AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC.
1791 Tullie Circle, N.E.
Atlanta, GA 30329
404-636-8400

TC MINUTES COVER SHEET

TC/TG/TRG NO TC 5.2 DATE January 15, 2019

TC/TG/TRG TITLE Duct Design

DATE OF MEETING January 15, 2019 LOCATION Atlanta, GA

MEMBERS PRESENT	TERM TO	MEMBERS ABSENT	YEA	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
Tim Eorgan, Chair	6/30/19			Larry Smith, Section 5 Head
Chris Van Rite, Vice Chair	6/30/21			Akshay Bhargava, Membership Chair
John Constantinide, Sec.	6/30/21		X	Vikram Murthy, CM
Pat Brooks, ALI Coord.	6/30/19			Kevin Gebke, CM
David Dias	6/30/19			Bob Reid, CM
John Hamilton	6/30/19			John Reints, CM
Cindy Bittel, Webmaster	6/30/20		X	Mark Smith, CM
Bill Smith	6/30/20			Craig Wray, CM
Neal Walsh	6/30/20			Steve Idem, CM
Wes Davis	6/30/21			Robert Hassler, CM
John Gierzak	6/30/21			Mark Terzigni, CM
Ralph Koerber	6/30/21			Dane Carey, CM
Scott Hobbs	6/30/22			Gert Jensen, CM
				Duane Smith, CM
				Marcus Bianchi, CM
				Perry Philp, CM
				Kartik Patel, PCM
				Micah Dawson, PCM
				Tim Orris, PCM
				Randy Young, PCM
				Cary Aiken, G
				Larry Felker, G
				Jennifer Kane, G
				David Krupa, G

*** Member Non-Quorum**
CM = Corresponding Member
PCM = Provisional Corresponding Member
G = Guest

DISTRIBUTION

All Members of TC plus the following:	
TAC Section Head	Larry Smith
TAC Chair	Kelley P Cramm
2017 Handbook Liaison (Fundamentals)	Dr. Bass Abushakra
2020 Handbook Liaison (Systems & Equipment)	Florentino Rodriguez
Research Liaison	Dennis L. Loveday
Standards Liaison	Dr. Arsen Melikov
ALI/PDC	James Bochat
Chapter Tech Transfer	Somasundaram Natarajan
Staff Liaison	Mike Vaughn

AMERICAN SOCIETY OF HEATING, REFRIGERATION AND AIR-CONDITIONIONG ENGINEERS

1791 Tullie Circle, N.E.
Atlanta, GA 30329

ASHRAE Annual Conference, Atlanta, GA

TC 5.2 Duct Design

Tuesday, January 15, 2019
Time: 3:30-6:00 PM
Georgia World Congress Center (GWCC), Bldg. A, Rm. A301,
Floor 3

1) **Call to Order**

2) **ASHRAE Code of Ethics Commitment (Tim Eorgan)**

   "In this and all other ASHRAE meetings, we will act with honesty, fairness, courtesy, competence, integrity and respect for others, and we shall avoid all real or perceived conflicts of interest. (See full Code of Ethics: https://www.ashrae.org/about-ashrae/ashrae-code-of-ethics.)"

3) **Introductions and Attendance**
   a) Introduction of people present
   b) Quorum was reached with 13 members
   c) Quorum requires 7 members present
   d) Corrections/additions and approve agenda

4) **2021 Handbook Liaison (Dr. Bass Abushakra)**
   a) Deadline for all content for the HVAC Systems and Equipment Handbook is July 31, 2020.
   b) Ensure that all contributing authors are identified. Contributing authors may be from outside of the TC.

5) **Houston (June 2018) Meeting Minutes**
   The Houston minutes were approved 7-0-1-7 CV on Friday, August 10, at 5:00 pm Eastern Time. The approved minutes were uploaded to Basecamp.

6) **Special Announcements**
   ASHRAE Vision - ASHRAE will be the global leader, the foremost source of technical and educational information, and the primary provider of opportunity for professional growth in the arts and sciences of heating, ventilating, air conditioning and refrigerating.

7) **Section Head Report**
   a) Thank You letters to employers are available upon request to the TC Chair.
   b) Section Head 5.0 Highlights --- *The Section 5.0 Chairman's breakfast was held 6:30 AM to 8:00 AM in Redwood (M1, North), Omni on Sunday, January 13, 2019.*
   c) Discussion from TC Chair Breakfast Meeting and Subcommittee meeting
      i) Challenge 2020 for Orlando
         1. Sections in 5.0 (5.1 Fans, 5.3 Rm Air Dist., etc.) have an opportunity to present in Track 7: Ventilation, IAQ and Air Distribution at the 2020 Winter Conference in Orlando.

2. TC 5.2 will need members to present on the DFDB/Duct Design Guide.
3. Other topics from TC 5.2 can include new research, new technology or other ideas related to Track 7. We need to submit seminar proposals to Larry in the next 2 weeks.

ii) TAC - Reorganizing Functional Groups (FG = TC's, TG's, MTG's & TRG's) into about 30 Technical Working Groups (TWG's) based on similar scope and function. See Attachment A for details, which was distributed on Basecamp.

1. Individual feedback is welcome. Please send your feedback to Larry Smith using the form in Attachment A.

d) Please update your online ASHRAE bio.

8) **TC 5.2 Items (T. Eorgan)**

a) Received a memo from Vikrant Aute Chair for Track 3: Optimization in HVAC&R for the upcoming ASHRAE Annual Conference in Kansas City. Mr. Aute is looking for members of TC 5.2 to submit program proposals on the latest in development and applications of systematic optimization to HVAC & R equipment design and operations. Proposals due Feb. 8th. Submission website https://ashraem.confex/ashraem/s19/cfp.cgi. Any questions can be directed to Vikrant Aute at vikrant@umd.edu.

b) Consulting Engineers & Contractor involvement – A*lways looking for more involvement*

c) Education internal to the TC entitled Airflow Research, what we have learned and what's next was the presentation by Chris Van Rite during our Subcommittee meeting. Dr. Stephen Idem also presented on the results of RP 1764.

i) Possible future sessions - Any suggestions are welcomed

ii) Future roundtables - We would like to entertain any ideas for future roundtables. Future roundtables need parties.

d) Honors and Awards and discussion on the "*The Herman and Dorothy Behls Travel Award and the Herman and Dorothy Behls HVAC Designer Certification Award*" (Steve Idem)

i) Funding is at $17,000. Goal is $30,000. Currently, we are in the second year of 6 years for fundraising.

9) **Subcommittee Reports** (Subcommittee Meeting Notes are in Attachment B.)

a) Handbook

i) We have two chapters — Authoring portal is available for TC 5.2 members can go on line to review and make changes to the Handbook in a collaborative effort.

ii) 2020 Handbook: HVAC Systems & Equipment, Duct Construction - David Dias, Ralph Koerber, **Bob Reid (Subcommittee Chair)**

1. Content deadline is May 2, 2019.
2. Vote can be made by letter ballot. Additional content changes may be made, with TC vote for approval, until August.
3. 30-day window starts after the conference for review of the chapter. Chapter will be placed on Basecamp for member distribution. E-mail changes back to Bob Reid.

iii) 2021 Handbook: Fundamentals, Duct Design – Vikram Murthy, Wes Davis, John Constantinide, Jeff Boldt — Chair: Micah Dawson

b) Membership (Akshay Bhargava)

i) Acknowledge our PCMs --- *mentorship — latch on to a member to get better acquainted with the process*
ii) New Provisional Corresponding Members over the past 6 months:
    (1) Mr. Tushar Kalra
    (2) Mr. Alan Kremzar
    (3) Mr. Rob Craddock
    (4) Dr. Devendra Kulkarni
    (5) Mrs. Robin Stegall
    (6) Kartik Patel
iii) 4 Voting Members are rolling off as of June 30, 2019:
    1) Tim Eorgan
    2) Pat Brooks
    3) David Dias
    4) John Hamilton
iv) Identified and interested Voting Members:
    1. Dr. Stephen Idem
    2. Akshay Bhargava
    3. Bob Reid
    4. Kevin Gebke
    5. Duane Smith
    6. Randy Young
    7. Marcus Bianchi
v) New individuals joining the committee must go to the website at www.ashrae.org/joinatc. By joining online, you are instantly placed on the committee and gives you immediate access to committee information.
vi) If you join the TC, please provide your e-mail address to Cindy Bittel (bittelcindy@gmail.com) to be added to the Basecamp for access to additional committee information and opportunities.

