Meeting the Challenges of Emerging Air-Tightness Requirements

Best Practices that Add Up

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Dallas, Texas
Air-tightness standards are increasing

<table>
<thead>
<tr>
<th>Climate Zones</th>
<th>Requirement</th>
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</thead>
<tbody>
<tr>
<td>1-2</td>
<td>5 ACH50</td>
</tr>
<tr>
<td>3-8</td>
<td>3 ACH50</td>
</tr>
</tbody>
</table>
Why is 3ACH a “heavy lift”?

I. Knowledge... *What’s Leaking?*

II. Building process... *It’s complicated!*

III. Change... *It’s difficult!*

*(But possible)*
If you’re looking for silver bullets...
Categories of air-leakage

1. blocking issues
2. penetrations
3. joints

Image Credit: U.S. Department of Energy
**blocking issue** *n* a large hole in the air-barrier created by the absence of a matching piece of air-impermeable material like wood.
Blocking issues > knee wall


**Root cause:**
- complex framing
- awareness

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Image courtesy of Southface Energy Institute
Root causes:
- sequencing
- restricted access
- division of labor
- complex framing
- awareness
Blocking issues > uncapped cavities

Root causes:
- complex framing
- awareness

Air leakage paths
no top plate blocking

no top plate blocking
Blocking issues > cantilevers & bump-outs

Root causes:
• sequence
• visibility
• human error
Penetration  n  a hole created in the air-barrier, usually for the purpose of adding functionality to a house.
Penetrations – examples

pipe-sheathing

can-drywall

boot-drywall

flue-collar
Penetrations – smurf tube

sealed smurf tube?...

...not inside.
**Joint** *n* a small hole in the air-barrier created at the interface between two adjacent building materials, like drywall and wood.
Joint air leakage study

https://w.owenscorning.com/building-genius/where-to-air-seal-for-maximum-impact-efficiency-and-savings
Joints – high leakage

(0.4 – 0.9 CFM50/ft)

Band joist (top & bot.)

Top plate-to-attic

Duct boots

Recessed lights

Garage-to-house
common wall

Sealing cost

Tightness

Most effective

Most effective

Joints – medium leakage

(0.2 – 0.4 CFM50/ft)

Sheathing-to-plate (top & bot.)

Window/Door Framing-to-Sheathing

Corners

Sealing cost

Tightness

Moderately effective

Joints – low leakage

(0 – 0.2 CFM50/ft)

What product do I use?

- **joints only**
  - **lower cost**
  - **fewer joints (framer)**
  - **exposure**

- **interior**
  - **more joints (insulator)**

- **exterior**
  - **higher cost**

- **complete coverage**
  - spray foam
  - membranes (wraps, peal & stick, fluid-applied, poly)
Other things to consider

• One sealant does not seal all joints!
• Joint movement
• Durability
PROCESS
It's complicated!
Process for creating air-barrier (simplified)

**FRAME**
- framer

**SEATH**
- cornice
- utilities
  - coordination
- insulator

**SEAL**
- inspection

**VARIABLES**
- weather, supply, demand, absence, ...

**CONSTRAINTS**
- maximize – production, return on investment, ...
- minimize – cost, labor, schedule, return trips ...

**TEST**
- rater
### Implications for who has air-sealing responsibility

Who should seal this?

<table>
<thead>
<tr>
<th>Who should seal this?</th>
<th>Pros</th>
<th>Cons</th>
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<tbody>
<tr>
<td>Insulator</td>
<td>Consolidate responsibility</td>
<td>Insulator has to buy high temperature sealant</td>
</tr>
<tr>
<td>Fire place installer</td>
<td>Seal penetrations when made</td>
<td>Distribute responsibility</td>
</tr>
</tbody>
</table>
Sequencing issues

- Blocked access to downstream trade
- Blocked access
- Delayed delivery
Communication helps work around sequencing issues.
Lifting constraints to achieve less than 1 ACH50

ceiling drywall before interior walls eliminates top-plate leakage

Image courtesy of Steven Baczek, Steven Baczek Architectural Services
Change
It’s possible...
A case study...

• 2015 Highland Homes started working with Owens Corning on achieving the new 3ACH50 standard.

• Average ACH50 ≈ 5

• Here’s what we did...
  – leveraged 2012 air-leakage study
  – implemented cost effective gasket
  – Owens Corning supported transition to a new process
Overview of framing gasket approach

- framing gasket
  - W = 3”
  - L = 50’
  - ≈ 60 rolls/house

- exterior
  - before sheathing
  - ≈ 3 man-hours

- interior
  - before drywall
  - ≈ 3 man-hours

- thicker than sill seal
**Training**

**Days before first install...**

**WHO**
- supervisors, purchasing manager, framing contractor, insulator, drywaller, energy rater

**WHY**
- educate on proper installation
- emphasize importance of air-barrier
- raise awareness of upcoming changes
- foster communication between trades

**HOW**
- learn through discussion
- at job-site
- English, Spanish, ...

**During install...**

**WHO**
- installer, supervisors

**WHY**
- educate on proper installation
- assess time to install

**HOW**
- learn by doing, trial & error
- at job-site
- English, Spanish, ...
Instructions

- Provide to job-site supervisors
- Show where and how product is applied
- English and Spanish
Focus on supervisors to sustain new process

Air-sealing knowledge orchestrates building process and interacts closely with installers.
Diagnostics reveal opportunities for improvement

- Blower door testing
- Smoke testing
- Make an impression

Find the leaks

Faulty dampers

Improve process
Continuous improvement mindset

It even helps when disposal crews are aware of new process opportunities to improve.
Where are they now?

2.5 ACH50
Recap

• There are no silver bullets.

• Keys to success...
  – Education and awareness
  – Continuous improvement mindset

• Change is possible!


*Thermal Performance of the Exterior Envelopes of Whole Buildings XII International Conference, 2013 ASHREA.*
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Questions?