TT 2021-10-05 Duct Design for Low-static Air Handlers, A.Bailes

Allison A Bailes III, Duct Design for Low-Static Air handlers: Passive House ventilation and heating with mini splits: 2021-10-05

This evening's talk by Allison Bailes features his unique irreverent attitude towards flex duct and his serious endorsement of properly insulated hard pipe ducting assembled with low equivalent length boots and fittings.

Summary of the Links and Product references in the chat:

10:05 AM Shannon Pendleton https://www.linkedin.com/in/allisonabailes/; https://www.energyvanguard.com/about/allison-bailes-iii-phd/

10:06 AM Mark Wille double down and connect and PHollow: https://www.linkedin.com/in/allisonabailes/

10:20 AM Zack Semke @Stephen and Everyone, this blog post by Allison is a great companion piece to tonight's presentation: https://www.energyvanguard.com/blog/busting-myth-about-low-static-ducted-mini-splits/

10:34 AM Shannon | New Hope https://www.energyvanguard.com/blog/; First questions: Stephen Gibson, Tom Bassett-Dilley Oak Park

10:49 AM Ian @ Vancouver Good article I found a while back on the difference between a MERV13 and MERV13A filter (for longer filter life which doesn't degrade): https://cleanair.camfil.us/2020/07/23/camfil-air-filtration-experts-explain-merv-13-filters-commercial-building-air-filtration/

10:51 AM Tom Phillips, Davis, CA Jeff Siegel, U. Of Toronto, has done a lot of research on in use filter performance for ASHRAE etc. https://civmin.utoronto.ca/home/about-us/directory/professors/jeffrey-siegel/

10:53 AM Tom Phillips, Davis, CA re: P sensor: we spec'd that for CA State buildings, and also for sustainable, high performance schools, as I recall (https://chps.net: Collaborative for High Performance Schools) (Editor's note: Check out the white paper 'School Ventilation for COVID-19: Improve Student Health and Achievement Through Indoor Air Quality' downloadable from this website.)

11:00 AM Zack Semke https://passivehouseaccelerator.com/videos/rockwool-s-stone-wool-solution-for-passive-house-component-spotlight

11:00 AM Shannon | New Hope https://passivehouseaccelerator.com/calendar

11:03 AM Shannon | New Hope http://www.phys.ufl.edu/~liz/

11:04 AM Kevin Brennan @ NYC https://www.youtube.com/channel/UCFsq1de6hTZOuwQd46pRUQg

11:04 AM Zack Semke @Francis Video of tonight's program should be available by next Monday here: https://www.youtube.com/c/PassiveHouseAccelerator/videos

11:05 AM Zack Semke or here: https://passivehouseaccelerator.com/construction-tech-tuesday

11:05 AM Shannon | New Hope http://www.phys.ufl.edu/~liz/home.html

11:11 AM Shannon | New Hope Corsi-Rosenthal Cube https://encycla.com/Corsi-Rosenthal_Cube

11:12 AM Mark Wille Construction Tech is on LinkedIn. Please tell your PHriends: https://www.linkedin.com/groups/13919520/

11:34 AM Shannon | New Hope http://www.truaire.com/product-category/residential/return-air-filter-grille/

11:37 AM Shannon | New Hope https://www.buildingscience.com/files/building-science-boot-camppdf

11:38 AM Adam Cronk Blower door rap with original gauges! https://www.youtube.com/watch?v=nYFBjiBwMZ4

11:45 AM Shannon | New Hope https://hvacrschool.com/; https://www.communityhousingpartners.org/people/anthony-cox/

For our Global audience: Abbreviations, Slang, and Technical Terms used in the chat:

ACCA / acca – Air Conditioning Contractors of America

ASHRE – American Society of Heating, Refrigeration and Air Conditioning Engineers. An international technical society organised to advance the arts and sciences of heating, ventilation, air conditioning and cooling.

BC - British Columbia

boot - a boot is a transition piece between a duct run and the vent in a room

CA – California

CFM – cubic feet / minute

DHW – Domestic Hot Water

elbow - In duct work, an 'elbow' fitting curves to re-direct the flow of air or water by 90 degrees. Generally speaking, an elbow with large radii on both its concave (inside edge or 'throat') and convex (outside edge or 'heel') curves prevents turbulence during the fluid's change of direction, enabling flow rate to remain high as velocity remains low. A sharp, 90 degree turn in an elbow's throat causes much more turbulence than a wider, more gradual, curve.

