

Mod Number	Text of Mod																				
<b>RE#1</b>	Adds applicable dwelling and building types, a subsection noting application of appendices, and moves “design and construction” language from R101.3 to Scope section																				
Related Mods: RED1-8-22	<p><b>R101.2 Scope.</b> This code applies to residential buildings, building sites and associated systems and equipment the design and construction of detached one- and two-family dwellings and multiple single-family dwellings (townhouses) and Group R-2, R-3 and R-4 buildings three stories or less in height above grade plane.</p> <p>R101.2.1 Appendices. Provisions in the appendices shall not apply unless specifically adopted</p> <table border="1"> <tr> <td>Staff Classification</td> <td>Correlates Directly</td> <td>Energy Standard Needed</td> <td colspan="2">Over lap</td> </tr> <tr> <td></td> <td>X</td> <td></td> <td colspan="2"></td> </tr> <tr> <td>Action</td> <td>AS</td> <td>AS/IC</td> <td>D</td> <td>D/IC</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>	Staff Classification	Correlates Directly	Energy Standard Needed	Over lap			X				Action	AS	AS/IC	D	D/IC					
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<b>RE#2</b>	Revises Intent section language, including adding optional supplemental requirements overview, non-mandatory appendices, and code update cycle discussions Renumbered from R101.5 Renumbered from R101.5.1																				
Related Mods:	<p><b>R101.3 Intent.</b> <del>This code shall regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.</del> The IECC—Residential Provisions provide market-driven, enforceable requirements for the design and construction of residential buildings, providing minimum efficiency requirements for buildings that result in the maximum level of energy efficiency that is safe, technologically feasible, and life cycle cost-effective, considering economic feasibility, including potential costs and savings for consumers and building owners, and return on investment. Additionally, the code provides jurisdictions with optional supplemental requirements, including requirements that lead to achievement of zero energy buildings, presently, and, through glidepaths that achieve zero energy buildings by 2030 and on additional timelines sought by governments, and achievement of additional policy goals as identified by the Energy and Carbon Advisory Council and approved by the Board of Directors. The code may include nonmandatory appendices DRAFT for AHJ Assessments ONLY incorporating additional energy efficiency and greenhouse gas reduction resources developed by the International Code Council and others. Requirements contained in the code will include, but not be limited to, prescriptive- and performance-based pathways. The code will aim to simplify code requirements to facilitate the code’s use and compliance rate. The code is updated on a 3-year cycle with each subsequent edition providing increased energy savings over the prior edition. The IECC residential provisions shall include an update to Chapter 11 of the International Residential Code. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this intent. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.</p> <p><del>R101.5</del><b>R101.4 Compliance.</b> Residential buildings shall meet the provisions of IECC—Residential Provisions. Commercial buildings shall meet the provisions of IECC—Commercial Provisions.</p> <p><del>R101.5.1</del><b>R101.4.1 Compliance materials.</b> The code official shall be permitted to approve specific computer software, worksheets, compliance manuals and other similar materials that meet the intent of this code.</p> <table border="1"> <tr> <td>Staff Classification</td> <td>Correlates Directly</td> <td>Energy Standard Needed</td> <td colspan="2">Over lap</td> </tr> <tr> <td></td> <td>X</td> <td></td> <td colspan="2"></td> </tr> <tr> <td>Action</td> <td>AS</td> <td>AS/IC</td> <td>D</td> <td>D/IC</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>	Staff Classification	Correlates Directly	Energy Standard Needed	Over lap			X				Action	AS	AS/IC	D	D/IC					
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**RE#3**  
 Renumbered from R101.4  
 Renumbered from R101.4.1  
 Renumbered from R108.3  
 Renumbered from R108.2  
 Renumbered from R108.1  
 Renumbered from R108.1.1  
 Renumbered from R108.1.2

Related Mods:  
 RED1-9-22

**SECTION 102 APPLICABILITY**

**R101.4 R102.1** Applicability. Where, in any specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive shall govern. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall govern

**R101.4.1 R102.1.1** Mixed residential and commercial buildings. Where a building includes both residential building and commercial building portions, each portion shall be separately considered and meet the applicable provisions of the IECC—Commercial Provisions or IECC—R

**R108.3 R102.2** Other laws. The provisions of this code shall not be deemed to nullify any provisions of local, state or federal law.

**R108.2 R102.3** Application of references. References to chapter or section numbers, or to provisions not specifically identified by number, shall be construed to refer to such chapter, section or provision of this code.

**R108.1 R102.4** Referenced codes and standards. The codes and standards referenced in this code shall be those indicated in Chapter 6, and such codes and standards shall be considered as part of the requirements of this code to the prescribed extent of each such reference and as further regulated in Sections R102.4.1 and R102.4.2.

**R108.1.1 R102.4.1** Conflicts. Where conflicts occur between provisions of this code and referenced codes and standards, the provisions of this code shall apply.

**R108.1.2 R102.4.2** Provisions in referenced codes and standards. Where the extent of the reference to a referenced code or standard includes subject matter that is within the scope of this code, the provisions of this code, as applicable, shall take precedence over the provisions in the referenced code or standard.

**R107.1 R102.5** General. Partial invalidity. If a portion of this code is held to be illegal or void, such a decision shall not affect the validity of the remainder of this code

Note: Original text of mod is not consistent with that of the 2023 FEC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

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Action	AS	AS/IC	D	D/IC
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**RE#4**  
 New section providing code compliance enforcement agency, appointment and deputy language  
 Provides enforcement agency creation language  
 Requires that the AHJ be appointed by the chief appointing authority of the jurisdiction  
 Provides for the AHJ's authority to appoint a deputy and other employees

Related Mods:  
 RED1-9-22

**PART 2—ADMINISTRATION AND ENFORCEMENT**  
**SECTION R103**  
**CODE COMPLIANCE AGENCY**

**R103.1** Creation of enforcement agency. The [INSERT NAME OF DEPARTMENT] is hereby created and the official in charge thereof shall be known as the authority having jurisdiction (AHJ). The function of the agency shall be the implementation, administration and enforcement of the provisions of this code.

**R103.2** Appointment. The AHJ shall be appointed by the chief appointing authority of the jurisdiction.

**R103.3 Deputies.** In accordance with the prescribed procedures of this jurisdiction and with the concurrence of the appointing authority, the AHJ shall have the authority to appoint a deputy AHJ, other related technical officers, inspectors and other employees. Such employees shall have powers as delegated by the AHJ.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

  

Action	AS	AS/IC	D	D/IC

**RE#5**

Renumbered from R102.1  
 Renumbered from R102.1.1 and changes the thermal envelope requirements from 2009 IECC table-based efficiencies to thermal conductance (TC) calculation efficiencies

Related Mods:  
 RED1-9-22  
 REPI-4-21  
 REPI-33-21  
 RED1-186-22  
 RED1-10-22  
 RED1 185-22

**SECTION R402-R104 ALTERNATIVE MATERIALS, DESIGN AND METHODS OF CONSTRUCTION AND EQUIPMENT**

**402.1 R104.1 General.** The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. The code official shall have the authority to approve an alternative material, design or method of construction upon the written application of the owner or the owner's authorized agent. The code official shall first find that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code for strength, effectiveness, fire resistance, durability, energy conservation and safety. The code official shall respond to the applicant, in writing, stating the reasons why the alternative was approved or was not approved.

**R402.1.1 R104.1.1 Above code programs.** The code official or other AHJ shall be permitted to deem a national, state or local energy-efficiency program to exceed the energy efficiency required by this code. Buildings approved in writing by such an energy-efficiency program shall be considered to be in compliance with this code where such buildings also meet the requirements identified in **Table R405.2** and the **proposed total building thermal envelope thermal conductance (TC) shall be less than or equal to the total building thermal envelope TC using the prescriptive U-factors and F-factors from Table R402.1.2 multiplied by 1.08 in Climate Zones 0, 1 and 2, and by 1.15 in Climate Zones 3 through 8, in accordance with Equation 1-1. The area-weighted maximum fenestration solar heat gain coefficients (SHGC) permitted in Climate Zones 0 through 3 shall be 0.30 is greater than or equal to levels of efficiency and solar heat gain coefficients (SHGC) in Tables 402.1.1 and 402.1.3 of the 2009 International Energy Conservation Code**

Note: Original text of mod is not consistent with that of the 2023 FEC.

For Climate Zones 0–2:  $TC_{Proposed\ design} \leq 1.08 \times TC_{Prescriptive\ reference\ design}$

For Climate Zones 3–8:  $TC_{Proposed\ design} \leq 1.15 \times TC_{Prescriptive\ reference\ design}$

Equation 1-1

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

  

Action	AS	AS/IC	D	D/IC

<p><b>RE#6</b></p>	<p>Renumbered from R103  Renumbered from R103.1  Renumbered from R103.2  Renumbered from R103.2.1  New section stipulating that where a solar-ready zone is provided, the construction documents indicate dedicated roof area, roof and ground loads, and routing of conduit, prewiring, or plumbing  Renumbered from R103.3  Renumbered from R103.3.1  Renumbered from R103.3.2  Renumbered from R103.3.3  Renumbered from R103.4  Renumbered from R103.5</p>
<p>Related Mods:  RED1-9-22  RED1-10-22</p>	<p><b>SECTION R403-R105</b>  <b>CONSTRUCTION DOCUMENTS</b>  <del>R403.1</del> <b>R105.1 General.</b> Construction documents , technical reports and other supporting data shall be submitted in one or more sets, or in a digital format where allowed by the code official, with each application for a permit. The construction documents and technical reports shall be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed. Where special conditions exist, the code official is authorized to require necessary construction documents to be prepared by a registered design professional.  <b>Exception:</b> The code official is authorized to waive the requirements for construction documents or other supporting data if the code official determines they are not necessary to confirm compliance with this code.</p> <p><del>R403.2</del> <b>R105.2</b> Information on construction documents. Construction documents shall be drawn to scale on suitable material. Electronic media documents are permitted to be submitted where approved by the code official. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the building, systems and equipment as herein governed. Details shall include the following as applicable: 1. Energy compliance path. 2. Insulation materials and their R-values. 3. Fenestration U-factors and solar heat gain coefficients (SHGC). 4. Area-weighted U-factor and solar heat gain coefficients (SHGC) calculations. 5. Mechanical system design criteria. 6. Mechanical and service water-heating systems and equipment types, sizes and efficiencies. 7. Equipment and system controls. 8. Duct sealing, duct and pipe insulation and location. 9. Air sealing details. R103.2.1R105.2.1 Building thermal envelope depiction. The building thermal envelope shall be represented on the construction documents .</p> <p><del>R403.2.1</del> <b>R105.2.1 Building thermal envelope dep</b> <i>thermal envelope shall be represented on the construction documents .</i></p> <p><b>R105.2.2 Solar-ready system.</b> Where a solar-ready zone is provided, the construction documents shall indicate details for a dedicated roof area for the solar-ready zone, roof dead load, roof live load, ground snow load and the routing of conduit or prewiring from the solar-ready zone to an electrical service panel or plumbing from the solar-ready zone to a service water heating system</p> <p><del>R403.3</del> <b>R105.3</b>  <b>Examination of documents.</b> The code official shall examine or cause to be examined the accompanying construction documents and shall ascertain whether the construction indicated and described is in accordance with the requirements of this code and other pertinent laws or ordinances. The code official is authorized to utilize a registered design professional, or other approved entity not affiliated with the building design or construction, in conducting the review of the plans and specifications for compliance with the code.</p> <p><del>R403.3.1</del> <b>R105.3.1 Approval of construction documents.</b> When the code official issues a permit where construction documents are required, the construction documents shall be endorsed in writing and stamped “Reviewed for Code Compliance.” Such approved construction documents shall not be changed, modified or altered without authorization from the code official. Work shall be done in accordance with the approved construction documents . One set of construction documents so reviewed shall be retained by the code official. The other set shall be returned to the applicant, kept at the site of work and shall be open to inspection by the code official or a duly authorized representative.</p>



~~R103.3.2~~ **R105.3.2 Previous approvals.** This code shall not require changes in the construction documents , construction or designated occupancy of a structure for which a lawful permit has been heretofore issued or otherwise lawfully authorized, and the construction of which has been pursued in good faith within 180 days after the effective date of this code and has not been abandoned.

~~R103.3.3~~ **R105.3.3 Phased approval.** The code official shall have the authority to issue a permit for the construction of part of an energy conservation system before the construction documents for the entire system have been submitted or approved, provided adequate information and detailed statements have been filed complying with all pertinent requirements of this code. The holders of such permit shall proceed at their own risk without assurance that the permit for the entire energy conservation system will be granted.

~~R103.4~~ **R105.4 Amended construction documents.** Work shall be installed in accordance with the approved construction documents , and any changes made during construction that are not in compliance with the approved construction documents shall be resubmitted for approval as an amended set of construction documents . R103.5R105.5 Retention of construction documents. One set of approved construction documents shall be retained by the code official for a period of not less than 180 days from date of completion of the perm

~~R103.5~~**R105.5 Retention of construction documents.** One set of *approved construction documents* shall be retained by the *code official* for a period of not less than 180 days from date of completion of the permitted work, or as required by state or local laws.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

  

Action	AS	AS/IC	D	D/IC

**RE#7**

Renumbered from R104  
 Renumbered from R104.1 and minor editing  
 Renumbered from R104.2  
 New section requiring applicant for a permit to provide an estimated value of the work at the time of application  
 Renumbered from R104.3  
 Renumbered from R104.4  
 Renumbered from R104.5

Related Mods:  
 RED1-9-22  
 CEPI-8-21 Part II, RED1-10-22

~~R104~~**R106 FEES**

~~R104.1~~**R106.1 Fees. Payment of fees.** A permit shall not be issued **valid** until the fees prescribed in ~~Section R106.2~~ **by law** have been paid, ~~nor~~ **Nor** shall an amendment to a permit be released until the additional fee, if any, has been paid.

~~R104.2~~**R106.2 Schedule of permit fees.** Where a permit is required, a fee for each permit shall be paid as required, in accordance with the schedule as established by the applicable governing authority.

**R106.3 Permit valuation.** The applicant for a permit shall provide an estimated value of the work for which the permit is being issued at the time of application. Such estimated valuations shall include the total value of the work, including materials and labor. Where, in the opinion of the *code official* , the valuation is underestimated, the permit shall be denied unless the applicant can show detailed estimates acceptable to the *code official* . The final valuation shall be *approved by the code official* .

~~R104.3~~**R106.4 Work commencing before permit issuance.** Any person who commences any work before obtaining the necessary permits shall be subject to an additional fee established by the *code official* that shall be in addition to the required permit fees.

~~R104.4~~**R106.5 Related fees.** The payment of the fee for the construction, *alteration* , removal or demolition of work done in connection to or concurrently with the work or activity authorized by a permit shall not relieve the applicant or holder of the permit from the payment of other fees that are prescribed by law.

~~R104.5~~**R106.6 Refunds.** The *code official* is authorized to establish a refund policy.

FBC – Section R104 is marked reserved in the 2023 FBC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

  

Action	AS	AS/IC	D	D/IC

**RE#8**

Renumbered from R105  
 Renumbered from R105.2  
 Renumbered from R105.2.1  
 Renumbered from R105.2.2, adds “air barrier” to title, and replaces existing insulation and fenestration inspection text with expanded air barrier inspection text (insulation and fenestration inspection text moved to new Section R107.2.6)  
 Renumbered from R105.3  
 Renumbered from R105.4, adds “third-party” to title, and adds requirement that third-party inspection agencies be approved prior to issuance of the building permit  
 New section requiring approved third-party inspection agency provide all requested information for the code official to determine that the agency meets the applicable requirements, and to authorize its work in the jurisdiction.  
 New section requiring that an approved third-party inspection agency be an independent business identity, perform its duties in accordance with the scope of delegated responsibilities established by the code official, disclose any conflicts of interest, and acknowledge in writing that it is authorized to work only within the scope of delegated responsibilities  
 New section that requires that an approved third-party inspection agency have adequate equipment to perform required inspections and tests and that all testing equipment be calibrated as required  
 New section that requires that personnel assigned by an approved third-party inspection agency to perform inspections and testing be trained or credentialed, and documentation of training or credentials be available upon request  
 New section that stipulates that where approved, a third-party inspection agency has the authority to perform delegated inspections and determine compliance or noncompliance of work  
 New section that stipulates third-party inspection agencies reporting requirements  
 Renumbered from R105.5

Renumbered from R105.6

Related Mods:  
 RED1 9-22  
 RED1-10-22  
 REPI-33-21,  
 RED1-14-22  
 RED1-16-22

SECTION R107 VALIDITY

**SECTION R105R107  
 INSPECTIONS**

**R105.4R107.1 General.** Construction or work for which a permit is required shall be subject to inspection by the *code official* or his or her designated agent, and such construction or work shall remain visible and able to be accessed for inspection purposes until *approved*. It shall be the duty of the permit applicant to cause the work to remain visible and able to be accessed for inspection purposes. Neither the *code official* nor the jurisdiction shall be liable for expense entailed in the removal or replacement of any material, product, system or building component required to allow inspection to validate compliance with this code.

**R105.2R107.2 Required inspections.** The *code official* or his or her designated agent, upon notification, shall make the inspections set forth in **Sections R107.2.1 through R107.2.7.**

~~R105.2.1~~**R107.2.1 Footing and foundation inspection.** Inspections associated with footings and foundations shall verify compliance with the code as to *R-value*, location, thickness, depth of burial and protection of insulation as required by the code and *approved* plans and specifications.

~~R105.2.2~~**R107.2.2 Framing and air barrier rough-in inspection.** Inspections at framing and rough-in shall be made before application of interior finish and shall verify compliance with the code as to: types of insulation and corresponding *R-values* and their correct location and proper installation; fenestration properties such as *U-factor* and SHGC and proper installation; air leakage controls as required by the code; and *approved* plans and specifications. *Air barrier* inspections at framing and rough-in shall be made before the application of air permeable insulation and shall be used to verify compliance with this code and *approved* plans and specifications. Exterior *air barriers* shall be permitted to be inspected after insulation is installed.

~~R105.2.3~~**R107.2.3 Plumbing rough-in inspection.** Inspections at plumbing rough-in shall verify compliance as required by the code and *approved* plans and specifications as to types of insulation and corresponding *R-values* and protection, and required controls. Where a *solar-ready zone* is provided for a solar thermal system, inspections shall verify pathways for routing of plumbing from *solar-ready zone* to service water heating system.

~~R105.2.4~~**R107.2.4 Mechanical rough-in inspection.** Inspections at mechanical rough-in shall verify compliance as required by the code and *approved* plans and specifications as to installed HVAC equipment type and size, required controls, system insulation and corresponding *R-value*, system air leakage control, programmable thermostats, *dampers*, whole-house *ventilation*, and minimum fan efficiency.

**Exception:** Systems serving multiple *dwelling units* shall be inspected in accordance with Section C107.2.4.

**R107.2.5 Electrical rough-in inspection.** Inspections at electrical rough-in shall verify compliance as required by the code and the *approved* plans and specifications as to the locations, distribution and capacity of the electrical system. Where the *solar-ready zone* is installed for electricity generation, inspections shall verify conduit or prewiring from *solar-ready zone* to electrical panel.

**R107.2.6 Insulation and fenestration rough-in inspection.** Inspections at insulation and *fenestration* rough-in shall be made before the application of interior finish and shall be used to verify compliance with this code as to types of insulation, corresponding *R-values* and their correct location and proper installation; and *fenestration* properties such as *U-factors*, SHGC and proper installation.

~~R105.2.5~~**R107.2.7 Final inspection.** The *building* shall have a final inspection and shall not be occupied until *approved*. The final inspection shall include verification of the installation of all required *building* systems, equipment and controls and their proper operation and the required number of high-efficacy lamps and fixtures.

~~R105.3~~**R107.3 Reinspection.** A *building* shall be reinspected where determined necessary by the *code official*.

~~R105.4~~**R107.4 Approved third-party inspection agencies.** The *code official* is authorized to accept reports of third-party inspection agencies not affiliated with the *building* design or construction, provided that such agencies are *approved* as to qualifications and reliability relevant to the *building* components and systems that they are inspecting or testing, and approval is granted prior to issuance of the building permit.

**R107.4.1 Authorization of approved third-party inspection agency.** An *approved* third-party inspection agency shall provide all requested information for the *code official* to determine that the agency meets the applicable requirements specified in **Sections R107.4.1.1 through R107.4.1.3** and to authorize its work in the jurisdiction.

**R107.4.1.1 Independence.** An *approved* third-party inspection agency shall be an independent business identity. The agency shall perform its duties in accordance with the scope of delegated responsibilities established by the *code official*. The agency shall disclose to the *code official* any conflicts of interest, including where fees for service are derived. The agency shall acknowledge in writing that it is authorized to work only within the scope of delegated responsibilities.

**R107.4.1.2 Equipment.** An *approved* third-party inspection agency shall have adequate equipment to perform inspections and tests required by the *code official* and this code. All testing equipment shall be periodically calibrated as required by the manufacturer, testing standards used in this code or certifications held by the *approved* third-party inspection agency.

**R107.4.1.3 Personnel.** Personnel assigned by an *approved* third-party inspection agency to perform inspections and testing shall be trained or credentialed, and documentation of training or credentials shall be available to the *code official* upon request.

**R107.4.1.4 Delegated authority.** Where *approved*, a third-party inspection agency shall have the authority to perform delegated inspections and determine compliance or noncompliance of work with *approved construction documents*.

**R107.4.2 Approved third-party inspection agency reporting.** An *approved* third-party inspection agency shall keep records of delegated inspections, tests and compliance documentation required by this code. The agency shall submit reports of delegated inspections and tests to the *code official* and to the owner or owner's representative. Reports shall indicate the compliance determination for the inspected or tested work based on *approved construction documents*. A final report documenting required delegated inspections and tests, and correction of any discrepancies noted in the inspections or tests, shall be submitted with other required compliance documentation at a time required by the *code official*.

**R107.5 Inspection requests.** It shall be the duty of the holder of the permit or their duly authorized agent to notify the *code official* when work is ready for inspection. It shall be the duty of the permit holder to provide access to and means for inspections of such work that are required by this code.

**R107.6 Reinspection and testing.** Where any work or installation does not pass an initial test or inspection, the necessary corrections shall be made to achieve compliance with this code. The work or installation shall then be resubmitted to the *code official* for inspection and testing.

FSEC – Anticipated energy impact on FBC-ER – None or slightly increased stringency.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

  

Action	AS	AS/IC	D	D/IC

**RE#9**

Renumbered from R106  
Renumbered from R106.1  
Renumbered from R106.2

Related Mods:  
RED1 9-22  
RED1-10-22

SECTION R108 REFERENCED STANDARDS

**SECTION R108 NOTICE OF APPROVAL**

**R108.1 Approval.** After the prescribed tests and inspections indicate that the work complies in all respects with this code, a notice of approval shall be issued by the *code official*.

**R108.2 Revocation.** The *code official* is authorized to, in writing, suspend or revoke a notice of approval issued under the provisions of this code wherever the certificate is issued in error, or on the basis of incorrect information supplied, or where it is determined that the *building* or structure, premise, or portion thereof is in violation of any ordinance or regulation or any of the provisions of

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**RE#10**  
 Renumbered from R110  
 Renumbered from R110.1  
 Renumbered from R110.2 and one edit regarding authority to interpret the administration of the code  
 Renumbered from R110.3 and adds qualification clarification  
 Renumbered from R110.4 and removes "immediate" from action requirement

Related Mods:  
 RED1-17-22

~~R440~~**R109** MEANS OF APPEALS

~~R440.1~~**R109.1 General.** In order to hear and decide appeals of orders, decisions or determinations made by the *code official* relative to the application and interpretation of this code, there shall be and is hereby created a board of appeals. The board of appeals shall be appointed by the applicable governing authority and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business and shall render all decisions and findings in writing to the appellant with a duplicate copy to the *code official* .

~~R440.2~~**R109.2 Limitations on authority.** An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equivalent or better form of construction is proposed. The board shall not have authority to waive requirements of this ~~code~~ or ~~interpret the administration of this code~~.

~~R440.3~~**R109.3 Qualifications.** The board of appeals shall consist of members who are qualified by experience and training ~~on matters pertaining to the provisions of this code~~ and are not employees of the jurisdiction.

~~R440.4~~**R109.4 Administration.** The *code official* shall take ~~immediate~~ **action** in accordance with the decision of the board.

Note: This section is marked reserved in the 2023 FEC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap	
			X	

Action	AS	AS/IC	D	D/IC

**RE#11**  
 Renumbered from R109  
 Renumbered from R109.1  
 Renumbered from R109.2  
 Renumbered from R109.3  
 Renumbered from R109.4

Related Mods:  
 CEC2D-4-23  
 Part II, RED1-9-22, RED1-10-22, RED1-17-22

~~R409~~**R110** STOP WORK ORDER

~~R409.1~~**R110.1 Authority.** Where the *code official* finds any work regulated by this code being performed in a manner contrary to the provisions of this code or in a dangerous or unsafe manner, the *code official* is authorized to issue a stop work order.

~~R409.2~~**R110.2 Issuance.** The stop work order shall be in writing and shall be given to the owner of the property, the owner's authorized agent or the person performing the work. Upon issuance of a stop work order, the cited work shall immediately cease. The stop work order

	<p>shall state the reason for the order and the conditions under which the cited work is authorized to resume.</p> <p><b>R109.3R110.3 Emergencies.</b> Where an emergency exists, the <i>code official</i> shall not be required to give a written notice prior to stopping the work.</p> <p><b>R109.4R110.4 Failure to comply.</b> Any person who shall continue any work after having been served with a stop work order, except such work as that person is directed to perform to remove a violation or unsafe condition, shall be subject to fines established by the AHJ.</p> <p>Original text of mod is not consistent with that of the 2023 FEC.</p> <table border="1"> <tr> <td>Staff Classification</td> <td>Correlates Directly</td> <td>Energy Standard Needed</td> <td>Over lap</td> </tr> <tr> <td></td> <td></td> <td></td> <td>X</td> </tr> <tr> <td>Action</td> <td>AS</td> <td>AS/IC</td> <td>D</td> <td>D/IC</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>	Staff Classification	Correlates Directly	Energy Standard Needed	Over lap				X	Action	AS	AS/IC	D	D/IC					
Staff Classification	Correlates Directly	Energy Standard Needed	Over lap																
			X																
Action	AS	AS/IC	D	D/IC															

<p><b>RE#12</b></p>	<p>New definitions added</p> <p>Edit changes “building envelope” to “building thermal envelope”</p> <p>Replaces “continuous passageway” based language with new language using newly defined “ductwork” and “space conditioning equipment” terms</p> <p>“High-Efficacy Light Sources” term deleted</p> <p>Replaces “building” with “dwelling unit” and “total building performance with “simulated building performance”</p> <p>Replaces “building” with “dwelling unit”</p> <p>Clarifies and expands definition</p> <p>Replaces definition for “dwelling unit enclosure area” and adds newly defined “sleeping unit” to wall height measurement stipulation</p>
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<p>Related Mods: AIR-HANDLING UNIT RED1-285-22</p> <p>APPROVED SOURCE REPI 150-21, RED1-268-22</p> <p>AIR-HANDLING UNIT RED1-285-22</p> <p>AUTOMATIC SHUT-OFF REPI-106-21</p> <p>BALANCED VENTILATION SYSTEM RED1-343-22</p>	<p style="text-align: center;">SECTION R202 GENERAL DEFINITIONS</p> <p><b>ADDITION.</b> An extension or increase in the <del>conditioned space</del> <b>floor</b> area, number of stories or height of a <i>building</i> or structure.</p> <table border="1"> <tr> <td>Staff Classification</td> <td>Correlates Directly</td> <td>Energy Standard Needed</td> <td>Over lap</td> </tr> <tr> <td></td> <td>X</td> <td></td> <td></td> </tr> <tr> <td colspan="4" style="text-align: center;"><b>RE#12 A</b></td> </tr> <tr> <td>Action</td> <td>AS</td> <td>AS/IC</td> <td>D</td> <td>D/IC</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> <hr style="border-top: 1px dashed orange;"/> <p><b>AIR-HANDLING UNIT.</b> A blower or fan used for the purpose of distributing supply air to a room, space or area.</p> <p style="text-align: center;"><b><u>Note: Original text of mod is not consistent with that of the 2023 FEC.</u></b></p>	Staff Classification	Correlates Directly	Energy Standard Needed	Over lap		X			<b>RE#12 A</b>				Action	AS	AS/IC	D	D/IC					
Staff Classification	Correlates Directly	Energy Standard Needed	Over lap																				
	X																						
<b>RE#12 A</b>																							
Action	AS	AS/IC	D	D/IC																			

BIODIESEL  
BLENDRECD1-  
12-22  
COMMON  
AREAS REPI 69-  
21, RED1-360-22

CONSTRUCTIO  
N DOCUMENTS  
REPI-150-21

CONTINUOUS  
PILOT REPI 74-  
21, RED1-283-22

DAMPER RED1-  
285-22

DEMAND  
RESPONSE  
SIGNAL REPI-  
90-21

DEMAND  
RESPONSIVE  
CONTROL  
REPI-90-21

DISTRIBUTION  
SYSTEM  
EFFICIENCY  
REPI-78-21

DUCTWORK  
RED1-285-22

EMITTANCE  
CEPI-15-21  
PART II, RED1-  
189-22,  
RE2D-3-23

ENCLOSED  
REFLECTIVE  
AIR SPACE  
REPI-11-21

ENERGY  
RATING  
INDEX RECPI

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap	
			X	
<b>RE#12 B</b>				
Action	AS	AS/IC	D	D/IC

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

### SECTION R202 GENERAL DEFINITIONS

**AUTOMATIC SHUTOFF CONTROL.** A device capable of automatically turning loads off without *manual* intervention. *Automatic shutoff controls* include devices such as, but not limited to, occupancy sensors, vacancy sensors, door switches, programmable time switches (i.e., timeclocks), or count-down timers.

**BALANCED VENTILATION SYSTEM.** A *ventilation* system that simultaneously supplies outdoor air to and exhausts air from a space, where the mechanical supply airflow rate and the mechanical exhaust airflow rate are each within 10% of the average of the two airflow rates.

**BIODIESEL BLEND.** A homogeneous mixture of hydrocarbon oils and mono alkyl esters of long chain fatty acids.

**COMMON AREAS.** All conditioned spaces within Group R occupancy buildings that are not *dwelling units* or *sleeping units*

**CONSTRUCTION DOCUMENTS.** Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a building permit.

**CONTINUOUS INSULATION (ci).** Insulating material that is continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior or exterior, or is integral to any opaque surface, of the *building thermal* envelope.

**CONTINUOUS PILOT.** A pilot which, once placed in operation, is intended to remain ignited continuously until it is manually interrupted.

**DAMPER.** A manually or automatically controlled device to regulate draft or the rate of flow of air or combustion gases.

**DEMAND RESPONSE SIGNAL.** A signal that indicates a price or a request to modify electricity consumption for a limited time period.

**DEMAND RESPONSIVE CONTROL.** A control capable of receiving and automatically responding to a *demand response signal*.

**DISTRIBUTION SYSTEM EFFICIENCY (DSE).** A system efficiency factor that adjusts for the energy losses associated with delivery of energy from the equipment to the source of the load.

**DUCT.** A tube or conduit utilized for conveying air. The air passages of self-contained systems are not to be construed as air *ducts*.

**DUCT SYSTEM.** A continuous passageway for the transmission of air that, in addition to ducts, includes duct fittings, dampers, plenums, fans and accessory air handling equipment and appliances. A system that consists of *space conditioning equipment* and *ductwork*, and includes any apparatus installed in connection therewith.

**DUCTWORK.** The assemblies of connected *ducts*, plenums, boots, fittings, *dampers*, supply registers, return grilles, and filter grilles through which air is supplied to or returned from the space to be heated, cooled, or ventilated. Supply *ductwork* delivers air to the spaces from the *space conditioning equipment*. Return *ductwork* conveys air from the spaces back to the *space conditioning equipment*. *Ventilation ductwork* conveys air to or from any space.

**DWELLING UNIT.** A single unit providing complete independent living facilities for one or more persons, including permanent provisions for living,



11-21, RED1-65-22

EXISTING BUILDING (RED1-264-22)

F-FACTOR (THERMAL TRANSMITTANCE) REPI-26-21

FUEL GAS RECD1-12-22

FUEL OIL RECD1-12-22

GRADE PLANE REPI-33-21, RED1-3-22

HEAT EXCHANGER RED1-285-22

LIQUID FUEL RECD1-12-22

LIVING SPACE REPI-33-21

LOW SLOPE REPI 33-21, RED1-182-22

OCCUPIABLE SPACE RED1-285-22

ON-DEMAND PILOT RED1-283-22

PLENUM RED1-285-22

RADIANT BARRIER REPI-

sleeping, eating, cooking and sanitation.

**EMITTANCE.** The ratio of the radiant heat flux emitted by a specimen measured on a scale from 0 to 1, where a value of 1 indicates perfect release of thermal radiation.

**ENCLOSED REFLECTIVE AIRSPACE.** An unventilated cavity with a low-emittance surface bounded on all sides by building components.

**ENERGY ANALYSIS.** A method for estimating the annual energy use of the *proposed design* and *standard reference design* based on estimates of energy use.

**ENERGY COST.** The total estimated annual cost for purchased energy for the *building* functions regulated by this code, including applicable demand charges.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

**RE#12 C**

Action	AS	AS/IC	D	D/IC

**ENERGY RATING INDEX (ERI).** A numerical integer value that represents the relative energy performance of a *rated design* or constructed *dwelling unit* as compared with the energy performance of the *ERI Reference Design*, where an ERI value of 100 represents the energy performance of the *ERI Reference Design* and an ERI value of 0 represents a *rated design* or constructed *dwelling unit* with zero net energy performance.

Note: Conflict with Section R406.3 of the 2023 FEC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

**RE#12 D**

Action	AS	AS/IC	D	D/IC

**EXISTING BUILDING.** A *building* erected prior to the date of adoption of the appropriate code, or one for which a legal building permit has been issued.

Note: Text of mod is not consistent with that of the 2023 FEC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

**RE#12 E**

Action	AS	AS/IC	D	D/IC

**F-FACTOR (THERMAL TRANSMITTANCE).** The perimeter heat loss factor for slab-on-grade floors (Btu/h × ft × °F) [W/(m × K)].

**FUEL GAS.** A natural gas, manufactured gas, liquified petroleum gas or a mixture of these.

**FUEL OIL.** Kerosene or any hydrocarbon oil having a flash point not less than 100°F (38°C).

**GRADE PLANE.** A reference plane representing the average of the finished ground level adjoining the *building* at all *exterior walls*. Where the finished

42-21, REPI-13-21

REFLECTIVE INSULATION REPI-11-21

SIMULATED BUILDING PERFORMANCE CEPI 24-21 PART II, RED1-31-22

SLEEPING UNIT REC2D-8-23

SOLAR-READY ZONE REPI-33-21

SPACE CONDITIONING RED1-285-22

SPACE CONDITIONING EQUIPMENT RED1-285-22

STEEP SLOPE REPI 33-21, RED1-182-22

SUBSTANTIAL IMPROVEMENT RED1-263-22, RE2D-8-23

WORK AREA REPI-144-21

ground level slopes away from the *exterior wall*, the reference plane is established by the lowest points within the area between the *building* and the lot line or, where the lot line is more than 6 feet (1829 mm) from the *building* between the structure and a point 6 feet (1829 mm) from the *building*.

**HEAT EXCHANGER.** A device that transfers heat from one medium to another.

**PLENUM.** An enclosed portion of the *building* structure, other than an *occupiable space* being conditioned, that is designed to allow air movement and thereby serve as part of the supply or return *ductwork*.

**INTERMITTENT IGNITION.** Type of ignition that is energized when an appliance is called on to operate and that remains continuously energized during each period of main burner operation and where the ignition is deenergized when the main burner operating cycle is completed.

**INTERRUPTED IGNITION.** Type of ignition that is energized prior to the admission of fuel to the main burner and that is deenergized when the main flame is established.

**KNEE WALL.** An *above-grade wall* assembly, or wall defined by vertical truss members, of any height that separates *conditioned space* from unconditioned buffer spaces, such as ventilated attics and entry porch roofs, rather than ambient outdoors.

**LIQUID FUEL.** A *fuel oil* or *biodiesel blend*.

**LIVING SPACE.** Space within a *dwelling unit* utilized for living, sleeping, eating, cooking, bathing, washing and sanitation purposes.

**LOW SLOPE.** A roof slope less than 2 units vertical in 12 units horizontal (17 percent slope).

**OCCUPIABLE SPACE.** An enclosed space intended for human activities, excluding those spaces intended primarily for other purposes, such as storage rooms and equipment rooms, that are only intended to be occupied occasionally and for short periods of time.

**ON-DEMAND PILOT.** A pilot that, once placed into operation, is intended to remain ignited for a predetermined period of time following an *automatic* or *manual* operation of the main burner gas valve, after which the pilot is automatically extinguished when no *automatic* or *manual* operation of the main burner gas valve occurs during the predetermined period of time.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

**RE#12 F**

Action	AS	AS/IC	D	D/IC

**PROPOSED DESIGN.** A description of the proposed ~~building~~ *dwelling unit* used to estimate annual energy use for determining compliance based on ~~total simulated~~ building performance.

~~**HIGH EFFICACY LIGHT SOURCES.** Any lamp with an efficacy of not less than 65 lumens per watt, or luminaires with an efficacy of not less than 45 lumens per watt.~~

Note: Original text of mod is not consistent with that of the 2023 FBC – EC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

**RE#12 G**

Action	AS	AS/IC	D	D/IC

**RADIANT BARRIER.** A material having a low *emittance* surface of 0.1 or less installed in building assemblies.

**RATED DESIGN.** A description of the proposed ~~dwelling unit~~ *building* used to determine the *energy rating index*.

**REFLECTIVE INSULATION.** A material with a surface *emittance* of 0.1 or less in an assembly consisting of one or more *enclosed reflective airspaces*.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

**RE#12 H**

Action	AS	AS/IC	D	D/IC

**RENEWABLE ENERGY CERTIFICATE (REC).** An *A market-based instrument that represents and conveys the environmental attributes of 1 megawatt hour of renewable energy—electricity generation and could be sold separately from the underlying physical electricity associated with renewable energy resources*; also known as an energy attribute certificate (EAC).

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

**RE#12 I**

Action	AS	AS/IC	D	D/IC

**ROOF REPLACEMENT.** An *alteration that includes the removal of all existing layers of roof assembly materials down to the roof deck and the installation of replacement materials above the existing roof deck*.~~The process of removing the existing roof covering, repairing any damaged substrate and installing a new roof covering.~~

**Note: Original text of mod is not consistent with that of the 2023 FEC.**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

**RE#12 J**

Action	AS	AS/IC	D	D/IC

**SIMULATED BUILDING PERFORMANCE.** A process in which the proposed building design is compared to a *standard reference design* for the purposes of estimating relative energy use to determine code compliance.

**SLEEPING UNIT.** A single unit that provides rooms or spaces for one or more persons, includes permanent provisions for sleeping and can include provisions for living, eating and either sanitation or kitchen facilities but not both. Such rooms and spaces that are part of a *dwelling unit* are not *sleeping units*.

**SOLAR-READY ZONE.** A section or sections of the roof or building overhang designated and reserved for the future installation of a solar photovoltaic or solar thermal system.

**SPACE CONDITIONING.** The treatment of air so as to control the temperature, humidity, filtration or distribution of the air to meet the requirements of a *conditioned space*.

**SPACE CONDITIONING EQUIPMENT.** The *heat exchangers* , *air-handling units* , filter boxes and any apparatus installed in connection therewith used to provide *space conditioning* .

**STANDARD REFERENCE DESIGN.** A version of the *proposed design* that meets the minimum requirements of this code and is used to determine the maximum annual energy use requirement for compliance based on ~~total~~ simulated building performance.

**STEEP SLOPE.** A roof slope 2 units vertical in 12 units horizontal (17 percent slope) or greater.

**SUBSTANTIAL IMPROVEMENT.** Any *repair* , reconstruction, rehabilitation, *alteration* , *addition* or other improvement of a *building* or structure, the cost of which equals or is more than 50 percent of the market value of the structure before the improvement. Where the structure has sustained substantial damage as defined in the **International Building Code**, any repairs are considered *substantial improvement* regardless of the actual *repair* work performed. *Substantial improvement* does not include the following:

1. Improvement of a *building* ordered by the code official to correct health, sanitary or safety code violations.
2. *Alteration* of a historic building where the *alteration* will not affect the designation as a historic building.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

**RE#12 K**

Action	AS	AS/IC	D	D/IC

**~~DWELLING UNIT ENCLOSURE AREA.~~ TESTING UNIT ENCLOSURE AREA.**

The sum of the area of ceiling, floors, and walls separating a *dwelling unit* 's or sleeping unit's *conditioned space* from the exterior or from adjacent conditioned or unconditioned spaces. Wall height shall be measured from the finished floor of the *dwelling unit* or *sleeping unit* to the underside of the floor above.

**Note: Original text of mod is not consistent with that of the 2023 FEC.**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

**RE#12 L**

Action	AS	AS/IC	D	D/IC

**WORK AREA.** That portion or portions of a *building* consisting of all reconfigured spaces as indicated on the *construction documents* . *Work area* excludes other portions of the *building* where incidental work entailed by the intended work must be performed and portions of the *building* where work not initially intended by the owner is specifically required by this code.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

**RE#12 M**

Action	AS	AS/IC	D	D/IC

**RE#13**

Adds requirements for what must be included on the certification for reflective insulation  
 Adds insulation mark exception for roof insulation installed above roof deck  
 New section stipulates requirements for using the R-value of an enclosed reflective airspace or enclosed nonreflective airspace for code compliance  
 New section stipulates standard requirements for radiant barriers

Related Mods:  
  
 REPI 11-21,  
 RED1-194-22  
  
 R303.1.2  
 CEPI-19-21 Part II  
 R303.1.6 RED1-194-22  
  
 R303.2.2  
 REPI 13-21,  
 RED1-194-22

SECTION R303

**MATERIALS, SYSTEMS AND EQUIPMENT**

**R303.1 Identification.** Materials, systems and equipment shall be identified in a manner that will allow a determination of compliance with the applicable provisions of this code.

**R303.1.1 Building thermal envelope insulation.** An *R-value* identification mark shall be applied by the manufacturer to each piece of *building thermal envelope* insulation that is 12 inches (305 mm) or greater in width. Alternatively, the insulation installers shall provide a certification that indicates the type, manufacturer and *R-value* of insulation installed in each element of the *building thermal envelope*. For blown-in or sprayed fiberglass and cellulose insulation, the initial installed thickness, settled thickness, settled *R-value*, installed density, coverage area and number of bags installed shall be indicated on the certification. For sprayed polyurethane foam (SPF) insulation, the installed thickness of the areas covered and the *R-value* of the installed thickness shall be indicated on the certification. For *reflective insulation*, the number of reflective sheets, the number and thickness of the enclosed reflective airspaces and the *R-value* for the installed assembly determined in accordance with **Section R303.1.6** shall be listed on the certification. For *insulated siding*, the *R-value* shall be on a label on the product's package and shall be indicated on the certification. The insulation installer shall sign, date and post the certification in a conspicuous location on the job site.

FSEC – Anticipated energy impact on FBC-ER – None or slightly increased stringency in applicable cases.

**R303.1.2 Insulation mark installation.** Insulating materials shall be installed such that the manufacturer's *R-value* mark is readily observable at inspection. For insulation materials that are installed without an observable manufacturer's *R-value* mark, such as blown or draped products, an insulation certificate complying with **Section R303.1.1** shall be left immediately after installation by the installer, in a conspicuous location within the *building*, to certify the installed *R-value* of the insulation material.

**Exception:** For roof insulation installed above the deck, the *R-value* shall be *labeled* as specified by the material standards in **Table 1508.2** of the *International Building Code* or **Table R906.2** of the *International Residential Code*, as applicable.

**Note:** Original text of mod is not consistent with that of the 2023 FEC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

**RE#13 A**

Action	AS	AS/IC	D	D/IC

**R303.1.6 Airspaces.** Where the *R-value* of an enclosed reflective airspace or enclosed nonreflective airspace is used for compliance with this code, the airspace shall be enclosed in a cavity bounded on all sides by building components and constructed to minimize airflow into and out of the enclosed airspace. Airflow shall be deemed minimized where one of the following conditions occur:

1. The enclosed airspace is unventilated.
2. The enclosed airspace is bounded on one or more sides by an anchored masonry veneer, constructed in accordance with **Chapter 7** of the *International Residential Code*, and vented by veneer weep holes located only at the bottom portion of the airspace and spaced not less than

15 inches (381 mm) on center with the top of the cavity airspace closed.

**Exception:** For ventilated cavities, the effect of the *ventilation* of airspaces located on the exterior side of the continuous *air barrier* and adjacent to and behind the exterior wall covering material shall be determined in accordance with **ASTM C1363**, modified with an airflow entering the bottom and exiting the top of the airspace at an air movement rate of not less than 70 millimeters per second.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

**RE#13 B**

Action	AS	AS/IC	D	D/IC

**R303.2 Installation.** Materials, systems and equipment shall be installed in accordance with the manufacturer's instructions and the *International Building Code* or the *International Residential Code*, as applicable.

**R303.2.1 Protection of exposed foundation insulation.** Insulation applied to the exterior of *basement walls*, *crawl space walls* and the perimeter of slab-on-grade floors shall have a rigid, opaque and weather-resistant protective covering to prevent the degradation of the insulation's thermal performance. The protective covering shall cover the exposed exterior insulation and extend not less than 6 inches (153 mm) below grade.

**R303.2.2 Radiant barrier.** Where installed, radiant barriers shall comply with the requirements of **ASTM C1313/C1313M** and shall be installed in accordance with **ASTM C1743**.

**Note: Original text of mod is not consistent with that of the 2023 FEC.**

FSEC – Anticipated energy impact on FBC-ER – None or slightly increased stringency in applicable cases.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

**RE#13 C**

Action	AS	AS/IC	D	D/IC

**RE#14**

As part of larger revision, removes requirement for residential buildings to comply with removed Section R401.2.5, which in the 2021 IECC, provided additional energy efficiency requirements  
 Adds Section R408 "credits" based Additional Efficiency Requirements for the Prescriptive compliance option  
 For the certificate that indicates listed efficiencies, in items 2 and 3 adds "thermal" to "building envelope", in item 7 adds requirement to indicate Section R408 additional efficiency measures selected, and adds item 8 regarding solar-ready zone

Related Mods:  
 REPI-18-21  
 CEPI-24-21 Part II  
 REPI-21-21  
 RED1 185-22,  
 RED1-285-22

CHAPTER 4 [RE] RESIDENTIAL ENERGY EFFICIENCY

SECTION R401 GENERAL

**R401.1 Scope.** This chapter applies to residential buildings.

**R401.2 Application.** Residential buildings shall comply with ~~Section R401.2.5~~ and **Section R401.2.1, R401.2.2, R401.2.3** or **R401.2.4.**

**Exception:** Additions, *alterations*, repairs and changes of occupancy to *existing buildings*

complying with **Chapter 5**.

**R401.2.1 Prescriptive Compliance Option.** The Prescriptive Compliance Option requires compliance with **Sections R401 through R404 and R408**.

