CASE STUDY

Power Plant Retrofits Cooling Water System With McCrometer FPI Mag Flow Meter

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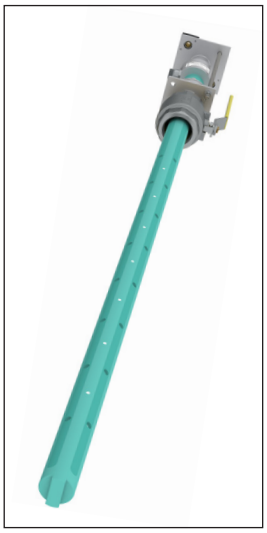
A large power generation plant on a coastal bay site in the United States needed to convert its cooling tower water system to a closed-loop design. The newly retrofitted closed-loop system is more efficient and reduces the thermal impact on the bay.

The Problem

The owner of the plant invested several hundred million dollars in retrofit equipment to minimize the amount of cooling water drawn from the bay. The plant's process and consulting engineers designed a closed-loop system which retrofits the piping already in place.

In the new design, the engineering team identified the need for liquid flow meter placement at multiple locations to measure the flow of water as it passed through the system. Accurate liquid flow measurement is necessary not only for operational purposes to support the cooling towers but also to determine the system influence on the bay's marine life.

The design team needed to find a flow measurement technology that provides accurate and dependable measurement in medium to large line sizes, which also could be installed easily within the existing piping layout. In addition, the flow meter needed to be constructed of rugged materials resistant to seawater, which is highly corrosive over time.



McCrometer's FPI Mag Flow Meter

The Solution

After looking at various flow measurement technologies, the design team contacted the local McCrometer sales representative who collaborated with the Applications Group at McCrometer in Hemet, California. The company specializes in flow measurement, and recommended the FPI Mag™ (Full Profile Insertion) flow meter for its reliable performance, ability to support large line sizes and the ease of its hot tap installation.

The FPI Mag is suitable for service in small to large-scale liquid measurement applications such as cooling tower water systems at electric power generation plants. It is the industry's most economical flow meter with its hot tap design, reducing installed costs by 45% or more. Whereas the total installed cost of conventional full bore meters goes up with increases in pipe diameter because of greater material 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.

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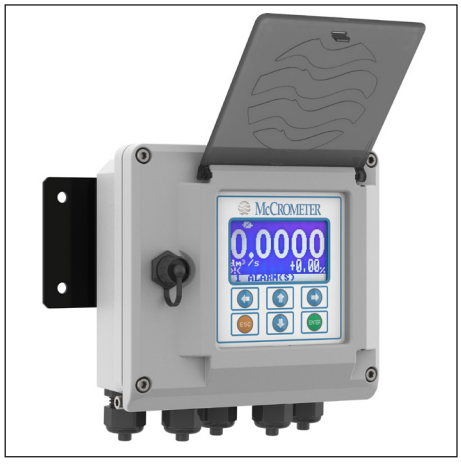
As the industry's only hot tap full profile insertion meter, the FPI Mag combines the ease of hot tap installation with an accurate measurement across the full flow profile. The FPI Mag flow meter delivers accuracy unmatched by other insertion mag meters, rivaling the performance of full bore mag meters at an economical price. McCrometer's high-performance FPI Mag flow meter provides excellent accuracy to ± 0.5% from 1 ft/s to 32 ft/s (0.3 m/s to 10 m/s), and up to ± 1% from 0.3 ft/s to 1 ft/s (0.1 m/s to 0.3 m/s) of reading and installs in line sizes from 4 to 138 inches.

Electric Power Generation Plant Water Cooling Tower

The electric power plant's operations technicians installed several FPI Mag flow meters during 2012 on its newly retrofitted closed-loop system. The FPI Mag is equally cost-effective for new or retrofit applications because of its compact insertion design that fits easily into limited access confined spaces. It also can be removed from pipes under pressure for easy inspection, cleaning or calibration verification without an expensive shutdown and re-start sequence, helping cut plant ownership costs.

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 which is directly proportional to the velocity of the water flowing through it.

The FPI Mag flow meter's unique sensor features multiple electrodes across the entire pipe diameter. Electromagnetic coils installed inside of the sensor produce magnetic fields. Stainless steel electrode pairs installed on the outside of the sensor collect the induced voltage cause by the flowing water. The total of each voltage signal is transmitted to the converter electronics, where it is converted to an average flow velocity. The converter then multiplies the average flow velocity by the pipe's cross-sectional area to create a volumetric flow rate.



ProComm Converter

Multi-electrode sensing provides accurate measurement without long upstream and downstream straight pipe runs. The FPI Mag provides a large rangeability and the multi-electrode sensor design compensates for variable flow profiles, including swirl, turbulence, and low-flow conditions. The FPI Mag's unique sensor configuration continually measures and reports the average flow rate over the full diameter of pipe for greater accuracy and repeatability.

The user-friendly FPI Mag uses McCrometer's preprogrammed, plug-and-play ProComm converter. The ProComm Converter, standard with all McCrometer mag meters, features built-in dual 4-20mA outputs for communication flexibility, additional programmable outputs to support SCADA systems and a simplified menu structure for ease of use.

The FPI Mag is packaged with a heavy-duty 316 stainless steel sensor body for maximum structural integrity, and for this application the optional Hastelloy® electrodes compatible with the corrosive seawater environment. The sensor is coated with a NSF certified 3M fusion-bonded epoxy coating for operational longevity. With no

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moving parts and a single-piece design, the FPI Mag flow meter contains nothing to wear or break, and is generally immune to clogging by grit or other debris. The flow sensor comes pre-calibrated from McCrometer's NIST traceable volumetric Calibration Lab and requires no recalibration in the field.

It is not uncommon for electric power generation plants to have complex pipe configurations that may require bi-directional flow measurement. The FPI Mag is available with bi-directional flow measurement. Bidirectional flow meters display positive and negative totalized flow or the option of displaying a net totalized flow measurement.

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 made the FPI Mag flow meter an excellent flow measurement choice for this electric power generation plant. After installing the meters in the retrofitted closed-loop cooling water system, the results have been positive.

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