

MODEL 964

GLOBE-STYLE PNEUMATIC CONTROL VALVE UNIT BODY IOM

SECTION I

I. DESCRIPTION AND SCOPE

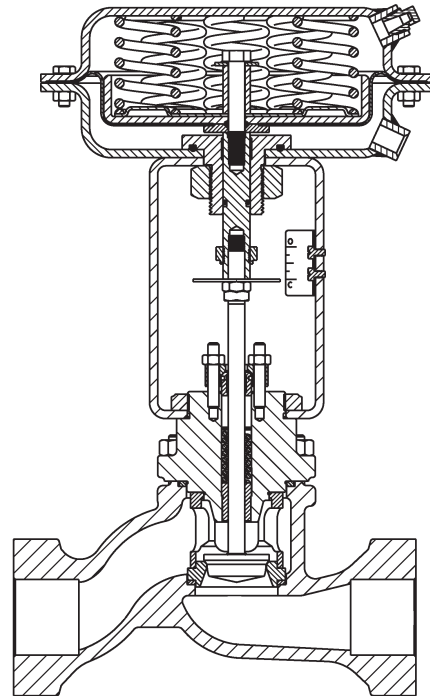
The Model 964 is a pneumatically actuated, sliding stem globe-style control valve. Sizes are 1/2", 3/4", 1", 1-1/2", & 2". Available in Cast Iron and Cast Steel body materials.

Failure position is determined by actuator for:

"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.

The valve is designed primarily for general service or utility applications such as steam, air, oil, gas and water.



**Model 964
with ATO - FC Actuator**

SECTION II

II. REFERENCES

Refer to Technical Bulletin 964-TB for complete technical specifications of a Model 964 coupled with either Cashco Actuator Model C27 or C53.
www.cashco.com/techbulletins/964.pdf

Refer to following Installation, Operation & Maintenance Manuals (IOM's) for either actuator and/or devices that maybe mounted to a Model 964:

Actuators: www.cashco.com/iom/C27-C53.pdf

ABBREVIATIONS

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

SECTION III

⚠ CAUTION

For welded installations, all internal trim parts and seals, must be removed from body prior to welding into pipeline. The heat of fusion welding will damage non-metallic parts if not removed. **NOTE:** This does not apply to units equipped with extended pipe nipples.

III. INSTALLATION

A. Orientation:

1. Recommended orientation when installed in a horizontal pipeline with the stem vertical. Valves may also be installed in vertical pipelines with stems horizontal.

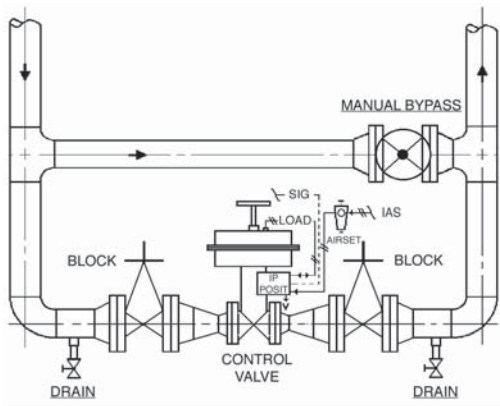


Figure 1: Typical Control Valve Station

2. Outdoors, all installations may be oriented any angle from horizontal-to-vertical.
3. Valves are not recommended for installation with the actuator oriented downwards..

B. Piping System:

1. It is recommended that the control valve unit be installed with a double-block and bypass as indicated in Figure 1. This arrangement is recommended especially where maintenance will be done on the valve body while still installed in the pipeline.
2. Pipe unions are recommended for NPT screwed or socket welded installations to allow complete removal from system. If removal for maintenance is by cutting torch for socket welded valves, leave sufficient pipe nipple space between the 964 body and the next piping component up or downstream to allow socket weld couplings for re-installation.

3. If pipe reducers are located before and/or after the valve body, keep the reducers as close as practical to the valve body; this is especially important where the reducers are more than one line size larger than the valve body size, which is common in gaseous service.
4. Clean the piping of all foreign debris, including chips, weld scale, weld spatter, oil, grease, sand or dirt prior to installing the control valve. This is an absolute requirement for valves supplied with composition soft seats. System start-up strainers, for removal shortly after initial start-up, are recommended.
5. Field hydrostatic testing the completed piping system to 1-1/2 x CWP in psig indicated on the nameplate, including the 964, is acceptable. If hydro test pressure exceeds the 1-1/2 x CWP limit, the 964 must be removed for such testing. Before pressurization, the valve plug should be lifted from the seat if of ATO-FC action. Tighten packing as required.
6. In placing thread sealant on pipe ends prior to engagement, ensure that excess material is removed and not allowed to enter the valve upon start-up.
7. Flow Direction: Install so the flow direction matches the arrow marked on the valve body.
8. For best performance, install in well drained horizontal pipe, properly trapped if a steam service application.
9. Valves are not to be direct buried underground.
10. Insulation may be applied as indicated in Figure 2. Drainage away from the packing area must be ensured when fully installed, sealed and lagged for outdoors installation.

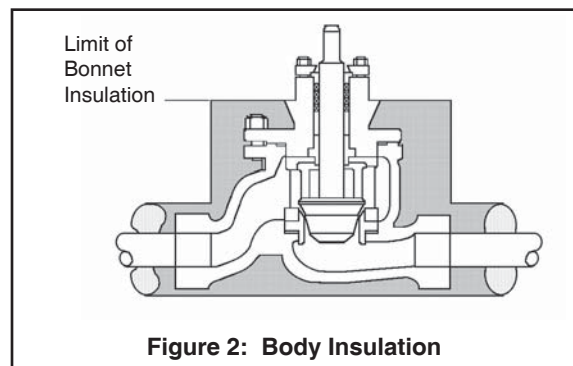


Figure 2: Body Insulation

11. Undue piping stress/strain or bending torques may not be transmitted through the valve body. One pipe (inlet or outlet) should be anchored rigidly for piping that is “hot” or “cold” with respect to ambient temperature; the remaining pipe (inlet or outlet) should be supported and guided to ensure unidirectional expansion/contraction.

