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DRAFT

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. TC 1.1 DATE 26 June 2022

TC/TG/MTG/TRG TITLE Thermodynamics and Psychrometrics

DATE OF MEETING 26 June 2022 LOCATION Sheraton Centre, Toronto

MEMBERS PRESENT	YEAR APPTD	MEMBERS ABSENT	YEAR APPTD	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
Omar Abdelaziz		Stanislav Perencevic		Matt Aikens
Vikrant Aute		Ayyoub Momen		Riad Assaf
Harshad Inamdar				Roy Crawford
Kashif Nawaz				Brian Fricke
				Hans-Joachim Kretschmar
				Hongmei Liang
				Liping Liu
				Eric Peterson
				Eric Ratts
				Raymond Rite
				SA Sherif
				Azam Thatte
				Steve Trimble

DISTRIBUTION: All Members of TC/TG/MTG/TRG plus the following:

TAC Section Head:	SHx@ashrae.net Where x is the section number
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

Note: These draft minutes have not been approved and not the official, approved record until approved by the TC.

DRAFT MINUTES: ASHRAE TC 1.1, Thermodynamics and Psychrometrics
26 June 2022, 1:30pm – 3:30pm (EDT)
Dufferin (2nd Floor), Sheraton Centre
Toronto, Ontario, Canada

Technical Committee (TC) 1.1 concerns basic thermodynamic laws and property relationships, particularly since they affect processes in heating, ventilating, and air conditioning (HVAC); refrigeration; and related areas of environmental engineering. A second concern of the TC includes the fundamental thermodynamic and transport relationships for air and water vapor mixtures used in studying, measuring, and calculating psychrometric properties and processes.

1. Call to Order/Introduction of members and guests/Establish quorum requirements (Kashif Nawaz)

The TC 1.1 meeting was called to order by Chair K. Nawaz at 1:36pm. Members and guest present both in-person and virtually introduced themselves.

Attendees at the TC 1.1 meeting included: Omar Abdelaziz (V), Matt Aikens, Riad Assaf, Vikrant Aute (V), Roy Crawford, Brian Fricke, Harshad Inamdar (YEA, V), Hans-Joachim Kretzschmar, Hongmei Liang, Liping Liu, Kashif Nawaz (V), Eric Peterson, Eric Ratts, Raymond Rite, SA Sherif, Azam Thatte, Steve Trimble

The roster of TC 1.1 includes six voting members, three of whom were present at the beginning of meeting (V. Aute, H. Inamdar, and K. Nawaz). Voting member O. Abdelaziz joined the meeting at 3:04pm, thus quorum was established at that time.

2. ASHRAE Code of Ethics Commitment (K. Nawaz)

For the benefit of those attending the meeting, the ASHRAE Code of Ethics Commitment was reviewed. The full Code of Ethics is available at:

<https://www.ashrae.org/about-ashrae/ashrae-code-of-ethics>

3. Review of Agenda (Kashif Nawaz)

The agenda for the meeting was reviewed and approved.

4. Review/approve minutes from summer 2021 meeting (Kashif Nawaz)

The draft minutes of the Summer 2021 TC 1.1 meeting were reviewed. It was noted that V. Aute's name was spelled incorrectly on the cover page of the minutes. It was also noted that, in the Membership section of the meeting minutes, there was no clear indication of when voting members were rolling on/off the roster. This will be an item for discussion and resolution during this meeting.

TC 1.1 voted to approve the Summer 2021 TC 1.1 Meeting Minutes, pending the spelling correction to V. Aute's name on the cover page.

5. Section Head Comments (Dave Meredith)

No report

6. Liaison Comments

Sonya Pouncy (Handbook Liaison)

Handbook Liaison S. Pouncy introduced herself to the committee members. R. Assaf requested S. Pouncy's presence at the kick-off handbook meeting for the next round of chapter updates. S. Pouncy will respond to R. Assaf's meeting poll and join the kick-off meeting as her schedule permits.

