1791 Tullie Circle, N.E./Atlanta, GA 30329
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TC/TG/MTG/TRG MINUTES COVER SHEET

(Minutes of all Meetings are to be distributed to all persons listed below within 60 days following the meeting.)

TC/TG/MTG/TRG No. 8.1 DATE February 2, 2022

TC/TG/MTG/TRG TITLE Positive Displacement Compressors

DATE OF MEETING February 2, 2022 LOCATION Hybrid/ Las Vegas NV

MEMBERS PRESENT	YEAR APPTD	MEMBERS ABSENT	YEAR APPTD	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
Craig Bradshaw		Justin Prosser		See Attachment 1
Joseph Sanchez		Hans-Joachim Kretzschmar		
Alexander Schmig				
James Douglas				
Davide Ziviani				
Eric Berg				
Riley Barta				
Vincent Hwang				
Georgi Kazachki				
Margaret Mathison				
Michael Perevozchikov				

DISTRIBUTION: ***All Members of TC8.1 plus the following:***	
TAC Section Head: Kevin Mercer	SH8.1@ashrae.net
All Committee Liaisons As Shown On TC/TG/MTG/TRG Rosters (Research, Standards, ALI, etc.)	See ASHRAE email alias list for needed addresses.
Mike Vaughn, Manager Of Research & Technical Services	MORTS@ashrae.net

Call to Order – Craig Bradshaw

Craig Bradshaw called the meeting to order at 3:34 PM on Tuesday, February 2, 2022. Attendees were reminded to review the ASHRAE Code of Ethics (https://www.ashrae.org/about/governance/code-of-ethics). They are also listed in

All members and visitors present self-introduced as part of a formal roll call to establish the meeting attendee list. There were 24 total attendees at the meeting. Attendees are listed in ***Attachment 1***.

Establishment of a Quorum – Craig Bradshaw

The Technical Committee consists of 13 voting members, one of which is a non-quorum voting member. 11 of the 12 voting members were present.

Approval of Minutes – Craig Bradshaw

Davide moves that the 2021 Annual meeting minutes (Phoenix Virtual Conference) be approved, Doug Collings seconds. The vote passes: **(8-0-1-2 Chair not Voting)**

Liaison Report

- None

Chair's Report – Craig Bradshaw

- Craig Bradshaw attended the Chair's Breakfast and Training Workshop on Sunday, January 30th.
  - TAC has moved more online and has reduced their involvement time by 50%
  - TAC Transparency
    - There is a form for submitting motions to TAC
    - asktac@ashrae.net
  - TAC launched their "Vision 2022" which is looking at the "silo's" assisting TC's to better align to the ASHRAE strategic plan.
    - Each functional group tasked with aligning to ASHRAE's strategic plan
  - Advice for TC Streamlining
    - TAC has updated MOP
      - TC's asked to reaffirm purpose annually (at annual conference)
    - TC Strategy and planning
      - TC's need to establish leadership/succession plan
    - MBO – manage by objective goals emphasized
    - Reminder to update TC rosters
    - The TC reorganization is complete
      - Continue to investigate new ways to streamline
  - Two new FG's
    - TG2.RAST (Reactive Air and Surface Treatment)
    - MTG.RES (Resilience)
  - ASHRAE continues to encourage additional (Virtual) meetings between Annual and Winter meetings

ASHRAE Standards –James Douglas (Chair)

- **Standard 23.1,** ***Methods of Test for Rating the Performance of Positive Displacement Compressors and Condensing Units that Operate at Subcritical Pressures of the Refrigerants*****.**
  - Standard 23.1-2019 is a published standard.

- **Standard 23.2,** ***Methods of Test for Rating the Performance of Positive Displacement Compressors and Compressor Units that Operate at Supercritical Pressures of the Refrigerants*****.**
  - Standard 23.2-2019 is a published standard.

- **Standard 23,** ***Methods for Performance Testing Positive Displacement Refrigerant Compressors and Compressor Units.***
  - Standard 23-2022, which combines Standards 23.1-2019 and 23.2-2019 into a single standard, and is now published

- **Standard 41.4,** ***Standard Methods for Measurement of Proportion for Lubricant in Liquid Refrigerant.***
  - SSPC 41 Subcommittee 41.4-2015R, chaired by Jim Douglas, will meet virtually in February (2022) to review the test results from the newest lubricant sampling apparatus.
  - Virtual meeting to be held at 1:30PM on Feb 17th.
  - The new method of test is meant to resolve the safety issue with the current standard
    - Intent is to prevent overfilling sample cylinders with liquid refrigerant

- **Standard 41.9,** ***Standard Methods for Refrigerant Mass Flow Measurement Using Calorimeters***.
  - Standard 41.9-2021 is a published standard.
  - Congratulations to Michael Perevozchikov, the 41.9-2018R revision subcommittee chair and the members of his subcommittee.

