

**CAD**  
CLEAN & ASEPTIC DESIGN



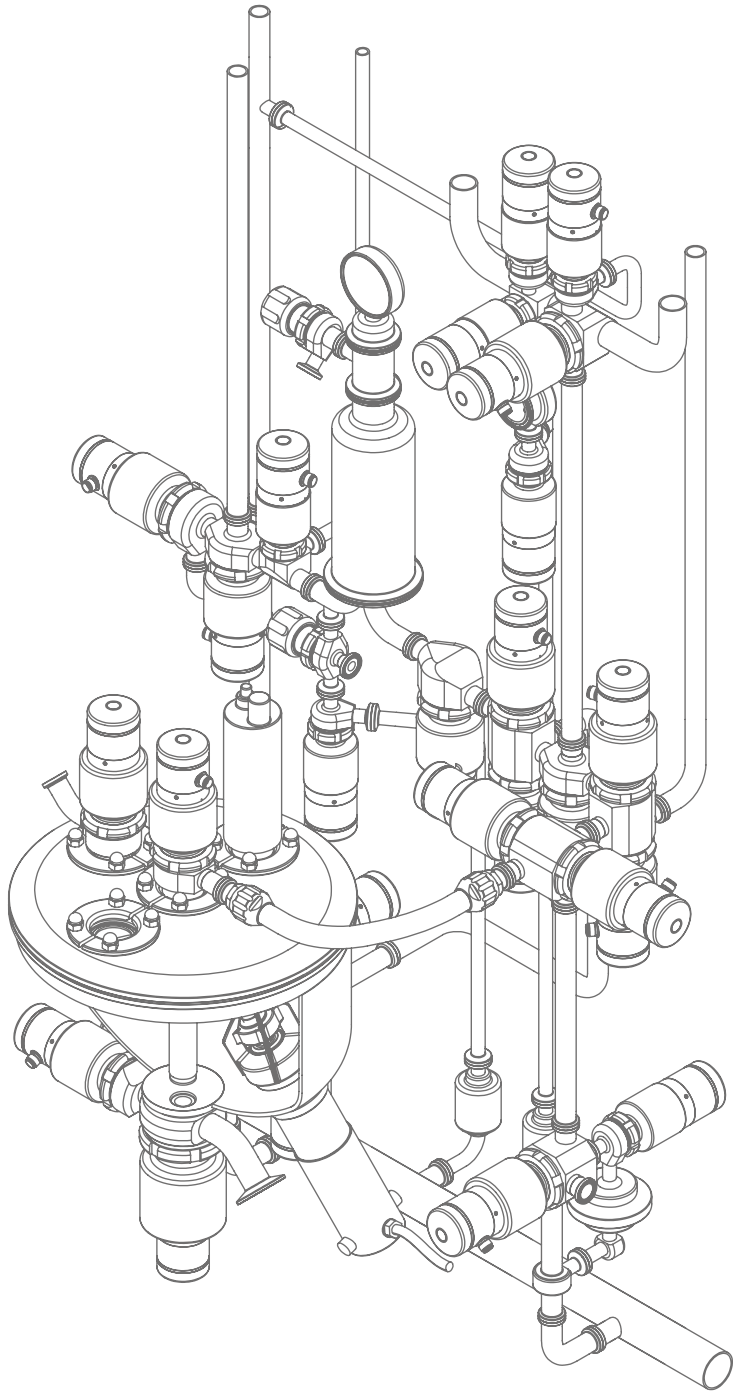
# INNOVATIVE SOLUTIONS FOR ASEPTIC PROCESSING

MARK 2

 **RATTINOX**  
ASEPTIC EQUIPMENT - DESIGN & SUPPLIER



**CAD**  
CLEAN & ASEPTIC DESIGN

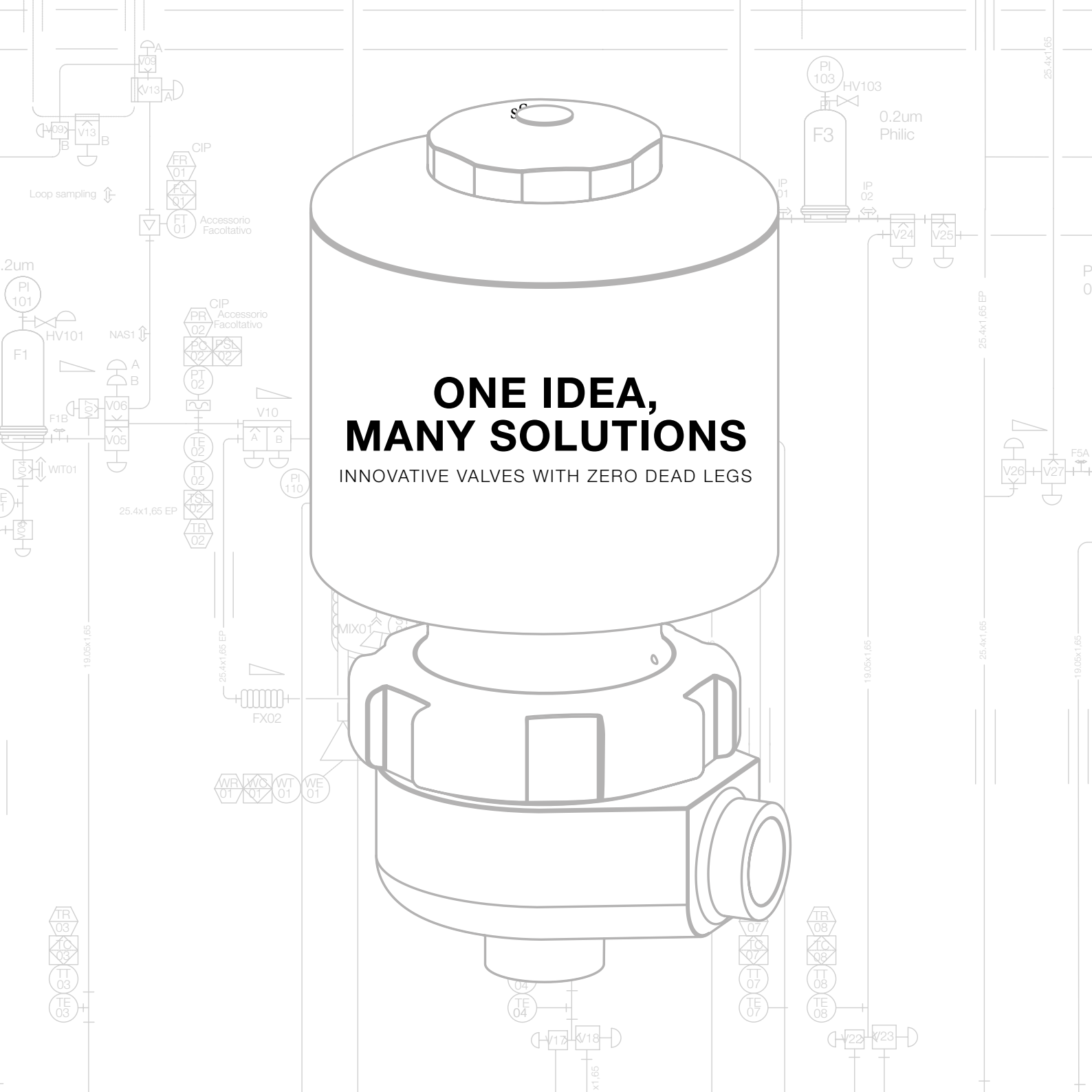


# INNOVATIVE SOLUTIONS FOR ASEPTIC PROCESSING

MARK 2

 **RATTINOX**  
ASEPTIC EQUIPMENT - DESIGN & SUPPLIER

**ONE IDEA,  
MANY SOLUTIONS**  
INNOVATIVE VALVES WITH ZERO DEAD LEGS



# INTRODUCTION

## **CAD Clean & Aseptic Design: One idea, many solutions.**

The CAD valve range is the key tool to help you easily satisfy critical aseptic processing criteria. Frustrated with poor performing hygienic valves, aseptic process designers are asking for equipment suitable for the most stringent requirements of CIP and SIP. CAD valves are designed to answer these demands with properly designed process configurations upstream, downstream and around process vessels. The family of CAD valves offers designers a wide range of engineered solutions enabling compact designs, free of dead legs, with minimal solution hold up. Processing with CAD valves, which have only 2 wetted materials: EN 1.4435-BN2 and PTFE USP Class VI-121°, will provide you an efficient, simple, reliable, and easy to validate process system.

### **CAD valves benefits:**

- Optimized CIP-SIP Cycles
- No unused portions
- Flush flow design
- Easy process Validation
- Wide range of design possibilities to meet unique applications
- Extensive technical documentation for Validation

**Valve design range:** the CAD family valve range is extensive. Our specialists in process design will support you in selecting the appropriate valve types, clusters and blocks. We can also help you optimize your solution preparation system in order to achieve a design free of dead legs, with minimal product hold up, in a compact design for rapid and robust CIP and SIP cycles.

**Standard preassembled valves:** a variety of valve assemblies are available to speed up process construction. Point of use, bottom drain point, and others are available as standard products.

**Tailored valves and valve assemblies:** if required, our specialists are able to quickly design, build and deliver special valves, valve clusters or blocks combining multiple process functions.

**Support:** this guideline will help you with the correct valve selection and suggest alternative solutions according to your needs. The goal is to improve general performance in terms of effective cleaning (CIP), sterilization (SIP) and full drainability. For additional information or support feel free to contact us at [info@rattiinox.com](mailto:info@rattiinox.com) or call the nearest Official CAD Distributor by looking at our website: <https://rattiinox.com>

We are proud to lead ASTM E55.11: Clean by Design



ASTM INTERNATIONAL  
Helping our world work better



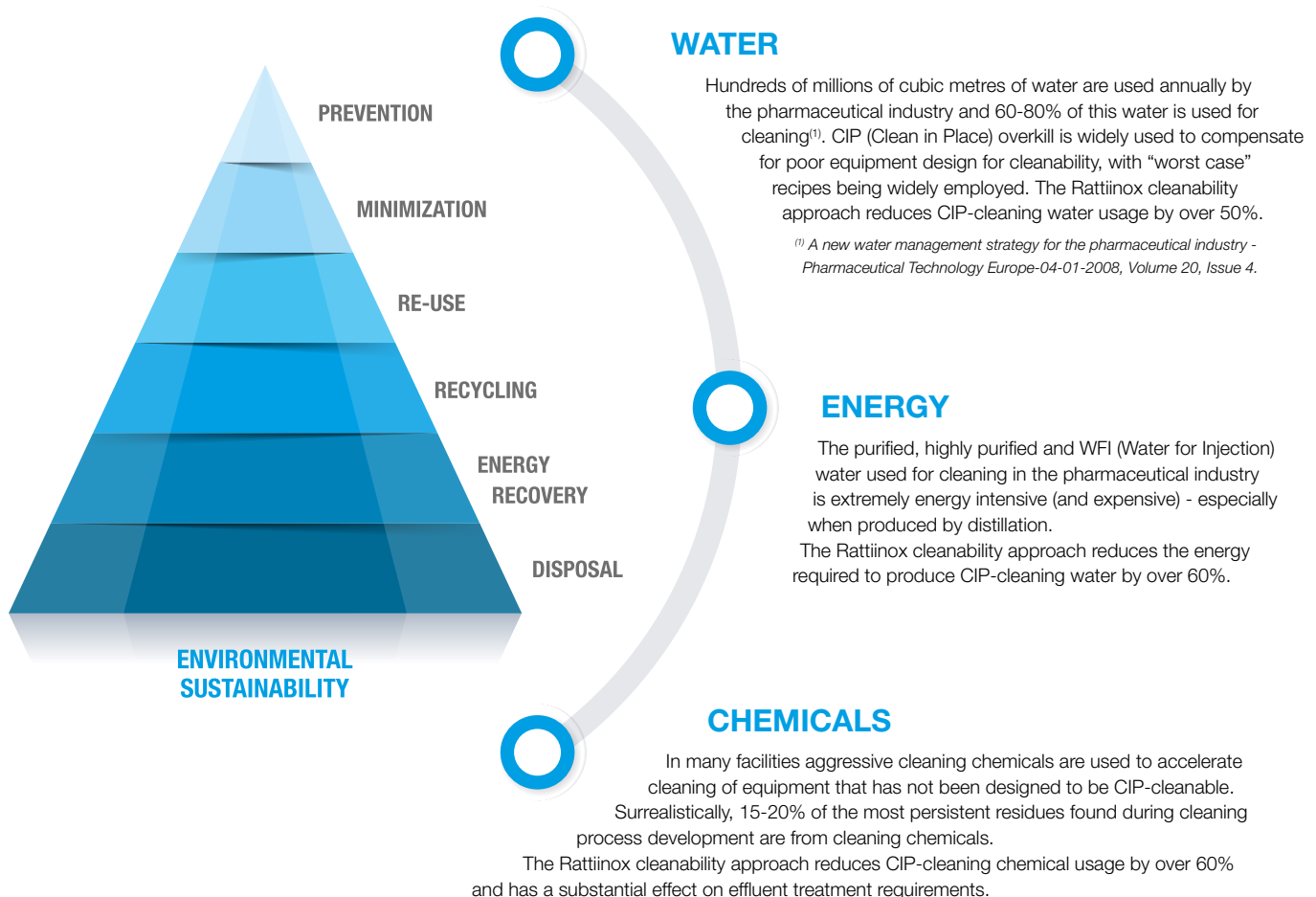
## ENVIRONMENTAL SUSTAINABILITY

- WATER
- ENERGY
- CHEMICALS



NOW OR NEVER

The Rattiinox cleanability approach fully embraces the ideal of resource reduction with three main themes:



**With adequate specification and good design - proven by cleanability testing at FAT or earlier - cleaning water, energy and chemical usage can be reduced by 50-60%.**

