

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 23, 2018

TC/TG/TRG TITLE Duct Design

DATE OF MEETING January 23, 2018 LOCATION Chicago, IL

MEMBERS PRESENT	TERM TO	MEMBERS ABSENT	Y E A	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
Tim Eorgan, Chair	6/30/19			Larry Smith, Section Head, CM
John Constantinide, Sec.	6/30/21		X	Chris Van Rite, Vice Chair
	6/30/18	Johnny Andersson*		Stephen Idem, Programs Chair, CM
Pat Brooks, ALI Coord.	6/30/19			Akshay Bhargava, Memb. Chair, PCM
David Dias	6/30/19			Marcus Bianchi, CM
John Hamilton	6/30/19			Mark Smith, CM
Cindy Bittel, Webmaster	6/30/20		X	Bill Smith, CM
Bill Smith	6/30/20			Edward Mosso, CM
Neal Walsh	6/30/20			Perry Philip, CM
Wes Davis	6/30/21			Vikram Murthy, CM
	6/30/21	John Gierzak		Bruce Meyer, CM
Ralph Koerber, CIS Chair	6/30/21			Suzi Agar, Guest
	6/30/22	Scott Hobbs		Ken Groeshel, CM
				Mark Terzigni, CM
				Kevin Gebke, CM
				Allison Bailes, CM
				Mark Hooks, CM
				John Reints, CM
				Jeff Boldt, CM
				Patrick Chinoda, CM
				Tim Orris, CM
				Gus Ferris, CM
				Gert Jensen, CM
				Craig Wray, CM
				Robert Hassler, CM
				Duane Smith, PCM
				Raymond Yam, PCM
				Andrew Askie, Guest

				Randy Young, Guest
				Shawn Ohara, Guest
				Valentina Hedelcu, Guest
				Mark Owen, ASHRAE Staff

*** 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-CONDITIONING
ENGINEERS**

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

ASHRAE Winter Conference, Chicago, IL

TC 5.2 Duct Design

**Tuesday, January 23, 2018
Time: 3:30-6:00 PM
Location: Logan
Palmer House, 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 10 members
- c) Quorum requires 8 members present
- d) Corrections/additions and approve agenda

Agenda: Hamilton moved, Dias seconded, Passed 8-0-0-3 CNV
(Davis stepped out of room. Walsh arrived later.)

4) **Long Beach (June 2017) Meeting Minutes.**

Minutes from the Long Beach meeting were approved by electronic ballot August 14, 2017, 8-0-1-4 CNV

5) **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.

6) **Section Head Report**

- a) Section Head 5.0 Highlights --- *The Section 5.0 Chairman's breakfast will be held in Salon #6, Palmer House on Sunday, January 21, 2018.*
- b) Please update your online ASHRAE bio

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

- a) Acknowledge our PCMs --- *mentorship* — *latch on to a member to get better acquainted with the process*
 - i) *New members over the past 6 months*
 - (1) John Reints
 - (2) Duane Smith

- (3) Harjit Singh
 - (4) Jack Pennuto
 - (5) Edward Pitochelli
 - (6) Edward Mosso
 - (7) Raymond Yam
 - (8) Jason Shelton
 - (9) Timothy Orris
- b) 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 functions.
 - c) Consulting Engineers & Contractor involvement – *Always looking for more involvement*
 - d) Any interest is being solicited by ASHRAE investigating interest regarding the topic of resiliency/natural disaster preparedness.
 - e) ASHRAE 125th Aniversary Call for Papers- Historical papers on technology and topics that occurred between 1920-2000. Accepted papers will be published and presented 2019 Annual Conference. Abstracts are due March 2018.
 - f) Education internal to the TC. We had a reflective insulation (bubble wrap) insulation presentation given during the subcommittee meeting on Monday.
 - i) Possible future sessions - Any suggestions are welcomed
 - ii) Future roundtables - We would like to entertain any ideas for future roundtables at the subcommittee meeting on Monday. Future roundtables need parties.
 - g) Honors and Awards (Steve Idem)
 - i) Steve spoke with Herman Behls' daughter and is supportive of an endowed scholarship fund or award named in his honor to support students and/or YEAs through the ASHRAE Foundation.
- 8) **Subcommittee Reports**
- a) Subcommittee meeting minutes are in **Attachment A**.
 - b) Handbook –we have two chapters—portal is available for 5.2 members can go on line to review and make changes to the Handbook in a collaborative effort.
 - i) 2020 Handbook: HVAC Systems & Equipment –Duct Construction-- David Dias, Ralph Koerber, Bob Reid
 - (1) Bob trying to get the most recently submitted chapter from PubEd Council to start work.
 - ii) 2021 Handbook: Fundamentals --- Duct Design Vikram Murthy, Wes Davis, John Constantinide, Jeff Boldt
 - (1) Chapter is current.
 - b) Membership (Akshay Bhargava)
 - i) Andersson (Non-Quorum) rolling off in 2018; Eorgan, Brooks, Dias, and Hamilton rolling off in 2019
 - ii) Interested prospective voting members: Jeff Boldt (pending VM status with SPC 180.1), Perry Philip, Kevin Goebke
 - iii) Constantinide to be TC Chair in 2019 and will need to appoint Vice Chair and Secretary
 - c) Programs (Steve Idem)
 - i) No report.
 - d) Duct Design Guide (DDG) (Pat Brooks)
 - i) DDG documents will be moved from the ASHRAE FTP site to Basecamp.
 - (1) John Constantinide will provide assistance with the document update.
 - ii) Pat Brooks tried to complete the static regain sections. Larry Smith is working on bringing together all sections.
 - iii) Intent now is to keep the guide as a fundamentals publication.

