plug and upper cage. |
| 4    | Pull out the lower cage.  |
| 5    | Remove the piston rings from the plug using a flat tip screwdriver.   |

### 4-2-2-2 Inspection

Inspect the disassembled parts for damage. If any damage is found, replace the parts. (When ordering parts, mention the Prod. No. of the valve which is indicated on the nameplate.)

- (1) Check that there are no scratches, etc., on gland packing box.
- (2) Check that there are no scratches, etc., on sliding portions of plug, cage, seat face and stem.
- (3) Check that there are no scratches, etc., on the slots on the plug. Do not reuse the removed piston rings. Use a new piston rings when reassembling the valve.
- (4) Check that there are no scratches, etc., on the body, bonnet and gasket surfaces.

### 4-2-2-3 Assembly procedure

| Step | Procedure   |
|------|---|
| 1    | Insert the spiral gasket into the valve body. (Apply Never-seize* on all valves except degreased valves for oil-free application.)                      |
| 2    | Insert the lower gasket into the valve body. (Apply Never-seize* on all valves except degreased valves for oil-free application.)                       |
| 3    | Insert the cage into the valve body. Align the matchmarks on the cage and valve body.<br>Refer to Figure 4-2 for the position of the matchmarks.        |
| 4    | Coat the piston ring lightly with silicone grease, assemble in the slot above the plug and push the plug into the cage.                                 |
| 5    | Put the upper gasket on the gasket surface of the cage. (Apply Never-seize* on all gaskets except those for degreased valves for oil-free application.) |

| Step | Procedure  |
|------|--|
| 6    | Put the bonnet on the valve body and check that the bonnet is correctly mated with the indented section of the valve body. Tighten the hex nuts uniformly (tighten alternately the ones located in opposite positions). For tightening torques, see Table 4-1. |
| 7    | Insert the gland packing as shown in Figure 2-1.<br>Note When yarn packing sheets are used, overlap sheets in such manner that their cut ends are positioned alternately.  |
| 8    | Place the packing follower and packing flange, and tighten the nuts. For the tightening torques, See Table 2-2, "Tightening torques of packing flange nuts".   |

