Whitepaper GEA Valves & Pumps: Selecting valves and pumps for pharmaceutical process applications

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Introduction: Flow components in pharma processes

Executive summary

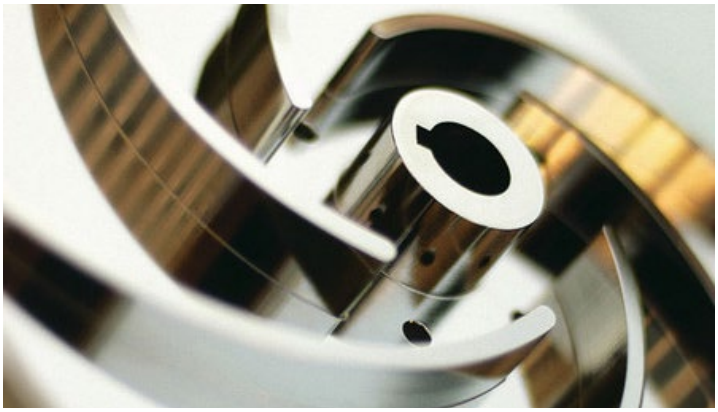
This paper sets out to explain the main criteria to be considered when selecting pumps and valves for liquid processes in pharma and biopharma production. The guidelines given here can help plant planners and operators to balance the goals of hygienic safety and economic efficiency. Suitable equipment, available options and business advantages are explained based on components taken from the comprehensive GEA pumps and valves portfolio.

Medical challenges and processing breakthroughs in the last decades have initiated an increasing number of new pharmaceutical products. The rise of mRNA vaccine production, accelerated by the development new peptide-based production processes, continues worldwide. Biotechnological innovations such as tissue-cell based production of complex biomolecules open further fields of therapeutical applications.[1] As a result, new types of production facilities are being built in great numbers and need to be adequately equipped. Equally important, technologies for gentle, sterile and low-maintenance processing have improved as well. This can be a motivation for operators of existing plants to upgrade their current equipment with a view to higher hygienic standards and lower OPEX.

Selecting the right pumps and valves to realize a hygienic and cost-efficient pipe network for product transfer may seem at first as a daunting task. The general pharma requirements, e.g. surface roughness and drainability, are only the starting point, as a deeper understanding of the flow components function is required for the correct selection.

Pumps and valves are the drivers and crucial gateways for the media flow in processing systems. In pharma applications, these components deliver and direct the media provided by black utilities, such as sterile steam and CIP fluid (Cleaning In Place), and by white utilities, such as PW (Purified Water), DW (Desalinated Water), and WFI (Water For Injection). They further guide the product in various stages through the up-stream process of media and buffer preparation as well as scale-up of the cell cultures, fermentation and harvesting. Finally, the down-stream process yields the target product substance to be dosed in its specified form for infusion, injection, oral intake or dermatological application.

More than in other processing industries, manufacturers of sensitive pharmaceuticals must use sufficiently secure equipment to ensure the integrity of the product at all times. However, to succeed in global competition, the pharma industry and its contract manufacturers must also produce as cost-effectively as possible. Factors such as sterile handling of media, sustainable resource consumption, ensured process availability and easy maintenance must be taken into account.



[1] Chinese Hamster ovary (CHO) and HeLa (human cervical cancer cells) are the dominant cells used for this – CHO cells more so as they remain stable during the process of selection, amplification, single-cell cloning etc.

Key hygienic requirements

The aim of each pharmaceutical plant operator is to reproducibly obtain the product in the targeted range of purity and sterility, as defined by international standards, such as relevant EHEDG guidelines, ASME/BPE codes and FDA/USP Class VI standards.[2]

Organic contamination is especially critical because microorganisms can get to spread in the product pathways and colonize at suitable spots. The following criteria are vital for the correct selection of valves and pumps in almost every pharmaceutical application.

