Analysis of Heat Exchanger Area of Two Stage Cascade Refrigeration System Using Taguchi

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Abstract : The present work describes relative contributions of operating parameters on required heat transfer area of three heat exchangers viz. evaporator, condenser and cascade condenser of two stage R404A-R508B cascade refrigeration system using Taguchi method. The operating parameters considered in present study includes (1) condensing temperature of high temperature cycle and low temperature cycle (2) evaporating temperature of low temperature cycle (3) degree of superheating in low temperature cycle (4) refrigerating effect. Heat transfer areas of three heat exchangers are studied with variation of above operating parameters and also optimum working levels of each operating parameter has been obtained for minimum heat transfer area of each heat exchanger using Taguchi method. The analysis using Taguchi method reveals that evaporating temperature of low temperature cycle and refrigerating effect contribute relatively largely on the area of evaporator. Condenser area is mainly influenced by both condensing temperature of high temperature cycle and refrigerating effect. Area of cascade condenser is mainly affected by refrigerating effect and the effects of other operating parameters are minimal.
Keywords : cascade refrigeration system, Taguchi method, heat transfer area, ANOVA, optimal solution