Thermal and Economical Optimization of Air Conditioning Units with Vapor Compression Refrigeration System

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Abstract

A new method of thermal and economical optimum design of air conditioning units with vapor compression refrigeration system, is presented. Such a system includes compressor, condenser, evaporator, centrifugal and axial fans. Evaporator and condenser temperatures, their heating surface areas (frontal surface area and number of tubes), centrifugal and axial fan powers, and compressor power are among the design variables. The data provided by manufacturers for fan (volume flow rate versus pressure drop) and compressor power (using evaporator and condenser temperatures) were used to choose these components directly from available data for consumers.

To study the performance of the system under various situations, and implementing the optimization procedure, a simulation program including all thermal and geometrical parameters was developed. The objective function for optimization was the total cost per unit cooling load of the system including capital investment for components as well as the required electricity cost. To find the system design parameters, this objective function was minimized by Lagrange Multipliers method. The effects of changing the cooling load on optimal design parameters were studied.

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