



1791 Tullie Circle, N.E./Atlanta, GA 30329
404-636-8400

DRAFT

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. TC8.2 DATE January 20, 2021

TC/TG/MTG/TRG TITLE Centrifugal Machines

DATE OF MEETING January 20, 2021 LOCATION Virtual - Zoom

MEMBERS PRESENT	YEAR APPTD	MEMBERS ABSENT	YEAR APPTD	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
Ray Good	2019	Lindsey King	2019	Matt Cambio
Trent Hunt	2017	Jeb Schreiber	2019	Phil Johnson
Scott MacBain	2019	Konstantinos Kontomaris	2017	Mark Rogan
Dan Kemper	2020			Fred Betz
Michael Perevozchikov	2019			Drew Turner
Vincent Hwang	2020			Daryl Showalter
				Kris Crosby
				Justin Prosser
				Brandon Gill
				Nick Zupp
				Emma Van Fossen
				Jaime Yeh
				Andrew Fiegen
				Larry Smith
				Ken Schultz
				Bill Dietrich
				Chris Miller

DISTRIBUTION: All Members of TC/TG/MTG/TRG plus the following:

TAC Section Head: Kevin Mercer	SH8@ashrae.net Where x is the section number
--------------------------------	---

All Committee Liaisons As Shown On TC/TG/MTG/TRG Rosters (Research, Standards, ALI, etc.)	See ASHRAE email alias list for needed addresses.
Mike Vaughn, Manager Of Research & Technical Services	MORTS@ashrae.net

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

MINUTES

- 1) Call to Order at 12:06 PM (EST) by Chair, Ray Good
- 2) Introduction of Attendees, Liaisons, Officers and Guests
 - 5 of 8 voting members in attendance, Quorum achieved
- 3) Code of ethics review
- 4) Agenda review – No changes
- 5) TC scope – Centrifugal compressors and chillers
- 6) TC Mission Statement
 - a) Discussion on direction to continue as current
 - b) Potential to separate into compressors / machines
 - i) If separating – Probably makes sense to combine with 8.1 machines
 - ii) Then probably makes sense to combine compressors as well
 - iii) Same number of committees in the end
 - iv) 8.1 does not have positive displacement chillers – Recognized committee gap
 - v) How to explore – Larry Smith starting the ball rolling with Kevin(?)
 - c) Question on cross-membership with 8.1 - ~25-30% joint
 - d) Discussion again on potential to combine – Previous conclusion was too much dilution
 - e) Motion to continue – Vincent motion; Trent 2nd, vote 6,0,0
- 7) Summer meeting minutes – Motion to accept; approved to accept, vote 6,0,0

8) Programs

Mark Rogan

- a) Proposals for Phoenix (virtual)
 - i) CFD for compressors – 8.1 sponsor / 8.2 co-sponsor
 - ii) Low-GWP refrigerants – 8.1 sponsor / 8.2 co-sponsor
 - iii) Vote to approve both submissions, 6,0,0
- b) Approved for 2021 winter virtual conference “what makes compressor heat pump compressor”
 - i) Seminar 87; on-demand; no Q&A
- c) Appears that how programs are submitted governs format. Program chair will research and report.
- d) Registration required to view live and on-demand – Open for several months after sessions
- e) PDH credits available
- f) Clarified that Margaret will chair low-GWP session
 - i) Matt Cambio & Steve Kujak presenting
- g) Procedural question on whether or not corresponding member can make motions – Protocol says no but standard practice is to leave it up to chair
- h) Future program topics:
 - i) Centrifugal chiller test method (related to standards 225, 23.1, and AHRI 1520P. Timing will depend on date of release for AHRI 1520P which will make it relevant.
 - ii) High lift compression topic –
 - (1) Discussion on continuing with this after also presenting on heat pumps
 - (2) Same trends and high-level drivers for both
 - (3) Proposal for Fred Betz to chair
 - (4) Suggestion to push it to Vegas Winter meeting
 - iii) Beyond Phoenix...
 - (1) High efficiency pumping – General industry knowledge gap and ‘hunger’
 - (2) Pump TC not responsive on collaboration