C. Air Supply:

1. Use a desiccant dried, instrument quality air supply. Such a supply is recommended for outdoor 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 the internals of the actuator casings.
4. Connections for the air supply are 1/4" female NPT. Use a suitable pipe thread sealant when installing the pipe or tube fitting. **DO NOT** allow sealant to enter the tube/pipe.

SECTION IV

IV. START-UP

A. General:

1. Ensure that the Model 964 unit has been properly adjusted and calibrated, including the positioner, if installed.
2. Recommend startup to be in a “manual” mode. This procedure assumes double block (isolation) and bypass valves for the “control valve station”. See Figure 1.
3. Start with either of the two block valves closed, with the other open. The bypass valve should be closed. Pressurize system, if possible/practical.
4. Back out the airset’s adjusting screw until loose.
5. Turn on air supply pressure.
6. Adjust the air supply airset (filter-regulator) to the proper level as indicated as follows:

Bench Setting		Airset Output	
psig	(Barg)	psig	(Barg)
5–15	(.34–1.0)	20	(1.4)
15–60	(1.0–4.1)	75	(5.2)

7. Place loop controller into “manual” mode. Vary setting from minimum - mid-range - maximum SIG output. Observe response of control valve unit to these changes of input SIG. The valve should fully stroke at the variation from minimum SIG to maximum SIG; the mid-range SIG should have the valve stem travel at/near 1/2 open.

CAUTION

DO NOT WALK AWAY AND LEAVE A MANUALLY CONTROLLED CONTROL VALVE UNATTENDED!

8. Confirm that action of controller and positioner - direct or reverse - are producing the desired response in the control unit. Confirm that the control valve “fail” position is as required.
9. Hereafter, the procedure assumes that actual fluid flow may be established. This may not be practical / possible in all cases; if so, vary procedure as required.

Always “heat” or “cool” down the system piping SLOWLY by opening the control valve station bypass valve in small increments.

10. With one of the control valve station block valves still closed, and the loop controller still in “manual” mode, open bypass valve and vary flow rate manually to observe the response of the controller and control valve unit together.
11. Attempt to develop manual control of the loop by opening/closing the manual bypass as required, or by manually controlling mainstream flow as required.
12. When the control valve is partially open, crack open slowly the closed block valve while simultaneously closing the bypass valve. Continue this procedure until the bypass is closed and the block valves are both fully open. The system is still under “manual”

mode control, but all flow is passing through the control valve.

13. Vary controller “manual” SIG output until matching the “automatic” SIG output, then

change the mode of the controller over to “automatic”, and the loop will experience a minimum of upset conditions, and will be in automatic control.

SECTION V

V. MAINTENANCE

WARNING

SYSTEM UNDER PRESSURE. Prior to performing any maintenance, isolate the valve/actuator from the system and relieve all pressure. Failure to do so could result in personal injury.

A. General:

1. Maintenance procedures hereinafter are based upon removal of the valve/actuator unit from the pipeline where installed.
2. Owner should refer to Owner’s procedures for removal, handling and cleaning of non-reusable parts, i.e. gaskets, suitable solvents, etc.
3. Valves supplied from the factory use a gasket sealant, Federal Process Company, PLS2, or equal. Owner may use such aids provided the aids are compatible with the Owner’s fluid.
4. All indicated Item Numbers that are with respect to the actuator assembly (AA) are in parenthesis and underscored; i.e. (20). All Item Numbers that are with respect to the body assembly (BA) of a Model 964 are not underscored; i.e. (32). Reference with respect to the positioner is in double parentheses; i.e. ((AP)).
5. **Special care must be exhibited when rotating the stem (3) of the valve to not mar that portion of the surface of the stem (3) where it contacts with the packing (6).** To rotate the stem (3), use the jam nuts (18) or grasp stem with soft-jawed pliers. **NOTE:** *When using the jam nuts (18) to rotate the stem (3), use the upper jam nut to rotate the stem CW, and the lower jam nut to rotate the stem CCW, when viewed from above valve stem.*

6. Hereafter, whenever text has the following notation, “(Note PA.)”, the following text is to be applied;

“For ATO-FC reverse action units, connect a temporary air source to the actuator and pressurize to a level sufficient to initiate travel to approximately mid-stroke.

7. Hereafter, whenever text has the following notation, “(Note RP.)”, the following text is to be applied:

“For ATO-FC reverse action units, release all temporary air pressure.

B. Actuator Removal:

1. Secure the body (1) in a vise with the actuator assembly (AA) oriented vertically. Place matchmarks between the body (1) bonnet flange, the bonnet (2) flange, and the yoke (3) to assist in final orientation when the body is disassembled and/or the actuator removed. If actuator has handwheel - see Actuator IOM for removal instructions.
2. **(Note PA.)** Using blunt end tool, hammer rap the tool to loosen yoke nut (29) turning CCW (viewed from above) approximately 2 revolutions. Secure the actuator stem (6). Loosen the stem jam nuts (18) by rotating CW (viewed from above) one-at-a-time to base of stem (3) threads.
3. Fully loosen any accessory devices that are connected to the stem (6) or (3) such as accessory plate ((AP)) for positioner.
4. Loosen packing (6) by rotating nuts (15) CCW 2-3 revolutions. **(Note RP.)**

NOTE: To fully disengage the actuator stem (6) from the plug/stem (3) is a two-step procedure. Be aware of the valve's stroke length as indicated on the nameplate (40) before beginning disengagement. During the disengagement, measure the distance extended, and stay at least 1/8" (3 mm) away from the full stroke length. Count and record the number of revolutions for each step in the box below:

For Steps 5 and 6: Count the number of revolutions to disengage plug/stem from actuator stem:	
Step A. _____	Step B. _____
TOTAL: _____	

5. For ATO-FC Reverse Action Units:

- a. **(Note PA.)**
- b. **Step A.** Rotate plug/stem (3) CW (viewed from above) to disengage the actuator stem (6) from the plug/stem (3), while holding the actuator stem (6). Record the number of plug/stem revolutions for Step A above. When the disengagement reaches about 50% of full stroke travel Step A is completed. **(Note RP)**.
- c. **Step B.** Support the actuator assembly (AA) from above. Fully loosen yoke nut (29). Lift the actuator assembly (AA) upwards approximately 1/4"-3/8" (6-8 mm). Again, rotate plug/stem (3) CW (viewed from above) to disengage the actuator stem (6) from the plug/stem (3) while holding the actuator stem (6). Record the number of plug/stem (3) revolutions for Step B above. This should allow the stems (6) (3) to fully disengage.

