

Field Fusion Air Seal Smarter!



 energyLogic

Presented by Nathan Kahre

Today's Host: The NoCo HBA

Nikki Giordano, Executive Officer

The NoCo HBA is a group of building professionals committed to raising the profile of the industry and helping our community thrive. Through advocacy, education and networking, our members find success.

The NoCo HBA was chartered in 1967. It represents every segment of the residential building industry in 54 municipalities and eight counties, including Greeley, Loveland, Windsor, Fort Collins and surrounding areas.



Click [here](#) to visit NoCo HBA's website.

Nathan Kahre



Business Development Manager

After graduating with a master's degree in building science from Appalachian State University, Nathan came to the Denver metro area to work for a high-performance production home builder. Time spent working for a builder has helped Nathan understand what is important to builders and what information they need to get the job done.

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No Need for Air Sealing Confusion!

Failed blower
door test?

Worried about
meeting 3
ACH50?



Image credit: Nathan Kahre, EnergyLogic.

Why Do We Care About Air Sealing?

Code Requirement

Starting in the 2012 IECC Blower Door testing is mandatory.

Occupant Comfort

Drafts and air leaks lead to comfort complaints.

Indoor Air Quality

Keeping outdoor air out keeps smoke, pollen and other contaminants out too.

Energy Cost Savings

Reducing air leakage by 1 ACH50 can save **hundreds** of dollars a year for homeowner.



Code References to Review

Table N1102.4.1.1 – Air Barrier and Insulation Installation

- Long table listing code require areas to be air sealed and insulated.

N1102.3.1.2 Testing

- Details the test methods and requirements for air leakage testing.

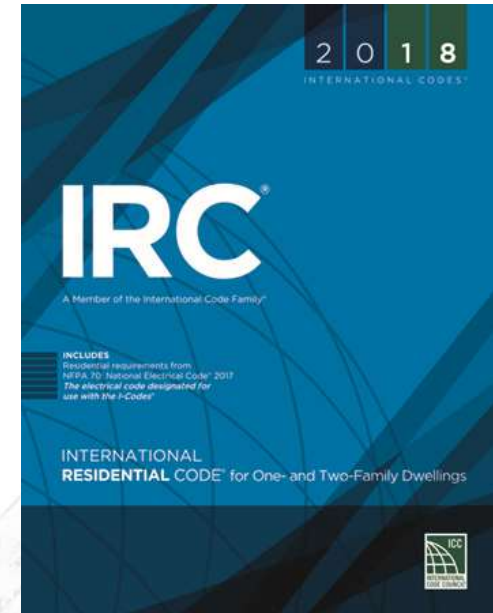


Image Source: [International Code Council](https://www.icc-inc.org/)



The Top Two Things to Remember

1. Only solid materials stop air.
 - Materials like fiberglass insulation can only slow air down.
2. Air leakage happens at edges, corners, and transitions.
 - Air leakage does not occur in the middle of the wall.

We are not going to talk about all points of air leakage, only the most important ones!



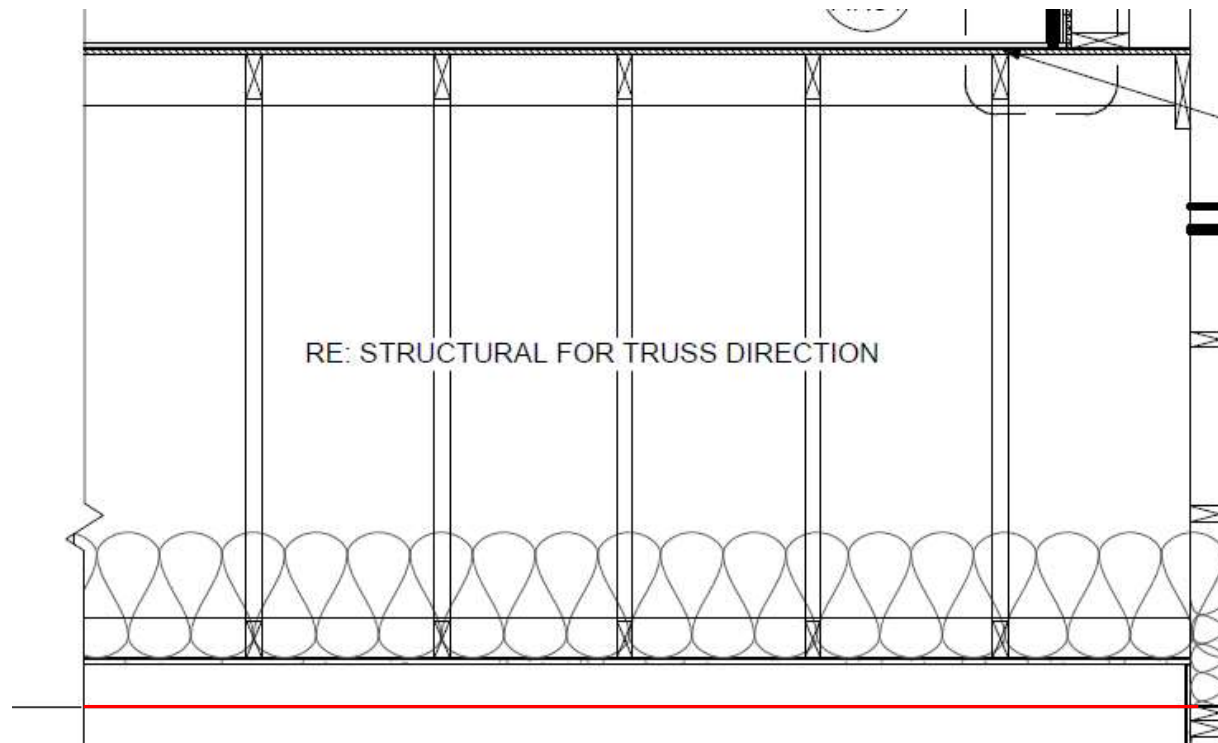
What Is an Air Barrier?

