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Modeling of air to air enthalpy heat exchanger
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Abstract
The thermal performance of a Z-shaped enthalpy heat exchanger utilizing 45-gsm Kraft paper as the heat and moisture transfer surface for heating, ventilation, and air conditioning (HVAC) energy recovery is experimentally investigated through temperature and moisture content measurements. A mathematical model is developed and validated against the experimental results using the effectiveness-NTU method. In this model the paper moisture transfer resistance is determined by paper moisture permeability measurements. Results showed that the paper moisture transfer resistance is not constant and varies with moisture gradient across the paper. Furthermore, the model is used to predict the heat exchanger performance for different heat exchanger flow configurations. The results showed that higher effectiveness values are achieved when the heat exchanger flow path width is reduced. Temperature and moisture distribution in the heat exchanger is also studied using a computational fluid dynamics package (FLUENT). To model the moisture transfer through the porous materials a nondimensional sensible-latent effectiveness ratio was developed to obtain the moisture boundary conditions on the heat exchanger surface. © 2012 Copyright Taylor and Francis Group, LLC.

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