NOTE: Take notice of the parts "dangling loosely" about the plug/stem (3), the order of their location and their proper orientation.

- d. Fully raise the actuator assembly (AA) from the valve body assembly (BA). Remove cautiously to prevent dangling parts - position indicating washer (26), accessory plate ((AP)), yoke nut (29) - from falling.

6. For ATC-FO Direct Action Units:

- a. **Step A.** Rotate plug/stem (3) CW (viewed from above) to disengage the actuator stem (6). Do not rotate the plug (3) into the seat (11). Record the number of plug/stem (3) revolutions for Step A above. When the disengagement reaches about 75% of full stroke travel, Step A. is completed.
- b. **Step B.** Support the actuator assembly (AA) from above. Fully loosen yoke nut (29) and remove. Lift the actuator assembly (AA) upwards approximately 1/4" - 3/8" (6-8 mm). Again, rotate plug/stem (3) CW (viewed from above) to disengage the actuator stem (6) from the plug/stem (3), while holding the actuator stem (6). Record the number of plug/stem revolutions for Step B. This should allow the stems (6) (3) to fully disengage.

NOTE: Take notice of the parts "dangling loosely" about the stem (3), the order of their location and their proper orientation.

- c. Fully raise actuator assembly (AA) from the valve body assembly (BA). Remove cautiously to prevent dangling parts - position indicating washer (26), accessory plate ((AP)), yoke nut (29) - from falling.

C. Actuator Replacement:

1. Secure body assembly (BA) in a vise with the plug/stem (3) oriented vertically. Push plug/stem (3) down until the plug touches the seating surface in the body.
2. Secure the actuator assembly (AA) from above. Use matchmarks from B.1. previous to assist with (BA) and (AA) alignment.
3. This procedure assumes that the bonnet (2) has been bolted to the body (1), with stem jam nuts (18) threaded on the plug/stem (3).
4. Lower actuator assembly (AA) until the plug/stem (3) penetrates the opening in the yoke (3). Reposition the "dangling parts" - yoke nut (29), accessory plate ((AP)) or indicating washer (26) - over threaded end of plug/stem (3). Continue to lower the actuator assembly (AA) until there is approximately 1/4" (6 mm) space between the two stems (6) (3).

5. **For ATC-FO:** Connect a temporary air supply hose that has an adjustable airset with gauge to the actuator inlet to allow pressurization. Slowly pressurize actuator to bring the actuator stem (6) to within 1/8" (3 mm) of reaching the plug/stem (3).
6. With hand lift plug/stem (3) up to touch actuator stem (6). Rotate plug/stem (3) CCW (viewed from above) to engage with actuator stem (6). Use the total number of revs engagement recorded in Step V.B. as the guide to control engagement of the stems (6) (3). While engaging, rotate yoke nut (29) as able to help stabilize topworks, continue to pressurize the actuator in 2-3 psi (.15-.20 Bar) increments in an alternating sequence with the distance engaged until the total number of revs engaged is reached.
7. Hand-tighten yoke nut (29) until fully positioned with the yoke (3) sitting on the bonnet (2).
8. Secure "dangling parts" - accessory plate ((AP)) and indicating washer (26) - to actuator stem (6) with stem jam nuts (18).
9. Hammer rap yoke nut (29) until tight. (Release temporary air source.)

D. Trim Removal and Replacement:

1. Secure body (1) assembly (BA) in a vise with actuator assembly (AA) directed upwards. Place match marks between the body (1) and the bonnet (2).
2. Secure the actuator assembly (AA) with an overhead support capable of vertical lift.
3. **(Note PA.)** Loosen all bonnet stud nuts (17) (four nuts for 1/2" through 1-1/2" sizes; six nuts for 2" size).
4. Ensure actuator support is "taut"; i.e. holding weight of actuator.
5. Remove all bonnet bolting nuts (17).
6. Lift the actuator assembly (AA), together with bonnet (2) and stem assembly (3) vertically out of the valve body (1). Lay the topworks assembly down onto a work bench horizontally. For 1/2" - 1-1/2" sizes, remove the cage (10) and seat ring (11) from the body (1) cavity.
7. From the topworks assembly, loosen the stem

jam nuts (18) by rotating CCW (viewed from plug end) while securing the actuator stem (6) with soft-jawed pliers.

8. Loosen stem packing (6) by turning nuts (15) CCW to a point just short of disengagement from the threads.
9. While securing the actuator stem (6) by soft-jawed pliers, rotate the valve stem assembly (3) CCW (viewed from plug end). Record the number of revolutions of disengagement in the box below:

Number of revolutions to disengage plug/stem assembly from actuator stem. _____

10. Remove packing flange nuts (15) with CCW rotation.
11. Partially withdraw plug/stem assembly (3). Remove position indicating washer (26), both jam nuts (18), packing flange (4), packing follower (5), and accessory plate ((AP)), if installed.
12. Fully withdraw stem/plug assembly (3). For 1/2" through 1-1/2" sizes, cage (10) may have come loose see Step 6 above.
13. Using a sharp, hooked-end, pick-type tool, hook and pull the packing rings (6) up and out of the bonnet's (2) packing bore individually. Discard old packing (6).

