

azbil

**NEW10-III
Pneumatic Single-Seated
Control Valve
Model: ACT**

User's Manual



Azbil Corporation

CM2-ACT100-2001
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Notes on Safety

- This manual contains procedures and precautions that must be observed to ensure the NEW10-III series Single-Seated Control Valve model ACT operates to specification. The installation, operation and maintenance procedures as stated in this manual for this device are essential to ensure it functions safely.
- For the device to function safely and to specifications, it is essential that all operators and service personnel follow the standard safety procedures in addition to the safety precautions specified in this manual.

The following symbols that used in this manual are to alert you of potential hazards:



WARNING

If the stated procedures are not followed as specified, a potentially hazardous situation may arise, which could result in death or serious injury.



CAUTION

Failure to observe these cautions may create dangerous conditions that could result in injury to the personnel and/or in physical damage to the device.

Verification of Valve Specifications and Precautions on Storage

Unpacking

Control valve is a precision equipment. Handle it with care to avoid damaging it. When unpacking, check for the following items in the crate:

- Main valve body of New10-III, actuators and accessories as ordered.
- Additional equipment as ordered

Verification of specifications

PRODUCT NO. is specified on the nameplate of actuator. Please verify and cross check with product approval drawings.

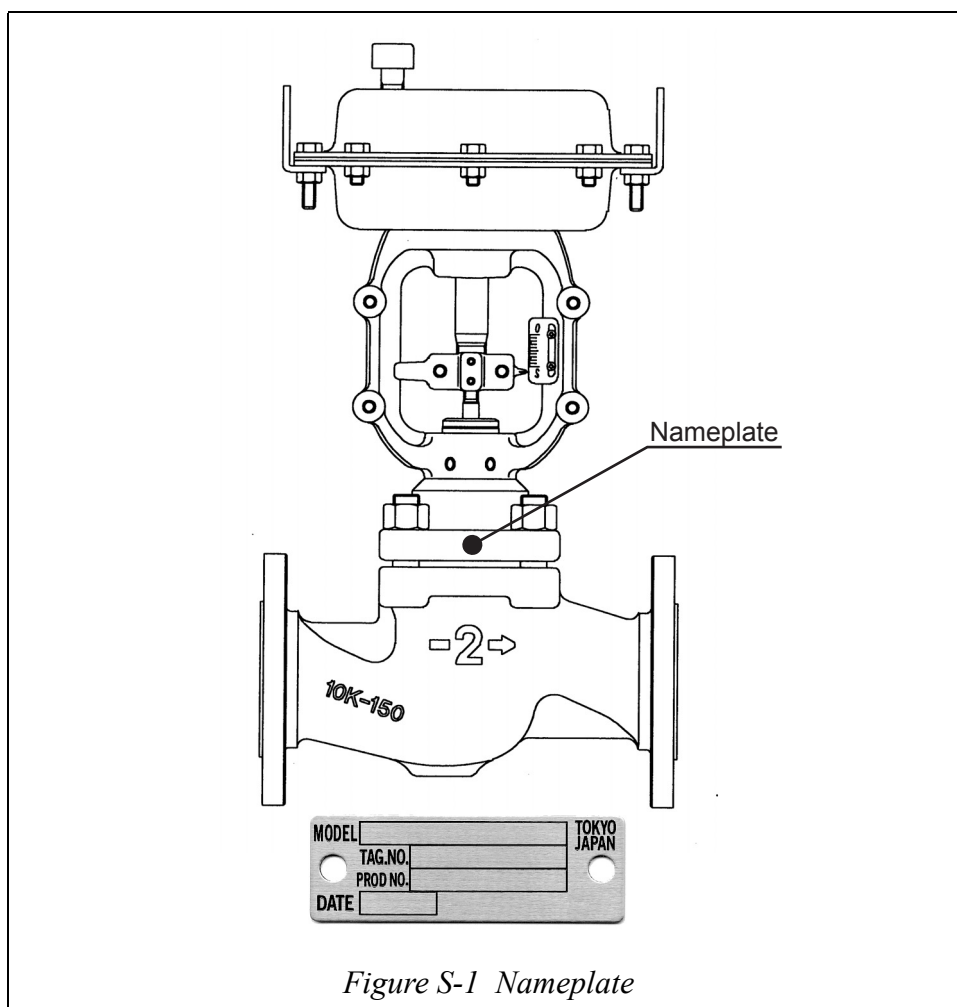


Figure S-1 Nameplate

Enquiries

If you have any questions regarding the specifications of your NEW10-III Single-Seated Control Valve model ACT, contact an Azbil Corp. representative. When making an enquiry, make sure to provide the model number and product number of your NEW10-III Single-Seated Control Valve model ACT.

Caution on storage

When storing the control valve, pay attention to the following precautions:

1. Control valve that has been packed in a cardboard box would be stored indoors at normal temperature and humidity.
2. Control valve that has been packed in a wooden crate should also be stored indoors at normal temperature and humidity as a rule. In the event of outdoor storage, open the crate, verify specifications and cover with polyethylene protecting sheet to avoid rain-water.

When storing a used valve, follow procedures as described below:

1. Flush out process fluid from inside the valve body and dry.
In the case of carbon steel (SCPH2), perform rust prevention treatment
2. To prevent water from getting into the instrument, cover pneumatic tubing connection and electric connector with watertight cap or tape. Also, protect connector threads.
3. Protect connector screw part.
4. Place flange cap on flange face to avoid possible damage.
5. Store indoors at normal temperature and humidity and in a place safe from vibration and electrical shocks.

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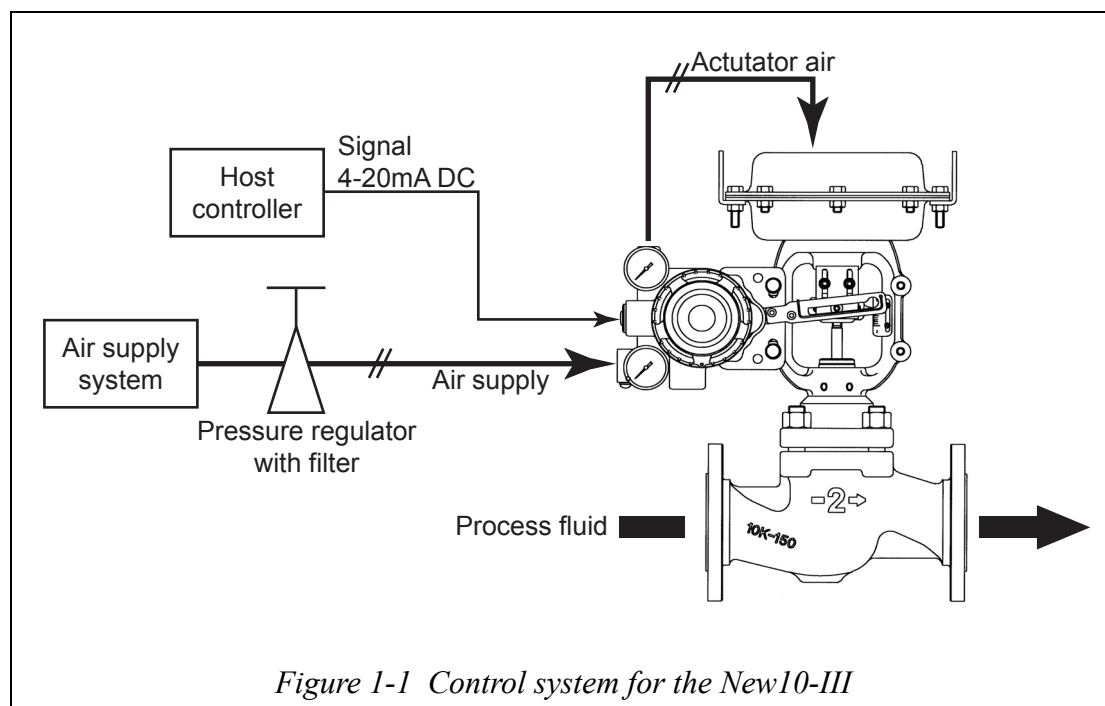
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Chapter 1 : Structure of the Control System

1-1 : General

New10-III is a control valve that operates on a 4 to 20mA DC or 20 to 100 kPa signal and uses a clean supply air of 140 to 340 kPa.

Figure 1-1 illustrates a standard control valve system.



This manual contains operating instructions for the “NEW10-III Series” Single seat Control Valve (Model ACT). For details on positioners, refer to the respective manuals listed below.

- Pneumatic valve positioner (Model HTP) No.OM2-8310-0200
- Pneumatic single action positioner (Model VPE) No.OM2-8310-0410
- Electro-Pneumatic valve positioners, Single acting-type (Model HEP)
No.OM2-8313-0100
- Smart valve positioner (model AVP300/301) No.CM2-AVP300-2001

1-2 : Structure

The control valve structure is primarily comprised of a valve body and an actuator. The valve body consists of a valve, valve plug, bonnet and other components. The actuator consists of among other parts, a diaphragm and an spring.

The structure of the control valve is illustrated in Figure 1-2.

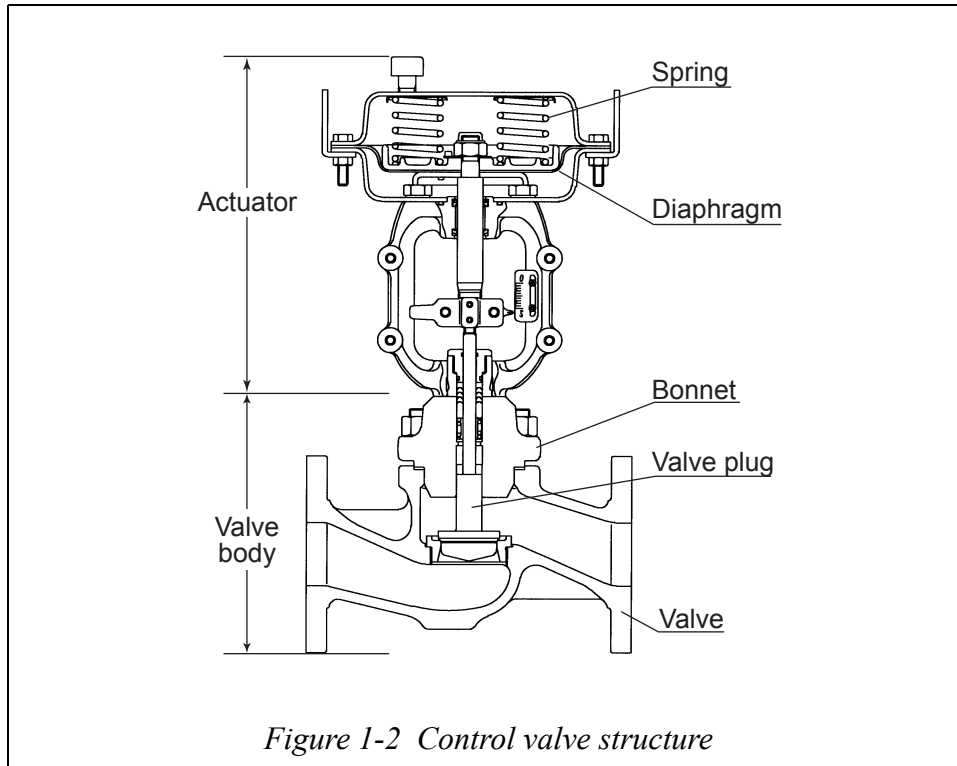


Figure 1-2 Control valve structure

The name and function of each valve part are listed below.

Table 1-1 Parts name

Name	Description
Valve body	<ul style="list-style-type: none"> Controls flow Connects to a pipe and contains all the valve components
Valve plug	<ul style="list-style-type: none"> Varies flow, pressure, etc. by changing the size of the flowing area
Valve	<ul style="list-style-type: none"> Part where the fluid flows through. Connects to the pipe. A main component of the pressure vessel.
Bonnet	<ul style="list-style-type: none"> Regulates the performance of the valve plug with respect to the flow characteristics. It is a main component of the pressure vessel.
Actuator	<ul style="list-style-type: none"> Adjusts valve travel in accordance to the signal being received
Diaphragm	<ul style="list-style-type: none"> Converts the air pressure being received into an electrical signal
Spring	<ul style="list-style-type: none"> Adjusts the position of the valve

To get a detailed look at the valve body's construction, refer to Figure 4-2 on page 4-10.

For a detailed diagram of the actuator's construction, refer to Figure 4-3 and Figure 4-4 on page 4-17.

1-3 : Control valve specifications



CAUTIONS

-
- Determine specifications for the control valve, such as pressure rating, material for valve main body construction and trim, etc. according to the conditions of the application that it will be used in. The control valve may not be used for applications other than the application it was specified for. Failure to comply with this caution could cause personal injury resulting from leakage of high-temperature and/or hazardous fluid.
 - This control valve must be used in compliance with all applicable safety regulations, specifications and standards.
-

The control valve is connected directly to the process flow. It is, therefore, essential that its specifications are appropriate for the process condition and the purpose of use.

1-4 : Dimensions and weight

The dimensions and weight for the model ACT are given in Appendix A.

Refer to Appendix A when performing installation or modifications.

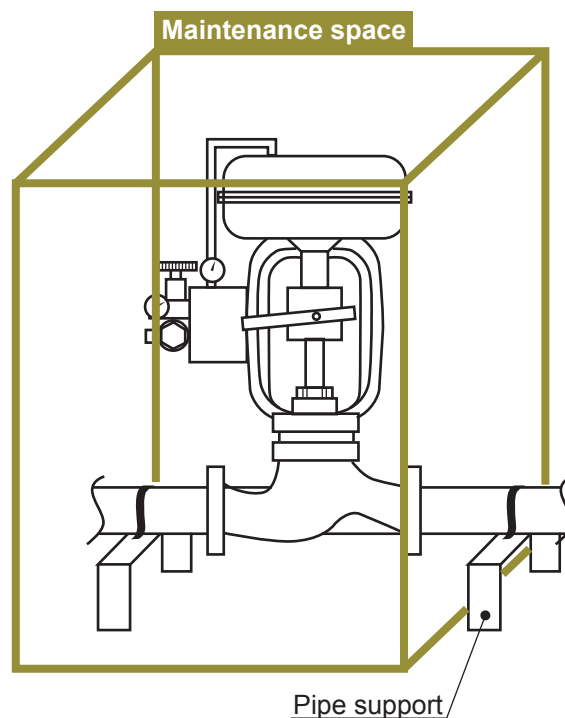
Chapter 2 : Installation

2-1 : Installation environments

Please follow the following cautions when selecting the site to install the Control Valve.

CAUTIONS

- Ensure sufficient space for easy and safe operation and maintenance of the control valve.
- Avoid installing the valve in a location where vibration or external stress may impair proper valve functions. If necessary, make appropriate provisions against these.
- Consider providing a support for the valve, so that the process piping is not burdened with the excessive weight of valve, or provide supports on the upstream and downstream pipe runs.
- Provide a cover or protective fence around the valve installation, when a valve is installed facing a path or if physical contact with valve is expected.
- Do not install a valve where it is submerged under the water, or snow or freezing may take place.
- Provide a wall for protection against heat radiation.
- Provide measures to protect the valve against salt spray or corrosive atmosphere.
- In order to guard against accident while handling the valve, always wear safety gloves, goggles and safety shoes.



New-10 III is designed to withstand severe operating conditions, but please follow the following conditions for the installation site in order to have a maximum performance.

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

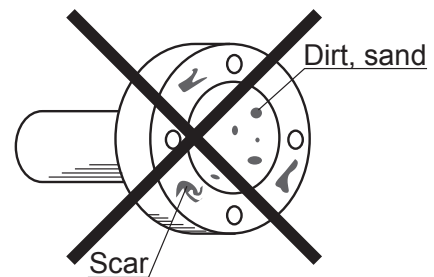
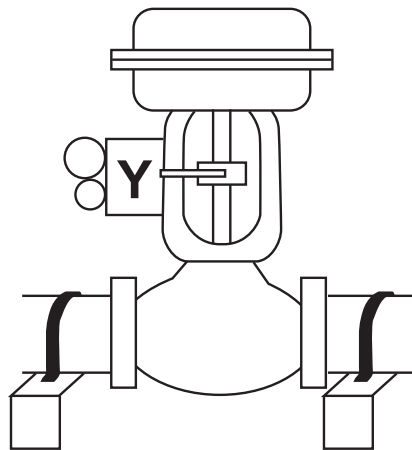
~Note *The vibration conditions for this equipment is stipulated for the vibration at the positioner when positioner, Model AVP, is assembled with Azbil Corporation's actuator, model PSK.*

2-2 : Inspection before mounting the pipe

Prior to installation work, follow the items of caution as described below:

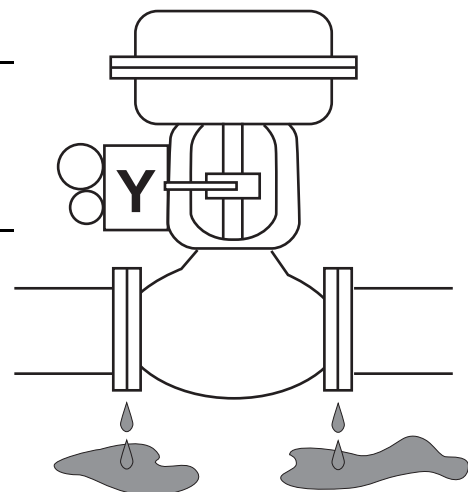
CAUTIONS

- Check and confirm that there is no external damage to the valve (body, actuator, accessories)
- Check and confirm that there is no damage on pipe connecting flanges.
- Ensure that temperature of welded part of pipe has been reduced before proceeding.
- Make sure that the flanges on pipe have been chamfered.
- Remove dust, sand welding spatter or any other foreign matter from pipe and clean out pipe. Any foreign matter will damage the valve seat and reduces shut-off characteristics.
- Ensure that upstream and downstream pipe supports are sufficiently strong. Otherwise, the valve's weight may cause leakage from flange connections.
- Check and confirm that the gland packing or bolt is not loose. Otherwise, there could be leakage.



WARNING

Operation of valve over and beyond the rated pressure or connection other than recommended of specified connection may cause damage or leakage which may result in serious injury.