- (3) Trent volunteering to chair but interested in other expert involvement –
 - (a) Steve Taylor or Brandon Gill from his firm
 - (b) Steve Duda?
- iv) Program related dates to keep in mind for Summer 2021 Meeting
 - (1) Feb. 22 Program submissions close
 - (2) April 5 Program accept/reject notifications
 - (3) May 1 PowerPoint uploads begin
- v) 2021 Summer Conference – Phoenix Tracks

9) Research

Daryl Showalter

- a) Nothing to report on chair breakfast yet
- b) Measurement and prediction of waterside fouling – Should publish soon
- c) Oil concentration measurement & method of test – Both delayed based on funding
- d) Future studies –
 - i) HVAC components & new refrigerants
 - ii) Low flow tube studies –
 - (1) Ties to variable pumping subject –
 - (a) Minimum turndown/differences
 - (b) Passes / modular considerations
 - (c) Fouling, drivers, oil vs oil-free
 - (2) Daryl agreed to take on work statement creation

10) Handbook

Scott

- a) Joint subcommittee meeting and efforts with 8.1
- b) Next revision on ch 38/43 for 2024 version
- c) ASHRAE behind with update from previous changes
- d) Both chapters pretty mature - Not anticipating major updates with next round

e) Rick Heiden, Scott MacBain, 8.2: Fred Betz, Drew Turner, Trent Hunt, Steve Duda have volunteered to be reviewers. They are encouraged to confirm document access on the authoring portal: <https://authoring.ashrae.org/>

Contact Chris Walter (CWalter@ashrae.org) if any issues with Microsoft login

11) Standards

Phil

- a) TC cognizant on 3 standards – 30, 184, 225
- b) Standard 30 –
 - i) Justin chairing; no 8.2 activity
 - ii) Several addenda published and out for public review
 - iii) Addendum c – 4-pipe, adiabatic, free cooling added
- c) Standard 184 – Need to decide if we re-affirm and/or form committee on it by 2024
- d) Standard 225 – Method of test for centrifugal compressor
 - i) Published July 2020
 - ii) Flow factor, head factor and efficiency
 - iii) Largely based on STD 23.1. One major difference is that the requirement for a secondary flow measurement required in 23.1 was eliminated in 225 when mass flow is the primary flow measurement method.
 - iv) Merge STD 225 into STD 23.1 is a future consideration.
- e) 90.1 –
 - i) Revision to K-adjust method for non-standard conditions (addendum x)
 - ii) Addendum y (not shown) – Heat pumps rating requirements
 - (1) Public review ending 1/29
- f) AHRI 550/590 & 551/591 (Vincent Hwang) – Activities on revisions kicking-off. If interested in joining the revision effort, contact Jamie Yeh: jyeh@ahrinet.org.
- g) AHRI standard 1520p – Performance rating of centrifugal compressors
 - i) Ready for public review mid-2nd quarter
- h) Standard 23 & 225 merger –

- i) Issues with merger? Standards seem to go together well but two different technologies
- ii) Maintenance of 2 separate standards as main driver
- iii) May be issues with testing application and capacities – Gas cycle stands & limited capacity range
- iv) Secondary massflow measurement requirement
- i) MTG low-GWP –
 - i) Not much to update and no voting activity
 - ii) Continued activity?

