Welcome!

Welcome to the ASHRAE TC 9.9 Hybrid In-Person/Virtual Meeting!

No need to say hello, we will begin promptly at 2:30 pm EST

High Level Agenda

- Welcome
- Hybrid Meeting Etiquette
- Introductions
- Membership
- Title, Purpose & Scope
- Liaison Reports
- Research
- IT Subcommittee
- Publications Work Session

Housekeeping

Audio

- Attendees are muted upon entry
- Do not un-mute your line
- If you are joining via computer and phone line, ensure both are muted

Video

- We encourage you to keep your video off
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Q&A

- Use the chat function to ask questions
- Our moderator will share questions throughout the presentation with the speaker to answer.
- If you need to speak, please use the Raise Hand button and the moderator will enable your microphone.

Attendance

- Please complete the attendance form found at the URL at the bottom of this slide or use the QR code below.

Attendance: https://forms.gle/TnV1uhvR2NLH2RxS7

Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment

ASHRAE Summer Conference 2023
Main Meeting
Hybrid In-Person/Virtual

Attendance: https://forms.gle/TnV1uhvR2NLH2RxS7

Agenda

Topic		Time	Presenter(s)	In-Person or Virtual
Welcome	Welcome, Agenda Review, Hybrid Meeting Etiquette	5	John Groenewold	IP
Introductions	Introductions of All In-Person Attendees, Officers, Voting Members and Subcommittee Chairs	10	John Groenewold	IP
Membership	Details of TC 9.9 Membership	5	John Groenewold	IP
Liaison Reports				
	Standard 90.1	5	Rick Pavlak	V
	Standard 90.4	5	Terry Rodgers	IP
	SPC-127	5	David McGlocklin	IP
	AHRI 1360	5	David McGlocklin	IP
	SSPC 300, Guideline 1.6	5	Terry Rodgers	IP
	Decarbonization Task Force	5	Lixia Wu	V
Break		20		
Special Topic	Liquid Cooling Performance Benchmarks	10	Steve Greenberg	V
Special Topic	Airflow & Energy Flow Metrics	10	Jim VanGilder	IP
Research	Research Committee Update	20	Mark Seymour	IP
IT Subcommittee & Publications	IT Subcommittee Update		Roger Schmidt	V
	Liquid Cooling Book	10	Dustin Demetriou	IP
	New TCS/FWS Class Proposed	5		
	Liquid Cooling Technical Brief	5		
	Marine Corrosion Work Study Proposal	10		
	Design Considerations Book	10		
	Power Trend Update	5		
	Thermal Guideline Technical Brief	5		
Work Session	Work Session on Publications	60	Don Beaty	IP
	Total Time:	220	Minutes	

Attendance: https://forms.gle/TnV1uhvR2NLH2RxS7

Virtual Meeting Etiquette

- Do not share your video due to the high number of virtual participants.
- Prior to speaking individuals should state their name so that others know who is speaking and speak into a microphone.
- Virtual participants should keep yourself muted unless giving permission to speak by the Host via chat.
- Please do not attempt to share your screen without being asked to do so by the Host or Co-Host.
- In-person participants are discouraged from joining the virtual meeting due to wireless bandwidth constraints.

Attendance: https://forms.gle/TnV1uhvR2NLH2RxS7

Virtual Meeting Housekeeping

Virtual Host: Vice Chair - Matt Koukl

- Monitor the chat thread for questions and comments.
- Mute and Unmute Virtual Participants and Guests.
- Manage discussions and voting.
- Manage screensharing and in-person presentation

Virtual Co-Host: Secretary - Mark Steinke

- Monitor time and keep the meeting on schedule.
- Record the event.
- Produce meeting minutes.
- Will repeat the attendance link multiple times during the meeting and upon chat request.
- Respond to audio problems.

Attendance: https://forms.gle/TnV1uhvR2NLH2RxS7

In Person Setup

- Video projector that displays the presentation being shared virtually.
- There are audio speakers in the room but unmuted virtual commentors may not be immediately connected. Please be patient.

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Attendance

ASHRAE TC 9.9 Attendance Record

ASHRAE Technical Committee 9.9 - Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment
2023 Summer Meeting

Programs, Research, & Publications
Virtual Event Timing: Sunday June 25, 2023; 6:00-8:00 pm ET
Event Address: https://www.microsoft.com/microsoft-teams/join-a-meeting
Meeting ID: 275 911 663 998
Passcode: 26xton

Virtual Event Timing: Monday June 26, 2023; 2:30 - 7:00 pm ET
Event Address: https://www.microsoft.com/microsoft-teams/join-a-meeting
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Contact us at tc99chair@gmail.com
Technical Committee Website: http://tc0909.ashraetcs.org

tc99chair@gmail.com Switch account

Not shared

* Indicates required question

Attendance is being recorded using a Google Form. Please make sure you complete the form at:

