

# **Diaphragm Motor Actuator (Air-O-Moter)**

**Model : VA  
User's Manual**

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**DIAPHRAGM MOTOR ACTUATOR**  
**MODEL: VA**  
**(AIR-O-MOTOR)**

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## ADJUSTMENT

### 1. General

As a rule, diaphragm motor actuators (Air-O-Motor) require no adjustments. However, adjustment should be made when combining to valve body, after overhaul, change in specification or parts replacement. For disassembly or reassembly of actuator and parts replacement, refer to paragraphs in later pages.

### 2. Spring Adjustment

- (1) When the actuator is combined with valve body, stem and spring adjustment will be required for spring range, stroke alignment of valve stem and actuator stem by adjusting spring adjuster.
- (2) First, connect air line to the actuator. Apply air pressure which corresponds to the maximum spring range of actuator (indication of pointer).
- (3) Check if the end of actuator stem positions to the proper place or not. If not, release air pressure and rotate the spring adjuster. Check once again. (Right hand turns of spring adjuster will tend to loosening of the spring)
- (4) When spring compression is determined, loosen travel indicator scale captive screws. Align "SHUT" on scale with pointer which matches to the movement of pointer indication.

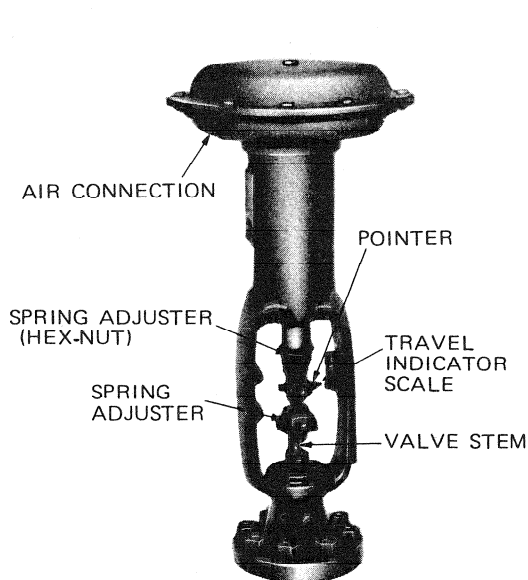


Figure 1. Model VA1R, VA2R diaphragm motor actuators, (Reverse acting type)

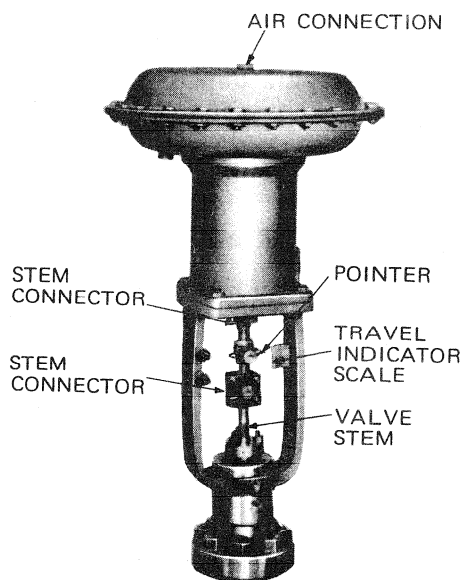


Figure 2. Model: VA4D and VA5D diaphragm motor actuators, (Direct acting type)

## **PARTS REPLACEMENT**

### **1. Diaphragm Replacement**

#### **1.1 Direct acting actuators**

- (1) In case of VA1D, VA2D and VA3D actuators, first remove air line at the top of diaphragm case, then loosen spring by turning spring adjuster to the right. Remove diaphragm case (upper), pull out split pin and remove slotted nut. Pointer lock nut may be held with a wrench during this operation but make sure that the stem does not turn. Remove stopper and retainer plate, then replace diaphragm. After reassembling, readjust spring compression.
- (2) In case of model VA4D and VA5D actuators, first remove air line at the top of diaphragm case, then loosen spring adjuster by turning spring adjuster clockwise. Remove diaphragm case (upper) and stopper. Replace diaphragm. After reassembling, readjust spring compression.

