

# **Instruction Manual**

## **Replacement Procedure of Diaphragm for 400 Model Series**

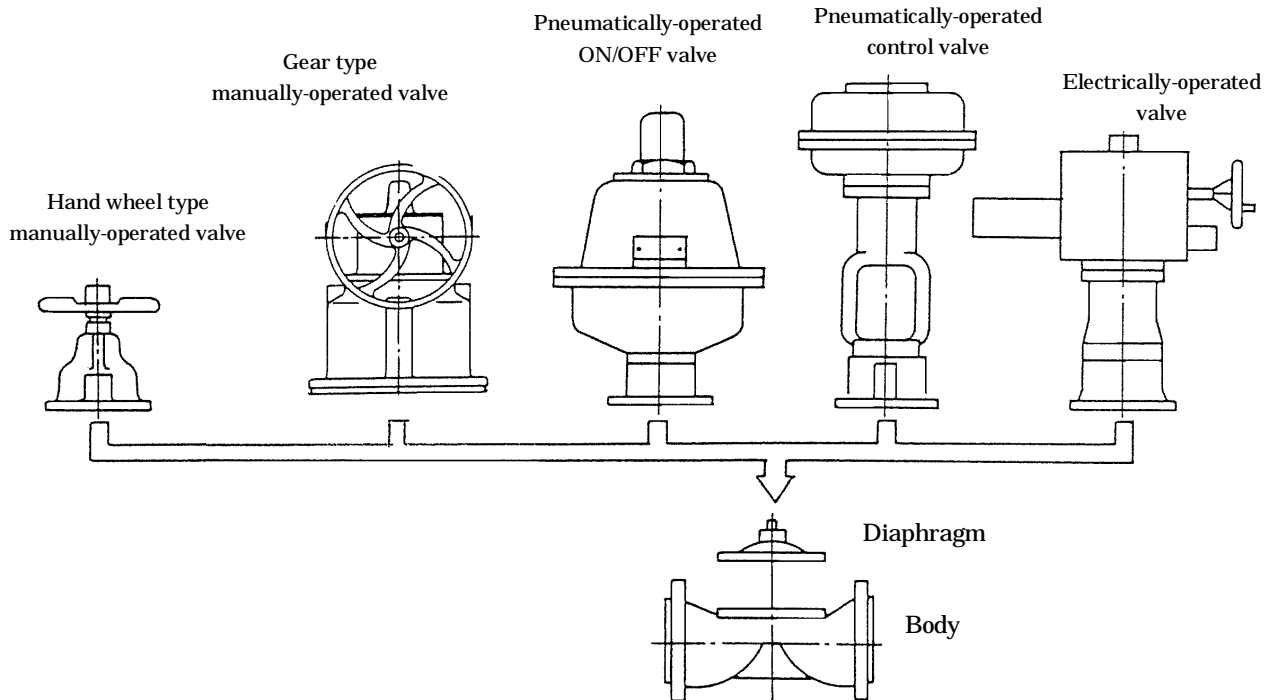
**Rubber Diaphragm**

**PTFE Diaphragm**

**Nippon Daiya Valve Co., Ltd.**

## Introduction

Diaphragms can be replaced with the valve body attached to the piping. However, when the actuator of the valve is fitted horizontally, or the valve is installed at a narrow place, removing a complete set of valve from the piping makes easier to replace the diaphragm. Diaphragm valves of 400 Model series can adopt their actuators respectively to meet their operating types as shown in the figure below. This instruction manual describes replacement procedure for diaphragms when these actuators are installed.



