



# MODEL 25

## SPRING/DIAPHRAGM LINEAR PNEUMATIC ACTUATORS

### SECTION I

#### I. DESCRIPTION AND SCOPE

Model 25 actuators are multi-spring, single acting, spring opposed, linear actuators used with Cashco sliding stem (linear), globe-style control valves. The "R" denotes "reverse" acting arrangement; the "D" denotes "direct" acting arrangement. The numeric characters denote actuator size. This family of actuators' action IS reversible in the field.

"D" = Direct action; on increasing air loading pressure, the actuator stem extends. Fail-safe position is with the stem retracted.

"R" = Reverse action; on increasing air loading pressure, the actuator stem retracts. Fail-safe position is with the stem extended.

When coupled with a globe-style control valve with pushdown to close action, (other than Models 964 or 2266), a "D"- direct acting actuator will provide valve "fail open" action; "D" = ATC-FO. When coupled with an "R" - reverse acting actuator, will provide valve "fail closed" action; "R" = ATO-FC.

Reference the technical bulletin of the valve body model the actuator is unitized with for operating/installation/selection specifications; i.e. available bench settings, strokes, etc.

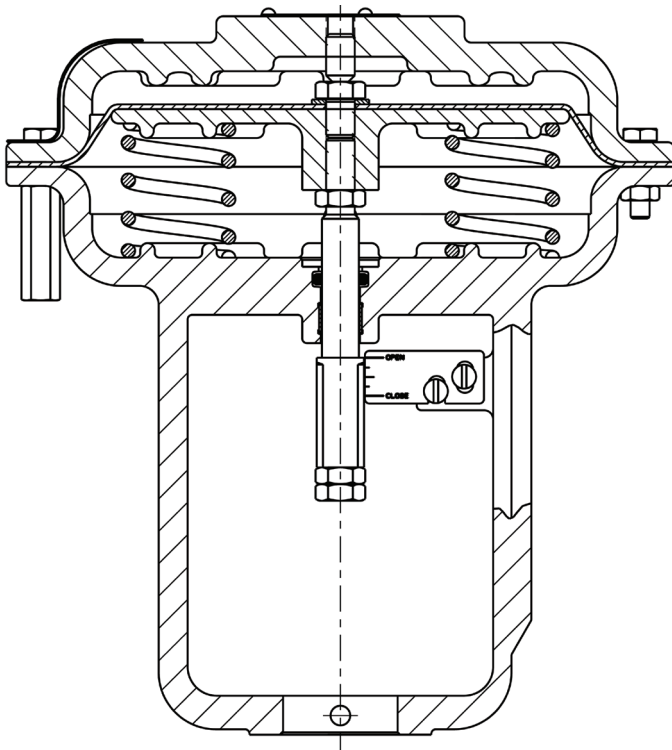


Figure 1  
Model 25 Actuator  
ATC-FO

#### ABBREVIATIONS

ATO-FC.....	Air-to-Open, Fail Closed
ATC-FO.....	Air-to-Close, Fail Open
CCW .....	Counter Clockwise
CW .....	Clockwise
D .....	Direct Acting
DIR .....	Direct Acting
IAS .....	Instrument Air Supply
IOM .....	Installation, Operation, and Maintenance Manual
LOAD .....	Positioner output air pressure
R .....	Reverse Acting
REV.....	Reverse Acting
SIG .....	Output signal air pressure from instrument
V.....	Vent

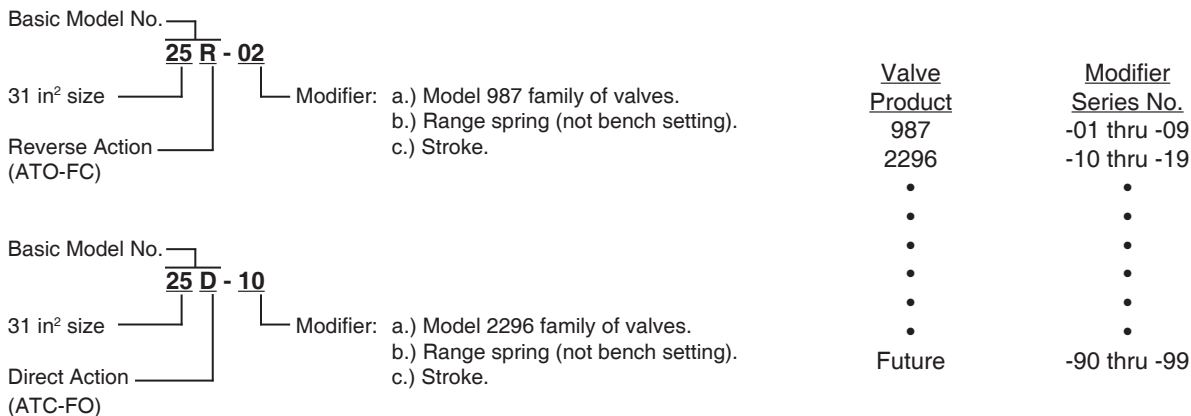


## SECTION II

### II. MODEL NUMBERING

The basic Model No. identifies actuator size and action. To identify a unique Model number, another series of 2-character modifiers is added to the basic number. This number will identify which basic valve body the actuator is used upon and which range spring is utilized.

Examples:



See Table 1 for complete listings of actuator Model No. vs Body Model.

**TABLE 1  
ACTUATOR MODEL NO. VS. VALVE BODY MODEL**

FULL ACTUATOR MODEL NO.		AVAILABLE BENCH SETTINGS		AIR SUPPLY PRESSURE		UNITIZED PRODUCTS *
BASIC ACTUATOR MODEL NO.	MODIFIER NO.	psig	(Barg)	psig	(Barg)	
25R	-01	3-15	(.21-1.03)	20	(1.4)	Model 987: 1/2" - 1" (DN15 - DN25); 2-step, 3-step, reduced port orifices.
	-02	8-15	(.55-1.03)	20	(1.4)	Model 987: 1/2" - 1" (DN15 - DN25); All orifice sizes.
	-03	6-30	(.41-2.07)	35	(2.4)	
	-04	16-30	(1.10-2.07)	35	(2.4)	
	-10	5-15	(.34-1.03)	20	(1.4)	Model 2296: 1/2" - 1-1/2" (DN15 - DN40); All orifice sizes. Model 2296: 1/2" - 1" (DN15 - DN25); full port orifice ONLY. 1-1/2" (DN40); All orifices.
	-11	11-30	(.76-2.07)	35	(2.4)	
25D	-01	3-15	(.21-1.03)	20	(1.4)	Model 987: All body sizes; all reduced port orifices; no full port.
	-02	3-10	(.21-.69)	20	(1.4)	Model 987: All body sizes ; all orifice sizes.
	-03	6-30	(.41-2.07)	35	(2.4)	
	-04	6-20	(.41-1.38)	35	(2.4)	
	-10	3-13	(.21-.90)	20	(1.4)	Model 2296: 1/2" - 1-1/2" (DN15 - DN40); All orifice sizes.
	-11	6-25	(.41-1.72)	35	(2.4)	Model 2296: 1/2" - 1" (DN15 - DN25); full port orifice ONLY. 1-1/2" (DN40); All orifices.

\* Metric body size in parenthesis

## SECTION III

### III. INSTALLATION

#### A. Orientation:

1. Recommended actuator major axis orientation with any model of Cashco control valve body is upwards in a horizontal pipe.
2. Actuator axis may be horizontal when valve is in a vertical pipe. However, air vents must be located to not collect rainwater.
3. Outdoors, all installations must be oriented any angle from horizontal-to-vertical. (Orient vent plug (14) to not collect rainwater that might freeze.)
4. Model 25 is not recommended for installation oriented downwards in either "D" or "R" action.
5. In no case is additional weight to be applied to the actuator when installed in an orientation other than vertical; i.e. the valve is unsafe as a "step" to support personnel.

