

**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 October 1, 2005

TC/TG/TRG TITLE Liquid to Refrigerant Heat Exchangers

DATE OF MEETING Monday, June 27, 2005 LOCATION Denver, CO

MEMBERS PRESENT	YEAR APPTD	MEMBERS ABSENT	YEAR APPTD	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
Jim Bogart	2003	Josua Meyer	2001	Amir Jokar
Axel Kreigsmann	2004	Jamal Yagoobi	2004	Bruce Babin
Steve Eckels	2004	Ben Dingel	2002	Ty Newell
Petur Thors	2001			Emad Jassim
Zahid Ayub	2001			Mike Heidenreich
Mahesh Valiya-Naduvath	2004	<i>Corresponding Members:</i>		Ralph Breisch
Kash Oza	2004	Nabil Hanna	2003	Michael Froelich
John Thome	2003	James Larson	2001	R. Stanley Kistler
		Keith Starner	1999	
<i>Corresponding Members:</i>		Michael Ohadi	2001	
Ken Schultz	2003	Olivier Pelletier	2004	
Joe Huber	2003	John Judge	2004	
Satheesh Kulankara	2003	Art Fovargue	2004	
Louay Chamra	2004			
Parviz Payvar	2002			
James Bryan	2004			
William McQuade	2002			
Samuel Yana-Motta	2004			

DISTRIBUTION

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

TAC SECTION HEAD:	Patricia Graef
TAC CHAIR:	William P Bahnfleth
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 Brian Dougherty —Standards Liason Jeff Traylor —Program Liason Thomas Kuehn —RAC Research Liason Kimball Ferguson —Special Publications Liason Mark Hydeman —Professional Development Comm (Educ) William Klock —Chapter Technology Transfer 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 27, 2005
2005 ASHRAE Annual Meeting, Denver, CO, June 25-29, 2005

****NOTE:** Minutes recorded by Ken Schultz, filling in for absent secretary Ben Dingel.**

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

Chairman Jim Bogart called the meeting to order at 4:20 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. The agenda was modified to include time for discussion of 1324-TRP.

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

Members and guests introduced themselves. The following were present:

Jim Bogart (chairman) member chairman	FlatPlate, Inc. 2161 Pennsylvania Ave York, PA 17404
Ken Schultz corr member	Trane 3600 Pammel Creek Rd La Crosse, WI 54601
Steve Eckels member	Kansas State University 64 Seaton Hall Manhattan, KS 66506
Zahid Ayub member	Isotherm, Inc. 3305 Thorntree Ct. Arlington, TX 76016
Satheesh Kulankara corr member	York International 631 S. Richland Ave. York, PA 17403
Petur Thors member	Wolverine Tube, Inc. 2100 Market St. NE Decatur, AL 35601
Mahesh Valiya-Naduvath member	York International 631 S. Richland Ave. York, PA 17403
Joe Huber corr member	Ketema LP 2300 W. Marshall Grand Prairie, TX 75051

John Thome member	Swiss Federal Institute of Technology (EPFL) Lausanne, Switzerland 1015
Louay Chamra corr member	Mississippi State University 210 Carpenter Eng. Bldg. Mississippi State, MS 39762
James Bryan corr member	University of Missouri Dept. of Mech. & Aero. Engineering Columbia, MO 65211
Kash Oza member	Standard Refrigeration Company 2050 N. Ruby Street Melrose Park, IL 60160
Amir Jokar guest	Washington State University 14204 NE Salmon Creek Ave. Vancouver, WA 98686
Bruce Babin guest	Kansas State University 342 Rathbone Manhattan, KS 66506
Ty Newell guest	University of Illinois 1206 W. Green St. Urbana, IL 61801
Emad Jassim guest	University of Illinois 1206 W. Green St. Urbana, IL 61801
Mike Heidenreich guest	Advanced Heat Transfer, LLC 1715 Aaron Brenner Dr. Suite 726 Memphis, TN 38120
Ralph Breisch corr member	SWEP North America 3483 Satellite Blvd. Suite 210 Duluth, GA 30096
Michael Froehlich guest	Carrier Corporation Carrier Parkway Syracuse, NY 13027
Samuel Yanamotta corr member	Honeywell 20 Peabody St. Buffalo, NY 14210
Axel Kriegsmann member	Wieland-Werke AG Seidlheck 7 Ulm, Germany D-89079
R. Stanley Kistler guest	HTRI 150 Venture Drive College Station, TX 77845

