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Ray W. Herrick Laboratories
Center for High Performance Buildings

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60800, Pakistan; ³Faculty of Engineering Sciences, Kyushu University, Kasuga-koen 6-1, Kasuga-shi, Fukuoka 816-8580, Japan; ⁴International

Institute for Carbon-Neutral Energy Research (WPI-I2CNER), Kyushu University, 744 Motoooka, Nishi-ku, Fukuoka 819-0395, Japan

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Xiaojie Lin, Yunho Hwang, Reinhard Radermacher, Saikée Oh

University Of Maryland, United States of America

Keywords: Temperature; Humidity; Control; VRF ; Heat Pump; Air Conditioning

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Christopher R. Laughman, Hongtao Qiao, Daniel J. Burns, Scott A. Bortoff

Mitsubishi Electric Research Laboratories, United States of America

Keywords: Dynamic Simulation, Control, Heat Pump, Modelica, Optimization

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Daniel J. Burns, Scott A. Bortoff

Mitsubishi Electric Research Laboratories, United States of America

Keywords: Controls, Feedback Systems, Multi-Evaporator Cycle Control

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Re/genT, Netherlands, The

Keywords: Expansion Device, Control Strategy, Small Cooling Capacity, Energy Efficiency

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Nathalie Martins Panoeiro¹, Ricardo Nicolau Nassar Koury², Luiz Machado², Antonio Augusto Torres Maia²

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Keywords: Superheating Control, PID Controller, Artificial Bee Colony Algorithm

R-13: Expansion Devices + Two Phase Separators

Time: Tuesday July 12, 2016: 1:30 PM - 3:30 PM — *Location:* 218 C&D

Session Chair: Ullrich Hesse

ID: 2062

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João Fabio Parise de Lara, Claudio Melo, Joel Boeng

Federal University of Santa Catarina, Brazil

Keywords: Expansion Device, Capillary Tube, Meso-Cooling

ID: 2009

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Thomas Tannert, Ullrich Hesse

Bitzer-Stiftungsprofessur für Kälte-, Kryo- und Kompressorentechnik / Technische Universität Dresden, Germany

Keywords: Refrigerator, Capillary Tube, Flow Pattern, Two Phase Flow, Noise

ID: 2426

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Xiangfei Liang^{1,2}, Jinsheng Fang², Bo Zheng^{1,2}, Youlin Zhang²

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Keywords: R-32, Electronic Expansion Valve, Capillary Tube, Throttling Model

ID: 2276

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Keywords: Two-Phase, Liquid Phase, Vapor Phase, Efficiency, Separator

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Nicholas Czaplá, Harshad Inamdar, Nicholas Salts, Eckhard Groll

Purdue University, United States of America

Keywords: Energy Recovery, Heat Pump, Turbine, Nozzle, R410A

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Session Chair: Lorenzo Cremaschi

ID: 2643

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Keywords: Evaporator, Frost, Defrost, Refrigeration

ID: 2195

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Marco Timmermann, Jader Barbosa

Federal University of Santa Catarina, Brazil

Keywords: Compact Heat Exchanger, Frost Formation, Porous Medium, Peripheral Fins

ID: 2222

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Ergin Bayrak^{1,2}, Akın Çağlayan¹, Alper Şevki Konukman²

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Keywords: Finned Tube Evaporators, Frosting, Air Flow Rate, Air and Refrigerant Side Maldistribution

ID: 2294

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Nickolas C. Schmiesing, Andrew D. Sommers

Miami University, Oxford, OH, United States of America

Keywords: Frost, Surface Wettability, Microchannels, Hydrophilic, Hydrophobic

ID: 2016

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Elie Keryakos^{1,2}, Joseph Toubassy¹, Denis Clodic¹, Georges Descombes²

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Keywords: Biogaz, Upgrading, Frost, Heat Exchanger, Heat Transfer

R-15: Commercial/Industrial Refrigeration III

Time: Tuesday July 12, 2016: 4:00 PM - 6:00 PM — *Location:* 218 A&B

Session Chair: Brian Fricke

ID: 2556

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Matej Visek¹, Stefan Elbel^{1,2}, Pega Hrnjak^{1,2}

¹Creative Thermal Solutions, United States of America; ²University of Illinois at Urbana-Champaign, United States of America

Keywords: Carbon Dioxide, Light Commercial, Performance, Thermal Storage, Optimization

ID: 2220

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EMBRACO, R&D

Keywords: Variable Speed Compressor, Natural Refrigerants, Light Commercial Application, Upright Freezer, Energy Saving

ID: 2388

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Barbara Haviland Minor¹, Sonali Shah², Luke Simoni³

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Keywords: Refrigerant, GWP, Refrigeration, XL20, Freezer

ID: 2561

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Michael Petersen, Gustavo Pottker, Gregory L. Smith, Samuel F. Yana Motta, Ankit Sethi

Honeywell International, United States of America

Keywords: Fractionation, Low GWP Blends, Miscibility, Solubility, Material Compatibility

ID: 2286

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Brian Fricke¹, Shitong Zha², Vishal Sharma¹, Jeff Newel²

¹Oak Ridge National Laboratory, United States of America; ²Hillphoenix, United States of America

Keywords: Commercial Refrigeration, Carbon Dioxide, Transcritical

ID: 2281

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Haithem Murgham¹, David Myszka¹, Vijay Bahel², Rajan Rajendran², Kurt Knapke², Suresh Shivashankar², Kyaw Wynn²

¹University of Dayton, United States of America; ²Emerson Climate Technologies

Keywords: Ice Maker, Transient Simulation

R-16: Ejector/Injector Analysis and Performance

Time: Tuesday July 12, 2016: 4:00 PM - 6:00 PM — Location: 218 C&D

Session Chair: Stefan Elbel

ID: 2666

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Kamil Smierciew¹, Dariusz Butrymowicz¹, Jerzy Gagan¹, Slawomir Pietrowicz²

¹Bialystok Technical University, Wiejska 45C, Bialystok, 15-351, Poland; ²Wroclaw University of Technology, Wybrzeze Wyspianskiego 27, Wroclaw, 50-370, Poland

Keywords: Gas Ejector, Isobutane, CFD

ID: 2012

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Université de Sherbrooke, Canada

Keywords: Ejectors, CFD, Thermodynamics, Air, Refrigeration

ID: 2155

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Deng Jianqiang¹, Zhang Yazhou¹, He Yang², Zheng Lexing¹

¹School of Chemical Engineering and Technology XI'AN JIAO TONG UNIVERSITY; ²State Key Laboratory of Multiphase Flow in Power Engineering, Xi'an Jiaotong University

Keywords: Visualization Measurement, Ejector, Refrigeration Cycle, Phase Transition, Flow Pattern

ID: 2671

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Roman Kwidziński¹, Dariusz Butrymowicz², Jaroslaw Karwacki¹, Marian Trela¹, Kamil Smierciew²

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Keywords: Two-Phase Flow, Injector, Low Pressure

ID: 2664

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Kamil Smierciew¹, Dariusz Butrymowicz¹, Tomasz Przybylinski²

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Keywords: Two-Phase Injector, Isobutane, Heat Transfer, Mass Transfer

ID: 2076

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Jingwei Zhu¹, Stefan Elbel^{1,2}

¹ACRC, University of Illinois at Urbana-Champaign; ²CTS – Creative Thermal Solutions, Inc. Urbana IL

Keywords: Ejector, Refrigeration, Air-Conditioning, Control, Vapor Compression

R-17: Heat Exchanger Refrigerant Flow Distribution

Time: Tuesday July 12, 2016: 4:00 PM - 6:00 PM — Location: 310

Session Chair: Pega Hrnjak

ID: 2089

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Karthik Panghat, Sunil S Mehendale

Michigan Technological University, United States of America

Keywords: Microchannel Heat Exchangers, Two-Phase Flow, Header, Refrigerant, Maldistribution, Take-Off Ratio

ID: 2471

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University of Illinois at Urbana-Champaign, United States of America

Keywords: Microchannel Heat Exchanger, Reverse Flow

ID: 2198

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Xuan Liu¹, Pega Hrnjak^{1,2}

¹ACRC, the University of Illinois, United States of America; ²CTS – Creative Thermal Solutions, Inc. Urbana IL

Keywords: Lubricant, MAC, OCR, Distribution

ID: 2367

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Yang Zou¹, Pega Hrnjak^{1,2}

¹University of Illinois at Urbana-Champaign; ²Creative Thermal Solutions

Keywords: Microchannel Heat Exchanger, Vertical Header, Two-Phase Flow, Refrigerant Distribution, CFD

ID: 2290

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Kazuhiro Endoh

Hitachi, Ltd., Japan

Keywords: Refrigerant Distribution, Two-Phase Flow, Header, Flat Tube, Heat Exchanger

ID: 2248

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Jun Li¹, Pega Hrnjak^{1,2}

¹ACRC, University of Illinois at Urbana-Champaign, United States of America; ²Creative Thermal Solution, Inc., Urbana IL, United States of America

