

## Hot CIP Sanitization Procedure for Liqui-Cel® Membrane Contactors in Stainless Steel Housing

Hot Clean-In-Place (CIP) sanitization is an accepted strategy against microbiological growth in many industries. It has been commonly used in the pharmaceutical and the food and beverage industry for years. Performed frequently as prevention strategy, hot water sanitization is a requirement for high purity water (HPW) for United States Pharmacopeia (USP) and European Pharmacopoeia (*Ph. Eur.*).

Performing hot water CIP subjects the contactor to material stress and high temperature influences. The following TechBrief provides some guidelines on how to perform hot sanitization with Liqui-Cel® Contactors correctly.

Liqui-Cel® Membrane Contactors available in SS housing that may be used for Hot CIP are:

- 4x13 Extra-Flow Liqui-Cel Contactors
- 4x28 Extra-Flow Liqui-Cel Contactors
- 10x28 Extra-Flow Liqui-Cel Contactors

Before starting the CIP process, consider the operating mode: vacuum, sweep mode or combo mode (sweep gas with vacuum). If the membrane contactors are being operated in vacuum or combo mode, then the vacuum must be turned off before starting the CIP process.

Sweep gas, if used, must also be considered. If contactors are operating in combo or sweep mode using air, then this gas supply must also be turned off since oxygen in air could oxidize the membrane at high temperatures.

If inert sweep gases such as nitrogen or carbon dioxide are being used, sweep gas flow should be maintained, at least at a minimum flow rate. For example, a minimum gas flow of 2 L/min for each 10-inch contactor is recommended during CIP process.

Once the type of sweep gas and vacuum are considered, CIP steps may be started. Isolate the contactor(s) from process lines and connect the contactor to the hot water loop (see Figure 2). Stop any vacuum and air sweep. Check that any other

sweep gas being maintained is flowing at minimum recommended flow rate for your product(s). Then, open the drain port to release and drain any water that may have condensed and collected in the lumens.

Start circulating CIP water through the contactor. Now start heating the water slowly by increasing the temperature at the rate of 2-3° C (35.6-37.4° F) per minute until 80-85° C (176-185° F) is reached. This maximum temperature should be maintained for 30 – 60 minutes. The hot water temperature should not exceed 85° C during this process.

During hot water recirculation, it is normal to see a slow drip of condensed water at lumen outlet port. This is from condensation of hot water vapour that passes through membrane pores during CIP onto the lumen side. The condensation rate depends on the liquid temperature. The warmer the liquid stream, the higher the water-vapor transport rate.

The flow rate of hot water through the contactor during CIP is not critical, but a minimum flow rate is recommended, for example 50 gpm for each 10x28 contactor. Do not exceed the contactor's maximum allowable water pressure of 2 bar (29 psig). Refer to the current cleaning guide for details.

The final step of CIP process is to slowly cool the water at the rate of 2-3° C (35.6-37.4° F) per minute. After cool-down, re-start or re-adjust sweep gas flow rate, and then re-apply vacuum.

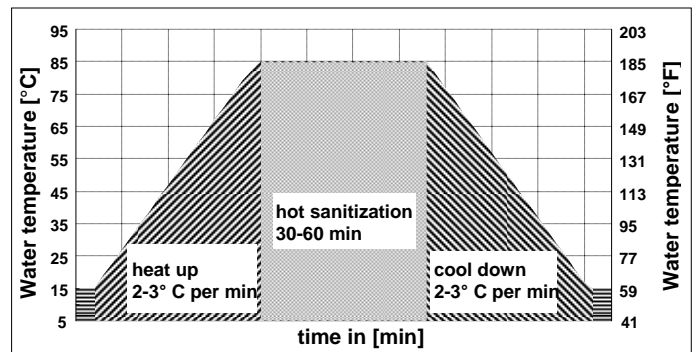


Figure 1: Illustrates the three main steps during hot sanitization.

When sweep gas and/or vacuum are applied after a hot water CIP procedure, a large slug of liquid water may come out of the vacuum port. This is due to the lumenside becoming saturated with water vapour and this is normal. A liquid water trap may be installed in the vacuum line to catch this water and protect the vacuum pump.

To clear the lumenside of any water vapor, it is advisable to purge with an inert sweep gas, such as N<sub>2</sub>, for 5-10 minutes at < 0.5 bar (< 10 psi) inlet gas pressure before re-applying vacuum to contactor. This can be done during or after cooling. However, if an inert gas is not available the vacuum should only be reapplied after the cartridge has cooled down.

Additionally, we recommend mounting the contactors vertically. If a vacuum is used on the system it should be pulled from the gas port on the bottom of

the contactor. This and the downward sweep gas flow used in vertically mounted contactors facilitate draining of condensed water from lumen side of the contactor.

The table below summarizes the general process requirements during CIP.

water temperature	max 85° C (185° F)
water pressure	max 2 bar (29 psi)
heating / cooling rate	2-3° C per min (3-5° F per min)
sanitization time	30 - 60 min after attaining sanitization temperature
Inert gas sweep flow rate during CIP	2 liters/min minimum for each 10x28 contactor
Vacuum/Air sweep	Must not be on or flowing during Hot CIP

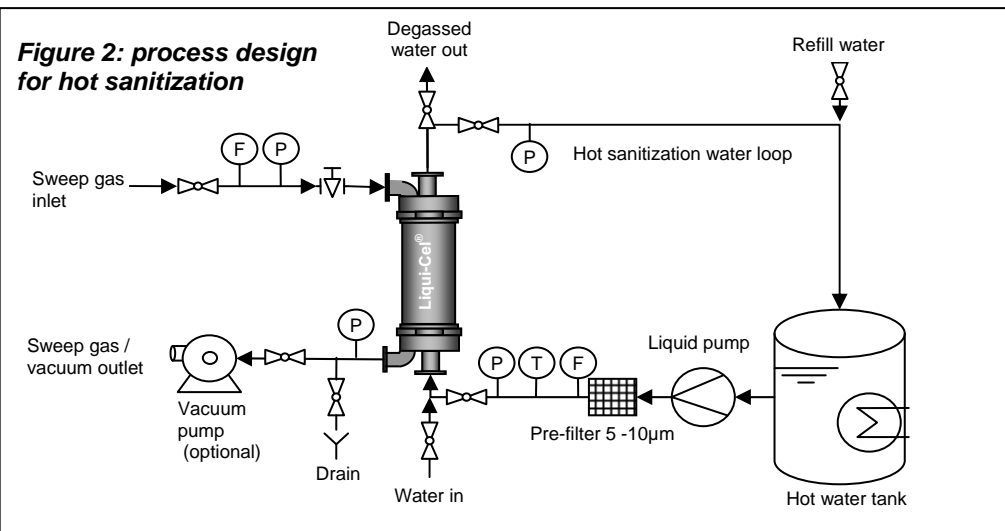


Figure 2 shows a basic system design. The system set up will depend on the operating conditions. More information about system design can be found in the operating guide.

Our cleaning guide also provides more information on other cleaning strategies. For any questions please contact your Membrana representative or visit us online at [www.liqui-cel.com](http://www.liqui-cel.com).

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