Cleanability
All surfaces in contact with the processed media must be fully cleanable. The internal geometry of the flow component must ensure that such areas are adequately flushed when the cleaning agent is applied. No residues from previously processed product and no traces of the cleaning agent may remain in the product area for the next processing batch. The required cleaning procedure will be largely determined by the physical, chemical and biological properties of the product, for instance adhesion and toxicity. The requirements for components to ensure cleanability are similar for all applications, mainly concerning the hygienic design of the surface in contact with the product and the selection of suitable materials for the alloy and the gaskets.

In numerous pharmaceutical applications steam sterilization at temperatures up to 140 °C is an added preparation step before the next batch is processed. Again, the requirements of strictly hygienic design apply so that the steam will reach every part of the product-wetted surface.

Drainability
Components designed to offer the best conditions for draining enable good cleaning results. Hence, fully drainable pumps and valves should be applied in pharma processes under given process requirements.

Hygienic design of components
The hygienic design of pumps and valves is of central importance for the safe handling of the product. As specified by the EHEDG guidelines for valves and pumps[3], the flow path must be designed completely drainable as well as free of sumps and domes, pits, crevices and gaps. Otherwise so-called dead spaces could lead to buildup of product (or detergent) residues in the component, entailing a suboptimal cleaning result. During the rinsing procedure, even minor residues will be detected by measuring the conductivity. Failure to reach the desired conductivity level will necessitate an additional cleaning cycle, which ultimately means a further expenditure of time and money before the next batch can be produced.

Hygienic materials
The standard material for all internal surfaces of pumps and valves in contact with pharma product is high-quality stainless steel (316L), polished to a hygienic-standard surface roughness (Ra ≤ 0.8 µm) and showing no surface defects. This ensures cleanliness, corrosion resistance and a long service life of the component, even when abrasive and aggressive cleaning media are used. Smooth, uncluttered exterior surfaces, ideally also made of stainless steel, additionally support the cleanliness of the production suite, for an overall hygienic-standard processing environment.

Only polymers that are animal-origin-free and certified may be used for the seals and gaskets, bellows or diaphragms. All these are spare parts that require regular servicing due to wear and tear during operation, in order to prevent component failure. This means that the materials must be selected to chemically withstand corrosive properties of the product, the cleaning agents and the sterilant. Plus, they must be capable of enduring the mechanical and thermal stress exposed to them during operation. For pump shafts processing pharmaceutical media, mechanical seals made of highly temperature resistant SiC/SiC composites and O-rings made of EPDM are the de-facto standard. Tefasep®, PTFE or EPDM are the standard materials for mechanical seals and O-rings on hygienic valves.

Secure containment preventing cross-contamination
Like all other plant components installed directly in the product flow, pumps and valves must be designed to prevent contamination of the product with unwanted organic or inorganic substances. This means first of all that particles from the atmosphere must not enter the flow path. Special technical solutions must be in place to ensure this for a sterile product. This is particularly important with valves, because the moving valve stem can in principle act as a carrier between atmosphere and product chamber (“elevator effect”).

A second important area of prevention concerns in particular those valves that control the flow of two incompatible media. The mixproof design of such valves, often secured with special technical protection systems, ensures that those media cannot come in contact with one another.

[2] https://www.ehedg.org/guidelines-working-groups/guidelines/guidelines
https://www.asme.org/codes-standards/find-codes-standards/bpe-bioprocessing-equipment-(1)
https://www.usp.org
[3] See footnote above

Key economic requirements

The main challenge for the producers and the users of pharma equipment is to successfully combine the hygienic design requirements with the best-possible economic efficiency of the equipment. Pharma engineers will not opt for the most complex, and most expensive valve or pump type when a sufficiently high hygienic standard can be achieved with a simpler component for the task at hand. However, a high hygienic standard and economic advantage are not always contrary goals. Safer equipment may often require a higher up-front investment but will also often ensure a smoother process flow and greater process availability during operations.

