

Installation and Instruction Manual

A100, A200 Series
Diaphragm Actuator

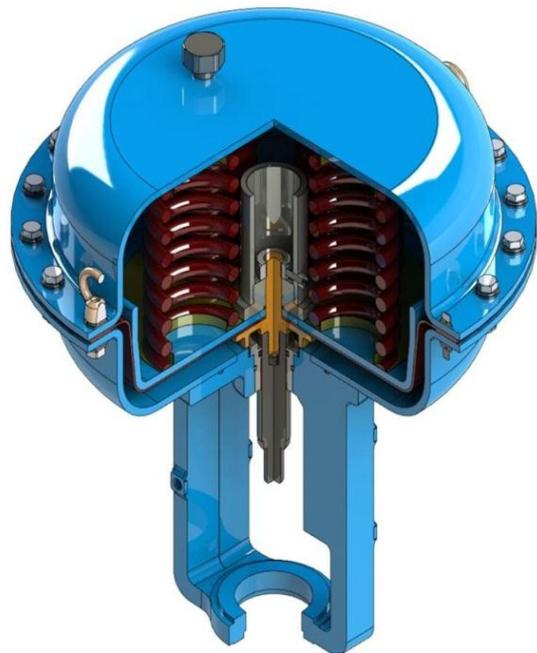


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Safety Information

Important – Please Read Before Installation

UNICON A100, A200 Series Diaphragm Actuator instructions contain **Danger**, **Warning** and **Caution** labels, where necessary, to alert you to safety related or other important information. Read the instructions carefully before installing and maintaining your control valve. **Danger** and **Warning** hazards are related to personal injury. **Caution** hazards involve equipment or property damage. Operation of damaged equipment can, under certain operational conditions, result in degraded process system performance that can read to injury or death. Total compliance with all **Danger**, **Warning** and **Caution** notices is required for safe operation.

The safety terms **Danger**, **Warning**, **Caution** and **Note** have used in these instructions to highlight particular dangers and/or to provide additional information on aspects that may not be readily apparent.

Danger : indicates that death , severe personal injury and/or substantial property damage will occur if proper precaution is not taken.

Warning : indicates that death, severe personal injury and/or substantial property damage can occur if proper precaution is not taken.

Caution : indicates that minor personal injury and/or property damage can occur if proper precaution is not taken.

Note : indicates and provides additional technical information which may not be obvious, even to qualified personnel.

1. Introduction

Pneumatic diaphragm actuator is the source of driving force operate control valves, we have developed and designed multi spring diaphragm actuator for all the reciprocating valves we manufacture. The A100, A200 is a pneumatic, spring opposed diaphragm actuator operating from plant air. Excellent long term accuracy and reliability is achieved through the use of multiple springs in the actuator. The rugged one piece yoke, the pressed steel diaphragm case and the special nylon reinforced diaphragm provide dependable, high thrust performance. Additionally, the precision formed diaphragm eliminates friction and reduces variations in the effective area during operation which, in turn, results in exceptional linearity. Actuators Five different sizes of the diaphragm actuators. An optional top or side mounted manual override is available in both direct and reverse acting with various accessories can virtually satisfy all application requirements.

1-1General

This instruction manual provides information on installation, adjustment, maintenance and parts ordering for the Type Pneumatic Diaphragm Actuator for sizes. This manual applies to the spring return pneumatic diaphragm actuators used on the V200 series control valves.

⚠ WARNING

When unpacking the valve, care must be exercised to prevent damage to the accessories and component parts. Do not install, operate, or maintain a diaphragm pneumatic actuator without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. Under certain operating conditions, the use of damaged equipment could cause a degradation of the performance of the system which may lead to personal injury or death. To avoid personal injury or property damage, it is important to carefully read, understand and follow all the contents of this manual. If you have any questions about problems arise, contact UNICON office.

2. Product description

The A100, A200 Series multi-spring diaphragm actuator is of non reversible type. This has been designed with an improved mechanical structure which makes the product extremely competitive in price as well as suitable for application with critical operating conditions. The stroke times for the multi-spring A100, A200 Series diaphragm actuator depend on the application. The factor which influences this characteristic are the stroke, air supply pressure, size of pipework connection, spring rate, operation action (air to open, air to close) and type of the possible associated positioner. Actuator stroking time of less than one second can be obtained by using booster.

Table 1. Specifications

Specification		Actuator Size									
		250 RA	250 DA	290 RA	290 DA	370 RA	370 DA	480 RA	480 DA	550 RA	550 DA
Nominal Effective Area		See tables 2 and 3.									
Maximum Operating Pressure to Diaphragm	BarG	4									
	PsiG	58									
Maximum Stroke	mm	20	30	40	70	90					
	inch	0.79	1.18	1.57	2.75	3.54					
Valve Stem Connector Thread	mm	M14 x 1.5P					M24 x 1.5P				
Temperature Range	°C	diaphragm and steel studs and nuts : -30 to +80									
	°F	diaphragm and steel studs and nuts : -20 to +180									
Pressure Connections	inch	1/4" NPT					3/8" NPT				

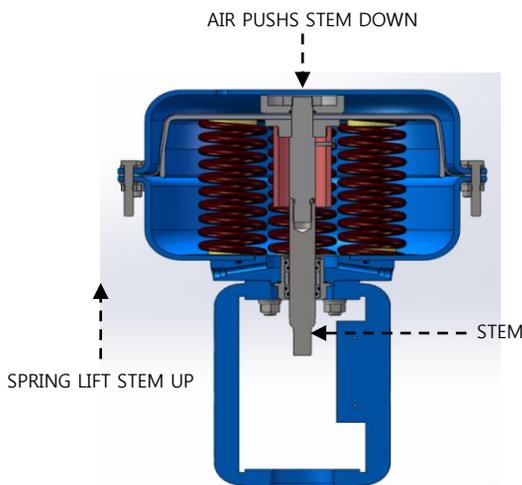


Figure 1. Direct Acting (Air to Close Type)

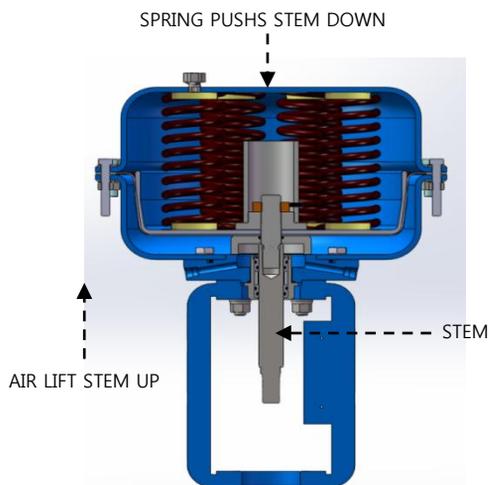


Figure 2. Reverse Acting (Air to Open Type)

Description

The Direct Acting (Air to Close Type) actuator (figure1) and The Reverse Acting (Air to Open Type) actuator (figure2) are spring-opposed pneumatic diaphragm actuators that provide automatic throttling or on-off operation of stem control valves. The actuator will position the valve plug in response to varying pneumatic loading pressure on the actuator diaphragm.

