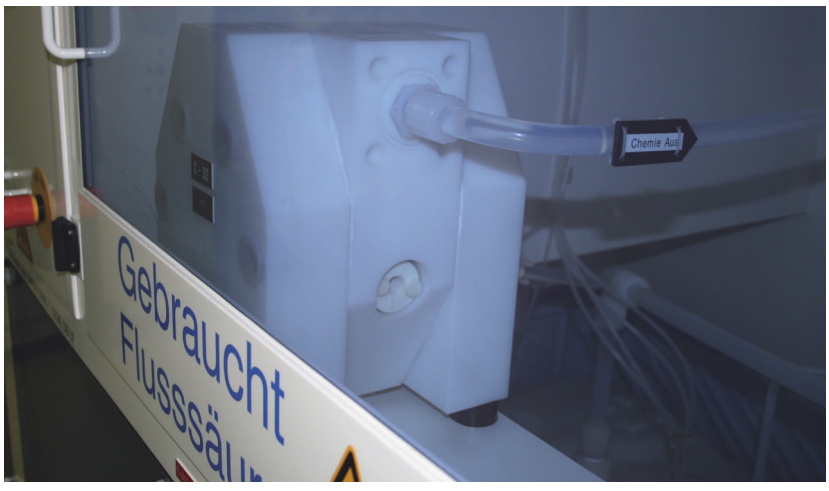
Chemical handling

Picking the right product for the job

There are strict regulations that manufacturers must meet to ensure that distribution and transfer in the global chemical manufacturing process protects humans and the environment. The transfer of such chemicals requires a specialized piece of pumping equipment.

Operators must learn to properly specify equipment based on the application, taking into consideration the unique properties of each dangerous chemical in the process. One example that exemplifies this theory is the Barton Solvents explosion, which occurred at its Wichita, Kansas, facility in 2007. Varnish Makers' and Painters' (VM&P) naphtha, a flammable liquid that can produce ignitable vapor-air mixtures inside tanks and accumulate dangerous levels of static electricity due to its low electrical conductivity, caused an explosion inside a vertical aboveground storage tank (AST), destroying the tank farm, injuring 11 residents and forcing the evacuation of the town's 6,000 residents. The U.S. Chemical Safety and Hazard Investigation Board determined that non-conductive flammable liquids capable of forming ignitable vapor-air mixtures inside tanks should be pumped at reduced pumping velocities to minimize the potential for a static ignition. (It is important to properly ground pumping and storage equipment when handling flammable and explosive media.)

Anytime a toxic, corrosive or explosive chemical is transferred from one container to another, it poses a notable threat to the health of workers and the environment. Pipes, valves, seals and connectors are all considered critical transfer components, but pumps are the most critical component. Pumps are used to transfer bulk chemicals from large containers and dispense them into portable containers for shipping to manufacturing or other end-user locations. Pumps also transfer chemicals for blending and dosing applications, among others.



The Almatec E-Series solid-body air-operated double-diaphragm (AODD) pumps represent one of the safest, most durable and effective options for transferring hazardous chemicals.

When selecting which pump is ideally suited for handling dangerous chemicals, it is important to consider which pump technology will provide the leak-free operation that is required; which technology has the chemical compatibility for all wetted parts; which pump provides constant flow rates with no slippage; and which technology provides the most reliable operation in harsh conditions or atmospheres.

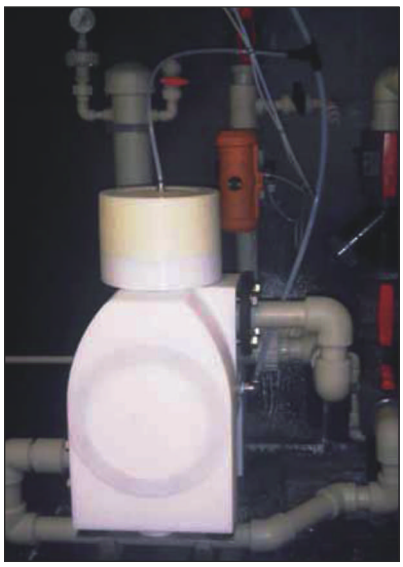
Comparing pump technologies

There are many factors that should go into determining the pump best suited for an operator's dangerous chemical-handling requirements, but seven of the most important factors to consider are:

