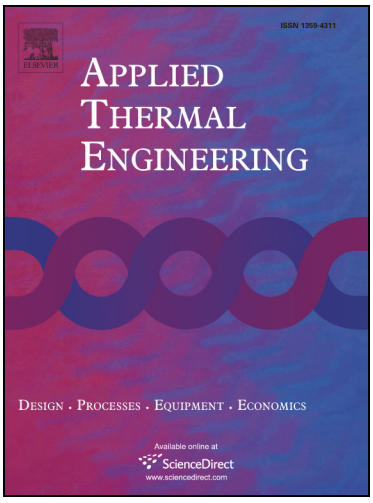

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Thermodynamic design of cold storage-based alternate temperature systems

Houlei Zhang[a,*], Runfa Zhou[a], Sylvie Lorente[b], Stéphane Ginestet[b]

[a]School of Energy and Power Engineering, Nanjing University of Science and Technology, Nanjing 210094, China

[b]LMDC, Université de Toulouse, UPS, INSA, Toulouse, France

*Corresponding author: Tel.: 86 25 84317344

Email address: zhanghl@njust.edu.cn (H. Zhang)

ABSTRACT

Alternate temperature systems are widely used in environmental tests in which the refrigeration device consumes the most energy. In this paper, we present a thermodynamic analysis of modified designs of an alternate temperature system. The modified designs are based on three methods: cold storage, independent air ducts and multi-source cooling. The cold storage method converts part-load operation to full-load operation and the cold storage-based designs decrease the work (or energy) consumption and the equivalent size of the refrigeration device simultaneously. The cold storage and the multi-source cooling improve the performance significantly, while the independent air ducts only have weak effect on the performance. When the refrigerant and the single-phase coolant (coming from the cold storage unit) cool the circulated air together, optimal area allocation between the evaporator and the coolant heat exchanger exists. We also explain the factors that affect the degree of improvement in product designs.

***Keywords*:** Alternate temperature; Work consumption; Size; Cold storage; Independent air ducts;