22ND INTERNATIONAL COMPRESSOR ENGINEERING CONFERENCE
15TH INTERNATIONAL REFRIGERATION AND AIR CONDITIONING CONFERENCE
3RD INTERNATIONAL HIGH PERFORMANCE BUILDINGS CONFERENCE

CONFERENCES JULY 14-17, 2014
SHORT COURSES JULY 13, 2014
On behalf of the Organizing Committee, the Ray W. Herrick Laboratories, Purdue University, the Co-Sponsoring Organizations and the Endorsing Organizations, it is a great pleasure to present the Final Program of the 22nd International Compressor Engineering Conference, the 15th International Refrigeration and Air Conditioning Conference, and the 3rd International High Performance Buildings Conference at Purdue 2014.

The Organizing Committee received more than 560 abstracts and accepted 410 papers for publication. Every effort was made to include papers of current engineering and scientific interest. Due to time constraints, papers were not submitted to a rigorous peer review. However, an internal review was conducted of each paper. Nevertheless, the Organizing Committee takes no responsibility for the correctness or completeness of any papers published.

On behalf of the Organizing Committee, I would like to thank the authors for having chosen this conference to present their work and for all their efforts in preparing and submitting papers. Thanks to them we present a conference program that is exciting and informative. I would also like to thank the session chairs and session co-chairs for their help in conducting the technical program. In addition, I would like to thank the members of the advisory committee, the Co-Sponsoring and Endorsing Organizations and their representatives for their support and helpful suggestions. In particular, I would like to thank the members of the Organizing Committee and the many graduate student helpers as well as Ms. Kim Stockment, our conference secretary, for their tremendous efforts in making our conferences a success.

We hope that you enjoy these conferences and return home with new ideas and professional contacts. The next Purdue Conferences are planned for July 11-14, 2016. We hope that we will see you again at that time.

Yours sincerely,

Eckhard A. Groll
General Chair

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**Organizing Committee**

**General Conference Chair**
Eckhard Groll

**International Refrigeration and Air Conditioning Conference**
Chair: James Braun
Co-Chair: Howard Cheung

**International Compressor Engineering Conference**
Chair: Travis Horton
Co-Chair: Stephen Caskey

**International High Performance Buildings Conference**
Chair: Thanos Tzempelikos
Co-Chair: Ying-Chieh Chan

**Short Course Chairs**
Orkan Kurtulus – Compressor Short Course
Bill Murphy – Refrigeration Short Course
James Braun – Automated FDD for RTU’s Workshop

**Student Paper Competition**
Panagiota Karava

**Director, Herrick Laboratories**
Patricia Davies

**Student Organization Committee**
Christian Bach
Brandon Woodland
Abhinav Krishna
Andrew Hjortland

**Conference Coordinator**
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ACCA
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Senior Vice President, Research & Technology
Air-Conditioning Contractors of America, USA

AEI
Ms. Carol Kurlancheek
Manager
Architectural Engineering Institute, USA

AHRI
Dr. Karim Amrane
Vice President, Regulatory & Research
Air-Conditioning, Heating & Refrigeration Institute
USA

ASHRAE
Mr. Michael Vaughn
Manager of Research and Technical Services
ASHRAE, USA

IIR
Mr. Didier Coulomb
Director
International Institute of Refrigeration, France

RSES
Mr. Roger Hensley
Chairman, Education & Examining Board
Refrigeration Service Engineers Society, USA

SAREK
Dr. Ji-Hwan Jeong
Professor
Pusan National University, South Korea

SBRN-SNEBRN
Dr. Andreas Athienitis
Professor and Concordia Research Chair Tier 1, Scientific
Director of NSERC Solar Buildings Research Network
Dept. of Building Civil and Environmental
Engineering, Canada

USBBC
Mr. Brendan Owens
Vice President, Lead Technical Development
U.S. Green Building Research Program, USA

USNC/IIR
Mr. Van D. Baxter
Distinguished Research Staff Member, Building
Equipment Research, Energy and Transportation
Science Division
Oak Ridge National Laboratory, USA

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Interstate University of Applied Sciences Buchs,
Switzerland

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CNR
Instituto per le Tecnologie della Costruzione, Italy

Dr. Joost J. Brasz
Aero/Thermo Manager
Danfoss Turbocor Compressors Inc.
Syracuse University Center for Advanced Systems, USA

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Tecumseh Products, USA

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University, Japan

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Professor and Executive Dean
School of Human Settlements and Civil
Engineering, Xi’an Jiaotong University, P.R. of China

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Packaged Products, Ingersoll Rand - Trane, USA

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Faculty of Mechanical, Maritime & Materials
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Professor and Head, Fundamental Mechatronics
Research Institute
Osaka Electro-Communications University, Japan

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Director of R&D, Technology Department
Embraco S.A., Brazil

Dr. Claudio Melo
Professor
Federal University of Santa Catarina, Brazil

Dr. Stephen B. Memory
Director, Thermal & Mechanical Technology
A.O. Smith Corporate Technology Center, USA

Dr. William E. Murphy
Professor of Mechanical Engineering and Director of
Engineering Extended Campus Programs – Paducah
Paducah, University of Kentucky, USA

Mr. Andrew Pearson
Managing Director
Star Refrigeration Ltd., Scotland

Mr. Gordon Powell
Compressor Center of Excellence, Ingersoll Rand –
Trane, USA

Mr. Gilles Pradel
Vice President Global CC R&D
Danfoss Commercial Compressors Division, France

Dr. Brent Protzman
Manager – Energy Information and Analytics
Lutron Electronics, USA

Dr. Joaquim Rigola
Associate Professor, Heat and Mass Transfer
Technological Center
Technical University of Catalonia, Spain

Dr.-Ing. Jurgen Suess
Leiter Operations (Leader of Operations)
Efficient Energy GmbH, Germany

Dr. Bob Turney
Engineering Fellow and Team Lead
Technology and Advanced Development Building
Efficiency, Johnson Controls Inc., USA

Dr. Ruzhu Wang
Professor and Director, Engineering Research Center for
Solar Energy
Shanghai Jiaotong University, P.R. of China

Mr. Simon Wang
Vice President of Research
Emerson Climate Technologies, USA

Mr. Jun Yang
Department Manager of Product Development,
R&D Center
Shanghai Hitachi Electrical Appliances Co., Ltd.,
P.R. of China
MONDAY, JULY 14 | 9:30 AM | LOEB THEATRE

DR. ACHILLES KARAGIOZIS, Director, Building Science
Owens Corning
“Current and Future Trends to Achieve High Performance Buildings”

Dr. Achilles Karagiozis is a Director of Building Science at Owens Corning and is responsible for leading, shaping, driving, educating and training others in energy efficiency and green building science at Owens Corning. His activities involve feeding Owens Corning’s innovation pipeline with customer-inspired and building science-informed solutions.

Previously, Dr. Karagiozis was a distinguished research and development engineer at the Oak Ridge National Laboratory (ORNL). He was in charge of research performed at ORNL in heat, air and moisture performance of buildings.

Dr. Karagiozis is the U.S. representative for IEA Annex 55 on Retrofit Analysis in Buildings, and is actively involved in a number of ASTM E06 technical committees and ASHRAE TC 4.4, and SPC 160. He has also developed several of the world’s most advanced hygrothermal models worldwide (WUFI, MOISTUREEXPERT, LATESTIT family). As an expert in the area of Moisture Engineering, Dr. Karagiozis has solved many hygrothermal designs and retrofit challenges, and has developed multiple design guidelines for various envelope systems. And he is the author of more than 120 technical papers and reports related to moisture in buildings.

TUESDAY, JULY 15 | PLENARY | 8:30 AM | FOWLER HALL

ROLAND RISSER, Director for the Building Technologies Office
U.S. Department of Energy (DOE)

Roland Risser has a Master of Science degree from the California Polytechnic State University in San Luis Obispo and a Bachelor of Science degree from the University of California, Irvine. He also graduated from the Haas School of Business, Executive Program, at the University of California, Berkeley.

Roland currently works with the U.S. Department of Energy, specifically in the Building Technologies office (BTO). BTO’s goal is to optimize US energy savings opportunities and help create a self-sustaining market for building energy efficiency by developing innovative new energy efficient technologies, accelerating the energy efficiency, speed and scale of codes and standards, and supporting cost effective deployment of solutions for highly energy efficient buildings and homes.

Prior to this position Roland served as the Director of Customer Energy Efficiency for Pacific Gas and Electric Company (PG&E). He was responsible for developing and implementing the strategies to support PG&E’s delivery of customer energy savings and strategies to support a Net Zero Energy future. In addition, he was responsible for assessing and deploying new technologies and products into PG&E’s energy efficiency portfolio, managing a building and appliance codes and standards program, as well as PG&E’s Pacific Energy, Energy Training, and Food Service Technology Centers. This program delivered over 200MW of customer energy savings a year.
TUESDAY, JULY 15 | LUNCHEON | PMU BALLROOMS

PETER AYRES, Director
Building Engineering, AECOM
“Cool Designs: Engineering at the Ends of the Earth”

Peter is a senior structural engineering director with AECOM. He has over 25 years experience leading multidisciplinary design teams on innovative projects around the world, and has the rare distinction of having worked on every continent on earth. He led the AECOM team which won the design competition and delivered the Halley VI Antarctic Station, the world’s first ever fully relocatable permanently manned Antarctic base. More recently, he had led engineering teams on major international sports programmes including stadia for the Rio 2016 Olympic Games, Russia 2018 and Qatar 2022.

WEDNESDAY, JULY 16 | PLENARY | 8:30 AM | FOWLER HALL

JACK SAULS, Technology Leader, Positive Displacement Compressors
Ingersoll Rand - Climate Solutions (Trane)
“Past, Present and Future of Twin Screw Compressors”

Mr. Sauls received his degree in Aerospace Engineering from Georgia Tech in 1970, and has worked on aircraft engine gas turbine compressors and compressors for refrigeration applications since 1970. The last 41 years have been spent with Trane, now a part of Ingersoll Rand, working with compressors for refrigeration applications. His primary role has been in the development and application of thermodynamic and fluid dynamic analyses for the simulation of compressor and compressor-system performance. In addition, he has been involved in the development of specialized design and manufacturing simulation models for screw compressor rotors. Mr. Sauls has published 36 technical papers in several conference venues, authored 43 Trane / Ingersoll Rand internal technical reports and hold three US Patents.

Since the early 1980’s, Mr. Sauls has developed comprehensive thermo-fluid simulations for screw, scroll and reciprocating compressors for use in air conditioning and refrigeration systems. These design and analysis tools are built largely by methods developed at Purdue. He can trace many improvements over the years to general ideas and specific suggestions garnered at the conferences which he has attended since 1982. Fifteen of the 36 papers Mr. Sauls has authored or co-authored have been presented at the Purdue compressor conferences.

THURSDAY, JULY 17 | PLENARY | 8:30 AM | FOWLER HALL

MARK MCLINDEN, Applied Chemicals and Materials Division
National Institute of Standards and Technology
“Optimizing the Selection of Low-GWP Refrigerants: Limits, Possibilities, and Tradeoffs”

Dr. McLinden received his BS degree from the University of Missouri-Columbia and MS and PhD degrees from the University of Wisconsin-Madison, all in chemical engineering. He joined what was then the National Bureau of Standards in 1984 and worked in the Thermal Machinery Group of NBS–Gaithersburg, where he developed an equation of state for refrigerant mixtures, carried out analytical studies on the optimum thermodynamic characteristics of refrigerants, and constructed an experimental apparatus to measure evaporative heat transfer coefficients. He joined the Thermophysical Properties Division (now the Applied Chemicals and Materials Division) of NIST in Boulder in 1988 where his research through the 1990s focused on the properties of alternatives to the ozone-depleting CFC and HCFC refrigerants. His current focus is on highly accurate measurements of fluid properties over wide ranges of temperature and pressure and the design and fabrication of instruments for such measurements. The current interest in low-GWP alternatives to the HFC refrigerants has reignited his research in the refrigerants area. He is the author or coauthor of more than 60 peer-reviewed publications and has received several awards related to his refrigerants research.
BREAKFAST FOR PRESENTERS, CHAIRPERSONS AND VICE CHAIRPERSONS
A complimentary lunch (on Monday) and breakfast (Tuesday – Thursday) is scheduled in the Purdue Memorial Union, West Faculty Lounge for presenting authors, session chairs & vice-chairs scheduled for each day. You can find your presentation time in the Conference Overview. It is important to attend the speaker lunch or breakfasts if you are presenting a paper to meet your session chair and address any presentation questions you might have. Updated presentations can also be loaded at this time. Instructions concerning audio/visual/projection systems and technical session organization will be addressed. Please only attend the breakfast on the day in which you present. If you have presentations scheduled for different days, you should attend the lunch or breakfasts each day so that you can meet your Session Chairperson and the other Presenters. If you are the Presenter in more than one session on the same day, please meet both Session Chairpersons. If you are a Presenter but not an author of a technical paper, you should be the person who attends this breakfast so that you may alert the Chairpersons that you are the Presenter.

PROGRAM FORMAT
The technical programs are continuous. In case of a “no show”, presentations will be moved up in the schedule. Each presenter is allotted 15 minutes to present with 5 minutes for questions and answers. These times may be adjusted depending on the number of presentations per session.

PICTURES AND VIDEOTAPE DURING THE CONFERENCES & PICTURE PHONES
Conference attendees may NOT take pictures, videotapes, nor use picture phones at any presentation without the consent of the author or presenter. An official photographer will be taking pictures during the conferences. Attendees may NOT take pictures during the tours because the research is often highly sensitive.

PRESENTATIONS
If you have last minute changes to your presentation (different from what was uploaded into Conftool), please see your session co-chair during the daily breakfast to make arrangements to upload your new file.

FUTURE CONFERENCE DATES
July 11-14, 2016
Short Courses are organized and presented by the faculty of Herrick Laboratories, in cooperation with our sponsoring organizations. Often, speakers from outside organizations and university serve as presenters for these courses. One CEU credit can be earned through attendance to any of the offered short courses.

The courses will meet from 8:00 a.m. until 5:00 p.m. on Sunday, July 13, 2014, and will meet concurrently.

EXPERIMENTAL TECHNIQUES TO MEASURE COMPRESSOR PERFORMANCE AND RELIABILITY
The short course focuses on presenting different experimental techniques that are used to measure compressor performance parameters and compressor reliability. In particular, the following topics will be part of the short course: compressor performance testing using calorimeters and hot gas bypass load stands, steady-state and dynamic instrumentation and data acquisition systems, experimental techniques to measure lubricant/refrigerant performance and reliability, performance testing of liquid flooded compression and compression with vapor injection. The short course consists of eight 45-minute lectures and will provide ample time for discussion.

OPTIMIZATION OF HVAC&R SYSTEMS
Before computers, vapor compression systems were designed using the experience of senior engineers that had developed an intuition for how component changes would affect performance, then verified with laboratory testing. The availability of desktop computers allowed system components to be modeled and a system pieced together to simulate what would be measured in the laboratory. Even with such computer power, the final design still depends to some extent on the intuition of the design engineer in selecting component details.

As HVAC manufacturers approach the practical limits of system performance using conventional components, a different design approach must be used to squeeze out the last bit of available efficiency. Design optimization methods can be used to identify the best of the hundreds of possible component combinations, without requiring the intuition of the senior engineers or the extensive laboratory testing.

This short course focuses on the use of modern computer optimization methods in the design of vapor compression systems. It begins with fundamental optimization techniques and then applies these methods to examples of heat transfer and fluid flow. Hands-on examples using Excel spreadsheets will be used to illustrate these optimization methods. Advanced topics related to the Oak Ridge heat pump design model and system control optimization techniques will also be covered, along with a discussion of how optimization can be used in a broader manufacturing context.

AUTOMATED FDD FOR RTU’S – MOVING FROM R&D TO COMMERCIALIZATION
Intended Audience:
1) commercial HVAC equipment and component manufacturers/engineers interested in developing and commercializing automated fault detection and diagnostics (FDD) for rooftop air conditioning units (RTUs);
2) policy makers and utilities interested in incentivizing the development and commercialization of RTU FDD

Goals:
1) review of existing and emerging technologies for diagnostic technologies applied to RTUs;
2) review of existing and emerging policy for development, adoption, and evaluation of RTU diagnostics;
3) review and discussion of the evolution of business opportunities for RTU diagnostics.
MONDAY, JULY 14
Reception & Tours at the Ray W. Herrick Laboratories
The reception is hosted by UTC Carrier and will be held from 6:00 to 8:00 p.m. Shuttle buses will depart from the Grant Street Parking Garage between 5:30 and 6:00 p.m. transporting attendees and guests to the reception. Attendees may also use CityBus and the Trolleys or walk to the Reception. There will be transportation available after the Reception. You may need to arrange shuttle service with your individual hotels. Some local restaurants and bars are open on Monday evenings in downtown Lafayette and the Purdue campus.

Walking Directions to Herrick Laboratories: Exit Stewart Center on the west end, nearest Loeb Theatre. Turn left, toward State Street. At the stop light on State Street, turn right (west), walk down State Street about four blocks. Turn left at the stoplight at the corner of Russell and State Streets, walk south on Russell about half a block, turn right (west) at the round-shaped Grounds Building. Just past this building, you will see the Reception Tent.

TUESDAY, JULY 15
Luncheon – Purdue Memorial Union, North & South Ballrooms
The buffet luncheon will be held from 12:00 to 1:30 p.m. It is hosted by Danfoss, Inc.

WEDNESDAY, JULY 16
Steak BBQ – The Trails Banquet Facility, West Lafayette
The informal steak barbeque will be held from 6 p.m. to dusk and is hosted by Emerson Climate Technologies. Buses will begin departing from the Grant Street Parking Garage entrance across from the Union Club Hotel at 5:45 p.m. The last bus will leave at approximately 6:15 p.m. for the barbeque. There will be games and a beer wagon and a chance to visit outside. The buses will return attendees and guests to the Purdue Memorial Union, University Inn, Holiday Inn and the Hilton Garden Inn after the barbeque. You may also drive your own vehicle to this venue.

Driving Directions to The Trails: From Grant Street Parking Garage, exit on North Street, turn left. Turn right on Grant Street, turn right on Northwestern Avenue (stop light) immediately curve left on Wiggins Street. Follow US 231 (on right) down the hill to State Road 43 North. Turn left on State Road 43 North. Proceed 5-1/2 miles to Burnetts Road, turn right. The Trails will be on your right.

STUDENT EVENTS
Student Paper Competition: Winners of the Student Paper Competition from each conference will be announced and awarded at the Steak BBQ at the Trails. Plan to join us and congratulate these students on a job well done.

ASHRAE Student Meeting – Monday, July 14 from 3:30-5:30 pm, Stewart 310
Purdue student chapter of ASHRAE meeting with ASHRAE President

Student Mixer – Tuesday, July 15 from 8-10 pm, 9 Irish Brothers in West Lafayette
Gather with other students from around the world at O'Bryan's Nine Irish Brothers located near Wabash Landing
CONFERENCE OFFICE / HOSPITALITY ROOM
Conference Office is located in Stewart Center, Room 306
Telephone Number: (765) 494-8828
Messages will be posted on a bulletin board throughout the conferences. We will also have coffee and refreshments are available throughout the conferences.

