

# NOTICE

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# Chapter 1. Overview

#### 1-1. Structure

This actuator includes a bonnet (top and bottom parts), a cylinder, staybolts, a yoke, a rod cover without side mounted manual operation lever (SHM), a snubber (with SHM), a hydraulic pump (with SHM).

For the appearance of the actuator, see Figures 1 and 2.



Figure 1. Appearance of DAP (without SHM)



Figure 2. Appearance of DAP (with SHM)

If an SHM is provided, the hydraulic pump has already been installed for manual operations and a stop valve for switching between manual and automatic operation is also included.

This pump consists of a handle and a body, which includes an oil pocket, a plunger-type pump, a check valve, and a pressure balance adjustment valve (see Figure 3).

Note: There is an air-bleeder plug over the oil pocket, so install the control valve with the pump vertical or tilted so that the plug will always be above the oil pocket.



Figure 3. Hydraulic Pump

### 1-2. Connection to the control valve

The actuator is connected to the control valve using the yoke tightening nuts (DAP560) or hexagon socket head bolts (DAP1000, 1500). To connect the valve stem to the piston rod, supply air into the actuator's bonnet bottom with the valve plug fully closed, check that the piston rod has risen about 3 mm, and then connect the valve stem to the piston rod using the stem connecter.

Next, position them by loosening the small truss screw on the scale plate so that the indicator needle will be equal to the scale value for strokes (see Figure 4).

Then, adjust the positioner according to the instruction manual. For further information, see the instruction manual for the control valve.



Figure 4. Section Where Control Valve Is Attached

### 1-3. Pneumatic piping

If you use this as a control valve, install a double action positioner for piping.For information on the double action positioner, see the following instruction manuals.Electropneumatic positioner (AVP300/301 type)No. CM2-AVP300-2001Electropneumatic positioner (HEP25/26 type)No. OM2-8310-0300Pneumatic positioner (VPP02/03 type)No. OM2-8310-0300

### 1-4. Warning

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- M20 eyenuts (5) and (17) on the top of the actuator may only be used when you hoist the actuator itself, but are not to be used to hoist the actuator with the valve body attached. Using the eyenuts to hoist more than the actuator is dangerous.
  - Installation position should be within ±45° from its vertical position. If the actuator and control valve is installed outside of this range, life of consumable parts (i.e. o-ring of sealing part) may be shortened.

# Chapter 2. Disassembly, Inspection, and Assembly of the Actuator

To disassemble, inspect, and assemble the actuator for periodic inspections, use the following procedures.

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Because individual components are heavy, use eyebolts and eyenuts. Hoist each component using a crane with the service taps of the components.

Items needed	Where used
M12 eyebolt (x2)	Piston
Chisel and hammer	Piston
M20 eyebolt (x2)	Bonnet top/bottom
Rags	For oil-drain in snubber
Tray	For oil-drain in snubber

### 2-1. Detaching the actuator from the main unit

See the instruction manual for the main unit.

### 2-2. Disassembling the actuator (see Figures 5 and 6.)

Before disassembling the actuator, securely fasten the bottom of the yoke (31) or (40) with the actuator vertical (so that yoke (31) or (40) is on the bottom).

Ν	No.	Part Name	Part Cou	Int	Ν	No.	Part Name	Part Cou	nt
1		Rod cover	1					DAP560	4
2		Piston rod	1		20		Hexagon socket head bolt	DAP1000	8
3		Hexagon bolt	4					DAP1500	12
4		Spring washer	4					DAP560	4
5		Eyenut	2		21		Spring washer	DAP1000	8
			DAP560	8				DAP1500	12
6		Spring washer	DAP1000	16	22		Locknut	1	
			DAP1500	24	23		Indicator needle	1	
			DAP560	4	24		Scale plate	1	
7		Staybolt	DAP1000	8	25		Small truss screw	2	
			DAP1500	12	26		Spring washer	2	
			DAP560	6	27		Hexagon nut	2	
8		Hexagon nut	DAP1000	14			Stem connecter attachment	1a	
			DAP1500	22	28	28-1	Stem connecter	1	
9		Instruction plate for eyenut	1			28-2	Hexagon bolt	4	
10		Bonnet	2		29		Name plate	1	
11		O-ring	3		30		Drive screw	4	
12		O-ring	2		31		Yoke	1	
13		Tape liner	4				Hexagon bolt	DAP560	1
14		Bushing	2		32		Llovegen eesket heed helt	DAP1000	8
15		Piston	1				Hexagon socket head bolt	DAP1500	8
16		O-ring	1				Yoke tightening nut	DAP560	1
17		Split ring	2 sets		33		Caring weeker	DAP1000	8
18		Plate tightening nut	1				Spring washer	DAP1500	8
19		Cylinder	1		34		Bushing	2	
					35		Hexagon socket head tapered plug	2	