Bill McQuade
corr member

York International
PO Box 1592-191A
York, PA 17405

Parviz Payvar
corr member

Northern Illinois University
Dekalb, IL

3. Establish Quorum Requirements

Voting members present were: Jim Bogart, Kash Oza, John Thome, Zahid Ayub, Steve Eckels, Axel Kriegsmann, Petur Thors, and Mahesh Valiya-Naduvath. Members absent were: Ben Dingel, Jamal Yagoobi, and Josua Meyer (int'l). With eight of ten (not counting the one absent international member) 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 (07-Feb-2005 Winter Meeting in Orlando) were circulated prior to the meeting. The committee voted unanimously [8-0-0] to approve the minutes as circulated. Ben Dingel will update the minutes to so indicate.

5. Chairman's Comments

ASHRAE is offering to send a thank you letter to supervisors, etc. for allowing participation in ASHRAE activities. A sign-up sheet was circulated for those wishing to have this letter sent.

ASHRAE continues to promote nominations for the Hightower Award. The purpose of the George B. Hightower Technical Achievement Award is to recognize annually an individual for his/her excellence in volunteer service during the preceding Society year in the area of TC/TG/TRG technical leadership and contribution, which includes all TC, TG and TRG activities except for research and standards. The award will serve to heighten general membership awareness of, and interest in, Society activities at the TC/TG level. Nominations are next due to the nominee's TAC Section Head by 30-Sep-2005 through the TC chair. Jim Bogart and Louay Chamra offered to take the lead on this.

6. Section Head Comments

None.

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

None.

Louay Chamra noted that ASHRAE is considering changes to the Program organization, in particular, technical sessions could be shortened with the possibility of eliminating Wednesday technical sessions.

8. Handbook Subcommittee Report

Subcommittee chair Louay Chamra has recruited reviewers for Systems and Equipment chapters 35 (Condensers) and 37 (Liquid Coolers), including Joe Huber, John Thome, Jim Bogart, Art Fovargue, and Josua Meyer. A password-protected area has been set up on the TC 8.5 website for this purpose. Modifications, review, and approval are needed by summer of 2006. The Handbook liaison would like to know approximately how much change in file size might occur.

9. Program Subcommittee Report

Our program subcommittee chair, Rusty Smith has “retired” because of a change in employment. At the previous meeting, Joe Huber agreed to take on the task of organizing the seminar for this (Denver) meeting. The seminar (Seminar 41: “Recent ASHRAE Research in Thermal and Fluid Flow Characteristics of HVAC, Refrigeration and A/C Processes”) is scheduled for the 10:15-12:15 session on Tuesday and includes five presentations. The presentations will be recorded for the DVD.

Amir Jokar proposed holding a seminar on brazed plate technology, both single- and two-phase applications. The committee approved [8-0-0] such a seminar for the upcoming Chicago meeting. Amir will organize; Joe Huber will help. Deadline for submission of a Chicago seminar package to ASHRAE is 05-Aug-2005.

10. Membership Subcommittee Report

Subcommittee chair Kash Oza reviewed the list of members whose terms begin or continue on 01-Jul-2005 and run through 30-Jun-2006. The 12 voting members for the next Society year 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 Yanamotta.

Amir Jokar has applied for corresponding member status. This was approved [8-0-0] by the committee. Amir’s corresponding member status will officially begin with the 2006-2007 Society year.

11. Standards Subcommittee Report

Subcommittee chair James Bryan reported that the title, purpose, and scope (TPS) for Standard 181 Method of Test (MOT) that will accompany ARI Standard 400-2001, “Liquid-to-Liquid Heat Exchangers” has been reworded to avoid conflict with ASME Standard PCT12.5 by limiting the scope to only air-conditioning and heating applications. ASHRAE is expected to vote on the reworded TPS and assign a committee at this (Denver) meeting.

ARI Standard 470 Desuperheater/Water Heaters fits within the scope of TC 8.5. As with other standards, ARI is asking ASHRAE to take on responsibility for the method of test to support this standard. The committee voted [8-0-0] to accept this responsibility. James will generate a title, purpose, and scope (TPS).

12. Journal/Insights/Webmaster Subcommittee Report

Webmaster Joe Huber reminded the meeting attendees to send him titles of papers generated from TC 8.5 funded research work. Joe will list these on the TC 8.5 website.

