

**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 August 29, 2003

TC/TG/TRG TITLE Liquid to Refrigerant Heat Exchangers

DATE OF MEETING Monday, June 30, 2003 LOCATION Kansas City, KS

MEMBERS PRESENT	YEAR APPTD	MEMBERS ABSENT	YEAR APPTD	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
Joe Huber	1999	Josua Meyer	2001	Ken Schultz
Ben Dingel	2002	Nabil Hanna	1999	John Thome
James Bryan	2000			A. Elsherbini
Kash Oza	1999			Tom Kuehn
Louay Chamra	2001	Corresponding Members:		Ehab Mina
John Judge	2000	Mark Spatz	2000	Gherhardt Ribatski
Petur Thors	2001	Ming Chyu	2000	Samuel Yana
Zahid Ayub	2001	James Larson	2001	Satheesh Kulankara
Art Fovargue	2000	Parviz Payvar	2002	Yongfang Zhong
Jamal Seyed-Yagoobi	1999	Ralph Briesch	2002	Karine Brand
		Keith Starner	1999	Andreas Knoepfler
Corresponding Members:		Michael Ohadi	2001	Markus Schuler
Satish Oza	2002	William McQuade	2002	
Axel Kreigsmann	2000	Neelkanth Gupte	2002	
Jim Bogart	2002			

DISTRIBUTION

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

TAC SECTION HEAD:	Stanley Westhoff (David Geary – 2004)
TAC CHAIR:	William Murphy (Arthur McIvor - 2004)
ASHRAE MANAGER OF RESEARCH AND TECHNICAL SERVICES:	Michael R. Vaughn, P.E.
ALL COMMITTEE LIAISONS AS SHOWN ON TC/TG/TRG ROSTERS:	Ron Davis—Handbook Liason Brian Dougherty—Standards Liason Kimball Ferguson—Journal/Insights Liason Arthur Garbarino—Program Liason William Klock—TEGA Liason Thomas Kuehn—RAC Research Liason Marilyn Listvan—Special Publications Liason Alberto Sanchez, P.E.—ALI Liason

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 30, 2003

2003 ASHRAE Annual Meeting, Kansas City, KS, June 28 – July 2, 2003

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

Chairman Joe Huber called the meeting to order at 4:18 PM. The scope of TC8.5 was read. The newly approved scope of TC 8.5 is: "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:

Ben Dingel	The Trane Company 3600 Pammel Creek Road La Crosse, WI 54601
Ken Schultz	The Trane Company 3600 Pammel Creek Road La Crosse, WI 54601
Zahid Ayub	Isotherm, Inc. 7401 Commercial Blvd. East Arlington, Texas 76001
Kash Oza	Standard Refrigeration Co. 2050 N. Ruby St. Melrose Park, IL 60160
Louay Chamra	Mississippi St. University 210 Carpenter Eng. Bldg. Mississippi State, MS 39762
John Thome	EPFL Lausanne, Switzerland 1015
Petur Thors	Wolverine Tube Inc. 2100 Market St. NE Decatur, AL 35601
Satish Oza	Wieland Metals Inc. 1052 Harvard Lane Buffalo Grove, IL 60089
Axel Kriegsmann	Wieland-Werke AG Seldcheck 7 Ulm, Germany D89081

Jim Bogart	Flat Plate, Inc 2161 Pennsylvania Ave York, PA 17404
John Judge	York International P.O. Box 1592 York, PA 17363
James Bryan	University of Missouri-Columbia Dept. Mechanical and Aerospace Engineering Columbia, MO 65211
Joe Huber	Ketema LP 2300 W. Marshall Grand Prairie, TX 75051
Samuel Yana	Honeywell 20 Peabody St. Buffalo, NY 14210
Satheesh Kulankara	York International 631 S. Richland Ave.-191A York, PA 17403
Andreas Knoepfler	Wieland-Werke AG Graf-Arco Str. 36 Ulm, Germany
Jamal Yagoobi	Illinois Institute of Technology 10 W. 32 nd Street, E1 Bldg. Chicago, IL 60616
Art Fovargue	James Madison University 1043 Chestnut Drive Harrisonburg, VA 22801
A. Elsherbini	University of Illinois – Urbana Champaign 1206 W. Green St. Urbana, IL 61801
Tom Kuehn	University of Minnesota 111 Church St. SE Minneapolis, MN 55455
Ehab Mina	University of Illinois – Urbana Champaign Department of Mechanical Engineering 1206 W. Green St. Urbana, IL 61801
Gherhardt Ribatski	University of Illinois – Urbana Champaign 1206 W. Green St. Urbana, IL 61801
Yongfang Zhong	University of Illinois 1206 W. Green St. Urbana, IL 61801

