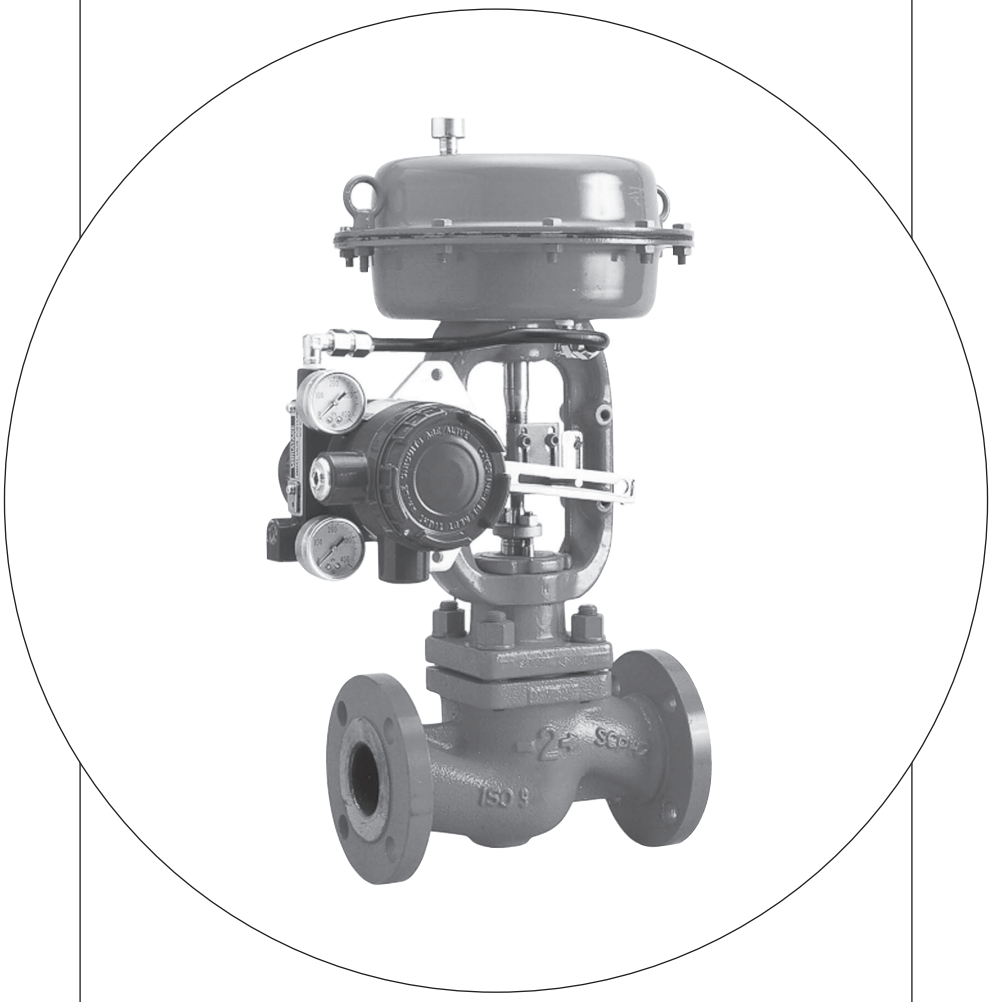
azbil

CM2-AGV200-2001D

Control Valves

Model AGVB_ _ _/AGVM_ _ _

User's Manual



Azbil Control Instruments (Dalian) Co., Ltd.

NOTICE

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Preface

Introduction

Thank you for purchasing the Azbil Corporation control valve.
The model AGVB/AGVM top-guided single-seat control valve features accurate flow control performance and reduced cost. It has a new lighter valve body design and multi-spring loaded actuator and is 20% lighter and smaller than conventional models. Minimize space, installation costs, and maintenance are assured when you choose the valve.

Additionally, the flow shutoff performance equals that of an emergency shutoff valve. The valve thus plays a dual role in your process control, normal flow control and emergency shutoff of process fluid.

Unpacking and Inspecting Your Valve

Unpacking the Valve

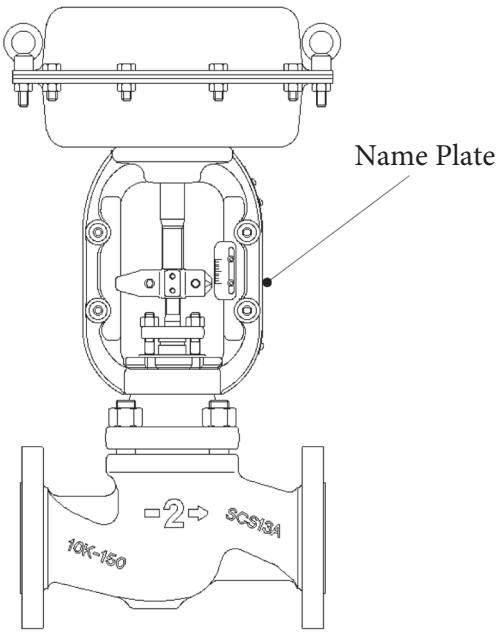
The valve is a precision instrument and should be handled with care to prevent damage or breakage.

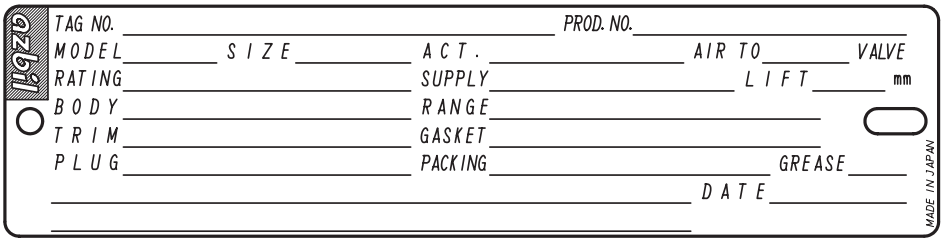
After unpacking the valve, verify that the following items are included:

- The valve
- Ordered accessories

Verifying the specifications

The specifications of your valve are written on an name plate attached actuator.





Name Plate

Enquiries

If you have any questions regarding the specifications of your valve, contact your nearest Azbil Corporation office or Azbil Corporation representative.

When making an enquiry, make sure to provide the model number and product number of your valve.

Storing your Valve

Precautions

An unused valve should be stored:

- indoors at normal temperature and humidity and in a place safe from vibration or shock.
- in the same condition and container as shipped.

Procedure

Used valves must be treated before storage using the following procedure:

Step	Action
1	Rinse the inside of the control valve body with water to remove residual fluids, then allow to dry. Anti-corrosive treatment is recommended for control valves with carbon steel bodies.
2	Attach waterproof caps or adhesive tape to air piping connections, electrical conduit connections of accessories to prevent moisture from entering.
3	Protect flange surface with flange-caps or other safeguards.
4	Store the valve indoors at normal temperature and humidity in a place safe from vibration or shock.

Table of Contents

Chapter 1. General Description

1-1. Scope

This manual contains the instructions for top-guided single-seated control valves (model AGVB/AGVM).

For the valve positioner instructions, refer to the following Operator's Manuals:

- OM2-8310-0200 (for model HTP)
- OM2-8313-0100 (for model HEP)
- OM2-8310-0410 (for model VPE)
- CM2-AVP300-2001 (for model AVP)

1-2. Major Components

Each control valve comprises two major components a valve body and an actuator. Combinations of valve body and actuator sizes, pressure ratings, types of materials, and actuator sizes are selectable according to process requirements.

1-3. Structures

A typical control valve is shown in Fig. 1-1.

The valve body is connected to the bonnet by stud bolts and nuts. Gaskets mounted between body and bonnet act as a seal for the internal fluid, making the valve body a pressure vessel.

The valve plug is supported by the guide bushing and driven by the actuator. The multi-spring actuator and a diaphragm convert the pneumatic control signal into a mechanical control action that positions the valve plug.

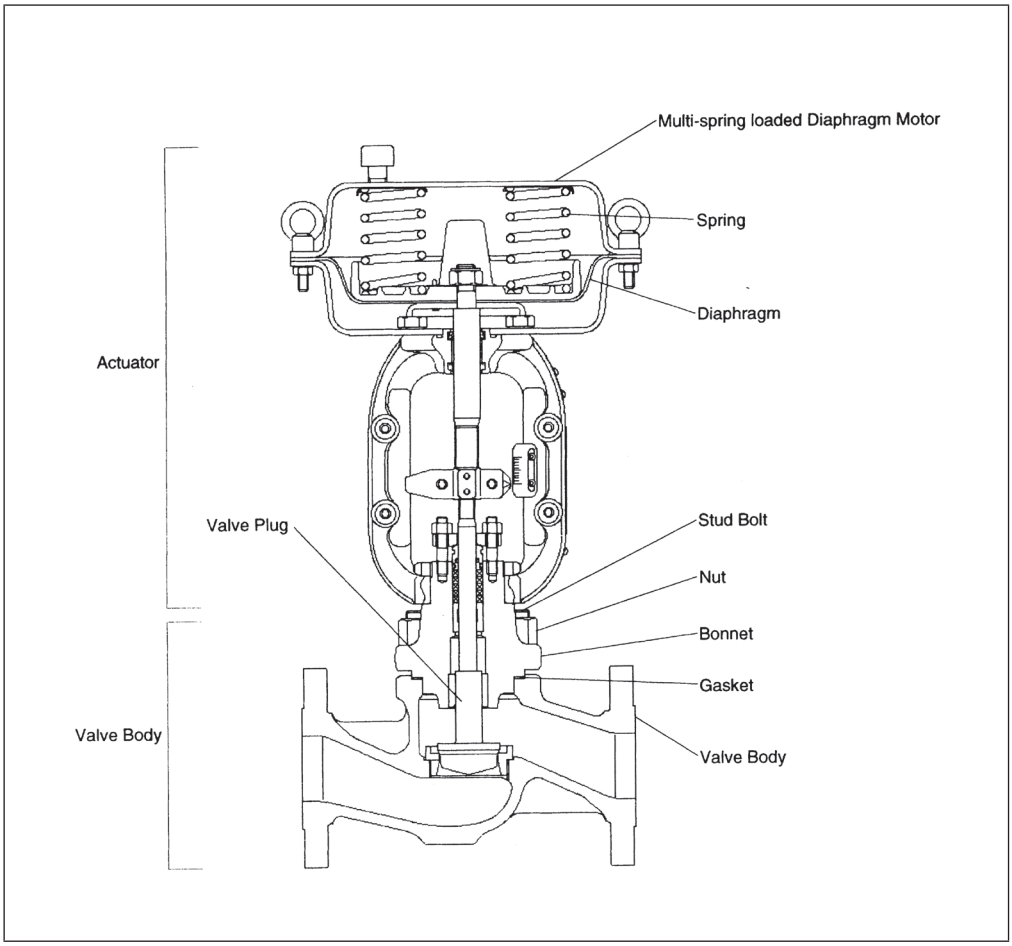


Fig. 1-1. Model AGVB/ABVM

Chapter 2. Installation

2-1. Maximum Lifting Loads of Eyebolts

The diaphragm case has a pair of eyebolts for lifting the valve. The allowable maximum lifting loads are shown in Table 2-1, so before moving the valve check that the total weight of the control valve (including accessories) is less than the total allowable maximum lifting load of the eyebolts.

Table 2-1. Maximum Lifting Loads of Eyebolts

Body size (inches)	Actuator model	Weight(kg) (Standard Bonnet)		Allowable maximum lifting load of eyebolts (kg)
		without handwheel	with side handwheel	
1/2, 3/4, 1	PSA1D, R	18	25	160
	PSA2D, R	21	28	
1-1/2	PSA1D, R	28	35	160
	PSA2D, R	31	38	
	PSA3D, R	51	78	
	PSA4D, R	69	96	220
2	PSA1D, R	29	36	160
	PSA2D, R	32	39	
	PSA3D, R	52	79	
	PSA4D, R	70	97	220
2-1/2	PSA3D, R	76	103	160
	PSA4D, R	94	121	220
	PSA6R	196	231	220 (Actuator only)
3	PSA3D, R	80	107	160
	PSA4D, R	98	125	220
	PSA6R	200	235	220 (Actuator only)
4	PSA3D, R	105	132	160
	PSA4D, R	123	150	220
	PSA6R	224	259	220 (Actuator only)

NOTE
When lifting a valve by its eyebolts, please use extreme care to prevent shock to either actuator or valve body.

2-2. Installing the Valve on a Process Pipe

(1) Before installing the valve, remove scales, welding chips or any other contaminants from both upstream and downstream sides of the process pipe.

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

(3) Ensure that the pipe connection gaskets do not intrude the process pipe.
Gasket materials suitable for the process fluid must be selected with care.

(4) Ensure that excessive stress is not transferred from the process pipe to the valve body.
Uniformly tighten the bolts on the process pipe connection flanges.

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

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

2-3. Check After Installation and Before Starting Operation

(1) Check for leakage from any air pipes.

(2) Check that the bolts and nuts on the diaphragm case are tight.

(3) Tighten the packing flange nuts to prevent leakage from the gland part. Standard tightening torques are shown in Table 2-2, 2-3, 2-4.

(4) Check for leakage at the process pipe.

Table 2-2. Tightening Torques of Packing Flange Nuts

Valve stem diameter (mm)	Yarn packing N·m {kgf/cm}	PTFE chevvron packing N·m {kgf/cm}
13	6 {62}	0.8 {8}
16	16 {163}	
30	34 {347}	

Note) These tightening toques are only reference values, and may vary depending on the packing used.

Table 2-3. Tightening Torques of packing Flange Nuts for PTFE yarn (Certified ISO 15848-1-compliant low-emission gland packing)

Actuator model	Stem size	Tightening torque
PSA2	ϕ 13 mm	11 N·m
PSA3, PSA4	ϕ 16 mm	25 N·m
PSA6R	ϕ 30 mm	54 N·m

Table 2-4. Tightening Torques of packing Flange Nuts for expanded graphite (Certified ISO 15848-1-compliant low-emission gland packing)

Actuator model	Stem size	Tightening torque
PSA2	ϕ 13 mm	11 → 0 (loosening) → 7 N·m
PSA3, PSA4	ϕ 16 mm	25 → 0 (loosening) → 17 N·m
PSA6R	ϕ 30 mm	54 → 0 (loosening) → 36 N·m

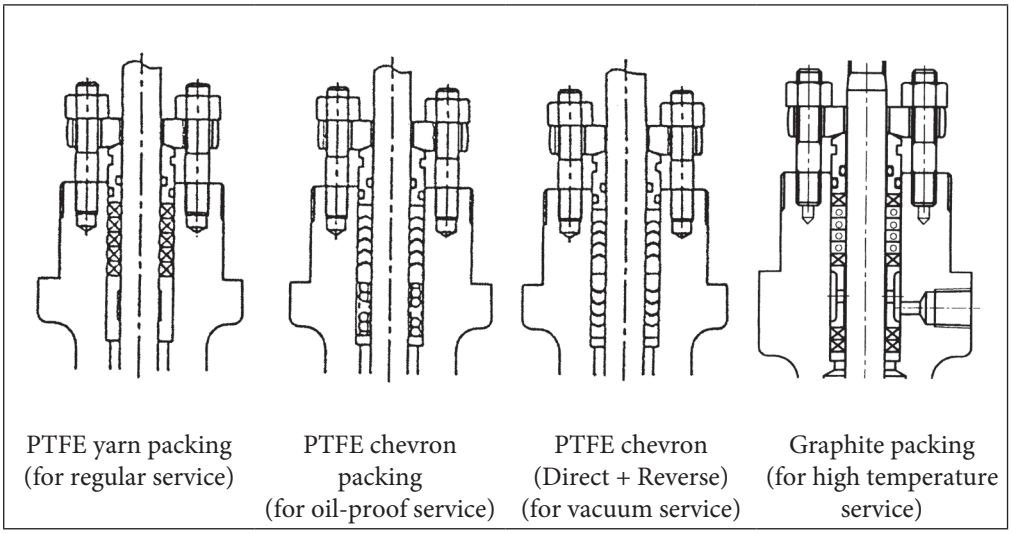


Fig. 2-1. Gland section

Chapter 3. Inspection and Maintenance

3-1. Inspection

Inspect and service the control valve as follows:

(1) Tightening the gland:

Tighten the gland approximately every 6 months. Follow the tightening procedures given in “2-3. Check After Installation and Before Starting Operation”.

(2) Check for valve position hunting. Refer to “Chapter 8. Trouble-shooting”.

(3) Check for abnormal noise and vibration. Refer to “Chapter 8. Trouble-shooting”.

Chapter 4. Disassembly and Assembly

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

4-1. Detaching Actuator from Valve Body

(1) Apply air pressure to the actuator so that the valve position pointer is at 10% to 20% over fully closed position.

(2) Loosen the clamping bolts on of the stem connector and remove it. Detach the actuator stem from the valve stem.

(3) Remove the yoke clamping nut.

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

⚠ CAUTION
(1) Before detaching the actuator from a valve that has already been installed on the process pipe, be sure to shut down the process and release the process pressure. (2) Ensure that the valve body is cool before detaching. (3) Loosen all process piping bolt and nuts so that excessive stress is not transferred to the eyebolts when detaching the control valve from the process pipe.

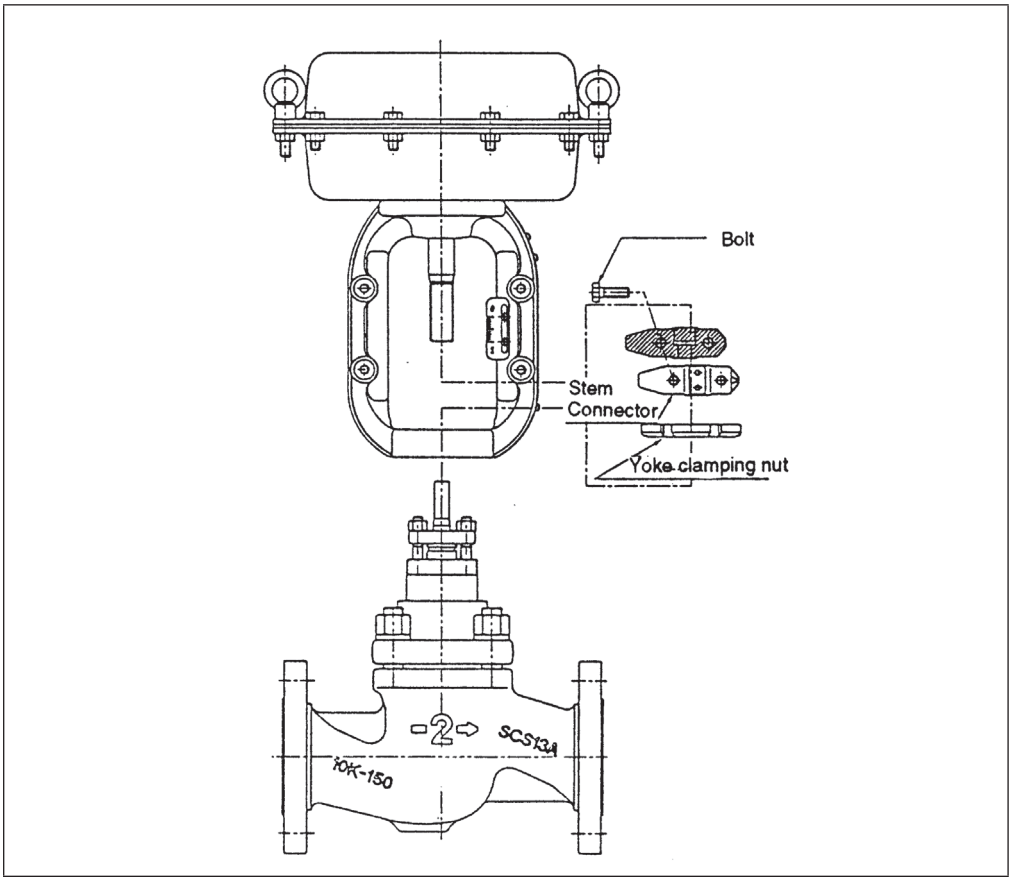


Fig. 4-1. Disassembling the actuator

4-2. Disassembly and Assembly of Valve Body

To disassemble or assemble the valve body, refer to Fig. 4-2. through Fig. 4-4. and proceed as described below.

Disassembly Procedure

(1) Loosen the hex nuts on the packing flange.

(2) Remove the hex nuts (1) on the bonnet.

(3) Raise and detach the bonnet from the valve body.

(4) A seat ring is threaded in to the valve body. To remove the seat ring special tools (available as an options) are required

⚠ CAUTION
If the valve plug comes out together with the bonnet, remove the plug from the bonnet by rotating the plug. When doing this, be careful not to damage the valve stem.

Inspection

Inspect the disassembled parts for damage before assembly. If any damage is found, replace the parts. When ordering parts, refer to the PROD. No. of the valve indicated on the nameplate.

(1) Do not reuse the gland packing once it has been removed, but use new packing when reassembling the valve. In case of vacuum service, verify the gland packing composition as shown in Fig. 2-1.

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

(3) Check that the gasket-contacting surfaces of valve body and bonnet are not damaged. Do not reuse the same gasket, but use a new gasket when reassembling the valve.

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

Assembly Procedure

(1) Securely fasten the seat ring onto the threaded valve body, using the special (optional) tools . For the tightening torque, see Table 4-1. Apply lubricant "Neverseize" to the threaded sections, except for oil free valves.

(2) Place the plug on the seat ring.

(3) Put the bonnet on the valve body and check that the bonnet is properly mated with the indented section of the valve body. Tighten the nuts alternately and evenly. For the tightening torque, see Table 4-2.

(4) Insert the gland packing as shown in Fig. 2-1.

Note) When yarn packing sheets are used, overlap the sheets so that their cut ends are alternately positioned.

(5) Install the packing follower and packing flange, and tighten the nuts. For the tightening torques, see Table 2-2.

(6) Check that the external O-Ring of the packing follower is installed to the bonnet gland box.

Table 4-1. Seat Ring Tightening Torques

Body size (inches)	Torque N·m {kgf/cm}
1/2, 3/4, 1	140 {1400}
1-1/2, 2	210 {2100}
2-1/2, 3	340 {3500}
4	590 {6000}

Table 4-2. Tightening Torque of Bonnet Stud Bolts.

