MODEL 2266

1/2" – 1-1/2" SIZE

GLOBE-STYLE PNEUMATIC CONTROL VALVE UNIT

BODY AND ACTUATOR

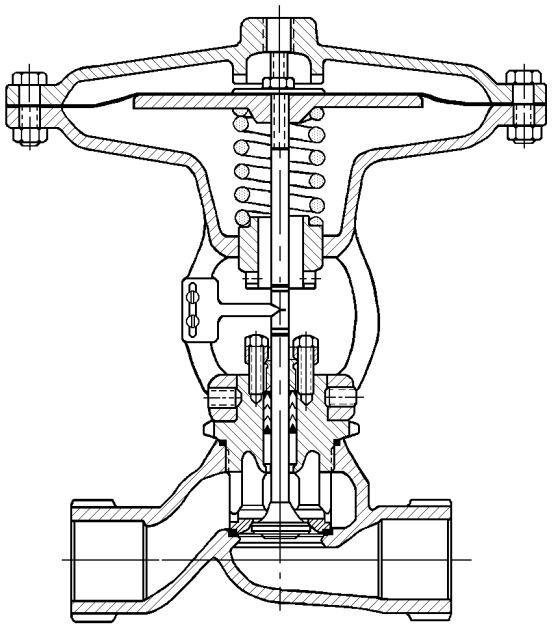
SECTION I

I. DESCRIPTION AND SCOPE

The Model 2266 is a pneumatically actuated, globe-style control valve, complete with the actuator mounted. The Model 2266 is only available with a single actuator for a given body size. Actuators are direct action; i.e. actuator stem extends on increase in loading pressure. Unit is field reversible by changing relative positions of plug-to-seat ring with respect to each other (see Figures 4 and 5).

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

The body is available only with NPT connections for cast bronze (BRZ) material.



1-1/2" Model 2266
ATO Fail Close

SECTION II

II. REFERENCES

Refer to Technical Bulletin 2266-TB for technical specifications of a Model 2266 Control Valve.

Refer to the following IOM for devices/accessories mounted to a Model 2266 Control Valve:

P/P POSITIONER
Moore Positioner Model 73N12F

ABBREVIATIONS

ATC-FO	-	Air-to-Close, Fail Open
ATO-FC	-	Air-to-Open, Fail Close
BRZ	-	Bronze
CCW	-	Counter Clockwise
CW	-	Clockwise
D	-	Direct Acting
DIR	-	Direct Acting
IAS	-	Instrument Air Supply
IOM	-	Installation, Operation, and Maintenance Manual
LOAD	-	Positioner Output Air Pressure
R	-	Reverse Acting
REV	-	Reverse Acting
SIG	-	Output Signal from Instrument
SST	-	Cast or Wrought 316 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. Model 2266 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.

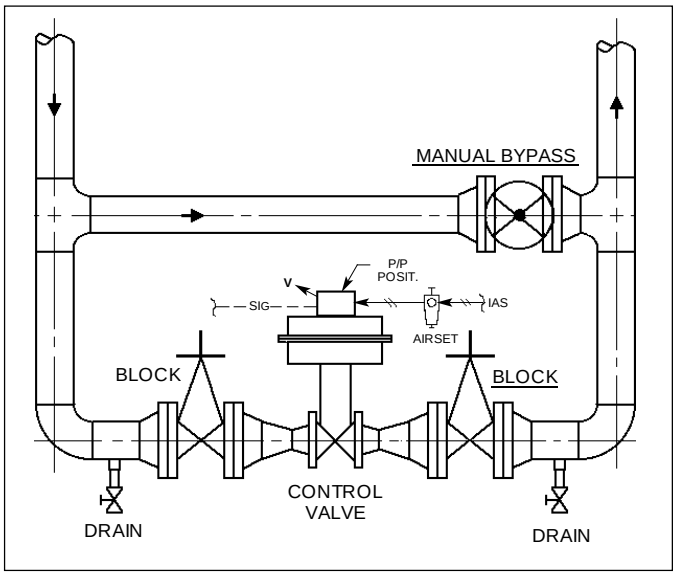


Figure 1: Typical Control Valve Station

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 2266, is acceptable. If hydro test pressure exceeds the 1-1/2 x CWP limit, the 2266 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.

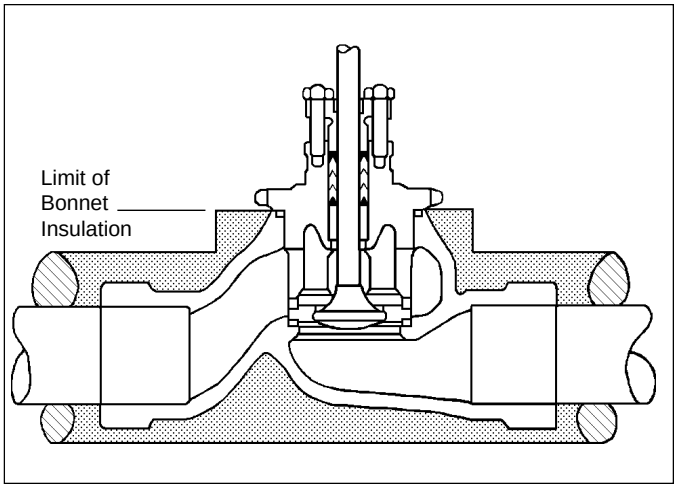


Figure 2: Body Insulation

11. Undue piping stress/strain or bending torques may not be transmitted through the 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.

SECTION IV

IV. 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-reuseable 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. (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. # 1134, the valve is suitable for oxygen service.

5. All indicated Item Numbers that are with respect to the actuator portion of a Model 2266 are in parenthesis and underscored; i.e. (20). All Item Numbers that are with respect to the body portion of a Model 2266 are not underscored; i.e. (32).

6. ***Special care must be exhibited when rotating the stem (4.6) of the valve to not mar that portion of the surface of the stem (4.6) where it contacts with the packing (10).*** To rotate the stem (4.6), use soft-jawed pliers.

7. Place matchmarks between the bonnet (2) flange and the yoke (1) to assist in final orientation when the body is disassembled and/or the actuator moved.

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

   "For ATO-FC units, place a temporary air source to the actuator and pressurize to a level sufficient to initiate travel to approximately mid-stroke. (This procedure is not required for ATC-FO units.)"

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

   "For ATO-FC units, release all temporary air pressure. (This procedure is not required for ATC-FO units.)"

B. Actuator Removal and Replacement:

1. Secure the body (1) in a vise with the actuator assembly (AA) oriented vertically. Place matchmarks between the bonnet (2) flange and the yoke (1) to assist in final orientation.

⚠ WARNING

SPRING UNDER COMPRESSION! Prior to removing actuator casing's bolting, relieve spring compression by backing out the spring adjustor. Failure to do so may result in flying parts that could cause personal injury!

2. Turn spring adjustor (4) CW, (viewed from above) to relieve all spring (6) compression. Count and record the number of revolutions in the box below.

Number of revolutions req'd. to relax range spring, Step 2.	_____
Stem Length per Step 5.	_____

3. Remove flange bolting (10 and 11) and upper case (2).

4. Using soft-jawed pliers, grasp the stem (4.6) just below the spring adjustor (4) and loosen diaphragm nut (9) CCW until removed. Remove diaphragm washer (8) and diaphragm (7).

5. Measure the distance from the top of the diaphragm plate (5) to the top end of the stem (4.6). Record measurement in box on previous page.

6. Remove diaphragm plate (5) by turning CCW when viewed from above.

7. Lift spring (6) out of yoke (1).

8. Loosen the two set screws (3) and lift yoke (1) off the bonnet (2).

9. Reassemble in reverse order using dimensions recorded earlier, and the following torque requirements:

Part Name	Ft - #	N-M
Diaphragm Washer Nut	9	13
Flange Bolting Nuts [1]	18	25

[1] Tighten in an alternating/crossing pattern.

10. Proceed to Section V for recalibration if required.

C. Trim/Packing Removal and Replacement:

1. Secure body in a vice with the actuator assembly (AA) oriented vertically. Place matchmarks between the body (1) bonnet flange, the bonnet (2) flange and the yoke (1) to assist in final assembly.

2. **(*Note PA*.)** Using a smooth jaw wrench, loosen the bonnet (2) from the body (1) by turning counter clockwise when viewed from above. Lift actuator and trim out of body and secure bonnet (2) in vise with actuator assembly (AA) directed upwards.
(*Note RP.*)

3. Proceed with disassembly of actuator, follow procedures in Steps IV.B, 1 through 8, beginning with the WARNING.

4. Remove the two packing flange nuts (12), packing flange (7) and packing follower (9).

5. Carefully push stem assembly (4) down through packing (10) and bonnet (2). Be careful not to damage stem (4.6) surface. For ATO-FC action units, the seat ring (3) will also be freed. For ATC-FO action units, lift seat ring (3) out of body (1).

6. For TFE V-ring Packing (**Standard Construction**), remove packing rings (10) and stem guide bushing (6) from recess in bonnet (2).

7. For TFE V-ring **Live Loaded Packing** (**Cryogenic Construction**), remove packing rings (10), packing washer (26), packing spring (25) and stem guide bushing (6).

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

8. Solvent clean all loose parts with suitable solvent and let dry.

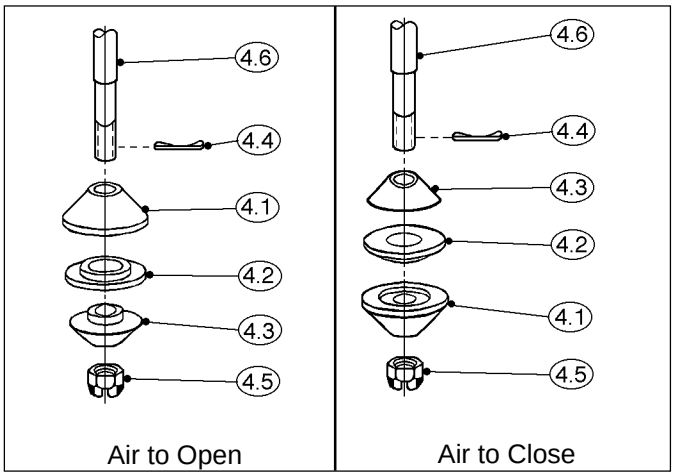


Figure 3: Composition Seat Arrangement

9. Examine seat ring (3), composition seat (4.2), metal seat plug (4), adaptor (4.1/4.3) and stem (4.6) at stem guide (6) for wear. Replace all worn parts.

   a. Stem surface should be centerless ground and polished to approximately an 8 µ-inch finish or better in the packing (10) zone.

   b. Plug head of stem assembly (4) on metal seated design may be hand lapped using suitable lapping compound. If hand lapping will not restore surface finish to an acceptable degree, then replacement of stem assembly (4) and seat ring (3) is recommended.

   c. For composition seated design, the TFE valve seat (4.2) can be replaced if the adaptors (4.1/4.3), cotter pin (4.4) and

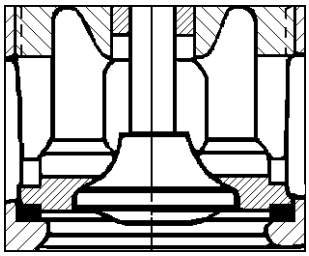
castle nut (4.5) are not wear damaged. Grip stem (4.6) in vise (using protective covering) directly above adaptor (4.1/4.3). Remove cotter pin (4.4), castle nut (4.5) adaptor (4.1 or 4.3) and valve seat (4.2). Insert new valve seat (4.2) and reassemble to desired seat arrangement. See Figure 3.

10. Remove gaskets (5), (8), clean gasket facing surfaces and replace with new gaskets (5) and (8).

11. For ATO-FC units, place seat ring (3), over end of stem (4.6) in proper orientation, and insert the plug and stem assembly (4) through bonnet (2) until it appears at top side of the bonnet (2). See Figure 4.

Action: Air-to-Open, Fail Close

Plug located beneath seat ring. Increased loading pressure pushes stem down, plug opens.



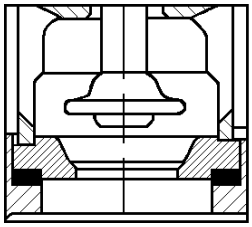
Fail Close, Air-to-Open

Figure 4: Seat and Plug Assembly, ATO-FC

For ATC-FO action units, place seat ring (3) into the body (1) cavity in proper orientation. Insert the plug and stem assembly (4) through bonnet (2) until it appears at top side of the bonnet (2). See Figure 5.

Action: Air-to-Close, Fail Open

Plug located above seat ring. increased loading pressure pushes stem down, plug closes.



Fail Open, Air-to-Close

Figure 5: Seat and Plug Assembly, ATC-FO

12. Place stem guide (6) over the stem assembly and back into the bonnet (2).

***NOTE**: Lubricate packing rings with Fluorolube GR-362 or equivalent for non-oxygen clean valves. Use Christo-Lube MCG #111 or equivalent for oxygen clean valves.*

13. For TFE V-ring packing (**Standard Construction**) slip new V-ring packing (10.1) (10.2) (10.3) over threaded end of stem (4) as indicated in figure 6. DO NOT INVERT PACKING RINGS (10).