Cost-efficient and sustainable flow control
Different operating modes of hygienic pumps will show different results when it comes to cost-efficient water and energy consumption. Pump motor sizes and speeds should be finely adapted to each task to ensure optimum energy efficiency. By choosing the right pump type and motor, manufacturers can ensure substantial savings and provide for a more sustainable operation – a factor of growing importance in the current energy supply environment.

Prevention of excess CIP fluid consumption
An uncompromising hygienic design of the valve geometry and surfaces offers not only the best protection for the product but will also ensure the least resistance to the flow. When less suitable valves are used, a backflow can occur from the remaining patch of process fluid in front of each valve. The accumulated volume of these fluid patches from numerous valves can necessitate prolonged CIP cycles and lead to more time spent during batch changeovers.

Optimized plant lifetime costs
Various pump and valve types are available to fulfill certain requirements at a competitive price level. However, pharma plant operators should also take into account that some types of components can require far more frequent and more intensive maintenance services than others. This is reflected in the classical dilemma of CAPEX vs. OPEX engineering decisions during the detail design phase of every pharma project.

Pump selection options

The first step on the way to the ideal hygienic pump is the choice between centrifugal and positive displacement pumps – so it's good when a supplier like GEA offers both.

Centrifugal pumps
Centrifugal pumps are often the right choice, but not always. They are quite simple in construction and thus easy to maintain and have a long service life if designed correctly. They can also be easily adapted to different operating parameters and are easy to clean in the hygienic design version. Due to the low investment costs, centrifugal pumps are used in many process plants. With viscous media, however, they quickly reach their limits.

From an economic point of view, the use of centrifugal pumps is largely limited to Newtonian fluids up to a viscosity of approx. 500 mPas. Additional criteria concern the gentle transfer of sensitive products. In terms of hydraulically optimized piping and cavitation-free operation, other pump types may prove better alternatives.

Positive displacement pumps
With increasing viscosity and higher solids contents, positive displacement pumps come into play. Their big advantage: They convey a set volume, depending on the motor speed, but almost independent of the pressure. This is why they are suitable, for example, for processes in which a precise and gentle transfer is particularly important.

The gentle handling of sensitive products is supported, above all, by the low pulsation level, achieved by multilobe impellers in the case of rotary lobe pumps, and by the near pulsation-free transfer through precision screws in the case of screw pumps. Both these pump types are mainly used for small or medium flow rates but are suitable for a wide range of viscosities and particle sizes in the fluid. This makes these pumps ideal problem solvers for filling tasks, even approaching the accuracy of dedicated dosing pumps for mixing applications. In this respect, rotary positive displacement clearly prevail over oscillating pump variants on the market.

Twin screw pumps can also cope with additional cleaning tasks, so that in some environments several applications can be handled with a single pump, removing the need for a second pump and a complex multi-pump control routine.

Energy-efficient, speed-controlled motors
Older pumps, even if they work reliably, are notorious for their low efficiency. The pumps consume more energy than necessary. In the case of pumps going too speedy, the product can be compromised by high shear forces, and more energy (i.e. heat) than required is transferred to the medium. This is always

a disadvantage with regard to possible microbiological contamination. It thus pays off soon to select pump lines that offer energy-efficient motors of all sizes and speeds.

Where frequency converters are worth considering
The use of frequency converters, while entailing various extra costs and side effects, can provide for more gentle handling of the product and substantial economic advantages. As centrifugal pumps are subject to the laws of affinity, a speed reduced by 50 percent will, for instance, lead to an impressive 87.5 percent reduction of power consumption. This makes the use of variable-speed drives economically attractive when pressure and flow rate requirements vary greatly (and only then). The alternative, power adjustment of the pumps via throttle valves or bypass circuits is suboptimal from an energy, hygiene and cleaning point of view.

