

Theoretical analysis of cycling losses in air source heat pump systems

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Abstract

ICR2023 | 26th International Congress of Refrigeration | August 21st-25th, 2023 | Paris, France DOI: 10.18462/iir.icr.2023.0773 Theoretical analysis of cycling losses in air source heat pump systems Hongtao QIAO, Christopher R. LAUGHMAN Mitsubishi Electric Research Laboratories Cambridge, 02139, USA qiao, laughman@merl.com ABSTRACT This paper presents quantitative analyses for the cycling losses of air source heat pump systems from a fundamental perspective. First-principles models are developed to facilitate the exploration of cycling characteristics. In this study, cycling performance of two systems (one with a conventional accumulator and the other one with a regenerative accumulator) is compared with different start-up methods. Numerical simulations show that the cycling losses can be reduced by more than 95% if refrigerant migration is prevented during off-cycle. Meanwhile, it is found that regenerative accumulator can greatly reduce the rise time of heating capacity by more than 75%, resulting in 60% reduction in cycling losses.

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