c) Programs (Steve Idem)
i) Aiming for program submissions for Track 7: Ventilation, IAQ and Air Distribution Systems at the Winter Conference in Orlando
ii) Bob Reid will organize and be a moderator for a panel on duct sealants. The panel will consist of a manufacturer, contractor, and academic/researcher for Track 7 in Orlando.

d) Duct Design Guide (DDG) (Pat Brooks)
i) Report is in Attachment C.
ii) Revised Table of Contents:
    1. Introduction
    2. Duct Design Fundamentals
    3. Duct Design Considerations
    4. Duct Design – Equal Friction
    5. Duct Design – Static Regain
    6. Duct Design – Local Exhaust Systems
    7. HVAC System Air Leakage
    8. Fans
    9. Duct System Materials
    10. Duct System Acoustical Analysis
iii) Any of these chapters can be updated in the future.

e) Duct Fitting Database (DFDB) (Pat Brooks)
i) Report is in Attachment D.

ii) The online version is available for purchase.
iii) Dr. Steve Idem will address problems with John Downey.
iv) The TC will investigate taking responsibility of DFDB maintenance.

f) Codes & Standards Interaction (Ralph Koerber)
   i) Report is in Attachment E.
   ii) **Action Item**: Larry Smith, Ralph Koerber, and John Hamilton will write content for the Duct Design chapter of the Fundamentals Handbook related to gypsum board.

g) ASHRAE Learning Institute (ALI) (Pat Brooks)
   i) No report. When DDG is in publication, follow-up will be done.

h) Webmaster (Cindy Bittel)
   i) TC 5.2 Website: https://TC0502.ashraetcs.org/
   ii) Website is up-to-date and to be used for non-TC members.
   iii) Basecamp is available to all members and should be used as much as possible. To be added to Basecamp, e-mail Cindy Bittel at bittelcindy@gmail.com.
      1. Note that files on the TC website are publicly available, while files on Basecamp are only available to TC members.

i) Liaison Reports
   i) 90.1 (Mark Smith/Jeff Boldt)
      1. Report is in Attachment F.
      2. 4.4.2.2. Duct Leakage Air Testing: The section was corrected and sent to Std. 90.1 Mech Subcommittee and, hopefully, will see errata and in Standard 90.1 - 2019.
      3. 90.1 TPS has expanded to include the building site (i.e. parking lots, mainly affecting lighting).
   ii) IMC ASHRAE Code Interaction of Standard Committee (John Hamilton)
      1. No report.
      2. Liaison will be removed from future agendas.

j) Research (Kevin Gebke/Stephen Idem)
   i) Duct Design Guide (1180-RP): See DDG report for details. Report was given to RAC.
   ii) 1764-RP Determine the Absolute Roughness for Phenolic Duct Board
      1. Completed.
      2. **Action Item**: Dr. Steve Idem will write a paragraph of content that can be published in the Duct Design chapter of the Fundamentals Handbook, to be reviewed by the former PMS of 1764-RP.
      3. Tie rod data is already in the DFDB.
   iii) WS-xxxx Reducing Barriers to Achieving Low Leakage Air Handling Systems (Wray/Reid) – No comments or activity. We are in a preliminary state.
   iv) A new form, PTAR (Publication Topic Acceptance Request), is now available for submission to Publication, which will then go back to RAC, for research projects that lead to publication content.

k) Standards (Kevin Gebke)
   i) SSPC 189.1 (Micah Dawson) – Report is in Attachment F.
   ii) SPC 215P (Craig Wray) – Published. Will be removed from the agenda for future meetings.

l) Historian (Bob Reid)

i) ASHRAE HQ and Bob Reid will review what was donated by the Behls Family.
ii) Relevant information may be posted to the TC website.
iii) The TC is grateful for Bob Reid, Larry Smith, Pat Brooks, Dr. Steve Idem, Craig Wray, and Kevin Gebke for their time to compile this information.

m) Duct Sealant (Larry Smith)
i) Group agreed to pursue 2 paths:
1. Approach ASTM to create a standard. Larry Smith will take the lead on approaching ASTM and chair the Duct Sealant Subcommittee.
2. Create an ANSI-approved ASHRAE standard.
ii) Chair approves the Duct Sealant Subcommittee and appoints Larry Smith to chair the subcommittee.

10) **Deadlines**

Deadlines for the 2019 *Annual* Conference, which will be held in Kansas City, June 2019 are:
Wednesday, January 2, 2019 - Website Opens for Seminar, workshop, Forum, Debate and Panel Proposals Friday, February 8, 2019 - Program (Seminar, Forum, Workshop, Debate and Panel) Proposals Due
Wednesday, May 1, 2019 – Upload of presentations begins
Friday, May 31, 2019 – All presentations due online

Deadlines for the 2019 *Annual* Conference, which will be held in Orlando, FL, June 2020 are:
Monday, March 18, 2019: Conference Paper Abstracts, Technical Papers and Paper Session Requests Due
Monday, April 22, 2019: Conference Paper Abstract Accept/Reject Notifications
Monday, June 17, 2019: Website Opens for Seminar, Workshop, Forum, Debate, and Panel Proposals
Monday, July 8, 2019: Final Conference Papers Due - Submitted for Review (Includes Bio, Learning Objectives and Methods of Assessment); Request for Conference Paper Sessions Due
Friday, July 26, 2019: Conference Paper Accept/Revise/Reject Notifications
Friday, August 9, 2019: Revised Conference Papers/Final Technical Papers Due
Friday, August 26, 2019: Conference and Technical Paper Final Accept/Reject Notifications
Friday, October 4, 2019: Seminar, Workshop, Forum, Debate, and Panel Accept/Reject

March 15, 2019, & May 15, 2019: RTAR submissions to RAC
February 15, 2019: Content review for Duct Construction chapter content
May 2, 2019: Submission of content for Duct Construction chapter

Action Item: TC must approve by letter ballot before Annual Conference. John Constantinide will organize the letter ballot.

Notifications

Wednesday, January 2, 2019	Website Opens for Seminar, workshop, Forum, debate and Panel Proposals
Friday, February 8, 2019	Program (Seminar, Forum, Workshop, Debate and Panel) Proposals Due

Wednesday, May 1, 2019	Upload of PPTs Begin
Friday, May 31, 2019	All PPTs Due Online

1) Old Business

2) New Business
   a) Larry Smith is working with Herman Behls' family to take his paperwork, publications, and documents to ASHRAE Headquarters for them to sort through and catalog items.
   b) RTAR from TC4.10

3) Action Items

TC 5.2 Duct Design Action Items			
Number	Description	Assigned to	Status
1	TC 5.2 Long Range Objectives	Individuals outlined in each objective	See statuses in Items 1a through 1d
1a	TC 5.2 will reach out to the following market segments for additional engagement and representation: a. Practicing Engineers and Commissioning Agents; b. Code Authorities/Authorities Having Jurisdiction; c. Building Owners and Managers via BOMA, IFMA, USGBC; d. SMACNA; and e. General Contractors and Mechanical Contractors, including Testing and Balancing Contractors, through organizations such as ACCA and SPIDA.	John Constantinide & Tim Eorgan	Active
1b	Duct Design Guide: a. Complete and publish the Duct Design Guide. b. Develop and promote educational and training material based on the Duct Design Guide for the practicing engineer, through the ASHRAE Learning Institute (ALI), and with engineering students at the college level.	Larry Smith & Pat Brooks. Refer to 1180-RP progress.	Active
1c	Present seminars and publish papers in response to publication and research based off of SPC 215 Method of Test to Determine Leakage of Operating HVAC Air-Distribution Systems.	Larry Smith, with Bob Reid assisting	Active
1d	Develop long-range and maintenance plans for the Duct Fitting Database, including incorporation of research.	Pat Brooks and Larry Smith. Refer to Agenda Item 8e for DFDB Subcommittee Report.	Active
2	RTAR covering cost to seal ductwork		Removed from future agendas.
3	Reach out to RAC Research Liaison about the TC 4.10 RTAR (Flow Characteristics of Installed Flex Ducts) and the research done via RP 1333.	Kevin Gebke	Completed