#### **1.2 Reverse acting actuators**

- (1) In case of model VA1R, VA2R and VA3R actuators, first remove air line at the top of diaphragm case. Then loosen spring by turning spring adjuster clockwise. Pull out split pin and remove slotted nut. Pointer lock nut may be held with a wrench during this operation but make sure that the stem does not turn. Remove stopper and diaphragm plate. Replace diaphragm. After reassembling, readjust spring compression.
- (2) In case of model VA4R and VA5R actuators, first remove air line at the bottom of diaphragm case. Loosen spring by turning spring adjuster clockwise. (If diaphragm is to be replaced with actuator remaining mounted on the valve body, loosening of spring adjuster is not necessary). Remove diaphragm case (upper). Loosen nut on diaphragm plate by holding diaphragm so that the actuator stem does not turn. Replace diaphragm. After reassembling, apply a sufficient amount of adhesive to nut of diaphragm plate to prevent air leakage, and readjust spring compression.

### **2. "O" Ring Replacement (Reverse acting actuator only)**

#### **2.1 Model AV1R, and VA3R actuators**

First, apply air pressure which is slightly higher than the lower limit of spring range to diaphragm, remove stem connector and drop air pressure to zero. Turn spring adjuster clockwise to loosen spring. Remove diaphragm case (upper) and remove pointer lock nut and pointer by turning pointer counterclockwise. Lift out diaphragm, diaphragm plate and actuator stem. Remove "O" ring with a marking needle or the like. Replace "O" ring.

#### **2.2 Model VA4R and VA5R actuators**

Without applying air pressure, loosen spring by turning spring adjuster clockwise. Then remove diaphragm case (upper) and provide a support at the bottom of actuator stem or stem connector so that it does not slip down. Remove nut of diaphragm plate and pull out diaphragm and plate. Pull out nut by turning "O" ring retaining nut. Remove "O" ring from inside of the nut and replace.

The slot to which "O" ring is to be fitted should be cleaned and given a light coat of silicon grease. After reassembling, readjust spring compression.

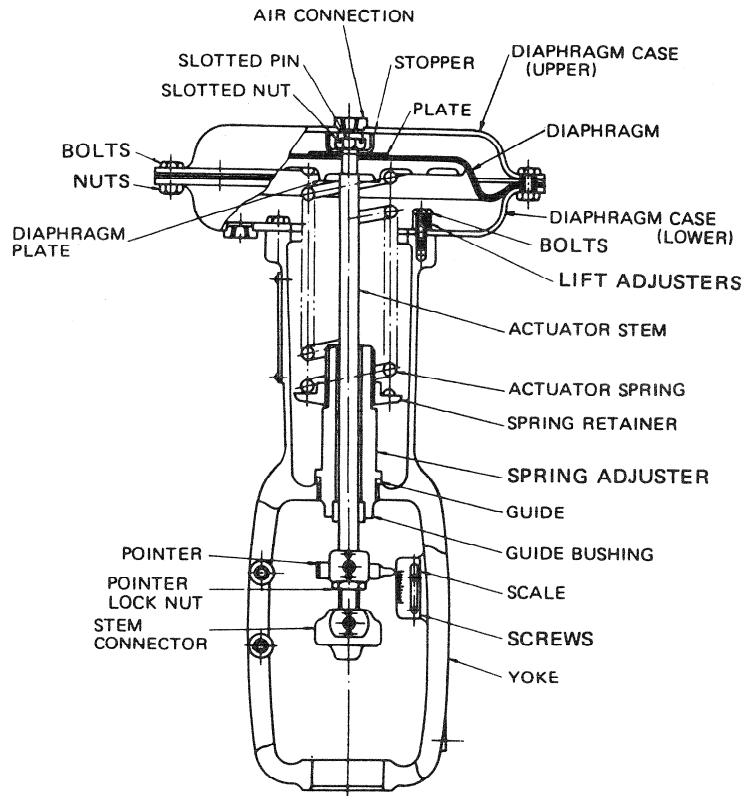


Figure 3. Model VA1D, VA2D and VA3D, direct acting actuators, cross section.