GEA pumps for pharma applications

A wide portfolio of centrifugal and positive displacement pumps and decades of experience deliver the ideal pump for every application. Sterile pumps from GEA are characterized by reliability and efficiency and ensure resource-conserving processes. The pumps are made of forged and cold-rolled stainless steel (316L) without pores or blowholes and with high-quality polymer sealings. They meet the highest hygiene standards, are easy to maintain and offer good cleanability. Their robustness promises a long service life and high reliability.

A large selection of hygienic pump types and sizes from GEA and an expert support from GEA engineers ensure the be-all and end-all of pump efficiency: A proper pump design (pump operating point close to the optimum, hydraulically correct dimensioning of the piping) for every point of application, energy-efficient motors, frequency converters for speed control, efficiency-optimized hydraulic system and loss reduction in coils and bearings.

GEA Hilge HYGIA
The “Swiss knife” of hygienic pumps stands for high all-around quality, reliability and flexibility. The wetted parts meet the requirements of the 3-A and EHEDG standards. The pump is equipped with a fully enclosed mechanical seal with a unique sealing surface design. It is also available in a high-pressure version. When installed vertically, the pump is completely self-draining without a drain valve.

GEA Hilge CONTRA
Available in single- and multi-stage variants, this pump ensures extremely reliable operation under the toughest operating conditions. The consistently hygienic and aseptic design and non-porous sealings combine to offer perfect solutions for many applications in sterile and hygienic processes. WFI loops in particular benefit from the use of low delta-ferrite, pore-free materials that are less suspectable to rouging. When installed vertically, the pump is completely self-draining without a drain valve.

GEA Hilge SIPLA-HT
This single-stage self-priming side channel pump is particularly suitable for SIP/CIP supply and return lines and applications with high gas content. The hygienic and robust pump is made of pore- free and blowhole-free Cr-Ni-Mo steel. The reversible flow direction facilitates emptying and refilling processes.

GEA Hilge NOVATWIN
This flexible twin screw pump enables production and CIP processes with a single pump. It meets the highest hygiene requirements, ensures reliable production and, thanks to the sophisticated twin screw pump design, guarantees gentle product handling with almost no pulsation.

GEA Hilge NOVALOBE
This rotary lobe pump was developed especially for highly viscous media and for applications requiring gentle transfer. With its vertical connections, the pump is completely drainable and meets the EHEDG requirements. It is available with a double-sealed, aseptic front cover, which provides better protection against the penetration of bacteria.

GEA Hilge sterile pumps for pharma

Valve selection options

Valves are required in pharma process applications for shut-off tasks in the pipeline or at tank bottoms, as well as for divert and merging functions. Hence, they allow for the safe transfer of fluids, such as media, buffer, WFI and product and for realizing the critical CIP and SIP processes among other various special tasks.

Valve operations are typically controlled and monitored by a central Process Logic Controller (PLC) in modern automated plant and process control setups. The switching operation in the valve is actuated pneumatically. Older plants can also still use pneumatic communication with the PLC. But the dominant setup today employs digital control tops that are fitted on all valves, integrated into a fieldbus network. The control top translates the electronic commands from the PLC into pneumatic valve actuation and uses path measuring sensors to provide continuous valve status feedback.

Membrane valve types

Membrane or diaphragm valves offer a relatively simple, economical valve design for pharma applications. To close the membrane valve, the valve stem – operated manually, pneumatically or electronically – presses a flexible membrane against a corresponding elevation, or "weir" in the product pathway, thereby shutting off the flow.

In principle, the membrane keeps the product area hygienically sealed from the atmosphere. However, membrane valves are notably hard to design with smooth, low-resistance flow paths. The pathway is typically crooked at the membrane contact point, and the large membrane surface may add further resistance to the flow.

Several drawbacks also make it difficult to maintain hygienic safety and efficiency: Microscopic gaps between the membrane and the valve body can be hard to clean. Unwanted residues can also build up through repeated pressure at the membrane's point of contact with its metal counterpart.