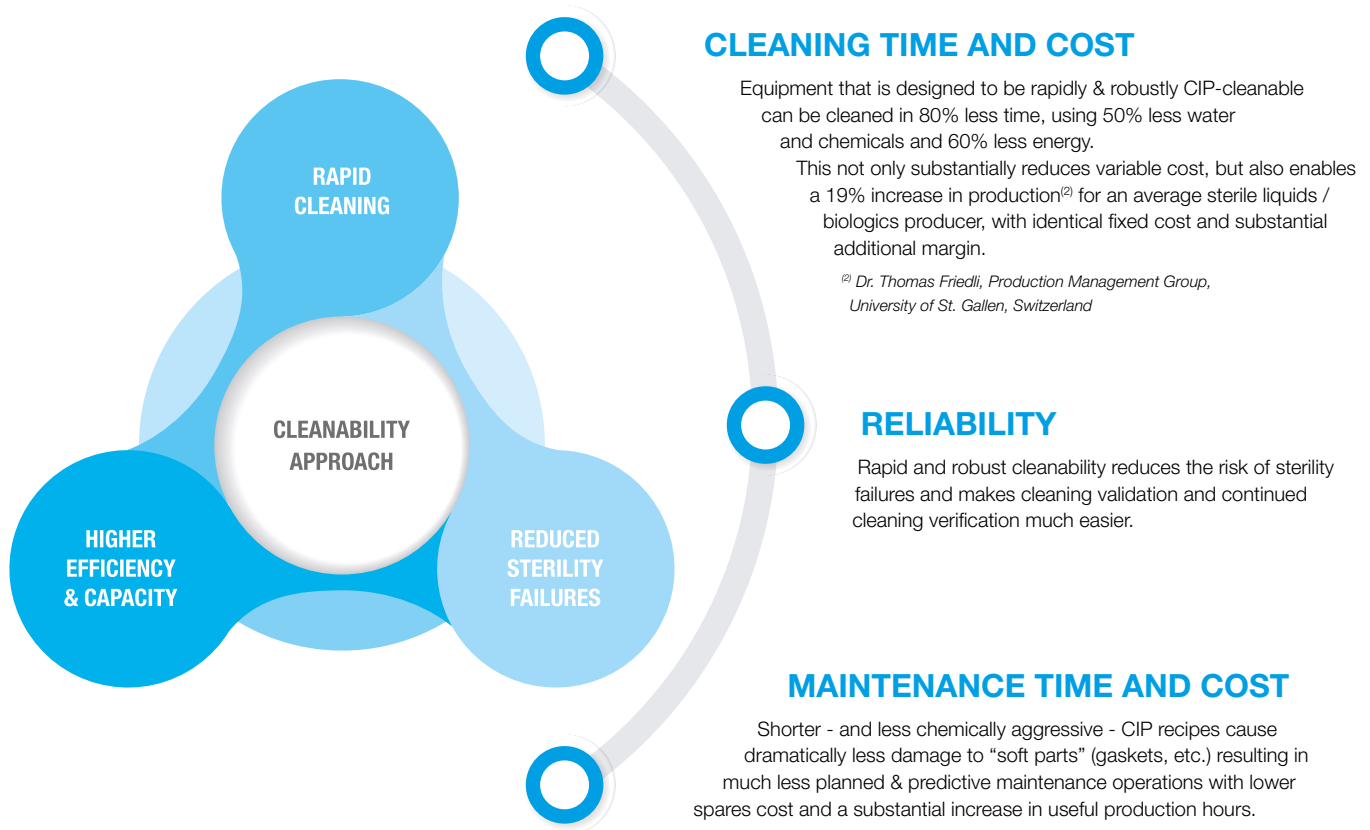


## **OEE, CAPACITY AND COST**

- **CLEANING TIME  
AND COST**
- **RELIABILITY**
- **MAINTENANCE TIME  
AND COST**



The Rattiinox cleanability approach helps customers increase their manufacturing efficiency and their production capacity with lower CAPEX and equal fixed costs:



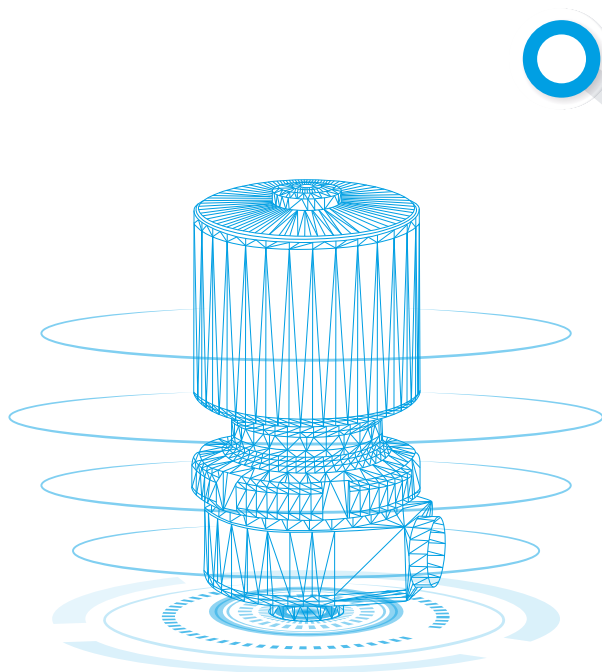
**With adequate specification and good design - proven by cleanability testing at FAT or earlier – manufacturing efficiency can be increased, maintenance reduced, and total production capacity increased dramatically.**



## **RATTIINOX CLEANABILITY APPROACH**

- **P&ID ADVICE**
- **VALVE SELECTION**
- **LAYOUT OPTIMIZATION**

**Rattiinox makes aseptic valves that are easy to CIP clean robustly and low maintenance, but these advantages are meaningless if your system has other substantial cleanability hazards. For this reason, we developed our holistic cleanability approach.**



## P&ID ADVICE

Our process experts study your P&ID and make suggestions that are uniquely related to cleanability - not to your process. You are the expert in your process, whilst we have many years' experience curing CIP-cleanability issues.

## VALVE SELECTION

Rattiinox has developed an extraordinary range of valve types, clusters and special valve blocks to suit a wide range of pharmaceutical and biologics process applications. All have absolutely minimized dead legs and excellent drainage. In new applications for us (for instance complex valve arrays for chromatography), we still invent new blocks to optimize cleanability, production efficiency and product yield.

## LAYOUT OPTIMIZATION

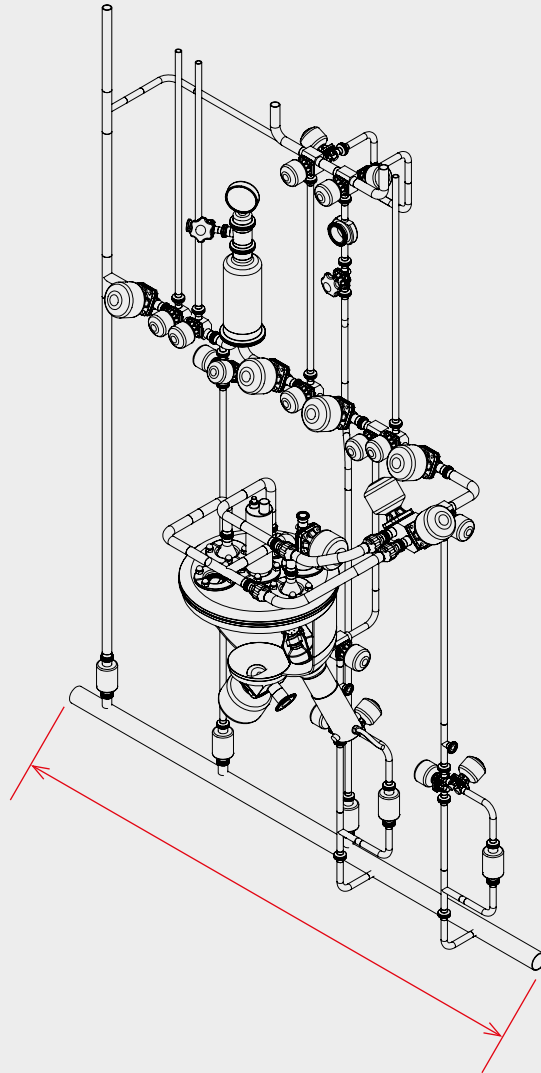
Following selection of basic valve types, projects typically involve several iterations of final valve, cluster or block configurations to reduce total pipework volume and skid footprint - and to allow good access for maintenance, etc. All Rattiinox valves have many port options to allow skid optimization - and we are very happy to help you in this process.

**We are keen to contribute to improved sustainability, manufacturing efficiency, reliability, and product availability in the pharmaceutical industry and to help reduce the cost of medicinal products.**

**To this end we are the founding member of the ASTM E55.11: Clean by Design draft standard.**

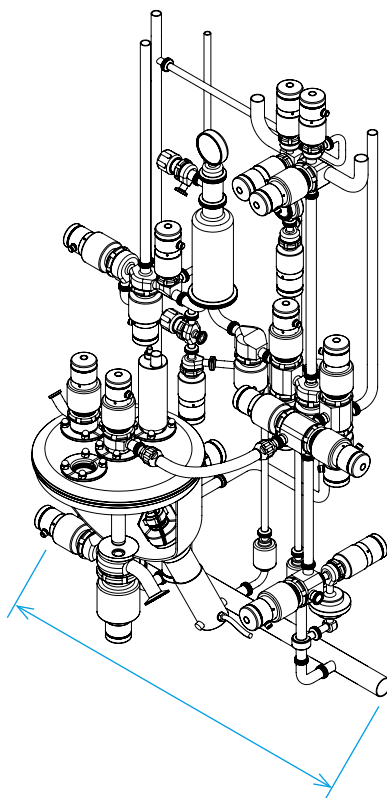
## CONVENTIONAL EQUIPMENT ISOMETRIC VIEW

Projects using classic weir style membrane valves require a large number of elbows and tees. These fittings have been developed to allow for orbital welding, which requires extended pipes. The final project often results in larger installations with some unused portions and dead legs, reducing the final efficiency and performance of the systems in terms of temperature distribution, drainability and cleanability.



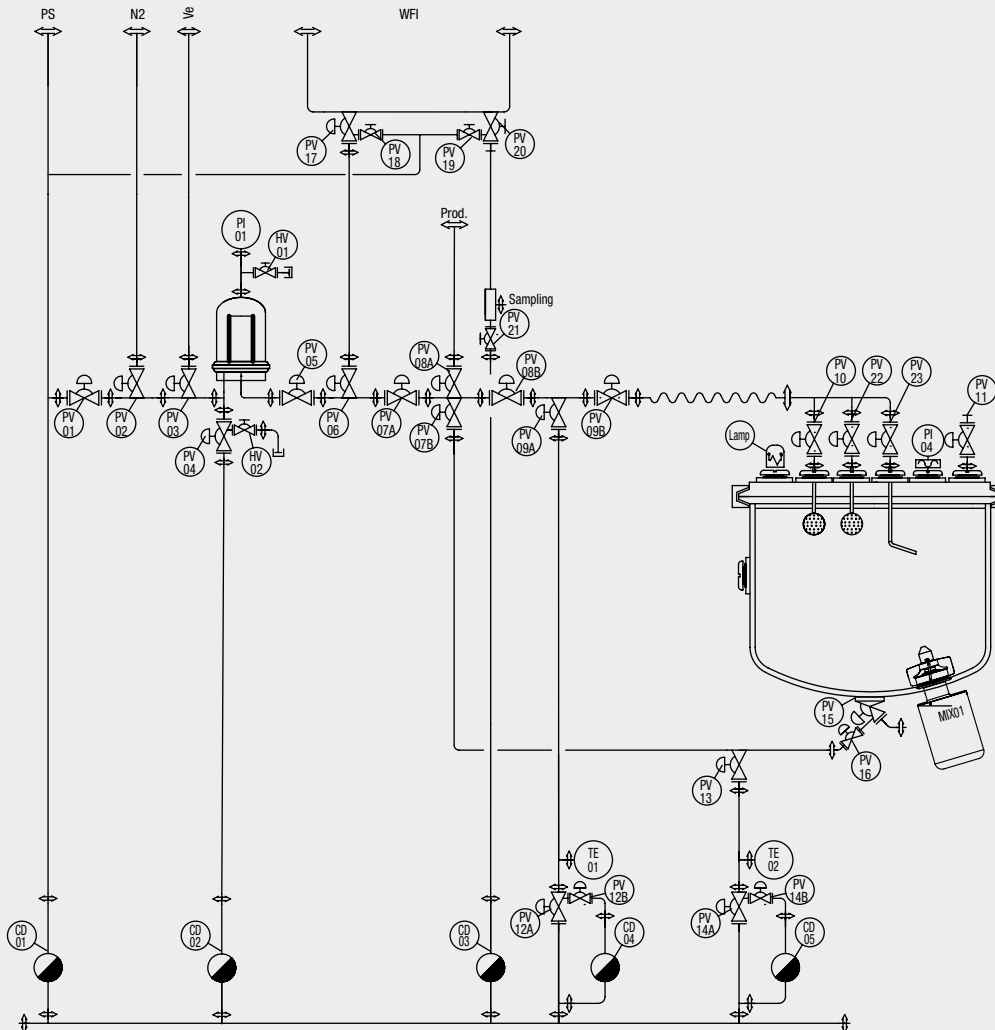
## CAD EQUIVALENT ISOMETRIC VIEW

Thanks to the CAD philosophy and the wide product range, the use of elbows or tees can be drastically reduced. The final project results in a very compact design with less piping which improves system performance, cleanability, sterilization and overall efficiency.



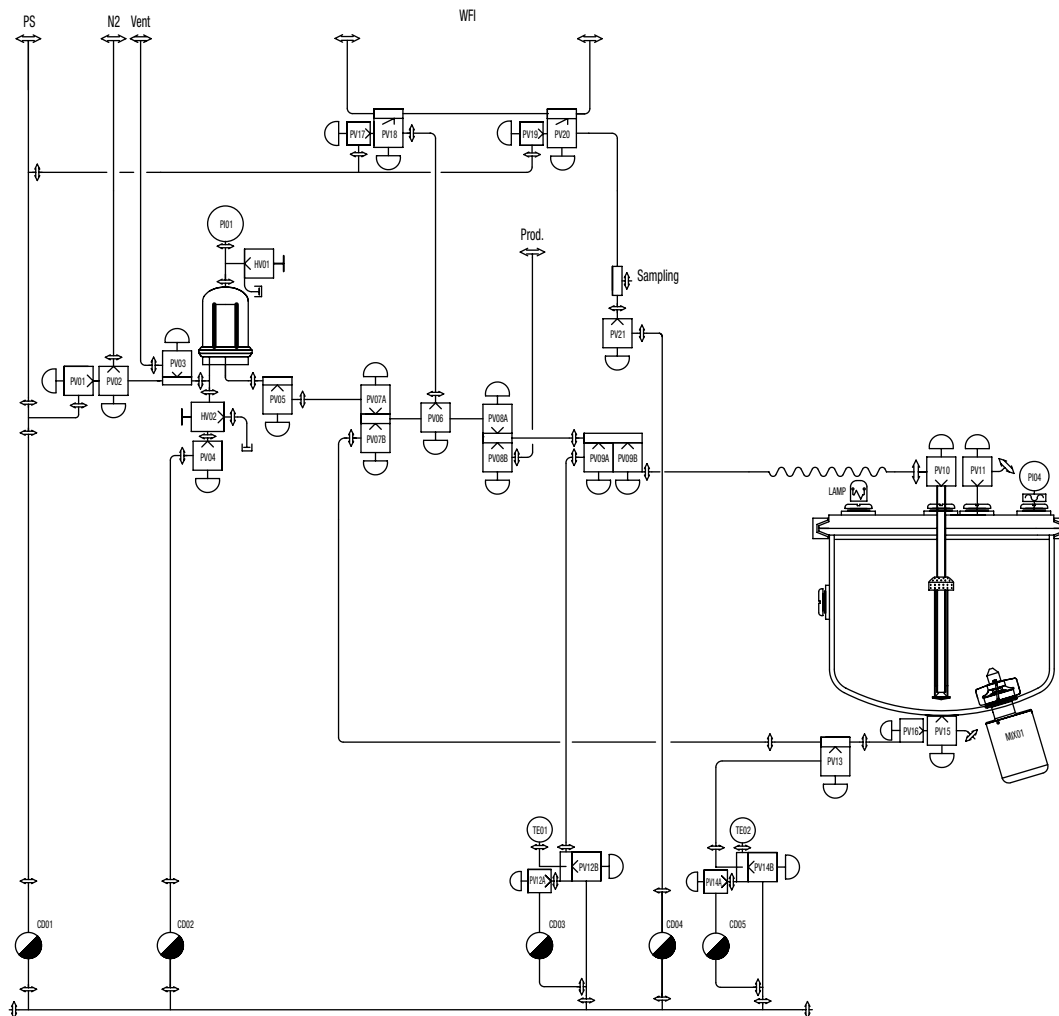
## CLASSIC EQUIPMENT P&ID

Typical P&IDs use unified symbols to identify the valves and components in an installation. Weir style valve symbols identify only a small list of bodies which sometimes leaves interpretation to the builders which can result in incorrect valve selection.