“Air barrier - Any part of the building shell that offers resistance to air leakage. The air barrier is effective if it stops most air leakage. The primary air barrier is the most effective of a series of air barriers. (Kriger & Dorsi, 2004, pg. 251)”

- It is what stops air from moving in or out of the building.
- Where are they?



Are They Found in the Ceiling?



Drywall is the only air barrier between top floor and attic.

Example diagram image created by EnergyLogic.

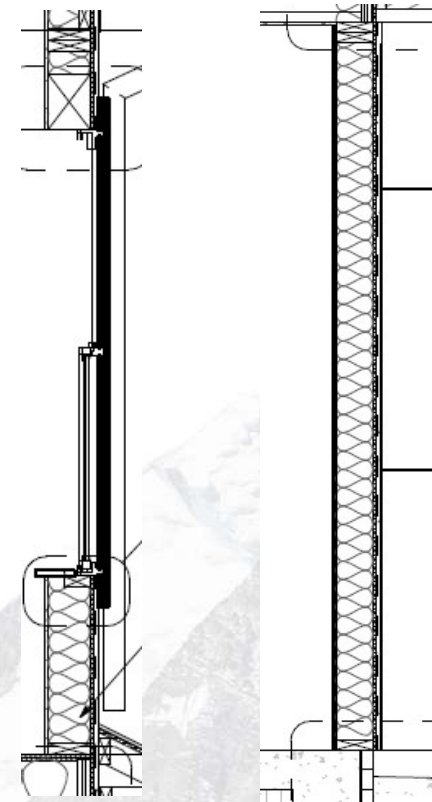
Are They Found in the Exterior Walls?

Materials in play:

- Drywall
- Framing
- Windows
- OSB sheathing
- Housewrap
- Exterior finishes

Reality:

None are perfect air barriers, and we use all of the above.



Example diagram image created by EnergyLogic.

What is ACH50?

ACH50

Air Changes per Hour at 50 Pascals of Pressure.

CFM50

Cubic Feet per Minute at 50 Pascals of Pressure.

- Number from Blower Door test

Formula

$$ACH_{50} = \frac{CFM_{50} \times 60 \text{ min/hr}}{\text{Volume of Home}}$$



Image credit: Nathan Kahre, EnergyLogic.

Quick Fixes to Look For

If You Are Failing a Blower Door Test

A hole in the
rim joist

Unadjusted door
thresholds

An unsealed
attic hatch

A hole in the
drywall

An open
damper



What Areas Should You Focus On Next?

1. Person size holes in the drywall
2. Holes to outside
3. Top plate to drywall intersection
4. Recessed lighting
5. Duct boots from unconditioned spaces
6. Band joist



Two Sample Homes

Impacts on ACH50

Two-Story Townhome With Attached Garage

- Area – 1,300 SF
- # Floors – 2
- Volume – 13,000 CF
- 3.0 ACH50 Target – 650 CFM50

Two-Story Single-Family Home With Attached Garage

- Area – 3,500 SF
- # Floors – 2 & BSMT
- Volume – 37,300 CF
- 3.0 ACH50 Target – 1865 CFM50

“Characterization of Air Leakage in Residential Structures” – Isolated and Tested the Air Leakage in assemblies and homes. We will use their values to estimate the air leakage at each of these areas.

1. People Sized Holes in the Drywall

Main Locations

- Duct chases
- Fireplaces
- Dropped soffits
- Behind tub or showers

Why?

- Ensuring a consistent air barrier at the attic and reinforcing the imperfect air barrier at the exterior walls.

