

Improve Heat Pipe Thermal Performance in H-VAC Systems Using CFD Modeling

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Abstract : A heat pipe is simple heat transfer device which combines the conduction and phase change phenomena to control the heat transfer without any need for external power source. At a hot surface of the heat pipe, the liquid phase absorbs heat and changes to the vapor phase. The vapor phase flows to condenser region and with the loss of heat changes to the liquid phase. Due to gravitational force the liquid phase flows to the evaporator section. In HVAC systems, the working fluid is chosen based on the operating temperature. The heat pipe has significant capability to reduce the humidity in HVAC systems. Each HVAC system which uses the heater, humidifier, or dryer is a suitable nominate for the utilization of heat pipes. Generally, heat pipes have three main sections: condenser, adiabatic region, and evaporator. Performance investigation and optimization of heat pipes operation in order to increase their efficiency is crucial. In the present article, a parametric study is performed to improve the heat pipe performance. Therefore, the heat capacity of the heat pipe with respect to geometrical and confining parameters is investigated. For the better observation of heat pipe operation in HVAC systems, a CFD simulation in Eulerian-Eulerian multiphase approach is also performed. The results show that heat pipe heat transfer capacity is higher for water as working fluid with the operating temperature of 340 K. It is also showed that the vertical orientation of heat pipe enhances its heat transfer capacity.

Keywords : heat pipe, HVAC system, grooved heat pipe, heat pipe limits

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