

flowmeters that fit



Lake Huron Treatment Plant



Pump gallery



42-in. line with FPI Mag flowmeter

By Sven Jensen & Michelle Christie

Magnetic flowmeter solves WTP's tight installation dilemma

The Lake Huron Water Treatment Plant (WTP) is a major facility in the city of Detroit's water distribution system under the management of the Water and Sewerage Department. The most recent addition to the distribution system, the plant began full-scale operations in 1974. The Lake Huron WTP supplies water to communities north of Detroit and was designed to be expandable for growing populations. Currently, the plant has a pumping capacity of 400 million gal per day.

Municipal water systems present a challenging operating environment in which the accurate and reliable measurement of liquid flow is essential for cost-effective plant and system operation. In order for these systems to run as economically as possible, accurate flow measurement is needed to ensure that limited water resources are processed efficiently.

Retrofit Complications

The High Lift Building at the Lake Huron WTP is designed with nine large input feed lines. During a recent instrumentation retrofit project, the plant's engineers needed to assess alternatives to an existing annubar flowmeter located outside the High Lift Building, below a manhole connected to the plant's underground discharge pipe. Whenever the plant staff faced issues with this meter, an entire plant shutdown was required to repair it.

The WTP worked with Metco Services of

Detroit to identify and install a flow measurement solution that would eliminate the costly plant shutdowns. The building's nine lines each are 48 in. in diameter and arranged in a tight pipe gallery. Their continuous operation is essential in supporting the needs of the plant's service area, rendering shutdowns for flowmeter maintenance, repair or new installations difficult and impractical.

After reviewing several flowmeter technologies, Metco Services contacted McCrometer to discuss alternatives to the annubar meter. The McCrometer applications team reviewed the system requirements and assessed alternatives before recommending the installation of the Full Profile Insertion (FPI) Mag flowmeter on one of the nine lift lines.

Flowmeter Found

The flowmeter selected is ideal for the needs of the Lake Huron WTP because it is economical for large line sizes, features a compact insertion design for ease of installation in compact spaces with limited access points and can be installed and maintained without shutting down flow.

Available for service in line sizes up to 138 in., the FPI Mag is designed for large-scale measurement needs such as those found at the Lake Huron plant. It reduces installed costs by 45% or more. While the total installed cost of conventional full-bore meters rises with increases in pipe diameter due to greater materials costs and more complex



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installation, the FPI Mag eliminates the need for heavy equipment or extensive manpower. Installation can occur without interrupting service, dewatering lines, cutting pipe or welding flanges.

A hot-tap full-profile insertion meter unique to the industry, the FPI Mag combines the ease of hot tap installation with an accurate measurement across the full flow profile. It delivers accuracy and rivals the performance of full-bore mag meters at a lower cost. Its highly stable profile provides accuracy of $\pm 1\%$ of reading, ± 0.03 ft/second zero stability from 0.3 to 20 ft/second velocity range.

The Lake Huron WTP's High Lift Building now houses the flowmeter on one of its nine large lift pumps, and it has yielded positive results. The solution is particularly cost-effective for retrofit applications because of its compact insertion design that fits easily into limited-access confined spaces. It can be removed in pipes under pressure for easy inspection, cleaning, calibrating or verification without an expensive shutdown and restart sequence, helping reduce plant ownership costs.

"The advantages of the [flowmeter] are the functionality, accessibility and maintainability," said Sven Jensen of Metco Services. "[It] works great in limited space, and having one meter for each high lift pump allows the meter to be isolated for service without an entire plant shutdown."

Operation

All mag meters operate under the principle of Faraday's Law of Electromagnetic Induction to measure water velocity. The principle of operation states that a conductor such as water, moving through a magnetic field, produces a voltage directly proportional to the velocity of the water moving through the field.

The flowmeter's streamlined sensor features multiple electrodes across the entire pipe diameter. Electrode pairs are located so that each pair measures an equal cross-sectional area. The velocity measurements are added and averaged, providing an area-weighted average velocity across the pipe's centerline. The flow is calculated by multiplying the average velocity by the cross-sectional area of the pipe.

Multi-electrode sensing provides accurate measurement without long upstream and downstream straight pipe runs. The multi-electrode sensor design compensates for variable flow profiles, including swirl, turbulence

and low-flow conditions. Multiple electrodes placed across the entire sensor body continuously measure and report the average flow rate over the full diameter of pipe for greater accuracy and repeatability.

The user-friendly flowmeter uses a preprogrammed, plug-and-play L Series converter. The converter features a six-point curve-fitting algorithm to improve accuracy; 4-20 mA analog output; three-key touch programming; an RS485 port for easy connection to DCS; and eight-line graphical display for access to real-time and total measurements, including flow rate, total flow (forward and reverse), flow direction, flow speed and alarms for empty pipes, high and low flow rates and other fault conditions.

The flowmeter is packaged in a heavy-duty 316 stainless steel sensor body for maximum structural integrity. The sensor is coated with an NSF-certified 3M fusion-bonded epoxy coating for operational longevity. With no moving parts and a single-piece design, the flowmeter contains nothing to wear or break; it generally is immune to clogging by grit or other debris. The flow sensor comes pre-calibrated from McCrometer's NIST traceable Calibration Lab, requiring no recalibration in the field.

It is not uncommon for older WTPs such as Lake Huron to have complex pipe configurations that may require bidirectional flow measurement, so the flowmeter now is available with bidirectional flow measurement. This provides a totalized measurement through the adding and subtracting of liquid flow, allowing for net flow calculations.

Problem-Free Results

Choosing the best flowmeter for the job will result in improved accuracy, repeatability and lower maintenance costs; it also will promote a long life for the flowmeter. The FPI Mag flowmeter has demonstrated positive and problem-free results at the Lake Huron WTP. In the future, the plant team plans to install these flowmeters on its eight remaining lift lines. **WWD**

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