

Before specifying a product, approving a building plan for permit, providing a building energy rating, or giving a “pass” on a field inspection, it is important to verify that materials providing the foundation for energy code compliance have a proper basis for any claimed or labeled R-value. Things may not actually be as they first appear. This Quick Guide provides some relevant background and important questions that can assist in ensuring that R-value data for insulation and other building products are valid.

## BACKGROUND

This section provides examples of conditions where claimed R-values may warrant a carefully considered compliance determination following a 3-step process outlined in the next section. The examples involve airspaces, building materials, or a combination of these two components. These examples are not exhaustive and are provided as a basis for using informed judgment when considering the need for an R-value compliance determination.

The presence of an airspace enclosed within a building envelope assembly is known to contribute to the overall thermal performance of the assembly. However, the actual or design R-value of an airspace can vary significantly depending on various conditions of use, such as the air-tightness of the assembly of materials enclosing an airspace.<sup>1</sup>

Airspaces when sealed or enclosed generally provide an R-value of less than 1.<sup>2</sup> Values can be larger (e.g., R-2 to R-2.5)

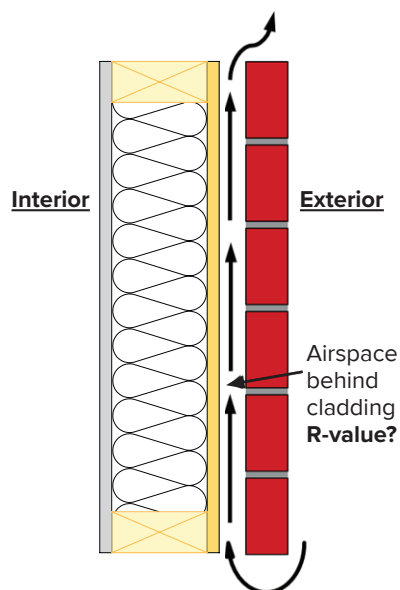
if the airspace is reflective and installation properly encloses an unventilated airspace in accordance with the tested<sup>3</sup> or pre-calculated R-value.<sup>4</sup> However, sometimes the claims put forward for products that rely on airspaces exceed what is physically possible or omit important installation conditions/limitations necessary to achieve the claimed R-value (see Figure 1).

Furthermore, some building wraps may claim high R-values without explicitly requiring installation of an airspace even though one or more sealed airspaces were included in the product’s testing. Thus, you may see R-value claims as high as R-5 to R-6 for materials like a thin “thermal” building wrap. Under actual installation conditions, this type of product may at best provide about R-2 with an enclosed, unvented, and reflective airspace or as little as R-1 or less where such an airspace is not present (see Figure 2).

**In short, if an R-value claim seems too good to be true, it very well may be.**

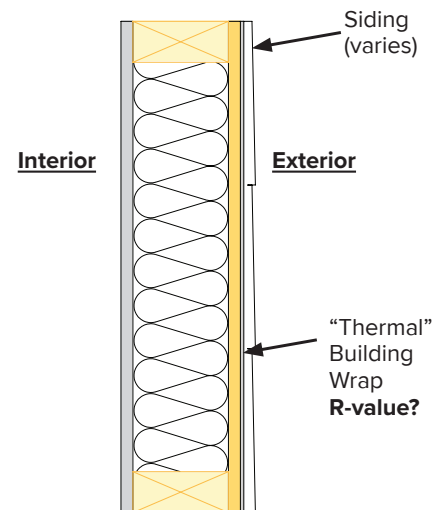
**Figure 1.**

Reflective or non-reflective wrap with vented airspace behind brick or various other sidings that have air-permeable joints or weeps.



**Figure 2.**

Thin “thermal” building wrap.



<sup>1</sup> For additional information and research, refer to [continuousinsulation.org/airspace-r-value](https://www.continuousinsulation.org/airspace-r-value).

<sup>2</sup> See ASHRAE Handbook of Fundamentals.

<sup>3</sup> ASTM C1363 assembly test.

<sup>4</sup> See ASHRAE Handbook of Fundamentals and ASHRAE 90.1 Appendix A, Section A9.4.2 and Table A9.4.2-1.

# 3 VERIFICATION STEPS TO INVESTIGATE THE VALIDITY OF AN R-VALUE CLAIM

## 1. VERIFY THE SOURCE

### Is the identified R-value for a product certified by a credible third party?

Sections [C303.1](#) and [R303.1](#) of the International Energy Conservation Code (IECC) give authority to the code official to determine if an R-value for a given product is “identified in a manner that will allow a determination of compliance.” Where a material’s identified R-value is in question (see BACKGROUND section for examples), a determination of compliance should consider the manner by which the R-value is identified. For example, what is the source and is it credible?

Many U.S. insulation manufacturers employ an accredited third party to certify reported R-values and other material properties as a means of demonstrating compliance.<sup>5</sup> Credible third parties that certify building material properties for code compliance qualify as *approved sources* and/or *approved agencies* (as defined below) in U.S. model building and energy codes. In general, such entities operate in accordance with accepted standards for certification of products, which includes monitoring quality control and conformity of installation instructions (ISO/IEC 17065), testing (ISO/IEC 17025), and inspection (ISO/IEC 17020). In the U.S., approved sources and approved agencies are commonly accredited by ANAB<sup>6</sup> (or other similar entity) for building materials product certification.

Where the identified R-value for a product is not certified by a credible third party and remains questionable, it is advisable to continue to STEPS 2 and 3.

**APPROVED SOURCE.** An independent person, firm or corporation, *approved* by the *building official*, who is competent and experienced in the application of engineering principles to materials, methods or systems analyses.

