



ITT



Pure-Flo®

## High Purity Diaphragm Valves



*Engineered for life*

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## Table of Contents

Introduction - Section A

Diaphragm Valve Bodies - Section B

Integrated Block Valves - Section C

Diaphragms - Section D

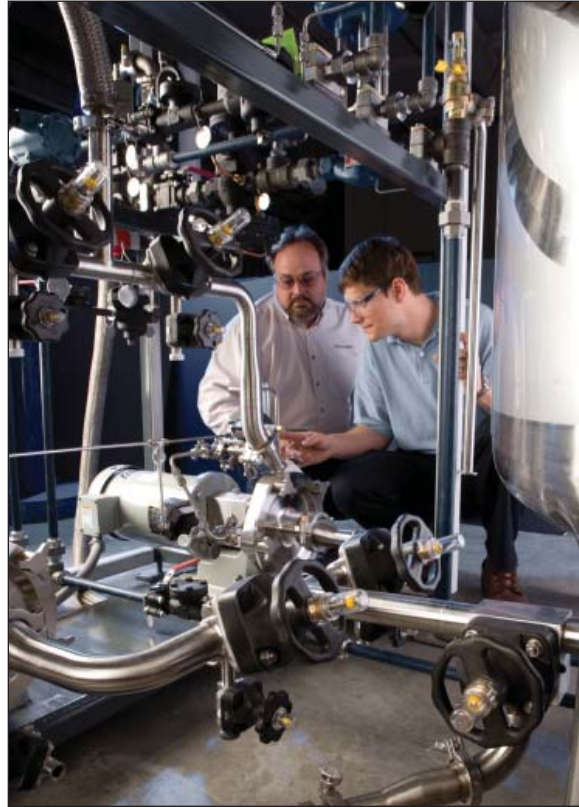
Topworks - Section E

Automation and Control - Section F

General Engineering - Section G

Sample and Bleed Valves - Section H

Diaphragm Valves



## Innovative Solutions ... time tested results

The ITT Pure-Flo® valve product line began in 1978 as an extension to the venerable ITT Dia-Flo product line. Since then ITT Pure-Flo has been delivering a process proven stainless steel diaphragm valve to high purity markets around the globe.

The Pure-Flo brand has earned a reputation for innovation, quality and performance. Providing products from standard forged valves to the most innovative block technology, each and every Pure-Flo valve is engineered to the highest standards.

Whether your process is manufacturing large molecule drugs for the Biopharm industry, bio-fuels, cosmetics or any high purity or aseptic process, ITT will combine decades of experience with cutting edge technology and a dash of ingenuity to provide value added solutions for your processing needs.

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### Global presence ... local feel

World class manufacturing facilities and engineering resources located throughout the world allows Pure-Flo to support customers with local expertise backed up by the strength and reliability of a global corporation.

### Partnership for success

Consistently atop the Forbes lists for best run companies, ITT is a strong, ethical company with visions and values that reflect those of our customers and our employees. By forming partnerships with our customers based on respect, responsibility and integrity your success will be our success.








## Product Details - Diaphragm Valve Bodies

|                             |   |   |   |
|-----------------------------|---|---|---|
|                             |    |   |    |
| Type                        | Forged<br>(2-Way)   | Wrought <sup>2</sup><br>(Block Bodies)  | Cast  |
| Size Range                  | 0.5-4 in.<br>DN15-100   | 0.5-6 in.<br>DN15-DN150   | 0.5-6 in.<br>DN15-150   |
| End Connections             | <ul style="list-style-type: none"> <li>• Tri-Clover Tri-Clamp®</li> <li>• 14, 16, 18, 20 O.D. Gauge Tubing</li> <li>• Schedule 5, 10, 40 Piping</li> <li>• ISO Ends</li> <li>• SMS 1146 Ends</li> <li>• DIN 11850 Ends</li> </ul> | <ul style="list-style-type: none"> <li>• Tri-Clover Tri-Clamp®</li> <li>• 14, 16, 18, 20 O.D. Gauge Tubing</li> <li>• Schedule 5, 10, 40 Piping</li> <li>• ISO Ends</li> <li>• SMS 1146 Ends</li> <li>• DIN 11850 Ends</li> </ul> | <ul style="list-style-type: none"> <li>• Tri-Clover Tri-Clamp®</li> <li>• 14, 16, 18, 20 O.D. Gauge Tubing</li> <li>• Schedule 5, 10, 40 Piping</li> <li>• ISO Ends</li> <li>• SMS 1146 Ends</li> <li>• DIN 11850 Ends</li> </ul> |
| Material                    | 316L Stainless Alloy Tri Certified to ASTM A182 Grade 316L, S9, EN 10222-5 EN 1.4435, BN2   | 316L Stainless Alloy ASTM A479, A240, 316L  | 316L Stainless Alloy ASTM A351 Grade CF 3M  |
| Special Alloys <sup>1</sup> |   | C22, C276, AL6XN  |   |
| Dimensional Standards       | USOD Tubing, Pipe, ISO/DIN/SMS  | USOD Tubing, Pipe, ISO/DIN  | USOD Tubing, Pipe   |

<sup>1</sup> Other materials available upon request

<sup>2</sup> Standard on tank bottom valves, divert valves and any block bodied fabrications.

## Product Details - Diaphragms


|                |   |   |   |   |  |
|----------------|---|---|---|---|--|
|                |  |  |  |  |  |
| Type           | B   | P   | W1  | E1  | TME  |
| Material       | Black Butyl Rubber  | Buna N  | White Butyl Rubber  | EPDM <sup>1</sup>   | PTFE Enhanced Backing  |
| Size Range     |   |   |   |   |  |
| 0.25" (DN 8)   | •   |   |   | •   | •  |
| 0.375" (DN 10) | •   |   |   | •   | •  |
| 0.5" (DN15)    | •   | •   | •   | •   | •  |
| 0.75" (DN20)   | •   | •   | •   | •   | •  |
| 1" (DN25)      | •   | •   | •   | •   | •  |
| 1.5 (DN32/40)  | •   | •   | •   | •   | •  |
| 2" (DN50)      | •   | •   | •   | •   | •  |
| 2.5" (DN65)    | •   | •   | •   | •   | •  |
| 3" (DN80)      | •   | •   | •   | •   | •  |
| 4" (DN100)     | •   | •   | •   | •   | •  |
| 6" (DN150)     | •   | •   | •   |   | •  |
| Temperature    | -20–250°F<br>-29–121°C  | 10–180°F<br>-12–82°C  | 0–225°F<br>-18–107°C  | -22–302°F <sup>2</sup><br>-30–150°C <sup>2</sup>                                  | -4–329°F<br>-20–165°C  |
| Compliance     | FDA<br>USDA   | FDA<br>USDA   | FDA<br>USDA   | FDA<br>USP  | FDA<br>USP   |

<sup>1</sup> For high temperature and/or high cycle applications, contact ITT.

<sup>2</sup> Temperature range is as follows:

- 4–194°F (-20–90°C) for liquid applications
- 22–285°F (-30–140°C) for continuous steam
- 22–302°F (-30–150°C) for intermittent steam

## Product Details - Manually Operated Topworks

|                             |   |   |   |  |   |   |   |
|-----------------------------|---|---|---|--|---|---|---|
|                             |  |  |  |  |  |  |  |
| Type                        | Bio-Pure  | Bio-Pure COP  | Bio-Tek   | 903  | 913   | 963   | 970   |
| Size Range                  |   |   |   |  |   |   |   |
| 0.25-0.5 (DN8-15)           | •   | •   |   |  |   |   |   |
| BT (DN8-15)                 |   |   | •   |  |   |   |   |
| 0.5" (DN15)                 |   |   |   | •  | •   | •   | •   |
| 0.75" (DN20)                |   |   |   | •  | •   | •   | •   |
| 1" (DN25)                   |   |   |   | •  | •   | •   | •   |
| 1.5 (DN32/40)               |   |   |   | •  | •   | •   | •   |
| 2" (DN50)                   |   |   |   | •  | •   | •   | •   |
| 2.5" (DN65)                 |   |   |   | •  | •   | •   |   |
| 3" (DN80)                   |   |   |   | •  | •   | •   |   |
| 4" (DN100)                  |   |   |   | •  | •   | •   |   |
| Material                    | Bonnet: 316 Stainless Steel Handwheel: Polyethersulfone (PES)                     | Bonnet: 316 Stainless Steel Handwheel: Polyethersulfone (PES)                     | Bonnet: 316 Stainless Steel Handwheel: Polyarylsulfone (PAS)                      | Cast Iron coated White Epoxy or PVDF   | Bonnet and Handwheel: 316 Stainless Steel   | Bonnet and Handwheel: Glass reinforced polyarylsulfane (PAS)                        | Bonnet: 316 Stainless Steel Handwheel: Glass reinforced polyarylsulfane (PAS)       |
| Maximum Service Pressure    | 150 psi<br>10.34 bar  | 150 psi<br>10.34 bar  | 150 psi<br>10.34 bar  | 0.5–1":<br>200 psig<br>13.8 bar  | 0.5–1":<br>200 psig<br>13.8 bar   | 150 psig<br>10.34 bar   | 0.5–1":<br>200 psig<br>13.8 bar   |
|                             |   |   |   | 1.5–2":<br>175 psig<br>12.1 bar  | 1.5–2":<br>175 psig<br>12.1 bar   |   | 1.5–2":<br>175 psig<br>12.1 bar   |
|                             |   |   |   | 3–4":<br>150 psig<br>10.3 bar  | 3–4":<br>150 psig<br>10.3 bar   |   |   |
| Maximum Service Temperature | 220°F (104°C)   | 220°F (104°C)   | 220°F (104°C)   | See page D-10  | See page D-10   | 300°F (149°C)   | See page D-10   |
| Autoclavable                | Yes   | Yes   | Yes   | No   | No  | Yes   | Yes   |
| Sealed Option               | No  | No  | Yes   | Yes  | Yes   | Yes   | No  |




## Product Details - Pneumatic Actuators

|                             |  |  |      |  |  |  |  |
|-----------------------------|---|---|---|---|--|---|---|
| Type                        | Advantage Excel - Series S  | Advantage Excel - Series S  | Advantage 2.0 and Advantage Actuator  | Advantage Actuator Series 47  | Advantage Actuator Series 33   | Advantage Piston Actuator (APA)   | Dia-Flo Actuator  |
| Size Range                  |   |   |   |   |  |   |   |
| BP - 0.25-0.5 (DN8-15)      | •   |   |   |   |  |   |   |
| BT - 0.25-0.5 (DN8-15)      |   |   | •   |   |  |   |   |
| 0.5" (DN15)                 |   | •   | •   |   |  | •   | •   |
| 0.75" (DN20)                |   | •   | •   |   |  | •   | •   |
| 1" (DN25)                   |   | •   | •   |   |  | •   | •   |
| 1.5 (DN32/40)               |   | •   | •   |   |  | •   | •   |
| 2" (DN50)                   |   | •   | •   |   |  | •   | •   |
| 2.5" (DN65)                 |   |   |   | •   | •  |   | •   |
| 3" (DN80)                   |   |   |   | •   | •  |   | •   |
| 4" (DN100)                  |   |   |   | •   | •  |   | •   |
| Material                    | 316 Stainless Steel   | 316 Stainless Steel   | Bonnet: 316 Stainless Steel<br>Cylinder Cover: Glass reinforced polyarylsulfane (PAS) | Bonnet: Nylon coated ductile iron<br>Cylinder Cover: Vinyl-Ester Thermoset        | Bonnet: Nylon coated ductile iron<br>Cylinder Cover: Vinyl-Ester Thermoset         | Bonnet: 316 Stainless Steel<br>Cylinder Cover: Polybutylene terephthalate (PBT)     | Bonnet: Ductile iron<br>Cylinder Cover: Aluminum                                    |
| Maximum Service Pressure    | 150 psig<br>10.34 bar   | 150 psig<br>10.34 bar   | 150 psig<br>10.34 bar   | 150 psig<br>10.34 bar   | 150 psig<br>10.34 bar  | 150 psig<br>10.34 bar   | See Dia-Flo Catalog   |
| Maximum Service Temperature | 300°F (149°C)   | 300°F (149°C)   | 300°F (149°C)   | 300°F (149°C)   | 300°F (149°C)  | 292°F (145°C)   |   |
| Autoclavable                | Yes   | Yes   | Yes   | No  | No   | No  | No  |
| Sealed Option               | No  | Yes   | Yes   | Yes   | Yes  | No  | Yes   |

## Product Details - Automation

|                       |  |  |  |  |
|-----------------------|---|---|--|---|
| Type                  | VSP   | SP2   | SP3  | Positioner  |
| Size Range            |   |   |  |   |
| 0.25" (DN 8)          | ●   | ●   | ●  |   |
| 0.375" (DN 10)        | ●   | ●   | ●  |   |
| 0.5" (DN15)           | ●   | ●   | ●  |   |
| 0.75" (DN20)          | ●   | ●   | ●  | ●   |
| 1" (DN25)             | ●   | ●   | ●  | ●   |
| 1.5 (DN32/40)         | ●   | ●   | ●  | ●   |
| 2" (DN50)             | ●   | ●   | ●  | ●   |
| 2.5" (DN65)           |   | ●   |  | ●   |
| 3" (DN80)             |   | ●   |  | ●   |
| 4" (DN100)            |   | ●   |  | ●   |
| Cover Material        | Polysulfone, FDA compliant  | Polyarylsulfone (PAS) Thermoplastic FDA compliant (Transparent Plastic)           | Polysulfone, FDA compliant   | Aluminum Brass<br>Stainless Steel   |
| Base Housing Material | Polyamide, FDA compliant  | Polyarylsulfone (PAS) Thermoplastic FDA compliant. (Black Plastic)                | Polyamide, FDA compliant   | Aluminum Brass<br>Stainless Steel   |
| Temperature Rating    | 140°F (60°C)  | 150°F (65°C)  | 140°F (60°C)   | 150°F (65°C)  |
| Autoclavable          | No  | No  | No   | No  |
| Electric Connection   | One M20 conduit port (1/2" NPT adapter available).                                | Two 1/2" NPT conduit ports  | One 1/2" NPT conduit port  | N/A   |
| Rotation              | 360°  | Increments of 45°   | 360°   |   |
| Mechanics             | Proximity and Mechanical Switches   | Proximity and Mechanical Switches   | Proximity and Mechanical Switches  | Proportioned valve control  |
| Approvals             | FM / CSA / Cenelec Zones 0, 1, 2 / UL   | FM / CSA / Cenelec Zones 0, 1, 2 / UL   | FM / CSA / Cenelec Zones 0, 1, 2 / UL  |   |

## Product Details - Control

|                       |  |  |  |
|-----------------------|---|---|---|
| Type                  | Solenoid  | Transducer  | Network Block   |
| Size Range            |   |   |   |
| 0.25" (DN 8)          | •   | •   | •   |
| 0.375" (DN 10)        | •   | •   | •   |
| 0.5" (DN15)           | •   | •   | •   |
| 0.75" (DN20)          | •   | •   | •   |
| 1" (DN25)             | •   | •   | •   |
| 1.5 (DN32/40)         | •   | •   | •   |
| 2" (DN50)             | •   | •   | •   |
| 2.5" (DN65)           | •   | •   | •   |
| 3" (DN80)             | •   | •   | •   |
| 4" (DN100)            | •   | •   | •   |
| Cover Material        |   | Aluminum  |   |
| Base Housing Material | Brass Polyamide<br>Stainless  | Aluminum  | Glass filled nylon  |
| Temperature Rating    | -10-100°C   | -40-160°F   | -40-70°C  |
| Autoclavable          | No  | No  | No  |
| Electric Connection   | DIN 43650   |   |   |
| Protection            | IP65  |   | IP65  |



## Introduction

ITT Pure-Flo has developed a line of valve bodies that help address the needs of the Bioprocessing and Pharmaceutical industries for high quality, welded process systems.

By providing valve bodies with controlled sulfur 316L/1.4435 stainless steel material and weld tangents long enough to accept the most common orbital weld heads in the industry, we have eliminated two of the most common concerns in valve-to-tube welding known today.

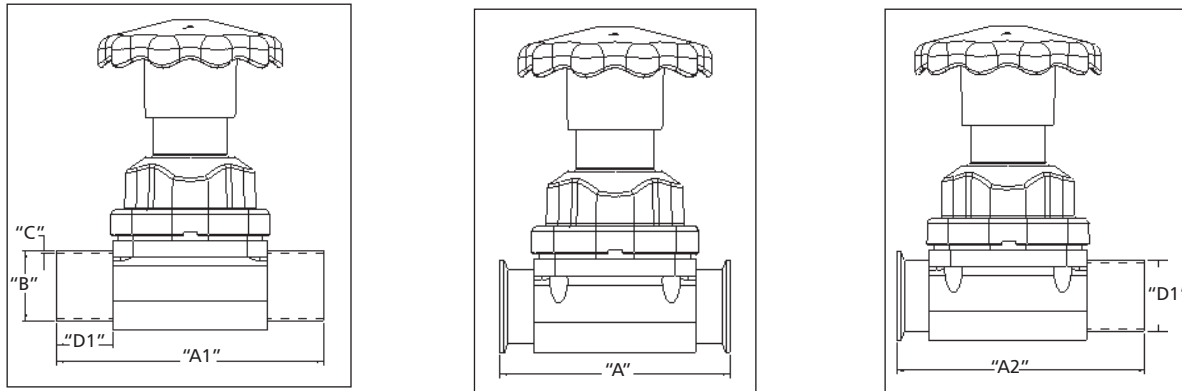
Automatic welding of 316L process components is greatly affected by the sulfur content of the mating process components. A disparity of sulfur content can result in reduced orbital weld quality and potentially incomplete fusion of the mating components. By controlling valve body sulfur content to the same chemistry as that required for ASME BPE fittings, welding problems due to material chemistry differences will be greatly reduced.



### 316L Sulfur Controlled Chemistry per ASME BPE Table DT-3

| Element         | % (316L)      |
|-----------------|---------------|
| Carbon (C)      | 0.035 max     |
| Chromium (Cr)   | 16.00 - 18.00 |
| Manganese (Mn)  | 2.00 max      |
| Molybdenum (Mo) | 2.00 - 3.00   |
| Nickel (Ni)     | 10.00 - 15.00 |
| Phosphorous (P) | 0.045 max     |
| Silicon (Si)    | 0.75 max      |
| Sulfur (S)      | 0.005-0.017   |

## Body Dimension Charts



### Body Dimension Charts US & SMS

| USOD (ANSI) Forgings & Castings |       |                             |                     |                     |                |                     |                              |                     |                              | SMS        |       |
|---------------------------------|-------|-----------------------------|---------------------|---------------------|----------------|---------------------|------------------------------|---------------------|------------------------------|------------|-------|
| B                               |       | A                           | A1                  | D1                  | A2             | C                   |                              |                     |                              | B          | C     |
| End Connection Size             |       | Overall Length <sup>1</sup> | Overall Length      | Weld Tangent        | Overall Length | 20 GA. 0.035"       | 18 GA. 0.049"                | 16 GA. 0.065"       | 14 GA. 0.083"                |            |       |
| IN                              | DN    | Tri Clamp                   | Extended BW Forging | Extended BW Forging | TC x BW        | Extended BW Forging | Extended BW Forging ASME BPE | Extended BW Forging | Extended BW Forging ASME BPE | BW Forging |       |
| Forgings                        |       |                             |                     |                     |                |                     |                              |                     |                              |            |       |
| BP/BT 0.25"                     | DN8   | 2.5" (64) <sup>2</sup>      | 3.5" (89)           | 1 (25)              | 3.0            | S                   | O                            |                     |                              |            |       |
| BP/BT 0.375"                    | DN10  | 2.5" (64) <sup>2</sup>      | 3.5" (89)           | 1 (25)              | 3.0            | S                   | O                            |                     |                              |            |       |
| BP/BT 0.5"                      | DN15  | 2.5" (64) <sup>2</sup>      | 3.5" (89)           | 1 (25)              | 3.0            |                     | O                            | S                   |                              |            |       |
| 0.5"                            | DN15  | 3.5" (89)                   | 5.06" (128)         | 1.5" (38)           | 4.28           | O                   | O                            | S                   | O                            |            |       |
| 0.75"                           | DN20  | 4" (102)                    | 5.5" (140)          | 1.5" (38)           | 4.75           | O                   | O                            | S                   | O                            |            |       |
| 1"                              | DN25  | 4.5" (114)                  | 5.93" (156)         | 1.5" (38)           | 5.22           |                     | O                            | S                   | O                            | (25)       | (1,2) |
| 1.5"                            | DN40  | 5.5" (140)                  | 6.8" (173)          | 1.5" (38)           | 6.15           |                     | O                            | S                   | O                            | (38)       | (1,2) |
| 2"                              | DN50  | 6.25" (159)                 | 7.42" (188)         | 1.5" (38)           | 6.84           |                     |                              | S                   | O                            | (51)       | (1,2) |
| 2.5" <sup>3</sup>               | DN65  | 8.75" (222)                 | 10" (254)           | 1.75" (44,5)        | 9.38           |                     |                              | S                   |                              | (63,5)     | (1,6) |
| 3"                              | DN80  | 8.75" (222)                 | 10" (254)           | 1.75" (44,5)        | 9.38           |                     |                              | S                   | O                            | (76,1)     | (2)   |
| 4"                              | DN100 | 11.5" (292)                 | 13" (330)           | 2.0" (51)           | 12.25          |                     |                              | O                   | S                            |            |       |
| Castings                        |       |                             |                     |                     |                |                     |                              |                     |                              |            |       |
| 0.5"                            | DN15  | 3.5" (89)                   | N/A                 | N/A                 | 3.5" (89)      | O                   | O                            | S                   | O                            |            |       |
| 0.75"                           | DN20  | 4" (102)                    | N/A                 | N/A                 | 4" (102)       | O                   | O                            | S                   | O                            |            |       |
| 1"                              | DN25  | 4.5" (114)                  | N/A                 | N/A                 | 4.5" (114)     |                     | O                            | S                   | O                            | (25)       | (1,2) |
| 1.5"                            | DN40  | 5.5" (140)                  | N/A                 | N/A                 | 5.5" (140)     |                     | O                            | S                   | O                            | (38)       | (1,2) |
| 2"                              | DN50  | 6.25" (159)                 | N/A                 | N/A                 | 6.25" (159)    |                     |                              | S                   | O                            | (51)       | (1,2) |
| 2.5"                            | DN65  | 7.62" (194)                 | N/A                 | N/A                 | 7.62" (194)    |                     |                              | S                   | O                            | (63,5)     | (1,6) |
| 3"                              | DN80  | 8.75" (222)                 | N/A                 | N/A                 | 8.75" (222)    |                     |                              | S                   | O                            | (76,1)     | (2)   |
| 4"                              | DN100 | 11.5" (292)                 | N/A                 | N/A                 | 11.5" (292)    |                     |                              | O                   | S                            |            |       |

<sup>1</sup> For 2.5" overall length does not comply with ASME BPE dimensions  
<sup>2</sup> BT TC x BW and TC x TC bodies are 2.5" (64) overall length with 0.5" (13) tangent  
<sup>3</sup> 2.5" size uses 3" topworks

Note: Extended Weld Tangents are available only with USOD (ANSI) end connections.  
 Dimensions in ( ) are mm  
 S = Standard, O = Optional, BT = Bio-Tek Body, BP = Bio-Pure

## Body Dimension Charts

### ISO/DIN Forgings

| End Connection Size | Topworks Size | ISO             |                 |       |   |     |     |   |     |     |           | DIN Series 1 |    | DIN Series 2 |     | DIN Series 3 |    |
|---------------------|---------------|-----------------|-----------------|-------|---|-----|-----|---|-----|-----|-----------|--------------|----|--------------|-----|--------------|----|
|                     |               | A               | D               | B     | C |     |     |   |     |     |           | B            | C  | B            | C   | B            | C  |
|                     |               | mm              | mm              | mm    | 1 | 1,2 | 1,6 | 2 | 2,3 | 2,6 | 2,9       | mm           | mm | mm           | mm  | mm           | mm |
| DN6                 | Bio-Tek       | 89 <sup>1</sup> | 25 <sup>1</sup> | 8     | S | O   |     |   |     |     |           | 8            | 1  |              |     |              |    |
| DN8                 | Bio-Tek       | 89 <sup>1</sup> | 25 <sup>1</sup> | 13,5  | O |     | S   | O |     |     |           | 10           | 1  |              |     |              |    |
| DN10                | Bio-Tek       | 89 <sup>1</sup> | 25 <sup>1</sup> | 17,2  | O |     | S   | O |     |     |           | 12           | 1  | 13           | 1,5 | 14           | 2  |
| DN15                | 0.5"          | 106             | 25              | 21,3  |   |     | S   | O |     |     |           | 18           | 1  | 19           | 1,5 | 20           | 2  |
| DN20                | 0.75"         | 118             | 25              | 26,9  |   |     | S   | O |     |     |           | 22           | 1  | 23           | 1,5 | 24           | 2  |
| DN25                | 1"            | 127             | 25              | 33,7  |   |     | O   | S |     |     |           | 28           | 1  | 29           | 1,5 | 30           | 2  |
| DN32                | 1.5"          | 174             | 35              | 42,4  |   |     | O   | S |     |     |           | 34           | 1  | 35           | 1,5 | 36           | 2  |
| DN40                | 1.5"          | 174             | 35              | 48,3  |   |     | O   | S |     |     |           | 40           | 1  | 41           | 1,5 | 42           | 2  |
| DN50                | 2"            | 191             | 35              | 60,3  |   |     |     | S | O   | O   | Cast Only | 52           | 1  | 53           | 1,5 | 54           | 2  |
| DN65                | 3"            | 254             | 44.5            | 76,1  |   |     |     | O | S   | O   |           | 70           | 2  |              |     |              |    |
| DN80                | 3"            | 254             | 44.5            | 88,9  |   |     |     |   | S   | O   |           | 85           | 2  |              |     |              |    |
| DN100               | 4"            | 330             | 51              | 114,3 |   |     |     |   | S   | O   |           | 104          | 2  |              |     |              |    |

<sup>1</sup> BT TC x BW and TC x TC bodies are 64 mm overall length with 13 mm tangent

Note: All measurements are mm unless otherwise noted.

S = Standard, O = Optional

### Benefits of the new Pure-Flo Body:

- No welded tube extensions required for most welding equipment
  - Less over-all valve body length compared to welded tube extensions
  - Fewer welds in the process system
  - Less validation paperwork due to fewer material certifications
  - Higher quality field welds
  - No narrow or off-set weld heads required.
- All these benefits add up to lower installation costs and improved production schedules.

### End Connections

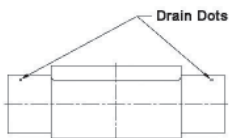
Pure-Flo Diaphragm Valve bodies are available in a variety of end connections:

- Tri-Clover Tri-Clamp®
- 14, 16, 18, 20 O.D. Gauge Tubing
- Schedule 5, 10, 40 Piping
- ISO Ends
- SMS 1146 Ends
- DIN 11850 Ends

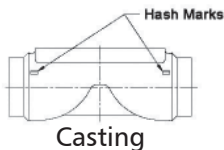
### Drainability

Pure-Flo diaphragm valves may be installed in vertical or horizontal lines as required. Drain marks are provided as standard on cast and forged bodies to facilitate installation and optimize drainability. One mark must be located in the vertical plane, cutting the centerline of the pipe.

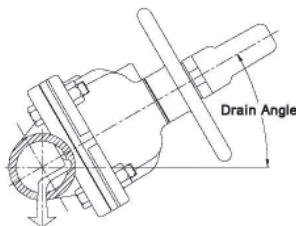
The slope of process piping must be designed to provide proper pitch in order to optimize drainability. Drainability in a process system is ultimately the responsibility of the system designer end user.



Forging/Wrought



Casting



### Weld Installation

Bio-Pure and Bio-Tek valves, 1/4"–1/2" (DN 8–15) and ISO End valves have minimum 1" (25 mm) cutbacks and generally do not require tube extensions for standard TIG orbital welding equipment.

Pure-Flo valves, 0.5–6" (DN15–150) have ASME BPE fitting compatible outbacks and generally can be welded without disassembly using most standard TIG orbital welding equipment.

### Drain Angles

| Valve Size         |                  | Forging           |     |     | Investment Casting |     |
|--------------------|------------------|-------------------|-----|-----|--------------------|-----|
| Inch               | DN               | ANSI <sup>5</sup> | ISO | DIN | ANSI               | ISO |
| 0.25 <sup>1</sup>  | 8 <sup>1</sup>   | 30° <sup>2</sup>  | 20° | 20° | N/A                | N/A |
| 0.375 <sup>1</sup> | 10 <sup>1</sup>  | 30° <sup>2</sup>  | 20° | 20° | N/A                | N/A |
| 0.50 <sup>1</sup>  | 15 <sup>1</sup>  | 30° <sup>2</sup>  | 20° | 20° | N/A                | N/A |
| 0.50               | 15               | 30°               | 13° | 16° | 30°                | 17° |
| 0.75               | 20               | 30°               | 21° | 25° | 30°                | 18° |
| 1.00               | 25               | 30°               | 22° | 26° | 31°                | 20° |
| 1.25               | 32               | N/A               | 22° | 25° | N/A                | 28° |
| 1.50               | 40               | 28°               | 17° | 22° | 30°                | 20° |
| 2.00               | 50               | 23°               | 16° | 19° | 25°                | 19° |
| 2.50               | 65               | 26° <sup>3</sup>  | 23° | 23° | 19°                | N/A |
| 3.00               | 80               | 20°               | 14° | 18° | 25°                | N/A |
| 4.00               | 100 <sup>4</sup> | 16°               | 11° | 14° | 20°                | N/A |
| 6.00               | 150              | N/A               | N/A | N/A | 20°                | N/A |

<sup>1</sup> Bio-Pure and Bio-Tek sizes.

<sup>2</sup> Bodies manufactured prior to 2010 have a 20° drain angle for the Bio-Tek buttweld bodies with 1" (25.4 mm) cutbacks and a 30° drain angle for Bio-Tek TC bodies. Consult engineering drawings for drain angles on Bio-Tek fabrications. Bio-Pure and Bio-Tek forgings have been standardized on 30° draing angle regardless of body type.

<sup>3</sup> 3" forged body with 2.5" end connection.

<sup>4</sup> DN 100 bodies to DIN/ISO dimensions are wrought.

<sup>5</sup> Forging drain angles apply to all end connections.

Note: As a rule of thumb drain angle tolerances of +/- 2° will assure optimal drainability. Consult Pure-Flo product engineering for specific drain angle tolerances.

## Manufacturing Methods

### Ferrite

The selection of process components in the Pharmaceutical/Bioprocessing Industry, especially in cell culture applications, demonstrates a distinct movement toward lower ferrite materials. However, in many applications the use of higher ferrite content components may have no effect on the product, service life, or performance of the component and the inherent cost of the component is reduced. The nature of the process, utility protocols (i.e. passivation, cleaning, sterilization, fabrication), as well as additional surface preparation of the material such as electropolishing, will impact the extent of the components corrosion resistance. ITT provides customers a choice in body types based on the needs and requirements of the customers process application.

Ferrite can be defined as the ferromagnetic, body-centered, microstructural constituent of variable chemical composition in iron-chromium-nickel alloys. This may be formed upon solidification from molten metal (delta ferrite) or by transformation from austenite or sigma phase on cooling in the solid state (alpha ferrite). The formation of ferrite is therefore a natural occurrence in stainless alloy products. Ferrite levels can be determined utilizing several techniques including chemical analysis, metallographic examination and magnetic attraction. As one can see from the below comparisons, ferrite is depleted as the material is worked, i.e. castings having the highest content and forgings having the lowest. Free delta ferrite contained in components in a process system may or may not be of concern to the end user.

### Metallurgy

ITT Pure-Flo customers have a choice of valve body types based on the needs and requirements of the process application. Pure-Flo standard body material for forged bodies is 316L, 1.4435 sulfur controlled to ASME BPE Table DT-3.

Applications may require special alloys or materials to provide a desired performance. Consult a Pure-Flo representative for availability and application information.

Wrought bodies are available in 316L, 1.4435 or other special materials. Biopharmaceutical ap-

All valve bodies are fully material heat traceable to EN 10204 3.1B. Certified Mill Test Reports are provided as standard.

## Manufacturing Methods (cont.)

### Forged

Pure-Flo bodies are produced from round stock or plate which has been processed from an ingot. The round stock or plate is compressed between two halves of a forging tool at elevated temperatures. The result is a shape which is then machined to create the shape required. Machining required is more extensive than a casting. Ferrite content for the ANSI Pure-Flo and ISO/DIN forged product lines is 0.5%.



### Wrought

The tank bottom valves, divert valves and block body fabrications are produced from wrought material. Wrought material is worked material such as plate or round stock. Rather than forging a shape between two halves of a tool, as in the case of a forged body, the shape required is machined directly from wrought material. Ferrite content in wrought material may vary depending primarily on the metallurgy of the material used.



### Cast

Pure-Flo bodies are produced utilizing the lost wax or investment cast method. A wax impression is created for the shape required. The wax impression is dipped or sprayed with ceramic material and then fired in a kiln. The wax evaporates leaving behind a hard ceramic shell into which molten material is poured. The solidification of molten metal may cause sub-surface porosity, which varies in occurrence depending on casting techniques, machining and interior finish specifications. The result is a product complete with flow path, bolt holes,

drain marks and body identification marks cast into the required shape. Machining is, therefore, minimal. Pure-Flo castings go through a rigorous qualification program to ensure the highest attainable quality is achieved. The levels of porosity are the absolute minimum possible.



## Surface Finish

Pure-Flo valve bodies are available in a complete range of mechanically polished and electropolished internal surface finishes to satisfy system design requirements. Pure-Flo valves are available in a complete range of ASME BPE compliant internal surface finishes.

ITT Pure-Flo provides a complete range of both internal and external electropolish options. Electropolish surface finishing creates a superior surface finish for biopharmaceutical applications. Electropolishing improves corrosion resistance, removes inclusions and contaminants, and improves the over-all surface for cleaning and sterilization.

### Surface Finishes per ASME BPE

Mechanical Polished Surface Finish (Interior Only)

| Code | R <sub>a</sub> , MAX |      |
|------|----------------------|------|
|      | μ-in                 | μm   |
| SF1  | 20                   | 0.51 |
| SF2  | 25                   | 0.64 |
| SF3  | 30                   | 0.76 |

General Notes:

1. All Ra readings are taken across the lay, wherever possible.
2. No single Ra reading shall exceed the Ra max. value in this table.
3. Other Ra readings are available if agreed upon between owner/user and manufacturer, not to exceed values in this table.

### Mechanical Polish Surface Finish (Interior Only)

| Code | Non-EU Service Microinch Max | EU Service Micron Max |
|------|------------------------------|-----------------------|
| 0    | No Mechanical Polish         | No Mechanical Polish  |
| 2    | 35 Ra                        | 0.8 Ra                |
| 6    | 25 Ra                        | 0.6 Ra                |
| 8    | 20 Ra                        | 0.5 Ra                |
| 7    | 15 Ra                        | 0.38 Ra               |
| 9    | 11 Ra                        | 0.28 Ra               |
| 10   | 10 Ra                        | 0.25 Ra               |

### Electropolish Surface Finish (Interior & Exterior)

| Code | Surface Finish                           |
|------|--|
| 0    | No Electropolish                         |
| 2    | Exterior Electropolish only              |
| 3    | Both Interior and Exterior Electropolish |
| 4    | Interior Electropolish only              |

Mechanical Polished & Electropolished Surface Finish (Interior Only)

| Code | R <sub>a</sub> , MAX |      |
|------|----------------------|------|
|      | μ-in                 | μm   |
| SF4  | 15                   | 0.38 |
| SF5  | 20                   | 0.51 |
| SF6  | 25                   | 0.64 |

## Electropolishing

Electropolishing is the electrochemical method of removing metal from a surface. Formally, electropolishing is defined as anodic dissolution in the presence of an electrolyte and an imposed current potential.

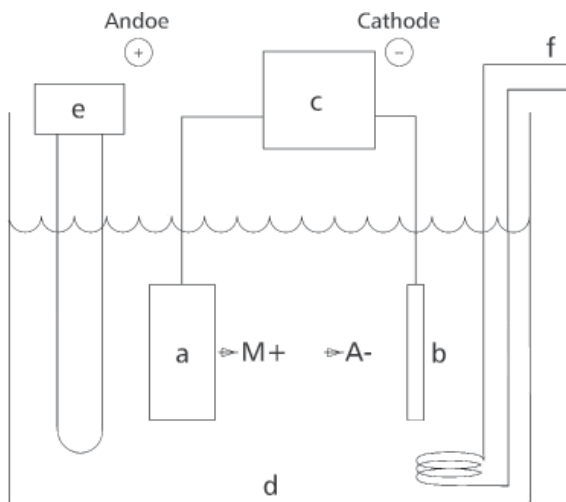
The inherent benefits derived from electropolishing are as follows:

- Provides a continuous, tenacious, chromium-rich oxide layer on the surface resulting in an excellent passive film enhancing corrosion resistance
- Surface leveling reduces the total surface height and relieves much of the surface tension inherent in mechanical polishing
- Enhances the optimization of cleanability and sterilization

- Provides a quality control mechanism exposing surface pits and defective welds
- Exposes and removes impurities within the surface layer
- Provides a lustrous, aesthetically pleasing appearance

For the reasons mentioned, the use of electropolishing over a mechanically polished surface is becoming more prevalent on the surfaces of system components in critical pharmaceutical and bioprocessing applications. The Pure-Flo product line is available with electropolished interior and exterior surfaces, sizes 0.25–6" (DN 8–150).

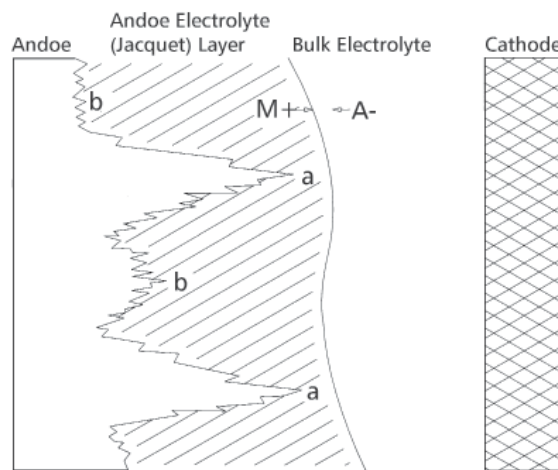
Diagram of a Typical Electropolishing Cell



Legend

- a Anode
- b Cathode
- c Power Source
- d Electrolyte
- e Heater and Temperature Regulator
- f Cooling Coil
- M+ Metal Ion
- A- Anion

Diagram Illustrating Micropolishing and Macropolishing



Legend

- a Region of Macropolishing
- b Region of Micropolishing
- M+ Metal Ion
- A- Anion



## Marking

Pure-Flo valve bodies are marked directly on the valve body, typically on the bottom of the valve or underside of the bonnet flange. Additional information such as customer tag number is available upon request.

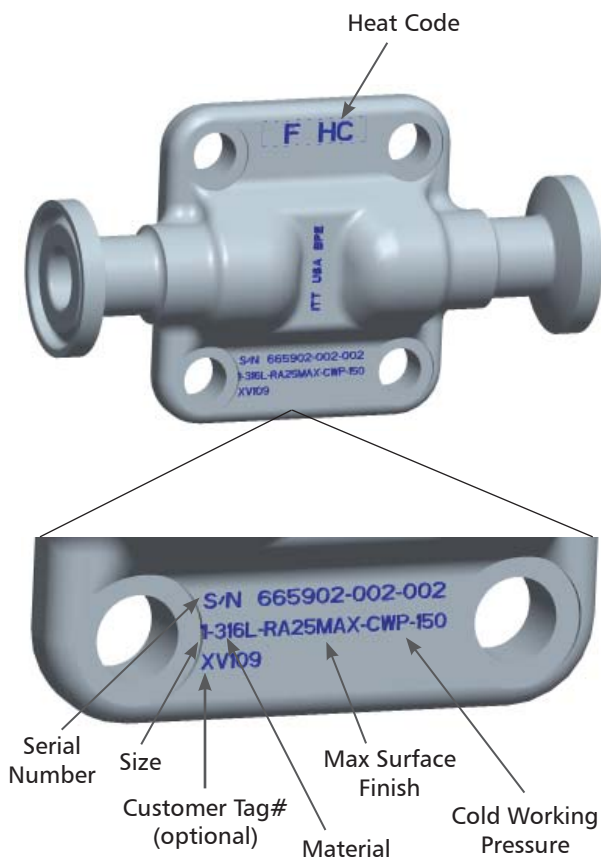
### Validation

ITT Pure-Flo provides critical validation information to meet the needs of the Pharmaceutical and Bioprocessing industries.

### Certified Mill Tests Reports

All Pure-Flo Valve bodies contain a heat number traceable per EN 10204 3.1. Certified Mill Test Reports (CMTRS) are provided as standard on all Pure-Flo valves.

### Standard Marking



### Certificate of Compliance to Specifications

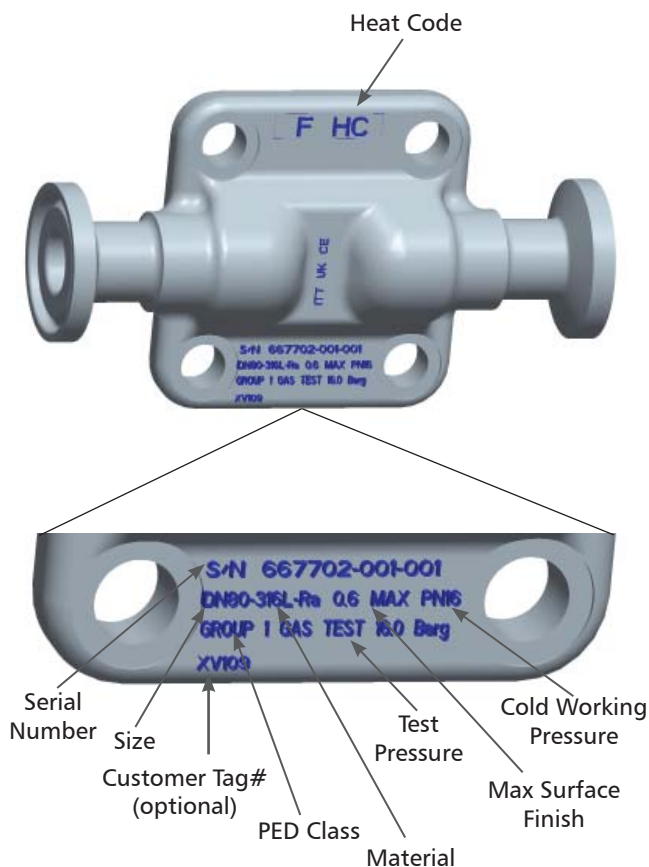
A Certificate of Compliance to customer specification is provided as a standard on all Pure-Flo valves.

