21CR Project 605-50015

Investigation of R-410A Air Conditioning System Performance Operating at Extreme Ambient Temperatures up to the Refrigerant Critical Point – ORNL

Updated 7 June 2006

Objectives:

(1) Improvement of DOE/ORNL Heat Pump Design Model (HPDM) to better predict performance of R-410A air conditioning systems at elevated ambient temperatures,
(2) Evaluation of compressor and refrigerant-side performance analysis of air conditioning test data for R-22 and R-410A systems at elevated ambient conditions,
(3) Calibration of HPDM to system test data and comparison of HPDM performance prediction trends over wide range of ambient temperatures, and
(4) Prediction of relative R-410A extreme ambient performance with different flow controls using a calibrated model.

Information/items expected to result from this project:

(1) A better understanding of the performance of R-410A versus R-22 air conditioners and heat pumps that are operated at extreme ambient temperatures,
(2) Information on the loss in performance of air conditioning and heat pump systems at high ambient conditions and the degree to which this can be simulated without further calibration to test data at higher ambient temperatures,
(3) Information on the adequacy of standard compressor performance maps for use under elevated ambient conditions and with non-standard airflows in-situ,
(4) Modified air conditioning system performance simulation program that can more accurately predict performance of R-410A and other lower critical temperature systems like R-404A and R-507C operating up to their critical temperature, and
(5) Accessible Web-based HPDM with operating and design parametrics with the above improved capabilities.

How are the results likely to be applied:

HAC&R manufacturers: design of equipment that is more energy efficient at high ambient temperatures, use of modified public domain system performance simulation model that is more capable of predicting accurate performance trends up to R-410A's critical temperature.

Research subcontractor:

Oak Ridge National Laboratory, Oak Ridge, TN (Principal Investigator: C. Keith Rice, Ph.D.)

Status:

Project completed. The final report can be downloaded at no cost from the ARTI website.

Responsible 21CR Subcommittee: HVAC&R Energy Efficiency