

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

**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 TC 8.5 DATE January 2, 2008

TC/TG/TRG TITLE Liquid to Refrigerant Heat Exchangers

DATE OF MEETING Monday, June 23, 2008 LOCATION Salt Lake City, UT

MEMBERS PRESENT	YEAR APPTD	MEMBERS ABSENT	YEAR APPTD	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
James Bryan	2006	Amir Jokar	2007	Scott MacBain
Axel Kreigsmann	2004			Vin Gupta
Samuel Yana-Motta	2005			Jon Hartfield
Mahesh Valiya-Naduvath	2004			Tony Jacobi
Joe Huber	2007	<i>Corresponding Members:</i>		Omar Abdelaziz
Ken Schultz	2007	Dan Kihm	2007	Justin Kauffman
Kash Oza	2004	Jim Bogart	2007	M Sultan Khan
Harry Li	2007	Keith Starner	1999	Ebrahim Alhajri
Art Fovargue	2005	Olivier Pelletier	2004	Massoud Neshan
Steve Eckels	2004	Tom Ortiz	2008	Rupal Choksi
		William McQuade	2002	Mustafa Yanik
<i>Corresponding Members:</i>		Ty Newell	2005	Stanislav Perencevic
Satheesh Kulankara	2003	Josua Meyer	2005	Ajay Iyengar
Zahid Ayub	2005	Jamal Yagoobi	2007	
Petur Thors	2005	Parviz Payvar	2007	
Ben Dingel	2007	John Judge	2004	
Andreas Knoepfler	2007	John Thome	2007	
Michael Ohadi	2001			

DISTRIBUTION

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

TAC SECTION HEAD:	Vinod Gupta
TAC CHAIR:	Bryan Becker
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 Michael Martin—Standards Liaison Ron Bailey —RAC Research Liaison Nathan Hart—Chapter Technology Transfer Liaison Program Liaison

ADDITIONAL DISTRIBUTION

MANAGER OF STANDARDS	Claire Ramspeck
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**AMERICAN SOCIETY OF HEATING, REFRIGERATION,
AND AIR-CONDITIONING ENGINEERS, INC.**

Minutes

Technical Committee 8.5

Liquid-to-Refrigerant Heat Exchangers

June 23, 2008

2008 ASHRAE Annual Meeting, Salt Lake City, UT, June 21-25, 2008

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

Chairman James Bryan called the meeting to order at 4:17 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:

James Bryan (Chairman)	Dell
Ben Dingel	Trane
Vin Gupta	3M
Steve Eckels	Kansas State University
Ken Schultz	Trane
Petur Thors	Wolverine Tube, Inc.
Zahid Ayub	Isotherm, Inc.
Satheesh Kulankara	Johnson Controls
Art Fovargue	James Madison University
Joe Huber	Ketema LP
Kash Oza	Standard Refrigeration Company
Mahesh Valiya Naduvath	Johnson Controls
Harry Li	Carrier Corporation
Samuel Yana Motta	Honeywell
Axel Kriegsmann	Wieland-Werke AG
Andreas Knoepfler	Wieland-Werke AG
Justin Kauffman	JCI
Jon Hartfield	Trane

Scott MacBain	Carrier
Omar Abdelaziz	University of Maryland
Ebrahim Alhajri	University of Maryland
Tony Jacobi	University of Illinois
Rupal Choksi	AHRI
Mustafa Yanik	JCI
M. Sultan Khan	GIK Institute
Stanislav Perencevic	Gunter AG&Co KG
Ajay Iyengar	United Technnologies/Carrier
Massoud Neshan	

3. Establish Quorum Requirements

Voting members present were: James Bryan, Kash Oza, Axel Kriegsmann, Samuel Yana Motta, Ken Schultz, Joe Huber, Harry Li, Steve Eckels, Art Fovargue, and Mahesh Valiya-Naduvath. Voting members absent were: Amir Jokar. With ten of eleven voting members present, the quorum was satisfied.

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

4. Review/Approve Previous Meeting Minutes

Minutes from the previous meeting were circulated prior to the meeting. The committee voted unanimously [10-0-0] to approve the minutes as circulated. Meeting minutes will become official and re-circulated.

