ABSTRACT

A plate fin heat exchanger is a form of compact heat exchanger consisting of a block of alternating layers of corrugated fins and flat separators known as parting sheets. They are widely used in aerospace, automobile and cryogenic industries due to their compactness (i.e., high heat transfer surface area to volume ratio) for desired thermal performance, resulting in reduced space, weight, support structure, footprint, energy requirement and cost. The literature review on this topic is summarized under three major sections. They are non-uniformity of the inlet fluid flow, wavy fin characteristics and offset fin characteristics.

The first part of the research work focuses on the pressure drop analysis for four types of compact plate fin heat exchangers. In all the four heat exchangers, the additional pressure drop encountered due to the presence of various bends at the inlet and outlet pipes that arise due to the space constraints in the aircraft are studied in detail by comparing the pressure drop without considering the bends at the inlet and outlet pipes. Experimental investigations are carried out for pressure drop and thermal performance analysis on three types of heat exchangers to validate the CFD results. In addition, the flow non-uniformity is estimated on one of the above four heat exchangers.
In the second part of research, considering the importance of $f$ and $j$ parameters for the design of compact plate heat exchanger, the studies are focused on the evaluation of these parameters for wavy and offset fins.

In the case of Wavy fins,

- Parametric studies on fin height, fin spacing, fin amplitude, fin wavelength and wavy tip radius are carried out.
- Correlations for both laminar and turbulent regimes are developed.
- The present correlations are validated with literature experimental data.

In the case of offset fins, since many correlations are available in the literature, the work is focused only on:

- the comparison of all the literature correlations as well as CFD results with the in-house experimental data.
- the generation of design data for six selected offset fins.