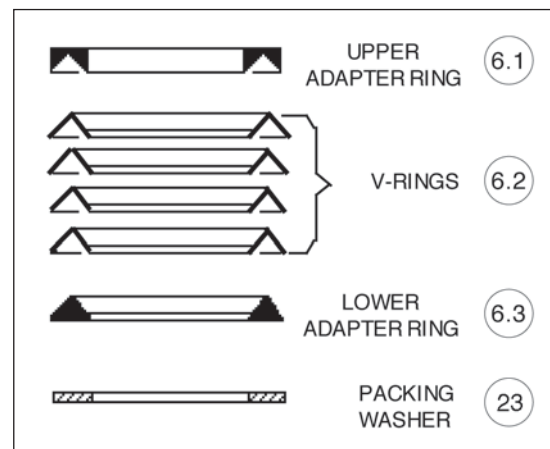
 **CAUTION**

Take extreme care to not mar internal wall surface of the bonnet (2).

14. Using a sharp pointed tool, remove packing washer (23) and packing spring (24).
15. Solvent clean all loose parts with suitable solvent and let dry.
16. **For SIZES 1/2" through 1-1/2"**, inspect guide bushing (8) in-place, as the bushing (8) is press fit into the bonnet (2). If worn badly or "scored":
 - a. Remove bonnet (2) by removing yoke nut (29).
 - b. Hydraulically press guide bushing (8) "out" of bonnet (2); press "in" new guide bushing (8).
 - c. Reinstall bonnet (2) back through yoke (3), and secure with yoke nut (29).

17. **For SIZE 2"**, inspect guide bushing (8) in place, as the bushing (8) is press fit into the bonnet (2). If worn or "scored":
 - a. Remove bonnet (2) by removing yoke nut (29).
 - b. Remove retaining ring (9).
 - c. Hydraulically press guide bushing (8) "out"; press "in" new guide bushing (8) into bonnet (2).
 - d. Replace retaining ring (9).
 - e. Reinstall bonnet (2) back together with actuator yoke (3), securing with yoke nut (29).
18. Examine cage (10), seat ring (11), plug/stem (3) seat insert (27), seat retainer (28) and gasket (13) for wear. Replace all worn parts. Refer to Figure 3 for correct orientation of composition seat parts.
19. Examine stem (3) in critical finish zone where contact is made with the packing (6). It is desirable to restore the surface of the stem (3) to a #8 Ra μ -in surface finish; metal removal should not exceed 0.001-inch material. A deeply scratched or pitted stem (3) should be replaced.
20. Plug head of stem (3) assembly for metal seated design may be hand lapped using suitable lapping compound. If hand lapping will not restore surface finish to an acceptable degree, replacement of stem (3) assembly and seat ring (11) is recommended.
21. Examine the inner surface of the bonnet's (2) packing bore. It is desirable to restore the surface of stuffing box to a #16 Ra μ -in surface finish; metal removal should not exceed 0.001-inch material. If inner surface is deeply scratched or pitted, bonnet (2) should be replaced.
22. Examine packing follower (5) for corrosion. Replace if significantly corroded. Remove follower bushing (25) from inside of packing follower (5) and replace with new.
23. Remove gasket (12) (13), clean gasket facing surfaces and replace with new gasket (12) (13).
24. Place seat ring (11) [and cage (10) - for sizes 1/2" - 1-1/2"] into the body (1) cavity. Insert the threaded end of stem (3) through bonnet (2) until it appears through the top side. Place bonnet on body. **(NOTE: The cage for 2" size is integral with bonnet (2).)**

25. **For SIZES 1/2" - 1-1/2"**, lower packing spring (24) into bonnet (2) packing bore.
For SIZE 2", first slide packing stop (7) into bonnet (2) packing bore followed by the packing spring (24).
26. Lower packing washer (23) into bonnet (2) packing bore. Ensure that washer (23) is resting flat on the packing spring (24).
27. Carefully place lower adapter (6.3) of packing ring set (6) over stem's (3) threaded end, properly oriented. Using the packing follower (5), push the lower adapter into the bonnet's (2) packing bore.



Packing Orientation

28. Carefully place a packing ring (6.2) properly oriented over the stem's (3) end and push into the packing bore similar to the adapter (6.3). Repeat process for balance of rings.
29. Carefully place upper adapter (6.1) over threaded end of stem (3).
30. Slide packing follower (5) with new follower bushing (25) over threaded end of stem.
31. Place packing flange (4) over end of stem (3) and over packing studs (14). Install both jam nuts (18) on stem and rotate to bottom of stem threads.
32. Slide indicating washer (26) and accessory plate ((AP)), if installed, over threaded end of stem (3).
33. Engage plug/stem (3) into actuator stem (6) per the same number of revolutions recorded per D. Step 9.
34. Rotate both jam nuts (18) up tight against position indicating washer (26).

35. Tighten packing nuts (15) evenly in ½ revolution increments, until the packing flange (4) is resting evenly on the upper edge of the bonnet (2) at the packing box. Snug both nuts (15) tightly.
36. Raise actuator assembly (AA). **(Note RP.)** Lower into body (1) over bonnet studs/bolts (16). Align with match marks.
37. For ATO-FC action units, wiggle the actuator assembly (AA) to assist in alignment.
38. For ATC-FO action units, pressurize actuator to the “higher” number of the bench set range indicated on nameplate (12) plus 2 psig (.14 Barg); for 5-15 psig (.34-1.03 Barg) bench setting, pressurize to 17 psig (1.17 Barg).

This should “lift” the bonnet (2) and “seat” the plug (3) firmly into the seat ring (11) for alignment purposes. Wiggle the actuator assembly (AA) to assist in alignment.

39. Wrench-tighten the bonnet bolting (16) (17) in an alternating cross-pattern in 1/4 revolution increments. Torque bonnet bolting to 30-35 ft/lbs (40-47 N-M) for sizes 1/2" - 1-1/2", and 50-55 ft/lbs (66-73 N-M) for size 2"
40. For ATC-FO action units, release actuator pressure.
41. Hammer rap yoke nut (29) tight.
42. Calibrate unit per Section VI.

SECTION VI

VI. CALIBRATION

A. General:

1. This section only covers calibration of the control valve with Actuator Models C27/C53.
2. Positioner, if installed, requires reference to the specific positioner model IOM for proper calibration procedure.
3. All indicated items numbers that are with respect to IOM-C27-C53 will be in parenthesis and underscored; i.e. (20); those that reference the positioner IOM will be in double parentheses; i.e. ((AP)). All item numbers that are with respect to this IOM-964 are not underscored; i.e. (3).