- Certification of compliance to CFR Title #21 section 177
- Certification to USP Class VI compliance and/or physical testing document

Additional Validation information available on request

- Interior Surface Characterization documentation
- Quality assurance manual
- ISO 9001 certification
- Certification of testing to MSS-SP-88

### European Union Service Marking



Pure-Flo valves comply with the European Union (EU) Pressure Equipment Directive (PED) 97/23/EC Category 1. Valve bodies are CE marked per the 97/23/EC when EU service is requested.

## Process Fabrications

Process fabrications consist of multiple 2-way valves ported in various ways to fit the application. The intent is to reduce hold up volume and improve drainability versus using standard valves and fittings. Process fabrications minimize the distance between valves improving cleanability and reducing risk of contamination. Fabrications are utilized when hold up volumes are a consideration but not critical. Many process fabrication combinations can comply with the cGMP requirements.

There are three styles of standard two valve fabrications:

### GMP Option:

The GMP fabrication is typically oriented in the vertical position. The design is utilized to reduce dead legs on point-of-use outlets in a typical WFI distribution loop.

### Sterile Access Option:

The Sterile Access orientation is designed for use when the orientation of the main valve is horizontal and the secondary or purge valve or outlet is in the vertical position. The main valve is ported at the low point of the main valve waterway to achieve optimum drainability when the main valve is on its drain angle.

### Horizontal Sterile Access Option:

The Horizontal Sterile Access orientation is similar in configuration to the Sterile Access configuration, but is employed when both the main valve and secondary valve have horizontal orientation.

### Typical Applications:

Sampling, steam condensate drain, divert port, and block and bleed.

### Size Range

0.25–6" (DN8–150) main valve  
0.25–6" (DN8–150) purge valve

### Body Material

316L Stainless Steel wrought, ASTM A479  
316L Stainless Steel Forging, ASTM A-182  
Other materials available upon request

### End Connections

Buttweld:

- 14, 16, 18, 20 Gauge O.D. Tubing
- Schedule 5, 10, and 40 Pipe
- DIN/ISO Ends

Hygienic clamp ends:



## Integrated Block Valves

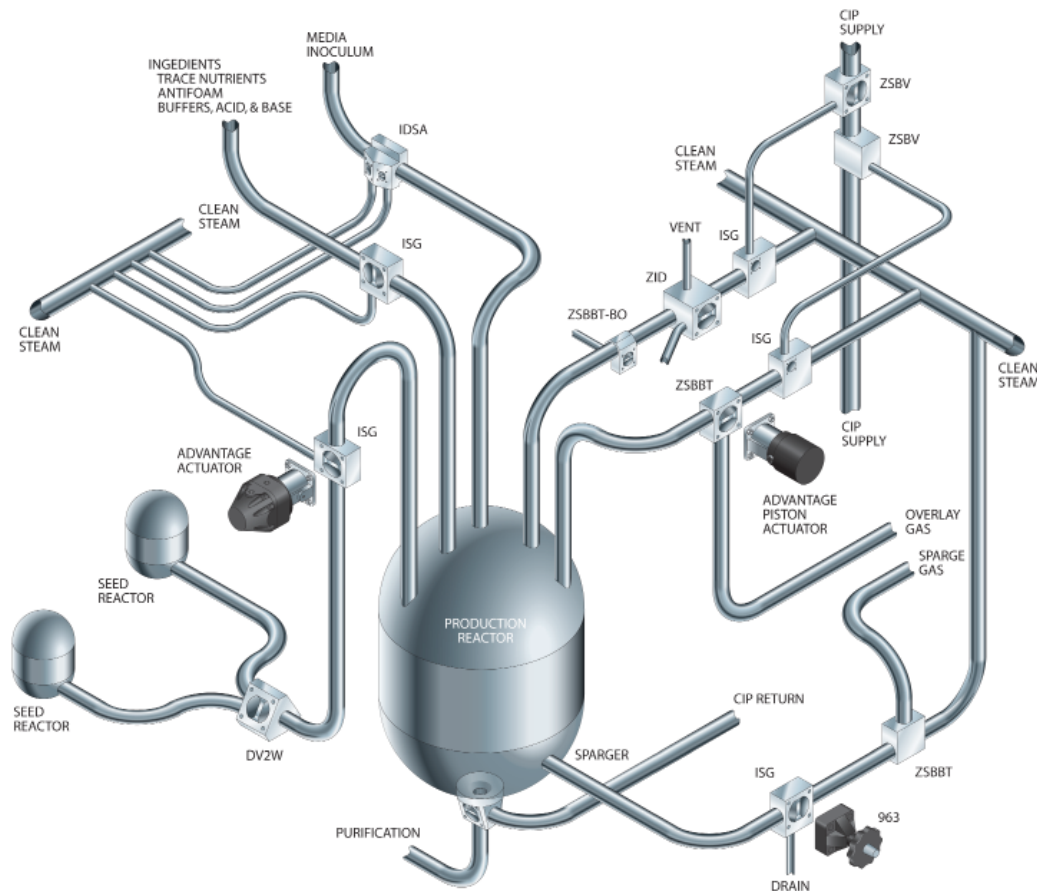
The Pure-Flo IBV - Integrated Block Valve product line is constantly changing to meet the rigorous demands of the Biopharmaceutical processing industry. An extensive array of innovative integrated block valves specifically designed to achieve the utmost in process efficiency. Pure-Flo developed the first integrated block body diaphragm valves over 30 years ago. We have a history of listening to customers and industry needs to develop valve solutions for the toughest applications.

Biopharm processes are complex and sensitive to system and environmental factors. Drug purity and process yield is greatly affected by system design. Integrated block valves can play a substantial role in developing a robust high yield process. Many valve solutions can produce acceptable results, but Pure-Flo integrated block valve technology can make a marginal process better and a good process great.

Integrated block technology is a cost effective means of reducing total cost of ownership. By optimizing drainability, hold-up volume, deadlegs and cleanability, block technology can decrease cleaning cycle times and increase process efficiency. Combining multiple valves into a single valve body can substantially reduce total installation and validation costs. Efficient designs pay for themselves over and over again.

Utilizing powerful 3D modeling software we can create almost any valve configuration imaginable. Working hand in hand our engineers will develop the valve configuration that fit your needs to a "T".

## Integrated Block Valves in a Typical Bioreactor Process



## Drainability and Hold Up Volume

ITT Pure-Flo hygienic weir style diaphragm valves have become the most important control element of process piping systems utilized in the Pharmaceutical and Bioprocessing industries. The weir style diaphragm valve has become the standard due to its unique ability to provide maximum drainability and minimized product hold up volumes.

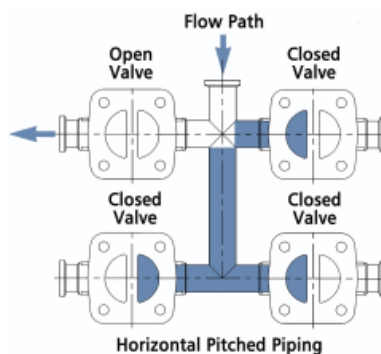
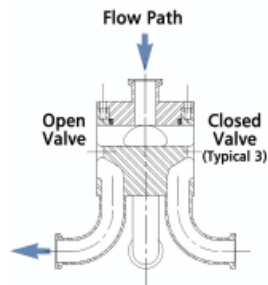
Integral Block technology further improves drainability and minimizes hold up volumes by reducing the process pipe volume between control elements.

Utilizing the unique characteristics of the weir style diaphragm valve, valve manufacturers have helped develop many process fabrications that have reduced product contact surfaces, reduced hold up volumes, and minimized piping dead-legs. The theory is that as contact surfaces are minimized, and hold-up volume are reduced in a process piping system, product yields and product purity will be improved.

In the not so distant past, typical process fabrications were produced by welding of standard forged valve bodies in configurations designed

specifically for certain applications and orientations. This fabrication has served the industry well, but has limitations. In many instances the dead leg between the two can fall outside FDA expectations.

4-Way Divert Valve vs. Conventional Divert Valve Assembly



Stagnant Fluid Shown in Blue

## Deadlegs

The FDA Guidelines for High Purity Water Systems has “defined dead legs as not having an unused portion greater in length than six diameters of the unused pipe, measured from the axis of the pipe in use. It should be pointed out that this was developed for hot (75-80° C) circulating systems. With colder systems (68-75° C) any drop or unused portion of any length of piping should be eliminated if possible, or have special sanitizing procedures”.

In case where process piping falls outside of FDA expectations, as noted from the High Purity Water Guide reference above, the owner of the system is expected to have special sanitizing procedures. These special sanitizing procedures can be costly in production time and processing cost and should be avoided whenever possible

## Current Good Manufacturing Practice (cGMP)

The cGMP regulation is a total quality concept applicable to processes and associated operations that assure the desired quality product. cGMP compliance, like quality, is fundamental and must be designed and built in from the earliest stages of a drug production project.

Drug manufacturers are required to maintain current Good Manufacturing Practices. This means that manufacturers must stay current with:

- New Technology
- New Methodology
- New Thinking
- New Requirements
- New Trends

One of the most critical factors in the production of drugs is the ability to clean and validate the drug production process. cGMPs require that processing equipment be designed to be cleaned and sterilized to minimize the potential for contamination, assuring the purity of the end drug product.

Hygienic weir style diaphragm valves have become the most important control element of process piping systems utilized in the Pharmaceutical and Bioprocessing industries, due to their unique ability to provide drainability with minimized product entrapment areas. Integrated block valve designs take these characteristics to an even higher level.

## Block Valves: Total Cost of Ownership

Total cost of ownership for a process system can not be calculated by material costs alone. Installation and ongoing operational costs should be taken into account when making any component purchasing decision. In many cases the cost of integrated block valves are greatly offset by reductions in installation costs, space requirements and improvements in operational efficiency.

Integrated Block Valves can improve production efficiencies by:

- Minimizing internal valve volume
- Minimizing hold up
- Minimizing dead-legs
- Reducing CIP cycle times
- Increasing product purity
- Reducing qualification and validation efforts

Integrated Block Valves also reduce:

- Installation time and cost
- Expensive field welds
- Process piping footprint

## 6D Rule vs. ASME BPE L/D

### Dead-legs - What ever happened to 6D?

Basically, a “dead-leg” is defined as a one-way water system. Dead-legs result in process systems that are difficult to clean. The FDA reference document “Guide to Inspections of High Purity Water Systems” indicates that dead-legs for hot (75-80° C) circulating water systems (self sanitizing) shall be no greater than 6 diameters of the unused pipe, measured from the axis of the pipe in use. Colder water systems (65-75° C) are not self sanitizing and therefore should eliminate dead-legs, if possible, or have special sanitizing procedures in place.

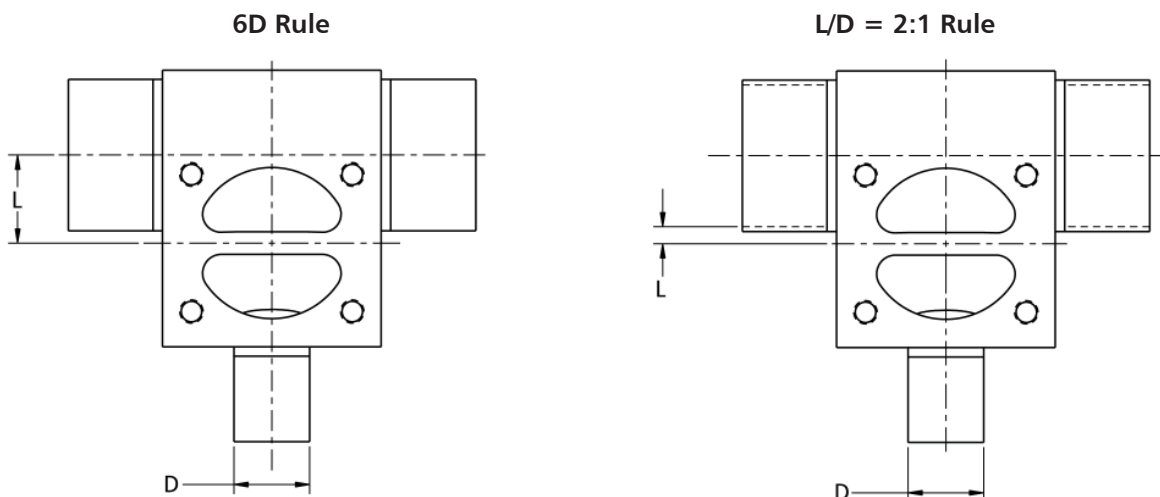
This 6D requirement has been the basic standard for many years when designing high purity water systems. Due to the method of measurement however, 6D as defined was not truly representative of what dead-leg characteristics are critical to designing a cleanable process piping system. Defining a dead-leg from the axis of the main pipe simply does not address the characteristics that affect the ability to clean and sanitize the dead-leg in question.

### ASME BPE L/D = 2:1

The Bioprocessing industry has found that 6D piping standards are not sufficient to assure optimal clean-able and sterilizeable process systems. The sensitive nature of the production processes and the substantial value of the end product have required the industry to develop even more stringent requirements in critical systems. In 1997 the American Society of Mechanical Engineers (ASME) addressed this need by creating the ASME Bioprocessing Equipment Standard. The ASME BPE standard suggests that high purity water, clean steam systems and bioprocessing systems such as fermentation, purification and filtration systems can be designed to meet an L/D ratio of 2:1. L is defined as the Length of the dead-leg extension measured from the ID wall normal to the flow pattern. D is the nominal size dimension of the extension of a valve or instrument.

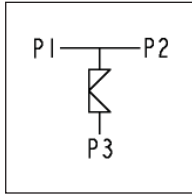
The ASME BPE standard states that the L/D ratio of 2:1 should be considered a target, not an absolute requirement, but the system designer/manufacturer should make every attempt to eliminate system dead-legs, and identify where exceptions exist.

Since the L/D ratio of 2:1 is a target, the system designer must make the determination of what L/D ratio is warranted for a particular system or project. In many cases L/D ratios of 2:1, 3:1 or sometimes 4:1 are utilized.

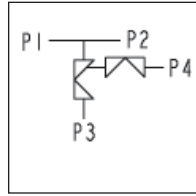


## P&ID Cross Reference

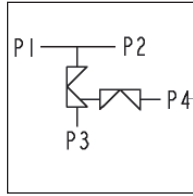
### Zero Static Use Points



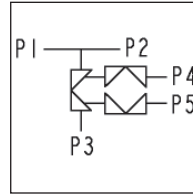
Zero Static Block Body  
Code: ZSBB



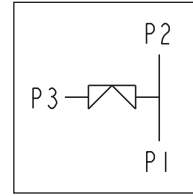
Zero Static Back to Back Sample  
Code: ZSBS



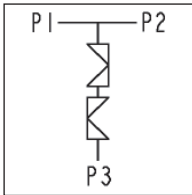
Zero Static with Downstream Purge  
Code: ZDP



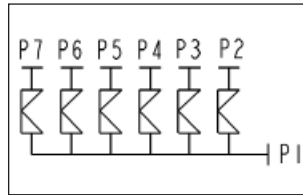
Zero Static with Upstream Sample and Downstream Purge  
Code: ZUD



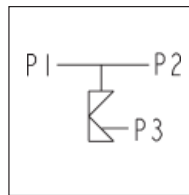
Zero Static Block Body with Vertical Run  
Code: ZSBV



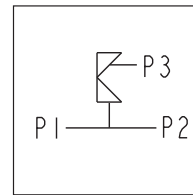
Zero Static Dual Inline  
Code: ZDI



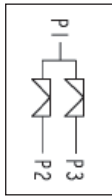
Zero Static In-Line (ZID)



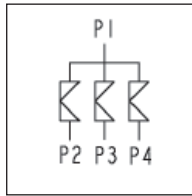
Zero Static Block Body with Back Outlet Option (ZSBBT-BO)



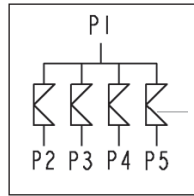
### Divert and Sterile Access Valves



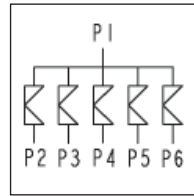
2-Way Divert Valve  
Code: DV2W



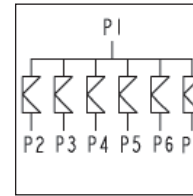
3-Way Divert Valve  
Code: DV3W



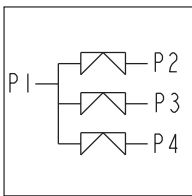
4-Way Divert Valve  
Code: DV4W



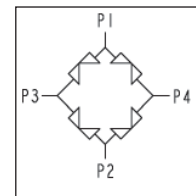
5-Way Divert Valve  
Code: DV5W



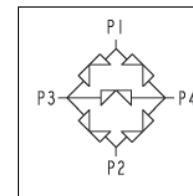
6-Way Divert Valve  
Code: DV6W



Horizontal Divert Valve 3-Way  
Code: HDV3W



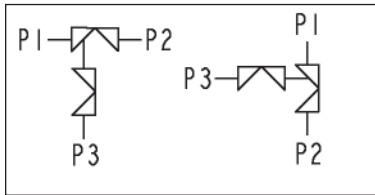
Chromatography without Bypass  
Code: CHN



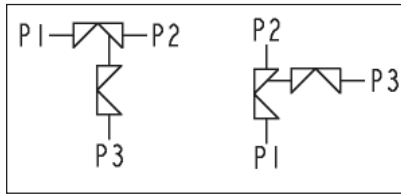
Chromatography with Bypass  
Code: CHRO

## P&ID Cross Reference

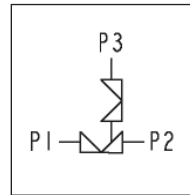
### Divert and Sterile Access Valves (cont.)



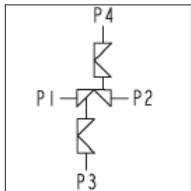
Integral Sterile Access and GMP (Left)  
Code: ISG



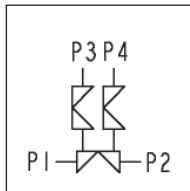
Integral Sterile Access and GMP (Right)  
Code: ISG



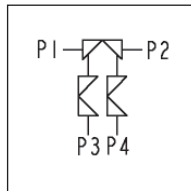
Integral Horizontal Sterile Access  
Code: IHSA



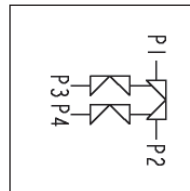
Integrated Dual Sterile Access  
Code: IDSA



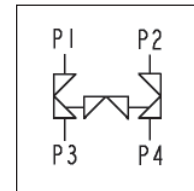
Integrated Dual Sterile Access  
Code: IDSA



Integrated Dual Sterile Access  
Code: IDSA

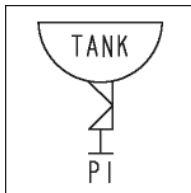


Integrated Dual Sterile Access  
Code: IDSA

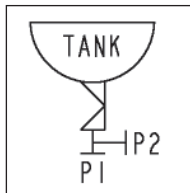


Crossover  
Code: CRO/CROD

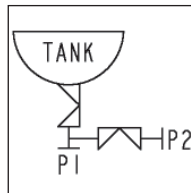
### Vessel Valves



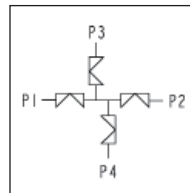
Tank Bottom Valve  
Code: TBV



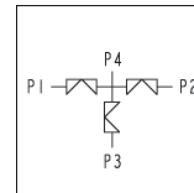
Tank Bottom Valve with CIP/SIP Port  
Code: TBV



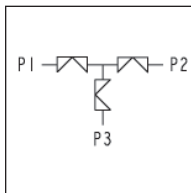
Tank Bottom Valve with CIP/SIP Valve  
Code: TBV



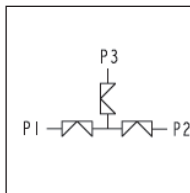
Sterile Barrier  
Code: SB1



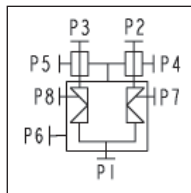
Block & Bleed with Vent Port  
Code: BBD



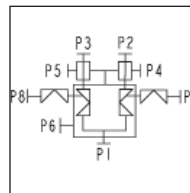
Block & Bleed  
Code: BBD



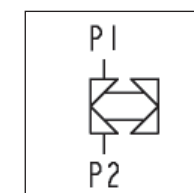
Block & Bleed  
Code: BBV



Sterile Filter Shunt Valve  
Code: DV2WS



Sterile Filter Shunt Valve with Condensate Drain Valves  
Code: DV2WS

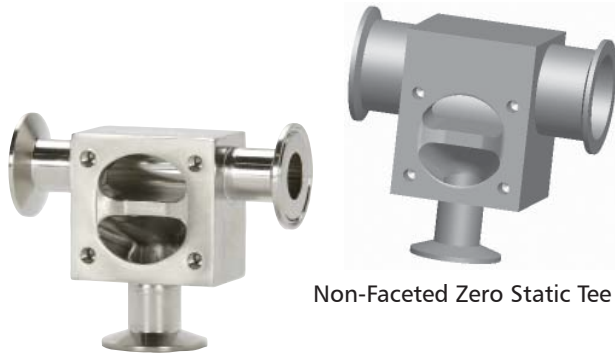


Bypass or Dual Flow  
Code: BYP or DF



## Zero Static Use Points

Zero Static use points are some of the most critical valves utilized in the Biopharmaceutical industry. Use point valves allow process fluids to be transferred, sampled, drained or diverted with minimal impact on critical systems such as WFI and purified water.

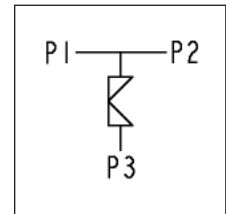


## Zero Static Tee (ZSBBT, ZSBT)

The new E-Series non-faceted zero static tee maintains the essential functional characteristics of the original zero static valve design while improving the cost effectiveness of block body assemblies. The E-Series design features minimized exterior body machining, minimizing overall valve costs without affecting valve performance.

### Typical Applications:

- Point-of-use valves
- Piping Branch valves



Flow Path



## Zero Static U-Bend (ZSBBVV, ZSBBHV, EZSBVV, EZSBHV)

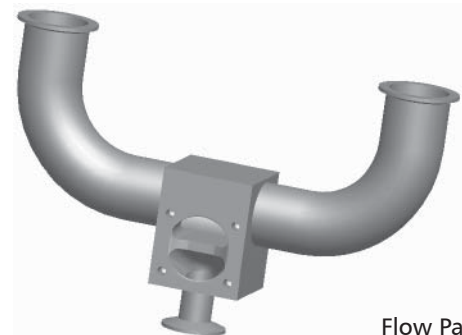
Zero Static use points are some of the most critical valves utilized in the Biopharmaceutical industry. Use point valves allow process fluids to be transferred, sampled, drained or diverted with minimal impact on critical systems such as WFI and purified water.

The new E-Series zero static u-bend maintains the essential functional characteristics of the original zero static valve design while improving the cost effectiveness of block body assemblies. The E-Series design features minimized exterior body machining, minimizing overall valve costs without affecting valve performance. The design also utilizes ASME autoweld elbow fittings, resulting in an increased u-bend centerline dimension as compared to the original zero static valve design. E-Series u-bend welds are left in the as-welded condition. Outlet fitting welds are polished to valve surface finish requirements.

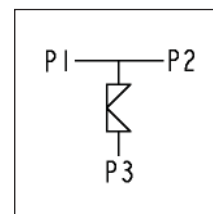
### Typical Applications:

- Point-of-use valves
- Piping branch valves

E-Series Zero Static U-Bend



Flow Path



## Zero Static Use Points

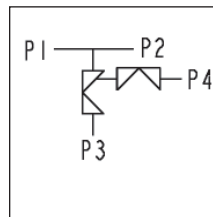
### Zero Static Back to Back Sample (ZSBBS)

The ZSBBS process fabrication is a modification of a standard Zero Static Tee. An integral valve located on the back of the valve assembly provides access to a sample port upstream of the Zero Static Tee weir. This sample port is utilized to take samples of the main process flow. The sample valve typically utilizes a .5" Bio-Tek or Pure-Flo valve.

The integral sample valve greatly reduces contact surfaces, hold up volume and possible deadlegs as compared to sample valves that are welded to the exterior of a standard Zero Static valve. The ZSBBS is an essential element of piping systems required to meet demanding L/D ratios suggested by the ASME BPE standard.

#### Typical Applications:

- Use point where sampling of loop water is required prior to opening main valve.



Flow Path



### Zero Static Downstream Purge (ZDP)

The ZDP process fabrication is a modification of a standard Zero Static valve. An integral valve located on the back of the valve assembly provides access to a purge port downstream of the ZSBBS weir. This purge can be utilized for a multitude of process and utility applications including steam, CIP solution or as a gas purge. The downstream integral purge valve typically utilizes a .5" Pure-Flo valve bonnet assembly. The integral purge valve greatly reduces contact surfaces, hold up volume and possible deadlegs as compared to purge valves that are welded to the exterior of a standard zero static valve. The ZDP is an essential element of piping systems required to meet demanding L/D ratios suggested by the ASME BPE standard.

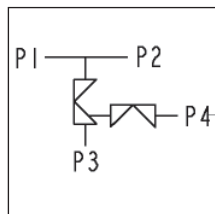
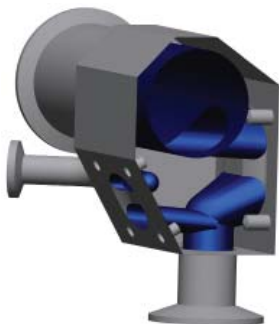
#### Typical Applications:

- Use point applications where cleaning (CIP), steam sterilization, and blow down of the downstream is required.



Patent # 6,397,887

Flow Path



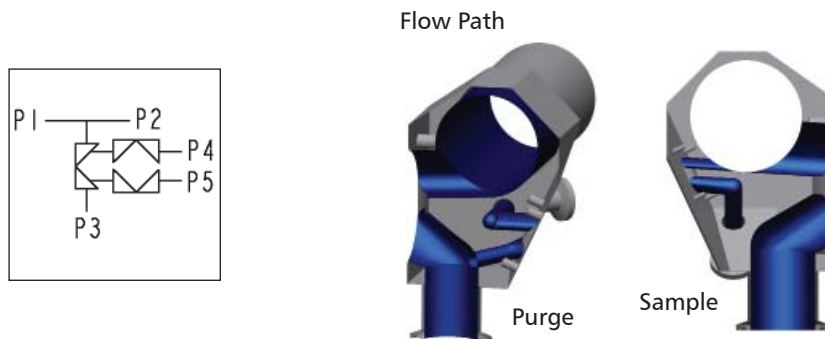
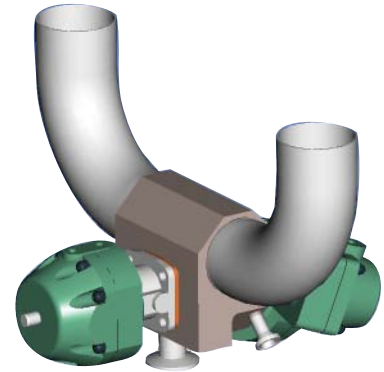
## Zero Static Use Points

### Zero Static with Upstream Sample and Downstream Purge (ZUD)

The Zero Static Upstream Sample and Downstream Purge valve allows for point of use sampling of the upstream flow, purging and sterilization of the downstream process, and sampling from the same Zero Static valve.

#### Typical Applications:

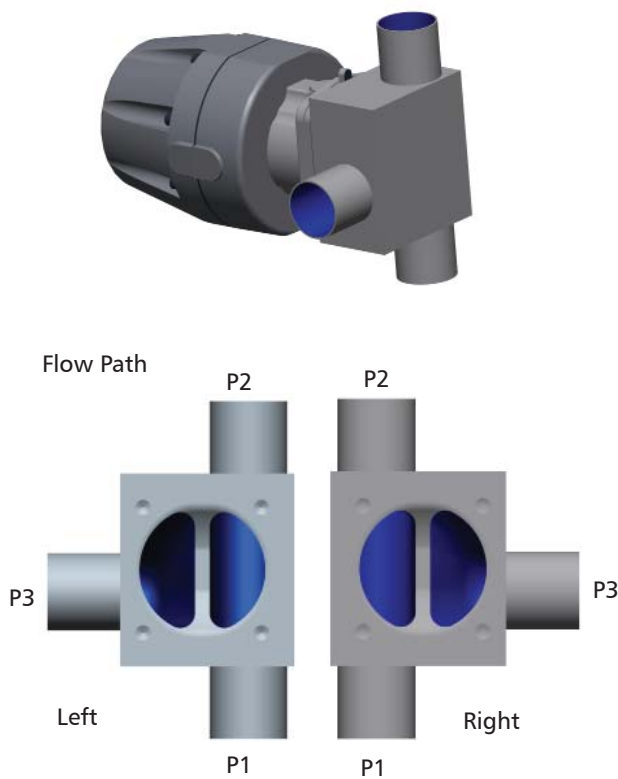
- A single use point with multiple outlets for purging and steam sterilization of the downstream line and sampling of the upstream line



### Zero Static Block Body with Vertical Run (ZSBV)

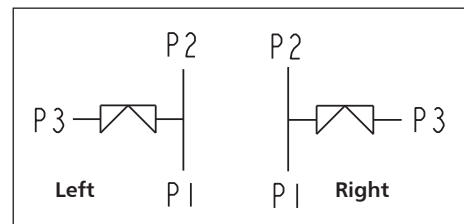
Zero Static use points are some of the most critical valves utilized in the Biopharmaceutical industry. Use point valves allow process fluids to be transferred, sampled, drained or diverted with minimal impact on critical systems such as WFI and purified water.

Standard Zero Static valves are limited to horizontal main runs by vertical outlet orientations. The ZSBV greatly expands the use of the Zero Static valve by allowing optimal drainability and hold up volumes with the main run in the vertical orientation and the outlet in the horizontal orientation.



#### Typical Applications:

- Vertical run use point, sampling and diverting.



## Zero Static Use Points

### Zero Static Inverted with Drain (ZID)

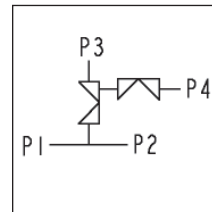
Zerostatic Inverted Drain valves integrate the benefits of a zero static for low point feed or return lines while allowing for cleaning, sterilization or and/or draining of the connected process piping.

#### Typical Applications:

- For line feed applications that require the ability to drain the up stream line



Flow Path

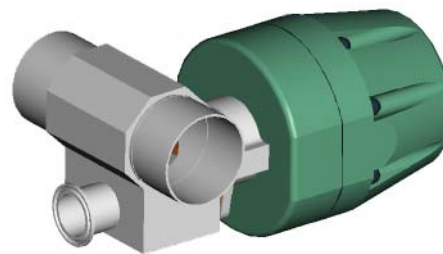


### Zero Static Block Body with Back Outlet Option (ZSBBT-BO)

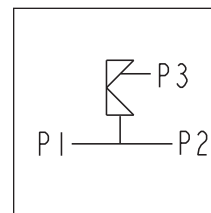
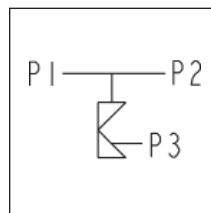
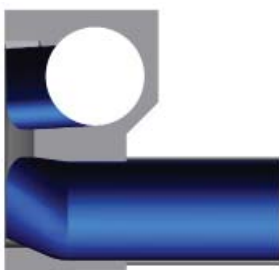
The ZSBBT-BO valve provides all the advantages of the standard zero static valve for transferring, sampling, draining and diverting critical fluids, while minimizing the vertical space required. Porting the outlet from the back of the valve substantially reduces the space necessary when piping would require a 90° elbow to change the direction.

#### Typical Applications:

- Low clearance areas below WFI and process vessels.
- Skidded process systems such as CIP.



Flow Path



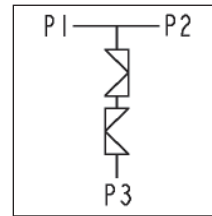
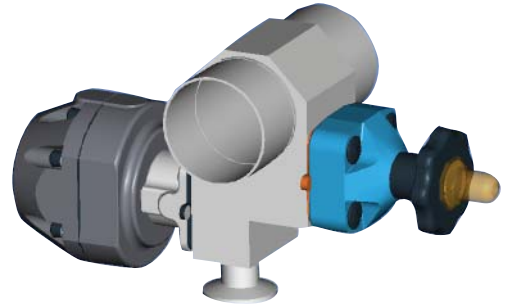
## Zero Static Use Points

### Zero Static Dual Inline (ZDI)

Zero Static use points are some of the most critical valves utilized in the Biopharmaceutical industry. Zero Statics are used extensively on Water for Injection (WFI) and purified water loops. These water loops supply nearly every manufacturing process. Water loop maintenance is typically scheduled for annual shut-downs so as not to affect production. Critical applications or use point locations that require maintenance on a more frequent basis or that would affect a large portion of the plant water loop may require additional valves to isolate the main water loop for maintenance. The Zero Static Dual Inline valve was designed specifically to allow for maintenance of two use points with minimum loop downtime.

#### Typical Applications:

- Use points where the loop service intervals need to be maximized



Flow Path



## Divert and Sterile Access Valves



Patent # 6,401,756

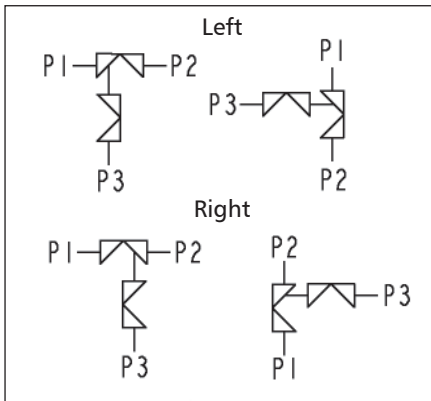
### Integral Sterile Access and GMP (ISG)

The ISG combines the functionality of the two most common process fabrications (Sterile Access (SA) and GMP) into one assembly, greatly reducing the deadlegs of conventional SA and GMP fabrications when a purge valve is required.

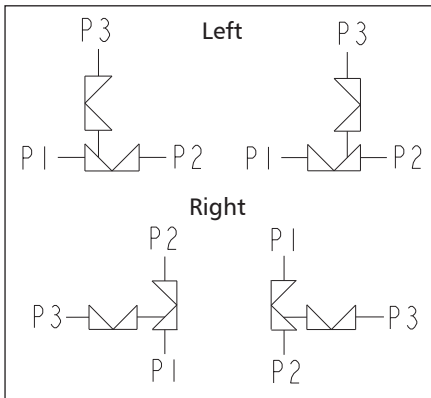
This is achieved by providing the purge valve integral to the main body design. By simply rotating the assembly, one fabricated block body can provide three process fabrication orientations: Standard Sterile Access Port (SAP) and vertical GMP porting above and below the weir. The result is one integral valve assembly, which reduces contact surfaces and hold up volume, while minimizing dimensional envelope and increasing design flexibility.

### Typical Applications:

- Process diversion, steam barrier/block sampling

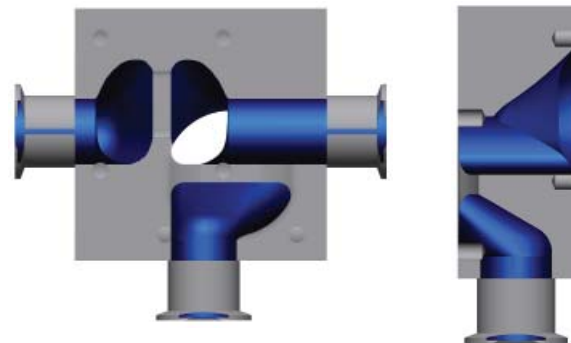


ISG

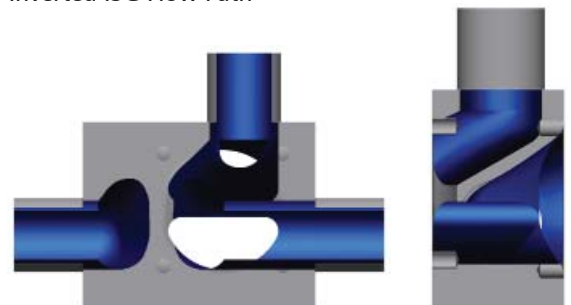


Inverted ISG

ISG Flow Path



Inverted ISG Flow Path



## Divert and Sterile Access Valves

### 2 through 6-Way Multiport Divert Valves

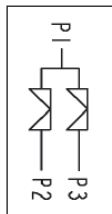
Divert valves are instrumental in achieving efficient, cost effective piping design. Divert valves allow process fluids to be diverted, mixed and/or sampled. ITT Pure-Flo is the first in the industry to incorporate the multiple weir block design. Divert valves minimize contact surfaces, minimize hold up volume, reduce CIP cycle times, improve product purity, minimize piping dimensional envelope, reduce number of system weldments, and are more easily actuated and validated than transfer panels.

#### Typical Applications:

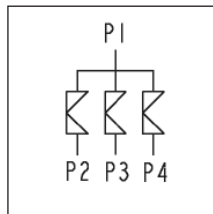
- Distribution of process flows (ie. mixing flow paths)
- 2-Way diverts are often used to switch between main and backup pumps on WFI loops
- Used in place of transfer panels
- Also used for bypass, drain and isolation
- CIP distribution
- Switching between buffers for Chromatography



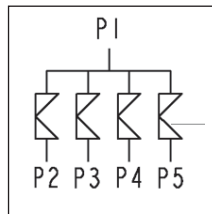
Patent for 2-Way  
# 6,237,637 and  
# 5,427,150



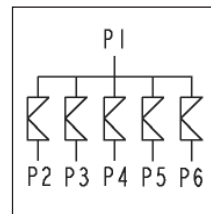
DV2W



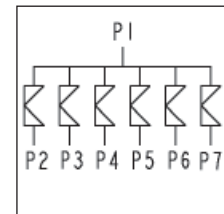
DV3W



DV4W



DV5W



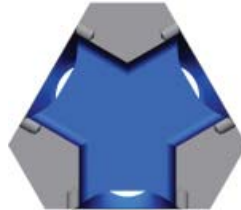
DV6W

#### Flow Path

2-Way (DV2W)



3-Way (DV3W)



4-Way (DV4W)



5-Way (DV5W)



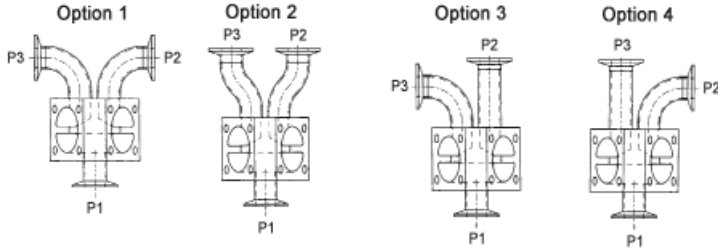
6-Way (DV6W)



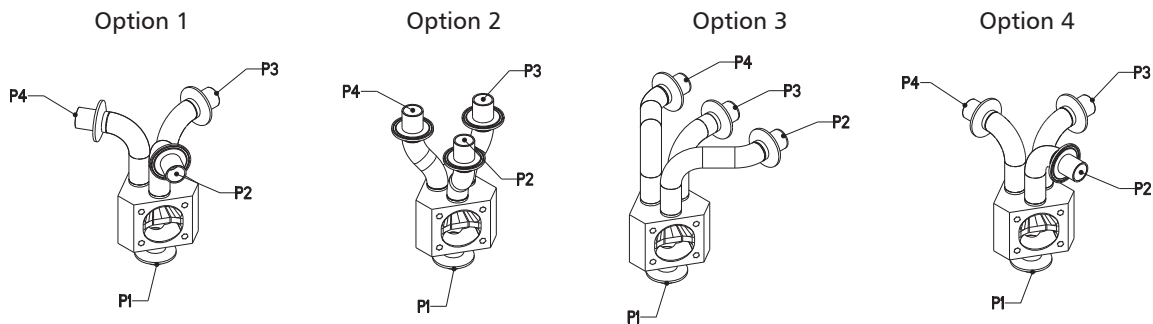
## Divert and Sterile Access Valves

### Divert Outlet Options

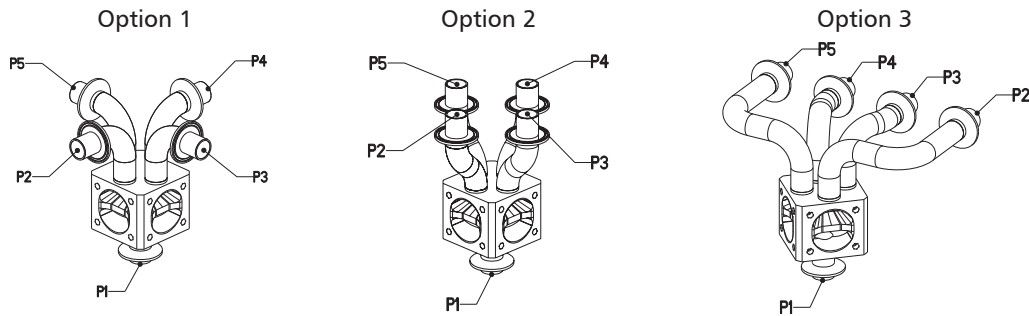
2-Way



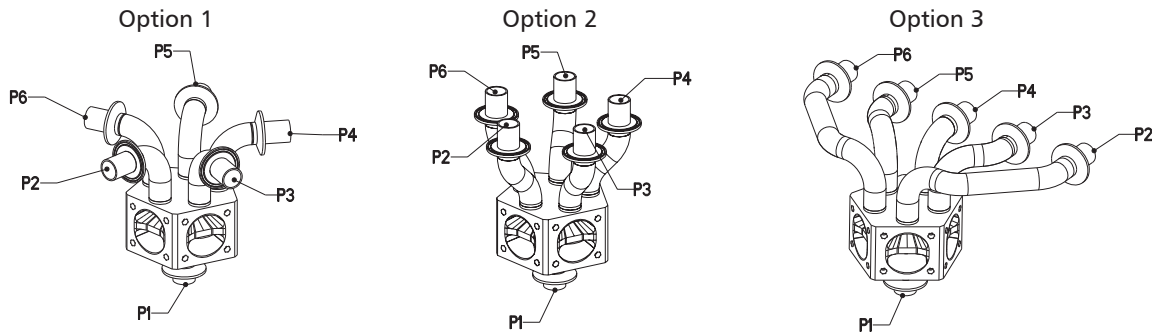
3-Way



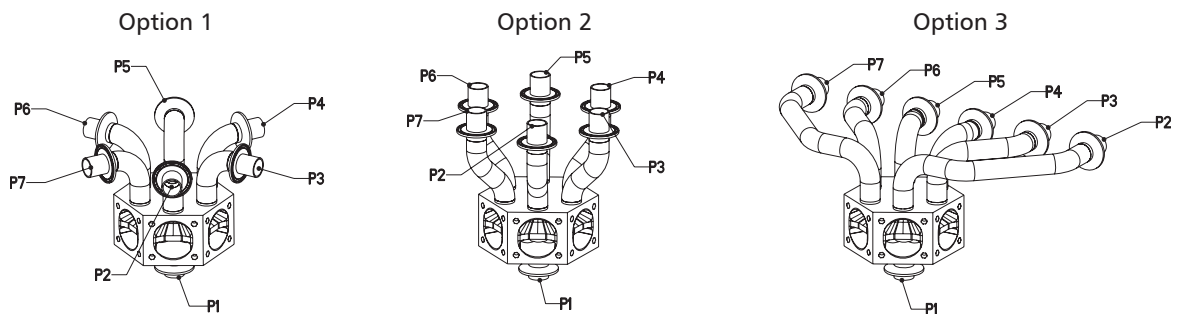
4-Way



5-Way



6-Way





## Divert and Sterile Access Valves

### Chromatography Valve (CHRO & CHN)

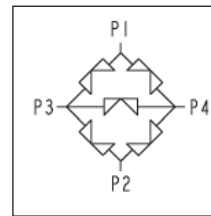
In a typical chromatography process, there is an assembly of five diaphragm valves that connect the chromatography column to the process piping. Manipulating those valves allows the process to flow through the chromatography column in the forward and reverse direction, as well as bypass the column completely. The Pure-Flo Integral Chromatography Valve Assembly accomplishes this task by integrating the required valves while retaining flexibility, minimizing dead legs in the process piping, and reducing the overall space needed for the assembly. The Integral Chromatography Valve provides the process needs of three (3) P&IDs, utilizing four or five valves in one integrally machined assembly, dramatically reducing contact surfaces and hold up volume.