Body size (inches)	Bolt size	Torque N·m {kgf/cm}
1/2, 3/4, 1	M10	140 {1400}
1-1/2, 2	M16	210 {2100}
2-1/2, 3	M16	340 {3500}
4	M16	590 {6000}

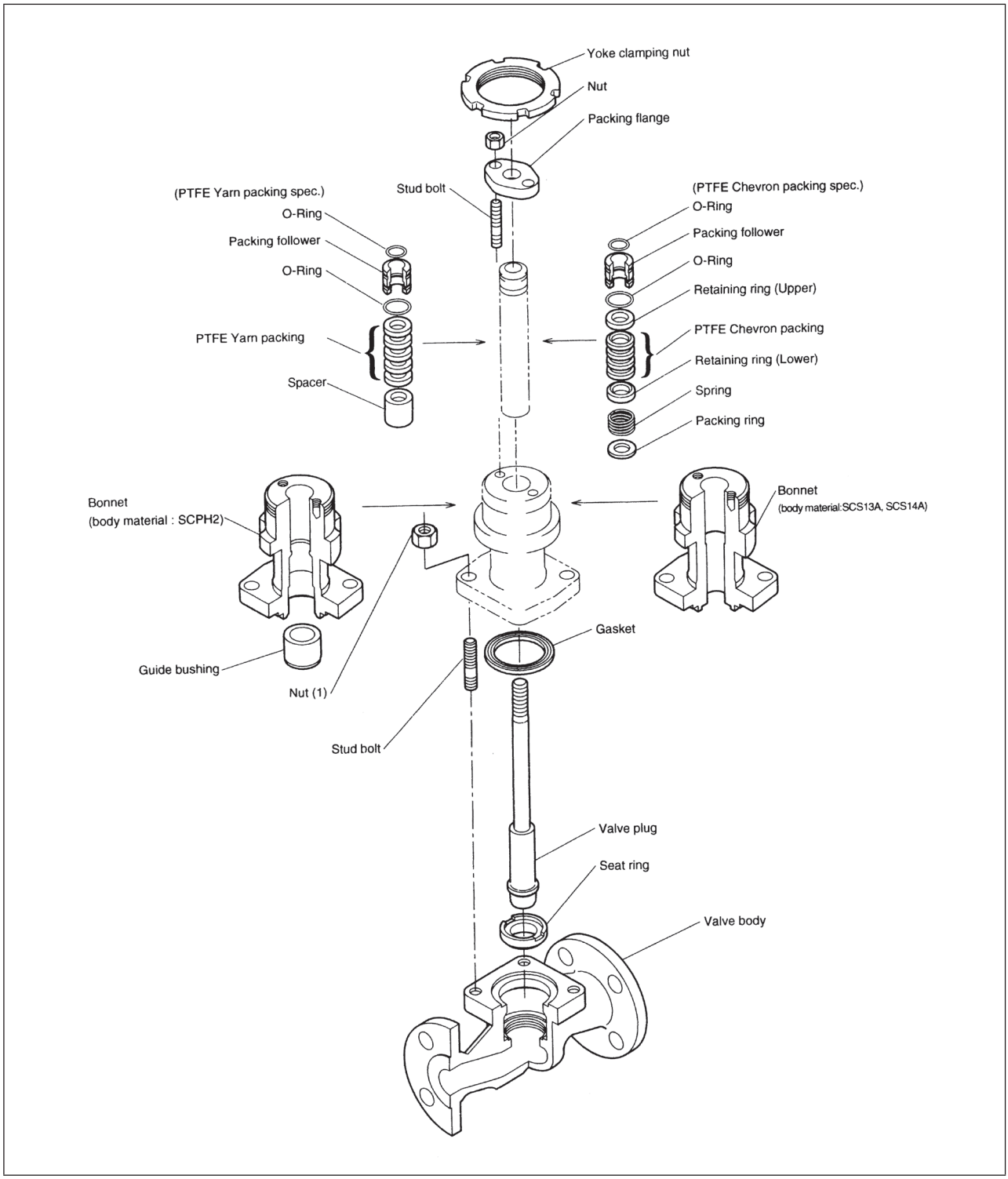


Fig. 4-2. Model AGVB Control Valve
(Available body sizes: 1/2 inches, 3/4 inches, 1 inch)

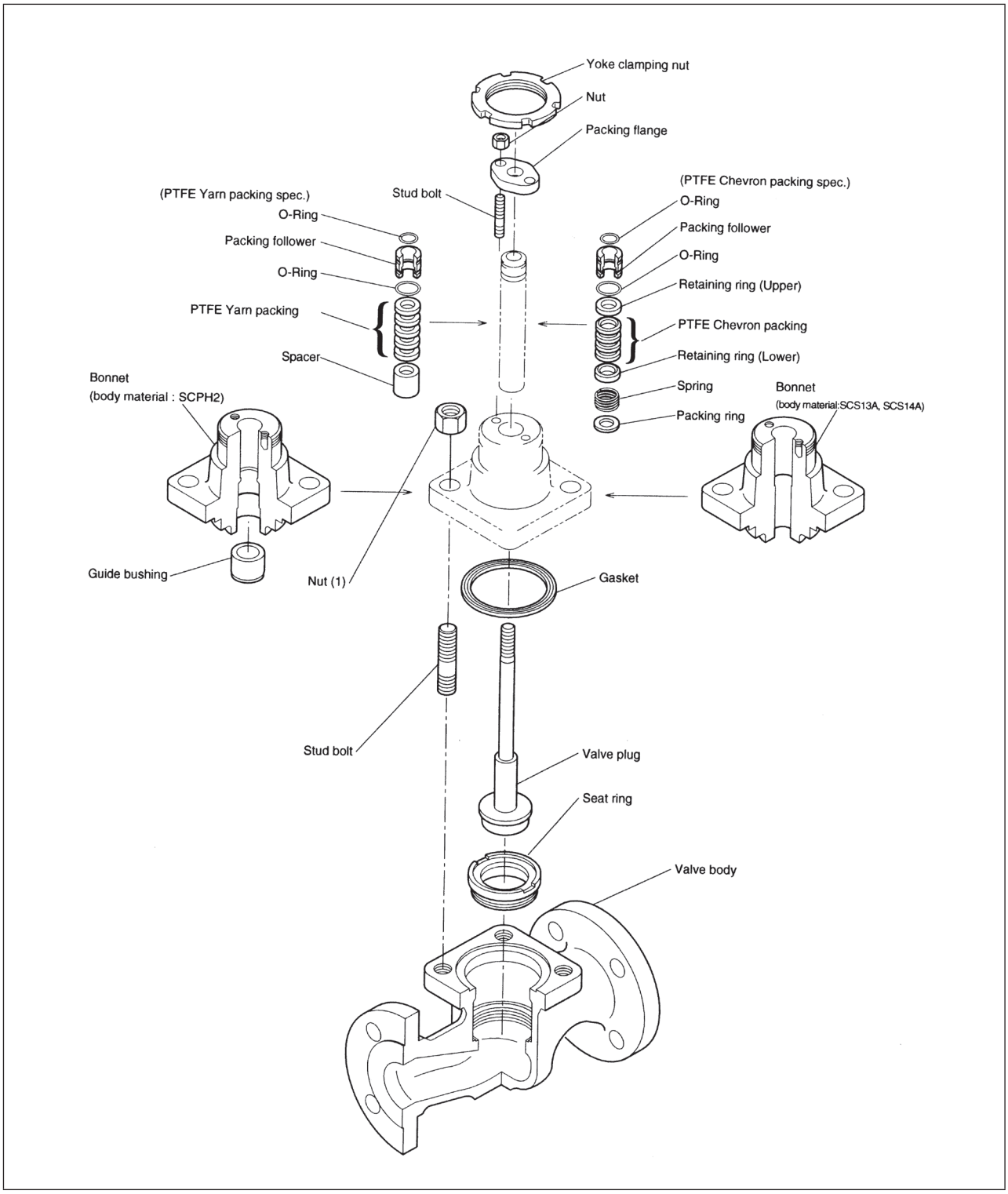


Fig. 4-3. Model AGVB Control Valve
(Available body sizes: 1-1/2 inches, 2 inches)

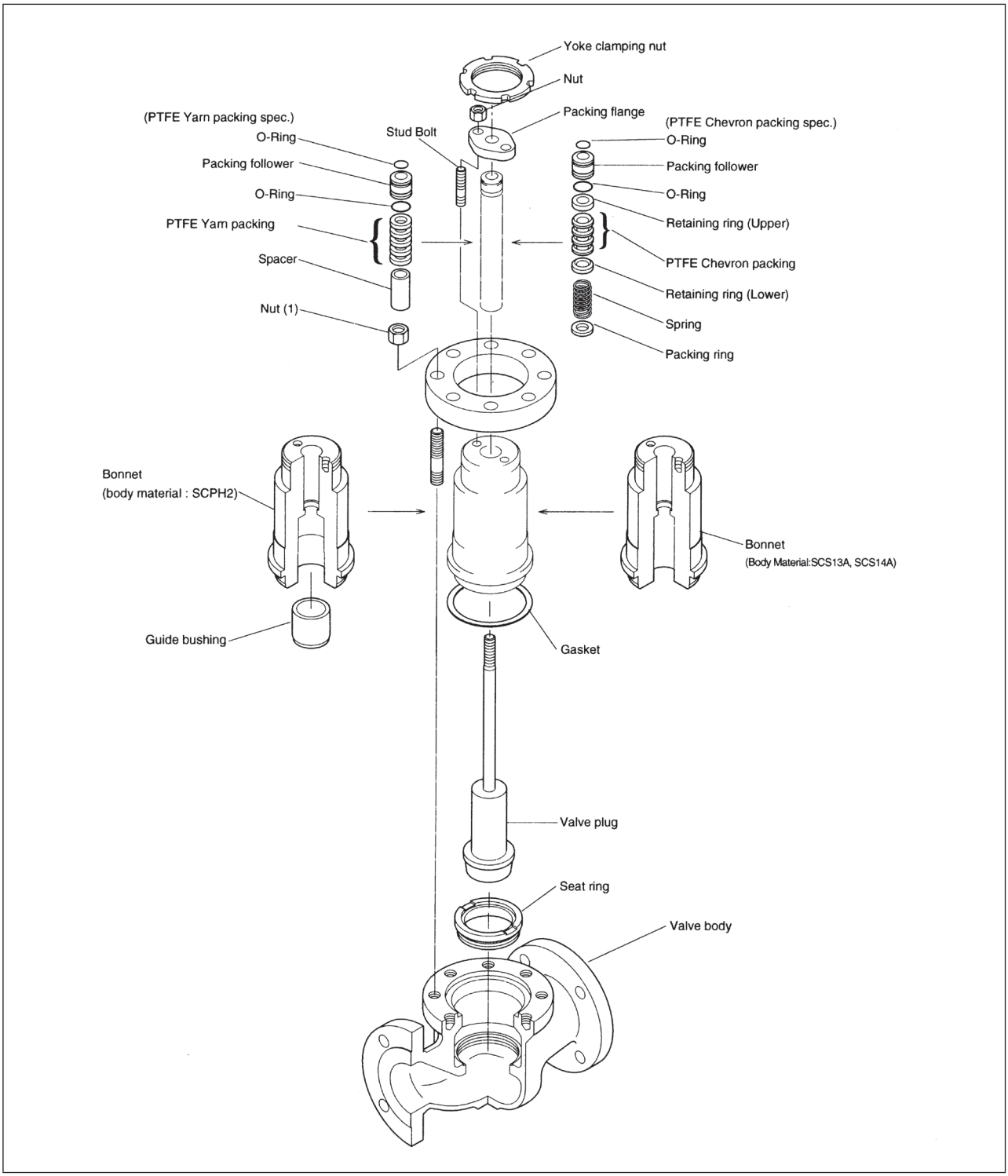


Fig. 4-4. Model AGVB Control Valve
(Available body sizes: 2-1/2 inches, 3 inches, 4 inches)

4-3. Disassembly and Assembly of Actuator

Normally, the actuator should require no adjustment. However, at certain times the actuator should be disassembled and reassembled. Reassembly is recommended when installing it on a valve body, when modifying its specifications, or when replacing damaged parts. The disassembly and reassembly procedures for the actuator in such cases are covered in subsections 4.3.1 and 4.3.2

Notes Before Disassembly

(1) Only the nuts for the eyebolts are made of stainless steel. Keep these nuts separate from the other nuts when assembling the diaphragm case.

(2) Make locating marks on the top and bottom diaphragm cases before disassembling the valve. This will help you to easily find the air piping connector location.

(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 injuries or other damage. When removing the bolts and nuts, be sure to closely follow the instructions given for disassembly and assembly procedures of the actuator and top handwheel.

4-3-1. Disassembly and Assembly of Model PSA 1, 2, 3, 4

Disassembly Procedure

A. Direct Action model (see Fig. 4-5**. or** Fig. 4-6**.)**

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

(2) Remove the stem connector.

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

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

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

(6) Take out the springs.

B. Reverse Action model (see Fig. 4-7**. or** Fig. 4-8**.)**

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

(2) Remove the stem connector.

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

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

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

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

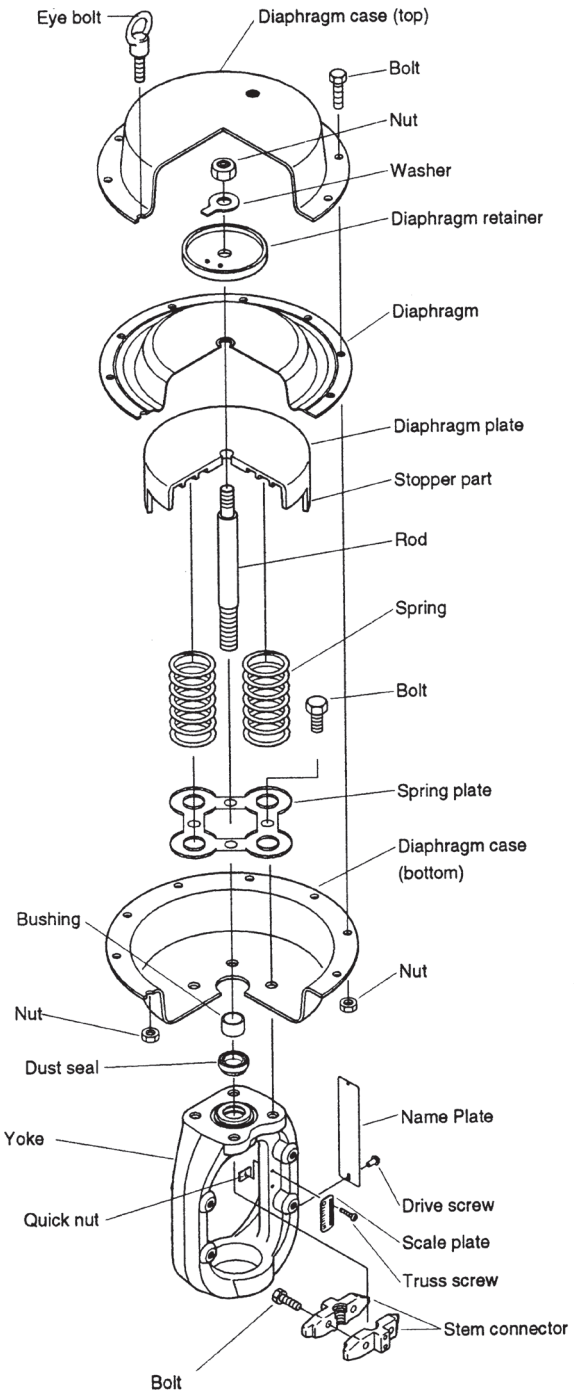


Fig. 4-5. Direct Action model
(Model PSA1D, PSA2D)

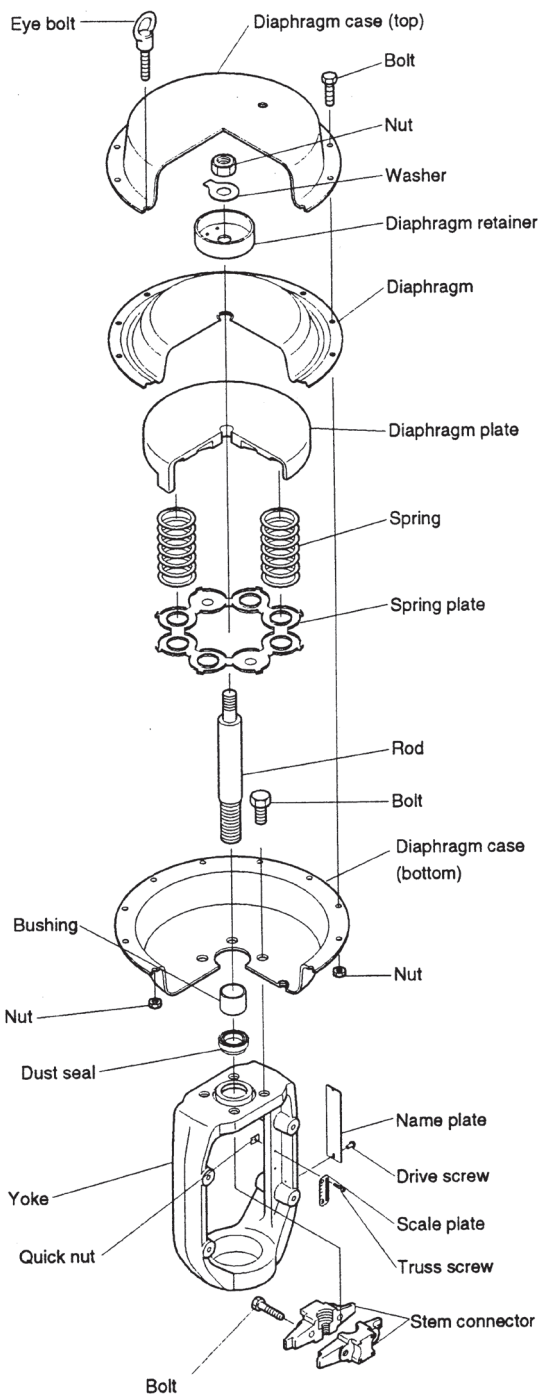


Fig. 4-6. Direct Action model
(Model PSA3D, PA4D)

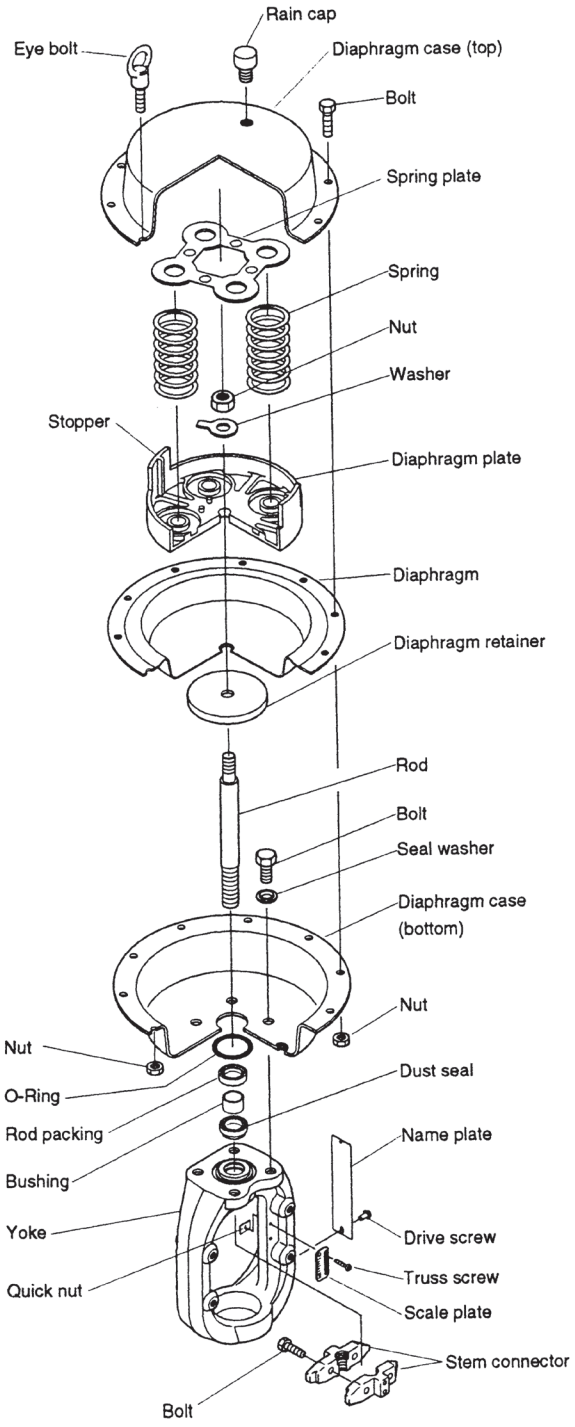


Fig. 4-7. Reverse Action model
(Model PSA1R, PSA2R)

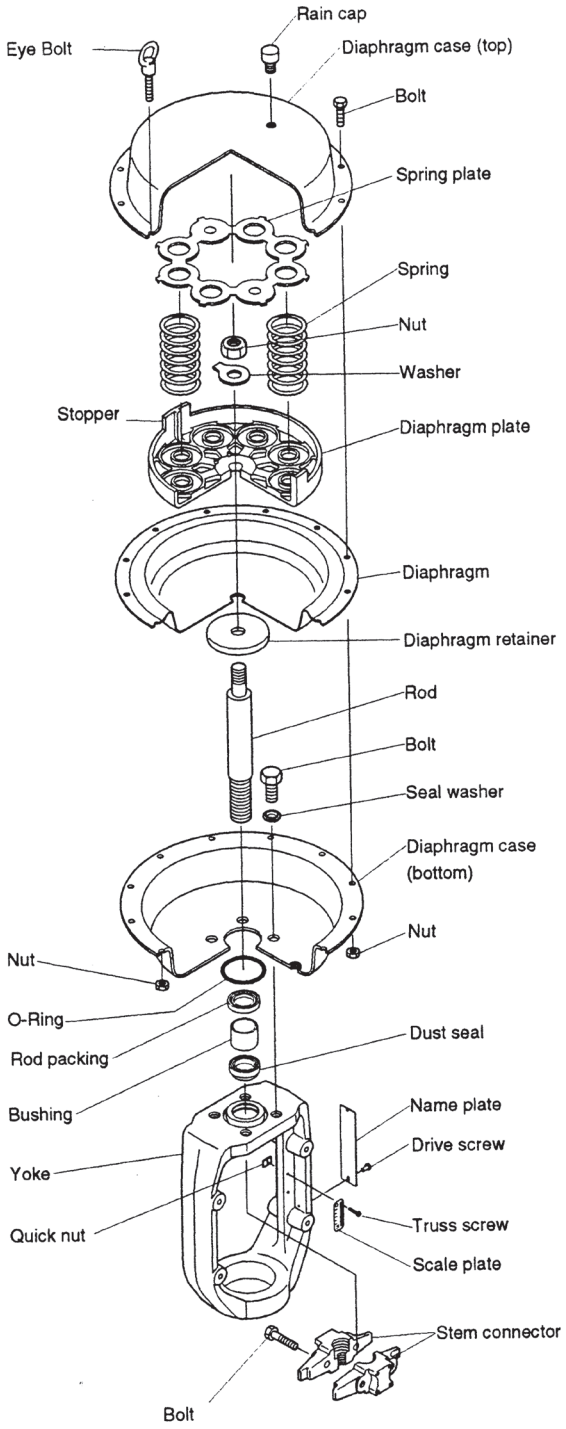


Fig. 4-8. Reverse Action model
(Model PSA3R, PSA4R)

Assembly Procedure

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

A. Direct Action models

■ See Fig. 4-5. and Fig. 4-6.

(1) Secure the diaphragm case (bottom) with the four bolts to the yoke. At the some time, set the air vent hole as shown in Fig. 4-9. and Fig. 4-10. For PSA1D and PSA2D actuators, secure the spring plate to the diaphragm case and yoke.

(2) Fasten the spring plate and install springs in the spring plate (see Fig. 4-9. and Fig. 4-10.)

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

(4) Rotate the actuator rod, locating the diaphragm plate stopper as shown in Fig. 4-9. and Fig. 4-10.

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

Notes) Set the air pipe connection port in the location shown in Fig. 4-9. and Fig. 4-10. Tighten the pair of eyebolts uniformly and alternately. The initial setting of the springs is completed by tightening these eyebolts.

(6) Clamp the diaphragm case with clamping bolts.

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

(8) After completing assembly, check the following:

■ Apply air pressure of 490kPa{5 kgf/cm^2} through the air pipe connection port in the top diaphragm case, and check the diaphragm periphery for air leakage with soapy water.

■ Check that the actuator operates smoothly through its full stroke by operating it as an independent unit.

⚠ CAUTION
Install packing for the rod and dustseal in the correct direction. Refer to Fig. 4-5. and Fig. 4-6.

