

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

Minutes

Technical Committee 8.5

Liquid-to-Refrigerant Heat Exchangers

Monday, January 27, 1997

ASHRAE Winter Meeting, Philadelphia, PA, January 25-29, 1997

1. Introduction of Members and Guests/Signing of Attendance Sheets

Chairman Art Fovargue called the meeting to order at 4:15 PM. The agenda was presented. Members and guests introduced themselves. The following were present:

Art Fovargue	Dunham-Bush, Inc. 101 Burgess Road Harrisonburg, VA 22801-9700
Jim Larson	The Trane Company 3600 Pammel Creek Road La Crosse, WI 54601-7511
Jamal Seyed-Yagoobi	Texas Engineering Experiment Station Dept. of Mechanical Engineering Texas A&M University College Station, TX 77843-3123
Dawood Ali	Modine Manufacturing 1500 DeKoven Ave Racine, WI 53403
Sam Moody	Carrier 108 Greenhaven Lane Cary, NC 27511
Ram Laks	Dunham-Bush, Inc. 101 Burgess Road Harrisonburg, VA 22801-9700
Joe Huber	Ketema Heat Transfer Div. 2300 W. Marshall Dr. Grand Prairie, TX 75051
Petur Thors	Wolverine Tube, Inc. 2100 Market Street, NE Decatur, AL 35601-2626
John Kelly	Department of Mechanical Engineering 302 Durland Hall Kansas State University Manhattan, KS 66506
Steve Eckels	Kansas State University 302 Durland Hall Manhattan, KS 66506

Neel Gupte	Carrier PO Box 4808 Carrier Parkway Syracuse, NY 13221
Axel Kriegsmann	Wieland-Werke AG Metallwerke Graf Arco Strasse Ulm, GermanyD-89070
Satish Oza	Wieland America, Inc. 1052 Harvard Lane Buffalo Grove, IL 60089-4325
Nabil Hanna	KOAX Corp. 518 N. Indiana Street Oklahoma City, OK 73106
Mark Spatz	Allied Signal 20 Peabody Street Buffalo, NY 14210-1523
Mike Ohadi	University of Maryland Mechanical Engineering Department College Park MD 20742-3035
John Judge	York PO Box 1592 York, PA 17405
Keith Starner	York International Corp. 49 Westview Manor York, PA 17404-4201
Parviz Payvar	Northern Illinois University Mechanical Engineering Dept. DeKalb, IL 60115-2854
Shane Moeykens	The Trane Company 3600 Pammel Creek Road La Crosse, WI 54601-7511
S.A. Sherif	University of Florida Dept. of Mechanical Engineering Gainesville, FL 32611-6300
Zahid Ayub	Thermofluid International 3305 Thorntree Ct Arlington, TX 76016-1140
Anthony Jacobi	University of Illinois Dept of Mechanical/Industrial Engineering Urbana, IL 61801

Brad Gustafson

Lawrence Berkeley Lab
1000 Independence Ave SW
Washington DC 20585-0001

2. **Establish Quorum Requirement**

At the beginning of the meeting it was established that a quorum was present. Voting members present were A. Fovargue, J. Larson, P. Thors, N. Gupte, N. Hanna, K. Starner, S. Sherif, and Z. Ayub.

3. **Review/Approve San Antonio Meeting Minutes**

A motion was made by P. Thors and seconded by N. Gupte to approve the minutes from the San Antonio meeting of June 1996. The motion passed unanimously.

4. **Chairman's Comments**

A. Fovargue made the following comments from the Chairman's Breakfast:

- M. Woodford, Standards Liaison, reported a change to the procedure on canvas ballots. When a canvas ballot is required, a TC will be assigned to respond. The TC should have a canvas ballot sub-committee. It is recommended that the TC use its existing Standards Sub-committee.
- Chad Dorgan, Program Liaison, noted that the session package for the Boston Summer meeting is due 2-14-97. The Program Sub-committee will now need to provide a priority for the programs they submit. In the future, some programs will be scheduled in conflict with committee meetings. Beginning with the San Francisco meeting, the Sub-committee will need to advise of any potential committee functions which would conflict with items in the program. The Public Session: "What You Need to Know about the Deregulation of Electric Power" is Tuesday afternoon at 1:00 P.M.
- Brad Gustafson, Handbook Liaison, noted that System Designers are the largest group of Handbook users. Handbook chapters should be written with their benefit in mind.
- Bruce Anderson, Journal Liaison, noted that he is always interested in articles for publication. Articles may be written for International Journal of Heating, Ventilating, Air-conditioning, and Refrigeration Research, ASHRAE Journal, or ASHRAE Insights.

5. **Section Head's Comments**

Not Present.

6. **Comments from Liaisons (Handbook, Standards, Journal, Research, Program)**

Sam Moody attended the meeting. He introduced himself as the new Refrigeration Liaison and expressed his intention work with the committee as needed.

7. **Handbook Subcommittee Report**

M. Ohadi reported that Handbook Chapters 35 and 37 will require updating again in 2000. Research project monitoring committees were also reminded that most projects require the investigator to write a paragraph for the Handbook at the conclusion of the project and that this is frequently overlooked until it is time to revise the handbook.

