

**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 31, 2006

TC/TG/TRG TITLE Liquid to Refrigerant Heat Exchangers

DATE OF MEETING Monday, June 26, 2006 LOCATION Quebec City, PQ

MEMBERS PRESENT	YEAR APPTD	MEMBERS ABSENT	YEAR APPTD	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
Jim Bogart	2003	Parviz Payvar	2005	Ralph Breisch
Axel Kreigsmann	2004	Art Fovargue	2005	Gary Zyhowski
Steve Eckels	2004	Louay Chamra	2005	M. Neshan
Mahesh Valiya-Naduvath	2004	Kash Oza	2004	Dan Kihm
John Thome	2003	Samuel Yana-Motta	2005	Andreas Knoepfler
Ben Dingel	2003			Saunders Smith
Jamal Yagoobi	2004	<i>Corresponding Members:</i>		Chris Seeton
		Keith Starner	1999	Justin Kauffman
		Michael Ohadi	2001	Steve Skalko
		Olivier Pelletier	2004	
<i>Corresponding Members:</i>		John Judge	2004	
Ken Schultz	2003	William McQuade	2002	
Satheesh Kulankara	2003	Josua Meyer	2005	
Zahid Ayub	2005	Allison Andrews	2005	
Petur Thors	2005	Ty Newell	2005	
Harry Li	2005	Joe Huber	2003	
		James Bryan	2005	
		Amir Jokar	2005	

DISTRIBUTION

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

TAC SECTION HEAD:	Bryan Becker
TAC CHAIR:	Eckhard Groll
ASHRAE MANAGER OF RESEARCH AND TECHNICAL SERVICES:	Michael R. Vaughn, P.E.
ALL COMMITTEE LIAISONS AS SHOWN ON TC/TG/TRG ROSTERS:	William Walter — Handbook Liason Steve Skalko—Standards Liason Lynn Werman—Program Liason Ron Bailey —RAC Research Liason Kimball Ferguson —Special Publications Liason Julian R De Bullet —Professional Development Comm (Educ) Michael Middleton—Chapter Technology Transfer Liason

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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 26, 2006

2006 ASHRAE Annual Meeting, Quebec City, PQ, June 24-28, 2006

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

Chairman Jim Bogart called the meeting to order at 4:22 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".

An agenda for the meeting had been sent by email prior to the meeting.

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

Members and guests introduced themselves. The following were present:

Jim Bogart (chairman)	FlatPlate, Inc. 2161 Pennsylvania Ave York, PA 17404
Ben Dingel	Trane 3600 Pammel Creek Road La Crosse, WI 54601
Ken Schultz	Trane 3600 Pammel Creek Rd La Crosse, WI 54601
Steve Eckels	Kansas State University 3410 Woods Dr. Manhattan, KS 66503
Zahid Ayub	Isotherm, Inc. 3305 Thorntree Ct. Arlington, TX 76016
Satheesh Kulankara	Johnson Controls (York) 631 S. Richland Ave. 191A York, PA 17403
Petur Thors	Wolverine Tube, Inc. 2100 Market St. NE Decatur, AL 35601
Mahesh Valiya-Naduvath	Johnson Controls (York) 631 S. Richland Ave. 191A York, PA 17403

John Thome	Swiss Federal Institute of Technology (EPFL) Lausanne, Switzerland 1015
Ralph Breisch	SWEP North America 3483 Satellite Blvd. Suite 210 Duluth, GA 30096
Harry Li	Carrier Corporation 6304 Thompson Road Syracuse, NY 13221
Axel Kriegsmann	Wieland-Werke AG Graf-Arco Str. 36 Ulm, Germany D-89073
Jamal Yagoobi	Illinois Institute of Technology 10 W. 32 nd St. Chicago, IL 60606
Dan Kihm	SWEP North America 3483 Satellite Blvd. Suite 210 Duluth, GA 30096
Gary Zyhowski	Honeywell 20 Peabody St. Buffalo, NY 14210
Andreas Knoepfler	Wieland-Werke AG Graf-Arco Str. 36 Ulm, Germany D-89076
Sauders Smith	ARI 4100 N. Fairfax Drive Suite 200 Arlington, VA 22203
Justin Kauffman	York/JCI 631 S. Richland Ave. York, PA 17406
Chris Seeton	University of Illinois
Steve Skalko	Portland Cement
M. Neshan	

3. Establish Quorum Requirements

Voting members present were: Jim Bogart, Ben Dingel, Jamal Yagoobi, John Thome, Steve Eckels, Axel Kriegsmann, and Mahesh Valiya-Naduvath. Members absent were: Louay Chamra, Kash Oza, Samuel Yana Motta, Parvis Payvar and Art Fovargue. With seven of twelve voting members present, the quorum was satisfied.