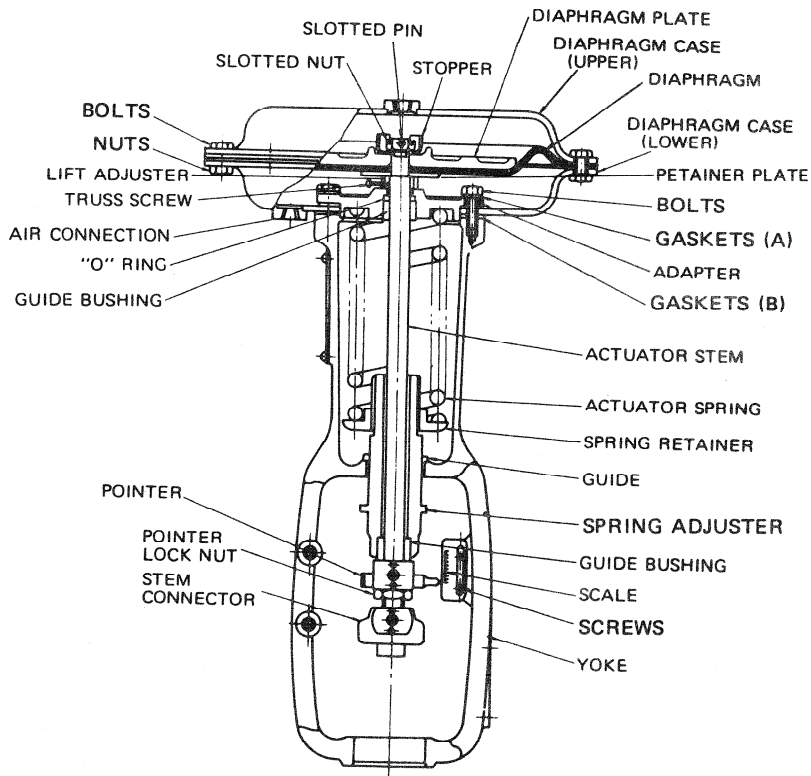


Figure 4. Model VA1R, VA2R and VA3R, reverse acting actuators, cross section.

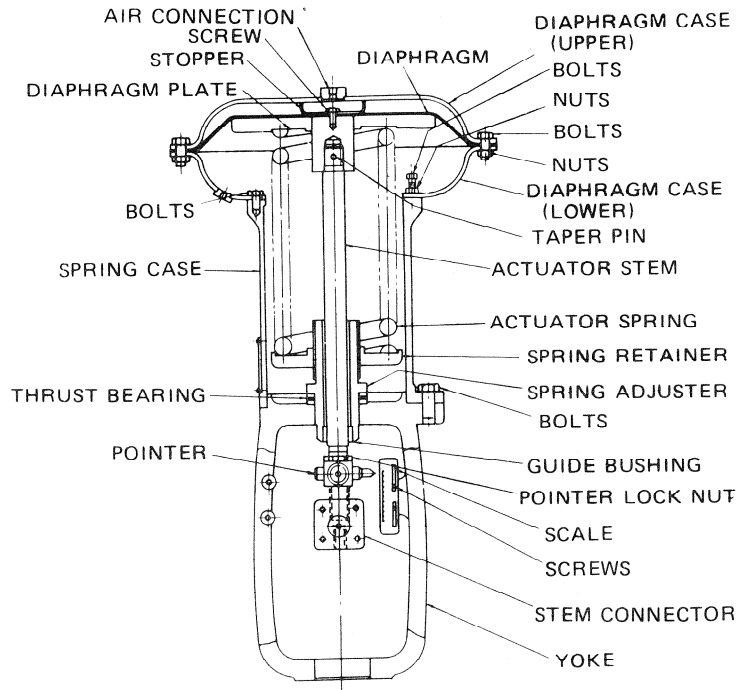


Figure 5. Model VA4D and VA5D direct acting actuators, cross section.

