

Latex Pumping Challenges

By Edison Brito

Air-operated double-diaphragm pump technology delivers the shear-sensitivity and leak-free operation required in this application.

Handling emulsions can be challenging. Even their basic definition—a mixture of two or more liquids that are normally unblendable—hints at the difficulties involved in creating and handling them. Still, examples in which emulsions have been successfully created—ranging from common milk to cutting fluids used in metal working—can be found everywhere.

Latex is a complex but stable emulsion consisting of polymer microparticles contained in an aqueous medium. Like emulsions in general, latex—the most recurring image of which is a latex glove—is present in many common products (paints, balloons, floor polishes and carpeting). Most latexes begin as simple emulsions in which droplets of the substance are added to water. This initiates a process known as emulsion polymerization in which the final product can be called latex.

Though latexes are versatile and can be used to enhance a product's performance characteristics—such as durability, dimensional stability and chemical resistance—they require precise manufacturing and handling processes. This article identifies and explains why air-operated double-diaphragm (AODD) pumping technology is ideal for the demands of latex handling.

The Challenges

Two basic challenges exist when pumping latex:

- Latex emulsions are extremely shear-sensitive, requiring pumps that reliably deliver a low shear rate.
- Any contact with air will further polymerize the latex, making it imperative that the pump feature a sealless design. Also, pumps with mechanical seals usually require flushing, which can create a possible leak path or dilution of the latex solution.

Other pump characteristics that are desirable when handling latex emulsions include dry-run capability, ability to handle liquids with varying viscosities, from thin to high-grade, self-priming operation, portability and easy cleaning and maintenance.

A lesser consideration, but still important, is the climatic conditions in which the latex emulsion will be created and handled. Since most types of latex are incapable of withstanding repeated freezing or thawing, they need to be stored at temperatures above 40 F (5 C). They should also not be kept in temperatures above 100 F (30 C) for extended periods because they can become susceptible to surface drying that will compromise their performance.

Through the years, the search for the perfect pump to handle latex emulsions has led manufacturers to experiment with a number of different technologies, most of which feature operational blind spots that negatively affect their performance in latex-handling applications. Some of these competitive technologies and their respective operational drawbacks are:

Gear Pumps

- They are not recommended for shear-sensitive fluids.
- If used, they must be oversized and operate at low speeds.
- Seals are prone to leakage.
- A pressure relief valve is required on the discharge side of the pump.

Centrifugal Pumps

- They are not recommended for, but known to be used with, thin emulsions.
- The seals must have a flush pan and/or be cooled to prevent product buildup around the pump shaft.
- A double mechanical seal or water seal with a packing gland is required.
- Low-flow operation can cause pump failure.
- They may require priming.

Progressive Cavity/Rotary Screw Pumps

- They can be expensive to maintain.
- They are difficult to disassemble.
- A pressure relief valve is required on the discharge side of the pump.
- Viscous materials require an oversized pump operating at low speed.

- They have tight internal clearances.
- They cannot be run dry.
- The seals are prone to leakage.

Circumferential Piston Pumps

- They are not recommended for shear-sensitive fluids.
- The multiple seals are prone to leakage.

Peristaltic (Hose) Pumps

- They are only suitable for low-flow applications.

The Solution

Positive displacement, air-operated double-diaphragm (AODD) pump technology does not have the disadvantages of other technologies. Some AODD pumps are ideal for latex-handling applications because they feature a sealless, bolted configuration that ensures total product containment. The design of the wetted path reduces internal friction, enabling the pump to deliver the level of shear-sensitive operation that is mandatory when working with latex. The AODD pump's positive-displacement operating principle also guarantees that the product flow rate will remain volumetrically consistent.

AODD pumps are available in several materials of construction—including aluminum or 316 stainless steel, which is generally preferred when handling latex, with PTFE elastomers. Some AODD pumps have other benefits, including:

- **Air-Distribution System (ADS)**—Provides operational flexibility through an efficiency management system that allows the user to optimize the ADS for any application demands.
- **Drop-in Pump Configuration**—Allows a pump to be installed in an existing footprint without the need to disturb the piping. They have a larger flow path, resulting in increased flow rates and decreased energy consumption.
- **Full-Stroke PTFE Diaphragms**—The full-stroke design results in increased product displacement per stroke, which translates into greater flow rates and higher efficiencies.
- **Easy Install Diaphragms**—Some pumps' diaphragms that are made of thermoplastic elastomer are easy to install and are a low-cost alternative to PTFE diaphragms when used in abrasive-handling applications. They have a flat-profile design that eliminates the need to invert the diaphragm when rebuilding a pump, allowing for easy, cost-effective installation.

These benefits also equate into energy savings because lower amounts of compressed air are needed to maintain the desired flow rates and pressures. Latex emulsion is, and will continue to be, a crucial component in many industries and products, some of which are as common as the adhesive on the back of a postage stamp. Sensitive handling characteristics make latex a difficult substance to pump. Through the years, manufacturers and handlers of latex emulsions have found that AODD pump technology reliably provides the required operational principles.

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