The URL for TC 8.5’s website is: <http://www.tc85.ashraetcs.org/>.

13. Research Subcommittee Report

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

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)

James Bryan (filling in for Art Fovargue) reported that the laboratory experienced a chilled water incident that led to blowing all of the rupture disks attached to the R134a canisters resulting in some damage to the lab. The facility has been repaired and tests have been completed with low fouling potential water at 2 ft/sec velocity. Insignificant fouling was seen. For this reason, there is no justification for running the 5 and 7 ft/sec tests with the low fouling potential water.

The PMS continues to work with Bill Pearson (water treatment/chemist). It is Bill's contention that it doesn't make sense to average water conditions found across the country. "Cambridge" water was chosen to create the low fouling potential water. The medium and high fouling potential waters should be created by "cycling up" (concentrating) this same Cambridge water. Bill has agreed to provide the chemicals and biocide to make the medium and high fouling potential waters for the project. (Results of this project will be limited to "this" water. An expanded program would use regionally representative waters cycled up to various concentrations. Louay agreed to document the lessons learned in the final report.)

The next step will be to make the medium fouling potential Cambridge water. Tests will then be run at a 2 ft/sec water velocity. The PI and PMS will review the results from these tests and determine the next step.

The no-cost contract extension to 31-May-06 granted at the previous meeting needs to get on ASHRAE's books. Ken Schultz to follow up with Donna Daniels. The PI is now up-to-date with quarterly reports.

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

Current Status: Priority Status on Research Implementation Plan (RIP), bids reviewed for second time.

Discussion of this project was conducted in closed session; all non-members and those affiliated with bid submissions were asked to leave the room. At the previous meeting, the committee approved recommending that this project be awarded to John Thome at EPFL (although this was confidential at the time and therefore not recorded explicitly in the minutes). Just prior to signing a contract with ASHRAE, circumstances came about that prevented EPFL from performing the work with R123 as specified in the work statement. The PES (Petur Thors, Ben Dingel, Satheesh Kulankara, and Louay Chamra) discussed the situation by email and teleconference. Two options were discussed: allowing EPFL to continue with the contract and use a different refrigerant or reviewing the other three bids received and recommending that the work be awarded elsewhere. In the end, the PES recommended the latter. The committee approved this direction [8-1-2, where the two abstentions were bidders] by email ballot. MORTS subsequently determined that each of the other three bidders was still interested in having their proposal considered.

PES chair Petur Thors reported that the PES re-reviewed the proposals from the other three bidders. The scores were very close, as were the bid amounts. However, the PES made a unanimous recommendation. Following some discussion and clarification, the committee voted [7-0-1, abstention was for bidder not present] to accept the PES recommendation and forward this to MORTS. Petur will prepare the necessary documentation and submit.

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

Current Status: Accepted on RIP, bids received and reviewed.

Remaining in closed session, PES chair Mahesh Valiya-Naduvath reported that following release of the work statement for bid, only two proposals were received, one from HTRI and one from Oklahoma State University. He also reported that two other parties contacted him. One declined for reasons of cost. The second needed more time to prepare a proposal. A quite long list of potential bidders had been identified and submitted to MORTS with the work statement.

The PES concluded that neither proposal met the scope of the work statement; both scores came in below the cut-off of 70. HTRI would like to propose the creation of an ASHRAE/HTRI database specifically for HVAC&R applications. There was some discussion about what the real issue is. Much data exists on behavior with air/water. Are models sufficiently developed to extend this to refrigeration equipment? Are the characteristics of highly enhanced tubes known well enough?

The consensus of the committee was to break down the work statement into smaller phases. The first phase would be to conduct a literature review that would lead us to the next step. It also might include obtaining some data with air/water and enhanced tubes. At the PES's recommendation, the committee voted [8-0-0] to find the two proposals non-responsive to the work statement. Mahesh will fill out the necessary documentation and submit it to MORTS. The committee also voted [8-0-0] to authorize rewriting the work statement into smaller phases. The new work statement will be circulated to the committee for review and approval.

2004-40-RTAR: Performance and Cleanability of Brazed-Plate Type Condensers Operating Under Fouling Conditions

Current Status: Accepted on RIP, second draft of work statement submitted for committee review.