Equivalent length – a measure of a fitting's resistance to the passage of air through it. The fitting's resistance causes the air pressure to drop. The degree to which the pressure drops is measured, then described as equivalent to the pressure drop through a known length of straight duct work.

ERV – Energy Recovery Ventilator – A type of mechanical ventilation heat recovery unit installed in Passivhaus homes. In general, where outdoor air is significantly drier or more humid than indoor air, an ERV is best. (Editor's note: this information summarised from A. Bailes, https://www.energyvanguard.com/blog/why-you-probably-need-an-erv-not-an-hrv/)

fitting - A component of an air-ducting system which links straight ducting and other components together.

heel - In duct work, at an 'elbow' shaped fitting, the heel is the outside (convex) curve.

HEPA – High Efficiency Particulate Air (filter); a HEPA filter can remove particles 0.3 microns and larger from the air. For best results, the filter should be at least 6" away from the air pipe

Hi vel - high velocity. In the context of a ventilation system, air moving quickly through the ducts will be noisier than air moving slowly. Air moves more quickly through small diameter ducts than through large ducts.

HRV – Heat Recovery Ventilator - A type of mechanical ventilation heat recovery unit installed in Passivhaus homes. In general, an HRV is most suitable for homes in mild climates. (Editor's note: this information summarised from A. Bailes, https://www.energyvanguard.com/blog/why-you-probably-need-an-erv-not-an-hrv/)

HVAC – Heating, Ventilation, Air Conditioning

IMO – In my opinion

LED – Light Emitting Diode – LED lights are highly efficient light sources requiring about 85% less electricity to deliver the same illuminance as tungsten bulbs.

Low vel – Low velocity. In the context of a ventilation system, air moving slowly through the ducts will be quieter than air moving quickly. Air moving at lower velocities through filters enables better filtration of particulate matter.

Lumencache – A proprietary LED lighting system (https://lumencache.lighting/)

Manual J – universal standards and best practice protocol developed by engineers at the ACCA to determine the amount of heating and cooling a home requires for year-round occupant comfort. Design factors considered include: number, sizes, and efficiencies of windows; local climate's average high and low temperatures and humidity; orientation to the sun; air-leakage rates of the home and the duct system; amount and quality of insulation installed; internal lighting and heat-generating appliances; number and ages of occupants

Manual D - a by-the-book methodology developed by the ACCA for designing residential ventilation systems which deliver balanced airflows through correctly sized and insulated supply and return ducts within the conditioned spaces of a home.

Manual S – specific procedures used to select specific heating / cooling equipment based upon Manual J calculated loads and design conditions. Manual S defers to the requirements of the Authority Having Jurisdiction (AHJ) (e.g. local permits, Energy Star, LEED etc.) for minimum rated efficiency values

MERV - This term refers to ASHRAE's national testing standards: MERV represents the Minimum Efficiency Reporting Value. Only ASHRE-tested filters can receive a MERV rating. The higher the MERV rating, the more efficient the air filter is at capturing airborne particles.

P drop – pressure drop

Static (pressure) / low static (pressure) – In fluid dynamics, static pressure is the pressure a fluid exerts on a body when the fluid is at rest; **Dynamic pressure** represents the pressure a fluid exerts on a body when the fluid is moving. Dynamic pressure is a function of fluid velocity and density. **Total pressure** (aka stagnation pressure) equals the static pressure plus the dynamic pressure. Keeping the static pressure of a system low avoids friction: friction leads to pressure loss. (https://www.simscale.com/blog/2018/05/what-is-static-pressure/) (Editor's note: These definitions are for those amongst us who, like me, are total neophytes with regard to fluid dynamics.)

TBD – Depending on the context: 'To Be Discussed'; 'To Be Determined; 'To be Decided'; 'To Be Done'

TEL - Total Effective Length –calculated by adding the actual length of all straight ducting runs plus the 'effective length' of all fittings used to join and configure the system. A fitting's effective length is calculated by the manufacturer based on the degree of air turbulence & friction slowing the passage of air through that fitting.

throat - In duct work, at an 'elbow' shaped fitting, the throat is the inner (concave) curve. A 'good' throat curve is wide and gradual. "A good curve on the throat is super important."

VAV - Variable Air Volume

The chat: (Note: time signatures are Australian Eastern Daylight Savings Time)

09:57 AM Daniel Levy Will I meet some of you for the first time at PHIUS next week? I hope so!

10:00 AM Reid Rowlands I'll show up with our trade show booth

10:00 AM Tom Bassett-Dilley Oak Park my god I'm gone for a few months and they come up with rockin' theme music

10:01 AM Reid Rowlands Accelerator gone total cinema mode

10:02 AM Shannon Pendleton Welcome Everyone!