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

4. **Review/Approve Previous Meeting Minutes**
Minutes from the previous meeting were circulated prior to the meeting. The committee voted unanimously [7-0-0] to approve the minutes as circulated. Meeting minutes will become official and re-circulated.
5. **Chairman's Comments**
Mahesh Valiya-Naduvath shared a number comments from the Chairman's breakfast meeting. Future ASHRAE meetings are to have specific themes, and programs consistent with these themes have a greater chance of being approved. The Dallas meeting theme is Energy Efficient Building Design and the Long Beach meeting theme will be Natural Resource Utilization for HVAC&R Systems. Also reported was an upcoming change to the committee roster software. In addition, it is now suitable to satisfy quorum requirements in committee meetings via phone (2-way conversation).
6. **Section Head Comments**
None.
7. **Comments from Liasons (Handbook, Standards, Journal, Research, Program, TEGA, Technical Services, Refrigeration)**
None.
8. **Handbook Subcommittee Report**
Subcommittee chair Louay Chamra was not present to report on Handbook activities.
9. **Program Subcommittee Report**
Subcommittee chair Amir Jokar was not present to report on future program activities. A TC8.5 sponsored seminar was scheduled for Wednesday's technical program, titled "Flow Distribution Issues in Heat Exchangers".
10. **Membership Subcommittee Report**
Subcommittee chair Kash Oza reviewed the list of current members. The 12 voting members for the current Society year (through end of June 2006) are: Jim Bogart, Ben Dingel, Louay Chamra, Kash Oza, Jamal Yagoobi, John Thome (Int'l), Steve Eckels, Art Fovargue, Axel Kriegsmann (Int'l), Parvis Payvar, Mahesh Valiya-Naduvath, and Samuel Yana Motta.

Voting members beginning on 7/1/2006 will be: James Bryan, Louay Chamra, Ben Dingel, Kash Oza, Jamal Yagoobi, John Thome, Steve Eckels, Art Fovargue, Axel Kriegsmann, Parviz Payvar, Mahesh Valiya-Naduvath, and Samuel Yana Motta.

Meeting attendees Dan Kihm from SWEP North America, Andreas Knoepfler from Wieland Werke AG and Saunders Smith from ARI were nominated for corresponding member status on TC8.5. Nominating motions for all were approved unanimously [7-0-0].
11. **Standards Subcommittee Report**
Standards Subcommittee chair James Bryan was not present to report on Standards activities.

Jim Bogart volunteered to serve on the SPC (Standards Project Committee) to create an ASHRAE Standard (method of test) for ARI Standard 470-2001, Desuperheater/Water Heaters.

12. Journal/Insights/Webmaster Subcommittee Report

Webmaster Joe Huber was not present to report on updates to the website. Please contact him with any 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), Ken Schultz reported that RAC now has the authority to approve projects with a cost of up to \$90,000 without approval of Tech Council. He also reported that an electronic version of the ASHRAE Research Manual is supposed to be available online. Finally, Ken reported that spending money for research is "tight", and will potentially impact TC8.5 research projects proceeding through the approval/bid process.

Following is a summary of 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 overview of the project along with a description of the test facility design and key equipment purchases. Test facility details were being finalized and construction underway. Steve also reported that a literature review was in progress and that it was hoped the facility would be operational by the next ASHRAE meeting.

A question about what tubes should be used in the test matrix was raised. To be consistent with previous ASHRAE studies on tube bundle boiling, it was suggested the Wolverine Turbo BII would be a suitable choice. This tube has specific tube surfaces designed for each refrigerant in the test plan (R134a and R123).

The range of tube pitches to be investigated was again specifically discussed by interested committee members. It was suggested that the use of two relatively standard P/D ratios (1.167 and 1.33) in addition to a third "large" value of either 1.66 or 1.50 would be an acceptable alternative to the values of 1.167, 1.45, and 1.76 proposed by the PI.

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

Current Status: Work statement approved and ready for bid

A revised work statement was approved by committee members via email ballot in February of 2006 [10 for – 0 against – 1 abstain – 1 non-response]. The work statement was ready to go out for bid as of this meeting, but was not on the current bid list due to funding limitations. It is expected to go out for bid in the future, pending fund availability.

