

ASHRAE
1791 Tullie Circle, N.E./Atlanta, GA 30329
404-636-8400

TC/TG/TRG MINUTES COVER SHEET

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

TC/TG/TRG NO 1.1 DATE June 29th 2015

TC/TG/TRG TITLE: Thermodynamics and Psychrometrics

DATE OF MEETING 6/29/2015 LOCATION Atlanta, GA

MEMBERS PRESENT	YEAR APPT	MEMBERS ABSENT	YEAR APPT	MEMBERS ABSENT	YEAR APPT
James Schaefer (Chair)	13	<i>Corresponding Members</i>		<i>Voting Members</i>	
Omar Abdelaziz (Vice Chair)	13	Mark Ahlers	05	Liping Liu (Secretary)	13
Vikrant Aute (Webmaster)	13	Chad Bowers	09	Bill Fox (Research)	13
Tony Jacobi	13	Robert Braun	05	Hans-Joachim Kretzschmar (Non-Quorum)	13
Thomas Kuehn	13	Steven Brown	07		
Stanislav Perencevic (Non-Quorum)	13	Yongfang Zhong	11	<i>Provisional Corresponding Members Absent</i>	
		Jonathan Douglas	07	Hongmei Liang (Ends 8/7/16)	
<i>Corresponding Members</i>		Ellen Franconi	99	Nick Mislak (Ends 4/4/15)	
Kashif Nawaz (Handbook)	13	Don Gatley	01	Om Taneja (Ends 1/14/16)	
Ray Rite	13	Art Geisler (Research Liais.)	11	Dario Petric (Ends 9/10/16)	
S. A. Sherif	05	Siviakumar Gopalnarayanan	06	Ciara Poolman (Ends 5/4/16)	
David Yuill (2017 Handbook Fundam.)	13	Anna Hueffed	09	Amanda Smith (Ends 6/30/15)	
Howard Cheung (Program)	11	Edwin Huestis	11		
Nadar Jayaraman (Section 1 Head)	15	Jason Hugenroth	07		
Roy Crawford	88	Omar Huzayyin	11		
Sebastian Herrmann	11	Sandy Klein	02		
Pedro Mago	05	Ness Lakadawala	11		
Hongmei Liang	14	Jason LeRoy	99		
<i>Provisional Corresponding Member</i>		Thomas Meyer	07		
Alamelu Brooks (Ends 6/30/15)		Pavan Naicker	11		
		Ron Nelson	86		
<i>Guests</i>		Nicole C Okamoto	04		
Wayne Kraft		Jose Perez-Galindo	04		
Heejin Cho		Eric Ratts	01		
Israel Martinez		Trilochan Singh	92		
Sanka Padhmanabhan		Robert Tozer	97		
		Kurt Zoellick	09		
		Hongmei Liang	14		
		Christopher Halford	13		
		Chris Laughman	14		
		Sunil Mehendale	14		
		S Sami	06		
		Laura Schaefer	02		

Distribution

<i>All members of TC/TG/TRG plus the following:</i>	
TAC Section Head:	SH1@ashrae.net
TAC Chair:	TACchair@ashrae.net
All Committee Liaisons As Shown on TC/TG/TRG Rosters:	
RAC Research:	RL1@ashrae.net
Program:	PL1@ashrae.net
Standards:	SL1@ashrae.net
Handbook:	hbfl@ashrae.net
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Manager Of Standards:	Claire Ramspeck MOS@ashrae.net
Manager Of Research & Technical Services:	Mike Vaughn MORTS@ashrae.net

Approved Minutes

TC 1.1 Thermodynamics and Psychrometrics Monday, Jun 29, 2015, Atlanta, GA 2:15 pm – 4:15 pm

1. Call to Order:

James Schaefer called the meeting to order at 2:15 pm. The current roster was distributed as the sign-in sheet and attendees registered. James asked attendees to introduce themselves. James asked whether anyone had extra items to add to the agenda and none was proposed.

James reviewed quorum. At the start of the meeting 4 of 7 voting members were present and quorum established. Later in the meeting other voting members arrive and one non-quorum voting member arrived for 6 out of 8 voting members present.