*NEW* E-PAPER CENTER
The E-Paper Center is located in Room 302, Stewart Center. Attendees may print up to 10 papers via the computer stations set up in room 302. You may also use the e-stations to print airline boarding passes, check emails, etc. Please be considerate of other guests, and limit time on the computer to 15 minute intervals.

OPERATION HOURS
Sunday afternoon 4:00 p.m. to 6:00 p.m.
Monday 8:00 a.m. to 4:00 p.m.
Tuesday 8:00 a.m. to 4:00 p.m.
Wednesday 8:00 a.m. to 4:00 p.m.
Thursday 8:00 a.m. to 12:00 p.m.

INTERNET ACCESS
Wireless internet is available to all attendees via the Conference Division/ATT WIFI hotspot. Please choose ATT Wifi as your internet connection. When you open a browser, you will be automatically connected. Your will need to provide your email address and accept terms & conditions. If you have difficulties, please visit the Conference Office, Stewart Center, 306.

DISPLAY CENTER
There will be several tables available in the Conference Hospitality Room, Stewart Center, Room 306. Please check with Conference staff before displaying any material. No commercialism is allowed. There is also a Bulletin Board where messages can be posted for other attendees and the Organizing Committee will post any last minute schedule changes.

PRINTING, COPYING AND FAXING
Attendees may print from a CD/disk/memory stick, make copies, send faxes, and more at The BoilerCopy Maker in the Purdue Memorial Union, Second Floor. Charges vary for different services.

SMOKING POLICIES ON CAMPUS
Smoking is prohibited on the West Lafayette Campus, except in designated smoking areas. All smoking material shall be extinguished and disposed of in an appropriate receptacle at the perimeter of the campus. Designated smoking areas are published in maps around the Purdue campus. The closest smoking area to Stewart Center is located near State Road 26.

TEMPERATURES INSIDE & OUTSIDE DURING THE CONFERENCES
Outside summer temperatures in Indiana are usually between 75-95°F and very humid. Room temperatures in technical session rooms are often cool for our European visitors; come prepared!

TIME DURING CONFERENCES
The time zone in Indiana is Eastern Daylight Time. This is the same time as New York City in the summer.
PRACTICAL GUIDE

BANKS AND CREDIT UNION LOCATED NEAR THE PURDUE CAMPUS (WITH ATM’S)

REGIONS BANK
Address: Stadium Square Center, 728 Northwestern Avenue, West Lafayette, IN
Telephone: (765) 476-8205
Hours: Monday-Thursday 9:00 a.m. – 5:00 p.m.; Friday 9:00 a.m. – 6:00 p.m.

CHASE BANK
Address: Chauncey Village, 210 West State Street, West Lafayette, IN
Telephone: (765) 423-0412
Hours: Monday – Friday 9:00 a.m. – 6:00 p.m.; Saturday 9:00 a.m. – 2:00 p.m.

PURDUE EMPLOYEES FEDERAL CREDIT UNION
ATMs available at Purdue Memorial Union in the Stewart Center Lobby, Northwestern Avenue and Garfield Streets
Hours: Monday – Friday 9:00 a.m. – 6:00 p.m.; Saturday 9:00 a.m. – 2:00 p.m.

TRANSPORTATION DURING THE CONFERENCE
There will be organized transportation available for the Conference Social Events or you may choose to use your own vehicles. The Conference Hotels will provide shuttle service between the hotels and the Purdue Memorial Union. They do not operate on a regular schedule so you may call for pick-up service. Please make sure that you obtain a contact number for your hotel shuttle. The Greater Lafayette Transit System’s buses and trolleys will also be available.

TROLLEY ROUTE

PARKING ON CAMPUS
Parking is available in garages on the Purdue campus. The Grant Street Garage is the closest garage to the Purdue Memorial Union and Stewart Center. Attendees may park in that garage for a maximum price of $10. Guests at the Union Club Hotel can park free. Visitors can purchase “A” garage permits or multiple day passes at the Parking facilities office (494-9494) Monday-Friday 7:30-4:30. Price is $5.00/day and allows parking in any garage EXCEPT Grant Street. Do not park in marked parking spaces or you will be ticketed. We are not able to get your ticket dismissed.
HOTEL LOCATIONS ON THE MAP & TELEPHONE CONTACT NUMBERS

B  Hilton Garden Inn ...........................................................................................................................(765) 743-2100
C  The Union Club Hotel at Purdue University ......................................................................................(765) 494-8900
D  First Street Towers ............................................................................................................................(765) 494-0926
G  Holiday Inn -Lafayette City Centre ...................................................................................................(765) 423-1000

Four Points by Sheraton .......................................................................................................................(765) 463-5511

(Located on U.S. 52, West of campus)

LIMO SERVICE TO AND FROM INDIANAPOLIS AND CHICAGO AIRPORTS

LAFAYETTE LIMO SERVICE
Provides service to and from the Indianapolis International Airport
(765) 497-3828 or lafayettelimo.com

STAR OF AMERICA
Shuttle service to and from the Indianapolis International Airport
1-800-933-0097 or StarofAmerica.com

EXPRESSION AIR COACH
Provides shuttle service to and from the Chicago O’Hare Airport
(765) 743-3120 or expressaircoach.com

Check their websites. Attendees must contact the companies themselves.

TRANSPORTATION SERVICES

AMTRAK – TRAIN
Riehle Plaza
Big Four Depot, 200 North 2nd Street
(800) 872-7245

GREYHOUND BUS
Riehle Plaza
Big Four Depot, 200 North 2nd Street
(765) 742-8836 or (800) 231-2222

CITY CAB
(765) 477-1234

FOUR STAR TAXI
(765) 742-8400

NOTES

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# SCHEDULE

## MONDAY

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<th>Time</th>
<th>Activity</th>
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<tbody>
<tr>
<td>7:00am – 5:00pm</td>
<td>Conference Registration – East Foyer, Stewart Center</td>
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<tr>
<td>8:00am – 4:00pm</td>
<td>Hospitality Room (Refreshments Available) – STEW 302/306 – Hosted by Tecumseh Products</td>
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| 9:30 – 11:30am | **Opening Session, Welcome and Keynote Address** – Loeb Playhouse, Stewart Center  
Dr. Achilles Karagiozis, Director, Building Science, Owens Corning  
“Current and Future Trends to Achieve High Performance Buildings”  |
| 11:30am – 1:00pm | Lunch Break  Complimentary Lunch for Session Chairs, Co-Chairs & Presenting Authors for Monday’s Sessions – West Faculty Lounge, 2nd Floor, Purdue Memorial Union |
| 1:00 – 3:00pm  | Session R1: Evaluating Alternative Refrigerants & Technologies  
Session R2: Ejectors  
Session R3: Transient Heat Exchanger Modeling  
Session B1: Building Controls  
Session B2: Building Design Issues & Optimization  
Session C1: Scroll Compressors I  
Session C2: Novel Compressors I |
| 3:00 – 3:30pm  | Coffee Break – STEW 302/306 – Hosted by Tecumseh Products                                    |
| 3:30 – 5:30pm  | Session R4: Alternative Refrigerant Performance Comparisons  
Session R5: Refrigerant & Oil Properties  
Session R6: Heat Exchanger Flow Distribution  
Session B3: Model Predictive Controls I  
ASHRAE Student Member Meeting with ASHRAE  
Session C3: Scroll Compressors II  
Session C4: Novel Compressors II |
| 5:30 – 6:00pm  | Shuttle Bus transportation provided from Grant Street Parking Garage to Herrick Laboratories for the Opening Reception and tours. |
| 6:00 – 8:00pm  | **Opening Reception hosted by UT Carrier** – Ray W. Herrick Laboratories  
Join us for a welcome reception to kick off the 2014 Conferences! Tours of the new Herrick Laboratories will be available. |
| 8:30 – 9:00pm  | Shuttle Bus transportation to area hotels available.                                          |

## TUESDAY

<table>
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<th>Time</th>
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| 7:15 – 8:15am | Complimentary Breakfast for Session Chairs, Co-Chairs & Presenting Authors for Tuesday’s Sessions  
West Faculty Lounge, Second Floor, Purdue Memorial Union |
| 8:00am – 4:00pm | Conference Registration – East Foyer, Stewart Center | Hospitality Room – STEW 302/306 – Hosted by Embraco |
| 8:30 – 9:30am  | **Plenary Session** – Fowler Hall, Stewart Center  
Roland Risser, Director for the Building Technologies Office, U.S. Department of Energy (DOE)  |
| 9:30 – 9:45am  | Hospitality Room (Refreshments Available) – STEW 302/306 – Hosted by Embraco                  |
| 9:45 – 11:45am | STEW 214 A&B  
Session R7: Heat Pumps I  
Session R8: Vapor Compression Cycle Enhancements I  
Session R9: Gas Cooling & Condensing Heat Transfer  
Session B4: HVAC Systems  
Session B5: Airflow & Ventilation Systems  
Session C5: Rotary Compressors  
Session C6: Dynamic Compressors |
| 12:00 – 1:15pm | **Conference Luncheon presented by Danfoss** (included in Registration), North and South Ballrooms, Purdue Memorial Union  
Peter Ayres, Director – Building Engineering, AECOM  
“Cool Designs: Engineering at the Ends of the Earth”  |
| 1:30 – 3:30pm  | Session R10: Heat Pumps II  
Session R11: Alternative Heating & Cooling Technologies  
Session R12: Refrigerant Heat Transfer & Pressure Drop  
Session B6: Building Simulation & Energy Modeling I  
Session B7: Solar Energy Systems in Buildings  
Session C7: Waste Heat Recovery  
Session C8: Compressor Modeling I |
| 3:30 – 4:00pm  | Coffee Break – STEW 302/306 – Hosted by Embraco                                               |
| 4:00 – 6:00pm  | Session R13: Transient System Modeling  
Session R14: Capillary Tubes, Vortex & two-phase Expanders  
Session R15: Air-side Heat Transfer, Fouling & Frosting  
Session B8: Facades & Lighting  
Session C9: Noise & Vibration  
Session C10: Compressor Modeling II |
| 4:00 – 5:30pm  | IIR Combined Section B and E Commission Mtg – STEW 307                                       |
| 6:30 – 8:00pm  | **Conference Advisory Committee Meeting** (by invitation only) – Location: McGraw’s Fish, Steak & Chop House |
| 8:00 – 10:00pm | Student Mixer at O’Bryan’s Nine Irish Brothers – Gather with other students from around the world at O’Bryan’s Nine Irish Brothers.  
Located near Wabash Landing. www.nineirishbrothers.com |
WEDNESDAY

7:15 – 8:15 am Complimentary Breakfast for Session Chairs, Co-Chairs & Presenting Authors for Wednesday’s Sessions
West Faculty Lounge, Second Floor, Purdue Memorial Union

8:00am – 12:00pm Conference Registration | East Foyer, Stewart Center
If arriving after 12:00 pm, please see Kim Stockment in the Conference Hospitality Room to register.

8:00am – 4:00pm Hospitality Room (Refreshments Available) | STEW 302/306 | Hosted by Kawneer Company, Inc. (Alcoa Building & Construction Systems)

8:30 – 9:30 am Plenary Session – Fowler Hall, Stewart Center
Jack Sauls, Technology Leader, Positive Displacement Compressors, Ingersoll Rand – Climate Solutions (Trane)
“Past, Present and Future of Twin Screw Compressors”


9:45am – 12:00pm

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<th>STEW 214 A&amp;B</th>
<th>STEW 214 C&amp;D</th>
<th>STEW 218 A&amp;B</th>
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<td>Session C11:</td>
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12:00 – 1:00 pm Lunch Break

1:00 – 3:00 pm

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<th>STEW 214 A&amp;B</th>
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<td>Session C14:</td>
<td>Session C15:</td>
<td>Session C16:</td>
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3:00 – 3:30 pm Coffee Break – STEW 302/306 | Hosted by Kawneer Company, Inc. (Alcoa Building & Construction Systems)

3:30 – 5:30 pm

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<th>STEW 214 A&amp;B</th>
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<td>Session R23:</td>
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5:45 – 6:15 pm Shuttle buses will transport attendees from the Grant Street Parking Garage to the Steak Barbeque

6:00 – 10:00 pm Steak Barbeque hosted by Emerson Climate Technologies | The Trails, West Lafayette, IN

9:30 – 10:00 pm Shuttle buses will transport attendees from the Steak Barbeque to the Grant Street Parking Garage

THURSDAY

7:15 – 8:15 am Complimentary Breakfast for Session Chairs, Co-Chairs & Presenting Authors for Thursday’s Sessions
West Faculty Lounge, Second Floor, Purdue Memorial Union

8:00am – 4:00pm Hospitality Room (Refreshments Available) – STEW 302/306 | Hosted by Parker Hannifin & SABIC

8:30 – 9:30 am Plenary Session – Fowler Hall, Stewart Center
Mark McLinden, Applied Chemicals and Materials Division, National Institute of Standards and Technology
“Optimizing the Selection of Low-GWP Refrigerants: Limits, Possibilities, and Tradeoffs”

9:30 – 9:45 am Coffee Break – STEW 302/306 | Hosted by Parker Hannifin & SABIC

9:45am – 12:00pm

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<th>STEW 214 A&amp;B</th>
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12:00 – 1:00 pm Lunch Break – Boxed Lunches available in the Conference Hospitality Room

1:00 – 3:00 pm

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<td>Session C23:</td>
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3:00 – 3:30 pm Coffee Break – STEW 302/306 | Hosted by Parker Hannifin & SABIC

3:30 – 5:30 pm Conference Advisory Committee Meeting (by invitation only) – STEW 307
R-01: EVALUATING ALTERNATIVE REFRIGERANTS & TECHNOLOGIES | STEW 214 A&B

Session Chair: Mark McLinden, NIST

ID: 2175
R-404A Alternative Refrigerant with Low Compressor Discharge Temperature
Barbara Minor¹, Vladimir Sulc², Jeff Berge³, Michal Kolda⁴, Michal Hegar⁵
¹DuPont Fluoroproducts; ²Thermo King, Corp, Ingersoll Rand; ³Thermo King, Corp, Ingersoll Rand; ⁴Ingersoll Rand Equipment Manufacturing; ⁵Ingersoll Rand Equipment Manufacturing

ID: 2250
AHRI Low Global Warming Potential Alternative Refrigerants Evaluation Program (Low-GWP AREP) – Summary of Phase I Testing Results
Xudong Wang, Karim Amrane
Air-Conditioning, Heating, and Refrigeration Institute, United States of America

ID: 2256
Evaluation and Soft-Optimization for R410A Low-GWP Replacement Candidates through Testing and Simulation
Yunho Hwang¹, Abdullah Alabdulkarem¹,², Radia Eldeeb¹, Vikrant Aute¹, Reinhard Radermacher¹
¹University of Maryland, College Park, United States of America; ²King Saud University, Riyadh, Saudi Arabia

ID: 2278
An Evaluation of the Environmental Impact of Different Commercial Supermarket Refrigeration Systems Using Low Global Warming Potential Refrigerants
Mohamed Beshr¹, Vikrant Aute¹, Omar Abdelaziz², Brian Fricke², Reinhard Radermacher¹
¹University of Maryland, United States of America; ²Oak Ridge National Laboratory, USA

ID: 2328
Assessment Of Life Cycle Climate Performance (LCCP) Tools For HVAC&R Applications With The Latest Next Generation Refrigerant Technology
Stephen Anthony Kujak, Panayu Robert Srichai, Kenneth J. Schultz
Ingersoll Rand, United States of America

ID: 2505
Novel Reduced GWP Refrigerant Compositions for Stationary Air Conditioning
Thomas J. Leck, Pavan K. Naicker, Joshua Hughes, Bianca Hydutsky
DuPont, United States of America

ID: 2670
Low GWP Refrigerants for Air Conditioning Applications
Samuel F. Yana Motta, Mark W. Spatz, Ankit Sethi, Elizabet Vera Becerra
Honeywell International Inc, Buffalo, NY, USA

R-02: EJECTORS | STEW 214 C&D

Session Chair: Orkan Kurtulus, Purdue University

ID: 2188
Analysis and Comparison of Two-Phase Ejector Performance Metrics for R134a and CO2 Ejectors
Neal Lawrence¹, Stefan Elbel¹²
¹University of Illinois at Urbana-Champaign; ²Creative Thermal Solutions, Inc.

ID: 2287
Two-dimensional Numerical Analysis on Ejector of Vapour Jet Refrigeration System
Arun Kodamkayath Mani, Shaligram Tiwari, Mani Annamalai
Mechanical Engineering Department, Indian Institute of Technology Madras, Chennai, India
ID: 2291
Three-dimensional Numerical Investigations on Ejector of Vapour Jet Refrigeration System
Parveen Banu Jiautheen, Shaligram Tiwari, Mani Annamalai
Department of Mechanical Engineering, Indian Institute of Technology Madras, India

ID: 2306
Thermodynamic Analysis Of Steam Ejector Refrigeration Cycle
Shengchun Liu¹, Chunyuan Zhu¹, Hailin Li²
¹Tianjin Key Laboratory of Refrigeration Technology, School of Mechanical Engineering, Tianjin University of Commerce, China; ²Department of Mechanical and Aerospace Engineering, West Virginia University

ID: 2403
Experimental Study on Performance of Two-phase Ejector Refrigeration Cycle System with Two-throat Nozzle
Li Qian Ren, Xian Min Guo, Xin Wei Guo, Tian Long Li
Tianjin University of Commerce, People’s Republic of China

ID: 2580
Review on Ejector Efficiencies in Various Ejector Systems
Fang Liu
Shanghai University of Electric Power, Shanghai, China

R-03: TRANSIENT HEAT EXCHANGER MODELING | STEW 218 A&B
Session Chair: Chris Laughman, Mitsubishi Electric Research Laboratories

ID: 2171
Transient pressure drop correlation between parallel minichannels during flow boiling of R134a
Dolaana M. Khovalyg¹,², Predrag S. Hrnjak¹, Anthony M. Jacobi¹
¹University of Illinois at Urbana-Champaign, USA; ²ITMO University, Russian Federation

ID: 2247
An Improved Moving Boundary Heat Exchanger Model with Pressure Drop
Hongtao Qiao, Vikrant Aute, Reinhard Radermacher
University of Maryland, United States of America

ID: 2249
A New Dynamic Heat Exchanger Model with Frosting and Defrosting
Hongtao Qiao, Vikrant Aute, Reinhard Radermacher
University of Maryland, United States of America

ID: 2294
Transient 1D heat exchanger model for the simulation of domestic cooling cycles working with R600a
Erwin Berger, Martin Heimel, Stefan Posch, Raimund Almbauer, Martin Eichinger
Graz University of Technology, Austria

ID: 2319
Investigation of the Dynamic Heat Transfer Coefficient of R-134a in a Horizontal Pipe
Jan Philipp Rückert¹, Gerhard Schmitz²
¹TU Tech, Germany; ²Hamburg University of Technology

ID: 2585
Effect of Pulsation Width Modulation (PWM) on the Performance of an Evaporator
Xiaofei Wang¹, Ke Tang¹,², Predrag S. Hrnjak¹²
¹University of Illinois at Urbana-Champaign, United States of America; ²CTS, Urbana, IL 61802, United States of America; ³Zhejiang University, Hangzhou 310027, China
**B-01: BUILDING CONTROLS | STEW 218 C&D**

