



ISO Registered Company

# MODEL 2296 / 2296HF

## GLOBE-STYLE, PNEUMATIC OR ELECTRIC ACTUATED CONTROL VALVE BODY IOM SECTION I

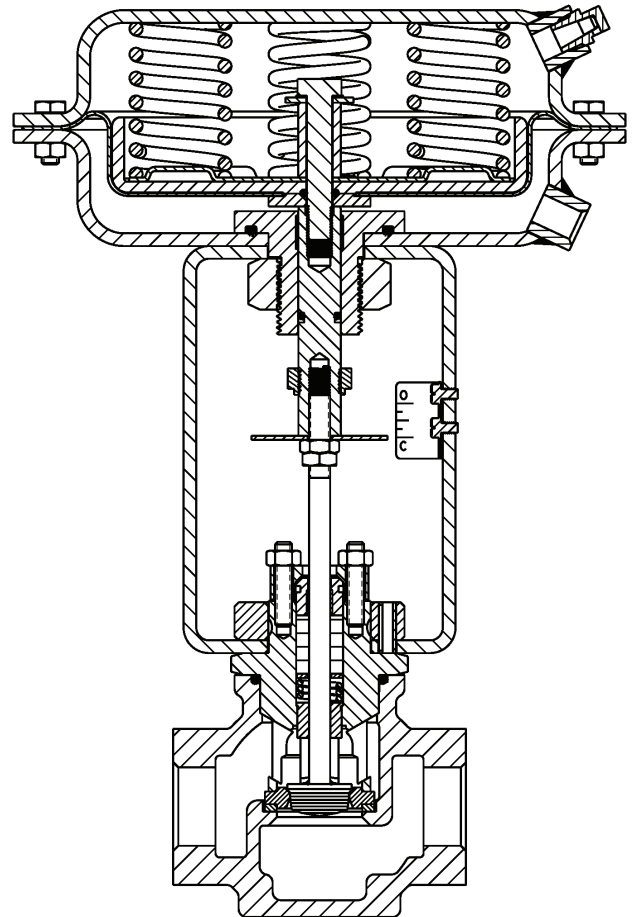
### I. DESCRIPTION AND SCOPE

The Model 2296 / 2296HF is a sliding stem, globe-style control valve. Can be supplied with either a pneumatic actuator or an electric actuated actuator. Available in Cast Bronze or 316L SST body material, in sizes 1/2" - 2" (DN15 - DN50). Model 2296HF is available in Cast Bronze body material and only in sizes 1-1/2" and 2" (DN40-DN50). Internal design is a "push down to close" arrangement.

Failure position is determined by actuator. For: "D" = Direct action; an increasing actuator signal will extend the stem. Fail-safe position is with the stem retracted.

"R" = Reverse action; an increasing actuator signal will retract the stem. Fail-safe position is with the stem extended.

This valve is designed to control general service through moderately corrosive applications, but may be applied in cryogenic applications also.



Model 2296

### SECTION II

### II. REFERENCE

Refer to Technical Bulletin 2296-TB for complete technical specifications of a Model 2296 coupled with either Cashco Actuator Model C27 or C53 or Rotork Actuator Model CML-750 or CVL-1500.

[www.cashco.com/product/77](http://www.cashco.com/product/77)

Refer to following Installation, Operation & Maintenance Manuals (IOM's) for either actuator and/or devices that may be mounted to a Model 2296:

C27 / C53 : <http://www.cashco.com/product/1>

Rotork: [www.rotork.com/en/product/index/cvilinear](http://www.rotork.com/en/product/index/cvilinear)  
[www.rotork.com/en/product/index/cmlilinear](http://www.rotork.com/en/product/index/cmlilinear)

