CASE STUDY

FPI Mag Meter Solves a Tight Installation Challenge at Lake Huron Water Treatment Plant

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The Lake Huron Water Treatment Plant 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, it began full-scale operations in 1974 (Fig 1). The Lake Huron Plant 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 gallons 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 such systems to run as economically as possible, accurate flow measurement is necessary to ensure that limited water resources are processed efficiently.

Figure 1: Lake Huron Plant

Retrofit Problem

The High Lift Building at the Lake Huron Water Treatment Plant (Fig 2) 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 flow meter.

Figure 2: High Lift Building

The existing annubar meter was located outside of 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 Lake Huron Water Treatment Plant 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 are each 48-inches in diameter and arranged in a tight pipe gallery. Their continuous operation is essential in order to support

the needs of the plant's service area, which makes shutdowns for flow meter maintenance, repair or new installations difficult and impractical.

After reviewing several flow meter technologies, METCO Services contacted McCrometer to discuss alternatives to the annubar meter. The applications team at McCrometer reviewed the system requirements and assessed alternatives before making a recommendation to install the FPI (Full Profile Insertion) Mag™ Flow Meter on one of the nine lift lines.

Solution

McCrometer's FPI (Full Profile Insertion) Mag Flow Meter (Fig 3) is ideal for the needs of the Lake Huron Water Treatment Plant 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.

Figure 3 McCrometer FPI Mag

Available for service in line sizes up to 138 inches, the FPI Mag is designed for large-scale measurement needs such as those found at the Lake Huron Plant. It is the industry's most economical flow meter for large line sizes, reducing installed costs by 45 percent or more. While the total installed cost of conventional full bore meters goes up with increases in pipe diameter due to greater materials costs and more complex 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.

As the industry's only hot tap full profile insertion meter, the FPI Mag combines the ease of hot tap installation with an accurate measurement across the full flow profile. It delivers accuracy unmatched by other insertion mag meters and rivals the performance of full-bore mag meters at a much lower cost. Its highly stable profile provides accuracy of ±1% of reading, ± 0.03 ft./sec zero stability from 0.3 to 20 ft/s velocity range.

The Lake Huron Water Treatment Plant's High Lift Building now has the FPI Mag Flow Meter installed on one of its nine large lift pumps with positive results. The FPI Mag 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 cut plant ownership costs. Sven Jensen, with METCO services, stated, "The advantages of the FPI Mag Meter are the functionality, accessibility and maintainability. The FPI meter 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."

All mag meters, including the FPI Mag, 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, the voltage is directly proportional to the velocity of the water moving through the field.

The FPI Mag Flow Meter's unique streamlined sensor features multiple electrodes across the entire pipe diameter. Electrode pairs are located so each pair measures an equal cross sectional area. The velocity measurements are

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added and averaged, providing an area-weighted average velocity across the pipe's centerline. Flow is then 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 FPI Mag utilizes McCrometer's preprogrammed, plug-and-play ProComm converter (Fig 4). The converter features a six point curve-fitting algorithm to improve accuracy, 4-20mA (1000 ohm) analog output, three-key touch programming, an RS485 port for easy connection to DCS and a 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 FPI Mag is packaged in heavy-duty 316 stainless steel sensor body for maximum structural integrity. The sensor is coated with a NSF certified 3M fusion-bonded epoxy coating for operational longevity. With no moving parts and a single-piece design, the FPI Mag flow meter contains nothing to wear or break and it is generally immune to clogging by grit or other debris. The flow sensor comes pre-calibrated from McCrometer's NIST traceable Calibration Lab and requires no recalibration in the field.

Figure 4: Plug-and-Play ProComm Converter

It is not uncommon for older water treatment plants such as the Lake Huron Plant to have complex pipe configurations that may require bidirectional flow measurement. The FPI Mag is now available with bi-directional flow measurement. Bi-directional flow meters provide a totalized measurement through the adding and subtracting of liquid flow, allowing for net flow calculations.

Conclusion

Choosing the flow meter best suited for an application will result in improved accuracy, repeatability, lowered maintenance costs and will promote a long-life for the flow meter. Its superior value in terms of the cost of installation and the cost of ownership make the FPI Mag an excellent flow measurement choice for municipal water facilities, such as the Lake Huron Water Treatment Plant. The meter has been installed and the results have been positive with no problems. In the future, the plant team plans to install the eight FPI Mag Flow Meters on the remaining lift lines.

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