- **Standard 41.10,** ***Standard Methods for Refrigerant Mass Flow Measurement Using Flowmeters*****. Standard 41.10-2020**
  - Addendum a. is being published and can be downloaded at no cost from the ASHRAE website. Standard 41.10-2020
  - Addendum b. is currently in the queue for public review.
  - New committee formed at the SSPC41 meeting in Las Vegas, NV to begin work on next revision

- At the 2022 ASHRAE Winter Conference in Las Vegas, ASHRAE is asking TC 8.01 to select 1 of 3 alternatives (Revise, Reaffirm, or Withdraw) for periodic maintenance on both Standards 23.1 and 23.2.
  - Jim Douglas makes a motion, "Do you, as a voting member of TC 8.01, approve the withdrawal of Standards 23.1 and 23.2 since Standard 23-2022 is published?" Seconded by Scott
  - The motion passes **(10-0-0-1 Chair not voting)**
  - Craig to follow up with Mark Weber to finish paperwork

Program -- Erik Anderson (Chair)

- Program for the Las Vegas Winter Meeting (See Attachment 3)
  - Sponsor:
    - **Seminar 37: Reduced Order Modeling for HVAC&R Systems and their Components**
      - Wednesday, February 2 8:00 AM – 9:30 AM PST
  - Co-Sponsor:

- **Seminar 31: High Efficiency Variable Speed Pumping Systems and Integration Challenges with Chiller Plant Design**
  - Tuesday, February 1 11:00 AM – 12:30 PM PST

- **Seminar 41: Design Challenges to the Electrification of Heating in Mid to Large Buildings**
  - Wednesday, February 2 11:00 AM – 12:30 PM PST

- **Electrification in Heating and Heat Pumps (Toronto)**
  - Haotian Liu volunteered to chair this seminar
    - Compressors for Heating Applications – Drew Turner (not sure he agreed yet)8.1 to supply speaker
    - Chillers for Heating Applications – (TC 8.2 (Ray supplied) speaker)
    - Chiller-Heater Systems – (TC 8.2 Speaker [ideally Chris Miller])
    - Systems with Thermal Storage – Mark MacCracken
  - Erik Anderson makes motion to sponsor a seminar on electrification in heating and Jim Douglas seconds. The motion passes **(10-0-0-1 Chair not voting)**

  - **Back to the Basics: Air Cooled vs Water Cooled Chillers (Atlanta)**
    - Davide volunteered to chair this seminar
    - Bring this topic up in Toronto to solicit more speaker interest
    - Erik Anderson makes motion to co-sponsor. Jim Douglas seconds. The motion passes **(10-0-0-1 Chair not voting)**

  - **The Deemphasis of Energy Efficiency with Decarbonization (Atlanta)**
    - Needs a chair and speakers
    - Bring this topic up in Toronto to solicit more speaker interest
    - Scott MacBain makes motion to sponsor. Georgi seconds. The motion passes **(10-0-0-1 Chair not voting)**

  - **Back to Basics: Compressor and System Integration Strategies and Modulation (Atlanta)**
    - Davide Volunteered to chair this seminar
    - Craig and Stefan volunteered to speak
    - Intermediate level
    - Discuss types of modulation (Variable Speed, Cycling, Digital Scroll, 2 stage, tandem, etc)
    - Davide makes motion to sponsor. Craig seconds. The motion passes **(10-0-0-1 Chair not voting)**

  - **Compressor Back to Basics**
    - Tabled until Toronto

Research Subcommittee – David Ziviani (Chair)

- New RAC initiatives:
  - Web-based process to be used to submit and track research project documents to reduce inefficiencies and time to approvals
  - Improve RAC feedback to and from TC
  - Improved coordination between MORTS, TC, Research SubCom Chair PMSc Chair, PMS
  - New Research SubCom. Basecamp

- Research budget:
  - Typically, $2.6-2.7M per year. Funds normally covers 12-15 projects per year along with IRG, NIA, GIA
  - Funds collected thus far ~$1.8M and only covers current contract commitments
    - IRG, NIA, GIA are suspended; URPs are stopped for the time being
  - RAC membership SY 2021-2022
    - Chair: Mike Pouchak; Vice-Chair: Omer Abdelaziz; RPS Chair: Paolo Tronville; RAS Chair: William Murphy.
    - Section1: Ahmed Kashif
    - Section2: William Hutzel
    - Section3: Chee Sheng Ow
    - Section4: Natascha Milesi-Ferretti
    - Section5: Jin Wen
    - Section6: Stefan Elbel
    - Section7: James Bogart
    - Section8: Chris Seaton
    - Section9: Roland Charneux
    - Section10: Lorenzo Cremaschi
  - 28 projects in the queue
  - RAC and PubCom have accepted first PTAR and are working to create first Funded publication