Table 1. DAP (without SHM) Table of Components



For the DAP560

Figure 5. DAP (without SHM) Development Diagram of Components

N	lo.	Part Name	Part Cou	Int	١	lo.	Part Name	Part Cou	nt
1		Snubber bonnet	1				Hexagon socket head bolt	DAP560	4
2		Piston rod	1		29			DAP1000	8
3		Locknut	1					DAP1500	12
			DAP560	4			Spring washer	DAP560	4
4		Staybolt	DAP1000	8	30			DAP1000	8
			DAP1500	12				DAP1500	12
			DAP560	4	31		Locknut	1	
5		Hexagon nut	DAP1000	8	32		Indicator needle	1	
			DAP1500	12	33		Scale plate	1	
			DAP560	4	34		Small truss screw	2	
6		Spring washer	DAP1000	8	35		Spring washer	2	
			DAP1500	12	36		Hexagon nut	2	
7		O-ring	2				Stem connecter attachment	1a	
8		O-ring	1		37	37-1	Stem connecter	1	
9		O-ring	1			37-2	Hexagon bolt	4	
10		Snubber piston	1		38		Name plate	1	
11		Snubber cylinder	1		39		Drive screw	4	
12		Snubber piece	1		40		Yoke	1	
13		O-ring	1				Hexagon bolt	DAP560	1
14		O-ring	3		41			DAP1000	8
15		Tape liner	4				Hexagon socket head bolt	DAP1500	8
16		Bushing	2				Yoke tightening nut	DAP560	1
17		Eyenut	2		42		Coring weeker	DAP1000	8
			DAP560	8			Spring washer	DAP1500	8
18		Spring washer	DAP1000	16	43		Bushing	2	
			DAP1500	24	44		Stop valve	1	
			DAP560	4	45		Instruction plate for stop valve	1	
19		Staybolt	DAP1000	8				DAP560	2
			DAP1500	12	46		Hexagon bolt	DAP1000	4
			DAP560	6				DAP1500	4
20		Hexagon nut	DAP1000	14				DAP560	2
			DAP1500	22	47		Spring washer	DAP1000	4
21		Instruction plate for eyenut	1					DAP1500	4
22		Bonnet	2		48		Hydraulic wheel mounting plate top	1	
23		O-ring	3		49		Hexagon bolt	4	
24		Piston	1		50		Spring washer	4	
25		O-ring	1				Spacer	DAP560	2
26		Split ring	2 sets		51		Hydraulic wheel mounting	DAP1000	1
27		Plate tightening nut	1				plate bottom	DAP1500	1
28		Cylinder	1		52		Hydraulic handle	1	