- (1) Air dispersion chapter may or may not be in the guide. Kevin Goebke is working on that chapter and, afterwards, will decide if that work will be a separate guide.
- (2) Jeff Boldt will revise acoustics chapter.
- e) Duct Fitting Database (DFDB) (Pat Brooks)
 - i) Larry, Herman, and Pat contacted John Downey, received a webinar from him, and will follow up about friction rate information. Update to be done by Houston.
 - ii) **Action Item:** Mark Terzigni will provide additional fitting data to Pat Brooks for Duct Fitting Database (DFDB).
 - iii) **Action Item:** Pat Brooks will recall the existing list to identify needs.
 - iv) Pat Brooks has additional fittings to add to the DFDB, but Larry Smith will need to assist with getting ASHRAE approval.
- f) Codes & Standards Interaction (Ralph Koerber)
 - i) Code Interaction Subcommittee Minutes is in **Attachment B**.
 - ii) IMC and IRC code cycle has started with proposals accepted until 1/8/18 and TC deliberations to take place in April.
 - iii) IAPMO UMC code cycle ended, and UMC 2018 will be printed soon.
 - (1) Appeal went to Standards Council, which lost support. Old code version put in. Standards Council approved TIA for flex bends with terminal ends.
 - (2) UMC cycle started in October with TC deliberation of proposals in May 2018.
 - (3) UMC added requirement for testing minimum 10% of duct system for leakage which normally was only in the energy code.
 - (4) 13 requirements for proper installation of flexible ducts were added to the code text.
 - (5) Requirement for gypsum ducts to have mold and mildew resistant surface. Gypsum ducts not to be used for supply.
 - (6) Joints and seams for duct systems shall comply with SMACNA duct construction standard. Closure systems for factory-made ducts and plenums must be listed and labeled to UL181A or UL181B. Added table for factory-made duct closure systems.
 - iv) Air dispersion systems listed to UL2518 were added.
 - v) 90.1 and 189.1 changes to be made. Need life-cycle cost analysis for 189.1 input. 90.1 data input proposal deadline this June.
- g) ASHRAE Learning Institute (ALI) (Pat Brooks)
 - i) Until the DDG is finished, no contact will be made to teach about the DDG.
- h) Webmaster (Cindy Bittel)
 - i) TC 5.2 Website: <https://TC0502.ashraetcs.org/>
 - ii) Website is up-to-date.
 - iii) Basecamp is available to all members and should be used as much as possible.
 - iv) **Action Item:** John Constantinide will present on Basecamp at the subcommittee meeting in Houston.
- i) Liaison Reports
 - i) 90.1 (Mark Smith/Jeff Boldt)
 - (1) Full report is in **Attachment C**.
 - (2) Looking at leakage in respect to energy consumption
 - ii) IMC ASHRAE Code Interaction of Standard Committee (John Hamilton)
 - (1) Requested ASHRAE to ask NFPA questions about an interpretation. If we want a code interpretation from ASHRAE officially, the ASHRAE President's approval is required.
 - (2) All questions were submitted personally by John Hamilton to NFPA with responses in **Attachment D**.
 - (3) Teleconference on February 5.
- j) Research (Stephen Idem)
 - i) Duct Design Guide (1180-RP): Still ongoing; completely revised the table of contents