Karine Brand Wieland-Werke AG
Graf-Arco Str. 36
Ulm, Germany 89079

Markus Schuler KWCP
Northfield Pkwy
Wheeling, IL 60090

3. **Establish Quorum Requirements**

Voting members present included: Joe Huber, Ben Dingel, James Bryan, Louay Chamra, John Judge, Kash Oza, Zahid Ayub, Petur Thors, Jamal Yagoobi, and Art Fovargue. Ten of the twelve voting members were present, establishing the quorum.

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

Minutes from the Chicago (Winter 2003) meeting were unanimously approved.

5. **Chairman's Comments**

Joe Huber passed along the following comments and information from the Chairman's breakfast. Additional comments were covered under the appropriate agenda items.

- There is a major reorganization of the ASHRAE technical committees. There will be five new groups added to section 8 from other sections. They include: TC 8.7 (old 9.13), TC 8.9 (old 7.1), TC 8.10 (old 7.5), TC 8.11 (old 7.6), TC 8.12 (old 3.5). The existing TC 8.11 committee was moved to section 1 (1.11). TC 8.5 was unaffected by these changes.
- International members make up approximately 20% of the ASHRAE membership. ASHRAE leadership suggests that TCs make an attempt to have at least two international members. TC 8.5 currently has two international members.
- The ASHRAE Learning Institute is the organization responsible for educational offerings sponsored by ASHRAE. J. Yagoobi is TC 8.5's representative for interfacing with the ALI.
- ASHRAE is considering a voice conferencing system or service that would be available for use by technical committees.
- ASHRAE is concerned about attendance at the 2004 AHR Expo in Anaheim. Technical committees are asked to encourage people to attend.

6. **Section Head Comments**

Stan Westhoff will no longer be Section 8 Head, David Geary is assuming that position.

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

Tom Kuehn, the Research liaison, offered the following comments

- The research budget has stabilized at approximately 2.5 million. 86 RTARs were accepted, 15 work statements are on hold and 8 work statements are up for bid.
- New RTARs should be submitted by August
- The next deadline for Work Statement submittal is in September for action in October.

Ron Davis, the Handbook liaison, offered the following comments

- Changes to 2004 Systems and Equipment handbook chapters (35 and 37 fall under TC 8.5s scope) can be made through July. As long as changes are approved by the committee prior to the end of July, they can be included in the next handbook printing.

8. Handbook Subcommittee Report

Louay Chamra reiterated that the electronic version of the handbooks will become the official handbook versions, as opposed to the bound, paper copies. A CD version of the handbook will be a member benefit starting in 2005. TC 8.5 is responsible for chapters 35 (condensers) and 37 (liquid coolers) in the 2004 Systems and Equipment handbook. Comments/changes for chapter 37 were received from John Thome, and will be reviewed by the voting members in July.

9. Program Subcommittee Report

Program subcommittee chair (Rusty Smith) was not in attendance. No programs are currently planned.

Joe shared the following comments related to Programs:

- ASHRAE encourages seminar presentations to be placed on the web. Seminar .ppt (PowerPoint) presentations may be placed on TC websites.
- The number of symposiums has been declining in recent meetings. ASHRAE is encouraging technical committees to promote symposiums.

10. Membership Subcommittee Report

In 2003, the following people will roll off as voting members of the committee: Joe Huber, Kash Oza, Jamal Yagoobi, and Nabil Hanna. The following people will begin a rotation as voting members: Jim Bogart, John Thome (international), and Satish Oza. With these changes, the roster will consist of 11 voting members beginning in July. Mark Spatz was removed as corresponding member due to successive years of non-participation.