Keywords: Two-Phase Flow, Separation, Vertical Header, Microchannel Heat Exchanger, Modeling

R-18: Rooftop Unit Diagnostics (IBO)

Time: Wednesday July 13, 2016: 9:45 AM - 12:00 PM — *Location:* 218 A&B

Session Chair: David Yuill

ID: 2364

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David Yuill¹, James Braun²

¹University of Nebraska - Lincoln, United States of America; ²Purdue University, United States of America

Keywords: FDD, Fault Detection and Diagnosis, Diagnostics, HVAC, Air-Conditioning

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Andrew L. Hjortland¹, James E. Braun¹, Mikhail Gorbounov²

¹Purdue University - Herrick Laboratory, United States of America; ²United Technologies Research Center, East Hartford, CT, United States of America

Keywords: FDD, Fault Impacts

ID: 2069

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Jinliang Wang¹, Mikhail Gorbounov¹, Murat Yasar¹, Hayden Reeve¹, Andrew L Hjortland², James E Braun²

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Keywords: RTU, FDD, Fault, Performance, Degradation

ID: 2074

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Jiangyan Liu¹, Huanxin Chen¹, Jiangyu Wang¹, Guannan Li¹, Haorong Li², Wenju Hu³

¹Huazhong University of Science and Technology, Wuhan 430074, Hubei, China; ²University of Nebraska-Lincoln, Lincoln, 68182, NE, USA;

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Keywords: Fault Diagnosis, Refrigerant Charge, Decision Tree, Principal Component Analysis, Variable Refrigerant Flow

ID: 2379

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Andrew L. Hjortland, James E. Braun

Purdue University - Herrick Laboratory, United States of America

Keywords: Fdd

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Mehdi Mehrabi, David Yuill

University Of Nebraska-Lincoln, Architectural Engineering, Omaha, NE, US

Keywords: Vapor Compression Cycle, Refrigerant Charge, Condenser Fouling, Fault Effects, Operating Parameters

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Time: Wednesday July 13, 2016: 9:45 AM - 12:00 PM — Location: 218 C&D

Session Chair: Donghun Kim

ID: 2031

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Yudong Xia, Shiming Deng

Department of Building Services Engineering, The Hong Kong Polytechnic University, Hong Kong S.A.R. (China)

Keywords: Operational Stability; Sensor Dynamics; Variable Speed; Hunting; EEV

ID: 2157

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Viren Bhanot, Jiazhen Ling, Vikrant Aute, Reinhard Radermacher

University of Maryland, College Park

Keywords: Transient, Modeling, Flash Tank, Vapor Injection, Simulink

ID: 2144

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Rohit Dhumane, Yilin Du, Jiazhen Ling, Vikrant Aute, Reinhard Radermacher

University of Maryland, United States of America

Keywords: Thermosiphon, Thermosyphon, Compact Storage, Air Conditioner, Heat Pump

ID: 2302

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Rohit Dhumane¹, Jiazhen Ling¹, Vikrant Aute¹, Reinhard Radermacher¹, Aravind Mikkilineni², Philip Bingham²

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Keywords: Multiphysics, LTMS, Transient, Air Conditioning

ID: 2027

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Michael Goodman Schroeder^{1,2}, Ellen Brehob², Michael Benedict^{1,3}

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Keywords: Magnetocaloric, Transient, Regenerator, Packed Bed, Stagnant

ID: 2224

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Jianqiang Deng, Lixing Zheng, Fei Wang

School of Chemical Engineering and Technology, Xian Jiaotong University, China.

Keywords: Dynamic Stability, Lyapunov Stability Theorem, Stability Margin, Refrigeration System

ID: 2441

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Zhiyu Yang¹, Junye Shi¹, Jianmin Li², Jiangping Chen¹

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Keywords: Transient Model, Optimization, Automotive HVAC, Time Series

R-20: Evaluation of R410A Alternatives

Time: Wednesday July 13, 2016: 9:45 AM - 12:00 PM — Location: 310

Session Chair: Barbara Haviland Minor

ID: 2402

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Hung M. Pham, Ken Monnier

Emerson Climate Technologies, United States of America

Keywords: Climate Change, Interim, Drop-In, R32, A2L HFO Blends, Discharge Temperature, Long-Term, LGWP, LCCP, System Architecture

ID: 2205

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Sho Fukuda¹, Hedeki Kojima¹, Chieko Kondou², Nobuo Takata¹, Shigeru Koyama¹

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Keywords: COP, Zeotropic Mixture, R1234yf, R32, R744

ID: 2459

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Toshimitsu Kamada, Tomoyuki Haikawa, Shigeharu Taira

Daikin Industries, LTD., Japan

Keywords: Air-Conditioner, Heat Exchanger, Refrigerant, Low-Gwp

ID: 2409

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Shigaharu Taira¹, Tomoyuki Haikawa², Tomoatsu Minamida³

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Keywords: GWP, COP, Refrigerant, Heat Pump System, R410A, R32/R1234ze, R32/R125/R1234yf, R32

ID: 2333

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Oak Ridge National Laboratories, United States of America

Keywords: Low GWP, RTU, DR-55, IEER, Modeling

ID: 2589

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The Chemours Company, United States of America

Keywords: Air Conditioning, DR-55, XL55, DR-5A, XL41

ID: 2116

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Kenneth Schultz

Ingersoll Rand, United States of America

Keywords: Alternative Refrigerants, Rooftop Unit, Component Performance

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Time: Wednesday July 13, 2016: 9:45 AM - 12:00 PM — Location: 278

Session Chair: Bernhard Vetsch

ID: 2132

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Keywords: Electric Vehicles, Heat Pump, Rotary Compressor, Refrigerants, Heating Capacity

ID: 2347

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Santanu Prasad Datta¹, Prasanta Kumar Das², Siddhartha Mukhopadhyay²

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Keywords: Experiment, Lead Acid Battery, Automotive HVAC, COP.

ID: 2411

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Ziqi Zhang, Xiaoning Chen, Cichong Liu, Wanyong Li, Junye Shi, Jiangping Chen

Shanghai Jiao Tong University, China, People's Republic of

Keywords: Mobile AC System, Energy Saving, LCCP, Fuel Economy, Default Cabin Air Recirculation

ID: 2407

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Anne Liebold¹, Po-Hsu Lin², Bernhard Vetsch¹, Cordin Arpagaus¹, Stefan S. Bertsch¹

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Keywords: VRF, Electric Buses, Variable Capacity, Dynamic Simulation, Public Transportation

ID: 2172

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Thomas Gillet^{1,2,3}, Emmanuelle Andrès¹, Amin El-Bakkali¹, Gérard Olivier¹, Vincent Lemort², Romuald Rullière³, Philippe Haberschill³

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Keywords: Multi-Evaporator Air Conditioning System, Automotive, Simulation

ID: 2199

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Xuan Liu¹, Pega Hrnjak^{1,2}

¹ACRC, the University of Illinois, United States of America; ²CTS – Creative Thermal Solutions, Inc. Urbana IL

Keywords: Lubricant, MAC, OCR, Distribution

R-22: Absorption/Adsorption Technology

Time: Wednesday July 13, 2016: 1:00 PM - 3:00 PM — *Location:* 214 C&D

Session Chair: Srinivas Garimella

ID: 2043

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Santosh Kumar Panda, Annamalai Mani

Indian Institute Of Technology Madras, India

Keywords: Bubble Absorber, Swirl Flow, Heat and Mass Transfer, CFD, R134a-Dmf

ID: 2159

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Institute of Refrigeration and Cryogenics, Shanghai Jiao Tong University, China, People's Republic of

Keywords: Chemisorption, Refrigeration, Solar Energy, Strontium Chloride, Consolidated Composite

ID: 2285

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Process and Energy Department, Delft University of Technology, The Netherlands

Keywords: Absorption Cycle; Heat Pump; ILs; NH₃;

ID: 2479

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Sung Joo Hong, Eiji Hihara, Chaobin Dang

University of Tokyo, Japan

Keywords: Automobile Air Conditioner, Desorber, Hollow Fiber Membrane Distillation, Flat Fiber Membrane Distillation, Hydrophobic Membrane, Vacuum Membrane Distillation, Vapor Absorption Refrigeration System

ID: 2467

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Tsung Yi Lin, Chien Chang Wu, Tsung Lin Chen

Department of Mechanical Engineering, National Chiao Tung University, Hsinchu 30010, Taiwan.