## 1. Preparation

Prepare the following tools and items prior to replacement of diaphragms

- (1) Spanner (or torque wrench)

Table 1

Nominal diameter (A)	15	20	25	40	50	65	80	100
Nominal size of hexagon nuts	M6		M8	M10		M12	M16	M12
Nominal size of spanner	10		13	17		19	24	19



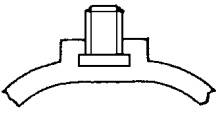

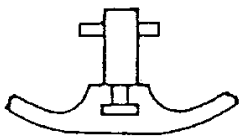


Nominal diameter (A)	125	200	250	250	300	350	400	450	500
Nominal size of hexagon nuts	M16			M18	M22		M24		
Nominal size of spanner	24			27	32		36		

- (2) Clean cloth and sand paper (granularity : # 240)  
For cleaning of dust, foreign matter, etc., if any of them are adhered)
- (3) Gloves  
Protective gloves for handling of harmful chemicals
- (4) Adjustable wrench, driver (+) and seal tape  
For detaching/attaching of pneumatic piping or electrical wiring for automatic valves (pneumatically-operated and electrically-operated valves)

(5) Diaphragm

Connection methods and shapes of diaphragms are different depending on the type of diaphragm and nominal diameter of the valves.

Table 2

Diaphragm	Valve nominal diameter	Connection method	Shape
Rubber diaphragm	15, 20	 Set-in type	 Straight sitting shape (normally-open type)
	25 - 300	 Screwed-in type	 Reverse sitting shape (normally- closed type)
	350 - 500		
PTFE diaphragm	15, 20	 Bayonet type	 Straight sitting shape (normally-open type)
	25 - 300		 Reverse sitting shape (normally- closed type)

2. Caution prior to disassembly

Before starting work, be sure to confirm that there is no residual pressure of fluid or vapor inside the piping

3. Replacement of diaphragm

3.1 Removal of the actuator

- (1) Set the valve to open position by operating it when it is closed.

Manually/ Electrically operated valves : operated by the hand wheel

Pneumatically operated valves : operated by supply air to the actuator

- (2) Remove nuts and bolts that fasten the body and the bonnet.

- (3) Remove the diaphragm and actuator from the body.

If the diaphragm does not come off from the body, gently swing the actuator and pull it upward.

- (4) Clean the weir of the valve body and the surface to which the diaphragm is fitted with a clean cloth. When there is any adhesion of foreign matters, remove them by lightly polishing the surface with sand paper. (Fig. 1)

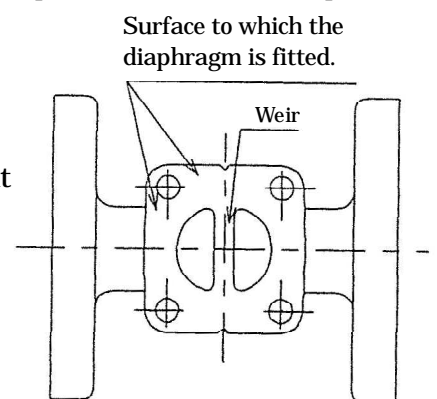


Fig. 1

### 3.2 Replacement of the diaphragm

- (1) Set the actuator to full-closed position which has been removed, and compressor will emerging out.

Manually/ Electrically operated valves : operated by the hand wheel

Pneumatically operated valves : operated by supply air to the actuator

- (2) Remove the diaphragm from the compressor.

In case the diaphragm is contacted with harmful chemicals such as acid or the like, wear protective gloves when handling it.

Set-in type : the diaphragm can be removed by pulling it while twisting.

Screwed-in type : the diaphragm comes out gradually by turning it counterclockwise to loosen the screw.

Bayonet type : the diaphragm can be removed by turning it by  $90^\circ$  to the right or left and pulling it out gently.

- (3) Confirm that the new diaphragm conforms to the nominal diameter of the valve and the type of material which is indicated on the diaphragm.

For the type of materials, see Table 3.

- (4) Be sure to the nominal diameter and type of material is correct, again.

For set-in type. Wet the diaphragm head slightly with water, and then push it in by hanging it on the compressor hole of one end of lip. (Fig. 2)

For screwed-in type. Screw-in the diaphragm until the upper surface of diaphragm boss comes into contact with the bottom surface of concave of the compressor.