5. Chairman's Comments

James Bryan shared a number of comments from the Chairman's breakfast meeting:

- Copies of the ASHRAE Strategic Plan should now be available on the ASHRAE website in .pdf form.
- The Chapter Technology Transfer Committee will be organizing a web broadcast on Advanced Indoor Air Quality which may be of interest. Material has been well received in the past.
- The Chapter Technology Transfer Committee is responsible for assembling a list/database of Distinguished Lecturers and making that information available to local chapters for presentations and seminars at the local chapter level. More information is available on the ASHRAE website regarding participation in this effort.
- More ASHRAE Fellows are desired. Fellows require at least 10 years of service in ASHRAE following promotion to member status.
- Nominations for the Hightower Award recognizing service in TC/TG/TRGs will be accepted until September 1. Requirements for nominations are available on the ASHRAE website.

6. **Section Head Comments**

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

- Appreciation was expressed for an active, vibrant, international technical committee. Thanks was expressed on behalf of the ASHRAE Board, Tech Council and TAC for the committees hard work and for advancing the HVAC industry through TC8.5's work on Programs, Standards, Handbooks, and Research Projects.
- Comments related to the ASHRAE Strategic Plan were shared. The ASHRAE Board sets the strategic plan and would like to be sure that members work correlates well with this plan. Net zero buildings, sustainability, high performance green buildings are current general themes. The new president's theme is "Operation of High Performance Building", which is similar to the outgoing president's theme of "Design of High Performance Buildings". Ideally, these themes should be used to help guide the writing of RTARs and creation of programs.
- The Tuesday evening of ASHRAE meetings is when technical committee forms are due. Forms include TC Activity sheets, roster forms, employer thank you letter requests, and liaison feedback forms.
- Vin reported that a concern at the chairman's breakfast was expressed regarding the mandatory recording of program speakers. The concern was that this requirement is limiting speaker's willingness to present material. To reinforce this concern it was noted that TC8.5 had one out of three speakers refuse to present at the last minute for the a program due to the recording requirement. The program organizer was very disappointed that the effort required to get this speaker to commit to a presentation was wasted. Other committee members expressed agreement that programs are suffering because of this requirement.

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

Harris Sheinman, Handbook – Errata can come in between handbook issues.

Michael Martin, Standards – Standard 24 needs to be reaffirmed (see Standards section).

8. **Handbook Subcommittee Report**

TC8.5 is responsible for two chapters in the 2008 HVAC Systems and Equipment Handbook – Condensers and Liquid Coolers. Jim Bogart was not present to report on status, but changes to the 2008 handbook chapters were submitted at the last possible moment prior to publishing.

James reported that sustainability and net-zero building content is being developed into new chapters and that "practical" examples are being stressed as desirable content for new additions to the handbook.

9. **Program Subcommittee Report**

Subcommittee chair Amir Jokar was not present.

James reported that TC8.5 co-sponsored Seminar 51 "Nanofluids for HVAC&R?" at this meeting.

Amir provided some additional information to James that he shared with the committee. Programs focusing on CFD modeling were not possible for the current meeting, but could be targeted (tentatively) for the Chicago Winter (2009) meeting. In addition, Amir may potentially have material from his own research that could be presented in a symposium in 2009.

Future ideas for programs were discussed briefly. One suggestion was to take advantage of current research projects by sponsoring a program tentatively titled "Recent Advances in ASHRAE Heat Transfer and Fluid Flow Research" or alternatively focus specifically on plate heat exchangers since the focus of multiple research projects is on this HEX type.

Apparently, there have been comments made at the ASHRAE board level that meetings may be too technical and that reducing the number of symposia might make meetings more accessible to members. The membership of TC8.5 does not agree with this assessment and feels that the technical comment of the committee meeting should remain strong in order to provide value for meeting attendees. A motion was made by Steve Eckels and seconded by Ken Schultz to communicate to the section head that the committee feels that there should be continued strong technical content in the programs at ASHRAE meetings. The motion passed unanimously [10-0-0].

10. Membership Subcommittee Report

Subcommittee chair Kash Oza reviewed the list of current members. Following this meeting, 4 voting members will roll off as voting members and 6 members will become new voting members. Kash Oza, Axel Kriegsmann, Steve Eckels, and Mahesh Valiya-Naduvath will roll off. Jim Bogart, Dan Kihm, Zahid Ayub, Andreas Knoepfler, Satheesh Kulanakara, and John Thome will roll on as voting members. This will bring the number of voting members on TC8.5 to 13.

The committee currently has 27 members. Two new potential members have sent their application in to ASHRAE and their applications will be reviewed during the Chicago meeting.

