

METERING APPLICATIONS WITH ECLIPSE GEAR PUMPS FOR WATER TREATMENT

How Rotary Gear Pumps are becoming the Pump-of-Choice for pH Control Applications

The Municipal Water Treatment market in the United States is a mature segment defined by best practices and proven technology. But today, water resources are more precious than ever, and tight municipal budgets force water treatment plants to look for ways to increase efficiency and save money. One area for potential savings is the pumping infrastructure used throughout the plant.

Municipal plants treat water in numerous ways: from removing solid material like sludge & sedimentation; to dissolving suspended organic materials; to disinfecting water by killing disease-causing micro-organisms. Each process involves a series of steps: like pH control; coagulation and flocculation; de-chlorination; chemical neutralization & stabilization; and various measures for taste and odor control. Each step requires an assortment of chemicals that are used in different combinations until the desired water standard has been achieved.

Different types of pumps (reciprocating, peristaltic, and rotary gear) are used to transfer liquids and meter the correct amounts of chemicals needed for each process. Each pump has advantages and disadvantages. When it comes to pH control applications - rotary gear pumps such as Pulsafeeder's Eclipse are increasingly being considered by consulting firms and end-users alike for metering chemicals such as Sodium Hypochlorite, Sodium Bisulfite and others. This white paper explains why.



Rotary Gear Pumps Defined:

A rotary gear pump is a positive displacement pump that distributes a constant amount of fluid for each revolution. As the outer (drive) gear turns, it drives the inner (idler) gear to draw liquid into the pump. The liquid travels along the casing to the discharge side of the pump, where the gear teeth mesh back together and force the fluid out of the pump.

Rotary gear pumps are one of the most versatile pump types available. They deliver smooth and pulseless flow, which is important for pH control applications. Gear pumps are designed to handle a wide range of volume flows. They can address a wide variety of fluid viscosities, and they are well suited to handle wide temperature ranges. With just a few moving parts, gear pumps are reliable and easy to maintain.

Metering Applications in Municipal Water Treatment Plants:

Some Metering applications in municipal water treatment plants are complex, whereas others are simple and straightforward. One of the most important applications in a municipal water treatment plant is pH control.

ph Control

pH stands for "potential of hydrogen," referring to the amount of hydrogen found in the substance (in this case, water). pH is measured on a scale from 0 to 14: Seven is neutral, indicating a balance between acid and alkalinity. The normal range for pH in surface water systems or groundwater systems ranges between 6 to 8.5.

Water with a pH below 7 can be acidic, naturally soft and corrosive. Acidic water can leach metals from pipes and fixtures, such as copper, lead and zinc. It also features aesthetic problems such as a metallic or sour taste. Drinking water with a pH level above 7 indicates that alkalinity minerals are present. High alkalinity does not pose a health risk, but it does create an alkali, or bitter taste.

Disinfection

Water treatment plants use Sodium Hypochlorite (NaOCl) to clean and purify water. It is often used on a large scale for surface purification, oxidation, bleaching, odor removal and water disinfection. It is effective in eliminating bacteria, viruses

and fungi. The presence of caustic soda in Sodium Hypochlorite increases the pH of water, prompting a secondary process to return pH levels to neutral. This secondary process is often completed by administering Sodium Bisulfate. In addition to pH reduction, Sodium Bisulfate also interacts with contaminated aldehydes, causing them to precipitate, which makes them easier to filter out.

Achieving Precise Turndown through System Design

Turndown is important in water treatment because the volume and quality of the incoming water can vary from time-to-time. It does not vary dynamically, on a minute-by-minute basis, but it can vary from shift-to-shift. Water treatment plants located on rivers have to deal with storms that alter conditions and carry different levels of sediment. Precipitation such as rain or snow fall can also impact incoming or influent water levels. On a larger scale, seasons can play a role in requiring turndown flexibility – as changes in influent water quality can impact chemicals like Sodium Hypochlorite that lose concentration more quickly in higher temperatures.

In any case, the required level of turndown capabilities that are needed for most water treatment applications – particularly pH control, where uniform distribution of chemicals are preferred – are well within the capabilities of gear pumps.

In a properly designed chemical feed system, an Eclipse gear pump when incorporated with a flow meter and other accessories provides closed-loop feedback to a variable frequency drive for an induction motor. Whenever changes in flow rate are required, the flow meter communicates with the pump controller, and the Eclipse pump reacts immediately to alter flow rates as needed.

Design Considerations:

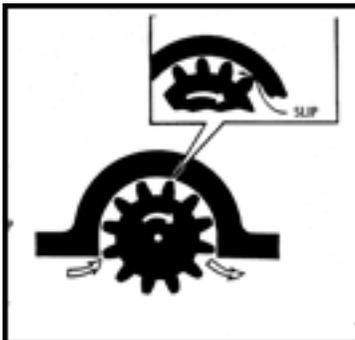
Vapor Locking

Sodium Hypochlorite and other bleaches are effervescent chemicals, prone to gasification when agitated. When the fluid gasifies, pumps can compresses the gas (along with the fluid) causing it to lock. Because treatment plants run large-scale operations with high-duty cycles over long shifts, the need to ensure the continuous and accurate distribution of chemicals is critical to the work flow.

Gear pumps can be effectively used to meter gaseous fluids by following proper piping practices and by installing the proper accessories to maintain accurate and continuous flow.

