

Heat Exchanger Optimization of a Domestic Refrigerator with Separate Cooling Circuits

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Abstract : Cooling system performance and energy consumption in the bypass two-circuit cycle have been studied experimentally to find optimum evaporator type and geometry, capillary tube diameter and capillary length. Two types of evaporators, such as wire on the tube and finned tube evaporators were used for the experiments in the fresh food compartment. As capillary tube inner diameter and total length; 0.66 mm and 0.8mm, and 3000 mm and 3500 mm were selected as parameters, respectively. Experiments were performed at the 25°C ambient temperature while the average temperature of the fresh food compartment is kept at 5°C and the highest package temperature of the freezer compartment is kept at -18°C, which are defined in IEC 62552 European standard. The Design of Experiments (DOE) technique which is six sigma method has been used to indicate of effective parameters in the bypass two-circuit cycle. The experimental results revealed that the most effective parameter of the system is the evaporator type. Finned tube evaporator with 12 tube passes was found as the best option for the bypass two-circuit refrigeration cycle among the 8 different opportunities. The optimum cooling performance and the lowest energy consumption were provided with 0.66 mm capillary tube inner diameter and 3500 mm capillary tube length.

Keywords : capillary tube, energy consumption, heat exchanger, refrigerator, separate cooling circuits

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