2. Liaison Reports:

David Yuill reported the status on 2017 Handbook Fundamentals.

Chapter: Psychrometrics (due 03/01/2016)

Chapter: Thermodynamics (due 07/28/2016) – with TC8.3

David mentioned that Kashif Nawaz attended the handbook meeting. The TC needs to vote even if no changes to the handbook sections are made.

Nadar Jayaraman Section 1 Head presented James Schaefer (outgoing Chair of TC 1.1) with a thank you certificate. He asked if the TC would be in favor of a required Membership Subcommittee Chair, Omar the incoming TC 1.1 Chair response for the TC with a “yes”.

3. Chair Report and Announcements:

James Schaefer discussed some of the announcements from the section breakfast and noted that he would distribute the scanned printed notes this week.

4. Previous Minutes Approval:

The previous Seattle meeting minutes were approved by the TC (4-0-0-3). Tony moved for the vote and Thomas seconded.

5. Roster Updates:

James asked the audience who would like to become a provisional corresponding member to go to www.ashrae.org/tcs and press “Join a TC”. Then to move from provisional corresponding member to a full corresponding member they need to discuss their interest and involvement with the Chair (Omar) before or during the next TC meeting in January 2016.

6. Subcommittee Reports:

Research Subcommittee (James Schaefer for Bill Fox)

URP-1767 on Moist Air Transport Properties was submitted to the committee. A PES was formed (Bill Fox, Alamelu Brooks, Kashif Nawaz, and James Schaefer), they will meet immediately after the TC 1.1 meeting in the same room (closed door). [Update after the meeting – PES met and ranked the URP very high. The TC voted via letter ballot to approve the PES recommendation 7-0-2-0, with two voting members abstaining as they are PI's on the URP.](#)

Possible Research –

Containments in air and how they affect the moist air properties, possibly with a tie in to fugacity. Ray Rite will work on an RTAR and might consult with James Schaefer. Ray noted that Dr. Jurgen Scharfe (js@jseb.de) thought that the process industry physical property simulators might provide valuable information. James Schaefer was not so confident due to the many different models that are available with no good guidance on which model to use. VMG thermos and Aspen Tech both have physical property simulators, similar to RefProp, though for use on a wider range of fluids.

Program Subcommittee (Howard Cheung)

Howard submitted “Psychrometric Calculations: Effort, Accuracy, Applicability” – Workshop. Speakers: Omar (chart analysis) – Vikrant (mathematical analysis) – James (Moderator). Co-sponsor SPC 213. The workshop was given on Sunday morning and can be viewed in the conference online recordings. Howard estimated that 40 people attended the workshop.

Howard will work with Omar on submitting a seminar “Advanced Non-Vapor Compression Cycles” The suggested speakers are - Dr. Ayyoub Momen (ORNL): Magnetic Cooling, Prof. Qiming Zhang (PSU) and/or Ravi Annapragada (UTRC): Electrocaloric cooling, Mr. Suxin Qian (UMD): Compressive Thermoelastic Cooling. Omar moved for a vote, with Thomas Seconding. The vote was 6-0-0-1.

Other program ideas are a conference paper on Vikrant’s work for Standard 213P, and a “Steady State versus Transient Heat Transfer Measurements” looking at how to tell if the system is steady, its impact on the heat balance. Tony was interested in adding to this topic on better ways to average the amount of heat transfer measured between two streams using the inverse of the uncertainty in the measurement of the two streams. Along these lines the Verification and Validation Symposium of ASME (<http://www.asmeconferences.org/VVS2015/>) was discussed.

Standard Subcommittee (James Schaefer)

James will stay as the Standard Subcommittee chair as he rolls off as TC 1.1 chair. Standard 213P (Method for Calculating Moist Air Thermodynamic Properties) is meeting on Tuesday Morning. It is James’s hope to wrap up this standard in ~1 years’ time as he is looking to reduce how often he attends the ASHRAE conferences due to work change.