B. Procedure - Reverse Action, ATO-FC:

1. Reference the nameplate (40) attached to the actuator yoke (3). Determine the bench setting of the installed range springs (10) from the nameplate (40); i.e. 5-15 psig (.34 -1.0 Barg), or 15-60 psig (1-4.1 Barg).
2. Connect a temporary air supply with an in-line adjustable airset regulator and gauge to the lower actuator connection. See Section IV. A. 6. for appropriate supply pressure. **DO NOT LOAD** with any air pressure at this point.
3. To determine when stem/plug (3) begins to lift out of the seat, touch the stem above the packing studs with one finger. (Stem will begin

to move when actuator pressure exceeds the spring load.)

4. Slowly pressurize the actuator to a pressure equal to the lower pressure level of the bench setting; i.e. for a 5-15 psig (.34 -1.0 Barg) range, set pressure at 5 psig (.34 Barg). Take note of pressure reading when the stem first begins to move.
5. If the loading pressure for the start of stem movement **is below the lower end** of the desired bench setting, then the combined stem (3, 6) length is too short.
 - a. Rotate both jam nuts (18) down to base of threads on stem (3) and tighten together.
 - b. Increase pressure in the actuator to approximately mid range of the bench setting.
 - c. Rotate upper jam nut CW to increase the combined stem length. **DO NOT** allow actuator stem (6) to rotate in the actuator.
 - d. Rotate upper jam nut CCW to hold indicating washer (26) up against stem (6).
 - e. Release all pressure from the actuator and repeat Step 4 previous.
6. If the loading pressure for the start of stem movement **is above the lower end** of the desired bench setting, then the combined stem (3, 6) length is too long.
 - a. Rotate both jam nuts (18) down to base of threads on stem (3) and tighten together.

- b. Increase pressure in the actuator to approximately mid range of the bench setting.
 - c. Rotate lower jam nut CCW to shorten the combined stem length. **DO NOT** allow actuator stem (6) to rotate in the actuator.
 - d. Rotate upper jam nut CCW to hold indicating washer (26) up against stem (6).
 - e. Release all pressure from the actuator and repeat Step 4 previous.
7. After the opening set point pressure has been established, rotate lower jam nut (18) CCW up tight under the upper jam nut.
 8. Release all pressure from the actuator.
 9. Examine the location of the indicating washer (26) to the "C" mark on the indicator plate (23), making sure to use the "top edge" of the indicating washer (26) as the reference point. Adjust indicator plate as needed.
 10. Increase pressure in the actuator until the indicating washer (26) is in alignment with the "O" mark on the indicator plate.
 11. To limit the up travel at the desired stroke length, rotate the travel stop nut (52) CW and secure to bottom of the attachment hub (4).
NOTE: *Secure the actuator stem (6) by the flats when rotating the travel stop nut.*
NOTE: *"Stroke" length is indicated on the nameplate (40), and is the distance between the "C" and "O" marks of the indicator plate (23).*
NOTE: *The proper calibration of the actuator/valve unit will occur when at the lower pressure level of bench setting, the valve plug (3) will just begin to travel from the "C" position. At the upper level of the bench setting, the actuator pressure should be within $\pm 8\%$ of the upper bench setting for the designed stroke length.*
 12. Release all pressure from actuator.

C. Procedure - Direct Action, ATC-FO:

1. Reference the nameplate (40) attached to the actuator yoke (3). Determine the bench setting of the installed range springs (10) from the nameplate (40); i.e. 5-15 psig (.34 -1.0 Barg), or 15-60 psig (1-4.1 Barg).
2. Connect a temporary air supply with an in-line adjustable airset regulator and gauge to the upper actuator connection. See Section IV. A. 6. for appropriate supply pressure. **DO NOT LOAD** with any air pressure at this point.
3. To determine when stem/plug (3) makes contact with the seat and travel stops, touch the stem above the packing studs with one finger. (Stem movement will stop when the plug engages the seat.)
4. Slowly pressurize the actuator to a pressure equal to the upper pressure level of the bench setting; i.e. for a 5-15 psig (.34 -1.0 Barg) range, set pressure at 15 psig (1.0 Barg). Take note of the pressure reading when stem travel actually stops.
5. If the loading pressure, when the stem movement stops, **is below the upper end** of the desired bench setting, then the combined stem (3, 6) length is too long.
 - a. Rotate both jam nuts (18) down to base of threads on stem (3) and tighten together.
 - b. Decrease pressure in the actuator to approximately mid range of the bench setting.
 - c. Rotate lower jam nut CCW to shorten the combined stem length. **DO NOT** allow actuator stem (6) to rotate in the actuator.
 - d. Rotate upper jam nut CW to hold indicating washer (26) up against stem (6).
 - e. Release all pressure from the actuator and repeat Step 4 previous.
6. If the loading pressure when the stem movement stops **is above the upper end** of the desired bench setting, then the combined stem (3, 6) length is too short.
 - a. Rotate both jam nuts (18) down to base of threads on stem (3) and tighten together.
 - b. Decrease pressure in the actuator to approximately mid range of the bench setting.
 - c. Rotate upper jam nut CW to increase the combined stem length. **DO NOT** allow actuator stem (6) to rotate in the actuator.
 - d. Rotate upper jam nut CCW to hold indicating washer (26) up against stem (6).
 - e. Release all pressure from the actuator and repeat Step 4 previous.
7. After the closed set point pressure has been established, rotate lower jam nut (18) CCW up tight under the upper jam nut.
8. Increase pressure in the actuator to the upper pressure level of the bench setting.
9. Observe the location of the indicating washer (26) to the "C" mark on the indicator plate (23), making sure to use the "top edge" of

the indicating washer (26) as the reference point. Adjust indicator plate as needed.

