

**AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS,
INC.
1791 Tullie Circle, N.E./Atlanta, GA 30329
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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 TC 8.5 DATE December 1, 2009

TC/TG/TRG TITLE Liquid to Refrigerant Heat Exchangers

DATE OF MEETING Monday, June 22, 2009 LOCATION Louisville, KY

MEMBERS PRESENT	YEAR APPTD	MEMBERS ABSENT	YEAR APPTD	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
Amir Jokar	2008	Art Fovargue	2005	Jon Hartfield
Zahid Ayub	2008	James Bryan	2008	Massoud Neshan
Samuel Yana-Motta	2005	Harry Li	2008	Rupal Choksi
Joe Huber	2008	Jim Bogart	2008	Vin Gupta
Ken Schultz	2008	Dan Kihm	2008	Trevor Houck
Satheesh Kulankara	2008	<i>Corresponding Members:</i>		
John Thome	2008	Michael Ohadi	2001	
Andreas Knoepfler	2008	Keith Starner	1993	
		Tom Ortiz	2008	
<i>Corresponding Members:</i>		William McQuade	2002	
Axel Kreigsmann	2008	Ty Newell	2005	
Kash Oza	2008	Josua Meyer	2005	
Petur Thors	2005	Parviz Payvar	2008	
Ben Dingel	2007	John Judge	2004	
Ebrahim Al Hajri	2009	Lorenzo Cremaschi (prov)	2009	
Stanislav Perencevic	2009	Mahesh Valiya-Naduvath	2008	
Omar Abdelaziz	2009	Jamal Yagoobi	2007	
Justin Kauffman	2009	Olivier Pelletier	2004	
Andreas Beutler	2009	Steve Eckels	2008	

DISTRIBUTION

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

TAC SECTION HEAD:	William McQuade
TAC CHAIR:	Donald Brundage
ASHRAE MANAGER OF RESEARCH AND TECHNICAL SERVICES:	Michael R. Vaughn, P.E.
ALL COMMITTEE LIAISONS AS SHOWN ON TC/TG/TRG ROSTERS:	Dan Dettmers — Handbook Liaison Florentino Mendez — ALI/PDC Richard Hermans — RAC Research Liaison Nathan Hart — Chapter Technology Transfer Liaison Stanley Mumma – Special Publications Martin Dieryckx– Standards Liaison
ADDITIONAL DISTRIBUTION	
MANAGER OF STANDARDS	Stephanie Reiniche

**AMERICAN SOCIETY OF HEATING, REFRIGERATION,
AND AIR-CONDITIONING ENGINEERS, INC.**

Minutes

Technical Committee 8.5

Liquid-to-Refrigerant Heat Exchangers

June 22, 2009

2009 ASHRAE Annual Conference, Louisville, KY, June 20-24, 2009

1. Call to Order and Reading of TC8.5 Scope

Chairman Amir Jokar called the meeting to order at 4:14 pm. The scope of TC 8.5 was read: "TC8.5 is concerned with the thermal and mechanical design, performance, and application of devices for accomplishing heat transfer between refrigerants (including secondary refrigerants) and liquids. Such devices include liquid cooled refrigerant condensers and refrigerant evaporators for cooling liquids".

2. Introduction of Members and Guests (Sign attendance sheet)

Members and guests introduced themselves. The following were present:

Amir Jokar	WSU Vancouver
Ben Dingel	Trane
John Thome	EPFL
Ken Schultz	Trane
Petur Thors	Wolverine Tube, Inc.
Zahid Ayub	Isotherm, Inc.
Satheesh Kulankara	Johnson Controls
Joe Huber	Alfa Laval
Kash Oza	Alfa Laval
Samuel Yana Motta	Honeywell
Axel Kriegsmann	Wieland-Werke AG
Andreas Knoepfler	Wieland-Werke AG
Andreas Beutler	Wieland-Werke AG
Justin Kauffman	JCI
Jon Hartfield	Trane
Omar Abdelaziz	University of Maryland
Ebrahim Alhajri	University of Maryland
Rupal Choksi	AHRI

Stanislav Perencevic

Gunter AG&Co KG

Trevor Houck

SWEP North America

Massoud Neshan

3. **Establish Quorum Requirements**

Voting members present were: Amir Jokar, John Thome, Andreas Knoepfler, Samuel Yana Motta, Ken Schultz, Joe Huber, Zahid Ayub, and Satheesh Kulankara. Voting members absent were: Jim Bogart, James Bryan, Art Fovargue, Dan Kihm, and Harry Li. With eight of thirteen voting members present, the quorum was satisfied.