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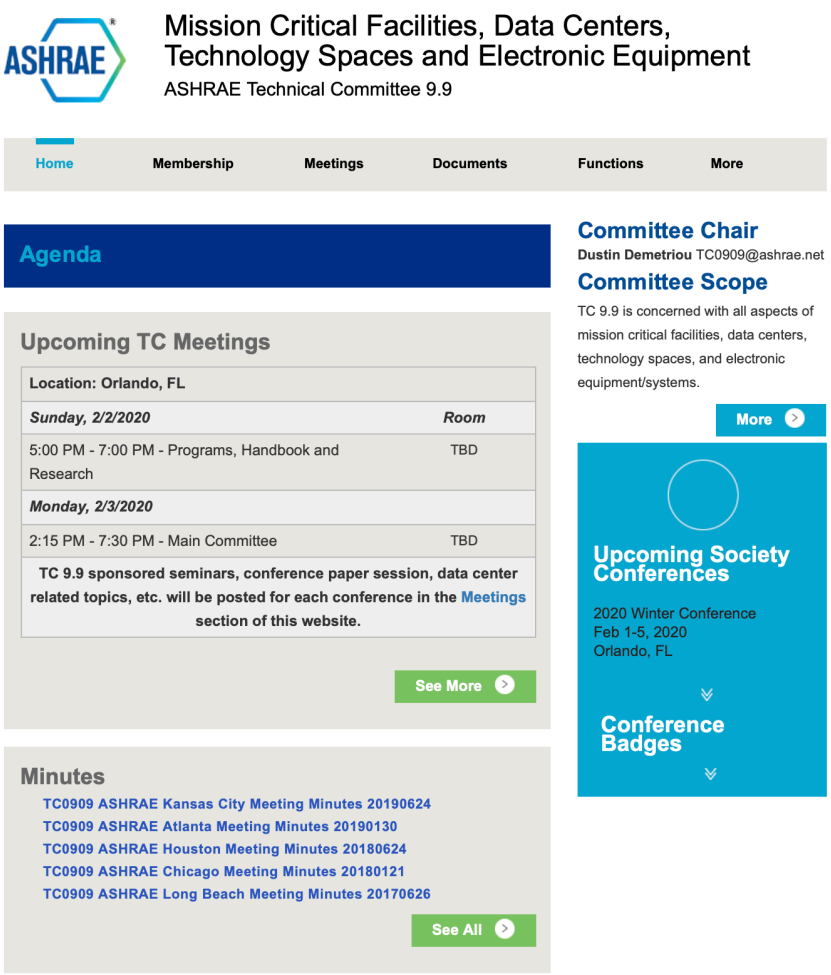
TC 9.9 Webpage



http://tc0909.ashraetcs.org

Attendance: https://forms.gle/TnV1uhvR2NLH2RxS7

ASHRAE TC 9.9 Overview

Title

- Mission Critical Facilities, Data Centers, Technology Spaces, and Electronic Equipment

Purpose

- To be recognized by ALL areas of the datacom industry as the UNBIASED engineering leader in HVAC and an effective provider of technical datacom information.

Scope

- All things datacom facilities: datacom refers to data processing and communication facilities. It includes rooms or closets used for communication, computers, or electronic equipment

Introductions

- In Room Only
  - Name
  - Business Title
  - TC Membership Status:
    - Voting Member
    - Corresponding Member
    - Provisional Corresponding Member
    - Guest
  - TC Leadership & Subcommittee Membership
    - Subcommittee Chair
    - Liaison
    - Subcommittee membership

Attendance: https://forms.gle/TnV1uhvR2NLH2RxS7

Join TC 9.9

Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment

ASHRAE Technical Committee 9.9

Home | Membership | Meetings | Documents | Functions | More

Member Roster

Current as of 6/04/2020

Join TC 9.9

If you want to become a provisional corresponding member of this TC, click on the "Join TC" button above. You will be automatically added to the roster and will receive all TC communications.

Committee members can download a copy of the complete roster in any of three formats by logging in to their ASHRAE member account, clicking on my account and selecting Committees.

http://tc0909.ashraetcs.org/membership.php

Membership

- Provisional Corresponding Members
  - Additions to Roster between roster update cycles.
  - Roster update always due Tuesday following main meeting during Winter Conference.
  - Usually at the request of someone wanting to participate.
  - If no action by TC leadership dropped from Roster after 2 years.
- Corresponding Members
  - Expected to participate in TC activities.
  - Attend Meetings when possible.
  - May serve as Vice-Chair or Secretary of TC if they attend meetings regularly.
  - Can be Voting Members.
  - Can serve as a subcommittee chair.

Keep Your ASHRAE Profile Updated!

TC 9.9 Officers

Chair
Matt Koukl
Affiliated Engineers

Vice-Chair
Mark Steinke
Advanced Micro Devices

Secretary
John Gross
J. M. Gross Engineering

Publications Chair
Don Beaty
Retired Founder/CEO of DLB Assoc.

Research Chair
Mark Seymour
Future Facilities

ITE Subcommittee Chair
Dr. Roger Schmidt
IBM Fellow Emertius & Syracuse U.

Standard Subcommittee Chair
Rick Pavlak
Heapy Engineering, Retired

Programs Chair
Eric Yang
Vantage Data Centers

Handbook Chair
Robert McFarlane
Shen Milsom & Wilke, LLC

Webmaster
Ecton English
U.S. Department of Defense

Marketing Subcommittee Chair
Paul Finch
KAO Data

Membership Chair
John Groenewold
Vantage Data Centers

Voting Members

1. John Groenewold, Vantage Data Centers
2. Dave Moss, Dell (retired)
3. John Gross, J.M. Gross Engineering
4. Matt Koukl, Affiliated Engineers
5. Dave Kelley, Vertiv
6. Mark Monroe, Microsoft
7. Rick Pavlak, Heapy
8. Mark Steinke, AMD
9. Paul Finch, KAO Data
10. Mark Seymour, Cadence Design Systems
11. Jason Matteson, Iceotope Technologies
12. David Quirk, DLB Associates
13. Joe Prisco, IBM
14. Bob McFarlane, Shen Milsom & Wilke
15. Lixia Wu, Cushman & Wakefield

Voting Members in RED will be ending their term as voting members after this meeting.