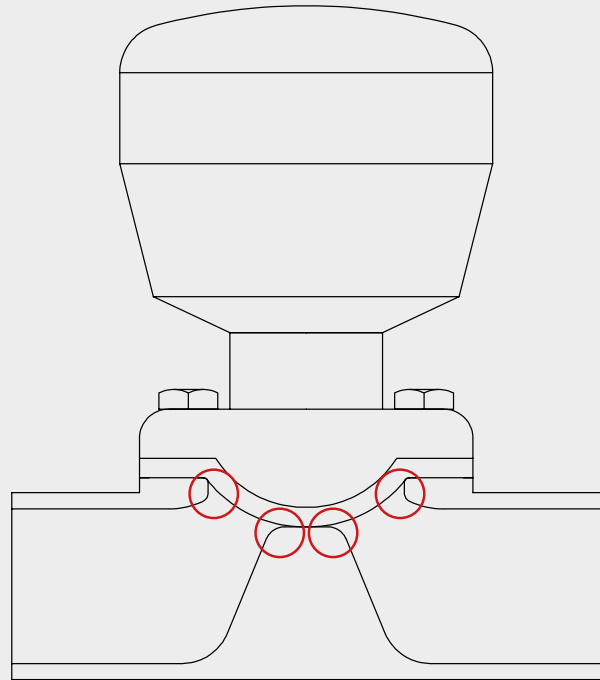
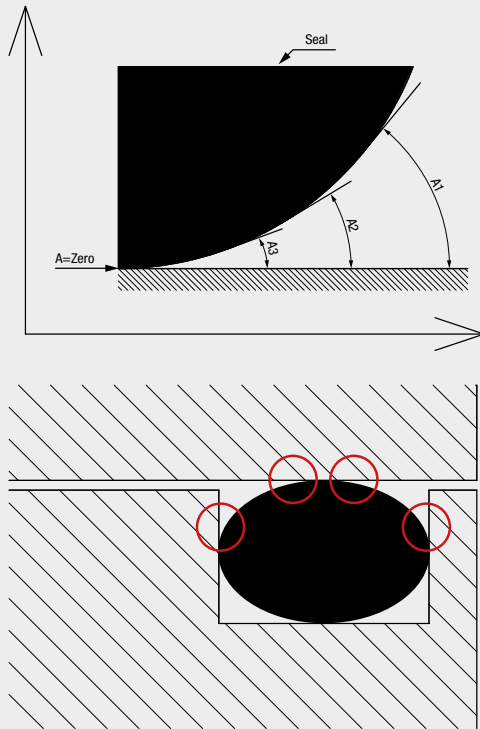
## CAD P&ID

The CAD valve product range is very extensive and we have developed our own P&ID symbols to make it possible to identify immediately the required valve configuration, such as Shut off 90°, Shut Off 180°, Flow Through, On Pipe, etc... Our process experts will help you in the conversion from your classic P&ID to a CAD P&ID.



## Features analysis: ASYMPTOTIC SEALS

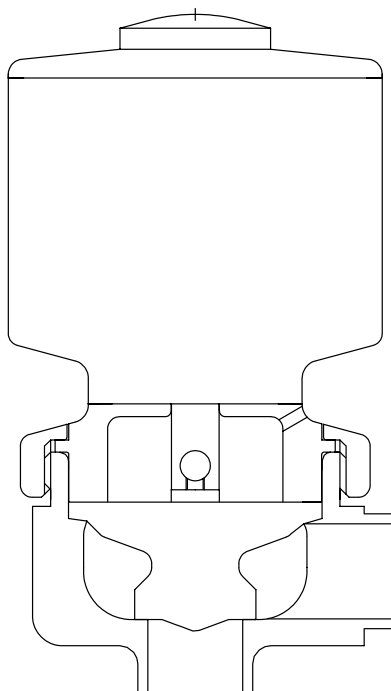
Two main factors affecting aseptic processing efficiency are CIP (Cleaning In Place) and temperature distribution for an effective SIP (Sterilization In Place). To achieve efficient and effective cleaning in place, turbulent flow is required. The key point to achieving turbulent flow is to avoid asymptotic areas. When the flow stops inside a weir type valve and fluid drains out, some remains - especially in the asymptotic areas. When the valve is then cleaned by CIP flow, most of the valve is cleaned but the asymptotic areas where there's no turbulence can remain dirty, leaving two options: a much more aggressive CIP process, or manual cleaning.





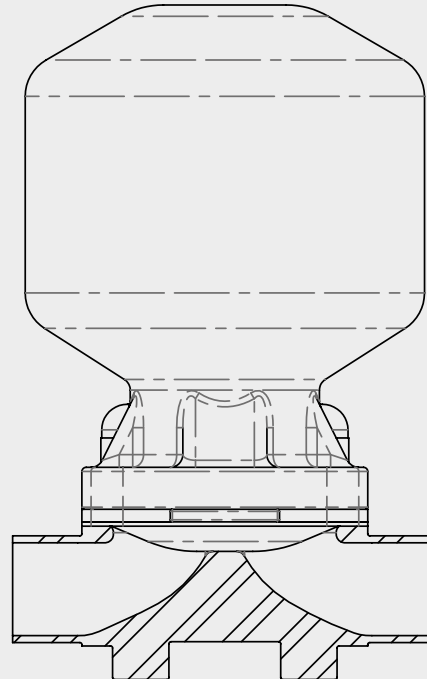
## CAD design: FREE FROM ASYMPTOTIC SEALS

Bioprocessing professionals more than ever require equipment able to efficiently fulfil the stringent requirements of CIP and SIP. The flush flow internal design of the CAD Valve, which is free from asymptotic closures and dead legs, is a key tool enabling you to guarantee critical criteria are easily satisfied. When CIP starts inside a CAD valve, the turbulent flow reaches every single area within the valve and leaves it perfectly clean. Rattinox CAD valves allow quick and robust CIP cleaning without leaving any residues. The machined from solid PTFE diaphragms are inert to CIP chemicals and resist many thousands of CIP and SIP cycles, typically requiring no maintenance for five or more years. Water for cleaning requires a very high energy input, so accelerating cleaning cycles with CAD valves, not only saves time, money, water and chemicals, but also helps to meet carbon footprint goals. The CAD Valve design also permits the use of pulsating vacuum/steam during SIP air-purge and heat-up and vacuum-accelerated drying without the risk of diaphragm blistering.



## Features analysis: DIAPHRAGM

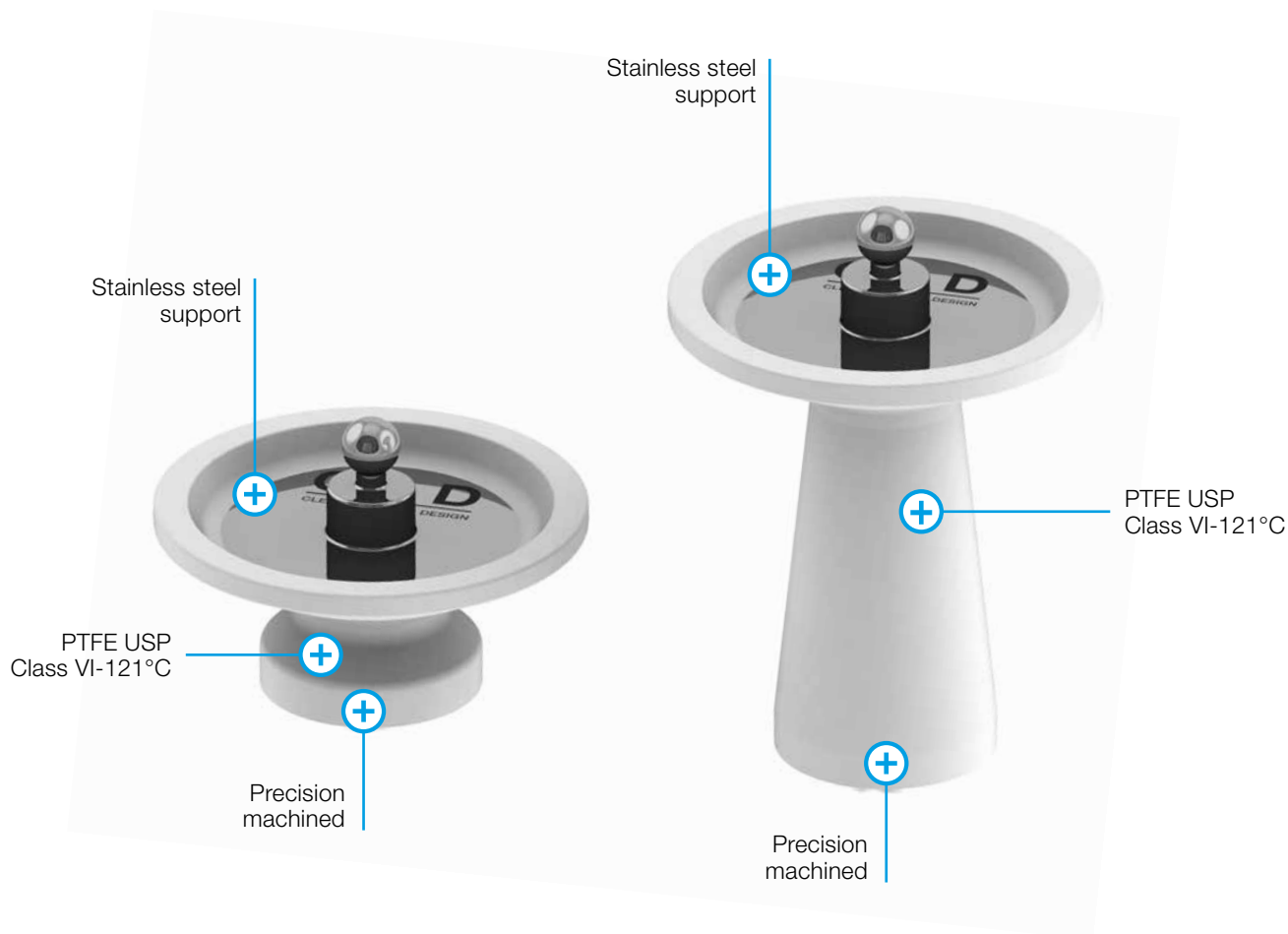
Weir-type valve manufacturers have added PTFE layers to increase the chemical and thermal resistance of traditional EPDM diaphragms. The PTFE layer is certainly more resistant, but suffers permeability due to micro-pores left between individual PTFE spheres during the moulding process. During SIP cycles, steam permeates through these pores into the area between the two bonded layers. Upon cooling, this steam condenses, leaving liquid between the layers. Repeated SIP cycles result in the growth of a blister, which can eventually reduce flow through the valve, or burst, with potentially disastrous contamination and cross-contamination consequences. Recent versions of these twin-layer diaphragms feature two separate, non-bonded, layers with weepage holes in the EPDM layer to vent liquid into the actuator housing and thence to atmosphere. Customers using this type of weeping valve should take precautions if they have dangerous process fluids and they should check whether such a valve maintains sterility.





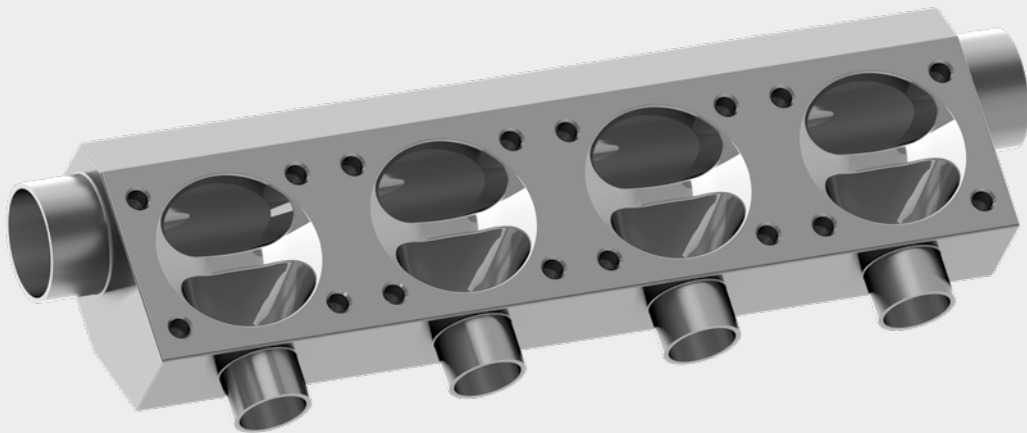
## CAD design: DIAPHRAGM

The machined from solid PTFE diaphragms of CAD Valves resist many hundreds or even thousands of high temperature SIP cycles, typically requiring no maintenance for five or more years. The PTFE radial diaphragms enable the use of pulsating steam-vacuum to accelerate SIP air-purge and heat-up, vacuum-drying and vessel emptying during CIP without diaphragm blistering risk.



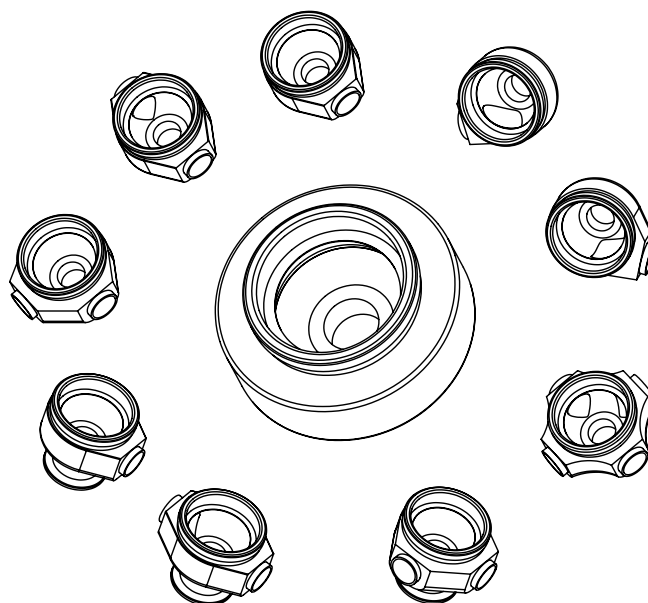
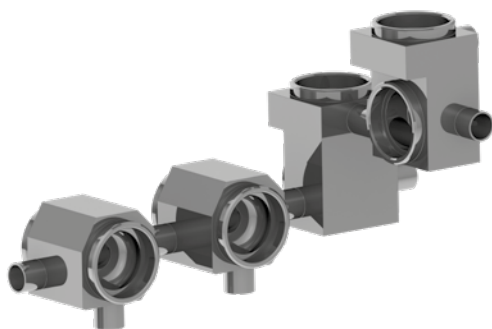
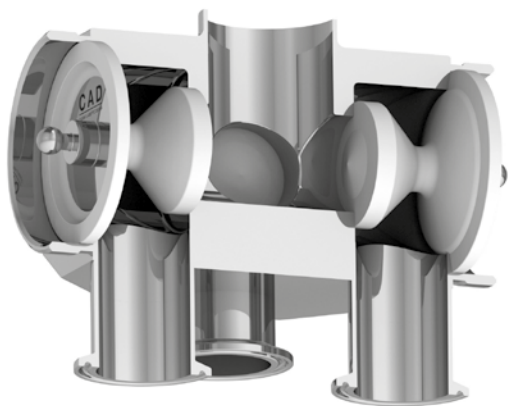
## Features analysis: WEIR-TYPE BLOCKS

Multiport weir-style membrane valves need heavy blocks of material that reduce energy efficiency during SIP cycles. Often dead leg ratios cannot be optimized, due to the strict design of the valve chamber.



