

ASHRAE TC 2.6 Sound and Vibration Control

Main Committee Meeting Minutes

2:30 PM – 4:30 PM ET Monday February 6, 2023

Winter Conference – Atlanta

NOTE: All Task Group Chairs and Subcommittee Chairs are asked to submit written report to the Secretary (Brandon Cudequest) before Friday February 10th, 2023

1. Call to order (Saenz-Acosta)

- 1.1. Read scope of TC 2.6: TC 2.6 is concerned with the fundamental scientific and engineering principles of sound and vibration, particularly as applied to the design and performance of the built environment.
- 1.2. ASHRAE Code of Ethics statement: "In this and all other ASHRAE meetings, we will act with honesty, fairness, courtesy, competence, inclusiveness and respect for others, which exemplify our core values of excellence, commitment, integrity, collaboration, volunteerism and diversity, and we shall avoid all real or perceived conflicts of interests.
(<https://www.ashrae.org/about/governance/code-of-ethics>)."
- 1.3. Additions and/or modifications to the agenda

2. Introduction of those present (Saenz-Acosta)

- 2.1. Welcome new members and visitors

3. Confirmation of current voting members

- 3.1. 10 members
8 present: **Ben Shafer, Michael Dick not present**

4. Review and approval of the minutes (Saenz-Acosta)

- Kay motioned to approve the minutes**
Robert second-ed
None opposed

5. Secretary's report (Cudequest)

- Nothing to report**

6. TC Chair's meeting report (Saenz-Acosta)

- 6.1. New online Roster changes, if you are not a member of TC 2.6 please go to our website:
<https://tpc.ashrae.org/Membership?cmtKey=5a477d0e-214d-4fd0-9e9e-edfbe24a623b>
- 6.2. New members were asked to join at the ASHRAE TC 2.6 website.

7. ASHRAE Liaison

- 7.1. Section Head – Jon Cohen
- 7.2. Research – William Hutzel – **departing June 2023**
- 7.3. Standard – Gerald Kettler
- 7.4. Staff – Steven Hammerling
- 7.5. Publications – **Caroline Calloway (Fundamentals), Joe Sanders (Applications)**

8. Chair's announcements and correspondence (Saenz-Acosta)

- 8.1. 2022-2023 Chair, Karina Saenz-Acosta
- 8.2. 2022-2023 Vice Chair, Paul Bauch
- 8.3. 2022-2023 Secretary, Brandon Cudequest
Karina to update the list with new year duties. Paul steps up to Chair, Brandon steps up to Vice Chair

9. Subcommittee reports (written reports to be provided to Secretary)

- 9.1. **Research Subcommittee (Meeuwsen) – Greg showed his report on the screen during the meeting. Report can be found towards the end of this document.**
 - 9.1.1. Research Chair's meeting report
 - 9.1.2. Work Statements/RTAR's/URP's
 - 9.1.2.1. RP 1707 – Annoyance Thresholds of Tones in Noise as Related to Building Services Equipment

There was an issue with certain audio files and LF components in the tones software. That has been resolved.

- 9.1.2.2. RP 1852 - Develop performance metric, criteria, and process to measure and predict of speech privacy in High Performance Buildings
- 9.1.2.3. RTAR 1919 - The Effects of Duct Size and Aspect Ratio on Flow Noise in Elbows
- 9.1.2.4. PTAR 001 – Update of ASHRAE Publication: Application of Manufacturers' Sound Data
- 9.1.2.5. RTAR 1882 - Procedure for Estimating Occupied Space Sound Levels in the Application of UFAD Air Terminals and Air Outlets
- 9.1.3. Topics for future research
- 9.2. **Programs Subcommittee** (Swan)
 - 9.2.1. Program Chair's meeting report
 - 9.2.2. Programs at Tampa 2023
Mentioned that our two programs were not accepted for the Atlanta meeting, but Lily's talk was related to IAQ and acoustics.
- 9.3. **Publications Subcommittee** (Wise)
 - 9.3.1. Handbook chapters
 - 9.3.2. Other publications
- 9.4. **Web page** (Saenz-Acosta)
Removed tones calculator per the discussion.
- 9.5. **Standards Subcommittee** (Bridger)
 - 9.5.1. ASHRAE
 - 9.5.1.1. PMP
About the measurement procedure
Group of 6-8 working through that
IAQ, thermal comfort, etc.
 - 9.5.1.2. Standard 189.1
Read Standard 189.1, you don't need to purchase it.
 - 9.5.2. Updates from Other Standards Organizations
 - 9.5.2.1. AHRI (Marks)
Sound and Vibration Sub-committee
Waterside (Karl Marks), Airside (Paul Bauch), and Measurements and Analysis (Kim Osbourn)
Went over affirmation and reviews of AHRI Standards
 - 9.5.2.2. AMCA (Brooks)
Brooks is tied up in the TC 5.1. Meeting.
 - 9.5.2.3. ANSI (Reuter)
No one present, but Viken stepped in to talk about a related standard for Healthcare spaces
Steve Lind and small group is looking at Background noise in 12.60
 - 9.5.2.4. ASTM E33 (Lilly/Shafer)
E477 regarding duct liner
1574 Residential Spaces from specific sources
 - 9.5.2.5. ISO (Golden)
Matt is no longer in charge of international standards
ISO is disbanding the committee on sound absorption measurements because no one can agree on method.
 - 9.5.2.6. WELL/LEED/ICC
Viken gave an update on LEED. LEED is undergoing significant rewrite over the next 9 months.
- 9.6. **Standing Subcommittees** [10 minutes]
 - 9.6.1. Vibration Isolation (Miller-Klein)
- 9.7. **Operations Subcommittee** (Saenz-Acosta) [15 minutes]
 - 9.7.1. Honors and awards

