# MODEL 521

## TOTAL TFE, GLOBE-PATTERN CONTROL VALVE *BODY*

### SECTION I

## I. DESCRIPTION AND SCOPE

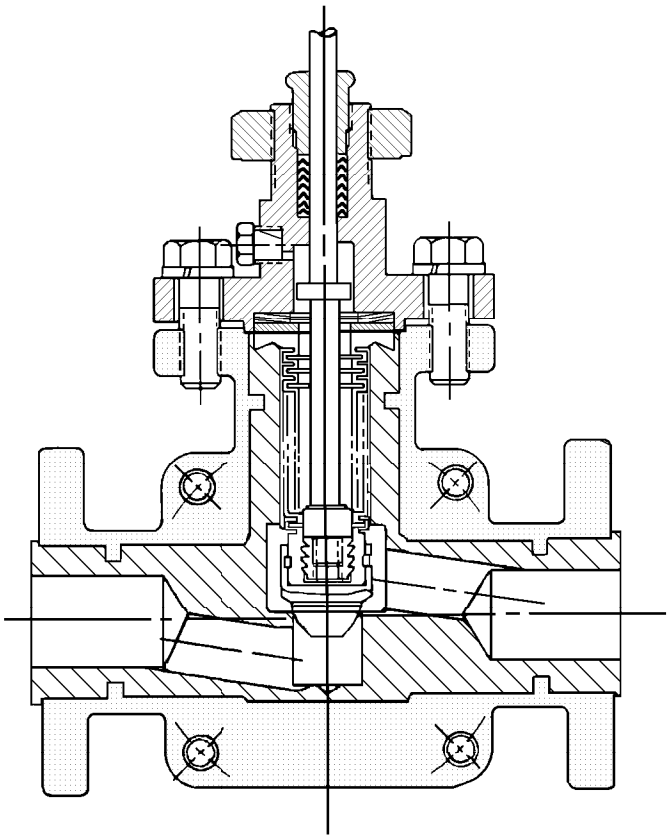
The Model 521 is a bellows sealed, globe-style control valve fabricated from a tee-block of isostatically compacted virgin TFE. Sizes are 1/2", 1", 1-1/2" and 2". The split body jacket is CF8 (304 SST) material. All wetted internal parts are of isostatically compacted TFE material. The standard stem is of 316 SST material; two optional Hastelloy C-276 stem constructions are available.

End connections are available to mate with 150#, 300# or DIN 16, 25 or 40 flanges. Each flange is drilled and tapped to receive stud bolting only.

The valve is designed for chemical service with fluids that are normally corrosive to metallic materials.

Application pressure vs. temperature zone is as indicated in Graph No. 1 (pg. 16).

Actuators that may be mounted to a Model 521 body are Cashco Models 30D or 30R (field reversible), or Models 55D, 55R, 75D, 75R, 115D or 115R (non-field reversible).



**Model 521 Body**

### SECTION II

## II. REFERENCES

Refer to Technical Bulletin 521-TB for complete technical specifications of a Model 521 coupled with any of the Cashco Models 30, 55, 75 or 115 actuators.

Refer to the following Installation, Operation and Maintenance Manuals (IOM's) for devices mounted to a Model 521 body or its actuator:

| P/P Positioner | I/P Positioner | Actuators |
|---|---|---|
| IOM-9540L | IOM-9520L | IOM-30 or IOM-55/75/115 |

ABBREVIATIONS

SST ..... Cast or Wrought Stainless Steel
HC ..... Wrought Hastelloy C-276
ATO-FC ... Air-to-Open, Fail Closed
ATC-FO ... Air-to-Close, Fail Open
CW ..... Clockwise
D ..... Direct Acting
DIR ..... Direct Acting
R ..... Reverse Acting
REV ..... Reverse Acting
IAS ..... Instrument Air Supply
IOM ..... Installation, Operation and Maintenance Manual
SIG ..... Output Signal from Instrument
LOAD ..... Positioner Output Air Pressure
V ..... Vent

## SECTION III

# III. INSTALLATION

### A. Orientation

1. Recommended orientation when installed is in a horizontal pipeline with the stem vertical. Valves may be installed in a vertical or horizontal pipeline with the stem between vertical and horizontal for all sizes, except when a Model 115D or 115R actuator is utilized. All valves with 115D/115R actuators must be installed with a vertical stem orientation.
2. Outdoors, all installations may be oriented at any angle from horizontal-to-vertical, except as limited in III.A.1. above. Orient actuator vent cap, if supplied, to not collect rainwater that might freeze.
3. Model 521 valves should not be installed with the stem oriented below horizontal/downwards.
4. In no case is additional weight to be applied to the actuator sub-assembly when installed in an orientation other than vertical.

**WARNING!!** **The valve/actuator unit should not be used as a "step" to support personnel. Failure to comply may cause leakage at the bonnet/body joint, allowing possible contact with harmful fluids.**

### 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.

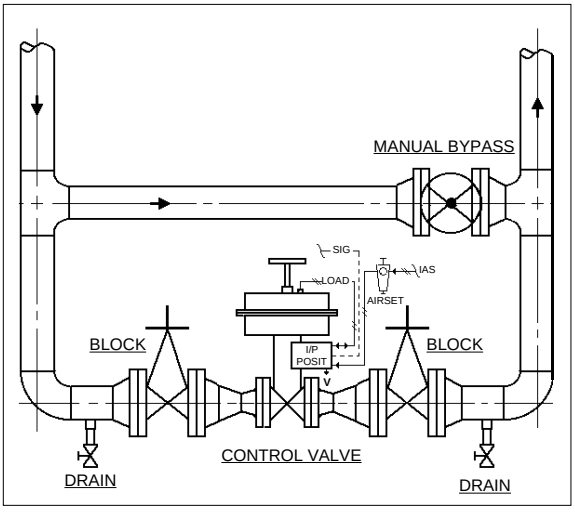



**Figure 1**: Typical Control Valve Station

2. 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.
3. Clean the piping of all foreign debris, including chips, weld scale, weld splatter, oil, grease, sand or dirt prior to installing the control valve; THIS IS AN ABSOLUTE REQUIREMENT.
4. Field hydrostatic testing the completed piping system, including the Model 521, to 1-1/2 x CWP indicated on Model 521 nameplate is acceptable. If hydro test pressure exceeds the 1-1/2 x CWP limit, the 521 must be removed for such testing. Before pressurization, the valve plug should be lifted from the seat if of reverse, ATO-FC action.
5. Flow Direction: Install so the flow direction matches the arrow cast on the valve body.
6. Valves are not to be direct buried underground.
7. Insulation may be applied as indicated in Figure 2. Drainage from the packing area must be assured when fully installed, sealed and lagged for outdoors installation. Vented pipe plug (12) should not be covered.

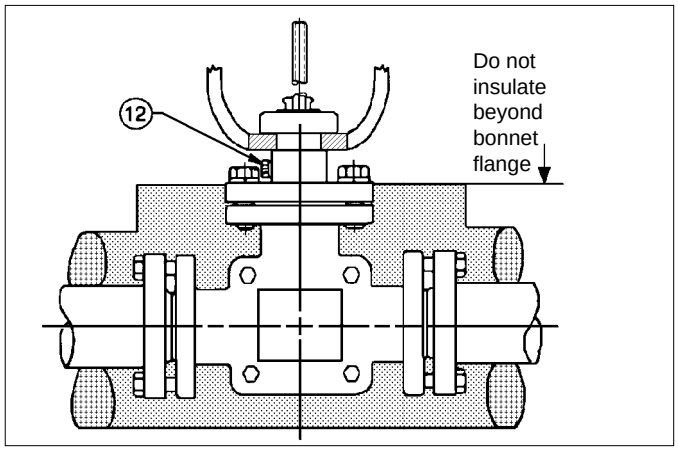



**Figure 2**: Body Insulation

8. 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 assure unidirectional expansion/contraction. Properly align prior to installing valve with required flange bolting.

9. The Model 521 is designed for a flanged connection that is gasketless. The raised face portion of end connection flange serves as the gasket.

10. An ANSI/DIN adapter gasket (17) is supplied with all Model 521 valves provided with DIN 16/25/40 end connections. See Figure 3. The purpose of this adapter gasket (17) is to assure proper compression of the body's TFE core (1.2) when used with DIN piping.

    To assist during installation, place pipe thread sealant on one side of adapter gasket (17), and press the sealant covered side of the adapter gasket over the exposed TFE of the body core (1.2) end connection. The sealant will hold the adapter gasket (17) to its proper location prior to joining with a piping flange.

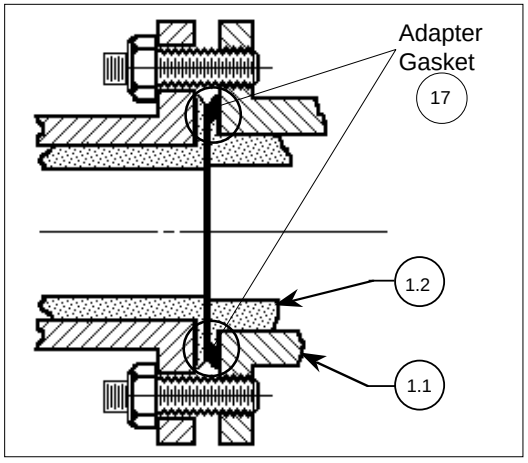



**Figure 3**: ANSI/DIN Adapter Gasket

11. Flange bolting must be of the stud-type. Each flange is drilled and tapped to accept studs. The studs should be of a length to penetrate the full depth of the bolt hole thru the flange; DO NOT USE STUDS/BOLTS OF TOO SHORT LENGTH. See Table 1 for stud size/ thread/length requirements.

