# Accepted Manuscript


Title: Effect of Jet Length and Ambient Temperature on the Performance of a Two-Phase Jet Impingement Heat Sink Refrigeration System

Author: Pablo A. de Oliveira, Jader R. Barbosa Jr.

PII: S0140-7007(17)30002-6
DOI: http://dx.doi.org/doi: 10.1016/j.ijrefrig.2017.01.001
Reference: JIJR 3512

To appear in: *International Journal of Refrigeration*

Received date: 29-10-2016
Revised date: 16-12-2016
Accepted date: 3-1-2017

# Effect of Jet Length and Ambient Temperature on the Performance of a Two-Phase Jet Impingement Heat Sink Refrigeration System

Pablo A. de Oliveira, Jader R. Barbosa Jr.

*POLO Research Laboratories for Emerging Technologies in Cooling and Thermophysics, Department of Mechanical Engineering, Federal University of Santa Catarina (UFSC), Florianópolis, SC, 88040900, Brazil, Phone/Fax: (+ 55) 48 3721-7900*

*Email address:* jrb@polo.ufsc.br (Jader R. Barbosa Jr.)

Highlights

- A novel jet-based heat sink integrates the evaporator and the expansion device
- The system was tested with a small-scale oil-free R-134a compressor
- Effects of piston stroke, thermal load, jet length and ambient temperature
- Evaluation based on COP, heat transfer coefficient (h) and heater temperature ($T_S$)
- Decreasing the jet length reduced the CHF; increasing $T_{amb}$ increased h

**Abstract**

The jet impingement heat sink integrated with a compact oil-free R-134a vapor compression refrigeration system introduced in a previous work (Oliveira and Barbosa, 2016) is now further evaluated in terms of the influence of the compressor piston stroke, applied thermal load, orifice-to-heater distance (jet length) and ambient (hot end) temperature. The proposed heat sink is a compact active thermal solution for concentrated heat loads because it integrates the evaporator and the expansion device into a single unit, making use of a single two-phase impinging jet as the cooling mechanism. The present analysis is based on the coefficient of performance and other steady-state heat transfer parameters associated with the impinging jet (heat transfer coefficient and heater surface temperature). A reduction of the jet length promoted a more vigorous splattering of the jet on the heated surface, enhancing the droplet breakup, which in turn reduced significantly the critical heat flux. An increase of the hot reservoir temperature increased the jet impingement heat transfer coefficient.