**R401.2.2 TotalSimulated Building Performance Option.** The TotalSimulated Building Performance Option requires compliance with **Section R405**.

**R401.2.3 Energy Rating Index Option.** The *Energy Rating Index* (ERI) Option requires compliance with **Section R406**.

**R401.2.4 Tropical Climate Region Option.** The Tropical Climate Region Option requires compliance with **Section R407**.

~~**R401.2.5 Additional energy efficiency.** This section establishes additional requirements applicable to all compliance approaches to achieve additional energy efficiency.~~

- ~~1. For buildings complying with **Section R401.2.1**, one of the additional efficiency package options shall be installed according to **Section R408.2**.~~
- ~~2. For buildings complying with **Section R401.2.2**, the building shall meet one of the following:
  - ~~2.1. One of the additional efficiency package options in **Section R408.2** shall be installed without including such measures in the proposed design under **Section R405**; or~~
  - ~~2.2. The proposed design of the building under **Section R405.3** shall have an annual energy cost that is less than or equal to 95 percent of the annual energy cost of the standard reference design.~~~~
- ~~3. For buildings complying with the Energy Rating Index alternative **Section R401.2.3**, the Energy Rating Index value shall be at least 5 percent less than the Energy Rating Index target specified in **Table R406.5**.~~

~~The option selected for compliance shall be identified in the certificate required by **Section R401.3**.~~

#### **R401.3 Certificate.**

A permanent certificate shall be completed by the builder or other *approved* party and posted on a wall in the space where the furnace is located, a utility room or an *approved* location inside the *building*. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory *label*, service disconnect *label* or other required labels. The certificate shall indicate the following:

1. The predominant *R*-values of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, *basement walls*, *crawl space walls* and floors and *ducts* outside *conditioned spaces*.
2. *U*-factors of *fenestration* and the *solar heat gain coefficient* (SHGC) of *fenestration*. Where there is more than one value for any component of the building *thermal* envelope, the certificate shall indicate both the value covering the largest area and the area weighted average value if available.
3. The results from any required *duct system* and building *thermal* envelope air leakage testing performed on the *building*.
4. The types, sizes and efficiencies of heating, cooling and service water-heating equipment. Where a gas-fired unvented room heater, electric furnace or baseboard electric heater is installed in the residence, the certificate shall indicate "gas-fired unvented room heater," "electric furnace" or "baseboard electric heater," as appropriate. An efficiency shall not be indicated for gas-fired unvented room heaters, electric furnaces and electric baseboard heaters.
5. Where on-site *photovoltaic panel* systems have been installed, the array capacity, inverter efficiency, panel tilt and orientation shall be noted on the certificate.
6. For buildings where an *Energy Rating Index* score is determined in accordance with **Section R406**, the *Energy Rating Index* score, both with and without any on-site generation, shall be listed on the certificate.
7. The code edition under which the structure was permitted, the compliance path used **and, where applicable, the additional efficiency measures selected for compliance with Section R408**.



8. The location and dimensions of a solar-ready zone where one is provided.

Note: Original text of mod is not consistent with that of the 2023 FEC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC

**RE#15**

Revises referenced building thermal envelope compliance sections to clarify R-value vs. new (revised from Total UA) Component performance alternative Prescriptive compliance options  
 Adds maximum F-factor requirement for applicable assemblies per new Table R402.1.2 limits  
 Flips table rows and columns  
 Changes “Fenestration U-Factor” column label into “Vertical Fenestration U-factor” (now row) label  
 Separates “Glazed Fenestration SHGC” into “Glazed Vertical Fenestration SHGC” and “Skylight SHGC,” and adds new skylight SHGC limits (0.28 in Climate Zones 1 and 2 vs. 0.25 for glazed vertical fenestration in Climate Zones 1 and 2); this maximum skylight limit is lowered from 2021 IECC’s (removed) footnote “d” exception for Climate Zones 1-3 which allowed skylight SHGCs up to 0.30  
 Adds “Insulation Entirely Above Roof Deck”, “Unheated Slab F-factor,” and “Heated Slab F-factor” assembly types  
 Decreases maximum allowed skylight U-factors from 0.75 to 0.60 for Climate Zone 1 and from 0.65 to 0.60 for Climate Zone 2  
 Increases maximum allowed ceiling U-factor for Climate Zone 2 from 0.026 to 0.030  
 Removes 2021 IECC footnote “e” which excluded Marine Zone SHGC requirements (for 2024 IECC, included in table)  
 2024 IECC footnote “d” (“f” in 2021 IECC) reduces maximum U-factor in Marine Climate Zone 4 and Climate Zones 5 through 8 for vertical fenestration products in provided cases  
 Adds new footnote “e” that provides slab F-Factor details  
 Adds “F-factor” to section, now allowing assemblies with an R-value of insulation materials equal to or greater than that specified in Table R402.1.3 to be an alternative to the U-factor or F-factor in Table R402.1.2  
 Flips table rows and columns  
 Changes “Fenestration U-Factor” column label into “Vertical Fenestration U-factor” (now row) label  
 Adds maximum vertical fenestration U-factor of 0.50 for Climate Zones 0 and 1  
 Separates “Glazed Fenestration SHGC” into “Glazed Vertical Fenestration SHGC” and “Skylight SHGC,” and adds new skylight SHGC limits (0.28 in Climate Zones 1 and 2 vs. 0.25 for glazed vertical fenestration in Climate Zones 1 and 2); this maximum skylight limit is lowered from 2021 IECC’s (removed) footnote “b” exception for Climate Zones 1-3 which allowed skylight SHGCs up to 0.30  
 Adds “Insulation Entirely Above Roof Deck” assembly type, and breaks “Slab R-value & Depth” assembly type into “Unheated Slab R-value & Depth,” and “Heated Slab R-value & Depth” assembly types  
 Decreases maximum allowed skylight U-factors from 0.75 to 0.60 for Climate Zone 1 and from 0.65 to 0.60 for Climate Zone 2  
 Decreases minimum allowed ceiling R-value for Climate Zone 2 from 49 to 38  
 New footnote “c” requires slab insulation to be installed in accordance with Section R402.2.9.1 , which provides requirements removed from 2021 IECC footnote “d”  
 Moves 2021 IECC footnote “f” regarding basement wall insulation in Warm Humid locations to footnote “d”  
 Moves 2021 IECC footnote “g” regarding frame wall cavity and continuous insulation to footnote “e”  
 Moves 2021 IECC footnote “h” regarding mass walls to footnote “f”  
 Moves 2021 IECC footnote “i” regarding vertical fenestration product U-factor for buildings in certain locations to footnote “g”, decreases the included Climate Zones from 3 – 8 to Marine 4 and 5 – 8, and reduces the maximum U-factor from 0.32 to 0.30  
 Adds cavity + continuous and continuous only insulation options for floors, and adds footnote “h” to provide clarifications regarding these options

Related Mods:  
 R402.1 RED1-196-22, RE2D-10-23

SECTION R402 BUILDING THERMAL ENVELOPE

**R402.1 General.** The *building thermal envelope* shall comply with the requirements of Sections R402.1.1 through R402.1.5. **one of the following:**

1. Sections R402.1.1 through R402.1.4 and Section R402.1.6.

R402.1.2 REPI-26-21

TABLE R402.1.3 REPI-28-21, REPI-30-21, REPI-33-21, REPI-35-21, REPI-150-21, RED1-199-22, RED1-204, RED1-268-22

2. Sections R402.1.1, R402.1.5 and R402.1.6.

Exceptions:

1. The following low-energy buildings, or portions thereof, separated from the remainder of the building by building thermal envelope assemblies complying with this section shall be exempt from the building thermal envelope provisions of Section R402.
  - 1.1. Those with a peak design rate of energy usage less than 3.4 Btu/h × ft<sup>2</sup> (10.7 W/m<sup>2</sup>) or 1.0 watt/ft<sup>2</sup> of floor area for space-conditioning purposes.
  - 1.2. Those that do not contain conditioned space.
2. Log homes designed in accordance with ICC 400.

**R402.1.1 Vapor retarder.** Wall assemblies in the building thermal envelope shall comply with the vapor retarder requirements of Section R702.7 of the International Residential Code or Section 1404.3 of the International Building Code, as applicable.

**R402.1.2 Insulation and fenestration criteria.** The building thermal envelope shall meet the requirements of Table R402.1.2, based on the climate zone specified in Chapter

3. Assemblies shall have a U-factor equal to or less than that specified in Table R402.1.2. Fenestration shall have a U-factor or F-factor equal to or less than that specified in Table R402.1.2. Fenestration shall have a U-factor and glazed fenestration SHGC equal to or less than that specified in Table R402.1.2.

TABLE R402.1.2  
MAXIMUM ASSEMBLY U-FACTORS<sup>a</sup> AND FENESTRATION REQUIREMENTS

CLIMATE ZONE	FENESTRATION U-FACTOR <sup>f</sup>	SKYLIGHT U-FACTOR	GLAZED FENESTRATION SHGC <sup>d,e</sup>	CEILING U-FACTOR	WOOD FRAME WALL U-FACTOR	MASS WALL U-FACTOR <sup>b</sup>	FLOOR	BASEMENT WALL U-FACTOR	CRAWL SPACE WALL U-FACTOR
0	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
1	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.25	0.026	0.084	0.165	0.064	0.360	0.477
3	0.30	0.55	0.25	0.026	0.060	0.098	0.047	0.094 <sup>e</sup>	0.136
4	0.30	0.55	0.40	0.024	0.045	0.098	0.047	0.059	0.065
4 except Marine	0.30	0.55	0.40	0.024	0.045	0.082	0.033	0.050	0.055
5 and Marine 4	0.30	0.55	NR	0.024	0.045	0.060	0.033	0.050	0.055
6	0.30	0.55	NR	0.024	0.045	0.057	0.028	0.050	0.055

For SI: 1 foot = 304.8 mm.

- a. Nonfenestration U-factors shall be obtained from measurement, calculation or an approved source.
- b. Mass walls shall be in accordance with Section R402.2.6. Where more than half the insulation is on the interior, the mass wall U-factors shall not exceed 0.17 in Climate Zones 0 and 1, 0.14 in Climate Zone 2, 0.12 in Climate Zone 3, 0.087 in Climate Zone 4 except Marine, 0.065 in Climate Zone 5 and Marine 4, and 0.057 in Climate Zones 6 through 8.
- c. In Warm Humid locations as defined by Figure R301.1 and Table R301.1, the basement wall U factor shall not exceed 0.360.
- d. The SHGC column applies to all glazed fenestration.

**Exception:** In Climate Zones 0 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

e. There are no SHGC requirements in the Marine Zone.

f. A maximum *U* factor of 0.32 shall apply in Marine Climate Zone 4 and Climate Zones 5 through 8 to vertical fenestration products installed in buildings located either:

1. Above 4,000 feet in elevation above sea level, or

2. In windborne debris regions where protection of openings is required by Section **R301.2.1.2** of the *International Residential Code*.

**TABLE R402.1.2  
MAXIMUM ASSEMBLY *U*-FACTORS<sup>a</sup> AND FENESTRATION REQUIREMENTS**

CLIMATE ZONE	0	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7 AND	
VERTICAL FENESTRATION <i>U</i> -FACTOR	0.50	0.50	0.40	0.30	0.30	0.28 <sup>d</sup>	0.28 <sup>d</sup>	0.27 <sup>d</sup>	°
SKYLIGHT <i>U</i> -FACTOR	0.25	0.25	0.25	0.25	0.40	NR	NR	NR	
GLAZED VERTICAL FENESTRATION SHGC	0.28	0.28	0.28	0.28	0.40	NR	NR	NR	
SKYLIGHT SHGC CEILING <i>U</i> - FACTOR	0.035	0.035	0.030	0.030	0.026	0.026	0.026	0.026	
INSULATION ENTIRELY ABOVE ROOF DECK	0.039	0.039	0.039	0.039	0.032	0.032	0.032	0.028	
WOOD-FRAMED WALL <i>U</i> -FACTOR	0.084	0.084	0.084	0.060	0.045	0.045	0.045	0.045	
MASS WALL <i>U</i> -FACTOR <sup>b</sup>	0.064	0.064	0.064	0.047	0.047	0.033	0.033	0.028	
FLOOR <i>U</i> -FACTOR	0.360	0.360	0.360	0.091 <sup>c</sup>	0.050	0.050	0.050	0.050	
BASEMENT WALL <i>U</i> -FACTOR	0.73	0.73	0.73	0.54	0.51	0.51	0.48	0.48	
UNHEATED SLAB <i>F</i> -FACTOR <sup>e</sup>	0.74	0.74	0.74	0.66	0.66	0.66	0.66	0.66	
HEATED SLAB <i>F</i> -FACTOR <sup>e</sup> CRAWL SPACE WALL <i>U</i> -FACTOR	0.477	0.477	0.477	0.136	0.065	0.055	0.055	0.055	

For SI: 1 foot = 304.8 mm.

- a. Nonfenestration *U*-factors and *F*-factors shall be obtained from measurement, calculation, an *approved source*, or **Appendix RF** where such appendix is adopted or *approved*.
- b. Mass walls shall be in accordance with Section R402.2.6. Where more than half the insulation is on the interior, the mass wall *U*-factors shall not exceed 0.17 in Climate Zones 0 and 1, 0.14 in Climate Zone 2, 0.12 in Climate Zone 3, 0.087 in Climate Zone 4 except Marine, 0.065 in Climate Zone 5 and Marine 4, and 0.057 in Climate Zones 6 through 8.
- c. In Warm Humid locations as defined by **Figure R301.1** and **Table R301.1**, the basement wall *U*-factor shall not exceed 0.360.
- d. A maximum *U*-factor of 0.30 shall apply in Marine Climate Zone 4 and Climate Zones 5 through 8 to vertical fenestration products installed in buildings located either:
  - 1. Above 4,000 feet in elevation above sea level, or
  - 2. In windborne debris regions where protection of openings is required by **Section R301.2.1.2** of the *International Residential Code*.
- e. *F*-factors for slabs shall correspond to the *R*-values of **Table R402.1.3** and the installation conditions of **Section R402.2.10.1**.

**R402.1.3 *R*-value alternative.** Assemblies with an *R*-value of insulation materials equal to or greater than that specified in **Table R402.1.3** shall be an alternative to the *U*-factor or *F*-factor in **Table R402.1.2**

**TABLE R402.1.3**  
**INSULATION MINIMUM *R*-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT<sup>a</sup>**

CLIMATE ZONE	FENESTRATION U-FACTOR <sup>b,i</sup>	SKYLIGHT <sup>b</sup> U-FACTOR	GLAZED FENESTRATION SHGC <sup>b,e</sup>	CEILING R-VALUE	WOOD FRAME WALL R-VALUE <sup>g</sup>	MASS WALL R-VALUE <sup>h</sup>	FLOOR R-VALUE	BASEMENT <sup>c,g</sup> WALL	SLAB <sup>d</sup> R-VALUE & DEPTH	CRAWL SPACE <sup>c,g</sup> WALL
0	NR	0.75	0.25	30	13 or 0&10ci					
4	NR	0.75	0.25	30	13 or 0&10ci					
2	0.40	0.65	0.25	49	13 or 0&10ci					
3	.30	0.55	0.25	49	13 or 0&10ci 20 or 13&5ci <sup>h</sup>	8/13	19	5ci or 13 <sup>f</sup>	10ci, 2 ft	5ci or 13 <sup>f</sup>
4 except Marine	.30	0.55	0.40	60	or 0&15ci <sup>h</sup>	8/13	19	10ci or 13	10ci, 4 ft	10ci or
5 and Marine 4	0.30 <sup>i</sup>	0.55	0.40	60	30 or 20&5ci <sup>h</sup> or 13&10ci <sup>h</sup> or 0&20ci <sup>h</sup>	13/17	30	15ci or 19 or 13&5ci	10ci, 4 ft	15ci or 19 or
6	0.30 <sup>i</sup>	0.55	NR	60	30 or 20&5ci <sup>h</sup> or 13&10ci <sup>h</sup> or 0&20ci <sup>h</sup>	15/20	30	15ci or 19 or 13&5ci	10ci, 4 ft	15ci or 19 or
7 and 8	0.30 <sup>i</sup>	0.55	NR	60	30 or 20&5ci <sup>h</sup> or 13&10ci <sup>h</sup>	19/21	38	15ci or 19 or 13&5ci	10ci, 4 ft	15ci or 19 or

or SI: 1 foot = 304.8 mm.

NR = Not Required.

ci = continuous insulation.

- a. R-values are minimums. U factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed R-value of the insulation shall be not less than the R-value specified in the table.

- b. The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

**Exception:** In Climate Zones 0 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

- e. "5ci or 13" means R-5 continuous insulation (ci) on the interior or exterior surface of the wall or R-13 cavity insulation on the interior side of the wall. "10ci or 13" means R-10 continuous insulation (ci) on the interior or exterior surface of the wall or R-13 cavity insulation on the interior side of the wall. "15ci or 19 or 13&5ci" means R-15 continuous insulation (ci) on the interior or exterior surface of the wall; or R-10 cavity insulation on the interior side of the wall; or R-13 cavity insulation on the interior of the wall in addition to R-5 continuous insulation on the interior or exterior surface of the wall.

- d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation R value for slabs, as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

- e. There are no SHGC requirements in the Marine Zone.

- f. Basement wall insulation is not required in Warm Humid locations as defined by **Figure R301.1** and **Table R301.1**.

- g. The first value is cavity insulation; the second value is continuous insulation. Therefore, as an example, "13&5" means R-13 cavity insulation plus R-5 continuous insulation.

- h. Mass walls shall be in accordance with **Section R402.2.6**. The second R value applies where more than half of the insulation is on the interior of the mass wall.

- i. A maximum U-factor of 0.32 shall apply in Climate Zones 3 through 8 to vertical fenestration products installed in buildings located either:

1. Above 4,000 feet in elevation, or

In windborne debris regions where protection of openings is required by Section R301.2.1.2 of the *International Residential Code*.

**TABLE R402.1.3**  
**INSULATION MINIMUM R-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT<sup>a</sup>**

CLIMATE ZONE	0	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7 AND 8
VERTICAL FENESTRATION U-FACTOR	0.50	0.50	0.40	0.30	0.30	0.28 <sup>g</sup>	<del>0.28<sup>g</sup></del>	0.27 <sup>g</sup>
SKYLIGHT U-FACTOR	0.60	0.60	0.60	0.53	0.53	0.50	0.50	0.50
GLAZED VERTICAL FENESTRATION SHGC	0.25	0.25	0.25	0.25	0.40	NR	<del>NR</del>	<del>NR</del>
SKYLIGHT SHGC	0.28	0.28	0.28	0.28	0.40	NR	<del>NR</del>	<del>NR</del>
CEILING R-VALUE	30	30	38	38	49	49	49	49
INSULATION ENTIRELY ABOVE ROOF DECK	25ci	<del>25ci</del>	<del>25ci</del>	<del>25ci</del>	30ci	<del>30ci</del>	<del>30ci</del>	35ci
WOOD-FRAMED WALL R-VALUE <sup>c</sup>	13 or 0&10ci	13 or 0&10ci	13 or 0&10ci	20 or 13&5ci or 0&15ci	30 or 20&5ci or 13&10ci or 0&20ci	30 or 20&5ci or 13&10ci or 0&20ci	30 or 20&5ci or 13&10ci or 0&20ci	30 or 20&5ci or 13&10ci or 0&20ci
MASS WALL R-VALUE <sup>f</sup>	3/4	3/4	4/6	8/13	8/13	13/17	15/20	19/21
FLOOR R-VALUE <sup>b</sup>	13 or 7+5ci or 10ci	13 or 7+5ci or 10ci	13 or 7+5ci or 10ci	19 or 13+5ci or 15ci	19 or 13+5ci or 15ci	30 or 19+7.5ci or 20ci	30 or 19+7.5ci or 20ci	38 or 19+10ci or 25ci
BASEMENT WALL R-VALUE <sup>b, e</sup>	0	0	0	5ci or 13 <sup>h</sup>	10ci or 13	15ci or 19 or 13&5ci	15ci or 19 or 13&5ci	15ci or 19 or 13&5ci
UNHEATED SLAB R-VALUE & DEPTH <sup>e</sup>	0	0	0	10ci, 2 ft	10ci, 3 ft	10ci, 3 ft	10ci, 4 ft	10ci, 4 ft
HEATED SLAB R-VALUE & DEPTH <sup>e</sup>	R-5ci edge and R-5 full slab	R-5ci edge and R-5 full slab	R-5ci edge and R-5 full slab	R10ci, 2 ft and R-5 full slab	R10ci, 3 ft and R-5 full slab	R10ci, 3 ft and R-5 full slab	R10ci, 4 ft and R-5 full slab	R10ci, 4 ft and R-5 full slab
CRAWL SPACE WALL R-VALUE <sup>b, e</sup>	0	0	0	0	5ci or 13 <sup>fd</sup>	10ci or 13	15ci or 19 or	15ci or 19 or 19 or

For SI: 1 foot = 304.8 mm.

NR = Not Required.  
ci = continuous insulation.

- a. *R*-values are minimums. *U*-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.
- b. "5ci or 13" means R-5 continuous insulation (ci) on the interior or exterior surface of the wall or R-13 cavity insulation on the interior side of the wall. "10ci or 13" means R-10 continuous insulation (ci) on the interior or exterior surface of the wall or R-13 cavity insulation on the interior side of the wall. "15ci or 19 or 13&5ci" means R-15 continuous insulation (ci) on the interior or exterior surface of the wall; or R-19 cavity insulation on the interior side of the wall; or R-13 cavity insulation on the interior of the wall in addition to R-5 continuous insulation on the interior or exterior surface of the wall.
- c. Slab insulation shall be installed in accordance with **Section R402.2.9.1**.
- d. *Basement wall* insulation is not required in Warm Humid locations as defined by **Figure R301.1** and **Table R301.1**.
- e. The first value is cavity insulation; the second value is continuous insulation. Therefore, as an example, "13&5" means R-13 cavity insulation plus R-5 continuous insulation.
- f. Mass walls shall be in accordance with **Section R402.2.6**. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.
- g. A maximum *U*-factor of 0.30 shall apply in Marine Climate Zone 4 and Climate Zones 5 through 8 to vertical fenestration products installed in buildings located either:
  - 1. Above 4,000 feet in elevation.
  - 2. In windborne debris regions where protection of openings is required by **Section R301.2.1.2** of the *International Residential Code*.
- h. "30 or 19+7.5ci or 20ci" means R-30 cavity insulation alone or R-19 cavity insulation with R-7.5 continuous insulation or R-20 continuous insulation alone.

Note: Original text of mod is not consistent with that of the 2023 FEC.

FSEC – Anticipated energy impact on FBC-ER – Slightly increased stringency in applicable cases.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

  

Action	AS	AS/IC	D	D/IC



**RE#16**

Changes title from “Total UA alternative” and replaces UA based compliance with thermal conductance (TC) based compliance which combines UA calculation with perimeter \* F-factor calculation

Renumbered from R402.4.4 and clarifies “building thermal envelope” term

Adds exception for Section R402.1.3 requirement of R-38 insulation in the ceiling or attic wherever the full height of uncompressed R-30 insulation extends over the wall top plate at the eaves, and removes a similar exception for when R-60 insulation is required

Replaces exception reference to “Total UA” alternative with “component performance” alternative for consistency with Section R402.1.5 change

New section requires that wood attic knee wall assemblies that separate conditioned space from unconditioned attic spaces comply with Table R402.1.3 for wood-framed walls, and steel attic knee wall assemblies comply with Section R402.2.7; also requires that these knee walls have an air barrier between conditioned and unconditioned space

New section requires that where wood vertical roof truss framing members are used to separate conditioned space and unconditioned space, they must comply with Table R402.1.3 for wood-framed walls, and steel frame vertical roof truss framing members used to separate conditioned space and unconditioned space must comply with Section R402.2.7

Renumbered from R402.2.3

Renumbered from R402.2.4

Replaces exception reference to “total UA” alternative with “component performance” alternative for consistency with Section R402.1.5 change

Renumbered from R402.2.4.1

Renumbered from R402.2.5

Renumbered from R402.2.6

Revises section, removing requirement to comply with the insulation R-value requirements of Table R402.2.6, keeping the U-factor requirements of Table R402.1.2, and revises the calculation of the U-factor, now requiring it to be in accordance with AISI S250 with modifications

Table removed as part of Section R402.2.7 revision

Renumbered from R402.2.7

Revises and clarifies floor insulation installation section

Renumbered from R402.2.8

Minor rewording

Renumbered from R402.2.8

Adds phrase “or in accordance with the proposed design or the rated design, as applicable”

Renumbered from R402.2.9

Changes floor surface criterion from “less than 12 inches (305 mm) below grade” to “within 24 inches (610 mm) above or below grade”

Renumbered from R402.2.9.1

Makes section requirements only applicable to Prescriptive compliance (Performance and ERI requirements in separate new section); with floor penetration exceptions, requires full-slab insulation to be continuous under the entire area of the floor; and adds heated slab perimeter requirements

New section stipulating that for Performance or ERI compliance, slab-on-grade insulation be installed in accordance with the proposed design or rated design

Renumbered from R402.2.10

Changes the crawl space wall insulation requirement from being in accordance with Table R402.1.3 to Section R402.2.11.1 or new 402.2.11.2

General rewording including changes to insulation location requirements

New section stipulating that for Performance or ERI compliance, crawl space wall insulation be installed in accordance with the proposed design or rated design

Renumbered from R402.2.11

Renumbered from R402.2.12

New section requiring that where installed, radiant barriers be installed in accordance with ASTM C1743

Renumbered from R402.3

Renumbered from R402.3.1

Renumbered from R402.3.2

Renumbered from R402.3.3 and changes reference to “Total UA” to new “component alternative” compliance option

Renumbered from R402.3.4 and changes reference to “Total UA” to new “component alternative” compliance option

Renumbered from R402.3.5

Renumbered from R402.4

Renumbered from R402.4.1

Renumbered from R402.4.1.1  
Renumbered from Table R402.4.1.1  
Added "Air Sealing" to "Air Barrier Criteria" header  
Adds requirement that air barriers installed in a dropped ceiling or soffit separate it from unconditioned space; removes requirement that the air barrier be aligned with the insulation and any gaps be sealed; and requires that seals for access openings, drop down stairs or knee wall doors to unconditioned attic spaces be sealed with gasketing materials that allow for repeated entrance over time  
Adds insulation installation requirement that access hatches and doors be installed and insulated in accordance with Section R402.2.5, and eave baffles be installed in accordance with Section R402.2.4  
Adds "building" to Insulation Installation Criteria section's "exterior thermal envelope" term as clarification.  
New component entry provides Air Barrier, Air Sealing Criteria and Insulation Installation Criteria requirements for knee walls  
Clarifies Air Barrier, Air Sealing Criteria requirements and adds that sealing must be in accordance with fenestration manufacturer's instructions  
Adds Insulation Installation Criteria section entry that insulation is not required in the rough opening gap except as required by the fenestration manufacturer's instructions  
Removes "exterior" from Air Barrier, Air Sealing Criteria section requirement: "Rim joists shall include an exterior air barrier."  
Replaces existing Air Barrier, Air Sealing Criteria section requirement that an air barrier be installed at any exposed edge of insulation with requirement that floor framing members that are part of the building thermal envelope be air sealed to maintain a continuous air barrier; also adds requirement that air permeable floor cavity insulation be enclosed  
Replaces existing floor framing cavity Insulation Installation Criteria requirements with requirement that floor insulation be installed in accordance with Section R402.2.8  
As clarification, puts comma between "basement" and "crawl space" in "Basement, crawl space and slab foundations" component title  
Changes component title from "Shower/tub on exterior wall" to "Showers, tubs and fireplaces adjacent to the building thermal envelope"  
Revises Air Barrier, Air Sealing Criteria requirement wording and adds fireplaces  
Revises Insulation Installation Criteria requirement wording slightly and adds fireplaces  
Changes component title from "Electrical/phone box on Exterior walls" to "Electrical, Communication and other equipment boxes, housings and enclosures"  
Revises Air Barrier, Air Sealing Criteria requirement air-sealing wording, and adds concealed opening sealing requirement  
Adds new Insulation Installation Criteria that boxes, housing and enclosures must be buried in or surrounded by insulation  
Removes "that penetrate building thermal envelope" from HVAC boot Air Barrier, Air Sealing Criteria requirement  
Adds new Insulation Installation Criteria that HVAC register boots located within a building thermal envelope assembly be buried in or surrounded by insulation  
New component entry provides Air Barrier, Air Sealing Criteria and Insulation Installation Criteria requirements for common walls or double walls separating attached single-family dwellings or townhouses, including fire-resistance-rating related  
Removes "air barrier" from footnote to clarify that "air barrier" is not intended to be included in this exception, leaving: "Insulation full enclosure is not required in unconditioned/ventilated attic spaces and at rim joists"  
Renumbered from R402.4.1.2, and renamed from "Testing"  
Revises air leakage testing requirement to specify that where applicable, each dwelling unit or (newly defined) sleeping unit in the building must be tested  
Air leakage rate limits are moved from this section to Section R402.5.1.3 and revised  
Adds ASTM E3158 testing standard  
Adds "differential" to clarify that air leakage testing is conducted and reported at a pressure differential of 0.2 inch water gauge (50 Pascals)  
Moves heated, attached private garages and heated, detached private garages exception from before "During testing" items to after these items  
Adds dwelling and sleeping unit sampling testing exception  
Removes individual dwelling units that are 1,500 square feet (139.4 m<sup>2</sup>) or smaller language from testing exception  
Removes mechanical ventilation requirement from this section (but similar language remains in Section R403.6  
New building air leakage testing sampling provision for buildings with eight or more dwelling units or sleeping units  
Renumbered section from R402.4.1.3 and renamed from "Leakage rate"  
Air leakage rate limits are moved from R402.1.2.1 to this section and revised downward, with exceptions for attached dwelling or sleeping units or when located in an R-2 occupancy, and for buildings with 1,500 square feet (139.4 m<sup>2</sup>) or less of conditioned floor area

	<p>Renumbered from R402.4.2  Renumbered from R402.4.3  Renumbered from R402.4.5  Renumbered from R402.4.6 and renamed from “Electrical and communication outlet boxes (air-sealed boxes)”  Revises wording to clarify section  Renumbered from R402.5</p>
<p>Related Mods:  REPI-26-21,  RED1-185-22,  RED1 186-22,  RED1-208-22</p> <p>RED1-243-22  Part I</p> <p>R402.2.1 RED1-186-22, REC2D-6-23</p> <p>R402.2.2 RED1-186-22</p> <p>R402.2.3 REPI 39-21, RED1-212-22</p> <p>R402.2.3.1 REPI 39-21, RED1-212-22</p> <p>R402.2.4 REPI 39-21, RED1-212-22</p> <p>R402.2.5 REPI-39-21, RED1-186-22, RED1-212-22</p> <p>R402.2.5.1 REPI 39-21, RED1-212-22</p> <p>R402.2.6 REPI 39-21, RED1-212-22</p> <p>R402.2.7 REPI-39-21, REPI-40-</p>	<p><b>402.1.4 R-value computation.</b> <i>Cavity insulation</i> alone shall be used to determine compliance with the <i>cavity insulation R-value</i> requirements in <b>Table R402.1.3</b>. Where <i>cavity insulation</i> is installed in multiple layers, the <i>R-values</i> of the <i>cavity insulation</i> layers shall be summed to determine compliance with the <i>cavity insulation R-value</i> requirements. The manufacturer’s settled <i>R-value</i> shall be used for blown-in insulation. <i>Continuous insulation</i> (ci) alone shall be used to determine compliance with the <i>continuous insulation R-value</i> requirements in <b>Table R402.1.3</b>. Where <i>continuous insulation</i> is installed in multiple layers, the <i>R-values</i> of the <i>continuous insulation</i> layers shall be summed to determine compliance with the <i>continuous insulation R-value</i> requirements. <i>Cavity insulation R-values</i> shall not be used to determine compliance with the <i>continuous insulation R-value</i> requirements in <b>Table R402.1.3</b>. Computed <i>R-values</i> shall not include an <i>R-value</i> for other building materials or air films. Where <i>insulated siding</i> is used for the purpose of complying with the <i>continuous insulation</i> requirements of <b>Table R402.1.3</b>, the manufacturer’s <i>labeled R-value</i> for the <i>insulated siding</i> shall be reduced by R-0.6.</p> <p><b>402.1.5 Total UA Component performance alternative.</b> Where the proposed total <i>building thermal envelope thermal conductance</i> (<math>TC_p</math>) UA, the sum of <i>U-factor times assembly area</i>, is less than or equal to the total <i>building thermal envelope thermal conductance</i> (<math>TC_r</math>) using factors UA resulting from multiplying the <i>U-factors</i> in <b>Table R402.1.2</b> by the same assembly area as in the proposed <i>building</i>, the <i>building</i> shall be considered to be in compliance with <b>Table R402.1.2</b>. The total thermal conductance (TC) shall be determined in accordance with Equation 4-1. The UA calculation shall be performed Proposed <i>U-factors</i> and slab- on-grade <i>F-factors</i> shall be taken from <b>ANSI/ASHRAE/IES Standard 90.1 Appendix A</b> or determined using a method consistent with the <i>ASHRAE Handbook of Fundamentals</i> and shall include the thermal bridging effects of framing materials. In addition to UA TC compliance, the SHGC requirements of <b>Table R402.1.2</b> and the maximum fenestration <i>U-factors</i> of <b>Section R402.6</b> shall be met.</p> $TC_p \leq TC_r \quad \text{Equation 4-1}$ <p>where:  <math>TC_p = U_pA + F_pP</math> <math>TC_r = U_rA + F_rP</math>  <math>U_pA</math> = the sum of proposed <i>U-factors</i> times the assembly areas in the proposed building.  <math>F_pP</math> = the sum of the proposed <i>F-factors</i> times the slab-on-grade perimeter lengths in the proposed building.  <math>U_rA</math> = the sum of <i>U-factors</i> in <b>Table R402.1.2</b> times the same assembly areas as in the proposed building.  <math>F_rP</math> = the sum of <i>F-factors</i> in <b>Table R402.1.2</b> times the same slab-on-grade perimeter lengths as in the proposed building.</p> <p><b>Exception:</b> For Climate Zones 0, 1 and 2, the value of <math>F_rP</math> shall equal the value of <math>F_pP</math>.</p> <p><b>402.1.6 Rooms containing fuel-burning appliances.</b> In Climate Zones 3 through 8, where open combustion air <i>ducts</i> provide combustion air to open combustion fuel-burning appliances, the appliances and combustion air opening shall be located outside the <i>building thermal envelope</i> or enclosed in a room that is isolated from inside the <i>building thermal envelope</i>. Such rooms shall be sealed and insulated in accordance with the <i>building thermal envelope</i> requirements of <b>Table R402.1.3</b>, where the walls, floors and ceilings shall meet a minimum of the <i>basement wall R-value</i> requirement. The door into the room shall be fully gasketed and any water lines and <i>ducts</i> in the room insulated in accordance with <b>Section R403</b>. The combustion air <i>duct</i> shall be insulated where it passes through <i>conditioned space</i> to an <i>R-value</i> of not less than R-8.</p> <p>Exceptions:</p> <ol style="list-style-type: none"> <li>1. Direct vent appliances with both intake and exhaust pipes installed continuous to the outside.</li> <li>2. Fireplaces and stoves complying with <b>Section R402.5.2</b> and <b>Section R1006</b> of the <i>International Residential Code</i>.</li> </ol>

21, RED1 185-22, RED1-212-22

R402.2.7 REPI-39-21, REPI-40-21, RED1 185-22, RED1-212-22

R402.2.9.1 REPI-39-21, RED1 212-22, RED1-217-22

R402.2.10 REPI-26-21, REPI-39-21, RED1-208-22, RED1-210-22, RED1 212-22, RED1-250-22

R402.2.10.1 REPI-26-21, REPI-39-21, RED1 212-22, RED1-250-22

R402.2.11.1 REPI-37-21, REPI-39-21, RED1 211-22, RED1-212-22

R402.2.11.2 REPI-39-21, RED1-212-22, RED1-250-22, REC2D-1-23  
R402.2.12 REPI 39-21, RED1-212-22

R402.2.13 REPI 39-21, RED1-212-22

R402.3 REPI 42-21, RED1-218-22

R402.5.1.2.1 REPI-61-21, RED1-222-22,

**R402.2 Specific insulation requirements.** In addition to the requirements of **Section R402.1**, insulation shall meet the specific requirements of **Sections R402.2.1** through **R402.2.13**.

**R402.2.1 Ceilings with attics.** Where **Section R402.1.3** requires R-38 insulation in the ceiling or attic, installing R-30 over 100 percent of the ceiling or attic area requiring insulation shall satisfy the requirement for R-38 insulation wherever the full height of uncompressed R-30 insulation extends over the wall top plate at the eaves. Where **Section R402.1.3** requires R-49 insulation in the ceiling or attic, installing R-38 over 100 percent of the ceiling or attic area requiring insulation shall satisfy the requirement for R-49 insulation wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves. ~~Where Section R402.1.3 requires R-60 insulation in the ceiling or attic, installing R-49 over 100 percent of the ceiling or attic area requiring insulation shall satisfy the requirement for R-60 insulation wherever the full height of uncompressed R-49 insulation extends over the wall top plate at the eaves.~~ This reduction shall not apply to the insulation and fenestration criteria in **Section R402.1.2** and the Total UA component performance alternative in **Section R402.1.5**.

**R402.2.2 Ceilings without attics.** Where **Section R402.1.3** requires insulation R-values greater than R-30 in the interstitial space above a ceiling and below the structural roof deck, and the design of the roof/ceiling assembly does not allow sufficient space for the required insulation, the minimum required insulation R-value for such roof/ceiling assemblies shall be R-30. Insulation shall extend over the top of the wall plate to the outer edge of such plate and shall not be compressed. This reduction of insulation from the requirements of **Section R402.1.3** shall be limited to 500 square feet (46 m<sup>2</sup>) or 20 percent of the total insulated ceiling area, whichever is less. This reduction shall not apply to the Total UA component performance alternative in **Section R402.1.5**.

**R402.2.3 Attic knee wall.** Wood attic knee wall assemblies that separate conditioned space from unconditioned attic spaces shall comply with **Table R402.1.3** for wood-framed walls. Steel attic knee wall assemblies shall comply with **Section R402.2.7**. Such knee walls shall have an air barrier between conditioned and unconditioned space.

**R402.2.3.1 Roof truss framing separating conditioned and unconditioned space.** Where wood vertical roof truss framing members are used to separate conditioned space and unconditioned space, they shall comply with **Table R402.1.3** for wood-framed walls. Steel frame vertical roof truss framing members used to separate conditioned space and unconditioned space shall comply with **Section R402.2.7**.

**FSEC – Anticipated energy impact on FBC-ER - None or slightly decreased stringency for Prescriptive and Performance projects in applicable cases.**

~~R402.2.3~~**R402.2.4 Eave baffle.** For air-permeable insulation in vented attics, a baffle shall be installed adjacent to soffit and eave vents. Baffles shall maintain a net free area opening equal to or greater than the size of the vent. The baffle shall extend over the top of the attic insulation. The baffle shall be permitted to be any solid material. The baffle shall be installed to the outer edge of the exterior wall top plate so as to provide maximum space for attic insulation coverage over the top plate. Where soffit venting is not continuous, baffles shall be installed continuously to prevent ventilation air in the eave soffit from bypassing the baffle.

~~R402.2.4~~**R402.2.5 Access hatches and doors.** Access hatches and doors from conditioned to unconditioned spaces such as attics and crawl spaces shall be insulated to the same R-value required by **Table R402.1.3** for the wall or ceiling in which they are installed.

Exceptions:

1. Vertical doors providing access from conditioned spaces to unconditioned spaces that comply with the fenestration requirements of **Table R402.1.3** based on the applicable climate zone specified in **Chapter 3**.
2. Horizontal pull-down, stair-type access hatches in ceiling assemblies that provide access from conditioned to unconditioned spaces in Climate Zones 0 through 4 shall not be required to comply with the insulation level of the surrounding surfaces provided the hatch meets all of the following:
  - 2.1. The average U-factor of the hatch shall be less than or equal to U-0.10 or have an average insulation R-value of R-10 or greater.

- 2.2. Not less than 75 percent of the panel area shall have an insulation *R-value* of R-13 or greater.
- 2.3. The net area of the framed opening shall be less than or equal to 13.5 square feet (1.25 m<sup>2</sup>).
- 2.4. The perimeter of the hatch edge shall be weather-stripped.

The reduction shall not apply to the ~~total UA~~ **component performance** alternative in **Section R402.1.5**.

~~R402.2.4.4~~ **R402.2.5.1 Access hatches and door insulation installation and retention.** Vertical or horizontal access hatches and doors from *conditioned spaces* to unconditioned spaces such as attics and crawl spaces shall be weather-stripped. Access that prevents damaging or compressing the insulation shall be provided to all equipment. Where loose-fill insulation is installed, a wood-framed or equivalent baffle, retainer, or dam shall be installed to prevent loose-fill insulation from spilling into *living space* from higher to lower sections of the attic and from attics covering *conditioned spaces* to unconditioned spaces. The baffle or retainer shall provide a permanent means of maintaining the installed *R-value* of the loose-fill insulation.

- ~~R402.2.5~~ **R402.2.6 Mass walls.** Mass walls where used as a component of the *building thermal envelope* shall be one of the following:
- 1. Above-ground walls of concrete block, concrete, insulated concrete form, masonry cavity, brick but not brick veneer, adobe, compressed earth block, rammed earth, solid timber, mass timber or solid logs.
  - 2. Any wall having a heat capacity greater than or equal to 6 Btu/ft<sup>2</sup> × °F (123 kJ/m<sup>2</sup> × K).

Original text of mod is not consistent with that of the 2023 FEC.

FSEC – Anticipated energy impact on FBC-ER – Would make the two codes of equal stringency for applicable Prescriptive compliance cases.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

**RE#16 A**

Action	AS	AS/IC	D	D/IC

~~R402.2.6~~ **R402.2.7 Steel-frame ceilings, walls and floors.** Steel-frame ceilings, walls, and floors shall comply with the insulation requirements of Table R402.2.6 or the *U-factor* requirements of **Table R402.1.2**. The calculation of the *U-factor* for a steel frame envelope assembly shall use a series-parallel path calculation method. **steel-framed ceilings and walls in a building thermal envelope assembly shall be determined in accordance with AISI S250, modified as follows:**

- 1. Where the steel-framed wall contains no *cavity insulation*, and uses *continuous insulation* to satisfy the *U-factor* maximum, the steel-framed wall member spacing is permitted to be installed at any on-center spacing.
- 2. Where the steel-framed wall contains framing spaced at 24 inches (610 mm) on center with a 23 percent framing factor or framing spaced at 16 inches (400 mm) on center with a 25 percent framing factor, the next lower framing member spacing input values shall be used when calculating using **AISI S250**.
- 3. Where the steel-framed wall contains less than 23 percent framing factors **AISI S250** shall be used without any modifications.

4. Where the steel-framed wall contains other than standard C-shaped framing members the **AISI S250** calculation option for other than standard C-shaped framing is permitted to be used.

~~R402.2.7~~**R402.2.8 Floors.** Floor *cavity insulation* shall ~~comply~~ be installed in accordance with ~~one~~ all of the following:

1. Installation shall be installed to maintain permanent contact with the underside of the subfloor decking in accordance with manufacturer instructions to maintain required *R*-value or readily fill the available cavity space. \_\_\_\_\_  
**Table R402.1.2 or R402.1.3** and manufacturer's instructions.
2. Floor framing *cavity insulation* shall be permitted to be in contact with the top side of sheathing separating the cavity and the unconditioned space below. Insulation shall extend from the bottom to the top of all perimeter floor framing members and the framing members shall be air sealed. \_\_\_\_\_

Floor framing members that are part of the *building thermal envelope* shall be air sealed to maintain a *continuous air barrier*.

3. A combination of *cavity and continuous insulation* shall be installed so that the *cavity insulation* is in contact with the top side of the *continuous insulation* that is installed on the underside of the floor framing separating the cavity and the unconditioned space below. The combined *R* value of the cavity and *continuous insulation* shall equal the required *R* value for floors. Insulation shall extend from the bottom to the top of all perimeter floor framing members and the framing members shall be air sealed. \_\_\_\_\_

One of the following methods:

- 3.1 *Cavity insulation* shall be installed to maintain permanent contact with the underside of the subfloor decking.
- 3.2 *Cavity insulation* shall be installed to maintain contact with the top side of sheathing separating the cavity and the unconditioned space below. Insulation shall extend from the bottom to the top of all perimeter floor framing members.
- 3.3 A combination of *cavity insulation* and *continuous insulation* shall be installed such that the *cavity insulation* maintains contact with the top side of the *continuous insulation* and the *continuous insulation* maintains contact with the underside of the structural floor system. Insulation shall extend from the bottom to the top of all perimeter floor framing members.
- 3.4 *Continuous insulation* shall be installed to maintain contact with the underside of the structural floor system. Insulation shall extend from the bottom to the top of all perimeter floor framing members.

FSEC – Anticipated energy impact on FBC-ER - Slightly increased stringency in applicable cases.

~~R402.2.8~~**R402.2.9 Basement walls.** *Basement walls* shall be insulated in accordance with Table R402.1.3.

**Exception:** *Basement walls* associated with unconditioned basements where all of the following requirements are met:

1. The floor overhead, including the underside stairway stringer leading to the basement, is insulated in accordance with **Section R402.1.3** and applicable provisions of **Sections R402.2** and **R402.2.8**.
2. There are no uninsulated ~~duct~~ductwork, domestic hot water piping, or hydronic heating surfaces exposed to the basement.
3. There are no HVAC supply or return diffusers serving the basement.
4. The walls surrounding the stairway and adjacent to *conditioned space* are insulated in accordance with **Section R402.1.3** and applicable provisions of **Section R402.2**.
5. The door(s) leading to the basement from *conditioned spaces* are insulated in accordance with **Section R402.1.3** and applicable provisions of **Section R402.2**, and weather-stripped in accordance with **Section R402.5**.
6. The *building thermal envelope* separating the basement from adjacent *conditioned spaces* complies with **Section**



**R402.5.**

FSEC – Anticipated energy impact on FBC-ER - None or slightly increase stringency in applicable cases.

**R402.2.9.1 R402.2.9.1 Basement wall insulation installation.** Where *basement walls* are insulated, the insulation shall be installed from the top of the *basement wall* down to 10 feet (3048 mm) below grade or to the basement floor, whichever is less, or in accordance with the *proposed design* or the *rated design*, as applicable.

FSEC – Anticipated energy impact on FBC-ER - None or slightly increase stringency in applicable cases.

**Original text of mod is not consistent with that of the 2023 FEC**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

**RE#16 B**

Action	AS	AS/IC	D	D/IC

**R402.2.9 R402.2.10 Slab-on-grade floors.** Slab-on-grade floors with a floor surface less than 12 inches (305 mm) within 24 inches (610 mm) above or below grade shall be insulated in accordance with **Section R402.2.10.1 or R402.2.10.2. Table R402.1.3.**

**Exception:** Slab-edge insulation is not required in jurisdictions designated by the *code official* as having a very heavy termite infestation *probability*.