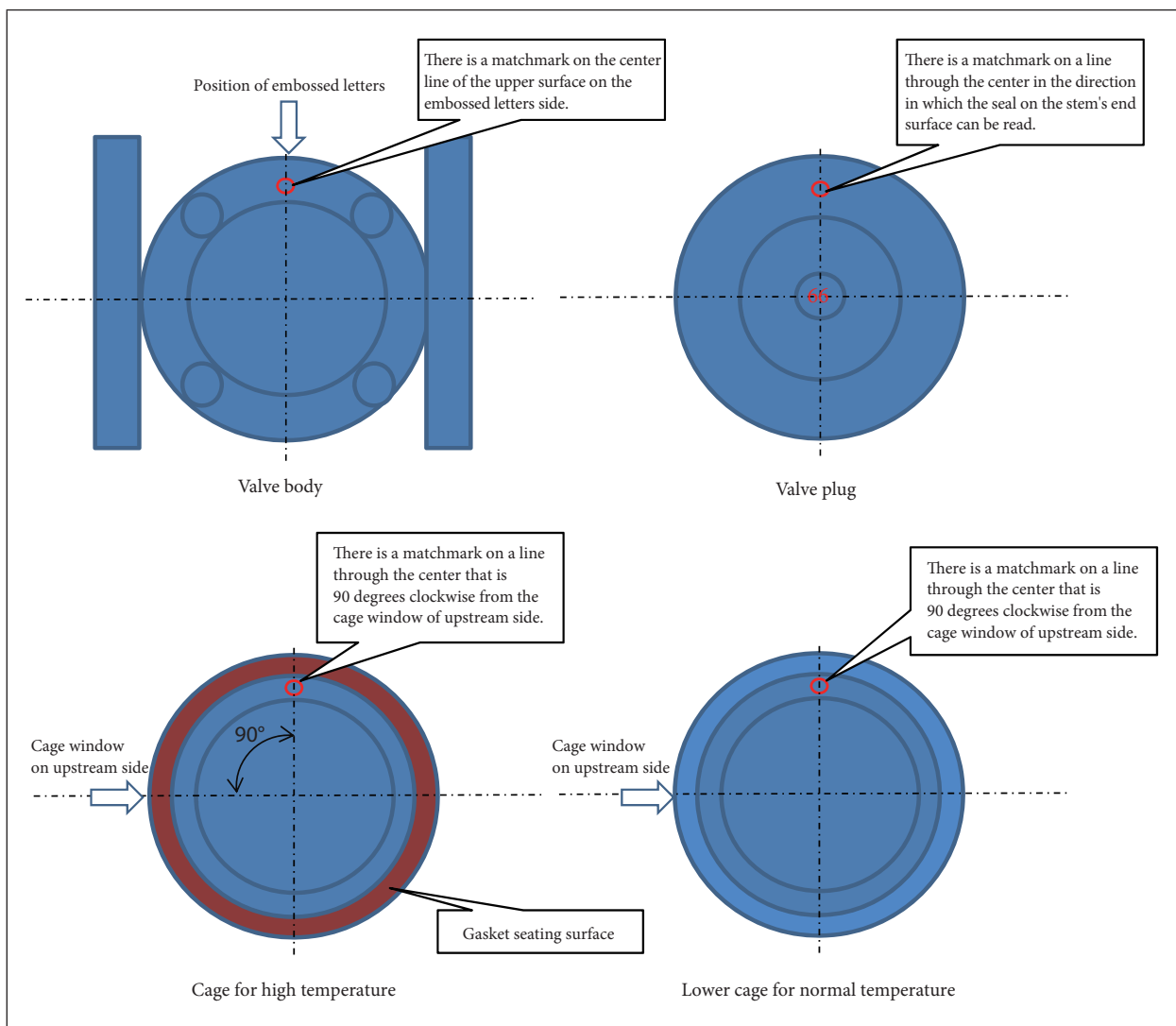


Figure 4-2. Position of matchmarks

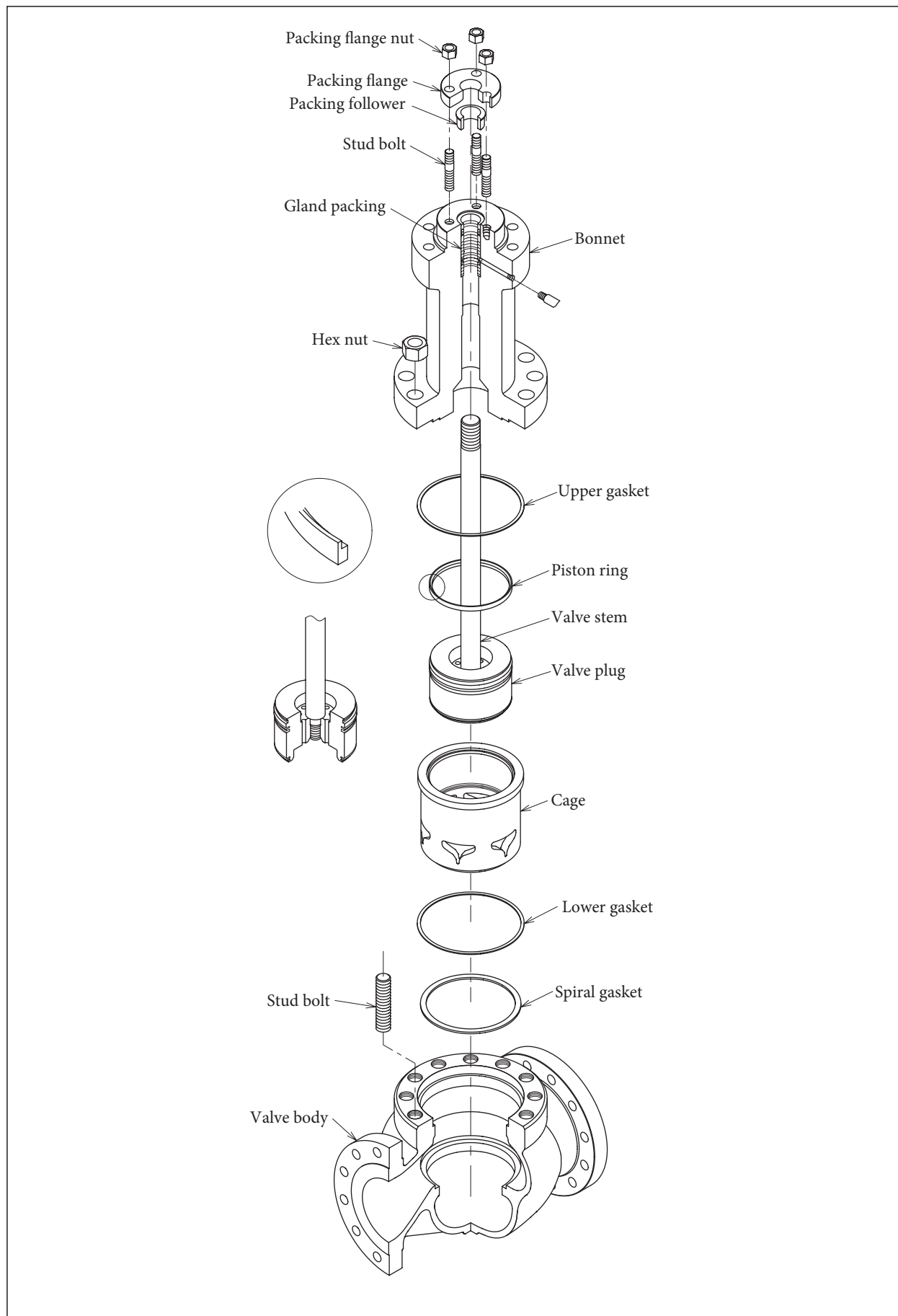


Figure 4-3. Model AC2 control valve with extension bonnet

### 4-3 Disassembly and assembly of model PSA6 actuator

#### Structure

This actuator is comprised of a cylinder, spring unit, lift stopper, spring retainer, hex stay, yoke, manual handwheel and a single action positioner. For an external view of the actuator, refer to Figure 4-4, "Exterior of PSA6R."

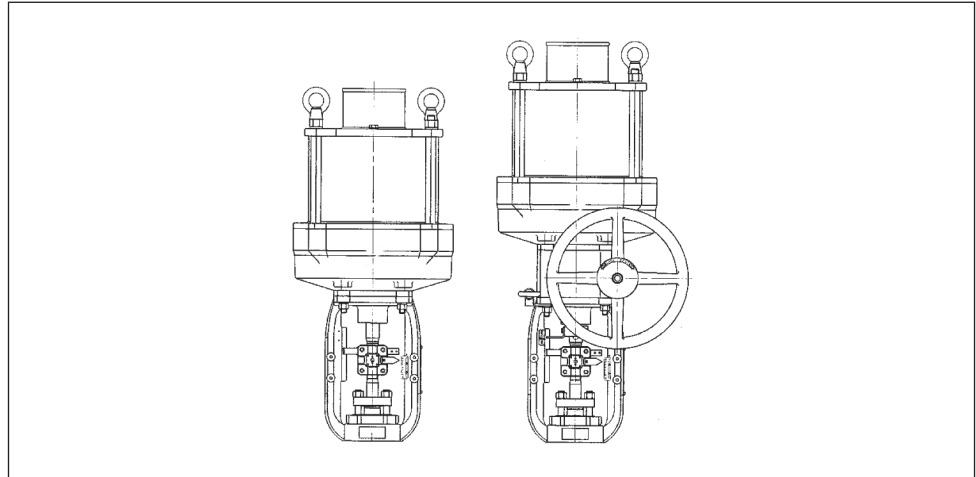


Figure 4-4. Exterior of PSA6R

#### Assembly on valve body

The assembly nuts are integral to the valve body. They connect the yoke and valve body. The stem connector connects the actuator's rod and valve stem.

#### Air piping connection

The tubing is connected to the single action positioner when used as a control valve. Refer to the following instruction manuals for details on single action positioners.

- Pneumatic positioner (Model HTP) No. OM2-8310-0200
- Electro-pneumatic positioner (Model HEP) No. OM2-8310-0100
- Electro-pneumatic positioner (Model AVP 300/301/302/200/201/202)  
No. CM2-AVP300-2001
- Electro-pneumatic positioner (Model AVP 303/203) No. CM2-AVP303-2001
- Smart valve positioner 700 series with HART type (Model AVP701/702)  
No. CM2-AVP702-2001
- Smart valve positioner 700 series with FOUNDATION Fieldbus type (Model AVP703)  
No. CM2-AVP703-2001

Refer to the following instruction manual for details on the springless piston cylinder.

No. CM2-DAP100-2001

#### Calibration

This actuator does not require any calibration.

When the connecting the valve stem of the valve body with the actuator's rod using a stem connector, adjustment should be made to sit the valve plug onto the seat ring. Then the screws on the actuator's scale plate should be loosened, and the stroke and index should be matched to properly position the scale plate.

## ⚠ CAUTION

In operation and handling

- When automatically operating an actuator that has a manual handwheel, verify that the AUTO/MANUAL switchover pin is inserted into the pin holder, the chain is engaged with the handwheel and the indicator is in AUTO position starting operation.
- When disassembling and assembling, always hold the actuator in an upright position (spring unit on top and yoke on the bottom)
- Eyebolts may be used to suspend the actuator, but an assembled valve should not be suspended with the eyebolts only.

### AUTO/MANUAL switchover of manual handwheel

With an actuator having an AUTO/MANUAL switchover function, switchover between automatic operation and manual operation using the handwheel is possible. See Figure 4-5. AUTO/MANUAL switchover can be made at any time during operation.

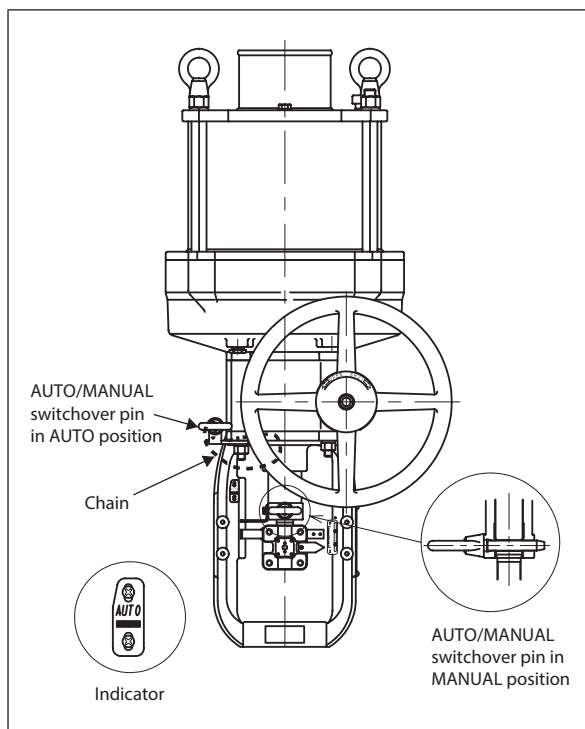


Figure 4-5.  
AUTO/MANUAL switchover

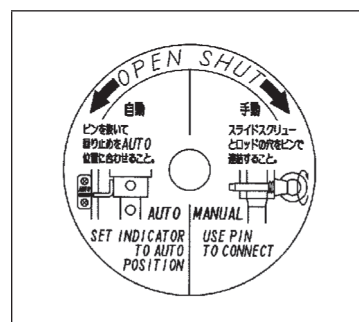



Figure 4-6.  
Operator's instruction label



**Procedure**

| Step | Procedure  |
|------|--|
| 1    | Pull AUTO/MANUAL switchover pin out of its holder and disengage the chain that connects the handwheel with the wheel.  |
| 2    | Check the label on the handwheel, turn the handle in the shut direction, and lower the slide screw.  |
| 3    | Align the round holes of the slide screw and the actuator rod, and then insert the pin. Push it all the way in and fix it there.   |
| 4    | Verify OPEN and SHUT arrows on the label, and turn the handwheel in either direction to open or close the valve. The turning torque should be under 127 N (13 kgf).  |
| 5    | When the handwheel does not turn any further, check the valve opening and then finish. <div data-bbox="603 757 1428 967" data-label="Complex-Block"> <div style="border: 1px solid black; padding: 5px;"> <div style="display: flex; align-items: center; justify-content: center;">  <div style="margin-left: 10px;"><b>CAUTION</b></div> </div> <p>Do not apply undue force to the valve when it comes to a full stop. Doing so may damage the valve stem. Refer to Chapter 6, “Troubleshooting” for remedial action.</p> </div> </div> |
| 6    | <p>To resume automatic operation, remove the switchover pin, turn the handwheel until the slide screw stop reaches the AUTO position (see Figure 4-7 below). Run the chain on the pin through in order to restrict handwheel movement and fix the pin on the holder. Resume automatic operation after verifying this condition.</p> <div data-bbox="890 1193 1141 1444" data-label="Image"> </div> <p style="text-align: center;">Figure 4-7.</p>  |

## 4-4 Disassembly and assembly of actuators

Disassembly and assembly procedures are described herein. Refer to them for periodic maintenance or if a malfunction occurs which may call for the disassembly or assembly of the actuator.