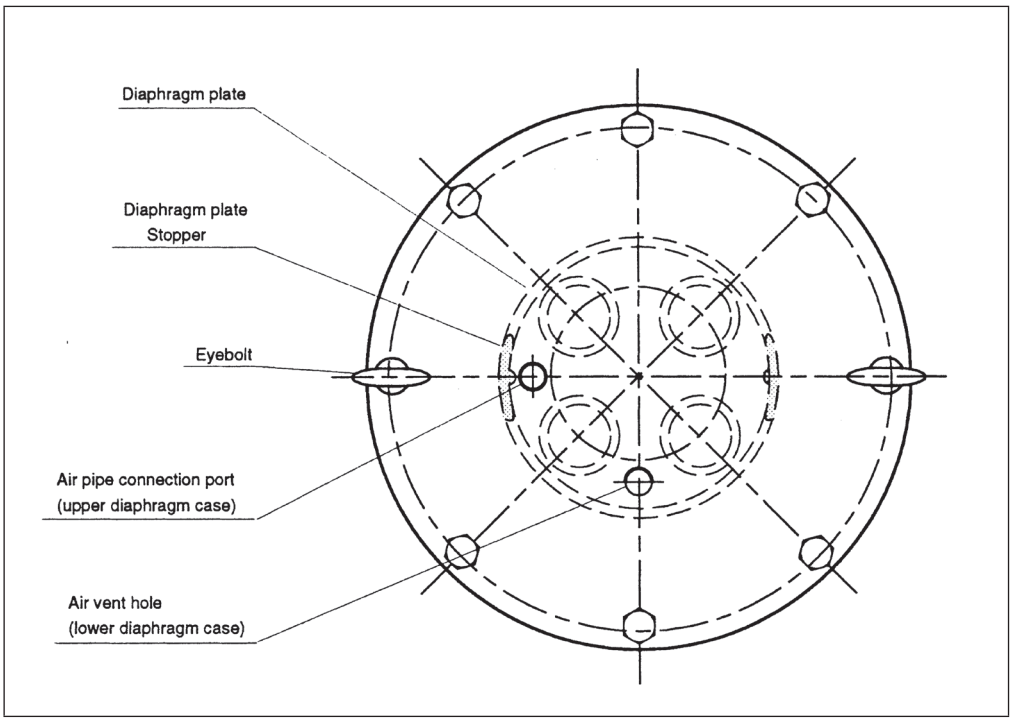


Fig. 4-9. Direct Action models: Model PSA1D Actuator

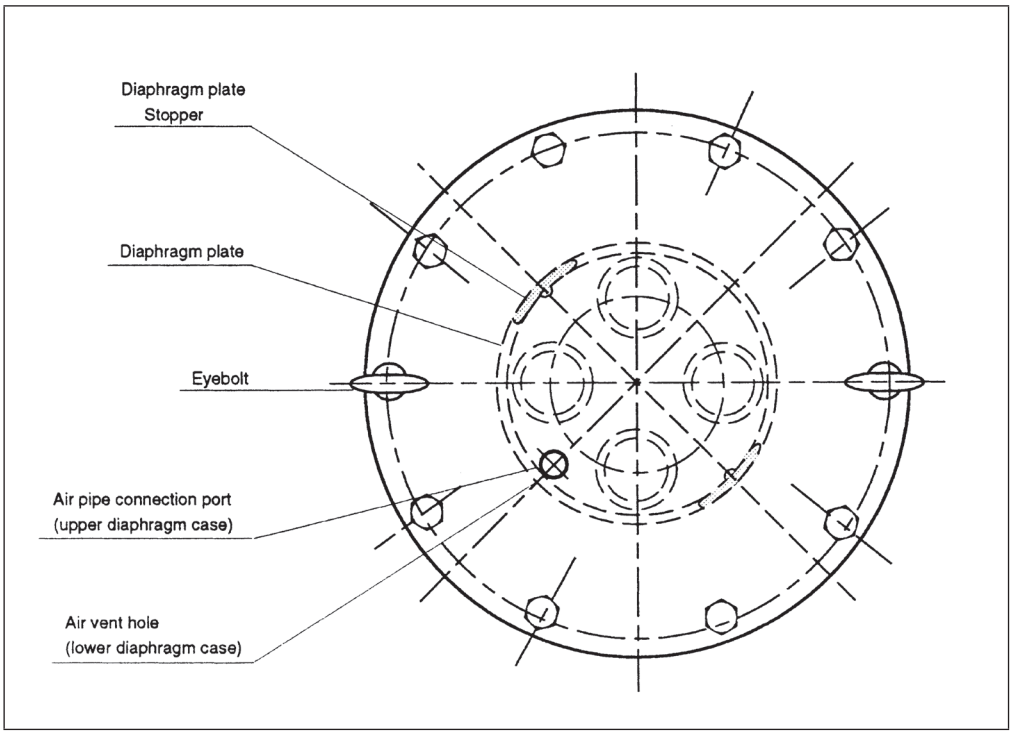


Fig. 4-10. Direct Action models: Model PSA2D Actuator

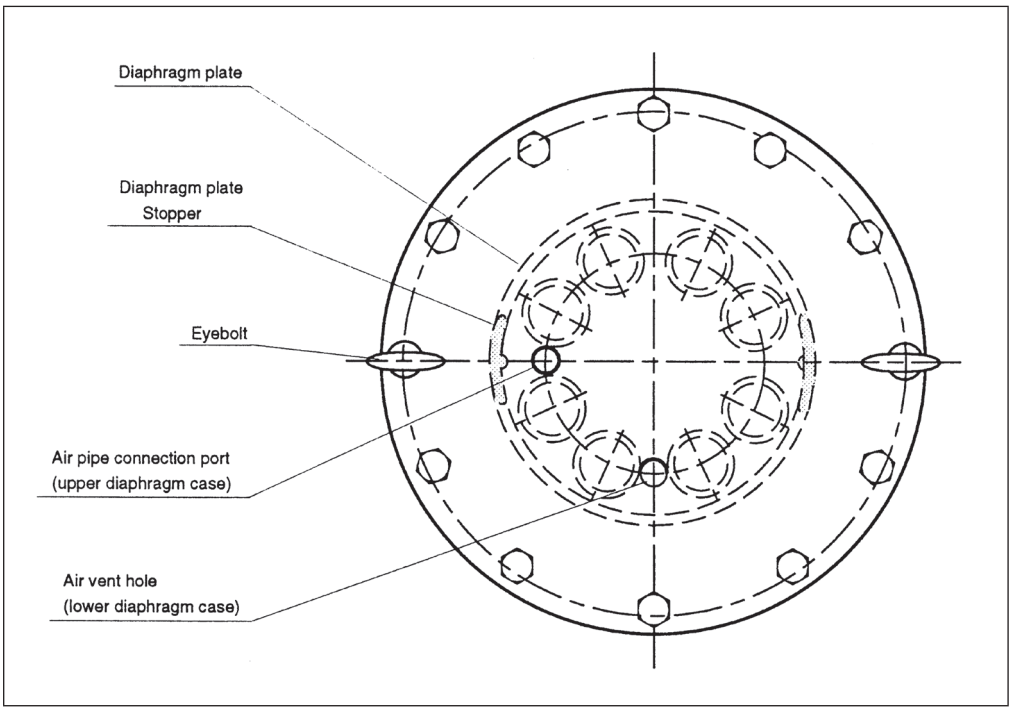


Fig. 4-11. Direct Action models: Model PSA3D Actuator

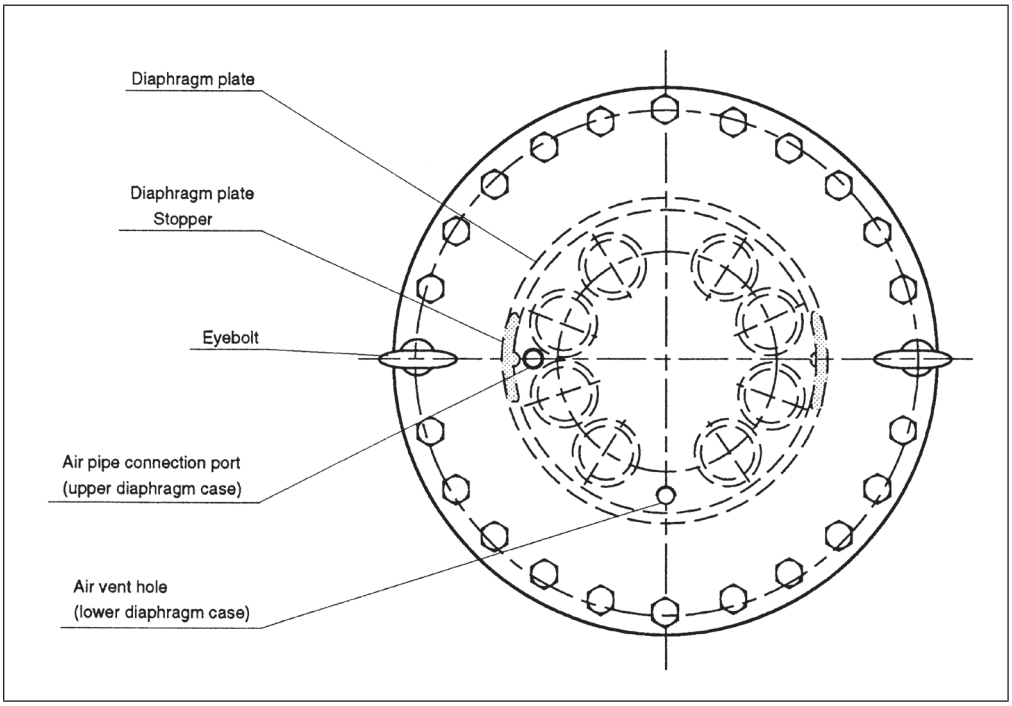


Fig. 4-12. Direct Action models: Model PSA4D Actuator

A. Reverse Action models

■ See Fig. 4-7. and Fig. 4-8.

(1) Secure the bottom diaphragm case with the four bolts to the yoke. At the same time, set the air pipe connection port in the location shown in Fig. 4-13. and Fig. 4-14.

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

(3) Rotate the actuator rod, locating its diaphragm plate stopper as shown in Fig. 4-13. and Fig. 4-14.

(4) Fasten the spring plate and install springs in the spring plate (see Fig. 4-13. and Fig. 4-14).

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

Notes) Set the air vent hole in the location shown in Fig. 4-13. and Fig. 4-14. Uniformly and alternately tighten the eyebolts. The initial setting of the springs is completed by tightening these eyebolts.

(6) Clamp the diaphragm case with clamping bolts.

(7) Install the stem connector.

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

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

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

■ Apply air pressure of 490kPa{5kgf/cm^2} through the air pipe connection port in the bottom diaphragm case, and check the diaphragm periphery for air leakage with soapy water.

■ Check that the actuator operates smoothly through its full stroke by operating the actuator as an independent unit.

⚠ CAUTION
Install packing for the rod and dustseal in the correct direction. Refer to Fig. 4-7. and Fig. 4-8.

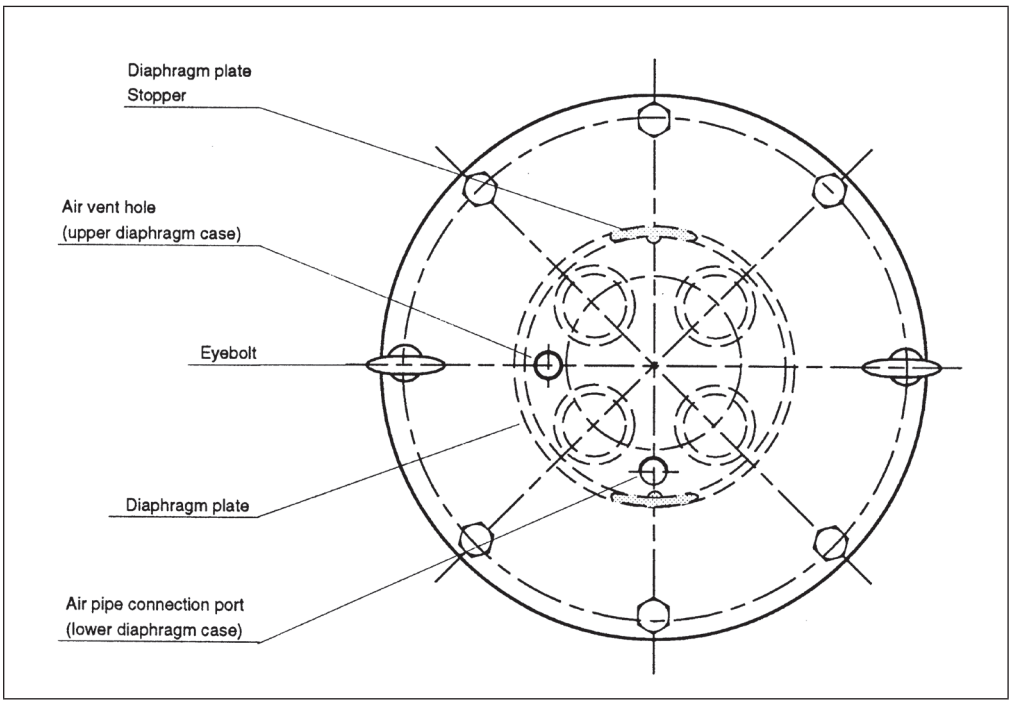


Fig. 4-13. Reverse Action models: Model PSA1R Actuator

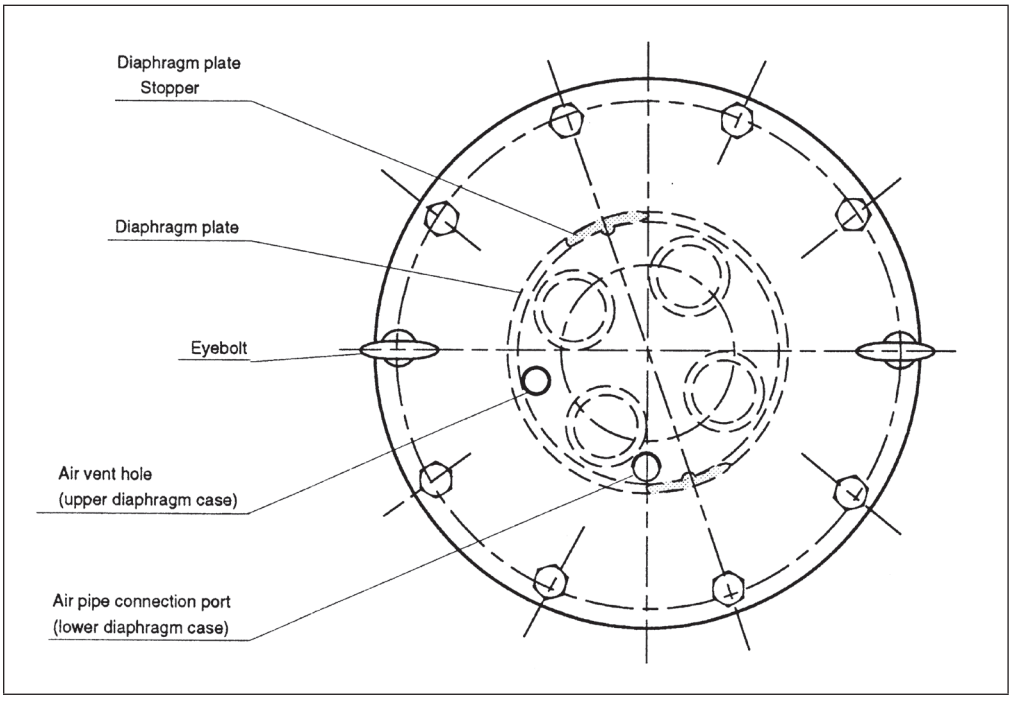


Fig. 4-14. Reverse Action models: Model PSA2R Actuator

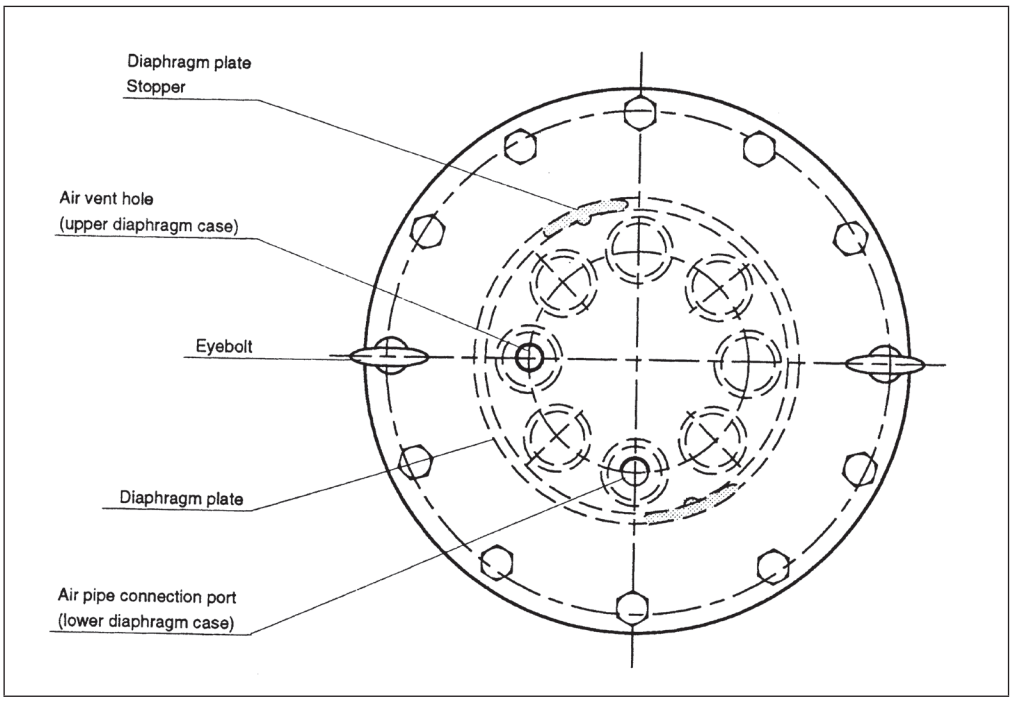


Fig. 4-15. Reverse Action models:Model PSA3R Actuator

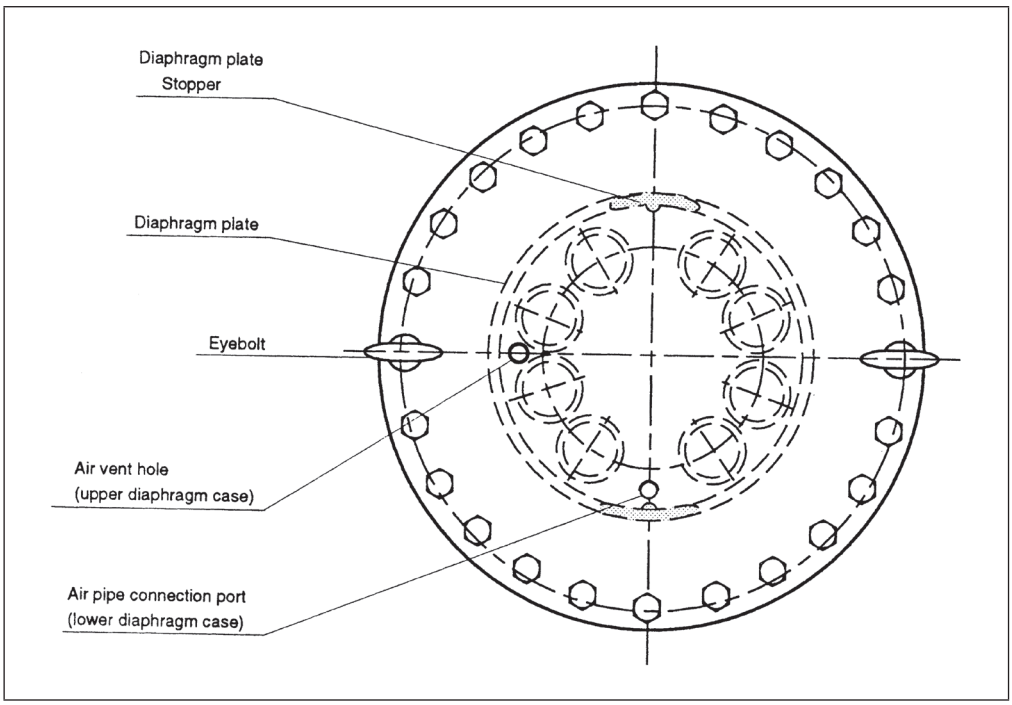


Fig. 4-16. Reverse Action models:Model PSA4R Actuator

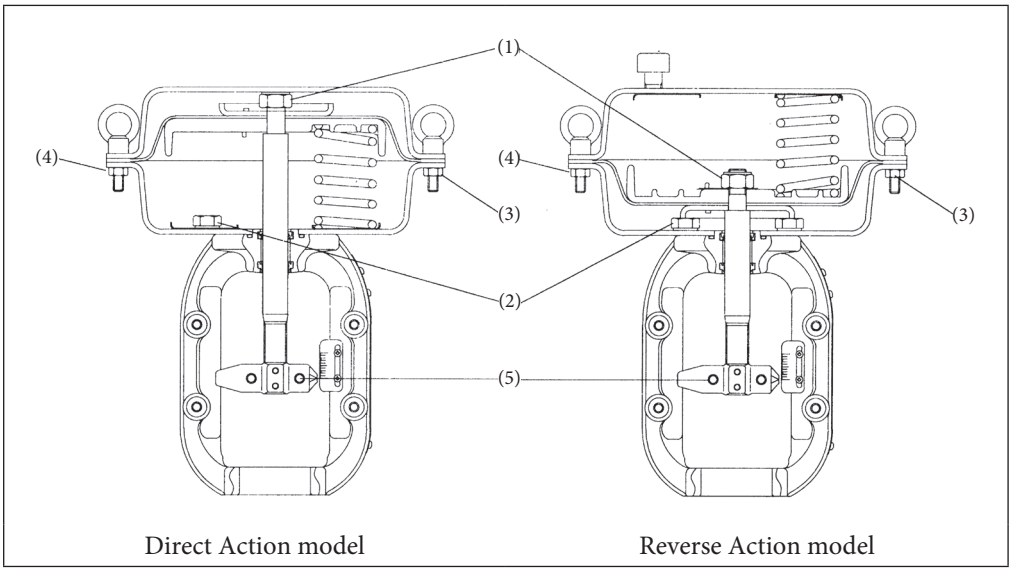


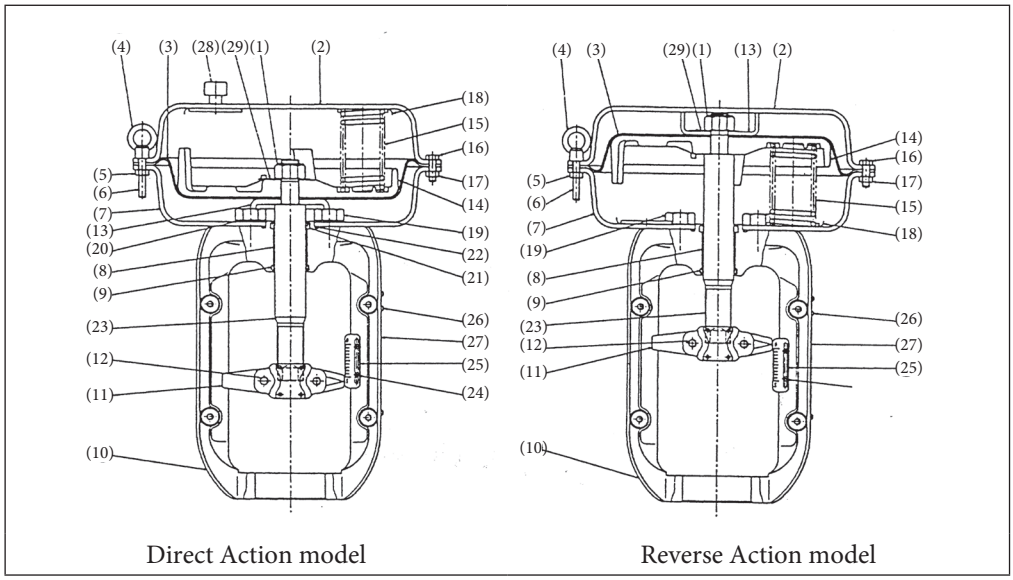
Fig. 4-17. Bolts and Nuts of Actuator

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

[N·m {kgf/cm}]

Key No.	Material	Model PSA1, 2		Model PSA3		Model PSA4	
(1)	S45C SK5	M14	45 to 70 {460 to 710}	M20	160 to 215 {1,600 to 2,200}	M20	265 to 358 {2,700 to 3,650}
(2)	S30C	M12	35 to 50 {360 to 510}	M16	90 to 120 {920 to 1,220}	M16	90 to 120 {920 to 1,220}
(3)	SUS304	M8	15 to 20 {150 to 200}	M8	15 to 20 {150 to 200}	M12	50 to 60 {510 to 610}
(4)	SUS304	M8	15 to 20 {150 to 200}	M8	15 to 20 {150 to 200}	M12	50 to 60 {510 to 610}
(5)	SUS304	M8	15 to 20 {150 to 200}	M10	50 to 60 {510 to 610}	M10	50 to 60 {510 to 610}

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



Direct Action model Reverse Action model

Fig. 4-18. Model PSA Actuator

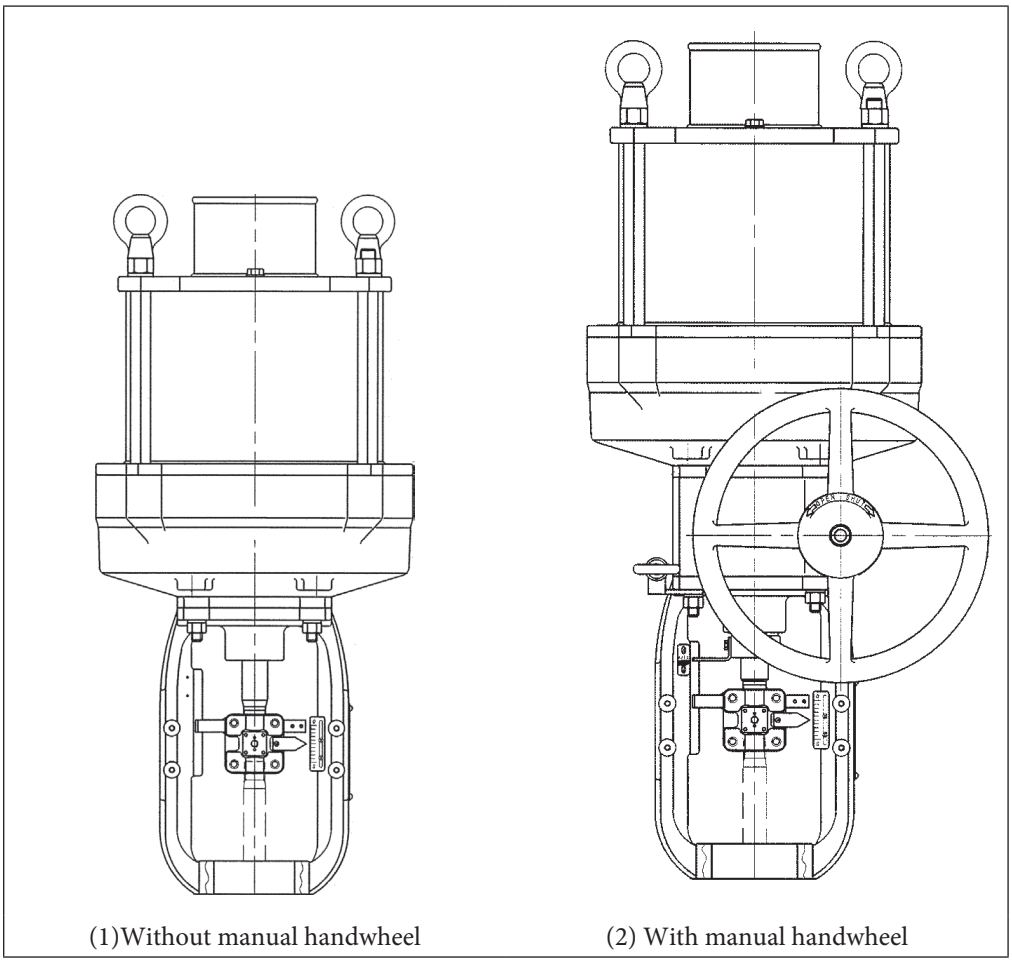
No.	Item	Material
(1)	Nut	S45C, SK5
(2)	Diaphragm case (top)	SAPH370
(3)	Diaphragm	EPDM, Polyaimid
(4)	Eyebolt	SUS304
(5)	Nut	SUS304
(6)	Bolt	SUS304
(7)	Diaphragm case (bottom)	SAPH370
(8)	Bushing	SPCC, bronze, PTFE
(9)	Dust seal	NBR
(10)	Yoke	A216WCB
(11)	Stem connector	SCS13A
(12)	Bolt	SUS304
(13)	Diaphragm retainer	SS400
(14)	Diaphragm plate	AC4A/AC4C
(15)	Spring	SWOSM-B/SWOSC-V
(16)	Bolt	SUS304
(17)	Nut	SUS304
(18)	Spring plate	SUS304CP
(19)	Bolt	S30C
(20)	Seal washer	NBR, SPCC
(21)	Packing for rod	NBR
(22)	O-Ring	NBR
(23)	Rod	SUS304
(24)	Truss screw	SUS304, SK5
(25)	Scale plate	SUS304
(26)	Drive screw	SUS304
(27)	Name plate	SUS304
(28)	Rain cap	SUS304
(29)	Washer	SUS304

4-3-2. Disassembly and assembly of Model PSA6 Actuator

1. General

Structure

This actuator consists of cylinder, spring unit, lift stopper, spring retainer, hexagon stay, yoke, manual handwheel and single action positioner.
For external appearance of the actuator, refer to Fig. 4-19, External Appearance of PSA6R.



(1)Without manual handwheel (2) With manual handwheel

Fig. 4-19. Exterior of PSA6R

Assembly on valve body

Assembling nuts integral to the valve body assembles yoke and valve body.
Stem connector connects actuator's rod and valve stem.

Air piping connection

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

Pneumatic positioner (Model HTP)	No. OM2-8310-0200
Electro-pneumatic positioner (Model HEP)	No. OM2-8310-0100
Electro-pneumatic positioner (Model AVP300/301)	No. CM2-AVP300-2001

Calibration

This actuator does not need calibration.
When connecting valve stem of the valve body with actuator's rod with stem connector, due adjustment should be made to seat the valve plug on the seat ring. Then screws on actuator's scale plate are loosened, stroke and index matched to properly position the scale plate.

Caution in operation and handling

⚠ CAUTION
• When automatically operating an actuator with manual handwheel, verify that the AUTO/MANUAL switchover pin is inserted into pin holder, chain is engaged on the handwheel and the indicator is in AUTO position before start of operation. • When disassembling and assembling, always hold the actuator in upright position (spring unit on top and yoke on bottom) • While eyebolts are used to suspend actuator, assembled valve should not be suspended by eyebolts only

2. AUTO/MANUAL switchover of manual handwheel

Refer to Fig.4-20 for details of AUTO/MANUAL switchover of handwheel.
With an actuator with AUTO/MANUAL switchover functions, switchover between automatic operation and manual operation by handwheel are available.
AUTO/MANUAL switchover can be made at any optional moment during operation.