TABLE 1

| Body Size in. (DN) | End Connection Flange Bolting | | |
|---|---|---|---|
| | 150# | 300# | DIN 16/25/40 |
| 1/2" (15) | 1/2"Ø - 1-3/4" 13 UNC-2B | 1/2"Ø - 1-3/4" 13 UNC-2B | 14mmØ - 45mm M12x1.75-6H |
| 1" (25) | 1/2"Ø - 2" 13 UNC-2B | 5/8"Ø - 2" 11 UNC-2B | 14mmØ - 52mm M12x1.75-6H |
| 1-1/2" (40) | 1/2"Ø - 2-1/2" 13 UNC-2B | 3/4"Ø - 2-3/4" 10 UNC-2B | 18mmØ - 70mm M16x2.0-6H |
| 2" (50) | 5/8"Ø - 2-1/2" 11 UNC-2B | 5/8"Ø - 2-3/4" 11 UNC-2B | 18mmØ - 70mm M16x2.0-6H |
| No. Bolt Holes | 4 | 4 or 8 * | 4 |

* 2" - 300# requires 8 bolt holes; all others 4.

12. Tighten flange stud nuts uniformly in a crossing pattern. Assure flange facing alignment. Do not use flange bolting to "pull" flanges into alignment. Tighten flange bolting to torque levels of Table 2 in increments of 1/2 revolution to assure uniform loading of valve's raised facing.

TABLE 2

| Body Size in (DN) | End Connection Flange | | |
|---|---|---|---|
| | ANSI-150 | ANSI-300 | DIN 16/25/40 |
| 1/2" (15) | 10–12 ft-# | 10–12 ft-# | 15–18 N-m |
| 1" (25) | 10–12 ft-# | 12–14 ft-# | 21–25 N-m |
| 1-1/2" (40) | 10–12 ft-# | 14–17 ft-# | 18–22 N-m |
| 2" (50) | 35–40 ft-# | 17–20 ft-# | 50–60 N-m |

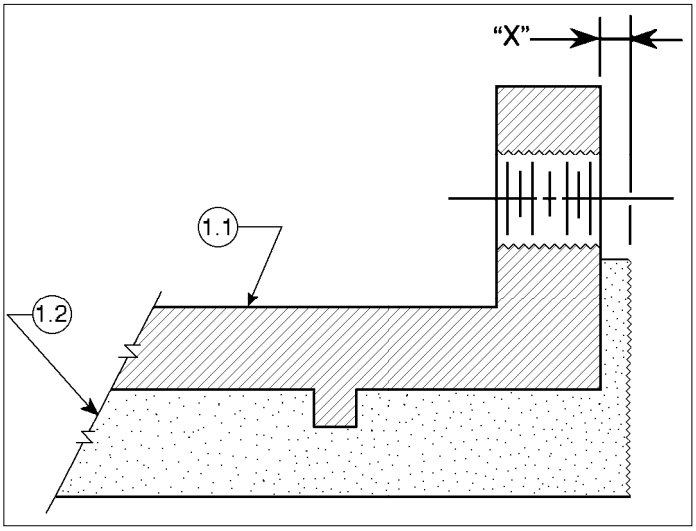



**Figure 4**: End Connection - Partial Section

**NOTE**: If the installed Model 521 has had the flange bolting over-torqued, distortion of TFE core (1.2) will occur. If dimension "X" in Figure 4 is 0.040" (1 mm) or less, a gasket is recommended upon reinstallation. If dimension "X" is less than 0.020" (0.5 mm), body replacement is recommended.

**C. Auxiliary Detection:**

1. When a fluid is known to permeate TFE over a finite time period and the fluid is lethal or is subject to stringent limits of fugitive emissions, the vented pipe plug (12) should be removed and one of, or a combination of, the following methods should be considered to monitor the integrity of the internal primary stem (9) seal – the bellows sub-assembly (8):

   a. gas detector with alarm
   b. pressure indicating gauge
   c. pressure switch with alarm
   d. inert gas, constant flow purge.

## SECTION IV

# IV. MAINTENANCE

1. **WARNING!!** **Model 521 control valves frequently are in hazardous/lethal fluid services. Before removal from pipeline or any level of disassembly, consult the Owner's safety procedures for proper flushing, cleaning and handling of a valve exposed to potentially hazardous fluids during de-pressurization and removal. Owner's safety procedures preempt any statements or recommendations contained in this IOM.**

2. Once fluid pressure has been isolated by block valves, and piping flange bolting has been only loosened, carefully remove vented pipe plug (12) from the bonnet (2), applying the safety procedures of 1. above, as a small quantity of fluid may be "trapped" in the void space of the bellows (8.1) interior due to permeation. The plug (12) has a "groove" notched in its threads to assure venting prior to the threads fully disengaging. Once fully vented and/or purged as required by safety procedures, reinstall the plug (12) using a fluid compatible lubricant . DO NOT USE THREAD SEALANT FOR VENTED PIPE PLUG (12) ON REINSTALLATION.

3. Maintenance procedures hereinafter are based upon removal of the valve/actuator unit from the pipeline where installed.

4. Owner should refer to Owner's procedures for removal, handling and cleaning of non-reuseable parts; i.e. gaskets, suitable solvents, etc.

5. Valves supplied from the factory do not use any aid to assist in gasket sealing such as oil, sealant or pipe dope.

6. All indicated Item Numbers that are with respect to IOM-55/75/115 or IOM-30 will be in parenthesis and underscored; i.e. (20); the same is true for the positioner parts. If a double parenthesis and underlined item number is used, this number applies only to the IOM-30 instruction; i.e. ((23)). All Item Numbers that are with respect to this IOM-521 are not underscored; i.e. (32).

7. The stem sub-assembly (9) is designed for non-rotation when installed. DO NOT ATTEMPT TO ROTATE WITH THE STEM SUB-ASSEMBLY (9) INSTALLED; FAILURE TO HEED MAY CAUSE DAMAGE TO THE STEM SUB-ASSEMBLY (9), THE BELLOWS SUB-ASSEMBLY (8), THE PLUG (3) AND/OR THE BODY SUB-ASSEMBLY(1). Exhibit special care when handling the stem (9) surface where it contacts the packing (6).

**B. Pressure Boundary Leakage Shop Test:**

1. Secure the body assembly (BA) in a vise with the valve stem (9) oriented vertically.

2. Remove vented pipe plug (12).

3. Install a pipe nipple, test pressure gauge and isolation valve into the 1/8"-NPT (female) opening. (See Figure 5.)

4. Place a suitable adhesive tape ("duct tape") around the perimeter of the bonnet/body flange. Place tape on the "joint lines" of the shell halves (1.1) (see Figure 12). Place blind flanges over the flanged end connections and bolt down; one of the blind flanges must have a hole thru the face; place tape over the opening of the blind flange.

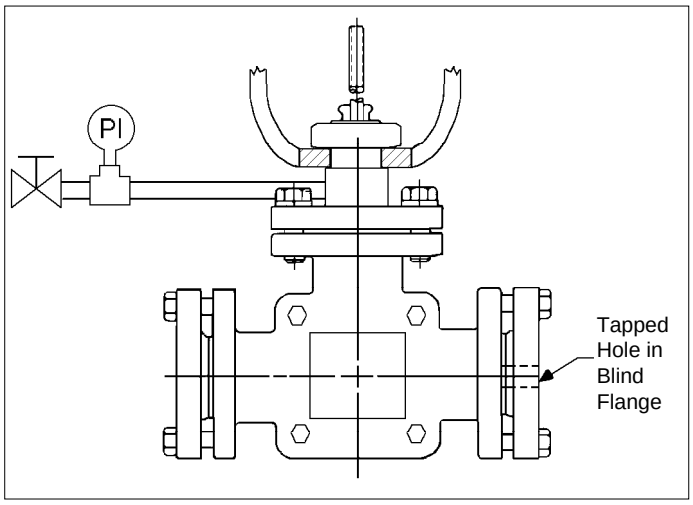



**Figure 5**:

5. Using a source of acceptable fluid such as nitrogen gas, pressurize the bellows "void zone" to 30 psig (2.1 Barg). Tightly close off the isolation valve of 3. above. Disconnect the pressure source.

6. Poke small holes in the tape at the bonnet/body flange and at the opening in the blind flange.

7. For units with reverse action (ATO-FC) actuators, introduce an air LOAD of approximately 12 psig (.8 Barg) to the input port of the actuator to hold the plug (3) away from the body (1) seat.

8. Apply leak detection fluid to all the potential leak paths:
   a. Packing gland nut (5). (Tighten as necessary.)
   b. Body (1)-to-bonnet (2) flange tape hole.
   c. Body (1) and bonnet (2) bolting (13, 14, 1.3, 1.4, 1.5).
   d. End connection blind flange tape hole.
   e. Test pressure piping connections.

9. If leakage occurs at:
   a. a. above, there is a packing (6) or a packing (6) /stem sub-assembly (9) failure.
   b. b. above, there is a bonnet gasket (11) failure.
   c. c. above, there is a bonnet gasket (11), or TFE core (1.2) failure.
   d. d. above, there is a bellows sub-assembly (8) failure.

10. Following this test procedure may help to solve maintenance problems when combined with visual examination of disassembled body assembly (BA).

**C. Actuator Assembly Removal:**

1. Reference the correct actuator IOM also for this procedure.

2. Secure the body assembly (BA) in a vise with the valve stem (9) oriented vertically upwards.

3. Rig actuator assembly (AA) to be supported above the valve body assembly (BA).

4. This procedure assumes that the body assembly (BA) has been fully assembled thru the bonnet (2), including the packing gland nut (5) and packing (6).