- 9.7.2. Long range planning
- 9.7.3. Membership
 - 9.7.3.1. Rolling off: Dan LaForgia, Benjamin Shafer, Karina Saenz Acosta
 - 9.7.3.2. Rolling on:
- 9.7.4. Liaisons (Saenz-Acosta)
 - 9.7.4.1. ASHRAE TC 2.1 Physiology and Human Environment (Eichelberger)
 - 9.7.4.2. ASHRAE TC 2.7 Seismic, Wind and Flood Resistant Design (Waters)
 - 9.7.4.3. ASHRAE TC 5.1 Fan Design and Application (Osborn)
 - 9.7.4.4. ASHRAE TC 5.2 Duct Design (Hassler)
 - 9.7.4.5. ASHRAE TC 5.3 Room Air Distribution (Zimmerman)
No place on the programs for the last five years
Efforts related to Nick Searle's RTAR
 - 9.7.4.6. ASHRAE TC 9.6 Healthcare (Koukounian)
Nothing to report for TC9.6, but they are interested in the speech privacy work we are getting up to.
 - 9.7.4.7. ASHRAE TC 9.7 Educational Facilities
Nothing to report.
 - 9.7.4.8. ASHRAE TC 9.8 Indoor Agriculture
Nothing to report
 - 9.7.4.9. ASA (Reuter)
Joint meeting at the ASA New Orleans May 2025.
One day with four sessions that are joint. One chair from each group
 - 9.7.4.10. VISCMA (Waters)
 - 9.7.4.11. Others: INCE/InterNoise (Golden), NCAC (Bridger), EGSA (Simmons), etc...

10. New business/Old business [5 minutes]

11. Next meeting date and location – Tampa, FL June 24 – June 28, 2023

12. Adjournment

Meeting adjourned at 4:06pm

Research project status:

RP-1707 - Annoyance Thresholds of Tones in Noise as Related to Building Services Equipment

- Another bug was found in the software, fixed about 3 weeks ago. Not updated on web site yet.
- Jerry Lilly suggests that distribution should be limited to TC 2.6 for now, and this can be done by moving it from the web site to Basecamp

RP-1852 - Develop performance metric, criteria, and process to measure and predict speech privacy in High Performance Buildings

- Contract awarded to Soft dB Acoustical Consulting, Roderick Mackenzie principal investigator. PMS chair is Erik Miller-Klein.
- Work is well along.
- Roderick provided a brief summary of progress.

RTAR-1919 - The Effects of Duct Size and Aspect Ratio on Flow Noise in Elbows

- The project was released for bid last fall. Bids have been received.
- Brandon Cudequest is lead author of WS and chair of PES.
- PES met in closed session yesterday afternoon to evaluate bids. After discussion with RAC and Mike Vaughn, they recommend that we revise the WS and rebid. RAC will respond quickly.

PTAR-001 - Update of ASHRAE Publication: Application of Manufacturers' Sound Data

- PTAR approved by RAC, work statement under development
- Steve Wise lead author. Hope to complete in time to vote at June meeting.

RTAR-1882 - Procedure for Estimating Occupied Space Sound Levels in the Application of UFAD Air Terminals and Air Outlets

- The RTAR was approved by RAC and the work statement is under development.
- TC 2.6 will be lead, TC 5.3 will be co-sponsor. Nick Searle from Titus is lead author of the RTAR, help from Burroughs and Meeuwssen.
- Nick presented the objectives and technical approach of the WS as currently drafted. There was much lively discussion, and we may revisit key components. Hope to have something approved by the June meeting.

Highlights from Research Chairs Breakfast Meeting

- Funding is back up to historical levels, \$5.5 million for 2022-23 society year. Grants-in-Aid and New Investigator awards are also started again.
- 42 active projects total \$6.2M. Total spent since 1959 is \$80M.
- Your donations to Research promotion provides a lot of the funding.
- Several projects recently released for bid received no bids. RAC is trying to understand the trend, possibly estimated costs are too low.
- The maximum budget that RAC can approve on it's own may be increasing from the current \$250K
- Remember that all RPs are free to members, download from the ASHRAE website.

ASHRAE TC 2.6 Sound and Vibration

PROGRAMS SUBCOMMITTEE MINUTES – 2023 Winter Meeting, Atlanta, Georgia – Sunday 5 February 2023

1. Overviewed types of programs
2. This meeting: no specific TC 2.6 programs this time, though there have been a few somewhat related sessions presented by others
3. Survey Monkey poll on future programs out for response (<https://www.surveymonkey.co.uk/r/79FLLPR>) Please forward this to others interested. Jason to forward to other TCs.
4. Next meeting Tampa (June 2023): Duct break out conference papers set. Agreed to resubmit highrise resi seminar with 3rd speaker. Paul assembling speakers for a prediction vs lab vs field seminar. Jason to run seminar proposals by the Track chairs.
5. Chicago (January 2024): Will resubmit Tunnel Ventilation with 3rd speaker discussing planning/regulatory, or with a local Chicago speaker