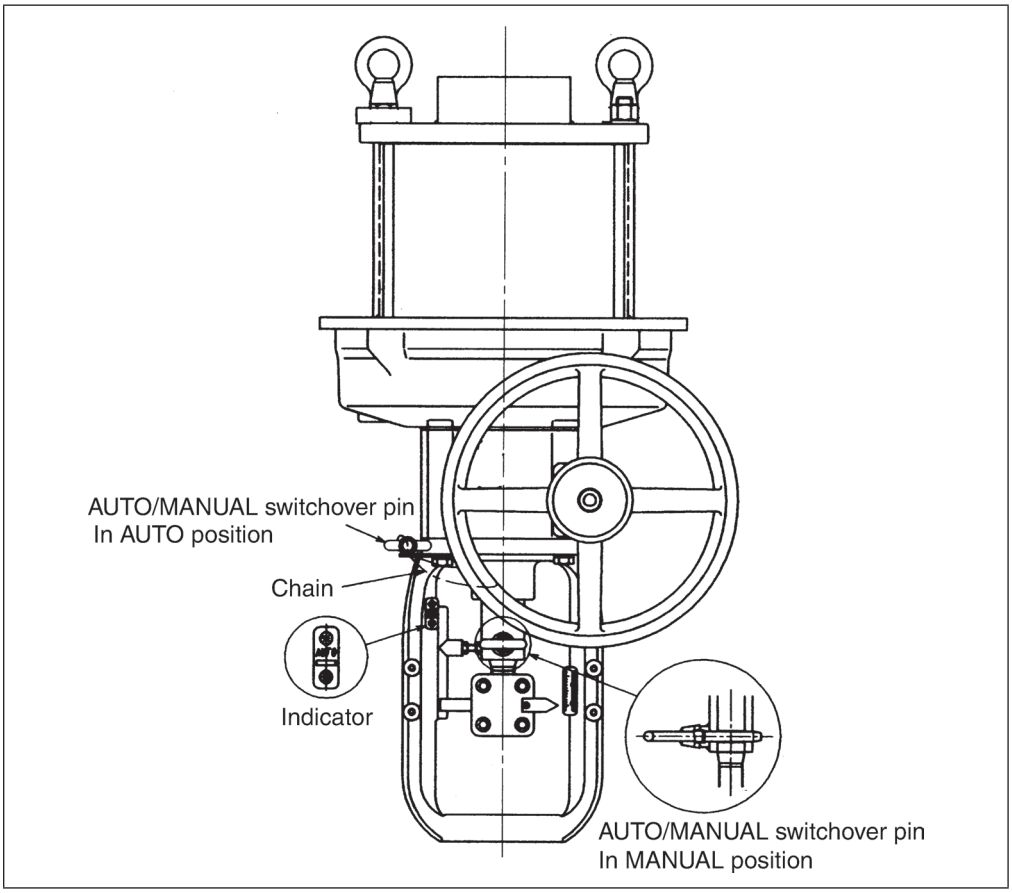


Fig. 4-20. AUTO/MANUAL switchover scheme

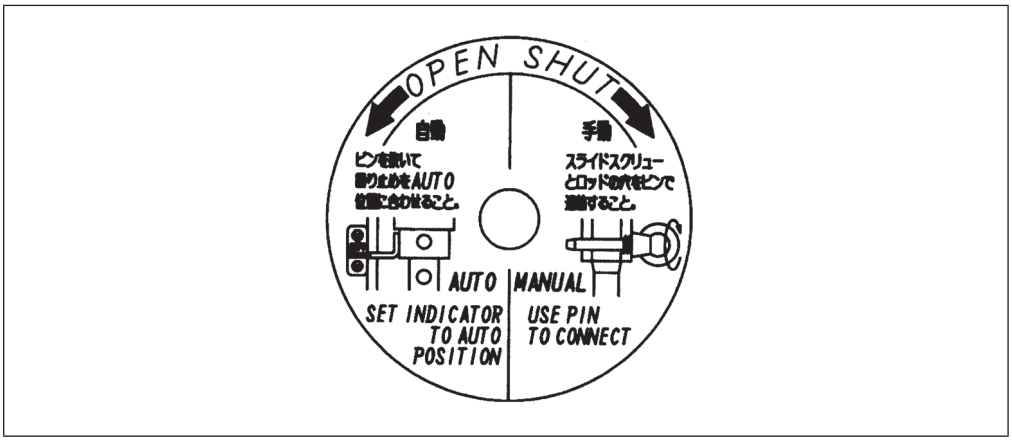
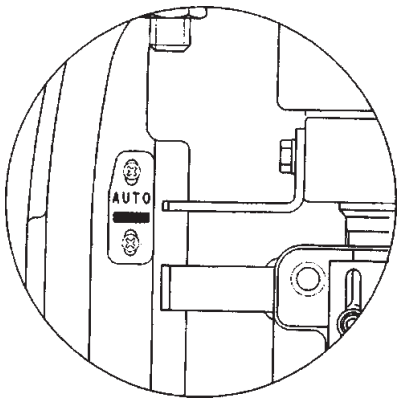


Fig. 4-21. Operator's instruction label

Step	Procedure
1	Pull out AUTO/MANUAL switchover pin out of holder and disengage chain, which binds handwheel from the wheel.
2	Verify operating label on handwheel and turn the handle to thedirec tion of SHUT and lower slide screw.
3	Match the round holes of slide screw and actuator's rod, and insert pin. Push it all the way in and fix it there.
4	Verify OPEN, SHUT arrows on label, and turn the handwheel to either direction to open or close the valve. The turning torque should be under 127N (13kgf)
5	When the handwheel does not turn any further, check valve opening and end operation. **⚠ CAUTION** Do not apply undue force on valve when it reaches mechanical stop. Otherwise valve stem may be damaged. Refer to page 8-1, "Chapter 8. Trouble-shooting"for remedial action.
6	To resume automatic operation, remove the switchover pin, turn handwheel until the slide screw stop reaches AUTO position (refer to Fig. 4-22 below). Run the chain on the pin through in order to restrict handwheel movement and fix the pin on holder. Resume automatic operation after verifying this condition.  Fig. 4-22.

3. Disassembly and assembly of actuator

Disassembly and assembly procedures are described herein. Refer to it whenever necessary for periodic maintenance or malfunction which may call for disassembly or assembly of the actuator.

Before disassembly

(1) Only the nus for the eye bolts are made of stainless steel. Keep these nuts separate from the other nuts when assembling the diaphragm case.

(2) Make locating marks on the top and bottom diapragm cases before disassembling the valve. This will help you to easily find the air piping connector location.

(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 injuries or other damage. When removing the bolts and nuts, be sure to closely follow the instructions given for disassembly and assembly procedures of the actuator and top hand wheel.

Detaching Actuator from Valve Body

Refer to “4-1. Detaching Actuator from Valve Body”, page 4-1.

Disassembly of actuator

<disassembly procedure>
Disassembly procedure of actuator is described herein.
Refer to and Fig. 4-23. and Fig. 4-24. or Table 4-4 for information.

(1) Marking and protection

Step	Procedure
1	Match mark on spring retainer on the top of actuator, lift stopper, cylinder and cylinder assembling yoke boss.
2	Wrap PVC tape on rod bushing to protect sealing parts, guide bushing.

≠ Removing slide screw detent

Step	Procedure
1	Loosen hexagon head bolt No.50 and hex nuts No.51 which fasten slide screw detent No.49
2	Remove slide screw detent No.49

(3) Removing spring retainer

Step	Procedure
1	Loosen hexagon nuts No.2 and eye nut No.1 on the top of actuator and remove.
2	Lift spring retainer No.17 straight up and remove.

✓ Removing lift stopper and spring unit

Step	Procedure
1	Loosen hexagon stay No.4, No.9 (four stays) which fasten lift stopper No.20 and cylinder No.21 and remove
2	Raise lift stopper No.20 straight up and remove.
3	Install eyebolts on threaded holes on the spring retainer No.59 which is located on the top of spring unit (M12 x 2) and lift spring unit (approximately 120 kg) up with a crane.
4	While suspended by crane, remove piston's No.57 sealing parts (tape liner No.7, O-ring No.8)

(5) Removing slide screw and cylinder

Step	Procedure
1	Turn slide screw No.34 by hand and extract from the bottom
2	Loosen hexagon head bolts No.12 (four bolts) which fasten cylinder and manual handwheel and remove.
3	Lift cylinder up straight and remove.

≈ Removing worm unit

Step	Procedure
1	Remove in the sequential order of bearing holder No.27, single column angular bearing, (upper) No.32, worm wheel No.33, and single column angular bearing (lower) No.32.
2	Loosen hexagon head bolts No.12 (four bolts), which fasten gear, case No.30 and yoke and remove.

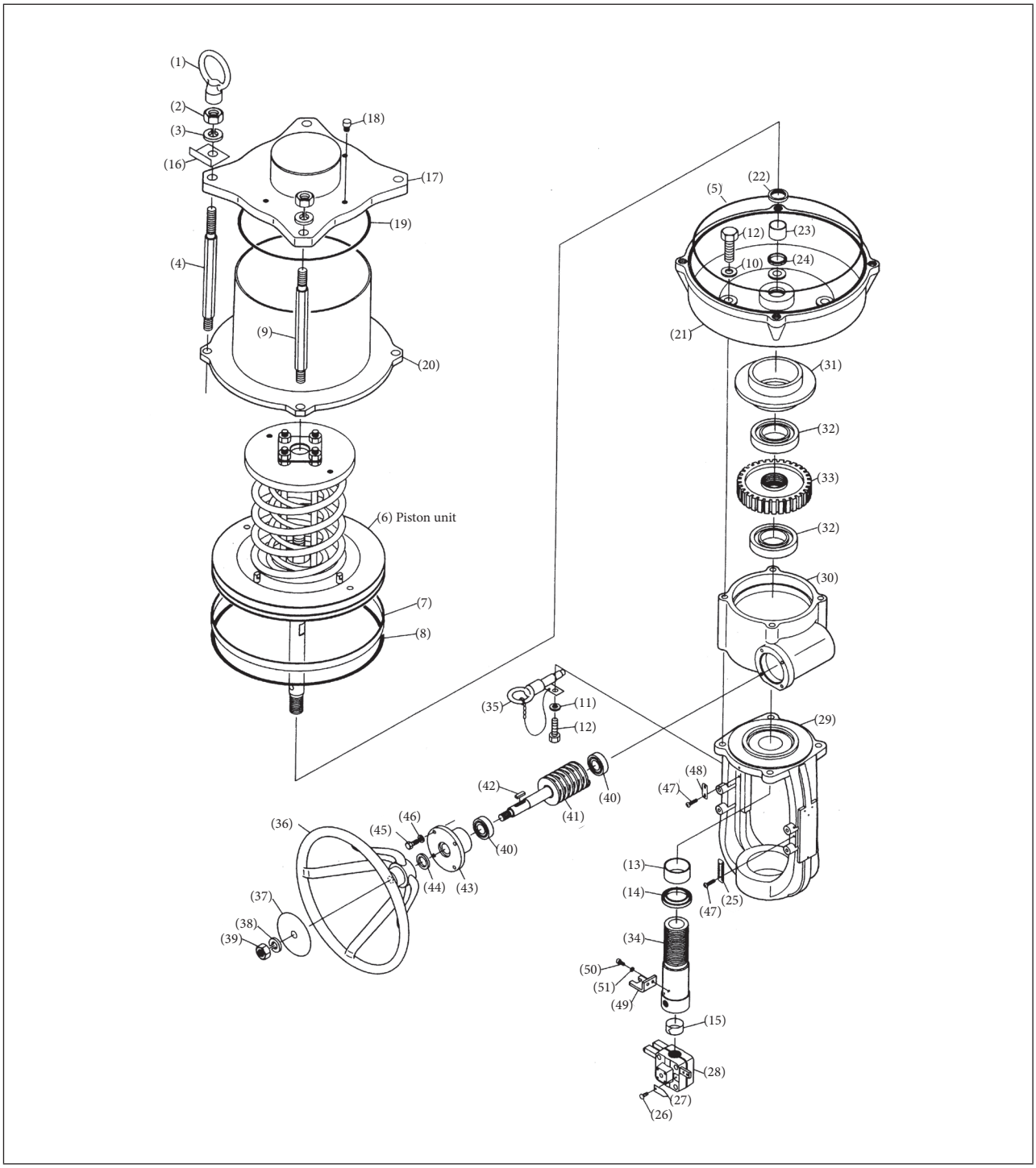


Fig. 4-23. Model PSA6R

Table 4-4. Parts reference List

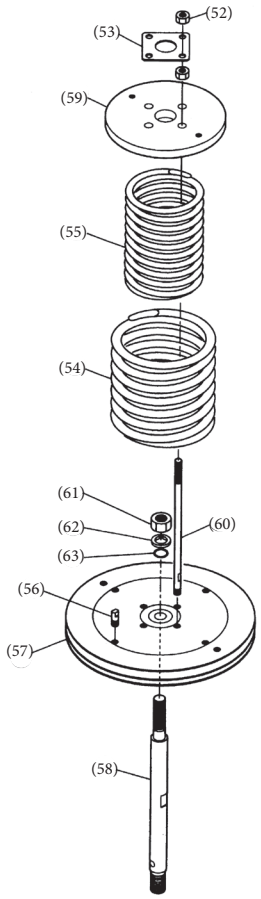


Fig. 4-24. Spring Unit

No.	Parts description	No.	Parts description
(1)	Eye nut	(33)	Worm wheel
(2)	Hexagon nut	(34)	Slide screw
(3)	Spring washer	(35)	Locking pin
(4)	Hexagon stay (long)	(36)	Handwheel
(5)	O ring	(37)	Operating instruction label
(6)	Piston unit	(38)	Spring washer
(7)	Tape liner	(39)	Locknut
(8)	O ring	(40)	Single column bearing
(9)	Hexagon stay (short)	(41)	Worm shaft
(10)	Seal washer	(42)	Key
(11)	Spring washer	(43)	Gear case cap
(12)	Hexagon head bolt	(44)	Dust seal
(13)	Round bushing	(45)	Hexagon head bolt
(14)	Dust seal	(46)	Spring washer
(15)	Wearing	(47)	Truss screw, small
(16)	Name plate	(48)	Indicator
(17)	Spring retainer	(49)	Slide screw lock
(18)	Rain shield cap	(50)	Hexagon head bolt
(19)	O ring	(51)	Hexagon nut
(20)	Lift stopper	(52)	Hexagon nut
(21)	Cylinder	(53)	Stopper retainer
(22)	Rod packing	(54)	Spring (large)
(23)	Guide bushing	(55)	Spring (small)
(24)	Dust seal	(56)	Spring stopper
(25)	Scale plate	(57)	Piston
(26)	Truss screw, small	(58)	Rod
(27)	Index	(59)	Spring receptacle
(28)	Stem connector	(60)	Stopper
(29)	Yoke	(61)	Detent nut
(30)	Gear case	(62)	Spring washer
(31)	Bearing holder	(64)	O ring
(32)	Single column angular bearing		

Disassembling spring unit

<disassembly procedure>

Disassembly procedure of spring unit is described herein.

Refer to page 4-26 , Fig. 4-24. for disassembling information.

Disassembling is not required if only piston's sealing parts (tape liner, O ring) are replaced.

(1) Removing spring unit

Step	Procedure
1	Loosen hexagon nuts No.52 (four nuts on top) and remove
2	Remove stopper retainer No.53
3	Evenly loosen hexagon nuts No.52 (four nuts on bottom) until tension of springs No.54 and No.55 becomes zero.
	⚠ CAUTION Follow disassembly procedure of spring unit when removing bolts and nuts. Otherwise, flying out of spring may cause injury.
4	Remove spring retainer No.59
5	Remove springs (large No.54, small No.55)

≠ Removing piston unit

Step	Procedure
1	Loosen stopper No.60 and remove
2	Loosen detent nut No.61 and remove, using flat faces of rod No.58.
3	Remove spring washer No.62, O-ring No.61. Exercise care so as not to damage O ring with rod's screw.
4	Separate rod No.58 from piston No.57.

Assembling actuator

<caution during assembly>

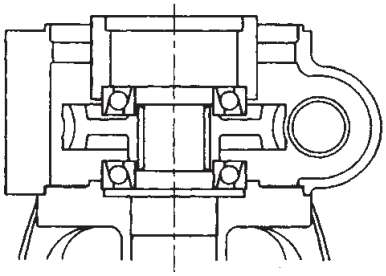
- Refer to the chapter of inspection items during disassembly and check, and ensure that no abnormality is found on parts. If found, replace or repair as required.
- O-ring of sliding parts should always be replaced at the time of periodic disassembly. Whenever O-ring on the fixed part is deformed or damaged, or scarred during disassembly, replace it.
- Clean O ring, oil seal, wearing, tape line O-ring recess and apply plenty of lubricant.
- Ensure that no dust or dirt from maintenance work prior to disassembly remains on sliding part of cylinder and guide bushing.

Assembly of actuator with manual handwheel

<assembly procedure>

Refer to page 4-25 , Fig. 4-23. for assembly information.

(1) Assembly procedure, manual handwheel and cylinder assembly

Step	Procedure
1	While yoke is in upright position, place gear No.30 and temporarily fasten with hexagon head bolts No.12 (four bolts)
2	Apply lubricant on single column angular bearing (top and bottom) and assemble in the sequential order of bearing (lower) No.32, worm wheel No.33, bearing (upper) No.32 and bearing holder No.31. Refer to the Fig. 4-25. below for details.  Fig. 4-25.
3	Insert and screw in from the bottom slide screw No.34 with tape liner No.13 assembled on. Apply lubricant on threaded parts of slide screw No.34.
4	Assemble slide screw No.34 with slide screw detent No.49, hexagon head bolt No.50 and nut No.51.
5	Apply lubricant on rod packing No.22 and dust seal No.24 and assemble on cylinder No.21.

Step	Procedure
6	Place cylinder No.21 on gear case No.30 and temporarily fasten by hexagon head bolts No.12 (four)
7	Use rod No.58 to set the position of cylinder by ensuring that the rod moves smoothly and tighten by the torque as shown in page 4-26, Table 4-4. If the rod does not move smoothly, tap cylinder or gear case with plastic hammer and set the position.

≠ Assembling piston unit, lift stopper and spring retainer

Step	Procedure
1	Install eyebolts on threaded hole (M12 x 2) on the top of spring retainer No.59 on the piston unit, suspend by crane and lift upright.
2	While suspended upright, assemble lubricated O ring No.8 and tape liner No.7 on piston No.57.
3	Assemble piston unit in cylinder No.21 from the top. See to it that the round hole of rod No.58 appears front.
4	Assemble lift stopper O-ring No.5 in the slot on the top of cylinder No.21.
5	Insert lift stopper No.20 from the top and fix by hexagon stay No.4, No.9 (four). Screw on the ones of same length diagonally.
6	Assemble so that the hexagon stays No.4, No.9 are fit into holt holes of spring retainer No.17.
7	Fix spring retainer No.17 with hexagon head nuts No.2 (four)
8	Install eye nuts No.1 (two) on hexagon stay No.4

Assembly of actuator without manual handwheel

When assembling actuator without manual handwheel, follow the procedure in “Assembly of actuator with manual handwheel” on page 4-28 except the applicable parts to actuator.

4. Major replacement parts

Actuator's parts have been designed to withstand prolong usage. However, it is recommended that the following parts be replaced in the interval as shown below:

Tape liner --------Every five years
Busing ---------- ″
Wearing ---------- ″
Seal washer ------ ″
Dust seal --------- ″ (to be replaced when disassembled)
Rod seal ---------- ″ (″)
O ring ---------- ″ (″)

Tightening torque of actuator assembly

Table below shows tightening torque of actuator assembling. Refer to Fig. 4-26, tightening torque of actuator's threaded parts.

Table 4-5.

Key No.	Size	Tightening torque [N·m{kgf/cm}]
(1)	M14	80 to 120 {800 to 1200}
≠	M20	270 to 360 {2700 to 3650}
(3)	M24	300 to 410 {3050 to 4150}
✓	M14	80 to 120 {800 to 1200}
(5)	M12	50 to 60 {500 to 600}

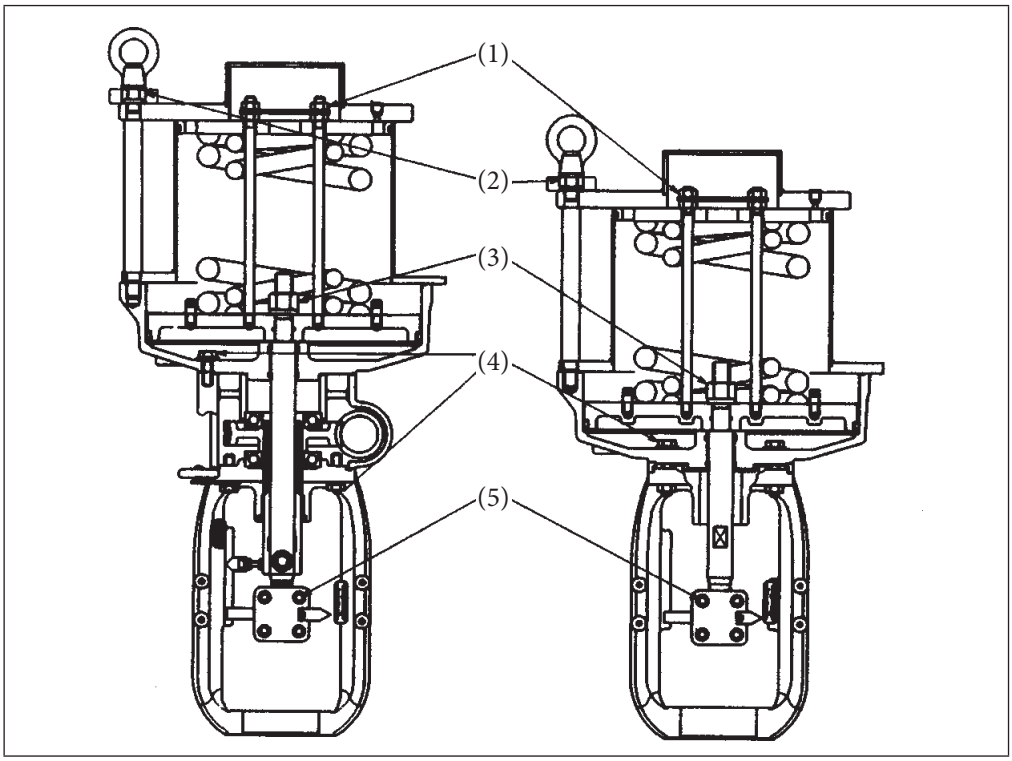


Fig. 4-26. Tightening torque of actuator threads

Chapter 5. Adjustment

As a general rule, diaphragm control valves do not require adjustment. However, adjustment of travel (stroke) is necessary when coupling an actuator to a valve body, after removing the actuator for overhaul, or for other purposes. For this adjustment, refer to Fig. 4-1. and Fig. 5-1. and proceed as follows:

(1) Connect the actuator to the valve body by securely tightening the yoke clamping nut using a chisel and hammer.

(2) Connect an adjustable air pressure source (with a pressure regulator) to the actuator to the top diaphragm case (direct action) or to the bottom diaphragm case (reverse action).

(3) Lower the valve seat and check that it comes into contact with the valve seat.

A. Direct Action models

(4) Apply the maximum air pressure to the actuator corresponding to the spring range indicated on the nameplate.

(5) Increase the air pressure to the supply pressure and check that the actuator stem responds by moving 1 to 2 mm. This movement represents the stroke allowance.

(6) Decrease the air pressure once. Then increase it again to the maximum value corresponding to the spring range, in the increasing direction.

(7) In the above state, align the actuator stem and valve stem on a straight line, adjust so that the thread of the stem connector mates with those of the actuator stem and valve stem, and securely tighten the clamping bolts of the stem connector. (See Fig. 5-1.)

B. Reverse Action models

(4) Apply the minimum air pressure to the actuator corresponding to the spring range indicated on the nameplate, and check that the actuator stem moves by 1 to 2 mm in response.

(5) Increase the air pressure once. Then decrease it again to the minimum value corresponding to the spring range, in the decreasing direction.

(6) Perform a procedure identical with that of Step (7) of Item A “Direct Action models” . (See Fig. 5-1.)

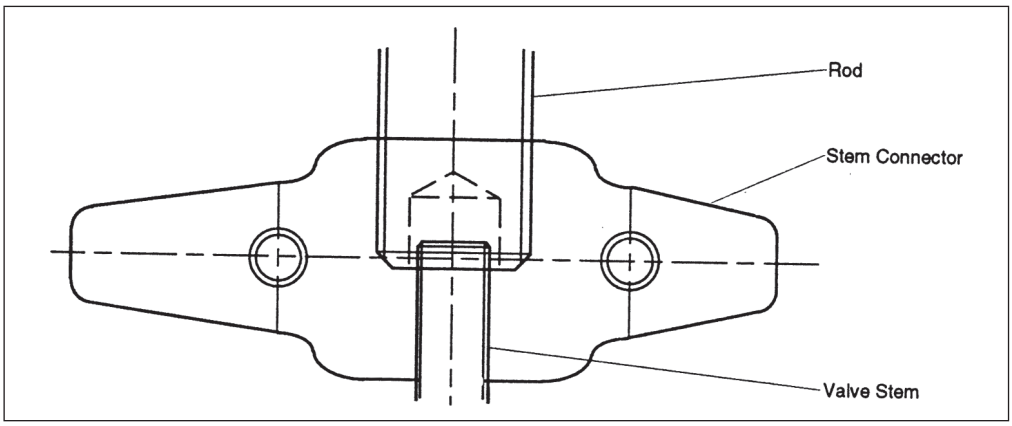


Fig. 5-1. Adjustment for Direct or Reverse Action models

Chapter 6. Azbil Low Emission standard-compliant gland packing

6-1. Overview

Azbil low emission gland packing is a gland structure that employs a Live Load structure to its performance for a long period of time. In order to meet the emission regulations for Volatile Organic Compounds (VOC) required by the U.S. Clean Air Act Amendments (CAAA), we confirmed that the amount of gland leakage was not more than 500 ppm in terms of the atmospheric concentration of the equivalent methane value on the basis of Azbil Corporation's own evaluation criteria. * For the structure of the gland, refer to the structural drawing of Azbil low emission gland packing in Fig. 6-1.

