

HAD or MAD?

Going for the Right Diaphragm Pump in Water Treatment & Reuse



Choosing the proper technology is crucial if your device is supposed to last long, be precise and require little maintenance, even when dealing with highly aggressive treatment chemicals



The world's resources of usable water keep getting ever scarcer. In draught-stricken areas such as California, in particular, the need for limiting water waste has been evident for a long time now. Treating water so that it can be reused or safely disposed of is gaining in significance with the metering pump playing a key role in the process. Depending on the treatment technology and the chemicals required for it, hydraulically or mechanically actuated diaphragm pumps (known as HAD or MAD pumps, respectively) are usually the best options to resort to.

Pumping Options

Various types of treatment activities take place at municipal wastewater plants. They include removing solid material such as sludge and sediment and dissolving suspended organic material such as nitrogen and phosphorus, as well as disinfecting water by killing disease-causing microorganisms. All these processes vary widely depending on what the final product is supposed to be used for. Drinking water obviously requires more intensive cleaning than water used for industrial or irrigation purposes.

A series of steps including coagulation and flocculation, pH control, de-chlorination, chemical precipitation and oxidation, ion exchange, chemical neutralization and stabilization, and taste and odor control need to be taken during each treatment process. In each of these steps an assortment of chemicals are used in different combinations until the desired water standard has been achieved.

It is here that diaphragm pumps come in handy, metering out the correct amounts of chemicals needed in each of these processes. The HAD and MAD pump technologies remain the two proven and most often used pressure solutions in the industry.

Pump Longevity

HAD metering pumps have been around for decades and are known in the market for their ability to handle even the harshest chemicals used in water treatment activities. Such pumps' liquid end features a PTFE diaphragm, which acts as a barrier between the piston and the process fluid. The hydraulic fluid that causes the diaphragm to flex back and forth as the piston reciprocates has the same pressure as the process fluid. This eliminates diaphragm stress and contributes to the pumps' longevity as none of their moving parts gets stretched or compressed.

HAD metering pumps can operate for up to 96,000 hours and require only minimal maintenance. This result is much better than the results achieved by pumps with other types of diaphragm designs where there is no pressure balance and the diaphragm (or the tube) has to contain the pressure coming from the process side.

HAD technology continues to be improved all the time with today's pumps featuring advanced diaphragm materials, efficient hydraulic system designs and enhanced control interfaces. Various motors and variable speed drives are in use, and the pumps have increased turndown (of up to 1,000-to-1).

Higher ROI

The elimination of the problem of vapor locking is another huge advantage of HAD pumps. The problem is the biggest pump issue faced by operators of water treatment facilities. Gas bubbles from the chemicals used at those facilities tend to form in pump heads leading to pump clogging and preventing the chemicals themselves from doing their job. Meanwhile, the continuous and accurate distribution of chemicals is critical for large-scale operations run at treatment plants.

Modern HAD metering pumps eliminate the problem of vapor locking by ensuring high fluid velocity through the pump head. Front-scavenging technology on the diaphragm prevents air bubbles from accumulating by removing the liquid end with every single stroke. Such an improvement means tangible benefits and a long-term return on investment for the operator as the expenditure on high-quality pump technology is offset by savings achieved from reduced downtime and lower repair and maintenance costs.

Leak Detection

Designed with the specific needs of the water treatment industry in mind, MAD metering pumps are suitable for environments with lower pressures than those which HAD pumps usually handle. Such pumps operate with a plunger directly attached to the diaphragm. The pump's drive and motor are connected to the liquid end with the drive's motion moving the diaphragm back and forth and causing suction from the supply tank.

MAD designs are suited for pressures of up to 175 psi; otherwise, they have some of the same features as HAD designs, including vapor lock eliminating solutions. Much emphasis is put on ensuring a leak-free environment – liquid ends that come in contact with hazardous process fluids are designed to be leak-proof and highly durable. An air-filled chamber on the drive side of the liquid end facilitates leak detection. Additionally, in some applications, a double-diaphragm rupture-detection system further protects the pump from hostile chemicals and contamination by hydraulic fluids.

Increased Turndown

In the past, metering pumps used to have a turndown ratio limited to 10-to-1 while maintaining accuracy. Almost three decades ago, the barrier was broken with an innovative design involving variable speed technology that increased turndown tenfold to 100-to-1. Today, many pumps boast similar capabilities.

Turndown plays an important role in water treatment as facilities are continuously faced with changing volumes and a variable quality of the incoming water. For example, in a riverside location a storm can dramatically alter the conditions in which a treatment plant operates. Higher levels of mud and sediment can require a significantly higher dose of certain chemicals. Apart from such specific location-determined conditions, seasons too have a lot to do with the need for turndown flexibility. For instance, seasonal temperature changes influence water quality and thus determine the types and amounts of chemicals used.

Both HAD and MAD pumps offer a variety of turndown ratios as standard. Adjustable speed drive with stepper motor technology and remote stroke control make it possible to achieve turndown as high as 1,000-to-1 while maintaining precise, steady-state accuracy.

End users in the water treatment industry have two reliable diaphragm pump technologies at their disposal, with each offering unique advantages. The HAD design stands out due to its longevity and low maintenance requirements, as well as performance that exceeds the industry's demands. For its part, the MAD pump offers the same performance and accuracy, but is suitable for lower-flow requirements.

Irrespective of which of the designs better fits your specific application needs, the metering pump you use should deliver performance, accuracy and reliability, as well as require minimum maintenance so that it meets the challenges of today's fast growing and ever more advanced water treatment industry.



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