Importantly, implementation and maintenance can afford considerably more time and effort with membrane valves than with other valve types. Technicians must take great pains to adhere to the inflexible 0° to -3° rotation window for the correct mounting angle of membrane valves. Otherwise there will be drawbacks during operation, including the accumulation of further residues that can entail batch losses. Inspection and replacement work takes up to six times longer on membrane valves than on more service-friendly seat valves. And inspection is required significantly more often – up to twice a year for membrane valves, compared to once every two or three years with most seat valves. Many operators find these short service intervals necessary to prevent breach of the membrane, as the material – without a defined metallic stop for support – is exposed to particularly high stress.

Seat valve types (overview)

Seat valves operate by pressing a pneumatically actuated valve disk into a corresponding valve seat to close the valve. The product paths can be designed with minimum dead spaces and minimum flow resistance. To securely shut off the product flow when the valve is closed, seat valves are equipped with efficient-to-clean EPDM O-rings. All other internal surfaces are generally pharma-certificated stainless steel (316L).

Seat valves are available as single-seat and double-seat valves in different grades of hygienic protection for all types of valve applications.

Sterile seat valves

To create the most hygienically safe process conditions in pharma production, sterile bellows valves have been specially developed for pharma applications. A pioneering example of this valve type is the GEA VESTA® valve series to be introduced in detail further below.

Sterile seat valves are single-seat valves that are always equipped with PTFE bellows to prevent outside contamination. They can be designed absolutely free of dead zones in the flow path. Compared to membrane valves, maintenance is significantly easier and more cost-effective. Regular service inspections for sterile seat valves are required only once every two to three years, and they take less than five minutes. This ensures lower service costs and corresponding OPEX advantages for the plant operator.

Prevailing switching leakage with mixproof valves can be substituted by setting up sterile valves in the classic block & bleed configuration. In this manner, sterile seat valves are able to cover the majority of all pharma applications in an economical way. For standard hygienic requirements, e.g. in CIP/SIP supply and return lines, mixproof double-seat valves can be a more cost-efficient solution. In case of special demands to aseptic processing, aseptic double-chamber valves are available.

Hygienic mixproof valves

Double-seat or mixproof/leakage valves have been developed as compact solutions for specific flow control applications such as CIP supply and return lines where two different media (product and CIP) will pass through pipeline junctions at alternating times but must always be kept separate. Mixproof or leakage valves feature two independent valve seats with a drainable intermediate leakage chamber to prevent any contact of the two media.

Protective technologies against risks to sterility

To protect sterile processes and counter possible risks to the product, both single-seat and double- seat valves are available in numerous safety-enhanced type variants, equipped with special technologies to meet any scope of sterile requirements according to demand.

No protection:

For CIP supply and return lines safely separated from the product flow, simple versions of seat valves are sufficient even under stringent pharma production regulations.

Protection against switching leakage:

For limited hygienic requirements, seat valves are available with axial seals, which allow for some measure of switching leakage. To shield more sensitive product from impurities, valve types with radial seals can be selected, which almost completely prevent switching leakage. Several types of seat valves can be arranged in block & bleed configurations to dispose of any switching leakage.

Protection against seal failure:

To meet more stringent hygienic requirements, producers may need to protect their product against the risk of a failing seal. Mixproof double-seat valves, as described above, can be selected in this situation. If a seal fails, the second valve seat with its own seal will keep the leakage separated from the second medium. Special variants of mixproof valves enhance this protection by generating a vacuum effect to immediately remove the leakage from the chamber between the two seats.

Protection against trapped residues:

To ensure yet higher purity and security for sensitive products, numerous seat valves are available with options to flush the valve seats in closed position so no residues can be trapped between valve disks. To prevent trappings between valve disk and seal, some valve types allow toggling the valve seats during CIP and SIP procedures.

Protection against elevator effect:

During the switching movement of the valve stem on seat valves, it is possible that the stem carries organic or inorganic substances from the atmosphere into the product chamber. To safely prevent this, manufacturers can select seat valve types that are equipped with PTFE or stainless steel bellows that shield the product chamber from the valve stem.