4	Write content for the Duct Design chapter of the Fundamentals Handbook related to gypsum board.	Larry Smith, Ralph Koerber, and John Hamilton	Assigned in Atlanta
5	Write a paragraph of content that can be published in the Duct Design chapter of the Fundamentals Handbook, to be reviewed by the former PMS of 1764-RP.	Dr. Steve Idem	Assigned in Atlanta
6	TC must approve by letter ballot Duct Construction chapter of the HVAC Systems Handbook before the upcoming Annual Conference.	Bob Reid (Content), John Constantinide (Letter Ballot)	Assigned in Atlanta

4) Adjournment – Chris Van Rite moved, David Dias seconded. No objections.

Upcoming Meetings:

2019 ASHRAE Annual Conference --- Kansas City, MO --- June 22-26, 2019

2020 ASHRAE Winter Conference --- Orlando, FL --- February 1-5, 2020

ATTACHMENT B

TC 5.2 DUCT DESIGN SUBCOMMITTEES MEETING NOTES

MONDAY, JANUARY 14, 2019, 8:00 AM to 12:00 Noon
Georgia World Congress Center, Building B, Floor 2, Room B207

- Introductions and Sign-in sheet
- Basecamp Introduction: John Constantinide
  - Demonstrated Basecamp log-in requirements, profile revision, Docs & Files, To-Do, Campfire, Schedule, Ping, and Message Board functions
  - New members and participants should e-mail John Constantinide to be added to the TC 5.2 Basecamp.
- Challenge 2020
  - Sections in 5.0 (5.1 Fans, 5.3 Room Air Distribution, etc.) have an opportunity to present in Track 7: Ventilation, IAQ and Air Distribution at the 2020 Winter Conference in Orlando.
  - TC 5.2 will need members to present on the DFDB/Duct Design Guide
  - Other topics from TC 5.2 can include new research, technology, or other ideas related to Track 7.
  - We need to submit proposals to Stephen Idem in the next 2 weeks.
- Duct Sealant Testing: Larry Smith
  - Larry will act as the POC on technical coordination with ASTM.
  - One point that was brought up is the issue of resilience related to the topic (e.g. natural disasters, acts of aggression/terrorism, etc.)
  - Items addressed:
    - Compliance with manufacturer's requirements
    - Testing done per UL 723
    - Maintain air tightness over life of product
  - Volunteers: John Hamilton, Randy Young
  - Should investigate why this is being done through ASTM instead of ASHRAE or to have a standard to collaborate between ASTM and ASHRAE
  - Standards Committee will review if this new proposed standard will duplicate an existing standard through PINS process
  - Could have this new standard or best practices guideline reference existing standards
  - Could have a special publication with best practices funded by a research project
    - Needs to be initiated via a PTAR (Publication Topic Acceptance Request)
  - Ensure that work done is within scope of ASHRAE and work with ASTM, UL, etc. to approach these organizations with their respective scopes.

- TAC Reorganization of Functional Groups (FG)[1], Discussion led by Chris Van Rite
  - **Attachment A** from TAC distributed to TC members via Basecamp and discussed by Chris
  - Intent is to consolidate existing FGs into about 30 Technical Working Groups (TWGs) based on similar scope and function
  - Section 5 has already moved in this direction that TAC wants through other activities (e.g. Challenge 2020).
  - Feedback to Larry welcome by e-mailing him at SH5@ashrae.net.
  - Will have a Basecamp to have a consolidated pilot TWG. John Constantinide will organize all communications.
    - For now, pilot TWG is set to address the topic of Air Distribution.
- Presentation by Chris Van Rite
  - Presentation is available on Basecamp.
- RP 1764
  - Presentation, Stephen Idem
  - Presentation is available on Basecamp
  - Report & Comments, Pat Brooks after Presentation

The Duct Design Guide presentation by Pat Brooks was moved to the full committee meeting.

[1] FGs = TCs, TGs, MTGs, & TRGs

ATTACHMENT C

Duct Design Guide Status and To Do List Update
per 13 January 2019 meeting

The following updates the To Do List 10 September 2018 List

The Table of Contents is good for now, 00 TOC_rev03.docx
Table of Contents is as follows.

Table of Contents (October 2018 - Revised)

Foreword – later (Idem/Brooks)

1. Introduction
2. Duct Design Fundamentals
3. Duct Design considerations
4. Duct Design - Equal Friction
5. Duct Design - Static Regain
6. Duct Design - Local Exhaust Systems (Constant Velocity)
7. HVAC System Air leakage
8. Fans
9. Duct System Materials
10. Duct System Acoustical Analysis

Acknowledgement and Forward – Status:
Still needs written - want a Dedication page and picture of Herman Behls. Steve will draft by the end of January 2019

Chapter 1 Introduction_rev03.docx – Status:
Should be in good shape. Sent to Basecamp 10/30/18

Chapter 2 Duct Design Fundamentals Idem 11-8 - 18 rev02.docx
Status:
Should be in good shape. Uploaded to Basecamp 11/20/18. Has two digital references. Appendix A as spreadsheet is the Equivalent Round Tables for Rectangular and Flat Oval. The ASHRAE IP-ADI Duct Calculator is also a spreadsheet used to calculate friction loss for Chapter 2 and moist air properties for Chapter 6. Reference is made to these two spreadsheets in the Chapter, but I have not tried to link them

Chapter 3 Duct Design Considerations Rev 04.docx – Status:
Should be in good shape. Uploaded to Basecamp 11/21/18. One Acoustics Chapter 10 reference will need to be updated once that chapter is complete.

Chapter 4 Duct Design - Equal Friction_rev 02 w Larry Smiths Corrections 10-11-18.docx – Status:
Still should be in good shape. To handle the use of loss coefficients for VAV boxes I just said they were derived from manufactures data. Found out that Titus (Randy Zimmerman) likes to use an inlet velocity of about 2000 fpm, with box outlet velocity equal to about 1000 fpm. To calculate loss coefficient, take the static pressure drop and add the change in velocity pressure across the box which will give you the total pressure drop. Divide by the inlet velocity pressure to get the loss coefficient. Uploaded to Basecamp 11/20/18. There are two digital references, the Master Equal Friction Loss spreadsheet and the spreadsheet with the sample Equal Friction design.

Chapter 5 Duct Design - Static Regain_rev02 w LAS corrections.docx – Status:
Should also be in good shape. Same VAV Loss Coefficient solution. Also has two digital references, the Master Static Regain Design spreadsheet and the Sample Problem Spreadsheet. Uploaded to Basecamp 11/20/18.

Chapter 6 Duct Design - Local Exhaust Systems (Constant Velocity)_rev02 LS 11-26-18.docx – Status:
Steve Idem updated the equations and nomenclature and got rid of conversion constants. Pat and Larry need toreview it. Pat needs to update references. By Mid March

Chapter 7 HVAC System Air Leakage_rev00 (1)w Brooks comments.doxc – Status: Unchanged
I substantially rewrote this as “Chapter 7 HVAC System Air Leakage_rev00 (1)w Brooks comments” and uploaded it, but left the old version as well. Larry should review my changes? We don’t want this to be a leakage manual. Just show how leakage affects performance and how leakage may be avoided.