#### B. Air Supply:

1. Recommendation is that a desiccant dried, instrument quality air supply be used. Such a supply is recommended for outdoors installations, and is required in areas of freezing weather conditions.
2. If air supply contains moisture and/or lubricating oil, the air should be filtered with a coalescing type of filter prior to use in stroking the actuator.
3. Failure to remove moisture will cause internal corrosion to the actuator casings (1, 2).
4. Connections for the air supply are 1/4" female NPT. A suitable pipe thread sealant is recommended to be used when installing the pipe or tube fitting. Exhibit care to prevent the sealant from getting inside the tube/pipe.

## SECTION IV

### IV. MAINTENANCE

#### A. General:

1. Hereafter, all maintenance, disassembly, etc., is assumed to be done in an indoor shop.
2. Actuators are a subassembly (AA) that is unitized with a body subassembly (BA). Reference should be made to the IOM for the correct body utilized.
3. Where the body is not being disassembled, special care MUST be exhibited to prevent valve stem rotation during any disassembly or reassemble for all types of valves. Following this procedure will ensure not damaging seating surfaces.
4. Remove all instrument tubing, airsets, limit switches, positioners, or other accessories mounted on the control valve unit (AA, BA).
5. All indicated Item Numbers that are with respect to IOM-987 or IOM-2296 will be in parenthesis and underscored; i.e. (20); the same is true for positioner parts. All Item Numbers that are with respect to this IOM-25 are not underscored; i.e. (19).

#### B. Diaphragm Removal/Replacement:

**NOTE:** It is recommended that O-ring (6) and bushing strip (38) be replaced when replacing diaphragm (4).

1. Remove all air pressure from the casings (1,2) prior to disassembly.

2. Securely fasten the body (1) into a vise or similar securing means. Orient with the casings (1, 2) upwards.
3. Using a pencil or similar device, scribe a mark on the position indicator plate (21) in alignment with the top edge of the actuator stem (19). Location should be at full "OPEN" or full "CLOSE".
4. The type of actuator stem (19)-to-valve stem (4) connection used on Model 987 and 2296 control valves is a non-swivel type.
5. Place a small matchmark on lower/yoke (2) support leg, align with top edge of the indicator plate (21). Remove screws (22) & indicator plate (21).
6. **The following steps apply to "direct-acting ATC-FO" arrangements.**
  - a. Loosen lower jam nut (17). Rotate to root of threaded body stem (4). Loosen and rotate upper jam nut (17) down to lower jam nut (17). Using two wrenches, re-jam upper jam nut (17) to lower jam nut (17).
  - b. Place an overhead sling to support actuator subassembly (AA) from above.

**c. Model 987:**

1. Hammer rap yoke nut (15) loose approximately one revolution.
2. Take slack out of overhead support.
3. Remove both packing stud nuts (21).
4. Place a wrench on upper jam nut (17) and rotate to disengage actuator stem (19) from valve body stem (4). Keep track of the number of revolutions required to separate the two stems (19, 4) in the box below:

No. of body stem (4) revolutions to cause stem (19, 4) separation _____
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Rotate in alternating sequence – disengage stems (19, 4) approximately 1/4" (6 mm), rotate yoke nut (15) the same 1/4" (6 mm) approximately, then lift actuator subassembly (AA) upwards the approximate 1/4" (6 mm) to remove slack in overhead support. Continue the alternating sequence until the yoke nut (15) is loose and the stems (19, 4) have separated.

5. Observe position/orientation of accessory plate (AP), if installed. Remove accessory plate (AP), if installed.
6. Lift actuator subassembly (AA) above and away from the body subassembly (BA), taking care to not drop the loose packing flange (23) or yoke nut (15).

**d. Model 2296 – 1/2" - 1-1/2" Sizes:**

1. Loosen both set screws (40) securing actuator subassembly (AA) to the body subassembly (BA) using a #5/32 Allen (hex) key wrench approximately 3 to 4 revolutions.
2. Take slack out of overhead support.
3. Place a wrench on upper jam nut (17) and rotate to disengage actuator stem (19) from valve body stem (4). Keep track of number of revolutions required to separate the two stems (19, 4) in the box below:

No. of body stem (4) revolutions to cause stem (19, 4) separation _____
---

Rotate in alternating sequence – disengage stems (19, 4) approximately 1/4" (6 mm), then lift actuator subassembly (AA) upwards the approximate 1/4" (6 mm) to remove slack in overhead support.

Continue the alternating sequence until the stems (19, 4) have separated.

4. Observe position/orientation of accessory plate (AP), if installed. Remove accessory plate (AP), if installed.
5. Lift actuator subassembly (AA) above and away from the body subassembly (BA).
- e. Place actuator subassembly (AA) into a vise with the diaphragm casings (1,2) on top side. Place permanent match marks between casings (1, 2).
- f. If supplied with manual handwheel operator, loosen handwheel locking lever (27) and rotate handwheel (25.1) CCW (viewed from above) until no longer able to rotate.



**WARNING**

**WARNING: SPRINGS UNDER COMPRESSION.**

- g. Loosen all flange bolting (10, 11, 12 & 13) two revolutions. In one revolution increments, loosen all opposing nuts (11, 13) until the short bolting (10, 11) disengages and can be removed. Pry apart the upper casing (1) from the diaphragm (4), as the two may be "stuck" together. Continue loosening extension nuts (13) in the alternating, one revolution pattern ensuring that casings (1, 2) are being "pushed apart", until the extension bolting (12, 13) is disengaged and removed.
- h. Remove the upper case (1).
- i. Pry apart the diaphragm (4) from the lower case/yoke (2), as they too may be "stuck" together.
- j. Remove uptravel stop cap screw (9) and thread seal washer (7).
- k. Discard thread seal washer (7).
- l. Remove diaphragm (4) and discard.
- m. Place permanent match marks between lower case/yoke (2) and the diaphragm plate (3) to ensure range spring (24) hub alignment at reassembly. Holding and pushing upwards the lower end of the actuator stem (19) with locking pliers, and keeping count of no. of revolutions to remove the diaphragm plate (3), rotate the diaphragm plate (3) CCW (viewed from above) until removed.

