ISO Registered Company

MODELS C27, C53 AND C110

SPRING/DIAPHRAGM LINEAR PNEUMATIC ACTUATORS

SECTION I

I. DESCRIPTION AND SCOPE

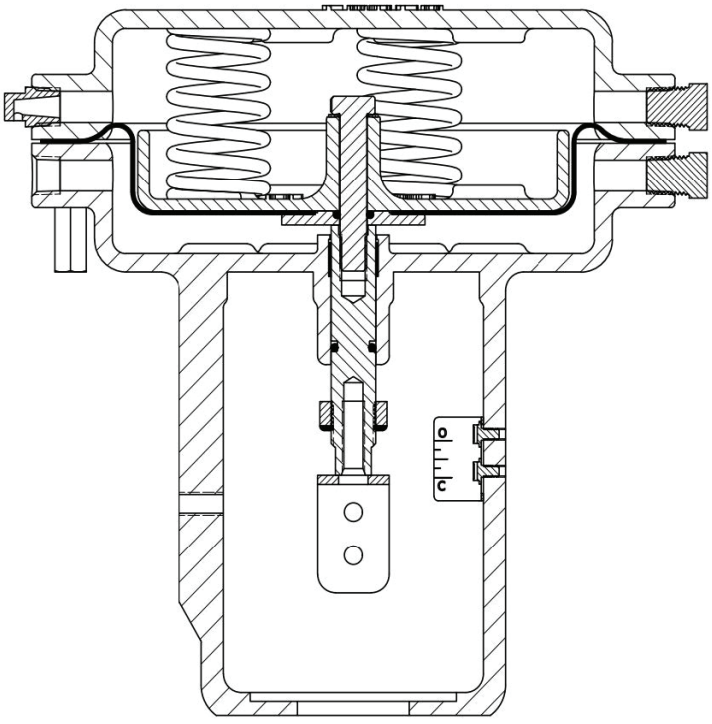
Actuator models C27, C53 and C110 are multi-spring, single acting, spring opposed, linear actuators used with Cashco sliding stem (linear), globe-style control valves: 987, 988, 989, 988-MB, 521,2296, 964, SCV-30, SCV-S.

The "R" denotes "reverse" acting arrangement; the "D" denotes "direct" acting arrangement and are field reversible.

"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, 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.



Shown w/ATO-FC Action

SECTION II

II. REFERENCES

Refer to the Control Valve Technical Bulletin this actuator is unitized with for complete technical specifications.

Refer to following Installation, Operation & Maintenance Manuals (IOM's) for other devices that maybe mounted to C27, C53 and C110 actuators:

Positioners: P/P: P5 or I/P: D20 or D3 go to http://www.pmv.nu/products.aspx?pathlocator
PS2 I/P: http://www.automation.siemens.com/sc-static/catalogs/catalog/pi/fi01/en/fi01_en_kap05.pdf

ABBREVIATIONS

ATO-FC ..... Air-to-Open, Fail Close
ATC-FO ..... Air-to-Close, Fail Open
CCW ..... Counter Clockwise
CW..... Clockwise
D or DIR..... Direct Acting
R or REV.. Reverse Acting
IAS..... Instrument Air Supply
SIG ..... Output Signal from Instrument
LOAD..... Positioner Output Air Pressure
V ..... Vent

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.

3. Outdoors, all installations must be oriented any angle from horizontal-to-vertical.

4. Models C27, C53 and C110 actuators are 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 corrosion to internals of 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. An actuator assembly (AA) is unitized with a body assembly (BA). Reference should be made to the body IOM for instructions about the specified body assembly (BA) utilized with the actuator.

3. Where the body is not being removed from the actuator, special care MUST be exhibited to prevent valve stem rotation during any disassembly or reassembly for all valve models. Following this procedure will ensure no damage to seating surfaces.

4. Remove instrument tubing, airset, positioner, and any other accessory that may be mounted on the control valve unit (AA, BA).

5. All indicated Item Numbers that are with respect to body (BA) IOM 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 manual are not underscored; i.e. (19).

B. Diaphragm Removal/Replacement:

NOTE: *Actuator (AA) must be separated from the body (BA) in order to replace O-rings (15 & 17) and diaphragm (7). Refer to specified body (BA) IOM for instructions to remove actuator (AA).*

NOTE: *If actuator (AA) has Handwheel refer to Step E and remove.*

1. Secure the lower case (2) in a vise. Orient with the (AA) upwards.

2. All air pressure must be released from the actuator casings (1,2).

3. Take note of alignment of supply ports on top and bottom cases (1,2); used to assist with orientation when actuator is re-assembled.

WARNING

SPRINGS UNDER COMPRESSION! To relax spring compression remove case bolting equally in an alternating pattern. Ensure that all "short" bolting is removed first.

4. Loosen all flange bolting (18,19,20,21) two revolutions. Pry apart the casings (1,2) if "stuck" together.

5. In one revolution increments loosen all opposing nuts (20, 21) until the short bolting (18, 20) disengages and can be removed. Continue loosening long nuts (21) in the alternating, one revolution pattern ensuring that the casings (1,2) are being "pushed apart", until the long bolting (19, 21) is disengaged and removed.

For Air-to-Close Construction:

6. Remove upper case (1). Secure the flats on the lower end of the actuator stem (6) with a wrench. With a second wrench rotate the upstop flex nut (52) CCW and remove.

NOTE: *Item (52) not used if actuator has handwheel.*

7. Re-secure the flats on stem and with a 9/16" socket wrench rotate bolt (12) CCW to remove.

8. Lift out lock washer (22), diaphragm washer (14) and O-ring (15). Remove diaphragm (7).

NOTE: *To replace stem bushing (39) and o-ring (17) refer to Step F.*

9. Install new diaphragm (7) over the diaphragm plate (8), convoluted side down. Align bolt holes in diaphragm with holes in lower case.