Protection against abrasions from the valve stem:

Abrasions from the valve stem can affect the product quality but again PTFE or stainless steel bellows that shield the stem from the product chamber provide a perfect solution to prevent this.

Aseptic valves for optimized process availability

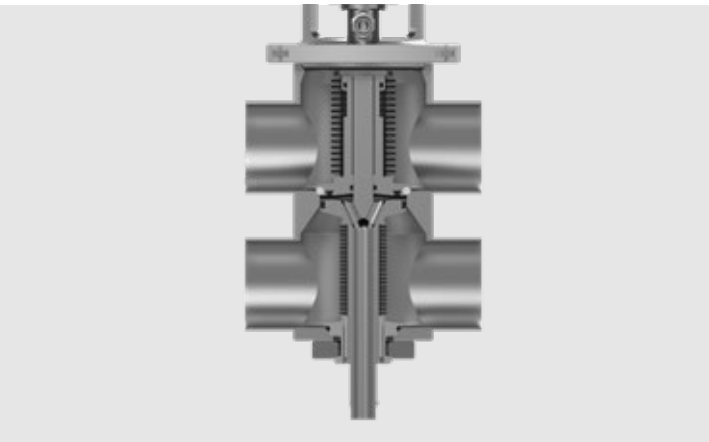
The most complex types of seat valves are aseptic valves. To prevent the elevator effect with maximum safety, aseptic valves are equipped with uncompromising stainless steel bellows. Double-chamber valves used to safely control two different media with just one valve are equipped with up to three Integrated Sterile Barriers (ISB) between the different product and leakage areas. These built-in cleaning and steaming systems (using their own integrated auxiliary steam valves) eliminate the contamination risks of possible switching leakage or seal failures by sterilizing the respective areas.

As this sterilization step with aseptic valves can be integrated into continuous processing setups, the high costs of these valves can be justified in such business cases where process availability over long, uninterrupted periods is of the essence, and the high product value helps setting of the costs.

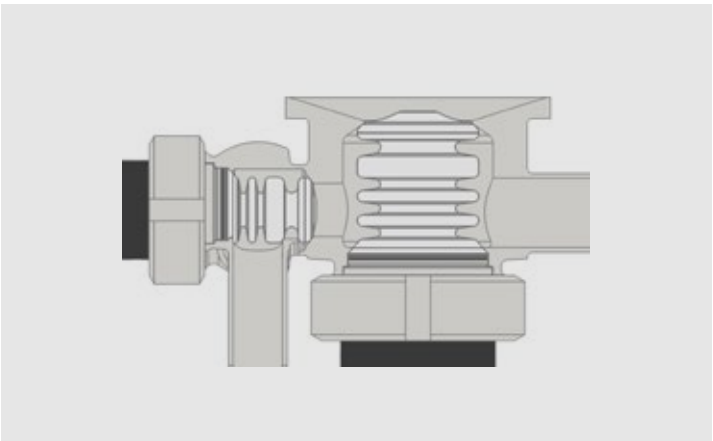
Tank bottom seat valve variants

Sterile seat valves, hygienic seat valves and aseptic valves are all available in tank bottom or bottom seal valves, which enable the complete drainage of storage or processing tanks in pharmaceutical processes. Housing connections can be welded directly into the tank bottom, flush-mounted into the tank bottom wall.

Mixproof tank bottom valves separate the pipelines from the tank interior and allow the pipeline to be cleaned while the process in the tank continues.



Sectional view of GEA Aseptomag® Leakage Valve LV



Sectional view of GEA VESTA® Tank Bottom Valve with CIP/SIP side valve

GEA valves for pharma applications

With a dedicated line of valves exclusively developed for pharma and personal care applications, GEA makes it particularly easy to assemble ideal equipment solutions for any pharma production process, fulfilling the most stringent hygienic and economic demands.