No. of revolutions to remove diaphragm plate _____
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- n. Hand-grasp actuator stem (19), remove lower jam nut (8), and stem (19) by lowering out the bottom of lower case/yoke (2).
  - o. Remove all four/eight range springs (24).
  - p. Remove embedded O-ring (6) from the top-side of lower case/yoke (2) using a pick-end tool.
  - q. Remove the embedded guide bushing tape (38) from the underneath-side of lower case yoke (2) using a pick-end tool.
  - r. Remove lower case/yoke (2) from vise and solvent clean all reusable parts (1, 2, 3, 8, 9, 13, 19, 24). Inspect parts for wear and/or damage. Replace all damaged parts with new parts. Properly dispose of spent solvent in accordance with Owner's requirements.
  - s. Place lower case/yoke (2) into vise with the lower case on top side.
  - t. Lubricate the O-ring (6) and its groove in the lower case/yoke (2) with lithium grease. Install O-ring (6) into its groove.
  - u. Form the guide bushing tape (38) into a cylinder and embed it into its groove.
  - v. Place a light coat of lithium grease onto the portion of the actuator stem (19) that touches the O-ring (6) and embedded guide bushing (38).
  - w. Insert actuator stem (19) through bottom of lower case/yoke (2), carefully pushing through guide bushing (38) and O-ring (6). Rotate a single jam nut (8) onto the threaded upper end of stem (19) all the way down to the root of the threaded portion of the stem (19). Allow the stem (19) to slide downwards until supported by jam nut (8).
  - x. Place all four/eight range springs (24) in a symmetric pattern over their respective hub located in the lower case/yoke (2). **NOTE:** *Four spring (24) configurations would use every other hub; eight springs (24) every hub.*
  - y. Push actuator stem (19) upwards from lower end. Rotate pressure plate (3) CW (viewed from above) onto the stem's (19) upper end three full revolutions. Align the hubs of the pressure plate (3) with the open upper end of the range springs (24). Allow the pressure plate (3) to be lowered down and onto each range spring (24). Using fingers, ensure that each spring (24) is properly aligned with its respective hub on the pressure plate (3).
  - z. Refer to item m. of this article, previous, for the number of revolutions to engage the actuator stem (19) into the diaphragm plate (3), subtracting the three revolutions of item y. this article, previous. Rotate the actuator stem (19) to the total number of revolutions required. Ensure square bottom end of actuator stem (19) is parallel with the final position of the travel indicator plate (21). Matchmarks of item m. of this article should align.
- aa. Place new diaphragm (4) onto diaphragm plate (3), aligning holes of casing (2) and diaphragm (4).
  - bb. Apply a silicone rubber adhesive/sealant, Dow-Corning "Silastic" #732 RTV or equal, at the diaphragm plate (3) center tapped hole. Apply same sealant to a new thread seal washer (7). Place washer (7) over center hole of diaphragm (4) and diaphragm plate (3).
  - cc. Place thread sealant (Loctite 242 or equal) on threads of uptravel stop screw (9). Tighten stop screw (9) into the diaphragm plate (3).
  - dd. Lift edge of diaphragm (4) and wrench tighten lower lock nut (8) up to hub of diaphragm plate (3) while pushing upwards on stem (19).
  - ee. Place upper case (1) onto top side of diaphragm (4), aligning matchmarks to properly orient the casing (1) tubing connections.
  - ff. Insert one extension bolt (12) into a bolt hole next to a tubing connection boss on the upper case (1); install its extension nut (13) fingertight. Locate the second extension bolt (12) directly opposite the first extension bolt (12); install its extension nut (13).
  - gg. Place a short bolt (10) into a bolt hole next to each extension bolt (12). Wrench-tighten the extension nuts (13) in a one revolution alternating pattern, compressing the springs (24) and pulling the casing (1,2) flanges together. Continue tightening pattern until the bottom of the protruding short bolt (10) provides enough exposed threads to install its nut (11).
  - hh. Insert short bolts (10) into each bolt hole, including caution tag (39) under one of the short bolt's (10) head. Install each nut (11) Hand-tighten.
  - ii. Wrench tighten each bolting set (10, 11, 12, 13) in a rotating, alternating cross-pattern in one revolution increments. Ensure that upper case (1) is being drawn down equally around the casing (1,2) flanges. Continue pattern until the upper case (1) flange is fully drawn

down. Torque flange bolting (10, 11, 12, 13) to 10-12 ft-lbs. (13-16 N-m) using same pattern.

- jj. Reattach travel indicator plate (21) with indicator plate screws (22). Align "OPEN" line on travel indicator plate (21) with the top edge of the upper edge of the square portion of the actuator stem (19) that is painted red."

**NOTE:** The matchmarks of article B.5, previous, between the travel indicator plate (21) and the support leg of the lower case/yoke (2), should closely align.

**7. The following steps apply to "reverse-acting ATO-FC" arrangements.**

- a. If supplied with a manual handwheel operator, fully loosen handwheel locking lever (27) and rotate handwheel (25.1) CCW( viewed from above) until the valve is fully "OPEN". Rotate locking lever (27) downwards by rotating CW (viewed from above) until stopped. If no manual handwheel operator is present, connect a temporary air supply with at least 4 ft (1.3 m) hose length (to provide "slack") to the lower case/yoke (2) 1/4" FNPT connection. Pressurize to max pressure indicated on unit nameplate (18) or caution tag (39).

- b. Loosen lower jam nut (17). Rotate to root of threaded body stem (4). Loosen and rotate upper jam nut (17) down to lower jam nut (17). Using two wrenches, re-jam upper jam nut (17) to lower jam nut (17).

- c. Place an overhead sling to support actuator subassembly (AA) from above.

**d. Model 987:**

1. Hammer rap yoke nut (15) loose approximately one revolution.
2. Take slack out of overhead support.
3. Remove both packing stud nuts (21).
4. Place a wrench on upper jam nut (17) and rotate to disengage actuator stem (19) from valve body stem (4). Keep track of the number of revolutions required to separate the two stems (19, 4) in the box below:

No. of body stem (4) revolutions to cause stem (19, 4) separation \_\_\_\_\_

Rotate in alternating sequence – disengage stems (19, 4) approximately 1/4" (6 mm), rotate yoke nut (15) the same 1/4" (6 mm) approximately, then lift actuator subassembly (AA) upwards the approx-

mate 1/4" (6 mm) to remove slack in overhead support. Continue the alternating sequence until the yoke nut (15) is removed and the stems (19, 4) have separated.

5. If a temporary air supply was provided, lift actuator subassembly (AA) upwards from body subassembly (BA) another 2-3 inches (50-75 mm). Depressurize temporary air supply and remove supply hose.
6. Lift actuator subassembly (AA) above and away from the body subassembly (BA), taking care to not drop the loose packing flange (23) or yoke nut (15).

**e. Model 2296 – 1/2" - 1-1/2" Sizes:**

1. Loosen both set screws (40) securing actuator subassembly (AA) to the body subassembly (BA) using a #5/32 Allen (hex) key wrench approximately 3 to 4 revolutions.
2. Take slack out of overhead support.
3. Place a wrench on upper jam nut (17) and rotate to disengage actuator stem (19) from valve body stem (4). Keep track of number of revolutions required to separate the two stems (19, 4) in the box below:

No. of body stem (4) revolutions to cause stem (19, 4) separation \_\_\_\_\_

Rotate in alternating sequence – disengage stems (19, 4) approximately 1/4" (6 mm), then lift actuator subassembly (AA) upwards the approximate 1/4" (6 mm) to remove slack in overhead support. Continue the alternating sequence until the stems (19, 4) have separated.

4. If a temporary air supply was provided, lift actuator subassembly (AA) upwards from body subassembly (BA) another 2-3 inches (50-75 mm). Depressurize temporary air supply and remove supply hose.
5. If equipped with a manual handwheel operator, rotate CW (viewed from above) until the resistance of the mechanism slackens fully.
6. Lift actuator subassembly (AA) above and away from the body subassembly (BA) taking care to not drop the loose packing flange (23) or yoke nut (15).

- f. Place actuator subassembly (AA) into a vise with the diaphragm casings (1, 2) on top

side. Place permanent match marks between casing (1, 2).



