

**GLOBE CONTROL VALVE – STEEL CYLINDER
INSTALLATION & MAINTENANCE MANUAL**

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1. INTRODUCTION

This document is a general maintenance manual intended for use on Mitech Globe Control Valves from sizes 100mm to larger, with Steel Actuator Cylinders

The drawings included in this manual do not refer to a particular valve/ but are used to show the typical layout of a Mitech globe control valve and actuator assembly. Additional documents are available from your local MITECH branch.

For identification of parts and components numbers, please refer to the drawings and parts descriptions tables.

2. SIGNIFICANT EQUIPMENT DETAILS

- 2.1. The Mitech globe control valve uses a top entry design to allow for easy trim inspection and service without having to remove the valve from the line.
- 2.2. The standard valve will have PTFE or graphite braid packing and may have live loading. Live loading can easily be recognised as it has Bellville (dished) washers under the gland flange nuts (15). For more information on live loading, refer to the Live Loading Maintenance Manual.
- 2.3. Special valves may have the following trims or accessories. Should this be the case, please see the relevant maintenance manuals, or contact your nearest Mitech Sales branch for assistance. Other manuals available are :-

- Pressure Balance Plugs
- Energy Dissipating Disk Stacks
- Low Noise Trims
- Cavitation Control
- ZZ Trims
- Bellow seal
- Live Loading
- Soft Seat Inserts

3. ROUTINE MAINTENANCE AND INSPECTION

To ensure optimum life of the valve the following inspections are recommended

3.1. Routine maintenance

- 3.1.1. Once the valve has been installed into the line the gland flange studs should be checked for tightness within the first two weeks.
- 3.1.2. Compensate for gland packing wear by occasionally retightening the gland flange nuts (44). Tighten until the leak stops, then half a turn more.
- 3.1.3. Never over tighten the gland flange nuts as this may shorten the life of the packing gland and also have an effect on the smooth operation of the valve.
- 3.1.4. The gland flange must be central and tightened evenly before operating the valve.

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3.2. Inspect and determine what maintenance is required

3.2.1. Observe the valve movement and process instrument readings to determine whether or not the valve needs maintenance, repair and adjustment.

3.2.2. Lookout for the following symptoms : -

- Poor controllability
- Action of the valve is no longer smooth
- When in closed position, the valve bypasses excessive product downstream
- Leaking at gland after tightening the gland flange
- Actuator leaking air
- Piston bypassing air

3.3. Trouble shooting –

For assistance with trouble shooting - refer to Appendix 3

4. DISASSEMBLY OF VALVE

Please refer to Figure 3 (pg 9) and Appendix 5 (pg 13) for parts identification

Warning: Depressurise the line to atmospheric pressure and drain all line fluids before working on the valve. Ensure that decontamination procedures have been carried out if necessary. Failure to do so can result in serious injury.

- 4.1. Disconnect all air lines and the positioner feedback arm (43). Removing the cap screw will disconnect the feedback arm.
- 4.2. Release pressure on the plug and seat by unscrewing the adjusting screw (33) on the top of the actuator.
- 4.3. Loosen the bonnet flange mounting nuts (17) evenly, using the 8-pass conventional system. Remove the actuator bonnet and plug assembly from the valve body.
- 4.4. Great care should be taken to remove the actuator and plug straight out of the body to avoid damage to the plug (5), seat ring (4) and retainer (7).
- 4.5. The plug should never be rotated while it is still on the seat.**
- 4.6. The seat and retainer can then be withdrawn from the valve body (2) as these are loose fitting and are held in position by the bonnet (9).
- 4.7. In order to check the plug thoroughly, loosen the gland flange nuts (15), and remove stem clamp bolt (36).
- 4.8. Unscrew the plug from the actuator stem and withdraw from bonnet.
- 4.9. Remove the gland flange nuts.
- 4.10. Remove the guides (10), spacers (12) and packing (46) by inserting a dowel stick, with a diameter slightly larger in diameter than the plug stem, through the bottom of the bonnet. The guides and packing must be removed through the top of the bonnet.