TYPES OF PROGRAM SESSIONS (with links)

Technical Paper

More rigorous, detailing research/theory
Maximum of 30 double-spaced text pages, not including references and up to 12 figures
Author submits directly, no abstract required, at least 9 months prior to the meeting
3 reviewers: double-blind, commercialism
Present: poster, or oral if grouped with related
Published in Transactions and recorded

Authors' Manual

Conference Paper/Extended Abstract

Less rigorous, can be on case studies
Maximum of 8 pages (3 pages for EAs), includes text, tables, figures, not references
Submitted directly by author, or by TC abstract 10 months prior to meeting paper 6 months prior
2 reviewers: single blind, commercialism
Present: oral, which is recorded

Conference paper template

ASHRAE asks for reviewers periodically

Seminar/Workshop/Forum

Session chairs and speakers selected by TCs
Program submitted by session chair/speakers
Include bios, abstracts, learning objectives, example questions/answers
Speakers submit final presentations 1 month prior to meeting for commercialism review

Seminar

60 minutes: 1 – 3 presentations
90 minutes: 3 – 4 presentations

Workshop

One chair and two presenters (maximum)
30 minutes for presentations
30 minutes for discussion

Debates

Experts (team/individual) present 2 sides
Hot button issues

Forum/Panel

One moderator
60-minute length
No presentations
Not recorded, 'off the record'

Hot Topic

Internal subcommittee presentation
Can be invited from outside TC 2.6
Listed in the ASHRAE schedule
Available to both TC 2.6 and larger organization
Speakers can be video-conferenced (ie, no registration fee)

****ASHRAE encourages use of their approved PowerPoint template for presentations; available on their website****

THIS MEETING:
Atlanta, 4-8 February 2023

Tracks:

- 1: Fundamentals and Applications
- 2: HVAC&R Systems and Equipment
- 3: Refrigeration & Refrigerants
- 4: Grid Resilience & Thermal Storage
- 5: Zero Energy Emissions & Decarbonization
- 6: Multifamily and Residential Buildings
- 7: Operations & Maintenance
- 8: Construction: Building Simulation/Virtual Design
- 9: Supply Chain challenges: Innovative responses

Seminars/Paper Sessions:

Seminar 36: *Interaction of IEQ Variables in Schools: Health & Performance Impacts* (Track 7)
Monday 6 February 2023, 11:00-12:00, GWCC A410

1. Correlations from a Cumulative Model: Acoustics, Lighting, IEQ, Thermal Comfort and Student Achievement
Lily Wang, U of Nebraska
2. Correlations between Measured IAQ, Thermal Comfort and Student Achievement
Josephine Lau, U of Nebraska

Seminar 13: Presentation 2: Ventilation, IEQ and Sleep Quality in Bedrooms, C Sekhar, Nat'l U of Singapore
Sunday 5 Feb 2023, 11:20-11:40, GWCC A407

Seminar 63: Presentation 3: Similarities and Differences in Air-Cooled and Water-Cooled Sound Levels, B Wallace, BRD
Wednesday 8 Feb '23, 11:40-12:00, GWCC A405

Hot Topics:

WELL certification acoustics (Miller-Klein/Bourdeau)

NEXT MEETING:
Tampa, 24-28 June 2023

Tracks:

- 1: HVAC&R Systems and Equipment
- 2: Fundamentals and Applications
- 3: Research Summit
- 4: Pathways to Net Zero Energy/Decarbonization
- 5: Future-Proofing the Built Environment
- 6: Building Automation/Control Systems (BACS)
- 7: Professional Development/Education

Seminars/Workshops/Forums:

Proposals due: 27 February 2023 (↑↓ 14 Apr 23)

Track 4/5: *Acoustic impact of designing for high performance/ decarbonization* (resubmit) Marks
Eichelberger: How ASHPs work, make noise
Miller-Klein: ASHP issues, multifamily residential
[Mech Eng]: new resi heat pumps, super quiet?

Track X: Prediction v Lab v Field (Bauch) Wowk/
Marks, Miller-Klein): Polled 6th, 12 votes (or 1st,
18 votes), attenuators [polled 2nd], validation,
acoustic cameras, ways to improve

Conference Papers/Extended Abstracts:

29 Mar 23: Conference Papers/Extended Abstracts
due (↑↓ 26 Apr 23)
10 May: Revised Conference Papers due (↑↓ 24
May)

Duct Noise Breakout (Lilly/Herrin x2)
Tied for 2nd, 15 votes

Hot topics:

[To be discussed at monthly meetings]

FOLLOWING MEETINGS:
Chicago, 20-24 January 2024

Tracks:

- 1: Fundamentals and Applications
- 2: HVAC&R Systems and Equipment
- 3: Refrigeration & Refrigerants
- 4: Decarbonization and Climate Change
- 5: Hydronic Systems
- 6: Ventilation, IAQ and Air Distribution Systems
- 7: Comfort, IEQ and Energy Efficiency
- 8: HVAC&R Controls
- 9: Project Delivery Methods

Seminars/Workshops/Forums:

Proposals due: 2 August 23 (↑↓ XX Sep 23)

Track X: Tunnel/ Underground ventilation
(LaForgia) w/5.1 (resubmit), add third speaker

Track X: Rooftop Systems (Peterman)