10. Slowly release air pressure in the actuator until the indicating washer (26) is in alignment with the "O" mark on the indicator plate.
11. To limit the up travel at the desired stroke length, rotate travel stop nut (52) CW and secure to bottom of the attachment hub (4).
NOTE: Secure the actuator stem (6) by the flats when rotating the travel stop nut.
NOTE: "Stroke" length is indicated on the nameplate (40), and is the distance between the "C" and "O" marks of the indicator plate (23).

NOTE: The proper calibration of the actuator/valve unit will occur when at the upper pressure level of bench setting, the valve plug (3) will be in the "C" position. At the lower level of bench set the actuator pressure should be within $\pm 8\%$ of the lower bench setting for the designed stroke length.

12. Release all pressure from actuator.

SECTION VII

VII. TROUBLE - SHOOTING GUIDE

1. Valve is "jumpy" in stroking.

Possible Causes	Remedies
A. Excess packing friction.	A1. Realign body - stem - actuator. A2. Packing follower too tight for optional packing designs. A3. Install positioner. A4. Increase bench set by changing to stiffer actuator range spring. Will require positioner if not installed. May require different airset.
B. Installed backwards.	B. Install per flow arrow.

2. Valve makes "screeching" noise.

Possible Causes	Remedies
A. Excess pressure drop.	A. Bring pressure drop within design limits.
B. Guide bushing wear.	B. Replace guide bushing.
C. Misalignment.	C. Realign body-stem-actuator.

3. Valve exhibits "excess" vibration.

Possible Causes	Remedies
A. Excess pressure drop.	A. Bring pressure drop within design limits.
B. Guide bushing wear.	B. Replace guide bushing.
C. Excessive cavitation in liquid service.	C1. Change operation parameters to relieve causes of cavitation. C2. Replace valve with valve equipped for cavitation control.
D. High outlet velocity.	D1. Reduce flow rate and/or pressure drop. D2. Use multiple valves in series or parallel. D3. Increase outlet pipe size.

4. Valve exhibits “excess” seat leakage.

Possible Causes	Remedies
A. Excess pressure drop.	A. Reduce pressure drop conditions.
B. Improper actuator bench setting.	B1. Calibrate actuator-to-valve. B2. Assure proper engagement of actuator stem-to-valve stem. Adjust as calibration dictates.
C. Metal seat design instead of composition seat design.	C. Convert valve to composition seat design.
D. Excess wear.	D1. Oversized valve operating too close to seat; go to reduced trim. D2. Incorporate stellite trim. D3. Incorporate stellite trim. D4. Remove particulate. D5. Possible excess cavitation in liquid service. Change operation parameters. Re-lap plug-seat surface.
E. Misalignment.	E. Realign body - stem - actuator.
F. Composition seat failure.	F1. Replace soft seat. F2. Remove "dirty" portion of fluid causing failure.
G. Seat ring gasket failure.	G. Replace seat ring gasket.

5. Premature packing leakage.

Possible Causes	Remedies
A. Over-temperature.	A1. Bring process temperature to 450°F (232°C) or less. A2. Remove insulation along bonnet; allow direct contact with ambient air.
B. Misalignment.	B. Realign body - stem - actuator.
C. Wear.	C1. Remove dirt/grit from fluid. C2. Reduce cyclic travel.
D. Improper design for applied service.	D1. Install alternate packing design.

6. Bonnet gasket leaking.

Possible Causes	Remedies
A. Improper bonnet bolting draw down.	A1. Replace gasket and draw down bolting evenly in a cross-pattern.

7. Body flange leakage.

Possible Causes	Remedies
A. Over-tightening flange bolting.	A1. Loosen bolting, replace gasket, reinstall new flange bolting. A2. Replace warped flanges.
B. Improper pipe supports and anchors.	B. Provide piping anchors and guides at control valve station. Restrain bending movements.

SECTION VIII

VIII. ORDERING INFORMATION

NEW REPLACEMENT UNIT vs PARTS "KIT" FOR FIELD REPAIR

To obtain a quotation or place an order, please retrieve the Serial Number and Product Code that was stamped on the metal name plate and attached to the unit. This information can also be found on the Bill of Material ("BOM"), a parts list that was provided when unit was originally shipped. (Serial Number typically 6 digits). Product Code typical format as follows: (last digit is alpha character that reflects revision level for the product).

□□□ - □□□ 7 - □□□□□□□□□□

NEW REPLACEMENT UNIT:

Contact your local Cashco, Inc., Sales Representative with the Serial Number and Product code. With this information they can provide a quotation for a new unit including a complete description, price and availability.

PARTS "KIT" for FIELD REPAIR:

Contact your local Cashco, Inc., Sales Representative with the Serial Number and Product code. Identify the parts and the quantity required to repair the unit from the "BOM" sheet that was provided when unit was originally shipped.



CAUTION

Do not attempt to alter the original construction of any unit without assistance and approval from the factory. All purposed changes will require a new name plate with appropriate ratings and new product code to accommodate the recommended part(s) changes.

NOTE: *Those part numbers that have a quantity indicated under "Spare Parts" in column "A" reflect minimum parts required for inspection and rebuild, - "Soft Goods Kit". Those in column "B" include minimum trim replacement parts needed plus those "Soft Goods" parts from column "A".*

If the "BOM" is not available, refer to the cross-sectional drawings included in this manual for part identification and selection.

A Local Sales Representative will provide quotation for appropriate Kit Number, Price and Availability.