In case the position of diaphragm hole a' does not match with the bolt hole a on the bonnet side, return the diaphragm by  $90^\circ$  to the left until both holes align as shown in Fig. 3.

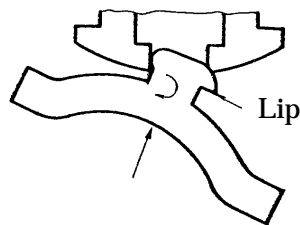


Fig. 2

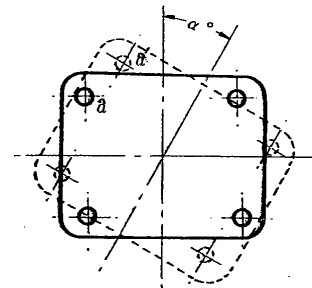


Fig. 3

For Bayonet type, insert the cross pin into the groove of the compressor with the diaphragm rotate by  $90^\circ$  against the regular mounting position to the bonnet, and turn it to the left or right by  $90^\circ$  while pressing the center of the diaphragm with finger covering it with a cloth. (Fig. 4)

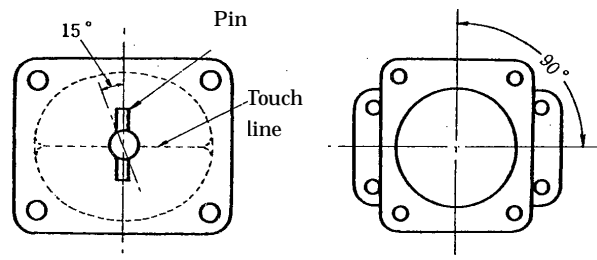


Fig. 4

Doing this, when the center of the diaphragm is not sufficiently pressed, the cross pin is got stuck on the groove of the compressor, and you will feel some resistance. If you continue to turn the diaphragm under such state, the cross pin and metal fixture rotate and get idle inside the diaphragm, and the diaphragm may become inoperable.

Enough care must be taken. (Fig. 5)

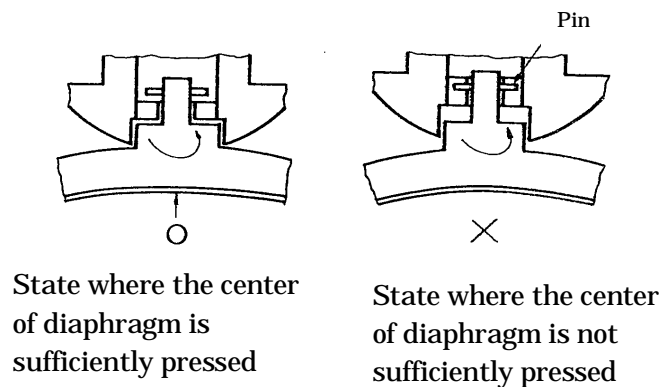


Fig. 5

Normally, the cross pin intersects against the touch line by  $90^\circ$ , but deflection within  $15^\circ$  is permitted. (Fig. 4)

Note : To fit the reverse sitting shape diaphragm, reverse it as shown in Fig. 6, and insert it into the compressor groove. Then, follow the above procedures for fitting.



Fig. 6

(5) Then, fully open the actuator.

Manually/ Electrically operated valves : operated by the hand wheel

Pneumatically operated valves : operated by supply air to the actuator

### 3.3 Reassembly of the valve

- (1) Assemble the valve in clean condition, confirm that there is no adhesion of foreign matters to the diaphragm, inner surface and weir of the valve body, preventing the foreign matters from being caught into the valve seat.
- (2) Place the actuator, fitted with the diaphragm, onto the valve body and tighten the nuts and bolts to the extent that the actuator moves slightly.
- (3) Under the temporary assembled state in the above, Open and close the valve a few times for centering the valve seat, and then close the valve completely.  
Manually/ Electrically operated valves : operated by the hand wheel  
Pneumatically operated valves : operated by supply air to the actuator
- (4) Lightly tighten the nuts and bolts diagonally in alternate steps. When the valve is secured, open the valve by more than 10 %, and tighten all nuts and bolts evenly.