1345-WS: Waterside Fouling Performance of Brazed-Plate Type Condensers in Cooling Tower Applications

Current Status: Work statement approved and ready for bid.

The work statement was conditionally approved by RAC in November of 2005, and Jim Bogart addressed the questions and comments. The work statement should now be sent out

for bid (Request For Proposal) pending fund availability. This project has co-funding from ARTI.

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

Current Status: Priority Status on RIP, waiting for work statement approval.

Zahid Ayub has prepared a draft work statement for committee review. Comments/feedback on the work statement is needed, and an email vote to approve the work statement will be required in order to meet a submission deadline of August 15 for RAC approval.

Fouling of Tube-in-Tube Type Condensers

This topic was put on the research plan at a previous meeting (Orlando); see those minutes for background information.

1205-RP – Water-side Fouling Inside Smooth and Augmented Copper Alloy Condenser Tubes in Cooling Tower Water Applications

Current Status: Active (end date extended to 31-May-06)

Since the Denver meeting (Jun 2005), difficulties had arisen between the PI and the PMS working on this project. Because of the situation, no report was given at the TC8.5/1.3 Sunday research review meeting for the second consecutive ASHRAE meeting. The situation was discussed in an “executive” session (voting and corresponding members only). Prior to this meeting, the PI was contacted and stated that he did not want to continue working with the PMS for this project, even indirectly (as recommended by the committee by a motion from the Chicago meeting). Furthermore, the PI was not interested in obtaining any of the remaining funds being withheld by ASHRAE pending completion of the project and did not plan to submit a final report.

Many members of the committee expressed disappointment that the project could not be brought to a logical conclusion that might provide the committee and interested ASHRAE members a complete set of experimental data. Also expressed was some frustration that the actions and recommendations made by the committee were not followed. Because of these contentious interactions with the ASHRAE organization and membership, many members of the committee felt that the PI (Louay Chamra) should not be considered for a leadership position in the committee at this time. After discussion, two motions were made (names specifically withheld).

A first motion was made to remove the 1205-RP PI, Louay Chamra, from his current position as TC8.5 committee Vice-Chair. This motion was seconded and passed unanimously [7-0-0]. A second motion was made to request Zahid Ayub contact the PI and ask about securing some form of a final report, even if unofficial, as a service to the committee. This motion was also seconded and passed unanimously [7-0-0].

Long Range Research Plan

Because of the planned RFP(Request For Proposal)/bidding activity associated with the most recent top priority TC8.5 research projects, projects associated with the already approved WS-1324 and WS-1345 were suggested to be moved off of the committee’s research priority list to make sure new, unapproved projects received the appropriate priority when submitted for approval by RAC. As such, a motion was made to modify the TC8.5 Long Range Research Plan to reflect the following priorities:

- 1) Study of Carbon Dioxide Condensation in a Chevron Angle Plate Geometry Exchanger
- 2) Fouling of Tube-in-Tube Type Condensers

The motion was made by John Thome, seconded by Mahesh Valiya-Naduvath and approved unanimously [7-0-0].

14. **New Business**

An unsolicited research proposal (1444-URP) titled "Experimental Evaluation of Two-Phase Pressure Drops and Flow Patterns in U-Bends for R-134a, R-410a, and Ammonia" was submitted to TC1.3, TC8.4, and TC8.5. A motion to table any action on this proposal pending review by TC1.3 was made by Mahesh Valiya-Naduvath and seconded by Axel Kriegsmann. The motion passed by unanimous vote [7-0-0].

15. **Schedule Next Meeting**

The next committee meeting will be held on January 29, 2007 at 4:15 PM in Dallas, TX.

16. **Adjourn**

The meeting was adjourned by unanimous vote [7-0-0] at 6:22 pm.