### 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
SST	-	Stainless Steel
V	-	Vent

## SECTION III

### III. INSTALLATION

#### A. Orientation:

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

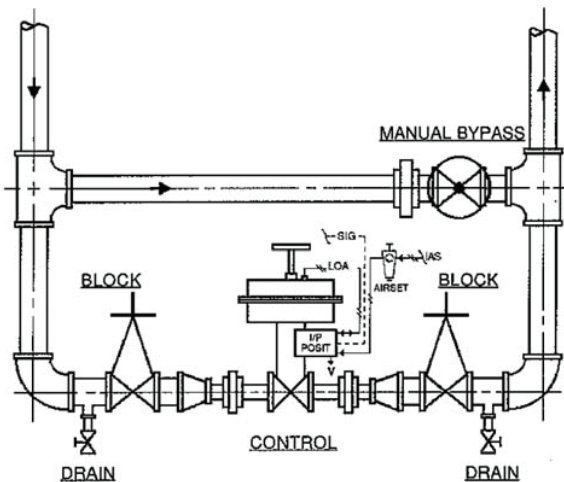


Figure 1: System Pipeline Drains

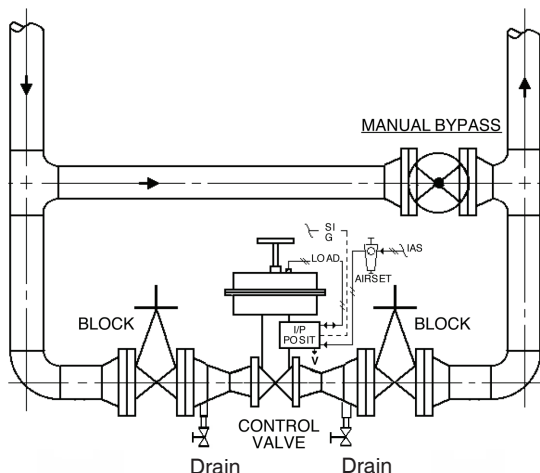


Figure 2: Control Valve Drain Locations

2. Pipe unions are recommended for NPT screwed installations to allow complete removal from system.
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 2296 / 2296HF, is acceptable. If hydro test pressure exceeds the 1-1/2 x CWP limit, the 2296 / 2296HF must be removed for such testing. Before pressurization, the valve plug should be lifted from the seat if of ATO-FC action.
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 body.
8. For best performance, install in well drained horizontal pipe, properly trapped if a steam service application.

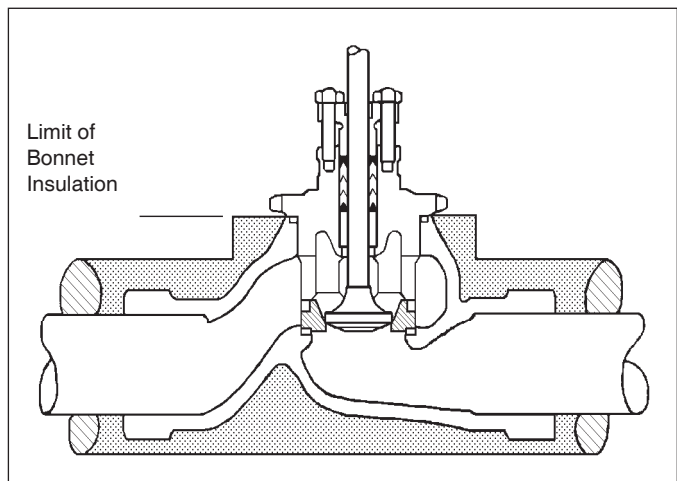


Figure 3: Body Insulation

9. Valves are not to be direct buried underground.
10. Insulation may be applied as indicated in Figure 3. Drainage away from the packing area must be ensured when fully installed, sealed and lagged for outdoors installation.
11. Undue piping stress/strain or bending torques may not be transmitted through the control 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 (C27 / C53 Actuators Only):**

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.

**NOTE:** Please refer to Rotork IOM for required electrical supply.

**SECTION IV**

**IV. STARTUP**

**A. General:**

1. Ensure that the Model 2296 / 2296HF 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 2.
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. For C27/C53 actuators, continue to Step 4. Refer to Rotork website for electric actuators, then continue to Step 7.
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.
8. Confirm the 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.

**CAUTION**

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

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 thru 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 nonreusable parts, i.e. gaskets, suitable solvents, etc.
3. General service valves supplied from the factory do not require use of any gasket sealant. (See below for "oxygen cleaned" valves.)
4. Valves originally supplied in accordance with Option-55 require special cleaning procedures. Refer to Cashco Specification No. S-1134 for details. When in compliance with Spec. #S-1134, the valve is suitable for oxygen service. Sealants and lubricants used in reassembly of a valve unit for use in oxygen service MUST be suitable for O<sub>2</sub> service.
5. 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) are not underscored; i.e. (32). Reference with respect to the positioner is in double parentheses; i.e. ((AP)).
6. **Special care must be exhibited when rotating the plug stem (4) in the body to not mar that portion of the surface of the stem (4) where it contacts with the packing (10). To rotate the stem use the jam nuts (17) or grasp**

stem with soft-jawed pliers. **NOTE:** When using the jam nuts (17) to rotate the stem (4), use the upper jam nut to rotate the stem CW, and the lower jam nut to rotate the stem CCW, when viewed from above the valve stem.

7. Hereafter, whenever text has the following notation, "(Note PA.)", the following text is to be applied:

**"For C27/C53 ATO-FC units ONLY, connect a temporary air source with gauge to the actuator and pressurize to a level sufficient to initiate travel to approximately mid-stroke."**

8. Hereafter, whenever text has the following notation, "(Note RP.)", the following text is to be applied:

**"For C27/C53 ATO-FC units ONLY, release all temporary air pressure."**

9. Hereafter, whenever text has the following notation, "(Note EL.)", the following text is to be applied:

**"For all Electric Actuators, set stem at half stroke per Rotork IOM."**

#### B. Actuator Removal:

1. Secure the body assembly (BA) in a vise with the actuator assembly (AA) oriented vertically. Place matchmarks between the body (1) and bonnet (2) flange, (for 2" size); mark the yoke (3) to assist in final orientation when the body is disassembled and/or the actuator removed.
2. **(Note PA.)** or **(Note EL.)** Using blunt end tool, hammer rap the tool to loosen yoke nut (15) turning CCW (viewed from above) approximately 2 revolutions. Secure the actuator stem (6). Loosen the stem jam nuts (17) by rotating CW (viewed from above) one-at-a-time until rotation stops.