## CAD design: FREE FORM BODY DESIGN

The design of CAD radial valves is very flexible, allowing the possibility to produce block valves (single piece) or valve clusters, achieving very compact and lightweight designs, which increase thermal efficiency. Many different types of valve can be made from a single semi-machined body. We stock semi-machined bodies for process, tank bottom and diverting valves to reduce your project lead time significantly.

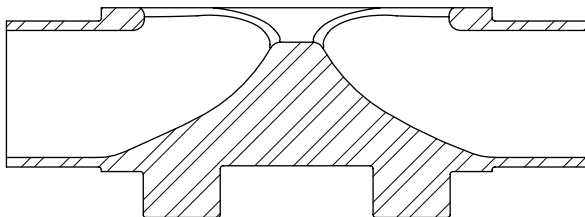


## PROCESS VALVES: SHUT OFF 90

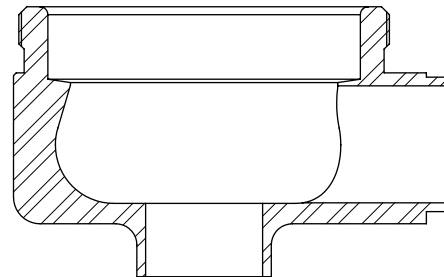
The typical straight-through design of standard membrane valves is commonly used for hygienic industrial applications but their internal design, with asymptotic closures, will always have two long dead legs at the valve entrance and outlet. This is an important feature that can reduce the efficiency of aseptic processing systems.

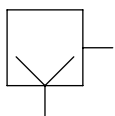
**CAD SOLUTION.** Radial valve designs drastically reduce the distance between the inlet of the valve and the sealing area. In the case of a Shut-Off 90° valve, the distance between the valve inlet and the outlet is reduced and drainability is improved. The internal design, free from asymptotic closure, increases the speed of CIP & SIP processes and avoids the necessity for disassembly and manual COP cleaning. The robust CIP-cleanability of our valve bodies and diaphragms, combined with some system cleanability suggestions from us, enable multi-use facilities to validate CIP cleaning processes without disassembly, COP and ECO (Elastomer Change Out) at PCO (Product Change Over). This dramatically increases the OEE (Overall Equipment Effectiveness) of facilities.

Example of conventional design

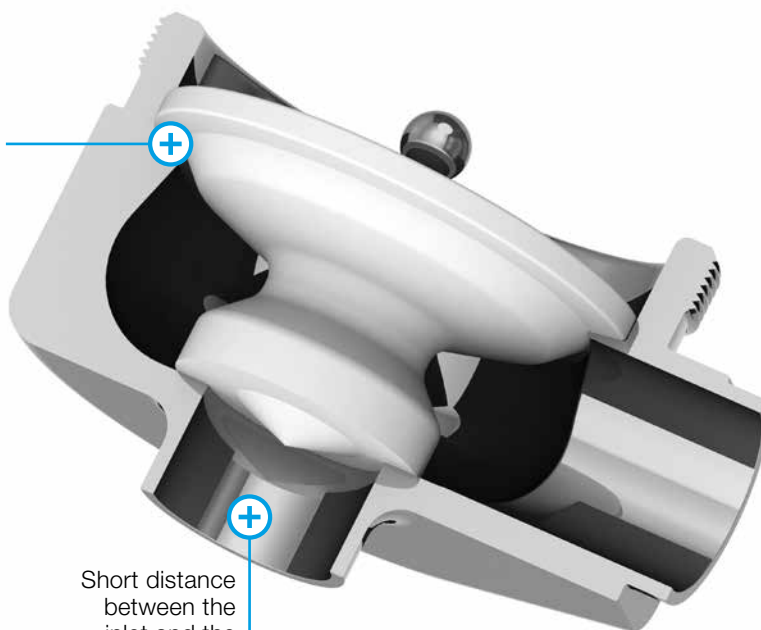


CAD design





Internal design  
free from  
asymptotic closure



Short distance  
between the  
inlet and the  
sealing area

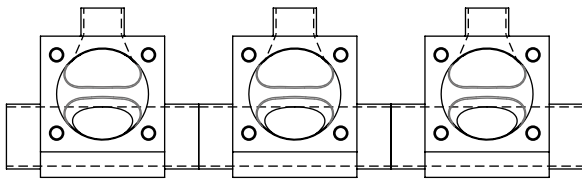
## PROCESS VALVES: FLOW THROUGH

For manifold applications T-block valves are the typical weir-type valve answer, but they have an asymptotic seal area which CIP flow cannot reach to effectively remove process residues, resulting in increased CIP times and more aggressive CIP cycles - or COP operations.

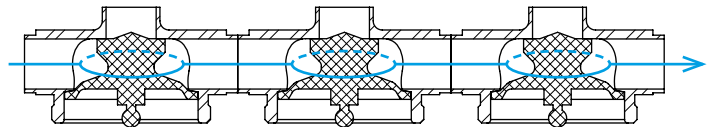
**CAD SOLUTION.** The Flow Through design allows the flowing medium to cross and circulate inside the valve and inner part of the diaphragm allowing rapid and robust CIP cleaning.

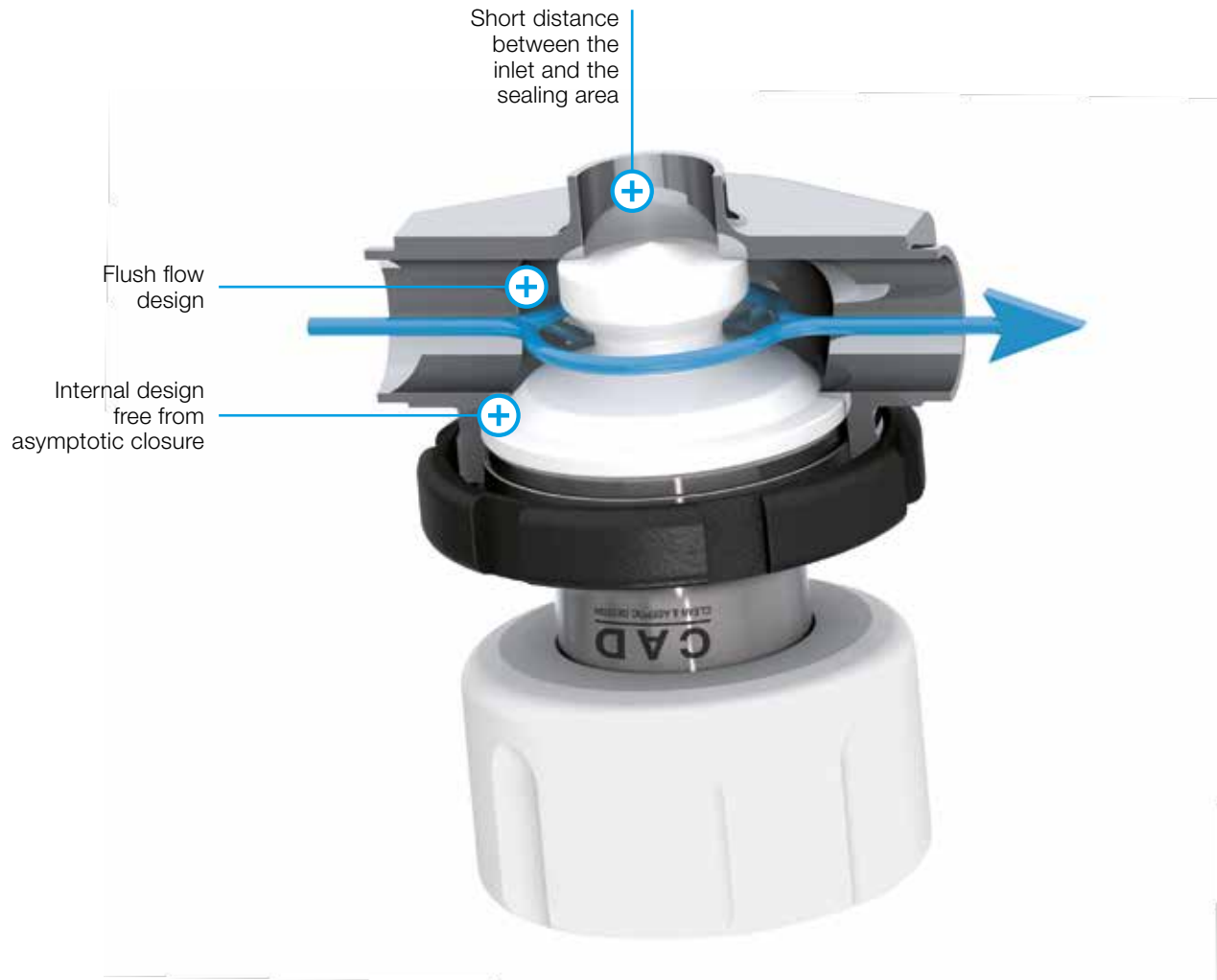
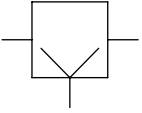
The typical Flow Through body configuration body is 180° in/out, but Flow Through 90° and tangential connections are also available as a standard designs to suit other mounting orientations.

Example of conventional design



CAD design

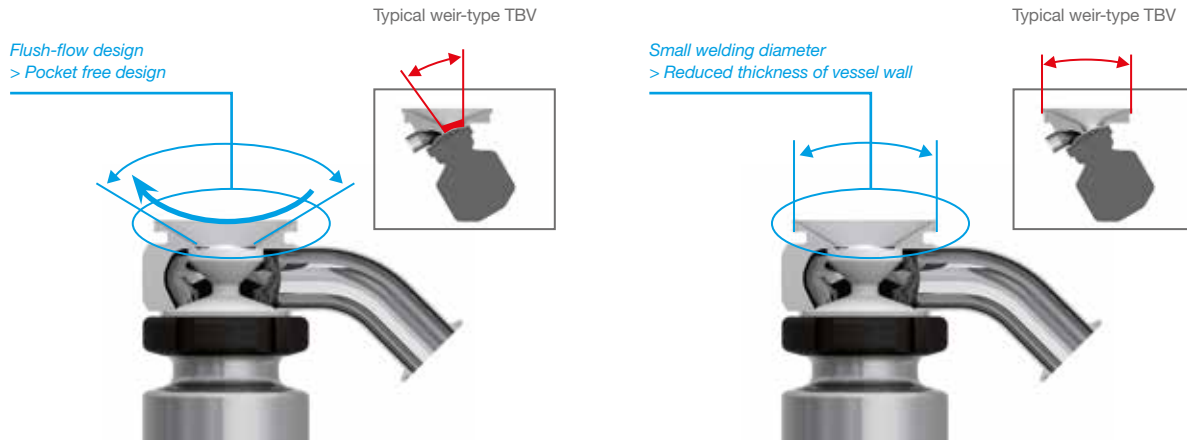


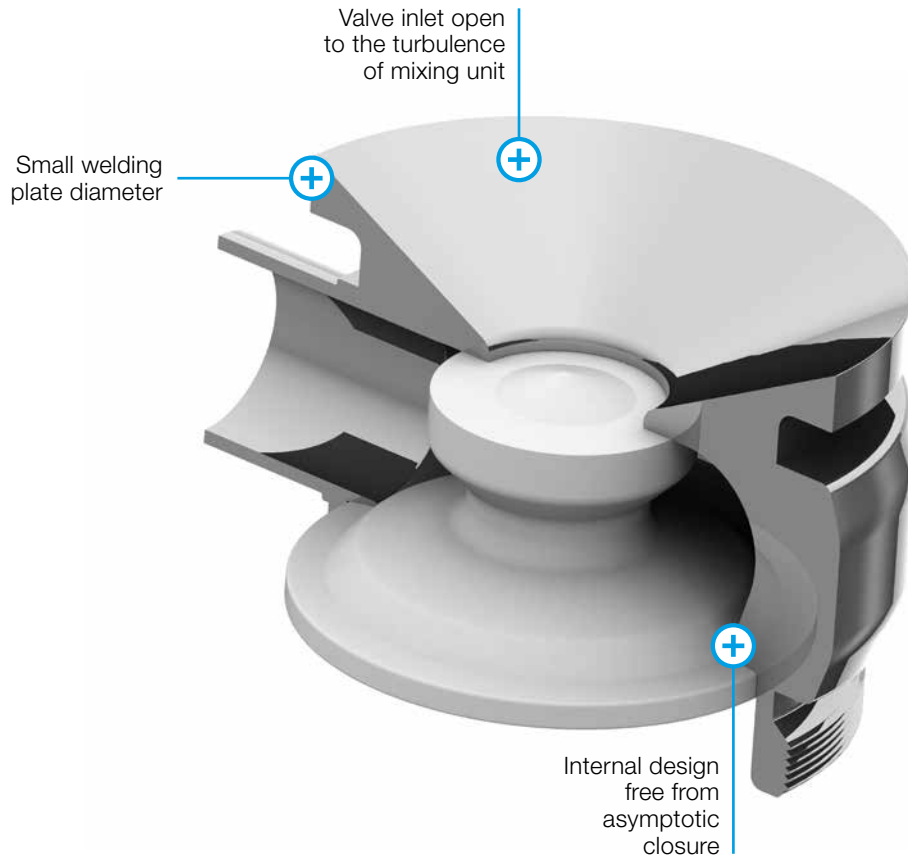
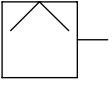


## TANK BOTTOM VALVES

Weir-type tank outlet valves have significant limitations as a large diameter welding plate is necessary. According to PED rules the thickness of the bottom dish may also need to be increased to accommodate the larger cut-out. The weir closure area has to be moved to a lower position so that the membrane fits, resulting in a pocket on the inside of the vessel. This pocket makes homogeneous mixing impossible, which can be problematic, especially for bioreactors.

**CAD SOLUTION.** CAD Tank Bottom Valves have been designed to follow the most stringent requirements for pharmaceutical vessels. Critically, the valve closure area (or seat) is positioned as close as possible to the vessel internal wall, without creating a pocket. The conical part of the valve inlet is open to the turbulence of the mixing unit ensuring good mixing and optimum conditions for improved biologics titre: homogenous temperature, pH, media availability, dissolved gases, etc. The welding plate diameter can be minimized, allowing designers to reduce the dish thickness as much as possible according to PED rules.

