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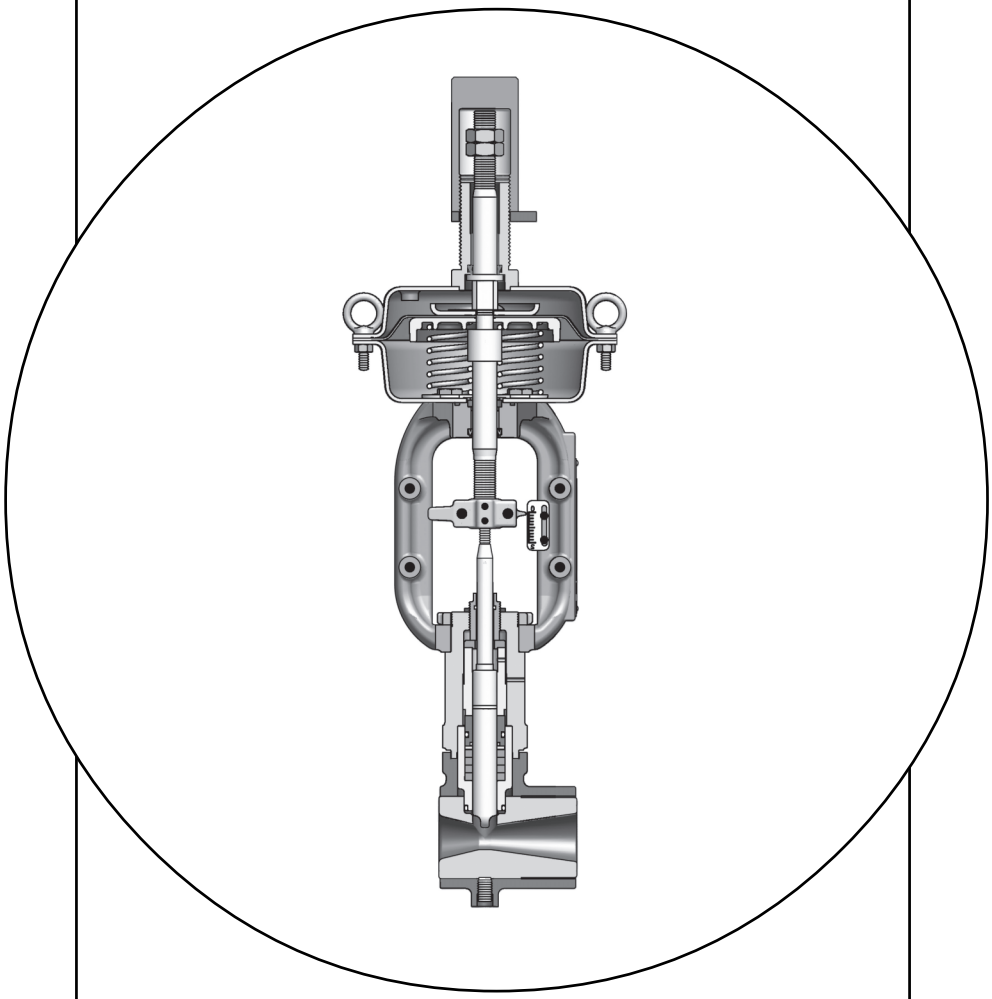
OM2-8193-0300

Ceramic Control Valves

Model : HIC

User's Manual



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1. GENERAL

Model HIC Ceramics Control Valves, which are of a straight-through type and employ ceramics throughout for their components contacted with the flow media, are exceptionally highly resistant against corrosion and abrasion. On the other hand, however, employment of ceramics call for particular care to be exercised when operating or servicing these valves. Be sure to observe especially carefully the instructions given in this manual when handling this particular model of control valves.

1.1 Scope

For the valve positioner, refer to the applicable operator's manual as follows:

- Model VPE OM2-8310-0410 Pneumatic valve positioner for small actuators
- Model HTP OM2-8310-0200 Pneumatic valve positioner (Single Acting type)
- Model HEP 15, l6, l7 OM2-8313-0100 Electro-Pneumatic Valve Positioner (Single Acting Type)
- Model AVP 300/301/302/200/201/202 CM2-AVP300-2001 Smart valve positioner
- Model AVP 303/203 CM2-AVP303-2001 Smart valve positioner

1.2 Major Components of Control Valves

Each control valve is comprised primarily of a valve body and an actuator, and may be equipped with a positioner and other auxiliary devices. A typical valve structure is shown in Fig. 1-1.

1.3 Valve Body Section

The valve body section is comprised of a valve body, a valve plug, a gland box, a casing, a bonnet, etc. The valve plug is vertically driven by the actuator to restrict the medium flow path of the valve body.

1.4 Actuator

For Model HIC Ceramics Control Valve, Model PSA1 (for 1-inch valve) or HA2 (for 1 1/2 to 3-inch valves) Actuator is used. The actuator is a multi-spring diaphragm motor which converts a pneumatic signal pressure into mechanical stroke of a stem with which to lift the valve plug. The actuator has a lift stopper to prevent the valve plug from hitting the valve seat in order to protect the trims.

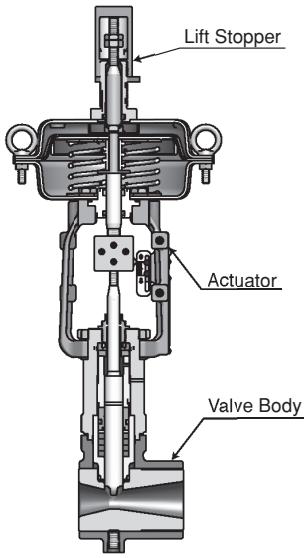


Fig. 1-1 A Typical Structure of Model HIC Ceramic Control Valve

1.5 Nameplate

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

Fig. 1-2 Nameplate

1.6 Structure of Valve Body Section

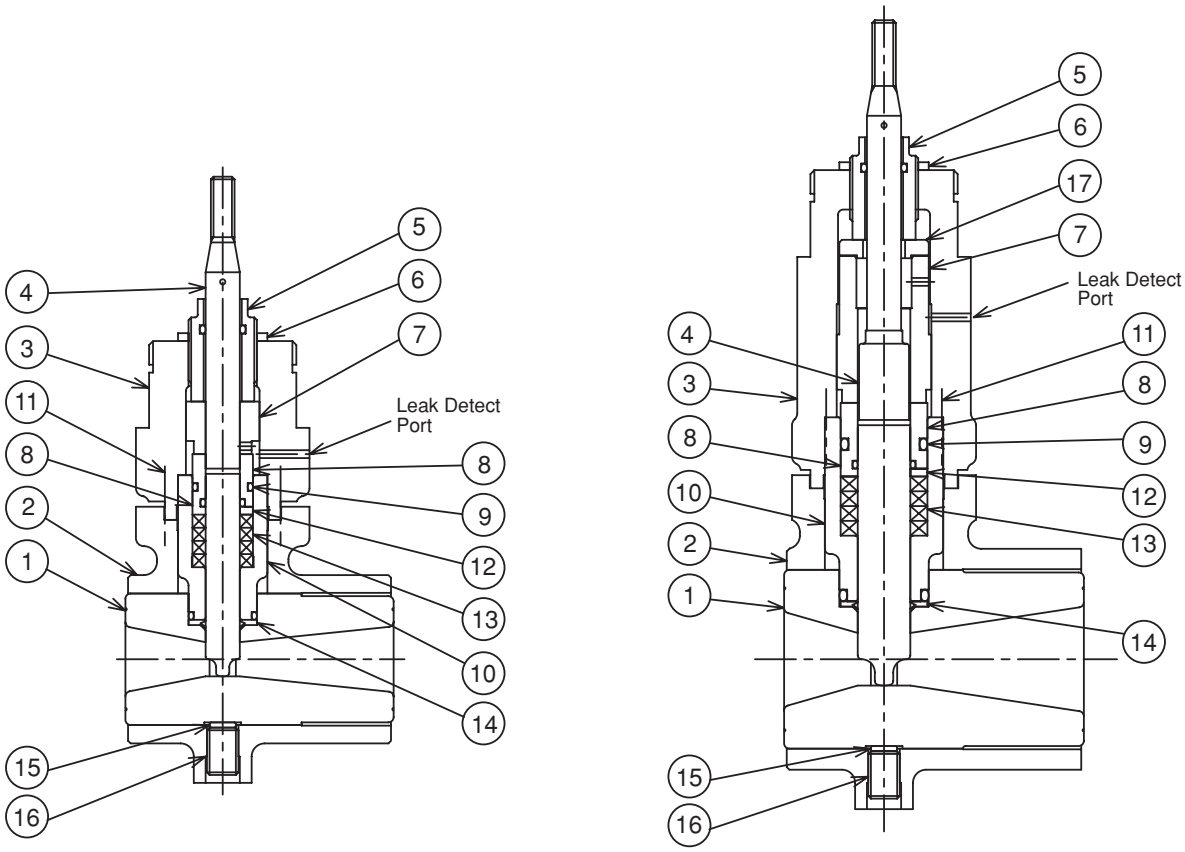


Fig. 1-3 Maximum Lifting Loads of Eyebolts

No.	Component	Material
1	Valve Body	Al_2O_3 or SiC
2	Valve Body Casing	FCD450 or SCS13
3	Bonnet	FCD450 or SCS13
4	Valve Plug	(Al_2O_3 or SUS316) or (SiC+SUS316)
5	Packing Follower	SUS304
6	Lock Nut	SUS304
7	Guide	SUS304
8	Spacer	SUS316 or Al2O3 or SiC
9	O-Ring	Fluoric rubber
10	Gland Box	Al_2O_3 or SiC
11	Hex Nut	SUS304
12	Packing Retainer	Al_2O_3 or SiC
13	Packing	PTFE-impregnated PTFE fiber (1200G)
14	Gasket with Scraper	PTFE with 15% CF
15	Cushion Spacer	Tough pitch steel (C110B)
16	Hex Socket Head Bolt	SUS304
17	Guide	SUS304

Table 1-1 Components of Valve Body Section

Notes : 1. When 8 Spacer is made of SUS316, 12 Packing Retainer is not needed.
2. Al_2O_3 : 99% alumina ceramics
3. SiC : Silicon carbide ceramics

2. INSTALLATION

When installing the control valve, be sure to observe the instructions given in this section.