FSEC – Anticipated energy impact on FBC-ER - None or slightly increase stringency in applicable cases.

**R402.2.9.1 R402.2.10.1 Slab-on-grade floor insulation installation.** Where installed, the ~~For buildings complying with Section R401.2.1, the slab edge *continuous* insulation shall extend downward from the top of the slab on the outside or inside of the foundation wall. Insulation located below grade shall extend the vertical distance provided in Table R402.1.3, but need not exceed the footing depth in accordance with Section R403.1.4 of the *International Residential Code*. or the distance of the proposed design, as applicable, by any combination of vertical insulation. Where a proposed design includes insulation extending away from the building, it under the slab or insulation extending out from the building. Insulation extending away from the building shall be protected by pavement or by not less than 10 inches (254 mm) of soil. The top edge of the insulation installed between the exterior wall and the edge of the interior slab shall be permitted to be cut at a 45-degree (0.79 rad) angle away from the exterior wall. Full-slab insulation shall be continuous under the entire area of the slab-on-grade floor, except at structural column locations and service penetrations. Slab edge insulation required at the heated slab perimeter shall not be required to extend below the bottom of the heated slab and shall be continuous with the full slab insulation.~~

**R402.2.10.2 Alternative slab-on-grade insulation configurations.** For buildings complying with **Section R405 or R406**, slab-on-grade insulation shall be installed in accordance with the *proposed design* or *rated design*.

FSEC – Anticipated energy impact on FBC-ER - None or slightly increase stringency in applicable cases.



~~R402.2.10~~**R402.2.11 Crawl space walls.** *Crawl space walls* shall be insulated in accordance with Table R402.1.3. **Section 402.2.11.1** or **402.2.11.2**.

**Exception:** *Crawl space walls* associated with a crawl space that is vented to the outdoors and the floor overhead is insulated in accordance with **Table R402.1.3** and **Section**

**R402.2.8**.

FSEC – Anticipated energy impact on FBC-ER - None or slightly increase stringency in applicable cases.

~~R402.2.10.1~~**R402.2.11.1 Crawl space wall insulation installations.** Where ~~*crawl space wall*~~ insulation is installed, it shall be permanently fastened *crawl space wall insulation shall be secured* to the wall and shall extend downward from the sill plate to not less than the top of the foundation wall footing. ~~floor to the finished grade elevation and then vertically or horizontally for not less than an additional 24 inches (610 mm).~~

**Exception:** Where the *crawl space wall* insulation is installed on the interior side of the wall and the crawl space floor is more than 24 inches (610 mm) below the exterior grade, the crawl space wall insulation shall be permitted to extend downward from the sill plate at the top of the foundation wall to not less than the interior floor of the crawl space.

Exposed earth in unvented crawl space foundations shall be covered with a continuous Class I vapor retarder in accordance with the **International Building Code** or **International Residential Code**, as applicable. Joints of the vapor retarder shall overlap by 6 inches (153 mm) and be sealed or taped. The edges of the vapor retarder shall extend not less than 6 inches (153 mm) up stem walls and shall be attached to the stem walls.

**R402.2.11.2 Alternative crawl space wall insulation configurations.** For *buildings* complying with **Section R405** or **R406**, *crawl space wall* insulation shall be installed in accordance with the *proposed design* or *rated design*.

~~R402.2.11~~**R402.2.12 Masonry veneer.** Insulation shall not be required on the horizontal portion of a foundation that supports a masonry veneer.

FSEC – Anticipated energy impact on FBC-ER - None or slightly increase stringency in applicable cases.

~~R402.2.12~~**R402.2.13 Sunroom and heated garage insulation.** *Sunrooms* enclosing *conditioned space* and heated garages shall meet the insulation requirements of this code.

**Exception:** For *sunrooms* and heated garages provided with *thermal isolation*, and enclosing *conditioned space*, the following exceptions to the insulation requirements of this code shall apply:

1. The minimum ceiling insulation *R-values* shall be R-19 in *Climate Zones* 0 through 4 and R-24 in *Climate Zones* 5 through 8.
2. The minimum wall insulation *R-value* shall be R-13 in all *climate zones*. Walls separating a *sunroom* or heated garage with *thermal isolation* from *conditioned space* shall comply with the *building thermal envelope* requirements of this code.

**R402.3 Radiant barriers.** Where installed, radiant barriers shall be installed in accordance with **ASTM C1743**.

FSEC – Anticipated energy impact on FBC-ER - None or slightly increased stringency in applicable cases.

**R402.3.4 R402.4 Fenestration.** In addition to the requirements of **Section R402**, *fenestration* shall comply with **Sections R402.4.1** through **R402.4.5**.

**R402.3.4.1 R402.4.1 U-factor.** An area-weighted average of *fenestration* products shall be permitted to satisfy the *U-factor* requirements.

**R402.3.4.2 R402.4.2 Glazed fenestration SHGC.** An area-weighted average of *fenestration* products more than 50 percent glazed shall be permitted to satisfy the SHGC requirements.

Dynamic glazing shall be permitted to satisfy the SHGC requirements of **Table R402.1.2** provided that the ratio of the higher to lower *labeled* SHGC is greater than or equal to 2.4, and the *dynamic glazing* is automatically controlled to modulate the amount of solar gain

into the space in multiple steps. *Dynamic glazing* shall be considered separately from other *fenestration*, and area-weighted averaging with other *fenestration* that is not dynamic glazing shall be prohibited.

**Exception:** Dynamic glazing shall not be required to comply with this section where both the lower and higher *labeled* SHGC comply with the requirements of **Table R402.1.2**.

**R402.3.4.3 R402.4.3 Glazed fenestration exemption.** Not greater than 15 square feet (1.4 m<sup>2</sup>) of glazed *fenestration* per *dwelling unit* shall be exempt from the *U-factor* and SHGC requirements in **Section R402.1.2**. This exemption shall not apply to the ~~Total UA~~ **component performance** alternative in **Section R402.1.5**.

**R402.3.4.4 R402.4.4 Opaque door exemption.** One side-hinged *opaque door* assembly not greater than 24 square feet (2.22 m<sup>2</sup>) in area shall be exempt from the *U-factor* requirement in **Section R402.1.2**. This exemption shall not apply to the ~~Total UA~~ **component performance** alternative in **Section R402.1.5**.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

**RE#16 C**

Action	AS	AS/IC	D	D/IC

**R402.3.5 R402.4.5 Sunroom and heated garage fenestration.** *Sunrooms* and heated garages enclosing *conditioned space* shall comply with the *fenestration* requirements of this code.

**Exception:** In Climate Zones 2 through 8, for *sunrooms* and heated garages with *thermal isolation* and enclosing *conditioned space*, the *fenestration U-factor* shall not exceed 0.45 and the skylight *U-factor* shall not exceed 0.70.

New *fenestration* separating a *sunroom* or heated garage with *thermal isolation* from *conditioned space* shall comply with the *building thermal envelope* requirements of this code.

**Original text of mod is not consistent with that of the 2023 FEC.**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

**RE#16 D**

Action	AS	AS/IC	D	D/IC

~~R402.4~~**R402.5 Air leakage.** The *building thermal envelope* shall be constructed to limit air leakage in accordance with the requirements of **Sections R402.5.1** through **R402.5.5**.

~~R402.4.1~~**R402.5.1 Building thermal envelope.** The *building thermal envelope* shall comply with **Sections R402.5.1.1** through **R402.5.1.3**. The sealing methods between dissimilar materials shall allow for differential expansion and contraction.

~~R402.4.1.1~~**R402.5.1.1 Installation.** The components of the *building thermal envelope* as indicated in **Table R402.5.1.1** shall be installed in accordance with the manufacturer’s instructions and the criteria indicated in **Table R402.5.1.1**, as applicable to the method of construction. Where required by the *code official*, an *approved* third party shall inspect all components and verify compliance.

FSEC – Anticipated energy impact on FBC-ER - None or slightly increased stringency impact in applicable cases depending on typical practices.

~~TABLE R402.4.1.1~~**TABLE R402.5.1.1**  
**AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION<sup>a</sup>**

COMPONENT	AIR BARRIER, AIR SEALING CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building thermal envelope. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	<del>The</del> An air barrier shall be installed in any dropped ceiling or soffit to separate it from unconditioned space. <del>shall be aligned with the insulation and any gaps in the air barrier shall be sealed.</del> Access openings, drop <u>down stairs</u> or knee wall doors to unconditioned attic spaces shall be sealed with gasketing materials that allow for repeated entrance over time.	The insulation in any dropped ceiling/soffit shall be aligned with the air barrier. <u>Access hatches and doors shall be installed and insulated in accordance with Section R402.2.5.</u> <u>Eave baffles shall be installed in accordance with Section R402.2.4.</u>
Walls	The junction of the foundation and sill plate shall be sealed. The junction of the top plate and the top of exterior walls shall be sealed. Knee walls shall be sealed.	Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance, R-value, of not less than R-3 per inch. Exterior <u>building</u> thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.
Knee wall	<u>Knee walls shall have an air barrier between conditioned and unconditioned space</u>	<u>Insulation installed in a knee wall assembly shall be installed in accordance with Section R402.2.3.</u> <u>Air-permeable insulation shall be enclosed inside an air barrier assembly.</u>
Windows, skylights and doors	<del>The space</del> <u>The rough opening gap between framing and the frames of skylights, and the j</u> ams of windows and doors, shall be sealed in accordance with fenestration manufacturer's instructions.	<u>Insulation shall not be required in the rough opening gap except as required by the fenestration manufacturer's instructions.</u>

		Rim joists	Rim joists shall include an exterior air barrier. <sup>tc</sup> The junctions of the rim board to the sill plate and the rim board and the subfloor shall be air sealed.	Rim joists shall be insulated so that the insulation maintains permanent contact with the exterior rim board. <sup>b</sup>
		Floors, including cantilevered floors and floors above garages	<del>The air barrier shall be installed at any exposed edge of insulation.</del> Floor framing members that are part of the building thermal envelope shall be air sealed to maintain a continuous air barrier.  Air permeable floor cavity insulation shall be enclosed.	<del>Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking. Alternatively, floor framing cavity insulation shall be in contact with the top side of sheathing, or continuous insulation installed on the underside of floor framing and extending from the bottom to the top of all perimeter floor framing members.</del> Floor insulation shall be installed in accordance with the requirements of Section R402.2.8.
		Basement, crawl space and slab foundations	Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder/ air barrier in accordance with Section R402.2.11. Penetrations through concrete foundation walls and slabs shall be air sealed. Class 1 vapor retarders shall not be used as an air barrier on below-grade walls and shall be installed in accordance with Section R702.7 of the <i>International Residential Code</i> .	Crawl space insulation, where provided instead of floor insulation, shall be installed in accordance with Section R402.2.11. Conditioned basement foundation wall insulation shall be installed in accordance with Section R402.2.9.1. Slab-on-grade floor insulation shall be installed in accordance with Section R402.2.10.
		Shafts, penetrations	Duct and flue shafts to exterior or unconditioned space shall be sealed. Utility penetrations of the air barrier shall be caulked, gasketed or otherwise sealed and shall allow for expansion, contraction of materials and mechanical vibration.	Insulation shall be fitted tightly around utilities passing through shafts and penetrations in the building thermal envelope to maintain required R-value.
		Narrow cavities	Narrow cavities of 1 inch or less that are not able to be insulated shall be air sealed.	Batts to be installed in narrow cavities shall be cut to fit or narrow cavities shall be filled with insulation that on installation readily conforms to the available cavity space.
		Garage separation	Air sealing shall be provided between the garage and conditioned spaces.	Insulated portions of the garage separation assembly shall be installed in accordance with Sections R303 and R402.2.8.

Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be air sealed in accordance with <b>Section R402.5.4.</b>	Recessed light fixtures installed in the building thermal envelope shall be airtight and IC <u>rated</u> , and shall be buried in or surrounded with insulation.
Plumbing, wiring or other obstructions	All holes created by wiring, plumbing or other obstructions in the air barrier assembly shall be air sealed.	Insulation shall be installed to fill the available space and surround wiring, plumbing, or other obstructions, unless the required R-value can be met by installing insulation and air barrier systems completely to the exterior side of the obstructions.
Shower/tub on exterior wall. Showers, tubs and fireplaces adjacent to the building thermal envelope	The An air barrier installed at exterior walls adjacent to shall separate insulation in the building thermal envelope from the shower, tub or fireplace assemblies. showers and tubs shall separate the wall from the shower or tub.	Exterior framed walls adjacent to showers and tubs and fireplaces shall be insulated.
Electrical/ phone box on exterior walls. Electrical communication and other equipment boxes, housings and enclosures	The air barrier shall be installed behind electrical and communication boxes. Alternatively, air-sealed boxes shall be installed. Boxes, housing and enclosures that penetrate the air barrier shall be caulked, taped, gasketed or otherwise sealed to the air barrier element being penetrated.  All concealed openings into the box, housing or enclosure shall be sealed.  Alternatively, air-sealed boxes shall be installed in accordance with <b>Section R402.5.5.</b>	Boxes, housing and enclosures shall be buried in or surrounded by insulation.
HVAC register boots	HVAC supply and return register boots that penetrate building thermal envelope shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	HVAC supply and return register boots located within a building thermal envelope assembly shall be buried in or surrounded by insulation.



Concealed sprinklers	Where required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.	—
Common walls or double walls separating attached single-family dwellings or townhouses	<p>An interior air barrier shall be provided. Air sealing at the intersections with building thermal envelope shall be provided.</p> <p>Where installed in a fire-resistance-rated wall assembly, air sealing materials shall comply with one of the following:</p> <ol style="list-style-type: none"> <li>1. Be in accordance with an approved design for the fire-resistance-rated assembly.</li> <li>2. Be supported by approved data that shows the assembly as installed complies with the required fire-resistance rating.</li> </ol>	Insulation materials recognized in the approved common wall or double-wall design and installed in accordance with the approved design shall be permitted to be used.

- a. Inspection of log walls shall be in accordance with the provisions of ICC 400.
- b. ~~Air barrier and insulation~~ full enclosure is not required in unconditioned/ventilated attic spaces and at rim joists.

FSEC – Anticipated energy impact on FBC-ER - None or slightly increased stringency in applicable cases.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

**RE#16 E**

Action	AS	AS/IC	D	D/IC

**R402.4.1.2R402.5.1.2 Air leakage testing** Testing. The building or each dwelling unit or sleeping unit in the building shall be tested for air leakage. The maximum air leakage rate for any building or dwelling unit under any compliance path shall not exceed 5.0 air changes per hour or 0.28 cubic foot per minute (CFM) per square foot [0.0079 m<sup>3</sup>/(s × m<sup>2</sup>)] of dwelling unit enclosure area. Testing shall be conducted in accordance with ANSI/ RESNET/ICC 380, ASTM E779, or ASTM E1827 or ASTM E3158 and reported at a pressure differential of 0.2 inch water gauge (50 Pascals). Where required by the code official, testing shall be conducted by an approved third party. A written report of the results of the test shall



be signed by the party conducting the test and provided to the *code official*. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope* have been *sealed*.

**Exception:** For heated, attached private garages and heated, detached private garages accessory to one- and two-family dwellings and townhouses not more than three stories above *grade plane* in height, building envelope tightness and insulation installation shall be considered acceptable where the items in **Table R402.5.1.1**, applicable to the method of construction, are field verified. Where required by the *code official*, an *approved* third party independent from the installer shall inspect both *air barrier* and insulation installation criteria. Heated, attached private garage space and heated, detached private garage space shall be thermally isolated from all other habitable, *conditioned spaces* in accordance with **Sections R402.2.13** and **R402.4.5**, as applicable.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other *infiltration* control measures.
2. *Dampers* including exhaust, intake, makeup air, backdraft and flue *dampers* shall be closed, but not sealed beyond intended *infiltration* control measures.
3. Interior doors, where installed at the time of the test, shall be open.
4. Exterior or interior terminations for continuous *ventilation* systems shall be sealed.
5. Heating and cooling systems, where installed at the time of the test, shall be turned off.
6. Supply and return registers, where installed at the time of the test, shall be fully open.

**Exceptions:** When testing individual *dwelling units*, an air leakage rate not exceeding 0.30 cubic feet per minute per square foot [0.008 m<sup>3</sup>/(s × m<sup>2</sup>)] of the dwelling unit enclosure area, tested in accordance with ANSI/RESNET/ICC 380, ASTM E779 or ASTM E1827 and reported at a pressure of 0.2 inch w.g. (50 Pa), shall be permitted in all climate zones for:

1. ~~Attached single and multiple family building *dwelling units*.~~ For heated, attached private garages and heated, detached private garages accessory to one- and two-family dwellings and townhouses not more than three stories above *grade plane* in height, *building thermal envelope* tightness and insulation installation shall be considered acceptable where the items in **Table R402.5.1.1**, applicable to the method of construction, are field verified. Where required by the *code official*, an *approved* third party independent from the installer shall inspect both *air barrier* and insulation installation criteria. Heated, attached private garage space and heated, detached private garage space shall be thermally isolated from all other habitable, conditioned spaces in accordance with **Sections R402.2.13** and **R402.4.5**, as applicable.
2. Buildings or *dwelling units* that are 1,500 square feet (139.4 m<sup>2</sup>) or smaller. ~~Where tested in accordance with **Section R402.5.1.2.1**, testing of each dwelling unit or sleeping unit is not required.~~

~~Mechanical ventilation shall be provided in accordance with Section M1505 of the *International Residential Code* or Section 403.3.2 of the *International Mechanical Code*, as applicable, or with other *approved* means of ventilation.~~

FSEC – Anticipated energy impact on FBC-ER – Increase stringency in applicable cases.

**R402.5.1.2.1 Unit sampling.** For *buildings* with eight or more *dwelling units* or *sleeping units*, seven or 20 percent of the *dwelling units* or *sleeping units*, whichever is greater, shall be tested. Tested units shall include a top-floor unit, a ground-floor unit, a middle-floor unit and the *dwelling unit* or *sleeping unit* with the largest *testing unit enclosure area*. Where the air leakage rate of a tested unit is greater than the maximum permitted rate, corrective actions shall be taken and the unit retested until it passes. For each tested *dwelling unit* or *sleeping unit* with an air leakage rate greater than the maximum permitted rate, three additional units, including the corrected unit, shall be tested. Where *buildings* have fewer than eight *dwelling units* or *sleeping units*, each unit shall be tested.

~~R402.4.1.3~~**R402.5.1.3 Leakage****Maximum air leakage rate.** When complying with Section R401.2.1, the *building* or dwelling unit shall have an air leakage rate not exceeding 5.0 air changes per hour in Climate Zones 0, 1 and 2, and 3.0 air changes per hour in Climate Zones 3 through 8, when tested in accordance with Section R402.5.1.2. **Where tested in accordance with Section R402.5.1.2**, the air leakage rate for *buildings, dwelling units or sleeping units* shall be as follows:

1. Where complying with **Section R401.2.1**, the *building* or the *dwelling units or sleeping units* in the *building* shall have an air leakage rate not greater than 4.0 air changes per hour in Climate Zones 0, 1 and 2; 3.0 air changes per hour in Climate Zones 3 through 5; and 2.5 air changes per hour in Climate Zones 6 through 8.
2. Where complying with **Section R401.2.2 or R401.2.3**, the *building* or the *dwelling units or sleeping units* in the building shall have an air leakage rate not greater than 4.0 air changes per hour, or 0.22 cubic feet per meter per square foot [1.1 L/(s × m<sup>2</sup>)] of the *building thermal envelope* area or the *dwelling testing unit enclosure area*, as applicable.

Exceptions:

1. Where *dwelling units or sleeping units* are attached or located in an R-2 occupancy, and are tested without simultaneously testing adjacent *dwelling units or sleeping units*, the air leakage rate is permitted to be not greater than 0.27 cubic feet per meter per square foot [1.4 L/(s × m<sup>2</sup>)] of the *dwelling testing unit enclosure area*. Where adjacent *dwelling units* are simultaneously tested in accordance with **ASTM E779**, the air leakage rate is permitted to be not greater than 0.27 cubic feet per meter per square foot [1.4 L/(s × m<sup>2</sup>)] of the *dwelling testing unit enclosure area* that separates *conditioned space* from the exterior.
2. Where *buildings* have 1,500 square feet (139.4 m<sup>2</sup>) or less of *conditioned floor area*, the air leakage rate is permitted to be not greater than 0.27 cubic feet per meter per square foot [1.4 L/(s × m<sup>2</sup>)].

**Note: Original text of mod is not consistent with that of the 2023 FEC.**

FSEC – Anticipated energy impact on FBC-ER - Increased stringency.

~~R402.4.2~~**R402.5.2 Fireplaces.** New wood-burning fireplaces shall have tight-fitting flue *dampers* or doors, and outdoor combustion air. Where using tight-fitting doors on factory-built fireplaces *listed* and *labeled* in accordance with **UL 127**, the doors shall be tested and *listed* for the fireplace.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

**RE#16 F**

Action	AS	AS/IC	D	D/IC

**R402.4.3R402.5.3 Fenestration air leakage.** Windows, *skylights* and sliding glass doors shall have an air *infiltration* rate of not greater than 0.3 cubic feet per meter per square foot (1.5 L/s/m<sup>2</sup>), and for swinging doors, not greater than 0.5 cubic feet per meter per square foot (2.6 L/s/m<sup>2</sup>), when tested in accordance with **NFRC 400** or **AAMA/WDMA/CSA 101/I.S.2/A440** by an accredited, independent laboratory and *listed* and *labeled* by the manufacturer.

**Exception:** Site-built windows, *skylights* and doors.

**R402.4.5R402.5.4 Recessed lighting.** Recessed luminaires installed in the *building thermal envelope* shall be sealed to limit air leakage between conditioned and *unconditioned spaces*. Recessed luminaires shall be IC-rated and *labeled* as having an air leakage rate of not greater than 2.0 cfm (0.944 L/s) when tested in accordance with **ASTM E283** at a pressure differential of 1.57 psf (75 Pa). Recessed luminaires shall be sealed with a gasket or caulked between the housing and the interior wall or ceiling covering.

**R402.4.6R402.5.5 Electrical-Air-sealed electrical and communication outlet boxes (air-sealed boxes).** ElectricalAir-sealed and communication outlet boxes that penetrated the installed in the *air barrier of the building thermal envelope* shall be sealed to limit air leakage between conditioned and unconditioned spacescaulked, taped, gasketed or otherwise sealed to the *air barrier element being penetrated*. Air-sealed boxes shall be buried in or surrounded by insulation. Air-sealed boxes Electrical and communication outlet boxes shall be tested in accordance with **NEMA OS 4, Requirements for Air-Sealed Boxes for Electrical and Communication Applications**, and shall have an air leakage rate of not greater than 2.0 cubic feet per minute (0.944 L/s) at a pressure differential of 1.57 psf (75 Pa). Electrical and communication outletAir-sealed boxes shall be tested and marked "NEMA OS 4" or "OS 4" in accordance with **NEMA OS 4**. Electrical and communication outletAir-sealed boxes shall be installed perin accordance with the manufacturer's instructions and with any supplied components required to achieve compliance with NEMA OS 4.

**R402.5R402.6 Maximum fenestration U-factor and SHGC.** The area-weighted average maximum fenestration *U-factor* permitted using tradeoffs from **Section R402.1.5** or **R405** shall be 0.48 in Climate Zones 4 and 5 and 0.40 in Climate Zones 6 through 8 for vertical *fenestration*, and 0.75 in Climate Zones 4 through 8 for skylights. The area-weighted average maximum fenestration *SHGC* permitted using tradeoffs from **Section R405** in Climate Zones 0 through 3 shall be 0.40.

**Exception:** The maximum *U-factor* and *solar heat gain coefficient* (SHGC) for *fenestrations* shall not be required in storm shelters complying with **ICC 500**.

Note: Original text of mod is not consistent with that of the 2023 FEC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

**RE#16 G**

Action	AS	AS/IC	D	D/IC

## RE#17

Revises heat pump supplementary heat section language to include fuel gas and liquid fuel heating systems, and further stipulates when supplemental heat can be used

Revises language including changing “oil” to “liquid fuel”

Renamed from “Ducts”

2021 IECC includes a duct testing exception in Section R403.3.5 for ventilation system ducts that are not integrated with ducts serving heating or cooling systems; the 2024 IECC modifies this exception language slightly and moves it up to Section R403.3 so it now applies to duct system testing and other duct system installation sections from R403.3.3 through R403.3.9

New section stipulating duct system design and sizing standards based on number of dwelling or sleeping units

Renumbered from R403.3.7 and term “ducts” changed to “ductwork”

Renumbered from R403.3.1, renamed from “Ducts located outside conditioned space”, and term “ducts” changed to “ductwork”

Renumbered from R403.3.2, renamed from “Ducts located in conditioned space”, and term “ductwork” changed to “duct systems”

Section language revised for clarification purposes; also adds unvented attics with vapor diffusion ports to buried ductwork option

Renumbered from R403.3.3, renamed from “Ducts buried within ceiling insulation”, term “duct” changed to “ductwork”, and minor additional text revisions

Adds items #4 and 4.1 which add an unvented attic (with vapor diffusion port) buried R8 supply duct option for Climate Zones 0A, 1A, 2A and 3A

Renumbered from R403.3.3.1, term “duct” changed to “ductwork”, and minor additional text revisions

Renumbered from R403.3.4, term “ducts” changed to “ductwork”, and minor additional text revisions

Renumbered from R403.3.4.1, renamed from “Sealed air handler”, and “air handlers” changed to “air-handling units” in text

Renumbered from R403.3.5, renamed from “Duct testing”, and revised, removing “rough-in test” and “postconstruction test” based organization

Adds duct testing exception for 10 feet or less of total ductwork when the duct system is entirely in conditioned space and the ductwork does not include building cavity or gypsum board plenums

Adds duct testing exception to section, allowing testing where space conditioning equipment is not installed-- in these cases, requires total supply and return duct leakage to be less than or equal to 3.0 cfm/sq. ft.; 2021 IECC had same allowance, but applied to Prescriptive only; now also applies to Performance

Adds exception to section which, in conjunction with new Section R403.3.9, allows duct testing sampling for buildings with eight or more dwelling units or sleeping units

Renumbered from R403.3.6, renamed from “Duct leakage”, and revised, moving from “rough-in test” and “postconstruction test” duct leakage limits organization to limits shown in new Table R403.3.8, based on floor area served by the duct system, equipment and duct configuration, and number of ducted returns

Adds duct testing unit sampling section which, in conjunction with new Section R403.3.7, allows duct testing sampling for buildings with eight or more dwelling units or sleeping units

Minor edit and new requirement that piping protection be removable no less than 6 feet (1828 mm) from the equipment for maintenance

Reorganizes language slightly, adds gravity circulation system prohibition, and adds requirement that where a cold water supply pipe is used as the return pipe, a temperature sensor connected to the controls be located on the hot water supply not more than two feet (305 mm) from the connection to the cold water supply pipe

Removes “where installed” and adds specifications on how controls must limit pump operation

Changes hot water pipe insulation requirements for stipulated conditions from R3 to 1.0 inch insulation thickness based on fluid operating temperature range and usage as provided in new Table R403.5.2; also removes piping serving more than one dwelling unit condition and provides exception for cold water returns in demand recirculation water systems; section now also applies to performance compliance

Adds “dwelling units” to the structures that must comply with this section, further changes the structures that must comply with this section by changing reference from Section R402.5.1 “Building thermal envelope” to R402.5.1.1 “Installation” and adds “mechanical” to phrase “shall be provided with mechanical ventilation...”

Adds Climate Zone 6 to those included in this section’s heat or energy recovery ventilation requirements and revises text to include sensible recovery efficiency (SRE) term and stipulates how SRE must be determined

Fixes typos, provides minor clarifications, and references and provides revised mechanical ventilation system fan efficacy Table R403.6.2 that includes test procedure for each system type and provides additional minimum efficacies for “Balanced ventilation system without heat or energy recovery” and “other exhaust fans” with airflow rate above 200 cfm; also provides footnote with means of determining efficacy for balanced ventilation systems, HRVs, and ERVs

Changes mechanical ventilation system testing stipulation from manufacturer’s instructions or code listed options to instead be in accordance with ANSI/RESNET/ICC 380; revises existing testing exception and adds two exceptions

Adds mechanical ventilation testing unit sampling section which, in conjunction with new Section R403.3.7, allows mechanical ventilation system testing sampling for buildings with eight or more dwelling units or sleeping units

New section requires exhaust system controls for bathrooms and toilet rooms when designed for intermittent operation

	<p>New section requires detached one- and two-family dwellings and townhouses in Climate Zones 4 through 8 using electric-resistance space heating to limit the total electric resistance heating capacity to not more than 2.0 kW or requires installation of a heat pump in the largest space that is not used as a bedroom</p> <p>Adds exception to Systems serving multiple dwelling units section for systems complying with new Section R403.9, which addresses mechanical systems located outside of the building thermal envelope</p> <p>New section provides requirements for mechanical systems located outside of the building thermal envelope</p> <p>New section provides type and control requirements for systems that provide heat outside of a building</p> <p>Renumbered from R403.9</p> <p>New section provides control requirements for roof and gutter deicing systems</p> <p>New section provides control requirements for freeze protection systems</p> <p>Replaces pool pump control exception's use of "solar" with "on-site renewable energy"</p> <p>With an exception for gas-fired combustion safety devices, new section requires gas fireplace systems to not be equipped with a continuous pilot, and instead be equipped with an on-demand pilot, intermittent ignition or interrupted ignition</p> <p>New section provides vented gas fireplace heater fireplace efficiency (FE) rating and listing and labeling requirements</p>
<p>Related Mods:</p> <p>R403.3.1 RED1-285-22, REC2D-8-23</p> <p>TABLE R403.3.8 REPI-86-21, RED1-285-22, RED1-309-22</p> <p>TABLE R403.3.8 REPI-86-21, RED1-285-22, RED1-309-22</p> <p>R403.3.9 REPI-85-21, RED1-285-22, REC2D-8-23</p> <p>TABLE R403.5.2 REPI-89-21</p> <p>R403.6.4 RED1-365-22, REC2D-8-23</p> <p>R403.6.5 RECD1-1-22</p> <p>R403.7.1 REPI-99-21, RED1-325-22,</p> <p>R403.9 RED1-329-22</p>	<p style="text-align: center;"><b>SECTION R403 SYSTEMS</b></p> <p><b>R403.1 Controls.</b> Not less than one <i>thermostat</i> shall be provided for each separate heating and cooling system.</p> <p><b>R403.1.1 Programmable thermostat.</b> The <i>thermostat</i> controlling the primary heating or cooling system of the <i>dwelling unit</i> shall be capable of controlling the heating and cooling system on a daily schedule to maintain different temperature set points at different times of day and different days of the week. This <i>thermostat</i> shall include the capability to set back or temporarily operate the system to maintain <i>zone</i> temperatures of not less than 55°F (13°C) to not greater than 85°F (29°C). The <i>thermostat</i> shall be programmed initially by the manufacturer with a heating temperature setpoint of not greater than 70°F (21°C) and a cooling temperature setpoint of not less than 78°F (26°C).</p> <p><b>R403.1.2 Heat pump supplementary heat.</b> Heat pumps having supplementary electric- resistance heat shall have controls that, except during defrost, prevent supplemental heat operation when the heat pump compressor can meet the heating load. <i>fuel gas</i> or <i>liquid fuel</i> heating systems shall have controls that are configured to prevent supplemental heat operation when the capacity of the heat pump compressor can meet the heating load. Supplemental heat operation shall be limited to only where one of the following applies:</p> <ol style="list-style-type: none"> <li>1. The vapor compression cycle cannot provide the necessary heating energy to satisfy the <i>thermostat</i> setting.</li> <li>2. The heat pump is operating in defrost mode.</li> <li>3. The vapor compression cycle malfunctions.</li> <li>4. The <i>thermostat</i> malfunctions.</li> </ol> <p><b>R403.2 Hot water boiler temperature reset.</b> <del>The manufacturer shall equip each gas, oil and electric boiler (other than a boiler where equipped with a tankless domestic water heating coil) coils, the manufacturer shall equip each gas, liquid fuel and electric boiler with automatic means of adjusting the water temperature supplied by the boiler to ensure so that</del> incremental change of the inferred heat load will cause an incremental change in the temperature of the water supplied by the boiler. This can be accomplished with outdoor reset, indoor reset or water temperature sensing.</p> <p><b>R403.3 Ducts. Duct systems.</b> <del>Ducts and air handlers</del> <i>Duct systems</i> shall be installed in accordance with <b>Sections R403.3.3</b> through <b>R403.3.9</b>.</p> <p><b>Exception:</b> <i>Ventilation ductwork</i> that is not integrated with <i>duct systems</i> serving heating or cooling systems.</p> <p><b>R403.3.1 Duct system design.</b> <i>Duct systems</i> serving one or two <i>dwelling units</i> or <i>sleeping units</i> shall be designed and sized in accordance with <b>ANSI/ACCA Manual D</b>. <i>Duct systems</i> serving more than two <i>dwelling units</i> or <i>sleeping units</i> shall be sized in accordance with the <b>ASHRAE Handbook of Fundamentals</b>, <b>ANSI/ACCA Manual D</b>, or other equivalent computation procedure.</p>

R403.9.1 RED1-329-22

R403.9.3 CEPI-82-21 Part II, RED1 107-22, RED1-329-22

R403.9.4 RED1-329-22

R403.10.2 RED1-299-22

R403.13 (New) ..... RED1-286-22

R403.13.1 REPI-65-21, RED1-286-22, RED1-287-22

FSEC – Anticipated energy impact on FBC-ER - None or slightly increased stringency impact in applicable cases depending on typical practices.

~~R403.3.7~~**R403.3.2 Building cavities.** *Building framing cavities shall not be used as ducts* ductwork or plenums.

~~R403.3.1~~**R403.3.3 Ducts** Ductwork located outside conditioned space. Supply and return ducts ductwork located outside conditioned space shall be insulated to an *R-value* of not less than R-8 for ducts 3 inches (76 mm) in diameter and larger and not less than R-6 for ducts smaller than 3 inches (76 mm) in diameter. DuctsDuctwork buried beneath a building shall be insulated as required per this section or have an equivalent *thermal distribution efficiency*. Underground ductsductwork utilizing the *thermal distribution efficiency* method shall be *listed* and *labeled* to indicate the *R-value* equivalency.

~~R403.3.2~~**R403.3.4 Ducts**Duct systems located in conditioned space. For ductwork duct systems to be considered inside a conditioned space, ~~it shall comply with one of the following:~~the space conditioning equipment shall be located completely on the conditioned side of the building thermal envelope. The ductwork shall comply with the following as applicable:

1. The duct system ductwork shall be located completely within the continuous air barrier and within on the conditioned side of the building thermal envelope.
2. Ductwork in ventilated attic spaces or unvented attics with vapor diffusion ports shall be buried within ceiling insulation in accordance with Section R403.3.5 and all of shall comply with the following conditions shall exist:
  - 2.1. The air handler is located completely within the continuous air barrier and within the building thermal envelope.
  - 2.2.1 The ductductwork leakage, as measured either by a rough-in test of the supply and return ductwork of the ducts or a post-construction totalduct system leakage test to outside the building thermal envelope in accordance with Section R403.3.7, is less than or equal to not greater than 1.5 cubic feet per minute (42.5 L/min) per 100 square feet (9.29 m<sup>2</sup>) of conditioned floor area served by the duct system.
  - 2.3.2.2. The ceiling insulation R-value installed against and above the insulated duct ductwork is greater than or equal to the proposed ceiling insulation R-value, less the R-value of the insulation on the duct ductwork.
3. Ductwork in floor cavities located over unconditioned space shall comply with all of contained within wall or floor assemblies separating unconditioned from conditioned space shall comply with the following:
  - 3.1. A continuous air barrier shall be installed as part of the building assembly between unconditioned space and the ductthe ductwork and the unconditioned space.
  - 3.2. Insulation installed in accordance with Section R402.2.8.Ductwork shall be installed in accordance with Section R403.3.3.
 

**Exception:** Where the building assembly cavities containing ductwork have been air sealed in accordance with Section R402.5.1 and insulated in accordance with Item 3.3, duct insulation is not required.
  - 3.3. A minimum R-19 insulation installed in the cavity width separating the duct from unconditioned space. Not less than R-10 insulation, or not less than 50 percent of the required insulation R-value specified in Table R402.1.3, whichever is greater, shall be located between the ductwork and the unconditioned space.

3.4 Segments of ductwork contained within these building assemblies shall not be considered completely inside conditioned space ~~in~~ for compliance with Section R405 or R406.



4. Ductwork located within exterior walls of the building thermal envelope shall comply with the following:
  - 4.1. A continuous air barrier installed between unconditioned space and the duct.
  - 4.2. Minimum R-10 insulation installed in the cavity width separating the duct from the outside sheathing.
  - 4.3. The remainder of the cavity insulation shall be fully insulated to the drywall side.



FSEC – Anticipated energy impact on FBC-ER - None or slightly increased stringency impact in applicable cases depending on typical practices.

**R403.3.3R403.3.5 Ductwork buried within ceiling insulation.** Where supply and return air ducts are ~~ductwork is~~ partially or completely buried in ceiling insulation, such ~~ducts~~ **ductwork** shall comply with all of the following:

1. The supply and return ~~ducts~~ **ductwork** shall ~~be insulated with~~ have an insulation ~~R-value~~ not less than R-8 **insulation**.
2. At all points along ~~the ductwork~~ **each duct**, the sum of the ceiling insulation ~~R-value~~ against and above the top of the ~~duct~~ **ductwork**, and against and below the bottom of the ~~duct~~ **ductwork**, shall be not less than R-19, excluding the ~~R-value~~ of the duct insulation.
3. In Climate Zones 0A, 1A, 2A and 3A, the supply ~~ducts~~ **ductwork** shall be completely buried within ceiling insulation, insulated to an ~~R-value~~ of not less than R-13 and in compliance with the vapor retarder requirements of **Section 604.11** of the *International Mechanical Code* or **Section M1601.4.6** of the *International Residential Code*, as applicable.

**Exception:** Sections of the supply ~~duct~~ **ductwork** that are less than 3 feet (914 mm) from the supply outlet ~~shall not be required to comply with these requirements~~.

4. In Climate Zones 0A, 1A, 2A and 3A where installed in an unvented attic with vapor diffusion ports, the supply ~~ductwork~~ shall be completely buried within the insulation in the ceiling assembly at the floor of the attic, insulated to an ~~R-value~~ of not less than R-8 and in compliance with the vapor retarder requirements of **Section 604.11** of the *International Mechanical Code* or **Section M1601.4.6** of the *International Residential Code*, as applicable.

**Exception:** Sections of the supply ~~ductwork~~ that are less than 3 feet (914 mm) from the supply outlet.

- 4.1. Air permeable insulation installed in unvented attics shall comply with **Section R806.5** of the *International Residential Code*.

**R403.3.3.1R403.3.5.1 Effective R-value of deeply buried ducts.** Where ~~complying~~ using **Section R405** the Total Building Performance Compliance Option in accordance with Section R401.2.2, sections of ~~ducts~~ **ductwork** that are installed in accordance with **Section R403.3.5**, located directly on or within 5.5 inches (140 mm) of the ceiling, ~~surrounded~~ with blown-in attic insulation having an ~~R-value~~ of R-30 or greater, and located such that the top of the ~~duct~~ **ductwork** is not less than 3.5 inches (89 mm) below the top of the insulation, shall be considered as having an effective duct insulation ~~R-value~~ of R-25.

**R403.3.4R403.3.6 Sealing.** Ducts ~~Ductwork~~, air handlers ~~air-handling units~~ and filter boxes shall be sealed. Joints and seams shall comply with ~~either the~~ *International Mechanical Code* or ~~the~~ *International Residential Code*, as applicable.

**R403.3.4.1R403.3.6.1 Sealed air handlerair-handling unit.** Air handlers ~~Air-handling units~~ shall have a manufacturer's designation for an air leakage of not greater than 2 percent of the design airflow rate when tested in accordance with **ASHRAE 193**.

**R403.3.5R403.3.7 Duct system testing.** ~~Ducts~~ **Each duct system** shall be pressure tested ~~for air leakage~~ in accordance with **ANSI/RESNET/ICC 380** or **ASTM E1554** to determine air leakage by one of the following methods: ~~Total leakage shall be measured with a pressure differential of 0.1 inch water gauge (25 Pa) across the duct system and shall include the measured leakage from the supply and return ductwork. A written report of the test results shall be signed by the party conducting the test and provided to the code official. Duct system leakage testing at either rough-in or post construction shall be permitted with or without the installation of registers or grilles. Where installed, registers and grilles shall be sealed during the test. Where registers and~~



grilles are not installed, the face of the register boots shall be sealed during the test.

- ~~1. Rough in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. Registers shall be taped or otherwise sealed during the test.~~
- ~~2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Registers shall be taped or otherwise sealed during the test.~~

~~A written report of the results of the test shall be signed by the party conducting the test and provided to the code official.~~

**Exception:**

~~A ductair leakage test shall not be required for ducts serving ventilation systems that are not integrated with ducts serving heating or cooling systems.~~

Exceptions:

1. Testing shall not be required for *duct systems* serving *ventilation* systems that are not integrated with *duct systems* serving heating or cooling systems.
2. Testing shall not be required where there is not more than 10 feet (3048 mm) of total *ductwork* external to the *space conditioning equipment* and both the following are met:
  - 2.1. The *duct system* is located entirely within *conditioned space*.
  - 2.2. The *ductwork* does not include plenums constructed of building cavities or gypsum board.
3. Where the *space conditioning equipment* is not installed, testing shall be permitted. The total measured leakage of the supply and return *ductwork* shall be less than or equal to 3.0 cubic feet per meter (85 L/min) per 100 square feet (9.29 m<sup>2</sup>) of *conditioned floor area*.
4. Where tested in accordance with **Section R403.3.9**, testing of each *duct system* is not required.

FSEC – Anticipated energy impact on FBC-ER - None or slightly increased stringency in applicable cases.

~~**R403.3.6**~~**R403.3.8 Duct system leakage.** The total leakage of the *ducts*, where measured in accordance with Section R403.3.7, shall be as follows: The total measured *duct system* leakage shall not be greater than the values in **Table R403.3.8**, based on the *conditioned floor area*, number of ducted returns, and location of the *duct system*. For *buildings* complying with **Section R405** or **R406**, where *duct system* leakage to outside is tested in accordance with **ANSI/RESNET/ICC 380** or **ASTM E1554**, the leakage to outside value shall not be used for compliance with this section, but shall be permitted to be used in the calculation procedures of **Section R405** and **R406**.

- ~~1. Rough in test: The total leakage shall be less than or equal to 4.0 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m<sup>2</sup>) of *conditioned floor area* where the air handler is installed at the time of the test. Where the air handler is not installed at the time of the test, the total leakage shall be less than or equal to 3.0 cubic feet per minute (85 L/min) per 100 square feet (9.29 m<sup>2</sup>) of *conditioned floor area*.~~
- ~~2. Postconstruction test: Total leakage shall be less than or equal to 4.0 cubic feet per minute (113.3 L/min) per 100 square feet~~

(9.29 m<sup>2</sup>) of conditioned floor area.

~~3. Test for ducts within thermal envelope: Where all ducts and air handlers are located entirely within the building thermal envelope, total leakage shall be less than or equal to 8.0 cubic feet per minute (226.6 L/min) per 100 square feet (9.29 m<sup>2</sup>) of conditioned floor area.~~

**TABLE R403.3.8  
MAXIMUM TOTAL DUCT SYSTEM LEAKAGE**

EQUIPMENT AND DUCT CONFIGURATION	DUCT SYSTEMS SERVING MORE THAN 1,000 ft <sup>2</sup> OF CONDITIONED FLOOR AREA		DUCT SYSTEMS SERVING 1,000 ft <sup>2</sup> OR LESS OF CONDITIONED FLOOR AREA
	cfm/100 ft <sup>2</sup>		cfm
	Number of ducted returns <sup>a</sup>		
	< 3	≥ 3	Any
Space conditioning equipment is not installed <sup>b, c</sup>	3	4	30
All components of the duct system are installed <sup>c</sup>	4	6	40
Space conditioning equipment is not installed, but the ductwork is located entirely in conditioned space <sup>d</sup>	6	8	60
All components of the duct system are installed and entirely located in conditioned space <sup>e</sup>	8	12	80

For SI: 1 cubic foot per meter per square foot = 0.0033 LPM/m<sup>2</sup>, 1 cubic foot per minute = 28.3 LPM.

- a. A ducted return is a duct made of sheet metal or flexible duct that connects one or more return grilles to the return-side inlet of the air-handling unit. Any other method to convey air from return or transfer grilles to the air-handling unit does not constitute a ducted return for the purpose of determining maximum total duct system leakage allowance.
- b. Duct system testing is permitted where space conditioning equipment is not installed, provided that the return ductwork is installed and the measured leakage from the supply and return ductwork is included.
- c. For duct systems to be considered inside a conditioned space, where the ductwork is located in ventilated attic spaces or unvented attics with vapor diffusion ports, duct system leakage to outside must comply with Item 2.1 of Section R403.3.4.
- d. Prior to the issuance of a certificate of occupancy, where the air-handling unit is not verified as being located in conditioned space, the total duct system leakage must be retested.

FSEC – Anticipated energy impact on FBC-ER – Slightly increased or decreased stringency for Prescriptive compliance depending on area served, configuration, and number of ducted returns, somewhat increased stringency for Performance compliance.

**R403.3.9 Unit sampling.** For buildings with eight or more *dwelling units* or *sleeping units*, the *duct systems* in the greater of seven or 20 percent of the *dwelling units* or *sleeping units* shall be tested, including a top floor unit, a ground floor unit, a middle floor unit and the unit with the largest *conditioned floor area*. Where buildings have fewer than eight *dwelling units* or *sleeping units*, the *duct systems* in each unit shall be tested. Where the leakage of a *duct system* is greater than the maximum permitted *duct system* leakage, corrective actions shall be made to the *duct system* and the *duct system* shall be system retested until it passes. For each tested *dwelling unit* or *sleeping unit* that has a greater total duct system leakage than the maximum permitted *duct system* leakage, an additional three *dwelling units* or *sleeping units*, including the corrected unit, shall be tested.

**Note: Original text of mod is not consistent with that of the 2023 FEC.**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

**RE#17 A**

Action	AS	AS/IC	D	D/IC

FSEC – Anticipated energy impact on FBC-ER - None or slightly increased stringency in applicable cases.

**R403.4 Mechanical system piping insulation.** Mechanical system piping capable of carrying fluids greater than 105°F (41°C) or less than 55°F (13°C) shall be insulated to an *R-value* of not less than R-3.

**R403.4.1 Protection of piping insulation.** Piping insulation exposed to weather shall be protected from damage, including that caused by sunlight, moisture, equipment maintenance physical contact and wind. The protection shall provide shielding from solar radiation that can cause degradation of the material and shall be removable no less than 6 feet (1828 mm) from the equipment for maintenance. Adhesive tape shall be prohibited.

**R403.5 Service hot water systems.** Energy conservation measures for service hot water systems shall be in accordance with Sections R403.5.1 through R403.5.3.

**R403.5.1 Heated water circulation and temperature maintenance systems.** Heated water circulation systems shall be in accordance with Section R403.5.1.1. Heat trace temperature maintenance systems shall be in accordance with Section R403.5.1.2. *Automatic* controls, temperature sensors and pumps shall be in a location with access. *Manual* controls shall be in a location with *ready access*.

