Sodium hypochlorite has become a common replacement for chlorine gas used to treat water. Going from a gas to a liquid has created the need for additional metering pumps. Typically, municipalities have stayed with their existing technologies to meter sodium hypochlorite with often less than desirable results. Sodium hypochlorite will gas off in higher concentrations causing many traditional pump technologies to vapor lock. This has directed many municipalities to search for a different pump technology. Facilities that are now using magnetically coupled external gear pumps find they effectively meter sodium hypochlorite without vapor locking and often provide additional benefits.

A magnetically coupled external gear pump (Figure 1) is an effective technology for metering sodium hypochlorite. The fluid stream is captured in segments between the gear teeth (Figure 2). The captured fluid moves at the same speed as the gears. This limits the amount of fluid actually flowing past stationary containment in the pumping process. Sodium hypochlorite pumps are often shut down for periods of time allowing gas to build inside the pump. Typical metering pumps, such as a diaphragm pump, contain valves. This gas is trapped by the valves and compresses inside the pump causing the pump to vapor lock losing its ability to pump. An external gear pump is a valveless flow through design. There is some slippage of fluid past the gears eliminating positive trapping of liquid and gas inside the pump. Upon start-up, any potential gas build up is mixed with the incoming liquid, compressed, and passed through the pump eliminating vapor locking.

**ACCURATE AND RELIABLE**

Magnetically coupled external gear pumps operate at motor speeds allowing usage of standard motors and speed controllers. The positive displacement design can
produce accuracies better than 0.25% providing excellent metering precision. Since there is so little slippage of fluid past the gears, an external gear pump can provide turn down ratios greater than 100:1 with standard 3:1 AC inverter drives. Figure 3 is an example of a 20:1 flow turndown with a 1.9:1 RPM turndown.

A magnetically coupled external gear pump has no dynamic seals that can wear and leak (Figure 1). The magnet containment cup makes the technology leak free. The driving and driven gear assemblies are the only moving parts. Combined with five bearings, the external gear pump can operate for as much as 20,000 hours before requiring service. The long life design maintains calibration for extended periods of time. An external gear pump is easily serviced by installing new gears, bearings, and o-rings. A service kit for an external gear pump is approximately 25% of the cost of a new pump and can be installed in minutes. Systems with external gear pumps typically require very little pump maintenance reducing the overall maintenance cost.

Typical reciprocating and some rotary technologies produce pulsations that make it difficult to use flow meters or residual chlorine sensors. Pulsation dampeners are only partially effective in removing pulsations in metering system requiring variable flow rates. An external gear pump does not produce pulsations eliminating the need for a pulsation dampener and making them compatible with flow meters and residual sensors. Adding a flow meter or residual sensing with a 4 to 20 mA or equivalent signal feedback to a variable flow system will provide the best metering accuracy. Sodium hypochlorite usage can be reduced with precision metering. Treated wastewater must meet stringent residual requirements before it can be returned to the environment. Improved accuracy of metered sodium hypochlorite produces less residual chlorine requiring less sodium.
bisulfite to remove the residual. This produces a cost savings of both sodium hypochlorite and sodium bisulfite.

**INSTALLATION RECOMMENDATIONS**

An external gear pump does not require a strict system design but there are some considerations to ensure effective performance. Figure 4 shows an example of a sodium hypochlorite system using an external gear pump. A 3 way valve is recommended to allow easy priming and allow purging the air out of the lines at start-up. This valve usually is not needed again until the system is drained and restarted. A flowmeter with a signal feedback is recommended for the best accuracy. A backpressure valve is recommended for systems not using a flowmeter. A backflow valve is required to preserve fluid in the system when a backpressure valve is not used.

A filter is recommended on the inlet to protect the external gear pump from foreign materials that could cause wear and reduce the life of the pump. As with any sodium hypochlorite system, gas trapping should be limited, especially on the inlet. Since external gear pumps will not trap the gas, less than ideal inlet piping designs have performed flawlessly.
COMPACT WITH EXCELLENT NPSHR

Magnetically coupled external gear pumps are typically designed to operate up to 5,000 RPM with excellent NPSHR. The gear diameters are small keeping maximum fluid velocities to less than 8 ft/second (2.4 m/s) at 3500 RPM, a 2 pole motor at 60 hertz. Many pump technologies have fluid velocities exceeding 20 ft/second (6 m/s) at 1750 RPM. Lower fluid velocity produces lower pump NPSHR. Low velocity combined with fluid segmenting results in low fluid shear. External gear pumps have a proven record for shear sensitive fluids such as polymers.

Small gear diameters help reduce the overall size of external gear pumps. A typical magnetoically coupled external gear pump with flows up to 2 GPM (7.6 LPM) is only 1.6 (40.6 mm) inches in diameter by 3 (76.2 mm) inches long. Flow rates up to 10 GPM (38 LPM) are achieved with pumps measuring 3 (76.2 mm) inches in diameter. The length of a pump with a NEMA or IEC motor typically ranges from 15 to 20 inches (381 to 508 mm) long by 6.8 inches (173 mm) high. The compact size allows easy retrofitting of other pump technologies with external gear pumps. The compact size provides easy installation and increases pump location options. In addition, the compact magnetically coupled external gear pump technology is typically less pricey than larger more complex pump technologies.

CHEMICAL AND CORROSION RESISTANT

Magnetically coupled external gear pumps are chemical and corrosion resistant. They are constructed with 316 stainless steel, hastelloy, or titanium combined with engineered plastic gears and bearings. The driven magnets are encapsulated ceramic or samarium cobalt and will not lose magnetism even in the unlikely event the magnets decouple. Magnetically coupled external gear pumps effectively meter and dose many chemicals used in the water and wastewater treatment process. Some other chemical examples include ferric chloride, sodium bisulfite, hydrofluorosilicic acid, sulfuric acid, methanol, polymer, and many more.

CONCLUSION

Magnetically coupled external gear pumps effectively meter sodium hypochlorite and other water and wastewater treatment chemicals. They are resistant to vapor locking since there is no vapor trapping from out gassing sodium hypochlorite. The positive displacement selfpriming external gear pump produces a very accurate pulse free flow. They require no pulsation dampener to work with a flow meter. Chemical and corrosion resistant construction makes external gear pumps compatible with most chemicals. The low fluid shear makes them effective for pumping polymers. They have a very long life and can be easily and quickly repaired in the field. The compact size simplifies the installation process and provides more location options. Since an external gear pump operates at motor speeds they use standard motors and controllers. In addition, there is a reasonable possibility of an overall cost reduction from low initial costs, reduced chemical usage, and reduced maintenance cost by using a magnetically coupled external gear pump. The magnetically coupled external gear pump is an effective metering technology for water and wastewater chemical metering applications.

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