The Direct Acting (Air to Close Type) actuator springs are located under the diaphragm plate and they fully retract the actuator stem for fail action upon loss of diaphragm casing pressure. The Reverse Acting (Air to Open Type) actuator springs are located on top of the diaphragm plate and they fully extend the actuator stem upon loss of diaphragm casing pressure. The actuator is mounted on the valve by means of yoke.

Table 2. Additional Specifications (Direct Acting)

Size	Spring Quantity	Maximum Stroke		Effective Diaphragm Area (1)		Maximum Output Thrust (Maximum Actuator Stem Force) (2)		
		mm	Inch	cm ²	Inches ²	kgf	N	lbf
250	4	20	0.79	270	41.85	400	4079	917
290	4	30	1.18	390	60.45	522	5323	1197
370	4	40	1.57	303	46.97	1370	13,970	3140
480	6	70	2.75	396	61.38	2000	20,394	4585
550	6	90	3.54	456	70.68	2371	24,177	5435

Table 3. Additional Specifications (Reverse Acting)

Size	Spring Quantity	Maximum Stroke		Effective Diaphragm Area (1)		Maximum Output Thrust (Maximum Actuator Stem Force) (2)		
		mm	Inch	cm ²	Inches ²	Kgf	N	lbf
250	4	20	0.79	270	41.85	357	3640	818
290	4	30	1.18	390	60.45	380	3875	871
370	4	40	1.57	303	46.97	645	6577	1479
480	6	70	2.75	396	61.38	1450	14,786	3324
550	6	90	3.54	456	70.68	1750	17,845	4011

Note!

(1) Effective diaphragm area at 0% valve travel from seat.

(2) Based upon 4 bar operating pressure to the diaphragm and valve travel at 0% from seat.

Control Valve	
TAG NO.	
MODEL NO.	
BODY SIZE	
RATING	
Cv / CHAR.	
STROKE	mm
FLOW DIR.	<input type="checkbox"/> UP <input type="checkbox"/> DOWN
MAT'L	BODY
	SEAT
	PLUG
	STEM
SERIAL NO.	
DATE	
UNICON SYSTEM / KOREA	

Figure 3. UNICON Actuator Nameplate

Specification

Refer to table 1 for Specifications of the Diaphragm Actuator. See the actuator nameplate (figure 3) for specific information about your actuator travel.

3. Operation

A100, A200 Series diaphragm actuator is normally shipped mounted on a valve. Refer to the appropriate valve instruction manual when installing the valve. If the actuator is shipped separately or if it is necessary to mount the actuator to the valve, perform the Actuator Installation procedure given below.

Warning

Personal injury or equipment damage caused by sudden release of pressure may result if the actuator assembly is installed where service conditions could exceed the limits given in tables 1, 2, and 3 or the appropriate nameplates.

To avoid parts damage, do not use a normal operating pressure that exceeds the Maximum Diaphragm Casing Pressure (see table 1) or produces a force on the actuator stem greater than the Maximum Allowable Output Thrust (see table 2 or 3) or Maximum Allowable Valve Stem Load.

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions.

Since some valve body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without contacting UNICON office.

4. Mounting The Actuator

The following procedure describes how to mount an A100, A200 Series diaphragm actuators on a top-guided control valve so that the actuator stem and valve stem thread engagement allows full travel and proper shut-off. Refer to figures 6, 7, 10, 11, 13, 14 for actuator dimensions. Item numbers referenced are shown in figures 15, 16, 17, 18.

- » Provide a temporary method of applying diaphragm air loading pressure to the diaphragm to move the actuator stem during adjustments.
- » Provide a vice or some other method of supporting the valve and the weight of the actuator during assembly.
- » Push the valve stem down until the valve plug is fully closed.
- » Screw the two stem locknuts to the lower end of the valve stem thread

Warning

The A100, A200 Series diaphragm actuators are designed to mount on top-guided control valves. Do not mount these actuators on any other type of valve without contacting UNICON office.

Note!

Perform one of the following procedures as appropriate

1. Carefully place the actuator on the valve so that the yoke fits over the valve bonnet.
 2. Be sure that the actuator and valve stem threads are engaging the threads of the stem clamp by at least the distance of one diameter of the stem.
 3. Secure the yoke clamp onto the yoke and tighten with bolts and nuts.
 4. Place the stem clamp approximately halfway between the actuator and valve stems but observing the dimension so that any positioner lever is horizontal at mid-travel.
 5. Install the other half of the stem clamp and insert the socket screws and nuts and tighten them.
 6. Lift the valve plug off the seat by the correct valve travel for the valve. This is stated on the nameplate.
-

⚠ Warning

When moving the actuator stem with diaphragm loading pressure use caution to keep hands and tools out of the actuator stem travel path. Personal injury or property damage is possible if something is caught between the actuator stem and other parts of the valve assembly.

⚠ Caution

Be sure that the diameter of the actuator stem and the valve stem in the clamp is equal. Incomplete engagement of either the valve or actuator stem in the stem connector can result in stripped threads or improper operation.

In the following procedure do not rotate the valve plug while it is seated. This may damage the seating surface and cause excessive leakage. While making adjustments, use tools carefully to avoid damaging the valve stem. A damaged stem could cut the packing and allow leakage through the packing set.

A-100 Series Actuator Spring Arrangement



Figure 4. Actuator Size 250, 290 and 370
4 Springs



Figure 5. Actuator Size 480, 550
6 Springs

5. Actuator Maintenance

Inspect and check all component parts for damage. Replace parts if necessary. The frequency of inspection and replacement depends upon the severity of the service conditions. When inspection or repairs are required, disassemble only those parts necessary to accomplish the job; then start to assemble at the appropriate step.

Warning

- » *Do not remove the actuator from the valve while the valve is still pressurized.*
- » *Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.*
- » *Use bypass valves or completely shut off the process to isolate the valve from the process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.*
- » *Vent the power actuator loading pressure and relieve actuator spring pre-compression.*
- » *Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.*
- » *The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.*

5-1 Diaphragm

In case there are damages on diaphragm surface, it should be replaced new case. To keep the best operating condition, dry air and allowable pressure must be used.

5-2 O-Ring

O-Ring helps the movement of actuator stem and prevent external leaks. Carefully inspect O-Rings for nicks and cuts. If damage on it, O-Ring must be replaced with new one.

Note!

- » Check Actuator size(Refer to Table 6, 7, 10 ,11, 13, 14)
 - » Check O-Ring amount(Refer to figure 15, 16, 17, 18 and Part List))
-

6. Actuator Disassembly

- ① For complete disassembly, the positioner and all accessories (if attached) must be removed from the actuator.
- ② For a top-loaded Air-to-Close(DA) actuator, reduce the diaphragm air pressure to zero and remove the piping or tubing from the connection in the upper diaphragm casing. For a bottom loaded Air-to-Open(RA) actuator, apply air pressure to the diaphragm to open the valve.
- ③ Undo the stem connector by first slackening the valve stem locknuts and then removing the socket bolts.
- ④ Undo the yoke nut on the valve bonnet and carefully lift the actuator off the valve.
- ⑤ Loosen and remove all hex bolts / nuts.
- ⑥ Loosen and remove eye bolts evenly that the top case and bottom case to separate.

