

CHEESE – CIP

Solutions Sales Training Reference

Receiving

Pasteurization

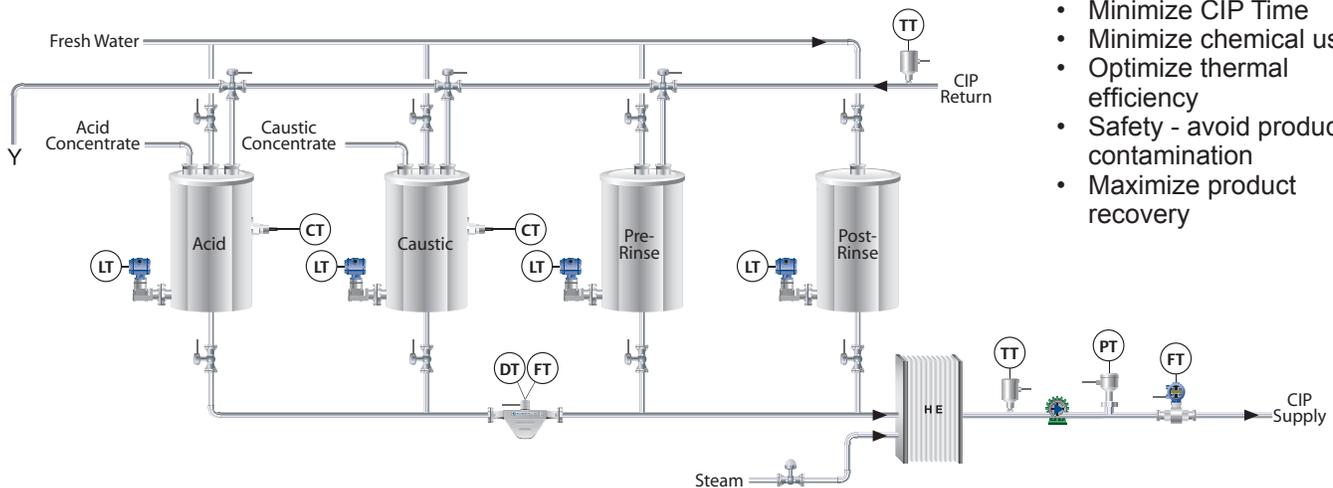
Standardization

Cheese Vat

Starter Room

Finishing

CIP



Key Objectives:

- Minimize CIP Time
- Minimize chemical usage
- Optimize thermal efficiency
- Safety - avoid product contamination
- Maximize product recovery

Receiving Process Description

Clean-in-Place (CIP) is the procedure for cleaning and sterilizing food plants by circulation water and chemicals through sections (called circuits) of the plant. This removes any product deposits and ensures the process equipment and pipework is clean/sterile and ready for the next production shift. Cheese plants typically clean-in-place once per day.

CIP systems, called units, are self contained and include either a three or four tank system; caustic detergent, acid detergent (typically for heated surfaces like pasteurizers), pre-rinse (fresh water) and post-rinse (spent rinse water). Cheese plants have at least three CIP units; one each for raw milk, pasteurized milk and the starter culture. Larger plants may have more CIP units distributed throughout the plant to avoid sending CIP chemicals over long distances (and avoid heat loss). Often these CIP units are fed by a common acid and alkali tank, where the chemical concentrate is diluted to the proper concentration.

Two types of CIP programs are common; those for heated surfaces like pasteurizers and those for cold surfaces. Heated surfaces usually require an acid wash to remove encrusted proteins and salts. A typical CIP program includes:

- Pre-rinse with warm water for 3 minutes at 130°F (10 minutes for heated surface wash).
- Circulation of an alkaline detergent (0.5% to 2.0%) for 10 minutes (30 minutes for heated surface wash) at 140°F to 170°F (e.g. silos= 140°F, cheese vat= 150°F, 167°F for other equipment).
- Inter-rinse for about 3 minutes (5 minutes for heated surface wash) to remove alkaline detergent.

- Circulation of acid (0.5% to 1.5% – for surfaces with encrusted proteins) for 20 minutes at 150-160°F.
- Disinfection with hot water at 200°F for 5 minutes (or liquid sterilant) if sterilization is required.
- Post rinsing and gradual cooling with cool water for 8-10 minutes (most tanks don't require this step).

When the CIP process is initiated pre-rinse water is sent through the circuit and “chases” the product (e.g. milk). A timing sequence based on distances and flow rates will switch the valves at the proper time, so the interface of product and rinse water follows the CIP circuit. Conductivity measurements are used to indicate the proper time to switch the valves and minimize this interface. At least 90% (often 99%) of the encrusted residue is removed during pre-rinse to minimize detergent use and maximize recovery of the valuable fat and proteins. The other stages of the cycle use the same method to switch valves and send the next fluids, minimizing the interface each time.

The CIP tanks are insulated to prevent heat loss and heat exchangers are used to boost each fluid to the final CIP temperature. Acid and caustic solutions may be mixed directly in the tank or may come from a common area of the plant. They are often re-used until they are “dirty,” and a new batch is made. A conductivity meter on each tank provides an indication of the detergent strength, and more chemical is added as they are diluted and neutralized. The post-rinse water is fresh, and is captured in the pre-rinse tank to be used in the next cycle to reduce fresh water use.

Select Measurement and Control Points in Pasteurization

CIP Supply and Return Temperatures

Proper cleaning is determined by detergent strength, cleaning time, and temperature; cleaning temperature must be validated.