- and chapters 2,3 and 4. See DDG report for details.
- ii) 1682-RP - This was closed out in 2017. Proposed disposition form is in **Attachment E**. This project yielded the following publications:
 - (1) Sleiti, A., Salehi, M., and Idem, S., 2017, "Detailed Velocity Profiles in Close-Coupled Elbows – Measurements and CFD Predictions," Science and Technology for the Built Environment, Vol. 23, No. 8, pp. 1212-1223.
 - (2) Salehi, M., Idem, S., and Sleiti, A., 2017, "Experimental Determination and CFD Predictions of Pressure Loss in Close-Coupled Elbows," Science and Technology for the Built Environment, Vol. 23, No. 3, pp. 1132-1141.
 - (3) Salehi, M., Sleiti, A., and Idem, S., 2017, "Study to Identify CFD Models for Use in Determining HVAC Duct Fitting Loss Coefficients," Science and Technology for the Built Environment, Vol. 23, No. 1, pp. 181-191.
 - iii) 1764-RP Determine the Absolute Roughness for Phenolic Duct Board
 - (1) Report was submitted in December. There was a meeting of the PMS in Chicago to discuss progress.
 - (2) Steve Idem gave report on effects of internal reinforcements.
 - iv) WS-xxxx Reducing Barriers to Achieving Low Leakage Air Handling Systems (Wray)
 - (1) Craig will write the Work Statement, which will be uploaded to Basecamp for TC vote. WS will require 2/3 vote in favor to approve.
 - v) WS-xxxx Test Performance Rating of Various Duct Materials
 - (1) Based on 2018 UMC code cycle to limit flex duct to less than 5 feet.
 - (2) No data is present about how much flex duct length affects airflow.
 - (3) ADI funding will be secured and will request ASHRAE for co-funding.
 - (a) May ask \$50,000 from TC 5.2 and \$50,000 from the ASHRAE Residential Committee.
 - (4) Will test a variety of conditions and options. Florida Solar Energy Center can assist with their experimental home setup.
 - k) Standards (Kevin Gebke)
 - i) All standards are completed and voted for publication or already published.
 - ii) SSPC 189.1 (Scott Hobbs/Jeff Boldt)
 - (1) Testing for 3 in. and above will be done.
 - (2) For background noise, need to add all non-human noise sources together.
 - iii) SPC 215P (Craig Wray)
 - (1) Standard is complete and voted out for publication. Will be available for purchase this spring.
 - l) Historian (Bob Reid)
 - m) TAC Liaison Report (Larry Smith)
 - i) Larry has been recently assigned as the Section 5 Head and will aim to get the Section 5 TCs to work together more.
- 9) Video about Herman Behls (Wray)
- a) Video is accessible at <https://file.ac/OUNIFO4E9Ek/>

10) Deadlines

2/9/2018 - 2018 Annual Conference (Houston) Proposals Due for Seminar, Forums, Debates & Panels

6/1/2018 - 2018 Annual Conference (Houston) Presentation Outlines Due

11) Old Business

a) Duct Design software programs

12) New Business

a. TC 5.2 and perhaps the Residential Building Committee co-funding with ADI group to fund a new research project to study system efficiency relating to various duct materials (metal duct vs flexible ducts).(Chris Van Rite)

- (1) Based on 2018 UMC code cycle to limit flex duct to less than 5 feet.
- (2) No data is present about how much flex duct length affects airflow.
- (3) ADI funding will be secured and will request ASHRAE for co-funding.
 - (a) May ask \$50,000 from TC 5.2 and \$50,000 from the ASHRAE Residential Committee.
- (4) Will test a variety of conditions and options. Florida Solar Energy Center can assist with their experimental home setup.

b. 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.

c. SPIDA is looking for engineers to join.

13) 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: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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 DDG report.	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.	Craig Wray, Jeff Boldt, Neal Walsh (to present to ABC), with John Hamilton's help publicizing	Active
1d	Develop long-range and maintenance plans for the Duct Fitting Database, including incorporation of research.	Pat Brooks, Larry Smith, Steve Idem. Refer to DFDB Subcommittee Report.	Active
2	RTAR covering cost to seal ductwork	Neal Walsh, Pat Brooks	Active

14) Adjournment

Constantinide moved. Adjourned at 5:59 pm.