Chapter 8 Chapter 8 Fan Selection_rev01 7-27-2018 (2) w Brooks Idem 10-01-2018 (1), Status: Needs Updated
Craig Wray to review. He said it was good enough per current conditions in TC 5.1 Steve Idem reviewed and updated the Basecamp version on 10-01-2018. Needs to be finalized by Brooks

Chapter 9 Duct System Materials_rev02.doxc. Status:
Should be in good shape. I did some minor updates and uploaded it to Basecamp 10/11/18. Larry may have some additional changes

Chapter 10_Duct System Acoustics_Rev0_Jan 2018_JGB Updates_1 Brooks Review with tracking changes accepted Status:
This version has been sent to Jeff Boldt to review and add additional information. He has not responded lately. I will follow up and see if we can get is done .

Pat
01-13-19

ATTACHMENT D

DFDB (Duct Fitting Data Base) Meeting Notes, 13 January 2019

- We determined the On Line version of the data base is 6.0005 from about 1/1/2016. The cost to download the program is an annual licensing fee for members of $110 and non-members of $130
- There are problems which Steve Idem will try to address with John Downey.
    - The saddle tap data has not been added to the DFDB
    - CD11-4 does not properly converge to give the correct diameter for a given friction loss rate
    - We need to add an out of range warning when the ratio is less than 0.10 or greater than 0.90 on any range that goes below 0.10 or above 0.90

- Other problems, Steve Idem needs to review the converging exhaust fittings to see which ones have negative loss coefficients for both branches. His paper on this showed it should not happen
- The web site still shows there is a DFDB APP. Larry Smith will get with Michael Vaughn to see if it can be removed. We don't support it.

- We would like to take over complete maintenance of the DFDB, probably by contracting out to TTU. Larry will approach Michael Vaugh with this suggestion. We will need to find out the logistics to do that.

The following people attended the meeting:
Patrick Brooks Kevin Gebke
Larry Smith
David Dias
John Reints
Marty Gissle
Mike Watz
Randy Young
Hugo Aquiler
Mark Smith
Tim Eorgan
Ralph Koerber
Steve Idem

ATTACHMENT E

Code Interaction Sub-Committee Update (1-14-19)

ICC 2021 IMC, IRC, IECC Code Revision Cycle

- Action hearing meetings for IMC & IRC comments was October 24 - 31, 2018
- Voting by TC members done by November 7, 2018
- Proposal deadline for IECC was January 7, 2019
- Proposals will be posted on March 4, 2019
- TC will meet April 28 to May 8, 2019 to consider proposals

IAPMO 2021 UMC Code Revision Cycle

- Technical Committee acted on the proposals during meetings in May
    - UMC TC approved proposal from the UMC Factory-Made Duct Task Group for rewording and reorganization of duct chapter that removes reference to the term "factory-made air duct" and replaces it with individual reference to various duct types (metal, non-metallic, phenolic, fibrous glass, etc.)
- Report on proposals published August 20, 2018
- Call for comments went out on September 3, 2018
- Assembly consideration session was held on October 2, 2018
- Deadline to submit a comment on proposals and TC action was January 3, 2019
- IAPMO to publish Report on Comments by March 22, 2019
- UMC TC will meet on April 29 to May 2, 2019 to consider public comments

NFPA 90A & 90B Standards 2021 Revision Cycle

- Proposals for 2021 revision accepted until June 27, 2018
- TC meetings held October 11, 2019 to review and act on all proposals to the standards
- All previously held-over comments from the 2018 cycle were considered by the TC
    - Most comments discussed the acceptance, performance, approval, and limitations for air connectors which were not accepted by the TC
- First Draft Report will be posted on February 27, 2019

Other

- Details regarding how gypsum is covered in the current codes and standards, noted on the following pages.

2018 ICC International Mechanical Code (IMC)

SECTION 602

PLENUMS

602.1 General. Supply, return, exhaust, relief and ventilation air plenums shall be limited to uninhabited crawl spaces, areas above a ceiling or below the floor, attic spaces, mechanical equipment rooms and the framing cavities addressed in Section 602.3. Plenums shall be limited to one fire area. Air systems shall be ducted from the boundary of the fire area served directly to the air-handling equipment. Fuel-fired appliances shall not be installed within a plenum.

602.2 Construction. *Plenum* enclosure construction materials that are exposed to the airflow shall comply with the requirements of Section 703.5 of the *International Building Code* or such materials shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E84 or UL 723.

The use of gypsum boards to form plenums shall be limited to systems where the air temperatures do not exceed 125ºF (52ºC) and the building and mechanical system design conditions are such that the gypsum board surface temperature will be maintained above the airstream dew-point temperature. Air plenums formed by gypsum boards shall not be incorporated in air-handling systems utilizing evaporative coolers.

602.2.1 Materials within plenums. Except as required by Sections 602.2.1.1 through 602.2.1.8, materials within plenums shall be noncombustible or shall be listed and labeled as having a flame spread index of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E84 or UL 723.

Exceptions:

1. Rigid and flexible ducts and connectors shall conform to Section 603.
2. Duct coverings, linings, tape and connectors shall conform to Sections 603 and 604.
3. This section shall not apply to materials exposed within plenums in one- and two-family dwellings.
4. This section shall not apply to smoke detectors.
5. Combustible materials fully enclosed within one of the following:
   - 5.1. Continuous noncombustible raceways or enclosures.
   - 5.2. Approved gypsum board assemblies.
   - 5.3. Materials listed and labeled for installation within a plenum and listed for the application.
6. Materials in Group H, Division 5 fabrication areas and the areas above and below the fabrication area that share a common air recirculation path with the fabrication area.

SECTION 603

DUCT CONSTRUCTION AND INSTALLATION

603.5 Nonmetallic ducts. Nonmetallic ducts shall be constructed with Class 0 or Class 1 duct material and shall comply with UL 181. Fibrous duct construction shall conform to the SMACNA *Fibrous Glass Duct Construction Standards* or NAIMA *Fibrous Glass Duct Construction Standards.* The air temperature within nonmetallic ducts shall not exceed 250ºF (121ºC).

603.5.1 Gypsum ducts. The use of gypsum boards to form air shafts (ducts) shall be limited to return air systems where the air temperatures do not exceed 125ºF (52ºC) and the gypsum board surface temperature is maintained above the airstream dew-point temperature. Air ducts formed by gypsum boards shall not be incorporated in air-handling systems utilizing evaporative coolers.

603.5.2 Phenolic ducts. Nonmetallic phenolic ducts shall be constructed and installed in accordance with the SMACNA Phenolic Duct Construction Standards.

603.9 Joints, seams and connections. Longitudinal and transverse joints, seams and connections in metallic and nonmetallic ducts shall be constructed as specified in SMACNA HVAC Duct Construction Standards - Metal and Flexible and NAIMA Fibrous Glass Duct Construction Standards. Joints, longitudinal and transverse seams and connections in ductwork shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems, liquid sealants or tapes. Tapes and mastics used to seal fibrous glass ductwork shall be listed and labeled in accordance with UL 181A and shall be marked “181 A-P” for pressure-sensitive tape, “181 A-M” for mastic or “181 A-H” for heat-sensitive tape. Tapes and mastics used to seal metallic and flexible air ducts and flexible air connectors shall comply with UL 181B and shall be marked “181 B-FX” for pressure-sensitive tape or “181 B-M” for mastic. Duct connections to flanges of air distribution system equipment shall be sealed and mechanically fastened. Mechanical fasteners for use with flexible nonmetallic air ducts shall comply with UL 181B and shall be marked “181 B-C.” Closure systems used to seal all ductwork shall be installed in accordance with the manufacturer's instructions.

Exception: For ducts having a static pressure classification of less than 2 inches of water column (500 Pa), additional closure systems shall not be required for continuously welded joints and seams and locking-type joints and seams. This exception shall not apply to snap-lock and button-lock type joints and seams located outside of conditioned spaces.

2018 ICC International Residential Code (IRC)

SECTION M1601

DUCT CONSTRUCTION

M1601.1 Duct design. *Duct systems* serving heating, cooling and *ventilation equipment* shall be installed in accordance with the provisions of this section and ACCA Manual D, the appliance manufacturer's installation instructions or other *approved* methods.

