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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 June 15, 2021

TC/TG/MTG/TRG TITLE Positive Displacement Compressors

DATE OF MEETING June 15, 2021 LOCATION Virtual (in place of Chicago, IL)

MEMBERS PRESENT	YEAR APPTD	MEMBERS ABSENT	YEAR APPTD	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
Eric Berg	2018	Hans-Joachim Kretzschmar	2017	See Attachment 1
Dr. Craig Bradshaw	2018	Margaret Mathison	2020	
Doug Collings	2018			
Dr. Georgi Kazachki	2020			
Scott MacBain	2017			
Erik Anderson	2017			
John Neel	2017			
Justin Prosser	2020			
Joe Sanchez	2018			
Dr. Davide Ziviani	2020			

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 2:35 PM on Tuesday, June 15, 2021. Attendees were reminded to review the ASHRAE Code of Ethics (https://www.ashrae.org/about/governance/code-of-ethics). They are also listed in ***Attachment 2***.

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 TC presently has 12 voting members including 1 non-quorum voting member. A roll call of the voting members was taken and a quorum was established with 10 of 12 Voting Members present.

Approval of Minutes – Craig Bradshaw

Davide Ziviani moved to accept the winter virtual (Chicago) minutes as distributed and Doug Collings seconded the motion. The motion pssed. **(8-0-1-1, CNV).** (Erik Anderson abstained)

Liaison Report

- None

Chair's Report – Craig Bradshaw

- Craig attended the Virtual Meeting "TC Chairs Breakfast and Training, June 2.
  - A recording of this meeting is located here (after registering):
    - **https://attendee.gotowebinar.com/register/3502042805798895119.**
- It has been updated that we can file a formal motion with TAC through our TC (in lieu of going through the section head)
- The TC reorganization is done and have issued final reports. There have been a handful of mergers.
- ASHRAE is looking for feedback on hybrid (virtual and face to face) format for meeting moving.
  - Discussion ensued regarding pros and cons of having a hybrid meeting such as the subcommittee meeting taking place virtual and the TC taking place face-to-face:
    - There was strong attendance at the virtual joint subcommittee meeting this year (June 7th).
    - Reducing the face-to-face meeting could negatively impact getting new members.
    - Having different structures for winter vs. annual (spring) is possible
    - Regardless, we should advertise on our website the "Zoom" links for any virtual meeting that we have
  - Craig will touch base on what does TC8.2 wants to (maintain a joint / virtual) moving forward
- ASHRAE is encouraging more [virtual] meetings in between the winter and annual.
  - Note: Must provide at least 2 weeks' notice to ASHRAE before having an entire committee meeting.
- ASHRAE Strategic plan 2019 thru 2024 has been extended to 2025.
- Program deadlines are due July 12 for Vegas.

ASHRAE Standards –James Douglas (Chair)

- **Standard 23.1,** ***Methods of Test for Performance Testing Positive Displacement Compressors 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 that Operate at Supercritical Pressures of the Refrigerants*****.** Standard 23.2-2019 is a published standard.

- **Standard 23P,** ***Methods for Performance Testing Positive Displacement Refrigerant Compressors and Compressor Units*****.** Standard 23-2020 combines Standards 23.1-2019 and 23.2-2019 into a single standard.
    - The second 23P Independent Substantive Change (ISC) Publication Public Review (PPR) draft period ended in February. Comments have been resolved and the next PPR will be submitted and expected to be published by the end of 2021.
    - There will likely be a motion at the winter conference meeting to withdraw Standards 23.1 and 23.2 in Vegas.

- **Standard 41.4-2014R,** ***Methods for Proportion of Lubricant in Liquid Refrigerant Measurement.*** SSPC 41 Subcommittee 41.4-2015R, chaired by Jim Douglas, did not meet during the Austin Virtual Conference and will not meet during the Chicago Virtual Conference because COVID-19 has delayed testing of the latest lubricant sampling apparatus.

- **Standard 41.9-2018,** ***Standard Methods for Refrigerant Mass Flow Measurement Using Calorimeters.*** The first 41.9-2021 is a published standard. Congratulations to Michael Perevozchikov, the chair of the 41.9-2018R revision committee and the members of that committee. This standard will be up for periodic maintenance in 2024.

- **Standard 41.10-2013R,** ***Standard Methods for Refrigerant Mass Flow Measurement Using Flowmeters.*** Standard 41.10-2020 has been published. Congratulations to John Neel, the chair of the 41.10-2014R revision committee and the members of that committee. This standard will be up for periodic maintenance in 2023.

