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404-636-8400

**TC/TG/MTG/TRG MINUTES COVER SHEET**

**(Minutes of all Meetings are to be distributed to all persons listed below within 60 days following the meeting.)**

TC/TG/MTG/TRG No. 1.3 DATE June 27, 2022, 4:30-6:30 PM ET, LOCATION Hilton Toronto

TC/TG/MTG/TRG TITLE Heat Transfer and Fluid Flow

MEMBERS PRESENT	END YEAR	MEMBERS ABSENT	END YEAR	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
Omar Abdelaziz	Voting	Lorenzo Cremaschi	Voting	Adnan Ayub
Vikrant Aute	Voting	Stefan Elbel	Voting	Melanie Derby
Pratik Deokar YEA	Voting	Xiaofei Wang	Voting	Pratik Deokar
Brian Fronk	Voting			Ahmed Elatur
Joseph Huber	Voting			Brian Fricke
Andreas Knoepfler	Voting			Evraam Gorgy
Icksoo Kyung	Voting			Achim Gotterbam
Kashif Nawaz	Voting			Joe Huber
Stanislav Perencevic	Voting			Harshad Inamdar YEA
Raymond Rite	Voting			Satheesh Kulankara
				Jun Li
				Lingnan Lin YEA
				Zach Londo
				David Meredith
				Michael Ohadi
				Kishan Padakannaya
				Sonya Pouncy
				Mirza M. Shah
				SA Sherif
				Azam Thatte
				Mike Wilson
				Cheng-Min Yang
				Emily Yin YEA

## TC 1.3 Scope

TC 1.3 is concerned with the fundamental principles of the transport of energy, mass, and momentum, especially the study of and application to, physical processes in air conditioning, refrigeration, heating and related areas of environmental engineering.

## Agenda

### 1. Call to Order

Chair Nawaz called the meeting to order at 4:44 PM ET.

### 2. Introduction of members and guest

In person and virtual guests introduced themselves.

### 3. Establish quorum requirements (Kashif Nawaz)

Ten voting members are present.

### 4. ASHRAE Code of Ethics Commitment (Kashif Nawaz)

In this and all other ASHRAE meetings, we will act with honesty, fairness, courtesy, competence, integrity and respect for others, and we shall avoid all real or perceived conflicts of interests. (See full Code of Ethics:

<https://www.ashrae.org/about-ashrae/ashrae-code-of-ethics.>)

### 5. Review of Agenda (Kashif Nawaz)

Chair Nawaz reviewed the agenda for today's meeting.

### 6. Review/Approve minutes (Winter 2022) (Michael Wilson/Melanie Derby)

Motion to approve as amended by Vikrant (Abdelaziz/Rite) 10-0-3 absent

### 7. Section Head Comments (Dave Meredith)

Dave Meredith provided an update. TAC is looking at the code of ethics. He emphasized empathy and patience with hybrid meetings. Each committee should have a succession plan of how the committee progresses up to chair, and to be mindful that with changing jobs, voids can occur. He suggests having an internal plan for leadership voids. Third, Victor Schmidt put together a leadership class online (on Basecamp under TAC), and he encouraged TC members to take the course if they are interested. Chair Nawaz asked about the timing of TC meetings, which created some logistical issues/conflicts with other TCs. As an example, TC 8.11 was happening at the same time as TC 1.3. TC 1.3 used to be scheduled on Tuesdays at 1PM. Also there were comments that it would be helpful if the meeting date was more prominent on the ASHRAE app.

### 8. Liaison Comments

Sonya Pouncy, handbook liaison for the Fundamentals Handbook gave an update. TC 1.3 is responsible for 4 chapters in the next Fundamentals Handbook, planned for publication in 2025.

Sonya mentioned that the TC should have lead authors selected and begin the review process for current chapters. Secretary Melanie Derby will send Sonya Pouncy the email address for Handbook Subcommittee chair, Guru Ravi.

#### 9. Membership Subcommittee (Achim Gotterbarm)

Four members will roll off after this meeting. Five members will roll on TC 1.3 on July 1: Vikrant Aute, Melanie Derby, Achim Gotterbarm, Guru Ravi, and Mike Wilson. The balance will be seven academic and five industry members. Attendees were encouraged to become a corresponding member of TC 1.3 online.

