

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

Minutes

Technical Committee 8.5

Liquid-to-Refrigerant Heat Exchangers

January 14, 2002

2002 ASHRAE Winter Meeting, Atlantic City, NJ, January 12-16, 2002

1. **Introduction of Members and Guests (Sign attendance sheet)**

Chairman Joe Huber called the meeting to order. The scope of TC8.5 was read. 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
Ralph Breisch	SWEP 1206 Lakewood Dr. McKinney, TX 75070
Kash Oza	Standard Refrigeration Co. 2050 N. Ruby St. Melrose Park, IL 60160
Louay Chamra	Mississippi St. University 210 Carpenter Eng. Bldg. Mississippi 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 Graf-Arco Str 36 Ulm, Germany
Jim Bogart	Flat Plate, Inc 2161 Pennsylvania Ave York, PA 17404
M. Neshan	Wolverine Tube, Inc. 200 Clinton Ave. Suite 100 Huntsville, AL 35801

Art Fovargue	Dunham Bush 101 Burgess Road Harrisonburg VA 22801
Keith Starner	49 Westview Manor York, PA 17404
John Judge	York International P.O. Box 1592 York, PA 17363
James Bryan	Outokumpu Copper 4720 Bowling Green Road Franklin, KY 42134
Neel Gupte	Carrier P.O. Box 4801 Carrier Parkway Syracuse, NY 13221
Joe Huber	API Katema 2300 W. Marshall Grand Prairie, TX 75051
Bill McQuade	York International P.O. Box 1592-191A York, PA 17405-1592
Anthony Jacobi	University of Illinois 1206 West Green Urbana, IL 61801
Nicole DeJong	San Jose State University One Washington Square San Jose, CA 95192-0087
Tim Shedd	University of Wisconsin-Madison 1500 Engineering Drive Madison, WI 53706
Karine Brand	Texas A&M University Mailstop 3123 College Station, TX 77843
Steve Eckels	Kansas State University 302 Rathbone Hall Manhattan, KS 66506
Samuel Yana	Honeywell 20 Peabody St. Buffalo, NY 14210
Satheesh Kulankara	York International 631 S. Richland Ave.-191A York, PA 17403

Jurgen Voss Outokumpu
 Grafenberger Allee 87
 Dusseldorf, Germany D-40237

Rusty Smith SWEF
 3805 Crestwood Parkway
 Duluth, GA 30096

Mike Rumfola SWEF
 41 Montrose Ave
 Buffalo, NY 14214

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

Voting members present included: Joe Huber, Art Fovargue, James Bryan, John Judge, Kash Oza, Satish Oza, Louay Chamra, and Petur Thors. Eight of the thirteen voting members were present, establishing the quorum.

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

Minutes from the Cincinnati summer meeting were unanimously approved without modifications.

4. **Chairman's Comments**

Joe Huber passed along the following comments. Additional comments were covered under the appropriate agenda items.

- The ASHRAE Learning Institute, responsible for educational offerings sponsored by ASHRAE, is looking for volunteers to write and put together material for self-directed short course offerings.
- The Learning Institute is also looking for help writing and revising existing seminars and writing new ones.
- There is a new environmental health organization within ASHRAE. This organization would like to add health related information to handbooks where relevant. Committee members were not aware of any health related issues associated with TC 8.5 handbook chapters.
- The ASHRAE organization overseas will be reorganized and broken into regions, similar to the current US structure.

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

Tom Kuehn, the Research liaison, asked for a status update on RP 1205, RP 984, and RP 1089 (see Research sub-committee section). The Research liaison also offered a number of comments:

- Because ASHRAE funding is at just 75% of the funding level two years ago, submitting quality RTARs is more important than ever.
- The Research Digest, which serves as a summary and guide for the research project (RTARs, Work statements, etc.) is available on the ASHRAE website.
- Nominations for the Service to ASHRAE Research award due by September 30.

