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Priority Air Sealing Locations for New Homes

HELPING BUILDERS
DESIGN A SMARTER
PLAN OF ATTACK



Air Sealing Strategy for New Construction

OUR LIST OF THE
TOP 5 AIR SEALING
LOCATIONS CAN HELP
BUILDERS DESIGN A
SMARTER PLAN OF
ATTACK TO MEET NEW
AIRTIGHTNESS
REQUIREMENTS.

Reducing air leaks through a building's envelope is critical to ensuring energy efficiency, durability, and occupant comfort. Getting airtight construction starts with framing and includes ensuring that the joints and openings in a building enclosure are properly air sealed. However, not all joints and openings contribute equally to air leakage. With so much area to air seal, are there places you should prioritize? The short answer is yes. Our guide reveals five of the top areas to air seal before installing cost-effective insulation products such as fiberglass and mineral wool. Sealing these areas will help builders meet code requirements for building a tighter, more energy-efficient house.



New Codes are Raising the Bar

The 2012 and 2015 editions of the International Energy Conservation Code (IECC) introduce stricter airtightness requirements for structures and require verification of the results with blower door tests. Older versions of the code let builders choose between either visual inspections or blower door testing.

RAISING THE BAR

To meet the new requirements, builders must prioritize airtight construction.

Achieving airtight structures can be a difficult task since the typical residence has nearly one mile of exterior joints¹ that can leak air.

The air sealing sections of the 2012 and 2015 IECC call out more than 16 locations or components that must be air sealed. The Version 3 and 3.1 Thermal Enclosure System Checklist of the ENERGY STAR Certified Homes program has a similarly extensive list.

It's important to point out that most of the air sealing locations in these lists are not within wall cavities. A commonly held belief is that cavities and insulation are the biggest culprits for air leaks. In fact, studies show that this is not where or even how most air leakage occurs.

Air sealing potential leakage points can reduce air leakage from structures and help builders achieve the new airtightness requirements. But with so much area to cover, air sealing also can become an overwhelming task. However, builders that gain a better understanding of how air moves through structures can develop an effective strategy to target air sealing priorities.

¹ Home Air Leakage Solutions by Owens Corning: Isolating critical joints through research and improving them with groundbreaking product systems.



Insulation Type has Low Impact on Air Infiltration

Insulation alone isn't designed to stop the flow of air.

While insulation does reduce air movement through wall cavities to some extent, its purpose is to control the flow of heat, not the flow of air. That's why house wrap is one of the most common strategies for limiting air leakage.

A study from the National Association of Home Builders (NAHB)² assessed the air infiltration from insulated wall cavities with properly taped house wrap, untapped house wrap, and without house wrap. When comparing a wall assembly insulated with fiberglass batts to a wall insulated with spray foam, researchers found there was very little difference in whole-home air infiltration between two cavities if the wall assembly had house wrap properly installed and taped.

In the study, there was a negligible difference between a home with walls insulated with spray foam and air sealed with house wrap, and a home with walls insulated with fiberglass batts and air sealed with house wrap. The study shows the air sealing improvement results from the proper installation of the house wrap and not the type of the insulation used.



² Air Infiltration of Wood Framed Walls, NAHB Research Center, 2009. The HIRL/NAHB study included air leakage rates through a sample wall cavity. These air leakage rates were extrapolated to the wall area of a typical single-family home (2,400 sq. Ft., 15% window to floor area, two-story home) and converted to ACH50 for comparative purposes.



Start with the Stack Effect



Devising an effective and practical air sealing strategy begins by understanding that some leakage points are more problematic than others. Many of these problematic leakage points are related to “the stack effect,” a cycle that occurs when warm, heated air rises and exits from a structure through upper-level openings, causing air to be pulled into the structure through lower-level windows or openings. The flow of air increases with the number of openings at upper floors, which worsens the leakage problem.

Effective air sealing will combat the stack effect by addressing these high and low entry and exit points by sealing gaps in the ceiling, wall-ceiling, and wall-floor interfaces. Leakage points in these areas have lengths exceeding those of the small penetrations through walls and are particularly likely to fuel the stack effect.