10. Install new o-ring (15) and reposition washers (14 & 22) on top of diaphragm.

11. Apply Loc-tite #242 or equal to stem bolt (12) threads, tighten stem bolt (12) to actuator stem (6) with 35 ft-lbs. torque.

12. Place upper case on lower case align upper and lower cases (1,2) per B.3 previous. Install long bolting (19) and nuts (21) equally spaced around the bolt circle - finger tighten.

13. Install remaining short bolts (18) and nuts (20). Torque all bolting to 75 in-lbs.

14. Thread upstop flex nut (52) [coupling assembly (33) for handwheel option] onto the actuator stem (6) and engage until just past stem flats.

NOTE: *Upstop position cannot be set until actuator is mounted on the body and the bench range is set.*

For Air-to-Open Construction:

15. Remove upper case (1). Place matchmarks on diaphragm plate (8) to mark location of the springs (10). Remove springs (10).

16. Rotate upstop flex nut (52) CCW and remove.

NOTE: *Item (52) not used if actuator has handwheel assembly.*

17. Secure the flats on stem (6) and with a 9/16" socket wrench rotate bolt (12) CCW to remove.

18. Remove lock washer (22).

19. Remove diaphragm plate (8), diaphragm (7), o-ring (15) and diaphragm washer (14).

20. Grasp stem (6) with hand and pull down thru the lower case (2). Remove o-ring (17) from stem (6). Lubricate new o-ring (17) with Lubri-plate or equivalent and install on stem (6).

21. From the top of the lower case (2) extract the stem bushing (39). Install new bushing.

22. Grasp stem (6) with hand and from below the lower case (2) push the stem up thru the stem bore on the lower case (2) until the bottom end of the stem aligns with the "C" close mark on the indicator plate (23).

23. Reposition diaphragm washer (14) "o-ring side up" and new o-ring (15) on top of lower case (2) bore for actuator stem (6).

24. Place the diaphragm plate (8) inside the diaphragm (7) and carefully place both on the diaphragm washer (14). Align bolt holes in diaphragm with holes in lower case.

25. Apply Loc-tite #242 to stem bolt (12) threads and insert down through stacked parts and rotate CW to engage threaded end of stem (6). Tighten stem bolt (12) to actuator stem (6) with 35 ft-lbs. torque.

26. Place springs (10) equally spaced around the diaphragm plate (8). See Step 15 previous for matchmarks.

27. Refer to B.3 previous, align upper and lower cases (1,2). Install long bolting (19) and nuts (21) equally spaced around the bolt circle - finger tight.

28. Install remaining short bolts (18) and nuts (20). Torque all bolting to 75 in-lbs.

29. Thread upstop flex nut (52) [coupling assembly (33) for handwheel option] CW onto the actuator stem (6) and engage until just past stem flats.

NOTE: *Upstop position cannot be set until actuator is mounted on the body and the bench range is set.*

C. Changing Action from Direct to Reverse; i.e. From ATC to ATO.

NOTE: *Not necessary to remove actuator assembly from body assembly, unless supplied with Handwheel Assembly.*

1. Follow steps from B.1 thru B.5 then continue as follows.

NOTE: **DO NOT** *rotate actuator stem (6) or body stem.*

2. Secure both stem jam nuts with wrenches and rotate the lower nut first down to thread base of the stem, followed by the upper nut.

3. Secure the flats on the lower end of the actuator stem (6) with a wrench. With a second wrench rotate the upstop flex nut (52) CCW 5 revolutions. (Required to help release spring preload when stem bolt (12) is removed.)

4. Remove upper case (1). Re-secure the flats on stem and with a 9/16" socket wrench rotate bolt (12) CCW and remove.

5. Lift out lock washer (22), diaphragm washer (14) and O-ring (15). Remove diaphragm (7).

6. Remove diaphragm plate (8) and springs (10).

7. With hand pressure - push stem (6) down to where bottom of stem (6) aligns with the "C" close mark on the indicator plate (23).

NOTE: **DO NOT** *rotate actuator stem (6) or body stem while plug is touching the seat surface.*

8. Re-assemble by placing diaphragm washer (14) "o-ring side up" and new o-ring (15) on lower case (2).

9. Place the diaphragm plate (8) inside the diaphragm (7) and carefully center both on the diaphragm washer (14). Align bolt holes in diaphragm with holes in lower case.

10. Apply Loc-tite #242 to stem bolt (12) threads and insert down through stacked parts. Rotate CW to engage threaded end of stem (6). Secure the flats on the lower end of the actuator stem (6) with a wrench. Tighten stem bolt (12) to actuator stem (6) with 35 ft-lbs. torque.

NOTE: **DO NOT** *rotate actuator stem (6) or body stem while plug is touching the seat surface.*

11. Place springs (10) equally spaced around the diaphragm plate (8).

12. Refer to B.3 previous, align top and bottom cases (1,2). Install long bolting (19) and nuts (21) equally spaced around the bolt circle - finger tight.

13. Install remaining short bolts (18) and nuts (20). Torque all bolting to 75 in-lbs.

14. Rotate upstop flex nut (52) CW up the actuator stem (6) until just past stem flats

NOTE: *Upstop position cannot be set until the bench range is set.*

15. Lift accessory plate (51) up to bottom of stem (6) and thread both jam nuts up secure underneath the indicating washer.