5. **Handbook Subcommittee Report**

Louay Chamra reported that the electronic version of the handbooks will become the official handbook versions, as opposed to the bound, paper copies. With the electronic version of the handbook comes the possibility of handbook updates at a more rapid pace than the 4-year paper handbook publishing cycle. Under consideration is the possibility

of having a web-based handbook. With the greater focus on the electronic versions of the handbook, ASHRAE is interested and encouraging the use of multimedia enhanced material in handbook chapters.

Louay also reported that ASHRAE has been receiving some complaints about the accuracy of data and formulas in handbooks. Authors should be sure published information is accurate. In addition, some members have reported using old handbook versions preferentially over newer versions.

The committee discussed a handbook survey being conducted by ASHRAE. The survey focused on identifying the types of multimedia and external software support that might be required in order to incorporate interactive graphics, movies, calculation or modeling programs, etc. into the digital version of the handbook. The discussion identified a number of file types (.jpg, .mpg, .wav, .avi, among others) and applications (including JAVA, Visual Basic, Microsoft Access, Filemaker Pro) that could potentially be used in future versions of handbook chapters.

6. **Program Subcommittee Report**

Ralph Breisch reported that no programs were scheduled for the Atlantic City meeting. A Symposium on Advances in Thermal and Fluid Flow Characteristics of HVAC to be cosponsored with TC 1.3 is planned for the Honolulu meeting during the summer of 2002. Because of the transition to a new Program chairman, there was some confusion as to what extent the outgoing Program Chairman (Mike Ohadi) had initiated and/or organized additional future program ideas.

Upcoming deadlines for paper submittals include:
Honolulu paper submittals (final): February 8, 2002
Chicago paper submittal (for review): April 2, 2002
Chicago paper submittals (final): August 2, 2002

Ralph reported that ASHRAE has updated the commercialism policy for presentations made at meetings. Highlights include:

- No paper copies of information/recommendations/brochures to be made available at presentation.
- Author affiliations, including company information and logos, are allowed on the first slide of the presentation only.
- Trade and company names and logos of a historical nature are allowed if the featured equipment is no longer manufactured.
- Reference may be made to industry standards, test methods and codes.
- Identification of critical test equipment by make or model is allowed for the purpose of allowing others to duplicate testing.

Ralph suggested that if anyone is interested in chairing a program session or has any program related ideas that they contact him.

7. **Membership Subcommittee Report**

With the current roster, following the Honolulu meeting there will be 10 voting members. Ben Dingel expressed interest in being added as a voting member this year. Although the committee approved their membership last year, due to processing difficulties Jim Bogart, Ralph Breisch, and Bill McQuade will be recognized as corresponding members starting this year (following Honolulu meeting).

Nabil Hanna will be stepping down as standards chair and Neel Gupte will be stepping down as research chair. Jim Bogart volunteered to accept research subcommittee chairmanship, and James Bryan agreed to accept standards subcommittee chairmanship.

8. **Standards Subcommittee Report**

Nabil Hanna reported that Standard 22 (Methods of Testing for Rating Water-Cooled Refrigerant Condensers) originally was released for public review approximately 2 years ago. Comments were received and set aside for some time. Due to the elapsed time, the standard will be released again for public review. Comments that result from this review will need to be addressed.

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

Joe Huber reported that the TC 8.5 website should be up and functional.

Joe also reported that the ASHRAE Journal 2003 editorial calendar will be available this quarter. It is currently taking 6-8 months to get an article published in the Journal. There is a \$100 credit at the ASHRAE bookstore for published articles.

Joe mentioned that upon completion of research projects, ASHRAE would like to have a short summary published in ASHRAE Insights.

10. **Research Subcommittee Report**

There are currently three active projects (summarized below) and two projects with work statements. The projects with work statements are currently priority 1 and 2 of the TC 8.5 research plan, and are titled "Experimental Evaluation of the Heat Transfer Impacts of Tube Pitch in a Highly Enhanced Surface Tube Bundle" and "Experimental Evaluation of the Heat Transfer Impacts of the Use of an Immiscible and Insoluble Lubricant/Refrigerant Pair". In addition, an RTAR has been written on the topic "Study of Single-Phase Flow Induced Tube Vibration in Shell and Tube Heat Exchangers". This topic is currently listed as priority 3 in the research plan.