2.1 Ambient Temperature

Be sure that the ambient temperature does not become higher than the specified ambient temperature limit of the actuator.

2.2 Cleaning Before Installation

Before installing the control valve in the process pipe, remove foreign matter (welding scales, chips, etc.) from the process pipe at both upstream and downstream sides of the control valve by blowing the process pipe with compressed air.

2.3 Precautions for Instillation

IMPORTANT

(1) Provide a straight process pipe section of 5D (D:pipe diameter) or more at each of the upstreatm and downstream sides of the control valve.

(2) For the gasket, use a PTFE-wrapped gasket or a PTFE sheet gasket. Never use any metallic gasket.

(3) Tighten the process pipe connection bolts uniformly, exercising care so that they are not tightened unevenly.

(4) When using both regular type and through type of bolts for process pipe connection (for valve size 2, 2 1/2, or 3 inches), tighten the through bolts first and the regular bolts last.

(5) handle the control valve extremely carefully lest it should be subjected to mechanical shocks. Do not drop it or hit it.

2.4 Installation Direction and Attitude

The blow direction is indicated on the valve body of control valve, Install the valve is the direction that it conforms with the process medium flow direction. Install the valve in an attitude that its actuator is positioned vertically (plumb). Allow a service space of 200mm above the valve so that its actuator can be dismantled.

2.5 Bolts and Nuts for Process Pipe Connection

To connect the control valve to the process pipe, use the bolts and nuts which are supplied accompanying the valve. When other bolts and nuts are to be used for any reason, use ones of the identical dimensions as the supplied ones (refer to 8.2 “Bolts For Valve and Process Pipe Connection”.)

2.6 Bolt Tightening Torques

For the tightening torques of bolts for process pipe connection, see Table 2-1.

Size (in.)	Torque (kgf/cm)			
	JIS 10K	JIS 20K	ANSI 150	ANSI 300
1	375 ~ 505	375 ~ 505	125 ~ 255	375 ~ 505
1 1/2	390 ~ 530	390 ~ 530	180 ~ 240	730 ~ 970
2	400 ~ 540	375 ~ 505	400 ~ 540	375 ~ 505
2 1/2	425 ~ 575	385 ~ 515	425 ~ 575	730 ~ 970
3	390 ~ 530	730 ~ 970	425 ~ 575	730 ~ 970

Table 2-1 Bolt Tightening Torques

2.7 Actuator Mounting Direction Change

To change the mounting direction of the actuator, loosen the yoke clamping-nut using a chisel, rotate the actuator by 180 degrees of angle, and tighten the clamping-nut securely. Note that the mounting direction can be changed only by 180 degrees and cannot be changed to any intermediate positions. (Refer to the instructions for disassembly and assembly of the actuator.)

3. PRECAUTIONS

3.1 Thermal Shocks and Temperature Gradient

(1) The allowable maximum thermal shock (ΔT) is 70˚C for the alumina ceramics control valve or 150˚C for the silicon carbide ceramics control valve. Pay attention so that the control valve is not subjected to thermal shocks larger than its allowable maximum thermal shock. Note that the control valve may be damaged of it is subjected to thermal shocks higher than its allowable limit.

(2) When feeding a high temperature process medium which can cause a differential temperature (between medium temperature and ambient temperature) greater than the allowable maximum thermal shock or when heating up the control valve to retain it at a certain temperature for a certain period, heat up the control valve with a temperature gradient of 200˚C/hour or slower.

(3) When heating up the control valve stepwise, allow temperature retaining periods as shown in Table 3-1.

Valve Body Material	Stepwise Temperature (˚C)	Temperature Retaining Period (Minute)
Alumina Ceramics	50	20
	70	30
Sillicon Carbide Ceramics	100	30

Table 3-1

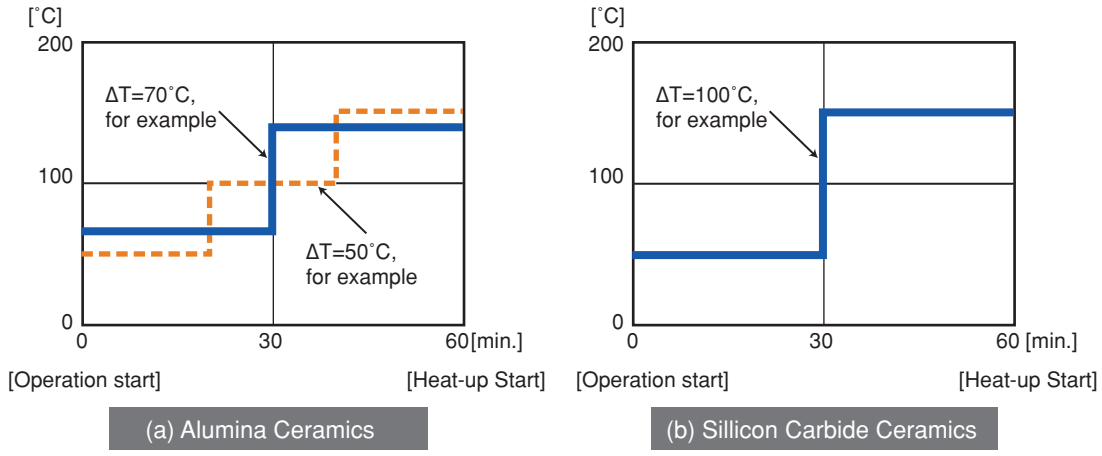


Fig 3-1 Example of Heating Up

(4) When stopping operation also, pay attention so that the control valve is not subjected to thermal shocks or temperature gradients greater than the allowable limit identical with those when starting operation.

3.2 Check Before Operation

Before starting operating the control valve, check the following items:

(1) Check that flow control direction of the control valve (indicated on the valve body) conforms with the actual flow direction of the process medium.

(2) Check that the following bolts and nuts are securely tightened and not loose.

  (a) Bolts which clamp bonnet to valve body

  (b) Yoke clamping-nut

  (c) Stem connector bolts

  (d) Packing follower lock nut

  (e) Diaphragm case bolts and nuts

(3) Check that the valve stem moves smoothly for its full lift stroke (from “S” to “O” of the scale plate).

(4) Check that the packing follower is securely tightened.

(5) Check that the valve stem (plug) is not bent.

(6) Check that the actuator stem is not bent or damaged.

4. INSPECTION AND MAINTENANCE

For the control valve in running use, periodically render inspection and maintenance service as follows:

(1) Check that there is no air leak from between the diaphragm case and the diaphragm seat.

(2) Check that there is no process medium leak from the leak detector hole of the valve bonnet.

(3) Check that the yoke clamping-nut is securely tightened and not loose.

(4) Check that the clamping-bolts of the auxiliary devices (valve positioner, regulator valve, etc.) are securely tightened and not loose.

(5) Check that the bolts of the stem connector are securely tightened and not loose.

(6) Check that the actuator stem is not bent or damaged.

(7) Check that the valve stem is not bent.

(8) Check that the control valve operates smoothly with proper lift stroke.

5. DISASSEMBLY AND ASSEMBLY

5.1 Disassembly Procedure

To disassemble the control valve, observe the instructions given in this section.

PRECAUTIONS

(1) Before starting dismantling the control valve from the process pipe, shut down the process medium flow and release its pressure from the control valve.

(2) Be sure that no process medium or pressure is remaining in the control valve and that it has been cooled off to nearly normal temperature.

5.1.1 Removing the Positioner

Check that the air pressure of the air piping has been released, disconnect the air piping, and then detach the positioner from the actuator yoke.

5.1.2 Detaching the Actuator from Valve Body

To detach the actuator from the valve body, observe the instructions given below. (The same instructions are applicable to both Model PSA1 Actuator (for valve size 1 in. or 1 1/2 in. and Model HA2 Actuator (for valve size 2 in. to 3 in.).)

(1) Disconnect the actuator stem from the valve stem by loosening the stem connector bolts 1.

(2) Loosen the yoke clamping-nut 2 using a chisel.

(3) Detach the actuator from the valve body, by pulling up the actuator while rotating it to right and left.