Table 2. DAP (with SHM) Table of Components



Figure 6. DAP (with SHM) Development Diagram of Components

#### 2-2-1. Without SHM (see Figure 5)

- 1) Marking and protection
  - Place a mark for matching on the rod cover (1), bonnet top (10), cylinder (19), bonnet bottom (10), and yoke (31).
  - Remove the indicator needle (23) and locknuts (22), and cover the thread part of the piston rod (2) with vinyl tape to protect the O-ring (12) and sliding part (bushing (14), tape liner (13)) during disassembly.
- 2) Removing the rod cover (1)
  - Loosen and remove the hexagon bolts (3) at the top of the actuator, and then remove the spring washers (4).
  - Lift the rod cover (1) vertically and remove it.
- 3) Removing the bonnet top (10) and staybolts (7)
  - Loosen and remove the hexagon nuts (8) and eyenuts (5) which are used to fix the bonnet top (10), and then remove the spring washers (6) and staybolts (7).
  - Hoist the bonnet top (10) vertically and remove it, and then remove the O-ring (11), tape liners (13), and O-ring (12).
- 4) Removing the piston rod (2) and piston (15)
  - Extract the piston rod (2) from the cylinder (19) with the piston (15) still attached, and then remove the O-ring (11) at the outer circumference of the piston (15).
  - Put the extracted piston rod (2) with the piston still attached upside down on the mount seat with a hole (which must be high enough so that the piston rod does not reach the surface below).
  - Loosen and remove the plate tightening nuts (18), extract the piston rod (2) from the piston (15), and then remove the split ring (17) and O-ring (16).
- 5) Removing the cylinder (19), bonnet bottom (10), and yoke (31)
  - Remove the cylinder (19), and then remove the hexagon socket head bolts (20) that fasten the bonnet bottom (10) to the yoke (31).
  - Hoist the bonnet bottom (10) vertically and remove it, and then remove the O-ring (11), tape liners (13), and O-ring (12).

#### 2-2-2. With SHM (see Figure 6)

- 1) Marking and protection
  - Place a mark for matching on the snubber bonnet (1), snubber cylinder (11), snubber piece (12), bonnet top (22), cylinder (28), bonnet bottom (22), and yoke (40). Remove the indicator needle (32) and locknuts (31), and cover the thread part of the piston rod (2) with vinyl tape to protect the O-ring (14) and sliding part (bushing (16), tape liner (15)) during disassembly.
- 2) Removing oil.

Remove oil as follows, according to Figures 3 and 8.

- Move the piston down to the bottom via the manual actuator with the actuator upright, and then remove plug 2.
- Remove joints A and B of the switch cock and then place a tray under the pipe outlet.
- Close stop valve 2 and open stop valve 3 to supply air pressure to the bonnet bottom (22), and then remove the oil by raising the snubber piston (10) to the top.
- After that, slowly remove the air pressure that has been supplied to the bonnet bottom.

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- A little oil will remain inside the snubber cylinder (11) and hydraulic piping. It is impossible to completely remove all the oil. Therefore, cover the snubber piece (12) and hydraulic pipe opening with rags before disassembling the snubber cylinder (11) and hydraulic piping.
  - Be sure to slowly remove the air pressure. Quick removal of the air pressure is very dangerous.
  - For manual operations, see section 3.
    - 3) Removing the snubber bonnet (1), snubber cylinder (11), and staybolts (4)
      - Loosen and remove the hexagon nuts (5) at the top of the actuator, and then remove the spring washers (6).
      - Lift the snubber bonnet (1) vertically and remove it.
      - Remove the O-ring (7) that is mounted to the snubber bonnet (1).
      - Wipe off the oil remaining inside the snubber cylinder (11) with a rag.
      - Remove the staybolts (4) and then remove the snubber cylinder (11).
    - 4) Removing the snubber piston (10) and snubber piece (12)
      - Supply air pressure to the bonnet bottom (22). With the pneumatic cylinder fully opened, loosen and remove the locknuts (3) that fix the snubber piston (10), and then remove the snubber piston (10), and O-rings (8) and (9).
      - After that, slowly remove the air pressure.

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• Be sure to slowly remove the air pressure. Quick removal of the air pressure is very dangerous.

- Remove the snubber piece (12), the O-rings (7) and (14) that were mounted, and the O-ring (13).
- 5) Removing the bonnet top (22) and staybolts (19)
  - Loosen and remove the eyenuts (17) and hexagon nuts (20) that are used to fix the bonnet top and bottom (22), and then remove the spring washers (18) and staybolts (19).
  - Hoist the bonnet top (22) vertically and remove it, and then remove O-ring (23), tape liners (15), and O-ring (14).
- 6) Removing the piston rod (2) and piston (24)
  - Extract the piston rod (2) from the cylinder (28) with the piston (24) still attached, and then remove the O-ring (23) at the outer circumference of the piston (24).
  - Put the extracted piston rod (2) with the piston still attached upside down on the mount seat with a hole (which must be high enough so that the piston rod does not reach the surface below).
  - Loosen and remove the plate tightening nuts (27), extract the piston rod (2) from the piston (24), and then remove the split ring (26) and O-ring (25).