Equipment:
Standards/Testing:
Consultant/Lessons:

Track X: Workshop: Upcoming changes to the
Vibration Table (Meeuwssen, Miller-Klein, Wise,
Golden, Wowk) Why changing. The theoretical,
the practical, the metrics

Track X: Pitfalls/Measuring success – Acoustics
issues to get you sued? Why consultants?
Attorney? (Boldt: Lilly)

Conference Papers:

28 Jun 2023: Abstracts due (↑↓ 19 Jul 2023)
16 Oct 2023: Papers due (↑↓ 8 Nov 2023)

**ASA/ASHRAE joint session, New Orleans, May
2025** (Kay Hatlestad)

Future:

Indianapolis 22-26 Jun 24 / **Orlando** 8-12 Feb 25
Phoenix 21-25 Jun 25 / **LasVegas** 31 Jan-4 Feb 26

What sound and vibration related programs would you like to see presented at ASHRAE conferences?

ASHRAE's Technical Committee 2.6: *Sound & Vibration* prepares programs for presentation at ASHRAE conferences. We are asking the broader acoustics and HVAC communities, particularly those who attend ASHRAE conferences, for what acoustics related topics they would most like to see presented at future conferences.

We have compiled a long list of potential topics from suggestions within our committee, and ask you in the survey linked below to select up to 6 of the topics you are most interested in. There is also a chance to suggest other topics to us.

The link for the survey is here: <https://www.surveymonkey.co.uk/r/79FLLPR>
There are only two questions, so it should not take much time at all.

The topics are grouped into categories: Equipment, Basics and General:

- Our **Equipment Series** seminars have three speakers cover 1) What the item of machinery is, how it works and how it makes noise, usually presented by a manufacturer; 2) What standards and specifications apply to the item, how its lab data are presented, and typical noise/vibration mitigation methods; and 3) Case studies showing field issues, testing challenges and general pitfalls.
- Our **Basics Series** of seminars are designed to present several aspects of an acoustics concept.
- And then there are other **general topics** that are good to cover from time to time.

If your company does not allow Survey Monkey for security reasons, and you are not able to take the survey in another way, please email Jason Swan and jason.swan@sandybrown.com for a manual questionnaire.

If you know of others who attend ASHRAE conferences and are interested in noise and vibration control, could you please forward this email and link to them?

Many thanks for this. It will help us better serve the needs of ASHRAE members.

Regards,
Karina

+++++

It also asks for suggestions on other topics

Please forward to those you think may be interested:
within ASHRAE (eg, other TCs)
within your company,
within the wider industry (eg, sales reps, students/universities)

TOPICS FOR FUTURE PROGRAMS

Series: Equipment Noise

- 17 Fan Selection for Acoustics (Schaffer)
- 15 Duct Breakout Noise (Lilly/Peterman)
- 15 Silencers: Performance v Design (Papadimos)
- 14 Rooftop systems (Peterman)
- 9 Fan Boxes: above/below floor (Zimmerman)
- 6 Air Distribution Systems (Zimmerman)
- 3 Compressors: Frequency Characteristics ()
- 3 Ductless Systems: PTACs, WSHP (Weinstein)
- 2 Electrical: Xfmrs, Elec Motors (Papadimos)
- 2 Plumbing noise (Wowk) TC 6.1/6.6?
- 2 Small Fan Coils (_____)
- 2 Under-floor Air Systems (Reynolds)
- 1 Boilers (Marks)
- 1 DOAS units (Peterman)
- 1 Generators (LaForgia)
- 0 Fume hoods
- 0 Industrial Ventilation (_____) dust collection, garages, LNG
- 0 Pumps (_____)
- 0 Refrigeration: Commercial/Transport (Marks)
- 0 Tankless water heaters

Format:

1. What it is, types, how works, why noisy
2. Standards, specification, lab data, mitigation methods
3. Field issues, case studies, testing

Series: Basics of HVAC Noise

- 14 Tones and Fluctuations (Lilly)
- 12 Prediction vs Lab vs Field (Papadimos/Marks)
- 7 Speech Privacy in Low Noise Offices (_____)
- 6 Predicted vs Actual Noise (Papadimos)
- 5 Noise Flanking Paths (Peppin)
- 4 How Noise Affects Design Process (Lilkendy)
- 3 Room Msmt: Test Method (Rockwood)
- 2 Commissioning (_____)
- 2 Effects of 'over-design' (Lilly)
- 2 Noise and Productivity (Wang)
- 2 Noise Calculations How To (CD?) (Peterman)
- 0 Applications Chapter Review (_____)

Workshop

Vibration Handbook Table: Debate on where to take in future? Get feedback

Hot Topics

How to apply the results of RP-1707 on Tones? Indoors/Outdoors? To products?

New Topics to add to the poll?