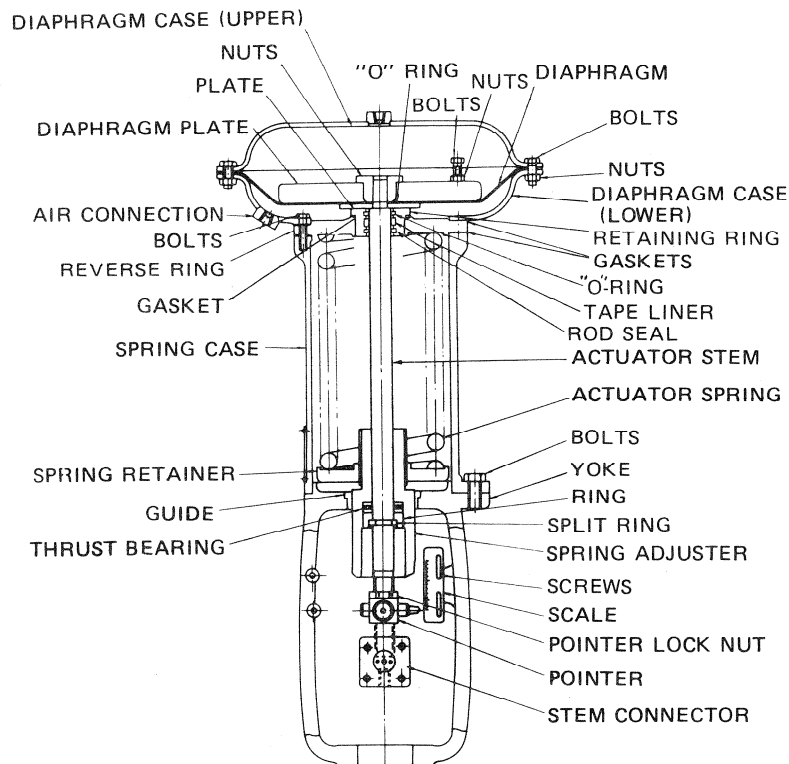


Figure 6. Model VA4R and VA5R reverse acting actuators, cross section.



## DISASSEMBLY AND REASSEMBLY

For disassembly and reassembly process, refer to Figs. 1 through 4. Disassembly and reassembly of Air-O-Motor must be performed in the upright position.

### 1. Model VA1, VA2 and VA3 Actuators

#### 1.1 Disassembly

##### 1.1.1 Direct acting actuators

- (1) Remove air line.
- (2) Loosen spring to zero spring compression by turning spring adjuster clockwise with wrench.
- (3) Remove stem connector. Loosen lock nut and screw out pointer.
- (4) Remove bolts and dismantle diaphragm case (upper).
- (5) Lift out actuator stem together with diaphragm.
- (6) After removal of actuator spring, remove bolts and dismantle diaphragm case (lower). Then, lift out spring adjuster and spring retainer.

##### 1.1.2 Reverse acting actuators

- (1) Remove air line.
- (2) Loosen spring to zero spring compression by turning spring adjuster clockwise with a wrench.
- (3) Remove stem connector. Loosen lock nut and screw out pointer.
- (4) Remove bolts and dismantle diaphragm case (upper).
- (5) Lift out actuator stem together with diaphragm case.
- (6) Remove adapter and diaphragm case (lower) by removing bolts and pull out spring. Screw out spring adjuster downward and lift out spring retainer.

#### 1.2 Reassembly

##### 1.2.1 Direct acting actuators

- (1) Install spring adjuster and screw in spring retainer, then install spring.
- (2) Mount diaphragm case (lower) and lift adjusters in place and fasten them with bolts. Lift adjusters are in the same matching position as bolt holes. In model VA2 actuator, a total of 4 lift adjusters should be arranged on every other hole and in model VA3 actuator, a total of 3 adjusters on every third hole. Long and short lift adjusters are sometimes piled up one upon another depending on the lift. If bolts are not the same in length, use the longer ones for fixing lift adjuster.
- (3) Install actuator stem (diaphragm already assembled).
- (4) Place diaphragm case (upper) and tighten it with bolts. Be sure that the bolts are secured evenly.

- (5) Screw pointer into actuator stem, and lock with pointer lock nut. Install stem connector.
- (6) Connect air line.
- (7) Adjust spring compression according to section "ADJUSTMENT".

#### 1.2.2 Reverse acting actuators

- (1) Install spring adjuster and screw in spring retainer, then install spring.
- (2) Place lower diaphragm case, adapter with "O" ring, guide bushing and gaskets (A and B), on designated position and tighten them with bolts.
- (3) Install lift adjuster to actuator stem. Tighten truss screw making sure that lift adjuster is correctly in contact with captive plate. Then, install actuator stem (diaphragm already assembled).
- (4) Place upper diaphragm case and tighten bolts. Be sure that the bolts are tightened evenly.
- (5) Screw pointer to actuator stem and lock it with pointer lock nut. Install stem connector.
- (6) Connect air line.
- (7) Adjust spring compression.

## 2. Model VA4 and VA5 Actuators

### 2.1 Disassembly

#### 2.1.1 Direct acting actuators

- (1) Disconnect air line.
- (2) Adjust spring to zero spring compression by turning spring adjuster clockwise.
- (3) Remove stem connector, loosen lock nut and remove pointer which is screwed in.
- (4) Lift out diaphragm case (upper) by removing bolts.
- (5) Lift out actuator stem together with diaphragm plate.
- (6) Remove spring, bolts and diaphragm case (lower), in that order. Then lift out spring adjuster, spring retainer and bearing.

