World Academy of Science, Engineering and Technology
International Journal of Environmental and Ecological Engineering
Vol:9, No:06, 2015

Experimental and Numerical Performance Analysis for Steam Jet Ejectors

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Abstract : The steam ejectors are the heart of most of the desalination systems that employ vacuum. The systems that employ low grade thermal energy sources like solar energy and geothermal energy use the ejector to drive the system instead of high grade electric energy. The jet-ejector is used to create vacuum employing the flow of steam or air and using the severe pressure drop at the outlet of the main nozzle. The present work involves developing a one dimensional mathematical model for designing jet-ejectors and transform it into computer code using Engineering Equation solver (EES) software. The model receives the required operating conditions at the inlets and outlet of the ejector as inputs and produces the corresponding dimensions required to reach these conditions. The one-dimensional model has been validated using an existed model working on Abu-Qir power station. A prototype has been designed according to the one-dimensional model and attached to a special test bench to be tested before using it in the solar desalination pilot plant. The tested ejector will be responsible for the startup evacuation of the system and adjusting the vacuum of the evaporating effects. The tested prototype has shown a good agreement with the results of the code. In addition a numerical analysis has been applied on one of the designed geometry to give an image of the pressure and velocity distribution inside the ejector from a side, and from other side, to show the difference in results between the two-dimensional ideal gas model and real prototype. The commercial edition of ANSYS Fluent v.14 software is used to solve the two-dimensional axisymmetric case.

Keywords : solar energy, jet ejector, vacuum, evaporating effects
Conference Title : ICDRE 2015 : International Conference on Desalination and Renewable Energy
Conference Location : Copenhagen, Denmark
Conference Dates : June 11-12, 2015

Open Science Index, Environmental and Ecological Engineering Vol:9, No:06, 2015 publications.waset.org/abstracts/25868.pdf