

AIR SEALING GUIDE

Whole Building Air Sealing for
Wood-Frame Flat-Roof Multifamily Buildings

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Introduction

Air sealing is the process of locating and sealing all the areas in a building and/or unit's envelope where air leakage could occur. This document focuses on the primary air barrier, which is the primary air enclosure boundary that separates indoor (conditioned) air and outdoor (unconditioned) air [Lstiburek, 2006]. While multi-unit buildings also need to be concerned with compartmentalization, which is the separation between units, this is typically less challenging to achieve.

In addition to being a code requirement, effective air sealing is a critical component in high performance buildings and can mean the difference between passing and failing an energy program. According to the 2021 IECC, new construction must undergo air leakage tests, with a maximum allowable rate of 0.30 CFM₅₀/ft². By contrast, Phius certification typically requires an airtightness limit of ≤ 0.06 CFM₅₀/ft². Were you ever told to not stand at the fridge with the door open for too long as a kid? These guidelines make sure the whole building isn't acting like a fridge with the door open!

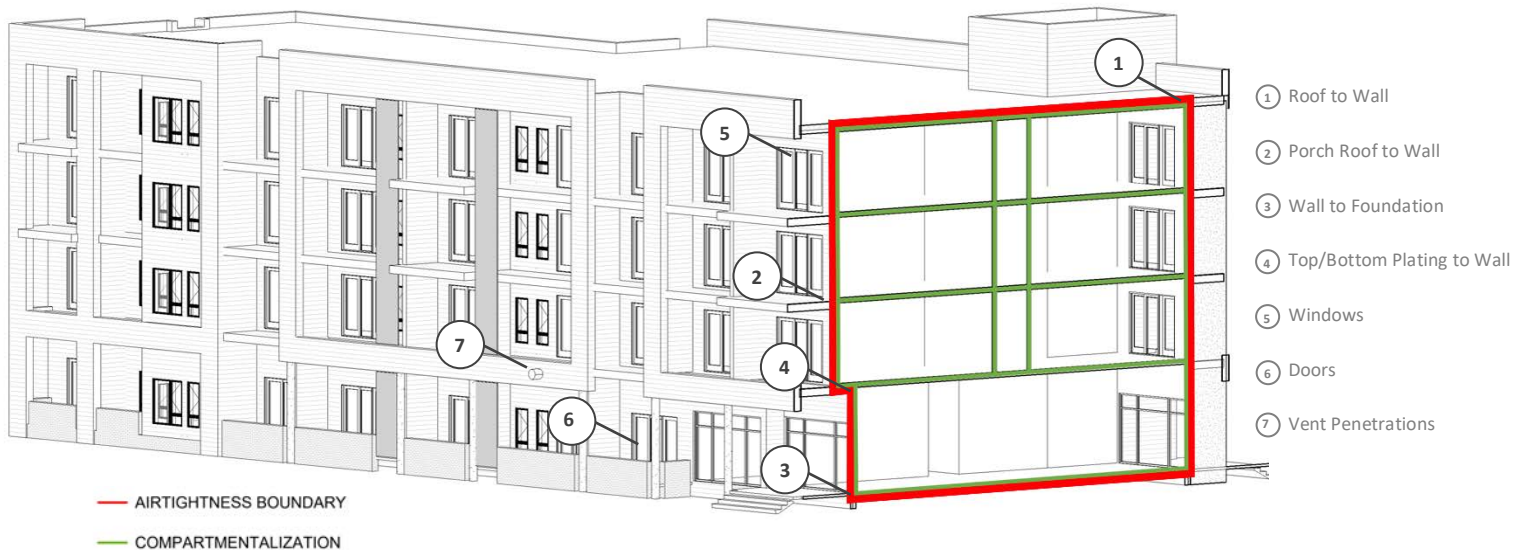
Air sealing will help improve a building's durability by reducing the air leakage, condensation potential, and thermal losses that lead to high energy bills. Air sealing also improves indoor air quality and comfort; it eliminates drafts, keeps outside air pollutants and pests out, and promotes noise reduction and odor control from outside and between adjacent units in multifamily buildings.

As an energy consultant, Sustainable Comfort, Inc. (SCI) typically conducts inspections and testing to ensure adequate air sealing. We are happy to help with any air sealing questions throughout the construction process.

