

Why pre-filtration and good cartridge filtration is important

TECHNICAL BULLETIN

Membrane Element Protection Matters

- 1. Removal of suspended solids to protect against membrane fouling:** Prefiltration (cartridge or depth filtration) is perhaps the most important part of satisfactory performance of RO unit after the RO membranes themselves. The ability of depth and cartridge filters to remove suspended particulates, colloids, and larger color causing organics (NOM) from the feed stream greatly impacts the performance and longevity of any RO equipment, specifically the high performance units.

The average size of the openings between the filter media in a depth filter is represented by void fraction, a dimensionless number. Additionally, in cartridge filters, the size of the opening is expressed in microns. For example, a 20-micron rating filter has larger openings than a 5-micron filter. Consequently, the 20-micron filter element will let particles smaller than 20 microns pass through the filter compared to the 5-micron rating cartridge filter. Veolia also makes a 1-micron rated cartridge filter that, in a series configuration with a 5 micron CF, can offer the best in feed water quality to an RO system. This dual cartridge filter arrangement is being used in a number of seawater RO desalination systems.
- 2. Achieving low SDI to protect against membrane fouling:** SDI, Color, and turbidity are the key factors that determine the correct use of any spiral wound RO/NF membrane elements. A good multimedia depth filter followed by robust cartridge filters are designed to decrease “SDI, Color, and turbidity,” increasing the life span of RO/NF elements as well as allowing continuous high performance of spiral wound RO/NF membrane elements.
- 3. Bacteria removal to prevent biofouling of the membranes:** Bacteria range in size from 0.2 to 2 microns in width or diameter and from 1 to 10 microns in length for the non-spherical specie, so a 1-micron filter will remove most bacteria and cysts in waters where biofouling is a concern.
- 4. Lower operating expense of the system:** Proper pretreatment prevents fouling of the membranes and results in lower operating costs. The savings include reduction of chemicals for cleaning, lower power consumption, and extended membrane life.
- 5. Reduced capital expense:** Proper pretreatment allows for consistently low SDI, which results in the designers’ ability to increase design flux of the membranes and thereby reducing the number of membranes required to treat the same volume of water. This results in decreased capital costs and a smaller overall footprint.

Selecting a proper cartridge pre-filter

Definitions

Nominal rating - a nominal rating for a filter is an arbitrary value assigned by the filter manufacturer and is expressed in terms of a percentage retention of a given challenge media such as ISO standard test dusts or glass beads. The value may represent the percentage of the entire distribution of particles that is removed from the test fluid or the percentage of a specific sized particle. Nominal filtration ratings are often used when comparing the performance of depth and non-membrane filters.

Absolute rating - An absolute rating is the size of the smallest particle retained by a filter with a stated efficiency, such as 99 %, under defined test conditions. Absolute ratings are typically applied to membrane or high performance non-woven filters.

Filter Sizing

As a general rule, the smaller micron rating for a filter is better. However, there is a trade-off; flow capability usually drops off as the micron rating gets smaller, especially if the water has a lot of sediment. Veolia offers an innovative depth filter using patented Z.Plex* technology that provides the following advantages without compromising flow. The depth filters using Z.Plex technology provide:

- Up to twice the life of conventional depth filters
- Up to 50% lower pressure drop
- Up to 100% greater dirt holding capacity with superior SDI reduction.

A 1-micron filter using Z.Plex technology will provide 1-micron filtration at an equivalent pressure drop or life span of a conventional 5-micron filter. Similarly, a 5-micron filter using Z.Plex technology will provide 5-micron filtration at an equivalent pressure drop or life span of a conventional 10-micron pressure drop filter.

Be aware that in certain situations, a smaller filter rating is not always better. For example, in many well water applications, sediments cause flow restriction through the filter. The best solution for this type of problem is to install a larger rated filter (i.e., sediment filter) upstream of the smaller micron rated filter to remove the larger pore-clogging particles and retain good flow rate. In such situations, it is common to see two or three sediment prefilters in the water flow, starting with the higher micron rating to remove the larger particulate, followed by lower micron rating filters. An example of a typical process flow is to first filter the water through a 20-micron sediment prefilter, then a 5-micron, and finally through a 1-micron or a sub-micron filter. This process extends the life of all filters and, most importantly, the downstream membrane elements.