5. Loosen stem nut (17) by rotating CW (viewed from above).

6. Fully loosen any accessory devices that are connected to/with the stems (19) ((23)) (9), such as accessory plate (AP) for limit switch or positioner.

7. If the actuator is to be reinstalled, put paint or dye marker between the valve stem (9) and the actuator stem (19) ((23)), to serve as matchmarks.

8. Loosen packing (6) by loosening packing gland nut (5) 2-3 revolutions.

9. To fully disengage the actuator stem (19) ((23)) from the valve stem (9) 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 attempt to make each step about half of full stroke. Keep track of the number of revolutions for each step in the box below.

| No. of revolutions to disengage valve stem for actuator swivel connector: |
|---|
| Step A. _____ Step B. _____ |
| TOTAL _____ |

10A. *For ATO-FC Reverse Action Actuators*:

   a. Grasp the valve's stem (9) at a point above the packing gland nut (5) using soft-jawed locking pliers.

   b. Pressurize the actuator to lift the valve's plug (3) away from the body's (1) integral seat until the plug (3) is 100% open.

   c. Using a blunt end tool, hammer rap the tool to loosen yoke nut (15), turning CCW (viewed from above) approximately 1/2 revolution.

   d. Step A. While holding the valve's stem (9), rotate swivel connector (73) at portion (73.3) CCW (viewed from above actuator). Keep track of the number of revolutions of swivel connector (73.3) in table above. When disengagement reaches half-stroke, Step A is completed.

   e. Step B. Support/rig the actuator assembly (AA) from above for lifting. Fully loosen yoke nut (15) to removal. Lift the actuator assembly (AA) upwards approximately 1⁄4"–3/8" (6–8 mm). Again, rotate swivel connector portion (73.3) CCW (viewed from above) until disengagement of valve's stem (9) from swivel connector (73.3). Keep track of the number of swivel connector (73.3) revolutions in the table above.

**NOTE**: Take notice of the parts “dangling loosely” about the stem (9), the order of their location and their proper orientation.

10B. *For ATC-FO Direct Action Actuators*:

   a. Grasp the valve's stem (9) at a point above the portion that penetrates into the packing rings (6) with soft-jawed locking pliers.

   b. Step A. While holding valve stem (9), rotate swivel connector (73) at portion (73.3) CCW (viewed from above actuator). Keep track of the number of revolu-

tions of swivel connector (73.3) on page 5. When disengagement reaches half-stroke, Step A is completed.

c. Using a blunt end tool, hammer rap the tool to loosen the yoke nut (15), turning CCW (viewed from above) approximately 1/2 revolution.

d. Step B. Support the actuator assembly (AA) from above. Fully loosen yoke nut (15) to removal. Lift the actuator assembly (AA) upwards approximately 1/4"–3⁄8" (6–8 mm). Again, rotate swivel connector portion (73.3) CCW (viewed from above) until disengagement of valve's stem (9) from swivel connector (73.3). Keep track of the number of swivel connector (73) revolutions in the table on page 5.

**NOTE**: Take notice of the parts "dangling loosely" about the stem (9), the order of their location and their proper orientation.

11. Fully raise the actuator assembly (AA) from the valve body assembly (BA). Release any actuator air pressure. Remove cautiously to prevent the "dangling parts" (position indicating disc (20), accessory plate (AP), yoke nut (15)) from falling.

**D. Body Disassembly:**

1. Access to body assembly (BA) internals may be accomplished with the actuator assembly (AA) intact with the bonnet (2) (i.e. yoke nut (15) is still fully tightened), or with the body assembly (BA) separated as per above paragraph IV.C.1.

2. Maintenance procedures hereinafter are based upon the actuator assembly (AA) fully interconnected with the valve stem assembly (9) during disassembly.

3. Secure the body assembly (BA) in a vise with the valve stem (9) oriented vertically.

4. Secure and rig the actuator assembly (AA) for a vertical lift using an overhead hoist. Remove slack from rigging.

5. Place matchmarks between body (1)-to-bonnet (2) flanges. Loosen all bonnet cap screws (14) approximately 1/4" (6 mm) by rotating CCW (viewed from above).

6. Raise actuator assembly (AA) with overhead hoist approximately 1/8" (3 mm).

7. Remove bonnet cap screws (14).

8. Using overhead hoist, lift the actuator assembly (AA) with the interconnected valve stem assembly (9), bellows assembly (8), bonnet (2), yoke nut (15), packing gland nut (5), packing rings (6), Belleville spring washers (7), bonnet gasket (11), plug (3) and plug retainer (4). Lay this assembly down on a horizontal work surface carefully, so as to not damage the valve's internals upon lowering.

9. Make a visual inspection of the body sub-assembly (1) exterior, which includes two shell halves (1.1), TFE core (1.2), and four body cap screws (1.3) with body nuts (1.4) and lockwashers (1.5).

***NOTE: DO NOT DISASSEMBLE THE PARTS OF THE BODY SUB-ASSEMBLY (1)! The valve body (1) is machined after the shell halves (1.1) have been bolted (1.3, 1.4, 1.5) around the TFE core (1.2). Disassembly of the body sub-assembly (1) will create alignment problems upon completed reassembly. The TFE core (1.2) is not replaceable, except as a body sub-assembly (1).***

10. Make a visual inspection of the trim portions still interconnected to the actuator assembly (AA) for obvious problems.

11. Hand-grasp the bellows sub-assembly (8) and rotate CCW (viewed from plug (3) end) to removal. Do not use any wrench, vise, etc., for grasping the bellows sub-assembly (8)! The bellows (8) should only be hand-tight.

12. Loosen packing gland nut (5) until fully disengaged from bonnet (2) by rotating CCW (viewed form stem (9) end).

13. Loosen jam nut (17) 1-2 revolutions.

14. Grasp the valve's stem sub-assembly (9) in the lower area (normally surrounded by the bellows (8.1)) using soft jawed pliers to prevent marring surface. Place a wrench on the actuator swivel connector (73) at part (73.3) Rotate swivel connector (73) CCW (viewed from actuator (AA) end) to removal. Keep track of the number of revolutions to disengage the stem sub-assembly (9) from the swivel connector (73); record below:

| |
|---|
| No. of revs to disengage valve stem from swivel connector _____. |

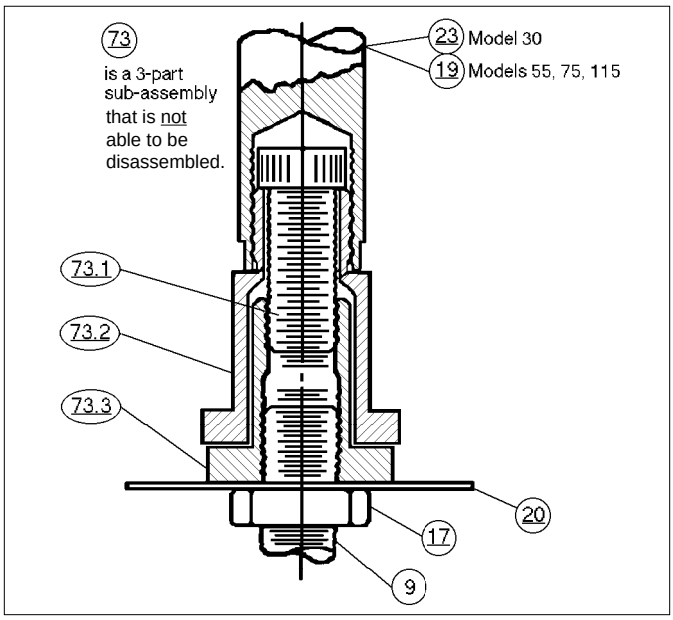



**Figure 6**: Swivel-Type Connector

15. Retract the stem sub-assembly (9) downwards thru the bonnet (2) until stopped by locknut (17). Rotate locknut (17), and stem travel indicator disc (20), until removal, withdrawing stem sub-assembly (9) as necessary.

16. Fully withdraw stem sub-assembly (9).

17. Visually inspect parts for wear, general corrosion, localized corrosion, dirty service fluid, uneven alignment, seat leakage wire drawing, excess plug-to-seat loading, flange facings, looseness of plug-to-bellows connection, primary seal at TFE Core (1.2) -to-bellows (8.1) joint, secondary seat at bonnet gasket (11) (See Figure 11), blisters on TFE surfaces, etc.

18. Attempt to determine the reason for a failure. Evaluate if process conditions need correction, if alternate materials are required for the stem sub-assembly (9), or if effects of possible permeation need considerations similar to those outlined in Section III.C.1.

**E. Plug, Bellows, or Both Replacement:**

1. Disassemble the body assembly (BA) per IV.D.1.-10. previous.

2. Hand-grasp the bellows sub-assembly (8) and hand-rotate the plug head (3) until the plug retainer strip (4) ends come into view thru the slot located on the side of the plug head (3).

3. Using a pointed end pick, get under one end of the plug retainer strip (4) and extract thru the plug's (3) slot. Manually rotate the plug head (3) end to allow more of the plug retainer strip (4) to be extracted. When able to grasp with needle nose pliers, lightly pull the plug retainer strip (4) and rotate the plug head (3) as necessary until the strip (4) is fully removed.

4. The plug head (3) should now be able to slide off the stub-end of the bellows sub-assembly (8).

5. Discard the plug head (3), if required. Always discard the plug retainer strip (4); only use a new plug retainer strip (4) for reassembly.