Keywords: Modeling, Refrigeration, Adsorption, Lumped Parameter, COP

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Time: Wednesday July 13, 2016: 1:00 PM - 3:00 PM — Location: 218 A&B

Session Chair: Stefan Elbel

ID: 2396

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Jiaheng Chen, Jianlin Yu, Gang Yan

Xi'an Jiaotong University, China, People's Republic of

Keywords: Zeotropic Mixtures, Gas-Gas Ejector, Autocascade Refrigeration Cycle, Performance Enhancement

ID: 2667

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Kamil Smierciew, Dariusz Butrymowicz, Jerzy Gagan

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Keywords: Ejection System, Low-Grade Heat, Working Fluid

ID: 2665

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Keywords: CO2, Ejector, Two-Phase Flow, Subcritical

ID: 2689

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Keywords: Ejector, Isobutane, Experimental Results

ID: 2045

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Jiautheen Parveen Banu, Jawali Maharudrappa Mallikarjuna, Annamalai Mani

Indian Institute of Technology Madras, India

Keywords: Ejector, Swirl, Entrainment Ratio, COP, VJRS

ID: 2368

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Jingwei Zhu¹, Stefan Elbel^{1,2}

¹ACRC, University of Illinois at Urbana-Champaign; ²CTS – Creative Thermal Solutions, Inc. Urbana IL

Keywords: Numerical, Flashing, Vortex, Ejector, Nozzle

R-24: Boiling Heat Transfer Enhancements

Time: Wednesday July 13, 2016: 1:00 PM - 3:00 PM — Location: 218 C&D

Session Chair: Kenneth Schultz

ID: 2513

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Martin Ryhl Kærn¹, Brian Elmegaard¹, Knud Erik Meyer¹, Björn E Palm²

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Keywords: Flow Boiling, Flow Pulsations, Heat Transfer Enhancement, Visualization, Experiments

ID: 2514

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Martin Ryhl Kærn¹, Brian Elmegaard¹, Knud Erik Meyer¹, Björn E Palm², Jørgen Holst³

¹Technical University of Denmark, Denmark; ²Royal Institute of Technology, Sweden; ³Danfoss Drives A/S, Denmark

Keywords: Flow Boiling, Flow Pulsations, Heat Transfer Enhancement, Response Surface Methods, Experiments

ID: 2098

Effect of Nanoparticles Aspect Ratio on the Two Phase Flow Boiling Heat Transfer Coefficient and Pressure Drop of Refrigerant and Nanolubricants Mixtures in a 9.5 Mm Micro-Fin Tube.....1328

Pratik Shashikant Deokar¹, Lorenzo Cremaschi¹, Thiam Wong³, Gennaro Criscuolo²

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Keywords: Micro-Fin Tube, Nanorefrigerant, Nanolubricant, Heat Transfer Enhancement, Flow Boiling

ID: 2340

A Comparison Between Recent Experimental Results and Existing Correlations for Microfin Tubes for Refrigerant and Nanolubricants Mixtures Two Phase Flow Boiling.....1338

Andrea A. M. Bigi, Lorenzo Cremaschi

Auburn University, United States of America

Keywords: Nano-Fluid, Microfin, Two-Phase Flow, Flow Boiling, Modeling

ID: 2129

Wettability Change by Pool Boiling of Nanofluids and Its Impact on Heat Transfer.....1348

Feini Zhang, Anthony Jacobi

University of Illinois at Urbana Champaign, United States of America

Keywords: Wettability, Nanofluid, Pool Boiling, Heat Transfer

ID: 2264

R134a Flow Boiling Heat Transfer on an Electrically Heated Carbon/Carbon Surface.....1356

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Keywords: Carbon/Carbon, Flow Boiling, R134a

R-25: Domestic Refrigeration I

Time: Wednesday July 13, 2016: 1:00 PM - 3:00 PM — *Location:* 310

Session Chair: Claudio Melo

ID: 2056

An Experimental Study on the Effect of a New Defrosting Strategy on the Energy Consumption of Household Refrigerators.....1366

Fernando Testoni Knabben, Claudio Melo

Federal University of Santa Catarina, Brazil

Keywords: Defrost Heater, Evaporator, Refrigerators, Energy Consumption

ID: 2401

Optimized On-Off Controller for Energy Saving in a Household Refrigerator.....1375

Ulisses Carvalho de Elian Saffar, Antônio Augusto Torres Maia

Universidade Federal de Minas Gerais, Brazil

Keywords: Household Refrigerator, On-Off Control, Energy Saving

ID: 2058

A Methodology for Measuring the Air Infiltration Rates Into Refrigerated Compartments.....1385

Paula do Vale Pereira, André Sgrott, Lucas F. Back, Débora T. Kohara, Claudio Melo

Federal University of Santa Catarina, Brazil

Keywords: Air Infiltration, Gasket, Tracer Gas, Household Refrigerator, Frost Accumulation

ID: 2063

An Experimental Study on the Use of Vaccum Insulation Panels in Household Refrigerators.....1395

Susan Thiessen, Fernando Testoni Knabben, Claudio Melo, Joaquim Manoel Gonçalves

Federal University of Santa Catarina, Brazil

Keywords: Household Refrigerator, Vaccum Insulation Panel, Thermal Insulation

ID: 2145

Observation of R600a Flow at Subcooled Temperature Conditions in a Vapor Compression Refrigeration System.....1403

Joonyoung Seo, Daesig Shin, Ji Hwan Jeong

Pusan National University, Korea, Republic of (South Korea)

Keywords: Phase Behavior, Refrigeration Cycle, Two Phase Flow, Non-Equilibrium, Enthalpy

R-26: Heat Exchanger Design, Manufacturing, and Operational Impacts

Time: Wednesday July 13, 2016: 1:00 PM - 3:00 PM — Location: 278

Session Chair: Christian Bach

ID: 2438

Accelerated Fatigue Testing of Aluminum Refrigeration Press Fittings for HVAC & R Applications.....1411

Stefan Elbel^{1,2}, Michael Duggan³, Tony LaGrotta³, Sharat Raj², Pega Hrnjak^{1,2}

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Keywords: Press Fitting, Flame Free, Accelerated Testing, Aluminum, Copper

ID: 2545

A Study of Microchannel Heat Exchanger Performance Associated With the Manufacturing Process.....1421

Hui Zhao¹, Sharat Raghunandan¹, Stefan Elbel^{1,2}, Pega Hrnjak^{1,2}

¹Creative Thermal Solutions, Inc., United States of America; ²University of Illinois at Urbana-Champaign, United States of America

Keywords: HVAC & R Heat Exchangers, Microchannel, Header, Brazing

ID: 2289

Manufacturing & Testing of Air-To-Refrigerant Heat Exchangers Based on 0.8mm Diameter Tubes.....1429

Yoram Shabtay¹, Zhiwei Huang², Vikrant Aute², Vishaldeep Sharma³, Reinhard Radermacher²

¹Heat Transfer Technologies, United States of America; ²University of Maryland, United States of America; ³Oak Ridge National Laboratory, United States of America

Keywords: Small Diameter Tubes, Heat Exchanger, Microchannel, Copper Tube, Manufacturing

ID: 2532

An Evaluation of a Pressure Expansion Method for the Manufacturing of Copper Tube Heat Exchangers.....1437

Roger Tetzloff¹, Vikrant Aute², Song Li³, Cara Martin³

¹Burr Oak Tool, Inc., Sturgis, MI, USA; ²Center for Environmental Energy Engineering, University of Maryland College Park; ³Optimized Thermal Systems, Inc., United States of America

Keywords: Heat Exchanger, Manufacturing, Expansion Process

ID: 2234

A Literature Review on Heat Exchanger Air Side Fouling in Heating, Ventilation and Air-Conditioning (HVAC) Applications.....1447

Omer Sarfraz, Christian Bach

Oklahoma State University, United States of America

Keywords: Air Side Fouling, Fouling Mechanism, Fin Tube Heat Exchangers, Fouling Matter, Air Pressure Drop

ID: 2246

Enhancement of R1234ze(Z) Pool Boiling Heat Transfer on Horizontal Titanium Tubes for High Temperature Heat Pumps.....1456

Ryuichi Nagata¹, Chieko Kondou², Nobuo Takata¹, Shigeru Koyama¹

¹Kyushu university, Japan; ²Nagasaki university, Japan

Keywords: Low GWP, R1234ze(Z), Pool Boiling, Heat Transfer

R-27: Absorption Technology II

Time: Wednesday July 13, 2016: 3:30 PM - 5:30 PM — Location: 214 C&D

Session Chair: Srinivas Garimella

ID: 2142

Investigations on Performance of an Auto-Cascade Absorption Refrigeration System Operating With Mixed Refrigerants.....1464

Shengjian Le, Qin Wang, Dahong Li, Xiaohong Han, Guangming Chen

Key Laboratory of Refrigeration and Cryogenic Technology of Zhejiang Province; Institute of Refrigeration and Cryogenics, Zhejiang University, China, People's Republic of

Keywords: Mixed Refrigerant, Absorption Refrigeration, Auto-Cascade

ID: 2273

Experimental Evaluation of a Small-Capacity, Direct-Fired Ammonia-Water Absorption Chiller.....1473

Anurag Goyal, Marcel A. Staedter, Dhruv C. Hoysall, Mikko J. Ponkala, Srinivas Garimella

Georgia Institute of Technology, United States of America

Keywords: Absorption Refrigeration, Waste Heat Recovery, Ammonia-Water

ID: 2270

Investigation of Air-Cooled Condensers for Ammonia-Water Absorption Chillers.....1484

Subhrajit Chakraborty, Victor C. Aiello, Srinivas Garimella

Georgia Institute of Technology, United States of America

Keywords: Absorption Refrigeration, Air-Cooled Condenser, Zeotropic Mixture Condensation

ID: 2603

A Preliminary Study on Innovative Absorption Systems That Utilize Low-Temperature Geothermal Energy for Air-Conditioning Buildings.....1494

Zhiyao Yang, Xiaobing Liu, Kyle R. Gluesenkamp, Ayyoub M. Momen

Oak Ridge National Laboratory, United States of America

Keywords: Low-Temperature Geothermal Energy, Energy Storage and Transportation, Absorption System, Renewable Energy, Economic Analysis

ID: 2552

Regional Climate Zone Modeling of a Commercial Absorption Heat Pump Hot Water Heater - Part 1: Southern and South Central Climate Zones.....1504

Patrick Geoghegan¹, Bo Shen¹, Christopher Keinath², Michael Garrabrant²

¹Oak Ridge National Laboratory; ²Stone Mountain Technologies, Inc.