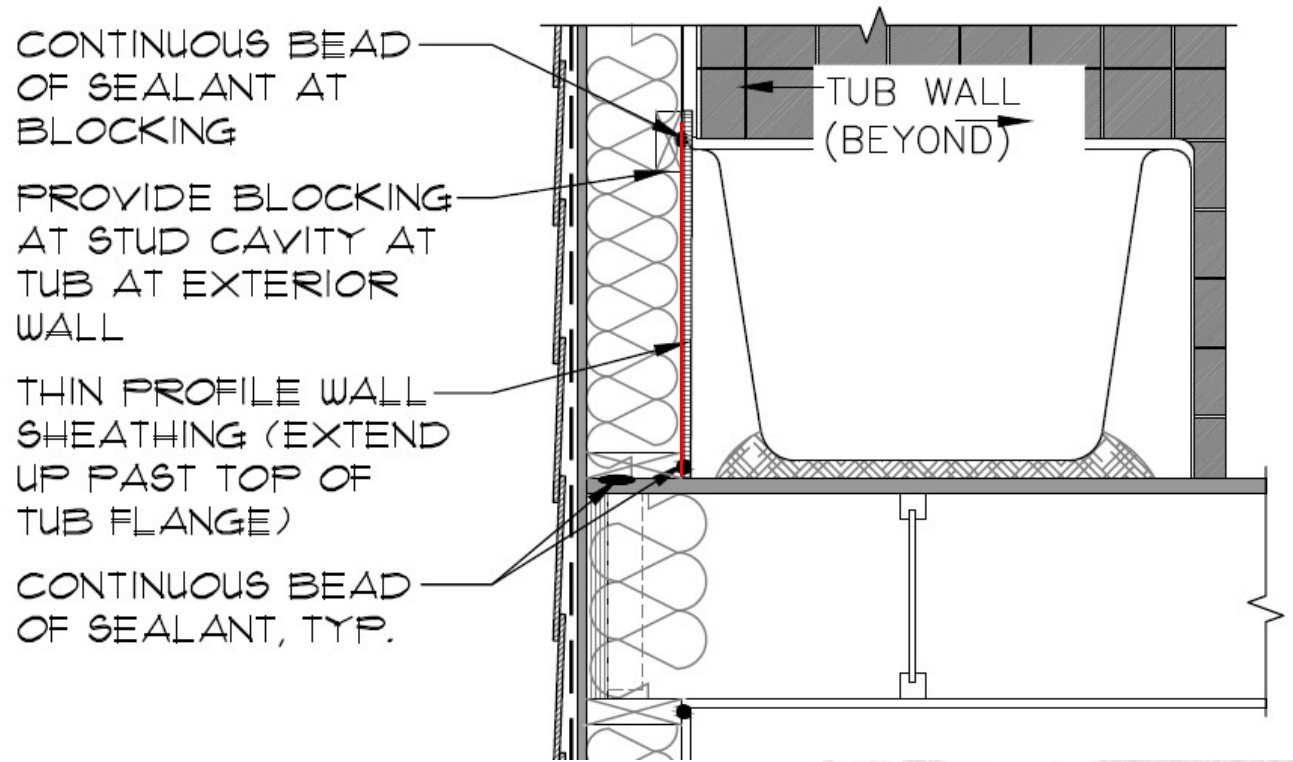
How Much Air?