**WARNING**

**WARNING: SPRINGS UNDER COMPRESSION.**

- g. Loosen all flange bolting (10, 11, 12 & 13) two revolutions. In one revolution increments, loosen all opposing nuts (11, 13) until the short bolting (10, 11) disengages and can be removed. Pry apart the upper casing (1) from the diaphragm (4), as the two may be “stuck” together. Continue loosening extension nuts (13) in the alternating, one revolution pattern, ensuring that casings (1, 2) are being “pushed apart”, until the extension bolting (12, 13) is disengaged and removed.
- h. Remove the upper case (1).
- i. Remove all four/eight range springs (24).
- j. Pry apart the diaphragm (4) from the lower case/yoke (2), as they too may be “stuck” together. Place a permanent matchmark between the lower case/yoke (2) flange and the pressure plate (3) to ensure range spring (24) hub alignment at reassembly.
- k. Keeping count of the number of revolutions to remove the diaphragm plate (3), place a wrench on the “square” of the bottom of the actuator stem (19) and a pipe wrench on the hub of the pressure plate (3). Break loose the pressure plate (3) from jam nuts (8) by rotating the diaphragm plate (3) CCW (viewed from above). Record number of revolutions to disengage the diaphragm plate (3) from the actuator stem (19) in box below.

No. of revolutions to remove diaphragm plate (3) _____
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**NOTE:** Do not disturb uptravel stop cap screw (9).

- l. Remove diaphragm (4) and thread seal washer (7) and discard.
- m. Loosen upper jam nut (8) while securing lower jam nut (8) by wrench. Fully remove upper jam nut (8).
- n. Holding lower end of actuator stem (19) with locking pliers, and keeping count of number of revolutions to disengage from stem (19), remove lower jam nut (8).

No. of revolutions to remove lower jam nut (8) _____
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- o. Remove locking pliers and remove actuator stem (19) by lowering out the bottom of lower case/yoke (2).

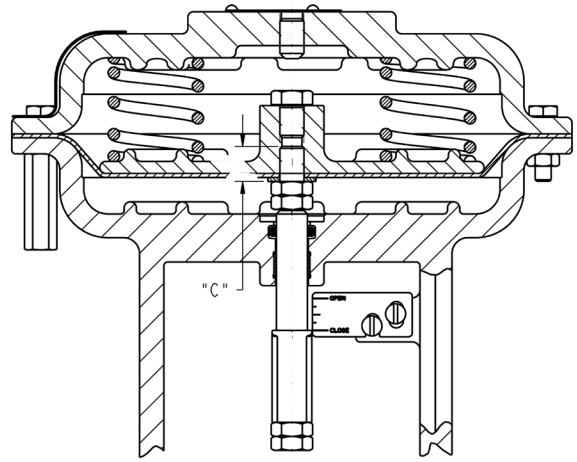
- p. Remove embedded O-ring (6) from the top-side of lower case/yoke (2) using a pick-end tool.
- q. Remove the embedded guide bushing tape (38) from the underneath-side of lower case/yoke (3) using a pick-end tool.
- r. Solvent clean all reusable parts (1, 2, 3, 8, 9, 13, 19, 24). Inspect parts for wear and/or damage. Replace all damaged parts with new parts. Properly dispose of spent solvent in accordance with Owner’s requirements.
- s. Place lower case/yoke (2) into vise with the lower case on top side.
- t. Lubricate the O-ring (6) and its groove in the lower case/yoke (2) with lithium grease. Install O-ring (6) into its groove.
- u. Form the guide bushing tape (38) into a cylinder and embed it into its groove.
- v. Place a light coat of lithium grease onto the portion of the actuator stem (19) that touches the O-ring (6) and embedded guide bushing (38).
- w. Insert actuator stem (19) through bottom of lower case/yoke (2), carefully pushing through guide bushing (38) and O-ring (6). Rotate a single jam nut (8) onto the threaded upper end of stem (19) the number of revolutions as recorded in this article, item n., previous. Allow the stem (19) to slide downwards until supported by jam nut (8).
- x. Rotate by hand upper jam nut (8) onto stem (19) and downwards to lower jam nut (8). Measure for dimension “C” as indicated in Fig. 2 and place into box provided below:

Actual Dimension “C” _____ in (_____ mm)	Design Dimension “C” _____ in (_____ mm)
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**NOTE:** Above actual and design dimensions should be within  $\pm 1/16"$  ( $\pm 1.6$  mm). If valves vary more than this, engagement of diaphragm plate (3) -to-actuator stem (19) should be adjusted to bring within given limit.

- y. Using two wrenches tighten the upper jam nut (8) to the lower jam nut (8).
- z. Apply a silicone rubber adhesive/sealant, Dow-Corning “Silastic” #732 RTV or equal, at the juncture of the diaphragm plate (3) and the actuator stem (19). Apply same sealant to a new thread seal washer (7). Place washer (7) over actuator stem (19) and downwards resting against the upper jam nut (8).

- aa. Aligning with lower case/yoke (2) bolt holes, place new diaphragm (4) over actuator stem (19) and downwards resting against the thread seal washer (7). Temporarily put four short flange bolts (10) through lower case yoke (2) and diaphragm (4) at 90° locations; rotate nuts (11) over bolt (10) ends and hand-tighten.
- bb. Determine the proper location of the range spring (24) hubs located on the diaphragm plate (3). Rotate the diaphragm plate (3) onto actuator stem (19) approximately 3 revolutions, ending with a location that is correct for range spring (24) hubs on diaphragm plate (3). Matchmarks of item j. of this article should align.
- cc. Refer to item k. of this article, previous, for the number of revolutions to engage the actuator stem (19) into the diaphragm plate (3), subtracting the three revolutions of item cc, this article, previous. Rotate the actuator stem (19) to the total number of revolutions required. Ensure square bottom end of actuator stem (19) is parallel with the final position of the travel indicator plate (21).
- dd. Place all four/eight range springs (24) in a symmetric pattern over their respective hub located in the lower case/yoke (2). **NOTE:** *Four spring (24) configurations would use every other hub; eight springs (24) every hub.*
- ee. Remove temporary flange bolting (10, 11) of item aa. of this article, previous.
- ff. Place upper case (1) onto top side of diaphragm (4), aligning matchmarks to properly orient the casing (1) tubing connections. Ensure springs (24) get properly aligned over their respective hubs in the upper case (1) by viewing with a mirror tool.
- gg. Insert one extension bolt (12) into a bolt hole next to a tubing connection boss on the upper case (1); Install its extension nut (13) fingertight. Locate the second extension bolt (12) directly opposite the first extension bolt (12); install its extension nut (13) finger tight.
- hh. Place a short bolt (10) into a bolt hole next to each extension bolt (12). Wrench-tighten the extension nuts (13) in a one revolution alternating pattern, compressing the springs (24) and pulling the casings (1, 2) flanges together. Continue tightening pattern until the bottom of the protruding short bolt (10) provides enough exposed threads to install its nut (11).



"C" = .5468" ( 13.89 mm) for 3-15, 5-15, 6-30 & 11-30 Bench ranges  
 = .3906" ( 9.92 mm) for 8-15 & 16-30 Bench ranges

**Figure 2: Model 25R, ATO-FC  
 Stroke Adjustment**

- ii. Insert short bolts (10) into each bolt hole, including caution tag (39) under one of the short bolt's (10) head. Install each nut (11). Hand-tighten.
  - jj. Wrench-tighten each bolting set (10, 11, 12, 13) in a rotating, alternating cross-pattern in one revolution increments. Ensure that upper case (1) is being drawn down equally around the casing (1, 2) flanges. Continue tightening pattern until the upper case (1) flange is fully drawn down. Torque flange bolting (10, 11, 12, 13) to 10-12 ft-lbs. (13-16 N-m) using same pattern.
  - kk. Reattach travel indicator plate (21) with indicator plate screws (22). Align the match marks of article B.5, previous, between the travel indicator plate (21) and the support leg of the lower case/yoke (2).
8. Place actuator subassembly (AA) into an overhead sling support. Loosen vise holding actuator subassembly (AA), and raise upwards.
  9. Place body subassembly (BA) into vise with valve stem (4) directed upwards. Push valve stem (4) fully down as far as able.
  10. Lower actuator assembly (AA) downwards over valve stem (4) until stems (4, 19) are about 3/4" (20 mm) apart.
    - a. **Model 987.** Place yoke nut (15) properly oriented between the two stems (4, 19), then downwards) to rest upon the yoke (2) or valve bonnet (2).