6. Do not attempt to field remove embedded nut (8.2) from bellows (8.1); these parts are only available as a sub-assembly (8). If embedded nut (8.2) is badly corroded, replace the entire bellows sub-assembly (8) and give strong consideration to alternate materials for stem sub-assembly (9) and bellows nut (8.2). If embedded nut (8.2) is "loose", consider potential causes and replace bellows sub-assembly (8).

7. If bellows sub-assembly (8) is to be reused, thoroughly clean the valleys of the bellows (8.1) convolutions (inside and outside) for the smallest of debris. Clean the grooves of the bellows (8.1) and the plug head (3) where the plug retainer strip (4) locates.

8. Place the plug head (3) over the bellows sub-assembly (8) end. Insert a new TFE plug retainer strip (4) into the slot/groove. Rotate the plug head (3) as necessary while feeding the strip (4) until the strip (4) is fully located into the groove. No cutting of the strip (4) should be required.

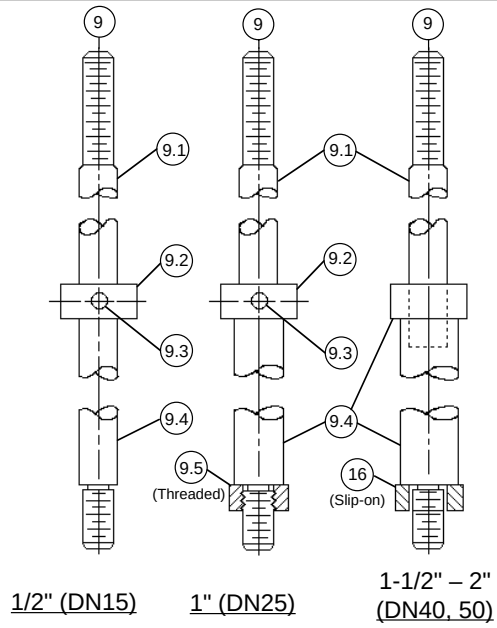
**F. Packing Ring Replacement:**

1. Disassemble the body assembly (BA) per IV.D. previous, including separation of body assembly (BA) from actuator assembly (AA).

2. Remove used packing rings (6) from packing box (recess) in bonnet (2).

3. Examine bonnet (2) wall for any sign of corrosion. If necessary, remove bonnet (2) by loosening yoke nut (15) to removal by rotating CCW (viewed from actuator end). Examine stem sub-assembly (9) at area of packing (6) contact.

4. Hone the bonnet's (2) packing box to a #16 RMS finish. Burnish the stem sub-assembly (9) to a #4 RMS finish in the packing (6) contact area.




NOTES:

1. For body sizes 1/2" and 1" (DN15 and DN25), the “Option F” or “Option D” alternate stem materials appear the same.

2. For body sizes 1-1/2" and 2" (DN40 and DN50), the standard construction has joint between 9.1 and 9.4 silver soldered.

3. For body sizes 1-1/2" and 2" (DN40 and DN50), the “Option F” and “Option D” alternate stem materials are constructed similar to the smaller sizes, in that the 9.2 and 9.3 parts are included.

**Figure 7**: Stem Sub-Assembly Constructions

**G. Reassembly of Body Assembly:**

1. Place body sub-assembly (1) in a vise with the bonnet (2) directed upwards.

2. For 1-1/2" and 2" (DN 40 & 50) body sizes, adapter (16) slips over the lower end of stem sub-assembly (9). See Figure 7.

3. Join the stem sub-assembly (9) to the bellows sub-assembly (8) (with new plug head (3) already installed) by rotating the stem's (9) lower end into embedded nut (8.2) CW (viewed from bellows (8.1) open end). Rotate the stem sub-assembly (9) as far as possible while hand-grasping the bellows (8.1) DO NOT USE A WRENCH IN THIS OPERATION. A light coat of Fluorolube (™ of Occidental Chemical Co.) lubricant may be used on the engaged end of the stem sub-assembly (9) if fluid compatible.

4. Place spacer washer (10) over the upper end of stem sub-assembly (9)

5. Referring to Figure 8 for proper orientation and quantity of Belleville spring washers (7), place the spring washers (7) over the upper end of stem sub-assembly (9).

6. Position a new bonnet gasket (11) into recess of body sub-assembly (1).

7. Observe the underneath side of bonnet (2) where square recess is located. Position combined bellows sub-assembly (8) and stem sub-assembly (9) so that the anti-rotation stop (9.2) (9.4 on std. 1-1/2" and 2" (DN40 and DN50)) is aligned to slip into the bonnet’s (2) recess.

8. Center the loose parts (10) (7) surrounding the stem (9) as close as possible.

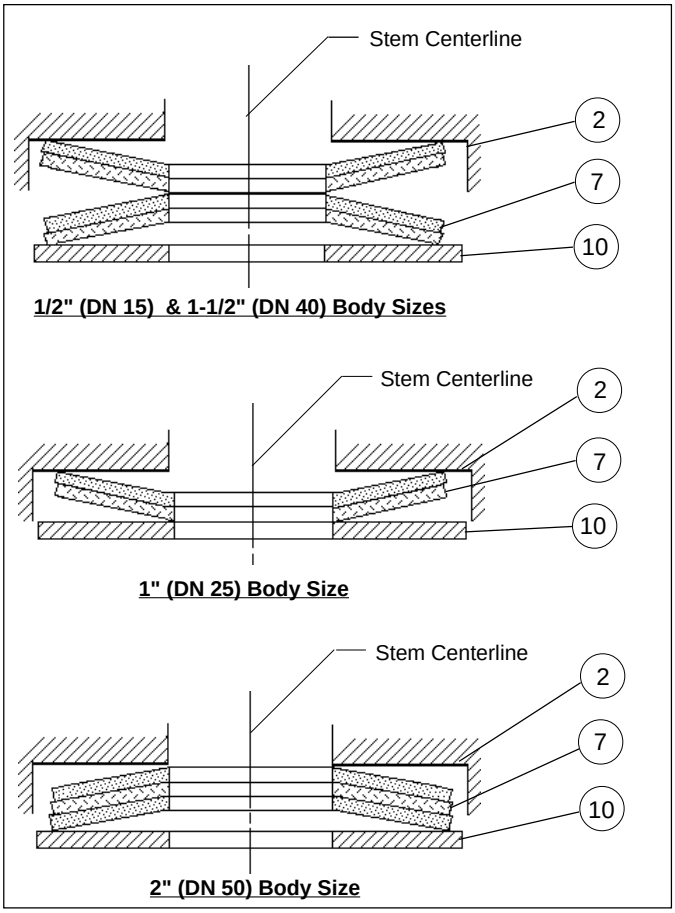



**Figure 8**: Belleville Spring Washer Orientation

9. Position the bonnet (2) over the exposed upper stem sub-assembly (9), assuring that the anti-rotation stop (9.2) (9.4 on std. 1-1/2" and 2" (DN40 and DN50)) is properly engaged into the bonnet (2) square recess.

10. Place anti-seize thread lubricant on bonnet cap screws (14). Engage all bonnet cap screws (14) with lockwashers (13) approximately 1-1/2 revolutions.

11. Place a temporary spacer device (screwdriver, nut, coins, etc.) to hold the bonnet (2) up, maximizing the gap between the bonnet flanges (1) (2).

12. Visually observing the gap between the bonnet (2) lower flange surface and the body sub-assembly (1) bonnet flange, apply downward force tending to seat the plug end (3). This will pull the bellows (8.1) into proper position for the primary bonnet seal.

13. When visually satisfied of concentricity and alignment of parts (10) (8) (11) (7) (9.2), remove temporary spacer while continuing downward force on the stem (9) while simultaneously holding the bonnet (2) from dropping downwards.

14. Lower bonnet (2) carefully downwards into the recess of the body sub-assembly (1) while continually applying downward force on the stem (9).

15. At this point, downward force on the stem (9) may be exchanged for downward force on the bonnet (2). Hand-tighten all four bonnet cap screws (14); relax downward force on bonnet once cap screws have taken up all slack.

16. Using a torque wrench, tighten bonnet cap screws (14) in alternating cross-pattern in 1/4 revolution increments. Repeat until the torque levels are reached as indicated below.

TABLE 3
BONNET BOLTING TORQUE LEVELS

| Body Size | | Torque Level | |
|---|---|---|---|
| in | DN | in–# | N-M |
| 1/2" | (15) | 40 | 55 |
| 1" | (25) | 40 | 55 |
| 1-1/2" | (40) | 40 | 55 |
| 2" | (50) | 40 | 55 |

***CAUTION**: Improper bonnet bolting torques may lead to premature failure of the primary and secondary bonnet seals.*

17. Engage threaded, vented pipe plug (12) into the 1/8" NPT tap on the bonnet (2). If a lubricating oil is compatible with the fluid, a light coating will aid in preventing galling of the plug (12). Assure that the tip of the notch on the threads is into the bonnet (2) at least 1-1⁄2 revolutions. Do not over-tighten to minimize chances of galling. Do not use thread sealing compound that might “fill in” the notch and negate the purpose of the notch.

18. The packing ring set (6) design is identical for all unit body sizes. It consists of seven V-rings (6.1) and one each male (6.2) and female (6.3) adapter . (See Figure 9.) The purpose of the packing rings (6) is to minimize moisture ingress, and to serve as a secondary stem seal in the event of bellows sub-assembly (8) failure.

    Carefully install rings (6) as indicated in Figure 9, one at a time, using a hollow tool to press the rings (6) to their final position. Take care in slipping the rings (6) over the threaded end of the stem (9) so as to not mar the ring’s (6) internal surfaces. Do not reverse orientation for vacuum service. Do not “split” rings (6) for ease in replacement. Do not reuse removed packing rings (6).

