Air Seal Top Plates or Blocking Missing at Top of Walls Adjoining Unconditioned Spaces

Last Updated: 02/13/2018

Scope

Install continuous top plates or blocking at the tops of walls adjacent to conditioned space to minimize air leakage.

- Design walls with top plates. Do not specify balloon framing.
- Install a continuous top plate at all full height walls.
- Where walls of varying heights meet, install blocking if needed in any wall cavities that are open to an unconditioned attic or other unconditioned space. Use rigid blocking material such as lumber, plywood, OSB, or rigid foam, caulked or sealed at edges.

See the Compliance Tab for related codes and standards requirements, and criteria to meet national programs such as DOE’s Zero Energy Ready Home program, ENERGY STAR Certified Homes, and Indoor airPLUS.
Description

Most wall cavities are composed of a horizontal top plate, a horizontal bottom plate, and the vertical studs. When gypsum board and wall sheathing are caulked and fastened to the inside and exterior faces of these components, they create an air-tight six-sided wall cavity. If one element is missing from this assembly or is not adequately air sealed to the other elements, air will flow through the cavity, potentially robbing any insulation present of its insulating value. Some wall designs have no top plate so the wall cavity is open to the area above, which may be an unconditioned attic or other unconditioned space. This opening can become a pathway allowing unconditioned air from the attic to flow down into the wall cavity and conditioned air from the wall to flow up into the attic. The result is unwanted heat loss or heat gain, cold spots in walls, and an increased potential for moisture problems in the wall or attic.

Missing top plates can sometimes occur when a room of one ceiling height abuts a room of a taller ceiling height. They can also occur when buildings are designed with balloon framing. Designers should not specify balloon framing. If the house design includes varying ceiling heights, blocking should be specified where the top of the lower wall meets the side of the higher wall if no top plate is present. This blocking material could be rigid foam, plywood, OSB, or lumber that is cut to fit. Alternately, the open stud cavities can be filled with fiberglass batting that is rolled and tucked into the cavity opening then covered with spray foam.

How to Air Seal a Wall with a Missing Top Plate

1. Identify missing top plates in adjoining walls with different ceiling heights.
2. Select a rigid air-blocking material (rigid foam insulation, plywood, OSB, lumber). Cut into pieces to fit each stud bay. Wrap a thin piece of strapping around the board to hold it in position while you glue each end with caulk or spray foam. Pull the strap out and glue the remaining two sides.
3. Or, roll a piece of unfaced fiberglass batt insulation for each cavity. Pressure fit the fiberglass batt roll into the top of the stud cavity. Cover the top with spray foam to air seal the roll and hold it in place.

Figure 1 - Ceiling heights may vary within a house design, for example, the ceiling in a hallway or bathroom may be lower than the ceiling in an adjoining dining room or bedroom. Where a lower ceiling meets the wall of a room with a higher ceiling, the lower wall may be missing a top plate, creating an open air pathway from the stud cavities to the attic space.
Figure 2 - Top plates may be missing where a lower ceiling meets the wall of a room with a higher ceiling. The open wall cavities should be closed off with an air-blocking material like rigid foam, plywood, or dimensional lumber that is cut to fit the stud cavity and sealed in place with caulk or spray foam or fiberglass batt insulation that is rolled and friction fit into place and air sealed with spray foam.

How to Air Seal Open Wall Cavities in Balloon-Framed Walls

1. Identify open wall cavities in balloon-framed walls. Note, balloon framed walls are walls that have no top plates so wall cavities are open from the bottom plate to the attic. This style of construction is not recommended.
2. Roll a piece of fiberglass batt and stuff it into place at the top of the wall where the top plate is missing.
3. Cover the roll of fiberglass batt with spray foam to air seal it in place.
4. Fill the attic with additional insulation.

Figure 3 - Balloon framing at a gable end wall allows air to flow from the attic down into the wall cavity.
Figure 4 - The space at the top of the wall can be filled with a piece of fiberglass batt that is rolled up and stuffed in place.