#### Typical Applications:

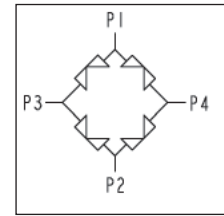
- Chromatography



Patent # 6,112,767 and 5,906,223

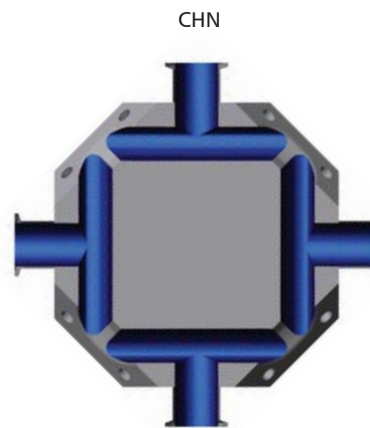
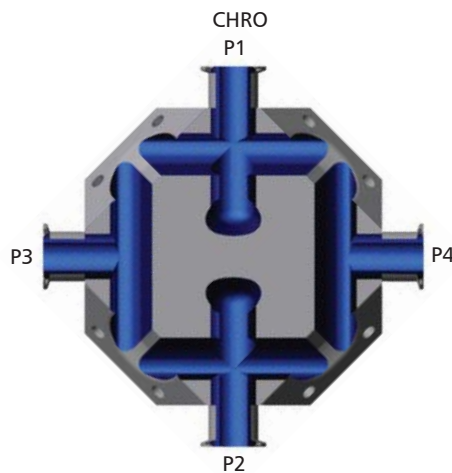


CHRO



CHN

#### Flow Path



## Divert and Sterile Access Valves

### Crossover (CROD & CRO)

Bioprocessing often requires the use of flow through equipment that must be isolated for maintenance. To facilitate maintenance without shutting down the entire process a configuration of three valves is typically used to isolate and bypass when necessary. The crossover valve integrates these three valves into a single drainable block with minimized deadlegs and hold up volume.

#### Typical Applications:

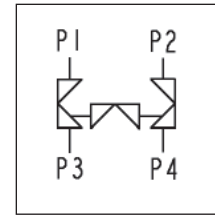
- Isolation and bypass or equipment such as filters, housings and bubble traps.



CROD

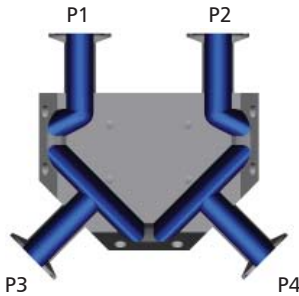


CRO

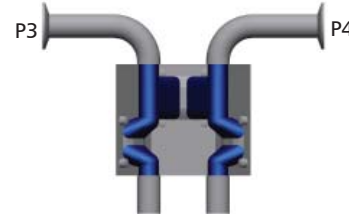


Flow Path

CROD



CRO

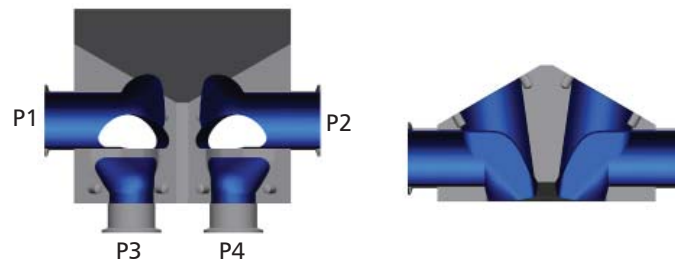
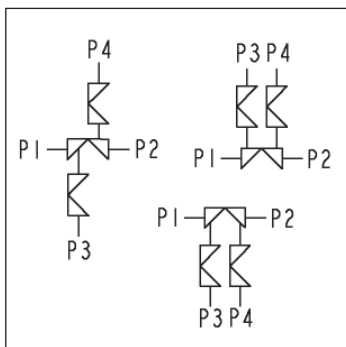


### Integral Dual Sterile Access (IDSA)

Sterile Access valves are widely used in the Bio-pharmaceutical industry. Sterile Access valves allow access to the process system for sterilizing, sampling, cleaning, diverting or draining. The Integral Dual Sterile Access valve integrates access on either side of the valve, with minimal deadlegs and hold up volumes. The integrated block design provides the possibility to orient the sterile access valves up or down, which can not be easily accommodated in a sterile access fabrication.

#### Typical Applications:

- Cleaning/Sterilization both upstream and downstream of the control point.



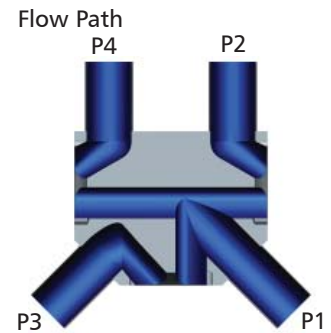
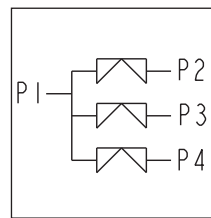
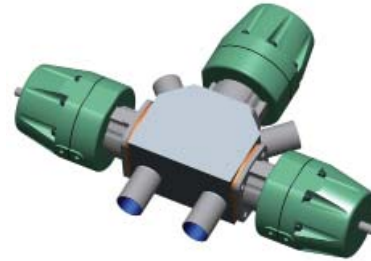
## Divert and Sterile Access Valves

### Horizontal Divert Valve 3-Way (HDV3W)

3-Way Divert valves are instrumental in achieving efficient, cost effective piping design. Divert valves allow process fluids to be diverted, mixed and/or sampled. Divert valves minimize contact surfaces, minimize hold up volume, reduce CIP cycle times, improve product purity, minimize piping dimensional envelope, and reduce number of system weldments. The Horizontal 3-way divert is specifically designed to be drainable in horizontal installations. The HDV3W is ideal for limited vertical space applications such as under process vessels.

#### Typical Applications:

- Divert process flow, mixing flow paths, drain and isolation
- Low vertical space installations

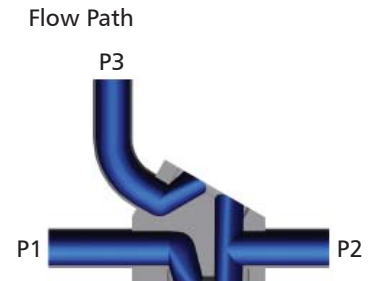
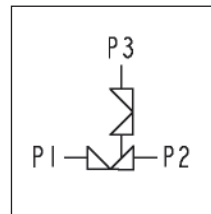
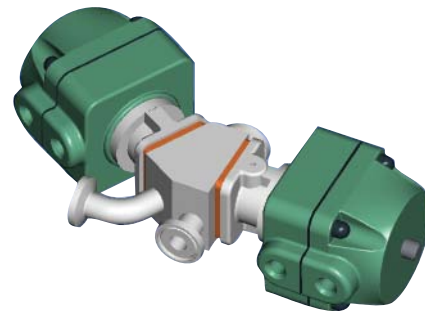


### Integral Horizontal Sterile Access (IHSA)

The Integral Horizontal Sterile Access (IHSA) is designed for sterile access applications where the piping for the main valve and purge valve are both on a horizontal plane. The IHSA provides additional benefits over standard Horizontal Sterile Access (HSA) fabrications. The IHSA should be used whenever optimal drainability and minimal deadlegs are required in horizontal orientations.

#### Typical Applications:

- Integral block incorporating second horizontal valve
- Ideal for vertical space constraints



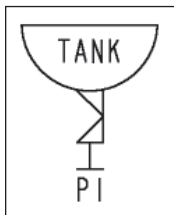
## Vessel Valves

### Tank Bottom Valve (TBV)

The Tank Bottom Diaphragm Valve is designed for use at the bottom of a tank or vessel to drain or sample while minimizing the interior sump and preventing any dead leg for bacteria or microorganism entrapment.

#### Typical Applications:

- Creating an aseptic barrier around bioreactors



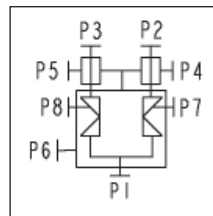
Patent # 5,227,401

### Sterile Tank Vent Filter Shunt (DV2WS)

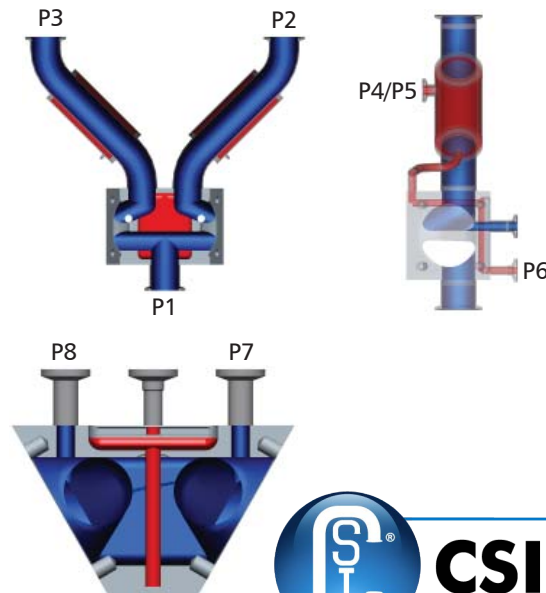
The DV2WS is a 2-Way Divert valve designed to facilitate changing from one vent filter to another on WFI storage tanks without interrupting operations.

Normally vent filter cartridges are not changed during operation due to potential for contamination. Large systems designed for continuous use often require two separate vent filtration units. The Sterile Filter Shunt valve is a sterilizable tank vent shunt valve assembly mounted on a single nozzle designed for this purpose.

The steam traced version of this valve when used with a steam jacketed filter housing, will prevent condensation from forming inside the filter housing. The assembly consists of a 2-way divert valve. The upstream side of the valve is connected to the two filter housings. The common port is connected to the tank vent nozzle. A steam condensate discharge port is positioned tangential to the weir of both valves. Two additional valves are used to close the condensate port after sterilization. These valves in turn are connected to a steam trap which then goes to drain.



Flow Path



#### Typical Applications:

- Used to change a vent filter cartridge on a WFI tank while the system is in operation



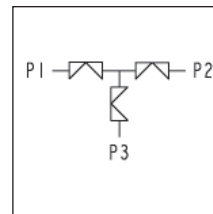
## Vessel Valves

### Block and Bleed (BBD, BBV)

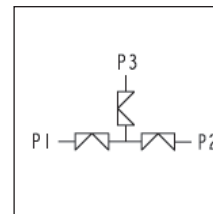
The double block and bleed method of creating an aseptic barrier between two processes is widely utilized in the Bioprocessing industry. Traditionally three standard valves would be fabricated into the double block and bleed configuration. The Block and Bleed Drain (BBD) and Block and Bleed Vent (BBV) valves integrate these three valves into one compact block, minimizing hold up volumes and enhancing cleanability. The compact design allows for greater valve density and flexible system design.

#### Typical Applications:

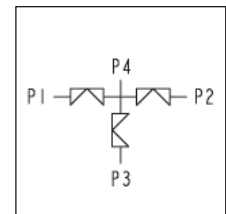
- Create steam block, isolate and clean chamber for aseptic barrier
- Block line flow for the purpose of draining the line or filling from an auxiliary source



Block & Bleed  
Code: BBD



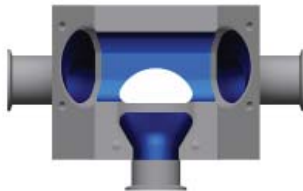
Block & Bleed  
Code: BBV



Block & Bleed with  
Optional Vent Port

### Flow Path

#### BBD



#### BBV



### Bypass (BYP)

Typical Bioprocessing and Pharmaceutical processes utilize large quantities of water. Processes such as WFI storage, Media hold and Buffer preparation utilize large vessels for holding or preparing the process fluids. The Bypass valve is specifically designed to optimize the fill rate of these large vessels. By utilizing two different flow paths the process can be filled quickly with the larger valve and filled at a slower rate by the smaller valve for topping off the process, saving significant time in the process.

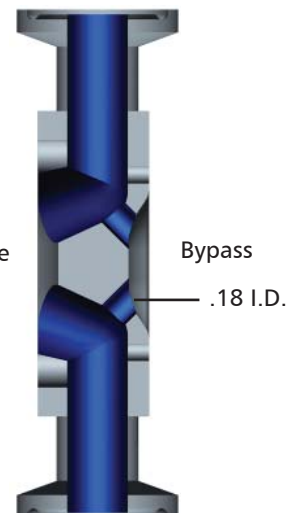
#### Typical Applications:

- Tank filling applications



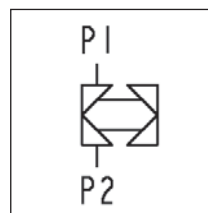
Main Valve

### Flow Path



Bypass

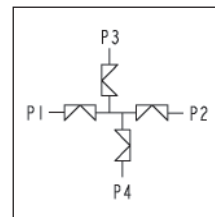
.18 I.D.



## Vessel Valves

### Integral Sterile Barrier (SB1)

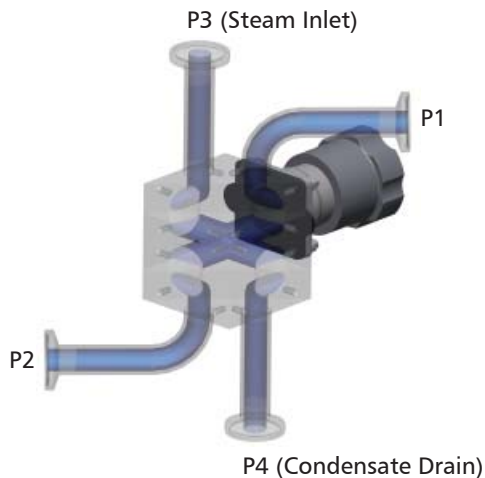
The Sterile Barrier block addresses the issues of achieving sterile barrier technology and utilizing a small dimensional envelope while minimizing contact surfaces and hold up volume. The Integral Sterile Barrier consists of four valves machined from a single block. The common chamber is located in the center of the block and the independent ports are located on the ends. The assemblies consist of two product valves, a steam injection valve and a condensate drain valve. When the two product valves are open and the steam injection and condensate valves are closed, product flows through to the reactor. When the product valves are closed, a chamber is formed between the two valves which, when injected with steam, provides a sterile barrier isolating the reactor.



### Typical Applications:

- Creating an aseptic barrier around bioreactors

### Flow Path



## Diaphragms

ITT has manufactured diaphragm valves for nearly 50 years and takes great pride in its reputation for supplying the highest quality hygienic diaphragm valves to the Biopharm industry.

The diaphragm is the most critical component of a diaphragm valve. Diaphragms are the valve component that provide positive shut-off between process fluids, protects the process from the environment and in some cases protects the environment from the process.

Genuine ITT diaphragms feature:

- Designs specifically matched to Pure-Flo weire geometry
- Engineered safety
- Reliability
- Industry proven performance
- Reduced total cost of ownership
- Complete product range
- Pure-Flo Topworks compatibility
- Material traceability permanently marked on diaphragms
- Original Equipment Manufacturer (OEM) materials and specifications
- Global availability
- Global technical support
- Preventative maintenance program development assistance



Regulatory Compliance to:

- FDA 21CFR Part 177
- Latest edition of the US Pharmacopeia Class VI
- Pressure Equipment Directive 97/23/EC
- EMEA/410/01 - TSE/BSE (Transmitting Animal Spongiform Encephalopathy)

ITT Pure-Flo diaphragms are qualified and approved for use with Pure-Flo diaphragm valves. Other makes of diaphragms are not recommended and/or guaranteed by Pure-Flo for use with Pure-Flo valves.

## Diaphragm Selection

The Pharmaceutical and Biotech industries consider a number of factors to determine the best diaphragm solution for a given process or application.

Key factors include:

- Regulatory Compliance
  - FDA
  - USP 31
- Biocompatibility
- Material extractibles
- Application temperatures
- Cleaning in place (CIP)
- Steaming in place (SIP)
- Passivation
- Failure mode



Applications within the Biotech industry are particularly sensitive to diaphragm materials because of the fact that many of the processes within the industry utilize living organisms. A balance or compromise must be struck between all of the key factors listed. Regulatory compliance in most cases is not sufficient by itself to guarantee a properly functioning system.

The worldwide network of ITT Pure-Flo technical resources are available to assist in determining the proper diaphragm for your application.

| Diaphragm Type |                    | Size    |        | Temperature          |                      |
|----------------|--------------------|---------|--------|----------------------|----------------------|
| Grade          | Material           | Inch    | DN     | °F                   | °C                   |
| B              | Black Butyl Rubber | 0.25-12 | 6-300  | -20-250              | -29-121              |
| E1             | EPDM <sup>1</sup>  | 0.25-4  | 6-100  | -22-302 <sup>2</sup> | -20-150 <sup>2</sup> |
| P              | Buna N             | 0.50-12 | 15-300 | 10-180               | -12-82               |
| TME            | PTFE               | 0.25-6  | 6-150  | -4-329               | -20-165              |
| W1             | White Butyl Rubber | 0.50-8  | 15-200 | 0-225                | -18-107              |

| Diaphragm Type |                    | Compliance |      |     |
|----------------|--------------------|------------|------|-----|
| Grade          | Material           | FDA        | USDA | USP |
| B              | Black Butyl Rubber | ✓          | ✓    |     |
| E1             | EPDM               | ✓          |      | ✓   |
| P              | Buna N             | ✓          | ✓    |     |
| TME            | PTFE               | ✓          |      | ✓   |
| W1             | White Butyl Rubber | ✓          | ✓    |     |

<sup>1</sup> For high temperature and/or high cycle applications, contact ITT.

<sup>2</sup> Temperature range is as follows:

-4-194°F (-20-90°C) for liquid applications  
 -22-285°F (-30-140°C) for continuous steam  
 -22-302°F (-30-150°C) for intermittent steam



## Diaphragm Design

Pure-Flo's two-piece PTFE diaphragms have proven through years of outstanding service to be a robust and forgiving design. The two-piece construction eliminates the delamination problems inherent in competitive "PTFE faced" diaphragms.

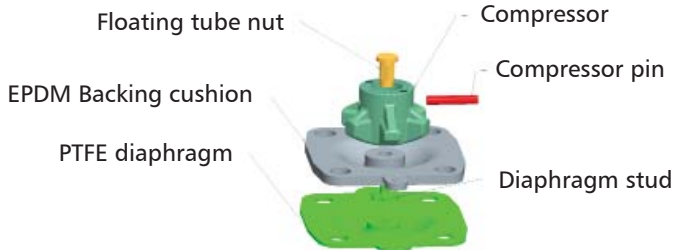
PTFE diaphragms utilize a floating tube nut connection. The floating tube nut design assures that downward closing forces will be

absorbed by the elastomer backing cushion and evenly distributed across the closing surface (weir) in the valve body.

### Design Benefits:

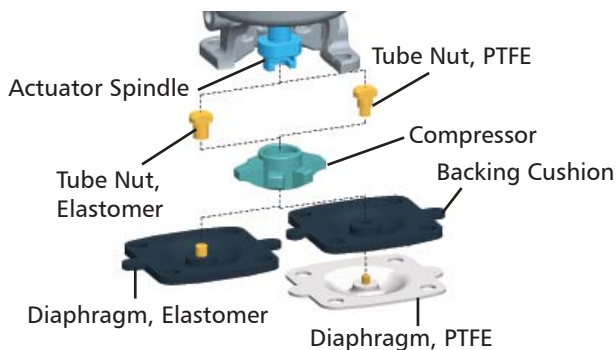
- Reduced cold flow
- Improved sealability
- Longer diaphragm life
- Reduced point loading
- Eliminates stud pullout

PTFE Diaphragm Compressor Assembly Showing Floating Tube Nut Design for Advantage, 903, and 913 (963 prior to 2010)

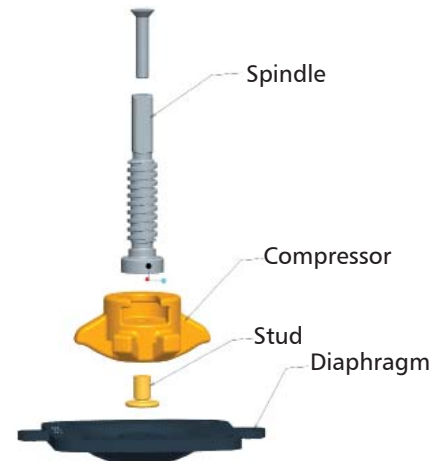


Note: Not available in Bio-Pure or Bio-Tek product line

Diaphragm Compressor Assembly with Modular Compressor Design for AXS and Advantage 2.0

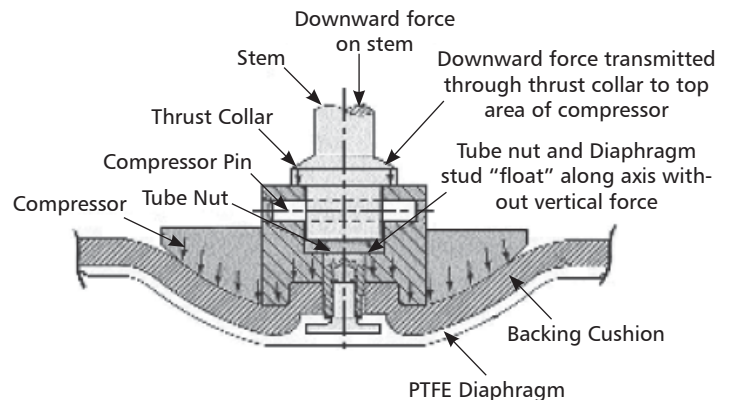


PTFE Diaphragm Compressor Assembly Showing T-slot Design for 970 and 963 with stainless compressor



## Principle of Operation

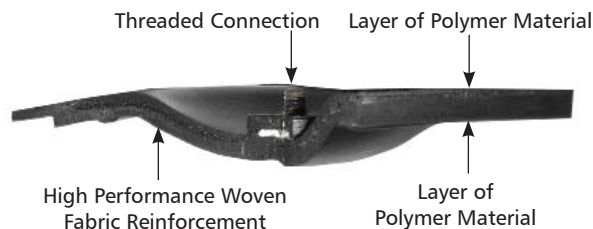
Downward force on top of compressor by-passed by tube nut and transformed to distributed pressure on bottom area of compressor. Compressor presses diaphragm over weir area of valve body.



## Elastomer Diaphragm Construction

Pure-Flo elastomer diaphragms are produced by a compression molding process. The completed elastomer diaphragm is of a one-piece design. The diaphragm is constructed with layers of polymer material and a high performance woven fabric reinforcement for maximum strength and durability.

Elastomer diaphragms utilize a threaded connection to the valve compressor. PTFE and Elastomer diaphragm threads are not interchangeable.



## Qualification Testing

Quality, performance and reliability of all Pure-Flo diaphragms is assured through extensive testing and comprehensive controls on the diaphragm material manufacturing process. Pure-Flo has years of experience in the development of diaphragm materials for use in the challenging applications within the Pharmaceutical and Bioprocessing industries. This knowledge is applied to each new material development. Successful completion of all appropriate regulatory requirements and operational performance benchmarks must be met before any new diaphragm material is released to the industry.

Typical conformance and performance tests:

- FDA extraction per 21CFR177.2600 (Elastomers)
- FDA extraction per 21CFR177.1550 (PTFE)
- USP Class VI <87> and <88> (70°C and 121°C<sup>1</sup>)
- Cycle testing using air, water, and steam
- Cycle testing against vacuum and positive pressure at 100% and 0%  $\Delta P$  conditions
- Cycle testing at ambient, cold, and elevated temperatures

<sup>1</sup> For PTFE Diaphragms

Note: ITT Pure-Flo diaphragms are qualified and approved for use with Pure-Flo diaphragm valves. Other makes of diaphragms are not recommended and/or guaranteed by Pure-Flo for use with Pure-Flo valves.

Diaphragm Development



### USP Class VI

Pure-Flo PTFE diaphragms are tested to USP standards at 70°C and 121°C to provide assurance that diaphragm materials do not affect the process when subjected to typical protocols.

## Grade TME PTFE

Grade TME combines the performance of the Grade TM PTFE diaphragm with a Grade B1 EPDM backing cushion that has been specifically formulated and processed to enhance material properties. Backing cushion compression and extrusion has been minimized with these changes. As a result diaphragm performance is improved in thermal cycling applications that are common place in the BioPharm industry.

The new backing cushion material is designated Grade B1 EPDM. This new backing cushion material remains EPDM and is compliant with all applicable FDA and USP requirements.

**Type:** TME

**Size Range:** BT-6" (DN6 - DN150)

**Temperature Rating:**  
-4°F to 329°F (-20°C to 165°C)

**Pressure Rating:**  
See Pressure & Temperature chart on page D-10

**Material (2 Piece Construction):**  
Product Contact Surface: Modified PTFE with PPVE\*  
Backing Cushion: Grade B1 EPDM

**Regulatory Compliance:**  
21CFR 177.1550 (a)  
USP Class VI, Chapter <87>, <88>  
(70°C and 121°C)  
21CFR177.2600 (Backing cushion)

\*TME Material is considered a homopolymer according to ISO 12086, ASTM D-4894 due to < 1% perfluoropropyl vinyl ether (PPVE) modification



## Pure-Life NGE Diaphragms - Grade E1

Created with the latest advanced technology polymer science. The NGE (E1) diaphragm was developed specifically for the intense applications of the Biopharmaceutical industry, the Pure-Life NGE diaphragm outperform all previous classes of EPDM and EPM diaphragms in these applications. Testing in extreme conditions both at ITT's state of the art diaphragm development laboratory and prominent Biopharm end users has shown order of magnitude performance gains over current generation of EPDM diaphragms.

**Type:** E1

**Size Range:** BT-6" (DN6 - DN150)

**Temperature Rating:**

- -4-194°F (-20-90°C) for liquid applications<sup>1</sup>
- -22-285°F (-30-140°C) for continuous steam<sup>1</sup>
- -22-302°F (-30-150°C) for intermittent steam<sup>1</sup>

**Pressure Rating:**

See Pressure & Temperature chart on page D-10  
Consult factory for steam rating

**Material:**

Ethylene Propylene Diene Monomer Peroxide Cured (EPDM)

**Regulatory Compliance:**

21CFR 177.2600  
USP Class VI, Chapter <87>, <88>

<sup>1</sup> For high temperature and/or high cycle applications, contact ITT.

**Benefits:**

- Reduced total cost of ownership
- Extended service life
- Improved uptime
- Ease of validation
- Improved resistance to steam, WFI and commonly used CIP chemicals
- Maintains ITT valve warranty



**Certifications:**

USP Class VI standard, Chapters <87> , <88> compliant  
FDA 21CFR177.2600 compliant  
Animal Derived Ingredient Free  
EMA /410/01 TSE/BSE (Transmitting Animal Spongiform Encephalopathy) compliant



## European Pressure Equipment Directive 97/23/EC

Diaphragm valves must comply with European Union Pressure Equipment Directive 97/23/EC. Valves must meet certain Essential Safety Requirements and design criteria. This includes diaphragms as they are an integral component of the valve pressure boundary.

The PED requires the manufacturer to maintain a technical file primarily consisting of:

- Design calculations or proof test
- Material testing
- Performance testing
- Declaration of Compliance to the PED 97/23/EC (available on request)

An excerpt from a guideline for the Pressure Equipment Directive 97/23/EC states:

“Pressure equipment which has been subject to important modifications that change its original characteristics, purpose and/or type after it has been put into service has to be considered as a new product covered by the directive.”<sup>1</sup>

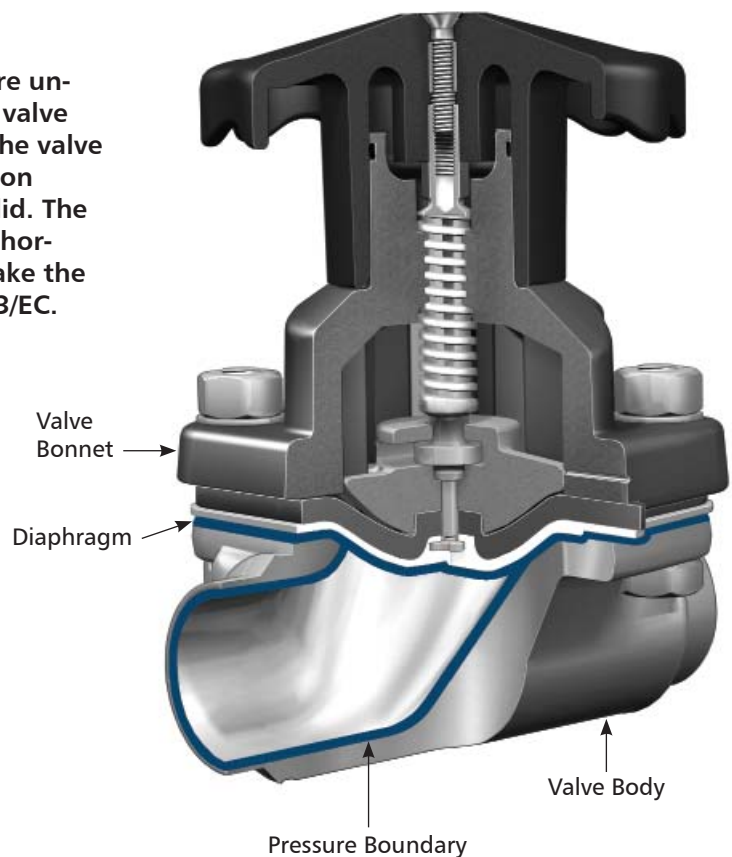
**Note:**

The use of unauthorized and therefore undocumented components within the valve constitutes a major modification to the valve and renders the original ITT Declaration and compliance to the Directive invalid. The end user or the supplier of the unauthorized replacement component must take the responsibility for compliance to 93/23/EC.

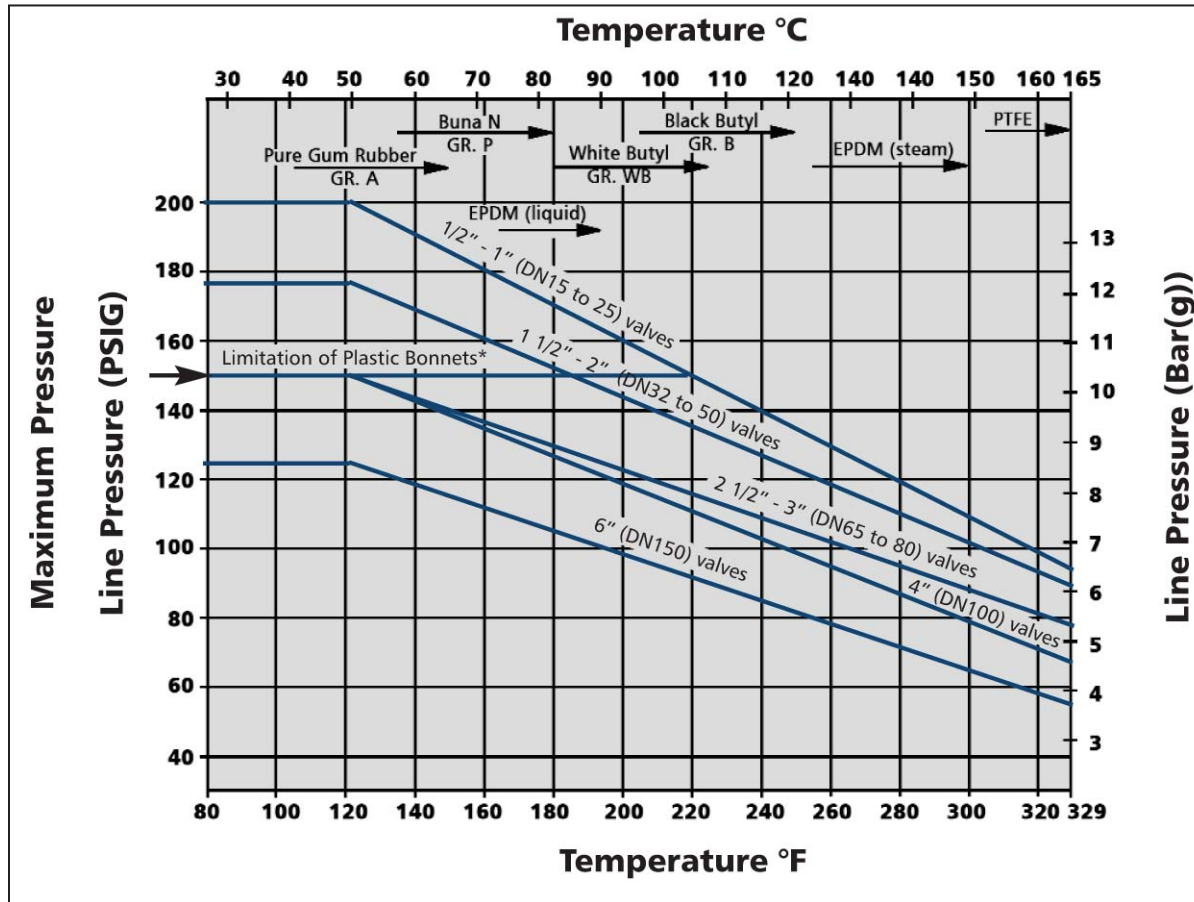
<sup>1</sup> [http://europa.eu.int/comm/enterprise/pressure\\_equipment/ped](http://europa.eu.int/comm/enterprise/pressure_equipment/ped)

### Pressure Boundary

The diaphragm is a critical pressure boundary component of a typical diaphragm valve in conjunction with the valve body, fasteners and manual or actuated bonnet. These components are designed, manufactured and tested to achieve specific pressure ratings and performance criteria. Changes in materials, dimensions or even tolerances of any of these components can have an adverse affect on the overall performance and safety of the valve. ITT Pure Flo conducts extensive testing to support the performance of the valve and pressure boundary.

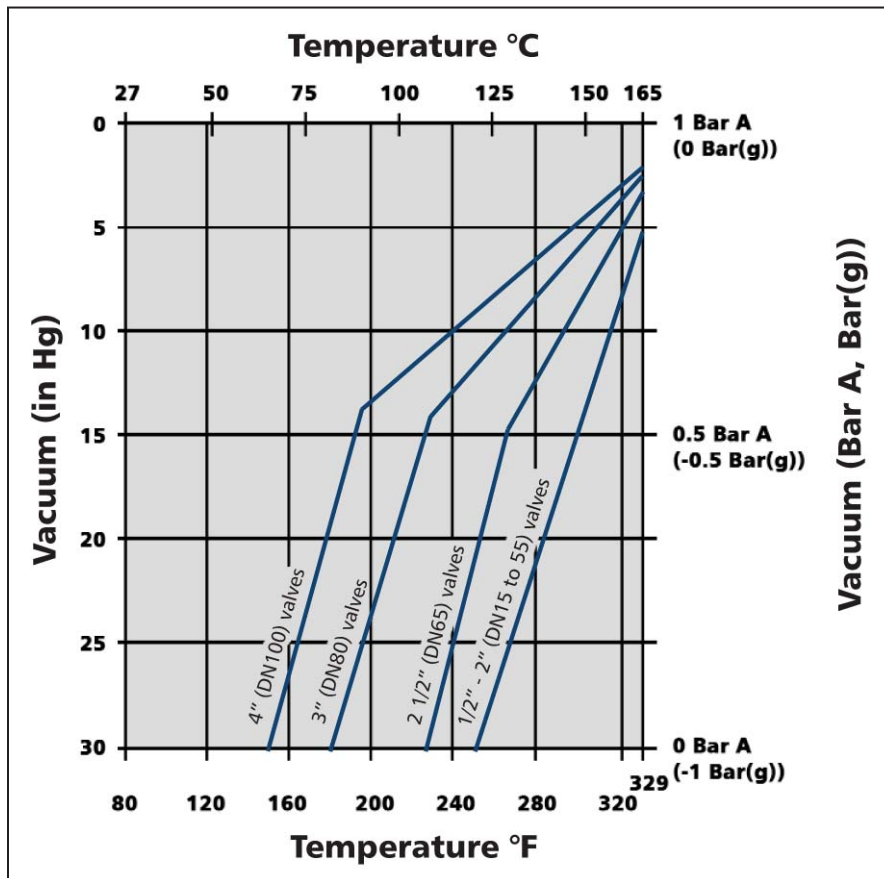


## Pressure/Temperature Recommendations



\* This line shows the limitation of plastic bonnets including the 963 and Advantage Actuators.  
 Note: Elastomer diaphragms may be used in vacuum service within above temperature recommendations. For services exceeding charted pressure/temperature recommendations, consult factory. The chart does not pertain to steam or corrosive services. Consult ITT DV-06 Technical Manual and Service Guide for specific recommendations.

## PTFE Diaphragms for Vacuum Service



**Notes:**

1. Service conditions falling to the right of these lines will require bonnet evacuation.
2. PTFE-Diaphragms, 6" (DN 150) size and larger, will not withstand full vacuum at any temperature unless bonnets are evacuated.
3. With evacuated bonnets any size PTFE-Diaphragms can be used up to 329°F (165°C).
4. See below for elastomer diaphragms for vacuum service

## Elastomer Diaphragms for Vacuum Service

The standard Pure-Flo diaphragm valve is ideally suited for vacuum service, providing dependable performance and good service life from atmospheric pressure down to nearly full vacuum (-30 in Hg, 0 Bar A) The diaphragm is bi-directional and presents a smooth face with no hidden voids on either side of the valve, whether open, closed or throttling.

## Validation and Compliance

ITT Pure-Flo recognizes the importance of product and process validation to the Pharmaceutical and Bioprocessing industries. A complete selection of documentation is available to facilitate the validation process.

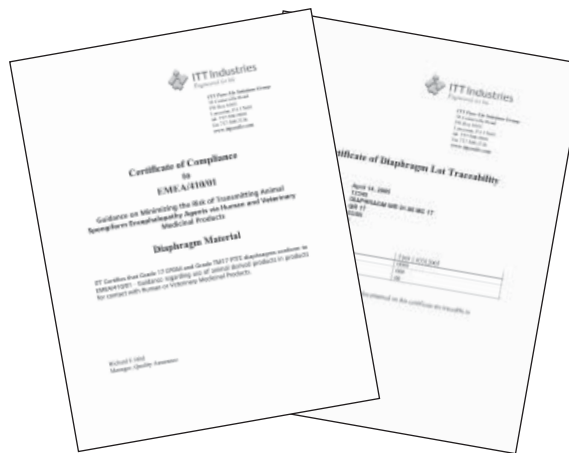
- Diaphragm ingredients and processing aids are FDA compliant
- Physical properties, raw materials, compounding and molding process are documented
- All diaphragms are available with FDA Certificate of Conformance
- 21CFR177.2600 - Elastomers
- 21CFR177.1550 - Perfluorocarbon
- All diaphragms are available with USP Class VI Certificate of Conformance
- Chapter 87 In-Vitro
- Chapter 88 In-Vivo
- Certificate of Compliance to EMEA/410/01 “Guidance on Minimising the Risk of Transmitting Animal Spongiform Encephalopathy Agents via Human and Veterinary Medicinal Products” available upon request
- Certificate of Traceability to EN 10204 3.1 B available upon request
- Third party testing and in-house performance data available upon request

Note: ITT Pure-Flo diaphragms are qualified and approved for use with Pure-Flo diaphragm valves. Other makes of diaphragms are not recommended and/or guaranteed by Pure-Flo for use with Pure-Flo valves.

## Genuine Replacement Parts

Replace the diaphragm in your ITT hygienic diaphragm valve with imitation diaphragms and you might risk more than you thought. Only one diaphragm is specifically designed and manufactured to deliver the performance you demand from your ITT valve. With an ITT diaphragm valve you get compliance with FDA, USP, and ASME BPE requirements, a design that creates a tight repeatable seal, and materials that protect your process and are completely traceable. And just as importantly, you have a valve that provides essential pressure containment protecting your plant and your people.

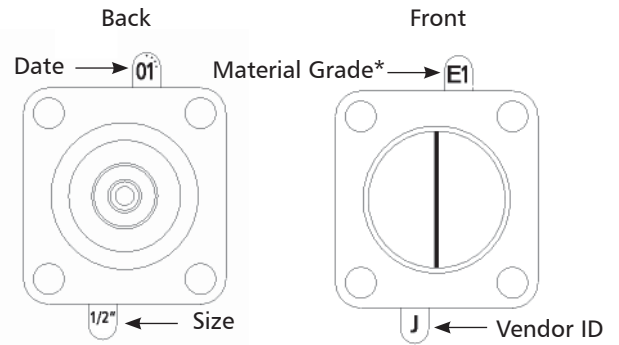
## Certificates of Compliance





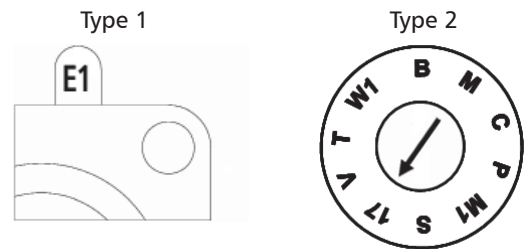
## Diaphragm Traceability

All diaphragm materials and physical properties are batch traceable via permanent codes molded into the diaphragm tabs. The molding date, material grade, and diaphragm size provide traceability to original batch records.



## Elastomer Material Grade Codes

Elastomer material grades are listed on page D-2 (Type 1). For diaphragms with a clock (Type 2) the arrow points to the material grade.



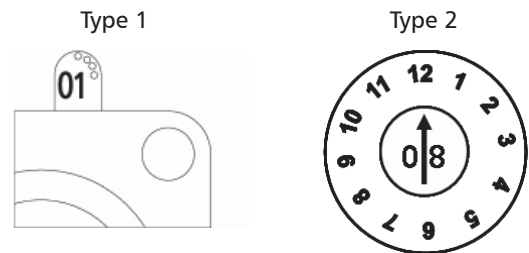
## Elastomer Date Codes

The date is a two digit year code and dots corresponding to months

Type 1: April 2001

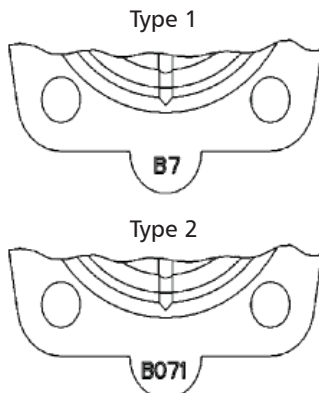
For diaphragms with a clock, the two digits in the middle are the year and the arrow points to the month.