Before connecting the pipe to the control valve model ACT, check the following:

1. Verify that the information stamped onto the nameplate conforms to the prescribed specifications.
2. Check and confirm that there is no external damage to the control valve (body, actuator, accessories, and each parts)
3. Check and confirm that there is no damage on pipe connecting flanges.
4. An eyebolt can be found on the actuator. Ensure that the weight of the actuator including accessories do not exceed the maximum lifting load limits. (Refer to Table 2-1.)
5. When lifting a valve using the eyebolt, make the angle 60° or more between the actuator and wire rope. (Refer to Figure 2-1.)
6. See to it so that the pipe is able to support the weight of the control valve. (Refer to Table 2-1)

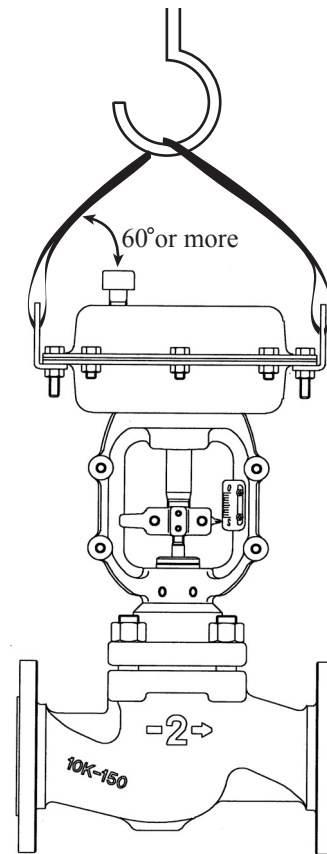


Figure 2-1 Example of lifting a valve

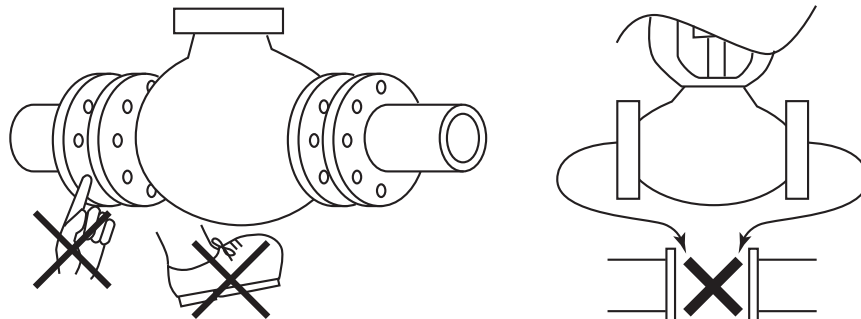
Table 2-1 Maximum loads

Connecting pipe diameter (inch (mm))	Control valve weight (kg)	Maximum lifting loads of eyebolt (kg)
1/2 (15)	13	160
3/4 (20)	14	160
1 (25)	15	160
1 ½ (40)	22	160
2 (50)	25	160
2 ½ (65)	38	160
3 (80)	39	160

2-3 : Installation work

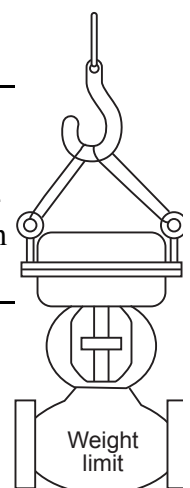
CAUTIONS

- Ensure that centers of upstream and downstream pipes are aligned when pipe installation has been completed. Any mis-alignment of pipe will distort the valve and will cause leakage from the connections (Gasket).
- Make sure that the face to face dimension of pipe flanges is equal to face to face dimension of valve body plus gasket thickness.
- When lifting a valve using the eyebolts (eye nuts) on the actuator, make sure that the rated weight of the bolt does not exceed the limit as described in this manual. A load in excess of the limitation will cause damage to actuator or will result in air leakage.
- When lifting a valve, avoid incurring to it any unnecessary vibration or shock.
- Use bolt and nuts for flanges that will meet the flange standard. Otherwise process fluid leakage may occur.
- Always use new gaskets for pipe flanges that will meet process fluid specifications, temperature and pressure conditions. Otherwise process fluid leakage may occur.
- When flushing pipes, keep valve in the fully open position and do not stroke the valve. Welding spatter or foreign matters may damage the valve.
- Prevent from cold insulating of the bonnet. Otherwise process fluid leakage may occur from the gland part.



WARNING

- When installing a valve on a pipe, keep hands and feet away from valve body's bottom or between flanges to avoid physical injury
- When reinstalling the valve after inspection, maintenance or modification, flush out process fluid remaining in the pipe or replace it with safer liquid. Remaining process fluid may cause personal injury.



(1) Example of standard installation

Figure 2-2 shows the standard installation.

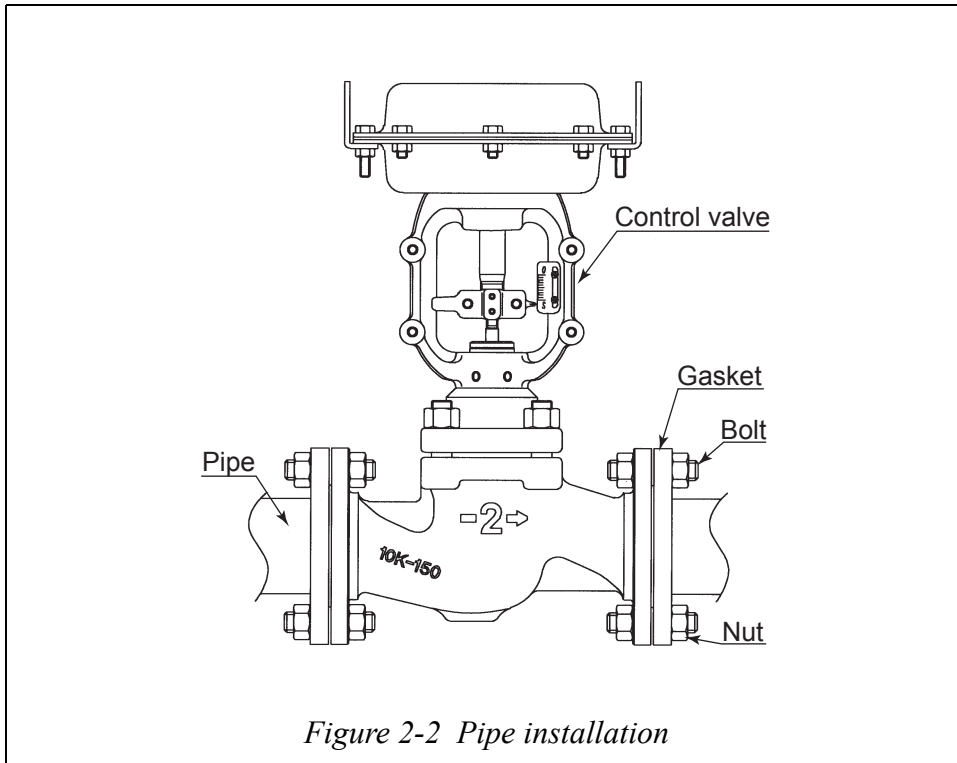


Figure 2-2 Pipe installation

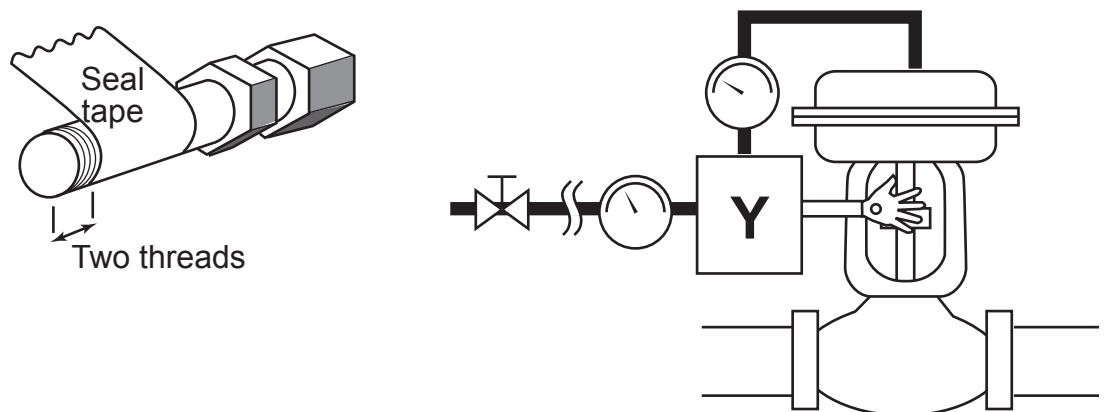
(2) Installation procedure

Step	Procedure
1	<p>Confirm that the direction of process fluid flow conforms with that of the arrow provided on the valve body.</p> <div data-bbox="810 1187 1364 1534" style="text-align: center;"> </div> <p>Figure 2-3 Process fluid direction</p>
2	<p>Insert the valve and the gasket into the pipe. Loosely tighten the pipe connecting flanges with the bolt and the nut.</p>
3	<p>Make sure that the pipe connecting gasket does not protrude into the pipe.</p>
4	<p>Tighten the pipe connecting flanges securely with the bolt and the nut in the diagonal order using a uniform torque.</p> <div data-bbox="970 1713 1364 1937" style="text-align: center;"> </div> <p>Figure 2-4 Pipe tightening</p>
5	<p>Once installation is complete, verify that all bolts and nut are tight and that there are no leaks.</p>

2-4 : Pneumatic piping work

⚠ CAUTIONS

- Pneumatic tubing should be sized so as not to cause air pressure drop when control valve is in operation.
- Pneumatic tubing should have an allowance in the bend (use specialized bending tool) and parallel tubings should be clamped together.
- When using seal tape on pneumatic tubing do not apply the tape on the first two threads from the tip of connector. This may block air passage and cause malfunction of valve.



This section contains pneumatic piping procedures for the electric pneumatic valve positioner, models AVP and HEP, and for the pneumatic valve positioner, models HTP and VPE.

(1) Air supply system

Clean and dry supply air ensures long-term stability of the valve positioner. Figure 2-5 shows the typical air supply system.

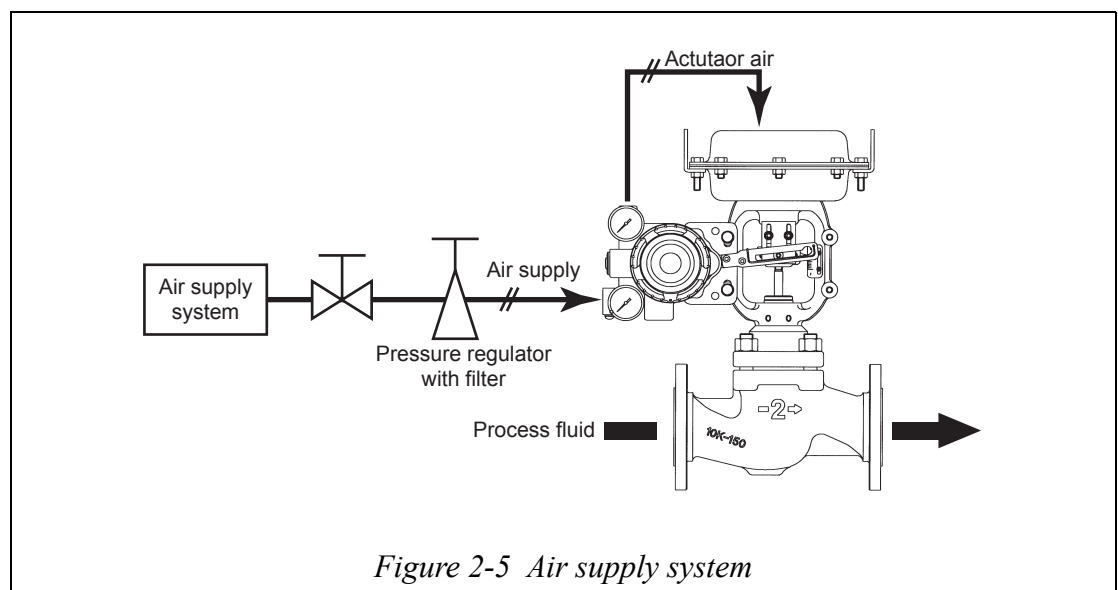


Figure 2-5 Air supply system

<p>Supply air</p>	<ul style="list-style-type: none"> • The air supply must be clean and dry; it should not contain foreign substances (moisture, oil, or dust). The after cooler, air drier or filter and other relevant devices should be installed downstream from the compressor of the air supply system. Therefore, considerations for this should be included with the supply piping plans. • Dry air refers to air having a dew point of 10°C or lower than the lowest ambient temperature for a positioner being used in atmospheric pressure. (For example: if the lowest environmental temperature the model AVP is exposed to is 0°C, the supply air should not condense at temperature under -10°C) • Before setting the positioner into operation, it is necessary to adjust the supply pressure to the actuator's specifications. The set point should be within the range stamped on its nameplate.
<p>Pressure regulator with filter</p>	<ul style="list-style-type: none"> • Used for adjusting the supply air pressure which goes to positioner. • Install as close as possible to the positioner unit. • Use a 5 µm or less filter to solid-state particulate matter from the air supply. • If a filter is not provided on the regulator, insert a separate 5 µm or less filter immediately before the regulator.
<p>Shut-off valve</p>	<ul style="list-style-type: none"> • This valve is used to temporarily shut off air supply to the positioner. • The shut-off valve enables disconnection of the positioner from the control valve for ease of maintenance.
<p>Recommended piping practices</p>	<ul style="list-style-type: none"> • Air supply pipes should have an inside diameter of 6 mm (1/4 inch) • Pipes should match the installation environment, i.e. for a corrosive environment, use vinyl-covered copper pipes. • Use joints that precisely fit the pipes.

(2) Air connection

The locations of the air supply connection and the air output connection are shown below.