This guide is not project-specific and cannot guarantee air sealing success. The contractor is responsible for working with the design team to ensure code and energy program compliance.

This guide was developed by SCI as a tool to assist project teams with understanding air sealing. This guide was funded through the NYSERDA Early Design Support program to study the Sol Apartments in Troy, NY. NYSERDA's Early Design Support program supports multifamily projects through technical support to embed carbon-neutral strategies at the earliest phases of design, when design decisions are most impactful. By partnering with the design community, NYSERDA builds firms' technical capacity and shares key findings through public resources—supporting broader adoption and driving clean energy market transformation.

Air Sealing: Overview



Airtightness Boundary [red]: When air sealing a building, it is important to target areas [examples called out above] where the primary air barrier material transitions to another material or when a penetration is made through the building's envelope [the exterior shell consisting of roofs, walls, and floors]. The primary air barrier is typically interrupted by components such as windows, doors, pipes, vents, and structural attachments.

Compartmentalization Boundary [green]: This boundary separates dwelling units from each other and common spaces, contributing to the quality of construction. Compartmentalization reduces the stack effect, thereby improving control of indoor airflow. It helps prevent the spread of pests, odor, and noise between apartments.

Pre-Construction Notes

Establish your primary air barrier early in the project in conversation with the energy consultant, architect, and builder. The primary air barrier should be clearly indicated by a continuous red line in sections and details [as above]. Work through each transition and penetration to ensure that materials will be applied in the right order by the right people. Work with the manufacturers' representatives to confirm material compatibility.

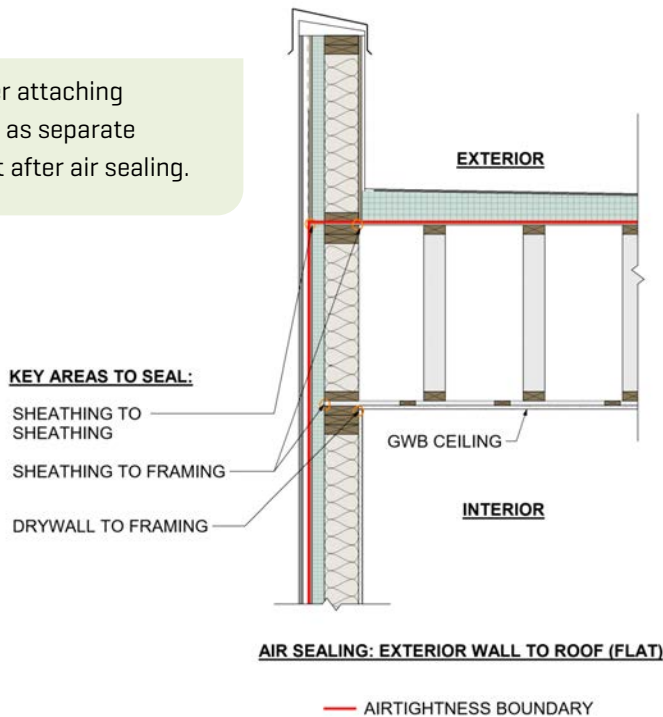
Construction Notes

As construction starts, continue to coordinate with your energy consultant to ensure proper air sealing practice. Identify potential leakage areas early by working with your energy consultant to coordinate a mid-point blower door test. Below are some best practices for air sealing:

1. Clean out cracks before applying sealant.
2. For gaps smaller than 1/4", use shrink-proof and crack-proof caulk.
3. For gaps larger than 1/4":
 - Use backer rod and caulk instead of foam at window and door openings.
 - Use flexible caulk material instead of foam where applicable.
 - Use expanding foam sparingly [greater negative environmental impact and prone to cracking].
4. Use the correct sealant for the temperature and conditions.

1. Roof to Wall: Flat Roof

Consider attaching parapet as separate element after air sealing.



Be sure to use appropriate materials such as caulk and/or sealant.

At all edges, the roof should be sealed, especially at areas where the primary air barrier is interrupted. Pay attention to the phasing of construction—air sealing areas before they are fully blocked off or covered over will make the process easier.

Roof air barrier should overlap wall air barrier (6" suggested) to provide continuous air sealing.