Note!

Unscrew the short and long diaphragm casing cap screws and nuts alternately, until only the longest casing cap screws remain engaged. Then allow the remaining spring compression to be slowly released by alternately unscrewing the long casing cap screws.

Warning

» *Prior to performing maintenance on actuator , isolate the entire valve.*

» *Vent all process pressure in accordance with site practice. Shut off all electrical power to accessories, and shut off all pneumatic signal and supply lines to the actuator.*

6-1 Air to Open Type(RA) Actuator (Refer to Figure 2, 15, 17)

- ① Remove diaphragm sub-assembly from actuator.
- ② Remove spacer and Unscrew lock nut by using socket wrench in the state of tightening actuator stem.
- ③ Loosen and remove spacer holder, diaphragm plate, diaphragm, diaphragm holder and actuator stem in sequence.
- ④ Clear all mating/seal ring surfaces which will come into contact with diaphragm plate, spacers and lock nuts.
- ⑤ Place new diaphragm. If there is damage on O-ring rotated in the stem guide bush. it should be replaced.

6-2 Air to Close Type(DA) Actuator (Refer to Figure 1, 16, 18)

- ① Remove diaphragm sub-assembly from actuator.
- ② Remove spacer and Unscrew lock nut by using socket wrench in the state of high actuator stem.
- ③ Loosen and remove spacer holder, diaphragm plate, diaphragm, diaphragm holder and actuator stem in sequence.
- ④ Clear all mating/seal ring surfaces which will come into contact with diaphragm plate, spacers and lock nuts.
- ⑤ Place new diaphragm. If there is damage on O-ring rotated in the stem guide bush. it should be replaced.

Table 4. Dimensions

Actuator Size	A	H	H1	H2	D	T	C
	Millimeters (mm)						
250 DA	252	352	-	135	56	20	200
250 RA		332	114	-			
290 DA	292	389	-	145			
290 RA		369	114	-			
370 DA	370	430	-	155	80	30	300
370 RA		410	114	-			
480 DA	482	649	-	206			
480 RA		629	134	-			
550 DA	560	698	-	223	80	30	300
550 RA		678	134	-			

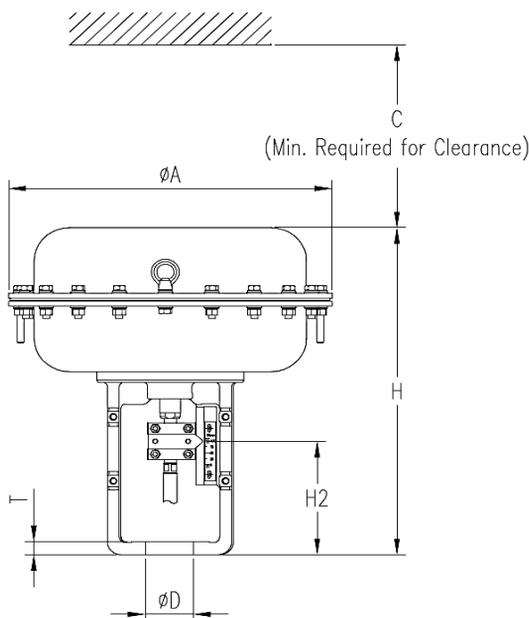


Figure 6. Direct Acting (DA)

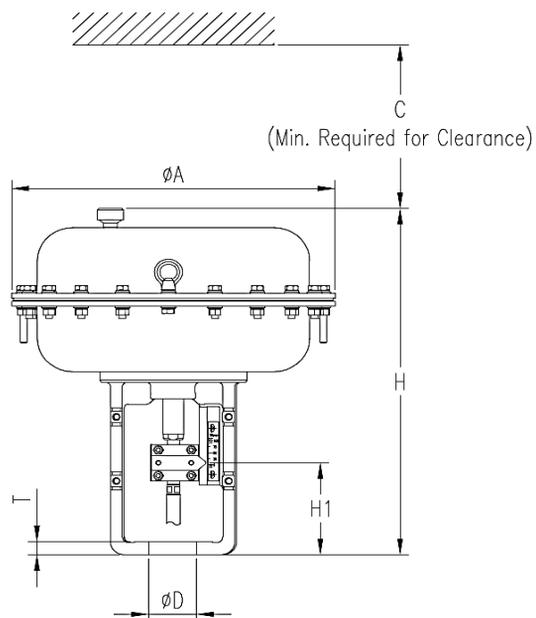
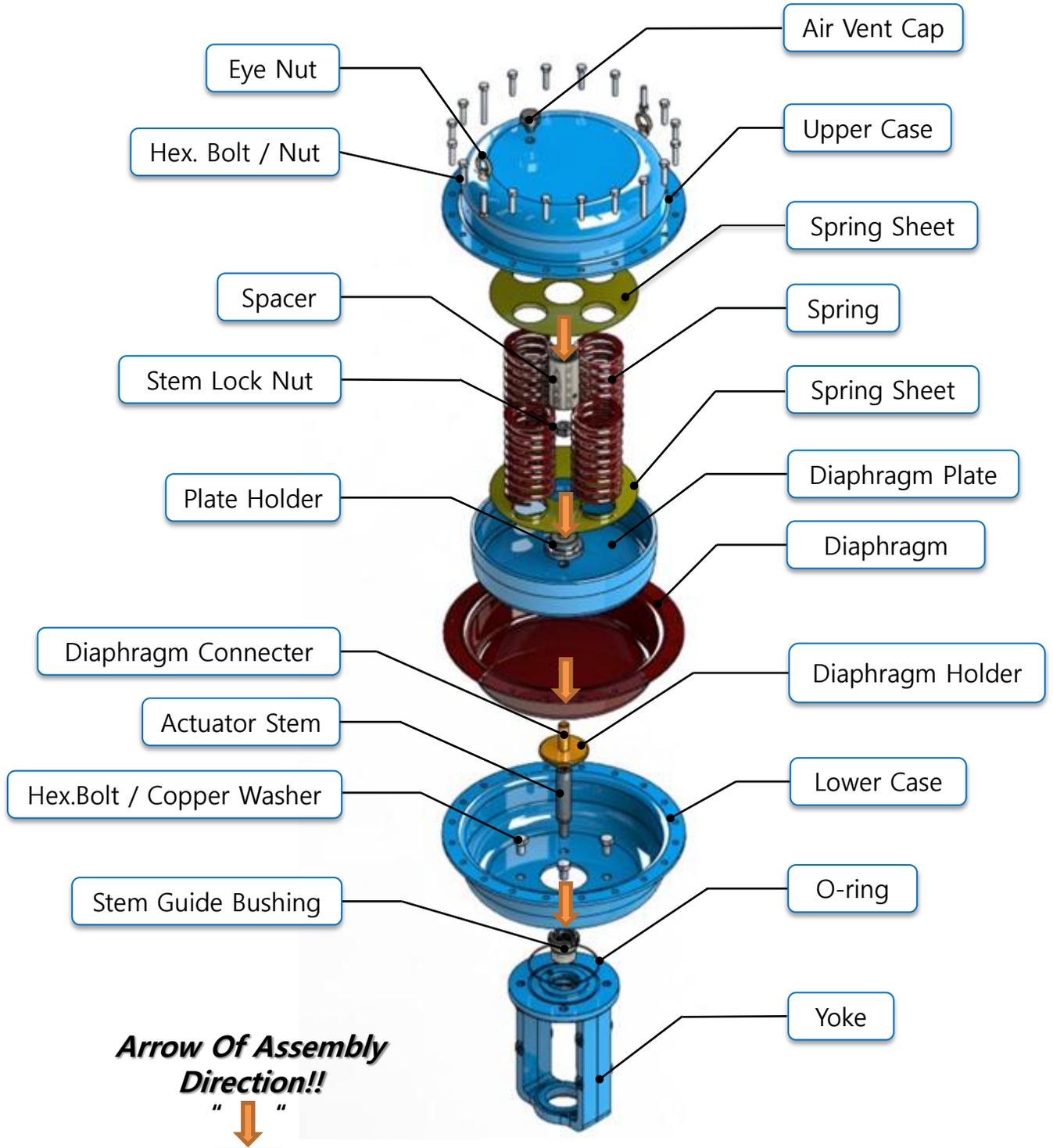