M1601.1.1 Above-ground duct systems. Above-ground *duct systems* shall conform to the following:

1. *Equipment* connected to *duct systems* shall be designed to limit discharge air temperature to not greater than 250°F (121°C).
2. Factory-made ducts shall be listed and labeled in accordance with UL 181 and installed in accordance with the manufacturer's instructions.
3. Fibrous glass duct construction shall conform to the SMACNA *Fibrous Glass Duct Construction Standards* or NAIMA *Fibrous Glass Duct Construction Standards*.
4. Field-fabricated and shop-fabricated metal and flexible duct constructions shall conform to the SMACNA HVAC *Duct Construction Standards-Metal and Flexible* except as allowed by Table M1601.1.1. Galvanized steel shall conform to ASTM A 653.
5. The use of gypsum products to construct return air ducts or plenums is permitted, provided that the air temperature does not exceed 125°F (52°C) and exposed surfaces are not subject to condensation.
6. *Duct systems* shall be constructed of materials having a flame spread index of not greater than 200.
7. Stud wall cavities and the spaces between solid floor joists to be used as air plenums shall comply with the following conditions:
    7.1. These cavities or spaces shall not be used as a plenum for supply air.
    7.2. These cavities or spaces shall not be part of a required fire-resistance-rated assembly.
    7.3. Stud wall cavities shall not convey air from more than one floor level.
    7.4. Stud wall cavities and joist-space plenums shall be isolated from adjacent concealed spaces by tight-fitting fire blocking in accordance with Section R602.8.
    7.5. Stud wall cavities in the outside walls of building envelope assemblies shall not be utilized as air plenums.
8. Volume dampers, equipment and other means of supply, return and exhaust air adjustment used in system balancing shall be provided with access.

2018 IAPMO Uniform Mechanical Code (UMC)

CHAPTER 6

DUCT SYSTEMS

602.0 Material.

602.1 General. Materials used for duct systems shall comply with Section 602.2 through Section 602.8 as applicable.

Concealed building spaces or independent construction within buildings shall be permitted to be used as ducts or plenums. Gypsum board shall not be used for positive pressure ducts.

Exception: In healthcare facilities, concealed spaces shall not be permitted to be used as ducts or plenums.

602.5 Gypsum. Where gypsum products are exposed in ducts or plenums, the air temperature shall be restricted to a range from 50°F (10°C) to 125°F (52°C), and moisture content shall be controlled so that the material is not adversely affected. All gypsum products shall have a mold or mildew resistant surface. For the purpose of this section, gypsum products shall not be exposed in supply ducts.

2018 NFPA 90A

4.3 Air Distribution.

4.3.1 Air Ducts.

4.3.1.1 Air ducts shall be constructed of iron, steel, aluminum, copper, concrete, masonry, or clay tile, except as otherwise permitted in 4.3.1.2 or 4.3.1.3.

4.3.1.3 Gypsum Board Air Ducts.

4.3.1.3.1 Gypsum board having a flame spread index not exceeding 25 without evidence of continued progressive combustion and a smoke developed index not exceeding 50 when tested in accordance with ASTM E 84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or ANSI/UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials*, shall be permitted to be used for negative pressure exhaust and return ducts where the temperature of the conveyed air does not exceed 52°C (125°F) in normal service.

4.3.1.3.2 The air temperature limits of 4.3.1.3.1 shall not apply where gypsum board material is used for emergency smoke exhaust air ducts.

2018 NFPA 90B

4.2.1 Duct Materials.

4.2.1.1 Return ducts shall be permitted to be constructed of metal, of 25.4 mm (1 in.) (nominal) wood boards, or of other suitable material, provided that no material more flammable than 25.4 mm (1 in.) (nominal) wood boards shall be used.

4.2.1.2 Portions of return ducts directly above the heating surface or closer than 0.61 m (2 ft) from the outer jacket or casing of the heater shall be constructed in accordance with provisions of 4.1.1 for supply ducts.

4.2.3 Continuous Ducts.

4.2.3.1 Return air shall be conducted to the appliance through continuous ducts, except as permitted in 4.2.3.2 through 4.2.3.5.

4.2.3.2* Underfloor spaces shall be permitted to be used as plenums for return of air from rooms directly above, provided that such spaces are cleaned of all combustible material, are tightly enclosed, and are not used for storage or occupancy.

From www.gypsum.org (Gypsum Association)

VIII. MOLD, MOISTURE, VAPOR & AIR PENETRATION

Mold

Mold is actually a family of several species of fungi that can infest damp interior surfaces. They are spread primarily by microscopic airborne spores that are abundant in most environments. These fungi require three conditions to grow: oxygen, a food source, and moisture. Eliminating one of these three elements will keep mold growth in check; however, two of the three are almost impossible to eliminate: oxygen and a food source. Mold will consume any available organic nutrient, especially pollen and common house dust, which are readily available on most interior surfaces and are almost impossible to contain. So, the only one of the three elements over which we have any real control is moisture. To keep mold in check, keep moisture out.

Warning: Some varieties of mold pose a health risk, particularly to people who are hypersensitive to mold. For this reason, mold abatement should only be attempted by trained professionals.

Moisture

Gypsum board will not withstand exposure to elevated levels of moisture for extended periods. Examples of elevated levels of moisture include, but are not limited to, exposure to rain, condensation, water leakage, and standing water. Some gypsum board exposed to these conditions may not need to be replaced, depending upon the source of the moisture and the condition of the gypsum board being considered for replacement. However, if there is ever any doubt about whether to keep or replace gypsum board that has been exposed to moisture – replace it.

Vapor Penetration

The penetration and accumulation of water vapor into building cavities can lead to mold growth and the deterioration of the building materials through rot or rust. Preventing unwanted vapor penetration is generally accomplished in two ways. The first is to block moist air from entering the building cavity by closing all passages into the building cavity. The second is to install a vapor retarder in the building cavity. However, proper placement of a retarder depends on the local climate.

Air Penetration

The loss of conditioned air (heated or cooled) from the interior of a building to the exterior is a major source of energy loss. In other words, unwanted air movement through a building will increase energy costs. Air barriers help reduce unwanted air and moisture movement. Gypsum panel products, including interior gypsum wallboard and gypsum sheathing serve as air barriers when properly installed and finished. However, cracks and other openings around exterior doors, windows, plumbing, electrical boxes, etc., provide passages for air to leak in and out of a conditioned space. For this reason, it is important to fill all openings through which conditioned air can escape to the outside with caulk or another appropriate material.

ATTACHMENT F

ASHRAE 90.1 Update:

Additional discussion Expanding Title Purpose and Scope to include Sites as well as Buildings. TPS Addendum, Addendum CB

Changes were passed which encompassed:

- Air Curtains
- Fan Efficiency
- Heat Recover Chillers
- Residential Energy Recovery Ventilators
- Exhaust Air Energy Recovery
- Fan Motor selection criteria
- Boiler Efficiency Exceptions

Craig identified some errors within the calculations in Section 6.4.4.2.2. Craig submitted the corrections to these calculations which have been reviewed by 90.1 MSC and approved. These will hopefully be included within the 90.1 – 2016 errata as well as 90.1 2019.

ATTACHMENT A

ASHRAE Shaping Tomorrow's Built Environment Today

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January 13, 2019

TC/ TG/ MTG/ TRG Chairs & Vice Chairs,

We have heard from our membership that the current Functional Groups (FG - includes TCs, TGs, MTGs, and TRGs) structure is not working as efficiently or effectively as in the past. We need to determine how to be contributors and the driving force in our industry. From our recent membership survey, we identified the following issues:

- We are working in silos; too specific; need more global perspective
- Management of stagnant TCs and membership is lacking
- Takes too long to change things in TCs- members are getting discouraged
- We are not maintaining industry leadership
- We need to do a better job of sharing best practices

TAC owns these issues and we are working to address them. We have started to invest time and funds in technology/ forms, including BaseCamp, a new electronic roster tool, and a revised activity tracking form. In addition, a committee was formed a few months ago to look at reorganizing the FG structure. By taking on this reorganization, we hope to:

- Decrease the silo effect
- Increase collaboration for programs, research & handbook
- Increase meeting efficiency & increase the effectiveness of members' volunteer time

PROPOSED PLAN

There are over 110 FG meetings and 180 subcommittee meetings at every conference. Many of these meetings overlap each other, and/or run concurrently to the technical program, limiting the number of attendees that could attend and participate in the discussion & exchange of ideas.