Votes below are listed as [for-against-abstain] and should add up to eight.

4. **Review/Approve Previous Meeting Minutes**

Minutes from the previous meeting (Chicago) were circulated prior to the meeting. The committee voted [8-0-0] to approve the minutes as circulated. Meeting minutes will become official and re-circulated.

5. **Chairman's Comments**

Comments from Chairman Amir Jokar are incorporated into the appropriate sections below.

6. **Section Head Comments**

Vin Gupta (Section 8 head) offered the following comments:

- Appreciation and thanks was expressed for the effort that has been exhibited by TC8.5. It has been recognized by TAC.
- Technical Committee chairs are encouraged to recommend someone for the George B. Hightower Technical Achievement Award. This award is to recognize annually an individual for his/her excellence in volunteer service in the area of TC/TG/TRG technical leadership and contribution. The award is recognition for work done over a period of the previous 4 years, which is a longer period of time than what was used in the past.
- The incoming ASHRAE President at his luncheon described his theme for the year – "Sustain our future by rebuilding our past". He is emphasizing investment in existing buildings.
- As always, roster changes and TC activity sheets are due by the Tuesday evening during each conference.
- Seminar recording practices have been further discussed. Currently, if you do not want to have a seminar presentation recorded, the only option is to write an eight page paper published as part of the Conference Transactions – no recording of Transactions sessions is allowed. ASHRAE is looking into the possibility of not recording a seminar if the speaker pays for the meeting registration on his/her own.

7. **Comments from Liasons (Handbook, Standards, Journal, Research, Program, TEGA, Technical Services, Refrigeration)**

None.

8. **Handbook Subcommittee Report**

TC8.5 is responsible for Chapters 38 and 41 in the 2012 Systems and Equipment Handbook. The Systems and Equipment Handbook was last published in 2008. There will be a new author and revisers guide distributed to the Handbook subcommittees with a recommended timeline for Handbook subcommittees. Year one following the publishing of a chapter should consist primarily of subcommittee organization. Year two should include the choice of lead reviewers. For TC8.5, the deadline for approved revisions of the aforementioned chapters is June 2011. Committee members interested in participating and helping with this process should contact Jim Bogart.

9. **Program Subcommittee Report**

Subcommittee chair Omar Abdelaziz reported on Program status.

TC8.5 co-sponsored the submission of a seminar for the Louisville meeting that summarized recent research conducted in projects sponsored by TC8.5 and TC1.3. The seminar was rejected. The seminar, titled "Recent Advances in Heat Transfer and Fluid Flow", will be resubmitted for the winter meeting in Orlando (July 10 submission deadline).

Two current TC8.5 research projects are being conducted using natural refrigerants, which could serve as the basis for a future program. Presenters would include Amir Jokar (1394-RP), Sultan Kahn (1352-RP), and possibly Zahid Ayub.

There was some discussion on papers that can be published as part of ASHRAE Transactions. There will be a new paper type called a "Conference Paper" in addition to "Technical papers". The characteristics/differences are summarized below (text taken from ASHRAE website):

Technical papers are presented by authors at ASHRAE Winter and Annual conferences and then published in ASHRAE Transactions. Papers submitted for review must be both technically accurate and clearly written. Technical papers undergo a rigorous double-blind review and must be approved by three reviewers knowledgeable in the subject matter. Technical papers can be up to 30 double-spaced manuscript pages in length, including tables and charts, and a maximum of 12 figures (not counted in the page count).

