

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

Minutes
Technical Committee 8.5
Liquid-to-Refrigerant Heat Exchangers
June 25, 2001
ASHRAE Annual Meeting, Cincinnati, OH, June 23-27, 2001

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

Chairman Joe Huber called the meeting to order. Members and guests introduced themselves. The following were present:

Art Fovargue	Dunham Bush 101 Burgess Road Harrisonburg VA 22801
Joe Huber	API Ketema 2300 W. Marshall Grand Prairie TX 75051
Zahid Ayub	Isotherm, Inc Arlington, TX
Parviz Payvar	Northern Illinois University Dept. of Mech. Engr. Dekalb IL 60115
Nabil Hanna	Koax Corp 518 N. Indiana Oklahoma City, OK 73132
Louay Chamra	Mississippi State University 210 Carpenter Eng. Bldg. Mississippi State MS 39762
Mike Ohadi	University of Maryland Dept. of Mech. Engr. College Park MD 20742
Tim Shedd	U-W Madison 1500 Engineering Drive Madison, WI 53706
Karine Brand	Wieland Werke AG Texas A&M University Dept. of Mechanical Engineering College Station TX 77843-3123
Axel Kriegsman	Wieland-Werke AG Seldlheck 7 Ulm Germany D-89081

John Thome	Swiss Federal Institute of Technology LTCM- EPFL Lausanne, Switzerland 1015
Satish Oza	Wieland Metals 1052 Harvard Lane Buffalo Grove, IL 60089
Jim Bogart	Flat Plate, Inc 2161 Pennsylvania Ave York, PA 17404
Ralph Breisch	SWEP 1206 Lakewood Dr McKinney, TX 75070
Mahesh Valiya-Nadurath	York International 631 S. Rockland Ave York PA 17403
Samuel Yana-Motta	Honeywell, Inc 20 Peabody street Buffalo, NY 14210
Massoud Neshan	Wolverine Tube 200 Clinton Ave, Suite 1000 Huntsville, AL 35801
A. Elsherbini	Univ. of Illinois-Urbana 1206 W. Green St. Urbana, IL 61801
Gordon Struder	Evapco, Inc. P.O. Box 1300 Westminster, MA 21158
Brian Bell	Fluent, Inc 10 Cavendish Ct Lebanon, NH 03766
Ram Narayananamurthy	Wolverine Tube, Inc 2100 Market Street NE Decatur AL 35825
Leon Tang	Outokumpu Copper 4720 Bowling Green Rd. Franklin KY 42134
Alberto Cavallini	University of Padova Via Venezia, 7 Padova, ITA, I 35131

Bill McQuade	York International PO Box 1592-191A York PA 17405-1592
Steve Eckels	Kansas State 346 Rathbone Hall Manhattan, KS 66506
David Smithey	Brazeway Inc 2711 E. Maumee St Adrian, MI 49221
Stan Westhoff	Section Head The Trane Company 301 Old Niskayuna Rd Latham, NY 12110
Hongming Ge	Univ. of Illinois 140 MEB 1206 W. Green St. Urbana, IL 61801
Kash Oza	Standard Refrigeration Co 2050 N. Ruby St Melrose Park, IL 60160
Petur Thors	Wolverine Tube, Inc 2100 Market Street NE Decatur AL 35601
John Judge	York International PO Box 1592 York PA 17405

2. Establish Quorum Requirement

Voting members Joe Huber, Art Fovargue, Parvis Payvar, Nabil Hanna, Louay Chamra, Mike Ohadi, Satish Oza, and John Judge, were present. Jim Larson, James Bryan, Jamal Seyed-Yagoobi and Kash Oza were absent. Kash Oza subsequently arrived. A quorum was present.

Joe Huber read the scope of TC8.5.

3. Review/Approve Minneapolis Meeting Minutes

Minutes of the Atlanta meeting were unanimously approved.

4. Chairman's Comments

Joe said that Dick Hayter of the Learning Institute had discussed the avenues of learning that ASHRAE conducts which includes Self Directed courses, Professional Development Seminars, & Workshops that are offered at meetings. ASHRAE would like to add topics; pass any suggestions on to Dick or Joe. TC's will be asked to review courses.