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5. DISASSEMBLY OF THE ACTUATOR

Please refer to Figure 1 (pg 7) and Appendix 5 (pg 13) for parts identification

- 5.1. Remove all air connections.
- 5.2. The actuator assembly must be removed completely from the valve for servicing.
- 5.3. Relieve the spring pressure by removing the spring adjusting screw (33).
Spring compression must be relieved before any further dismantling is undertaken
- 5.4. Loosen and remove cylinder tie bar nuts (59). Remove the end plate upper (53).
- 5.5. Remove the end plate upper “O” ring (53).
- 5.6. On Fail Closed applications, withdraw the spring (30) and spring button (34).
- 5.7. Withdraw piston and piston shaft sub assembly from cylinder (52).
- 5.8. On Fail Open applications, withdraw the fail-safe spring (30) from under the plug.
- 5.9. Remove cylinder tie bars (58).
- 5.10. Remove cylinder tube and end plate lower “O” ring (54).
- 5.11. Loosen the piston-retaining nut (29), taking care not to damage the actuator stem, slide the actuator spacer (27) and piston (28) off the actuator stem.
- 5.12. Remove stem bushes (26) (only if necessary) and stem O-ring (47) from the base of the cylinder.

6. ACTUATOR COMPONENT INSPECTION

- 6.1. Clean all the metal components with a suitable cleaning solvent.
- 6.2. Check the actuator cylinder for any signs of internal scoring and external damage to the nylon coating.
- 6.3. Check the actuator stem for any visible damage that might have been caused by galling or scoring.

7. VALVE COMPONENT INSPECTION

- 7.1. Clean all the metal components with a suitable cleaning solvent and inspect for any excessive wear or damage.
- 7.2. Check both the plug (5) and seat ring (4) surfaces for damage. Ensure that the seat gasket (3) surfaces on the seat ring, bonnet and body are clean and undamaged.
- 7.3. Check the plug stem, guide liners (11) and guide retainers (10) for:
 - 7.3.1. Uneven wear
 - 7.3.2. Any indication of cavitation, erosion, flashing or steam cutting
- 7.4. Check plug and seat for:
 - 7.4.1. Any wear
 - 7.4.2. Type of material, particularly if damage has occurred
 - 7.4.3. Any indication of cavitation, erosion, flashing or steam cutting

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8. REASSEMBLY OF THE ACTUATOR

Please refer to Figure 1 (pg 7) and Appendix 5 (pg 13) for parts identification

8.1. *The following parts must be replaced:*

- Piston "O"-ring (48)
- Flange "O"-ring (54)
- Piston stem "O"-ring (49)
- Actuator stem "O"-ring (47)
- Adjusting screw "O" ring (55)
- Piston Support "O" ring (57)

8.2. *If the stem bushings were removed: -*

- 8.2.1. Slightly roughen the outer surface of the stem bushes using emery tape to improve adhesion of the loctite.
- 8.2.2. Apply loctite primer and a thin coat of loctite adhesive "601" to the first bush and press it right to the shoulder of the actuator stem neck.
- 8.2.3. Insert the actuator stem "O" ring.
- 8.2.4. Repeat (8.2.1) on the second bush and make sure it does not press too tightly on the "O" ring, leaving +/- 0.5mm clearance. The top of the second bush should be flush with cylinder face.
- 8.2.5. Check if the piston shaft slides freely through bushes and the actuator stem "O" ring.

8.3. **Fail Closed Orientation**

- 8.3.1. Replace the piston support "O" ring (57), and piston support washer (56) into the piston.
- 8.3.2. Hold the actuator stem on the flats in a soft jaw vice. Fit the piston stem "O" ring (49) onto actuator stem (25) and assemble the piston (28) to the actuator stem. The groove in the piston must be at the top, i.e. on the same side as the nylok nut.
- 8.3.3. Place the actuator spacer (27) on top of the piston.
- 8.3.4. Place and tighten the nylok nut (29) on the actuator stem. See appendix 2 for torque figures.
- 8.3.5. Put light smear of silicon grease on the piston "O" ring (48) and fit to the piston.
- 8.3.6. Apply a liberal coating of grease to the bore of the cylinder tube.
- 8.3.7. Place the end plate lower (51) onto a hollow stand then insert the piston sub assembly through it so that there will be a +/-100mm gap between the end plate lower and the piston.
- 8.3.8. Replace the end plate lower "O" ring (54) into groove and apply a light coating of silicon grease.
- 8.3.9. At a 45° angle, slide the cylinder tube over the piston and piston "O" ring. **Do not damage the "O" ring.** Once the piston is located in the tube, straighten the tube and slide it onto the end plate lower and "O" ring.
- 8.3.10. Refit the cylinder tie bars (58).
- 8.3.11. Fit the spring (30) into the groove in the piston.
- 8.3.12. Place spring button (34) onto spring. Make sure that they are fitted correctly to each other
- 8.3.13. If the end plate upper (53) had an "O" ring and bushes when disassembling, replace according to the noted sequence.