Type 2: December 2008



## PTFE Date Codes

The first letter identifies the month the lot was manufactured. For a two digit code, the second digit is the year (Type 1: B7 = February 2007). For a four digit code, the next two digits indicate the year, and the last number indicates the batch number (Type 2: B071 = February 2007, batch 1).



| PTFE Code - Months |           |
|--------------------|-----------|
| A                  | January   |
| B                  | February  |
| C                  | March     |
| D                  | April     |
| E                  | May       |
| F                  | June      |
| G                  | July      |
| H                  | August    |
| I                  | September |
| J                  | October   |
| K                  | November  |
| L                  | December  |

| PTFE Code - Year |              |              |
|------------------|--------------|--------------|
| Year             | 4 Digit Code | 2 Digit Code |
| 2005             | 05           | 5            |
| 2006             | 06           | 6            |
| 2007             | 07           | 7            |
| 2008             | 08           | 8            |
| 2009             | 09           | 9            |
| 2010             | 10           | 0            |
| 2011             | 11           | 1            |
| etc.             | etc.         | etc.         |

## Packaging

All Pure-Flo diaphragms are sealed in individual tamper evident packages to prevent damage and contamination during transportation, handling and storage. Tamper evident packaging provides an extra level of assurance that the diaphragm has not been exposed to potential contamination during storage or maintenance activities prior to installation.



All Pure-Flo Diaphragm packages contain important information necessary for validation and maintenance.

- Diaphragm part number
- Description
- Material
- Pack date
- Cure date
- Installation graphic

## Storage Recommendations

- Storage temperature should be between 40-75°F (5-25°C). Higher temperatures may affect overall service.
- Diaphragms should be stored in a cool dry environment so that condensation does not occur.
- Diaphragms should be protected from direct sunlight and Ultra Violet light sources.
- Where possible diaphragms should be protected from circulating air. Storage in bags or other air tight containers is recommended for longest service life.
- Physical properties and performance of rubber diaphragms can deteriorate when stored for long periods. The diaphragm may become unsuitable for service due to environmental, physical, and chemical factors.

## Shelf Life

| Material          | Grade | Shelf Life |
|-------------------|-------|------------|
| Butyl             | B, W1 | 10         |
| EPDM              | E1    | 6          |
| Buna N            | P     | 6          |
| PTFE <sup>1</sup> | TME   | 10         |

<sup>1</sup> PTFE diaphragm face only.

## Application

Pure-Flo diaphragms are suitable for a wide range of utility and process applications utilized in the Pharmaceutical and Biotech industries. However, not all diaphragm materials are suitable for all processes and conditions. The accompanying tables should be used as a reference.

The worldwide network of ITT Pure-Flo technical resources are available to assist in determining the proper diaphragm for your application.

### Typical Process Applications:

- WFI
- Purified water
- Product solutions
- Buffer solutions
- Cell culture solutions
- Media
- Solvents
- Protein solutions
- Ultra filtration

### Typical Utility Applications:

- Passivation protocols
- Cleaning protocols
- Sterilization protocols

### Passivation

|          | Nitric Acid 15% <sup>1</sup> | Phosphoric 10% <sup>1</sup> | Citric Acid 15% <sup>1</sup> | Mixed Chelants <sup>2</sup> |
|----------|------------------------------|-----------------------------|------------------------------|-----------------------------|
| PTFE     | R                            | R                           | R                            | R                           |
| EPDM     | U                            | R                           | R                            | R                           |
| Butyl    | R                            | R                           | R                            | R                           |
| Silicone | U                            | U                           | R                            | R                           |

<sup>1</sup> At 60°C/140°F

<sup>2</sup> Amonium citrate Base at 80°C/176°F

R = Resistant

U = Unsatisfactory

### Cleaning

|          | Sodium Hydroxide NaOH | Sodium ypochlorite NaOCl | Potassium Hydroxide KOH | Phosphoric Acid H3PO4 | Hydrogen Peroxide H2O2 |
|----------|-----------------------|--------------------------|-------------------------|-----------------------|------------------------|
| PTFE     | R                     | R                        | R                       | R                     | R                      |
| EPDM     | R                     | R                        | R                       | R                     | R                      |
| Butyl    | R                     | R                        | R                       | R                     | U                      |
| Silicone | R                     | R                        | U                       | U                     | R                      |

Consult factory for specific temperature and concentration limitations.

### Sterilization

|          | Saturated Steam <sup>1</sup> |                   |                   | Dry Heat <sup>2</sup> | Ozone <sup>3</sup> |
|----------|------------------------------|-------------------|-------------------|-----------------------|--------------------|
|          | 20 psi 1.4 Bar(g)            | 30 psi 2.1 Bar(g) | 40 psi 2.8 Bar(g) |                       |                    |
| PTFE     | R                            | R                 | R                 | R                     | R                  |
| EPDM     | R*                           | R*                | R*                | U                     | R                  |
| Butyl    | R*                           | R*                | R*                | U                     | R                  |
| Silicone | U                            | U                 | U                 | U                     | R                  |

1 20psi/1.4 Bar(g) = 259°F/126°C

30psi/2.1 Bar(g) = 274°F/135°C

40psi/2.8 Bar(g) = 286°F/142°C

2 338°F/170°C

3 3% at 80°F/27°C

\* Limited life and undesirable failure mode

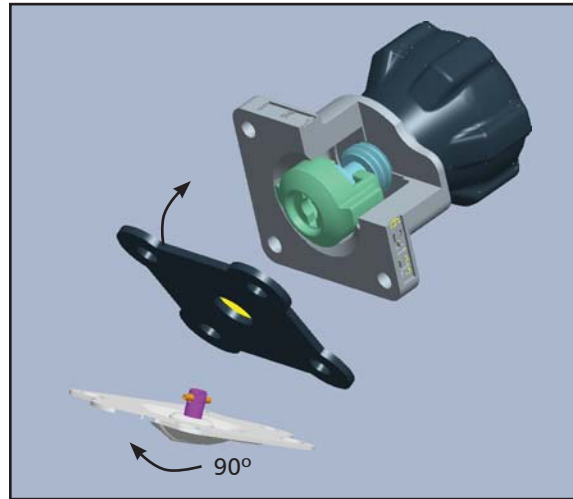
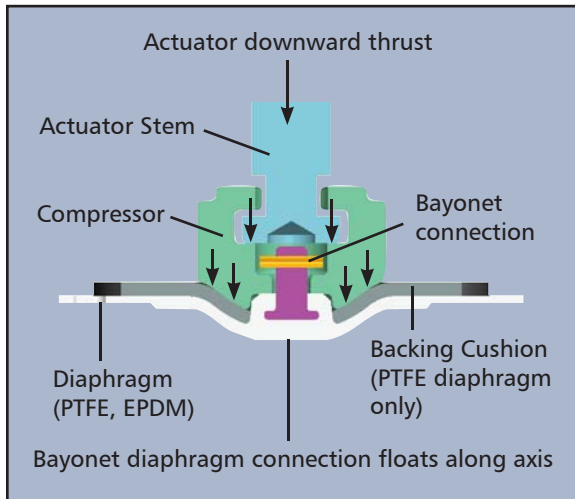
## Bio-Pure Diaphragm

### Interchangeability

All Bio-Pure valves feature a common diaphragm connection. Elastomer and PTFE diaphragms can be interchanged as required on both the manual and actuated bonnets.

### Installation

Bio-Pure diaphragm installation is simplified by utilizing a bayonet diaphragm connection. The diaphragm is inserted into the compressor and turned 90°. The bayonet design provides float to eliminate point loading on PTFE diaphragms.



The Pure-Flo product offering continues to evolve to meet the needs of the Bioprocessing industry. A complete line of manual and pneumatically actuated options are available to suit most any requirement. All Pure-Flo top works are robustly designed and constructed of durable FDA compliant materials. With decades of proven reliability and long cycle life, Pure-Flo actuators are the route to trouble free operation and reduced total cost of ownership.

## Table of Contents

### Manual

|                   |      |
|-------------------|------|
| Bio-Pure. . . . . | E5-6 |
| Bio-Tek. . . . .  | E7   |
| 963 . . . . .     | E3-4 |
| 970 . . . . .     | E2   |
| 903 . . . . .     | E8   |
| 913 . . . . .     | E9   |

### Actuated

|  |        |
|--|--------|
| Advantage 2.0 and Advantage . . . . .      | E10-11 |
| Advantage Series 33 . . . . .              | E12    |
| Advantage Series 47 . . . . .              | E13    |
| Advantage Piston Actuator (APA) . . . . .  | A14-15 |
| Advantage Excel - Series S (AXS) . . . . . | E16-17 |
| Dia-Flo. . . . .                           | E18    |

## 970 Stainless Steel Manual Bonnet

Resistant to standard washdown protocols, the 970 stainless steel bonnet is the compact, autoclavable solution for Pharmaceutical/ Bioprocessing applications.

Type: 970

Size Range: 0.5–2" (DN15-DN50)

Max Service Pressure:  
 0.5–1": 200 psig (13.8 bar)  
 1.5–2": 175 psig (12.1 bar)

Max Service Temperature:  
 See page D-10

Bonnet Material:  
 316 Stainless Steel

Handwheel Material:  
 Glass reinforced polyarylsulfane (PAS)  
 FDA compliant to 21CFR 177.1660

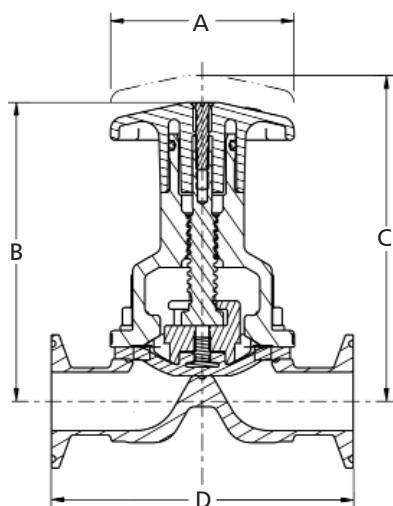
Corrosion Resistance:  
 Resists alcohol, chloride and most caustic washdowns. For specific chemical resistance, consult factory.



Standard Features:

- Easy assembly and disassembly
- Rising handwheel
- Adjustable travel stop\*
- Visual position indicator
- O-ring splash seal
- Stainless steel stem
- Bronze compressor

\* Patent # 6,241,213



| Valve Size |    | Bonnet Weight |      |
|------------|----|---------------|------|
| Inch       | DN | lb.           | kg.  |
| 0.50       | 15 | 0.97          | 0,44 |
| 0.75       | 20 | 1.23          | 0,56 |
| 1.00       | 25 | 1.67          | 0,76 |
| 1.50       | 40 | 5.00          | 2,27 |
| 2.00       | 50 | 6.50          | 2,95 |

| Valve Size |    | A    |       | B    |       | C    |       | D <sup>1</sup> |     | D <sup>2</sup> |     | D <sup>3</sup> |
|------------|----|------|-------|------|-------|------|-------|----------------|-----|----------------|-----|----------------|
| Inch       | DN | Inch | mm    | Inch | mm    | Inch | mm    | Inch           | mm  | Inch           | mm  | mm             |
| 0.50       | 15 | 2.75 | 69,9  | 3.65 | 92,7  | 3.93 | 99,7  | 3.50           | 89  | 5.12           | 130 | 106            |
| 0.75       | 20 | 2.75 | 69,9  | 3.89 | 98,8  | 4.26 | 108,3 | 4.00           | 102 | 5.50           | 140 | 118            |
| 1.00       | 25 | 2.75 | 69,9  | 4.54 | 115,3 | 4.99 | 126,7 | 4.50           | 114 | 5.88           | 149 | 127            |
| 1.50       | 40 | 5.25 | 133,3 | 5.86 | 148,8 | 6.67 | 169,4 | 5.50           | 140 | 7.00           | 178 | 174            |
| 2.00       | 50 | 5.25 | 133,3 | 6.49 | 164,8 | 7.61 | 193,3 | 6.25           | 159 | 7.62           | 194 | 191            |

Note: Handwheel diameter and assembly heights are from body centerline to top of bonnet assembly.

<sup>1</sup> Tri Clamp, TC x BW, Short Tangent BW

<sup>2</sup> Extended BW Forging

<sup>3</sup> ISO/DIN

## 963 PAS Manual Bonnet

Capable of withstanding typical washdown media, the 963 bonnet is a fully featured, compact, lightweight, yet rugged design. The 963 is packed with features that fulfill the most demanding requirements of today's critical bioprocessing systems.

Type: 963 & 963S

Size Range: 0.5–4" (DN15-DN100)

Service Pressure/Temperature:

Max Service Pressure:

150 psig (10.34 bar)

Max Service Temperature:

300°F (149°C)

External Temperature Limitations:

300°F (149°C)

Bonnet & Handwheel Material:

Glass reinforced polyarylsulfane (PAS)

FDA compliant to 21CFR 177.1660

Corrosion Resistance:

Resists alcohol, chloride and most caustic washdowns.

For specific chemical resistance, consult factory.

Standard Features:

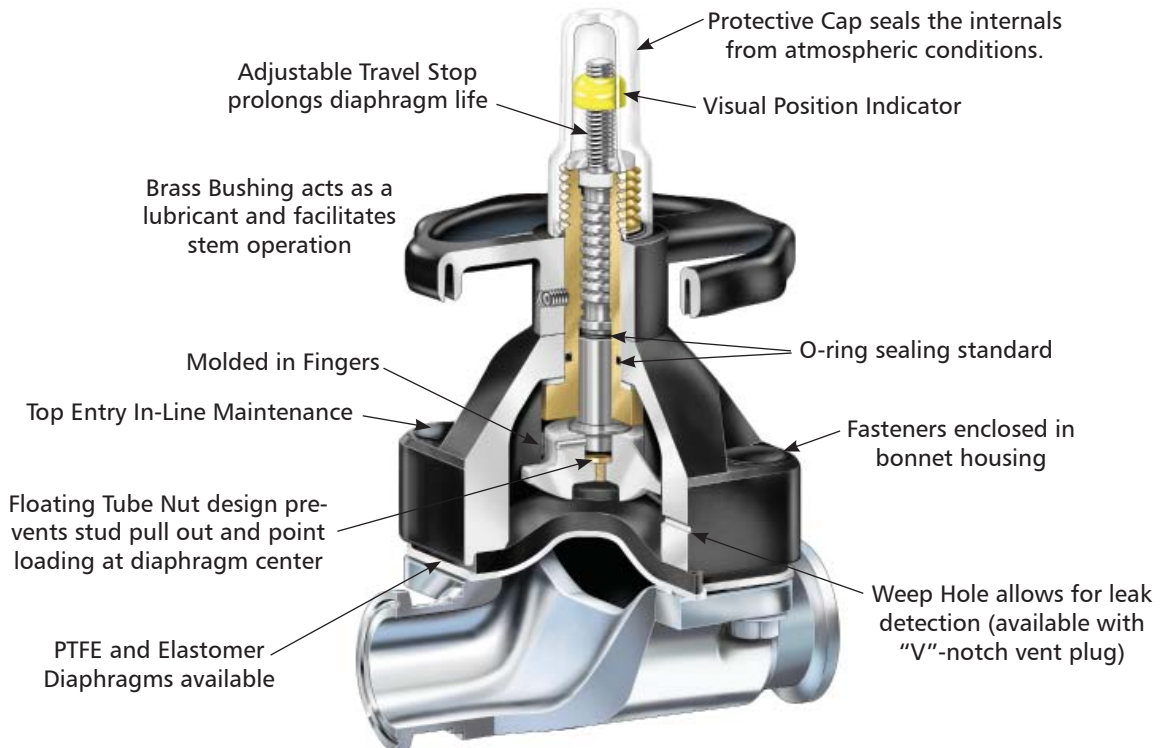
- Autoclavable
- Rising stem
- Adjustable travel stop
- Protective PPS cap
- Brass stem bushing
- Visual position indicator
- Permanent lubrication
- O-ring seals
- Stainless steel compressor
- Enclosed fasteners 0.5–3" (DN15–DN80)
- Hygienic internals: 0.5–2"



Optional Features:

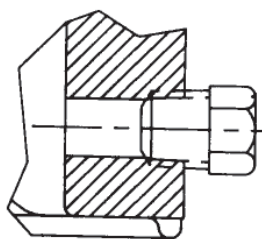
- Sealed bonnets: 963S
- Hygienic internals (M2): 3–4"
- Lockable: 0.5, 0.75, 1, 1.5, 2, 3, 4 in. sizes

Note: Bonnets manufactured 2010 and beyond with model number 963 and 963S and stainless compressor are autoclavable as standard. Bronze compressor versions are autoclavable only with S2-M2-M17 options.

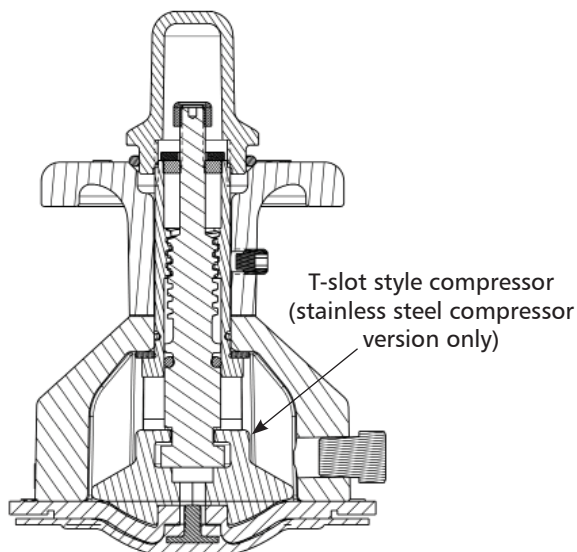


## Sealed Bonnet Option:

A sealed bonnet provides a secondary containment area for process fluids if the diaphragm should ever fail. A v-notch vent plug is provided to serve as a leak detector and prevents the release of process fluids into the atmosphere. Sealed bonnets are an available option on 963 manual bonnets.

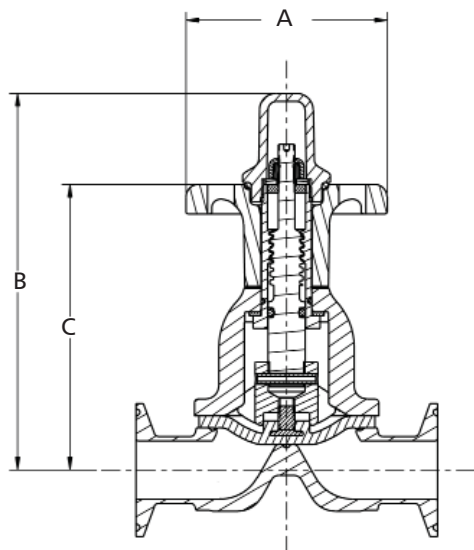


V-Notch Vent Plug Detail



Sealed Bonnet - V-Notch Vent Plug

## Weights and Dimensions for 963 Manual Bonnets



| Valve Size        |     | A     |       | B     |       | C     |       | Bonnet Weight |      |
|-------------------|-----|-------|-------|-------|-------|-------|-------|---------------|------|
| Inch              | DN  | Inch  | mm    | Inch  | mm    | Inch  | mm    | lb            | kg   |
| 0.50              | 15  | 3.00  | 76,2  | 3.65  | 92,7  | 2.78  | 70,6  | 0.6           | 0,27 |
| 0.75              | 20  | 3.00  | 76,2  | 4.57  | 116,0 | 3.44  | 87,2  | 0.9           | 0,41 |
| 1.00              | 25  | 3.00  | 76,2  | 5.54  | 140,8 | 4.21  | 107,0 | 1.3           | 0,59 |
| 1.50              | 40  | 5.50  | 139,7 | 8.44  | 214,2 | 5.34  | 135,5 | 3.9           | 1,77 |
| 2.00              | 50  | 5.50  | 139,7 | 9.06  | 230,0 | 5.96  | 151,3 | 5.3           | 2,41 |
| 2.50 <sup>1</sup> | 65  | 7.75  | 196,8 | 11.85 | 300,9 | 7.77  | 197,4 | NA            | NA   |
| 3.00 <sup>1</sup> | 80  | 7.75  | 196,8 | 11.85 | 300,9 | 7.77  | 197,4 | 11.7          | 5,32 |
| 4.00              | 100 | 10.00 | 254,0 | 14.90 | 378,6 | 10.24 | 260,2 | 16.2          | 7,36 |

<sup>1</sup> The 2.5 in. (DN65) valve is a 3 in. (DN80) body and topworks with 2.5 in. (DN65) end connections.



## Bio-Pure® Manual Bonnet

The Bio-Pure is the compact solution for the most demanding Biopharm applications. Available in fractional sizes and a wide selection of body materials and end connections the Bio-Pure is the ideal choice for sampling and other low flow, high value processes. Bioreactors, chromatography systems, filtration skids are just a small number of applications that will benefit from the compact, reliable performance. Bio-Pure is capable of withstanding typical Steam in Place (SIP) and Clean in Place (CIP) protocols. For demanding Clean out of Place (COP) requirements the manual BPMC option is the solution for reliable trouble free operation. A standard 2 piece PTFE diaphragm prevents separation of the diaphragm, which is common in laminated diaphragm designs.

### Typical Applications

- Sampling
- Bioreactors
- Chromatography systems
- Filtration skids
- Portable vessels

### Size Range

0.25", 0.31" 0.375", 0.5" (DN 6, 8, 10, 15)

### Service Pressure/Temperature

150 psi at 220°F (10.34 bar at 104°C)



### Standard Body Materials:

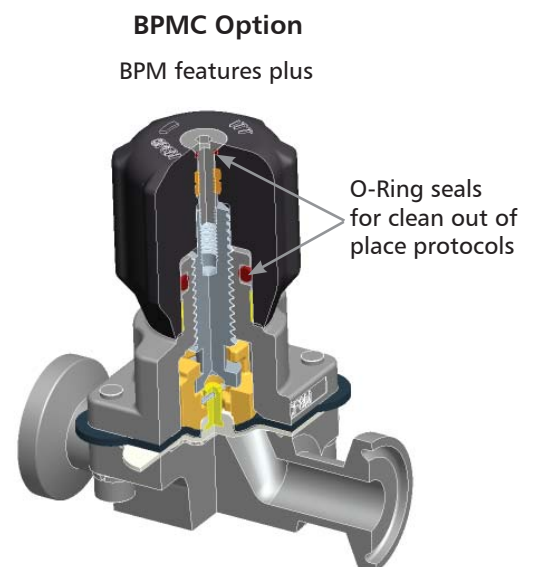
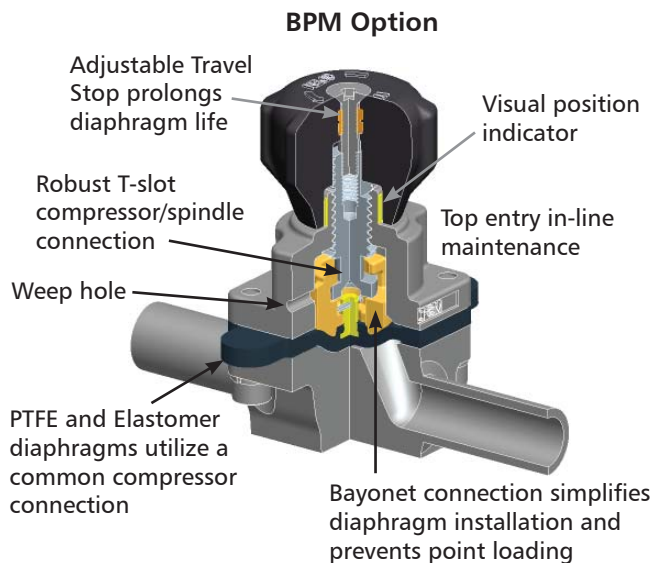
- ASTM A182 Grade 316, DIN 17440. 1.4435
- ASTM A479
- Other materials available upon request

### Available End Connections:

- 0.5" (DN 15) 16 Gauge
- 0.25", 0.375" (DN 8, 10) 20 Gauge
- DIN/ISO
- Tri-Clover Tri-Clamp®

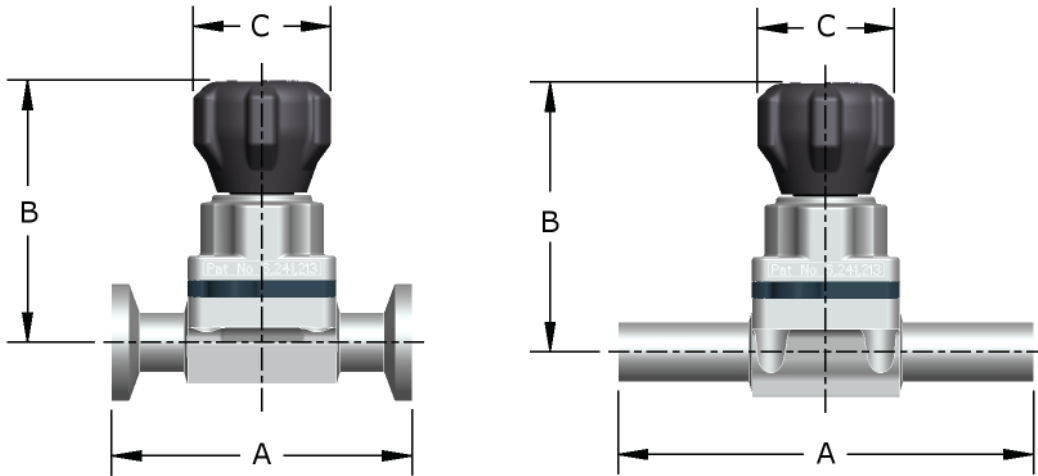
### Corrosion Resistance:

Resists alcohol, chloride and most caustic wash-downs.



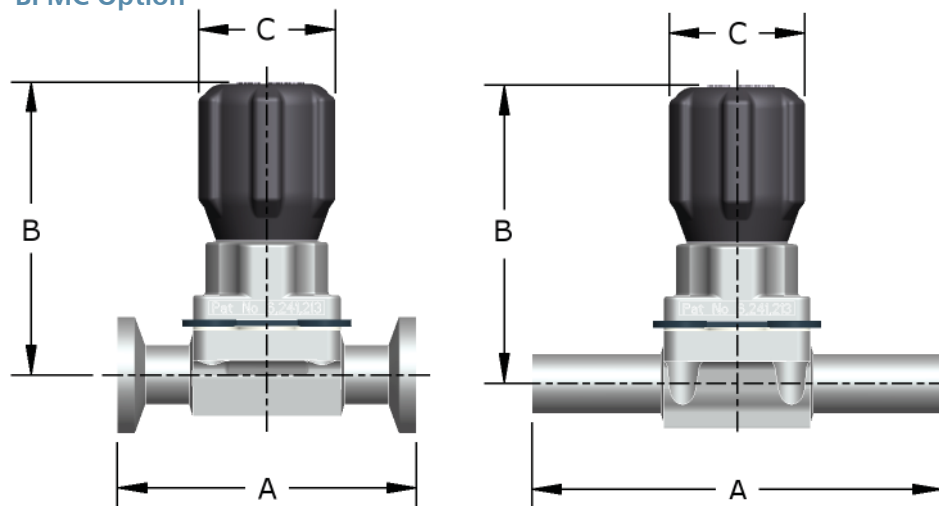
## Dimensions

### BPM Option



|     | ANSI (USOD)    |               | DIN/ISO   | B<br>Closed | B Open | C    |
|-----|----------------|---------------|-----------|-------------|--------|------|
|     | A<br>Tri-Clamp | A<br>Buttweld | A         |             |        |      |
| In. | 2.53           | 3.50          | 3.50      | 2.23        | 2.39   | 1.25 |
| mm  | 64,3           | 89,0          | 64,3/89,0 | 56,6        | 60,7   | 31,8 |

### BPMC Option



|     | ANSI (USOD)    |               | DIN/ISO   | B<br>Closed | B Open | C    |
|-----|----------------|---------------|-----------|-------------|--------|------|
|     | A<br>Tri-Clamp | A<br>Buttweld | A         |             |        |      |
| In. | 2.53           | 3.50          | 3.50      | 2.61        | 2.77   | 1.25 |
| mm  | 64,3           | 89,0          | 64,3/89,0 | 66,4        | 70,4   | 31,8 |

Topworks



## Bio-Tek® Manual Bonnet

The Bio-Tek is a compact, lightweight solution ideal for Bioprocessing applications and utilized frequently as a sample or drain port in Pharmaceutical process systems and Pure-Flo fabrications.

Type: 18 & 18S

Size Range: 0.25", 0.375", 0.5"  
(DN6-DN15)

Service Pressure/Temperature:  
150 psi at 220°F (10.34 bar, 104°C)  
Maximum external temperature: 300°F (149°C)

Bonnet Materials:

Model 18

- Bonnet: 316 Stainless Steel
- Spindle: Stainless Steel
- Compressor: Stainless Steel

Model 18S

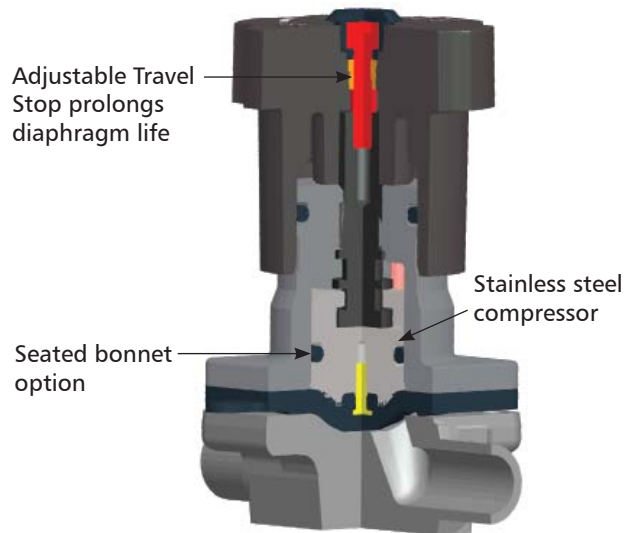
- Bonnet: 316 Stainless Steel
- Spindle: Stainless Steel
- Compressor: Stainless Steel
- O-rings: Fluoropolymer, FDA compliant

Handwheel Material:  
PAS (Polyarylsulphone)

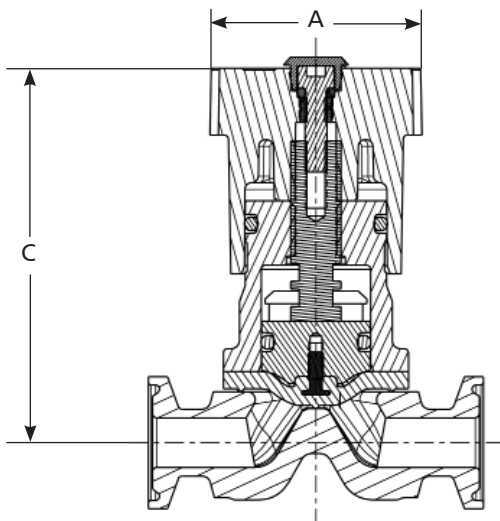
Standard Features:

- Adjustable travel stop
- Autoclavable

Note: This bonnet is available for Bio-Tek type bodies only.



## Dimensions for Bio-Tek Bonnet



| Valve Size             |              | A    |      | C    |      |
|------------------------|--------------|------|------|------|------|
| Inch                   | DN           | Inch | mm   | Inch | mm   |
| 0.25,<br>0.375,<br>0.5 | 8, 10,<br>15 | 1.61 | 41,1 | 2.62 | 66,5 |

## 913 Stainless Steel Manual Bonnet

Satisfying the most stringent biopharm processing requirements, the 913 is available with many standard and optional features. Stainless steel construction and the availability of a sealed option make the 913 bonnet an excellent choice for critical applications requiring reliability, corrosion resistance and secondary product containment.

Type: 913 & 913S

Size Range: 0.5"–4" (DN15-DN100)

Max Service Pressure:  
 0.5–1": 200 psig (13.8 bar)  
 1.5–2": 175 psig (12.1 bar)  
 3–4": 150 psig (10.3 bar)

Max Service Temperature:  
 See Page D-10

Bonnet and Handwheel Material:  
 316 Stainless Steel

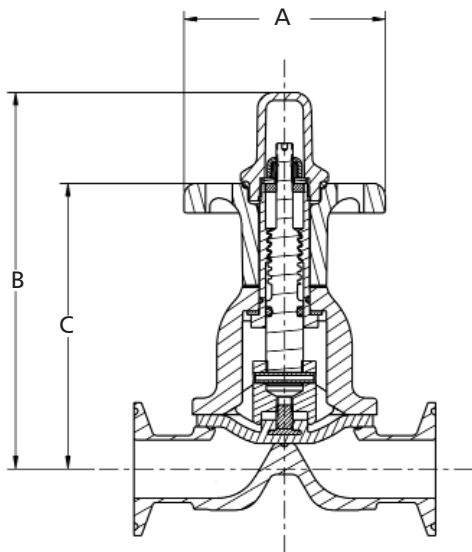
Corrosion Resistance:  
 Resists alcohol and most caustic washdowns.  
 For specific chemical resistance, consult factory.



- Standard Features:
- Adjustable travel stop
  - Protective cap
  - Brass stem bushing
  - Visual position indicator
  - Permanent lubrication
  - O-ring seals
  - Bronze compressor
  - Hygienic internals

- Optional Features:
- Sealed bonnets: 913S
  - Adjustable opening stop
  - Lockable
  - Extended handwheel

- Autoclavable Options:
- 913 (Unsealed)
  - 913S (Sealed)



| Valve Size        |     | A     |       | B     |       | C     |       | Weight |       |
|-------------------|-----|-------|-------|-------|-------|-------|-------|--------|-------|
| Inch              | DN  | Inch  | mm    | Inch  | mm    | Inch  | mm    | lb     | kg    |
| 0.50              | 15  | 3.00  | 76,2  | 3.65  | 92,7  | 2.78  | 70,6  | 0.72   | 0,33  |
| 0.75              | 20  | 3.00  | 76,2  | 4.57  | 116,0 | 3.44  | 87,2  | 1.8    | 0,82  |
| 1.00              | 25  | 3.00  | 76,2  | 5.54  | 140,8 | 4.21  | 107,0 | 2.3    | 1,05  |
| 1.50              | 40  | 5.50  | 139,7 | 8.44  | 214,2 | 5.34  | 135,5 | 7.8    | 3,55  |
| 2.00              | 50  | 5.50  | 139,7 | 9.06  | 230,0 | 5.96  | 151,3 | 8.4    | 3,82  |
| 2.50 <sup>1</sup> | 65  | 7.75  | 196,8 | 11.85 | 300,9 | 7.77  | 197,4 | 13.0   | 5,90  |
| 3.00 <sup>1</sup> | 80  | 7.75  | 196,8 | 11.85 | 300,9 | 7.77  | 197,4 | 19.0   | 8,64  |
| 4.00              | 100 | 10.00 | 254,0 | 14.90 | 378,6 | 10.24 | 260,2 | 32.0   | 14,55 |

## 903 Cast Iron Bonnet

The 903 is an economical option for applications that do not require autoclavability. A selection of coatings makes the 903 suitable for a range of sanitary service including USDA 3A requirements.

Type: 903 & 903S

Size Range: 0.5–4" (DN15–DN100)

Max Service Pressure:

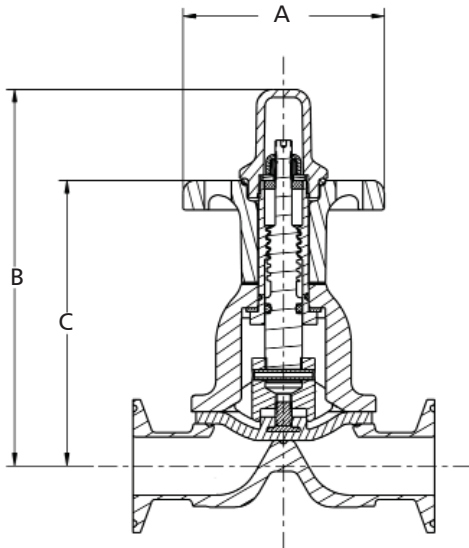
0.5–1": 200 psig (13.8 bar)

1.5–2": 175 psig (12.1 bar)

3–4": 150 psig (10.3 bar)

Max Service Temperature:

See Page D-10



Bonnet Material:

Cast iron with coating

Coatings available: Atmospheric white epoxy and PVDF

Handwheel Material:

Glass reinforced polyarylsulfane (PAS) coated to match bonnet 0.5–1" (DN15–DN25)

Cast iron with coating 1.5–4" (DN40–DN100)

Corrosion Resistance:

Resists alcohol and most semi-caustic wash-downs. For specific chemical resistance, consult factory.

Standard Features:

- Adjustable travel stop
- Protective cap
- Brass stem bushing
- Visual position indicator
- Permanent lubrication
- O-ring seals
- Cast iron or zinc compressor

Optional Features:

- Sealed bonnets: 903S
- Hygienic internals
- Adjustable opening stop
- Bronze compressor
- Extended handwheel
- Lockable

| Valve Size        |     | A     |       | B     |       | C     |       | Weight |       |
|-------------------|-----|-------|-------|-------|-------|-------|-------|--------|-------|
| Inch              | DN  | Inch  | mm    | Inch  | mm    | Inch  | mm    | lb     | kg    |
| 0.50              | 15  | 3.00  | 76,2  | 3.65  | 92,7  | 2.78  | 70,6  | 0.72   | 0,33  |
| 0.75              | 20  | 3.00  | 76,2  | 4.57  | 116,0 | 3.44  | 87,2  | 1.8    | 0,82  |
| 1.00              | 25  | 3.00  | 76,2  | 5.54  | 140,8 | 4.21  | 107,0 | 2.3    | 1,05  |
| 1.50              | 40  | 5.50  | 139,7 | 8.44  | 214,2 | 5.34  | 135,5 | 7.8    | 3,55  |
| 2.00              | 50  | 5.50  | 139,7 | 9.06  | 230,0 | 5.96  | 151,3 | 8.4    | 3,82  |
| 2.50 <sup>1</sup> | 65  | 7.75  | 196,8 | 11.85 | 300,9 | 7.77  | 197,4 | 13.0   | 5,90  |
| 3.00 <sup>1</sup> | 80  | 7.75  | 196,8 | 11.85 | 300,9 | 7.77  | 197,4 | 19.0   | 8,64  |
| 4.00              | 100 | 10.00 | 254,0 | 14.90 | 378,6 | 10.24 | 260,2 | 32.0   | 14,55 |

## Advantage<sup>®</sup> 2.0 and Advantage<sup>®</sup> Actuator

The Advantage is a diaphragm driven, compact, lightweight actuator designed to meet the stringent space constraints of the Bioprocessing and Pharmaceutical Industries. The unit is designed as an on/off pneumatic actuator available with three modes of closure.

### Corrosion Resistance:

Resists alcohol, chloride and most caustic wash-downs. For specific chemical resistance, consult factory.

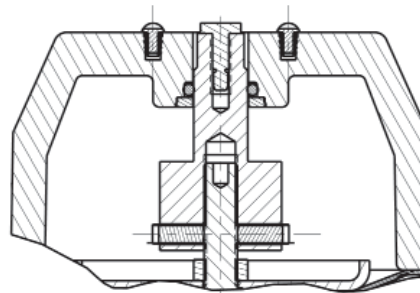
### Standard Features:

- Max air pressure: 90 psi
- Stainless steel bonnet
- Visual position indicator
- O-ring seals
- Hygienic internals
- Autoclavable
- Switch mounting bolt pattern

### Optional Features:

- Adjustable opening stop
- Adjustable travel stop
- Solenoids available

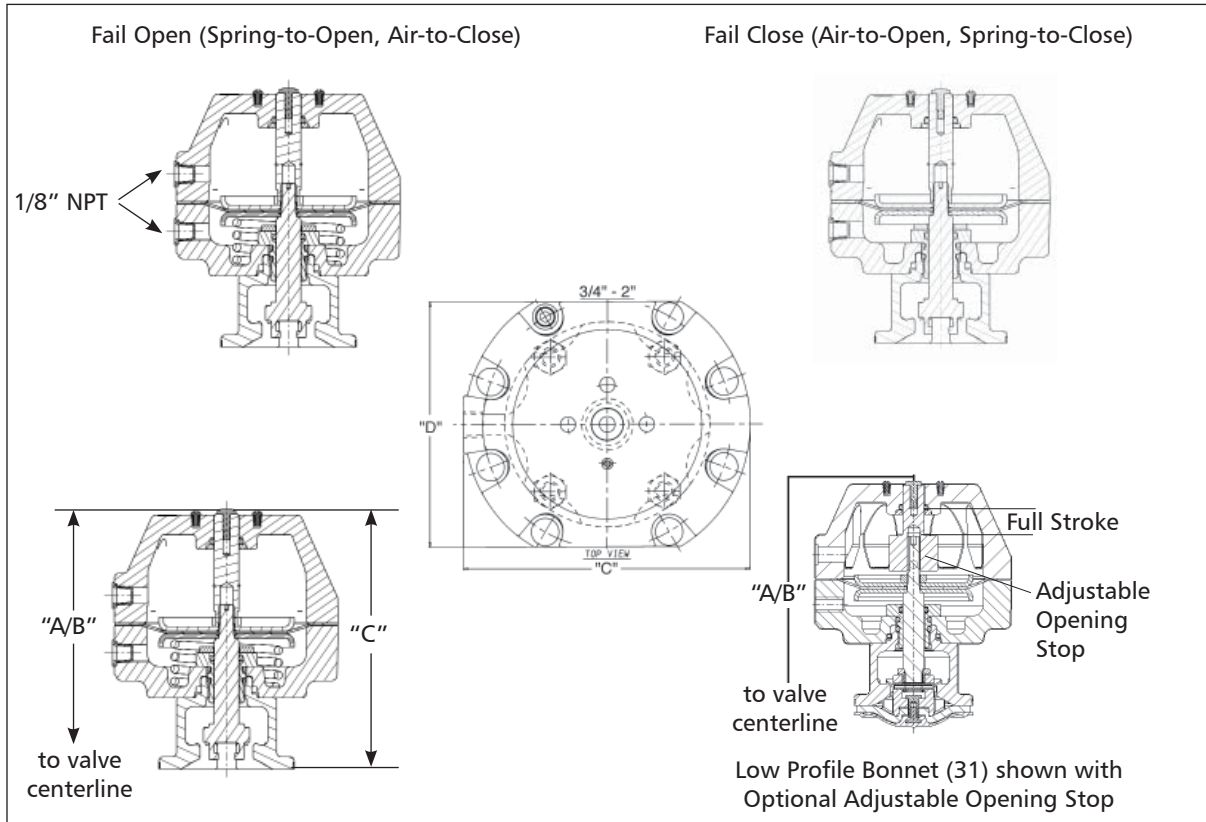
Note: See page G-3-G-5 for actuator sizing.



