

Integrated Block Valves

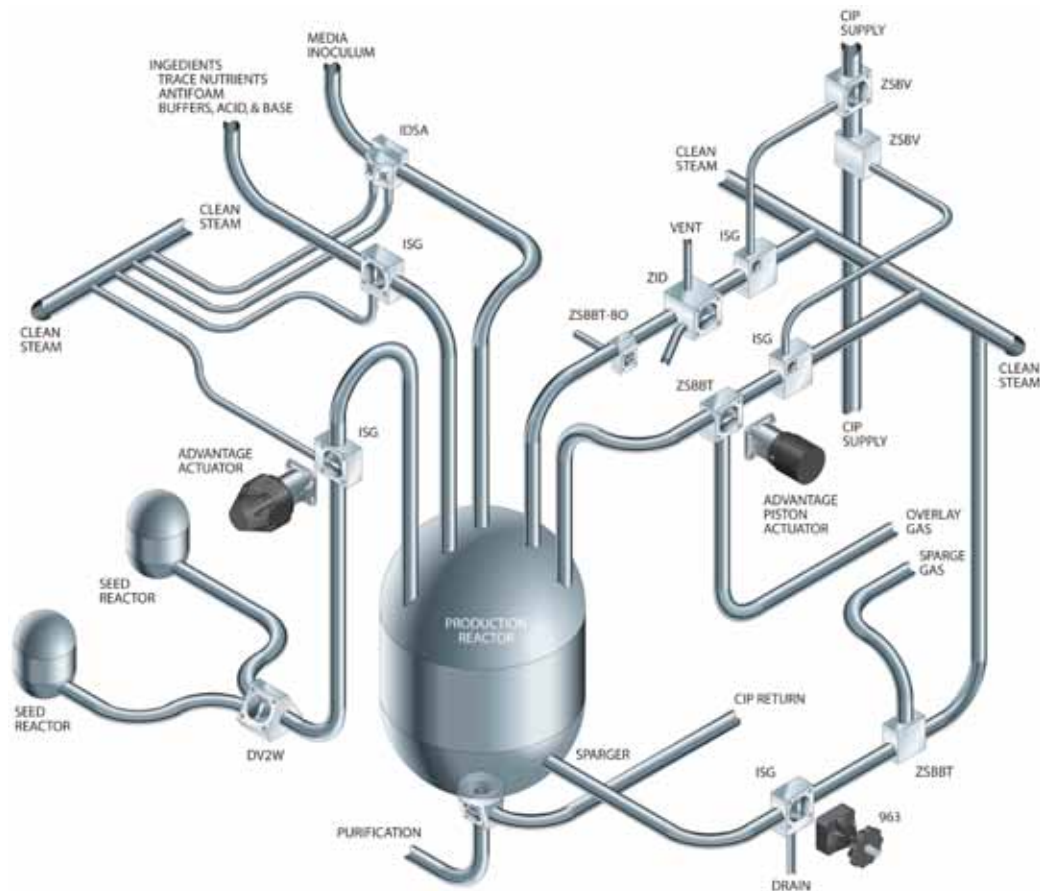
The Pure-Flo IBV - Integrated Block Valve product line is constantly changing to meet the rigorous demands of the Biopharmaceutical processing industry. An extensive array of innovative integrated block valves specifically designed to achieve the utmost in process efficiency. Pure-Flo developed the first 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.

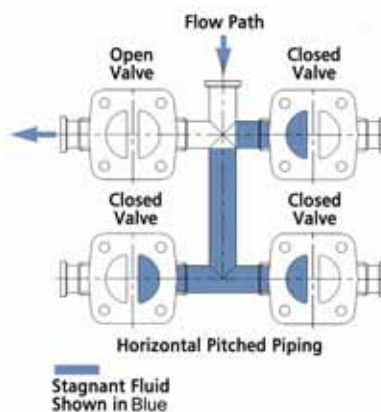
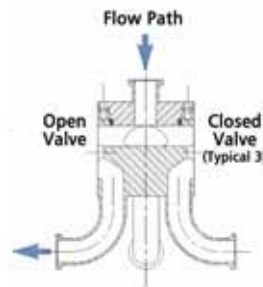
Integral Block technology further improves drainability and minimizes hold up volumes by reducing the process pipe volume between control elements.

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



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.

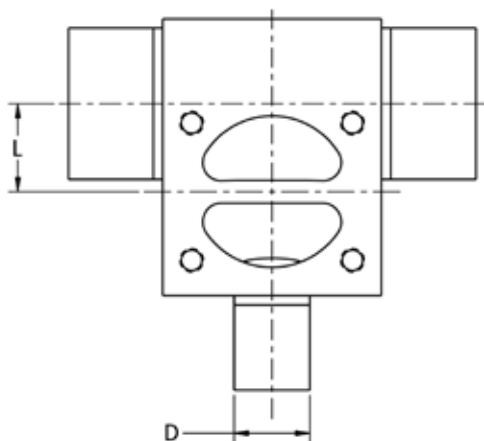
ASME BPE L/D = 2:1

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.

