



1791 Tullie Circle, N.E./Atlanta, GA 30329
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. TC 9.9 DATE February 5, 2023

TC/TG/MTG/TRG TITLE Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment

DATE OF MEETING February 5, 2023 LOCATION Omni CNN Center Atlanta, GA

Note: These draft minutes have not been approved and not the official, approved record until approved by the TC.

VOTING MEMBERS PRESENT	VOTING MEMBERS ABSENT
Paul Fitch	Mark Monroe
John Groenewold	David Quirk
John Gross	Lixia Wu
David Kelley	
Matt Koukl	
Jason Matteson	
Bob McFarlane	
David Moss	
Rick Pavlak	
Joe Prisco	
Mark Seymour	
Mark Steinke	

CORRESPONDING MEMBERS PRESENT	PROVISIONAL MEMBERS PRESENT
Gerardo Alfonso	Rani Doughty
Mukul Anand	Kyle Longbrake
Matt Archibald	William Martin
John H Bean, Jr	Don Mitchell
Donald L Beaty	Izuh Obinelo
Norm Bourassa	DOUGLAS SICK
Nan Chen	Ashwin Siddarth
Brad Cochran	Robert Tozer
Dustin Demetriou	
Benedict Dolcich	

Ecton English	
Mark Fisher	
Nigel Gore	
David Grant	
Steve Greenberg	
Mustafa Kadhim	
Steve Krupka	
Carlos Lisboa	
Michael McKenna	
Shlomo Novotny	
Terry Rodgers	
Timothy Startt	
Jeff Stein	
Mark Steinke	
Jim VanGilder	
Jonell Watson	
Eric Yang	

GUESTS PRESENT	
Juan Alfonso	
Marcus Hassen	
Nathan Parkison	
Lynndy Ruddell	
Ron Spangler	
Le Van Duc	
Nick Xu	

PUBLISHED AGENDA

Sunday, February 5, 2023
TC 9.9 Programs, Research, & Publications
6:00 PM – 8:00 PM EST
Location: Hilton, Omni CNN Center Atlanta, Magnolia (M2-North)

Microsoft Teams Meeting
Meeting ID: 225 016 118 130
Passcode: 7zUxeq

Attendance
<https://forms.gle/CcscQ5iohYYeVNuQA>

Topic		Time	Presenter	In-Person or Virtual
Introduction	Welcome and Introductions	10	John Groenewold	IP
Programs	2023 Winter Atlanta & 2023 Summer Tampa	10	Nick Gangemi	V
Research	Research Update	20	Mark Seymour	IP
Publications	Publications Update	20	Don Beaty	IP
Research	Workshop (Room: Magnolia M2-North)	60	Mark Seymour	IP
Publications	Workshop (Room: Juniper M2-North – Teams Meeting Meeting ID: 279 451 360 874 / Passcode: Fisfom)	60	Don Beaty	IP
Total Time:		120	Minutes	

CALL TO ORDER: 02/05/23 6:02 pm EST - John Groenewold

INTRODUCTION – John Groenewold

- Welcome
 - Main meeting for the first hour
 - Breakout sessions for the second hour
- Meeting Housekeeping
 - Hybrid meetings
 - Teams for Sunday meeting
 - Teams for Monday meeting
- Attendance Form
 - Link: <https://forms.gle/CcscQ5iohYYeVNuQA>
 - Both in person and virtual attendees to click and fill out the attendance form
 - Must fill out for each meeting (Sunday/Monday)
- Introductions
 - In-room introductions
 - Virtual introductions

PROGRAMS - Nick Gangemi Slides presented by John Groenewold

- Reviewed 2023 ASHRAE Winter Program – Atlanta
 - Panel 3 (A2L) Refrigerant Readiness in North America
 - Monday, February 6, 2023 11:00 am – 12:00 pm EST
 - Mukul Anand – Johnson Controls
 - Seminar – Data Center interest
 - Monday February 6, 2023 9:45 am EST
- Reviewed 2023 ASHRAE Summer Program – Tampa
 - Upcoming deadlines
 - Website opens for Seminar, Workshop, Panel, Debates, and Forums

- Friday, January 6, 2023
 - Seminar, Workshop, Panel, Debates, and Forums Due Date
 - Monday, February 27, 2023
 - Seminar, Workshop, Panel, Debates, and Forums Reject Notifications
 - Friday, April 14, 2023
- Program Chair change
 - Nick Gangemi will step down as Program Chair
 - Contact Nick for interest
 - nickgangemi@microsoft.com
 - (585) 721-8795