### Before disassembly

- (1) Only the nuts for the eyebolts are made of stainless steel. Keep these nuts separate from other nuts when disassembling the diaphragm case.
- (2) Make locating marks on the top and bottom diaphragm cases before disassembling the valve. This will help you to find the air piping connector location easily.
- (3) Store the removed parts in a clean place.



### CAUTION

Use extreme care when removing the bolts and nuts from the actuator. The actuator contains powerful compressed springs that may cause physical injury or damage to equipment. When removing the bolts and nuts, be sure to closely follow the instructions given for the disassembly and assembly of the actuator and top handwheel.

### Detaching actuator from valve body

Refer to 4-1, “Detaching actuator from valve body”.

## Disassembly of actuator

### <Disassembly procedure>

Disassembly procedure of actuator is described herein. Refer to Figure 4-8 and Figure 4-9 or Table 4-2 for information.

#### 1. Marking and protection

| Step | Procedure  |
|------|--|
| 1    | Match the marks on the spring retainer No. 10 at the top of actuator, lift stopper No. 13, cylinder No. 14 and cylinder assembly No. 23 yoke boss. |
| 2    | Wrap PVC tape around threaded part of the rod to protect sealing parts and the guide bushing.  |

#### 2. Removing slide screw rotation stopper (for models with handwheel)

| Step | Procedure   |
|------|---|
| 1    | Loosen hex head bolt No. 37 and hex nuts No. 38 which fasten the slide screw rotation stopper No. 36. |
| 2    | Remove slide screw rotation stopper No. 36.   |

#### 3. Removing spring retainer

| Step | Procedure  |
|------|--|
| 1    | Loosen and remove hex nuts No. 2 and eye nut No. 1 at the top of actuator. |
| 2    | Lift spring retainer No. 10 straight up and remove.                        |

#### 4. Removing lift stopper and spring unit

| Step | Procedure   |
|------|---|
| 1    | Loosen hex stays No. 4 (four stays) which fasten lift stopper No. 13 and cylinder No. 14 and remove.  |
| 2    | Raise lift stopper 13 straight up and remove.   |
| 3    | Install eyebolts in the threaded holes on the spring receiver No. 9 which is located on the top of spring unit (M12*2) and lift the spring unit (approximately 120 kg) up with a crane. |
| 4    | While it is suspended by a crane, remove the piston's No. 3 sealing parts (tape liner No. 14, O-ring No. 15)  |

**5. Removing slide screw and cylinder**

| Step | Procedure  |
|------|--|
| 1    | Turn slide screw No. 32 by hand and remove it from the bottom.   |
| 2    | Loosen hex head bolts No. 6 (four bolts) which fasten the cylinder and manual handwheel and remove them. |
| 3    | Lift the cylinder straight up and remove.  |

**6. Removing the worm unit (for models with handwheel)**

| Step | Procedure   |
|------|---|
| 1    | Remove in sequential order the bearing holder No. 29, single column angular bearing (upper), No. 30, worm wheel No. 31, and single column angular bearing (lower) No. 30. |
| 2    | Loosen hex head bolts No. 9 (four), which fasten the gear case No. 28 and yoke and remove.  |