12) Membership

Ray

- a) TC leadership changes – No corresponding voting member changes
- b) External design firm participants
 - i) Brandon Gill – Taylor Engineering partner
 - (1) Large commercial, data centers, labs
 - (2) Interest on centrifugal applications and move to electrification
 - ii) Chris Miller – P2S Engineering
 - (1) Critical facilities application experience – Hospitals, etc
 - (2) Heat recovery machines and electrification
 - (3) Also based in CA and similar interest drivers with Brandon

13) Webmaster

Dan Kemper

- a) Recent access and no updates but will be coming

14) Awards

Fred Betz

- a) Proposing Mark Adams for ASHRAE Research award for 10 years leading on this committee
- b) Agreement to propose

15) Chairs breakfast

Drew

16) New business

Ray

17) Adjourn – 2:05 PM EST

Addendum with full reports or sections from presentations submitted for the meeting:

Program Subcommittee Report (Mark Rogan, Chair):

- Combined TC 8.02/8.01 Program Subcommittee Report
- 2021 Winter Meeting, Chicago, IL now Virtual
- Subcommittee Meeting: January 12th, 12:00 am -2:00 pm
- Attendees: Mark Rogan, Fred Betz, Drew Turner, Matt Cambio, Daryl Showalter, Justin Prosser, Margaret Matheson, Michael Perevozchikov, Trent Hunt, Davide Ziviani, Ray Good, Scott McBain, Dan Kemper, Craig Bradshaw, Kris Crosby, Chris Seeton, Joe Sanchez, Erik Anderson, Nick Zupp, and Emma Van Fossen
- Virtual Chicago Meeting Update
- What makes a compressor a Heat Pump compressor: David Ziviani is chair of seminar. Seminar submitted by TC8.1 with TC8.2 cosponsoring and accepted. Will be available during the virtual meeting in an "On Demand" format and is Seminar # 87
- CFD for compressors: Matt Cambio is chair of seminar. Sponsored by TC8.2 and cosponsored by TC8.1. Program was submitted, accepted we thought, and then later rejected before programs could be uploaded.
- Low GWP Alternative Refrigerant Evaluations for Centrifugal Machines: Panel Discussion format. Mark Rogan is chair of panel discussion. Program was submitted for second time, accepted we thought, and then later rejected before programs could be uploaded.
 - Phillip Johnson with Daikin and Steve Kujak with Trane Technologies are presenters

- Future Programs – Phoenix (still virtual it appears) or Las Vegas (should be live it appears)
- Phoenix recommendations: Subcommittee recommends resubmitting the Low GWP and CFD seminars not accepted for the Chicago Virtual meeting for the Phoenix Summer meeting. Will require a vote of the committee. Other possibilities are below but much less developed at this point.
- Standard 225; Centrifugal Chiller Method of Test compared to Standard 23.1 Justin Prosser to chair. Thought is to compare and contrast. Nick Zupp &/or Matt Cambio to speak. Can we possibly merge the two? This is also coinciding with AHRI 1520 and Justin Prosser suggested that we wait until the release of AHRI 1520 for which he will give us an update on timing.
- Dynamic Compression and High Lift Applications: Trent Hunt made this suggestion. The thinking is to explore how newly available magnetic bearing high lift chillers are performing low-temp process and ice making applications. Committee should discuss the overlap between this topic and the heat pump topic which is program # 3. Can we combine perhaps?

- Future Programs – Phoenix (still virtual it appears) or Las Vegas (should be live it appears)
- Phoenix recommendations: Subcommittee recommends resubmitting the Low GWP and CFD seminars not accepted for the Chicago Virtual meeting for the Phoenix Summer meeting. Will require a vote of the committee. Other possibilities are below but much less developed at this point.
- Standard 225; Centrifugal Chiller Method of Test compared to Standard 23.1 Justin Prosser to chair. Thought is to compare and contrast. Nick Zupp &/or Matt Cambio to speak. Can we possibly merge the two? This is also coinciding with AHRI 1520 and Justin Prosser suggested that we wait until the release of AHRI 1520 for which he will give us an update on timing.
- Dynamic Compression and High Lift Applications: Trent Hunt made this suggestion. The thinking is to explore how newly available magnetic bearing high lift chillers are performing low-temp process and ice making applications. Committee should discuss the overlap

between this topic and the heat pump topic which is program # 3. Can we combine perhaps?

