Construct framed walls using advanced framing details like insulated corners that reduce framing and thermal bridging and allow more space for insulation.

- Construct corners with two studs or three studs aligned to allow more room for insulation along the exterior wall.
- Use drywall clips as needed to hold drywall in place.
- ENERGY STAR requires that the space provided at the corner allow for at least R-6 of insulation (ENERGY STAR 2018).

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

Exterior wall corners are typically framed with three studs. The third stud generally only provides a nailing edge for interior gypsum board and its typical placement blocks off the wall cavity, preventing insulation from being installed. If the third stud can be eliminated, there is more room inside the wall for insulation. Drywall clips, a 1x nailing strip, or a recycled plastic nailing strip can be used to create a two-stud corner that still provides a surface on which to hang the drywall. Using drywall clips also reduces opportunities for drywall cracking and nail popping, frequent causes of builder callbacks.

The designer should include the corner detail on building plans. It should be installed by the framer. If two-stud corners are used, they can be insulated by the insulation contractor. This task should be included in the contract for the appropriate trade, depending on the workflow at a specific job site. ENERGY STAR Version 3.0 requires that all exterior corners shall be constructed to allow access for the installation of > R-6 insulation that extends to the exterior wall sheathing. See the Compliance tab for 2009 IECC-specified wall insulation levels.

How to Insulate Corners

Construct exterior corners to allow access for the installation of > R-6 insulation that extends to the exterior wall sheathing in one of the following ways:

1. Construct a two-stud corner using a nailing strip or drywall clips, which allows the wall cavity at the corner to be insulated in sequence with the rest of the installation at full wall thickness.

   - When drywall clips are used, they should be installed above the level of the interior trim so trim nails will not interfere.
   - If installing trim, the noncoped trim piece should be installed first, against the drywall that bears on the clip, so that the coped trim piece can be nailed to the stud.
   - If rigid foam is used as the sheathing instead of OSB or another solid nailable sheathing, install a wood nailer strip behind the sheathing if necessary for attaching exterior trim or siding at the corner on the side that does not have a stud.

![Figure 1](https://www.buildingscience.com)

Figure 1 - This side view shows drywall clips installed on studs at a two-stud corner (the second stud is not visible behind the first corner stud). The plan view in the detail shows the placement of nails for fastening exterior corner trim (Source: Building Science Corporation).
Figure 2 - Conventional three-stud corners leave a cavity that must be insulated by the framers—not good.
**Figure 3** - The improved three-stud corner allows insulation to be installed later, in sequence.

**Figure 4** - Two-stud corners with drywall clips use the least wood and give the best thermal performance.
Ensuring Success
The quality of the insulation installation should be visually inspected by the site supervisor before the drywall is installed. It may be possible to detect heat loss at the corners of exterior walls with an infrared camera, if a sufficient temperature difference exists between the outside and the conditioned space of the house.
Climate

No climate specific information applies.
Training

Right and Wrong Images

Display Image: ES_TESRC_4.4.5_PG106_198b_102811_0.jpg
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](mailto:webmaster) if you find broken links.

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

National Rater Field Checklist

Thermal Enclosure System.
3. Reduced Thermal Bridging.
3.4.3a Corners insulated ? R-6 to edge.

Footnote 22) All exterior corners shall be constructed to allow access for the installation of ? R-6 insulation that extends to the exterior wall sheathing. Examples of compliance options include standard-density insulation with alternative framing techniques, such as using three studs per corner, or high-density insulation (e.g., spray foam) with standard framing techniques.

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.
Exhibit 2, Item 2) Ceiling, wall, floor, and slab insulation shall meet or exceed 2015 IECC levels and achieve Grade 1 installation, per RESNET standards.

**2009 IECC**

Table 402.4.2 Air Barrier and Insulation Inspection Component Criteria, Walls: Corners, headers, narrow framing cavities, and rim joists are insulated. Table 402.4.2, Air barrier and thermal barrier: Exterior wall insulation is installed in substantial contact and continuous alignment with the air barrier. Air permeable insulation is not used as a sealing material.

**2012, 2015, and 2018 IECC**

Table R402.4.1.1 Air Barrier and Insulation Installation, Walls: Corners, headers, and rim joists making up the thermal envelope are insulated. Table R402.4.1.1, Air barrier and thermal barrier: A continuous air barrier is installed in the building envelope including rim joists and exposed edges of insulation. Breaks or joints in the air barrier are sealed. Air permeable insulation is not used as a sealing material.


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 Component Criteria, Walls: Corners, headers, narrow framing cavities, and rim joists are insulated. Table N1102.4.2, Air barrier and thermal barrier: Exterior wall insulation is installed in substantial contact and continuous alignment with the air barrier. Air permeable insulation is not used as a sealing material.

**2012, 2015, and 2018 IRC**

Table N1102.4.1.1 Air Barrier and Insulation Installation, Walls: Corners, headers, and rim joists making up the thermal envelope are insulated. Table N1102.4.1.1, Air barrier and thermal barrier: A continuous air barrier is installed in the building envelope including rim joists and exposed edges of insulation. Breaks or joints in the air barrier are sealed. Air permeable insulation is not used as a sealing material.


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.
Case Studies

1. **New Whole-House Solutions Case Study: Insight Homes: Deep Creek, Seaford, Delaware**
   - Author(s): PNNL
   - Organization(s): PNNL
   - Publication Date: April, 2012
   - Case study about a home builder that has refined its home designs to achieve HERS scores of 49 to 56 on 40 to 70 homes per year.

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
   - Publication Date: January, 2012
   - 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.

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.
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.

Author(s): International Code Council
Organization(s): ICC
Publication Date: November, 2017
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.

9. Advanced Framing Construction Guide
Author(s): APA - The Engineered Wood Association
Organization(s): APA - The Engineered Wood Association
Publication Date: January, 2014
Detailed guide to advanced framing, a system of construction framing techniques designed to optimize material usage and increase energy efficiency.

10. Advanced Wall Framing
Author(s): NAHB, Southface Energy Institute, Oak Ridge National Laboratory, National Renewable Energy Laboratory
Organization(s): NAHB, Southface Energy Institute, Oak Ridge National Laboratory, National Renewable Energy Laboratory
Publication Date: January, 2002
Information sheet about advanced wall framing.

Author(s): Baechler, Gilbride, Hefty, Cole, Love
Organization(s): Pacific Northwest National Laboratory, Oak Ridge National Laboratory
Publication Date: February, 2011
Guide describing measures that builders in the cold and very cold climates can take to build homes that have whole-house energy savings of 40% over the Building America benchmark with no added overall costs for consumers.

12. Building Science Insights: Advanced Framing
Author(s): Lstiburek
Organization(s): Building Science Corporation
Publication Date: February, 2010
Report detaining advanced framing techniques, including discussion of cost and energy savings.

13. 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.

14. 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).

15.
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.

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