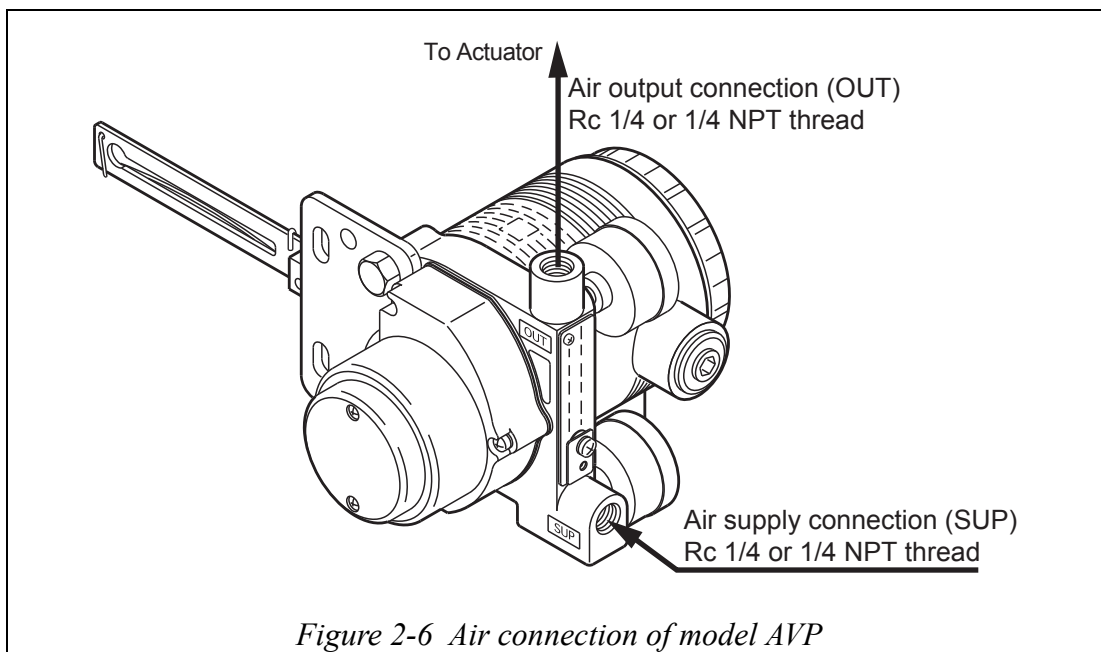


Figure 2-6 Air connection of model AVP

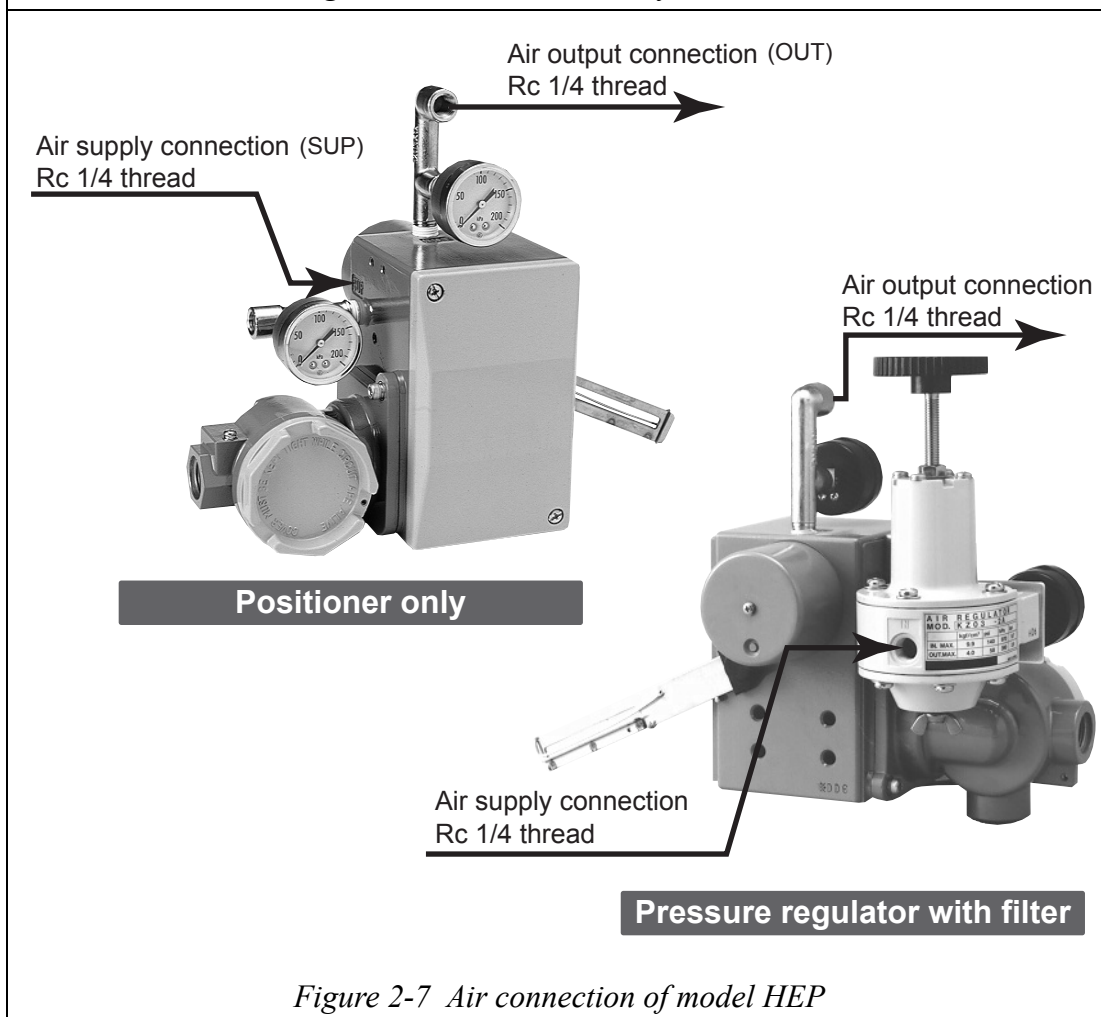


Figure 2-7 Air connection of model HEP

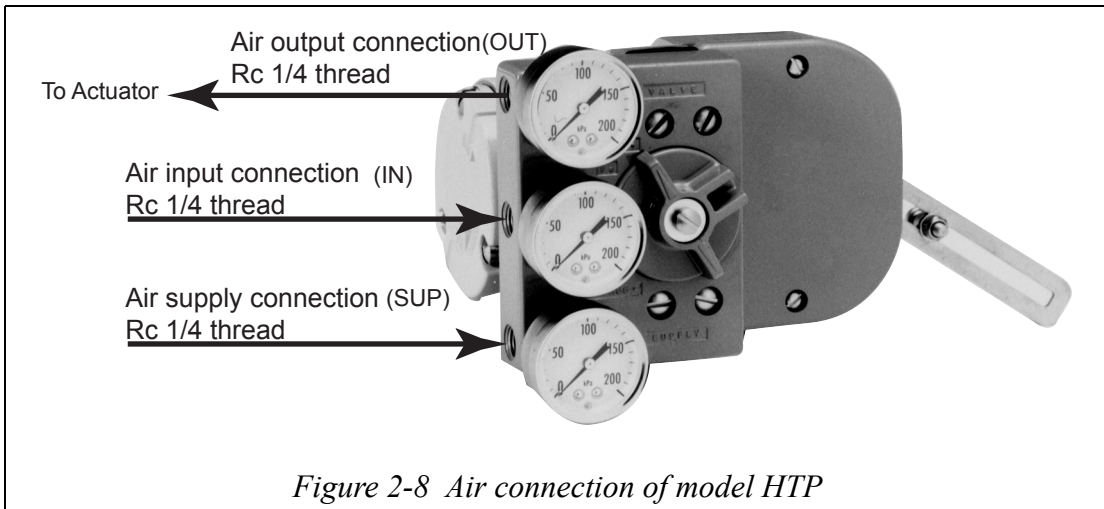


Figure 2-8 Air connection of model HTP

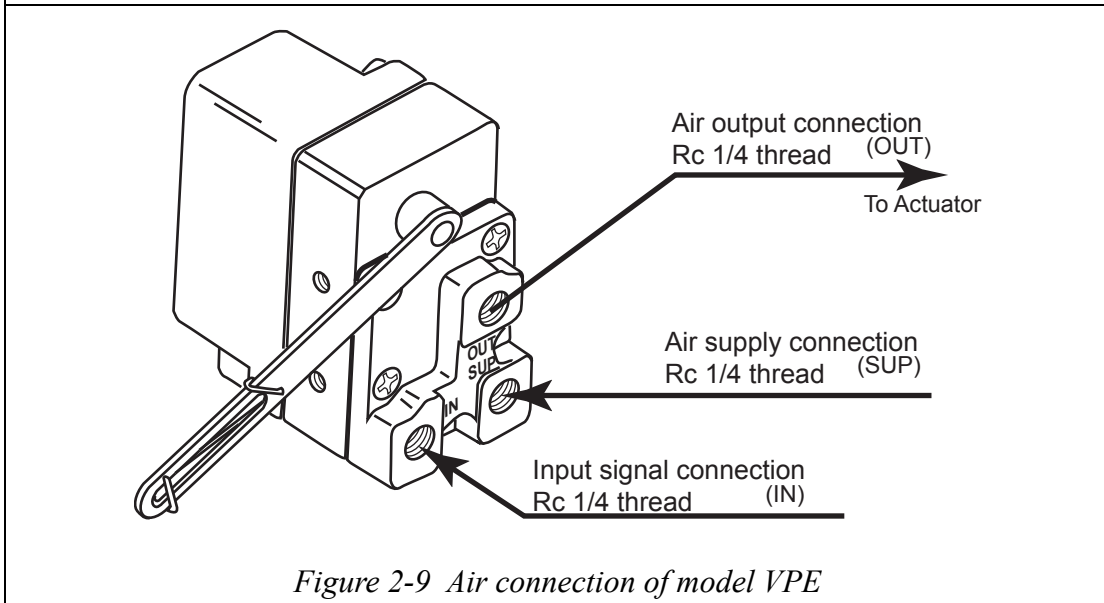


Figure 2-9 Air connection of model VPE

(3) Procedure for air pipe connection

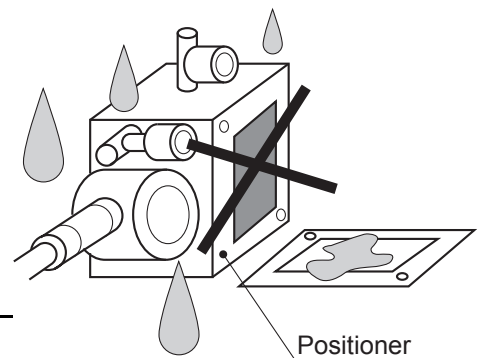
The pneumatic piping procedure for the positioner power source is given below.

Step	Procedure
1	Remove the dust plug from the output air connection on the model AVP.
2	Connect the joint to the air output connection.
3	Connect the other air connection to each joints. ~Note <ul style="list-style-type: none"> • Completely flush the pipes before use, check for burrs and other problems. • Use the right length of piping, avoid excess length.
4	Check for leaks after installation.

2-5 : Electric work

 **CAUTION**

- Only qualified persons should do electric work in accordance to electrical facility engineering standards.
- Cable connections should be made to conform to the facility's conditions. A suitable adaptor or packing should be selected to suit the outer dimension of the completed installation.
- Avoid electrical work in rainy weather or at the time of high humidity. Any intrusion of water into connector or terminal will cause rusting and electric shock.
- Covers of accessories such as the positioner are provided with seal packing (gasket). Exercise care so as not to misplace or lose them while electric work is in progress.
- Exercise care so as not to lose fixing screws of accessories such as the positioner. When tightening screws, ensure that packing is in place and tighten screws with an even torque.
- Cable threads and conduit seal should be tightened so as to ensure that water does not get in.



This section contains the procedure for electric wiring for the electric pneumatic valve positioner, model AVP. The terminal box of the electric pneumatic valve positioner, model AVP, is shown in Figure 2-10.

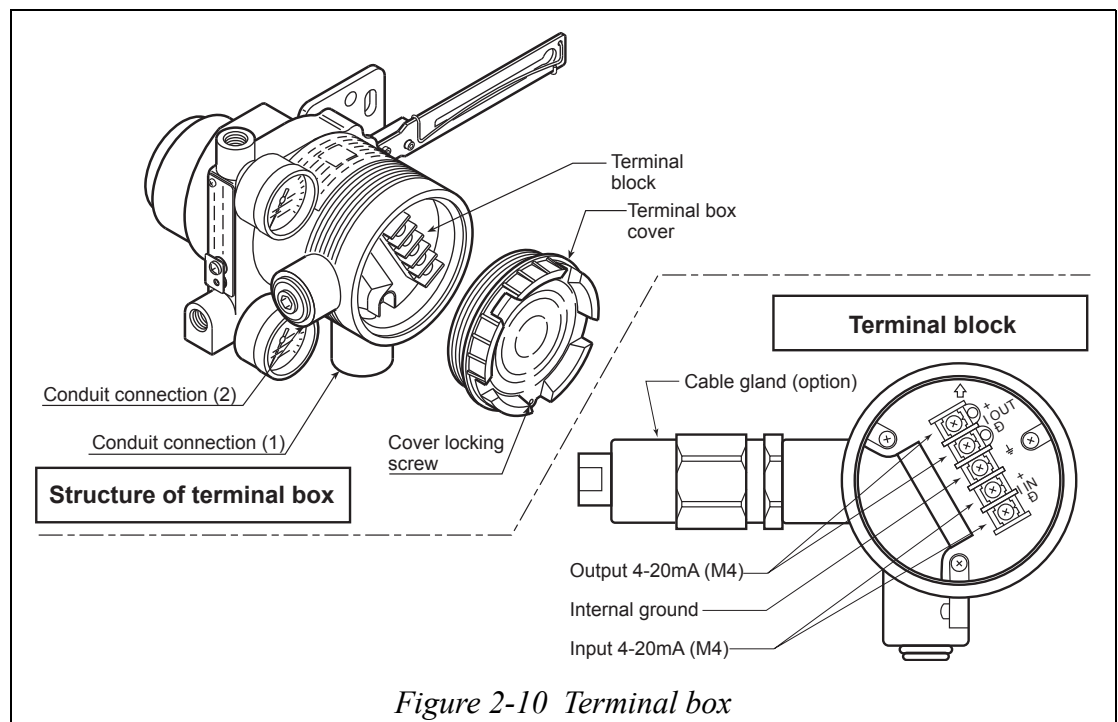
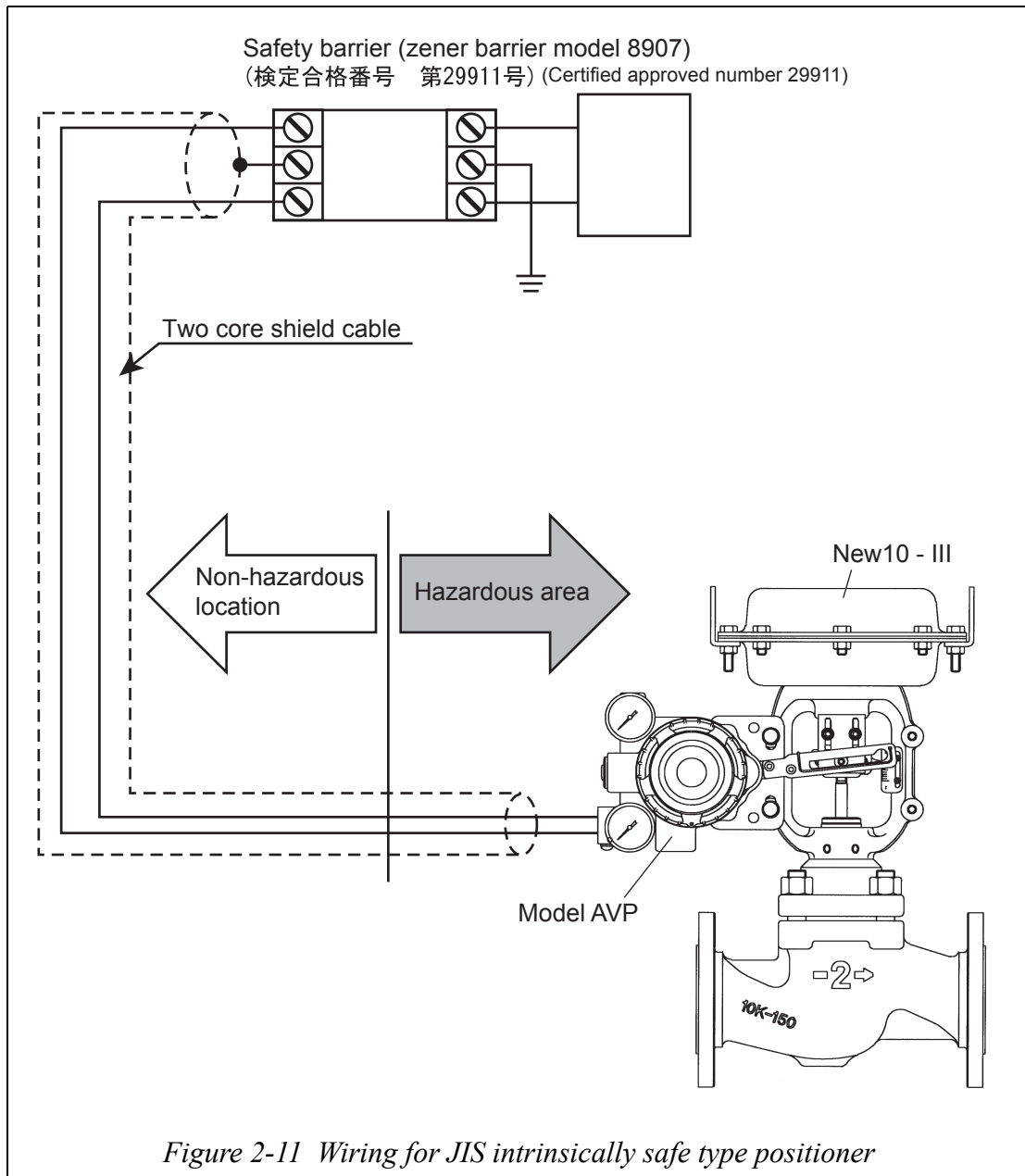


Figure 2-10 Terminal box

2-5-1 : JIS intrinsically safe wiring

- This device cannot be used in combination with any other equipment than the intrinsically safe equipment shown in Figure 2-11.
- When doing the wiring for the JIS intrinsically safe type electric/pneumatic valve positioner (model HEP16), and safety barrier (zener barrier, model 8907), avoid laying the wiring near other equipment or otherwise use shielded cable in order to avoid influence or noise from other equipment.



2-5-2 : Electrical wiring connection

(1) Selection of cable

- For the installation of this device, a 600 V control cable with PVC insulation, vinyl sheath CVV (JIS C3401) twisted pair wire with conductor cross section 1.25 mm² or equal is recommended.
- If electrostatic noise exists at cable installation location, a shielded cable is recommended.
- Select a suitable sheath material which can withstand cable installation environments such as ambient temperature, corrosive gas or liquid.
- The cable is interconnected to the terminal box through a conduit (G1/2 internal thread or 1/2NPT internal thread).
- Use a cable of 9 to 11mm outer diameter. When a pressure withstanding packing cable adaptor is used, make sure that the size of the packing fits the outer diameter of cable.
- A crimp-on terminal with an insulation sleeve (M4 screw) is recommended for termination.
- The maximum length of cable is 1500 m.

(2) Cable laying

When laying cable between the valve positioner model HEP and the controller, pay particular attention to the following:

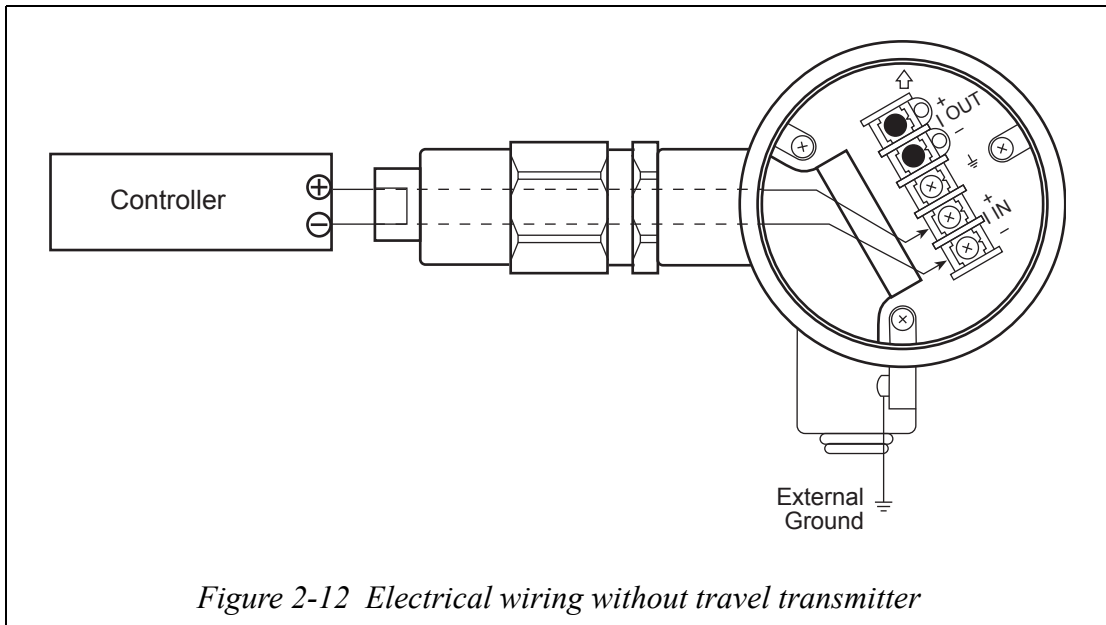
- Lay the cable away from large capacity transformers, motors or plant power sources that may generate noise. Also, do not lay the cable in the same tray or duct with other power source cables.
- It is recommended to use a conduit and duct to water proof and protect the exterior of the cable. Also, install a waterproof adaptor on the connecting ends of the conduit.

2-5-3 : Electrical wiring types

There are two types of electrical wiring that differ by the purpose of the system.

- Electrical wiring without travel transmitter (2-core cable connection)
- Electrical wiring with travel transmitter (4-core cable connection)

(1) Electrical wiring without travel transmitter (2-core cable connection)



- Use only one of the two ground terminals (internal or external) to ground the instrument. Perform this work according to all local laws and ordinances governing electrical work.

(2) Electrical wiring with travel transmitter (4-core cable connection)

Remove the terminal box cover and connect the wires as shown in the figure below.