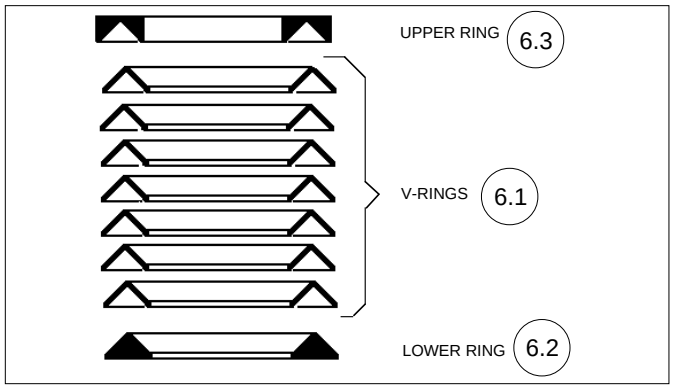



**Figure 9**: Packing Ring Set

19. Place anti-seize thread lubricant on threads of packing gland nut (5). Place gland nut (5) over the stem (9) end and engage with the bonnet (2) by rotating CW (viewed from exposed stem (9) end); continue finger-tightening to the point of resistance. Wrench tighten gland nut (5) 1/4 revolution past the manual resistance point.

20. Valve body assembly (BA) is completed, and may be pressure tested up to 275 psig x 1.5 = 413 psig (19.0 Barg x 1.5 = 28.5 Barg) at ambient temperature. Before pressurizing for hydro, assure that plug (3) is away from body (1) seat. (Note: Use soft gaskets on body

assembly (BA) end flanges to prevent distortion of TFE flange facings.)

**H. Mounting Actuator Assembly to Body Assembly:**

1. Reference the correct acutator IOM also for this procedure.
2. Secure the body assembly (BA) in a vise with the valve stem (9) oriented vertically.
3. Rig actuator assembly (AA) to be supported above the valve body assembly (BA).
4. This procedure assumes that the bonnet (2) has been bolted to the body sub-assembly (1).
5. Engage stem jam nut (17) to the body assembly's stem (9) by rotating CW (viewed from valve stem (9) end). Rotate jam nut (17) all the way to the root of the valve stem (9) threads.
6. Lower actuator assembly (AA) until the opening of the actuator yoke (1) is at the level of jam nut (17).
7. Place yoke nut (15) over the valve stem (9) and lower the nut (15) to rest upon the yoke (1).
8. Place travel indicator disc (20) and accessory plate (AP) over the valve stem (9) and lower the disc (20) and accessory plate (AP) to rest upon stem jam nut (17).
9. Hook up a temporary air supply hose that has an adjustable airset connected at the actuator inlet to allow pressurization.
10. Push valve stem (9) downward towards seating position. (Note: The valve bellows (8) may give "spring action" to keep the plug (3) partially away from the seat.)
11. *For Direction Action ATC-FO Actuators Only:* Pressurize actuator to a level equal to the upper pressure level of the bench setting; i.e. for 5–15 psig (.34–1.03 Barg) range, set pressure at 15 psig (1.03 Barg).
12. Continue lowering the actuator assembly (AA) until the actuator's swivel connector (73) and the valve's stem (9) just touch.
13. Screw yoke nut (15) onto bonnet (2) as far as able to help stabilize topworks. Wrench-tighten one-half (1/2) extra revolution.
14. Engage valve stem (9) to actuator swivel connector (73). Rotate swivel part (73.3) CW (viewed from actuator end) to engage with actuator stem (19) ((23)) the number of revolutions of swivel connector (73.3) recorded in Step A of the table of IV.C.10.
15. Fully lower the actuator assembly (AA) downwards until the yoke (1) is properly positioned on the valve bonnet (2). Hand-tighten yoke nut (15).
16. Complete engagement of valve stem (9) into swivel connector (73.3) the number of revolutions recorded in Step B of the table of IV.C.10.
17. Connect "dangling parts" – accessory plate (AP) and travel indicator disc (20) – to actuator stem (19) ((23)) with stem jam nut (17).
18. Release air pressure from actuator assembly (AA) and remove temporary air supply.
19. Re-tighten packing gland nut (5).
20. Impact tighten yoke nut (15) by hammer rapping with a blunt end tool.
21. Calibrate actuator to valve per Section V.

## SECTION V

# V. CALIBRATION

**A. General:**

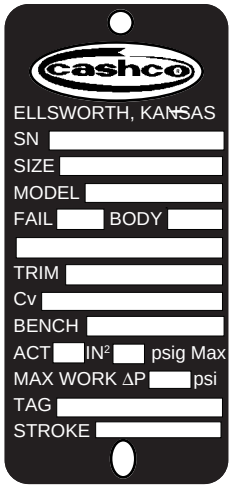
1. This section only covers calibration of the control valve unit – Actuator Model 30, 55, 75 or 115 plus a Model 521 valve body.
2. Positioner, if installed, requires reference to the specific positioner model IOM for proper calibration procedure.
3. All indicated Item Numbers that are with respect to IOM-55/75/115 or IOM-30 will be in parenthesis and underscored; i.e. (20); the same is true for the positioner parts. If a double parenthesis and underlined item number is used, this number applies only to the IOM-30 instruction; i.e. ((23)). All Item Numbers that are with respect to this IOM-521 are not underscored; i.e. (32).

**B. Procedure – Reverse Action, ATO-FC:**

1. Provide a temporary air supply with an in-line adjustable airset regulator to the actuator top works connection. Do not LOAD with any air pressure.

2. Valve plug (3) should be in "closed" or "shut" position. 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) ).

3. 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. 3-15 psig (.21-1.03 Barg), or 6-30 psig (.41-2.07 Barg).




4. Remove vented pipe plug (12).

5. Pressurize the actuator to a pressure level of 2–3 psig less than the upper pressure level of the bench setting; i.e. for 3-15 psig (.21–1.03 Barg) range, set pressure at 12-13 psig (.83–.90 Barg).

6. While watching the anti-rotational stop (square) (9.3) (9.4) thru the hole where the vented pipe plug (12) was removed, increase pressure to 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 3-15 psig (.21-1.03 Barg) range, set pressure at 17-18 psig (1.2-1.3 Barg).

7. Observe the location of the anti-rotational stop (square) (9.3) (9.4) thru the hole. The stop (9.3) 9.4) should not function as an up travel stop by pushing against the bonnet (2). A gap of about 1/16" (1-1/2 mm) should exist. If the stop (9.3) (9.4) reaches the bonnet (2), the stroke is too long; if the gap is greater than 1/16" (1-1/2 mm), the stroke is too short. (Note: The purpose of a correct calibration of actuator assembly (AA) stroke to body assembly (BA) stroke is to cause up travel to be limited by the actuator travel stop.)

8. 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 "O" (for "open"), then the valve stem (3)-to-actuator stem (19) ((23)) combined length is incorrect and must be adjusted.

9. a. If travel goes beyond the "O" (for "open") position, the combined stem (9, 19) ((9, 23)) is short. Loosen jam nut (17) holding the travel indicator disc (20) against swivel connector part (73.3).

   b. Increase combined stem (9, 19) ((9, 23)) length by rotating swivel part (73.3) CW (viewed from actuator end) a distance equal to the amount of overtravel.

10. a. If travel comes below the "O" position, the combined stem (9, 19) ((9, 23)) length is long. Loosen jam nut (17) holding the travel indicator disc (20) against swivel part (73.3).

    b. Decrease combined stem (9, 19) ((9, 23)) length by rotating swivel connector part (73.3) CCW (viewed from actuator end) a distance equal to the amount of undertravel.

11. Readjust the indicator plate (21) to the indicator disc (20) so they align at the "O" (for "open") position.

12. Release air pressure in actuator allowing valve stem (9) to travel to the "closed" or "S" (for "shut") position. Check the position indicated on the indicator plate (21).

13. If the "S" (for "closed" or "shut") position is not correct, repeat steps 9 thru 12 above until the combined stem (9, 19)) ((9, 23)) length is correct.

14. Pressurize the actuator to a pressure level corresponding to the lower pressure level of the bench setting; i.e. for 3-15 psig (.21-1.03 Barg) range, set pressure at 3 psig (.21 Barg). Do the pressurization slowly while observing the indicator disc (20) and indicator plate (21) simultaneously.

15. The proper calibration of the actuator / valve unit will occur when at the lower pressure level of bench setting the valve plug (3) will just begin to travel from the closed position.

    Pressurize actuator slowly. If plug (3) 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 valve side) in 1/4 revolution increments until desired bench setting is reached.

Pressurize actuator slowly. If plug (3) 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 valve side) in 1/2 revolution increments until desired bench setting is reached.

16. Increase pressure to actuator up to the upper level of bench setting and observe valve plug (3) position at the indicator plate (21). The valve plug (3) 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).)

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

| | | |
|---|---|---|
| Theoretical Bench Setting from Nameplate | _____ | psig<br>Barg |
| Setting at "S" Position | _____ | psig<br>Barg |
| Setting at "O" Position | _____ | psig<br>Barg |

18. Reinstall vented pipe plug (12) using "Fluorolube" grease on threads.

**C. Procedure – Direct Action, ATC-FO:**

1. Provide a temporary air supply with an in-line adjustable airset regulator to the actuator top works connection. Do not LOAD with any air pressure.

2. Valve plug (3) should be in "open" position. 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).)

3. 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. 3-15 psig (.21-1.03 Barg), or 6-30 psig (.41-2.07 Barg).