Top Locations for Air Sealing

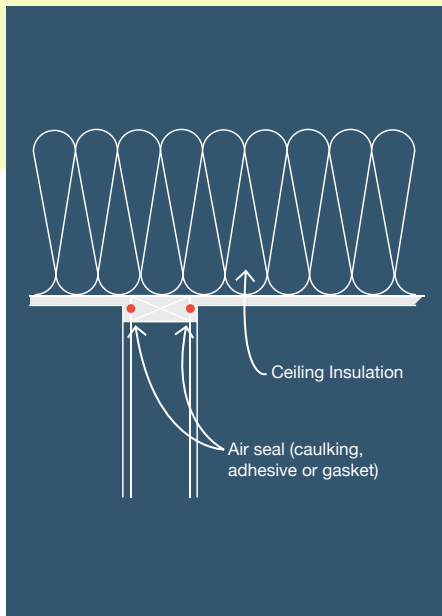
Strategic air sealing of major gaps is an important first step to achieving a tight house. Builders can focus their efforts, using a sealant such as good quality caulk, canned foam, sealing tape, or a gasketing product to stop the flow of air where it matters most. Having a prioritized list of air sealing locations helps because builders can plan and budget air sealing resources.

Research³ findings have quantified the leakage from various interfaces within the thermal envelope of a typical single-family home and compared them with the costs to address them. The following five locations were determined to be the most critical due to their potential to reduce air leakage.

³ *Characterization of Air Leakage in Residential Structures, Parts 1 & 2.* Wolf, David and Frank Tyler, 2013 ASHRAE.

Top Locations for Air Sealing

01.



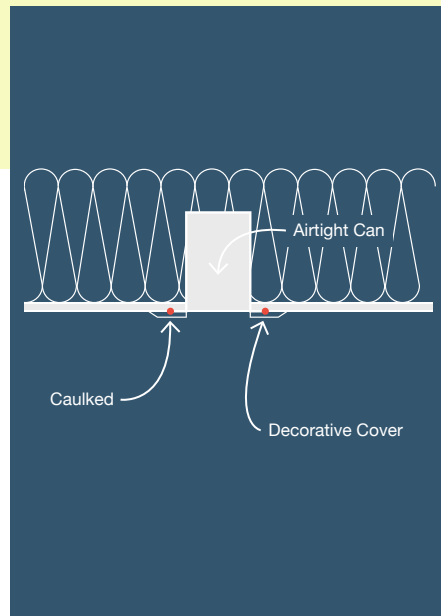
TOP PLATE TO ATTIC DRYWALL

Research indicates that air sealing this location from the attic either above or between the sheetrock and the top plate can deliver the greatest impact of all locations identified.

**Potential ACH50 reduction:
up to 1.6 exchanges.**

Source: Pg 3 of https://www1.eere.energy.gov/buildings/publications/pdfs/building_america/airtight_drywall_approach.pdf

02.



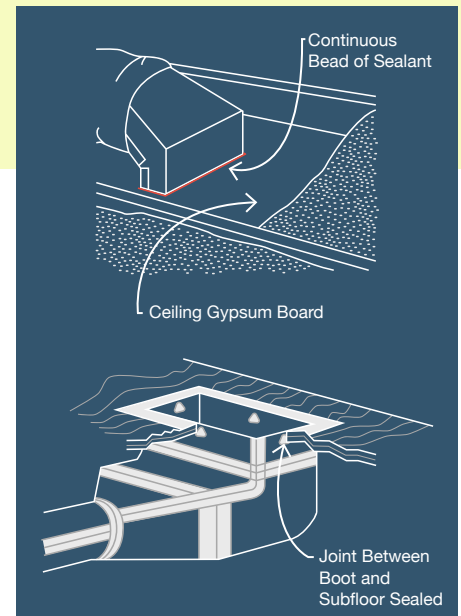
RECESSED LIGHT TO FINISHED SURFACE

Although most recessed fixtures are rated as airtight, these fixtures still require the important step of being sealed to the sheetrock or protected with an airtight cover. Other penetrations such as fan/electrical boxes should also be sealed.