Jim Bogart has written an additional RTAR on the topic of condenser fouling in brazed plate heat exchangers that will require review and prioritization in the research plan.

RP 984 "Effects of Inundation and Miscible Oil upon the Condensation Heat Transfer Performance of R-134a"

Joe Huber reported that this project is reaching its completion. Experimental data for smooth, 2D, and 3D tube bundles with both 68 SUS and 120 SUS lubricant was presented at the research project review session. For the enhanced tubes and the oil concentrations examined in the study, the presence of oil showed a minor to no impact on condensation heat transfer performance. Questions regarding oil concentration measurements were addressed by comparing the oil concentration of both liquid and vapor samples, which showed good agreement. The final report for this project is complete and is available for review by the PMS. A vote to approve or disapprove the final report is expected within the next few weeks.

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 pure refrigerant data has been taken using smooth tubes and low-fin tubes, and data collection is beginning using a 3D enhanced tube. Experimental data taken with varying mass flux, quality, and heat flux was presented at the research project review session. Low-fin tube data showed a significant dependence of heat transfer on heat flux, but little dependence on mass velocity. The 3D enhanced tube will continue to be tested, both in single tube and bundle configurations with 3 refrigerants (R-134a, R-410a, and R-507a). Additional data will be taken using a high flux tube. After all pure refrigerant testing is complete, data will be taken with the presence of lubricant. Petur reported that there have been some delays in the testing due to a variety of

reasons (personnel changes, leaks and experimental difficulties), but that testing should be completed by the September time frame. Petur made a motion to give this project a 1 year no-cost extension. The motion was seconded by Art Fovargue and approved unanimously.

RP 1205

Art Fovargue reported that this project is working through its initial stages after starting in June of 2001. The first critical portion of this project is a national survey of water quality. The objective was to analyze water samples from 60 diverse sites. Surveys were sent to 95 separate sites, only 6 of which have actually returned the survey. The PMS met to offer suggestions as to how to complete the water survey. A number of follow-up actions were suggested, including: a follow up letter to survey recipients, communication with a representative from the water treatment industry to try and obtain information from an existing water quality database, determine if the survey work previously completed by Webb et. al can be leveraged, and communication with the three largest chiller manufacturers to see if samples can be obtained through their respective service organizations. In addition, the water quality analysis that was initially expected to be free of charge to the investigator is now expected to cost approximately \$400 per sample. The water analysis requirements will be examined to see if the identified constituents can be reduced.

Art also reported that the experimental study will utilize a combination of commercially available tubes and specially manufactured tubes to look at the effect of various internal surface parameters on fouling. The investigator has a table of internal tube geometry that brackets a majority of commercially available tubes. A total of 9 internal surface types will be tested, 8 of which are enhanced.

11. New Business

The name of TC 8.5 (Liquid-to-Refrigerant Heat Exchangers) was reaffirmed by unanimous vote.

There was a short discussion on whether or not to reaffirm the current scope of TC 8.5. The current scope is: "TC 8.5 is concerned with devices for accomplishing heat transfer between refrigerants (including secondary refrigerants) and liquids such as water or liquid cooled condensers, or evaporators for cooling water or other liquids." Jim Bogart, with assistance from Keith Starnier, will work to adjust the wording of the scope to reflect the interests of the committee.

There was a brief discussion on the current #4 and #5 priorities of the current research plan (CFD Analysis of Turbulent Flow in Enhanced Chiller Tubes with Helical Fins and CFD Analysis for Vapor Flow in Shell and Tube Condensers). Petur Thors agreed to work on a RTAR for the CFD Analysis in Enhanced Tubes topic.

12. Schedule Next Meeting

The next meeting will be held on June 24 in Honolulu, Hawaii, pending attendance by a quorum of voting members. Joe will be polling the committee for expected meeting attendance prior to the meeting.

