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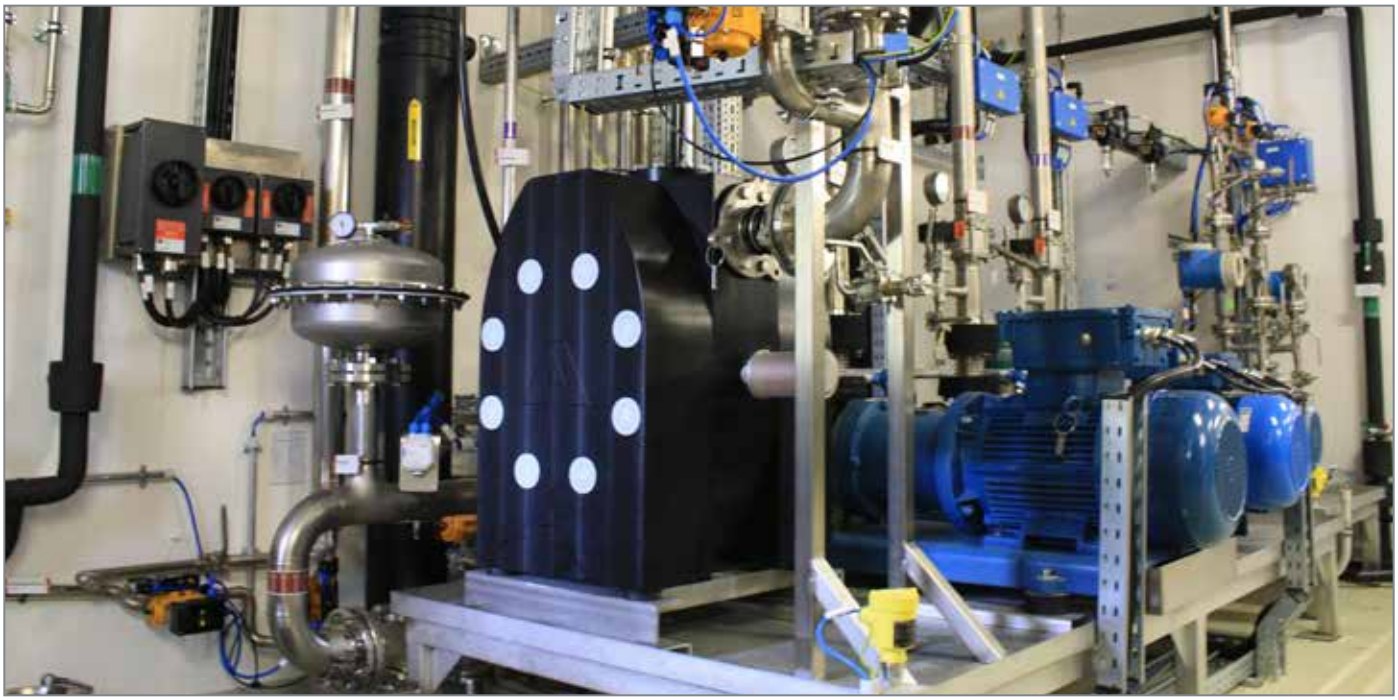
Achieving Full Containment With Dangerous Chemicals

E-SERIES AODD PUMPS FROM ALMATEC® OFFER THE DESIGN AND OPERATIONAL ADVANTAGES THAT ARE NECESSARY TO ENSURE THE RELIABLY SAFE HANDLING OF HAZARDOUS LIQUIDS

By Peter Schüten



The need to use hazardous or dangerous chemicals in the manufacture of numerous products or the completion of a wide array of industrial processes is a fact of life. Utilizing Almatec® plastic solid-body E-Series Air-Operated Double-Diaphragm (AODD) Pumps will help ensure that these liquids are fully contained and that their release will not harm humans, animals or the environment.

Introduction

There's an old adage, usually credited to the first chancellor of Germany, Otto Von Bismarck, that "Laws are like sausages, it is better not to see them being made." The implication is that reaching the consensus required to create a new law can oftentimes be unpleasant and it may be best not to know what the actual "ingredients" are and how that consensus was reached.

The same can said for a number of industrial processes, whether it be the refining of petroleum products, manufacture of pharmaceuticals or the treatment of wastewater. In many cases, these processes require the use of many dangerous chemicals. Among them can be strong acids and caustics like hydrogen chloride (HCl), hydrogen fluoride (HF), nitric acid (HNO_3), sulfuric acid (H_2SO_4), potassium hydroxide (KOH) and sodium hydroxide (NaOH). Then there are dangerous solvents like toluene, a colorless, water-insoluble liquid that can cause a series of severe reactions in the body when exposed to humans, and xylene, a slightly greasy, colorless flammable liquid with some level of acute toxicity.