- When a 4-core cable is used

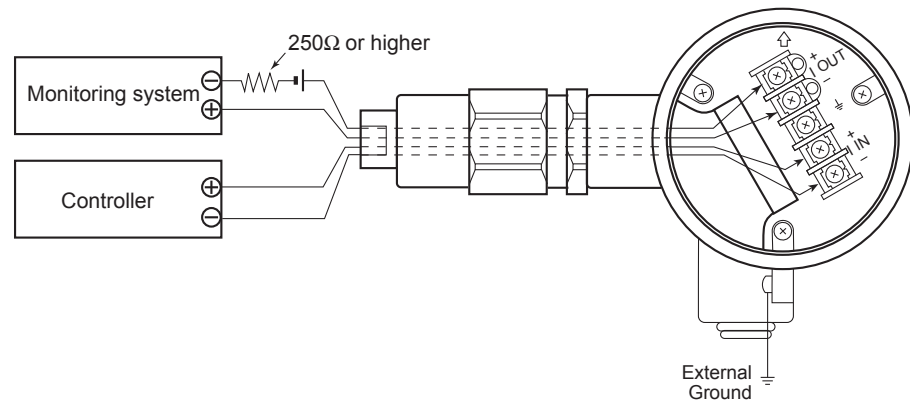


Figure 2-13-1 Electrical wiring (4-core cable)

- When a 2-core cable is used

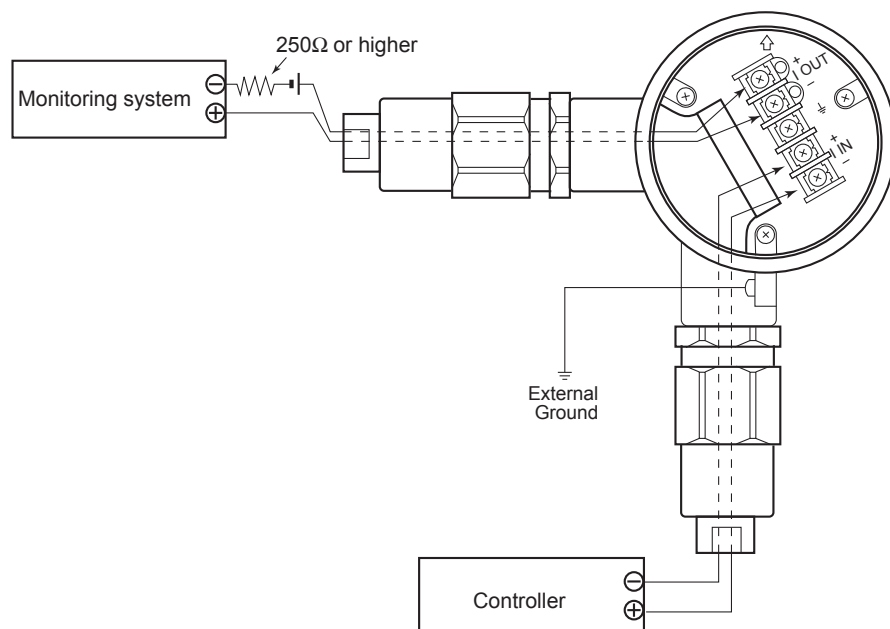


Figure 2-13-2 Electrical wiring (2-core cable)

- Use the following wiring if the monitoring system is a voltage input (1 to 5 V) device.

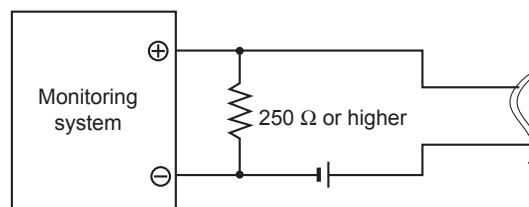


Figure 2-13-3 Wiring when the monitoring system is a voltage input device

- Use only one of the two ground terminals (internal and external) to ground the instrument. Perform this work according to all local laws and ordinances governing electrical work.

2-5-4 : Input signal and travel transmission

(1) Input signal

The input signal for the device is 4 to 20mA DC. The travel transmitter is self powered, two-wire type which derives its operating power from the input signal 4 to 20mA current loop itself.

- ~Note**
- *Maximum upper current limit is 24mA DC.*
 - *The model AVP requires a minimum of 3.85mA DC to operate.*

(2) Travel transmission and load resistance

The load resistance of the travel transmission loop and the power voltage must not exceed the allowable operating range given in the figure below.

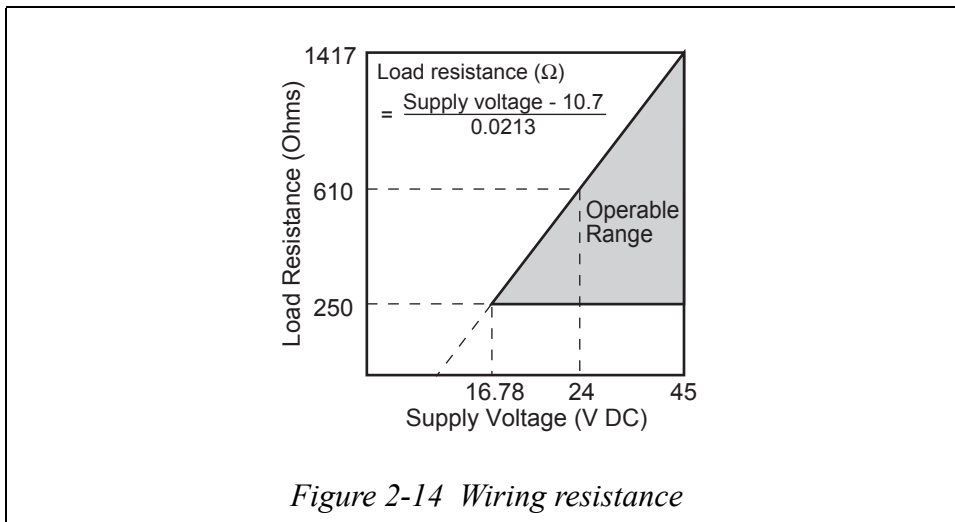



Figure 2-14 Wiring resistance

- ~Note** *The applied voltage must never exceed 45 V DC.*

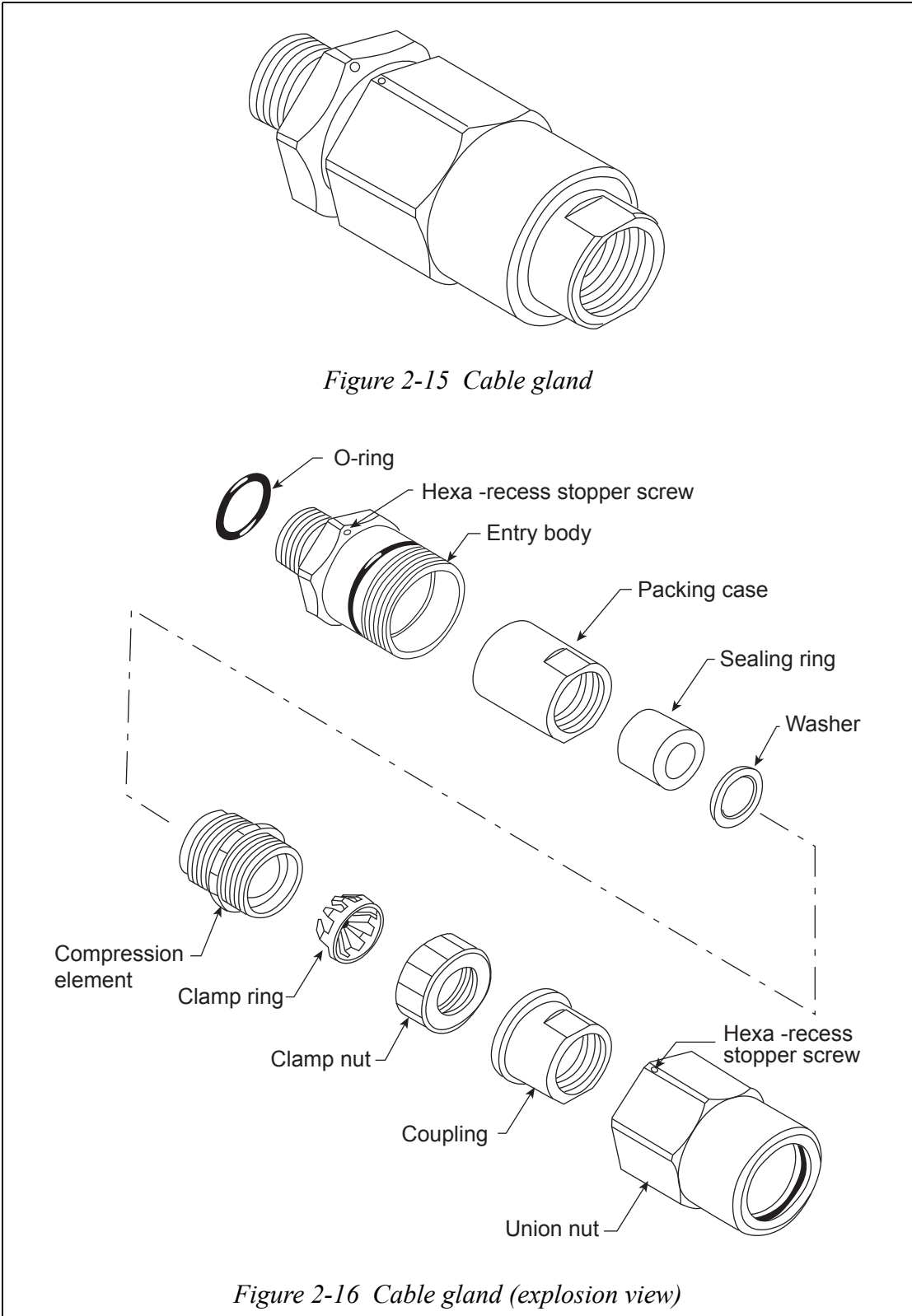
2-5-5 : Wiring procedure

Shown below is the wiring procedure for operating electric pneumatic valve positioner model AVP.

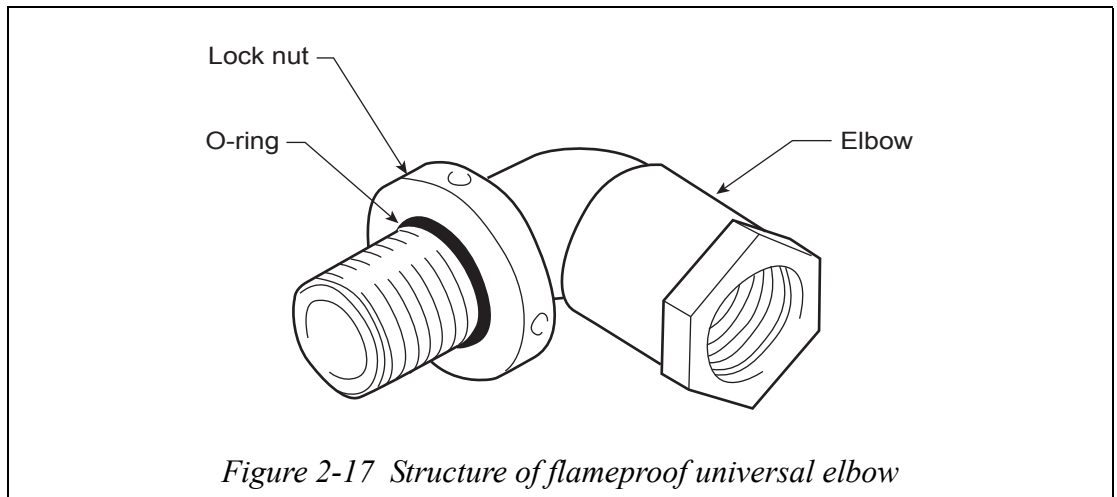
Step	Procedure
1	Unscrew the Phillips terminal box cover screw (M3) on the terminal box cover using hexagonal wrench (1.5).
2	Unscrew the terminal box cover screw and remove it. ~Note <i>Be careful not to scratch painted surfaces with tools at this time.</i>
3	Remove the supplied conduit connection blind plugs.
4	Insert cables into the conduit connection. ~Note <i>Be careful not to damage the cable sheath at this time.</i>
5	Refer to Figure 2-9 on page 2-10., strip and attach the appropriate wires to the terminals. ~Note <ul style="list-style-type: none"> • <i>Be careful for polarity</i> • <i>Tighten the terminal screws fully to the torque of 1.5 N•m (15 kgf/cm).</i>
6	Apply adequate waterproofing measures to the conduits to prevent the entry of rainwater or water from any other source. ~Note <i>We recommend the use of silicon resin based non-hardening seal materials.</i>
7	Screw the terminal box cover onto the model AVP until it is hand-tight. Use the Phillips terminal box screw to secure the terminal box cover. <div style="text-align: center;">  CAUTION </div> <hr/> <p style="text-align: center;">Be careful not to hurt your fingers on the edges of the cover and screw threads.</p> <hr/> ~Note <i>Be careful not to scratch painted surfaces with tools at this time.</i>

Cable gland and flameproof universal elbow

- The cable gland seals the cable entering the positioner enclosure to withstand an internal explosion and protects the cable from damage mechanically and electrically.

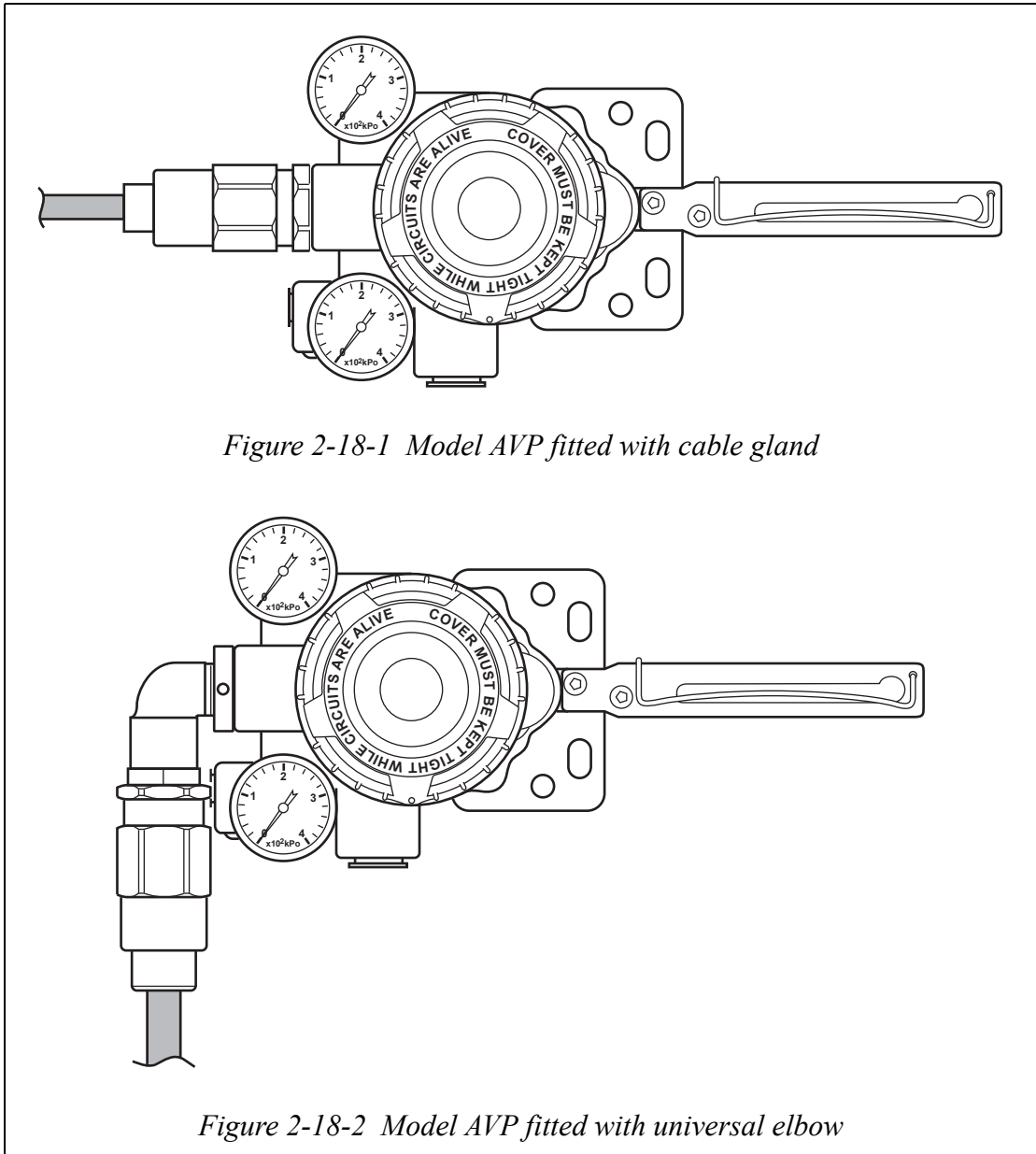




- The figure below shows the flameproof universal elbow.



Mounting example

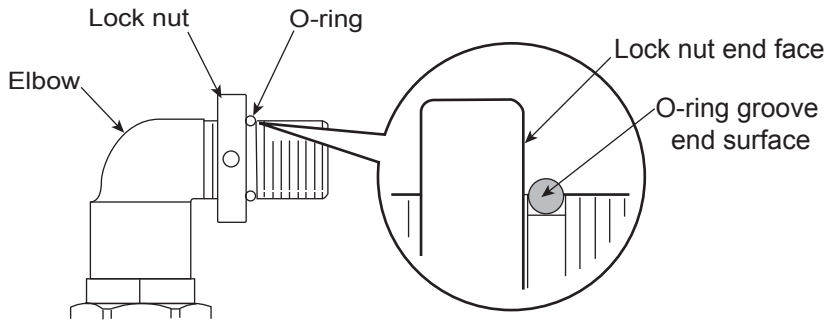
The flameproof cable gland and the universal elbow are used to connect the field wiring cable to the model AVP enclosure as shown below.