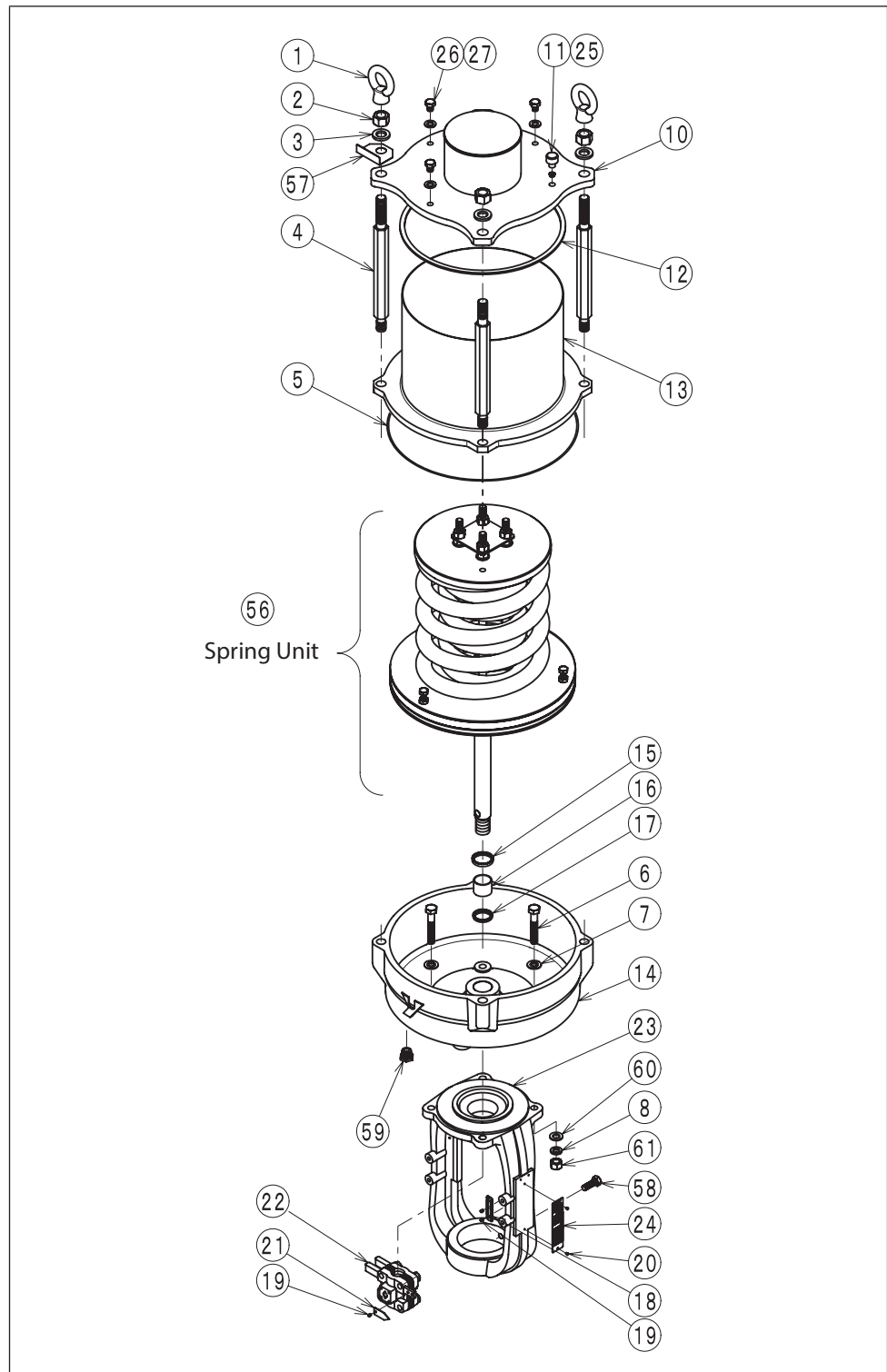


Figure 4-8. PSA6R

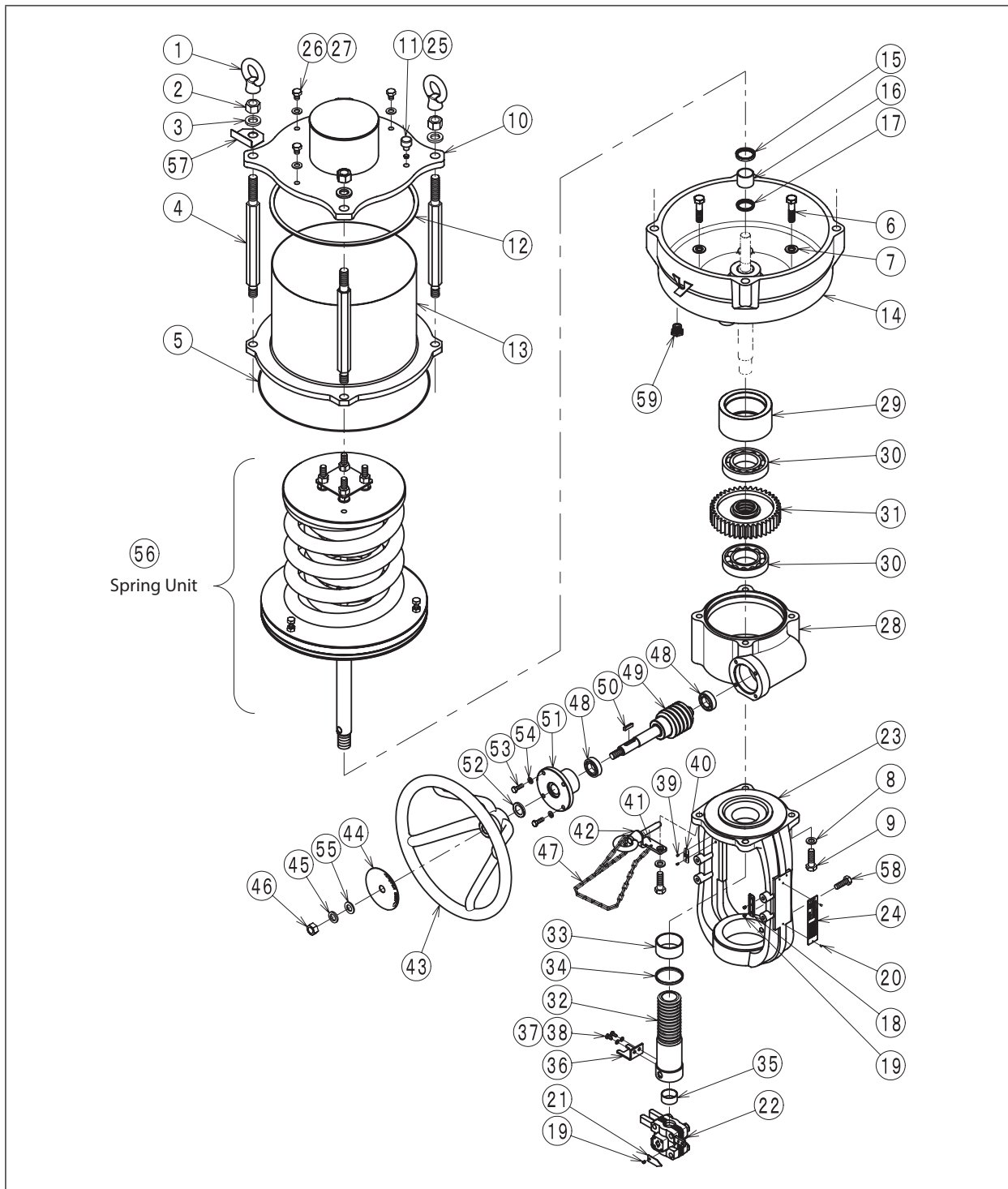


Figure 4-9. PSA6R with Handwheel

Table 4-2. Parts reference list

| No. | Parts description             |
|-----|-------------------------------|
| 1   | Eye Nut                       |
| 2   | Hex Nut                       |
| 3   | Spring Washer                 |
| 4   | Hex Stay(Long)                |
| 5   | O-Ring                        |
| 6   | Hex Bolt                      |
| 7   | Seal Washer                   |
| 8   | Spring Washer                 |
| 9   | Hex Bolt                      |
| 10  | Spring Retainer               |
| 11  | Rain Cap                      |
| 12  | Lift Stopper Seal             |
| 13  | Lift Stopper                  |
| 14  | Cylinder                      |
| 15  | Rod Packing                   |
| 16  | Bushing                       |
| 17  | Dust Seal                     |
| 18  | Scale Plate                   |
| 19  | Truss Screw                   |
| 20  | Drive Screw                   |
| 21  | Pointer                       |
| 22  | Stem Connector                |
| 23  | Yoke                          |
| 24  | Name Plate                    |
| 25  | Filter Screen                 |
| 26  | Hex Bolt                      |
| 27  | Washer                        |
| 28  | Gear Case                     |
| 29  | Bearing Holder                |
| 30  | Single Column Angular Bearing |
| 31  | Worm Wheel                    |

| No. | Parts description             |
|-----|-------------------------------|
| 32  | Slide Screw                   |
| 33  | Bushing                       |
| 34  | Dust Seal                     |
| 35  | Tape Liner                    |
| 36  | Slide Screw Rotation Stopper  |
| 37  | Hex Bolt                      |
| 38  | Seal Washer                   |
| 39  | Truss Screw                   |
| 40  | Indicator                     |
| 41  | Pin Holder                    |
| 42  | Pin                           |
| 43  | Handwheel                     |
| 44  | Operating Instruction Label   |
| 45  | Spring Washer                 |
| 46  | Hex Nut                       |
| 47  | Chain                         |
| 48  | Single Column Angular Bearing |
| 49  | Worm Shaft                    |
| 50  | Key                           |
| 51  | Gear Case Cap                 |
| 52  | Dust Seal                     |
| 53  | Hex Bolt                      |
| 54  | Hex Nut                       |
| 55  | Washer                        |
| 56  | Spring Unit                   |
| 57  | Caution Plate                 |
| 58  | Hex Bolt                      |
| 59  | Bushing Joint                 |
| 60  | Washer                        |
| 61  | Hex Nut                       |

| No. | Parts description |
|-----|-------------------|
| 1   | Rod               |
| 2   | O-Ring            |
| 3   | Piston            |
| 4   | Spring Washer     |
| 5   | Locking Nut       |
| 6   | Stopper           |
| 7   | Spring (Small)    |
| 8   | Spring (Large)    |
| 9   | Spring Receiver   |
| 10  | Hex Nut           |
| 11  | Stopper Retainer  |
| 12  | Hex Bolt          |
| 13  | Hex Nut           |
| 14  | Wear Ring         |
| 15  | O-Ring            |
| 16  | Washer            |

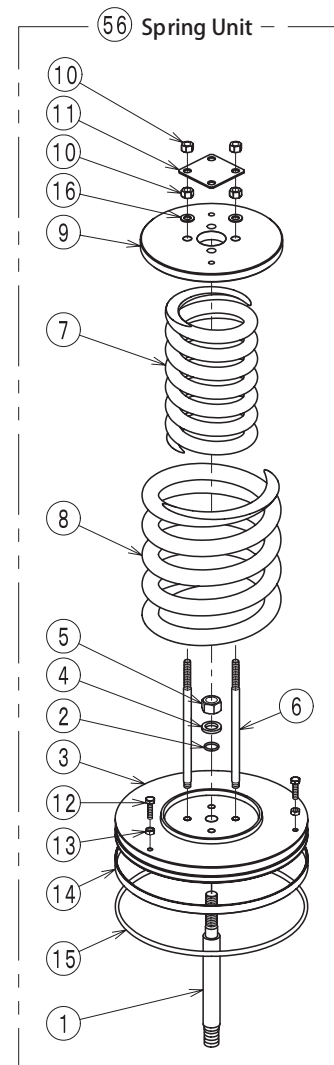


Figure 4-10. Spring Unit

## Disassembling the spring unit


### <Disassembly procedure>

The disassembly procedure for the spring unit is described herein.

See Figure 4-10 for part names.

Disassembly is not required if only the piston's sealing parts (tape liner, O-ring) are to be replaced.

### 1. Removing the spring unit

| Step | Procedure   |
|------|---|
| 1    | Loosen and remove hex nuts No.10 (four at the top).   |
| 2    | Remove stopper retainer No. 11.   |
| 3    | Evenly loosen hex nuts No. 10 (four at the bottom) until there is no tension on springs No. 7 and No. 8.  |
|      | <div style="border: 1px solid black; padding: 5px;"> <div style="display: flex; align-items: center;">  <div style="margin-left: 5px;"><b>CAUTION</b></div> </div> <p>Follow the disassembly procedure for the spring unit when removing bolts and nuts. Otherwise, the release of the springs may result in physical injury.</p> </div> |
| 4    | Remove spring receiver No. 9.   |
| 5    | Remove springs (large No. 8, small No. 7).  |

### 2. Removing piston unit

| Step | Procedure   |
|------|---|
| 1    | Loosen stopper No. 6 and remove.  |
| 2    | Loosen locking nut No. 5 and remove, using the flat surfaces of rod No. 1.                              |
| 3    | Remove spring washer No. 4, O-ring No. 2.<br>Exercise care so as not to damage the O-ring with the rod. |
| 4    | Separate rod No. 1 from piston No. 3.   |



## Assembling the actuator

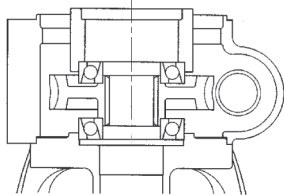
### <Cautions during assembly>

- Refer to the chapter covering items to inspect during disassembly and verify that no abnormality is found on the parts. If a problem found, replace or repair as required.
- The O-rings of sliding parts should always be replaced at the time of periodic disassembly.
- Whenever the O-ring on the fixed part is deformed, damaged, or scratched during disassembly, replace it.
- Clean the O-ring, oil seal, wear ring, and tape liner O-ring recess and apply sufficient lubricant.
- Ensure that no dust or dirt from maintenance work prior to reassembly remains on sliding parts of the cylinder and guide bushing.

## Assembly of actuator with manual handwheel

See Figure 4-8 and Figure 4-9 for part names.