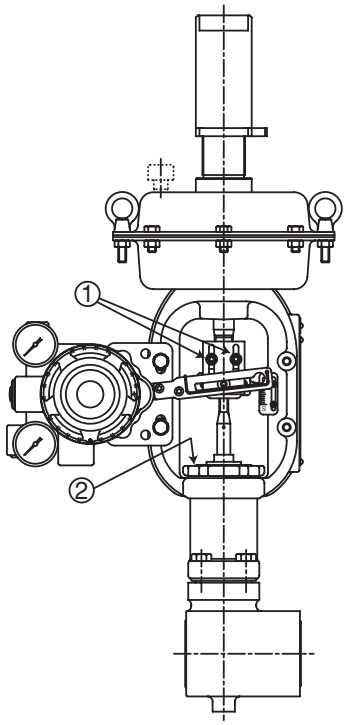


Fig. 5-1 Locations of Stem Connector Bolts and Yoke Clamping-nut

5.1.3 Disassembly of Valve Body

To disassemble the valve body, observe the instructions given below. (The same instructions are applicable to all sizes of the ceramics control valves, although their structures slightly differ between that of valve size 1 in. and that of larger sizes.)

PRECAUTIONS

Be extremely careful when handling the ceramics components. Note that they are not highly resistant against mechanical shocks and vibration.

(1) Release the packing follower by removing its nut.

(2) Detach the bonnet from the valve body by removing the clamping-bolts of the bonnet.

(3) Remove the guide retainer (except valve size 1in.), remove the guide, and then take out the valve plug.

(4) Remove the spacer, packing retainer (except when the spacer is made of stainless steel), and gland packing.

(5) Pull out the gland box from the valve body.

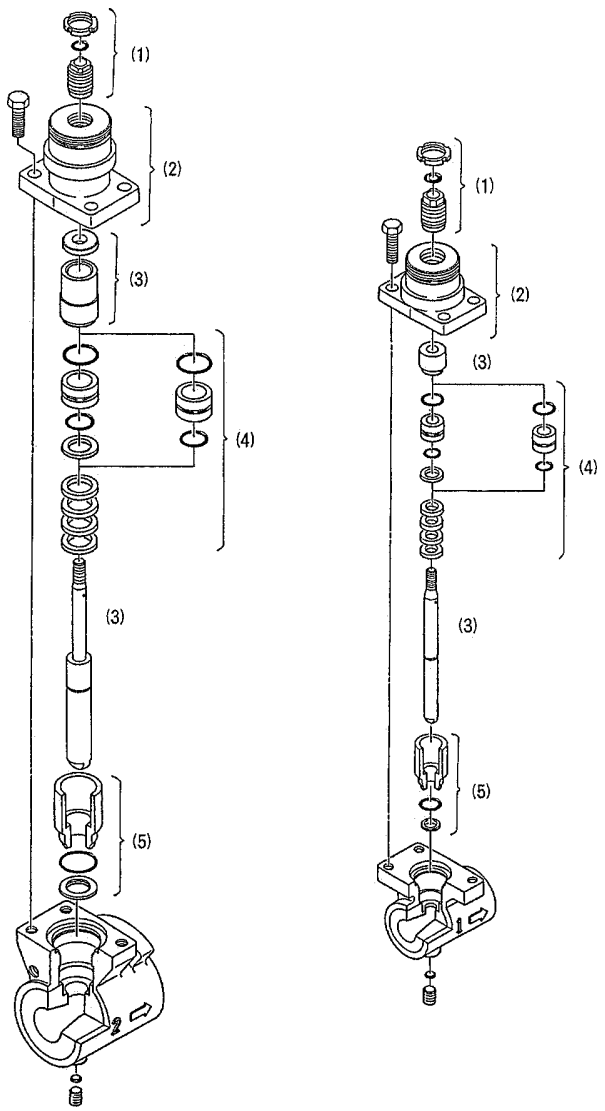


Fig. 5-2 Exploded Views of Valv Body Sections of Ceramics Control Valves

5.2 Disassembly and Assembly of Actuator

Normally the actuator requires no adjustment. However, it should be disassembled and assembled when installing it on a valve body, when modifying its specifications, or when replacing damaged parts. The disassembly and assembly procedure of the actuator for such purposes are covered in Sections 5.3 and 5.4.
To disassemble the actuator, refer to fig.5-3 to Fig.5-14.

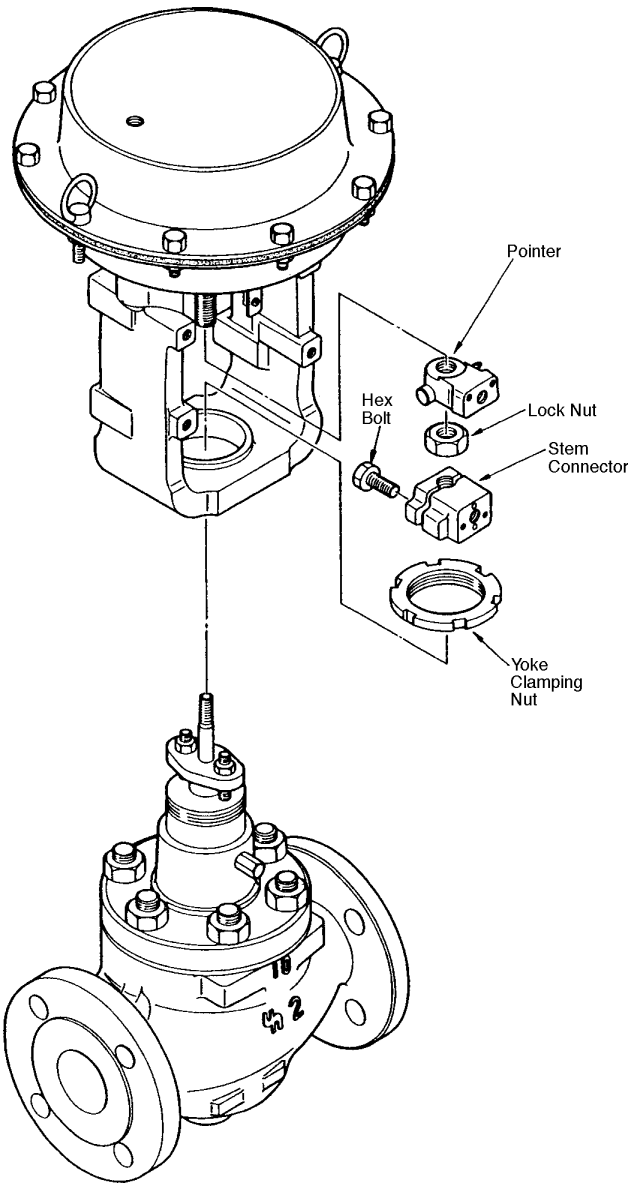


Fig. 5-3

When disassembling or assembling the actuator, keep it in the vertical attitude. For the tightening torques of bolts and nuts, see Tables 5-1,5-2.
For the names of the parts, see Figs.5-9 and 5-14.

Notes for Disassembly

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

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

5.3 Disassembly and assembly of model PSA 1

Disassembly procedure

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

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

(2) Remove the stem connector.

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

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

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

(6) Take out the springs.

B. Reverse action model (see Figure 5-5)

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

(2) Remove the stem connector.

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

(4) 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 on the springs.