Step	Procedure									
1	<p>Firmly tighten the entry body on the connection port and the flameproof universal elbow to hold it in place, Once held in place, tighten the hexa-recess stopper screw on the entry body.</p> <p>~Note <i>Apply adequate waterproofing to these parts. We recommend the use of silicone resin based non-hardening seal materials.</i></p>									
2	<p>Refer to Figure 2-16 on page 2-18. and insert the cable carefully.</p> <p> CAUTION</p> <p>Refer to the table below and select a packing adaptor whose internal diameter matches the external diameter of the cable.</p> <p style="text-align: right;">[Unit: mm]</p> <table border="1" data-bbox="727 826 1410 992"> <thead> <tr> <th>Cable external size (mm)</th> <th>Packing internal size</th> <th>Note</th> </tr> </thead> <tbody> <tr> <td>7.0 to 10.0</td> <td>10</td> <td>attached</td> </tr> <tr> <td>10.1 to 12.0</td> <td>12</td> <td>built-in</td> </tr> </tbody> </table>	Cable external size (mm)	Packing internal size	Note	7.0 to 10.0	10	attached	10.1 to 12.0	12	built-in
Cable external size (mm)	Packing internal size	Note								
7.0 to 10.0	10	attached								
10.1 to 12.0	12	built-in								
3	<p>Fit the clamp nut onto the compression element and tighten it down to hold it in place.</p>									
4	<p>Fit the packing case onto the compression element and tighten it down to hold it in place.</p> <p> CAUTION</p> <p>To prevent injury due to spark travel, be sure to tighten down the packing adequately.</p>									
5	<p>Pass the cable through the entry body and insert it into the terminal box.</p>									
6	<p>Screw the union nut onto the entry body and tighten it down securely to hold it in place. Then, tighten the union nut's recess screw.</p>									

Mounting procedure for flameproof universal elbow

The procedure for mounting the flameproof universal elbow is shown below.

Step	Procedure
1	Align the end surface of the lock nut with the end surface of the O-ring groove as show below.
2	<p>Screw the flameproof universal elbow into the terminal box conduit connection port until the lock nut end surface hits the connection port end surface.</p>  <p style="text-align: center;"><i>Figure 2-19 Arrangement of lock nut and O-ring</i></p> <p>~Note Apply adequate waterproofing to these parts.</p>
3	<p>Turn the flameproof universal elbow to loose in the desired direction.</p> <p>~Note Do not loosen it more than 1 turn</p>
4	Lock the flameproof universal elbow in place by tightening down the lock nut using the special tool.

2-5-6 : Check after installation and before operation

- ~Note**
- Check the leakage from the air pipe connection.
 - Check bolts, nuts, etc. of the diaphragm case, bonnet, etc. are tighten.
 - When raising the temperature to a valve which is used for high temperature service, raise the temperature gradually (standard rate is 100 degrees C per hour and do not operate the valve while the temperature is being raised).
 - When pressuring the valve, check that there is no leak from the gasket sections, valve body and gland packing. Especially when the process fluid temperature is 400°C or higher, tighten the nuts again after raising temperature of the valve so that it may be in serve for a longer period without requiring immediate maintenance service. Standard tightening torques are given in Table 4-1, 4-2, and 4-3 on page 4-12.

Chapter 3 : Operation

3-1 : Inspection and adjustment during operation

(1) Operational test

Apply a 4 to 20mA DC simulated input signal (0 to 100%) to valve positioner or actuator to verify rated travel of the valve positioner or the actuator. Refer to Table 3-1 for tolerable travel. If the travel exceeds the specified tolerable value, adjust the actuator.

For valve positioner adjustment, see page 1-1, and refer to the relevant manuals.

Table 3-1 Control valve performance characteristics

Positioner	Hysteresis	Linearity
HEP, HTP, AVP	Within 1% F.S.	Within $\pm 1\%$ F.S.
VPE	Within 1% F.S.	Within $\pm 3\%$ F.S.

(2) Loop check

Apply an output signal of a higher level control system to the actuator, check and verify if the signal wires are connected as specified and fulfill the functional requirements for control.

3-2 : Troubleshooting

Table 3-2 shows possible failures during operation. If any one of these failures occurs, take necessary remedial action including replacement of parts.

Table 3-2 Control valve malfunction and remedial action

Phenomenon		Cause	Countermeasures
Unstable valve operation	Hunting around fully closed position	Cv value is too large	<ul style="list-style-type: none"> Reduce differential pressure of CV inlet/outlet Replace to plug with small Cv Value
		Fluid is flowing to closed direction of the single seated plug	<ul style="list-style-type: none"> Reinstall to opposite flow direction of the valve
	Fluctuating air supply pressure	lack of the volume for the instrument air facility	<ul style="list-style-type: none"> Enlarge volume of tank or compressor Provide special purpose compressor in addition
		Air pressure regulator malfunction	<ul style="list-style-type: none"> Check air pressure regulator
	Hunting of air signal pressure	The resistance or volume for Control loop is not suitable	<ul style="list-style-type: none"> Try to put the volume tank or restriction unit
		Controller malfunction	<ul style="list-style-type: none"> Check controller
	Hunting even after the signal or air supply pressure is stable	Hunting of the positioner circuit	<ul style="list-style-type: none"> Check worn for each part of positioner Check positioner pilot Reduce gain of the positioner
		Fluctuation of unbalance and axial thrust from fluid pressure fluctuation	<ul style="list-style-type: none"> Reduce differential pressure of valve inlet/outlet Replace to large stiffness actuator Add positioner
Valve vibrates	Vibrates at any valve opening	Insufficient valve support	<ul style="list-style-type: none"> Provide the supports at valve inlet/outlet both side
		Vibration source exist nearby	<ul style="list-style-type: none"> Remove vibration source
		Worn-out guide	<ul style="list-style-type: none"> Replace guide bushing or valve plug
Sluggish valve movement	Valve stroke sluggish in both upward and downward directions	Slurry adhering on valve plug guide or upper/lower bonnets	<ul style="list-style-type: none"> Disassembling and cleaning Enlarge pressure balancing hole of guide Modify body to steam jacket type Replace to straight through type valve
		Gland packing deteriorated and hardened	<ul style="list-style-type: none"> Replace gland packing or grease

Table 3-2 Control valve malfunction and remedial action

Phenomenon		Cause	Countermeasures
Valve does not operate	Air supply is normal but the signal air pressure does not go up.	Leakage from signal tube.	• Check the signal tube (especially joint part)
		Leakage from the diaphragm or damage.	• Replace parts
		Leakage from the signal receiver of the positioner or damage	• Replace the bellows receiver and /or the diaphragm
		Controller malfunction	• Check controller
	The signal pressure is normal but air supply pressure is low or not supplied.	Blocking of the filter in the air pressure regulator	• Clean the air filter
		Leakage or blocking of the air tube	• Check the air tube (especially joint part)
		Pressure regulator malfunction	• Check air pressure regulator
	No positioner output	Positioner and pilot valve malfunction	• Check positioner and pilot valve
		Leakage from Actuator diaphragm or damage	• Replace diaphragm
	Actuator does not work even air supply is given.	Jammed or seized valve stem and guide	• Disassemble and inspect valve body, repair or replace with new one
		Foreign matters jamming valve plug	• Disassemble, inspect and clean
		Bent valve stem	• Repair valve stem
Actuator malfunction		• Check by isolating actuator functions from others	

Table 3-2 Control valve malfunction and remedial action

Phenomenon		Cause	Countermeasures
Valve does not fully close / Excessive leakage from inner valve	Valve stem in fully closed position	Corrosion, erosion, worn or scar of valve plug or seat ring	<ul style="list-style-type: none"> • Re-lapping valve seat • Re-machining valve seat • Replace valve plug, seat ring (reconsider stellite face)
		Exterior of seat ring (thread or gasket) corroded or eroded	<ul style="list-style-type: none"> • Replace seat ring or gasket • Re-examine seat ring assembly (welding model)
		Leakage from valve body wall	<ul style="list-style-type: none"> • Patch weld pin-hole • Replace valve body
	Valve stem does not fully close	Excessive fluid differential pressure	<ul style="list-style-type: none"> • Reduce differential pressure • Increase actuator output
		Jamming from foreign matter	<ul style="list-style-type: none"> • Disassembly, inspect and clean
		Seized guide or plug	<ul style="list-style-type: none"> • Re-machine seized part
	Inner fluid leaks out of gland packing	Loose packing gland or bolt	<ul style="list-style-type: none"> • Tighten packing gland and bolt
		Grease depleted (asbestos packing)	<ul style="list-style-type: none"> • Replenish grease
		Gland packing deteriorated	<ul style="list-style-type: none"> • Replace gland packing (review material)
		Scar, corrosion or erosion of valve stem or packing box interior	<ul style="list-style-type: none"> • Disassemble, remachine or replace parts • Install valve packing protecting felt ring or rubber bellows (if dust is excessive)
	Inner fluid leaks out of gasket	Scar, corrosion or erosion of gasket's face	<ul style="list-style-type: none"> • Replace gasket (review material)
Valve opening changes and rangeability reduced	Corrosion, erosion or wear of valve plug	<ul style="list-style-type: none"> • Replace valve plug and seat ring (review material for corrosive resistance or hardness) 	

Chapter 4 : Maintenance

4-1 : Preventive maintenance

The control valve should be checked regularly to ensure that it is functioning properly and also to look for any sign of problems.

There are two types of checking to be carried out for the New10-III: Daily checks and periodic shutdown maintenance (overhaul). The procedures for both are given below.

4-1-1: Daily checks

The following four items should be confirmed daily as a part of routine plant inspection rounds.

< Items to be checked >

(1) Gland

The valve gland is to be checked for leakage. If a leakage is found see "3-2 : Troubleshooting" on page 3-2.

(2) Flange connections

The flange between the device body and bonnet and flange between the device and the pipe are to be inspected for any sign of leakage. If there is leakage, see "3-2 : Troubleshooting" on page 3-2.

(3) Control valve operation check

Look and listen for any problems such as hunting. If there is evidence of hunting, see "3-2 : Troubleshooting" on page 3-2.

(4) Abnormal noise/sound

Check that there is no abnormal noise or vibration from the device during operation. If there is, see "3-2 : Troubleshooting" on page 3-2.

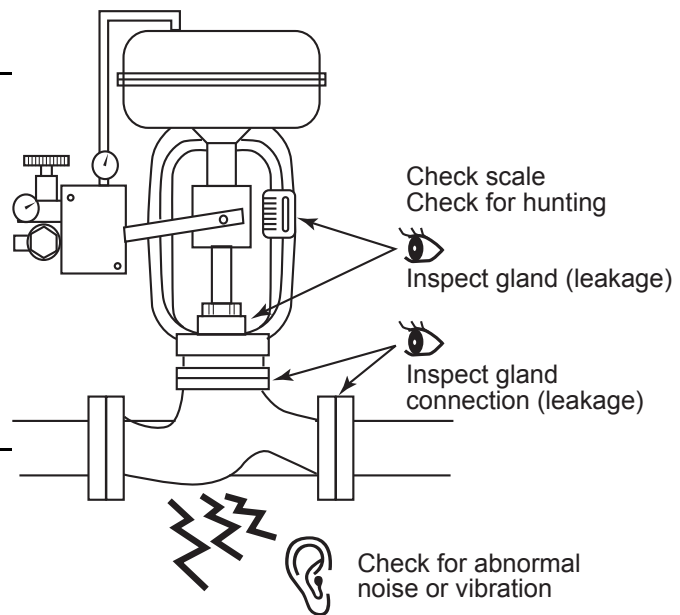


WARNING

When leakage from a valve is found, do not come close to the valve until safety is assured of. A serious accident or physical injury may occur depending on the type of fluid.

⚠ CAUTION

- Check gland daily and ensure that there is no leakage from it.
- Check valve operation daily, and confirm that it is not hunting.
- Make sure that there is no abnormal vibration or noise during operation.



4-1-2: Periodic shutdown maintenance

The control valve must be overhauled at least once every two or three years. When being serviced, all expendable parts should be replaced and any part found to be defective must be repaired or replaced.

For instructions on valve disassembly and reassembly, refer to "4-3 : Disassembling and reassembling the control valve" on page 4-6.

<Recommendation>

We suggest users keep a record of the work was done to each device at the time of periodic inspection. This information is useful for troubleshooting, checking the replaced part and to provide detailed information of life expectancy of the equipment.

<Precautions>

- Be sure that the control valve's temporary removal will not affect any of the other process equipment
- Prior to performing overhauling, familiarize yourself to the cautions provided in this manual.
- Keep a record of what steps and spare parts / tools are necessary for reassembly
- Check for abnormalities by applying a simulated input to the actuator or positioner before conducting an overhaul.

<Checklist>

(1) Visible surfaces

Check diaphragm case, waterproof cap, yoke, stem connector, bonnet, body, mounting bolts and nuts, and air connection for missing parts, damage, abrasion or corrosion. Check also for any sign of erosion of device finish.

(2) Stem abrasion

Check to see there is no evidence of abrasion (scratches, scrapes, etc.) on valve stem and actuator stem.

(3) Leakage (body / bonnet)

Check for any trace of leakage from body and bonnet connection.

(4) Leakage (gland)

Check for any trace of leakage from gland.

(5) Valve seat

Inspect the plug and of the surface where the seat ring is fitted, for any sign of scratches or corrosion that could cause seat ring leakage.

If any deformity is found, take appropriate remedial procedures (i.e. lapping, additional machining or replacement).

(6) Guide

Check for any large or deep abrasions on the surfaces of the plug guide or bonnet guide.

Repair or replace any defective parts.

(7) Scaling

Check and remove any scaling formation seen accumulated inside the valve body, valve plug, bonnet guide, gland box, and seat ring.

(8) Gland box

Check inside the gland box for deterioration such as scratches or corrosion, which could cause gland leakage

If any such deterioration is found, machine or replace the damaged part.

(9) Gasket face

Inspect the body-bonnet gasket face for any damage or corrosion, which may cause leakage. Repair, machine, or replace any damaged parts.



CAUTION

To prevent environmental hazard, any old /worn-out parts that have been removed to be discarded during disassembly or maintenance must be disposed of as industrial waste in compliance to all applicable laws and regulations

4-2 : Uninstalling the control valve

This procedure is to be followed when removing an installed control valve from the process line. Refer to these instructions when removing the control valve for inspection.

<Precautions>

- Prepare sufficient work space and safety for control valve removal,
- Confirm control valve removal will not adversely affect any other process operation or equipment,
- Shutdown the process fluid flow and allow the pipe to completely depressurize before removing the control valve,

- Allow the valve temperature to cool to ambient temperature before removing the control valve,
- When lifting the control valve from the process, be sure that all connecting bolts have been removed.

Use a hoist to lift the valve using the eyebolts provided on the valve body.

< Uninstalling the control valve >

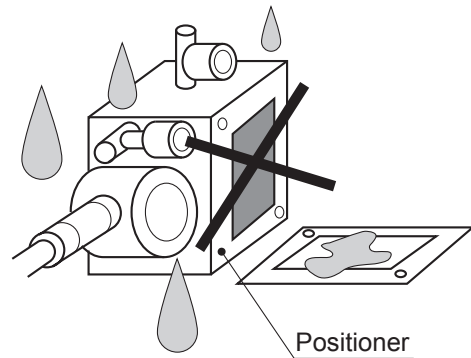
(1) Disconnecting electrical wiring

Before disconnecting any wiring, turn off the electric signal and power supply to the control valve.

Refer to "2-5-2 : Electrical wiring connection" on page 2-13.

CAUTION

- Only licensed engineer(s) should do electric work in accordance with electric facility engineering standard.
- Avoid electric work in rainy weather or at the time of high humidity. An intrusion of water into connector or terminal will cause rusting and electric shock.
- Cover of accessories such as positioner which are provided with seal packing (gasket). Exercise care as not lose them while electric work is in progress.
- Exercise cares so as not to lose fixing screws of accessories such as the positioner. When tightening screws, ensure that packing is in place and tighten screws with an even torque.
- Cable threads and conduit seal should be tightened to ensure blocking water intrusion.



(2) Disconnecting the pneumatic tubing

Shut-off the air supply to the control valve by closing the stop valve. Then disconnect and remove the pneumatic tubing.

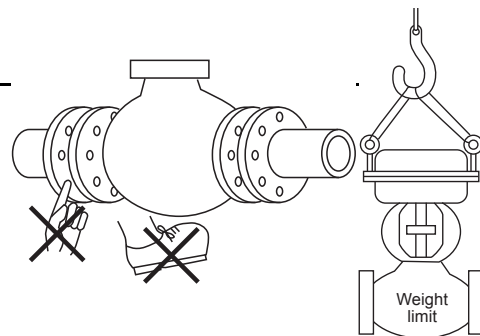
Refer to "2-4 : Pneumatic piping work" on page 2-7.

(3) Lifting the control valve from the process pipe

The valve should be suspended at a fixed height from the hoist by using a sling fastened to lifting eyebolts on the valve body. Loosen all bolts and nuts from the flanges, then remove the control valve.

 **CAUTION**

-
- When lifting a valve using the eyebolts (eye nuts) on the actuator, make sure that the rated weight of the bolt does not exceed the limit as described in this manual. A load in excess of the limitation will cause damage to actuator or will result in air leakage.
 - When installing a valve on a pipe, keep hands and feet away from valve body's bottom or between flanges to avoid physical injury.
-



4-3 : Disassembling and reassembling the control valve

Follow the procedures below when it is necessary to disassemble or reassemble the control valve when undertaking periodic maintenance or any repairs.

4-3-1: Before disassembly

- Provide sufficient workspace to remove the control valve. If more than one control valve is to be disassembled, make sure that enough space is provided so as not to confuse their individual parts.
- Prepare tools for disassembly,
- Shut off the process fluid flow and allow the pipe to completely depressurize before uninstalling the control valve,
- Allow the valve temperature to cool to ambient temperature before control valve removal,
- Make a note of the information stamped on the device's nameplate, the type of positioner, etc.

4-3-2: Tools for disassembly

Prepare the following tools for disassembly:

- Hammer
- Chisel
- Punch
- Wrench or socket wrench
- Specialized tool (seat spanner)
- Compressed air source (340kPa max.) to test the valve

Contact your Azbil representative to inquire about the specialized tool (seat spanner).