VRF/electrical systems, movement to lower carbon equipment
Water Source Heat Pumps
Tones: Incorporating into criteria

Other Topics:

- 9 Classrooms: ICC adopts S12.60 (Bridger)
- 9 Noise Fluctuations (Lilly)
- 8 Performance Rated Buildings (Roy)
- 5 Passive vs Active (Wise)
- 4 Design of Healthcare Facilities (Miller-Klein) Alarm fatigue, FGI Guidelines, Privacy Team up with healthcare TCs?
- 3 Standard Test: Seismic Devices (w/2.7)
- 3 Industrial noise (Keith)
- 3 Noisy kit near to occupied?
- 3 Shell & Core vs Tenant Fit-Out/Improvement
- 2 Tunnel Ventilation (LaForgia)
- 1 Labs internal: Air Valves/Fume Hoods (Wowk)
- 1 Labs external: Stacks, ventilation, nozzles
- 0 Mission Critical Facilities (_____)

Past Items:

- 4 Plenum array fans
- 1 *Hearing protection: TWA, Hospitals, Escape / S/N / STI, WHO*
- 0 Refrigerated processes/Storage (Swan offered Keith's talk to TC10.5)

[Contact other TCs that may want to team up]

RESULTS of DOODLE POLL (Spring 2021, redo in Spring 2022?)

34 participants, 208 votes

17 votes

Equipment: Fan Selection for Acoustics (Schaffer)

15 votes

Equipment: Duct Breakout Noise (Lilly/Peterman)

Equipment: Silencers: Performance v Design (Papadimos)

14 votes

Equipment: Rooftop systems (Peterman)

Basics: Tones and Fluctuations (Lilly)

12 votes (technically 18 votes)

Basics: Prediction vs Lab vs Field (Papadimos/Marks/Miller-Klein) **

9 votes

Equipment: Fan Boxes: above/below floor, VAV, CAV, VFD (Zimmerman)

General: Classrooms: ICC adopts S12.60 (Bridger)

General: Noise Fluctuations (Lilly)

8 votes

General: Performance Rated Buildings (Roy)

7 votes

Basics: Speech Privacy in Low Noise Offices ()

6 votes

Equipment: Air Distribution Systems (Zimmerman)

Basics: Predicted vs Actual Noise (Papadimos) **

5 votes

General: Passive vs Active (Wise)

Basics: Noise Flanking Paths (Peppin)

4 votes

Equipment: Plenum array fans

General: Healthcare Facilities: Design, Alarm fatigue, FGI Guidelines, Privacy (Miller-Klein)

Basics: How Noise Affects Design Process (Lilkendy)

3 votes

Equipment: Compressors: Frequency Characteristics ()

Equipment: Ductless Systems: PTACs, WSHP (Weinstein)

General: Industrial noise (Keith)

General: Noisy equipment near to occupied

General: Seismic Devices: Standard Test (w/2.7)

General: Shell & Core vs Tenant Fitout/Improvement

Basics: Room Measurement: Test Method (Rockwood)

2 votes

Equipment: Electrical: Transformers, Elec Motors (Papadimos)

Equipment: Plumbing noise (Wowk) TC 6.1/6.6?

Equipment: Small Fan Coils ()

Equipment: Under-floor Air Systems (Reynolds)

General: Tunnel Ventilation (Laforgia)

Basics: Commissioning ()

Basics: Effects of 'over-design' (Lilly)

Basics: Noise and Productivity (Wang)

Basics: Noise Calcs/How To (CD) (Peterman)

1 vote

Equipment: Boilers (Marks)

Equipment: DOAS units (Peterman)

Equipment: Generators (LaForgia)

General: Labs internal: Air Valves/Fume Hoods (Wouk)

General: Labs external: Stacks, ventilation, nozzles

General: Hearing protection: TWA, Hospitals, Escape / S/N / STI, WHO

0 votes

Equipment: Fume hoods

Equipment: Industrial Ventilation (), dust collection, garages, LNG

Equipment: Pumps ()

Equipment: Refrigeration: Commercial/Transport (Marks)

Equipment: Tankless water heaters

General: Mission Critical Facilities ()

General: Refrigerated processes/Storage (Swan offered Keith's talk to TC10.5)

Basics: Applications Chapter Review ()

PAST PROGRAMS (Available online [\[link\]](#). Cost? Also at the TC 2.6 website.)

2022 Las Vegas/Toronto

Select/Size HVAC Fans for Optimum Acoustical Performance (Lilly/Bausch/Ganesh)

2021 “Chicago”/”Phoenix”

Elevator Noise, Vibration, Energy Efficiency (Boldt/Miller-Klein)

Noise/Vibration Commissioning/Remediation (Bauch/Miller-Klein)

Sound/Vibration Issues w/Mission Critical Facilities (Bauch/LaForgia/Miller-Klein)

2020 Orlando/”Austin”

Vibration Isolation Advances

(Golden/Scarlett/Meeuwsen)

Beware These Common Concerns in Multi-Family Buildings (Miller-Klein, Dong/Rawlins/Golden)

When Is “Quiet” Quiet Enough (Marks/Kollevoll)

HT: ANSI S12:60 / FGI vs 189.1 (Miller-Klein)

HT: Speech Privacy (Koukounian)

HT: Pandemic effects on acoustics

2019 Atlanta/Kansas City

RP-1408 Ductwork research (Herrin/Schwob)

VRF Systems (Lilly/Miller-Klein/Wowk)

Noise/Vib Equipment Selection

(Boldt/Eichelberger/Wowk)

HT: IBC updates (Schmeida)

HT: Basecamp (Miller-Klein)

Commissioning (Miller-Klein/Swan)

Chilled Beams (Searle/Peterman/M-K)

Blocked Impedance (Meeuwsen)

2018 Chicago/Houston

Impacts of Safeguarding Buildings/HVAC Systems (Miller-Klein)