#### Tightening the nuts and bolts that fasten the diaphragm

##### (a) Rubber diaphragm

Since the rubber diaphragm has better air tightness of the connection between diaphragm and the valve body than PTFE one, it is enough to tighten by hand with a spanner. If you need the tightening torque as a reference, the torque listed in Table 4 is to be used.

##### (b) PTFE diaphragm

Open the valve and tighten the nuts and bolts evenly with the torque value in Table 4.

Retighten with proper torque 4 hours or more after the first tightening to increase reliability of the seal between diaphragm and the valve body.

Note: Conduct a hydraulic test to check for leakage after tightening the diaphragm.

If there are scratches on the threaded portion of nuts and bolts due to repeated maintenance work, desired tightening torque cannot be obtained in some cases even if tightened with the torque value in Table 4. Be sure to confirm that there is no leakage by the hydraulic test.

### 4. Inspection

Perform the inspection after completing replacement of the diaphragm using the following procedure.

#### (1) Hydraulic test

Conduct the test with the test pressure indicated in Table 5 or lower.

#### (2) Leakage test of valve seat

Manually operated valve : Conduct the leakage test with the test pressure indicated in Table 5 or lower.

Acuator operated valve : Conduct the leakage test with the working pressure indicated in the nameplate attached to the valve or lower.

**Table 3 Type of diaphragm materials**

Category	Name (material)	Code symbol
Rubber	Natural rubber	NR
	Chloroprene	CR
	Butyl rubber	BG
	Nitrile rubber	AB
	EPDM rubber	EP
PTFE Lined rubber	PTFE	TF
	New PTFE	TX
	EPDM	CE
	EPDM +	CX

**Table 4 Torque values for tightening nuts fastening diaphragm N·m**

Nominal diameter (A)	PTFE diaphragm		Rubber diaphragm	Nominal diameter (A)	PTFE diaphragm		Rubber diaphragm
	Other than hard rubber-lined body	Rubber-lined body			Other than hard rubber-lined body	Rubber-lined body	
15	3.0	4.0	2.0	150	50.0	50.0	30.0
20	4.0	5.5	3.0	200	65.0	65.0	35.0
25	6.5	9.0	4.0	250	70.0	70.0	35.0
40	12.0	17.0	9.0	300	85.0	85.0	50.0
50	20.0	30.0	13.0	350	-	-	50.0
65	35.0	55.0	20.0	400	-	-	60.0
80	60.0	90.0	35.0	450	-	-	65.0
100	30.0	45.0	14.0	500	-	-	65.0
125	50.0	50.0	25.0	-	-	-	-

Table 5 Test pressure for diaphragm valve (hydraulic pressure) MPa

Body materials Nominal diameter(A)	Rubber diaphragm		PTFE diaphragm	
	Gray cast iron Ductile cast iron Stainless cast steel Rubber lining PFA lining ETFE lining	Glass lining Ceramic	Gray cast iron Ductile cast iron Stainless cast steel Rubber lining PFA lining ETFE lining	Hard natural rubber lining Glass lining Ceramic
15	1.6	1.2	1.2	1.2
20	1.6	1.2	1.2	1.2
25	1.6	1.2	1.2	0.85
40	1.6	1.2	1.2	0.85
50	1.6	0.85	1.2	0.85
65	1.2	0.85	1.2	0.85
80	1.2	0.85	1.2	0.85
100	1.2	0.6	1.2	0.6
125	1.0	0.6	0.85	0.6
150	1.0	0.6	0.85	0.6
200	0.85	0.6	0.85	0.6
250	0.6	0.5	0.5	0.5
300	0.5	0.5	0.5	0.5
350	0.4	-	-	-
400	0.4	-	-	-
450	0.4	-	-	-
500	0.4	-	-	-