**R403.5.1.1 Circulation systems.** Heated water circulation systems shall be provided with a circulation pump. ~~The system return pipe shall be a dedicated return pipe or a cold water supply pipe.~~ Gravity and thermosyphon circulation systems shall be prohibited. Controls for *circulating hot water system* pumps shall automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is no demand for hot water. ~~The system return pipe shall be a dedicated return pipe or a cold water supply pipe.~~ Where a cold water supply pipe is used as the return pipe, a temperature sensor connected to the controls shall be located on the hot water supply not more than two feet (305 mm) from the connection to the cold water supply pipe. The controls shall limit the temperature of the water entering the cold water piping to not greater than 104°F (40°C).

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

**RE#17 B**

Action	AS	AS/IC	D	D/IC

**R403.5.1.1.1 Demand recirculation water systems.** ~~Where installed, demand~~ **Demand recirculation water systems** shall have controls that start the pump upon receiving a signal from the action of a user of a fixture or appliance, sensing the presence of a user of a fixture or sensing the flow of hot or tempered water to a fixture fitting or appliance. **The controls shall limit pump operation by:**

1. Shutting off the pump when the temperature sensor detects one of the following:
  - 1.1. An increase in the water temperature of not more than 10°F (5.6°C) above the initial temperature of the water in the pipe.
  - 1.2. The temperature of the water in the pipe reaches 104°F (40°C).
2. Limiting pump operation to a maximum of 5 minutes following activation.
3. Not activating the pump for at least 5 minutes following shutoff or when the temperature of the water in the pipe exceeds 104°F (40°C).

**R403.5.1.2 Heat trace systems.** Electric heat trace systems shall comply with **IEEE 515.1** or **UL 515**. Controls for such systems shall automatically adjust the energy input to the heat tracing to maintain the desired water temperature in the piping in accordance with the times when heated water is used in the occupancy.

**Note: Original text of mod is not consistent with that of the 2023 FEC.**

FSEC – Anticipated energy impact on FBC-ER - None or slightly increased stringency in applicable cases.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

**RE#17 C**

Action	AS	AS/IC	D	D/IC

**R403.5.2 Hot water pipe insulation.** ~~Insulation for service hot water piping with a thermal resistance, R-value, of not less than R-3 shall~~ **shall comply with Table R403.5.2** and be applied to the following:

1. Piping <sup>3</sup>/<sub>4</sub> inch (19.1 mm) and larger in nominal diameter located inside the *conditioned space*.
- 2. ~~Piping serving more than one dwelling unit.~~
3. ~~Piping located outside the *conditioned space*.~~
  1. ~~Piping from the water heater to a distribution manifold.~~
  4. ~~Piping located under a floor slab.~~
  5. ~~Buried piping.~~
  6. ~~Supply and return piping in circulation and recirculation systems other than cold water pipe return demand recirculation systems.~~ **circulating hot water systems.**

**Exception:** Cold water returns in *demand recirculation water systems*.

**TABLE R403.5.2  
MINIMUM PIPE INSULATION THICKNESS**

FLUID OPERATING TEMPERATURE RANGE AND USAGE (°F)	INSULATION CONDUCTIVITY		MINIMUM PIPE INSULATION THICKNESS (inches)
	Conductivity in/(h × ft <sup>2</sup> × °F) <sup>a</sup>	Mean rating Btu × temperature (°F)	
141–200	0.25–0.29	125	1.0
105–140	0.21–0.28	100	1.0

For SI: 1 inch = 25.4 mm, °C = (°F – 32)/1.8.

- a. For insulation outside the stated conductivity range listed in this table, the minimum thickness (*T*) listed in this table shall be determined as follows:

where:

$$T = r[(1 + t/r)^{Kk} - 1]$$

*T* = Minimum insulation thickness.

*r* = Actual outside radius of pipe.

*t* = Insulation thickness listed in the table for applicable fluid temperature and pipe size (1 inch).

*K* = Conductivity of alternate material at mean rating temperature indicated for the applicable fluid temperature (Btu × in/h × ft<sup>2</sup> × °F).

*k* = The upper value of the conductivity range listed in this table for the applicable fluid temperature.

FSEC – Anticipated energy impact on FBC-ER - None or slightly increased stringency in applicable cases.

**R403.5.3 Drain water heat recovery units.** Where installed, drain water heat recovery units shall comply with **CSA B55.2**. Drain water heat recovery units shall be tested in accordance with **CSA B55.1**. Potable water-side pressure loss of drain water heat recovery units shall be less than 3 psi (20.7 kPa) for individual units connected to one or two showers. Potable water-side pressure loss of drain water heat recovery units shall be less than 2 psi (13.8 kPa) for individual units connected to three or more showers.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

**RE#17 D**

Action	AS	AS/IC	D	D/IC

**R403.6 Mechanical ventilation.** The *buildings and dwelling units* complying with **Section R402.5.1.1** shall be provided with *mechanical ventilation* that complies with the requirements of **Section M1505** of the *International Residential Code* or the *International Mechanical Code*, as applicable, or with other *approved* means of *ventilation*. Outdoor air intakes and exhausts shall have *automatic* or *gravity dampers* that close when the *ventilation* system is not operating.

**R403.6.1 Heat or energy recovery ventilation.** *Dwelling units* shall be provided with a heat recovery or energy recovery *ventilation* system in Climate Zones 6, 7 and 8. The system shall be a balanced *ventilation system* with a minimum sensible heat recovery efficiency (SRE) of not less than 65 percent at 32°F (0°C) at a flow an airflow greater than or equal to the design airflow. The SRE shall be determined from a *listed* value or from interpolation of *listed* values.

**R403.6.2 Whole-dwelling mechanical ventilation system fan efficacy.** *Fan efficacy for whole-house mechanical ventilation systems and outdoor air ventilation systems.* Fan used to provide whole-dwelling mechanical *ventilation* shall meet the efficacy requirements of **Table R403.6.2** at one or more rating points. Fans shall be tested in accordance with ~~HV-916~~ *the test procedure referenced by Table R403.6.2 and listed*. The airflow shall be reported in the product listing or on the label. Fan efficacy shall be reported in the product listing or shall be derived from the input power and airflow values reported in the product listing or on the label. Fan efficacy for fully ducted HRV, ~~ERCERV~~, balanced *ventilation systems* and in-line fans shall be determined at a static pressure of not less than 0.2 inch ~~w.c.~~ *water gauge* (49.8550 Pa). Fan efficacy for ducted range hoods, bathroom and utility room fans shall be determined at a static pressure of not less than 0.1 inch ~~w.c.~~ *water gauge* (24.9125 Pa).

TABLE R403.6.2

WHOLE-DWELLING MECHANICAL VENTILATION SYSTEM FAN EFFICACY<sup>a</sup> -

TABLE R403.6.2 FAN LOCATION	AIRFLOW RATE MINIMUM (CFM)	MINIMUM EFFICACY (CFM/WATT)
HRV, ERV	Any Any	1.2 cfm/watt
In-line supply or exhaust fan Other	< 90	3.8 cfm/watt
exhaust fan	≥ 90	2.8 cfm/watt
Other exhaust fan		3.5 cfm/watt
Air handler that is integrated to tested and <del>listed HVAC equipment</del>		
	Any	1.2 cfm/watt

**TABLE R403.6.2**

For SI: 1 cubic foot per minute = 28.3 L/min.

a. Design outdoor airflow rate/watts of fan used.

**WHOLE-DWELLING MECHANICAL VENTILATION SYSTEM FAN EFFICACY<sup>a</sup>**

SYSTEM TYPE	AIRFLOW RATE (CFM)	MINIMUM EFFICACY (CFM/WATT)	TEST PROCEDURE
HRV or ERV	Any	1.2 <sup>a</sup>	CAN/CSA C439
Balanced ventilation system without heat or energy recovery	Any	1.2 <sup>a</sup>	ASHRAE 51 (ANSI/AMCA Standard 210)
Range hood	Any	2.8	
In-line supply or exhaust fan	Any	3.8	
Other exhaust fan	< 90	2.8	
	≥ 90 and < 200	3.5	
	≥ 200	4.0	
Air-handling unit that is integrated to tested and listed HVAC equipment	Any	1.2	Outdoor airflow as specified. Air-handling unit fan power determined in accordance with the applicable US Department of Energy Code of Federal Regulations <b>DOE10 CFR 430</b> or other approved test <u>method</u> .

For SI: 1 cubic foot per minute = 28.3 L/min.

a. For balanced ventilation systems, HRVs, and ERVs, determine the efficacy as the outdoor airflow divided by the total fan power.

**R403.6.3 Testing.** Mechanical *ventilation* systems shall be tested and verified to provide the minimum *ventilation* flow rates required by **Section R403.6**, in accordance with **ANSI/ RESNET/ICC 380**. Testing shall be performed according to the *ventilation equipment* manufacturer's instructions, or by using a flow hood or box, flow grid, or other airflow measuring device at the mechanical *ventilation* fan's inlet terminals or grilles, outlet terminals or grilles, or in the connected *ventilation* ducts. Where required by the *code official*, testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*.

**Exceptions:**

1. Kitchen range hoods that are ducted to the outside with ducting having a diameter of 6 inches (152 mm) or larger, a length of 10 feet (3028 mm) or less, duct and not more than one 90-degree (1.57 rad) elbows or equivalent in the duct run shall not require testing.
2. A third-party test shall not be required where the ventilation system has an integrated diagnostic tool used for airflow measurement, and a user interface that communicates the installed airflow rate.

3. accordance with **Section R403.6.4**, testing of each mechanical ventilation system is not required.



**R403.6.4 Unit sampling.** For buildings with eight or more *dwelling units* or *sleeping units*, the mechanical *ventilation* systems in the greater of seven units or 20 of the total units shall be tested. Tested systems shall include systems in a top floor unit, systems in a ground floor unit, systems in a middle floor unit, and the systems in the *dwelling unit* or *sleeping unit* with the largest *conditioned floor area*. Where buildings have fewer than eight *dwelling units* or *sleeping units*, the mechanical *ventilation* systems in each unit shall be tested. Where the *ventilation* flow rate of a mechanical *ventilation* system is less than the minimum permitted rate, corrective actions shall be taken and the system retested until it passes. For each tested *dwelling unit* or *sleeping unit* system with a *ventilation* flow rate lower than the minimum permitted, three additional systems, including the corrected system, shall be tested.

**R403.6.5 Intermittent exhaust control for bathrooms and toilet rooms.** Where an exhaust system serving a bathroom or toilet room is designed for intermittent operation, the exhaust system controls shall include one or more of the following:

1. A timer control with one or more delay setpoints that automatically turns off exhaust fans when the selected setpoint is reached. Not fewer than one delay-off setpoint shall be 30 minutes or less.
2. An *occupant sensor control* with one or more delay setpoints that automatically turns off exhaust fans in accordance with the selected delay setpoint after all occupants have vacated the space. Not fewer than one delay-off setpoint shall be 30 minutes or less.
3. A humidity control with an adjustable setpoint ranging between 50 percent or more and 80 percent or less relative humidity that automatically turns off exhaust fans when the selected setpoint is reached.
4. A contaminant control that responds to a particle or gaseous concentration and automatically turns off exhaust fans when a design setpoint is reached.

*Manual-off* functionality shall not be used in lieu of the minimum setpoint functionality required by this section.

**Exception:** Bathroom and toilet room exhaust systems serving as an integral component

FSEC – Anticipated energy impact on FBC-ER - Slightly increased stringency in applicable cases.

**R403.7 Equipment sizing and efficiency rating.** Heating and cooling *equipment* shall be sized in accordance with **ACCA Manual S** based on *building* loads calculated in accordance with **ACCA Manual J** or other *approved* heating and cooling calculation methodologies. New or replacement heating and cooling *equipment* shall have an efficiency rating equal to or greater than the minimum required by federal law for the geographic location where the *equipment* is installed.

**R403.7.1 Electric-resistance space heating.** Detached one- and two-family dwellings and townhouses in Climate Zones 4 through 8 using electric-resistance space heating shall limit the total installed heating capacity of all electric-resistance space heating serving the *dwelling unit* to not more than 2.0 kW or shall install a heat pump in the largest space that is not used as a bedroom.

**R403.8 Systems serving multiple dwelling units.** Except for systems complying with **Section R403.9**, systems serving multiple *dwelling units* shall comply with **Sections C403** and **C404** of the *International Energy Conservation Code*—Commercial Provisions instead of **Section R403**.

**R403.9 Mechanical systems located outside of the building thermal envelope.** Mechanical systems providing heat outside of the building thermal envelope of a *building* shall comply with **Sections R403.9.1** through **R403.9.4**.

**R403.9.1 Heating outside a building.** Systems installed to provide heat outside a *building* shall be radiant systems. Such heating systems shall be controlled by an occupancy-sensing device or a timer switch, so that the system is automatically de-energized when

occupants are not present.

FSEC – Anticipated energy impact on FBC-ER - None or slightly increased stringency in applicable cases.

**R403.9.2 Snow melt and ice system controls.** Snow- and ice-melting systems, supplied through energy service to the *building*, shall include *automatic* controls capable of shutting off the system when the pavement temperature is greater than 50°F (10°C) and precipitation is not falling, and an *automatic* or *manual* control that will allow shutoff when the outdoor temperature is greater than 40°F (4.8°C).

**R403.9.3 Roof and gutter deicing controls.** Roof and gutter deicing systems, including but not limited to self-regulating cable, shall include *automatic* controls that are configured to shut off the system when the outdoor temperature is above 40°F (4.4°C) and shall include one of the following:

1. A moisture sensor configured to shut off the system in the absence of moisture.
2. A daylight sensor or other means configured to shut off the system between sunset and sunrise.

**R403.9.4 Freeze protection system controls.** Freeze protection systems, such as heat tracing of outdoor piping and *heat exchangers*, including self-regulating heat tracing, shall include *automatic* controls configured to shut off the systems when outdoor air temperatures are above 40°F (4.4°C) or when the conditions of the protected fluid will prevent freezing.

FSEC – Anticipated energy impact on FBC-ER - None or slightly increased stringency in applicable cases.

**R403.10 Energy consumption of pools and spas.** The energy consumption of pools and permanent spas shall be controlled by the requirements in **Sections R403.10.1** through **R403.10.3**.

is an integral part of the heater mounted on the exterior of the heater in a location with *ready access*, or external to and within 3 feet (914 mm) of the heater. Operation of such switch shall not change the setting of the heater *thermostat*. Such switches shall be in addition to a circuit breaker for the power to the heater. Gas-fired heaters shall not be equipped with continuously burning ignition pilots.

**R403.10.2 Time switches.** Time switches or other control methods that can automatically turn heaters and pump motors off and on according to a preset schedule shall be installed for heaters and pump motors. Heaters and pump motors that have built-in time switches shall be in compliance with this section.

Exceptions:

1. Where public health standards require 24-hour pump operation.
2. Pumps that operate ~~solar~~ *on-site renewable energy* and waste-heat-recovery pool heating systems.

**R403.10.3 Covers.** Outdoor heated pools and outdoor permanent spas shall be provided with a vapor-retardant cover or other *approved* vapor-retardant means.

**Exception:** Where more than 75 percent of the energy for heating, computed over an operation season of not fewer than 3 calendar months, is from a heat pump or an *on-site renewable energy* system, covers or other vapor-retardant means shall not be required.

**R403.11 Portable spas.** The energy consumption of electric-powered portable spas shall be controlled by the requirements of **APSP 14**.

**R403.12 Residential pools and permanent residential spas.** Where installed, the energy consumption of residential swimming pools and permanent residential spas shall be controlled in accordance with the requirements of **APSP 15**.

**Note: Original text of mod is not consistent with that of the 2023 FEC.**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

**RE#17 E**

Action	AS	AS/IC	D	D/IC

**R403.13 Gas fireplaces.** Gas fireplace systems shall not be equipped with a *continuous pilot* and shall be equipped with an *on-demand pilot*, *intermittent ignition* or *interrupted ignition*, as defined by **ANSI Z21.20**.

**Exception:** Gas-fired appliances using pilots within a *listed* combustion safety device.

**R403.13.1 Gas fireplace efficiency.** Vented gas fireplace heaters shall have a fireplace efficiency (FE) rating not less than 50 percent as determined in accordance with **CSA P.4.1**, and shall be *listed* and *labeled* in accordance with **CSA/ANSI Z21.88**. Vented gas fireplaces (decorative appliances) shall be *listed* and *labeled* in accordance with **CSA/ANSI Z21.50**.

**FSEC – Anticipated energy impact on FBC-ER - None or slightly increased stringency in applicable cases depending on typical practice.**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

**RE#17 F**

Action	AS	AS/IC	D	D/IC

**RE#18**

Adds "renewable energy to section title  
Replaces high efficacy lighting sources language with actual efficacy minimums and adds three exceptions  
Revisions include moving connected exterior lighting compliance requirement from Section C405.5 to new Sections R404.1.2 through R404.1.4, specifying applicability is for Group R-2, R-3 and R-4 residential buildings, and adding exception for Group R-3 buildings that do not contain more than two dwelling units  
New section adds applicable exterior lighting power requirements from Section C405.5 (as part of moving requirements from commercial provisions)  
New section adds applicable exterior lighting power allowance from Section C405.5 including new Table R404.1 used to calculate allowed lighting power for various area types (as part of moving requirements from commercial provisions)  
New section provides for additional exterior lighting power allowances for building facades  
Renumbered from R404.1.2, renamed from "Fuel gas lighting equipment", revises existing language and adds that gas-fired lighting appliances are not be equipped with a continuous pilot, and instead be equipped with an on-demand pilot, intermittent ignition or interrupted ignition  
Revises section language to refer to new Sections R404.2.1 and R404.2.2 and removes three exception locations, leaving an exception for safety or security lighting only  
New section requires all permanently installed luminaires in habitable spaces to be controlled with a manual dimmer or automatic shutoff control; also must incorporate a manual control to allow occupants to turn the lights on or off  
New section requires all permanently installed luminaires in garages, unfinished basements, laundry rooms and utility rooms to be controlled by an automatic shutoff control; also must incorporate a manual control to allow occupants to turn the lights on or off  
Revises Section R404.3 to instead of providing exterior lighting controls requirements in this section which included an exception for lighting serving multiple dwelling units, moves the existing controls requirements to new Section R404.3.1 which specifies applicability to individual dwelling units  
New section requires that where renewable energy generation is used to comply with the code, documentation be provided demonstrating that where renewable energy certificates (RECs) or energy attributable certificates (EACs) are associated with that portion of renewable energy used to comply with this code, the RECs or EACs will be retained, or retired, on behalf of the property owner

Related Mods:  
 REPI-158-21  
 REPI-101-21  
 REPI-102-21  
 Part I  
 REPI 105-21,  
 RED1-110-22  
 REPI-105-21  
 REPI 105-21,  
 RED1-110-22,  
 REPI-69-21

SECTION R404

**ELECTRICAL POWER, AND LIGHTING AND RENEWABLE ENERGY SYSTEMS**

**R404.1 Lighting equipment.** All permanently installed lighting fixtures, excluding kitchen appliance lighting fixtures, shall contain only high-efficacy lighting sources. Luminaires shall be capable of operation with an efficacy of not less than 45 lumens per watt or shall contain lamps capable of operation with an efficacy of not less than 65 lumens per watt.

Exceptions:

1. Appliance lamps
2. Antimicrobial lighting used for the sole purpose of disinfecting.
3. General service lamps complying with **DOE 10 CFR**, Part 430.32.
4. Luminaires with a rated electric input of not greater than 3.0 watts.

**TABLE R404.1  
 LIGHTING POWER ALLOWANCES FOR BUILDING EXTERIORS**

<b>BASE SITE ALLOWANCE</b>	<b>280 WATTS</b>
Uncovered parking areas and drives	0.026 W/ft <sup>2</sup>
<b>Building grounds</b>	
Walkways and ramps	0.50 W/linear foot
Plaza areas	0.049 W/ft <sup>2</sup>
Dining areas	0.273 W/ft <sup>2</sup>
Stairways	Exempt
Pedestrian tunnels	0.110 W/ft <sup>2</sup>
Landscaping	0.025 W/ft <sup>2</sup>
<b>Building entrances and exits</b>	
Pedestrian and vehicular entrances and exits	9.8 W/linear foot of opening
Entry canopies	0.126 W/ft <sup>2</sup>

For SI: 1 watt per square foot = 10.76 w/m<sup>2</sup>, 1 foot = 304.8 mm.

**R404.1.1 Exterior lighting.** Connected exterior lighting for **Group R-2, R-3 and R-4** residential buildings shall comply with ~~Section C405.5.~~ **Sections R404.1.2 through R404.1.5.**

Exceptions:

1. Detached one- and two- family dwellings.
2. Townhouses.
3. **Group R-3 buildings that do not contain more than two dwelling units**
- ~~3-4.~~ Solar-powered lamps not connected to any electrical service.
- ~~4-5.~~ Luminaires controlled by a motion sensor.
- ~~5-6.~~ Lamps and luminaires that comply with **Section R404.1.**

**R404.1.2 Exterior lighting power requirements.** The total exterior connected lighting power shall be not greater than the exterior lighting power allowance calculated in accordance with **Section R404.1.3**. The total exterior connected lighting power shall be the total maximum rated wattage of all lighting that is powered through the energy service for the *building*.

**Exceptions:** Lighting used for the following applications shall not be included.

1. Lighting *approved* for safety reasons.
2. Emergency lighting that is automatically off during normal operations.
3. Exit signs.
4. Specialized signal, directional and marker lighting associated with transportation.
5. Lighting for athletic playing areas.
6. Temporary lighting.
7. Lighting used to highlight features of art, public monuments and the national flag.
8. Lighting for water features and swimming pools.
9. Lighting controlled from within *sleeping units* and *dwelling units*.
10. Lighting of the exterior means of egress as required by the **International Building Code**.

**R404.1.3 Exterior lighting power allowance.** The total area or length of each area type multiplied by the value for the area type in **Table R404.1** shall be the lighting power (watts) allowed for each area type. For area types not listed, the area type that most closely represents the proposed use of the area shall be selected. The total exterior lighting power allowance (watts) shall be the sum of the base site allowance plus the watts from each area type.

**R404.1.4 Additional exterior lighting power.** Additional exterior lighting power allowances shall be available for the building facades at  $0.075 \text{ W/ft}^2$  ( $0.807 \text{ w/m}^2$ ) of gross *above-grade wall* area. These additional power allowances shall be used only for the luminaires serving the facade and shall not be used to increase any other lighting power allowance.

~~R404.1.2~~**R404.1.5 Fuel gas lighting equipment.** ~~Fuel gas lighting systems shall not have continuously burning pilot lights.~~ Gas-fired lighting appliances shall not be equipped with a *continuous pilot* and shall be equipped with an *on-demand pilot*, *intermittent ignition* or *interrupted ignition* as defined by **ANSI Z21.20**.

**R404.2 Interior lighting controls.** ~~Permanently~~All permanently installed lighting fixtures/luminaires shall be controlled with either a dimmer, an occupant sensor control or other control that is installed or built into the fixture, as required in **Sections R404.2.1** and **R404.2.2**.

**Exception:** Lighting controls shall not be required for the following: safety or security lighting.

- ~~1. Bathrooms.~~
- ~~2. Hallways.~~
- ~~3. Exterior lighting fixtures.~~
- ~~4. Lighting designed for safety or security.~~

**R404.2.1 Habitable spaces.** All permanently installed luminaires in habitable spaces shall be controlled with a *manual dimmer* or with an *automatic* shutoff control that automatically turns off lights within 20 minutes after all occupants have left the space and shall incorporate a *manual* control to allow occupants to turn the lights on or off.

**R404.2.2 Specific locations.** All permanently installed luminaires in garages, unfinished basements, laundry rooms and utility rooms shall be controlled by an *automatic* shutoff control that automatically turns off lights within 20 minutes after all occupants have left the space and shall incorporate a *manual* control to allow occupants to turn the lights on or off.

**R404.3 Exterior lighting controls.** ~~Where the total permanently installed exterior lighting power is greater than 30 watts, the permanently~~

installed exterior lighting shall comply with the following: **Exterior lighting controls shall comply with Section R404.3.1.**

1. Lighting shall be controlled by a *manual* on and off switch which permits *automatic* shut-off actions.

**Exception:** Lighting serving multiple dwelling units.

2. Lighting shall be automatically shut off when daylight is present and satisfies the lighting needs.
3. Controls that override *automatic* shut-off actions shall not be allowed unless the override automatically returns *automatic* control to its normal operation within 24 hours.



**R404.3.1 Controls for individual dwelling units.** Where the total permanently installed exterior lighting power is greater than 30 watts, the permanently installed exterior lighting shall comply with the following:

1. Lighting shall be controlled by a *manual* on and off switch which permits *automatic* shutoff actions.
2. Lighting shall be automatically shut off when daylight is present and satisfies the lighting needs.
3. Controls that override *automatic* shutoff actions shall not be allowed unless the override automatically returns *automatic* control to its normal operation within 24 hours.

**R404.4 Renewable energy certificate (REC) documentation.** Where renewable energy generation is used to comply with this code, documentation shall be provided to the *code official* by the property owner or owner's authorized agent demonstrating that where renewable energy certificates (RECs) or energy attributable certificates (EACs) are associated with that portion of renewable energy used to comply with this code, the RECs or EACs shall be retained, or retired, on behalf of the property owner.

FSEC – Anticipated energy impact on FBC-ER - Slight reduction in overall community energy use for applicable projects as these RECs won't be used for offsetting others

Note: Original text of mod is not consistent with that of the 2023 FEC.

FSEC – Anticipated energy impact on FBC-ER - None or slightly increased stringency in applicable cases.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

  

Action	AS	AS/IC	D	D/IC



**RE#19**

Changes section title from “Total Simulated Building Performance”

Revision clarifies that simulated building performance analysis is limited to dwelling units, and Spaces other than dwelling units in Group R-2, R-3 or R-4 buildings are to comply with Sections R402 through R404

Renamed from “Performance-based compliance”

Revises Table R405.2 requirements for simulated building performance entries: removes Section R402.1.5 Additional Energy Efficiency, requires all of Section R403.5 Service hot water systems instead of previously just R403.5.1 Heated water circulation and temperature maintenance systems and R403.5.3 Drain water heat recovery units subsection; adds R402.1.6 Rooms containing fuel-burning appliances (for Climate Zone 3-8), new R402.2.3 Attic knee wall, R402.2.10 Slab-on grade floors, R402.5.1.3 Maximum air leakage rate, R402.5.2 Fireplaces, R402.5.3 Fenestration air leakage, R402.5.4 Recessed lighting, R402.5.5 Air-sealed electrical and communication outlet boxes, R403.2 Hot water boiler temperature reset, R403.13 Gas fireplaces; also changes crawl space requirement from R402.2.11.1 to R402.2.11; also removes Section R403.3 Duct systems exceptions, also edits for Section number and name changes consistency

Changes item #2 requirement to meet 2009 IECC thermal envelope efficiencies to new thermal conductance (TC) based requirement; also reduces the maximum weighted fenestration SHGC for Performance compliance in Climate Zones 0 through 3 to 0.30

Changes item #3 requirement that the annual energy cost be less than or equal to that of the standard reference design to separate requirements for dwelling units that use fuel-burning appliances for space heating, water heating, or both vs. for all other dwelling units, with annual energy cost limits being 80 percent and 85 percent of that of the standard reference design, respectively; also, for each dwelling unit with greater than 5,000 square feet (465 m2) of living space above grade plane, the annual energy cost of the dwelling unit must be reduced by an additional 5 percent; also adds source energy multipliers for natural gas, propane, fuel oil, and imported liquefied natural gas, and revises source energy multiplier for electricity for energy use based on source energy exception; and adds new exception for energy use based on site energy

Renamed from “Documentation” and revises language, separating requirements into application and certificate of occupancy compliance reports (requirement moved up from Section R405.5.4)

Removes section, replacing it with revised language in Section R405.4.1

Revises, reorganizes, and clarifies existing sections, including stipulating revised R405.5 software tools approval section which includes new Section R405.5.2 requirement that software vendors test software in accordance with ANSI/ASHRAE 140 Class II, Tier 1 test procedures and publish results; also moves Input values section from R405.5.3 to R405.4.3

Revises Standard Reference Design solar absorptance specification to solar reflectance without changing stringency

Revises Standard Reference Design solar absorptance specification to solar reflectance without changing stringency

Revises Standard Reference Design foundation specification, removing “area” and adding “foundation wall or slab perimeter length”

Adds that foundation wall Standard Reference Design U-factor and slab F-factor be as specified in Table R402.1.2

Changes building component section title from “Air exchange rate” and revises Climate Zone 0 – 2 Standard Reference Design air leakage rate from 5.0 ACH50 to 4.0 ACH50 (applies to detached one-family dwellings > 1,500 sq. ft.); also changes Proposed Design entry from “The measured air exchange rate” to “The measured air leakage rate”

Adds separate Standard Reference Design air leakage rate of 0.27 cfm/ft2 of the testing unit enclosure area at a pressure of 0.2 inch water gauge (50 Pa) for detached one-family dwellings that are 1,500 ft2 or smaller and attached dwelling units or sleeping units

Removes “Where required by the code official, testing shall be conducted by an approved party” from footnote “a”, but per the proponent, just due to redundancy, as this language is still included in Section R402.5.1.2 Air leakage testing

Breaks out Table R405.4.2(1) 2021 IECC “Mechanical ventilation” section into “Mechanical ventilation rate” and “Mechanical ventilation fan energy” sections

Replaces Standard Reference Design annual vent fan energy use equation with specification that the mechanical ventilation rate be in addition to the air leakage rate and the same as in the proposed design, but not greater than a provided new equation based limit

Changes Proposed Design specification from “As proposed” to the measured mechanical ventilation rate (calculated according to specified ASHRAE Handbook of Fundamentals sections), and specifies it be in addition to the measured air leakage rate

New section clarifies that the Standard Reference Design mechanical ventilation system type be the same as in the proposed design; also adds that heat recovery or energy recovery be modeled for mechanical ventilation where required by R403.6.1 [Climate Zones 6-8] and not be modeled where not required by R403.6.1 [includes Florida]; also modifies annual vent fan energy use equation; also specifies that the Proposed Design fan energy use is “As proposed”

Adds “thermal” to “building envelope” for Proposed Design specification

For Standard Reference Design, removes “for other than electric heating without a heat pump: as Proposed” and “where the proposed design utilizes electric heating without a heat pump, the standard reference design shall be an air source heat pump meeting the requirements of Section C403 of the IECC—Commercial Provisions”

Also removes “Capacity: sized in accordance with Section R403.7” and replaces with “Fuel Type/Capacity: Same as proposed design”

Adds “Product class: Same as proposed design”

2021 IECC’s Standard Reference Design specifies “for other than electric heating without a heat pump: [efficiency] as Proposed” and “where the proposed design utilizes electric heating without a heat pump, the standard reference design shall be an air source heat pump meeting the requirements of Section C403 of the IECC—Commercial Provisions” vs. 2024 IECC specification that efficiency comply with 10 CFR §430.32 for heat pump, fuel gas and liquid fuel furnace, and fuel gas and liquid fuel boiler (making the 2024 IECC more like the FBC-EC, which allows equipment trade-offs)

Also new footnote “j” stipulates a split system heat pump complying

2021 IECC’s Standard Reference Design specifies “for other than electric heating without a heat pump: [efficiency] as Proposed” and “where the proposed design utilizes electric heating without a heat pump, the standard reference design shall be an air source heat pump meeting the requirements of Section C403 of the IECC—Commercial Provisions” vs. 2024 IECC specification that efficiency comply with 10 CFR §430.32 for heat pump, fuel gas and liquid fuel furnace, and fuel gas and liquid fuel boiler (making the 2024 IECC more like the FBC-EC, which allows equipment trade-offs)

Also new footnote “j” stipulates a split system heat pump complying

with 10 CFR §430.32 (2021) for the Standard Reference Design if the Proposed Design has electric resistance heat

2024 IECC footnote “k” adds that for heating systems, cooling systems, or water heating systems not included in Table R405.4.2(1), the Standard Reference Design be the same as proposed design

Changes Standard Reference Design fuel type from “as proposed” to electric, capacity from “sized in accordance with Section R403.7” to “Same as proposed design”, and adds Standard Reference Design specification that efficiencies comply with 10 CFR §430.32 (making the 2024 IECC more like the FBC-EC, which allows equipment trade-offs)

Replaces “As proposed” specification for Standard Reference Design with:

- Fuel Type: Same as proposed design
- Rated Storage Volume: Same as proposed design
- Draw Pattern: Same as proposed design
- Efficiencies: Uniform Energy Factor complying with 10

CFR §430.32 (making the 2024 IECC more like the FBC-EC, which allows equipment trade-offs)

- Tank Temperature: 120oF (48.9oC)

For Proposed Design, adds “As proposed” specification for Fuel Type, Rated Storage Volume, Draw Pattern, Efficiencies, and Tank Temperature

Removes Standard Reference and Proposed Design language from this footnote regarding nonstorage type water heaters (now addressed in the table itself)

2024 IECC footnote “g” also revises assumptions for the Standard Reference and Proposed Designs for proposed designs without a water heater, but draft language unclear

Footnote “g” changes also add Standard Reference Design specifications for proposed designs with heat pump water heaters; 40 gallon storage volume specification would mean that the Standard Reference Design uses a much less efficient water heater in cases where the Proposed Design’s volume is over 55 gallons

IECC continues to require R8 ducts for the Standard Reference Design for most cases where ducts are outside of conditioned space, and specifies duct insulation as being “as proposed” for the Proposed Design, with a 2024 IECC footnote “m” added for the Proposed Design specifying that sections of ductwork installed in accordance with Section R403.3.5.1 (deeply buried) are assumed to have an effective duct insulation R-value of R-25.

2024 IECC moved from applying a distribution system efficiency (DSE) of 0.88 to the Standard Reference Design heating and cooling system efficiencies for non-tested ducted systems and specifying 4 cfm per 100 sq. ft. for tested duct systems, to specifying 4 cfm per 100 sq. ft. of conditioned floor area for duct systems serving > 1,000 sq. ft. and 40 cfm of leakage to outside for duct systems serving ≤ 1,000 sq. ft. of conditioned floor area

2024 IECC also moved from specifying the Standard Reference Design duct location as being same as the proposed design to location based on foundation type and number of stories

2024 IECC Proposed Design duct location “as proposed” is same as 2021 IECC Proposed Design duct location, but adds footnote “i” which states that only sections of ductwork that are installed in accordance with Section R403.3.4, Items 1 and 2 are assumed to be located completely inside conditioned space; all other sections of ductwork are not assumed to be located completely inside conditioned space

2024 IECC Proposed Design thermal distribution system efficiency was changed from “as tested” for tested duct systems to the measured total duct system

leakage rate being entered as the duct system leakage to outside rate, with exceptions allowing outside leakage to instead be entered where leakage is tested in accordance with ANSI/RESNET/ICC 380 or ASTM E1554, or where total duct system leakage is measured without space conditioning equipment installed, entry is 4 cfm per 100 sq. ft. of conditioned floor area

Changed the Standard Reference Design distribution system efficiency (DSE) for ductless systems from 1.0 to 0.88, and made the DSE for the Proposed Design for ductless systems as specified in Table R405.4.2(2), with changes to the table

Modifies footnote "a" which clarifies that default values in the table are for untested distribution systems, which must still "comply with Section R403", instead of 2021 IECC: must still "meet minimum requirements for duct system insulation"

Revises footnote "c", removing "including the air handler unit" from: "Entire system in conditioned space shall mean that no component of the distribution system, including the air-handler unit, is located outside of the conditioned space"

Replaces "manufacturer's air-handler enclosure" with "space conditioning equipment"

Renumbered from R405.5.3

Rewords section, incorporating "permitted to be approved" language from deleted Section R405.5.2

Revises and updates section language including adding "approved software tools"

As also noted above in Section R405.4 discussion, new section requires that prior to approval, software tools be tested by the software vendor in accordance with ANSI/ASHRAE 140 Class II, Tier 1 test procedures

New section specifies that algorithms not tested in accordance with Section R405.5.2 be permitted in accordance with ANSI/RESNET/ICC 301

Renumbered from R405.3.2, title changed from "Compliance report", removes compliance report language which was moved to Section R405.3, and adds "approved" – "Approved software tools shall generate..."

Renumbered from R405.3.2.1, and minor language revisions

Renumbered from R405.3.2.2, and minor language revisions

Related Mods:  
 CEPI-24-21 Part II  
 RED1 35-22,  
 RED1-249-22  
 CEPI-24-21 Part II,  
 REPI-118-21,  
 REPI-121-21,  
 REPI-18-21,  
 REPI-33-21,  
 REPI-117-21,  
 RED1-35-22,  
 RED1-43-22,  
 RED1-185-22,  
 RED1-186-22,  
 RED1-249-22,  
 RE2D-24-23

TABLE  
 R405.4.2(1)  
 RECI-2-21,  
 REPI-63-21,  
 REPI-64-21,  
 REPI-68-

SECTION R405 TOTAL SIMULATED BUILDING PERFORMANCE

**R405.1 Scope.** This section establishes criteria for compliance using ~~total simulated~~ building performance analysis. Such analysis shall include heating, cooling, mechanical *ventilation* and service water-heating energy only. *Such analysis shall be limited to dwelling units*. Spaces other than *dwelling units* in Group R-2, R-3 or R-4 buildings shall comply with **Sections R402 through R404**.

**R405.2 Performance-based ~~Simulated building performance~~ compliance.** Compliance based on ~~total simulated~~ building performance requires that a ~~proposed design meets all of~~ *building comply with* the following:

1. The requirements of the sections indicated within **Table R405.2**.
2. ~~The building thermal envelope shall be greater than or equal to levels of efficiency and solar heat gain coefficients in Table R402.1.1 or R402.1.3 of the 2009 International Energy Conservation Code.~~ *The proposed total building thermal envelope thermal conductance (TC) shall be less than or equal to the required total building thermal envelope TC using the prescriptive U-factors and F-factors from **Table R402.1.2** multiplied by 1.08 in Climate Zones 0, 1 and 2, and 1.15 in Climate Zones 3 through 8, in accordance with **Equation 4-2** and **Section R402.1.5**. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.*

$$\text{For Climate Zones 0–2: } TC_{\text{Proposed design}} \leq 1.08 \times TC_{\text{Prescriptive reference design}}$$

$$\text{For Climate Zones 3–8: } TC_{\text{Proposed design}} \leq 1.15 \times TC_{\text{Prescriptive reference design}}$$

3. *For each dwelling unit with one or more fuel-burning appliances for space heating, water heating, or both, the annual energy cost of the dwelling unit shall be that is less than or equal to 80 percent of the annual energy cost of the standard reference design. For all other dwelling units, the annual energy cost of the proposed design shall be less than or equal to*

21,REPI-78-21,  
REPI-86-21,  
REPI-122-21,  
REPI-124-21,  
RECD1-12-22,  
RED1-185-22,  
RED1-186-22,  
RED1-249-22,  
RED1-251-22,  
RED1-252-22,  
RED1-285-22,  
RED1-336-22,  
RED1-337-22,  
RED1-339-22,  
RED1-340-22,  
REC2D-4-23,  
REC2D-8-23

TABLE  
R405.4.2(2)  
REPI-86-21,  
REPI-122-  
21,RED1-285-22

RECD1-8-22,  
RE2D-28-23

85 percent of the annual *energy cost* of the *standard reference design*. For each dwelling unit with greater than 5,000 square feet (465 m<sup>2</sup>) of *living space* located above grade plane, the annual *energy cost* of the *dwelling unit* shall be reduced by an additional 5 percent of annual *energy cost* of the *standard reference design*. Energy prices shall be taken from ~~an approved source approved by the code official~~, such as the US Energy Information Administration's State Energy Data System prices and expenditures reports. Code officials shall be permitted to require time-of-use pricing in *energy cost* calculations.

Exceptions:

1. The energy use based on source energy expressed in Btu or Btu per square foot of *conditioned floor area* shall be permitted to be substituted for the *energy cost*. The source energy multiplier for electricity shall be ~~3.16~~2.51. ~~The source energy multiplier for fuels other than electricity shall be 1.1.~~ The source energy multipliers shall be 1.09 for natural gas, 1.15 for propane, 1.19 for fuel oil, and 1.30 for imported liquified natural gas.
2. The energy use based on site energy expressed in Btu or Btu per square foot of conditioned floor area shall be permitted to be substituted for the energy cost.

**TABLE R405.2  
REQUIREMENTS FOR TOTAL SIMULATED BUILDING PERFORMANCE**

<b>SECTION<sup>a</sup></b>	<b>TITLE</b>
<b>General</b>	
R401.2.5	Additional energy efficiency
R401.3	Certificate
<b>Building Thermal Envelope</b>	
R402.1.1	Vapor retarder
R402.1.6	Rooms containing fuel-burning appliances
R402.2.3	Attic knee wall
R402.2.4	Eave baffle
R402.2.5.1	Access hatches and doors door insulation installation and retention
R402.2.10	Slab-on-grade floors
R402.2.11.1 R402.2.11	Crawl space wall insulation installations walls
R402.5.1.1	Installation
R402.5.1.2	Testing Air leakage testing
R402.5.1.3	Maximum air leakage rate
R402.5.2	Fireplaces
R402.5.3	Fenestration air leakage
R402.5.4	Recessed lighting
R402.5.5	Air-sealed electrical and communication outlet boxes
R402.6	Maximum fenestration <i>U</i> -factor and SHGC
<b>Mechanical</b>	
R403.1	Controls
R403.2	Hot water boiler temperature reset
R403.3, including R403.3.3, except Sections R403.3.4, R403.3.5 and R403.3.8	Ducts Duct systems
R403.4	Mechanical system piping insulation
R403.5	Service hot water systems
R403.5.1	Heated water circulation and temperature maintenance systems
R403.5.3	Drain water heat recovery units
R403.6	Mechanical ventilation
R403.7, except Section R403.7.1	Equipment sizing and efficiency rating

R403.8	Systems serving multiple dwelling units Snow melt
R403.9.2	and ice systems <del>system controls</del> Energy consumption
R403.10	of pools and spas Portable spas
R403.11	
R403.12	Residential pools and permanent residential spas
R403.13	Gas fireplaces
<b>Electrical Power and Lighting Systems</b>	
R404.1	Lighting equipment
R404.2	Interior lighting controls

a. Reference to a code section includes all the relative subsections except as indicated in the table.

FSEC – Anticipated energy impact on FBC-ER - None to slightly increased stringency as applicable (limited due to trade-offs).

**R405.3 Documentation.** ~~Documentation of the software used for the performance design and the parameters for the building shall be in accordance with Sections R405.3.1 through R405.5.4.2. The following compliance reports, which document that the performance of the proposed design and the performance of the as-built dwelling unit comply with the requirements of Section R405, shall be submitted to the code official.~~ **Compliance documentation.** Documentation of the software used for the performance design and the parameters for the building shall be in accordance with Sections R405.3.1 through R405.5.4.2. The following compliance reports, which document that the performance of the proposed design and the performance of the as-built dwelling unit comply with the requirements of Section R405, shall be submitted to the code official.

1. A compliance report in accordance with Section R405.5.4.1 shall be submitted with the application for the building permit.
2. A compliance report in accordance with Section R405.5.4.2 shall be submitted before a certificate of occupancy is issued.

~~**R405.3.1 Compliance software tools.** Documentation verifying that the methods and accuracy of the compliance software tools conform to the provisions of this section shall be provided to the code official.~~

**R405.4 Calculation procedure.** ~~Calculations of the performance design~~ Performance calculations shall be in accordance with Sections R405.4.1 and R405.4.2, through R405.4.3. Except as specified by this section, the standard reference design and proposed design shall be configured and analyzed using identical methods and techniques.

**R405.4.1 General.** Except as specified by this section, the standard reference design and proposed design shall be configured and analyzed using identical methods and techniques. Calculation procedures used to comply with Section R405 shall use a software tool, approved in accordance with Section R405.5, capable of calculating the annual energy consumption of all building elements that differ between the standard reference design and the proposed design.

**R405.4.2 Residence specifications.** The standard reference design, and proposed design and as-built dwelling unit shall be configured and analyzed as specified by Table R405.4.2(1). Table R405.4.2(1) shall include, by reference, all notes contained in Table R402.1.3. Proposed U-factors and slab-on-grade F-factors shall be taken from Appendix RF, ANSI/ASHRAE/IES Standard 90.1

Appendix A, or determined using a method consistent with the *ASHRAE Handbook of Fundamentals* and shall include the thermal bridging effects of framing materials.

FSEC – Anticipated energy impact on FBC-ER - Slightly increased stringency.

**Note: Original text of mod is not consistent with that of the 2023 FEC.**

**TABLE R405.4.2(1)  
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS**



BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Above-grade walls	Type: mass where the proposed wall is a mass wall; otherwise wood frame.	As proposed.
	Gross area: same as proposed.	As proposed.
	$U$ -factor: as specified in <b>Table R402.1.2</b> .	As proposed.
	Solar absorptance – $0.75 \times \text{reflectance} = 0.25$	As proposed.
Basement and crawl space walls	Emittance = 0.90.	As proposed.
	Type: same as proposed.	As proposed.
	Gross area: same as proposed.	As proposed.
Above-grade floors	$U$ -factor: as specified in <b>Table R402.1.2</b> , with the insulation layer on the interior side of the walls.	As proposed.
	Type: wood frame.	As proposed.
Ceilings	Gross area: same as proposed.	As proposed.
	$U$ -factor: as specified in <b>Table R402.1.2</b> .	As proposed.
	Type: wood frame.	As proposed.
Roofs	Gross area: same as proposed.	As proposed.
	Solar absorptance – $0.75 \times \text{reflectance} = 0.25$	As proposed.
	Emittance = 0.90.	As proposed.
	Type: composition shingle on wood sheathing.	As proposed.
Attics	Type: vented with an aperture of 1 ft <sup>2</sup> per 300 ft <sup>2</sup> of ceiling area.	As proposed.
Foundations	Type: same as proposed.	As proposed.
	Foundation wall area extension above and below grade and soil characteristics: same as proposed. Foundation wall or slab perimeter length: same as proposed. Soil characteristics: same as proposed.	As proposed.
	Foundation wall $U$ -factor and slab $F$ -factor: as specified in <b>Table R402.1.2</b> .	
Opaque doors	Area: 40 ft <sup>2</sup> .	As proposed.
	Orientation: North.	As proposed.
	$U$ -factor: same as fenestration as specified in <b>Table R402.1.2</b> .	As proposed.