ASHRAE is looking for nominees for the Technology Achievement Award; there have been none from Section 8. This should be for someone who has done cutting edge work over the last year.

All chairman & secretarial correspondence for TC8.5 is being done on-line and seems to be working well. Joe asked for anyone having problems with this to let him know.

Michael Vaughn is the new manager of Technical Services.

Joe said he would make comments from the Chairman's breakfast meeting at the appropriate agenda items.

5. Section Head's Comments

Stan Westhoff, Section Head, had no comments.

6. Comments from Liaisons (Handbook, Standards, Journal, Research, Program, TEGA, Technical Services, Refrigeration)

Tom Kuehn, the new RAC liaison, stated that there is not enough research money to fund all projects and that ASHRAE is looking at ways of prioritizing projects. He said it is important to emphasize the value of a given research project and that it would be good to add a section to this effect to Work Statements.

Ron Davis, from the Handbook Committee, said that he has had the Liquid Cooler chapter assigned to him and gave Louay Chamra the schedule for the next Equipment Handbook. He will check on whom from the committee is responsible for the water-cooled part of the Condenser chapter. He said he does not know when they are going to discontinue the hard/paper version of the Handbooks.

7. Handbook Subcommittee Report

Joe Huber passed along the following comments that Norm Maxwell of the Handbook Committee made at the Chairman's Breakfast meeting:

- Mark Owen has taken over Handbook at ASHRAE Headquarters.
- The Handbooks are to be mailed July 5; some members will get 2 copies due to a mix-up on the mailing list. Unfortunately, some approved chapters were lost
- ASHRAE has assigned Reference nos. (AHR number) for Handbook chapters that are to be used for all communication with the Handbook Committee liaison and with Headquarters staff. The AHR number for the water cooled part of the Condenser chapter is 178, and for the Liquid Cooler chapter is 182.
- The Handbook Committee is looking for 4 TC's to rise to the challenge of providing electronic enhancements to one of its chapters for the electronic Handbook. This might include color figures, sound files, "hot" equations or graphs, animations, etc.

8. Program Subcommittee Report

Mike Ohadi reported that the Seminar proposed for this meeting did not go through because it was not marked priority. He stated that there was a Symposium on CFD use in Heat Exchanger design sponsored by TC1.3.

Mike stated that the future program plans are: Atlantic City – a Symposium on Advances in Thermal and Fluid Flow Characteristics of HVAC, Refrigeration and A/C Processes, and a Seminar on the Application of Meso and Micro Scale Technologies for Air Conditioning and Refrigeration; Honolulu - a Symposium on Advances in Thermal and Fluid Flow Characteristics of HVAC, Refrigeration and A/C Processes, a Seminar on Innovative Design in Heat Exchangers, and a Seminar on Opportunities in Electronic Cooling including Cryogenic Cooling Applications. This Program was approved unanimously.

Joe stated that since Mike can no longer continue as Program Chairman, we are looking for someone to fill that position. Ralph Breisch volunteered to be Program chair and was accepted.

Joe passed along the following comments from Ron Shelton, our Program liaison, from the Chairman's Breakfast meeting:

- 50% of the Cincinnati program submittals were made on-line. ASHRAE was pleased with this and encourages its continuation.
- The ASHRAE web site should be checked for changes being made under "Author or Speaker Information" for new program Preparation Instructions, Speaker's Manual, and Commercialism Policy.
- The Program Committee requests that the TC's actively participate in making seminar information available upon request.
- The deadline for Atlantic City paper submittals is August 3, 2001 and for Honolulu is February 8, 2002.

9. Membership Sub-Committee Report

Satish Oza reported that we presently have 19 members for the ASHRAE 2002 year. This was later amended to 21, as Jim Larson and Mike Ohadi had been inadvertently omitted as Corresponding Members on the ASHRAE roster. Thirteen are voting members, including one International member. Fifteen are from industry and six from universities.

Satish said we have 5 candidates for membership, three of which were present. Jim Bogart, Ralph Breisch and Bill McQuade (all from Industry) were approved for membership by a unanimous vote. They will serve as Corresponding members for the first year.

