Experimental Investigation of Condensation Pressure Drop of Propane in Helically Coiled Tube-in-tube Heat Exchanger

dr. sc. Gordan LJEŠIĆ
University of Mostar, Faculty of Mechanical Engineering, Computing and Electrical Engineering, Mostar, Bosnia and Herzegovina
e-mail: gordan.ljesic@fsre.sum.ba

prof. dr. sc. Vladimir SOLDO, dipl. ing.
University of Zagreb, Faculty of Mechanical Engineering and Naval Architecture, Zagreb, Croatia
e-mail: vladimir.soldo@fsb.hr

Abstract
This paper presents conducted comparison of experimentally obtained pressure drop values during propane (R 290) two-phase flow through annular passage of helically coiled tube-in-tube condenser and pressure drop values obtained by Lockhart-Martinelli, Chisholm, Grönnerud, Friedel, Wongwises-Polsongkram and Müller-Steinhagen and Heck correlations. Experimental rig is compression refrigerant cycle that consists of compressor, condenser, expansion valve and evaporator. Compression cycle is equipped with internal heat exchanger that can be bypassed to see the effect of the component on the pressure drop in condenser. The test section (condenser) is made of two copper tubes that are coaxially oriented. Inner tube of the condenser is grooved on its outside surface. Internal diameter of inner tube is 19,7 mm and the nominal outer diameter is 22,2 mm. Inner diameter of outer tube is 30,0 mm. The coil diameter is 280 mm and the coil pitch is 35 mm. The coil axis is oriented vertically, so the pressure drop is affected by gravitational force. Pressure drop values are determined at different saturation temperatures 35 °C, 40 °C and 45 °C, and different heat flux values in the range 15 - 25 kW/m2.
The research results show that the Lockhart-Martinelli correlation most closely describes the pressure drop for the case of two-phase propane flow in helically coiled condenser.

Keywords: *pressure drop, propane (R 290), condensation, two-phase flow, coaxial heat exchanger*