Vertical fenestration other than opaque doors	Total area <sup>b</sup> = (a) The proposed glazing area, where the proposed glazing area is less than 15 percent of the conditioned floor area. (b) 15 percent of the conditioned floor area, where the proposed glazing area is 15 percent or more of the conditioned floor area.	As proposed.
	Orientation: equally distributed to four cardinal compass orientations (N, E, S & W).	As proposed.
	U-factor: as specified in <b>Table R402.1.2</b> .	As proposed.
	SHGC: as specified in <b>Table R402.1.2</b> except for climate zones without an SHGC requirement, the SHGC shall be equal to 0.40.	As proposed.
	Interior shade fraction: $0.92 - (0.21 \times \text{SHGC for the standard reference design})$ .	Interior shade fraction: $0.92 - (0.21 \times \text{SHGC as proposed})$ .
	External shading: none	As proposed
Skylights	None	As proposed.
Thermally isolated sunrooms	None	As proposed.
Air exchange leakage rate	The air leakage rate at a pressure of <u>0.2 inch w.g.</u> (50 Pa) shall be Climate Zones 0 through 2: 5.0 air changes per hour. Climate Zones 3 through 8: 3.0 air changes per hour. <del>For detached one-family dwellings, the air leakage rate at a pressure of 0.2 inch water gauge (50 Pa) shall be as follows:</del> Climate Zones 0 through 2: 4.0 air changes per hour. Climate Zones <u>3, 4, and 5</u> : 3.0 air changes per hour. Climate Zones <u>6 through 8</u> : 2.5 air changes per hour. For detached one-family dwellings that are 1,500 ft <sup>2</sup> or smaller and attached dwelling units or sleeping units, the air leakage rate at a pressure of <u>0.2 inch</u> water gauge (50 Pa) shall be 0.27 cfm/ft <sup>2</sup> of the testing unit enclosure area.	The measured air exchange <del>leakage</del> rate. <sup>a</sup>
	The mechanical ventilation rate shall be in addition to the air leakage rate and shall be the same as in the proposed design, but not greater than $0.01 \times CFA + 7.5 \times (N_{br} + 1)$ where:  $CFA$ = conditioned floor area, ft <sup>2</sup> . $N_{br}$ = number of bedrooms.  The mechanical ventilation system type shall be the same as in the proposed design. Energy recovery shall not be assumed for mechanical ventilation.	The mechanical ventilation rate <sup>b</sup> shall be in addition to the air leakage rate and shall be as proposed.



Mechanical ventilation rate	<p>Where mechanical ventilation is not specified in the proposed design: None</p> <p>Where mechanical ventilation is specified in the proposed design, the annual vent fan energy use, in units of kWh/yr, shall equal <math>(1/e_v) \times [0.0876 \times CFA + 65.7 \times (N_{br} + 1)]</math> where:</p> <p><math>e_v</math> = the minimum fan efficacy, as specified in Table 403.6.2, corresponding to the system type at a flow rate of <math>0.01 \times CFA + 7.5 \times (N_{br} + 1)</math></p> <p>CFA = conditioned floor area, ft<sup>2</sup></p> <p><math>N_{br}</math> = number of bedrooms. The mechanical ventilation rate shall be in addition to the air leakage rate and shall be the same as in the proposed design, but not greater than <math>B \times M</math> where:</p> <p><math>B = 0.01 \times CFA + 7.5 \times (N_{br} + 1)</math>, cfm.</p> <p><math>M = 1.0</math> where the measured air leakage rate is <math>\geq 3.0</math> air changes per hour at 50 Pascals, and otherwise, <math>M = \text{minimum}(1.7, Q/B)</math>.</p> <p>Q = the proposed mechanical ventilation rate, cfm.</p> <p>CFA = conditioned floor area, ft<sup>2</sup>.</p> <p><math>N_{br}</math> = number of bedrooms.</p>	As proposed. The measured mechanical ventilation rate <sup>b</sup> , Q, shall be in addition to the measured air leakage rate.
Mechanical ventilation fan energy	<p>The mechanical ventilation system type shall be the same as in the proposed design. Heat recovery or energy recovery shall be modeled for mechanical ventilation where required by <b>Section R403.6.1</b>. Heat recovery or energy recovery shall not be modeled for mechanical ventilation where not required by <b>Section R403.6.1</b>.</p> <p>Where mechanical ventilation is not specified in the proposed design: None</p> <p>Where mechanical ventilation is specified in the proposed design, the annual vent fan energy use, in units of kWh/yr, shall equal <math>(8.76 \times B \times M)/e_f</math> where:</p> <p>B and M are determined in accordance with the air exchange mechanical ventilation rate row of this table.</p> <p><math>e_f</math> = the minimum fan efficacy, as specified in Table 403.6.2, corresponding to the system type at a flow rate of <math>B \times M</math>.</p>	As proposed.
Internal gains	<p>I<sub>Gain</sub>, in units of Btu/day per dwelling unit, shall equal <math>17,900 + 23.8 \times CFA + 4,104 \times N_{br}</math> where:</p> <p>CFA = conditioned floor area, ft<sup>2</sup>.</p> <p><math>N_{br}</math> = number of bedrooms.</p>	Same as standard reference design.

		Internal mass	Internal mass for furniture and contents: 8 pounds per square foot of floor area.	Same as standard reference design, plus any additional mass specifically designed as a thermal storage element, but not integral to the building thermal envelope or structure.
Structural mass	For masonry floor slabs: 80 percent of floor area covered by R-2 carpet and pad, and 20 percent of floor directly exposed to room air.	As proposed.		
	For masonry basement walls: as proposed, but with insulation as specified in <b>Table R402.1.3</b> , located on the interior side of the walls.	As proposed.		
	For other walls, ceilings, floors, and interior walls: wood frame construction.	As proposed.		
Heating systems <sup>d, e, j, k</sup>	<del>For other than electric heating without a heat pump: as proposed.</del> Where the proposed design utilizes electric heating without a heat pump, the standard reference design shall be an air source heat pump meeting the requirements of Section C403 of the IECC—Commercial Provisions. Capacity: sized in accordance with <b>Section R403.7</b> . Fuel Type/Capacity: Same as proposed design	As proposed.		
	Product class: Same as proposed design	As proposed.		
	Efficiencies:			
	Heat pump: Complying with <b>10 CFR §430.32</b>	As proposed.		
	Fuel gas and liquid fuel furnaces: Complying with <b>10 CFR §430.32</b>	As proposed.		
	Fuel gas and liquid fuel boilers: Complying with <b>10 CFR §430.32</b>	As proposed.		
Cooling systems <sup>d, f, k</sup>	<del>As proposed. Fuel type: Electric</del> Capacity: sized in accordance with <b>Section R403.7</b> . Same as proposed design	As proposed		
	Efficiencies: Complying with <b>10 CFR §430.32</b>	As proposed		

		Service water heating <sup>d, g, k</sup>	<p>As-proposed: Use, in units of gal/day = <math>25.5 + (8.5 \times N_{bc})</math> where: <math>N_{bc}</math> = number of bedrooms.</p>	<p>As-proposed Use, in units of gal/day = <math>25.5 + (8.5 \times N_{bc}) \times (1 - HWDS)</math> where: <math>N_{bc}</math> = number of bedrooms. <math>HWDS</math> = factor for the compactness of the hot water distribution system.</p> <table border="1"> <thead> <tr> <th colspan="2">Compactness ratio factor</th> <th>HWDS</th> </tr> </thead> <tbody> <tr> <td>1 story</td> <td>2 or more stories</td> <td></td> </tr> <tr> <td>&gt; 60%</td> <td>&gt; 30%</td> <td>0</td> </tr> <tr> <td>&gt; 30% to ≤ 60%</td> <td>&gt; 15% to ≤ 30%</td> <td>0.05</td> </tr> <tr> <td>&gt; 15% to ≤ 30%</td> <td>&gt; 7.5% to ≤ 15%</td> <td>0.10</td> </tr> <tr> <td>≤ 15%</td> <td>≤ 7.5%</td> <td>0.15</td> </tr> </tbody> </table>	Compactness ratio factor		HWDS	1 story	2 or more stories		> 60%	> 30%	0	> 30% to ≤ 60%	> 15% to ≤ 30%	0.05	> 15% to ≤ 30%	> 7.5% to ≤ 15%	0.10	≤ 15%	≤ 7.5%	0.15
Compactness ratio factor		HWDS																				
1 story	2 or more stories																					
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> 30% to ≤ 60%	> 15% to ≤ 30%	0.05																				
> 15% to ≤ 30%	> 7.5% to ≤ 15%	0.10																				
≤ 15%	≤ 7.5%	0.15																				
			Fuel Type: Same as proposed design	As proposed.																		
			Rated Storage Volume: Same as proposed design	As proposed.																		
			Draw Pattern: Same as proposed design	As proposed.																		
			Efficiencies: Uniform Energy Factor complying with 10 CFR §430.32	As proposed.																		
			Tank Temperature: 120°F (48.9°C)	Same as standard reference design.																		

Thermal distribution systems	<p>Duct insulation: in accordance with <b>Section R403.3.3</b>. A thermal distribution system efficiency (DSE) of 0.88 shall be applied to both the heating and cooling system efficiencies for all systems other than tested duct systems.</p> <p>Duct location: same as proposed design.</p> <p><b>Exception:</b> For nonducted heating and cooling systems that do not have a fan, the standard reference design thermal distribution system efficiency (DSE) shall be 1. For tested duct systems, the leakage rate shall be 4 cfm (113.3 L/ min) per 100 ft<sup>2</sup> (9.29 m<sup>2</sup>) of <i>conditioned floor area</i> at a pressure of differential of 0.1 inch w.g. (25 Pa).</p> <hr/>			<p>Duct location: as proposed</p> <p>Duct insulation: as proposed.<sup>m</sup></p> <p>As tested or, where not tested, as specified in <b>Table N1105.4.2(2)</b>.</p>
	Duct location:			Duct location: as proposed. <sup>l</sup>
	Foundation type	Slab on grade	Unconditioned crawl space	Basement or conditioned crawl space



	Duct location (supply and return)	One-story building: 100% in unconditioned attic All other: 75% in unconditioned attic and 25% inside conditioned space	One-story building: 100% in unconditioned crawl space All other: 75% in unconditioned crawl space and 25% inside conditioned space	75% inside conditioned space 25% unconditioned attic	Duct system leakage to outside: The measured total duct system leakage rate shall be entered into the software as the duct system leakage to outside rate. <b>Exceptions:</b> 1. Where duct system leakage to outside is tested in accordance <b>ANSI/RESNET/ICC 380</b> or <b>ASTM E1554</b> , the measured value shall be permitted to be entered. 2. Where total duct system leakage is measured without space conditioning equipment installed, the simulation value shall be 4 cfm per 100ft <sup>2</sup> of conditioned floor area.
	<p>Duct system leakage to outside: for duct systems serving &gt; 1,000 ft<sup>2</sup> of conditioned floor area, the duct leakage to outside rate shall be 4 cfm per 100 ft<sup>2</sup> of conditioned floor area.</p> <p>For duct systems serving ≤ 1,000 ft<sup>2</sup> of conditioned floor area, the duct leakage to outside rate shall be 40 cfm.</p>				
	Distribution System Efficiency (DSE): for hydronic systems and ductless systems a thermal distribution system efficiency (DSE) of 0.88 shall be applied to both the heating and cooling system efficiencies.				Distribution System Efficiency (DSE): for hydronic systems and ductless systems, DSE shall be as specified in <b>Table R405.4.2(2)</b> .
Thermostat	Type: Manual, cooling temperature setpoint = 75°F; Heating temperature setpoint = 72°F.				Same as standard reference design.

<u>Dehumidistat</u>	<p>Where a mechanical ventilation system with latent heat recovery is not specified in the proposed design:</p> <p>None.</p> <p>Where the proposed design utilizes a mechanical ventilation system with latent heat recovery:</p> <p><u>Dehumidistat</u> type: manual, setpoint = 60% relative humidity.</p> <p>Dehumidifier: <u>whole-dwelling</u> with integrated energy factor = 1.77 liters/kWh.</p>	Same as standard reference design.
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For SI: 1 square foot = 0.93 m<sup>2</sup>, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m<sup>2</sup>, 1 gallon (US) = 3.785 L, °C = (°F – 32)/1.8, 1 degree = 0.79 rad, 1 cubic foot per minute = 28,317 L/min.

- a) ~~Where required by the code official, testing shall be conducted by an approved party.~~ Hourly calculations as specified in the **ASHRAE Handbook of Fundamentals**, or the equivalent, shall be used to determine the energy loads resulting from infiltration.
- b) The combined air exchange rate for infiltration and mechanical ventilation shall be determined in accordance with Equation 43 of **2001 ASHRAE Handbook of Fundamentals**, page 26.24 and the "Whole-house Ventilation" provisions of **2001 ASHRAE Handbook of Fundamentals**, page 26.19 for intermittent mechanical ventilation.
- c) Thermal storage element shall mean a component that is not part of the floors, walls or ceilings that is part of a passive solar system, and that provides thermal storage such as enclosed water columns, rock beds, or phase-change containers. A thermal storage element shall be in the same room as fenestration that faces within 15 degrees (0.26 rad) of true south, or shall be connected to such a room with pipes or ducts that allow the element to be actively charged.
- d) For a proposed design with multiple heating, cooling or water heating systems using different fuel types, the applicable standard reference design system capacities and fuel types shall be weighted in accordance with their respective loads as calculated by accepted engineering practice for each equipment and fuel type present.
- e) For a proposed design without a proposed heating system, a heating system having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and proposed design.
- f) For a proposed design ~~home~~ without a proposed cooling system, an electric air conditioner having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and the proposed design.

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- g) For a proposed design without a proposed water heater, the following assumptions shall be made for

both the proposed design and standard reference design.

~~with a nonstorage-type water heater, a 40-gallon storage-type water heater having the prevailing federal minimum energy factor for the same fuel as the predominant heating fuel type shall be assumed. For a proposed design without a proposed water heater, a 40-gallon storage-type water heater having the prevailing federal minimum efficiency for the same fuel as the predominant heating fuel type shall be assumed for both the proposed design and standard reference design.~~ For a proposed design with a heat pump water heater, the following assumptions shall be made for the standard reference design, except the fuel type shall be electric. Fuel Type: Same as the predominant heating fuel type

Rated Storage Volume: 40 gallons Draw Pattern: Medium

Efficiency: Uniform Energy Factor complying with **10 CFR** § 430.32

- h) For residences with conditioned basements, R-2 and R-4 residences, and for townhouses, the following formula shall be used to determine glazing area:

$$AF = A_s \times FA \times F$$

where:

$AF$  = Total glazing area.

$A_s$  = Standard reference design total glazing area.

$FA$  = (Above-grade thermal boundary gross wall area)/(above-grade boundary wall area + 0.5 × below-grade boundary wall area).

$F$  = (above-grade thermal boundary wall area)/(above-grade thermal boundary wall area + common wall area) or 0.56, whichever is greater.

and where:

- Thermal boundary wall is any wall that separates conditioned space from unconditioned space or ambient conditions.
- Above-grade thermal boundary wall is any thermal boundary wall component not in contact with soil.
- Below-grade boundary wall is any thermal boundary wall in soil contact.
- Common wall area is the area of walls shared with an adjoining dwelling unit.
- l) The factor for the compactness of the hot water distribution system is the ratio of the area of the rectangle that bounds the source of hot water and the fixtures that it serves (the "hot water rectangle") divided by the floor area of the dwelling.
  1. Sources of hot water include water heaters, or in multiple-family buildings with central water heating systems, circulation loops or electric heat traced pipes.
  2. The hot water rectangle shall include the source of hot water and the points of termination of all hot water fixture supply piping.
  3. The hot water rectangle shall be shown on the floor plans and the area shall be computed to the nearest square foot.
  4. Where there is more than one water heater and each water heater serves different plumbing fixtures and appliances, it is permissible to establish a separate hot water rectangle for each hot water distribution system and add the area of these rectangles together to determine the compactness ratio.
  5. The basement or attic shall be counted as a story when it contains the water heater.
  6. Compliance shall be demonstrated by providing a drawing on the plans that shows the hot water distribution system rectangle(s), comparing the area of the rectangle(s) to the area of the dwelling and identifying the appropriate compactness ratio and *HWDS* factor.

- j) For a proposed design with electric resistance heating, a split system heat pump complying with **10 CFR §430.32 (2021)** shall be assumed modeled in the standard reference design.
- k) For heating systems, cooling systems, or water heating systems not included in this table, the standard reference design shall be the same as proposed design.
- l) Only sections of ductwork that are installed in accordance with **Section R403.3.4**, Items 1 and 2 are assumed to be located completely inside conditioned space. All other sections of ductwork are not assumed to be located completely inside conditioned space.
- m) Sections of ductwork installed in accordance with **Section R403.3.5.1** are assumed to have an effective duct insulation *R*-value of R-25.

**TABLE R405.4.2(2)**  
 DEFAULT DISTRIBUTION SYSTEM EFFICIENCIES FOR PROPOSED DESIGNS<sup>a</sup>

DISTRIBUTION SYSTEM CONFIGURATION AND CONDITION	FORCED AIR SYSTEMS	HYDRONIC SYSTEMS <sup>b</sup>
Distribution system components located in unconditioned space	NA	0.95
<del>Untested distribution systems</del> Distribution system components entirely located in conditioned space <sup>c</sup>	0.88NA	1
<del>"Ductless" systems<sup>d</sup></del>	1	NA

NA = Not Applicable.

- a. Default values in this table are for untested distribution systems, which must still meet ~~minimum requirements for duct system insulation~~ **comply with Section R403**.
- b. Hydronic systems ~~shall mean~~ those systems that distribute heating and cooling energy directly to individual spaces using liquids pumped through closed-loop piping and that do not depend on ducted, forced airflow to maintain space temperatures.
- c. Entire system in conditioned space ~~shall mean~~ that no component of the distribution system, ~~including the air handler unit~~, is located outside of the conditioned space.
- d. Ductless systems ~~shall be~~ **are** allowed to have forced airflow across a coil but ~~shall must~~ not have any ducted airflow external to the **space conditioning equipment** ~~manufacturer's air handler enclosure~~.

**Note: Original text of mod is not consistent with that of the 2023 FEC.**

FSEC – Anticipated energy impact on FBC-ER -Increased stringency for applicable cases.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

**RE#19 A**

Action	AS	AS/IC	D	D/IC

~~R405.5.3~~**R405.4.3 Input values.** When calculations require input values not specified by **Sections R402, R403, R404** and **R405**, those input values shall be taken from an *approved* source.

**R405.5 Calculation software tools.** Calculation software, where used, shall be in accordance with **Performance analysis tools meeting the applicable provisions of Sections R405.5.1 through R405.5.4 shall be permitted to be approved**. Tools are permitted to be *approved* based on meeting a specified threshold for a jurisdiction. The *code official* shall be permitted to approve such tools for a specified application or limited scope.

~~R405.5.1~~**R405.5.1 Minimum capabilities.** ~~Calculation procedures used to comply with this section shall be software tools capable of calculating the annual energy consumption of all building elements that differ between the *standard reference design* and the *proposed design* and~~**Approved software tools** shall include the following capabilities:

1. Computer generation of the *standard reference design* using only the input for the *proposed design*. The calculation procedure shall not allow the user to directly modify the building component characteristics of the *standard reference design*.
2. Calculation of whole-dwelling unit building (as a single zone) sizing for the heating and cooling equipment in the *standard reference design* residence in accordance with **Section R403.7**.
3. **Hourly calculations of building operation for a full calendar year (8,760 hours).**
- 3.4. Calculations that account for the effects of hourly variations of indoor and outdoor temperatures and part-load ratios on the performance of heating, ventilating and air-conditioning equipment based on climate and equipment sizing.
4. Printing of a *code official* inspection checklist listing each of the *proposed design* component characteristics from **Table R405.4.2(1)** determined by the analysis to provide compliance, along with their respective performance ratings such as *R-value*, *U-factor*, SHGC, HSPF<sub>2</sub>, AFUE, SEER<sub>2</sub> and UEF.

~~R405.5.2~~**R405.5.2 Specific approval.** ~~Performance analysis tools meeting the applicable provisions of **Section R405** shall be permitted to be approved. Tools are permitted to be approved based on meeting a specified threshold for a jurisdiction. The *code official* shall be permitted to approve such tools for a specified application or limited scope.~~

**R405.5.2 Testing required by software vendors.** Prior to approval, software tools shall be tested by the software vendor in accordance with **ANSI/ASHRAE 140** Class II, Tier 1 test procedures. During testing, hidden inputs that are not normally available to the user shall be permitted to avoid introducing source code changes strictly used for testing. Software vendors shall publish, on a publicly available website, the following **ANSI/ASHRAE 140** test results, input files and modeler reports for each tested version of a software tool:

1. Test results demonstrating the software tool was tested in accordance with **ANSI/ASHRAE 140**.
2. The modeler report in **ANSI/ASHRAE 140**, Annex A2, Attachment A2.7.

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**R405.5.3 Algorithms not tested.** Algorithms not tested in accordance with **Section R405.5.2** shall be permitted in accordance with **ANSI/RESNET/ICC 301**. Numerical settings not tested, such as timestep duration and tolerances, shall be permitted when they represent a higher resolution than the numerical settings used for testing.

FSEC – Anticipated energy impact on FBC-ER - Slightly increased stringency.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

**RE#19 B**

Action	AS	AS/IC	D	D/IC

~~R405.3.2~~**R405.5.4 Compliance report.** ~~reports.~~ Compliance **Approved** software tools shall generate a report that documents that the *proposed design* complies with Section R405.3. A compliance report on the *proposed design* shall be submitted with the application for the building permit. Upon completion of the building, a confirmed compliance report based on the confirmed condition of the building shall be submitted to the *code official* before a certificate of occupancy is issued.

~~Compliance reports shall include information~~ **compliance reports** in accordance with Sections R405.5.4.1 and R405.5.4.2.

~~R405.3.2.1~~**R405.5.4.1 Compliance report for permit application.** A compliance report ~~submitted~~ **generated for submission** with the application for building permit shall include the following:

1. Building street address or other *building site* identification.
2. The name of the individual performing the analysis and generating the compliance report.
3. The name and version of the compliance software tool.
4. Documentation of all inputs ~~entered into~~ **to** the software used to produce the results for the *standard reference design* and ~~for the rated home~~ **the proposed design**.
5. A certificate indicating that the *proposed design* complies with Section R405.3. **Section R405.2.** The certificate shall document the building components' energy specifications that are included in the calculation including: component-level insulation *R-values* or *U-factors*; *duct system* and building **thermal** envelope air leakage testing assumptions; and the type and rated efficiencies of proposed heating, cooling, mechanical *ventilation* and service water-heating equipment to be installed. ~~If~~ **Where** *on-site renewable energy* systems will be installed, the certificate shall report the type and production size of the proposed system.
6. Where a site-specific report is not generated, the *proposed design* shall be based on the worst-case orientation and configuration of the rated ~~home~~ **dwelling unit**.

~~R405.3.2.2~~**R405.5.4.2 Compliance report for certificate of occupancy.** A compliance report ~~submitted~~ **generated for submission prior to** ~~for~~ obtaining the certificate of occupancy shall include the following:

1. Building street address, or other building site identification.
2. Declaration of the ~~total~~ **simulated** *building performance* path on the title page of the energy report and the title page of the building plans.
3. A statement, bearing the name of the individual performing the analysis and generating the report, indicating that the as-built *building* complies with ~~Section R405.3.~~ **Section R405.2.**

4. The name and version of the compliance software tool.
5. A site-specific *energy analysis* report that is in compliance with ~~Section R405.3~~ the requirements of **Section R405.4**, where all inputs for the *proposed design* have been replaced in the simulation with confirmed energy features of the *as-built dwelling unit*.
6. A final confirmed certificate indicating compliance based on inspection, and a statement indicating that ~~the as-built building complies with Section R405.2~~ confirmed rated design of the built home complies with ~~Section R405.3~~. The certificate shall report the energy features that were confirmed to be in the ~~home~~ *building*, including component-level insulation *R*-values or *U*-factors; results from any required *duct system* and *building thermal envelope* air leakage testing; and the type and rated efficiencies of the heating, cooling, mechanical *ventilation* and service water-heating equipment installed.
7. When *on-site renewable energy* systems have been installed, the certificate shall report the type and production size of the installed system.

Note: Original text of mod is not consistent with that of the 2023 FEC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

**RE#19 C**

Action	AS	AS/IC	D	D/IC



**RE#20**

Revision clarifies Energy Rating Index analysis is limited to dwelling units, and Spaces other than dwelling units in Group R-2, R-3 or R-4 buildings are to comply with Sections R402 through R404

Several revisions including adding that the “as-built dwelling unit” also meet the listed requirements

Revises Table R406.2 requirements for simulated building performance entries: removes Section R402.1.5 Additional Energy Efficiency, requires all of Section R403.5 Service hot water systems instead of previously just R403.5.1 Heated water circulation and temperature maintenance systems and R403.5.3 Drain water heat recovery units subsection; adds R402.1.6 Rooms containing fuel-burning appliances (for Climate Zone 3-8), R402.2.10 Slab-on grade floors, R402.5.1.3 Maximum air leakage rate, R402.5.2 Fireplaces, R402.5.3 Fenestration air leakage, R402.5.4 Recessed lighting, R402.5.5 Air-sealed electrical and communication outlet boxes, R406.3 Building thermal envelope, R403.2 Hot water boiler temperature reset, R403.13 Gas fireplaces; also changes crawl space requirement from R402.2.11.1 to R402.2.11; also removes Section R403.3 Duct systems exceptions, also edits for Section number and name changes consistency

Revises R406.3 and removes R406.3.1 and R406.3.2, changing from an on-site renewables vs. no on-site renewables based thermal envelope requirements to new thermal conductance (TC) based requirement; also reduces the maximum weighted fenestration SHGC for Performance compliance in Climate Zones 0 through 3 to 0.30

Revises section, adding that “the mechanical ventilation rates used for the purpose of determining the ERI shall not be construed to establish minimum ventilation requirements for compliance with this code” and removing “except for buildings covered by the International Residential Code, the ERI reference design ventilation rate shall be in accordance with Equation 4-2” (also removing Equation 4-2); also removes limit on energy use reduction from on-site renewable energy

Makes several minor edits and breaks out maximum ERI by whether onsite renewables are installed or not, providing new maximum ERI values for projects that use onsite renewable power, and reducing the maximum ERI values slightly for projects that do not use on-site renewable power

Also provides two new exceptions, one of which, where approved by the code official, permits an Average Dwelling Unit Energy Rating Index calculated in accordance with ANSI/RESNET/ICC 301 to be used for buildings with 20 or more dwelling units

General changes to the ERI Documentation section and its subsections include clarification edits and section updates

R406.7.1 Compliance software tools section changes include a new requirement for software vendors to publish documentation that the software has been validated using the Class II, Tier 1 test procedure in ANSI/ASHRAE 140

R406.7.3 Renewable energy certificate (REC) documentation section changes “on-site renewable energy” to “renewable energy power production”, and removes its previous two documentation options, instead requiring documentation compliance with new Section R404.4

For compliance item #6, “low slope” is added to “the exterior low slope roof surface” compliance requirement, and instead of referencing compliance options in Table C402.3, adds Table R407.2 which provides the compliance options

Related Mods:  
 REPI-126-21,  
 RED1-65-22,  
 REPI-7-21, REPI-  
 21-21, REPI-68-  
 21, REPI-86-21,  
 REPI-89-21,  
 REPI-90-21,  
 REPI-99-21,  
 REPI-115-21,  
 REPI-120-21,  
 REPI-126-21,  
 RED1-185-22,  
 RED1-224-22  
 Part I, RED1-250-  
 22, RED1-286-  
 22, REPI-33-21,  
 RED1-186-22,  
 RED1-208-22

SECTION R406

**ENERGY RATING INDEX COMPLIANCE ALTERNATIVE**

**R406.1 Scope.** This section establishes criteria for compliance using an *Energy Rating Index* (ERI) analysis. *Such analysis shall be limited to dwelling units. Spaces other than dwelling units in Group R-2, R-3 or R-4 buildings shall comply with Sections R402 through R404.*

**R406.2 ERI compliance.** Compliance based on the ERI requires that the *rated design and as-built dwelling unit meet* ~~meets~~ all of the following:

1. The requirements of the sections indicated within **Table R406.2**.
2. Maximum ERI values indicated in ~~of~~ **Table R406.5**.

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

<u>SECTION<sup>a</sup></u>	<u>TITLE</u>
<b>General</b>	
R401.2.5	Additional efficiency packages
<b>R401.3</b>	Certificate
<b>Building thermal envelope</b>	
R402.1.1	Vapor retarder
<b>R402.1.6</b>	Rooms containing fuel-burning appliances
R402.2.4	Eave baffle
R402.2.5.1	Access hatches and <del>doors</del> <b>door insulation installation and retention</b>
<b>R402.2.10</b>	Slab-on-grade floors
R402.2.11	Crawl space <del>walls</del> <b>wall insulation installation</b>
R402.5.1.1	<del>Installation</del>
R402.5.1.2	<del>Testing</del> <b>Air leakage testing</b>
<b>R402.5.1.3</b>	Maximum air leakage rate
<b>R402.5.2</b>	Fireplaces
<b>R402.5.3</b>	Fenestration air leakage
<b>R402.5.4</b>	Recessed lighting
<b>R402.5.5</b>	Air-sealed electrical and communication outlet boxes
<b>R406.3</b>	Building thermal envelope
<b>Mechanical</b>	
R403.1	Controls
<b>R403.2</b>	Hot water boiler temperature reset
R403.3 except Sections R403.3.2, R403.3.3 and R403.3.6	<del>Ducts</del> <b>Duct systems</b>
→ R403.4	Mechanical system piping insulation
R403.5.1-	Heated water calculation and temperature maintenance systems
R403.5.3 <b>R403.5</b>	Drain water heat recovery units <del>Service</del> <b>hot water systems</b>
R403.6	Mechanical ventilation
R403.7, except <b>Section R403.7.1</b>	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9.2	Snow melt and ice <del>systems</del> <b>system controls</b>

R403.10	Energy consumption of pools and spas
R403.11	Portable spas
R403.12	Residential pools and permanent residential spas
<b>R403.13</b>	<b>Gas fireplaces</b>
<b>Electrical power and lighting systems</b>	
<b>R404.1</b>	Lighting equipment
<b>R404.2</b>	Interior lighting controls

a. Reference to a code section includes all of the relative subsections except as indicated in the table.

FSEC – Anticipated energy impact on FBC-ER - None or slightly increased stringency as applicable, but limited due to trade-offs.

**R406.3 Building thermal envelope.** Building and portions thereof shall comply with Section R406.3.1 or R406.3.2. The proposed total *building thermal envelope* thermal conductance (TC) shall be less than or equal to the required total *building thermal envelope* TC using the prescriptive *U*-factors and *F*-factors from **Table R402.1.2** multiplied by 1.08 in Climate Zones 0, 1 and 2, and by 1.15 in Climate Zones 3 through 8, in accordance with **Equation 4-2** and **Section R402.1.5**. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

~~**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.~~



(Equation 4-1)

~~**R406.3.2 On-site renewables are included.** Where on-site 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 2018 *International Energy Conservation Code*.~~

**R406.4 Energy Rating Index.** The *Energy Rating Index* (ERI) shall be determined in accordance with **ANSI/RESNET/ICC 301**. The *mechanical ventilation* rates used for the purpose of determining the ERI shall not be construed to establish minimum *ventilation* requirements for compliance with this code. except for buildings covered by the *International Residential Code*, the ERI reference design ventilation rate shall be in accordance with Equation 4-2.



(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 ERI-based compliance.** Compliance based on an ERI analysis requires that the *rated proposed design* and each confirmed *as-built dwelling unit* be shown to have an ERI less than or equal to the appropriate value indicated in **Table R406.5** when where compared to the *ERI reference design* as follows:

1. Where on-site renewables are not installed, the values under ENERGY RATING INDEX NOT INCLUDING OPP apply.
2. Where on-site renewables are installed, the values under ENERGY RATING INDEX INCLUDING OPP apply.

Exceptions:

1. Where the ERI analysis excludes OPP, the values under ENERGY RATING INDEX NOT INCLUDING OPP shall be permitted to be applied.

For buildings with 20 or more *dwelling units*, where *approved* by the *code official*, compliance shall be permitted using the *Average Dwelling Unit Energy Rating Index*, as calculated in accordance with **ANSI/RESNET/ICC 301**

**TABLE R406.5 MAXIMUM ENERGY RATING**

**INDEX**

CLIMATE ZONE	ENERGY RATING INDEX NOT INCLUDING OPP	ENERGY RATING INDEX WITH OPP
0-1	5251	35
2	5251	34
3	5450	33
4	5453	40
5	5554	43
6	5453	43
7	5352	46
8	5352	46

**R406.6 Verification by approved agency.** Verification of compliance with **Section R406** as outlined in **Sections R406.5** and **R406.7** 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 R107.4**.

**R406.7 Documentation.** Documentation of the software used to determine the ERI and the parameters for the *residential building-ERI reference design* shall be in accordance with **Sections R406.7.1** through **R406.7.4**.

**R406.7.1 Compliance software tools.** Software tools used for determining *ERI* shall be *approved* software rating tools in accordance with as defined by **ANSI/RESNET/ICC**

**301.** Software vendors shall publish, on a publicly available website, documentation that the software tool has been validated using the Class II, Tier 1 test procedure in **ANSI/ASHRAE 140**.

**R406.7.2 Compliance report.** Compliance software tools shall generate a report that documents that the ~~home and the~~ *ERI* score of the *rated design and as-built dwelling unit* complies with ~~Sections R406.2, R406.3, and R406.4~~ through **R406.5**. 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 *as-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 R406.7.2.1** and **R406.7.2.2**.

**R406.7.2.1 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 *ERI reference design* and ~~for the rated home~~ *design*.
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 thermal 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. ~~Where~~ *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~~ *dwelling unit*.

**R406.7.2.2 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 *ERI reference design* and ~~for the rated home~~ *the as-built dwelling unit*.
6. A final confirmed certificate indicating that the ~~confirmed rated design of the built home~~ *as-built building* complies with Sections **R406.2, and R406.4 and R406.5**. The certificate shall report the energy features that were confirmed to be in the ~~home~~ *building*, including: component-level insulation *R*-values or *U*-factors; results from any required *duct system* and *building thermal 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~~ *building*, the certificate shall report the type and production size of the installed system.

**R406.7.3 Renewable energy certificate (REC) documentation.** Where ~~on-site renewable energy~~ renewable energy power production is included in the calculation of an *ERI*, one of the following forms of documentation shall be provided to the code official: documentation shall comply with **Section R404.4**.

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.

**R406.7.4 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*.

**R406.7.5 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 Input values.** Where calculations require input values not specified by **Sections R402, R403, R404** and **R405**, those input values shall be taken from **ANSI/RESNET/ICC 301**.

Note: Original text of mod is not consistent with that of the 2023 FEC,  
FSEC – Anticipated energy impact on FBC-ER - None or slightly increased stringency.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

  

Action	AS	AS/IC	D	D/IC

**RE#21**

For compliance item #6, "low slope" is added to "the exterior low slope roof surface" compliance requirement, and instead of referencing compliance options in Table C402.3, adds Table R407.2 which provides the compliance options

Related Mods:  
REPI-68-22,  
REPI-70-21,  
RED1-253-22,  
RE2D-32-23

TABLE R407.2  
RED1-253-22,  
RE2D-31-23,  
RE2D-33-23

SECTION R407

**TROPICAL CLIMATE REGION COMPLIANCE PATH**

**R407.1 Scope.** This section establishes alternative criteria for residential buildings in the tropical region at elevations less than 2,400 feet (731.5 m) above sea level.

**R407.2 Tropical climate region.** Compliance with this section requires the following:

1. Not more than one-half of the *occupied* space is air conditioned.
2. The *occupied* space is not heated.
3. Solar, wind or other renewable energy source supplies not less than 80 percent of the energy for *service water heating*.
4. Glazing in *conditioned* spaces has a *solar heat gain coefficient* (SHGC) of less than or equal to 0.40, or has an overhang with a projection factor equal to or greater than 0.30.
5. Permanently installed lighting is in accordance with **Section R404**.
6. The exterior *low slope* roof surface complies with one of the options in ~~Table C402.3 of the International Energy Conservation Code - Commercial Provisions~~ **Table R407.2** or the roof or ceiling has insulation with an *R-value* of R-15 or greater. Where attics



- are present, attics above the insulation are vented and attics below the insulation are unvented.
7. Roof surfaces have a slope of not less than  $\frac{1}{4}$  unit vertical in 12 units horizontal (2 percent slope). The finished roof does not have water accumulation areas.
  8. Operable *fenestration* provides a *ventilation* area of not less than 14 percent of the floor area in each room. Alternatively, equivalent *ventilation* is provided by a *ventilation* fan.
  9. Bedrooms with *exterior walls* facing two different directions have operable *fenestration* on *exterior walls* facing two directions.
  10. Interior doors to bedrooms are capable of being secured in the open position.
  11. A ceiling fan or ceiling fan rough-in is provided for bedrooms and the largest space that is not used as a bedroom.

**TABLE R407.2**  
**MINIMUM LOW SLOPE ROOF REFLECTANCE AND EMITTANCE OPTIONS<sup>a</sup>**

OPTIONS
Three-year-aged solar reflectance <sup>b</sup> of 0.55 and 3-year aged thermal emittance <sup>c</sup> of 0.75
Three-year-aged solar reflectance index <sup>d</sup> of 64

- a. The use of area-weighted averages to comply with these requirements shall be permitted. Materials lacking 3-year-aged tested values for either solar reflectance or thermal emittance shall be assigned both a 3-year-aged solar reflectance in accordance with **Section R408.2.1.3.1** and a 3-year-aged thermal emittance of 0.90.
- b. Aged solar reflectance tested in accordance with **ASTM C1549**, **ASTM E903** or **ASTM E1918** or **CRRC-S100**.
- c. Aged thermal emittance tested in accordance with **ASTM C1371**, **ASTM E408** or **CRRC-S100**.
- d. Solar reflectance index (SRI) shall be determined in accordance with **ASTM E1980** using a convection coefficient of 2.1 Btu/h × ft<sup>2</sup> × °F (12 W/m<sup>2</sup> × K). Calculation of aged SRI shall be based on aged tested values of solar reflectance and thermal emittance.

Note: Original text of mod is not consistent with that of the 2023 FEC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC



<p><b>RE#22</b></p>	<p>Changes section title from Additional Efficiency Package Options  Scope is modified to reflect additional efficiency requirement changes  Changes section title from Additional efficiency package options and details revised additional energy efficiency requirements which are specified in new Table R408.2  Changes section title from Enhanced envelope performance option, revises section, and adds four new subsections that provide specifications for enhanced building thermal envelope options, including enhanced building thermal envelope performance, improved fenestration, roof solar reflectance index, and reduced air leakage  Revises section and provides revised and expanded listing of more efficient HVAC options applicable to all Climate Zones, and also by grouped Climate Zones, and specifically for Climate Zone 4  Deletes existing language and hot water system efficiency options, and replaces with expanded table of options; also provides specifications for a compact hot water distribution system option  Changes section title from More efficient duct thermal distribution system option, revises existing options, and provides new ductwork located outside conditioned space option  Revises section, providing expanded list of improved air sealing and efficient ventilation system options, plus revised minimum performance requirements for measures requiring either an ERV or HRV  New additional energy efficiency credit compliance option provides table of efficient appliance options and related requirements  New additional energy efficiency credit compliance option specifies on-site renewable energy production and renewable energy certificate (REC) documentation requirements  New additional energy efficiency credit compliance option specifies thermostat demand responsive control requirements, including those for single-stage HVAC systems and variable-capacity and two-stage HVAC system  New additional energy efficiency credit compliance option specifies that for buildings in Climate Zones 4 and 5, the maximum U-factor of 0.060 is permitted for wood-framed walls for compliance with Table R402.1.2 where complying with one or more of four provided options  New additional energy efficiency credit compliance option specifies lighting controls capable of turning off all permanently installed interior lighting; includes two exceptions  New additional energy efficiency credit compliance option specifies requirements for higher efficacy hardwired lighting; includes two exceptions</p>
<p>Related Mods:</p> <p>REPI-18-21,  RED1-54-22,  RED1-71-22,  RED1-73-22,  RED1-166-22,  REPI-136-21,  RED1-76-22,  RED1-79-22,  RED1-254-22,  RED1-255-22,  RED1-263-22,  RED1-285-22,  RED1-343-22,  RED1-351-22,  RE2D-37-23,  RE2D-38-23,  RE2D-42-23,  RE2D-59-23,  RE2D-66-23,  RE2D-67-23,  REPI-33-21,  RED1-185-22,</p>	<p>SECTION R408</p> <p style="text-align: center;"><b>ADDITIONAL EFFICIENCY PACKAGE OPTIONS REQUIREMENTS</b></p> <p><b>R408.1 Scope.</b> This section establishes additional efficiency package options to achieve additional energy efficiency in accordance with Section R401.2.5. provides additional efficiency measures and credits required to comply with Section R401.2.1.</p> <p><b>R408.2 Additional energy efficiency package options credit requirements.</b> Additional efficiency package options for compliance with Section R401.2.1 are set forth in Sections R408.2.1 through R408.2.5. Residential buildings shall earn not less than 10 credits from not less than two measures specified in Table R408.2. Five additional credits shall be earned for <i>dwelling units</i> with more than 5,000 square feet (465 m<sup>2</sup>) of <i>living space</i> located above <i>grade plane</i>. To earn credit as specified in Table R408.2 for the applicable <i>climate zone</i>, each measure selected for compliance shall comply with the applicable subsections of Section R408. Each <i>dwelling unit</i> or <i>sleeping unit</i> shall comply with the selected measure to earn credit. Interpolation of credits between measures shall not be permitted.</p> <p style="text-align: center;"><b>TABLE R408.2  CREDITS FOR ADDITIONAL ENERGY EFFICIENCY</b></p>

MEASURE NUMBER	MEASURE DESCRIPTION	CREDIT VALUE								
		Climate Zones 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4 except Marine	Climate Zone 4 Marine	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.1.1(1)	≥2.5% Reduction in total TC	0	0	0	1	1	1	1	1	1
R408.2.1.1(2)	≥5% reduction in total TC	0	1	1	2	1	2	2	2	2
R408.2.1.1(3)	>7.5% reduction in total TC	0	1	2	2	2	2	3	3	3
R408.2.1.1(4)	>10% reduction in total TC	1	1	2	3	3	4	4	5	5
R408.2.1.1(5)	>15% reduction in total TC	1	2	2	4	4	5	6	7	8
R408.2.1.1(6)	>20% reduction in total TC	2	4	4	5	6	7	8	9	11
R408.2.1.1(7)	>30% reduction in total TC	3	6	6	8	8	11	12	13	16
R408.2.1.2(1)	U-factor and SHGC for vertical fenestration per <b>Table R408.2.1.2</b>	1	1	1	2	1	1	1	1	1
R408.2.1.3(1)	Roof solar reflectance index (roof is part of the building thermal envelope and directly above cooled, conditioned space)	1	0	0	0	0	0	0	0	0
R408.2.1.3(2)	Roof solar reflectance index (roof is above an unconditioned space that contains a duct system)	1	1	0	0	0	0	0	0	0

R408.2.1.4	Reduced air leakage	1	1	1	2	1	3	NA	NA	NA
R408.2.2(1) <sup>b</sup>	Ground source heat pump	14	14	14	15	10	15	17	18	21
R408.2.2(2) <sup>b</sup>	High Performance Cooling (Option 1)	5	4	3	2	1	1	1	1	1
R408.2.2(3) <sup>b</sup>	High Performance Cooling (Option 2)	6	4	3	2	1	1	1	1	1
R408.2.2(4) <sup>b</sup>	High Performance Gas furnace (Option 1)	0	1	2	5	3	6	7	7	9
R408.2.2(5) <sup>b</sup>	High Performance Gas furnace (Option 2)	0	1	2	4	3	5	6	7	8
R408.2.2(6) <sup>b</sup>	High Performance Gas furnace (Option 3)	0	1	1	NA	NA	NA	NA	NA	NA
R408.2.2(7) <sup>b</sup>	High Performance Gas furnace and cooling (Option 1)	5	5	4	NA	NA	NA	NA	NA	NA
R408.2.2(8) <sup>b</sup>	High Performance Gas furnace and cooling (Option 2)	6	5	5	NA	NA	NA	NA	NA	NA
R408.2.2(9) <sup>b</sup>	High Performance Gas furnace and heat pump (Option 1)	15	13	11	<del>NA</del>	NA	NA	NA	NA	NA
R408.2.2(10) <sup>b</sup>	High Performance Heat pump with electric resistance backup (Option 1)	13	12	11	12	NA	NA	NA	NA	NA
R408.2.2(11) <sup>b</sup>	High Performance Gas furnace and cooling (Option 3)	NA	NA	NA	5	4	6	7	7	9

R408.2.2(12) <sup>b</sup>	High Performance Gas furnace and cooling (Option 4)	NA	NA	NA	6	5	7	8	8	10
R408.2.2(13) <sup>b</sup>	High Performance Gas furnace and heat pump (Option 2)	NA	NA	NA	12	8	11	11	12	12
R408.2.2(14) <sup>b</sup>	High Performance Heat pump with electric resistance backup (Option 2)	NA	NA	NA	12	8	12	13	14	16
R408.2.3(1)(a) <sup>d</sup>	Gas-fired storage water heaters (Option 1)	8	7	7	5	6	4	4	3	2
R408.2.3(1)(b) <sup>d</sup>	Gas fired storage water heaters (Option 2)	9	8	8	6	7	5	4	4	3
R408.2.3(2)(a) <sup>d</sup>	Gas-fired instantaneous water heaters (Option 1)	10	9	9	6	7	5	5	4	3
R408.2.3(2)(b) <sup>d</sup>	Gas-fired instantaneous water heaters (Option 2)	11	10	9	6	7	6	5	4	3
R408.2.3(3) <sup>d</sup>	Electric water heaters (Option 1)	10	9	9	7	6	4	3	3	2
R408.2.3(4) <sup>d</sup>	Electric water heaters (Option 2)	8	8	8	6	5	4	3	3	2
R408.2.3(5)(a) <sup>d</sup>	Electric water heaters (Option 3)	7	8	8	6	7	5	4	3	3
R408.2.3(5)(b) <sup>d</sup>	Electric water heaters (Option 4)	8	9	10	7	8	5	5	4	3
R408.2.3(6) <sup>d</sup>	Electric water heaters (Option 5)	10	9	9	7	6	4	3	3	2
R408.2.3(7)(a) <sup>d</sup>	Solar hot water heating system (Option 1)	13	13	13	9	8	5	4	4	3
R408.2.3(7)(b) <sup>d</sup>	Solar hot water heating system (Option 2)	10	9	9	6	7	6	5	4	3

R408.2.3(8) <sup>a</sup>	Compact hot water distribution	2	2	2	2	2	2	2	2	2
R408.2.4(1) <sup>a</sup>	Ductless or hydronic thermal distribution	3	4	5	7	8	10	10	10	14
R408.2.4(2) <sup>a</sup>	100% of duct systems in conditioned space	2	3	4	6	7	9	9	9	13
R408.2.4(3) <sup>a</sup>	≥80% of ductwork inside conditioned space	2	3	3	5	6	7	7	7	9
R408.2.4(4) <sup>a</sup>	Reduced total duct system leakage	1	1	1	1	1	1	2	2	2
R408.2.5(1) <sup>a</sup>	ERV or HRV installed	0	0	0	0	1	3	2	2	2
R408.2.5(2) <sup>a</sup>	≤2.0 ACH50 with ERV or HRV installed	0	0	0	4	4	8	5	5	5
R408.2.5(3) <sup>a</sup>	≤2.0 ACH50 with a balanced ventilation system	0	0	0	0	0	0	4	4	4
R408.2.5(4) <sup>a</sup>	≤1.5 ACH50 with ERV or HRV installed	0	0	0	6	5	10	9	9	9
R408.2.5(5) <sup>a</sup>	≤1.0 ACH50 with ERV or HRV installed	0	0	1	7	6	12	12	12	12
R408.2.6 <sup>a</sup>	Energy efficient appliances	1	1	1	1	1	1	0	0	0
R408.2.7	On-site renewable energy measures	17	16	17	11	11	9	8	7	4
R408.2.8 <sup>a</sup>	Demand responsive thermostat	1	1	1	1	1	1	1	1	1
R408.2.10	Whole-home lighting control	1	1	1	0	0	0	0	0	0
R408.2.11	Higher efficacy lighting	0	0	0	0	0	0	0	0	0

NA = Not Applicable.