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8.4. Fail Open Orientation

- 8.4.1. Replace the piston support "O" ring (57), and piston support washer (56) into the piston.
 - 8.4.2. Hold the actuator stem on the flats in a soft jaw vice. Place the actuator spacer (27) onto the actuator stem. Fit the piston stem "O" ring (49) onto the actuator spacer.
 - 8.4.3. Assemble the piston (28) to the actuator stem making sure the groove of the piston would face the actuator yoke not the nylok nut side.
 - 8.4.4. Place the spring button (34) on top of the piston – upside down.
 - 8.4.5. Place the nylok nut (29) above the spring button onto the actuator stem and tighten. See appendix 2 for torque figures.
 - 8.4.6. Put light smear of silicon grease on the piston "O" ring (48) and fit to the piston.
 - 8.4.7. Place the end plate lower (51) onto a hollow stand.
 - 8.4.8. Replace the end plate lower "O" ring (54) into groove and apply a light coating of silicon grease.
 - 8.4.9. Place the spring (30) onto the end plate lower and slide the actuator stem of the piston sub assembly through the end plate lower yoke. Locate the spring into the groove on the bottom side of the piston.
 - 8.4.10. Apply liberal coating of grease to the bore of the cylinder.
 - 8.4.11. At a 45° angle, slide the cylinder tube over the piston and piston "O" ring. **Do not damage the "O" ring.** Once the piston is located in the tube, straighten the tube and slide it onto the end plate lower and "O" ring.
- 8.5. Fit "O" ring (54) in top end flange (53) groove and apply a light coating of silicon grease.
 - 8.6. Replace cylinder tie bar nuts (59) and evenly tighten.
 - 8.7. Fit "O" ring (55) to the insert bolt (33) and tighten the bolt to the flange.
 - 8.8. Check cylinder operation using an air line. Pressure should be approximately 5 Bar.
 - 8.9. Check for leaks at cap end by pouring soap water onto the cap and pressurising cylinder using hole nearest the cap.
 - 8.10. Pour soap water into the cylinder neck and check for leaks at this end by pressurising the cylinder using the hole nearest the neck. If the "O" ring on this side leaks, the cylinder must be dismantled and the second bush pressed further in to compress the "O" ring slightly.
 - 8.11. Stroke the actuator to ensure smooth operation of the actuator.