We propose to re-form the existing FGs into about 30 new technical working groups (TWGs) based on similar scope & function, with merged attendance of between 75-125 members. The meetings would take place during a block schedule (see attachment), moving meetings into afternoon timeslots and utilizing technical program rooms (large rooms with AV). In these 2-hour slots, TWGs could present topical programs (to be included in the technical program), some business of interest to the group and subcommittee breakouts within their slot.

We now have an opportunity to direct the technical vision of the society as we will soon celebrate our 125th anniversary. We have presented a draft proposal to you and now we want your input and suggestions- talk amongst yourselves and feel free to talk to us. We are looking for your input on potential synergies with other functional groups, for example, if your FG were to reform with 1 or 2 other groups, which ones do you think most align with your current scope? Our goal is to discuss your questions and concerns in Atlanta and propose a working model for consideration in Kansas City and a rollout in Orlando (2020). Please direct your answers or inquires to TAC through your individual Section Head or to Sarah Maston, the TWG Reorganization Chair. Thanks for all you do for your membership and ASHRAE!

Best Regards,

Sarah Maston, Chair (sarah@greenfootprintscx.com)
Victor Goldschmidt, TAC (creating2@earthlink.net)
Thom Justice, TAC Chair (justfilter@yahoo.com)
Tom Lawrence, TAC BOD ExO (lawrence@engr.uga.edu)
Barbara Minor, TAC (Barbara.H.Minor@chemours.com)
Larry Smith, TAC (LarryS@li-hvac.com)
Bill McQuade, Planning (William.F.Mcquade@jci.com)

Technical Program / Technical Working Group Draft Block Schedule

ATLANTA 1/2019

	SUNDAY								MONDAY								TUESDAY							
	Room 1	Room 2	Room 3	Room 4	Room 5	Room 6	Room 7	Room 8	Room 1	Room 2	Room 3	Room 4	Room 5	Room 6	Room 7	Room 8	Room 1	Room 2	Room 3	Room 4	Room 5	Room 6	Room 7	Room 8
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Notes:

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FUTURE CONFERENCE

	SUNDAY								MONDAY								TUESDAY							
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TC/ TG/ MTG/ TRG Reorganization

Feedback Form

We now have an opportunity to direct the technical vision of the society
as we will soon celebrate our 125th anniversary.
We have presented a draft proposal to you and now we want your input and suggestions:

Name_____ TC_____

We are looking for your input on potential synergies with other functional groups, for example, if your FG were to reform with 1 or 2 other groups, which ones do you think most align with your current scope?

_____

_____

I am excited about

_____

_____

I would like to propose

_____

_____

I think we will have difficulty with

_____

_____

Other

_____

_____

_____

Please direct your answers or inquires to TAC through your individual Section Head
or to Sarah Maston, the TWG Reorganization Chair, at sarah@greenfootprintscx.com
Thanks for all you do for your membership and ASHRAE!

ATTACHMENT B

TC 5.2 DUCT DESIGN SUBCOMMITTEES MEETING NOTES

MONDAY, JANUARY 14, 2019, 8:00 AM to 12:00 Noon
Georgia World Congress Center, Building B, Floor 2, Room B207

- Introductions and Sign-in sheet
- Basecamp Introduction: John Constantinide
  - Demonstrated Basecamp log-in requirements, profile revision, Docs & Files, To-Do, Campfire, Schedule, Ping, and Message Board functions
  - New members and participants should e-mail John Constantinide to be added to the TC 5.2 Basecamp.
- Challenge 2020
  - Sections in 5.0 (5.1 Fans, 5.3 Room Air Distribution, etc.) have an opportunity to present in Track 7: Ventilation, IAQ and Air Distribution at the 2020 Winter Conference in Orlando.
  - TC 5.2 will need members to present on the DFDB/Duct Design Guide
  - Other topics from TC 5.2 can include new research, technology, or other ideas related to Track 7.
  - We need to submit proposals to Stephen Idem in the next 2 weeks.
- Duct Sealant Testing: Larry Smith
  - Larry will act as the POC on technical coordination with ASTM.
  - One point that was brought up is the issue of resilience related to the topic (e.g. natural disasters, acts of aggression/terrorism, etc.)
  - Items addressed:
    - Compliance with manufacturer's requirements
    - Testing done per UL 723
    - Maintain air tightness over life of product
  - Volunteers: John Hamilton, Randy Young
  - Should investigate why this is being done through ASTM instead of ASHRAE or to have a standard to collaborate between ASTM and ASHRAE
  - Standards Committee will review if this new proposed standard will duplicate an existing standard through PINS process
  - Could have this new standard or best practices guideline reference existing standards
  - Could have a special publication with best practices funded by a research project
    - Needs to be initiated via a PTAR (Publication Topic Acceptance Request)
  - Ensure that work done is within scope of ASHRAE and work with ASTM, UL, etc. to approach these organizations with their respective scopes.

- TAC Reorganization of Functional Groups (FG)[1], Discussion led by Chris Van Rite
  - **Attachment A** from TAC distributed to TC members via Basecamp and discussed by Chris
  - Intent is to consolidate existing FGs into about 30 Technical Working Groups (TWGs) based on similar scope and function
  - Section 5 has already moved in this direction that TAC wants through other activities (e.g. Challenge 2020).
  - Feedback to Larry welcome by e-mailing him at SH5@ashrae.net.
  - Will have a Basecamp to have a consolidated pilot TWG. John Constantinide will organize all communications.
    - For now, pilot TWG is set to address the topic of Air Distribution.
- Presentation by Chris Van Rite
  - Presentation is available on Basecamp.
- RP 1764
  - Presentation, Stephen Idem
  - Presentation is available on Basecamp
  - Report & Comments, Pat Brooks after Presentation

The Duct Design Guide presentation by Pat Brooks was moved to the full committee meeting.

[1] FGs = TCs, TGs, MTGs, & TRGs

ATTACHMENT C

Duct Design Guide Status and To Do List Update
per 13 January 2019 meeting

The following updates the To Do List 10 September 2018 List

The Table of Contents is good for now, 00 TOC_rev03.docx
Table of Contents is as follows.

Table of Contents (October 2018 - Revised)

Foreword – later (Idem/Brooks)

1. Introduction
2. Duct Design Fundamentals
3. Duct Design considerations
4. Duct Design - Equal Friction
5. Duct Design - Static Regain
6. Duct Design - Local Exhaust Systems (Constant Velocity)
7. HVAC System Air leakage
8. Fans
9. Duct System Materials
10. Duct System Acoustical Analysis

Acknowledgement and Forward – Status:
Still needs written - want a Dedication page and picture of Herman Behls. Steve will draft by the end of January 2019

Chapter 1 Introduction_rev03.docx – Status:
Should be in good shape. Sent to Basecamp 10/30/18

Chapter 2 Duct Design Fundamentals Idem 11-8 - 18 rev02.docx
Status:
Should be in good shape. Uploaded to Basecamp 11/20/18. Has two digital references. Appendix A as spreadsheet is the Equivalent Round Tables for Rectangular and Flat Oval. The ASHRAE IP-ADI Duct Calculator is also a spreadsheet used to calculate friction loss for Chapter 2 and moist air properties for Chapter 6. Reference is made to these two spreadsheets in the Chapter, but I have not tried to link them

Chapter 3 Duct Design Considerations Rev 04.docx – Status:
Should be in good shape. Uploaded to Basecamp 11/21/18. One Acoustics Chapter 10 reference will need to be updated once that chapter is complete.