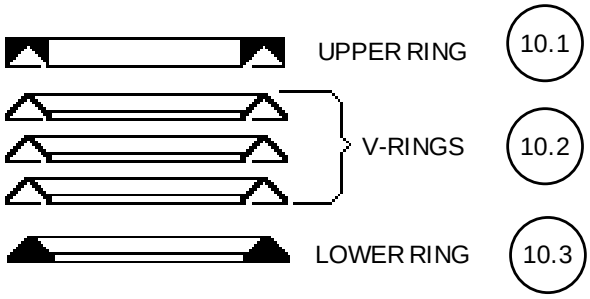


Figure 6: Packing

14. For TFE V-ring **Live Loaded Packing** (**Cryogenic Construction**):

    a. Lower packing spring (25) into extension column (2) packing box.

    b. Lower packing washer (26) into extension column (2) packing box. Ensure that washer (26) is resting "flat" on the packing spring (25).

    c. Individually press new V-ring packing (10) into extension column (2). Refer to Figure 9 for correct orientation.

15. Slide packing follower (9) and packing flange (7) over end of stem (4).

16. Push the stem (4) all the way into the bonnet.

17. Hand tighten packing flange nuts (12) onto packing studs (11) using a crossing pattern and then loosen two revolutions.

18. Place yoke (1) on bonnet (2), align match marks and tighten set screws (3).

19. Position range spring (6) over stem (4) resting on spring adjustor (4). Thread the diaphragm plate (5) on to the stem (4), recalling the recorded measurement in IV.B.2.

20. Install diaphragm (7), diaphragm washer (8) and diaphragm washer nut (9). Tighten nut (9) to 9 ft/lbs (13 N-M) torque using a torque wrench.

***NOTE**: Valves supplied from factory use Dow-Corning "Silastic" #732RTV silicone adhesive between diaphragm (7) and diaphragm washer (8).*

21. Reposition upper case (2) on yoke (1). Install diaphragm flange bolts (10) and nuts (11); wrench tighten firmly in alternating crossing pattern. Final tighten to 18 ft/lbs (25 N-M) torque using a torque wrench.

22. **(*NOTE PA.*)** Fit actuator (AA) onto the body (1) and tighten the bonnet (2) using a smooth jaw wrench by turning CW when viewed from above.
(*NOTE RP.*)

23. Reapply compression to the range spring (6) by rotating the spring adjustor (4) CW, when viewed from body side, as per the number of revolutions recorded in IV.B.2.

D. Diaphragm Inspection and Replacement:

⚠ WARNING

SPRING UNDER COMPRESSION! Prior to removing actuator casing's bolting, relieve spring compression by backing out the spring adjustor. Failure to do so may result in flying parts that could cause personal injury!

1. Turn spring adjustor (4) CW (viewed from above) to relieve all spring (6) compression. Count and record the number of revolutions in the following box.

Number of Revolutions required to relax range spring: _____

2. Remove flange bolting (10 and 11) and upper case (2).

3. Using soft-jawed pliers, grasp the stem (4.6) just below the spring adjustor (4) and loosen diaphragm nut (9) CCW until removed. Remove diaphragm washer (8) and diaphragm (7).

4. Inspect diaphragm (7) for possible cause of failure and replace.

5. Reassemble in reverse order. Tighten diaphragm washer nut (9) to 9 ft/lbs (13 N-M) torque, using torque wrench.

   ***NOTE**: Valves supplied from factory use Dow-Corning "Silastic" #732RTV silicone adhesive between diaphragm (7) and diaphragm washer (8).*

6. Position upper case (2) on yoke (1). Install diaphragm flange bolts (10) and nuts (11); wrench tighten firmly in alternating crossing pattern. Final tighten to 18 ft/lbs (25 N-M) torque using a torque wrench.

7. Reapply compression to range spring (6) by rotating the spring adjustor (4) CW, when viewed from body side, as per the number of revolutions recorded in IV.D.1.

E. Handwheel Seal Replacement – "O-Ring Type":

1. Release all air pressure in actuator upper case (2) by disconnecting instrument signal line at 1/4" NPT connection in the upper case (2).

2. Remove machine screw (37) limiting travel of handwheel subassembly (16).

3. Rotate handwheel (16) CCW, viewed from above, to removal.

4. Remove O-ring (36) from handwheel subassembly stem (16). Clean assembly (16) in solvent cleaner. Lightly lubricate new O-ring (36) and threaded portion of the stem (16) with lithium grease and install o-ring (36).

5. Solvent clean the interior of the packing box (35) on the upper casing (2), taking care to remove rust, dust, etc., from that portion of the interior where the O-ring (36) will contact. Place a light coating of lithium grease on O-ring (36) contacting surface inside packing box (35).

6. Reinsert the handwheel subassembly (16) into the packing box (35), screwing the handwheel (16) CW (viewed from above) until the tip of the stem (16) reaches the diaphragm washer nut (9).

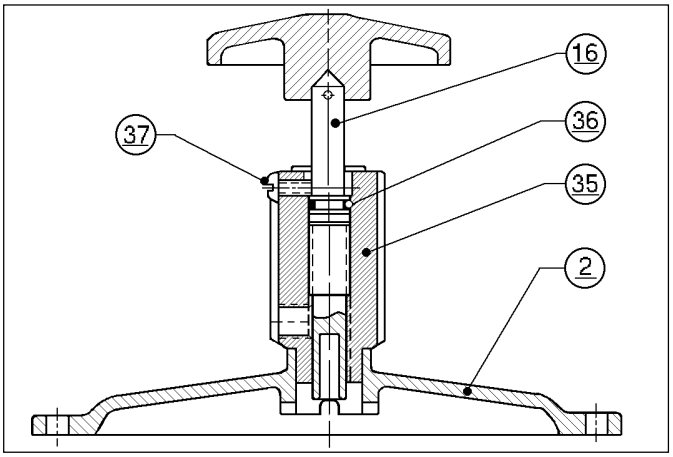


Figure 7: Top Mounted Handwheel Assembly

7. Reinstall machine screw (37). Back handwheel (16) out, rotating CCW to ensure that the screw (37) is properly functioning as a travel stop.

F. Reversing Unit Action:

1. Changing valve action from Direct (ATC-FO) Action to Reverse (ATO/FC) Action or vice versa is accomplished not in the actuator, but in the body by reversing the orientation of the plug and stem assembly (4) with respect to the seat ring (3). See Figures 4 and 5. This requires disassembly of the trim; follow procedures in steps IV.C.1 through 15.

***NOTE**: When changing valve action, consideration should be given to replacement of packing rings (10). Bonnet/body gasket (8) and seat ring gasket (5) are recommended for replacement once the bonnet (2) and seat ring (3) have been removed; reuse of gaskets (8) (5) may allow fluid leakage upon reassembly and pressurization.*

2. Refer to Figure 8 to obtain new measurements for proper stroke setting.

3. Install diaphragm (7), diaphragm washer (8) and diaphragm washer nut (9). Tighten nut (9) to 9 ft/lbs (13 N-M) torque using a torque wrench.

***NOTE**: Valves supplied from factory use Dow-Corning "Silastic" #732RTV silicone adhesive between diaphragm (7) and diaphragm washer (8).*

4. Reposition upper case (2) on yoke (1). Install diaphragm flange bolts (10) and nuts (11); wrench tighten firmly in alternating crossing pattern. Final tighten to 18 ft/lbs (25 N-M) torque using a torque wrench.

5. **(*NOTE PA.*)** Fit actuator (AA) onto the body (1) and tighten the bonnet (2) using a smooth jaw wrench by turning CW when viewed from above.
(*NOTE RP.*)

6. Record changes on unit's name plate (12).

7. Loosen machine screws (32) to realign indicator plate (30) to indicate correct failure marking ("O" for open, "C" for close) on stem (4.6).

8. Proceed to Section V.C. or D. for calibration of bench setting.

SECTION V

V. CALIBRATION

A. General:

1. This section covers calibration of the control valve unit. Calibration consists of adjusting stroke length and bench setting.

2. Positioner, if installed, requires reference to the specific positioner model IOM for proper calibration procedure.

3. All indicated Item Numbers that are with respect to IOM-2266 and are part of the "body" will be in single parenthesis; i.e. (2). Those that are part of the actuator will be in single parenthesis and underscored; i.e. (2).

B. Valve Stroke:

1. Setting the correct stroke with respect to valve action requires removal of the diaphragm (7). Follow procedures in Steps IV.D.1. through 3.

2. See Figure 8 for correct stroke setting dimensions between the diaphragm plate (5) and the yoke (1) with respect to fail action required.

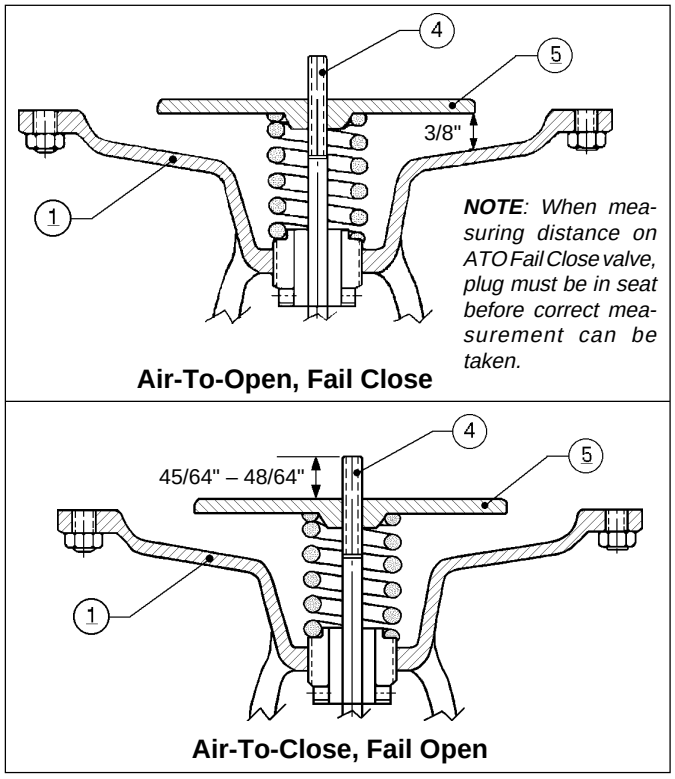


Figure 8: Stroke Setting

3. Install diaphragm (7), diaphragm washer (8) and diaphragm washer nut (9). Tighten nut (9) to 9 ft/lbs (13 N-M) torque using a torque wrench.

4. Reposition upper case (2) on yoke (1). Install diaphragm flange bolts (10) and nuts (11); wrench tighten firmly in alternating crossing pattern. Final tighten to 18 ft/lbs (25 N-M) torque using a torque wrench.

C. ATO-FC Action – Bench Setting:

1. Provide a temporary air supply with an in-line adjustable airset regulator and gauge to the actuator topworks connection.

2. Reference the nameplate (12) attached to the yoke (1). Determine the bench setting of the installed range spring (6); i.e. 5-15 psig (.34–1.03 Barg), or 10–30 psig (.62–2.07 Barg).

3. Pressurize the actuator to a level corresponding to the lower pressure level of the bench setting; i.e. for 5–15 psig (.34–1.03 Barg) range, set pressures at 5 psig (.34 Barg). Apply pressure slowly while observing for plug and stem (4) movement.

4. The proper calibration of the actuator/valve unit will occur when, at the lower pressure level of the bench setting, the valve's plug and stem assembly (4) will just begin to travel from the closed position.

   If the plug and stem assembly (4) begins travel before reaching the lower pressure level of bench setting, increase the actuator's range spring (6) compression by wrench tightening spring adjustor (4) CW (viewed from valve side) in 1/2 revolution increments until desired bench setting is reached.

   If the plug and stem assembly (4) begins travel after surpassing the lower pressure level of bench setting, reduce the actuator's range spring (6) compression by wrench loosening spring adjustor (4) CCW (viewed from valve side) in 1/2 revolution increments until desired bench setting is reached.

5. Increase pressure to actuator up to the upper level of bench setting and observe that stem travel should equal approximately 3/8". If travel exceeds or falls short of this measurement, return to Subsection B., preceding, for calibration of valve stroke.

6. Record the theoretical and actual pressure levels of paragraphs 4. and 5. in the following box.

Theoretical Bench Setting From Nameplate	_____	psig
	_____	Barg
Setting When Travel Begins	_____	psig
	_____	Barg
Setting When Travel Ends	_____	psig
	_____	Barg

D. ATC-FO Action – Bench Setting:

1. Provide a temporary air supply with an in-line adjustable airset regulator and gauge to the actuator topworks connection.

2. Reference the nameplate (12) attached to the yoke (1). Determine the bench setting of the installed range spring (6); i.e. 3-13 psig (.20–.90 Barg) or 6–26 psig (.41–1.79 Barg).