- Provide leak-free operation
- Ability to run dry
- Self-priming
- Materials of construction
- Low shear
- Ability to deadhead
- Ease of maintenance

Leak-free operation

The most important factor in chemical transfer is containment. End-users have to trust that a pump will not only successfully transfer any challenging chemical in its process, but it will fully contain it. Pumps with mechanical seals are more prone to



Almatec's E-Series Plastic AODD pumps are machined from solid plastic blocks of polyethylene (PE) or polytefrafluoroethylene (PTFE), allowing the pumps to handle the harshest environments.

failure and product leakage than pumps that do not have mechanical seals or packing.

Run dry

In dangerous chemical applications, friction is undesirable and, in certain cases, can be hazardous. When a pump runs dry, that means it continues to run after the chemical has completely passed through it. Where there is no fluid present, internal moving parts will not be lubricated, which can lead to catastrophic failures. This includes the pump's bearings, which will burn up, leading to impeller seizure and bringing the process to a halt.

Self-priming

The location in a hazardous chemical application can often be dictated by the safety and convenience to the operator. This means that large barrels of toxic chemicals are often placed at ground level in protective cabinets and the pumps are situated either on top or on the side of these containers. Strong suction is required in these instances in order to ensure proper flow and transfer rates, which requires a pump that is self-priming.

Materials of construction

Each of the components along the chemical supply chain must be constructed with materials that are compatible with the chemical being handled. For pump equipment, this includes all components on the wetted end, but it is also helpful for the "dry" side of the pump to also have the ability to handle the chemical in the event of an internal seal breakdown or diaphragm rupture.

Shear-sensitivity

When a product is damaged in the pumping process, it is known as 'shearing." 'ubstances that require a minimum of agitation are 'shear-sensitive.' Pumping technologies that have a propensity for shearing are pumps that have meshing teeth or pumps that introduce the fluid to multiple moving parts, such as gear, centrifugal, vane or progressive cavity pumps. The ideal pumping solution will provide the gentle handling necessary to eliminate the chance of altering a fluid's chemical properties.

Deadheading

Many chemical applications require a very specific and accurate flow rate to maintain the consistency and quality of the product being handled or manufactured. This can involve valves on the discharge side of the pump that must close quickly, which shuts down flow and causes a jolt to the pump. This process is known as "deadheading."

Technologies such as gear and rotary vane pumps need an integral relief valve and a system relief valve to re-circulate fluid back to the source, which means extra piping and, more importantly, the introduction of more heat into the process with the potential for unwanted temperature increases occurring with the liquid. In some cases, this can be critical, especially when handling explosive liquids.

Ease of maintenance

Maintenance is a key consideration when selecting the right pump technology, no matter the application. However, for pumps in dangerous or hazardous applications, maintenance can be a critical factor due to the elevated safety levels involved when performing any type of maintenance. In addition, any significant downtime due to a pump failure translates into expensive repairs and lost revenue.

Advantages of AODD pumps

Air-operated double-diaphragm (AODD) pumps represent the safest and most efficient pumping options available when an end-user needs to handle the most dangerous chemicals in their application. AODD pumps are reciprocating, positive-displacement type pumps that only have a few wetted parts and are driven by an air distribution system rather than an electric motor. This allows the pump to run dry and deadhead without damage.

These pumps have no mechanical seal, which eliminates a crucial leak point; provide the superior suction necessary in dangerous chemicals-handling; and are among the safest and most shear-sensitive pumps because the fluid is simply drawn into a chamber and then pushed out with no contact to moving parts within a linear path.

Competitive technologies such as lobe and gear pumps have disadvantages that make them less reliable in handling dangerous chemicals. Lobe pumps, for example, are not true positive displacement pumps, which makes them prone to slipping, affecting flow rates and production volumes. With gear pumps, the meshing gears will begin to wear as soon as the pump is turned on. As gears wear, volumetric consistency is compromised, leading to reduced or inconsistent flow rates and increased energy consumption.