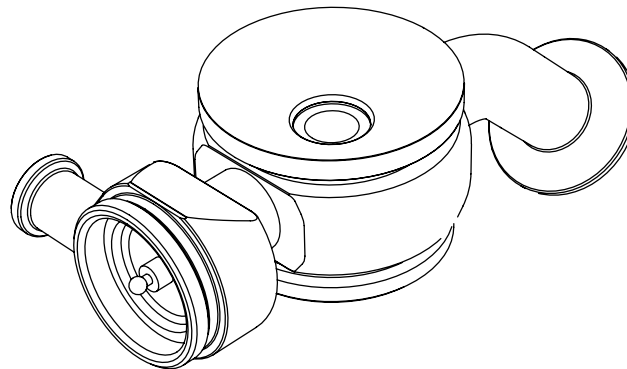


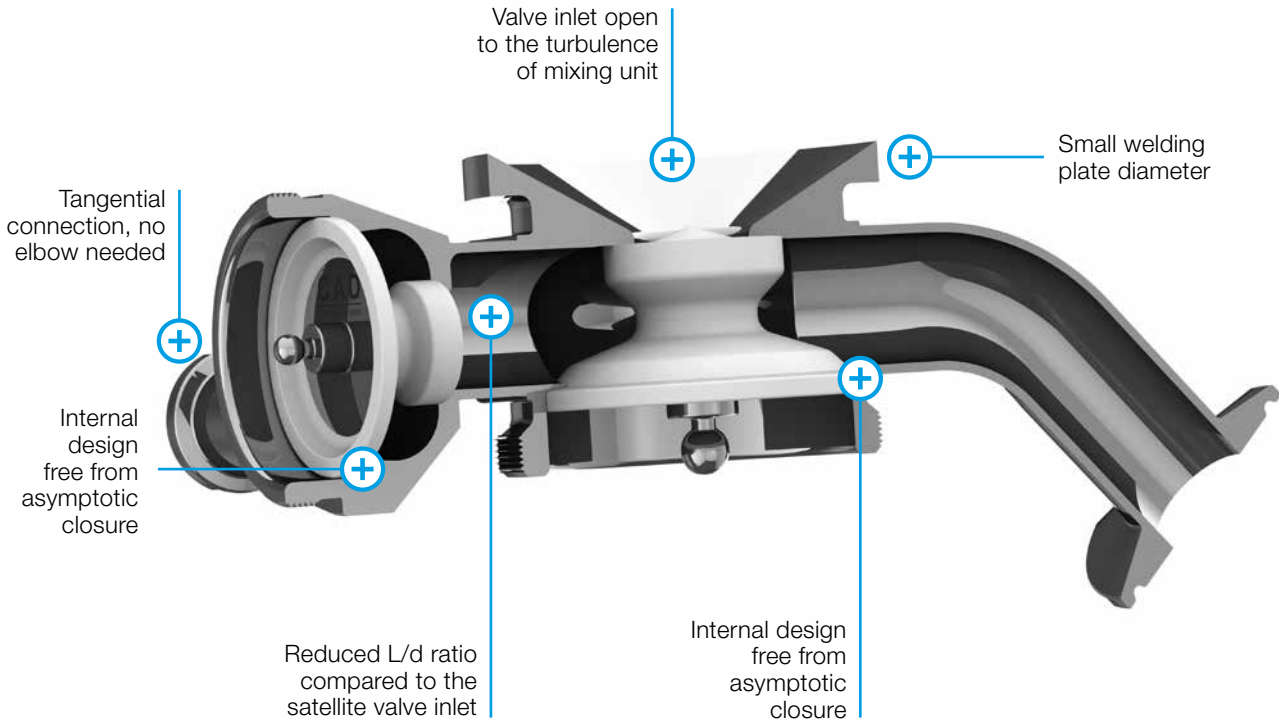
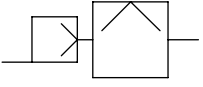


## TANK BOTTOM VALVES + SATELLITE

In many applications tank bottom valves and their downstream pipework are difficult to CIP-clean robustly. This is due to the fact that TBVs are generally quite large compared with other valves in the system to ensure good drainage during vessel CIP to avoid the typical “bath-ring” residue effect. The resultant low head of liquid in the vessel means that the flow-rate through the TBV is far below the flow required to clean the valve - and especially the valve outlet and downstream pipework.

**CAD SOLUTION.** To overcome this we offer CIP/SIP satellite valves with eccentric connection to the main valve to enable larger satellite valves with improved L/d ratio to be fitted and with tangential inlet options (left and right) to save space under the vessel. This permits effective TBV and downstream CIP after vessel cleaning, with higher flows than available from the vessel itself. In the case of particularly difficult to clean residues, all of our tank bottom valves are also available with extended bodies and diaphragms (see next pages) which make sufficient space available under a vessel for a satellite CIP/SIP valve of the same size as the main TBV for full CIP flow, optimized cleaning and increased production efficiency.



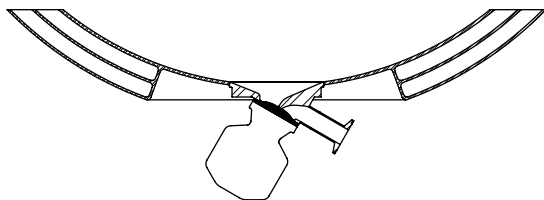


## TANK BOTTOM VALVES FOR JACKETED VESSELS

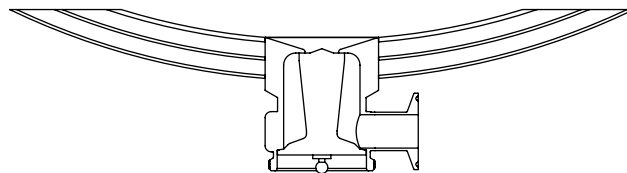
Usually bioreactors and fermenters for biotech applications require full insulation to keep the vessel contents at a specific controlled temperature. Typically this jacket only covers a portion of the vessel bottom, but not the tank outlet valve, leaving this part of the vessel at a less-controlled temperature.

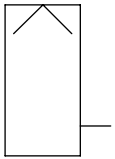
**CAD SOLUTION.** Thanks to the CAD Extended Tank Bottom Valve Bodies, it is possible to weld the jacket all the way to the valve body. The result is the valve and the entire vessel bottom can be insulated, eliminating temperature variations and improving batch titre. MAB cryogenic storage and transport vessels also make use of this improved insulation method to extend vessel usage times whilst disconnected from cooling systems.

Example of conventional design



CAD design





Valve inlet open  
to the turbulence  
of mixing unit



Small welding  
plate diameter



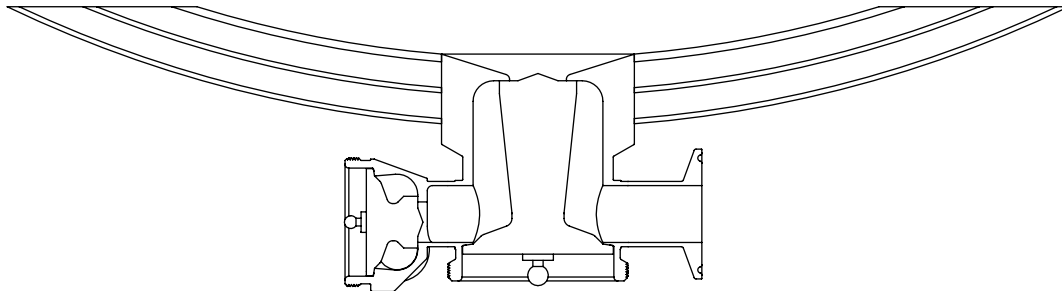
Extended welding  
area for jacket

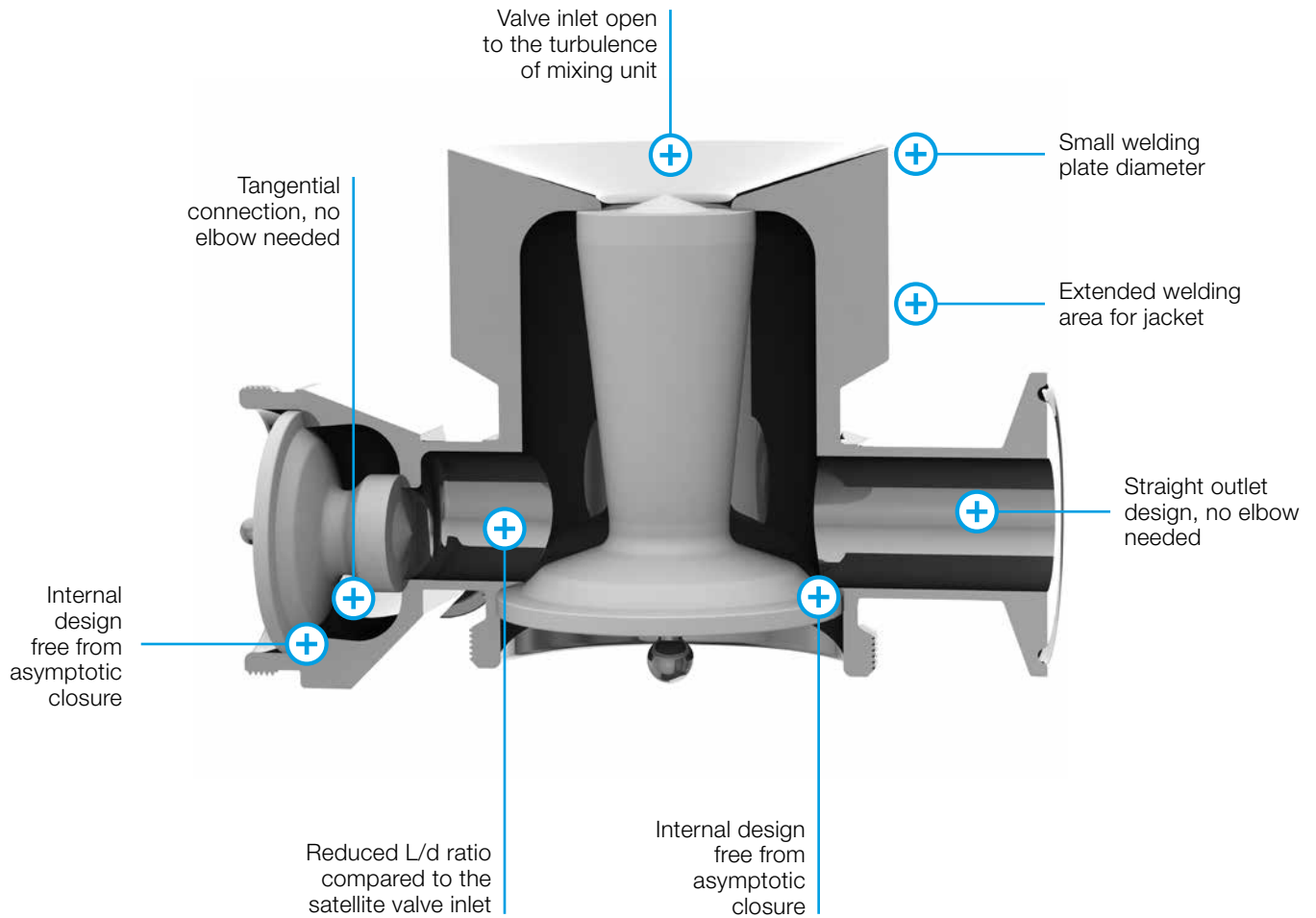
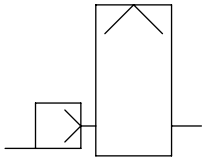


Internal design  
free from  
asymptotic closure

## TANK BOTTOM VALVES FOR JACKETED VESSELS + SATELLITE

**CAD SOLUTION.** The advantages of fully controlled vessel temperature and rapid & robust downstream CIP/SIP can be combined by fitting an extended tank bottom valve with satellite CIP/SIP valve for CIP-cleaning and sterilization of fully jacketed vessels.





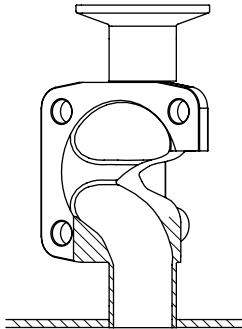
## TOP-MOUNTED TANK WELDABLE VALVES

Adding a valve on the top of a vessel requires a connection. Valves with a built-in dead leg that cannot be cleaned by through-flow CIP create a cleanability hazard - especially if they are mounted on ferrules (nozzles) which makes the dead leg even longer. CADCON aseptic connectors reduce the distance between the inside of the vessel and the valve closure area, making CIP spray-ball cleaning easier. Sometimes, however, this is not still enough...

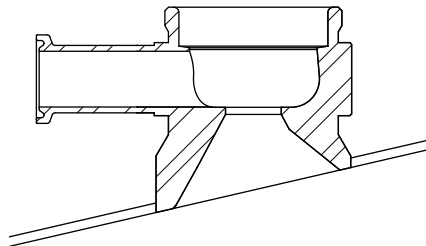
**CAD SOLUTION.** CAD Tank Weldable Valves drastically reduce the distance between the inside of the vessel and the valve closure area, allowing direct impingement of CIP spray on the face of the diaphragm. This completely removes any dead leg and enables rapid and robust CIP/SIP cycles of the vessel.

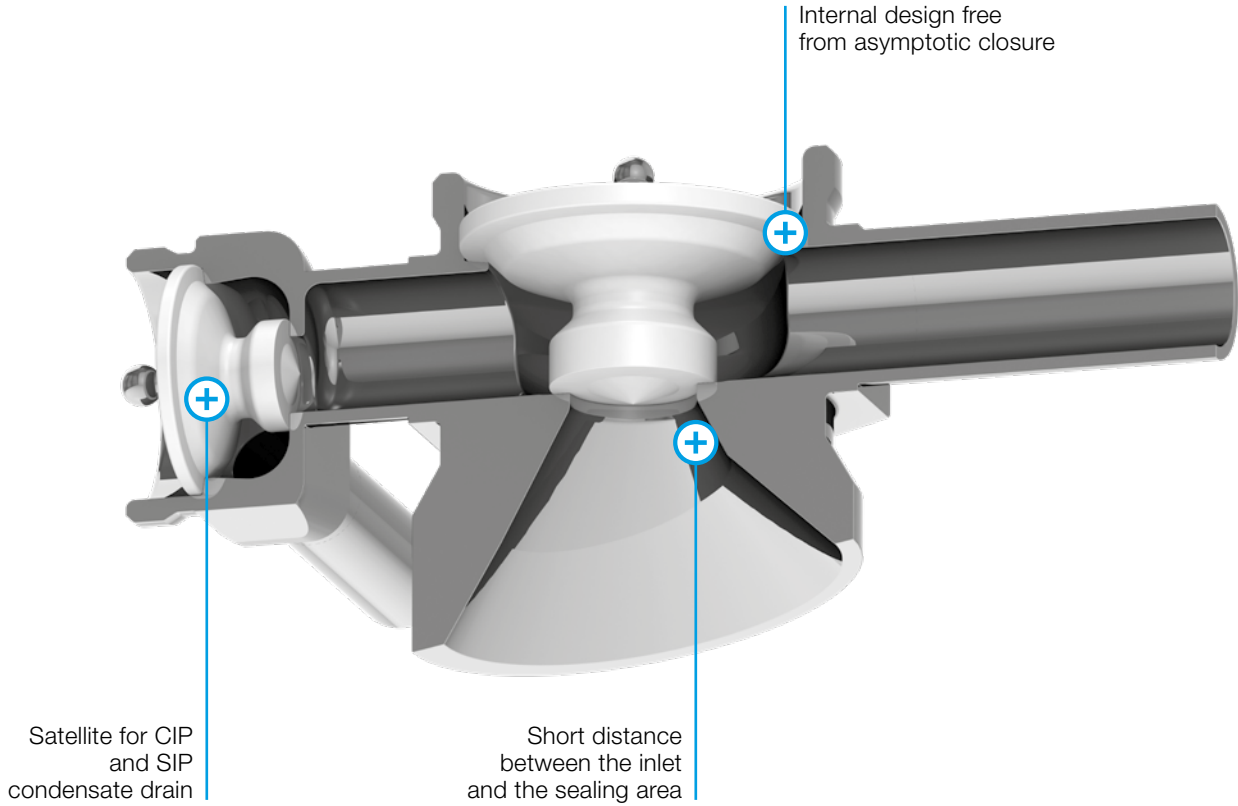
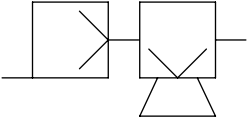
On request, the welding area of CAD Tank Weldable Valve can be machined with the same form as the vessel top, simplifying welding and moving the valve closure area even closer to the inside of the vessel. Our Top-Mounted Tank Weldable Valves such as product inlet or vent valves can also be equipped with satellite valves for CIP/SIP cycles.