Figure 7. Reverse Acting (RA)

Figure 8. Diaphragm Actuator Assembly Drawing



7. Diaphragm Actuator Steering Wheel Type



7-1 Top Steering Wheel Type

- » Diaphragm 250, 290, 370 size can use the top handle wheel of diameter 250mm.
- » Top handle has been designed to decompose.
- » The handle yoke is fixed with screws that you can Decomposition the screw, a handle is removable.

Figure 9. 250, 290, 370 Size Diaphragm With Top Steering Handle Wheel Type

» Top handle wheel type actuator provides a pin which can be fixed so as not to rotate by others.



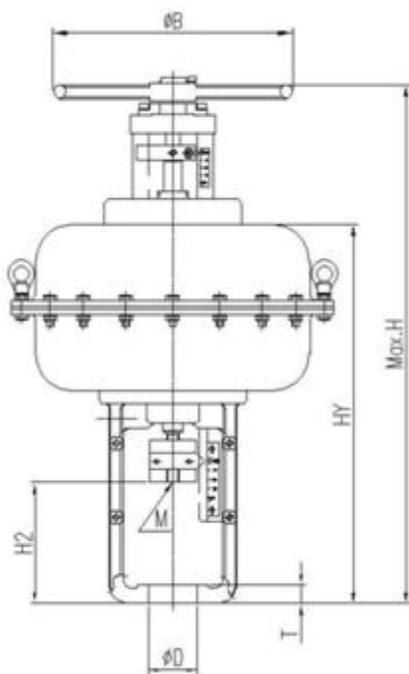


Figure 10. Direct Acting (DA)

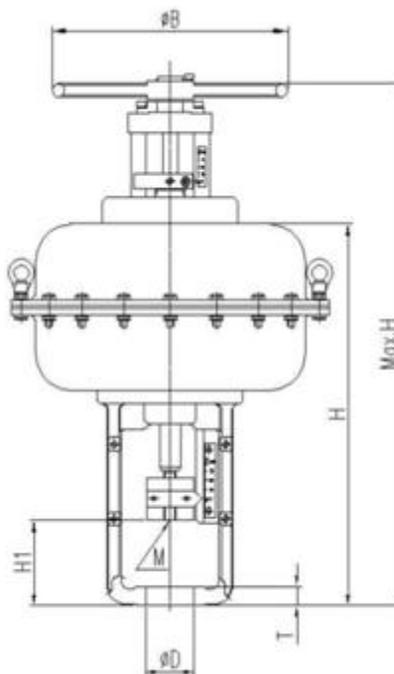


Figure 11. Reverse Acting (RA)

Unit : mm

Size	250	290	370	370L
ΦB	250	300	300	300
Max.H	430	520	560	643
H	332	369	410	460
H1	91			
H2	111	121	131	131
ΦD	56			
T	20			
M	M14 * 1.5P			



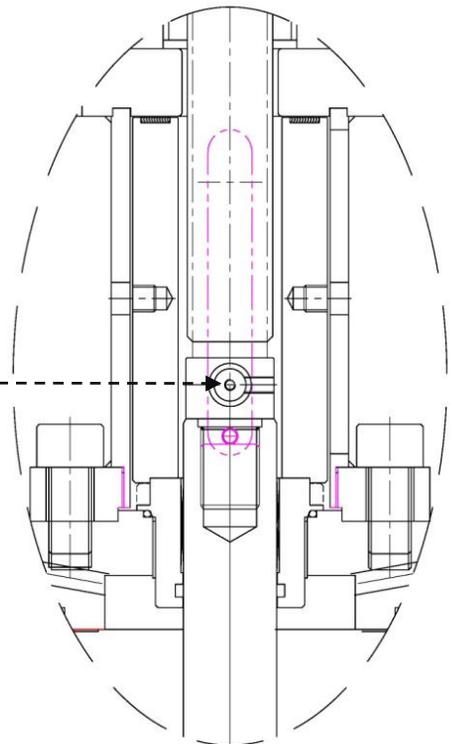
Figure 12. 480,550 Size Diaphragm With Side Handle wheel

7-2 Side Steering Wheel Type

- » Diaphragm 480 & 550 size can use the side handle wheel of diameter 500mm.
- » Side handle gear box is used in common with the cylinder actuator(12", 16", 20" size) and diaphragm actuator(480, 550 size).
- » Side handle wheel type actuator provides a pin which can be fixed so as not to rotate by others.
- » The biggest advantage of the side handle wheel type is that you do not have to operate to climb to high places.

» And you can be a small force, all the stems by moving up and down, it can open and close the fluid and gas with handle gearbox.

» Removing the bearing shaft by hand, it is possible to separate the handle gearbox. That it does not require excessive strong force is an advantage.



