

Foxboro® 871FT Conductivity Sensor – Hydroflouric Acid

Flow-through conductivity sensor reduces equipment corrosion without jeopardizing worker safety in hazardous chemical applications

Summary

The Foxboro 871FT conductivity sensors are a comprehensive family of flow-through, non-invasive electrodeless assemblies that measure the conductivity of almost any conductive liquid.

Business Value

With more than 40 years experience in conductivity measurement, Foxboro offers the most complete line of instrumentation available. The proven reliability and robustness of the Foxboro conductivity flow-through sensor helps improve process performance, increases production yields and reduces equipment corrosion.

Results

This specialty chemical processor has eliminated equipment corrosion resulting from excessive water, and after 10 years of use, is still using the first installed 871FT flow-through sensor, which has paid for itself many times over. This has improved production yields and significantly reduced maintenance costs. Also of importance, the company has all but eliminated exposure of personnel to a potentially deadly chemical. Flow-through conductivity sensing technology has allowed the company to be proactive in redirecting problems before they occur, improving operations, and profitability without jeopardizing worker safety.



About The Foxboro Flow-Through Conductivity Sensors

Foxboro 871FT conductivity sensors are a comprehensive family of flow-through, noninvasive electrodeless assemblies that measure the conductivity of almost any conductive liquid. The 871FT sensors are available in several line sizes from 0.5 to 4.0 inch (1.27 to 10.16 cm); and there is a wide choice of wetted parts materials and end connections and including both industrial and sanitary types. Featuring a built-in calibration port, the 871FT sensors can be calibrated in-line to improve applications with aggressive chemicals and those in industries such as pharmaceuticals where the process line cannot be broken.

Benefits

- Reduced material and maintenance costs
- Improved production yields and reduced equipment corrosion
- Reduced exposure of personnel to a potentially deadly chemical

Technical Challenges

Hydrofluoric acid (HF) is a key component in products ranging from pharmaceutical intermediates to industrial lubricants, and is highly corrosive to equipment and extremely hazardous to humans.

HF is a weak acid concerning its direct corrosive properties; the presence of water in anhydrous HF can seriously corrode process equipment. In chemical processing, operations equipment replacement costs can run into the hundreds of thousands of dollars for labor and materials, especially when replacement includes premium-performance metal alloys such as Monel® and Inconel®. Furthermore, downtime and loss of production during equipment repair can corrode profits for chemical processors.

A specialty chemical company that uses HF as a basic building block of its main product lines addressed this problem through distillation. To reduce much of the corrosiveness resulting from the high water content, the company developed a distillation process that extracted up to 90 percent of the water from incoming HF. The process involves tanker trucks unloading the raw HF into a storage vessel, from which it is fed to a distillation column where it is processed at a rate of 1 gallon per minute (gpm). The process reduces the water content from 100 ppm to 10 ppm.

The company found that removing up to 90 percent of the water from the incoming HF reduced equipment corrosion significantly, without sacrificing product quality. However, distillation process variables still allowed some HF to pass through with unacceptable water levels. To help eliminate equipment corrosion completely, engineers required a safe and reliable method to measure exactly how much water remained.

The company tried acquiring grab samples for lab analysis, but soon deemed this impractical since it interrupted the distillation process and exposed workers to HF. Even brief exposure can cause serious health problems. By applying flow-through conductivity sensing, a technology with which it had little experience at the time, the company found a way to obtain high-precision analyses of HF streams without jeopardizing worker safety.

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The Foxboro Solution

After evaluating several analytical approaches, the company's engineering team concluded that conductivity sensing, a proven technology that was relatively unfamiliar to them, would be the correct solution. They selected Foxboro technology.

In this application, conductivity sensors assist in the water extraction process by using changes in conductivity as an index to changes in concentration. Foxboro worked closely with this company to fully understand the parameters of the distillation process and desired outcome, and recommended its unique industrial flow-through technology, in which the process fluid actually passes through the toroidal sensing head, which acts as a section of the process pipeline. The company installed the noninvasive Foxboro 871FT industrial flow-through conductivity sensor at the exit of the distillation column. For this application, the allowable range of water content is 10 ppm to 25 ppm. When this limit is exceeded, as determined by conductivity, the 871FT sensor triggers an alarm so that adjustments can be made to achieve the allowable level of water content. The detection is rapid, reliable, and accurate. Conductivity measurement in the ~500 microsiemens/centimeter ($\mu\text{S}/\text{cm}$) range is required for this application, but the 871FT is suitable for applications with measurements ranging from 10 $\mu\text{S}/\text{cm}$ - 2000 mS/cm .

Another advantage of Foxboro 871FT flow-through sensors is that they enable calibration in-line, which significantly reduces scheduled maintenance time and related exposure of personnel or the environment to aggressive and dangerous chemicals. Traditional conductivity calibration involves pulling the probe, capping the line, actual calibration, and then cleanup, which can be tedious, dangerous to personnel, and quite costly. As part of the flow-through design, the Foxboro 871FT conductivity sensor features a calibration port that eliminates the need to break into the line, thus eliminating associated costs and safety concerns.