

ABB Analytical – Conductivity Clean-In-Place sanitary applications

Industry: Food & Pharmaceutical

Monitoring cleaning of food and pharmaceutical production systems

In the past, food and pharmaceutical manufacturers had to dismantle equipment between production batches for manual cleaning. Manual cleaning is time-consuming, expensive, and subject to variable outcomes. It also exposes personnel to potentially harmful chemicals.

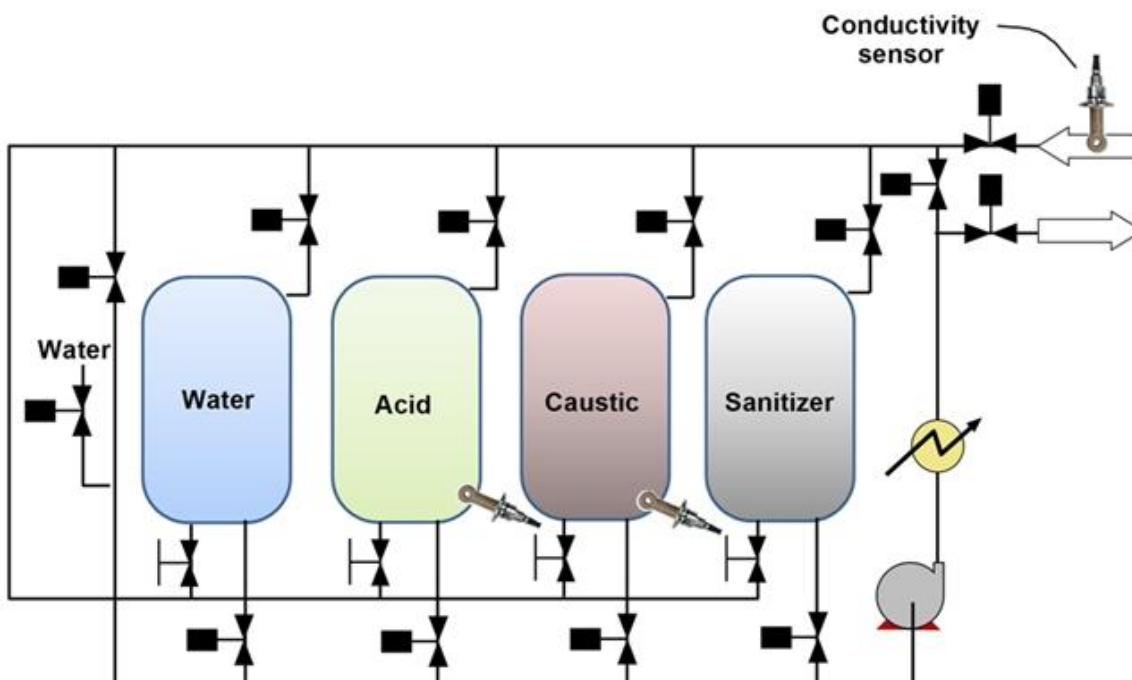
Cleaning-In-Place (CIP) is the modern, multi-step process for sanitizing process equipment between production batches without the need for disassembly. CIP techniques effectively clean the interior surfaces of pipes, vessels, process equipment, and associated fittings. The CIP process includes multiple rinses with water, weak acids, weak bases, detergents, steam, and similar cleaning agents. Elevated temperatures often enhance cleaning effectiveness.

Depending on the process, the goal of the CIP system is to eliminate any organic residues such as precipitated proteins, carbohydrates, fats, and minerals, among others. In some cases, the system will include product recovery.

Evolving sophistication

CIP has evolved from simple operator-controlled systems, which still exist, to fully automated systems with PLCs, multiple balance tanks, sensors, valves, heat exchangers, data acquisition systems, and special spray nozzles.

Specifics depend on the degree of cleaning necessary (often mandated by government regulations) and the process configuration. For piping and some equipment CIP must provide highly turbulent, high flow-rate fluids. If vessels need minimal cleaning, a low-energy static sprayball may work. More rigorous cleaning or large diameter vessels may require a dynamic nozzle with a high-energy spray.



Monitoring CIP with conductivity

The various cleaning solutions are at higher conductivity than the rinse water, thus conductivity measurement provides a simple way to monitor each phase of the CIP process. The conductivity of the cleaning solution varies directly with its chemical concentration. The plant can apply conductivity measurements to control and record the strength of the cleaning solutions used, validating compliance. As noted, conductivity also indicates when rinsing between cleaning steps is complete. At these stages in the cycle the conductivity will drop to the level of the rinse water. This will trigger the next step or end the cleaning cycle.

In short, conductivity sensors benefit the plant by:

- Maximizing safety, avoiding cross-contamination between batches
- Reducing liability for the facility by ensuring quality end-product
- Minimizing CIP time, quickly determining step endpoints and returning equipment to production
- Optimizing thermal efficiency, reducing energy requirements

Conductivity sensors used in CIP processes are characterized by a smooth surface finish to minimize the possibility of bacterial growth.



TB25 is a sterilizable 2-electrode stainless steel body conductivity sensor. It is often used on measuring rinse water conductivity.

The ABB solution: CIP conductivity sensors

ABB offers several models of specialized conductivity sensors for CIP applications. These sensors connect to the process via 2-inch (50mm) Tri-Clamp sanitary fittings. Each sensor model has a 2-inch flange that secures to the Tri-Clamp fitting. The sensor tip sticks into the process to be measured. ABB has 2- and 4-electrode conductivity CIP sensors, as well as toroidal units. Choosing the right CIP sensor depends on the conductivity range needed and the process chemical composition. Some examples include the conductivity sensors pictured below:



TB4043 is a sanitary electrodeless toroidal sensor. It meets the requirements of 3A approval with a seamless food-grade PEEK body and 2-inch tri-clamp flange.



TB45 sensors have options for stainless and kynar bodies. These four electrode sensors have options for flush or extended tip mounting depending on the application requirements.

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