Figure 5 - The fiberglass roll is covered with spray foam to air seal the top of the wall. The top plate of the wall under the rafter can also be spray foamed between the ceiling gypsum and the bottom side of the rafter insulation baffle. Then the area can be covered with blown insulation.
Ensuring Success

Design homes so that all full-height walls have a continuous top plate. If the house plan has some area where a top plate cannot practically be included in the framing design, such as where a room with a lower ceiling height abuts a room with a higher ceiling height, indicate on the plans that air-blocking material should be installed, then inspect that it is properly installed and sealed in place with caulk or spray foam.
Climate

No climate specific information applies.
Training

Right and Wrong Images

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Ceiling Epsilum Board
Air Barrier
Continuous Bead
of Sealant
Continuous Minimal
Expanding Foam at
Window Perimeter
Window Intas
Air Barrier
Continuous Minimal
Expanding Foam at
Window Perimeter
Continuous Bead
of Sealant
Continuous Bead
of Adhesive
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PDF: 319&522_CAD_1-1_air_seal_lower_wall_5-02003_GBA_1-31-12.pdf
Compliance

The Compliance tab contains both program and code information. Code language is excerpted and summarized below. For exact code language, refer to the applicable code, which may require purchase from the publisher. While we continually update our database, links may have changed since posting. Please contact our webmaster if you find broken links.

ENERGY STAR Certified Homes, Version 3/3.1 (Rev. 09)

National Rater Field Checklist

Thermal Enclosure System.
4. Air Sealing (Unless otherwise noted below, “sealed” indicates the use of caulk, foam, or equivalent material).
4.4 Continuous top plate or blocking is at top of walls adjoining unconditioned space, and sealed.

Please see the ENERGY STAR Certified Homes Implementation Timeline for the program version and revision currently applicable in your state.

DOE Zero Energy Ready Home (Revision 07)

Exhibit 1 Mandatory Requirements.
Exhibit 1, Item 1) Certified under the ENERGY STAR Qualified Homes Program or the ENERGY STAR Multifamily New Construction Program.

2009 IECC

Table 402.4.2 Air Barrier and Insulation Inspection Component Criteria, Walls: Corners, headers, narrow framing cavities, and rim joists are insulated.

2012, 2015, and 2018 IECC

Table R402.4.1.1 Air Barrier and Insulation Installation, Walls: Junction of foundation and wall sill plates, wall top plate and top of wall, sill plate and rim-band, and rim band and subfloor are sealed. Corners, headers, and rim joists making up the thermal envelope are insulated.


Section R101.4.3 (Section R501.1.1 in 2015 and 2018 IECC). Additions, alterations, renovations, or repairs shall conform to the provisions of this code, without requiring the unaltered portions of the existing building to comply with this code. (See code for additional requirements and exceptions.)

2009 IRC

Table N1102.4.2 Air Barrier and Insulation Inspection, Walls: Corners, headers, narrow framing cavities, and rim joists are insulated.

2012, 2015, and 2018 IRC

Table N1102.4.1.1 Air Barrier and Insulation Installation, Walls: Junction of foundation and wall sill plates, wall top plate and top of wall, sill plate and rim-band, and rim band and subfloor are sealed. Corners, headers, and rim joists making up the thermal envelope are insulated.


Section N1101.3 (Section N1107.1.1 in 2015 and 2018 IRC). Additions, alterations, renovations, or repairs shall conform to the provisions of this code, without requiring the unaltered portions of the existing building to comply with this code. (See code for additional requirements and exceptions.)

Appendix J regulates the repair, renovation, alteration, and reconstruction of existing buildings and is intended to encourage their continued safe use.
Access to some references may require purchase from the publisher. While we continually update our database, links may have changed since posting. Please contact our webmaster if you find broken links.

Case Studies
None Available

References and Resources*

1. **2009 IECC - International Energy Conservation Code**
   Author(s): International Code Council
   Organization(s): ICC
   Publication Date: January, 2009
   Code establishing a baseline for energy efficiency by setting performance standards for the building envelope (defined as the boundary that separates heated/cooled air from unconditioned, outside air), mechanical systems, lighting systems and service water heating systems in homes and commercial businesses.

2. **2009 IRC - International Residential Code for One and Two Family Dwellings**
   Author(s): International Code Council
   Organization(s): ICC
   Publication Date: January, 2009
   Code for residential buildings that creates minimum regulations for one- and two-family dwellings of three stories or less. It brings together all building, plumbing, mechanical, fuel gas, energy and electrical provisions for one- and two-family residences.