7) Removing the cylinder (28), bonnet bottom (22), and yoke (40)

- Remove the cylinder (28), and then remove the hexagon socket head bolts (29) that fasten the bonnet bottom (22) to the yoke (40).
- Hoist the bonnet bottom (22) vertically and remove it, and then remove O-ring (23), tape liners (15), and O-ring (14).

### 2-3. Inspecting components

Make sure that the disassembled components have no defects. The service life of the DAP is 10 years when limited service life components are used following recommended replacement cycle. Although components have been manufactured to tolerate prolonged use, you should repair or replace components as necessary if they have any defects. Table 3 lists the components with limited service life. Replace components according to this table.

No.	Part Name	Pari	t Number	Recommended Replacement Cycle	Remarks	Part Count
11	O-ring	DAP560	82592232-296	5 years	Replace	3
		DAP1000	000 80256742-896 during	96 during dis-	during dis- assembly	
		DAP1500	80228578-196			
12	O-ring	DAP560	82592225-396			2
		DAP1000	82592225-396			
		DAP1500	82592226-296			
13	Tape liner	DAP560	82601995-001			4
		DAP1000	82601995-001			
		DAP1500	82601995-002	Rep		
16	O-ring	DAP560	82592235-596		Replace	1
		DAP1000	82592235-596		during dis-	
		DAP1500	82592235-796		assembly	

Table 3. List of Components with Limited Service Life (without SHM)

No.	Part Name	Par	t Number	Recommended Replacement Cycle	Remarks	Part Count
7	O-ring	DAP560	82592237-796	5 years	Replace	2
		DAP1000	82592237-796		during dis-	
		DAP1500	82592238-796		assembly	
8	O-ring	DAP560	82592228-796			1
		DAP1000	82592228-796			
		DAP1500	82592229-896			
9	O-ring	DAP560	82592235-596			1
		DAP1000	82592235-596			
		DAP1500	82592235-796			
13	O-ring	DAP560	82592236-996			1
		DAP1000	82592236-996			
		DAP1500	82592237-696			
14	O-ring	DAP560	82592225-396			3
		DAP1000	82592225-396			
		DAP1500	82592226-296			
15	Tape liner	DAP560	82601995-001			4
		DAP1000	82601995-001			
		DAP1500	82601995-002			
23	O-ring	DAP560	82592232-296		Replace	3
		DAP1000	80256742-896		during dis- assembly	
		DAP1500	80228578-196		accombry	
25	O-ring	DAP560	82592235-596			1
		DAP1000	82592235-596			
		DAP1500	82592235-796			

Table 4. List of Components with Limited Service Life (with SHM)

### 2-4. Assembling the actuator

Before assembly, clean the components with a rag, etc. When assembling the actuator, be sure to prevent foreign matter from enterting the sliding section.

Apply supplementary material to the O-rings, tape liner, inner surface of the cylinder without dirt. For details on the supplementary materials and application locations, see Tables 5 and 6.

For information on tightening screws, see Tables 7, 8, 9, and 10, and apply the specified tightening torque.

Refer to the marks that you made before disassembly in order to remember the directions in which components should be installed.

No.	Part Name	Applied Location and Supplementary Material
3	Hexagon bolt	Thread part
5	Eyenut	NEVER-SEEZ Bostik Inc
8	Hexagon nut	
18	Plate tightening nut	
20	Hexagon socket head bolt	
22	Locknut	
23	Indicator needle	
28-1	Stem connecter	
28-2	Hexagon bolt	
32	Hexagon bolt	
	Hexagon socket head bolt	
33	Yoke tightening nut	
11	O-ring	The entire sliding part of components, mounting slots
12	O-ring	Plastilube No. 3
13	Tape liner	
16	O-ring	
19	Inner surface of the cylinder	Nichimoly C Powder Shin-Etsu Chemical Co., Ltd., G40-M
34	Bushing	Tapered thread part
35	Hexagon socket head tapered plug	NIPPON VALQUA INDUSTRIES, LTD., Seal

Table 5. List of Supplementary Materials (without SHM)

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- Before assembly, clean the O-rings, tape liners, and O-ring slots, and then apply lubricant to them.
- Note that any flaws or foreign matter on the bushing, insufficient lubrication, or incorrect installation may affect performance.
- Thoroughly apply molybdenum disulfide to the inner surface of the cylinder. Then, lightly apply Plastilube No.3 to it.