7. Membership Subcommittee (Vikrant Aute)

Major TC 1.1 roster changes are required, especially regarding the management team and the voting members.

Voting Members

The current voting members of TC 1.1 include O. Abdelaziz, V. Aute, H. Inamdar, A. Momen, K. Nawaz, and S. Perencevic. K. Nawaz's term as voting member will end following this meeting, and H. Inamdar has one more year remaining in his term as a voting member. The following individuals will be added as voting members of TC 1.1: R. Assaf, H. Liang, and S.A. Sherif.

Management Team

K. Nawaz's term as chair will end following this meeting, and A. Momen has indicated that he is no longer able to continue as secretary for TC 1.1. Thus, volunteers are needed to fill the Secretary, Vice Chair and Chair positions. For the next Society year, the following individuals have volunteered to serve in TC 1.1 management positions:

- R. Rite will serve as Chair
- H. Inamdar will serve as Vice Chair
- B. Fricke will serve as Secretary

Subcommittee Chairs

The following individuals will continue to serve in their roles as subcommittee chairs:

- V. Aute to continue as Membership subcommittee chair
- R. Assaf to continue as Handbook subcommittee chair
- R. Crawford to continue as Standards subcommittee chair

ACTION: V. Aute will confirm with O. Abdelaziz that O. Abdelaziz is willing to continue serving as Program subcommittee chair.

ACTION: R. Rite will confirm with W. Fox that W. Fox is willing to continue serving as Webmaster and Research subcommittee chair.

V. Aute suggested that the Awards subcommittee chair position and the Membership subcommittee chair position be combined and held by the same individual. With no objections, V. Aute indicated that he is willing to assume both roles.

8. Handbook Subcommittee (Riad G Assaf)

R. Assaf would like to thank all the members of the handbook subcommittee, especially H. Inamdar, H.-J. Kretzschmar and S. Herrmann, for their efforts in updating the handbook chapter. The following

table was presented, indicating the names of members interested in participating in the updating of TC 1.1's handbook chapter.

Here is a table of the interested members:

Member	Initials	email	Position
Hans-Joachim Kretzschmar	HJK	hj.kretzschmar@hszg.de	Chapter 1
Harshad Inamdar	HI	hinamdar@alumni.purdue.edu	
Kashif Nawaz	KN	nawazk@ornl.gov	TC01.01 Chair
Nick Roberts	NR	nick.roberts@usu.edu	
Riad Assaf	RA	riadassaf@hotmail.com	Handbook Subcommittee Chair
Sebastian Herrmann	SH	s.herrmann@hszj.de	Chapter 1
Sonya Pouncey	SP	sonya.pouncey@gmail.com	Handbook Liaison
Sunil Mehendale	SM	ssmehend@mtu.edu	

R. Assaf will organize a kick-off e-meeting for the next round of handbook chapter revisions. Members are encouraged to please respond to the meeting poll.

E. Peterson from TC 4.2 expressed great interest in the psychrometric equations presented in the ASHRAE Handbook, and he further noted that the presentation of the psychrometric equations in Chapter 1 was beautiful. In addition, E. Peterson indicated that the Chair of TC 4.2 is willing to share his work in psychrometrics near the freezing point with TC 1.1. Perhaps this work can complement the information presented in Chapter 1.

9. Standards Subcommittee (Roy Crawford)

TC 1.1 is the cognizant committee for Standard 213P, Method for Calculating Moist Air Thermodynamic Properties, and Standard Project Committee (SPC) 213P is chaired by V. Aute. V. Aute noted that the project committee is currently developing explicit dew point and wet bulb equations. SPC 213P will be meeting Tuesday afternoon at 3:30pm at the Sheraton Centre, Oak Room (M). If anyone would like to join the SPC, they can join as a "consultant" (the preferred membership category, so as not to upset the committee balance). V. Aute greatly appreciates the hard work of H. Inamdar and S. Herrmann, particularly related to the development and verification of the equations which appear in the standard.