- A lot



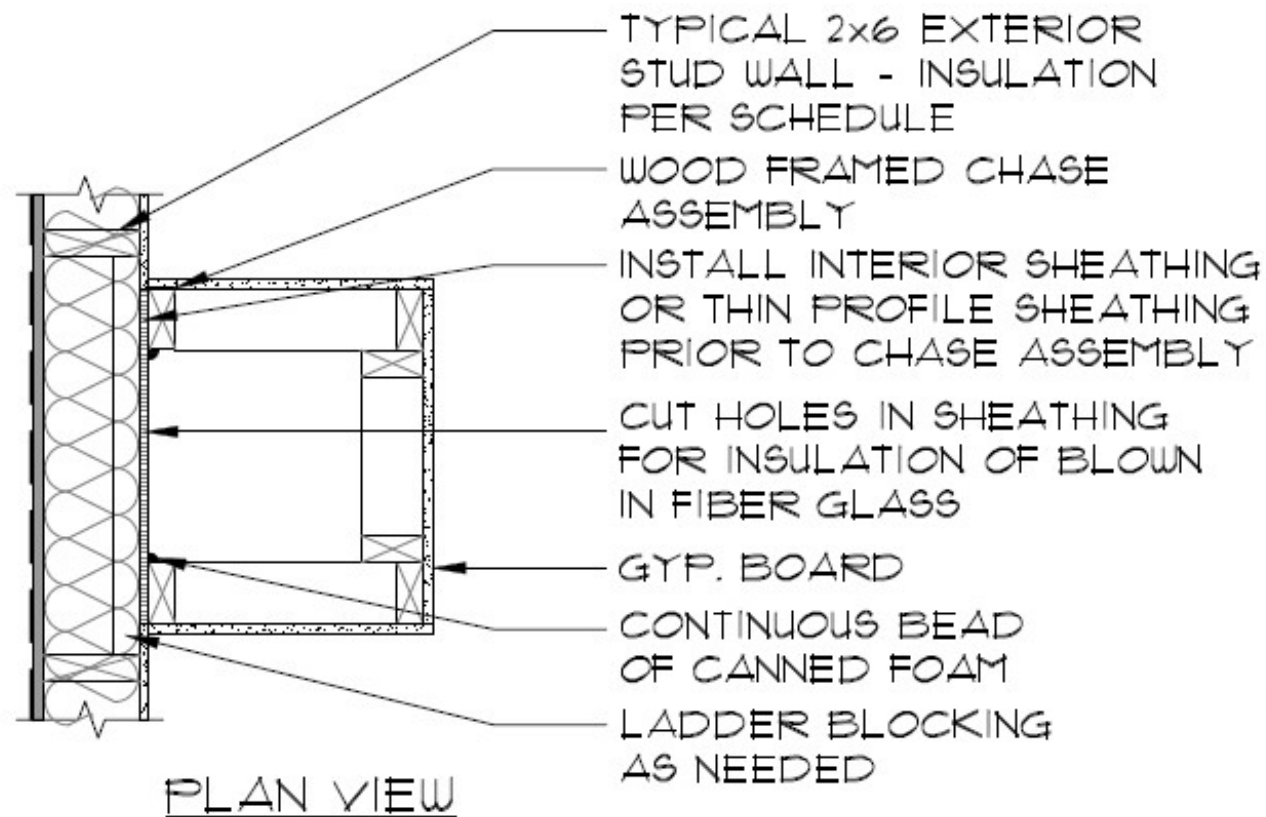
Image credit: Nathan Kahre, EnergyLogic.

At Bathtubs or Showers



Detail Created By EnergyLogic.

At Vertical Chase



Detail Created By EnergyLogic.

2. Holes to Outside

Main Locations

- Atmospherically exhausted equipment
- Make up air intakes

Why?

- ANSI/RESNET/ICC 380 -19
 - 4.2.11.5 – “non-dampered intentional openings between Conditioned Space Volume and the exterior... shall be left open.”

How Much Air?

- 6" Round Opening Can Lead to Over 120 CFM50.
- ACH50 Impact
 - Townhome - 0.50 ACH50
 - Single-Family Home – 0.20 ACH50



3. Top Plate to Drywall Intersection

Main Locations

- Gap between drywall and top plate
- Penetrations in top plate

Why?

- Air leaks from bottom of drywall and any holes up and out the top of the wall

How Much Air?

- 1.75 CFM50 Per LF of Joint
- ACH50 Impact
 - Townhome
 - 293 LF of Joint = 512 CFM50 = 2.3 ACH50
 - Single-Family Home
 - Over 400 LF of Joint = 695 = 1.11 ACH50

