

Technical session topic: 4. New fluids, new systems, and system integration (energy efficiency refrigeration systems)

Experimental investigation of refrigeration system operation with modulating condensing pressure

¹Mohamed Ouzzane, ²Daniel Giguère and ³Roberto Sunyé

^{1, 2 et 3} Natural Resources Canada
CANMET Energy Technology Centre–Varenes
1615, Lionel Boulet Blvd, P. O. Box, Varenes (Québec) J3X 1S6 Canada

¹Tél.: (450) 652 4636 Fax : (450) 652-5177 E-mail : mohamed.ouzzane@nrcan.gc.ca

²Tél.: (450) 652 5015 Fax : (450) 652-5177 E-mail : dgiguere@nrcan.gc.ca

³Tél.: (450) 652 7822 Fax : (450) 652-5177 E-mail : rsunye@nrcan.gc.ca

Corresponding author: Mohamed Ouzzane

Abstract

The refrigeration group of the CANMET Energy Technology Centre - Varenes has investigated several methods to improve the energy efficiency of the refrigeration systems. One of the most promising methods is to modulate the condensing pressure, thereby benefiting from the Canadian climate. A system that is able to operate optimally during varying condensing pressure can realize some important benefits, such as, energy consumption reduction, increased refrigeration capacity, increased system reliability and compressor life expectancy. Experiments were conducted on a water-based refrigeration test bench system utilizing a common 3.73kW and 1750-RPM semi-hermetic compressor and very precise instrumentation. With relatively fast acquisition of data, studies were made of component dynamic response during start-up and shutdown stages of cycling the system. Capacity of the system critical components was determined to be within a relative error of 3.65% or less. System phenomenon occurring during pump-down cycles were studied in detail and during this operational condition, increased compressor power of 93% and compression ratio of 78% was observed. The effects of several parameters on steady state system efficiency were also examined in this study. During steady state operation it was demonstrated that an 87% increase in performance could be expected when at a condensing pressures corresponding to a 10°C climatic ambient temperature – common conditions during a mild Canadian winter.