4-3-3: Disassembly procedure

Step	Procedure
1	<p>Marking</p> <p>Punch mark the matching positions of actuator, body and bonnet at points as shown in Figure 4-1.</p> <p>These reference punch marks are to be followed while reassembling</p>
2	<p>Removing the stem connector</p> <p>For a reverse acting actuator, apply an air pressure to the actuator to raise its opening to 10 to 20% of full stroke before removing the stem connector.</p> <p>Hold this position.</p> <p>Loosen hexagon bolts that fasten the stem connector and then remove it.</p> <p>Separate rod from the stem connector.</p> <p>Finally, release the air pressure from the actuator.</p>
3	<p>Removing accessories</p> <p>Uninstall accessories such as positioner and limit switch. Protect the air supply and output tube joints by covering them with PVC tape.</p>
4	<p>Separating the actuator from the body</p> <p>Loosen the hexagon screws that have concave holes (four). Lift actuator to separate it from valve body.</p>

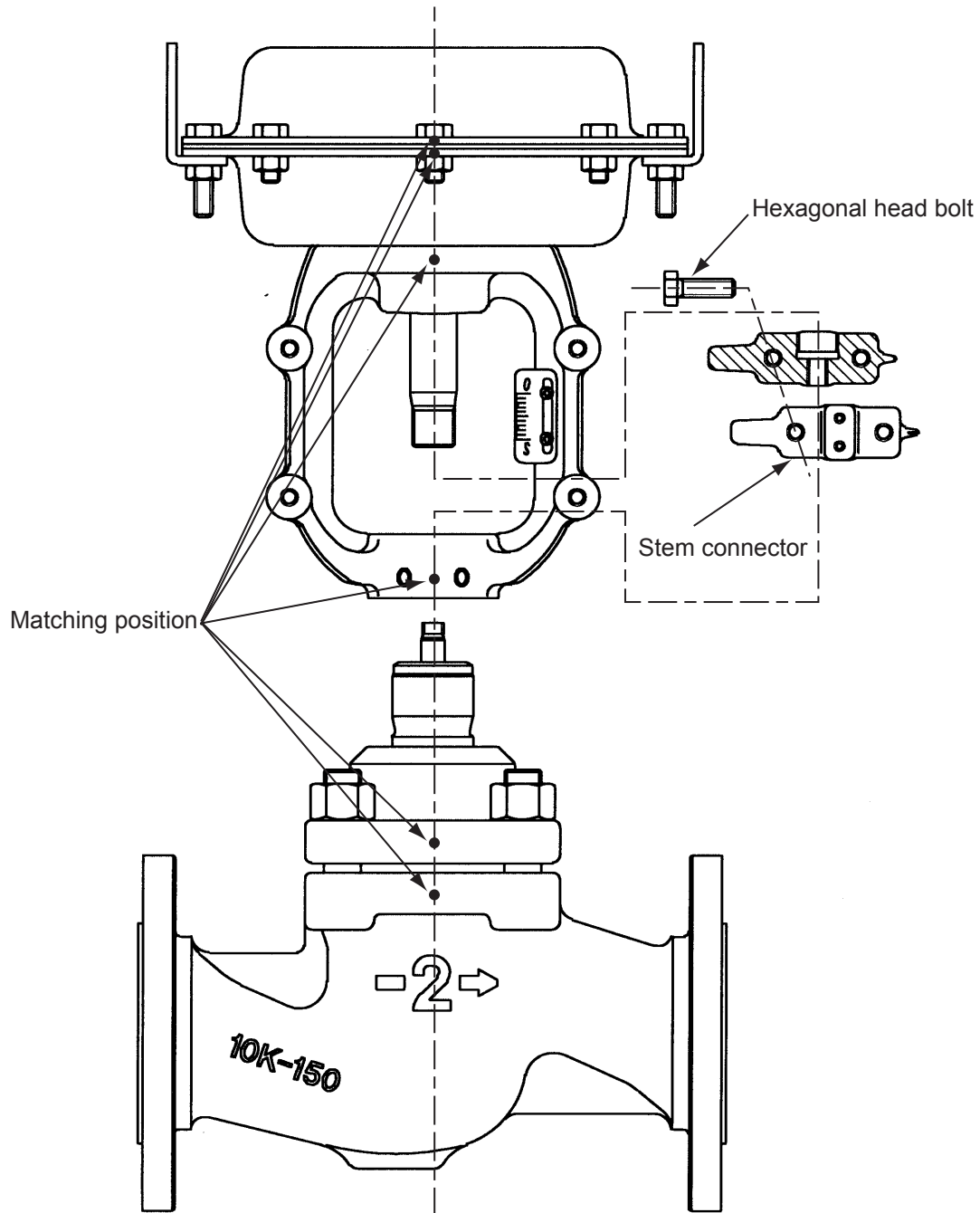


Figure 4-1 Separating body and actuator and assembly

4-3-4: Disassembling the valve body

<Precautions>

- Disassembly should be done on a cloth in order not to damage the valve,
- After disassembling, cover the gasket face, valve plug seat, sliding parts and the seat ring with clean cloth to protect them,


CAUTION

To prevent environmental hazard, any old /worn-out parts that have been removed to be discarded during disassembly or maintenance must be disposed of as industrial waste in compliance to all applicable laws and regulations

<Disassembly procedure>

Verify the size of the control valve connection for disassembling work refer to Figures 4-2, 4-3, and 4-4.

(1) Disassembling the main body and bonnet

Steps	Procedure
1	Loosen packing nut,
2	Use spanner or socket wrench to loosen hexagon nuts connecting bonnet to body,
3	Lift the bonnet vertically upwards after loosening the nuts. Remove the nuts only after confirming that the pressure inside the valve body has been depressurized
4	For valve sizes 2½ inches or larger, separate bonnet from body after removing bonnet flange. For valve sizes of 2 inches or smaller, remove bonnet (integral flange) from body. Next, carefully lift the bonnet vertically up so as not to de-center the valve stem. Once the valve plug has been extracted together with the bonnet, rotate the plug to remove it from bonnet while exercising care not to damage the stem.
5	Remove the gasket that is between the valve body and bonnet. <div style="text-align: center;"> WARNING</div> <ul style="list-style-type: none"> • Before disassembling a valve, ensure that the pressure within the valve has been reduced to atmospheric pressure. Blowout of process fluid may cause physical injury. • When disassembling a valve, flush out interior of the valve or replace the fluid inside thereof. Residual process fluid in pipe may cause physical injury.

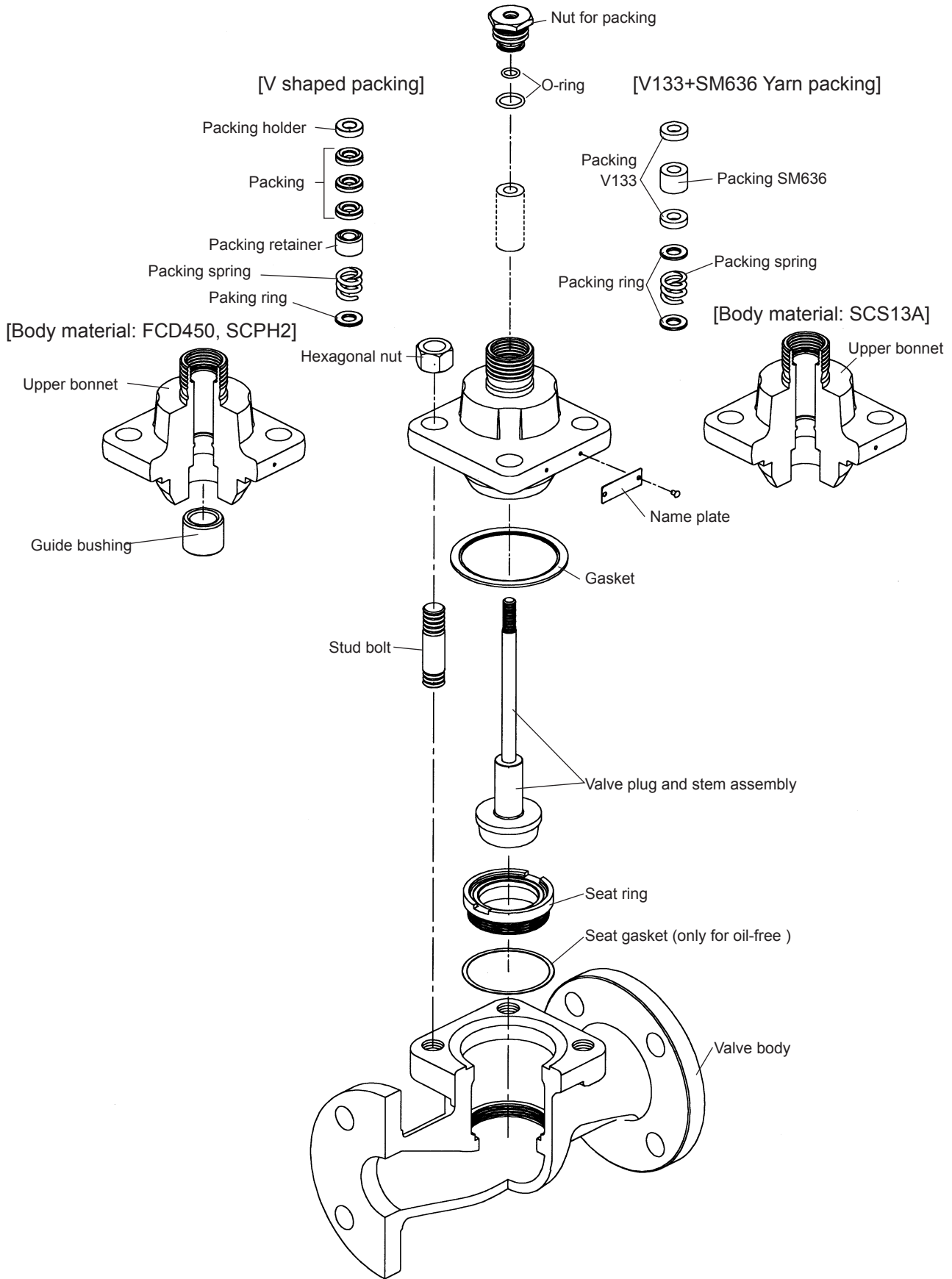


Figure 4-2 Valve body construction

(2) Removing inner valve

Once the valve plug has been removed out, proceed to remove the seat ring with the specialized tool (seat spanner).

(3) Removing the gland parts

Use a pipe when removing gland parts. It is recommended that the order of disassembly, type and quantity of gland parts (gland packing, spacer, etc.) be recorded to facilitate correct reassembly later.

 **CAUTION**

When removing the trim (inner valve) use the specialized tool, otherwise damage will occur. The instruction manual mentions details and procedures for the necessity of using the specialized tool.

4-3-5: Assembling the valve body

<Precautions>

- Confirm that each part is not defective. Refer to the inspection items list. Repair or replace as required.
- Always reassemble using new gland packing and gaskets,
- Note that the type of gland packing and quantity, assembling direction and assembling order differ according to the fluid conditions and specifications.
- Before reassembling the device, make sure the valve body is clean of any debris that may have been incurred by earlier maintenance or repair work.
- As per application of the valve and process fluid appropriate degree of cleansing of the valve is mentioned in valve specifications.


Auxiliary materials or seal parts may differ from the general-purpose specifications. Confirm valve's specifications.

<Assembly procedure>

Confirm the device's control valve connection size.

Use Figure 4-2 for reference when reassembling.

(1) Reassembling the seat ring

Step	Procedure
1	Screw the seat ring manually onto the valve body Apply anti-seize agent ^{*1} onto the body's threads and onto the seating surface, For degreased applications, use a seat ring gasket. Apply lubricating grease ^{*2} and screw the seat ring onto the valve body.
2	Set the specialized tool (seat spanner) on the body and tighten the seat ring at specified torque as mentioned in Table 4-1. <div style="text-align: center;">  CAUTION </div> <hr/> Before assembling the trim, select and confirm as per specifications the correct specialized tool to be used for tightening.

Note) *1. Never-Seez (Bostik, U.S.) or equivalent

Note) *2. Daiflon grease DG-203 (Daikin Kogyo K. K.) or equivalent

Table 4-1 Seat ring tightening torque [unit: N•m]

Connection size (inch)	Seat ring tightening torque
1/2, 3/4, 1	140
1½, 2	210
2½, 3	340

Table 4-2 Bonnet hexagon nut tightening torque [unit: N•m]

Connection size (inch)	Bonnet hexagon nuts	Tightening torque
1/2, 3/4, 1	M10	40
1½, 2	M16	100
2½, 3	M16	100

Table 4-3 Screw gland tightening torque [unit: N•m]

Stem size (mm)	PTFE ^{*1} yarn packing	V-shape PTFE packing
10 dia.	10	1.6

Note) *1. PTFE: Polytetrafluoroethylene


Note) For reference only. Type of packing varies.

(2) Lapping of seating face

Lap seating face of valve plug and seat ring.


Step	Procedure
1	Place old gasket on body's gasket face,
2	Apply a thin coat of compound on plug's seating surface.
3	Set the valve plug on bonnet and temporarily assemble body and bonnet with stud bolts and nuts,
4	To center lapping operation, insert an old packing in between,
5	Lightly press valve plug on seat ring, turn the plug to lap. (A stem connector temporarily installed on the top end of valve plug can be used as a handle.) After lapping, remove bonnet and valve plug from the body and ensure that there is no scar on seating surface of the plug and seat.
6	Wipe off compound when the work is completed and remove stem connector, old packing and gasket.

(3) Reassembling the valve plug and bonnet

Step	Procedure
1	Apply anti-seize agent ^{*1} onto a new gasket and place it on body's gasket face,
2	Install valve plug on bonnet and assemble body with bonnet. Make sure that the matching punch marks punched before disassembly are aligned to ensure relative positions of body and bonnet,
3	Apply anti-seize agent ^{*1} on stud bolt of body, tighten body and bonnet with nuts using spanner. Evenly tighten nuts in an alternating crisscross pattern to ensure the device is properly centered.
4	Finally, tighten all nuts using the torque specified in Table 4-2 <div style="text-align: center;">  CAUTION </div> <hr/> <ul style="list-style-type: none"> • Always use new gaskets and packing when reassembling the valve body. Reusing old gaskets or packing could result in leakage. • Always tighten the valve's bolts or nuts with the torque specified in the manual. Additionally, any corrosion on the bolts and nuts may lead to the control valve becoming damaged or it to malfunction or could result in physical injury. Replace any disfigured or corroded bolts, screws or nuts with new ones. • Tighten the nuts with equal torque when connecting the bonnet to the body in an alternating crisscross pattern. <hr/>

Note) ^{*1}. For non-degreasing specifications, use Never-Seez (Bostik, U.S.) or an equivalent. For degreasing specifications, use Daiiflon grease DG-203 (Daikin Kogyo K. K.) or an equivalent

(4) Reassembling the gland parts

Step	Procedure
1	Refer to the notes recorded when the gland parts were disassembled and to Figure 4-2 for the correct sequence of steps to reassemble the gland parts. If necessary, use a pipe to firmly insert parts.
2	Apply anti-seizure agent ^{*1} to the packing tightening nuts. Tighten packing tightening nuts with the torque specified in Table 4-3. <div style="text-align: center;">  WARNING </div> <hr/> Always tighten the valve's bolts or nuts with the torque specified in the manual. Additionally, any corrosion on the bolts and nuts may lead to the control valve becoming damaged or it to malfunction or could result in physical injury. Replace any disfigured or corroded bolts, screws or nuts with new ones. <hr/>

Note) *1. Never-Seez (Bostik, U.S.) or equivalent

4-3-6: Disassembling the actuator

<Precautions>

- Place removed parts on a clean location,
- Place the actuator in vertical position
- Depressurize diaphragm case before disassembly.



WARNING

Always make certain to depressurize the pneumatic actuator before disassembling it. Failure to do so may cause serious physical injury.



CAUTION

To prevent environmental hazard, any old /worn-out parts that have been removed to be discarded during disassembly or maintenance must be disposed of as industrial waste in compliance to all applicable laws and regulations

<Disassembly procedure>

Verify the actuator's size.


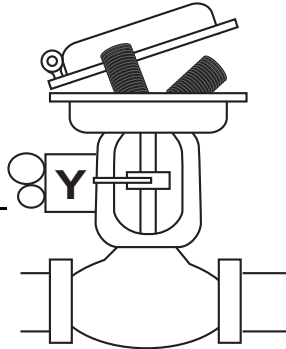
Use Figure 4-3, 4-4 and 4-5 on page 4-17 and 4-18 for reference while disassembling.

(1) Marking and protection

Step	Procedure
1	Make reference punch marks on the upper and lower diaphragm cases and the diaphragm case assembly's yoke boss,
2	Wrap the threads of the sealing part rod and bushing rod with PVC tape to protect them.

(2) Removing diaphragm case's bolts and nuts

Step	Procedure
1	Loosen and remove all hexagon nuts on the diaphragm case except the eyebolt nuts.

