

Design of Cross Flow Heat Exchanger Using Performance Charts

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Abstract— The manuscript reviews the various steps involved in the design of a cross flow heat exchanger. Performance charts describing the thermal performance of the heat exchanger in terms of dimensionless parameters are used to develop the preliminary design of the heat exchanger. The preliminary design involves choosing the required number of heat exchanger passes, the required number of transfer units (NTU) and the capacity rate ratio for a given heat transfer application. These dimensionless parameters account for material, flow and thermal characteristics of the heat exchanger. In addition, NTU accounts for heat exchanger size, flow configuration and the type of heat exchanger. Since the preliminary design accounts for all the major characteristics of the heat exchanger, this approach is beneficial in optimizing the heat exchanger during the design phase. Performance charts indicate that indefinitely increasing the surface area (or NTU) does not increase the rate of heat transfer. There exists a threshold limit beyond which increasing the surface area adds no benefit to the heat exchanger. Instead, it just adds weight, material and cost of the heat exchanger. It must be noted that an undersized heat exchanger for a given application may not deliver the required heat transfer and while an oversized heat exchanger will increase the capital cost. Hence, it is very important to choose the right parameters during design of a heat exchanger. From the preliminary design, the detailed design for the heat exchanger can be readily extrapolated. The benefits of using performance charts in the design of a cross flow heat exchanger are described in the manuscript.

Index Terms—crossflow heat exchanger, performance charts, heat exchanger optimization, heat exchanger design, heat exchanger steady state analysis.