Upcoming Meetings:

2018 ASHRAE Annual Conference --- Houston, TX June 23-27, 2018

2019 ASHRAE Winter Conference --- Atlanta, GA January 12-16, 2019

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

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

ATTACHMENT A

Sub-committee Meeting Minutes

Monday – January 22, 2018: 8:00 – 12:00 PM

Location:, Palmer House

Room: Water Tower, Floor 6th

Subcommittees Meeting

1. Duct Design Guide (Brooks)

Progress is being made with the guide's content, with a range of 6 months to 1 year as the additional time needed to finish the guide.

The equipment layout section may not be a fit and will be reduced as appropriate based on a motion passed by the TC at the Annual Conference in Long Beach. This version of the guide will be done only in IP units, based on a motion passed by the TC. The next version will include SI units.

2. Base Camp Instructions WEB source (J. Constantinide/C. Bittel)

Explained Basecamp functions

3. Subcommittee Work Statements

a. Future research and work statement proposals (Wray, Reid)

i. Potential TC 5.2 Research Project -- Reducing Barriers to Achieving Low-Leakage Air-Handling Systems

From disbanded MTG.EAS. Aims to look at *why* systems leak and what system component leakage looks like. AMCA has some existing data as a place to start for availability to designers via a database. Details are available on Basecamp.

At this point, it is in a proposal to DoE but not prepared as an RTAR. This is an opportunity for the TC to move forward on better understanding system leakage.

Next step: Turn the proposal into an RTAR for the TC to vote on and submit to RAC. Consider combining with other projects.

ii. ASHRAE TC5.2 Duct Leakage Data Collection Project (Reid)

Refer to research project proposal uploaded to Basecamp. Propose that TC obtain data on leakage of various duct materials as basis of comparison by testing using AMCA standards, without ASHRAE funding and funded by industry firms and institutions, before forming a research project. A test rig is estimated to cost about \$20,000. By having a self-funded or privately funded mechanism, can expedite the project start date and have flexibility with which duct materials and arrangements to test. Training of rig, if completed prior to the upcoming Annual Conference, can be done at the Annual Conference.

Suggestion by TC Members: Consistent test methods, uncertainty, and standards need to be established early when obtaining information about material and component leakage.

Test method and pursuit of new standard may be a combined effort if have similar interests. Standard 215P does address duct leakage in many respects, but not component leakage.

Next step: Turn proposal directly into Work Statement, with Dennis

Loveday's help.

Action Item: Bob Reid will form the proposal with comments and associated documentation into a Work Statement, with the help of Ralph, Craig Wray, and Eddy, and with assistance from Dennis Loveday, with a draft deadline by the end of March for approval of the full committee by letter ballot.

4. Code Interaction (Chris Van Rite)

Question brought up with UMC review. Whole system research needs to be done, which can be accommodated by Florida Solar Energy Center. Studies have been done by Air Duct Council (ADI) on flexible duct materials. ADI has voted to fully fund the project, if necessary, but the TC will solicit co-funding partners including ASHRAE, ACCA, utility companies, equipment manufacturers, etc.

Next step: Propose to Residential Committee and TC 5.2 to pursue project. Would like to test performance rating of various duct materials. Like RP 1333, utilities, ACCA, and DoE will be invited to participate.

Suggestion by Craig Wray: Look at commercial sector and define metric in light of difference of material and system leakage amounts.

Action Item: Chris Van Rite will write a draft RTAR by mid-February (targeted date to submit RTAR to RAC on March 15) for approval by the full committee via letter ballot. Ralph and Wes Davis will help. Chris will talk to Dennis Loveday for assistance.

5. Research Liaison Update (Dennis Loveday)

March 15 submission is added as an opportunity to submit RTAR, WS, and other documents to RAC. If there are any projects that will close up, all disposition documentation needs to be completed and turned in to RAC via Dennis.

6. Duct Sealant Testing @ 9:30 AM (Larry Smith, David Dias)

Discussion on the current state of duct sealants from the manufacturers' standpoints and proposal of a working group to look into this item. Refer to Handbook chapter documents distributed and, as of the meeting, uploaded to Basecamp.

Action Item: Larry Smith will assemble volunteers to write a draft Work Statement for a research project to address this topic. David Dias is willing to spearhead this effort, with Larry Smith involved.

Action Item: Volunteers are asked to e-mail Larry Smith (sh5@ashrae.net) to create a draft Work Statement for a project addressing this topic.