Step	Procedure
2	<p data-bbox="427 219 1053 291">Next, evenly loosen and remove the two eyebolt nuts.</p> <div data-bbox="427 347 657 407">  <p>CAUTION</p> </div> <p data-bbox="427 436 1072 586">Carefully follow the disassembly procedure while removing the bolts and nuts of the spring-loaded actuator. There is a risk of the spring popping out and causing physical injury.</p> <div data-bbox="1098 224 1385 571">  </div>

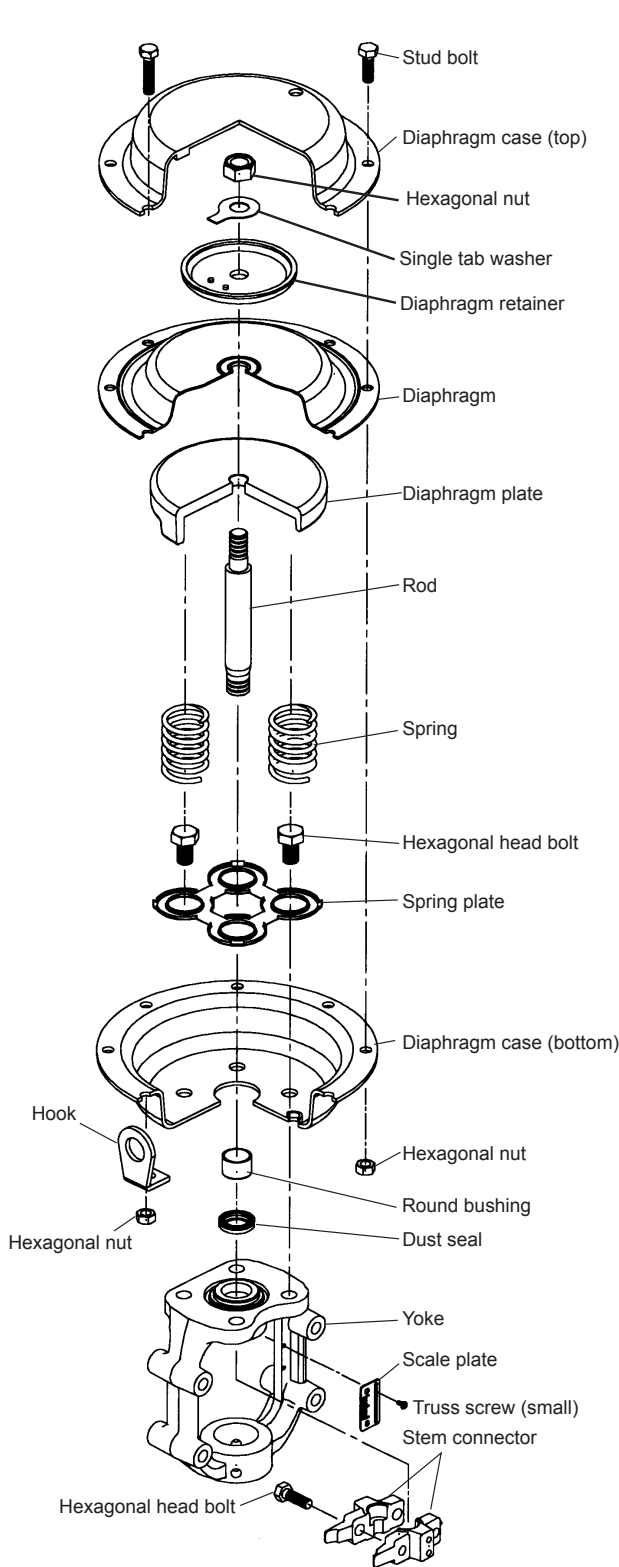


Figure 4-3 Actuator constructions:
Model PSK1D - direct action type

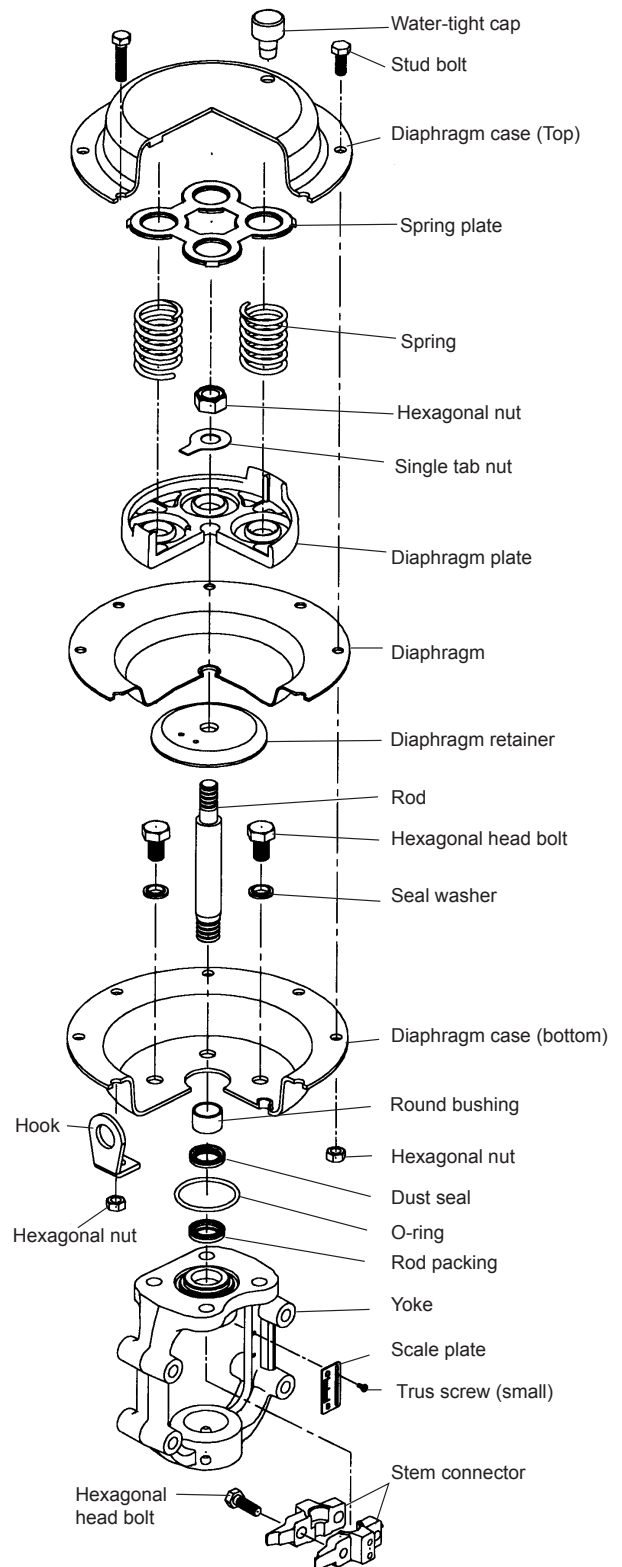


Figure 4-4 Actuator constructions:
Model PSK1R - reverse action type

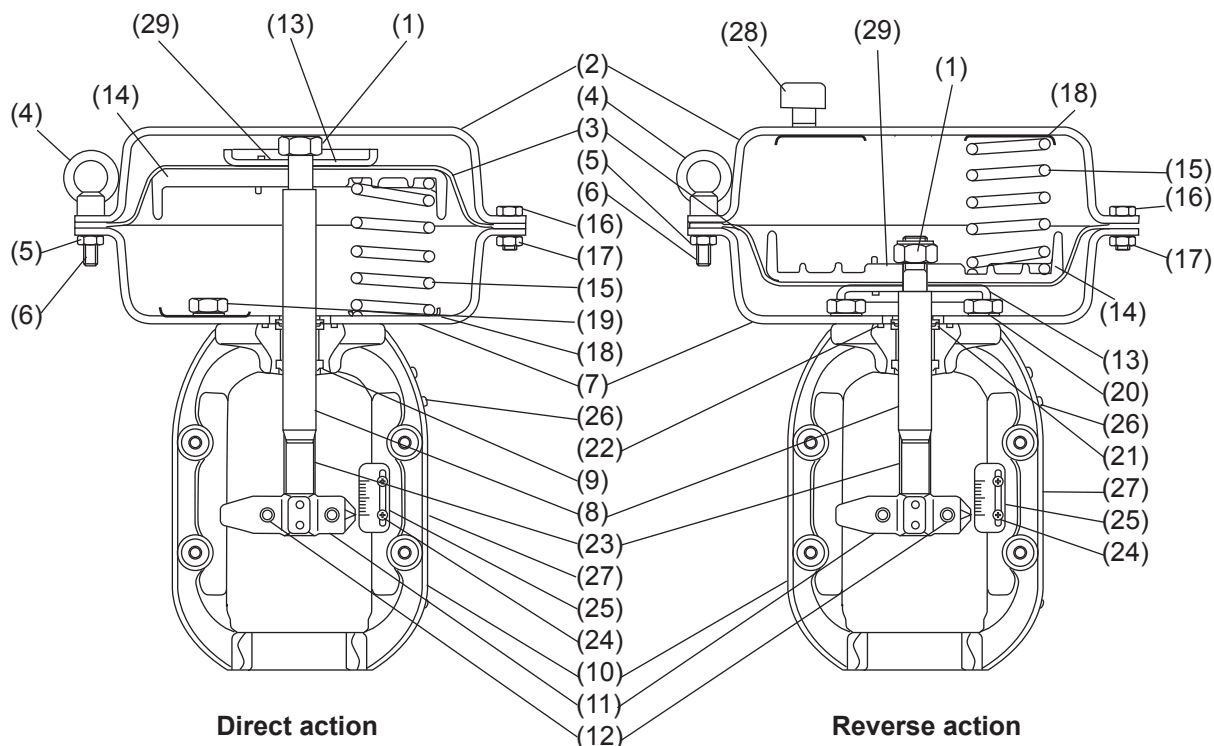


Figure 4-5 Cross-section of PSK1-type actuator

Table 4-4 Parts name

No.	Parts name	Material
(1)	Hexagonal nut	S45C, SK5
(2)	Diaphragm case (top)	SAPH370
(3)	Diaphragm	EPDM, Polyaimid
(4)	Eye-bolt	SUS304
(5)	Hexagonal nut	SUS304
(6)	Through bolt	SUS304
(7)	Diaphragm case (bottom)	SAPH370
(8)	Round bushing	SPCC, bronze, PTFE, lead
(9)	Dust seal	NBR
(10)	Yoke	A216WCB
(11)	Stem connector	SC13A
(12)	Stem connector bolt	SUS304
(13)	Diaphragm retainer	SS400
(14)	Diaphragm plate	AC4A / AC4C
(15)	Spring	SWOSM-B / SWOSC-V
(16)	Hexagonal head bolt	SUS304
(17)	Hexagonal nut	SUS304
(18)	Spring plate	SPCC
(19)	Hexagonal head bolt	S30C
(20)	Seal washer	NBR, SPCC
(21)	Packing for rod	NBR
(22)	O-ring	NBR
(23)	Rod	SUS304
(24)	Truss screw (small)	SUS304, SK5
(25)	Scale	SUS304
(26)	Drive screw	SUS304
(27)	Nameplate	SUS304
(28)	Cap	SUS304
(29)	Single tab washer	SUS304

(3) Removing the upper diaphragm case and diaphragm unit

Step	Procedure
1	Remove the upper diaphragm case
2	For direct-acting valves, first remove the diaphragm unit, then the spring and lastly then spring plate. For reverse-acting valves, remove spring plate first, then spring and the diaphragm unit last. Lift the rod upward along with the diaphragm unit.

(4) Removing the lower diaphragm case's seal parts

Step	Procedure
1	Remove the hexagon bolts that connects the diaphragm case to the yoke, then separate the diaphragm case from the yoke,
2	For reverse-acting actuators, remove the seal washer, O-ring, rod packing and dust seal. For direct-acting valves, remove the dust seal only.

(5) Disassembling the diaphragm unit

Step	Procedure
1	Flatten the single tongue washer with a screwdriver,
2	Loosen the detent nut and remove,
3	Separate the rod, diaphragm, diaphragm plate and diaphragm retainer by pressing down.

4-3-7: Reassembling the actuator**<Precautions>**

- Confirm that each part is not defective. Refer to inspection items list. Repair or replace as required.
- Always use new seal washers, dust seals and rod seals.
- Prior to reassembly, check whether there is any foreign particles left inside the diaphragm case, which may be remaining over from maintenance work.

<Assembly procedure>

Verify the actuator's size.

Use Figure 4-3, 4-4, and 4-5 as references while reassembling

(1) Reassembling the diaphragm unit

Step	Procedure
1	Assemble the rod, diaphragm, diaphragm plate and diaphragm retainer with single tongue washer and nut. If the single tongue washer is brand new, bend it at the same place as the old one.
2	Temporarily assemble the yoke and lower diaphragm case. (Do not install sealing parts.) Insert diaphragm unit and temporarily set the stem connector on the rod threads,
3	Using detent of stem connector, tighten nut of diaphragm unit at the torque as specified in Table 4-5 on page 4-21,
4	After tightening, apply anti-sealing agent ^{*1} on thread. Then bend the single tongue washer along the shape of nut,
5	Then again disassemble only the lower diaphragm case, yoke and stem connector (not the diaphragm unit)

Note) *1. Three Bond's liquid gasket No. 1104 or equivalent recommended

(2) Reassembling the seal parts

Step	Procedure
1	For reverse-acting actuators, install rod packing, O-ring and dust seal; and for direct acting actuators install dust seal on regular position of the yoke. Apply lubricant ^{*1} as specified on the thread

Note) *1. Warren Refining Chemical's (USA) Plasteloo No. 3 or equivalent recommended

(3) Reassembling the lower diaphragm case

Step	Procedure
1	Place the lower diaphragm case onto the yoke by verifying matching punch marks.
2	For reverse-acting actuators, apply liquid sealant to the seal washer and place the washer around the hole of lower diaphragm case,
3	Apply anti-seize agent ^{*1} to hexagon head bolt and tighten with the torque specified in Table 4-5 on page 4-21.

Note) *1. Never-Seez (Bostik Co., U.S.) or equivalent recommended

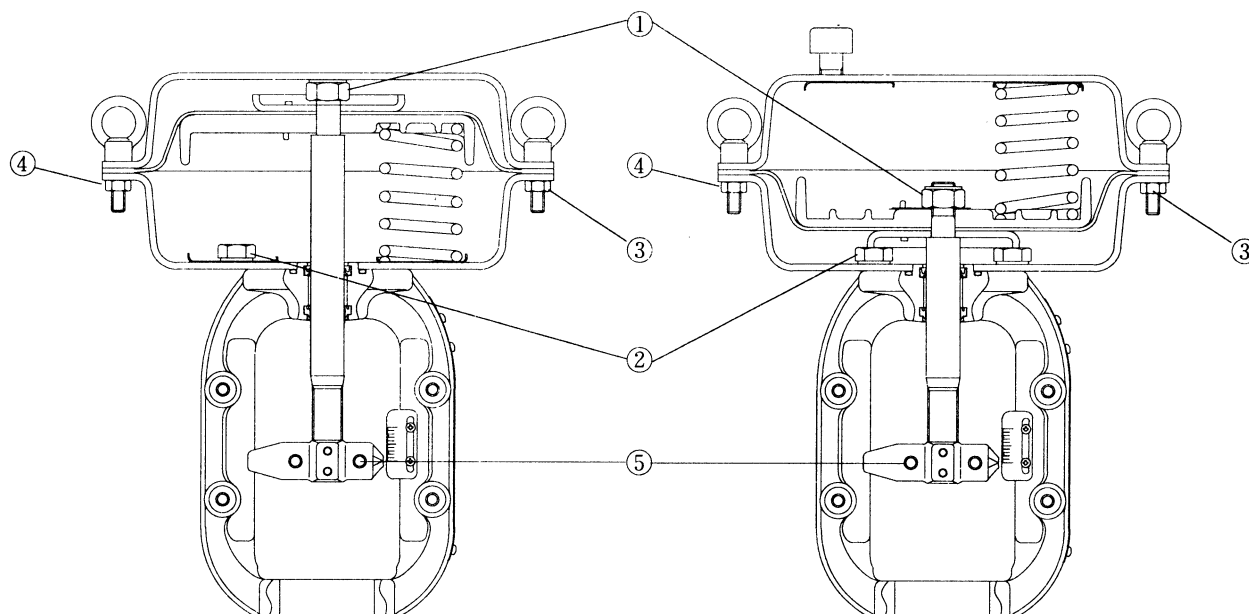


Figure 4-6 PSK1-type actuator's tightening of threads

Table 4-5 Tightening torque for actuator assembly

[Unit: N•m]

Key No.	Material	Type PSK1	
1	S45C SK5	M14	45 - 70
2	S30C	M12	35 - 50
3	S30C	M8	15 - 20
4	SUS304	M8	15 - 20
5	S30C	M8	10 - 15
	SUS304	M8	15 - 20

(4) Reassembling the diaphragm unit and spring


For direct-acting actuators

Step	Procedure
1	Install the spring onto the spring plate,
2	Check that the thread on the rod is protected with PVC tape,
3	Insert the diaphragm unit's rod to the specified position. Take caution not to damage the coil busing or dust seal.

For reverse-acting actuators

Step	Procedure
1	Check that the thread on the rod is protected with PVC tape.
2	Insert the diaphragm unit's rod into the yoke. Take caution not to damage the coil bushing, dust seal or rod packing.
3	Install the spring onto the diaphragm plate,
4	Install the spring plate on top of the spring.

(5) Reassembling the upper diaphragm case

Step	Procedure
1	Set upper diaphragm case. Use the matching punch marks for alignment
2	Place upper diaphragm case and tighten eye-bolts evenly using an alternating, crisscross pattern,
3	Tighten hexagon head bolts to assemble upper and lower diaphragm cases,
4	Tighten bolts diagonally with an even torque. Refer to Table 4-5 on page 4-21 for tightening torque,
5	For reverse acting actuators, screw on a waterproof cap on air vent of upper diaphragm case. <div style="text-align: center;">  CAUTION </div> <hr/> <p>Carefully follow the assembly procedure while removing the bolts and nuts of the spring-loaded actuator. There is a risk of the spring popping out and causing physical injury.</p> <hr/>

(6) Verification test after assembly is completed

Step	Procedure
1	Apply an air pressure of 340 kPa to the diaphragm case through its air supply connection on the diaphragm case. Use soap water to check for air leaks on the circumference of the diaphragm case for reverse-acting actuators, carry out the air leakage test around the rod.
2	Vary air pressure within actuator's air supply range, and confirm that it strokes smoothly throughout over its entire range. Check and confirm that the spring range for the valve opening is identical to that stamped on its nameplate.

4-3-8: Reassembling the body and actuator

<Assembly procedure>

When reassembling, refer to Figure 4-1.

(1) Verification test after reassembling is completed

Step	Procedure
1	Apply anti-seize agent ^{*1} on bonnet, yoke and connecting parts,
2	Place actuator on body. Align actuator matching with punch marks made before disassembly,
3	Firmly tighten the female socket hexagon head bolt of the lower yoke, using Allen Key Wrench

Note) *1. Never-Seez (Bostik Co., U.S.) or equivalent recommended.

(2) Reassembling the stem connector

For direct-acting actuators

Step	Procedure
1	Press valve plug down until it seats on the valve seat,
2	Verify spring range as stamped/specified on nameplate, then apply the range's upper maximum pressure,
3	Increase air pressure up to air supply source pressure,
4	Reduce pressure once, then increase the pressure to the maximum limit of the spring range and hold it there. Temporarily tighten rod and valve stem with stem connector,
5	Reduce air pressure down to a several percent valve opening and stop (for valve plug and seat clearance). Then, tighten hexagon headed bolt of stem connector with the torque specified in Table 4-5 on page 4-21.

For reverse-acting actuators

Step	Procedure
1	Press valve plug down until it seats on the valve seat,
2	Verify spring range as specified on nameplate, then apply that range's lower limit pressure,
3	Reduce air pressure further then verify that the rod moves several millimeters,
4	Increase pressure and set the air pressure to the lower limit of the spring range and hold it there. Temporarily tighten rod and valve stem with stem connector,

Step	Procedure
5	Increase the air pressure up to a several percent of valve opening then stop (for valve plug and seat clearance). Then, tighten hexagon head bolt of stem connector with the torque specified in Table 4-5 on page 4-21.

(3) Reinstalling accessories

Reassemble accessories as they were.

(4) Verification test after reassembly is completed

- Apply the specified input signal and supply air pressure to the positioner or actuator and confirm that there is no air leakage from the pneumatic tubing or air tubing joints,
- Verify operation by varying the input signal
- Perform a valve seat leakage test and confirm that performance is within specification,
- Perform a pressure-withstanding test to the body to confirm that there are no leaks from the body, bonnet connection part or gland.

