

Air Sealing and Insulating Attic Knee Walls - Code Compliance Brief

Overview:

The intent of this brief is to provide code-related information about attic knee walls to help ensure that the measure will be accepted as being in compliance with the code. Providing notes for code officials on how to plan review and conduct field inspections can help builders or remodelers with proposed designs and provide jurisdictional officials with information for acceptance. Providing the same information to all interested parties (e.g., code officials, builders, designers, etc.) is expected to result in increased compliance and fewer innovations being questioned at the time of plan review and/or field inspection.

Attic knee walls are typically short, vertical walls approximately 2 to 3 feet high in an attic that separates attic space from conditioned space. Most common attic knee walls are associated with the creation of a bonus room that can have many uses. The walls screen out the unusable space where the rafters meet exterior wall top plates and/or the attic floor.

Unfortunately, the space on the unconditioned side of the knee wall often is not well sealed or insulated and the wall structure by itself does not provide enough of a thermal barrier to adequately maintain the temperature of the conditioned side of the knee wall in a vented non-conditioned attic. Furthermore, attic knee walls really need to thermally perform better than an exterior wall, especially in the summer months when the temperature difference between the unconditioned attic space and the conditioned space is likely to be much greater than to the temperatures that exterior walls are exposed to. During the summer, the temperature in an unconditioned attic can exceed 130°F.

Properly sealing and insulating attic knee walls can significantly reduce air leakage and heat loss between the conditioned space and the unfinished attic. It is important to choose an air-barrier and insulation material that will reduce the air leakage and heat loss as much as possible. For example, rigid foam board can act as both a thermal barrier and an air barrier across the unconditioned side of the knee wall. Some insulation options either do not provide air sealing or are difficult to install outside of the wall framing.

While the energy code does not specify any one type of material or how to air seal and insulate attic knee walls, Building America recommends best practices as to what materials perform better in specific situations and how the materials should be properly installed. Refer to the “description” tab of this guide (<https://basc.pnnl.gov/resource-guides/attic-knee-walls> [1]) and the Technical Validation Section of this brief for additional resources on best practices on air sealing and installing insulation and recommended air-barrier and insulation materials.

This brief provides an overview of the energy provisions of the 2009 through 2015 International Energy Conservation Code (IECC) and International Residential Code (IRC) code for attic knee walls. While the IECC/IRC does not specifically define attic knee walls, they are included in the definition of the “*building thermal envelope*” [1] as other building elements that enclose conditioned space or provide a boundary between conditioned space and exempt or unconditioned space.

[1] “*Building Thermal Envelope*” is defined as the basement walls, exterior walls, floor, roof, and any other building elements that enclose conditioned space or provide a boundary between conditioned space and exempt or unconditioned space.

Plan Review:

Per the 2015 IECC/IRC, Section R103.3/R106.3, Examination of Documents. The code official/building official must examine, or cause to be examined, construction documents for code compliance.

This section lists the applicable code requirements followed by details helpful for plan review regarding the provisions to meet the requirements for “attic knee walls.”

- **Construction Documentation.** Review the construction documents for details describing attic knee wall insulation, installation, air sealing, and construction techniques.

- **2015 IECC/IRC, Section R103.2/N1101.5 (2012 IECC/IRC, Section R103.2/N1101.8), Information on Construction Documents.** Construction documents should include:

- o Insulation materials and their R-values
- o Air sealing details.

— **NEW** language (section) in the **2015 IECC/IRC, Section R103.2.1/N1101.5.1, Thermal Envelope Depiction.** The building's thermal envelope should be represented on the construction drawings.

— Insulation. All three versions of the IECC/IRC allow compliance to be demonstrated by the following three prescriptive approaches: 1) R-value computation, 2) U-factor alternative, or 3) total UA alternative. This brief provides the general prescriptive requirements per the R-value computation approach.

— **2015 IECC/IRC, Section R402.1.2/N1102.1.2, Insulation and Fenestration Criteria.** The building thermal envelope should meet the requirements of Table R402.1.2/N1102.1.2, based on the climate zone specified in Chapter 3 of the IECC and Section N1101.10 in the IRC.

— **2015 IECC/IRC, Section R402.1.3/N1102.1.3, R-Value Computation.** Insulation material used in layers, such as framing cavity insulation, or continuous insulation should be summed to compute the corresponding component R-value. The manufacturer's settled R-value should be used for blown insulation. Computed R-values should not include an R-value for other building materials or air films.

— Excerpt from the Insulation and Fenestration Requirements by Component

2015 IECC/IRC Table R402.1.2/N1101.1.2, Table R402.1.1/N1102.1.1 (2012 IECC/IRC)
(R-values are the same for both versions)

Insulation and Fenestration Requirements by Component Table

CLIMATE ZONE	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7, 8
Wood Frame Wall R-Value	13	13	20 or 13+5 ^a	20 or 13+5 ^a	20 or 13+5 ^a	20+5 ^a or 13+10 ^a	20+5 ^a or 13+10 ^a
^a The first value is cavity insulation, the second value is continuous insulation, so 13+5 means R-13 cavity insulation plus R-5 continuous insulation.							

2009 IECC/IRC Insulation and Fenestration Requirements by Component Table 402.1.1/N1102.1

CLIMATE ZONE	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7, 8
Wood Frame Wall	R-13	R-13	R-13	R-13	R-20 or 13+5	R-20 or 13+5	R-21

- o **Air Sealing/Air Leakage Control**
- o **2015 IECC/IRC, R402.4./N1102.4, Air Leakage.** The *building thermal envelope* should be constructed to limit air leakage.
- o **R402.4.1/N1102.4.1, Building Thermal Envelope.** The sealing methods between dissimilar materials should allow for differential expansion and contraction.
- o **R402.4.1.1/N1102.4.1.1, Installation.** The components listed in the Air Barrier and Insulation Installation Table^[2] should be installed in accordance with the manufacturer's instructions and the criteria listed as the applicable method of construction. Below are the General Requirement and components from the table that are applicable to sealing and insulating attic knee walls.
- o **R402.4.1.1/N1102.4.1.1, Air Barrier and Insulation Installation Table**
 - **Air Barrier General Requirements.** A *continuous air barrier*^[3] should be installed in the building envelope. The exterior thermal envelope contains a *continuous air barrier*. Breaks or joints in the *air barrier*^[4] should be sealed.
 - **Air-Barrier Criteria:**
 - **Walls** – The junction of the top plate and top of exterior walls should be sealed.
 - **Insulation Installation:**
 -