Keywords: Commercial, Absorption, Heat, Pump, Water

R-28: Heat Exchanger Modeling and Characterization

Time: Wednesday July 13, 2016: 3:30 PM - 5:30 PM — Location: 218 A&B

Session Chair: Hongtao Qiao

ID: 2534

A Review of State of the Art in Modeling of Air-To-Refrigerant Heat Exchangers for HVAC&R Applications.....1512

Vikrant C. Aute

University of Maryland, United States of America

Keywords: Heat Exchanger, Modeling, Optimization, Tube-Fin, Microchannel

ID: 2672

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Dariusz Butrymowicz, Jerzy Gagan, Teodor Skiepkó, Adam Dudar, Michał Łukaszuk, Kamil Smierciew

Białystok University of Technology, Wiejska 45C, Białystok, 15-351, Poland

Keywords: Heat Exchanger, Minichannel, Propane, Investigation

ID: 2474

Round-Tube and Microchannel Heat Exchanger Modeling at Wet Air Condition.....1532

Yang Zou¹, Huize Li¹, Ke Tang², Pega Hrnjak^{1,2}

¹University of Illinois at Urbana-Champaign; ²Creative Thermal Solutions

Keywords: Round Tube Heat Exchanger, Microchannel Heat Exchanger, Model, Wet Air

ID: 2137

Development and Validation of a Minichannel Evaporator Model Under Different Dehumidifying Conditions.....1542

Abdelrahman Hussein Hassan¹, José González-Maciá¹, Santiago Martínez-Ballester¹, José R. García-Cascales²

¹Institute for Energy Engineering, Universitat Politècnica de València, Spain; ²DITF, ETSII, Universidad Politécnica de Cartagena, Spain

Keywords: Minichannel Evaporator, Numerical Modeling, Heat and Mass Transfer

ID: 2298

Modeling of Finned-Tube Heat Exchangers: A Novel Approach to the Analysis of Heat and Mass Transfer Under Cooling and Dehumidifying Conditions.....1552

Hongtao Qiao, Christopher R. Laughman

Mitsubishi Electric Research Laboratories, United States of America

Keywords: Modeling, Evaporator, Heat and Mass Transfer, Dehumidification, Partially Wet

ID: 2453

Internal Heat Exchanger Performance Quantification and Comparison Testing Methods Including Exploration of the Effects of Location of Measurements and Oil in Circulation.....1562

Andrew Musser¹, Pega Hrnjak^{1,2}, Stefan Elbel^{1,2}

¹Creative Thermal Solutions, Inc., United States of America; ²University of Illinois at Urbana-Champaign, United States of America

Keywords: Internal Heat Exchanger, Suction Line Heat Exchanger, Effectiveness, Test Standard, Customized Test Facility

R-29: Desiccant and Other Heat/Mass Transfer Studies

Time: Wednesday July 13, 2016: 3:30 PM - 5:30 PM — *Location:* 218 C&D

Session Chair: Carlos Infante Ferreira

ID: 2096

Adsorption and Desorption Isotherms of Desiccants for Dehumidification Applications: Silica Aerogels and Silica Aerogel Coatings on Metal Foams.....1569

Kashif Nawaz¹, Shelly J. Schmidt², Anthony M. Jacobi³

¹Department of Aerospace and Mechanical Engineering, University of Oklahoma, Norman, OK, 73071; ²Department of Food Science and Human Nutrition, University of Illinois at Urbana Champaign, Urbana, IL, 61801; ³Department of Mechanical Science and Engineering, University of Illinois at Urbana Champaign, Urbana, IL, 61801

Keywords: Dehumidification, Silica Aerogels, Metal Foams, Adsorption, Desorption, Isotherms

ID: 2125

Parametric Evaluation of Governing Heat and Mass Transfer Resistances in Membrane Based Heat and Moisture Exchangers.....1579

Paul D. Armatis, Brian M. Fronk

Oregon State University, United States of America

Keywords: Energy Recovery, Heat and Mass Transfer, Dehumidification, Membrane

ID: 2670

Numerical Modelling of Heat and Mass Transfer Processes in Chinese Cabbage Cold Storage Chamber.....1589

Mirosława Kolodziejczyk, Dariusz Butrymowicz, Kamil Smierciew, Jerzy Gagan

Białystok University of Technology, ul. Wiejska 42A, Białystok, 15-351, Poland

Keywords: CFD, Cold Storage Chamber, Heat Mass Transfer, Vegetables

ID: 2262

Investigation of Hydrate Growth Rate on the Interface Between Liquid and Solid Film.....1598

Hongxia Zhou, Carlos Infante Ferreira

Technology University of Delft, The Netherlands,

Keywords: Hydrate Slurry, Crystallization, Kinetic Model

R-30: Domestic Refrigeration II

Time: Wednesday July 13, 2016: 3:30 PM - 5:30 PM — Location: 310

Session Chair: Joaquim Rigola

ID: 2057

The Influence of Non-Condensable Gases on the Thermal-Acoustic Behavior of Household Refrigerators.....1608

Rodolfo da Silva Espíndola, Fernando Testoni Knabben, Claudio Melo

Federal University of Santa Catarina, Brazil

Keywords: Mon-Condensable Gases, Energy Consumption, Refrigerator

ID: 2500

Performance Characteristics of a Refrigerator-Freezer With Parallel Evaporators Using a Linear Compressor.....1617

Byungchae Min¹, Sangjin Song¹, Kiyoul Noh¹, Geonwoo Kim¹, Teaseung Yoon¹, Sangkyung Na¹, Sanghoon Song², Jangsik Yang³, Gyungmin Choi⁴, Duckjool Kim⁴

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Keywords: Domestic Refrigerator, Linear Compressor, R600a, Experimental Simulation, Performance

ID: 2553

Virtual Household Refrigerators at Steady-State and Transient Conditions. Numerical Model and Experimental Validation.....1625

Nicolas Ablanque, Carles Oliet, Joaquim Rigola, Carlos-David Pérez-Segarra

Heat and Mass Transfer Technological Center - POLYTECHNIC UNIVERSITY OF CATALONIA, Spain

Keywords: Refrigerator Model, Experimental Validation, Steady-State, Transient, Parametric Studies

ID: 2060

A Numerical and Experimental Study on Skin Condensers Applied to Household Refrigerators.....1635

Elias Gava Colombo, Rodolfo da Silva Espíndola, Fernando Testoni Knabben, Claudio Melo

Federal University of Santa Catarina, Brazil

Keywords: Hot-Wall Condenser, Skin Condenser, Household Refrigerator, Heat Exchanger

ID: 2217

Numerical Simulation of the 3D Transient Temperature Evolution Inside a Domestic Single Zone Wine Storage Cabinet With Forced Air Circulation.....1645

Johann Hopfgartner¹, Martin Heime¹, Stefan Posch¹, Erwin Berger¹, Raimund Almbauer¹, Stephan Schlemmer²

¹TU Graz, Austria; ²Liebherr-Hausgeraete Lienz GmbH

Keywords: CFD, Simulation, Forced-Convection, Domestic Wine Cabinet

ID: 2280

Calibration Strategies and Limitations of Cycle Simulations Representing Complex Domestic Cooling Devices.....1655

Martin Heime¹, Erwin Berger¹, Stefan Posch¹, Johann Hopfgartner¹, Stephan Schlemmer², Raimund Almbauer¹

¹Graz University of Technology, Austria; ²Liebherr-Hausgeräte Lienz GmbH

Keywords: Cycle Simulation, Experiment, Actuators, Calibration

R-31: Property Measurements, Modeling, and Assessments I

Time: Wednesday July 13, 2016: 3:30 PM - 5:30 PM — *Location:* 278

Session Chair: Ian Bell

ID: 2014

Method of Measuring the Vapor Pressure and Concentration of Fluids Using VLE and Vibrating Tube Densitometer Apparatuses.....1665