HT: User Manual 189.1 Acoustic Ctrl, Next Steps

HT: LNG Facilities (Keith)

2017 Las Vegas/Long Beach

Acoustic Performance Standards for Residential Buildings (Miller-Klein)

HT: Mech Equipment Vibration & Structural Interaction (Wowk)

2016 Orlando/St Louis

TP: Simulating Noise Attenuation in Ducts (Kuehn)

Acoustics in Multi-Family Residential Environments (Papadimos)

Avoiding Pitfalls Integrating Seismic and Sound Control (w/2.07)

HT: Algorithms for HVAC Acoustics

2015 Chicago/Atlanta

System Effects from Inlet of Centrifugal/Plenum Fans (w/5.1,5.9)

Acoustic Mitigation for Lightweight Roof Assemblies (Miller-Klein)

Green Building Acoustics (Miller-Klein)

HT: Condensing Units on Lightweight Roof (Lilly)

HT: Sound measurement in rooms (Lilly)

2014 New York/Seattle

Equipment: Hydronic Systems (Miller-Klein)

Basics: Environmental Noise Impact & Mitigation (Wang)

2013 Dallas/Denver

Basics of HVAC Noise Control (Miller-Klein)

Numerical Methods for Noise/Vibration Simulation (Eichelberger)

HT: ASHRAE 189.1

2012 Chicago/San Antonio

Vibration Induced Noise & Mech Equipment Isolation (Marks)

HT: BIM and Acoustics

Impacts of Poor Aerodynamic HVAC Conditions (Schaffer)

New Acoustical Criteria and Measuring Methods (Peterman)

Review of Updated AHRI Standards (Papadimos)

2011 Las Vegas/Montreal

Recent Research: Healthcare Facility Acoustics (Papadimos)

Acoustic Codes/Standards/Guidelines (Muehleisen)

HT: Classroom Physical Environment Effects on Learning (Reynolds)

Fan Array Efficiency/Performance (Raychaudhuri)

Forum: Incorporating Acoustics into BIM (Peterman/Mitchell)

2010 Orlando/Albuquerque

Acoustics in High Performance Building (Peterman)

Noise & Mech System Design Process (Lilkendey)

Multiple Plenum Fans in an Array (Ganesh)

HT: Criteria (Paige) / Lined Duct End Reflection (Lilly)

HT: Int'l GBC (Marks) / Terminal Unit Tests/ASHRAE 130 (Peterman)

Classroom HVAC Noise Control (Lilkendey)

Unique Case Studies (Papadimos)

TP: Effects of Mech System Noise on Human Perf./Perception (Roy)

Sustainability and Our Environment (Ronsse)

2009 Chicago/Louisville

Staff Performance/Patient Welfare in Healthcare Facilities (Wang)

2008 New York/Salt Lake City

TP: End Reflection (RP-1314) (Eichelberger)

TP: Fan System Effects (RP-1219) (Eichelberger)

2007 Dallas/Long Beach

Acoustics for Green Buildings (Roy)

Acoustic vs Seismic (Lama/Marks/Blazier)

Lab Noise Control (Johnson/Moiseev)

ASHRAE TECHNICAL COMMITTEES

1.0-FUNDAMENTALS AND GENERAL

- 1.1 Thermodynamics and Psychrometrics
- 1.2 Instruments and Measurements
- 1.3 Heat Transfer and Fluid Flow
- 1.4 Control Theory and Application
- 1.5 Computer Applications
- 1.6 Terminology
- 1.7 Business, Management & General Legal Education
- 1.8 Mechanical Systems Insulation
- 1.9 Electrical Systems
- 1.10 Electric Motors and Motor Control
- 1.11 Moisture Management in Buildings
- 1.13 Optimization

2.0-ENVIRONMENTAL QUALITY

- 2.1 Physiology and Human Environment
- 2.2 Plant and Animal Environment
- 2.3 Gaseous Air Contaminants and Gas Contaminant Removal Equipment
- 2.4 Particulate Air Contaminants and Particulate Contaminant Removal Equipment
- 2.5 Global Climate Change
- 2.6 Sound and Vibration
- 2.7 Seismic, Wind and Flood Resistant Design
- 2.8 Building Environmental Impacts and Sustainability
- 2.9 Ultraviolet Air and Surface Treatment
- 2.10 Resilience and Security
- TG2 HVAC Security

3.0-MATERIALS AND PROCESSES

- 3.1 Refrigerants and Secondary Coolants
- 3.2 Refrigerant System Chemistry
- 3.3 Refrigerant Contaminant Control
- 3.4 Lubrication
- 3.6 Water Treatment
- 3.8 Refrigerant Containment

4.0-LOAD CALCULATION, ENERGY REQUIREMENTS

- 4.1 Load Calculation Data and Procedures
- 4.2 Climatic Information
- 4.3 Ventilation Requirements and Infiltration

- 4.4 Building Materials and Building Envelope Performance
- 4.5 Fenestration
- 4.7 Energy Calculations
- 4.10 Indoor Environmental Modeling
- TRG4 Indoor Air Quality Procedure Development

5.0-VENTILATION AND AIR DISTRIBUTION

- 5.1 Fans
- 5.2 Duct Design
- 5.3 Room Air Distribution
- 5.4 Industrial Process Air Cleaning (Air Pollution Ctrl)
- 5.5 Air-to-Air Energy Recovery
- 5.6 Control of Fire and Smoke
- 5.7 Evaporative Cooling
- 5.9 Enclosed Vehicular Facilities
- 5.10 Kitchen Ventilation
- 5.11 Humidifying Equipment

