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Control strategies for defrost and evaporator fans operation in walk-in freezers

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Abstract

Heat removal is the most extended method for food preservation in food manufacturing industry by lowering food temperatures to stop microorganisms growing, which might spoil the product and could cause toxicity. Therefore, walk-in freezers are used for that purpose consuming a relevant part of the energy on service sector. The compression refrigeration system of the walk-in freezers can be blocked by the frost accumulated on the evaporator. For that reason a defrost process, which requires an important part of the energy consumption, has to be launched from time to time. In this paper, the schedule which manages the defrost process is investigated to limit its activation only when it is necessary. Moreover, different fan operation strategies were tested regarding the energy efficiency of the whole refrigeration system. This study has provided a system control strategy both for defrost and fans operation, depending on the frost built up on the evaporator. The control improves the energy performance of the whole refrigeration system.

Keywords: Compression refrigeration system; defrost cycle; fans operation; cooling.

Nomenclature

$E_{\text{compressor}}$	Active electrical energy consumption of the compressor
E_{defrost}	Energy consumed by the defrost process
E_{fans}	Energy consumed per hour by fans
E_{total}	Total energy consumption by the refrigeration system and defrost
h	hour
kW	kilo Watt

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