Momin Elhadi Abdalla¹, Siddharth Pannir²

¹University of Khartoum, Sudan; ²Purdue University

Keywords: R152a, R365mfc, VTPR, Vapor Pressure, Concentration

ID: 2013

Density of the Refrigerant Fluids of R365mfc and R152a: Measurement and Prediction.....1675

Momin Elhadi Abdalla¹, Siddharth Pannir²

¹University of Khartoum, Sudan; ²Purdue University

Keywords: Density, VTPR, Vibrating Tube, R152a, R365mfc

ID: 2283

Measurements of Thermodynamic Properties for R1123 and R1123+R32 Mixture.....1685

Yukihiro Higashi¹, Ryo Akasaka²

¹Kyushu University, I2CNER, Japan; ²Kyushu Sangyo University, Japan

Keywords: Low GWP Refrigerant, R1123, R1123+R32 Mixture, Thermodynamic Properties, Critical Parameter

ID: 2448

Hot Surface Ignition Testing of Low GWP 2L Refrigerants.....1695

Mary Koban, Barbara Minor, Patrick Coughlan, Nina Gray

Chemours Fluoroproducts, United States of America

Keywords: Low GWP Refrigerant, Class 2L Flammable, Burning Velocity

ID: 2122

Compositional Fractionation Studies of R410A Alternative R452B or DR55 and Their Impact on Flammability Behavior and Safety Implications.....1703

Steve Kujak, Ken Schultz

Ingersoll Rand, United States of America

Keywords: DR-55, R410A Alternatives, Flammability, Safety, R-452b

ID: 2318

Use of Nanoparticles in Refrigeration Systems: A Literature Review Paper.....1711

Amey Majgaonkar

Kirloskar Pneumatic Co. Ltd, India

Keywords: Nanoparticles, Nanofluids, Nanorefrigerants, Heat Transfer, Efficiency

R-32: Equipment Performance Measurements and Modeling

Time: Thursday July 14, 2016: 9:45 AM - 12:00 PM — *Location:* 214 A&B

Session Chair: Reinhard Radermacher

ID: 2382

Harmonization of Life Cycle Climate Performance (LCCP) Methodology.....1721

Sarah Troch, Hoseong Lee, Yunho Hwang, Reinhard Radermacher

University Of Maryland, United States of America

Keywords: LCCP; Vapor Compression Cycle; Residential Heat Pump

ID: 2067

Steady State Modeling of Advanced Vapor Compression Systems.....1729

Mohamed Beshr, Vikrant Aute, Reinhard Radermacher

University of Maryland, United States of America

Keywords: Steady State Simulation, Advanced Vapor Compression Systems, Multiple Air and Refrigerant Loops

ID: 2328

Second-Law Analysis to Improve the Energy Efficiency of Environmental Control Unit.....1738

Ammar M. Bahman, Eckhard A. Groll

Ray W. Herrick Laboratories, Purdue University, United States of America

Keywords: Exergy Destruction, Irreversibility, Performance, Energy, ECU

ID: 2052

Steady-State Numerical Simulation of a Vapor Compression Heat Pump System as an Effective Method to Predict Its Performance.....1748

Zvonimir Janković¹, Jaime Sieres Atienza², Fernando Cerdeira Pérez², Branimir Pavković³

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Keywords: Simulation Model, Heat Pump, R407C, Vapor Compression System

ID: 2109

Automated Optimization of Air Conditioning Systems Using Geometry Based Simulation Models.....1758

Joerg Aurich, Rico Baumgart, Eric Tomoscheit

IAV GmbH, Germany

Keywords: Automated Optimization, Physical Based Simulation, Household Appliance Industry, Air Conditioning, Dehumidification Unit

ID: 2235

Development of Operating Envelope Limits for Equipment Tested in a Wind Tunnel.....1768

Omer Sarfraz, Christian Bach

Oklahoma State University, United States of America

Keywords: Wind Tunnel, Operating Envelope, Capacity Limit, Low Temperature Testing, Psychrometric Analysis

ID: 2102

Oil Return Measurements in a Unitary Split System Air Conditioner Using Different Refrigerant Mixtures.....1778

Gabriel A. Feichter¹, Eckhard A. Groll², Orkan Kurtulus², Ben Meng³

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Keywords: Oil Return, R22 Replacement, Drop-In Refrigerant R438

R-33: Evaluation of Natural Refrigerants

Time: Thursday July 14, 2016: 9:45 AM - 12:00 PM — Location: 214 C&D

Session Chair: Frank Rinne

ID: 2615

Conversion of Platelet Incubator Refrigeration System to R600a and Performance Optimization.....1787

Matej Visek¹, Stefan Elbel^{1,2}, Pega Hrnjak^{1,2}, Brian Hoaglan³, Chengzhi Tang³, Dennis Smith³

¹Creative Thermal Solutions, United States of America; ²University of Illinois at Urbana-Champaign, USA; ³Helmer Scientific, USA

Keywords: Hydrocarbon, Laboratory Equipment, Performance, Optimization, Conversion

ID: 2530

Experimental Comparison of a Cascade Refrigeration System Operating With R744/R134a and R744/R404a.....1797

Marcus Vinicius Almeida Queiroz¹, Victor Hugo Panato¹, Arthur Heleno Pontes Antunes¹, Jose Alberto Reis Parise², Enio Pedone Bandarra Filho¹

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Keywords: Cascade Refrigeration, R744, R134a, R404a

ID: 2429

A Fair Comparison of CO₂ and Propane Used in Light Commercial Applications Featuring Natural Refrigerants.....1807

Stefan Elbel^{1,2}, Matej Visek², Pega Hrnjak^{1,2}

¹University of Illinois at Urbana-Champaign, United States of America; ²Creative Thermal Solutions, United States of America

Keywords: Natural Refrigerant, Light Commercial, Efficiency, Comparison, Design

ID: 2008

Modelling of an R-290/Poe ISO 22 Variable Speed Air Conditioner System Under SEER Conditions.....1816

Guilherme B. Ribeiro¹, Jader Riso Barbosa Jr.²

¹Aerospace Science and Technology Department, Brazil; ²Federal University of Santa Catarina, Brazil

Keywords: Simulation, Mixture, Oil, SEER, Air Conditioner

ID: 2049

Performance Comparison of R32, R410A and R290 Refrigerant in Inverter Heat Pumps Application.....1825

Supharuek Konghuayrob, Kornvalee Khositkullaporn

Siam Compressor Industry, Thailand

Keywords: R32, Heat Pump, DSH Control

ID: 2105

CO₂ as an Alternative Refrigerant for Applications Below -50°C.....1835

Robin Langebach, Ullrich Hesse, Yixia Xu

TU Dresden, Germany

Keywords: CO₂, Cycle, Sublimation Heat Transfer

ID: 2202

Development of a Refrigerant to Refrigerant Heat Exchanger for High Efficiency CO₂ Refrigerant Cycle.....1845

Ryuhei Kaji, Shun Yoshioka, Hirokazu Fujino

Daikin Industries, LTD, Japan

Keywords: Refrigerant to Refrigerant Heat Exchanger, CO₂ Refrigerant Cycle, Evaporating Performance, Heat Transfer

R-34: Flow Boiling

Time: Thursday July 14, 2016: 9:45 AM - 12:00 PM — Location: 218 A&B

Session Chair: Claudio Zilio

ID: 2417

Experimental Investigation on Up-Flow Boiling of R1234yf in Aluminum Multi-Port Extruded Tubes.....1853

Jiyang Li, Chaobin Dang, Eiji Hihara

Department of Human and Engineered Environmental Studies, The University of Tokyo

Keywords: Upflow Boiling, Heat Transfer, Multi-Port Extruded Tube, Rectangular Minichannel

ID: 2371

Flow Boiling Heat Transfer Characteristics of R32 Inside a Horizontal Small-Diameter Microfin Tube.....1861

Daisuke Jige, Kentaro Sagawa, Norihiro Inoue

Tokyo University of Marine Science and Technology, Japan

Keywords: Boiling Heat Transfer, Pressure Drop, Microfin Tube, Small-Diameter, R32

ID: 2251

An Experimental Investigation of Convective Boiling Heat Transfer Using Alternative and Natural Refrigerants Inside Horizontal Microchannels.....1869

Nguyen-Ba Chien, Pham-Quang Vu, Kwang-II Choi, Jong-Taek Oh

Chonnam National University, Korea, Republic of (South Korea)

Keywords: Correlation, R32, R410A, R290, Boiling Heat Transfer, Microchannel

ID: 2265

R134a Flow Boiling Inside a 4.3 Mm ID Microfin Tube.....1879

Simone Mancin¹, Claudio Zilio¹, Giulia Righetti¹, Luca Doretto², Giovanni A. Longo¹

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Keywords: Microfin Tube, Flow Boiling, R134a, Heat Transfer, Pressure Drop