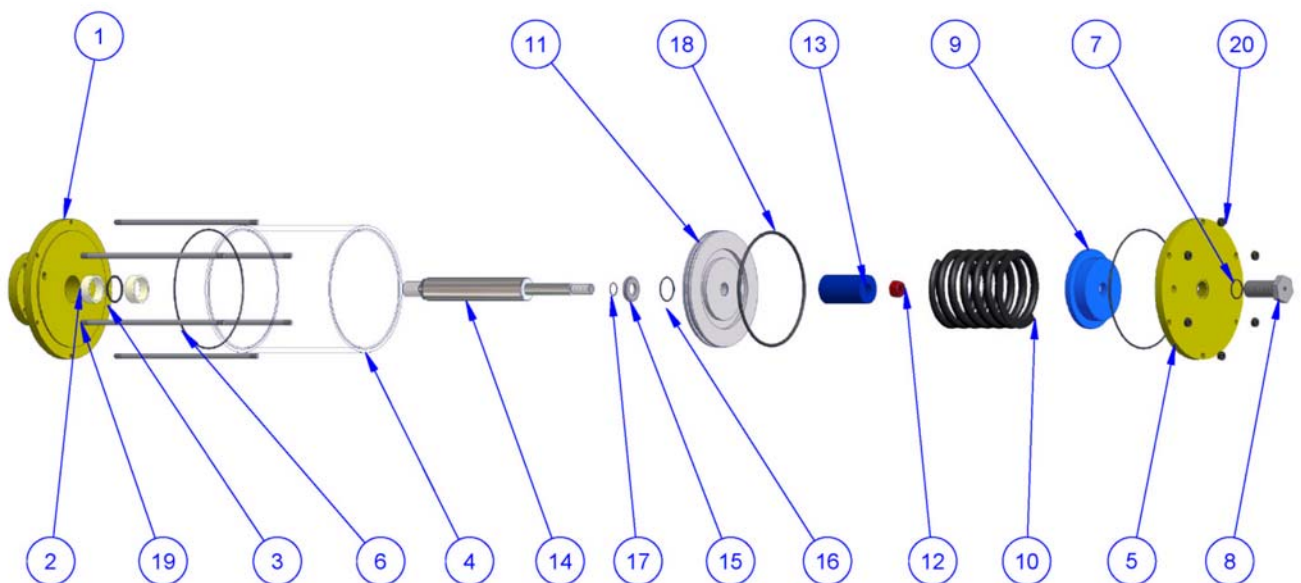


Figure 1: Cylinder Assembly

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9. REASSEMBLY OF THE VALVE

Please refer to Figure 2+3 (pg 8+9) and Appendix 5 (pg 13) for parts identification

9.1. On reassembly the following parts must be replaced:

- Gland packing (46)
- Seat gasket (3)
- Bonnet gasket (6)
- Plug stem guide liner (11)

N.B. Under no circumstances should the spiral wound gasket be re-used

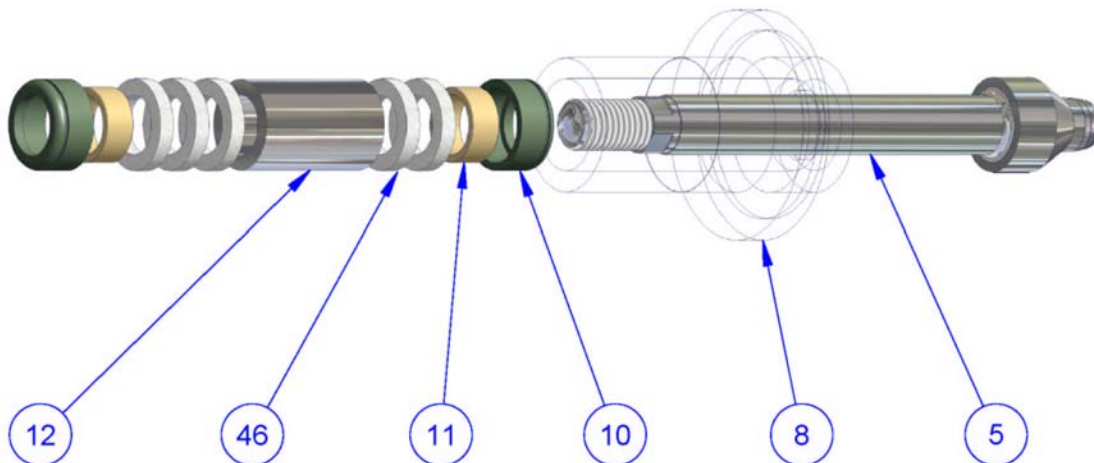


Figure 2 : Packing Arrangement

- 9.2. Reassembly of the valve must be built from the valve body up.
- 9.3. The valve body (2) must be secured to prevent movement during assembly.
- 9.4. All parts must be clean.
- 9.5. Place the seat gasket (3), seat ring (4) and seat retainer (7) into the valve body.
- 9.6. Place the bonnet gasket (6) into the valve body.
- 9.7. Slide the bonnet (8) over the plug stem taking care not to score the stem and insert the bonnet assembly into the valve body.
- 9.8. Insert the solid lower guide retainer (10) or the retainer with liner (11), the lower gland packing (46), the packing spacer (12), the upper gland packing (46), upper guide retainer (10) and or liner (11), all in sequence. See Figure 2
- 9.9. Fit the bonnet flange (9) into position, and screw the bonnet nuts (17) on loosely.
- 9.10. Screw the mounting bars (19) into the bonnet flange tightly.
- 9.11. Fit the gland flange and loosely screw in the gland flange nuts (15).
- 9.12. Position the actuator stem clamp (35) over the plug stem.
- 9.13. Ensure that the gland flange (14) and stem clamp are in place before
- 9.14. Refit the mounting flange (18) onto the mounting bars and replace the bolts (20).
- 9.15. Screw the plug stem (5) into the actuator stem (25). Leave approximately 5 threads exposed.
- 9.16. Slide stem clamp up over actuator stem, align the cut out in the stem with the bolt hole in the stem clamp and fit the bolt (36).
- 9.17. Tighten the actuator mounting bolts (20) evenly.
- 9.18. To align the seat and plug on air to open valves screw in the adjusting screw so that the spring is under tension and the plug forced into the seat. For fail open valves use low air pressure to move the plug into the seat.