3. Pressurize the actuator to a level 2–3 psig (0.1–0.2 Barg) above the upper pressure level of the bench setting; i.e. for 3–13 psig (.20–.90 Barg) range, set pressure at 15–16 psig (1.0–1.1 Barg).

4. The proper calibration of the actuator/valve unit will occur when, at the upper pressure level of bench setting, the plug and stem assembly (4) will just begin to travel from the closed position. Depressurize actuator slowly.

   If plug and stem assembly (4) begins travel before reaching the upper pressure level of bench setting, release all air pressure from actuator topworks, then decrease range spring (6) compression by wrench loosening spring adjustor (4) CCW (viewed from valve side) in 1/2 revolution increments until desired bench setting is reached.

   If plug and stem assembly (4) begins travel after surpassing the upper pressure level of bench setting, release all air pressure, then increase the range spring (6) compression by wrench tightening spring adjustor (4) CW (viewed from valve side) 1/2 revolution increments until desired bench setting is reached.

5. Decrease pressure to actuator down to the lower level of bench setting and observe that stem travel should equal approximately 3/8". If travel exceeds or falls short of this measurement, return to Subsection B., preceding, for calibration of valve stroke.

6. Record the theoretical and actual pressure levels of paragraphs 4 and 5 in the box on page 8.

SECTION VI

VI. STARTUP

A. General:

1. Ensure that the Model 2266 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".

3. Start with either of the two block valves closed, with the other open. The bypass valve should be closed. Pressurize the system, if possible or 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 in the following table. **DO NOT STROKE THE CONTROL VALVE WITH AN AIR SUPPLY PRESSURE SETTING GREATER THAN RECOMMENDED MAXIMUM PRESSURE!**

TABLE 1

Bench Setting		Airset Output	
psig	(Barg)	psig	(Barg)
5–15	(.34–1.03)	20	(1.4)
3–13	(.21–.90)		
10–30	(.69–2.07)	35	(2.4)
6–26	(.41–1.79)		

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 that action of controller and positioner – direct or reverse – are producing the desired response in the control unit. Confirm the control valve "fail" position is as required.

Hereafter, the procedure assumes that actual fluid flow may be established. This may <u>not</u> be practical or possible in all cases; if so, vary procedure as required.

9. Always "heat" or "cool" down the system piping <u>SLOWLY</u> 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 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 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 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 Cause	Remedy
A. Excess pressure drop.	A. Bring pressure drop within design limits.
B. Lower bushing wear.	B. Replace stem guide bushing.

3. Valve exhibits “excess” vibration.

Possible Cause	Remedy
A. Excess pressure drop.	A. Bring pressure drop within design limits.
B. Lower bushing wear.	B. Replace stem guide bushing.
C. Excessive cavitation in liquid service.	C1. Change operation parameters to relieve causes of cavitation. C2. Replace valve with valve equipped for cavitational 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 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.
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. Remove particulate. D4. Possible excess cavitation in liquid service. Change operation parameters. D5. Re-lap plug-seat surface (metal seat only).
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.
H. Improper seat ring gasket load.	H. Tighten bonnet to body joint.

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. Wear.	B1. Remove dirt/grit from fluid. B2. Reduce cyclic travel.

SECTION VIII

VIII. PARTS ORDERING INFORMATION:

There are three methods to obtain parts ordering information/numbers. These methods are listed below, in order of ease of entering. The least expensive method is to utilize parts in kits where possible (See table Page 13).

METHOD A – USE OF PRODUCT CODE.

Step 1. If available, obtain the 18 character product code number from the Bill of Materials sheet attached herein.

□□□–□□□7–□□□□□□□□□□

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

NOTE: *Kit "A" contains gasket(s), packing and soft seat, where applicable. Kit "B" contains plug/stem assembly, seat ring plus gasket(s) and packing.*

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

METHOD B – NO PRODUCT CODE AVAILABLE – DISASSEMBLED VALVE.

Step 1. Determine all available information from valve's metal tag.
   a. Serial number.
   b. Valve "type" or "model" number.
   c. Size (may have to observe body tap).
   d. Body material.
   e. Fail position.
   f. Trim designation number (if available).
   g. Cv or port size.
   h. Bench set.

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

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

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

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

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

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

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

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

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

MODEL 2266
STANDARD CONSTRUCTION (TFE V-RING PACKING)
PARTS KIT NUMBERS
(Kit Nos. Shaded)

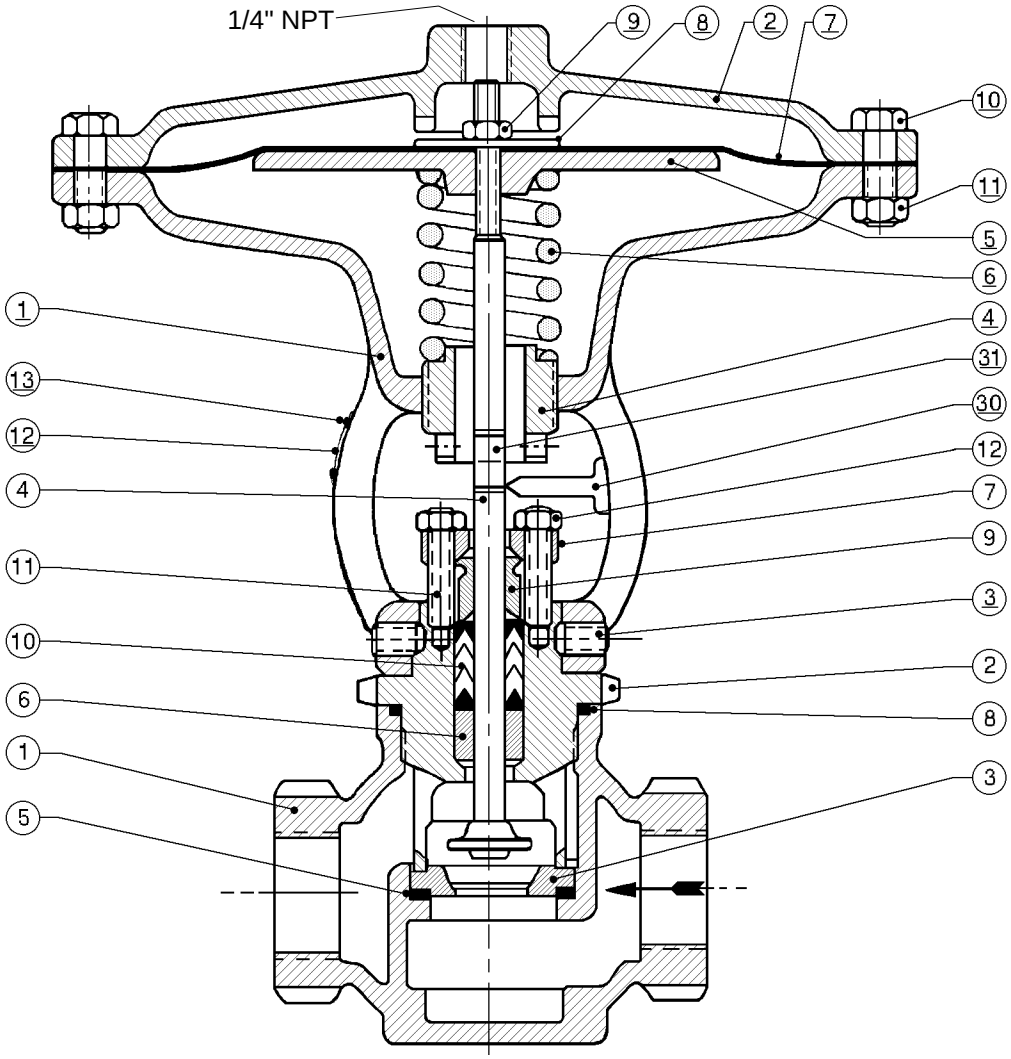
Trim Desig. No.	Action	Kit Abbre.	BODY SIZE	
			3/4" – 1"	1-1/2"
S2	ATO & ATC	A	**421-510K-5AA**	**423-510K-5AA**
S2	ATO & ATC	B	**421-510K-5BA**	**423-510K-5BA**
S4	ATO & ATC	A	**421-610K-5AA**	**423-610K-5AA**
S4	ATO	B	**421-610K-5BA**	**423-610K-5BA**
S4	ATC	B	**421-610K-7BA**	**423-610K-7BA**

NOTE: *Neoprene diaphragm not included in above kits. If required, select the following part number. Consult your Cashco Sales Representative for pricing.*

SIZE	PART NUMBER
3/4", 1" & 1-1/2"	210-43-1-02200-00

NOTES

1/2", 3/4" and 1" MODEL 2266
ATC-FO ACTION



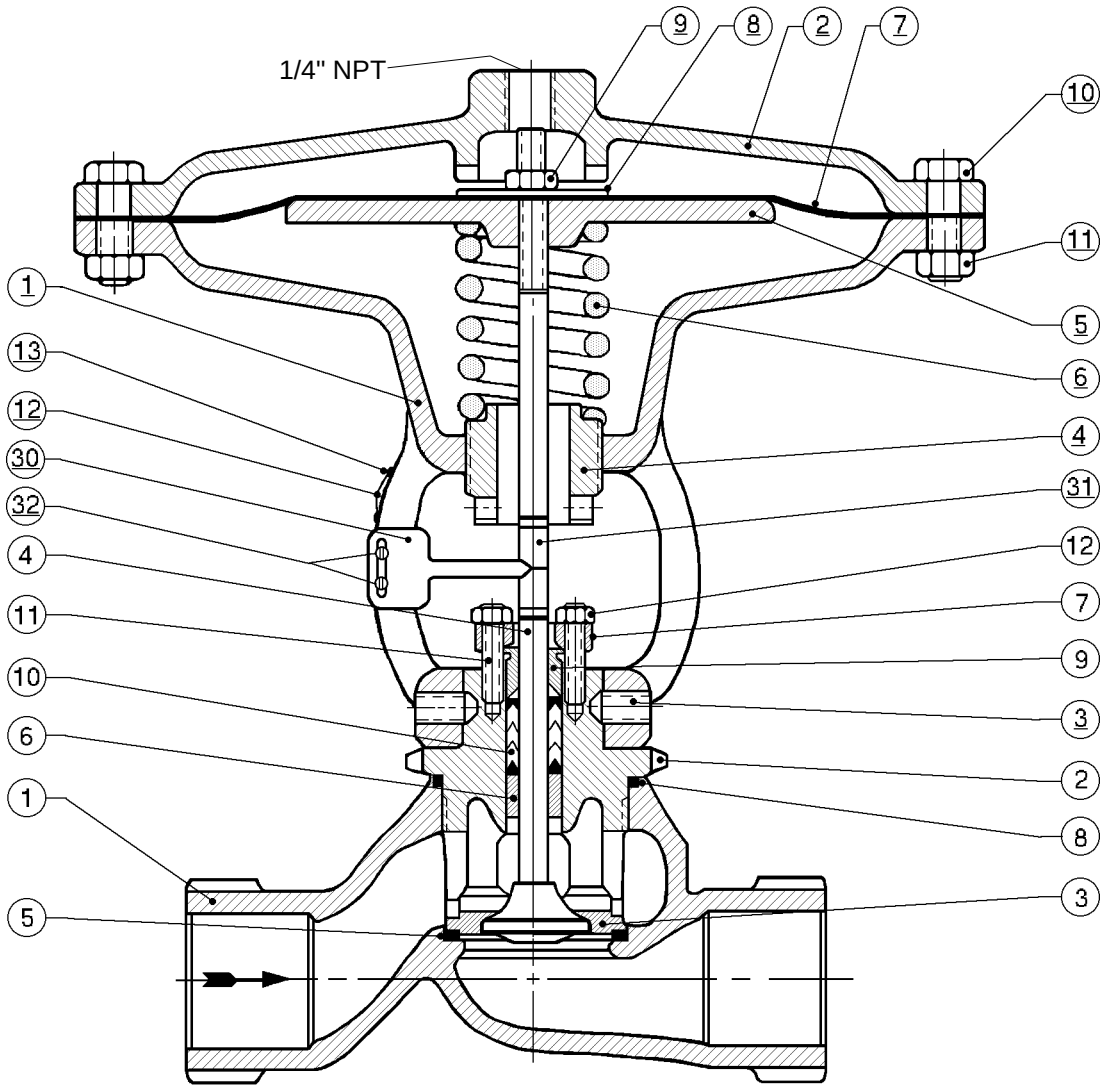
Item No.	Description
1	Yoke
2	Upper Case
3	Yoke Set Screw
4	Spring Adjustor
5	Diaphragm Plate or Pressure Plate
6	Range Spring (3-9, 3-15 & 6-30)
7	Diaphragm
8	Diaphragm Washer
9	Diaphragm Washer Nut
10	Flange Bolt
11	Flange Bolt Nut
12	Name Plate
13	Name Plate Screw
* 16	Handwheel Sub-assembly
30	Indicator Plate
31	Indicator Dial
* 35	Packing Box
* 36	O-Ring
* 37	Screw

