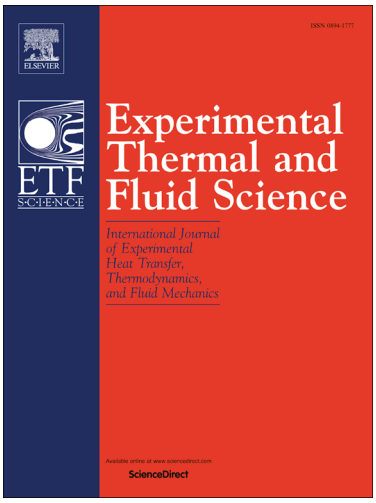

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Effect of Geometrical Parameters on the Performance of Chevron Type Plate Heat Exchanger

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Abstract

This work reports the effects of geometrical parameters on the hydraulic and thermal performance of a single pass U-type plate heat exchanger for the range of Reynolds number 800-2300. Influence of chevron angle on mean channel friction factor, mean channel pressure drop, and effectiveness is experimentally investigated. The current investigation also presents the in-depth analysis of flow non-uniformity or maldistribution on the performance of plate heat exchangers Two symmetrical plates set with chevron angle, $\beta=60^o/60^o$ and $30^o/30^o$, and one unsymmetrical plate set with chevron angle $\beta=60^o/30^o$ are used. The experiments are conducted for 21 channels (11 cold fluid and 10 hot fluid) plates set using water as the fluid. Chevron angle significantly affects the fluid flow distribution in the channels which eventually has a severe impact on the thermal performance and power consumption of a PHE. The increase in mean channel pressure drop on increasing chevron angle from (30°/30°) to (60°/30°) and (60°/30°) to (60°/60°) is found to be 22.05% and 37.9% respectively. For the same increments of chevron angle, enhancement in effectiveness is found to be 17.73% and 22.05% respectively. Effectiveness is also found to be monotonically decreasing with increase in mass flow rate for all the chevron angles. Based on the experimental data, empirical correlations for the friction factor and effectiveness, taking into consideration chevron angle and enlargement factor, are developed.

Keywords: Plate heat exchanger, Chevron angle, Maldistribution, Mean Channel Pressure Drop, Effectiveness

1. Introduction

Gasketed plate heat exchangers provide efficient heat transfer in compact equipment. The units have a flexible design and are easy to service and maintain. They are used for heating, cooling, heat recovery, evaporation and condensation**.** They are employed in a varied range of industries from HVAC, refrigeration, engine cooling, dairy, and food to heavier processes industries like chemical processing, oil production and power generation. Higher turbulence is achievable at lower flow rates in PHEs as