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- 9.19. Tighten each bonnet nut (17) one flat at a time working diagonally across from one to another.
- 9.20. Tighten all bolts evenly. Refer to the torque figures in Appendix 1.
- 9.21. Reconnect positioner (1) and piping.
- 9.22. Stroke the valve to check the smooth operation of the plug.
- 9.23. Check the full stroke of the valve by making the appropriate signal changes on the positioner and compare with indicator plate.
- 9.24. Check all air connections, gland packing and gaskets for air leaks using soap water.
- 9.25. Check that the valve moves in the right direction (air to open or air to close).

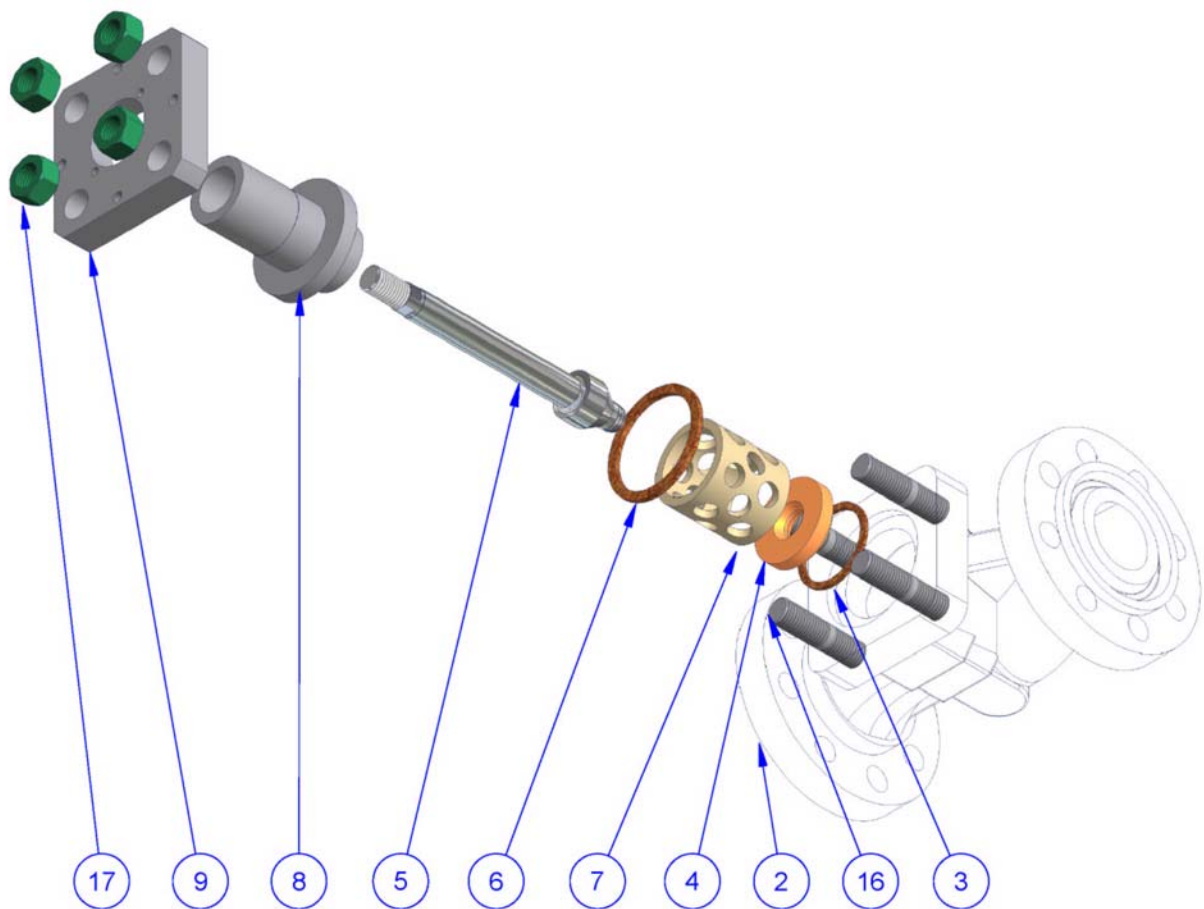


Figure 3: Body Assembly

10. POSITIONER CALIBRATION

While the valve is still in the workshop, the positioner must be calibrated. See Positioner Maintenance Manual to calibrate a Mitech positioner. Once the valve is installed back in the line, the unit should be tested again.

