

Energy codes and tapered insulation

IECC provides guidance for tapered insulation requirements

by Mark S. Graham

A QUESTION frequently asked regarding roof systems incorporating tapered insulation is what minimum insulation thickness should be used to comply with the applicable energy code's minimum thermal insulation requirements.

Energy codes regulate the efficient use of energy in buildings and provide minimum thermal insulation requirements for building envelopes. For roof assemblies using tapered insulation, roofing professionals often are unclear how to represent tapered insulation R-values.

Methods

Roofing professionals generally represent R-values of tapered insulation systems based on the average R-values for tapered insulation layouts. There are multiple ways to determine tapered insulation systems' average R-values. Depending on the tapered insulation layout and method used to determine average R-value, up to half to two-thirds of a roof area covered by a tapered insulation system can have an R-value less than the average R-value determined.

Because energy codes typically provide minimum requirements, using the average R-value for evaluating tapered insulation systems may not be appropriate for energy code compliance purposes.

IECC

The 2006 and 2009 editions of the International Energy Conservation Code

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(IECC), the applicable energy code for most of the U.S., include specific guidelines for evaluating thermal insulation of varying thicknesses in roof assemblies.

In Chapter 5—Commercial Energy Efficiency, an exception to Section 502.2.1—Roof Assembly indicates: "Continuously insulated roof assemblies where the thickness of the insulation varies by 1 inch (25 mm) or less and where the area-weighted U-factor is equivalent to the same assembly with the R-value specified in Table 502.2(1)." The table provides minimum R-value requirements for building envelope systems, including roof assemblies.

The code's intent is a roof area-weighted R-value determination method is only appropriate for tapered insulation systems where the insulation thickness varies by no more than 1 inch.

The Commentary to IECC's 2009 edition indicates the 1-inch limitation is not intended to prevent tapered insulation systems from having larger variations in thickness; the limitation simply does not allow the insulation thickness beyond the 1-inch variation to be factored into the R-value used for energy code compliance purposes.


When the tapered insulation's thickness variation exceeds 1 inch, the Commentary indicates it is permissible to use an R-value based on the thickness of the insulation where the insulation is 1 inch thicker than the tapered system's low point. Portions of the roof area with insulation thicknesses greater than that 1-inch variation are assumed to have the same R-value for energy code compliance purposes.

For example, for a ¼-inch-per-foot tapered insulation system, the 1-inch thickness variation will occur 4 feet from the tapered system's low point. In this case, the R-value for the insulation at that 4-foot point in the tapered system is intended to be used to comply with the energy code.

Code compliance

IECC's 2006 and 2009 editions contain a provision about insulation of varying thicknesses that can be interpreted to apply to tapered insulation systems.

I encourage you to consult the building official in the jurisdiction where the specific building being considered is located for his or her interpretation of the energy code's minimum R-value requirements for tapered insulation systems.

Additional information about tapered insulation systems is provided on pages 67-76 of *The NRCA Roofing Manual: Membrane Roof Systems—2011*. 

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