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

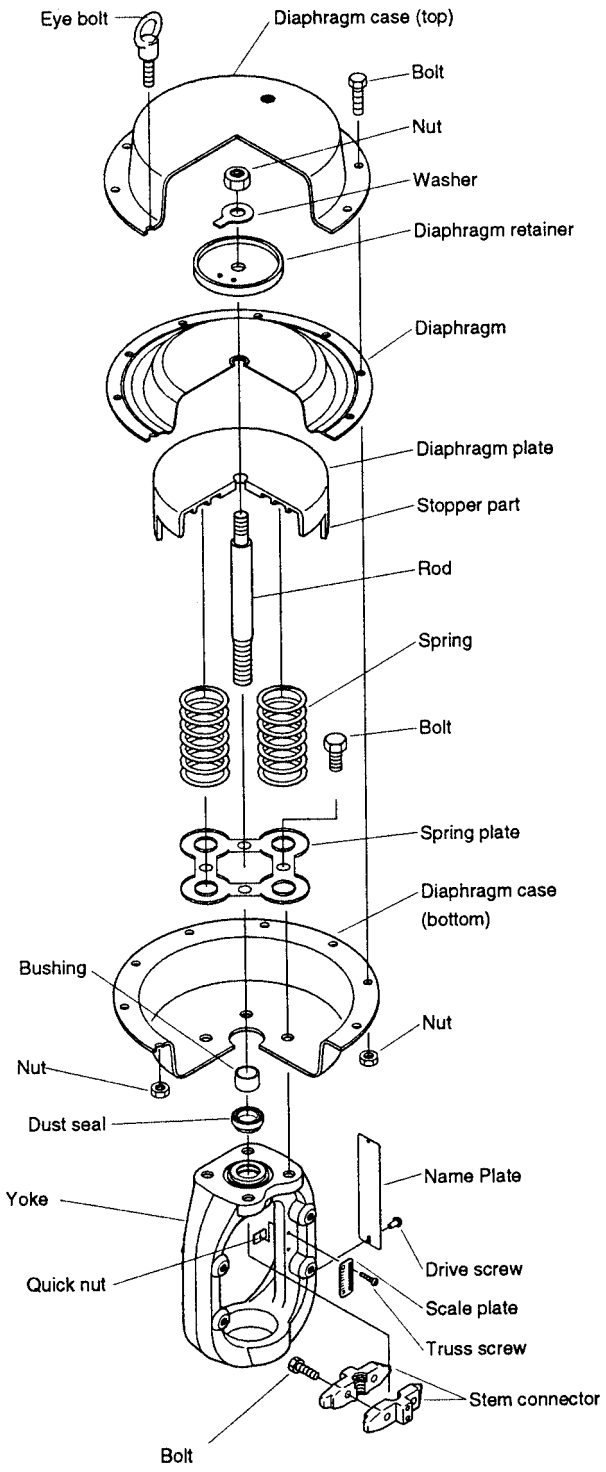


Fig. 5-4 Direct Action model PSA1D

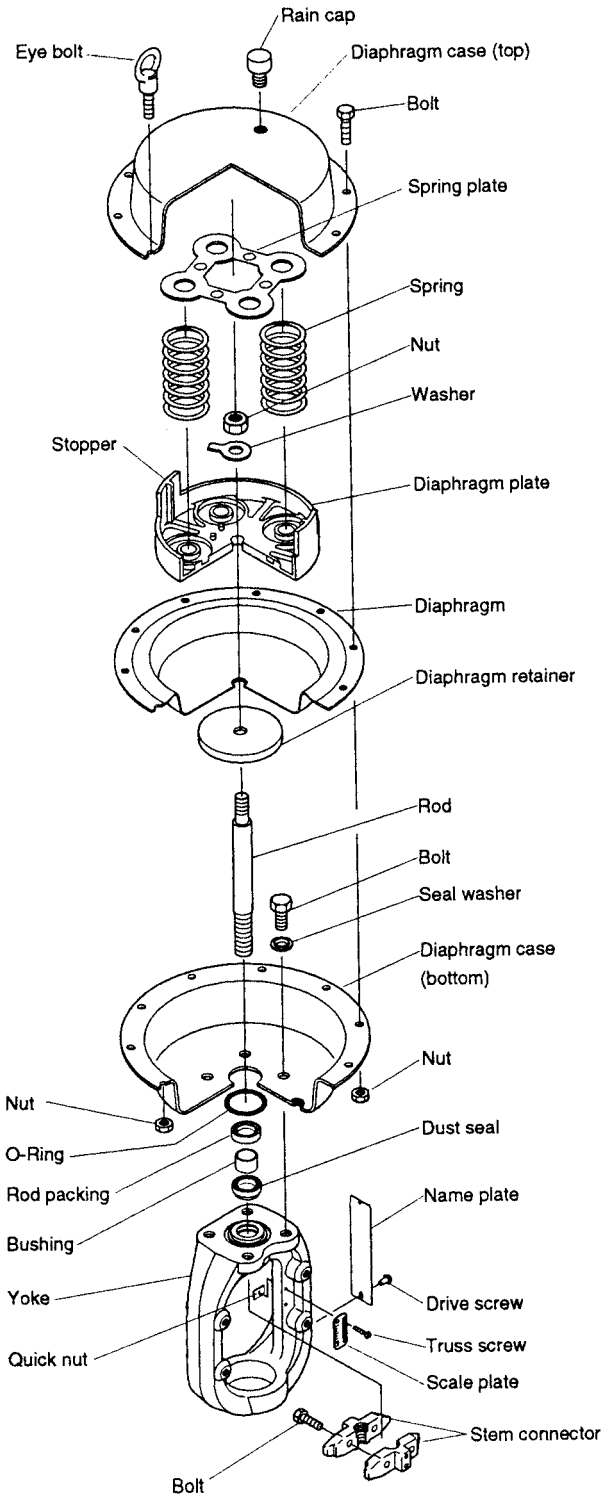


Fig. 5-5 Reverse Action model PSA1R

Assembly

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

A. Direct action models

(1) Secure the diaphragm case (bottom) with the four bolts to the yoke. At the same time, set the air vent hole as in Fig. 5-6. For PSA1D actuator, secure the spring plate to the diaphragm case and yoke.

(2) Fasten the spring place and install the springs onto the spring plate (see Fig. 5-6).

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

(4) Rotate the actuator rod, locating the diaphragm plate stopper as shown in Fig.5-6.

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

Note: Set the air pipe connection port to the location shown in Fig. 5-6. Tighten the pair of eyebolts uniformly and alternately. The initial setting of the springs is completed by tightening these eyebolts.

(6) Clamp the diaphragm case with clamping bolts.

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

(8) After completing assembly, check the following:

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

⚠ CAUTION

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

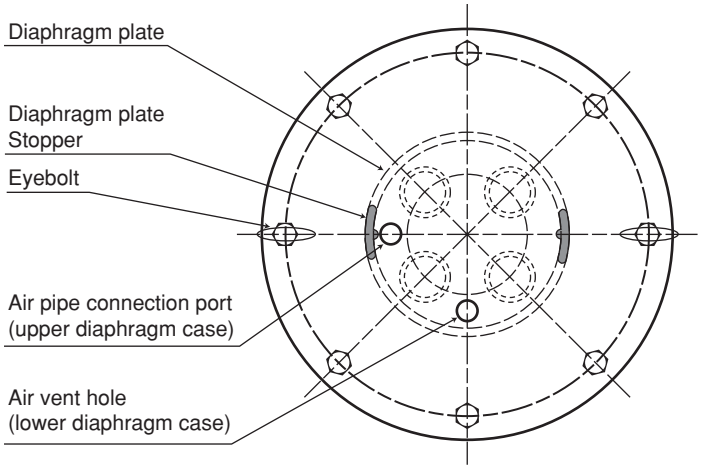


Fig. 5-6 Direct Action Models Model PSA1D Actuator

B. Reverse action models

(1) Secure the bottom diaphragm case with the four bolts to the yoke. At the same time, set the air pipe connection port in the location shown in the Fig. 5-7.

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

(3) Rotate the actuator rod, locating its diaphragm plate stopper as shown in Fig. 5-7.

(4) Fasten the spring plate and install the springs onto the spring plate. (see Fig. 5-7).

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

Note: Set the air vent hole to the location shown in Fig. 5-7. 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 stem cap onto the air vent port.

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

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

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

⚠ CAUTION

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

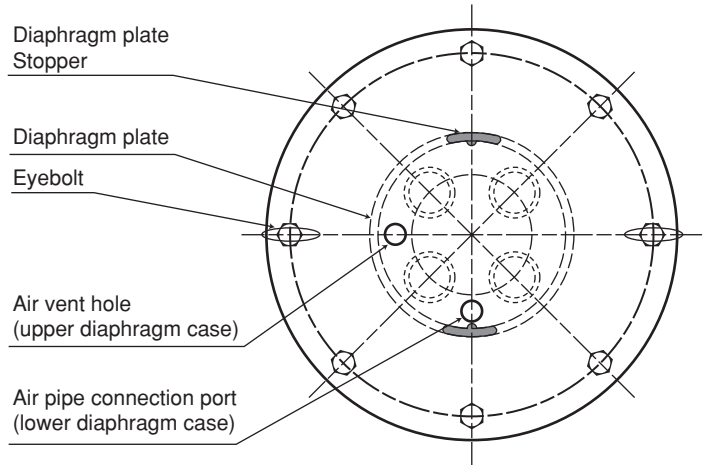
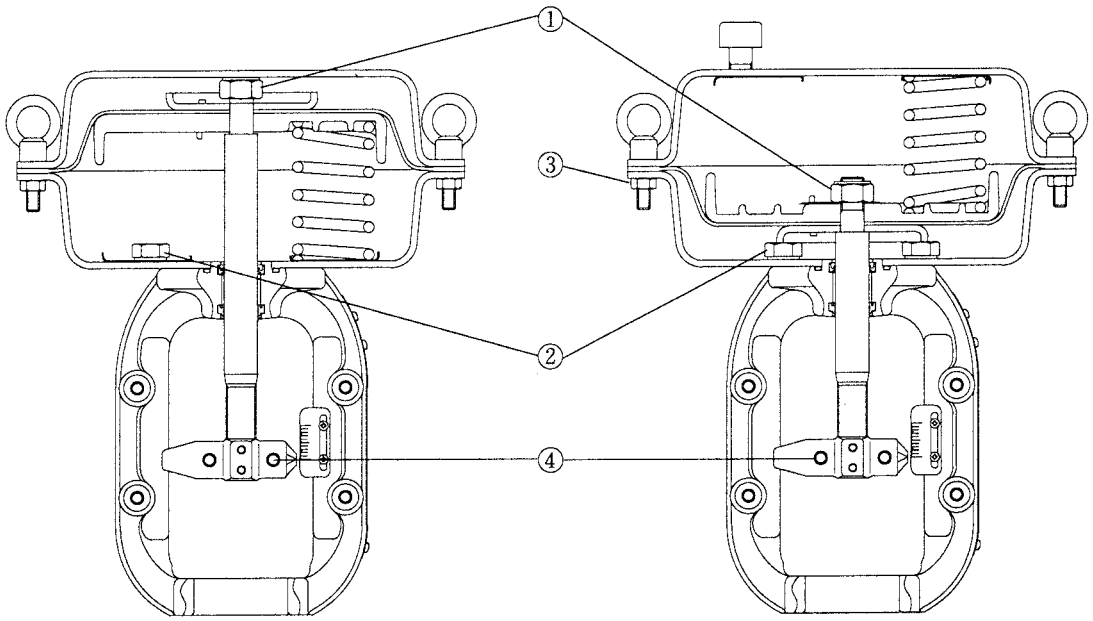