Session Chair: TBD

ID: 3370
Integrating Li-Fi Wireless Communication and Energy Harvesting Wireless Sensor for Next Generation Building Management

**Qian Huang**¹, Xiaohang Li², Mark Shaurette³

¹Physical Facilities, Purdue University, West Lafayette, IN, United States of America; ²ECE Department, Purdue University, West Lafayette, IN, United States of America; ³Building Construction Management Department, Purdue University, West Lafayette, IN, United States of America

ID: 3303
Low Energy Houses Heated By Biomass Boilers: Optimization Of The Heating System Control Strategy By Means Of Dynamic Simulation

**Elisa Carlon**¹,², Markus Schwarz¹, Matteo Rimoldi¹-³, Laszlo Golicza¹, Vijay Kumar Verma¹, Alessandro Prada², Christoph Schmidl¹, Marco Baratieri², Andrea Gasparella², Walter Haslinger¹

¹Bioenergy2020+ GmbH, Gewerbepark Haag 3, 3250 Wieselburg Land, Austria; ²Free University of Bozen-Bolzano, Universitätsplatz - piazza Università 5, 39100 Bozen-Bolzano, Italy; ³Politecnico di Milano, Piazza Leonardo da Vinci 32, 20133 Milano, Italy

ID: 3494
An Inexpensive Retrofit Technology for Reducing Peak Power Demand in Small and Medium Commercial Buildings

**James Nutaro**, Teja Kuruganti, David Fugate, Michael Starke

Oak Ridge National Laboratory, United States of America

ID: 3377
Microgrids for Improving Manufacturing Energy Efficiency

**Terance J. Harper**¹, William J. Hutzel¹, Athula Kulatunga¹, J. Christopher Foreman¹, Aaron L. Adams²

¹Purdue University, United States of America; ²Alabama A&M University, United States of America

ID: 3568
A Novel Human Machine Interface for Advanced Building Controls and Diagnostics

**Ritesh Khire**, Francesco Leonardi, Paul Quimby, Soumik Sarkar

United Technologies Research Center, United States of America

ID: 3624
Application of Near-Optimal Tower Control and Free Cooling on the Condenser Water Side for Optimization of Central Cooling Systems

**Rita Cristina Jaramillo**, James E. Braun, W. Travis Horton

Purdue University, West Lafayette, IN

**B-02: BUILDING DESIGN ISSUES & OPTIMIZATION | STEW 310**

Session Chair: Hui Shen, Purdue University

ID: 3365
On the Energy Performance Design of a Skilled Nursing Facility Building

**Giovanni Curculacos**², Gianluca Turchetto², Ugo Mazzali¹, Fabio Peron¹, Piercarlo Romagnoni¹, Francesca Cappelletti¹, Fred Bauman³, Massimiliano Scarpa¹

¹Università IUAV di Venezia, Italy; ²TFE Engineering; ³Center for the Built Environment

ID: 3503
Deploying and Testing Integrated Design Roadmaps for Advanced Energy Retrofits

**Kristen Albee**, Franca Trubiano, Meghan Brennan

University of Pennsylvania, United States of America
Rare Event Analysis of High Dimensional Building Operational Data Using Data Mining Techniques
Cheng Fan, Fu Xiao, Shengwei Wang
The Hong Kong Polytechnic University, Hong Kong S.A.R. China

Robustness of Multi-Objective Optimization of Building Refurbishment to Suboptimal Weather Data
Alessandro Prada¹, Giovanni Pernigotto², Francesca Cappelletti³, Andrea Gasparella¹, Jan L. M. Hensen⁴
¹Free University of Bozen/Bolzano, Italy; ²University of Padova, Italy; ³University IUAV Venice, Italy; ⁴Eindhoven University of Technology, The Netherlands

Advanced Energy Retrofit - Designing Integrated Design Roadmaps
Franca Trubiano, Meghan Brennan, Kristen Albee
University of Pennsylvania, United States of America

Enhanced Performance Buildings Connected to District Heating Systems: Multi-Objective Optimisation Analysis
Dario Prando¹, Alessandro Prada¹, Fabian Ochs², Andrea Gasparella¹, Marco Baratieri¹
¹Free University of Bolzano, Italy; ²University of Innsbruck, Austria

Development Of An Integrated Solution For Multi Scroll Compressors With Wet Vapor Injection
Stephane Bertagnolio, Eric Winandy, Sonia Vazquez
Emerson Climate Technologies

Numerical Simulation of Unsteady Flow in a Scroll Compressor
Haiyang Gao
Simerics, Inc, United States of America

Seal Mechanism of Tip Seal in Scroll Compressor
Mitsuhiro Fukuta¹, Daisuke Ogi², Masaaki Motozawa¹, Tadashi Yanagisawa¹, Shigeki Iwanami³, Tadashi Hotta³
¹Shizuoka University, Japan; ²Graduate School of Engineering, Shizuoka University, Japan; ³Denso Corporation

Numerical Simulation Of Three-dimension Unsteady Flow In The Compression Chambers Of A Scroll Compressor
Shuanglai Liu, Xiaoli Kang, Caixia Shan, Yusheng Hu
Compressor and Motor Institute of Gree Electric Appliances, Inc. of Zhuhai, China

Development of Scroll Compressor for 16HP VRF System
Fumikazu Nagaoka, Masashi Myogahara, Taro Kato
Mitsubishi Electric Corporation, Japan

A Study on PWM Bypass Capacity Control of Scroll Compressors
Ryota Iijima, Masaki Koyama
Hitachi, Ltd., Japan
C-02: NOVEL COMPRESSORS I | STEW 322

Session Chair: Bryce Shaffer, Air Squared, Inc.

ID: 1669
Twenty Years of Compressor Innovation at NTU, Singapore
Kim Tiow Ooi
School of Mechanical and Aerospace Engineering, Nanyang Technological University, 50 Nanyang Avenue, Singapore 639798

ID: 1134
Modelling and Simulation of the Dynamics of Cross Vane Expander-Compressor Unit for Vapour Compression Cycle
Ken Shaun Yap1,2, Kim Tiow Ooi1, Anutosh Chakraborty1
1Nanyang Technological University, Singapore, Singapore; 2TUM CREATE

ID: 1435
A Chiller Control Algorithm for Multiple Variable-speed Centrifugal Compressors
Piero Caballero1, Chiang Shih1, W. Turner Thornton2, Joost J. Brasz2
1Florida State University, United States of America; 2Danfoss Turbocor, United States of America

ID: 1177
Influence of Volumetric Displacement and Aspect Ratio on the Performance Metrics of the Rotating Spool Compressor
Craig R. Bradshaw1, Greg Kemp1, Joseph Orosz1, Eckhard A. Groll2
1Torad Engineering, United States of America; 2Purdue University, United States of America

ID: 1178
Loss Analysis of Rotating Spool Compressor Based on High-Speed Pressure Measurements
Craig R. Bradshaw1, Greg Kemp1, Joseph Orosz1, Eckhard A. Groll2
1Torad Engineering, United States of America; 2Purdue University, United States of America

ID: 1489
Small-Scale and Oil-Free Turbocompressor for Refrigeration Applications
Jürg Schiffmann
Ecole Polytechnique Federale de Lausanne, Switzerland
R-04: ALTERNATIVE REFRIGERANT PERFORMANCE COMPARISONS | STEW 214 A&B

Session Chair: Karim Amrane, Air-Conditioning, Heating and Refrigeration Institute

ID: 2371
Experimental Performance Investigation of New Low-GWP Refrigerants for Use in Two-Phase Evaporative Cooling of Electronics
Alexis Nicolette-Baker, Elizabeth Garr, Abhijit Sathe, Steve O'Shaughnessey
Parker Hannifin Corporation, United States of America

ID: 2582
Performance of an R-410A Room Air Conditioner Modified for Use with R-1234ze
Charles Janicki¹, Konrad Hermann², John Neuman¹, Patrick Riley³, Margaret M. Mathison¹
¹Marquette University; ²Kuhn North America; ³Rexnord Corporation

ID: 2381
Performance of R410A and R22 Low GWP Alternative Refrigerants at Elevated Ambient Temperatures
Kenneth J. Schultz
Ingersoll Rand, United States of America

ID: 2515
Theoretical analysis of low GWP mixture R600a/R1234ze as a possible alternative to R600a in domestic refrigerators
Jinyou Qiu, Hua Zhang, Zilong Wang, Zhigang Zhou
Institute of Refrigeration and Cryogenic Engineering, University of Shanghai for Science and Technology, Shanghai, China

ID: 2275
Assessment of Environmentally Friendly Refrigerants for Window Air Conditioners
Bo Shen, Pradeep Bansal
ORNL, United States of America

ID: 2349
Energy Efficiency of a Chiller using R410A or R32
Bachir Bella¹, Norbert Kaemmer¹, Riccardo Brignoli², Claudio Zilio³
¹Emerson Climate Technologies, Germany; ²Industrial Engineering Department – University of Padova, Italy; ³Department of Management and Technology – University of Padova, Italy

ID: 2671
Refrigerants with Low Environmental Impact for Refrigeration Applications
Samuel F. Yana Motta, Mark W. Spatz, Gustavo Pottker, Gregory L. Smith
Honeywell International Inc, Buffalo, NY, USA

R-05: REFRIGERANT & OIL PROPERTIES | STEW 214 C&D

Session Chair: Barbara Minor, DuPont Fluoroproducts

ID: 2465
Vapor-liquid equilibrium properties of binary mixture refrigerants (R1234ZE+R290, R290+R227ea)
Yingxia Qi, Hua Zhang, Wei Zhao, Yefeng Liu, Xunhai Liu
University of Shanghai for Science and Technology, China

ID: 2463
Thermodynamic and Heat Transfer Properties of Al2O3 Nanolubricants
Lorenzo Cremaschi, Thiam Wong, Andrea A. M. Bigi
Oklahoma State University, United States of America
A New Method for Calculating Viscosity and Solubility of Lubricant-Refrigerant Mixtures
Jung-Tsung Hung, Jeng-Shiang Tsaih, Hsu-Hua Tang
Patech Fine Chemicals Co., Ltd., Taiwan, Republic of China

A Thermodynamic Property Model for the R-134a/245fa Mixture
Ryo Akasaka¹, Yukihiro Higashi²
¹Kyushu Sangyo University, Japan; ²Iwaki Meisei University, Japan

Standardized Polynomials for Fast Evaluation of Refrigerant Thermophysical Properties
Vikrant Aute, Reinhard Radermacher
University of Maryland, United States of America

Low GWP Refrigerant and Partial Miscible Lubricant
Pierre Ginies¹, Philippe Dewitte¹, Marie France Terrier², Mehdi Charni²
¹Danfoss Commercial Compressors, 01600 Trevoux; France; ²CNAM IFFI, 7503 Paris; France

Quantification of Liquid Refrigerant Distribution in Parallel Flow Microchannel Heat Exchanger Using Infrared Thermography
Huize Li, Predrag S. Hrnjak
University of Illinois at Urbana-Champaign, United States of America

Comparison and Generalization of R410A and R134a Distribution in the Microchannel Heat Exchanger with the Vertical Header
Yang Zou¹, Predrag S. Hrnjak¹,²
¹University of Illinois at Urbana-Champaign, United States of America; ²Creative Thermal Solutions

Principles Of Refrigerant Circuit Optimization In Single Row Microchannel Condensers
Sunil Mehendale¹, Vikrant Aute², Reinhard Radermacher²
¹Michigan Technological University, United States of America; ²University of Maryland, College Park, MD, United States of America

Interleaved Circuitry And Hybrid Control As Means To Reduce The Effects Of Flow Maldistribution.
Christian K. Bach, Eckhard A. Groll, James E. Braun, W. Travis Horton
Purdue University in West Lafayette, United States of America

Single-phase Flow Pressure Drop of R134a Vapor and Liquid in the Vertical Header of Multi-Pass Microchannel Heat Exchanger
Yang Zou¹, Predrag S. Hrnjak¹,²
¹University of Illinois at Urbana-Champaign, United States of America; ²Creative Thermal Solutions
ID: 2396
Determination of Refrigerant Path Number for Fin-tube Condenser Considering Heat Transfer Performance and Pumping Power
Won Jong Lee, Ji Hwan Jeong
Pusan National University, Korea, Republic of (South Korea)

ID: 2542
Single phase pressure drop in round cylindrical headers of parallel flow MCHXs
Tao Ren¹, Amir Chavoshi², Guoliang Ding¹, Predrag S. Hrnjak²,³
¹Institute of Refrigeration and Cryogenics, Shanghai Jiao Tong University, Shanghai 200240, China; ²Air Conditioning and Refrigeration Center, Department of Mechanical Engineering, University of Illinois at Urbana Champaign, 1206 West Green Street, Urbana, IL 61801, USA; ³CTS, 2209 Willow Rd, Urbana IL 61802

B-03: MODEL PREDICTIVE CONTROLS I | STEW 218 C&D
Session Chair: Quim Rigola, Technical University of Catalonia

ID: 3636
A State-Space Modeling Approach and Subspace Identification Method for Predictive Control of Multi-Zone Buildings with Mixed-Mode Cooling
Jianjun Hu, Panagiota Karava
School of Civil Engineering and Division of Construction Engineering and Management, Purdue University, United States of America

ID: 3617
Experimental Demonstration of Model Predictive Control in a Medium-Sized Commercial Building
Pengfei Li, Dapeng Li, Draguna Vrabie, Sorin Bengea, Stevo Mijanovic
United Technologies Research Center, United States of America

ID: 3341
Optimal Chiller and Thermal Energy Storage Design for Building HVAC Systems
David I. Mendoza-Serrano, Donald J. Chmielewski
Illinois Institute of Technology, United States of America

ID: 3635
Impact Of Solar Irradiance Data On MPC Performance Of Multizone Buildings
Donghun Kim¹, Lucas Witmer², Jeffrey R. S. Brownson², James E. Braun¹
¹Ray W. Herrick Laboratories, School of Mechanical Engineering, Purdue University; ²John and Willie Leone Family Department of Energy and Mineral Engineering, The Pennsylvania State University

ID: 3638
Stochastic Model Predictive Control of Mixed-mode Buildings Based on Probabilistic Interactions of Occupants With Window Blinds
Seyed Amir Sadeghi, Panagiota Karava
Purdue University, West Lafayette, IN, United States of America

ID: 3616
Model Predictive Control and Fault Detection and Diagnostics of a Building Heating, Ventilation, and Air Conditioning System
Veronica Adetola¹, Sorin Bengea¹, Keunmo Kang¹, Anthony Kelman², Francesco Leonardi¹, Pengfei Li¹, Teems Lovett¹, Soumik Sarkar¹, Sergey Vichik²
¹United Technologies Research Center, United States of America; ²University of California, Berkeley
C-03: SCROLL COMPRESSORS II | STEW 314
Session Chair: Hung Pham, Emerson Climate Technologies
ID: 1652
Energy Saving Potential in Existing Compressors
Roberto Cipollone, Diego Vittorini
University of L'Aquila, Italy

ID: 1299
Experimental Pressure-Volume diagrams of scroll compressors
Alain Picavet, Pierre Ginies
Danfoss Commercial Compressors, France

ID: 1557
The scroll compressor with internal cooling system – conception and CFD analysis
Józef Rak, Sławomir Pietrowicz, Zbigniew Gnutek
Wrocław University of Technology, Poland

ID: 1558
The Scroll Compressor With Internal Cooling System In Cryogenics Applications
Józef Rak, Sławomir Pietrowicz, Zbigniew Gnutek
Wrocław University of Technology, Poland

ID: 1444
Simulation study on the performance of an Injection Scroll Compressor in a Heat Pump for Electric Vehicles
Jongho Jung1, Dongwoo Kim1, Yongseok Jeon1, Yongchan Kim2
1Graduate School of Mechanical Engineering, Korea University, Korea, Republic of (South Korea); 2Department of Mechanical Engineering, Korea University, Korea, Republic of South Korea

ID: 1136
Gas Pulsation Control Using a Shunt Pulsation Trap
Paul Xiubao Huang1, Sean Yonkers1, David Hokey2
1Hi-Bar MC Tech, United States of America; 2GE Oil and Gas, United States of America

C-04: NOVEL COMPRESSORS II | STEW 322
Session Chair: Matt Cambio, Ingersoll Rand - The Trane Company
ID: 1378
An update on the Performance and Operating Characteristics of a Novel Rotating Spool Compressor -
Joseph Orosz, Craig R. Bradshaw, Greg Kemp, Eckhard A. Groll
Torad Engineering, United States of America

ID: 1644
Performance and Operating Characteristics of a Novel Positive-Displacement Oil-Free CO2 Compressor
Orkan Kurtulus1, Bin Yang1, Dominique Lumpkin1, Eckhard A. Groll1, Lee Jestings2, Ricardo Conde3
1Mechanical Engineering, Purdue University, West Lafayette, IN; 2S-Ram Dynamics, Franklin, TN; 3ReGen Power Systems, New Salem, MA

ID: 1418
Compressor with Turning-Paired Vane and Piston
Kiyoshi Sawai1, Manabu Doi1, Noriaki Ishii2, Hiroaki Nakai2, Hirofumi Yoshida2, Takashi Morimoto3
1Hiroshima Institute of Thechnology; 2Osaka Electro Communication University; 3Panasonic Corporation
ID: 1373
Experimental Investigation of Water Injection in an Oil-Free Co-rotating Scroll Machinery for Compressed Air Energy Storage
Luis Mendoza Toledo¹, Angel Iglesias², Daniel Favrat³, Jürg Schiffmann¹
¹Laboratory for Applied Mechanical Design, Ecole Polytechnique Fédérale de Lausanne; ²Enairys Powertech SA, EPFL Innovation Park; ³Energy Center, Ecole Polytechnique Fédérale de Lausanne

ID: 1297
Optimized design for micro Wankel compressor used in space-borne vapor compression heat pump
Yuting Wu, Chongfang Ma, Xia Chen, Chunxu Du
Beijing University of Technology, China,

ID: 1704
Practical Heat Pumps In Cold Climates – An Enabling Technology
Thomas Walter, Travis Jonas
Mechanical Solutions, Inc., United States of America
R-07: HEAT PUMPS I | STEW 214 A&B
Session Chair: Frank Rinne, Emerson Climate Technologies

ID: 2436
Field Evaluation for Air-source Transcritical CO2 Heat Pump Water Heater with Optimal Pressure Control
Bin Hu1, Yongning He1, Shouguo Wang2, Feng Cao1, Ziwen Xing1
1School of Energy and Power Engineering, Xi’an Jiaotong University, Xi’an, China; 2Guodian Science & Technology Research Institute Beijing Branch, Beijing, China

ID: 2528
Experimental investigation on the influencing factors of a transcritical CO2 heat pump
J.L. Ma1, C.H. Liu1, Y. Hou1,2, T.W. Lai1
1School of Energy and Power Engineering, Xi’an Jiaotong University, Xi’an, China; 2State Key Laboratory of Multiphase Flow in Power Engineering, Xi’an Jiaotong University, Xi’an, China

ID: 2455
Development Of An Industrial High Temperature Heat Pump With Twin Screw Compressor
Yongning He, Dongfang Yang, Feng Cao, Gang Li
Xi’an Jiaotong University, China