3. Fully loosen any accessory devices that are connected to the stem (6) or (4) such as accessory plate ((AP)) for limit switch or positioner.
4. Loosen stem packing (10) by turning nuts (21) CCW 2-3 revolutions. **(Note RP.)**

**NOTE:** To fully disengage the actuator stem (6) from the plug/stem (4) 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:

No. of revolutions to disengage valve stem from actuator stem:	
Step A. _____	Step B. _____
TOTAL: _____	

**5. For ATO-FC Reverse Action Units:**

- a. **(Note PA.)**
- b. Step A. Rotate valve stem (4) CW (viewed from above) to disengage the actuator stem (6) from the plug/stem (4), while holding the actuator stem (6). Count and record the number of valve stem revolutions for Step A above. When the disengagement reaches about 50% of full stroke travel, **(Note RP.)**. Step A is completed.
- c. Step B. Support the actuator assembly (AA) from above. Fully loosen yoke nut (15). Lift the actuator assembly (AA) upwards approximately 1/4"-3/8" (6-8 mm). Again, rotate valve stem (4) CW (viewed from above) to disengage the actuator stem (6) from the plug/stem (4) while holding the actuator stem (6). Count and record the number of valve stem revolutions for Step B above. This should allow the stems (6) (4) to fully disengage.

**NOTE:** Take notice of the parts "dangling loosely" about the stem (4), 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 (16), accessory plate ((AP)), yoke nut (15) - from falling.

**6. For ATC-FO Direct Action Units:**

- a. Step A. Rotate valve stem (4) CW (viewed from above) to disengage the actuator stem (6). **DO NOT** rotate the plug/stem (4) down into the seating surface. Count and record the number of plug/stem (4) 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 (15). Lift the actuator assembly (AA) upwards approximately 1/4" - 3/8" (6-8 mm). Again, rotate plug/stem (4) CW (viewed from above) to disengage the actuator stem (6) from the plug/stem (4), while holding the actuator stem (6). Count and record the number of plug/stem revolutions for Step B. This should allow the stems (6) (4) to fully disengage.

**NOTE:** Take notice of the parts "dangling loosely" about the stem (4), the order of their location, and their proper orientation.

- c. Fully raise the actuator assembly (AA) from the valve body assembly (BA). Remove cautiously to prevent dangling parts - position indicating washer (16), accessory plate ((AP)), yoke nut (15) - from falling.

**7. For Electric Actuator Units:**

- a. **(Note EL.)**
- b. Step A. Rotate valve stem (4) CW (viewed from above) to disengage the actuator stem from the plug/stem (4), while holding the actuator stem. Count and record the number of valve stem revolutions for Step A above. When the disengagement reaches about 50% of full stroke travel. Step A is completed.
- c. Step B. Support the actuator assembly (AA) from above. Fully loosen yoke nut (15). Lift the actuator assembly (AA) upwards approximately 1/4"-3/8" (6-8mm). Again, rotate valve stem (4) CW (viewed from above) to disengage the actuator stem from the plug/stem (4) while holding the actuator stem. Count and record the number of valve stem revolutions for Step B above. This should allow the stems (4) to fully disengage.

**NOTE:** Take notice of the parts “dangling loosely” about the stem (4), 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 (16), accessory plate ((AP)), yoke nut (15) - from falling.

### C. Actuator Replacement:

1. Secure body assembly (BA) in a vice with the plug/stem (4) oriented vertically. Push plug/stem (4) down until the plug touches the seating surface in the body (1).
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 installed to the body (1), with stem jam nuts (17) on the plug/stem (4). **(Note PA.), (Note EL.)**
4. Lower actuator assembly (AA) until the plug/stem (4) penetrates the opening in the yoke (3). Reposition the “dangling parts” - yoke nut (15), accessory plate ((AP)) and indicating washer (16) - over the plug/stem (4). Continue to lower the actuator assembly (AA) until there is approximately 1/4" (6 mm) space between the two stems (6) (4).
5. **For C27/C53 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 be within 1/8" (3 mm) of contacting the plug/stem (4).
6. With hand, lift stem (4) up to touch actuator stem (6). Rotate plug/stem (4) CCW (viewed from above) to engage w/ actuator stem (6). Use the total number of revs engagement recorded in Step V.B.4. as the guide to control engagement of the stems (6) (4). While engaging the stems, rotate yoke nut (15) 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 (15) until fully positioned with the yoke (3) sitting on the bonnet (2).

