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Comparative analysis of the performance of integrated and split type air source heat pump water heaters by diagnostic characterization

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Abstract content
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Air source heat pump water heater generates sanitary hot water by harnessing the aero-thermal energy during the process of vapor compression refrigerant cycles. The study focuses on identification of critical parameters (volume of hot water drawn off, ambient temperature and relative humidity) as well as deterministic quantities (time used, power consumption and the coefficient of performance) as the indicators to benchmark the efficiencies of the both systems. The analyses were performed based on two predominant scenarios (first hour heating rating and heating up cycle due to hot water drawn off) whereby both the integrated and split type ASHP water heaters were undergoing VCRC. The both types of ASHP water heater were of 200 L tank capacity with the auxiliary heating element disabled. The results analyses were presented for the two systems with their hot water set point temperature at 55o C. Multiple contour simulation plots were developed and built in Matlab to simulate the COP of the systems using the critical parameters as predictors. The multiple contour simulation plots showed the variation of the COP of the systems and the desired predictor with the others invariant. Conclusively, it was demonstrated that the integrated type ASHP water heater demonstrated performed better than the split type system.

keywords: integrated ASHP water heater, Split type ASHP water heater, vapor compression refrigerant cycles, predictors, multiple contour simulation plots, coefficient of performance.

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Primary author: Mr TANGWE, Stephen (Fort Hare Institute of Technology, University of Fort Hare)

Co-authors: Prof. MEYER, Edson (Fort Hare Institute of Technology, University of Fort Hare); Dr SIMON, Michael (Fort Hare Institute of Technology, University of Fort Hare)

Presenter: Mr TANGWE, Stephen (Fort Hare Institute of Technology, University of Fort Hare)

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