Ken Schultz will serve as Research Subcommittee chair starting in July, as Jim Bogart moves from the Research chair to take on TC 8.5 chairmanship.

11. Standards Subcommittee Report

James Bryan reminded the committee that ASHRAE has asked TC 8.5 to consider developing a Method of Testing (MOT) for ARI Standard 400-2001 LIQUID TO LIQUID HEAT EXCHANGERS. The standard is available for review at <http://www.ari.org/std/individual/400-2001.pdf>. James Bryan made an official motion for TC 8.5 to create a method of test for ARI standard 400. The motion was seconded by John Judge and approved unanimously.

Standard 22 (Methods of Testing for Rating Water-Cooled Refrigerant Condensers) was recently reaffirmed and requires no action at this time.

12. Journal/Insights/Webmaster Subcommittee Report

Joe Huber reported that ASHRAE will begin providing web space for TC websites and that the TC 8.5 website will be moved to this space in the future. Joe also stated that the ASHRAE commercialization policy has been modified to allow for links to commercial sites for educational purposes.

13. Research Subcommittee Report

Jim Bogart shared the following items related to research.

- New RTARS are due by August 1. Deadline dates for work statement submittals in 2003 are September 6 and December 15.
- Procedural errors can delay the initiation of a research project by up to one year.
- Fewer than 50% of work statements are currently being funded.
- Research projects that directly improve or update standards and guidelines are being given preference for funding.
- PMS/PES committees should be part of the work statement submittal.

- The TC Chairman appoints PES members for research projects.
- Other technical committees have been submitting work statements up to 7-8 pages long.
- In order to vote on a work statement, one half of the committee members must be present, and two-thirds must approve the work statement. For email ballots, approval by two-thirds of all members is necessary.

TC 8.5 currently has two active research projects and three RTARs (one with priority) which have been accepted by ASHRAE. Work statements are in process for the three projects with accepted RTARs. These five projects are summarized below:

RP 1089 “Flooded Evaporation Heat Transfer Performance Investigation for Tube Bundles Including the Effects of Oil Using R-410A and R-507A”

Petur Thors reported that John Thome’s work is nearing its conclusion. A significant amount of experimental data was presented at this and previous meetings. Testing activities to date have resulted in a very significant body of data for external refrigerant evaporation on single tubes and tube bundles, plain and enhanced tubes, both with and without the presence of oil. Petur reported that the experimental and modeling work is now complete, and that 80% of the final report was finished. The entire body of work covered by this project will be documented by approximately 7 technical papers currently in review and 2 papers that have already been published. The final report is expected to be presented to the PMS in July. Joe Huber made a motion that a no-cost extension to the end of September be given for RP 1089 for the purpose of completing the final report and associated procedural requirements (report approval, etc.). The motion was seconded by Petur Thors and passed unanimously.

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

Art Fovargue reported that this project is in its third year, and has focused on two main aspects: a water quality survey and experimental testing. Most recently, a great deal of work has been done to bring the experimental fouling test facility to operational status. Physical hardware, including the refrigerant flow loop, water flow loop, test sections, and data acquisition system are in place, making the system nearly complete. A number of safety aspects (over-pressurization, electrical irregularities, etc.) were addressed due to the long-term running nature of the experimental testing. Some difficulties (delays) in the set-up process were a result of a slow university response to the electrical needs of the test set-up. The Mississippi State Chemical Laboratory has been selected to provide/monitor the water solution used for testing. Testing can commence after final definition of the water quality that will be used for experimentation.

The first critical portion of this project was a national survey of water quality. Currently, the survey has resulted in 20 water samples from which to define three levels of water quality in terms of their fouling characteristics (benign, average, and severe). This is fewer samples than was expected by the PMS. Due to concern with defining the average and severe levels of water quality with a limited number of water samples, the PMS has recommended that testing begin with a benign water quality level. This will allow some time to refine the foulant levels for the remaining two levels. Possible action might include the inclusion of R. Webb’s EPRI water quality survey data (which lacks particulate data) or some additional efforts to obtain water samples.