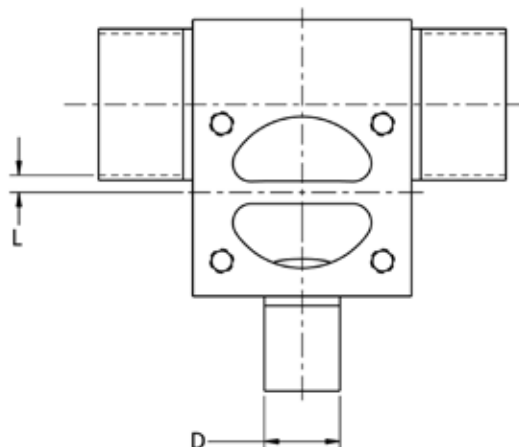
The ASME BPE standard states that the L/D ratio of 2:1 should be considered a target, not an absolute requirement, but the system designer/manufacturer should make every attempt to eliminate system dead-legs, and identify where exceptions exist.

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.

6D Rule

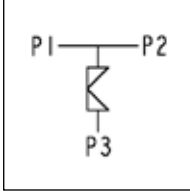


L/D = 2:1 Rule

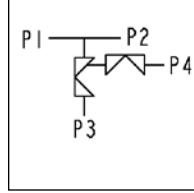


P&ID Cross Reference

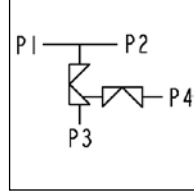
Zero Static Use Points



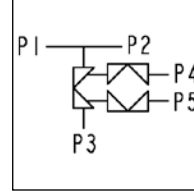
Zero Static Block Body
Code: ZSBB



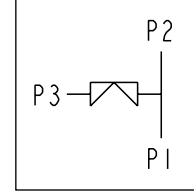
Zero Static Back to Back Sample
Code: ZSBS



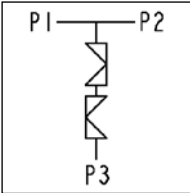
Zero Static with Downstream Purge
Code: ZDP



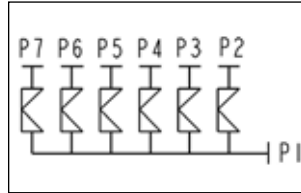
Zero Static with Upstream Sample and Downstream Purge
Code: ZUD



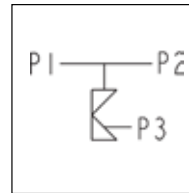
Zero Static Block Body with Vertical Run
Code: ZSBV



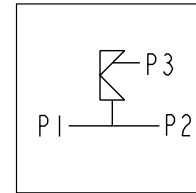
Zero Static Dual Inline
Code: ZDI



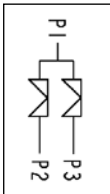
Zero Static In-Line (ZID)



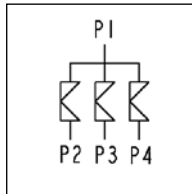
Zero Static Block Body with Back Outlet Option (ZSBBT-BO)



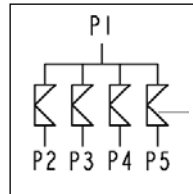
Divert and Sterile Access Valves



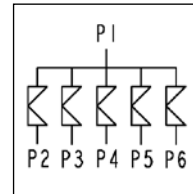
2-Way Divert Valve
Code: DV2W



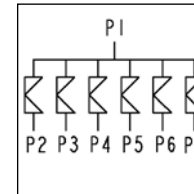
3-Way Divert Valve
Code: DV3W



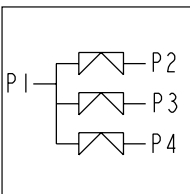
4-Way Divert Valve
Code: DV4W



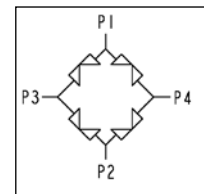
5-Way Divert Valve
Code: DV5W



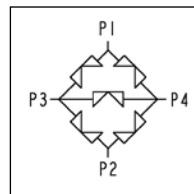
6-Way Divert Valve
Code: DV6W



Horizontal Divert Valve 3-Way
Code: HDV3W



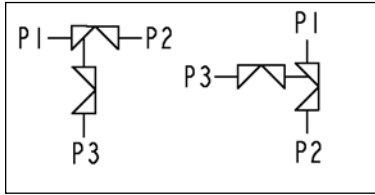
Chromatography without Bypass
Code: CHN



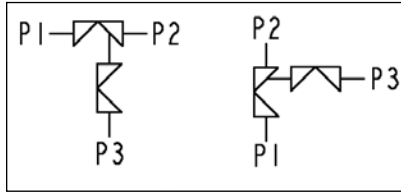
Chromatography with Bypass
Code: CHRO

P&ID Cross Reference

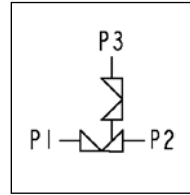
Divert and Sterile Access Valves (cont.)



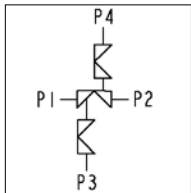
Integral Sterile Access and GMP (Left)
Code: ISG



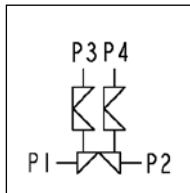
Integral Sterile Access and GMP (Right)
Code: ISG



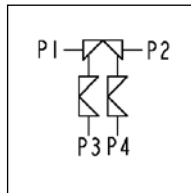
Integral Horizontal Sterile Access
Code: IHSA



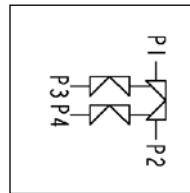
Integrated Dual Sterile Access
Code: IDSA



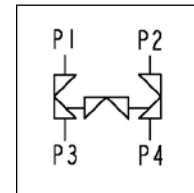
Integrated Dual Sterile Access
Code: IDSA