When compared to centrifugal and gear pumps, whose turbulence can damage the particulates present in certain chemical processes, AODD pumps provide a gentle pumping action. There is no friction, which eliminates the "shearing" that can damage or alter the chemical properties. AODD pumps also offer a variety of compatible materials of construction depending on the chemical being used. By removing the need for mechanical seals, AODD pumps also provide leak-free product containment.

Almatec's E-Series Plastic AODD pumps are machined from solid plastic block, which increases its strength and life cycle while eliminating many maintenance concerns. The E-Series' CNC-machined solid block of polyethylene (PE) or polytefrafluoroethylene (PTFE) allows the pump to deal with the harshest environments. When there is a temperature variation, components can deform and create a potential leak path, no matter how tight the bolts are. However, with Almatec's solid-block design, there are no crevices where a potential leak path can be created.

Material compatibility

The E-Series features housing constructed of PE, PTFE, PE conductive and PTFE conductive; EPDM, PTFE/EPDM and NBR

diaphragms; EPDM, PTFE, NBR and stainless-steel ball valves; and PTFE cylinder valves. Conductive plastics give the operator peace of mind in explosion-proof zones pumping flammable media or if the pumps are used in an aggressive atmosphere. Although AODD pumps are intrinsically safe, the materials of construction for such applications require conductive materials to properly ground the pump and dissipate electrostatic charges. Almatec's PE conductive and PTFE conductive E-Series Pumps meet the requirements for the ATEX 94/9/EG directive.

PERSWING P air control system

The PERSWING P air control system offers efficiency when comparing flow rate and the air consumption it takes to get to that point, which translates into lower energy costs. It is a lube-free valve with two moving parts, resulting in a maintenance-free air valve.

Diaphragm and containment ring

Almatec offers a stainless-steel containment ring. The containment ring helps create consistent high-torque compression all the way around the ring, pulling the components tightly together, compressing the diaphragm, resulting in a leak-free seal. The surface of Almatec diaphragms is smooth and not interrupted by any seals. Due to the integrated metal core, they do not require diaphragm discs that can frequently give rise to leaks and attract dirt.

The diaphragms are produced in their priming position, simplifying assembly and almost completely eliminating the dead space on the air side since the inner side of the diaphragm rests against the central housing in the limit position, thus optimising efficiency and reducing air consumption. Since the medium is displaced and delivered by the compressed air, the diaphragms serve as barriers and are not pressurized– an important factor in the outstanding service life of the diaphragms

Pulsation dampener

The Almatec ET Series pulsation dampener is the latest generation of active self-regulating dampeners. Its automatic adjustment feature optimises the diaphragm setting and ensures a consistent flow rate with minimal pulsation and vibration. If a virtually uniform flow is needed, pulsation dampeners in different versions are available. The E-Series pumps can be equipped with screwed-on or flanged integral pulsation dampeners. This eliminates the need for piping between the pump and the dampener.

Barrier chamber

The Almatec barrier chamber system meets safety requirements. The individual diaphragm is replaced by two diaphragms arranged in tandem with a barrier chamber of conductive PE between them and filled with a non-conductive liquid.

Given a diaphragm breach, a change in the conductivity within the barrier liquid is detected by sensors and signaled to a controller, which can trigger an alarm, stop air supply to the pump, and/or supply air to a back up pump to prevent process interruption. More importantly, the barrier chamber system prevents media from spilling to atmosphere. It helps to minimize follow-up costs and waste of expensive media.

Draining system

The Almatec draining system allows the end-user to remove any product left inside a pump between batches. This is critical in chemical-handling applications where crystallization occurs.

The Almatec draining system will pneumatically or manually drain their pumps up to 99% of their volume, leaving virtually no residue left in the pump. This allows the pump to be cleaned without removing the pump from the piping. Capability to cleaning and retrieval of the pumped media as well as the prevention of chemical reaction of different products and frost protection are reasons for using a draining system. ■

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