Thermal efficiency analysis of a single-flow solar air heater with different mass flow rates in a smooth plate

Frontiers in Heat and Mass Transfer (FHMT). 2013;4.

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Abstract

The present study aims to review of designed and analyzed a thermal efficiency of flat-plate solar air heaters. The received energy and useful energy rates of the solar air heaters were evaluated for various air flow rates (0.0108, 0.0145, 0.0161, 0.0184 and 0.0203 kg.s-1) are investigated. Optimum values of air mass flow rates are suggested to maximize the performance of the solar collector. Since ambient temperature has a significant effect on the performance of a solar air heaters, the effect of ambient and inlet temperature to the solar air heater on the performance of solar air heater equipped with flat-plate. The efficiency of this collector varies depending on the solar radiation, outside temperature, and collector fluid temperature. Air produced at a good temperature (of the order of 48 to 60 °). Efficiency of the solar collector at air mass flow rates 0.0203 kg.s-1; it is found to be higher than the air mass flow rates of 0.0108, 0.0145, 0.0161and 0.0184 kg.s-1 by 11%. Maximum efficiency obtained for the single pass air heater between the air mass flow rates from 0.0108 to 0.0184 kg.s-1; were 39.72% and 50.47 % respectively, with tilt angle equal 45° in location Biskra city of Algeria. The thermal efficiency correspondently the mass flow rates were 28.63, 39.69, 46.98, 55.70 and 63.61 %, respectively.

Keywords : Solar air heater; Experimental; Exergy analysis; Single-flow; Thermal efficiency.

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