

# Boiler Feed Water

Surface water is water from above ground sources such as rivers, lakes, wetlands or the ocean and acquires its characteristics from the environment with which it comes into contact. It typically contains various contaminants, such as silts and clays, dissolved minerals and salts, organic material from vegetation and wildlife, algae, bacteria, protozoans, viruses and man-made pollutants.

Surface waters provide a convenient and reliable water source for both municipal and industrial uses. Steam boilers used in industrial and power plants require high purity feed water to ensure proper operation. By removing a high percentage of solids and contaminants from the feed, membrane filtration allows for the usage of treated surface water as an economic alternative to municipal water.

## **BOILER FEED WATER TREATMENT SYSTEMS**

Steam boilers require consistent, high quality water for operation despite changes in raw water qualities to ensure an efficient process and quality steam generation. A boiler feed water treatment system is typically made up of several individual technologies that address the specific boiler feed water treatment needs. The most appropriate boiler feed water treatment system will help avoid costly plant downtime, expensive maintenance and boiler failure as a result of scaling, corrosion and fouling of the boiler and downstream equipment. For example, low pressure boilers may only need reverse osmosis or ion exchange to achieve the appropriate level of water purity, while others may require an entire water treatment system, including coagulation and flocculation, screens and filters, ultrafiltration, ion exchange, dealkalization, reverse osmosis or nanofiltration and degasification to produce ultra-pure water.

To produce such water, all bacteria and organic material, suspended solids (TSS) and dissolved solids (TDS) such as hardness, iron, silica, sodium and chlorides, must be removed. MICRODYN-NADIR offers both ultrafiltration (UF) and reverse osmosis (RO) products to produce the high-quality water required for steam boilers.

### **Ultrafiltration**

Ultrafiltration membrane modules are typically used to remove suspended solids, viruses, silica and other particles that may have passed through the pretreatment step (i.e. coarse or fine screens, automatic or sand filters or even coagulants and flocculants). The reduction in particulate matter, suspended solids and total organic carbon (TOC) will prevent RO membranes from scaling and fouling, but will also enhance turbine and boiler efficiency.

MICRODYN AQUADYN® FZ50 UF modules are made of cellulose triacetate (CTA) membranes. These are inside-out hollow fiber membrane modules that can handle up to 50 mg/L suspended solids and 100 NTU turbidity. A system using these AQUADYN UF modules is typically operated as a feed & bleed system with a yield of 90%.

MICRODYN iSep™ 500 UF modules or MICRODYN SpiraSep™ UF modules may be used for feed waters with higher concentrations of suspended solids. These modules are vacuum-driven, backwashable, spiral-wound membrane modules designed to handle up to 1,000 mg/L suspended solids. Both modules are available with either a 0.03 micron PVDF membrane or a 0.03 micron PES membrane.

### **Reverse Osmosis**

Reverse osmosis is typically used after ultrafiltration to produce high purity feed water for the steam boilers. By removing a high percentage of dissolved solids, salts, silica and contaminants from the feed, RO reduces scale build-up and corrosion rates, reduces the use of boiler chemicals due to less frequent blowdown requirements, and reduces the frequency of ion exchange regeneration downstream resulting in less downtime and lower costs.

TRISEP® X-20™ low-fouling RO elements are highly recommended if organics are still present in the UF effluent or RO feed (often due to seasonal upsets such as high or low rainfall). The X-20 membrane is a fouling-resistant membrane with a unique, proprietary formulation that results in low-fouling characteristics. The unique barrier layer chemistry does not degrade over time like some competitive “fouling resistant” membranes that are simply “modified” or “coated” standard membranes. Excellent for wastewater and other high fouling applications, X-20 membrane elements are extremely durable and offer consistent high salt rejection while lowering cleaning frequency and extending membrane life.

## TECHNICAL APPLICATIONS

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MICRODYN RO elements may also be used so long as most of the organics have been removed prior to the RO system. MICRODYN BW RO elements have a high rejection brackish water RO membrane that is suitable for water purification where high solute rejection is required. MICRODYN LE RO elements are ideal for water purification applications where reduced energy consumption is required. These elements feature our low energy membrane for directly replacing competitive RO products and operate at low pressure conditions.

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