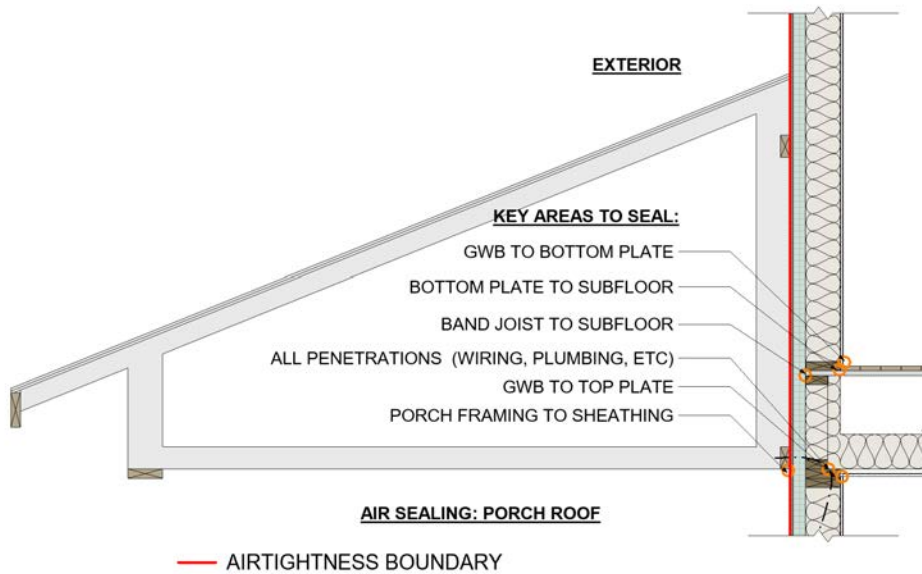


Roof Deck: Using the correct amount of sealant with proper application will ensure proper air sealing.



Above Grade Wall to Roof: Conducting a smoke test can help indicate whether the roof is properly air sealed. It is important to keep the air barriers continuous and to seal off any gaps in the building envelope.

2. Roof to Wall: Structural Attachment



When installing an exterior structural attachment, use ledgers fastened over the sealed air barrier to avoid disruptions. Seal penetrating fasteners from the exterior and/or interior.



Framing members penetrate the primary air barrier, which increases leakage and is difficult to air seal effectively.

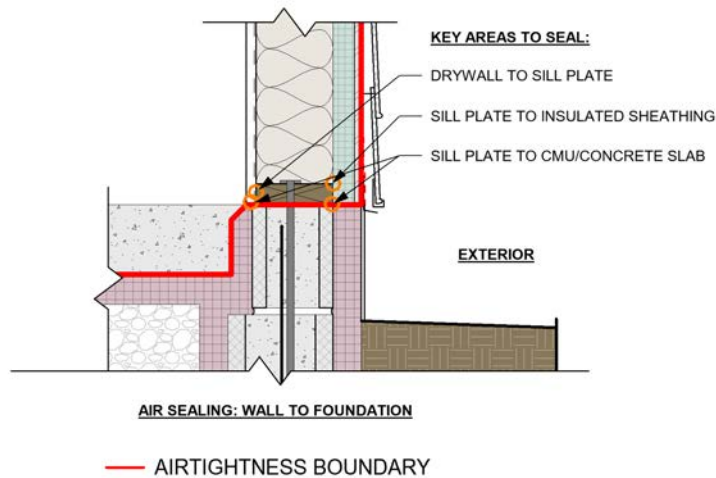


Structural attachments should be applied after the air barrier is complete and should minimize penetrations through the barrier. Any nail or screw penetrations should be sealed.



Sheathing with integrated air barrier was not sealed behind the framing, creating an area for air leakage. Fully seal the primary air barrier before blocking access to the gap.

3. Wall to Foundation



Installing caulk, sealant, or tape to key areas of the building will help prevent air leakage. Connect the vapor barrier from under the slab onto the top of the foundation wall and into the exterior wall barrier. Do not rely on sill sealer as an air barrier connection at this junction. We recommend using a liquid-applied or self-sealing product to connect the sub-slab air/vapor barrier to the exterior wall air barrier.

Have conversations with manufacturers to ensure material compatibility and create mock-up for early testing.