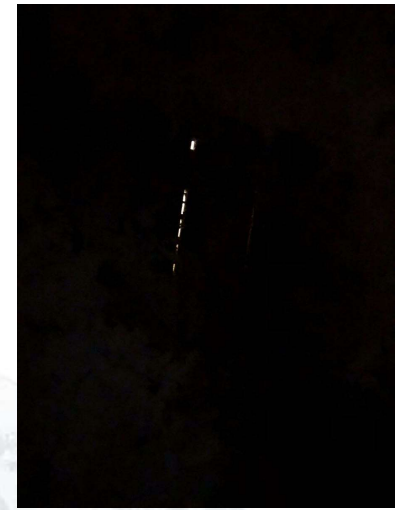
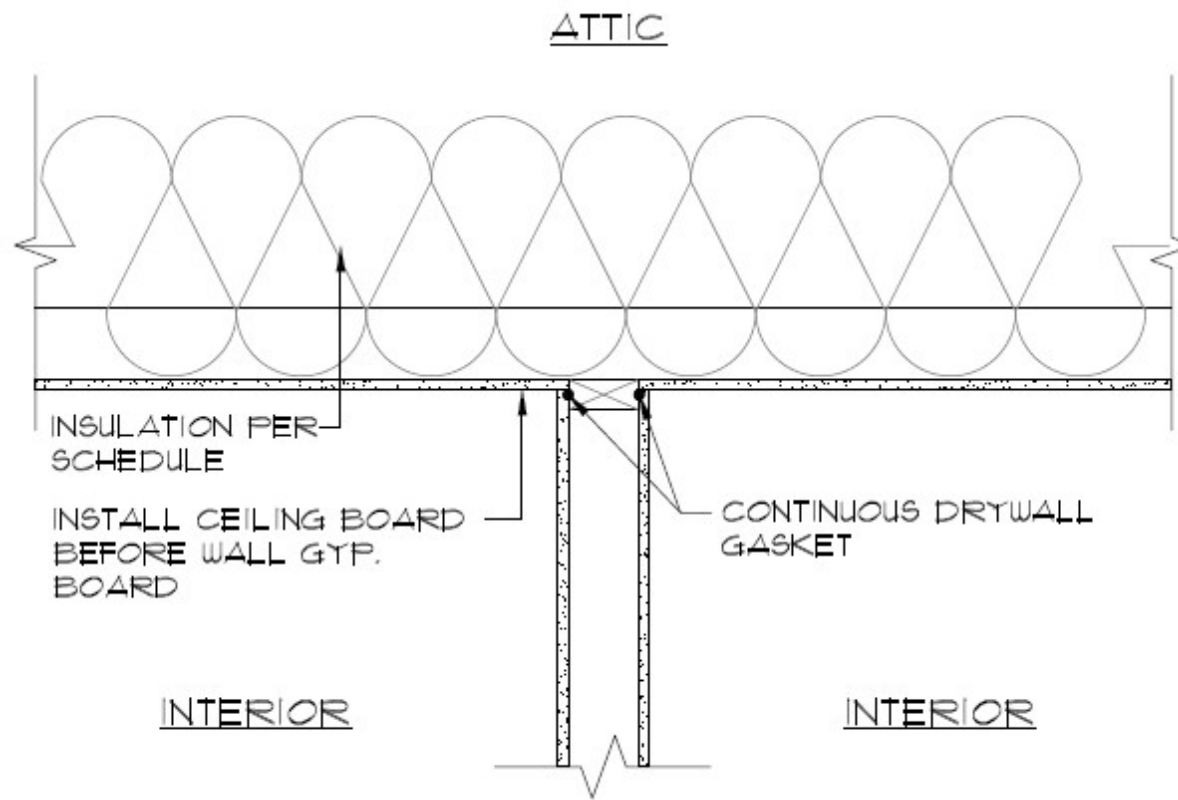


Image credit: Greydon Studor, EnergyLogic.

Top Plate to Drywall Intersection (1 of 2)



Detail Created By EnergyLogic.

Top Plate to Drywall Intersection (2 of 2)



Image credit: Nathan Kahre, EnergyLogic.

Trade Coordination Is Key



Image credit: Greydon Studor, EnergyLogic.

Remember Penetrations In the Top Plate

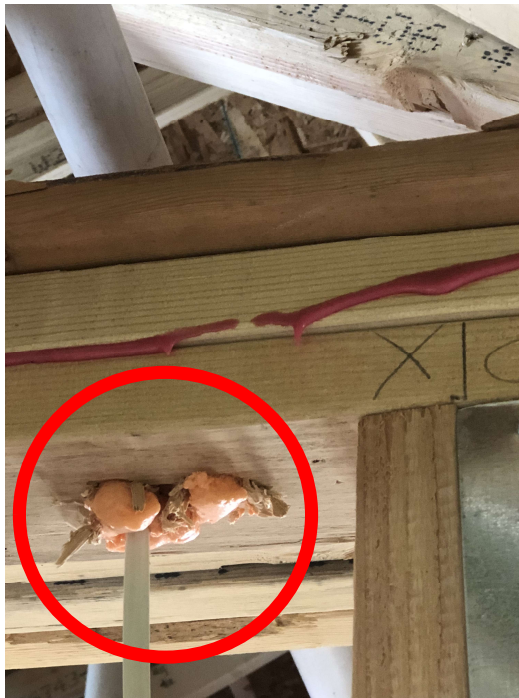


Image credit: Nathan Kahre, EnergyLogic.

4. Recessed Lighting

Main Locations

- Lights and penetrations in the top floor drywall lid.

Why?

- Holes in the drywall are directly connected to outside.

How Much Air?