No.	Part Name	Applied Location and Supplementary Material					
3	Locknut	Thread part					
4	Staybolt	NEVER-SEEZ					
5	Hexagon nut	Dootin, mo.					
17	Eyenut						
20	Hexagon nut						
27	Plate tightening nut						
29	Hexagon socket head bolt						
31	Locknut						
32	Indicator needle						
37-1	Stem connecter						
37-2	Hexagon bolt						
41	Hexagon bolt						
	Hexagon socket head bolt						
42	Yoke tightening nut						
46	Hexagon bolt						
49	Hexagon bolt						
7	O-ring	The entire slidi	ng part of co	mponents, m	ounting slots		
8	O-ring	SULFCO, INC.	3				
9	O-ring						
13	O-ring						
14	O-ring						
15	Tape liner						
23	O-ring						
25	O-ring						
28	Inner surface of the cylinder	Nichimoly C Po Shin-Etsu Che	owder mical Co., Lte	d., G40-M			
43	Bushing	Tapered thread	l part QUA INDUST	RIES, LTD., S	Seal		
	Hydraulic oil	Nippon Petrochemicals Co., Ltd Super Hyrando 32 Equivalent product: COSMO OIL Co., Ltd Swaloop R032 Amount of Hydraulic Oil (L)					
		Stroke (mm)	DAP560	DAP1000	DAP1500		
		75, 100	4	4	6.5		

#### Table 6. List of Supplementary Materials (with SHM)

No.	Part Name	DAF	°560	DAP	1000	DAP1500	
		Screw Size	Tightening Torque	Screw Size	Tightening Torque	Screw Size	Tightening Torque
3	Hexagon bolt	M20	130 to 175	M20	130 to 175	M20	130 to 175
8	Hexagon nut	M20	130 to 175	M20	130 to 175	M20	130 to 175
20	Hexagon socket head bolt	M20	250 to 340	M20	250 to 340	M20	250 to 340
22	Locknut	M36×1.5	480	M36×1.5	480	M42×1.5	650
28-2	Hexagon bolt	M14	80 to 110	M14	80 to 110	M20	130 to 175
32	Hexagon socket head bolt Hexagon bolt	M12	52 to 70	M22	160 to 215	M22	160 to 215

Table 7. List of Tightening Torques (without SHM)

(N·m)

Table 8.	List of	Tightening	Torques	(with SHM)	(N·m)
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No.	Part Name	DAF	P560	DAP	1000	DAP	1500
		Screw Size	Tightening Torque	Screw Size	Tightening Torque	Screw Size	Tightening Torque
3	Locknut	M36×1.5	480	M36×1.5	480	M42×1.5	650
5	Hexagon nut	M20	130 to 175	M20	130 to 175	M20	130 to 175
20	Hexagon nut	M20	130 to 175	M20	130 to 175	M20	130 to 175
29	Hexagon socket head bolt	M20	250 to 340	M20	250 to 340	M20	250 to 340
31	Locknut	M36×1.5	480	M36×1.5	480	M42×1.5	650
37-2	Hexagon bolt	M14	80 to 110	M14	80 to 110	M20	130 to 175
41	Hexagon socket head bolt Hexagon bolt	M12	52 to 70	M22	160 to 215	M22	160 to 215
46	Hexagon bolt	M10	30 to 40	M10	30 to 40	M10	30 to 40
49	Hexagon bolt	M8	15 to 20	M8	15 to 20	M8	15 to 20

Tables 7 and 8 show Tightening torque of bolts and nuts when these are made with stainless steel.

