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
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.

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.


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.


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 Starner, 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, 2002  
**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

<table>
<thead>
<tr>
<th>Location</th>
<th>Past 12 Months</th>
<th>Date</th>
<th>Planned Next 12 Months</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlanta</td>
<td></td>
<td></td>
<td>Honolulu</td>
<td>Jan 2002</td>
</tr>
<tr>
<td>Cincinnati</td>
<td></td>
<td>June 2001</td>
<td>Chicago</td>
<td>Jan 2003</td>
</tr>
<tr>
<td>Atlantic City</td>
<td></td>
<td>Jan 2002</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## TC/TG/TRG SUBCOMMITTEES

<table>
<thead>
<tr>
<th>Function</th>
<th>Chairman</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program</td>
<td>Ralph Breisch</td>
</tr>
<tr>
<td>Membership</td>
<td>Satish Oza</td>
</tr>
<tr>
<td>Research</td>
<td>Jim Bogart</td>
</tr>
<tr>
<td>Handbook</td>
<td>Louay Chamra</td>
</tr>
<tr>
<td>Standards</td>
<td>James Bryan</td>
</tr>
<tr>
<td>Journal/Web/Insights</td>
<td>Joe Huber</td>
</tr>
</tbody>
</table>

## RESEARCH PROJECTS—CURRENT

<table>
<thead>
<tr>
<th>Project Title</th>
<th>Contractor</th>
<th>Monitoring Comm. Chpt.</th>
<th>Report Made At Meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>RP 984 Effects of Inundation and Miscible Oil upon the Condensation Heat Transfer Performance of R-134a</td>
<td>Kansas State</td>
<td>Joe Huber</td>
<td>Yes</td>
</tr>
<tr>
<td>RP 1089 Flooded Evaporation Heat Transfer Performance Investigation for Tube Bundles Including the Effects of Oil Using R-410A and R-507A.</td>
<td>Swiss Federal Institute of Technology</td>
<td>Petur Thors</td>
<td>Yes</td>
</tr>
<tr>
<td>RP 1205 Waterside Fouling Inside Smooth and Augmented Copper-Alloy Condenser Tubes in Cooling Tower Water Applications.</td>
<td>Mississippi State University</td>
<td>Art Povargue</td>
<td>Yes</td>
</tr>
</tbody>
</table>

## LONG RANGE RESEARCH PLAN

<table>
<thead>
<tr>
<th>Rank</th>
<th>Title</th>
<th>W/S Written</th>
<th>Apprv.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Experimental Evaluation of the Heat Transfer Impacts of Tube Pitch in a Highly Enhanced Surface Tube Bundle</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>2.</td>
<td>Experimental Evaluation of the Heat Transfer Impacts of the Use of an Immiscible and Insoluble Lubricant /Refrigerant Pair</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>3.</td>
<td>Experimental evaluation of tube vibration in bundles with single-phase crossflow</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>CFD Analysis of Turbulent Flow in Enhanced Chiller Tubes with Helical Fins</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>CFD Analysis for Vapor Flow in Shell and Tube Condensers</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

(OVER PLEASE)
# Handbook Responsibilities

<table>
<thead>
<tr>
<th>Year &amp; Volume</th>
<th>Chapter</th>
<th>Title</th>
<th>No.</th>
<th>Deadline</th>
<th>Handbook Subcom Liaison</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004 Systems</td>
<td>Chapter 37:</td>
<td>Liquid Coolers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004 Systems</td>
<td>Chapter 35:</td>
<td>Condensers</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Standards Activities - List and Describe Subjects

<table>
<thead>
<tr>
<th>Standard</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>No current activity</td>
</tr>
<tr>
<td>24</td>
<td>No current activity</td>
</tr>
</tbody>
</table>

## Technical Papers from Sponsored Research - Title, when presented (past 3 yrs. present & planned)

<table>
<thead>
<tr>
<th>Reference</th>
<th>Title</th>
<th>Location</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>RP-751</td>
<td>Effects of Oil on Boiling R-123 and R-134a Flowing Normal to an Integral-Finned Tube Bundle</td>
<td>Chicago, 1999</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Effects of Oil on Boiling of Replacement Refrigerants Flowing Normal to a Tube Bundle-Part I: R-123</td>
<td>Dallas, 2000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Effects of Oil on Boiling of Replacement Refrigerants Flowing Normal to a Tube Bundle-Part II: R-134a</td>
<td>Dallas, 2000</td>
<td></td>
</tr>
</tbody>
</table>

## TC/TG Sponsored Symposia - Title, when presented (past 3 yrs. present & planned)

<table>
<thead>
<tr>
<th>Reference</th>
<th>Title</th>
<th>Location</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Advances in Thermal and Fluid Characteristics in HVAC and Refrigeration Processes</td>
<td>Chicago, 1999</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Advances in Thermal and Fluid Aspects of Alternative Refrigerants/Refrigerant Mixtures</td>
<td>Seattle, 1999</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Advances in Thermal and Fluid Flow Characteristics of HVAC and Refrigeration Processes</td>
<td>Dallas, 2000</td>
<td></td>
</tr>
</tbody>
</table>

## TC/TG Sponsored Seminars - Title when present (past 3 yrs. present & planned)

<table>
<thead>
<tr>
<th>Reference</th>
<th>Title</th>
<th>Location</th>
<th>Year</th>
</tr>
</thead>
</table>

## 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
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

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

Corresponding Members:

K. Starner: 1999

DISTRIBUTION:

ALL MEMBERS OF TC/TG/TRG

RESEARCH & TECHNICAL COMMITTEE CHAIRMAN: 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

ADDITIONAL DISTRIBUTION:

Standards: Claire Ranspeck - Manager

Standards: Charles Arnold, Liaison

Research: Carolyn Kerr, Liaison

Education: Richard Hayter, Liaison

TEGA: William E. Tinsley, Liaison

Special Publications: Joseph A. Driscoll, Liaison