ID: 2345
Evaluation of performance of heat pump system using R32 and HFO mixed refrigerant.
Shigeharu Taira, Tomoyuki Haikawa, Hayato Nuno
DAIKIN INDUSTRIES,LTD, Japan

ID: 2493
Development of Flat Tube Heat Exchanger for Heat Pump Air Conditioner
Takuya Matsuda1, Akira Ishibashi1, Takashi Okazaki1, Keisuke Hokazono2, Daisuke Shimamoto2, Hiroki Okazawa2
1Living Environment Systems Laboratory, Mitsubishi Electric Corporation; 2Air-Conditioning & Refrigeration Systems Works, Mitsubishi Electric Corporation

ID: 2674
Study on Energy-Saving Performance of a Novel CO2 Heat Pump with Applications in Dairy Processes
Yefeng Liu1, Eckhard A. Groll2, Orkan Kurtulus2, Kazuaki Yazawa2
1University of Shanghai for Science &Technology, China; 2Purdue university, United States of America

R-08: VAPOR COMPRESSION CYCLE ENHANCEMENTS I | STEW 214 C&D
Session Chair: Roy Crawford, Ingersoll Rand

ID: 2231
Investigation of Application of Suction Line Heat Exchanger in R290 Air Conditioner with Small Diameter Copper Tube
Tao Ren1, Guoming Wu1, Guoliang Ding1, Yongxin Zheng2, Yifeng Gao2, Song Ji2
1Institute of Refrigeration and Cryogenics, Shanghai Jiao Tong University, China; 2International Copper Association Shanghai Office

ID: 2284
Technologies to Improve the Performance of A/C Systems in Hot Climate Regions
Ammar M. Bahman, Eckhard A. Groll, W. Travis Horton, James E. Braun
Ray W. Herrick Laboratories, Purdue University, United States of America
ID: 2443
Yongseok Jeon¹, Sanghun Lee¹, Jongho Jung¹, Yongchan Kim²
¹Graduate school of Mechanical Engineering, Korea university, Korea, Republic of (South Korea); ²Department of Mechanical Engineering, Korea university, Korea, Republic of South Korea

ID: 2631
Application Of Oil Flooded Compression With Regeneration To A Packaged Heat Pump System
Bin Yang, Timothy N. Blatchley, Christian K. Bach, James E. Braun, W. Travis Horton, Eckhard A. Groll
Purdue University, United States of America

ID: 2111
Experimental Investigation of Vapor Injected Compression for Cold Climate Heat Pumps
Christian K. Bach¹, Bernhard Vetsch², Eckhard A. Groll¹, W. Travis Horton¹, James E. Braun¹
¹Purdue University in West Lafayette, United States of America; ²Interstate University of Applied Sciences of Technology NTB in Buchs, Switzerland

ID: 2675
Effects of Vapor Injected Compression, Hybrid Evaporator Flow Control, and Other Parameters on Seasonal Energy Efficiency.
Christian K. Bach, Eckhard A. Groll, James E. Braun, W. Travis Horton
Purdue University in West Lafayette, United States of America

R-09: GAS COOLING & CONDENSING HEAT TRANSFER | STEW 218 A&B

Session Chair: Neera Jain, Mitsubishi Electric Research Laboratories

ID: 2208
HFO1234ze(Z) saturated vapour condensation inside a brazed plate heat exchanger
Giovanni A. Longo¹, Claudio Zilio¹, Giulia Righetti¹, J. Steven Brown²
¹University of Padova - DTG, Italy; ²The Catholic University of America, US

ID: 2276
A Model for Performance Prediction of Brazed Plate Condensers with Conventional and Alternative Lower GWP Refrigerants
Radia Eldeeb, Vikrant Aute, Reinhard Radermacher
University of Maryland, College Park, United States of America

ID: 2283
Heat Transfer Characteristics of the Non-uniform Grooved Tube considering Tube Expansion
Sangmu Lee¹, Akira Ishibashi², Takuya Matsuda³
¹Shizuoka Works, Mitsubishi Electric Corporation, Japan; ²Living Environment Systems Laboratory, Mitsubishi Electric Corporation, Japan; ³Living Environment Systems Laboratory, Mitsubishi Electric Corporation, Japan

ID: 2227
A Discussion about the Methodology to Validate the Correlations of Heat Transfer Coefficients and Pressure Drop during the Condensation in a Finned-Tube Heat Exchanger
Alessandro Pisano¹, Santiago Martinez-Ballester¹, José M. Corberán¹, Fernando Hidalgo Monpeán², Fernando Illán Gómez², J-Ramón García Cascales²
¹Institute for Energy Engineering, Universitat Politècnica de València, Spain; ²Thermal and Fluid Engineering Department, Technical University of Cartagena, Spain
ID: 2551
Pressure Drop in Condensing Superheated Zone
Melissa Meyer¹, Predrag S. Hrnjak¹,²
¹Air Conditioning and Refrigeration Center, University of Illinois at Urbana-Champaign; ²Creative Thermal Solutions, Urbana, Illinois

ID: 2113
Theoretical And Experimental Analysis Of Supercritical Carbon Dioxide Cooling
Martin van Eldik, Paul Marius Harris, Werner Heinrich Kaiser, Pieter Gerhardus Rousseau
North-West University, South Africa

B-04: HVAC SYSTEMS | STEW 218 C&D
Session Chair: Bing Dong, University of Texas San Antonio

ID: 3447
The Effect Of Seasonal Variation On Thermal Performance Of Horizontal Slinky-Loop Ground Heat Exchanger
Salsuwanda Selamat¹, Akio Miyara²
¹Graduate School of Science and Engineering, Saga University, Japan; ²Department of Mechanical Engineering, Saga University, Japan

ID: 3656
Techno-Economic Analysis of Heat Pump and Cogeneration Systems for a High Performance Midrise Apartment in the Canadian Climate
Martin Kegel, Justin Tamasauskas, Roberto Sunye, Daniel Giguere
Natural Resources Canada, CanmetENERGY, Quebec, Canada

ID: 3361
A Study on a New Performance Rating Approach for a Multi-Split (VRF) Air-Conditioning System
Xiaogen Su, Qiang Liu
Emerson Climate Technologies, Asia Pacific, China

ID: 3619
Improving HVAC Performance Through Spatiotemporal Analysis of Building Thermal Behavior
Michael Vincent Georgescu, Igor Mezic
University of California, Santa Barbara, United States of America

ID: 3254
Development of an Empirical Passive Chilled Beam Model for use in Building Simulation
Janghyun Kim¹, James E. Braun¹,², Athanasios Tzempelikos¹,², W. Travis Horton¹,²
¹Ray W. Herrick Laboratories, School of Mechanical Engineering, Purdue University, United States of America; ²School of Civil Engineering, Purdue University, United States of America

ID: 3522
Study Of Pool Fire Heat Release Rate Using Video Fire Detection
Arthur Kwok Keung Wong, Nai-Kong Fong
Department of Building Services Engineering, The Hong Kong Polytechnic University, Hong Kong S.A.R. China
B-05: AIRFLOW & VENTILATION SYSTEMS | STEW 310

Session Chair: Bill Murphy, University of Kentucky

ID: 3661
Analysis of IAQ Based on Modeling of Building Envelope Coupled with CFD&HT Room Airflow
Roser Capdevila¹, Oriol Lehmkuhl¹², Joaquim Rigola¹, López Joan¹, Assensi Oliva¹
¹Heat and Mass Transfer Technological Center (CTTC), Universitat Politècnica de Catalunya - BarcelonaTech (UPC), Terrassa (Barcelona), Spain; ²Termo Fluids, S.L., Terrassa (Barcelona), Spain

ID: 3471
Experimental Study on Extremum Seeking Control for Efficient Operation of Air-side Economizer
Baojie Mu¹, Yaoyu Li², John E. Seem³
¹University of Texas at Dallas, United States of America; ²University of Texas at Dallas, United States of America; ³High Altitude Trading Inc., United States of America

ID: 3614
Energy Modeling of a Botanical Air Filter
Daniel W. Newkirk¹, William J. Hutzel¹, Michael Dana², Ming Qu⁴
¹Purdue University, United States of America; ²Purdue University, United States of America; ³Purdue University, United States of America; ⁴Purdue University, United States of America

ID: 3511
Numerical Study Of The Effect Of Air Terminal Layouts On The Performance Of Stratum Ventilation System
Ting Yao, Zhang Lin
Division of Building Science and Technology, City University of Hong Kong, Hong Kong S.A.R. China

ID: 3173
Energy Conservation Potential By Optimization Of Air Flow Rate Of Mechanical Ventilation
Bing Gu¹, Joerg Schmid², Michael Schmidt³
¹Forschungsgesellschaft HLK Stuttgart mbH, Germany; ²HLK Stuttgart GmbH, Germany; ³Institute of Building Energetics, University of Stuttgart, Germany

ID: 3112
Heat Release Rate of an Open Kitchen Fire of Small Residential Units in Tall Buildings
W.K. Chow
The Hong Kong Polytechnic University, Hong Kong S.A.R. China

C-05: ROTARY COMPRESSORS | STEW 314

Session Chair: Noriaki Ishii, Osaka Electro-Communication University

ID: 1668
Oil-Less Swing Compressor Development
Jason James Hugenroth
Inventherm, Baton Rouge, Louisiana, USA

ID: 1651
Performance Enhancement in Sliding Vane Rotary Compressors through a Sprayed Oil Injection Technology
Giuseppe Bianchi¹, Roberto Cipollone¹, Stefano Murgia², Giulio Contaldi²
¹University of L'Aquila, Italy; ²Ing. Enea Mattei S.p.A., Vimodrone (Milan), Italy

ID: 1214
The Mechanism Discuss of Periodic Sound in Rolling Piston Compressor under Low Operating Frequency in Air-conditioner System
Huanhuan Gu, Rongting Zhang, Yusheng Hu
Gree Electric Appliance, Inc. of Zhuhai, China
ID: 1226
Rotary Compressor With The Stationary Crankshaft
Nelik Dreiman
Retired. Tecumseh Products Co, United States of America

ID: 1350
Development of a miniature Twin Rotary Compressor
Jeong-Bae Lee, Ui-Yoon Lee, Jin-Ah Chung, Un-Seop Lee
Samsung Electronics, Korea, Republic of South Korea

ID: 1215
A Novel Structure of High Efficiency Rotary Compressor
Linbo Lv, Liping Ren, Jia Xu, Yusheng Hu
Gree Electric Appliances, Inc. of Zhuhai, China

C-06: DYNAMIC COMPRESSORS | STEW 322
Session Chair: Joost Brasz, Danfoss Turbocor Compressors, Inc.

ID: 1329
Increasing the Stable Operating Range of a Fixed-Geometry Variable-Speed Centrifugal Compressor
Joost J. Brasz
Danfoss Turbocor Compressors, United States of America

ID: 1498
Using Magnetic Bearing Orbit Information to Maximize Centrifugal Compressor Efficiency at Off-Design Conditions
W. Turner Thornton, Joost J. Brasz
Danfoss Turbocor, United States of America

ID: 1123
Non Adiabatic Centrifugal Compressor Gas Dynamic Performance Definition
Kristina Soldatova
Sankt-Peterburg State Polytechnical University, Russian Federation

ID: 1165
Supersonic Axial Compressor Stage Simplified Analysis
Kristina Soldatova¹, Yuri Galerkin²
¹Sankt-Peterburg State Polytechnical University, Russian Federation; ²Sankt-Peterburg State Polytechnical University, Russian Federation

ID: 1225
Centrifugal Compressor Performance Deviations with Various Refrigerants, Impeller Sizes and Shaft Speeds
Yuanjie Wu, Chris Thilges
Ingersoll Rand -Trane, United States of America

ID: 1393
Performance Analysis of Centrifugal Compressor under Multiple Working Conditions Based on Time-weighted Average
Yuanyang Zhao, Jun Xiao, Liansheng Li, Qichao Yang, Guangbin Liu, Le Wang, Bin Tang
State key laboratory of compressor technology, Hefei General Machinery Research Institute, Hefei 210031, P. R. China
R-10: HEAT PUMPS II | STEW 214 A&B
Session Chair: Stefan Bertsch, Interstate University of Applied Sciences, Buchs

ID: 2233
Thermodynamic Assessment of High-Temperature Heat Pumps for Heat Recovery
Chieko Kondou, Shigeru Koyama
Kyushu University, Japan

ID: 2161
Theoretical Study of A Thermoelectric-assisted Vapor Compression Cycle for Air-source Heat Pump Applications
Lin Zhu, Jianlin Yu
Xi’an Jiaotong University, China

ID: 2301
Exergy Based Methodology for Optimized Integration of Heat Pumps in Industrial Processes
Karim Besbes¹,², Assaad Zoughaib¹, Florence De Carlan³, Jean-Louis Peureux²
¹CES Mines ParisTech, France; ²EDF, France

ID: 2369
Accelerated Thermal Cycling test for Heat Exchangers Used in Reversible Heat Pump
Chad D. Bowers¹, George Baker², Stefan Elbel¹,³, Predrag S. Hrnjak¹,³
¹Creative Thermal Solutions, United States of America; ²Modine Manufacturing; ³University of Illinois

ID: 2245
Thermal Comfort Evaluation of a Heat Pump System using Induced-air Supply Unit
Jiazhen Ling¹, Jian Xu²,³, Vikrant Aute¹, Reinhard Radermacher¹
¹University of Maryland, College Park, United States of America; ²Zhejiang University, Zhejiang, P.R.China; ³Zhejiang Dun’an Artificial Environmental Co, Ltd, Zhejiang, P.R.China

ID: 2246
Optimization Of A Heat Pump For Satellite Cooling
Ian Bell, Vincent Lemort
University of Liège, Liège, Belgium

R-11: ALTERNATIVE HEATING & COOLING TECHNOLOGIES | STEW 214 C&D
Session Chair: Joaquim Rigola, Technical University of Catalonia

ID: 2108
Two-Dimensional Modeling of Thermoelectric Cells
Klaudio S. M. Oliveira, Rodrigo P. Cardoso, Christian J. L. Hermes
UFPR, Brazil

ID: 2534
Magnetocaloric Cooling Near Room Temperature - A Status Quo with Respect to Household Refrigeration
Robin Langebach, Marcel Klaus, Christoph Haberstroh, Ullrich Hesse
TU Dresden, Germany

ID: 2344
Exergy And Energy Analysis Of Waste Heat Recovery Options For Cooling Capacity Production
Chantal Maatouk¹, Rayan Slim²
¹Saint-Joseph University, Faculty of Engineering – ESIB, Lebanon (Lebanese Republic); ²Notre Dame University, Faculty of Engineering - NDU, Lebanon
ID: 2501
Experimental and Modeling Improvements to a Co-Fluid Cycle Utilizing Ionic Liquids and Carbon Dioxide
Scott S. Wujek¹, Mark J. McCready², George Mozurkewich³, William F. Schneider², Stefan Elbel¹
¹Creative Thermal Solutions; ²University of Notre Dame; ³Zelenidyne

R-12: REFRIGERANT HEAT TRANSFER & PRESSURE DROP | STEW 218 A&B
Session Chair: Reinhard Radermacher, University of Maryland

ID: 2594
Experimental Study on Liquid Film Thickness of Annular Flow in Microchannels
Yuki Yoshinaga¹, Hao Peng², Chaobin Dang³, Eiji Hihara¹
¹The University of Tokyo, Japan; ²Beijing University of Civil Engineering and Architecture, China

ID: 2488
R32 Heat Transfer Coefficient During Condensation In A Mini-Channel Multiport Tube
Alejandro Lopez-Belchi, Fernando Illán-Gómez, José-Ramón García-Cascales, Francisco Vera-García
Technical University of Cartagena, Spain

ID: 2337
Condensation and Evaporation of R744/R32/R1234ze(E) Flow in Horizontal Microfin Tubes
Chieko Kondou, Fumiya Mishima, JinFan Liu, Shigeru Koyama
Kyushu University, Japan

ID: 2333
Condensation and Evaporation of R134a, R1234ze(E) and R1234ze(Z) Flow in Horizontal Microfin Tubes at Higher Temperature
Chieko Kondou, Fumiya Mishima, JinFan Liu, Shigeru Koyama
Kyushu University, Japan

ID: 2556
Two-Phase Flow and Heat Transfer of a Non-Azeotropic Mixture inside a Single Microchannel
Davide Del Col, Marco Azzolin, Stefano Bortolin
University of Padova, Italy

ID: 2204
Uncertainty Analysis on Prediction of Heat Transfer Coefficient and Pressure Drop in Heat Exchangers Due to Refrigerant Property Prediction Error
Long Huang, Vikrant Aute, Reinhard Radermacher
University of Maryland, College Park, United States of America

B-06: BUILDING SIMULATION & ENERGY MODELING I | STEW 218 C&D
Session Chair: Marco Baratieri, University of Trento

ID: 3547
Assessment Of Long-Term Visual And Thermal Comfort And Energy Performance In Open-Space Offices With Different Shading Devices
Anna Maria Atzeri¹, Francesca Cappelletti², Andrea Gasparella¹, Hui Shen³, Athanasios Tzempelikos³
¹Free University of Bolzano-Bozen, piazza Università 1, 39100 Bolzano, Italy; ²University IUAV of Venezia, Dorsoduro 2206, 30123 Venezia, Italy; ³School of Civil Engineering, Purdue University, 550 Stadium Mall Dr., West Lafayette, IN 47907, USA
ID: 3514
Comparative Analysis on Energy Consumption of Commercial Buildings Based on Sub-metered Data
Mingjin Guo, Jianjun Xia, Qi Shen, Le Yang
Tsinghua University, China

ID: 3107
The Contribution Of Occupancy Behavior To Energy Consumption In Low Income Residential Buildings
Yifei Duan, Bing Dong
University of Texas at San Antonio, United States of America

ID: 3270
Influence Of Building Zoning On Annual Energy Demand
Lisa Rivalin1,2, Dominique Marchio1, Pascal Stabat1, Marcello Caciolo2, Benoit Cogné2
1Mines ParisTech, France; 2Cofely Axima, France

ID: 3156
A Study on the Fire Safety Issues for Large Window Openings in Supertall Residential Buildings in Hong Kong
K.W. Lau, W.K. Chow
The Hong Kong Polytechnic University, Hong Kong S.A.R. China

ID: 3293
Performance analysis of an energy efficient building prototype by using TRNSYS
Kun Lai1, Wen Wang1, Harry Giles2
1Shanghai Jiao Tong University, China; 2University of Michigan, USA

B-07: SOLAR ENERGY SYSTEMS IN BUILDINGS | STEW 310
Session Chair: N.K. Fong, Hong Kong Polytechnic University

ID: 3559
A New Model for the Analysis of Performance in Evacuated Tube Solar Collectors
Ahmed Aboulmagd2, Andrea Padovan1, Rejane De Césaro Oliveski3, Davide Del Col1
1University of Padova, Italy; 2Cairo University, Egypt; 3University of Vale do Rio dos Sinos, Brazil

ID: 3623
Integration of Photovoltaics into Building Energy Usage through Advanced Control of Rooftop Unit
Michael Starke, James Nutaro, Teja Kuruganti, David Fugate
Oak Ridge National Laboratory, United States of America