A second draft work statement was circulated for review prior to the meeting by author Jim Bogart. The title has been revised to be consistent with 1205-RP. Jim noted that ARI is willing to co-fund this work (\$47,000). Art Fovargue (by email feedback) commented that the corrosion inhibitor/biocide package should be specified, test conditions need to be more specific (but do they then become over constrained?), and multiple velocities should be tested (but then scope increases). Jim specified higher entering superheat in this work statement than 1205-WS because of how and where BPHE's are applied. Testing of a straight plain tube was added as a way to check ability to duplicate 1205-RP results. Petur Thors questioned the size of the plate pack (30 plates) as too large, requiring 15 tons worth of auxiliary equipment. Objective should be to have water channel heated on both sides, so a minimum of four plates and three channels (two refrigerant and one water). Mahesh suggested Jim enhance the value to ASHRAE section with dollar values.

Jim agreed to write a third draft and submit it to the committee for review. The expectation is that the rewrite, review, and vote (by email) can be accomplished in time for 15-Aug-2005 submission to MORTS for consideration by RAC at their October meeting.

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

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

Zahid said he would begin working on the work statement after he rolls off of RAC (in a few days). He will try to circulate a draft prior to the 15-Aug-2005 next submission date.

Research Plan

Additional potential research projects considered by TC8.5 were discussed:

Fouling of Tube-in-Tube Type Condensers

This topic was put on the research plan at the previous meeting (Orlando); see those minutes for background information. These products see applications similar to BPHE's. The unknown here is the effect of curvature on fouling due to secondary flow. Co-funding from ARI is likely. Jim Bogart will begin working on the RTAR after the next draft of the BPHE/fouling work statement is completed.

Electrostatic Removal of Contaminants from Refrigerant Flows

This topic was determined not to fit within the scope of TC 8.5 and was removed from the research plan at the previous meeting. The RTAR was referred to TC 3.3 Refrigerant Contamination, but after some debate it was determined not to fit within their scope either.

Heat Transfer Enhancement of In-Tube Evaporation and Condensation Through the Use of Liquid Phase EHD Pumping

After some discussion, the committee voted [8-0-0] to drop this topic from the research plan.

14. New Business

Amir Jokar (Washington State University – Vancouver) was nominated for Program Chair. He accepted the nomination. The committee voted [8-0-0] to approve the nomination.

15. Schedule Next Meeting

The next meeting will be held on January 23, 2006 at 4:15 PM in Chicago, IL.

16. Adjourn

The meeting was adjourned by unanimous vote [8-0-0] at 6:55 pm (!).

ASHRAE TC/TG/TRG ACTIVITIES SHEET

DATE: June 27, 2005

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
Denver	June 2005	Chicago	Jan 2006
Orlando	Feb 2005	Quebec City, Canada	June 2006
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
RP 1205 Waterside Fouling Inside Smooth and Augmented Copper-Alloy Condenser Tubes in Cooling Tower Water Applications.	Mississippi State University	Art Fovargue	Yes
1316-TRP Experimental Evaluation of the Heat Transfer Impacts of Tube Pitch in a Highly Enhanced Surface Tube Bundle	Bidder selected by TC8.5, recommendation forwarded to MORTS	Petur Thors	N/A
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.	N/A	
LONG RANGE RESEARCH PLAN			
Rank	Title	W/S Written	Apprv.
			To R&T
1.	Waterside Fouling Performance of Brazed-Plate Type Condensers in Cooling Tower Water Applications (2004-40 RTAR)	Draft	No
2.	Study of Carbon Dioxide Condensation in a Chevron Angle Plate Geometry Exchanger (1394-RTAR)	No	No
3.	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 awaiting approval.					
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)					
Advances in Thermal and Fluid Flow Characteristics of HVAC, Refrigeration and A/C Processes Honolulu, 2002					
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					
Braze Plate Heat Exchanger Technology - Single and Two-Phase Flow Chicago, 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>International Journal of HVAC&R Research</i> Volume 9, Number 1/January 2003					
RP-1089 Local Bundle Boiling Heat Transfer Coefficients on a Plain Tube Bundle <i>International Journal of HVAC&R Research</i> Volume 10, Number 1/January 2004					
Local Bundle Boiling Heat Transfer Coefficients on an Integral Finned Tube Bundle <i>International Journal of HVAC&R Research</i> Volume 10, Number 3/July 2004					
Local Bundle Boiling Heat Transfer Coefficients on a Turbo-BII HP Tube Bundle <i>International Journal of HVAC&R Research</i> Volume 10, Number 4/October 2004					

Submitted By: Ben Dingel