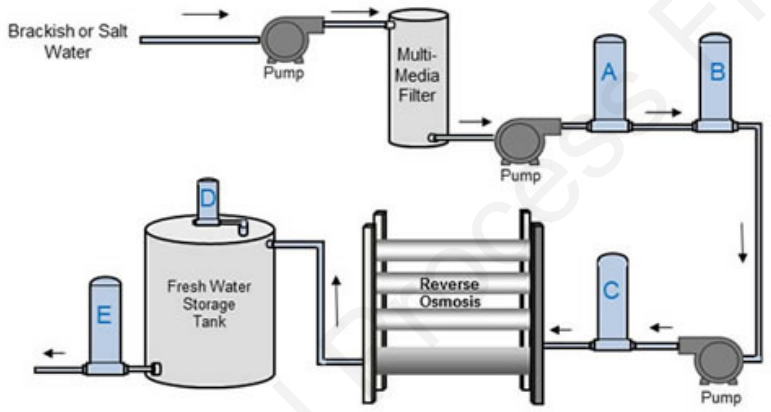
CRITICAL PROCESS FILTRATION, INC.

Application Summary

Particle Filtration in Desalination Systems

Bacteria Control in Desalination Systems

There are many reasons to remove larger particles 1 micron or larger in water systems. All are intended to help downstream processes operate efficiently. For desalination systems, the level of particulate matter can vary considerably with the feed water. If drawing water from underground to treat for saltwater intrusion, the particle levels may be lower because the water has been 'filtered' by the ground. If drawing directly from an estuary or the open sea, particle levels could be much higher. Using the right filters can improve membrane life and reduce operating costs.



A- Large Particle (>20µm) Filtration
B- Particle Filtration (5µm to 20µm)
C- RO Prefilter (1µm to 5µm)
D- Tank Vent Filter
E- Bacteria Filter (optional)

Figure 1: Basic Desalination System Components

Removing Particulates from Water

In most cases, the water entering a reverse osmosis (RO) membrane system is filtered to remove particles larger than 1 to 5 microns, depending on the system. Removing these particles prevents premature fouling of the reverse osmosis membranes, which are the most critical and expensive component in a desalination system.

The quality of the incoming water is the biggest determinant of the number and types of filters needed to protect the RO membranes. Figure 1 shows a basic system, but specific installations could have multiple screens and other large-scale filters before or in place of the multi-media filter, depending on the source water. Below is a brief explanation of each particle filter that might be used after the multimedia filter. Please note that the operator may choose to install only one filtration step, but we assume high particle loads for this summary and show a three step system

that can provide the best filter efficiency and highest membrane protection.

Large Particle Filtration (Housing A)

The multimedia filter (sand filter) could be designed and filled with media that will remove most particles larger than 2 or 3 microns, however, due to the very high particle loads in raw water, the multimedia filters used may only remove visible particles (30 microns or larger). That reduces the number of filters required and the need for frequent backwashing. The first cartridge filter step will remove larger particles and trap media that the sand filters might release downstream.

Particle Filter (Housing B)

The second prefilter step is to remove particles larger than the ones that the final prefilter will be asked to remove. If the final prefilter is a 5 micron filter, the operator may choose to use 10 micron filters at this step. If the final prefilter is a 1 micron filter, a 5 micron filter may be used here. The choice is entirely based on particle loads and the recommendation of the RO membrane manufacturer on maximum particle size for their membrane.

RO Prefiltration (Housing C)

The most important particle filter is the RO prefilter. This filter keeps particles from the membranes. Reducing particle loads prevents membrane fouling and performance loss due to particles. Longer membrane life means reduced system cleaning and maintenance expenses as well as lower replacement costs over the life of the system.

The particle size allowed will vary by membrane manufacturer and feed water conditions. Water with lower dissolved solids may be treated with higher recovery rates and vice versa. The recovery rate is the percentage of water going through the membrane (permeate). The remaining water, the concentrate, is sent to drain after flushing particles and debris off the upstream side of the membrane. If less water is available to flush the membrane surface, then the particle size allowed may be smaller. That is not a given, though. Some operators believe that larger particles can act as 'scrubbers' to drive particles off the membrane surface and keep the system cleaner. Each system and water source is different, and testing during actual operation may be required before the prefiltration system can be optimized in any installation.

Filter Options

Depth filtration products such as Critical Process Filtration Melt-Blown Polypropylene or Nano-Spun Polypropylene cartridges are commonly used for particulate removal. These products will hold a large quantity of silt or sediment before requiring replacement. Yarn wound filters are also utilized in this application, but they may add surfactants to the water upon installation. Additionally, the superior construction of Critical Process Filtration's Melt-Blown or Nano-Spun filters ensures consistent particle removal unmatched by yarn wound filters.

Depending on the type and number of particles in the source water, an economical alternative to standard depth filters may be pleated media filters. Pleated filtration products, such as pleated polypropylene depth filters, have several times more surface area than melt-blown or nano-spun depth filters and will hold a much higher quantity of sediment or silt. Pleated filters do generally cost more, but the increased life in high-particle-load applications and labor savings from reduced filter change frequency may make pleated filters economical.

Filter Media Options for Particle Filtration in Desalination Systems

Process Area	Filter Application	Filtration Function	Media **
Prefiltration	Particulate Reduction	Reduce particulate load to protect performances of downstream water treatment processes	MB
	Carbon Fines Removal	Remove carbon fines to protect downstream processes	MB, NS
	RO Prefiltration	Remove particulates that might prematurely foul membrane or interfere with membrane performance	MB, NS, PD

**Media Codes

MB = Melt-Blown Polypropylene Depth NS = Mano-Spun Polypropylene Depth PD = Pleated Polypropylene Depth

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