Attendance: https://forms.gle/TnV1uhvR2NLH2RxS7

TC 9.9 Liaisons

- Standard 90.1: Rick Pavlak
- Standard 90.4:
- Standard 127: David McGlocklin
- AHRI 1360: David McGlocklin
- Standard 300, Guideline 1.6: Terry Rodgers
- Decarbonization Task Force: Lixia Wu

2023 Votes

Vote	Date	Approved
Adoption of 2022 Summer Meeting Minutes	1/27/2023	Yes
Vote to move forward with putting all published materials online and accessible through a subscription model.	2/6/2023	Yes
Vote on TC 9.9 co-sponsoring a TC 4.10 RTAR titled, "Compact CFD Modeling Guidance for Flow Resistances."	3/13/2023	Yes

Thank You

TC 9.9 Website

tc0909.ashraetcs.org

90.1 Liaison Report

Rick Pavlak

The 2022 edition of Standard 90.1 incorporates over 80 addenda to the 2019 edition. Major additions appearing for the first time in a minimum-efficiency U.S. model energy standard or code at the national level include:

- A minimum prescriptive requirement for on-site renewable energy
- An optional Mechanical System Performance Path allowing HVAC system efficiency tradeoffs based on the new total system performance ratio (TSPR) metric
- New requirements to address the impacts of thermal bridging

Other highlights include:

- An expanded scope to include sites as well as buildings
- New energy credit requirements for a customized approach to improving energy efficiency
- New informative guidance for using carbon emissions, site energy, or source energy as alternative performance metrics to the current energy cost metric
- Significant efficiency increases in IEER for commercial rooftops and a new SEER2/HSPF2 metric for <65kbtu sized air-cooled heat pumps.

- Refrigerant Pipe Insulation: Addendum E first proposed in 2020 to Standard 90.1-2019 has not moved forward and as of now is still a pending action.

90.4 Liaison Report

Rick Pavlak

SSPC 127

David McGlocklin

SSPC 127

Method of Testing for Rating Cooling Equipment Serving Data Center and Other Information Technology Equipment Spaces

Purpose: The purpose of the standard is to establish a uniform method of test requirements for rating cooling equipment that is applied in data center (DC) and other information technology facilities, spaces, and equipment..

Scope: This standard applies to classes of cooling equipment that are used to remove thermal loads in data center (DC) and other information technology facilities, spaces, and equipment.

2023 June Update & Plans:

Our TPS has been revised to be inclusive of liquid cooling.

Updated work plan created and approved.

Two new subcommittees have been formed:

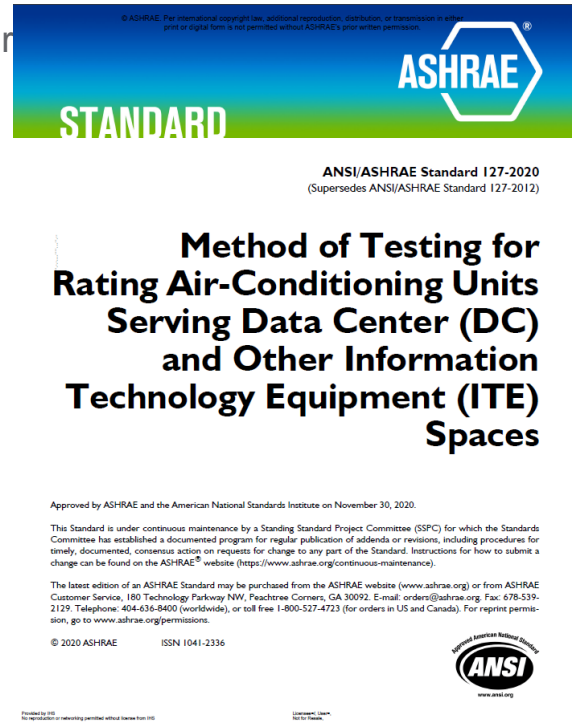
- Air Subcommittee – Chair Dave McGlocklin, Secretary Dave Meadows

- Liquid Subcommittee - Chair Dr. Tim Shedd, Vice Chair John Gross, Secretary Dustin Demetriou

Air Sub is continuing with our work on the overall harmonization of 127 with AHRI 1360 standard & iNSenCOP

Liquid Sub is just getting going putting pen to paper after spending the last few meetings going over housekeeping & members thoughts on liquid scope & MoT. New members officially roll on July 1st.

Call for members and interested parties. Meeting Tuesday 8-12 (Tampa Marriott Waterside – Meeting room 11 (3rd floor))



AHRI 1360

David McGlocklin

AHRI 1360

Performance Rating Standard for Datacom Air-Conditioning Units

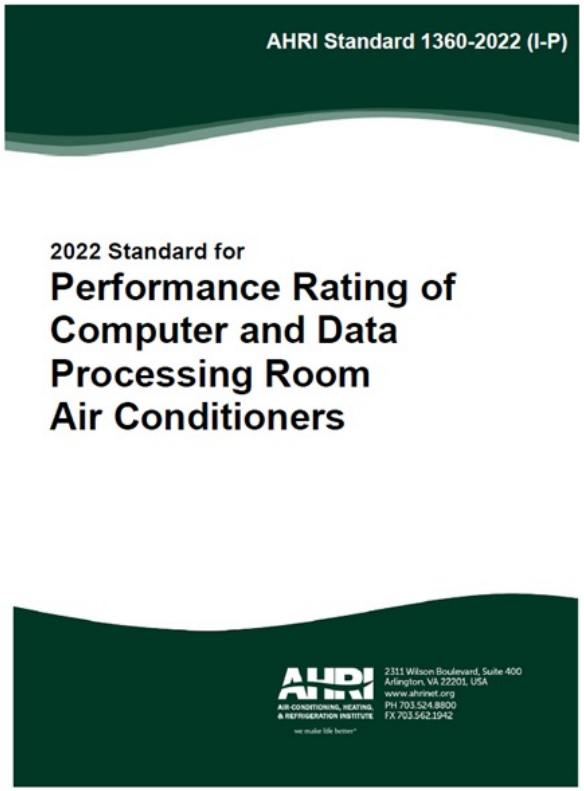
Purpose: To establish for Computer and Data Processing Room Air Conditioners (CDPR): definitions; classification; test requirements; rating requirements; minimum data requirements for Published Ratings; marking and nameplate data; and conformance conditions.