* In Japan and overseas as of October, 2005, there are no industry standards that lay down any evaluation method for gland leakage.

Key	Part name
(1)	Gland stud
(2)	Gland nut
(3)	Packing flange
(4)	Spring case
(5)	Belleville spring
(6)	Packing follower
(7)	O-ring (inner diameter side)
(8)	O-ring (outer diameter side)
(9)	Gland packing
(10)	Spacer
(11)	Stem
(12)	Stuffing box

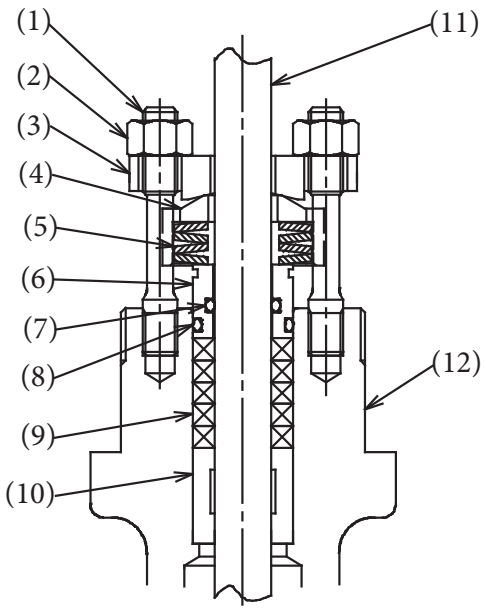


Fig. 6-1. Structural drawing of Azbil low emission gland packing

6-2. Structure

The gland packing P4519 for use in Azbil low emission gland packing is woven PTFE yarn with carbon fiber core. This gland packing provides asbestos-free properties in addition to low sliding friction and adaptability to heat cycles, and is adaptable to a wide range of fluids.
This gland packing is fastened with a Live Load structure comprised of Belleville springs. The Belleville springs are made to be tight compressing at the time of initial fastening. As a valve is operated, the seal performance of the gland packing becomes deteriorated because of strain release, but the restoring force of the Belleville springs automatically retightens it to maintain seal performance. The Belleville springs are installed in the spring case for the purposes of positioning and environmental protection. The loading conditions of the Belleville springs can be determined by checking a front window and scale marks of the spring case.

The set of parts can be added to an existing product without any change of its main body or actuator if it is an applicable control valve.

6-3. Installation into the gland

6-3-1. Preparation for installation

1. Checking for the surface conditions of parts

If there is any flaw or the like on the surface of a part, the total amount of gland leakage may exceed a specified value because of fluid leakage from the periphery. For this reason, check the surface conditions of the following parts:

Table 6-1. Parts whose surface conditions need to be checked

Part name	FInding:	Assumption
Stem	• No flaws or defects, including scratches and dents • No rust or corrosion • The finished surface should be uniform over its entire area. • No burrs • Clean, without adhesion of any coating material, powdery material, or dirt • When necessary, measures should be taken, such as cleaning with alcohol.	The total amount of gland leakage may exceed the specified value because of fluid leakage from the periphery of a flaw .
Stuffing box		
Both ends of the spacer Packing follower Packing contact surface O-ring groove		
Packing flange Gland nut contact surface		The amount of gland leakage may exceed the specified value because of insufficient tightening.
Packing flange Entire surface Gland stud Gland nut	• No flaws, rust, or defects.	Damage to the control valve may be caused, and may lead to physical injury.

2. Preparation of new parts

Be sure to prepare new parts at the time of the first installation or reinstallation of the following parts.

Table 6-2. Parts that need to be renewed

Part name	Finding	Assumption
Gland packing	No flaws, coating materials, or dirt on the surface	The amount of leakage may exceed the specified value because of fluid leakage from the periphery of a flaw or the like.
Belleville spring		The amount of gland leakage may exceed the specified value in a short period of time because of overtightening or insufficient tightening.

3. Preparation of lubricating grease and anti-seize compound

Prepare proper amounts of lubricating grease and anti-seize compound indicated in the following table. (Equivalents also can be used.)

Table 6-3. Lubricating grease and anti-seize compound

Product name	Area to be coated
Silicone grease G40M made by Shin-Etsu Chemical Co., Ltd.	Entire surface of the gland packing
Plastilube No. 3 made by Sulflo, Inc., in the U.S.	Entire surface of the backup O-rings
Anti-seize compound Never-Seez made by Bostik, Inc., in the U.S.	Surface of the threads of the gland studs
	Bearing surface of the gland nuts

6-3-2. Start of installation

1. Coating with lubricating grease

Step 1: Apply a thin film (not more than 0.3 mm thick) of the grease indicated in Table 6-3 [G40M made by Shin-Etsu Chemical Co., Ltd.] to the entire surface of all the gland packing.

Step 2: Apply the grease indicated in Table 6-3 [Plastilube No. 3 made by Sulflo, Inc., in the U.S.] to each of the two backup O-rings on the inner diameter side and the outer diameter side of the packing follower.

2. Installation of parts

Step 1:

With reference to Fig. 6-2, check the direction of the gland studs. After applying the anti-seize compound indicated in Table 6-3 [Never-Seez made by Bostik, Inc., in the U.S.] to the surface of the threads, install them into the stuffing box.

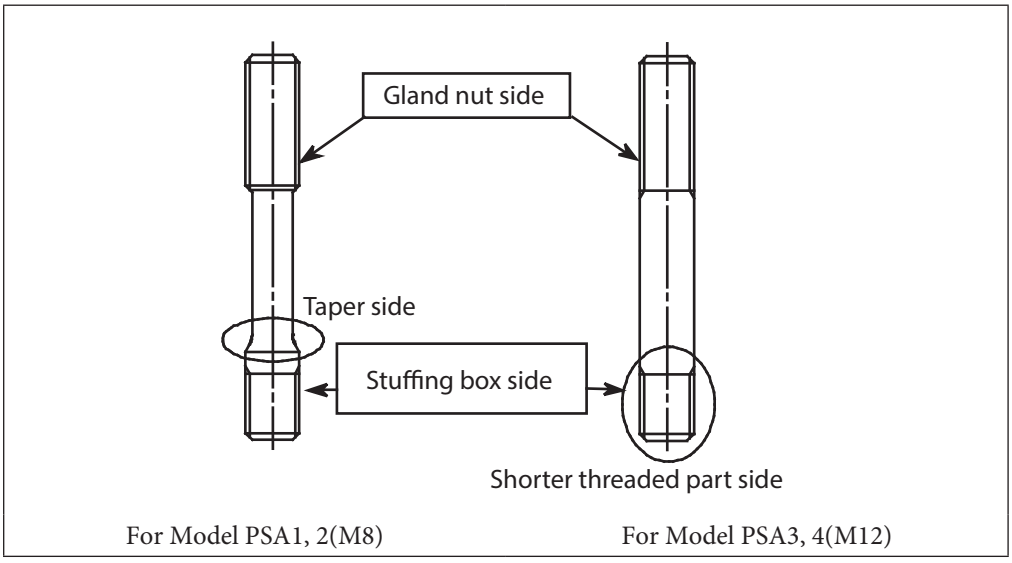


Fig. 6-2. Direction of the gland studs

Step 2:
Being careful not to damage the surface of the stem, install the spacer first.
Step 3:
Next, install one piece of the gland packing. Be sure to note how to open indicated in Fig.6-3. Insert it tightly with a pipe or the like. Finally, press it lightly.
Insert the second and subsequent pieces, with the gap position shifted by 180 degrees.

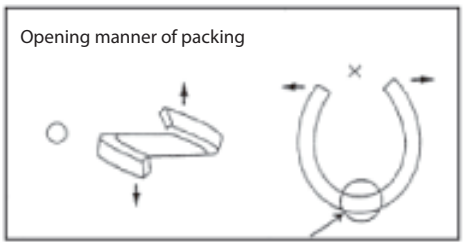


Fig. 6-3. How to handle gland packing

Step 4:
Next, check the direction of the packing follower. (See Fig. 6-1.) The outside O-ring side is the packing side.) Install it while being careful not to damage the surface of the stem.
Step 5:
With reference to Fig. 6-1, install the Belleville springs while being careful not to damage the surface of the stem.
Step 6:
With reference to Fig. 6-4, install the spring case in such a manner that two opposed side grooves are guided with the gland studs. (Two pairs of opposed side grooves are the same in dimension.) At the time of the installation, be careful not to damage the surface of the stem. Incidentally, when the Belleville springs are set in the spring case, they do not come into contact with the stem.

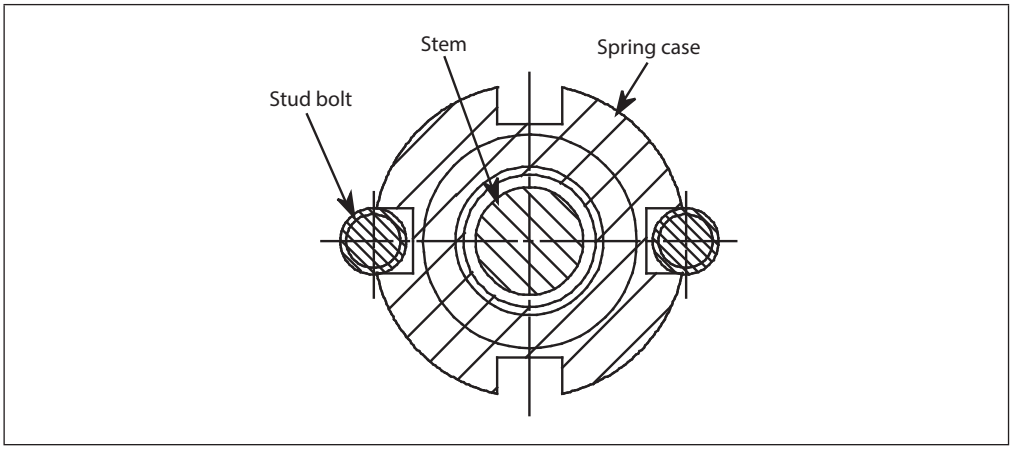


Fig. 6-4. Installation of the spring case Top view

Step 7:
Being careful not to damage the surface of the stem, install the packing flange.
Step 8:
After applying the anti-seize compound indicated in Table 6-3 [Never-Seez made by Bostik, Inc., in the U.S.] to the surface of the threads of the stud bolts and the bearing surface of the nuts, tighten them by hand.

3. Tightening
Step 1:
With reference to Fig. 6-5, check the position of the Belleville springs through the front window of the spring case. When the Belleville springs are set properly, the lower edge of the outer diameter of the lowest Belleville spring almost coincides with the lower scale mark of the spring case. (In some cases, it does not exactly coincide because of the dimensional tolerance of the Belleville springs.)

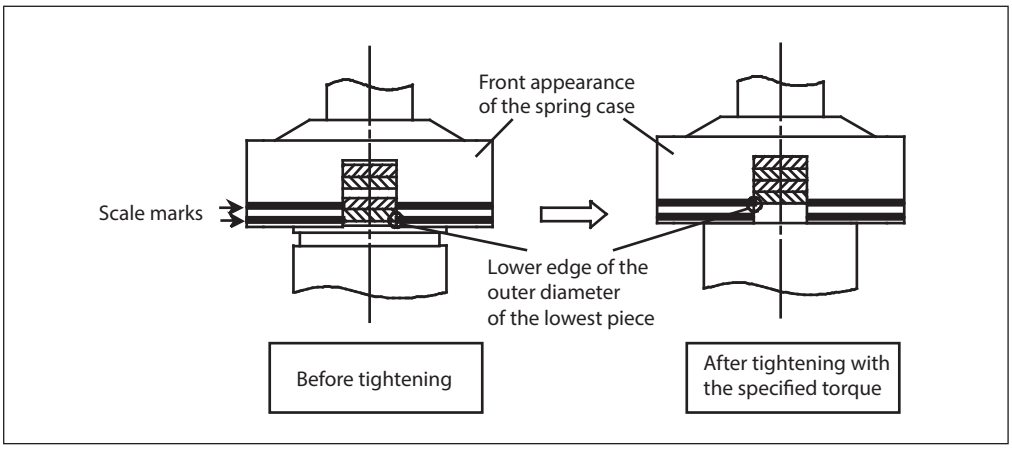


Fig. 6-5. Loading conditions of the Belleville springs

Step 2:
Tighten each of the right and left gland nuts by half a turn alternately to the specified torque. Table 6-4 shows the tightening torque.
If the tightening torque is less than the specified value, be aware that the amount of leakage may exceed the specified value because of insufficient tightening.
If the tightening torque is more than the specified value, be aware that the amount of leakage may exceed the specified value in a short period of time because of the accelerated wear of the gland packing, in addition to the increased sliding friction of the stem.

Table 6-4. Tightening torque of the gland nuts

Actuator model	Stem size	Tightening torque
PSA1, 2	ϕ 13 mm	6 to 7 N·m
PSA3, 4	ϕ 16 mm	15 to 17 N·m

6-3-3. Retightening

In the following cases, retighten the gland nuts with the specified torque:

a) At the time of an inspection before the installation of the control valve
b) At the time of a test operation or start-up operation of the equipment
c) In case the leakage amount of the gland exceeds the specified value during operation of the equipment.

If the leakage amount of the gland still exceeds the specified value after retightening, reinstall the complete set of gland parts. In addition, it is recommended that the gland packing and the Belleville springs be replaced with new parts.

Chapter 7. Certified ISO 15848-1 compliant low emission gland packing

7-1. Overview

Certified ISO 15848-1 low emission gland packing 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 Fig. 7-1 and Fig. 7-2.

No.	Name
(1)	Gland stud
(2)	Gland nut
(3)	Packing flange
(4)	Belleville spring
(5)	Packing follower
(6)	Carbon ring (P6210C2FS)
(7)	Adapter packing (P6720)
(8)	Main packing (P4519)
(9)	Spacer
(10)	Stem
(11)	O-ring for inner side of packing follower (optional)
(12)	O-ring for outer side of packing follower (optional)
(13)	Stuffing box

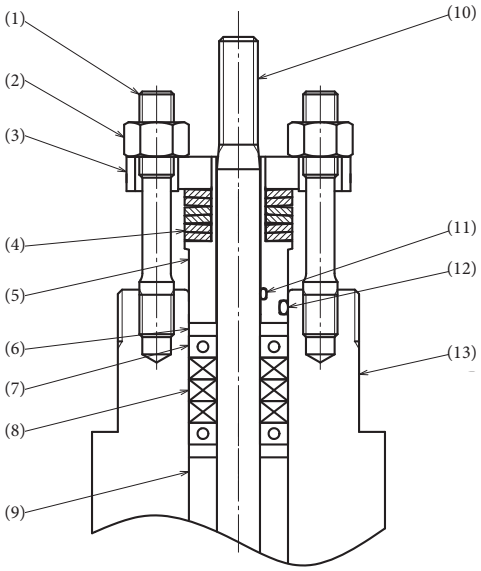


Fig. 7-1. Structure of Certified ISO 15848-1 low emission gland packing (for PTFE yarn)

No.	Name
(1)	Gland stud
(2)	Gland nut
(3)	Packing flange
(4)	Belleville spring
(5)	Packing follower
(6)	Carbon ring (P6210)
(7)	Adapter packing (P6720)
(8)	Main packing (P6617CL)
(9)	Spacer
(10)	Stem
(11)	O-ring for inner side of packing follower (optional)
(12)	O-ring for outer side of the packing follower (optional)
(13)	Stuffing box

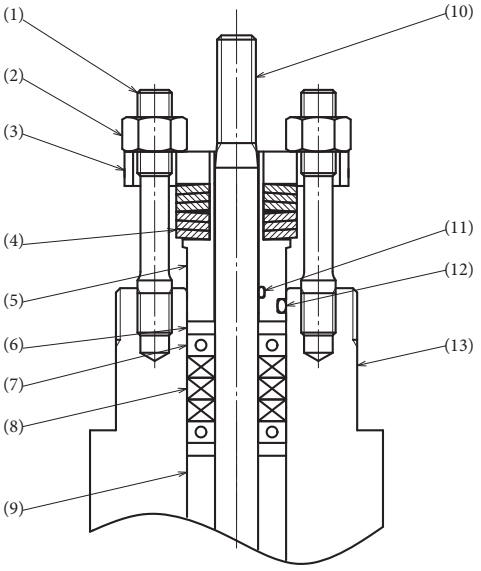


Fig. 7-2. Structure of Certified ISO 15848-1 low emission gland packing (for expanded graphite)

7-2. 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.

7-3. Starting Operation

Before operating the valve, tighten (or retighten) the gland. For instructions, refer to 7-4-2, "(3) Tightening".

If leakage from the gland continues even after proper tightening, obtain and prepare parts as indicated in "7-4-1. Preparation for assembly", and follow the procedure given in "7-4-2. Assembly".

7-4. Assembling the parts of the gland

7-4-1. 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 7-1. Parts to be checked for surface condition

<table>
<tr><th>Part</th><th>Checkpoints</th><th>Possible problems</th></tr>
<tr><td>Stem
Stuffing box
Both ends of the spacer
Packing follower
Packing contact surface
O-ring groove</td><td rowspan="2">• No flaws or defects, including scratches and dents
• No rust or corrosion
• The entire surface is even.
• No burrs
• Clean surface, with no adhering coating material, powder, or dirt.
• If necessary, take necessary measures such as cleaning with alcohol.</td><td>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.</td></tr>
<tr><td>Packing flange
Gland nut contact surface</td><td>The total amount of leakage from the gland may exceed the specified value because of insufficient tightening.</td></tr>
<tr><td>Packing flange (entire surface)
Gland stud
Gland nut</td><td>• No flaws, rust, or defects</td><td>The problems on the left, if they remain, can cause control valve damage, leading to injuries.</td></tr>
</table>

(2) New parts

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

Table 7-2. Parts requiring treatment

Part name	Checkpoints	Possible problems
Gland packing (main packing and adapter packing) Carbon ring	• No flaws. • No coating materials or dirt stuck to the surface.	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 7-3. 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

7-4-2. Assembly

(1) Applying lubricating grease

Step 1

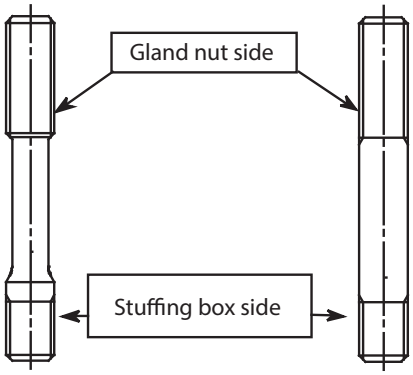
For Certified ISO 15848-1 low emission gland packing for PTFE yarn, apply a thin film of grease Krytox GPL207 indicated in Table 7-3 to the surface of all gland packings (main packing and adapter packing). For Certified ISO 15848-1 low emission gland packing for expanded graphite, greasing is not necessary.

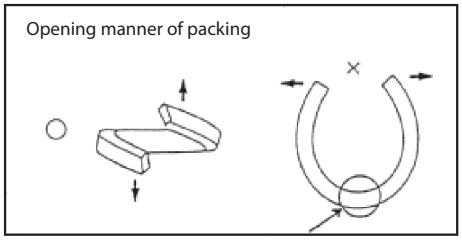
Step 2

For Certified ISO 15848-1 low emission gland packing 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 7-3 to both rings.

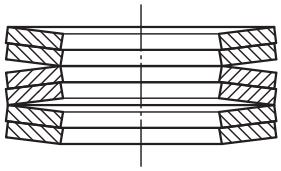
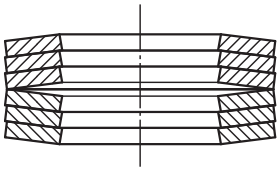
(2) Assembling

(1/3)

Step	Procedure
1	Check the correct direction of the gland studs in Fig. 7-3. Apply Never-Seez anti-seizing agent made by Bostik Inc. (indicated in Table 7-3) to the threads on the stuffing box end of the studs, and screw them into the stuffing box.  Gland stud end with fewer threads Fig. 7-3. Direction of the gland stud
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	**[Certified ISO 15848-1 low emission gland packing for PTFE yarn]** Insert one adapter packing ring, without opening the gap, all the way to the bottom with a pipe, etc., and push it lightly. Open the gap of the main packing rings as illustrated in Fig. 7-4 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˚. Insert one adapter packing ring, without opening the gap, all the way to the bottom with a pipe, etc., and push it lightly.  Fig. 7-4. How to open the main packing rings **[Certified ISO 15848-1 low emission gland packing for expanded graphite]** Insert one adapter packing ring, without opening the gap, all the way to the bottom with a pipe, etc., and push it lightly. Insert one of the main packing rings, without opening the gap, 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. Insert one adapter packing ring, without opening the gap, all the way to the bottom with a pipe, etc., and push it lightly.
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 Fig. 7-1. or Fig. 7-2. Insert it, paying extra attention not to damage the surface of the stem.

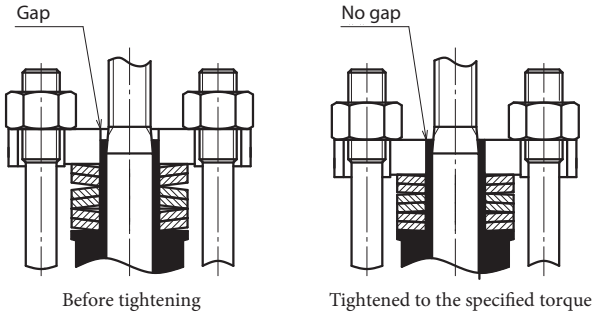
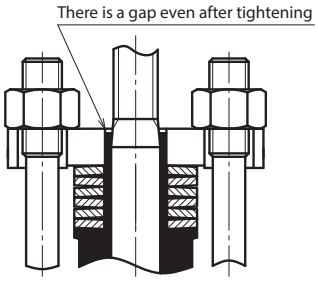
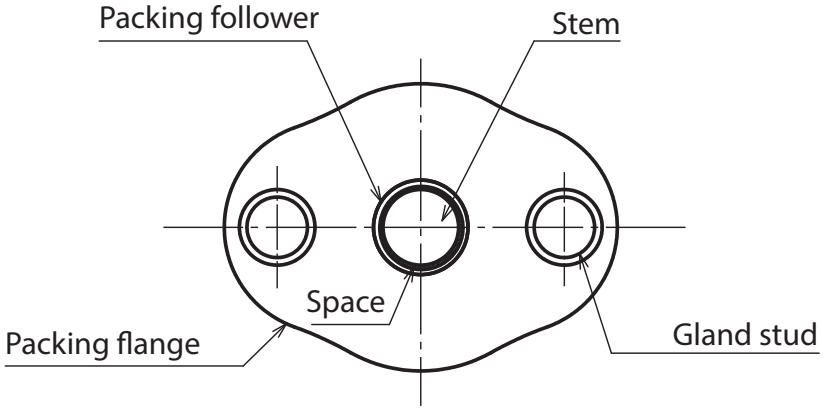
(3/3)

Step	Procedure
7	Stack the Belleville spring washers as shown in Fig. 7-5, and insert them into the packing follower.  2 same-direction washers × 3 [For PTFE yarn]  3 same-direction washers × 2 [For expanded graphite] Fig. 7-5. .
8	Place the packing flange onto the packing follower.
9	Apply anti-seizing agent Never-Seez made by Bostik Inc. (Table 7-3) to the threads on the gland nut end of the gland studs, and screw the nuts on by hand.

(3) Tightening

(1/2)

Step	Procedure
1	Tighten the left and right gland nuts alternately, making approximately a half turn each, until the torque indicated in Table 7-4 or Table 7-5 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. Table 7-4. Gland nut tightening torque (for PTFE yarn) **Actuator model** / **Stem size** / **Tightening torque** PSA2 / ϕ 13 mm / 11 N·m PSA3, PSA4 / ϕ 16 mm / 25 N·m PSA6R / ϕ 30 mm / 54 N·m Table 7-5. Gland nut tightening torque (for expanded graphite) **Actuator model** / **Stem size** / **Tightening torque** PSA2 / ϕ 13 mm / 11 → 0 (loosening) → 7 N·m PSA3, PSA4 / ϕ 16 mm / 25 → 0 (loosening) → 17 N·m PSA6R / ϕ 30 mm / 54 → 0 (loosening) → 36 N·m

Step	Procedure
2	By tightening the gland nuts to the torque indicated in Table 7-4 or Table 7-5, the top of the packing flange and packing follower will be at almost the same level, as illustrated in Fig. 7-6 below (the level may not be exactly the same due to the tolerance of the Belleville springs and friction on the gland studs or gland nuts). 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 7-4 and Table 7-5, the level of the top of the packing flange and packing follower will not be the same (see Fig. 7-7). Check if the direction of washers of the Belleville springs and the tightening torque are correct.  Fig. 7-6. Load on Belleville springs (correctly assembled)  Fig. 7-7. Load on Belleville springs (incorrectly assembled)
3	View the assembly from above to check that the space between the stem and the packing follower is even (see Fig. 7-8).  Fig. 7-8. Top view

7-5. Application to existing control valves

If Certified ISO 15848-1 low emission gland packing 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 Certified ISO 15848-1 low emission gland packing may not be achieved. If scratches are found, replace the affected parts with new ones.
- Check if Certified ISO 15848-1 low emission gland packing can be used for the current valve and actuator by referring to the specification sheet for Certified ISO 15848-1 low emission gland packing (SS2-SSL100-0100) or by contacting us. Because the resistance to sliding of Certified ISO 15848-1 low emission gland packing is greater than general gland packing systems, it may not be possible to use Certified ISO 15848-1 low emission gland packing 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 Certified ISO 15848-1 low emission gland packing meets the temperature requirements of the current control valve. Attention is needed for expanded graphite Certified ISO 15848-1 low emission gland packing 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.

7-6. 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 8. Trouble-shooting

This section covers the symptoms, causes, and remedies of problems. Parts may need to be replaced. For further assistance, please contact your Azbil Corporation representative.