Advantage AOS



## Weights and Dimensions for Advantage® Actuator 0.25" - 2"



### Dimensions

| Valve Size                       |                        | A<br>Valve Open |     | B<br>With Limit Switch, SP2 |     | C    |     | D    |     |
|----------------------------------|------------------------|-----------------|-----|-----------------------------|-----|------|-----|------|-----|
| Inch                             | DN                     | Inch            | mm  | Inch                        | mm  | Inch | mm  | Inch | mm  |
| TC 0.25, 0.375, 0.5 <sup>1</sup> | 8, 10, 15 <sup>1</sup> | 4.33            | 110 | 9.23                        | 234 | 2.84 | 72  | 2.50 | 63  |
| BW 0.25, 0.375, 0.5 <sup>2</sup> | 8, 10, 15 <sup>2</sup> | 4.40            | 112 | 9.30                        | 236 | 2.84 | 72  | 2.50 | 63  |
| 0.50                             | 15                     | 4.90            | 124 | 9.77                        | 248 | 3.34 | 85  | 3.00 | 76  |
| 0.75                             | 20                     | 5.99            | 152 | 10.78                       | 274 | 4.56 | 116 | 3.88 | 98  |
| 1.00                             | 25                     | 6.60            | 168 | 11.19                       | 284 | 4.56 | 116 | 3.88 | 98  |
| 1.50                             | 40                     | 10.55           | 268 | 14.89                       | 378 | 6.41 | 163 | 5.94 | 151 |
| 2.00                             | 50                     | 11.31           | 287 | 15.37                       | 390 | 6.41 | 163 | 5.94 | 151 |

<sup>1</sup> Bio-Tek valve series tri-clamp ends

<sup>2</sup> Bio-Tek valve series butt-weld ends

### Actuator Weights (less body)

| Valve Size                    |                        | Double Acting |      | Fail Open |      | Fail Close |      |
|-------------------------------|------------------------|---------------|------|-----------|------|------------|------|
| Inch                          | DN                     | Lbs.          | Kg.  | Lbs.      | Kg.  | Lbs.       | Kg.  |
| 0.25, 0.375, 0.5 <sup>1</sup> | 8, 10, 15 <sup>1</sup> | 1.25          | 0,57 | 1.31      | 0,59 | 1.37       | 0,62 |
| 0.50                          | 15                     | 2.00          | 0,91 | 2.09      | 0,95 | 2.34       | 1,06 |
| 0.75                          | 20                     | 3.69          | 1,67 | 3.78      | 1,71 | 4.34       | 1,97 |
| 1.00                          | 25                     | 4.47          | 2,03 | 4.59      | 2,08 | 5.16       | 2,34 |
| 1.50                          | 40                     | 12.10         | 5,49 | 12.60     | 5,71 | 16.44      | 7,46 |
| 2.00                          | 50                     | 15.16         | 6,88 | 15.66     | 7,10 | 19.50      | 8,84 |

<sup>1</sup> Bio-Tek sizes

## Series 33 Advantage® Actuator

The Series 33 Advantage Actuators extend the size range of the Advantage Actuator product line to 3" and 4" valves. The Series 33 Advantage Actuators have been introduced to further reduce the dimensional envelope and weight for installations in the Pharmaceutical/ Bioprocessing industries. The Series 33 4" Spring to Close actuator is 25% smaller in diameter, has 22% reduction in height and offers a 32% reduction in weight than a comparable 4" Series 47 actuator.

Type: Series 33 Advantage Actuator

Size Range: 3-4" (DN80-DN100)

Operating Modes:

Fail Close\*, Fail Open, Double Acting

Max Service Pressure/Temperature:

150 psig (10.34 bar)

300°F (149°C)

External Temperature Limitations:

150°F (66°C)

Actuator Cover Material:  
Vinyl-Ester Thermoset  
(FDA compliant)

Bonnet Material:  
Nylon coated ductile  
iron

Corrosion Resistance:  
Resists alcohol, chloride  
and most caustic wash-  
downs.

For specific chemical resistance, consult factory.



Standard Features:

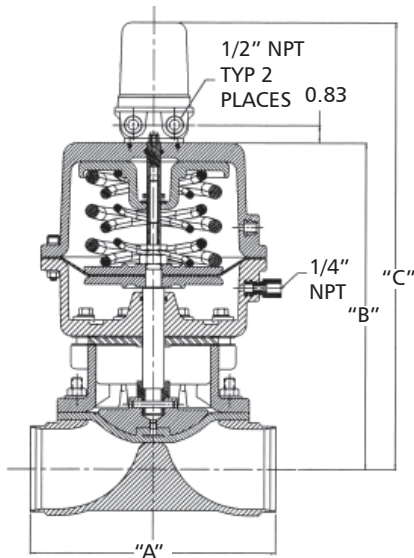
- Visual position indicator
- O-ring seals
- Switch mounting bolt pattern

Optional Features:

- Hygienic internals
- Solenoids available

\*Springs self-contained (Fail close only)

Note: See page H-3-H-5 for actuator sizing.



### Dimensions

| Valve Size |     | A     |       | B     |       | C <sup>1</sup> |       | D     |       |
|------------|-----|-------|-------|-------|-------|----------------|-------|-------|-------|
| Inch       | DN  | Inch  | mm    | Inch  | mm    | Inch           | mm    | Inch  | mm    |
| 3.00       | 80  | 10.00 | 254,0 | 14.44 | 366,7 | 19.64          | 498,8 | 10.57 | 268,5 |
| 4.00       | 100 | 13.00 | 230,2 | 15.82 | 401,7 | 21.02          | 533,8 | 10.57 | 268,5 |

<sup>1</sup> With Limit Switch SP2

### Actuator Weights (less body)

| Valve Size |     | Double Acting |       | Fail Open |       | Fail Close |       |       |       |
|------------|-----|---------------|-------|-----------|-------|------------|-------|-------|-------|
| Inch       | DN  | Lbs.          | Kg.   | Lbs.      | Kg.   | 60#        |       | 90#   |       |
| Inch       | DN  | Lbs.          | Kg.   | Lbs.      | Kg.   | Lbs.       | Kg.   | Lbs.  | Kg.   |
| 3.00 (33)  | 80  | 39.00         | 17,69 | 42.30     | 19,19 | 54.20      | 24,59 | 58.00 | 26,31 |
| 4.00 (33)  | 100 | 44.00         | 19,96 | 47.30     | 21,46 | 59.20      | 26,85 | 63.00 | 28,58 |



**CSI** 417.831.1411  
csidesigns.com



## Series 47 Advantage® Actuator

The Series 47 Advantage Actuators extend the size range of the Advantage Actuator product line to 3" and 4" valves. Similar to the smaller valve sized Advantage Actuators, the 3–4" series 47 (DN80–DN100) actuator is also diaphragm driven, o-ring furnished and available in three modes of operation. The actuator design features the same dimensional envelope regardless of operation mode.

Type: Series 47 Advantage Actuator

Size Range: 3–4" (DN80–DN100)

Operating Modes:  
Fail Close\*, Fail Open, Double Acting

Max Service Pressure/Temperature:  
150 psig (10.34 bar)  
300°F (149°C)

External Temperature Limitations:  
150°F (66°C)

Actuator Cover Material:  
Vinyl-Ester Thermoset (FDA compliant)

Bonnet Material:  
Nylon coated ductile iron

Corrosion Resistance:  
Resists alcohol, chloride and most caustic wash-downs.  
For specific chemical resistance, consult factory.

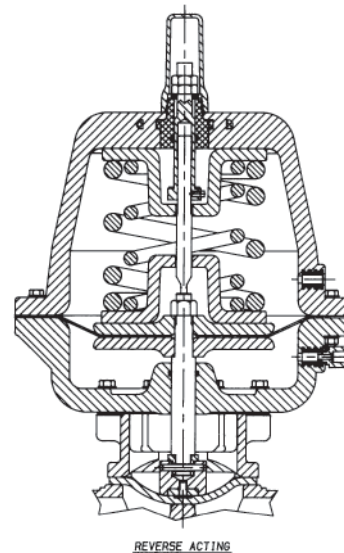
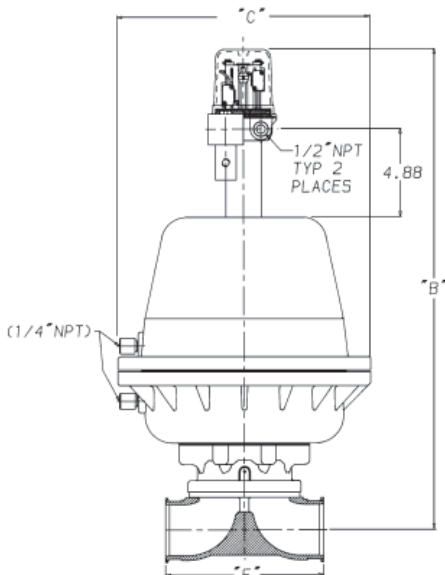
Standard Features:

- Visual position indicator
- O-ring seals
- Adjustable Opening Stop (AOS)
- Adjustable Travel Stop (ATS)
- Switch mounting bolt pattern

Optional Features:

- Hygienic internals
- Solenoids available

\*Springs self-contained (Fail close only)  
Note: See page G3-G-5 for actuator sizing.



### Dimensions

| Valve Size |     | A     |     | B <sup>1</sup> |     | C     |     | D     |     |
|------------|-----|-------|-----|----------------|-----|-------|-----|-------|-----|
| Inch       | DN  | Inch  | mm  | Inch           | mm  | Inch  | mm  | Inch  | mm  |
| 3.00       | 80  | 21.51 | 546 | 27.08          | 688 | 14.00 | 356 | 8.75  | 222 |
| 4.00       | 100 | 22.90 | 582 | 28.47          | 723 | 14.00 | 356 | 11.50 | 292 |

<sup>1</sup> With Limit Switch SP2

## Advantage Piston Actuator - APA®

The APA was designed to provide a smaller dimensional envelope than the Advantage Actuator product line while satisfying the basic needs of the Bioprocessing and Pharmaceutical industries.

Type: Advantage Piston Actuator (APA)

Size Range: 0.5–2" (DN15–DN50)

Mode of Operation:  
Fail close (Reverse acting) pneumatic piston actuator.

Service Pressure/Temperature:

Max Service Pressure:  
150 psig (10.34 bar)

Max Service Temperature:  
292°F (145°C)

Bonnet Material:  
316 Stainless Steel

Cylinder/Cover Material:  
Polybutylene terephthalate (PBT)  
FDA compliant to 21CFR 177.1660

Corrosion Resistance:  
Resists alcohol, chloride and most caustic wash-downs. For specific chemical resistance, consult factory.

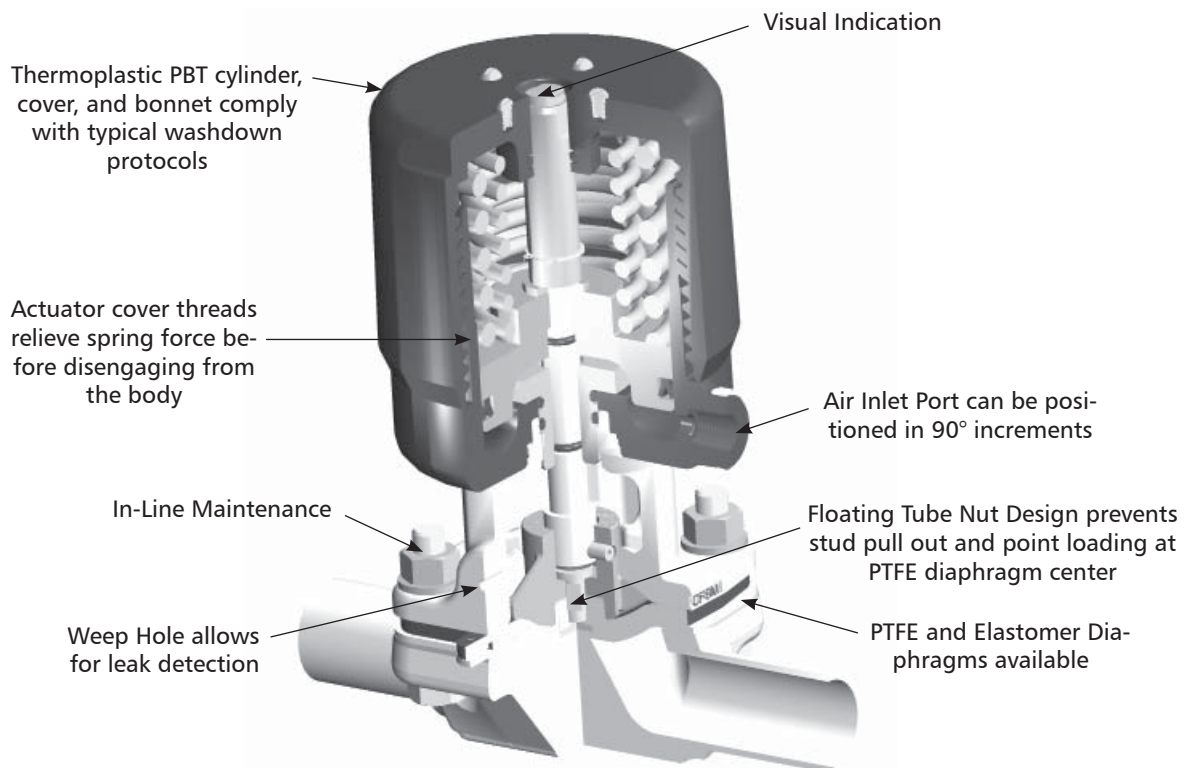
Standard Features:

- Visual position indicator
- Permanent lubrication
- O-ring seals
- Switch mounting bolt pattern
- Hygienic internals

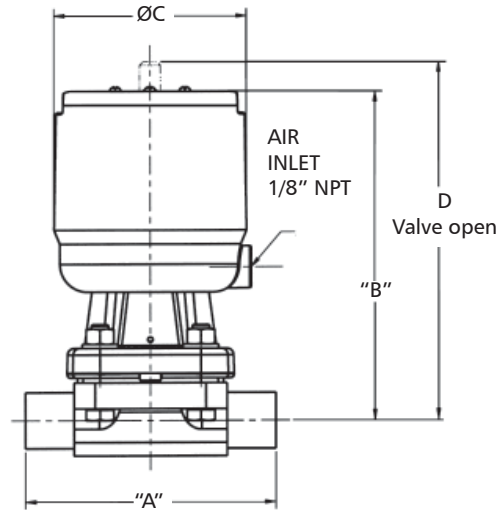
Optional Features:

- Adjustable opening stop
- Switch packages
- Solenoids available

Note: See page G-8 for actuator sizing.



## Weights and Dimensions for Advantage Piston Actuator (APA)



### Dimensions

| Valve Size |    | A    |       | B     |       | C    |       | D     |       |
|------------|----|------|-------|-------|-------|------|-------|-------|-------|
| Inch       | DN | Inch | mm    | Inch  | mm    | Inch | mm    | Inch  | mm    |
| 0.50       | 15 | 3.50 | 89,8  | 4.53  | 115,0 | 2.75 | 69,9  | 4.90  | 124,4 |
| 0.75       | 20 | 4.00 | 101,6 | 5.34  | 135,6 | 3.38 | 85,9  | 5.80  | 147,3 |
| 1.00       | 25 | 4.50 | 114,3 | 5.90  | 149,8 | 3.38 | 85,9  | 6.42  | 163,0 |
| 1.50       | 40 | 5.50 | 139,7 | 9.53  | 242,0 | 5.00 | 127,0 | 10.34 | 262,7 |
| 2.00       | 50 | 6.25 | 158,7 | 10.07 | 255,8 | 5.00 | 127,0 | 11.18 | 284,1 |

### Actuator Weights (less body)

| Valve Size |    | Actuator Weight |      |
|------------|----|-----------------|------|
| Inch       | DN | lb.             | Kg.  |
| 0.50       | 15 | 1.80            | 0,81 |
| 0.75       | 20 | 3.23            | 1,46 |
| 1.00       | 25 | 3.62            | 1,64 |
| 1.50       | 40 | 11.75           | 5,32 |
| 2.00       | 50 | 13.30           | 6,03 |

## Advantage Excel - Series S Actuator (AXS)

The Advantage Excel - Series S (AXS) is the latest addition to the process proven Advantage Actuator product line. Designed as a maintenance free actuator, it is engineered to handle the most demanding requirements of the bio-processing and pharmaceutical industries. The stainless steel construction of the AXS is suited for severe duty applications, such as SIP and high cycle applications. It has been subjected to extensive life cycle testing far exceeding industry requirements.

The compact size of the AXS provides the utmost in design flexibility. It allows for space saving process designs further minimizing hold up volumes which are critical to increasing efficiency and in the end saving time and money. Engineering improvements in the AXS offer a cost-effective alternative for clean room use, lab environments and other critical applications. With a stainless steel exterior the AXS is perfect for clean room applications requiring both aesthetics and wash down compatibility.

All of this makes the AXS a versatile, feature packed, cost effective option for the demanding Biopharm industry

Type: Piston Actuator

Size Range: BP, 0.5-2" (DN8-50) <sup>1</sup>

<sup>1</sup> Not available in Bio-Tek size.

Operating Modes:

Fail Close, Fail Open, Double Acting

Max Service Pressure:

150 psig (10 bar)

See sizing charts on pg. G-6-G-8 for exact shut-off pressures

Max Service Temperature:

300°F (150°C)



Max Autoclave Temperature:  
300°F (150°C)

Max Actuator Chamber Pressure:  
100 psig (7 bar)

Corrosion Resistance:  
Resists alcohol, chloride and most caustic wash-downs.

Approximate Maximum Chamber Volume

| Valve Size |    | Fail Close      |                 |                 |                 | Fail Open       |                 |                 |                 | Double Acting   |                 |                 |                 |
|------------|----|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|            |    | Upper Chamber   |                 | Lower Chamber   |                 | Upper Chamber   |                 | Lower Chamber   |                 | Upper Chamber   |                 | Lower Chamber   |                 |
| Inch       | DN | in <sup>3</sup> | cm <sup>3</sup> | in <sup>3</sup> | cm <sup>3</sup> | in <sup>3</sup> | cm <sup>3</sup> | in <sup>3</sup> | cm <sup>3</sup> | in <sup>3</sup> | cm <sup>3</sup> | in <sup>3</sup> | cm <sup>3</sup> |
| BP         | BP | 1.49            | 24,47           | 1.08            | 17,70           | 1.60            | 26,24           | 1.27            | 20,86           | 1.60            | 26,24           | 1.48            | 24,20           |
| 0.50       | 15 | 4.2             | 68,7            | 1.9             | 31,8            | 2.8             | 46,0            | 3.8             | 61,6            | 3.8             | 62,1            | 2.4             | 39,4            |
| 0.75       | 20 | 12.1            | 197,8           | 4.0             | 65,7            | 6.4             | 104,9           | 10.1            | 166,1           | 13.1            | 214,8           | 4.7             | 76,3            |
| 1.00       | 25 | 12.8            | 209,0           | 4.7             | 76,6            | 7.1             | 116,2           | 10.8            | 177,0           | 13.8            | 226,0           | 5.3             | 87,2            |
| 1.50       | 40 | 30.1            | 493,5           | 11.0            | 179,8           | 19.6            | 321,2           | 24.5            | 401,3           | 36.2            | 593,0           | 11.7            | 191,3           |
| 2.00       | 50 | 48.5            | 794,7           | 20.8            | 340,7           | 37.5            | 614,1           | 39.1            | 641,0           | 59.2            | 970,3           | 21.6            | 354,8           |

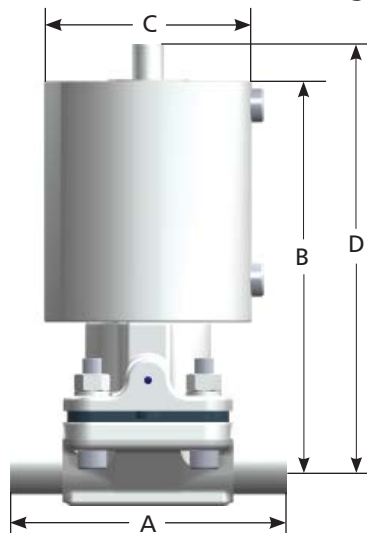
Actuator Weights (Including Actuator and Forged Body)

| Valve Size |    | Fail Close |      | Fail Open |      | Double Acting |     |
|------------|----|------------|------|-----------|------|---------------|-----|
| Inch       | DN | Lbs.       | Kg   | Lbs.      | Kg   | Lbs.          | Kg  |
| BP         | BP | 1.5        | 0,7  | 1.5       | 0,7  | 1.5           | 0,7 |
| 0.50       | 15 | 4.0        | 1,8  | 3.9       | 1,8  | 3.9           | 1,8 |
| 0.75       | 20 | 7.3        | 3,3  | 7.1       | 3,2  | 6.6           | 3,0 |
| 1.00       | 25 | 8.4        | 3,8  | 8.2       | 3,7  | 7.7           | 3,5 |
| 1.50       | 40 | 16.6       | 7,5  | 15.5      | 7,0  | 14.4          | 6,5 |
| 2.00       | 50 | 24.7       | 11,2 | 22.4      | 10,2 | 21.0          | 9,5 |

Actuator Weights (Less Body and Diaphragm)

| Valve Size |    | Fail Close |      | Fail Open |      | Double Acting |      |
|------------|----|------------|------|-----------|------|---------------|------|
| Inch       | DN | Lbs.       | Kg   | Lbs.      | Kg   | Lbs.          | Kg   |
| BP         | BP | 1.2        | 0,55 | 1.2       | 0,55 | 1.2           | 0,55 |
| 0.50       | 15 | 3.5        | 1,6  | 3.4       | 1,5  | 3.4           | 1,5  |
| 0.75       | 20 | 6.4        | 2,9  | 6.2       | 2,8  | 5.7           | 2,6  |
| 1.00       | 25 | 6.8        | 3,1  | 6.6       | 3,0  | 6.1           | 2,8  |
| 1.50       | 40 | 13.3       | 6,0  | 12.2      | 5,5  | 11.1          | 5,0  |
| 2.00       | 50 | 19.3       | 8,7  | 16.9      | 7,7  | 15.5          | 7,0  |

Dimensional Data with Forged Body



Valve Stroke

| Valve Size | Approx. Stroke |
|------------|----------------|
| BP         | 0.16"          |
| BP         | 4,1 mm         |
| 0.50"      | 0.25"          |
| DN 15      | 6,3 mm         |
| 0.75"      | 0.30"          |
| DN 20      | 7,6 mm         |
| 1.00"      | 0.40"          |
| DN 25      | 10,1 mm        |
| 1.50"      | 0.56"          |
| DN 40      | 14,2 mm        |
| 2.00"      | 0.78"          |
| DN 50      | 19,8 mm        |

| Valve Size |    | A    |       | B    |       | C    |       | D (open) |       |
|------------|----|------|-------|------|-------|------|-------|----------|-------|
| Inch       | DN | Inch | mm    | Inch | mm    | Inch | mm    | Inch     | mm    |
| BP         | BP | 3.5  | 89,0  | 3.55 | 90,2  | 1.75 | 44,5  | 3.9      | 99,1  |
| 0.50       | 15 | 3.50 | 88,9  | 4.43 | 112,5 | 2.61 | 66,3  | 4.80     | 121,8 |
| 0.75       | 20 | 4.00 | 101,6 | 5.62 | 142,6 | 3.36 | 85,3  | 6.01     | 152,8 |
| 1.00       | 25 | 4.50 | 114,3 | 6.26 | 159,0 | 3.36 | 85,3  | 6.78     | 172,2 |
| 1.50       | 40 | 5.50 | 139,7 | 8.49 | 215,5 | 4.15 | 105,4 | 9.18     | 233,1 |
| 2.00       | 50 | 6.25 | 158,8 | 9.39 | 238,6 | 4.90 | 124,5 | 10.30    | 261,7 |

## Dia-Flo® Actuator

The Dia-Flo actuator, diaphragm driven and pneumatically operated, is a process proven actuator suitable for both the Pure-Flo and Dia-Flo product lines. The Dia-Flo actuator is recommended as an alternative to the Advantage Actuator for applications in which the line pressure or available plant air pressure is not within the advantage actuator parameters.

Type: Dia-Flo

Size Range:

Available in seven interchangeable sizes and can be readily mounted to any size valve with the proper size bonnet. See Dia-Flo catalog DV for actuator sizing

Actuator Materials:

Aluminum  
Ductile iron - optional

Corrosion Resistant Coatings:

White epoxy  
PVDF  
Nylon

Bonnet Materials:

Ductile iron  
Stainless steel – optional

Actuator Air Pressure:

85 psi (5.9 bar) max

Options:

- Adjustable opening stop
- Adjustable travel stop<sup>1</sup>
- Hygienic internals
- Visual position indicator
- Wrench or handwheel operated
- Manual overrides
- Solenoids available

<sup>1</sup>Adjustable travel stop is standard on all fail close actuators (except 3212)

## Dualrange® Control Valve

The Dualrange control valve is the first diaphragm valve designed expressly for control work. Available in 1–6" sizes, it combines all the advantages of ITT weir-type diaphragm valves with greatly improved throttling characteristics. The Dualrange utilizes the Dia-Flo actuator and has greater rangeability than other diaphragm valves, due to the dual nested compressors unique to Pure-Flo. Refer to the Dia-Flo catalog DV at [www.engvalves.com](http://www.engvalves.com) for more information.



## Automation and Control

ITT is a world leader in the design and manufacture of aseptic diaphragm valves. We also strive to offer our customers the latest technology for the networking, monitoring and control of these valves. Whether it be as simple as on/off switch or a more complicated positioner or networked feedback device, we can supply our customer's needs for a complete automated valve with precise control requirements.

Our accessories are simple to mount and set, and are compact enough to be easily installed and maintained where space is at a premium.

Many of our accessories have been installed in other industries such as oil and petrochemical, chemical, pulp and paper, mining and power plants across the world, as well as in less demanding environments.

Our accessory portfolio includes our VSP and SP2 switch devices as well as our Moore positioners. To handle our customers' network

needs, we are introducing the ConnectITT series of network hardware. This product line was designed to offer the customer a tremendous savings on their network needs. Where required, we can also provide control devices for more demanding hazardous location applications.

While ITT strives for "One Valve – One Source – One Solution" for our customers' valve needs, we recognize that we may need to offer alternative solutions for their valve controls. We continue to utilize the latest emerging technologies in our product offerings. Along with our dedicated and experienced engineering staff, we can combine our own products with those of 3rd party suppliers to provide the customer with the best and most economical solution for their particular needs.

Providing a valve to fit your application and not your application to fit your valve; this is what ITT is all about.



## Value Switch Package (VSP)

The VSP is a switch package engineered with cost effectiveness, simplicity and flexibility in mind. The VSP maintains a small dimensional envelope for process piping installations where space is at a premium. The VSP is offered with a complete range of mechanical switches and proximity sensors to meet your electrical and control system specifications.

The VSP is a perfect compliment to both the Advantage® and Advantage® Piston Actuator lines of pneumatic actuation.



### Specifications

|  | US  | Metric   |
|--|---|----------|
| Size Range   | 0.25–2"   | DN8-DN50 |
| Temperature  | 140°F   | 60°C     |
| Switch Selection   | Mechanical and Proximity (see chart)  |          |
| Housing Material   | Polyamide, FDA compliant  |          |
| Cover Material   | Polysulfone, FDA compliant  |          |
| Wire Gauge   | 12 Gauge max. input   |          |
| Conduit Port   | One M20 conduit port, located radially at any position, 360° (½"-NPT adapter available)   |          |
| Enclosure Rating   | Nema: Nema 4X<br>Ingress Protection Rating: IP66  |          |
| Switch Certifications                                      | VSPN: CE, cCSAus, FM, ATEX<br>VSPP Sensor: CE, cULus<br>VSPZ: CE, cULus<br>VSPS48, VSPG30: cULus<br>Terminal Strip: CE, cULus   |          |
| Hazardous Ratings for VSPN with Approved Amplifier/Barrier | Intrinsically Safe - FM, ATEX, cCSAus approved<br>Group II, category 1D T6<br>Group II, category 1G/2G T6<br>Class I, II & III, Division 1, Groups A-G T6<br>Entity Parameters: Vmax=15V, Imax=50mA,<br>Pmax=120mW, Ci=80nF, Li=110µH |          |

Note: VSP is not autoclavable

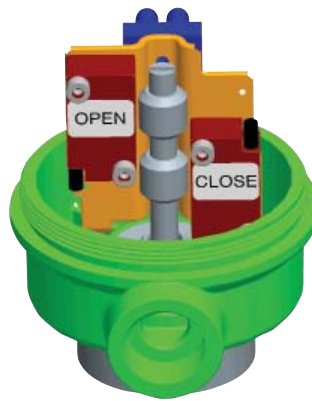


## Value Switch Package (VSP)

| Order Code | Switch Type | Switch Contact/ Output | Amperage | Voltage      |
|------------|-------------|------------------------|----------|--------------|
| VSPS48     | Mechanical  | Silver SPDT            | 6A       | 12-48 VAC/DC |
| VSPS240    | Mechanical  | Silver SPDT            | 10A      | 240 VAC/DC   |
| VSPG30     | Mechanical  | Gold SPDT              | 100 mA   | 30 VAC/DC    |
| VSPZ       | Proximity   | 2 Wire "Z"             | 200 mA   | 5-36 VDC     |
| VSPN       | Proximity   | 2 Wire Namur           | 1 mA     | 7.5-30 VDC   |
| VSPPP      | Proximity   | 3 Wire PNP             | 200 mA   | 10-36 VDC    |

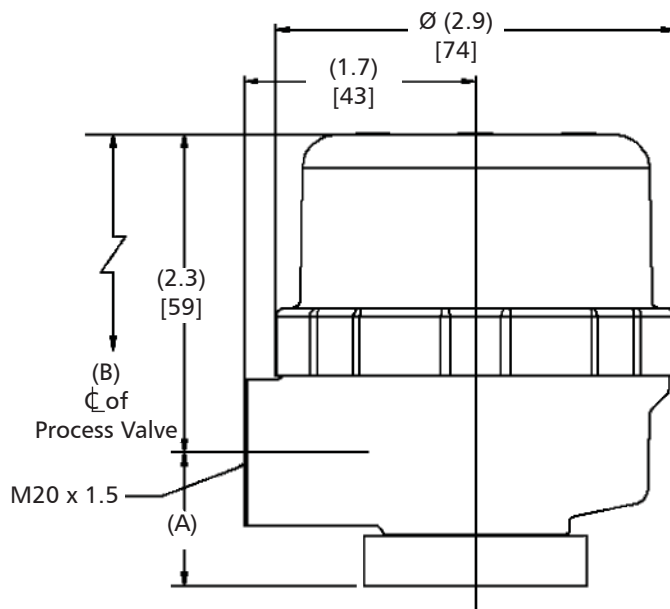


Mechanical



Proximity

## Dimensions



| Valve Size | A    |      | B            |       |                    |       |
|------------|------|------|--------------|-------|--------------------|-------|
|            | in   | mm   | APA Actuator |       | Advantage Actuator |       |
|            |      |      | in           | mm    | in                 | mm    |
| BT         | 1.00 | 25.4 | 7.51         | 190.8 | 7.39               | 187.7 |
| 0.5        | 1.00 | 25.4 | 7.79         | 197.9 | 7.83               | 198.9 |
| 0.75       | 1.00 | 25.4 | 8.63         | 219.2 | 8.82               | 224.0 |
| 1          | 1.00 | 25.4 | 9.18         | 233.2 | 9.28               | 235.7 |
| 1.5        | 1.50 | 38.1 | 13.30        | 337.8 | 13.45              | 341.6 |
| 2          | 1.50 | 38.1 | 13.84        | 351.5 | 14.07              | 357.4 |

Note: Dimensions are with elastomer diaphragm and butt-weld forged bodies.

## Switch Package SP2

As automation becomes increasingly more important, the need for an accurate and reliable control system for your system is vital. The SP2 switch not only complies with industry standards but is a great solution for your automation needs. The SP2 product line is complete with a full range of mechanical switches and proximity sensors to meet your valve control system requirements.



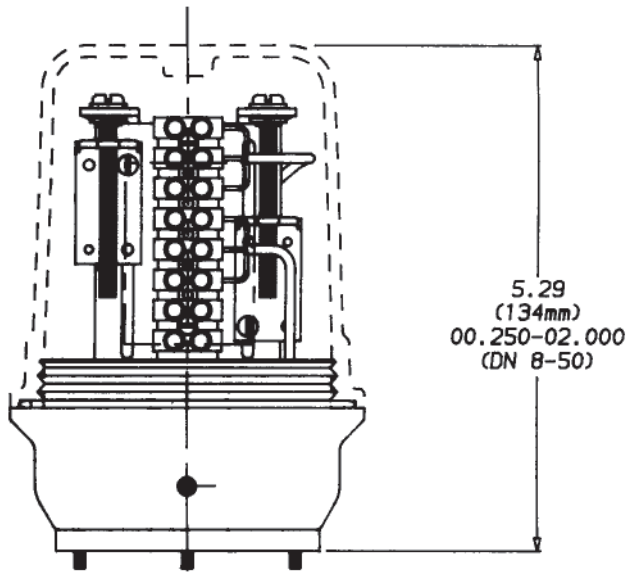
### Specifications

|  | US  | Metric    |
|--|---|-----------|
| Size Range   | 0.25–4"   | DN8–DN100 |
| Temperature  | 150°F   | 65°C      |
| Switch Selection   | Mechanical and Proximity (see chart)  |           |
| Housing Material   | Polyarylsulfone (PAS) Thermoplastic FDA compliant. Maximum temperature is 300°F (149°C).  |           |
| Cover Material   | Polyarylsulfone (PAS) Thermoplastic FDA compliant. Maximum temperature is 300°F (149°C).  |           |
| Wire Gauge   | 12 Gauge Max  |           |
| Conduit Port   | Two 1/2" NPT conduit ports. Package can be rotated at 45° increments.   |           |
| Enclosure Rating   | Nema: Nema 4x<br>Ingress Protection Rating: IP66  |           |
| Switch Certifications                                      | SP2S:CSA, UL<br>SP2G:CSA, UL<br>SP2Z:CE, cULus<br>SP2N:CE, cCSAus, FM, ATEX<br>SP2P:ce, cULus<br>SP2B:CE, CSA, cULus, CCC<br>Terminal strip: UL, CSA  |           |
| Hazardous Ratings for SP2N with Approved Amplifier/Barrier | Intrinsically Safe - FM, ATEX, cCSAus Approved<br>Group II, category 1D T6<br>Group II, category 1G/2G T6<br>Class I, II & III, Division 1, Groups A-G T6<br>Entity Parameters: Vmax=15V, Imax=50mA,<br>Pmax=120mW, Ci=80nF, Li=110μH |           |

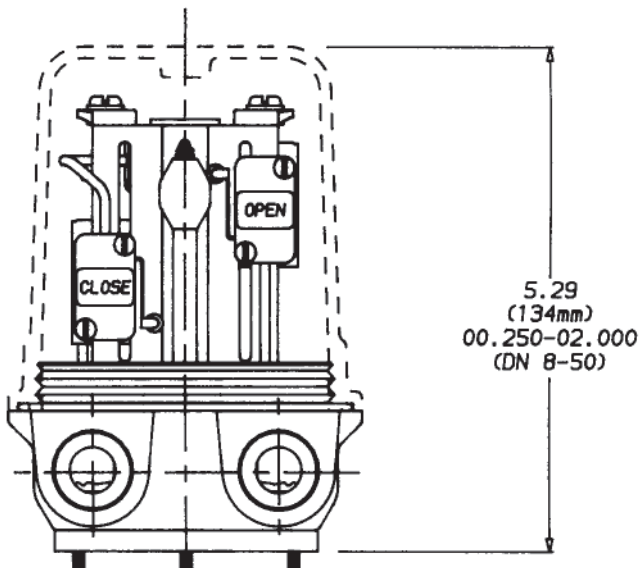
Note: SP2 is not autoclavable

## Switch Package SP2

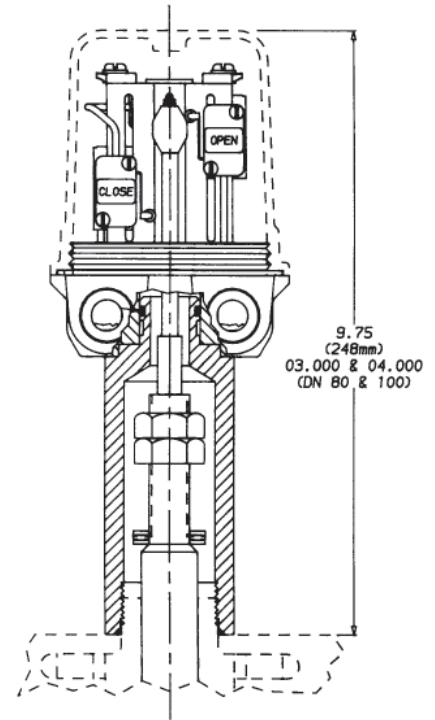
| Order Code | Switch Type | Switch Contact/ Output | Amperage | Voltage |
|------------|-------------|------------------------|----------|---------|
| SP2S       | Mechanical  | Silver                 | 10A      | 250 VAC |
|            |             |                        | 250 mA   | 250 VDC |
| SP2G       | Mechanical  | Gold                   | 1 A      | 125 VAC |
| SP2Z       | Proximity   | 2 Wire "Z"             | 100 mA   | 30 VDC  |
| SP2N       | Proximity   | 2 Wire Namur           | 3 mA     | 24 VDC  |
| SP2P       | Proximity   | 3 Wire PNP             | 100 mA   | 30 VDC  |
| SP2NP      | Proximity   | 3 Wire NPN             | 100 mA   | 30 VDC  |



Bio-Tek - 2" (DN 8-50) and Series 33 Back View



Bio-Tek - 2" (DN 8-50) and Series 33 Front View



3" - 4" (DN 80-100) Series 47 Only

## Switch Package SP3

The SP3 is specifically designed for a broad range of Pharmaceutical and Bio-Processing applications. The SP3 provides a small dimensional envelope while increasing the design flexibility. The SP3 is offered in a variety of options including mechanical switches and proximity sensors in both 2 and 3 wire.



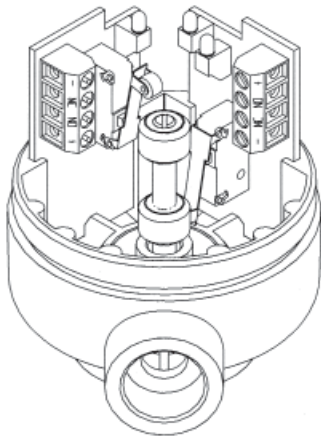
### Specifications

|  | US   | Metric   |
|--|--|----------|
| Size Range   | 0.25–2"  | DN8-DN50 |
| Temperature  | 140°F  | 60°C     |
| Switch Selection   | Mechanical and Proximity (see chart)   |          |
| Housing Material   | Polyamide, FDA compliant.  |          |
| Cover Material   | Polysulfone, FDA compliant.<br>Maximum temperature is 140°F (60°C).  |          |
| Wire Gauge   | 16 Gauge Max   |          |
| Conduit Port   | One 1/2" NPT conduit port, located radially at any position, 360°.   |          |
| Enclosure Rating   | Nema: Nema 4x<br>Ingress Protection Rating: IP65   |          |
| Switch Certifications                                      | SP3S48:NF, UL, cUL<br>SP3S110:NF, UL, cUL<br>SP3S240:NF, UL, cUL<br>SP3G30:NF, UL, cUL<br>SP3GSA:NF, UL, cUL<br>SP3Z:cULus, cCSAus, FM<br>SP3N:cULus, FM, cCSAus, Ex Cenelec<br>SP3P:CE<br>SP3NP:CE<br>Terminal strip: UL, CSA |          |
| Hazardous Ratings for SP3N with Approved Amplifier/Barrier | Intrinsically Safe - FM, Ex Cenelec cCSAus Approved<br>Class I, II & III, Division 1, Groups A-G T6<br>Entity Parameters:<br>Vmax=16V, Imax=25mA, Pmax=34mW,<br>Ci=40nF, Li=50µH   |          |

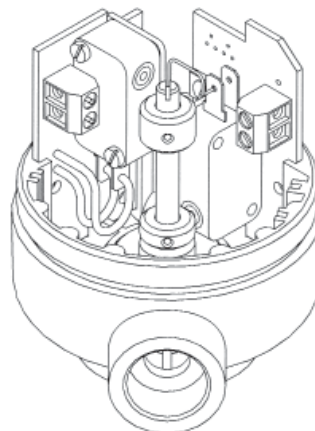
Note: SP3 is not autoclavable

## Switch Package SP3

| Order Code | Switch Type | Switch Contact/Output | Amperage | Voltage        |
|------------|-------------|-----------------------|----------|----------------|
| SP3S240    | Mechanical  | Silver                | 10 A     | 110-230 VAC/DC |
| SP3S110    | Mechanical  | Silver                | 10 A     | 48-110 VAC/DC  |
| SP3S48     | Mechanical  | Silver                | 12A      | 12-48 VAC/DC   |
| SP3G30     | Mechanical  | Gold                  | 100 mA   | 12-30 VAC/DC   |
| SP3Z       | Proximity   | 2 Wire "Z"            | 100 mA   | 10-30 VDC      |
| SP3N       | Proximity   | 2 Wire Namur          | 3 mA     | 5-25 VDC       |
| SP3P       | Proximity   | 3 Wire PNP            | 200 mA   | 10-30 VDC      |
| SP3NP      | Proximity   | 3 Wire NPN            | 200 mA   | 10-30 VDC      |

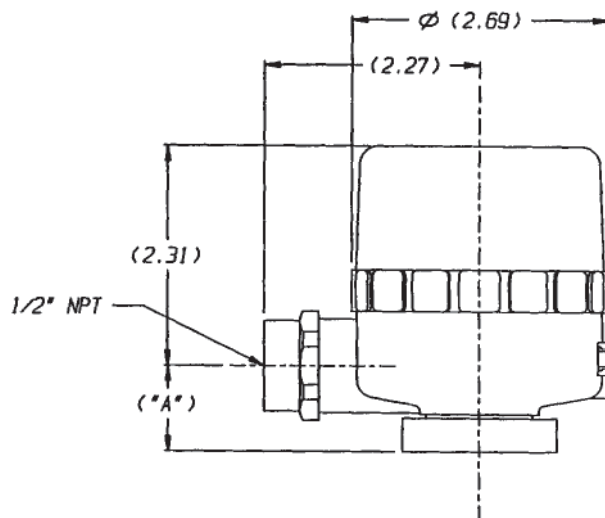


Mechanical



Proximity

## Dimensions



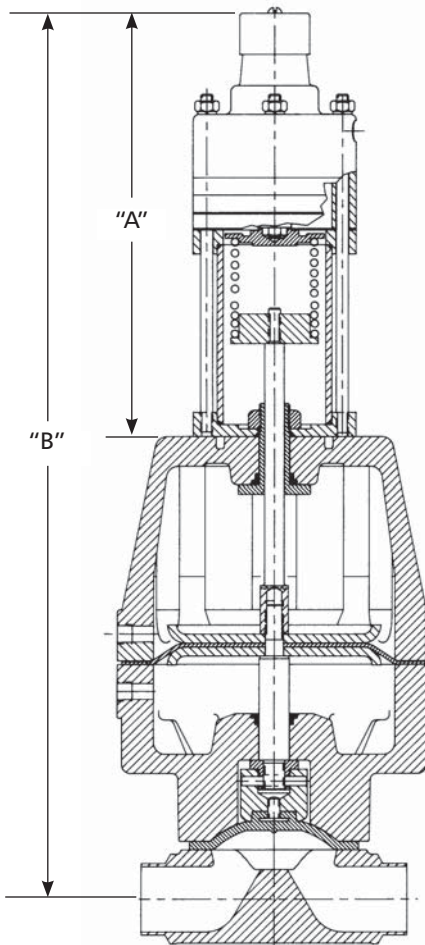
| Actuator Size | "A"  |      |
|---------------|------|------|
|               | Inch | mm   |
| Bio-Tek - 1.0 | 0.98 | 24,9 |
| 1.5 - 2.0     | 1.46 | 37,1 |

## Positioner

For throttling and flow control applications, the direct mounted Siemens (formerly Moore) Positioner with Advantage<sup>®</sup> Actuator is a compact and reliable solution.

