May 11, 2021 @ 1:00pm
Christopher Hine (PHRC)

Air Sealing Tips, Tricks, and Details

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Program Description

- Air sealing continues to be a great area to increase energy efficiency and, in some cases, a trouble spot to meet code compliance. In this webinar, we will look at a few specific areas that are sometimes hard to seal and review a couple techniques for each to achieve compliance.

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Program Objectives

- Review the 2015 IRC and IECC requirements on air leakage.
- Understand the physical transition of a home with a higher leakage rate to a home with a lower leakage rate and how that change can affect the sustainability of building components.
- Learn why air sealing is important to the occupant comfort and health by not allowing air infiltration from potentially contaminated areas.
- Review air sealing techniques that can help achieve this lower prescriptive standard.

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Today's Agenda

- Why air seal?
- Air sealing and energy efficiency
- Air infiltration and the code
- 5 key trouble spots in air sealing

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Why Air Seal?

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The Leaky Boat Principle

- What's a better solution?

Larger bilge pump
OR
Fix the leak

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The Wind Breaker Principle

- What's a better solution?

Heavy cable knit sweater?
OR
Medium weight parka?

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Then Why Would We Claim "The Home Needs To Breathe??"

- Air leakage - significant source of heat loss (convection)
- Air sealing often considered most cost-effective way to save energy in a house
- Intent: Create a controlled air exchange

"Let the House Breathe"
vs.
"Build Tight / Ventilate Right"

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Then vs. Now

- "Old homes were able to breathe" was not a construction technique
- It was a product of:
  - Lack of air sealing building science technologies
  - Lack of commonly used air sealing materials
  - Relatively low cost of heating
    - Wood
    - Coal
    - Oil

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The Goal with Air Sealing

- **Energy savings through:**
  - Fewer units
  - Smaller units
  - Reduction in energy loss through convection
- **Consumer comfort by:**
  - Reducing temperature irregularities
  - Reduction in cold/hot spots
  - Lower utility bills
  - Better IAQ
    - Healthy Homes

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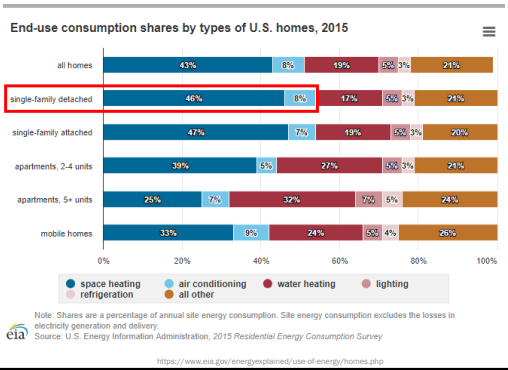

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Air Sealing and Energy Efficiency and Potential Savings

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Understanding the Costs

Upfront purchase price / Mortgage cost / Fixed

Vs

Monthly expenses / Operating cost / Variable

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Case Study

- Parameters
  - 2-Story Home
  - 2200 sq. ft. above grade
  - Conditioned basement
  - Total conditioned area: 3214 sq ft
  - Heating / Cooling system – Heat Pump
- *Disclaimer
  - May want to discuss with your energy rater using your parameters

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7 ACH_{50} - Pre 2018

- Heating - $1538
- Cooling - $57
- Total - $1595

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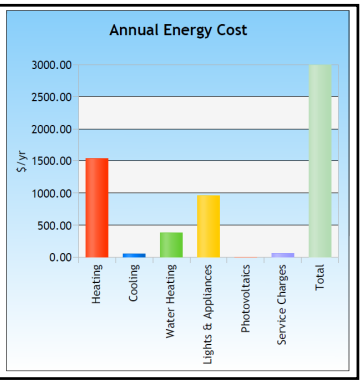

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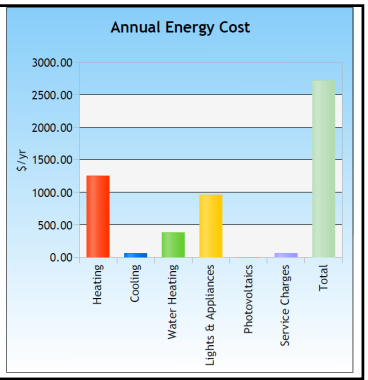
5 ACH_{50} – 2018 through 2021

- Heating - $1256
- Cooling - $60
- Total - $1316

- Difference from 7 to 5 ACH_{50} = $279 or 18% reduction



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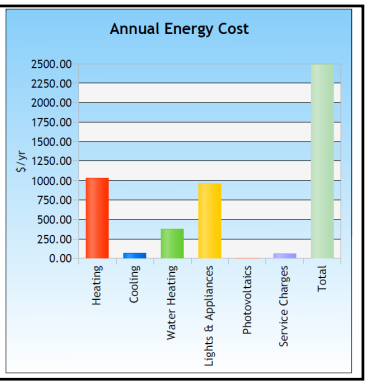
3 ACH_{50} – 2022+