Integrated Dual Sterile Access
Code: IDSA

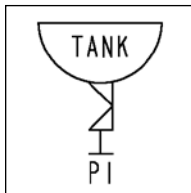


Integrated Dual Sterile Access
Code: IDSA

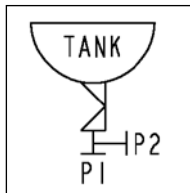


Crossover
Code: CRO/CROD

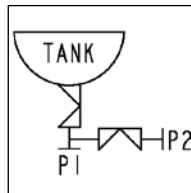
Vessel Valves



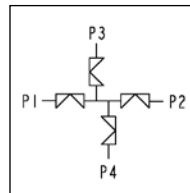
Tank Bottom Valve
Code: TBV



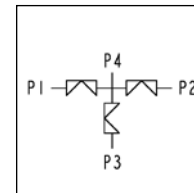
Tank Bottom Valve with CIP/SIP Port
Code: TBV



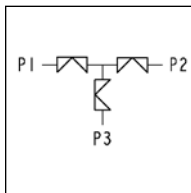
Tank Bottom Valve with CIP/SIP Valve
Code: TBV



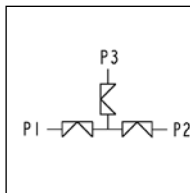
Sterile Barrier
Code: SB1



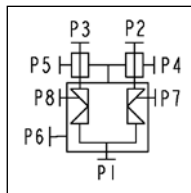
Block & Bleed with Vent Port
Code: BBD



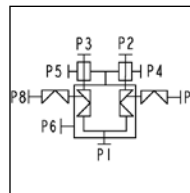
Block & Bleed
Code: BBD



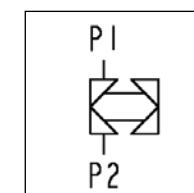
Block & Bleed
Code: BBV



Sterile Filter Shunt Valve
Code: DV2WS



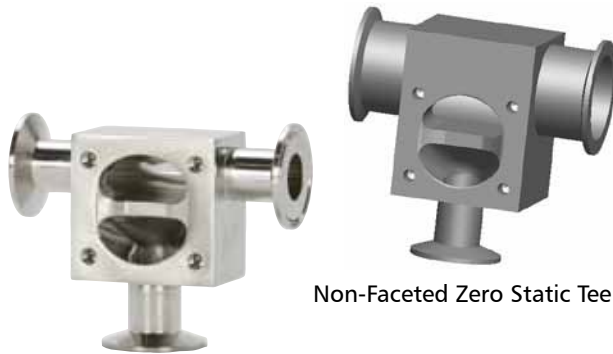
Sterile Filter Shunt Valve with Condensate Drain Valves
Code: DV2WS



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.

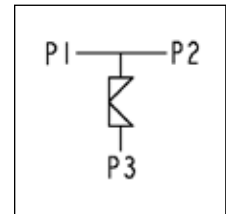


Zero Static Tee (ZSBBT, ZSBT)

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)

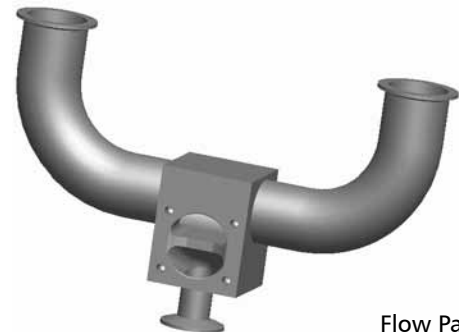
Zero Static use points are some of the most critical valves utilized in the Biopharmaceutical industry. Use point valves allow process fluids to be transferred, sampled, drained or diverted with minimal impact on critical systems such as WFI and purified water.

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.

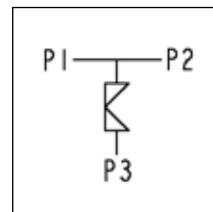
Typical Applications:

- Point-of-use valves
- Piping branch valves

E-Series Zero Static U-Bend



Flow Path



Zero Static Use Points

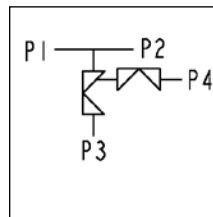
Zero Static Back to Back Sample (ZSBBS)

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.

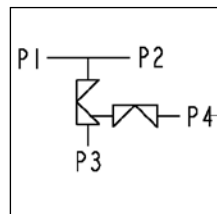
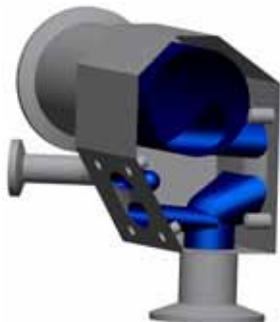


Flow Path



Patent # 6,397,887

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.