**APPROVED AGENCY.** An established and recognized agency that is regularly engaged in conducting tests, furnishing inspection services or furnishing product certification where such agency has been *approved* by the *building official*.

## 2. CHECK THE TECHNICAL DATA

### Is the technical basis for the identified R-value compliant with the code?

There must be a credible technical basis for the identified R-value associated with any product. The technical basis should include relevant test data, calculations, or published data from a credible source (see STEP 1). Such technical data is necessary to make a “determination of compliance.”

Where technical data complying with IECC Sections [C303.1.4](#) and [R303.1.4](#) is not available, it is not possible to make a determination of compliance. Therefore, the absence of such data should be the basis for a determination of non-compliance.

Where technical data is available or made available upon request, then the following questions should be investigated to support a determination of compliance or non-compliance:

- Were the required tests, calculations, or published data produced by an approved source, approved agency, or accredited third party<sup>5</sup> (see STEP 1)?
- Does the technical data include adequate information to make a determination that the test methods, calculations, or published data used to determine the R-value comply with IECC Sections [C303.1.4](#) and [R303.1.4](#)?<sup>7</sup>
- Does the technical data clearly indicate the presence or absence of any deviation from the test methods, calculations, or published data required by IECC Sections [C303.1.4](#) and [R303.1.4](#)?<sup>7</sup>
  - ▶ If deviations are found to exist they may render the data irrelevant, not consistent with accepted practice, or otherwise require coordination with installation conditions in a manner consistent with the deviations (see STEP 3).
- Does the test approach, calculations, or published data include materials or components other than the product itself, such as a sealed and enclosed airspace or other material layers?
  - ▶ If so, the R-value is not that of the product. Rather, the R-value represents that of the system or assembly. Therefore, all of the tested components must be included in the installation instructions and the final installation to achieve compliance (see STEP 3).
  - ▶ Where systems or assemblies are used as the technical basis for an R-value, it typically does not qualify as a product R-value as used for R-value compliance. Instead, it may require compliance by means of a tested U-factor for the specific building envelope assembly conditions (see STEP 3).

<sup>5</sup> Requiring an accredited third party certification or testing of a product’s R-value is not an explicit code requirement except in the case of fenestration (see IECC Sections [C303.1.3](#) and [R303.1.3](#)). However, it is a matter of code official discretion in applying the intent of Sections [C303.1](#) and [R303.1](#) of the IECC to materials other than fenestration.

<sup>6</sup> For additional information on ANAB, refer to [anab.ansi.org](http://anab.ansi.org).

<sup>7</sup> The required test methods or other technical bases for determining insulation product R-values are found in the Federal Trade Commission (FTC) R-value Rule ([CFR Title 16, Part 460](#)).

### 3. CHECK INSTALLATION DETAILS

#### Are the installation instructions and installed conditions consistent with the technical data investigated in STEP 2?

Finally, for a product to be used in a compliant manner, it is important to confirm that the manufacturer's installation instructions match the technical basis for determining the product's R-value as outlined in STEP 2. Several matters related to installation conditions were addressed in STEP 2 and, where found to be applicable, the product manufacturer's installation instructions should be obtained and verified to include all applicable installation conditions. The same installation conditions should also be verified as part of the inspection process during construction.

If one or more airspaces were included in the technical basis for a product's R-value (as determined in STEP 2), then it is particularly important that the installation instructions include those airspaces (including the presence of one or more reflective surfaces if applicable to the technical basis of the product's R-value).

In addition, it must be verified that the airspace is installed in accordance with code requirements for the construction of airspaces used to help comply with the code's building thermal envelope requirements. Such requirements are found in [IECC Section C402.2.7](#), [ASHRAE 090.1-2019 Section A9.4.2](#), and also in the [ASHRAE Handbook of Fundamentals](#). In general, the airspace must be unventilated and enclosed on all sides.

**If these questions check out, then it is likely that the R-value claim is legitimate. The main issue is to ensure installation in the field reasonably matches the basis for the claimed R-value.**

## Why is verifying material R-values important?

1. The energy conservation intent of the energy code<sup>8</sup> relies on the R-values of materials used for compliance.
2. Energy code compliance (for all compliance paths) depends on insulation material R-values complying with Chapter 3 of the IECC.
3. Building moisture control and durability performance required in the building code depends on the R-value of insulation materials<sup>9</sup> and this also carries potential health and safety implications over the useful life of the building related to the purpose of the building code.<sup>10</sup>
4. Energy use of commercial and residential buildings is fundamentally linked to the performance of insulation materials complying with the code.
5. The duties and powers assigned to the building official to enforce the provisions of the building code<sup>11</sup> includes energy conservation and the approval of materials,<sup>12</sup> as well as the approval of alternative materials and methods as being equivalent to those specified in the code.<sup>13</sup>

<sup>8</sup> See IECC Sections [C101.3](#) and [R101.3](#).

<sup>9</sup> See [IBC Section 1404.3](#) and [IRC Section R702.7](#).

<sup>10</sup> See [IBC Section 101.3](#) and [IRC Section R101.3](#).

<sup>11</sup> See [IBC Section 104](#) and [IRC Section R104](#).

<sup>12</sup> See [IBC Section 104.9](#) and [IRC Section R104.9](#).

<sup>13</sup> See [IBC Section 104.11](#), [IRC Section R104.11](#), and IECC Sections [C102](#) and [R102](#).

**DISCLAIMER** While reasonable effort has been made to ensure the accuracy of the information presented, the actual design, suitability and use of this information for any particular application is the responsibility of the user. Where used in the design of buildings, the design, suitability and use of this information for any particular building is the responsibility of the Owner or the Owner's authorized agent. The information contained herein is provided "as is."

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