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1/2"-1-1/2" Sizes MODEL 964

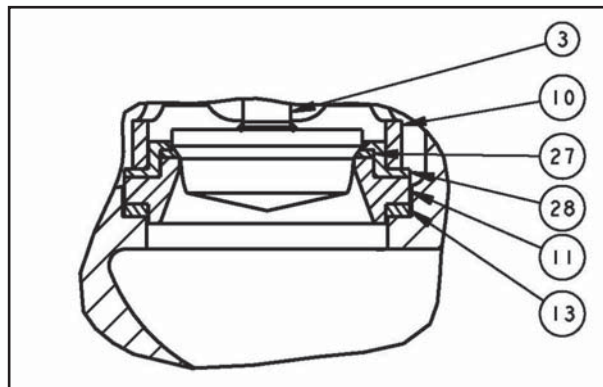
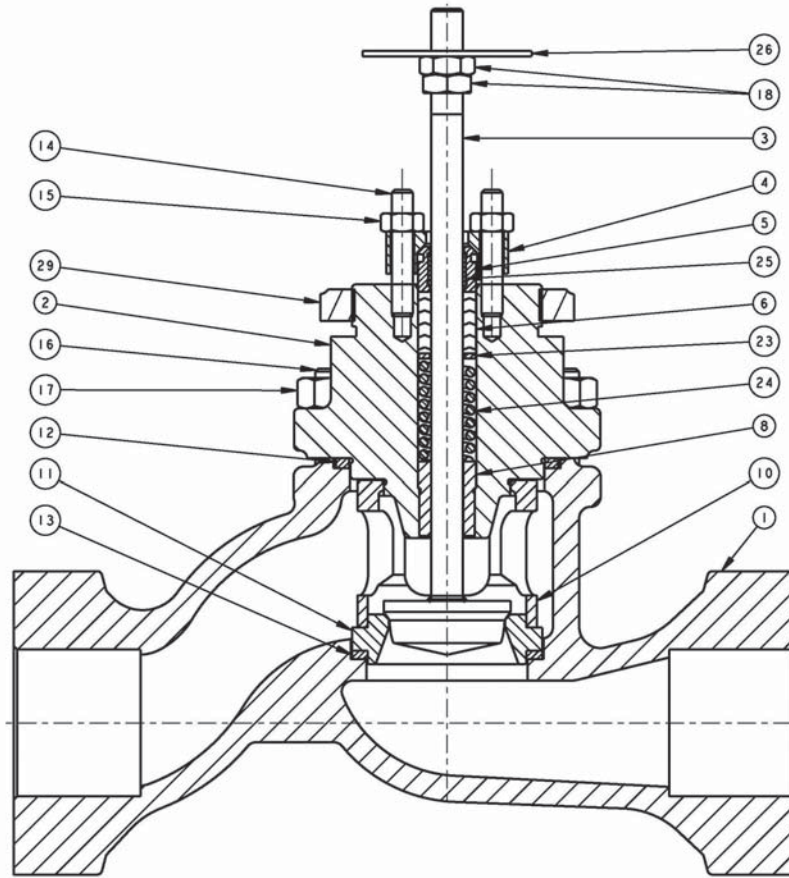
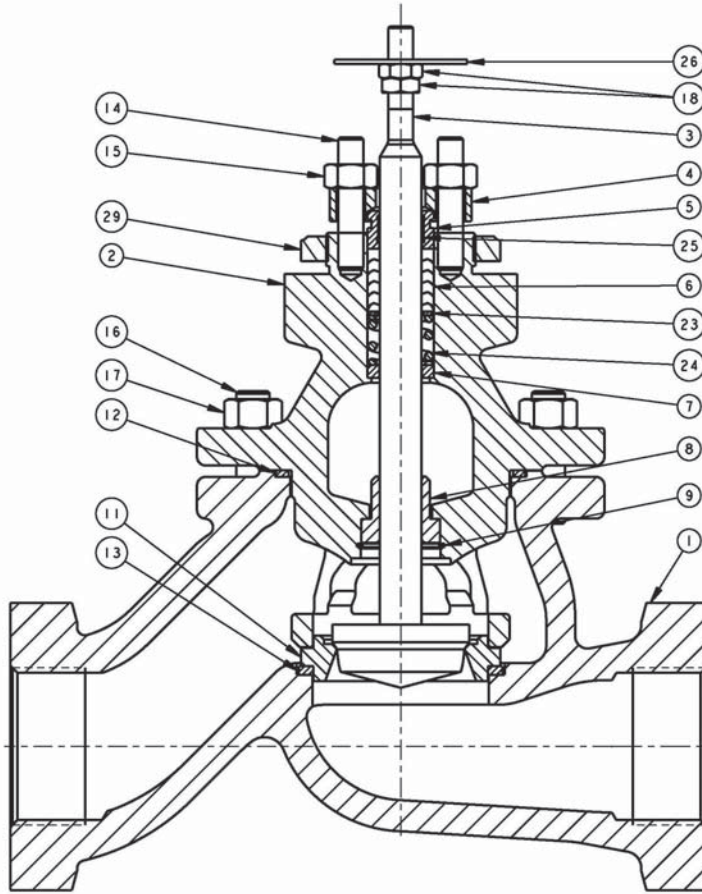


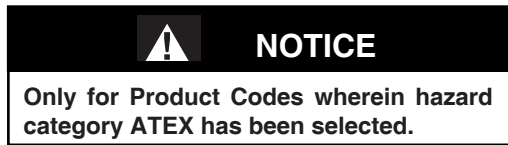
Figure 3: Composition Seat Arrangement

2" Size MODEL 964



<u>Item No.</u>	<u>Description</u>		<u>Item No.</u>	<u>Description</u>	
1	Body		14	Packing Flange Stud	
2	Bonnet		15	Packing Flange Nut	
3	Plug & Stem Subassembly	‡	16	Studs - Body	
4	Packing Flange		17	Stud Nuts	
5	Packing Follower		18	Jam Nuts	
6	Packing	‡	23	Packing Washer	
7	Packing Stop (2" Size only)		24	Packing Spring	
8	Guide Bushing		25	Packing Follower (Bushing)	
9	Retaining Ring (2" Size only)		26	Indicating Washer	
10	Cage		27	Seat Insert	‡
11	Seat Ring		28	Seat Retainer	
12	Gasket - Body	‡	29	Yoke Nut	
13	Gasket - Seat Ring	‡			
			‡	Recommended replacement parts.	

ATEX 94/9/EC: Explosive Atmospheres and Cashco Inc. Regulators



These valves satisfy the safety conditions according to EN 13463-1 and EN 13463-5 for equipment group IIG 2 c.

Caution: Because the actual maximum temperature depends not on the equipment itself, but upon the fluid temperature, a single temperature class or temperature cannot be marked by the manufacturer.