### Features:

- Pneumatic Siemens 73-series positioner
- Operates on 3-15 psi (0.2-1.0 bar)
- A transducer can be adapted to handle an I/P conversion from a typical 4-20 mA
- Close-coupled design allows for direct air loading from the Siemens positioner to the upper actuator chamber in Air to Open - Air to Close and Fail Open actuators
- The transparent tubing and red spring disc allows for visual position verification



| Valve Size        |     | A    |     | B     |     |
|-------------------|-----|------|-----|-------|-----|
| Inch              | DN  | Inch | cm  | Inch  | cm  |
| 0.75              | 20  | 8.34 | 212 | 14.06 | 357 |
| 1.00              | 25  | 8.34 | 212 | 14.06 | 367 |
| 1.50              | 40  | 9.06 | 230 | 18.81 | 478 |
| 2.00              | 50  | 9.06 | 230 | 19.28 | 490 |
| 3.00 <sup>1</sup> | 80  | 9.81 | 249 | 27.03 | 687 |
| 4.00 <sup>1</sup> | 100 | 9.81 | 249 | 28.23 | 717 |

<sup>1</sup> Dimensions reflect 47 acuator

## ConnectITT - Network Block

The ITT Network Block combines standard discrete ITT switches to create a network for valves. The installed cost of this simple network is significantly less than traditional networked valves with DeviceNet nodes built in. Networked valves are not really “smart” and have no diagnostics or intelligence built in. If you need to know if the valve is open or closed and be able to turn the valve on and off, the Network Block is your solution.

The Network Block will also allow you to retrofit existing discrete valve installations so they can communicate with network systems. The Network Block is capable of connecting up to four valve switches. Additionally, it can power up to four additional devices requiring up to 0.5 A.

### Features and Benefits

- Connects four valves to the DeviceNet
- Valves are “Non-Smart” or standard issue
- Regularly stocked valves that you have always used can be part of the network
- Allows connection of PNP or 2 wire switches and low wattage solenoid with spring return
- Bottom four ports are available for solenoids only or for Double-Acting Solenoids
- Impossible to improperly connect the valve to the valve block
- The 5 pin receptacle is factory mounted or field mounted in the valve
- One cordset connects the valve to the valve block

### Advantages

- Fast and easy to install
- Less wire and labor is required compared to traditional networked valves
- Commissioning and debugging time is less than traditional networked valves
- Cost Savings!
  - Switch costs less than a DeviceNet switch
  - Wiring cost is reduced
  - Installation cost is reduced
  - Less I/O points (each block is a node vs. each switch)
  - Less bandwidth on the network is required, which will reduce overhead cost



### How DeviceNet™ Works

DeviceNet protocol is used to control and transfer data. It is a low cost communications protocol that connects and networks industrial devices such as limit switches, photoelectric sensors, valve manifolds, motor starters, process sensors, bar code readers, variable frequency drives, panel displays and operator interfaces, among other things.

The DeviceNet network eliminates point-to-point wiring by allowing direct connection to control devices. The direct connection provides improved communication between devices, as well as important device-level diagnostics not easily accessible or available through point-to-point I/O interfaces. DeviceNet is dedicated to the network and connected to PLCs by a single network cable. The stations obtain and transmit messages to the network via these PLCs and are typically programmed by a computer.

Devices connected to DeviceNet stations can also be hot swapped, which means they can be removed and replaced without affecting other operations connected to the station.

A DeviceNet network supports up to 64 nodes and virtually an unlimited amount of I/O. The bus uses a trunkline-dropline topology, where bus power and communication are supplied on a single cable. Bus power is 24 VDC and supplies current to operate the nodes and (typically) power input devices. Some DeviceNet stations require an additional 24 VDC auxiliary power to supply current for outputs.

DeviceNet is a flexible network with the capability of bridging other networks such as PROFIBUS®, As-interface®, RS485, etc. Further, multiple manufacturers’ products are compatible with DeviceNet, thereby allowing stations to be added to existing operations with the ability to connect to virtually any device.

## ConnectITT - Network Block

|                              |  |
|------------------------------|--|
| <b>Input Circuits</b>        | (8) PNP 3-wire sensors or dry contacts   |
| Input Voltage                | 11-26 VDC                                |
| Input Short-Circuit          | <700 mA (total, short-circuit protected) |
| Input Signal Current (Input) | OFF <2 mA<br>ON 2.5-3.2 mA at 24 VDC     |
| Input Delay                  | 2.5 ms                                   |
| <b>Output Circuits</b>       | (8) DC actuators                         |
| Output Voltage               | 11-26 VDC                                |
| Output Load Current          | 0.5 A per output                         |
| Maximum Switching Frequency  | 100 Hz                                   |

### I/O LED Indications

Off = Not Active  
Green = Active

### Module Status LED

Off = Power off  
Green = Operating  
Flashing Green = Autobaud  
Flashing Red = I/O short

### Network Status LED

Off = No connection  
Green = Established connection  
Flashing Green = Ready for connection  
Flashing Red = Connection time-out  
Red = Connection not possible

### Adjustments

Address 0-63 via rotary switch

### Housing

Material 220 x 60 x 40 (H x W x D)  
Glass filled nylon with nickel plated brass connectors  
Mounting Enclosure 4 through-holes, 5.3 diameter  
NEMA 1, 3, 4, 6, 6P, 12, 13 and IP 67, 68, and 69K  
Operating Temperature -40° to 70°C (-40° to 158° F)

### Module Specifications

#### Supply Voltage

Bus Power 11-26 VDC, powers communication and I/O  
Internal Current Consumption ≤75 mA plus sum of sensor and output currents (from bus power)

### I/O Data Mapping

Item Number: F0148  
Product Type/Code: 7/2369

|             | Byte | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|-------------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| Input Data  | 0    | I-7   | I-6   | I-5   | I-4   | I-3   | I-2   | I-1   | I-0   |
|             | 1    | OS-7  | OS-6  | OS-5  | OS-4  | OS-3  | OS-2  | OS-1  | OS-0  |
|             | 2    | IGS   | OGS   |       |       |       |       |       |       |
| Output Data | Byte | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|             | 0    | O-7   | O-6   | O-5   | O-4   | O-3   | O-2   | O-1   | O-0   |

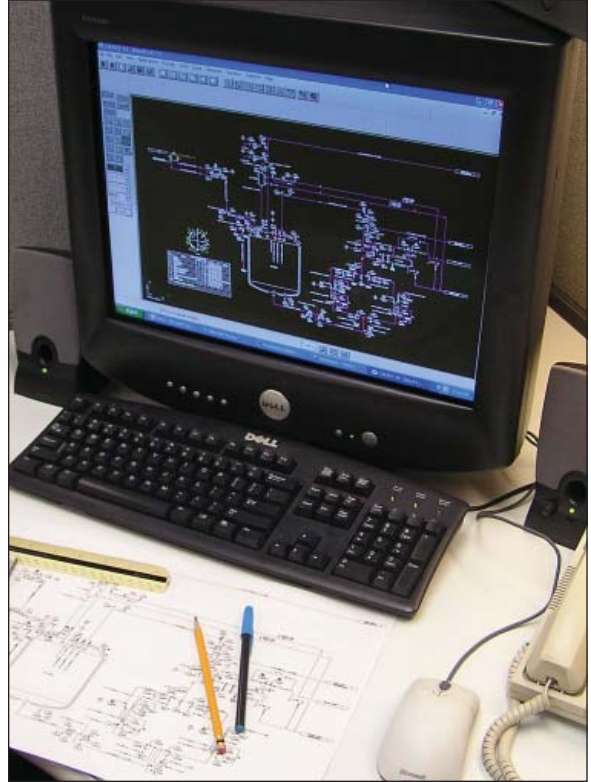
### Abbreviations

I = Input Data (0=OFF, 1=ON)  
O = Output Data (0=OFF, 1=ON)  
OGS = Output Group Status (0=Working, 1=Fault)  
IGS = Input Group Status (0=Working, 1=Fault)



## Table of Contents

|  |        |
|--|--------|
| Actuator Sizing . . . . .              | G2-9   |
| Valve stroke. . . . .                  | G9     |
| Flow coefficients . . . . .            | G10-11 |
| Validation and qualification . . . . . | G12    |
| Compliance . . . . .                   | G13-14 |
| Approvals . . . . .                    | G15-20 |





Advantage® and Advantage® 2.0 Actuator Sizing - Fail Close

| Fail Close Actuators - Air-To-Open, Spring-To-Close (Reverse Acting) |                              |      |       |     |      |     |     |     |                 |      |       |     |      |     |     |     |  |    |
|--|------------------------------|------|-------|-----|------|-----|-----|-----|-----------------|------|-------|-----|------|-----|-----|-----|--|----|
| Actuator and Spring Package  | Maximum Line Pressure (psig) |      |       |     |      |     |     |     |                 |      |       |     |      |     |     |     | Air pressure required to open for full stroke at 0 psi line pressure |    |
|  | Valve Size                   |      |       |     |      |     |     |     |                 |      |       |     |      |     |     |     |  |    |
|  | 100% ΔP                      |      |       |     |      |     |     |     | 0% ΔP           |      |       |     |      |     |     |     |  |    |
|  | BT <sup>2</sup>              | 0.5" | 0.75" | 1"  | 1.5" | 2"  | 3"  | 4"  | BT <sup>2</sup> | 0.5" | 0.75" | 1"  | 1.5" | 2"  | 3"  | 4"  |  |    |
| Elastomer Diaphragm  | A203/B203 60#                | 150  |       |     |      |     |     |     | 150             |      |       |     |      |     |     |     | 55   |    |
|  | A204/B204 90#                | 150  |       |     |      |     |     |     | 150             |      |       |     |      |     |     |     | 75   |    |
|  | A205/B205 60#                |      | 110   |     |      |     |     |     |                 | 90   |       |     |      |     |     |     | 50   |    |
|  | A206/B206 90#                |      | 150   |     |      |     |     |     |                 | 150  |       |     |      |     |     |     | 90   |    |
|  | A208/B208 60#                |      |       | 100 |      |     |     |     |                 |      | 60    |     |      |     |     |     | 45   |    |
|  | A208/B208 60#                |      |       |     | 150  |     |     |     |                 |      |       | 80  |      |     |     |     | 60   |    |
|  | A209/B209 90#                |      |       | 150 | 150  |     |     |     |                 |      |       | 120 | 130  |     |     |     | 90   |    |
|  | A216/B216 60#                |      |       |     |      | 100 |     |     |                 |      |       |     |      | 65  |     |     | 50   |    |
|  | A216/B216 60#                |      |       |     |      |     | 70  |     |                 |      |       |     |      |     | 30  |     | 60   |    |
|  | A217/B217 90#                |      |       |     |      | 150 | 150 |     |                 |      |       |     |      | 130 | 75  |     | 90   |    |
|  | A233 60#                     |      |       |     |      |     |     | 95  | 70              |      |       |     |      |     |     | 60  | 35   | 62 |
|  | A234 90#                     |      |       |     |      |     |     | 150 | 110             |      |       |     |      |     |     | 92  | 50   | 85 |
|  | A247 60#                     |      |       |     |      |     |     | 150 |                 |      |       |     |      |     |     | 92  |  | 57 |
|  | A247 60#                     |      |       |     |      |     |     |     | 119             |      |       |     |      |     |     |     | 59   | 60 |
| A248 80#   |                              |      |       |     |      |     | 150 |     |                 |      |       |     |      |     | 150 |     | 76   |    |
| A248 80#   |                              |      |       |     |      |     |     | 150 |                 |      |       |     |      |     |     | 93  | 82   |    |
| PTFE Diaphragm <sup>1</sup>  | A203/B203 60#                | 70   |       |     |      |     |     |     | 55              |      |       |     |      |     |     |     | 55   |    |
|  | A204/B204 90#                | 150  |       |     |      |     |     |     | 125             |      |       |     |      |     |     |     | 75   |    |
|  | A206/B206 90#                |      | 150   |     |      |     |     |     |                 | 150  |       |     |      |     |     |     | 90   |    |
|  | A208/B208 60#                |      | 150   | 140 |      |     |     |     |                 | 100  | 70    |     |      |     |     |     | 60   |    |
|  | A208/B208 60#                |      |       |     | 100  |     |     |     |                 |      |       | 35  |      |     |     |     | 70   |    |
|  | A209/B209 90#                |      |       | 150 | 150  |     |     |     |                 |      | 80    | 80  |      |     |     |     | 90   |    |
|  | A216/B216 60#                |      |       |     |      | 125 |     |     |                 |      |       |     | 70   |     |     |     | 50   |    |
|  | A216/B216 60#                |      |       |     |      |     | 60  |     |                 |      |       |     |      |     | 45  |     | 60   |    |
|  | A217/B217 90#                |      |       |     |      | 150 | 150 |     |                 |      |       |     |      | 125 | 70  |     | 90   |    |
|  | A233 60#                     |      |       |     |      |     |     | 50  | 30              |      |       |     |      |     |     | 20  | 15   | 62 |
|  | A234 90#                     |      |       |     |      |     |     | 105 | 60              |      |       |     |      |     |     | 45  | 30   | 85 |
|  | A247 60#                     |      |       |     |      |     |     | 133 | 70              |      |       |     |      |     |     | 68  |  | 61 |
|  | A247 60#                     |      |       |     |      |     |     |     |                 |      |       |     |      |     |     |     | 41   | 62 |
|  | A248 80#                     |      |       |     |      |     |     | 150 |                 |      |       |     |      |     |     | 114 |  | 82 |
| A248 80#   |                              |      |       |     |      |     |     | 150 |                 |      |       |     |      |     |     | 70  | 90   |    |

| Fail Close Actuators - Air-To-Open, Spring-To-Close (Reverse Acting) |                             |       |       |       |       |       |       |       |                 |       |      |      |      |      |       |       |  |      |
|--|-----------------------------|-------|-------|-------|-------|-------|-------|-------|-----------------|-------|------|------|------|------|-------|-------|--|------|
| Actuator and Spring Package  | Maximum Line Pressure (bar) |       |       |       |       |       |       |       |                 |       |      |      |      |      |       |       | Air pressure required to open for full stroke at 0 bar line pressure |      |
|  | Valve Size                  |       |       |       |       |       |       |       |                 |       |      |      |      |      |       |       |  |      |
|  | 100% ΔP                     |       |       |       |       |       |       |       | 0% ΔP           |       |      |      |      |      |       |       |  |      |
|  | BT <sup>2</sup>             | DN15  | DN20  | DN25  | DN40  | DN50  | DN80  | DN100 | BT <sup>2</sup> | DN15  | DN20 | DN25 | DN40 | DN50 | DN80  | DN100 |  |      |
| Elastomer Diaphragm  | A203/B203 60#               | 10,34 |       |       |       |       |       |       | 10,34           |       |      |      |      |      |       |       | 3,79   |      |
|  | A204/B204 90#               | 10,34 |       |       |       |       |       |       | 10,34           |       |      |      |      |      |       |       | 5,17   |      |
|  | A205/B205 60#               |       | 7,58  |       |       |       |       |       |                 | 6,21  |      |      |      |      |       |       | 3,45   |      |
|  | A206/B206 90#               |       | 10,34 |       |       |       |       |       |                 | 10,34 |      |      |      |      |       |       | 6,21   |      |
|  | A208/B208 60#               |       |       | 6,89  |       |       |       |       |                 |       | 4,14 |      |      |      |       |       | 3,10   |      |
|  | A208/B208 60#               |       |       |       | 10,34 |       |       |       |                 |       |      | 5,52 |      |      |       |       | 4,14   |      |
|  | A209/B209 90#               |       |       | 10,34 | 10,34 |       |       |       |                 |       | 8,27 | 8,96 |      |      |       |       | 6,21   |      |
|  | A216/B216 60#               |       |       |       |       | 6,89  |       |       |                 |       |      |      |      | 4,48 |       |       | 3,45   |      |
|  | A216/B216 60#               |       |       |       |       |       | 4,83  |       |                 |       |      |      |      |      | 2,07  |       | 4,14   |      |
|  | A217/B217 90#               |       |       |       |       | 10,34 | 10,34 |       |                 |       |      |      |      | 8,96 | 5,17  |       | 6,21   |      |
|  | A233 60#                    |       |       |       |       |       |       | 6,55  | 4,83            |       |      |      |      |      |       | 4,14  | 2,41   | 4,28 |
|  | A234 90#                    |       |       |       |       |       |       | 10,34 | 7,59            |       |      |      |      |      |       | 6,34  | 3,45   | 5,86 |
|  | A247 60#                    |       |       |       |       |       |       | 10,34 |                 |       |      |      |      |      |       | 6,34  |  | 3,93 |
|  | A247 60#                    |       |       |       |       |       |       |       | 8,20            |       |      |      |      |      |       |       | 4,07   | 4,14 |
| A248 80#   |                             |       |       |       |       |       | 10,34 |       |                 |       |      |      |      |      | 10,34 |       | 5,24   |      |
| A248 80#   |                             |       |       |       |       |       |       | 10,34 |                 |       |      |      |      |      |       | 6,41  | 5,65   |      |
| PTFE Diaphragm <sup>1</sup>  | A203/B203 60#               | 4,83  |       |       |       |       |       |       | 3,79            |       |      |      |      |      |       |       | 3,79   |      |
|  | A204/B204 90#               | 10,34 |       |       |       |       |       |       | 8,62            |       |      |      |      |      |       |       | 5,17   |      |
|  | A206/B206 90#               |       | 10,34 |       |       |       |       |       |                 | 10,34 |      |      |      |      |       |       | 6,21   |      |
|  | A208/B208 60#               |       | 10,34 | 9,65  |       |       |       |       |                 | 6,89  | 4,83 |      |      |      |       |       | 4,14   |      |
|  | A208/B208 60#               |       |       |       | 6,89  |       |       |       |                 |       |      | 2,41 |      |      |       |       | 4,83   |      |
|  | A209/B209 90#               |       |       | 10,34 | 10,34 |       |       |       |                 |       | 5,52 | 5,52 |      |      |       |       | 6,21   |      |
|  | A216/B216 60#               |       |       |       |       | 8,62  |       |       |                 |       |      |      |      | 4,83 |       |       | 3,45   |      |
|  | A216/B216 60#               |       |       |       |       |       | 4,14  |       |                 |       |      |      |      |      | 3,10  |       | 4,14   |      |
|  | A217/B217 90#               |       |       |       |       | 10,34 | 10,34 |       |                 |       |      |      |      | 8,82 | 4,83  |       | 6,21   |      |
|  | A233 60#                    |       |       |       |       |       |       | 3,45  | 2,07            |       |      |      |      |      |       | 1,38  | 1,03   | 4,28 |
|  | A234 90#                    |       |       |       |       |       |       | 7,24  | 4,14            |       |      |      |      |      |       | 3,10  | 2,07   | 5,86 |
|  | A247 60#                    |       |       |       |       |       |       | 9,17  | 4,83            |       |      |      |      |      |       | 4,69  |  | 4,21 |
|  | A247 60#                    |       |       |       |       |       |       |       |                 |       |      |      |      |      |       |       | 2,83   | 4,27 |
|  | A248 80#                    |       |       |       |       |       |       | 10,34 |                 |       |      |      |      |      |       | 7,86  |  | 5,65 |
| A248 80#   |                             |       |       |       |       |       |       | 10,34 |                 |       |      |      |      |      |       | 4,83  | 6,21   |      |

<sup>1</sup> The exposure of the diaphragm to steam may increase the air requirements to close by as much as 30%.

<sup>2</sup> Bio-Tek includes size 0.25" (DN8), 0.375" (DN10), and 0.5" (DN15).

Note: See Page G-9 brochure for ΔP Pressure Drop definition.



Advantage® and Advantage® 2.0 Actuator Sizing - Fail Open

| Fail Open Actuators - Air-To-Close, Spring-To-Open (Direct Acting) |     |                                       |    |           |    |           |    |           |    |           |    |           |    |      |    |      |    |      |    |      |    |
|--|-----|---------------------------------------|----|-----------|----|-----------|----|-----------|----|-----------|----|-----------|----|------|----|------|----|------|----|------|----|
|  |     | Air Pressure Required to Close (psig) |    |           |    |           |    |           |    |           |    |           |    |      |    |      |    |      |    |      |    |
| Size   |     | Bio-Tek <sup>2</sup>                  |    | 0.5"      |    | 0.75"     |    | 1"        |    | 1.5"      |    | 2"        |    | 3"   |    | 4"   |    | 3"   |    | 4"   |    |
| Actuator   |     | A103/B103                             |    | A105/B105 |    | A108/B108 |    | A108/B108 |    | A116/B116 |    | A116/B116 |    | A133 |    | A133 |    | A147 |    | A147 |    |
| Line Pressure  |     | % ΔP                                  |    |           |    |           |    |           |    |           |    |           |    |      |    |      |    |      |    |      |    |
|  |     | 100                                   | 0  | 100       | 0  | 100       | 0  | 100       | 0  | 100       | 0  | 100       | 0  | 100  | 0  | 100  | 0  | 100  | 0  | 100  | 0  |
| Elastomer Diaphragm  | 20  | 38                                    | 40 | 38        | 45 | 38        | 55 | 28        | 40 | 36        | 40 | 40        | 45 | 44   | 46 | 48   | 55 | 32   | 37 | 30   | 40 |
|  | 40  | 40                                    | 42 | 40        | 50 | 42        | 60 | 32        | 45 | 38        | 44 | 45        | 50 | 50   | 58 | 55   | 69 | 41   | 44 | 36   | 47 |
|  | 60  | 42                                    | 44 | 44        | 55 | 46        | 65 | 36        | 55 | 42        | 48 | 50        | 60 | 55   | 66 | 64   | 85 | 42   | 49 | 42   | 56 |
|  | 80  | 46                                    | 48 | 48        | 60 | 50        | 70 | 40        | 60 | 44        | 52 | 56        | 70 | 61   | 76 | 72   | 90 | 44   | 56 | 48   | 66 |
|  | 100 | 48                                    | 52 | 50        | 65 | 52        | 75 | 45        | 70 | 48        | 56 | 60        | 75 | 66   | 90 | 80   | -  | 52   | 65 | 53   | 79 |
|  | 125 | 52                                    | 56 | 54        | 70 | 60        | 85 | 50        | 75 | 50        | 60 | 64        | 80 | 78   | -  | 90   | -  | 63   | 73 | 59   | 90 |
|  | 150 | 56                                    | 60 | 58        | 75 | 68        | -  | 55        | 85 | 52        | 65 | 68        | -  | 81   | -  | -    | -  | 71   | 83 | 65   | -  |
| PTFE Diaphragm <sup>1</sup>  | 20  | 42                                    | 50 | 46        | 66 | 55        | 55 | 50        | 55 | 45        | 52 | 48        | 50 | 64   | 60 | 78   | 80 | 36   | 53 | 46   | 48 |
|  | 40  | 44                                    | 52 | 50        | 68 | 58        | 60 | 55        | 60 | 50        | 56 | 50        | 60 | 68   | 78 | 84   | 90 | 44   | 60 | 52   | 66 |
|  | 60  | 48                                    | 56 | 52        | 72 | 60        | 65 | 60        | 65 | 55        | 60 | 56        | 70 | 74   | 88 | 90   | -  | 51   | 75 | 56   | 74 |
|  | 80  | 52                                    | 60 | 56        | 76 | 65        | 70 | 65        | 70 | 60        | 64 | 64        | 80 | 78   | -  | -    | -  | 55   | 85 | 62   | 81 |
|  | 100 | 54                                    | 65 | 60        | 82 | 68        | 75 | 70        | 80 | 64        | 68 | 70        | 90 | 84   | -  | -    | -  | 57   | -  | 70   | 90 |
|  | 125 | 58                                    | 70 | 64        | 86 | 74        | 80 | 75        | -  | 68        | 72 | 76        | -  | 90   | -  | -    | -  | 59   | -  | 79   | -  |
|  | 150 | 62                                    | 75 | 68        | -  | 80        | 85 | 80        | -  | 72        | 76 | 82        | -  | -    | -  | -    | -  | 63   | -  | 83   | -  |

| Fail Open Actuators - Air-To-Close, Spring-To-Open (Direct Acting) |       |                                      |      |           |      |           |      |           |      |           |      |           |      |      |      |       |      |      |      |       |      |
|--|-------|--------------------------------------|------|-----------|------|-----------|------|-----------|------|-----------|------|-----------|------|------|------|-------|------|------|------|-------|------|
|  |       | Air Pressure Required to Close (bar) |      |           |      |           |      |           |      |           |      |           |      |      |      |       |      |      |      |       |      |
| Size   |       | Bio-Tek <sup>2</sup>                 |      | DN15      |      | DN20      |      | DN25      |      | DN40      |      | DN50      |      | DN80 |      | DN100 |      | DN80 |      | DN100 |      |
| Actuator   |       | A103/B103                            |      | A105/B105 |      | A108/B108 |      | A108/B108 |      | A116/B116 |      | A116/B116 |      | A133 |      | A133  |      | A147 |      | A147  |      |
| Line Pressure  |       | % ΔP                                 |      |           |      |           |      |           |      |           |      |           |      |      |      |       |      |      |      |       |      |
|  |       | 100                                  | 0    | 100       | 0    | 100       | 0    | 100       | 0    | 100       | 0    | 100       | 0    | 100  | 0    | 100   | 0    | 100  | 0    | 100   | 0    |
| Elastomer Diaphragm  | 1,38  | 2,62                                 | 2,76 | 2,62      | 3,10 | 2,62      | 3,79 | 1,93      | 2,76 | 2,48      | 2,76 | 2,76      | 3,10 | 3,03 | 3,17 | 3,31  | 3,79 | 2,21 | 2,55 | 2,07  | 2,76 |
|  | 2,76  | 2,76                                 | 2,90 | 2,21      | 3,45 | 2,70      | 4,14 | 2,21      | 3,10 | 2,62      | 3,03 | 3,10      | 3,45 | 3,45 | 4,00 | 3,79  | 4,76 | 2,83 | 3,03 | 2,48  | 3,24 |
|  | 4,14  | 2,90                                 | 3,03 | 3,03      | 3,79 | 3,17      | 4,48 | 2,48      | 3,79 | 2,90      | 3,31 | 3,45      | 4,14 | 3,79 | 4,55 | 4,41  | 5,86 | 2,90 | 3,38 | 2,90  | 3,86 |
|  | 5,52  | 3,17                                 | 3,31 | 3,31      | 4,14 | 3,45      | 4,83 | 2,76      | 4,14 | 3,03      | 3,56 | 3,86      | 4,83 | 4,21 | 5,24 | 4,97  | 6,21 | 3,03 | 3,86 | 3,31  | 4,55 |
|  | 6,89  | 3,31                                 | 3,59 | 3,45      | 4,48 | 3,59      | 5,17 | 3,10      | 4,83 | 3,31      | 3,86 | 4,14      | 5,17 | 4,55 | 6,21 | 5,52  | -    | 3,59 | 4,48 | 3,65  | 5,45 |
|  | 8,62  | 3,59                                 | 3,86 | 3,72      | 4,83 | 4,14      | 5,86 | 3,45      | 5,17 | 3,45      | 4,13 | 4,41      | 5,52 | 5,38 | -    | 6,21  | -    | 4,34 | 5,03 | 4,07  | 6,21 |
|  | 10,34 | 3,86                                 | 4,14 | 4,00      | 5,17 | 4,70      | -    | 3,79      | 5,86 | 3,59      | 4,48 | 4,69      | -    | 5,59 | -    | -     | -    | 4,90 | 5,72 | 4,48  | -    |
| PTFE Diaphragm <sup>1</sup>  | 1,38  | 2,90                                 | 3,45 | 3,17      | 4,55 | 3,79      | 3,79 | 3,45      | 3,79 | 3,10      | 3,59 | 3,31      | 3,45 | 4,41 | 4,14 | 5,38  | 5,52 | 2,48 | 3,65 | 3,17  | 3,31 |
|  | 2,76  | 3,03                                 | 3,59 | 3,45      | 4,70 | 4,00      | 4,14 | 3,79      | 4,14 | 3,45      | 3,86 | 3,45      | 4,14 | 4,69 | 5,38 | 5,79  | 6,21 | 3,03 | 4,14 | 3,59  | 4,55 |
|  | 4,14  | 3,31                                 | 3,86 | 3,59      | 4,97 | 4,14      | 4,48 | 4,14      | 4,48 | 3,79      | 4,14 | 3,86      | 4,83 | 5,10 | 6,07 | 6,21  | -    | 3,52 | 5,17 | 3,86  | 5,10 |
|  | 5,52  | 3,59                                 | 4,14 | 3,86      | 5,24 | 4,48      | 4,83 | 4,48      | 4,83 | 4,14      | 4,41 | 4,41      | 5,52 | 5,38 | -    | -     | -    | 3,79 | 5,86 | 4,27  | 5,58 |
|  | 6,89  | 3,72                                 | 4,48 | 4,14      | 5,65 | 4,69      | 5,17 | 4,83      | 5,52 | 4,41      | 4,69 | 4,83      | 6,21 | 5,79 | -    | -     | -    | 3,93 | -    | 4,83  | 6,21 |
|  | 8,62  | 4,00                                 | 4,83 | 4,41      | 5,93 | 5,10      | 5,52 | 5,17      | -    | 4,69      | 4,97 | 5,24      | -    | 6,21 | -    | -     | -    | 4,07 | -    | 5,45  | -    |
|  | 10,34 | 4,27                                 | 5,17 | 4,70      | -    | 5,52      | 5,86 | 5,52      | -    | 4,96      | 5,24 | 5,65      | -    | -    | -    | -     | -    | 4,34 | -    | 5,72  | -    |

<sup>1</sup> The exposure of the diaphragm to steam may increase the air requirements to close by as much as 30%.

<sup>2</sup> Bio-Tek includes size 0.25" (DN8), 0.375" (DN10), and 0.5" (DN15).

Note: See Page G-9 brochure for ΔP Pressure Drop definition.



Advantage® and Advantage® 2.0 Actuator Sizing - Double Acting

| Double Acting Actuators - Air-To-Close, Air-To-Open |     |                                       |     |           |     |           |     |           |     |           |     |           |     |      |     |      |     |      |     |      |    |
|---|-----|---------------------------------------|-----|-----------|-----|-----------|-----|-----------|-----|-----------|-----|-----------|-----|------|-----|------|-----|------|-----|------|----|
|   |     | Air Pressure Required to Close (psig) |     |           |     |           |     |           |     |           |     |           |     |      |     |      |     |      |     |      |    |
| Size  |     | Bio-Tek <sup>2</sup>                  |     | 0.5"      |     | 0.75"     |     | 1"        |     | 1.5"      |     | 2"        |     | 3"   |     | 4"   |     | 3"   |     | 4"   |    |
| Actuator  |     | A303/B303                             |     | A305/B305 |     | A308/B308 |     | A308/B308 |     | A316/B316 |     | A316/B316 |     | A333 |     | A333 |     | A347 |     | A147 |    |
| Line Pressure                                       |     | % ΔP                                  |     |           |     |           |     |           |     |           |     |           |     |      |     |      |     |      |     |      |    |
| Elastomer Diaphragm <sup>1</sup>                    | 100 | 0                                     | 100 | 0         | 100 | 0         | 100 | 0         | 100 | 0         | 100 | 0         | 100 | 0    | 100 | 0    | 100 | 0    | 100 | 0    |    |
|   | 20  | 22                                    | 26  | 24        | 30  | 18        | 25  | 12        | 20  | 16        | 20  | 22        | 40  | 18   | 24  | 16   | 25  | 11   | 14  | 9    | 25 |
|   | 40  | 24                                    | 28  | 26        | 35  | 20        | 30  | 16        | 25  | 20        | 25  | 26        | 45  | 26   | 29  | 24   | 38  | 17   | 21  | 15   | 30 |
|   | 60  | 26                                    | 30  | 28        | 40  | 24        | 35  | 20        | 35  | 24        | 30  | 30        | 50  | 32   | 38  | 30   | 55  | 22   | 28  | 22   | 46 |
|   | 80  | 28                                    | 32  | 32        | 45  | 26        | 40  | 24        | 40  | 28        | 35  | 35        | 55  | 38   | 48  | 38   | 68  | 23   | 35  | 27   | 60 |
|   | 100 | 30                                    | 34  | 34        | 50  | 30        | 50  | 28        | 50  | 32        | 40  | 40        | 60  | 42   | 58  | 48   | 84  | 26   | 43  | 32   | 68 |
|   | 125 | 32                                    | 38  | 38        | 55  | 34        | 55  | 36        | 55  | 36        | 45  | 45        | 70  | 52   | 68  | 58   | -   | 34   | 53  | 40   | 76 |
| PTFE Diaphragm <sup>1</sup>                         | 150 | 34                                    | 44  | 42        | 60  | 38        | 60  | 44        | 65  | 40        | 50  | 50        | 80  | 57   | 80  | 68   | -   | 37   | 61  | 49   | 88 |
|   | 20  | 34                                    | 36  | 34        | 36  | 28        | 30  | 25        | 35  | 25        | 34  | 35        | 40  | 38   | 38  | 42   | 44  | 19   | 33  | 31   | 37 |
|   | 40  | 36                                    | 40  | 36        | 40  | 34        | 35  | 35        | 40  | 30        | 38  | 40        | 50  | 41   | 49  | 50   | 60  | 21   | 40  | 35   | 53 |
|   | 60  | 40                                    | 44  | 40        | 46  | 38        | 40  | 45        | 50  | 35        | 42  | 50        | 60  | 47   | 58  | 56   | 74  | 29   | 46  | 44   | 59 |
|   | 80  | 42                                    | 46  | 42        | 50  | 40        | 45  | 50        | 55  | 40        | 46  | 55        | 70  | 53   | 67  | 65   | 90  | 32   | 51  | 49   | 65 |
|   | 100 | 44                                    | 52  | 44        | 54  | 42        | 50  | 55        | 60  | 45        | 50  | 60        | 80  | 58   | 78  | 73   | -   | 35   | 58  | 54   | 77 |
|   | 125 | 46                                    | 56  | 46        | 58  | 44        | 55  | 60        | 70  | 50        | 55  | 64        | 90  | 64   | 90  | 82   | -   | 42   | 68  | 62   | -  |
| 150   | 48  | 62                                    | 48  | 62        | 46  | 60        | 65  | 80        | 55  | 62        | 68  | -         | 69  | -    | 90  | -    | 45  | 78   | 68  | -    |    |

| Double Acting Actuators - Air-To-Close, Air-To-Open |       |                                      |      |           |      |           |      |           |      |           |      |           |      |      |      |       |      |      |      |       |      |
|---|-------|--------------------------------------|------|-----------|------|-----------|------|-----------|------|-----------|------|-----------|------|------|------|-------|------|------|------|-------|------|
|   |       | Air Pressure Required to Close (bar) |      |           |      |           |      |           |      |           |      |           |      |      |      |       |      |      |      |       |      |
| Size  |       | Bio-Tek <sup>2</sup>                 |      | DN15      |      | DN20      |      | DN25      |      | DN40      |      | DN50      |      | DN80 |      | DN100 |      | DN80 |      | DN100 |      |
| Actuator  |       | A303/B303                            |      | A305/B305 |      | A308/B308 |      | A308/B308 |      | A316/B316 |      | A316/B316 |      | A333 |      | A333  |      | A347 |      | A147  |      |
| Line Pressure                                       |       | % ΔP                                 |      |           |      |           |      |           |      |           |      |           |      |      |      |       |      |      |      |       |      |
| Elastomer Diaphragm <sup>1</sup>                    | 100   | 0                                    | 100  | 0         | 100  | 0         | 100  | 0         | 100  | 0         | 100  | 0         | 100  | 0    | 100  | 0     | 100  | 0    | 100  | 0     |      |
|   | 1,38  | 1,51                                 | 1,79 | 1,65      | 2,07 | 1,24      | 1,72 | 0,83      | 1,38 | 1,10      | 1,38 | 1,52      | 2,76 | 1,24 | 1,66 | 1,10  | 1,72 | 0,76 | 0,79 | 0,62  | 1,72 |
|   | 2,76  | 1,65                                 | 1,93 | 1,79      | 2,41 | 1,38      | 2,07 | 1,10      | 1,72 | 1,38      | 1,72 | 1,79      | 3,10 | 1,79 | 2,00 | 1,66  | 2,62 | 1,17 | 1,45 | 1,03  | 2,07 |
|   | 4,14  | 1,79                                 | 2,07 | 1,93      | 2,75 | 1,65      | 2,41 | 1,38      | 2,41 | 1,65      | 2,07 | 2,07      | 3,45 | 2,21 | 2,62 | 2,07  | 3,79 | 1,52 | 1,93 | 1,52  | 3,17 |
|   | 5,52  | 1,93                                 | 2,21 | 2,21      | 3,10 | 1,79      | 2,76 | 1,65      | 2,76 | 1,93      | 2,41 | 2,41      | 3,79 | 2,62 | 3,31 | 2,62  | 4,69 | 1,59 | 2,41 | 1,86  | 4,14 |
|   | 6,89  | 2,07                                 | 2,34 | 2,34      | 3,45 | 2,07      | 3,45 | 1,93      | 3,45 | 2,21      | 2,76 | 2,76      | 4,14 | 2,90 | 4,00 | 3,31  | 5,79 | 1,79 | 2,96 | 2,21  | 4,69 |
|   | 8,62  | 2,21                                 | 2,62 | 2,62      | 3,79 | 2,34      | 3,79 | 2,48      | 3,79 | 2,48      | 3,10 | 3,10      | 4,83 | 3,59 | 4,69 | 4,00  | -    | 2,34 | 3,65 | 2,76  | 5,24 |
| PTFE Diaphragm <sup>1</sup>                         | 10,34 | 2,34                                 | 3,03 | 2,90      | 4,14 | 2,62      | 4,14 | 3,03      | 4,48 | 2,76      | 3,45 | 3,45      | 5,52 | 3,93 | 5,52 | 4,69  | -    | 2,55 | 4,21 | 3,38  | 6,07 |
|   | 1,38  | 2,34                                 | 2,48 | 2,34      | 2,48 | 1,93      | 2,07 | 1,72      | 2,41 | 1,72      | 2,34 | 2,41      | 2,76 | 2,62 | 2,62 | 2,90  | 3,03 | 1,31 | 2,28 | 2,14  | 2,55 |
|   | 2,76  | 2,45                                 | 2,76 | 2,48      | 2,76 | 2,34      | 2,41 | 2,41      | 2,76 | 2,07      | 2,62 | 2,76      | 3,45 | 2,83 | 3,38 | 3,45  | 4,14 | 1,45 | 2,76 | 2,41  | 3,66 |
|   | 4,14  | 2,76                                 | 3,03 | 2,76      | 3,17 | 2,62      | 2,76 | 3,10      | 3,45 | 2,41      | 2,90 | 3,45      | 4,14 | 3,24 | 4,00 | 3,86  | 5,10 | 2,00 | 3,17 | 3,03  | 4,07 |
|   | 5,52  | 2,90                                 | 3,17 | 2,90      | 3,45 | 2,76      | 3,10 | 3,45      | 3,79 | 2,76      | 3,17 | 3,79      | 4,83 | 3,66 | 4,62 | 4,48  | 6,21 | 2,21 | 3,52 | 3,38  | 4,48 |
|   | 6,89  | 3,03                                 | 3,57 | 3,03      | 3,72 | 2,90      | 3,45 | 3,79      | 4,14 | 3,10      | 3,45 | 4,14      | 5,52 | 4,00 | 5,38 | 5,03  | -    | 2,41 | 4,00 | 3,72  | 5,31 |
|   | 8,62  | 3,17                                 | 3,86 | 3,17      | 4,00 | 3,03      | 3,79 | 4,14      | 4,83 | 3,45      | 3,79 | 4,41      | 6,21 | 4,41 | 6,21 | 5,66  | -    | 2,90 | 4,69 | 4,28  | -    |
| 10,34   | 3,31  | 4,27                                 | 3,31 | 4,28      | 3,17 | 4,14      | 4,48 | 5,52      | 3,79 | 4,28      | 4,69 | -         | 4,76 | -    | 6,21 | -     | 3,10 | 5,38 | 4,69 | -     |      |

<sup>1</sup> The exposure of the diaphragm to steam may increase the air requirements to close by as much as 30%.

<sup>2</sup> Bio-Tek includes size 0.25" (DN8), 0.375" (DN10), and 0.5" (DN15).

Note: See Page G-9 brochure for ΔP Pressure Drop definition.