- Heating - $1027
- Cooling - $65
- Total - $1092

- Difference from 5 to 3 ACH_{50} = $224 or 17% reduction



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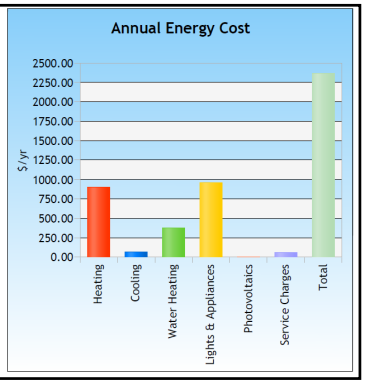
1.5 ACH_{50} – Above Code

- Heating - $900
- Cooling - $68
- Total - $968

- Difference from 3 to 1.5 ACH_{50} = $124 or 12% reduction



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Final Look at the Numbers For 3 ACH_{50}

- 2200 sq.ft. home @ $175/sq.ft. = $385,000 (sales price)
- Example air sealing package for 2200 sq.ft home = $700.00
  - 0.2% Cost of the sale of this home
- Annual energy savings of $224/yr.
- $224 x 13 years* = $2912 in potential energy savings

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* Median duration of homeownership in the U.S. - https://www.nar.realtor/blogs/economists-outlook/how-long-do-homeowners-stay-in-their-homes

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Air Infiltration and the Code

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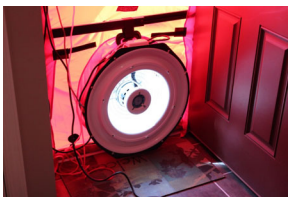
2015 IECC Section R402.4.1.2 *Modification*

2015 IRC Section N1102.4.1.2

- **Topic:** Air leakage testing
- **Code Section Summary:** 2015 IECC mandates air leakage testing and the rate to not exceed 3ACH50 in climate zones 3-8
- **PA Amendment:** Changes the requirement to not exceed 5ACH50 in climate zones 1-8



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Source: International Code Council. (2014). 2015 International Energy Conservation Code, ICC Country Club Hill, Ill.

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Moving Forward

- The testing requirements for air leakage in all Pennsylvania climate zones will move to not exceeding 3 ACH_{50}
- For more information on how we got here, please keep a lookout for upcoming UCC webinars.

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What is the Timeline?

- Contracts signed prior to the effective date of regulation (early 2022) and construction permits applied for within six months of the effective date of the regulation will be under the 2015 IRC (5 ACH_{50})
- Contracts signed on and after the effective date of regulations (early 2022) will fall under the 2018 IRC (3 ACH_{50})

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Phase-In Period

- Act 36 of 2017
  - Where a design or construction contract was signed before the effective date of regulations for a subsequent Uniform Construction Code or International Fuel Gas Code issued under this act, the permit may be issued under the Uniform Construction Code or International Fuel Gas Code in effect at the time the design or construction contract was signed if the permit is applied for within six months of the effective date of the regulation or the period specified by a municipal ordinance, whichever is less.

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5 Key Trouble Spots

https://insulationinstitute.org/wp-content/uploads/2019/03/NAIMA_5-Priority-Air-Sealing-Locations-for-New-Homes.pdf

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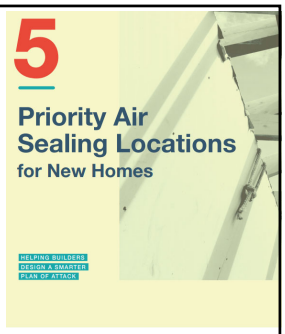
"Achieving airtight structures can be a difficult task since the typical residence has nearly one mile of exterior joints that can leak air." – Home Air Leakage Solution by Owens Corning



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https://insulationinstitute.org/wp-content/uploads/2019/03/NAIMA_5-Priority-Air-Sealing-Locations-for-New-Homes.pdf

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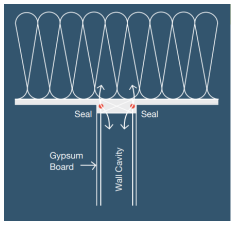
#1 – Seal the Wall / Ceiling Joint

- This is often sealed at the exterior wall
- Often missed on interior partitions
- More than tape and compound needed
- Potential reduction: ~1.6 ACH50