#### 2.1.2 Reverse acting actuators

- (1) Disconnect air line.
- (2) Adjust spring to zero spring compression by turning spring adjuster clockwise.
- (3) Remove stem connector, loosen lock nut and remove pointer which is screwed in.
- (4) Lift out diaphragm case (upper) by removing bolts.
- (5) In order to avoid falling off or rotation of actuator stem during disassembling, hold the actuator stem. (Mounting stand is required for disassembly if actuator is not assembled on valve body.)
- (6) After holding the stem, remove nuts of diaphragm plate, O-ring, diaphragm plate, diaphragm and retainer plate in that order.
- (7) Remove 'O' ring retainer nuts and gaskets.
- (8) Remove diaphragm case (lower) and reverse ring by pulling out bolts.
- (9) Lift out spring and remove spring case.
- (10) Lift out actuator stem, spring retainer and spring adjuster together; Actuator stem and spring adjuster should be disassembled at last.

### 2.2 Reassembly

For assembly of the actuator, follow the above procedures but in reverse order. Except reverse acting actuator, must pay attention to the following.

- (1) "O" Ring and sliding section requires greasing.
- (2) Apply sealing agent (Bond No. 4) around gaskets of the reverse ring.
- (3) Firmly tighten nut of diaphragm plate.

## CHANGE OF ACTUATOR ACTION

### 1. General

In valves with model VA1, VA2 and VA3 actuators, action of actuators can be changed into reverse actuation. To change the actuation, obtain necessary parts and follow the procedures described in the following paragraphs.

Table 1. Parts to be used for action change from direct to reverse acting

Parts	Model No.	VA 1 D			VA 2 D			VA 3 D		
	Lift (mm)	Part No.	Q'ty	Lift (mm)	Part No.	Q'ty	Lift (mm)	Part No.	Q'ty	
Adapter	—	80224016-001	1	—	80224116-001	1	—	80224216-001	1	
Guide bushing	—	80224012-001	1	—	80224012-002	1	—	80224012-003	1	
“O” ring	—	80256902-003	1	—	80256902-009	1	—	80257641-001	1	
Hex-head bolts	—	82592042-004	6	—	82592042-004	8	—	82592042-005	12	
Gaskets (A)	—	80224017-001	2	—	80224117-001	2	—	80224217-001	2	
Gaskets (B)	—	80225046-001	6	—	80225046-001	8	—	80225046-001	12	
Truss screw	8 10 14.3	82592152-001	1	Except the items below	82592152-001	1	Except the items below	82592152-001	1	
	19.05 25	Not required	—	31.75 37.5	Not required	—	50	Not required	—	
List adjusters	14.3	80225043-001	—	14.3 16	80225043-005	1	14.3 16	80225043-003	2	
	19.05 25	Not required	—	19.05 20	80225043-004	1	19.05 20	80225043-006	1	
				23.8 25	80225043-001	1	23.8 25	80225043-002	2	
				31.75 37.5	Not required	—	31.75	80225043-003	1	
							37.5	80225043-002	1	
							44	80225043-007	1	
							50	Not required	—	

Table 2. Parts to be used for action change from reverse to direct acting

Model No. Parts	VA 1 R			VA 2 R			VA 3 R		
	Lift (mm)	Part No.	Q'ty	Lift (mm)	Part No.	Q'ty	Lift (mm)	Part No.	Q'ty
Hex-head bolts	—	82592042-001	6	14.3 16 20	82592042-001	8	14.3 16 20	82592042-002	12
				19.05 23.8 25	82592042-001 82592042-008	4 4	19.05 23.8 25	82592042-002 82592042-009	9 3
				31.75 37.5	82592042-001 82592042-004	4 4	31.75 37.5	82592042-002 82592042-008	9 3
							44 50	82592042-002 82592042-005	9 3
Lift adjusters				14.3 16 20	Not required		14.3 16 20	Not required	
				19.05	80225042-003	4	19.05	80225042-004	3
				23.8 25	80225042-002	4		80225042-003	3
				31.75 37.5	80225042-001	4	23.8 25	80225042-004	3
								80225042-002	3
							31.75	80225042-003	3
							37.5	80225042-002	3
							44 50	80225042-004	3

## 2. Procedures for Change (refer to Figures in “Parts Replacement” section)

- (1) Remove air line.
- (2) Turn spring adjuster clockwise to zero spring compression.
- (3) Remove stem connector, loosen lock nut. Remove pointer which is screwed in.
- (4) Remove bolts of diaphragm cases and dismantle diaphragm case (upper).
- (5) Lift out diaphragm together with actuator stem.