#### 10. Handbook Subcommittee (Guru Ravi)

Handbook Subcommittee Chair Guru Ravi was not able to attend the meeting. Chair Nawaz commented about the 4 chapters for which TC 1.3 is responsible. TC 1.3 is using the ASHRAE authoring portal for handbook revisions. Anyone who is a member of TC 1.3 have access and changes will be tracked. Then the handbook subcommittee will review, discuss, and approve the changes. The handbook chair works closely with the liaison. If you are interested in working on these revisions, please contact Guru Ravi. A year before the publication, all revisions will need to be finalized. When adding additional content, need to be mindful of page limits, although there may be more flexibility with soft copies.

#### 11. Program Subcommittee (Pratik Deokar)

##### a. Status of other current/proposed programs

Seminar 34 on condensation of LowGWP refrigerants tomorrow at 9:45AM is sponsored by TC 1.3 and co-sponsored by MTG.LowGWP, TC 8.4, and TC 8.5.

Seminar 51 on thermal energy storage energy solutions on Wednesday at 11AM is sponsored by TC 1.3. and co-sponsored by 6.9.

The Atlanta winter conference will have nine tracks, and programs are due on Aug 9. The TC discussed potential program ideas and speakers. Program Subcommittee Chair Pratik Deokar summarized seminars sponsored or cosponsored by TC 1.3 over the last 2 years. The TC commended Pratik Deokar for the success of TC 1.3's programs. It was suggested to organize a panel on heat transfer/heat exchangers relevant to decarbonization/electrification of buildings, including opportunities and barriers. Prof. Ohadi volunteered to speak, and additional speakers are needed. A submission is planned for the decarbonization track. Vikrant Aute volunteered to chair the session. The TC discussed a seminar on thermal hydraulic performance of in-tube evaporation low GWP refrigerants. Lingnan Lin expressed interest to present on evaporation in microfin tubes. Kashif Nawaz will check with ORNL, and the a potential speaker from Ottawa was mentioned.

Motion for program passes (Abdelaziz/Knoepfler) 10-0-3 absent

For the next annual meeting, conference papers are due ~6 months ahead of time (rather than 9 months), with abstracts due in November. The timelines should be announced shortly.

## 12. Webmaster (TBD)

The webmaster position is currently vacant. Chair Nawaz asked the current TC members for volunteers. The webmaster uploads the latest meeting minutes/agendas. Lingnan Lin volunteered to be webmaster.

## 13. MTG Liaison: Low GWP Refrigerants (Omar Abdelaziz -Liaison, Satheesh Kulankara – Alt#1, Evraam Gorgy–Alt#2)

Liaison Omar Abdelaziz gave a report. The MTG met yesterday mainly to discuss research. There is currently one active project, RP-1806. The MTG expects the contractor will finish the project in six months, although it may require a reduced scope. It was noted that humidity levels affect flammability. Globally, there is an effort underway to update standards for low GWP refrigerants, including safe refrigerant charge limits. The MTG is interested in cosponsoring any low GWP work, particularly focused on safety.

## 14. Research (Joe Huber)

### a. Updates from the Society research meeting

Research Subcommittee Chair Joe Huber shared notes from the research breakfast. There will be the same research liaison for next year and Omar Abdelaziz will become RAC chair next year. The typical ASHRAE research budget \$2.6-2.7M/year. Covid impacts continue; hopeful the new investigator award, grants in aid, and innovative research grants may resume in SY22-23. The main goal of the research program is to maintain current project funding. The AHRI show occurred in Las Vegas, which provides significant research funding. At the spring meeting, three RTARs were accepted. At the annual meeting, eight more research projects awarded for bid. The 2021 ASHRAE strategic research plan is published on ASHRAE website, and includes six research initiatives. RTARs should connect to the new research plan. PES and PMS new training modules are available online. ASHRAE will utilize a web-based process to track research projects. It is important to publish a time for research review meetings, as these annual and winter meetings should be public. Need clarification if interim research meetings are public/advertised. It was suggested that in the future, the PMS chair and researcher can write a paragraph to give to the secretary for inclusion in the minutes.

### b. 1683-RP: “Experimental Evaluation of 2-Phase Pressure Drop and Flow Pattern in U-Bends with Ammonia”

A review paper has been submitted for ASHRAE STBE, and will address data in a Lima and Thome paper relevant to this project.

The PI described the test rig at his lab and provided photos of the set-up. The pre-heating equipment should be delivered shortly. The differential pressure transducers have been purchased but the lead time is long.

The stainless steel and glass u-bends have been fabricated. There is concern about ovality in the bends that will affect the data. The PI will make some measurements and possibly conduct destructive tests of some additional bends to determine if there is an ovality problem. A suggestion was made to use aluminum tubes for easier bending. It is difficult to braze taps to aluminum, and there may be a corrosion issue when doing shakedown testing with water, so the PI would prefer to not use aluminum tubes.