ID: 2167

HFO1234ze(E) and HFC134a Flow Boiling Inside a 4mm Horizontal Smooth Tube.....1889

Giovanni A. Longo, Simone Mancin, Giulia Righetti, Claudio Zilio

University of Padova, Italy

Keywords: Boiling, Tube, HFO

ID: 2166

HFO1234ze(E) Boiling Inside a Brazed Plate Heat Exchanger.....1899

Giovanni A. Longo, Simone Mancin, Giulia Righetti, Claudio Zilio

University of Padova, Italy

Keywords: Boiling, BPHE, HFO

ID: 2244

Comparison on Evaporation Heat Transfer Between R32/R1234yf and R32/R1234ze(E) Flowing in Horizontal Microfin Tubes.....1909

Shingo Nakamura¹, Chieko Kondou², Nobuo Takata¹, Shigeru Koyama¹

¹Kyushu university, Japan; ²Nagasaki university, Japan

Keywords: Low GWP, Refrigerant Mixtures, Evaporation, Heat Transfer

R-35: Residential Heat Pumps

Time: Thursday July 14, 2016: 9:45 AM - 12:00 PM — Location: 218 C&D

Session Chair: Bo Shen

ID: 2035

Experimental Evaluation of Low-Cost Gas Heat Pump Prototypes for Building Space Heating.....1918

Michael Garrabrant¹, Roger Stout¹, Christopher Keinath¹, Paul Glanville²

¹Stone Mountain Technologies, Inc.; ²Gas Technologies Institute

Keywords: Heat Pump, Absorption, Ammonia-Water, Prototype, Space Heating

ID: 2505

Experimental Evaluation of High Performance Integrated Heat Pump.....1926

William A. Miller¹, Robert Berry², Neal Durfee¹, Van D. Baxter¹

¹Oak Ridge National Laboratory, United States of America; ²Unico, Inc., United States of America

Keywords: Heat Pump, Integrated, Space Heating, Space Cooling, Water Heating

ID: 2586

Laboratory Performance Evaluation of Residential Scale Gas Engine Driven Heat Pump.....1936

Ahmad Abu-Heiba¹, Isaac Y. Mahderekal³, Ayyoub Momen²

¹Oak Ridge Associated Universities, United States of America; ²Oak Ridge National Laboratory; ³IntelliChoice Energy

Keywords: Gas Heat Pump, GHP

ID: 2171

Techno-Economic Analysis of a Novel Solar Thermal and Air-Source Heat Pump System.....1945

Stefano Poppi^{1,2}, Chris Bales¹

¹Dalarna University, Falun; ²KTH, Energy Technology, Stockholm

Keywords: Air Source Heat Pumps, Vapor Injection, Solar Thermal Combisystems.

ID: 2442

Research on the Operating Characteristics of Floor Heating System With Residential EVI Air Source Heat Pump in China.....1955

Xiaoning Chen, Ziqi Zhang, Junye Shi, Zhiyu Yang, Jiangping Chen

Shanghai Jiao Tong University, China, People's Republic of

Keywords: Air Source Heat Pump, EVI, Floor Heating, Cold Region, HSPF

ID: 2103

Evaluation of R-410A Refrigerant Alternatives in a Residential Reversible Air to Water Heat Pump.....1964

Pierre Pardo, Louis Charbonnier, Michèle Mondot

CETIAT, Centre Technique des Industries Aéronautiques et Thermiques, Villeurbanne, France

Keywords: Residential Heat Pump, Refrigerant Alternatives, DR-5A, L41-2, Drop-In Tests

ID: 2408

Performance Evaluation of Heat Pump System Using R32 and HFO-mixed Refrigerant in High Ambient Temperature.....1970

Shigeharu Taira¹, Tomoatsu Minamida³, Tomoyuki Haikawa², Fumio Ota⁴

¹Japan; ²Japan; ³Japan; ⁴Japan

Keywords: GWP, COP, Refrigerant, Heat Pump System, R410A, R32/R1234yf, R32, Zeotropic, High Ambient Temperature

R-36: Property Measurements, Modeling, and Assessments II

Time: Thursday July 14, 2016: 9:45 AM - 12:00 PM — Location: 310

Session Chair: Barbara Haviland Minor

ID: 2287

Viscosity Correlations for Refrigerants and Other Working Fluids From Residual Entropy Scaling.....1980

Ian Bell, Arno Laesecke

National Institute of Standards and Technology, United States of America

Keywords: Fluid Properties, Viscosity, Entropy Scaling

ID: 2297

A Helmholtz Energy Equation of State for Trifluoroethylene (R-1123).....1990

Ryo Akasaka¹, Masato Fukushima², Eric W. Lemmon³

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Keywords: Equation of State, Low GWP Refrigerant, R-1123, Thermodynamic Property, Vapor Pressure

ID: 2176

Comparison of Models for Calculation of the Thermodynamic Properties of NH₃-CO₂-H₂O Mixture.....2000

Vilborg Gudjonsdottir, Carlos Infante Ferreira

Delft University of Technology, Section Engineering Thermodynamics, Netherlands

Keywords: NH₃-CO₂-H₂O, Thermodynamic Model, Extended UNIQUAC, E-Nrtl, Aspen Plus

ID: 2288

Psychrometric Properties of Humid Air From Multi-Fluid Helmholtz-Energy-Explicit Models.....2010

Ian Bell, Eric Lemmon, Allan Harvey

National Institute of Standards and Technology, United States of America

Keywords: Psychrometric Properties, Humid Air, Thermodynamics

ID: 2204

The Viscosity Characteristics for the Mixed Refrigerant HFO-1234yf + HFC-152a.....2021

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Keywords: Liquid Viscosity, Mixed Refrigerant, HFO-1234yf, HFC-152a

ID: 2151

Thermodynamic Properties of Low-Gwp Refrigerant for Centrifugal Chiller.....2029

Masato Fukushima, Hiroki Hayamizu, Mai Hashimoto

AGC Chemicals, ASAHI GLASS Co.,Ltd, Japan

Keywords: Thermodynamic Properties, Low-Gwp, Refrigerant, HFO, Centrifugal Chiller

R-37: Plate Heat Exchangers

Time: Thursday July 14, 2016: 9:45 AM - 12:00 PM — Location: 278

Session Chair: Vikrant C. Aute

ID: 2279

An Improved Approach for Modeling Plate Heat Exchangers Based on Successive Substitution in Alternating Flow Directions.....2039

Radia Eldeeb, Vikrant Aute, Reinhard Radermacher

University of Maryland, United States of America

Keywords: Plate Heat Exchanger, Numerical Modeling, Validation

ID: 2338

A Method to Combine Local Heat Transfer and Flow Visualization of Flow Boiling in Frame-And-Plate Heat Exchanger.....2047

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Keywords: Plate Heat Exchanger; Local Heat Transfer Coefficient; Flow Boiling; Visualization

ID: 2600

Local Heat Transfer Characteristics of the R1234ze(E) Two Phase Flow Inside a Plate Heat Exchanger.....2057

Keishi Kariya, Mohammad Sultan Mahmud, Akitoshi Kawazoe, Akio Miyara

Saga university, Saga, Japan

Keywords: Plate Heat Exchanger, Local Heat Transfer, HFO Refrigerant, Two Phase Flow

ID: 2278

Investigation of Thermal-Hydraulic Characteristics of Pillow Plate Heat Exchangers Using CFD.....2065

Radia Eldeeb, Vikrant Aute, Reinhard Radermacher

University of Maryland, United States of America

Keywords: Pillow Plate Heat Exchanger, NURBS, CFD

ID: 2337

Effect of End Plates on Heat Transfer of Plate Heat Exchanger.....2075

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Keywords: Plate Heat Exchanger; End Plate Effect

ID: 2106

Experimental Results for Hydrocarbon Refrigerant Vaporization in Brazed Plate Heat Exchangers at High Pressure.....2085

Adriano Desideri¹, Torben Schmidt Ommen³, Jorrit Wronski², Sylvain Quoilin¹, Vincent Lemort¹, Fredrik Haglind³

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Keywords: Brazed Plate Heat Exchanger, Experimental Test Rig, High Pressure Evaporation

ID: 2609

Single Phase Pressure Drop and Flow Distribution in Brazed Plate Heat Exchangers.....2094

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Keywords: Single Phase, Pressure Drop, Flow Distribution, Brazed Plate Heat Exchangers (BPHE)

R-38: HVAC Equipment Performance Enhancements

Time: Thursday July 14, 2016: 1:00 PM - 3:00 PM — Location: 214 A&B

Session Chair: Roy Crawford

ID: 2387

Isentropic Mixtures and Their Application in Heat Pumps in Cold Climate Region.....2104

Nan Zheng^{1,2}, Yunho Hwang¹, Li Zhao², Reinhard Radermacher¹

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Keywords: Zeotropic Mixture; Vapor Injection; Multi-Stage; Thermodynamic;