RESEARCH – Mark Seymour

- Quick Summary of Research Projects
 - RP 1675 - End of Project Presentation
 - Beichao Hu presenting in the Research Breakout
 - Final report submitted
 - Journal paper to be published in Winter 2024 meeting
 - Sea Salt Corrosion
 - Focus on sea salt corrosion and filtration
 - RAC felt this required co-funding from the industry
 - ~\$300,000 in funding required
 - Research budget is being restored after other priorities are completed
 - Proposed RTAR Wetted Materials – Mark Steinke
 - Need to form small group
 - Establish a method to establish test method
- Future Research Projects
 - Guidelines for External Airflow Modelling
 - Mark Seymour & Brad Cochran to lead
 - mseymour@cadence.com
 - Immersion Cooling
 - No method of test, standards, equipment
 - Third party lab setting up to provide testing of immersion might want to engage
 - Fluid property differences lead to various results
 - Suggest we discuss this SPC127 and expand the scope
 - Consider an RTAR around this topic
 - Gaseous Contamination
 - More research on this topic
 - Delayed responses to corrosion exposures creates tracing failures difficult
 - Coupons might provide transient insight
 - Determine if there are better methods for prediction
 - Battery Duration
 - No good models to predict thermal shutdown of battery backup systems
 - Propose modelling or method to determine

PUBLICATIONS – Don Beaty

- Opening comments
 - Reorganized publications to get better alignment
 - Books have not gotten wide consumption
 - Consider changing format to be consumed on phones and other modern devices
- Moved to Technical bulletins vs White Papers
 - Focus attention for the reader
 - Detailed the changes to the Technical Bulletins format
- Recommendation
 - Convert books to online subscription

- Issue updates at a chapter level
 - Reduce chapter size
- Speed to market is required

MAIN MEETING ADJOURNED: 02/05/23 7:16 pm EST - John Groenewold

RESEARCH WORKSHOP

- Room: Magnolia M2-North

PUBLICATIONS WORKSHOP

- Room: Juniper M2-North

CALL TO CLOSE: 02/05/23 7:00 pm EST - John Groenewold

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Bob McFarlane	
David Moss	
Rick Pavlak	
Joe Prisco	
Mark Seymour	
Mark Steinke	

CORRESPONDING MEMBERS PRESENT	PROVISIONAL MEMBERS PRESENT
Gerardo Alfonso	Glenn Brenneke
Matt Archibald	Brian DeLeon
John H Bean, Jr	Rani Doughty
Donald L Beaty	Kyle Longbrake
Ray Beezley	William Martin
Norman Bourassa	Sankar Padhmanabhan
Nick Casale	Ashwin Siddarth
Tom Davidson	
Dustin Demetriou	
Benedict Dolcich	
John Dumler	
Ecton English	
Mark Fisher	
Charles Freda	
Nigel Gore	
David Grant	
Steve Greenberg	
Mustafa Kadhim	

Girish Kini	
Alexandre Kontoyanis	
Sang Lee	
Mike Licitra	
Carlos Lisboa	
Mark Malkin	
David McGlocklin	
Michael McKenna	
Don Mitchell	
Chris Muller	
Chris Muller	
Shlomo Novotny	
Melissa Olson	
John Peterson	
Roger Schmidt	
Tim Shedd	
Ron Spangler	
Timothy Startt	
Mark Steinke	
David Tootle	
Jonell Watson	
Philip Yu	

GUESTS PRESENT	
Davis Adler	Jorge Padilla
Juan Alfonso	Nathan Parkison
Liz Balke	Tim Shippen
Galen Gerig	Robert Tozer
Hung-Tsung Hung	Phil Vozza
Raven Jones	Jinliang Wang
Rajendera Kapoor	Nick Xu
Keith LaChance	Sarah Young
Stuart Lawrence	
Ramesh Navaratnam	

PUBLISHED AGENDA

Monday, February 6, 2023
TC 9.9 Main Meeting
2:30 PM – 7:00 PM EST
Location: Georgia World Congress Center, A311 (3)

