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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. 8.4 DATE June 27, 2017
 TC/TG/MTG/TRG TITLE Air-to-refrigerant heat transfer equipment
 DATE OF MEETING June 27, 2017 LOCATION Long Beach, CA

MEMBERS PRESENT	YEAR APPTD	MEMBERS ABSENT	YEAR APPTD	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
Dr. Sankar Padhmanabhan	2016	Dr. Liping Liu	2015	Please see attached
Dr. Kashif Nawaz	2016	Dr. Hyunyoung Kim	2013	
Dr. Chad Bower	2014	Dr. Ebrahim S. Al-Hajri	2016	
Dr. Omar Abdelaziz	2016	Mr. Ankit Sethi	2016	
Prof. Man-Hoe Kim	2013			
Mr. Shenghan Jin	2016			

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

TAC Section Head: Dustin Meredith	SH0804@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

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

I. CALL TO ORDER

Sankar Padmanabhan, the Chair of TC 8.4, called the meeting to order at 3:30 p.m. The title, purpose and scope of the TC were read.

II. SELF INTRODUCTIONS AND ATTENDENCE:

Everyone present introduced themselves, and signed a roster sheet. One YEA member was welcomed. Chair identified 6 out of 9 voting members, including one non-quorum member, as in attendance. Quorum was met. As the roster had not been updated to roll Dr. Abdelaziz off as recorded in the Las Vegas Minutes,

Voting Members at this meeting in Long Beach are as follows:	End of term (Jun 30 of...)	Present
1. Dr. Sankar Padmanabhan (Chair)	(2019)	Yes
2. Mr. Shenghan Jin (Vice-chair)	(2019)	Yes
3. Dr. Kashif Nawaz (handbook sub. Chair)	(2019)	Yes
4. Dr. Liping Liu (membership)	(2018)	No
5. Dr. Chad Bower (research sub. chair)	(2018)	Yes
6. Dr. Ebrahim S. Al-Hajri	(2020)	No
7. Mr. Ankit Sethi	(2020)	No
8. Dr. Omar Abdelaziz	(2017)	Yes
Voting Member non-quorum in this meeting		
9. Prof. Man-Hoe Kim	(2018)	Yes
10. Dr. Hyunyoung Kim	(2017)	No
Total Present		6 out of 10 VMs
Quorum		YES

I. PROGRAM SUBCOMMITTEE REPORT

Program Sub-committee chair, Ed Vineyard, presented the report.

Chair called for a motion to co-sponsor Lorenzo's panel forum. Vikrant relayed that as proposed the panel content exceeds the 1hr limit. Chad Bowers moved to co-sponsor two 1hr panels; Man-Hoe Kim seconded. 5-0-1-CV. Chair to contact Lorenzo to split the panel into two.

A seminar on Corrosion in Air-Refrigerant Heat Exchangers seminar was proposed for Chicago. Chad Bowers volunteered to chair. Potential speakers are: Dave Ellerbrock, Vigos & Matthew. Shenghan Jin made the motion to propose the seminar; Kashif Nawaz seconded. 5-0-1-CV.

Vikrant Aute proposed that TC8.4 co-sponsor TC1.3's program on Advances in Measurement Methods for Heat Transfer for the Houston Meeting, and Factors that Impact Heat Exchanger Performance session proposed for Atlanta.

TC1.13 is considering a proposal for Atlanta or Kansas City as a Track on Optimization of HVAC/R systems and equipment and is seeking TC support. Chad Bowers moved to support TC1.13's track on HVAC/R Systems & Equipment Optimization. Shenghan Jin seconded. 5-0-1-CV.

II. MEMBERSHIP REPORT

Chair presented the Membership Committee report. Kishan Padakannayya volunteered to step in as Membership SC Chair, as Liping has asked to be rolled off that position.

Total of 139 members, 9 voting with 2 non-quorum. 16 PCMs.

Voting membership update: Beginning the 2017-2018 Society Year, Liping Liu and Hyunyoung Kim will roll off. Vikrant Aute, Kishan Padakannayya and Matthew Richard Baker will roll on. With these, the voting membership will be 10 with 2 non-quorum.

III. CHAIRS REPORT

Chair presented highlights from the Chair's breakfast. Report is appended to these minutes.

IV. SECTION HEAD REPORT

The Section 8 Head Dustin Meredith commented that the meeting is well attended. No new announcement was made from the board.

V. HANDBOOK SUBCOMMITTEE REPORT

Handbook Sub-committee chair, Kashif Nawaz, reported that TC 8.4 is responsible for the following chapters

1. Chapter 23 air cooling & dehumidification coils (Fundamentals)
2. Chapter 27 air heating coils (Fundamentals)
3. Chapter 39 condensers (Fundamentals)
4. Chapter 14 Forced circulation in coolers (Refrigeration)

First three chapter (fundamentals) are due during 2020 and Chapter 14 (Forced circulation in coolers-Refrigeration) is due by the end of July 2017.