8. **Program Subcommittee Report**
R. Laks reported that a Symposium, "Thermal and Fluid Flow Characteristics of Alternative Refrigerants/Refrigerant Mixtures"; was jointly sponsored with TC 1.3. Another Symposium of the same title is planned for the summer meeting in Boston along with "Flow Visualization of Refrigerants and Refrigerant Mixtures", Plans for San Francisco include: "Flow Maldistribution and its Impact on Evaporation and Condensation".
9. **Membership Sub-Committee Report**
S. Oza noted that the committee currently has 14 members from industry and 6 from universities. He proposed one candidate for membership; Jamal Seyed-Yagoobi from Texas A&M. A motion was made by S. Oza, seconded by Z. Ayub and approved by the committee (8-0-0) to accept him as a member.
10. **Standards Sub-Committee Report**
S. Moeykens reported that the roster for the SPC to revise Standard 24, Methods of Testing for Rating Liquid Coolers, was approved. He expects to have a draft of the new standard by the summer meeting and draft for public review in one year.
11. **Journal/Insight Article Subcommittee**
J. Huber reported that he has received no articles, so far. He has a list of potential topics and proposed a collaborative effort. Further discussion indicated that an article on a "back-to-basics" subject would be of interest to several members. Joe will pursue the issue further.
12. **Research Sub-Committee Report**
K. Starnier reported the work statement for Oil and Liquid Refrigerant Inundation in Condensers was written and two proposals have been received.

Remaining on the Long Range Research Plan are:

1) Effect of Immiscible, Insoluble Oils on Heat Transfer

2) Waterside Fouling Inside Smooth and Augmented Condenser Tubes in Cooling Tower Water Applications

This project is still in limbo to avoid duplicating the waterside fouling work which is continuing at Penn State. A. Fovargue summarized his conversation with R. Webb, the investigator at Penn State. His work has not been concluded because of short cooling seasons the last two summers.

We will need to finalize the Long Range Research Plan within about two weeks following the summer meeting.

13. **944-TRP: Effects of Inundation and Oil on Condensing R-134a**
S. Moeykens reported that proposals had been received from Kansas State University with a bid of \$111,244 and Texas A&M with a bid of \$105,416. The proposal review committee recommended Kansas State because of elements in the work statement which were omitted from the Texas A&M proposal. A motion by S. Sherif was seconded by P. Thors and passed by the committee 8-0-0 to recommend to the R&T that the contract be awarded to Kansas State University.

14. **751-RP: Effect of Oil on Heat Transfer in Flooded Evaporators**
A. Fovargue and P. Payvar reported that testing of 26 FPI tubes with R-123 was complete. Data was obtained for bundle average oil concentrations up to 14%. Testing of the 26 FPI bundle with R-134a has begun, but no data with oil has been taken yet. Some data with R-22 without oil will also be taken to allow comparison with previous work. Turbo B HP will also be tested with R-134a. All experimental work is expected to be finished by June, with the report expected to be complete by August. A no cost extension for 6 months following March, 1997 will be requested.

15. **752-RP: Heat Transfer - Brazed Plate HX's**
P. Payvar reported that the investigator, W. Stewart, had presented the old data in the form of heat transfer coefficient vs. mass flux with the condenser data sorted by subcooling and the evaporator sorted by superheat. The hot gas bypass has been installed. No new data has been taken, but he will forward it to P. Payvar as soon as it is available (hopefully within a month). W. Stewart had checked with the manufacturer, and learned that the heat exchangers did not have any elements which would produce significant inlet or outlet pressure drop. An extension to June 1 has been requested.

16. **857-RP: EHD Enhancement in Evaporating Refrigerants**
J. Larson and J. Seyed-Yagoobi reported that pool boiling data for R-123 & R-134a with both smooth and 19 FPI tube is complete. Electrical properties of all refrigerants have been measured. The data for R-410a will be repeated.

Current activities include in-tube boiling tests with R-134a, and the start of long term effects testing.

Future plans include

1. Electrode optimization studies for pool boiling
2. Pool boiling with R-410a & R-407c
3. Test 4 different electrodes for in-tube boiling with smooth tube. Test the best electrodes with enhanced tube.
4. In -tube boiling with R-404a, smooth and enhanced tube with the best electrode
5. Determine effect of oil on in-tube boiling
6. Complete long term tests. Review in June, after 4 months to see if an extension to see if an extension is indicated to test for 6 months.

J. Larson will follow up with P. Payvar to determine which oil he is using in his R-134a testing. The same oil will be used in the long term effects testing. M. Spatz will provide a new sample of R-410a.

17. **922-RP: EHD Enhancement in Condensing Refrigerants**
P. Thors reported that in-tube condensation with R-404a is complete. M. Ohadi is working to complete all in-tube condensation testing. One enhanced tube will be included in this work. He will then begin external condensation.

18. New Business

A. Fovargue noted that his 2 year term is coming to an end. He will be looking for a successor.

B. Gustafson, Handbook Liaison noted that the goal for the Systems and Equipment for 2000 is to make it more user friendly for the system designer.

Z. Ayub will make arrangements for the Summer Meeting joint TC 1.3/TC 8.5 Research Review meeting for Boston.

Keith Starner noted that he has a new address for anyone mailing him ASHRAE materials.

19. Schedule Next Meeting and Adjourn

The next meeting will be Monday, June 30, 1997 at 4:15 PM during the Summer ASHRAE meetings in Boston.

P. Thors moved that the meeting be adjourned. It was adjourned at 6:15 PM.