ID: 2606

Reduction of Energy Consumption in Air-Conditioning Systems Employing Direct Evaporative Pre-Cooling of Condenser Air.....2114

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Keywords: Cellulose Pad, Evaporative Cooling, Air-Conditioning System, Condenser, Coefficient of Performance

ID: 2101

Two-Stage Heat Pump Using Oil-Free Turbocompressors - System Design and Simulation.....2124

Cordin Arpagaus¹, Stefan Bertsch¹, Adeel Javed², Jürg Schiffmann²

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Keywords: Two-Stage Heat Pump, Multiple Heat Sources, Oil-Free Turbocompressors, System Design, Simulation

ID: 2528

An Integrated Solution for Commercial AC Chillers Using Variable Speed Scroll Compressors.....2134

Stephane Bertagnolio, Eric Winandy, Dina Koepke

Emerson Climate Technologies, Aachen, Germany

Keywords: Chiller, Control, Variable Speed Scroll

ID: 2123

Modelling and Simulation of a R744 Based Air Conditioning Unit.....2143

Mihir Mouchum Hazarika, Maddali Ramgopal, Souvik Bhattacharyya

IIT KHARAGPUR, India

Keywords: R744, Lmtd, Lmed

ID: 2140

Cost Optimization of Thermoelectric Sub-Cooling in Air-Cooled CO₂ Air Conditioners.....2153

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Keywords: Sub-Cooler, CO₂, Thermoelectric

R-39: Alternative Refrigerant Evaluation Methods and Results

Time: Thursday July 14, 2016: 1:00 PM - 3:00 PM — *Location:* 214 C&D

Session Chair: Andy Pearson

ID: 2649

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Ankit Sethi, Samuel Yana Motta

Honeywell, United States of America

Keywords: Refrigerants, Low GWP, Air Conditioning, Chiller

ID: 2064

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Xudong Wang, Karim Amrane

Air-Conditioning, Heating, and Refrigeration Institute, United States of America

Keywords: Low GWP, Refrigerants

ID: 2614

Analysis of the Drop-In Operation of a Refrigeration System by the Response Surface Methodology.....2180

Victor Hugo Panato, Marcus Almeida Queiroz, Luis Manoel Paiva Souza, Arthur Heleno Pontes Antunes, Enio Pedone Bandarra Filho

Federal University of Uberlandia, Brazil

Keywords: Drop-In, Response Surface Methodology, Optimization, COP, Desirability Function

ID: 2071

R-32 as an Alternative to Ammonia in Industrial Refrigeration.....2190

Andy Pearson

Star Refrigeration Ltd, United Kingdom

Keywords: Industrial, Refrigeration, Ammonia, R-32, Hazard

ID: 2332

Novel Reduced GWP Refrigerant Compositions to Replace R-134a in Stationary Air-Conditioning and Refrigeration.....2198

Laurent Abbas¹, Sarah Kim¹, Kenneth Schultz²

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Keywords: R-134a, Low GWP, New Refrigerant

ID: 2450

Multi-Year Evaluation of R-449a as a Replacement for R-22 in Low Temperature and Medium Temperature Refrigeration Applications.....2206

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Keywords: Refrigeration, HFOs, R-22 Replacement, GWP, Retrofits

R-40: Refrigerant Heat Transfer and Pressure Drop I

Time: Thursday July 14, 2016: 1:00 PM - 3:00 PM — Location: 218 A&B

Session Chair: Harshad Vijay Inamdar

ID: 2077

A New Flow Map and Flow Characterization of Condensation in Smooth Round Tube From Superheated Vapor.....2216

Jiange Xiao¹, Pega Hrnjak^{1,2}

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Keywords: Condensation, Condensing Superheated Region, Flow Regime, Void Fraction, Film Thickness

ID: 2078

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Jiange Xiao¹, Pega Hrnjak^{1,2}

¹ACRC, the University of Illinois; ²CTS – Creative Thermal Solutions, Inc. Urbana IL

Keywords: Condensation, Condensing Superheated Region, Heat Transfer

ID: 2053

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Jaime Sieres¹, José Antonio Martínez-Suárez¹, Elena Martín²

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Keywords: Degree of Superheat, Convection, Heat Transfer Coefficient, Vertical Tube, Measurement and Instrumentation

ID: 2299

Heat Transfer and Visualization in Large Flattened-Tube Condensers With Variable Inclination.....2245

William A. Davies¹, Yu Kang¹, Pega Hrnjak^{1,2}, Anthony M. Jacobi¹

¹ACRC, University of Illinois, United States of America; ²CTS - Creative Thermal Solutions, Inc. Urbana IL

Keywords: Air-Cooled Condenser, Steam Condensation, Heat Transfer

ID: 2413

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Cichong Liu, Ziyang Sun, Ziqi Zhang, Junye Shi, Jiangping Chen

Shanghai JiaoTong University, China, People's Republic of

Keywords: R290; Condensation; Evaporation; Heat Transfer; Pressure Drop

ID: 2250

Effect of Inclination on Pressure Drop in Large Flattened-Tube Steam Condensers.....2265

Yu Kang¹, William A. Davies¹, Pega Hrnjak^{1,2}, Anthony M. Jacobi¹

¹ACRC, University of Illinois, United States of America; ²CTS – Creative Thermal Solutions, Inc. Urbana, IL

Keywords: Pressure Drop of Steam, Air Cooled Condenser, Inclination, Flattened Tube

R-41: Heat Pump Water Heaters

Time: Thursday July 14, 2016: 1:00 PM - 3:00 PM — Location: 218 C&D

Session Chair: Van D. Baxter

ID: 2174

High Efficiency Heat Pump With Subcooling for Sanitary Hot Water Production Working With Propane.....2275

Miquel Pitarch-Mocholí, Emilio Navarro-Peris, José Gonzalvez-Maciá, José Miguel Corberán

Instituto de Ingenieria Energética, Universitat Politècnica de València, Spain

Keywords: Propane, Heat Pumps, Natural Refrigerants, Hot Water, Subcooling

ID: 2469

Investigation, Analysis and Solution of Higher Noise of Heat Pump Water Heater.....2285

Bo Huang, Weiyang Chu, Yinxiao Lu

Shanghai Hitachi Electrical Appliances Co.,Ltd, China, People's Republic of

Keywords: Water Heaters; Compressor; Fan; Noise;

ID: 2277

Heat Pump Driven by a Gas Engine for Heating and Domestic Hot Water Generation.....2292

Amine Mekdache^{1,2}, Assaad Zoughaib¹, Denis Clodic²

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Keywords: Heat Pump, Gas Engine, Grey Waters, Heat Recovery, Positive Energy Buildings

ID: 2633

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William E. Murphy

Retired - University of Kentucky, United States of America

Keywords: Heat Pump Water Heater, Dehumidification, Field Tests

ID: 2112

Modeling and Experimental Study of a Heat Pump Water Heater Cycle.....2309

Kevin Ruben Deutz^{1,2}, Odile Cauret¹, Romuald Rullière², Philippe Haberschill²

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Keywords: Heat Pump Water Heater, Modeling, Simulation, Convection, Stratification

ID: 2134

Experimental Investigation on the Influence of Refrigerant Charge on the Performance of Trans-Critical CO₂ Water-Water Heat Pump.....2319

Ze Zhang^{1,2}, Rong Xue², Shuangtao Chen², Shijie Song², Yu Hou^{1,2}

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Keywords: CO₂, Heat Pump Water Heater, Refrigerant Charge, Performance

R-42: Thermal Storage

Time: Thursday July 14, 2016: 1:00 PM - 3:00 PM — *Location:* 310

Session Chair: Gerhard Schmitz

ID: 2192

Integrated Thermal Energy Storage.....2327

William L. Kopko

Johnson Controls, United States of America

Keywords: Energy Storage, Subcooling, Demand Reduction, Refrigeration Cycle, Chillers

ID: 2141

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Ruixin Zhou, Xiaole Chen, Yang Lu, Bei Guo

School of Energy and Power Engineering, Xi'an Jiaotong University, China

Keywords: Phase Change Material, Thermal Energy Storage Unit, SiC Honeycomb, Numerical Simulation, Solar Power Generation

ID: 2018

Design and Performance of Thermal Energy Storage Module Using High Thermal Conductivity Phase Change Composite Material.....2347

Siddique Khateeb Razack², Yoram Shabtay¹, Mukund Bhaskar¹, Yoram Shabtay², Hal Stilman¹, Said Al-Hallaj¹

¹Heat Transfer Technologies, United States of America; ²NetEnergy, United States of America

Keywords: Thermal Energy Storage, Phase Change Material, Peak Load Shifting

ID: 2221

Experimental Analysis of Latent Heat Storages Integrated Into a Liquid Cooling System for the Cooling of Power Electronics.....2361

Thomas Bezerra Helbing, Gerhard Schmitz

Institute of Thermo-Fluid Dynamics, Hamburg University of Technology, Germany

Keywords: Latent Heat Storage, Phase Change Materials, Buffer Storage, Liquid Cooling System, Peak Load