In addition, plant operators and suppliers can rely on a nearly inexhaustible portfolio of further GEA valve types and valve technology solutions suitable for pharma applications. These can be selected from two dedicated valve families for every hygienic and aseptic process standard. Importantly, all valve series from GEA are compatible with one another. The corresponding GEA T.VIS® digital control tops are either identical or conform to identical communication protocols.

GEA VESTA® sterile bellows valves
To support pharma producers with a dedicated valve series addressing their safety needs, GEA has developed the GEA VESTA® series of sterile bellows valves. These seat valves are characterized by the most uncompromising, optimally cleanable hygienic design, entirely free of dead spaces, which safely prevents any issues from product residues in the flow path. Optimal hygienic materials such as stainless steel (316L) and EPDM seals are used throughout.

A hallmark of the GEA VESTA® series is the use of hygienically safe, chemically and mechanically robust PTFE bellows to seal off the valve stem from the product area, thus safely preventing the elevator effect as well as any other contamination from internal abrasions or the atmosphere. The optimized geometry of the flow path makes smaller and larger valve clusters effective. It ensures minimum flow resistance of the open valve. This recommends GEA VESTA® valves as an ideal choice for large valve aggregates and valve matrices.

Tank bottom variants of GEA VESTA® valves are available to provide a secure peripherical shut-off of fermentation vessels, buffer and media preparation tanks and other containers.

GEA VARIVENT® hygienic process valves
The GEA VARIVENT® family of hygienic single-seat and mixproof valves is different from other valve series, as it can be described as an entire modular valve system. Extensive combination possibilities and variants and a large range of nominal widths up to DN150 enable any conceivable process application, even highly complex and innovative ones. Control valves, overflow valves and other valves with special functions are offered in a complementary series.

GEA VARIVENT® valves are designed and certified for hygienic application. In addition to hygienic-standard geometries, materials and seal concept, they can be configured with optional technologies for hygienic protection and sterility, for instance:

- Flush valves to flush out any residues trapped between valve seats
- Hermetic PTFE or stainless steel bellows (retrofittable on some single-seat valves)
- Balancers on valve disks, stabilizing them against pressure shocks in the pipeline that could otherwise compromise a closed valve seat

GEA VARIVENT® double-seat or mixproof valves are the solution of choice for CIP return cycles or other processes where two different media must be kept separate. The GEA VARIVENT® Mixproof Valve Type R with radial mechanical seal is a variant that is particularly often used in pharma processes, especially in the assembly of distribution matrices.

The new mixproof Valve Type MX achieves a higher level of protection. It is equipped with two balancers against pressure shocks, one on each valve disk, and with a vacuum-inducing geometry of the leakage chamber to ensure immediate and complete draining in case of a seal failure.

GEA Aseptomag® single-, double- and triple-chamber valves and leakage valves
The GEA Aseptomag® portfolio represents the highest standard of hygienic and aseptic protection in valve technology by GEA. A wide range of aseptic valves is available in this portfolio, all with superbly cleanable flow path geometries, and all characterized by the use of welded, pressure- monitored stainless steel bellows as a hermetic sealing between the valve stem and the product area.

For applications that demand the highest standard of hermetic and aseptic sealing and maximum-secure separation of the flow paths, a comprehensive range of GEA Aseptomag® Double-Chamber Valves is available. These valves represent the state of the art for aseptic media separation with uncompromising ISB safety technology.

Depending on plant complexity and required level of safety, double-chamber valves can be executed with one (Type DK), two (Type DDK) or three (Type AXV) steam barriers. The barriers can be operated independently from each other and enable the safe separation of both product lines, even when two of the four valve seats are lifted. The integrated function of the single-seat lifting capability permits fully automatic seat cleaning during production. With three independent steam barriers, GEA Aseptomag® Double-Chamber Valves Type AXV enable maintenance in one product line while production continues on the other side.

