



**R406.2 ERI compliance.** Compliance based on the ERI requires that the rated design meets all of the following:

1. The requirements of the sections indicated within Table R406.2.
2. Maximum ERI of Section R406.4 values indicated in of Table R406.5-4.

**TABLE R406.2  
REQUIREMENTS FOR ENERGY RATING INDEX**

SECTION <sup>a</sup>	TITLE
<b>General</b>	
R401.2.5	Additional efficiency packages
R401.3	Certificate
<b>Building Thermal Envelope</b>	
R402.1.1	Vapor retarder
R402.2.3	Eave baffle
R402.2.4.1	Access hatches and doors
<u>R402.2.8.1</u>	<u>Basement Wall Insulation Installation</u>
<u>R402.2.9.1</u>	<u>Slab-on-grade floor insulation installation</u>
R402.2.10.1	Crawl space wall insulation installation
R402.4.1.1	Installation
R402.4.1.2	Testing
<u>R402.4.2</u>	<u>Fireplaces</u>
<u>R402.4.3</u>	<u>Fenestration air leakage</u>
<u>R402.4.4</u>	<u>Rooms containing fuel burning appliances</u>
<u>R402.4.5</u>	<u>Recessed lighting</u>
<u>R402.4.6</u>	<u>Electrical and communication outlet boxes (air Sealed boxes)</u>
<b>Mechanical</b>	
R403.1	Controls
<u>R403.2</u>	<u>Hot water boiler temperature reset</u>
R403.3 except Sections R403.3.2, R403.3.3 and R403.3.6	Ducts
R403.4	Mechanical system piping insulation
R403.5.1	Heated water calculation and temperature maintenance systems
R403.5.3	Drain water heat recovery units
R403.6	Mechanical ventilation
R403.7	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9	Snow melt and ice systems
R403.10	Energy consumption of pools and spas
R403.11	Portable spas

R403.12	Residential pools and permanent residential spas
<b>Electrical Power and Lighting Systems</b>	
R404.1	Lighting equipment
404.2	Interior lighting controls
<del>R406.3</del>	<del>Building thermal envelope</del>

~~**R406.3 Building thermal envelope.** Building and portions thereof shall comply with Section R406.3.1 or R406.3.2.~~  
~~**R406.3.1 On-site renewables are not included.** Where on-site renewable energy is not included for compliance using the ERI analysis of Section R406.4, the proposed total building thermal envelope UA, which is sum of U factor times assembly area, shall be less than or equal to the building thermal envelope UA using the prescriptive U factors from Table R402.1.2 multiplied by 1.15 in accordance with Equation 4-1. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.~~

$$UA_{\text{Proposed design}} = 1.15 \times UA_{\text{Prescriptive reference design}}$$

~~(Equation 4-1)~~

~~**R406.3.2 On-site renewables are included.** Where onsite renewable energy is included for compliance using the ERI analysis of Section R406.4, the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the 2015 *International Energy Conservation Code*.~~

~~**R406.4.3 Energy Rating Index.** The Energy Rating Index (ERI) shall be determined in accordance with ANSI/RESNET/ICC 301. Except for buildings covered by the *International Residential Code*, the ERI reference design ventilation rate shall be in accordance with Equation 4-2.~~

$$\text{Ventilation rate, CFM} = \frac{(0.01 \times \text{total square foot area of house}) + [7.5 \times (\text{number of bedrooms} + 1)]}{\text{floor area}}$$

~~(Equation 4-2)~~

Energy used to recharge or refuel a vehicle used for transportation on roads that are not on the building site shall not be included in the *ERI reference design* or the *rated design*. For compliance purposes, any reduction in energy use of the rated design associated with on-site renewable energy shall not exceed 5 percent of the total energy use.

~~**R406.5.4 ERI-based compliance.** Compliance based on an ERI analysis requires that the *rated proposed design* and confirmed built dwelling be shown to have an ERI score less than or equal to the appropriate value indicated in Table R406.5.50 when compared to the *ERI reference design*.~~

~~**TABLE R406.5  
MAXIMUM ENERGY RATING INDEX**~~

<del>CLIMATE ZONE</del>	<del>ENERGY RATING INDEX without OPP</del>
<del>0-1</del>	<del>52</del>
<del>2</del>	<del>52</del>
<del>3</del>	<del>51</del>
<del>4</del>	<del>54</del>
<del>5</del>	<del>55</del>
<del>6</del>	<del>54</del>
<del>7</del>	<del>53</del>
<del>8</del>	<del>53</del>

~~**R406.6.5 Verification by approved agency.** Verification of compliance with Section R406 as outlined in Sections R406.4.3 and R406.6.5 shall be completed by an *approved* third party. Verification of compliance with Section R406.2 shall be completed by the authority having jurisdiction or an *approved* third-party inspection agency in accordance with Section R105.4.~~

**R406.7.6 Documentation.** Documentation of the software used to determine the ERI and the parameters for the *residential building* shall be in accordance with Sections R406.7.6.1 through R406.7.6.4.

