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英文論文名稱: Thermodynamic Optimization of Vapor-Compression Liquid Chillers

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[摘要]

蒸汽壓縮式冰水機組為空調系統中最主要之耗用能源設備，故而致力於提升該製冷設備能源效率之相關研究一直是熱力學第一定律(能量守恒定律)之性能係數COP，然而該係數僅能表達冰水機組之整體能量平衡與能源轉換效率，度。由於冰水機整體能源效率受到各元件可用能轉換之無效性的影響，因此將焦點集中於探討設計參數對元件可用效率之最直接的途徑。此外，發展考量熱經濟觀念之冰水機組熱系統最佳化設計之研究，也是目前所迫切需求的。因此本文之主要研究目的為：藉由熱力學第一、第二定律與可用能之觀念並配合實驗之驗證，發展可供具體分析與以確定提升冰水機組能源效率之改善方向。接著再經由設計參數分析探討冷凝與蒸發溫度對於機組各元件之不可逆源效率之潛力。最後，在考量熱經濟效益之前提下，發展熱力最佳化分析模式，藉以尋找熱交換器最佳熱導度(UA 佳化之目的。

研究結果顯示：(1)影響冰水機組能源效率之元件可用能毀滅率，以壓縮機最大(約為37.4 - 46.6 %)，其次為冷凝器(約為8.6 - 10.3 %)，而連接管路之不可逆性對系統性能的影響可忽略。(2)降低冷凝溫度1℃，之相對變化率為 -4.1 %，相對變化率為 -4.6 %，COP相對變化率為 3.9 %。(3)在相同的熱交換器總熱導度 與冷凍能力之條件下，當冷凝器之熱力最佳化，此結果與Bejan [11]、Khan and Zubair [24] 所獲得的結論相同。

[英文摘要]

The vapor-compression liquid chiller is the main energy consuming equipment in the air-conditioner system, so the coefficient of performance (COP) used to express the whole energy efficiency for liquid chillers performance thermodynamics, which is not able to indicate the exergy destruction or irreversibility of each component. Therefore becomes the most direct way to improve energy efficiency of liquid chiller. In addition, the research on thermodynamic chiller is urgent for equipment designer.

Therefore, the main research purposes of this study are: (1) developing an irreversibility analysis method for liquid chiller improvement; (2) parametric studying the influence of design parameters, such as condensing and evaporating temperature on system performance, and to estimate the improvement potential of each component on the system energy efficiency method together with the consideration of thermoeconomic to study the optimum allocation proportion of thermal data are compared with the prediction results obtained herein.

The results show that the compressor possesses the largest potential to improve energy efficiency with the range (about 22.1-26.7 %), and then the evaporator (about 16.7-24.2 %). Reducing 1℃ of the condensation temperature will results the change of irreversibility the COP of 3.4 % . In addition, increasing 1℃ of the evaporation temperature will results the change of irreversibility

thermal conductance of heat exchanger and cooling capacity, the optimum allocation ratio of thermal conductance

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