The concern was expressed that active voting members lose voting privileges when they are forced to roll off.

Satish noted that it was a concern that we did not have any members from the Government category. It was stated that the last one we had failed to participate, and that we would be glad to accept any qualified candidate from Government.

10. Standards Sub-Committee Report

Brian Daugherty is taking over as our Standards Liaison from Joe Pietsch.

11. Journal/Insight/Webmaster Report

Joe Huber reported that the Editorial Calendar for the ASHRAE Journal is now up on their web-site. The review period time frame has been reduced from one year to six months.

ASHRAE still needs articles for the "Technology Corner" in the Insights. If there is not enough input for this they may drop it.

The TC8.5 website has been on-line about one year now. Joe is still looking for electronic copies of old Work Statements to post. Also, Joe requested that as soon as any papers from an ASHRAE project are published to let him know so that he can post.

12. Research Sub-Committee Report

Joe Huber passed along the following comments that Chad Dorgan of RAC made at the Chairman's Breakfast meeting:

- bids were received for six projects, and contractor selections and awards were approved at the Winter Meeting in Atlanta.
- twelve Work Statements were released at the Atlanta meeting and bids have been received.
- for 2000-01 the research expenditures were approximately \$2.9 million. For 2001-02 the budget is about \$2.8 million.
- \$300,000 have been set aside for "High Risk" research projects.
- ASHRAE is hearing comments that it is too technical in its research as well as in the Handbook, and it is not providing the type of practical information that is required. The TC's should carefully consider how research project results will be of value to ASHRAE and put more work into the "Justification" section of Work Statements.
- Tech Council is concerned about Work Statements written by a person who then bids on the project, particularly if there is only one bidder. There should be at least three potential bidders listed on WS cover sheets. The Board of Directors has adopted a policy that Committee Chairs, Vice-chairs and Secretaries are discouraged from bidding on projects sponsored by their committee.

- Of the over 180 projects from 1990 to 1995, only six short summaries of the benefits have been received. This is needed to help justify the research program; please send in your summary if you were one of the ones requested to do this

In our Research Plan we presently have two projects with Work Statements, "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", and one project with an RTAR, "Experimental Evaluation of Tube Vibration in Bundles with Single Phase Crossflow." These projects are prioritized 1, 3 and 2 respectively in the 2001 Research Plan. The 2002 Research Plan is due August 1, 2001.

Joe reported that Neel Gupte had proposed two new projects as follows: "CFD Analysis for Vapor Flow in Shell and Tube Condensers" and "CFD Analysis of Turbulent Flow in Enhanced Chiller Tubes with Helical Fins". It was noted that we can have more than three projects on our Research Plan, and that we could co-sponsor the above two with TC1.3 potentially. The committee voted unanimously to add these two projects to the Research Plan.

John Judge made a motion that the year 2002 Research Plan should be as follows:

- 1) Experimental Evaluation of the Heat Transfer Impacts of Tube Pitch in a Highly Enhanced Surface Tube Bundle
- 2) Experimental Evaluation of the Heat Transfer Impacts of the use of an Immiscible and Insoluble Lubricant/Refrigerant Pair
- 3) Experimental Evaluation of Tube Vibration in Bundles with Single Phase Crossflow
- 4) CFD Analysis of Turbulent Flow in Enhanced Chiller Tubes with Helical Fins
- 5) CFD Analysis for Vapor Flow in Shell and Tube Condensers

After a second by Nabil Hanna, the motion passed 7-0-0.

John Judge said he would work with Neel Gupte to do an RTAR for project number 4 (CFD for flow in tubes) and that one of his co-workers was doing a Work Statement for project number 3 (tube vibration). It was noted that Work Statements must be to ASHRAE by September 15, 2001 to be considered in the next RAC meeting.

There has been no change in the status of 752RP, Heat Transfer in Brazed Plate HX's, since the Atlanta Meeting. That is, no Summary Report of the accomplished work has been received from the Contractor and ASHRAE is still holding the final payment. The question was raised whether RAC will consider this Contractor's performance with this project for any future projects that he may bid on. This was addressed to Zahid Ayub, who will be a member of RAC starting in the 2002 ASHRAE year.