6.0-HEATING EQUIPMENT, HEATING AND COOLING SYSTEMS AND APPLICATIONS

- 6.1 Hydronic and Steam Equipment and Systems
- 6.2 District Energy
- 6.3 Central Forced Air Heating and Cooling Systems
- 6.5 Radiant Heating and Cooling
- 6.6 Service Water Heating Systems
- 6.7 Solar and Other Renewable Energies
- 6.8 Geothermal Heat Pump and Energy Recovery Applications
- 6.9 Thermal Storage
- 6.10 Fuels and Combustion

7.0-BUILDING PERFORMANCE

- 7.1 Integrated Building Design
- 7.2 HVAC&R Construction & Design Build Technologies
- 7.3 Operation and Maintenance Management
- 7.4 Exergy Analysis for Sustainable Buildings (EXER)
- 7.5 Smart Building Systems
- 7.6 Building Energy Performance
- 7.7 Testing and Balancing
- 7.8 Owning and Operating Costs
- 7.9 Building Commissioning

8.0-AIR-CONDITIONING AND REFRIGERATION SYSTEM COMPONENTS

- 8.1 Positive Displacement Compressors
- 8.2 Centrifugal Machines
- 8.3 Absorption and Heat Operated Machines
- 8.4 Air-to-Refrigerant Heat Transfer Equipment
- 8.5 Liquid-to-Refrigerant Heat Exchangers
- 8.6 Cooling Towers and Evaporative Condensers
- 8.7 Variable Refrigerant Flow (VRF)
- 8.8 Refrigerant System Controls and Accessories
- 8.9 Residential Refrigerators and Food Freezers
- 8.10 Mechanical Dehumidification Equipment and Heat Pipes
- 8.11 Unitary and Room Air Conditioners & Heat Pumps
- 8.12 Desiccant Dehumidification Equipment and Components

9.0-BUILDING APPLICATIONS

- 9.1 Large Building Air-Conditioning Systems
- 9.2 Industrial Air Conditioning and Ventilation
- 9.3 Transportation Air Conditioning
- 9.4 Justice Facilities
- 9.6 Healthcare Facilities
- 9.7 Educational Facilities
- 9.8 Large Building Air-Conditioning Applications
- 9.9 Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment
- 9.10 Laboratory Systems
- 9.11 Clean Spaces
- 9.12 Tall Buildings

10.0-REFRIGERATION SYSTEMS

- 10.1 Custom Engineered Refrigeration Systems
- 10.2 Automatic Icemaking Plants and Skating Rinks
- 10.3 Refrigerant Piping, Controls and Accessories
- 10.5 Refrigerated Processing and Storage
- 10.6 Transport Refrigeration
- 10.7 Commercial Food and Beverage Refrigeration Equipment
- 10.8 Refrigeration Load Calculations

Email Programs' chair: TCXXx.PRO@ashrae.net

TC 2.6 Publications Subcommittee Minutes – Atlanta Hybrid, February 2023

Activities and Timeframe:

		2021		2022			2023			2024		
		Phoenix	4Q	LasVegas	2Q	Toronto	4Q	Atlanta	2Q	Tampa	4Q	Chicago
Ch 49 - Applications		Waiting for Galley Proofs										
	General Discussions											
	Edit markups											
	Submittal											
	Galley Proofs											
Ch 9 - Fundamentals		Led by Sturm with Cudequest/Miller-Klein/Steward/Wortman										
	General Discussions											
	Edit markups											
	Submittal											
New Vibration Isolation Table Concept		Monthly Meetings led by Miller-Klein										
	Format Draft											
	Needed Research RTARs											
Joint Booklet PRACTICAL GUIDE		Task Group Monthly Meetings										
	phase 1 - format											
	phase 2 -chapter outlines											
	phase 3 - 75%+ drafts											
	- Ch 1 Fundamentals Wise											
	- Ch 2 Specifications Cudequest											
	- Ch 3 Overview Wise etal											
	- Ch 4 Airside Bauch etal											
	- Ch 5 Waterside Marks/Arun/Wortman											
	- Ch 6 Packaged Units Meeuwsen etal											
	- Ch 7 Auxiliary Boldt etal											
	- Ch 8 Silencers/Mounts Peterman etal											
	- Ch 9 Commissioning Lilly etal											
	- Ch 10 Lab Tests Lilly etal											
	phase 4 - Work Statement / Contract Editor											
	phase 5 - final edits											--->>>

Vibration Isolation

We reviewed the Survey method (screenshot attached), Erik talked a little about the engineering method. The group is continuing to fill out the table and determine strategies for those equipment types.

Someone brought up the trouble of footnotes and that footnotes are never read.

Discussion in the room regarding isolation base requirements differing from manufacturer and seismic requirements. Commentor is far from the mic, so only catching partial words.