## CAUTION

It sometimes occurs that the seat ring (3), cage (19), and seat ring gasket (5) will “stick” to the bonnet (2) or cage (19), and pull out with parts of this step above. **DO NOT ALLOW THE SEAT RING (3) OR CAGE (19) TO DROP and do personal injury or deform parts (3, 19)!**

8. Secure “dangling parts” - accessory plate ((AP)) and indicator washer (16) - to actuator stem (6) with stem jam nuts (17).
9. For 1/2"-1-1/2" sizes, tighten screws (14); For 2" size, hammer rap yoke nut (15) until tight. **For C27/C53, release temporary air source.**

### D. Trim/Packing Removal and Replacement:

**NOTE:** This Subsection assumes that the actuator subassembly (AA) has been already removed per Sub-section B. previous.

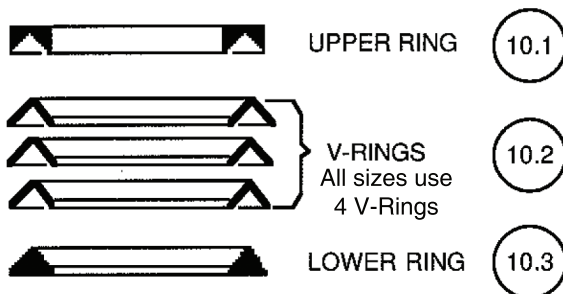
1. Secure (BA) in a vise with the plug/stem (4) pointing upwards. Place matchmarks between the body (1) and bonnet (2).
2. Pull plug/stem (4) upwards. Hold stem (4) up if necessary using soft-jawed locking pliers.
3. Sizes 1/2" – 1-1/2":
  - a. Using a smooth jaw wrench, loosen bonnet (2) from the body (1) by rotating CCW (viewed from above). It may be necessary to hammer-rap the wrench to break the bonnet (2) loose. Remove bonnet (2) from body (1).
  - b. Lift the bonnet (2) (with integral cage), stem (4), stem guide bushing (12), and all the stem packing components (10,11,20,21,23,25,26,29) directly upwards and out of the body (1) cavity, ensuring not to damage the threaded portion of the body (1)-to-bonnet (2) joint. Lay this partial assembly aside.
  - c. Remove o-ring/gasket (6).
4. Size 2":
  - a. Loosen & remove 4 body stud nuts (28).
  - b. Carefully wiggle plug/stem (4) side-to-side to loosen bonnet (2) from body (1) and cage (19). Lift the bonnet (2) directly upwards along with stem (4), stem guide bushing (12), and all the stem packing components (10,11,20,21,23,25,26,29). Lay this assembly aside.
  - c. Remove cage (19) from body (1) cavity by lifting upwards.
  - d. Remove bonnet gasket (6).

- Remove seat ring (3), gasket (5) from body cavity.

**NOTE: - For Composition (Soft) Seated Trim-**  
Remove seat retainer (8) and seat insert (7).  
See Figure 5.

- Remove body (1) from vise and place in cleaning solvent.
- Place the bonnet (2) and packing assembly (4,10,11,12,20,21,23,25,26 & 29) into the vise with stem (4) directed upwards. **NOTE: Soft-jawed locking pliers is still clamped to stem (4).** Position the bonnet (2) with respect to the vise such that the plug end of the stem (4) can prevent the stem from falling out once the locking pliers are removed. Remove the soft-jawed locking pliers.
- Remove both packing stud nuts (21). Lift upwards to remove the packing flange (23), packing follower (11) and bushing (29).
- While holding the plug/stem (4) with your fingers to keep it from dropping, reorient the bonnet (2) within the vise to allow the stem (4) to be withdrawn out the bottom of the bonnet (2).
- Using a pick-end tool, extract packing rings (10) from within the bonnet's (2) packing box; discard packing rings (10). **NOTE: Four v-rings, plus an upper and lower ring make a set.**
- Rotate packing stud nuts (21) over end of packing studs (20) to prevent impact damage.
- Remove bonnet (2) with guide bushing (12) still in packing box from vise. Turn bonnet (2) upside down and allow washer (26), spring (25) and guide bushing (12) to slide out.