984-RP: R-134a/Oil Shellside Condensation

Joe Huber reported that data is complete for the 2-D and 3-D surfaces with both 68 and 120 SUS oils, and for the smooth tube with 68 SUS oil. They are please with the entering oil conditions based on the observed fog. Typically, a slight degradation in heat transfer is seen at small concentrations of oil. They are struggling to get high enough oil concentrations and will look for ways to increase the circulating concentration. Also, there is concern that the calculation of the oil concentration is perhaps low; they will try to measure concentration by sampling the gas stream. A motion to grant a no cost extension through the next meeting was approved by a unanimous vote.

1089- RP: R-410A/R-507 Flooded Evaporator

Petur Thors reported that data was presented for pure R-134a on the smooth tube bundle, looking at the effects of heat and mass flux and quality, and also for the modified Wilson plots. It was pointed out that there is a significant effect of heat flux, but little effect of mass flux. So far the results of the modeling are encouraging. Data has been collected on the low fin tube. The high flux surface still has not been received. It was noted that the investigator is presently working on a one year, no cost extension.

1205-RP: Fouling in Smooth & Augmented Condenser Tubes

Art Fovargue reported that this three year project got its official start on June 1, 2001. A brief overview was given at the Research Monitoring session. Initial work will concentrate on the Literature Survey and collection of the samples for the water quality survey. Questions the investigator had for the PMS included what refrigerant to use and whether to test commercially available tubes or tubes specially manufactured with a range of important parameters such as the number of internal fins. It was suggested that a range of parameters using special manufactured tubes could be studied with one of the tubes having the same geometry as a commercially available tube. The PMS (the majority of which were not at this meeting) will review.

13. New Business

Joe Huber noted that Jim Larson is stepping down as secretary and Mike Ohadi is stepping down as Program Chair. He thanked them for their involvement over the years.

14. Schedule Next Meeting

The next meeting will be from 4:15 to 6:30 PM on January 14, 2002 in Atlantic City, NJ.

15. Adjourn

The meeting was adjourned at 5:55 PM after a unanimous vote to do so.

ASHRAE TC/TG/TRG ACTIVITIES SHEET

DATE: Sept 12, 2001TC/TG/TRG NO.: TC 8.5 TC/TG/TRG TITLE: Liquid-to-Refrigerant Heat ExchangersCHAIRMAN: J. Huber VICE CHAIRMAN: _____ SECRETARY: J. Larson

TC/TG/TRG MEETING SCHEDULE			
Location-Past 12 Months	Date	Location-Planned Next 12 Months	Date
Minneapolis	June 2000	Atlantic City	Jan 2002
Atlanta	Jan 2001	Honolulu	June 2002
Cincinnati	June 2001	Chicago	Jan 2003
TC/TG/TRG SUBCOMMITTEES			
Function		Chairman	
Program		M. Ohadi/R. Breisch	
Membership		S. Oza	
Research Monitoring		J. Huber, A. Fovargue, P. Thors	
Research Initiation		N. Gupte	
Handbook		L. Chamra	
Standards		N. Hanna	
Journal		J. Huber	
RESEARCH PROJECTS-CURRENT			
Project Title	Contractor	Monitoring Comm. Chpt.	Report Made At Meeting
See Attached			
LONG RANGE RESEARCH PLAN			
Rank	Title	W/S Written	Apprv.
1.	See Attached		
2.			
3.			
4.			

(OVER PLEASE)

RESEARCH PROJECTS - CURRENT

<u>Project Title</u>	<u>Contractor</u>	<u>Monitoring Committee Chairman</u>	<u>Report Made at Meeting</u>
RP-984: Effects of Inundation & Oil on Condensing R134a	Kansas State	J. Huber	Yes
RP-1089: Effect of Oil on Heat Transfer with HFC 410a & HFC 507	Swiss Federal Institute of Tech.	P. Thors	Yes
RP-1205: Waterside Fouling Inside Smooth and Augmented Condenser Tubes in Cooling Tower Water Applications	Mississippi State Univ.	A. Fovargue	Yes

