

HEAT PUMP FOR HEAT RECOVERY WITH SUPERHEATED VAPOR

by

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Short paper

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A heat pump for heat recovery is designed to produce hot water through recovering the heat from the superheated vapor and hot refrigerant in the condenser. The experimental results show that performance of the heat pump system with superheated vapor heat exchanger has obvious superiority over the regular condenser for hot water production.

Key words: *heat pump, superheated vapor, heat recovery*

Introduction

Heat pump is a green and energy-conservative unit, but similar to other air conditioning units, a lot of condensation heat is discharged and wasted during the daily operation [1]. If the condensation heat can be recovered and recycled, heat pump will be widely promoted and used. Based on previous researches [2-4], the paper proposes a heat pump system with a superheated vapor heat recovery unit, and its heat recovery is studied.

In our experiment, water in a domestic water tank is recycled and heated by the superheated vapor heat recovery unit. The total effective volume of the tank is 180 L, and the water temperature rises by 25 °C. During the test, the water flow rate is adjusted to be 350, 550, and 750 L per hour, respectively. Initial temperature for water in the tank is 15.6 °C, and operating conditions for cooling water and chilled water are kept unchanged.

Results

With different flow rates, the relation between the domestic hot water temperature rise and time is illustrated in fig 1. It is obvious that flow rate greatly affects the heating efficiency. It requires less time to rise the temperature of water to 40 °C for a higher flow rate.

Figure 2 shows a curve of the recovered heat from the condensation and superheated vapor with the water flow rate of 750 L per hour. The heat absorbed by chilled water rises from initial 2.69 kW to 6.39 kW in 160 minutes and then tends to be stable; the superheated vapor recovery decreases from initial 5.24 kW to 1.35 kW in same period. The heat recovery rate at condensation decreases from 65% to 17%, and then it tends to be stable. It proves that there are close coincidence relations among water temperature, condensation heat and heat recovery at condensation.

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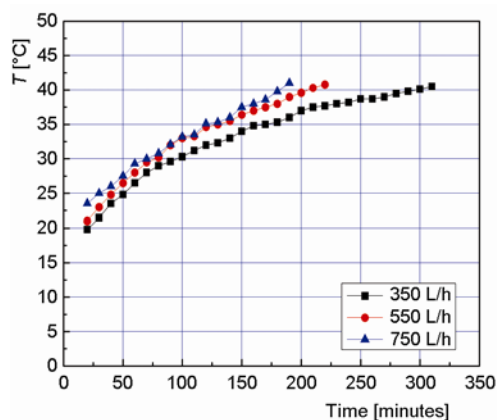


Figure 1. Hot water temperature at different hot water flow

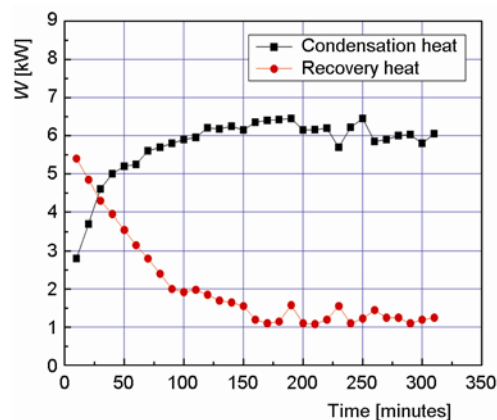


Figure 2. Condensation heat and recovery heat with the time

Conclusions

The research results show that the performance of heat pump system with superheat vapor recovery unit has obvious superiority over the heat pump system with condensation for hot water production. When hot water temperature is lower than condensation temperature, the hot water absorbs not only sensible heat of refrigerant but also the latent heat.

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