### 1. Assembly of manual handwheel and cylinder assembly

| Step | Procedure   |
|------|---|
| 1    | While yoke No. 23 is in upright position, place gear case No. 28 and temporarily fasten it with hex head bolts No. 9 (four).  |
| 2    | Apply lubricant to the single column angular bearings (top and bottom) and assemble in sequential order lower bearing No. 30, worm wheel No. 31, upper bearing No. 30 and bearing holder No. 29. See Figure 4-11 below.<br><br> |
| 3    | Insert and screw in from the bottom slide screw No. 32 assembled with wear ring No. 14. Apply lubricant on the threaded parts of slide screw No. 32.  |
| 4    | Assemble slide screw No. 32 with slide screw rotation stopper No. 36, hex head bolt No. 50 and nut No. 51.  |
| 5    | Apply lubricant on rod packing No. 15 and dust seal No. 17 and assemble them into cylinder No. 14.  |
| 6    | Place cylinder No. 14 on gear case No. 28 and temporarily fasten it with hex head bolts No. 6 (four) and seal washer No. 7.   |
| 7    | Use rod No. 1 to set the position of the cylinder by ensuring that the rod moves smoothly and then tighten to the torque given in Table 4-5. If the rod does not move smoothly, tap the cylinder or gear case gently with a plastic hammer and set the position.  |

**2. Assembly of piston unit, lift stopper and spring retainer**

| Step | Procedure  |
|------|--|
| 1    | Install eyebolts into threaded holes (M12*2) at the top of spring retainer No. 9 on the piston unit, suspend with crane and lift upward. |
| 2    | While suspended, assemble lubricated O-ring No. 15 and wear ring No. 14 on piston No. 3.   |
| 3    | Assemble piston unit in cylinder No. 14 from the top. Make sure the round hole of rod 1 is in the front.                                 |
| 4    | Assemble lift stopper seal No. 12 in the groove on the top of cylinder No. 14.   |
| 5    | Insert lift stopper No. 13 from the top and fix by the hex stays No. 4 (four). Screw in the ones of the same length alternately.         |
| 6    | Assemble so that the hex stays No. 4 fit into bolt holes of spring retainer No. 10.  |
| 7    | Attach spring retainer No. 10 with hex head nuts No. 2 (four).   |
| 8    | Install eye nuts No. 1 (two) on hex stay No. 4.  |

**Assembly of actuator without manual handwheel**

When assembling an actuator without a manual handwheel, follow the procedure given in “Assembly of actuator with manual handwheel”, except for instructions applying to the actuator.

**Parts to be replaced**

The actuator's parts have been designed to withstand prolonged usage. However, it is recommended that the following parts be replaced at the indicated intervals.

Tape liner ..... Every five years  
 Bushing ..... Every five years  
 Seal washer ..... Every five years  
 Dust seal..... Every five years (or whenever disassembled)  
 Rod packing..... Every five years (or whenever disassembled)  
 O ring ..... Every five years (or whenever disassembled)

### Tightening torques of actuator assembly

The table below lists the tightening torques for actuator assembly.

Refer to Figure 4-12.

Table 4-3. Tightening torque of bolt and nuts of actuator

| Key No. | Size | Tightening torque (N·m {kgf·cm}) |
|---------|------|----------------------------------|
| 1       | M14  | 80 to 120 {800 to 1200}          |
| 2       | M20  | 285 to 385 {2850 to 3850}        |
| 3       | M24  | 305 to 410 {3050 to 4100}        |
| 4       | M14  | 80 to 120 {800 to 1200}          |
| 5       | M12  | 50 to 70 {500 to 700}            |

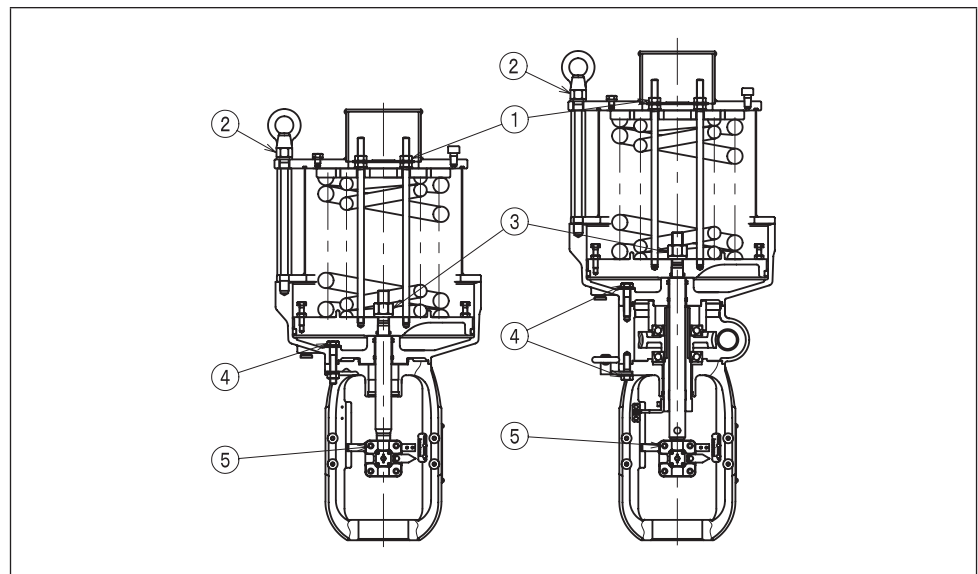


Figure 4-12. Tightening torque of actuator thread



## Chapter 5 SECURE-SEAL Certified ISO 15848-1-Compliant Low-Emission Gland Packing System

### 5-1 Overview

SECURE-SEAL employs a live-loaded packing system to maintain valve seal performance for a long period of time. The gland packing system has acquired third-party certification for compliance with ISO15848-1, which is the international standard for low-emission performance of valves. For the structure of the gland, see Figure 5-1 and Figure 5-2.

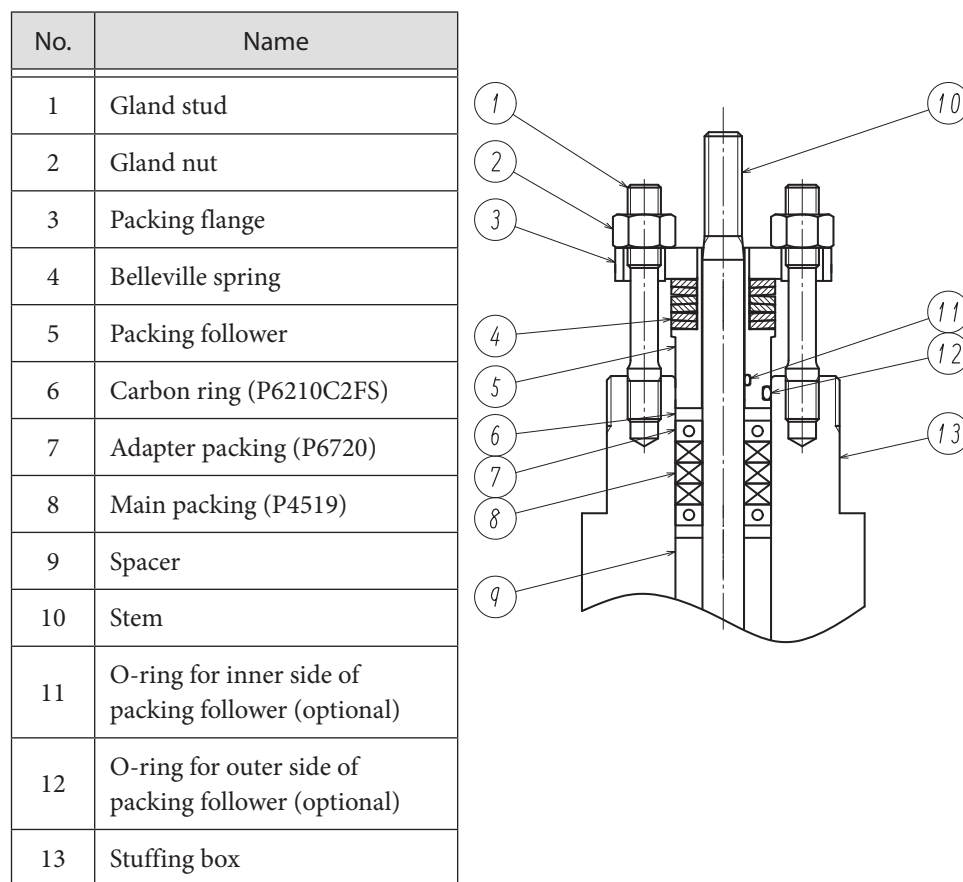


Figure 5-1. Structure of SECURE-SEAL (for PTFE yarn)