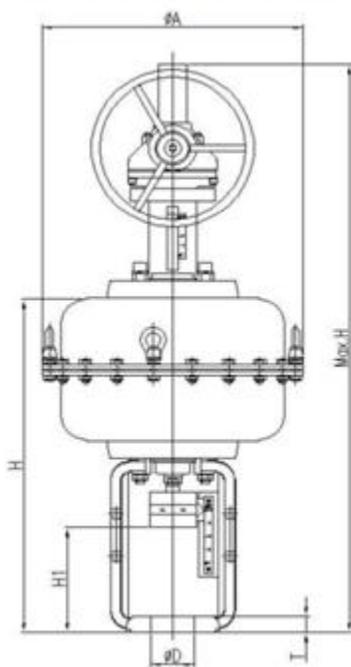


Figure 13. Direct Acting (DA)

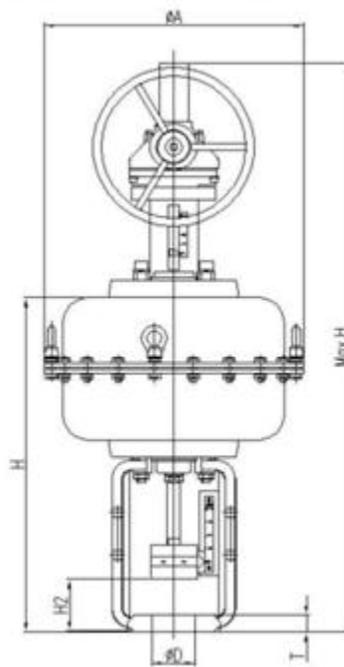


Figure 14. Reverse Acting (RA)

Unit : mm

Size	480	480H	550	550H	550L
ΦA	480	480	550	550	550
Max.H	1070	1070	1120	1120	1250
H	629	629	678	678	708
H1	102	102	102	102	102
H2	172	152	192	152	222
ΦD	80				
T	30				
M	M24 * 1.5P				

Figure 15. Reverse Acting 250, 290, 370 TYPE

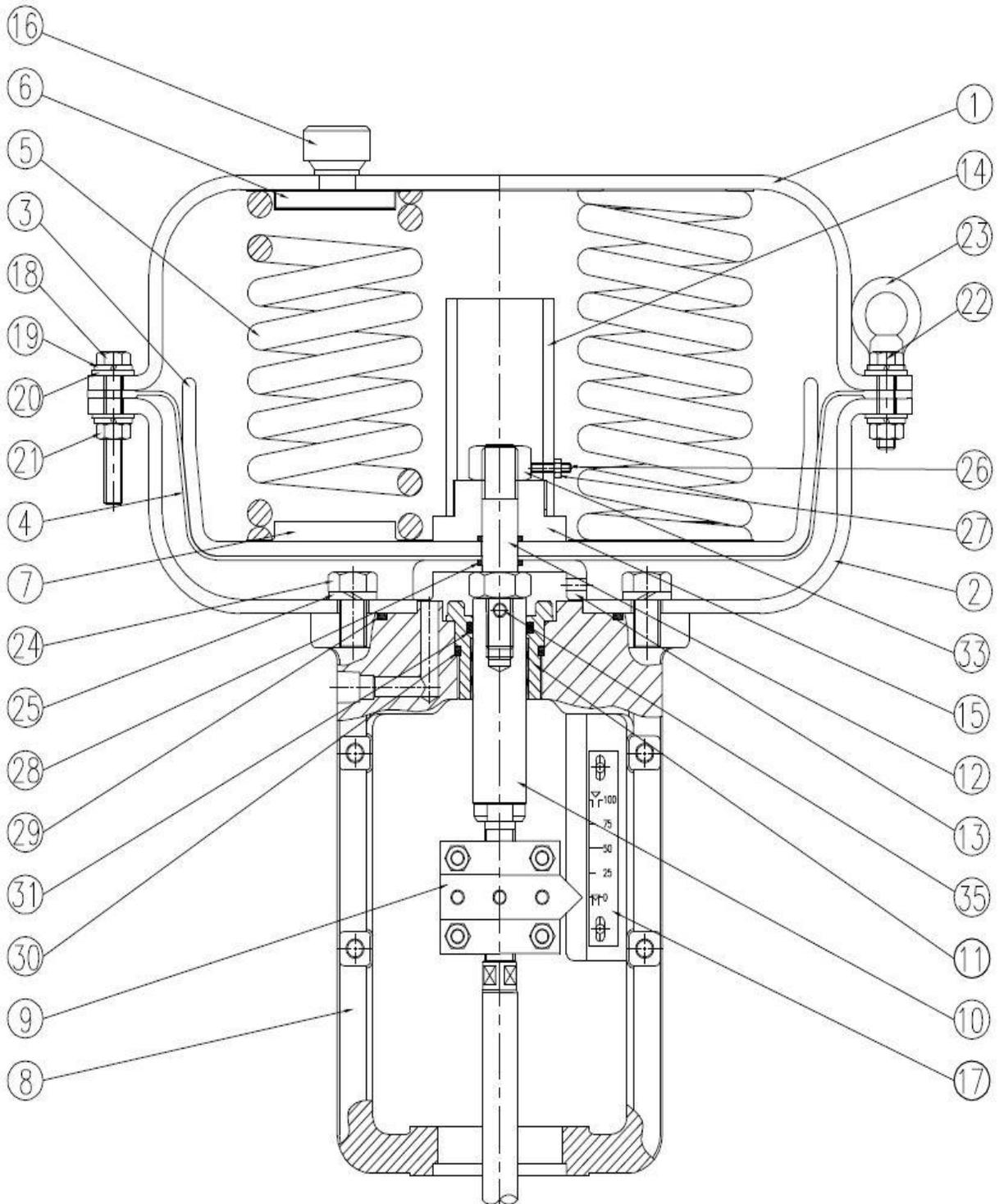
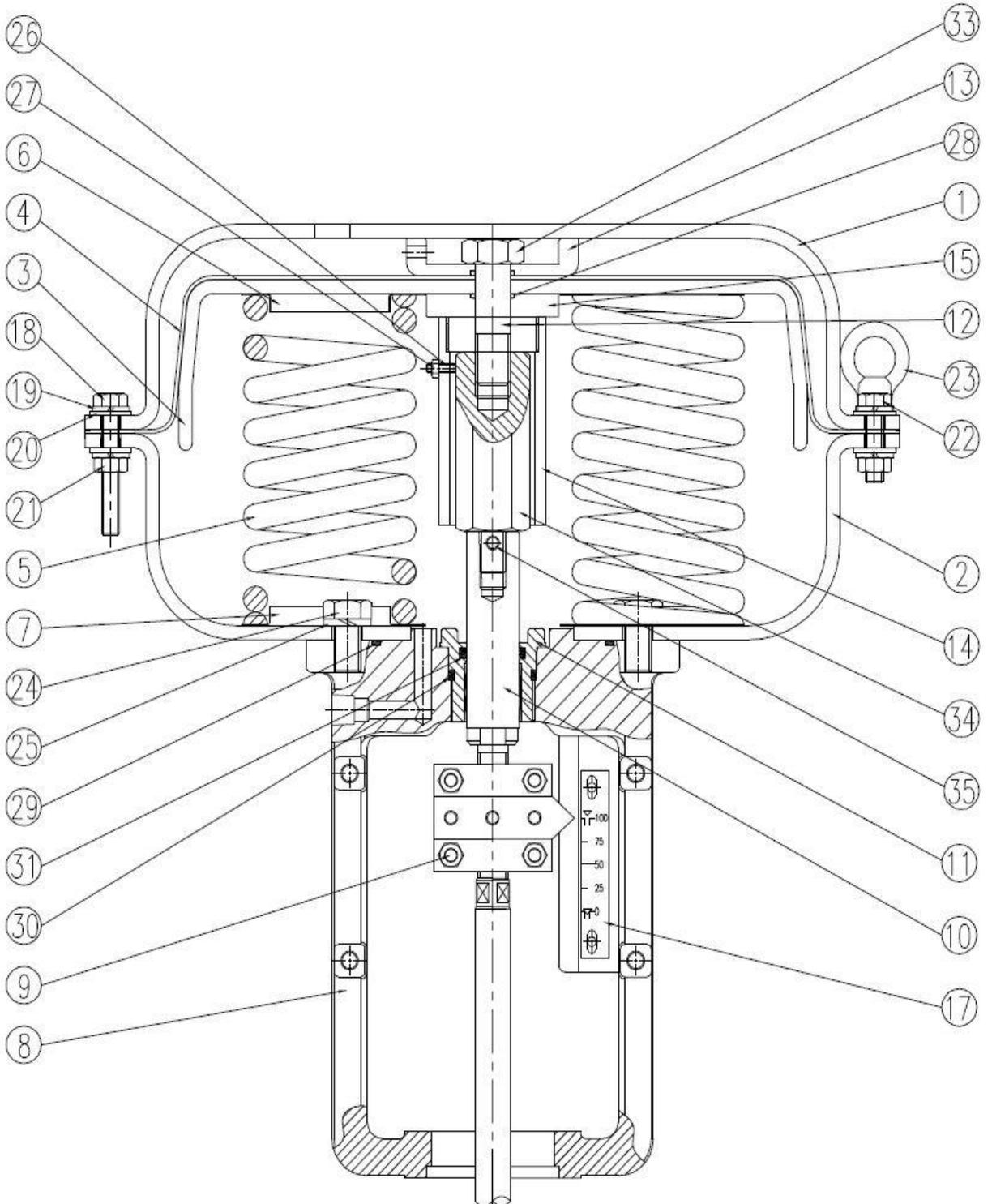