Fig. 5-7 Reverse Action Model Model PSA1R Actuator



Direct Action type *Reverse Action type*

Fig. 5-8 Bolts and Nuts of Actuator

Table 5-1 Tihtening Torques of Bolts and Nuts of Actuator

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

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

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

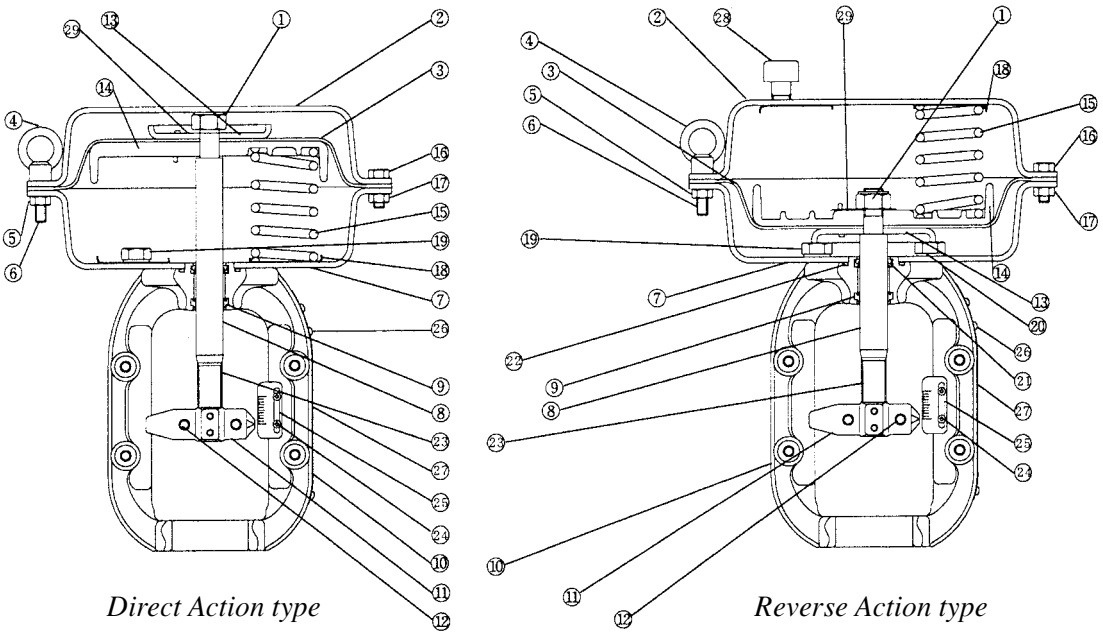


Fig. 5-9 Model PSA Actuator

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, Lead
9	Dust seal	NBR
10	Yoke	A216WBC(SCPH2)
11	Stem connector	SCS13A
12	Bolt	SUS304
13	Diaphragm retainer	SS400
14	Diaphragm plate	AC4A/AC4C
15	Spring	SWOSM-B, SWOSC-V

No.	Item	Material
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	Nameplate	SUS304
28	Rain cap	SUS304
29	Washer	SUS304

5.4 Disassembly and Assembly of Model HA2 Actuator

Disassembly Procedure

A. Direct Action Type

(1) Disconnect the air piping and detach the accessories from the actuator.
(2) Remove the stem connector, pointer and lock nut.
(3) Remove the clamping-bolts (except the pair of eyebolts) of the diaphragm case.
(4) Loosen evenly and alternately the pair of eyebolts. (The initial setting of the springs is done by these eyebolts.)
(5) Remove the diaphragm case. Pull out upward the actuator rod together with the diaphragm.
(6) Take out the springs.

B. Reverse Action Type

(1) Disconnect the air piping and detach other external items from the actuator.
(2) Remove the stem connector, pointer and lock nut.
(3) Remove the clamping-bolts (except the pair of eyebolts) of the diaphragmcase.
(4) Loosen evenly and alternately the pair of eyebolts. (The initial setting of the springs is done by these eyebolts.)
(5) Remove the diaphragm case. Take out the springs.
(6) Pull out upward the actuator rod together with the diaphragm.

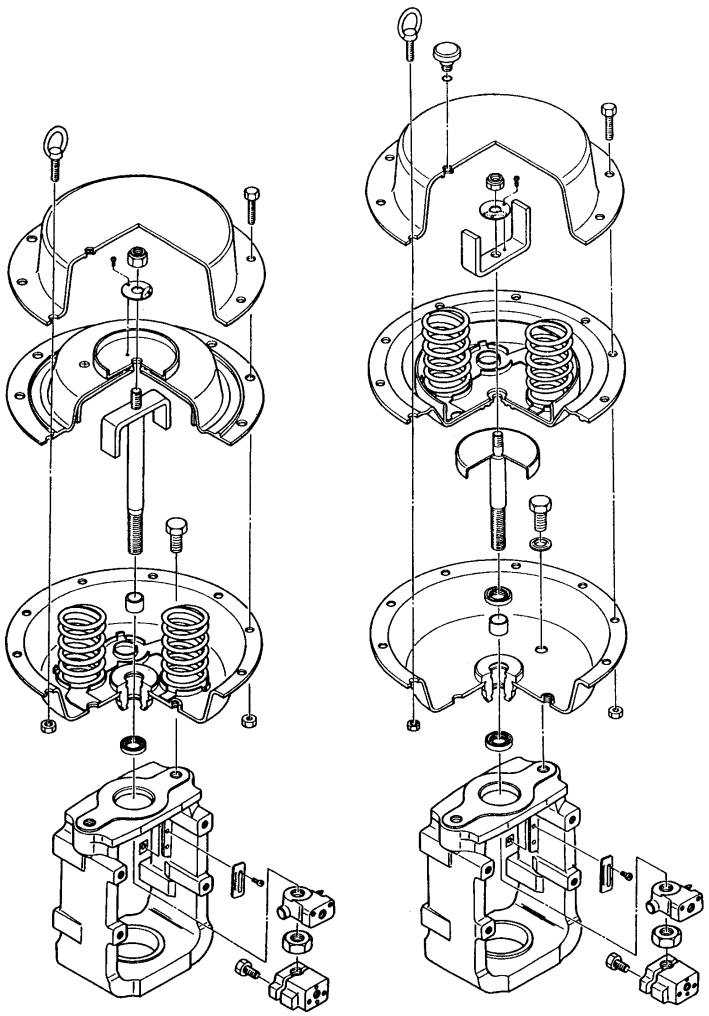


Fig. 5-10 HA2 Actuator

Assembly Procedure

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

(a) Direct Action Type

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

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

HA2.....4 springs

Except particular models as follows:

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

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

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

Notes:
- Set the air piping connection port in the location shown in the illustration. (Fig. 5-11)
- Tighten the pair of eyebolts uniformly by tightening them alternately. The initial setting of the springs is complete by tightening of these eyebolts.

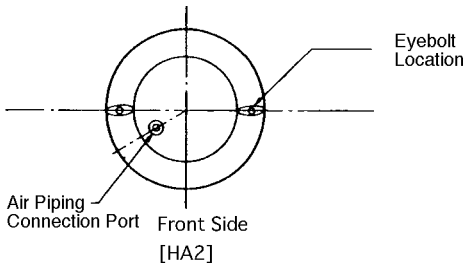


Fig. 5-11 Direct Action Type

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

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

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

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

2. Check that the actuator smoothly operates for its full stroke.

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

(b) Reverse Action Type

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

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

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

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

HA2.....4 springs

Except particular models as follows:

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

(5) Place the top diaphragm case and fix it with the pair of eyebolts. Set the air vent hole in the location shown in the illustration (Fig. 5-12). Uniformly and alternately tighten the eyebolts. The initial setting of the springs is complete by tightening of these eyebolts.

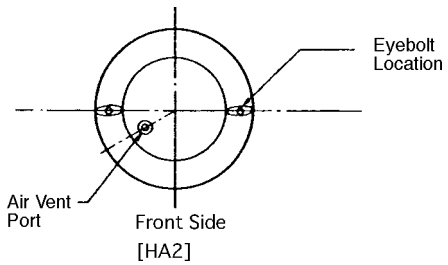


Fig. 5-12 Reverse Action Type

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

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

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

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

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

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

2.Check that the actuator smoothly operates for its full stroke.

