

HELPING TO KEEP YOUR BUSINESS FLOWING

FLUID HANDLING

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AODD in O&G

**AODD pumps are
the workhorse of choice
for oil and gas operators**

Getting into position

**Use of independent position transmitters can
improve the performance of a control loop**

Look at that

solid body!

Full containment of dangerous chemicals can only be realised through the use of a pump technology that is corrosion-resistant and significantly reduces the chance of product leaks

It is a well-established fact that the manufacture, transfer, handling, and use of dangerous chemicals such as acids, caustics and solvents – which can be highly corrosive, toxic, and hazardous to life and the environment – is best not attempted with steel pumps. From basic stainless steels through the more exotic alloys, specific types of steel pumps are only able to cover a narrow chemical-resistance band, which severely limits their application range when considering the handling of dangerous chemicals.

A better alternative in dangerous chemical manufacturing and handling operations is the plastic pump. Within

this subset, there are many types of pump technologies to choose from: lobe, gear, vane, centrifugal, and progressive cavity, to name a few. However, the list of operational shortcomings of these technologies – inability to run dry or self-prime, use of leak-prone mechanical seals, shear-producing operation, inability to deadhead, limited viscosity ranges, and elevated maintenance costs – often make them impractical for chemical-related applications.

By process of elimination, a good pump technology for use with dangerous chemicals is the plastic air-operated double-diaphragm (AODD) pump. Plastic AODD pumps are capable of running dry and self-priming, produce a shear-sensitive flow, have no mechanical seals, can deadhead, are powered by air, and are easily maintained.

Making a solid choice

With plastic AODD pumps acknowledged as the best technology to feature in operations that manufacture or transfer dangerous chemicals, one question remains: should the pump be constructed of

injection-moulded plastic or from a solid plastic block?

Without a doubt, an excellent choice is the plastic solid-body AODD pump, specifically one that is machined from a solid block of polyethylene (PE) or polytetrafluoroethylene (PTFE). These materials are also available in PE conductive and PTFE conductive formulations for use in potentially explosive atmospheres.

Solid-body plastic AODD pumps are preferred over their injection-moulded cousins for a variety of reasons. Injection-moulded pumps are inherently thin-walled, making them susceptible to instability during the pumping process. Injection-moulding can leave small cavities or crevices in the body where liquids can accumulate and leak paths can form. Finally, injection-moulded pumps are lightweight. This can lead to any motion during the pumping process being transferred to surrounding system components and piping, which can then be damaged or compromised.

With these shortcomings in mind, only a pump that is machined from a solid block of PE or PTFE can provide the necessary weight, wall thicknesses, chemical compatibility, seal-less design, and ability to be used in potentially explosive atmospheres.

Additionally, the machining of a solid block of PE or PTFE is economical due to advanced modern computer numerical controlled (CNC) technology. With CNC it is possible to achieve far tighter tolerances than those possible with injection-moulded parts, which require tightening straps and seals to compensate for mechanical variations in surrounding parts. The occurring loads in a solid-body AODD pump are absorbed by the component itself with no external reinforcements necessary. This allows the external unit to be designed without any metal, which is always at risk of corrosion.

An AODD pump with a solid-block design is better capable to withstand external shocks, such as those created by



Solid-body AODD pumps working at a solvents application



Almatec's E-Series conductive pumps can be used in potentially explosive atmospheres

improper handling. A solid-body pump can also absorb the loads that are created by connecting pipes. Finally, solid-body AODD pumps that are constructed of PE/PTFE conductive plastic are intrinsically safe and meet the operational requirements of the European ATEX 94/9/EG directive, as well as those of the US Food & Drug Administration for hygienic-manufacturing operations that take place in potentially explosive atmospheres.

The whole package

One manufacturer of solid-body AODD pumps is Germany-based Almatec, part of PSG. In 2009, the company introduced the E-Series, a then-new product line of plastic solid-body AODD pumps as a direct replacement for one of its long-running models, the A-Series. These E-Series pumps feature a solid-body design, being constructed mostly out of polyethylene (PE), which offers high abrasion-resistance. The pumps, due to their PE construction, have been shown to last seven times longer than pumps that are made with polypropylene – while still having similar chemical-resistance characteristics – and to be 1.6 times more durable than stainless-steel pumps.

Solid PE also delivers better sealing, higher static weight, smoother operation, and better torque retention than other popular materials of construction. E-Series pumps are constructed of PE, PE conductive, PTFE, or PTFE conductive plastics. Out of these, PTFE has a nearly universal chemical resistance. All of the pump's cylinder valves are manufactured from PTFE with the diaphragms (EPDM, PTFE/EPDM, NBR) and ball valves available in EPDM, PTFE, NBR and stainless steel. To meet the requirements of a wide range of applications the pumps can be equipped with accessories such as



Almatec AODD pumps in a CNC machine during manufacture

pulsation dampeners, stroke counting, diaphragm monitoring, barrier chamber systems, and special diaphragms (PTFE conductive or modified PTFE) for high safety requirements, draining systems, and external control models without an air-control system.

All housing parts on an E-Series pump are tightened to each other via housing bolts. However, instead of single bolts that press punctually against the housing, all of the bolts are tightened against a diaphragm-sized ring on each side of the pump. This results in a more even spread of the housing bolt force and an increase in permissible bolt torque, which enhances safety and reliability. An optimised flow pattern reduces the pumps' flow resistance, which results in increased efficiency and lower air consumption.

From the field

Any time substances comprised of dangerous chemicals are manufactured or 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 all forms of life, in addition to causing damage to the environment.

Knowing that, E-Series pumps have been used successfully by a number of high-profile companies that require full containment of the dangerous chemicals that play an important part in their manufacturing processes. Two examples of such companies include:

- Many of the solvents that a Switzerland-based pharmaceutical company uses in its production process are produced at its German research and diagnostics facility. These solvents are classified as hazardous or dangerous chemicals that

must be handled according to the ATEX requirements of the EU directive 94/9/EG regarding the use and disposal of potentially explosive liquids.

'Safety and efficiency are the two most important aspects here at our site, and that's why we chose the Almatec pump,' says the facility's assistant tank manager. 'We have a long relationship and the E-Series pump is the next step in our relationship with Almatec. I think that the E-Series pumps are very safe and reliable, and they are one thing that I never have to worry about.'

- A company in the Netherlands specialises in creating and supplying complete systems that are used in surface-treating steel, particularly pretreatment applications in the hot-dip galvanising process. This process uses a flux fluid that is highly abrasive and corrosive, necessitating the use of plastic pumps.

'We knew that to manufacture our products we would need plastic pumps that would have to deal with very corrosive fluids like hydrochloric acid,' says the director and co-owner of the company. 'Steel, carbon steel, and stainless steel are not compatible with these very aggressive fluids, so you need plastics like PE. The heart of our units is formed by the Almatec pumps. We have to rely on them, and we would choose nothing else.'

Conclusion

Achieving the full containment of hazardous, flammable, or explosive chemicals is a daily challenge and concern for plant operators who manufacture, handle, or use them. Notable shortcomings in chemical compatibility, corrosion resistance, and operational capabilities have essentially eliminated the choice of all forms of steel pumps and other pump technologies from the equation. While plastic AODD pumps, especially those constructed of PE or PTFE, have risen to the fore in dangerous chemical applications, the ultimate choice is a plastic solid-body AODD pump. Solid-body AODD pumps possess the weight, wall thickness, tolerances, and machining that are needed to deliver reliably leak-free operation when handling dangerous chemicals. 💧

For more information:

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