13. Adjourn

The meeting was adjourned by unanimous vote.

ASHRAE TC/TG/TRG ACTIVITIES SHEET

DATE: January 14, 2002TC/TG/TRG NO.: TC 8.5 TC/TG/TRG TITLE: Liquid-to-Refrigerant Heat ExchangersCHAIRMAN: Joe Huber VICE CHAIRMAN: _____ SECRETARY: Ben Dingel

TC/TG/TRG MEETING SCHEDULE				
Location-Past 12 Months	Date	Location-Planned Next 12 Months	Date	
Atlanta	Jan 2001	Honolulu	June 2002	
Cincinnati	June 2001	Chicago	Jan 2003	
Atlantic City	Jan 2002			
TC/TG/TRG SUBCOMMITTEES				
Function	Chairman			
Program	Ralph Breisch			
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 984 Effects of Inundation and Miscible Oil upon the Condensation Heat Transfer Performance of R-134a	Kansas State	Joe Huber	Yes	
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	No	
2.	Experimental Evaluation of the Heat Transfer Impacts of the Use of an Immiscible and Insoluble Lubricant /Refrigerant Pair	Yes	No	
3.	Experimental evaluation of tube vibration in bundles with single-phase crossflow	No		
4.	CFD Analysis of Turbulent Flow in Enhanced Chiller Tubes with Helical Fins	No		
5.	CFD Analysis for Vapor Flow in Shell and Tube Condensers	No		

(OVER PLEASE)

HANDBOOK RESPONSIBILITIES					
Year & Volume	Chapter	Title	No.	Deadline	Handbook Subcom Liaison
2004 Systems	Chapter 37:	Liquid Coolers			
2004 Systems	Chapter 35:	Condensers			
STANDARDS ACTIVITIES-List and Describe Subjects					
Standard 22: No current activity					
Standard 24: No current activity					
TECHNICAL PAPERS from Sponsored Research-Title, when presented (past 3 yrs. present & planned)					
<u>RP-751</u> Effects of Oil on Boiling R-123 and R-134a Flowing Normal to an Integral-Finned Tube Bundle Chicago, 1999 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 Characteristics in HVAC and Refrigeration Processes Chicago, 1999 Advances in Thermal and Fluid Aspects of Alternative Refrigerants/Refrigerant Mixtures Seattle, 1999 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)					

Submitted By: Ben Dingel

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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.: T.C 8.5 DATE: March 20, 2002

TC/TG/TRG TITLE: Liquid-to-Refrigerant Heat Exchangers

DATE OF MEETING: Monday, January 14, 2002 LOCATION: Atlantic City

MEMBERS PRESENT	YEAR APPTD	MEMBERS ABSENT	YEAR APPTD	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
J. Huber	2000	J. Meyer	2001	K. Schultz
J. Bryan	2000	N. Hanna	1999	R. Breisch
S. Oza	1998	Z. Ayub	2001	J. Thome
A. Fovargue	2000	P. Payver	1998	J. Bogart
K. Oza	1999	J. Seyed-Yagoobi	1999	M. Neshan
L. Chamra	2001			B. McQuade
J. Judge	2000			A. Jacobi
P Thors	2001			N. DeJong
				T. Shedd
Corresponding Members:		Corresponding Members:		K. Brand
				S. Eckels
A. Kriegsmann	2000	M. Spatz	2000	S. Yana
B. Dingel	2001	M. Chyu	2000	S. Kulankara
N. Gupte	2001	J. Larson	2001	J. Voss
K. Starner	1999			R. Smith
				M. Rumfola

DISTRIBUTION:

ALL MEMBERS OF TC/TG/TRG

RESEARCH & TECHNICAL COMMITTEE CHAIRMEN: K. William Dean

TAC SECTION HEAD: Stanley Westhoff

LIAISONS:

Program: Ronald Shelton Journal: Kimball E. Ferguson

Handbook: _____

MANAGER OF TECHNICAL SERVICES: Martin Weiland

MANAGER OF RESEARCH: William W. Seaton

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