

<https://doi.org/10.7250/CONNECT.2023.008>

EXPLORING THE CONTROL OF THE POSITION OF THE ISOTHERMS OF THE HEAT PUMP CYCLE IN AN AIR HANDLING UNIT: AN EXPERIMENTAL STUDY

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Abstract – The use of heat pumps in the building heating and cooling supply chain is increasing, and air-to-air heat pumps are increasingly being installed in modern air handling units. The energy conversion modes of such devices are constantly changing due to the constant change in the state of the outdoor air (temperature, humidity). Flexibility, the ability to efficiently and rationally respond to ambient air parameters, is an important feature of choosing the operating mode of energy transformers and their control. The overall seasonal efficiency of the air handling unit depends on it. Modern commercial heat pumps have two control degrees of freedom. They have a variable-speed compressor and an electronic expansion valve. This combination of control components once made it possible to increase the seasonal efficiency of heat pumps. For a long time, the possibility of controlling the cycle in this way prevailed, and only electronic control tools were improved. Little attention is paid to how the changes in the thermodynamic cycle are combined with the energy demands of air preparation corresponding to the outdoor temperature. It would be relevant to look for additional components of the heat pump circuit that could control its operating cycle, which could increase the efficiency indicators of the air preparation process. The article's authors seek to introduce an additional component into traditional measures of heat pump control, providing the third degree of freedom of the control cycle. For this purpose, studies are being conducted to experimentally assess the impact of the volume of the heat pump system on the shifts of the isotherms of its thermodynamic operating cycle. The results show that the system volume parameter has the potential for regulation capabilities in controlling the operation of a heat pump, so it is worthwhile to further develop and study such a technological solution in more detail.

Keywords – Air handling unit; control; heat pump; experimental study; isotherms; vapor compression cycle