ID: 2170

Experimental Comparison of Different Composite Latent Heat Storage Devices With Spatially Non-Constant Heat Loads.....2371

Henrik Veelken, Gerhard Schmitz

Institute of Thermo-Fluid Dynamics, Hamburg University of Technology, Germany

Keywords: Composite Latent Heat Storage, Phase Change Materials, Optimization

R-43: Air Conditioning Equipment Assessments

Time: Thursday July 14, 2016: 3:30 PM - 5:30 PM — *Location:* 214 A&B

Session Chair: Kevin Mercer

ID: 2227

Conversion Factors for Comparing the Performance of Variable Refrigerant Flow Systems.....2381

Emi Matsui¹, Shigeki Kametani¹, Tatsuo Nobe²

¹Tokyo University of Marine Science and Technology, Japan; ²Kogakuin University, Japan

Keywords: Conversion Factor, Energy Saving, Performance Evaluation Method

ID: 2541

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Piljae Im, Malhotra Mini, Jeffrey D Munk, Jehyeon Lee

Oak Ridge National Laboratory, United States of America

Keywords: Variable Refrigerant Flow, Occupancy Emulated Building, HVAC Field Performance Evaluation

ID: 2439

Design Integration of Dedicated Outdoor Air System With Variable Refrigerant Flow System.....2398

Milind Vishwanath Rane, Deepa M Vedartham, Niranjana Bastakoti

IIT Bombay, India

Keywords: DOAS, Air to Air Heat Recovery Unit, Indirect Evaporative Cooling, Sensible Heat Exchangers, Desiccant Dehumidification

ID: 2138

A Study of High Efficiency CO₂ Refrigerant VRF Air Conditioning System Adopting Multi-Stage Compression Cycle.....2408

Tetsuya Okamoto, Kazuhiro Furusho, Ikuhiro Iwata, Eiji Kumakura, Ryuhei Kaji

Daikin Industries, Ltd.

Keywords: CO₂, VRF, High Efficiency, Four-Stage Compression, New Type Compressor

ID: 2303

Simulation of a R410A Residential Air-Conditioning System With Round-Tube And/Or Microchannel Evaporators and Condensers Under Both Dry and Wet Air Conditions.....2418

Yang Zou¹, Huize Li¹, Pega Hrnjak^{1,2}

¹University of Illinois at Urbana-Champaign; ²Creative Thermal Solutions

Keywords: Air-Conditioning System, Simulation, Microchannel, Wet Air

ID: 2563

Low GWP Refrigerants Modelling Study for a Room Air Conditioner Having Microchannel Heat Exchangers.....2428

Bo Shen¹, Mahabir Bhandari¹, Milind Rane², Deep Mota²

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Keywords: Low GWP. Micro-Channel Heat Exchanger, Modelling, Room Air Conditioner

ID: 2472

Experimental Study on Microchannel and Round Tube Plate Fin Evaporators in a Residential Air Conditioning System.....2437

Huize Li¹, Pega Hrnjak^{1,2}

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Keywords: Microchannel Evaporator, Round Tube Evaporator

R-44: Electronics/Thermoelectric Cooling

Time: Thursday July 14, 2016: 3:30 PM - 5:30 PM — *Location:* 214 C&D

Session Chair: Orkan Kurtulus

ID: 2263

Loop Heat Pipes and Mini-Vapour Cycle System for Helicopter Avionics Electronic Thermal Management.....2446

Claudio Zilio¹, Simone Mancin¹, Romain Hodot², Claude Sarno², Vincent Pomme³, Bertrand Truffart³

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Keywords: Electronics Thermal Management, VCS, Loop Heat Pipe, Avionic

ID: 2196

Compact Refrigeration System for Electronics Cooling Based on a Novel Two-Phase Jet Impingement Heat Sink.....2456

Pablo de Oliveira, Jader Barbosa

Federal University of Santa Catarina, Brazil

Keywords: Compact Vapor Compression System, Enhanced Heat Transfer, Two-Phase Jet, Heat Sink, Electronics Cooling

ID: 2473

The Transient Supercooling Enhancement for a Pulsed Thermoelectric Cooler (TEC).....2466

Jia-ni Mao, Jun-yan Du, Shi-fei Wang, Jing-wei Zhou, Yu-gang Wang

Department of Energy and Power Engineering, China JILiang University, Hangzhou 310018, People's Republic of China

Keywords: Thermoelectric Cooler (TEC), Dynamic Behaviour, Optimization, Supercooling Effect, Pulse-Excitation Voltage

ID: 2623

Thermoelectric Multi-Utility Water Heater Cum Air-Conditioner.....2477

Milind Vishwanath Rane¹, Dinesh B Uphade¹, Aditya M Rane²

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Keywords: Thermoelectric, Multi-Utility, Heat Pump, Water Heater

ID: 2567

Experimental Evaluation and Thermodynamic System Modeling of Thermoelectric Heat Pump Clothes Dryer.....2487

Viral K. Patel, Dakota Goodman, Kyle Gluesenkamp, Anthony Gehl

ORNL, United States of America

Keywords: Energy-Efficient, Clothes Drying, Thermoelectric, Model, Energy Factor

R-45: Refrigerant Heat Transfer and Pressure Drop II

Time: Thursday July 14, 2016: 3:30 PM - 5:30 PM — *Location:* 218 A&B

Session Chair: Pega Hrnjak

ID: 2189

Two-Phase Evaporation Pressure Drop Experimental Results for Low Refrigerant Mass Flux.....2495

Anna Fenko, Ellen Brehob, Andrea Kelecy

GE Appliances, United States of America

Keywords: Two-Phase, Pressure Drop, Low Mass Flux, R600A, R134A, Refrigerator Evaporator

ID: 2394

Evaporation Heat Transfer and Pressure Drop of R32 Inside Small-Diameter 4.0 Mm Tubes.....2504

Norihiro Inoue, Daisuke Jige, Kentaro Sagawa

Tokyo University of Marine Science and Technology

Keywords: Evaporation, Heat Transfer, Pressure Drop, Helical-Grooved Tube, Small-Diameter, R32

ID: 2133

Heat Transfer and Pressure Drop During Evaporation of R134a in Microchannel Tubes.....2512

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Keywords: Microchannel, Refrigerant, Heat Transfer, Pressure Drop, Experiment

ID: 2602

Experimental Study on Boiling and Condensation Heat Transfer in a Horizontal Mini Channel.....2522

Yasuhiro Kudo, Kyosuke Nakaiso, Keishi Kariya, Akio Miyara

Saga university, Saga, Japan

Keywords: Minichannel, Boiling, Condensation

ID: 2437

Flow Boiling Pressure Drop for R410A and RL32H in Multi-Channel Tube.....2529

Xiu Wei Yin, Wen Wang, Vikas Patnaik, Jin Sheng Zhou, Xiang Chao Huang

Ingersoll Rand, China, People's Republic of

Keywords: Flow Boiling, Pure Refrigerant, Refrigerant-Oil Mixture, Pressure Drop

ID: 2044

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Jerin Robins Ebenezer, Annamalai Mani

Indian Institute Of Technology Madras, India

Keywords: Falling Film Evaporation, Vertical Corrugated Plate Conduit, Numerical Simulation, Heat Transfer Enhancement, Thermal Spray Metal Coating

R-46: Geothermal/Ground Source Heat Pumps

Time: Thursday July 14, 2016: 3:30 PM - 5:30 PM — *Location:* 218 C&D

Session Chair: Ron Domitrovic

ID: 2351

Improvement of Thermal Conductivity of Grout Mixture for Geothermal Heat Pump Systems.....2548

Chantal Maatouk

Saint Joseph University, Lebanon (Lebanese Republic)

Keywords: Geothermal Heat Pump, Thermal Conductivity, Grout.

ID: 2601

Experimental Performance Estimations of Horizontal Ground Heat Exchangers for GSHP System.....2556

Md. Hasan Ali, Salsuwanda Bin Selamat, Keishi Kariya, Akio Miyara

Saga university, Saga, Japan

Keywords: Ground Source Heat Pump, Heat Exchanger, Experiment, Numerical Simulation

ID: 2207

Heat Pumps Architecture Optimization for Enhanced Medium Temperature Geothermal Heat Use in District Heating.....2566

Matthildi Apostolou^{1,2}, Sahar Salame¹, Stéphanie Barrault¹, Assaad Zoughaib¹

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Keywords: Geothermal, District Heating, Heat Pumps

ID: 2412

Experimental Investigation on the Performance of Ground-Source Heat Pump With the Refrigerant R410A.....2576

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Keywords: Ground-Source Heat Pump, R410A, Experimental Investigation, Performance Research, Test.

ID: 2284

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Sergio Bobbo, Laura Colla, Antonella Barizza, Stefano Rossi, Laura Fedele

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Keywords: Nanofluid, Fumed Al₂O₃, Secondary Fluid, Geothermal Application, Efficiency