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Theoretical analysis of sliding vane energy recovery device

O.M. Al-Hawaj*

Department of Mechanical Engineering, Kuwait University, P.O. Box: 5969 Safat – 13060, Kuwait
Fax: +9654847131; email:osamah@kuc01.kuniv.edu.kw

ABSTRACT

This paper presents a theoretical analysis of a novel energy recovery device, termed 'sliding vane work exchanger (SVWE)'. The device operates as a combined positive displacement pump and a positive displacement turbine whereby hydraulic energy recovered from the brine in the turbine section of the device is conveyed to the feed in the pump section by means of dual sliding vane rotor assembly disposed within an elliptical chamber. The paper presents models for flow variation, friction and leakage losses, and overall volumetric and hydraulic efficiencies of the device. Furthermore, a parametric study was carried out to investigate the effect of geometrical, physical, and operational parameters on the performance of the device. The study indicates that the viability of the SVWE as an energy recovery device is highly dependent on having low values of vane tip friction and vane tip leakage.

Keywords: Work-exchanger; Energy recovery; Reverse osmosis; Seawater; Desalination