**NOTE: Guide bushing (12) is "pressed" into bonnet. If stuck in place, use a tool on the guide**



Packing Orientation

*bushing's (12) bottom end to push the guide bushing (12) out.*

- Place all metallic parts in cleaning solvent. Remove parts and allow to dry or wipe clean. Dispose of solvent or solvent soaked rags/towels according to Owner's procedures.
- Inspect the stem (4) OD and the guide bushing (12) ID in the areas exposed to wear. Replace all parts showing wear or axial scratches/grooves on the stem (4). It is recommended that the guide bushing (12) also be replaced if the stem (4) shows scratches/grooves.
- Inspect seating surfaces of stem & seat:
  - Examine plug head (4) at location where plug (4) seats to seat ring (3). Closely examine these parts (3, 4) for any wire drawing. Replace soft seat insert (7) and both stem (4) and seat ring (3) whenever one or the other shows any signs of wear.
  - For metal seat - use a small amount of diamond lapping compound and gently hand-lap the plug (4) to the seat ring (3),
- Recondition interior surface of bonnet's (2) packing box bore to an 8 micro-inch Ra finish where OD of the packing rings (10) seal.
- Press guide bushing (12) back in the bonnet- **small O.D. end first.**
- Place bonnet (2) into a vise positioned to allow bottom insertion of stem (4) assembly.
- Put TFE thread sealant tape over upper end of stem (4). Insert stem (4) upwards thru the bonnet (2) until the plug-end (4) touches the bonnet (2). Loosen vise and reposition bonnet (2) to prevent stem (4) from dropping out the bottom of the bonnet (2). Retighten vise.
- Place spring (25) and washer (26) over end of stem and into bonnet (2) cavity.
- Insert lower ring (10.3) over upper end of stem (4) and push into bonnet's (2) packing box. Use a hollow tool or packing follower (11) to press the lower ring (10.3) fully into place. Repeat for each of the packing v-rings (10.2) and the upper ring (10.1). **DO NOT INVERT PACKING RINGS (10).**
- Insert new tape bushing (29) inside the packing follower. Place the packing follower (11) properly oriented over the stem (4).

23. Remove both packing stud nuts (21).
24. Place the packing flange (23) properly oriented over the stem (4) and packing studs (20) down onto the packing follower (11).
25. Install packing stud nuts (21) onto the packing studs (20) and tighten nuts evenly such that the packing flange (23) rest tight against the bonnet (2).
26. Remove bonnet assembly from vise and lay aside.
27. Place body (1) into vise with cavity opening on top side.
28. Place seat ring gasket (5) into body (1) cavity.
29. See Figures 3A / 3B and 4 for proper seat ring (3) orientation into body (1) cavity.

**NOTE: - For Composition (Soft) Seated Trim-**  
Insert seat insert (7) and seat retainer (8).  
See Figure 5.

**30. 1/2" – 1-1/2" Body Sizes:**

- a. Place bonnet o-ring/gasket (6) into body (1) recess.
- b. Place thread lubricant/sealant Bostik Never Seez®, or equal, onto threaded portion of bonnet (2).
- c. Pull stem (4) upwards through the bonnet as far as possible. Packing (10) friction should hold the stem (4) up.
- d. Engage threaded male end of bonnet (2) into female threaded joint of body (1) cavity, ensuring not to cross-thread. Bonnet assembly should be rotated easily by hand; **DO NOT FORCE ENGAGEMENT WITH A WRENCH.**
- e. When the gap between the bonnet and body joint is approximately 1/4" (6mm), firmly press the stem (4) downwards to touch the seat ring (3). Lift stem (4) upwards and off of the seat ring (3) a minimum of 3/8" (10 mm).
- f. Continue engagement of bonnet (2)-to-body (1) until it is necessary to use a wrench to fully tighten. Hammer-rap the bonnet (2) tightening tool. Matchmarks of article C.1. should align, and bonnet (2) should be touching body (1) with no gap at joint.

**31. 2" Body Size:**

- a. Place cage (19) properly oriented into body (1) cavity and ensure that the bottom edge of the cage (19) shoulders onto seat ring (3) properly.
- b. Place bonnet o-ring/gasket (6) into body (1) recess.
- c. Pull stem (4) upwards through the bonnet as far as possible. Packing (10) friction should hold the stem (4) up.
- d. Observing location of matchmarks of article D.1., align bonnet (2) over the body studs (27) and lower the bonnet assembly downwards to the body (1). When the gap between the bonnet and body is approximately 1/4" (6mm) of the body (1), push the stem (4) downwards until the plug end of the stem (4) pushes against the seat ring (3). Continue lowering the bonnet (2) until it comes to rest on the bonnet gasket (6).
- e. Install body stud nuts (28) finger-tight on studs (27). In an alternating, crossing-pattern, and in 1/2 revolution increments, torque nuts (28) to 30-32 ft.-lbs. (40.6-43.4 N-m). **NOTE: Body (1)-to-bonnet (2) joint should be drawn together with no gap.**

32. Remove TFE thread sealant tape of D.19. previous.

33. Connect a temporary gaseous pressure supply ( minimum of 100 psig - 6.8 Barg) to both inlet and outlet body (1) connections simultaneously. Move stem (4) up and down manually a few times. Using leak-detection solution, check body (1)-to-bonnet (2) joint and stem packing (10) for leakage. Tighten packing stud nuts evenly as required to eliminate leakage.