Figure 16. Direct Acting 250, 290, 370 TYPE



Part List

Key	Description	Explanation
1	Upper Diaphragm Case	Different for each size ① 250 ② 290 ③ 370
2	Lower Diaphragm Case	
3	Diaphragm Plate	
4	Diaphragm	
5	Spring	
6	Upper Spring Guide	
7	Lower Spring Guide	
8	Yoke	Size ① 250 ② 290, 370
9	Stem Clamp	
10	Actuator Stem	Size ① 250 DA ② 250 RA ③ 290, 370 DA ④ 290, 370 RA
11	Stem Guide Bush	
12	Diaphragm Connector	Size ① 250 DA ② 290, 370 DA ③ 290, 370 RA * 250 RA not used.
13	Diaphragm Holder	Size ① 250 ② 290, 370
14	Spacer	Size ① 250 ② 290 ③ 370
15	Spacer Holder	Size ① 250 ② 290, 370
16	Air Vent Cap	Using only RA type
17	Scale - Travel	Depending on the respective specifications.
18	Compression Cap Screw	Use two screws per one thing
19	Spring Washer	Size ① 250 (24 required) ② 290 (32 required) ③ 370 (40 required)
20	Plain Washer	Size ① 250 (24 required) ② 290 (32 required) ③ 370 (40 required)
21	Hex Nut	Size ① 250 (12 required) ② 290 (16 required) ③ 370 (20 required)
22	Hex Head Cap Screw	Size① 250 (8 required) ② 290 (12 required) ③ 370 (16 required)