* Not Pictured – See Figure 7

Item No.	Description
1	Body
2	Bonnet or Extension Column
3	Seat Ring
4	Plug & Stem Assembly
	4.1 Lower Seat Adaptor
	4.2 Valve Seat
	4.3 Upper Seat Adaptor
	4.4 Cotter Pin
	4.5 Castle Nut
	4.6 Stem
5	Seat Ring Gasket
6	Stem Guide
7	Packing Flange
8	Body/Bonnet O-Ring or Body/Bonnet Gasket
9	Packing Follower
* 10	Packing
11	Packing Stud
12	Packing Stud Nut

* See Figure 6

1-1/2" MODEL 2266
ATO-FC ACTION

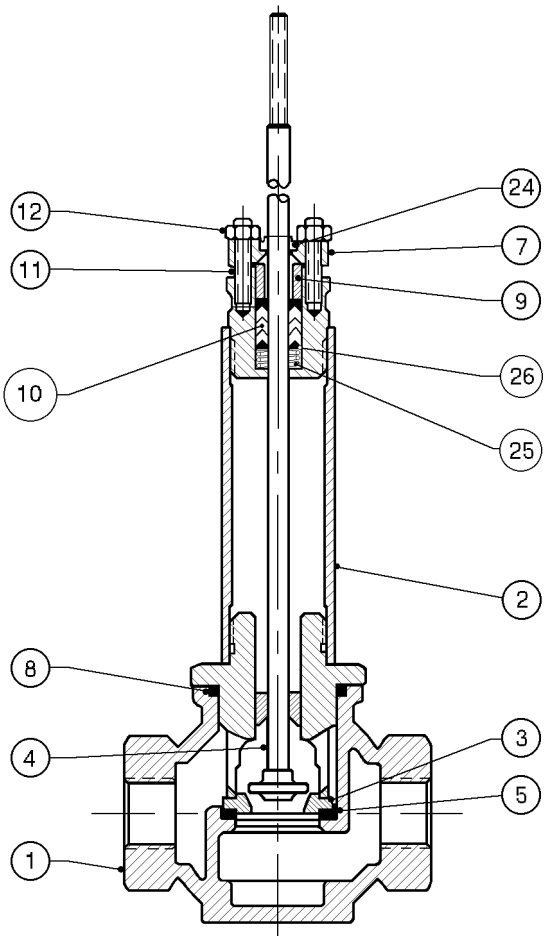


Item No.	Description
1	Yoke
2	Upper Case
3	Yoke Set Screw
4	Spring Adjustor
5	Diaphragm Plate or Pressure Plate
6	Range Spring (3-9, 3-15 & 6-30)
7	Diaphragm
8	Diaphragm Washer
9	Diaphragm Washer Nut
10	Flange Bolt
11	Flange Bolt Nut
12	Name Plate
13	Name Plate Screw
* 16	Handwheel Sub-Assembly
30	Indicator Plate
31	Indicator Dial
32	Machine Screws
* 35	Packing Box
* 36	O-Ring
* 37	Screw

* Not Pictured – See Figure 7

Item No.	Description
1	Body
2	Bonnet or Extension Column
3	Seat Ring
4	Plug & Stem Assembly
	4.1 Lower Seat Adaptor
	4.2 Valve Seat
	4.3 Upper Seat Adaptor
	4.4 Cotter Pin
	4.5 Castle Nut
	4.6 Stem
5	Seat Ring Gasket
6	Stem Guide
7	Packing Flange
8	Body/Bonnet O-Ring or Body/Bonnet Gasket
9	Packing Follower
* 10	Packing
11	Packing Stud
12	Packing Stud Nut

* See Figure 6



1/2" – 1" Model 2266
Cryogenic Construction

Item No.	Description
1	Body
2	Bonnet or Extension Column
3	Seat Ring
4	Plug & Stem Subassembly
5	Seat Ring Gasket
7	Packing Flange
8	Body/Bonnet O-Ring or Body/Bonnet Gasket
9	Packing Follower
10	Packing
11	Packing Stud
12	Packing Stud Nut
24	Wiper Ring
25	Spring
26	Washer

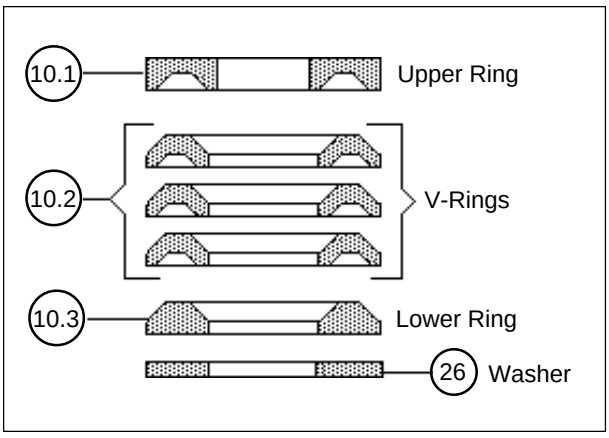
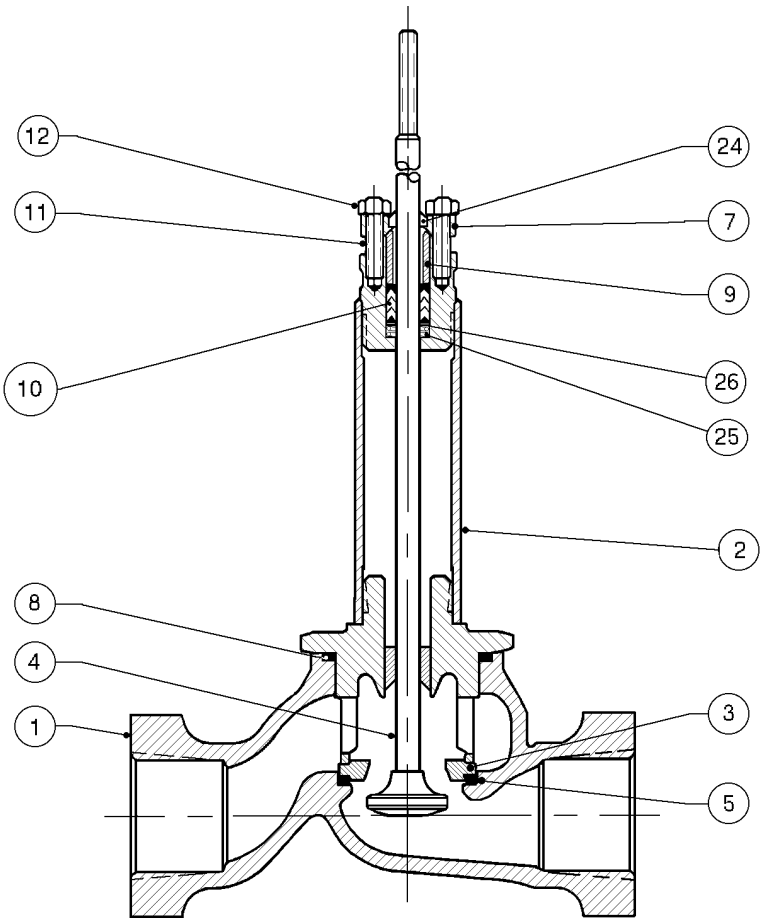


Figure 9: Packing Ring Orientation for Live Loaded Cryogenic Construction



1-1/2" Model 2266
Cryogenic Construction

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Printed in U.S.A. IOM-2266-1 -gh

MODEL 2266

(2" SIZE ONLY)

GLOBE-STYLE PNEUMATIC CONTROL VALVE UNIT (BODY AND ACTUATOR)

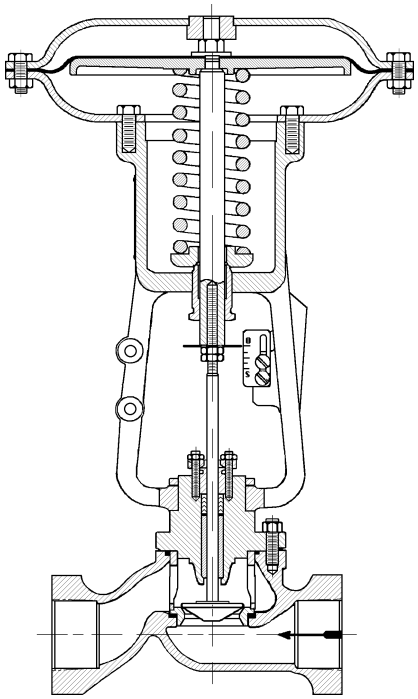
SECTION I

I. DESCRIPTION AND SCOPE

The Model 2266 is a pneumatically actuated, globe-style control valve, complete with the actuator mounted. The 2" size, Model 2266 is only available with a single actuator. Actuator is direct acting; i.e. actuator stem extends on increase in loading pressure. Unit is field reversible by changing relative positions of plug-to seat with respect to each other (see Figures 6 and 7).

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

The body is available with NPT connections for bronze (BRZ) material.



2" Model 2266 ATC-Fail Open
TFE V-ring Packing

SECTION II

II. REFERENCES

Refer to Technical Bulletin 2266-TB for technical specifications of a Model 2266 Control Valve.

Refer to the following IOM's for devices/accessories mounted to a Model 2266 Control Valve:

P/P POSITIONER	I/P POSITIONER
IOM-9540L	IOM-9520L

ABBREVIATIONS

ATC-FO	=	Air-to-Close, Fail Open
ATO-FC	=	Air-to Open, Fail Close
BRZ	=	Bronze
CCW	=	Counter Clockwise
CW	=	Clockwise
D	=	Direct Acting
DIR	=	Direct Acting
IAS	=	Instrument Air Supply
IOM	=	Installation, Operation, and Maintenance Manual
LOAD	=	Positioner Output Air Pressure
R	=	Reverse Acting
REV	=	Reverse Acting
SIG	=	Output Signal from Instrument
SST	=	Cast or Wrought 316 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. Model 2266 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 installations to allow complete removal from system.

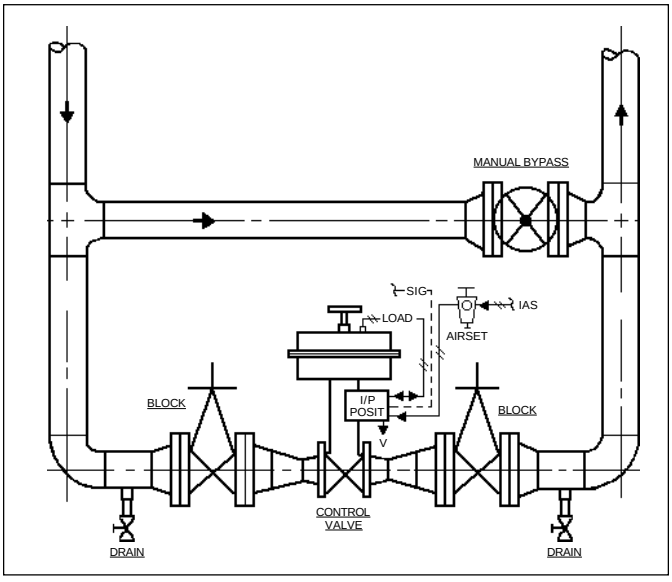


Figure 1: Typical Control Valve Station

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 2266, is acceptable. If hydro test pressure exceeds the 1-1/2 x CWP limit, the 2266 must be removed for such testing. Before pressurization, the valve plug & stem subassembly 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 directly 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.
11. Undue piping stress/strain or bending torques may not be transmitted thru 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.

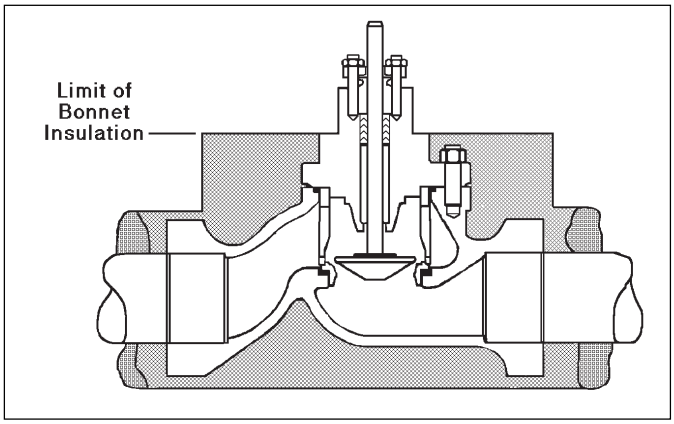


Figure 2: Body Insulation

SECTION IV

IV. 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, PLS®2, or equal. Owner may use such aids provided the aids are compatible with the Owner's fluid. (See below for "oxygen cleaned" valves.)

4. Valves originally supplied in accordance with Option-55 require special cleaning procedures. Refer to Cashco Specification #S1134 for details. When in compliance with/to Spec. #1134, the valve is suitable for oxygen service.