## 2.1 To change from direct acting to reverse acting

Reversely mount diaphragm and actuator stem. (See Fig. 1 at page 3)

- (1) After dismantling the spring, remove bolts and diaphragm case. Next, lift out spring adjuster and spring retainer.
- (2) Proceed with assembly for reverse acting actuator. Install spring adjuster and screw in spring retainer, then install spring.
- (3) Place diaphragm case (lower), guide bushing, adapter with “O” ring, and gaskets (A and B) on designated positions and tighten them with bolts as listed in Table 1.
- (4) Install lift adjuster to actuator stem then tighten truss screw making sure that lift adjuster is correctly in contact with captive plate. Then, insert actuator stem (diaphragm is being assembled).
- (5) Place upper diaphragm case and tighten bolts. Be sure that the bolts are tightened evenly.
- (6) Screw pointer onto actuator stem and lock it with pointer lock nut. Install stem connector.
- (7) Connect air line.
- (8) Adjust spring compression by referring to “Adjustment” section.

## 2.2 To change from reverse acting to direct acting

Reversely mount diaphragm and actuator stem. (See Fig. 1 at page 3)

- (1) Remove bolts, adapter and diaphragm case (lower). Turn spring adjuster clockwise and remove it. Lift out spring and spring retainer.
- (2) Proceed to assembly for direct action. Install spring adjuster and then screw in spring retainer. Install spring.
- (3) Place diaphragm case (lower) and lift adjuster in the prescribed position. Then, tighten them with bolts as listed on Table 2. However, lift adjuster must be in the same position as bolt holes. In model VA2 actuator, a total of 4 lift adjusters must be arranged on every other hole, and in model VA3 actuator a total of 3 adjusters on every third hole. Long and short lift adjusters are sometimes piled up one upon another depending on the lift. If bolts are not the same in length, use longer ones for fixing lift adjusters.
- (4) Insert actuator stem (diaphragm already assembled).
- (5) Place diaphragm case (upper) and tighten bolts. Be sure that bolts are secured evenly.
- (6) Screw pointer to actuator stem, and lock with pointer lock nut. Install stem connector.
- (7) Connect air line.
- (8) Adjust spring compression according to “Adjustment” section.

## INSTRUCTION FOR TOP MOUNTED HANDLE WHEEL

### 1. Operation Instruction

- (1) For manual operation, loosen a cross shape lock nut which restricts the handle movement then turn a handle to the direction of arrow. By turning a handle clockwise, stem will move to downward direction in both direct and reverse acting actuators. Handle has been stamped for "SHUT" in the clockwise direction.
- (2) For restoration to automatic operation,  
For direct acting type – Upward turning of handle shaft in full travel.  
For reverse acting type – Downward turning of handle shaft in full travel.  
After completion of turning, lock it in the position by tightening lock nut.