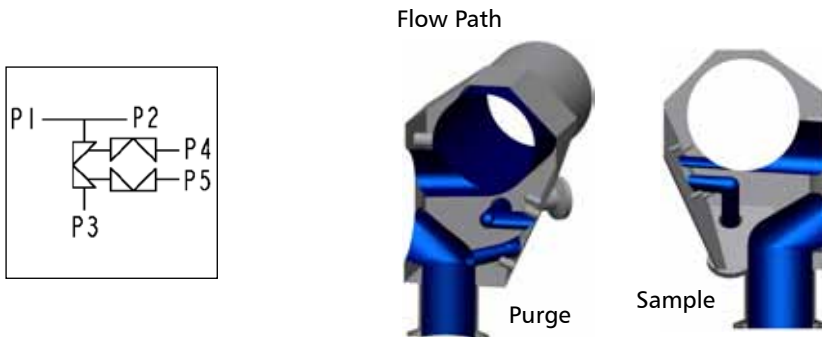
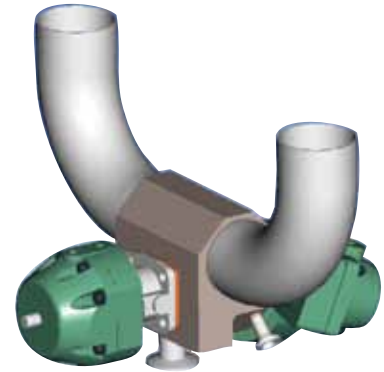
Zero Static Use Points

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:

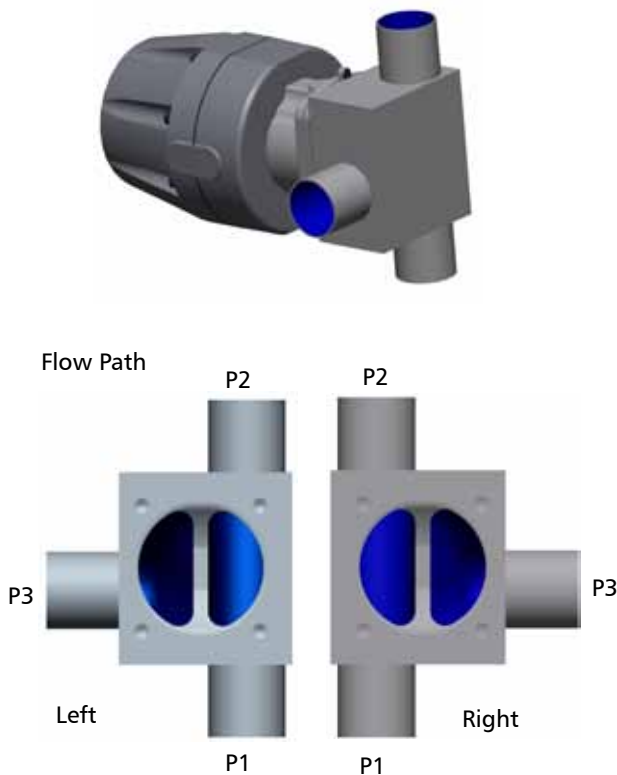
- A single use point with multiple outlets for purging and steam sterilization of the downstream line and sampling of the upstream line



Zero Static Block Body with Vertical Run (ZSBV)

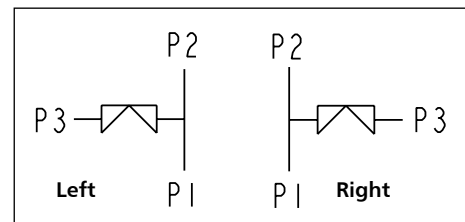
Zero Static use points are some of the most critical valves utilized in the Biopharmaceutical industry. Use point valves allow process fluids to be transferred, sampled, drained or diverted with minimal impact on critical systems such as WFI and purified water.

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)

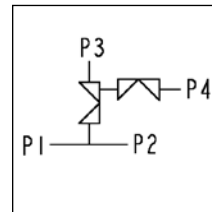
Zerostatic Inverted Drain valves integrate the benefits of a zero static for low point feed or return lines while allowing for cleaning, sterilization or and/or draining of the connected process piping.

Typical Applications:

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



Flow Path

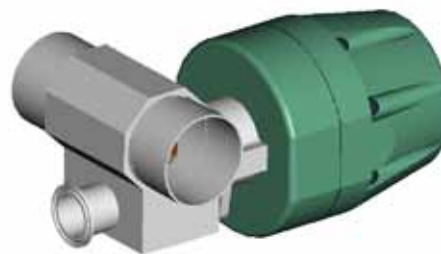


Zero Static Block Body with Back Outlet Option (ZSBBT-BO)

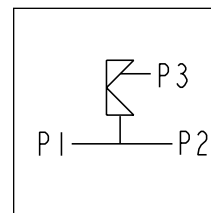
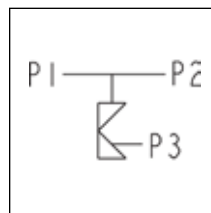
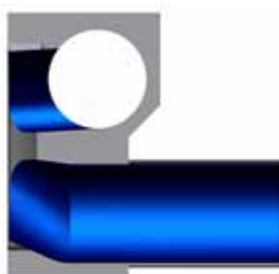
The ZSBBT-BO valve provides all the advantages of the standard zero static valve for transferring, sampling, draining and diverting critical fluids, while minimizing the vertical space required. Porting the outlet from the back of the valve substantially reduces the space necessary when piping would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



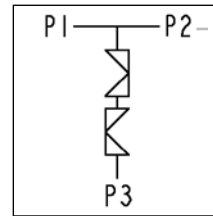
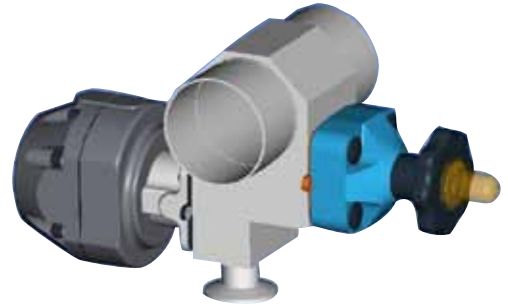
Zero Static Use Points