Experimental Evaluation of the Heat Transfer Impacts of Tube Pitch in a Highly Enhanced Surface Tube Bundle

Prior to the summer meeting, Ben Dingel forwarded a draft copy of a work statement for this research topic. A number of comments were received in response. Comments ranged from general suggestions on stressing benefits to ASHRAE membership to comments on the specific details of the desired experimental test matrix. These

comments will be addressed in a future draft that can likely be voted on by the committee. In accordance with Jim's recommendation, preliminary members of the PES were selected (Satheesh Kulankara, Petur Thors, Louay Chamra, Ben Dingel).

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

Mahesh Valiya-Naduvath forwarded a draft copy of a work statement prior to the summer meeting. The work statement generated a number of responses, including a question on the general validity of the research. Prior to the committee meeting, a number of TC8.5 members met to discuss this issue. There was agreement that the intent of the research was worthwhile both in its own right and as a precursor to follow-up studies that might include two-phase flow. The issue was re-addressed by the committee and it was determined this project should remain a high priority on the TC8.5 research plan (see priority list below). Comments and suggestions regarding the content of the work statement will be reviewed and crafted into an updated work statement that can be reviewed by the committee. Preliminary members of the PES were selected (John Judge, Axel Kriegsmann, Ben Dingel).

Performance and Cleanability of Brazed-Plate Type Condensers Operating under Fouling Conditions.

Jim Bogart informed the committee that he has been working with Rusty Smith to create a work statement for this project. This work will continue.

Research Plan

The TC 8.5 research plan was discussed. The three projects that currently have approved RTARs were deemed to be the committee's top priority. Three new research projects were proposed by the membership, and were added to the research plan. The following research priority list was approved unanimously by the TC 8.5 voting members.

Priority 1: Experimental Evaluation of the Heat Transfer Impacts of Tube Pitch in a Highly Enhanced Surface Tube Bundle

Current Status: RTAR written and accepted by ASHRAE (RTAR# 2004-39) for priority status. Work Statement awaiting revision, committee approval, and final submission to ASHRAE

Priority 2: Study of Single-Phase Flow-Induced Tube Vibration in Shell and Tube Heat Exchangers

Current Status: RTAR written and accepted by ASHRAE (RTAR# 2004-38). Work Statement awaiting revision, committee approval and final submission to ASHRAE

Priority 3: Performance and Cleanability of Brazed-Plate Type Condensers Operating Under Fouling Conditions

Current Status: RTAR written and accepted by ASHRAE (RTAR# 2004-40). Awaiting writing of Work Statement

Priority 4: Electrostatic Removal of Contaminants from Refrigerant Flows

Current Status: RTAR written (post-meeting -7/31/03)

Priority 5: Evaluation of enhanced surfaces for Ammonia/Carbon Dioxide Cascade Condensers

Current Status: Awaiting writing of RTAR

Priority 6: Heat transfer enhancement of in-tube evaporation and condensation through the use of liquid phase EHD pumping.

Current Status: Awaiting writing of RTAR

The research topic titled: "Experimental Evaluation of the Heat Transfer Impacts of the Use of an Immiscible and Insoluble Lubricant/Refrigerant pair" which had been listed on previous research priority lists was not included in the updated list. It was suggested that documents related to this topic be sent back to the originator and that he be asked to supply relevance. In the absence of further input from the originator, the topic was deemed by the committee to have little interest to the majority of ASHRAE and the HVAC&R community.

14. New Business

The membership of TC 8.5 would like to thank Joe Huber for serving as committee chairman for the past three years. His attitude, leadership, and organization skills have served the committee and ASHRAE exceptionally well.

15. Schedule Next Meeting

The next meeting will be held on January 26 in Anaheim, CA.

16. Adjourn

At 6:10 PM the meeting was adjourned by unanimous vote.

