ARTI 605-20040

REFRIGERANT EVAPORATION CHARACTERISTICS INSIDE FLAT PASSAGES

EXECUTIVE SUMMARY

The following goals were reached in this project:

1. Two-phase pressure drop experimental values were obtained during evaporation conditions on six different tube configurations (2 round and 4 flat) under evaporation conditions and covering a wide range of test variables.
2. Flow boiling experimental heat transfer coefficients values were obtained on six different tube configurations (2 round and 4 flat) covering a wide range of test variables.
3. A new method for predicting frictional two-phase pressure drops under evaporation conditions in round tubes was proposed.
4. A new method for predicting frictional two-phase pressure drops under evaporation conditions in flat tubes was proposed based in a new equivalent diameter definition.
5. A new flow pattern based heat transfer method was successfully compared to the heat transfer coefficients measured under evaporation conditions inside round tubes.
6. A new method for predicting heat transfer coefficients under evaporation conditions was proposed based on the round tube method, a new equivalent diameter definition for flat tubes and a new flat tube correlation factor.

All proposed new methods are easy to implement and are ready to use. The flat tubes have a two-phase pressure drop penalty ranging from about 1.3 at high vapor qualities up to 4.5 times at low vapor qualities relative to the best plain tube prediction method (Grönnerud corrected for round tubes).

There is a significant flow boiling augmentation offered by the flat tubes only for R410-A, primarily at low vapor qualities that give up to 180% better performance, while not much is gained by R-22 in flat tubes.

It is recommended for the future to extend these tests and methods to flattened microfin tubes.