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

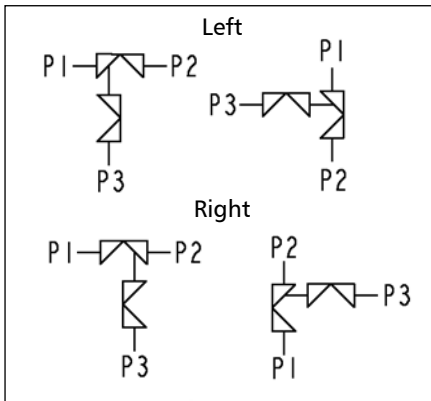
Integral Sterile Access and GMP (ISG)

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.

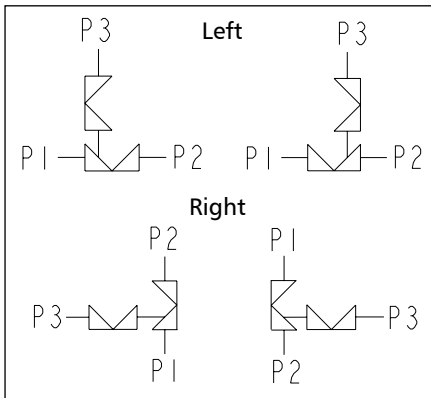
This is achieved by providing the purge valve integral to the main body design. By simply rotating the assembly, one fabricated block body can provide three process fabrication orientations: Standard Sterile Access Port (SAP) and vertical GMP porting above and below the weir. The result is one integral 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

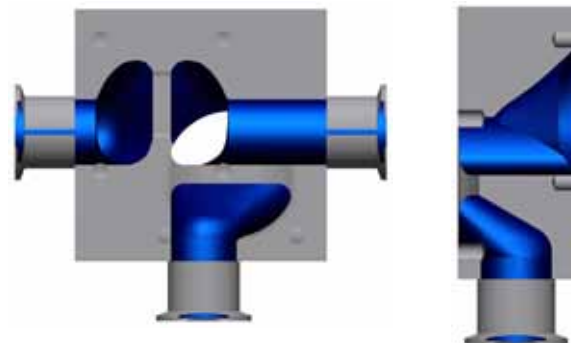


ISG

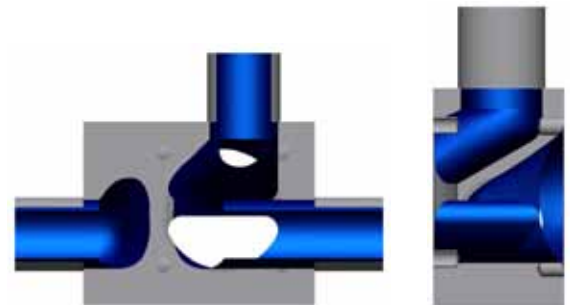


Inverted ISG

ISG Flow Path



Inverted ISG Flow Path



Divert and Sterile Access Valves

2 through 6-Way Multiport Divert Valves

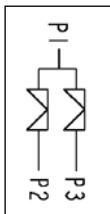
Divert valves are instrumental in achieving efficient, cost effective piping design. Divert valves allow process fluids to be diverted, mixed and/or sampled. ITT Pure-Flo is the first in the industry to incorporate the multiple weir block design. Divert valves minimize contact surfaces, minimize hold 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:

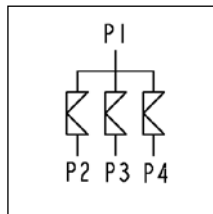
- Distribution of process flows (ie. mixing flow paths)
- 2-Way diverts are often used to switch between main and backup pumps on WFI loops
- Used in place of transfer panels
- Also used for bypass, drain and isolation
- CIP distribution
- Switching between buffers for Chromatography



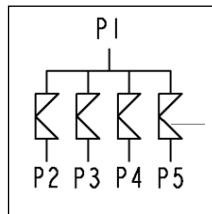
Patent for 2-Way
6,237,637 and
5,427,150



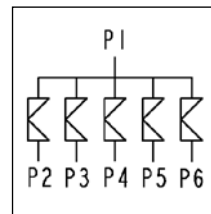
DV2W



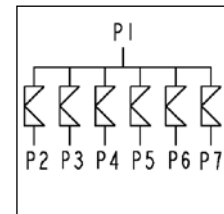
DV3W



DV4W



DV5W



DV6W

Flow Path

2-Way (DV2W)



3-Way (DV3W)



4-Way (DV4W)



5-Way (DV5W)



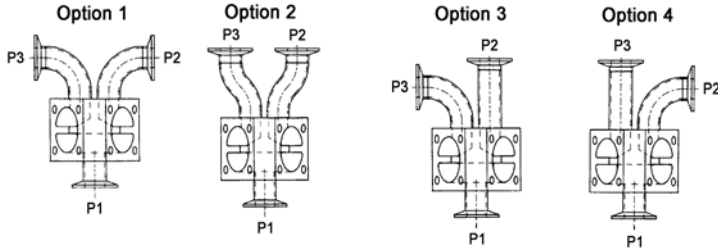
6-Way (DV6W)