4. Remove vented pipe plug (12).

5. Observe the location of the anti-rotational stop (9.3) (9.4) thru the hole. The stop (9.3) (9.4) should not function as an up travel stop by pushing against the bonnet (2). A gap of about 1/16" (1.5 mm) should exist. If the stop (9.3) (9.4) reaches the bonnet (2), the stroke is too long; if the gap is greater than 1/16" (1.5 mm), the stroke is too short. (Note: The purpose of a correct calibration of actuator assembly (AA) stroke to body assembly (BA) stroke is to cause up travel to be limited by the actuator travel stop.)

6. Slowly pressurize the actuator to a pressure level 1–2 psig (.07–.14 Barg) less than the upper pressure level of the bench setting; i.e. for 3–15 psig (.21–1.03 Barg) range, set pressure to 13–14 psig (.90–.96 Barg). Valve plug (3) should be nearly "shut" or "closed". Increase pressure slowly until plug (3) seats in body core (1.1) orifice.

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" or "closed"), then the valve stem (3)-to-actuator stem (19) ((23)) combined length is incorrect and must be adjusted.

8. a. If travel goes beyond the "closed" or "S" position, the combined stem (9, 19) ((9, 23)) is short. Loosen jam nut (17) holding the travel indicator disc (20) against swivel connector part (73.3).

   b. Increase combined stem (9, 19) ((9, 23)) length by rotating swivel part (73.3) CW (viewed from actuator end) a distance equal to the amount of overtravel.

9. a. If travel comes below the "closed" or "S" position, the combined stem (9, 19) ((9, 23)) length is long. Loosen jam nut (17) holding the travel indicator disc (20) against swivel part (73.3).

   b. Decrease combined stem (9, 19) ((9, 23)) length by rotating swivel connector part (73.3) CCW (viewed from actuator end) a distance equal to the amount of undertravel.

10. Readjust the indicator plate (21) to the indicator disc (20) so they align at the "O" (for "open") position.

11. Release air pressure in actuator allowing valve stem (9) to travel to the "open" or "O" position. Check the position indicated on the indicator plate (21).

12. If the "O" (for "open") position is not correct, repeat steps 8 thru 11 until the combined stem (9, 19)) ((9, 23)) length is correct.

13. Pressurize the actuator to a pressure level corresponding to the upper pressure level of the bench setting; i.e. for 3-15 psig (.21-1.03 Barg) range, set pressure at 15 psig (1.03 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 upper pressure level of bench setting the valve plug (3) will just begin to travel from the closed position.

    De-pressurize actuator slowly. If plug (3) begins travel before reaching 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 form valve side) in 1/4 revolution increments until desired bench setting is reached. Repeat this procedure until desired bench setting is reached.

    De-pressurize actuator slowly. If plug (3) begins travel after surpassing the upper pressure level of bench setting, release all air pressure, then reduce the actuator's range spring (6) compression by wrench loosening spring adjustor (4) CCW (viewed from valve side) in 1/4 revolution increments until desired bench setting is reached. Repeat this procedure until desired bench setting is reached.

15. Decrease pressure to actuator down to the lower level of bench setting and observe valve plug (3) position at the indicator plate (21). The valve plug (3) should be within ±8% (of full "stroke") of the "S" (for "shut" or "closed") 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 12 and 13:

| | | |
|---|---|---|
| Theoretical Bench Setting from Nameplate | _____ | psig<br>Barg |
| Setting at "S" Position | _____ | psig<br>Barg |
| Setting at "O" Position | _____ | psig<br>Barg |

## SECTION VI

## VI. STARTUP

A. General:

1. Assure that the Model 521 unit has been properly adjusted and calibrated, including the positioner, if installed.

2. Recommend startup to be in "manual" mode. This procedure assumes double block (isolation) and bypass valves for the "control valve station". See Figure 10.

3. Start with either of the two block valve 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.

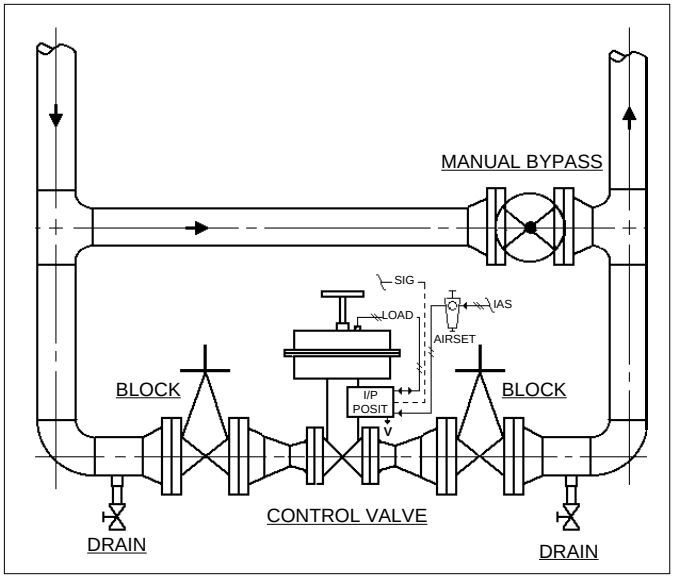



**Figure 10**: Typical Control Valve Station

5. Turn on air supply pressure.

6. Adjust the air supply airset (filter-regulator) to the proper level as indicated in IOM-55/75/115, IOM-30, or the technical bulletin 521-TB. DO NOT STROKE THE CONTROL VALVE WITH AN AIR SUPPLY PRESSURE SETTING GREATER THAN RECOMMENDED MAXIMUM PRESSURE!

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.

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

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

   NOTE: 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; it may be necessary/desirable to vary the manual output SIG from the controller simultaneously also. Continue this procedure until the bypass is closed and the block valves are both fully open. The system is still under "manual" mode control, but all flow is passing thru the control valve.

13. Vary controller "manual" SIG output until matching the "automatic" SIG output, then change the mode of the controller over to "automatic", and the loop will experience a minimum of upset conditions, and will be in automatic control.

## SECTION VII

## VII. TROUBLE-SHOOTING GUIDE:

1. Valve is "jumpy" in stroking.

| Possible Cause | Remedy |
|---|---|
| A. Excess packing friction. | A1. Re-align body–stem–actuator.<br>A2. Packing follower too tight; back packing gland nut out.<br>A3. Install positioner.<br>A4. Increase bench set by changing to stiffer actuator range spring. May require positioner if not installed. May require different airset. |
| B. Installed backwards. | B. Install per flow arrow. Direction is only FTO. |

2. Valve/actuator makes "screeching" noise.

| Possible Cause | Remedy |
|---|---|
| A. Excess pressure drop. | A. Bring pressure drop within design limits. |

3. Valve exhibits “excess” vibration.

| Possible Cause | Remedy |
|---|---|
| A. Excess pressure drop. | A. Bring pressure drop within design limits. |
| B. Excessive cavitation in liquid service. | B. Change operation parameters to relieve causes of cavitation. |
| C. High outlet velocity. | C1. Reduce flow rate and/or pressure drop.<br>C2. Use multiple valves in series or parallel.<br>C3. Increase outlet pipe size.<br>C4. Use larger valve body with reduced trim. |

4. Valve exhibits “excess” seat leakage.

| Possible Cause | Remedy |
|---|---|
| A. Excess pressure drop. | A1. Reduce pressure drop conditions.<br>A2. Convert to reduced trim.<br>A3. Increase actuator thrust by changing actuator range spring. |
| B. Improper actuator bench setting. | B1. Calibrate actuator-to-valve.<br>B2. Assure proper engagement of actuator stem-to-valve stem. Adjust as calibration dictates. |
| C. Excess body and/or plug wear. | C1. Oversized valve operating too close to seat; go to reduced trim.<br>C2. Remove abrasive particulate.<br>C3. Possible excess cavitation in liquid service. Change operation parameters.<br>C4. Replace body assembly if seat is badly worn. Replace plug if badly worn. |

5. Bonnet gasket leakage.

| Possible Cause | Remedy |
|---|---|
| A. Improper bonnet bolting drawdown. | A1. Remove bonnet taking necessary safety precautions. Inspect bellows to determine if primary seal at body/bellows is damaged. If bellows is damaged, replace bellows.<br>A2. Inspect secondary seal bonnet gasket for uneven thickness. Replace bonnet gasket.<br>A3. Draw down bonnet bolting evenly and in a cross pattern; use bonnet bolting torque levels indicated herein. |
| B. Cantilevered actuator. | B1. Do not allow use of the actuator as a “step” upon which personnel may climb.<br>B2. Do not “set” any added weight on the actuator.<br>B3. Install vertically. |

6. Body flange leakage.

| Possible Cause | Remedy |
|---|---|
| A. Over-tightening flange bolting. | A. Loosen bolting, replace/install new gasket, retighten flange bolting in s cross-pattern evenly. |
| B. Improper pipe supports and anchors. | B. Provide piping anchors and guides at control valve station. Restrain bending movements. |
| C. Corroded flange bolting. | C. Replace with corrosion resistant flange bolting. |
| D. Used outside pressure/temperature limits. | D. Bring process variables within required range of application; see Graph 1. |

7. Bellows Failure.

| Possible Cause | Remedy |
|---|---|
| A. Overstroke of actuator | A. Recalibrate valve/actuator unit. |
| B. Abrasive particulate in fluid. | B. Remove all fluid particulate. |
| C. Pressure, temperature, or pressure drop outside limits. | C. Bring process variables within required range of application; see Graph 1. |
| D. Fluid absorption. | D1. Reduce pressure/temperature if possible.<br>D2. Reduce number of startups/shutdowns, or rapid depressurizations. |
| E. Frequent stroking causing fatigue failure of TFE material. | E1. Stabilize input SIG.<br>E2. Stabilize positioner output LOAD.<br>E3. Stabilize process variations to steady state, steady flow.<br>E4. Excess “play” in actuator swivel adapter; replace adapter.<br>E5. Cycle life reached; replace bellows. |
| F. Corrosion of embedded nut. | F1. Consult factory.<br>F2. Use alternate stem material. |