**R406.7.6.1 Compliance software tools.** Software tools used for determining ERI shall be *Approved* Software Rating Tools in accordance with RESNET/ICC 301.

**R406.7.6.2 Compliance report.** Compliance software tools shall generate a report that documents that the home and the ERI score of the *rated design* complies with Sections R406.2, R406.3 and R406.4. Compliance documentation shall be created for the proposed design and shall be submitted with the application for the building permit. Confirmed compliance documents of the built *dwelling unit* shall be created and submitted to the code official for review before a certificate of occupancy is issued. Compliance reports shall include information in accordance with Sections R406.7.6.2.1 and R406.7.6.2.2.

**R406.7.6.2.1 Proposed compliance report for permit application.** Compliance reports submitted with the application for a building permit shall include the following:

1. Building street address, or other *building site* identification.
2. Declare ERI on title page and building plans.
3. The name of the individual performing the analysis and generating the compliance report.
4. The name and version of the compliance software tool.
5. Documentation of all inputs entered into the software used to produce the results for the reference design and/or the rated home.
6. A certificate indicating that the proposed design has an ERI less than or equal to the appropriate score indicated in Table R406.5 when compared to the ERI reference design. The certificate shall document the building component energy specifications that are included in the calculation, including: component level insulation *R*-values or *U*-factors; assumed duct system and building envelope air leakage testing results; and the type and rated efficiencies of proposed heating, cooling, mechanical ventilation, and service water-heating equipment to be installed. If on-site renewable energy systems will be installed, the certificate shall report the type and production size of the proposed system.
7. When a site-specific report is not generated, the proposed design shall be based on the worst-case orientation and configuration of the rated home.

**R406.7.6.2.2 Confirmed compliance report for a certificate of occupancy.** A confirmed compliance report submitted for obtaining the certificate of occupancy shall be made site and address specific and include the following:

1. Building street address or other *building site* identification.
2. Declaration of ERI on title page and on building plans.
3. The name of the individual performing the analysis and generating the report.
4. The name and version of the compliance software tool.
5. Documentation of all inputs entered into the software used to produce the results for the reference design and/or the rated home.
6. A final confirmed certificate indicating that the confirmed rated design of the built home complies with Sections R406.2 and R406.4. The certificate shall report the energy features that were confirmed to be in the home, including: component-level insulation *R*-values or *U*-factors; results from any required duct system and building envelope air leakage testing; and the type and rated efficiencies of the heating, cooling, mechanical ventilation, and service water-heating equipment installed. Where on-site renewable energy systems have been installed on or in the home, the certificate shall report the type and production size of the installed system.

**R406.7.6.3 Renewable energy certificate (REC) documentation.** Where on-site renewable energy is included in the calculation of an ERI, one of the following forms of documentation shall be provided to the code official:

1. Substantiation that the RECs associated with the on-site renewable energy are owned by, or retired on behalf of, the homeowner.
2. A contract that conveys to the homeowner the RECs associated with the on-site renewable energy, or conveys to the homeowner an equivalent quantity of RECs associated with other renewable energy.

**R406.7.6.4 Additional documentation.** The *code official* shall be permitted to require the following documents:

1. Documentation of the building component characteristics of the *ERI reference design*.
2. A certification signed by the builder providing the building component characteristics of the *rated design*.
3. Documentation of the actual values used in the software calculations for the *rated design*.

**R406.7.6.5 Specific approval.** Performance analysis tools meeting the applicable subsections of Section R406 shall be *approved*. Documentation demonstrating the approval of performance analysis tools in accordance with Section R406.7.1 shall be provided.

**R406.7.6.6 Input values.** Where calculations require input values not specified by Sections R402, R403, R404 and R405, those input values shall be taken from RESNET/ICC 301.

**Supporting Information (Required):**

**Purpose:**

The purpose of this proposal is to clarify language in section R406, better align the compliance path in R406 with the prescriptive path in the code and to calibrate the ERI target in the R406 compliance path with the goals for efficiency for residential buildings in *Denver's Net Zero Energy New Buildings & Homes Implementation Plan*

**Reason:**

Achieving Denver's goals for the 2022 code cycle will require substantial improvements to the efficiency of the energy code and corresponding changes to the ERI target in section R406. Additionally, as the Denver energy code gets more stringent, more projects will gravitate to the ERI compliance option in R406. This creates an important need to ensure that the language in section R406 is clearly understandable and enforceable and that the ERI and prescriptive paths are well-aligned and that no important requirements found in the prescriptive path are missed in the ERI path.