D. Changing Action from Reverse to Direct; i.e. From ATO to ATC.

NOTE: *Not necessary to remove actuator assembly from body assembly, unless supplied with Handwheel Assembly.*

1. Follow steps from B.1 thru B.5, then continue as follows.

2. Remove upper case (1) and springs (10).

3. Secure the flats on stem (6) and with a 9/16" socket wrench rotate bolt (12) CCW to remove.

NOTE: **DO NOT** *rotate actuator stem(6) or body stem while plug is touching the seat surface.*

4. Remove lock washer (22).

5. Remove diaphragm plate (8), diaphragm (7), o-ring (15) and diaphragm washer (14).

6. Grasp stem (6) with hand and push upwards to where indicating washer aligns with the "O" open mark on the indicator plate (23).

7. Place springs (10) equally spaced in lower case (2) around the stem bore in lower case (2).

8. Carefully position diaphragm plate (8) over top the tops of the springs. Ensure the springs are properly engaged.

9. Install diaphragm (7) over the diaphragm plate (8) and align with bolt holes in lower case (2). Insert new o-ring (15) into groove in the diaphragm washer (14).

10. Position diaphragm washer (14) "o-ring side down" and lock washer (22) on top of diaphragm (7).

11. Apply Loc-tite #242 to stem bolt (12) threads and insert down through stacked parts, rotate CW to engage threaded end of stem (6). Secure the flats on the lower end of the actuator stem (6) with a wrench. Tighten stem bolt (12) to actuator stem (6) with 35 ft-lbs. torque.

NOTE: **DO NOT** *rotate actuator stem (6) or body stem while plug is touching the seat surface.*

12. Refer to B.3 previous, align upper and lower cases (1,2). Install long bolting (19) and nuts (21) equally spaced around the bolt circle - finger tight.

13. Install remaining short bolts (18) and nuts (20). Torque all bolting to 75 in-lbs.

14. Rotate upstop flex nut (52) to align just past the flats on the stem (6).

NOTE: *Upstop position cannot be set until the bench range is set.*

E. To Remove Handwheel Assembly- limited to C27 & C53 Actuartor.

For Air to Close Construction:

1. Rotate locknut (36) CCW two revolutions. Rotate handwheel (31.2) CCW until it spins freely.

2. With hammer and pointed punch, tap the spring pin (35) out of the handwheel and remove handwheel.

3. Remove nuts (38) and lock washer (48) from cap screws (37). **DO NOT** let bracket assembly fall as cap screws are removed. Lift bracket assembly up such that the opening of the pivot brackets (26) slip over the posts on the coupling assembly (33). Set bracket assembly aside.

4. Provide a temporary air supply with an in-line adjustable airset regulator to the actuator connection.

5. Pressurize the actuator to a pressure level 2-3 psig (0.1-0.2 Barg) above the lower pressure level of the bench setting; i.e. for a 5-15 psig (.34 -1.0 Barg) range, set pressure at 7-8 psig (0.48-0.55 Barg).

6. Rotate the coupling assembly (33) CCW to remove and release all air pressure from actuator.

Return to Section IV. B. Step 1.

For Air to Open Construction:

1. Rotate locknut (36) CCW up to base of handwheel. Rotate handwheel (31.2) CW until it spins freely.

2. With hammer and pointed punch, tap the spring pin (35) out of the handwheel and remove handwheel.

3. Remove nuts (38) and lock washer (48) from cap screws (37). DO NOT let bracket assembly fall as cap screws are removed. Lift bracket assembly up such that the opening of the pivot brackets (26) slip over the posts on the coupling assembly (33). Set bracket assembly aside.

4. Rotate coupling assembly (33) CCW to remove.

Return to Section IV. B. Step 1.

F. Bushing & O-ring Replacement ATC only. (Extension of IV. B. Steps 1 - 8.)

1. Remove diaphragm plate (8),

2. Place matchmarks on lower case (2) to mark location of the springs (10). Remove springs (10).

3. Grasp stem (6) with hand and pull down thru lower case (2). Remove o-ring (17) from stem (6). Lubricate new o-ring (17) with Lubri-plate or equivalent and install on stem (6).

4. From the top of the lower case (2) extract the stem bushing (39). Install new bushing.

5. Grasp stem (6) with hand and from below the lower case (2) push the stem back up thru the lower case (2) until the bottom end of the stem aligns with the “O” open mark on the indicator plate (23).

6. Reset springs (10) equally spaced around the lower case (2). See Step 2 previous for matchmarks.

7. Carefully position the diaphragm plate (8) over the tops of the springs (10). Make sure the springs are properly engaged.

8. Return to Section IV. B. Step 9.

SECTION V

V. TROUBLE SHOOTING GUIDE

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

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 or thru vent plug.	A1. Overpressure. Check source of air supply and determine if pressure is greater than indicated in Technical Bulletin; reset airset pressure as required. A2. Tighten flange bolting. A3. Faulty seal at stem-diaphragm-seal joint. Remove upper case - diaphragm. Install new o-ring (15).
B. Leakage from around stem and attachment hub.	B. Replace O-ring (17).

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

Symptom	Cause-Remedy
A. Leakage at diaphragm-to-upper casing joint or thru vent plug.	A1. Overpressure. Check source of air supply and determine if pressure is greater than indicated in Technical Bulletin; reset airset pressure as required. A2. Tighten flange bolting. A3. Faulty seal at stem-diaphragm-seal joint. Remove upper case - diaphragm washer. Install new o-ring (15).