ID: 3486
Effect of Solar Radiation Model on the Predicted Energy Performance of Buildings
Alessandro Prada1, Giovanni Pernigotto1, Paolo Baggio2, Andrea Gasparella1, Ardeshr Mahdavi3
1Free University of Bozen/Bolzano, Italy; 2University of Trento, Trento, Italy; 3Vienna University of Technology, Vienna, Austria; 4University of Padova, Vicenza, Italy

ID: 3544
Annual Performance Of A Solar Assisted Heat Pump Using Ice Slurry As A Latent Storage Material
Justin Tamasauskas1, Michel Poirier1, Radu Zmeureanu2, Martin Kegel1, Roberto Sunye1
1Natural Resources Canada/CannetENERGY, Canada; 2Department of Building, Civil and Environmental Engineering, Concordia University, Canada

ID: 3484
Yuehong Lu, Shengwei Wang
The Hong Kong Polytechnic University, Hong Kong S.A.R. China
C-07: WASTE HEAT RECOVERY | STEW 314
Session Chair: Ahmed Kovacevic, City University London

ID: 1470
Geothermal ORC Systems Using Large Screw Expanders
Tim R. Biederman, Joost J. Brasz
cyq, United States of America

ID: 1451
Experimental Campaign and Modeling of a Low-capacity Waste Heat Recovery System Based on a Single Screw Expander
Adriano Desideri¹, Martijn van den Broek², Sergei Gusev², Vincent Lemort¹, Sylvain Quoilin¹
¹University of Liege, Belgium; ²University of Ghent, Belgium

ID: 1609
The Benefit of Variable-Speed Turbine Operation for Low Temperature Thermal Energy Power Recovery
Joost J. Brasz
Syracuse University CASE Incubation Center

C-08: COMPRESSOR MODELING I | STEW 322
Session Chair: Ian Bell, Emerson University of Liege

ID: 1186
Simulation of a Refrigeration Compressor evaluating accuracy of results with variation in 3D component discretization
Sidnei Jose De Oliveira¹, Marcelo Real¹, Dan Marsh²
¹Tecumseh Products Co, United States of America; ²Gamma Tecnologies, United States of America

ID: 1137
PD Compression: A Quasi-Static or Dynamic Process?
Paul Xiubao Huang
Hi-Bar MC Tech, United States of America

ID: 1153
Development And Validation Of Integrated Design Framework For Compressor System Model
Parag Mantri, Aditya Bhakta, Srinivas Mallampalli, Greg Hahn, Srujan Kusumba
GE, India
ID: 1152
An Improved Analytical Model for Efficiency Estimation in Design Optimization Studies of a Refrigerator Compressor
Aditya Bhakta, Parag Mantri, Bhaskar Tamma
GE, India

ID: 1131
A Numerical Simulation of Fluid-Structure Interaction for Refrigerator Compressors Suction and Exhaust System Performance Analysis
Shoufei Wu, Zonghuai Wang
Jiaxipera Compressor Co., Ltd., China

ID: 1124
Influence of approaches in CFD Solvers on Performance Prediction in Screw Compressors
Ahmed Kovacevic¹, Sham Rane¹, Nikola Stosic¹, Yu Jiang², Sam Lowry², Michal Furmanczyk²
¹City University London, United Kingdom; ²Simerics, Inc, United States of America
R-13: TRANSIENT SYSTEM MODELING | STEW 214 A&B
Session Chair: Pradeep Bansal, Oak Ridge National Laboratory

ID: 2472
Extremum Seeking Control of Hybrid Ground Source Heat Pump System
Bin Hu1, Yaoyu Li1, Baojie Mu1, Shaojie Wang2, John E. Seem4, Feng Cao3
1University of Texas at Dallas, United States of America; 2Climate Master, Inc., Oklahoma City, OK 73179, USA; 3Xi’an Jiaotong University, China; 4High Altitude Trading, Inc., Jackson, WY 83001, USA

ID: 2264
Modelica-based Heat Pump Model for Transient and Steady-State Simulation Using Low-GWP Refrigerants
Jiazhen Ling1, Hongtao Qiao1,2, Abdullah Alabdulkarem1, Vikrant Aute1, Reinhard Radermacher1
1University of Maryland, College Park, United States of America; 2King Saud University, PO Box 800, Riyadh 11421, Saudi Arabia

ID: 2244
Dynamic Performance Of A Compression Thermoelastic Cooling Air-Conditioner Under Cyclic Operation Mode
Suxin Qian, Jiazhen Ling, Yunho Hwang, Reinhard Radermacher
University of Maryland, College Park, United States of America

ID: 2266
Steady State And Transient Validation Of Heat Pumps Using Alternative Lower-GWP Refrigerants
Viren Bhanot1, Daniel Bacellar1, Jiazhen Ling1, Abdullah Alabdulkarem1,2, Vikrant Aute1, Reinhard Radermacher1
1University of Maryland, College Park, United States of America; 2King Saud University, Riyadh, Saudi Arabia

ID: 2593
A Comparison of Transient Heat-Pump Cycle Simulations with Homogeneous and Heterogeneous Flow Models
Christopher R. Laughman
Mitsubishi Electric Research Laboratories, United States of America

ID: 2603
Transient Exergy Destruction Analysis of a Vapor Compression System
Neera Jain, Andrew Alleyne
University of Illinois at Urbana-Champaign, United States of America

R-14: CAPILLARY TUBES, VORTEX & TWO-PHASE EXPANDERS | STEW 214 C&D
Session Chair: TBD

ID: 2655
An Experimental Comparison of the Refrigerant Flow through Adiabatic and Non-Adiabatic Helical Capillary Tubes
Puya Javidmand2, Masoud Zareh1
1Department of Mechanical and Aerospace Engineering, Science and Research Branch; 2Wichita State University, United States of America

ID: 2664
Numerical Model of Capillary Tubes: Enhanced Performance and Study of Non-Adiabatic Effects
Nicolas Ablanque, Carles Oliet, Joaquim Rigola, Carlos David Pérez-Segarra
Centre Tecnològic de Transferència de Calor (CTTC), Universitat Politècnica de Catalunya (UPC)
ID: 2521
Experimental study of the Couple Characteristics of the Refrigerants and Vortex Tube
Nian Li¹, Zheng Wang², Xiaohong Han¹, Guangming Chen¹
¹Institute of Refrigeration & Cryogenics, Zhejiang University, Hangzhou, China; ²Department of Mechanical Engineering, University College London, London, WC1E 7JE, UK

ID: 2169
Design Of A Turgo Two-Phase Turbine Runner
Youssef Aaraj¹, Sorina Mortada¹, Denis Clodic¹, Maroun Nemer²
¹EREI; ²Mines Paristech

ID: 2531
Design and Setup of the Micro-Turboexpander Transcritical CO2 System
Y. Hou¹,², C.H. Liu¹, J.L. Ma¹, J. Cao¹, S.T. Chen¹
¹School of Energy and Power Engineering, Xi’an Jiaotong University, China; ²State Key Laboratory of Multiphase Flow in Power Engineering, Xi’an Jiaotong University, China

ID: 2261
Non-Adiabatic Capillary Tubes In Cycle Simulations
Martin Heimel, Erwin Berger, Stefan Posch, Martin Eichinger, Raimund Almbauer
Graz University of Technology, Austria

ID: 2193
A Fresh Look At Vortex Tubes Used As Expansion Device In Vapor Compression Systems
Muhammad Mohiuddin¹, Stefan Elbel¹,²
¹University of Illinois at Urbana-Champaign, USA; ²Creative Thermal Solutions, USA

R-15: AIR-SIDE HEAT TRANSFER, FOULING & FROSTING | STEW 218 A&B
Session Chair: TBD

ID: 2109
Thermodynamic Optimization of Tube-Fin Evaporators Operating under Frosting Conditions
Rafael S. Ribeiro, Christian J. L. Hermes
UFPR, Brazil

ID: 2140
Experimental Study of Fouling Performance of Air Conditioning System with Microchannel Heat Exchanger
Bo Xu¹, Junye Shi¹, Ying Wang¹, Jiangping Chen¹, Feng Li², Dong Li²
¹Shanghai Jiao Tong University, China; ²SICHUAN CHANGHONG ELECTRIC CO.,LTD, China

ID: 2143
Visualization of Evaporatively Cooled Heat Exchanger Wetted Fin Area
Sahil Popli, Hoseong Lee, Yunho Hwang, Reinhard Radermacher
CEEE, University of Maryland, United States of America

ID: 2195
Experimental Evaluation Of The Frost Formation
Yusuke Tashiro, Mamoru Hamada
Mitsubishi Electric, Japan

ID: 2240
CFD-Based Correlation Development For Air Side Performance Of Finned And Finless Tube Heat Exchangers With Small Diameter Tubes
Daniel Bacellar, Vikrant Aute, Reinhard Radermacher
University of Maryland, College Park, United States of America
ID: 2466
The Effects Of Surface Characteristics On Liquid Behaviors Of Fins During Frosting And Defrosting Processes
Feng Wang, Cai Hua Liang, Ming Tao Yang, Xiao Song Zhang
School of Energy and Environment, Southeast University, Nanjing, Jiangsu, P R China

R-16: AUTOMATED FAULT DETECTION AND DIAGNOSTICS | STEW 218 C&D
Session Chair: Mikhail Gorbounov, United Technologies Research Center
ID: 2584
Virtual Power Consumption and Cooling Capacity Virtual Sensors for Rooftop Units
Howard Cheung, James E. Braun
Purdue University, United States of America

ID: 2310
Development of Economic Impact Models for RTU Economizer Faults
Andrew L. Hjortland, James E. Braun
Purdue University - Herrick Laboratory, United States of America

ID: 2496
HVAC System Cloud Based Diagnostics Model
Fadi M. Alsaleem, Robert Abiprojo, Jeff Arensmeier, Gregg Hemmelgarn
Emerson Climate Technologies, United States of America

ID: 2605
Evaluating Fault Detection and Diagnostics Tools with Simulations of Multiple Vapor Compression Systems
David P. Yuill, Howard Cheung, James E. Braun
Purdue University, United States of America

ID: 2606
Validation of a Fault-Modeling Equipped Vapor Compression System Model Using a Fault Detection and Diagnostics Evaluation Tool
David P. Yuill, Howard Cheung, James E. Braun
Purdue University, United States of America

ID: 2628
Kalman filter-based FDD for an Air Handling Unit (AHU)
Timothy Mulumba, Afshin Afshari, Luiz Augusto Friedrich
Masdar Institute, United Arab Emirates

B-08: FACADES & LIGHTING | STEW 310
Session Chair: Francesca Cappelletti, University of Venice
ID: 3259
Fluiglass - Façade Elements for Active Solar Control for High-Rise Buildings
Anne Liebold¹, Daniel Oppliger¹, Daniel Gstöhl², Tobias Menzi¹, Stefan Bertsch¹
¹Interstate University of Applied Sciences of Technology Buchs, Institute for Energy-Systems IES, Switzerland;
²University of Lichtenstein, Institute for architecture and spatial development

ID: 3339
A Global Method for Efficient Synchronized Shading Control Using the “Effective Daylight” Concept
Hui Shen, Athanasios Tzempelikos
Purdue University, United States of America
ID: 3437  
**Effects of Fixed and Motorized Window Louvers on the Daylighting and Thermal Performance of Open-Plan Office Buildings**  
*Yuxiang Chen, Samson Yip, Andreas Athienitis*  
Concordia University, Canada

ID: 3389  
**Solar Optical Properties of Roller Shades: Modeling Approaches, Measured Results and Impact on Energy Use and Visual Comfort**  
*Ying-Chieh Chan¹,², Athanasios Tzempelikos¹,², Brent Protzman³*  
¹School of Civil Engineering, Purdue University, 550 Stadium Mall Dr., West Lafayette, IN 47907 USA; ²Ray W. Herrick Laboratories, School of Mechanical Engineering, Purdue University, 140 S. Martin Jischke Dr., West Lafayette, IN 47907, USA; ³Lutron Electronics Co. Inc., 7200 Suter Rd., Coopersburg, PA 18036 USA

ID: 3646  
**Development of a Façade Retrofit Performance Guide Using Climate-based Analysis Including Dynamic Façade Systems**  
*Hui Shen¹,², Ying-Chieh Chan¹,², Athanasios Tzempelikos¹,²*  
¹School of Civil Engineering, Purdue University, West Lafayette IN USA; ²Herrick Labs, Purdue University, West Lafayette IN USA

ID: 3155  
**Feasibility Study of Zero Carbon Domestic Building in the UK**  
*Jie Zhu*  
The University of Nottingham, United Kingdom

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**C-09: NOISE & VIBRATION | STEW 314**  
**Session Chair:** Stuart Bolton, *Purdue University*

ID: 1133  
**Diesel-Driven Compressor Torque Pulse Measurement in a Transport Refrigeration Unit**  
*Young Chan Ma¹, Cody Kleinboehl², Lars Sjoholm³, David Secrist⁴*  
¹Ingersoll Rand / Thermo King, United States of America; ²Ingersoll Rand / Thermo King, United States of America; ³Ingersoll Rand / Thermo King, United States of America; ⁴Ingersoll Rand / Thermo King, United States of America

ID: 1146  
**Muffler Design for a Refrigerator Compressor**  
*Vamshidhar Done¹, Venkatesham Balide², Bhaskar Tamma¹, Kunal Soni¹, Subhrajit Dey¹, Shruti Angadi¹, Vishal G P²*  
¹General Electric Global Research Center, Bangalore, India; ²Department of Mechanical Engineering, IIT Hyderabad, India

ID: 1199  
**Analysis And Experimental Validation Of Structure-Borne Noise From Acoustic Enclosure Of Compressor**  
*Satish Konderao Deshmukh¹, Onkar Sunil Madhekar²*  
¹Kirloskar Pneumatic Company Limited, India; ²Sinhgad College Of Engineering, Pune, India

ID: 1216  
**Theoretical Analysis of Revolving Vane Compressor Vibrations**  
*Kuan Thai Aw, Kim Tiow Ooi*  
Nanyang Technological University, Singapore
ID: 1307
Acoustic Improvements for a New Generation of Variable Speed Compressor
Carlos Eduardo Vendrami, Claudio de Pellegrini, Marcos Akira Hattori, Douglas Climaco
Embraco - Research & Development, Brazil

ID: 1320
Noise Characteristics Improvements for a New Generation of Variable Capacity Compressor using Linear Motor Technology
Claudio de Pellegrini¹, Alexandre Schroeder¹, Otavio Santini¹, Carlos Eduardo Vendrami¹, Arcanjo Lenzi², Olavo Silva²
¹Embraco - Research and Development, Brazil; ²Federal University of Santa Catarina, Brazil

C-10: COMPRESSOR MODELING II | STEW 322
Session Chair: Patricia Davies, Purdue University

ID: 1241
Methods of fluid properties for compressible refrigerant CFD analysis
Scott Branch
Ingersoll Rand - Trane, United States of America

ID: 1260
Comparison and Validation of Semi-empirical Compressor Models for Cycle Simulation Application
Stefan Posch¹, Erwin Berger¹, Martin Heimel¹, Raimund Almbauer¹, Axel Stupnik², Hans-Peter Schögler²
¹Graz University of Technology, Austria; ²ACC – Austria GmbH, Fürstenfeld

ID: 1358
Numerical Investigation Of The Leakage Flows In Twin Screw Compressor Rotors
Maria Pascu, David Buckney, Manoj Heiyanthudu Wage, Graeme Cook
Howden Compressors Ltd, United Kingdom

ID: 1295
Fatigue Prediction of the Discharge Pipe in Reciprocating Compressor
Jung-Hyoun Kim, Dae-II Kwon, Jeong-Bae Lee, Jong-Soo Noh, Seong-Woo Park, Un-Seop Lee
Samsung Electronics, Korea, Republic of South Korea

ID: 1242
A Semi-Empirical Prediction Model for the Discharge Line Temperature of Hermetic Compressors
David Myszka¹, Chen Guan¹, Andrew Murray¹, Thomas Hodapp²
¹University of Dayton, United States of America; ²Emerson Climate Technologies

ID: 1416
Discharge Tube Design For Reciprocating Compressor – How To Do It Right The First Time And Quickly
Marcos Giovani Dropa de Bortoli, Fabio Medeiros de Lima, Julio Cesar Silva
Embraco, Brazil
R-17: ADVANCED CONTROLS | STEW 214 A&B
Session Chair: TBD

ID: 2125
An energy-saving control strategy for VRF and VAV combined air conditioning system in heating mode
Yonghua Zhu, Xinqiao Jin, Zhimin Du, Xing Fang, Bo Fan
Shanghai Jiao Tong University, China

ID: 2154
A PD Law Based Fuzzy Logic Control Strategy For Simultaneous Control Of Indoor Temperature And
Humidity Using A Variable Speed Direct Expansion Air Conditioner
Zhao Li¹, Xiang Guo Xu², Shi Ming Deng¹, Dong Mei Pan¹
¹Department of Building Services Engineering, The Hong Kong Polytechnic University, Hong Kong S.A.R. (China); ²Institute of Refrigeration and Cryogenics, Zhejiang University, Hangzhou, China

ID: 2273
Realtime Optimization of MPC Setpoints using Time-Varying Extremum Seeking Control for Vapor
Compression Machines
Walter K. Weiss¹, Daniel J. Burns², Martin Guay¹
¹Queen's University, Canada; ²Mitsubishi Electric Research Labs, United States of America

ID: 2343
The Performance Matching of Inverter Room Air Conditioner
Bo Huang, Xiyuan Zhu, Hong Tao, Da Shi
SHANG HITACHI, China,

ID: 2613
Model Predictive Control of Variable Refrigerant Flow Systems
Neera Jain, Daniel J. Burns, Stefano Di Cairano, Christopher R. Laughman, Scott A. Bortoff
Mitsubishi Electric Research Labs, United States of America

ID: 2508
Multi-variable Extremum Seeking Control for Mini-split Air-conditioning System
Yan Xiao¹, Yaoyu Li¹, John E. Seem²
¹The University of Texas at Dallas, United States of America; ²Johnson Controls Inc., United States of America

R-18: HEAT PUMPS III | STEW 214 C&D
Session Chair: Dan Fisher, Oklahoma State University

ID: 2359
The Effects of Gas Cooler Inlet Pressure on System Performance in Heat Pump Tumble Dryers
Serkan Erdem, Cenk Onan, Hasan Alpay Heperkan, Derya Burcu Özkan
Yildiz Technical University, Turkey

ID: 2360
The Effects of Fin Spacing and Tube Outer Diameter of Evaporator on System Performance in Heat Pump
Tumble Dryers
Cenk Onan, Serkan Erdem, Derya Burcu Özkan, Hasan Alpay Heperkan
Yildiz Technical University, Turkey

ID: 2142
Heat Pump with Two Heat Sources on Different Temperature Levels
Stefan Bertsch, Michael Uhlmann, Andres Heldstab
NTB University of Applied Sciences in Buchs, Switzerland
ID: 2431
Linked Modelling of Heat Pump Water Heater Vapor Compression System and Water Tank
Tejas Shah, Predrag S. Hrnjak
Air Conditioning and Refrigeration Center, University of Illinois at Urbana-Champaign, United States of America