10:02 AM Barbara in Oz Great intro! love the graphics - very tech-y.

10:03 AM Dan Levy, Upstate NY And Allison is a wild man at table tennis too! Hi Allison!

10:03 AM Zack Semke @TBD ;)

10:04 AM Mark Wille Hey Tom next week we replace the music with a mime ...

10:05 AM Shannon Pendleton https://www.linkedin.com/in/allisonabailes/; https://www.energyvanguard.com/about/allison-bailes-iii-phd/

10:06 AM Mark Wille double down and connect and PHollow: https://www.linkedin.com/in/allisonabailes/

10:06 AM Barbara in Oz @Mark - NOOO!!! stick with the music ☺

10:07 AM Shannon Pendleton "the Joy of Flex"

10:08 AM Andrew Bobyn | Vancouver :)

10:09 AM Zoe Kaufman The sarcasm in this presentation is inspiring!

10:09 AM S Lindsay Klein These photos make me feel good!

10:10 AM Tom Bassett-Dilley Oak Park This is as hard hitting as David Attenborough's latest

10:10 AM Shannon Pendleton & you don't even need to keep it connected!

10:11 AM Stephen Gibson Please define Low Static Air Handler.

10:13 AM Shannon Pendleton "low static pressure is caused by leaking duct work, separated duct connections, missing filters, or low fan speeds" I'm not so sure my source is right ;) @Steven we'll get Allison's definition for you during the Q&A

10:19 AM Shannon Pendleton "It's not the actual length that matters it's the total effective length (TEL)… and the fittings make all the difference"

10:20 AM Zack Semke @Stephen and Everyone, this blog post by Allison is a great companion piece to tonight's presentation: https://www.energyvanguard.com/blog/busting-myth-about-low-static-ducted-mini-splits/

10:22 AM Stephen Gibson Thanks, @Zack!

10:24 AM Tom Bassett-Dilley Oak Park Q for Allison: are the "good" fittings as readily available as lousy ones, or should we plan on longer lead times and increased HVAC bids? Let's say it's a competent HVAC sub who is accustomed to installing split systems, not just a couple knuckleheads shopping at Home Depot.

10:26 AM Aubrey Gewehr Allison, maybe mention what a good rule of thumb is for the throat radius relative to the duct width or diameter?

10:27 AM Tom Phillips, Davis, CA What is filter P drop when it is loaded?

10:29 AM Shannon Pendleton Face velocity: the measured air speed at an inlet or outlet of a heating ventilation and air conditioning (HVAC) system

10:31 AM S Lindsay Klein Does the Merv 13 filter help with muffling machine noise?

10:32 AM Jane Sanders what do you think of ducted returns to each room instead of 1 return in the hallway?

10:33 AM BEST Techs Contracting Design Build Remodel Inc. IMO - You should always have a supply and return in any room that you can close a door on.

10:34 AM Shannon | New Hope https://www.energyvanguard.com/blog/; First questions: Stephen Gibson, Tom Bassett-Dilley Oak Park

10:35 AM BEST Techs Contracting Design Build Remodel Inc. 👏

10:36 AM Tom Bassett-Dilley Oak Park Shannon, I have no mic, can't unmute--could you read my question?

10:36 AM Shannon | New Hope You bet Tom :)

10:36 AM Fred Flickinger Great clarification on the factors involved in determining a smooth low friction path.

10:37 AM Ian @ Vancouver We're using a single big head on a reno job as a furnace-like-object and using a HEPA filter on the return, and upsized it to a 24"x24"x12" industrial filter to do enough surface area ... I got to do a big deep dive into the world of static pressures on that one ... trying to design a smoke-season-handling system for a house in BC.

10:38 AM Jane Sanders If ducts are fully in the conditioned space, do they always need to be insulated? If so, what are the advantages and disadvantages of insulating on the outside of the duct vs a duct liner insulation?

10:38 AM Ian @ Vancouver ... the question would be ... what is the smallest HEPA filter you could imagine being able to get away with for a typical system, if you want to handle smoke season with a 'normal' heat pump system?

10:38 AM Adrian Balanzario / BCIT I understand that VAV boxes work better with straight intake piping to induce a laminar flow with the variable airflow. What would you recommend when angle fittings need to be used with VAV boxes?

10:41 AM Tom Bassett-Dilley Oak Park thanks!

10:41 AM Barbara in Oz Same principles as Gary Klein's DHW design!