**Substantiation:**

This proposal is based on research that has identified inconsistencies within the IECC energy Rating Index that has caused the IECC ERI and the RESNET HERS ERI to diverge from each other. Modeling exercises have determined that score differences between the two ERI scores can be as much as 10 to 16 points. This is primarily due to a ventilation amendment that was added to Section R406 in the 2021 IECC specifically in section R406.4 Energy Rating Index. This section requires the use of RESNET/ICC/ANSI 301 standard to guide the generation of the index score. The 2021 IECC changed the ventilation rate for the 2021 ERI score which is the primary reason, amongst some others, that has led to the divergence. This proposed amendment will link the ERI score used in Denver's code to the unamended ANSI 301 standard to avoid confusion in the marketplace and because this is the ERI score that the city used in the climate action plan. An additional justification for the unamended ANSI 301 standard's ERI is that the index score is used in nationally recognized programs such as EnergyStar, DOE Zero Energy Ready Homes, and PHIUS. Therefore, use of the unamended ANSI 301 standard creates consistency in the marketplace.

This proposal also expands the R406 requirement table to ensure parity between the prescriptive path and this performance compliance path. It does this by requiring all things that are associated with installation that is required by the prescriptive path. These items used to be called mandatory measures in the 2018 IECC. That language was abandoned in the 2021 IECC and was replaced by the work Requirement. It was made clear that these requirements are required in the performance compliance approaches by inserting a requirement table that points to each requirement outlined in Section R402 in sections R405 Building Performance and R406 Energy Rating Index.

A simple example would be Section R402.2.3 Eave Baffles which used to be labeled mandatory in the prescriptive section of the 2018 IECC. This created confusion because the intent of the code is that if a building is using a ventilated attic, it must also install attic eave baffles regardless of the compliance option used. In other words, attic eave baffles or the way that you install insulation is not a tradeable item, the only things that can be traded are R-values and U-values. Using this logic, this proposal adds some section to Table R406.2 which discuss how to install a component that were felt to be advertently left out of the table.

Finally, the proposal calibrates the ERI path to Denver's goals for the 2022 code cycle. *Denver's Net Zero Energy New Buildings & Homes Implementation Plan* sets a goal of an ERI of 50 without onsite renewables and 40 with onsite renewables. Another proposal in this code cycle creates a minimum onsite renewable energy requirement that fulfils the goal of increased onsite renewable energy for Denver homes, so this

proposal is focused on fundamental performance and has been coordinated with that proposal (that proposal stipulates that onsite renewable energy that is used to comply with the minimum renewable energy requirement can't be used to meet the ERI target). This proposal does not require onsite renewable energy, but it does allow a small amount of additional onsite renewable energy (5%) to be used to meet the ERI target to provide some increased flexibility for projects. (This limit is in the current code language.) This recognizes that setting the ERI compliance score with only limited onsite power production (OPP) is a means to ensure a sound thermal envelope that is reasonably equal to the prescriptive path while still offering designers and builders greater flexibility to specify energy features and building techniques to determine the most cost-effective way to achieve compliance. In this way the ERI score itself is used as a backstop to ensure that a sound building thermal envelope is always part of what is achieved through the building code.

By setting an ERI target that is Denver specific, it was also possible to simplify the code language by moving the ERI target from a multi-climate-zone table into the code text itself and eliminate the table.

**Bibliography and Access to Materials** (as needed when substantiating material is associated with the amendment proposal):

**Other Regulations Proposed to be Affected**

**\*For proposals to delete content from the 2019 Denver Green Code in conjunction with adding it to other mandatory Denver codes and/or regulations, only.**

Please identify which other mandatory codes or regulations are suggested to be updated (if any) to accept relocated content.

**Referenced Standards:**

List any new referenced standards that are proposed to be referenced in the code.

**Impact:**

How will this proposal impact cost and restrictiveness of code? ("X" answer for each item below)

Cost of construction: \_\_\_ Increase \_\_\_ Decrease \_\_x\_\_ No Impact

Cost of design: \_\_X\_\_ Increase \_\_\_ Decrease \_\_\_ No Impact

Cost may increase as this path requires the use of a 3<sup>rd</sup> party energy consultant/Energy Rater.

Restrictiveness: \_\_\_ Increase \_\_x\_\_ Decrease \_\_\_ No Impact

**Departmental Impact (City use only):**

This amendment proposal increases/decreases/is neutral to the cost of plans review.

This amendment increases/decreases/is neutral to the cost of inspections.