- WS 1793 (motor cooling research / thermal conductivity, co-sponsored with TC 8.2)
) Report from MORTS: comments to address & resubmit [Chris Seeton, RAC 2022/01/20 & Res. SubCom. Chair Breakfast 2022/01/31]
- TRP 1879 "Foamability Properties of LGWP Refrigerant and Oil Mixtures" (co-sponsored with TC 3.4)
) Selected bidders and need to check whether they will agree with the original $ amount and WS
- Craig Bradshaw and Davide Ziviani submitted a URP to ASHRAE to support compressor development titled: "The future of compressor technologies for air-conditioning applications with near zero-GWP refrigerants"
) URPs are not supported. Could become a PTAR
- RTAR for co-sponsorship, "Capillary Tube and Short Tube Orifice Performance for Low GWP Refrigerants", sponsored by TC 8.8, seeking co-sponsorship additionally from 8.11, 8.4, 10.7, and 9.3. RTAR is moving forward, but TC8.1 elected not to sponsor.
- [Chris Seeton, RAC 2022/1/20 and Research Chair Breakfast 2022/1/31] 28 projects in the queue
) Currently ~2 years of backlog.
  i) Need to submit RTAR. Budget is an issue and RAC will look to fund low-cost projects.
- Research IDEAS (volunteers):
) Semi-empirical models (Haotian Liu)
  i) Decarbonization: high temperature heat pumps, higher pressure and loads on bearings, thermal conductivity
    (1) Compressors for heating mode (Matt Cambio, Drew Turner, Chris)
    (2) Nilesh Purohit (Honeywell) will get back with some feedback/suggestions
    (3) Degradation at high temperatures (e.g., high water temp. 120C) and pressures; TC3.2 possible co-sponsorship; accelerated life testing; possible degradation of refrigerants

Handbook – Scott MacBain (Chair)

- Chapter 8 – Factory Dehydrating, Charging & Testing
  i) Chris Seaton volunteering for chapter 8 on the next cycle
  ii) Draft I/P, MacBain, Sanchez, Perevozchikov, Submitted 03/31/21
- Chapter 38 and 43 due in 2024

i) 9 volunteers (Ziviani, Bradshaw, Perevozchikov, Heiden, MacBain, Betz, Turner, Hunt, Duda)
ii) Chapters not due until May/July, Scott to set up meetings to start meeting soon

Membership – Jim Douglas (Chair)

- New Secretary – Alex Schmig
- Joe Sanchez, Eric Berg and Craig Bradshaw are rolling off
- Erik Anderson, Chris Seaton, Scott MacBain, and Heinz Juergenson rolling on

- **Leadership Plan: Starting 2022 Annual Meeting**
  - Chair: Davide Ziviani
  - Vice Chair: Alex Schmig
  - Secretary: Open Riley Barta
  - Research Chair: Matt Cambio
  - Other subcommittee chairs are reaffirmed

Website – Eric Berg (Webmaster)

Website is up to date.

Old Business – Craig Bradshaw

None.

New Business - Craig Bradshaw

- We have a basecamp site (2 actually)
- Craig to send out link

Motion to Adjourn

Motion to adjourn by Jim Douglas at 5:31PM

Attachment 1 – Meeting Attendance List

In Person

1. Craig Bradshaw
2. Scott MacBain
3. Davide Ziviani
4. Eric Berg
5. Jethro Medina
6. Jeffery Wilms
7. Chris Seaton
8. Kris Crosby
9. Rony Cherian
10. Amjid Kham
11. Shahzad Yousaf
12. M. Mohsin Tranveer
13. Mazharid Islam
14. Matt Cambio
15. Rick Heiden
16. Stefan Elbel
17. Sugun Tej Inampudi

Online

18. Heinz Jurgensen
19. Erik Anderson
20. Jim Douglas
21. Pat Collins
22. Manfred Burke
23. Margaret Mathison
24. Joe Sanchez
25. Riley Barta
26. Georgi Kazachki
27. Steve Rudy
28. Doug Collings
29. Michael Perevozchikov
30. Nilesh Purohit
31. Alex Schmig

Attachment 2 – Code Of Ethics

ASHRAE Code of Ethics

(Approved by ASHRAE Board of Directors January 31, 2007)

As members of ASHRAE, we pledge to act with honesty, fairness, courtesy, competence, integrity and respect for others in our conduct.

Efforts of the Society, its members, and its bodies shall be directed at all times to enhancing the public health, safety and welfare.

Members and organized bodies of the Society shall be good stewards of the world's resources including energy, natural, human and financial resources

Our products and services shall be offered only in areas where our competence and expertise can satisfy the public need.

