

**International Energy Journal, Volume 9, Issue 4, December
2008**

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Performance Study of a Water-to-Water Heat Pump Using Non-azeotropic Refrigerant Mixtures R407C

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Abstract

This paper compares the performance of the refrigerant R22 and the non-ozone depleting R407C for high temperature heat pump heat recovery application. While most reported works were conducted on residential heat pumps with evaporating temperature below zero degree Celsius, this study considers higher evaporating temperatures, from 5 to 35 degrees Celsius. The comparison was made by theoretical cycle calculation with variable heating and cooling capacities and at different temperatures. The experimental results of R407C were compared with the existing R22 refrigerant to explore the potential for retrofitting existing installations. It has been found that both the thermodynamic properties and general performance of R407C are comparable with that of R22. The operational behavior of R407C was found better with the increasing condensation and evaporation temperature. It has also been observed that the heating capacity of the refrigerant R407C is 5% higher than that of R22. When the compression ratio exceeds 3, at high evaporating temperatures, the coefficient of performance with R407C is greater than that obtained with R22. Therefore, R407C is a good substitute for R22 in all applications requiring high evaporation temperatures, such as air-conditioning plants and heat pumps for heat recovery.

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