No.	Part Name	DAF	2560	DAP	1000	DAP1500	
		Screw Size	Tightening Torque	Screw Size	Tightening Torque	Screw Size	Tightening Torque
3	Hexagon bolt	M20	130 to 175	M20	130 to 175	M20	130 to 175
8	Hexagon nut	M20	130 to 175	M20	130 to 175	M20	130 to 175
20	Hexagon socket head bolt	M20	130 to 175	M20	130 to 175	M20	130 to 175
22	Locknut	M36×1.5	480	M36×1.5	480	M42×1.5	650
28-2	Hexagon bolt	M14	50 to 70	M14	50 to 70	M20	130 to 175
32	Hexagon socket head bolt Hexagon bolt	M12	35 to 40	M22	180 to 240	M22	180 to 240

Table 9. List of Tightening Torques (without SHM)

(N·m)

Table 10. List of Tightening Torques (with SHM) (N·m)

No.	Part Name	DAP560		DAP1000		DAP1500	
		Screw Size	Tightening Torque	Screw Size	Tightening Torque	Screw Size	Tightening Torque
3	Locknut	M36×1.5	480	M36×1.5	480	M42×1.5	650
5	Hexagon nut	M20	130 to 175	M20	130 to 175	M20	130 to 175
20	Hexagon nut	M20	130 to 175	M20	130 to 175	M20	130 to 175
29	Hexagon socket head bolt	M20	130 to 175	M20	130 to 175	M20	130 to 175
31	Locknut	M36×1.5	480	M36×1.5	480	M42×1.5	650
37-2	Hexagon bolt	M14	50 to 70	M14	50 to 70	M20	180 to 240
41	Hexagon socket head bolt Hexagon bolt	M12	35 to 45	M22	180 to 240	M22	160 to 215
46	Hexagon bolt	M10	20 to 25	M10	20 to 25	M10	20 to 25
49	Hexagon bolt	M8	10 to 13	M8	10 to 13	M8	10 to 13

Tables 9 and 10 show Tightening torque of bolts and nuts when these are made with carbon steel.

#### 2-4-1. Without SHM (see Figure 5)

- 1) Assembling the piston (15), piston rod (2)
  - Put the piston (15) upside down on the mount seat with a hole and mount O-ring (11).
  - Insert the piston rod (2) into the piston (15), and mount the O-ring (16) and split ring (17).
  - Secure them with the plate tightening nuts (18).
- 2) Assembling the bonnet bottom (10), yoke (31), cylinder (19), and piston rod (2)
  - Place the bonnet bottom (10) with O-rings (11), (12), and tape liner (13) mounted on the yoke (31), and adjust them so that the bolt holes of the yoke (31) engage the thread holes of the bonnet bottom (10). Then, secure them using the hexagon socket head bolts (20) with the spring washer (21).
  - Install the cylinder (19) and then install the piston rod with the piston (2) (which was assembled in 1).
- 3) Assembling the bonnet top (10) and staybolt (7).
  - Install the bonnet top (10) with O-rings (11), (12), and tape liner (13) mounted so that the holes of the bonnet top (10) engage the holes of the bonnet bottom (10).
  - Mount the staybolt (7), spring washer (6), and eyenut instruction plate (9) on it, and secure them with eyenuts (5) and hexagon nuts (8).
- 4) Installing the rod cover (1)
  - Install the rod cover (1) so that the holes of the rod cover (1) engage the thread holes of the bonnet top (10).
  - Secure them using hexagon bolts (3) with spring washers (4).

5) Installing the locknut (22) and indicator needle (23)

• Install the locknuts (22) and indicator needle (23) onto the piston rod (2).

