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Choosing a Metering Pump for Boiler Water Treatment

Metering pumps are used to pump many chemical solutions and additives. For boiler water applications, these devices must dispense accurate chemical dosages every time to ensure the proper chemical treatment for the conditioning of boiler feed water.

By Tom O'Donnell, Neptune Pump Co.

At their simplest, metering pumps are used to inject liquids at precisely controlled, adjustable flow rates, which is a process that often is called metering. As defined by the Hydraulic Institute's Metering Pump Section, controlled volume metering pumps are reciprocating, positive-displacement pumps that typically are used for the injection of chemical additives, proportional blending of multiple components, or metered transfer of a single liquid.

Metering pumps normally consist of a solenoid drive or a gearbox with a motor, a control mechanism, and a pump head with valves. It is through the latter that the liquid being pumped enters the inlet connection and exits the discharge connection. Metering pumps are designed to pump into low or high discharge pressures at controlled flow rates.

For boiler water treatment applications, the metering pumps used must be able to dispense accurate chemical dosages every time in order to ensure the proper chemical treatment of the boiler feed water. Nearly every process within boiler feed water treatment requires metering pumps to dose treatment chemicals to help eliminate erosion, corrosion and scale buildup. Metering pumps meet these requirements because they have the flexibility to easily vary the amount of chemical dosage rates according to the process conditions. They are also suited for boiler water treatment applications that include the injection of phosphates to control phosphate levels in boiler feed water, and the injection of hydrazine, morphaline and ammonia for corrosion control.

Taking all of these parameters into account, metering pumps rightfully remain one of the most versatile and relied upon technologies for the safe,

Hydraulic diaphragm pumps are a popular selection because of their longevity in process applications.

accurate and efficient injection of an array of chemicals in boiler water treatment applications. To employ them effectively, the user must effectively define the process-specific variables that need to be evaluated when choosing and installing the proper metering pump or complete chemical feed system. Having the proper metering pump and chemical feed system can help users inject liquids or slurries regardless of viscosity and help ensure that the metering is done in an efficient, environmentally friendly and energy-wise manner.

Metering Pump Selection

As seems to be the case with most everything, size really does matter when determining the proper metering pump to be used in a boiler water treatment application. More specifically, selection begins by understanding the proper size in terms of capacity of both the pump's flow rate and discharge pressure.

Simply put, metering pumps should not be oversized. In fact, a metering pump should be sized so that its maximum expected flow rate is 85 to 90 percent of the pump's capacity, which leaves additional capacity, if needed. At the other end of the spectrum, a metering pump's minimum capacity should never be less than 10 percent of the capacity. Anything less will, in many cases, affect the pump's accuracy.

Selecting a metering pump cannot be done until the proper flow rates, discharge pressures and type of fluids are identified for the specific application. Once that is determined, the type of metering pump can be selected, i.e., hydraulic diaphragm, mechanically actuated diaphragm, solenoid driven or piston style.

Hydraulic diaphragm pumps are a popular selection because of their longevity and robust design. Most hydraulic diaphragm pumps handle clear liquids with viscosities generally ranging from water (which has a viscosity around 1 cps at 68°F [20°C]) to 1,500 cps. Special liquid ends or special heads are available for applications outside this viscosity range (fluid viscosities to 20,000 cps and slurries up to 10 percent solids).

Metering pumps normally consist of a solenoid drive or a gearbox with a motor, a control mechanism, plus a pump head with valves — through which the liquid being pumped enters the inlet connection and exits the discharge connection.

Another key determination is materials of construction. Selection of a metering pump must take into consideration any corrosion, erosion or solvent action that may occur when handling specific substances. For example, solvents may dissolve pump heads constructed of plastic. Acids and caustics only may be compatible with stainless steel or certain steel alloys, and abrasive slurries can erode some materials. Fortunately, metering pumps are available in a range of materials of construction.