Scope: This standard applies to all CDPR units and is intended for the guidance of the industry, including manufacturers, engineers, installers, contractors, users, and regulators.

2023 June Update & Plans: Committee has started meeting again after the release of the 2022 version of the standard.

We have approved a new project charter scope for next 202X revision:

This committee will work on revisions to AHRI 1360 including harmonization with ASHRAE 127, harmonization with ASHRAE 37, further development of iNSenCOP or other possible annualized metrics, and to investigate incorporating a method of rating for liquid cooling while the method of test is being developed in ASHRAE 127.



SSPC 300, Guideline 1.6

Terry Rodgers

Decarbonization Building Task Force

Lixia Wu

Attendance

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- Reorganization
- Liaison Reports
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Liquid Cooling Benchmarks

Steve Greenberg

ASHRAE TC 9.9

BERKELEY LAB

LAWRENCE BERKELEY NATIONAL LABORATORY

U.S. DEPARTMENT OF ENERGY

Benchmarks for Water-Cooled Data Centers

Steve Greenberg, PE

ASHRAE TC 9.9

June 26, 2023

Metrics for Water-Cooled Data Centers

- PUE, Power Usage Effectiveness (total data center energy/ITE energy)
- ITUE, IT Usage Effectiveness (total energy into ITE/total energy into compute components)
- TUE, Total Usage Effectiveness (PUE x ITUE = total data center energy/total energy into compute components)
- ERE, Energy Reuse Effectiveness (total data center energy – reuse energy/IT energy)
- WUE, Water Usage Effectiveness (liters of water usage/total data center energy in kWh)
- Compute energy efficiency (e.g. flops/watt)

Benchmarks for Water-Cooled Data Centers

- PUE: typical goal 1.1, typical operation 1.05
- ITUE: little available data
- TUE: higher than PUE, little available data
- ERE: highly site specific
- WUE: 1.6 l/kWh (site) with 100% evaporative rejection and no blowdown; typical goal 1.25 with hybrid rejection and 1.0 operation. Site vs. source complexity.
- Compute energy efficiency (e.g. flops/watt): holy grail of efficiency; complicated due to different computing functions
- Common themes:
  - Need appropriate metering
  - Comparisons worthwhile internally, less so across data centers

Steve Greenberg

Lawrence Berkeley National Laboratory

segreenberg@lbl.gov

ASHRAE Research Policy Update

- Budget increased to 350k ☺
- However typical cost:
  - 2-year US$250k-330k ☺
  - 3-year US$350k-450k ☺

- Therefore cost share can be required.
- the suggestion is that co-funding can come from other organisations like DOE AHRI…
- Not so much commercial…

Sea Salt

- Justification from industry – Oil & gas industry, Telecom could provide support
- Review of Work Statement – need reviewers
- Co-funding – in-kind or financial. Could be organizational e.g. DOE, AHRI,…

Wetted Materials

External Flow

- It appears there may already be a an RTAR in progress more generally on external flow for buildings
  - Should we combine with that?
  - Should we stick to more data center centric?
- May be difficult to get second project funded by RAC.
- Should we work independently to retain focus?
- Can we have support statements and commercial funding to justify DC focus for additional RAC funding?

Other Research Ideas

- Refrigerant ignition and flammability as applied to data centers – Rick Pavlak initiating potential RTAR. Currently exploring the topic

- Other ideas?

Airflow & Energy Flow Metrics

Jim VanGilder

2023 ASHRAE Annual Conference

Tampa, FL | June 24-28, 2023

Poster 4: Heat Pump Water Heaters / Data Centers (Poster)