**Potential ACH50 reductions:
0.2+ exchanges.**

Source: <https://basf.pnnl.gov/resource-guides/air-sealing-recessed-light-fixtures-below-unconditioned-space#quicktabs-guides=1>

03.



DUCT BOOT TO FINISHED SURFACE

Duct Boot from Attic & Duct Boot from Floor

Typical 10 x 6 duct boots are usually sealed to the ductwork leading up to the boot but often not sealed to either the gypsum board ceiling material or the subfloor. Air sealing is required when the space below the subfloor (crawl space or basement) is unconditioned space. The duct, boot, and underfloor will also need to be insulated when they are in unconditioned space.

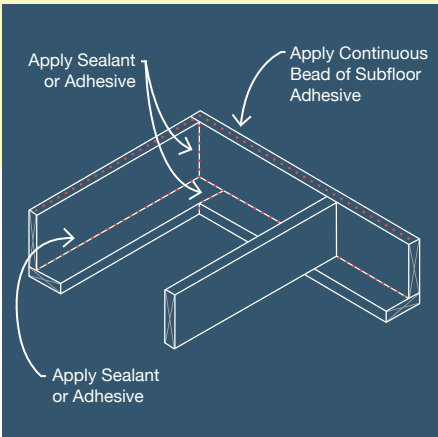
**Potential ACH50 reductions:
0.2+ exchanges.**

Top Diagram Source: <https://buildingscience.com/documents/guides-and-manuals/gm-attic-air-sealing-guide/view>

Bottom Diagram Source: <https://buildingscience.com/documents/information-sheets/information-sheet-duct-sealing>

Top Locations for Air Sealing

04.



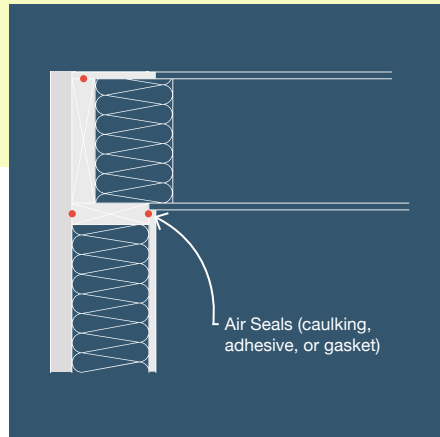
BAND JOIST (TOP & BOTTOM)

Band joist areas are commonly insulated but also need proper air sealing. This is a key location for two reasons. (1) Length of cracks: over 200 ft of leaks could be left unaddressed if not sealed. (2) Low location in the home: band joists are commonly located above the foundation wall and provide a low point for air infiltration into the home.

Potential ACH50 reductions:
0.4 exchanges.

Source: <https://buildingscience.com/documents/information-sheets/air-barriers-airtight-drywall-approach>

05.



GARAGE HOUSE TO COMMON WALL

This is the only location on the list focusing on a wall cavity. Even here, much of the leakage in the walls could be impacted by doors and top or bottom plates.

Air leakage commonly occurs here because the exterior finish is typically drywall rather than exterior cladding or sheathing. For example, in an 8-foot x 10-foot common wall between the house and garage, construction may comprise 2.5 sheets of 4-foot x 8-foot gypsum board, leaving up to 52 feet of joints and edges to be sealed.

Potential ACH50 reductions:
0.2+ exchanges.

Source: Figure 7 <https://buildingscience.com/documents/reports/r-0403-air-barriers/vie>

TOP 5 LOCATIONS FOR AIR SEALING

Air Sealing Location	Potential ACH50 Reduction
Top Plate to Attic Drywall	up to 1.6
Recessed Light to Finished Surface	0.2+
Duct Boot to Finished Surface	0.2+
Band Joist (Top & Bottom)	0.4
Garage-House Common Wall	0.2+

Total ACH50 Reduction Potential Up to 2.6

Source: *Characterization of Air Leakage in Residential Structures, Parts 1 & 2*. Wolf, David and Frank Tyler, 2013, ASHRAE. These air leakage rates were converted to ACH50 for comparative purposes

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