- b. All Models. Place packing flange (23) properly oriented between the two stems (4, 19), then over the protruding packing studs (20), then downwards to rest upon the yoke nut (15) or packing follower (11).
  - c. All Models. Place properly oriented accessory plate (AP) (used with positioners or limit switches) between the two stems (4, 19), then downwards to rest upon the yoke (2) or valve bonnet (2).
  - d. All Models. Install upper and lower jam nuts (17) to root of valve stem (4).
11. Carefully lower actuator assembly (AA) to the point where the two stems (4, 19) are about 1/4" (6 mm) apart.
  12. Using fingers, lift valve stem (4) upwards and engage with actuator stem (19) by rotating valve stem (4) CCW (viewed from above). Keep count of number of revolutions engaged in box below in article 14. Engage threads of stems (4, 19) approximately 3/8" (10 mm) or as far as able. **DO NOT CROSS THREAD.**
  13. Lower actuator assembly (AA) until it rests on its ledge of the valve bonnet (2).
  14. Continue engaging stems (4, 19) until the total number of revolutions is reached as recorded in the following:

Actuator Action.....	ATC-FO Direct....	ATO-FC Reverse
Model 987 see .....	IV.B.6.c.4 .....	IV.B.7.d.4
1/2" - 1-1/2" 2296.....	IV.B.6.d.3 .....	IV.B.7.e.3
Total No. or Revs. to Disengage	_____	_____
No. of Revs. Engaged per 12 above	_____	_____
No. of Revs. Engages per 14 above	_____	_____

15. **Model 987**. Rotate yoke nut (15) CW (viewed from above) onto valve bonnet (2) and finger-tighten until the yoke nut (15) reaches the surface of the lower case yoke (2). Reverse approximately 1/4 revolution.
  - a. Properly align lower case yoke (2) with respect to body subassembly (BA).
  - b. Tighten yoke nut (15) to lower case/yoke(2).
  - c. Using a blunt-end tool, hammer rap yoke nut (15) tight.
  - d. Position packing flange (23) over its respective studs (20).

- e. Install both packing stud nuts (21). Draw down evenly until they make metal to metal contact with follower and then rotate each stud nut (21) another 1/4 revolution. If leakage occurs during testing or under operating conditions, rotate each stud nut (21) in 1/4 turn adjustments until leakage stops.
16. **Model 2296 – 1/2" - 1-1/2" Size**. Properly align the actuator assembly (AA) with respect to the valve body subassembly (BA). Using a #5/32 Allen (hex) key wrench, finger-tighten set screws (40) to the same tightness on each side. Key wrench-tighten set screws (40) in alternating 1/8 revolution increments until fully tightened.
  17. Calibrate stroke of valve unit (AA, BA) using procedure included within the valve body's applicable IOM.

**C. Reversing Action from Reverse-to-Direct; i.e. From ATO-FC to ATC-FO.**

**NOTE 1:** Care must be taken to ensure the valve plug (4) head does not rotate while touching the valve seat ring (3) (no separate seat ring (3) for Model 987 with integral body seat (1)).

**NOTE 2:** If actuator subassembly (AA) is equipped with a manual handwheel operator, it is not possible to field reverse action without additional handwheel operator parts. See Fig. 3 for listing of required item numbers to modify from reverse acting to direct acting.

1. Place valve unit (AA, BA) into a vise with actuator assembly (AA) on topside.
2. Remove all air pressure from casings (1, 2) prior to disassembly.
3. Remove all airsets, limit switches, positioners, or other accessories mounted on the control valve unit (AA, BA).
4. **Follow procedures from IV.B.7. to IV.B.7.k then continue on as follows.**
  - l. Remove diaphragm (4) and thread sealwasher (7). Remove sealant as much as possible from these parts to be reused.
  - m. Loosen both jam nuts (8) from each other. Remove only the upper jam nut (8). Rotate the lower jam nut (8) down to the root of the threaded actuator stem (19).
  - n. Remove uptravel stop cap screw (9) from diaphragm plate (3).

- o. Place all four/eight range springs (24) in a symmetric pattern over a hub of the lower case/yoke (2). **NOTE:** *Four spring (24) configurations would use every other hub; eight springs (24) every hub.*
  - p. Solvent clean the diaphragm plate (3). Properly dispose of solvent in accordance with owner's requirements.
  - q. Place Loctite #242, or equal, onto the exposed threads of the actuator stem (19).
  - r. Push actuator stem (19) upwards from lower end. Flip top/bottom orientation of pressure plate (3) from original position and rotate diaphragm plate (3) CW (viewed from above) onto the stem's (19) upper end three full revolutions. Align the hubs of the diaphragm plate (3) with the open upper end of the range springs (24). Allow the diaphragm plate (3) to be lowered down and onto each range spring (24). Using fingers, ensure that each spring (24) is properly aligned with its respective hub on the diaphragm plate (3).
  - s. Rotate the actuator stem (19) into the diaphragm plate (3).
  - t. Place diaphragm (4) onto diaphragm plate (3) in same orientation to diaphragm plate (3) as removed, aligning over bolt holes of lower case/yoke (2). Temporarily put four short flange bolts (10) through lower case/yoke (2) flange and diaphragm (4) at four locations 90° apart; rotate nuts (11) over bolt (10) ends and fingertighten.
  - u. Apply a silicone rubber adhesive/sealant, Dow-Corning "Silastic" #732 RTV or equal, at the diaphragm plate's (3) center tapped hole. Apply some sealant to the thread seal washer (7). Place threadseal washer (7) over center hole of diaphragm (4) and diaphragm plate (3).
  - v. Place same thread sealant as above on threads of uptravel stop screw (9). Engage uptravel stop screw (9) into the tapped center hole of the diaphragm plate (3) until it is tight.
  - w. Follow procedures from IV.B.6.dd. through to IV.B.6.jj., disregarding last "NOTE". This completes reassembly of actuator subassembly (AA).
  - x. Follow procedures from IV.B.8. through to IV.B.17. This mounts actuator subassembly (AA) to valve body subassembly (BA).
  - y. Remove vent plug (14) from upper case (1). Place pipe thread sealant on vent plug (14) and reinstall in lower case/yoke (2) directly below position previously installed.
  - z. Reference positioner IOM's for proper mounting orientation action reversal; i.e. positioner mounts on opposite side of lower case/yoke (2).
- D. Reversing Action from Direct-to-Reverse; i.e. From ATC-FO to ATO-FC.**
- NOTE 1:** Care must be taken to ensure that the valve plug (4) head does not rotate while touching the valve seat ring (3) (no separate seat ring (3) for Model 987 with integral body seat (1)).
- NOTE 2:** If actuator subassembly (AA) is equipped with a manual handwheel operator, it is not possible to field reverse action without additional handwheel operator parts. See Fig. 4 for listing of required item numbers to modify from reverse acting to direct acting.
1. Place valve unit (AA, BA) into a vise with actuator assembly (AA) on topside.
  2. Remove all air pressure from casings (1, 2) prior to disassembly.
  3. Remove all airsets, limit switches, positioners, or other accessories mounted on the control valve unit (AA, BA).
- 4. Follow procedures from IV.B.6. to IV.B.6.i then continue on below.**
- j. Remove uptravel stop screw (9).
  - k. Remove threadseal washer (7) and diaphragm (4). Remove sealant as much as possible from these parts to be reused.
  - l. Using locking pliers, push the actuator/valve stem (19, 4) upwards as far as possible and hold. Lift edge of diaphragm (4) up and loosen lower jam nut (8) from diaphragm plate (3) lower center hub by rotating CW (viewed from above).
  - m. Again, hold the actuator/valve stem (19, 4) upwards. Grasp outer edge of diaphragm plate (3) and rotate CCW (viewed from above) until fully removed. Carefully allow stem (19, 4) to be lowered until valve plug (4) rests at seat (3).
  - n. Remove all 4/8 range springs (24).
  - o. Rotate relocated upper jam nut (8) onto actuator stem (19) upper end, all the

way down to the lower jam nut (8).