34. Remove temporary gaseous supply pressure. and reassemble (BA) to (AA) per Section V.C.

**E. Cryogenic Construction-Opt.-36 (See Fig. 6):**

1. Maintenance for cryogenic construction valve – Option-5 or 36 – is similar to that of a standard unit, except that a cryogenic unit includes a wiper ring (24) with the packing flange (23).
2. Wiper ring (24) is located in the groove of the cryogenic packing flange (23), oriented on upper end of follower (11). See Fig. 6A or B.
3. The packing stud nuts (21) should be evenly tightened with a torque wrench to approximately 9.0 ft.- lbs. (12.2 N-m).



## SECTION VI

### VI. CALIBRATION

#### A. General:

1. This section only covers calibration of the control valve with Actuator Models C27/C53. Refer to Rotork IOM for Electric Actuators.
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 parentheses 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-2296 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 (4) 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 (4, 6) length is too **short**.
  - a. Rotate both jam nuts (17) down to base of threads on stem (4) 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 (16) 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 (4, 6) length is too **long**.
    - a. Rotate both jam nuts (17) down to base of threads on stem (4) and tighten together.
    - b. Increase pressure in the actuator to approximately mid range of the bench set.
    - 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 (16) 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 (17) CCW up tight under the upper jam nut.
  8. Release all pressure from the actuator.
  9. Examine the location of the indicating washer (16) to the "C" mark on the indicator plate (23), making sure to use the "top edge" of the indicating washer (16) as the reference point. Adjust indicator plate as needed.
  10. Increase pressure in the actuator until the indicating washer (16) 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" points of the indicator plate (23).*
  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 (4) 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 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 (4, 6) length is too long.
  - a. Rotate both jam nuts (17) down to base of threads on stem (4) 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 (16) 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 (4, 6) length is too short.

- a. Rotate both jam nuts (17) down to base of threads on stem (4) 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 (16) 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 (17) CCW up tight under the upper jam nut.
  8. Increase pressure in the actuator to the upper pressure level of the bench setting.
  9. Examine the location of the indicating washer (16) to the "C" mark on the indicator plate (23), making sure to use the "top edge" of the indicating washer (16) as the reference point. Adjust indicator plate as needed.
  10. Decrease pressure in the actuator until the indicating washer (16) 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" points 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 (4) will be in the "C" position. At the lower level of bench set the actuator pressure should be within ± 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 Cause	Remedy
A. Excess packing friction.	A1. Realign body–stem–actuator.
	A2. Install Positioner.
	A3. Increase bench.
B. Installed backwards.	B. Install per flow arrow.

2. Valve makes "screeching" noise.

Possible Cause	Remedy
A. Excess pressure drop.	A. Bring pressure drop within design limits.
B. Bushing wear.	B. Replace bushing and stem.
C. Misalignment.	C. Realign body-stem-actuator.

3. Valve exhibits "excess" vibration.

Possible Cause	Remedy
A. Excess pressure drop.	A. Bring pressure drop within design limits.
B. Bushing wear.	B. Replace bushing and stem.
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 in parallel. D3. Increase outlet pipe size.

4. Valve exhibits "excess" seat leakage.

Possible Cause	Remedy
A. Excess pressure drop.	A1. Reduce pressure drop conditions. A2. Convert to reduced trim.
B. Improper actuator bench setting.	B1. Calibrate actuator-to-valve. B2. Assure proper engagement of act.stem to valve stem.
C. Metal seat design instead of composition seat design.	C. Convert valve to composition seat.
D. Excess wear.	D1. Oversized valve operating too close to seat, convert to reduced trim. D2. Remove particulate. D3. Possible excess cavitation in liquid service, change operation parameters. D4. 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 Cause	Remedy
A. Over-temperature.	A1. Bring process temperature to 400° F (205° 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.	D. Install alternate packing design.
E. Corrosion of stem.	E. Consider use of Model 987 or 988 or 989.

6. Bonnet gasket leaking.

Possible Cause	Remedy
A. Loose threaded bonnet.	A. Re-tighten bonnet.
B. Improper bonnet draw down	B. Replace gasket and draw down bolting evenly in a cross-pattern.
C. Corrosion.	C. Consider use of Model 987 or 988 or 989.
D. Warped bonnet and/or body flange.	D. Replace body and/or bonnet and bonnet gasket. Draw down bonnet bolting evenly in a cross-pattern.

## 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).


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#### 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.