Chapter 4 Duct Design - Equal Friction_rev 02 w Larry Smiths Corrections 10-11-18.docx – Status:
Still should be in good shape. To handle the use of loss coefficients for VAV boxes I just said they were derived from manufactures data. Found out that Titus (Randy Zimmerman) likes to use an inlet velocity of about 2000 fpm, with box outlet velocity equal to about 1000 fpm. To calculate loss coefficient, take the static pressure drop and add the change in velocity pressure across the box which will give you the total pressure drop. Divide by the inlet velocity pressure to get the loss coefficient. Uploaded to Basecamp 11/20/18. There are two digital references, the Master Equal Friction Loss spreadsheet and the spreadsheet with the sample Equal Friction design.

Chapter 5 Duct Design - Static Regain_rev02 w LAS corrections.docx – Status:
Should also be in good shape. Same VAV Loss Coefficient solution. Also has two digital references, the Master Static Regain Design spreadsheet and the Sample Problem Spreadsheet. Uploaded to Basecamp 11/20/18.

Chapter 6 Duct Design - Local Exhaust Systems (Constant Velocity)_rev02 LS 11-26-18.docx – Status:
Steve Idem updated the equations and nomenclature and got rid of conversion constants. Pat and Larry need toreview it. Pat needs to update references. By Mid March

Chapter 7 HVAC System Air Leakage_rev00 (1)w Brooks comments.doxc – Status: Unchanged
I substantially rewrote this as “Chapter 7 HVAC System Air Leakage_rev00 (1)w Brooks comments” and uploaded it, but left the old version as well. Larry should review my changes? We don’t want this to be a leakage manual. Just show how leakage affects performance and how leakage may be avoided.

Chapter 8 Chapter 8 Fan Selection_rev01 7-27-2018 (2) w Brooks Idem 10-01-2018 (1), Status: Needs Updated
Craig Wray to review. He said it was good enough per current conditions in TC 5.1 Steve Idem reviewed and updated the Basecamp version on 10-01-2018. Needs to be finalized by Brooks

Chapter 9 Duct System Materials_rev02.doxc. Status:
Should be in good shape. I did some minor updates and uploaded it to Basecamp 10/11/18. Larry may have some additional changes

Chapter 10_Duct System Acoustics_Rev0_Jan 2018_JGB Updates_1 Brooks Review with tracking changes accepted Status:
This version has been sent to Jeff Boldt to review and add additional information. He has not responded lately. I will follow up and see if we can get is done .

Pat
01-13-19

ATTACHMENT D

DFDB (Duct Fitting Data Base) Meeting Notes, 13 January 2019

- We determined the On Line version of the data base is 6.0005 from about 1/1/2016. The cost to download the program is an annual licensing fee for members of $110 and non-members of $130
- There are problems which Steve Idem will try to address with John Downey.
    - The saddle tap data has not been added to the DFDB
    - CD11-4 does not properly converge to give the correct diameter for a given friction loss rate
    - We need to add an out of range warning when the ratio is less than 0.10 or greater than 0.90 on any range that goes below 0.10 or above 0.90

- Other problems, Steve Idem needs to review the converging exhaust fittings to see which ones have negative loss coefficients for both branches. His paper on this showed it should not happen
- The web site still shows there is a DFDB APP. Larry Smith will get with Michael Vaughn to see if it can be removed. We don't support it.

- We would like to take over complete maintenance of the DFDB, probably by contracting out to TTU. Larry will approach Michael Vaugh with this suggestion. We will need to find out the logistics to do that.

The following people attended the meeting:
Patrick Brooks Kevin Gebke
Larry Smith
David Dias
John Reints
Marty Gissle
Mike Watz
Randy Young
Hugo Aquiler
Mark Smith
Tim Eorgan
Ralph Koerber
Steve Idem

ATTACHMENT E

Code Interaction Sub-Committee Update (1-14-19)

ICC 2021 IMC, IRC, IECC Code Revision Cycle

- Action hearing meetings for IMC & IRC comments was October 24 - 31, 2018
- Voting by TC members done by November 7, 2018
- Proposal deadline for IECC was January 7, 2019
- Proposals will be posted on March 4, 2019
- TC will meet April 28 to May 8, 2019 to consider proposals

IAPMO 2021 UMC Code Revision Cycle

- Technical Committee acted on the proposals during meetings in May
    - UMC TC approved proposal from the UMC Factory-Made Duct Task Group for rewording and reorganization of duct chapter that removes reference to the term "factory-made air duct" and replaces it with individual reference to various duct types (metal, non-metallic, phenolic, fibrous glass, etc.)
- Report on proposals published August 20, 2018
- Call for comments went out on September 3, 2018
- Assembly consideration session was held on October 2, 2018
- Deadline to submit a comment on proposals and TC action was January 3, 2019
- IAPMO to publish Report on Comments by March 22, 2019
- UMC TC will meet on April 29 to May 2, 2019 to consider public comments

NFPA 90A & 90B Standards 2021 Revision Cycle

- Proposals for 2021 revision accepted until June 27, 2018
- TC meetings held October 11, 2019 to review and act on all proposals to the standards
- All previously held-over comments from the 2018 cycle were considered by the TC
    - Most comments discussed the acceptance, performance, approval, and limitations for air connectors which were not accepted by the TC
- First Draft Report will be posted on February 27, 2019

Other

- Details regarding how gypsum is covered in the current codes and standards, noted on the following pages.

2018 ICC International Mechanical Code (IMC)

SECTION 602

PLENUMS

602.1 General. Supply, return, exhaust, relief and ventilation air plenums shall be limited to uninhabited crawl spaces, areas above a ceiling or below the floor, attic spaces, mechanical equipment rooms and the framing cavities addressed in Section 602.3. Plenums shall be limited to one fire area. Air systems shall be ducted from the boundary of the fire area served directly to the air-handling equipment. Fuel-fired appliances shall not be installed within a plenum.

602.2 Construction. *Plenum* enclosure construction materials that are exposed to the airflow shall comply with the requirements of Section 703.5 of the *International Building Code* or such materials shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E84 or UL 723.

The use of gypsum boards to form plenums shall be limited to systems where the air temperatures do not exceed 125ºF (52ºC) and the building and mechanical system design conditions are such that the gypsum board surface temperature will be maintained above the airstream dew-point temperature. Air plenums formed by gypsum boards shall not be incorporated in air-handling systems utilizing evaporative coolers.

602.2.1 Materials within plenums. Except as required by Sections 602.2.1.1 through 602.2.1.8, materials within plenums shall be noncombustible or shall be listed and labeled as having a flame spread index of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E84 or UL 723.

Exceptions:

1. Rigid and flexible ducts and connectors shall conform to Section 603.
2. Duct coverings, linings, tape and connectors shall conform to Sections 603 and 604.
3. This section shall not apply to materials exposed within plenums in one- and two-family dwellings.
4. This section shall not apply to smoke detectors.
5. Combustible materials fully enclosed within one of the following:
   - 5.1. Continuous noncombustible raceways or enclosures.
   - 5.2. Approved gypsum board assemblies.
   - 5.3. Materials listed and labeled for installation within a plenum and listed for the application.
6. Materials in Group H, Division 5 fabrication areas and the areas above and below the fabrication area that share a common air recirculation path with the fabrication area.

SECTION 603

DUCT CONSTRUCTION AND INSTALLATION

603.5 Nonmetallic ducts. Nonmetallic ducts shall be constructed with Class 0 or Class 1 duct material and shall comply with UL 181. Fibrous duct construction shall conform to the SMACNA *Fibrous Glass Duct Construction Standards* or NAIMA *Fibrous Glass Duct Construction Standards.* The air temperature within nonmetallic ducts shall not exceed 250ºF (121ºC).