Specific Precaution to Installer: Electrical grounding of valve must occur to minimize risk of effective electrical discharges.

Specific Precaution to Installer: Atmosphere vent holes should be plugged to further minimize the risk of explosion.

Specific Precaution to Maintenance: The Valve Body/ Housing must be regularly cleaned to prevent buildup of dust deposits.

Specific Precaution to Maintenance: Conduct periodic Continuity Check between Valve Body/ Housing and Tank to minimize risk of electrical discharges.

Attention: When repairing or altering explosion-protected equipment, national regulations must be adhered to. For maintenance and repairs involving parts, use only manufacturer's original parts.

ATEX requires that all components and equipment be evaluated. Cashco pressure regulators are considered components. Based on the ATEX Directive, Cashco considers the location where the pressure regulators are installed to be classified Equipment-group II, Category 3 because flammable gases would only be present for a short period of time in the event of a leak. It is possible that the location could be classified Equipment-group II, Category 2 if a leak is likely to occur. Please note that the system owner, not Cashco, is responsible for determining the classification of a particular installation.

Product Assessment

Cashco performed a conformity assessment and risk analysis of its pressure regulator and control valve models and their common options, with respect to the Essential Health and Safety Requirements in Annex II of the ATEX directive. The details of the assessment in terms of the individual Essential Health and Safety Requirements, are listed in Table 1. Table 2 lists all of the models and options that were evaluated and along with their evaluation.

Models and options not listed in Table 2 should be assumed to not have been evaluated and therefore should not be selected for use in a potentially explosive environment until they have been evaluated.

Standard default options for each listed model were evaluated even if they were not explicitly listed as a separate option in the table. Not all options listed in the tables are available to all models listed in the tables. Individual TB's must be referenced for actual options.

When specifying a regulator that is to be used in a potentially explosive environment one must review the evaluations in Table 1 and 2 for the specific model and each and every option that is being specified, in order to determine the complete assessment for the unit.

A summary of the models and options found to have an impact on ATEX assessment due to potential ignition sources or other concerns from the ATEX Essential Health and Safety Requirements, are listed below.

1. The plastic knob used as standard on some models, (P1, P2, P3, P4, P5, P7, 3381, 4381, 1171, and 2171) is a potential ignition source due to static electricity. To demonstrate otherwise, the knob must be tested to determine if a transferred charge is below the acceptable values in IEC 60079-0 Section 26.14 (See items 25, 27, and 28 in Appendix A). Until the plastic knob has been shown to be acceptable, then either the metal knob option, or a preset outlet pressure option is required to eliminate this ignition source (See items 45 and 64 in Tables).
2. The pressure gauges offered as options on a few of the regulator models (DA's, P1-7, D, 764, 521), use a plastic polycarbonate window that is a potential ignition source due to static electricity. To demonstrate that the gauges are not a potential source of ignition, the gauges would need to be tested to determine if a transferred charge is below the acceptable values in IEC 60079-0 Section 26.14 or the pressure gauge supplier must provide documentation indicating the gauge is compliant with the ATEX Directive (See items 26, 27, and 28 in Appendix A). Until compliance is determined, regulators should not be ordered with pressure gauges for use in potentially explosive environments.

3. Tied diaphragm regulators with outlet ranges greater than 100 psig should be preset to minimize the risk that improper operation might lead to an outboard leak and a potentially explosive atmosphere (See item 6 in Table 1).
4. Regulators must be ordered with the non-relieving option (instead of the self-relieving option) if the process gas they are to be used with is hazardous (flammable, toxic, etc.). The self-relieving option vents process gas through the regulator cap directly into the atmosphere while the non-relieving option does not. Using regulator with the self-relieving option in a flammable gas system could create an explosive atmosphere in the vicinity of the regulator.
5. Regulators with customer supplied parts are to be assumed to not have been evaluated with regard to ATEX and thus are not to be used in a potentially explosive environment unless a documented evaluation for the specific customer supplied parts in question has been made. Refer to Table 1 for all models and options that have been evaluated.

Product Usage

A summary of ATEX related usage issues that were found in the assessment are listed below.

1. Pressure regulators and control valves must be grounded (earthed) to prevent static charge build-up due to the flowing media. The regulator can be grounded through any mounting holes on the body with metal to metal contact or the system piping can be grounded and electrical continuity verified through the body metal seal connections. Grounding of the regulator should follow the same requirements for the piping system. Also see item 30 in Table 1.
2. The system designer and users must take precautions to prevent rapid system pressurization which may raise surface temperatures of system components and tubing due to adiabatic compression of the system gas.
3. Heating systems installed by the user could possibly increase the surface temperature and must be evaluated by the user for compliance with the ATEX Directive. User installation of heating systems applied to the regulator body or system piping that affects the surface temperature of the pressure regulator is outside the scope of this declaration and is the responsibility of the user.
4. The Joule-Thomson effect may cause process gases to rise in temperature as they expand going through a regulator. This could raise the external surface temperature of the regulator body and downstream piping creating a potential source of ignition. Whether the Joule-Thomson effect leads to heating or cooling of the process gas depends on the process gas and the inlet and outlet pressures. The system designer is responsible for determining whether the process gas temperature may rise under any operating conditions. If a process gas temperature rise is possible under operating conditions, then the system designer must investigate whether the regulator body and downstream piping may increase in temperature enough to create a potential source of ignition.

The process gas expansion is typically modeled as a constant enthalpy throttling process for determining the temperature change. A Mollier diagram (Pressure – Enthalpy diagram with constant temperature, density, & entropy contours) or a Temperature – Entropy diagram with constant enthalpy lines, for the process gas, can be used to determine the temperature change. Helium and hydrogen are two gases that typically increase in temperature when expanding across a regulator. Other gases may increase in temperature at sufficiently high pressures.

Product Declaration

If the above issues are addressed by selecting options that do not have potential sources of ignition, avoiding options that have not been assessed, and by taking the proper usage issue precautions, then Cashco regulators can be considered to be a mechanical device that does not have its own source of ignition and thus falls outside the scope of the ATEX directive.

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