5. All indicated Item Numbers that are with respect to the actuator portion of a Model 2266 are in parenthesis and underscored; i.e. (20). All Item Numbers that are with respect to the body portion of a Model 2266 are not underscored; i.e. (32). All Item Numbers that are with respect to the positioners are in double parentheses; i.e. ((9)).

6. ***Special care must be exhibited when rotating the plug & stem subassembly (4) of the valve to not mar that portion of the surface of the plug & stem subassembly (4) where it contacts with the packing (10).*** To rotate the plug & stem subassembly (4), use the jam nuts (22) or soft-jawed pliers. ***(NOTE:*** *When using the jam nuts (22) to rotate the plug & stem subassembly (4), use the upper jam nut (22) to rotate the plug & stem subassembly CW, and the lower jam nut (22) to rotate the plug & stem subassembly CCW, when viewed from above valve plug & stem subassembly (4)).*

7. Place matchmarks between the body (1) bonnet flange, the bonnet (2) flange, and the yoke (1) to assist in final orientation when the body is disassembled and/or the actuator moved.

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

   "For ATO-FC reverse action units, place a temporary air source to the actuator and pressurize to a level sufficient to initiate travel to approximately mid-stroke. (This procedure is not required for ATC-FO direct action units.)"

9. 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. (This procedure is not required for ATC-FO direct action units.)"

B. Actuator Removal:

1. Secure the body (1) in a vise with the actuator assembly (AA) oriented vertically.

2. ***(Note PA.)*** Using blunt end tool, hammer rap the tool to loosen yoke nut (17) turning CCW (viewed from above) approximately 1 revolution. Secure the actuator stem (19). Loosen the stem jam nuts (22) 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 (19) or (4) such as accessory plate ((AP)) for limit switch or positioner.

4. Loosen stem packing (10) by turning nuts (12) CCW 2-3 revolutions. ***(Note RP.)***

NOTE: *To fully disengage the actuator stem (19) from the valve plug & stem subassembly (4) is a two-step procedure. Be aware of the valve's stroke length as indicated on the nameplate (12) before beginning disengagement. During the disengagement, measure the distance extended, and stay at least 1/8" (3 mm) away from the full stroke length. Record the number of revolutions for each step in the box below:*

No. of revolutions to disengage valve stem subassembly from actuator stem:

Step A._____ Step B._____

TOTAL:_____

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

   a. ***(Note PA.)***

   b. Step A. Rotate valve plug & stem subassembly (4) CW (viewed from above) to disengage the actuator stem (19) from the plug & stem subassembly (4), while holding the actuator stem (19). Record the number of valve plug & stem subassembly 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 the yoke nut (17). Lift actuator assembly (AA) upwards approximately 1/4"–3/8" (6–8 mm). Again, rotate valve plug & stem subassembly (4) CW (viewed from above) to disengage the actuator stem (19) from the valve plug & stem subassembly (4) while holding the actuator stem (19). Record the number of valve plug & stem subassembly (4) revolutions for Step B above. This should allow the actuator stem (19) to fully disengage from the valve plug & stem subassembly (4).

      NOTE: *Take notice of the parts "dangling loosely" about the plug & stem subassembly (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 the dangling parts - position indicating disc (20), accessory plate ((AP)), yoke nut (17) - from falling.

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

   a. Step A. Rotate plug & stem subassembly (4) CW (viewed from above) to disengage from the actuator stem (19). Do not rotate the plug & stem subassembly (4) into the seat (3). Record the number of plug & stem subassembly (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 the yoke nut (17). Lift actuator assembly (AA) upwards approximately 1/4"–3/8" (6-–8 mm). Again, rotate plug & stem subassembly (4) CW (viewed from above) to disengage the actuator stem (19) from the plug & stem subassembly (4), while holding the actuator stem (19). Record the number of valve plug & stem subassembly revolutions for Step B on page 3. This should allow the stem (19) (4) to fully disengage.

      NOTE: *Take notice of the parts "dangling loosely" about the plug & stem subassembly (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 the dangling parts - position indicating disc (20), accessory plate ((AP)), yoke nut (17) from falling.

C. Actuator Replacement:

1. Secure body assembly (BA) in a vice with the valve plug & stem subassembly (4) oriented vertically. Push plug & stem subassembly (4) down until the plug & stem subassembly (4) touches the body (1) for ATO-FC actions, or seat ring (3) for ATC-FO action.

2. Secure the actuator assembly (AA) from above.

3. This procedure assumes that the bonnet (2) has been bolted to the body (1), with stem jam nuts (22) on the valve plug & stem subassembly (4).

4. Lower actuator assembly (AA) until the valve plug & stem subassembly (4) penetrates the opening in the yoke (1). Reposition the "dangling parts" – yoke nut (17), accessory plate ((AP)) and indicating disc (20) – over the body plug & stem subassembly (4). Continue to lower the actuator assembly (AA) until there is approximately 1/4" (6 mm) space between stems (19) (4).

5. Hook up a temporary air supply hose that has an adjustable airset connected at the actuator inlet to allow pressurization.

6. Slowly pressurize actuator to bring the actuator stem (19) to within 1/8" (3 mm) of reaching the valve plug & stem subassembly (4).

7. Hand lift valve plug & stem subassembly (4) up to touch actuator stem (19). Rotate valve plug & stem subassembly (4) CCW (viewed from above) to engage with actuator stem (19). Use the total number of revs. engagement recorded in Step IV.B. as the guide to control engagement of the stems (19) (4). While engaging, rotate yoke nut (17) as able to help stabilize top-works, 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.

8. Hand-tighten the yoke nut (17) until the yoke (1) is sitting on the bonnet (2).

9. Secure "dangling parts" - accessory plate ((AP)) and indicator disc (20) - to actuator stem (19) with stem jam nuts (22).

10. Properly position the actuator yoke (1) with respect to the body (1), and hammer rap yoke nut (17) until tight. Release temporary air source.

11. Calibrate actuator-to-valve per Section V.

D. Trim Removal and Replacement:

1. Secure body (1) in a vice with actuator assembly (AA) directed upwards. Place matchmarks between the bonnet (2) and the body (1).

2. Secure the actuator assembly (AA) with an overhead support capable of vertically hoisting.

3. ***(Note PA.)*** Loosen all (quantity of 4) bonnet stud nuts (21) by turning CCW (viewed from actuator end).

4. Ensure actuator support is "taut"; i.e. holding weight of actuator.

5. Remove all bonnet bolting nuts (21).

6. Lift the actuator assembly (AA), together with bonnet (2) and plug & stem subassembly assembly (4) vertically out of the valve body (1). ***NOTE:*** *For ATO-FC action units, the removal will also pull the seat ring (3) and cage (19) out simultaneously. Lay the top-works assembly down onto a work bench horizontally. For ATC-FO action units, remove the cage (19) and seat ring (3) from the body (1) cavity.*

7. Turn attention to the removed top-works assembly. Loosen the stem jam nuts (22) by rotating CCW (viewed from plug end) while securing the actuator stem (19) with soft-jawed pliers.

8. Loosen stem packing (10) by turning nuts (12) CCW to a point just short of disengagement of threads.

9. While securing the actuator stem (19) by soft-jawed pliers, rotate the valve plug & stem subassembly (4) CCW (viewed from plug end). Record the number of revolutions of disengagement in the box below.

Number of revolutions to disengage valve plug & stem subassembly from actuator stem: _____

10. Remove packing flange nuts (12) with CCW rotation.

11. Partially withdraw plug & stem subassembly (4). Remove position indicator disc (20), both jam nuts (22), packing flange (7), packing follower (9), and accessory plate ((AP)), if installed.

12. Fully withdraw plug & stem subassembly (4). For ATO-FC action units, the loose cage (19) and seat ring (3) will also be freed.

13. **For TFE V-ring packing (Standard Construction):**

    a. Remove packing rings (10) from recess in bonnet (2).

14. **For TFE V-ring Live-Loaded Packing (Cryogenic Construction):**

    a. Remove packing rings (10), packing washer (26) and packing spring (25).

⚠ CAUTION

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

15. Solvent clean all loose parts with suitable solvent and let dry.

16. Inspect I.D. of guide bushing (6) while in place. If worn badly or "scored" –

    a. Remove bonnet (2) by removing yoke nut (17).

b. Hydraulically press guide bushing (6) "out"; press "in" new guide bushing (6) into bonnet (2), if necessary.

c. Reinstall bonnet (2) back together with actuator yoke (1), securing with yoke nut (17).

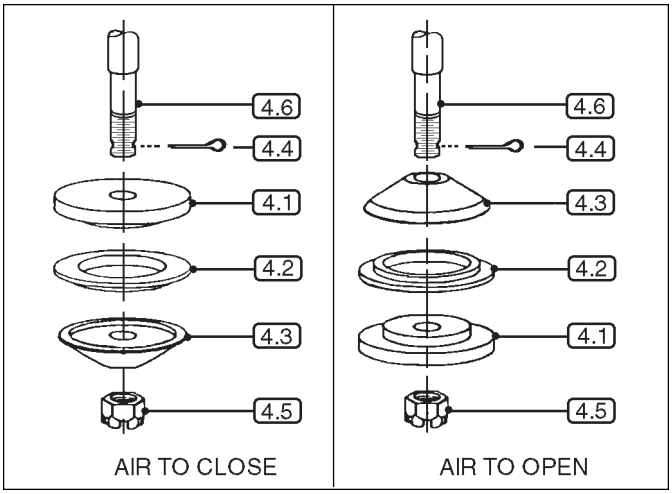


Figure 3: Composition Seat Arrangement

17. Examine cage (19), seat ring (3), composition seat (4.2), stem (4.6) or plug (4) or adapters (4.1) (4.3) for wear. Replace all worn parts.

    a. Stem surface should be centerless ground and polished to approximately an 8 µ - inch finish or better in the packing (10) zone.

    b. Plug head of stem assembly (4) for metal seated design may be hand lapped using suitable lapping compound. If hand lapping will not restore surface finish to an acceptable degree, then replacement of stem assembly (4) and seat ring (3) is recommended.

    c. For composition seated design, the TFE valve seat (4.2) can be replaced if the adaptors (4.1) (4.3), cotter pin (4.4) and castle nut (4.5) are not wear damaged. Grip stem (4.6) in vise (using protective covering) directly above adaptor (4.1)(4.3). Remove cotter pin (4.4), castle nut (4.5), adaptor (4.1 or 4.3) and valve seat (4.2). Insert new valve seat (4.2) and reassemble to desired seat arrangement. *See Figure 3.*

18. Remove gaskets (5) (8), clean gasket facing surfaces and replace with new gaskets (5) (8).

19. For ATO-FC action units, place seat ring (3) and cage (19) over end of stem (4.6) in proper orientation and insert stem into the body (1) cavity. Insert the plug & stem subassembly (4) until it appears through the top side of the bonnet (2). *See Figure 6.*

20. For ATC-FO action units, place seat ring (3) and cage (19) into the body (1) cavity. Insert the plug & stem subassembly (4) until it appears thru the top side of the bonnet (2). *See Figure 7.*

21. **For TFE V-ring Packing (Standard Construction):**

    a. Slip new V-ring packing (10.1)(10.2)(10.3) over threaded end of stem (4) as indicated in Figure 4. **DO NOT INVERT PACKING RINGS (10)!**

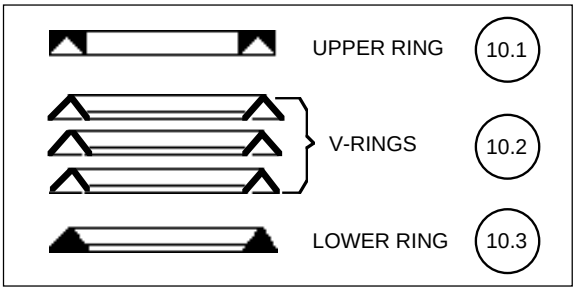


Figure 4: Packing

22. **For TFE V-ring Live Loaded Packing (Cryogenic Construction):**

    a. Lower packing spring (25) into extension column (2) packing box.

    b. Lower packing washer (26) into extension column (2) packing box. Ensure that washer (26) is resting flat on the packing spring (25).

    c. Individually press new V-ring packing (10) into extension column (2). Refer to Figure 8 for correct orientation.

23. Slide packing follower (9) and packing flange (7) over end of plug & stem subassembly (4). Screw both jam nuts (22) fully onto plug & stem subassembly (4). Slide position indicator disc (20) and accessory plate ((AP)), if installed, over end of plug & stem subassembly (4).

24. Engage valve plug & stem subassembly (4) into actuator stem (19) the same number of revolutions recorded in Step 9.

25. Tighten both jam nuts (22) up against position indicator plate (20).

26. Screw both packing flange nuts (12) back onto packing studs (11). Hand-tighten pack-

ing flange nuts (12) in a crossing pattern, then loosen 2 revolutions.

27. Raise actuator assembly (AA). ***(Note RP.)*** Lower into body (1) over bonnet studs/bolts (20). Align with matchmarks.