- Future Program Ideas – Beyond Phoenix
- High Efficiency Pumping and integrating variable flow pumping into high efficiency Chiller Plant models. Pump TC could Co-Sponsor
- Back to Basics: Positive Displacement Compressors. TC 8.1 to sponsor with TC 8.2 to cosponsor. Matt Cambio to chair possibly.
- Steam Turbines
- Recent Omnibus Bill and it's impact on the Industry
- Standard 225
- District Cooling Plants; What effect with R-123 retiring have on systems: Co-Sponsor with District Cooling TC
- What impact has 90.1 – 2019 had on design practices regarding 15 degree delta T?
- Next Meeting
- Subcommittee will meet via conference call in June 2021
- Respectfully submitted by:
- Mark Rogan, P.E., CEM, GBE
- TC 8.02 Program Subcommittee Chair
- January 19th, 2021
- email: markrogan1@gmail.com
- phone: 540-255-8110 (cell)

- 2021 ASHRAE Winter Meeting Chicago:
- Important dates:
- Feb. 22 Program submissions close
- April 5 Program accept/reject notifications
- May 1 PowerPoint uploads begin
- 2021 Summer Conference – Phoenix Tracks
 - HVAC&R Fundamental and Applications
 - Systems and Equipment
 - Refrigeration and Refrigerants
 - Environmental Health Through IEQ
 - Building Performance and Commissioning for Operation and Management
 - Energy Conservation
 - International Design
 - Standards, Guidelines and Codes

Research Subcommittee Report (Daryl Showalter, Chair):

Research S/C Chair Breakfast notes of interest

- Research Chairs breakfast is scheduled for February 11th. Nothing to report today.

Current Activities

- Research Subcommittee online meeting was held with Handbook & Program on January 12, 2021.

Project Status

- 1677 - Measurement and Prediction of Waterside Fouling Performance of Internally Enhanced Tubes in Cooling Tower Applications
 - We are cosponsoring a study being undertaken by TC 8.5 on fouling of enhanced tubes. Looking at a smooth bore tube and multiple enhanced surface tubes. Scope includes testing, providing a model of the results, and a simulation calculation methodology. Report is under review by the PMS. Expect to publish in the next few months.
 - No update waiting to hear from PMS
- 1716 - Oil concentration of field-installed liquid chillers with flooded type evaporators.
 - WS was approved. This WS is ready to bid. It is on the list to release but did not go out in the spring. We hopefully will make it in the fall.
 - Delayed due to shortfall in funding.
- 1793 - Development of Method of Test for Motor Component Thermal Conductivity
 - We submitted, with co-sponsorship from TC8.1 and TC1.11, a WS for research of heat transfer of motor components for hermetic motors in refrigerant. This would develop correlations for motor manufactures to use for motor design.
 - We are going to resubmit.

Delay due to shortfall in funding.

Future Activities

- We discussed possible new ideas for research at the on-line meeting with some thoughts:
 - HVAC components and new refrigerants.
 - Low flow tube study.

These ideas will continue to be investigated. We will continue to solicit additional ideas.

Handbook Subcommittee Report (Scott MacBain, Chair):

- Chapter 38 and 43: Published in 2020 volume. Thank you.
- TC 8.1: 2022 Refrigeration: Chapter 8 - Factory Dehydrating, Charging & Testing
 - Draft I/P: MacBain, Sanchez, Perevozchikov
 - Due 4/2021 Target 2/15/21 approval request
 - Draft available on authoring portal
- TC 8.1 & 8.2: 2024 HVAC Systems & Equipment: Chapter 38 and 43 2024 (due dates below)
 - 8.1: Davide Ziviani, Michael Perevozchikov, Craig Bradshaw, 8.1&8.2: Rick Heiden, Scott MacBain, 8.2: Fred Betz, Drew Turner, Trent Hunt, Steve Duda
 - Confirm document access on authoring portal: <https://authoring.ashrae.org/>
 - Contact Chris Walter (CWalter@ashrae.org) if any issues with Microsoft login
 - Working with ASHRAE on timing for their upload of 38 & 43 to portal: Latest Est. May 2021