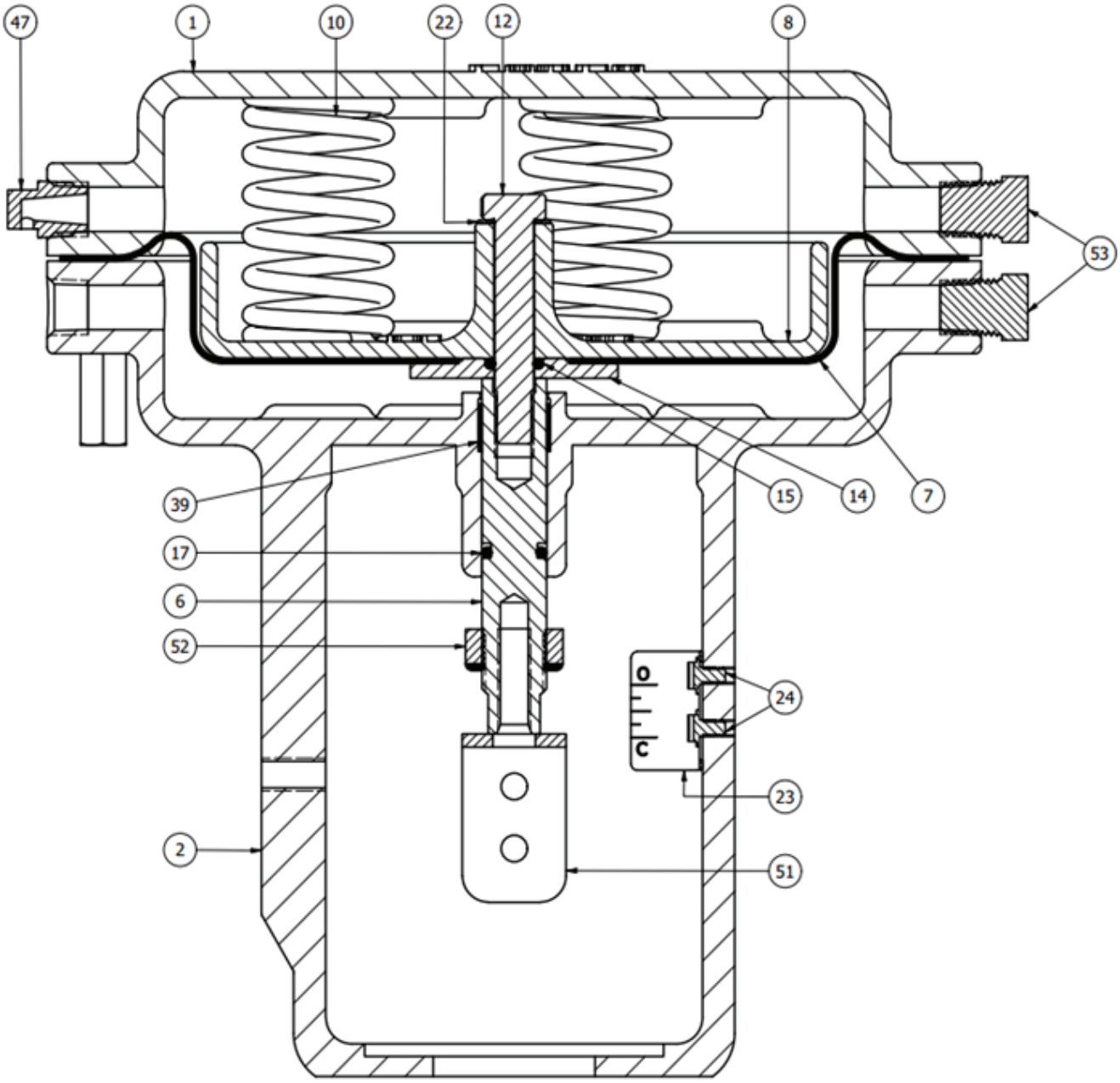
3. Unstable stroking.

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.

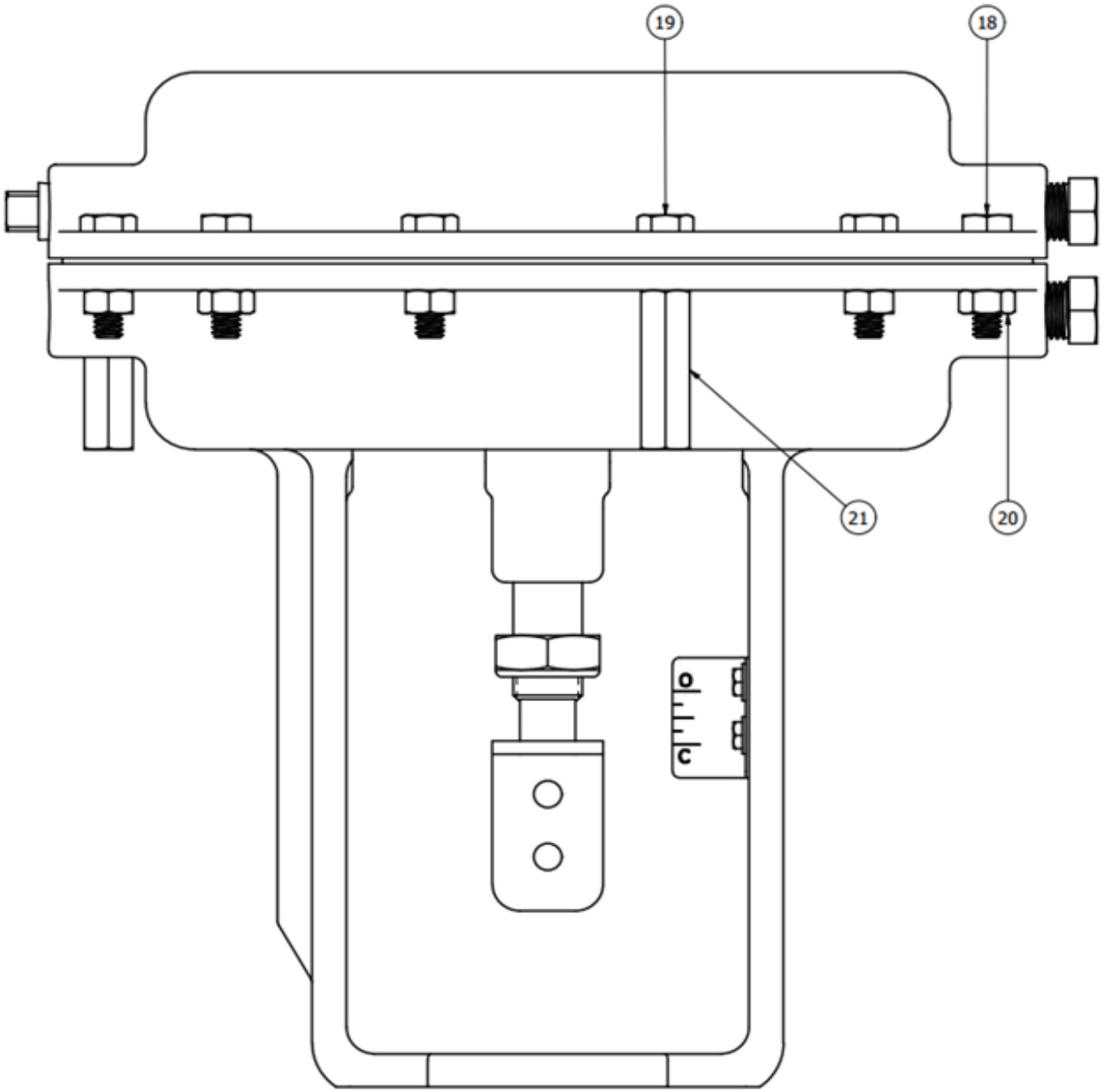
4. Actuator can not deliver full stroke.