Example of conventional design



CAD design





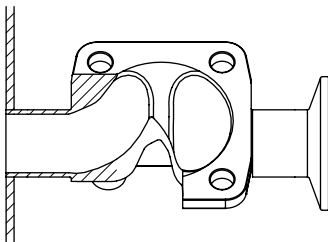
## SIDE-MOUNTED TANK WELDABLE VALVES

Adding a valve on the side of a vessel requires a connection. Valves with a built-in dead leg that cannot be cleaned by through-flow CIP create a cleanability hazard - especially if they are mounted on ferrules (nozzles) which makes the dead leg even longer. CADCON aseptic connectors reduce the distance between the inside of the vessel and the valve closure area, making CIP spray-ball cleaning easier. Sometimes, however, this is not still enough...

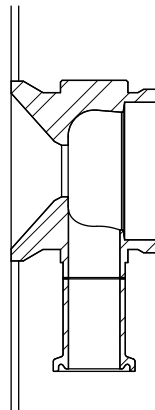
**CAD SOLUTION.** CAD Tank Weldable Valves drastically reduce the distance between the inside of the vessel and the valve closure area, allowing direct impingement of CIP spray on the face of the diaphragm. This completely removes any dead leg and enables rapid and robust CIP/SIP cycles of the vessel.

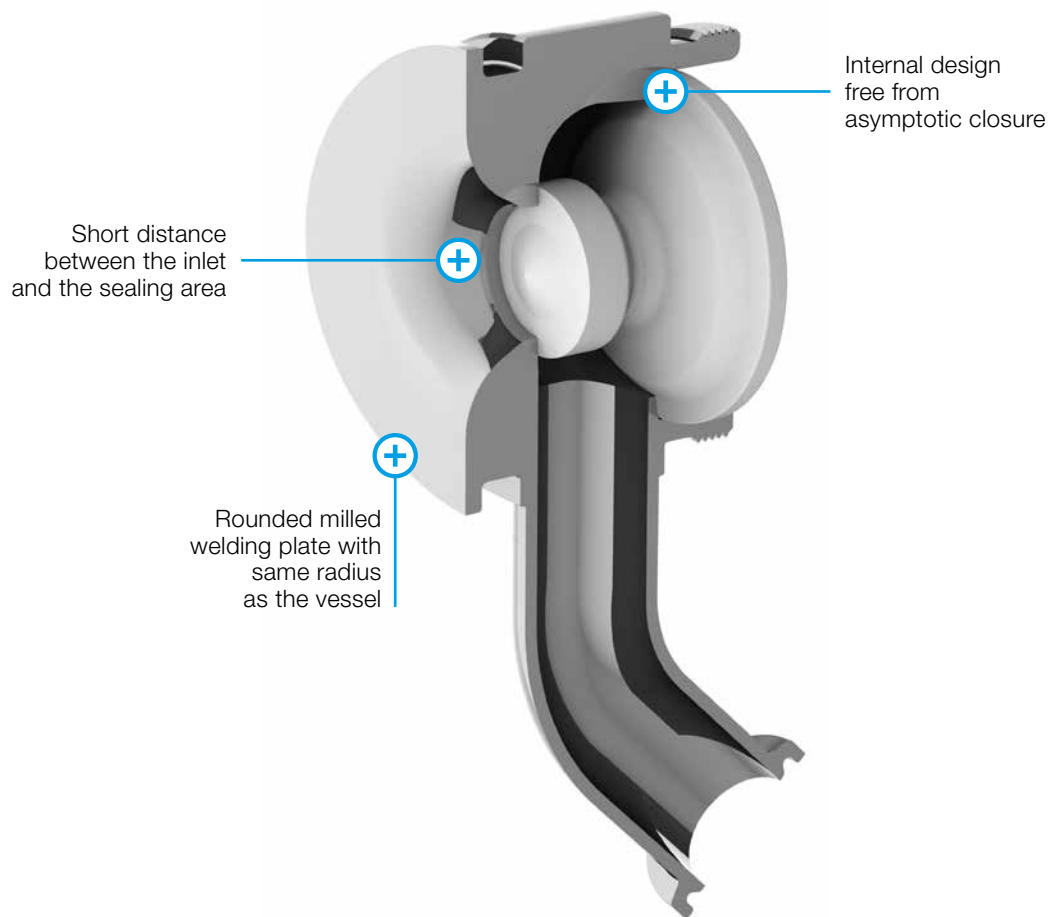
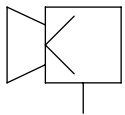
On request, the welding area of CAD Tank Weldable Valve can be machined with the same radius as the vessel wall, simplifying welding and moving the valve closure area even closer to the inside of the vessel. Our Side-Mounted Tank Weldable Valves such as perfusion inlet or sample valves can also be equipped with satellite valves for CIP/SIP cycles.

Example of conventional design



CAD design



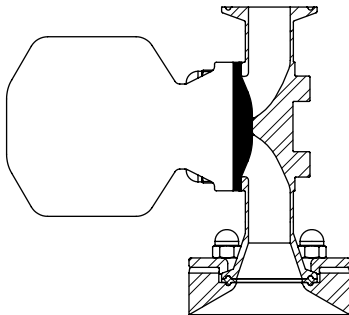


## TOP-MOUNTED TC CONNECTABLE VALVES

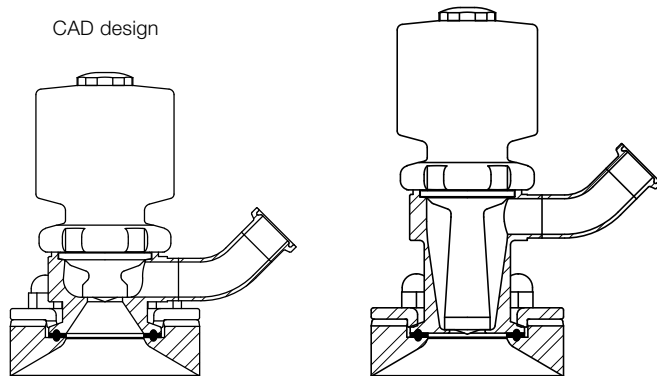
Adding a valve on the top of a vessel requires a connection. Valves with a built-in dead leg that cannot be cleaned by through-flow CIP create a cleanability hazard - especially if they are mounted on ferrules (nozzles) which makes the dead leg even longer. CADCON aseptic connectors reduce the distance between the inside of the vessel and the valve closure area, making CIP spray-ball cleaning easier.

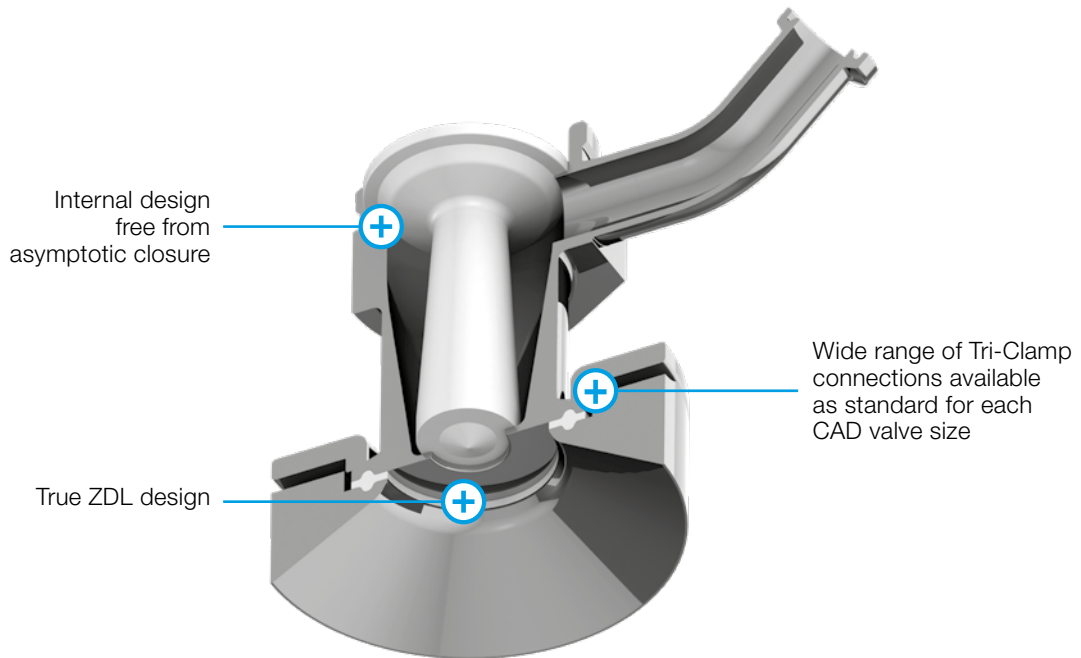
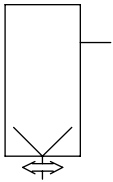
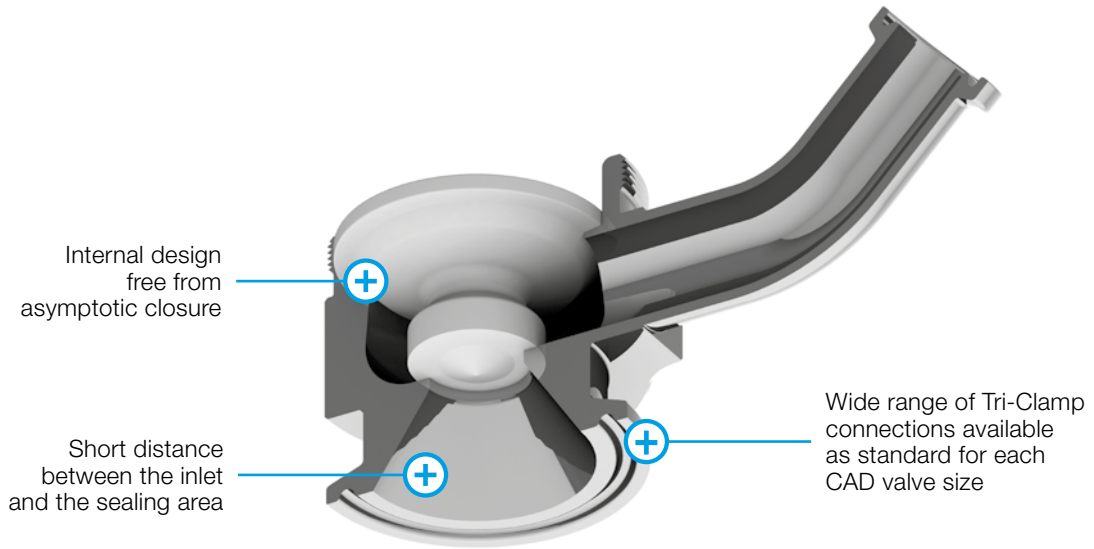
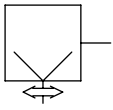
**CAD SOLUTION.** The easy solution to reduce dead legs on the top of the vessels is to bring the valve closure area as close as possible to the inside of the vessel. This is the most important reason for development of the CAD TC Connectable valves. All CAD valve designs are available as standard with Tri-Clamp connections pre-machined on the valve body. These valves are ready to be connected to a CADCON connection which offers designers and operators complete flexibility. The valves are designed to avoid interference between the valve body and the bolts over the flange. For each valve size there are a many different versions available such as Shut-Off, Flow Through, etc..., even with different Tri-Clamp sizes. Extended versions are also available - these bring the valve closure even closer to the inside of the vessel and leave more space for required satellite valves.

Example of conventional design



CAD design



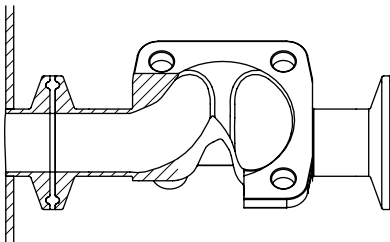


## SIDE-MOUNTED TC CONNECTABLE VALVES

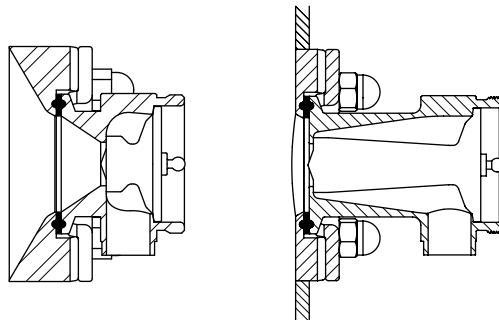
Adding a valve on the side of a vessel requires a connection. Valves with a built-in dead leg that cannot be cleaned by through-flow CIP create a cleanability hazard - especially if they are mounted on ferrules (nozzles) which makes the dead leg even longer. CADCON aseptic connectors reduce the distance between the inside of the vessel and the valve closure area, making CIP spray-ball cleaning easier.

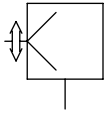
**CAD SOLUTION.** The easy solution to reduce dead legs on the top of the vessels is to bring the valve closure area as close as possible to the inside of the vessel. This is the most important reason for development of the CAD TC Connectable valves. All CAD valve designs are available as standard with Tri-Clamp connections pre-machined on the valve body. These valves are ready to be connected to a CADCON connection which offers designers and operators complete flexibility. The valves are designed to avoid interference between the valve body and the bolts over the flange. For each valve size there are many different versions available such as Shut-Off, Flow Through, etc..., even with different Tri-Clamp sizes. Extended versions are also available - these bring the valve closure even closer to the inside of the vessel and leave more space for required satellite valves.