- p. Using a measuring tool, relocate the upper jam nut (8) until the dimension "C" of Fig. 2 is obtained. With a wrench holding upper jam nut (8), rotate lower jam nut (8) up to upper jam nut (8) and jam-tighten both nuts (8) together.
- q. Apply a silicone rubber adhesive/sealant, Dow-Corning "Silastic" #732 RTV or equal, to the top edge of the upper jam nut (8).
- r. Apply same adhesive sealant as above to the threadseal washer (7) and place the washer (7) over the actuator stem (19) and down to the upper jam nut (8).
- s. Aligning bolt holes, place diaphragm (4) over the actuator stem (19) and allow center to go down to threadseal washer (7). Finger-press the diaphragm (4) to the threadseal washer (7).
- t. Temporarily put four short flange bolts (10) through lower case/yoke (2) flange and diaphragm (4) at four locations 90° apart; rotate nuts (11) over bolts (10) and finger-tighten.
- u. Place a small amount of adhesive/sealant per above at juncture of diaphragm (4) and actuator stem (19).
- v. Place thread sealant, Loctite #242 or equal, onto protruding actuator stem (19) threads near top.
- w. Rotate diaphragm plate (3) with reoriented flat portion of plate (3) on bottom side, onto the actuator stem (19) and down to the jam nuts (8). Hand-tighten diaphragm plate (3) as tight as possible while ensuring that hubs of diaphragm plate (3) and lower case/yoke are aligned.
- x. Place thread sealant per above on threaded uptravel stop screw (9), and rotate the screw (9) into the center hub of the diaphragm plate (3).
- y. Reassemble the actuator assembly (AA) following procedures as stated from IV.B.7.bb. to IV.B.7.ii., disregarding the last note.
- z. Follow procedures from IV.B.8. through to IV.B.17 to mount actuator subassembly (AA) to valve body subassembly (BA)
- aa. Remove vent plug (14) from lower case

(2). Place pipe thread sealant on vent plug (14) and reinstall in upper case (1) directly above position previously installed.

- bb. Reference positioner IOM's for proper mounting orientation action reversal; i.e. positioner mounts on opposite side of lower case/yoke (2).

#### E. Manual Handwheel Operator Maintenance; Direct Action, FTC-FO:

1. Place actuator assembly (AA) into a vise holding the assembly (AA) at the legs of the lower case/yoke (2) with handwheel (25.1) on topside.

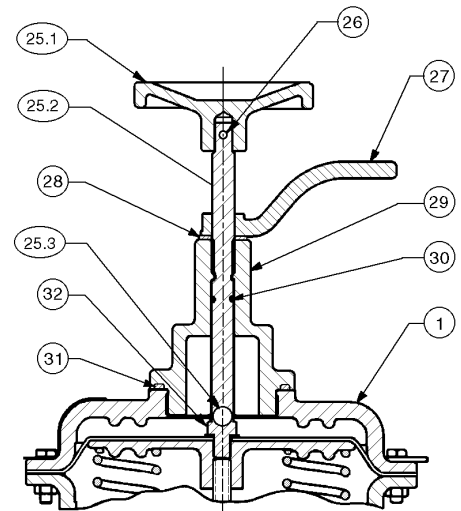


Figure 3

2. **Manual Handwheel Operator; ATC-FO**  
Ensure that handwheel (25.1) is fully rotated outwards/upwards by rotating CCW (viewed from above).



#### WARNING

**Failure to heed may cause springs (24) to make handwheel assembly (25, 26, 27, 28, 29, 30) into a projectile that could cause bodily injury!**

3. Place a pipe wrench on the largest outer diameter of the handwheel bonnet (29). Rotate handwheel bonnet (29) CCW (viewed from above) to removal as a subassembly (25 thru 31).
4. Place handwheel bonnet (29) into a vise with handwheel (25.1) on top.
5. Drive rolled pin (26) from handwheel (25.1) and stem (25.2). Remove handwheel (25.1) by lifting upwards.
6. Rotate locking lever (27) CCW up the stem (25.2) to removal. **NOTE:** It may be necessary

- to hold stem (25.2) from rotating using locking pliers on upper end.
7. Remove threadseal washer (28) and discard.
  8. Remove handwheel bonnet (29) from vise and rotate upper-to-lower end. Secure handwheel bonnet (29) in vise.
  9. Rotate stem (25.2) CCW (viewed from above) to removal. **NOTE:** Place wrench only on upper or lower ends of stem (25.2).
  10. Remove O-rings (30, 31) and discard.
  11. Solvent clean the handwheel bonnet (29), locking lever (27) and stem (25.2). Dispose of solvent and rags in accordance with Owner's requirements.
  12. Examine ball (25.3) at end of stem (25.2). If there are signs of wear, galling or slivering of metal from any of the parts exposed to pressurization of air, replace these parts to prevent damage to diaphragm (4).
  13. Place lithium grease on new O-ring (30) and slide over non-threaded stem (25.2) end and into its groove.
  14. Place a light coating of lithium grease on the inner surface of the handwheel bonnet (29) in the zone where the O-ring (30) slides.
  15. Place a heavy weight wheel bearing grease on the ball (25.3) end of the stem (25.2). Place a generous amount of lithium grease on the threaded portion of the stem (25.2).
  16. Place handwheel bonnet (29) into vise with the larger OD portions on topside. Insert threaded end of stem (25.2) into the bonnet (29) and rotate as far as able. Use wrench as required.
  17. Flip handwheel bonnet (29) end-to-end in the vise. Place new threadseal washer (28) over protruding upper end of stem (25.2).
  18. Rotate locking lever (27) properly oriented onto the stem (25.2) until fully thread engaged.
  19. Position handwheel (25.1) over upper end of stem (25.2) aligning holes.
  20. Drive roll pin (26) into handwheel (25.1) and through stem (25.2).
  21. Place a light layer of lithium grease onto the lower threaded portion of handwheel bonnet (29) that connects to the actuator upper case (1) and into the groove for O-ring (31). Also, lightly grease the new O-ring (31).

22. Place a dab of heavy wheel bearing grease into the recess of the uptravel stop screw (32) within the actuator's (AA) internals.
23. Remove handwheel assembly (25 thru 30) from vise. Place greased O-ring (31) into the recess of handwheel bonnet (29).
24. Rotate handwheel assembly (25 thru 30) CW into actuator upper case (1). Wrench-tighten such that handwheel bonnet (29) is drawn fully down to the actuator upper case (1).