- It was reported that all TC members have access to online portal to review and revise the chapters.
- ASHRAE intends to use the Handbook as an effective tool to disseminate the research projects outcomes by adding a mandatory section in research project reports which can become a part of handbook.

VI. MINUTES OF PREVIOUS MEETING

Kashif Nawaz moved to approve the Las Vegas Meeting Minutes. A typo correction was recorded to change one instance from "Orlando" to "Las Vegas". Chad Bowers seconded the amended motion to approve the minutes with the typo corrected. 5-0-0-CV.

VII. WEBMASTERS REPORT

Webmaster Christian Ludwig, reported that all approved prior meeting minutes had been posted to the TC8.4 web site. A proposal was made to provide links to recently completed TC8.4 sponsored projects on the site.

VIII. MTG LIAISON REPORT

MTG Liaison, Vikrant Aute, presented a report on Low GWP MTG. MTG Information and Latest Minutes:

<https://www.ashrae.org/standards-research-technology/technical-committees/section-mtg-multidisciplinary-task-groups/mtg-lowgwp-lower-global-warming-potential-alternative-refrigerants>

The MTG.Low GWP website is being updated on a regular basis and as such the information about MTG representation and involvement is not repeated here. The latest roster and meeting minutes can be found at the above link.

Activities Highlights

- **RP-1806**, Flammable Refrigerants Post-Ignition Simulation and Risk Assessment Update. Status: Awarded to Gexcon US in December 2016, Project Start Date: 1/1/17, Duration: 12 months, Original cost: \$797k, Funded Extension in the amount of \$46.5k was approved in June 2017 to accurately quantify the source term for the AHRTI 9007 project, which includes amount of entrained air, fraction of vapor and liquid, and velocity of the release as well as other details from the AHRTI 9007 project.
- **RP-1807**, Guidelines for Flammable Refrigerant Handling, Transporting, Storing, and Equipment Servicing and Installation. Status: Awarded to Navigant Consulting in January 2017, Project Start Date: 3/1/17, Duration: 6 months, Cost: \$80k
- **RP-1808**, Servicing and Installing Equipment Using Flammable Refrigerants: Assessment of Field-made Mechanical Joints. Status: Awarded to Creative Thermal Solutions, Inc. in April 2017, Project Start Date: 5/1/17, Duration: 6 months, Cost: \$115k
RP1808- Just started; Duration: May 2017 to Dec 2017. Summary as below:
Servicing and Installing Equipment Using Flammable Refrigerants: Assessment of Field Made Mechanical Joint Systems
Focus: A2, A2L and A3
Status: Test matrix and methods discussed with PMS; incorporated feedback and finalized; waiting for full signed contract.
Joints: Brazed (Cu-Cu), flare (Cu-Cu, Cu-Al), compression(Cu-Cu, Cu-Al), press fittings(Cu-Cu, Cu-Al)
Skilled (2 categories of joint difficulty) and un-skilled (two categories)
Harshness Testing: PT Cycling; Freeze-Thaw Cycling; Vibration test. Detailed included in the PPT.
325 Total fittings
Procedure: Prepare Fitting - Initial Leak Test with N2 - Harshness Test - Final Leak Rate Analysis (PMGA) - Vacuum Test
- Identify other ASHRAE projects related to alternative refrigerants and the best path for the MTG to contribute to them.
- Maintain and review future conference deadlines for publications related to MTG scope and goals.
- Coordinate LCCP related efforts with IIR LCCP working party.

Other Updates

1. MTG to meet on Sunday and Wednesday of the ASHRAE meetings. Sunday meeting (5-6pm) is for research project updates and Wed meeting (10am-12pm) is the main meeting.

Refer to MTG Website for the latest information on Membership and Project, Research and Program Updates.

IX. RESEARCH SUBCOMMITTEE REPORT

Research Sub-committee Chair, Chad Bowers, presented a report from the Research chair's breakfast. Notes attached.

Bill Fox reported on RP1705. PI requested a 1 year no-cost extension. Kashif Nawaz moved to approve the 1 year no-cost extension. Chad Bowers seconded. 5-0-0-CV.

Omar Abdelaziz relayed interest in joining the RP1705 PMS in lieu of Liping Liu. Chair agreed to send a note to Hugh to do so.

Chad Bowers raised a motion to require the PI's to make a presentation of technical results in the form of a Webinar before the Chicago Meeting. Kashif Nawaz seconded. 5-0-0-CV.