Handbook Subcommittee (Kashif Nawaz)

Practical examples and sustainability examples are desired. Might be able to link to Joe Lstiburek articles of the journal which are available on-line for condensing plain psychrometric applications and examples.

In one example problem of the handbook, if using the entropy number shown, one couldn't get the sensible heat ratio from the chart. Kashif is still confirming that there is an error, though it looks like there is and it will be updated in the next version.

Might be able to get Don Gatley to add a section on the definition(s) of Relative Humidity.

Might be able to borrow some uncertainty examples from standard 41.6 that James Schaefer had done in the past.

Kashif asked for handbook reviewers. James Schaefer, Vikrant Aute, and Ayyoub Momen volunteered.

MTG Liaison

Ray Rite reported about MTG. Low GWP. The task group was trying to organize programs about lower GWP alternative refrigerants and has a whole track in one of the future conferences. Ray Rite will be the primary and Sankar Padhmanabhan will be the secondary. Vikrant is having trouble getting information from the TC's on who the representatives are.

Website (Vikrant Aute)

<http://tc11.ashraetcs.org>

Approved meeting minutes will be updated on the website. The way that the website is edited will be changing. Also Vikrant does not mind if someone else would like to increase their involvement and take over the website.

7. Old Business:

Previous meetings:

James reported that Donald Gatley contacted him about the definition of relative humidity for superheated steam. James mentioned that they are working on possible changes on the definition and he would get more details and forward them to the committee.

Hans-Joachim Kretzschmar reported that the International Association for the Properties of Water and Steam (IAPWS) is looking to propose a new definition of relative humidity, not via molar fractions or partial pressures but using fugacity of water in humid air. James asked why moving to fugacity. It seemed a problem because not many people know about fugacity. Hans-Joachim also mentioned that the IAPWS is looking to develop a new definition of PH value for areas at high salt concentrations to agree on a standard for the definition of relative humidity in the atmosphere. Omar explained that the definition is for areas relevant to sea water, not everywhere. Thomas asked what if for normal air. Hans-Joachim said he would send the proposal from IAPWS to James to be shared with the TC as a base for future discussion.

IAPWS

2014 - Thermometry Working Group 'Relative Humidity' on the TEOS-10 salinity standard (which uses the IAPWS-2008 Gibbs function formulation for seawater) compatible calculation of fugacity and relative fugacity of water vapour in humid air.

2013 - Coordinated by the IAPWS/SCOR/IAPSO Joint Committee on the Properties of Seawater, which links IAPWS to the ocean science organizations SCOR (Scientific Committee on Oceanic Research) and IAPSO (International Association for the Physical Sciences of the Ocean), steps were taken towards finding a 'traceable link' between the TEOS-10 salinity standard (which uses the IAPWS-2008 Gibbs function formulation for seawater) and the SI (international system of units). A plan was also formulated

to investigate the development of a traceable definition of pH that would be relevant at the high salt concentrations found in the ocean and to agree on a standard for the definition of relative humidity in the atmosphere.

Explanation of Fugacity – For ideal gas the value is 1 and thus has not affect.

<https://www.youtube.com/watch?v=AMBoLiQJMFQ>

Is the fugacity ratio in our temperature/pressure range 1 and thus it does not really matter to us? Does fugacity help with containments and the research into the impact they have to moist air properties.

This meeting:

Don Gatley also sent the committee further information. The TC would like Don to take the information that he sent and form it into a Handbook section if he could.

8. New Business

None

9. Adjournment:

Vikrant moved, Omar seconded. The meeting was adjourned at 3:45PM.