- a. Where the measure is selected, each dwelling unit, sleeping unit, and *common area* where the measure is applicable must have the measure installed.

Where multiple heating or cooling systems are installed, credits shall be determined using a weighted average of the square footage served by each system.

b. Where the measure is selected, each dwelling unit and sleeping unit must comply with the measure.

c. Where the measure is selected, each dwelling unit shall be served by a water heater meeting the applicable requirements.

Where multiple service water heating systems are installed, credits shall be determined using a weighted average of the square footage served by each system.

- d. Eleven credits are available for Climate Zone 4 where the following measure is used: gas furnace and heat pump (Option 3): greater than or equal to 95% AFUE fuel gas furnace and 7.8 HSPF2, 15.2 SEER2 and 10.0 EER2 air source heat pump.

**R408.2.1 Enhanced building thermal envelope performance options.** ~~The total building thermal envelope UA, the sum of U-factor times assembly area, shall be less than or equal to 95 percent of the total UA resulting from multiplying the U-factors in Table R402.1.2 by the same assembly area as in the proposed building. The UA calculation shall be performed in accordance with Section R402.1.5. The area weighted average SHGC of all glazed fenestration shall be less than or equal to 95 percent of the maximum glazed fenestration SHGC in Table R402.1.2.~~

The *building thermal envelope* shall comply with one or more of the following:

1. **Section R408.2.1.1 or R408.2.1.2.** Credit shall be permitted from only one measure.
2. Section R408.2.1.3.
3. **Section R408.2.1.4.**

**R408.2.1.1 Enhanced building thermal envelope performance.** The total *building thermal envelope* thermal conductance (TC) shall be calculated for the proposed building in accordance with **Section R402.1.5** and shall be reduced by not less than the percentage indicated in **Table R408.2** in comparison to the reference building.

**R408.2.1.2 Improved fenestration.** The area weighted average *U-factor* and SHGC of all *vertical fenestration* shall be equal to or less than the values specified in **Table R408.2.1.2**.

**TABLE R408.2.1.2 IMPROVED FENESTRATION**

CLIMATE ZONE	U-FACTOR	SHGC
0	0.32	0.23
1	0.32	0.23
2	0.30	0.23
3	0.28	0.23
4 except Marine 4	0.25	0.40
5 and Marine 4	0.25	NR
6	0.25	NR
7 and 8	0.25	NR

NR = No Requirement.

**R408.2.1.3 Roof solar reflectance index.** *Low slope* roofs in Climate Zones 0 through 2 shall earn credit for **Table R408.2** measure numbers R408.2.1.3(1) and R408.2.1.3(2) where the 3-year aged solar reflectance index (SRI) is greater than or equal to 75. To earn credit, not less than 95 percent of the roof area shall comply. The combined area of the following portions of roof shall not be greater than 5 percent of the roof area:

1. Portions that include or are covered by the following:

- 1.1. Photovoltaic systems or components.
- 1.2. Solar air or water-heating systems or components.
- 1.3. Vegetative roofs or landscaped roofs.
- 1.4. Above-roof decks or walkways.
- 1.5. Skylights.
- 1.6. HVAC systems and components, and other opaque objects mounted above the roof.
2. Portions shaded during the peak sun angle on the summer solstice by permanent features of the *building*, permanent features of adjacent buildings or natural objects.
3. Portions that are ballasted with a minimum stone ballast of 17 pounds per square foot (psf) (74 kg/m<sup>2</sup>) or 23 psf (117 kg/m<sup>2</sup>) pavers.

The 3-year aged SRI shall be determined in accordance with **ASTM E1980** using a convection coefficient of 2.1 Btu/h × ft<sup>2</sup> × °F (12 W/m<sup>2</sup> × K). Calculation of aged SRI shall be based on 3-year aged solar reflectance values tested in accordance with **ASTM C1549**, **ASTM E903**, **ASTM E1918** or **CRRC S100** and 3-year aged thermal *emittance* values tested in accordance with **ASTM C1371**, **ASTM E408** or **CRRC S100**.

**R408.2.1.3.1 Aged solar reflectance.** Where a tested 3-year aged solar reflectance value is not available, an assigned value shall be determined in accordance with **Equation 4-3**.

$$R_{aged} = [0.2 + 0.7(R_{initial} - 0.2)] \quad \text{Equation 4-3}$$

where:

$R_{aged}$  = The aged solar reflectance.

$R_{initial}$  = The initial solar reflectance determined in accordance with **ASTM C1549**, **ASTM E903**, **ASTM E1918** or **CRRC S100**.

**R408.2.1.4 Reduced air leakage.** The *building* shall have a measured air leakage rate not less than 2.0 ACH50 and not greater than 2.5 ACH50 or the *dwelling units* in the *building* shall have an average measured air leakage rate not greater than 0.24 cubic feet per minute per square foot [1.2 L/(s × m<sup>2</sup>)].

**R408.2.2 More efficient HVAC equipment performance options.** Heating and cooling *equipment* shall meet one of the following ~~efficiencies~~: measures as applicable for the *climate zone* where heating and cooling efficiencies are represented by Annual Fuel Utilization Efficiency (AFUE), Coefficient of Performance (COP), Energy Efficiency Ratio (EER and EER2), Heating Season Performance Factor (HSPF2) and Seasonal Energy Efficiency Ratio (SEER2). Where multiple heating or cooling systems are installed serving different zones, credits shall be earned based on the weighted average of square footage of the zone served by the system.

HVAC options applicable to all climate zones:

1. ~~Greater than or equal to 95 AFUE natural gas furnace and 16 SEER air conditioner.~~ Ground source heat pump: Greater than or equal to 16.1 EER and 3.1 COP ground source heat pump.
2. ~~Greater than or equal to 10 HSPF/16 SEER air source heat pump.~~ Cooling (Option 1): Greater than or equal to 15.2 SEER2 and 12.0 EER2 air conditioner.
3. ~~Greater than or equal to 3.5 COP ground source heat pump.~~ Cooling (Option 2): Greater than or equal to 16.0 SEER2 and 12.0 EER2 air conditioner.
4. Gas furnace (Option 1): Greater than or equal to 97 percent AFUE *fuel gas* furnace.
5. Gas furnace (Option 2): Greater than or equal to 95 percent AFUE *fuel gas* furnace.



VAC options applicable to Climate Zones 0, 1, 2 and 3:

6. Gas furnace (Option 3): Greater than or equal to 90 percent AFUE *fuel gas* furnace.
7. Gas furnace and cooling (Option 1): Greater than or equal to 90 percent AFUE *fuel gas* furnace and 15.2 SEER2 and 10.0 EER2 air conditioner.
8. Gas furnace and cooling (Option 2): Greater than or equal to 95 percent AFUE *fuel gas* furnace and 16.0 SEER2 and 10.0 EER2 air conditioner.
9. Gas furnace and heat pump (Option 1): Greater than or equal to 90 percent AFUE *fuel gas* furnace and 7.8 HSPF2, 15.2 SEER2 and 10.0 EER2 air source heat pump.
10. Heat pump (Option 1): Greater than or equal to 7.8 HSPF2, 15.2 SEER2, and 11.7 EER2 air source heat pump.

HVAC options applicable to Climate Zones 4, 5, 6, 7 and 8:

11. Gas furnace and cooling (Option 3): Greater than or equal to 95 percent AFUE *fuel gas* furnace and 15.2 SEER2 and 12.0 EER2 air conditioner.
12. Gas furnace and cooling (Option 4): Greater than or equal to 97 percent AFUE *fuel gas* furnace and 16.0 SEER2 and 12.0 EER2 air conditioner.
13. Gas furnace and heat pump (Option 2): Greater than or equal to 95 percent AFUE *fuel gas* furnace and 8.1 HSPF2 and 15.2 SEER2 air source heat pump capable of meeting a capacity ratio  $\geq 70$  percent of heating capacity at 5°F (-15°C) versus rated heating capacity at 47°F (8.3°C).
14. Heat pump (Option 2): Greater than or equal to 8.1 HSPF2 and 15.2 SEER2 air source heat pump capable of meeting a capacity ratio  $\geq 70$  percent of heating capacity at 5°F (-15°C) versus rated heating capacity at 47°F (8.3°C).

~~For multiple cooling systems, all systems shall meet or exceed the minimum efficiency requirements in this section and shall be sized to serve 100 percent of the cooling design load. For multiple heating systems, all systems shall meet or exceed the minimum efficiency requirements in this section and shall be sized to serve 100 percent of the heating design load.~~

**R408.2.2.1 More efficient HVAC equipment for Climate Zone 4.** For Climate Zone 4, the following HVAC options shall also apply:

1. Gas Furnace and Heat Pump (Option 3): Greater than or equal to 95 percent AFUE *fuel gas* furnace and 7.8 HSPF2, 15.2 SEER2 and 10.0 EER2 air source heat pump.
2. Heat Pump (Option 1): Greater than or equal to 7.8 HSPF2, 15.2 SEER2 and 11.7 EER2 air source heat pump.

~~**R408.2.3 Reduced energy use in service water-heating option.options.** The hot water system shall meet one of the following efficiencies:~~ For measure numbers R408.2.3 (1) through R408.2.3(7), the installed hot water system shall meet one of the Uniform Energy Factors (UEF) or Solar Uniform Energy Factors (SUEF) in **Table R408.2.3**. For measure number R408.2.3(8), the hot water distribution system shall comply with **Section R408.2.3.1**.

- ~~1. Greater than or equal to 0.82 EF fossil fuel service water heating system.~~
- ~~2. Greater than or equal to 2.0 EF electric service water heating system.~~
- ~~3. Greater than or equal to 0.4 solar fraction solar water heating system.~~

**TABLE R408.2.3  
SERVICE WATER HEATING EFFICIENCIES**

MEASURE NUMBER	WATER HEATER	SIZE AND DRAW PATTERN	TYPE	EFFICIENCY
R408.2.3(1)(a)	Gas-fired storage water heaters (option 1)	All storage volumes, all draw patterns		UEF $\geq$ 0.81
R408.2.3(1)(b)	Gas-fired storage water heaters (option 2)	$\leq$ 55 gallons, High		UEF $\geq$ 0.86
		> 55 gallons, Medium or High		UEF $\geq$ 0.86
		Rated input capacity > 75,000 Btu/h		UEF $\geq$ 0.86 or $E_t \geq$ 94%
R408.2.3(2)(a)	Gas-fired instantaneous water heaters (option 1)	All storage volumes, Medium or High		UEF $\geq$ 0.92
R408.2.3(2)(b)	Gas-fired instantaneous water heaters (option 2)	All storage volumes, Medium or High		UEF $\geq$ 0.95
R408.2.3(3)	Electric water heaters (option 1)	All storage volumes, Low, Medium, or High	Integrated HPWH	UEF $\geq$ 3.30
R408.2.3(4)	Electric water heaters (option 2)	All storage volumes, Low, Medium, or High	Integrated HPWH, 120 Volt/15 Amp Circuit	UEF $\geq$ 2.20
R408.2.3(5)(a)	Electric water heaters (option 3)	All storage volumes, Low, Medium, or High	Split-system HPWH	UEF $\geq$ 2.20
R408.2.3(5)(b)	Electric water heaters (option 4)	All storage volumes, Low, Medium, or High	Split-system HPWH	UEF $\geq$ 3.75
R408.2.3(6)	Electric water heaters (option 5)	Rated input capacity > 12 kW		COP $\geq$ 3.00
R408.2.3(7)(a)	Solar water heaters (option 1)	All storage volumes, all draw patterns	Electric backup	SUEF $\geq$ 3.00
R408.2.3(7)(b)	Solar water heaters (option 2)	All storage volumes, all draw patterns	Gas backup	SUEF $\geq$ 1.80

UEF = Uniform Energy Factor,  $E_t$  = Thermal Efficiency, COP = Coefficient of Performance.

**R408.2.3.1 Compact hot water distribution system option.** The pipe shall store not more than 16 ounces (0.47 L) of water between the nearest source of heated water and the termination of the fixture supply pipe when calculated using **Section**

**R408.2.3.1.1.** Where the source of heated water is a circulation loop, the loop shall be primed with a *demand recirculation water system* that complies with **Section R403.5.1.1.1**. There shall be a dedicated return line for the loop that begins after the branch to the last fixture on the supply portion of the loop and runs back to the water heater.

**TABLE R408.2.3.1  
INTERNAL VOLUME OF VARIOUS WATER DISTRIBUTION TUBING**

OUNCES OF WATER PER FOOT OF TUBE									
NOMINAL SIZE (inches)	Copper Type M	<del>Copper Type L</del>	<del>Copper Type K</del>	CPVC CTS SDR 11	CPVC SCH 40	CPVC SCH 80	PE-RT SDR 9	Composite ASTM F1281	PEX CTS SDR 9
3/8	1.06	0.97	0.84	N/A	1.17	—	0.64	0.63	0.64
1/2	1.69	1.55	1.45	1.25	1.89	1.46	1.18	1.31	1.18
3/4	3.43	3.22	2.90	2.67	3.38	2.74	2.35	3.39	2.35
1	5.81	5.49	5.17	4.43	5.53	4.57	3.91	5.56	3.91
1 1/4	8.70	8.36	8.09	6.61	9.66	8.24	5.81	8.49	5.81
1 1/2	12.18	11.83	11.45	9.22	13.20	11.38	8.09	13.88	8.09
2	21.08	20.58	20.04	15.79	21.88	19.11	13.86	21.48	13.86

For SI: 1 foot = 304.8 mm, 1 inch = 25.4 mm, 1 liquid ounce = 0.030L, 1 ounces per square foot = 305.15 g/m<sup>2</sup>.

N/A = Not Available.

**R408.2.3.1.1 Water volume determination.** The water volume in the piping between a source of heated water and the termination of a fixture supply shall be calculated in accordance with this section. Water heaters, circulating water systems and heat trace temperature maintenance systems shall be considered to be sources of heated water. The volume shall be the sum of the internal volumes of pipe, fittings, valves, meters and manifolds between the nearest source of heated water and the termination of the fixture supply pipe. The volume in the piping shall be determined from **Table R408.2.3.1**. The volume contained within fixture shutoff valves, within flexible water supply connectors to a fixture fitting and within a fixture fitting shall not be included in the water volume determination. Where heated water is supplied by a recirculating system or heat-traced piping, the volume shall include the portion of the fitting on the branch pipe that supplies water to the fixture.

**R408.2.4 More efficient duct thermal distribution system options.** The thermal distribution system shall meet one of the following efficiencies: comply with one of the following:

1. 100 percent of ducts and air handlers located entirely within the *building thermal envelope*. The ductless thermal distribution system or hydronic thermal distribution system is located completely on the conditioned side of the building thermal envelope.
2. 100 percent of ductless thermal distribution system or hydronic thermal distribution system located completely inside the *building thermal envelope*. The *space conditioning equipment* is located inside *conditioned space*. In addition, 100 percent of the *ductwork* is located completely inside *conditioned space* as defined by **Section R403.3.4**, Items 1 and 2.
3. 100 percent of duct thermal distribution system located in *conditioned space* as defined by **R403.3.4**. The *space conditioning equipment* is located inside *conditioned space* and no less than 80 percent of *ductwork* is located completely

inside *conditioned space* as defined by **Section R403.3.4**, Items 1 and 2. In addition, no more than 20 percent of *ductwork* is contained within building assemblies separating unconditioned from *conditioned space* as defined by **Section R403.3.4**, Item 3.

4. Where *ductwork* is located outside conditioned space, the total leakage of the *duct system* measured in accordance with **Section R403.3.7** is one of the following:
  - 4.1. Where the *space conditioning equipment* is installed at the time of testing, total leakage is not greater than 2.0 cubic feet per minute (0.94 L/s) per 100 square feet (9.29 m<sup>2</sup>) of *conditioned floor area*.
  - 4.2. Where the *space conditioning equipment* is not installed at the time of testing, total leakage is not greater than 1.75 cubic feet per minute (0.83 L/s) per 100 square feet (9.29 m<sup>2</sup>) of *conditioned floor area*.

**R408.2.5 Improved air sealing and efficient ventilation system options.** The measured air leakage rate *and ventilation system shall meet one of the following:* ~~shall be less than or equal to 3.0 ACH50, with either an Energy Recovery Ventilator (ERV) or Heat Recovery Ventilator (HRV) installed. Minimum HRV and ERV requirements, measured at the lowest tested net supply airflow, shall be greater than or equal to 75 percent Sensible Recovery Efficiency (SRE), less than or equal to 1.1 cubic feet per minute per watt (0.03 m<sup>3</sup>/min/watt) and shall not use recirculation as a defrost strategy.~~

1. Either an Energy Recovery Ventilator (ERV) or a Heat Recovery Ventilator (HRV) installed.
2. Less than or equal to 2.0 ACH50, with either an ERV or HRV installed.
3. Less than or equal to 2.0 ACH50, with a *balanced ventilation system*.
4. Less than or equal to 1.5 ACH50, with either an ERV or HRV installed.
5. Less than or equal to 1.0 ACH50, with either an ERV or HRV installed.

~~In addition, the ERV shall be greater than or equal to 50 percent Latent Recovery/Moisture Transfer (LRMT), for measures requiring either an ERV or HRV, HRV and ERV Sensible Recovery Efficiency (SRE) shall be not less than 75 percent at 32°F (0°C) at the lowest *listed* net airflow. ERV Latent Recovery/Moisture Transfer (LRMT) shall be not less than 50 percent at the lowest *listed* net airflow. In Climate Zone 8, recirculation shall not be used as a defrost strategy.~~

**R408.2.6 Energy efficient appliances.** Each appliance of a type listed in **Table R408.2.6** installed in a residential *building* shall comply with the efficiency requirements specified in that table. Each appliance specified in **Table R408.2.6** shall be installed. A clothes washer shall be installed at each location plumbed for a clothes washer.

**Exception:** In *dwelling units* of Group R-2 occupancies where a dishwasher is not installed in each unit, not fewer than two appliance types complying with **Table R408.2.6** shall be installed.

**TABLE R408.2.6  
MINIMUM EFFICIENCY REQUIREMENTS: APPLIANCES**

APPLIANCE TYPES	EFFICIENCY IMPROVEMENT	TEST PROCEDURE
Refrigerator	Maximum Annual Energy Consumption (AEC), not greater than 620 kWh/yr.	10 CFR 430, Subpart B, Appendix A
Dishwasher	Maximum Annual Energy Consumption (AEC), not greater than 240 kWh/yr.	10 CFR 430, Subpart B, Appendix C1
Clothes washer and clothes dryer	<p>Clothes washer located within <i>dwelling units</i>: Maximum Annual Energy Consumption (AEC), not greater than 130 kWh/yr and Integrated Modified Energy Factor (IMEF) &gt; 1.84 cu ft/kWh/cycle</p> <p>Clothes washer not located within <i>dwelling units</i> and where <i>dwelling units</i> are not provided with rough-in plumbing for washers: Modified Energy Factor (MEF) &gt; 2.0 cu ft/kWh/cycle</p>	10 CFR 430, Subpart B, Appendices D1, D2 and J2.

For SI: 1 cubic foot per kilowatt hour per cycle = 0.028 m<sup>3</sup>/kWh/cycle.

**R408.2.7 Renewable energy.** *Renewable energy resources* shall be permanently installed and have the rated capacity to produce not less than 1.0 watt of *on-site renewable energy* per square foot of *conditioned floor area*. To qualify for this option, *renewable energy certificate* (REC) documentation shall meet the requirements of **Section R404.4**.

**R408.2.8 Demand response.** The *thermostat* controlling the primary heating or cooling system of each *dwelling unit* shall be provided with a *demand responsive control* capable of communicating with the Virtual End Node (VEN) using a wired or wireless bi-directional communication pathway that provides the occupant the ability to voluntarily participate in utility demand response programs, where available. The *thermostat* shall be capable of executing the following actions in response to a *demand response signal*:

1. Automatically increasing the *zone* operating cooling set point by the following values: 1°F (0.5°C), 2°F (1°C), 3°F (1.5°C) and 4°F (2°C).
2. Automatically decreasing the *zone* operating heating set point by the following values: 1°F (0.5°C), 2°F (1°C), 3°F (1.5°C) and 4°F (2°C).

Thermostats controlling single-stage HVAC systems shall comply with **Section R408.2.8.1**. Thermostats controlling variable capacity systems shall comply with **Section R408.2.8.2**. Thermostats controlling multistage HVAC systems shall comply with either **Section R408.2.8.1** or **R408.2.8.2**. Where a *demand response signal* is not available, the *thermostat* shall be capable of performing all other functions.

**R408.2.8.1 Single-stage HVAC system controls.** Thermostats controlling single-stage HVAC systems shall be provided with a *demand responsive control* that complies with one of the following:



1. Certified **OpenADR 2.0a VEN**, as specified under Clause 11, Conformance.
2. Certified **OpenADR 2.0b VEN**, as specified under Clause 11, Conformance.
3. Certified by the manufacturer as being capable of responding to a *demand response signal* from a certified **OpenADR 2.0b VEN** by automatically implementing the control functions requested by the VEN for the equipment it controls.
4. **IEC 62746-10-1**.
5. The communication protocol required by a controlling entity, such as a utility or service provider, to participate in an automated demand response program.
6. The physical configuration and communication protocol of **CTA 2045-A** or **CTA-2045-B**.

**R408.2.8.2 Variable-capacity and two-stage HVAC system controls.** Thermostats controlling variable-capacity and two-stage HVAC systems shall be provided with a *demand responsive control* that complies with the communication and performance requirements of **AHRI 1380**.

**R408.2.9 Opaque walls.** For buildings in Climate Zones 4 and 5, the maximum *U-factor* of 0.060 shall be permitted to be used for wood-framed walls for compliance with **Table R402.1.2** where complying with one or more of the following:

1. Primary space heating is provided by a heat pump that meets one of the efficiencies in Section R408.2.2.
2. All installed water heaters are heat pumps that meet one of the efficiencies in **Section R408.2.3**.
3. In addition to the number of credits required by **Section R408.2**, three additional credits are achieved.
4. *Renewable energy resources* are installed to meet the requirements of **Section R408.2.7**.

**R408.2.10 Whole-home lighting control.** The *dwelling unit* shall have a *manual* control by the main entrance that turns off all the permanently installed interior lighting or a lighting control system that has the capability to turn off all permanently installed interior lighting from remote locations.

Exceptions:

1. Up to 5 percent of the total lighting power may remain uncontrolled.
2. Spaces where lighting is controlled by a count-down timer or *occupant sensor control*.

**R408.2.11 Higher efficacy lighting.** All spaces shall be provided with hardwired lighting with a lamp efficacy of 90 lm/W or a luminaire efficacy of 55 lm/W.

Exceptions:

1. Closets.
2. Other storage spaces.

Note: Original text of mod is not consistent with that of the 2023 FEC.

FSEC – Anticipated energy impact on FBC-ER - Increased stringency..

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

  

Action	AS	AS/IC	D	D/IC

**RE#23**

Moves additional non-energy code compliance requirements from Section R501.4 which has same title to this section  
 Renumbered from R501.5  
 Renumbered from R501.6  
 New section (largely moved from 2021 IECC Section R502.2) requires that any unconditioned or low-energy space that is altered to become conditioned space be brought into full compliance with Section R502 (Additions), with Section R405 exception

Related Mods:  
 RED1-264-22,  
 REPI 143-21,  
 RED1-264-22,

CHAPTER 5 [RE] EXISTING BUILDINGS

**User notes:**

**About this chapter:** Many buildings are renovated or altered in numerous ways that could affect the energy use of the building as a whole. Chapter 5 requires the application of certain parts of **Chapter 4** in order to maintain, if not improve, the conservation of energy by the renovated or altered building.

SECTION R501 GENERAL

**R501.1 Scope.** The provisions of this chapter shall control the *alteration, repair, addition* and change of occupancy of existing buildings and structures.

**R501.1.1 General.** Except as specified in this chapter, this code shall not be used to require the removal, *alteration* or abandonment of, nor prevent the continued use and maintenance of, an existing *building* or *building* system lawfully in existence at the time of adoption of this code. Unaltered portions of the *existing building* or *building* supply system shall not be required to comply with this code.

\*\*

**R501.2 Compliance.** *Additions, alterations, repairs* or changes of occupancy to, or relocation of, an existing *building*, building system or portion thereof shall comply with **Section R502, R503, R504** or **R505**, respectively, in this code and the provisions for *alterations, repairs, additions and changes of occupancy or relocation*, respectively, in the *International Building Code, International Existing Building Code, International Fire Code, International Fuel Gas Code, International Mechanical Code, International Plumbing Code, International Property Maintenance Code, International Private Sewage Disposal Code, International Residential Code* and **NFPA 70, as applicable**. Changes where unconditioned space is changed to *conditioned space* shall comply with **Section R501.6**.

**R501.3 Maintenance.** *Buildings* and structures, and parts thereof, shall be maintained in a safe and sanitary condition. Devices and systems that are required by this code shall be maintained in conformance to the code edition under which installed. The owner or the owner's authorized agent shall be responsible for the maintenance of *buildings* and structures. The requirements of this chapter shall not provide the basis for removal or abrogation of energy conservation, fire protection and safety systems and devices in existing structures.

**Note: Original text of mod is not consistent with that of the 2023 FEC.**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

**RE#23 A**

Action	AS	AS/IC	D	D/IC

~~**R501.4 Compliance.** *Alterations, repairs, additions* and changes of occupancy to, or relocation of, existing buildings and structures shall comply with the provisions for *alterations, repairs, additions* and changes of occupancy or relocation, respectively, in this code and the *International Residential Code, International Building Code, International Existing Building Code, International Fire Code, International Fuel Gas Code, International Mechanical Code, International Plumbing Code, International Property Maintenance Code, International Private Sewage Disposal Code* and **NFPA 70**.~~



\*

**R501.5R501.4 New and replacement materials.** Except as otherwise required or permitted by this code, materials permitted by the applicable code for new construction shall be used. Like materials shall be permitted for *repairs* , provided that hazards to life, health or property are not created. Hazardous materials shall not be used where the code for new construction would not allow their use in *buildings* of similar occupancy, purpose and location.

**R501.6R501.5 Historic buildings.** Provisions of this code relating to the construction, *repair, alteration* , restoration and movement of structures, and *change of occupancy* shall not be mandatory for *historic buildings* provided that a report has been submitted to the *code official* and signed by the owner, a *registered design professional* , or a representative of the State Historic Preservation Office or the historic preservation authority having jurisdiction, demonstrating that compliance with that provision would threaten, degrade or destroy the historic form, fabric or function of the *building* .

\*\*

**R501.6 Change in space conditioning.** Any unconditioned or low-energy space that is altered to become *conditioned space* shall be required to be brought into full compliance with **Section R502**.

**Exception:** Where the simulated performance option in **Section R405** is used to comply with this section, the annual *energy cost* of the *proposed design* is permitted to be 110 percent of the annual *energy cost* otherwise allowed by **Section R405.2**.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

**RE#23 B**

Action	AS	AS/IC	D	D/IC

<p><b>RE#24</b></p>	<p>Revises (Additions) General section, with removed language largely provided or implied elsewhere in Chapter 5  Removed and largely rewritten in Section R501.6  Renumbered from R502.3 and adds new Section R502.2.5 (Additional energy efficiency credit requirements for additions) to listing of sections with which additions must comply  Renumbered from R502.3.1, and "building envelope" changed to "building thermal envelope" in title and text  Renumbered from R502.3.2, "ducts" changed to "ductwork", and clarification added that testing is not required for the exception  Renumbered from R502.3.3  Renumbered from R502.3.4  New section requires additions to, with three exceptions (including for Performance and ERI compliance), achieve not less than five additional energy efficiency credits</p>
<p>Related Mods:  RED1-264-22  RED1-263-22  REPI-143-21,  REPI 144-21,  REPI-145-21,  RED1-285-22,  CEPI-24-21 Part II,</p>	<p style="text-align: center;">SECTION R502 ADDITIONS</p> <p><b>R502.1 General.</b> <del>Additions to an existing building, building system or portion thereof shall conform to the provisions of this code as those provisions relate to new construction without requiring the unaltered portion of the existing building or building system to comply with this code. Additions shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code where the addition alone complies, where the existing building and addition comply with this code as a single building, or where the building with the addition does not use more energy than the existing building. Additions shall be in accordance with Section R502.2 or R502.2.</del></p> <p><b>R502.2 Change in space conditioning.</b> <del>Any unconditioned or low-energy space that is altered to become conditioned space shall be required to be brought into full compliance with this code.</del></p> <p>Exceptions:</p> <ol style="list-style-type: none"> <li><del>1. Where the simulated performance option in Section R405 is used to comply with this section, the annual energy cost of the proposed design is permitted to be 110 percent of the annual energy cost otherwise allowed by Section R405.2.</del></li> <li><del>2. here the Total UA, as determined in Section R402.1.5, of the existing building and the addition, and any alterations that are part of the project, is less than or equal to the Total UA generated for the existing building.</del></li> <li><del>3. here complying in accordance with Section R405 and the annual energy cost or energy use of the addition and the existing building, and any alterations that are part of the project, is less than or equal to the annual energy cost of the existing building. The addition and any alterations that are part of the project shall comply with Section R405 in its entirety.</del></li> </ol> <p><b>R502.3 R502.2 Prescriptive compliance.</b> Additions shall comply with Sections R502.2.1 through R502.2.4, R502.2.5.</p> <p><b>R502.3.1 R502.2.1 Building thermal envelope.</b> New building thermal envelope assemblies that are part of the addition shall comply with Sections R402.1, R402.2, R402.4.1 through R402.4.5, and R402.5.</p> <p><b>Exception:</b> New building thermal envelope assemblies are exempt from the requirements of Section R402.5.1.2</p> <p><b>R502.3.2 R502.2.2 Heating and cooling systems.</b> HVAC ducts ductwork newly installed as part of an addition shall comply with Section R403.</p> <p><b>Exception:</b> Where ducts ductwork from an existing heating and cooling system are is extended to an addition, Sections R403.3.7 and R403.3.8 shall not be required.</p> <p><b>R502.3.3 R502.2.3 Service hot water systems.</b> New service hot water systems that are part of the addition shall comply with Section R403.5.</p>

**R502.3.4 R502.2.4 Lighting.** New lighting systems that are part of the *addition* shall comply with **Section R404.1**.

**R502.2.5 Additional energy efficiency credit requirements for additions.** Additions shall comply with sufficient measures from **Table R408.2** to achieve not less than five credits. Alterations to the *existing building* that are not part of the *addition*, but are permitted with an *addition*, shall be permitted to be used to achieve this requirement.

Exceptions:

1. *Additions* that increase the *building's* total *conditioned floor area* by less than 25 percent.
2. *Additions* that do not include the addition or replacement of equipment covered in Section R403.5 or R403.7.
3. *Additions* that do not increase *conditioned space*.
4. Where the *addition* alone or the existing building and *addition* together comply with **Section R405 or R406**.

Note: Original text of mod is not consistent with that of the 2023 FEC.

FSEC – Anticipated energy impact on FBC-ER – Somewhat increased Prescriptive stringency.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

  

Action	AS	AS/IC	D	D/IC

**RE#25**

Revises Building thermal envelope section and adds five new subsections to provide more detailed requirements for building thermal envelope alterations; adds requirement for new building thermal envelope assemblies that are part of an alteration to comply with Section R402; also revises exceptions

For fenestration, Section R503.1.1.1 is renamed from Replacement fenestration and revised to add a requirements for new fenestration area added to an existing building to comply with Section R402.4

New Section R503.1.1.2 requires roof, ceiling, and attic alteration insulation to comply with Section R402.1, with approved alternative  
 Revises Building thermal envelope section and adds five new subsections to provide more detailed requirements for building thermal envelope alterations; adds requirement for new building thermal envelope assemblies that are part of an alteration to comply with Section R402; also revises exceptions

For fenestration, Section R503.1.1.1 is renamed from Replacement fenestration and revised to add a requirements for new fenestration area added to an existing building to comply with Section R402.4

New Section R503.1.1.2 requires roof, ceiling, and attic alteration insulation to comply with Section R402.1, with approved alternative design allowance for certain listed alterations where conditions prevent compliance with R402.1

New Section R503.1.1.3 specifies requirements for above-grade wall alterations, with separate requirements for exposed wall cavities, added exterior wall coverings, or for new interior finishes or exterior wall coverings

New Section R503.1.1.4 provides requirements for when floor cavities or overhangs are exposed

New Section R503.1.1.5 provides requirements for where an unconditioned below-grade space is changed to conditioned space, and for alterations to building thermal envelope walls of conditioned below-grade space

New Section R503.1.1.6 provides air barrier requirements for altered building envelope assemblies

Revises Heating and cooling systems alterations section and adds four new subsections to provide more detailed requirements for new and existing heating and cooling systems and ductwork that are part of an alteration

New Section R503.1.2.1 provides requirements for HVAC ductwork newly installed as part of an alteration

New Section R503.1.2.2 provides sizing requirements for new heating and cooling equipment that is part of an alteration

For certain listed duct system alterations, new Section R503.1.2.3 requires duct system testing and total leakage limit

New Section R503.1.2.4 provides controls requirements for new heating and cooling equipment that is part of an alteration

New section requires that with three exceptions (including for Performance and ERI compliance), substantial achieve not less than three additional energy efficiency credits

Related Mods:

RED1-185-22,  
 RED1 260-22,  
 RED1-268-22,  
 RED1-263-22,  
 RED1-277-22,  
 RED1 285-22,  
 REPI-144-21  
 REPI-145-21,  
 REPI-150-21,  
 REPI-151-21,  
 RECD1-10-22  
 REC2D-10-23

SECTION R503 ALTERATIONS

**R503.1 General.** *Alterations* to any *building* or structure shall comply with the requirements of the code for new construction, without requiring the unaltered portions of the existing building or building system to comply with this code. *Alterations* shall be such that the *existing building* or structure is not less conforming to the provisions of this code than the existing building or structure was prior to the *alteration*.

*Alterations* shall not create an unsafe or hazardous condition or overload existing building systems. *Alterations* shall be such that the existing building or structure does not use more energy than the *existing building* or structure prior to the *alteration*. *Alterations* to existing buildings shall comply with **Sections R503.1.1** through **R503.1.5**.

**R503.1.1 Building thermal envelope.** ~~Building envelope assemblies that are part of the alteration shall comply with Section R402.1.2 or R402.1.4, Sections R402.2.1 through R402.2.13, R402.4.1, R402.4.2, R402.5.3 and R402.5.4.~~ Alterations of existing building thermal envelope assemblies shall comply with this section. New building thermal envelope assemblies that are part of the alteration shall comply with **Section R402**. The *R-value* of insulation shall not be reduced, nor the *U-factor* of a building thermal envelope assembly increased as part of a building thermal envelope alteration except where the building after the alteration complies with **Section R405** or **R406**.

**Exception:** The following alterations shall not be required to comply with the requirements for new construction provided that the energy use of the building is not increased:

1. Storm windows installed over existing *fenestration*.



2. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.

3. Construction where the existing roof, wall or floor cavity is not exposed.

4.2. Roof recover.



5. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during *reroofing* shall be insulated either above or below the sheathing.

6.3. Surface-applied window film installed on existing single pane fenestration assemblies to reduce solar heat gain provided that the code does not require the glazing or fenestration assembly to be replaced.

4. Roof replacement where roof assembly insulation is integral to or located below the structural roof deck.

**R503.1.1.1 Replacement fenestration.** ~~Fenestration alterations.~~ Where some or all of an existing ~~new~~ *fenestration* area is added to an *existing building*, the new *fenestration* shall comply with **Section R402.4**. Where some or all of an existing fenestration unit is replaced with a new *fenestration* product, including sash and glazing, the replacement *fenestration* unit shall meet the applicable requirements for *U-factor* and *solar heat gain coefficient* (SHGC) as specified in **Table R402.1.3**. Where more than one replacement *fenestration* unit is to be installed, an area-weighted average of the *U-factor*, SHGC or both of all replacement fenestration units shall be an alternative that can be used to show compliance.

**R503.1.1.2 Roof, ceiling and attic alterations.** Roof, ceiling and attic insulation shall comply with **Section R402.1**. Alternatively, where limiting conditions prevent compliance with **Section R402.1**, an *approved* design that minimizes deviation from **Section R402.1** shall be provided for the following alterations:

1. An *alteration* to roof/ceiling construction other than *reroofing* where existing insulation located below the roof deck or an attic floor above *conditioned space* does not comply with **Table R402.1.3**.
2. Roof replacements or a roof *alteration* that includes removing and replacing the roof covering where the *roof assembly* includes insulation entirely above the roof deck. Where limiting conditions require use of an *approved* design to minimize deviation from **Section R402.1** for a Group R-2 *building*, a registered design professional or other *approved* source shall provide *construction documents* that identify the limiting conditions and the means to address them.
3. Conversion of an unconditioned attic space into *conditioned space*.
4. Replacement of ceiling finishes exposing cavities or surfaces of the roof/ceiling.

**R503.1.1.3 Above-grade wall alterations.** *Above-grade wall* alterations shall comply with the following as applicable:

1. Where wall cavities are exposed, the exposed cavities shall be filled with insulation complying with **Section R303.1.4**. New cavities created shall be insulated in accordance with **Section R402.1** or an *approved* design that minimizes deviation from **Section R402.1**. An interior vapor retarder shall be provided where required in accordance with **Section R702.7** of the *International Residential Code* or **Section 1404.3** of the *International Building Code*, as applicable.
2. Where exterior wall coverings and *fenestration* are added or replaced for the full extent of any exterior facade of one or more elevations of the *building*, *continuous insulation* shall be provided where required in accordance with **Section R402.1** or the wall insulation shall be in accordance with an *approved* design that minimizes deviation from **Section R402.1**. Where specified, the *continuous insulation* requirement also shall comply with **Section R702.7** of the *International Residential Code*. Replacement exterior wall coverings shall comply with the water-resistance requirements of **Section R703.1.1** of the *International Residential Code* or **Section 1402.2** of the *International Building Code*, as applicable, and manufacturers' instructions.
3. Where new interior finishes or exterior wall coverings are applied to the full extent of any exterior wall assembly of mass construction, insulation shall be provided in accordance with **Section R402.1** or an *approved* design that minimizes deviation from **Section R402.1**.

**R503.1.1.4 Floor alterations.** Where cavities in a floor or floor overhang are exposed and the floor or floor overhang is part of the *building thermal envelope*, the floor or floor overhang shall comply with **Section R402.1** or an *approved* design.

**R503.1.1.5 Below-grade wall alterations.** Where an unconditioned below-grade space is changed to *conditioned space*, the *building thermal envelope* walls enclosing such space shall be insulated in accordance with **Section R402.1**. Where the below-grade space is *conditioned space* and where *building thermal envelope* walls enclosing such space are altered, they shall be insulated in accordance with **Section R402.1**.

**R503.1.1.6 Air barrier.** Altered *building thermal envelope* assemblies shall be provided with an *air barrier* in accordance with

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap	
	X			
<b>RE#25 A</b>				
Action	AS	AS/IC	D	D/IC

FSEC – Anticipated energy impact on FBC-ER - Somewhat increased Prescriptive stringency,

**R503.1.2 Heating and cooling systems.** HVAC ducts newly installed as part of an **New heating and cooling systems and ductwork** that are part of the *alteration* shall comply with **Section R403** and this section. Alterations to existing heating and cooling systems and ductwork shall comply with this section.

**Exception:** Where ducts *ductwork* from an existing heating and cooling system are *is* extended to an **addition**.

**R503.1.2.1 Ductwork.** HVAC *ductwork* newly installed as part of an *alteration* shall comply with **Section R403**.

**Exception:** Where *ductwork* from an existing heating and cooling system is extended.

**R503.1.2.2 System sizing.** New heating and cooling equipment that is part of an *alteration* shall be sized in accordance with **Section R403.7** based on the *existing building* features as modified by the *alteration*.

**Exception:** Where it has been demonstrated to the *code official* that compliance with this section would result in heating or cooling equipment that is incompatible with the remaining portions of the existing heating or cooling system.

**R503.1.2.3 Duct system leakage.** Where an *alteration* includes any of the following, *duct systems* shall be tested in accordance with **Section R403.3.7** and shall have a total leakage less than or equal to 12.0 cubic feet per minute (339.9 L/min) per 100 square feet (9.29 m<sup>2</sup>) of *conditioned floor area*:

1. Twenty-five percent or more of the registers that are part of the *duct system* are relocated.
2. Twenty-five percent or more of the total length of all *ductwork* in the *duct system* is relocated.
3. The total length of all *ductwork* in the *duct system* is increased by 25 percent or more.

**Exception:** *Duct systems* located entirely inside a *conditioned space* in accordance with **Section R403.3.4**.

**R503.1.2.4 Controls.** New heating and cooling equipment that is part of the *alteration* shall comply with **Sections R403.1** and **R403.2**.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap	
			X	
<b>RE#25 B</b>				
Action	AS	AS/IC	D	D/IC

**R503.1.3 Service hot water systems.** New service hot water systems that are part of the *alteration* shall comply with **Section R403.5**.

**R503.1.4 Lighting.** New lighting systems that are part of the *alteration* shall comply with Section R404.1.

**Exception:** *Alterations* that replace less than 10 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.

FSEC – Anticipated energy impact on FBC-ER - From slightly decreased stringency, to based on proponent’s cost statement, somewhat increased stringency for some alterations

**R503.1.5 Additional efficiency credit requirements for substantial improvements.**

*Substantial improvements* shall comply with sufficient measures from **Table R408.2** to achieve not less than three credits.

Exceptions:

1. *Alterations* that are permitted with an *addition* complying with **Section R502.2.5**.
2. *Alterations* that comply with **Section R405** or **R406**.
3. *Substantial improvements* that do not include the *addition* or replacement of equipment covered in either **Section R403.5** or **R403.7**.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

**RE#25 C**

Action	AS	AS/IC	D	D/IC

**RE#26**

Changes “code” to “chapter” to clarify section to state that any space that is converted to a dwelling unit or portion thereof from another use or occupancy must comply with this chapter (instead of “code”); also in exception, changes “simulated performance option” to “simulated building performance option”

Related Mods:  
RED1-264-22,  
CEPI-24-21 Part II

SECTION R505

### CHANGE OF OCCUPANCY OR USE

**R505.1 General.** Any space that is converted to a *dwelling unit* or portion thereof from another use or occupancy shall comply with this ~~code~~ **chapter**.

**Exception:** Where the *simulated building performance* option in **Section R405** is used to comply with this section, the annual *energy cost* of the *proposed design* is permitted to be 110 percent of the annual *energy cost* allowed by **Section R405.2**.

**R505.1.1 Unconditioned space.** Any unconditioned or low-energy space that is altered to become a *conditioned space* shall comply with **Section R501.6**.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC

Note: Original text of mod is not consistent with that of the 2023 FEC.