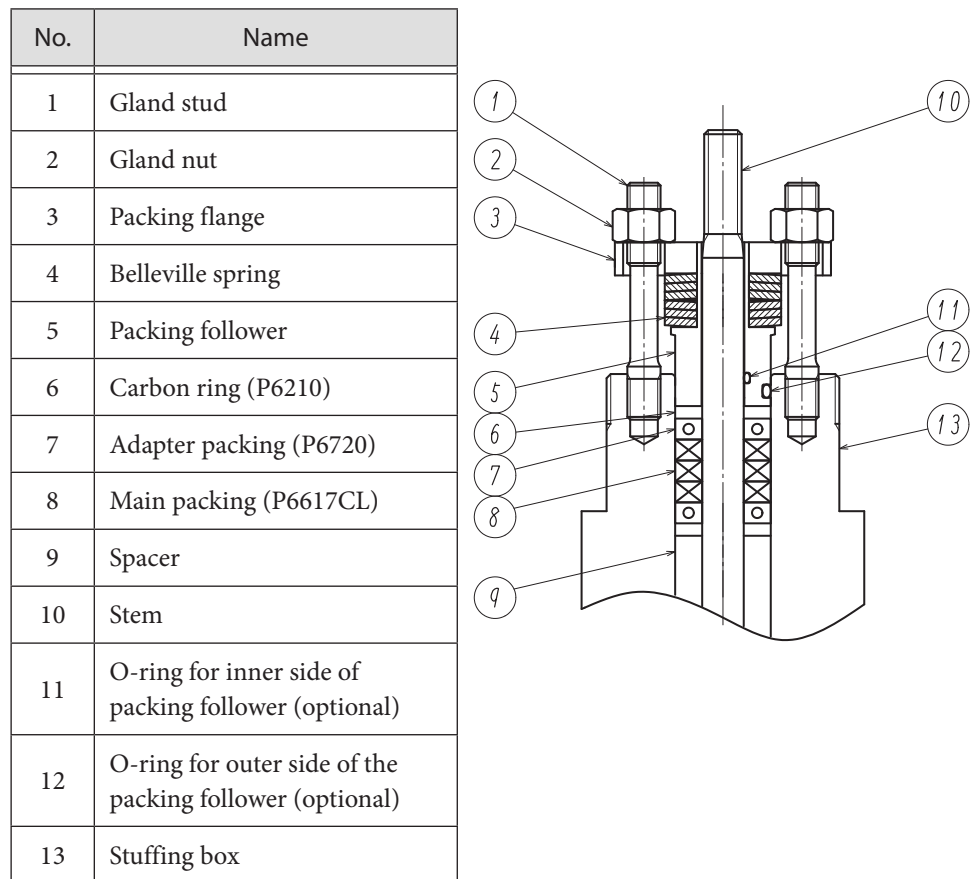


Figure 5-2. Structure of SECURE-SEAL (for expanded graphite)

## 5-2 Structure

The main packing (No. P4519) is PTFE yarn with a carbon fiber core. It features low friction and can be used for various types of fluids. The main packing (No. P6617CL) is an expanded graphite packing. The part of it that slides is aligned with an expanded graphite sheet that was specially modified and lubricated. The adapter packing (No. P6720) is made by braiding expanded graphite yarn reinforced with PTFE fiber, and features low friction.

These gland packings are tightened by the live-loaded packing system, which is composed of Belleville springs and other parts. With other systems, in the course of valve operation, seal performance deteriorates due to loosening of the gland packing. The force of the Belleville springs reduces the release of tension to maintain the seal. The load on the Belleville springs can be observed from the position of the packing flange and packing follower.

## 5-3 Starting Operation

Before operating the valve, tighten (or retighten) the gland. For instructions, refer to 5-4-2, “(3) Tightening.”

If leakage from the gland continues even after proper tightening, obtain and prepare parts as indicated in 5-4-1, “Preparation for assembly”, and follow the procedure given in 5-4-2, “Assembly.”

## 5-4 Assembling the parts of the gland

### 5-4-1 Preparation for assembly

(1) Checking the surface condition of the parts

Any flaw or the like on the surface of the parts may cause leakage from that area, resulting in a total amount of leakage from the gland that exceeds the specified value. Therefore, check the surface of the following parts.

Table 5-1. Parts to be checked for surface condition

| Part                            | Checkpoints   | Possible problems  |
|---------------------------------|---|--|
| Stem                            | <ul style="list-style-type: none"> <li>No flaws or defects, including scratches and dents</li> <li>No rust or corrosion</li> <li>The entire surface is even.</li> <li>No burrs</li> <li>Clean surface, with no adhering coating material, powder, or dirt.</li> </ul> | If the problems stated on the left remain, fluid leaks from flawed areas may cause the total amount of leakage from the gland to exceed the specified value. |
| Stuffing box                    |   |  |
| Both ends of the spacer         |   |  |
| Packing follower                |   |  |
| Packing contact surface         |   |  |
| O-ring groove                   | <ul style="list-style-type: none"> <li>If necessary, take necessary measures such as cleaning with alcohol.</li> </ul>  | The total amount of leakage from the gland may exceed the specified value because of insufficient tightening.  |
| Packing flange                  |   |  |
| Gland nut contact surface       | <ul style="list-style-type: none"> <li>No flaws, rust, or defects</li> </ul>  | The problems on the left, if they remain, can cause control valve damage, leading to injuries.   |
| Packing flange (entire surface) |   |  |
| Gland stud                      |   |  |
| Gland nut                       |   |  |



## (2) New parts

When assembling or reassembling, for the parts indicated in the table below, be sure to use new parts.

Table 5-2. Parts requiring treatment

| Part name   | Checkpoints   | Possible problems   |
|---|---|---|
| Gland packing (main packing and adapter packing)<br>Carbon ring | <ul style="list-style-type: none"> <li>No flaws.</li> <li>No coating materials or dirt stuck to the surface.</li> </ul> | Fluid leaks from flawed areas can cause the total amount of leakage from the gland to exceed the specified value.                       |
| Belleville spring   |   | The total amount of leakage from the gland may exceed the specified value in a short period of time because of insufficient tightening. |

## (3) Lubricating grease and anti-seizing agent

Have an appropriate amount of the following lubricating grease and anti-seizing agent (or equivalent) on hand.

Table 5-3. Lubricating grease and anti-seizing agent

| Product name  | Applied area   | Gland for PTFE yarn | Gland for expanded graphite |
|---|--|---------------------|-----------------------------|
| Krytox GPL207 fluoropolymer grease made by DuPont Co.     | Entire surface of the gland packing (main packing and adapter packing) | Needed              | –                           |
| Plastilube No. 3 non-dripping grease, made by Sulflo Inc. | Entire surface of the O-rings  | Needed              | Needed                      |
| Never-Seez anti-seizing agent, made by Bostik Inc.        | Threads of the gland studs   | Needed              | Needed                      |
|   | Bottom of the gland nuts   | Needed              | Needed                      |

## 5-4-2 Assembly

### (1) Applying lubricating grease

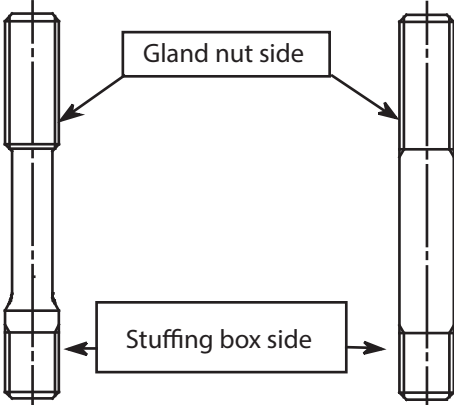
#### Step 1

For SECURE-SEAL for PTFE yarn, apply a thin film of grease Krytox GPL207 indicated in Table 5-3 to the surface of all gland packings (main packing and adapter packing). For SECURE-SEAL for expanded graphite, greasing is not necessary.

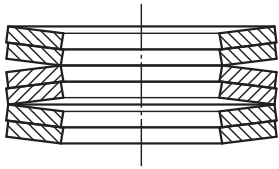
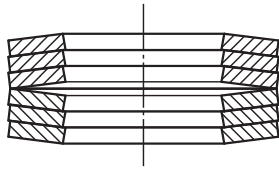
#### Step 2

For SECURE-SEAL with two O-rings, which are placed inner and outer sides of the packing follower, apply grease Plastilube No.3 made by Sulflo Inc. indicated in Table 5-3 to both rings.