28. For ATO-FC action units, wiggle the actuator assembly (AA) to assist in alignment.

29. 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 3–13 psig (.21–.90 Barg) bench setting, pressurize to 15 psig (1.03 Barg). This should "lift" the bonnet (2) and "seat" the plug (4) firmly into the seat ring (11) for alignment purposes. Wiggle the actuator assembly (AA) to assist in alignment.

30. Wrench-tighten the bonnet bolting (20) (21) in an alternating cross-pattern in 1/4 revolution increments. Torque bonnet bolting to 30 ft/lbs (41 N-M).

31. For ATC-FO action units, release actuator pressure.

32. Torque packing flange nuts (12) to 12 ft/lbs (16 N-M).

33. Hammer rap yoke nut (17) tight. It was loosened in Step 16a.

34. Calibrate unit per Section V.

E. Diaphragm Replacement:

WARNING

SPRING UNDER COMPRESSION! Prior to removing actuator casing's bolting, relieve spring compression by backing out the spring adjustor. Failure to do so may result in flying parts that could cause personal injury.

1. Place valve's body (1) in a vise with the actuator assembly (AA) directed upwards.

2. Release all air pressure loaded into the actuator's upper casing (2).

3. Rotate spring adjustor (4) CCW (viewed from plug end) until actuator's range spring (6) is fully relaxed. Record the number of revolutions required to loosen in box below:

Number of revolutions required to relax actuator range spring: _____

4. Fully remove all casing bolting (10) (11), except for two sets of bolting (10) (11) that are 180° across from each other. Loosen these final sets of bolting (10) (11) in alternating sequence one revolution of the nut (11) at a time. If the casings (2) (3) pull apart on their own, the spring adjustor (4) may require more loosening. Go back to step 3 above.

5. Remove upper casing (2). Lift diaphragm (7) from lower casing (3) flange. A putty knife or similar device may be required to help separate.

6. Place a wrench on the lower stem jam nut (22) and loosen diaphragm washer nut (9) CCW (viewed from above) to removal. Remove diaphragm washer (8); use putty knife, if necessary, to pry away.

7. Remove diaphragm (7) and examine for possible cause of failure. Discard used diaphragm (7).

8. Clean diaphragm plate (5), if necessary. Place new diaphragm (7) into position, aligning bolt holes of diaphragm (7) with lower casing (3) holes.

9. Apply a silicone rubber adhesive/sealant similar to Dow-Corning "Silastic" #732RTV between the diaphragm (7) and washer (8) at the juncture of the diaphragm plate (5) and the actuator stem (19). Place diaphragm washer (8) into position. Tighten diaphragm washer nut (9) to 35 ft/lbs (47 N-M) torque using torque wrench.

10. Reposition upper casing (2) with lower casing (3) flange with diaphragm (7) between flanges.

11. Reinstall diaphragm bolting cap screws (10) and nuts (11); wrench-tighten firmly in alternating crossing pattern. Final-tighten bolting (10) (11) to 20-25 ft/lbs (27-34 N-M) torque using torque wrench.

12. Reapply compression to the range spring (6) by rotating the spring adjustor (4) CW (viewed from plug end) the same number of revolutions recorded in box of Step 3, this subsection.

F. Manual Handwheel Seal Replacement:

1. The 2" Model 2266 utilizes an O-ring type seal. See Figure 5.

   a. Release all air pressure in actuator upper casing (2).

   b. Remove machine screw (63) limiting travel of handwheel subassembly (60).

   c. Rotate handwheel (60) CCW (viewed from above) to removal.

d. Remove O-ring (51) from handwheel subassembly stem (60). Clean assembly (60) in solvent cleaner. Lightly lubricate the O-ring (51) and threaded portion of the stem (60) with lithium grease.

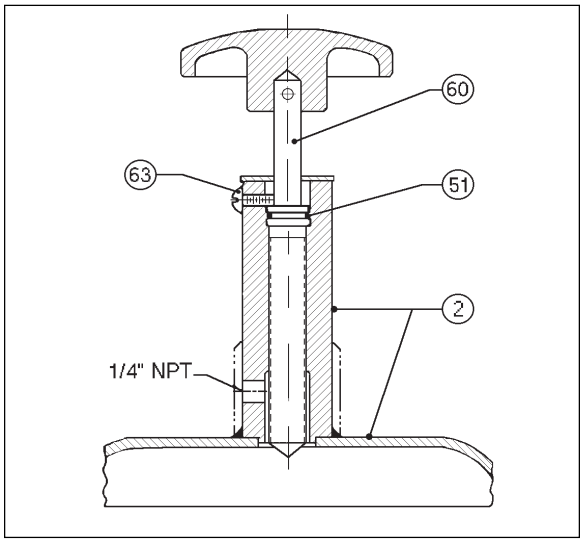


Figure 5: Handwheel Subassembly

e. Solvent clean the interior of the extension mounted on the upper casing (2), taking care to remove rust, dust, etc. from that portion of the extension (2) where the O-ring (51) will contact. Place a light coating of lithium grease on the O-ring (51) contacting surface of the extension (2).

f. Reinsert the handwheel subassembly (60) into the extension (2), screwing the handwheel (60) CW (viewed from above) until the tip of the stem (60) reaches the diaphragm washer nut (9).

g. Reinstall machine screw (63). Back handwheel (60) out rotating CCW to ensure that the screw (63) is properly functioning as a travel stop.

G. Reversing Unit Action:

1. Place body (1) into vise with actuator assembly (AA) directed upwards. Place matchmarks between the bonnet (2) and body (1).

2. Secure actuator assembly (AA) with an overhead support capable of vertically hoisting.

3. Rotate spring adjustor (4) CCW (viewed from body side) until actuator's range spring (6) is fully relaxed. Record the number of revolutions required to loosen in box below:

Number of revolutions required to relax actuator range spring: _____

4. Loosen all bonnet stud/bolt nuts (20) (21) to removal.

5. Lift actuator assembly (AA) upwards approximately 8 inches (200 mm), and lay horizontally on a work bench.

NOTE: *When changing unit action, consideration should be given to replacement of packing rings (10). Body O-ring (8) and seat ring gasket (5) are recommended for replacement once the bonnet (2) and seat ring (3) have been removed; reuse of gaskets (5) (8) may allow fluid leakage upon reassembly and pressurization.*

6. Remove body O-ring (8) from body (1) recess. Remove seat ring gasket (5) from body (1) recess. Clean gasket facing surfaces in body (1) and on bonnet (2).

NOTE: *The changing of unit action from direct ATC-FO or from reverse ATO-FC action is accomplished not in the actuator, but in the body by reversing the orientation of the plug & stem subassembly (4) with respect to the seat ring (3). See Figures 6 and 7.*

7. ***From ATO-FC to ATC-FO Action:***

a. With this action, the seat ring (3) and loose cage (19) are retracted from the body (1) when the actuator assembly (AA) is removed.

b. Loosen jam nuts (22). Loosen packing flange nuts (12).

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

c. Using soft-jawed pliers, grasp the plug & stem subassembly (4) just below at the threaded portion, and rotate the plug & stem subassembly assembly (4) CCW (viewed from plug end) to removal. Record the number of revolutions required to disengage in box below.

Number of revolutions to disengage valve plug & stem subassembly from actuator stem: _____

d. Partially withdraw the plug & stem subassembly assembly (4) from the bonnet (2), taking care not to drop the loose cage

(19), seat ring (3), position indicating disc (20) and accessory plate ((AP)), if installed.

e. Remove jam nuts (22). Fully withdraw plug & stem subassembly assembly (4) from the bonnet (2).

f. Clean gasket facing surfaces and install a new seat ring gasket (5) in the body (1) cavity. Set the seat ring (3) into the body (1) cavity in an inverted orientation from the way removed.

g. Set loose cage (19) so that it clears the lip of the seat ring (3) and sets properly on the ledge of the seat ring (3).

h. Place a new body O-ring (8) in the body (1) recess.

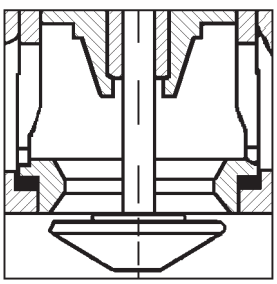
i. Remove and replace packing rings (10) as directed in Section H.

j. Insert the plug & stem subassembly (4) back into the bottom of the bonnet (2). Screw both jam nuts (22) back onto plug & stem subassembly (4), and locate at the root of the thread portion. Replace all the "loose dangling" parts back in their proper order and orientation.

NOTE: *Reference the IOM for the positioner as the orientation/location of the ((AP)) may change. If the action of the positioner does not change when the valve unit's action is changed, the location of the positioner unit will change from the right side of the actuator yoke (1) to the left side, or vice versa. This requires that the actuator be rotated 180° from the beginning body-to-bonnet orientation, and that the positioner be removed and reoriented to an opposite position.*

Action: Air-to-Open, Fail Close

Plug located beneath seat ring. Increased loading pressure pushes stem down, plug opens.



Fail Close,
Air-to-Open

Figure 6: ATO-FC Action

k. Reengage the valve plug & stem subassembly (4) with the actuator stem (19). Engage the number of revolutions recorded in Step 7.c, plus the number of revs indicated in Table 2.

l. Tighten one jam nut (22) into position.

m. Lift actuator assembly (AA) and lower into the body (1) cavity, aligning over body bolting (20). Reset the bonnet (2) onto the body O-ring (8).

n. Install nuts (21) onto bonnet bolting (20). Hand tighten; loosen one revolution.

o. Replace compression to actuator range spring (6) by rotating spring adjustor (4) CW (viewed from plug end) the number of revs indicated in the box of Step 3 previous.

p. Slowly pressurize the actuator casing (2) to the higher level of the new bench set indicated from Table 1.

TABLE 1

ATO-FC CONVERTED TO ATC-FO					
Bench Set Indicated on Nameplate		**New Bench Set to be Utilized**		**Loading Pressure Step G.7.p.**	
psig	(Barg)	psig	(Barg)	psig	(Barg)
5-15	(.34-1.03)	3-13	(.21-.90)	13	(.90)
10-30	(.69-20.7)	6-26	(.41-1.79)	27	(1.86)

q. Observe that the bonnet (2) rises as the plug head (4) pushes against the seat ring (3).

r. Wiggle the actuator assembly (AA) to align all the moving parts. Wrench-tighten the bonnet bolting nuts (21) in alternating cross-pattern and in 1/2 revolution increments until fully tightened.

s. Release air pressure in actuator and proceed to Step 9.

TABLE 2

No. of Stem Revs to be Added/Subtracted	
ATO-FC to ATC-FO	**ATC-FO to ATO-FC**
+6	-6

8. ***From ATC-FO to ATO-FC Action:***

a. With this action, the seat ring (3) and loose cage (19) remain in the body (1) when the actuator assembly (AA) is removed.

b. Loosen jam nuts (22). Loosen packing flange nuts (12).

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

c. Using soft-jawed pliers, grasp the plug & stem subassembly (4) just below/at the threaded portion, and rotate the plug & stem subassembly (4) CCW (viewed from plug end) to removal. Record the number of revolutions required to disengage in the following box:

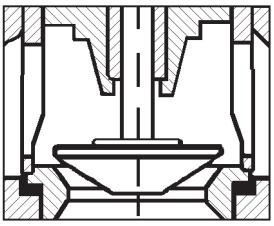
Number of revolutions to disengage valve plug & stem subassembly from actuator stem: _____

d. Partially withdraw the plug & stem subassembly (4) from the bonnet (2), taking care not to drop the "dangling parts" — position indicator disc (20) and ((AP)), if installed.

e. Remove jam nuts (22). Fully withdraw plug & stem subassembly (4) from the bonnet (2).

Action: Air-to-Close, Fail Open

Plug located beneath seat ring. Increased loading pressure pushes stem down, plug opens.



Fail Open
Air-to-Close

Figure 7: ATC-FO Action

f. Lift out the loose cage (19) and seat ring (3) from the body cavity. Remove the seat ring gasket (5). Clean gasket facing surfaces and install new seat ring gasket (5) and new body O-ring (8) into body (1) recesses.

g. Remove and replace packing rings (10) as directed in Section H.

h. Place the seat ring (3) over the end of the plug & stem subassembly (4) in an inverted) orientation from the way removed. Place loose cage (19) over end of plug & stem subassembly (4) and set it on the ledge of the seat ring (3).

i. Insert the plug & stem subassembly (4) back into the bottom of the bonnet (2). Screw both jam nuts (22) back onto plug & stem subassembly (4), and locate at the root of the thread portion. Replace all the "loose dangling" parts back in their proper order and orientation.