CIP Detergent Strength

The caustic and acid detergent strength is controlled based on the type of CIP circuit.

CIP Supply Flow

The flow of CIP fluids must be turbulent to properly scrub the process equipment. The fluid velocity is validated by a measurement after the supply pump.

CIP/ Process Interface

The interface between the process and the cleaning fluid must be carefully measured to minimize product loss and avoid product contamination.

CIP Supply Temperature

Control Point Challenge:

The temperature of each phase of the cycle is critical to effective cleaning. Each detergent has a specific temperature at which it performs optimally. Pre-rinse water cannot be too high or it will coagulate the proteins encrusted in the pipes and vessels, making them difficult to remove. Also, disinfectant temperature is critical to remove bacteria with hot ware.

Solution:

A hygienic sensor with good accuracy and stability is used to control the steam to the heat exchanger on the CIP supply line. Proper heating control depends on a reliable temperature measurement.



Rosemount 248 Temperature Transmitter and 68Q Sensor

- Cost-effective measurement
- Unsurpassed economy tier performance

CIP Return Temperature

Control Point Challenge:

Detergent effectiveness is dependent on temperature, and proper cleaning must be validated with a temperature measurement on the CIP return line. Once the return temperature is validated, the phase timer begins.

Solution:

A hygienic sensor with good accuracy and stability is necessary to provide a reliable signal for validation and record keeping.



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Steam Flow to CIP Heater

Control Point Challenge:

Steam is used to heat the CIP rinse water and chemicals in a small heat exchanger. By measuring totalized steam flow, anomalies in every use can be detected and used to optimize performance of the CIP cycle. This measurement also aids in overall energy management for the cheese plant.

Solution:

A mass flow measurement will enable totalized steam flow for the CIP heater. Trending of this information will provide visibility to exceptions where steam use is out of line, indicating a problem with the equipment. It can also be used on overall plant energy management.



Rosemount 3095 MF Mass Flow Meter

- Multivariable: flow, P, T, DP
- 1% mass flow accuracy with up to 10:1 turndown
- Pressure and temperature compensation



Rosemount 8800MV Mass Flow Vortex

- Multivariable: flow and T
- 2% accuracy with up to 30:1 turndown
- Temperature compensation for saturated steam
- Process isolated removable temperature sensor

CIP Acid and Caustic Detergenet Concentration

Control Point Challenge:

To provide detergent to the proper concentration in each CIP circuit.

Solution:

Conductivity on the returning acid and caustic is measured since it is proportional to concentration or solution strength, and is recorded for validation. The fluids are often partially neutralized during the CIP process and additional concentrate dosing is required. A conductivity measurement on each of the tanks indicates when enough of the concentrate has been added. Good mixing is required in these tanks.

I do not have a picture for these products.

Rosemount Analytical 1056 Analyzer and 225 Toroidal Conductivity Sensor

- PEEK sensors meet 3A requirements
- Chemical resistant for long term reliability
- Temperature compensated for improved accuracy
- Differentiate between acids, caustics, water and product

CIP/Process Interface & CIP Completion

Control Point Challenge:

To detect the interface between cleaning fluids and the product to minimize interface and resulting product loss; to detect the interface between cleaning fluids and rinse water to minimize CIP time, and to validate cleaning was done at the proper detergent strength.

Solution:

Since the various cleaning solutions are more conductive than the water used for flushing and final rinsing, conductivity is a cost-effective measurement to monitor the steps of the CIP cycle. When the conductivity drops to the value for rinse water, it indicates the water is running clear and the next step can begin (or the cycle is complete). It is also useful to show the interface between product and the pre-rinse that "chases" it, so the valves can be switched at a time to minimize product loss.

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CIP Supply Flow

Control Point Challenge:

Turbulent flow is required to “scrub” the surfaces (5-10 ft/sec or 1.5-3 m/s is common) for all CIP cycles to ensure proper cleaning.

Solution:

A flow meter is typically placed on the CIP supply line after the heat exchanger to prove a flow rate above 5-10 ft/sec (1.5-3 m/s) was used for that cleaning cycle.

**Rosemount 8721 Magmeter**

- 3A and EHEDG approved
- 0.25% accuracy
- Full diameter; no pressure drop
- Isolated electronics and LOI for long term reliability

CIP Supply Tank Level

Control Point Challenge:

Avoid safety hazards posed by chemical overflow (caustic and acid) as well as loss of water and chemicals, and to ensure proper inventory of all CIP fluids before each cycle begins.

Solution:

Level measurements on all CIP tanks ensure proper inventory of chemicals and rinse water and avoid chemical spills and waste. These measurements are also used as a safeguard to indicate build-up of cleaning fluid in large tanks like the milk silos. A drop in inventory is a good indication that cleaning fluid has built up in a process unit.

**Rosemount 3051S DP Level Transmitter**

- 12 year warranty (10 year stability)
- Lowest total cost of ownership
- Variety of hygienic tank connections

CIP Supply Pressure

Control Point Challenge:

This is often used by plants to ensure there is proper pressure in the line for cleaning. It can also be used to protect the pump from running when the line is dry.

Solution:

A simple gauge pressure device is placed in the CIP supply line just after the CIP supply pump to prove proper pressure for the cleaning cycle.

**Rosemount 4500 Temperature Transmitter**

- Designed for Food and Beverage
- Small, stable, and reliable
- Conforms to 3-A and EHEDG standards.
- Withstands CIP and wash-down.