A special range of mixproof GEA Aseptomag® Leakage Valves Type LV offers economically attractive valves by combining the stainless steel bellows with the classic double-seat design of mixproof valves. This is an ideal solution for typical application points of mixproof valves, such as sterile water processing, in any process environments that requires superior protection against outside contamination.

Important business benefits

In general, there are two business situations in pharma production where plant planners and operators benefit from a fitting selection of pumps and valves, and where components from GEA especially provide advantages.

First, there is the equipment of new or newly expanded process lines, which is a frequent occurrence today due to the increasing global demand for pharma products and the constant progress in applications and production processes. Pharma producers are well advised to ensure that both the functional capability and the hygienic standard of their future equipment reflects the dynamic development of process concepts and standards. It must also be considered that competition among manufacturers is likely to remain strong or even growing stronger. Savings in OPEX, especially in maintenance, may be a decisive success factor. Sustainable use of energy resources may be another one.

Second, plant operators who have not upgraded their flow components in a long time have the chance to gain substantial savings from reduced operational costs, reduced product losses and simplified processing if they invest in state-of-the-art pump and valve technology. This will provide enhanced profit and secure a stronger market position for them. Key areas of improvement include on the one hand the use of pumps with more energy-efficient motors. Extensive technical improvements in that area have been achieved in recent years. On the other hand, they include the use of valves that may require up to 90 percent less staff effort for servicing (as can be the case, for instance, with GEA VESTA® sterile valves compared to maintenance-intensive membrane valves). Moreover, CIP and sanitation times are shortened every day, enabling longer production time, the more hygienically the plant is designed.

With FDA- and GMP-compliant GEA equipment, plant operators can rely on the safety of their products and maximum availability of their process. The uncompromising hygienic design prevents a great fraction of possible process errors and faults. This is supported by the variety of safety-enhancing technologies that can be selected, especially through the options offered by the different GEA valve families. The service network of the established global manufacturer GEA is standing by worldwide in case of any problems.

Importantly, GEA equipment also ensures a speedy certification of new or upgraded process lines, saving valuable time for plant operators to enjoy success with their optimally selected flow components.

How much can you benefit?

What is the number of maintenance-intensive membrane valves in your plant?
What is the cost p/y for maintenance work on these valves? It could be 90 % less!

How many pumps do you use that are not optimized for energy efficiency?
Each one could seriously affect your OPEX and sustainability.

How future-proof do you want your process equipment to be?
State-of-the-art equipment will increase speedy CIP, process safety, availability and flexibility.

Don’t miss your chance to optimize!
Take stock of your possibilities, fill out our questionnaire, and contact your GEA sales partner!

Abbreviations / Glossary

ASME
American Society of Mechanical Engineers

BPE
Bioprocessing Equipment, as covered in an engineering standard issued by ASME

CAPEX
Capital expenditure of a company or organization

CIP
Cleaning In Place

Cr-Ni-Mo
Corrosion-resistant austenitic stainless steels containing molybdenum

DW
Desalinated Water, as used in pharma applications

EHEDG
European Hygienic Engineering and Design Group

EPDM
Ethylene propylene diene monomer rubber, a synthetic elastic material

FDA
Federal Drug Administration, an agency of the U. S. Department of Health and Human Services

GMP
Good Manufacturing Practice, as specified by relevant agencies such as FDA

ISB
Integrated Steam Barrier, a protective system used in aseptic valve technology

OPEX
Operating expenditure of a company or organization

PLC
Process Logic Controller, the central control unit of a process system

PTFE
Polytetrafluoroethylene, a synthetic plastic material

PW
Purified Water, as used in pharma applications

SiC
Silicon carbide, a hard chemical compound

SIP
Sterilization In Place

Tefasep®
A thermoplast used by GEA for temperature-resistant sealings

USP Class VI
The United States Pharmacopeial Convention (USP) is a scientific nonprofit organization that sets standards to help protecting public health. Class VI administers tests and impact of materials and their substances on animal and human tissues.

WFI
Water For Injection, as used in pharma applications

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