Rationalizing Data Center Whitespace Airflow and Energy-Flow Metrics

Jim VanGilder, PE

Schneider Electric

jim.vangilder@se.com

Schneider Electric

2023 ASHRAE Annual Conf

Acknowledgements

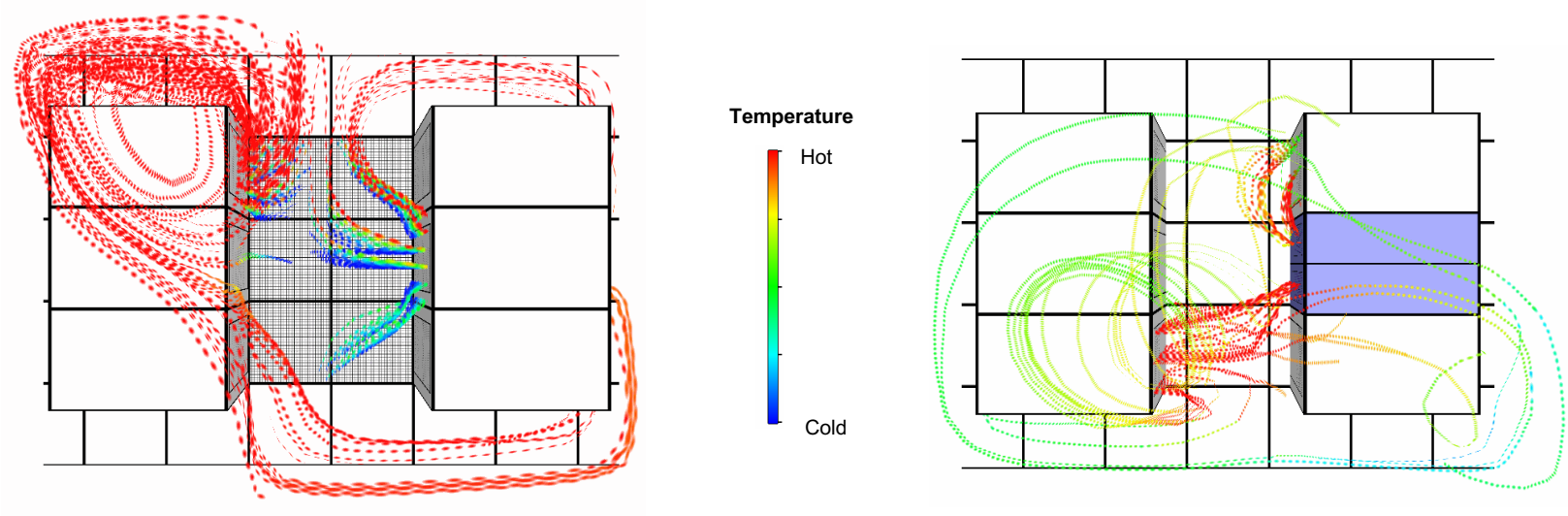
Wei Tian, PhD – Schneider Electric

Mike Condor – Schneider Electric

Bias Disclosure: The presenter's company produces and sells data center CFD software.

Data Center Cooling

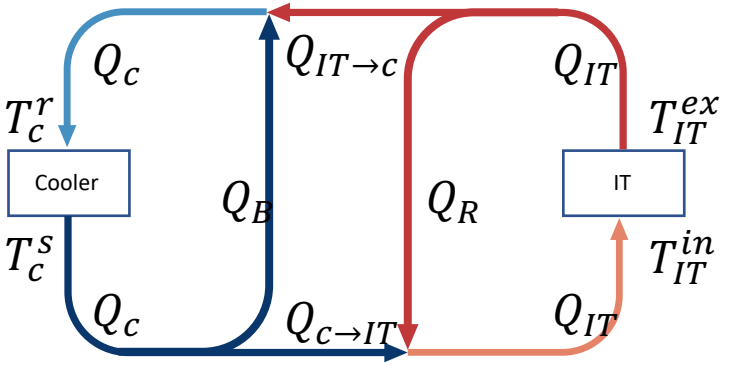
Managing airflow patterns key to effective and efficient whitespace cooling



Rationalizing Existing Whitespace Metrics

Metric	Type	Definition	Relationship to Other Metrics
Air Ratio	Airflow	$AR = \frac{Q_c}{Q_{IT}}$	$AR = \frac{\Delta T_{IT}}{\Delta T_c}$
IT Airflow Effectiveness[1, 2]	Airflow	$\varepsilon_{ITa} = \frac{Q_{c\to IT}}{Q_{IT}}$	$\varepsilon_{ITa} = \frac{\Delta T_{IT}}{\Delta T_{max}} = (AR)\eta_{ca} = \varepsilon_{ITt}$
Cooler Airflow Efficiency[1]	Airflow	$\eta_{ca} = \frac{Q_{IT\to c}}{Q_c}$	$\eta_{ca} = \frac{\Delta T_c}{\Delta T_{max}} = \frac{\varepsilon_{ITa}}{AR} = \eta_{ct}$
IT Thermal Effectiveness[3]	Energy flow	$\varepsilon_{ITt} = \frac{\dot{q}_{IT}}{\dot{q}_{c\to IT} + \dot{q}_{IT}}$	$\varepsilon_{ITt} = \frac{\Delta T_{IT}}{\Delta T_{max}} = (AR)\eta_{ct} = \varepsilon_{ITa}$
Cooler Thermal Efficiency	Energy flow	$\eta_{ct} = \frac{\dot{q}_c}{\dot{q}_{IT\to c} + \dot{q}_c}$	$\eta_{ct} = \frac{\Delta T_c}{\Delta T_{max}} = \frac{\varepsilon_{ITt}}{AR} = \eta_{ca}$

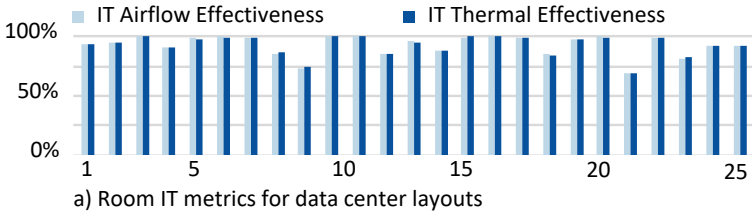
[1]Originally "IT Supply/Return Effectiveness" and "ACU Supply/Return Effectiveness" by Seymour and Herrlin 2015.
[2]Originally "Capture Index (*CI*)" by VanGilder and Shrivastava 2007; renamed and extended here.
[3]Originally "Return Heat Index (*RHI*)" by Sharma et al. 2002; renamed and extended here.



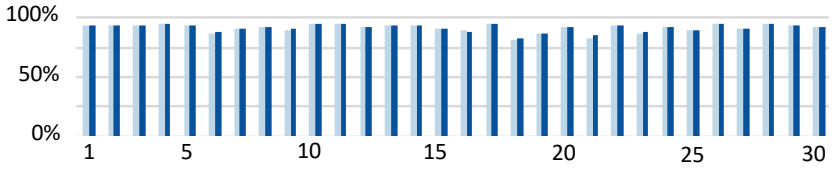
Simple Data Center Airflow Idealization

Airflow/Energy-Flow Metrics Nearly Identical

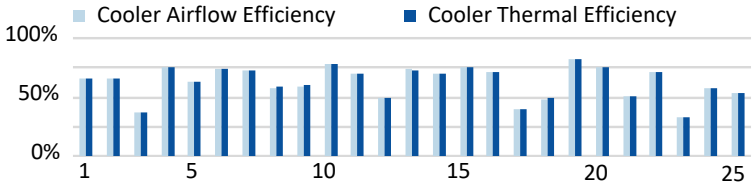
Comparisons over 25 data centers



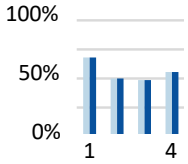
a) Room IT metrics for data center layouts



b) Rack metrics for Layout 25



a) Room cooler metrics for data center layouts



b) Cooler metrics for Layout 25

Recommended Metrics for Data Center CFD

Airflow metrics better than *energy-flow* metrics for data center CFD

Room Airflow Metrics

Air Ratio (AR)	1.34	IT Equipment Effectiveness (ε_{ITa}^{in})	85%	Cooler Efficiency (η_{ca})	63%