7. Reflective insulation (bubble wrap) presentation started at 11:00AM (Intro by Chris Van Rite)

Opportunities to present have been extended to the industry, with only one response. The presentation, "Reflective Insulation and Radiant Barriers for HVAC Applications," has been presented. The presentation offered 1 AIA LU and 1 GBCI CE to attendees.

ATTACHMENT B

Codes & Standards Interaction Sub-Committee Minutes (1/23/18)

ICC 2021 IMC and IRC Code Revision Cycle

- Proposals for IMC and IRC-M were submitted by January 8th to start off the revision cycle.
- Technical Committees to act on the proposals during upcoming meetings in April.

IAPMO 2018 UMC Code Revision Cycle Wrap-Up

- IAPMO Standards Council dismissed the appeal for the proposal that would remove the residential exception in 603.4.1 leading to a 5' limit for all flex installations, residential or commercial. The result of the Council's decision will be a return to the current 2015 language for the 2018 code printing.
- IAPMO Standards Council approved the TIA allowing use of a flex bend at the terminal ends.
- 13 requirements for proper installation of flexible ducts were added to the code text.
- Air Dispersion systems were included where listed and labeled to UL2518 and installed in exposed positive-pressure duct systems.
- Leakage testing requirements - not less than 10% of the total installed duct area or 40% if the 10% fails to comply.
- Gypsum must have a mold or mildew resistant surface when used for air ducts. Gypsum shall not be used for supply ducts.
- Joints and seams for duct systems shall comply with SMACNA duct construction standard. Closure systems for factory-made ducts and plenums must be listed and labeled to UL181A or UL181B. Added table for factory-made duct closure systems.
- Air dispersion systems listed to UL2518 were added.

IAPMO 2021 UMC Code Revision Cycle

- Proposals for 2021 UMC submitted from October 2017 through March 16, 2018.
- Technical Committee to act on the proposals during upcoming meetings in May.

Other

The Air Duct Council (ADC) offers a free flexible duct installation training course and manual on-line at www.airductcouncil.org. All contractors, inspectors, students, and other interested parties are encouraged to take advantage of this free on-line course demonstrating the proper installation practices for flexible duct installs.

ATTACHMENT C

NFPA interpretation when using air connecting passing through fire rated assemblies

Question #1: Can an air connector be used as part of HVAC duct system that passes through a rated firewall? **No**

Example: 20' of metal duct connects to 10' of air connector that connects to a metal sleeve that passes through the firewall, which extends 2" out both sides of the firewall allowing the air connector to attach to 4 feet of air connectors on the other side of the sleeve. The air connector is not going through the firewall it is used before and after the firewall and attached to metal, which is passing through the firewall.

Question #2: Can air connector be used as a section of the duct system that penetrates a fire rated assembly? **No**

Example: 20' of metal duct connects to 10' of air connector that connects to a metal sleeve that passes through the fire rated assembly, which extends 2" out of both sides of the fire rated assembly so the air connector is not passing through the fire rated assembly.

Question #3: Can an air connector be used as any part or section of duct system that terminates through a floor? **No**

Example: 20' of metal duct connects to 10' of air connector in a basement that connects to a 6" metal fitting (floor boot) that passes through the floor terminates just above the floor.

Question #4: Can air connectors be used in a return air duct run inside a mechanical room which serves floors above or outside of the mechanical room, or ducts that pass through a fire rated assembly? **No**

Example 30' metal return air duct, 3 feet of air connector attached to metal duct that is connected to the inlet of the HVAC fan.

Question #5: When gypsum wall board is used as a duct do all tapes and mastics used for sealing the gypsum duct need to be UL 181 approved? **Yes**

Background information:

The following questions were previously asked of NFPA, and the NFPA answers are attached.

Dear Mr. Hamilton,

You've asked the following questions related to NFPA 90A and I have inserted my response below each:

Question #1: Can air connector be used in any section of duct system that passes through a rated fire wall?

Response #1: No, per 4.3.2.1.4 of NFPA 90A

Question #2: Can air connector be used in a section of duct system that penetrate a fire rated assembly?

Response #2: No, per 4.3.2.1.4 of NFPA 90A

Question #3: Can air connector be used in a an part or section of duct system that passes through a floor?

Response #3: No, per 4.3.2.1.4 of NFPA 90A

As an air connector is not rated, it will quickly fail under fire/heat conditions and allow smoke/flame to pass freely from one side of the particular assembly to the other therefore defeating the purpose of the particular rated assembly.