8. Corrosion of stem sub-assembly at packing area.

| Possible Cause | Remedy |
|---|---|
| A. Loose packing | A. Disassemble valve and replace stem. Reassemble and tighten packing. |
| B. Fluid permeation of bellows. | B1. Bring process variables within required range of application; see Graph 1.<br>B2. Use alternate stem materials construction.<br>B3. Locate, or position valve to be out of ambient moisture.<br>B4. Modify insulation if “trapping” moisture around packing gland nut.<br>B5. Purge “void zone”. |
| C. Bellows failure. | C. See 7. above. |

9. Corrosion of silver soldered joint in stem sub-assembly (1-1/2" or 2" sizes only).

| Possible Cause | Remedy |
|---|---|
| A. Fluid permeation with chemical attack of silver solder. | A1. Use alternate stem materials construction.<br>A2. Purge “void zone”. |

10. Corrosion surrounding vented pipe plug on bonnet.

| Possible Cause | Remedy |
|---|---|
| A. Fluid permeation and loose vented pipe plug. | A1. Tighten plug.<br>A2. Replace corroded plug.<br>A3. Purge “void zone”. |
| B. Bellows failure. | B. Replace bellows. |

11. External corrosion of jacket halves, bonnet, and body and bonnet bolting.

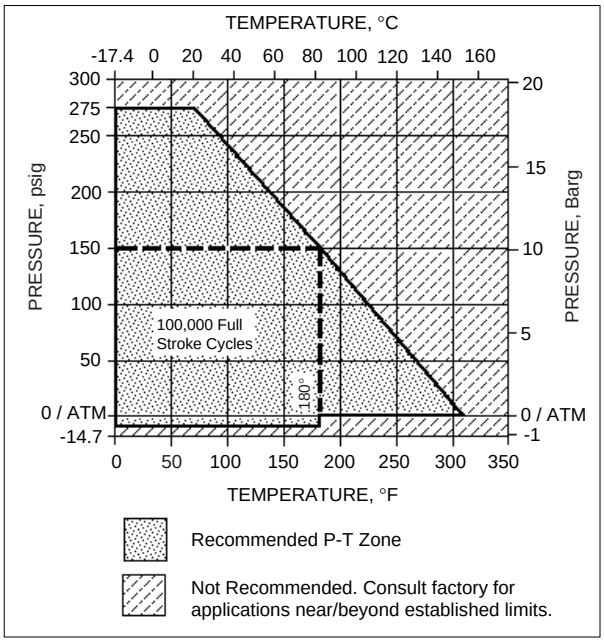
| Possible Cause | Remedy |
|---|---|
| A. Corrosive ambient environment. | A1. Determine location of corrosive fluid and maintain cause of leakage.<br>A2. Coat exposed portions with suitable corrosive resistant epoxy to degree able. |

13. Blisters on TFE internals.

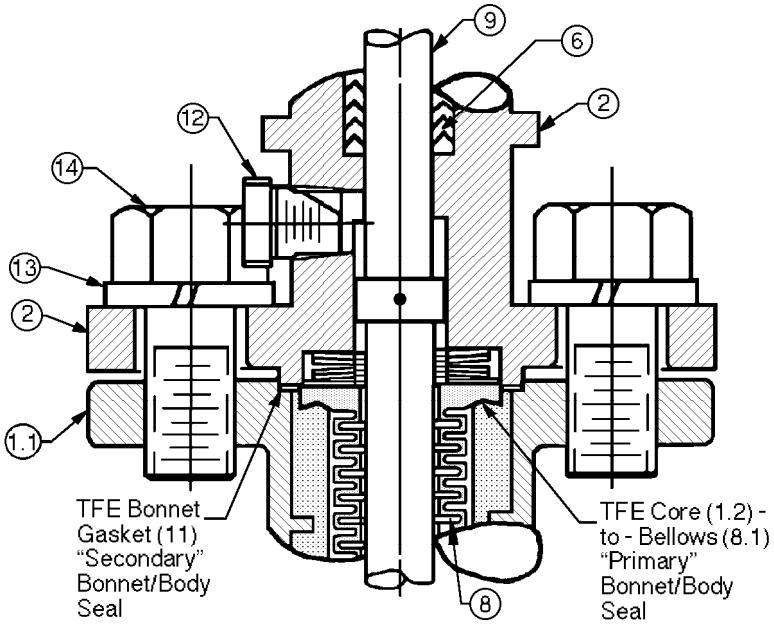
| Possible Cause | Remedy |
|---|---|
| A. Effects of absorption. | A1. Reduce pressure/temperature levels.<br>A2. Reduce startups/shutdowns and rapid depressurizations.<br>A3. Replace body assembly. |

14. General corrosion of internals in “void zone”, including Belleville washers, embedded nut, bonnet, anti-rotation stop, and stem.

| Possible Cause | Remedy |
|---|---|
| A. Permeation together with ingress of moisture into “void zone”. | A1. Remove moisture source to greatest degree possible.<br>A2. Purge “void zone”. |




**Graph No. 1**



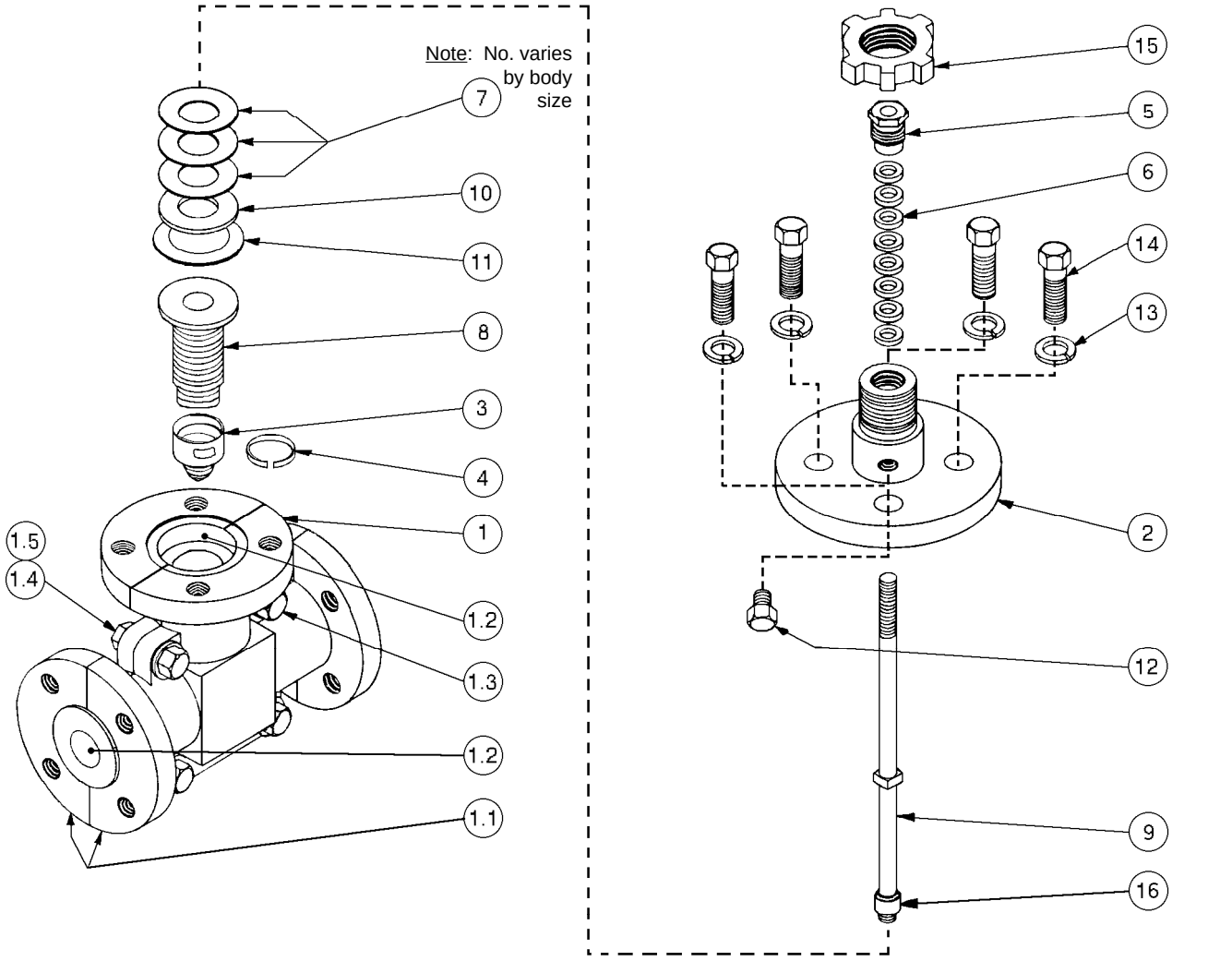



**Figure 12**
Model "521" Control Valve
Internals

| ITEM NO. | DESCRIPTION | ITEM NO. | DESCRIPTION |
|---|---|---|---|
| 1 | Body Sub-Assembly | 8 | Bellows Sub-Assembly |
| 1.1 | * Half Shell | 9 | Stem Sub-Assembly |
| 1.2 | * TFE Core | 10 | Spacer Washer |
| 1.3 | * Cap Screw | 11 | Bonnet Gasket |
| 1.4 | * Nut | 12 | Vented Pipe Plug |
| 1.5 | * Lockwasher | 13 | Lockwasher |
| 2 | Bonnet | 14 | Hex Hd. Cap Screw |
| 3 | Plug Head | 15 | Yoke Nut |
| 4 | Plug Retainer Strip | 16 | Adapter (1-1/2" & 2" sizes only) |
| 5 | Packing Gland | 17 | ANSI/DIN adapter Gasket (not shown) |
| 6 | Packing Set | | |
| 7 | Belleville Spring Washer | | |

* Sub-level parts that make up the body sub-assembly; ***NOTE: DO NOT DISASSEMBLE THE PARTS OF THE BODY SUB-ASSEMBLY (1)! The valve body (1) is machined after the shell halves (1.1) have been bolted (1.3, 1.4, 1.5) around the TFE core (1.2). Disassembly of the body sub-assembly (1) will create alignment problems upon completed reassembly. The TFE core (1.2) is not replaceable, except as a body sub-assembly (1).***

## 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 packing and bonnet gasket. Kit "B" contains bellows, plug retainer, plus packing and bonnet gasket. For replacement of plug heads, select part number fromP/N's indicated herein in Table 5.