RP1785 awarded to Oklahoma State.

Bo Shen volunteered to prepare an RTAR on multi-physics accelerated testing of heat exchangers.

The WS for RP1683 has been conditionally approved. Comments have not yet been received by the TC

X. STANDARDS SUBCOMMITTEE REPORT

Standards sub-committee chair, Bill Fox, reported on:

- Standard 20 – remote air cooled condensers. This is in the final phases of the write. Public review by end of Aug is planned. Comments will be reviewed in Chicago.
- Standard 25 – Method of Testing of Air Coolers. Multiple interim meetings have been held since Vegas. Public review by end of Aug is planned.
- Standard 64 – Testing of Evaporative Condensers committee is waiting on Standard 25. TC8.6 is leading that standard.

Team is recognized for diligence and hard work to get it done.

Standards staff, Steve Ferguson, introduced ASHRAE's Standards organization and offered to help with any questions/issues related to Standards. Notes appended.

VII OLD BUSINESS

None.

XI NEW BUSINESS

None.

XII ADJOURNMENT

At 5.35pm, Kashif Nawaz moved to adjourn. Chad Bowers seconded. 5-0-0-CV. Meeting adjourned.

TC Sign-in Sheet

Meeting Info: _____ TC8.4 Committee Meeting, Long Beach, CA _____ Date: _____ June 27th, 2017 _____

Name	Affiliation	E-mail	Member (Voting, Corresponding, or Guest?)	YEA Member? (Yes/No)
Kashif Nawaz	ORNL	nawazk@ornl.gov	V.M	Y
STANISLAV PENEVSKI	GUMNER	s.penevski@quentner.com	C.M	N
Shenghan Jin	Univ. of Illinois	sjin8@illinois.edu	V.M	Y
Bo SHEN	ORNL	SHENB@ORNL.GOV	C.M.	N
SCOTT CREANWAL	RHEEM	SCOTT.CREANWAL@RHEEM.COM	PROV/C.M	N
KISHAN PADAKANAYA	Johnson Controls	Kishan.Padakanaya@jci.com	C.M	N
Pedro Perez	AARON	Perezperez@gmail.com pedrop@aaron.com	Guest / Former C.M	N
Eric. Gong	Luvata	eric.gong@luvata.com	Guest	N
Scott Fisher	State Farm Retired	Sfishbmi@gmail.com	Handbook-Representation Liaison	N
Jordan Morrow	Kean's State University	morrowjordan@gmail.com	guest	Y

Name	Affiliation	E-mail	Member (Voting, Corresponding, or Guest?)	YEA Member? (Yes/No)
Yirong Jiang	Thermo King	YRjiang71@yahoo.com	CM	No
Bill Cox	TRAKS	BLAX@TRAKS.COM	CM	No
Oman Abdelaziz	ORNL	oaz@ornl.gov	VM	No
Steve Ferguson	ASHRAE	Sferguson@ashrae.org	Guest	No
Chad Zousses	TRAKS	CHAD.ZOUSSÉS@TRACO.COM	VM	No
CHRIS HAYS	INTERTEK	CHRISHAYS@INTERTEK.COM	G	No
GORDON STRIDER	EVAPCO, INC.	GSTRIDER@EVAPCO.COM	CM	No
Christian Bach	Oklahoma State University	cbach@okstate.edu	webmaster	No
Man-Hoe Kim	Kyungpook National Univ.	Kimmh@asme.org	VM	No
Matthew Baker	Braceway	mbaker@braceway.com	CM	No

Name	Affiliation	E-mail	Member (Voting, Corresponding, or Guest?)	YEA Member? (Yes/No)
Scott Wajek	N/A	scott.wajek@gmail.com	CM	Y
hars Reinholdt	Danish Technological Inst.	hredt@dti.dk	guest	N
Vikrant Aute	U of MD	vikrant@umd.edu	cm	N
S.A. Sherif	Univ. of Florida	sasherif@ufl.edu	CM	N
SANKAR PADHMANABHAN	DANFOSS	SANKAR@DANFOSS.COM	CHAIR	N.
SOTYAM BENDAPUDI	UTC CCS CARRIER	Sotyambendapudi@ Carrier.utk.edu	SEC	N



TC 8.4 Research Meeting: Air to Refrigerant Heat Transfer Equipment
Long Beach, Monday, June 26th, 2017, 6:00 – 9:00 PM
Room: Bixby 1