ID: 2701
Experimental Study of a CO2 Thermal Battery for Simultaneous Cooling and Heating Applications
Tianwei Wang¹, Supriya Dharkar², Orkan Kurtulus³, Eckhard A. Groll², Kazuaki Yazawa³
¹Purdue University Calumet, United States of America; ²Purdue University, United States of America; ³Birck Nanotechnology Center, Purdue University, West Lafayette, Indiana, USA

ID: 2257
Analysis of a Data Center Using Liquid-Liquid CO2 Heat Pump for Simultaneous Cooling and Heating
Supriya Dharkar¹, Orkan Kurtulus¹, Eckhard A. Groll¹, Kazuaki Yazawa¹
¹Mechanical Engineering, Purdue University, West Lafayette, Indiana, USA; ²Birck Nanotechnology Center, Purdue University, West Lafayette, Indiana, USA

R-19: HEAT EXCHANGER ANALYSIS | STEW 218 A&B
Session Chair: Gerhard Schmitz, Hamburg University of Technology

ID: 2203
Design Optimization of Variable Geometry Microchannel Heat Exchangers
Long Huang, Vikrant Aute, Reinhard Radermacher
University of Maryland, College Park, United States of America

ID: 2555
Innovative Minichannel Condensers and Evaporators for Air Conditioning Equipment
Davide Del Col¹, Marco Rossato¹, Stefano Bernardinello², Luca Zaramella¹
¹University of Padova, Italy; ²Blue Box – Swegon, Italy

ID: 2587
Experimental Analysis Of Twisted Shaped Spot Evaporators At High Heat Fluxes
Tobias Knipping¹, Michael Arnemann², Ullrich Hesse³, Frank Humpfer¹
¹Karlsruhe UAS, Institute of Materials and Processes (IMP), Germany; ²Karlsruhe UAS, Institute of refrigeration, air conditioning and environmental technology (IKKU), Germany; ³TU Dresden, BITZER Chair of Refrigeration-, Cryo- and Compressor Technology, Germany

ID: 2570
New Copper-based Heat Exchangers for Alternative Refrigerants
Yoram Shabtay¹, John Black², Frank Kraft³
¹Heat Transfer Technologies LLC, United States of America; ²Metal Scope LLC, United States of America; ³Ohio University, United States of America

ID: 2355
Performance Comparison Of Round Tubes Finned Heat Exchangers And Macro Micro-Channel Heat Exchangers In A Low Capacity Heat Pump
Assaad Zoughaib¹, Sorina Mortada¹, Florence Khayat¹, Cédric Teuillieres², Christine Arzano-Daurelle²
¹Center for Energy Efficiency of Systems, Mines Paris-Tech; ²EDF R&D, France
B-09: BUILDING SIMULATION & ENERGY MODELING II | STEW 218 C&D
Session Chair: Panagiota Karava, Purdue University

ID: 3480
Development Of Sets Of Simplified Building Models For Building Simulation
Giovanni Pernigotto¹, Alessandro Prada², Andrea Gasparella², Jan L. M. Hensen³
¹University of Padova, Italy; ²Free University of Bozen-Bolzano, Italy; ³Eindhoven University of Technology, The Netherlands

ID: 3385
Informed Building Retrofit based on Simulation and Data Analysis
Dong Luo, Tiejun Wu, Jinliang Wang, Timothy Wagner
United Technologies Research Center, United States of America

ID: 3561
Uncertainty Analysis of a Heavily Instrumented Building at Different Scales of Simulation
George Ostrouchov¹, Joshua New¹, Jibonananda Sanyal¹, Pragneshkumar Patel³
¹Oak Ridge National Laboratory, United States of America; ³University of Tennessee in Knoxville

ID: 3571
A Heuristic Supply Air Temperature Reset Strategy for VAV Systems Employing Variable-Capacity DX Cooling Equipment
Jie Cai, James E. Braun
Purdue University, United States of America

ID: 3552
Enhancing the Energy and Non-Energy Performance of Existing Buildings: a Multi-Objective Approach
Paola Penna¹, Alessandro Prada¹, Francesca Cappelletti², Andrea Gasparella¹
¹Free University of Bozen-Bolzano, Italy; ²University IUAV of Venice, Italy

ID: 3263
Validation of retrofit analysis simulation tool: Lessons learned
Marija Trcka, Jose Miguel Pasini, Stella Maris Oggianu
United Technologies Research Center, United States of America

ID: 3583
Energy Simulation And Optimized Retrofit Practices Applied To A Real Dwelling
Giulia Marinello¹, Stephen L. Caskey¹, Eric J. Bowler², Eckhard A. Groll¹
¹Purdue University, United States of America; ²Whirlpool Corporation, United States of America

C-11: TRIBOLOGY & LUBRICATION I | STEW 310
Session Chair: Jack Elson, Emerson Climate Technologies

ID: 1563
Source Identification and In Situ Quantification of Oil-Refrigerant Mist Generation by Discharge Valve Opening Process
Augusto Jose Pereira Zimmermann¹, Predrag S. Hrnjak¹²
¹University of Illinois at Urbana-Champaign, United States of America; ²CTS, Urbana, IL, USA

ID: 1569
Visualization of the Opening Process of a Discharge Reed Valve in the Presence of Oil
Augusto Jose Pereira Zimmermann¹, Predrag S. Hrnjak¹²
¹University of Illinois at Urbana-Champaign, United States of America; ²CTS, Urbana-IL, USA
ID: 1565
Optimization of EHL Lubrication Performance in Thrust Slide-Bearings of Scroll Compressors
Noriaki Ishii¹, Takuma Tsuji², Keiko Anami³, Charles W. Knisely⁴, Katsunori Kurihara¹, Tatsuya Oku², Kiyoshi Sawai³, Hirofumi Yoshida⁶, Hiroaki Nakai⁶
¹Osaka Electro-Communication University, Japan; ²Mayekawa MFG. Co., Ltd.; ³Ashikaga Institute of Technology, Japan; ⁴Bucknell University, USA; ⁵Hiroshima Institute of Technology, Japan; ⁶Appliances Company, Panasonic Corporation

ID: 1248
Numerical and Experimental Examination for Oil Pump System Using a Simplified Uncoupled Simulation Model
Mauricio Pereira Tada, Thiago Hoffmann, Paulo Rogério Carrara Couto, Adilson Luiz Manke, Marcos Giovani Dropa de Bortoli
Embraco, Brazil

ID: 1354
Experimental Study About An Amount Of Oil Charge On Electric Driven Scroll Compressor For Electric Vehicle
Donglim Nam¹, Poyoung Lee¹, Geonho Lee², Yunki Kwon², Jinho Lee³
¹Doowon Heavy Industrial, Korea, Republic of (South Korea); ²Doowon Technical University College, Republic of (South Korea); ³Yonsei University, Republic of South Korea

ID: 1110
Hydrodynamic Lubrication Analysis of Eccentric Bearing in Rotary Compressor
Xingbiao Zhou, Bo Jiang, Shuangjian Liang
Guangdong Meizhi Compressor Co. Ltd., China

ID: 1288
Selection of a refrigeration oil for the R32 refrigerant and evaluation of the compressor reliability
Masaru Tanaka, Hideki Matsuura, Shigeharu Taira, Akinori Nakai
DAIKIN INDUSTRIES,LTD., Japan

C-12: RECIPROCATING COMPRESSORS | STEW 314
Session Chair: Craig Bradshaw, Torad Engineering, LLC

ID: 1181
Influence of Shell Volume on Pressure Pulsations in a Hermetic Reciprocating Compressor
Keith Adam Novak
Ingersoll Rand - Trane, United States of America

ID: 1182
Influence of Cylinder Bore Volume on Pressure Pulsations in a Hermetic Reciprocating Compressor
Keith Adam Novak
Ingersoll Rand - Trane, United States of America

ID: 1151
Friction Model Development for a reciprocating compressor
Parag Mantri, Bhavesh Kachhia, Bhaskar Tamma, Aditya Bhakta
GE, India

ID: 1163
Flexible-body Dynamics Simulation of Crankshaft Torsional Vibration System
Junming Cheng¹, Zhan Liu², Binyan Yu³, Qin Tan⁴, Quanke Feng⁵
¹School of Energy and Power Engineering,Xi’an Jiaotong University, Xi’an, P.R.China; ²School of Energy and Power Engineering,Xi’an Jiaotong University, Xi’an, P.R.China; ³School of Energy and Power Engineering,Xi’an Jiaotong University, Xi’an, P.R.China; ⁴School of Energy and Power Engineering,Xi’an Jiaotong University, Xi’an, P.R.China; ⁵School of Energy and Power Engineering,Xi’an Jiaotong University, Xi’an,P.R.China
ID: 1267
Numerical Investigation of the Gas Leakage through the Piston-Cylinder Clearance of Reciprocating Compressors
Sérgio Koerich Lohn, Evandro Luiz Lange Pereira
Embraco, Brazil

ID: 1367
Development of a Lumped-Parameter Model for Hermetic Reciprocating Compressor with Thermal-Electrical Coupling
Thiago Dutra, Cesar J. Deschamps
POLO/ Federal University of Santa Catarina, Brazil

ID: 1479
Optimization Rotor Hole to Reduce Force in Cold Pressing Rotor into Crankshaft
Chengguo Chu, Jun Luo, Shoufei Wu, Xiaoli Liu
Jiaxipera Compressor Co., Ltd., China

C-13: COMPRESSOR MODELING III | STEW 322
Session Chair: Jason Hugenroth, InvenTherm, LLC

ID: 1662
Numerical Analysis of Suction Mufflers
Joaquim Rigola¹, Joan López¹, Giorgos Papakokkinos¹, Oriol Lehmkuhl², Assensi Oliva¹
¹Heat and Mass Transfer Technological Center – Universitat Politècnica de Catalunya, Terrassa (Barcelona), Spain;
²Termo Fluids S.L., Sabadell (Barcelona), Spain

ID: 1659
Fluid-Structure Interaction of a Reed Type Valve Subjected to Piston Displacement
Olga Estruch¹, Oriol Lehmkuhl¹², Joaquim Rigola¹, Carles David Pérez-Segarra¹
¹Heat and Mass Transfer Technological Center – Polytechnic University of Catalonia, Terrassa (Barcelona), Spain;
²Termo Fluids S.L., Sabadell (Barcelona), Spain

ID: 1412
Predicting the Suction Gas Superheating in Reciprocating Compressors
Jonatas Ferreira Lacerda¹, Celso Kenzo Takemori²
¹Tecumseh Products Company, Brazil; ²Vibroacústica Development and Research, Brazil

ID: 1589
Equivalent Linkages of Compressor Mechanisms
Hubert Bukac
Little Dynamics, Inc., United States of America

ID: 1548
3-D Transient CFD Model For A Rolling Piston Compressor With A Dynamic Reed Valve
Hui Ding, Haiyang Gao
Simerics Inc., United States of America

ID: 1336
Investigation Of Compressor Heat Dispersion Model
Da Shi, Hong Tao, Min Yang
Shanghai Hitachi Electronic Appliances, China

ID: 1274
Tubulence Modelling Evaluation for Reciprocating Compressor Simulation
Tadeu Tonheiro Rodrigues
Embraco - Research and Development, Brazil
R-20: TRANSPORTATION AIR CONDITIONING | STEW 214 A&B

Session Chair: Ulli Hesse, Technische Universität Dresden

ID: 2116
Energy saving measures for automotive air conditioning (AC) system in the tropics
Alison Subiantoro¹, Kim Tiow Ooi², Ulrich Stimming¹
¹TUM CREATE, Singapore; ²School of Mechanical and Aerospace Engineering, Nanyang Technological University, Singapore

ID: 2399
Effect of Refrigerant Charge, Compressor Speed and Air Flow Through the Evaporator on the Performance of an Automotive Air Conditioning System
Santanu Prasad Datta, Prasanta Kumar Das, Siddhartha Mukhopadhyay
Indian Institute of Technology Kharagpur, India

ID: 2510
Optimization Of A Main Engine Driven Roof Top Bus Air-Conditioning System
Srinivasa Yenneti, Gurudath Nayak, Premchand Reddy Punuru
Ingersoll Rand, India

ID: 2410
Comparison between HFC-134a and Alternative Refrigerants in Mobile Air Conditioners using the GREEN-MAC-LCCP® Model
Stella Papasavva¹, William Moomaw²
¹Stella Papasavva Consulting; ²Professor of International Environmental Policy at the Fletcher School, Tufts University

R-21: HEAT DRIVEN REFRIGERATION SYSTEMS | STEW 214 C&D

Session Chair: Vikant Aute, University of Maryland

ID: 2194
Analysis on Parameters of Regeneration Subsystem in Liquid Desiccant Dehumidification Systems
Min Tu¹,³, Chengqin Ren², Huanxin Cheng³, Haijia Lin¹
¹Refrigeration Institute of Gree Electric Appliances, Inc. of Zhuhai, China; ²College of Mechanical and Vehicle Engineering, Hunan University, China; ³School of Energy and Power Engineering, Huazhong University of Science and Technology, China

ID: 2207
Experimental Study On Bubble Absorber With Multiple Tangential Nozzles
Santosh Kumar Panda, Mani Annamalai
IIT MADRAS, India

ID: 2429
Optimized Performance of One-Bed Adsorption Cooling System
Takahiko Miyazaki¹,³, Ibrahim I. El-Sharkawy¹,³, Bidyut Baran Saha²,³, Shigeru Koyama¹,³
¹Faculty of Engineering Sciences, Kyushu University, Japan; ²Green Asia Education Center, Kyushu University, Japan; ³International Institute for Carbon-Neutral Energy Research, Kyushu University, Japan
ID: 2440
Transient Performance of a Liquid Desiccant Solar Regenerator
Habtamu Tafesse Gezahegn, Subhash Chandra Mullick, Sanjeev Jain
Indian Institute of Technology, Delhi, India

ID: 2456
Thermodynamic Analysis of Adsorption Refrigeration Cycles Using Parent and Surface Treated Maxsorb III/Ethanol Pairs
Kutub Uddin¹, Ibrahim I. El-Sharkawy¹², Takahiko Miyazaki¹, Bidyut Baran Saha¹, Shigeru Koyama¹
¹Kyushu University, Japan; ²Mansura University, Egypt

R-22: HEAT & MASS TRANSFER PERFORMANCE & ANALYSIS | STEW 218 A&B
Session Chair: Bo Shen, Oak Ridge National Laboratory

ID: 2432
Mass Diffusion Coefficient Of Desiccants For Dehumidification Applications: Silica Aerogels And Silica Aerogel Coatings On Metal Foams
Kashif Nawaz¹, Shelly J. Schmidt², Anthony M. Jacobi¹
¹Department of Mechanical Science and Engineering, University of Illinois at Urbana Champaign, United States of America; ²Department of Food Science and Human Nutrition, University of Illinois at Urbana Champaign, United States of America

ID: 2198
Impact of Dehumidification Modelling on the Performance Prediction for Minichannel Evaporators
Abdelrahman Hussein Hassan, Santiago Martinez-Ballester, José Gonzálvez-Maciá
Institute for Energy Engineering, Universitat Politècnica de València, Spain

ID: 2205
Fin Performance Analysis for Microchannel Heat Exchangers Under Dry, Wet and Partial Wet Conditions
Long Huang, Daniel Bacellar, Vikrant Aute, Reinhard Radermacher
University of Maryland, College Park, United States of America

ID: 2445
Absorption Heat Transfer Performance of Ammonia-Water Mixture in 116 Tube Mini-Channel Heat Exchanger
Dennis Marijn van de Bor, Carlos A. Infante Ferreira
TU Delft, Netherlands

ID: 2567
Designing And Testing An Air-PCM Heat Exchanger For Building Ventilation Application Coupled To Energy Storage
Bertrand Dechesne¹, Samuel Gendebien¹, Jonathan Martens², Vincent Lemort¹
¹University of Liège, Aerospace and Mechanical Engineering Department, Thermodynamics Laboratory; ²Greencom development s.c.r.l

ID: 2405
The Effect Of Type-III Antifreeze Proteins (AFPs) On CO2 Hydrate Slurry Formation
Hongxia Zhou, Carlos A. Infante Ferreira
Delft University of Technology, Netherlands
B-10: MODEL PREDICTIVE CONTROLS II  |  STEW 218 C&D  
Session Chair: Bill Hutzel, Purdue University

ID: 3610  
Simulation of Model-based Predictive Control Applied to a Solar-assisted Cold Climate Heat Pump System  
Jose Candanedo, Vahid R. Dehkordi  
CanmetENERGY-Varennes, NRCan, Canada

ID: 3641  
Modeling And Predictive Control Of High Performance Buildings With Distributed Energy Generation And Thermal Storage  
Siwei Li¹, Panagiota Karava²  
¹Purdue University, School of Civil Engineering, West Lafayette, Indiana, USA; ²Purdue University, School of Civil Engineering and Division of Construction Engineering and Management, West Lafayette, Indiana, USA

ID: 3379  
Model Predictive Control for Central Plant Optimization with Thermal Energy Storage  
Michael J. Wenzel, Robert D. Turney, Kirk H. Drees  
Johnson Controls Inc., United States of America

ID: 3314  
Smart Grid Energy Flexible Buildings Through The Use Of Heat Pumps In The Belgian Context  
Emeline Georges¹, Gabrielle Masy², Clara Verheist³, Vincent Lemort¹, Philippe André¹  
¹University of Liège; ²Haute Ecole de la Province de Liège; ³E

ID: 3268  
Energy Consequences of Non-optimal Heat Pump Parameterization  
Alberto Tejeda¹, Anamaria Milu², Philippe Riviere¹, Dominique Marchio¹  
¹CES Mines Paristech, France; ²EDF R&D, France

ID: 3611  
Distributed Model Predictive Control for building HVAC systems: A Case Study  
Vamsi Kalyan Putta, Donghun Kim, Jie Cai, Jianghai Hu, James E. Braun  
Purdue University, United States of America

C-14: TRIBOLOGY LUBRICATION II  |  STEW 310  
Session Chair: Kirill Igniatiev, Emerson Climate Technologies

ID: 1562  
Hydrodynamic-Pressure-Induced Elastic Deformation of Thrust Slide-Bearings in Scroll Compressors and Oil Film Pressure Increase Due to Oil Envelopment  
Noriaki Ishii¹, Takuma Tsuji², Keiko Anami³, Charles W. Knisely⁴, Tatsuya Oku², Koichi Nokiyama¹, Kiyoshi Sawai³, Hirofumi Yoshida⁶, Hiroaki Nakai⁶  
¹Osaka Electro-Communication University, Japan; ²Mayekawa MFG. Co., Ltd.; ³Ashikaga Institute of Technology, Japan; ⁴Bucknell University, USA; ⁵Hiroshima Institute of Technology, Japan; ⁶Appliances Company, Panasonic Corporation

ID: 1507  
Effect of Lubricant-Refrigerant Mixture Properties on Compressor Efficiencies  
Scott S. Wujek¹, Chad D. Bowers¹, Paul Okarma¹, Roberto A. Urrego², Edward T. Hessell², Travis L. Benanti²  
¹Creative Thermal Solutions; ²Chemtura Corporation
ID: 1296
Mixed Lubrication Analysis of Vane Sliding Surface in Rotary Compressor Mechanisms
Yasutaka Ito1, Hitoshi Hattori1, Kazuhiko Miura2
1Corporate Research & Development Center, Toshiba Corporation, Japan; 2Toshiba Carrier Corporation