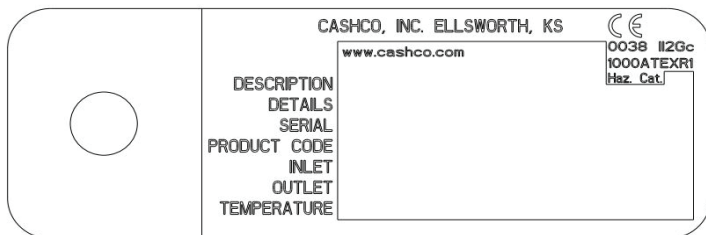
 **CAUTION**

**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".

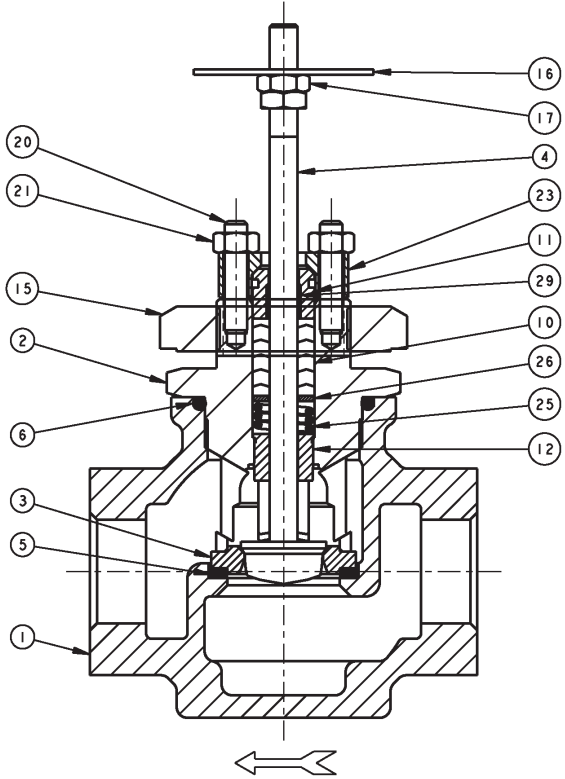
If the "BOM" is not available, refer to the cross-sectional drawings included in this manual for part identification and selection.

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

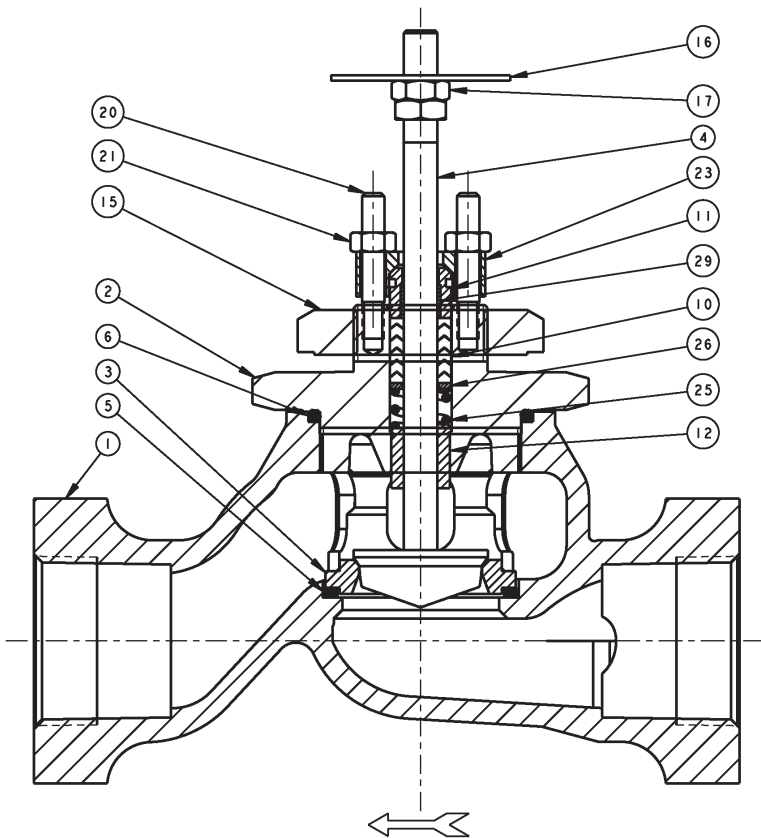


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**Figure 4A**  
**1/2" – 1-1/2" Body Sizes**  
**Metal Seat Design.**

