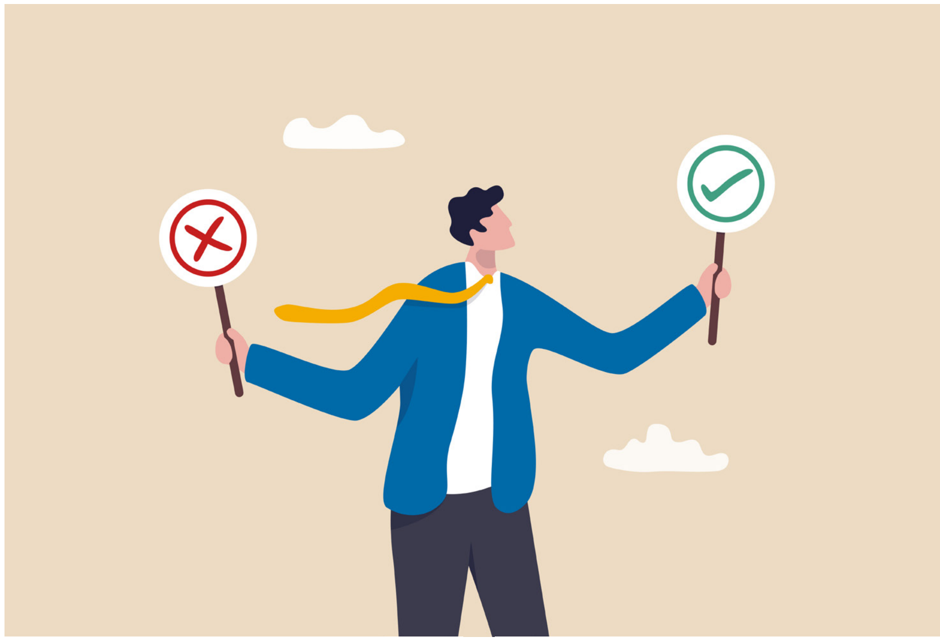
Peristaltic Vs. Diaphragm: How To Choose The Best Option For Your Chemical Treatment Application

Metering pumps are essential components in any water treatment system, whether it's for drinking water, public wastewater, or industrial effluent. There are many different kinds of pump technologies, although the two most common types for chemical metering are peristaltic and diaphragm pumps (Figure 1). Both types of pumps can often be found in a water treatment system, as each has its own unique benefits and drawbacks.



Unfortunately, it's also common to find diaphragm pumps used in applications where a peristaltic pump is a better fit, and vice versa. Sometimes this is the result of misunderstanding the benefits of a particular technology; other times it can be due to a misreading of the spec sheet.

Then there are applications where neither type of pump is an ideal fit. Such situations are more common than many realize. Thankfully, a multi-diaphragm pump can fit these applications very well. Determining which type of pump best fits the situation requires a detailed breakdown of the technologies, their benefits, and their limitations.

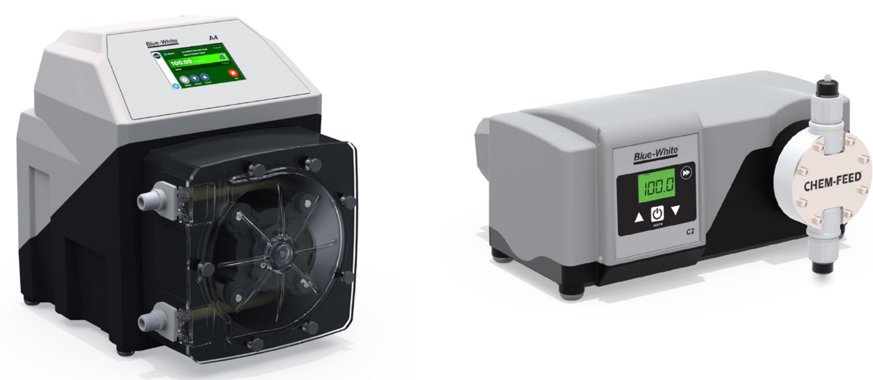


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Figure 1. Peristaltic pumps (left) are low maintenance and work well at low flow rates. Diaphragm pumps (right) require more maintenance and can run at low or high flow rates, although the latter can cause water hammering.

Overview Of Diaphragm And Peristaltic Pumps

A diaphragm pump uses a flexible membrane connected to a shaft, which creates a separation between compressed air and the fluid. A motor connected to a cam alternately pushes and pulls the membrane. The inward motion creates a vacuum for suction, while the outward motion creates discharge.

The diaphragm pump design is energy-efficient and generally costs less to operate in the long run. They are commonly used in areas where budgets are tight, including water treatment plants in small municipalities throughout the developed world and in developing countries, such as Vietnam and Cambodia.

Diaphragm pumps work well under pressure and handle a range of liquids, although they are ideal for clear, stable chemicals. They can run at a variety of pressures and at either low or high flow rates, although with some limitations (see below).

In a peristaltic pump, fluid is fed through a hose or tube using rollers or a similar mechanism that squeezes the hose to move the liquid. As the tube is released, it creates a vacuum that pulls more liquid into the hose and the process repeats. Peristaltic pumps are sometimes called hose pumps or tube pumps.

Depending on the material makeup of the tube, a peristaltic pump can handle more difficult chemicals than a diaphragm pump, such as viscous liquids and liquids with high solids content. They also work well for off-gassing chemicals. Peristaltic pumps require minimal maintenance — only the tube must be changed occasionally, and there are no valves to clean as in a diaphragm pump.

Many mid-to-large municipalities run these pumps. A peristaltic pump can be placed at a higher elevation than the water tank, due to its strong suction lift. They operate well at low speeds and have a steady flow rate.

Limitations Of Peristaltic And Diaphragm Pumps

Diaphragm pumps have several limitations. The valves must be regularly maintained. While this is not costly, it does require labor and downtime to perform. Liquids with high solids content can clog the pump, leading to additional downtime.

While diaphragm pumps operate well at high speeds, they can cause water hammering, which can damage the pump and downstream infrastructure. This can be compensated for by performing a stroke adjustment, which reduces the piston movement. However, the reduced stroke can leave the pump underpowered and cause vapor locking, as the diaphragm is no longer being pushed into the entire cavity, allowing air to compress and inhibiting flow.

Peristaltic pumps have two limitations: flow rate and pressure. Peristaltic pumps are typically limited to a pressure of 125 psi. A common problem with these pumps is that they are often run at the maximum flow rate and pressure listed on the spec sheet. Doing this for a long period of time will quickly wear out the tube, causing unnecessary downtime and potentially reducing the life of the pump.

Multi-diaphragm Pumps Bridge The Gap

A multi-diaphragm pump is a more recent design that can solve several problems traditional diaphragm and peristaltic pumps cannot resolve alone. It utilizes two membranes connected through a central shaft. This shaft pulls one membrane to create suction while simultaneously pushing the other membrane to discharge liquid. The push-pull combination creates a smooth flow that allows the pump to run at high speeds without water hammering.

Photo courtesy of Blue-White Industries

Figure 2. A multi-diaphragm pump offers the advantages of traditional diaphragm pumps without the risk of vapor locking or water hammering.

The dual push-pull action also means the pump is resistant to vapor lock, allowing it to handle off-gassing chemicals. Knowing this, some manufacturers use patented membrane material that allows them to work with aggressive chemicals, such as peracetic acid and sodium hypochlorite.

The cost of multi-diaphragm pumps is comparable to regular diaphragm pumps. Operators should keep in mind that these are still diaphragm pumps, and regular maintenance is required. However, if they are maintained well, a multi-diaphragm pump should provide quality performance for a long time. ■