- **Informative Note on ASHRAE 90.1 from Rick Heiden**
    - Addendum X completed first public review with 4 comments and Addendum Y started public review on Jan. 29th.
    - Applies to updates for chillers and heat pump efficiency minimums

Program -- Erik Anderson (Chair)

- Program for the Annual Meeting, June 28-30, 202: All are On Demand Seminars. See Attachment 3.
    - Sponsor:
        - Seminar 31*:* Back to Basics: The Right Compressor for the Job. (Chaired by Margaret Mathison)
    - Co-Sponsor
        - Seminar 26: Application of Computational Fluid Dynamics to HVAC&R Compressor Design (TC 8.2)
        - Latest Developments in Low-GWP Refrigerants and Systems for Refrigeration (TC 10.7)

- For Winter 2022 in Vegas:

  - Sponsor: Reduced order modeling for HVAC/R systems and their components. Craig Bradshaw and Davide Ziviani will each provide speaker: Alex Schmig to chair. Erik motioned to sponsor. Davide second. Motion passed (9-0-0-2, CNV)
  - Co-Sponsoring with TC8.2: high efficiency pumping systems. Erik motioned to sponsor. Davide second. Motion passed (9-0-0-2, CNV)
  - Co-sponsoring with TC8.2: Electrification of HVAC equipment with heat recovery / energy storage. Erik motioned to sponsor. Joe second. Motion passed (9-0-0-2, CNV)
  - Co-sponsoring with TC10.7 (Introduced by Georgi Kazachki): Latest developments in Low GWP refrigerant system with respect to regulations. One presentation on ASHRAE 15, another regarding UL, policies. Erik motioned to sponsor. Davide second. Motion passed (9-0-0-2, CNV)
- For Future Conference:
  - ASHRAE 23 vs. ASHRAE 225 vs AHRI 1520, chaired by Justin Prosser. Will wait until 1520 is released to submit seminar. Planning on targeting 2022 summer / 2023 winter.

Research Subcommittee – David Ziviani (Chair)

- ASHRAE is out of funds for research due to not having AHRI expo, which provides 50% of funds. Fundraising was also down (still around $2M).
- You can contribute to ASHRAE research through a button on the website.
- Projects
  - WS 1793 (motor cooling research / thermal conductivity, co-sponsored with TC 8.2)
  - TRP 1879 "Foamability Properties of LGWP Refrigerant and Oil Mixtures" (co-sponsored with TC 3.4)
    - Per Chris Seeton, this is in queue to be approved once sufficient funding is available
  - 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"
    - Per Chris Seeton the current status of this is not clear. Recommends that Craig and Davide directly request the status and then pursue turning into RTAR
  - RTAR for co-sponsorship, "Capillary Tube and Short Tube Orifice Performance for Low GWP Refrigerants", sponsored by TC 8.8, seeking co-sponsorship from TC8.1 (in addition to 8.11, 8.4, 10.7, and 9.3
    - Discussion took place and included whether RAC will push back on the request and also does this project really align with TC 8.1
    - It was decided to table the topic and provide feedback.

- Other Topics:
  - Georgi Kazachki asked if a project related to raising the discharge temperatures of compressors could be possible.
    - A discussion ensued and it was recommended by Craig Bradshaw to continue work on the idea with assistance from Davide Ziviani if necessary.

Handbook – Scott MacBain (Chair)

- A joint subcommittee meeting was held with TC 8.2 on June 2nd.

- 2022 Refrigeration Handbook: Chapter 8, "Dehydration and Charging
  - Draft I/P by MacBain, Sanchez, Perevozchikov

    - Revision was submitted 03/31/21
- 2024 HVAC Systems and Equipment Handbook
    - Two chapters will be due in 2024 (Revision will need to completed in early 2023):
        - Chapter 38, "Compressors" (Sections 1, 2 and 3)
        - Chapter 43, "Liquid-Chilling Systems" (Sections 1, 2 and 4)
        - 9 volunteers so far (Ziviani, Bradshaw, Perevozchikov, Heiden, MacBain, Betz, Turner, Hunt, Duda)
        - Additional volunteers are always welcome

Membership – Jim Douglas (Chair)

- The committee currently has 12 voting members (one international).
- Upcoming Changes:
    - Erik Anderson, Doug Collings, Scott MacBain and John Neel will roll off at as July 1.
    - Riley Barta, Jim Douglas, Michael Perevozchikov, Chris Seeton and Alex Shmig will roll on at the start of July 1st.
        - Riley Barta will be an additional international member.
    - Number of voting members will become 13 (2 international)
- Craig Bradshaw will remain chair, Joe Sanchez will remain vice-chair, and Margaret will remain as secretary (All other positions also staying as is)
- Anyone interested in joining TC as a provisional corresponding member can do so from the ASHRAE website.

Website – Eric Berg (Webmaster)

- Website is up to date
- Eric will replace draft minutes with final minutes
- Eric will start adding the links for the virtual meeting.

Old Business – Craig Bradshaw

None.

New Business - Craig Bradshaw

None.

Motion to Adjourn

Motion to adjourn by Davide Ziviani at 4:25 PM.