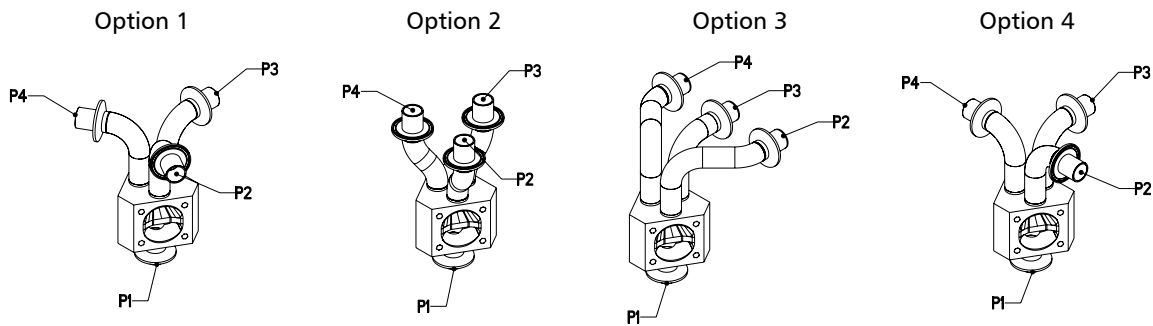
Divert and Sterile Access Valves

Divert Outlet Options

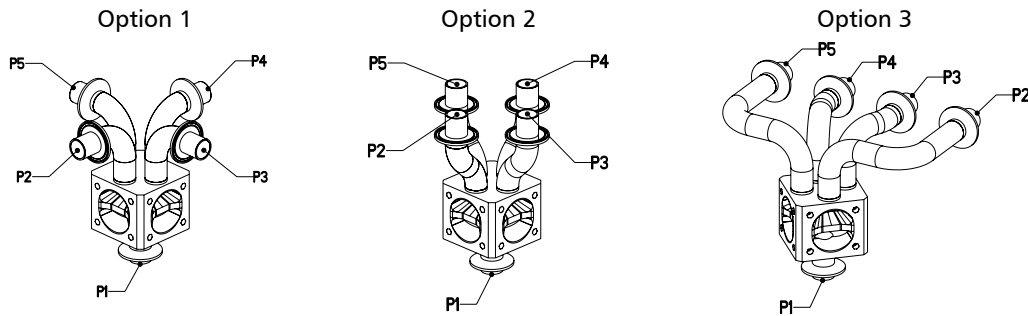
2-Way



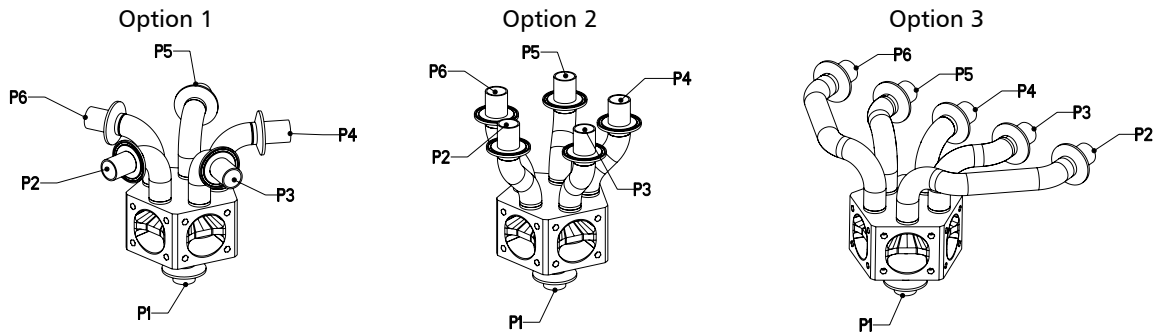
3-Way



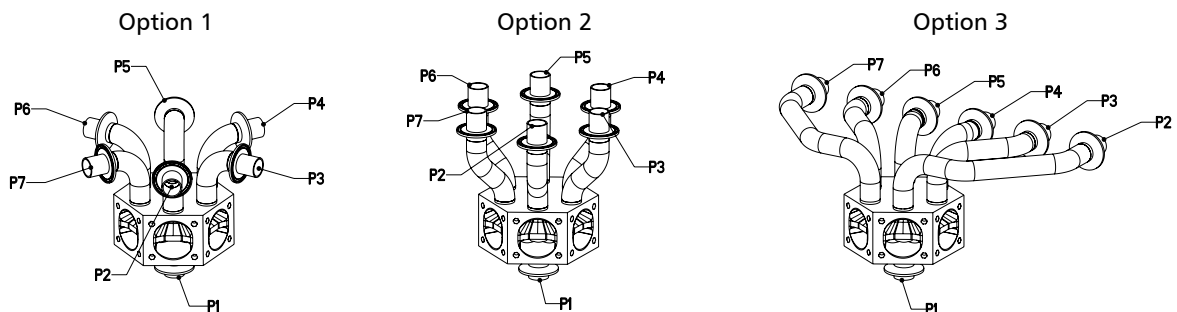
4-Way



5-Way



6-Way



Divert and Sterile Access Valves

Chromatography Valve (CHRO & CHN)

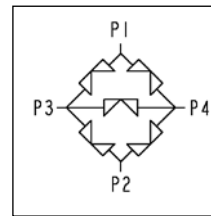
In a typical chromatography process, there is an assembly of five diaphragm valves that connect the chromatography column to the process piping. Manipulating those valves allows the process to flow through the chromatography column in the forward and reverse direction, as well as bypass the column completely. 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:

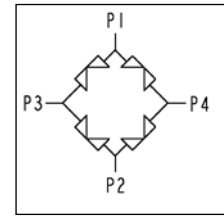
- Chromatography



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

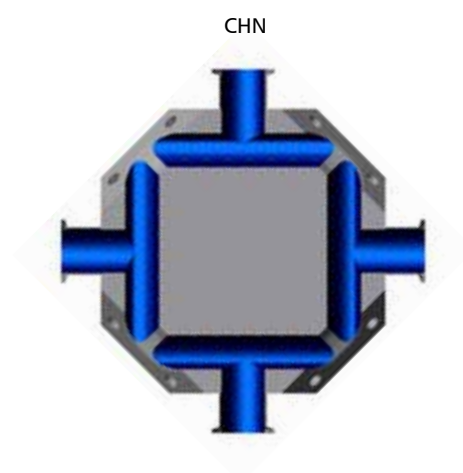
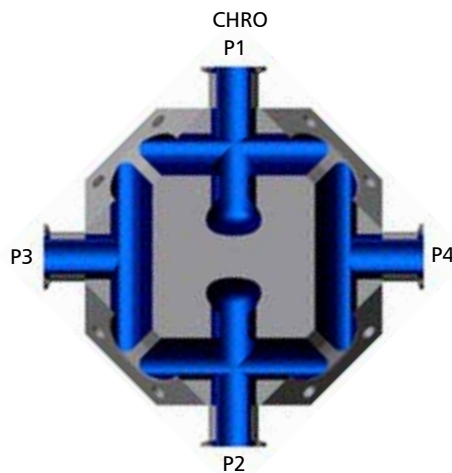


CHRO



CHN

Flow Path



Divert and Sterile Access Valves

Crossover (CROD & CRO)

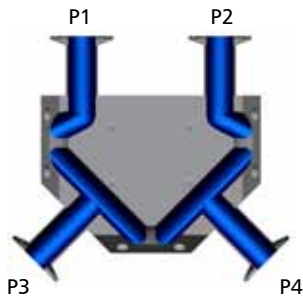
Bioprocessing often requires the use of flow through equipment that must be isolated for maintenance. To facilitate maintenance without shutting down the entire process a configuration of three valves is typically used to isolate and bypass when necessary. The crossover valve integrates these three valves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

Flow Path

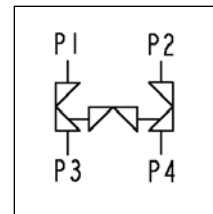
CROD



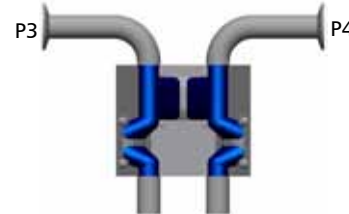
CROD



CRO



CRO

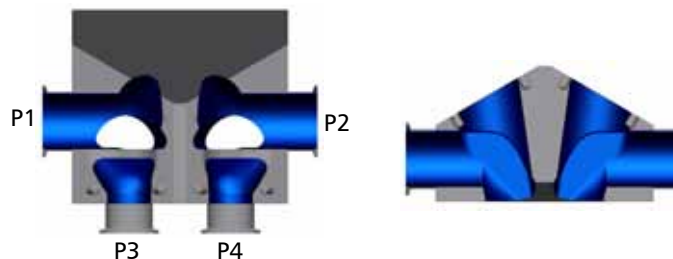
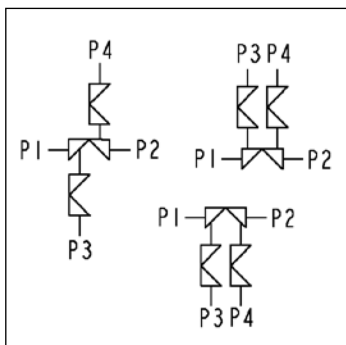


Integral Dual Sterile Access (IDSA)

Sterile Access valves are widely used in the Biopharmaceutical 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.



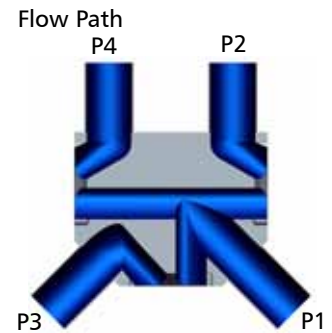
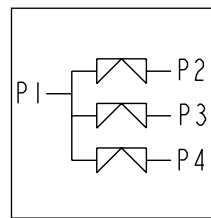
Divert and Sterile Access Valves

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

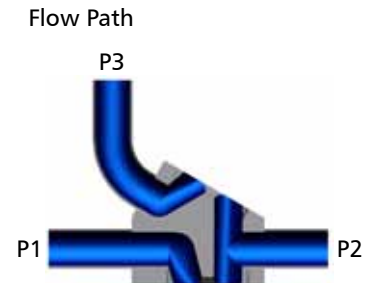
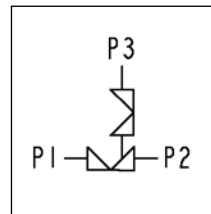
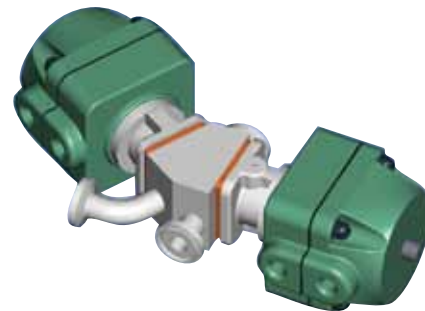