10. Program Subcommittee (Omar Abdelaziz)

It was noted that A. Momen worked with the track chair to resubmit the previous program for presentation at the Toronto meeting. Unfortunately, that program was not approved for presentation at Toronto.

Various program ideas were suggested for the Winter ASHRAE meeting in Atlanta:

- Thermodynamics of drying
- Life cycle assessment of technologies
- Thermodynamics of refrigerants for the winter meeting's refrigerant track (performance of new refrigerants from a thermodynamic point of view)

Based on the program discussion, the following program proposals were approved for the Atlanta meeting:

Topic: Separation and dehumidification (Kashif to lead)
Co-sponsor with desiccant dehumidification TC (TC8.12?)
Omar will follow up with TC 8.12

Topic: Not-in-kind technologies (decarbonization track)
Could get participation from Annex 53
Brian Fricke volunteered to work with Annex 53 members to organize session

Topic: Technologies for ultra-low refrigeration, including cryogenic, autocascade, not-in-kind
V. Aute can suggest potential speakers, and will forward contact information to O. Abdelaziz.
O. Abdelaziz will lead ultra-low refrigeration topic

11. Webmaster (Bill Fox)

No report (W. Fox not present). It appears that the TC 1.1 website has not been updated since 2020.

12. MTG Liaison: Low GWP Refrigerants (Ray Rite -Liaison, S. Padmanabhan –Alternate#1)

R. Rite noted that MTG LowGWP will be meeting this evening at 6:00pm to discuss research-related items. Additional MTG LowGWP meetings to be held at the Winter ASHRAE conference include the Codes and Standards meeting on Tuesday afternoon, and the main committee meeting on Wednesday morning. R. Rite will distribute notes to the TC 1.1 membership resulting from these upcoming MTG LowGWP meetings.

13. Research (Kashif Nawaz)

It was noted that ASHRAE is now slowly beginning to fund new research projects following a moratorium resulting from the low level of research funding available during the pandemic. While TC 1.1 is a relatively small committee, historically the TC has had at least one active project. Given that TC 1.1 has not sponsored a research project for some time, it was noted that it would be a good idea to start developing RTARs.

H.-J. Kretzschmar shared information regarding an unsolicited proposal that he is developing entitled “Simplified Equations for Transport Properties of Moist Air” as a precondition for an ASHRAE standard. The motivation for the proposal is that the transport property equations developed in research project RP-1767, “Proposed Moist Air Transport Properties Research,” are too complex to be implemented in ASHRAE standards. There is a need for relatively simple, fast and accurate equations for the transport properties of moist air. Following the discussion of this topic, the members felt that the concept was good, and the members encouraged H.-J. Kretzschmar to pursue submission of the proposal.

Other potential research topics discussed included decarbonization, COVID, hydrogen and ammonia. Several questions were raised:

- What can TC 1.1 do regarding the thermodynamics of hydrogen and ammonia?
- Are transport properties of hydrogen/methane mixtures needed?

Regarding hydrogen, it was noted that two issues currently limit its utilization, including the difficulty related to storing and transporting hydrogen, and hydrogen is not economic and/or efficient for heating. Perhaps a thermodynamic study of heating methods using hydrogen could be performed, including a life

cycle analysis. It was noted that hydrogen-related research could be co-sponsored by TC 6.10, Fuels and Combustion. Following the discussion on hydrogen, the committee members felt that it would be good to give this topic more thought and discuss further at the next meeting.

15. Chair Comments (Kashif Nawaz)

K. Nawaz will share with the TC 1.1 membership the slides that were presented at the TC Chair's Breakfast.

16. New Business

V. Aute congratulated K. Nawaz on receiving the ASHRAE Exceptional Service Award.

17. Next meeting: TBD

The next TC 1.1 meeting will be held on 6 February 2022 in Atlanta, Georgia.

18. Adjourn

The TC 1.1 meeting was adjourned at 3:38pm.

Respectfully submitted,
Brian Fricke