10:43 AM Peter H. Molenaar | Oshawa ON Q : What would you suggest as the best sealant method at all air-duct joints to reduce air-flow losses ?

10:44 AM dan Schumacher 30 years ago I saw a very fast low-tech low-skill non-metal duct work small-scale residential installation using foil-faced poly-isocyanurate sheeting cut to fit in joist spaces & sealed with plastic tape but without the benefit of elbows. How Passiv is this

10:45 AM Zack Semke Hi all - thanks in advance for filling out this short survey. It helps us understand our audience and plan future programming.

10:45 AM Shannon | New Hope Next Qs from: Lindsay Klein; Jane Sanders (2); Ian @ Vancouver

10:47 AM Fred Flickinger Q why have manufacturers not included a differential pressure sensor to help remind customers?

10:49 AM Derek Cowburn LumenCache: "Put a little Active in your Passive". monitoring and alerts are critical for operational success over time.

10:49 AM Shannon | New Hope Nice Derek!

10:49 AM Ian @ Vancouver Good article I found a while back on the difference between a MERV13 and MERV13A filter (for longer filter life which doesn't degrade):

https://cleanair.camfil.us/2020/07/23/camfil-air-filtration-experts-explain-merv-13-filters-commercial-building-air-filtration/

10:50 AM Peter H. Molenaar | Oshawa ON … the tea kettle whistle as a reminder alarm. PHabulous !

10:51 AM dan Schumacher Thank you

10:51 AM Derek Cowburn @fred, compatibility issues stop this. Plus they're pinching pennies and it's additional cost. Plus service techs lobby against to some degree.

10:51 AM Tom Phillips, Davis, CA Jeff Siegel, U. Of Toronto, has done a lot of research on in use filter performance for ASHRAE etc. https://civmin.utoronto.ca/home/about-us/directory/professors/jeffrey-siegel/

10:51 AM Gene DeJoannis, CT IF the attic filter box was made out of fiberglass duct board, it would provide some muffling.

10:53 AM Tom Phillips, Davis, CA re: P sensor: we spec'd that for CA State buildings, and also for sustainable, high performance schools, as I recall (CHPS.NET: Collaborative for High Performance Schools)

10:54 AM Shannon | New Hope Thx Gene & Tom :). Qs Up Next: Ian @ Vancouver; Adrian Balanzario / BCIT; Peter H. Molenaar | Oshawa ON.

10:57 AM BEST Techs Contracting Design Build Remodel Inc. 👏👏👏

11:00 AM Zack Semke https://passivehouseaccelerator.com/event-announcements/rockwool-s-stone-wool-solution-for-passive-house

11:00 AM halc You should do a longer interview on embedded energy vs maintenance energy.

11:00 AM Shannon | New Hope https://passivehouseaccelerator.com/calendar

11:02 AM Zack Semke @halc Good thought!

11:03 AM Mark Wille Connect with Allison on LinkedIn and Thank him for presenting tonight on PHACT. https://www.linkedin.com/in/allisonabailes/

11:03 AM Shannon | New Hope http://www.phys.ufl.edu/~liz/

11:03 AM Francis Where will be the today video to upload to? Anyone points me the direction. Need to watch the video later again.

11:04 AM Shannon | New Hope @Francis ~ It will be here in 1 week: https://passivehouseaccelerator.com/calendar

11:04 AM Kevin Brennan @ NYC https://www.youtube.com/channel/UCFsq1de6hTZOuwQd46pRUQg

11:04 AM Zack Semke @Francis Video of tonight's program should be available by next Monday here: https://www.youtube.com/channel/passivehouseaccelerator

11:05 AM Francis Thanks for direction, Zack.

11:05 AM Zack Semke or here: https://passivehouseaccelerator.com/videos?videoType=construction-tech-tuesdays

11:05 AM Shannon | New Hope http://www.phys.ufl.edu/~liz/home.html

11:07 AM Tom Phillips, Davis, CA Rule of Thumb Manual J?

11:07 AM S Lindsay Klein Good HVAC design a big issue on single family residential

11:08 AM Francis Good night everyone. Need to head home now.

11:09 AM Mark Wille — Thank You to everyone for being a part of tonight. We hope to see you next week on #PHACT.

11:09 AM S Lindsay Klein — PH did an amazing presentation on fires and Passive Houses last year

11:10 AM Steven Boston MA — Great Job Allison - best to you buddy!

11:10 AM Jane Sanders — I have Merv 13 on my ERV, are the standard Mitsubishi filters ok on the minisplits then?