**RE#27**

Related Mods:  
ADM52-22,  
REPI-13-21,  
REPI-42-21,  
REPI-43-21,  
REPI-68-21,  
REPI-70-21,  
REPI-90-21  
REPI-95-21,  
REPI-121-21,  
REPI-122-21  
RED1-315-22,  
RED1-65-22,  
RED1-7-22  
RED1-286-22,  
RECD1-2-22,  
REC2D-3-23,  
RECPI-11-21,  
RECPI-6-21,  
RECPI-7-21,  
CE2D-78-23 Part  
II,

**CHAPTER 6 [RE] REFERENCED STANDARDS**

**User notes:**

**About this chapter:** *This code contains numerous references to standards promulgated by other organizations that are used to provide requirements for materials and methods of construction. Chapter 6 contains a comprehensive list of all standards that are referenced in this code. These standards, in essence, are part of this code to the extent of the reference to the standard.*

<i>This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the</i>
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referenced standards shall be as specified in

## AAMA

AMERICAN ARCHITECTURAL MANUFACTURERS

Association  
1827 Walden Office Square  
Suite 550  
Schaumburg, IL 60173-4268

**AAMA/WDMA/CSA 101/I.S.2/A440—17:: North American Fenestration Standard/Specification for Windows, Doors, and Skylights**

R402.5.3

## ACCA

Air Conditioning Contractors of America  
1330 Braddock Place, Suite 350  
Alexandria, VA 22314

**ANSI/ACCA 1 Manual D—2023: Residential Duct Systems**

R403.3.1

**ANSI/ACCA 2 Manual J—2016: Residential Load Calculation**

R403.7

**ANSI/ACCA 3 Manual S—2014/2023: Residential Equipment Selection**

R403.7

**ANSI/ACCA 5 QI - 2010: HVAC Quality Installation Specification**

R408.2.4

## AHRI

Air-Conditioning, Heating, and Refrigeration  
Institute  
2311 Wilson Blvd, Suite 400  
Arlington, VA 22201

**1380—2019: Demand Response through Variable Capacity HVAC Systems in Residential and Small Commercial Applications**

R408.2.8.2

## AISI

American Iron and Steel Institute  
25 Massachusetts Avenue, NW, Suite 800  
Washington, DC 20001

**AISI S250—22: North American Standard for Thermal Transmittance of Building Envelopes with Cold-Formed Steel Framing, with Supplement 1, Dated 2022**

R402.2.7

## ANSI

American National Standards Institute  
25 West 43rd Street, 4th Floor  
New York, NY 10036

**ANSI Z21.20—2005 (R2016): Automatic Gas Ignition Systems And Components**

R403.13R404.1.5

**ANSI/AMCA 210-ANSI/ASHRAE 51—23: Laboratory Methods of Testing Fans for Aerodynamic Performance Rating Table R403.6.2**

**ANSI/ASHRAE 140—2017 (2020): Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs**

R405.5.2R406.7.1

ANSI/CTA 2045-B—February 2021: [Modular Communications Interface for Energy Management](#)  
Table R403.5.4R408.2.8.1

CSA/ANSI Z21.88—19/CSA 2.33—19: [Vented Gas Fireplace Heaters](#)  
R403.13.1

Z21.50-19/CSA 2.22—2019: [Vented Decorative Gas Appliances](#)  
R403.13.1

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## ASHRAE

ASHRAE  
180 Technology Parkway NW  
Peachtree Corners, GA 30092

ANSI/ASHRAE/IES 90.1—2022: [Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings](#)  
R402.1.5R402.2.10.2R402.2.11.2R405.2

ASHRAE 193—2010(RA 2014): [Method of Test for Determining the Airtightness of HVAC Equipment](#)  
R403.3.6.1

ASHRAE—2001: 2001 ASHRAE Handbook of Fundamentals  
Table R405.4.2(1)

ASHRAE—2017: 2017 ASHRAE Handbook of Fundamentals  
R402.1.5R403.3.1R405.4.2Table R405.4.2(1)

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## ASTM

ASTM International  
100 Barr Harbor Drive, P.O. Box C700  
West Conshohocken, PA 19428-2959

C1313/C1313M—13(2019): [Standard Specification for Sheet Radiant Barriers for Building Construction Applications](#)

R303.2.2

C1363—14:19: [Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus](#)

R303.1.4.1

C1371—15(2022): [Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emitters](#)

Table R407.2R408.2.1.3

C1549—16(2022): [Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer](#)

Table R407.2R408.2.1.3R408.2.1.3.1

C1743—19: [Standard Practice for Installation and Use of Radiant Barrier Systems \(RBS\) in Residential Building Construction](#)

R303.2.2R402.3

E283/E283M—2004(2012)19: [Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen](#)  
R402.5.4

E408—13(2019): [Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques](#)

Table R407.2R408.2.1.3

E779—2010(2018)19: [Standard Test Method for Determining Air Leakage Rate by Fan Pressurization](#)  
R402.5.1.2R402.5.1.3

E903—20: [Standard Test Method for Solar Absorptance, Reflectance and Transmittance of Materials Using Integrating Spheres \(Withdrawn 2005\)](#)

Table R407.2R408.2.1.3R408.2.1.3.1

E1554/E1554M—E2013(2018): [Standard Test Methods for Determining Air Leakage of Air Distribution Systems by Fan Pressurization](#)

R403.3.7R403.3.8Table R405.4.2(1)

E1827—2011(2017)22: [Standard Test Methods for Determining Airtightness of Building Using an Orifice Blower Door](#)

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R402.5.1.2

E1918—21: Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field

Table R407.2R408.2.1.3R408.2.1.3.1

E1980—11(2019): Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces

Table R407.2R408.2.1.3

E2178—201321a: Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permanence of Building Materials

R303.1.5

E3158—18: Standard Test Method for Measuring the Air Leakage Rate of a Large or Multizone Building

R402.5.1.2

F1281—2017(2021)e1: Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene Pipe and Tubing

Table R408.2.3.1

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## CRRC

Cool Roof Rating Council  
2435 North Lombard Street  
Portland, OR 97217

ANSI/CRRC S100—2021: Standard Test Methods for Determining Radiative Properties of Materials

Table R407.2R408.2.1.3R408.2.1.3.1

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## CSA

CSA Group  
8501 East Pleasant Valley Road  
Cleveland, OH 44131-5516

AAMA/WDMA/CSA 101/I.S.2/A440—4722: North American Fenestration Standard/Specification for Windows, Doors, and Unit Skylights

R402.5.3

CAN/CSA C439—18: Laboratory Methods of Test for Rating the Performance of Heat/Energy-Recovery Ventilators

Table R403.6.2

CSA B55.1—2045: Test Method for Measuring Efficiency and Pressure Loss of Drain Water Heat Recovery Units

R403.5.3

CSA B55.2—2045: Drain Water Heat Recovery Units

R403.5.3

CSA P.4.1—21: Testing Method for Measuring Fireplace Efficiency

R403.13.1

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## CTA

Consumer Technology Association  
Technology & Standards Department, 1919 S  
Eads Street  
Arlington, VA 22202

ANSI/CTA-2045-A—2018: Modular Communications Interface for Energy Management

Table R403.5.4R408.2.8.1

ANSI/CTA-2045-B—2018: Modular Communications Interface for Energy Management

Table R403.5.4R408.2.8.1

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## DASMA

Door & Access Systems Manufacturers  
Association  
1300 Sumner Avenue  
Cleveland, OH 44115-2851

ANSI/DASMA 105—20172020: Test Method for Thermal Transmittance and Air Infiltration of Garage Doors and Rolling Doors

R303.1.3

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## DOE

US Department of Energy  
1000 Independence Avenue SW  
Washington, DC 20585

10 CFR, Part 430—2021: Energy Conservation Program for Consumer Products: Energy and Water Conservation Standards and Their Compliance Dates

Table R403.6.2R404.1Table R405.4.2(1)Table R408.2.6

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## FGIA

Fenestration & Glazing Industry Alliance  
(formerly American Architectural Manufacturers Association)  
1900 E Golf Road, Suite 250  
Schaumburg, IL 60173-4268

AAMA/WDMA/CSA 101/I.S.2/A440—22: North American Fenestration Standard/Specification for Windows, Doors, and Skylights

R402.5.3

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## HVI

Home Ventilating Institute  
1740 Dell Range Blvd., Ste H, PMB 450  
Cheyenne, WY 82009

916—18: Airflow Test Procedure

Table R403.6.2

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## ICC

International Code Council, Inc.  
200 Massachusetts Avenue, NW, Suite 250  
Washington, DC 20001

ANSI/APSP/ICC 14—2019: American National Standard for Portable Electric Spa Energy Efficiency  
R403.11

ANSI/APSP/PHTA/ICC 15a—20202021: American National Standard for Residential Swimming Pool and Spa Energy Efficiency

R403.12

ANSI/RESNET/ICC 301—20192022: Standard for the Calculation and Labeling of the Energy Performance of Dwelling and Sleeping Units Using an Energy Rating Index—includes Addendum A, Approved July 28, 2022, and Addendum B, Approved October 12, 2022

R405.5.3R406.4R406.5R406.7.1R406.7.6

ANSI/RESNET/ICC 380—20192022: Standard for Testing Airtightness of Building, Dwelling Unit and Sleeping Unit Enclosures; Airtightness of Heating and Cooling Air Distribution Systems, and Airflow of Mechanical Ventilation Systems

R402.5.1.2R403.3.7R403.3.8R403.6.3Table R405.4.2(1)

IBC—2424: International Building Code®

R201.3R202R303.1.1R303.1.2R303.2R402.1.1R402.2.11.1R404.1.2R501.2R501.4R503.1.1.3

ICC 400—4722: Standard on the Design and Construction of Log Structures

R402.1Table R402.5.1.1

ICC 500—20: ICC/NSSA Standard for the Design and Construction of Storm Shelters

R402.6

IEBC—2424: International Existing Building Code®

R501.2

IECC—06: 2006 International Energy Conservation Code®

R202

IFC—2424: International Fire Code®

R201.3R404.6.2.3R501.2

IFGC—2424: International Fuel Gas Code®

R201.3R501.2

IMC—2424: International Mechanical Code®

R201.3 R403.3.5 R403.3.6R403.6R501.2

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IPC—2124: International Plumbing Code®  
R201.3R501.2

IPMC—2124: International Property Maintenance Code®  
R501.2

IPSDC—2124: International Private Sewage Disposal Code®  
R501.2

IRC—2124: International Residential Code®  
R201.3R303.1.1R303.1.2R303.1.6R303.2R402.1.1Table R402.1.2Table  
R402.1.3R402.1.6R402.2.10.1 R402.2.11.1R402.2.11.1Table R402.5.1.1 R403.3.5  
R403.3.6R403.6R404.6.1.1R501.2R501.4R503.1.1.3

## IEC

IEC Regional Centre for North America  
446 Main Street, 16th Floor  
Worcester, MA 01608

IEC 62746-10-1—2018: Systems interface between customer energy management system and the power management system – Part 10-1: Open automated demand response  
R408.2.8.1

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## IEEE

Institute of Electrical and Electronics Engineers,  
Inc.  
3 Park Avenue, 17th Floor  
New York, NY 10016-5997

515.1—2012: IEEE Standard for the Testing, Design, Installation and Maintenance of Electrical Resistance Trace Heating for Commercial Applications  
R403.5.1.2

## NEMA

National Electrical Manufacturers Association  
1300 17th Street N #900  
Arlington, VA 22209

OS 4—2016: Requirements for Air-Sealed Boxes for Electrical and Communication Applications  
R402.5.5

## NFPA

National Fire Protection Association  
1 Batterymarch Park  
Quincy, MA 02169-7471

70—2023: National Electrical Code  
RL101.2.4 RL101.2.5R501.2

## NFRC

National Fenestration Rating Council, Inc.  
6305 Ivy Lane, Suite 140  
Greenbelt, MD 20770

100—2020/2023: Procedure for Determining Fenestration Products U-Factors  
R303.1.3

200—2020/2023: Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence  
R303.1.3

400—2020/2023: Procedure for Determining Fenestration Product Air Leakage  
R402.5.3

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## OpenADR

OpenADR Alliance  
111 Deerwood Road, Suite 200  
San Ramon, CA 94583

OpenADR 2.0a and 2.0b—2019: Profile Specification Distributed Energy Resources

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R408.2.8.1

## APSP PHTA

Pool & Tub Alliance (formerly the APSP)  
1650 King Street, Suite 602  
Alexandria, VA 22314

ANSI/APSP/ICC 14—2019: American National Standard for Portable Electric Spa Energy Efficiency  
R403.11

ANSI/APSP/ICC 15a—2014/2021: American National Standard for Residential Swimming Pool and Spas—Includes Addenda A, Approved January 9, 2013 Spa Energy Efficiency  
R403.12

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## RESNET

Residential Energy Services Network, Inc.  
P.O. Box 4561  
Oceanside, CA 92052-4561

ANSI/RESNET/ICC 301—2019/2022: Standard for the Calculation and Labeling of the Energy Performance of Dwelling and Sleeping Units using an Energy Rating Index—includes Addendum A, Approved July 28, 2022, and Addendum B, Approved October 12, 2022  
R405.5.3R406.4R406.5R406.7.1R406.7.6

ANSI/RESNET/ICC 380—2019/2022: Standard for Testing Airtightness of Building, Dwelling Unit and Sleeping Unit Enclosures; Airtightness of Heating and Cooling Air Distribution Systems, and Airflow of Mechanical Ventilation Systems  
R402.5.1.2 R403.3.7R403.3.8R403.6.3Table R405.4.2(1)

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## UL

UL LLC  
333 Pfingsten Road  
Northbrook, IL 60062

127—2011: Standard for Factory-Built Fireplaces—with Revisions through July 2016 February 2020  
R402.5.2

515—2015: ~~Standard for~~ Electrical Resistance Trace Heating for Commercial Applications  
R403.5.1.2

## US-FTC

United States-Federal Trade Commission  
600 Pennsylvania Avenue NW  
Washington, DC 20580

CFR Title 16 (2015): R-Value Rule  
R303.1.4

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## WDMA

Window & Door Manufacturers Association  
2001 K Street NW, 3rd Floor North  
Washington, DC 20006

AAMA/WDMA/CSA 101/I.S.2/A440—4722: North American Fenestration Standard/Specification for windows, doors, and skylights  
R402.5.3

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Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

  

Action	AS	AS/IC	D	D/IC

**RE#28**

Related Mods:  
ADM43-19 Part IV

APPENDIX RA BOARD OF APPEALS—RESIDENTIAL

*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*

User notes:

**About this appendix:** *Appendix RA provides criteria for board of appeals members. Also provided are procedures by which the board of appeals should conduct its business.*

SECTION RA101 GENERAL

**RA101.1 Scope.** A board of appeals shall be established within the jurisdiction for the purpose of hearing applications for modification of the requirements of this code pursuant to the provisions of **Section R109**. The board shall be established and operated in accordance with this section, and shall be authorized to hear evidence from appellants and the *code official* pertaining to the application and intent of this code for the purpose of issuing orders pursuant to these provisions.

**RA101.2 Application for appeal.** Any person shall have the right to appeal a decision of the *code official* to the board. An application for appeal shall be based on a claim that the intent of this code or the rules legally adopted hereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. The application shall be filed on a form obtained from the *code official* within 20 days after the notice was served.

**RA101.2.1 Limitation of authority.** The board shall not have authority to waive requirements of this code or interpret the administration of this code.

**RA101.2.2 Stays of enforcement.** Appeals of notice and orders, other than Imminent Danger notices, shall stay the enforcement of the notice and order until the appeal is heard by the board.

**RA101.3 Membership of board.** The board shall consist of five voting members appointed by the chief appointing authority of the jurisdiction. Each member shall serve for **[INSERT NUMBER OF YEARS]** years or until a successor has been appointed. The board members' terms shall be staggered at intervals, so as to provide continuity. The *code official* shall be an ex officio member of said board but shall not vote on any matter before the board.

**RA101.3.1 Qualifications.** The board shall consist of five individuals, who are qualified by experience and training to pass on matters pertaining to building construction and are not employees of the jurisdiction.

**RA101.3.2 Alternate members.** The chief appointing authority is authorized to appoint two alternate members who shall be called by the board chairperson to hear appeals during the absence or disqualification of a member. Alternate members shall possess the qualifications required for board membership, and shall be appointed for the same term or until a successor has been appointed.

**RA101.3.3 Vacancies.** Vacancies shall be filled for an unexpired term in the same manner in which original appointments are required to be made.

**RA101.3.4 Chairperson.** The board shall annually select one of its members to serve as chairperson.

**RA101.3.5 Secretary.** The chief appointing authority shall designate a qualified clerk to serve as secretary to the board. The secretary shall file a detailed record of all proceedings, which shall set forth the reasons for the board's decision, the vote of each member, the absence of a member and any failure of a member to vote.

**RA101.3.6 Conflict of interest.** A member with any personal, professional or financial interest in a matter before the board shall declare such interest and refrain from participating in discussions, deliberations and voting on such matters.

**RA101.3.7 Compensation of members.** Compensation of members shall be determined by law.

**RA101.3.8 Removal from the board.** A member shall be removed from the board prior to the end of their term only for cause. Any member with continued absence from regular meeting of the board may be removed at the discretion of the chief appointing authority.

**RA101.4 Rules and procedures.** The board shall establish policies and procedures necessary to carry out its duties consistent with the provisions of this code and applicable state law. The procedures shall not require compliance with strict rules of evidence, but shall mandate that only relevant information be presented.

**RA101.5 Notice of meeting.** The board shall meet upon notice from the chairperson, within 10 days of the filing of an appeal or at stated periodic intervals.

**RA101.5.1 Open hearing.** All hearings before the board shall be open to the public. The appellant, the appellant's representative, the *code official* and any person whose interests are affected shall be given an opportunity to be heard.

**RA101.5.2 Quorum.** Three members of the board shall constitute a quorum.

**RA101.5.3 Postponed hearing.** When five members are not present to hear an appeal, either the appellant or the appellant's representative shall have the right to request a postponement of the hearing.

**RA101.6 Legal counsel.** The jurisdiction shall furnish legal counsel to the board to provide members with general legal advice concerning matters before them for consideration. Members shall be represented by legal counsel at the jurisdiction's expense in all matters arising from service within the scope of their duties.

**RA101.7 Board decision.** The board shall only modify or reverse the decision of the *code official* by a concurring vote of three or more members.

**RA101.7.1 Resolution.** The decision of the board shall be by resolution. Every decision shall be promptly filed in writing in the office of the *code official* within 3 days and shall be open to the public for inspection. A certified copy shall be furnished to the appellant or the appellant's representative and to the *code official*.

**RA101.7.2 Administration.** The *code official* shall take immediate action in accordance with the decision of the board.

**RA101.8 Court review.** Any person, whether or not a previous party of the appeal, shall have the right to apply to the appropriate court for a writ of certiorari to correct errors of law. Application for review shall be made in the manner and time required by law following the filing of the decision in the office of the chief administrative officer.

APPENDIX RB SOLAR-READY PROVISIONS—DETACHED ONE- AND TWO-FAMILY DWELLINGS  
AND TOWNHOUSES

*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*

User notes:

**About this appendix:** *Harnessing the heat or radiation from the sun's rays is a method to reduce the energy consumption of a building. Although Appendix RB does not require solar systems to be installed for a building, it does require the space(s) for installing such systems, providing pathways for connections and requiring adequate structural capacity of roof systems to support the systems.*

## SECTION RB101 SCOPE

**RB101.1 General.** These provisions shall be applicable for new construction where solar-ready provisions are required.

## SECTION RB102 GENERAL DEFINITION

**SOLAR-READY ZONE.** A section or sections of the roof or building overhang designated and reserved for the future installation of a solar photovoltaic or solar thermal system.

## SECTION RB103 SOLAR-READY ZONE

**RB103.1 General.** New detached one- and two-family dwellings, and townhouses with not less than 600 square feet (55.74 m<sup>2</sup>) of roof area oriented between 110 degrees and 270 degrees of true north shall comply with **Sections RB103.2** through **RB103.8**.

Exceptions:

1. New residential buildings with a permanently installed *on-site renewable energy* system.
2. A *building* where all areas of the roof that would otherwise meet the requirements of **Section RB103** are in full or partial shade for more than 70 percent of daylight hours annually.

**RB103.2 Construction document requirements for solar-ready zone.** *Construction documents* shall indicate the *solar-ready zone* .

**RB103.3 Solar-ready zone area.** The total *solar-ready zone* area shall be not less than 300 square feet (27.87 m<sup>2</sup>) exclusive of mandatory access or setback areas as required by the **International Fire Code**. New townhouses three stories or less in height above *grade plane* and with a total floor area less than or equal to 2,000 square feet (185.8 m<sup>2</sup>) per dwelling shall have a *solar-ready zone* area of not less than 150 square feet (13.94 m<sup>2</sup>). The *solar-ready zone* shall be composed of areas not less than 5 feet (1524 mm) in width and not less than 80 square feet (7.44 m<sup>2</sup>) exclusive of access or setback areas as required by the **International Fire Code**.

**RB103.4 Obstructions.** *Solar-ready zones* shall be free from obstructions, including but not limited to vents, chimneys, and roof-mounted equipment.

**RB103.5 Shading.** The *solar-ready zone* shall be set back from any existing or new permanently affixed object on the *building* or site that is located south, east or west of the solar zone a distance

not less than two times the object's height above the nearest point on the roof surface. Such objects include, but are not limited to, taller portions of the *building* itself, parapets, chimneys, antennas, signage, rooftop equipment, trees and roof plantings.

**RB103.6 Capped roof penetration sleeve.** A capped roof penetration sleeve shall be provided adjacent to a *solar-ready zone* located on a roof slope of not greater than 1 unit vertical in 12 units horizontal (8-percent slope). The capped roof penetration sleeve shall be sized to accommodate the future photovoltaic system conduit, but shall have an inside diameter of not less than 1<sup>1</sup>/<sub>4</sub> inches (32 mm).

**RB103.7 Roof load documentation.** The structural design loads for roof dead load and roof live load shall be clearly indicated on the *construction documents* .

**RB103.8 Interconnection pathway.** *Construction documents* shall indicate pathways for routing of conduit or plumbing from the *solar-ready zone* to the electrical service panel or service hot water system.

**RB103.9 Electrical service reserved space.** The main electrical service panel shall have a reserved space to allow installation of a dual pole circuit breaker for future solar electric installation and shall be labeled "For Future Solar Electric." The reserved space shall be positioned at the opposite (load) end from the input feeder location or main circuit location.

**RB103.10 Construction documentation certificate.** A permanent certificate, indicating the *solar-ready zone* and other requirements of this section, shall be posted near the electrical distribution panel, water heater or other conspicuous location by the builder or registered design professional.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

  

Action	AS	AS/IC	D	D/IC

**RE#29**

Extensively revises appendix which provides requirements for zero energy residential buildings based on Energy Rating Index; revisions include changes to appendix title, new definitions section, revised calculations, and decreased maximum Energy Rating Index values not including renewable energy

Related Mods:  
REPI-154-21,  
REPI-153-21,  
REPI-158-21,  
REPI 160-21,  
REPI 161-21,  
RECPI 11-21,  
RED1-1-22

**APPENDIX RC ZERO NET ENERGY RESIDENTIAL BUILDING PROVISIONS**

*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*

User notes:

**About this appendix:** This appendix provides requirements for residential buildings intended to result in zero net energy consumption over the course of a year. Where adopted by ordinance as a requirement, **Sections RC101.1, RC101.2, RC103.2, RC103.4 and RC103.5** are intended to replace **Sections R401.1, R401.2, R406.2, R406.4 and R406.5**, respectively. Where adopted by ordinance as a requirement, **Sections R401.3** (Certificate), **R406.1** (Scope), **R406.3** (Building thermal envelope ), **R406.6** (Verification by approved agency) and **R406.7** (Documentation) are not replaced.

**SECTION RC101 COMPLIANCE GENERAL**

**RC101.1 Scope.** This appendix applies to new residential buildings.

~~**RC101.2 Scope** [no change, same as R406.1]~~

**RC101.2 Application.** Residential buildings shall comply with **Section R406**.

**Exception:** Additions, alterations, repairs and changes of occupancy to existing buildings complying with **Chapter 5**.

**RC101.3 Certificate.** (No change, same as **Section R401.3**.)

**SECTION RC102 GENERAL DEFINITIONS**

**COMMUNITY RENEWABLE ENERGY FACILITY (CREF).** A facility that produces energy from *renewable energy resources* and that is qualified as a community energy facility under applicable jurisdictional statutes and rules.

**FINANCIAL RENEWABLE ENERGY POWER PURCHASE AGREEMENT (FPPA).** A financial arrangement between a renewable electricity generator and a purchaser wherein the purchaser pays or guarantees a price to the generator for the project's renewable generation. Also known as a financial power purchase agreement and virtual power purchase agreement.

**PHYSICAL RENEWABLE ENERGY POWER PURCHASE AGREEMENT (PPPA).** A contract for the purchase of renewable electricity from a specific renewable electricity generator by a purchaser of renewable electricity.

## ZERO NET ENERGY RESIDENTIAL BUILDINGS

**RC103.1 Scope.** (No change, same as **Section R406.1**.)

**RC103.2 ERI compliance.** Compliance based on the ERI requires that the *rated design* meets one of the following:

1. The requirements of the sections indicated within **Table R406.2** and **Sections R406.3** through **R406.7**, or
2. The requirements of **ASHRAE/IES Standard 90.2**, including:
  - 2.1. The ERI requirements of **ASHRAE/IES Standard 90.2** Table 6-1 without the use of on-site power production (OPP).
  - 2.2. The requirements of **Sections R402.5.1.1, R402.5.1.2, and R406.3**.
  - 2.3. The maximum ERI including adjusted OPP of **Table RC103.5** determined in accordance with **Section RC103.4**.

**RC103.3 Building thermal envelope.** (No change, same as **Section R406.3**.)

**RC103.4 Energy Rating Index.** The *Energy Rating Index* (ERI) not including *renewable energy resources* shall be determined in accordance with **ANSI/RESNET/ICC 301**. The ERI including *renewable energy resources* shall be determined in accordance with **ANSI/RESNET/ICC 301**, except where electrical energy is provided from a community renewable energy facility (CREF) or contracted from a physical or financial renewable energy power purchase agreement that meets requirements of **Section RC103.4.1**, on-site power production (OPP) shall be adjusted in accordance with **Equation RC-1**.

$$\text{Adjusted OPP} = \text{OPP}_{\text{kWh}} + \text{CREF}_{\text{kWh}} + \text{PPPA}_{\text{kWh}} + \text{FPPA}_{\text{kWh}}$$

Equation RC-1

$$\text{Adjusted OPP} = \text{OPP}_{\text{kWh}} + \text{CREF}_{\text{kWh}} + \text{PPPA}_{\text{kWh}} + \text{FPPA}_{\text{kWh}}$$

where:

$\text{OPP}_{\text{kWh}}$  = Annual electrical energy from *on-site renewable energy*, in units of kilowatt-hours (kWh).

$\text{CREF}_{\text{kWh}}$  = Annual electrical energy from a community renewable energy facility (CREF), in units of kilowatt-hours (kWh).

$\text{PPPA}_{\text{kWh}}$  = Where not included as OPP, the annual electrical energy contracted from a physical renewable energy power purchase agreement, in units of kilowatt-hours (kWh).

$\text{FPPA}_{\text{kWh}}$  = Where not included as OPP, the annual electrical energy contracted from a financial renewable energy power purchase agreement (FPPA), in units of kilowatt-hours (kWh).

**RC103.4.1 Renewable energy contract.** The renewable energy shall be delivered or credited to the *building site* under an energy contract with a duration of not less than 15 years. The contract shall be structured to survive a partial or full transfer of ownership of the building property.

**RC103.5 ERI-based compliance.** Compliance based on an ERI analysis requires that the *rated design* and confirmed built dwelling be shown to have an ERI less than or equal to both values indicated in **Table RC103.5** when compared to the *ERI reference design*.

RC102.2 TABLE RC103.5 MAXIMUM ENERGY RATING INDEX<sup>a</sup> =

CLIMATE ZONE	ENERGY RATING INDEX NOT INCLUDING OPP <del>RENEWABLE ENERGY</del>	ENERGY RATING INDEX INCLUDING ADJUSTED OPP <del>(as proposed)</del>
0	42	0
1	4342	0
2	4542	0
3	4742	0
4	4742	0
5	4742	0
6	4642	0
7	4642	0
8	4642	0

**RC103.6 Verification by approved agency.**

(No change, same as **Section R406.6.**)

**RC103.7 Documentation.** (No change, same as **Section R406.7.**)

**Note:** Original text of mod is not consistent with that of the 2023 FEC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X
<b>RE#29 A</b>			
Action	AS	AS/IC	D
			D/IC

SECTION RC104 REFERENCED STANDARDS

**RC104.1 General.** See **Table RC104.1** for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard

**TABLE RC104.1  
REFERENCED STANDARDS**

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
ASHRAE/ IES 90.2— 2018	<i>Energy-Efficient Design of Low-Rise Residential Buildings, including approved addenda [Addenda A (approved Jan 2021), B (June 2021) and D (February 2022)]</i>	<b>RC103.2</b>

Note: Original text of mod is not consistent with that of the 2023 FEC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

**RE#29 B**

Action	AS	AS/IC	D	D/IC

**RE#30**

New appendix provides electric energy storage readiness provision requirements, with applicability for new construction with solar-ready measures or on-site PV system requirements

Related Mods:  
REPI-33-21

APPENDIX RD ELECTRIC ENERGY STORAGE PROVISIONS

*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*

User notes:

**About this appendix:** *This voluntary appendix provides requirements for electric energy storage readiness provisions.*

SECTION RD101 SCOPE

**RD101.1 General.** These provisions shall be applicable for new construction where solar-ready measures or an on-site solar PV system are required.

SECTION RD102 GENERAL DEFINITION

**ENERGY STORAGE SYSTEM (ESS).** One or more devices, assembled together, capable of storing energy in order to supply electrical energy at a future time.

SECTION RD103 ELECTRICAL ENERGY STORAGE

**RD103.1 Electrical energy storage.** One- and two-family *dwellings*, townhouse units and Group R-3 occupancies shall comply with either **Section RD103.2** or **RD103.3**. *Buildings* with Group R-2 and R-4 occupancies shall comply with **Section RD103.4**.

**RD103.2 Electrical energy storage energy capacity.** Each *building* shall have an *ESS* with a rated energy capacity of not less than 5 kWh with not fewer than four *ESS*-supplied branch circuits.



**RD103.3 Electrical energy storage system readiness.** Each *building* shall be energy-storage ready in accordance with **Sections RD103.3.1 through RD103.3.4.**

**RD103.3.1 Energy storage system space.** Interior or exterior space with dimensions and locations in accordance with **Section R330** of the *International Residential Code* and Section 110.26 of **NFPA 70** shall be reserved to allow for the future installation of an *ESS*.

**RD103.3.2 System isolation equipment space.** Space shall be reserved to allow for the future installation of a transfer switch within 3 feet (305 mm) of the main panelboard. Raceways shall be installed between the panelboard and the transfer switch location to allow the connection of an *ESS*.

**RD103.3.3 Panelboard with backed-up load circuits.** A dedicated raceway shall be provided from the main service to a panelboard that supplies the branch circuits served by the *ESS*. All branch circuits are permitted to be supplied by the main service panel prior to the installation of an *ESS*. The trade size of the raceway shall be not less than 1 inch (25 mm). The panelboard that supplies the branch circuits shall be labeled, "Subpanel reserved for future battery energy storage system to supply essential loads."

**RD103.3.4 Branch circuits served by the ESS.** Not fewer than four branch circuits shall be identified and have their source of supply collocated at a single panelboard supplied by the *ESS*. The following end uses shall be served by the branch circuits:

1. A refrigerator.
2. One lighting circuit near the primary egress.
3. A sleeping room receptacle outlet.

**RD103.4 Electrical energy storage system.** *Buildings* with Group R-2 and R-4 occupancies shall comply with **Section C405.15.**

- 4.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

  

Action	AS	AS/IC	D	D/IC

**RE#31** New appendix provides electric vehicle charging infrastructure requirements for adopting jurisdictions

Related Mods:  
REPI-33-21,  
RED1-145-22,  
RED1-154-22,  
RED1-157-22,  
RE2D-20-23,

**APPENDIX RE ELECTRIC VEHICLE CHARGING INFRASTRUCTURE**

*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*

User notes:

**About this appendix:** *This appendix provides requirements for electric vehicle charging infrastructure for adopting jurisdictions.*

**SECTION RE101**

**ELECTRIC VEHICLE POWER TRANSFER**

RE101.1 Definitions.

**AUTOMOBILE PARKING SPACE.** A space within a building or private or public parking lot, exclusive of driveways, ramps, columns, office and work areas, for the parking of an automobile.

**ELECTRIC VEHICLE (EV).** An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, neighborhood electric vehicles and electric motorcycles, primarily powered by an electric motor that draws current from a building electrical service, electric vehicle supply equipment (EVSE), a rechargeable storage battery, a fuel cell, a photovoltaic array or another source of electric current.

**ELECTRIC VEHICLE CAPABLE SPACE (EV CAPABLE SPACE).** A designated automobile parking space that is provided with electrical infrastructure such as, but not limited to, raceways, cables, electrical capacity, a panelboard or other electrical distribution equipment space necessary for the future installation of an EVSE

**ELECTRIC VEHICLE READY SPACE (EV READY SPACE).** An automobile parking space that is provided with a branch circuit and an outlet, junction box or receptacle that will support an installed EVSE

**ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE).** Equipment for plug-in power transfer, including: ungrounded, grounded and equipment grounding conductors; electric vehicle connectors; attached plugs; any personal protection system; and all other fittings, devices, power outlets or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the electric vehicle.

**ELECTRIC VEHICLE SUPPLY EQUIPMENT INSTALLED SPACE (EVSE SPACE).** An automobile parking space that is provided with a dedicated EVSE connection.

**RE101.2 Electric vehicle power transfer infrastructure.** New residential *automobile parking spaces* for residential *buildings* shall be provided with *electric vehicle power transfer infrastructure* in accordance with **Sections RE101.2.1** through **RE101.2.5**.

**RE101.2.1 Quantity.** New one- and two-family dwellings and townhouses with a designated attached or detached garage or other on-site private parking provided adjacent to the *dwelling unit* shall be provided with one EV capable, EV ready or EVSEspace per *dwelling unit*. R-2 occupancies or allocated parking for R-2 occupancies in mixed-use *buildings* shall be provided with an *EV capable space*, *EV ready space* or *EVSEspace* for 40 percent of the *dwelling units* or *automobile parking spaces*, whichever is less.

Exceptions:

1. Where the local electric distribution entity certifies in writing that it is not able to provide 100 percent of the necessary distribution capacity within 2 years after the estimated certificate of occupancy date, the required EV charging infrastructure shall be reduced based on the available existing electric distribution capacity.
2. Where substantiation is *approved* that meeting the requirements of **Section RE101.2.5** will alter the local utility infrastructure design requirements on the utility side of the meter so as to increase the utility side cost to the builder or developer by more than \$450 per *dwelling unit*.

**RE101.2.2 EV capable spaces.** Each *EV capable space* used to meet the requirements of **Section RE101.2.1** shall comply with all of the following:

1. A continuous raceway or cable assembly shall be installed between a suitable panelboard or other on-site electrical distribution equipment and an enclosure or outlet located within 6 feet (1828 mm) of the *EV capable space*.
2. The installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with **Section RE101.2.5**.
3. The electrical distribution equipment to which the raceway or cable assembly connects shall have sufficient dedicated space and spare electrical capacity for a two-pole circuit breaker or set of fuses.

4. The electrical enclosure or outlet and the electrical distribution equipment directory shall be marked: "For future electric vehicle supply equipment (EVSE)."

**RE101.2.3 EV ready spaces.** Each branch circuit serving *EV ready spaces* shall comply with all of the following:

1. Termination at an outlet or enclosure, located within 6 feet ( 1828 mm) of each *EV ready space* it serves and marked "For electric vehicle supply equipment (EVSE)."
2. Service by an electrical distribution system and circuit capacity in accordance with Section RE101.2.5.
3. Designation on the panelboard or other electrical distribution equipment directory as "For electric vehicle supply equipment (EVSE)."

**RE101.2.4 EVSE spaces.** An installed EVSE with multiple output connections shall be permitted to serve multiple EVSE spaces. Each EVSE serving either a single EVSE space or multiple EVSE spaces shall comply with the following:

1. Be served by an electrical distribution system in accordance with **Section RE101.2.5**.
2. Have a nameplate charging capacity of not less than 6.2 kVA (or 30A at 208/240V) per *EVSEspace* served. Where an *EVSE* serves three or more *EVSEspaces* and is controlled by an energy management system in accordance with **Section RE101.2.5**, the nameplate charging capacity shall be not less than 2.1 kVA per *EVSEspace* served.
3. Be located within 6 feet (1828 mm) of each *EVSE* space it serves.
4. Be installed in accordance with **NFPA 70** and be *listed* and *labeled* in accordance with **UL 2202** or **UL 2594**.

**RE101.2.5 Electrical distribution system capacity.** The branch circuits and electrical distribution system serving each EV capable space, EV ready space and EVSE space used to comply with **Section RE101.2.1** shall comply with one of the following:

1. Sized for a calculated EV charging load of not less than 6.2 kVA per *EVSE*, *EV ready* or *EV capable space*. Where a circuit is shared or managed, it shall be in accordance with **NFPA 70**.
2. The capacity of the electrical distribution system and each branch circuit serving multiple *EVSE* spaces, *EV ready spaces* or *EV capable spaces* designed to be controlled by an energy management system in accordance with **NFPA 70** shall be sized for a calculated EV charging load of not less than 2.1 kVA per space. Where an energy management system is used to control EV charging loads for the purposes of this section, it shall not be configured to turn off electrical power to *EVSE* or *EV ready spaces* used to comply with **Section RE101.2.1**.

#### SECTION RE102 REFERENCED STANDARDS

**RE102.1 General.** See **Table RE102.1** for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

TABLE RE102.1 REFERENCED STANDARDS

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
UL 2202—2009 UL 2594—2016	<i>Electric Vehicle (EV) Charging System Equipment—with revisions through February 2018</i>	RE101.2.4
	<i>Standard for Electric Vehicle Supply Equipment</i>	RE101.2.4

Note: This appendix is already part of the 2023 FEC,

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

  

Action	AS	AS/IC	D	D/IC

**RE#32**

New resource provides code compliance pathways for residential buildings intended to result in all-electric buildings (not permit combustion equipment in buildings), with application for adopting jurisdictions or individual projects

Related Mods:  
REPI-155-21,  
IRCEAPP-01-24,

RESOURCE RRA ALL-ELECTRIC RESIDENTIAL BUILDINGS

*Resources are related information that are not part of the code.*

User notes:

**About this resource:** This resource provides code compliance pathways for residential buildings intended to result in all-electric buildings for adopting jurisdictions or individual projects.

**ICC Council Policy-49 Note:** In considering whether to adopt the content in this resource, jurisdictions in the United States should note that federal law might be found to preempt the provisions it prescribes. See the Public Health and Welfare Act, 42 U.S.C. § 6297: Effect on other law. Whether the content of this resource or a modification thereof is subject to preemption may depend on court decisions or whether a waiver has been issued by the US Department of Energy pursuant to 42 U.S.C. § 6297(d).

SECTION RRA101 GENERAL

**RRA101.1 Intent.** The intent of this resource is to amend the **International Energy Conservation Code** to reduce greenhouse gas emissions and improve the safety and health of *buildings* by not permitting combustion equipment in *buildings* .

**RRA101.2 Scope.** This resource applies to new *residential buildings* .

SECTION RRA102 GENERAL DEFINITIONS

**ALL-ELECTRIC BUILDING.** A *building* that contains no *combustion equipment*, or plumbing for *combustion equipment*, installed within the *building* or *building site* .

**APPLIANCE.** A device or apparatus that is manufactured and designed to utilize energy and for which this code provides specific requirements.

**COMBUSTION EQUIPMENT.** Any *equipment* or *appliance* used for space heating, *service water heating* , cooking, clothes drying or lighting that uses *fuel gas* or *liquid fuel* .

**EQUIPMENT.** Piping, *ducts* , vents, control devices and other components of systems other than *appliance* that are permanently installed and integrated to provide control of environmental conditions for *buildings* . This definition shall also include other systems

specifically regulated in this code.

SECTION RRA103

ALL-ELECTRIC RESIDENTIAL BUILDINGS

Residential buildings shall be *all-electric buildings* and comply with Section R401.2.1, R401.2.2, R401.2.3 or R401.2.4.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap	
	X			

  

Action	AS	AS/IC	D	D/IC

**RE#33**

New appendix provides expanded R-value options for compliance with Section R402.1.2 U-factor criteria and supplements the selection of insulation conditions addressed in the Table R402.1.3 R-value approach

Related Mods:  
REPI-165-21,  
RED1-261-22,  
REC2D-1-23

APPENDIX RF ALTERNATIVE BUILDING THERMAL ENVELOPE INSULATION  
**R-VALUE OPTIONS**

*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*  
User notes:

**About this appendix:** *The purpose of this appendix is to provide expanded R-value options for determining compliance with the U-factor criteria prescribed in Section R402.1.2. It also supplements the limited selection of common insulation conditions addressed in the R-value approach of Table R402.1.3.*

SECTION RF101 GENERAL

**RF101.1 General.** This appendix shall be used as a basis to determine alternative building assembly and insulation component *R-value* solutions that comply with the maximum *U*-factors and *F*-factors in **Table R402.1.2**. Alternative building assembly insulation solutions determined in accordance with this appendix also shall comply with the requirements of **Section R702.7** of the *International Residential Code*.

SECTION RF102

**ABOVE-GRADE WALL ASSEMBLIES**

**RF102.1 Wood-framed walls.** *Wood-framed above-grade wall assemblies shall comply with both the cavity insulation and continuous insulation R-values and framing conditions specified by Table RF102.1 where the tabulated U-factors are less than or equal to those needed for compliance with Section R402.1.2. For assemblies not addressed by the conditions of Table RF102.1, U-factors shall be determined by using accepted engineering practice or by testing in accordance with ASTM C1363 and shall be subject to approval by the code official in accordance with Section R104.1. Use of a lesser framing fraction than the indicated maximums in Table RF102.1 shall require wall framing layout details on approved construction documents for each above-grade wall elevation and shall be inspected for compliance.*

TABLE RF102.1  
ASSEMBLY U-FACTORS FOR WOOD-FRAMED WALLS<sup>a, b, c, d, e, f</sup>



WOOD STUD SIZE AND SPACING	CAVITY INSULATION INSTALLED R-VALUE	CONTINUOUS INSULATION R-VALUE																			
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	20	25	30	
2 x 4 (12 inches O.C.)	0	0.324	0.239	0.190	0.158	0.136	0.119	0.106	0.096	0.087	0.080	0.074	0.069	0.064	0.060	0.057	0.054	0.042	0.035	0.030	
	11	0.094	0.085	0.078	0.072	0.067	0.062	0.059	0.055	0.052	0.050	0.047	0.045	0.043	0.041	0.040	0.038	0.032	0.027	0.024	
	12	0.090	0.082	0.075	0.069	0.064	0.060	0.057	0.054	0.051	0.048	0.046	0.044	0.042	0.040	0.039	0.037	0.031	0.027	0.024	
	13	0.087	0.079	0.072	0.067	0.063	0.059	0.055	0.052	0.049	0.047	0.045	0.043	0.041	0.039	0.038	0.036	0.031	0.027	0.023	
	14	0.084	0.076	0.070	0.065	0.061	0.057	0.054	0.051	0.048	0.046	0.044	0.042	0.040	0.038	0.037	0.036	0.030	0.026	0.023	
	15	0.082	0.074	0.068	0.063	0.059	0.055	0.052	0.049	0.047	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.030	0.026	0.023	
	16	0.079	0.072	0.066	0.062	0.058	0.054	0.051	0.048	0.046	0.044	0.042	0.040	0.038	0.037	0.036	0.034	0.029	0.025	0.022	
	17	0.077	0.070	0.065	0.060	0.056	0.053	0.050	0.047	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.029	0.025	0.022	
	18	0.076	0.069	0.063	0.059	0.055	0.052	0.049	0.046	0.044	0.042	0.040	0.038	0.037	0.036	0.034	0.033	0.028	0.025	0.022	
	19	0.074	0.067	0.062	0.058	0.054	0.051	0.048	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.032	0.028	0.024	0.022	
20	0.072	0.066	0.061	0.056	0.053	0.050	0.047	0.044	0.042	0.040	0.039	0.037	0.036	0.034	0.033	0.032	0.027	0.024	0.021		
2 x 6 (12 inches O.C.)	0	0.0313	0.230	0.183	0.153	0.131	0.115	0.102	0.093	0.084	0.078	0.072	0.067	0.063	0.059	0.055	0.053	0.041	0.034	0.029	
	18	0.065	0.060	0.056	0.053	0.050	0.048	0.045	0.043	0.041	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.027	0.024	0.021	
	19	0.063	0.059	0.055	0.052	0.049	0.047	0.044	0.042	0.040	0.039	0.037	0.036	0.035	0.033	0.032	0.031	0.027	0.024	0.021	
	20	0.062	0.057	0.054	0.051	0.048	0.046	0.043	0.041	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.026	0.023	0.021	
	21	0.060	0.056	0.053	0.050	0.047	0.045	0.043	0.041	0.039	0.037	0.036	0.035	0.033	0.032	0.031	0.030	0.026	0.023	0.021	
	22	0.059	0.055	0.052	0.049	0.046	0.044	0.042	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.026	0.023	0.020	
	23	0.058	0.054	0.051	0.048	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.025	0.022	0.020	
	24	0.057	0.053	0.050	0.047	0.044	0.042	0.040	0.039	0.037	0.036	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.025	0.022	0.020
	25	0.056	0.052	0.049	0.046	0.044	0.042	0.040	0.038	0.036	0.035	0.034	0.032	0.031	0.030	0.029	0.028	0.025	0.022	0.020	
	30	0.052	0.048	0.045	0.043	0.041	0.039	0.037	0.035	0.034	0.033	0.031	0.030	0.029	0.028	0.027	0.027	0.023	0.021	0.019	
35	0.049	0.046	0.043	0.040	0.038	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.026	0.025	0.022	0.020	0.018		
2 x 8 (12 inches O.C.)	0	0.308	0.226	0.179	0.149	0.128	0.112	0.100	0.091	0.083	0.076	0.070	0.066	0.061	0.058	0.054	0.052	0.041	0.034	0.029	
	20	0.056	0.053	0.050	0.047	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.033	0.032	0.031	0.030	0.026	0.023	0.020	
	21	0.055	0.052	0.049	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.034	0.033	0.032	0.031	0.030	0.029	0.025	0.022	0.020	
	22	0.053	0.050	0.048	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.025	0.022	0.020	
	23	0.052	0.049	0.047	0.044	0.042	0.040	0.039	0.037	0.036	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.025	0.022	0.020	
	24	0.051	0.048	0.046	0.044	0.042	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.024	0.022	0.019	
	25	0.050	0.047	0.045	0.043	0.041	0.039	0.037	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.024	0.021	0.019	
	30	0.046	0.044	0.041	0.039	0.038	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.026	0.026	0.023	0.020	0.018	
	35	0.043	0.041	0.039	0.037	0.035	0.034	0.032	0.031	0.030	0.029	0.028	0.027	0.026	0.026	0.025	0.024	0.021	0.019	0.017	
	40	0.041	0.039	0.037	0.035	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.026	0.025	0.024	0.024	0.023	0.020	0.018	0.017	
2 x 4 (16 inches O.C.)	0	0.331	0.243	0.193	0.161	0.138	0.120	0.107	0.097	0.088	0.081	0.075	0.069	0.065	0.061	0.057	0.054	0.043	0.035	0.030	
	11	0.092	0.083	0.076	0.071	0.066	0.061	0.058	0.054	0.052	0.049	0.047	0.045	0.043	0.041	0.039	0.038	0.032	0.027	0.024	
	12	0.088	0.080	0.073	0.068	0.063	0.059	0.056	0.053	0.050	0.048	0.045	0.043	0.041	0.040	0.038	0.037	0.031	0.027	0.024	
	13	0.084	0.077	0.071	0.066	0.061	0.057	0.054	0.051	0.049	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.030	0.026	0.023	
	14	0.081	0.074	0.068	0.064	0.059	0.056	0.053	0.050	0.047	0.045	0.043	0.041	0.039	0.038	0.037	0.035	0.030	0.026	0.023	
	15	0.079	0.072	0.066	0.062	0.058	0.054	0.051	0.049	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.034	0.029	0.025	0.023	
	16	0.077	0.070	0.065	0.060	0.056	0.053	0.050	0.047	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.029	0.025	0.022	
	17	0.075	0.068	0.063	0.058	0.055	0.052	0.049	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.034	0.033	0.028	0.025	0.022	
	18	0.073	0.066	0.061	0.057	0.053	0.050	0.048	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.033	0.028	0.024	0.022	
	19	0.071	0.065	0.060	0.056	0.052	0.049	0.047	0.044	0.042	0.040	0.039	0.037	0.036	0.034	0.033	0.032	0.027	0.024	0.021	
20	0.069	0.063	0.059	0.055	0.051	0.048	0.046	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.032	0.031	0.027	0.024	0.021		
2 x 6 (16 inches O.C.)	0	0.322	0.236	0.187	0.156	0.133	0.117	0.104	0.094	0.086	0.079	0.073	0.068	0.063	0.059	0.056	0.053	0.042	0.034	0.029	
	18	0.063	0.059	0.055	0.052	0.049	0.047	0.044	0.042	0.041	0.039	0.037	0.036	0.035	0.034	0.032	0.031	0.027	0.024	0.021	
	19	0.061	0.057	0.054	0.051	0.048	0.046	0.043	0.042	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.027	0.023	0.021	
	20	0.060	0.056	0.052	0.050	0.047	0.045	0.042	0.041	0.039	0.037	0.036	0.035	0.033	0.032	0.031	0.030	0.026	0.023	0.021	
	21	0.058	0.055	0.051	0.048	0.046	0.044	0.042	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.026	0.023	0.020	
	22	0.057	0.053	0.050	0.047	0.045	0.043	0.041	0.039	0.037	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.025	0.022	0.020	
23	0.056	0.052	0.049	0.046	0.044	0.042	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.025	0.022	0.020		