Accuracy losses through gear slip

All gear pumps are susceptible to losses in dosing accuracy based on “slip,” which is defined as the small amount of chemical that passes between the gear and the housing as the gears turn. Slip is minimal upon early years of operation as the gears and housing operate with the minimum allowable factory tolerance. Over time, as the pump matures and the gears, bearings and shafts naturally wear, accuracy loss due to chemical slip may increase. Slip can be managed with a well-designed system complete with closed-loop feedback and a flow meter. As long as the flow meter communicates with the pump’s induction motor, the pump speed will always increase speed to deliver the required flow.



Summary of Gear Pump Benefits:

Continuous Flow:

Other pump types can be used for municipal water applications, but with tradeoffs. Peristaltic pumps deliver flows in a pulsed fashion, which can pump “slugs” of chemical into the process. To remedy this, pulsation dampeners are required, which come at an added cost. Even with pulsation dampeners, flow delivered from a peristaltic pump is not as smooth or uniform as that of a gear pump. Even a minimal slug of sodium hypochlorite dispersed in the early part of the process can bleach water erratically, which prompts the need for more sodium bisulfate later in the process, to maintain the pH balance. An uneven flow in the first part of the process creates ripple effects elsewhere.

Safety:

Sodium hypochlorite is typically used in concentrations that are 10-times the strength of household bleach. If a pump leaks during the process, the chemical is harsh enough to corrode parts of the system, and it is also a pulmonary irritant that can cause respiratory issues for plant workers.

The single biggest issue with peristaltic pumps is the wear factor on hoses, which must be changed frequently to avoid failures. Because hoses do not provide an early warning, and in some cases, they do not provide ANY indication of potential failure, it can sometimes be a guessing game from a preventative maintenance perspective. Not all hoses last for the same period of time, and not all concentrations of chemicals are the same. Further variances in temperature and flow volumes can also create variables that maintenance teams must be mindful of when it comes to maintaining peristaltic pumps, greasing hoses, and changing hoses when necessary.

The Eclipse pump features a sealless magnetic design with static seals to eliminate leak points. If internal components wear or fail, corrosive chemicals will still be contained and they will not leak into the environment, further reducing risks for plant personnel and other equipment.

Simplified Maintenance:

There once was a time when every plant had a maintenance person, or maintenance team. But as budgets get cut, maintenance is a place where owners look to save money. As a result, some maintenance personnel may need to cover multiple plants, making the scheduling of maintenance a greater priority, while also increasing the risks, and the costs that accompany emergency repairs. For these reasons, reliability – and the ability to minimize the maintenance a pump requires – is more important than ever.

Maintenance starts with a simple design. The inner workings of the Eclipse gear pump are readily accessible, enabling engineers to repair the pump in place, which can substantially minimize downtime (see diagram). Pumps that do not feature a front pull-out design force engineers to decouple the motor, close the valves, remove piping at both the suction and discharge ports, lock out/tag out the pump and move it to the repair shop (which, in some plants must be done by a separate union employee.)

Some peristaltic pumps are designed for a limited life, and purchasing decisions are purely based on cost. But rotary gear pumps provide reliability over a longer lifespan, while minimizing the cost of repairs.

The simpler the equipment is to maintain, the quicker it can be done. This gives plant operators more flexibility to schedule maintenance between shifts, or whenever it is most opportunistic (or least disruptive) to do so.

Several municipal water treatment plants throughout the United States have been using Eclipse gear pumps for several years. They typically run the pumps at 40-percent of their capacity. At this rate, they report (on average) that they only need to replace the gears and spare parts every three years. Some plants have gotten five years of continuous service from Eclipse pumps before replacing the spare parts.

Spare Parts:

Maintaining an inventory of gears, shafts, O-rings, and liners is critical. Eclipse Keep-On-Pumping Kits (KOPkit), which can be procured with just a single part number, contain every part that the Eclipse pump requires. The design of the



Diagram 2 – Front Pull Out design of Eclipse Gear Pump

Eclipse gear pump makes spare parts easy to install. The parts only fit one way, making replacements virtually mistake proof, which further helps to minimize repair times.

Economics - Return on Investment

The initial up-front costs for rotary gear pumps are slightly more than peristaltic pumps. But when overall lifecycle costs are considered, and maintenance is factored in, no pump type can match the overall value of the rotary gear pump.

Perhaps the most important metric is the fact that maintenance costs for any single repair will always be insignificant compared to the costs associated with lost production and process restarts. The true R.O.I. associated with any type of pump should be connected to a plant's uptime.

Conclusion

Rotary gear pumps such as Eclipse merit consideration for low to moderate pressure (150 psi or less) applications because they overcome many of the problems encountered with peristaltic pumps, and are more affordable than reciprocating pumps. The total lifecycle costs – even when compared to peristaltic pumps – are significant when maintenance costs are factored in.

Ultimately, there will always be a role for different types of pumps in a municipal water treatment plants. But when it comes to metering chemicals for pH control, the uniform flow, the safety, the reliability, and the streamlined maintenance associated with Eclipse Gear Pumps make it an attractive solution for these types of applications.

For more information, visit (www.pulsa.com/eclipse).

Eclipse Product Specifications:

http://www.pulsa.salesmrc.com/pdfs/Eclipse_Bro_web.pdf

“We’ve replaced peristaltic pumps with rotary gear pumps to end the addiction to hoses and hose replacements. The peristaltic model is akin to razor blades or color printers – where the unit itself is inexpensive, but the need for continuous replacement parts never ends. With rotary pumps like Eclipse, we don’t need to change that often - and when we do, it’s quick, easy, and inexpensive.”

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