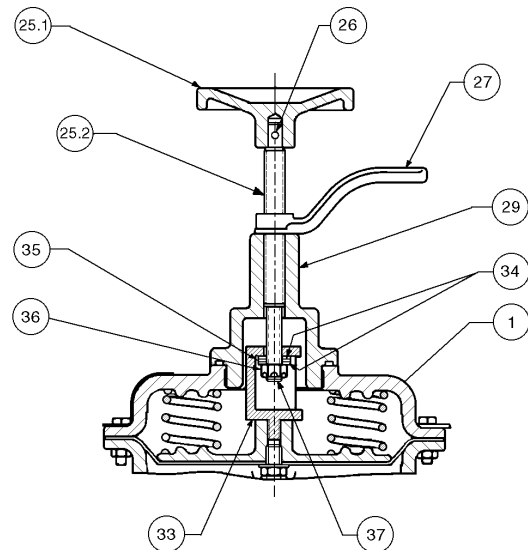
**F. Manual Handwheel Operator Maintenance; Reverse Action, ATO-FC:**

1. Place actuator assembly (AA) into a vise holding the assembly (AA) at the legs of the lower case/yoke (2) with handwheel (25.1) on topside.
2. Ensure that handwheel (25.1) is fully rotated outwards/downwards by rotating CW (viewed from above) while ensuring that the locking lever (27) is not preventing travel downwards.

**⚠ WARNING**

**Failure to heed may cause springs (24) to make handwheel assembly (25, 26, 27, 29) into a projectile that could cause bodily injury!**

3. Place a pipe wrench on the largest outer diameter of the handwheel bonnet (29). Rotate handwheel bonnet (29) CCW (viewed from above) as far as possible.



**Figure 4**  
**Manual Handwheel Operator; ATO-FC**

4. Rotate handwheel (25.1) CCW (viewed from above) upwards/outwards until resistance is encountered.
5. Place a regulated temporary air supply of 18 psig (1.24 Barg) into the lower case/yoke (2) pressurization zone.
6. Fully rotate handwheel subassembly (25, 26, 27, 29) out of the actuator upper case (1). Once threads of handwheel bonnet (39) disengage from upper case (1), slide subassembly (25, 26, 27, 29,) sideways to disengage from handwheel coupling (33).
7. Place handwheel bonnet (29) into a vise with the castle-nut (36) upwards. Remove cotter pin (37) and discard.
8. Remove castle-nut (36), thrust bearing (35) and bearing races (34).
9. Flip handwheel bonnet (29) end-to-end in the vise so that handwheel (25.1) is upwards. Fully rotate stem (25.2) outwards/upwards from bonnet (29) by rotating CCW (viewed from above).
10. Remove locking lever (27) from stem (25.2).
11. Solvent clean all parts to be reused. Dispose of rags and solvent in accordance with Owner's requirements.
12. Rotate locking lever (27) properly oriented back onto the stem (25.2) and fully up against the handwheel (25.1).
13. Place lithium grease on the lower 1-1/2" (38 mm) of the threaded portion of the stem (25.2) that engages with bonnet (8).
14. Place bonnet (29) into a vise with handwheel-end (25.1) directed upwards. Engage stem (25.2) into bonnet (29). Rotate stem (25.2) as far downwards as possible.
15. Flip bonnet (29) end-to-end in vise such that the threaded end of stem (25.2) is directed upwards.
16. Using a heavy wheel bearing grease, pack thrust bearing (35) and bearing race (34) liberally. Place thrust bearing (35) over end of stem (25.2).
17. Rotate castle nut (36) onto end of stem (25.2). As soon as threads are engaged sufficiently to allow a new cotter pin (37) clearance to be inserted, stop rotating nut (36) and insert pin (37). Bend ends of cotter pin in opposite directions.
18. Using a flat tool, place wheel bearing grease onto the portion of the handwheel coupling (33) where the thrust bearing bears.
19. Place a light coat of lithium grease on the threaded portion of the handwheel bonnet (29) that engages.
20. Position the handwheel assembly (25, 26, 27, 29) above the actuator assembly (AA) that is still pressurized to 18 psig (1.24 Barg). Engage the stem (25.2), thrust bearing (35), bearing race (34) and castle nut (36) into the notch located in the handwheel coupling (33), ensuring that bearing race (34) bears against the coupling (33). Engage the threaded portion of bonnet (29) with upper case (1). As engagement proceeds, when resistance is encountered, rotate handwheel (25.1) CW (viewed from above) inwards/downwards until resistance is encountered. At that point, release air pressure to 9 psig (0.62 Barg). Repeat engagement of bonnet (29), then handwheel (25.1), then release air pressure fully to 0 psig (0 Barg). Engage bonnet until fully resting against upper case (1).
21. Rotate handwheel (25.1) CCW (viewed from above) until resistance is encountered. Stop rotating handwheel (25.1). Lower locking lever (27) down to bonnet (29).

## SECTION V

### V. TROUBLE SHOOTING GUIDE

1. Air Leakage; reverse action units. Diaphragm removal/replacement per Section IV. MAINTENANCE in its entirety.

Symptom	Cause-Remedy
A. Leakage at diaphragm-to-lower casing flange.	A1. Overpressure. Check source of air supply and determine if pressure is greater than indicated in 987-TB; reset airset pressure as required. A2. Tighten flange bolting. A3. Faulty seal at stem-diaphragm-seal joint. Remove upper case and diaphragm. Install new thread seal.
B. Leakage from spring enclosure zone of yoke.	B. Replace O-ring (6).

**NOTE:** Cashco, Inc. recommends that if the casings are unbolted, the diaphragm, O-ring seal and TFE tape guide bushing should always be replaced.

2. Air Leakage; direct action units. Diaphragm removal/replacement per Section IV. MAINTENANCE in its entirety.

Symptom	Cause-Remedy
A. Leakage at diaphragm-to-lower casing joint.	A1. Overpressure. Check source of air supply and determine if pressure is greater than indicated in 987-TB; reset airset pressure as required. A2. Tighten flange bolting. A3. Faulty seal at stem-diaphragm-seal joint. Remove upper case and washer. Install new thread seal.
B. Leakage from spring enclosure zone of yoke.	B1. Failure of diaphragm (4); remove and replace diaphragm. B2. Replace O-ring (6).

3. Unstable stroking.

Symptom	Cause-Remedy
A. Intermittent screeching noise, jumpy motion; positioner/controller loading stable	A1. Excessive valve packing friction. Maintain valve packing per valve instructions. A2. Misalignment of valve stem-to-actuator stem; realign per valve instructions. A3. Excessive valve guide wear. Maintain valve per valve instructions. A4. Flow induced instability thru valve. Stabilize A5. Install high range spring in actuator; i.e. increase bench setting level.
B. Positioner output unstable; positioner input signal stable.	B1. Refer to the positioner IOM B2. Reduce positioner gain. B3. Re-calibrate positioner.
C. Controller output signal unstable.	C1. Stabilize controller by increasing proportional band, adding reset, adding rate, or combinations of all. C2. Unstable process. Snub process if able. Stabilize process.

