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Exergy analysis of vapor compression refrigeration system using R450A as a replacement of R134a

- [Jatinder Gill](#),
- [Jagdev Singh](#),
- [Olayinka S. Ohunakin](#) &
- [Damola S. Adelekan](#)

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Abstract

This paper experimentally investigated exergetic performance analysis of vapor compression refrigeration system using R450a as a replacement for R134a at different evaporator and condenser temperatures within controlled environmental conditions. The exergetic performance analysis of the vapor compression refrigeration system with test parameters including efficiency defects in the components, total irreversibility, and exergy efficiency of the refrigeration system was performed. Findings showed that the total irreversibility and exergy efficiency of the vapor compression refrigeration system using R450A refrigerant were lower and higher than R134a by about 15.25–27.32% and 10.07–130.93%, respectively. However, the efficiency defect in the condenser, compressor, and evaporator of the R450A refrigeration system was lower than R134a by about 16.99–26.08%, 5.03–20.11%, and 1.85–15.85%, respectively. Conversely, efficiency defect in the capillary tube of the R450A refrigeration system was higher than R134a by about 14.66–78.97% under similar operating conditions. Overall, it was found that the most efficient component was the evaporator, and the least efficient component was the compressor for both refrigerants.

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Author information

Affiliations

- 1. Department of Mechanical Engineering, IKGPTU, Kapurthala, Punjab, India**
Jatinder Gill
- 2. Faculty of Mechanical Engineering Department, BCET Gurdaspur, Gurdaspur, Punjab, India**
Jagdev Singh
- 3. The Energy and Environment Research Group (TEERG), Mechanical Engineering Department, Covenant University, Ota, Ogun State, Nigeria**
Olayinka S. Ohunakin & Damola S. Adelekan

Corresponding author

Correspondence to [Jatinder Gill](#).

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