603.5.1 Gypsum ducts. The use of gypsum boards to form air shafts (ducts) shall be limited to return air systems where the air temperatures do not exceed 125ºF (52ºC) and the gypsum board surface temperature is maintained above the airstream dew-point temperature. Air ducts formed by gypsum boards shall not be incorporated in air-handling systems utilizing evaporative coolers.

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Exception: For ducts having a static pressure classification of less than 2 inches of water column (500 Pa), additional closure systems shall not be required for continuously welded joints and seams and locking-type joints and seams. This exception shall not apply to snap-lock and button-lock type joints and seams located outside of conditioned spaces.

2018 ICC International Residential Code (IRC)

SECTION M1601

DUCT CONSTRUCTION

M1601.1 Duct design. *Duct systems* serving heating, cooling and *ventilation equipment* shall be installed in accordance with the provisions of this section and ACCA Manual D, the appliance manufacturer's installation instructions or other *approved* methods.

M1601.1.1 Above-ground duct systems. Above-ground *duct systems* shall conform to the following:

1. *Equipment* connected to *duct systems* shall be designed to limit discharge air temperature to not greater than 250°F (121°C).
2. Factory-made ducts shall be listed and labeled in accordance with UL 181 and installed in accordance with the manufacturer's instructions.
3. Fibrous glass duct construction shall conform to the SMACNA *Fibrous Glass Duct Construction Standards* or NAIMA *Fibrous Glass Duct Construction Standards*.
4. Field-fabricated and shop-fabricated metal and flexible duct constructions shall conform to the SMACNA HVAC *Duct Construction Standards-Metal and Flexible* except as allowed by Table M1601.1.1. Galvanized steel shall conform to ASTM A 653.
5. The use of gypsum products to construct return air ducts or plenums is permitted, provided that the air temperature does not exceed 125°F (52°C) and exposed surfaces are not subject to condensation.
6. *Duct systems* shall be constructed of materials having a flame spread index of not greater than 200.
7. Stud wall cavities and the spaces between solid floor joists to be used as air plenums shall comply with the following conditions:
    7.1. These cavities or spaces shall not be used as a plenum for supply air.
    7.2. These cavities or spaces shall not be part of a required fire-resistance-rated assembly.
    7.3. Stud wall cavities shall not convey air from more than one floor level.
    7.4. Stud wall cavities and joist-space plenums shall be isolated from adjacent concealed spaces by tight-fitting fire blocking in accordance with Section R602.8.
    7.5. Stud wall cavities in the outside walls of building envelope assemblies shall not be utilized as air plenums.
8. Volume dampers, equipment and other means of supply, return and exhaust air adjustment used in system balancing shall be provided with access.

2018 IAPMO Uniform Mechanical Code (UMC)

CHAPTER 6

DUCT SYSTEMS

602.0 Material.

602.1 General. Materials used for duct systems shall comply with Section 602.2 through Section 602.8 as applicable.

Concealed building spaces or independent construction within buildings shall be permitted to be used as ducts or plenums. Gypsum board shall not be used for positive pressure ducts.

Exception: In healthcare facilities, concealed spaces shall not be permitted to be used as ducts or plenums.

602.5 Gypsum. Where gypsum products are exposed in ducts or plenums, the air temperature shall be restricted to a range from 50°F (10°C) to 125°F (52°C), and moisture content shall be controlled so that the material is not adversely affected. All gypsum products shall have a mold or mildew resistant surface. For the purpose of this section, gypsum products shall not be exposed in supply ducts.

2018 NFPA 90A

4.3 Air Distribution.

4.3.1 Air Ducts.

4.3.1.1 Air ducts shall be constructed of iron, steel, aluminum, copper, concrete, masonry, or clay tile, except as otherwise permitted in 4.3.1.2 or 4.3.1.3.

4.3.1.3 Gypsum Board Air Ducts.

4.3.1.3.1 Gypsum board having a flame spread index not exceeding 25 without evidence of continued progressive combustion and a smoke developed index not exceeding 50 when tested in accordance with ASTM E 84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or ANSI/UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials*, shall be permitted to be used for negative pressure exhaust and return ducts where the temperature of the conveyed air does not exceed 52°C (125°F) in normal service.

4.3.1.3.2 The air temperature limits of 4.3.1.3.1 shall not apply where gypsum board material is used for emergency smoke exhaust air ducts.

2018 NFPA 90B

4.2.1 Duct Materials.

4.2.1.1 Return ducts shall be permitted to be constructed of metal, of 25.4 mm (1 in.) (nominal) wood boards, or of other suitable material, provided that no material more flammable than 25.4 mm (1 in.) (nominal) wood boards shall be used.

4.2.1.2 Portions of return ducts directly above the heating surface or closer than 0.61 m (2 ft) from the outer jacket or casing of the heater shall be constructed in accordance with provisions of 4.1.1 for supply ducts.

4.2.3 Continuous Ducts.

4.2.3.1 Return air shall be conducted to the appliance through continuous ducts, except as permitted in 4.2.3.2 through 4.2.3.5.

4.2.3.2* Underfloor spaces shall be permitted to be used as plenums for return of air from rooms directly above, provided that such spaces are cleaned of all combustible material, are tightly enclosed, and are not used for storage or occupancy.

From www.gypsum.org (Gypsum Association)

VIII. MOLD, MOISTURE, VAPOR & AIR PENETRATION

Mold

Mold is actually a family of several species of fungi that can infest damp interior surfaces. They are spread primarily by microscopic airborne spores that are abundant in most environments. These fungi require three conditions to grow: oxygen, a food source, and moisture. Eliminating one of these three elements will keep mold growth in check; however, two of the three are almost impossible to eliminate: oxygen and a food source. Mold will consume any available organic nutrient, especially pollen and common house dust, which are readily available on most interior surfaces and are almost impossible to contain. So, the only one of the three elements over which we have any real control is moisture. To keep mold in check, keep moisture out.

Warning: Some varieties of mold pose a health risk, particularly to people who are hypersensitive to mold. For this reason, mold abatement should only be attempted by trained professionals.

Moisture

Gypsum board will not withstand exposure to elevated levels of moisture for extended periods. Examples of elevated levels of moisture include, but are not limited to, exposure to rain, condensation, water leakage, and standing water. Some gypsum board exposed to these conditions may not need to be replaced, depending upon the source of the moisture and the condition of the gypsum board being considered for replacement. However, if there is ever any doubt about whether to keep or replace gypsum board that has been exposed to moisture – replace it.

Vapor Penetration

The penetration and accumulation of water vapor into building cavities can lead to mold growth and the deterioration of the building materials through rot or rust. Preventing unwanted vapor penetration is generally accomplished in two ways. The first is to block moist air from entering the building cavity by closing all passages into the building cavity. The second is to install a vapor retarder in the building cavity. However, proper placement of a retarder depends on the local climate.

Air Penetration

The loss of conditioned air (heated or cooled) from the interior of a building to the exterior is a major source of energy loss. In other words, unwanted air movement through a building will increase energy costs. Air barriers help reduce unwanted air and moisture movement. Gypsum panel products, including interior gypsum wallboard and gypsum sheathing serve as air barriers when properly installed and finished. However, cracks and other openings around exterior doors, windows, plumbing, electrical boxes, etc., provide passages for air to leak in and out of a conditioned space. For this reason, it is important to fill all openings through which conditioned air can escape to the outside with caulk or another appropriate material.

ATTACHMENT F

ASHRAE 90.1 Update:

Additional discussion Expanding Title Purpose and Scope to include Sites as well as Buildings. TPS Addendum, Addendum CB

Changes were passed which encompassed:

- Air Curtains
- Fan Efficiency
- Heat Recover Chillers
- Residential Energy Recovery Ventilators
- Exhaust Air Energy Recovery
- Fan Motor selection criteria
- Boiler Efficiency Exceptions

Craig identified some errors within the calculations in Section 6.4.4.2.2. Craig submitted the corrections to these calculations which have been reviewed by 90.1 MSC and approved. These will hopefully be included within the 90.1 – 2016 errata as well as 90.1 2019.