Analytical and experimental analysis of a low-pressure heat exchanger suitable for passive ventilation

Abstract

A core element in sustainable ventilation systems is the heat recovery system. Conventional heat recovery systems have a high pressure drop that acts as blockage to naturally driven airflow. The heat recovery system we propose here consists of two separated air-to-liquid heat exchangers interconnected by a liquid loop powered by a pump ideal as a component in a heat recovery system for passive ventilation systems. This paper describes the analytical framework and the experimental development of one exchanger in the liquid-loop. The exchanger was constructed from the 8mm plastic tubing that is commonly used in water-based floor-heating systems. The pressure loss and temperature exchange efficiency was measured. For a design airflow rate of 560L/s, the pressure loss was 0.37Pa and the efficiency was 75.6%. The experimental results agree well with the literature or numerical fluid calculations. Within the analytical framework, the total heat recovery of two liquid-coupled exchangers was calculated to be in the range 64.5–75.4%, depending on the parasitic heat loss in the experimental setup. The total pressure drop of the heat recovery system is 0.74Pa. Moreover, preliminary improvement calculations promise a future total efficiency of 80% with a pressure drop of 1.2Pa.

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