Microsoft Teams Meeting
Meeting ID: 268 959 024 61
Passcode: YpPqdW

Attendance
<https://forms.gle/1TAR6b1xWtmqnCQ67>

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
TC 9.9 Purpose & Scope	Review of TC 9.9 Original Purpose and Scope	10	John Groenewold & Don Beaty	IP
Reorganization	Discussion of Committee and Publications Reorganization ASHRAE Publications	40	Don Beaty, John Groenewold, Mark Owens	IP
Liaison Reports				
	Standard 90.1 & 90.4	5	Rick Pavlak	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	IP
	MTG.CYB	5	Ecton English	IP
Break		20		
Research	Research Committee Update	20	Mark Seymour	IP
IT Subcommittee	IT Subcommittee Update Liquid Pressure Test for Servers Corrosion Research Liquid Cooling Book Status Plan for Updating Power Trends	45	Roger Schmidt	IP
Break		15		
IT Subcommittee	IT Subcommittee Workshop (Room: A312 (3) Teams Meeting – Meeting ID: 299 090 189 603 / Passcode BtJpNW)	70	Roger Schmidt	IP
Publications	Publications Workshop (Room A311 (3) Teams Meeting – Meeting ID: 237 515 786 807 / Passcode 4JiTLJ)	70	Don Beaty	IP
Total Time:		270	Minutes	

CALL TO ORDER: 02/06/23 2:33 pm EST - John Groenewold

INTRODUCTION – John Groenewold

- Welcome
 - Attendees are both in person and joining virtually
- Virtual meetings will be in two platforms
 - Teams for Sunday meeting
 - Teams for Monday meeting
- Procedures to conduct hybrid meeting
 - Virtual attendees to stay muted. Unmute to ask a question
 - In person attendees to unmute table microphones to be heard by virtual attendees
- Attendance form
 - Link: <https://forms.gle/1TAR6b1xWtmqnCQ67>
 - Both in person and virtual attendees to click and fill out the attendance form
 - Must fill out for each meeting (Sunday/Monday)
- ASHRAE Code of Ethics presented
- Overview of today's meeting
- Introduction to the TC 9.9 website
 - <https://tc0909.ashraetcs.org>
- TC9.9 Work Activities
 - Handbook Chapter 20
 - Datacom book 1
 - Datacom book 3
 - ADD some more...
- TC9.9 Officers
 - TC 9.9 Chair - John Groenewold, Vantage Data Centers
 - TC 9.9 Vice-Chair - Matt Koukl, Affiliated Engineers
 - TC 9.9 Secretary - Mark Steinke, Advanced Micro Devices
 - Publications Chair – Don Beaty, Retired DLB Associates
 - Research Subcommittee Chair - Mark Seymour, Future Facilities
 - 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
 - Marketing Subcommittee Chair - Paul Finch, KAO Data
- TC 9.9 Liaisons
 - Standard 90.1: Rick Pavlak
 - Standard 90.4: Dave Kelley
 - Standard 127: John Bean
 - AHRI 1360: David McGlocklin
 - Standard 300, Guideline 1.6: Terry Rodgers
 - International: Don Beaty
 - MTG.CYB: Ecton English
 - Building Decarbonization: Lixia Wu
 - Standard 300, Guideline 1.6: Terry Rodgers
- Voting Members
 - John Groenewold, Vantage Data Centers
 - Dave Moss, Dell
 - John Gross, J.M. Gross Engineering
 - Matt Koukl, Affiliated Engineers
 - Dave Kelley, Vertiv
 - Mark Monroe, Microsoft
 - Rick Pavlak, Heapy
 - Mark Steinke, AMD
 - Paul Fitch, KOA Data

- Mark Seymour, Cadence Design Systems
- Jason Matteson, Iceotope Technologies
- David Quirk, DLB Associates
- Joe Prisco, IBM
- Bob McFarlane, Shen Milsom & Wilke
- Lixia Wu, Cushman & Wakefield
- TC9.9 2022 – 2023 Votes
 - 1675-RP Approval of Final Report – Approved
 - Proposed Thermal Guidelines 5th Edition – Include Classes B & C – Approved
 - Adoption of 2022 Winter Meeting Minutes – Approved
 - Adoption of 2021 Summer Meeting Minutes – Approved
 - ASHRAE 2023 Applications Handbook Chapter 20 – Approved
 - Adoption of 2022 Summer Meeting Minutes - Approved
- Reviewed membership data
 - Provisional 90
 - Corresponding 338
- Reminder to keep ASHRAE account email up to date and through job changes
 - Email bounce backs are used to purge the roster

REORGANIZATION OF PUBLICATIONS – Don Beaty, John Groenewold

- Opening comments
 - Reorganized publications to get better alignment
 - Books have not gotten wide consumption
 - Consider changing format to be consumed on phones and other modern devices
- Moved to Technical bulletins vs White Papers
 - Focus attention for the reader
 - Detailed the changes to the Technical Bulletins format
- Recommendation
 - Convert books to online subscription
 - Issue updates at a chapter level
 - Reduce chapter size
- Speed to market is required
- AHRAE Publications support from Mark Owens
- Motion - Move publications to online
 - Motion Seconded
 - TC 9.9 Voting member to convene at break and vote
 - Motion Passed Unanimously