ID: 1485
Investigation On Premature Failure Of the Self-lubricated Piston Rings in Oil-free Compressor
Jinfeng Chen, Bin Zhao, Jianmei Feng, Xueyuan Peng
Xi’an Jiaotong University, China

ID: 1348
Oil Management Solutions For Manifolding Scroll Compressors For Refrigeration Systems
Ying Dong1, Leping Zhang2, Serdar Suindykov3, Kang Zheng4, Peng Liu5
1Danfoss, China; 2Danfoss, China; 3Danfoss, China; 4Danfoss, China; 5Danfoss, China

ID: 1201
An Investigation on the Bearing Design and Friction Characteristics of a Hermetic Reciprocating Compressor
Ahmet Refik Ozdemir1, Erhan Kasapoğlu2, Bilgin Hacıoğlu2, Mustafa Duyar3
1Arcelik A.S. Research and Development Center, Istanbul, Turkey; 2Arcelik A.S. Compressor Plant, Eskisehir, Turkey; 3Anova Mühendislik., Istanbul, Turkey

C-15: EXPANDERS | STEW 314
Session Chair: Vincent Lemort, University of Liege

ID: 1446
Analysis of a Rotating Spool Expander for Organic Rankine Cycles in Heat Recovery Applications
Abhinav Krishna1, Craig R. Bradshaw2, Eckhard A. Groll1
1Purdue University, United States of America; 2Torad Engineering LLC, Alpharetta, GA

ID: 1538
Multi-Variable Optimisation Of Wet Vapour Organic Rankine Cycles With Twin-Screw Expanders
Matthew Read, Ian Smith, Nikola Stosic
City University London, United Kingdom

ID: 1506
Comprehensive Model of a Single-screw Expander for ORC-Systems
Davide Ziviani1, Ian Bell2, Martijn van den Broek1, Michel De Paepe1
1Ghent University, Belgium; 2University of Liege

ID: 1129
Introduction of the Novel Cross Vane Expander-Compressor Unit for Vapour Compression Cycle
Ken Shaun Yap1,2, Kim Tiow Ooi1, Anutosh Chakraborty1
1Nanyang Technological University, Singapore, Singapore; 2TUM CREATE

ID: 1478
Analysis of a Twin Screw Expander for ORC Systems using Computational Fluid Dynamics with a Real Gas Model
Iva Papes, Joris Degroote, Jan Vierendeels
Ghent University, Belgium
ID: 1449
Application-Oriented Design and Theoretical Investigation of a Screw-Type Steam Expander
Manuel Grieb, Andreas Bruemmer
TU Dortmund University, Germany

C-16: COMPRESSOR MODELING IV | STEW 322
Session Chair: TBD

ID: 1300
Accounting for Local Thermal Distortions in a Chamber Model for Twin Screw Compressors
David Buckney¹, Ahmed Kovacevic², Nikola Stosic²
¹Howden Compressors Ltd., United Kingdom; ²City University London, Centre for Positive Displacement Compressor Technology, London, UK

ID: 1237
Investigation Of The Parameters Affecting Crankshaft And Rotor Interference Fit
Nazım Arda Eyyuboğlu
Arçelik A.Ş. Compressor Plant, Turkey

ID: 1374
A NTU-Based Model to Estimate Suction Superheating In Scroll Compressors
Marco C. Diniz, Cesar J. Deschamps
POLO / UFSC, Brazil

ID: 1372
A Neural Network to Predict the Temperature Distribution in Hermetic Refrigeration Compressors
Ernane Silva, Marco C. Diniz, Cesar J. Deschamps
POLO / UFSC, Brazil

ID: 1414
Wave Propagation in a Radial Duct with Mean Swirling Flow
Yujun Leng, Sanford Fleeter
Purdue University, West Lafayette, United States of America

ID: 1701
Implementation of Sobol’s Method of Global Sensitivity Analysis to a Compressor Simulation Model
Nasir Bilal
Purdue University, United States of America
R-23: AIR CONDITIONING FOR HYBRID & ELECTRIC VEHICLES | STEW 214 A&B

Session Chair: Stefan Elbel, Creative Thermal Solutions, Inc.

ID: 2526
Comparison and Evaluation of a New Innovative Drive Concept for the Air Conditioning Compressor of Electric Vehicles
Joerg Aurich, Rico Baumgart, Christoph Danzer, Jan Ackermann
IAV GmbH, Germany

ID: 2202
Experimental Comparison of the Refrigerant Reservoir Position in a Primary Loop Refrigerant Cycle with Optimal Operation
Jan Christoph Menken¹, Thomas Weustenfeld¹, Jürgen Köhler²
¹AUDI AG, Germany; ²Technische Universität Braunschweig, Institut für Thermodynamik, Germany

ID: 2509
Mobile Heat Pump Exploration Using R445A and R744
Andrew Musser, Predrag S. Hrnjak
Creative Thermal Solutions, Inc., United States of America

ID: 2386
Chances and Limitations of a Hybrid Refrigerant System for Vehicle Air Conditioning
Ullrich Hesse
Technische Universität Dresden, Germany

R-24: ORGANIC RANKINE CYCLE | STEW 214 C&D

Session Chair: Tim Wagner, United Technologies Research Center

ID: 2402
Experimental investigation of a Scroll unit used as a compressor and as an expander in a Heat Pump/ORC reversible unit
Olivier Dumont, Sylvain Quoilin, Vincent Lemort
ULg, Belgium

ID: 2190
Brandon J. Woodland, James E. Braun, Eckhard A. Groll, W. Travis Horton
Herrick Laboratories, United States of America

ID: 2330
Combined Rankin and Organic Rankin Cycles with Screw Expanders
Yan Tang
Kaishan Compressor, China

ID: 2546
Comparing R1233zd and R245fa For Low Temperature ORC Applications
Bala V. Datla¹, Joost J. Brasz²
¹Verdicorp, Tallahassee, FL; ²Syracuse Turbo Machinery LLC, Syracuse, NY

ID: 2550
HFO-1336mzz-Z: High Temperature Chemical Stability and Use as A Working Fluid in Organic Rankine Cycles
Konstantinos Kontomaris
DuPont Fluorochemicals, United States of America
R-25: FLOW & POOL BOILING | STEW 218 A&B

Session Chair: Yunho Hwang, University of Maryland

ID: 2220
Experimental Analysis of R134a and R1234ze(E) Flow Boiling Inside a Roll Bond Evaporator
Giulia Righetti, Claudio Zilio, Giovanni A. Longo
University of Padova, Department of Management and Engineering, I-36100 Vicenza, Italy

ID: 2334
Theoretical and Experimental Research on CO2 Electrical Heating Pool Boiling Heat Transfer Outside a Horizontal Tube
Lan Li, Shengchun Liu, Jinghong Ning
Tianjin University of Commerce, China

ID: 2332
Two Phase Flow Boiling Heat Transfer and Pressure Drop of Two New LGWP Developmental Refrigerants Alternative to R-410A
Jeremy Ryan Smith, Lorenzo Cremaschi
School of Mechanical and Aerospace Engineering, Oklahoma State University

ID: 2392
A General Correlation to Predict The Flow Boiling Heat Transfer of R410A in Macro/Mini Channels
Nguyen-Ba Chien¹, Pham-Quang Vu¹, Kwang-II Choi², Jong-Taek Oh²
¹Graduate School, Chonnam National University, San 96-1, Dunduk-Dong, Yeosu, Chonnam 550-749, Republic of Korea; ²Department of Refrigeration and Air Conditioning Engineering, Chonnam National University, San 96-1, Dunduk-Dong, Yeosu, Chonnam 550-749, Republic of Korea

ID: 2383
Hydrodynamic Modeling of Flow Reversal in Micro-channel Flow Boiling
Milagros Belmares, Young-Gil Park
University of Texas-Pan American, United States of America

ID: 2460
R1234yf FLOW BOILING HEAT TRANSFER INSIDE A 3.4 mm ID MICROFIN TUBE
Andrea Diani¹, Mariana Tiemi Tamura², Simone Mancin¹, Jader Barbosa², Luisa Rossetto¹
¹University of Padova, Dept. of Industrial Engineering, Padova, 35131, Italy; ²Departamento de Engenharia Mecânica, Universidade Federal de Santa Catarina, Florianópolis, SC, Brazil

B-11: BUILDING ENVELOPE SYSTEMS & COMFORT | STEW 218 C&D

Session Chair: Pengfei Li, UTRC

ID: 3654
A Review of Thermal Analysis on Novel Roofing Systems
Yuanpei Song, Ming Qu
Purdue University, West Lafayette, IN, US
ID: 3523
Selection of Representative Buildings through Preliminary Cluster Analysis
Rigoberto Arambula Lara¹, Francesca Cappelletti², Piercarlo Romagnoni², Andrea Gasparella¹
¹Free University of Bozen/Bolzano, Italy; ²University IUAV of Venezia, Italy

ID: 3575
Daylight Glare Probability Measurements And Correlation With Indoor Illuminances In A Full-Scale Office
With Dynamic Shading Controls
Jason Konstantzos¹,², Athanasios Tzempelikos¹,²
¹School of Civil Engineering, Purdue University, 550 Stadium Mall Dr., West Lafayette, IN 47907 USA; ²Ray W. Herrick Laboratories, School of Mechanical Engineering, Purdue University, 140 S. Martin Jischke Dr., West Lafayette, IN 47907, USA

ID: 3629
Study of Unsteady State Thermal Characteristics of Homogeneous and Composite Walls of Building and
Insulating Materials for Passive Cooling
Ashok Babu Puttaranga Setty Talanki, S Saboor
National Institute of Technology Karnataka, India

ID: 3183
Thermal Performance and Moisture Accumulation of Mechanical Pipe Insulation Systems Operating at
Below Ambient Temperature in Wet Conditions with Moisture Ingress
Weiwei Zhu, Shanshan Cai, Lorenzo Cremaschi
Oklahoma State University, United States of America

ID: 3139
Experimental Evaluation on Fire Protection of Load Bearing Steel Structures with Coatings Commonly used
in China
Xue Dong, W.K. Chow, Nai-Kong Fong
The Hong Kong Polytechnic University, Hong Kong S.A.R. China

C-17: ALTERNATIVE REFRIGERANTS | STEW 310
Session Chair: Samuel Yana Motta, Honeywell – Buffalo Research Laboratory

ID: 1390
Lower GWP Refrigerants Compared to R404A for Economizer Style Compressors
Lars Sjoholm¹, Cody Kleinboehl³, Young Chan Ma²
¹Ingersoll Rand / Thermo King, United States of America; ²Ingersoll Rand / Thermo King, United States of America;
³Ingersoll Rand / Thermo King, United States of America

ID: 1491
Solution Properties Of Polyol Ester Lubricants Designed For Use With R-32 And Related Low GWP
Refrigerant Blends
Roberto Arturo Urrego Leon, Travis L. Benanti, Edward T. Hessell
Chemtura Corporation, United States of America

ID: 1595
Evaluation of methods to decrease the discharge temperature of R32 scroll compressor
Baolong Wang¹, Minghong Yang¹, Philippe Dewitte², Leping Zhang³, Wenxing Shi¹
¹Department of Building and Science, Tsinghua University, Beijing, 100084, China; ²Danfoss Commercial
Compressor, BP331-ZI de Reyrieux Trevoux Cedex, F-01603, France; ³Danfoss (Tianjin) Ltd, Commercial Scroll
Compressor, Tianjin, China
Effects of Low Suction Temperature on the Boil-off Gas compressor
Bin Zhao, Bin Du, Xueyuan Peng, Jianmei Feng
Xi’an JiaoTong University, China

Research and Development of R290 Less Oil Rotary Compressor
Bin Gao, Canyu Qian, Zhenhua Chen, Shuangjian Liang
Guangdong Meizhi Compressor Co., Ltd., China

Development of High Efficiency Swing Compressor for R32 Refrigerant
Yuichi Yamamoto, Takehiro Kanayama, Kenichi Yuasa, Hideki Matsuura
DAIKIN INDUSTRIES LTD., Japan

C-18: SCREW COMPRESSORS | STEW 314
Session Chair: Jack Sauls, Ingersoll Rand - The Trane Company

The Selection Of Screw Rotor Geometry With Compressor Speed As A Design Variable
Matt Cambio, Gordy Powell
Ingersoll Rand, United States of America

Modelling and Experimental Investigation of Unsteady Behaviour of a Screw Compressor Plant
Ekatarina Chukanova, Nikola Stosic, Ahmed Kovacevic
City University London, United Kingdom

Study of Multiphase Flow at the Suction of Screw Compressor
Mohammad Arjeneh, Ahmed Kovacevic, Manolis Gavaises, Sham Rane
City University London, United Kingdom

Experimental Studies of The Multi-cylinders Compound Profile Meshing Pair
Rui Huang, Ting Li, Jian Li, Feilong Liu, Quanke Feng
Xi’an JiaoTong University, China

Non-contacting Seals in Screw Compressors
Michael Beinert, Jan Hauser
GHH RAND Schraubenkompressoren GmbH - Ingersoll Rand Industrial Technologies, Germany

Experiment Study of a Water Injected Twin Screw Compressor for Mechanical Vapor Compression System
Jiubing Shen, Hao Tang, Zhen Zhang, Ziwen Xing
Xi’an JiaoTong University, China
Global Sensitivity Analysis of a Multi-Cylinder Automotive Reciprocating Compressor
Nasir Bilal
Purdue University, United States of America

Design Optimization of the Suction Manifold of a Reciprocating Compressor Using Sensitivity Analysis
Nasir Bilal
Purdue University, United States of America

Investigation of Flow Losses Through Discharge Line of Household Type Refrigerator Compressors
Ismail Yesilaydin1, L. Berrin Erbay2, Cemil Inan1
1Arcelik A.S. Refrigerator & Compressor Plants, Turkey; 2Eskisehir Osmangazi University, Turkey

New Version of the Universal Modeling for Centrifugal Compressor Gas Dynamic Design
Kristina Soldatova1, Galerkin Yuri2, Drozdov Aleksandr3
1Sankt-Peterburg State Polytechnical University, Russian Federation; 2Sankt-Peterburg State Polytechnical University, Russian Federation; 3Sankt-Peterburg State Polytechnical University, Russian Federation

The Finite Element Analysis of the Deflection of the Crankshaft of Rotary Compressor
Lingchao Kong, Liping Ren, Jia Xu, Yusheng Hu
Gree Electric Appliances, Inc. of Zhuhai, China

Modeling of Rolling-Piston Compressors with Special Attention to the Suction and Discharge Processes
Ricardo D. Brancher, Cesar J. Deschamps
Federal University of Santa Catarina, Brazil
**R-26: AIR CONDITIONER PERFORMANCE & ANALYSIS | STEW 214 A&B**

**Session Chair:** Gerhard Schmitz, Hamburg University of Technology

**ID: 2121**

*The Evaluation method of HVAC System’s operation performance based on Energy Flow Analysis and DEA*

Xing Fang¹, Xinqiao Jin², Bo Fan³, Yonghua Zhu⁴

¹Shanghai Jiao Tong University, China; ²Shanghai Jiao Tong University, China; ³Shanghai Jiao Tong University, China; ⁴Shanghai Jiao Tong University, China,

**ID: 2185**

*Experimental Study on Match for Indoor and Outdoor Heat Exchanger of Residential Air-conditioner*

Xiaoping Tu¹, Xiangfei Liang², Rong Zhuang³

¹Chinese National Engineering Research Center of Green Refrigeration Equipment, Zhuhai City, Guangdong Province, P. R. China; ²Chinese National Engineering Research Center of Green Refrigeration Equipment, Zhuhai City, Guangdong Province, P. R. China; ³Gree Electric Appliances Inc. of Zhuhai, Refrigeration Institute, Zhuhai City, Guangdong Province, P. R. China

**ID: 2277**

*Impact of Charge Degradation on the Life Cycle Climate Performance of a Residential Air-Conditioning System*

Mohamed Beshr¹, Vikrant Aute¹, Omar Abdelaziz³, Brian Fricke³, Reinhard Radermacher¹

¹University of Maryland, United States of America; ²Oak Ridge National Laboratory, USA

**ID: 2566**

*Refrigeration Modeling Components in OpenStudio*

Mark Adams¹, Jibonananda Sanyal¹, Brian Fricke¹, Kyle Benne²

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

**ID: 2438**

*Estimation of Vapor Quality at Compressor Suction of Air Conditioner*

Kazuhiro Endoh

Hitachi, Ltd., Japan

**R-27: SUPERMARKET & BEVERAGE REFRIGERATION SYSTEMS | STEW 214 C&D**

**Session Chair:** Van Baxter, Oak Ridge National Laboratory

**ID: 2126**

*Comparing COP Optimization with Maximizing the Coefficient of System Performance for Refrigeration Systems in Supermarkets*

Martin R. Braun¹, Stephen B. M. Beck¹, Haşim Altan²

¹The University of Sheffield, Sheffield, United Kingdom; ²The British University in Dubai, Dubai Academic International City, United Arab Emirates

**ID: 2441**

*Waste Heat Dehumidification in CO2 Booster Supermarket*

Brian Fricke, Vishaldeep Sharma, Pradeep Bansal

ORNL, United States of America
ID: 2467
Refrigerant Charge Reduction In Small Commercial Refrigeration Systems
Lingyan Jiang¹, Predrag S. Hrnjak²
¹ACRC, U of Illinois, United States of America; ²ACRC, U of Illinois, CTS

ID: 2192
Successful Design, Implementation, And Validation Of Transcritical R744 Technology For Beverage Display Coolers
Stefan Elbel¹,², Yadira Padilla Fuentes¹, Chad D. Bowers¹, Predrag S. Hrnjak¹,²
¹Creative Thermal Solutions, USA; ²University of Illinois at Urbana-Champaign, USA

ID: 2457
Reducing Display Bottle Cooler Energy Consumption Using PCM As Active Thermal Storage
Marcel van Beek, Hans de Jong
Re/genT BV, Netherlands

ID: 2458
Extremely Low Refrigerant Charge Beverage Display Cooler Technology Using Propane
Yadira Padilla Fuentes¹, Stefan Elbel¹,², Predrag S. Hrnjak¹,²
¹Creative Thermal Solutions, USA; ²University of Illinois at Urbana-Champaign, USA

ID: 2473
Study On Energy Conservation And Carbon Dioxide Emission Reduction Of Commercial Display Refrigerator Of Supermarket Utilizing The Exhaust Heat From The Novel Environment-Friendly Dispersed Power
Tatsuya Shikano³, Sangchul Bae¹, Masafumi Katsuta², Tomohiro Anamizu³
¹Environmental Research Institute/Waseda University, Japan; ²Department of Modern Mechanical Engineering/Waseda University, Japan; ³Graduate School of Modern Mechanical Engineering/Waseda University, Japan

R-28: REFRIGERANT & LUBRICANT DESIGN & ANALYSIS I | STEW 218 A&B
Session Chair: Bernhard Vetsch, Interstate University of Applied Sciences, Buchs