   Author(s): International Code Council
   Organization(s): ICC
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4. **2012 IRC - International Residential Code for One and Two Family Dwellings**
   Author(s): International Code Council
   Organization(s): ICC
   Publication Date: January, 2012
   Code for residential buildings that creates minimum regulations for one- and two-family dwellings of three stories or less. It brings together all building, plumbing, mechanical, fuel gas, energy and electrical provisions for one- and two-family residences.

5. **2015 IECC - International Energy Conservation Code**
   Author(s): International Code Council
   Organization(s): ICC
   Publication Date: May, 2014
   Code establishing a baseline for energy efficiency by setting performance standards for the building envelope (defined as the boundary that separates heated/cooled air from unconditioned, outside air), mechanical systems, lighting systems and service water heating systems in homes and commercial businesses.

6. **2015 IRC - International Residential Code for One and Two Family Dwellings**
   Author(s): International Code Council
   Organization(s): ICC
   Publication Date: May, 2014
   Code for residential buildings that creates minimum regulations for one- and two-family dwellings of three stories or less. It brings together all building, plumbing, mechanical, fuel gas, energy and electrical provisions for one- and two-family residences.

7. 
Code establishing a baseline for energy efficiency by setting performance standards for the building envelope (defined as the boundary that separates heated/cooled air from unconditioned, outside air), mechanical systems, lighting systems, and service water heating systems in homes and commercial businesses.

8. **2018 IRC - International Residential Code for One and Two Family Dwellings**
   - **Author(s):** International Code Council
   - **Organization(s):** ICC
   - **Publication Date:** August, 2017
   - Code for residential buildings that creates minimum regulations for one- and two-family dwellings of three stories or less. It brings together all building, plumbing, mechanical, fuel gas, energy and electrical provisions for one- and two-family residences.

   - **Author(s):** Baechler, Gilbride, Hefty, Cole, Williamson, Love
   - **Organization(s):** Pacific Northwest National Laboratory, Oak Ridge National Laboratory
   - **Publication Date:** April, 2010
   - Report identifying the steps to take, with the help of a qualified home performance contractor, to seal unwanted air leaks while ensuring healthy levels of ventilation and avoiding sources of indoor air pollution.

10. **DOE Zero Energy Ready Home National Program Requirements (Rev. 07)**
    - **Author(s):** U.S. Department of Energy
    - **Organization(s):** DOE
    - **Publication Date:** May, 2019
    - Standard requirements for DOE’s Zero Energy Ready Home national program certification.

11. **ENERGY STAR Certified Homes, Version 3/3.1 (Rev. 09) National Program Requirements**
    - **Author(s):** U.S. Environmental Protection Agency
    - **Organization(s):** EPA
    - **Publication Date:** September, 2018
    - Webpage with links to documents providing the program requirements and checklists for ENERGY STAR Certified Homes (Ver. 3/3.1, Rev. 09).

12. **Guide to Attic Air Sealing**
    - **Author(s):** Lstiburek
    - **Organization(s):** Building Science Corporation
    - **Publication Date:** January, 2010
    - Fact sheet providing detailed information about air sealing attics.

13. **Measure Guideline: Air Sealing Attics in Multifamily Buildings**
    - **Author(s):** Otis, Maxwell
    - **Organization(s):** CARB, National Renewable Energy Laboratory, Steven Winter Associates, SWA
    - **Publication Date:** June, 2012
    - Document providing an understanding of the importance of the different types of multifamily building attics and their unique challenges, and outlines strategies and materials used in air sealing them.

14. **Measure Guideline: Guide to Attic Air Sealing**
    - **Author(s):** Lstiburek
    - **Organization(s):** Building Science Corporation
    - **Publication Date:** September, 2014
    - Report that provides information and specifications to anyone that is attempting to air seal existing attics.

15. **Thermal Enclosure System Rater Checklist Guidebook**
    - **Author(s):** U.S. Environmental Protection Agency
    - **Organization(s):** EPA
    - **Publication Date:** October, 2011
    - Guide describing details that serve as a visual reference for each of the line items in the Thermal Enclosure System Rater Checklist.
Contributors to this Guide
The following authors and organizations contributed to the content in this Guide.

Steven Winter Associates, lead for the Consortium for Advanced Residential Buildings (CARB), a DOE Building America Research Team

Building Science Corporation, lead for the Building Science Consortium (BSC), a DOE Building America Research Team