- 9 CFM50 Per Can Light
- ACH50 Impact
 - Townhome
 - 16 Lights = 144 CFM = 0.66 ACH50
 - Single-Family Home
 - 27 Lights = 243 CFM = 0.4 ACH50

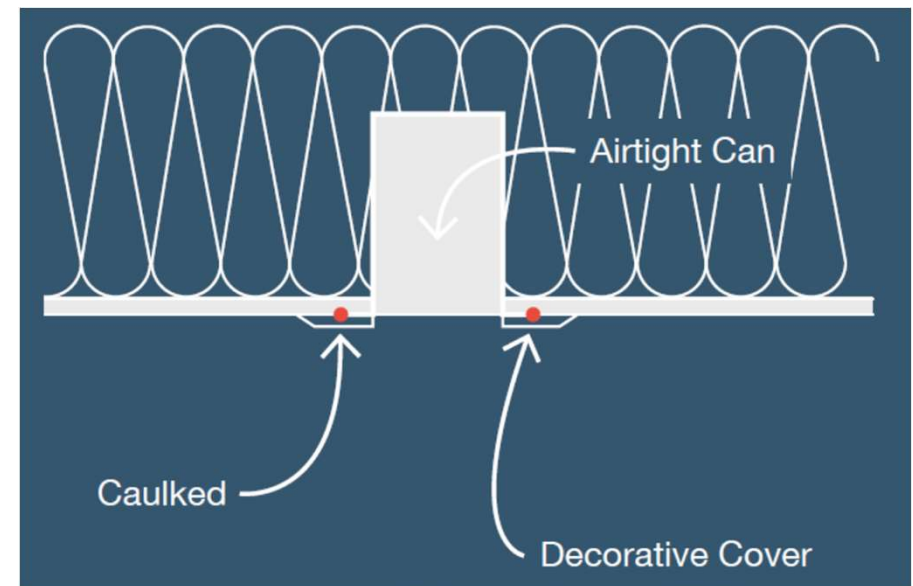


Image Credit [Energy Efficiency & Renewable Energy](#)

Seal All Can Lights & Electrical Boxes in the Ceiling



Image credit: Nathan Kahre, EnergyLogic.

5. Duct Boots from Unconditioned Spaces

Main Locations

- Ducts from attic or from unconditioned crawlspace

Why?

- Edges around the duct are holes for leakage

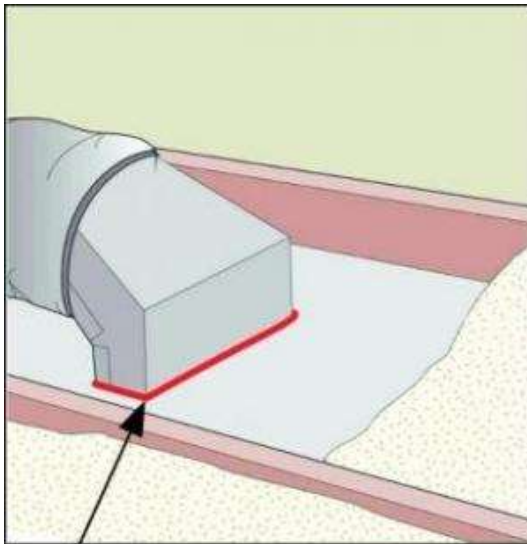
How Much Air?

- 7.5 CFM50 per duct boot.
 - Both homes have ducts in conditioned space, but still have bathroom exhaust fans.
- Townhome
 - 23 CFM50 = .1 ACH50
- Sing-Family Home
 - 30 CFM50 = .05 ACH50



Image credit: Nathan Kahre, EnergyLogic.

Subfloor or Attic Lid?



- Caulk with a continuous bead of sealant



Image Source: [Energy Efficiency & Renewable Energy](#)

6. Band Joist

Main Locations

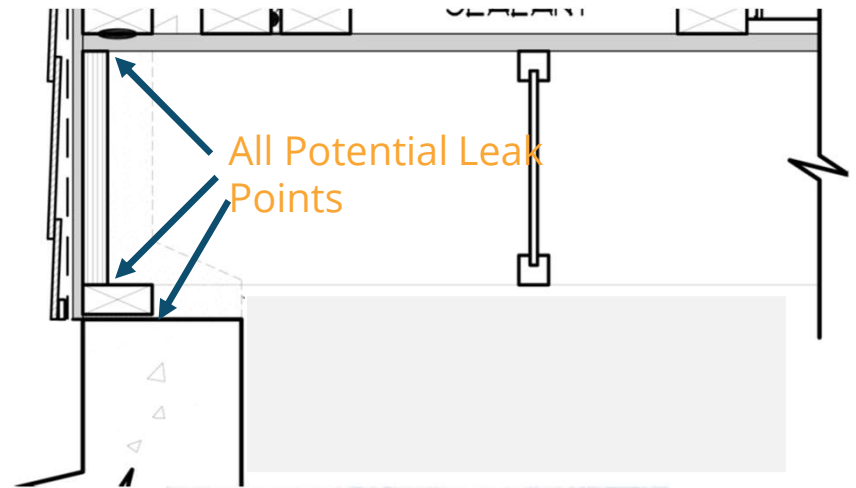
- Sill plate to foundation
- Bottom of band joist to plate
- Top of band joist to subfloor

Why?