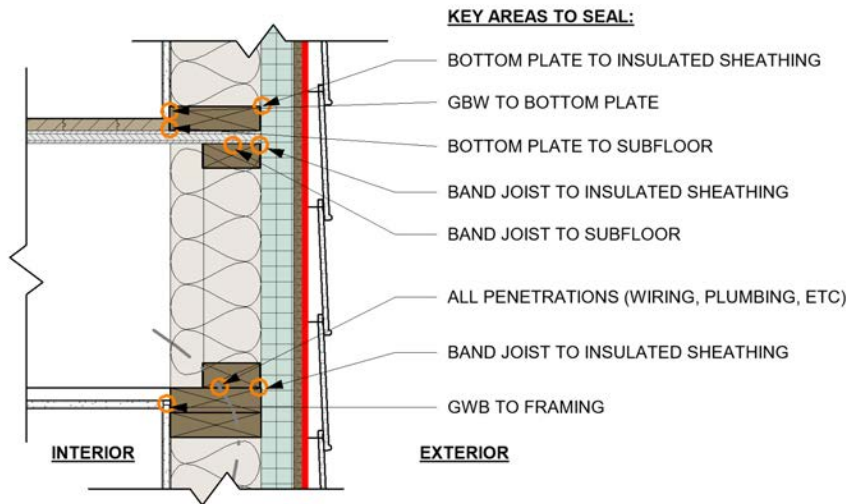


Primary air barrier is not continuous. Bridge the material gap and continue the air barrier from one layer to another. Follow the red line in the plans!



Seal transition between above grade wall air barrier and foundation to create one continuous air barrier.

4. Top/Bottom Plating



When air sealing the top and bottom plates, it is recommended to use caulk or other sealants. Before installing drywall, be sure to air seal gaps between the framing and sheathing, as well as any additional cracks in the framing first. Otherwise, it will be difficult to seal these areas once the drywall is installed.

AIR SEALING: TOP & BOTTOM PLATES

— AIRTIGHTNESS BOUNDARY

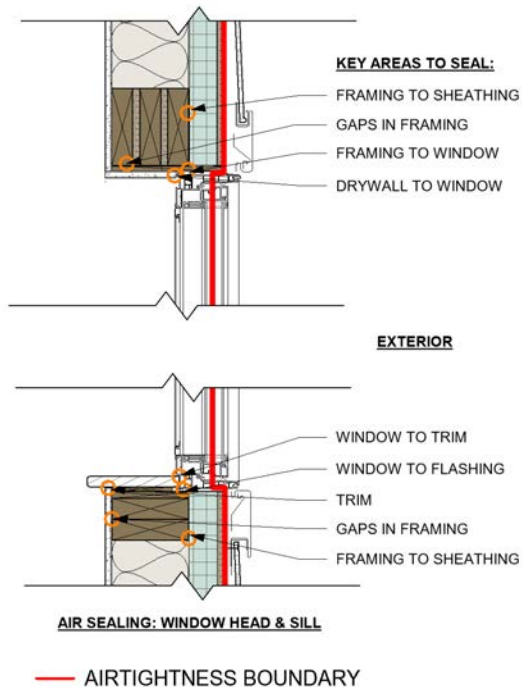


Properly sealing off the bottom plate to subfloor will prevent air leakage. Be sure the air seal is continuous throughout.



Do not leave air gap between foundation and wall above.

5. Windows: Head & Sill



When air sealing windows, it is recommended to use backer rod and caulk. Be sure to seal all gaps and to provide a continuous air seal. The primary air barrier should wrap in and connect with the window flashing.

Checking for air leakage with an air infiltration test can help indicate how well sealed these areas are.

Create mock-ups of window assemblies prior to full installation.

Level rough openings and have a trained installer/rep balance and calibrate the windows.



Leaky Window: Conducting a smoke test may help indicate whether the windows are properly installed and sealed.