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https://www.builderonline.com/building/building-enclosure/air-sealing-whys-and-hows_o
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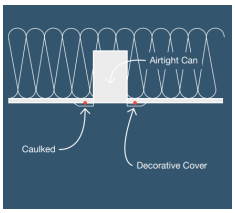
#2 – Seal Recessed Lights, Ceiling Boxes & Bath Fans

- Most units are "airtight"
- Must use airtight cover or seal to drywall
- This includes bathroom fans and other fixture boxes in the ceiling
- Potential reduction: ~0.2+ ACH50



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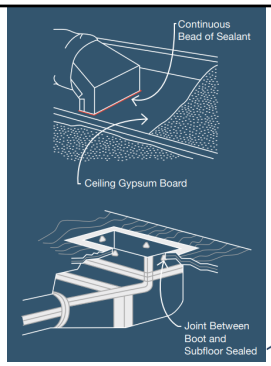
#3 – Duct Boot Sealing

- Duct to boot is usually sealed
- Boot to surrounding surface often overlooked
- Allows conditioned air to leak into unconditioned area
- Potential reduction: ~0.2+ ACH50



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Caulking the perimeter of the duct boot prevents air leakage.

https://www.builderonline.com/building/building-enclosure/air-sealing-whys-and-hows_o

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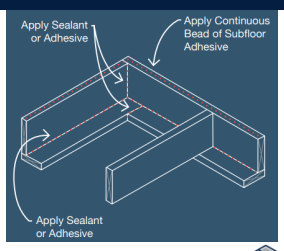
#4 – Seal Band Joist

- Often simply overlooked
- If over looked, it's usually not isolated. It will be the entire perimeter x2.
- Potential reduction: ~0.4 ACH50



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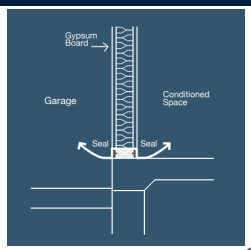
#5 – Seal Wall Conditioned and Unconditioned Space

- This wall can be overlooked and seen as an "interior wall"
- Not limited to bottom plate
- Penetrations are also overlooked
- Potential reduction: ~0.2+ ACH50



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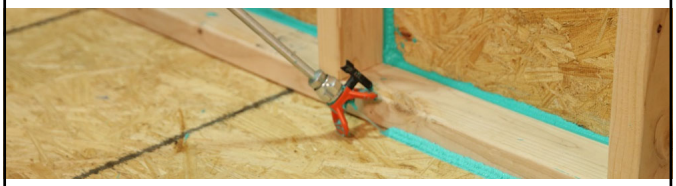

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Image Source: http://www.touch-n-seal.com/airstop.html

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Sole plates should be sealed to the floor and to the sheathing.

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https://www.builderonline.com/building/building-enclosure/air-sealing-whys-and-hows_o

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Bonus Trouble Spot

- Transition between concrete and wood.
  - Framed wall and slab on grade
  - Framed wall and stem wall
  - Sill plate and foundation wall

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Image Source: https://www.jlconline.com/how-to/exteriors/sealing-the-foundation-to-the-framing_o

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Moving From 5ACH$_{50}$ To 3ACH$_{50}$

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Looking at the Numbers

- **5 Trouble Spots**
  - Wall to Ceiling joint – 1.6 ACH$_{50}$
  - Recessed Lights, Ceiling Boxes & Bath Fans– 0.2+ ACH$_{50}$
  - Duct Boot Sealing – 0.2+ ACH$_{50}$
  - Sealing the Band Joist – 0.4 ACH$_{50}$
  - Seal Between Conditioned and Unconditioned– 0.2+ ACH$_{50}$

  - Total Potential ACH$_{50}$ Reduction – Up to **2.6 ACH$_{50}$**

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Moving Into 2022

- Baseline should already be established
- More attention given to just these 5 areas can help soften the change from 5 to 3 ACH_{50}

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Summary

- Functioning whole house mechanical ventilation system is critical
- Seal the "Connection Points"
- Air sealing scope of work – Does it need to be more in depth?
- A house can't be too tight but must be properly ventilated
- Building in predictability
- Marketing – Set yourself apart with Building Science
- Have the conversation with your Energy Rater NOW

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Questions?

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Resources

- Insulation Institute "Priority Air Sealing Locations for New Homes" - https://insulationinstitute.org/wp-content/uploads/2019/03/NAIMA_5-Priority-Air-Sealing-Locations-for-New-Homes.pdf
- Matt Risinger "Super Sill Sealer" video - https://www.youtube.com/watch?v=wXsUnZ4NYZ4
- Builder Online "Air-Sealing Whys and Hows" - https://www.builderonline.com/building/building-enclosure/air-sealing-whys-and-hows_o

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