Handbook_Chapters					
Chapter No	Title	Files Due to HQ	Volume	TC	
8	Factory Dehydrating, Charging, and Testing	4/9/21	Refrigeration	08.01	
38	Compressors (pt 2 of 2)	5/30/23	HVAC Systems and Equipment	08.02	
43	Liquid-Chilling Systems (pt 2 of 2)	7/11/23	HVAC Systems and Equipment	08.02	

Standards Subcommittee STATUS REPORT

Standards

TC 8.2 is the cognizant TC for:

- ASHRAE Standard 30-2019 Method of Testing Liquid Chillers
[TC 8.2 is lead; TC 8.5 is co-cognizant]
- ASHRAE Standard 184-2020 Method of Test for Field Performance of Liquid-Chilling Systems
- ASHRAE Standard 225-2020 Method for Performance Testing Centrifugal Refrigerant Compressors and Condensing Units

TC 8.2 also monitors activity for the following standards of interest to members:

- ASHRAE Guideline 22-2012 Instrumentation for Monitoring Central Chilled-Water Plant Efficiency
[TC 9.1 is cognizant]
- ASHRAE Standard 90.1-2019 Energy Standard for Buildings Except Low-Rise Residential Buildings
[TC 7.6 is cognizant]
- AHRI Standard 550/590-2020 Performance Rating of Water-chilling and Heat Pump Water-heating Packages using the Vapor Compression Cycle
- AHRI Standard 1520P Performance Rating of Centrifugal Refrigerant Compressors

SSPC 30

- Standard 30-2017 was published under periodic maintenance (5 year cycle) by SPC 30
- Standard 30-2019 was published under continuous maintenance (addenda at any time, combined into new edition every 3 years)
- SPC 30 (finally) converted to SSPC 30 effective 2020-Jul-2. Current roster has 8 voting members, 1 non-voting member. Chair is Justin Prosser.
- **Addendum a** to Standard 30-2019 – published in 2020
Mainly clean-up including a requirement to test based on defined operating mode set points
- **Addendum b** to Standard 30-2019 – **available for public review Jan 1 thru Feb 15**
Mainly clean-up including clarification of Δp_{adj}
- **Addendum c** to Standard 30-2019 – public review expected in Q2 2021
Addition of free-cooling and 4-pipe chillers
- **Addendum d** to Standard 30-2019 – **available for public review Jan 1 thru Feb 15**
Review of steady-state criteria
- **Addendum d** to Standard 30-2019 – public review expected in Q2 2021
Harmonization with AHRI 550/590, Section 4
- **Please share public review drafts within your companies, review the changes, and comment**
<https://osr.ashrae.org/>

SPC 184

- Standard 184-2016 was published under periodic maintenance (5-year cycle) by SPC 184.
- Disbanded in 2019 after December 2018 publication of **Addendum a** to Standard 184-2016.
- In Orlando (January 2020) TC 8.2 voted to recommend reaffirmation of the standard. Recommendation was approved by SPLS & StdC, then ASHRAE staff merged the content of **Addendum a** into the standard and published as a new edition.
- Standard 184-2020 was published in November under periodic maintenance.
- TC 8.2 needs to decide if and when to form another committee, if there is interest to revise the standard (e.g. additional work on the uncertainty calculator spreadsheet workbook). 5-year cycle would need to

publish next edition by 2025, deadline to decide “withdraw, reaffirm, or revise” will be 2024 but can act earlier.

SPC 225

- Committee formed, meetings during 2019 Atlanta (Jan) and Kansas City (Jun).
- Used ASHRAE 23.1 as a starting point. Defines the performance variables of flow factor, head factor, and efficiency to characterize performance. Removed the need of a secondary flow meter when the primary mass flow measurement is a flow meter. Added a normative appendix on the calculation of total properties from measurements of static properties. Added an informative appendix on the calculation of compressor efficiency.
- First public review in early 2020.
- Standard 225-2020 was published under periodic maintenance in April (~July) by SPC 225.
- SPC 225 has been disbanded.
- TC 8.2 will need to decide if and when to form another committee to revise the standard. 5-year cycle would need to publish next edition by 2025, deadline to decide “withdraw, reaffirm, or revise” will be 2024 but can act earlier.

