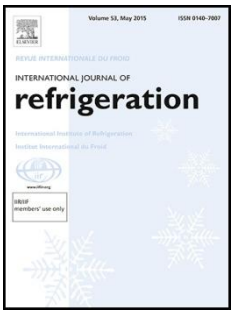
Accepted Manuscript



Title: Development and analysis of a portable compressed liquid air cooling system for fast vehicle cabin cooling

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PII: S0140-7007(17)30351-1
DOI: http://dx.doi.org/doi: 10.1016/j.ijrefrig.2017.09.004
Reference: JIJR 3744

To appear in: *International Journal of Refrigeration*

Received date: 12-7-2017
Revised date: 26-8-2017
Accepted date: 2-9-2017

Please cite this article as: Maan Al-Zareer, Ibrahim Dincer, Marc A. Rosen, Development and analysis of a portable compressed liquid air cooling system for fast vehicle cabin cooling, *International Journal of Refrigeration* (2017), http://dx.doi.org/doi: 10.1016/j.ijrefrig.2017.09.004.

Development and Analysis of a Portable Compressed Liquid Air Cooling System for Fast Vehicle Cabin Cooling

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Highlights:

- A novel instant vehicle cabin cooler based on compressed liquid air is proposed
- Successfully reduced the temperature of the vehicle cabin in one minute by 12.0^{o}C
- Increasing the container pressure from 5 to 9 bar reduce the temperature 3.2^{o}C more

Abstract

Fast cooling of the cabin of parked vehicles under in sunshine has received considerable attention, especially when the vehicle cooling system does not have the capacity to perform such a task in a very short period of time. Most studies have focused on cooling the vehicle cabin throughout the parking period. In this paper, a novel portable cooling system is proposed to cool the vehicle cabin in 60 seconds. A three dimensional heat and mass transfer model is developed and used to evaluate the performance of the proposed cooling system. The proposed cooling system consists of an insulated container with a volume of 1.0 liter that is filled with compressed liquid air, which requires simple modification to the rear air vent system. The proposed system was able to lower the temperature of the vehicle by 12.0^{o}C and 15.2^{o}C for container pressures of 5.0 bar and 9.0 bar, respectively.

Keywords: Cooling, liquid air, vehicle cabin cooling, heat transfer.

Nomenclature

c_p	Specific heat capacity (kJ/kg.K)
F	External forces acting on the fluid domain (N)
k	Thermal conductivity (W/m.K)
$\dot{Q}$	Thermal energy rate (W)
t	Time (s)
T	Temperature (^{o}C or K)
u	Velocity (m/s)
Greek letters	
ρ	Mass density (kg m^{-3})
Ω	Fluid domain
μ	Dynamic viscosity (Pa.s)