Advantage® Excel Actuator Sizing - Fail Close

| Fail Close Actuators - Air-To-Open, Spring-To-Close (Reverse Acting) |                |                              |      |       |     |      |     |                 |      |       |     |      |  |    |
|--|----------------|------------------------------|------|-------|-----|------|-----|-----------------|------|-------|-----|------|--|----|
|  | Spring Package | Maximum Line Pressure (psig) |      |       |     |      |     |                 |      |       |     |      | Air pressure required to open for full stroke at 0 psi line pressure |    |
|  |                | Valve Size                   |      |       |     |      |     |                 |      |       |     |      |  |    |
|  |                | 100 % ΔP                     |      |       |     |      |     | 0% ΔP           |      |       |     |      |  |    |
|  |                | BP <sup>2</sup>              | 0.5" | 0.75" | 1"  | 1.5" | 2"  | BP <sup>2</sup> | 0.5" | 0.75" | 1"  | 1.5" | 2"   |    |
| Elastomer Diaphragm  | 60#            | 150                          |      |       |     |      |     | 125             |      |       |     |      |  | 58 |
|  | 90#            | 150                          |      |       |     |      |     | 150             |      |       |     |      |  | 84 |
|  | 60#            |                              | 120  |       |     |      |     |                 | 50   |       |     |      |  | 65 |
|  | 90#            |                              | 150  |       |     |      |     |                 | 105  |       |     |      |  | 80 |
|  | 60#            |                              |      | 150   |     |      |     |                 |      | 80    |     |      |  | 69 |
|  | 90#            |                              |      | 150   |     |      |     |                 |      | 110   |     |      |  | 74 |
|  | 60#            |                              |      |       | 150 |      |     |                 |      |       | 110 |      |  | 71 |
|  | 90#            |                              |      |       | 150 |      |     |                 |      |       | 130 |      |  | 77 |
|  | 60#            |                              |      |       |     | 135  |     |                 |      |       |     | 90   |  | 61 |
|  | 90#            |                              |      |       |     | 150  |     |                 |      |       |     | 110  |  | 76 |
|  | 60#            |                              |      |       |     |      | 80  |                 |      |       |     |      | 55   | 59 |
|  | 90#            |                              |      |       |     |      | 150 |                 |      |       |     |      | 90   | 77 |
| PTFE Diaphragm <sup>1</sup>  | 60#            | -                            |      |       |     |      |     | -               |      |       |     |      |  | -  |
|  | 90#            | 150                          |      |       |     |      |     | 140             |      |       |     |      |  | 87 |
|  | 60#            |                              | 60   |       |     |      |     |                 | 30   |       |     |      |  | 70 |
|  | 90#            |                              | 120  |       |     |      |     |                 | 50   |       |     |      |  | 89 |
|  | 60#            |                              |      | 150   |     |      |     |                 |      | 90    |     |      |  | 69 |
|  | 90#            |                              |      | 150   |     |      |     |                 |      | 130   |     |      |  | 82 |
|  | 60#            |                              |      |       | 80  |      |     |                 |      |       | 50  |      |  | 69 |
|  | 90#            |                              |      |       | 130 |      |     |                 |      |       | 70  |      |  | 80 |
|  | 60#            |                              |      |       |     | 50   |     |                 |      |       |     | 15   |  | 67 |
|  | 90#            |                              |      |       |     | 105  |     |                 |      |       |     | 60   |  | 80 |
|  | 60#            |                              |      |       |     |      | 55  |                 |      |       |     |      | 30   | 62 |
|  | 90#            |                              |      |       |     |      | 100 |                 |      |       |     |      | 45   | 80 |

| Fail Close Actuators - Air-To-Open, Spring-To-Close (Reverse Acting) |                |                             |       |       |       |       |       |                 |      |      |      |      |  |      |
|--|----------------|-----------------------------|-------|-------|-------|-------|-------|-----------------|------|------|------|------|--|------|
|  | Spring Package | Maximum Line Pressure (bar) |       |       |       |       |       |                 |      |      |      |      | Air pressure required to open for full stroke at 0 bar line pressure |      |
|  |                | Valve Size                  |       |       |       |       |       |                 |      |      |      |      |  |      |
|  |                | 100 % ΔP                    |       |       |       |       |       | 0% ΔP           |      |      |      |      |  |      |
|  |                | BP <sup>2</sup>             | DN15  | DN20  | DN25  | DN40  | DN50  | BP <sup>2</sup> | DN15 | DN20 | DN25 | DN40 | DN50   |      |
| Elastomer Diaphragm  | 4 bar          | 10,34                       |       |       |       |       |       | 8,62            |      |      |      |      |  | 4,00 |
|  | 6 bar          | 10,34                       |       |       |       |       |       | 10,34           |      |      |      |      |  | 5,79 |
|  | 4 bar          |                             | 7,58  |       |       |       |       |                 | 4,83 |      |      |      |  | 3,79 |
|  | 6 bar          |                             | 10,34 |       |       |       |       |                 | 7,24 |      |      |      |  | 4,96 |
|  | 4 bar          |                             |       | 10,34 |       |       |       |                 |      | 6,89 |      |      |  | 4,14 |
|  | 6 bar          |                             |       | 10,34 |       |       |       |                 |      | 7,58 |      |      |  | 5,17 |
|  | 4 bar          |                             |       |       | 10,34 |       |       |                 |      |      | 7,58 |      |  | 4,41 |
|  | 6 bar          |                             |       |       | 10,34 |       |       |                 |      |      | 8,96 |      |  | 5,31 |
|  | 4 bar          |                             |       |       |       | 7,58  |       |                 |      |      |      | 6,21 |  | 4,21 |
|  | 6 bar          |                             |       |       |       | 10,34 |       |                 |      |      |      | 7,58 |  | 5,24 |
|  | 4 bar          |                             |       |       |       |       | 5,52  |                 |      |      |      |      | 3,79   | 4,07 |
|  | 6 bar          |                             |       |       |       |       | 10,34 |                 |      |      |      |      | 6,55   | 5,31 |
| PTFE Diaphragm <sup>1</sup>  | 4 bar          | -                           |       |       |       |       |       | -               |      |      |      |      |  | -    |
|  | 6 bar          | 10,34                       |       |       |       |       |       | 9,65            |      |      |      |      |  | 6,00 |
|  | 4 bar          |                             | 4,14  |       |       |       |       |                 | 2,76 |      |      |      |  | 4,83 |
|  | 6 bar          |                             | 8,27  |       |       |       |       |                 | 3,45 |      |      |      |  | 6,14 |
|  | 4 bar          |                             |       | 10,34 |       |       |       |                 |      | 6,21 |      |      |  | 4,76 |
|  | 6 bar          |                             |       | 10,34 |       |       |       |                 |      | 8,96 |      |      |  | 5,52 |
|  | 4 bar          |                             |       |       | 5,52  |       |       |                 |      |      | 3,45 |      |  | 4,76 |
|  | 6 bar          |                             |       |       | 10,34 |       |       |                 |      |      | 5,52 |      |  | 5,72 |
|  | 4 bar          |                             |       |       |       | 3,45  |       |                 |      |      |      | 1,03 |  | 4,62 |
|  | 6 bar          |                             |       |       |       | 7,24  |       |                 |      |      |      | 4,48 |  | 5,58 |
|  | 4 bar          |                             |       |       |       |       | 3,79  |                 |      |      |      |      | 2,07   | 4,14 |
|  | 6 bar          |                             |       |       |       |       | 6,89  |                 |      |      |      |      | 3,10   | 5,38 |

<sup>1</sup> The exposure of the diaphragm to steam may increase the air requirements to close by as much as 30%.

<sup>2</sup> Bio-Pure includes size 0.25" (DN8), 0.375" (DN10), and 0.5" (DN15).

Note: See page G-9 brochure for ΔP Pressure Drop definition.



Advantage® Excel Actuator Sizing - Fail Open

| Fail Open Actuators - Air-To-Close, Spring-To-Open (Direct Acting) |               |                                       |    |      |    |       |    |     |    |      |    |     |     |
|--|---------------|---------------------------------------|----|------|----|-------|----|-----|----|------|----|-----|-----|
|  | Line Pressure | Air Pressure Required to Close (psig) |    |      |    |       |    |     |    |      |    |     |     |
|  |               | Bio-Pure <sup>2</sup>                 |    | 0.5" |    | 0.75" |    | 1"  |    | 1.5" |    | 2"  |     |
|  |               | % ΔP                                  |    |      |    |       |    |     |    |      |    |     |     |
|  |               | 100                                   | 0  | 100  | 0  | 100   | 0  | 100 | 0  | 100  | 0  | 100 | 0   |
| Elastomer Diaphragm <sup>1</sup>                                   | 20            | 46                                    | 43 | 49   | 49 | 55    | 56 | 41  | 48 | 31   | 38 | 47  | 59  |
|  | 40            | 49                                    | 48 | 52   | 56 | 58    | 63 | 46  | 56 | 36   | 47 | 52  | 67  |
|  | 60            | 52                                    | 52 | 54   | 63 | 61    | 69 | 50  | 64 | 41   | 55 | 57  | 75  |
|  | 80            | 54                                    | 57 | 56   | 69 | 64    | 75 | 54  | 71 | 46   | 63 | 62  | 83  |
|  | 100           | 57                                    | 61 | 59   | 76 | 67    | 82 | 59  | 79 | 51   | 72 | 67  | 90  |
|  | 125           | 60                                    | 67 | 62   | 84 | 70    | 90 | 64  | 88 | 57   | 82 | 73  | 100 |
|  | 150           | 63                                    | 72 | 64   | 92 | 73    | 97 | 69  | 97 | 62   | 92 | 78  | -   |
| PTFE Diaphragm <sup>1</sup>  | 20            | 72                                    | 61 | 61   | 62 | 79    | 67 | 79  | 82 | 64   | 64 | 55  | 66  |
|  | 40            | 75                                    | 66 | 65   | 67 | 83    | 73 | 84  | 90 | 68   | 74 | 60  | 83  |
|  | 60            | 77                                    | 70 | 69   | 72 | 87    | 79 | 89  | 98 | 71   | 83 | 64  | 100 |
|  | 80            | 79                                    | 74 | 72   | 76 | 91    | 84 | 94  | -  | 74   | 92 | 65  | -   |
|  | 100           | 81                                    | 78 | 76   | 81 | 95    | 90 | 99  | -  | 77   | -  | 73  | -   |
|  | 125           | 84                                    | 83 | 80   | 87 | 100   | 97 | -   | -  | 81   | -  | 78  | -   |
|  | 150           | 86                                    | 88 | 84   | 92 | -     | -  | -   | -  | 84   | -  | 83  | -   |

| Fail Open Actuators - Air-To-Close, Spring-To-Open (Direct Acting) |               |                                      |      |      |      |      |      |      |      |      |      |      |      |
|--|---------------|--------------------------------------|------|------|------|------|------|------|------|------|------|------|------|
|  | Line Pressure | Air Pressure Required to Close (bar) |      |      |      |      |      |      |      |      |      |      |      |
|  |               | Bio-Pure <sup>2</sup>                |      | DN15 |      | DN20 |      | DN25 |      | DN40 |      | DN50 |      |
|  |               | % ΔP                                 |      |      |      |      |      |      |      |      |      |      |      |
|  |               | 100                                  | 0    | 100  | 0    | 100  | 0    | 100  | 0    | 100  | 0    | 100  | 0    |
| Elastomer Diaphragm <sup>1</sup>                                   | 1,38          | 3,17                                 | 2,96 | 3,17 | 3,10 | 3,72 | 3,79 | 2,76 | 3,10 | 2,00 | 2,48 | 3,03 | 3,38 |
|  | 2,76          | 3,38                                 | 3,31 | 3,38 | 3,59 | 3,93 | 4,21 | 3,03 | 3,65 | 2,34 | 3,10 | 3,45 | 4,00 |
|  | 4,14          | 3,59                                 | 3,59 | 3,59 | 4,00 | 4,07 | 4,62 | 3,31 | 4,21 | 2,69 | 3,65 | 3,79 | 4,62 |
|  | 5,52          | 3,72                                 | 3,93 | 3,79 | 4,41 | 4,21 | 5,03 | 3,59 | 4,76 | 3,03 | 4,21 | 4,14 | 5,17 |
|  | 6,89          | 3,93                                 | 4,21 | 4,00 | 4,90 | 4,41 | 5,38 | 3,86 | 5,31 | 3,38 | 4,83 | 4,48 | 5,79 |
|  | 8,62          | 4,14                                 | 4,62 | 4,21 | 5,45 | 4,62 | 5,86 | 4,21 | 6,00 | 3,79 | 5,52 | 4,96 | 6,55 |
|  | 10,34         | 4,34                                 | 4,96 | 4,41 | 5,93 | 4,76 | 6,34 | 4,48 | 6,48 | 4,21 | 6,21 | 5,38 | -    |
| PTFE Diaphragm <sup>1</sup>  | 1,38          | 4,96                                 | 4,21 | 4,76 | 5,17 | 4,83 | 4,55 | 5,24 | 5,10 | 3,93 | 3,72 | 3,72 | 5,17 |
|  | 2,76          | 5,17                                 | 4,55 | 4,96 | 5,52 | 5,10 | 4,90 | 5,58 | 5,65 | 4,21 | 4,27 | 4,07 | 5,86 |
|  | 4,14          | 5,31                                 | 4,83 | 5,17 | 5,79 | 5,31 | 5,24 | 5,86 | 6,14 | 4,41 | 4,83 | 4,34 | 6,55 |
|  | 5,52          | 5,45                                 | 5,10 | 5,38 | 6,07 | 5,52 | 5,58 | 6,21 | 6,69 | 4,62 | 5,38 | 4,62 | -    |
|  | 6,89          | 5,58                                 | 5,38 | 5,58 | 6,34 | 5,72 | 5,93 | 6,48 | -    | 4,83 | 5,93 | 4,96 | -    |
|  | 8,62          | 5,79                                 | 5,72 | 5,79 | 6,69 | 6,00 | 6,34 | 6,89 | -    | 5,10 | 6,62 | 5,31 | -    |
|  | 10,34         | 5,93                                 | 6,07 | 6,00 | -    | 6,27 | 6,69 | -    | -    | 5,31 | -    | 5,65 | -    |

<sup>1</sup> The exposure of the diaphragm to steam may increase the air requirements to close by as much as 30%.

<sup>2</sup> Bio-Pure includes size 0.25" (DN8), 0.375" (DN10), and 0.5" (DN15).

Note: See Page G-9 brochure for ΔP Pressure Drop definition.



Advantage® Excel Actuator Sizing - Double Acting

| Double Acting Actuators - Air-To-Close, Air-To-Open |               |                                       |    |      |    |       |    |     |    |      |    |     |    |
|---|---------------|---------------------------------------|----|------|----|-------|----|-----|----|------|----|-----|----|
|   | Line Pressure | Air Pressure Required to Close (psig) |    |      |    |       |    |     |    |      |    |     |    |
|   |               | Bio-Pure <sup>2</sup>                 |    | 0.5" |    | 0.75" |    | 1"  |    | 1.5" |    | 2"  |    |
|   |               | % ΔP                                  |    |      |    |       |    |     |    |      |    |     |    |
|   |               | 100                                   | 0  | 100  | 0  | 100   | 0  | 100 | 0  | 100  | 0  | 100 | 0  |
| Elastomer Diaphragm                                 | 20            | 21                                    | 15 | 27   | 36 | 27    | 30 | 19  | 20 | 18   | 20 | 21  | 23 |
|   | 40            | 24                                    | 20 | 30   | 43 | 30    | 36 | 23  | 27 | 23   | 29 | 27  | 33 |
|   | 60            | 27                                    | 24 | 33   | 50 | 32    | 42 | 26  | 33 | 28   | 37 | 33  | 42 |
|   | 80            | 29                                    | 29 | 36   | 58 | 34    | 48 | 29  | 39 | 32   | 45 | 39  | 54 |
|   | 100           | 32                                    | 33 | 39   | 63 | 37    | 54 | 32  | 45 | 37   | 53 | 44  | 60 |
|   | 125           | 35                                    | 39 | 43   | 71 | 40    | 61 | 36  | 53 | 43   | 63 | 51  | 72 |
| PTFE Diaphragm <sup>1</sup>                         | 150           | 38                                    | 44 | 46   | 79 | 42    | 68 | 40  | 60 | 48   | 73 | 58  | 83 |
|   | 20            | 47                                    | 36 | 52   | 58 | 38    | 36 | 39  | 37 | 47   | 48 | 28  | 34 |
|   | 40            | 50                                    | 41 | 55   | 65 | 42    | 41 | 45  | 46 | 51   | 57 | 34  | 47 |
|   | 60            | 52                                    | 45 | 58   | 71 | 46    | 45 | 50  | 54 | 54   | 65 | 39  | 60 |
|   | 80            | 54                                    | 49 | 60   | 77 | 49    | 49 | 55  | 62 | 57   | 74 | 44  | 73 |
|   | 100           | 56                                    | 53 | 63   | 83 | 53    | 54 | 60  | 71 | 60   | 82 | 49  | 86 |
|   | 125           | 59                                    | 58 | 66   | 91 | 57    | 59 | 67  | 81 | 64   | 93 | 56  | -  |
| 150   | 61            | 63                                    | 69 | 98   | 61 | 64    | 73 | 91  | 68 | -    | 62 | -   |    |

| Double Acting Actuators - Air-To-Close, Air-To-Open |               |                                      |      |      |      |      |      |      |      |      |      |      |      |
|---|---------------|--------------------------------------|------|------|------|------|------|------|------|------|------|------|------|
|   | Line Pressure | Air Pressure Required to Close (bar) |      |      |      |      |      |      |      |      |      |      |      |
|   |               | Bio-Pure <sup>2</sup>                |      | DN15 |      | DN20 |      | DN25 |      | DN40 |      | DN50 |      |
|   |               | %ΔP                                  |      |      |      |      |      |      |      |      |      |      |      |
|   |               | 100                                  | 0    | 100  | 0    | 100  | 0    | 100  | 0    | 100  | 0    | 100  | 0    |
| Elastomer Diaphragm                                 | 1,38          | 1,45                                 | 1,03 | 1,79 | 2,62 | 1,86 | 1,93 | 1,10 | 1,38 | 1,10 | 1,03 | 1,03 | 1,31 |
|   | 2,76          | 1,65                                 | 1,38 | 2,07 | 2,96 | 2,07 | 2,34 | 1,38 | 1,86 | 1,45 | 1,65 | 1,45 | 2,07 |
|   | 4,14          | 1,86                                 | 1,65 | 2,28 | 3,31 | 2,21 | 2,76 | 1,65 | 2,28 | 1,79 | 2,21 | 1,79 | 2,76 |
|   | 5,52          | 2,00                                 | 2,00 | 2,48 | 3,65 | 2,34 | 3,10 | 1,93 | 2,69 | 2,07 | 2,76 | 2,14 | 3,45 |
|   | 6,89          | 2,21                                 | 2,28 | 2,69 | 4,00 | 2,48 | 3,52 | 2,21 | 3,17 | 2,41 | 3,38 | 2,48 | 4,14 |
|   | 8,62          | 2,41                                 | 2,69 | 2,96 | 4,41 | 2,69 | 4,00 | 2,55 | 3,72 | 2,83 | 4,07 | 2,96 | 5,03 |
|   | 10,34         | 2,62                                 | 3,03 | 3,17 | 4,76 | 2,83 | 4,41 | 2,83 | 4,21 | 3,17 | 4,76 | 3,38 | 5,86 |
| PTFE Diaphragm <sup>1</sup>                         | 1,38          | 3,24                                 | 2,48 | 3,59 | 4,00 | 2,28 | 2,14 | 3,38 | 4,00 | 2,69 | 2,83 | 1,93 | 2,14 |
|   | 2,76          | 3,45                                 | 2,83 | 3,86 | 4,48 | 2,55 | 2,55 | 3,65 | 4,55 | 2,96 | 3,38 | 2,07 | 3,10 |
|   | 4,14          | 3,59                                 | 3,10 | 4,07 | 4,90 | 2,76 | 2,90 | 3,93 | 5,03 | 3,17 | 3,93 | 2,34 | 4,00 |
|   | 5,52          | 3,72                                 | 3,38 | 4,34 | 5,38 | 2,96 | 3,24 | 4,21 | 5,52 | 3,38 | 4,48 | 2,62 | 4,90 |
|   | 6,89          | 3,86                                 | 3,65 | 4,55 | 5,79 | 3,17 | 3,59 | 4,48 | 6,00 | 3,59 | 5,03 | 2,90 | 5,93 |
|   | 8,62          | 4,07                                 | 4,00 | 4,83 | 6,34 | 3,45 | 4,07 | 4,83 | 6,62 | 3,86 | 5,72 | 3,24 | -    |
|   | 10,34         | 4,21                                 | 4,34 | 5,10 | 6,89 | 3,65 | 4,48 | 5,17 | -    | 4,14 | 6,34 | 3,52 | -    |

<sup>1</sup> The exposure of the diaphragm to steam may increase the air requirements to close by as much as 30%.

<sup>2</sup> Bio-Pure includes size 0.25" (DN8), 0.375" (DN10), and 0.5" (DN15).

Note: See Page G-9 brochure for ΔP Pressure Drop definition.



## Advantage Piston Actuator (APA) Sizing

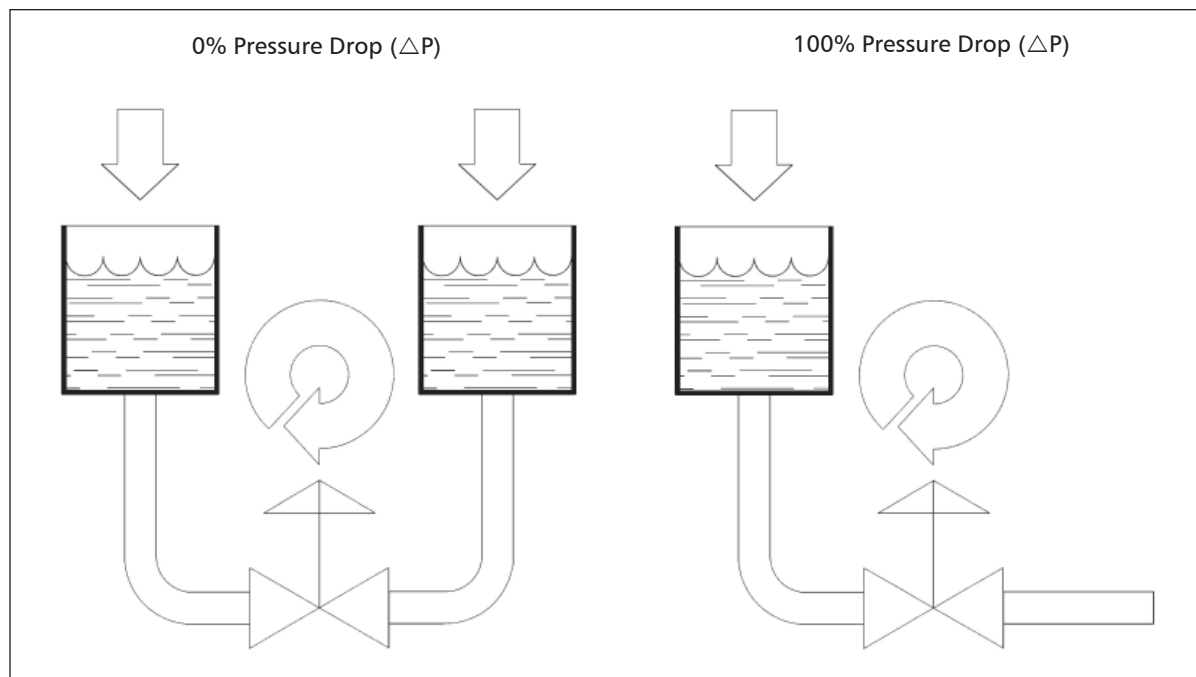
| Fail Close Actuators - Air-To-Open, Spring-To-Close (Reverse Acting) |                              |       |     |      |     |       |       |     |      |    |  |
|--|------------------------------|-------|-----|------|-----|-------|-------|-----|------|----|--|
| Actuator and Spring Package  | Maximum Line Pressure (psig) |       |     |      |     |       |       |     |      |    | Air pressure required to open for full stroke at 0 psi line pressure |
|  | Valve Size                   |       |     |      |     |       |       |     |      |    |  |
|  | 100 % ΔP                     |       |     |      |     | 0% ΔP |       |     |      |    |  |
|  | 0.5"                         | 0.75" | 1"  | 1.5" | 2"  | 0.5"  | 0.75" | 1"  | 1.5" | 2" |  |
| Elastomer Diaphragm  | AP0506 60#                   | 80    |     |      |     | 60    |       |     |      |    | 60   |
|  | AP0509 90#                   | 150   |     |      |     | 100   |       |     |      |    | 85   |
|  | AP0756 60#                   |       | 100 |      |     |       | 50    |     |      |    | 60   |
|  | AP0759 90#                   |       | 150 |      |     |       | 100   |     |      |    | 85   |
|  | AP1006 60#                   |       |     | 130  |     |       |       | 70  |      |    | 60   |
|  | AP1009 90#                   |       |     | 150  |     |       |       | 110 |      |    | 88   |
|  | AP1506 60#                   |       |     |      | 100 |       |       |     | 50   |    | 54   |
|  | AP1509 90#                   |       |     |      | 150 |       |       |     | 120  |    | 82   |
|  | AP2006 60#                   |       |     |      |     | 70    |       |     |      | 30 | 58   |
|  | AP2009 90#                   |       |     |      |     | 140   |       |     |      | 75 | 90   |
| PTFE Diaphragm <sup>1</sup>  | AP0506 60#                   | 50    |     |      |     | 30    |       |     |      |    | 60   |
|  | AP0509 90#                   | 150   |     |      |     | 70    |       |     |      |    | 85   |
|  | AP0756 60#                   |       | 60  |      |     |       | 60    |     |      |    | 60   |
|  | AP0759 90#                   |       | 105 |      |     |       | 80    |     |      |    | 85   |
|  | AP1006 60#                   |       |     | 40   |     |       |       | 35  |      |    | 60   |
|  | AP1009 90#                   |       |     | 110  |     |       |       | 75  |      |    | 88   |
|  | AP1506 60#                   |       |     |      | 40  |       |       |     | 40   |    | 54   |
|  | AP1509 90#                   |       |     |      | 150 |       |       |     | 90   |    | 82   |
|  | AP2006 60#                   |       |     |      |     | 40    |       |     |      | 20 | 58   |
|  | AP2009 90#                   |       |     |      |     | 90    |       |     |      | 35 | 90   |

| Fail Close Actuators - Air-To-Open, Spring-To-Close (Reverse Acting) |                              |       |       |       |       |       |      |      |      |      |  |
|--|------------------------------|-------|-------|-------|-------|-------|------|------|------|------|--|
| Actuator and Spring Package  | Maximum Line Pressure (psig) |       |       |       |       |       |      |      |      |      | Air pressure required to open for full stroke at 0 bar line pressure |
|  | Valve Size                   |       |       |       |       |       |      |      |      |      |  |
|  | 100 % ΔP                     |       |       |       |       | 0% ΔP |      |      |      |      |  |
|  | DN15                         | DN20  | DN25  | DN40  | DN50  | DN15  | DN20 | DN25 | DN40 | DN50 |  |
| Elastomer Diaphragm  | AP0506 60#                   | 5,52  |       |       |       | 4,14  |      |      |      |      | 4,14   |
|  | AP0509 90#                   | 10,34 |       |       |       | 6,89  |      |      |      |      | 5,86   |
|  | AP0756 60#                   |       | 6,89  |       |       |       | 3,45 |      |      |      | 4,14   |
|  | AP0759 90#                   |       | 10,34 |       |       |       | 6,89 |      |      |      | 5,86   |
|  | AP1006 60#                   |       |       | 8,96  |       |       |      | 4,83 |      |      | 4,14   |
|  | AP1009 90#                   |       |       | 10,34 |       |       |      | 7,58 |      |      | 6,07   |
|  | AP1506 60#                   |       |       |       | 6,89  |       |      |      | 3,45 |      | 3,72   |
|  | AP1509 90#                   |       |       |       | 10,34 |       |      |      | 8,27 |      | 5,65   |
|  | AP2006 60#                   |       |       |       |       | 4,89  |      |      |      | 2,07 | 4,00   |
|  | AP2009 90#                   |       |       |       |       | 9,65  |      |      |      | 5,17 | 6,21   |
| PTFE Diaphragm <sup>1</sup>  | AP0506 60#                   | 3,45  |       |       |       | 2,07  |      |      |      |      | 4,14   |
|  | AP0509 90#                   | 10,34 |       |       |       | 4,83  |      |      |      |      | 5,86   |
|  | AP0756 60#                   |       | 4,14  |       |       |       | 4,14 |      |      |      | 4,14   |
|  | AP0759 90#                   |       | 7,24  |       |       |       | 5,52 |      |      |      | 5,86   |
|  | AP1006 60#                   |       |       | 2,76  |       |       |      | 2,41 |      |      | 4,14   |
|  | AP1009 90#                   |       |       | 7,58  |       |       |      | 5,17 |      |      | 6,07   |
|  | AP1506 60#                   |       |       |       | 2,76  |       |      |      | 2,76 |      | 3,72   |
|  | AP1509 90#                   |       |       |       | 10,34 |       |      |      | 6,21 |      | 5,65   |
|  | AP2006 60#                   |       |       |       |       | 2,76  |      |      |      |      | 4,00   |
|  | AP2009 90#                   |       |       |       |       | 6,21  |      |      |      |      | 6,21   |

<sup>1</sup> The exposure of the diaphragm to steam may increase the air requirements to close by as much as 30%.  
 Note: See Page G-9 brochure for ΔP Pressure Drop definition.



## Pressure Drop Definition



### Approximate Maximum Chamber Volume

| Valve Size                    |                        | Advantage Actuator Upper Chamber |                 | Advantage Actuator Lower Chamber |                 | APA Lower Chamber |                 |
|-------------------------------|------------------------|----------------------------------|-----------------|----------------------------------|-----------------|-------------------|-----------------|
| Inch                          | DN                     | in <sup>3</sup>                  | cm <sup>3</sup> | in <sup>3</sup>                  | cm <sup>3</sup> | in <sup>3</sup>   | cm <sup>3</sup> |
| 0.25, 0.375, 0.5 <sup>1</sup> | 6, 10, 15 <sup>1</sup> | 2.62                             | 43              | 2.26                             | 37              | -                 | -               |
| 0.5                           | 15                     | 5.49                             | 90              | 4.27                             | 70              | 3.22              | 52,8            |
| 0.75                          | 20                     | 12.51                            | 205             | 7.63                             | 125             | 3.72              | 61,0            |
| 1                             | 25                     | 12.08                            | 198             | 9.15                             | 150             | 4.06              | 66,5            |
| 1.5                           | 40                     | 71.00                            | 1163            | 34.78                            | 570             | 14.6              | 239             |
| 2                             | 50                     | 71.00                            | 1163            | 38.75                            | 635             | 18.3              | 300             |
| 3 (47)                        | 80                     | 463.80                           | 7600            | 250.20                           | 4100            | NA                | NA              |
| 4 (47)                        | 100                    | 463.80                           | 7600            | 250.20                           | 4100            | NA                | NA              |

<sup>1</sup> Bio-Tek sizes

### Valve Stroke (approximate)

| Valve Size |         | Manual |      | Actuated |      |
|------------|---------|--------|------|----------|------|
| Inch       | DN      | Inch   | mm   | Inch     | mm   |
| BP/BT      | 8,10,15 | 0.16   | 4,1  | 0.16     | 4,1  |
| 0.5        | 15      | 0.25   | 6,3  | 0.25     | 6,3  |
| 0.75       | 20      | 0.38   | 9,6  | 0.38     | 9,6  |
| 1          | 25      | 0.50   | 12,7 | 0.50     | 12,7 |
| 1.5        | 40      | 0.81   | 20,6 | 0.87     | 20,6 |
| 2          | 50      | 1.00   | 25,4 | 1.00     | 25,4 |
| 3          | 80      | 1.62   | 41,3 | 1.62     | 41,3 |
| 4          | 100     | 2.12   | 53,8 | 1.62     | 41,3 |

## Flow Coefficients

### $C_v$ Ratings for Advantage, APA, 903, 913, 963, and 970 Topworks

| Size (in) | 0.50 | 0.75 | 1.00 | 1.50 | 2.00 | 2.50 | 3.00 | 4.00 <sup>1</sup> |
|-----------|------|------|------|------|------|------|------|-------------------|
| 10% Open  | 0.19 | 1.2  | 2.0  | 6.0  | 6    | 16.0 | 24   | 25.6              |
| 20% Open  | 0.38 | 2.4  | 3.8  | 11.5 | 11   | 29.6 | 44   | 56                |
| 30% Open  | 0.67 | 3.3  | 5.8  | 17.5 | 16   | 41.6 | 68   | 104               |
| 40% Open  | 1.14 | 4.1  | 7.6  | 22.5 | 21   | 52.0 | 92   | 160               |
| 50% Open  | 1.43 | 4.7  | 9.2  | 27.5 | 25   | 60.0 | 108  | 212               |
| 60% Open  | 1.90 | 5.2  | 10.9 | 31.5 | 31   | 66.4 | 124  | 232               |
| 70% Open  | 2.28 | 5.7  | 12.2 | 35.0 | 35   | 71.2 | 132  | 256               |
| 80% Open  | 2.66 | 6.0  | 13.3 | 35.0 | 41   | 75.2 | 136  | 288               |
| 90% Open  | 2.85 | 6.2  | 13.6 | 33.5 | 45   | 76.0 | 140  | 308               |
| 100% Open | 3.33 | 6.2  | 13.6 | 28.0 | 51   | 76.0 | 144  | 320               |

<sup>1</sup>  $C_v$  for 4" valve full open with Advantage Actuator is 272.

### $C_v$ Ratings for Advantage 2.0 and AXS Topworks

| Size (in) | 0.50 | 0.75 | 1.00 | 1.50 | 2.00 |
|-----------|------|------|------|------|------|
| 10% Open  | 0.19 | 1.0  | 1.6  | 4.0  | 5    |
| 20% Open  | 0.38 | 1.9  | 3.2  | 9.0  | 10   |
| 30% Open  | 0.67 | 2.8  | 4.8  | 12.5 | 15   |
| 40% Open  | 1.14 | 3.5  | 6.2  | 16.5 | 19   |
| 50% Open  | 1.43 | 4.1  | 7.6  | 20.0 | 23   |
| 60% Open  | 1.90 | 4.6  | 8.9  | 23.5 | 28   |
| 70% Open  | 2.28 | 5.0  | 10.2 | 27.0 | 33   |
| 80% Open  | 2.66 | 5.5  | 11.3 | 30.5 | 38   |
| 90% Open  | 2.85 | 5.8  | 12.5 | 33.5 | 42   |
| 100% Open | 3.33 | 6.0  | 13.3 | 35.5 | 46   |

### $C_v$ Ratings for Bio-Tek

| Size (in) | 0.25 | 0.375 | 0.50 |
|-----------|------|-------|------|
| 100% Open | 0.89 | 1.92  | 3.03 |

### $C_v$ Ratings for Bio-Pure

| Size (in) | 0.25 | 0.375 | 0.50 |
|-----------|------|-------|------|
| 100% Open | 0.47 | 1.10  | 1.60 |

Note:  $C_v$  values expressed in GPM per one psi pressure drop.

## Flow Coefficients

### K<sub>v</sub> Ratings for Advantage, APA, 903, 913, 963, and 970 Topworks

| Size (DN) | 15   | 20  | 25   | 40   | 50   | 65   | 80    | 100 <sup>1</sup> |
|-----------|------|-----|------|------|------|------|-------|------------------|
| 10% Open  | 0,16 | 1,0 | 1,7  | 5,2  | 5,2  | 13,6 | 20,4  | 21,8             |
| 20% Open  | 0,33 | 2,1 | 3,3  | 9,9  | 9,5  | 25,2 | 37,4  | 47,7             |
| 30% Open  | 0,58 | 2,9 | 5,0  | 15,1 | 13,8 | 35,4 | 57,8  | 88,5             |
| 40% Open  | 0,99 | 3,5 | 6,6  | 19,5 | 18,2 | 44,2 | 78,3  | 136,2            |
| 50% Open  | 1,23 | 4,1 | 8,0  | 23,8 | 21,6 | 51,0 | 91,9  | 180,4            |
| 60% Open  | 1,65 | 4,5 | 9,4  | 27,2 | 26,8 | 56,5 | 105,5 | 197,4            |
| 70% Open  | 1,97 | 4,9 | 10,6 | 30,3 | 30,3 | 60,6 | 112,3 | 217,8            |
| 80% Open  | 2,30 | 5,2 | 11,5 | 30,3 | 35,5 | 64,6 | 115,8 | 245,1            |
| 90% Open  | 2,47 | 5,4 | 11,8 | 29,0 | 38,9 | 64,6 | 119,1 | 262,1            |
| 100% Open | 2,88 | 5,4 | 11,8 | 24,2 | 44,1 | 64,6 | 122,6 | 272,3            |

<sup>1</sup> K<sub>v</sub> for DN100 valve full open with Advantage Actuator is 232.

### K<sub>v</sub> Ratings for Advantage 2.0 and AXS

| Size (DN) | 15   | 20  | 25   | 40   | 50   |
|-----------|------|-----|------|------|------|
| 10% Open  | 0,16 | 0,9 | 1,4  | 3,5  | 4,3  |
| 20% Open  | 0,33 | 1,6 | 2,8  | 7,8  | 8,7  |
| 30% Open  | 0,58 | 2,4 | 4,2  | 10,8 | 13,0 |
| 40% Open  | 0,99 | 3,0 | 5,4  | 14,3 | 16,4 |
| 50% Open  | 1,23 | 3,5 | 6,6  | 17,3 | 19,9 |
| 60% Open  | 1,65 | 4,0 | 7,7  | 20,3 | 24,2 |
| 70% Open  | 1,97 | 4,3 | 8,8  | 23,4 | 28,5 |
| 80% Open  | 2,30 | 4,8 | 9,8  | 26,4 | 32,9 |
| 90% Open  | 2,47 | 5,0 | 10,8 | 29,0 | 36,3 |
| 100% Open | 2,88 | 5,2 | 11,5 | 30,7 | 39,8 |

### K<sub>v</sub> Ratings for Bio-Tek

| Size (DN) | 8    | 10   | 15   |
|-----------|------|------|------|
| 100% Open | 0,76 | 1,63 | 2,58 |

### K<sub>v</sub> Ratings for Bio-Pure

| Size (DN) | 8    | 10   | 15   |
|-----------|------|------|------|
| 100% Open | 0,40 | 0,95 | 1,36 |

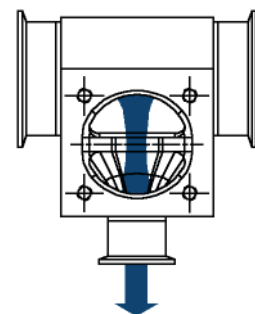
Note: K<sub>v</sub> values expressed in m<sup>3</sup>/h per one bar pressure drop.

### Zerostatic Block Body T Flow Reduction (% Reduction) Estimate of Reduction of C<sub>v</sub> (Standard 2-Way Valve Baseline)

| Valve Size<br>Run Size | BT 0.5" (DN15) | 0.5" (DN15) | 0.75" (DN20) | 1" (DN25) | 1.5" (DN40) | 2" (DN50) |
|------------------------|----------------|-------------|--------------|-----------|-------------|-----------|
| 0.5" (DN15)            | 15.2           | 18.0        | NA           | NA        | NA          | NA        |
| 0.75" (DN20)           | 14.5           | 17.2        | 16.2         | NA        | NA          | NA        |
| 1" (DN25)              | 13.8           | 16.3        | 15.4         | 23.5      | NA          | NA        |
| 1.5" (DN40)            | 13.1           | 15.5        | 14.6         | 22.3      | 25.5        | NA        |
| 2" (DN50)              | 12.4           | 14.6        | 13.8         | 21.0      | 24.1        | 19.0      |
| 2.5" (DN65)            | 12.0           | 14.1        | 13.4         | 20.3      | 23.3        | 18.4      |
| 3" (DN80)              | 12.0           | 14.1        | 13.4         | 20.3      | 23.3        | 18.4      |
| 4" (DN100)             | 11.6           | 13.7        | 12.9         | 19.7      | 22.6        | 17.8      |

Notes: Consider entrance loss (at valve inlet) is similar to flow through branch of standard tee.

Reduced Flow vs.  
Standard 2 Way Valve



Example: 1.5" (DN40) Zero Static Tee with 3" (DN80) Run

$$\begin{aligned} \text{Approximate 100\% open } C_v &= \\ 28 - (23.3\%) (28) &= 21.5 C_v \\ &= 18,3 K_v \end{aligned}$$

## Validation and Qualification Documentation

Pure-Flo can provide the following documentation to aid the validation and qualification process upon request.

### Process Validation Documentation

- Certified Mill Test Reports
- Interior Surface Characterization
- Certification of compliance to specifications
- Certification of compliance to CFR Title #21 section 177
- Certification to latest edition of the USP Class VI compliance
- Quality assurance manual
- ISO 9001 certification
- Certification of testing to MSS SP-88

### Qualification Assistance

To assist you in compliance to IQs, OQs and PQs, a preventative maintenance program can be established for the changeout of diaphragms based on your passivation, cleaning, sterilization and process protocols.

Test Certificate 2005/3004047  
Date 30/06/2005  
Page 1

INDUSTRIAL INC. ITT ENGINEERED VALVES  
550 TEST RD. 33 CENTERVILLE ROAD  
17603 LANCASTER, PA 17603 LANCASTER, PA

|                           |                                      |                    |                         |
|---------------------------|--------------------------------------|--------------------|-------------------------|
| Customer Order #83-SPCKY  | Delivery Note 12005/000/0031635      | Invoice IO 0031639 | Delivered Q by 2,500,00 |
| Code Article #15002163106 | Part Description BODY B10 TEK 113208 | P/N 42409          |                         |

Material - Type Specification  
F316L9/1.4455 ASTM A182+DIN 17440-A ND NABEL STD B22

|                    |                            |            |                |
|--------------------|----------------------------|------------|----------------|
| Heat Number 236913 | Steel Mill TEST INDUSTRIAL | Trade Mark | Forgin Code PM |
|--------------------|----------------------------|------------|----------------|

CHEMICAL ANALYSIS

| Elem.  | C      | Cr     | Co      | Mo     | Ni     | Mn     | P      | S      | Si     | Ti     |
|--------|--------|--------|---------|--------|--------|--------|--------|--------|--------|--------|
| Heat 1 | 0.0160 | 0.0300 | 18.0000 | 0.0000 | 2.0000 | 0.0000 | 0.0010 | 0.0010 | 0.0010 | 0.0010 |

MECHANICAL PROPERTIES

| Laboratory Code | IN               | THICKNESS | YIELD   | TENSILE | ELONG | REDUCED   |
|-----------------|------------------|-----------|---------|---------|-------|-----------|
| 0005/NU/05      | 10178 Sp1t Aab T | 10/mm     | 325,000 | 347,000 | 40%   | 50315,000 |
| 0005/NU/05      | 10178 Sp1t Aab T | 10/mm     | 325,000 | 347,000 | 40%   | 50315,000 |
| 0005/NU/05      | 10178 Sp1t Aab T | 10/mm     | 325,000 | 347,000 | 40%   | 50315,000 |

Heat Treatment  
SOLUTION ANNEAL:  
ALL PIECES WERE HEATED TO 1040 F.  
HELD AT THIS TEMPERATURE FOR 1 HOUR FOR EACH 1" OF THICKNESS AND QUENCHED IN WATER.

APPROVED BY: [Signature]  
NOV 30 2005  
O. A. DEPARTMENT

Remarks  
DELTA FERRITE CONTENT = 0.24  
FERRITE AS TO B22 = 5.56  
MATERIAL FINISHED ACCORDING TO ITT SPEC. ESA-0143 AND ESA-0059  
3.1B CERTIFICATE ACCORDING TO EN 10204

1 - The results of chemical analysis to a test and certified copy of the mill certificate issued by the manufacturer of the steel employed.  
2 - The material or components shipped under the above order number did not come in direct contact with mercury or any of its compounds, or with any mercury containing device employing a single boundary of containment, during the manufacturing process, inspection or storage.



