# Experimental and Numerical Analysis of Transcritical Carbon Dioxide Flow Through Diabatic Capillary Tubes

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This paper advances an experimental and theoretical study of the diabatic flow of carbon dioxide through lateral capillary tube suction line heat exchangers. The influence of both operating conditions (inlet and exit pressures, capillary tube and suction line inlet temperatures) and tube geometry (capillary tube diameter and length, heat exchanger length and relative position, and suction line diameter) on the $CO_2$ mass flow rate and the heat exchanger effectiveness was experimentally evaluated using a purpose-built testing facility with a strict control of the measured variables. In total, 59 tests were carried out with refrigerant mass flow rates ranging from 12 to 22 kg/h and effectivenesses spanning from 0.3 to 0.8. In addition, a mathematical model was put forward based on the mass, energy and momentum conservation principles written accordingly to the one-dimensional differential formulation. The numerical approach consisted of solving the resulting set of differential equations by a 2nd order Runge-Kutta method taking the pressure as the integration domain. The model was validated against experimental data, when a good agreement between the experimental and calculated mass flow rates was achieved with 91.5 % and 100 % of the data points being within ±5 % and ±10 % error bands, respectively.