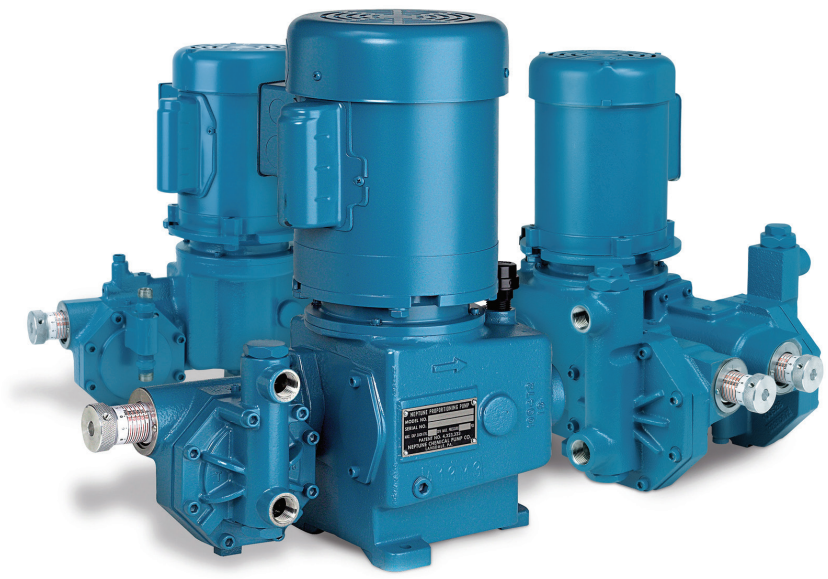
Critical Factors in Sizing & Selecting Metering Pumps & Components



By Tom O'Donnell

System success is highly dependent on proper planning

Metering pumps are a method of injecting chemicals into various water treatment, chemical process and agriculture applications. Their ability to adhere to dosing schedules, handle large volumes of chemicals and operate over a wide variation of pressures makes them an ideal pump for these applications.

When specifying a metering pump and associated equipment, a number of factors must be considered to assure efficient operations, system safety and minimum downtime.

Operating Parameters

The following factors are critical when creating specifications for a metering pump:

- **Flow rate:** Size the pump so that the maximum expected flow rate is 85% to 90% of the pump's capacity, which is optimum but leaves room for additional capacity if needed. Unlike other types of pumps, metering pumps should never be oversized.
- **Chemical composition:** Specify the pump materials according to the corrosion, erosion and solvent action of the chemicals with which it will come in contact. The effects of erosion are especially important when the chemical takes the form of an abrasive slurry.
- **Chemical viscosity:** Be aware of the application's chemical formulations, which can range from extremely thin to highly viscous, and slurry and off-gas. Chemicals with viscosities that approach 5,000 cPs or have light suspensions will require special liquid ends. Those with viscosities up to 20,000 cPs or that contain up to 10% solids will require special diaphragms, while those that automatically vent accumulated gas will need their own variety of liquid ends.
- **Environment:** Take into account all environmental and safety issues before determining suitable pump drivers, which can be electricity, water, gas, air or sun.
- **Method of control:** Determine if the pump will be used in continuous manual operation or in an on/off operational sequence governed by a process signal; whether the pump flow rate will require frequent adjustment or remain at a standard setting during operations; and the required accuracy of the dosing injection. Ultimately, the method of control may be the most important variable in specifying a pump.

Pump Control Methods

Several methods are utilized to control dosing frequency, injection flow rate and amount of chemical injected at each dosing.

A micrometer dial is frequently utilized for applications requiring only manual flow rate adjustment. Adjusting this dial changes the pump's stroke length and allows it to be operated anywhere between 10% and 100% of its rated flow capacity. Another feature is a variable speed drive allowing adjustment of the pump's stroke speed. The two in unison can provide additional adjustability or turndown capabilities over the range of the drive.

A process signal to actuate electric or pneumatic positioners for automatic flow rate control is often used to adjust the stroke length, allowing a full 10-to-1 turndown ratio. In this method, the number of doses remains constant while the size of each dose is reduced, resulting in uniformly distributed doses in a constant line of flow.

Variable speed drives allow the pump to inject a dose of the same size on each stroke. The drawback is that when the stroke speed changes, the doses themselves will vary in frequency. Also, variable speed drives are not practical on motor-driven pumps at speeds less than 100 to 150 spm because slowing the motor causes each stroke to take longer to complete from start to finish. However, electronic metering pumps pulsed by a solenoid are uniform at every stroking speed.

Additional Important System Components

Other installation components that must be considered beforehand include:

- **Suction piping:** Generally, use suction piping that is one size larger than the pump's suction connection, though piping the same size as the suction connection is acceptable if the metering pump will operate at a slow speed when transferring low-viscosity chemicals. Generally, do not use hard piping that is smaller than ½ in. in diameter or that is smaller than ⅜ in. in diameter for low-flow applications that use plastic tubing.
- **Discharge piping:** The size of discharge piping is not as critical as that of suction piping, but must be suitable for the discharge pressure. Typically, matching the pipe size to the discharge connection should be sufficient.
- **Suction strainer:** A suction strainer should always be used to prevent foreign matter from entering the pump's ball checks.
- **Flanges/unions/compression fittings:** At least one of these must be installed at the pump's suction and discharge ports to more easily facilitate maintenance procedures.
- **Isolation valves:** Large-port, quick-opening isolation valves should be placed at both the suction and discharge ends of the installation to ease maintenance operations. Ball valves are usually the best choice, while needle valves should not be used because their design will create a flow restriction.
- **Calibration column:** Because metering pumps

often feature pulsed flow at low volumes, a draw-down calibration column is the most accurate and convenient method to measure pump performance. A tall, thin column should be used to ensure ease of reading and reporting accuracy.

- **Relief valve:** Even if the metering pump has an internal relief valve, it is recommended that an external relief valve also be installed. The external relief valve should be set at 50 psi (3.5 bar) or 10% above the maximum operating pressure, whichever is greater.
- **Back-pressure valve:** This component is only necessary when the installation does not produce adequate back-pressure and the pump does not contain a built-in back-pressure device.
- **Pressure gauge:** The pressure gauge should be sized 30% to 50% larger than the maximum expected pressure that is produced by the system and utilize a diaphragm seal if the pump is to be transferring chemicals that are corrosive to stainless-steel gauge parts.
- **Pulsation dampener:** The pulsation dampener will minimize pressure spikes that may be caused under acceleration circumstances and, in the case of high-volume pumps, reduce piping harmonics.
- **Injection quills/check valves:** An injection quill installed at the pump's injection pump will serve as a check valve while providing better dispersion of the chemical. In low-pressure applications, an injection quill that incorporates a corporation stop, which allows the injection quill to be inserted or removed without having to drain or shut down the system, will improve efficiency and overall performance.

Conclusion

To adequately select the optimum metering pump, a critical list of important variables must be considered, along with an array of system components. Successful, trouble-free chemical injection via metering pump will only be achieved if all variables are taken into consideration and equipment is adequately selected for the planned application. w&wd

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