2 x 8 (16 inches (٤٤))	24	0.055	0.051	0.048	0.046	0.043	0.041	0.039	0.038	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.028	0.025	0.022	0.020
	25	0.054	0.050	0.047	0.045	0.042	0.040	0.039	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.024	0.022	0.019
	30	0.050	0.046	0.044	0.046	0.039	0.037	0.036	0.034	0.033	0.032	0.031	0.029	0.029	0.028	0.027	0.026	0.023	0.020	0.018
	35	0.047	0.043	0.041	0.039	0.037	0.035	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.026	0.025	0.025	0.022	0.019	0.017
	0	0.317	0.232	0.184	0.152	0.131	0.115	0.102	0.092	0.084	0.077	0.071	0.066	0.062	0.058	0.055	0.052	0.041	0.034	0.029
	20	0.055	0.052	0.049	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.026	0.023	0.020
	21	0.053	0.050	0.048	0.045	0.043	0.041	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.025	0.022	0.020
	22	0.052	0.049	0.047	0.044	0.042	0.040	0.039	0.037	0.036	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.025	0.022	0.020
	23	0.051	0.048	0.046	0.043	0.041	0.040	0.038	0.036	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.024	0.022	0.020
	24	0.050	0.047	0.045	0.043	0.041	0.039	0.037	0.036	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.024	0.021	0.019
	25	0.049	0.046	0.044	0.042	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.024	0.021	0.019
	30	0.045	0.042	0.040	0.038	0.037	0.035	0.034	0.032	0.031	0.030	0.029	0.028	0.027	0.027	0.026	0.025	0.022	0.020	0.018
35	0.042	0.039	0.037	0.036	0.034	0.033	0.031	0.030	0.029	0.028	0.027	0.027	0.026	0.025	0.024	0.024	0.021	0.019	0.017	
40	0.039	0.037	0.035	0.034	0.032	0.031	0.030	0.029	0.028	0.027	0.026	0.025	0.024	0.024	0.023	0.022	0.020	0.018	0.016	
2 x 4 (24 inches (٦١))	0	0.339	0.248	0.196	0.163	0.139	0.122	0.108	0.098	0.089	0.081	0.075	0.070	0.065	0.061	0.058	0.055	0.043	0.035	0.030
	11	0.089	0.081	0.075	0.069	0.065	0.061	0.057	0.054	0.051	0.048	0.046	0.044	0.042	0.040	0.039	0.037	0.031	0.027	0.024
	12	0.085	0.078	0.072	0.067	0.062	0.058	0.055	0.052	0.049	0.047	0.045	0.043	0.041	0.039	0.038	0.036	0.031	0.027	0.023
	13	0.082	0.075	0.069	0.064	0.060	0.056	0.053	0.050	0.048	0.046	0.044	0.042	0.040	0.038	0.037	0.036	0.030	0.026	0.023
	14	0.079	0.072	0.067	0.062	0.058	0.055	0.052	0.049	0.047	0.044	0.042	0.041	0.039	0.037	0.036	0.035	0.030	0.026	0.023
	15	0.076	0.070	0.065	0.060	0.056	0.053	0.050	0.048	0.045	0.043	0.041	0.040	0.038	0.037	0.035	0.034	0.029	0.025	0.022
	16	0.074	0.068	0.063	0.058	0.055	0.052	0.049	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.034	0.033	0.028	0.025	0.022
	17	0.072	0.066	0.061	0.057	0.053	0.050	0.048	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.033	0.028	0.024	0.022
	18	0.070	0.064	0.059	0.055	0.052	0.049	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.034	0.033	0.032	0.027	0.024	0.021
	19	0.068	0.062	0.058	0.054	0.051	0.048	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.032	0.031	0.027	0.024	0.021
	20	0.066	0.061	0.056	0.053	0.050	0.047	0.044	0.042	0.040	0.039	0.037	0.036	0.034	0.033	0.032	0.031	0.027	0.023	0.021
	0	0.330	0.241	0.191	0.159	0.136	0.119	0.106	0.095	0.087	0.080	0.074	0.068	0.064	0.060	0.057	0.053	0.042	0.035	0.030
18	0.061	0.057	0.054	0.051	0.048	0.046	0.044	0.042	0.040	0.038	0.037	0.036	0.034	0.033	0.032	0.031	0.027	0.024	0.021	
19	0.060	0.056	0.052	0.050	0.047	0.045	0.043	0.041	0.039	0.037	0.036	0.035	0.034	0.032	0.031	0.030	0.026	0.023	0.021	
20	0.058	0.054	0.051	0.048	0.046	0.044	0.042	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.026	0.023	0.020	
21	0.057	0.053	0.050	0.047	0.045	0.043	0.041	0.039	0.037	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.025	0.022	0.020	
22	0.055	0.052	0.049	0.046	0.044	0.042	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.025	0.022	0.020	
23	0.054	0.051	0.049	0.045	0.043	0.041	0.039	0.037	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.028	0.025	0.022	0.020	
24	0.053	0.049	0.047	0.044	0.042	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.024	0.022	0.019	
25	0.052	0.048	0.046	0.043	0.041	0.039	0.038	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.024	0.021	0.019	
30	0.047	0.044	0.042	0.040	0.038	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.026	0.025	0.022	0.020	0.018	
35	0.044	0.041	0.039	0.037	0.035	0.034	0.032	0.031	0.030	0.029	0.028	0.027	0.026	0.025	0.025	0.024	0.021	0.019	0.017	
0	0.326	0.238	0.188	0.156	0.133	0.117	0.104	0.094	0.085	0.078	0.072	0.067	0.063	0.059	0.056	0.053	0.042	0.034	0.029	
20	0.054	0.051	0.048	0.046	0.043	0.042	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.025	0.022	0.020	
21	0.052	0.049	0.047	0.044	0.042	0.041	0.039	0.037	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.029	0.025	0.022	0.020	
22	0.051	0.048	0.046	0.043	0.041	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.024	0.022	0.020	
23	0.050	0.047	0.044	0.042	0.041	0.039	0.037	0.036	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.028	0.024	0.021	0.019	
24	0.048	0.046	0.044	0.041	0.040	0.038	0.036	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.024	0.021	0.019	
25	0.047	0.045	0.043	0.041	0.039	0.037	0.036	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.027	0.023	0.021	0.019	
30	0.043	0.041	0.039	0.037	0.035	0.034	0.033	0.032	0.030	0.029	0.029	0.028	0.027	0.026	0.025	0.025	0.022	0.020	0.018	
35	0.040	0.038	0.036	0.034	0.033	0.032	0.030	0.029	0.028	0.027	0.027	0.026	0.025	0.024	0.024	0.023	0.021	0.018	0.017	
40	0.037	0.035	0.034	0.032	0.031	0.030	0.029	0.028	0.027	0.026	0.025	0.024	0.024	0.023	0.022	0.022	0.019	0.018	0.016	

For SI:  $1 \text{ W/m}^2 \times \text{K} = 0.176 \text{ Btu/h} \times \text{ft}^2 \times \text{°F}$

- Linear interpolation of *U*-factors shall be permitted between continuous insulation and cavity insulation *R*-values. For nonstandard stud spacing, use the next-lesser stud spacing shown in the table.
- Table values are based on the parallel path calculation procedure as applicable to wood-frame assemblies and require compliance with the following assembly conditions:

- Framing fractions of not greater than 28 percent (assumed for 12-inch (٣٠٥)), 25 percent (assumed for 16-inch (٤٠٦)), and 22 percent (assumed for 24-inch (٦١٠)) with 4 percent attributed to headers in all cases. The framing fraction is the percentage of overall opaque wall area occupied by framing members.
- Wood framing materials or species with a thermal resistivity of not greater than R-1.25 per inch.
- Exterior sheathing with an *R*-value of not less than R-0.62 as based on wood structural panel. For walls having no exterior sheathing or sheathing of lesser *R*-value, footnote d shall be used to adjust the tabulated *U*-factor.
- Siding of not less than R-0.62 as based on the assumption of vinyl siding. For walls with siding having a lower *R*-value, [Note g](#) shall be used to adjust the tabulated *U*-factor.



5. Interior finish of not less than R-0.45 based on 1/2-inch gypsum. For walls having no interior finish or a finish of lesser R-value, Note d shall be used to adjust the tabulated U-factor.
  6. Cavity insulation with a rated R-value installed as required by the manufacturer's installation instructions to satisfy the indicated installed R-value, considering a reduced R-value for compression in an enclosed cavity where applicable.
  7. Continuous insulation specified in accordance with the indicated rated R-value and installed continuously over all exterior wood framing, including studs, plates, headers and rim joists.
  8. Indoor air film R-value of 0.68 and outdoor air-film R-value of 0.17.
- e. Where any of the building materials that are continuous over the interior or exterior wall surface vary from those stated in footnote b, it is permissible to adjust the U-factor as follows:  $U_{adj} = 1/[1/U + Rd]$  where U is the U-factor from the table and Rd is the increase (positive) or decrease (negative) in the cumulative R-value of building material layers on the outside and inside faces of the wall, excluding the continuous insulation R-value if present.
  - f. For a specific continuous insulation R-value not addressed in this table, the U-factor of the assembly shall be determined as follows:  $U_{adj} = 1/[1/U_{nci} + R_{ci}]$  where U<sub>nci</sub> is the U-factor from the table for no continuous insulation (0 R-value column) and R<sub>ci</sub> is the specific rated R-value of continuous insulation added to the assembly.
  - g. For double wall framing, the U-factor shall be determined by combining the U-factors for single wall framing from the table as follows:  $U_{combined} = 1/[1/U1 + 1/U2]$  where U1 and U2 are the U-factors from the table for each of the adjacent parallel walls in the double wall assembly.
  - h. The use of insulation in accordance with this table does not supersede requirements in Section R702.7 of the *International Residential Code* for use of insulation and water vapor retarders to control water vapor.

RF102.2 Mass walls. Reserved.

RF102.3 Cold-formed steel frame walls. Reserved.

## SECTION RF103 ROOF AND CEILING ASSEMBLIES—RESERVED

## SECTION RF104 FLOOR ASSEMBLIES—RESERVED

## SECTION RF105 BASEMENT AND CRAWL SPACE WALLS

**RF105.1 Basement and crawl space walls.** U-factors for basement and *crawl space walls* shall be as specified in accordance with **Table RF105.1**. Effective U-factors for the proposed and reference foundation wall design must be used to demonstrate compliance with **Section R402.1.5**. Effective U-factors shall not be used for other compliance methods referenced in **Section R401.2.1**.

**TABLE RF105.1**  
**U-FACTORS FOR BASEMENT AND CRAWL SPACE WALLS<sup>a</sup>**

<u>INSULATION CONFIGURATIONS<sup>b</sup></u>	<u>WALL U-FACTOR<sup>c</sup></u> (Btu/h × ft <sup>2</sup> × F)	<u>WALL EFFECTIVE U-FACTOR<sup>d</sup> BY PERCENTAGE OF WALL HEIGHT PROJECTING ABOVE GRADE (Btu/h × ft<sup>2</sup> × F) FOR USE ONLY WITH SECTION R402.1.5</u>	—	—	—
—	—	50%	35%	20%	5%
<b>Basement walls</b>					
Uninsulated and unfinished basement wall	0.360	0.324	0.288	0.252	0.216
Continuous insulation	—	—	—	—	—
R-5ci	0.122	0.109	0.097	0.085	0.073
R-7.5ci	0.093	0.084	0.075	0.065	0.056
R-10ci	0.076	0.068	0.060	0.053	0.045
R-15ci	0.055	0.049	0.044	0.038	0.033
R-20ci	0.043	0.039	0.034	0.030	0.026
R-25ci	0.035	0.032	0.028	0.025	0.021
Cavity insulation	—	—	—	—	—
R-11	0.076	0.068	0.060	0.053	0.045
R-13	0.067	0.060	0.054	0.047	0.040
R-15	0.060	0.054	0.048	0.042	0.036
R-19	0.050	0.045	0.040	0.035	0.030
R-21	0.045	0.041	0.036	0.032	0.027
Cavity + continuous insulation	—	—	—	—	—
R-13 + R-5ci	0.050	0.045	0.040	0.035	0.030
R-13 + R-7.5ci	0.045	0.040	0.036	0.031	0.027
R-13 + R-10ci	0.040	0.036	0.032	0.028	0.024
R-19 + R-5ci	0.040	0.036	0.032	0.028	0.024
R-19 + R-7.5ci	0.036	0.033	0.029	0.025	0.022
R-19 + R-10ci	0.033	0.030	0.027	0.023	0.020
<b>Crawl space walls</b>					
Uninsulated crawl space wall	0.477	0.429	0.382	0.334	n/a

R-5ci	0.141	0.127	0.113	0.099	N/A
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R-7.5ci	0.104	0.094	0.083	0.073	—
R-10ci	0.083	0.074	0.066	0.058	—
R-15ci	0.058	0.053	0.047	0.041	—
R-20ci	0.045	0.041	0.036	0.032	—
R-25ci	0.037	0.033	0.030	0.026	—
Cavity insulation	—	—	—	—	—
R-11	0.083	0.074	0.066	0.058	N/A
R-13	0.072	0.065	0.058	0.051	—
R-15	0.065	0.058	0.052	0.045	—
R-19	0.054	0.049	0.043	0.038	—
R-21	0.048	0.043	0.038	0.033	—
Cavity + continuous insulation	—	—	—	—	—
R-13 + R-5ci	0.053	0.048	0.043	0.037	N/A
R-13 + R-7.5ci	0.047	0.042	0.038	0.033	—
R-13 + R-10ci	0.042	0.038	0.034	0.029	—
R-19 + R-5ci	0.043	0.038	0.034	0.030	—
R-19 + R-7.5ci	0.039	0.035	0.031	0.027	—
R-19 + R-10ci	0.035	0.032	0.028	0.025	—

For SI: 1 British thermal unit per hour per square foot per °Fahrenheit = 5.6783 W/m<sup>2</sup> × K.

N/A = Not Applicable.

- a. The wall *U*-factor excludes exterior the air-film *R*-value and, for insulated assemblies, includes the following: R-0.68 for interior air film, R-0.45 for 1/2-inch gypsum panel finish (insulated basement walls only), and R-2.1 for 12-inch block basement wall or R-1.4 for 8-inch block crawl space wall, both with empty cells. Where cavity insulation is included between 2 × 4 or 2 × 6 framing on the interior side of a foundation wall, wood stud material with thermal resistivity of R-1.25/in is assumed to be spaced at not less than 16 inches on center with an assumed framing factor not greater than 0.15.
- b. All insulation configurations extend from the top of the foundation wall to the floor of the basement or crawl space. Extrapolation to partial height insulation shall not be permitted; *U*-factors for such insulation configurations shall be determined by accepted engineering practice for modeling of thermal bridging and ground-coupled assemblies.
- c. Applicable to Sections **R402.1.2**, **R405** and **R406**.
- d. Effective *U*-factors are adjusted to account for ground-coupling effects to provide equivalency to *U*-factors used for above-grade building thermal envelope assemblies. The effective *U*-factors are provided for use with **Section R402.1.5** for evaluation of trade-offs with above-grade assemblies and other components of the building thermal envelope. The effective *U*-factor shall apply to the foundation wall area from the interior floor or ground *n* between *R*-values and percentage of wall height

	projecting above grade within a given insulation configuration type is permitted.
	<p style="text-align: center;">SECTION RF106 SLABS-ON-GRADE</p> <p><b>RF106.1 Slabs-on-grade.</b> <i>F</i>-factors for unheated and heated slabs-on-grade shall be as specified in <b>Table RF106.1</b>. All applicable adjustment factors in the table notes shall apply. <i>F</i>-factors for basement floor slabs and crawl space ground surfaces located below exterior grade shall be adjusted in accordance Note f as applicable</p>

**TABLE RF106.1**  
**F-FACTORS FOR SLABS-ON-GRADE<sup>a, b, c, d, e, f</sup>**

<b>UNHEATED SLABS-ON-GRADE: INSULATION CONFIGURATIONS</b>	<b>F-FACTOR (Btu/h * ft<sup>2</sup> * °F)</b>
Uninsulated slab	—
Horizontal insulation under slab at slab perimeter—slab edge not insulated	—
≥ R-5 for 2 ft	0.70
R-5 for 4 ft	0.67
≥ R-10 for 4 ft	0.64
Vertical insulation on exterior face <sup>a</sup> —slab edge insulated <sup>b</sup>	—
R-2.5 for 2 ft	0.66
R-5 for 2 ft	0.58
R-7.5 for 2 ft	0.56
R-10 for 2 ft	0.54
R-15 for 3 ft	0.52
R-5 for 3 ft	0.56
R-7.5 for 3 ft	0.54
R-10 for 3 ft	0.51
R-15 for 3 ft	0.49
R-5 for 4 ft	0.54
R-7.5 for 4 ft	0.51
R-10 for 4 ft	0.48
R-15 for 4 ft	0.45
Fully insulated slab—full slab area and slab edge continuously insulated	—
R 5 entire slab area and R 3.5 edge	0.48
R-5 entire slab area and edge	0.46
R 7.5 entire slab area and R 3.5 edge	0.45
R-7.5 entire slab area and edge	0.41
R 10 entire slab area and R 5 edge	0.40
R-10 entire slab area and edge	0.36
R 15 entire slab area and R 5 edge	0.35
R-15 entire slab area and edge	0.30
R-10 slab edge and under slab perimeter inward 4 ft; R-5 remaining slab area	0.42

R-15 slab edge and under slab perimeter inward 4 ft; R-5 remaining slab area	0.40
R-15 slab edge and under slab perimeter inward 4 ft; R-10 remaining slab area	0.34
<b>HEATED SLABS-ON-GRADE: INSULATION CONFIGURATIONS</b>	<b>F-FACTOR (Btu/h × ft × °F)</b>
Uninsulated	1.35
Fully insulated slab—full slab area and slab edge continuously insulated	—
R-5 entire slab area and R-3.5 edge	0.77
R-5 entire slab area and edge	0.74
R-7.5 entire slab area and R-3.5 edge	0.71
R-7.5 entire slab area and edge	0.64
R-10 entire slab area and R-5 edge	0.62
R-10 entire slab area and edge	0.55
R-15 entire slab area and R-5 edge	0.54
R-15 entire slab area and edge	0.44
R-20 entire slab area and R-7.5 edge	0.44
R-20 entire slab area and edge	0.37
R-5 entire slab area and R-10 slab edge extending downward for minimum 3 ft	0.66
R-10 slab edge and under slab perimeter inward 4 ft; R-5 remaining slab area	0.66
R-15 slab edge and under slab perimeter inward 4 ft; R-5 remaining slab area	0.62
R-15 slab edge and under slab perimeter inward 4 ft; R-10 remaining slab area	0.51

- a. For alternative slab-on-grade insulation configurations, *F*-factors shall be determined in accordance with accepted engineering practice for modeling three-dimensional ground-coupled building assemblies using project-specific building and site conditions to estimate annual energy use attributed to foundation heat transfer and converting the result to an equivalent air-to-air *F*-factor basis.
- b. Interpolation between *R*-values for a given insulation configuration type is permitted.
- c. Tabulated *F*-factors are based on a typical soil thermal conductivity of 0.75 Btu/h × ft × F and shall be multiplied by one of the following adjustment factors as applicable to site soil conditions: (1) rock or any soil on sites with poor drainage or high water table, 1.2; (2) sandy soils, 1.1; (3) loam or clay soils on well-drained sites in dry *climate zones*, 0.85; and (3) for all other soil or site conditions, 1.00. Where soil conditions are unknown, use of 1.00 is permitted.
- d. Tabulated *F*-factors are based on a slab area to perimeter length ratio of 9:1 and shall be multiplied by one of the following adjustment factors as applicable to a slab's area to perimeter length ratio: 5:1, 0.7; 6:1, 0.8; 7:1, 0.9; 8:1, 0.95; 9:1, 1.0; 10:1, 1.05; 15:1, 1.2; 20:1, 1.35; 30:1, 1.5; and for ≥ 40:1, 1.7.



British thermal unit per hour per square foot per °Fahrenheit = 5.6783 x W/m<sup>2</sup> x K

- e. Tabulated *F*-factors are based on a slab perimeter edge projection above exterior finish grade of 6 inches. For portions of slab perimeter projecting 12 inches or more above grade, multiply the tabulated *F*-factors by one of the following adjustment factors as applicable: less than 12 inches, 1.0; 12 inches, 1.05; 18 inches, 1.1; 24 inches, 1.15; and 30 inches, 1.2.
- e. For basement floor slabs, crawl space slabs or gravel floors, the tabulated *F*-factors shall be multiplied by one of the following adjustment factors based on the depth of the floor surface below exterior finish grade: less than 1 foot, 1.0; 1 foot, 0.95; 3 feet, 0.9; and 6 feet or more, 0.8.
- f. Vertical insulation on the exterior shall extend for the indicated depth below finish grade and above grade to the top of the slab or stem wall. Where insulation is placed on the interior side of a foundation stem wall, it shall extend from the top of the slab to the indicated depth below the exterior finish grade and the applicable tabulated *F*-factor shall be multiplied by 1.05.
- g. The *R*-value of the vertical insulation located on the interior side of a stem wall shall be permitted to be reduced to R-2.5 at the slab edge, not exceeding 6 inches thick, provided that the applicable *F*-factor is multiplied by 1.15 where R-5 vertical insulation is specified, 1.2 where R-10 vertical insulation is specified, or 1.25 where R-15 vertical insulation is specified.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

  

Action	AS	AS/IC	D	D/IC

**RE#34** New appendix provides requirements to achieve lower residential building energy consumption than adoption of the residential code provisions would otherwise provide

Related Mods:  
RED1-27-22

APPENDIX RG 2024 IECC STRETCH CODE

*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*

User notes:

**About this appendix:** *This appendix provides requirements for residential buildings intended to result in lower energy consumption compared to adoption of the residential provisions of this code. Where adopted by ordinance as a requirement, Section RG101.1 language is intended to replace Section R405.2, Section RG101.2 language is intended to replace Section R406.5, and Section RG101.3 language is intended to replace Section R408.2. Where those sections of the code have been amended for other purposes, this appendix is only intended to increase the number of credits required in the Prescriptive path, to increase the energy cost savings in the Simulated Performance path, and to lower the maximum ERI in the ERI path.*

**ICC Council Policy-49 Note:** *This voluntary appendix is intended for adopting authorities that wish to extend beyond the mandatory provisions of this code toward Zero Net Energy goals. For jurisdictions in the United States, compliance options appear to be available but may be limited in Climate Zones 0-3 if using only minimum efficiency mechanical and service water heating equipment. Adopting authorities may need to consider alternative means to expand methods for compliance under these conditions (see Section R104.1).*

SECTION RG101 COMPLIANCE

**RG101.1 (R405.2) Simulated building performance compliance.** Compliance based on *simulated building performance* requires that a *building* comply with the following:

1. The requirements of the sections indicated within **Table R405.2**.
2. The proposed total *building thermal envelope* thermal conductance, TC, shall be less than or equal to the *building thermal envelope* TC using the prescriptive *U*-factors and *F*-factors from **Table R402.1.2** multiplied by 1.08 in Climate Zones 0, 1 and 2, and



1.15 in Climate Zones 3 through 8 in accordance with **Equation 4-2** and **Section R402.1.5**. The area- weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

3. For each *dwelling unit* with one or more fuel-burning appliances for space heating, water heating, or both, the annual *energy cost* of the *dwelling unit* shall be less than or equal to 70 percent of the annual *energy cost* of the *standard reference design*. For all other *dwelling units*, the annual *energy cost* of the *dwelling unit* shall be less than or equal to 75 percent of the annual *energy cost* of the *standard reference design*. For each *dwelling unit* with greater than 5,000 square feet (465 m<sup>2</sup>) of *living space* located above *grade plane*, the annual *energy cost* of the *dwelling unit* shall be reduced by an additional 5 percent of annual *energy cost* of the *standard reference design*. Energy prices shall be taken from an *approved source*, such as the US Energy Information Administration's state energy data system prices and expenditures reports. *Code officials* shall be permitted to require time-of- use pricing in *energy cost* calculations.

Exceptions:

1. The energy use based on source energy expressed in Btu or Btu per square foot of *conditioned floor area* shall be permitted to be substituted for the *energy cost*. The source energy multiplier for electricity shall be 2.51. The source energy multiplier for fuels other than electricity shall be 1.09.
2. The energy use based on site energy expressed in Btu or Btu per square foot of *conditioned floor area* shall be permitted to be substituted for the *energy cost*.

**RG101.2 (R406.5) ERI-based compliance.** Compliance based on an *Energy Rating Index* (ERI)

analysis requires that the *rated design* and each confirmed as-built *dwelling unit* be shown to have an ERI less than or equal to the applicable value indicated in **Table RG101.2** where compared to the *ERI reference design* as follows:

1. Where on-site renewables are not installed, the maximum ENERGY RATING INDEX NOT INCLUDING OPP applies.
2. Where on-site renewables are installed, the maximum ENERGY RATING INDEX INCLUDING OPP applies.

Exceptions:

1. Where the ERI analysis excludes OPP, the maximum ENERGY RATING INDEX NOT INCLUDING OPP shall be permitted.
2. For *buildings* with 20 or more *dwelling units*, where *approved* by the *code official*, compliance shall be permitted using the Average Dwelling Unit *Energy Rating Index*, as calculated in accordance with **ANSI/RESNET/ICC 301**.

**TABLE RG101.2 (R406.5)  
MAXIMUM ENERGY RATING INDEX  
TABLE RG101.2 (R406.5)  
MAXIMUM ENERGY RATING INDEX**

CLIMATE ZONE	ENERGY RATING INDEX NOT INCLUDING OPP	ENERGY RATING INDEX WITH OPP
0-1	46	27
2	46	26
3	45	24
4	48	32
5	49	37
6	48	39
7	47	43
8	47	43

**RG101.3 (R408.2) Additional energy efficiency credit requirements.** Residential buildings shall earn not less than 20 credits from not less than two measures specified in **Table R408.2**. Five additional credits shall be earned for *dwelling units* with more than 5,000 square feet (465 m<sup>2</sup>) of *living space* located above *grade plane*. To earn credit as specified in **Table R408.2** for the applicable *Climate Zone*, each measure selected for compliance shall comply with the applicable subsections of **Section R408**. Each *dwelling unit* or *sleeping unit* shall comply with the selected measure to earn credit. Interpolation of credits between measures shall not be permitted.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC

**RE#35**

New appendix provides means to evaluate the greenhouse gas performance of a building according to ANSI/RESNET/ICC 301

Related Mods:  
RED1-28-22

APPENDIX RH OPERATIONAL CARBON RATING AND ENERGY REPORTING

*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*

User notes:

**About this appendix:** This appendix provides a means to evaluate a building's greenhouse gas performance determined in accordance with **ANSI/RESNET/ICC 301**.

SECTION RH101 GENERAL DEFINITIONS

**CO<sub>2</sub>e INDEX.** A numerical integer value, calculated in accordance with **ANSI/RESNET/ICC 301**, that represents the relative Carbon Dioxide equivalence (CO<sub>2</sub>e) emissions of a *rated design* as compared with the CO<sub>2</sub>e emissions of the CO<sub>2</sub>e reference design, where an Index value of 100 represents the CO<sub>2</sub>e performance of the CO<sub>2</sub>e reference design and an Index value of 0 (zero) represents a home that emits zero net CO<sub>2</sub>e annually.

Additional Content

SECTION RH102 COMPLIANCE

**RH102.1 Application (replaces Section R401.2).** Residential buildings shall comply with Section R406.

**Exception:** Additions, alterations, repairs and changes of occupancy to existing buildings complying with **Chapter 5**.

**RH102.2 Certificate (replaces Section R401.3).** A permanent certificate shall be completed by the builder or other *approved* party and posted on a wall in the space where the furnace is located, a utility room or an *approved* location inside the *building*. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. The certificate shall indicate the following:

1. The predominant *R-values* of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, *basement walls*, *crawl space walls* and floors and *ducts* outside *conditioned spaces*.
2. *U-factors* of *fenestration* and the *solar heat gain coefficient* (SHGC) of *fenestration*. Where there is more than one value for any component of the *building thermal envelope*, the certificate shall indicate both the value covering the largest area and the area weighted average value if available.
3. The results from any required *duct system* and *building thermal envelope* air leakage testing performed on the *building*.

4. The types, sizes and efficiencies of heating, cooling and service water-heating equipment. Where a gas-fired unvented room heater, electric furnace or baseboard electric heater is installed in the residence, the certificate shall indicate “gas-fired unvented room heater,” “electric furnace” or “baseboard electric heater,” as appropriate. An efficiency is not required to be indicated for gas-fired unvented room heaters, electric furnaces or electric baseboard heaters.
5. Where on-site photovoltaic panel systems have been installed, the array capacity, inverter efficiency, panel tilt and orientation shall be noted on the certificate.
6. For *buildings* where an *Energy Rating Index* score is determined in accordance with **Section R406**, the *Energy Rating Index* score and *CO<sub>2e</sub> Index*, both with and without any on-site generation, shall be listed on the certificate.
7. The code edition under which the structure was permitted.
8. Where a *solar-ready zone* is provided, the certificate shall indicate the location and dimensions.

**RH102.3 ERI and CO<sub>2e</sub> Index compliance (replaces Section R406.2).** Compliance based on the *ERI* and *CO<sub>2e</sub> Index* requires that the *rated design* and *as-built dwelling unit* meet all of the following:

1. The requirements of the sections indicated in **Table R406.2**.
2. Maximum *ERI* values indicated in **Table R406.5**.
3. For all-electric *dwelling units*, maximum *CO<sub>2e</sub> Index* of 65, not including OPP, determined in accordance with **ANSI/RESNET/ICC 301**. For mixed-fuel *dwelling units*, a maximum *CO<sub>2e</sub> Index* established at the time of adoption of this appendix by the authority having jurisdiction based on the *CO<sub>2e</sub> emissions* data specific to the jurisdiction.

**RH102.4 Confirmed compliance report for a certificate of occupancy (replaces Section R406.7.2.2).** 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* and *CO<sub>2e</sub> Index* 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 *ERI reference design* and the *as-built dwelling unit*.
6. A final confirmed certificate indicating that the *as-built building* has been verified to comply with **Sections R406.2, R406.4 and R406.5**. The certificate shall report the energy features that were confirmed to be in the *building*, including: component-level insulation *R-values* or *U-factors*; results from any required *duct system* and *building thermal envelope* air leakage testing; and the type and rated efficiencies of the heating, cooling, mechanical *ventilation* and service water-heating equipment installed. The certificate shall report the estimated *dwelling unit* energy use by fuel type, inclusive of all end uses. Where *on-site renewable energy* systems have been installed on or in the *building*, the certificate shall report the type and production size of the installed system.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC

<p><b>RE#36</b></p> <p>RE#34 Related Mods: RED1-91-22</p>	<p>New appendix provides requirements for prescriptive solar PV where required at the time of construction</p> <p>APPENDIX RI ON-SITE RENEWABLE ENERGY</p> <p><i>The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.</i></p> <p>User notes: <b>About this appendix:</b> <i>This proposal describes requirements for prescriptive solar PV that must be installed at the time of construction.</i></p> <p>SECTION RI101 GENERAL</p> <p><b>RI101.1 Scope.</b> These provisions shall apply where <i>on-site renewable energy</i> is required.</p> <p>SECTION RI102 GENERAL DEFINITIONS</p> <p><b>ANNUAL SOLAR ACCESS.</b> The ratio of annual solar insolation with shade to the annual solar insolation without shade. Shading from obstructions located on the roof or any other part of the <i>building</i> are not included in the determination of annual solar access. Shading from existing permanent natural or person-made obstructions that are external to the <i>building</i>, including but not limited to trees, hills and adjacent structures, are included in annual solar access calculations.</p> <p><b>PHYSICAL RENEWABLE ENERGY POWER PURCHASE AGREEMENT.</b> A contract for the purchase of renewable electricity from a specific renewable electricity generator to a purchaser of renewable electricity.</p> <p><b>POTENTIAL SOLAR AREA ZONE.</b> The combined area of any <i>steep slope</i> roofs oriented between 90 degrees and 300 degrees of true north and any <i>low slope</i> roofs where the annual solar access is 70 percent or greater.</p> <p>SECTION RI103</p> <p style="text-align: center;"><b>ON-SITE RENEWABLE ENERGY</b></p> <p><b>RI103.1 General.</b> <i>Buildings</i> shall comply with <b>Section R401.2</b> and the requirements of this section.</p> <p><b>RI103.1.1 Installed capacity.</b> An <i>on-site renewable energy</i> system shall be installed on, or at the site of, the <i>building</i> with a peak rated capacity, measured under standard test conditions, in accordance with one of the following:</p> <ol style="list-style-type: none"> <li>1. For one- and two- family dwellings, townhouses and other Group R-3 occupancies, the peak rated capacity shall be not less than 2 kW.</li> <li>2. For Group R-2 or R-4 <i>residential buildings</i>, the peak rated capacity shall be not less than 0.75 watts per square foot (8.07 W/m<sup>2</sup>) multiplied by the gross <i>conditioned floor area</i>.</li> <li>3. Where a <i>building</i> includes both commercial occupancies and R-2 or R-4 occupancies required to comply with this code, the peak capacity shall be not less than 0.75 watts per square foot (8.07 W/m<sup>2</sup>) multiplied by the gross <i>conditioned floor area</i> of the Group R-2 and R-4 occupancies.</li> </ol> <p>The capacity of installed <i>on-site renewable energy</i> systems used to comply with this appendix shall be in addition to the total capacity of installed <i>on-site renewable energy</i> systems used to comply with all other requirements of this code.</p> <p>Exceptions:</p> <ol style="list-style-type: none"> <li>1. A <i>building</i> with a permanently installed domestic solar water heating system sized with a solar savings fraction of not less than 0.5 based on the total <i>service water heating</i> load of all residential occupancies.</li> <li>2. One- and two-family dwellings, townhouses and other Group R-3 Occupancies in Climate Zone 4C, 5C or 8.</li> <li>3. Group R-2 or R-4 occupancies in Climate Zone 8.</li> <li>4. <i>Buildings</i> where the potential solar zone area is less than 300 square feet (28 m<sup>2</sup>)</li> </ol>
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5. *Buildings* with a physical renewable energy power purchase agreement with a duration of not less than 15 years from a utility or a community renewable energy facility and for not less than 80 percent of the estimated whole-building electric use on an annual basis. This exception shall not apply where off-site renewable energy credits are used to comply with the requirements of **Section R408**.
6. *Buildings* that demonstrate compliance in accordance with **Section RI103.1.1.1**.

**RI103.1.1.1 Alternate capacity determination.** Where compliance is demonstrated in accordance with **Section R405** and the *proposed design* and *standard reference design* are adjusted in accordance with Items 1 and 2, the required capacity of the installed renewable energy systems shall be permitted to differ.

1. *Proposed Design*. Where applicable, the *proposed design* shall comply with one of the following:

1.1. Where one or more systems providing *on-site renewable energy* are included in the *construction documents*, the systems shall be modeled in the *proposed design* with a design capacity not greater than the required capacity in accordance with **Section RI103.1.1**. A combination of *on-site renewable energy* systems shall be permitted to be included in the *proposed design*.

1.2. Where no *on-site renewable energy* systems are specified in the *construction documents*, no *on-site renewable energy* systems shall be modeled in the *proposed design*.

2. *Standard Reference Design*. Where applicable, the *standard reference design* shall comply with one of the following:

2.1. Where a *proposed design* includes one or more *on-site renewable energy* systems, the same systems shall be modeled identically in the *standard reference design* except the total rated capacity of all systems shall be equal to the required capacity in accordance with **Section RI103.1.1**. Where more than one type of *on-site renewable energy* system is modeled, the total capacity of each system shall be allocated in the same proportion as in the *proposed design*.

2.2. Where the *proposed design* does not include any *on-site renewable energy* systems, an unshaded photovoltaic system shall be modeled in the *standard reference design* in accordance with the performance criteria in **Table RI103.1.1.1**.

**TABLE RI103.1.1.1  
PERFORMANCE CRITERIA FOR STANDARD REFERENCE DESIGN PHOTOVOLTAIC SYSTEMS**

CRITERIA	DESIGN MODEL
Size Module	Rated capacity not less than required in accordance with <b>Section RI103.1.1</b> .
type	Crystalline silicon panel with a glass cover, 19.1% nominal efficiency and temperature coefficient (Tc Power) of -0.37%/°C.
Array type	Rack-mounted array with installed nominal operating cell temperature (INOCT) of 103°F (45°C).
Total system losses (DC output)	11.3%
Tilt	0 degrees (mounted horizontally)
Azimuth	180 degrees

For SI: °C = [(°F) – 32]/1.8.

**RI103.1.2 ERI with OPP requirements.** Where compliance is demonstrated in accordance with **Section R406.5** using the *Energy Rating Index* with OPP, a project shall comply with the requirements of this appendix if the rated *proposed design* and confirmed built dwelling are shown to have an ERI less than or equal to the values in **Table RI103.1.2**.

**TABLE RI103.1.2  
MAXIMUM ENERGY RATING INDEX INCLUDING OPP**

CLIMATE ZONE	ENERGY RATING INDEX WITH OPP
0 and 1	35
2	34
3	33
4	40
5	43
6	43
7 and 8	46

**RI103.2 Renewable energy certificate (REC) documentation.** Where *renewable energy certificates* (RECs) are associated with renewable energy power production required documentation shall comply with **Section R404.4**.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

  

Action	AS	AS/IC	D	D/IC

**RE#37**

New appendix provides requirements for demand responsive controls integration for water heaters

Related Mods:  
REPI-90-21,  
RED1-315-22

APPENDIX RJ DEMAND RESPONSIVE CONTROLS

*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*

User notes:

**About this appendix:** This appendix can be adopted by authorities having jurisdiction seeking demand responsive controls to be integrated into water heating systems.

SECTION RJ101

**DEMAND RESPONSIVE WATER HEATING**

**RJ101.1 Demand responsive water heating.** Electric storage water heaters with a rated water storage volume of 40 gallons (150 L) to 120 gallons (450 L) and a nameplate input rating equal to or less than 12 kW shall be provided with demand responsive controls in accordance with **Table RJ101.1**.

Exceptions:

1. Water heaters that are capable of delivering water at a temperature of 180°F (82°C) or greater.
2. Water heaters that comply with Section IV, Part HLW or Section X of the **ASME Boiler and Pressure Vessel Code**.
3. Water heaters that use three-phase electric power.

**TABLE RJ101.1  
DEMAND RESPONSIVE CONTROLS FOR WATER HEATING**

EQUIPMENT TYPE	CONTROLS	
	Manufactured before 7/1/2025	Manufactured on or after 7/1/2025
Electric storage water heaters	AHRI 1430 (I-P) or ANSI/CTA-2045-B Level 1 and also capable of initiating water heating to meet the temperature set point in response to a demand response signal.	AHRI 1430 (I-P).



SECTION RJ102 REFERENCED STANDARDS

**RJ102.1 General.** See **Table RJ102.1** for standards that are referenced in various section of this appendix. Standards are listed by the standard identification with the effective date, the standard title, and the section or sections of this appendix that reference this standard.

**TABLE RJ102.1 |  
REFERENCED STANDARDS**

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
AHRI 1430—2022 (I-P)	<i>Demand Flexible Electric Storage Water Heaters</i>	<b>Table RJ101.1</b>
ASME BPVC	<i>ASME Boiler and Pressure Vessel Code</i>	<b>RJ101.1</b>

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

  

Action	AS	AS/IC	D	D/IC

**RE#38** New appendix provides electric readiness provisions for water heaters, household clothes dryers and cooking appliances

Related Mods:  
REPI-33-21,  
RECD1-12-22,  
RED1-116-22,

APPENDIX RK ELECTRIC-READY RESIDENTIAL BUILDING PROVISIONS

*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*  
User notes:  
**About this appendix:** *This appendix can be adopted by authorities having jurisdiction seeking electrification readiness.*

SECTION RK101 ELECTRIC READINESS

**RK101.1 Electric readiness.** Water heaters, household clothes dryers and cooking appliances that use fuel gas or liquid fuel shall comply with **Sections RK101.1.1** through **RK101.1.4**.

**RK101.1.1 Cooking appliances.** A dedicated branch circuit outlet with a rating not less than 240 volts and not less than 40 amperes shall be installed and terminate within 3 feet (914 mm) of conventional cooking tops, conventional ovens or cooking appliances combining both.

**Exception:** Cooking appliances not installed in an individual *dwelling unit*.

**RK101.1.2 Household clothes dryers.** A dedicated branch circuit with a rating not less than 240 volts and not less than 30 amperes shall be installed and terminate within 3 feet (914 mm) of each household clothes dryer.

**Exception:** Clothes dryers not installed in an individual *dwelling unit*.

**RK101.1.3 Water heaters.** A dedicated branch circuit with a rating either not less than 240 volts and not less than 30 amperes, or not

less than 120 volts and not less than 20 amperes, shall be installed and terminate within 3 feet (914 mm) of each water heater.

**Exception:** Water heaters serving multiple *dwelling units* in a R-2 occupancy.

**RK101.1.4 Electrification-ready circuits.** The unused conductors required by **Sections RK101.1.1** through **RK101.1.3** shall be labeled with the word "spare." Space shall be reserved in the electrical panel in which the branch circuit originates for the installation of an overcurrent device. Capacity for the circuits required by Sections **RK101.1.1** through **RK101.1.3** shall be included in the load calculations of the original installation.

Staff Classification	Correlates Directly	Energy Standard Needed	Overlap
	X		

  

Action	AS	AS/IC	D	D/IC

**RE#39**

New appendix provides requirements for building renewable energy infrastructure readiness

Related Mods:  
REPI-33-21,  
RECD1-4-22,  
RED1-137-22

APPENDIX RL RENEWABLE ENERGY INFRASTRUCTURE

*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*

User notes:

**About this appendix:** *This appendix provides readiness requirements for renewable energy infrastructure.*

SECTION RL101 RENEWABLE ENERGY  
INFRASTRUCTURE

**RL101.1 Renewable energy infrastructure.** The *building* shall comply with the requirements of Section RL101.1.1 or RL101.1.2.

**RL101.1.1 One- and two-family dwellings and townhouses.** One- and two-family dwellings and townhouses shall comply with Sections **RL101.1.1.1** through **RL101.1.1.4**.

Exceptions:

1. A *dwelling unit* with a permanently installed on-site renewable energy system.
2. A *dwelling unit* with a *solar-ready zone* area that is less than 500 square feet (46 m<sup>2</sup>) of roof area oriented between 110 degrees (1.92 rad) and 270 (4.71 rad) degrees of true north.
3. A *dwelling unit* with less than 500 square feet (46 m<sup>2</sup>) of roof area oriented between 110 degrees and 270 degrees of true north.
4. *Dwelling units* where 50 percent of the *solar-ready zone* area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the *building* for more than 2,500 annual hours between 8:00 a.m. and 4:00 p.m.
5. A *dwelling unit* that complies with **Appendix RC**.
6. A *dwelling unit* with a renewable energy power purchase agreement with a duration of not less than 15 years from a utility or a community renewable energy facility and for not less than 80 percent of the estimated *dwelling unit* whole-building electric use on an annual basis.
7. A *dwelling unit* with less than or equal to 1,500 square feet (139 m<sup>2</sup>) of living space located above grade plane.

**RL101.1.1.1 Solar-ready zone area.** The total area of the *solar-ready zone* shall not be less than 250 square feet (23.2 m<sup>2</sup>) and shall be composed of areas not less than 5.5 feet (1676 mm) in one direction and not less than 80 square feet (7.4 m<sup>2</sup>) exclusive of access or set back areas as required by the **International Residential Code**.

**Exception:** Dwelling units in townhouses three stories or less in height above grade plane and with a total floor area less than or equal to 2,000 square feet (186 m<sup>2</sup>) per dwelling shall be permitted to have a solar-ready zone area of not less than 150 square feet (14 m<sup>2</sup>).

**RL101.1.1.2 Obstructions.** *Solar-ready zones* shall be free from obstructions, including but not limited to vents, chimneys and roof-mounted equipment.

**RL101.1.1.3 Electrical service reserved space.** The main electrical service panel shall have a reserved space for a dual-pole circuit breaker and shall be labeled "For Future Renewable Electric." The reserved space shall be at the opposite (load) end of the busbar

from the primary energy source.

**RL101.1.1.4 Electrical interconnection.** An electrical junction box shall be installed within 24 inches (610 mm) of the main electrical service panel and shall be connected to a capped roof penetration sleeve or a location in the attic that is within 3 feet (914 mm) of the *solar-ready zone* by a nonflexible metallic conduit not less than 1 inch (25 mm) in diameter or by permanently installed wire as *approved*. Where the interconnection terminates in the attic, the location shall be not less than 12 inches (35 mm) above ceiling insulation. Both ends of the interconnection shall be labeled "For Future Renewable Electric."

**RL101.1.2 Group R occupancies.** Residential *buildings* other than one- and two-family dwellings and townhouses shall comply with Sections RL101.1.2.1 through RL101.1.2.8.

**RL101.1.2.1 General.** A *solar-ready zone* shall be located on the roof of residential *buildings* that are oriented between 110 degrees and 270 degrees of true north or have low slope roofs. *Solar-ready zones* shall comply with Sections RL101.1.2.2 through RL101.1.2.8.

**Exceptions:** Add optional paragraph text here

1. A *building* with a permanently installed on-site renewable energy system.
2. A *building* with a *solar-ready zone* area that is shaded for more than 70 percent of daylight hours annually.
3. A *building* where an *approved* party certifies that the incident solar radiation available to the *building* is not suitable for a *solar-ready zone*.
4. A *building* where an *approved* party certifies that the *solar-ready zone* area required by Section RL101.1.2.3 cannot be met because of rooftop equipment, skylights, vegetative roof areas or other obstructions.
5. A *building* that complies with Appendix RC.
6. A *building* with a renewable energy power purchase agreement with a duration of not less than 15 years from a utility or a community renewable energy facility and for not less than 80 percent of the estimated electric use of the residential occupancy portion of the building on an annual basis.

**RL101.1.2.2 Construction document requirements for a *solar-ready zone*.** *Construction documents* shall indicate the *solar-ready zone*.

**RL101.1.2.3 Solar-ready zone area.** The total *solar-ready zone* area shall be not less than 40 percent of the roof area calculated as the horizontally projected gross roof area less the area covered by penthouses, mechanical equipment, rooftop structures, skylights, occupied roof decks, vegetative roof areas and mandatory access or set back areas as required by the **International**

**Fire Code.** The *solar-ready zone* shall be a single area or smaller, separated sub-zone areas. Each sub-zone shall be not less than 5 feet (1524 mm) in width in the narrowest dimension.

**RL101.1.2.4 Obstructions.** *Solar-ready zones* shall be free from obstructions, including pipes, vents, ducts, HVAC equipment, skylights and roof-mounted equipment.

**RL101.1.2.5 Roof loads and documentation.** A collateral dead load of not less than 5 pounds per square foot (24.41 kg/m<sup>2</sup>) shall be included in the gravity and lateral design calculations for the *solar-ready zone*. The structural design loads for roof dead load and roof live load shall be indicated on the *construction documents*.

**RL101.1.2.6 Interconnection pathway.** *Construction documents* shall indicate pathways for routing of conduit or plumbing from the *solar-ready zone* to the electrical service panel or service hot water system.

**RL101.1.2.7 Electrical service reserved space.** The main electrical service panel shall have a reserved space to allow installation of a dual-pole circuit breaker for future solar electric and shall be labeled "For Future Renewable Electric." The reserved spaces shall be positioned at the end of the panel that is opposite from the panel supply conductor connection.

**RL101.1.2.8 Construction documentation certificate.** A permanent certificate, indicating the *solar-ready zone* and other requirements of this section, shall be posted near the electrical distribution panel, water heater or other conspicuous location.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

  

Action	AS	AS/IC	D	D/IC