Attachment 1 – Meeting Attendance List

1. Eric Berg, VM, Webmaster
2. Craig Bradshaw, VM, Chair
3. Doug Collings, VM
4. Georgi Kazachki, VM
5. Scott MacBain, VM, Handbook
6. Erik Anderson, VM, Programs
7. John Neel, VM
8. Justin Prosser, VM
9. Joe Sanchez, VM, Vice-Chair
10. Davide Ziviani, VM, Research
11. Riley Barta, CM
12. Matt Cambio, CM
13. Kris Crosby, Guest
14. Jim Douglas, CM, Standards/ Membership
15. Michael Perevozchikov, CM
16. Chris Seeton, CM
17. Wayne Zhang, PCM
18. Georgi Kazacki, VM
19. Joe Karnaz, Guest
20. Jamie Yeh, CM
21. Steve Rudy, CM
22. Jethro Medina, Guest
23. Satheesh Kulankara, CM
24. Carlos Brignone, PCM

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

Seminar 26 (Basic)

Application of Computational Fluid Dynamics to HVAC&R Compressor Design

Track: HVAC&R Systems and Equipment

Sponsor: 8.2 Centrifugal Machines, 8.1 Positive Displacement Compressors

Chair: Matt Cambio, Member, Trane Technologies, La Crosse, WI

Computational Fluid Dynamics (CFD) has been a modeling tool available to engineers for more than 40 years. In recent time computational hardware and commercially available codes has moved CFD from a research tool to a design tool. In addition engineers are continually taking on more complex problems. CFD provides insights that are not possible to obtain through testing or other types of models. This session provides examples of how CFD is used in the design process to improve compressor performance and reliability.

1. Modified Cut-Cell Method Applied to CFD Simulations of Positive Displacement Compressors
***Davide Ziviani, Ph.D., Member**, Center for High Performance Buildings, Purdue University, West Lafayette, IN*

2. Effects of Liquid Carryover on the Performance of a Centrifugal Compressor
***Chaitanya Halbe, Ph.D.**, Carrier Global Corporation, Bloomfield, CT*

3. Application of 3D CFD to a Scroll Compressor with Vapor Injection
***Joe Ziolkowski**, Trane Technologies, La Crosse, WI*

Seminar 31 (Basic)

Back to Basics: The Right Compressor for the Job

Track: HVAC&R Systems and Equipment

Sponsor: 8.1 Positive Displacement Compressors

Chair: Margaret Mathison, Ph.D., Member, Iowa State University, Ames, IA

This seminar provides an overview of the types of compressors available for HVAC&R applications, leaving attendees with an improved understanding of the capabilities and limitations of different designs. Speakers explain the operating characteristics of some of the most common compressors, including rolling piston, scroll, and centrifugal machines. They use similarity analysis to explore the appropriate application of each. Speakers also address how changes in refrigerants impact compressor operation, which proves especially important to understand as the industry continues to move towards low-GWP refrigerants.

1. Governing Principles of Compressor Design and Choice
***Matt Cambio, Member**, Trane Technologies, La Crosse, WI*

2. Performance Evaluation of Low-GWP Refrigerants in 1-100 Ton Scroll Compressors
***M. Mohsin Tanveer, Student Member** and Craig Bradshaw, Ph.D., Member, Oklahoma State University, Stillwater, OK*

3. Effects of Low-GWP Refrigerants on Hermetic Rolling Piston Compressors
***Davide Ziviani, Ph.D., Member**, Center for High Performance Buildings, Purdue University, West Lafayette, IN*

4. Electrification of Heating and Centrifugal Compressor Design
***Chris Thilges**, Trane Technologies, La Crosse, WI*

Seminar 52 (Advanced)

Latest Developments in Low-GWP Refrigerants and Systems for Refrigeration

Track: HVAC&R Systems and Equipment

Sponsor: 10.7 Commercial Food and Beverage Refrigeration Equipment, 3.1 Refrigerants and Secondary Coolants , REF-CPCC, TC8.1, TC10.6

Chair: Georgi Kazachki, Ph.D., Fellow ASHRAE, Cryotherm, Raleigh, NC

The last years witnessed unprecedented development and implementation of new environment-friendly refrigerants and associated refrigeration technologies with constantly improving energy efficiency and acceptable cost and return on investments. This seminar provides the stage for presenting the broad variety of refrigeration technologies demonstrating the application of refrigerants with low-GWP, natural refrigerants, refrigerants with low flammability limits, flammable refrigerants and also refrigeration technologies with enhanced efficiency.

1. Distributed Scroll Booster for Supermarket Refrigeration
***Mike Saunders, Member**, Emerson, Dayton, OH*

2. Performance Evaluation of a Multi-Temperature Refrigerated Container Using R744 Technology
***Neal Lawrence, Ph.D., Associate Member**, Creative Thermal Solutions, Urbana, IL*

3. Dynamic Analysis of Multi-Evaporator Transcritical CO2 Refrigeration Systems with Expansion Work Recovery
***Riley Barta, Ph.D., Member**, Technical University of Dresden, Dresden, Germany*

4. Sorting through Lubricants and Low GWP Refrigerants for Commercial Refrigeration Applications
***Joe Karnaz, DSc, Member**, Shrieve Chemical, Houston, TX*

5. Case Study Demonstrating the Energy Efficiency Improvements with the Use of HC (R-290) and Variable Speed Compressor Technology in Self-Contained Frozen Island Merchandisers
***Mike Devine**, Tecumseh Product Company, Ann Arbor, MI*