Example of conventional design



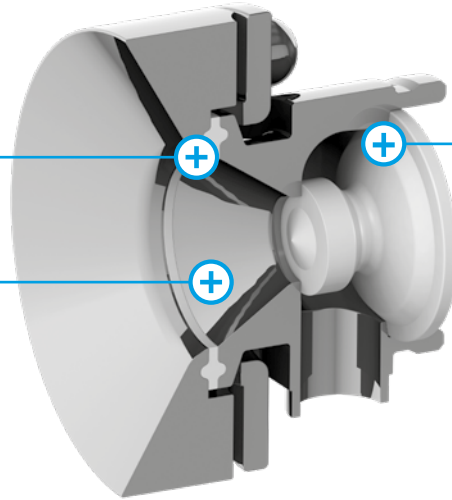
CAD design



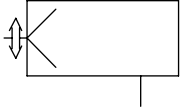


Wide range of Tri-Clamp connections available as standard for each CAD valve size

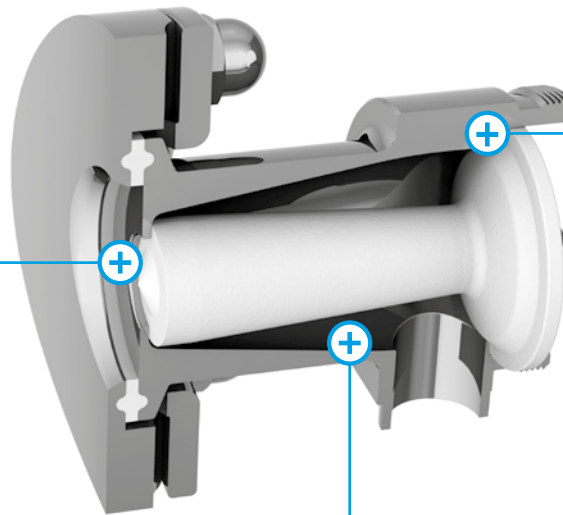
Short distance between the inlet and the sealing area



Internal design free from asymptotic closure



Real Zero Dead Leg design



Internal design free from asymptotic closure

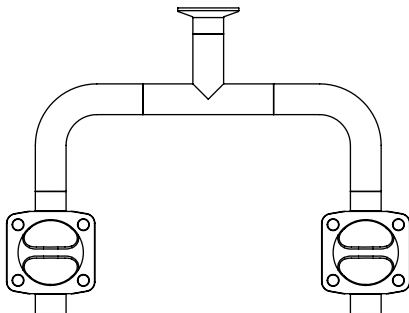
Fully drainable internal design

## DIVERTING VALVES

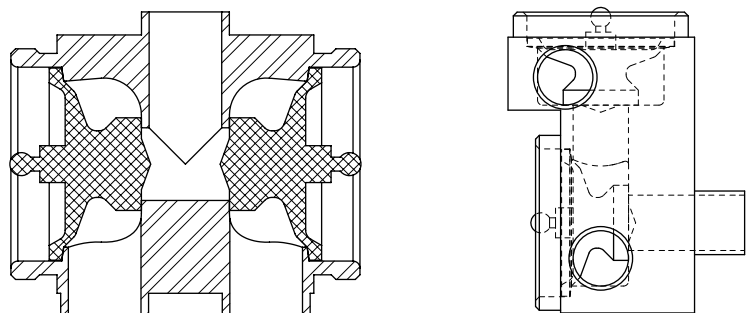
During Aseptic Processing many different fluids and gases such as: product and intermediates, CIP chemicals and CIP fluid, clean steam, purified water or WFI, media, buffers, sterile gases, foam suppressors, etc. need to be controlled in vessels, skids and pipework. This very often requires that one flow be connected to one or the other of two outlets (e.g. a holding vessel needs to connect to one of two filling machines) - or one or the other of two inlets be connected to one outlet (e.g. CIP flow for cleaning or WFI flow for filling need to be connected to the sprayball of a media-preparation vessel).

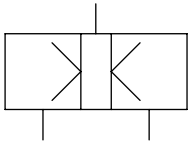
**CAD SOLUTION.** CAD Diverting valves are the solution when the flow path has to be controlled in different directions. The distance between the two closure areas is equal to the internal diameter of the common inlet pipe, achieving a very compact design, free of tee pieces or junctions. CAD Diverting valves are available with a large number of different port options which allow for mounting in different orientations and to suit your specific layout requirements.

Example of conventional design

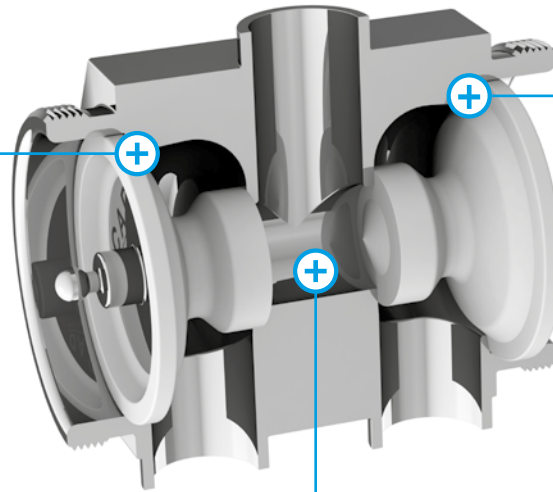


CAD design



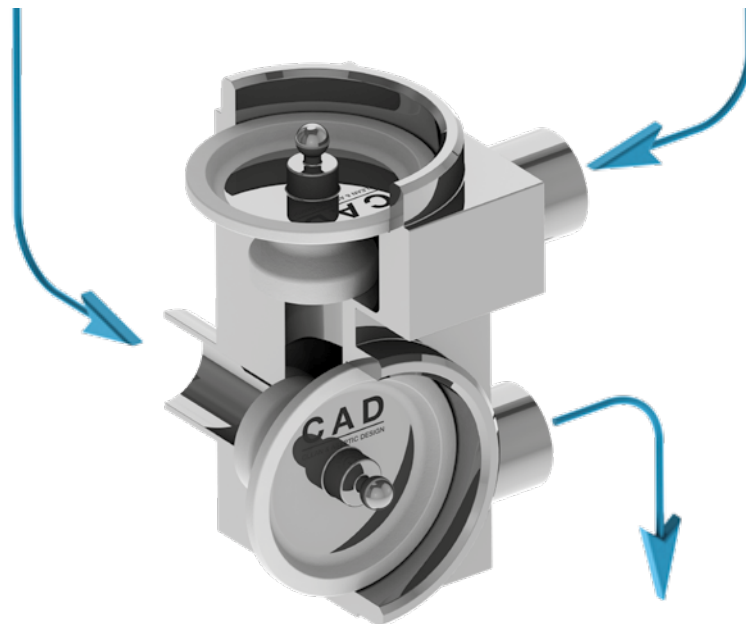
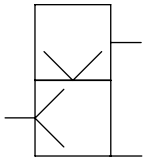


Internal design free from asymptotic closure



Internal design free from asymptotic closure

Minimized distance between diaphragms

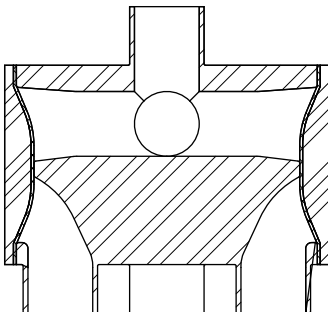


## MULTI-PORT DIVERTING VALVES

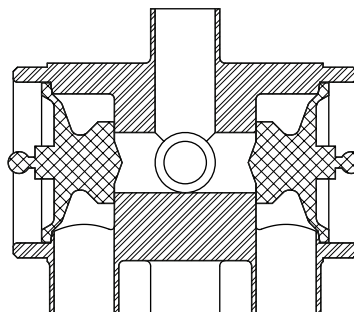
Multiport weir-style membrane valves need heavy blocks of material, that reduce energy efficiency during SIP cycles. Often dead leg ratios cannot be optimized, due to the straight design of its valve chamber and complete drainability cannot be achieved due to fluid retention in the asymptotic area, causing potential cross contamination issues.

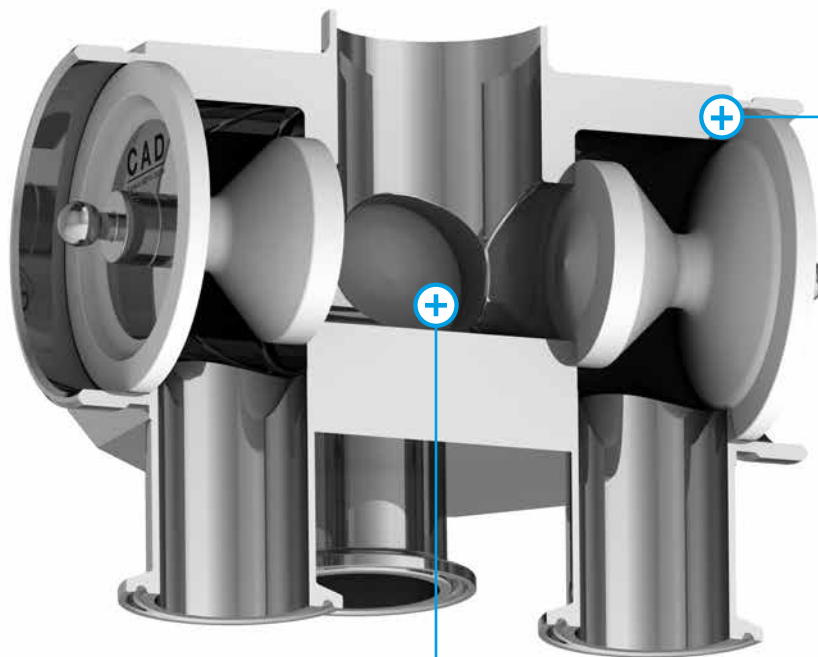
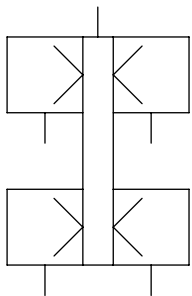
**CAD SOLUTION.** The design of CAD radial diaphragm valves is very flexible, allowing the possibility to produce block valves (single piece) or valve clusters, achieving a very compact and lightweight design, increasing thermal efficiency. The radial design allow more flexibility, so the final 3D layout development is easier and more efficient.

Example of conventional design



CAD design





Internal design free from asymptotic closure

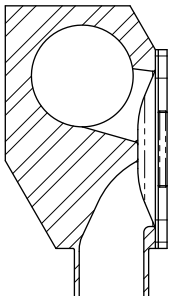
Minimized distance between diaphragms

## COAXIAL VALVES ON PIPE

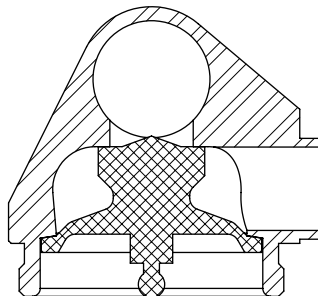
Fluid take-off from or feed-in to a pipeline are typical applications requiring dedicated valves. In these cases the distance between the inner pipe and closure area of the additional valve has to be reduced as much as possible. T-block valves are the typical weir-type valve answer to this need, but they have an asymptotic seal, which can cause process CIP or water sanitization issues which then require desmounting for COP.

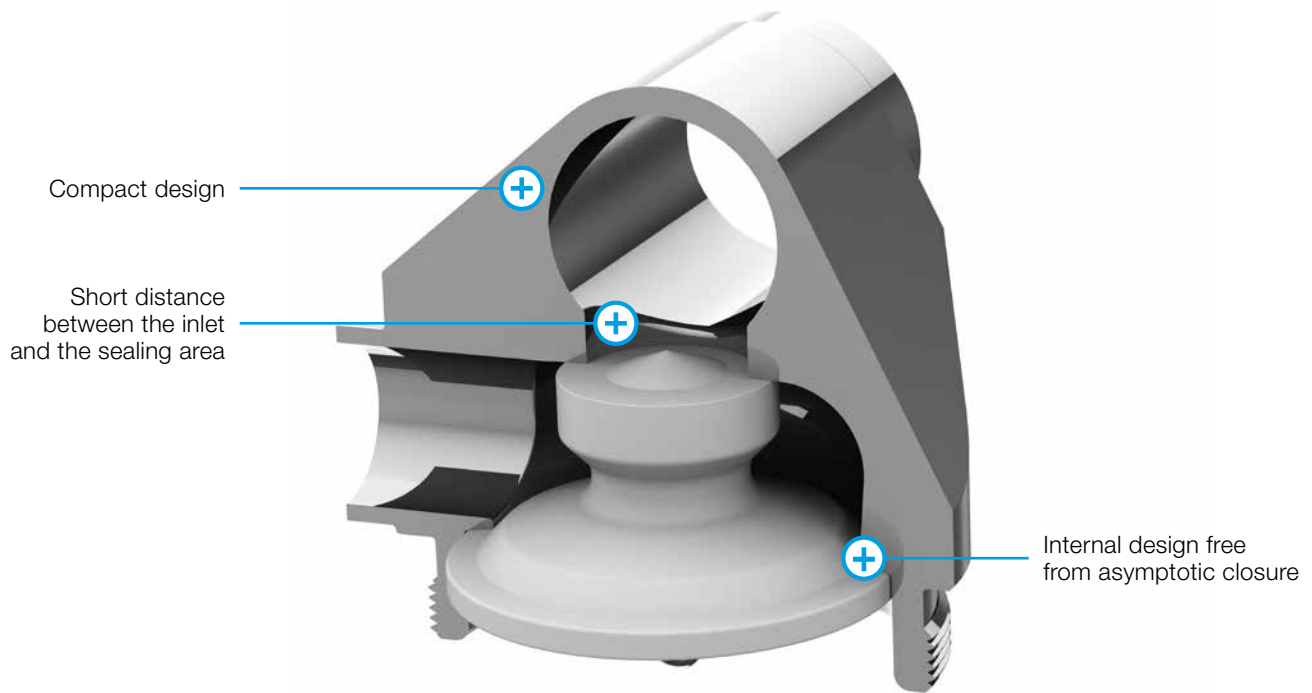
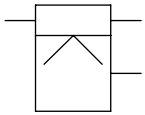
**CAD SOLUTION.** CAD Coaxial On Pipe Valves, respond to this requirement by putting the valve closure area in direct contact with the fluid in the pipeline; like a finger that closes a hole on the side of a pipe: a real Zero Dead Leg design. Ideal for feed-in to a pipe, and for take-off or sampling from a pipe. Specifically developed for the most stringent WFI, PW loop or PS distribution piping applications. These valves are available in Shut-Off or Flow Through designs and also with additional satellite valves for downstream sterilization. If required, full drainability of the piping system can be achieved by connecting the valve in a vertical upside down orientation.

Example of conventional design



CAD design



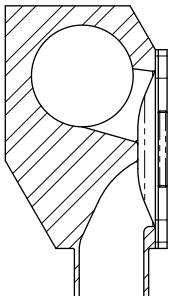


## TANGENTIAL VALVES ON PIPE

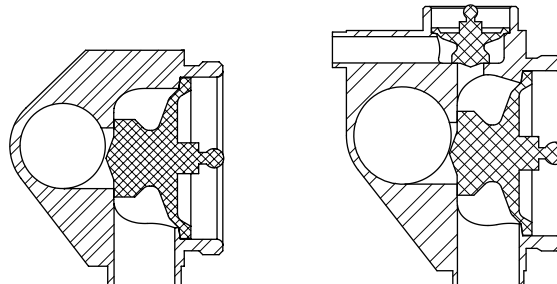
Fluid take-off from or feed-in to a pipeline are typical applications requiring dedicated valves. In these cases the distance between the inner pipe and closure area of the additional valve has to be reduced as much as possible. T-block valves are the typical weir-type valve answer to this need, but they have an asymptotic seal, which can cause process CIP or water sanitization issues which then require desmounting for COP.

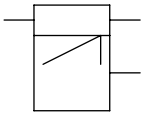
**CAD SOLUTION.** CAD Tangential On Pipe Valves, are the answer where full drainability of the main pipeline is required in a horizontal assembly of the valve. In this design, the valve inlet is very close to the valve closure point and is tangential to the lower internal diameter of the pipe. This allows for the complete draining of the main pipe down to the last drop. For easier connection and space saving, the valve outlet is vertical, without requiring an additional elbow. These valves are available in various different sizes to suit different take-off flows from main pipelines from 1/2" to 4". Shut-Off, Flow Through, with or without satellite for downstream sterilization are all standard catalogue products. Ideal for feed-in to a pipe, and for take-off or sampling from a pipe CAD valves are suitable for the most stringent applications of WFI and PW distribution loops.