ID: 2502
Refrigerant and Lubricant Mass Distribution in a Convertible Split System Residential Air-Conditioner
Scott S. Wujek¹, Chad D. Bowers¹, Joshua W. Powell¹, Roberto A. Urrego², Edward T. Hessell², Travis L. Benanti²
¹Creative Thermal Solutions; ²Chemtura Corporation

ID: 2499
Effects of Refrigerant-Lubricant Combinations on the Energy Efficiency of a Convertible Split-System Residential Air-Conditioner
Travis L. Benanti¹, Edward T. Hessell¹, Roberto A. Urrego¹, Scott S. Wujek², Chad D. Bowers², Stefan Elbel²
¹Chemtura Corporation; ²Creative Thermal Solutions

ID: 2413
Lubricants Optimized for use with R-32 and Related Low GWP Refrigerant Blends
Edward T. Hessell, Roberto A. Urrego, Travis L. Benanti
Chemtura Corporation, United States of America

ID: 2331
Lubricant Development To Meet Lower GWP Refrigerant Challenges
Joseph A. Karnaz
CPI Engineering, United States of America
ID: 2351
Development of refrigeration oil for use with R32
Hitoshi Takahashi, Katsuya Takigawa, Takeshi Okido
JX Nippon Oil & Energy Corporation, Japan

ID: 2673
Development of PVE Refrigeration Lubricants for R32
Tomoya Matsumoto, Yasuhiro Kawaguchi
Idemitsu Kosan Co., Ltd., Japan

R-29: VAPOUR COMPRESSION CYCLE ENHANCEMENTS II | STEW 218 C&D
Session Chair: Kevin Mercer, Carrier Corp - United Technologies

ID: 2439
Control Method Of Circulating Refrigerant Amount For Heat Pump System
Jin Woo Yoo, Dong Ho Kim, Mo Se Kim, Min Soo Kim
Division of WCU Multiscale Mechanical Design, School of Mechanical & Aerospace Engineering, Seoul National University, Korea, Republic of South Korea

ID: 2269
Long Term Viability of HFO-1234yf in Stationary Refrigeration Systems – Multi-Year Evaluation of Refrigerant, Lubricant, and Compressor Performance in a Domestic Freezer
Charles C. Allgood, Bianca Hydutsky, Thomas J. Leck, Joshua Hughes
DuPont Refrigerants, United States of America

ID: 2598
Thermodynamic Analysis and Optimization of Cascade Condensing Temperature of a CO2(R744)/R404A Cascade Refrigeration System
Baris Yilmaz1, Nasuh Erdonmez1, Mustafa Kemal Sevindir2, Ebru Mancuhan1
1Marmara University, Turkey; 2Yildiz Technical University, Turkey

ID: 2363
Improvements in Refrigerant Flow Distribution Using an Expansion Valve with Integrated Distributor
Chad D. Bowers1, Dave Wrocklage2, Stefan Elbel1,3, Predrag S. Hrnjak1,3
1Creative Thermal Solutions, United States of America; 2Parker-Hannifin Sporlan Division; 3University of Illinois

ID: 2387
Potential Of Controlling Subcooling In Residential A/C System
Lihan Xu1, Predrag S. Hrnjak2
1Air Conditioning and Refrigeration Center, University of Illinois at Urbana-Champaign, United States of America; 2Creative Thermal Solution

ID: 2427
Seasonal Applicability of Refrigerant Release Technology in Room Air Conditioner
Baolong Wang, Wenjie Ji, Linjun Han, Wenxing Shi
Tsinghua University,

R-30: ADVANCED HEAT EXCHANGER MANUFACTURING & SURFACE TREATMENTS | STEW 310
Session Chair: Carlos Infante Ferreira, Delft University of Technology

ID: 2158
Self-healing, Slippery Surfaces for HVAC&R Systems
Rong Yu, Anthony M. Jacobi
University of Illinois at Urbana-Champaign, United States of America
ID: 2252
Enhanced Heat Exchanger with Offset Spine Fin Design
Michael Kempiak, Brent Junge
General Electric, United States of America

ID: 2397
Nanoparticle Deposition by Boiling on Aluminum Surfaces to Enhance Wettability
Feini Zhang, Anthony M. Jacobi
University of Illinois at Urbana Champaign, United States of America

ID: 2411
Using Surface Wettability to Impact the Frost Properties and Defrosting Effectiveness of a Metallic Heat Transfer Surface
Nicholas Trust, Catherine Puleo, Edgar Caraballo, Andrew Sommers
1Dept. of Mechanical and Manufacturing Engineering, Miami University, Oxford, OH 45056; 2Dept. of Chemical, Paper, and Biomedical Engineering, Miami University, Oxford, OH 45056

ID: 2461
Influence of Surface Morphology on Wetting Behaviors of Liquid Metal during Aluminum Heat Exchanger Fabrication
Hui Zhao, Stefan Elbel, Predrag S. Hrnjak
Creative Thermal Solutions, Inc., United States of America

C-20: EFFICIENCY ENHANCEMENTS | STEW 314
Session Chair: Michael Perevozchikov, Emerson Climate Technologies

ID: 1219
On The Strategies Towards Isothermal Gas Compression And Expansion
Mahbod Heidari, Sylvain Lemofouet, Alfred Rufer
LEI, EPFL, Switzerland

ID: 1168
Compressor Efficiency Improvement By Reducing Heat Transfer
Sophie Colmek
Tecumseh Europe, France

ID: 1469
Volumetric Efficiency Improvement by Overflow in Rolling Piston Compressor
Wen Wang, Gensheng Huang, Yilin Zhang
Shanghai Jiao Tong University, China

ID: 1649
An Experimental Study of a Multi-port Vapor Injected Scroll Compressor
Yuanpei Song, Bin Yang, Eckhard A. Groll, James E. Braun, W. Travis Horton
Purdue University, West Lafayette, IN, US

ID: 1346
Performance Improvement of a High Side Scroll Compressor by Thrust Surface Oil Groove
Hyun-Jin Kim, Yong-Hee Kim, Young-Sung Lee, Un-Seop Lee, Jeong-Bae Lee, Yang-Hee Cho
1Incheon National University, Korea, Republic of (South Korea); 2Compressor R&D Group, Comp. & Motor Team, Digital Appliances, Samsung Electronics Co. Ltd
ID: 1434
Development of Rotary Compressor for High-efficiency CO2 Heat-pump Hot-Water Supply System
Takeshi Chinen, Hisataka Kato, Masaya Ichihara, Hiroyuki Mizuno
Toshiba Carrier Corporation, Japan

ID: 1262
Theoretical and Experimental Research on The Optimal Displacement Ratio of Rotary Two-Stage Inverter Compressor With Vapor Injection
Huifang Luo, Lingao Lu, Huijun Wei, Ouxiang Yang, Xumin Zhao
Gree Electric Appliances, Inc. of Zhuhai, China

C-21: VALVES I | STEW 206
Session Chair: Margaret Mathison, Marquette University

ID: 1217
Experimental Analysis of the Fluid Structure Interaction in a Suction Valve Model
José Luiz Gasche, Danilo Martins Arantes, Thiago Andreotti
Unesp-Ilha Solteira

ID: 1543
Efficiency Improvement of Rotary Compressor by Improving the Discharge path through Simulation
Siva Rama Krishna Bolloju, Vamsi Tiruveedhula, Naveen Munnangi, Koteswara Rao Vaddadi, Pratap Reddy M
Tecumseh Products India Private Limited, India

ID: 1144
An Approach Towards Reed Valve Geometry Design
Sandeep Dhar, Bhaskar Tamma, Aditya Bhakta, Murali Krishna
GE Global Research Bangalore, India

ID: 1159
Effective Flow And Force Areas Of Discharge Valve In A Rotary Compressor
Qin Tan, Zhan Liu, Junming Cheng, Quanke Feng
Xi’an Jiaotong University, China,

ID: 1209
Dynamic Performance of Valve in Reciprocating Compressor Used Stepless Capacity Regulation System
Guangbin Liu, Yuanyang Zhao, Le Wang, Qichao Yang, Bin Tang, Liansheng Li
State key laboratory for compressor technology, Hefei General Machinery Research Institute, People’s Republic of China

ID: 1408
Selection of Flapper Valve Steel for High Efficient Compressor
Mathias Hareland¹, Anders Hoel¹, Stefan Jonsson², David Liang², Guocai Chai¹,³
R-31: NOISE & ACOUSTICS | STEW 214 A&B
Session Chair: Stuart Bolton, Purdue University
ID: 2127
An Experimental Study on the Capillary Tube Flow and its Effect on the Acoustic Behavior of Household Refrigerators
Daniel Hartmann, Cláudio Melo
Federal University of Santa Catarina, Brazil

ID: 2141
Noise Generation in Household Refrigerators: An Experimental Study on fluid Borne Noise
Carlos Boabaid Neto, Cláudio Melo, Arcanjo Lenzi, André L. G. Caetano
Federal University of Santa Catarina, Brazil

ID: 2312
Shape Optimization of a Compressor Supporting Plate Based on Vibration Modes
Olavo M. Silva, Thiago M. Guesser, Igor M. Guesser, Claudio de Pellegrini, Carlos E. Vendrami, Arcanjo Lenzi
1Federal University of Santa Catarina, Brazil; 2EMBRACO, Research & Development Group, Brazil

ID: 2160
Pressure Loss Analysis of the Perforated Tube Attenuator
Zhan Liu, Qin Tan, Jming Cheng, Xling Yu, Quanke Feng
Xi’an Jiaotong university, China

R-32: DOMESTIC REFRIGERATION & FREEZER ANALYSIS | STEW 214 C&D
Session Chair: Pradeep Bansal, Oak Ridge National Laboratory
ID: 2119
Prediction of Evaporator Frosting in Household Refrigerators Subjected to Periodic Door Opening
Bruno N. Borges, Cláudio Melo, Christian J. L. Hermes
1Federal University of Santa Catarina; 2Federla University of Paraná

ID: 2228
Visualization of the Refrigerant Flow at the Capillary Tube Inlet of a Household Refrigeration System
Santiago Martinez-Ballester, Laetitia Bardoulet, Alessandro Pisano, José M. Bordes-Costa, José M. Corberán
1Institute for Energy Engineering, Universitat Politècnica de València, Spain; 2Institut Catholique des Arts et Métiers, France

ID: 2128
Numerical and Experimental Analysis of Heat and Mass Transfer Processes on Water Trays in Household Refrigerators
Adriano Francisco Ronzoni, Cláudio Melo, Carolin Ries
1Federal University of Santa Catarina, Brazil; 2Europaische Studienakademie Kalte

ID: 2663
Dynamic Simulation of Household Refrigerators: Numerical Model and Experimental Comparison
Nicolas Ablanque, Carles Oliet, Joaquim Rigola, Oriol Lehmkuhl, Assensi Oliva
1Centre Tecnològic de Transferència de Calor (CTTC), Universitat Politècnica de Catalunya (UPC); 2Termo Fluids S.L., Barcelona, Spain

ID: 2189
Aspects of Household Cooling Technology
Matthias Mrzyglod, Stefan Holzer
BSH Bosch und Siemens Hausgeräte GmbH, Germany
R-33: REFRIGERANT & MATERIAL SAFETY & RELIABILITY | STEW 218 A&B

Session Chair: Matt Vargo, Carrier Corp - United Technologies

ID: 2669
Chemical Compatibility of High-Performance Engineering Thermoplastics in Compressor Environments
Vandita Pai-Paranjape
SABIC, United States of America

ID: 2459
Leakage of Mildly Flammable Refrigerants into a Room
Hiroaki Okamoto, Tatsuhito Hattori, Chaobin Dang, Eiji Hihara
The university of Tokyo, Japan

ID: 2132
Materials Compatibility of HVACR System Materials with Low GWP Refrigerants
Julie A. Majurin, William Gilles, Steven J. Staats
Trane/Ingersoll Rand, United States of America

ID: 2564
Design of Accelerated Fatigue Tests for Flame Free Refrigeration Fittings
Michael Wilson¹, Chad D. Bowers²
¹Cerro Flow Products, United States of America; ²Creative Thermal Soluations, United States of America

ID: 2591
Thermal Decomposition of Lower-GWP Refrigerants
Makoto Ito, Chaobin Dang, Eiji Hihara
The University of Tokyo, Japan

ID: 2421
Fire Hazards of Refrigerants in Air Conditioning Control System
Y.W. Ng, W.K. Chow
The Hong Kong Polytechnic University, Hong Kong S.A.R. China

ID: 2672
Autoignition of R32 and R410 Refrigerant Mixtures with Lubricating Oil
Adam Boussouf¹, Vivien R. Lecoustre¹, Hao Li², Robert By³, Peter B. Sunderland¹
¹Department of Fire Protection Engineering, University of Maryland, College Park MD USA; ²Goodman Manufacturing, Houston TX USA

R-34: VAPOR COMPRESSION CYCLE ENHANCEMENTS III | STEW 218 C&D

Session Chair: Daniel Fisher, Oklahoma State University

ID: 2454
Experimental Research On Gas Injection High Temperature Heat Pump With An Economizer
Yongning He, Lei Jin, Feng Cao, Shengkun Chen
Xi’an Jiaotong University, China

ID: 2187
Experimental and Numerical Study on the Performance of R410A Liquid Recirculation Cycles with and without Ejectors
Neal Lawrence¹, Stefan Elbel¹²
¹University of Illinois at Urbana-Champaign; ²Creative Thermal Solutions, Inc.

ID: 2157
A Low Carbon Defrost System
Thomas William Davies, Robin Campbell
Frigesco Ltd, United Kingdom
ID: 2375
Experimental Investigation of Multi-Functional Variable Refrigerant Flow System
Xiaojie Lin¹, Hoseong Lee¹, Yunho Hwang¹, Reinhard Radermacher¹, Saikee Oh²
¹University of Maryland, United States of America; ²LG Electronics, Republic of Korea

ID: 2519
Effect of Height Difference on The Performance of Two-phase Thermosyphon Loop Used in Air-conditioning System
Penglei Zhang¹, Xianting Li², Sheng Shang³, Wenxing Shi³, Baolong Wang⁴
¹Tsinghua University, China; ²Tsinghua University, China; ³Tsinghua University, China; ⁴Tsinghua University, China; ⁵Tsinghua University, China

R-35: REFRIGERANT & LUBRICANT DESIGN & ANALYSIS II | STEW 310
Session Chair: Samuel Yana Motta, Honeywell International, Inc.

ID: 2398
Refrigerant and Lubricant Charge in AC Heat Exchangers: Experimentally Validated Model
Shenghan Jin, Predrag S. Hrnjak
University of Illinois, United States of America

ID: 2279
Modeling of Lubricant Effects in a Microchannel Type Condenser
Andrea A. M. Bigi, Lorenzo Cremaschi, Daniel E. Fisher
Oklahoma State University, United States of America

ID: 2148
An Experimentally Validated Model for Microchannel Heat Exchanger Incorporating Lubricant Effect
Huize Li, Predrag S. Hrnjak
University of Illinois at Urbana-Champaign, United States of America

ID: 2325
Measurements of Oil Retention in a Microchannel Condenser for AC Systems
Ardiyansyah S. Yatim¹, Lorenzo Cremaschi¹, Daniel E. Fisher¹
¹Oklahoma State University, Stillwater, OK, USA; ²University of Indonesia, Depok, West Java, Indonesia

ID: 2170
Nanofluids Application as Nanolubricants in Heat Pumps Systems
Laura Fedele¹, Laura Colla¹, Mauro Scattolini¹, Filippo Bellomare², Sergio Bobbo¹
¹Istituto per le Tecnologie della Costruzione, Consiglio Nazionale delle Ricerche, Corso Stati Uniti 4, 35131 Padova, Italy; ²Industrial Engineering Department, University of Padova, Via Venezia 1, 35131 Padova, Italy

ID: 2347
Haitao Hu¹, Hao Peng², Guoliang Ding³, Yongxin Zheng³, Yifeng Gao³, Ji Song³
¹Shanghai Jiao Tong University, China; ²Key Lab of HVAC, Beijing University of Civil Engineering and Architecture, China; ³International Copper Association Shanghai Office, China

C-22: TESTING & EVALUATION | STEW 314
Session Chair: TBD

ID: 1549
Modeling of a Hot Gas Bypass Test Block for Centrifugal Compressors
Paul D. Gessler, Margaret M. Mathison, Anthony J. Bowman
Marquette University, United States of America
Thursday • 1:00-3:00 PM

ID: 1539
Design of a Compressor Load Stand Capable of Supplying Two-Phase Refrigerant at Two Intermediate Pressures
Rui Gu, Margaret M. Mathison
Marquette University, United States of America

ID: 1650
Assessing the Quality of Experimental Data with Gaussian Processes: Example with an Injection Scroll Compressor
Sylvain Quoilin¹, Jessica Schrouff²
¹Energy Systems Research Unit B49, University of Liège, Campus du Sart Tilman, B-4000 Liège, Belgique; ²Cyclotron Research Centre B30, University of Liège, Campus du Sart Tilman B-4000 Liège, Belgique

ID: 1130
Study on Gravity Independence of Compressor Performance for Space-borne Vapor Compression Heat Pump
Xia Chen, Yuting Wu, Gang Liu, Rui Ma, Chongfang Ma
Key Laboratory of Enhanced Heat Transfer and Energy Conservation, Ministry of Education of China, Key Laboratory of Heat Transfer and Energy Conversion, Beijing Municipality, Beijing University of Technology, Beijing 100124, China

ID: 1290
Performance Measurement of Revolving Vane Compressor
Kok Ming Tan¹, Wei Chong Choo¹, Michael Chee¹, Ken Law¹, Ismail Iswan¹, Kim Tiow Ooi²
¹SANDEN INTERNATIONAL SINGAPORE PTE LTD, SINGAPORE; ²NANYANG TECHNOLOGICAL UNIVERSITY, SINGAPORE

ID: 1376
Experimental Analysis of Refrigerant Flow in Small Clearances
Ernane Silva, Marcos Rojas-Cárdenas, Cesar J. Deschamps
POLO/UFSC, Brazil

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Session Chair: TBD

ID: 1315
A Comparative Study Of Different Numerical Models For Flapper Valve Motion
Joerg Mayer, Preben Bjerre, Fabian Brune
Secop GmbH, Germany

ID: 1428
Numerical Simulation on the Opening Delay of a Discharge Reed Valve in Compressors
Fumitaka Yoshizumi¹, Yasuhiro Kondoh¹, Takahiro Moroi², Shinji Tamano³, Yohei Morinishi³
¹Toyota Central R&D Labs., Inc.; ²Toyota Industries Co.; ³Nagoya Institute of Technology

ID: 1464
Prediction of Refrigerant Leakage for Discharge Valve System in A Rolling Piston Rotary Compressor
Byung Chae Min, Ki Youl Noh, Jang Sik Yang, Gyung Min Choi, Duck Jool Kim
Pusan National University, Korea, Republic of South Korea

ID: 1324
Correlation Between the Fluid Structure Interaction Method and Experimental Analysis of Bending Stress of a Variable Capacity Compressor Suction Valve
Julio Cesar Silva¹, Eduardo Arceno²
¹Embraco - Research and Development, Brazil; ²Embraco - Research and Development, Brazil
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Welcome Reception  Steak BBQ Dinner  Tuesday Luncheon

Refreshment Breaks

Student Paper Competition Awards