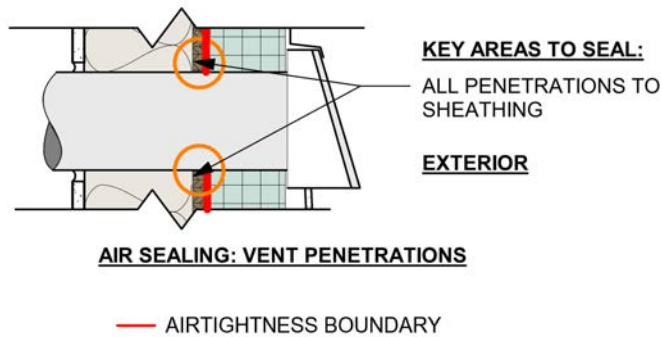


Caulk and backer-rod is recommended when air sealing.



Caulk seams at the rough openings around the windows and doors prior to flashing installation.

6. Penetrations: Assemblies



Vent penetrations create significant areas that are vulnerable to air leakage. Be sure to properly seal around the penetrations to the air barrier.

Tape, gaskets, fluid-applied sealants, and caulk are effective materials for air sealing vent penetrations. Always coordinate the type of sealant with the vent type and manufacturer.



Sealing off vent/pipe penetrations will provide proper air sealing. Keep pipes separate from each other to minimize issues.



Pipe has air gaps at penetration point. Be sure to properly seal penetrations from the interior and exterior. Proper application and amount of material is critical. Sealing should be done before pre-rock is installed.

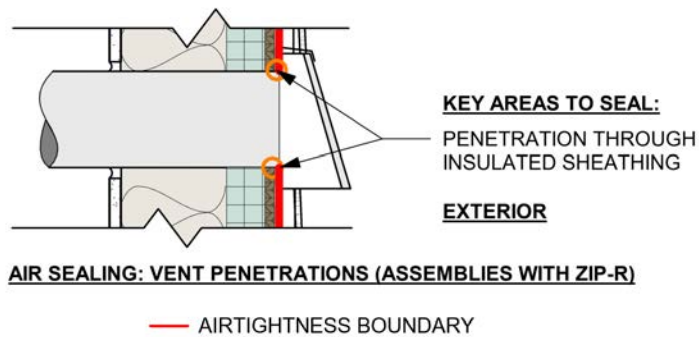


Pipe penetrations should be separated neatly.



Pipes are grouped together, making sealing difficult.

7. Penetrations: Assemblies With Insulated Sheathing



With insulated sheathing, the product has an integral air barrier. Air seal around the penetration on the exterior side of the sheathing. Avoid making unnecessary cuts or cracks in the sheathing to prevent unwanted air infiltration/leakage.

Tape, gaskets, fluid-applied sealants, flexible boots, and caulk are effective materials for air sealing vent penetrations.



Using a high-quality sealant tape or flexible boot to connect pipes and ducts back to the primary air barrier.



Vent penetration has large gaps around opening. Be sure to cut vent penetrations in sheathing to size to prevent unwanted gaps that will be hard to seal later.

8. Additional Areas to Air Seal



Seal off all penetrations from electrical boxes.



Insulated sheathing was cut after installation. Seal any cuts and gaps created after insulated sheathing is installed.



Sealing off all gaps in the insulated sheathing will ensure proper air sealing.



Sheathing is not sealed at seams. Seal sheathing at all seams.



Sheathing is damaged. Refer to manufacturer's instructions for repair and proper sealing.

Example Products

Cracks and Gaps

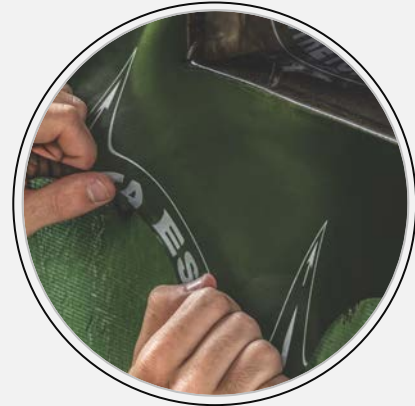


ECOSEAL Plus -
www.knaufnorthamerica.com



AirStop - www.dap.com

Vent Penetrations



ZIP System Stretch Tape -
www.huberwood.com

Penetration Management Strategies



<https://475.supply/blogs/design-construction-resources/how-to-seal-air-barrier-penetrations>

References

Lstiburek, J. [2006, October 24]. *BSD-104: Understanding Air Barriers*. Building Science Corporation.
<https://buildingscience.com/documents/digests/bsd-104-understanding-air-barriers>