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

C27/C53 Actuator
Air To Open - Fail Close



C27/C53 Actuator
Case Bolting

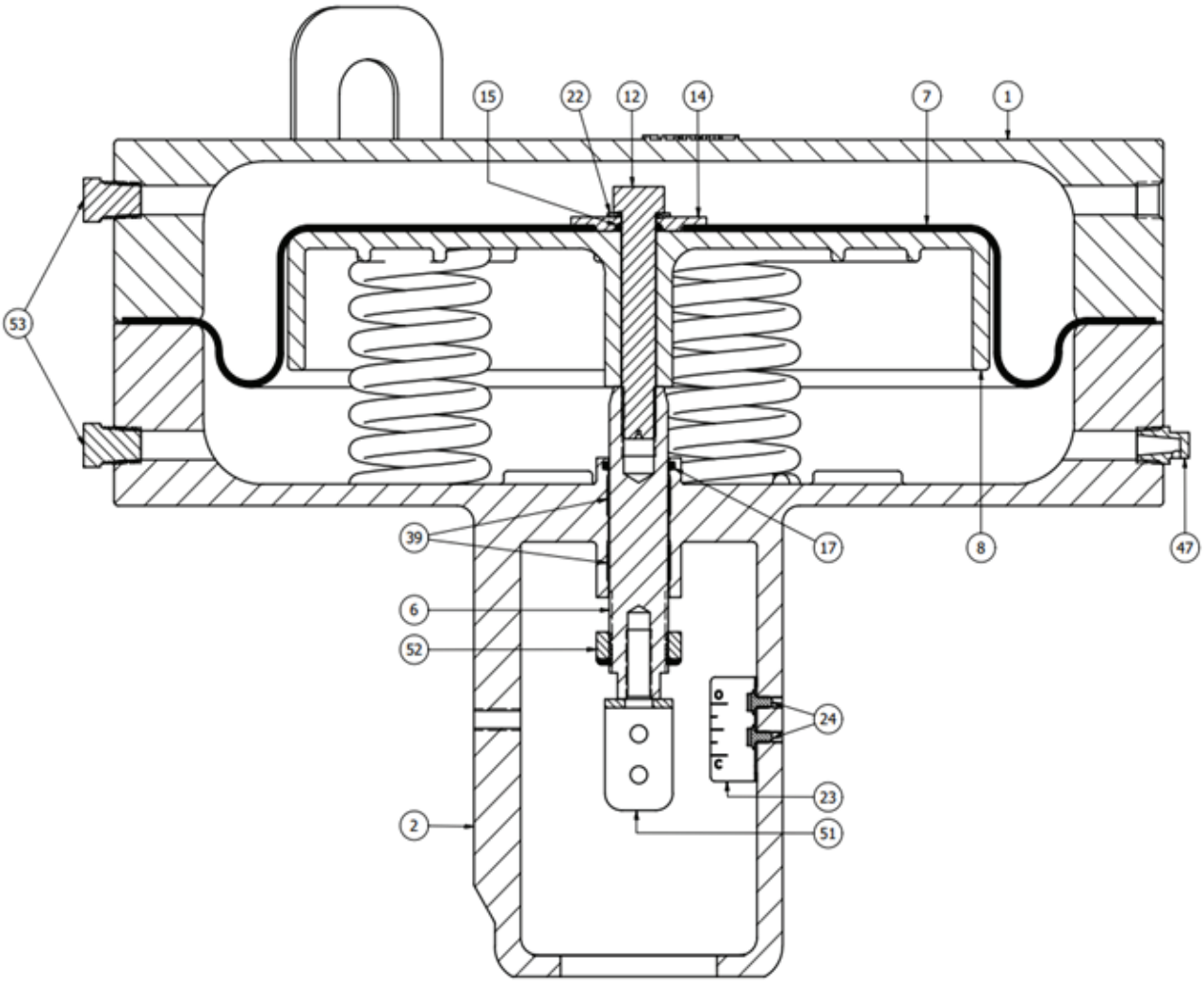


C27/C53 Parts List

Item #	Qty	Description	Material
1	1	Upper Case	ASTM A352 LCC
2	1	Lower Case	ASTM A352 LCC
6	1	Stem	ASTM A479 S31600/3
7	1	Diaphragm	NITRILE/POLYESTER 50 DURO SINGLE PLY
8	1	Diaphragm Plate	ASTM A352 LCC
10	*	Spring	ASTM A228
12	1	Stem Bolt	ASTM A479 S31600/3
14	1	Diaphragm Washer	ASTM A479 S31600/3
15	1	O-Ring	BUNA-N, NBR 70 DURO
17	1	O-Ring	BUNA-N, 75 DURO
18	9	Hex Head Cap Screw	SAE J429 GR. 5 - ZINC PLATED
19	3	Hex Head Cap Screw	SAE J429 GR. 5 - ZINC PLATED
20	9	Hex Nut	SAE J995 GR. 5 - ZINC PLATED
21	3	Extension Hex Nut	STEEL - ZINC PLATED
22	1	Lock Washer	STEEL - ZINC PLATED
23	1	Indicator Plate	304 SST
24	2	Machine Screw	18-8 SST
39	1	Stem Bushing	PTFE/MULTIFIL 427
47	1	Vent Plug	PLASTIC
49	1	Caution Plate	ASTM A240 S30400/3
51	1	Accessory Plate	ASTM A240 S30400/3
52	1	Lock Nut	18-8 SST