When considering the type of head the pump should have, consider whether special features are required for your application. For instance, some models are offered with double-diaphragm heads with leak detection and alarm capabilities for applications where any diaphragm failure must be sensed immediately.

Selecting a driver is another area of concern. A driver should be chosen by matching it to the available utilities, which usually include electricity, air, gas or other means of driving the pump. When the pump's parameters are determined, you must then consider the environment in which the pump will operate.

Hazardous area requirements also must be identified when selecting the driver. When evaluating a hazardous environment, remember to consider dust, which can ignite just like fumes or vapors. Is the pump to be utilized indoors or outdoors? If it is located outdoors, it should be sheltered from direct sunlight. As far as temperature requirements, most pumps will operate in freezing conditions provided that the fluid to be pumped will not freeze and that the correct lubricants are selected. In this case, freeze protection and heat tracing may be required. Finally, operation in corrosive environments may require special pump coatings.

Total Control

Determining the pump's method of control is next on the list of determining factors. The choices usually include:

- Manual continuous operation.
- On/off operation.
- Automatic proportional control in response to a process signal.

In general, metering pump flow rates can be adjusted manually through the use of a micrometer dial. This manual control allows the pump to be operated between 10 and 100 percent of capacity by changing the stroke length.

By comparison, a manual variable-speed drive changes the stroke speed. A combination of the two may allow additional adjustability or turndown over the range of the drive, depending upon the stroking speed of the pump. For example, a pump operating at 75 strokes per minute (which could be turned down to 15 strokes per minute) would allow a 5:1 turndown on speed when using the variable-speed drive, and a 10:1 turndown on stroke length when using the micrometer dial.

Metering pump flow rates also can be controlled automatically — in response to a process signal — by electric positioners

that change the pump's stroke length, or by variable-speed drives that alter the stroking speed. Using a positioner gives the operator a full 10:1 turndown, which is the full adjustable range. Using a variable-speed drive will supply only as much turndown as the ratio of the pump stroking speed divided by the minimum operating speed of the pump.

Remember that it is not practical to use a variable-speed drive on motor-driven pumps that normally operate at less than 100 strokes per minute. Slowing the motor causes each stroke to take longer from start to finish and, as a practical matter, hydraulic motor-driven pumps should not be operated at less than 15 strokes per minute.

Electronic diaphragm pumps, which are pulsed by a solenoid, can operate at less than a single stroke per minute because the characteristic and timing of each stroke, from start to finish, is the same at all stroking speeds. The moving parts in modern diaphragm pumps offer long service at all stroking speeds. The highest stroking speeds should be avoided with viscous or abrasive chemicals.

When a metering pump is controlled by automatic or electric stroke positioners, the number of doses remains constant and the size of each dose is reduced, thus keeping the doses uniformly distributed in a constantly flowing line. Use of a variable-speed drive changes the stroke speed. Also, the size of the dose injected on each stroke remains the same, but the variable-speed drive makes the doses less frequent as the motor speed is slowed. This, however, can produce an undesirable process result in a constantly flowing line as the discreet slugs of chemical are more widely separated than if a constant dose interval were maintained.

Finally, consider the application and level of quality.

- Is the unit to be used for intermittent operation in light-duty applications where economy is an important consideration?
- Is the unit for an industrial plant, refinery, power plant or waste-treatment facility where ruggedness and additional features are required?
- Is initial cost or lifecycle cost more important?

Metering-pump flow rates can be controlled automatically (in response to a process signal) by electric positioners, which change the pump's stroke length, or by variable-speed drives, which alter the stroking speed.

In boiler water treatment applications, metering pumping technology that comprehensively offers the best in operation, reliability and energy efficiency when handling an array of liquids, chemicals and slurries is the way to go. When boiler feed water must be treated to eliminate erosion, corrosion and scale buildup, having the best chemical metering pumps on hand makes meeting those goals much easier and safer. **PH**

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Planning a Metering Pump Installation

A metering pump installation must be planned from the day tank or liquid source up to the injection point.

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