ASHRAE TC/TG/TRG ACTIVITIES SHEET TC/TG/TRG

DATE Jan 2015

TC/TG/TRG NO. 1.1 TC/TG/TRG TITLE: Thermodynamics and Psychrometrics

CHAIRMAN: James Schaefer, Jr. VICE CHAIRMAN: Omar Abdelaziz SECRETARY: Liping Liu

TC/TG/TRG Meeting Schedule

Location Past 24 months

- San Antonio, TX – June 23-27, 2012
- Dallas, TX – January 27-31, 2013
- Denver, CO – June 22-26, 2013
- New York City, NY – January 18-22, 2014
- Seattle, Washington – June 2014
- Chicago, IL - January 2015
- Atlanta, Georgia - June 27 – July 1 2015

Location next 24 months

- Winter 2016 - Orlando, Florida; January 25 – 27
- Annual 2016 – St. Louis, Missouri; June 25 – 29
- Winter 2017 – Las Vegas, Nevada; Jan 28-Feb 1
- Annual 2017 – Long Beach, CA; Jun 24-28
- Winter 2018 – Chicago, IL; Jan 20-24

TC/TG/TRG Subcommittees

Function	Chairperson
Standards	James Schaefer
Handbook	Kashif Nawaz
Programs	Howard Cheung
Research	Bill Fox
Webmaster	Vikrant Aute

RESEARCH PROJECTS – Current & Past

<u>Project Title</u>	<u>Contractor</u>	<u>Monitoring Comm. Chair</u>	<u>Report Made</u>	<u>Reported by</u>
TRP – 1460				
URP – 1485	Don Gatley	Ron Nelson	June 2008	

LONG RANGE RESEARCH PLAN

<u>Rank</u>	<u>Title</u>	<u>W/S</u>	<u>Approved</u>	<u>To R&T</u>

HANDBOOK RESPONSIBILITIES

<u>Year and Volume</u>	<u>Chapter and Title</u>	<u>No.</u>	<u>Deadline</u>	<u>Handbook Sub. Liason</u>
2017 Fundamentals	1 Psychrometrics		2016	Kashif Nawaz
	2 Thermodynamics		2016	

STANDARDS ACTIVITIES

Standard 213P: Thermodynamic Properties of Moist Air

TECHNICAL PAPERS from Sponsored Research – Title, when presented (past 10 yrs & planned)**TC/TG/TRG Sponsored Symposia – Title, when presented (past 10 yrs & planned)**

Exergy Efficient Systems and Applications for Sustainable Buildings, Long Beach, CA – June 2007

Exergy: A New Frontier in Green Building Simulation, Long Beach, CA – June 2007

TC/TG/TRG Sponsored Conference – Title, when presented (past 10 yrs & planned)

Exergy as a Measure of Performance and Sustainability (planned), Albuquerque, NM – June 2010

TC/TG/TRG Sponsored Seminars – Title, when presented (past 10 yrs & planned)

Environmentally Sound Refrigeration, Chicago, IL – January 2015

Thermoelectric cooling new applications for an old idea, Dallas, TX – January 2013

Magneto-Caloric Refrigeration: Are You Attracted to Cool Ideas?, Chicago, IL – January 2012

Thermodynamics of Advanced Cycles and Systems, Orlando, FL – January 2010

Thermoeconomics of Net Zero Design, New York, NY – January 2008

Exergy 101 for Beginners, Long Beach, CA - June 2007

Exergy 201 Use it or Lose it, Long Beach, CA - June 2007

Advanced Cycles and Systems, Dallas, TX – January 2007

Advanced Cycles and Systems for Air Conditioning, Refrigeration and Power, Quebec City, Canada – June 2006

Exergy Analysis and Sustainability, Part I: Fundamentals, Quebec City, Canada – June 2006

Soft Cake Yet Not Crusted: Humidity Control and Measurement Challenges and New Technologies at Room, Low, and High Temperature Ranges, Chicago, IL – January 2006

Second Law Analysis and Optimization: Orlando, FL – February 2005

TC/TG/TRG Sponsored Forums – Title, when presented (past 10 yrs & planned)

Thermodynamics of Biological Systems and Processes (planned); Orlando, FL – June 2009

Thermodynamics of Sustainable Urban Energy Systems; Chicago, IL – January 2009

Humidity Measurements at Extreme Temperatures; Denver, CO – June 2005

TC/TG/TRG Sponsored Work Shops

Psychrometric Calculations: Effort, Accuracy, Applicability; Atlanta, GA June 2015

JOURNAL PUBLICATIONS – Title, when published (past 3 yrs & planned)

Submitted by: James Schaefer