Conference papers are shorter than technical papers, undergo a less stringent review and can be prepared closer to the conferences. Unlike technical papers, abstracts of conference papers are submitted first for review. Upon acceptance, papers are due three months after abstract acceptance and undergo a single-blind review and must be approved by two reviewers. Upon approval, papers are scheduled for oral presentation and are published in ASHRAE Transactions. Conference papers can be a maximum of eight single-spaced pages in length. Papers are submitted in "final" form using a template.

The goal for future program submission will be 2 Seminars for Orlando and possibly 1 Transactions session for Albuquerque (Sumer 2010).

10. **Membership Subcommittee Report**

Subcommittee chair Kash Oza reviewed the list of current members. It was reported that as of July the committee will consist of 35 members. Dan Kihm, Art Fovargue, and Samuel Yana Motta will be rolling off as voting members following the meeting. In addition, Harry Li is resigning his voting member status. Petur Thors will be added as a new voting member, bringing the total number of voting members to 10.

11. **Standards Subcommittee Report**

Joe Huber reported that as the new Standards subcommittee chair, he has been researching the status of a number of Standards related activities started by the committee. An effort to create Standard 181, Method of Test for Liquid to Liquid Heat Exchangers, was started in 2001. No recent action has been taken relating to the creation of this standard. Joe is researching and trying to determine status and best course of action.

Other Standards related responsibilities that Joe is researching include the status of creating a standard for Method of Test for Desuperheaters and the re-affirmation status of two active standards for which the committee is responsible.

12. **Journal/Insights/Webmaster Subcommittee Report**

Webmaster Joe Huber reported that he continues to update the committee website as needed.

Please contact Joe with material to publish or with any website errors or omissions. The URL for TC 8.5's website is: <http://www.tc85.ashraetcs.org/>.

13. **Research Subcommittee Report**

In addition to the discussion of specific research projects (see below), Research Subcommittee Chairman Ken Schultz reported on information shared at the Research Chair Breakfast:

- The next deadline for RTAR/WS submission is September 15.
- Going forward, the Standard Research Agreement will require the use of dual units in reports (not just in published papers).
- Research liaisons need to be involved in development of RTARs/WSs. Research liaisons should also be present at PES (Proposal Evaluation Subcommittee) meetings. The liaison shall score the proposals, but has no vote at the meeting. The intent is to put the liaison in a better position to champion the PES selection.
- Performance evaluation forms are now to be submitted for each active project at each ASHRAE meeting; this is to ensure that the TC is MONITORING the project.
- RAC meetings are open. TC participation is welcome to help in evaluation of RTARs/WSs.
- This was Ron Bailey's last meeting as research liaison for Section 8. The incoming research liaison is Rick Hermans.
- The Research Strategic Plan 2010-2015 continues to be developed. The number of goals has been reduced down to 10 at this point and is likely to be consolidated further.

Following is a summary of TC8.5 sponsored research projects and the status of each project.

1316-RP – Experimental Evaluation of the Heat Transfer Impacts of Tube Pitch in a Highly Enhanced Surface Tube Bundle

Current Status: Active

At the research review meeting, Steve Eckels presented an update and overview of the progression of this research project. A number of problems with the experimental test vessel were discovered, primarily related to leaks and incompatibility between R123 and numerous gaskets and seals in the facility. Gasket and sealing materials have been changed to R123 compatible materials. A plain tube bundle has been installed in the test vessel and successfully rolled into the tubesheets. Testing is expected to commence on enhanced tubes very soon. The current project extension lasts only until the summer of 2009, so a 1 year

(no-cost) extension was requested. Petur Thors made a motion that a 1 year no-cost extension be granted to Kansas State University to continue the project. The motion was seconded by John Thome and passed unanimously [8-0-0].

1345-RP – Waterside Fouling Performance of Brazed-Plate Type Condensers in Cooling Tower Applications

Current Status: Active.