Rack Airflow Metrics

IT inlet airflow from coolers (ε_{ITa}^{in})	83%
IT inlet airflow from IT in other racks	12%
Recirculation (Internal: 2%, External 3%)	5%
IT exhaust airflow to coolers (ε_{ITa}^{ex})	79%
IT exhaust airflow to IT in other racks	16%
Recirculation (Internal: 2%, External 3%)	5%

Cooler Airflow Metrics

Supply airflow to IT inlets (η_{ca}^{s})	67%
Supply airflow to other coolers	22%
Recirculation to self	11%
Return airflow from IT inlets (η_{ca}^{r})	79%
Return airflow from other coolers	10%
Recirculation from self	11%

Conclusion

- Airflow and energy-flow metrics provide valuable insights
- Existing metrics have inconsistent naming, redundancies, and gaps
- Proposal: Standardize on *IT Airflow Effectiveness* and *Cooler Airflow Efficiency*

Bibliography

- Seymour, M. and Herrlin, M. 2015. Data center optimization using performance metrics. Proceedings of InterPACK, July 6-9, San Francisco, California.
- Sharma, R. K, Bash, C. E., and Patel, C. D. 2002. Dimensionless parameters for evaluation of thermal design and performance of large-scale data centers. 8th ASME/AIAA Joint Thermophysics and Heat Transfer Conf., St. Louis, Missouri.
- VanGilder, J. and Shrivastava, S. K. 2007. Capture index: an airflow-based rack cooling performance metric. ASHRAE Transactions, Vol. 113, Part 1.

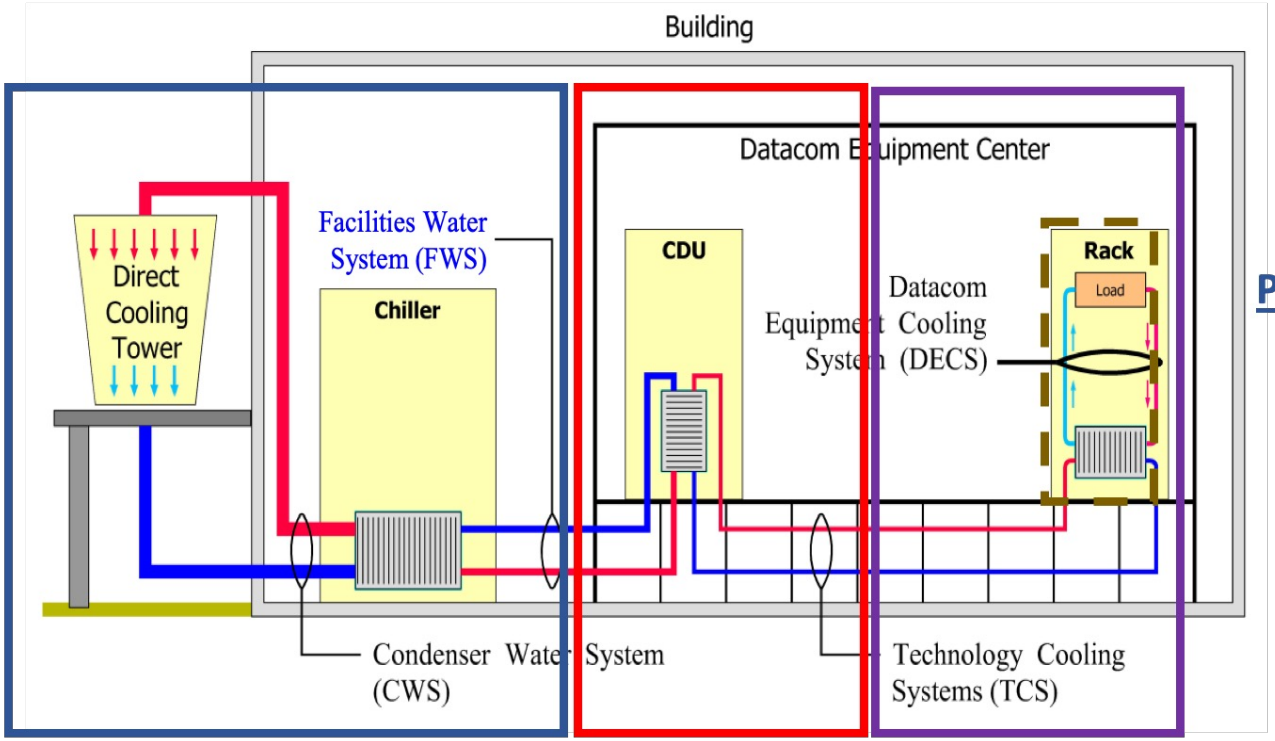
Questions

- Jim VanGilder, PE
- jim.vangilder@se.com

Agenda

- Liquid cooling book
- New TCS class proposal
- Liquid cooling Tech Brief
- Marine corrosion research WS
- Power trends update
- Thermal guidelines Tech Brief

