

SWRO ENERGY RECOVERY DEVICES: PUSHING THE ENVELOPE OF MATERIALS CAPABILITIES

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Abstract

Energy recovery devices (ERD) have played a key role in enabling cost effective seawater desalination. Ironically, increasing efficiency and reliability requirements for large water factories are now pushing energy recovery devices to the next level of performance. Expectations are ever increasing in terms of reliability, efficiency, availability, and lower operational costs. Simply put, expectations are high and units must operate trouble free in one of the most corrosive and inhospitable industrial environments known. Energy recovery efficiency is still paramount; however reliability, serviceability, customer support, and system availability are becoming all equally important to our customers.

The SWRO process plant offers possibly one of the most challenging materials application of any industry. Noise, heat, vibrations, humidity, corrosion, and process chemistry stresses exceed the properties of common engineering materials. In addition, the environment is not ideal since it is possible that ERDs are subjected to variable levels of TDS, pressure excursions, sand, debris, and occasional neglect. Pumps, turbochargers, and isobaric devices must be designed with the proper materials to survive in extreme conditions. These materials are ever evolving and must be combined with robust designs that take full advantage of their properties.

Energy Recovery Inc (ERI) is in a unique position to offer high pressure pumps, isobaric and centrifugal energy recovery systems into the SWRO industry. With approximately 12,000 installed units in the field, we have a strong visibility of what mechanical/materials systems work best in each plant. This presentation will provide a summary of our most successful materials applications in process lubricated bearings. Gone are the days of 316 stainless steel, Delrin, and expensive polymers such as PEEK. Today's materials challenges are met with a variety of advanced stainless steels, ceramics, and polymer composites optimized specifically for seawater applications.

Process lubricated fluid bearings in ERDs can be hydrostatic or hydrodynamic. These bearings can operate at rotational speeds of up to 40,000 RPM, are used in all ERI ERD and pump applications. Process lubricated bearings achieve a long life, low vibration levels, and debris tolerance, from the marriage of a solid mechanical design, fluid dynamics, and proper materials selection. Key materials attributes such as hardness, pitting resistance, alloy composition, and foreign material tolerance for reliable high speed hydrodynamic bearings will be presented. Performance, wear, and debris tolerance data for radial (ceramic and graphitic) and tilt pad thrust bearings will be discussed for SWRO applications.

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