講演番号	214

文献番号	20226214

Effect of Oil Concentrations on Condensation Heat Transfer Coefficients for Refrigerant HFO-1234yf

Dr. Gursaran D. Mathur, P.E.

Sr. Manager, Highly-Marelli North America (former Calsonic-Kansei North America), Climate Control Research & Development
27000 Hills Tech Court (GD_Mathur@Highly-Marelli.com)
Farmington Hills, MI, 48331 USA

KEY WORDS: Energy, Environment, Refrigerants, Temperature Control, Heating & Cooling

The author has conducted experimental studies with HFO-1234yf to determine AC system performance along with detailed condenser performance by experimentally measuring condensing heat transfer coefficients as a function of oil circulation ratio (OCR) for automotive parallel flow condensers. In this paper, author has presented condensation heat transfer coefficients as a function of OCR for HFO-1234yf flowing in typical automotive parallel flow condensers.

The tests were conducted on the system bench with the detailed instrumentation to measure local and average heat transfer coefficients. Tests were conducted such that condensation process was carefully maintained over the entire condenser length with saturated vapor condition at the inlet and saturated liquid condition at the outlet. Refrigerant HFO-1234yf was used as the working fluid for this information. The oil circulation ratio by mass (OCR) was varied between 0 and 5%. Typical refrigerant mass flowrates that are encountered in an automotive air condition system were used for this study. These tests have been conducted with the cabin maintained at 25°C with a relative humidity of 50% and evaporator airflow rate varied from 5 to 9m^3/min with refrigerant mass flowrate ranging from 180 to 475 kg/hr. Average condensation temperature for the tests was maintained at 50°C. Based on the current investigation, the following are the main conclusions:

- As the oil circulation rate increases in the system, condensation heat transfer coefficient decreases
- The local condensation heat transfer coefficients are reduced by a maximum of 28% at an oil concentration of 5% in comparison to pure refrigerant (0 % OCR)
- The average condensing heat transfer coefficients decreased by 23.7% at lower refrigerant mass flowrates and approx. by 16% for medium to higher flowrates
- The above indicates that the performance of condenser is impacted by the use of lubricating oil in the system

The data form this study will be helpful for the HVAC and heat exchanger design engineers for prediction of thermal performance of the condenser, and hence, AC system performance.