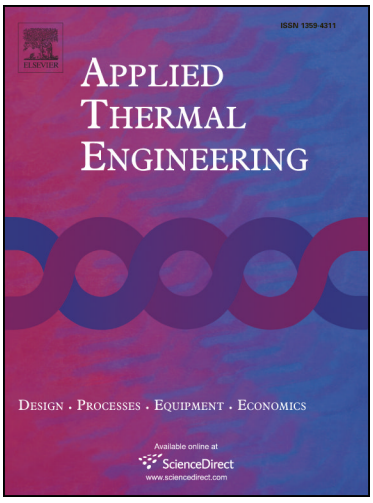

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PII: S1359-4311(17)35403-0
DOI: https://doi.org/10.1016/j.applthermaleng.2017.10.098
Reference: ATE 11296

To appear in: *Applied Thermal Engineering*

Received Date: 20 August 2017
Revised Date: 12 October 2017
Accepted Date: 18 October 2017

Please cite this article as: A.C. Kheirabadi, D. Groulx, Experimental evaluation of a thermal contact liquid cooling system for server electronics, *Applied Thermal Engineering* (2017), doi: https://doi.org/10.1016/j.applthermaleng.2017.10.098

Experimental Evaluation of a Thermal Contact Liquid Cooling System for Server Electronics

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Highlights

- A thermal contact water cooling system is proposed and experimentally evaluated.
- The system eliminates leakage risks by replacing fluidic connectors with a heat exchanger.
- An experimental setup simulating heat dissipation from a single processor is constructed.
- The system requires inlet water at 53.2 ºC to maintain a 300 W heat source below 85 ºC.
- The system consumes 43 % more power than conventional water cooling in warm regions.

Abstract

This paper presents the outcomes of a research project aimed at designing and experimentally evaluating a thermal contact liquid cooling system for military applications. The proposed system replaces fluidic connectors found in conventional water cooling systems with a thermal contact heat exchanger. This approach enhances reliability by eliminating leakage risks; however, it also undermines thermal performance by adding thermally resistive heat transfer interfaces. Experiments were conducted to quantify the downgraded thermal performance and to establish whether it is a viable trade-off for enhanced reliability. An experimental setup was constructed in order to simulate heat generation by a single processor. Results showed that the proposed system requires inlet water as warm as 53.2 ºC at a maximum heat load of 300 W. For comparison, it was also shown that the proposed thermal contact water cooling system would require 43 % more energy than a conventional water cooling system if operating at ambient temperatures sufficiently higher than 50 ºC.

Keywords: high power electronics, thermal management, electronics cooling, liquid cooling, thermal contact heat exchanger