GPC 22

- Guideline 22-2012 was published with editorial updates to references as revision to 2008 edition.
- GPC 22 formed in 2016 and drafted an update, work plan was to put out for PPR1 during 2019, then re-targeted for 2020 but not yet complete. Expect PPR1 during 2021.

SSPC 90.1

- Standard 90.1-2019 published, already with published addenda. 2019 User Manual published.
- *Addendum w* for public review (PPR1) during November 20 thru December 20 (public comment period has closed). Proposes revisions to chiller sizing requirements for use in Appendix G baseline building design.
- *Addendum x* for public review (PPR1) during November 20 thru January 4 (public comment period has closed). Proposes revisions to K_{adj} used for establishing minimum efficiency requirements for centrifugal chillers at non-standard rating conditions. Four comments were received (2 substantive and 2 supportive).
- *Addendum y* for public review (PPR1) during January 29 thru March 15. Proposed change to update Table 6.8.1-16 Heat-Pump and Heat Recovery Chiller Packages—Minimum Efficiency Requirements. Clarifies heating duty compliance (addressing 2 interpretations). 17°F positive displacement heat pump performance derated to account for defrost. Adjust rating categories to align with 550/590-2020, (simultaneous heating and cooling separate from heat recovery). Adjust cooling efficiencies to correct for conversion errors – resulted in derating positive displacement water source ratings for < 75 ton Path A and all Path B.

Other

- In January 2019 (Atlanta) Rick Heiden informally proposed development of a standard for refrigerant-cooled motors, such as defining standardized frame sizes, due to lack of such standard within NEMA. (There are NEMA standards for many types of motors, but refrigerant-cooled motors typically fall into the category of ‘definite purpose motors’ and typically end up with numerous ‘custom’ frame sizes that are not standardized globally. TC 1.11 “Electric Motors and Motor Control” likely to be cognizant. TC 8.2 expressed general interest and support.
- SPC 23 activities
 - Standard 23.1-2019 published
“Methods of Testing for Performance Rating Positive Displacement Refrigerant Compressors and Condensing Units That Operate at Subcritical Temperatures of the Refrigerant”

- Standard 23.2-2019 published
“Methods of Test for Rating the Performance of Positive Displacement Compressors that Operate at Supercritical Pressures of the Refrigerants”
 - Standard 23P (proposed) will combine both above. PPR1 during April 10 to May 25, 2020.
Now PPR2 ISC during December 18 thru February 1, 2021.
“Methods for Performance Testing Positive Displacement Refrigerant Compressors and Compressor Units”
 - There remains potential for a future merger of 23P and 225P.
- AHRI Standard 550/590-2020 (I-P) and 551/591-2020 (SI)
 - 2020 editions published as AHRI standards and ANSI approval process will begin soon. These editions directly reference ASHRAE Standard 30-2019 and remove large portions of the former Appendix C in 550/590/551/591.
 - Already started working group for next editions. Scope of changes include the following items:
 - Review tolerances and incorporate units with variable flow
 - Continue to work toward harmonizing section 4 with ASHRAE 30
 - Review uncertainty analysis reporting requirements
 - Adiabatic cooled condensers
 - Heat Pump Part-Load Metrics
 - Review of rounding throughout documents
 - Review Standard Rating Conditions
 - Regional part load metrics
- AHRI Standard 1520P (proposed) Performance Rating of Centrifugal Refrigerant Compressors
 - Started to develop this new standard around May 2016
 - Met several times during 2020
 - A software tool for reference purposes is in development, to allow comparison of compressor ratings (whether per AHRI 1520P or per AHRI 540)

Respectfully Submitted,

Phillip Johnson,
TC 8.2 Standards Subcommittee