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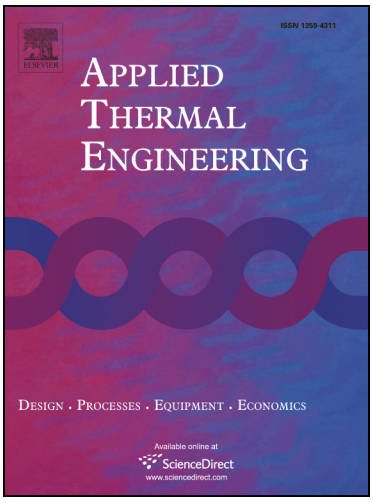

Nusselt number and friction factor correlations for forced convective type counter flow solar air heater having discrete multi V shaped and staggered rib roughness on both sides of the absorber plate

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PII: S1359-4311(17)34989-X
DOI: https://doi.org/10.1016/j.applthermaleng.2017.10.080
Reference: ATE 11278

To appear in: *Applied Thermal Engineering*

Received Date: 28 July 2017
Revised Date: 11 October 2017
Accepted Date: 13 October 2017

Please cite this article as: R. Kant Ravi, R.P. Saini, Nusselt number and friction factor correlations for forced convective type counter flow solar air heater having discrete multi V shaped and staggered rib roughness on both sides of the absorber plate, *Applied Thermal Engineering* (2017), doi: https://doi.org/10.1016/j.applthermaleng.2017.10.080

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Nusselt number and friction factor correlations for forced convective type counter flow solar air heater having discrete multi V shaped and staggered rib roughness on both sides of the absorber plate

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Abstract

In this work, the results of an experimental study on heat transfer and friction factor in a counter flow double pass solar air heater (DPSAH) duct with discrete multi V-shaped and staggered rib roughness on two broad surfaces of the heated plate have been investigated. The investigation covers a wide range of Reynolds number (*Re*) from 2000 - 20000, relative staggered rib pitch (*p'/p*) from 0.2–0.8, relative staggered rib size (*r/e*) from 1–4 and relative roughness width (*W/w*) from 5-8. The optimum values of flow and geometrical parameters of roughness have been attained and explained in detail. For the Nusselt number (*Nu*), the maximum increase of 4.52 times to the corresponding value of smooth double pass duct has been achieved, however it has also been seen that the friction factor (*f*) enhanced by 3.13 folds as compared to smooth one. The rib parameters corresponding to maximum increase in *Nu* and *f* are r*/e=3.5, p'/p=0.6* and *W/w =7*. Further, correlations for *Nu* and *f* have also been developed on the basis of experimental data.

Keywords: *Double pass solar air heater, artificial roughness, Nusselt number, friction factor,*

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