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

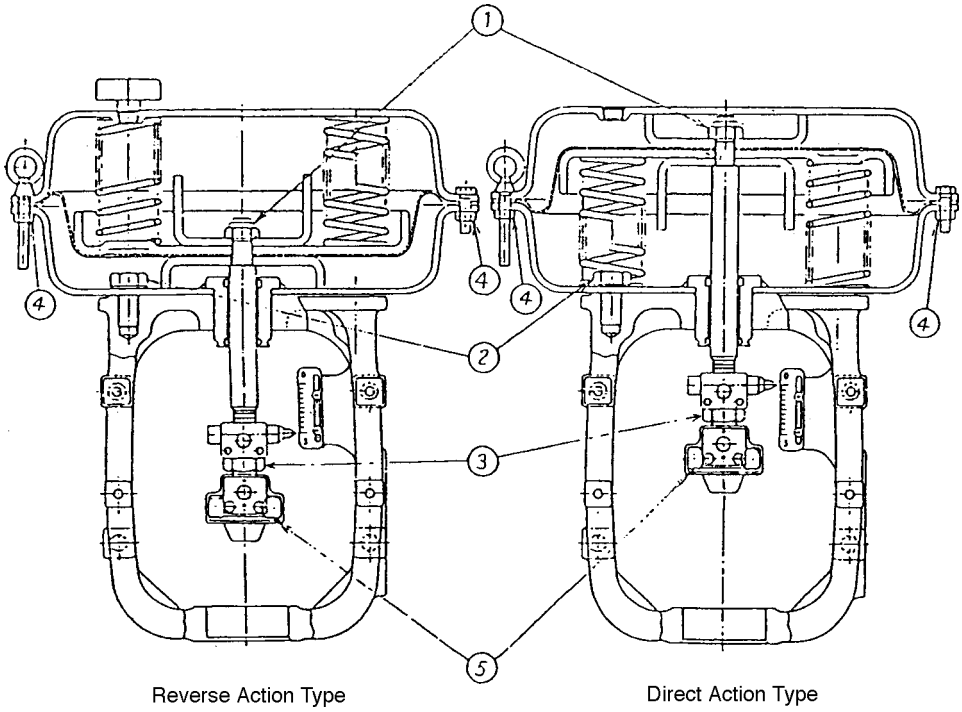
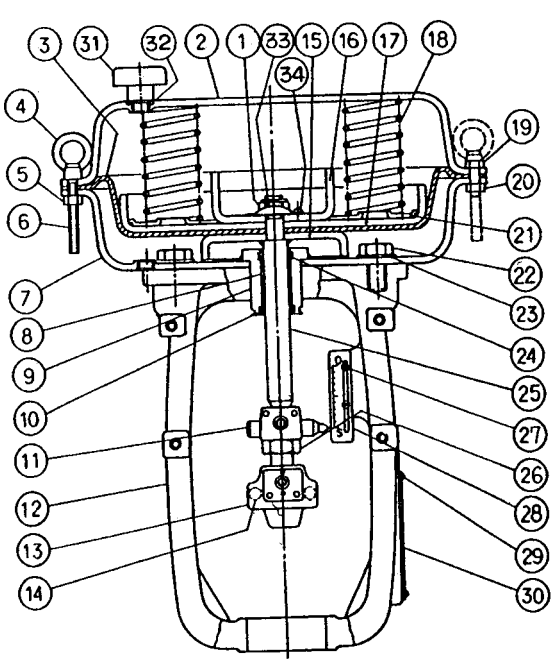


Fig. 5-13 Bolts and Nuts of Actuator

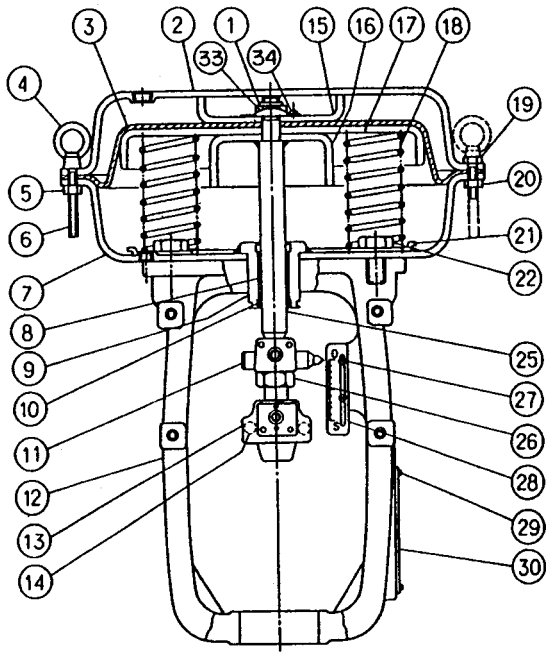
Table 5-2 Tightening Torques of Bolts and Nuts of Actuator

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

No.	Materials	For HA2	
1	SK5 S45C	M10	37{370}
2	S30C	M12	42{420}
3	S20C	M14	69{690}
4	SUS304	M8	18{185}
5	SUS304	M10	56{560}



Reverse Action Type (Model HA□R)



Direct Action Type (Model HA□D)

No.	Parts Name
1	Nut
2	Diaphragm Case(Top)
3	Diaphragm
4	Eye Bolt
5	Nut
6	Bolt
7	Diaphragm Case(Bottom)
8	Bushing
9	Bearing
10	Dust Seal
11	Pointer
12	Yoke
13	Stem Connector
14	Bolt
15	Diaphragm Retainer
16	Stopper
17	Diaphragm Plate

No.	Parts Name
18	Coil Spring
19	Bolt
20	Nut
21	Spring Plate
22	Bolt
23	Washer
24	Packing
25	Rod
26	Lock Nut
27	Trus Screw (Washer, Nut)
28	Scale Plate
29	Screw
30	nameplate
31	Cap
32	O-Ring
33	Washer
34	Tapping Screw

Fig. 5-14 Cut View of Actuator

5.5 Assembly Procedure

5.5.1 Assembly of Valve Body

To assemble the valve body, follow in the reverse order the disassembly procedure of 5.1.3 “Disassembly of Valve Body”.

PRECAUTIONS

(1) Exercise care so that the bolts are not tightened unevenly. Tighten them evenly and securely.

(2) When assembling the valve body, clean the sealing surfaces and apply grease of other sealing agent. (Use sealing agent which will not be deteriorated by process medium. Silicone grease is used before shipment by the manufacturer.)

5.5.2 Attaching Actuator to Valve Body

To attach the actuator to the valve body, refer to Section 5.2 or 5.3 and proceed as follows:

(1) Place the actuator on the actuator seat of the valve bonnet, turn the actuator to the correct direction, and tighten the yoke clamping-nut using a chisel.

(2) Remove the cover of the lift stopper adjustment mechanism and fully loosen the hex nut of the stopper shaft.

(3) Slowly lower the valve stem until the valve plug end is contacted with the bottom of the valve body.

(4) Turn the valve stem so that its small hole is directed at the right angle (90 Degrees) with respect to the flow direction.

(5) For Model PSA1D or HA2D Actuator which is of the direct action type (air-to-open type), apply the air-supply pressure to the actuator. For model PSA1R or HA2R which is of the reverse action type (air-to-close type), apply no pressure to the actuator.

(6) Connect the actuator stem to the actuator stem with the stem connector. When tightening the stem connector bolts, exercise care so that the valve stem (plug) is not turned or moved up.

PRECAUTIONS

(1) Lest the valve should be damaged, be sure to provide a gap of 0.1-0.3mm between the valve plug and the valve body. To provide this gap, remove the cover of lift stopper adjustment mechanism of the actuator and drive the nut of the stopper shaft in the direction of pulling up the stopper shaft.

(2) After setting the gap between the valve plug and the valve body, securely fix the mechanism with the double nuts.

(7) Loose the drive screws of the scale plate and align the “S” position of the scale plate to the pointer of the stem connector.

(8) Increase the air pressure applied to the actuator until the pointer of the stem connector is aligned with the “O” position of the scale plate (for the direct type, reduce the air pressure).

(9) Turn the adjustment cover until it hits the top end of the stopper shaft and then fix it with the rotation stopper.

5.6 Mechanical Lift Stopper

Figs.5-15 and 16 shows the structure of the Mechanical Lift Stopper. The Mechanical Lift Stopper actions as either the maximum lift stopper or the minimum lift stopper as required. The Stopper can also limit both the maximum and minimum lifts.

When used as the minimum lift stopper, the Stopper limits the maximum retracted stroke (the maximum valve lift when the valve shaft assumes direct action), while it limits the maximum projection stroke (the maximum valve left when the shaft assumes reverse action) when used as the maximum stopper.

5.6.1 Adjustment of the Minimum Lift Stopper

(1) Loosen the anti-rotation clip 2 and remove the maximum stopper 1 (the adjustment cover) from the housing 5.

(2) Loosen the hex nut 3 and remove the stopper from the stopper shaft 4. This disables the stopper to perform the specified valve action.

(3) Adjust the positioner's air signal pressure or the supply air pressure (or operate the hand manual device) to match the valve to the specified stopper position.

(4) With the valve shaft set to the position, screw the hex nut 3 into the stopper shaft 4 and lock it when it touches the housing.

(5) Assemble the maximum stopper 1 and the anti-rotation clip 2 and lock them at the place where they do not touch the stopper shaft 4 when the shaft assumes the maximum projection stroke.

5.6.2 Adjustment of the Maximum Lift Stopper

(1) Loosen the anti-rotation clip 2 and remove the maximum stopper 1 (the adjustment cover) from the housing 5.

(2) Loosen the hex nut 3 and remove the stopper from the stopper shaft 4.
This disables the stopper to perform the specified valve action.

(3) Adjust the positioner's air signal pressure or the supply air pressure (or operate the hand manual device) to open the valve full.

(4) With the valve shaft set to the position, screw the hex nut 3 into the stopper shaft 4. Lock the hex nut 3 on the highest possible part of the stopper shaft 4 so that the distance between the lower edge of the nut 3 and the housing 5 is longer than the specified lift.

(5) Adjust the positioner's air signal pressure or the supply air pressure (or operate the hand manual device) to set the valve to specified stopper position.

(6) With the valve set to the position, screw the maximum stopper 1 into the housing 5, lock the stopper using the anti-rotation clip when the stopper touches the hex nut 3 or the stopper shaft 4.

5.6.3 Adjustment of the Minimum and Maximum Stopper

Carry out both Items 5.6.1 and 2.

⚠ CAUTION

When fastening or loosening the hex nut 3, use a wrench carefully so that the stopper shaft is not subjected to an excessive torque.