Example of conventional design

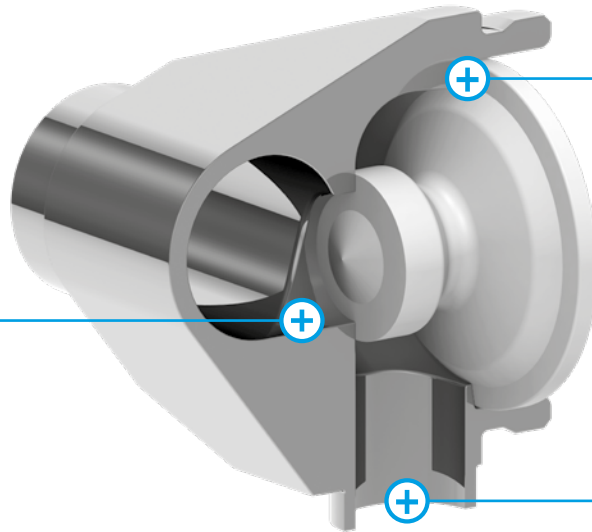


CAD design



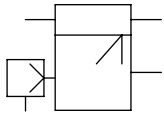


Short distance between the inlet and the sealing area



Internal design free from asymptotic closure

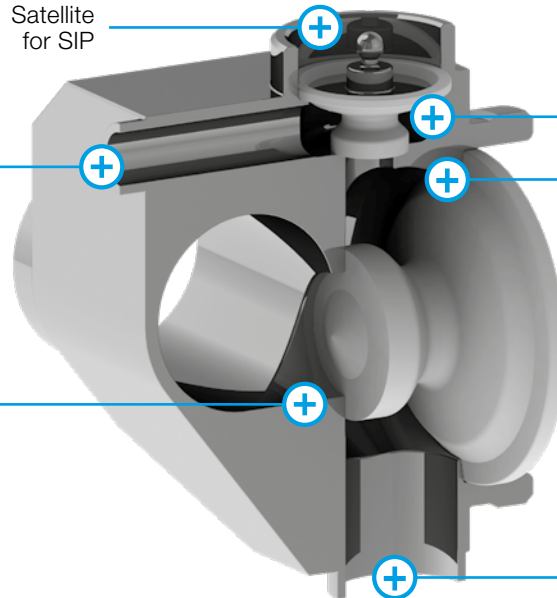
Straight outlet for optimal drainability



Stream IN

Short distance between the inlet and the sealing area

Satellite for SIP



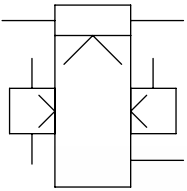
Internal design free from asymptotic closure

Straight outlet for optimal drainability

## POINT OF USE PROCESS ASSEMBLIES

Typically complete point of use valves on pharmaceutical water loops for aseptic processing are comprised of a main user valve, a sampling valve and two additional satellite valves for downstream sterilization of both valves. Welding 4 valves together on a loop requires complex and expensive work that has to be done during the installation of the piping. This job usually has to be done with orbital welding machines to assure good weld quality. Components developed for orbital welding machines require long butt-weld ends which increases system volume. The positioning and orientation of the valves during installation can be very difficult and time consuming.

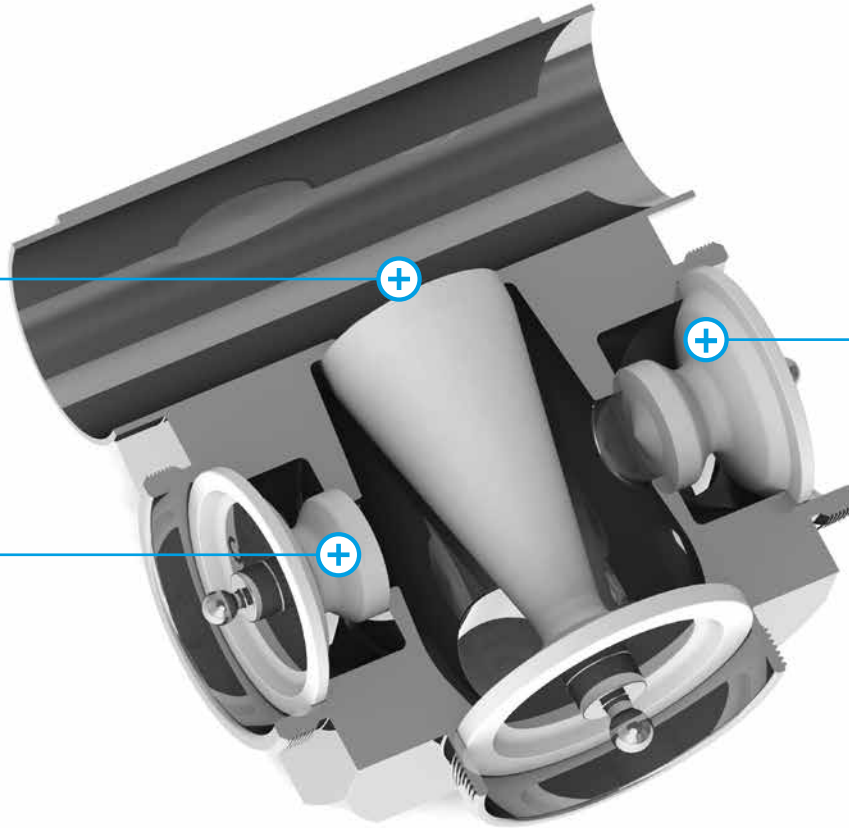
**CAD SOLUTION.** CAD Point of Use Assemblies are the answer to the highest demands in terms of efficiency and compact design. Using precision machining capabilities, all the required valves can be machined from a single block, thus keeping the system's dimension to the absolute minimum. During the installation, only two connections have to be made to the main pipeline. The block can be delivered with ready to work Tri-Clamped steam inlets and outlets, saving hours of job site installation and achieving a level of quality not possible in the field. Several configurations are available. Our process experts will help you in the correct configuration according to your needs.



Real Zero Dead Leg design

Satellite flow through valve for nitrogen or sterile air

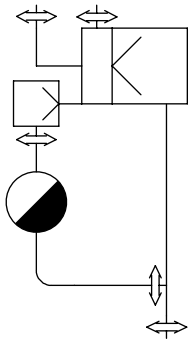
Satellite shut-off valve for steam



## BOTTOM POINT PROCESS ASSEMBLIES

Typical bottom point drains in pharmaceutical installations for aseptic processing are composed of a large CIP drain valve and a smaller valve for the SIP condensate. These valves may have a common inlet, but the two outlets have to be separated and work alternately according to the current process: CIP or SIP. An additional connection for a temperature transmitter is also necessary, close to the SIP drain valve closure to allow accurate temperature detection at the lowest part of the installation for SIP cycle verification. Welding of all the components of this system together require repetitive and sometimes complex work due to the fact that the height available is often very limited.

**CAD SOLUTION.** CAD Bottom Point Assemblies are the answer to this need. Two different designs are available according to the requested steam trap. Both types are available in two main sizes: 3/4" valve for CIP drain valve + 1/2" for condensate drain valve or 1" CIP drain + 1/2" condensate drain. Both systems have all required Tri-Clamp connections and can be connected to the installation in a few minutes, saving hours of on-site work and speeding the finishing of the installation. The CAD Bottom Point assembly results in a very compact design with a final quality level not possible when compared to the same work done with typical tools available during on-site or skid fabrication.



Reversible connections: line in or temperature transmitter



Smaller valve for condensate drain (SIP)



Larger valve for CIP drain



Steam trap



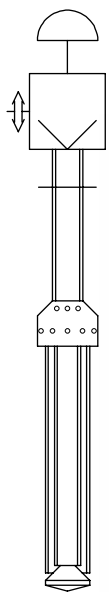
Waste collector connection



## DIP-TUBE SPRAY BALL PROCESS ASSEMBLIES

Typical pharmaceutical vessels require several connections on the top of the vessel, each for a different purpose: product inlet, dip-tube inlet, rupture disc, CIP inlet, sparger, etc... In many designs two or more spray balls are required in a vessel to overcome CIP shadowing issues.

**CAD SOLUTION.** Following the CAD philosophy, the total number of connections on the top dish can be drastically reduced using the CAD Dip Tube Spray Ball. This simplifies design and improves the cleanability of the vessel. Tank filling, SIP, CIP and gas bubbling can all be done with just one component, using only one inlet connection.



Additional head  
for gas bubbling



Only one inlet  
for all utilities



Customized spray ball  
machined from solid



Tailored overall  
length



2 versions, both available in several dimensions: 2 functions for feed in/SIP + CIP or 3 functions for feed in/SIP + CIP + gas bubbling.

## ACTUATORS

The most stringent demands in aseptic processing typically require the use of stainless steel and PTFE due to their almost universal compatibility. During COP cleaning process, plastic handles can be damaged. Plastic pneumatic actuators are large compared to stainless actuators and their functionality and life can be compromised by the heat of repeated SIP cycles. Plastic position sensors also have limited temperature resistance.

**CAD SOLUTION.** CAD manual actuators are made from stainless steel with PTFE handles and are fully autoclaveable. Some versions are also washable in ultrasonic washing machines. Pneumatic actuators are made of stainless steel. CAD Sensor / indicators are made from stainless steel and are fully programmable via PLC or the CAD Programmer, without mechanical adjustment. Extended handles are available for manually-actuated tank bottom valves and the Double Position Sensor can be connected.

Mechanical stroke limitators can be installed over all pneumatic NC actuators, with or without CAD position sensor / indicators.



## DIAPHRAGMS

Weir-type valve manufacturers have added PTFE layers to increase the chemical and thermal resistance of traditional EPDM diaphragms. The PTFE layer is certainly more resistant, but suffers permeability due to micro-pores left between individual PTFE spheres during the moulding process. During SIP cycles, steam permeates through these pores into the area between the two bonded layers. Upon cooling, this steam condenses, leaving liquid between the layers. Repeated SIP cycles result in the growth of a blister, which can eventually reduce flow through the valve or burst, with disastrous contamination and cross-contamination consequences. Recent versions of these twin-layer diaphragms feature two separate, non-bonded, layers with weepage holes in the EPDM layer to vent liquid into the actuator housing and thence to atmosphere. Customers using this type of “weeping” valve should take precautions if they have dangerous process fluids and they should check whether such a valve maintains sterility.

**CAD SOLUTION.** From their inception CAD valves have been based on the application of PTFE diaphragms for all sizes, from half inch up to four inch, and in two lengths: short and extended. Thanks to this idea, dead legs can now be eliminated in places where it has not been possible before today. The machined from solid PTFE diaphragms resist many hundreds or even thousands of high temperature SIP and chemically aggressive CIP cycles, typically requiring no maintenance for five or more years. The CAD PTFE Diaphragm is impervious to vacuum, even when hot. This enables the use of pulsating steam-vacuum to accelerate air and condensate purging during SIP heat-up, as well as the use of vacuum for drying vessels & pipework or even to accelerate drainage of vessels during CIP. We can also supply EPDM diaphragms.



CAD diaphragms: short or extended, both available from 1/2" up to 4"

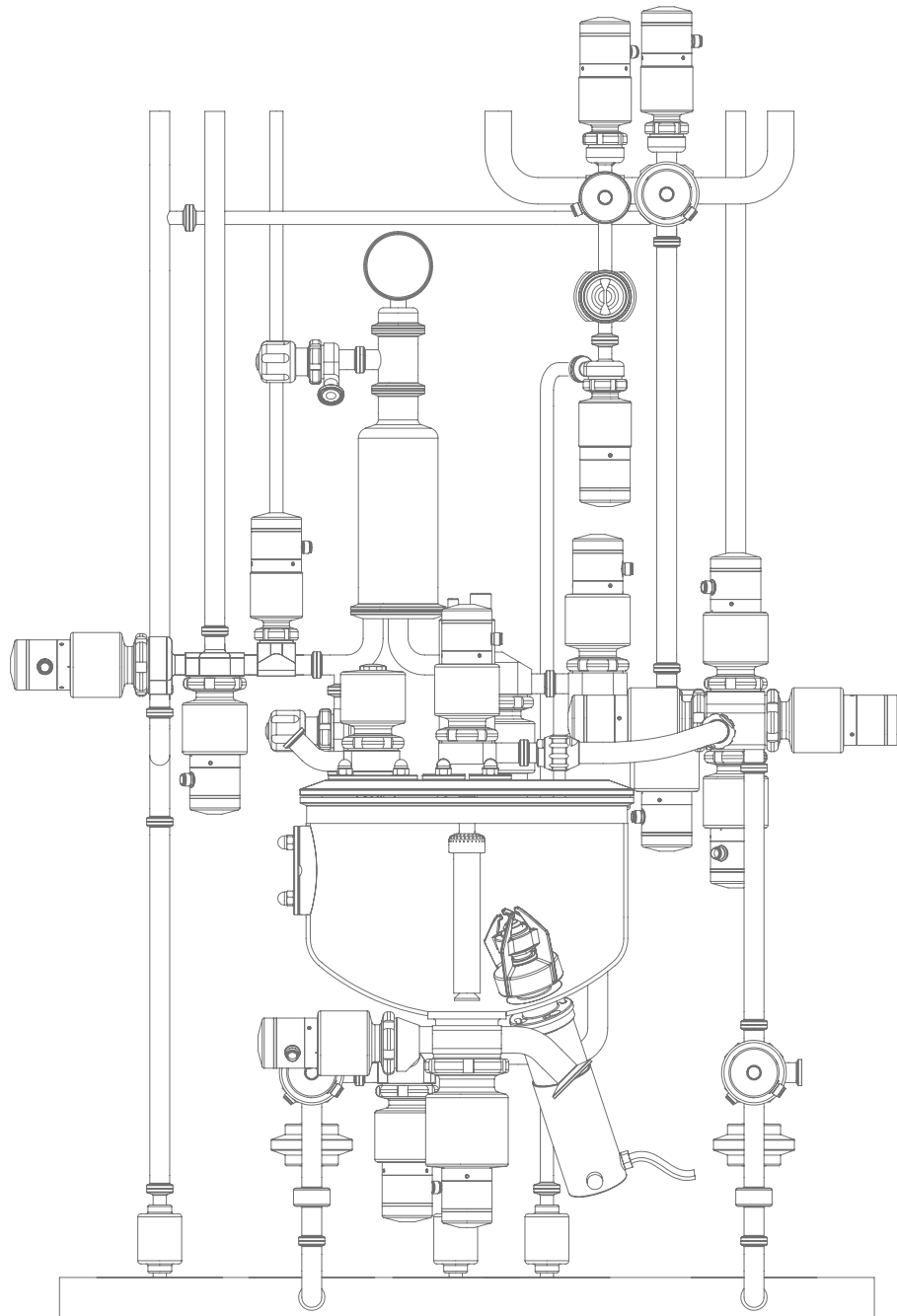
## UPGRADES

During the design of a new installation, reduction of the external dimensions as well as the internal volume should be a priority in order to optimize the performance of the entire manufacturing system. The CAD valve range has been engineered to allow designers of modern aseptic process systems to optimize layouts of extremely compact skids with minimum external dimensions and reduced pipework internal volumes.

**CAD SOLUTION.** For applications such as tank bottom valves or for instrument connections, an elbow with TC connection or long butt weld ends for orbital welding may be needed. We offer a wide range of high quality connections to suit your specifications: straight, 45°, butt-weld or Tri-Clamp.



CAD upgrades: straight, 45°, butt-weld ends or Tri-Clamp, all available from 1/2" up to 4"







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