Table 8-1. Troubleshooting

Symptom	Cause and Remedy
Unstable Valve Operation Valve hunts when almost fully closed	• CV value is too large. • Reduce CV value. • For a single seat valve, the valve is installed in the reverse flow direction.
Air supply pressure is unstable	• Large pneumatic equipment is hooked up to the same air supply line. • Check air supply capacity, piping capacity, and restriction capacity are appropriate. • Supply air pressure regulator is inadequate or not operating properly.
Signal pressure is unstable	• Controller is not properly tuned. • Properly tune the controller (properly set the proportional band and other parameters). • Check that the controller output does not change abnormally.
Valve hunts even when signal pressure is stable	• Hunting output of positioner itself. • Check and repair or replace the positioner. • Being affected by pressure change of process fluid as power of the actuator is insufficient. Replace the actuator with a larger model.
Vibration of valve Valve vibrates (generates noise) at any position of valve plug	• Piping vibrates. • Securely fasten the piping. • Check for other sources of vibration. • Worn valve plug or guides. • Check the parts and replace them as required.
Valve vibrates (generates noise) only when valve plug is set at a certain position	• Check for changes in process fluid flow conditions (change in restriction orifice, CV value, etc.) • Check for changes in plug configuration (change in flow control characteristics.)
Sluggish valve operation or inoperative valve	• Air leak from piping. • Air leak from actuator. • Foreign matter trapped in guide section of valve plug. • Aged and hardened gland packing, causing increased hysteresis. • Malfunctioning positioner (check the positioner by operating it directly on an air supply known to be operating normally).
Fluid leakage from gland section	• Check for loose nuts of bonnet. • Check for damaged valve shaft.
Even when valve plug is in closed position, large flow leak to downstream side	• Air leak at actuator section. • Apply the air supply pressure or atmospheric pressure to the actuator. Check the air supply source and positioner. • Check whether the valve plug is actually in the closed position. • Check the plug seat ring for corrosion and erosion. • Check the guide sections for binding.

Chapter 9. Recommended Spare Parts

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

1. Valve Body

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

■ Gland packing

■ Gaskets

2. Actuator

Replace the following parts every 5 years or so:

■ Diaphragm

■ Bushing

■ Seal Washer. Be sure to replace whenever the actuator is disassembled.

■ Dust Seal and Rod Seal. Be sure to replace whenever the actuator is disassembled.

Appendix-A. DIMENSIONS

Table A-1, 2 shown the dimensions and weight of the control valves. Note that the addition of any optional specifications will change their installed dimensions and weights.

Table A-1. Main dimensions and product weights

Valve size (inches)	Actuator model	Dimensions (mm)										
		A			H		ϕB	Classified by positioner C				
											AVP	
		JIS10K ANSI150 JPI150	JIS16K	JIS20K,30K ANSI300 JPI300	General Use bonnet	Extension bonnet		VPE	HTP	HEP	with Air Set	w/o Air Set
1/2, 3/4	PSA1D, R	184	190	194	420	545	218	145	225	290	312	221
	PSA2D, R				450	575	267	-				
1	PSA1D, R	184	193	197	420	545	218	145				
	PSA2D, R				450	575	267	-				
1-1/2	PSA1D, R	222	231	235	420	605	218	145	225	290	312	221
	PSA2D, R				450	635	267	-				
	PSA3D, R				630	760	350	-	270	330	318	227
	PSA4D, R				680	815	470	-				
2	PSA1D, R	254	263	267	420	605	218	145	225	290	312	221
	PSA2D, R				450	635	267	-				
	PSA3D, R				630	760	350	-	270	330	318	227
	PSA4D, R				680	815	470	-				
2-1/2	PSA3D, R	276	288	292	675	800	350	-	270	330	318	227
	PSA4D, R				725	855	470	-				
	PSA6R				1145	1275	470	-			348	257
3	PSA3D, R	298	313	317	675	800	350	-	270	330	318	227
	PSA4D, R				725	855	470	-				
	PSA6R				1145	1275	470	-			348	257
4	PSA3D, R	352	364	368	680	800	350	-	270	330	318	227
	PSA4D, R				730	860	470	-				
	PSA6R				1150	1275	470	-			348	257

Table A-2. Product Weight (kg)

	Valve size (inch)	1/2		3/4		1		1-1/2	
	Pressure rating	JIS 10K ANSI 150 JPI 150	JIS 20K ANSI 300 JPI 300	JIS 10K ANSI 150 JPI 150	JIS 20K ANSI 300 JPI 300	JIS 10K ANSI 150 JPI 150	JIS 20K ANSI 300 JPI 300	JIS 10K ANSI 150 JPI 150	JIS 20K ANSI 300 JPI 300
Actuator model	PSA 1	15	16	16	19	17	19	27	32
	PSA 2	18	19	19	22	20	22	30	35
	PSA 3	-	-	-	-	-	-	50	55
	PSA 4	-	-	-	-	-	-	68	73
	PSA 6	-	-	-	-	-	-	-	-

	Valve size (inch)	2		2-1/2		3		4	
	Pressure rating	JIS 10K ANSI 150 JPI 150	JIS 20K ANSI 300 JPI 300	JIS 10K ANSI 150 JPI 150	JIS 20K ANSI 300 JPI 300	JIS 10K ANSI 150 JPI 150	JIS 20K ANSI 300 JPI 300	JIS 10K ANSI 150 JPI 150	JIS 20K ANSI 300 JPI 300
Actuator model	PSA 1	30	33	-	-	-	-	-	-
	PSA 2	33	36	-	-	-	-	-	-
	PSA 3	53	56	71	77	73	81	89	106
	PSA 4	71	74	89	95	91	99	107	124
	PSA 6	-	-	190	197	192	201	208	225

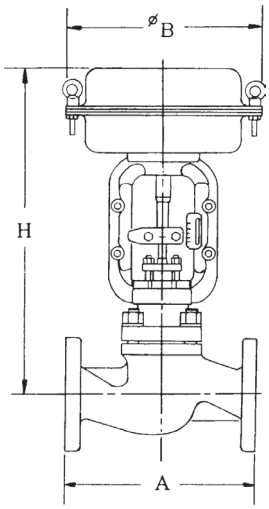


Fig. A-1. face-to-face dimension and overall dimensions

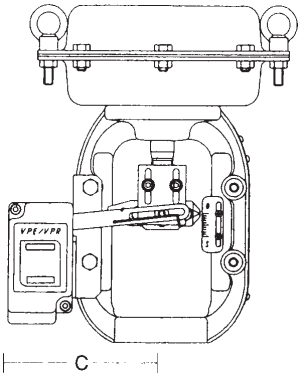


Fig. A-2. model VPE positioner mounted

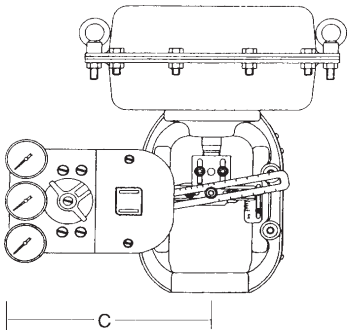


Fig. A-3. model HTP positioner mounted

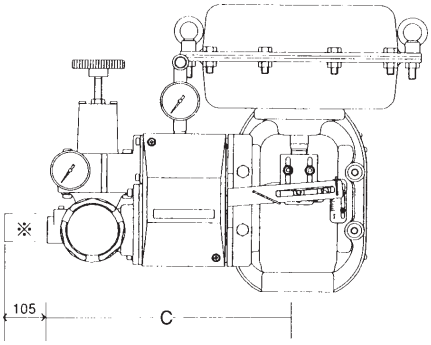


Fig. A-4. model HEP positioner mounted

*When applying a presureproof packing, add 105 mm

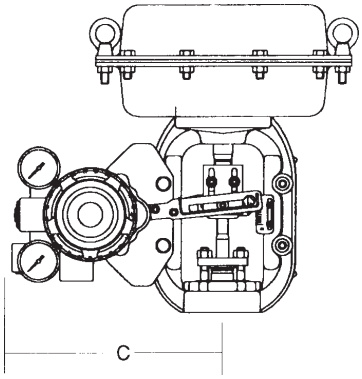


Fig. A-5. model SVP positioner mounted

The overall dimensions and the valve weight will change when a manual handwheel is mounted. Ins standard mounting, the position of operation of the side handwheel is at the back of the actuator (on the side opposite that where the valve positioner is mounted).

Table A-3. Hand wheel dimensions

Type of handwheel	Actuator model	Dimension (mm)			Maximum driving force of handwheel N (kgf)	Weight (kg)
		I max	ϕF	K		
Side handwheel	PSA1D, R		200	215	80 (8)	7
	PSA2D, R		200		150 (15)	
	PSA3D, R		355	345	260 (27)	27
	PSA4D, R		355		450 (46)	
	PSA6R		380	310	127 (13)	35

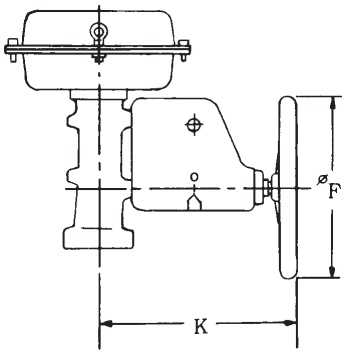


Fig. A-6. Side handwheel

Appendix-B. PARTS LIST

1. Bonnet

1-1. Bonnet for fluid temperature -17 to +230 deg.C : Standard Actuator

Connection Size	Body Material	Trim Material		Actuator model	Additional Condition	Parts No.
1/2inch 3/4inch 1inch	SCPH2	SUS440C		PSA1,2		82-553462 - 111
		SUS316	316Soft Seat	PSA1,2		82-553462 - 111
		SUS316	316Soft Seat	PSA1,2	Oil free	82-553462 - 131
		SUS316CoCr	CoCr face	PSA1,2		82-553462 - 121
	SCS13A	SUS440C		PSA1,2		82-553462 - 112
		SUS316	316Soft Seat	PSA1,2		82-553462 - 101
		SUS316	316Soft Seat	PSA1,2	Oil free	82-553462 - 132
		SUS316CoCr	CoCr face	PSA1,2		82-553462 - 122
	SCS14A	SUS316	316Soft Seat	PSA1,2		82-553288 - 102
		SUS316	316Soft Seat	PSA1,2	Oil free	82-553462 - 133
		SUS316CoCr	CoCr face	PSA1,2		82-553462 - 123
1-1/2inch 2inch	SCPH2	SUS440C		PSA1,2		82-553462 - 211
		SUS316	316Soft Seat	PSA1,2		82-553462 - 211
		SUS316	316Soft Seat	PSA1,2	Oil free	82-553462 - 231
		SUS316CoCr	CoCr face	PSA1,2		82-553462 - 221
	SCS13A	SUS440C		PSA1,2		82-553462 - 212
		SUS316	316Soft Seat	PSA1,2		82-552993 - 101
		SUS316	316Soft Seat	PSA1,2	Oil free	82-553462 - 232
		SUS316CoCr	CoCr face	PSA1,2		82-553462 - 222
	SCS14A	SUS316	316Soft Seat	PSA1,2		82-552993 - 102
		SUS316	316Soft Seat	PSA1,2	Oil free	82-553462 - 233
		SUS316CoCr		PSA1,2		82-553462 - 223
2-1/2inch 3inch	SCPH2	SUS440C		PSA3,4		82-553462 - 311
		SUS316	316Soft Seat	PSA3,4		82-553462 - 311
		SUS316	316Soft Seat	PSA3,4	Oil free	82-553462 - 331
		SUS316CoCr	CoCr face	PSA3,4		82-553462 - 321
	SCS13A	SUS440C		PSA3,4		82-553462 - 312
		SUS316	316Soft Seat	PSA3,4		82-553290 - 101
		SUS316	316Soft Seat	PSA3,4	Oil free	82-553462 - 332
		SUS316CoCr	CoCr face	PSA3,4		82-553462 - 322
	SCS14A	SUS316	316Soft Seat	PSA3,4		82-553290 - 102
		SUS316	316Soft Seat	PSA3,4	Oil free	82-553462 - 333
		SUS316CoCr	CoCr face	PSA3,4		82-553462 - 323
4inch	SCPH2	SUS440C		PSA3,4		82-553462 - 411
		SUS316	316Soft Seat	PSA3,4		82-553462 - 411
		SUS316	316Soft Seat	PSA3,4	Oil free	82-553462 - 431
		SUS316CoCr	CoCr face	PSA3,4		82-553462 - 421
	SCS13A	SUS440C		PSA3,4		82-553462 - 412
		SUS316	316Soft Seat	PSA3,4		82-553291 - 101
		SUS316	316Soft Seat	PSA3,4	Oil free	82-553462 - 432
		SUS316CoCr	CoCr face	PSA3,4		82-553462 - 422
	SCS14A	SUS316	316Soft Seat	PSA3,4		82-553291 - 102
		SUS316	316Soft Seat	PSA3,4	Oil free	82-553462 - 433
		SUS316CoCr	CoCr face	PSA3,4		82-553462 - 423

1-2. Bonnet for fluid temperature 17 to 230 deg C : Standard

Connection Size	Body Material	Trim Material		Actuator model	Additional Condition	Parts No.
1-1/2 inch 2 inch	SCPH2	SUS440C		PSA3,4		82-553939 - 211
		SUS316	316Soft Seat	PSA3,4		82-553939 - 211
		SUS316	316Soft Seat	PSA3,4	Oil free	82-553939 - 231
		SUS316CoCr	CoCr face	PSA3,4		82-553939 - 221
	SCS13A	SUS440C		PSA3,4		82-553939 - 212
		SUS316	316Soft Seat	PSA3,4		82-553887 - 101
		SUS316	316Soft Seat	PSA3,4	Oil free	82-553939 - 232
		SUS316CoCr	CoCr face	PSA3,4		82-553939 - 222
	SCS14A	SUS316	316Soft Seat	PSA3,4		82-553887 - 102
		SUS316	316Soft Seat	PSA3,4	Oil free	82-553939 - 233
		SUS316CoCr	CoCr face	PSA3,4		82-553939 - 223
2-1/2 inch 3 inch	SCPH2	SUS440C		PSA6R		82-553939 - 311
		SUS316	316Soft Seat	PSA6R		82-553939 - 311
		SUS316	316Soft Seat	PSA6R	Oil free	82-553939 - 331
		SUS316CoCr	CoCr face	PSA6R		82-553939 - 321
	SCS13A	SUS440C		PSA6R		82-553939 - 312
		SUS316	316Soft Seat	PSA6R		82-553910 - 101
		SUS316	316Soft Seat	PSA6R	Oil free	82-553939 - 332
		SUS316CoCr	CoCr face	PSA6R		82-553939 - 322
	SCS14A	SUS316	316Soft Seat	PSA6R		82-553910 - 102
		SUS316	316Soft Seat	PSA6R	Oil free	82-553939 - 333
		SUS316CoCr	CoCr face	PSA6R		82-553939 - 323
4 inch	SCPH2	SUS440C		PSA6R		82-553939 - 411
		SUS316	316Soft Seat	PSA6R		82-553939 - 411
		SUS316	316Soft Seat	PSA6R	Oil free	82-553939 - 431
		SUS316CoCr	CoCr face	PSA6R		82-553939 - 421
	SCS13A	SUS440C		PSA6R		82-553939 - 412
		SUS316	316Soft Seat	PSA6R		82-553882 - 101
		SUS316	316Soft Seat	PSA6R	Oil free	82-553939 - 432
		SUS316CoCr	CoCr face	PSA6R		82-553939 - 422
	SCS14A	SUS316	316Soft Seat	PSA6R		82-553882 - 102
		SUS316	316Soft Seat	PSA6R	Oil free	82-553939 - 433
		SUS316CoCr	CoCr face	PSA6R		82-553939 - 423

2. Valve plug with stem

Plug is packed with the stem attached

2-1. Connection Size 1/2 inch to 1 inch

* of these part's numbers means the following materials.

For Cv value=0.25 or under, the material is only SUS316 CoCr face.

*	Material Table
5	SUS316 CoCr face
6	SUS316L
7	SUS316L CoCr

Standard: For fluid temperature -17 to +230 deg.C
Others: Lower than -17 deg.C, higher than +230 deg.C

Connection Size (inch)	Cv value	Material	Flow characteristic	Actuator model	Additional Condition	Part No.
1/2 3/4 1	0.1	Refer to Material table	linear	PSA1,2	Standard	82-553274 - 01 *
			linear	PSA1,2	Others	82-553764 - 01 *
	0.16		linear	PSA1,2	Standard	82-553274 - 02 *
			linear	PSA1,2	Others	82-553764 - 02 *
	0.25		linear	PSA1,2	Standard	82-553274 - 03 *
			linear	PSA1,2	Others	82-553764 - 03 *

2-2. Connection Size 1/2 inch to 1 inch Cv0.4 or upper : Metal Seat

The "*" mark in the column of parts No. means materials.
For the details, please refer to the following table.

*	Material Table
2	SUS316
5	SUS316 CoCr (For Cv value=0.25 or under chose"8")
6	SUS316L
7	SUS316L CoCr
8	SUS316 CoCr face

Connection Size (inch)	Cv value	Material	Flow characteristic	Actuator model	Additional Condition	Part No.
	0.4	Refer to Material table	equal percent	PSA1,2	Standard	82-553274 - 04 *
			equal percent	PSA1,2	Others	82-553764 - 04 *
	0.63		equal percent	PSA1,2	Standard	82-553274 - 05 *
			equal percent	PSA1,2	Others	82-553764 - 05 *
	1.0		equal percent	PSA1,2	Standard	82-553274 - 06 *
			equal percent	PSA1,2	Others	82-553764 - 06 *
	1.6		equal percent	PSA1,2	Standard	82-553274 - 07 *
			equal percent	PSA1,2	Others	82-553764 - 07 *
	2.5		equal percent	PSA1,2	Standard	82-553274 - 08 *
			equal percent	PSA1,2	Others	82-553764 - 08 *
1/2 3/4 1	4		equal percent	PSA1,2	Standard	82-553274 - 09 *
			equal percent	PSA1,2	Others	82-553764 - 09 *
3/4 1	6.3		equal percent	PSA1,2	Standard	82-553274 - 16 *
			equal percent	PSA1,2	Others	82-553764 - 13 *
	8		equal percent	PSA1,2	Standard	82-553274 - 10 *
			equal percent	PSA1,2	Others	82-553764 - 10 *
1	10		equal percent	PSA1,2	Standard	82-553274 - 11 *
			equal percent	PSA1,2	Others	82-553764 - 11 *
	14		equal percent	PSA1,2	Standard	82-553274 - 12 *
			equal percent	PSA1,2	Others	82-553764 - 12 *

2-3. Connection Size 1/2 inch to 1 inch Material SUS440C : Metal seat

Connection Size (inch)	Cv value	Material	Flow characteristic	Actuator model	Additional Condition	Parts No.
1/2 3/4 1	0.1	SUS440C	linear	PSA1,2	Standard	82-553471 - 0 1 1
			linear	PSA1,2	Others	82-553766 - 0 1 1
	0.16		linear	PSA1,2	Standard	82-553471 - 0 2 1
			linear	PSA1,2	Others	82-553766 - 0 2 1
	0.25		linear	PSA1,2	Standard	82-553471 - 0 3 1
			linear	PSA1,2	Others	82-553766 - 0 3 1
	0.4		equal percent	PSA1,2	Standard	82-553471 - 0 4 1
			equal percent	PSA1,2	Others	82-553766 - 0 4 1
	0.63		equal percent	PSA1,2	Standard	82-553471 - 0 5 1
			equal percent	PSA1,2	Others	82-553766 - 0 5 1
	1.0		equal percent	PSA1,2	Standard	82-553471 - 0 6 1
			equal percent	PSA1,2	Others	82-553766 - 0 6 1
	1.6		equal percent	PSA1,2	Standard	82-553471 - 0 7 1
			equal percent	PSA1,2	Others	82-553766 - 0 7 1
	2.5		equal percent	PSA1,2	Standard	82-553471 - 0 8 1
			equal percent	PSA1,2	Others	82-553766 - 0 8 1
	4		equal percent	PSA1,2	Standard	82-553471 - 0 9 1
			equal percent	PSA1,2	Others	82-553766 - 0 9 1
3/4 1	6.3	SUS440C	equal percent	PSA1,2	Standard	82-553471 - 1 6 1
			equal percent	PSA1,2	Others	82-553766 - 1 7 1
	8		equal percent	PSA1,2	Standard	82-553471 - 1 0 1
			equal percent	PSA1,2	Others	82-553766 - 1 0 1
1	10	SUS440C	equal percent	PSA1,2	Standard	82-553471 - 1 1 1
			equal percent	PSA1,2	Others	82-553766 - 1 1 1
	14		equal percent	PSA1,2	Standard	82-553471 - 1 2 1
			equal percent	PSA1,2	Others	82-553766 - 1 2 1

2-4. Connection Size 1-1/2 inch to 4 inch : Bonnet for fluid temperature -17 to +230 deg.C

Connection Size (inch)	Port size (inch)	Material	Flow characteristic	Actuator model	Additional Condition	Parts No.
1-1/2	1	SUS316	equal percent	PSA1,2	Standard	82-553274 - 1 2 2
			equal percent	PSA3,4	Standard	82-553912 - 0 1 2
		SUS316CoCr	equal percent	PSA1,2	Standard	82-553274 - 1 2 5
			equal percent	PSA3,4	Standard	82-553912 - 0 1 5
		SUS316CoCr face	equal percent	PSA1,2	Standard	82-553274 - 1 2 8
			equal percent	PSA3,4	Standard	82-553912 - 0 1 8
		SUS440C	equal percent	PSA1,2	Standard	82-553471 - 1 2 1
			equal percent	PSA3,4	Standard	82-553911 - 0 1 1
		SUS316L	equal percent	PSA1,2	Standard	82-553274 - 1 2 6
			equal percent	PSA3,4	Standard	82-553912 - 0 1 6
		SUS316LCoCr	equal percent	PSA1,2	Standard	82-553274 - 1 2 7
			equal percent	PSA3,4	Standard	82-553912 - 0 1 7
1-1/2 2	1-1/4	SUS316	equal percent	PSA1,2	Standard	82-553274 - 1 4 2
			equal percent	PSA3,4	Standard	82-553912 - 0 3 2
		SUS316CoCr	equal percent	PSA1,2	Standard	82-553274 - 1 4 5
			equal percent	PSA3,4	Standard	82-553912 - 0 3 5
		SUS316CoCr face	equal percent	PSA1,2	Standard	82-553274 - 1 4 8
			equal percent	PSA3,4	Standard	82-553912 - 0 3 8
		SUS440C	equal percent	PSA1,2	Standard	82-553471 - 1 4 1
			equal percent	PSA3,4	Standard	82-553911 - 0 3 1
		SUS316L	equal percent	PSA1,2	Standard	82-553274 - 1 4 6
			equal percent	PSA3,4	Standard	82-553912 - 0 3 6
		SUS316LCoCr	equal percent	PSA1,2	Standard	82-553274 - 1 4 7
			equal percent	PSA3,4	Standard	82-553912 - 0 3 7
1-1/2 2	1-1/2	SUS316	equal percent	PSA1,2	Standard	82-553274 - 1 3 2
			equal percent	PSA3,4	Standard	82-553912 - 0 2 2
		SUS316CoCr	equal percent	PSA1,2	Standard	82-553274 - 1 3 5
			equal percent	PSA3,4	Standard	82-553912 - 0 2 5
		SUS316CoCr face	equal percent	PSA1,2	Standard	82-553274 - 1 3 8
			equal percent	PSA3,4	Standard	82-553912 - 0 2 8
		SUS440C	equal percent	PSA1,2	Standard	82-553471 - 1 3 1
			equal percent	PSA3,4	Standard	82-553911 - 0 2 1
		SUS316L	equal percent	PSA1,2	Standard	82-553274 - 1 3 6
			equal percent	PSA3,4	Standard	82-553912 - 0 2 6
		SUS316CoCr	equal percent	PSA1,2	Standard	82-553274 - 1 3 7
			equal percent	PSA3,4	Standard	82-553912 - 0 2 7
2	2	SUS316	equal percent	PSA1,2	Standard	82-553274 - 1 5 2
			equal percent	PSA3,4	Standard	82-553912 - 0 4 2
		SUS316CoCr	equal percent	PSA1,2	Standard	82-553274 - 1 5 5
			equal percent	PSA3,4	Standard	82-553912 - 0 4 5
		SUS316CoCr face	equal percent	PSA1,2	Standard	82-553274 - 1 5 8
			equal percent	PSA3,4	Standard	82-553912 - 0 4 8
		SUS440C	equal percent	PSA1,2	Standard	82-553471 - 1 5 1
			equal percent	PSA3,4	Standard	82-553911 - 0 4 1
		SUS316L	equal percent	PSA1,2	Standard	82-553274 - 1 5 6
			equal percent	PSA3,4	Standard	82-553912 - 0 4 6
		SUS316LCoCr	equal percent	PSA1,2	Standard	82-553274 - 1 5 7
			equal percent	PSA3,4	Standard	82-553912 - 0 4 7

2-4. Connection Size 1-1/2 inch to 4 inch : Bonnet for fluid temperature -17 to +230 deg.C