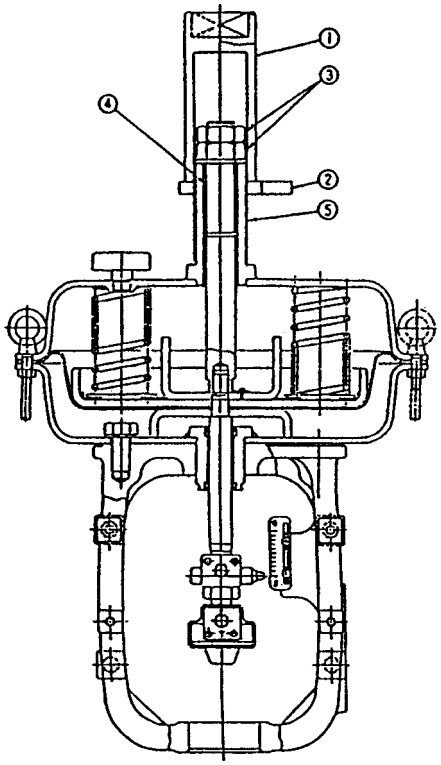


Fig. 5-15 Reverse Action Type

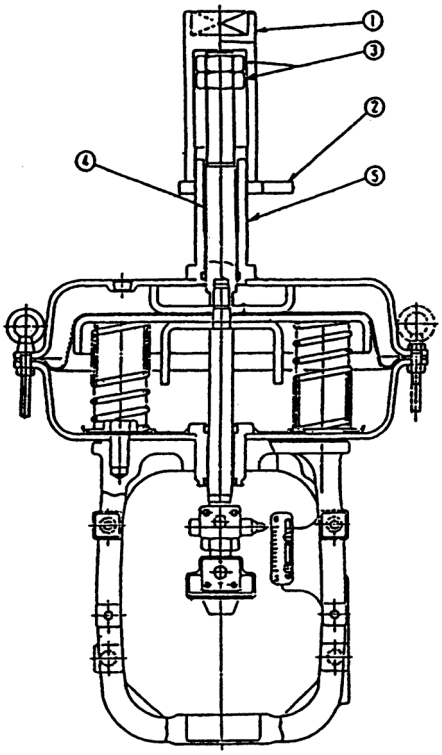


Fig. 5-16 Direct Action Type

No.	Parts Name
1	MAX. stopper (adjustment cover)
2	ANTI-ROTATION CLIP
3	Hex nut for MIN. stopper
4	Stopper shaft
5	Housing

No.	Parts Name
1	MAX. stopper (adjustment cover)
2	ANTI-ROTATION CLIP
3	Hex nut for MIN. stopper
4	Stopper shaft
5	Housing

6. ADJUSTMENT

As a general rule the diaphragm type control Valves require no adjustment. However, when coupling an actuator to a valve body after removing the actuator for overhaul or other purposes, adjustment of travel (stroke) is necessary. For this adjustment, refer to Fig. 5-3, Fig. 6-1 and proceed as follows:

(1) Fix the actuator to the valve body by securely tightening the yoke clamping-nut (use a chisel and a hammer).

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

(3) Lower the valve seat and check that it is contacted with the valve seat.

For the Direct Action Type

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

(5) Increase the air pressure to the supply pressure and check that the actuator stem moves by 1 - 2 mm in response. (This movement represents the allowance of stroke.)

(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 actuator stem and valve stem and securely tighten the clamping-bolts of the stem connector. (See Fig. 6-1.)

For the Reverse Action Type

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

(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 Item (7) of"For the Direct Action Type." (See Fig. 6-1.)

stem connector can be rotated with your hand, this means that the valve plug is not seated on the seat. If this is the case, repeat the adjustment all over again.

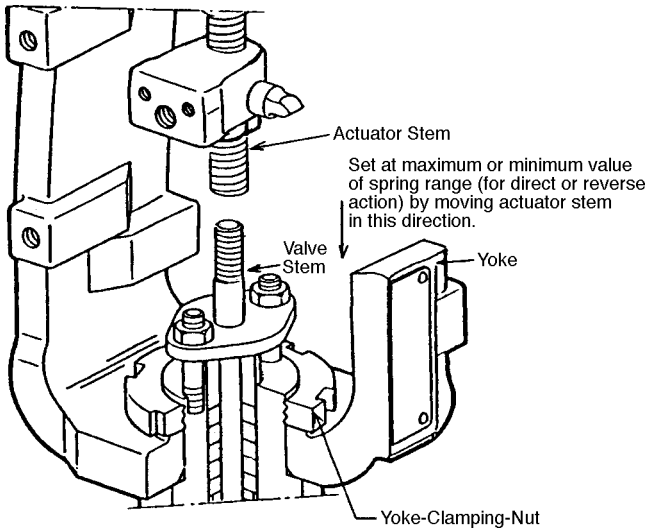

Actuator Stem
Set at maximum or minimum value of spring range (for direct or reverse action) by moving actuator stem in this direction.
Valve Stem
Yoke
Yoke-Clamping-Nut

Fig. 6-1

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

7.1 Direct/Reverse Action Change

As a general rule it is most recommendable to prepare separately the direct type and reverse type of actuators and not to convert actuators into different types. However, when it has become unavoidable to convert actuators into other types, conversions may be done by using the parts mentioned below (Table 7-1 and Table 7-2). The parts marked "+" are the ones which are newly needed and those marked "-" are ones which are not used.

Table 7-1 To Convert the Direct Action Type into the Reverse Action Type

PSA1D -> PSA1R			
Parts neme	Q'ty		
Rod unite	+1	82559228-102	14.3mm
		82559228-101	25mm
Rod	-1	82559229-102	14.3mm
		82559229-101	25mm
Seal washer	+4	82521069-101	
Rod packing	+1	82521067-102	
Rain cap	+1	82553334-101	
Washer	+1	82592235-596	
"O" ring	+1	82553318-101	

HA2D -> HA2R			
Part name	Q'ty	For stroke 14.3mm, 25mm	For stroke 38mm
Seal washers	+2	82521069-101	82521069-101
Rod packing	+1	82521067-101	82521067-101
Rod unit	+1	82521431-101 (14.3mm)	82521431-103
		82521431-102 (25mm)	
Rain cap	+1	82553334-101	82553334-101
Rod	(-1)	82521427-101 (14.3mm)	82521427-103
		82521427-102 (25mm)	

Table 7-2 To Convert the Reverse Action Thpe into the Direct Action Type

PSA1R -> PSA1D			
Parts neme	Q'ty		
Rod unite	+1	82559229-102	14.3mm
		82559229-101	25mm
Rod	-1	82559228-102	14.3mm
		82559228-101	25mm
Seal washer	-4	82521069-101	
Rod packing	-1	82521067-102	
Rain cap	-1	82553334-101	
Washer	-1	82592235-596	
"O" ring	+1	82553318-101	

HA2R -> HA2D			
Part name	Q'ty	For stroke 14.3mm, 25mm	For stroke 38mm
Seal washers	(-2)	82521069-101	82521069-101
Rod packing	(-1)	82521067-101	82521067-101
Rod unit	+1	82521427-101 (14.3mm)	82521427-103
		82521427-102 (25mm)	
Rod	(-1)	82521431-101 (14.3mm)	82521431-103
		82521431-102 (25mm)	
Rain cap	(-1)	82553334-101	82553334-101

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

7.2 Stroke And Range Spring Change

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

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

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

Table 7-3 Parts Required for Respective Stroke Ranges

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

Actuator		PSA1D -> PSA1R		
Part name		Q'ty	For Stroke 25mm -> 14.3mm	For Stroke 14.3mm -> 25mm
Scale plate		1	82559230-102	82559230-101
Spring	20-98{0.2-0.1}	4	82521340-101	82521340-104
	80-240{0.8-2.4}	4	82521340-102	82521340-103
Rod unit	R (Reverse action)	1	82559228-102	82559228-101
	D (Direct action)	1	82559229-102	82559229-101
Washer		1	82553318-101	82553318-101

Actuator		HA2D -> HA2R		
Part name		Q'ty	For Stroke 25mm -> 14.3mm	For Stroke 14.3mm -> 25mm
Scale plate		1	80225032-164	80225037-164
Spring	20-98{0.2-0.1}	4	82521205-101	82521205-103
	80-240{0.8-2.4}	4	82521205-102	82521208-101
Rod unit	R (Reverse action)	1	82521431-101	82521431-102
	D (Direct action)	1	82521427-101	.82521427-102

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

Color Codes and Dimensions of the Springs of Model HA Actuators

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

Table 7-4 Color Codes and Dimensions of Springs

Rated stroke \ Model / Range	PSA1	HA2
14.3	20-98 {0.2-1.0}	Red 64.6	Red 86
	80-240 {0.8-2.4}	Blue 69.8	Blue 90
25	20-98 {0.2-1.0}	Green 68.7	Yellow 91.4
	80-240 {0.8-2.4}	Purple 78.8	Brown 99
38	20-98 {0.2-1.0}		Green 95
	80-240 {0.8-2.4}		Purple 107

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

8. PARTS FOR VALVE BODY AND PROCESS PIPE CONNECTION

8.1 Sealing Parts of Valve Body

	Name	Number	Rate
1"	O-ring	82592221-501	P14
		82592221-801	P18
		82592221-401	P12.5
		82592222-201	P22
	Packing	82509813-103	ø23*ø13*t2
	Gasket	82592623-101	ø25*ø13*t2
1 1/2"	O-ring	82592221-501	P14
		82592222-801	P26
		82592221-901	P20
		82592222-901	P28
	Packing	82509815-103	ø33*ø20*t6.4
	Gasket	82592623-102	ø33*ø22*t2
2"	O-ring	82592221-501	P14
		82592223-601	P32
		82592222-601	P25
		82592223-701	P34
	Packing	82509625-107	ø38*ø25*t6.4
	Gasket	82592623-103	ø39*ø27*t2
2 1/2"	O-ring	82592221-501	P14
		82592224-101	P36
		82592223-301	P30
		82592224-401	P40
	Packing	82509816-103	ø43*ø30*t6.4
	Gasket	82592423-104	ø45*ø32*t2
3"	O-ring	82592221-501	P14
		82592225-301	P50
		82592224-401	P40
		82592225-301	P50
	Packing	82509814-103	ø56*ø40*t8
	Gasket	82592623-105	ø55*ø42*t2