In contrast to being dangerous, these substances are also invaluable in the manufacture of thousands of consumer products and the production of components that are used to create consumer goods or facilitate industrial processes. The challenge, then, for manufacturers and users of these dangerous chemicals is to construct, handle and transfer them in a way that eliminates any chance for their release into the atmosphere where they can harm humans or the environment.

This article will illustrate how one type of pumping technology—positive displacement (PD) solid-body plastic air-operated double-diaphragm (AODD) pumps—possesses the design and construction features that are necessary to guarantee full containment of dangerous chemicals, while also offering working characteristics that enable the highest level of operational efficiency to be achieved.

The Challenge

Any time substances comprised of dangerous chemicals are handled there is an inherent risk involved. This risk stems from the fact that the release of these chemicals can lead to severe health consequences for humans and animals, as well as damage to the environment. While safety in handling these chemicals is a top concern for those who come in contact with them, there is also a secondary one: these chemicals are often very expensive and any loss due to leakage or release has a direct effect on the manufacturer's bottom line.

However, keeping these dangerous chemicals fully contained is often easier said than done. Since many can also be highly corrosive, the pumping equipment used to transfer them is prone to chemical attack if the materials of construction are not compatible with the acid, caustic or solvent. Materials of construction are not the only factor to consider when determining if a pump should be used to handle dangerous chemicals. Another area to focus on is the actual design features of the pump. For example, if the design incorporates mechanical seals or packing, they may be prone to leaking.

The plastic solid-body construction of Almatec® E-Series AODD Pumps eliminates the small crevices or cavities that can be found in injection-molded models. It is in these crevices that liquids can accumulate and leak paths can be created.

Attempts have been made to circumvent the shortcomings of pumps that feature mechanical seals through the implementation of magnetic couplings or double barrier seals. While these methods of containment do outperform mechanical seals, there are other shortcomings that limit their effectiveness. The viscosity range of liquids that are transferred by pumps with magnetic couplings is limited by the amount of transferable torque that can be created.

The use of pumps with double seals or barrier liquids can be impractical due to their high cost and the elevated level of maintenance required.

Some common pump styles that have traditionally been used to handle dangerous chemicals include lobe, gear and centrifugal models. While they may be constructed of chemical-compatible materials, their design features mechanical seals, the performance of which can be compromised over time, raising the possibility that leaks will occur.

Harsh chemicals can cause compatibility concerns when used with some types of pumps. Almatec® E-Series AODD Pumps can be constructed of plastic materials that are specifically compatible with the chemicals that are being handled, which eliminates corrosion and leak fears.

In terms of actual performance, these competitive pump styles also have shortcomings when it comes to the reliable, energy-efficient transfer of dangerous chemicals. Gear pumps, for instance, move liquids through the meshing of gears. Over time, however, as the gears wear, the pump's volumetric consistency is adversely affected, resulting in unreliable flow rates and increased energy usage. The operation of both gear and centrifugal pumps can create turbulence in the pumped liquid, which can lead to shearing that can damage or alter the liquid's chemical properties. Since they are not true PD pumps, lobe models can be subject to product slippage, which can make attaining a consistent flow problematic and result in compromised production rates.

Other positive displacement pump styles like gear and lobe will lose volumetric consistency over time, leading to higher operating costs. By the nature of their operation, Almatec® E-Series AODD Pumps reliably maintain their flow rates over time, resulting in optimized production cycles and energy usage.

The Solution

While other PD-pump technologies have shortcomings when handling dangerous chemicals, the AODD pump does not come with such concerns. Specifically, plastic solid-body AODD pumps are the preferred choice over their injection-molded cousins. In general, solid-body AODD pumps are stronger and have a longer life cycle with less required maintenance. Injection-molded plastic pumps, on the other hand, can have small cavities or crevices in the body where liquids can accumulate and potential leak paths can be created. During their operation, injection-molded pumps can also bounce more than solid-body models, which can loosen pipework and increase the chances for a product leak.

Plastic AODD pumps can also be constructed of materials that are specifically compatible with the chemicals that are being handled, which eliminates corrosion and leak concerns. The overall design and operation of AODD pumps gives them dry-run capability and good controllability, while they are seal-less. Their compressible drive medium permits gentle delivery with attenuated pressure peaks. Start-up is simple and the space required is considerably less than in the case of piston-actuated diaphragm pumps or eccentric screw pumps.