Step 3. Contact your local Cashco, Inc., Sales Representative and specify the product code number along with any part numbers not included in desired kits. Costs of required parts and kits 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. (See page 10).
a. Serial number.
b. Size (may have to observe body connection).
c. Valve "Type" or "Model".
d. Fail position.
e. Trim characteristic
f. Cv or port size.
g. Bench set.
h. actuator Model (size)

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

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.

**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 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.

TABLE 4
PART KIT NUMBERS
MODEL 521 TOTAL TFE VALVE BODY

| Stem, Pin Anti-Rotation Stop Material | Kit Abbr. | SIZE | | | |
|---|---|---|---|---|---|
| | | 1/2" | 1" | 1-1/2" | 2" |
| All | A | **AT1-B00K-0A** | **AT2-B00K-0A** | **STA-B00K-0A** | **AT4-B00K-0A** |
| Std. 316 SST | B | **AT1-B00K-0B** | **AT2-B00K-0B** | **STA-B00K-0B** | **AT4-B00K-0B** |
| Hastelloy C **(Opt. D)** | B | **AT1-D00K-0B** | **AT2-D00K-0B** | **STA-D00K-0B** | **AT4-D00K-0B** |

TABLE 5
PLUG HEAD PART NUMBERS

| Body Size in (mm) | Orifice Size in (mm) | Cv | Plug Part Number (640-89-4-_ _ _ _ _ - _ _) | | |
|---|---|---|---|---|---|
| | | | Basic No. | Equal % | Linear |
| 1/2" (DN15) | .250 (6.35) | .10 | 640-89-4- | 60255-00 | 60254-00 |
| | | .16 | 640-89-4- | 60257-00 | 60256-00 |
| | | .25 | 640-89-4- | 60259-00 | 60258-00 |
| | | .40 | 640-89-4- | 60261-00 | 60260-00 |
| | | .63 | 640-89-4- | 60263-00 | 60262-00 |
| | .438 (11.12) | 1.0 | 640-89-4- | 60266-00 | 60265-00 |
| | | 1.6 | 640-89-4- | 60268-00 | 60267-00 |
| | | 2.5 | 640-89-4- | 60270-00 | 60269-00 |
| 1" (DN25) | .250 (6.35) | .10 | 640-89-4- | 60210-00 | 60209-00 |
| | | .16 | 640-89-4- | 60212-00 | 60211-00 |
| | | .25 | 640-89-4- | 60214-00 | 60213-00 |
| | | .40 | 640-89-4- | 60216-00 | 60215-00 |
| | | .63 | 640-89-4- | 60218-00 | 60217-00 |
| | .562 (14.27) | 1.0 | 640-89-4- | 60221-00 | 60220-00 |
| | | 1.6 | 640-89-4- | 60223-00 | 60222-00 |
| | | 2.5 | 640-89-4- | 60225-00 | 60224-00 |
| | | 4.0 | 640-89-4- | 60227-00 | 60226-00 |
| | | 5.0 | 640-89-4- | 60229-00 | 60228-00 |
| | .875 (22.22) | 6.3 | 640-89-4 | 60232-00 | 60231-00 |
| | | 7.5 | 640-89-4- | 60234-00 | 60233-00 |
| | | 10.0 | 640-89-4- | 60236-00 | 60235-00 |
| 1-1/2" (DN40) | .875 (22.22) | 6.3 | 640-89-4- | 60341-00 | 60340-00 |
| | | 7.5 | 640-89-4- | 60343-00 | 60342-00 |
| | 1.50 (38.10) | 10.0 | 640-89-4- | 60351-00 | 60350-00 |
| | | 15.0 | 640-89-4- | 60353-00 | 60352-00 |
| | | 25.0 | 640-89-4- | 60355-00 | 60354-00 |
| 2" (DN50) | 1.50 (38.10) | 10.0 | 640-89-4- | 60239-00 | 60238-00 |
| | | 15.0 | 640-89-4- | 60241-00 | 60240-00 |
| | | 25.0 | 640-89-4- | 60243-00 | 60242-00 |
| | 1.75 (44.45) | 35.0 | 640-89-4- | 60246-00 | 60245-00 |
| | | 40.0 | 640-89-4- | 60248-00 | 60247-00 |

## NOTES

(Place double-sided tape here to attach separate BOM sheets)

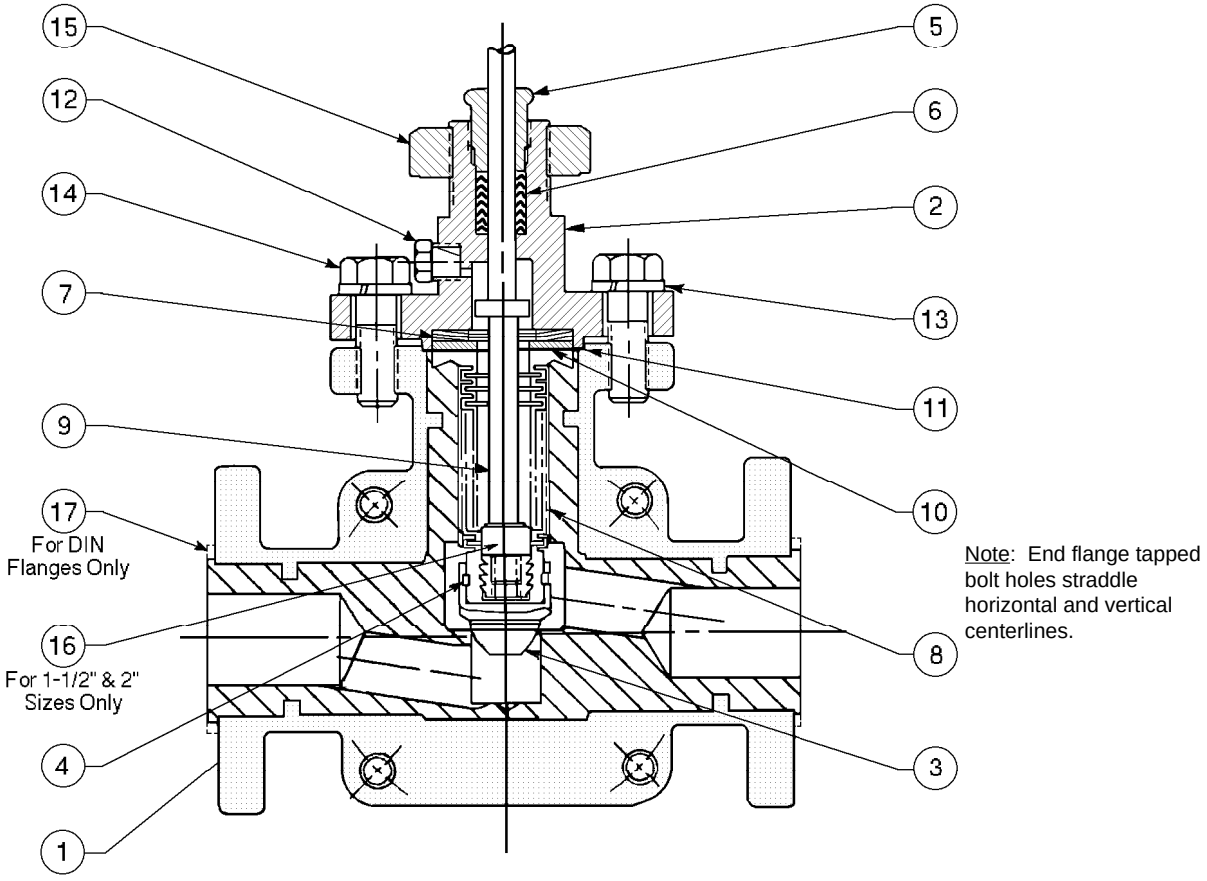



**Figure 13**
Model 521 Body Assembly (BA)

| ITEM NO. | DESCRIPTION | ITEM NO. | DESCRIPTION |
|---|---|---|---|
| 1 | Body Sub-Assembly | 9 | Stem Sub-Assembly |
| 2 | Bonnet | 10 | Spacer |
| 3 | Plug | 11 | Bonnet Gasket |
| 4 | Plug Retainer | 12 | Vented Pipe Plug |
| 5 | Packing Gland Nut | 13 | Washer |
| 6 | Packing | 14 | Bonnet Cap Screw |
| 7 | Belleville Spring Washer | 15 | Yoke Nut |
| 8 | Bellows Sub-Assembly | 16 | Adapter (1-1/2 & 2") |
| | | 17 | ANSI/DIN Adapter Gasket |

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