KOVALUS Separation Solutions™

CASE STUDY

PURON® MP Membranes Improve Performance of Boiler Water Pretreatment

Overview

The treatment of surface water, ground water and seawater for industrial use is becoming a common practice around the world. Reverse Osmosis (RO) technology removes dissolved solids, both organic matter and inorganic salts, from the source water making the water suitable for use in various industrial processes. Ultrafiltration membrane technology is an excellent option for pretreatment of RO membranes, as it produces consistent water quality, free of suspended solids and with low fouling potential.

The Eemshaven power station, operated by RWE, is a large coal-fired power station and from 2019 also a biomass-fired power plant. The plant is located in the north of the Netherlands and utilizes seawater taken directly from the North Sea to feed their large water consuming boilers.

The UF system is a six-train configuration with a total design capacity of 1080 m^3/h (4755 gpm). To ensure continuous production of water at the required flow rate, the system was designed to have two redundant trains (N+2). The system was commissioned in 2014 and was originally equipped with 8" diameter ultrafiltration cartridges supplied by others, featuring nonreinforced PVDF membranes with a dual-potted (header) cartridge configuration. Decreasing performance of the installed membranes, along with a desire to increase capacity, led RWE to explore options for replacement in two of the six ultrafiltration trains.

The Challenge

RWE wanted to improve the performance of their system with respect to productivity and reliability but were also conscious of the potential cost impact of changing to a different ultrafiltration membrane product. The replacements would need to "plug-and-play" without significant changes to the existing infrastructure or control system and energy consumption. The new membranes needed to have enough membrane area and flux potential, and similar or improved fouling resistance.

Key Highlights

Kovalus boosted productivity with better solids management and higher permeability.

- Gradual upgrades optimize performance without disrupting operations
- PURON MP membranes improve performance without major system changes
- Significant system performance increases productivity

This feed water is treated by a multistep purification process:

1. Multiflo System with Disc Filtration
2. Ultrafiltration (UF)
3. RO Desalination
4. Ion Exchange polishing

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> "The UF was the weakest link in our water treatment process. The skid now retrofitted with the PURON® MP technology is working smoothly, improving significantly the performance of the entire system"

Gideon Ernst, Process Coordinator
Water Treatment Plants of RWE Eemshaven

The Solution

KSS initially provided 96 PURON® MP ultrafiltration cartridges to retrofit one of the existing trains. In addition to the membranes, KSS also provided operating guidelines and design recommendations for cartridge connection kits to facilitate a quick and easy replacement. The unique design of the PURON MP product, featuring a single header configuration with integral air scouring and reinforced hollow fiber membranes, provides excellent solids management, allowing the system to demonstrate high, sustained permeability values. With an equivalent membrane area as the previously installed membrane product, the PURON MP cartridges are able to provide an increase in productivity with improved performance without impacting footprint.

Operation Experience

After a year of operation, the PURON MP membranes were operating extremely well with membrane permeability that was approximately twice as high as the competitor's membranes. Being able to maintain a high and stable permeability at design capacity for an extended period of time is a testimonial to the operation benefits, reliability and extended life of the PURON MP product.

Performance Comparison[1]

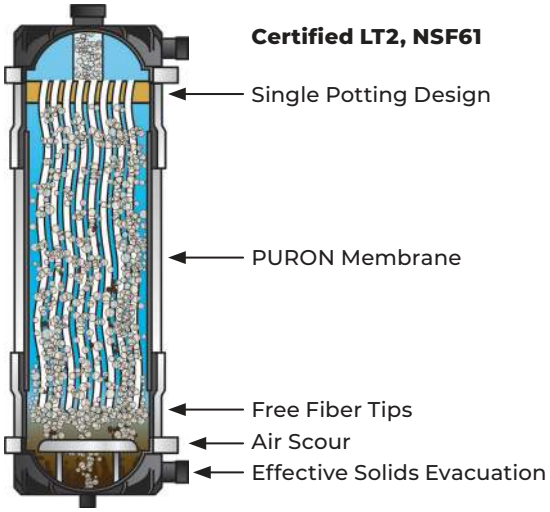
Train	Membrane Type	Installed	Permeability lmh/bar [gfd/psi]	Capacity m^3/h [gpm]
1, 2, 3[2]	Competitor (old type)	2014	20 / 0.8	110 / 484 per train
4[3]	Competitor (old type)**	February 2017	32 / 1.3	200 / 881
5	**PURON MP**	**October 2017**	**225 / 8.1**	**275 / 1211**
6[4]	Competitor (new generation)***	January 2018	100 / 4.1	275 / 1211

[1]Data taken in February 2018, 12°C. [2]* replaced by KSS PURON MP in 2018. [3]** replaced by KSS PURON MP in 2021. [4]*** replaced by KSS PURON MP in 2023

Full Transition to PURON MP Membranes

The positive result of the PURON MP membranes running alongside its competitor convinced RWE to make further investment and gradually replace all competitor membranes with the PURON MP product to help the Eemshaven powerplant facility meet its water treatment objectives.

In 2018, RWE Eemshaven replaced three more trains with PURON MP modules and after that, RWE decided to replace all remaining competitor membranes with PURON MP. With the replacement completion in 2023, the system is now running to the customer's fullest satisfaction with an increased total capacity of 1250 m^3/h (5504 gpm).



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