

RO OPERATION ON HIGH TEMP (>85°F) FEED WATER

Background

Operation and Maintenance manuals specify a maximum feed water temperature of 85° to 90° Fahrenheit (F), based on the respective heritage of each machine. In certain geographic regions, ground water temperatures can be more than the 90°F maximum specified limit. A general understanding of reverse osmosis water systems teaches that product/permeate flow rates increase as temperature increases. Product/permeate flow rates above the specification for the machine can cause premature membrane element failure.

Discussion

Maximum feed water temperature specifications are established based on optimizing performance of the membrane elements while considering the effects of temperature on materials of construction. Operation with water temperatures above 90°F can lead to the following issues:

- Premature fouling of the membrane element(s)
- Reduction in product water flow rate (long term)
- Reduction in % Rejection/Increase in product water TDS
- Reduction in membrane life

NOTE: Premature failure of membrane elements due to operation at temperatures outside of the specifications shown in the respective Operations and Maintenance Manual will void the warranty.

Application sites with warm feed water need to carefully consider and understand the following options:

- Installation of a feed water cooling device, such as a chiller will allow the machine to be exposed to cooler water on a continuous basis and operate within the normal parameters. No further adjustments to the RO machine are needed.

If cooling the feed water is not possible, adjustments can be made to the machine that maximize membrane element life. In all cases, adjustments are made understanding that the product/permeate flow rate must NOT exceed that specified for the machine. An additional objective is for the machine to operate at the specified recovery rate (ratio of product/permeate to feed flow rate).

- Adjust the waste/concentrate and recycle flow rates as needed to meet the machine specification. The exact combination of flow rates will be different for each machine (set of membranes) and the actual water temperature. In most cases, this will mean increasing the waste/concentrate flow rate (open the valve) and reducing the recycle flow rate (close the valve). Adjust each valve slowly, ½ turn at time and allow the machine the re-adjust. After 5 to 10 seconds, continue to adjust as needed and monitor performance.

NOTE: When adjusting the waste/concentrate and recycle valves the pump/primary pressure must NOT exceed the pressure specified in the operation and maintenance manual for the respective machine. The minimum pump/primary pressure allowed is 150 psi. Operating below 150 psi may cause damage to the high-pressure centrifugal pump.

- Restrict the product/permeate flow rates with a valve, or install a fixed flow control device. This is like the effect of a direct feed system where the RO product/permeate flows directly to the patient loop, then re-circulates back to the feed of the RO machine.

CAUTION: When restricting the product/permeate flow rate, the “back pressure” on the membranes must not exceed 80 psi. Product/permeate back pressures above 80 psi will cause immediate, permanent damage to the membrane elements.

NOTE: Contact us for assistance when making these adjustments, if needed.

During cleaning and disinfection, there will be a natural tendency for the solutions to increase in temperature. This is a result of continuous recirculation of the cleaning solution and/or heat generated by the chemical reaction between the solutions and the foulant being dissolved on the membrane surface. The specified temperature limits for the machine must be adhered to during this process as well. In addition, some peracetic acid-based disinfecting solutions have a maximum temperature limit of 75°F.

A simple method to control the temperature of cleaning and disinfection solutions is to add ice to the solution tank. The ice can be in the form of cubes or a block, and must be inside a watertight bag in order to prevent diluting the solutions as the ice melts.

Conclusion

Reverse osmosis membrane element life in application sites with warm feed water can be maximized by careful adjustments to the flow and pressure settings. Adjustments should be made such that the flow rates are within specification, i.e., the pump/primary pressure must not exceed the machine specification, yet must be greater than 150 psi. While these adjustments to the machine’s operating parameters will not re-instate the warranty, membrane element life can be maximized.