NOTE: *Reference the IOM for the positioner, as the orientation/location of the ((AP)) may change. If the action of the positioner does not change when the valve unit's action is changed, the location of the positioner unit will change from the right side of the actuation yoke (1) to the left side, or vice versa. This requires that the actuator be rotated 180° from the beginning body-to-bonnet orientation, and that the positioner be removed and reoriented to an opposite position.*

j. Reengage the valve plug & stem subassembly (4) with the actuator stem (19). Engage the number of revolutions recorded in Step 8.c., minus the number of revs indicated in Table 2.

k. Tighten one jam nut (22) into position.

l. Replace compression to actuator range spring (6) by rotating spring adjustor (4) CW (viewed from plug end) the number of revs indicated in the box of Step 3 previous. As the plug & stem subassembly (4), cage (19) and seat ring (3) are "drawn together", make sure that pieces are properly aligned.

m. Lift actuator assembly (AA) and lower into the body (1) cavity, aligning over body bolting (20). Rest the bonnet (2) onto the body O-ring (8).

n. Install nuts (21) onto body bolting (20). Wiggle the actuator assembly (AA) to align all the moving parts. Wrench tighten the bonnet bolting nuts (21) in alternating cross-pattern and in 1/2 revolution increments until fully tightened.

o. See Table 3 for correct bench set.

TABLE 3

ATC-FO CONVERTED TO ATO-FC			
Bench Set Indicated on Nameplate		**New Bench Set to be Utilized**	
psig	**(Barg)**	**psig**	**(Barg)**
3-13	(.21-.90)	5-15	(.34-1.03)
6-26	(.41-1.79)	10-30	(.69-2.07)

9. Record changes of new bench set on unit's nameplate (12). Remove indicator plate screws (22) and rotate indicator plate (21) top to bottom. Replace indicator plate screws (22).

10. Modify flow direction arrow located on body. (Valve-Actuator Unit is always designed with the flow tending to push the plug open — FTO, regardless as to ATO-FC or ATC-FO actions.)

11. Wrench tighten packing to a minimum of 12 ft/lbs (16 N-M). ***(NOTE:*** *Field tightening may be required to seal leakage.)*

12. Tighten second jam nut (22).

H. Packing Replacement:

1. Requires that the actuator stem (19) be separated from the valve plug & stem subassembly (4) to replace packing (10).

2. Follow procedure in Section IV.D.1 through IV.D.15., Section IV.D.21. through IV.D.34.

SECTION V

V. CALIBRATION

A. General:

1. This section covers calibration of the control valve unit. Calibration consists of adjusting stroke length and bench setting.

2. Positioner, if installed, requires reference to the specific positioner model IOM for proper calibration procedure.

3. All indicated Item Numbers that are with respect to IOM-2266-2" and are part of "body" will be in single parenthesis; i.e. (2). Those that are part of the actuator will be in single parenthesis and underscored; (2). Those that are part of the positioner IOM will be in double parenthesis; i.e. ((AP)).

4. Following procedures assume assembled valve unit has been removed from the pipeline where installed and all maintenance has been completed per instructions of Section IV preceding.

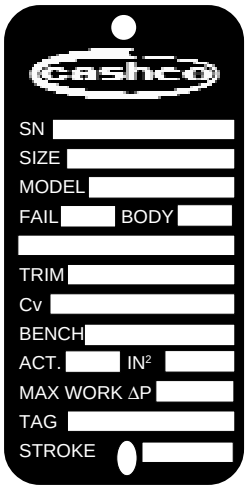
B. Procedure — Reverse Action, ATO-FC:

1. Place body (1) in a vise with actuator (AA) directed upwards.

2. Connect a temporary air supply with an in-line adjustable airset regulator with gauge to the actuator top-works connection.

3. Loosen lower stem jam nut (22) by rotating CCW (viewed from plug end) 2-3 revolutions. Using upper stem jam nut (22), firmly locate the indicator disc (20) up against the actuator stem (19) bottom.

4. Loosen screws (22) and position the indicator plate (21) at "S" (for shut); tighten screws (22) to secure indicator plate (21). ***NOTE****: Set the indicator plate (21) at the top edge of the indicator disc (20).*



5. Reference the nameplate (12) attached to the actuator yoke (1). Determine the bench setting of the installed range spring (6) from the nameplate (12); i.e. 5-15 psig (.34 -1.03 Barg), or 10-30 psig (.69-2.07 Barg).

6. Pressurize the actuator to a pressure level 2-3 psig (0.1-0.2 Barg) above the upper pressure level of the bench setting: i.e. for 5-15 psig (.34-1.03 Barg) range, set pressure at 17-18 psig (1.2-1.3 Barg).

7. Observe the position of the indicator disc (20) on the scale of the indicator plate (21), making sure to use the "top edge" of the indicator disc (20) as the reference point. If the position indicated is not exactly at "O" (for "open"), then the valve plug & stem subassembly (4) – to–actuator stem (19) combined length is incorrect, and must be adjusted.

8. a. If travel stops above the "O" position, the combined stem (4) (19) length is short. Loosen jam nut (22) holding the indicator disc (20) against actuator stem (19).
   b. Increase combined stem (4) (19) length by rotating the valve plug & stem subassembly (4) CCW (viewed from plug end) a distance equal to the amount of undertravel. Retighten jam nut (22).

9. a. If travel stops (below) the "O" position, the combined stem (4) (19) length is long. Loosen jam nut (22) holding the indicator disc (20) against actuator stem (19).
   b. Decrease combined stem (4) (19) length by rotating the valve plug & stem subassembly (4) CW (viewed from plug end) a distance equal to the amount of overtravel. Retighten jam nut (22).

10. Confirm that the position of the indicator disc (20) aligns with the indicator plate (21) at the "O" position.

11. Release air pressure in actuator allowing valve plug & stem subassembly (4) to travel to the closed or "S" position. Check the position indicated on the indicator plate (21).

12. If the "S" closed position is not correct, repeat steps 8 through 11 until the combined stem (4) (19) length is correct.

13. Pressurize the actuator to a pressure level corresponding to the lower pressure level of the bench setting; i.e. for 5-15 psig (.34-1.03 Barg) range, set pressure at 5 psig (.34 Barg). Do the pressurization slowly while observing the indicator disc (20) and indicator plate (21) simultaneously.

14. The proper calibration of the actuator/valve unit will occur when, at the lower pressure level of bench setting, the valve plug & stem subassembly's (4) plug will just begin to travel from the closed position.

    Pressurize actuator slowly. If plug & stem subassembly (4) begins travel before reaching the lower pressure level of bench setting, then increase the actuator's range spring (6) compression by wrench tightening spring adjustor (4) CW (viewed from plug end) in 1/2 revolution increments until desired bench setting is reached.

    Pressurize actuator slowly. If plug & stem subassembly (4) begins travel after surpassing the lower pressure level of bench setting, then reduce the actuator's range spring (6) compression by wrench loosening spring adjustor (4) CCW (viewed from plug end) in 1/2 revolution increments until desired bench setting is reached.

15. Increase pressure to actuator up to the upper level of bench setting and observe valve plug & stem subassembly (4) position at the indicator plate (21). The valve plug & stem subassembly (4) should be within ±8% (of full "stroke") of the "O" (for "open") position of the indicator plate (21). ("Stroke" length is indicated on the nameplate (12), and is the distance between the "S" and "O" points of the indicator plate (21).)

16. Record here the theoretical and actual pressure levels of paragraphs 14 and 15.

Theoretical Bench Setting from Nameplate	_____	psig
	_____	Barg
Setting at "S" Position	_____	psig
	_____	Barg
Setting at "O" Position	_____	psig
	_____	Barg

17. Tighten second stem jam nut (22).

C. Procedure — Direct Action, ATC-FO:

1. Place body (1) in a vise with actuator assembly (AA) directed upwards.

2. Connect a temporary air supply with an in-line adjustable airset regulator with gauge to the actuator top-works connection.

3. Loosen lower stem jam nut (22) by rotating CCW (viewed from plug end) 2-3 revolutions. Using upper stem jam nut (22) firmly locate the indicator disc (20) up against the actuator stem (19) bottom. With no pressure in the actuator, the upwards travel is halted by the actuator's internal upstop mechanism.

4. Loosen screws (22) and position the indicator plate (21) at "O" (for Open); tighten screws (22) to secure indicator plate (21). ***NOTE****: Set the indicator plate (21) at the top edge of the indicator disc (20).*

5. Reference the nameplate (12) attached to the actuator yoke (1). Determine the bench setting of the installed range spring (6) from the nameplate (12); i.e. 3-13 psig (.20-.90 Barg), or 6-26 psig (.41-1.79 Barg).

6. Pressurize the actuator to a level 2-3 psig (0.1-0.2 Barg) above the upper pressure level of the bench setting; i.e. for 3-13 psig (.20-.90 Barg) range, set pressure at 15-16 psig (1.0 - 1.1 Barg).

7. Observe the position of the indicator disc (20) and the indicator plate (21), making sure to use the "top edge" of the indicator disc (20) as the reference point. If the position indicated is not exactly at "S" (for "shut"), then the valve plug & stem subassembly (4)–to–actuator stem (19) combined length is incorrect, and must be adjusted.

8. a. If travel stops above the "S" position, the combined stem (4) (19) length is long. Loosen jam nut (22) holding the indicator disc (20) against actuator stem (19).
   b. Release 6-8 psig (0.4-0.6 Barg) of pressure level in the actuator. This step will ensure that when the combined stem (4) (19) length is decreased, the plug & stem subassembly will not be mistakenly rotated while seated.
   c. Decrease combined stem (4) (19) length by rotating the valve plug & stem subassembly (4) CW (viewed from plug end) a distance equal to the amount of undertravel. Retighten jam nut (22).

9. a. If travel stops below the "S" position, the combined stem (4) (19) length is short. Loosen jam nut (22) holding the indicator disc (20) against actuator stem (19).
   b. Release 6-8 psig (0.4-0.6 Barg) of pressure level in the actuator. This step will assure that when the combined stem (4) (19) length is increased, the plug & stem subassembly will not be mistakenly rotated while seated.
   c. Increase combined stem (4) (19) length by rotating the valve plug & stem subassembly (4) CCW (viewed from plug end) a distance equal to the amount of undertravel. Retighten jam nut (22).

10. Repressurize the actuator to the level of Step 6 above. If the "S" closed position is not correct, repeat Steps 8 and 9 until the combined stem (4) (19) length is correct.

11. Pressurize the actuator to a pressure level corresponding to the level of Step 6. Do the pressurization slowly while observing the indicator disc (20) and indicator plate (21) simultaneously.

12. The proper calibration of the actuator/valve unit will occur when, at the upper pressure level of bench setting, the plug & stem subassembly's (4) plug will just begin to travel from the closed position.

    Depressurize actuator slowly. If plug & stem subassembly (4) begins travel before reaching the upper pressure level of bench setting, release all air pressure, then decrease the actuator's range spring (6) compression by wrench loosening spring adjustor (4) CCW (viewed from plug end) in 1/2 revolution increments. Repeat this procedure until desired bench setting is reached.

    Depressurize actuator slowly. If plug & stem subassembly (4) begins travel after surpassing the upper pressure level of bench setting, release all air pressure, then increase the actuator's range spring (6) compression by wrench tightening spring adjustor (4) CW (viewed from plug end) 1/2 revolution increments. Repeat this procedure until desired bench setting is reached.

13. Decrease pressure to actuator down to the lower level of bench setting and observe valve plug & stem subassembly (4) position at the indicator plate (21). The valve plug & stem subassembly (4) should be with ±8% (of full stroke) of the "S" (for "shut") position of the indicator plate (21). ("Stroke" length is indicated on the nameplate (12), and is the distance between the "S" and "O" points of the indicator plate (21).)

14. Record here the theoretical and actual pressure levels of paragraphs 12 and 13:

Theoretical Bench Setting from Nameplate	_____	psig
	_____	Barg
Setting at "S" Position	_____	psig
	_____	Barg
Setting at "O" Position	_____	psig
	_____	Barg

15. Tighten second stem jam nut (22).

SECTION VI

VI. START-UP

A. General:

1. Ensure that the Model 2266 unit has been properly adjusted and calibrated, including the positioner, if installed.

2. Recommend start-up to be 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 in the following table.

   DO NOT STROKE THE CONTROL VALVE WITH AN AIR SUPPLY PRESSURE SETTING GREATER THAN RECOMMENDED MAXIMUM PRESSURE!

Bench Setting		Airset Output	
psig	(Barg)	psig	(Barg)
5-15	(.34-1.03)	20	(1.4)
3-13	(.21-.90)		
10-30	(.69-2.07)	35	(2.4)
6-26	(.41-1.79)		

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 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.

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.

9. 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 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 VII

VII. TROUBLESHOOTING GUIDE

1. Valve is "jumpy" in stroking.

Possible Cause	Remedy
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 exhibits “excess” vibration.

Possible Causes	Remedy
A. Excess pressure drop.	A. Bring pressure drop within design limits.
B. Lower bushing wear.	B. Replace stem guide bushing.
C. Excessive cavitation in liquid service.	C1. Change operation parameters to relieve causes of cavitation. C2. Replace valve with valve equipped for cavitational 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.