#### 2-4-2. With SHM (see Figure 6)

- 1) Assembling the piston (24), piston rod (2)
  - Put the piston (24) upside down on the mount seat with a hole and mount O-ring (23).
  - Insert the piston rod (2) into the piston (24), and mount O-ring (25) and split ring (26).
  - Secure them with plate tightening nuts (27).
- 2) Installing the bonnet bottom (22), yoke (40), cylinder (28), and piston rod (2)
  - Place the bonnet bottom (22) with O-rings (14), (23), and tape liner (15) mounted on the yoke (40), and adjust them so that the bolt holes of the yoke (40) engage the thread holes of the bonnet bottom (22). Then, secure them using the hexagon socket head bolts (29) with the spring washer (30).
  - Install the cylinder (28) and then install the piston rod with the piston (2) (which was attached in 1).
- 3) Assembling the bonnet top (22) and staybolt (19).
  - Install the bonnet top (22) with O-rings (14), (23), and tape liner (15) mounted so that the holes of the bonnet top (22) engage the holes of the bonnet bottom (10).
  - Mount the staybolt (19), spring washer (18), and eyenut instruction plate (21) on it, and secure them with eyenuts (17) and hexagon nuts (20).
- 4) Installing the snubber piece (12)
  - Mount O-ring (13) on the bonnet top (22), and then install the snubber piece (12) with O-rings (7) and (14) mounted.

- 5) Assembling the snubber piston (10) and snubber cylinder (11)
  - Apply air pressure to the bonnet bottom (22), and install the snubber piston (10) with O-rings (8), (9) mounted to the piston rod (2) with the air cylinder fully open, and then secure them with locknuts (3).
  - After that, slowly remove the air pressure.

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Be sure to slowly remove the air pressure. Quick removal of the air pressure is very dangerous.

- Install the snubber cylinder (11).
- 6) Assembling the snubber bonnet (1) and staybolt (4)
  - Adjust the snubber bonnet (1) with O-ring (7) mounted so that the holes of the bonnet engage the thread holes of the bonnet top (22), and then secure them.
  - Insert the staybolt (4) into the bolt hole of the snubber bonnet (1) and thread hole of the bonnet top (22), and secure them with spring washers (6) and hexagon nuts (5).
- 7) Assembling the locknut (31) and indicator needle (32)
- Install the locknuts (31) and indicator needle (32) onto the piston rod (2).
- 8) Lubrication
  - Set up the cylinder vertically and perform the following, referring to Figures 3 and 7.

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Do not remove plugs 1 and 4 at the same time. If you remove them, oil may flow out of plug 4.

- Move the piston down to the bottom position with (A) Automatic operation described in Table 1, remove plugs 1 and 2, and then inject sufficient oil into the hole of plug 1. After that, close plugs 1 and 2.
- (2) Remove plugs 3 and 4 with the state (C) "Manually open the valve" in Table 1, also open cock 2.
- (3) Inject an amount of oil into the hole of plug 4 up to half of the oil pocket and then send oil to the bottom of the piston by operating the hydraulic pump with stop valve 3 opened. Then, close plug 3 after oil starts flowing out from the hole of plug 3.
- (4) Then, operate the hydraulic pump, and repeat the operation of Fully Open <=> Fully Closed once or twice to remove the remaining oil in the hydraulic piping.
- (5) Lastly, operate the hydraulic pump and move the piston up to the top, and then use a level gage, which is attached to plug 4, to fill the oil pocket with oil until 200 mm of air remains at the top. Then, close plug 4 and cock 2.

During this operation, make sure that the piston is at the top. Do not perform any operations if the piston is not in the top position.

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How to remove the hook of the hydraulic pump While pulling the hook with one hand in the direction of removal, remove the handle with your other hand as you push the handle toward the oil pocket. At this time, do not loosen hook 2.

### 2-5. Assembling the valve body and air cylinder

#### 2-5-1. For when a SHM is not provided

1) Lift the piston cylinder by using eyenut (5) and place it on the valve body.

#### For the DAP560

Tightly fix the yoke (31) to the body with yoke tightening nuts (33), and tighten the hexagon bolts (32).

#### For the DAP1000 and 1500

Tightly fix the yoke (31) to the body using hexagon socket head bolts (32) with a spring washer (33) mounted.

- 2) Make sure that the valve system is fully closed. Then, apply air pressure to the bonnet bottom (10) so that the indicator needle points the fully closed position.
- 3) Mount the screws of the stem connecter (28) so that they engage the threads of the piston rod (2) and valve stem.
- 4) Install the positioner and then run the pneumatic piping.