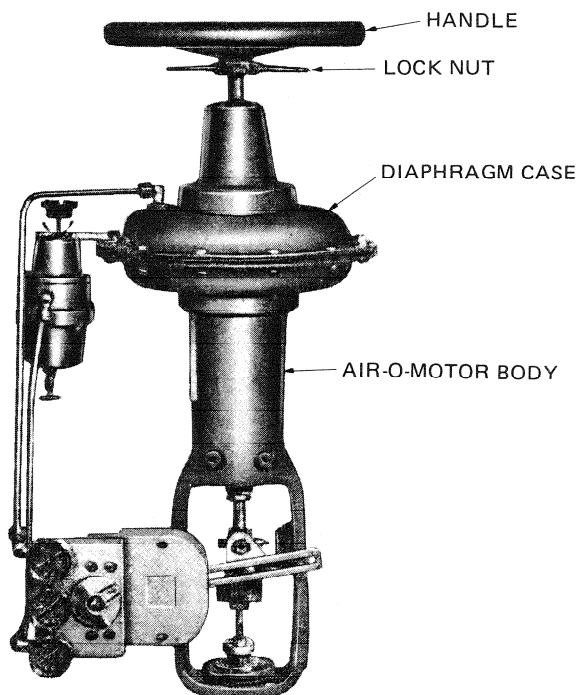


Figure 7. Air-O-Motor with Top Handle

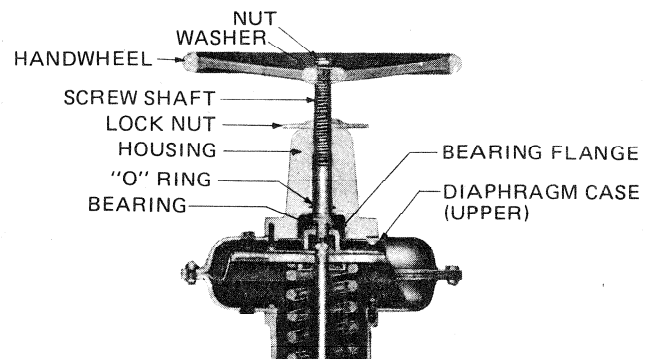


Figure 8. Cross section of Top Handle for direct acting type.

### 2. Disassembly and Assembly of Top Handle

#### 2.1 Direct Acting

- (1) Disconnect air piping. Then loosen the spring by means of turning spring adjuster clockwise.
- (2) Dismantle diaphragm case (upper).
- (3) After loosening lock ring or bolt, dismantle spring retainer.
- (4) After turning the handle fully to inward direction, dismantle handwheel and lock nut then with further inward turning, dismantle screw shaft from housing.
- (5) Remove "O" ring. Assembly must follow the reserve procedure of disassembly process.

Note: "O" ring and "O" ring groove must be cleaned then apply a light coat of silicone grease.

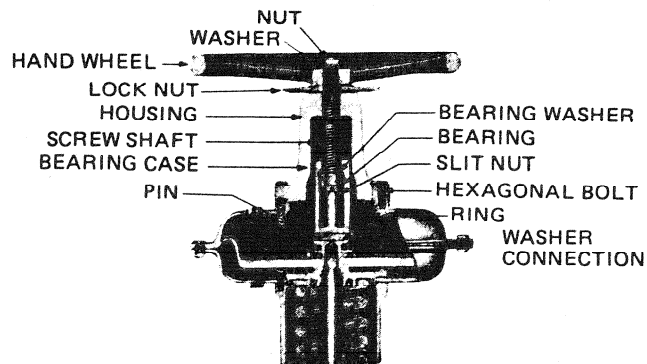


Figure 9. Corss section of Top Handle for reverse acting type

## 2.2 Reverse Acting

- (1) Disconnect air supply line, loosen spring by means of turning spring adjuster in right hand direction.
- (2) Dismantle hexagon nut, handwheel, and lock nut.
- (3) After loosening housing mounting bolt, dismantle housing by turning it clockwise.
- (4) After loosening diaphragm case bolt, dismantle diaphragm case (upper).
- (5) Draw out split pin and remove cylindrical pin.
- (6) Draw out split pin and remove slotted nut.
- (7) Remove bearing washer and bearing.

Assembly shall follow reverse procedure of disassembly process.



## INSTRUCTION FOR SIDE MOUNTED HANDWHEEL

By turning handle in the clockwise direction, stem will move to downward direction in both direct and reverse acting actuators. The handle has been stamped "SHUT" in the clockwise direction.

### 1. Mounting Procedure (Refer dwg.)

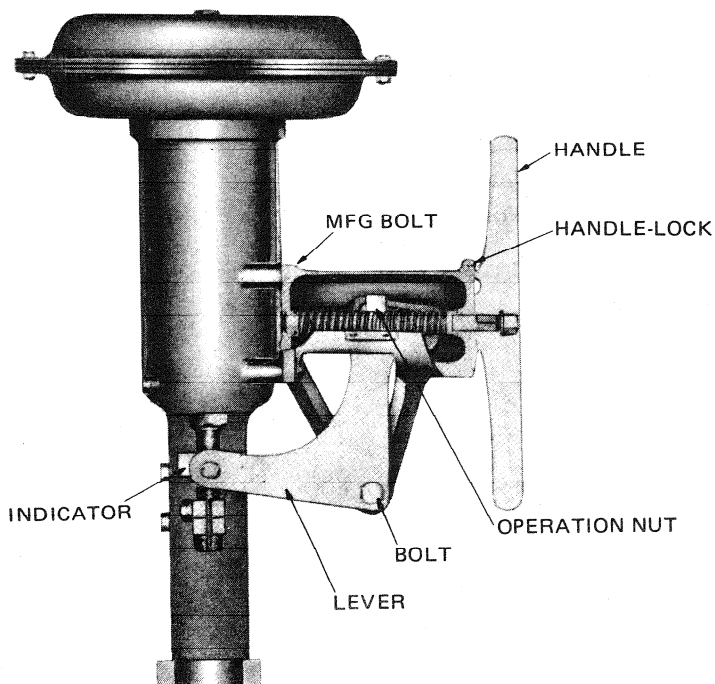
- (1) Prepare manual device kit (manual device and mounting kit). Mounting to actuator will not require any supplemental fabrication.
- (2) By turning handle, set indicator of operation nut to match with AUTO position.
- (3) By loosening bolt as shown in Fig. 10 (1 pc. for VA1-3, 3 pcs. for VA4 & 5), widen the lever space.
- (4) Mount manual operation device on mounting pad in the back of actuator with mounting bolts.
- (5) After setting one each hole on two lever tips, namely, one on indicator boss and others on operating nut, mount firmly with bolts.
- (6) When control valve is in operation, set indicator on operation nut to AUTO position and lock handle.