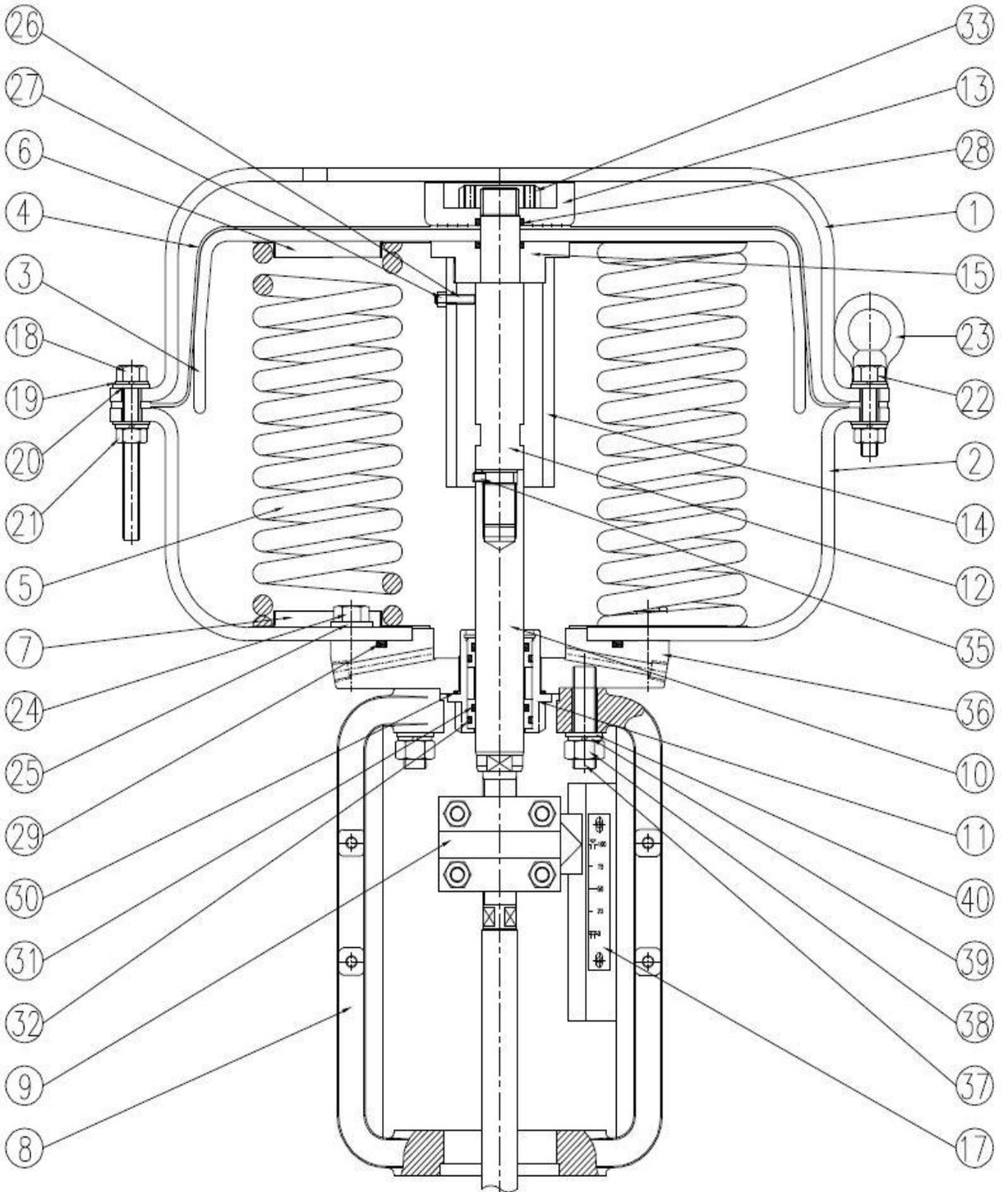
Part List

Key	Description	Explanation
23	Eye Bolt	2required
24	Hex Head Cap Screw	4 required
25	Cooper Washer	4 required
26	Set Screw	Size 250, 290, 370 Shared
27	Hex Nut	Size 250, 290, 370 Shared
28	O-Ring (Diaphragm Holder)	250, 290, 370 (2 required) Shared
29	O-Ring	Size ① 250 ② 290, 370
30	O-Ring	Size 250, 290, 370 Shared
31	O-Ring (Stem Bush)	Size 250, 290, 370 Shared
32	O-Ring (Stem Bush)	Not Used
33	Lock Nut	Size 250, 290, 370 DA Shared * 250, 290, 370 RA not used.
34	Stem Connector	Size ① 290 DA ② 370 DA * Using only 290 DA, 370 DA
35	Set Screw	Using only 290, 370, 480, 550
36	Case Adapter Flange	Not Used
37	Stud Bolt	Using only 480, 550 Each of 4 required
38	Hex Nut	
39	Spring Washer	
40	Plain Washer	

Note!

The size number is used as a grouping by item.

Figure 18. Direct Acting 480, 550 TYPE



Part List

Key	Description	Explanation
1	Upper Diaphragm Case	Different for each size ① 480 ② 550
2	Lower Diaphragm Case	
3	Diaphragm Plate	
4	Diaphragm	
5	Spring	
6	Upper Spring Guide	
7	Lower Spring Guide	
8	Yoke	Size 480, 550 Shared
9	Stem Clamp	Size 480, 550 Shared
10	Actuator Stem	Size 480, 550 Shared
11	Stem Guide Bush	Size 480, 550 Shared
12	Diaphragm Connector	Size ① 480 DA ② 550DA ③ 480, 550RA
13	Diaphragm Holder	Size 480, 550 Shared
14	Spacer	Size ① 480 ② 550
15	Spacer Holder	Size 480, 550 Shared
16	Air Vent Cap	Using only RA type
17	Scale - Travel	Depending on the respective specifications.
18	Compression Cap Screw	Use two screws per one thing
19	Spring Washer	Size ① 480 (40 required) ② 550 (48 required)
20	Plain Washer	Size ① 480 (40 required) ② 550 (48 required)
21	Hex Nut	Size ① 480 (20 required) ② 550 (24 required)
22	Hex Head Cap Screw	Size ① 480 (14 required) ② 550 (18 required)

Part List

Key	Description	Explanation
23	Eye Bolt	2 required
24	Hex Head Cap Screw	4 required
25	Cooper Washer	4 required
26	Set Screw	Size 250, 290, 370 Shared
27	Hex Nut	Size 250, 290, 370 Shared
28	O-Ring (Diaphragm Holder)	250, 290, 370 (2 required) Shared
29	O-Ring	Size ① 250 ② 290, 370
30	O-Ring	Size 250, 290, 370 Shared
31	O-Ring (Stem Bush)	Size 250, 290, 370 Shared
32	O-Ring (Stem Bush)	Not Used
33	Lock Nut	Size 250, 290, 370 DA Shared * 250, 290, 370 RA not used.
34	Stem Connector	Size ① 290 DA ② 370 DA * Using only 290 DA, 370 DA
35	Set Screw	Using only 290, 370, 480, 550
36	Case Adapter Flange	Not Used
37	Stud Bolt	Using only 480, 550 Each of 4 required
38	Hex Nut	
39	Spring Washer	
40	Plain Washer	

Note!

The size number is used as a grouping by item.

8. Connection disassembly from the Body

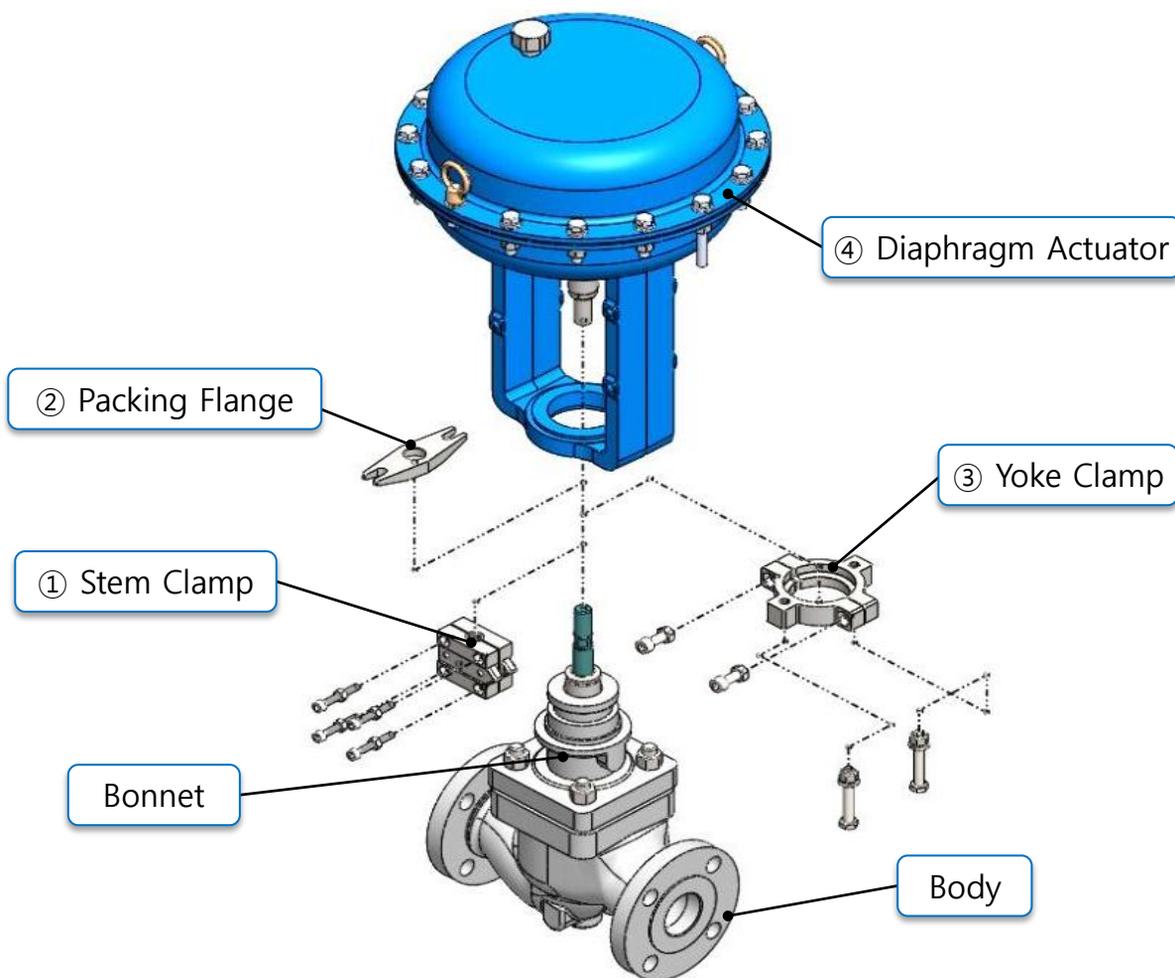
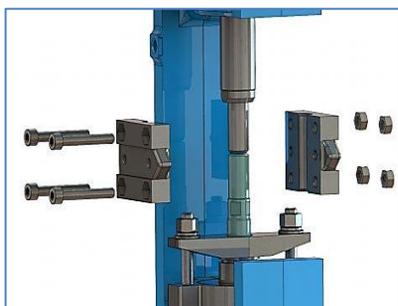
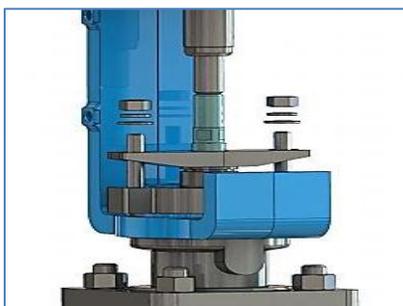