Liquid Cooling Book Status



Part 1:Technology Trends

5 pgs.-Liquid Cooling Bk – 2nd
5 pgs.-Components WP
20 pgs.-Technology Emergence
3 pgs.-Liquid Cooling Brief

65 pgs.-Liquid Cooling Bk – 2nd
12 Pgs – Thermal Guidelines – 4th

Part 2: Facilities

5 pgs.-Liquid Cooling Bk-2nd
20 pgs.-Components

20 pgs.-Liquid Cooling Bk-2nd
20 pgs.-Component Whitepaper
10 pgs.-IT Equipment Design Impact Bk
5 pgs.-Immersion Cooling

Part 3: Technology and Cooling Systems

Liquid Cooling Book Status

- At winter meeting, it was reported that the “Facilities” and “IT” group efforts were merged.
- Significant progress was made on completing a first draft since the winter meeting.
- Special thanks to Paul Artman, Mark Steinke, Tim Shedd, John Bean, Roger Schmidt for bi-weekly meetings to further develop content, writing, editing, and reviewing..
- First draft is 11 chapters, 169 pages and 2 Appendix

Liquid Cooling Book Status

The third edition provides expanded and new information covering the following topics:

- A discussion on the IT component power trends that are driving the need for liquid cooling to support the next generation of IT workloads.
- A new set of environmental classes (S-Classes) for the supply temperature of the Technology Cooling System (TCS) coolant are introduced. These new guidelines provide a link to the Facility Water System (FWS) classes (W-Classes) to ensure both the facility and the datacom equipment are properly designed to support energy efficiency.
- Expanded treatment of the differences in fluid quality requirements for the TCS and FWS loops.
- Details are provided on the design characteristics of conductive cold plate cooling and immersion cooling systems.
- Design guidance is added for air cooled facilities that are being upgraded to support liquid cooled datacom equipment.

Overview of Chapters

- **Chapter 1** states the purpose and objective of this book, defines key terminology associated with liquid cooling, and highlights the emerging trends driving the adoption of data center liquid cooling.
- **Chapter 2** provide the reader with an overview of the facility cooling system equipment and design considerations.
- **Chapter 3** provides detailed descriptions of the various liquid cooling implementations.
- **Chapter 4** describes the cooling distribution unit (CDU) function and design considerations.
- **Chapter 5** characterizes the facility cooling systems by providing guidelines on the interface requirements between the facility water system and the technology cooling system.
- **Chapter 6** introduces new technology cooling system (TCS) temperature guidelines (S-Classes) to ensure the IT equipment delivers full performance

Overview of Chapters

- **Chapter 7** describes the fluids and fluid quality considerations for both the Facility Water System and Technology Cooling System.
- **Chapter 8** describes the common components and their attributes that make up a conductive cooling (cold plate) liquid cooling solution for datacom equipment.
- **Chapter 9** describes different implementations of immersion cooling systems and considerations in their design.
- **Chapter 10** describes consideration for transitioning an air cooled data center to support liquid cooled datacom equipment.
- **Chapter 11** describes other considerations for liquid cooling environments such as monitoring/control, reliability and availability, commissioning, fire detection and suppression, and data center modeling.
- **Appendix A** provides general characteristics of common fluid used in immersion cooling systems.
- **Appendix B** provides guidance on considerations for commissioning liquid cooled datacom equipment.

Remaining Work / Needs

- Looking for Server OEMs to help provide data on the number of liquid cooled products since 2017.
- Finalize TCS supply water temperature classification values and provide further guidance for their use.
- Need a figure showing Wet Break quick disconnects
- Need support from design or consulting engineers with experience in upgrade an air-cooled data center to liquid to enhance Chapter 10: Transitioning to Liquid Cooling
- Need somebody experienced with commissioning to review Appendix B: Liquid Cooling System Commissioning Checklist

TCS Water Classes

The goal of the TCS temperature classification is to define a simple explanation of the relationship between the FWS and TCS such that the data center facility and ITE can be designed for interoperability across many generations of ITE. In addition, guidance is provided in the form of trends for maximum allowable TCS and FWS based on industry hardware power trends. The trend of maximum TCS fluid temperature can be translated to the maximum FWS water temperature using the CDU approach temperature.

Table 6.1 TCS temperature classification

TCS Fluid Class	Typical Infrastructure Design		TCS Supply Temperature °C (°F)
	FWS Facilities	TCS Facilities	
S20	Chiller	CDU	20°C (68°F)
S30	Chiller / Cooling Tower		30°C (86°F)
S40	Cooling Tower		40°C (104°F)
S50	Cooling Tower / Dry Cooler		50°C (122°F)

Liquid Cooling Tech Brief

~10 pages of key points for those new to data center liquid cooling

A. Issues with Air cooling
   1. CPU/GPU
   2. Acoustics
   3. Air flow
   4. xxx
B. Server Liquid cooling designs
C. Facilities transition to Liquid cooling

Marine Corrosion Research

Motivation for Proposed Research

From an extensive literature search there are no published environmental conditions for operating data centers in marine environments that combine the key marine environmental parameters of salinity, T, RH, Wet/dry cycles, SO2, and particle size to guide data center operators on reliable operation, especially when those data centers desire to save energy by operating in economizer mode.