LIAISON REPORTS

- Standard 90.1 – Rick Pavlak
 - Energy Standard for Buildings Except Low-Rise Residential Buildings
 - Standard 90.1-2022 is published
 - Incorporates 80+ addenda
 - Other additions
 - Min prescriptive requirement for on-site renewable energy
 - Optional Mechanical System Performance Path
 - New requirements to address impacts of thermal bridging
- Standard 90.4 – Rick Pavlak
 - Energy Standard for Data Centers
 - Standard 90.4-2022 is out for review
 - Addenda h made changes to electrical performance calculations
 - Performance cooling standard is expanding to all mechanical
- SSPC-127 – David McGlocklin
 - Method of Testing for Rating Air Conditioning Units Serving Data Center (DC) and Other Information Technology Equipment (ITE) Spaces

- Lots of public comments and now addressed
- Balance roster achieved
- Revising title, purpose, & scope to include liquid cooling
- Discuss the forms of liquid cooling. Desire to include all forms, DLC, immersion, CDUs, ect..
- AHRI 1360 – Dave McGlocklin
 - Performance Rating Standard for Datacom Air-Conditioning Units
 - 1360-2022 & 1361-2022 are released
 - Work with SSPC 127 to harmonize the two standards
- MTG.CYB – Ecton English
 - MD task force for Cyber security
 - Look at it wholistically through the full stack
 - How it interacts with our domain
 - Manage Backnet to be publish soon
 - Mfg guide to cybersecurity. To be publish soon
 - Push out education on cyber security
 - Call for partitions, email Ecton
- DOE/LBNL – Steve Greenderg
 - Workshop to update US report
 - Workshop on DC efficiency
 - Decarbonization discussion
 - CoE has resources and website
 - New resources
 - Server selection guidelines
 - IT equipment
 - Newsletter, email, website

BREAK – Restart at 4:20 pm EST

- In-room introductions
- SSPC 300, Guideline 1.6 – Terry Rodgers
 - Data Center Commissioning
 - Guideline to be used in conjunction with Guideline 0
 - New guideline focused on new construction
 - Working on several sections
 - Contact Terry for interest

RESEARCH – Mark Seymour

- Quick Summary of Research Projects
 - RP 1675 - End of Project Presentation in the Monday Meeting
 - Tropical Data Centers Presentation in the Monday Meeting
 - Singapore is in tropical climate and limits free cooling
 - Sea Salt Corrosion
 - Focus on sea salt corrosion and filtration
 - RAC felt this required co-funding from the industry
 - Proposed RTAR Wetted Materials
 - Immersion Cooling
 - Gaseous Contamination
 - Battery Duration
 - A2L refrigerants and risks with server usage

IT SUBCOMMITTEE – Dustin Demetriou

- Pressure Testing Requirements for IT Liquid Components
 - Concern with IEC 62368-1 to pressure test to 5x maximum working pressure
 - IEC 62368-1 4th edition will now update to 1.5x maximum working pressure
 - Liquid cooling book with provide clarification
 - Question: Is the requirement to test every item
 - Answer: you need to test relative to the requirement. Need to clarify working pressure vs manufacturer pressure

- Liquid Cooling Guideline Book
 - Plans to update 2nd edition
 - Reordered chapters
 - Combined information from the multiple sources
 - Significant new content
 - Water cooling components
 - Immersion cooling
 - Clarity on FWS vs. TCS
 - TCS temperature classification
 - Emerging trends and liquid cooling adoption
 - Help needed to complete chapter content
 -

LIAISON REPORTS

- Task Force for Building Decarbonization - Lixia Wu
 - Formed Spring 2021
 - Reorganized the TF
 - Working on six Technical Resources
 - Any questions or interest contact Lixia Wu, Lixia.Wu@CushWake.com

MAIN MEETING ADJOURNED: 02/06/23 5:21 pm EST - John Groenewold

IT SUBCOMMITTEE WORKSHOP

- Session 1
 - Room A311
 - Liquid Pressure Test for Servers
 - Intro Liquid Cooling Book
 - Liquid Cooling Book Status
- Session 2
 - Room: A312
 - Thermal Guidelines Envelope Issues
 - H Class usage
 - IEC Safety STD – touch temp
 - Liquid Cooling Book work items
 - Future Technical Briefs – Liquid Cooling & Power Trends
 - Interim IT Zoom Meetings

PUBLICATIONS WORKSHOP

- Canceled

CALL TO CLOSE: 02/06/23 7:00 pm EST - John Groenewold