53	2	Pipe Plug	ASTM A105 - ZINC PLATED

Stainless Steel Instance - For Use With SCV-30 & SCV-S Valves			
Item #	**Qty**	**Description**	**Material**
1	1	Upper Case	ASTM A351 CF8M
2	1	Lower Case	ASTM A351 CF8M
6	1	Stem	ASTM A479 S31600/3
7	1	Diaphragm	NITRILE/POLYESTER 50 DURO SINGLE PLY
8	1	Diaphragm Plate	ASTM A352 LCC
10	*	Spring	ASTM A228
12	1	Stem Bolt	ASTM A479 S31600/3
14	1	Diaphragm Washer	ASTM A479 S31600/3
15	1	O-Ring	BUNA-N, NBR 70 DURO
17	1	O-Ring	BUNA-N, 75 DURO
18	9	Hex Head Cap Screw	ASTM F593 GP1 CW
19	3	Hex Head Cap Screw	18-8 SST
20	9	Hex Nut	ASTM F594 GP1 CW
21	3	Extension Hex Nut	18-8 SST
22	1	Lock Washer	STEEL - ZINC PLATED
23	1	Indicator Plate	304 SST
24	2	Machine Screw	18-8 SST
39	1	Stem Bushing	PTFE/MULTIFIL 427
47	1	Vent Plug	316 SST
49	1	Caution Plate	ASTM A240 S30400/3
51	1	Accessory Plate	ASTM A240 S30400/3
52	1	Lock Nut	18-8 SST
53	2	Pipe Plug	ASTM A182 F316

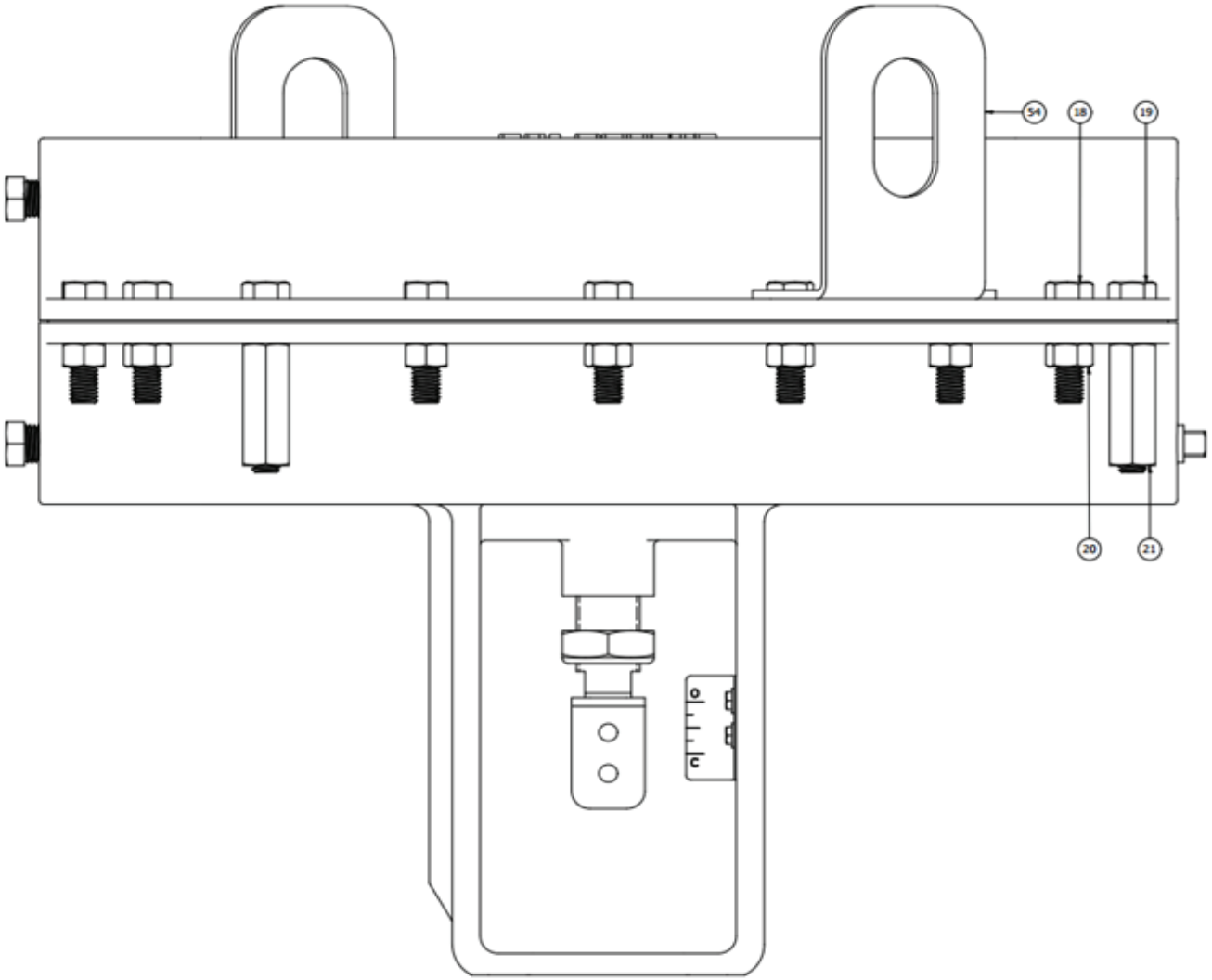
C110 Actuator
Air To Close - Fail Open Action