Integral Horizontal Sterile Access (IHSA)

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



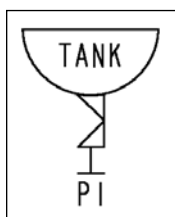
Vessel Valves

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)

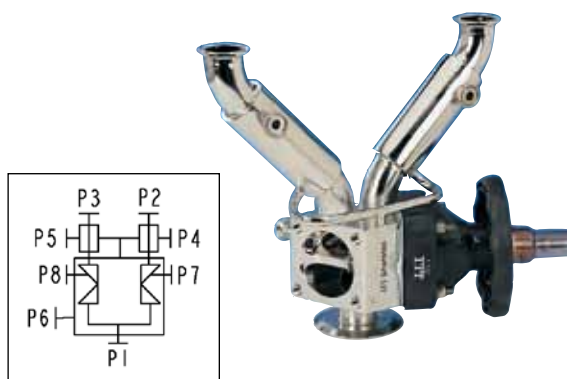
The DV2WS is a 2-Way Divert valve designed to facilitate changing from one vent filter to another on WFI storage tanks without interrupting operations.

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.

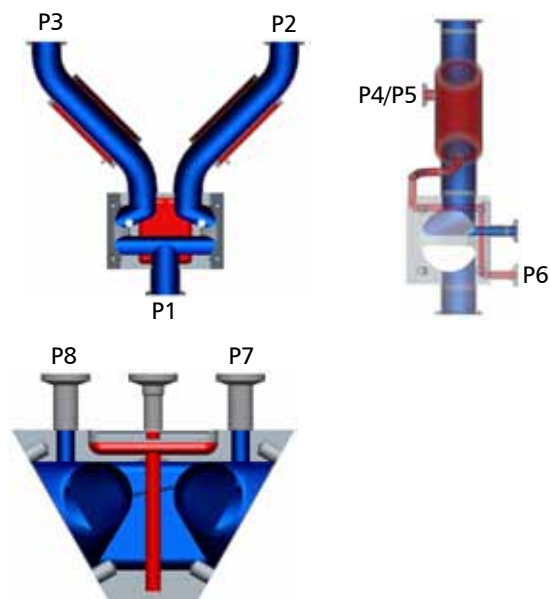
The steam traced version of this valve when used with a steam jacketed filter housing, will prevent condensation from forming inside the filter housing. The assembly consists of a 2-way divert valve. The upstream side of the valve is connected to the two filter housings. The common port is connected 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.

Typical Applications:

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



Flow Path



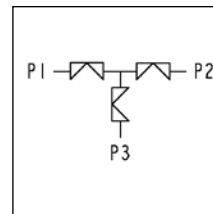
Vessel Valves

Block and Bleed (BBD, BBV)

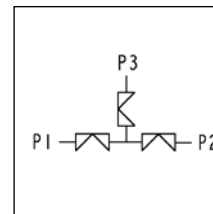
The double block and bleed method of creating an aseptic barrier between two processes is widely utilized in the Bioprocessing industry. Traditionally three standard valves would be fabricated into the double block and bleed configuration. The Block and Bleed Drain (BBD) and Block and Bleed Vent (BBV) 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:

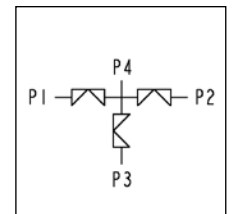
- Create steam block, isolate and clean chamber for aseptic barrier
- Block line flow for the purpose of draining the line or filling from an auxiliary source



Block & Bleed
Code: BBD



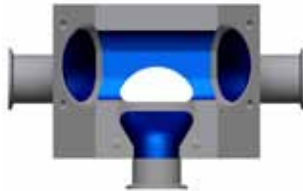
Block & Bleed
Code: BBV



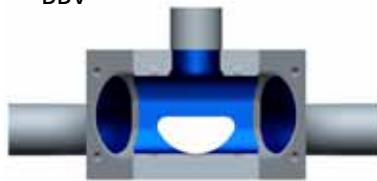
Block & Bleed with
Optional Vent Port

Flow Path

BBD



BBV



Bypass (BYP)

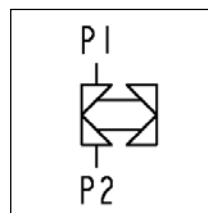
Typical Bioprocessing and Pharmaceutical processes utilize large quantities of water. Processes such as WFI storage, Media hold and Buffer preparation utilize large vessels for holding or preparing the process fluids. The Bypass valve is specifically designed to optimize the fill rate of these large 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:

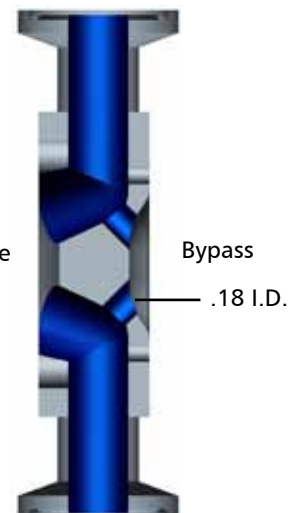
- Tank filling applications



Main Valve



Flow Path



Bypass

.18 I.D.

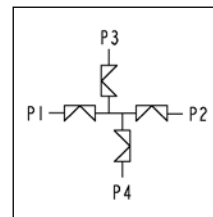
Vessel Valves

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