11. Standards Subcommittee Report

Standard 24: "Methods of Testing for Rating Liquid Coolers" is due for reaffirmation. Mahesh made a motion that TC8.5 reaffirm Standard 24. The motion was seconded by Art Fovargue. The motion passed unanimously [10-0-0].

12. Journal/Insights/Webmaster Subcommittee Report

Webmaster Joe Huber reported that he continues to update the committee website, although there have been problems with the server at times.

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:

- ASHRAE's research budget is ~\$2.5 million per year. Currently \$1.3 million is available for new projects. There are currently 85 active projects -- 30 added during the 07-08 fiscal year, 14 completed.
- Martha Hewett is the incoming RAC chairman.
- A number of research collaboration opportunities exist and should be taken advantage of if possible. These include ARTI and the California Energy Commission.
- Input to the 2010-2015 Research Strategic Plan is possible through the ASHRAE website.

- Scheduling of rooms for PES (Proposal Evaluation Subcommittee) meetings is being encouraged to avoid holding these types of meetings in public places.

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. Pool boiling tests have been completed for both enhanced and smooth tubes in both R134a and R123. Results are in good agreement with data available in the literature. Both tube-average and local shell-side heat transfer coefficients were determined, with good agreement between the two. Two journal papers are being finalized for publication. The initial build of the bundle test section/vessel failed. This initial vessel was scrapped and a new test vessel was designed to be more robust and easier to manufacture. The updated test facility is expected to be ready for testing by fall. Because of this delay, the project will likely need to be extended into 2009.

1324-RFP – Study of Single-Phase Flow-Induced Tube Vibration in Shell and Tube Heat Exchangers

Current Status: No response to RFP

No update.

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

Current Status: Active.

The contract for this project was signed April 1, so it is just beginning. A presentation was given during the Sunday research review by Lorenzo Cremaschi which summarized the status. The test facility is in the early design phase. A number of testing details have been discussed and agreed on by the PI and PMS in a recent teleconference. Refrigerant conditions for testing will be a 170 degrees F inlet and 105 degrees F saturation condition. Entering water temperature will be 85 degrees F. Testing will continue to an asymptotic condition, with the PMS involved in the determination of the end of the test. Three different water qualities with different levels of fouling potential will be used, with two heat flux levels and 4 heat exchanger designs/samples (three different aspect ratios and a fourth with a different chevron angle). Water qualities to be used are the same as those identified in 1205-RP. A water quality consultant (Bill Pearson) has agreed to provide input if necessary. Water conditions will be monitored using an on-campus laboratory. GEA will supply 24 HEX samples for the project. It is hoped that the test facility can be designed to be able to test multiple heat exchangers at once. An uncertainty analysis has been conducted which indicates that a 10% uncertainty in fouling resistance is possible as long as the delta T due to fouling is at least 2 degrees F at the completion of the test period. The investigators are also working on a literature survey.

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. The investigators are actively obtaining equipment for testing, and have already obtained a 0.1 to 0.5 gpm CO2 pump. Test heat exchangers will consist of four plates forming three channels - a center channel for CO2 condensation and outer channels for the cooling fluid. Three chevron angles will be

tested. Dynalene will be used as the working fluid for low temperature operation. A modified Wilson plot data reduction technique for single-phase heat transfer performance will be used. There was some discussion as to how to best define the hydraulic diameter/minimum free flow area used in calculating a Reynolds number. This issue will require further investigation. It is hoped that some initial data will be available for the Chicago meeting.

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.

Future Research Projects

One possibility for a new research project that was suggested was to create a somewhat open-ended, general Request For Proposal that would gather new and innovative ideas for heat transfer and heat exchanger technology. For example, set general heat transfer performance targets and see if any submissions seem worthy of further study.

Other suggestions included examining "new", low GWP refrigerants such as hydrocarbons (propane).

Further suggestions focused on continuing to examine water-side fouling 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". Related to fouling, TC 8.2 has expressed an interest in examining fouling and its relationship to variable primary water flow chiller applications. This may be worth considering in the scope of any future fouling projects involving enhanced tubes.

14. New Business

James will be rolling off as chairman following this meeting. Amir Jokar is the incoming chairman.

15. Schedule Next Meeting

The next committee meeting will be held on January 26, 2009 at 4:15 PM in Chicago, IL.

16. Adjourn

The meeting was adjourned by unanimous vote [10-0-0] at 6:19 pm.