Filter Cartridge Management

Objective:
Regeneration of Eaton Membran PS Wine and PS Plus Filter Cartridges

Purpose:
Regeneration of filter cartridges is crucial in winemaking for both cost-effectiveness and maintaining filtration efficiency. Over time, filter cartridges become clogged with yeast, colloids, and other particulate matter, leading to a rapid pressure increase and reduced throughput. Instead of discarding and replacing expensive cartridges after each use, regeneration removes the accumulated debris. This process significantly extends the lifespan of the cartridges, reducing the winery's operating costs and minimizing waste. Furthermore, effective regeneration ensures the filters maintain their specified pore size and flow rate, guaranteeing that the wine is consistently clarified and biologically stabilized without introducing off-flavors or contaminants.

There are several pathways a winery can take to regenerate filter cartridges. How a winery chooses to navigate this process will depend on the level of material on the filter, the type of product filtered, ease of use, and the winemaker's preference. The process is roughly split into emptying and rinsing the filter, sterilizing, chemical sanitation, and acid neutralizing. It is not necessary to perform everything every time the filter is regenerated. However, cartridge regeneration is recommended at the conclusion of filtration. Do not store unregenerated (dirty) filter cartridges. Please reach out to your ATPGroup Enology representative for more information.

Emptying and Rinsing the Filter

I. Emptying the housing

a. Using compressed gas suitable for contact with food, push through the filters in the direction of product flow until the housing is empty.
b. For the prefilter housings, maintain a differential pressure similar to that used during filtration.
c. To complete the emptying of the housings containing the final, 0.45µm cartridges, it may be necessary to increase the pressure above the bubble point of the pore size, usually 2 bar (29 psi).

II. Cold Water Rinse

a. The purpose of this is to remove any loose material in the filter.
b. Introduce water with a maximum temperature of 86°F (30°C) in the same direction as the product flow, at 1.5x the flow rate of wine, for 2-5 minutes or until the water runs clear. Do not recirculate this water.
c. Open the housing vent valves slightly to ensure the rinse water fills the entire housing and cartridge.
d. Do not exceed 1.0 bar (14.5 psi) differential pressure.

III. Hot Water Rinse

a. The purpose of this is to remove any dissolvable material in the filter.
b. Introduce water with a temperature of 110–130°F (45–55°C) in the same direction as the product flow, at 1.5x the flow rate of wine, for 2–5 minutes or until the water runs clear. After the water clears, this step can be recirculated for 10–20 minutes, then drained.
c. Open the housing vent valves slightly to ensure the rinse water fills the entire housing and cartridge.
d. Target a maximum of 0.6 bar (8.7 psi) differential pressure.

NOTE: In this section, only step 1 is essential. However, all three steps are recommended and performed in order. The instructions for a cold water backflush are not included; this can be used in addition to or instead of both rinsing steps.

Chemical Sanitation

I. Caustic Cleaning

a. This step is for a deeper filter cleaning than the sterilization step. More formally, the caustic hydrolysis and solubilization of the material retained by the filter medium.
b. Introduce hot water, between 120–140°F (50–60°C) in the same direction as product flow until it runs clear out the discharge of the housing. Start the recirculation loop and add caustic detergent at approximately 2% concentration to bring the solution up to pH 13. Allow the solution to circulate at 1.5x the filtration flow rate for 1–2 hours.

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c. Open the housing vent valves slightly to ensure the rinse water fills the entire housing and cartridge.
d. Target a maximum of 0.6 bar (8.7 psi) differential pressure.

II. After a caustic cleaning, repeat a cold water rinse until all of the caustic has been neutralized from the system.

III. Enzymatic caustic cleaning is also an option in addition to caustic cleaning. However, the washing procedures will vary according to the product used. Contact ATPGroup and Eaton Technical Support to customize this protocol.

Sterilization

I. Hot Water Sterilization

a. This step is for the thermal inactivation of microbiological cells or the sterilization of the filters.
b. In the same direction as product flow, introduce hot water (180–200°F / 82–93°C) and recirculate for a minimum of 30 minutes. Allow the water to run freely until the temperature is reached at the discharge of the cartridges before recirculating.
c. The temperature must remain in range for the duration of the cleaning.
d. Circulate the water at 1.5x the flow rate of wine or a maximum of 0.6 bar (8.7 psi) differential pressure, with the housing vented to ensure water flows through the entire cartridge.

II. Steam Sterilization

a. This step is for the thermal inactivation of microbiological cells or the sterilization of the filters.
b. Introduce steam (230–250 °F / 110–120°C) in the same direction as product flow. Allow the steam to flow freely for 20–30 minutes.
c. The temperature must remain in range for the duration of the cleaning.
d. Circulate the steam at a maximum of 0.3 bar (4.4 psi) differential pressure, with the housing vented ensure the steam flows through the entire cartridge.
e. At the end of the sterilization, the entire system should have reached 212°F (100°C).

III. Cold Oxidizing Sterilization

a. This step can be used as an alternative to hot water or steam sterilization for chemical inactivation of microbiological cells or sterilization of filters.
b. Introduce water, at a maximum temperature of 77°F (25°C) in the same direction as product flow until the system is filled. Add an oxidizing agent (such as PAA) at a concentration of 0.2% to reach a maximum concentration in the solution of 500 ppm. Allow the water to circulate at 1.5x the filtration flow rate for 20–30 minutes.
c. Circulate at a maximum of 1.0 bar (7.5 psi) differential pressure, with the housing vented to ensure the water flows through the entirety of the cartridge.

NOTE: Only one sterilization step needs to be used; it is not necessary to use all of them.

Acid Neutralization

I. Acid Neutralization

a. This step restores the system's pH to a value close to that of wine.
b. Prepare a solution of 1% citric acid in water with a maximum temperature of 77°F (25°C).
c. Introduce the solution in the same direction as the product flow, at 1.5x the flow rate of wine, for 2-5 minutes or until the discharge has a pH of 4 or lower. This solution can be recirculated for 10–30 minutes, if desired; however, recirculation is not required.
d. Open the housing vent valves slightly to ensure the rinse water fills the entire housing and cartridge.
e. Target a maximum of 1.0 bar (14.5 psi) differential pressure.

In conclusion, a robust filter cartridge regeneration protocol is an essential practice for every winery utilizing membrane filtration. By systematically cleaning and regenerating the cartridges, wineries can significantly extend their operational life, directly translating to reduced operating costs and less waste. Adhering to these cleaning procedures also guarantees that the filters maintain their specified filtration integrity, ensuring every batch of wine is consistently clarified and biologically stable for a high-quality finished product. For additional assistance with cleaning or storing Eaton filter cartridges, contact your ATPGroup Enology or Technical representative.

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