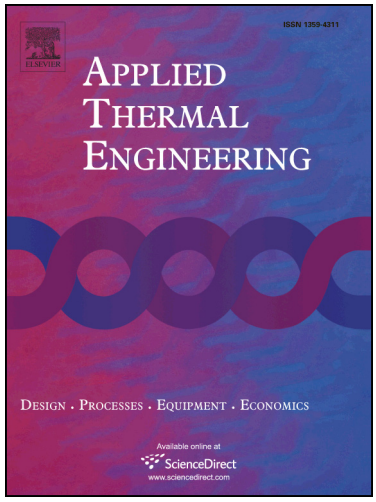

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PII: S1359-4311(16)33288-4
DOI: http://dx.doi.org/10.1016/j.applthermaleng.2017.02.076
Reference: ATE 9957

To appear in: *Applied Thermal Engineering*

Received Date: 14 November 2016
Revised Date: 13 February 2017
Accepted Date: 17 February 2017

Please cite this article as: T. Zhu, Y. Diao, Y. Zhao, C. Ma, Performance evaluation of a novel flat-plate solar air collector with micro-heat pipe arrays (MHPA), *Applied Thermal Engineering* (2017), doi: http://dx.doi.org/10.1016/j.applthermaleng.2017.02.076

Performance evaluation of a novel flat-plate solar air collector with micro-heat pipe arrays (MHPA)

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Abstract

This paper proposes a new type of a flat-plate solar air collector (SAC) with micro-heat pipe arrays (MHPA), which consist of a heat collection and transfer section and an air ventilation and heat exchange section. In the unique structure, the heat exchange of air is separated from heat collection and transmission. This work experimentally and theoretically investigates the heat transfer and friction factor characteristics of the proposed MHPA-flat plate solar air collector. Numerical simulation and experimental results are compared to show the instantaneous performance of the collector under quasi-steady state conditions. Efficiency, time constant, inlet temperature, outlet temperature, absorber temperature, and glass cover temperature are obtained. The effects of weather condition, and operational parameters are evaluated on the basis of thermal efficiency, outlet temperature, heat loss, and heat transfer. Results reveal that the average efficiency is approximately 69% at a flow rate of 290 m^3/h. In the testing range of the air flow rate, the frictional coefficient varies from 0.05 to 0.18.

Key words: Micro-heat pipe arrays; Flat-plate; Solar air collector; Thermal performance;

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