LONG RANGE RESEARCH PLAN

<u>Rank</u>	<u>Title</u>	<u>W/S Written</u>	<u>Approved</u>	<u>To R & T</u>
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		

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)					
TC/TG Sponsored Symposia-Title, when presented (past 3 yrs. present & planned)					
See Attached					
TC/TG Sponsored Seminars-Title when present (past 3 yrs. present & planned)					
Emerging Technologies-Heat Exchanger Miniaturization - Toronto, 1998					
Flow Visualization of HVAC and Refrigeration Processes - Atlanta, 2001					
MEMS for HVAC/Refrigeration Heat Exchanger and System Miniaturization - Atlanta, 2001					
Application of Meso and Micro Scale Technologies for A/C & Refrigeration - Atlantic City, 2002					
Innovative Design in Heat Exchangers - Honolulu, 2002					
<u>Opportunities in Electronic Cooling including Cryogenic Cooling Applications - Honolulu, 2003</u>					
TC/TG Sponsored Forums-Title, when presented (past 3 yrs. present & planned)					
JOURNAL PUBLICATIONS, when published (past 3 yrs. present & planned)					

Submitted By: J. W. Larson

TC/TG SPONSORED SYMPOSIA - TITLE

**Thermal and Fluid Characteristics in HVAC and Refrigeration Heat Exchanger Processes
Toronto, 1998**

**Advances in Thermal and Fluid Characteristics in HVAC and Refrigeration Processes
Chicago, 1999**

**Advances in Thermal and Fluid Characteristics in HVAC and Refrigeration Processes
Seattle, 1999**

**Advances in Thermal and Fluid Flow Characteristics of HVAC, Refrigeration and AC Processes
Dallas, 2000**

**Heat Exchanger Miniaturization
Dallas, 2000**

**Advances in Thermal and Fluid Flow Characteristics of HVAC, Refrigeration, and AC Processes
Minneapolis, 2000**

**Use of Computational Fluid Dynamics in Heat Exchanger Design
Minneapolis, 2000**

**Advances in Thermal and Fluid Flow Characteristics of HVAC, Refrigeration and A/C Processes
Atlanta, 2001**

**Use of Computational Fluid Dynamics in HVAC/Refrigeration Design
Atlanta, 2001**

**Advances in Thermal and Fluid Flow Characteristics of HVAC, Refrigeration and A/C Processes
Atlantic City, 2002**

**Advances in Thermal and Fluid Flow Characteristics of HVAC, Refrigeration and A/C Processes
Honolulu, 2002**

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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: Sept. 12, 2001

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

DATE OF MEETING: Monday, June 25, 2001 LOCATION: Cincinnati

MEMBERS PRESENT	YEAR APPTD	MEMBERS ABSENT	YEAR APPTD	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
J. Huber	'00	J. Larson (M)	'00	B. McQuade
N. Hanna	'99	J. Bryan (M)	'00	J. Bogart
S. Oza	'98	K. Starner (CM)	'99	M. Valiya-Nadurath
A. Fovargue	'00	N. Gupte (CM)	'00	S. Eckels
K. Oza	'99	M. Chyu (CM)	'00	T. Shedd
L. Chamra	'00	J. Seyed-Yagoobi (M)	'99	R. Breisch
P. Payvar	'98	M. Spatz (CM)	'00	S. Westhoff
M. Ohadi	'98	J. Meyer (CM)	'00	S. Yana-Motta
J. Judge	'00			K. Brand
Corresponding Members:				J. Thome
Z. Ayub	'00			M. Neshan
A. Kriegsmann	'00			A. Elsherbini
P. Thors	'00			G. Struder
				B. Bell
				R. Narayananmurthy
				L. Tang
				A. Cavallini
				D. Smithey
				H. Ge

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

ADDITIONAL DISTRIBUTION: Standards: Claire Ramspeck - Manager

Standards: Charles Arnold, Liaison

Research: Carolyn Kerr, Liaison

Refrigeration: A. Guerra, Liaison

TEGA: William E. Tinsley, Liaison

Special Publications: Joseph A. Driscoll, Liaison