ASHRAE TC/TG/TRG ACTIVITIES SHEET

DATE: June 30, 2003

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

CHAIRMAN: Joe Huber VICE CHAIRMAN: _____ SECRETARY: Ben Dingel

TC/TG/TRG MEETING SCHEDULE				
Location-Past 12 Months	Date	Location-Planned Next 12 Months	Date	
Chicago	Jan 2003	Anaheim	Jan 2004	
Kansas City	June 2003	Nashville	June 2004	
TC/TG/TRG SUBCOMMITTEES				
Function	Chairman			
Program	Rusty Smith			
Membership	Satish Oza			
Research	Jim Bogart			
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 1089 Flooded Evaporation Heat Transfer Performance Investigation for Tube Bundles Including the Effects of Oil Using R-410A and R-507A.	Swiss Federal Institute of Technology	Petur Thors	Yes	
RP 1205 Waterside Fouling Inside Smooth and Augmented Copper-Alloy Condenser Tubes in Cooling Tower Water Applications.	Mississippi State University	Art Fovargue	Yes	
LONG RANGE RESEARCH PLAN				
Rank	Title	W/S Written	Apprv.	To R&T
1.	Experimental Evaluation of the Heat Transfer Impacts of Tube Pitch in a Highly Enhanced Surface Tube Bundle	Yes (Draft)	No	
2.	Study of Single_Phase Flow-Induced Tube Vibration in Shell and Tube Heat Exchangers	Yes (Draft)	No	
3.	Performance and Cleanability of Brazed-Plate Tybe Condensers Operating Under Fouling Conditions	No	No	
4.	Electrostatic Removal of Contaminants from Refrigerant Flows			
5.	Evaluation of Enhanced Surfaces for Ammonia/Carbon Dioxide Cascade Condensers	No	No	
6.	Heat Transfer Enhancement of In-tube Evaporation and Condensation Through the Use of Liquid Phase EHD Pumping	No	No	

(OVER PLEASE)

HANDBOOK RESPONSIBILITIES					
Year & Volume	Chapter	Title	No.	Deadline	Handbook Subcom Liaison
2004 Systems	Chapter 37:	Liquid Coolers		7/31/03	Ron Davis
2004 Systems	Chapter 35:	Condensers		7/31/03	Ron Davis
STANDARDS ACTIVITIES-List and Describe Subjects					
Standard 22: Standard reaffirmed. No current activity					
Standard 24: No current activity					
Standard ???: Create new standard for Method of Testing for Liquid to Liquid Heat Exchangers (to accompany ARI standard 400)					
TECHNICAL PAPERS from Sponsored Research-Title, when presented (past 3 yrs. present & planned)					
<u>RP-751</u>					
Effects of Oil on Boiling of Replacement Refrigerants Flowing Normal to a Tube Bundle-Part I: R-123 Dallas, 2000					
Effects of Oil on Boiling of Replacement Refrigerants Flowing Normal to a Tube Bundle-Part II: R-134a Dallas, 2000					
<u>RP-1089</u>					
Thermal Performance of Flooded Evaporators, Part 1: Review of Boiling Heat Transfer Studies Atlanta, 2001					
Thermal Performance of Flooded Evaporators, Part 2: Review of Void Fraction, Two-Phase Pressure Drop, and Flow Pattern Studies Atlanta, 2001					
TC/TG Sponsored Symposia-Title, when presented (past 3 yrs. present & planned)					
Advances in Thermal and Fluid Flow Characteristics of HVAC and Refrigeration Processes Dallas, 2000					
Advances in Thermal and Fluid Flow Characteristics of HVAC, Refrigeration, and AC Processes Minneapolis, 2000					
Advances in Thermal and Fluid Flow Characteristics of HVAC, Refrigeration and A/C Processes Atlanta, 2001					
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)					
Heat Transfer and Fluid Flow in Visualization of HVAC and Refrigeration Processes Atlanta, 2001					
TC/TG Sponsored Forums-Title, when presented (past 3 yrs. present & planned)					
JOURNAL PUBLICATIONS, when published (past 3 yrs. present & planned)					
<u>RP-984</u>					
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					

Submitted By: Ben Dingel