- Joints between members aren't perfect and will leak air.

How much air?

- Combined leakage of 0.87 CFM50 per LF
- Townhome
 - 96 LF = 84 CFM50 = .38 ACH50
- Single-Family Home
 - 306 LF = 260 CFM50 = .40 ACH50



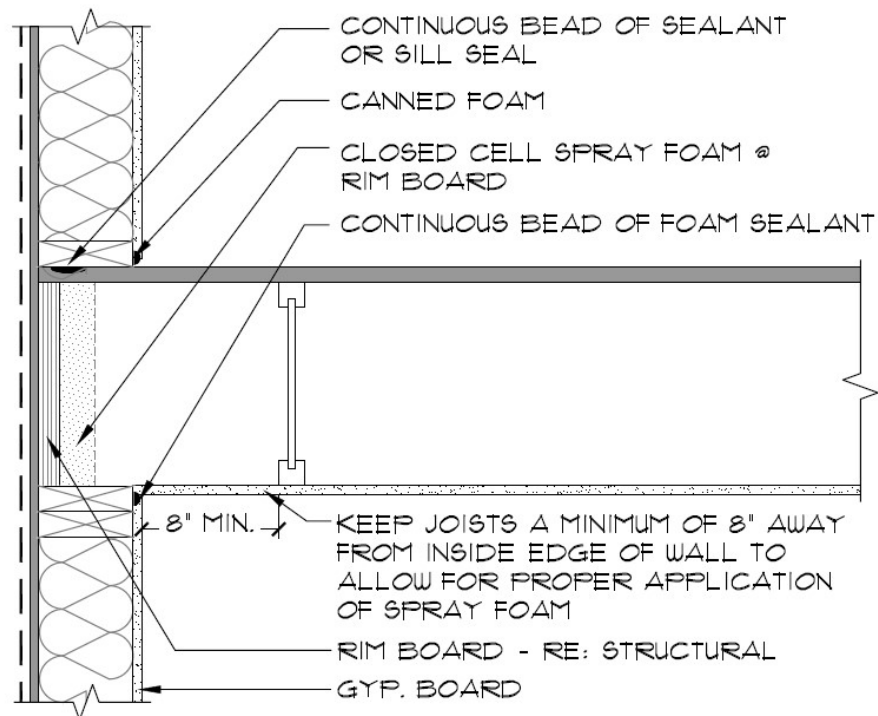
Example diagram image created by EnergyLogic.

Solution #1

Spray Foam



Image credit: Nathan Kahre, EnergyLogic.



Detail Created by EnergyLogic.

Solution #2

Hand Sealed with Caulk or Foam

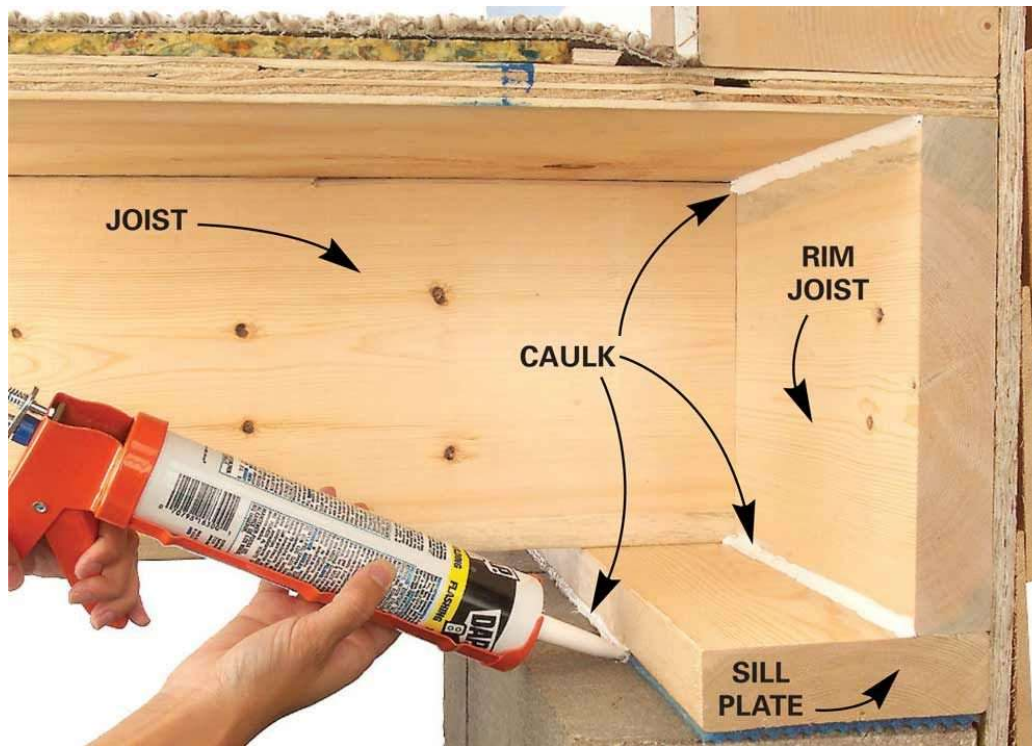


Image Source: [Green Building Advisor](#)