### 2. Operation Instruction

- (1) For manual operation, unlock handle (Fork shape part for VA1-3, chain for VA4 & 5) then turn handle in arrow pointed direction.
- (2) When return to automatic operation, turn handle until it reaches AUTO indication on operation nut then lock handle.

### 3. Disassembly and Assembly Of Side Handle

Prior to disassembly, ascertain that handle has been on automatic position.



- (1) Loosen lever connecting bolt, remove lever from pointer (or lever mounting nut).
- (2) Loosen mounting bolt which links actuator and manual operator body then remove the manual operator from actuator.
- (3) Remove lock nut of handle then dismantle handwheel.
- (4) Dismantle feed shaft from the manual operator body by lightly tapping feed shaft in the direction of handle side.
- (5) After removal of retaining nut, remove bearing.

For assembly, follow the reverse procedure of disassembly.

Figure 10. Side Handle

## LEVER TYPE ACTUATOR

### 1. Operating Importance

Prior to operation, necessary to ascertain proper installation of split pin of cylindrical pin (2 pcs.) which been installed at fulcrum of lever.

### 2. Disassembly and Assembly of Lever Section

- (1) Disconnect lever and operation section such as dumper.
- (2) Pull out split pin of cylindrical pin.
- (3) Remove cylindrical pin
- (4) Loosen yoke tightening nut then separate lever from actuator.
- (5) Loosen lock nut then remove lever fork from actuator stem. Assembly shall follow the reverse order of the disassembly procedure.

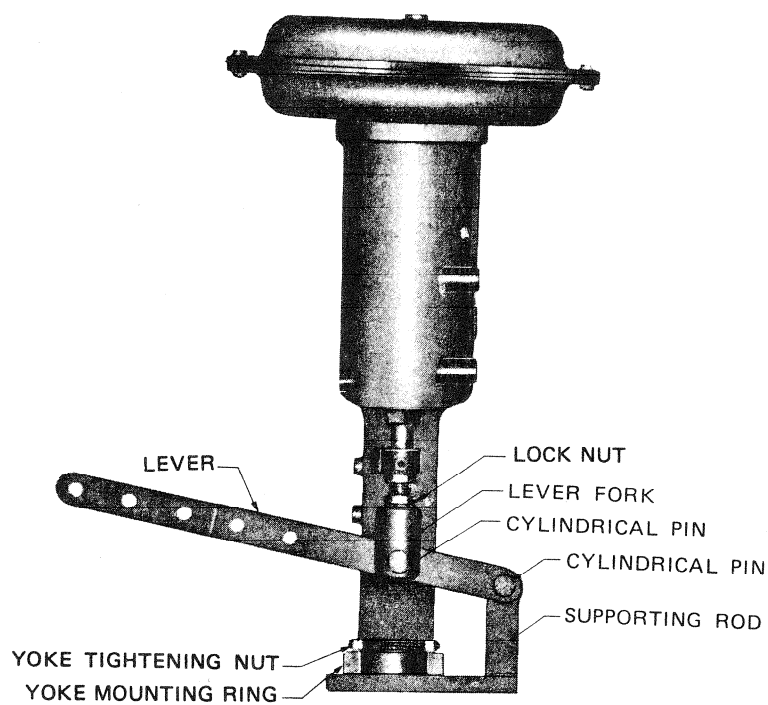


Figure 11. Lever Type Actuator

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