The Principal Investigator for this project is Lorenzo Cremaschi at Oklahoma State University. A presentation was given during the Sunday research review which summarized the status. The investigator's team has been working on creating water chemistry which meets the project work statement guidelines. Creating a satisfactory "high" fouling potential water using chemical additives has been particularly problematic. The PMS held a conference with the PI on June 15 to discuss these problems. A proposed alternative was to use water taken from the Oklahoma State cooling tower facility. This water has LSI values in the ~2.2 range (medium-high fouling potential). However, the chloride and sulfate concentrations are higher than targeted. Bill Pearson recommended using a corrosion inhibitor to counter this. The PMS voted to follow Bill's recommendation initially – to use the OSU cooling tower water with inhibitor.

Additional discussion between the PMS and the PI is expected in order to settle finally on how many types of water chemistry will be examined and what the characteristics of the water will be. In the meantime, the test facility is ready and testing will commence following the initial water chemistry recommendation of the PMS. Currently, the PI believes he is approximately 1 to 2 months behind his original planned schedule.

1394-RP – Study of Carbon Dioxide Condensation in a Chevron Angle Plate Geometry Exchanger

Current Status: Active

The Principal Investigator for this project is Amir Jokar at WSU-Vancouver. Current project status was summarized at the Sunday research review. Data collection (single and two-phase) is complete. Analysis is now underway. It was noted that the highest temperature and lowest heat flux data may have resulted in less than ideal conditions for the performance and/or integrity of the BPHE samples. Data for high, medium and low chevron angles were presented to the Sunday research review audience. It was noted that during condensation approximately 90% of the plate was subjected to two-phase flow. The data is being analyzed, with an eye towards trends based on mass flux and/or heat flux.

Zahid Ayub made a motion to grant a six month no-cost extension to WSU-Vancouver to complete the project. The motion passed with one abstention (Amir Jokar) [7-0-1].

Fouling of Tube-in-Tube Type Condensers

Jim Bogart has been tasked with writing the RTAR for this project. HTRI has expressed interest in doing this project. ARTI has indicated co-funding might also be available for this project. As mentioned in previous meetings, it is logical to approach this project as a successor to the currently active project on fouling in brazed plate heat exchangers, therefore further progression of this project through the committee hinges partially on the results of 1345-RP.

Future Research Projects

The topic of potential future research projects was discussed.

In addition to the study of fouling of tube-in-tube condensers, it was again suggested that a logical extension of the current research project on fouling (1345-RP) would be to examine water-side fouling in enhanced tubes on a more fundamental level and completing the

experimental study of fouling on enhanced tube surfaces that was left largely unfinished by RP-1205. This type of work could focus on creating a more fundamentally based model for fouling that could be used in place of a generic fouling factor “constant”.

Dr. Jamal Yagoobi previously submitted an idea to the committee titled “Enhancement of Internal Flow Heat Transfer Coefficient with Micro-Encapsulated Phase Change Material”. Dr. Yagoobi has suggested that he would like to look at applying this technique to flow and heat transfer conditions that would be representative of equipment used/manufactured by ASHRAE members. There were a number of comments suggesting that perhaps this research might best be evaluated/supported by TC 1.3, at least initially.

Jon Hartfield has completed a work statement (1556-WS) for the research project “Characterization of Liquid Refrigerant Flow Emerging from a Flooded Evaporator Tube Bundle”. This project is being led by TC 1.3, with co-sponsorship from TC8.5. An updated work statement is being considered for approval by RAC at this meeting.

Other potential research topics included nanofluids and properties of newly developed refrigerants with potential for commercial application in the HVAC industry (such as HFO 1234ze). Samuel Yana Motta and Jon Hartfield agreed to begin drafting an RTAR focusing on new refrigerants tentatively titled: “Characteristics of new low GWP refrigerants in heat transfer equipment”.

14. New Business

Omar Abdulaziz reported that a new Task Group, TG1 – Optimization, has been formed. The purpose of this task group is to disseminate optimization techniques to ASHRAE members.

15. Schedule Next Meeting

The next committee meeting will be held on January 25, 2010 at 4:15 PM in Orlando, FL.

16. Adjourn

The meeting was adjourned by unanimous vote [8-0-0] at 6:04 pm.