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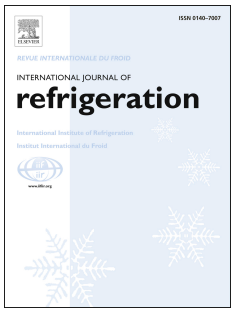

Regenerated air cycle potentials in heat pump applications

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PII: S0140-7007(14)00346-6

DOI: 10.1016/j.ijrefrig.2014.11.016

Reference: JIJR 2930

To appear in: *International Journal of Refrigeration*

Received Date: 12 October 2014

Revised Date: 22 November 2014

Accepted Date: 29 November 2014

Please cite this article as: Yuan, H., Zhang, C.-L., Regenerated air cycle potentials in heat pump applications, *International Journal of Refrigeration* (2015), doi: 10.1016/j.ijrefrig.2014.11.016.

Regenerated air cycle potentials in heat pump applications

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Abstract Air (reversed Brayton) cycle has been utilized in the area of refrigeration and cryogenics for several decades, but its potentials in heat pump applications were longtime underestimated. In this paper, a thermodynamic model for the regenerated air heat pump cycle with practical compressor, expander and regenerated heat exchanger was developed. Based on the model, the relations between the system performance and the operating parameters were analyzed. The optimal heating COP (coefficient of performance) and the corresponding pressure ratio were derived. Then, air heat pump cycles (regenerated cycle and basic cycle) and vapor-compression heat pump cycles (CO_2 trans-critical cycle and R410A subcritical cycle) were numerically compared. The results indicated that the regenerated air heat pump cycle not only gets the heating capacity in line with the heating load under different operating conditions but also achieves higher COP over trans-critical CO_2 heat pump cycle in applications of large temperature difference.

Keywords Air cycle; CO_2 cycle; Heat pump; Model

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The original paper was presented on the 11th IIR Gustav Lorentzen Conference on Natural Refrigerants (GL2014), Aug.31 to Sept.2, 2014, Hangzhou, China.