Connection Size (inch)	Port size (inch)	Material	Flow characteristic	Actuator model	Additional Condition	Parts No.
2-1/2	1-1/2	SUS316	equal percent	PSA3,4	Standard	82-553277 - 0 3 2
			equal percent	PSA6R	Standard	82-553941 - 0 3 2
		SUS316CoCr	equal percent	PSA3,4	Standard	82-553277 - 0 3 5
			equal percent	PSA6R	Standard	82-553941 - 0 3 5
		SUS316CoCr face	equal percent	PSA3,4	Standard	82-553277 - 0 3 8
			equal percent	PSA6R	Standard	82-553941 - 0 3 8
		SUS440C	equal percent	PSA3,4	Standard	82-553472 - 0 3 1
			equal percent	PSA6R	Standard	82-553940 - 0 3 1
		SUS316L	equal percent	PSA3,4	Standard	82-553277 - 0 3 6
			equal percent	PSA6R	Standard	82-553941 - 0 3 6
		SUS316LCoCr	equal percent	PSA3,4	Standard	82-553277 - 0 3 7
			equal percent	PSA6R	Standard	82-553941 - 0 3 7
2-1/2 3	2	SUS316	equal percent	PSA3,4	Standard	82-553277 - 0 2 2
			equal percent	PSA6R	Standard	82-553941 - 0 2 2
		SUS316CoCr	equal percent	PSA3,4	Standard	82-553277 - 0 2 5
			equal percent	PSA6R	Standard	82-553941 - 0 2 5
		SUS316CoCr face	equal percent	PSA3,4	Standard	82-553277 - 0 2 8
			equal percent	PSA6R	Standard	82-553941 - 0 2 8
		SUS440C	equal percent	PSA3,4	Standard	82-553472 - 0 2 1
			equal percent	PSA6R	Standard	82-553940 - 0 2 1
		SUS316L	equal percent	PSA3,4	Standard	82-553277 - 0 2 6
			equal percent	PSA6R	Standard	82-553941 - 0 2 6
		SUS316LCoCr	equal percent	PSA3,4	Standard	82-553277 - 0 2 7
			equal percent	PSA6R	Standard	82-553941 - 0 2 7
2-1/2 3 4	2-1/2	SUS316	equal percent	PSA3,4	Standard	82-553277 - 0 1 2
			equal percent	PSA6R	Standard	82-553941 - 0 1 2
		SUS316CoCr	equal percent	PSA3,4	Standard	82-553277 - 0 1 5
			equal percent	PSA6R	Standard	82-553941 - 0 1 5
		SUS316CoCr face	equal percent	PSA3,4	Standard	82-553277 - 0 1 8
			equal percent	PSA6R	Standard	82-553941 - 0 1 8
		SUS440C	equal percent	PSA3,4	Standard	82-553472 - 0 1 1
			equal percent	PSA6R	Standard	82-553940 - 0 1 1
		SUS316L	equal percent	PSA3,4	Standard	82-553277 - 0 1 6
			equal percent	PSA6R	Standard	82-553941 - 0 1 6
		SUS316LCoCr	equal percent	PSA3,4	Standard	82-553277 - 0 1 7
			equal percent	PSA6R	Standard	82-553941 - 0 1 7
3 4	3	SUS316	equal percent	PSA3,4	Standard	82-553277 - 0 4 2
			equal percent	PSA6R	Standard	82-553941 - 0 4 2
		SUS316CoCr	equal percent	PSA3,4	Standard	82-553277 - 0 4 5
			equal percent	PSA6R	Standard	82-553941 - 0 4 5
		SUS316CoCr face	equal percent	PSA3,4	Standard	82-553277 - 0 4 8
			equal percent	PSA6R	Standard	82-553941 - 0 4 8
		SUS440C	equal percent	PSA3,4	Standard	82-553472 - 0 4 1
			equal percent	PSA6R	Standard	82-553940 - 0 4 1
		SUS316L	equal percent	PSA3,4	Standard	82-553277 - 0 4 6
			equal percent	PSA6R	Standard	82-553941 - 0 4 6
		SUS316LCoCr	equal percent	PSA3,4	Standard	82-553277 - 0 4 7
			equal percent	PSA6R	Standard	82-553941 - 0 4 7

2-4. Connection Size 1-1/2 inch to 4 inch : Bonnet for fluid temperature -17 to +230 deg.C

Connection Size (inch)	Port size (inch)	Material	Flow characteristic	Actuator model	Additional Condition	Parts No.
4	4	SUS316	equal percent	PSA3,4	Standard	82-553277 - 0 5 2
			equal percent	PSA6R	Standard	82-553941 - 0 5 2
		SUS316CoCr	equal percent	PSA3,4	Standard	82-553277 - 0 5 5
			equal percent	PSA6R	Standard	82-553941 - 0 5 5
		SUS316CoCr face	equal percent	PSA3,4	Standard	82-553277 - 0 5 8
			equal percent	PSA6R	Standard	82-553941 - 0 5 8
		SUS440C	equal percent	PSA3,4	Standard	82-553472 - 0 5 1
			equal percent	PSA6R	Standard	82-553940 - 0 5 1
		SUS316L	equal percent	PSA3,4	Standard	82-553277 - 0 5 6
			equal percent	PSA6R	Standard	82-553941 - 0 5 6
		SUS316LCoCr	equal percent	PSA3,4	Standard	82-553277 - 0 5 7
			equal percent	PSA6R	Standard	82-553941 - 0 5 7

2-5. Connection Size 1-1/2 inch to 4inch : Bonnet for fluid temperature higher than 230 deg.C

Connection Size (inch)	Port size (inch)	Material	Flow characteristic	Actuator model	Additional Condition	Parts No.
1-1/2	1	SUS316	equal percent	PSA1,2	Others	82-553771 - 1 3 2
			equal percent	PSA3,4	Others	82-554094 - 0 1 2
		SUS316CoCr	equal percent	PSA1,2	Others	82-553771 - 1 3 5
			equal percent	PSA3,4	Others	82-554094 - 0 1 5
		SUS316CoCr face	equal percent	PSA1,2	Others	82-553771 - 1 3 8
			equal percent	PSA3,4	Others	82-554094 - 0 1 8
		SUS440C	equal percent	PSA1,2	Others	82-553766 - 1 3 1
			equal percent	PSA3,4	Others	82-553931 - 0 1 1
		SUS316L	equal percent	PSA1,2	Others	82-553771 - 1 3 6
			equal percent	PSA3,4	Others	82-554094 - 0 1 6
		SUS316LCoCr	equal percent	PSA1,2	Others	82-553771 - 1 3 7
			equal percent	PSA3,4	Others	82-554094 - 0 1 7
1-1/2 2	1-1/4	SUS316	equal percent	PSA1,2	Others	82-553771 - 1 5 2
			equal percent	PSA3,4	Others	82-554094 - 0 3 2
		SUS316CoCr	equal percent	PSA1,2	Others	82-553771 - 1 5 5
			equal percent	PSA3,4	Others	82-554094 - 0 3 5
		SUS316CoCr face	equal percent	PSA1,2	Others	82-553771 - 1 5 8
			equal percent	PSA3,4	Others	82-554094 - 0 3 8
		SUS440C	equal percent	PSA1,2	Others	82-553766 - 1 5 1
			equal percent	PSA3,4	Others	82-553931 - 0 3 1
		SUS316L	equal percent	PSA1,2	Others	82-553771 - 1 5 6
			equal percent	PSA3,4	Others	82-554094 - 0 3 6
		SUS316LCoCr	equal percent	PSA1,2	Others	82-553771 - 1 5 7
			equal percent	PSA3,4	Others	82-554094 - 0 3 7

2-5. Connection Size 1-1/2 inch to 4 inch : Bonnet for fluid temperature higher than 230 deg.C

Connection Size (inch)	Port size (inch)	Material	Flow characteristic	Actuator model	Additional Condition	Parts No.
1-1/2 2	1-1/2	SUS316	equal percent	PSA1,2	Others	82-553771 - 1 4 2
			equal percent	PSA3,4	Others	82-554094 - 0 2 2
		SUS316CoCr	equal percent	PSA1,2	Others	82-553771 - 1 4 5
			equal percent	PSA3,4	Others	82-554094 - 0 2 5
		SUS316CoCr face	equal percent	PSA1,2	Others	82-553771 - 1 4 8
			equal percent	PSA3,4	Others	82-554094 - 0 2 8
		SUS440C	equal percent	PSA1,2	Others	82-553766 - 1 4 1
			equal percent	PSA3,4	Others	82-553931 - 0 2 1
		SUS316L	equal percent	PSA1,2	Others	82-553771 - 1 4 6
			equal percent	PSA3,4	Others	82-554094 - 0 2 6
		SUS316LCoCr	equal percent	PSA1,2	Others	82-553771 - 1 4 7
			equal percent	PSA3,4	Others	82-554094 - 0 2 7
2	2	SUS316	equal percent	PSA1,2	Others	82-553771 - 1 6 2
			equal percent	PSA3,4	Others	82-554094 - 0 4 2
		SUS316CoCr	equal percent	PSA1,2	Others	82-553771 - 1 6 5
			equal percent	PSA3,4	Others	82-554094 - 0 4 5
		SUS316CoCr face	equal percent	PSA1,2	Others	82-553771 - 1 6 8
			equal percent	PSA3,4	Others	82-554094 - 0 4 8
		SUS440C	equal percent	PSA1,2	Others	82-553766 - 1 6 1
			equal percent	PSA3,4	Others	82-553931 - 0 4 1
		SUS316L	equal percent	PSA1,2	Others	82-553771 - 1 6 6
			equal percent	PSA3,4	Others	82-554094 - 0 4 6
		SUS316LCoCr	equal percent	PSA1,2	Others	82-553771 - 1 6 7
			equal percent	PSA3,4	Others	82-554094 - 0 4 7
2-1/2	1-1/2	SUS316	equal percent	PSA3,4	Others	82-553765 - 0 3 2
			equal percent	PSA6R	Others	82-554039 - 0 3 2
		SUS316CoCr	equal percent	PSA3,4	Others	82-553765 - 0 3 5
			equal percent	PSA6R	Others	82-554039 - 0 3 5
		SUS316CoCr face	equal percent	PSA3,4	Others	82-553765 - 0 3 8
			equal percent	PSA6R	Others	82-554039 - 0 3 8
		SUS440C	equal percent	PSA3,4	Others	82-553767 - 0 3 1
			equal percent	PSA6R	Others	82-554040 - 0 3 1
		SUS316L	equal percent	PSA3,4	Others	82-553765 - 0 3 6
			equal percent	PSA6R	Others	82-554039 - 0 3 6
		SUS316LCoCr	equal percent	PSA3,4	Others	82-553765 - 0 3 7
			equal percent	PSA6R	Others	82-554039 - 0 3 7
2-1/2 3	2	SUS316	equal percent	PSA3,4	Others	82-553765 - 0 2 2
			equal percent	PSA6R	Others	82-554039 - 0 2 2
		SUS316CoCr	equal percent	PSA3,4	Others	82-553765 - 0 2 5
			equal percent	PSA6R	Others	82-554039 - 0 2 5
		SUS316CoCr face	equal percent	PSA3,4	Others	82-553765 - 0 2 8
			equal percent	PSA6R	Others	82-554039 - 0 2 8
		SUS440C	equal percent	PSA3,4	Others	82-553767 - 0 2 1
			equal percent	PSA6R	Others	82-554040 - 0 2 1
		SUS316L	equal percent	PSA3,4	Others	82-553765 - 0 2 6
			equal percent	PSA6R	Others	82-554039 - 0 2 6
		SUS316LCoCr	equal percent	PSA3,4	Others	82-553765 - 0 2 7
			equal percent	PSA6R	Others	82-554039 - 0 2 7

2-5. Connection Size 1-1/2 inch to 4 inch : Bonnet for fluid temperature higher than 230 deg.C

Connection Size (inch)	Port size (inch)	Material	Flow characteristic	Actuator model	Additional Condition	Parts No.
2-1/2 3 4	2-1/2	SUS316	equal percent	PSA3,4	Others	82-553765 - 0 1 2
			equal percent	PSA6R	Others	82-554039 - 0 1 2
		SUS316CoCr	equal percent	PSA3,4	Others	82-553765 - 0 1 5
			equal percent	PSA6R	Others	82-554039 - 0 1 5
		SUS316CoCr face	equal percent	PSA3,4	Others	82-553765 - 0 1 8
			equal percent	PSA6R	Others	82-554039 - 0 1 8
		SUS440C	equal percent	PSA3,4	Others	82-553767 - 0 1 1
			equal percent	PSA6R	Others	82-554040 - 0 1 1
		SUS316L	equal percent	PSA3,4	Others	82-553765 - 0 1 6
			equal percent	PSA6R	Others	82-554039 - 0 1 6
		SUS316LCoCr	equal percent	PSA3,4	Others	82-553765 - 0 1 7
			equal percent	PSA6R	Others	82-554039 - 0 1 7
3 4	3	SUS316	equal percent	PSA3,4	Others	82-553765 - 0 4 2
			equal percent	PSA6R	Others	82-554039 - 0 4 2
		SUS316CoCr	equal percent	PSA3,4	Others	82-553765 - 0 4 5
			equal percent	PSA6R	Others	82-554039 - 0 4 5
		SUS316CoCr face	equal percent	PSA3,4	Others	82-553765 - 0 4 8
			equal percent	PSA6R	Others	82-554039 - 0 4 8
		SUS440C	equal percent	PSA3,4	Others	82-553767 - 0 4 1
			equal percent	PSA6R	Others	82-554040 - 0 4 1
		SUS316L	equal percent	PSA3,4	Others	82-553765 - 0 4 6
			equal percent	PSA6R	Others	82-554039 - 0 4 6
		SUS316LCoCr	equal percent	PSA3,4	Others	82-553765 - 0 4 7
			equal percent	PSA6R	Others	82-554039 - 0 4 7
4	4	SUS316	equal percent	PSA3,4	Others	82-553765 - 0 5 2
			equal percent	PSA6R	Others	82-554039 - 0 5 2
		SUS316CoCr	equal percent	PSA3,4	Others	82-553765 - 0 5 5
			equal percent	PSA6R	Others	82-554039 - 0 5 5
		SUS316CoCr face	equal percent	PSA3,4	Others	82-553765 - 0 5 8
			equal percent	PSA6R	Others	82-554039 - 0 5 8
		SUS440C	equal percent	PSA3,4	Others	82-553767 - 0 5 1
			equal percent	PSA6R	Others	82-554040 - 0 5 1

2-6. Three-face Cut off plug

2-6-1. Connection Size 1/2 inch to 1 inch under CV0.25 : metal seat

The "*" mark in the column of parts No. means materials.
For the details, please refer to the following table.
For Cv value=0.25 or under, the material is only SUS316 CoCr face.

*	Material Table
8	SUS316 CoCr face
6	SUS316L
7	SUS316L CoCr

Connection Size (inch)	Cv value	Material	Flow characteristic	Actuator model	Additional Condition	Parts No.
1/2 3/4 1	0.1	Refer to Material table	linear	PSA1,2	Standard	82-554885 - 01 *
	0.16		linear	PSA1,2	Standard	82-554885 - 02 *
	0.25		linear	PSA1,2	Standard	82-554885 - 03 *

2-6-2. Connection Size 1/2 inch to 1 inch over Cv0.4 : Metal Seat

The "*" mark in the column of parts No. means materials.
For the details, please refer to the following table.

*	Material Table
2	SUS316
5	SUS316 CoCr (For Cv value=0.25 or under chose"8")
6	SUS316L
7	SUS316L CoCr
8	SUS316 CoCr face

Connection Size (inch)	Cv value	Material	Flow characteristic	Actuator model	Additional Condition	Parts No.
1/2 3/4 1	0.4	Refer to Material Table	equal percent	PSA1,2	Standard	82-554885 - 04 *
	0.63		equal percent	PSA1,2	Standard	82-554885 - 05 *
	1.0		equal percent	PSA1,2	Standard	82-554885 - 06 *
	1.6		equal percent	PSA1,2	Standard	82-554885 - 07 *
	2.5		equal percent	PSA1,2	Standard	82-554885 - 08 *
	4		equal percent	PSA1,2	Standard	82-554885 - 09 *
3/4 1	6.3		equal percent	PSA1,2	Standard	82-554885 - 25 *
	8		equal percent	PSA1,2	Standard	82-554885 - 10 *
1	10		equal percent	PSA1,2	Standard	82-554885 - 11 *
	14		equal percent	PSA1,2	Standard	82-554885 - 12 *

2-6-3. Three-face Cut off plug Connection Size 1-1/2 inch to 4 inch : Bonnet for fluid temperature -17 to +230 deg.C

Connection Size (inch)	Port size (inch)	Material	Flow characteristic	Actuator model	Additional condition	Parts No.
1-1/2	1	SUS316	equal percent	PSA1,2	Standard	82-554885 - 1 2 2
			equal percent	PSA3,4	Standard	82-554885 - 0 1 2
		SUS316CoCr	equal percent	PSA1,2	Standard	82-554885 - 1 2 5
			equal percent	PSA3,4	Standard	82-554885 - 0 1 5
		SUS316CoCr face	equal percent	PSA1,2	Standard	82-554885 - 1 2 8
			equal percent	PSA3,4	Standard	82-554885 - 0 1 8
		SUS440C	equal percent	PSA1,2	Standard	Refer to factory
			equal percent	PSA3,4	Standard	Refer to factory
		SUS316L	equal percent	PSA1,2	Standard	82-554885 - 1 2 6
			equal percent	PSA3,4	Standard	82-554885 - 0 1 6
		SUS316LCoCr	equal percent	PSA1,2	Standard	82-554885 - 1 2 7
			equal percent	PSA3,4	Standard	82-554885 - 0 1 7
1-1/2 2	1-1/4	SUS316	equal percent	PSA1,2	Standard	82-554885 - 1 4 2
			equal percent	PSA3,4	Standard	82-554885 - 0 3 2
		SUS316CoCr	equal percent	PSA1,2	Standard	82-554885 - 1 4 5
			equal percent	PSA3,4	Standard	82-554885 - 0 3 5
		SUS316CoCr face	equal percent	PSA1,2	Standard	82-554885 - 1 4 8
			equal percent	PSA3,4	Standard	82-554885 - 0 3 8
		SUS440C	equal percent	PSA1,2	Standard	Refer to factory
			equal percent	PSA3,4	Standard	Refer to factory
		SUS316L	equal percent	PSA1,2	Standard	82-554885 - 1 4 6
			equal percent	PSA3,4	Standard	82-554885 - 0 3 6
		SUS316LCoCr	equal percent	PSA1,2	Standard	82-554885 - 1 4 7
			equal percent	PSA3,4	Standard	82-554885 - 0 3 7
1-1/2 2	1-1/2	SUS316	equal percent	PSA1,2	Standard	82-554885 - 1 3 2
			equal percent	PSA3,4	Standard	82-554885 - 0 2 2
		SUS316CoCr	equal percent	PSA1,2	Standard	82-554885 - 1 3 5
			equal percent	PSA3,4	Standard	82-554885 - 0 2 5
		SUS316CoCr face	equal percent	PSA1,2	Standard	82-554885 - 1 3 8
			equal percent	PSA3,4	Standard	82-554885 - 0 2 8
		SUS440C	equal percent	PSA1,2	Standard	Refer to factory
			equal percent	PSA3,4	Standard	Refer to factory
		SUS316L	equal percent	PSA1,2	Standard	82-554885 - 1 3 6
			equal percent	PSA3,4	Standard	82-554885 - 0 2 6
		SUS316CoCr	equal percent	PSA1,2	Standard	82-554885 - 1 3 7
			equal percent	PSA3,4	Standard	82-554885 - 0 2 7
2	2	SUS316	equal percent	PSA1,2	Standard	82-554885 - 1 5 2
			equal percent	PSA3,4	Standard	82-554885 - 0 4 2
		SUS316CoCr	equal percent	PSA1,2	Standard	82-554885 - 1 5 5
			equal percent	PSA3,4	Standard	82-554885 - 0 4 5
		SUS316CoCr face	equal percent	PSA1,2	Standard	82-554885 - 1 5 8
			equal percent	PSA3,4	Standard	82-554885 - 0 4 8
		SUS440C	equal percent	PSA1,2	Standard	Refer to factory
			equal percent	PSA3,4	Standard	Refer to factory
		SUS316L	equal percent	PSA1,2	Standard	82-554885 - 1 5 6
			equal percent	PSA3,4	Standard	82-554885 - 0 4 6
		SUS316LCoCr	equal percent	PSA1,2	Standard	82-554885 - 1 5 7
			equal percent	PSA3,4	Standard	82-554885 - 0 4 7

2-6-3. Three-face Cut off plug Connection Size 1-1/2 inch to 4 inch : Bonnet for fluid temperature -17 to +230 deg.C

Connection Size (inch)	Port size (inch)	Material	Flow characteristic	Actuator model	Additional condition	Parts No.
2-1/2	1-1/2	SUS316	equal percent	PSA3,4	Standard	82-554885 - 0 3 2
			equal percent	PSA6R	Standard	82-554885 - 0 3 2
		SUS316CoCr	equal percent	PSA3,4	Standard	82-554885 - 0 3 5
			equal percent	PSA6R	Standard	82-554885 - 0 3 5
		SUS316CoCr face	equal percent	PSA3,4	Standard	82-554885 - 0 3 8
			equal percent	PSA6R	Standard	82-554885 - 0 3 8
		SUS440C	equal percent	PSA3,4	Standard	Refer to factory
			equal percent	PSA6R	Standard	Refer to factory
		SUS316L	equal percent	PSA3,4	Standard	82-554885 - 0 3 6
			equal percent	PSA6R	Standard	82-554885 - 0 3 6
		SUS316LCoCr	equal percent	PSA3,4	Standard	82-554885 - 0 3 7
			equal percent	PSA6R	Standard	82-554885 - 0 3 7
2-1/2 3	2	SUS316	equal percent	PSA3,4	Standard	82-554885 - 0 2 2
			equal percent	PSA6R	Standard	82-554885 - 0 2 2
		SUS316CoCr	equal percent	PSA3,4	Standard	82-554885 - 0 2 5
			equal percent	PSA6R	Standard	82-554885 - 0 2 5
		SUS316CoCr face	equal percent	PSA3,4	Standard	82-554885 - 0 2 8
			equal percent	PSA6R	Standard	82-554885 - 0 2 8
		SUS440C	equal percent	PSA3,4	Standard	Refer to factory
			equal percent	PSA6R	Standard	Refer to factory
		SUS316L	equal percent	PSA3,4	Standard	82-554885 - 0 2 6
			equal percent	PSA6R	Standard	82-554885 - 0 2 6
		SUS316LCoCr	equal percent	PSA3,4	Standard	82-554885 - 0 2 7
			equal percent	PSA6R	Standard	82-554885 - 0 2 7
2-1/2 3 4	2-1/2	SUS316	equal percent	PSA3,4	Standard	82-554885 - 0 1 2
			equal percent	PSA6R	Standard	82-554885 - 0 1 2
		SUS316CoCr	equal percent	PSA3,4	Standard	82-554885 - 0 1 5
			equal percent	PSA6R	Standard	82-554885 - 0 1 5
		SUS316CoCr face	equal percent	PSA3,4	Standard	82-554885 - 0 1 8
			equal percent	PSA6R	Standard	82-554885 - 0 1 8
		SUS440C	equal percent	PSA3,4	Standard	Refer to factory
			equal percent	PSA6R	Standard	Refer to factory
		SUS316L	equal percent	PSA3,4	Standard	82-554885 - 0 1 6
			equal percent	PSA6R	Standard	82-554885 - 0 1 6
		SUS316LCoCr	equal percent	PSA3,4	Standard	82-554885 - 0 1 7
			equal percent	PSA6R	Standard	82-554885 - 0 1 7
3 4	3	SUS316	equal percent	PSA3,4	Standard	82-554885 - 0 4 2
			equal percent	PSA6R	Standard	82-554885 - 0 4 2
		SUS316CoCr	equal percent	PSA3,4	Standard	82-554885 - 0 4 5
			equal percent	PSA6R	Standard	82-554885 - 0 4 5
		SUS316CoCr face	equal percent	PSA3,4	Standard	82-554885 - 0 4 8
			equal percent	PSA6R	Standard	82-554885 - 0 4 8
		SUS440C	equal percent	PSA3,4	Standard	Refer to factory
			equal percent	PSA6R	Standard	Refer to factory
		SUS316L	equal percent	PSA3,4	Standard	82-554885 - 0 4 6
			equal percent	PSA6R	Standard	82-554885 - 0 4 6
		SUS316LCoCr	equal percent	PSA3,4	Standard	82-554885 - 0 4 7
			equal percent	PSA6R	Standard	82-554885 - 0 4 7

2-6-3. Three-face Cut off plug Connection Size 1-1/2 inch to 4 inch : Bonnet for fluid temperature -17 to +230 deg.C

Connection Size (inch)	Port size (inch)	Material	Flow characteristic	Actuator model	Additional condition	Parts No.
4	4	SUS316	equal percent	PSA3,4	Standard	82-554885 - 0 5 2
			equal percent	PSA6R	Standard	82-554885 - 0 5 2
		SUS316CoCr	equal percent	PSA3,4	Standard	82-554885 - 0 5 5
			equal percent	PSA6R	Standard	82-554885 - 0 5 5
		SUS316CoCr face	equal percent	PSA3,4	Standard	82-554885 - 0 5 8
			equal percent	PSA6R	Standard	82-554885 - 0 5 8
		SUS440C	equal percent	PSA3,4	Standard	Refer to factory
			equal percent	PSA6R	Standard	Refer to factory
		SUS316L	equal percent	PSA3,4	Standard	82-554885 - 0 5 6
			equal percent	PSA6R	Standard	82-554885 - 0 5 6
		SUS316LCoCr	equal percent	PSA3,4	Standard	82-554885 - 0 5 7
			equal percent	PSA6R	Standard	82-554885 - 0 5 7

3. Seat ring

3-1. Connection Size 1/2 inch to 1 inch

* of these parts' numbers means the following materials.

For Cv value=0.25 or under, the material is only SUS316 CoCr face.