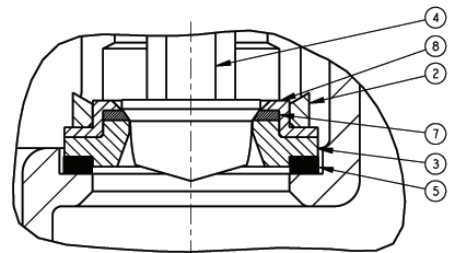


**Figure 4B**  
**1-1/2" HF Body Size**  
**Metal Seat Design.**



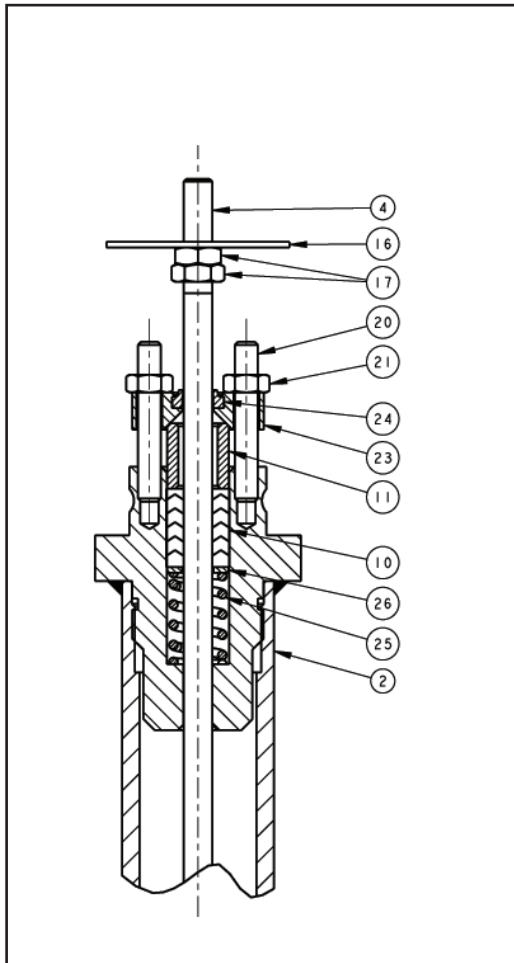
Item No.	Description	
1	Body	
2	Bonnet Or Extension Column	
3	Seat Ring	
4	Plug & Stem Subassembly	
5	Seat Ring Gasket	‡
6	Body O-Ring Or Body Gasket	‡
7	Seat Insert	‡
8	Seat Retainer	
10	Packing	
11	Packing Follower	‡
12	Stem Guide Bushing	
13	Spring Pin	
15	Yoke Nut	
16	Indicating Washer	
17	Stem Jam Nuts	
19	Cage (2" size only)	
20	Packing Stud	
21	Packing Stud Nut	
23	Packing Flange	
24	Wiper Ring	‡
25	Spring (Packing)	
26	Washer (Packing)	
27	Body Stud (2" size only)	
28	Body Stud Nut (2" size only)	
29	Bushing (Packing Follower)	

‡ Recommended replacement parts.

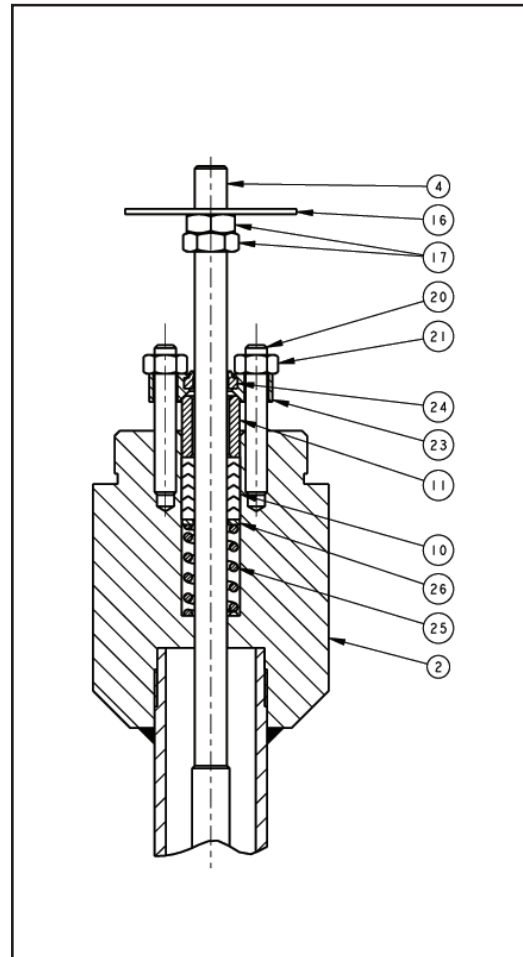


**Figure 5**  
**Composition Seat Design**

## Cryogenic Extension Column



**Fits 1/2" - 1-1/2" Sizes  
Figure 6A**



**Fits 2" Size  
Figure 6B**

<u>Item No.</u>	<u>Description</u>
2	Bonnet - Extension Column
4	Plug & Stem subassembly
10	Packing
11	Packing Follower
16	Indicating Washer
17	Stem Jam Nuts
20	Packing Studs
21	Packing Stud Nuts
23	Packing Flange
24	Wiper Ring
25	Spring (Packing) ‡
26	Washer (Packing)

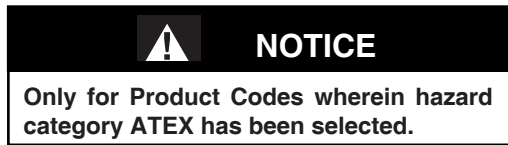
‡ Recommended replacement parts.

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## 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.