ATTACHMENT D

ASHRAE 90.1 Liaison Report:

ASHRAE 90.1 Mechanical Subcommittee

ASHRAE 90.1 is interested in obtaining data that would allow them to understand whether changing the duct leakage testing requirements from 4" and above to 3" and up, or even lower. ASHRAE has already made this change within 189.1 based on energy savings, but would like to consider this change for 90.1, which requires an economic analysis.

To calculate the "scalar", which is basically a straight line payback with fixed energy costs, we need two things:

- Leakage data for leak tested and non-leak tested ducts in various pressure classes. There is excellent data from AeroSeal, but it is one data source and it would be beneficial to acquire additional data or independent test data.
- Cost for the leak testing, and in some percentage of cases subsequent sealing. Jeff's first thought is that this is not proportional to the duct surface area, but is something like \$X to do the test + \$Y/SF of surface area for sealing and maybe that last figure should be multiplied by the odds that any further sealing is required.

Jeff Boldt can do all the math for the economic analysis, but needs the raw data.

ATTACHMENT E

DISPOSITION OF ASHRAE SPONSORED RESEARCH RESULTS

Research Project Number and Title of Project: RP-1682 Study to Identify CFD Models for Use in Determining HVAC Duct Fitting Loss Coefficients

Sponsoring TC/TG: 5.2 Duct Design

Project Principal Investigator and Affiliation: Dr. Ahmad K. Sleiti, Ph.D., P.E., CEM; Embry-Riddle Aeronautical University (August 2013 - August 2015), Qatar University (August 2015 - present)

Date Research Completed: April, 2017

Will research be reported in special publication: _____ Yes; X No.

If so, has Special Publications been contacted? _____ Yes; _____ No.

Should research results be included in ASHRAE Handbooks? X Yes; _____ No.

If so, what chapter(s) in what volume(s)?

Chapter 21, Duct Design, in Handbook of Fundamentals

Should research results be included in and ASHRAE Standard? _____ Yes; X No.

If so, which Standard(s)? _____

Will other industry affiliates use this research (ARI, USGBC, EPA, LEED, etc.) X Yes; _____ No.

If so, which Standards, guides or publications?

ACCA. 2014. Manual D Residential Duct Systems, Third Edition. Arlington, VA: Air Conditioning Contractors of America.

ADC. 2010. Flexible Duct Performance & Installation Standards, Fifth Edition. Schaumburg, IL: Air Duct Council.

To assist MORTS in disseminating the results of ASHRAE's research, list specific organizations, companies, associations, standards bodies, government agencies (local, state, federal, or foreign), universities, or individuals who should be notified directly of the completion of the research and receive a Summary of the project and its results. (Use additional sheet if necessary).

ACCA; ADC; SMACNA

Please prepare and attach an Executive Summary of this project from the approved Final Report for this project (of approximately 800 words). The summary should include the need that, which initiated the project, the scope the results and how the results will benefit the industry and/or the public. (NOTE: The TC/TG/SPC may submit a summary that is edited from the Executive Summary in the Final Report if it so desires.)

A systematic study was performed to establish whether CFD techniques are capable of predicting pressure drop in duct fittings, including a single elbow, and close-coupled five-gore elbows having nominal diameters of 203 mm (8 in.) and 304.8 mm (12 in.) and turning radii $r/D = 1.5$. The close-coupled elbow combinations comprised either a Z-shape or a U-shape. In every instance the duct length separating the center points of the elbows was systematically varied. An experimental program was likewise conducted to

verify the CFD predictions. Zero-length pressure loss coefficients were predicted using the k- ϵ and k- ω models, as well as the Reynolds Stress Model (RSM), and compared to experimental data. Two-equation turbulence models except the k- ϵ model predicted incorrect trends when applied to flow in U- and Z-configuration ducts. However, the k- ϵ and the Reynolds Stress Models (RSM) with enhanced wall treatment were generally able to correctly predict elbow loss coefficients with an error of less than 15%. None of the two-equation and RSM models could predict the experimental velocity profiles of Z- and U- configurations accurately.

Please complete form and send to:

Manager of Research and Technical Services
ASHRAE
1791 Tullie Circle NE
Atlanta, GA 30329
MORTS@ashrae.net

Manager of Research and Technical Services will send to Special Publications, Handbook and relevant TC's, TG's and SPCs for action.