ASHRAE TC/TG/TRG ACTIVITIES SHEET

DATE: June 26, 2006

TC/TG/TRG NO.: TC 8.5 TC/TG/TRG TITLE: Liquid-to-Refrigerant Heat Exchangers

CHAIRMAN: Jim Bogart VICE CHAIRMAN: James Bryan SECRETARY: Ben Dingel

TC/TG/TRG MEETING SCHEDULE			
Location-Past 12 Months	Date	Location-Planned Next 12 Months	Date
Quebec City, Canada	June 2006	Dallas	Jan 2007
Chicago	Jan 2006	Long Beach	June 2007
TC/TG/TRG SUBCOMMITTEES			
Function		Chairman	
Program		Amir Jokar	
Membership		Kash Oza	
Research		Ken Schultz	
Handbook		Louay Chamra	
Standards		James Bryan	
Journal/Web/Insights		Joe Huber	
RESEARCH PROJECTS-CURRENT			
Project Title	Contractor	Monitoring Comm. Chpt.	Report Made At Meeting
1205-RP Waterside Fouling Inside Smooth and Augmented Copper-Alloy Condenser Tubes in Cooling Tower Water Applications.	Mississippi State University	Art Fovargue	No
1316-RP Experimental Evaluation of the Heat Transfer Impacts of Tube Pitch in a Highly Enhanced Surface Tube Bundle	Kansas State University	Petur Thors	Yes
1324-TRP Study of Single-Phase Flow-Induced Tube Vibration in Shell and Tube Heat Exchangers	Proposals submitted were voted non-responsive by TC 8.5 - Work Statement reworked and ready for bid	N/A	N/A
1345-WS Waterside Fouling Performance of Braze-Plate Type Condensers in Cooling Tower Water Applications	Work statement approved and ready for bid	N/A	N/A
LONG RANGE RESEARCH PLAN			
Rank	Title	W/S Written	Apprv. To R&T
1.	Study of Carbon Dioxide Condensation in a Chevron Angle Plate Geometry Exchanger (1394-RTAR)	Yes	No
2.	Fouling of Tube-in-Tube Type Condensers	No	No

(OVER PLEASE)

HANDBOOK RESPONSIBILITIES					
Year & Volume	Chapter	Title	No.	Deadline	Handbook Subcom Liaison
2008 Systems	Chapter 37:	Liquid Coolers		7/31/07	William Walter
2008 Systems	Chapter 35:	Condensers		7/31/07	William Walter
STANDARDS ACTIVITIES-List and Describe Subjects					
Standard 22: No current activity					
Standard 24: No current activity					
Standard 181: Create new standard for Method of Testing for Liquid to Liquid Heat Exchangers (to accompany ARI standard 400). TPS approved.					
Standard ??: Create new standard for Method of Testing for Desuperheater/Waters (to accompany ARI standard 470). TPS approved by TC8.5 and being forwarded to standards committee.					
TECHNICAL PAPERS from Sponsored Research-Title, when presented (past 3 yrs. present & planned)					
TC/TG Sponsored Symposia-Title, when presented (past 3 yrs. present & planned)					
TC/TG Sponsored Seminars-Title when present (past 3 yrs. present & planned)					
Recent ASHRAE Research in Thermal and Fluid Flow Characteristics of HVAC, Refrigeration and A/C Processes Denver, 2005					
Design and Application of Brazed and Welded Plate-Type Heat Exchangers in the HVAC&R Industries Chicago, 2006					
Flow Maldistribution in Heat Exchangers Quebec City, 2006					
TC/TG Sponsored Forums-Title, when presented (past 3 yrs. present & planned)					
JOURNAL PUBLICATIONS, when published (past 3 yrs. present & planned)					
RP-984 An Investigation of Condensation Heat Transfer Performance of HFC-134a on Single Enhanced Tubes <i>HVAC&R Research Volume 9, Number 1/January 2003</i>					
Effect of Inundation Upon the Condensation Heat Transfer Performance of R-134a: Part I-Facility Overview and Data Analysis <i>HVAC&R Research Volume 11, Number 4/October 2005</i>					
Effect of Inundation Upon the Condensation Heat Transfer Performance of R-134a: Part II-Results <i>HVAC&R Research Volume 11, Number 4/October 2005</i>					
RP-1089 Local Bundle Boiling Heat Transfer Coefficients on a Plain Tube Bundle <i>HVAC&R Research Volume 10, Number 1/January 2004</i>					
Local Bundle Boiling Heat Transfer Coefficients on an Integral Finned Tube Bundle <i>HVAC&R Research Volume 10, Number 3/July 2004</i>					
Local Bundle Boiling Heat Transfer Coefficients on a Turbo-BII HP Tube Bundle <i>HVAC&R Research Volume 10, Number 4/October 2004</i>					
Void Fraction and Two-Phase Pressure Drops for Evaporating Flow over Horizontal Tube Bundles <i>Heat Transfer Engineering Volume 27, Number 3/April 2006</i>					
Prediction of Local Bundle Boiling Heat Transfer Coefficients: Pure Refrigerant Boiling on Plain, Low Fin, and Turbo-BII HP Tube Bundles <i>Heat Transfer Engineering Volume 27, Number 10/December 2006</i>					