3. Valve makes “screeching” noise.

Possible Cause	Remedy
A. Excess pressure drop.	A. Bring pressure drop within design limits.
B. Lower bushing wear.	B. Replace stem guide bushing.
C. Misalignment.	C. Re-align body-stem-actuator

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 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. Remove particulate. D4. Possible excess cavitation in liquid service. Change operation parameters. D5. 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.

6. Body O-ring leaking.

Possible Cause	Remedy
A. Improper bonnet bolting draw down.	A. Replace O-ring and draw down bolting evenly in a cross-pattern.
B. Warped bonnet and/or body flange.	B. Replace body and/or bonnet and body O-ring. Draw down bonnet bolting evenly in a cross-pattern.
C. Over-tightened flange bolting.	C. Loosen bolting, replace body O-ring, reinstall new flange bolting.

SECTION VIII

VIII. PARTS ORDERING INFORMATION

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

METHOD A – USE OF PRODUCT CODE.

Step 1. If available, obtain the 18 character product code number from the Bill of Materials sheet attached herein.

□□□ – □□□ **7** – □□□□□□□□□□

Step 2. Identify which kits or parts are desired from the Bill of Materials sheet or refer to the cross-sectional drawings.
***NOTE**: Kit "A" contains gasket(s), packing and soft seat, where applicable. Kit "B" contains plug/ stem assembly, seat ring plus gasket(s) and packing.*

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

METHOD B – NO PRODUCT CODE AVAILABLE – DISASSEMBLED VALVE.

Step 1. Determine all available information from valve's metal tag.
   a. Serial number.
   b. Valve "Type" or "Model" number.
   c. Size (may have to observe body tap).
   d. Body material.
   e. Fail position.
   f. Trim designation number (if available).
   g. Cv or port size
   h. Bench set.

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

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

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

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

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

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

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

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

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

2" MODEL 2266
STANDARD CONSTRUCTION (TFE V-RING PACKING)
PARTS KIT NUMBERS
(Kit Nos. Shaded)

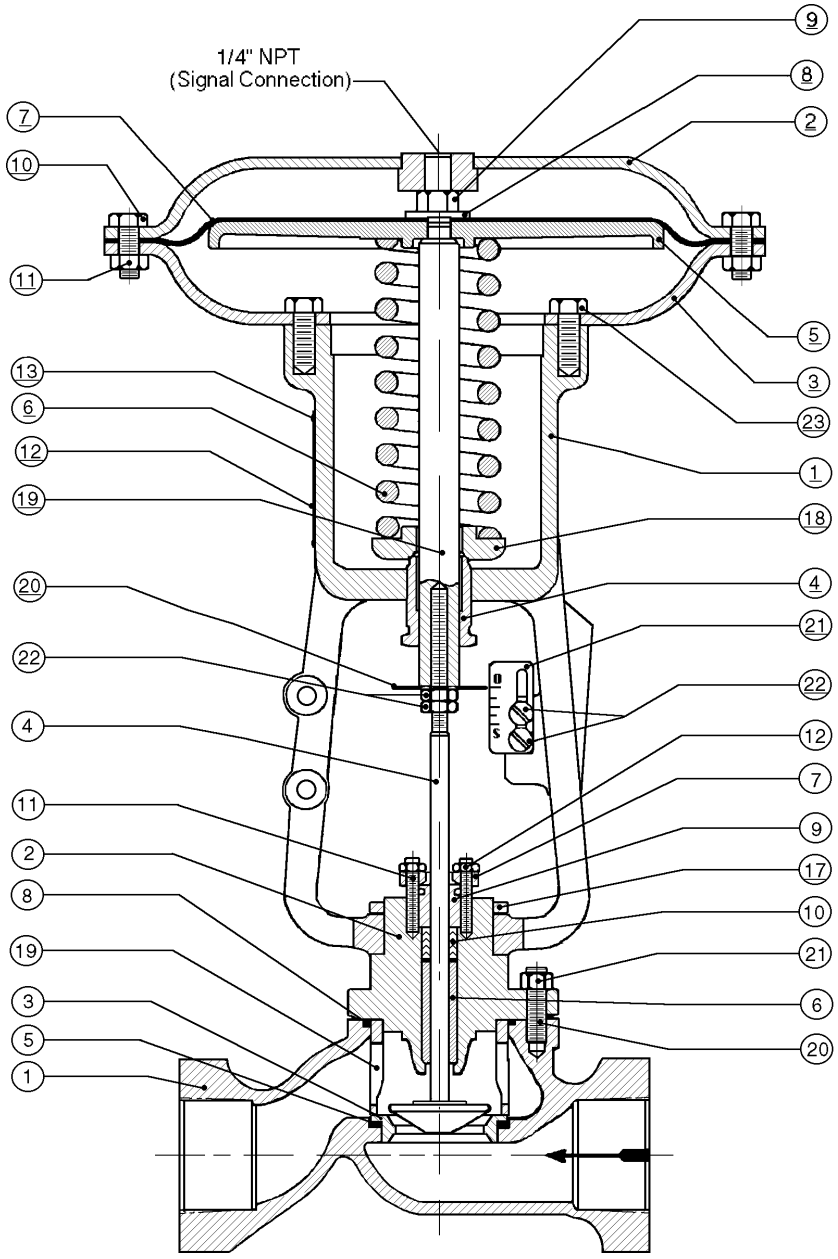
Trim Desig. No.	Action	Kit Abbre.	2" (DN50) Body Size	
S2	ATO & ATC	A	424-510K-5AA	***NOTE:** Neoprene Diaphragm not included in kits. If required, reference the following part numbers. Consult your Cashco Sales Representative for pricing.*
S2	ATO & ATC	B	424-510K-5BA	
S4	ATO & ATC	A	424-610K-5AA	Part Number
S4	ATO	B	424-610K-5BA	210-43-2-05028-00
S4	ATC	B	424-610K-7BA	

2" MODEL 2266 : STANDARD UNIT w/ TFE V-RING PACKING

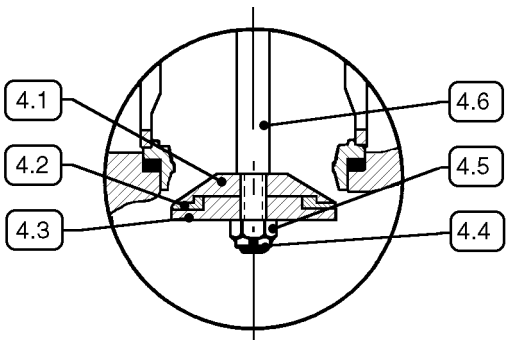
Item No.	Description
1	Yoke
2	Upper Case Subassembly
3	Lower Case
4	Spring Adustor
5	Diaphragm Plate
6	Range Spring
7	Diaphragm
8	Diaphragm Washer
9	Diaphragm Washer Nut
10	Case Bolt
11	Case Bolt Nut
12	Name Plate
13	Name Plate Screw
17	Yoke Nut
18	Spring Seat
19	Actuator Stem
20	Travel Indicator
21	Indicator Plate
22	Indicator Plate Screw
23	Yoke Bolt
1	Body
2	Bonnet
3	Seat Ring
4	Plug & Stem Subassembly (Metal & Composition Seat)
	4.1 Lower Seat Adapter (Composition Seat)
	4.2 Seat (Composition Seat)
	4.3 Upper Seat Adapter (Composition Seat)
	4.4 Cotter Pin (Composition Seat)
	4.5 Castle Nut (Composition Seat)
	4.6 Stem (Composition Seat)
5	Seat Ring Gasket
6	Stem Guide Bushing
7	Packing Flange
8	Body O-ring or Body Gasket
9	Packing Follower
10	Packing
11	Packing Stud
12	Packing Stud Nut
19	Cage
20	Body Stud
21	Body Stud Nut
22	Stem Nut

Not Shown:

23	Bushing
24	Wiper Ring



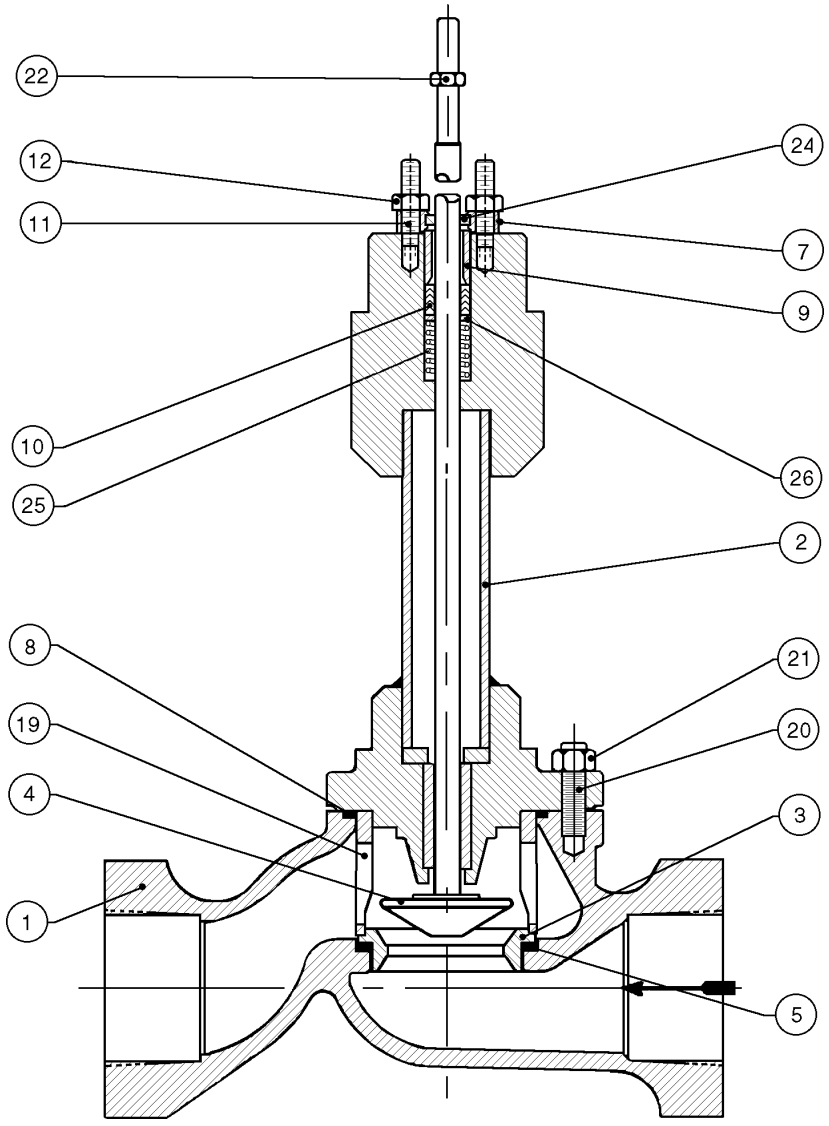
ATC-FO Action, Metal Seat Design



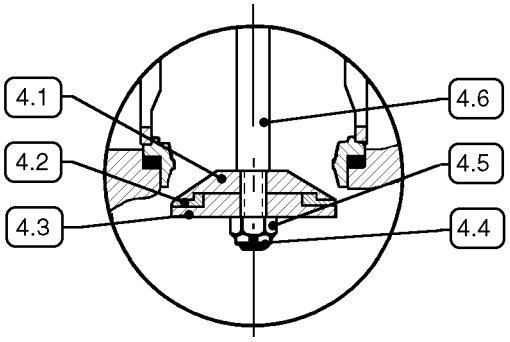
ATO-FC Action, Composition Seat Design

2" MODEL 2266 CRYOGENIC CONSTRUCTION
w/ TFE V-RING LIVE-LOADED PACKING

Item No.	Description
1	Body
2	Extension Column
3	Seat Ring
4	Plug & Stem Subassembly (Metal & Composition Seat)
	4.1 Lower Seat Adapter (Composition Seat)
	4.2 Seat (Composition Seat)
	4.3 Upper Seat Adapter (Composition Seat)
	4.4 Cotter Pin (Composition Seat)
	4.5 Castle Nut (Composition Seat)
	4.6 Stem (Composition Seat)
5	Seat Ring Gasket
7	Packing Flange
8	Body O-ring or Body Gasket
9	Packing Follower
10	Packing
11	Packing Stud
12	Packing Stud Nut
19	Cage
20	Body Stud
21	Body Stud Nut
22	Stem Nut
24	Wiper Ring
25	Spring (Packing)
26	Washer (Packing)
Not Shown:	
23	Bushing



ATC-FO Action, Metal Seat Design



ATO-FC Action, Composition Seat Design

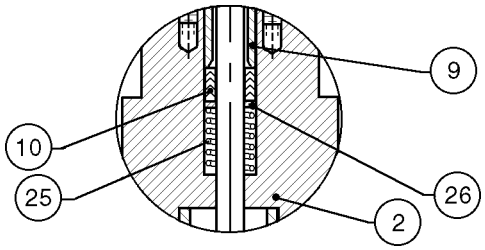


Figure 8: Live-loaded V-ring Packing

NOTES

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