### (2) Assembling

| Step | Procedure  |
|------|--|
| 1    | <p>Check the correct direction of the gland studs in Figure 5-3. Apply Never-Seez anti-seizing agent made by Bostik Inc. (indicated in Table 5-3) to the threads on the stuffing box end of the studs, and screw them into the stuffing box.</p>  <p style="text-align: center;">Gland stud end with fewer threads</p> <p style="text-align: center;">Figure 5-3. Direction of the gland stud</p> |
| 2    | First, insert the spacer, paying extra attention not to damage the surface of the stem.  |
| 3    | Gently insert a carbon ring all the way to the bottom with a pipe, etc., taking care not to damage the ring.   |

| Step | Procedure  |
|------|--|
| 4    | <p data-bbox="571 230 911 259">[SECURE-SEAL for PTFE yarn]</p> <p data-bbox="571 277 1374 342">Insert one adapter packing ring, without opening the gap, all the way to the bottom with a pipe, etc., and push it lightly.</p> <p data-bbox="571 405 1425 504">Open the gap of the main packing rings as illustrated in Figure 5-4 and insert one of them all the way to the bottom with a pipe, etc., and push it lightly. Insert the remaining two main packing rings with the gap position shifted by 180°.</p> <p data-bbox="571 566 1374 631">Insert one adapter packing ring, without opening the gap, all the way to the bottom with a pipe, etc., and push it lightly.</p> <div data-bbox="751 674 1262 931"> <p data-bbox="778 689 1027 719">Opening manner of packing</p> </div> <p data-bbox="730 952 1267 981">Figure 5-4. How to open the main packing rings</p> <p data-bbox="571 1043 995 1072">[SECURE-SEAL for expanded graphite]</p> <p data-bbox="571 1090 1374 1155">Insert one adapter packing ring, without opening the gap, all the way to the bottom with a pipe, etc., and push it lightly.</p> <p data-bbox="571 1218 1425 1317">Insert one of the main packing rings, with the marking facing upward, all the way to the bottom with a pipe, etc., and push it lightly. Insert the remaining two main packing rings in the same manner.</p> <p data-bbox="571 1379 1374 1444">Insert one adapter packing ring, without opening the gap, all the way to the bottom with a pipe, etc., and push it lightly.</p> |
| 5    | Gently insert a carbon ring all the way to the bottom with a pipe, etc., taking care not to damage the ring.   |
| 6    | Check the correct mounting orientation of the packing follower in Figure 5-1 or Figure 5-2. Insert it, paying extra attention not to damage the surface of the stem.   |

| Step | Procedure  |
|------|--|
| 7    | <p>Stack the Belleville spring washers as shown in Figure 5-5, and insert them into the packing follower.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>2 same-direction washers × 3<br/>[For PTFE yarn]</p> </div> <div style="text-align: center;">  <p>3 same-direction washers × 2<br/>[For expanded graphite]</p> </div> </div> <p style="text-align: center;">Figure 5-5.</p> |
| 8    | Place the packing flange onto the packing follower.  |
| 9    | Apply anti-seizing agent Never-Seez made by Bostik Inc. (Table 5-3) to the threads on the gland nut end of the gland studs, and screw the nuts on by hand.   |

## (3) Tightening

| Step           | Procedure  |                             |           |                   |              |         |        |            |         |        |                |           |                   |              |         |                             |            |         |                             |
|----------------|--|-----------------------------|-----------|-------------------|--------------|---------|--------|------------|---------|--------|----------------|-----------|-------------------|--------------|---------|-----------------------------|------------|---------|-----------------------------|
| 1              | <p>Tighten the left and right gland nuts alternately, making approximately a half turn each, until the torque indicated in Table 5-4 or Table 5-5 is reached. Note that if the tightening torque is insufficient, the amount of leakage may exceed the specified value. On the other hand, tightening the gland nuts with excessive torque increases the friction on the stem and causes the gland packing to wear out faster, which may lead to an amount of leakage exceeding the specified value in a short period of time.</p> <p>Table 5-4. Gland nut tightening torque (for PTFE yarn)</p> <table><tr><th>Actuator model</th><th>Stem size</th><th>Tightening torque</th></tr><tr><td>PSA6, DAP560</td><td>ϕ 30 mm</td><td>54 N·m</td></tr><tr><td>DAP1000(X)</td><td>ϕ 40 mm</td><td>65 N·m</td></tr></table> <p>Table 5-5. Gland nut tightening torque (for expanded graphite)</p> <table><tr><th>Actuator model</th><th>Stem size</th><th>Tightening torque</th></tr><tr><td>PSA6, DAP560</td><td>ϕ 30 mm</td><td>54 → 0 (loosening) → 36 N·m</td></tr><tr><td>DAP1000(X)</td><td>ϕ 40 mm</td><td>65 → 0 (loosening) → 43 N·m</td></tr></table> | Actuator model              | Stem size | Tightening torque | PSA6, DAP560 | ϕ 30 mm | 54 N·m | DAP1000(X) | ϕ 40 mm | 65 N·m | Actuator model | Stem size | Tightening torque | PSA6, DAP560 | ϕ 30 mm | 54 → 0 (loosening) → 36 N·m | DAP1000(X) | ϕ 40 mm | 65 → 0 (loosening) → 43 N·m |
| Actuator model | Stem size  | Tightening torque           |           |                   |              |         |        |            |         |        |                |           |                   |              |         |                             |            |         |                             |
| PSA6, DAP560   | ϕ 30 mm  | 54 N·m                      |           |                   |              |         |        |            |         |        |                |           |                   |              |         |                             |            |         |                             |
| DAP1000(X)     | ϕ 40 mm  | 65 N·m                      |           |                   |              |         |        |            |         |        |                |           |                   |              |         |                             |            |         |                             |
| Actuator model | Stem size  | Tightening torque           |           |                   |              |         |        |            |         |        |                |           |                   |              |         |                             |            |         |                             |
| PSA6, DAP560   | ϕ 30 mm  | 54 → 0 (loosening) → 36 N·m |           |                   |              |         |        |            |         |        |                |           |                   |              |         |                             |            |         |                             |
| DAP1000(X)     | ϕ 40 mm  | 65 → 0 (loosening) → 43 N·m |           |                   |              |         |        |            |         |        |                |           |                   |              |         |                             |            |         |                             |

| Step | Procedure   |
|------|---|
| 2    | <p>By tightening the gland nuts to the torque indicated in Table 5-4 or Table 5-5, the top of the packing flange and packing follower will be at almost the same level, as illustrated in Figure 5-6 below (the level may not be exactly the same due to the tolerance of the Belleville springs).</p> <p>If the Belleville springs are mounted in the wrong direction, or if the gland nuts are tightened to a torque that does not comply with the torque specified in Table 5-4 and Table 5-5, the level of the top of the packing flange and packing follower will not be the same (see Figure 5-7). Check if the direction of washers of the Belleville springs and the tightening torque are correct.</p> <div data-bbox="662 593 1300 929" data-label="Image"> </div> <p>Figure 5-6. Load on Belleville springs (correctly assembled)</p> <div data-bbox="829 1019 1149 1288" data-label="Image"> </div> <p>Figure 5-7. Load on Belleville springs (incorrectly assembled)</p> |
| 3    | <p>View the assembly from above to check that the space between the stem and the packing follower is even (see Figure 5-8).</p> <div data-bbox="718 1467 1260 1736" data-label="Image"> </div> <p>Figure 5-8. Top view</p>  |

## 5-5 Parts List

Table 5-6. For PTFE yarn

| Part name                       | Actuator model  | Material     | Part No.      | Qty. |
|---------------------------------|-----------------|--------------|---------------|------|
| Main packing                    | PSA6R<br>DAP560 | P4519        | 80255388- 111 | 3    |
| Adapter packing                 |                 | P6720        | 82573475- 204 | 2    |
| Carbon ring                     |                 | P6210C2FS    | 82573484- 010 | 2    |
| Belleville spring               |                 | SUS304       | 82573462- 105 | 6    |
| O-ring (small)                  |                 | Viton        | 82592223- 397 | 1    |
| O-ring (large)                  |                 | Viton        | 82592224- 197 | 1    |
| Gland stud                      |                 | A193 GrB8CL2 | 82592006- 769 | 2    |
| Gland nut                       |                 | SUS304       | 82592448- 033 | 2    |
| Packing flange                  |                 | SCS13        | 82573460- 101 | 1    |
| Packing follower                |                 | SUS304       | 82573471- 101 | 1    |
| Packing follower for O-ring use |                 | SUS304       | 82573472- 101 | 1    |
| Spacer                          |                 | SUS304       | 82553331- 781 | 1    |
| Main packing                    | DAP1000(X)      | P4519        | 82571048- 115 | 3    |
| Adapter packing                 |                 | P6720        | 82573475- 205 | 2    |
| Carbon ring                     |                 | P6210C2FS    | 82573484- 011 | 2    |
| Belleville spring               |                 | SUS304       | 82573462- 106 | 6    |
| O-ring (small)                  |                 | Viton        | 82592224- 497 | 1    |
| O-ring (large)                  |                 | Viton        | 82592235- 697 | 1    |
| Gland stud                      |                 | A193 GrB8CL2 | 82592008- 369 | 3    |
| Gland nut                       |                 | SUS304       | 82592448- 043 | 3    |
| Packing flange                  |                 | SCS13        | 82573461- 101 | 1    |
| Packing follower                |                 | SUS304       | 82573473- 101 | 1    |
| Packing follower for O-ring use |                 | SUS304       | 82573474- 101 | 1    |
| Spacer                          |                 | SUS304       | 82553331- 977 | 1    |