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11. REVERSING THE AIR ACTION

Note :

- For specialised trims, be aware that flow direction is specific and this needs to be taken into account.
- Reversing the fail action will affect the piping.

- 10.1 To reverse the air action, disassemble the actuator in accordance with section 5.
- 10.2 When changing the air action, it is likely that the flow direction may also need to be changed.
- For fail closed valves (air to open), flow should be over the plug
 - For fail open valves (air to close), flow should be under the plug.
- 10.3 Reassemble the actuator in accordance with section 8. for fail open or fail closed operation.
- 10.4 For air to open, the control air port for the positioner is connected to the lower cylinder port and the balance air output to the top port.
- 10.5 For Air to close (fail open), reverse these connections on the positioner.
- 10.6 Please consult figure 4 below to verify arrangement of parts.

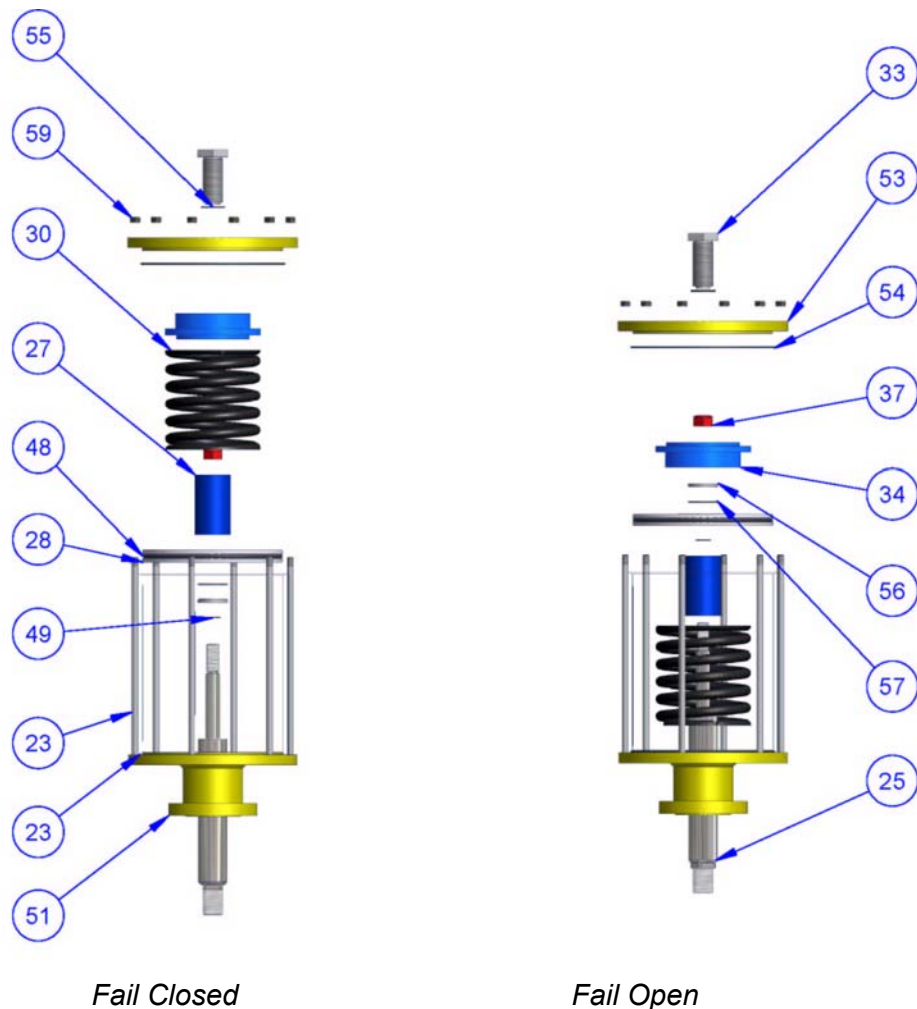


Figure 4: Cylinders with Fail Open and Fail Closed Orientation

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APPENDIX 1 : TORQUE VALUES FOR BONNET NUTS

VALVE SIZE	GRADE	BOLT SIZE	TORQUE (Nm)
150mm (6")	ASTM A193 B7 (M/S)	1 – 1/8" UNC	1420
	316 (A4)	ST/ST 1 – 1/8" UNC	536
200mm (8")	ASTM A193 B7 (M/S)	1 – 1/4" UNC	
	316 (A4)	ST/ST 1 – 1/4" UNC	
300mm (12")	ASTM A193 B7 (M/S)	1 – 1/2" UNC	
	316 (A4)	ST/ST 1 – 1/2" UNC	