#### 2-5-2. With SHM

1) Lift the piston cylinder by using eyenut (17) and place it on the valve body.

#### For the DAP560

Tightly secure the yoke (40) to the body with yoke tightening nuts (42), and tighten the hexagon bolts (41).

For the DAP1000 and 1500

Tightly secure the yoke (40) to the body using hexagon socket head bolts (41) with a spring washer (42) mounted.

- 2) Make sure that the valve system is fully closed. Then, apply air pressure to the bonnet bottom (22) so that the indicator needle points approximately 2 to 3 mm above the fully closed position.
- 3) Mount the screws of the stem connecter (37) so that they engage the threads of the piston rod (2) and valve stem.
- 4) Install the positioner and then run the pneumatic piping.

# Chapter 3. Piping Configuration and Manual Operation Methods

### 3-1. Piping



Figure 7 Piping System Diagram

### 3-2. Manual/automatic operation methods

### 3-2-1. Piping status

There are four statuses of piping depending on the type of operation.

- (A) Automatic operation
- (B) Manually close the valve
- (C) Manually open the valve
- (D) Lock it in any position

If you change the above status, be sure to change it along the directions of arrows (1) to (6) shown in Figure 8. Therefore, if you change the current status to a new status, change it to (D) Lock it in any position and then change it to the new status. After manual operations, change it back to (D) Lock it in any position for safety.

Table 9 shows the settings of piping equipment in each status.



Figure 8. Operation Flow

Table 9. Pip	oing Equipmer	t Settings
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Operation type Piping Equipment Name	(A) Automatic operation	(B) Manually close the valve	(C) Manually open the valve	(D) Lock it in any position
Switch cock	N/L position	SHUT position	OPEN position	N/L position
Stop valve 2	OPEN	SHUT	SHUT	SHUT
Stop valve 3	OPEN	OPEN when the manu SHUT when the manu operated. (See Section 3.2.2 (3)	SHUT	
Stop valve 4	SHUT	OPEN	OPEN	OPEN

#### 3-2-2. Switching operation procedure

For switching operations (1) to (6) in Figure 8, see Figures 2, 3, and 7. Be sure to follow the operation procedure below.

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The operation procedures described here allow for the force that the valve receives from fluid. Therefore, never perform any operations except the operations described below.

Before and after a switching operation, make sure that the piping equipment settings satisfy Table 1.

- (1) (A) Automatic operation (D) Lock it in any position
  - (1)-1 Set a supply air pressure to the positioner and input signals.
  - (1)-2 Fully close stop valves 2 and 3.
  - (1)-3 Fully open stop valve 4.
- (2) (D) Lock it in any position  $\rightarrow$  (A) Automatic operation
  - (2)-1 Set a supply air pressure to the positioner and input signals.
  - (2)-2 Fully close stop valve 4.
  - (2)-3 Gradually open stop valves 2 and 3 until they are fully open.

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Slowly open valves while looking at the valve position pointer to avoid quickly opening the valve.

- (3) (D) Lock it in any position (B) Manually close the value
  - (3)-1 Move the switch cock to the SHUT position.
    - (3)-2 Slowly open stop valve 3. Operate the hydraulic pump to close the valve with stop valve 3 fully open.

Fully close stop valve 3 at any valve opening.

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Slowly open valves while looking at the valve position pointer to avoid quickly opening the valve.

Do not operate the hydraulic pump with stop valve 3 fully closed.

- (4) (B) Manually close the value  $\rightarrow$  (D) Lock it in any position
  - (4)-1 Fully close stop valve 3.
  - (4)-2 Move the switch cock to the N/L position.
- (5) (D) Lock it in any position (C) Manually open the value
  - (5)-1 Move the switch cock to the OPEN position.
  - (5)-2 Slowly open stop valve 3. Operate the hydraulic pump to open the valve with stop valve 3 fully open.

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Slowly open valves while looking at the valve position pointer to avoid quickly opening the valve.

Do not operate the hydraulic pump with stop valve 3 fully closed.

(6) (C) Manually open the valve (D) Lock it in any position

(6)-1 Fully close stop valve 3.

(6)-2 Move the switch cock to the N/L position.

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