4. Actuator can not deliver full stroke.

Symptom	Cause-Remedy
<p>A. Valve can not fully close for “Direct Action-ATC-FO” arrangement; or valve can not fully open for “Reverse Action-ATO-FC” arrangement.</p>	<p>A1. Insufficient air supply pressure. Check 987-TB for proper air supply pressure.            A2. Manual handwheel out of “neutral” position.            A3. If equipped with a pneumatic positioner, positioner may “bypass” mode.            A4. Excessive pressure drop. Check technical bulletin of control valve for maximum allowable <math>\Delta P</math>.            A5. Bench range not properly calibrated. Check calibration or stem overall length and re-calibrate per valve instructions.            A6. Restriction in air supply line limiting volume available            A7. Restriction in valve. Gain access to the valve’s internals for any debris.</p>
<p>B. Valve can not fully open for “Direct Action-ATC-FO” arrangement; or valve can not fully close for “Reverse Action-ATO-FC” arrangement.</p>	<p>B1. Insufficient air supply pressure. Check 987-TB for proper air supply pressure.            B2. Manual handwheel out of “neutral” position.            B3. If equipped with a pneumatic positioner, positioner may “bypass” mode.            B4. Excessive pressure drop. Check technical bulletin of control valve for maximum allowable <math>\Delta P</math>.            B5. Bench range not properly calibrated. Check calibration or stem overall length and re-calibrate per valve instructions.            B6. Restriction in air supply line limiting volume available            B7. Restriction in valve. Gain access to the valve’s internals for any debris.</p>

## SECTION VI

### VI. PARTS ORDERING INFORMATION

There are three methods to obtain parts ordering information/numbers. These methods are listed below, in order of ease of entering. The least expensive method is to utilize parts in kits where possible.

#### **METHOD A – USE OF PRODUCT CODE.**

Step 1. If available, obtain the 18 character product code number from the Bill of Materials sheet attached in the Valve Body IOM.

□ □ □ - □ □ □ 7- □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □

Step 2. Identify which kits or parts are desired from the Bill of Materials sheet or refer to the cross-sectional drawings.

**NOTE:** Actuator Kit packaged with a selection of parts suitable for general overhaul of either the “Direct” or “Reverse” acting units with or without a handwheel.

Step 3. Contact your local Cashco, Inc., Sales Representative and specify the product code number and any part numbers not included in desired kits. Costs of required parts can be given by the Sales Representative.

#### **METHOD B – NO PRODUCT CODE AVAILABLE – DISASSEMBLED VALVE.**

Step 1. Determine all available information from valve’s metal tag.

- a. Serial number.
- b. Valve “Type” or “Model” number.
- c. Size (may have to observe body tap).
- d. Body material.
- e. Fail position.
- f. Trim designation number (if available).
- g. Cv or port size
- h. Bench set.

Step 2. Determine construction of trim (metal or composition (soft) seat).

Step 3. With the information from Steps 1 and 2 above, contact your local Cashco, Inc., Sales Representative.

Step 4. Sales Representative will contact the factory to determine the original internal construction. Factory will relay information to the Sales Representative.

Step 5. Await the Sales Representative’s return contact with the proper part numbers and cost.

#### **METHOD C – NO PRODUCT CODE AVAILABLE – ASSEMBLED VALVE IN SERVICE.**

Step 1. Determine all available information from valve tag using Step 1, Method B.

Step 2. Contact your local Cashco, Inc., Sales Rep with the above information.

Step 3. Sales Representative will contact the factory to determine the original internal construction. Factory will relay information to the Sales Representative.

Step 4. Await the Sales Representative’s return contact with the proper part numbers and cost.

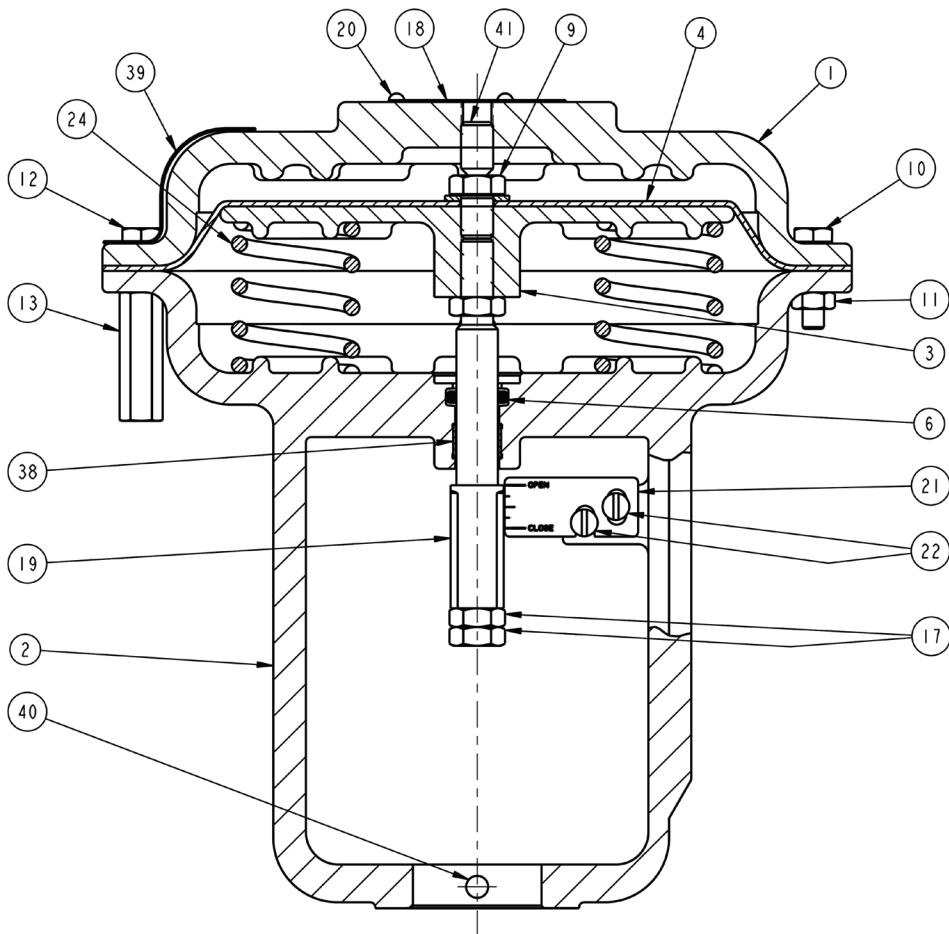
### **MODELS 25D AND 25R ACTUATORS PARTS KIT NUMBER\* (Kit Nos. Shaded)**

The shaded parts kit number below represents an abbreviated identification number for a basic actuator (no options).

Model Number	Kit Abbreviation	Kit Number
25D AND 25R	A	AU4-200K-0AA
<p>* For the proper selection of kit numbers to overhaul the main valve body and trim, refer to the individual VALVE BODY IOM'S (i.e. 987 or 2296)</p>		

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## NOTES



**Figure 5**  
**Model 25D Actuator ATC-FO**

<u>ITEM NO.</u>	<u>DESCRIPTION</u>	<u>ITEM NO.</u>	<u>DESCRIPTION</u>
1	Upper Case	40	Yoke Set Screw (2296)
2	Yoke?Lower Case	41	Set Screw
3	Diaphragm Plate	<b>HANDWHEEL ASSEMBLY</b>	
4	Diaphragm	<u>ITEM NO.</u>	<u>DESCRIPTION</u>
6	O-Ring	25	Handwheel Assembly
7	Thread Seal	25.1	Handwheel
8	Hex. Head Jam Nut	25.2	Stem
9	Hex. Head Cap Screw (Stop)	25.3	Ball
10	Hex. Head Cap Screw (Case)	26	Pin (Roll)
11	Hex. Head Cap Nut (Case)	27	Locking Lever
12	Cap Screw	28	Thread Seal
13	Extension Nut	29	Handwheel Bonnet
17	Stem Jam Nut	30	O-Ring (Screw - Bonnet)
18	Name Plate	31	O-Ring (Bonnet - Uper Case)
19	Actuator Stem	32	Pivot Screw
20	Drive Screw		
21	Indicator Plate		
22	Indicator Plate Screw		
24	Range Spring		
38	Bushing		
39	Caution Tag		
<b>ITEMS NOT SHOWN</b>			
14	Vent (plug)	15	Pipe Plug (1/4")



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