Figure 19 . Actuator separated from the Body (250, 290, 370)

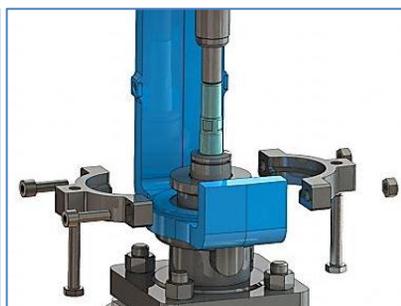
Disassembly Order
① → ② → ③ → ④



1. disassemble the Stem Clamp



2. disassemble the Packing Flange



3. disassemble the Yoke Clamp

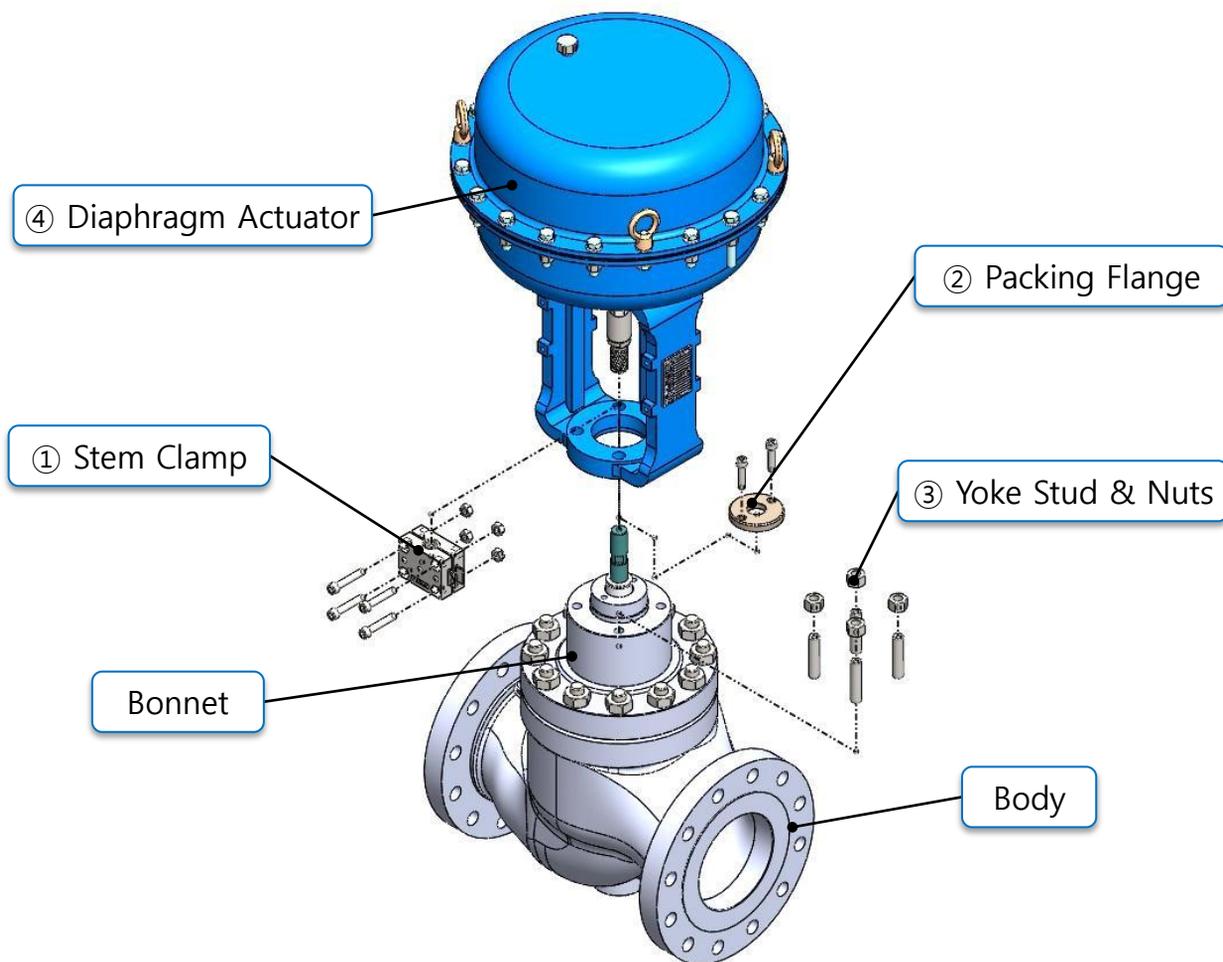
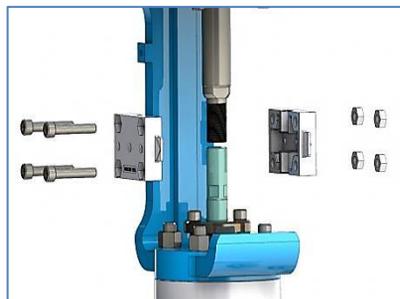
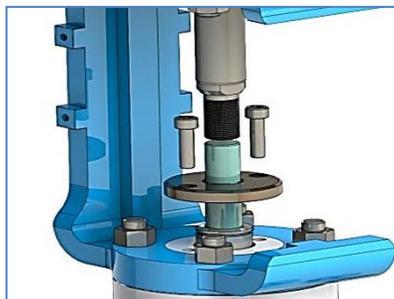


Figure 20 . Actuator separated from the Body (480, 550)

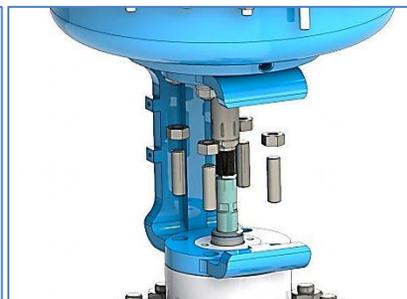
Disassembly Order
① → ② → ③ → ④



1. disassemble the Stem Clamp



2. disassemble the Packing Flange



3. disassemble the Yoke Stud & Nuts