Innovative Applications of Fiberglass Reinforced Plastics for Process Water Pretreatment

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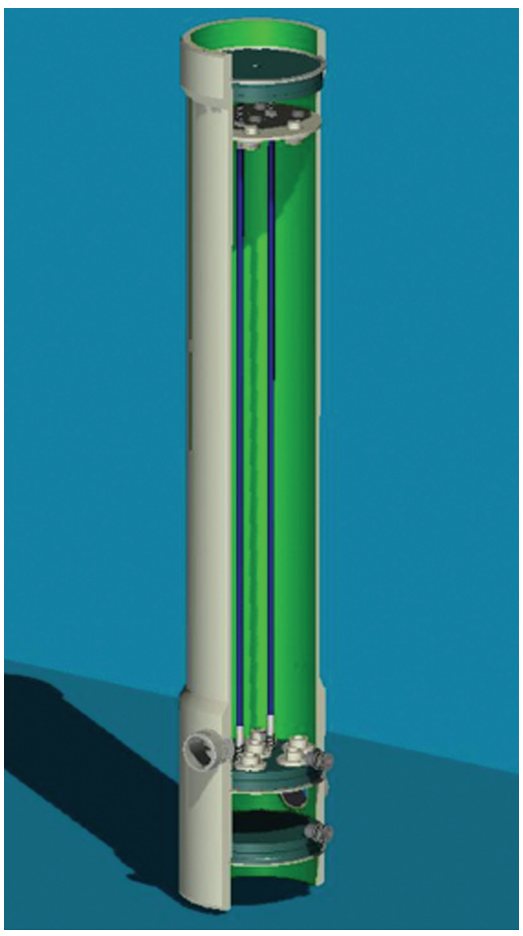
Traditionally reverse osmosis systems are designed with pretreatment systems to control fouling of the membranes, maintain performance of the membranes, and lower the cost of cleaning the membranes. The pretreatment system extends the life of the membranes which in part will lower the overall total cost of operating the seawater reverse osmosis system.



One pretreatment method is the use of multiple cartridge housings. These housings are typically designed and manufactured utilising metallic materials such as 304L stainless steel, 316L stainless steel or polymer coated stainless steel.

In recent years, the increase in raw material prices of the stainless steel has led to increases in the cost of manufactured components. The cost of pretreatment systems for process water reverse osmosis systems have also been affected since they are typically designed with the stainless steel multiple cartridge housings.

Stainless steel is not the desired material in process water reverse osmosis systems due to the corrosive nature of the raw feed water. Over the last 30 years, many developments have been made with alternative materials to integrate them into components used in seawater reverse osmosis. One of those materials is fiberglass reinforced plastics (FRP). For example, the standard material of construction for membrane housings has become FRP.

FRP has many benefits when compared to stainless steel. The most important benefit is the corrosion and chemical resistance properties. FRP will not corrode in applications with high salinity feed water or with chemicals added to assist in the pre-filtration or cleaning. Another benefit of FRP is weight. FRP can be up to 1/3 the weight of stainless steel and maintain the same engineering properties required for the application. These benefits lead to a lower cost of operating, both in initial capital required for the components and installation, as well as the operating maintenance costs.

Although FRP has been used in the process industry and many other industries over the last 50 years and has a proven track record, the water treatment industry has been slower to adopt it. One of the main benefits of FRP is the strength to weight ratio. Depending on the design parameters required, the weight of a FRP product can be 5-50% less than the weight of steel product with the same strength properties. The average density of fiberglass is 0.06 pounds per cubic inch and stainless steel is 0.29 pounds per cubic inch. The American Society of Mechanical Engineers specify the given design parameters and minimum requirements to meet an ASME Code qualified product. The section for selection and construction of steel materials is governed by Section II and VIII while Section X is specifically for FRP products. A summary of the primary differences is that Section VIII typically requires a safety factor of 3.25:1 and proof by calculation. Section X requires a safety factor of 6:1, design calculations and actual burst pressure proof testing of the product.

FRP has many advantages over other materials. Fiberglass components can be designed to have strength in specific areas by orienting the direction of the fibers. Fiberglass also allows for single piece construction where as steel requires fabrication of individual components. It is recommended to consult with the manufacturer or design engineer with your specific design and operating requirements to confirm that FRP is suitable for the application.

The added benefit of FRP is not only the interior or wetted surfaces of the product but also the exterior of the product. In many process water reverse osmosis systems the environmental conditions in which the product is installed can also be a cause for corrosion. With the use of FRP products, the elimination of costly coatings to steel or use of stainless steel, lowers the cost of the systems and requires less maintenance. Corrosion resistance is also a factor when determining the flow and pump size required as over time the inside of a metallic pipe will begin to corrode. This corrosion leads to a higher cost to operate pumps based on the original shear and velocity calculations. Again, with FRP products the corrosion and related costs (purchase and replacement) are minimal.

The ECH FRP Multiple Cartridge Filter Housing from Enceladus Water (USA) is available for many commercial, industrial, and municipal applications where aggressive solutions are being filtered and can lead to corrosion if stainless steel was used. The ECH Cartridge Housing product line includes models for lengths of cartridges from 20" to 70" and 5 round to 60 round. The ECH cartridge housing is designed in accordance with ASME Section X standards with maximum operating pressure at 150 psi.