		Sizing/Loading + Support Conditions				Notes & Assumptions		Vibrat	
Type	RPM	Method 1: Natural Frequency* (Dynamic Stiffness)		Method 2: Static Deflection* (Static Stiffness)				Isolator Type	
		Natural Freq (fn)	Elevated Slab	Isolator Type	Static Deflection				
Chillers / Heat Pump		Slab on Grade		Elevated Slab		Slab on Grade		Elevated Slab	
Centrifugal: Air-Cooled	All	< 12 Hz	< 3 Hz		0.10"		2.0"		PR or MR
Centrifugal: Water-Cooled	All	< 12 Hz	< 3 Hz		0.10"		2.0"		PR or MR
Scroll: Air-Cooled	All	< 12 Hz	< 3 Hz		0.10"		2.0"		PR or MR
Scroll: Water-Cooled	All	< 12 Hz	< 3 Hz		0.10"		2.0"		PR or MR
Screw: Air-Cooled	All	< 12 Hz	< 3 Hz		0.10"		2.0"		PR or MR
Screw: Water-Cooled	All	< 12 Hz	< 3 Hz		0.10"		2.0"		PR or MR
Absorption	All	< 12 Hz	< 3 Hz		0.10"		2.0"		PR or MR
Magnetic Bearing Centrifugal	All	< 12 Hz	< 3 Hz		0.10"		2.0"		PR or MR
Air Handlers		SOG	ELEV	see notes				Attenuation starts above 50 Hz. Select for natural frequency 1/3 of typical fan RPM	
Fan array	> 2,000 RPM	None	< 12 Hz				0.10"	Internal vibration isolation shall be coordinated with the manufacturer and could supersede the noted external vibration isolation	
Conventional	< 2,000 RPM	< 3 Hz	2 to 3 Hz		2.0"		2.0"	Internal vibration isolation shall be coordinated with the manufacturer and could supersede the noted external vibration isolation	
Packaged (AHU + Compressors)		<12Hz	<3Hz	RP or RM	1"	RP+FS	2"		
Computer Room Units		<12Hz	<3Hz	RP	0.1"	RP	1"		
Pumps								Consult an expert if vibration reduction required	
Frame mounted		2 to 3 Hz					2.0"	Consult an expert if vibration reduction required	
		2 to 3 Hz					2.0"	Concrete base recommended to add stiffness and allow for good motor/pump alignment	
		2 to 3 Hz					2.0"	Concrete base recommended to add stiffness and allow for good motor/pump alignment	
In-line									

RTAR for Booklet

Discussed Practical Guide, unlikely that the group can get a WS together by March 15. Have decided that we need a single editor/writer of the book with assistance from the group.

Large discussion centered around artwork for the book. Collecting 200+ images is a full-time job. Perhaps the volunteer group can generate images where we need them most. The manufacturers are likely to have the best images.

There was mention of collaborating with AHRI on the images. Steve W to explore.

Vibration Isolation Subcommittee

Sample of Draft Chapter 49 Vibration Isolation Table for Survey Method

Sizing/Loading + Support Conditions		Method 1: Natural Frequency* (Dynamic Stiffness)		Method 2: Static Deflection* (Static Stiffness)		Notes & Assumptions	
Type	RPM	Slab on Grade		Elevated Slab		Isolator Type	Static Deflection
		Natural Freq (fn)	Natural Freq (fn)	Isolator Type	Static Deflection		
Chillers / Heat Pump							
Centrifugal: Air-Cooled	All	< 12 Hz	< 3 Hz			0.10"	2.0"
Centrifugal: Water-Cooled	All	< 12 Hz	< 3 Hz			0.10"	2.0"
Scroll: Air-Cooled	All	< 12 Hz	< 3 Hz			0.10"	2.0"
Scroll: Water-Cooled	All	< 12 Hz	< 3 Hz			0.10"	2.0"
Screw: Air-Cooled	All	< 12 Hz	< 3 Hz			0.10"	2.0"
Screw: Water-Cooled	All	< 12 Hz	< 3 Hz			0.10"	2.0"
Absorption	All	< 12 Hz	< 3 Hz			0.10"	2.0"
Magnetic Bearing Centrifugal	All	< 12 Hz	< 3 Hz			0.10"	2.0"
Air Handlers							
Fan array	> 2,000 RPM	None	see notes			No	Attenuation starts above 50 Hz. Select for natural frequency 1/3 of typical fan RPM
	< 2,000 RPM		< 12 Hz			0.10"	Internal vibration isolation shall be coordinated with the manufacturer and could supersede the noted external vibration isolation
Conventional		< 3 Hz	2 to 3 Hz			2.0"	Internal vibration isolation shall be coordinated with the manufacturer and could supersede the noted external vibration isolation
Packaged (AHU + Compressors)		<12Hz	<3Hz	BP or RM		1"	RP+FS
Computer Room Units		<12Hz	<3Hz	BP		0.1"	RP
Pumps							
Frame mounted							2.0"
		2 to 3 Hz					2.0"
		2 to 3 Hz					2.0"
		2 to 3 Hz					2.0"
In-line							

Discussion about Survey Method and needs for clearly detailed notes and assumptions.

- Not intended for noise sensitive spaces, suggested for NC 40 or louder
- Not intended for lightweight floor-ceiling assemblies for Elevated Slab
- Intended for Maximum Marginal less than 0.5" or 0.25" (TBD)
- Base type are intended to be coordinated between equipment manufacturer, seismic requirements, and vibration isolation manufacturer.

Next Steps

- 1) Complete Survey Method Table
- 2) Complete Survey Method Notes and Assumptions
- 3) Complete Engineering Method Sections
 - a. Could include equipment table with summary and connection to Practical Guide Book