8.2 Bolts For Valve and Process Pipe Connection

Valve Size : 1"

Applicable Std.	Bolt	Size	Q'ty
JIS 10K	Through	M16 * L204	4
JIS 20K	Through	M16 * L204	4
ANSI 150	Through	M12 * L191	4
ANSI 300	Through	M16 * L204	4

Valve Size : 1-1/2"

Applicable Std.	Bolt	Size	Q'ty
JIS 10K	Through	M16 * L204	4
JIS 20K	Through	M16 * L204	4
ANSI 150	Through	M12 * L191	4
ANSI 300	Through	M16 * L204	4

Valve Size : 2"

Applicable Std.	Bolt	Size	Q'ty
JIS 10K	Through	M16 * L240	4
JIS 20K	Through	M16 * L240	6
	Hex-nut	M16 * L35	4
ANSI 150	Through	M16 * L240	4
ANSI 300	Hex-nut	M16 * L240	6
	Through	M16 * L35	4

Valve Size : 2-1/2"

Applicable Std.	Bolt	Size	Q'ty
JIS 10K	Through	M16 * L260	4
JIS 20K	Through	M16 * L260	6
	Hex-nut	M16 * L40	4
ANSI 150	Through	M16 * L260	4
ANSI 300	Hex-nut	M16 * L260	6
	Through	M16 * L45	4

Valve Size : 3"

Applicable Std.	Bolt	Size	Q'ty
JIS 10K	Hex-nut	M16 * L280	6
	Through	M16 * L40	4
JIS 20K	Hex-nut	M20 * L300	6
	Through	M20 * L45	4
ANSI 150	Through	M16 * L280	4
ANSI 300	Hex-nut	M20 * L300	6
	Through	M20 * L45	4

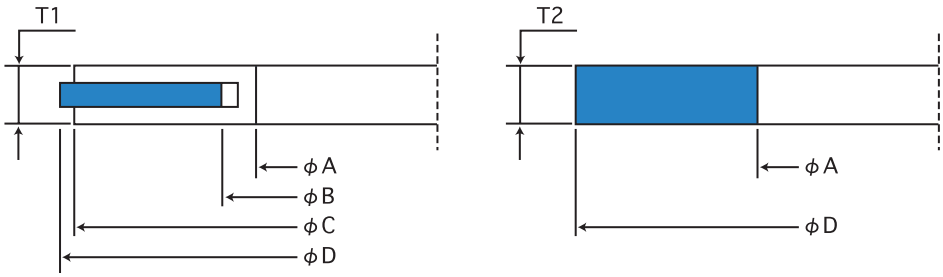
8.3 Dimensions of Gaskets for Piping

For the gaskets for valve and process pipe connection, use ones made of soft material such as rubber or PTFE-wrapped ones. For the dimensions of the gaskets, see Table 8-1.

Table 8-1 Recommendable Gasket Dimensions

[mm]

Nominal Dia.	Rated Pressure	øA	øB	øC	øD	T1	T2
1"	JIS 10K	30	33	70	74	2.5	2.0
	JIS 20K						
	ANSI 150			67	73		1.5
	ANSI 300						
1 1/2"	JIS 10K	45	48	85	89	2.5	2.0
	JIS 20K						
	ANSI 150			86	95		
	ANSI 300						
2"	JIS 10K	55	58	98	104	3.2	3.0
	JIS 20K			100	104		
	ANSI 150			92	104		2.0
	ANSI 300			92	110		
2 1/2"	JIS 10K	70	73	114	124	3.2	3.0
	JIS 20K			116	126		
	ANSI 150			105	123		2.0
	ANSI 300			105	129		
3"	JIS 10K	80	83	130	134	3.2	3.0
	JIS 20K			135	140		
	ANSI 150			121	135		2.0
	ANSI 300			127	148		



PTFE-wrapped gasket *Rubber gasket*

Fig. 8-1 Gaskets for Piping

9. INSTRUCTIONS FOR SIDE HANDWHEEL OF ACTUATOR

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

9.1 Installation Procedure

To install the side handwheel, refer to Fig. 9-1 and proceed as follows:

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

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

(3) Loosen the bolt (item number 6 as-show in Fig. 9-1) and widen the distance between levers.

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

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

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

9.2 Operating Instructions

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

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

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

Model PSA1 : 80N {8kgf}, Model HA2 : 190N {l9kgf}
(at the outermost periphery of the handwheel)

9.3 Disassembly of Side Assembly of Side Handwheel

Before starting disassembly, check that the pointer is set at the AUTO position. (Refer to Fig. 9-1)

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

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

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

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

To assemble the side handwheel, refer to Fig. 9-1 and follow the disassembly procedure in the reverse order.

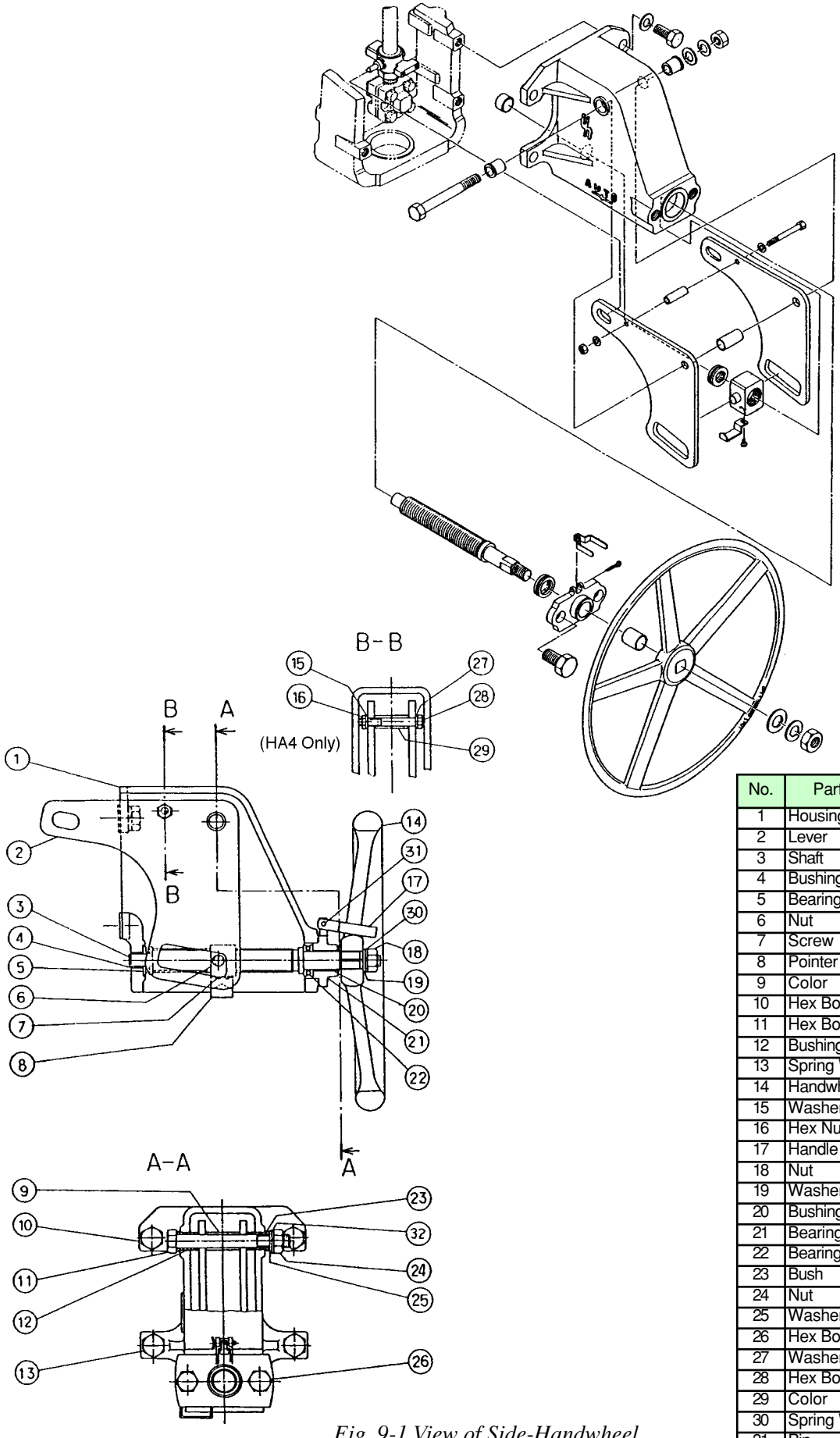


Fig. 9-1 View of Side-Handwheel

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

10. TROUBLESHOOTING

This section covers the symptoms, causes and remedies of most probable types of troubles. Parts may be required to be replaced depending on the type of trouble. For further troubles, please order your Yamatake Corporation agent for repair.

Table 10-1. Troubleshooting

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

11. RECOMMENDED SPARE PARTS

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

- **Valve Body**

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

  - Gland packing
  - Gaskets

- **Actuator**

  Replace the following Parts at every 5 years or thereabout.

  - Diaphragm
  - Bushing
  - Cap
  - Seal washer
  - Dust seal
  - Rod seal

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

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