Some shakedown testing has been completed with water. Measured pressure drops for the bends and straight lengths were compared to known correlations, and agreement is very good.

There are differences between ammonia properties in REFPROP 9.1 vs. 10. The PI is aware of the issue and will evaluate the effect during data reduction.

The project is a few months behind, but there is possibility to catch up. As soon as first test sections are finished in GIK's lab, those test sections will be sent to Auburn for the low temperature tests. Thus, simultaneous testing can occur in both labs.

c. RP-1800: "Spray Evap. on Enhanced Tube bundles with low GWP Pure ref. and ref./miscible oil mixtures"

The following tests have been completed:

Bundle No. 1: Triangular Configuration, 5 rows, Condensation Surface Tubes

- R1234ze(E) and multiple POE oils with different viscosity (full circular cone nozzles)
- R1233zd(E) (full circular cone nozzles)

Bundle No. 2: Square Configuration, 5 rows, Condensation Surface Tubes

- R134a and POE oil (full circular cone nozzles)
- R134a and POE oil (full circular cone nozzles)
- R1234ze(E) and POE oil (full circular cone nozzles)
- R1233zd(E) (full circular cone nozzles)

A diaphragm pump was installed. This significantly improved flow control for the R1234ze(E) tests, and allowed establishing flow for the R1233ze(E) test. The tests with R1233zd(E) are still difficult to conduct, because maintaining flow rate requires a large amount of subcooling, and the large amount of subcooling adversely affects the measured heat transfer coefficient. As R1233zd(E) is a low-pressure refrigerant with a large vapor volume, the PMS believes there could be a pressure drop/vapor lock problem somewhere in the flow loop. The PI will investigate.

There is concern that the measured heat transfer coefficients for all tests on the condensation surface tubes are too low. The PI will work with the tube manufacturer to resolve this concern.

The PI is actively checking for non-condensable on the tests with R1233zd(E). So far, no non-condensable contamination has been observed.

The PI has reduced the uncertainty on the sampling method of measuring oil concentration. The improvement uncertainty confirms the oil concentration values measured by the mass flow meter.

TC 1.3 co 8.4 Rite is chair, Sankar, Chad Bowers, Kashif Georgio Nelson. Ahmad called in from Pakistan, presented status. On the verge of collecting data, need to complete a few more items on test stand. Validating pressure drop with water flow. Initially issue with -40o (blastdown freezers) but Lorenzo will be able to do this at Auburn University using the same test sections (shipping). Schedule has slipped a few months will be talking about a no cost extension in January. Looking at data at next meeting in January.

#### d. Co-sponsorship opportunities

In February 2022, it was mentioned there was a possible co-sponsorship opportunity from TC 2.8 for a very early stage RTAR concerning improving pressure drop data for friction factors in modern pipes in Ch 3 fundamentals and some of the other component chapters. The TC will consider co-sponsorship in the future, but it not actionable now. It was suggested that pipe fittings pressure loss might have more research opportunities.

#### e. Pending research topics and future research plans

1909 RTAR conditionally accepted, and brought to TC 1.3 for the annual meeting. The work statement is not yet complete; it is important to work on the work statement in the next year so it doesn't expire.

Vikrant Aute reported that the RTAR on fluted tube still in progress.

No other research topics are currently in the pipeline. Low GWP or natural refrigerants were suggested as a timely topic, and discussion followed. TC members mentioned it was important to conduct research related to industry needs, and request feedback from manufacturers. It was suggested a seminar could be used for this discussion; Omar Abdelaziz suggested a forum was previously used that mechanism. Dr. Shah suggested a small amount (e.g., \$10k) be dedicated to consolidate data and develop correlations from existing data. Dr. Shah volunteered to prepare a list, if there was interest. The committee expressed concerns that more funds would be required to complete this work; Omar Abdelaziz suggested using the PTAR mechanism. Regarding current data, Vikrant Aute mentioned the Heat Transfer Experimental Database, maintained by Prof. Akio Miyara at Saga University, Japan, as a potential resource.

#### 15. Chair Comments (Kashif Nawaz)

Technical committee task groups are now being called functional groups. FGs and MTGs now have separate MOPs. Chair Nawaz noted A/V issues particularly in hybrid mode. ASHRAE understands the need more A/V equipment, particularly for FGs.

#### 16. New Business

No new business was discussed

17. Next Meeting: TBD

18. Adjourn

TC 1.3 adjourned at 6:34 PM ET. (Knoepfler/Abdelaziz)