*	Material
2	SUS316
3	SUS440C
5	SUS316 CoCr
6	SUS316L
7	SUS316L CoCr

Connection Size (inch)	Cv value	Material	Additional Condition	Parts No.
1/2 3/4 1	0.1	Refer to Material Table		82-553264 - 01 *
	0.16			82-553264 - 01 *
	0.25			82-553264 - 01 *
	0.4			82-553264 - 02 *
	0.63			82-553264 - 02 *
	1			82-553264 - 03 *
	1.6			82-553264 - 03 *
	2.5			82-553264 - 04 *
	4			82-553264 - 04 *
3/4 1	6.3			82-553264 - 05 *
	8			82-553264 - 05 *
1	10			82-553008 - 10 *
	14			82-553008 - 10 *

3-2. Connection Size 1-1/2 inch to 4 inch

Connection Size (inch)	Port size (inch)	Material	Additional condition	Parts No.
1-1/2	1	SUS316		82-553010 - 0 4 2
		SUS316CoCr		82-553010 - 0 4 5
		SUS440C		82-553010 - 0 4 3
		SUS316L		82-553010 - 0 4 6
		SUS316LCoCr		82-553010 - 0 4 7
1-1/2 2	1-1/4	SUS316		82-553010 - 0 3 2
		SUS316CoCr		82-553010 - 0 3 5
		SUS440C		82-553010 - 0 3 3
		SUS316L		82-553010 - 0 3 6
		SUS316LCoCr		82-553010 - 0 3 7
1-1/2 2	1-1/2	SUS316		82-553010 - 0 2 2
		SUS316CoCr		82-553010 - 0 2 5
		SUS440C		82-553010 - 0 2 3
		SUS316L		82-553010 - 0 2 6
		SUS316LCoCr		82-553010 - 0 2 7
2	2	SUS316		82-553010 - 0 1 2
		SUS316CoCr		82-553010 - 0 1 5
		SUS440C		82-553010 - 0 1 3
		SUS316L		82-553010 - 0 1 6
		SUS316LCoCr		82-553010 - 0 1 7
2-1/2	1-1/2	SUS316		82-553012 - 0 4 2
		SUS316CoCr		82-553012 - 0 4 5
		SUS440C		82-553012 - 0 4 3
		SUS316L		82-553012 - 0 4 6
		SUS316LCoCr		82-553012 - 0 4 7
2-1/2 3	2	SUS316		82-553012 - 0 3 2
		SUS316CoCr		82-553012 - 0 3 5
		SUS440C		82-553012 - 0 3 3
		SUS316L		82-553012 - 0 3 6
		SUS316LCoCr		82-553012 - 0 3 7
2-1/2 3	2-1/2	SUS316		82-553012 - 0 2 2
		SUS316CoCr		82-553012 - 0 2 5
		SUS440C		82-553012 - 0 2 3
		SUS316L		82-553012 - 0 2 6
		SUS316LCoCr		82-553012 - 0 2 7
3	3	SUS316		82-553012 - 0 1 2
		SUS316CoCr		82-553012 - 0 1 5
		SUS440C		82-553012 - 0 1 3
		SUS316L		82-553012 - 0 1 6
		SUS316LCoCr		82-553012 - 0 1 7

3-2. Connection Size 1-1/2 inch to 4 inch

Connection Size (inch)	Port size (inch)	Material	Additional condition	Parts No.
4	2-1/2	SUS316		82-553013 - 0 3 2
		SUS316CoCr		82-553013 - 0 3 5
		SUS440C		82-553013 - 0 3 3
		SUS316L		82-553013 - 0 3 6
		SUS316LCoCr		82-553013 - 0 3 7
	3	SUS316		82-553013 - 0 2 2
		SUS316CoCr		82-553013 - 0 2 5
		SUS440C		82-553013 - 0 2 3
		SUS316L		82-553013 - 0 2 6
		SUS316LCoCr		82-553013 - 0 2 7
	4	SUS316		82-553013 - 0 1 2
		SUS316CoCr		82-553013 - 0 1 5
		SUS440C		82-553013 - 0 1 3
		SUS316L		82-553013 - 0 1 6
		SUS316LCoCr		82-553013 - 0 1 7

4. Gasket

4-1. For general use

Gasket : Gasket between bonnet and valve body
Seat Gasket : Gasket between seat ring and valve body

Connection Size	Parts	Material	Parts No.	Qty.
1/2 3/4 1	Gasket	V543(PTFE)	82-553016 - 1 0 1	1
1-1/2 2	Gasket	V543(PTFE)	82-553016 - 2 0 1	1
2-1/2 3	Gasket	V543(PTFE)	82-553016 - 3 0 1	1
4	Gasket	V543(PTFE)	82-553016 - 4 0 1	1

4-2. For oil free treatment

Connection Size	Parts	Material	Parts No.	Qty.
1/2 3/4 1	Gasket	V543(PTFE)	82-553016 - 1 0 1	1
	Seat Gasket	V543(PTFE)	82-660153 - 1 0 1	1
1-1/2 2	Gasket	V543(PTFE)	82-553016 - 2 0 1	1
	Seat Gasket	V543(PTFE)	82-660153 - 3 0 1	1
2-1/2 3	Gasket	V543(PTFE)	82-553016 - 3 0 1	1
	Seat Gasket	V543(PTFE)	82-553463 - 1 0 1	1
4	Gasket	V543(PTFE)	82-553016 - 4 0 1	1
	Seat Gasket	V543(PTFE)	82-553463 - 2 0 1	1

4-3. For high temperature

Connection Size	Parts	Material	Parts No.	Qty.
1/2 3/4 1	Gasket	V543	82-553757 - 1 0 1	1
	Seat Gasket	V563(Monel)	82-553756 - 1 0 1	1
1-1/2 2	Gasket	V543	82-553757 - 2 0 1	1
	Seat Gasket	V563(Monel)	82-553756 - 2 0 1	1
2-1/2 3	Gasket	V543	82-553757 - 3 0 1	1
	Seat Gasket	V563(Monel)	82-553756 - 3 0 1	1
4	Gasket	V543	82-553757 - 4 0 1	1
	Seat Gasket	V563(Monel)	82-553756 - 4 0 1	1

5. Gland packing

5-1. PTFE Yarn packing : For general use

Connection Size	Actuator model	Model No.	Additional condition	Parts No.	Qty.
1/2inch to 2inch	PSA1,2	P4519		82-553327-101	5
2-1/2inch to 4inch	PSA3,4	P4519		82-553328-101	5

5-2. V type PTFE packing : For oil free

Connection Size	Actuator model	Model No.	Additional condition	Parts No.	Qty.
1/2inch to 2inch	PSA1,2	V-PTFE		82-553020-101	4
2-1/2inch to 4inch	PSA3,4	V-PTFE		82-509693-001	4

5-3. V type PTEF packing : For vacuum service

Connection Size	Actuator model	Model No.	Additional condition	Parts No.	Qty.
1/2inch to 2inch	PSA1,2	V-PTFE	Direct/Reverse	82-553020-101	6
2-1/2inch to 4inch	PSA3,4	V-PTFE	Direct/Reverse	82-509693-001	6

5-4. Expanded graphite packing : For high temperature

Connection Size	Actuator model	Model No.	Additional condition	Parts No.	Qty.
1/2inch to 2inch	PSA1,2	P6610CL		82-554274-101	3
		P6722		82-554275-101	4
2-1/2inch to 4inch	PSA3,4	P6610CL		82-554274-102	3
		P6722		82-554275-102	4

6. Surrounding parts of grand packing

6-1. PTFE Yarn packing (P4519) used : For general use

Actuator model PSA1,2

Parts	Actuator model	Material	Additional condition	Parts No.	Qty.
Packing follower	PSA1,2	SUS316		82-553026-101	1
O-ring (P18)	PSA1,2	Aflas		82-592221-801	1
O-ring (P12.5)	PSA1,2	Aflas		82-592221-401	1
Spacer	PSA1,2	SUS316		82-553331-125	1

Actuator model PSA3,4

Parts	Actuator model	Material	Additional condition	Parts No.	Qty.
Packing follower	PSA3,4	SUS316		82-553027-101	1
O-ring (P22.4)	PSA3,4	Aflas		82-592222-401	1
O-ring (P16)	PSA3,4	Aflas		82-592221-701	1
Spacer	PSA3,4	SUS316		82-553331-254	1

6-2. V type PTFE packing : For general use

Actuator model PSA1,2

Parts	Actuator model	Material	Additional condition	Parts No.	Qty.
Packing follower	PSA1,2	SUS316		82-553026-101	1
O-ring (P18)	PSA1,2	Aflas		82-592221-801	1
O-ring (P12.5)	PSA1,2	Aflas		82-592221-401	1
Retaining ring upper	PSA1,2	SUS316		82-553272-101	1
Retaining ring lower	PSA1,2	SUS316		82-553273-101	1
Spring	PSA1,2			82-553329-101	1
Packing ring	PSA1,2	SUS316		82-509712-166	1
Spacer	PSA1,2	SUS316		82-553331-111	1

Actuator model PSA3,4

Parts	Actuator model	Material	Additional condition	Parts No.	Qty.
Packing follower	PSA3,4	SUS316		82-553027-101	1
O-ring (P22.4)	PSA3,4	Aflas		82-592222-401	1
O-ring (P16)	PSA3,4	Aflas		82-592221-701	1
Retaining ring upper	PSA3,4	SUS316		82-509683-166	1
Retaining ring lower	PSA3,4	SUS316		82-509703-166	1
Spring	PSA3,4			82-553329-102	1
Packing ring	PSA3,4	SUS316		82-509653-166	1

6-3. V type PTFE packing : For oil free use

Actuator model PSA1,2

Parts	Actuator model	Material	Additional condition	Parts No.	Qty.
Packing follower	PSA1,2	SUS316	Oil free	82-553026-101	1
O-ring (P18)	PSA1,2	Viton	Oil free	82-592221-897	1
O-ring (P12.5)	PSA1,2	Viton	Oil free	82-592221-497	1
Retaining ring upper	PSA1,2	SUS316	Oil free	82-553272-101	1
Retaining ring lower	PSA1,2	SUS316	Oil free	82-553273-101	1
Spring	PSA1,2		Oil free	82-553329-101	1
Packing ring	PSA1,2	SUS316	Oil free	82-509712-166	1
Spacer	PSA1,2	SUS316	Oil free	82-553331-111	1

Actuator model PSA3,4

Parts	Actuator model	Material	Additional condition	Parts No.	Qty.
Packing follower	PSA3,4	SUS316	Oil free	82-553027-101	1
O-ring (P22.4)	PSA3,4	Viton	Oil free	82-592222-497	1
O-ring (P16)	PSA3,4	Viton	Oil free	82-592221-797	1
Retaining ring upper	PSA3,4	SUS316	Oil free	82-509683-166	1
Retaining ring lower	PSA3,4	SUS316	Oil free	82-509703-166	1
Spring	PSA3,4		Oil free	82-553329-102	1
Packing ring	PSA3,4	SUS316	Oil free	82-509653-166	1

6-4. V type PTFE packing (direct/reverse) use : For vacuum service use

Actuator model PSA1,2

Parts	Actuator model	Material	Additional condition	Parts No.	Qty.
Packing follower	PSA1,2	SUS316	For vacuum	82-553026-101	1
O-ring (P18)	PSA1,2	Aflas	For vacuum	82-592221-801	1
O-ring (P12.5)	PSA1,2	Aflas	For vacuum	82-592221-401	1
Retaining ring upper	PSA1,2	SUS316	For vacuum	82-553272-101	2
Retaining ring lower	PSA1,2	SUS316	For vacuum	82-553273-101	2
Packing ring	PSA1,2	SUS316	For vacuum	82-509712-166	2

Actuator model PSA3,4

Parts	Actuator model	Material	Additional condition	Parts No.	Qty.
Packing follower	PSA3,4	SUS316	For vacuum	82-553027-101	1
O-ring (P22.4)	PSA3,4	Aflas	For vacuum	82-592222-401	1
O-ring (P16)	PSA3,4	Aflas	For vacuum	82-592221-701	1
Retaining ring upper	PSA3,4	SUS316	For vacuum	82-509683-166	2
Retaining ring lower	PSA3,4	SUS316	For vacuum	82-509703-166	2
Spacer	PSA3,4	SUS316	For vacuum	82-553331-228	1

6-5. V type PTFE packing (direct/reverse) use : For vacuum service and oil free use

Actuator model PSA1,2

Parts	Actuator model	Material	Additional condition	Parts No.	Qty.
Packing follower	PSA1,2	SUS316	For vacuum • Oil free	82-553026-101	1
O-ring (P18)	PSA1,2	Viton	For vacuum • Oil free	82-592221-897	1
O-ring (P12.5)	PSA1,2	Viton	For vacuum • Oil free	82-592221-497	1
Retaining ring upper	PSA1,2	SUS316	For vacuum • Oil free	82-553272-101	2
Retaining ring lower	PSA1,2	SUS316	For vacuum • Oil free	82-553273-101	2
Packing ring	PSA1,2	SUS316	For vacuum • Oil free	82-509712-166	2

Actuator model PSA3,4

Parts	Actuator model	Material	Additional condition	Parts No.	Qty.
Packing follower	PSA3,4	SUS316	For vacuum • Oil free	82-553027-101	1
O-ring (P22.4)	PSA3,4	Viton	For vacuum • Oil free	82-592222-497	1
O-ring (P16)	PSA3,4	Viton	For vacuum • Oil free	82-592221-797	1
Retaining ring upper	PSA3,4	SUS316	For vacuum • Oil free	82-509683-166	2
Retaining ring lower	PSA3,4	SUS316	For vacuum • Oil free	82-509703-166	2
Spacer	PSA3,4	SUS316	For vacuum • Oil free	82-553331-228	1

6-6. Expanded graphite packing used : For high temperature service use

Actuator model PSA1,2

Parts	Actuator model	Material	Additional condition	Parts No.	Qty.
Packing follower	PSA1,2	SUS316	High temperature	82-553026-101	1
		SUS316L	High temperature	82-553026-201	1
O-ring (P18)	PSA1,2	Viton	High temperature	82-592221-897	1
O-ring (P12.5)	PSA1,2	Viton	High temperature	82-592221-497	1
Lantern ring	PSA1,2	SUS316	High temperature	82-553862-101	1
		SUS316L		82-553862-201	1
Packing ring	PSA1,2	SUS316	High temperature	82-509712-166	1
		SUS316L		82-509712-201	1

Actuator model PSA3, 4

Parts	Actuator model	Material	Additional condition	Parts No.	Qty.
Packing follower	PSA3,4	SUS316	High temperature	82-553027-101	1
		SUS316L		82-553027-201	1
O-ring (P22.4)	PSA3,4	Viton	High temperature	82-592222-497	1
O-ring (P16)	PSA3,4	Viton	High temperature	82-592221-797	1
Lantern ring	PSA3,4	SUS316	High temperature	82-553863-101	1
		SUS316L		82-553863-201	1
Packing ring	PSA3,4	SUS316	High temperature	82-509653-166	1
		SUS316L		82-509653-201	1

6-7. Certified ISO 15848-1 – Compliant low emission gland packing system

6-7-1. For PTFE yarn (actuator model PSA2)

Part name	Actuator model	Material	Part No.	Qty.
Main packing	PSA2	P4519	82553327- 101	3
Adapter packing		P6720	82573475- 201	2
Carbon ring		P6210C2FS	82573484- 006	2
Belleville spring		SUS304	82573462- 102	6
O-ring (small)		AFLAS	82592221- 401	1
O-ring (large)		AFLAS	82592221- 801	1
Gland stud		A193 GrB8CL2	82559311- 012	2
Gland nut		SUS304	82592448- 163	2
Packing flange		SCS13	82573477- 101	1
Packing follower		SUS304	82573478- 101	1
Packing follower for O-ring use		SUS304	82573479- 101	1
Spacer		SUS304	82553331- 120	1

6-7-2. For PTFE yarn (actuator model PSA3, 4)

Part name	Actuator model	Material	Part No.	Qty.
Main packing	PSA3 PSA4	P4519	82553328- 101	3
Adapter packing		P6720	82573475- 202	2
Carbon ring		P6210C2FS	82573484- 007	2
Belleville spring		SUS304	82573462- 103	6
O-ring (small)		AFLAS	82592221- 701	1
O-ring (large)		AFLAS	82592222- 401	1
Gland stud		A193 GrB8CL2	82559312- 012	2
Gland nut		SUS304	82592448- 013	2
Packing flange		SCS13	82573458- 101	1
Packing follower		SUS304	82573480- 101	1
Packing follower for O-ring use		SUS304	82573481- 101	1
Spacer		SUS304	82553331- 249	1

6-7-3. For PTFE yarn (actuator model PSA6R)

Part name	Actuator model	Material	Part No.	Qty.
Main packing	PSA6R	P4519	82571048- 109	3
Adapter packing		P6720	82573475- 204	2
Carbon ring		P6210C2FS	82573484- 010	2
Belleville spring		SUS304	82573462- 105	6
O-ring (small)		AFLAS	82592223- 301	1
O-ring (large)		AFLAS	82592224- 101	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

6-7-4. For expanded graphite (actuator model PSA2)

Part name	Actuator model	Material	Part No.	Qty.
Main packing	PSA2	P6617CL	82573489- 006	3
Adapter packing		P6720	82573475- 201	2
Carbon ring		P6210	82573488- 006	2
Belleville spring		SUS304	82573462- 107	6
O-ring (small)		Viton	82592221- 497	1
O-ring (large)		Viton	82592221- 897	1
Gland stud		A193 GrB8CL2	82559311- 012	2
Gland nut		SUS304	82592448- 163	2
Packing flange		SCS13	82573477- 101	1
Packing follower		SUS304	82573478- 201	1
Packing follower for O-ring use		SUS304	82573479- 201	1
Spacer		SUS304	82553331- 126	1

6-7-5. For expanded graphite (actuator model PSA3, 4)

Part name	Actuator model	Material	Part No.	Qty.
Main packing	PSA3 PSA4	P6617CL	82573489- 007	3
Adapter packing		P6720	82573475- 202	2
Carbon ring		P6210	82573488- 007	2
Belleville spring		SUS304	82559308- 102	6
O-ring (small)		Viton	82592221- 797	1
O-ring (large)		Viton	82592222- 497	1
Gland stud		A193 GrB8CL2	82559312- 012	2
Gland nut		SUS304	82592448- 013	2
Packing flange		SCS13	82573458- 101	1
Packing follower		SUS304	82573480- 201	1
Packing follower for O-ring use		SUS304	82573481- 201	1
Spacer		SUS304	82553331- 247	1

6-7-6. For expanded graphite (actuator model PSA6R)

Part name	Actuator model	Material	Part No.	Qty.
Main packing	PSA6R	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 for O-ring use		SUS304	82573472- 201	1
Spacer		SUS304	82553331- 779	1

7. Other parts

Parts	Actuator model	Material	Additional condition	Parts No.	Qty.
Packing flange	PSA1,2	SCS13		82-553028-201	1
Packing flange	PSA3,4	SCS13		82-509513-264	1
Stud bolt	PSA1,2	SUS304		82-592002-264	2
Nut	PSA1,2	SUS304		82-592103-264	2
Stud bolt	PSA3,4	SUS304		82-592004-264	2
Nut	PSA3,4	SUS304		82-592103-464	2
Nut to fasten york	PSA1,2	S25C		82-509501-126	1
Nut to fasten york	PSA3,4	S25C		82-509503-126	1

8. Actuator

8-1. Chaging actuator action : Charging from direct action to reverse action.

Actuator model	Parts Connection	Size	Additional condition	Parts No.	Qty.
PSA1D to PSA1R	Rod	1/2, 3/4, 1inch		82-553314-103	1
	Seal washer	1/2, 3/4, 1inch		82-521069-101	4
	O-ring	1/2, 3/4, 1inch		82-592235-596	1
	Rod packing	1/2, 3/4, 1inch		82-521067-102	1
	Washer	1/2, 3/4, 1inch		82-553318-101	1
	Rain cap	1/2, 3/4, 1inch		82-553334-101	1
PSA2D to PSA2R	Rod	1/2, 3/4, 1inch		82-553314-103	1
	Seal washer	1/2, 3/4, 1inch		82-521069-101	4
	O-ring	1/2, 3/4, 1inch		82-592235-596	1
	Rod packing	1/2, 3/4, 1inch		82-521067-102	1
	Washer	1/2, 3/4, 1inch		82-553318-101	1
	Rain cap	1/2, 3/4, 1inch		82-553334-101	1
PSA3D to PSA3R	Rod	1-1/2, 2inch		82-553315-103	1
	Diaphragm retainer(reverse)	1-1/2, 2inch		82-553313-101	1
	Seal washer	1-1/2, 2inch		82-521069-102	4
	O-ring	1-1/2, 2inch		82-592235-896	1
	Rod packing	1-1/2, 2inch		82-521067-103	1
	Washer	1-1/2, 2inch		82-553318-102	1
	Rain cap	1-1/2, 2inch		82-553334-101	1
	Diaphragm case (upper)	1-1/2, 2inch	connectionRc1/4 Standard finish	82-562893-101	1
			connection1/4NPT Standard finish	82-562893-102	1
			connectionRc1/4 corrosion resistant	82-562893-103	1
			connection1/4NPT corrosion resistant	82-562893-104	1
	Rod	3, 4inch		82-553315-103	1
	Diaphragm retainer(reverse)	3, 4inch		82-553313-101	1
	Seal washer	3, 4inch		82-521069-102	4
	O-ring	3, 4inch		82-592235-896	1
	Rod packing	3, 4inch		82-521067-103	1
	Washer	3, 4inch		82-553318-102	1
	Rain cap	3, 4inch		82-553334-101	1
PSA4D to PSA4R	Rod	1-1/2, 2inch		82-553315-104	1
	Diaphragm retainer(reverse)	1-1/2, 2inch		82-553313-101	1
	Seal washer	1-1/2, 2inch		82-521069-102	4
	O-ring	1-1/2, 2inch		82-592235-896	1
	Rod packing	1-1/2, 2inch		82-521067-103	1
	Washer	1-1/2, 2inch		82-553318-102	1
	Rain cap	1-1/2, 2inch		82-553334-101	1
	Diaphragm case (upper)	1-1/2, 2inch	connectionRc1/4 Standard finish	82-562564-101	1
			connection1/4NPT Standard finish	82-562564-102	1
			connectionRc1/4 corrosion resistant	82-562564-103	1
			connection1/4NPT corrosion resistant	82-562564-104	1
	Rod	3, 4inch		82-553315-104	1
	Diaphragm retainer(reverse)	3, 4inch		82-553313-101	1
	Seal washer	3, 4inch		82-521069-102	4
	O-ring	3, 4inch		82-592235-896	1
	Rod packing	3, 4inch		82-521067-103	1
	Washer	3, 4inch		82-553318-102	1
	Rain cap	3, 4inch		82-553334-101	1

8-2. Changing actuator action :
Changing from reverse action to direct action

Actuator model	Parts Connection	Size	Additional condition	Parts No.	Qty.
PSA1R to PSA1D	Rod	1-1/2, 2inch		82-553314-101	1
	Washer	1-1/2, 2inch		82-553318-101	1
PSA2R to PSA2D	Rod	1-1/2, 2inch		82-553314-102	1
	Washer	1-1/2, 2inch		82-553318-101	1
PSA3R to PSA3D	Rod	1-1/2, 2inch		82-563133-101	1
	Washer	1-1/2, 2inch		82-553318-101	1
	Diaphragm retainer (direct)	1-1/2, 2inch		82-553312-101	1
	Diaphragm case	1-1/2, 2inch	connectionRc1/4 Standard finish	82-521022-101	1
			connection1/4NPT Standard finish	82-521022-102	1
			connectionRc1/4 corrosion resistant	82-521022-103	1
			connection1/4NPT corrosion resistant	82-521022-104	1
PSA4R to PSA4D	Rod	3, 4inch		82-553315-101	1
	Washer	3, 4inch		82-553318-101	1
	Diaphragm retainer (direct)	3, 4inch		82-553312-101	1
	Rod	1-1/2, 2inch		82-563133-102	1
	Washer	1-1/2, 2inch		82-553318-102	1
	Diaphragm retainer (direct)	1-1/2, 2inch		82-553312-101	1
	Diaphragm case	1-1/2, 2inch	connectionRc1/4 Standard finish	82-521024-101	1
			connection1/4NPT Standard finish	82-521024-102	1
			connectionRc1/4 corrosion resistant	82-521024-103	1
			connection1/4NPT corrosion resistant	82-521024-104	1
	Rod	3, 4inch		82-553315-102	1
	Washer	3, 4inch		82-553318-102	1
	Diaphragm retainer (direct)	3, 4inch		82-553312-101	1

8-3. Actuator diaphragm

Actuator model	Parts		Additional condition	Parts No.	Qty.
PSA1	Diaphragm			82-553306-101	1
PSA2	Diaphragm			82-553307-101	1
PSA3	Diaphragm			82-553308-101	1
PSA4	Diaphragm			82-553309-101	1

8-4. Actuator spring

Actuator model		Spring Range		Parts No.	Qty.
PSA1	Spring	20 to 100kPa	0.2 to 1.0kgf/cm^2	82-553617-103	4
		80 to 240kPa	0.8 to 2.4kgf/cm^2	82-553310-101	4
PSA2	Spring	20 to 100kPa	0.2 to 1.0kgf/cm^2	82-553618-101	4
		80 to 240kPa	0.8 to 2.4kgf/cm^2	82-553617-101	4
PSA3	Spring	20 to 100kPa	0.2 to 1.0kgf/cm^2	82-553618-102	8
		80 to 240kPa	0.8 to 2.4kgf/cm^2	82-553310-103	8
PSA4	Spring	20 to 100kPa	0.2 to 1.0kgf/cm^2	82-553618-103	8
		80 to 240kPa	0.8 to 2.4kgf/cm^2	82-553617-102	8

Terms and Conditions

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

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

1. Warranty period and warranty scope

   1.1 Warranty period

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

   1.2 Warranty scope

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

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

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

2. Ascertainment of suitability

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

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

   *1. A design that is safe even if the user makes an error.
   *2. A design that is safe even if the device fails.
   *3. Avoidance of device failure by using highly reliable components, etc.
   *4. The use of redundancy.

3. Precautions and restrictions on application

   3.1 Restrictions on application

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

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

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

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

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

   3.2 Precautions on application

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

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

4. Precautions against long-term use

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

5. Recommendation for renewal

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

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

6. Other precautions

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

7. Changes to specifications

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

8. Discontinuance of the supply of products/parts

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

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

9. Scope of services

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

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

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

Document Number:	CM2-AGV200-2001D
Document Name:	Control Valves Model AGVB_ _ _ /AGVM_ _ _ User's Manual
Date:	1st edition: Nov. 2012 2nd edition: Dec. 2018
Edited by:	Azbil Corporation
Issued by:	Azbil Control Instruments (Dalian) Co., Ltd.
Address:	No.18 Dong Bei Second Street Dalian Econmy & Technical Development, Dalian P.R.China.
URL:	https://www.azbil.com/global/

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