APPENDIX 2: TORQUE VALUES FOR NYLOK NUTS FOR SECURING PISTON

ACTUATOR SIZE	NUT SIZE (mm)	TORQUE (Nm)
MT – 100	24	220
MT – 200	30	280
MT – 300	30	280

APPENDIX 3 : SEAT LEAKAGE MEASUREMENT

SEAT LEAKAGE	MEASURE
ANSI II.	<ul style="list-style-type: none"> • 0.5 % of rated C_v. • Used for pressure balanced trims with metal seals.
ANSI IV	<ul style="list-style-type: none"> • 0.1 % of rated C_v. • Used for all standard valves with metal seals.
ANSI V.	<ul style="list-style-type: none"> • 4 x 10⁻¹² m³/hr per mm of orifice dia per bar pressure drop
ANSI VI.	<ul style="list-style-type: none"> • Bubble tight. • Used for soft seated valves where tight shut off is important.

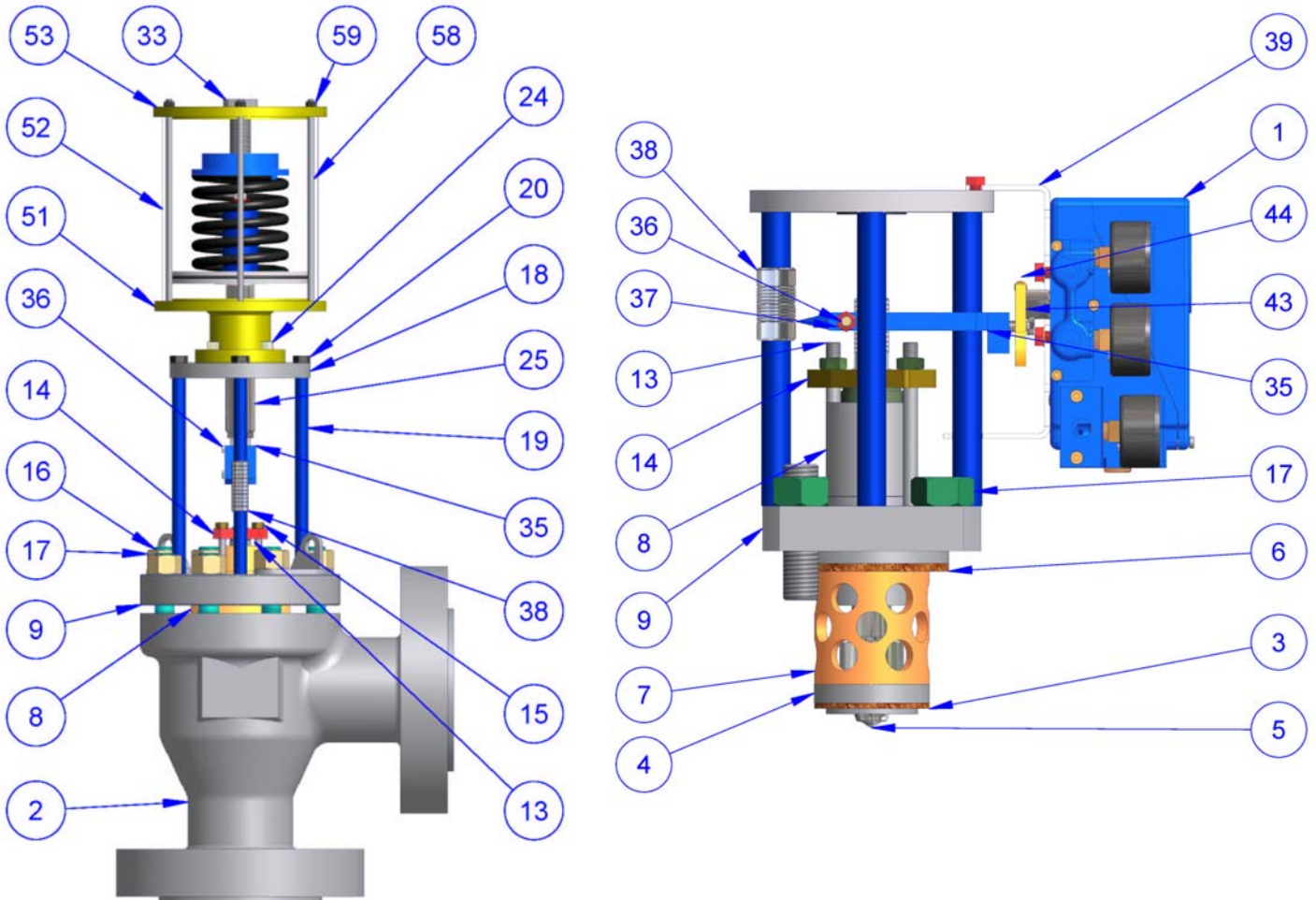
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APPENDIX 4 : TROUBLE SHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
Valve operation not smooth	Gland Flange over tightened Packing too dry Poor air supply Alignment of actuator stem and Plug. Actuator faulty	Loosen Gland Flange Nuts and re tighten just over finger tight. Lubricate packing. Warning: do not use oil on valves for oxygen service. Check air supply pressure to Actuator during operation. Check actuator cylinder is square & tight on mounting flange. Service actuator as per maintenance bulletin
Valve passing excessive product when closed	Poor air supply Calibration out Actuator cylinder passing air Plug not achieving full travel Incorrect flow direction Damaged Seat or Plug surfaces	Check air supply pressure during operation Check readings on Positioner gauges and re calibrate if necessary. Check for air leaks with soap water at cylinder cap and neck air connections by removing one pipe whilst stroking the valve. Check plug travel against indicator plate Check flow corresponds with direction on valve. Check Plug and Seat as per Maintenance Bulletin
Valve not opening fully	Poor air supply Calibration out Actuator cylinder passing air Plug not achieving full travel	Check air supply pressure during operation. Check readings on Positioner gauges and re calibrate if necessary. Check for air leaks with soap water at cylinder cap and or neck whilst stroking the valve Check plug travel against indicator plate.
Poor Control	Poor air supply Speed and accuracy of response	Check air supply pressure during operation Check that the speed of response and the position of the plug correspond with signal changes.
Excessive Noise	Cavitation (liquid) Flashing (liquid) Velocity (gas) Cavitation (gas)	Check Trim type is suitable for the application. Refer to supplier
Damage to plug and or seat	Cavitation. Recognised by dull colour and material looks porous Flashing. Can be recognised by shiny colour and loss of material similar to erosion Erosion. Can be recognised by polished finish. Corrosion. Various	Change trim type. Add Hard facing. Add Hard facing. Change Materials.
Leaks from bonnet.	Bonnet flange not tight. Bonnet gasket leaking.	Check bonnet flange nuts are correctly tightened. Replace bonnet gasket. Torque bonnet flange nuts evenly.