ITT Industries  
Engineered Process Solutions Group  
33 Centerville Road  
P.O. Box 6164  
Lancaster, PA 17603-0064  
Phone: (805) 366-1111  
Fax: (717) 509-2336

### CERTIFICATE OF COMPLIANCE

Date Issued: October 24, 2005

Customer: ABC COEP Quantity: 100  
Customer Order Number: 100000  
ITT Order Number: 76760  
ITT Line Number: 032  
ITT Item Number: 42175

| Item Number (Description) | QTY | DESCRIPTION             |
|---------------------------|-----|-------------------------|
| (A)                       | 100 | KIT DIA-BKG CSH BT TM17 |
| (B)                       | 100 | PEC                     |

Additional Information:

- 34851 DIAPHRAGM BT MC TFM GR TM Quantity: 100  
Care Date: 9/05  
Grade TM (modified PTFE) diaphragms have a LIMITED SHELF LIFE of 14 years.  
Grade TM (modified PTFE) diaphragms comply with the FDA Code of Federal Regulations Title 21 Section 177.1550 and have been tested in accordance with and successfully passed the U.S. Pharmacopoeia XXVII Class VI Biological Reactivity test, Section 67 and Section 68.  
The maximum temperature rating for Grade TM (modified PTFE) diaphragms is 350°F/176°C
- 43226 BACKING CUSH BT FDA 17 GR EPDM-17 Quantity: 100  
Care Date: 9/05  
Grade 17 (EPDM) backing cushions have a LIMITED SHELF LIFE of 6 years.  
Grade 17 (EPDM) backing cushions comply with the FDA Code of Federal Regulations Title 21 Section 177.2000 and have been tested in accordance with and successfully passed the U.S. Pharmacopoeia XXVII Class VI Biological Reactivity test, Section 67 and Section 68.

Comments:

We certify that the components on the above referenced purchase order meet the requirements of the purchase order, applicable drawings, and our ISO 9001:2000 manufacturing, testing, and inspection procedures to assure an acceptable quality level applicable to the product.

/S/ Richard E. Bird  
Richard E. Bird  
Manager, Quality Assurance (as representative)  
(This certificate was created electronically and is valid without signature.)

This certificate is correct at the time of issue and no changes shall be made to it without the authorization of the issuing ITT Manager. If any unauthorized changes are made, the certificate is void.  
CERTIFICATE ID: 20380

## Compliance

### 100% Interior Surface Finish Inspection:

- 100% visual inspection
- Statistical profilometer checks

### 100% Visual Weld Inspection:

- 100% visual inspection of fabrication welds
- Welds by ASME Section IX certified welders.
- 100% pressure test of fabricated welds

### Seat and Shell Test:

- Valves are statistically seat and shell tested per MSS SP-88
- 100% inspection is available upon request

### 100% Final Assembly Inspection:

- All valve assemblies are 100% visually inspected prior to shipment

### Certified Mill Tests Reports:

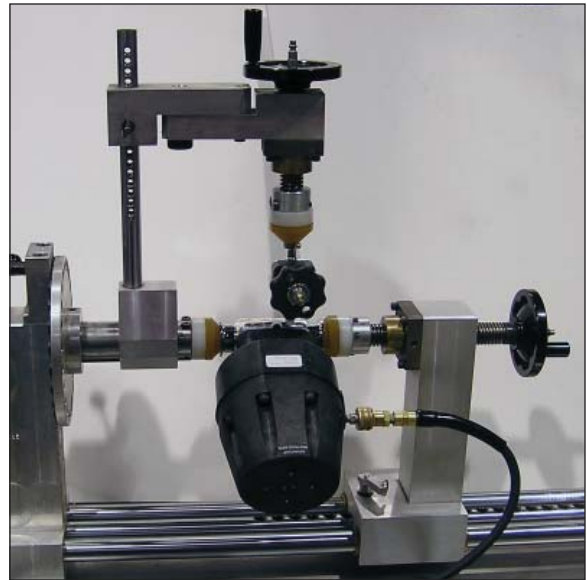
- All valve bodies contain a heat number traceable to a Certified Mill Test Report (CMTR)
- CMTRs for weld wire, tubing, and fittings used in valve fabrications.

### Non-Destructive Testing:

(available upon request)

- Alloy Identity Testing identifies the exact chemical composition of material
- Liquid Penetration Inspection surface inspection capable of identifying subsurface porosity and weld defects
- Radiographic Inspection volumetric test capable of locating voids or inclusions within material

Leak and Shell Test



Alloy Identity Testing

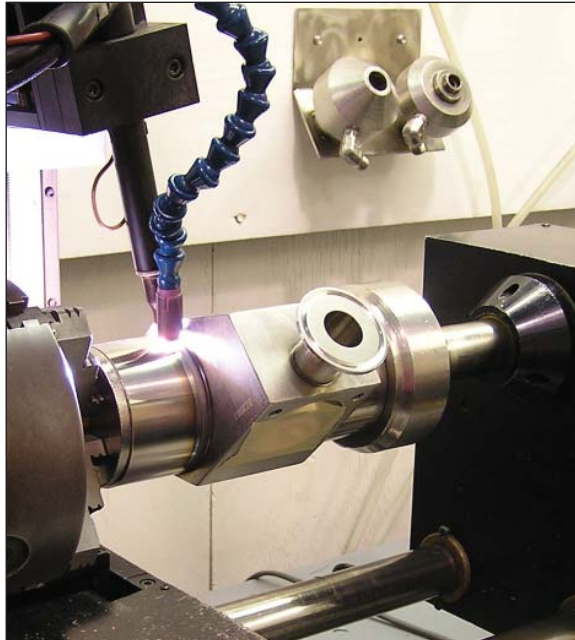


## Compliance

Visual Inspection



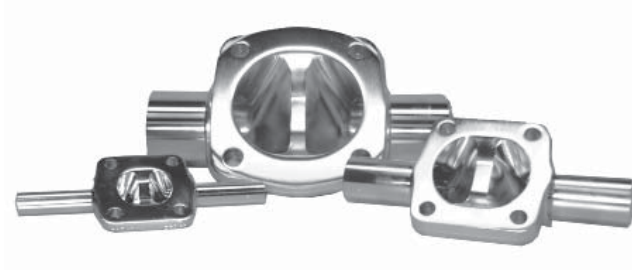
Welding



Profilometer Check for Valve Surface Finish



Stainless Steel Valve Bodies



## Approvals

### USDA Accepted

The Pure-Flo diaphragm valve is accepted by the USDA for use in federally inspected meat and poultry plants.

Selection from the following configurations is necessary to assure USDA acceptance.

### Body:

- 316L casting
- 316L forging
- Sizes: 0.5–6" (DN15–150)

### Interior Polishes:

- 35  $\mu\text{in}$  (0,89  $\mu\text{m}$ ) - 11  $\mu\text{in}$  (0,28  $\mu\text{m}$ ), see page B-7 for Surface Finish chart.
- Electropolish exterior (optional)

### End Connections:

- Tri-Clover Tri-Clamp
- Cherry Burrell "S", "Q", and "I" line, male sanitary thread

### Diaphragms:

- Black Butyl
- Buna N
- EPDM
- PTFE

### Bonnets:

- White epoxy
- PVDF coatings
- Stainless steel

Grade TM17 PTFE and Grade 17 EPDM Diaphragms



## ASME Bioprocessing Equipment Standard (ASME BPE)

### Scope:

The BPE standard was created to develop requirements for the design, materials, construction, inspection, and testing of vessels, piping, and related accessories such as pumps, valves, and fittings for use in the biopharmaceutical industry.

Pure-Flo valves are manufactured in accordance with applicable portions of the ASME BPE.

The BPE standard applies to all parts of equipment and piping that contact:

- Finished product
- Raw materials
- Product intermediates

This includes systems such as:

- Water-for-injection (WFI)
- Clean steam
- Purified water
- Ultrafiltration
- Intermediate product storage

## The BPE is divided into sections or “Parts”

### Part SD - Design for Sterility & Cleanability

Outlines accepted practices for the fabrication of bioprocessing equipment that is both Cleanable and Sterilizable.

- Cleanability
- Sterility
- Dead Legs L/D = 2:1 target
- Drainability
- Preferred, recommended, and not recommended designs

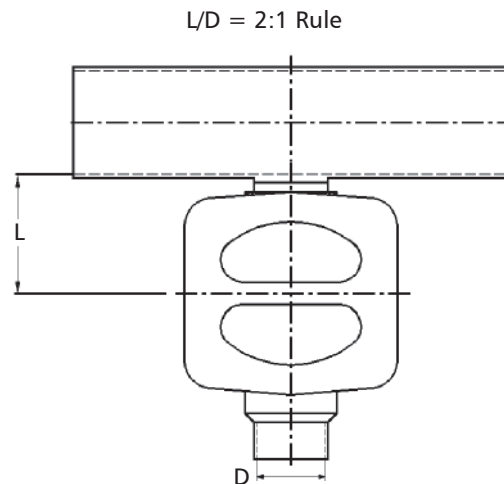
### Part DT - Dimensions and Tolerances

Establishes acceptable dimensions, tolerances, and markings. This section is not intended to cover valves.

### Part DT - V - Dimensions and Tolerances - Valves

Addresses valve related criteria including:

- Dimensions
- Tolerances
- Reduced sulfur content 316L specification
- Weld end tangent lengths
- Product marking information





## ASME Bioprocessing Equipment Standard (ASME BPE)

### Part MJ - Material Joining

Establishes requirements for the joining of bioprocessing equipment.

Weld beads acceptance criteria for:

- Misalignment
- OD / ID concavity
- Lack of penetration
- Convexity
- Width variation
- Meander

### Part SF - Surface Finish

Specification of interior surface finishes for vessels, distribution systems, and other components having product contact.

- Ra measurements (profilometer)
- Mechanical polish and electropolish requirements
- Visual acceptance criteria

### Part SG - Seals

Establishes requirements for various mechanical seals and gaskets including valve diaphragms.

- Biocompatibility - compliance to USP Class VI
- Leakage rates
- Process compatibility

### ASME Table SF-6

#### R<sub>a</sub> Readings for Valves

Mechanically Polished or any other finishing method that meets the R<sub>a</sub> Max

| Code | R <sub>a</sub> MAX |       |
|------|--------------------|-------|
|      | μ-in.              | μm    |
| SF1  | 20                 | 0.5   |
| SF2  | 25                 | 0.625 |
| SF3  | 30                 | 0.75  |

General Notes:

1. All Ra readings are taken across the lay, wherever possible.
2. No single R<sub>a</sub> reading shall exceed the R<sub>a</sub> max. value in this table.
3. Other R<sub>a</sub> readings are available if agreed upon between owner/user and manufacturer, not to exceed values in this table.

### ASME Table DT-3

#### Chemical Composition for Automatic Weld Ends, %

| Element         | % (316L)        |
|-----------------|-----------------|
| Carbon (C)      | 0.035 max       |
| Silicon (Si)    | 0.75 max        |
| Manganese (Mn)  | 2.0 max         |
| Nickel (Ni)     | 10 - 15         |
| Chromium (Cr)   | 16 - 18         |
| Molybdenum (Mo) | 2 - 3           |
| Phosphorous (P) | 0.04 max        |
| Sulfur (S)      | 0.005-0.017 max |

### ASME Table DT-4

#### Tangent Lengths

| Nominal OD Tu be Size |     | Tangent, T |    |
|-----------------------|-----|------------|----|
| In                    | DN  | In         | mm |
| 0.25                  | 8   | 1.5        | 38 |
| 0.375                 | 10  | 1.5        | 38 |
| 0.50                  | 15  | 1.5        | 38 |
| 0.75                  | 20  | 1.5        | 38 |
| 1                     | 25  | 1.5        | 38 |
| 1.5                   | 40  | 1.5        | 38 |
| 2                     | 50  | 1.5        | 38 |
| 2.5                   | 65  | 1.5        | 38 |
| 3                     | 80  | 1.75       | 44 |
| 4                     | 100 | 2          | 50 |
| 6                     | 150 | 2.5        | 63 |

Mechanically Polished and Electropolished

| Code | R <sub>a</sub> MAX |       |
|------|--------------------|-------|
|      | μ-in.              | μm    |
| SF4  | 15                 | 0.375 |
| SF5  | 20                 | 0.5   |
| SF6  | 25                 | 0.625 |

## European Union Directives

European Union Directives apply to categories of equipment. CE Marking is applied to products where applicable.

### Relevant Directives for Valves

- Pressure Equipment Directive (PED) 97/23/EC
- Electromagnetic Compatibility Directive (EMC) 89/336/EEC
- Low-Voltage Directive (LVD) 73/23/EEC
- Safety of Machinery Directive 98/37/EC
- Equipment for Explosive Atmospheres (ATEX) 94/9/EC

### PED - Pressure Equipment Directive 97/23/EC

- The nominal size (DN)
- Maximum allowable pressure
- State of the intended fluid contents (gas or liquid)
- The classification of the intended fluid contents (Group 1 or 2 as defined in Council Directive 67/548/EEC)
- Fluid categories (Liquid or Gas)
  - Group 1
    - Explosive
    - Extremely flammable
    - Highly flammable
    - Flammable (where max allowable temp is above flashpoint)
    - Very toxic
    - Toxic
    - Oxidizing
  - Group 2
    - All other fluids including steam

### PED Compliance Categories

- Sound Engineering Practice "SEP"
- Valves < 1" (DN25) by definition
- "CE" can not be marked
- Category I
- Valves > 1"(DN25) and < 6"(DN150)
- "CE" is marked



| Valve Size      |                    | PN Rating<br>Stainless<br>Steel<br>Bonnet | PN Rat-<br>ing<br>PAS<br>Bonnet | Suitable Fluid Categories |                   |                |                |
|-----------------|--------------------|---|---------------------------------|---------------------------|-------------------|----------------|----------------|
| DN              | Inch               |   |                                 | Liquid<br>Group 2         | Liquid<br>Group 1 | Gas<br>Group 2 | Gas<br>Group 1 |
| 6 <sup>1</sup>  | 0.25 <sup>1</sup>  | 10.3                                      | 10.3                            | SEP                       | SEP               | SEP            | SEP            |
| 10 <sup>1</sup> | 0.375 <sup>1</sup> | 10.3                                      | 10.3                            | SEP                       | SEP               | SEP            | SEP            |
| 15 <sup>1</sup> | 0.5 <sup>1</sup>   | 10.3                                      | 10.3                            | SEP                       | SEP               | SEP            | SEP            |
| 15              | 0.5                | 13.8                                      | 10.3                            | SEP                       | SEP               | SEP            | SEP            |
| 20              | 0.75               | 13.8                                      | 10.3                            | SEP                       | SEP               | SEP            | SEP            |
| 25              | 1                  | 13.8                                      | 10.3                            | SEP                       | SEP               | SEP            | SEP            |
| 40              | 1.5                | 12.1                                      | 10.3                            | I                         | I                 | I              | I              |
| 50              | 2                  | 12.1                                      | 10.3                            | I                         | I                 | I              | I              |
| 65              | 2.5                | 10 <sup>2</sup>                           | 10 <sup>2</sup>                 | I                         | I                 | I              | I              |
| 80              | 3                  | 10 <sup>2</sup>                           | 10 <sup>2</sup>                 | I                         | I                 | I              | I              |
| 100             | 4                  | 10 <sup>2</sup>                           | 10 <sup>2</sup>                 | I                         | I                 | I              | I              |
| 150             | 6                  | 8.6                                       | N/A                             | I                         | I                 | I              | II             |

<sup>1</sup> Bio-Pure and Bio-Tek

<sup>2</sup> Derated to 145 psi / 10 bar from standard product

Requires Technical File & Notified Body (Optional upon request/ agreement)



ITT Industries  
Engineered Process Solutions Group  
33 Centerville Road  
Lancaster, PA 17603 USA

**Declaration of Incorporation  
Machinery Directive 98/37/EC**

|   |  |
|---|--|
| <p>Authorized Representative within the European Union</p> <p>ITT Pure-Flow® (UK) Ltd.<br/>Richard Street<br/>Kirkham,<br/>Lancashire<br/>England<br/>PR4 2HU<br/>Tel: +44 (0)1772-682096</p> | <p>Manufacturing Site</p> <p>ITT Pure-Flow® (UK) Ltd.<br/>Richard Street<br/>Kirkham,<br/>Lancashire<br/>England<br/>PR4 2HU<br/>Tel: +44 (0)1772-682096</p> |
|---|--|

**Description of the machinery or parts:**

|   |   |
|---|---|
| <p>Manufacturer's Name<br/>Valve Type<br/>Model<br/>End connections<br/>Materials of Construction</p> | <p>ITT Industries – Engineered Valves<br/>Diaphragm valve<br/>Pure-Flow<br/>All<br/>Body – A182 F316L (SA479 316L/DIN 17440 1.4435)<br/>Topworks – Actuated</p> |
|---|---|

The machinery (valve or valve assembly) to which this Declaration of Incorporation relates must not be put in service until the relevant machinery into which it is to be incorporated has been declared in conformity with the provisions of the Machinery Directive 98/37/EC.

Authorized representative:  
  
 M. Steele  
 Managing Director  
 Date: 30<sup>th</sup> June 2003

## European Union Directives (cont.)

### EMC - Electromagnetic Compatibility Directive 89/336/EEC

The EMC Directive covers any apparatus liable to cause electromagnetic disturbance or can be affected by such disturbance.

Included Apparatus:

- Solenoid valves
- Proximity switches
- Electro Pnuematic positioners
- Electro Pnuematic transducers

Excluded Apparatus:

- Limit switches
- "CE" Marked

### LVD - Low Voltage Directive 73/23/EEC


- Electrical equipment rated between 50 - 1000 VAC, 75-1500 VDC
- EC Declaration of Conformity required
- "CE" marked

### Safety of Machinery Directive 98/37/EC

- An assembly of linked parts or components, at least one of which that moves
- Actuated valves are considered components and therefore require a Declaration of Incorporation
- Manual valves are excluded from this directive

## ATEX Directive 94/9/EC

- Institutes uniform controls on equipment intended for use in potentially explosive atmospheres (PEAs) within the EU and European Economic Area (EEA)
- Compliance mandatory on July 1, 2003 - All equipment intended for use in potentially explosive atmospheres, defined as machines, apparatus, fixed or mobile devices, control components and instrumentation which, separately or jointly, are capable of causing an explosion through their own potential sources of ignition.
- Facility owners must classify potentially explosive atmospheres into Zones
- Products must be classified into Equipment Groups and Categories
- Pure-Flo valves are Equipment Group II products
  - Zone 0 environments require Category 1 hardware
  - Zone 1 environments require Category 1 or 2 hardware
  - Zone 2 environments require Category 1, 2, or 3 hardware
  - A facility must specify whether the hazard present is due to gas or dust. The ATEX Directive treats these hazards differently and outlines different methods of protection
  - An equipment manufacturer must provide
    - ambient temperature range
    - maximum surface temperature
- All products must be assessed as a system. The compliance of individual components is not sufficient justification for deeming the assembly as ATEX approved.
- All ATEX approved products must bear a CE mark
- A Declaration of Conformity and Instructions for Safe Use are supplied as required
- Manufacturers and Users are responsible for compliance



ITT Industries  
Engineered Process Solutions Group  
33 Centerville Road  
Lancaster, PA 17603 USA

**Declaration of Conformity  
94/9/EC (ATEX)**

|   |  |
|---|--|
| <p><i>Authorized Representative within the European Union</i></p> <p>ITT Pure-Flo® (UK) Ltd.<br/>Richard Street<br/>Kirkham,<br/>Lancashire<br/>England<br/>PR4 2HL<br/>Tel: +44 (0)1772-682096</p> | <p><i>Manufacturing Site</i></p> <p>ITT Pure-Flo® (UK) Ltd.<br/>Richard Street<br/>Kirkham,<br/>Lancashire<br/>England<br/>PR4 2HL<br/>Tel: +44 (0)1772-682096</p> |
|---|--|

We hereby certify that the products listed below satisfy the requirements set forth in the Directives of the Committee for the Harmonization of Legal Regulations of Member States concerning Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres (ATEX 94/9/EC).

Advantage® Actuator



Models: A103, A105, A106, A116, A203, A204, A205, A206, A209, A216, A217, A303, A309, A308, A316, A323, A233, A234, A232

The following standard was consulted with respect to the compliance with ATEX 94/9/EC


EN13463-1, April 2002 Non-electrical equipment for potentially explosive atmospheres

The marking of the equipment listed above shall include the following:

Consult the Instructions for Safe Use for further information on using this equipment in potentially explosive environments.



II 2 G  
T3...T6X

Authorized representative:



M. Smith  
Managing Director

Date: 14<sup>th</sup> August 2003

### Application

The Pure-Flo product line of Sample and Bleed Valves provides compact and economical means to extract process samples and bleed off excess condensate while maintaining product sterility.

### Benefits

Stagnant fluid inherent to the take-off leg of a conventional diaphragm or ball valve sample valve is eliminated in the Pure-Flo Sample Valve. By providing a stainless steel metal to metal shut off directly at the Tri-Clamp®, the typical take-off leg is eliminated.

Pure-Flo Sample and Bleed Valves are available in Sample, Zero Static Sample, and Bleed, and with a number of standard and optional features to best suit your system design.

Sample and Bleed Valves are manufactured from 316L stainless steel and utilize a thermoplastic handwheel so that they can withstand typical cleaning and sterilization protocols, including autoclaving.

The relatively simple design utilizing “off the shelf” o-ring seals allows for easy replacement of sealing components.

The Sample Valve handle and stem are designed to provide smooth operation and limited wear on the internal components.

The Zero Static Sample Valve can be installed directly in line and allows a sample to be taken or condensate to be drained without the typical hold up volume or contact surfaces inherent to branch valve assemblies.

The Bleed valve is a simple but effective design for providing a quick and easy way to asperate or drain a system. These are often used for filter housings, bubble traps, and small tanks. An optional weld end allows the bleed valve to become an integral part of any assembly.

All product contact materials are FDA compliant.



### Standard Features

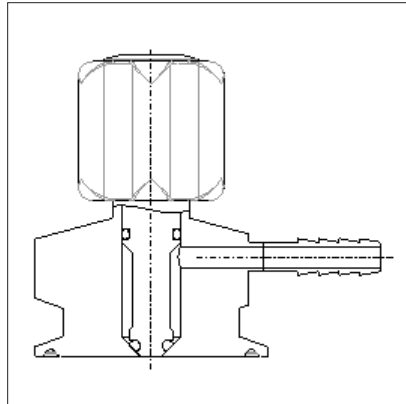
- Body Material: 316L
- O-Ring/Seal Material: EPDM FDA compliant, USP Class VI
- Handwheel Material: Polyphenylsulfone
- Standard Interior Surface Finish: 11 $\mu$ m (0,3 $\mu$ m) Ra
- Electropolish: Interior and Exterior
- Inlet End Connection: Tri-Clamp®
- Outlet End Connection: Tri-Clamp®, Butt weld, Hose Barb
- Maximum Temperature/Pressure: 275°F (135°C) 100 psi (7,0 bar)
- Autoclavable

### Available Options

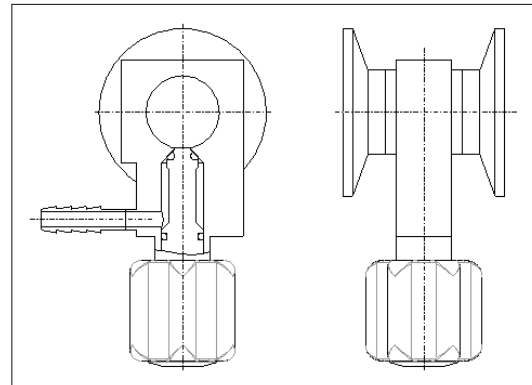
- Body Material: 1.4435, AL6XN, C276, C22
- O-Ring Seal Material: Viton - FDA compliant, Viton - FDA compliant and USP Class VI
- End Connections: ISO/DIN
- Outlet Option: 2nd outlet, steaming port
- Operation: Toggle style handle available on sample valve and zerostatic sample valve
- Other options available upon request

## Sample Valves

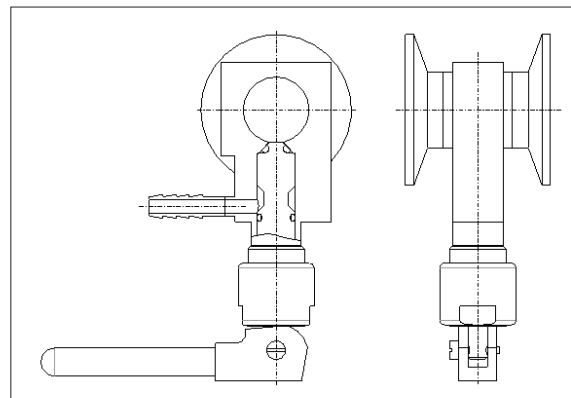
Sample Valve



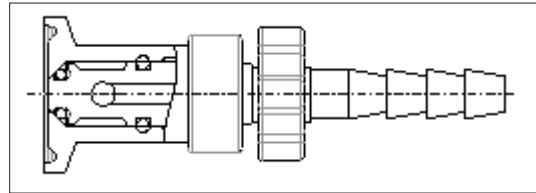
Zero Static Sample Valve



Toggle Style Operation



## Bleed Valve



Drawing is an example of a customer specific sample valve drawing

## Sample valve configurations

### Standard configuration

SV – W – 1 – 419 – .38 – X41 – EPDM

| Code        | SV         | W        | 1          | 419                  | .38         | X41                   | EPDM        |
|-------------|------------|----------|------------|----------------------|-------------|-----------------------|-------------|
| Description | Valve type | Material | Inlet size | Inlet end connection | Outlet size | Outlet end connection | O-ring type |

### Special configuration

SV-WD-.5-419-34-.25-X19S1-34-VIT-SPEC:2nd Outlet 0.25"-PER DRAWING:K18000-MAX FERR:3%

| Code        | SV         | WD       | .5         | 419                  | 34                      | .25         | X19S1                 |
|-------------|------------|----------|------------|----------------------|-------------------------|-------------|-----------------------|
| Description | Valve type | Material | Inlet size | Inlet end connection | Special inlet Tri-clamp | Outlet size | Outlet end connection |

| 34                       | VIT         | SPEC: 2nd Outlet 0.25"        | Per Drawing: K18000 | MAX FERR:3%        |
|--------------------------|-------------|-------------------------------|---------------------|--------------------|
| Special outlet Tri-clamp | O-ring type | Special outlet configurations | Special             | Controlled ferrite |

## Options

### Valve Type (Block valve)

| Code    | Description                    | Inlet/run sizes | End Connections | Outlet sizes | End Connections     |
|---------|--------------------------------|-----------------|-----------------|--------------|---------------------|
| SV      | Sample valve                   | ¼ - 4.0"        | TC / BW / SPEC  | 1/8 – 1/2    | TC / BW / HB / SPEC |
| ZSS     | Zerostatic sample valve        | ¼ - 4.0"        | TC / BW / SPEC  | 1/8 – 1/2    | TC / BW / HB / SPEC |
| BV      | Bleed valve                    | ¼ - 4.0"        | TC / BW / SPEC  | 1/8 – 3/8    | HB ONLY             |
| SV-TSH  | Toggle sample valve            | ¼ - 4.0"        | TC / BW / SPEC  | 1/8 – 1/2    | TC / BW / HB / SPEC |
| ZSS-TSH | Toggle zerostatic sample valve | ¼ - 4.0"        | TC / BW / SPEC  | 1/8 – 1/2    | TC / BW / HB / SPEC |
| SPEC    | Special sample valve           | ¼ - 4.0"        | TC / BW / SPEC  | 1/8 – 1/2    | TC / BW / HB / SPEC |

## Model Codes

### Valve Type

| Code | Description             |
|------|-------------------------|
| SV   | Sample valve            |
| ZSS  | Zerostatic sample valve |
| BV   | Bleed valve             |
| SPEC | Special                 |

### Operation option

| Code | Description         |
|------|---------------------|
| TSH  | Toggle style handle |

### Material

| Code | Description     |
|------|-----------------|
| W    | 316L SS         |
| WD   | 1.4435 SS       |
| WA   | AL-6XN          |
| WC6  | Hastelloy c-276 |
| WC2  | Hastelloy c-22  |
| OTH  | Other material  |

### Inlet/run size

| Code | Description   |
|------|---------------|
| 0.25 | 1/4" (DN06)   |
| 0.38 | 3/8" (DN10)   |
| 0.5  | 1/2" (DN15)   |
| 0.75 | 3/4" (DN20)   |
| 1.0  | 1" (DN25)     |
| 1.5  | 1 1/2" (DN40) |
| 2.0  | 2" (DN50)     |
| 2.5  | 2 1/2" (DN65) |
| 3.0  | 3" (DN80)     |
| 4.0  | 4" (DN100)    |

### Inlet/run end connection

| Code  | Description        |
|-------|--------------------|
| 419S2 | Tri-Clamp 14 Gauge |
| 419   | Tri-Clamp 16 Gauge |
| 419S  | Tri-Clamp 18 Gauge |
| 419S1 | Tri-Clamp 20 Gauge |
| 429   | Buttweld 14 Gauge  |
| 428   | Buttweld 16 Gauge  |
| 423   | Buttweld 18 Gauge  |
| 424   | Buttweld 20 Gauge  |
| SPEC  | Special            |

### Outlet size

| Code | Description |
|------|-------------|
| 0.13 | 1/8" (DN04) |
| 0.25 | 1/4" (DN06) |
| 0.38 | 3/8" (DN10) |
| 0.5  | 1/2" (DN15) |

### Outlet end connection

| Code  | Description        |
|-------|--------------------|
| X19   | Tri-Clamp 16 Gauge |
| X19S  | Tri-Clamp 18 Gauge |
| X19S1 | Tri-Clamp 20 Gauge |
| X28   | Buttweld 16 Gauge  |
| X23   | Buttweld 18 Gauge  |
| X24   | Buttweld 20 Gauge  |
| X40   | Hosebarb 16 Gauge  |
| X41   | Hosebarb 18 Gauge  |
| SPEC  | Special            |

### O-ring type

| Code   | Description                       |
|--------|-----------------------------------|
| EPDM   | EPDM o-ring (FDA & USP CLASS VI)  |
| VIT    | Viton o-ring (FDA)                |
| VITUSP | Viton o-ring (FDA & USP CLASS VI) |

### Special inlet tri-clamp diameter

| Code | Description      |
|------|------------------|
| 25   | 25mm Tri-clamp   |
| 34   | 34mm Tri-clamp   |
| 50.5 | 50.5mm Tri-clamp |

### Special outlet tri-clamp diameter

| Code | Description      |
|------|------------------|
| 25   | 25mm Tri-clamp   |
| 34   | 34mm Tri-clamp   |
| 50.5 | 50.5mm Tri-clamp |

### Special outlet configuration

| Code | Description        |
|------|--------------------|
| Spec | Special (text box) |

### Special tagging

| Code  | Description        |
|-------|--------------------|
| RTAG  | STN STL round tag  |
| STAG  | STN STL square tag |
| SPEC  | Special tag        |
| CHAIN | STN STL chain      |
| TIE   | Plastic tie wrap   |
| WIRE  | STN STL wire       |



## Figure Number Cross Reference

### Bleed Valve

| PFCA Part Number | Old Figure Number | New Figure Number         | Description   |
|------------------|-------------------|---------------------------|---|
| S100855          | BV-BL-HB-BL-01    | -                         | BLEED VLV ASSY, BL X .125, BL X HB, 11 PG A 316L/EPDM     |
| S101490          | BV-NPT-HB-02-02   | -                         | BLEED VLV ASSY, .250 X .250, MNPT X HB, 11 PG A 316L/EPDM |
| S100856          | BV-BL-HB-BL-02    | -                         | BLEED VLV ASSY, BL X .250, BL X HB, 11 PG A 316L/EPDM     |
| S100824          | BV-TC-HB-04-01    | BV-W-.5-419-.13-X41-EPDM  | BLEED VLV ASSY, .500 X .125, TC X HB, 11 PG A 316L/EPDM   |
| S100825          | BV-TC-HB-04-02    | BV-W-.5-419-.25-X41-EPDM  | BLEED VLV ASSY, .500 X .250, TC X HB, 11 PG A 316L/EPDM   |
| S100826          | BV-TC-HB-12-01    | BV-W-1.5-419-.13-X41-EPDM | BLEED VLV ASSY, 1.50 X .125, TC X HB, 11 PG A 316L/EPDM   |
| S100827          | BV-TC-HB-12-02    | BV-W-1.5-419-.25-X41-EPDM | BLEED VLV ASSY, 1.50 X .250, TC X HB, 11 PG A 316L/EPDM   |
| S100828          | BV-TC-HB-16-02    | BV-W-2-419-.25-X41-EPDM   | BLEED VLV ASSY, 2.00 X .250, TC X HB, 11 PG A 316L/EPDM   |

### Bleed Valve with Viton O-Rings

| PFCA Part Number | Old Figure Number | New Figure Number       | Description  |
|------------------|-------------------|-------------------------|--|
| S102585          | -                 | BV-W-.5-419-.25-X41-VIT | BLEED VLV ASSY, .500 X .250, TC X HB, 11 PG A 316L/VITON |

### Sample Valve

| PFCA Part Number | Old Figure Number | New Figure Number           | Description  |
|------------------|-------------------|-----------------------------|--|
| S101848          | SV-TC-HB-04-01    | SV-W-.5-419-.13-X41-EPDM    | SAMPLE VLV ASSY, .500 X .125, TC X HB, 11 PG A 316L/EPDM   |
| S100829          | SV-TC-HB-04-02    | SV-W-.5-419-.25-X41-EPDM    | SAMPLE VLV ASSY, .500 X .250, TC X HB, 11 PG A 316L/EPDM   |
| S100831          | SV-TC-HB-04-03    | SV-W-.5-419-.38-X41-EPDM    | SAMPLE VLV ASSY, .500 X .375, TC X HB, 11 PG A 316L/EPDM   |
| S101612          | SV-TC-HB-04-04    | SV-W-.5-419-.5-X40-EPDM     | SAMPLE VLV ASSY, .500 X .500, TC X HB, 11 PG A 316L/EPDM   |
| S101849          | SV-TC-HB-12-01    | SV-W-1.5-419-.13-X41-EPDM   | SAMPLE VLV ASSY, 1.50 X .110, TC X HB, 11 PG A 316L/EPDM   |
| S100832          | SV-TC-HB-12-02    | SV-W-1.5-419-.25-X41-EPDM   | SAMPLE VLV ASSY, 1.50 X .250, TC X HB, 11 PG A 316L/EPDM   |
| S102228          | -                 | -                           | SAMPLE VLV ASSY, 1.50 X .250, TC X 45HB, 15 PG A 316L/EPDM |
| S100833          | SV-TC-HB-12-03    | SV-W-1.5-419-.38-X41-EPDM   | SAMPLE VLV ASSY, 1.50 X .375, TC X HB, 11 PG A 316L/EPDM   |
| S100834          | SV-TC-HB-12-04    | SV-W-1.5-419-.5-X40-EPDM    | SAMPLE VLV ASSY, 1.50 X .500, TC X HB, 11 PG A 316L/EPDM   |
| S100835          | SV-TC-HB-16-02    | SV-W-2-419-.25-X41-EPDM     | SAMPLE VLV ASSY, 2.00 X .250, TC X HB, 11 PG A 316L/EPDM   |
| S100836          | SV-TC-HB-32-02    | SV-W-4-419S2-.25-X41-EPDM   | SAMPLE VLV ASSY, 4.00 X .250, TC X HB, 11 PG A 316L/EPDM   |
| S100837          | SV-TC-TC-04-02    | SV-W-.5-419-.25-X19S1-EPDM  | SAMPLE VLV ASSY, .500 X .250, TC X TC, 11 PG A 316L/EPDM   |
| S100838          | SV-TC-TC-04-04    | SV-W-.5-419-.5-X19-EPDM     | SAMPLE VLV ASSY, .500 X .500, TC X TC, 11 PG A 316L/EPDM   |
| S100839          | SV-TC-TC-12-02    | SV-W-1.5-419-.25-X19S1-EPDM | SAMPLE VLV ASSY, 1.50 X .250, TC X TC, 11 PG A 316L/EPDM   |
| S100840          | SV-TC-TC-12-04    | SV-W-1.5-419-.5-X19-EPDM    | SAMPLE VLV ASSY, 1.50 X .500, TC X TC, 11 PG A 316L/EPDM   |
| S101487          | SV-BL-HB-BL-02    | -                           | SAMPLE VLV ASSY, BL X .250, BL X HB, 11 PG A 316L/EPDM     |
| S102180          | -                 | -                           | SAMPLE VLV ASSY, BL X .250, BL X WE, ACT, 11 A 316L/EPDM   |
| S102181          | -                 | -                           | SAMPLE VLV ASSY, .500 X .500, TC X TC, ACT, 11 A 316L/EPDM |

## Figure Number Cross Reference

### Sample Valve with Viton O-Rings

| PFCA Part Number | Old Figure Number | New Figure Number         | Description   |
|------------------|-------------------|---------------------------|---|
| S102582          | -                 | SV-W-.5-419-.25-X41-VIT   | SAMPLE VLV ASSY, .500 X .250, TC X HB, 11 PG A 316L/VITON |
| S102583          | -                 | SV-W-.5-419-.5-X19-VIT    | SAMPLE VLV ASSY, .500 X .500, TC X TC, 11 PG A 316L/VITON |
| S102584          | -                 | SV-W-1.5-419-.25-X41-VIT  | SAMPLE VLV ASSY, 1.50 X .250, TC X HB, 11 PG A 316L/VITON |
| S102586          | -                 | SV-W-.5-419-.25-X19S1-VIT | SAMPLE VLV ASSY, .500 X .250, TC X TC, 11 PG A 316L/VITON |

### Zero Static Sample Valve

| PFCA Part Number | Old Figure Number | New Figure Number            | Description   |
|------------------|-------------------|------------------------------|---|
| S100842          | ZSS-TC-HB-02-02   | ZSS-W-.25-419S1-.25-X41-EPDM | SAMPLE VLV ZS ASSY, .250 X .250, TC X HB, 11 PG A 316L/EPDM |
| S100843          | ZSS-TC-HB-04-02   | ZSS-W-.5-419-.25-X41-EPDM    | SAMPLE VLV ZS ASSY, .500 X .250, TC X HB, 11 PG A 316L/EPDM |
| S100844          | ZSS-TC-HB-04-03   | ZSS-W-.5-419-.38-X41-EPDM    | SAMPLE VLV ZS ASSY, .500 X .375, TC X HB, 11 PG A 316L/EPDM |
| S100841          | ZSS-TC-WE-06-02   | ZSS-W-.75-419-.25-X24-EPDM   | SAMPLE VLV ZS ASSY, .750 X .250, TC X WE, 11 PG A 316L/EPDM |
| S100845          | ZSS-TC-HB-06-02   | ZSS-W-.75-419-.25-X41-EPDM   | SAMPLE VLV ZS ASSY, .750 X .250, TC X HB, 11 PG A 316L/EPDM |
| S100846          | ZSS-TC-HB-06-04   | ZSS-W-.75-419-.5-X40-EPDM    | SAMPLE VLV ZS ASSY, .750 X .500, TC X HB, 11 PG A 316L/EPDM |
| S100847          | ZSS-TC-HB-08-02   | ZSS-W-1-419-.25-X41-EPDM     | SAMPLE VLV ZS ASSY, 1.00 X .250, TC X HB, 11 PG A 316L/EPDM |
| S101499          | ZSS-TC-HB-08-04   | ZSS-W-1-419-.5-X40-EPDM      | SAMPLE VLV ZS ASSY, 1.00 X .500, TC X HB, 11 PG A 316L/EPDM |
| S100848          | ZSS-TC-HB-12-02   | ZSS-W-1.5-419-.25-X41-EPDM   | SAMPLE VLV ZS ASSY, 1.50 X .250, TC X HB, 11 PG A 316L/EPDM |
| S101500          | ZSS-TC-HB-12-04   | ZSS-W-1.5-419-.5-X40-EPDM    | SAMPLE VLV ZS ASSY, 1.50 X .500, TC X HB, 11 PG A 316L/EPDM |
| S100849          | ZSS-TC-HB-16-02   | ZSS-W-2-419-.25-X41-EPDM     | SAMPLE VLV ZS ASSY, 2.00 X .250, TC X HB, 11 PG A 316L/EPDM |
| S101545          | ZSS-TC-TC-04-04   | ZSS-W-.5-419-.5-X19-EPDM     | SAMPLE VLV ZS ASSY, .500 X .500, TC X TC, 11 PG A 316L/EPDM |

### Toggle Sample Valve

| PFCA Part Number | Old Figure Number | New Figure Number            | Description  |
|------------------|-------------------|------------------------------|--|
| S100852          | TSV-TC-HB-04-04   | SV-TSH-W-.5-419-.5-X40-EPDM  | SAMPLE VLV TOG ASSY, .500 X .500, TC X HB, 11 PG A 316L/EPDM |
| S100850          | TSV-TC-HB-04-02   | SV-TSH-W-.5-419-.25-X41-EPDM | SAMPLE VLV TOG ASSY, .500 X .250, TC X HB, 11 PG A 316L/EPDM |
| S100851          | TSV-TC-HB-04-03   | SV-TSH-W-.5-419-.38-X41-EPDM | SAMPLE VLV TOG ASSY, .500 X .375, TC X HB, 11 PG A 316L/EPDM |

### Angle Bleed Valve

| PFCA Part Number | Old Figure Number | Elogia Figure Number | Description  |
|------------------|-------------------|----------------------|--|
| S100819          | ABV-BL-HB-BL-02   | OBSOLETE             | BLEED VLV ANGL ASSY, BL X .250, BL X HB 11 PG A 316L/EPDM                |
| S100821          | ABV-TC-HB-04-04   | OBSOLETE             | BLEED VLV ANGL ASSY, .500 X .500, TC X HB, 11 PG A 316L/EPDM             |
| S100815          | ABV-TC-HB-04-02   | OBSOLETE             | BLEED VLV ANGL ASSY, .500 X .250, TC X HB, 11 PG A 316L/EPDM             |
| S101758          | ABV-TC-HB-04-03   | OBSOLETE             | BLEED VLV ANGL ASSY, .500 X .375, TC X HB, 11 PG A 316L/EPDM             |
| S100820          | ABV-TC-TC-04-02   | OBSOLETE             | BLEED VLV ANGL ASSY, .500 X .250, TC X TC, 11 PG A 316L/EPDM             |
| S100816          | ABV-TC-HB-12-02   | OBSOLETE             | BLEED VLV ANGL ASSY, 1.50 X .250, TC X HB, 11 PG A 316L/EPDM             |
| S101759          | ABV-TC-HB-12-03   | OBSOLETE             | BLEED VLV ANGL ASSY, 1.50 X .375, TC X HB, 11 PG A 316L/EPDM             |
| S100817          | ABV-TC-HB-16-02   | OBSOLETE             | BLEED VLV ANGL ASSY, 2.00 X .250, TC X HB, 11 PG A 316L/EPDM             |
| S100818          | ABV-TC-HB-24-02   | OBSOLETE             | BLEED VLV ANGL ASSY, 3.00 X .250, TC X HB, 11 PG A 316L/EPDM             |
| S102362          | -                 | OBSOLETE             | BLEED VLV ANGL ASSY, .500 X .250 X .250, TC X HB X HB, 11 PG A 316L/EPDM |



**ITT**

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