

Study on Efficiency Improvement of Year Round Cooling Packaged Air Conditioners With a Refrigerant Pump

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The air conditioners which cool computer rooms or telecommunication equipment rooms must operate throughout the year. In this paper, with the goal of enhancing the efficiency of year-round cooling packaged air conditioners, we add a refrigerant pump to be implemented in the compression cycle and only operate it during periods of low outdoor air temperature.

At first, we employ laboratory testing and simulation to investigate control methods for regulating the refrigerant pump. Through testing, we established that there is a specific refrigerant pump frequency at which the cooling capacity is maximized. It was found that at this time the refrigerant at the outlet of the evaporator is in a completely vaporized state. It was also found that adjusting the airflow of the condenser fan had a greater effect on changing the cooling capacity than altering the frequency of the refrigerant pump. These finding led me to propose that the degree of superheat at the evaporator outlet should be controlled by refrigerant pump frequency and the equipment room temperature should be regulated by the frequency of the condenser fan.

Next, This paper gives an overview of my successful development and fabrication of the packaged air conditioner based on the refrigerant pump and above new control methods. Through the running trial in an actual load environment, we verified that the air conditioner operated at very high efficiency and maintained the temperature of the room at the specified setting. It was found that, compared to a conventional air conditioner, the new air conditioner reduced electric consumptions by 50% of cooling load over a year period.