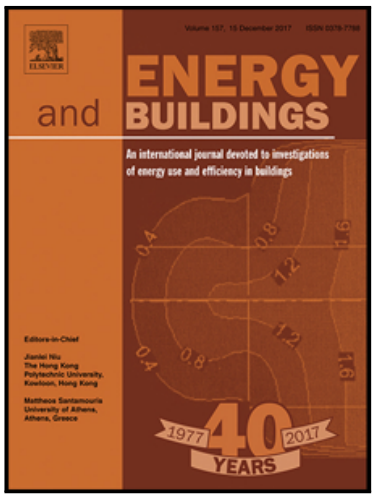

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A Thermodynamic Comparison Between Heat Pump and Refrigeration Device Using Several Refrigerants

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Abstract:

Heat pumps and refrigerators are two systems with different usage, but same working principles. Generally, HPs work in steady state condition and specific thermodynamic cycle, but refrigerator or freezer apparatus have variable cycle and work in the unsteady condition.

In this study, two different data sources are gathered to analyze thermodynamic differences between two mentioned systems. Initially, an existing heat pump unit is analyzed in different working conditions with different refrigerants and then the unit is converted to a refrigeration device to compare their thermodynamic conditions and treatments.

Thermodynamic laws, COP value and efficiency, compressor power consumption, optimum charge amount, and flow rate of secondary fluid are main parameters which are considered to compare heat pump and refrigerator performances by using several refrigerants including R134a, R407c, R22, and R404a.

In the case of freezer mode, entropy reduction in compressor and COP_L drop to very low values are other substantial issues discussed in this research. It was also revealed that, optimal charge amount of the freezer is 15-25% lower than that of the system when works in HP mode. Experiments showed that, in some cases COP of the heat pump was even more than 100 times greater than that of the freezer.

Key words: Thermodynamics; Heat pump; Refrigerator; Efficiency; COP

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