ASHRAE Work Statement Proposal

Study of the Corrosion Impact on Information Technology Equipment in Data Centers Located in Coastal Regions with High Sea Salt Concentrations and the Level of Filtration Required to Maintain Reliable Operation of this Equipment

Marine Corrosion Research

Work Statement rejected with the following areas for improvements:

- Split into 2 projects – one filtration and one corrosion
- Follow sea salt established testing stds
- Improve on design of testing apparatus
- Provide more data on the need of this research
- Expand on testing conditions to mimic server environments
- Support of IT Industry/Co-funding

:

- Sponsor: TC 9.9 Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment

- Coordinated with: TC 2.3 Gaseous Air Contaminants and TC2.4 Particulate Contaminants (all 3 TC's voted unanimously on the draft WS to support this research)

Before updated Work Statement(WS) is submitted(targeted for end of this year)

1.Need 2 or 3 volunteers who have an interest in this subject to critically review updated WS and become co-authors

2.Need additional Data Center Operators/IT server manufacturers confirm reliability issues for data centers located in marine environments

3.Need some co-funding(in-kind or other) from those in the data center industry

Power Trends Update

Thermal Guidelines for Air Cooling
General Comments

- These are guidelines and not a standard
- They are developed from the best information that are gathered from IT manufacturers
- They are updated periodically as new information is obtained – 5th update in 20 years
- These guidelines are meant for operating data centers world-wide
- Any data center can choose not to use these environmental guidelines and develop they own; the Thermal Guideline book offers a process by which to develop unique guidelines
- Location conditions may permit improved reliability and energy efficiencies from operating in a different environmental envelope
- If different environmental envelopes are used just be aware of the warranty requirements of the servers related to the environmental conditions

Item 3: Liquid Cooling Tech Brief

Roger Schmidt

~10 pages of key points for those new to data center liquid cooling

A. Issues with Air cooling
   1. CPU/GPU
   2. Acoustics
   3. Air flow
   4. xxx
B. Server Liquid cooling designs
C. Facilities transition to Liquid cooling

Item 4: Marine Corrosion Research

Motivation for Proposed Research

From an extensive literature search there are no published environmental conditions for operating data centers in marine environments that combine the key marine environmental parameters of salinity, T, RH, Wet/dry cycles, SO2, and particle size to guide data center operators on reliable operation, especially when those data centers desire to save energy by operating in economizer mode.

ASHRAE Work Statement Proposal

Submitted Dec 15, 2020

Study of the Corrosion Impact on Information Technology Equipment in Data Centers Located in Coastal Regions with High Sea Salt Concentrations and the Level of Filtration Required to Maintain Reliable Operation of this Equipment

Marine Corrosion Research

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Thank You

TC 9.9 Website:

tc0909.ashraetcs.org

Attendance: https://forms.gle/uR4n7Scq5G6TWar7A

Attendance

ASHRAE TC 9.9 Attendance Record

ASHRAE Technical Committee 9.9 - Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment
2023 Summer Meeting

Programs, Research, & Publications
Virtual Event Timing: Sunday June 25, 2023; 6:00-8:00 pm ET
Event Address: https://www.microsoft.com/microsoft-teams/join-a-meeting
Meeting ID: 275 911 663 998
Passcode: 26xton

Virtual Event Timing: Monday June 26, 2023; 2:30 - 7:00 pm ET
Event Address: https://www.microsoft.com/microsoft-teams/join-a-meeting
Meeting ID: 277 656 060 182
Passcode: ejXvUU

Contact us at tc99chair@gmail.com
Technical Committee Website: http://tc0909.ashraetcs.org

tc99chair@gmail.com Switch account

Not shared

* Indicates required question

Attendance is being recorded using a Google Form. Please make sure you complete the form at:

https://forms.gle/TnV1uhvR2NLH2RxS7

Or use the QR Code below:

Current Work Items

General TC9.9 Work Items

		Status	Expected Completion	Membership	Contact
Research	1675-RP, Guidance for CFD Modeling of Data Centers	On-going	3Q2021	Closed	Mark Seymour mark.seymour@futurefacilities.com
Standards	SSPC 127, Method of Testing for Rating Computer and Data Processing Room Unitary Air Conditioners	On-going	Continuous	Open	John Bean jbean@grcooling.com
Standards	AHRI 1360, Performance Rating of Computer and Data Processing Room Air Conditioners	On-going	Continuous	Closed	David Kelley kelleydave9@gmail.com
Standards	ANSI/ASHRAE 90.1, Energy Standard for Buildings Except Low-Rise Residentail Buildings	SSPC	Continuous	Closed	Richard Pavlak rlpavlak@heapy.com
Standards	ANSI/ASHRAE 90.4, Energy Standard for Data Centers	SSPC	Continuous	Closed	David Kelley kelleydave9@gmail.com
Handbook	HVAC Applications, Chapter 20, Data Centers and Telecommunication Facilities	On-going	Continuous	Open	Bob McFarlane rmcfarlane@smwllc.com

IT Subcommittee

		Status	Expected Completion	Membership	Contact
White Paper	Liquid Cooling Guidelines for Datacom Equipment Centers 3rd Edtion	On-going	2023	Open	Roger Schmidt c28rrs@us.ibm.com

Facilities Subcommittee

		Status	Expected Completion	Membership	Contact
Datacom Book	Design Considerations for Datacom Equipment Centers, 2nd Edition	In Review	4Q2021	Open	John Gross john@jmgrossengineering.com
White Paper	Data Center Cooling Resiliency	On-going	2022	Open	Mark Mannex markm@mannex-eng.com

Attendance: https://forms.gle/uR4n7Scq5G6TWar7A

ICC-2024 UL/CSA 60335-2-40 ASHRAE Std. 15

Ben Dolcich

International

Don Beaty

Attendance: https://forms.gle/uR4n7Scq5G6TWar7A

TC 9.9 Officers

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ITE Subcommittee Chair		Dr. Roger Schmidt, *IBM Fellow Emeritus* *Syracuse University*
Standards Subcommittee Chair		Rick Pavlak, *Heapy Engineering Retired*
Program Subcommittee Chair		Nick Gangemi, *Northern Air Systems*
Handbook Subcommittee Chair		Robert McFarlane, *Shen Milsom & Wilke, LLC*
Webmaster		Ecton English, *Department of Defense*
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