Agenda

1. Welcome and Introductions

2. Update from Research Subcommittee Chair Breakfast

- Link to new online data base of ASHRAE research
<http://research.ashrae.org>
- 7 RTAR's considered by RAC – 1 accepted, 3 accepted with comments, 3 rejected
- 11 Work Statements considered by RAC – 1 accepted, 7 conditionally accepted, 3 returned
- Innovative Research Grant – approved to fund 1 IRG
- New Investigator Award – 16 nominations received, 1 selected for award
- New PDF WS form providing some difficulties for both authors and readers (use Word template if difficulties persist)
- PMS Training not happening
- Curt Eichelberger from JCI is RL (Curtis.eichelberger@jci.com),

3. Active Research Projects

Update on Research Project 1645 Development of New Corrosion Test for Aluminum Heat Exchangers
Contractor: Prof. Seifollah Nasrazadani, University of North Texas
Project Monitoring Subcommittee: David Ellerbrock, Hyunyoung Kim, Russell Tharp, Claudi, Stanislav
Final report submitted by the end of September 2017.

Work Statement for a Phase II follow on project.

Update on Research Project 1705 Investigation of Airside Fouling on Outdoor Heat Exchangers
Contractor: Prof David Yuill University of Nebraska
Project Monitoring Subcommittee: Hugh Henderson, Bill Fox, and Liping Liu, Looking for an additional PMS member. Omar volunteered during 8.11 Research meeting and has talked with Bill Fox. PMS met with PI on Monday to review progress in person. Asking for a 1 year no-cost extension due to the project falling behind.

5. Potential Research Projects and Older Ideas

- TRP1785 Refrigerant Charge Modelling in Coils for Residential Split Systems – WS by Ray Rite and Chad Bowers from TC8.11. TC8.4 co-sponsoring. Awarded to Oklahoma State University. Project to officially start late August or early September.
- TRP-1807 (Guidelines for Flammable Refrigerant Handling, Transporting, Storing and Equipment Servicing and Installation) – co sponsor with Low GWP MTG (status from Vikrant), Chad on the PMS. PI moving along well with progress
- RTAR – 1826 Bio-Inspired Liquid to Air Heat Exchangers for HVAC&R Applications. RAC will be Reviewing the RTAR for the first time in Long Beach
- RP 1683 Conditionally Approved – we need to make sure we are listed as co-sponsoring TC
- Additional oil retention studies to add on to the data and modeling efforts from Project 1564. Chad Bowers and Scott Wujek (TC3.4 for co-sponsorship) worked on RTAR still about 80% complete. Chad and Scott met once since the last meeting and made some progress, but not complete. Aim for August 15th deadline?

- ~~Reverse flow in microchannel heat exchangers suggested by Bill Fox – no new activity, keep on list~~
- Heat exchanger performance as a system diagnostic tool for leak detection. (A2L) – A2L project may already be covering, pursue through Low GWP MTG (what parameters in heat exchanger, fault diagnostic TC, performance) Yang Zhou. Yang has done a lot of work on background literature but is looking for some help in finishing up the RTAR. Not being covered by MTG. TC3.8 Refrigerant containment. Help from Ratnesh Tiwari. Is it pre-competitive?
- Air side heat transfer for small diameter tubes – Bill Fox to work with Vikrant on RTAR. DOE work from Maryland. 2mm-5mm. Vikrant will present in optimization session and come out at other conference. May need project to get heat exchangers and update coefficient based on experimental data, ideally smaller than 3-4mm. **Validation of theoretical correlation**, finding someone to build and testing wind tunnel testing. Additive mfg. Wait for mfg to catch up.
- Modelling microchannel headers – pressure drop in headers (ongoing at ACRC) and charge Stefan Elbel and Lorenzo to work on. Do we want to work on evaporators or condensers, intermediate? Maybe focus more on charge modelling easier to justify than pressure drop. (Continue to wait on ACRC)
- Performance degradation of “aged” or degraded coated coils (bring in phase II of corrosion project add coating (get knowledge from coaters)) – Sankar will work on RTAR. Is it precompetitive.
- Microchannel with bent tubes and the effects on performance – with uniform air profile (to validate CFD) Scott Wujek and Bill Fox to work on RTAR. No work. Keep it on the list.
- ~~Temperature glide in heat exchangers, superheat, and TXVs Yang Zhou. Developing a guideline for drop in replacements. More a system design issue. Not 8.4~~

6. New Ideas

- Fouling of indoor condensers (refrigerators and freezers). TC8.9 Do we want to look at heat pump dryers
- Better HALT testing, external environmental testing. What is a good test to accelerate “aging” of coils. Couple all accelerated testings. Automotive does aging tests, can we look into what they do. Bill won't lead. Do we need materials people. Bo Shen will lead effort to write RTAR.
- -

Note: We'd like to take time in Long Beach to present more in depth presentation of both ongoing research projects during our typical research meeting time.

Get both PI's to host Webinars in the next month or two.