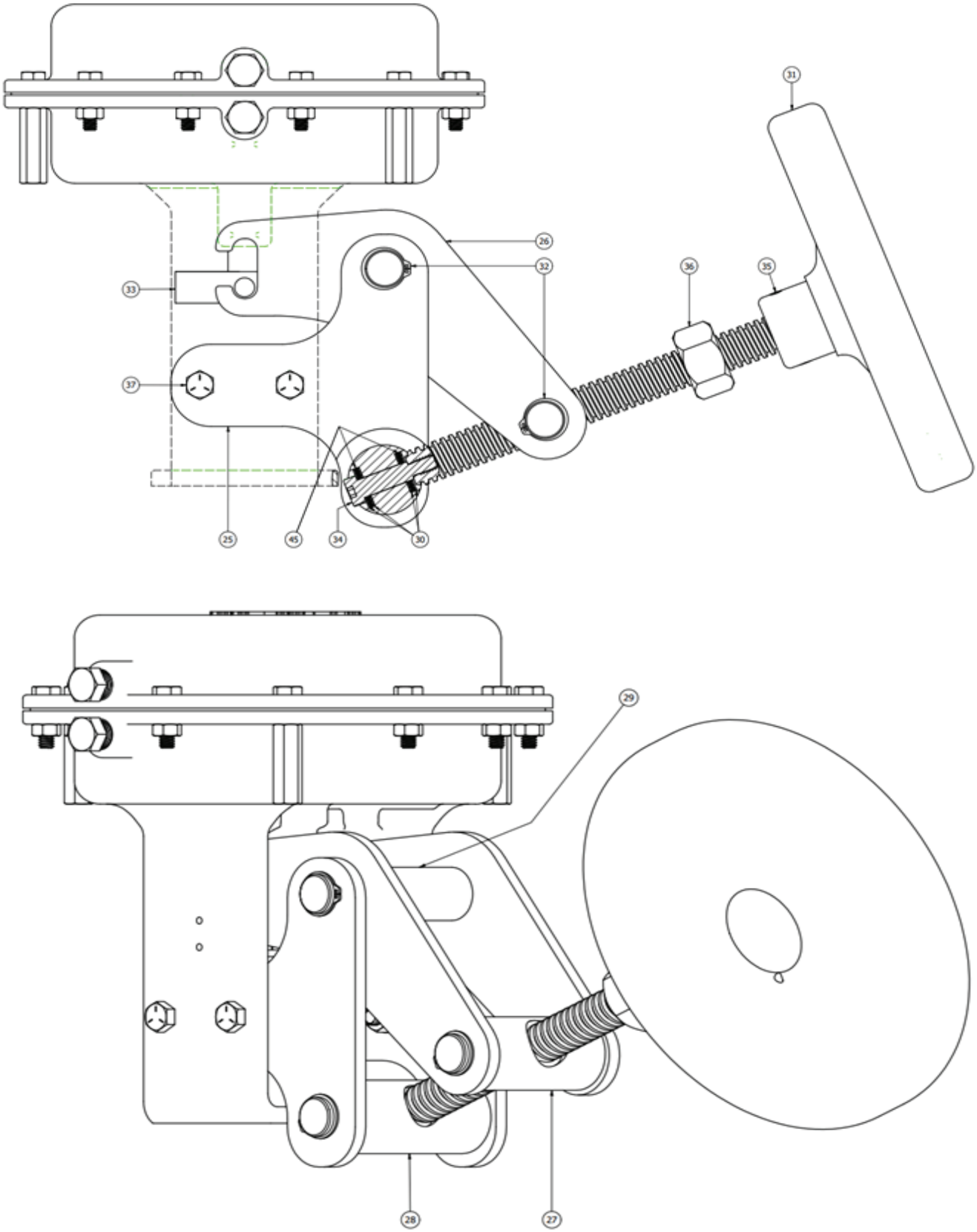
C110 ACTUATOR PARTS LIST							
Item #	Qty	Description	Material	Item #	Qty	Description	Material
1	1	Upper Case	ASTM A352 LCC	20	15	Hex Nut	SAE J995 GR5 - ZINC PLATED
2	1	Lower Case	ASTM A352 LCC	21	3	Extension Hex Nut	STEEL - ZINC PLATED
6	1	Stem	ASTM A479 S31600/3	22	1	Lock Washer	STEEL - ZINC PLATED
7	1	Diaphragm	NITRILE/POLYESTER 50 DURO SINGLE PLY	23	1	Indicator Plate	304 SST
8	1	Diaphragm Plate	ASTM A352 LCC	24	2	Machine Screw	18-8 SST
10	*	Spring	ASTM A401	39	2	Stem Bushing	PTFE/MULTIFIL 427
12	1	Stem Bolt	ASTM A479 S31600/3	47	1	Vent Plug	PLASTIC
14	1	Diaphragm Washer	ASTM A479 S31600/3	49	1	Caution Plate	ASTM A240 S30400/3
15	1	O-Ring	BUNA-N, 50 DURO	51	1	Accessory Plate	ASTM A240 S30400/3
17	1	O-Ring	BUNA-N, NBR, 70 DURO	52	1	Lock Nut	18-8 SST
18	15	Hex Head Cap Screw	SAE J429 GR5 - ZINC PLATED	53	2	Pipe Plug	ASTM A105 - ZINC PLATED
19	3	Hex Head Cap Screw	SAE J429 GR5 - ZINC PLATED	54	2	Life Bracket	ASTM A240 S30400/3