Table 5-7. For expanded graphite

| Part name                          | Actuator model  | Material     | Part No.      | Qty. |
|------------------------------------|-----------------|--------------|---------------|------|
| Main packing                       | PSA6R<br>DAP560 | P6617CL      | 82573489- 009 | 3    |
| Adapter packing                    |                 | P6720        | 82573475- 204 | 2    |
| Carbon ring                        |                 | P6210        | 82573488- 010 | 2    |
| Belleville spring                  |                 | SUS304       | 82573462- 109 | 6    |
| O-ring (small)                     |                 | Viton        | 82592223- 397 | 1    |
| O-ring (large)                     |                 | Viton        | 82592224- 197 | 1    |
| Gland stud                         |                 | A193 GrB8CL2 | 82592006- 769 | 2    |
| Gland nut                          |                 | SUS304       | 82592448- 033 | 2    |
| Packing flange                     |                 | SCS13        | 82573460- 101 | 1    |
| Packing follower                   |                 | SUS304       | 82573471- 201 | 1    |
| Packing follower<br>for O-ring use |                 | SUS304       | 82573472- 201 | 1    |
| Spacer                             |                 | SUS304       | 82553331- 779 | 1    |
| Main packing                       | DAP1000(X)      | P6617CL      | 82573489- 010 | 3    |
| Adapter packing                    |                 | P6720        | 82573475- 205 | 2    |
| Carbon ring                        |                 | P6210        | 82573488- 011 | 2    |
| Belleville spring                  |                 | SUS304       | 82573462- 110 | 6    |
| O-ring (small)                     |                 | Viton        | 82592224- 497 | 1    |
| O-ring (large)                     |                 | Viton        | 82592235- 697 | 1    |
| Gland stud                         |                 | A193 GrB8CL2 | 82592008- 369 | 2    |
| Gland nut                          |                 | SUS304       | 82592448- 043 | 2    |
| Packing flange                     |                 | SCS13        | 82573461- 101 | 1    |
| Packing follower                   |                 | SUS304       | 82573473- 201 | 1    |
| Packing follower<br>for O-ring use |                 | SUS304       | 82573474- 201 | 1    |
| Spacer                             |                 | SUS304       | 82553331- 975 | 1    |

## 5-6 Application to existing control valves

If SECURE-SEAL is used for an existing control valve, please note the following:

If there are scratches on the inner surface of the stuffing box or the surface of the stem of the current valve, the specified seal performance of SECURE-SEAL may not be achieved. If scratches are found, replace the affected parts with new ones.

Check if SECURE-SEAL can be used for the current valve and actuator by referring to the specification sheet for SECURE-SEAL (SS2-SSL100-0100) or by contacting us. Because the resistance to sliding of SECURE-SEAL is greater than general gland packing systems, it may not be possible to use SECURE-SEAL with the current actuator. In addition, if it is used with the actuator, the shutoff differential pressure will decrease. If supply air pressure to the actuator is increased in order to meet the required shutoff differential pressure, check that the specifications for the pressure gauge of the positioner and pressure reducing valve are satisfied and that there is no effect on the pressure at the source.

Check if the operating temperature range of the gland packing (main packing and adapter packing) of SECURE-SEAL meets the temperature requirements of the current control valve. Attention is needed for expanded graphite SECURE-SEAL in particular, because the operating temperature high limit of the main packing used for this packing system is lower than that of general expanded graphite packings.

## 5-7 Disposal

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



## Chapter 6 Troubleshooting

This chapter covers problems, causes and remedial actions for the most probable types of troubles. Parts may require replacement depending on their type. For further problems, please contact an Azbil Corporation representative for repair.

Table 6-1. Troubleshooting

| Problem   | Cause and Remedial Action   |
|---|---|
| Unstable valve operation <ul style="list-style-type: none"> <li>Valve position hunting occurs when almost fully closed.</li> <li>Air supply pressure is unstable.</li> <li>Signal pressure is unstable.</li> <li>Valve position hunting occurs even when signal pressure is stable</li> </ul> | <ul style="list-style-type: none"> <li>Cv value is too large.</li> <li>Reduce Cv value</li> <li>Large air consuming equipment is hooked up to the same air supply line.</li> <li>Check that the air supply capacity, piping capacity and restriction capacity are appropriate.</li> <li>Supply air pressure regulator is inadequate or not operating properly.</li> <li>Controller is not properly tuned.</li> <li>Properly tune the controller (properly set the proportional band and other parameters).</li> <li>Check that the controller output does not change abnormally.</li> <li>Hunting of output of positioner itself.</li> <li>Check and repair or replace the positioner.</li> <li>Effects from pressure change of process fluid because power of the actuator is insufficient. Replace the actuator with a larger one.</li> </ul> |
| Vibration of valve <ul style="list-style-type: none"> <li>Valve vibrates (generates noise) at any position of valve plug</li> <li>Valve vibrates (generate noise) only when valve plug is set at a certain position.</li> </ul>   | <ul style="list-style-type: none"> <li>Piping is vibrating.</li> <li>Securely attach the piping.</li> <li>Check for other sources of vibration.</li> <li>Worn valve plug or guides.</li> <li>Check for change in process fluid flow conditions.</li> <li>(Change in restriction orifice, Cv value, etc.)</li> <li>Check for change in plug configuration (change in flow control characteristics.)</li> </ul>   |

Table 6-1. Troubleshooting

| Problem  | Cause and Remedial Action   |
|--|---|
| Sluggish valve operation or inoperative valve                                    | <ul style="list-style-type: none"> <li>• Air leak from piping</li> <li>• Air leak from actuator</li> <li>• Foreign matter trapped in guide section of valve plug</li> <li>• Aged and hardened gland packing, causing increased hysteresis</li> <li>• Malfunctioning positioner</li> <li>• (Check the positioner by operating it directly on an air supply known to be operating normally.)</li> </ul>   |
| Fluid leak from gland section  | <ul style="list-style-type: none"> <li>• Check for loose packing flange.</li> <li>• Check for insufficient grease.</li> <li>• Check for damaged valve shaft.</li> </ul>   |
| Liquid leak from gasket section  | <ul style="list-style-type: none"> <li>• Check for loose nuts on bonnet.</li> <li>• Check for defective gasket (deformed or damaged).</li> </ul>  |
| Even when valve plug is in closed position, large flow leaks to downstream side. | <ul style="list-style-type: none"> <li>• Air leak at actuator section</li> <li>• As a test, apply the air supply pressure or atmospheric pressure to the actuator. (Check the air supply source pressure to the actuator.)</li> <li>• Check whether the valve plug is actually in the closed position or not. (Check the valve plug lift.)</li> <li>• Check the plug seat ring for corrosion and erosion.</li> <li>• Check the guide sections for binding.</li> <li>• Check for damaged seal ring.</li> </ul> |

# Chapter 7 Recommended spare parts

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

**Valve Body**

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

- Gland packing
- Gaskets

The frequency of replacement of seal ring or scraper ring differs greatly depending upon such conditions as type of flow fluid, fluid temperature, and pressure. As a general rule, replace them once every 100,000 full stroke cycles or once every three years.

The frequency of replacement of plug and cage differs greatly depending upon such conditions as type of flow fluid, fluid temperature or pressure. As a general rule, replace them once every 100,000 full stroke cycles.

**Actuator**

Replace the following parts every 5 years or thereabouts:

O-ring

Tape liner

Bushing

Seal washer

Dust seal

Rod seal

}

Be sure to replace these parts whenever the actuator is disassembled

Please give the parts name and the product number indicated on the nameplate when ordering spare parts.





# 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

Azbil Corporation's products other than those explicitly specified as applicable (e.g. azbil Limit Switch For Nuclear Energy) shall not be used in a nuclear energy controlled area (radiation controlled area).

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.

In addition,

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  
[For use outside nuclear energy controlled areas] [For use of Azbil Corporation's Limit Switch For Nuclear Energy]
  - \* 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 inquiries 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. 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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|                         |   |
|-------------------------|---|
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