Almatec® Maschinenbau GmbH, Kamp-Lintfort, Germany, is a premium manufacturer and the actual inventor of plastic solid-body AODD pumps and offers an extensive product range. In the handling and transfer of dangerous chemicals, Almatec, which is a product brand of PSG®, a Dover company, Oakbrook Terrace, IL, USA, recommends its E-Series AODD Pumps. E-Series pumps offer a long list of features and benefits for handlers of dangerous chemicals:

- **Solid-Body Construction.** E-Series pumps are CNC-machined from solid blocks of polyethylene (PE) or polytetrafluoroethylene (PTFE). The result is a pump that is not prone to the creation of leak paths while being able to operate with the most dangerous chemicals in the harshest pumping environments.
- **Diaphragm and Containment Ring.** The E-Series features a unique stainless-steel containment ring and ring-tightening structure that helps create consistent high-torque compression that pulls the components tightly together and compresses the diaphragm in such a way that a leak-free seal is achieved.
- **PERSWING P® Air Control System.** The PERSWING P® is a lube-free valve with only two moving parts that allows the E-Series pump to achieve superior flow-rate efficiency and air consumption, which helps lower the overall cost of operation.
- **Material Compatibility.** The E-Series pump's housing can be constructed of PE, PTFE, PE conductive or PTFE conductive, which allows it to be used with a wide range of chemical formulations. Additional versatility in regards to material compatibility is realized through the availability of EPDM, PTFE/EPDM and NBR diaphragms; EPDM, PTFE, NBR and stainless-steel ball valves; and PTFE cylinder valves.

- **Intrinsic Safety.** E-Series pumps that are constructed of PE/PTFE conductive plastics are intrinsically safe and meet the requirements of the ATEX 94/9/EG directive. This means they can be safely used in explosive atmospheres or when pumping flammable liquids.

Almatec is now offering its E-Series AODD pumps, which can be used a s a direct replacement for its previous A-Series line, in seven sizes: the 6.4-mm (1/4") E08 with flow rate to 15 L/min (4 gpm); the 9.5-mm (3/8") E10 with flow rate to 23 L/min (6 gpm); the 12.7-mm (1/2") E15 with flow rate to 55 L/min (15 gpm); the 25.4-mm (1") E25 with flow rate to 130 L/min (35 gpm); the 38.1-mm (1-1/2") E40 with flow rate to 330 L/min (88 gpm); the 50.8-mm (2") E50 with flow rate to 600 L/min (160 gpm); and the 76.2-mm (3") E80 with flow rate to 800 L/min (210 gpm).

Conclusion

You may not want to see how they are made, but we can't live without laws. The same is true for thousands of consumer or industrial products that are manufactured on a daily basis. While we may not want to know what types of dangerous chemicals, solvents, caustics or acids are being used to make paints, detergents, paper and fertilizer, we also know that we can't live without them and that we don't want them to be released to the atmosphere or environment.

That's why full containment of these hazardous, flammable or explosive substances is a front-of-mind concern for the plant operators who handle them. Those concerns can be alleviated, however, through the use of pumping equipment that has been designed to achieve full containment of dangerous chemicals. While other pump technologies can claim to do this, only plastic solid-body AODD pumps, specifically the E-Series model from Almatec, can turn those claims into reality.

During their operation, injection-molded AODD Pumps can bounce, which can loosen pipework and increase the chances of a chemical leak. Almatec® solid-body AODD Pumps are more stable during their operation, which leads to a higher level of product containment.

About the Author:

Peter Schüten is the Almatec® Product Manager with Almatec® Maschinenbau GmbH, Kamp-Lintfort, Germany. He can be reached at Peter.Schuten@psgdover.com or +49 2842 961-0. Almatec is one of the world's leading manufacturers of air-operated double-diaphragm (AODD) pumps, owns numerous patents and has one of the largest product ranges in the field of pneumatic diaphragm pumps. Almatec is part of PSG®, a Dover company, Oakbrook Terrace, IL, USA. PSG is comprised of several of the world's leading pump brands, including Abaque®, Almatec®, Blackmer®, Ebsray®, Griswold™, Neptune™, Maag Industrial Pumps, Mouvex®, Quattroflow™, RedScrew™ and Wilden®. You can find more information on Almatec and PSG at www.almatec.de and www.psgdover.com.

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