Overall Reductions

Townhome

Area	ACH50 Reduction
Person Size Holes in the Drywall	
Holes to Outside	0.5
Top Plate to Drywall Intersection	2.3
Recessed Lighting	0.7
Duct Boots from Unconditioned Spaces	0.1
Band Joist	0.4
Total	4.0

Single-Family Home

Area	ACH50 Reduction
Person Size Holes in the Drywall	
Holes to Outside	0.2
Top Plate to Drywall Intersection	1.1
Recessed Lighting	0.4
Duct Boots from Unconditioned Spaces	0.05
Band Joist	0.4
Total	2.15

Key Takeaways

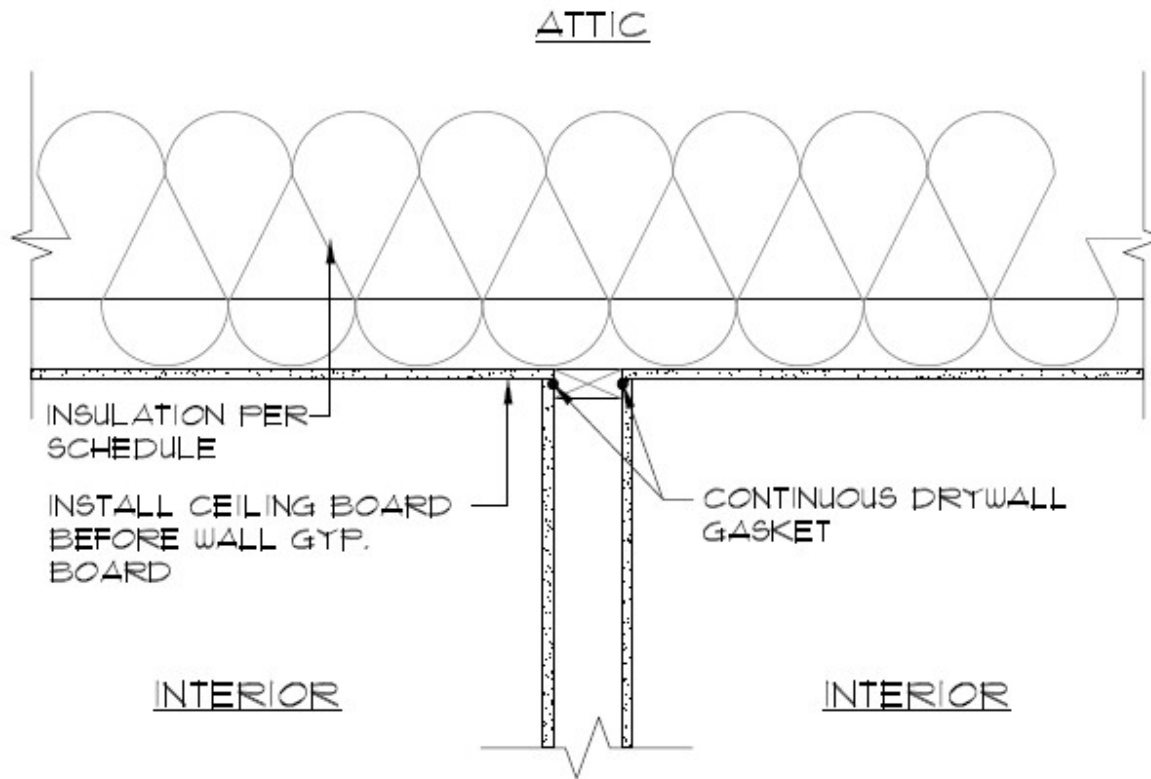
Get information in the plans and make sure trades are bidding on it.

Make sure key trades know the what and why of each piece.

Focus on the high impact areas and move down from there.



Want Details for Your Plan Sets?



EnergyLogic has both PDF and DWG formats available for all details shown in this presentation.

Detail Created By EnergyLogic.

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Want to Continue the Journey?

Contact Nathan:

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720-597-0304



A special thanks to today's Field Fusion host, The NoCo HBA!



About eEnergyLogic

Berthoud, Colorado-based EnergyLogic is a software and building consulting company that has provided expert resources, education and support to new home builders and energy raters involved in the construction of high-performance homes since 2006.