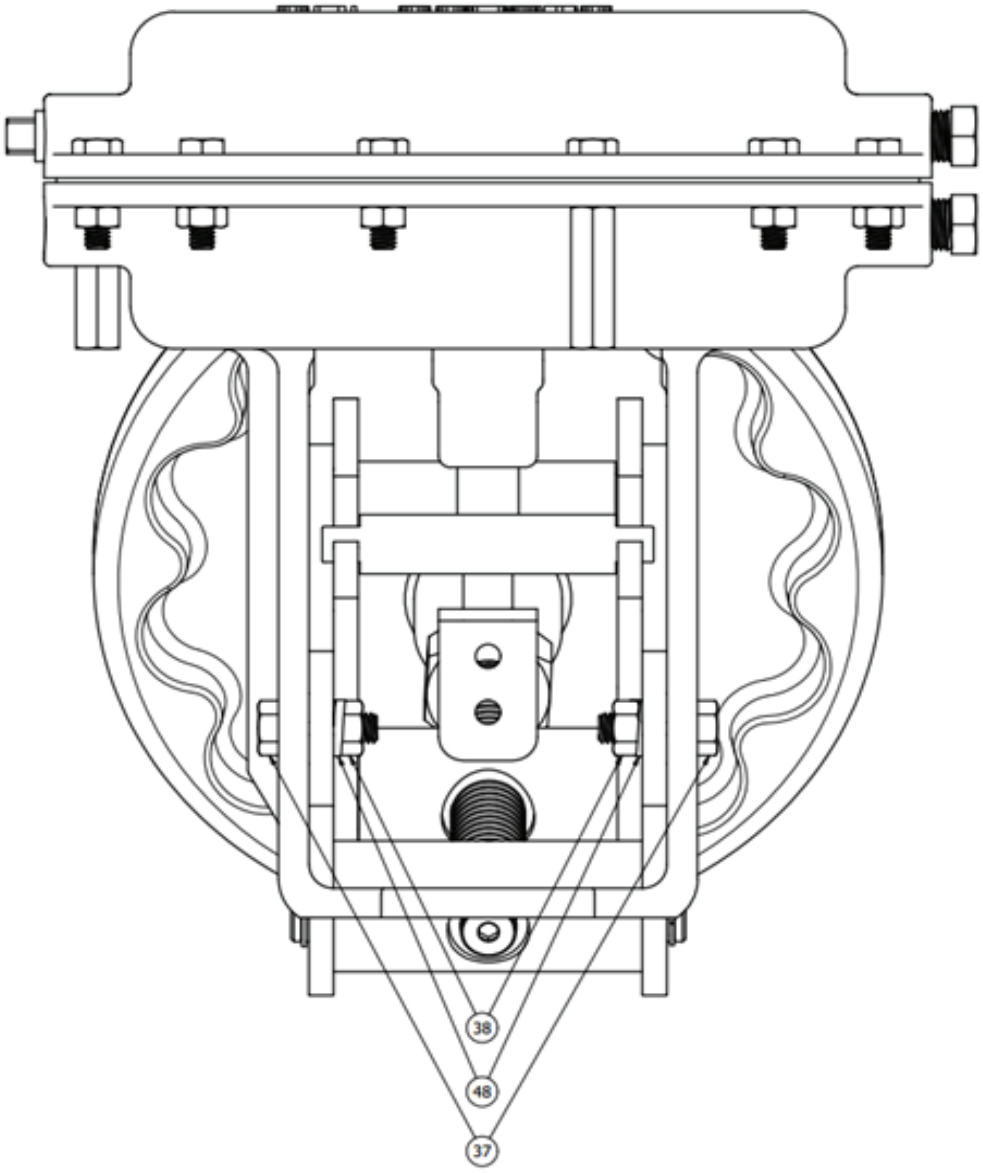
C110 Actuator Is Not Available With Handwheel Option

C110 Actuator
Case Bolting



Handwheel Assembly
Not Available with
C110 Actuator





Item #	Qty	Description	Material
25	2	Fixed Bracket	ASTM A516 GR. 55
26	2	Pivot Bracket	ASTM A36
27	1	Threaded Pin	ASTM B150 C63000
28	1	Thrust Pin	ASTM B150 C63000
29	1	Rocker Pin	ASTM B150 C63000
30	4	Thrust Washer	STEEL
31	1	Handwheel Asm	N/A
32	6	Retaining Ring	ASTM A693 S15700
33	1	Coupling Asm	N/A
34	1	Shoulder Bolt	18-8 SST
35	1	Spring Pin	STEEL - ZINC PLATED
36	1	Hex Nut	STEEL - ZINC PLATED
37	4	Hex Head Cap Screw	SAE J429 GR5 - ZINC PLATED
38	4	Hex Nut	SAE J995 GR5 - ZINC PLATED
45	2	Thrust Washer	ACETAL
48	4	Lock Washer	STEEL - ZINC PLATED

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