We shall act with care and competence in all activities, using and developing up to date knowledge and skills.

We shall avoid real or perceived conflicts of interest whenever possible, and disclose them to affected parties when they do exist.

The confidentiality of business affairs, proprietary information, intellectual property, procedures, and restricted Society discussions and materials shall be respected.

Each member is expected and encouraged to be committed to the code of ethics of his or her own professional or trade association in their nation and area of work.

Activities crossing national and cultural boundaries shall respect the ethical codes of the seat of the principal activity.

Attachment 3: Programs

11:00 AM - 12:30 PM
Seminar 31 (Intermediate)

High Efficiency Variable Speed Pumping Systems and Integration Challenges with Chiller Plant Design

Track: Buildings at 360°

NY PDH G

Room: Augustus III/IV

Sponsor: 8.2 Centrifugal Machines, 6.1 Hydronic and Steam Equipment and Systems , TC 8.1, TC 2.8

Chair: Trent Hunt, Member, Mechanical Products NSW, Salt Lake City, UT

This session overviews variable speed chilled water pumping systems with a technical understanding of how a chiller fits into primary-secondary, variable primary and distributed-variable primary systems. The purpose of this seminar is to present the technical points of each type of pumping system in terms of function and operation while providing an understanding of how a water chiller responds functionally to a variable fluid flow through its evaporator. Presenters provide pointers and suggestions in the form of lessons learned regarding the control and operation of each of these systems.

1. Key Chiller Selection Criteria in a Variable Flow Pumping System
***Rick Heiden, Member**, Trane, La Crosse, WI*

2. Pumps That Know the Flow in Chilled Water Pumping Systems

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***David Lee, P.Eng., Member**, Armstrong Fluid Technology, Toronto, ON, Canada*

3. Lessons Learned in Control and Operation of Primary-Secondary and Distributed Pumping Chilled Water Systems
***Chris Miller, P.E., Member**, P2S, Inc., Long Beach, CA*

4. Key Design Considerations for the Implementation of Variable Primary Chilled Water Pumping Systems
***Brandon Gill, P.E., Member**, Taylor Engineers, Alameda, CA*

8:00 AM - 9:30 AM
Seminar 37 (Intermediate)

Reduced Order Modeling for HVAC&R Systems and their Components

Track: HVAC&R Systems and Equipment

NY PDH

Room: Augustus III/IV

24

Sponsor: 8.1 Positive Displacement Compressors, 8.2 Centrifugal Machines

Chair: Alex Schmig, Member, Trane, La Crosse, WI

This seminar will focus on methods and advantages of simplifying physical analytical models to reduced order models that can be implemented and adapted for use in system models or for standalone analysis. Presenters focus on differing approaches to reduce modeling complexity and decrease computational intensity. Topics explore modulation and extrapolation of reduced order compressor models, uncertainty propagation, adaptability to new low-GWP refrigerants, simulated cycle modeling and validation of reduced order models.

1. Application of Data-Driven Models for Positive Displacement Compressor Mapping
***Davide Ziviani, Ph.D., Member**, Purdue University, West Lafayette, IN*

2. Semi-Empirical Compressor Model Evaluation Considering Modulation and Extrapolation Performance
***Kalen Gabel, Student Member**, Center for Integrated Building Systems, Oklahoma State University, Stillwater, OK*

3. Reduced-Order Modeling and Fast Simulation of Transient Vapor Compression Cycles
***Jiacheng Ma, Student Member**, Purdue University, West Lafayette, IN*

11:00 AM - 12:30 PM

Seminar 41 (Advanced)

Design Challenges to the Electrification of Heating in Mid to Large Buildings

Track: Energy System Integration

Room: Milano I-III

Sponsor: 8.2 Centrifugal Machines, 2.8 Building Environmental Impacts and Sustainability

Chair: Raymond Good Jr., P.E., Member, Danfoss Turbocor Compressors, Inc., Tallahassee, FL

Electrification of heating is becoming an imperative based on a desire to reduce heating with fossil fuels and in some cases to meet codes and standards enacted to reduce greenhouse gas emissions. This seminar introduces some of the basic concepts and driving forces behind the current and developing trend of electrified heating. It also explores some of the technologies available and share specific design and control strategies that make the dream a reality.

1. Fundamentals and Technologies of Heating Electrification

Trent Hunt, Member[1] *and Drew Turner*[2]*, (1)Mechanical Products NSW, Salt Lake City, UT, (2)Danfoss, Baltimore, MD*

2. Time Independent Energy Recovery: The Solution to Large Building Electrification

Brandon Gill, P.E., Member*, Taylor Engineers, Alameda, CA*

3. The Ins and Outs of Heat Recovery Chiller Sizing and Control

Chris Miller, P.E., Member*, P2S, Inc., Long Beach, CA*