Chapter 5 : Recommended Spare Parts

Maintenance information

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

Part list

Refer to the parts list on page B-1.

Ordering

Consult an Azbil Corp. representative for the part names and part numbers.

Maintenance service

Consult with a Azbil representative for maintenace service.

Appendix A

Table A -1 shows the dimensions and weights of the control valves. Note that the addition of any optional specifications will change their installed dimensions and weights.

Table A -1 Face-to-face dimension and weight

Nominal size (inch)	Size (mm)		Weight (kg)
	A	H	
1/2	184	365	13
3/4	184	365	14
1	184	365	15
1½	222	365	22
2	254	365	25
2½	276	385	38
3	298	385	39

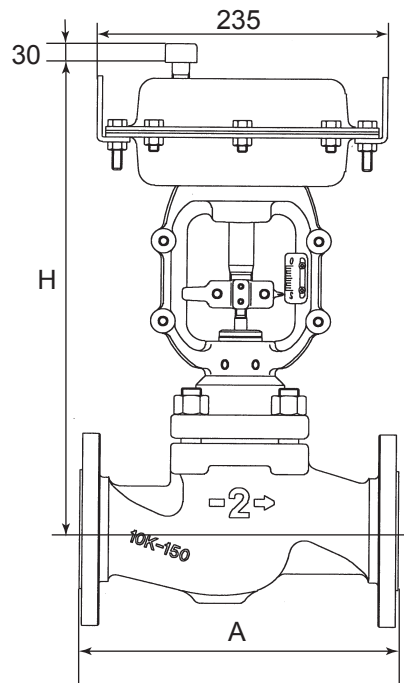


Figure A-1 Face-to-face and dimension drawing

Appendix B

1: Valve plug (with valve plug stem)

1-1: Valve plug (material: SUS316)

Table B -1 Valve plug (material: SUS316)

Name	Parts no.	Qty.	
1/2 in. Cv=0.4, %C	plug, stem assembly SUS316	82557807-01100	1
1/2 in. Cv=0.63, %C	plug, stem assembly SUS316	82557807-02100	1
1/2 in. Cv=1.0, %C	plug, stem assembly SUS316	82557807-03100	1
1/2 in. Cv=2.5, %C	plug, stem assembly SUS316	82557807-04100	1
1/2 in. Cv=4.0, %C	plug, stem assembly SUS316	82557807-05100	1
3/4 in. Cv=0.4, %C	plug, stem assembly SUS316	82557807-01100	1
3/4 in. Cv=0.63, %C	plug, stem assembly SUS316	82557807-02100	1
3/4 in. Cv=1.0, %C	plug, stem assembly SUS316	82557807-03100	1
3/4 in. Cv=2.5, %C	plug, stem assembly SUS316	82557807-04100	1
3/4 in. Cv=4.0, %C	plug, stem assembly SUS316	82557807-05100	1
3/4 in. Cv=8.0, %C	plug, stem assembly SUS316	82557807-06100	1
1 in. Cv=0.4, %C	plug, stem assembly SUS316	82557807-01100	1
1 in. Cv=0.63, %C	plug, stem assembly SUS316	82557807-02100	1
1 in. Cv=1.0, %C	plug, stem assembly SUS316	82557807-03100	1
1 in. Cv=2.5, %C	plug, stem assembly SUS316	82557807-04100	1
1 in. Cv=4.0, %C	plug, stem assembly SUS316	82557807-05100	1
1 in. Cv=8.0, %C	plug, stem assembly SUS316	82557807-06100	1
1 in. Cv=14, %C	plug, stem assembly SUS316	82557807-07100	1
1½ × 1 in. (Cv=14), %C	plug, stem assembly SUS316	82557807-08100	1
1½ × 1½ in. (Cv=30), %C	plug, stem assembly SUS316	82557807-09100	1
2 × 1½ in. (Cv=30), %C	plug, stem assembly SUS316	82557807-09100	1
2 × 2 in. (Cv=50), %C	plug, stem assembly SUS316	82557807-10100	1
2½ × 2½ in. (Cv=70), %C	plug, stem assembly SUS316	82557807-11100	1
3 × 3 in. (Cv=100), %C	plug, stem assembly SUS316	82557807-12100	1

1-2: Valve plug (material: SUS316ST)

Table B -2 Valve plug (material: SUS316ST)

Name	Parts no.	Qty.	
1/2 in. Cv=0.4, %C	plug, stem assembly SUS316	82557807-01200	1
1/2 in. Cv=0.63, %C	plug, stem assembly SUS316	82557807-02200	1
1/2 in. Cv=1.0, %C	plug, stem assembly SUS316	82557807-03200	1
1/2 in. Cv=2.5, %C	plug, stem assembly SUS316	82557807-04200	1
1/2 in. Cv=4.0, %C	plug, stem assembly SUS316	82557807-05200	1
3/4 in. Cv=0.4, %C	plug, stem assembly SUS316	82557807-01200	1
3/4 in. Cv=0.63, %C	plug, stem assembly SUS316	82557807-02200	1
3/4 in. Cv=1.0, %C	plug, stem assembly SUS316	82557807-03200	1
3/4 in. Cv=2.5, %C	plug, stem assembly SUS316	82557807-04200	1
3/4 in. Cv=4.0, %C	plug, stem assembly SUS316	82557807-05200	1
3/4 in. Cv=8.0, %C	plug, stem assembly SUS316	82557807-06200	1
1 in. Cv=0.4, %C	plug, stem assembly SUS316	82557807-01200	1
1 in. Cv=0.63, %C	plug, stem assembly SUS316	82557807-02200	1
1 in. Cv=1.0, %C	plug, stem assembly SUS316	82557807-03200	1
1 in. Cv=2.5, %C	plug, stem assembly SUS316	82557807-04200	1
1 in. Cv=4.0, %C	plug, stem assembly SUS316	82557807-05200	1
1 in. Cv=8.0, %C	plug, stem assembly SUS316	82557807-06200	1
1 in. Cv=14, %C	plug, stem assembly SUS316	82557807-07200	1
1½ × 1 in. (Cv=14), %C	plug, stem assembly SUS316	82557807-08200	1
1½ × 1½ in. (Cv=30), %C	plug, stem assembly SUS316	82557807-09200	1
2 × 1½ in. (Cv=30), %C	plug, stem assembly SUS316	82557807-09200	1
2 × 2 in. (Cv=50), %C	plug, stem assembly SUS316	82557807-10200	1
2½ × 2½ in. (Cv=70), %C	plug, stem assembly SUS316	82557807-11200	1
3 × 3 in. (Cv=100), %C	plug, stem assembly SUS316	82557807-12200	1

1-3: Valve plug (material: SUS316PTFE)**Table B -3 Valve plug (material: SUS316PTFE)**

	Name	Parts no.	Qty.
1/2 in. Cv=0.4, %C	plug, stem assembly SUS316	82557808-01100	1
1/2 in. Cv=0.63, %C	plug, stem assembly SUS316	82557808-02100	1
1/2 in. Cv=1.0, %C	plug, stem assembly SUS316	82557808-03100	1
1/2 in. Cv=2.5, %C	plug, stem assembly SUS316	82557808-04100	1
1/2 in. Cv=4.0, %C	plug, stem assembly SUS316	82557808-05100	1
3/4 in. Cv=0.4, %C	plug, stem assembly SUS316	82557808-01100	1
3/4 in. Cv=0.63, %C	plug, stem assembly SUS316	82557808-02100	1
3/4 in. Cv=1.0, %C	plug, stem assembly SUS316	82557808-03100	1
3/4 in. Cv=2.5, %C	plug, stem assembly SUS316	82557808-04100	1
3/4 in. Cv=4.0, %C	plug, stem assembly SUS316	82557808-05100	1
3/4 in. Cv=8.0, %C	plug, stem assembly SUS316	82557808-06100	1
1 in. Cv=0.4, %C	plug, stem assembly SUS316	82557808-01100	1
1 in. Cv=0.63, %C	plug, stem assembly SUS316	82557808-02100	1
1 in. Cv=1.0, %C	plug, stem assembly SUS316	82557808-03100	1
1 in. Cv=2.5, %C	plug, stem assembly SUS316	82553926-10200	1
1 in. Cv=4.0, %C	plug, stem assembly SUS316	82553926-10200	1
1 in. Cv=8.0, %C	plug, stem assembly SUS316	82553926-20200	1
1 in. Cv=14, %C	plug, stem assembly SUS316	82553929-10200	1
1½ × 1 in. (Cv=14), %C	plug, stem assembly SUS316	82557808-07100	1
1½ × 1½ in. (Cv=30), %C	plug, stem assembly SUS316	82557808-09100	1
2 × 1½ in. (Cv=30), %C	plug, stem assembly SUS316	82557808-09100	1
2 × 2 in. (Cv=50), %C	plug, stem assembly SUS316	82557808-10100	1
2½ × 2½ in. (Cv=70), %C	plug, stem assembly SUS316	82557808-11100	1
3 × 3 in. (Cv=100), %C	plug, stem assembly SUS316	82557808-12100	1

2: Seat ring**2-1: Seat ring (material: SUS316)****Table B -4 Seat ring (material: SUS316PTFE)**

	Name	Parts no.	Qty.
1/2 in. Cv=0.4, %C	Seat ring SUS316	82553264-02200	1
1/2 in. Cv=0.63, %C	Seat ring SUS316	82553264-02200	1
1/2 in. Cv=1.0, %C	Seat ring SUS316	82553264-03200	1
1/2 in. Cv=2.5, %C	Seat ring SUS316	82553264-04200	1
1/2 in. Cv=4.0, %C	Seat ring SUS316	82553264-04200	1
3/4 in. Cv=0.4, %C	Seat ring SUS316	82553264-02200	1
3/4 in. Cv=0.63, %C	Seat ring SUS316	82553264-02200	1
3/4 in. Cv=1.0, %C	Seat ring SUS316	82553264-03200	1
3/4 in. Cv=2.5, %C	Seat ring SUS316	82553264-04200	1
3/4 in. Cv=4.0, %C	Seat ring SUS316	82553264-04200	1
3/4 in. Cv=8.0, %C	Seat ring SUS316	82553264-05200	1
1 in. Cv=0.4, %C	Seat ring SUS316	82553264-02200	1
1 in. Cv=0.63, %C	Seat ring SUS316	82553264-02200	1
1 in. Cv=1.0, %C	Seat ring SUS316	82553264-03200	1
1 in. Cv=2.5, %C	Seat ring SUS316	82553264-04200	1
1 in. Cv=4.0, %C	Seat ring SUS316	82553264-04200	1
1 in. Cv=8.0, %C	Seat ring SUS316	82553264-05200	1
1 in. Cv=14, %C	Seat ring SUS316	82553008-10200	1
1½ × 1½ in. (Cv=14), %C	Seat ring SUS316	82553010-04200	1
1½ × 1½ in. (Cv=30), %C	Seat ring SUS316	82553010-02200	1
2 × 2 in. (Cv=50), %C	Seat ring SUS316	82553010-02200	1
2 × 2 in. (Cv=50), %C	Seat ring SUS316	82553010-01200	1
2½ × 2½ in. (Cv=70), %C	Seat ring SUS316	82553012-02200	1
3 × 3 in. (Cv=100), %C	Seat ring SUS316	82553012-01200	1

2-2: Seat ring (material: SUS316ST)**Table B -5 Seat ring (material: SUS316ST)**

	Name	Parts no.	Qty.
1/2 in. Cv=0.4, %C	Seat ring SUS316	82553264-02500	1
1/2 in. Cv=0.63, %C	Seat ring SUS316	82553264-02500	1
1/2 in. Cv=1.0, %C	Seat ring SUS316	82553264-03500	1
1/2 in. Cv=2.5, %C	Seat ring SUS316	82553264-04500	1
1/2 in. Cv=4.0, %C	Seat ring SUS316	82553264-04500	1
3/4 in. Cv=0.4, %C	Seat ring SUS316	82553264-02500	1
3/4 in. Cv=0.63, %C	Seat ring SUS316	82553264-02500	1
3/4 in. Cv=1.0, %C	Seat ring SUS316	82553264-03500	1
3/4 in. Cv=2.5, %C	Seat ring SUS316	82553264-04500	1
3/4 in. Cv=4.0, %C	Seat ring SUS316	82553264-04500	1
3/4 in. Cv=8.0, %C	Seat ring SUS316	82553264-05500	1
1 in. Cv=0.4, %C	Seat ring SUS316	82553264-02500	1
1 in. Cv=0.63, %C	Seat ring SUS316	82553264-02500	1
1 in. Cv=1.0, %C	Seat ring SUS316	82553264-03500	1
1 in. Cv=2.5, %C	Seat ring SUS316	82553264-04500	1
1 in. Cv=4.0, %C	Seat ring SUS316	82553264-04500	1
1 in. Cv=8.0, %C	Seat ring SUS316	82553264-05500	1
1 in. Cv=14, %C	Seat ring SUS316	82553008-10500	1
1½ × 1½ in. (Cv=14), %C	Seat ring SUS316	82553010-04500	1
1½ × 1½ in. (Cv=30), %C	Seat ring SUS316	82553010-02500	1
2 × 2 in. (Cv=50), %C	Seat ring SUS316	82553010-02500	1
2 × 2 in. (Cv=50), %C	Seat ring SUS316	82553010-01500	1
2½ × 2½ in. (Cv=70), %C	Seat ring SUS316	82553012-02500	1
3 × 3 in. (Cv=100), %C	Seat ring SUS316	82553012-01500	1

2-3: Seat ring (material: SUS316) (PTFE soft seat)

Table B -6 Seat ring (material: SUS316) (PTFE soft seat)

Name		Parts no.	Qty.
1/2 in. Cv=0.4, %C	Seat ring SUS316	82553928-20200	1
1/2 in. Cv=0.63, %C	Seat ring SUS316	82553928-20200	1
1/2 in. Cv=1.0, %C	Seat ring SUS316	82553928-30200	1
1/2 in. Cv=2.5, %C	Seat ring SUS316	82553926-10200	1
1/2 in. Cv=4.0, %C	Seat ring SUS316	82553926-10200	1
3/4 in. Cv=0.4, %C	Seat ring SUS316	82553928-20200	1
3/4 in. Cv=0.63, %C	Seat ring SUS316	82553928-20200	1
3/4 in. Cv=1.0, %C	Seat ring SUS316	82553928-30200	1
3/4 in. Cv=2.5, %C	Seat ring SUS316	82553926-10200	1
3/4 in. Cv=4.0, %C	Seat ring SUS316	82553926-10200	1
3/4 in. Cv=8.0, %C	Seat ring SUS316	82553926-20200	1
1 in. Cv=0.4, %C	Seat ring SUS316	82553928-20200	1
1 in. Cv=0.63, %C	Seat ring SUS316	82553928-20200	1
1 in. Cv=1.0, %C	Seat ring SUS316	82553928-30200	1
1 in. Cv=2.5, %C	Seat ring SUS316	82553926-10200	1
1 in. Cv=4.0, %C	Seat ring SUS316	82553926-10200	1
1 in. Cv=8.0, %C	Seat ring SUS316	82553926-20200	1
1 in. Cv=14, %C	Seat ring SUS316	82553929-10200	1
1½ × 1½ in. (Cv=14), %C	Seat ring SUS316	82553936-10200	1
1½ × 1½ in. (Cv=30), %C	Seat ring SUS316	82553935-02200	1
2 × 2 in. (Cv=50), %C	Seat ring SUS316	82553935-02200	1
2 × 2 in. (Cv=50), %C	Seat ring SUS316	82553935-01200	1
2½ × 2½ in. (Cv=70), %C	Seat ring SUS316	82553934-02200	1
3 × 3 in. (Cv=100), %C	Seat ring SUS316	82553934-01200	1

3: Upper bonnet

Table B -7 Upper bonnet

Name			Parts No.	Qty.
Upper bonnet	1 inch or less	FCD, SCPH2	82557786-10100	1
Upper bonnet	1 inch or less	SUS	82557787-10100	1
Upper bonnet	1½, 2 inch	FCD, SCPH	82557788-10100	1
Upper bonnet	1½, 2 inch	SUS	82557789-10100	1
Upper bonnet	2½, 3 inch	FCD	82557790-10100	1
Upper bonnet	2½, 3 inch	SCPH2	82557791-10100	1
Upper bonnet	2½, 3 inch	SUS	82557811-10100	1

4: Gasket

4-1: Gasket

Table B -8 Gasket

Name		Parts No.	Qty.
Gasket	1 inch or less	82553016-10100	1
Gasket	1½, 2 inch	82553016-20100	1
Gasket	2½, 3 inch	82553016-30100	1

4-2: Seat gasket

Table B -9 Seat gasket

Name		Parts No.	Qty.
Seat gasket	1 inch or less	82660153-10100	1
Seat gasket	1½, 2 inch	82660153-30100	1
Seat gasket	2½, 3 inch	82553463-10100	1

5: Gland parts**5-1: Yarn packing V133 + Self mold SM636****Table B -10 Yarn packing V133 + Self mold SM636**

No.	Name	Parts No.	Qty.
1	O-ring P10 Aflas	82592220-80100	1
2	Nut for packing	82509727-16600	1
3	O-ring P16 Aflas	82592221-70100	1
4	Yarn packing V133	82509713-10100	2
5	Packing mold SM636	82509715-10200	1
6	Packing spring	82509716-16600	1
7	Packing ring	82509714-16600	2

5-2: V type PTFE packing**Table B -11 Yarn packing V133 + Self mold SM636**

No.	Name	Parts No.	Qty.
1	O-ring P10 Aflas	82592220-80100	1
2	Nut for packing	82509727-16600	1
3	O-ring P16 Aflas	82592221-70100	1
4	Packing holder	82509735-10300	1
5	Yarn packing V133	82509736-10100	3
6	Packing mold SM636	82509737-10200	1
7	Packing spring	82509716-16600	1
8	Packing ring	82509714-16600	1

Appendix C

All control valve parts are manufactured to endure long use. However, the following parts should be replaced at times of periodic overhauls to the control valve.

Main parts

Gland packing
Gasket

Actuator

Standard replacement period is every 5 years, for
Diaphragm
Bushing
Seal washer^{*1}
Dust seal^{*1}
Rod seal^{*1}

*Note) *1. Replace parts each time the valve is overhauled*

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Model: ACT
User's Manual

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