11:11 AM Shannon | New Hope — Corsi-Rosenthal Cube https://encycla.com/Corsi-Rosenthal_Cube

11:12 AM Gene DeJoannis, CT — For a HEPA filter you need a special mounting frame to keep air from leaking around the frame.

11:12 AM Mark Wille — Construction Tech is on LinkedIn. Please tell your PHriends: https://www.linkedin.com/groups/13919520/

11:13 AM Shannon | New Hope — Up next: Adrian Balanzario / BCIT; Peter H. Molenaar | Oshawa ON; dan Schumacher

11:13 AM Jackson Lehr — I think Minotair units use MERV-15.

11:15 AM Ian @ Vancouver — the only HRV I know of that does handle a HEPA filter is the Venmar X24 or the EVO5 700 (which is small) ... but the efficiency of either is lower than we're used to in the PH world

11:17 AM Gene DeJoannis, CT — Adrian, On VAV systems you can reduce the pressure drop at the box by having the control system check all the boxes and reset the supply air pressure to keep at least one box 100% open.

11:18 AM Shannon | New Hope — Thx Gene!

11:18 AM Derek Cowburn — Has anyone tried Flair VAV? Duct vent controls.

11:18 AM Ian @ Vancouver — gottta go all! ... great talk tonight!

11:18 AM Gene DeJoannis, CT — The controls will keep dropping the pressure until one VAV box opens to 100%

11:19 AM Mark Wille — Right on Kevin... QUESTIONS You should be ASKING.

11:19 AM Andy Solages — I'm off to put the babies to bed. This was wonderful, Allison. Thanks, PHA.

11:20 AM Mark Wille — Those attending PHIUS CON please take photos and share on social media. #PHACT

11:24 AM Adrian Balanzario / BCIT — Thank you all

11:25 AM Shannon | New Hope — PRE-PHab Ducts!

11:25 AM Zoe Kaufman @Denver — If you're on larger properties where they don't put the roof on until after duct work, use non-water-soluble mastic

11:29 AM buckmoorhead — Thank you Allison and all!

11:32 AM Shannon | New Hope — Fred Flickinger; Jane Sanders; Tom Phillips, Davis, CA; Adam Cronk

11:32 AM Barbara in Oz — @ Kevin - Are Building Science summer camp sessions recorded and put online somewhere?

11:32 AM Kevin Brennan @ NYC — they are not recorded

11:32 AM Nitin — Thanks for the great presentation.

11:33 AM Andy Mroczek Seattle — Thank you for the info and have a good night all.

11:33 AM Shannon | New Hope Barbara you'll have to go to camp :)

11:33 AM Paul Thompson | BluPath | Philly Thanks, Alison. I learned so much. Another great Tech Tuesday.

11:34 AM Barbara in Oz We're still in lockdown here n Oz - our international borders are closed. Maybe next year! also - where exactly are they?

11:34 AM Shannon | New Hope http://www.truaire.com/product-category/residential/return-air-filter-grille/

11:36 AM Allison Bailes How Often Should You Change the Filter https://www.energyvanguard.com/blog/how-often-should-you-change-hvac-filter

11:37 AM Shannon | New Hope https://www.buildingscience.com/files/building-science-boot-camppdf

11:38 AM Adam Cronk Blower door rap with original gauges! https://www.youtube.com/watch?v=nYFBjiBwMZ4

11:40 AM Kevin Brennan @ NYC thanks adam great video!

11:40 AM Shannon | New Hope Last Q from Adam Cronk! :)

11:41 AM Derek Cowburn Mark's "locker chart"

11:41 AM Shannon | New Hope Pheel Phree to add if you're pondering on any HVAC troubleshooting on your projects :)

11:41 AM Sandra Rohler Thanks Allison. Great presentation and great discussion!

11:42 AM Tom Phillips, Davis, CA I confess that I did not have our duct work design checked (Manual J calms) for a major remodel in 1992. I was short on cash and somewhat naive. So now I live with some flex duct work that does not flow very well in the remodelled part.

11:45 AM Shannon | New Hope https://hvacrschool.com/; https://www.communityhousingpartners.org/people/anthony-cox/

11:49 AM Rohan Walters (he, him)(Toronto) Thank you Allison!

11:49 AM S Lindsay Klein good night everyone1

11:50 AM Derek Cowburn I'm flying to US Oct 25 so I'll miss it but trying to get a few lumencache reps there 😟

11:51 AM Adam Cronk Thanks Allison and crew!

11:51 AM Derek Cowburn thanks Allison!