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APPENDIX 5 : VALVE PARTS IDENTIFIER



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APPENDIX 6 : VALVE PARTS DESCRIPTION

ITEM	DESCRIPTION		ITEM	DESCRIPTION
1	Positioner		30	Spring
2	Body		31	Cylinder Cap
3	Seat Gasket		32	Cylinder Cap Circlip
4	Seat Ring		33	Adjusting Screw
5	Plug		34	Spring Button
6	Bonnet Gasket		35	Stem Clamp
7	Retainer		36	Stem Clamp Bolt
8	Bonnet		37	Nut Nylok
9	Bonnet Flange		38	Indicator Plate
10	Guide Retainer		39	Positioner Bracket
11	Guide Liner		40	Bolt (Set)
12	Packing Spacer		41	Shoulder Screw
13	Gland Flange Stud		43	Feedback Arm
14	Gland Flange		44	Capscrew - Positioner
15	Gland Flange Nut		45	Star Washer
16	Bonnet Stud		46	Packing Braid
17	Bonnet Nut		47	Actuator Stem "O" ring
18	Mounting Flange (Actuator)		48	Piston "O" ring
19	Mounting Bar		49	Piston Stem "O" ring
20	Bolt - Mounting Flange		50	Cover Ring
21	Wiper Adapter		51	End Plate Lower
22	Wiper Rod		52	Cylinder Tube
23	Cylinder		53	End Plate Upper
24	Actuator Mounting Bolts		54	Flange "O" Ring
25	Actuator Stem		55	Adjusting Screw "O" Ring
26	Stem Bushing		56	Piston Support Washer
27	Actuator Spacer		57	Piston Support "O" Ring
28	Piston		58	Cylinder Actuator Tie Bar
29	Nut Nylok - Piston Retaining		59	Tie Bar Nut